

International Material Comparison Chart

Chart I

Germany		USA	U. K.	France	Japan	Sweden
Standard						
DIN, DIN EN	Mat. No.	AISI/SAE	BS	AFNOR	JIS	SS
Structural and machine construction steels						
S185	1.0035	A 283 (A)	1449 15 HR; HS	A 33	–	1300
S235JR	1.0037	1015, A 283	Fe 360 B	E 24-2	STKM 12 A; C	1311
S235JRG1	1.0036	A 283 (C)	Fe 360 B 4360-40 B	–	–	1311, 1312
S235JRG2	1.0038	A550.36	Fe 360 B; 6323-ERW 3; CEW 3	E 24-2 NE	STKM 12A; C	1312
S235J0	1.0114	–	4360-40 C	E 24-3, E 24-4	–	–
S235J2G3	1.0116	A 515 (55)	Fe 360 D 1 FF	E 24-3, E 24-4	–	1312, 1313
S235J2G4	1.0117	1513	A 2	E 36-4	–	–
S275JR	1.0044	1020	Fe 430 B FU	E 28-2	SN 400 B; C; SN 490 B; C	1412
S275J0	1.0143	A 572 (42)	4360-43 C	E 28-3, E 28-4	–	1414-01
S275J2G3	1.0144	A 500 (A; B; D)	Fe 430 D1 FF	E 28-3, E 28-4	SM 400 A; B; C	1411, 1412, 1414
S355JR	1.0045	–	4360-50 B	E 36-2	STK 400	2172
S355J0	1.0553	A 678 (C)	A 3	320-560 M	–	1606
S355J2G3	1.0570	1024; 1524	1449 50/35 HR; HS	E 36-3, E 36-4	STK 500	2132 to 2134, 2174
S355J2G4	1.0577	A 738 (A; C)	Fe 510 D2 FF	A 52 FP	–	2174
S355K2G3	1.0595	A 678 (C)	224-430	–	–	–
S355K2G4	1.0596	A 678 (C)	224-430	–	–	–
E295	1.0050	A 570 (50)	Fe 490-2 FN	A 50-2	SS 490	1550, 2172
E335	1.0060	A 572 (65)	Fe 590-2 FN	A 60-2	SM 570	1650
E360	1.0070	–	Fe 590-2 FN	SM 570	1650	–
Unalloyed quality steels						
S275N	1.0490	A 516 (60)	–	–	–	–
S275M	1.8818	A 715 (7)	–	–	–	–
S355N	1.0545	A 714 (III)	4360-50 E	E 355 R	–	2334-01, 2134-01
S355M	1.8823	A 715 (7)	–	–	–	–
Alloy high grade steels						
S420N	1.8902	A 633 m	–	E 420 R	–	–
S420M	1.8825	–	–	–	–	–
S460N	1.8901	A 633 m	–	E 460 R	–	–
S460M	1.8827	A 734 (B)	–	–	–	–
Quenched and tempered structural steels with higher yield strength						
S460QL	1.8906	–	4360-55 F	S 460 Q, T	SM 520 B, C	2143
S500QL	1.8909	–	–	S 500 T	–	–
S620QL	1.8927	–	–	S 620 T	–	–
S960QL	1.8933	–	–	S 960 T	–	–
Unalloyed steels – Case hardened steels						
C10E	1.1121	1010	040 A 10, 045 M 10	C 10, CX 10	S 9 CK, S 10 C	1265
C10R	1.1207	1011	–	E 355 C	–	–
C15E	1.1141	1015	040 A 15, 080 M 15	XC 12	S 15, S 15 CK	1370
C15R	1.1140	1016	080 A 20	–	–	–
Alloy steels – Case hardened steels						
16MnCr5	1.7131	5115	527 M 17	16 MC 5, 16 Mn Cr 5	–	2173
16MnCrS5	1.7139	5115	620-440	16 MC 5	–	2127
18CrMo4	1.7243	5120/5120 H	527 M 20	20 MC 5	Scr 420 M	2523
18CrMoS4	1.7244	5120/5120 H	527 M 20	20 MC 5	Scr 420 M	2523
20MoCr4	1.7321	K 12220	–	–	–	–
20MoCrS4	1.7323	K 12220	–	–	–	–
15NiCr13	1.5752	3310	655 H 13	12 NC 15	SNC 815 (H)	–
20NiCrMo2-2	1.6523	8620 H	805 H 20	20 NCD 2	SNCM 220 H	2506
20NiCrMoS2-2	1.6526	8620/8620 H	–	20 NCD 2	SNCM 220 M	2506
17NiCrMo6-4	1.6566	–	815 M 17	18 NCD 6	–	2523

International Material Comparison Chart

Chart II

Germany		USA	U. K.	France	Japan	Sweden
Standard						
DIN, DIN EN	Mat. No.	AISI/SAE	BS	AFNOR	JIS	SS
17NiCrMoS6-4	1.6569	4718/47 18 H	–	–	–	–
20MnCr5	1.7147	5120	527 M 20	20 MC 5	SMn C 420 H	–
20MnCrS5	1.7149	5120/5120 H	527 M 20	20 MC 5	Scr 420 M	2523
14NiCrMo13-4	1.6657	9310	832 M 13	16 NCD 13	–	–
18CrNiMo7-8	1.6687	–	–	18 NCD 6	–	–
Unalloyed steels – Quenched and tempered steels						
C22	1.0402	1020	055 M 15	AF 42 C 20	S 20 C, S 22 C	1450
C22E	1.1151	1023	055 M 15	2 C 22, XC 18, XC 25	S 20 C	1450
C25	1.0406	1025	070 M 26	1 C 25	–	–
C25E	1.1158	1025	(070 M 26)	2 C 25, XC 25	S 25 C, S 28 C	1450
C35	1.0501	1035	060 A 35	C 35, 1 C 35	S 35 C, S 35 CM	1572, 1550
C35E	1.1181	1035	080 A 35	C 35	S 35 C	1550, 1572
C45	1.0503	1045	080 A 46	C 45	S 45 C, S 45 CM	1672, 1650
C45E	1.1191	1042, 1045	080 M 46	XC 42 H 1	S 45 C	1672
C60	1.0601	1060	060 A 62	C 60	S 58 C	–
C60E	1.1221	1064	060 A 62, 070 M 60	2 C 60	S 58 C, S 60 CM, S 65 CM	1665, 1678
C30	1.0528	G 10300	080 A 30	XC 32	S 30 C	–
C35	1.0501	1035	060 A 35	–	–	–
C40	1.0511	1040	080 M 40	AF 60 C 40	–	F. 114A
C50	1.0540	G 10500	080 M 50	XC 50	S 50 C	–
C55	1.0535	1055	070 M 55, 5770-50	C 54; 1 C 55	S 55 C, S 55 CM	1655
Alloy steels – Quenched and tempered steels						
38Cr2	1.7003	–	120 M 36	38 C 2, 38 Cr 2	–	–
38CrS2	1.7023	5140	530 A 40	42 C 4	Scr 440 M	2245
46Cr2	1.7006	5045	–	42 C 2, 46 Cr 2	–	–
46CrS2	1.7025	A 768 (95)	–	–	SNB 5	–
34Cr4	1.7033	5132	530 A 32	32 C 4, 34 Cr 4	SCr 430 (H)	–
34CrS4	1.7037	4340/4340 H	818 M 40	35 NCD 6	SNCM 439	–
37Cr4	1.7034	5135	530 A 36	37 Cr4, 38 C 4	Scr 435 (H) (M)	–
37CrS4	1.7038	5135/5135 H	–	38 Cr 4	Scr 435 H	–
25CrMo4	1.7218	4118	708 M 25	25 CD 4	SCM 420	2225
24CrMoS4	1.7213	4130/4130 H	CDS 110	30 CD 4	SCM 430 M	2223-01
41Cr4	1.7035	5140	530 A 40	41 Cr 4, 42 C 4	Scr 440 (H) (M)	–
41CrS4	1.7039	L 1	524 A 14	–	–	2092
34CrMo4	1.7220	4137	708 A 37	35 CD 4	SCM 432	2234
42CrMo4	1.7225	4140	708 M 40	42 CD 4	SCM 440 (H)	2244
50CrMo4	1.7228	4150, 4147	708 A 47	50 Cr Mo 4	SCM 4454 (H)	2512
51CrV4	1.8159	6150	735 A 50	50 CV 4	SUP 10	2230
36CrNiMo4	1.6511	9840	817 M 37	36 CrNiMo 4, 35 NCD 5, 40 NCD 3	–	–
34CrNiMoS4	1.6582	4337, 4240	816 M 40, 817 M 40	34 CrNiMo 8	SNCM 447	2541
30NiCrMo8	1.6580	–	823 M 30	30 CrNiMo 8	SNCM 431	–
36NiCrMo16	1.6773	5135/5135 H	–	38 Cr 4	Scr 435 M	–
Nitriding steels						
31CrMo12	1.8515	–	722 M 24	30 CD 12	–	2240
34CrAlMo5-10	1.8507	A 355 Cl.D	–	30 CAD 6.12	–	–
40CrAlMo7-10	1.8509	E 7140	905 M 39, En 41 B	40 CAD 6.12	SACM 1, SACM 645	2940
40CrMoV13-9	1.8523	–	897 M 39	–	–	–
Steels for flame and induction hardening						
Cf45	1.1193	1045	060 A 47, 080 M 46	XC 42 H 1 TS	S 45 C, S 45 CM	1672
42Cr4	1.7045	5140	530 A 40	42 C 4 TS	Scr 440	2245
41CrMo4	1.7223	4142	708 M 40, 3111-5/1	42 CD 4 TS	SNB 22, SCM 440	2244
Cf35	1.1183	1035	080 A 35	XC 38 H 1 TS	S 35 C, S 35 CM	1572

International Material Comparison Chart

Chart III

Germany		USA	U. K.	France	Japan	Sweden
Standard						
DIN, DIN EN	Mat. No.	AISI/SAE	BS	AFNOR	JIS	SS
Cf53	1.1213	1050	070 M 55	XC 48 H 1 TS	S 50 C, S 50 CM	1674
Cf70	1.1249	–	–	–	–	–
Free cutting steels						
11SMn30	1.0715	1213	230 M 07	S 250	SUM 22	1912
11SMnPb30	1.0718	12 L 13	–	S 250 Pb	SUM 23 L	1914
11SMn37	1.0736	1215	–	S 300	SUM 25	–
11SMnPb37	1.0737	12 L 14	–	S 300 Pb	–	1926
10S20	1.0721	1108, 1109	(210 M 15)	10 F 2	–	–
10SPb20	1.0722	–	–	10 Pb F 2	–	–
35S20	1.0726	1140	212 M 36	35 MF 6	–	1957
46S20	1.0727	1146	En 8 DM	45 MF 4	SUM 43	–
Cold work steels, unalloyed						
C80U	1.1525	W 108	–	C 80 E 2 U, Y ₁ 80	–	–
C105U	1.1545	W 1	BW 1 A	Y 105	SK 3	1880
Cold work steels, alloy						
45WCrV7	1.2542	S 1	BS 1	45 WCrV 8	S 1	2710
60WCrV8	1.2550	S 1	BS 1	55 WC 20	–	–
100MnCrW4	1.2510	O 1	BO 1	90 MnWCrV 5	SKS 3	–
90MnCrV8	1.2842	O 2	BO 2	90 Mn V 8, 90 MV 8	–	–
X210Cr12	1.2080	P 3	BD 3	Z 200 C 12	SKD 12	2710
102Cr6	1.2067	L 3	(BL 3)	100 Cr 6, Y 100 C 6	SUJ 2	–
45NiCrMo16	1.2767	–	BP 30	Y 35 NCD 16	–	–
X153CrMoV12	1.2379	D 2	BD 2	Z 160 CDV 12	SKD 12	2260
X100CrMoV51	1.2363	A 2	BA 2	Z 100 CDV 5	SKD 12	2260
X40CrMoV51	1.2344	H 13	BH 13	Z 40 CDV 5	SKD 61	2242
X210CrW12	1.2436	D4 (D6)	BD 6	Z 210 CW 12-01	SKD 2	2312
Hot work steels						
55NiCrMoV7	1.2714	–	–	–	SKS 51	–
X37CrMoV5-1	1.2343	H 11	BH 11	Z 38 CDV 5	SKD 6	–
32CrMoV12-28	1.2365	H 10	BH 10	32 CDV 12-28	–	–
High speed steels						
HS6-5-2C	1.3343	M 2	BM 2	HS 6-5	SKH 51	2722
HS6-5-2-5	1.3243	M 35	BM 35	Z 85 WDKCV 06-05-04-02	SKH 55	2723
HS10-4-3-10	1.3207	–	BT 42	HS 10-4-3-10	SKH 57	–
HS2-9-2	1.3348	M 7	–	HS 2-9-2, Z 100 DCWV 09-04-02-02	–	2782
HS2-9-1-8	1.3247	M 42	BM 42	HS 2-9-1-8	SKH 59	2716
S2-9-2-8	1.3249	M 42	BM 34	–	–	–
Stainless steels, austenitic						
X10CrNi18-8	1.4310	301	301 S 21/22	Z 12 CN 18-09	SUS 301	2331
X2CrNi18-9	1.4307	F 304 L	304 L	–	SUS F 304 L	–
X5CrNi18 9	1.4350	304	304 S 31	Z 5 CN 18.09	SUS 304	2332
X2CrNi19-11	1.4306	304 L	304/305 S 11	Z 2 CN 18-10	SCS 19, SUS 304 L	2352
X2CrNi18-10	1.4311	304 LN	304 S 61	Z 3 CN 18-07 Az	SUS 304 LN	2371
X5CrNi18-10	1.4301	304	304 S 17	Z 5 CN 17-08	SUS 304	2332, 2333
X8CrNiS18-9	1.4305	303	303 S 22/31	Z 8 CNF 18-09	SUS 303	2346
X6CrNiTi18-10	1.4541	321	321 S 31/51	Z 6 CNT 18-10	SUS 321	2337
X4CrNi18-12	1.4303	305/308	305 S 17, 305 S 19	Z 5 CN 18-11 FF	SUS 305 J1, SUS 305	–
X5CrNiMo17-12-2	1.4401	316	316 S 13/17/19	Z 3 CND 17-11-01	SUS 316	2347
X6CrNiMoTi17-12-2	1.4571	316 Ti	320 S 18/31	Z 6 CNDT 17-12	SUS 316 Ti	2350
X2CrNiMo18-14-3	1.4435	316 L	316 S 11/13/14	Z 3 CND 17-12-03/ Z 3 CND 18-14-03	SUS 316 L	2353

International Material Comparison Chart

Chart IV

Germany		USA	U. K.	France	Japan	Sweden
Standard						
DIN, DIN EN	Mat. No.	AISI/SAE	BS	AFNOR	JIS	SS
X2CrNiMoN17-13-3	1.4429	316 LN	326 S 63	Z 3 CND 17-12 Az	(SUS 316 LN)	2375
X2CrNiMoN17-13-5	1.4439	316 L	316 S 11	Z 2 CND 17-12	SUSF 316 L	2348
X1NiCrMoCu25-20-5	1.4539	USN N 08904	–	Z 2 NCDU 25-20	–	2562
Stainless steels, ferritic						
X2CrNi12	1.4003	A 268	–	–	–	–
X6Cr13	1.4000	403	403 S 17	Z 8 C 12, Z 8 C 13 FF	SUS 403	2301
X6Cr17	1.4016	430	430 S 15	Z 8 C 17	SUS 430	2320
X2CrTi12	1.4512	409	409 S 19	Z 3 CT 12	SUH 409	–
X6CrMo17-1	1.4113	434	434 S 17	Z 8 CD 17.01	SUS 434	–
X2CrMoTi18-2	1.4521	443/444	–	–	SUS 444	2326
Stainless steels, martensitic						
X12CrS13	1.4005	416	416 S 21 Z 11 CF13	SUS 416	–	2380
X12Cr13	1.4006	410	410 S 21	Z 10 C 13	SUS 410	2302
X20Cr13	1.4021	420	420 S 37	Z 20 C 13	SUS 420 J 1	2303
X30Cr13	1.4028	420 F	420 S 45	Z 30 C 13	SUS 420 J 2	2304
X46Cr13	1.4034	–	(420 S 45)	Z 44 C 14, Z 38 C 13 M	SUS 420 J2	2304
X39CrMo17-1	1.4122	5925	–	–	–	–
X3CrNiMo13-4	1.4313	CA 6-NM	425 C 11	Z 4 CND 13.4 M	SCS 5, SCS 6	2384
Hot rolled steels for springs						
38Si7	1.5023	–	–	41 Si 7	–	–
46Si7	1.5024	9255	–	51 S 7, 51 Si 7	–	2090
55Cr3	1.7176	5155	525 A 58	55 Cr 3, 55 C 3	SUP 9 (A) (M)	2253
61SiCr7	1.7108	9261, 9262	–	61 SC 7	–	–
51CrV4	1.8159	6150	735 A 50	55 Cr V 4	SUP 10	2230
Cold rolled strip and sheet from soft steels						
DC03	1.0347	A 619	1449 3 CR	E	CR 2	1146
DC04	1.0338	A 620 (1008)	1449 2 CR; 3 CR	ES	SPCE; HR 4	1147
Cast iron with flake graphite (gray iron)						
EN-GJL-100	EN-JL-1010	A 48 20 B	1452 Grade 100	Ft 10 D	G 5501 FC 10	0110-00
EN-GJL-150	EN-JL-1020	A 48 25 B	1452 Grade 150	A 32-101 FGL 150; FT 15 D	G 5501 FC 15	0115-00
EN-GJL-200	EN-JL-1030	A 48 30 B	1452 Grade 220	A 32-101 FGL 200; FT 20 D	G 5501 FC 20	0120-00
EN-GJL-250	EN-JL-1040	A 48 40 B	1452 Grade 250/260	A 32-101 FGL 250; FT 25 D	G 5501 FC 25	0125-00
EN-GJL-300	EN-JL-1050	A 48 45 B	1452 Grade 300	A 32-101 FGL 300; FT 30 D	G 5501 FC 30	0130-00
EN-GJL-350	EN-JL-1060	A 48 50 B	1452 Grade 350	A 32-101 FGL 350; FT 35 D	G 5501 FC 35	0135-00
Cast iron with spheroidal (nodular) graphite						
EN-GJS-350-22	EN-JS-1010	–	–	–	–	0717-15
EN-GJS-500-7	EN-JS-1050	A 536 60-45-12	2789 Grade 500/7	A 32-201 FGS 500-7	G 5502 FCD 500	0727-02
EN-GJS-600-3	EN-JS-1060	A 536 80-55-06	2789 Grade 600/3	A 32-201 FGS 600-3	G 5502 FCD 600	0732-03
EN-GJS-700-2	EN-JS-1070	A 536 100-70-03	2789 Grade 700-2	A 32-201 FGS 700-2	G 5502 FCD 700	0737-01
Malleable cast iron						
EN-GJMW-350-4	EN-JM 1010	–	86681 W 35-04	A 32-701 MB 35-7	G 5703 FCMW 330	–
EN-GJMW-400-5	EN-JM 1030	–	6681 W 40-05	A 32-701 MB 40-05	G 5703 FCMW 370	–
EN-GJMW-450-7	EN-JM 1040	–	6681 45-07	A 32-701 MB 450-7	G 5703 FCMWP 440	–
EN-GJMB-350-10	EN-JM 1130	A 47 Grade 22010+32510	310 B 340/12	A 32-702 MN 350-10	G 5703 FCMB 340	0815-00
EN-GJMB-450-6	EN-JM 1140	–	6681 P 45-06	A 32-703 MP 50-5	–	0854-00
EN-GJMB-550-4	EN-JM 1160	–	6681 P 55-04	A 32-703 MP 60-3	G 5703 FCMP 540	0856-00
EN-GJMB-650-2	EN-JM 1180	–	6681 P 65-02	–	–	0862-03
EN-GJMB-700-2	EN-JM 1190	A220 Grade 70003	6681 P 70-02	A 32-703 MP 70-2	G 5703 FCMP 690	0862-03

International Material Comparison Chart

Chart V

Germany		USA	U. K.	France		Japan	Sweden
Standard							
DIN, DIN EN	Mat. No.	AISI/SAE	BS	AFNOR		JIS	SS
Cast steels for general applications							
GS-38	1.0420	–	–	–		SC 360	–
GS-45	1.0446	A 27	–	–		SC 450	–
Cast steels for pressure vessels							
GP240GH	1.0619	A 216 Grade WCC	1504-161 Gr. B	–		–	–
G17CrMo5-5	1.7357	A 217 Grade WC 6	–	–		–	–
Aluminum and wrought aluminum alloys							
			old	new	old	new	
Al 99.5	1050 A	1050 A	1 B	1050 A	A-5	1050 A	A 1050
Al Mn1	3103	3103	N 3	3103	–	–	–
Al Mn1Cu	3003	3003		(3103)	A-M 1	3003	A 3003
Al Mg1	5005 A	5005 A	N 41	5005	A-G 0.6	5005	A 5005
Al Mg2	5251	5251	N 4	5251	A-G 2 M	5251	–
Al Mg3	5754	5754	–	–	A-G 3 M	5754	–
Al Mg5	5019/5119	5019/5119	–	–	A-G 5	–	–
Al Mg3Mn	5454	5454	N 51	5454	A-G 3 MC	5454	A 5454
Al Mg4.5Mn0.7	5083	5083	N 8	5083	A-G 4.5 MC	–	A 5083
AlCuPbMgMn	2007	2007	–	–	A-U 4 PB	–	–
Al Cu4PbMg	2030	2030	–	–	–	–	–
Al MgSiPb	6012	6012	–	–	A-SGPB	–	–
Al Cu4SiMg	2014	2014	H 15	(2014 A)	A-U 4 SG	–	–
Al Cu4MgSi	2017	2017	–	–	A-U 4 G	–	A 2017
Al Cu4Mg1	2024	2024	2 L 97/9	2024	A-U 4 G1	2024	A 2024
Al MgSi	6060	6060	H 9	(6063)	A-GS	6060	A 6063
Al Si1MgMn	6082	6082	H 30	6082	A-SGM 0.7	6082	–
Al Zn4.5Mg1	7020	7020	H 17	7020	A-Z 5 G	7020	(A 7 N 01)
Al Zn5Mg3Cu	7022	7022	–	–	A-Z 4 GU	–	–
Al Zn5.5MgCu	7075	7075	2 L 95/96	7075	A-Z 5 GU	7075	A 7075
Aluminum casting alloys							
AC-AlSi7Mg	AC-42000	A 356	L M 25	A-S 7 g		–	–
Magnesium alloys, Titanium, Titanium alloys							
MgMn2	3.3520	M 1 A	MAG-E-101	G-M 2		–	–
MgAl3Zn	3.5312	AZ 31 B	MAG-E-111	G-A 3 Z 1		–	–
MgAl6Zn	3.5612	AZ 61 A	MAG-E-121	G-A 6 Z 1		–	–
MgAl8Zn	3.5812	AZ 80 A	–	G-A 7 Z 1		–	–
Ti1	3.7025	–	T A 1	–		–	–
Ti2	3.7035	–	T A 2	–		–	–
TiAl6V4	3.7165	–	T A 10-13, 28, 56	–		–	–
TiAlMo4Sn2	3.7185	–	T A 45-51, 57	–		–	–

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ISO	Coromant Material Classifi- cation (CMC)	Country									
		Great Britain		Sweden	USA	Germany		France	Italy	Spain	Japan
		Standard									
		BS	EN	SS	AISI/SAE	W.-nr.	DIN	AFNOR	UNI	UNE	JIS
P 											

ISO	Coromant Material Classifi- cation (CMC)	Country										
		Great Britain		Sweden	USA	Germany		France	Italy	Spain	Japan	
		Standard										
		BS	EN	SS	AISI/SAE	W.-nr.	DIN	AFNOR	UNI	UNE	JIS	
P	02.1/02.2	816M40	110	-	9840	1.6511	36CrNiMo4	40NCD3	38NiCrMo4(KB)	35NiCrMo4	-	
	02.1/02.2	817M40	24	2541	4340	1.6582	35CrNiMo6	35NCD6	35NiCrMo6(KB)	-	-	
	02.1/02.2	530A32	18B	-	5132	1.7033	34Cr4	32C4	34Cr4(KB)	35Cr4	SCr430(H)	
	02.1/02.2	530A40	18	-	5140	1.7035	41Cr4	42C4	41Cr4	42Cr4	SCr440(H)	
	02.1/02.2	(527M20)	-	2511	5115	1.7131	16MnCr5	16MC5	16MnCr5	16MnCr5	-	
	02.1/02.2	1717CDS110	-	2225	4130	1.7218	25CrMo4	25CD4	25CrMo4(KB)	55Cr3	SCM420;SCM430	
	02.1/02.2	708A37	19B	2234	4137;4135	1.7220	34CrMo4	35CD4	35CrMo4	AM26CrMo4	-	
	02.1/02.2	708M40	19A	2244	4140;4142	1.7223	41CrMo4	42CD4TS	41CrMo4	34CrMo4	SCM432;SCCRM3	
	02.1/02.2	708M40	19A	2244	4140	1.7225	42CrMo4	42CD4	42CrMo4	42CrMo4	SCM 440	
	02.1/02.2	722M24	40B	2240	-	1.7361	32CrMo12	30CD12	32CrMo12	42CrMo4	SCM440(H)	
	02.1/02.2	735A50	47	2230	6150	1.8159	50CrV4	50CV4	50CrV4	F.124.A	-	
	02.1/02.2	905M39	41B	2940	-	1.8509	41CrAlMo7	40CAD6, 12	41CrAlMo7	51CrV4	SUP10	
	02.1/02.2	BL3	-	-	L3	1.2067	100Cr6	Y100C6	-	41CrAlMo7	-	
	02.1/02.2	-	-	2140	-	1.2419	105WC6	105WC13	10WC6	100Cr6	-	
	02.1/02.2	-	-	-	-	-	-	-	107WC6	105WC5	SKS31	
	02.1/02.2	-	-	-	L6	1.2713	55NiCrMoV6	55NCDV7	107WC5KU	-	SKS2, SKS3	
	High-alloy steel											
	03.11	1501-509;510	-	-	ASTM A353	1.5662	X8Ni9	-	X10Ni9	XBNi09	-	
	03.11	-	-	-	2515	1.5680	12Ni19	Z18N5	-	-	-	
	03.11	832M13	36C	-	-	1.6657	14NiCrMo134	-	15NiCrMo13	14NiCrMo131	-	
	03.11	BD3	-	-	D3	1.2080	X210Cr12	Z200C12	X210Cr13KU X250Cr12KU	X210Cr12	SKD1	
	03.11	-	-	2314	-	1.2083	-	-	-	-	-	
	03.11	BH13	-	2242	H13	1.2344	X40CrMoV5 1	Z40CDV5	X35CrMoV05KU X40CrMoV511KU	X40CrMoV5	SKD61	
	03.11	BA2	-	2260	A2	1.2363	X100CrMoV5 1	Z100CDV5	X100CrMoV51KU	X100CrMoV5	SKD12	
	03.11	-	-	2312	-	1.2436	X210CrW12	-	X215CrW12 1KU	X210CrW12	SKD2	
	03.11	BS1	-	2710	S1	1.2542	45WCv7	-	45WCv8KU	45WCvSi8	-	
	03.11	BH21	-	-	H21	1.2581	X30WCv9 3	Z30WCV9	X28W09KU	X30WCv9	SKD5	
	03.11	-	-	2310	-	1.2601	X30WCv9 3KU	-	X30WCv9 3KU	-	-	
	03.11	401S45	52	-	HW3	1.4718	X165CrMoV 12	-	X165CrMoV12KU	X160CrMoV12	-	
	03.11	4959BA2	-	2715	D3	1.3343	X45GrSi93 S6-5-2	Z45CS9 Z40CSD10	X45GrSi8 15NiCrMo13	F322	SUH1 SUH3	
	03.13	BM 2	-	2722	M 2	1.3343	S6/5/2	Z 85 WDCV	HS 6-5-2-2	F-5603.	SKH 51	
	03.13	BM 35	-	2723	M 35	1.3243	S6/5/2/5	6-5-2-5	HS 6-5-2-5	F-5613	SKH 55	
	03.13	-	-	2782	M 7	1.3348	S2/9/2	-	HS 2-9-2	F-5607	-	
	03.21	-	-	2736	HNv3	1.2379	X210Cr12 G	-	-	-	-	
	Steel castings											
	06.2	-	-	2223	-	-	-	-	-	-	-	
	06.33	Z120M12	-	-	-	1.3401	G-X120Mn12	Z120M12	XG120Mn12	X120Mn12	SCMnH/1	
	06.33	BW 10	-	2183	-	1.3401	-	2120 M12	GX120 Mn12	F-8251	SEMn H1	
	Trade names											
	02.1	OVAKO 520M (Ovako Steel)										
	02.1	FORMAX (Uddeholm Tooling)										
	02.1	IMACRO NIT (Imatra Steel)										
	02.2	INEXA 482 (XM) (Inexa Profil)										
		S355J2G3(XM)										
		C45(XM)										
		16MnCrS5(XM)										
		INEXA280(XM)										
		070M20(XM)										
	02.2	HARDOX 500 (SSAB - Swedish Steel Corp.)										
	02.2	WELDOX 700 (SSAB - Swedish Steel Corp.)										

ISO	Coromant Material Classifi- cation (CMC)	Country									
		Great Britain		Sweden	USA	Germany		France	Italy	Spain	Japan
		Standard									
		BS	EN	SS	AISI/SAE	W.-nr.	DIN	AFNOR	UNI	UNE	JIS
M <											

ISO	Coromant Material Classifi- cation (CMC)	Country									
		Great Britain		Sweden	USA	Germany		France	Italy	Spain	Japan
		Standard									
		BS	EN	SS	AISI/SAE	W.-nr.	DIN	AFNOR	UNI	UNE	JIS
M		Trade names									
		Stainless steels									
	05.21/15.21	SANMAC 304 (Sandvik Steel)									
	05.21/15.21	SANMAC 304L (Sandvik Steel)									
	05.21/15.21	SANMAC 316 (Sandvik Steel)									
	05.21/15.21	SANMAC 316L (Sandvik Steel)									
	05.23/15.23	254 SMO									
	05.23/15.23	654 SMO									
	05.23/15.23	SANMAC SANICRO (Sandvik Steel)									
	05.52/15.52	SANMAC SAF 2205 (Sandvik Steel)									
05.52/15.52	SANMAC SAF 2507 (Sandvik Steel)										
K	Malleable cast iron										
	07.1	8 290/6		0814			-	MN 32-8			FCMB310
	07.1	B 340/12		0815	32510		GTS-35	MN 35-10			FCMW330
	07.2	P 440/7		0852	40010	0.8145	GTS-45	Mn 450	GMN 45		FCMW370
	07.2	P 510/4		0854	50005	0.8155	GTS-55	MP 50-5	GMN 55		FCMP490
		P 570/3		0858	70003		GTS-65	MP 60-3			FCMP540
	07.2	P570/3		0856	A220-70003	0.8165	GTS-65-02	Mn 650-3	GMN 65	-	FCMP590
	07.3	P690/2		0862	A220-80002	0.8170	GTS-70-02	Mn700-2	GMN 70		FCMP690
	Grey cast iron										
	08.1			0100							
	08.1			0110	No 20 B		GG 10	Ft 10 D			FC100
	08.1	Grade 150		0115	No 25 B	0.6015	GG 15	Ft 15 D	G 15	FG 15	FC150
	08.1	Grade 220		0120	No 30 B	0.6020	GG 20	Ft 20 D	G 20		FC200
	08.2	Grade 260		0125	No 35 B	0.6025	GG 25	Ft 25 D	G 25	FG 25	FC250
					No 40 B						
	08.2	Grade 300		0130	No 45 B	0.6030	GG 30	Ft 30 D	G 30	FG 30	FC300
	08.2	Grade 350		0135	No 50 B	0.6035	GG 35	Ft 35 D	G 35	FG 35	FC350
	08.2	Grade 400		0140	No 55 B	0.6040	GG 40	Ft 40 D			
	08.3	L-NiCuCr202		0523	A436 Type 2	0.6660	GGL-NiCr202	L-NC 202	-	-	
	Nodular cast iron										
	09.1	SNG 420/12		0717-02	60-40-18	0.7040	GGG 40	FCS 400-12	GS 370-17	FGE 38-17	FCD400
	09.1	SNG 370/17		0717-12	-		GGG 40.3	FGS 370-17			
	09.1	-		0717-15	-	0.7033	GGG 35.3	-			
	09.1	SNG 500/7		0727-02	80-55-06	0.7050	GGG 50	FGS 500-7	GS 500	FGE 50-7	FCD500
	09.1	Grade S6		0776	A43D2	0.7660	GGG-NiCr202	S-NC 202	-	-	
	09.2	SNG 600/3		0732-03	-		GGG 60	FGS 600-3			FCD600
	09.2	SNG 700/2		0737-01	100-70-03	0.7070	GGG 70	FGS 700-2	GS 700-2	FGS 70-2	FCD700

Non-ferrous metals

STRUCTURAL STEELS 1/(New European Designations)

New Designation according to:		Europe				Germany	France	United Kingdom	Italy
EN 10025-2		EN 10025(93)	EN 10025(90)	EN 10113-2	EN 10113-3	DIN 17100	NF A 35-501	BS 4360	UNI 7070
S185	1.0035	S 185	Fe 310-0			St 33	A 33		Fe 320
S 235 JR	1.0038	S 235 JR (G2)	Fe E 360 B			R St 37-2	E 24-2	40 (A) B	Fe 360 B
S 235 JO	1.0114	S 235 JO	Fe E 360 C			St 37-3 U	E 24-3	40 C	Fe 360 C
		S 235 J2G3	Fe E 360 D1			St 37-3 N	E 24-4	40 D	Fe 360 D
S 235 J2	1.0117	S 235 J2G4	Fe E 360 D2					40 EE	
S 275 JR	1.0044	S 275 JR	Fe 430 B			St 44-2	E 28-2	43 (A) B	Fe 430 B
S 275 JO	1.0143	S 275 JO	Fe 430 C			St 44-3 U	E 28-3	43 C	Fe 430 C
		S 275 J2G3	Fe 430 D1	S 275 N	S 275 M	St 44-3 N	E 28-4	43 D	Fe 430 D
S 275 J2	1.0145	S 275 J2G4	Fe 430 D2	S 275 NL	S 275 ML			43 EE	
S 355 JR	1.0045	S 355 JR	Fe 510 B				E 36-2	50 B	Fe 510 B
S 355 JO	1.0553	S 355 JO	Fe 510 C			St 52-3 U	E 36-3	50 C	Fe 510 C
		S 355 J2G3	Fe 510 D1	S 355 N	S 355 M	St 52-3 N		50 D	Fe 510 D
S 355 J2	1.0577	S 355 J2G4	Fe 510 D2	S 355 NL	S 355 ML				
		S 355 K2G3	Fe 510 DD1				E 36-4	50 DD	Fe 510 DD
S 355 K2	1.0596	S 355 K2G4	Fe 510 DD2					50 EE	

Remark: Qualities according to EN 10025 (93) can be performed with cold forming aptitude; the steel designation is then followed by the C letter.

STRUCTURAL STEELS (New European Designations)

New Designation according to:		Europe	Spain	Belgium	Sweden	Portugal	Austria	Norway
EN 10025-2		EN 10025(93)	UNE 36.080	NBN 21101	MNC 810E	NP 1729	M3116	
S185	1.0035	S 185	A 310-0	A 320	SS13.00.00	FE 310-0	St 320	NS 12 120
			AE 235 B-FU				USt 360 B	NS 12 122
S 235 JR	1.0038	S 235 JR (G2)	AE 235 B-FN	AE 235 B	SS 13.11.00	FE 360-B	RSt 360 b	NS 12 123
S 235 JO	1.0114	S 235 JO	AE 235 C	AE 235 C	SS 13.12.00	FE 360-C	St 360 C	NS 12 124
							St 360 CE	
		S 235 J2G3	AE 235 D	AE 235 D		FE 360-D	St 360 D	NS 12 124

S 235 J2	1.0117	S 235 J2G4		AE 255 A,B,C,D				
S 275 JR	1.0044	S 275 JR	AE 275 B	AE 295 B	SS 14.12.00	FE 430-B	St 430 B	NS 12 142
S 275 JO	1.0143	S 275 JO	AE 275 C	AE 295 C		FE 430-C	St 430 C	NS 12 143
							St 430 CE	
		S 275 J2G3	AE 275 D	AE 295 D	SS 14.14.00	FE 430-D	St 430 D	NS 12 143
S 275 J2	1.0145	S 275 J2G4		AE 295 DD	SS 14.14.01			
					SS 26.32.00			
					SS 26.34.11			
					SS 21.72.00			
					SS 21.74.01			
S 355 JR	1.0045	S 355 JR	AE 355 B	AE 355 B	SS 21.32.01	FE 510-B		
S 355 JO	1.0553	S 355 JO	AE 355 C	AE 355 C	SS 21.34.01	FE 510-C	St 510 C	NS 12 153
		S 355 J2G3	AE 355 D	AE 355 D	SS 21.35.01	FE 510-D	St 510 D	NS 12 153
S 355 J2	1.0577	S 355 J2G4			SS 26.42.00			
		S 355 K2G3		AE 355 DD	SS 26.44.11	FE 510-DD		
S 355 K2	1.0596	S 355 K2G4						

Remark: Qualities according to EN 10025 (93) can be performed with cold forming aptitude; the steel designation is then followed by the C letter.

STRUCTURAL STEELS (New European Designations)

New Designation according to:		Europe	Canada	India	Japan		International	U.S.A.
EN 10025-2		EN 10025 (93)	CSA 40-21	IS	JIS 3101	JIS 3106	ISO 630	ASTM
S185	1.0035	S185			SS 330			A 283
							E 185	A, B, C, D
S 235 JR	1.0038	S 235 JR(G2)	230 G	IS 226	SS 400	SM 400 A	E 235B	
S 235 JO	1.0114	S 235 JO		Fe 410-S		SM 400 B	E 235C	
		S 235 J2G3				SM 400 C	E235D	
S 235 J2	1.0117	S 235 J2G4						A 36
S 275 JR	1.0044	S 275 JR	260 W, WT	IS 2062			E275B	A 529
S 275 JO	1.0143	S 275 JO		Fe 410 WA			E275C	gr.50, 55
		S 275 J2G3		Fe 410 WB			E275 D	A 572
S 275 J2	1.0145	S 275 J2G4		Fe 410 WC				gr.42, 50
			300 W, WT					
								A 573
								gr.58, 65, 70
S 355 JR	1.0045	S 355 JR	350 W, WT	IS 961	SS 490	SM 490 A		A 633
S 355 JO	1.0553	S 355 JO		Fe 570 HT		SS 490 B	E355C	gr. A, C, D
		S 355 J2G3		Fe 540 WHT		SS 490 C	E355D	
S 355 J2	1.0577	S 355 J2G4				SS 490 YA		A 656
		S 355 K2G3				SS 490 YB		gr. 50
S 355 K2	1.0596	S 355 K2G4				SM 520 B		

						SM 520 C		A 709
								gr.36,50,50W
								A808

Remark: Qualities according to EN 10025 (93) can be performed with cold forming aptitude;
the steel designation is then followed by the C letter.

STRUCTURAL STEELS (New European Designations)

Following Designation EN 10.025 (90) + A1 (93)		PR. EN 10.025-2 (99)		PR. EN 10.025-2 (99) Forming qualities		PR. EN 10.025-3 (99) Weldable steels, fine grain normalized or normalized rolled		PR. EN 10.025-4 (99) Weldable steels, fine grain thermomechanical rolling		PR. EN 10.025-5 (99) Steels resistant to atmospheric corrosion	
According to EN 10027-1 et ECISS IC 10	According to EN 10027-2	According to EN 10027-1 et CR 10260	According to EN 10027-2	According to EN 10027-1	According to EN 10027-2	According to EN 10027-1	According to EN 10027-2	According to EN 10027-1	According to EN 10027-2	According to EN 10027-1	According to EN 10027-2
S185	1.0035	S185	1.0035								
S235JR	1.0037	—	—								
S235JRG1	1.0036	—	—	S235JRC	1.0122						
S235JRG2	1.0038	S235JR	1.0038	—	—						
S235J0	1.0114	S235J0	1.0114	S235JOC	1.0115					S235J0W	1.8958
S235J2G3	1.0116	—	—	—	—						
S235J2G4	1.0117	S235J2	1.0117	S235J2C	1.0119					S235J2W	1.8951
S275JR	1.0044	S275JR	1.0044	S275JRC	1.0128						
S275J0	1.0143	S275J0	1.0143	S275JOC	1.0140	S275N	1.0490	S275M	1.8818		
S275J2G3	1.0144	—	—	—	—	—	—	—	—		
S275J2G4	1.0145	S275J2	1.0145	S275J2C	1.0142	S275NL	1.0491	S275ML	1.8819		
S355JR	1.0045	S355JR	1.0045	S355JRC	1.0551					—	—
S355J0	1.0553	S355J0	1.0553	—	—					S355J0W	1.8959
S355J2G3	1.0570	—	—	S355JOC	1.0554					S355J0WP	1.8945
S355J2G4	1.0577	S355J2	1.0577	S355J2C	1.0579	S355N	1.0545	S355M	1.8823	S355J2W	1.8965
S355K2G3	1.0595	—	—	—	—	—	—	—	—	S355J2WP	1.8946
S355K2G4	1.0596	S355K2	1.0596	S355K2C	1.0594	S355NL	1.0546	S355ML	1.8824	S355K2W	1.8967
						S420N	1.8902	S420M	1.8825		
						S420NL	1.8912	S420ML	1.8836		
						S460N	1.8901	S460M	1.8827		
						S460NL	1.8903	S460ML	1.8838		

7.1 | Material data sheets

Designations, available types, temperature limits

HYDRA

Material group	Material no. to DIN EN 10 027	Short name to DIN EN 10 027	Short name to DIN (old)	Semi-finished product	Documentation	Documentation old	Upper temp. limit °C
Unalloyed steel	1.0254	P235TR1	St 37.0	Welded tube Seamless tube	DIN EN 10217-1 DIN EN 10216-1	DIN 1626 DIN 1629	300
	1.0255	P235TR2	St 37.4	Welded tube Seamless tube	DIN EN 10217-1 DIN EN 10216-1		
	1.0427	C22G1	C 22.3	Flanges	VdTÜV-W 364		350
Common structural steel	1.0038	S235JRG2	RSt 37-2	Steel bar, flat products, wire rod, profiles	DIN EN 10025 ADW1		300
	1.0050	E295	St 50-2				
	1.0570	S355J2G3	St 52-3				
Heat resistant unalloyed steel	1.0460	C22G2	C 22.8	Flanges	VdTÜVW 350		450
Heat resistant steel	1.0345	P235GH	H1	Sheet	DIN EN 10028	DIN 17155	480
				Seamless tube	DIN EN 10216		450
	1.0425	P265GH	H11	Sheet	DIN EN 10028	DIN 17155	480
	1.0481	P295GH	17 Mn 4	Sheet	DIN EN 10028 DIN 17175	DIN 17155	500
				Seamless tube			
	1.5415	16Mo3	15 Mo 3	Sheet	DIN EN 10028 DIN 17175	DIN 17155	530
				Seamless tube			
	1.7335	13CrMo4-5	13 CrMo 4 4	Sheet Seamless tube	DIN EN 10028 DIN 17175	DIN 17155	570
	1.7380	10CrMo9-10	10 CrMo 9 10	Sheet Seamless tube	DIN EN 10028 DIN 17175	DIN 17155	600
	1.0305	P235G1TH	St 35.8	Seamless tube	DIN 17175		480
Fine-grained structural steel Standard	1.0562	P355N	StE 355	Sheet Strip Steel bar	DIN EN 10028	DIN 17102	
heat resist.	1.0565	P355NH	WStE 355				400
cold resist.	1.0566	P355NL1	TStE 355				(-50) ¹⁾
special	1.1106	P355NL2	ESStE 355				(-60) ¹⁾

1) Cold resistant limit

7.1 | Material data sheets

Strength values at room temperature (RT)
(guaranteed values ¹⁾)

HYDRA

Material no. to DIN EN 10 027	Yield point min. R _{0.2H} N/mm ²	Tensile strength R _m N/mm ²	Breaking elongation, min. A ₅ % A ₈₀ %		Notched bar impact strength min. A _K (KV ²⁾) J	Remarks
1.0254	235	360-500	23			s ≤ 16
1.0255	235	360-500	23		at 0 °C: 27	s ≤ 16
1.0427	240	410-540	20 (transverse)		at RT: 31	s ≤ 70
1.0038	235	340-470	21-26 ¹⁾	17-21 ³⁾	at RT: 27	3 ≤ s ≤ 100 (R _m)
1.0050	295	470-610	16-20 ¹⁾	12-16 ³⁾		10 ≤ s ≤ 150 (KV)
1.0570	355	490-630	18-22 ¹⁾	14-18 ³⁾	at -20 °C: 27	s < 16 (R _{0.2H})
1.0460	240	410-540	20		at RT: 31	s ≤ 70
1.0345	235	360-480	25		at 0 °C: 27	s ≤ 16
	235	360-500	23		at 0 °C: 27	s ≤ 16
1.0425	265	410-530	23		at 0 °C: 27	s ≤ 16
1.0481	295	460-580	22		at 0 °C: 27	s ≤ 16
	270					
1.5415	275	440-590	24		at RT: 31	s ≤ 16
	270					
1.7335	300	440-600	20		at RT: 31	s ≤ 16
1.7380	310	480-630	18		at RT: 31	s ≤ 16
	280					
1.0305	235	360-480	23		at RT: 34	s ≤ 16
1.0562	355	490-630	22		at 0 °C: 47	s ≤ 16
1.0565					at 0 °C: 47	s ≤ 16
1.0566					at 0 °C: 55	s ≤ 16
1.1106					at 0 °C: 90	s ≤ 16

1) Smallest value of longitudinal or transverse test

2) New designation to DIN EN 10045; average of 3 specimens in DIN EN standards

3) Dependent on product thickness

7.1 | Material data sheets

Designations, available types, temperature limits

HYDRA

Material group	Material no. to DIN EN 10 027	Short name to DIN EN 10 027	Semi-finished product	Documentation	Documentation old	Upper temp. limit °C
Stainless ferritic steel	1.4511	X3CrNb17	Strip	DIN EN 10088 VdTÜV-W422	DIN 17441 ²⁾	200 nach VdTÜV
	1.4512	X2CrTi12	Strip	DIN EN 10088 SEW 400		350
Stainless austenitic steel	1.4301	X5CrNi18-10	Strip Strip Sheet	DIN EN 10088	DIN 17441/97 DIN 17440/96	550 / 300 ¹⁾
	1.4306	X2CrNi19-11	Strip Strip Sheet	DIN EN 10088	DIN 17441/97 DIN 17440/96	550 / 350 ¹⁾
	1.4541	X6CrNiTi18-10	Strip Strip Sheet	DIN EN 10088	DIN 17441/97 DIN 17440/96	550 / 400 ¹⁾
	1.4571	X6CrNiMoTi17-12-2	Strip Strip Sheet	DIN EN 10088	DIN 17441/97 DIN 17440/96	550 / 400 ¹⁾
	1.4404	X2CrNiMo17-12-2	Strip Strip Sheet	DIN EN 10088	DIN 17441/97 DIN 17440/96	550 / 400 ¹⁾
	1.4435	X2CrNiMo18-14-3	Strip Strip Sheet	DIN EN 10088	DIN 17441/97 DIN 17440/96	550 / 400 ¹⁾
	1.4565	X2CrNiMnMoNbN25-18-5-4	Strip, Strip Sheet	SEW 400 / 97	SEW 400 / 91	550 / 400 ¹⁾
	1.4539	X1NiCrMoCu25-20-5	Strip Sheet, Strip	DIN EN 10088		550 / 400 ¹⁾
			Seamless tube	VdTÜV-W421		400
	1.4529	X1NiCrMoCuN25-20-7	Strip Sheet, Strip Seamless tube	DIN EN 10088	VdTÜV-W 502	400
Austenitic steel of high heat resistance	1.4948	X6CrNi18-10	Strip Sheet strip Forging Seamless tube	DIN EN 10028-7 DIN EN 10222-5 DIN 17459	DIN 17460 DIN 17460	600 600 600
	1.4919	X6CrNiMo17-13	Sheet, strip, bar Forging Seamless tube	DIN 17460 DIN 17459		600 600
	1.4958	X5NiCrAlTi31-20	Sheet, strip, bar Forging Seamless tube	DIN 17460 DIN 17459		600 600

1) Temperature limit where risk of intercrystalline corrosion

2) Earlier standard DIN 17441 7/85

7.1 | Material data sheets

Strength values at room temperature (RT)
(guaranteed values ³⁾)

HYDRA

Material no. to DIN EN 10 027		Yield points min. R _{p0.2} N/mm ² R _{p1.0} N/mm ²		Tensile strength R _m N/mm ²	Breaking elongation, min. > 3 mm Thickness A ₅ % < 3 mm Thickness A ₈₀ %		Notched bar impact strength > 10 mm thickness, transverse min. KV in J	Remarks
1.4511		230		420-600		23		s ≤ 6
1.4512		210		380-560		25		s ≤ 6
1.4301	q	230	260	540-750	45	45	at RT: 60	s ≤ 6
	l	215	245		43	40		
1.4306	q	220	250	520-670	45	45	at RT: 60	s ≤ 6
	l	205	235		43	40		
1.4541	q	220	250	520-720	40	40	at RT: 60	s ≤ 6
	l	205	235		38	35		
1.4571	q	240	270	540-690	40	40	at RT: 60	s ≤ 6
	l	225	255		38	35		
1.4404	q	240	270	530-680	40	40	at RT: 60	s ≤ 6
	l	225	255		38	35		
1.4435	q	240	270	550-700	40	40	at RT: 60	s ≤ 6
	l	225	255		38	35		
1.4565	q	420	460	800-1000	30	25	at RT: 55	s ≤ 30
1.4539	q	240	270	530-730	35	35	at RT: 60	s ≤ 6
	l	225	255		33	30		
		220	250	520-720	40	40		
1.4529	q	300	340	650-850	40	40	at RT: 60	s ≤ 75
	l	285	325		38	35		
		300	340	600-800	40	40	at RT: 84	
1.4948	q	230	260	530-740	45	45	at RT: 60	s ≤ 6
	q	195	230	490-690	35		at RT: 60	s ≤ 250
	q	185	225	500-700	30		at RT: 60	
1.4919		205	245	490-690	35	30	at RT: 60	
		205	245	490-690	30		at RT: 60	
1.4958		170	200	500-750	35	30	at RT: 80	
		170	200	500-750	35		at RT: 80	s ≤ 50

3) Smallest value of longitudinal or transverse test, q = tensile test, transverse, l = tensile test, longitudinal

7.1 | Material data sheets

Designations, available types, temperature limits

HYDRA

Material group	Material no. to DIN EN 10 027 ¹⁾	Short name to DIN EN 10 027	Trade name	Semi-finished product	Documentation	Upper temp. limit °C
Heat resistant steel	1.4828	X15CrNiSi20-12		Strip Sheet, Strip,	DIN EN 10095 (SEW470)	900
	1.4876	X10NiCrAlTi32-21	INCOLOY 800	Strip Sheet, Strip all	SEW470 VdTÜV-W412	600
		X10NiCrAlTi32-21 H	INCOLOY 800 H	Strip Sheet, Strip all	VdTÜV-W434 DIN EN 10095	950 900
Nickel-based alloys	2.4858	NiCr21Mo	INCOLOY 825	all Strip Sheet, Strip	DIN 17750/02 VdTÜV-W432 DIN 17744 ²⁾	450
	2.4816	NiCr15Fe	INCONEL 600	Strip Sheet, Strip	DIN EN 10095 DIN 17750/02 VdTÜV-W305 DIN 17742 ²⁾	1000 450
			INCONEL 600 H			
	2.4819	NiMo16Cr15W	HASTELLOY C-276	Strip Sheet, Strip	DIN 17750/02 VdTÜV-W400 DIN 17744 ²⁾	450
	2.4856	NiCr22Mo9Nb	INCONEL 625	Flat products Strip Sheet, Strip	DIN EN 10095 DIN 17750/02 (VdTÜV-W499) DIN 17744 ²⁾	900 450
			INCONEL 625 H			
	2.4610	NiMo16Cr16Ti	HASTELLOY-C4	Strip Sheet, Strip Strip Sheet, Strip	DIN 17750/02 VdTÜV-W424 DIN 17744 ²⁾	400
	2.4360	NiCu30Fe	MONEL	Strip, Strip Sheet	DIN 17750/02 VdTÜV-W 263	425
				Seamless tube Forging	DIN 17743 ²⁾	

1) In the case of nickel-based alloys, DIN 17007 governs the material number

2) Chemical composition

7.1 | Material data sheets

Strength values at room temperature (RT)
(guaranteed values ³⁾)

HYDRA

Material no. to DIN EN 10 027 ¹⁾	Yield points min. R _{p0.2} N/mm ² R _{p1.0} N/mm ²		Tensile strength R _m N/mm ²	Breaking elongation, min. A ₅ % A ₈₀ %		Notched bar impact strength min. KV J	Remarks
1.4828	230	270	500-750				s ≤ 3 mm solution annealed
1.4876 INCOLOY 800	170 210	210 240	450-680 500-750	22 30		at RT: 150 ⁴⁾	Soft annealed
(1.4876 H) INCOLOY 800H	170 170	200 210	450 -700 450-680	30	28		solution annealed (AT)
2.4858 INCOLOY 825	240 235	270 265	≥ 550 550-750	30		at RT: 80	Soft annealed s ≤ 30 mm
2.4816 INCONEL 600 INCONEL 600 H	240 180 200 180	210 210 230 210	500-850 ≥ 550 550-750 500-700		28 30 35	at RT: 150 ⁴⁾ at RT: 150 ⁴⁾	Annealed (+A) solution annealed (F50) Soft annealed solution annealed
2.4819 HASTELLOY C-276	310 310	330 330	≥ 690 730-1000	30 30	30 30	at RT: 96	s ≤ 5 mm, solution annealed (F69)
2.4856 INCONEL 625 H INCONEL 625	415 275 400	305 305 440	820-1050 ≥ 690 830-1000			at RT: 100	s ≤ 3 mm, Annealed (+A) solution annealed (F69) s ≤ 3 mm; Soft annealed
2.4610 HASTELLOY-C4	305 280	340 315	≥ 690 700-900	40 40	30 30	at RT: 96 at RT: 96	s ≤ 5, solution annealed 5 < s ≤ 30
2.4360 MONEL	175 175	205	≥ 450 450-600	30 30		at RT: 120	s ≤ 50, Soft annealed Soft annealed

3) Smallest value of longitudinal or transverse test

4) Value a_k in J/cm²

7.1 | Material data sheets

Designations, available types, temperature limits

HYDRA

Material group	Material designation				Semi-finished product	Documentation	Documentation old	Upper temp. limit °C
	DIN EN 1652 (new)		DIN 17670 (old)					
	Number	Short name	Number	Short name				
Copper-based alloy	CW354H	CuNi30Mn1Fe	2.0882	CuNi30Mn1Fe CUNIFER 30 ¹⁾	Strip, Strip Sheet	DIN-EN 1652 AD-W 6/2	DIN 17664 DIN 17670	350
Copper	CW024A	Cu-DHP	2.0090	SF-Cu	Strip, Strip Sheet	DIN-EN 1652 AD-W 6/2	DIN 1787 DIN 17670	250
Copper-tin alloy	CW452K	CuSn6	2.1020	CuSn6 Bronze	Strip, Strip Sheet	DIN-EN 1652	DIN 17662 DIN 17670	
Copper-zinc alloy	CW503L	CuZn20	2.0250	CuZn 20	Strip, Strip Sheet	DIN-EN 1652	DIN 17660 DIN 17670	
	CW508L	CuZn37	2.0321	CuZn 37 Brass	Strip, Strip Sheet	DIN-EN 1652	DIN 17660 DIN 17670	
			2.0402	CuZn40Pb2	Strip, Strip Sheet	DIN 17670 DIN 17660		
	DIN EN 485-2 (new)		DIN 1745-1 (old)		Semi-finished product	Documentation	Documentation old	Upper temp. limit °C
	Number	Short Name	Number	Short Name				
Wrought aluminium alloy	EN AW-5754	EN AW-AI Mg3	3.3535	AlMg 3	Strip, Strip Sheet	DIN EN 485-2 DIN EN 575-3 AD-W 6/1	DIN 1745 DIN 1725	150 (AD-W)
	EN AW-6082	EN AW-AISi1MgMn	3.2315	AlMgSi 1	Strip, Strip Sheet	DIN-EN 485-2 DIN-EN 573-3	DIN 1745 DIN 1725	
Pure nickel	2.4068	LC-Ni 99		LC-Ni 99	Strip, Strip	VdTÜV-W 345		600
Titanium	3.7025	Ti 1		Ti 1	Sheet Strip, Strip Sheet	DIN 17 850 DIN 17 860 VdTÜV-W 230		250
Tantalum		Ta		Ta	Strip, Strip Sheet	VdTÜV-W382		250

1) Trade name

7.1 | Material data sheets

Strength values at room temperature (RT)
(guaranteed values ²⁾)

HYDRA

Material no.	Yield points min.		Tensile strength	Breaking elongation, min.	Notched bar impact strength min. KV J	Remarks
	R _{p0.2} N/mm ²	R _{p1.0} N/mm ²	R _m N/mm ²	A ₅ %		
CW354H 2.0882	≥ 120		350-420	35 ⁶⁾		R350 (F35) ⁴⁾ 0.3 ≤ s ≤ 15
CW024A 2.0090	≤ 100 ≤ 140		200-250 220-260	42 ⁶⁾ 33 ⁷⁾ / 42 ⁴⁾		R200 (F20) ⁴⁾ s > 5 mm R220 (F22) ⁴⁾ 0.2 ≤ s ≤ 5 mm
CW452K 2.1020	≤ 300		350-420	45 ⁷⁾ 55 ⁶⁾		R350 (F35) ⁴⁾ 0.1 ≤ s ≤ 5 mm
CW503L 2.0250	≤ 150		270-320	38 ⁷⁾ 48 ⁶⁾		R270 (F27) ⁴⁾ 0.2 ≤ s ≤ 5 mm
CW508L 2.0321	≤ 180		300-370	38 ⁷⁾ 48 ⁶⁾		R300 (F30) ⁴⁾ 0.2 ≤ s ≤ 5 mm
2.0402	≤ 300		≥ 380	35		(F38) ³⁾ 0.3 ≤ s ≤ 5 mm
Material no.	Yield points min.		Tensile strength	Breaking elongation, min.	Notched bar impact strength min. KV J	Remarks
	R _{p0.2} N/mm ²	R _{p1.0} N/mm ²	R _m N/mm ²	A ₅ %		
EN AW-5754 3.3535	≥ 80		190-240	14 (A50)		0.5 < s ≤ 1.5 mm State: 0 / H111 DIN EN-values
EN AW-6082 3.2315	≤ 85		≤ 150	14 (A50)		0.4 ≤ s ≤ 1.5 mm State: 0; DIN EN values
2.4068	≥ 80	≥ 105	340-540	40		
3.7025	≥ 180	≥ 200	290-410	30 / 24 ⁸⁾	62	0.4 < s ≤ 8 mm
TANTAL - ES	≥ 140		≥ 225	35 ³⁾		0.1 ≤ s ≤ 5.0 Electron beam melted Sintered in vacuum
TANTAL - GS	≥ 200		≥ 280	30 ³⁾		

2) Smallest value of longitudinal or transverse test

3) Measured length l₀ = 25 mm

4) State designation to DIN EN 1652 or (–) to DIN

5) To DIN, material not contained in the DIN EN

6) Specification in DIN EN for s > 2.5 mm

7) Breaking elongation A₅₀, specification in

DIN EN for s ≤ 2.5 mm

8) A50 for thicknesses ≤ 5 mm

7.1 | Material data sheets

Chemical composition
(percentage by mass)

HYDRA

Material group	Material no.	Short name	C ¹⁾	Si max.	Mn	P max.	S max.	Cr	Mo	Ni	Other elements
Unalloyed steel	1.0254	P235TR1	≤ 0.16	0.35	≤ 1.20	0.025	0.020	≤ 0.30	≤ 0.08	≤ 0.30	Cu ≤ 0.30 Cr+Cu+Mo+Ni ≤ 0.70
	1.0255	P235TR2	≤ 0.16	0.35	≤ 1.20	0.025	0.020	≤ 0.30	≤ 0.08	≤ 0.30	Cu ≤ 0.30 Cr+Cu+Mo+Ni ≤ 0.70 Al _{ges} ≥ 0.02
	1.0427	C22G1	0.18 - 0.23	0.15 - 0.35	0.40 - 0.90	0.035	0.030	≤ 0.30			Al _{ges} ≥ 0.015
Common structural steel	1.0038	S235JRG2	≤ 0.17		≤ 1.40	0.045	0.045				N ≤ 0.009
	1.0050	E295				0.045	0.045				N ≤ 0.009
	1.0570	S355J2G3	≤ 0.20	0.55	1.60	0.035	0.035				Al _{ges} ≥ 0.015
Heat resist. unalloyed steel	1.0460	C22G2	0.18 - 0.23	0.15 - 0.35	0.40 - 0.90	0.035	0.030	≤ 0.30			
Heat resistant steel	1.0345	P235GH	≤ 0.16	0.35	0.40 - 1.20	0.030	0.025	≤ 0.30	≤ 0.08	≤ 0.30	Nb, Ti, V Al _{ges} ≥ 0.020 Cu ≤ 0.30
	1.0425	P265GH	≤ 0.20	0.40	0.50	0.030	0.025	≤ 0.30	≤ 0.08	≤ 0.30	
	1.0481	P295GH	0.08 - 0.20	0.40	0.90 - 1.50	0.030	0.025	≤ 0.30	≤ 0.08	≤ 0.30	Cr+Cu+Mo+Ni ≤ 0.70
	1.5415	16Mo3	0.12 - 0.20	0.35	0.40 - 0.90	0.030	0.025	≤ 0.30	0.25 - 0.35	≤ 0.30	Cu ≤ 0.3
	1.7335	13CrMo4-5	0.08 - 0.18	0.35	0.40 - 1.00	0.030	0.025	0.70 - 1.15	0.40 - 0.60		Cu ≤ 0.3
	1.7380	10 CrMo9-10	0.08 - 0.14	0.50	0.40 - 0.80	0.030	0.025	2.00 - 2.50	0.90 - 1.10		Cu ≤ 0.3
	1.0305	P235G1TH	≤ 0.17	0.10 - 0.35	0.40 - 0.80	0.040	0.040				

1) Carbon content dependent on thickness. Values are for a thickness of ≤ 16mm.

7.1 | Material data sheets

Chemical composition
(percentage by mass)

HYDRA

Material group	Material no.	Short name	C max.	Si max.	Mn	P max.	S max.	Cr	Mo	Ni	Other elements
Fine-grained structural steel	1.0562	P355N	0.20	0.50	0.90 - 1.70	0.030	0.025	≤ 0.3	≤ 0.8	≤ 0.5	Al _{ges} ≥ 0.020 (s. DIN EN 10028-3)
	1.0565	P355NH	0.20	0.50	0.90 - 1.70	0.030	0.025	≤ 0.3	≤ 0.8	≤ 0.5	Cu, N, Nb, Ti, V Nb + Ti + V ≤ 0.12
	1.0566	P355NL1	0.18	0.50	0.90 - 1.70	0.030	0.020	≤ 0.3	≤ 0.8	≤ 0.5	
	1.1106	P355NL2	0.18	0.50	0.90 - 1.70	0.025	0.015	≤ 0.3	≤ 0.8	≤ 0.5	
Stainless ferritic steel	1.4511	X3CrNb17	0.05	1.00	≤ 1.00	0.040	0.015	16.0 - 18.0			Nb: 12 x % C - 1,00
	1.4512	X2CrTi12	0.03	1.00	≤ 1.00	0.040	0.015	10.5 - 12.5			Ti: 6 x (C+N) - 0.65
Stainless austenitic steel	1.4301	X5CrNi18-10	0.07	1.00	≤ 2.00	0.045	0.015	17.0 - 19.5		8.00 - 10.50	
	1.4306	X2CrNi19-11	0.03	1.00	≤ 2.00	0.045	0.015	18.0 - 20.0		10.0 - 12.0	
	1.4541	X6CrNiTi18-10	0.08	1.00	≤ 2.00	0.045	0.015	17.0 - 19.0		9.0 - 12.0	Ti: 5 x % C - 0.7
	1.4571	X6CrNiMoTi17 12 2	0.08	1.00	≤ 2.00	0.045	0.015	16.5 - 18.5	2.0 - 2.5	10.5 - 13.5	Ti: 5 x % C - 0.7
	1.4404	X2CrNiMo17 12 2	0.03	1.00	≤ 2.00	0.045	0.015	16.5 - 18.5	2.0 - 2.5	10.0 - 13.0	N ≤ 0.11
	1.4435	X2CrNiMo18 14 3	0.03	1.00	≤ 2.00	0.045	0.015	17.0 - 19.0	2.5 - 3.0	12.5 - 15.0	
	1.4565	X2CrNiMoNb2518-5-4	0.04	1.00	4.50 - 6.50	0.030	0.015	21.0 - 25.0	3.0 - 4.5	15.0 - 18.0	Nb ≤ 0.30, N: 0.04 - 0.15
	1.4539	X1NiCrMoCu25-20-5	0.02	0.70	≤ 2.00	0.030	0.010	19.0 - 21.0	4.0 - 5.0	24.0 - 26.0	Cu, N: ≤ 0.15
	1.4529	X2NiCrMoCuN25-20-7	0.02	0.50	≤ 1.00	0.030	0.010	19.0 - 21.0	6.0 - 7.0	24 - 26.0	Cu: 0.5 - 1 N: 0.15 - 0.25

7.1 | Material data sheets

Chemical composition
(percentage by mass)

HYDRA

Material group	Material no.	Short name Trade name	C	Si	Mn	P max.	S max.	Cr	Mo	Ni	Other elements
Austenitic steel of high heat resistance	1.4948	X6CrNi18-10	0.04 - 0.08	≤ 1.00	≤ 2.0	0.035	0.015	17.0 - 19.0		8.0 - 11.0	
	1.4919	X6CrNiMo 17-13	0.04 - 0.08	≤ 0.75	≤ 2.0	0.035	0.015	16.0 - 18.0	2.0 - 2.5	12.0 - 14.0	
Heat resistant steel	1.4828	X15CrNiSi 20-12	≤ 0.20	1.50 - 2.00	≤ 2.0	0.045	0.015	19.0 - 21.0		11.0 - 13.0	N: max 0.11
	1.4876 (DIN EN 10095)	X10NiCrAlTi32-21 INCOLOY 800H	≤ 0.12	≤ 1.00	≤ 2.0	0.030	0.015	19.0 - 23.0		30.0 - 34.0	Al: 0.15 - 0.60 Ti: 0.15 - 0.60
Nickel-based alloy	2.4858	NiCr21Mo INCOLOY 825	≤ 0.025	≤ 0.50	≤ 1.0	0.020	0.015	19.5 - 23.5	2.5 - 3.5	38.0 - 46.0	Ti, Cu, Al, Co ≤ 1.0
	2.4816	NiCr15Fe INCONEL 600 INCONEL 600 H	0.05 - 0.10	≤ 0.50	≤ 1.0	0.020	0.015	14.0 - 17.0		> 72	Ti, Cu, Al
	2.4819	NiMo16Cr15W HASTELLOY C-276	≤ 0.01	0.08	≤ 1.0	0.020	0.015	14.5 - 16.5	15.0 - 17.0	Re- mainder	V, Co, Cu, Fe
	2.4856	NiCr22Mo9Nb INCONEL 625 INCONEL 625 H	0.03 - 0.10	≤ 0.50	≤ 0.5	0.020	0.015	20.0 - 23.0	8.0 - 10.0	> 58	Ti, Cu, Al Nb/Ta: 3.15 - 4.15 Co ≤ 1.0
	2.4610	NiMo16Cr16Ti HASTELLOY C4	≤ 0.015	≤ 0.08	≤ 1.0	0.025	0.015	14.0 - 18.0	14.0 - 17.0	Re- mainder	Ti, Cu, Co ≤ 2.0
	2.4360	NiCu30Fe MONEL	≤ 0.15	≤ 0.50	≤ 2.0		0.020			> 63	Cu: 28 - 34% Ti, Al, Co ≤ 1.0
Copper-based alloy	2.0882	CuNi 30 Mn1 Fe CUNIFER 30	≤ 0.05		0.5 - 1.5		0.050			30.0 - 32.0	Cu: Rest, Pb, Zn

7.1 | Material data sheets

Chemical composition
(percentage by mass)

HYDRA

Material group	Material no.	Short name	Cu	Al	Zn	Sn	Pb	Ni	Ti	Ta	Other elements
Copper	CW024A (2.0090)	Cu DHP (SF-Cu)	≥ 99.9								P: 0.015 - 0.04
Copper-tin alloy	CW452K (2.1020)	CuSn 6 Bronze	Rest		≤ 0.2	5.5 - 7.0	≤ 0.20	≤ 0.2			P: 0.01 - 0.4 Fe: ≤ 0.1
Copper-zinc alloy	CW503L 2.0250	CuZn 20	79.0 - 81.0	≤ 0.02	Re- mainder	≤ 0.1	≤ 0.05				
	CW508L (2.0321)	CuZn 37 Brass	62.0 - 64.0	≤ 0.05	Re- mainder	≤ 0.1	≤ 0.10	≤ 0.3			
	2.0402	CuZn 40 Pb 2	57.0 - 59.0	≤ 0.10	Re- mainder	≤ 0.3	1.50 - 2.50	≤ 0.4			
Wrought aluminium alloy	EN AW-5754 (3.3535)	EN AW-Al Mg3	≤ 0.10	Re- mainder	≤ 0.1				≤ 0.15		Si, Mn, Mg
	EN AW-6082 (3.2315)	EN AW-Al SiMgMn	≤ 0.10	Re- mainder	≤ 0.2				≤ 0.1		Si, Mn, Mg
Pure nickel	2.4068	LC-Ni 99	≤ 0.025					≥ 99	≤ 0.1		C ≤ 0.02 Mg ≤ 0.15 S ≤ 0.01 Si ≤ 0.2
Titanium	3.7025	Ti							Re- mainder		N ≤ 0.05 H ≤ 0.013 C ≤ 0.06 Fe ≤ 0.15
Tantalum	-	Ta						≤ 0.01	≤ 0.01	Rem.	

7.1 | Material data sheets

Strength values at elevated temperatures

HYDRA

Material no. to DIN	Type of value	Material strength values in N/mm ²															
		Temperatures in °C															
		RT ¹⁾	100	150	200	250	300	350	400	450	500	550	600	700	800		
1.0254	R _{p 0,2}	235															
1.0255	R _{p 0,2}	235															
1.0427	R _{p 0,2}	220	210	190	170	150	130	110									
1.0038	R _{p 0,2}	205	187		161	143	122	(values to AD W1)									
1.0570	R _{p 0,2}	315	254		226	206	186										
1.0460	R _{p 0,2}	240	230	210	185	165	145	125	100	80							
	R _{p 1/100000}								136	80	(53)						
	R _{p 1/1000000}								95	49	(30)						
	R _{m 10000}								191	113	(75)						
	R _{m 100000}								132	69	(42)						
1.0345	R _{p 0,2}	206	190	180	170	150	130	120	110								
	R _{p 1/100000}								136	80	(53)						
	R _{p 1/1000000}								95	49	(30)						
	R _{m 10000}								191	113	(75)						
	R _{m 100000}								132	69	(42)						
1.0425	R _{p 0,2}	234	215	205	195	175	155	140	130	80	(53)						
	R _{p 1/100000}								95	49	(30)						
	R _{p 1/1000000}								191	113	(75)						
	R _{m 10000}								132	69	(42)						
	R _{m 200000}								115	57	(33)						
1.0481	R _{p 0,2}	272	250	235	225	205	185	170	155	130	(53)						
	R _{p 1/100000}								167	93	49						
	R _{p 1/1000000}								118	59	29						
	R _{m 10000}								243	143	74						
	R _{m 100000}								179	85	41						
1.5415	R _{p 0,2}	275			215	200	170	160	150	145	140						
	R _{p 1/100000}								216	132		(84)					
	R _{p 1/1000000}								167	73	(36)						
	R _{m 10000}								298	171	(102)						
	R _{m 100000}								239	101	(53)						
1.7335	R _{p 0,2}				230	220	205	190	180	170	165						
	R _{p 1/100000}								245	157	(53)						
	R _{p 1/1000000}								191	98	(24)						
	R _{m 10000}								370	239	(76)						
	R _{m 100000}								285	137	(33)						
	R _{m 200000}								260	115	(26)						

1) Room temperature values valid up to 50 °C

7.1 | Material data sheets

Strength values at elevated temperatures

HYDRA

Material no. to DIN	Type of value	Material strength values in N/mm ²															
		Temperatures in °C															
		RT ¹⁾	100	150	200	250	300	350	400	450	500	550	600	700	800		
1.7380	R _{p 0,2}				245	230	220	210	200	190	180						
	R _{p 1/100000}									240	147	83	44				
	R _{p 1/1000000}									166	103	49	22				
	R _{m 10000}									306	196	108	61				
	R _{m 100000}									221	135	68	34				
	R _{m 200000}									201	120	58	28				
1.0305	R _{p 0,2}	235			185	165	140	120	110	105							
	R _{p 1/100000}								136	80	(53)						
	R _{p 1/1000000}								95	49	(30)						
	R _{m 10000}								191	113	(75)						
	R _{m 100000}								132	69	(42)						
	R _{m 200000}								115	57	(33)						
1.0565	R _{p 0,2}	336	304	284	245	226	216	196	167								
1.4511	R _{p 0,2}	230	230	220	205	190	180	165									
1.4512	R _{p 0,2}	210	200	195	190	186	180	160									
1.4301	R _{p 0,2}	215	157	142	127	118	110	104	98	95	92	90					
	R _{p 1}		191	172	157	145	135	129	125	122	120	120					
	R _{m 10000}							(approx. values to DIN 17441)					122	48	(17)		
	R _{m 100000}												74	23	(5)		
	R _{m 200000}																
1.4306	R _{p 0,2}	205	147	132	118	108	100	94	89	85	81	80					
	R _{p 1}		181	162	147	137	127	121	116	112	109	108					
1.4541	R _{p 0,2}	205	176	167	157	147	136	130	125	121	119	118					
	R _{p 1}		208	196	186	177	167	161	156	152	149	147					
	R _{m 10000}							(approx. values to DIN 17441)					115	45	(17)		
	R _{m 100000}												65	22	(8)		
	R _{m 200000}																
1.4571	R _{p 0,2}	225	185	177	167	157	145	140	135	131	129	127					
	R _{p 1}		218	206	196	186	175	169	164	160	158	157					
1.4404	R _{p 0,2}	225	166	152	137	127	118	113	108	103	100	98					
	R _{p 1}		199	181	167	157	145	139	135	130	128	127					
1.4435	R _{p 0,2}	225	165	150	137	127	119	113	108	103	100	98					
	R _{p 1}		200	180	165	153	145	139	135	130	128	127					
1.4565	R _{p 0,2}	420	350	310	270	255	240	225	210	210	210	200					
	R _{p 1}	460	400	355	310	290	270	255	240	240	240	230					
1.4539	R _{p 0,2}	220	205	190	175	160	145	135	125	115	110	105					
	R _{p 1}		235	220	205	190	175	165	155	145	140	135					
	R _{m (VdTV)}	520	440	420	400	390	380	370	360								
1.4529	R _{p 0,2}	300	230	210	190	180	170	165	160								
	R _{p 1}	340	270	245	225	215	205	195	190								

1) Room temperature values valid up to 50 °C

7.1 | Material data sheets

Strength values at elevated temperatures

HYDRA

Material no. to DIN	Type of value	Material strength values in N/mm ²															
		Temperatures in °C															
		RT ¹⁾	100	150	200	250	300	350	400	450	500	550	600	700	800	900	
1.4948	R _{p 0,2}	230	157	142	127	117	108	103	98	93	88	83	78				
	R _{p 1}	260	191	172	157	147	137	132	127	122	118	113	108				
	R _m	530	440	410	390	385	375	375	375	370	360	330	300				
	R _{p 1/100000}										147	121	94	35			
	R _{p 1/1000000}										114	96	74	22			
	R _{m 10000}										250	191	132	55			
	R _{m 100000}										192	140	89	28			
1.4919	R _{p 0,2}	205	177		147		127		118		108	103	98				
	R _{p 1}	245	211		177		157		147		137	132	128				
	R _{p 1/100000}											180	125	46			
	R _{p 1/1000000}											125	85	25			
	R _{m 10000}											250	175	65			
	R _{m 100000}											175	120	34			
1.4828 DIN EN 10095	R _{p 0,2}	230	332		318		300		279		253		218	(Manufacturer's figures)			
	R _m	550	653		632		600		550		489		421				
	R _{p 1/1000}												120	50	20	8	
	R _{p 1/100000}												80	25	10	4	
	R _{m 10000}												190	75	35	15	
	R _{m 100000}												120	36	18	8.5	
													65	16	7,5	3.0	
1.4876 DIN EN 10095 Incoloy 800H	R _{p 0,2}	170	185	170	160	150	145		130		125	120	115	(Manufacturer's figures)			
	R _{p 1}	210	205	190	180	170	165		150		145	140	135				
	R _m	450	425		400		390		380		360		300				
	R _{p 1/1000}												130	70	30	13	
	R _{p 1/100000}												90	40	15	5	
	R _{m 10000}												200	90	45	20	
	R _{m 100000}												152	68	30	10	
2.4858	R _{p 0,2}	235	205	190	180	175	170	165	160	155							
	R _{p 1}	265	235	220	205	200	195	190	185	180							
	R _m	550	530		515		490		485								
2.4816 DIN EN 10095	R _{p 0,2}	200	180		165		155		150	145				(Soft annealed)			
	R _m	550	520		500		485		480	475							
		-750															
	R _{p 0,2}	180	170		160		150		150	145				(solution annealed)			
	R _m	500	480		460		445		440	435							
		-700															
	R _{p 1/100000}										153		91	43	18	8	
	R _{p 1/1000000}										126		66	28	12	4	
	R _{m 10000}												160	96	38	22	
	R _{m 100000}										297		138	63	29	13	
	R _{m 1000000}										215		97	42	17	7	

1) Room temperature values valid up to 50 °C

7.1 | Material data sheets

Strength values at elevated temperatures

HYDRA

Material no. to DIN	Type of value	Material strength values in N/mm ²															
		Temperatures in °C															
		RT	100	150	200	250	300	350	400	450	500	550	600	700	800	900	
2.4819 Vd TÜV-W 400	R _{p 0,2}	310	280		240		220		195								
	R _{p 1}	330	305		275		215		200								
2.4856 DIN EN 10095	R _{p 0,2}	410	350		320		300		280		170						
	R _{p 1/1000000}															250	90
	R _{m 1000000}															290	135
	R _{m 10000}															260	107
2.4610	R _{p 0,2}																
	R _{p 1}	305	285		255		245		225								
2.4360	R _{p 0,2}	340	315		285		270		260								
	R _m	175	150	140	135	132	130	130	130	(130)							
	R _{p 1/100000}	450	420	400	390	385	380	375	370	(360)							
	R _{p 1/1000000}				107	99	92	84									
	R _{p 1/1000000}				102	94	86	78									
	K/S	93	87	84	82	80	78	75									
CW354H 2.0882	R _{p 1}	140	130	126	123	120	117	112									
	R _{p 1/100000}				107	99	92	84									
	R _{p 1/1000000}				102	94	86	78									
	K/S	93	87	84	82	80	78	75									
CW024A 2.0090	R _{p 1}	65	58	58													
	R _m	220	220	195	170	145											
	R _{p 2/100000}		58	53	46	37											
	R _{p 2/1000000}		56	49	40	30											
	K/S	57	57	50	43	36											
	K/S	67	63	56	49	41											
3.3535 EN-AW 5754	R _{p 0,2}	80	70														
	R _{m 1000000}	(80)	45														
2.4068 Nickel	R _{p 0,2}	80	70		65		60		55		50		40				
	R _{p 1}	105	95		90		85		80		75		65				
	R _m	340	290		275		260		240		210		150				
	R _{p 1/100000}																
	R _{p 1/1000000}																
3.7025 Titan	R _{p 1}	200	180	150	110	90											
	R _{m 100000}	220	160	150	130	110											
	R _{m 1000000}	200	145	130	120	90											
Tantal	R _{p 0,2}	140	100	90	80	70											
	R _m	225	200	185	175	160	150										
	A _{30[%]}	35															
	R _{p 0,2}	200	160	150	140	130											
	R _m	280	270	260	240	230											
	A _{30[%]}	25															

1) Room temperature values valid up to 50 °C

7.1 | Material data sheets

Material designations according to international specifications

HYDRA

Material no. to DIN EN	USA			JAPAN		
	Standard	UNS designation	Semi-finished product applications / title	Standard	Designation	Semi-finished product applications
1.0254	ASTM A 53-01	K02504 A 53	Welded and seamless black-oxidized and galvanized steel tubes	JIS G 3445 (1988)	STKM 12 A	Tubes
	ASTM A 106-99	K02501 A 106	Seamless tubes of high-temperature unalloyed steel	JIS G 3454 (1988)	STPG 370	Pipes under pressure
				JIS G 3457 (1988)	STPY 400	Welded tubes
1.0255	ASTM A 135-01	K03013 A 135	Electric resistance welded tubes	JIS G 3455 (1988)	STS 370	Pipes subjected to high pressures
1.0038	ASTM A 500-01	K03000 A 500	Welded and seamless fittings of cold-formed unalloyed steel			
1.0050				JIS G 3101 (1995)	SS 490	General structural steels
1.0570	ASTM A 694-00	K03014 A 694	Forgings of unalloyed and alloyed steel for pipe flanges, fittings, valves and other parts for high-pressure drive systems	JIS G 3106 (1999)	SM 490 A	Steels for welded constructions
				JIS G 3106 (1999)	SM 520 B	
1.0345	ASTM A 414-01	K02201 A 414	Sheet of unalloyed steel for pressure tanks	JIS G 3115 (2000)	SPV 450	Heavy plate for pressure vessels
1.0425	ASTM A 414-01	K02505 A 414		JIS G 3118 (2000)	SGV 480	
1.0481	ASTM A 414-01	K02704 A 414		JIS G 3118 (2000)	SGV 410	
1.5415	ASTM A 204-99	K12320 A 204	Sheet of molybdenum alloyed steel for pressure tanks	JIS G 3458 (1988)	STPA 12	Tubes
1.7335	ASTM A 387-99	K11789 A 387	Sheet of Cr-Mo alloyed steel for pressure tanks	JIS G 3462 (1988)	STBA 22	Boiler and heat exchanger pipes
1.7380	ASTM A 387-99	K21590 22 (22L)		JIS G 4109 (1987)	SCMV 4	Heavy plate for pressure vessels
1.0305	ASTM A 106-99	K02501 A 106	Seamless tubes of high-temperature unalloyed steel	JIS G 3461 (1988)	STB 340	Boiler and heat exchanger pipes

7.1 | Material data sheets

Material designations according to international specifications

HYDRA

Material no. to DIN EN	KOREA			CHINA		
	Standard	Designation	Semi-finished product applications	Standard	Designation	Semi-finished product applications
1.0254	KS D 3583 (1992)	SPW 400	Welded tubes of carbon steel			
1.0255						
1.0038				GBT 700 (1988)	Q 235 B; U12355	(unalloyed structural steels)
1.0050	KS D 3503 (1993)	SS 490	General structural steels	GBT 700 (1988)	Q 275; U12752	
1.0570	KS D 3517 (1995)	STKM 16C	Unalloyed steel tubes for general mechanical engineering	GBT 713 (1997)	16Mn; L20162	Plate for steam boilers
				GBT 8164 (1993)	16Mn; L20166	Strip for welded tubes
1.0345	KS D 3521 (1991)	SPPV 450	Heavy plate for pressure vessels for medium application temp.			
1.0425	KS D 3521 (1991)	SPPV 315				
1.0481						
1.5415	KS D 3572 (1990)	STHA 12	Tubes for boilers and heat exchangers	GB 5310 (1995)	15MoG; A65158	Seamless tubes for pressure vessels
1.7335	KS D 3572 (1990)	STHA 22		YBT 5132 (1993)	12CrMo; A30122	Plate of alloyed structural steels
1.7380	KS D 3543 (1991)	SCMV 4	Cr-Mo steel for pressure vessels	GB 5310 (1995)	12Cr2MoG; A30138	Seamless tubes for pressure vessels
1.0305						

7.1 | Material data sheets

Material designations according to international specifications

HYDRA

Material no. to DIN EN	USA			JAPAN		
	Standard	UNS designation (AISI)	Semi-finished product applications / title	Standard	Designation	Semi-finished product applications
1.0562	ASTM A 299-01	K02803 A 299	Plate of C-Mn-Si steel for pressure tanks	JIS G 3106 (1999)	SM 490 A;B;C;	Steels for welded constructions
	ASTM A 714-99	K12609 A 714 (II)	Welded and seamless tubes of high-strength low-alloy steel	JIS G 3444 (1994)	STK 490	Steels for welded constructions
1.0565	ASTM A 633-01	K12037 A633(D)	Normalized high-strength low-alloy structural steel			
	ASTM A 724-99	K12037 A724(C)	Plate of tempered unalloyed steel for welded pressure tanks of layered construction			
1.0566	ASTM A 573-00	K02701 A 573	Plate of unalloyed structural steel with improved toughness	JIS G 3126 (2000)	SLA 365	Heavy plate for pressure vessels (low temperature)
1.1106	ASTM A 707-02	K12510 A 707 (L3)	Forged flanges of alloyed and unalloyed steel for use in low temperatures	JIS G 3444 (1994)	STK 490	Tubes for general use

7.1 | Material data sheets

Material designations according to international specifications

HYDRA

Material no. to DIN EN	KOREA			CHINA		
	Standard	Designation	Semi-finished product applications / title	Standard	Designation	Semi-finished product applications
1.0562						
1.0565						
1.0566	KS D 3541 (1991)	SLA1 360	Heavy plate for pressure vessels (low temperature)	GB T 714 (2000)	Q420q-D; L14204	Steels for bridge construction
1.1106				GB 6654 (1996)	16MnR; L20163	Heavy plate for pressure vessels

7.1 | Material data sheets

Material designations according to international specifications

HYDRA

Material no. to DIN EN	USA			JAPAN		
	Standard	UNS designation (AISI)	Semi-finished product applications / title	Standard	Designation	Semi-finished product applications
1.4511				JIS G 4305 (1999)	SUS 430LX	Cold-rolled sheet, heavy plate and strip
1.4512	ASTM A 240-02	S40900; A 240 (409)	Sheet and strip of heatproof stainless Cr and Cr-Ni steel for pressure tanks			
1.4301	ASTM A 240-02	S30400; A 240 (304)		JIS G 4305 (1999)	SUS 304	Cold-rolled sheet, heavy plate and strip
1.4306	ASTM A 240-02	S30403; A 240 (340L)		JIS G 4305 (1999)	SUS 304L	
1.4541	ASTM A 240-02	S32100 A 240 (321)		JIS G 4305 (1999)	SUS 321	
1.4571	ASTM A 240-02	S31635 A240 (316Ti)		JIS G 4305 (1999)	SUS 316Ti	
1.4404	ASTM A 240-02	S31603 A240 (316L)		JIS G 4305 (1999)	SUS 316L	
1.4435	ASTM A 240-02	S31603 A240 (316L)		JIS G 4305 (1999)	SUS 316L	
1.4565	ASTM A 240-02	S34565 A240				
1.4539	ASTM A 240-02	N08904 A240 (904L)				
1.4529	ASTM B 625-99	N08925 B 625	Sheet and strip of low-carbon Ni-Fe-Cr-Mo-Cu alloys			

7.1 | Material data sheets

Material designations according to international specifications

HYDRA

Material no. to DIN EN	KOREA			CHINA		
	Standard	Designation	Semi-finished product applications	Standard	Designation	Semi-finished product applications
1.4511	KS D 3698 (1992)	STS 430LX	Cold-rolled sheet, heavy plate and strip			Cold-rolled sheet, heavy plate and strip
1.4512				GBT 4238 (1992)	0Cr11Ti; S11168	Hot-rolled sheet of heatproof steel, ferritic
1.4301	KS D 3698 (1992)	STS 304	Cold-rolled sheet, heavy plate and strip	GBT 3280 (1992)	0Cr18Ni9; S30408	Cold-rolled sheet, heavy plate and strip
1.4306	KS D 3698 (1992)	STS 304L		GBT 3280 (1992)	00Cr19Ni10; S30403	
1.4541	KS D 3698 (1992)	STS 321		GBT 3280 (1992)	0Cr18Ni10Ti; S32168	
1.4571	KS D 3698 (1992)	STS 316Ti		GBT 3280 (1992)	0Cr18Ni12Mo2Cu2 S31688	
1.4404	KS D 3698 (1992)	STS 316L		GBT 4239 (1991)	00Cr17Ni14Mo2; S31603	
1.4435	KS D 3698 (1992)	STS 316L		GBT 3280 (1992)	00Cr17Ni14Mo2; S31603	
1.4565						
1.4539						
1.4529	KS D 3698 (1992)	STS 317J5L	Cold-rolled sheet, heavy plate and strip			

7.1 | Material data sheets

Material designations according to international specifications

HYDRA

Material no. to DIN EN	USA			JAPAN		
	Standard	UNS designation (AISI)	Semi-finished product applications / title	Standard	Designation	Semi-finished product applications
1.4948	ASTM A 240-02	S30409 A240 (304H)	Sheet and strip of heatproof stainless Cr and Cr-Ni steel for pressure tanks			
1.4919	ASTM A 240-02	S31609 A240 (316H)				
1.4958	ASTM A 240-02	N 08810 A 240				
1.4828	ASTM A 167-99	S30900 A 167 (309)	Sheet and strip of stainless heatproof Cr-Ni steel	JIS G 4312 (1991)	SUH 309	Heatproof sheet and heavy plate
1.4876	ASTM A 240-02	N 08800 A 240	Sheet and strip of stainless heatproof Cr and Cr-Ni steel for pressure tanks	JIS G 4902 (1991)	NCF 800	Special alloy in sheet form
2.4858	ASTM B 424-98	N 08825 B 424	Sheet and strip of low-carbon Ni-Fe-Cr-Mo-Cu alloys (UNS N08825 and N08221)	JIS G 4902 (1991)	NCF 825	
2.4816	ASTM B 168-98	N 06600 B 168	Sheet and strip of low-carbon Ni-Cr-Fe and Ni-Cr-Co-Mo alloys (UNS N06600 and N06690)			
2.4819	ASTM B 575-99	N 10276 B 575	Sheet and strip of low-carbon Ni-Mo-Cr alloys			
2.4856	ASTM B 443-99	N 06625 B 443	Sheet and strip of Ni-Cr-Mo-Nb alloy (UNS N06625)	JIS G 4902 (1991)	NCF 625	Special alloy in sheet form
2.4610	ASTM B 575-99	N 06455 B 575	Sheet and strip of low-carbon Ni-Mo-Cr alloys			
2.4360	ASTM B 127-98	N 04400 B 127	Sheet and strip of Ni-Cu alloy (UNS N04400)			

7.1 | Material data sheets

Material designations according to international specifications

HYDRA

Material no. to DIN EN	KOREA			CHINA		
	Standard	Designation	Semi-finished product applications	Standard	Designation	Semi-finished product applications
1.4948						
1.4919						
1.4958						
1.4828	KS D 3732 (1993)	STR 309	Heatproof sheet and heavy plate	GBT 1221 (1992)	1Cr20Ni14Si2; S38210	Heatproof steels, austenitic
1.4876	KS D 3532 (1992)	NCF 800	Special alloys in sheet and heavy plate form	GBT 15007 (1994)	NS 111; H01110	Stainless alloys
2.4858	KS D 3532 (1992)	NCF 825		GBT 15007 (1994)	NS 142; H01420	
2.4816				GBT 15007 (1994)	NS 312; H03120	
2.4819				GBT 15007 (1994)	NS 333; H03330	
2.4856	KS D 3532 (1992)	NCF 625	Special alloys in sheet and heavy plate form	GBT 15007 (1994)	NS 336; H03360	
2.4610				GBT 15007 (1994)	NS 335; H03350	
2.4360						

7.1 | Material data sheets

Permissible operating pressures and temperatures for threaded fittings in malleable cast iron

Threaded fasteners of malleable cast iron are applicable up to the operating pressures indicated in the table below, depending on type of fluid and operating temperature.

permissible operating pressure for the fluids					
DN	d inch	water and gas up to max. 120 °C	gases and steam up to max. 150 °C	gases and steam up to 300 °C	oils up to 200 °C
nipples, flat sealing threaded fasteners					
6-50	1/4 - 2	65 bar	50 bar	40 bar	35 bar
conically sealing threaded fasteners					
6-32	1/4 - 1 1/4	65 bar	50 bar	40 bar	35 bar
40	1 1/2	65 bar	50 bar	40 bar	30 bar
50	2	55 bar	40 bar	32 bar	24 bar

Sealing is to be carried out with special care. The sealing materials are to be selected according to the operating conditions. Only approved sealing materials must be applied for sealing of threaded fasteners in drinking water and gas insulations.

Only high-quality threads are appropriate for high operating requirements.

Cross Reference to Steels

FRANCE

Designation	AISI	Page
AFNOR		
20 MC 5	5120	167
20 MC 5	5120H	167
20 NCD 2	8617	188
20 NCD 2	8617H	188
20 NCD 2	8620	189
20 NCD 2	8620H	189
22 NCD 2	8617	188
22 NCD 2	8617H	188
22 NCD 2	8620	189
22 NCD 2	8620H	189
25 CD 4 (S)	4130	108
25 CD 4 (S)	4130H	108
32 C 4	5130H	168
32 C 4	5132	170
32 DCV 28	H10	457
35 CD 4	4135	110
35 CD 4	4135H	110
35 CD 4 TS	4135	110
35 CD 4 TS	4135H	110
35 M 5	1039	26
38 C 4	5132H	170
38 C 4	5135	171
40 CD 4	4137	112
40 CD 4	4137H	112
40 CD 4	4140	113
40 CD 4	4140H	113
40 M 5	1335	81
40 M 5	1335H	81
42 C 2	5140H	172
42 C 2	5150	175
42 C 4	5135H	171
42 C 4	5140	172
42 CD 4	4137	112
42 CD 4	4137H	112
42 CD 4	4140	113
42 CD 4	4140H	113
45 C 2	5140H	172
45 C 2	5150	175
50 CV 4	6150	182
50 CV 4	6150H	182
55 C 3	5155	177
55 C 3	5155H	177
55 S 7	9255	220
55 WC 20	S1	436
60 S 7	9260	222
60 S 7	9260H	222
61 SC 7	9260	222
61 SC 7	9260H	222
90 MV 8	O2	440
100 C 6	E52100	154
CC 20	1020	16
CC 35	1035	21
CC 55	1060	34
XC 10	1010	10
XC 15	1015	11
XC 15	1017	13
XC 18	1015	11
XC 18	1017	13
XC 18 S	1023	20
XC 25	1023	20
XC 32	1034	21
XC 35	1034	21
XC 38	1034	21

FRANCE (continued)

Designation	AISI	Page
AFNOR		
XC 38 TS	1038	26
XC 38 TS	1038H	26
XC 42	1045	30
XC 42	1045H	30
XC 42 TS	1045	30
XC 42 TS	1045H	30
XC 45	1045	30
XC 45	1045H	30
XC 48	1045	30
XC 48	1045H	30
XC 60	1064	40
XC 65	1064	40
XC 68	1070	40
XC 90	1086	488
Z 2 CND 17.12	316L	296
Z 2 CND 19.15	317L	303
Z 6 CA 13	405	324
Z 6 CN 18.09	304	273
Z 6 CND 17.11	316	292
Z 6 CNN6 18.10	347	311
Z 6 CNT 18.10	321	304
Z 6 CNU 17.04	431	356
Z 8 C 17	430	353
Z 8 CD 17.01	434	353
Z 10 C 13	410	328
Z 10 C 14	410	328
Z 10 CF 17	430F	349
Z 10 CNF 18.09	303	265
Z 12 C 13	410	328
Z 12 C 13 M	403	317
Z 12 CN 17.08	301	253
Z 12 CNS 25.20	310	288
Z 12 CNS 25.20	314	291
Z 15 CN 16.02	431	356
Z 15 CN 24.13	309S	285
Z 18 N 5	A2515	94
Z 20 C 13	420	344
Z 30 WCV 9	H21	457
Z 38 CDV 5	H11	457
Z 40 COV 5	H13	457
Z 80 WCV		
18-04-01	T1	463
Z 80 WKC V		
18-05-04-01	T4	463
Z 85 DCWV		
08-04-02-01	H41	457
Z 85 DCWV		
08-04-02-01	M1	465
Z 85 WDCV		
06-05-04-02	M2	465
Z 90 WDCV		
06-05-04-02	M3 (Class 1)	465
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Z 110 WKCDV		
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Safety information in connection with grinding of cemented carbide

Ingredients

Hard metal products contain tungsten carbide and cobalt. Other substances may contain titanium carbide, tantalum carbide, niobium carbide, chromium carbide, molybdenum carbide or vanadium carbide. Some grades contain titanium carbo nitride and/or nickel.

Routes of exposure

Grinding or heating of hard metal blanks or hard metal products will produce dust or fumes with dangerous ingredients that can be inhaled, swallowed or come in contact with the skin or eyes.

Acute toxicity

The dust is toxic by inhalation. Inhalation may cause irritation and inflammation of the airways. Significantly higher acute inhalation toxicity has been reported during simultaneous inhalation of cobalt and tungsten carbide compared to inhalation of cobalt alone. Skin contact can cause irritation and rash. Personnel whose skin is sensitive may experience an allergic reaction.

Chronic toxicity

Repeated inhalation of aerosols containing cobalt may cause obstruction in the airways. Prolonged inhalation of increased concentrations may cause lung fibrosis or lung cancer. Epidemiological studies indicate that workers exposed in the past to high concentrations of tungsten carbide/cobalt carried an increased risk of developing lung cancer. Cobalt and nickel are potent skin sensitizers. Repeated or prolonged contact can cause irritation.

Risk phrases

Toxic: danger of serious damage to health by prolonged exposure through inhalation
Toxic by inhalation
Possible risk of irreversible effects
May cause sensitization by inhalation and skin contact

Preventive measures

- Avoid formation and inhalation of dust. Use local exhaust ventilation that is adequate to limit personal exposure well below the nationally authorised limits.
- If ventilation is not available or adequate, use respirators nationally approved for the purpose.
- Use safety goggles or glasses with side shields when necessary.
- Avoid repeated skin contact. Wear suitable gloves. Wash skin thoroughly after handling.
- Use suitable protective clothing. Launder clothing as needed.
- Do not eat, drink or smoke in the working area. Wash skin thoroughly before eating, drinking or smoking.

Material cross reference list

ISO	Coromant Material Classification (CMC)	Country									
		Great Britain		Sweden	USA	Germany		France	Italy	Spain	Japan
		Standard									
		BS	EN	SS	AISI/SAE	W.-nr.	DIN	AFNOR	UNI	UNE	JIS
P	Unalloyed steel										
Steel	01.1	4360 40 C	1A	1311	A570.36	1.0038	RSt.37-2	E 24-2 Ne			STKM 12A;C
	01.1	030A04		1325	1115	1.0038	GS-CK16	-			-
	01.1	4360 40 B		1312	A573-81 65	1.0116	St.37-3	E 24-U			-
	01.1	080M15		1350	1015	1.0401	C15	CC12			-
	01.1	050A20	2C/2D	1450	1020	1.0402	C22	CC20	C15C16	F.111	-
	01.1	230M07		1912	1213	1.0715	9SMn28	S250			-
	01.1	-	1B	1914	12L13	1.0718	9SMnPb28	S250Pb	CF9SMnPb28	11SMnPb28	SUM22
	01.1	-		-	-	1.0722	10SPb20	10PbF2	CF10SPb20	10SPb20	SUM22L
	01.1	240M07		-	1215	1.0736	9SMn36	S 300	CF9SMn36	12SMn35	-
	01.1	-		1926	12L14	1.0737	9SMnPb36	S300Pb	CF9SMnPb36	12SMnP35	-
	01.1	080M15	32C	1370	1015	1.1141	Ck15	XC12	C16	C15K	S15C
	01.1	-		-	1025	1.1158	Ck25	-			S25C
	01.1	4360 55 E		2145	A572-60	1.8900	StE 380	-	FeE390KG		
	01.1	4360 55 E		2142	A572-60	-	17 Mn V 6	NFA 35-501 E 36			
	01.2	060A35	-	1550	1035	1.0501	C35	CC35	C35	F.113	-
	01.2	080M46	-	1650	1045	1.0503	C45	CC45	C45	F.114	-
	01.2	212M36	8M	1957	1140	1.0726	35S20	35MF4		F210G	-
	01.2	150M36		15	1039	1.1157	40Mn4	35M5			-
	01.2	-	-	2120	1335	1.1167	36MN5	40M5	-	36Mn5	SMn438(H)
	01.2	150M28	14A	-	1330	1.1170	28Mn6	20M5	C28Mn		SCMn1
	01.2	060A35		1572	1035	1.1183	Cf35	XC38TS	C36	-	S35C
	01.2	080M46	-	1672	1045	1.1191	Ck45	XC42	C45	C45K	S45C
	01.2	060A52	-	1674	1050	1.1213	Cf53	XC48TS	C53	-	S50C
	01.3	070M55	-	1655	1055	1.0535	C55	-	C55	-	-
	01.3	080A62	43D	-	1060	1.0601	C60	CC55	C60	-	-
	01.3	070M55		-	1055	1.1203	Ck55	XC55	C50	C55K	S55C
	01.3	080A62	43D	1678	1060	1.1221	Ck60	XC60	C60	-	S58C
	01.4	060 A 96	-	1870	1095	1.1274	Ck 101	XC 100	-	F-5117	-
	01.4	BW 1A	-	1880	W 1	1.1545	C 105 W1	Y105	C36KU	F-5118	SK 3
	01.4	BW2	-	2900	W210	1.1545	C105W1	Y120	C120KU	F.515	SUP4
	Low-alloy steel (02.1 = Non-hardened, 02.2 = Hardened and tempered)										
	02.1	4360 43C	45	1412	A573-81	1.0144	St.44-2	E 28-3	Fe52BFN/Fe52CFN		SM 400A;B;C
	02.1	4360 50B		2132	-	1.0570	St.52-3	E36-3			SM490A;B;C;YA;YB
	02.1	150 M 19		2172	5120	1.0841	St.52-3	20 MC 5			-
	02.1	250A53		2085	9255	1.0904	55Si7	55S7			-
	02.1	-	31	-	9262	1.0961	60SiCr7	60SC7	60SiCr8	F.131	-
	02.1	534A99		2258	52100	1.3505	100Cr6	100C6			SUJ2
	02.1	1501-240		2912	ASTM A204Gr.A	1.5415	15Mo3	15D3			-
	02.1	1503-245-		-	4520	1.5423	16Mo5	-			-
	02.1	-	362	-	ASTM A350LF5	1.5622	14Ni6	16N6	20NiCrMo2	40NiCrMo2(KB)	-
	02.1	805M20		2506	8620	1.6523	21NiCrMo2	20NCD2			SNCM220(H)
	02.1	311-Type 7		-	8740	1.6546	40NiCrMo22	-			SNCM240
	02.1	820A16		-	-	1.6587	17CrNiMo6	18NCD6			-
	02.1	523M15	48	-	5015	1.7015	15Cr3	12C3			SCr415(H)
	02.1	-		2245	5140	1.7045	42Cr4	-			SCr440
	02.1	527A60		-	5155	1.7176	55Cr3	55C3			SUP9(A)
	02.1	-		2216	-	1.7262	15CrMo5	12CD4			SCM415(H)
	02.1	1501-		-	ASTM A182 F11;F12	1.7335	13CrMo4 4	15CD3.5	14CrMo4 5	14CrMo45	-
	02.1	-		-	ASTM A182 F.22	1.7380	10CrMo9 10	15CD4.5			-
	02.1	1501-622 Gr.31;45		2218	-	-	-	12CD9, 10			TU.H
	02.1	1503-660-		-	-	1.7715	14MoV6 3	-			-
	02.1	722 M 24	40C	2240	-	1.8515	31 CeMo 12	30 CD 12	30CrMo12	F-1712	-
	02.1	897M39		-	-	1.8523	39CrMoV13 9	-			-
	02.1	524A14		2092	L1	1.7039	34MoCrS4 G	-			-
	02.1	605A32		2108	8620	1.5419	20MoCrS4	-			-
	02.1	823M30	33	2512	-	1.7228	55NiCrMoV6G	-	653M31		-
	02.1	-		2127	-	1.7139	16MnCr5	-			-
	02.1	830 M 31		2534	-	-	31NiCrMo134	-			F-1270
	02.1	-		2550	L6	1.2721	50NiCr13	55NCV6			F-528
	02.2	640A35	111A	-	3135	1.5710	36NiCr6	35NC6	16NiCr11	15NiCr11	SNC236
	02.2	-		-	3415	1.5732	14NiCr10	14NC11			SNC415(H)
	02.2	655M13;		36A	3415;3310	1.5752	14NiCr14	12NC15			SNC815(H)
	02.2	-		2090	9255	1.0904	55Si7	55S7			-

ISO	Coromant Material Classificatio n (CMC)	Country										
		Great Britain		Sweden	USA	Germany		France	Italy	Spain	Japan	
		Standard										
		BS	EN	SS	AISI/SAE	W.-nr.	DIN	AFNOR	UNI	UNE	JIS	
P	02.1/02.2	816M40	110	-	9840	1.6511	36CrNiMo4	40NCD3	38NiCrMo4(KB)	35NiCrMo4	-	
	02.1/02.2	817M40	24	2541	4340	1.6582	35CrNiMo6	35NCD6	35NiCrMo6(KB)	-	-	
	02.1/02.2	530A32	18B	-	5132	1.7033	34Cr4	32C4	34Cr4(KB)	35Cr4	SCr430(H)	
	02.1/02.2	530A40	18	-	5140	1.7035	41Cr4	42C4	41Cr4	42Cr4	SCr440(H)	
	02.1/02.2	(527M20)	-	2511	5115	1.7131	16MnCr5	16MC5	16MnCr5	16MnCr5	-	
	02.1/02.2	1717CDS110	-	2225	4130	1.7218	25CrMo4	25CD4	25CrMo4(KB)	55Cr3	SCM420;SCM430	
										AM26CrMo4		
	02.1/02.2	708A37	19B	2234	4137;4135	1.7220	34CrMo4	35CD4	35CrMo4	34CrMo4	SCM432;SCCRM3	
	02.1/02.2	708M40	19A	2244	4140;4142	1.7223	41CrMo4	42CD4TS	41CrMo4	42CrMo4	SCM 440	
	02.1/02.2	708M40	19A	2244	4140	1.7225	42CrMo4	42CD4	42CrMo4	42CrMo4	SCM440(H)	
	02.1/02.2	722M24	40B	2240	-	1.7361	32CrMo12	30CD12	32CrMo12	F.124.A	-	
	02.1/02.2	735A50	47	2230	6150	1.8159	50CrV4	50CV4	50CrV4	51CrV4	SUP10	
	02.1/02.2	905M39	41B	2940	-	1.8509	41CrAlMo7	40CAD6, 12	41CrAlMo7	41CrAlMo7	-	
	02.1/02.2	BL3	-	-	L3	1.2067	100Cr6	Y100C6	-	100Cr6	-	
	02.1/02.2	-	-	2140	-	1.2419	105WCr6	105WC13	10WCr6	105WCr5	SKS31	
									107WCr5KU		SKS2, SKS3	
	02.1/02.2	-	-	-	L6	1.2713	55NiCrMoV6	55NCDV7	-	F.520.S	SKT4	
	High-alloy steel											
	Steel	03.11	1501-509;510	-	-	ASTM A353	1.5662	X8Ni9	-	X10Ni9	XBNI09	-
		03.11	-	-	-	2515	1.5680	12Ni19	-	-	-	-
03.11		832M13	36C	-	-	1.6657	14NiCrMo134	Z18N5	15NiCrMo13	14NiCrMo131	-	
03.11		BD3	-	-	D3	1.2080	X210Cr12	Z200C12	X210Cr13KU X250Cr12KU	X210Cr12	SKD1	
03.11				2314		1..2083						
03.11		BH13	-	2242	H13	1.2344	X40CrMoV5 1	Z40CDV5	X35CrMoV05KU X40CrMoV511KU	X40CrMoV5	SKD61	
03.11		BA2	-	2260	A2	1.2363	X100CrMoV5 1	Z100CDV5	X100CrMoV51KU	X100CrMoV5	SKD12	
03.11		-	-	2312	-	1.2436	X210CrW12	-	X215CrW12 1KU	X210CrW12	SKD2	
03.11		BS1	-	2710	S1	1.2542	45WCrV7	-	45WCrV8KU	45WCrSi8	-	
03.11		BH21	-	-	H21	1.2581	X30WCrV9 3 X30WCrV9 3KU	Z30WCV9	X28W09KU X30WCrV9 3KU	X30WCrV9	SKD5	
03.11		-	-	2310	-	1.2601	X165CrMoV 12	-	X165CrMoW12KU	X160CrMoV12	-	
03.11		401S45	52	-	HW3	1.4718	X45GrSi93	Z45CS9	X45GrSi8	F322	SUH1	
03.11		4959BA2	-	2715	D3	1.3343	S6-5-2	Z40CSD10	15NiCrMo13	-	SUH3	
03.13		BM 2	-	2722	M 2	1.3343	S6/5/2	Z 85 WDCV	HS 6-5-2-2	F-5603.	SKH 51	
03.13		BM 35	-	2723	M 35	1.3243	S6/5/2/5	6-5-2-5	HS 6-5-2-5	F-5613	SKH 55	
03.13		-	-	2782	M 7	1.3348	S2/9/2	-	HS 2-9-2	F-5607	-	
03.21		-	-	2736	HNV3	1.2379	X210Cr12 G	-	-	-	-	
Steel castings												
06.2		-	-	2223	-	-	-	-	-	-	-	-
06.33	Z120M12	-	-	-	1.3401	G-X120Mn12	Z120M12	XG120Mn12	X120Mn12	SCMnH/1		
06.33	BW 10	-	2183	-	1.3401		2120 M12	GX120 Mn12	F-8251	SEMn H1		
		Trade names										
02.1	OVAKO 520M (Ovako Steel)											
02.1	FORMAX (Uddeholm Tooling)											
02.1	IMACRO NIT (Imatra Steel)											
02.2	INEXA 482 (XM) (Inexa Profil)											
	S355J2G3(XM)											
	C45(XM)											
	16MnCrS5(XM)											
	INEXA280(XM)											
	070M20(XM)											
02.2	HARDOX 500 (SSAB – Swedish Steel Corp.)											
02.2	WELDOX 700 (SSAB – Swedish Steel Corp.)											

ISO	Coromant Material Classificatio n (CMC)	Country											
		Great Britain		Sweden	USA	Germany		France	Italy	Spain	Japan		
		Standard											
		BS	EN	SS	AISI/SAE	W.-nr.	DIN	AFNOR	UNI	UNE	JIS		
M	Stainless steels												
	Ferritic/martensitic materials (05.11, 12 = Forged, 15.11, 12 = Cast)												
	05.11/15.11	403S17	-	2301	403	1.4000 1.4001	X7Cr13 X7Cr14	Z6C13 -	X6Cr13 -	F.3110 F.8401	SUS403 -		
	05.11/15.11	416 S 21	-	2380	416	1.4005	X12CrS13	Z11CF13	X12 CrS 13	F-3411	SUS 416		
	05.11/15.11	430S15	960	2320	430	1.4016	X8Cr17	Z8C17	X8Cr17	F3113	SUS430		
	05.11/15.11	410S21	56A	2302	410	1.4006	X10Cr13	Z10C14	X12Cr13	F.3401	SUS410		
	05.11/15.11	430S17	60	2320	430	-	X8Cr17	Z8C17	X8Cr17	F.3113	SUS430		
	05.11/15.11	420S45	56D	2304	-	1.4034	X46Cr13	Z40CM Z38C13M	X40Cr14	F.3405	SUS420J2		
	05.11/15.11	405S17	-	-	405	1.4002	-	Z8CA12	X6CrAl13	-	-		
	05.11/15.11	420S37	-	2303	420	1.4021	-	Z20C13	X20Cr13	-	-		
	05.11/15.11	431S29	57	2321	431	1.4057	X22CrNi17	Z15CNi6.02	X16CrNi16	F.3427	SUS431		
	05.11/15.11	-	-	2383	430F	1.4104	X12CrMoS17	Z10CF17	X10CrS17	F.3117	SUS430F		
	05.11/15.11	434S17	-	2325	434	1.4113	X6CrMo17	Z8CD17.01	X8CrMo17	-	SUS434		
	05.11/15.11	425C11	-	2385	CA6-NM	1.4313	X5CrNi13-4	Z4CND13.4M	(G)X6CrNi304	-	SCS5		
	05.11/15.11	403S17	-	-	405	1.4724	X10CrA113	Z10C13	X10CrA112	F.311	SUS405		
	05.11/15.11	430S15	60	-	430	1.4742	X10CrA118	Z10CAS18	X8Cr17	F.3113	SUS430		
	05.11/15.11	443S65	59	-	HNV6	1.4747	X80CrNiSi20	Z80CSN20.02	X80CrSiNi20	F.320B	SUH4		
	05.11/15.11	-	-	2322	446	1.4762	X10CrA124	Z10CAS24	X16Cr26	-	SUH446		
	05.11/15.11	349S54	-	-	EV8	1.4871	X53CrMnNiN21-9	Z52CMN21.09	X53CrMnNiN21 9	-	SUH35, SUH36		
	05.11/15.11	-	-	2326	S44400	1.4521	X1CrMoTi18-2	-	-	-	-		
	05.11/15.11	-	-	2317	-	1.4922	X20CrMoV12-1	-	X20CrMoNi 12 01	-	-		
	05.12/15.12	-	-	-	630	1.4542/ 1.4548	-	Z7CNU17-04	-	-	-		
	Stainless steel	Austenitic materials (05.21, 22, 23 = Forged, 15.21, 22, 23 = Cast)											
		05.21/15.21	304S11	-	2352	304L	1.4306	-	Z2CN18-10	X2CrNi18 11	-	-	
		05.21/15.21	304S31	58E	2332/2333	304	1.4350	X5CrNi189	Z6CN18.09	X5CrNi18 10	F.3551 F.3541 F.3504	SUS304	
		05.21/15.21	303S21	58M	2346	303	1.4305	X12CrNiS18-8	Z10CNF 18.09	X10CrNiS 18.09	F.3508	SUS303	
		05.21/15.21	304S15	58E	2332	304	1.4301	X5CrNi18-9	Z6CN18.09	X5CrNi18 10	F.3551	SUS304	
			304C12	-	2333				Z3CN19.10	-	-	SUS304L	
		05.21/15.21	304S12	-	2352	304L	1.4306	X2CrNi18-9	Z2CrNi18 10	X2CrNi18 11	F.3503	SCS19	
		05.21/15.21	-	-	2331	301	1.4310	X12CrNi17-7	Z12CN17.07	X12CrNi17 07	F.3517	SUS301	
		05.21/15.21	304S62	-	2371	304LN	1.4311	X2CrNiN18-10	Z2CN18.10	-	-	SUS304LN	
		05.21/15.21	316S16	58J	2347	316	1.4401	X5CrNiMo18-10	Z6CND17.11	X5CrNiMo17 12	F.3543	SUS316	
		05.21/15.21	-	-	2375	316LN	1.4429	X2CrNiMoN18-13	Z2CND17.13	-	-	SUS316LN	
		05.21/15.21	316S13	-	2348	316L	1.4404	-	Z2CND17-12	X2CrNiMo1712	-	-	
		05.21/15.21	316S13	-	2353	316L	1.4435	X2CrNiMo18-12	Z2CND17.12	X2CrNiMo17 12	-	SCS16	
									-	-	-	SUS316L	
		05.21/15.21	316S33	-	2343 2347	316	1.4436	-	Z6CND18-12-03	X8CrNiMo1713	-	-	
		05.21/15.21	317S12	-	2367	317L	1.4438	X2CrNiMo18-16	Z2CND19.15	X2CrNiMo18 16	-	SUS317L	
		05.21/15.21	-	-	2562	UNS V 0890A	1.4539	X1NiCrMo	Z2 NCDU25-20	-	-	-	
		05.21/15.21	321S12	58B	2337	321	1.4541	X10CrNiTi18-9	Z6CNT18.10	X6CrNiTi18 11	F.3553 F.3523	SUS321	
		05.21/15.21	347S17	58F	2338	347	1.4550	X10CrNiNb18-9	Z6CNNb18.10	X6CrNiNb18 11	F.3552 F.3524 F.3535	SUS347	
		05.21/15.21	320S17	58J	2350	316Ti	1.4571	X6CrNiMoTi-12-2	Z6NDT17.12	X6CrNiMoTi17 12	-	-	
		05.21/15.21	-	-	-	318	1.4583	X10CrNiMoNb 18-12	Z6CNDNb17 13B	X6CrNiMoNb17 13	-	-	
		05.21/15.21	309S24	-	-	309	1.4828	X15CrNiSi20-12	Z15CNS20.12	-	-	SUH309	
		05.21/15.21	310S24	-	2361	310S	1.4845	X12CrNi25-21	Z12CN25 20	X6CrNi25 20	F.331	SUH310	
		05.21/15.21	301S21	58C	2370	308	1.4406	X10CrNi18.08	Z1NCDU25.20	-	F.8414	SCS17	
		15.21	-	-	2387	-	1.4418	X4 CrNiMo16-5	Z6CND16-04-01	-	-	-	
		05.22/15.22	316S111	-	-	17-7PH	1.4568/ 1.4504	-	Z8CNA17-07	X2CrNiMo1712	-	-	
		05.23/15.23	-	-	2584	NO8028	1.4563	-	Z1NCDU31-27-03	-	-	-	
		05.23/15.23	-	-	2378	S31254	-	-	Z1CNDU20-18-06AZ	-	-	-	
			Austenitic / ferritic materials (Duplex) (05.51, 52 = Forged, 15.51, 52 = Cast)										
			05.51/15.51	-	-	2376	S31500	1.4417	X2CrNiMoSi19-5	-	-	-	-
			05.51/15.51	-	-	2324	S32900	-	X8CrNiMo27-5	-	-	-	-
			05.52/15.52	-	-	2327	S32304	-	X2CrNiN23-4	Z2CN23-04AZ	-	-	-
			05.52/15.52	-	-	2328	-	-	-	-	-	-	-
			05.52/15.52	-	-	2377	S31803	-	X2CrNiMoN22-53	Z2CND22-05-03	-	-	-

ISO	Coromant Material Classification (CMC)	Country	Great Britain		Sweden	USA	Germany		France	Italy	Spain	Japan
		Standard										
		BS	EN	SS	AISI/SAE	W.-nr.	DIN	AFNOR	UNI	UNE	JIS	
M		Trade names										
		Stainless steels										
	05.21/15.21	SANMAC 304 (Sandvik Steel)										
	05.21/15.21	SANMAC 304L (Sandvik Steel)										
	05.21/15.21	SANMAC 316 (Sandvik Steel)										
	05.21/15.21	SANMAC 316L (Sandvik Steel)										
	05.23/15.23	254 SMO										
	05.23/15.23	654 SMO										
	05.23/15.23	SANMAC SANICRO (Sandvik Steel)										
05.52/15.52	SANMAC SAF 2205 (Sandvik Steel)											
05.52/15.52	SANMAC SAF 2507 (Sandvik Steel)											
K	Malleable cast iron											
	07.1	8 290/6		0814			-	MN 32-8				FCMB310
	07.1	B 340/12		0815	32510		GTS-35	MN 35-10				FCMW330
	07.2	P 440/7		0852	40010	0.8145	GTS-45	Mn 450	GMN 45			FCMW370
	07.2	P 510/4		0854	50005	0.8155	GTS-55	MP 50-5	GMN 55			FCMP490
		P 570/3		0858	70003		GTS-65	MP 60-3				FCMP540
	07.2	P570/3		0856	A220-70003	0.8165	GTS-65-02	Mn 650-3	GMN 65	-		FCMP590
	07.3	P690/2		0862	A220-80002	0.8170	GTS-70-02	Mn700-2	GMN 70			FCMP690
	Grey cast iron											
	08.1			0100								
	08.1			0110	No 20 B		GG 10	Ft 10 D				FC100
	08.1	Grade 150		0115	No 25 B	0.6015	GG 15	Ft 15 D	G 15	FG 15		FC150
	08.1	Grade 220		0120	No 30 B	0.6020	GG 20	Ft 20 D	G 20			FC200
	08.2	Grade 260		0125	No 35 B	0.6025	GG 25	Ft 25 D	G 25	FG 25		FC250
					No 40 B							
	08.2	Grade 300		0130	No 45 B	0.6030	GG 30	Ft 30 D	G 30	FG 30		FC300
	08.2	Grade 350		0135	No 50 B	0.6035	GG 35	Ft 35 D	G 35	FG 35		FC350
	08.2	Grade 400		0140	No 55 B	0.6040	GG 40	Ft 40 D				
	08.3	L-NiCuCr202		0523	A436 Type 2	0.6660	GGL-NiCr202	L-NC 202	-	-		
	Nodular cast iron											
	09.1	SNG 420/12		0717-02	60-40-18	0.7040	GGG 40	FCS 400-12	GS 370-17	FGE 38-17		FCD400
	09.1	SNG 370/17		0717-12	-		GGG 40.3	FGS 370-17				
	09.1	-		0717-15	-	0.7033	GGG 35.3	-				
	09.1	SNG 500/7		0727-02	80-55-06	0.7050	GGG 50	FGS 500-7	GS 500	FGE 50-7		FCD500
	09.1	Grade S6		0776	A43D2	0.7660	GGG-NiCr202	S-NC 202	-	-		
	09.2	SNG 600/3		0732-03	-		GGG 60	FGS 600-3				FCD600
	09.2	SNG 700/2		0737-01	100-70-03	0.7070	GGG 70	FGS 700-2	GS 700-2	FGS 70-2		FCD700

ISO	Coromant Material Classificatio n (CMC)	Country												
		Great Britain		Sweden	USA	Germany		France	Italy	Spain	Japan			
		Standard												
		BS	EN	SS	AISI/SAE	W.-nr.	DIN	AFNOR	UNI	UNE	JIS			
N	Non-ferrous metals													
		30.21	-	-	4251	SC64D	3.2373	G-AISI9MGWA	A-S7G	-	-	C4BS		
		30.21	LM5	-	4252	GD-AISI12	-	G-ALMG5	A-SU12	-	-	AC4A		
		30.21/30.22	LM25	-	4244	356.1	GD-AISI12 GD-AISI8Cu3 G-AISI12(Cu) G-AISI12 G-AISI10Mg(Cu)					A5052		
				-	4247	A413.0						A6061		
			LM24	-	4250	A380.1						A7075		
			LM20	-	4260	A413.1						ADC12		
LM6	-	4261	A413.2											
LM9	-	4253	A360.2											
S	Heat resistant super alloys	Heat resistant super alloys												
		20.11	-	-	-	330	1.4864	X12NiCrSi36 16	Z12NCS35.16	F-3313	-	SUH330		
		20.11	330C11	-	-	-	1.4865	G-X40NiCrSi38 18	-	XG50NiCr39 19	-	SCH15		
		20.21	-	-	-	5390A	2.4603	-	NC22FeD	-	-			
		20.21	-	-	-	5666	2.4856	NiCr22Mo9Nb	NC22FeDNB	-	-			
		20.21	HR5.203-4	-	-	-	2.4630	NiCr20Ti	NC20T	-	-			
		20.22	-	-	-	5660	LW2.4662	NiFe35Cr14MoTi	ZSNCDT42	-	-			
		20.22	3146-3	-	-	5391	LW2 4670	S-NiCr13A16MoNb	NC12AD	-	-			
		20.22	HR8	-	-	5383	LW2.4668	NiCr19Fe19NbMo	NC19eNB	-	-			
		20.22	3072-76	-	-	4676	2.4375	NiCu30Al	-	-	-			
		20.22	Hr401.601	-	-	-	2.4631	NiCr20TiAk	NC20TA	-	-			
		20.22	-	-	-	AMS 5399	2.4973	NiCr19Co11MoTi	NC19KDT	-	-			
		20.22	-	-	-	AMS 5544	LW2.4668	NiCr19Fe19NbMo	NC20K14	-	-			
		20.24	-	-	-	AMS 5397	LW2 4674	NiCo15Cr10MoAlTi	-	-	-			
		20.32	-	-	-	5537C	LW2.4964	CoCr20W15Ni	KC20WN	-	-			
		-	-	-	-	AMS 5772	-	CoCr22W14Ni	KC22WN	-	-			
		Titanium alloys												
		23.22	TA14/17	-	-	-	AMS R54520	-	TiAl5Sn2.5	T-A5E	-	-		
		23.22	TA10-13/TA28	-	-	-	AMS R56400	-	TiAl6V4	T-A6V	-	-		
		23.22	TA11	-	-	-	AMS R56401	-	TiAl6V4ELI	-	-	-		
		23.22	-	-	-	-	-	-	TiAl4Mo4Sn4Si0.5	-	-	-		
		Heat resistsans super alloys		Trade names										
				Iron base										
				20.11	Incoloy 800									
				Nickel base										
				20.2	Haynes 600									
				20.2	Nimocast PD16									
				20.2	Nimonic PE 13									
				20.2	Rene 95									
				20.21	Hastelloy C									
				20.21	Incoloy 825									
				20.21	Inconel 600									
20.21	Monet 400													
20.22	Inconel 700													
20.22	Inconel 718													
20.22	Mar – M 432													
20.22	Nimonic 901													
20.22	Waspaloy													
20.24	Jessop G 64													
Cobalt base														
20.3	Air Resist 213													
20.3	Jetalloy 209													
H	Hardened materials	Hardened materials												
		04.1	-	-	2258-08	440A	1.4108	X100CrMo13	-	-	-	C4BS		
		04.1	-	-	2534-05	610	1.4111	X110CrMoV15	-	-	-	AC4A		
		04.1	-	-	2541-06	0-2	-	X65CrMo14	-	-	-	AC4A		

ISO	ANSI	ISO	ANSI	ISO	ANSI
CCGT 06 02 01-UM	CCGT 2(1.5)03-UM	CCMT 12 04 08-MM	CCMT 432-MM	CNGP 12 04 08	CNGP 432
CCGT 06 02 02-UM	CCGT 2(1.5)0-UM	CCMT 12 04 08-MR	CCMT 432-MR	CNGQ 120708 T02520	CNGQ 452 T0820
CCGT 06 02 04-UM	CCGT 2(1.5)1-UM	CCMT 12 04 08-PM	CCMT 432-PM	CNGQ 120708 T02520WG	CNGQ 452 T0820WG
CCGT 09 T3 01-UM	CCGT 3(2.5)03-UM	CCMT 12 04 08-PR	CCMT 432-PR	CNGQ 120712 T02520	CNGQ 453 T0820
CCGT 09 T3 02-UM	CCGT 3(2.5)0-UM	CCMT 12 04 08-UR	CCMT 432-UR	CNGQ 120712 T02520WG	CNGQ 453 T0820WG
CCGT 09 T3 04-UM	CCGT 3(2.5)1-UM	CCMT 12 04 08-WM	CCMT 432-WM	CNGQ 120716 T02520	CNGQ 454 T0820
CCGT 09 T3 08-UM	CCGT 3(2.5)2-UM	CCMT 12 04 12-KR	CCMT 433-KR	CNGQ 120716 T02520WG	CNGQ 454 T0820WG
CCGT 12 04 04-UM	CCGT 431-UM	CCMT 12 04 12-MM	CCMT 433-MM	CNGQ 160712 T02520	CNGQ 553 T0820
CCGT 12 04 08-UM	CCGT 432-UM	CCMT 12 04 12-MR	CCMT 433-MR	CNGQ 160716 T02520	CNGQ 554 T0820
CCGX 06 02 02-AL	CCGX 2(1.5)0-AL	CCMT 12 04 12-PM	CCMT 433-PM	CNMA 12 04 04-KR	CNMA 431-KR
CCGX 06 02 04-AL	CCGX 2(1.5)1-AL	CCMT 12 04 12-PR	CCMT 433-PR	CNMA 12 04 04S01020E	CNMA 431S0320E
CCGX 09 T3 04-AL	CCGX 3(2.5)1-AL	CCMW 06 02 04	CCMW 2(1.5)1	CNMA 12 04 08-KR	CNMA 432-KR
CCGX 09 T3 08-AL	CCGX 3(2.5)2-AL	CCMW 06 02 04FP	CCMW 2(1.5)1FP	CNMA 12 04 08S01020E	CNMA 432S0320E
CCGX 12 04 04-AL	CCGX 431-AL	CCMW 09 T3 04	CCMW 3(2.5)1	CNMA 12 04 12-KR	CNMA 433-KR
CCGX 12 04 08-AL	CCGX 432-AL	CCMW 09 T3 04FP	CCMW 3(2.5)1FP	CNMA 12 04 12S01020E	CNMA 433S0320E
CCMT 06 02 02-KF	CCMT 2(1.5)0-KF	CCMW 09 T3 08FP	CCMW 3(2.5)2FP	CNMA 12 04 16-KR	CNMA 434-KR
CCMT 06 02 02-MF	CCMT 2(1.5)0-MF	CNGA 090304S01020A	CNGA 321S0320A	CNMA 16 06 08-KR	CNMA 542-KR
CCMT 06 02 02-PF	CCMT 2(1.5)0-PF	CNGA 090304T01020A	CNGA 321T0320A	CNMA 16 06 12-KR	CNMA 543-KR
CCMT 06 02 02-UF	CCMT 2(1.5)0-UF	CNGA 090304T01020AWG	CNGA 321T0320AWG	CNMA 16 06 24-KR	CNMA 544-KR
CCMT 06 02 04-KF	CCMT 2(1.5)1-KF	CNGA 090304T01020AWH	CNGA 321T0320AWH	CNMA 19 06 08-KR	CNMA 642-KR
CCMT 06 02 04-KM	CCMT 2(1.5)1-KM	CNGA 090308S01020A	CNGA 322S0320A	CNMA 19 06 12-KR	CNMA 643-KR
CCMT 06 02 04-MF	CCMT 2(1.5)1-MF	CNGA 090308T01020A	CNGA 322T0320A	CNMA 19 06 16-KR	CNMA 644-KR
CCMT 06 02 04-MM	CCMT 2(1.5)1-MM	CNGA 090308T01020AWG	CNGA 322T0320AWG	CNMA 19 06 24-KR	CNMA 646-KR
CCMT 06 02 04-PF	CCMT 2(1.5)1-PF	CNGA 090308T01020AWH	CNGA 322T0320AWH	CNMG 09 03 04-MF	CNMG 321-MF
CCMT 06 02 04-PM	CCMT 2(1.5)1-PM	CNGA 12 04 04S01020A	CNGA 431S0320A	CNMG 09 03 04-PF	CNMG 321-PF
CCMT 06 02 04-UF	CCMT 2(1.5)1-UF	CNGA 12 04 04T01020A	CNGA 431T0320A	CNMG 09 03 04-PM	CNMG 321-PM
CCMT 06 02 04-UM	CCMT 2(1.5)1-UM	CNGA 12 04 08S01020A	CNGA 432S0320A	CNMG 09 03 04-QF	CNMG 321-QF
CCMT 06 02 04-UR	CCMT 2(1.5)1-UR	CNGA 12 04 08T01020	CNGA 432T0320	CNMG 09 03 04-QM	CNMG 321-QM
CCMT 06 02 04-WF	CCMT 2(1.5)1-WF	CNGA 12 04 08T01020A	CNGA 432T0320A	CNMG 09 03 04-QM	CNMG 321-QM
CCMT 06 02 08-KM	CCMT 2(1.5)2-KM	CNGA 12 04 08T02520	CNGA 432T0820	CNMG 09 03 04-WF	CNMG 321-WF
CCMT 06 02 08-KR	CCMT 2(1.5)2-KR	CNGA 12 04 12S01020A	CNGA 433S0320A	CNMG 09 03 08-MF	CNMG 322-MF
CCMT 06 02 08-MM	CCMT 2(1.5)2-MM	CNGA 12 04 12T01020	CNGA 433T0320	CNMG 09 03 08-PF	CNMG 322-PF
CCMT 06 02 08-MR	CCMT 2(1.5)2-MR	CNGA 12 04 12T01020A	CNGA 433T0320A	CNMG 09 03 08-PM	CNMG 322-PM
CCMT 06 02 08-PM	CCMT 2(1.5)2-PM	CNGA 12 04 12T02520	CNGA 433T0820	CNMG 09 03 08-QF	CNMG 322-QF
CCMT 06 02 08-PR	CCMT 2(1.5)2-PR	CNGA 12 04 16T01020	CNGA 434T0320	CNMG 09 03 08-QM	CNMG 322-QM
CCMT 06 02 08-UF	CCMT 2(1.5)2-UF	CNGA 12 04 16T02520	CNGA 434T0820	CNMG 09 03 08-WF	CNMG 332-WF
CCMT 06 02 08-UM	CCMT 2(1.5)2-UM	CNGA 120404S01030A	CNGA 431S0330A	CNMG 09 03 12-QM	CNMG 323-QM
CCMT 06 02 08-WF	CCMT 2(1.5)2-WF	CNGA 120404S01525	CNGA 431S0625	CNMG 12 04 04-23	CNMG 431-23
CCMT 06 02 08-WM	CCMT 2(1.5)2-WM	CNGA 120404S01525WH	CNGA 431S0625WH	CNMG 12 04 04-KF	CNMG 431-KF
CCMT 09 T3 02-KF	CCMT 3(2.5)0-KF	CNGA 120404T01020AWG	CNGA 431 T0320AWG	CNMG 12 04 04-MF	CNMG 431-MF
CCMT 09 T3 02-MF	CCMT 3(2.5)0-MF	CNGA 120404T01020AWH	CNGA 431 T0320AWH	CNMG 12 04 04-PF	CNMG 431-PF
CCMT 09 T3 02-PF	CCMT 3(2.5)0-PF	CNGA 120404T01030AWH	CNGA 431T0330AWH	CNMG 12 04 04-PM	CNMG 431-PM
CCMT 09 T3 02-UF	CCMT 3(2.5)0-UF	CNGA 120408 T01020WG	CNGA 432 T0320WG	CNMG 12 04 04-QF	CNMG 431-QF
CCMT 09 T3 04-KF	CCMT 3(2.5)1-KF	CNGA 120408S01030A	CNGA 432S0330A	CNMG 12 04 04-QM	CNMG 431-QM
CCMT 09 T3 04-KM	CCMT 3(2.5)1-KM	CNGA 120408S01525	CNGA 432S0625	CNMG 12 04 04-SM	CNMG 431-SM
CCMT 09 T3 04-MF	CCMT 3(2.5)1-MF	CNGA 120408S01525WH	CNGA 432S0625WH	CNMG 12 04 04-WF	CNMG 431-WF
CCMT 09 T3 04-MM	CCMT 3(2.5)1-MM	CNGA 120408T01020AWG	CNGA 432 T0320AWG	CNMG 12 04 08-23	CNMG 432-23
CCMT 09 T3 04-PF	CCMT 3(2.5)1-PF	CNGA 120408T01020AWH	CNGA 432 T0320AWH	CNMG 12 04 08-KF	CNMG 432-KF
CCMT 09 T3 04-PM	CCMT 3(2.5)1-PM	CNGA 120408T01030AWH	CNGA 432T0330AWH	CNMG 12 04 08-KR	CNMG 432-KM
CCMT 09 T3 04-UF	CCMT 3(2.5)1-UF	CNGA 120408T01525	CNGA 432T0625	CNMG 12 04 08-KR	CNMG 432-KR
CCMT 09 T3 04-UM	CCMT 3(2.5)1-UM	CNGA 120408T01525WH	CNGA 432T0625WH	CNMG 12 04 08-MF	CNMG 432-MF
CCMT 09 T3 04-UR	CCMT 3(2.5)1-UR	CNGA 120412 T01020WG	CNGA 433 T0320WG	CNMG 12 04 08-MM	CNMG 432-MM
CCMT 09 T3 04-WF	CCMT 3(2.5)1-WF	CNGA 120412S01030A	CNGA 433S0330A	CNMG 12 04 08-MR	CNMG 432-MR
CCMT 09 T3 04-WM	CCMT 3(2.5)1-WM	CNGA 120412S01525	CNGA 433S0625	CNMG 12 04 08-MR	CNMG 432-MR
CCMT 09 T3 08-KF	CCMT 3(2.5)2-KF	CNGA 120412S01525WH	CNGA 433S0625WH	CNMG 12 04 08-PF	CNMG 432-PF
CCMT 09 T3 08-KM	CCMT 3(2.5)2-KM	CNGA 120412T01030AWH	CNGA 433T0330AWH	CNMG 12 04 08-PM	CNMG 432-PM
CCMT 09 T3 08-KR	CCMT 3(2.5)2-KR	CNGA 120416 T01020WG	CNGA 434 T0320WG	CNMG 12 04 08-PR	CNMG 432-PR
CCMT 09 T3 08-MF	CCMT 3(2.5)2-MF	CNGA 16 06 08T01020	CNGA 542T0320	CNMG 12 04 08-QF	CNMG 432-QF
CCMT 09 T3 08-MM	CCMT 3(2.5)2-MM	CNGA 16 06 12T01020	CNGA 543T0320	CNMG 12 04 08-QM	CNMG 432-QM
CCMT 09 T3 08-MR	CCMT 3(2.5)2-MR	CNGA 16 06 12T02520	CNGA 543T0820	CNMG 12 04 08-SM	CNMG 432-SM
CCMT 09 T3 08-PF	CCMT 3(2.5)2-PF	CNGA 16 06 16T02520	CNGA 544T0820	CNMG 12 04 08-WF	CNMG 432-WF
CCMT 09 T3 08-PM	CCMT 3(2.5)2-PM	CNGA 19 06 16T02520	CNGA 644T-0820	CNMG 12 04 08-WM	CNMG 432-WM
CCMT 09 T3 08-PR	CCMT 3(2.5)2-PR	CNGN 12 04 08T01020	CNG 432T0320	CNMG 12 04 12-23	CNMG 433-23
CCMT 09 T3 08-UF	CCMT 3(2.5)2-UF	CNGN 12 04 08T02520	CNG 432T0820	CNMG 12 04 12-KF	CNMG 433-KF
CCMT 09 T3 08-UM	CCMT 3(2.5)2-UM	CNGN 12 04 12T01020	CNG 433T0320	CNMG 12 04 12-KM	CNMG 433-KM
CCMT 09 T3 08-UR	CCMT 3(2.5)2-UR	CNGN 12 04 12T02520	CNG 433T0820	CNMG 12 04 12-KR	CNMG 433-KR
CCMT 09 T3 08-WF	CCMT 3(2.5)2-WF	CNGN 12 04 16T01020	CNG 434T0320	CNMG 12 04 12-MF	CNMG 433-MF
CCMT 09 T3 08-WM	CCMT 3(2.5)2-WM	CNGN 12 04 16T02520	CNG 434T0820	CNMG 12 04 12-MM	CNMG 433-MM
CCMT 09 T3 12-KR	CCMT 3(2.5)3-KR	CNGN 12 07 08T01020	CNG 452T0320	CNMG 12 04 12-MR	CNMG 433-MR
CCMT 09 T3 12-MR	CCMT 3(2.5)3-MR	CNGN 12 07 08T02520	CNG 452T0820	CNMG 12 04 12-PF	CNMG 433-PF
CCMT 09 T3 12-PR	CCMT 3(2.5)3-PR	CNGN 12 07 12T01020	CNG 453T0320	CNMG 12 04 12-PM	CNMG 433-PM
CCMT 12 04 04-KF	CCMT 431-KF	CNGN 12 07 12T02520	CNG 453T0820	CNMG 12 04 12-PR	CNMG 433-PR
CCMT 12 04 04-KM	CCMT 431-KM	CNGN 12 07 16T01020	CNG 454T0320	CNMG 12 04 12-QF	CNMG 433-QF
CCMT 12 04 04-MF	CCMT 431-MF	CNGN 12 07 16T02520	CNG 454T0820	CNMG 12 04 12-QM	CNMG 433-QM
CCMT 12 04 04-MM	CCMT 431-MM	CNGN 16 07 08T01020	CNG 552T0320	CNMG 12 04 12-SM	CNMG 433-SM
CCMT 12 04 04-PF	CCMT 431-PF	CNGN 16 07 12T01020	CNG 553T0320	CNMG 12 04 12-WF	CNMG 433-WF
CCMT 12 04 04-PM	CCMT 431-PM	CNGN 16 07 12T02520	CNG 553T0820	CNMG 12 04 12-WM	CNMG 433-WM
CCMT 12 04 04-WM	CCMT 431-WM	CNGN 16 07 16T01020	CNG 554T0320	CNMG 12 04 16-KM	CNMG 434-KM
CCMT 12 04 08-KM	CCMT 432-KM	CNGN 16 07 16T02520	CNG 554T0820	CNMG 12 04 16-KR	CNMG 434-KR
CCMT 12 04 08-KR	CCMT 432-KR	CNGP 12 04 04	CNGP 431	CNMG 12 04 16-MF	CNMG 434-MF

ISO	ANSI	ISO	ANSI	ISO	ANSI
CNMG 12 04 16-MM	CNMG 434-MM	CNMM 16 06 16-WR	CNMM 544-WR	DCMT 07 02 08-UM	DCMT 2(1.5)2-UM
CNMG 12 04 16-MR	CNMG 434-MR	CNMM 16 06 24-MR	CNMM 546-MR	DCMT 11 T3 02-KF	DCMT 3(2.5)0-KF
CNMG 12 04 16-PM	CNMG 434-PM	CNMM 16 06 24-QR	CNMM 546-QR	DCMT 11 T3 02-MF	DCMT 3(2.5)0-MF
CNMG 12 04 16-PR	CNMG 434-PR	CNMM 19 06 08-QR	CNMM 642-QR	DCMT 11 T3 02-PF	DCMT 3(2.5)0-PF
CNMG 12 04 16-QM	CNMG 434-QM	CNMM 19 06 12-MR	CNMM 643-MR	DCMT 11 T3 04-KF	DCMT 3(2.5)1-KF
CNMG 16 06 04-QM	CNMG 541-QM	CNMM 19 06 12-PR	CNMM 643-PR	DCMT 11 T3 04-KM	DCMT 3(2.5)1-KM
CNMG 16 06 08-23	CNMG 542-23	CNMM 19 06 12-QR	CNMM 643-QR	DCMT 11 T3 04-MF	DCMT 3(2.5)1-MF
CNMG 16 06 08-KM	CNMG 542-KM	CNMM 19 06 16-HR	CNMM 644-HR	DCMT 11 T3 04-MM	DCMT 3(2.5)1-MM
CNMG 16 06 08-MM	CNMG 542-MM	CNMM 19 06 16-MR	CNMM 644-MR	DCMT 11 T3 04-PF	DCMT 3(2.5)1-PF
CNMG 16 06 08-MR	CNMG 542-MR	CNMM 19 06 16-PR	CNMM 644-PR	DCMT 11 T3 04-PF	DCMT 3(2.5)1-PF
CNMG 16 06 08-PM	CNMG 542-PM	CNMM 19 06 16-QR	CNMM 644-QR	DCMT 11 T3 04-PM	DCMT 3(2.5)1-PM
CNMG 16 06 08-PR	CNMG 542-PR	CNMM 19 06 16-WR	CNMM 644-WR	DCMT 11 T3 04-UF	DCMT 3(2.5)1-UF
CNMG 16 06 08-QM	CNMG 542-QM	CNMM 19 06 24-HR	CNMM 646-HR	DCMT 11 T3 04-UM	DCMT 3(2.5)1-UM
CNMG 16 06 08-WM	CNMG 542-WM	CNMM 19 06 24-PR	CNMM 646-PR	DCMT 11 T3 04-UR	DCMT 3(2.5)1-UR
CNMG 16 06 12-23	CNMG 543-23	CNMM 19 06 24-QR	CNMM 646-QR	DCMT 11 T3 08-KF	DCMT 3(2.5)2-KF
CNMG 16 06 12-KM	CNMG 543-KM	CNMM 19 06 32-MR	CNMM 648-MR	DCMT 11 T3 08-KM	DCMT 3(2.5)2-KM
CNMG 16 06 12-KR	CNMG 543-KR	CNMM 25 09 24-HR	CNMM 866-HR	DCMT 11 T3 08-KR	DCMT 3(2.5)2-KR
CNMG 16 06 12-MM	CNMG 543-MM	CNMM 25 09 24-MR	CNMM 866-MR	DCMT 11 T3 08-MF	DCMT 3(2.5)2-MF
CNMG 16 06 12-MR	CNMG 543-MR	CNMM 25 09 24-QR	CNMM 866-QR	DCMT 11 T3 08-MM	DCMT 3(2.5)2-MM
CNMG 16 06 12-PM	CNMG 543-PM	CNMM 25 09 32-HR	CNMM 868-HR	DCMT 11 T3 08-MR	DCMT 3(2.5)2-MR
CNMG 16 06 12-PR	CNMG 543-PR	CNMM 25 09 32-MR	CNMM 868-MR	DCMT 11 T3 08-PF	DCMT 3(2.5)2-PF
CNMG 16 06 12-QM	CNMG 543-QM	CNMX 1204A1-SM	CNMX 43A1-SM	DCMT 11 T3 08-PM	DCMT 3(2.5)2-PM
CNMG 16 06 12-SM	CNMG 543-SM	CNMX 1204A2-SM	CNMX 43A2-SM	DCMT 11 T3 08-PR	DCMT 3(2.5)2-PR
CNMG 16 06 12-WM	CNMG 543-WM	CPMT 06 02 02-MF	CPMT 2(1.5)0-MF	DCMT 11 T3 08-UF	DCMT 3(2.5)2-UF
CNMG 16 06 16-23	CNMG 544-23	CPMT 06 02 02-PF	CPMT 2(1.5)0-PF	DCMT 11 T3 08-UM	DCMT 3(2.5)2-UM
CNMG 16 06 16-KM	CNMG 544-KM	CPMT 06 02 04-KF	CPMT 2(1.5)1-KF	DCMT 11 T3 08-UR	DCMT 3(2.5)2-UR
CNMG 16 06 16-KR	CNMG 544-KR	CPMT 06 02 04-KM	CPMT 2(1.5)1-KM	DCMT 11 T3 12-KM	DCMT 3(2.5)3-KM
CNMG 16 06 16-MM	CNMG 544-MM	CPMT 06 02 04-MF	CPMT 2(1.5)1-MF	DCMT 11 T3 12-KR	DCMT 3(2.5)3-KR
CNMG 16 06 16-MR	CNMG 544-MR	CPMT 06 02 04-MM	CPMT 2(1.5)1-MM	DCMT 11 T3 12-MM	DCMT 3(2.5)3-MM
CNMG 16 06 16-PM	CNMG 544-PM	CPMT 06 02 04-PF	CPMT 2(1.5)1-PF	DCMT 11 T3 12-MR	DCMT 3(2.5)3-MR
CNMG 16 06 16-PR	CNMG 544-PR	CPMT 06 02 04-PM	CPMT 2(1.5)1-PM	DCMT 11 T3 12-PM	DCMT 3(2.5)3-PM
CNMG 16 06 16-QM	CNMG 544-QM	CPMT 06 02 08-KM	CPMT 2(1.5)2-KM	DCMT 11 T3 12-PR	DCMT 3(2.5)3-PR
CNMG 16 06 24-PR	CNMG 546-PR	CPMT 06 02 08-MM	CPMT 2(1.5)2-MM	DCMT 11 T3 12-UR	DCMT 3(2.5)3-UR
CNMG 19 06 04-QM	CNMG 641-QM	CPMT 06 02 08-PM	CPMT 2(1.5)2-PM	DCMW 11 T3 04	DCMW 3(2.5)1
CNMG 19 06 08-23	CNMG 642-23	CPMT 09 T3 02-KF	CPMT 3(2.5)0-KF	DCMW 11 T3 04FP	DCMW 3(2.5)1FP
CNMG 19 06 08-MM	CNMG 642-MM	CPMT 09 T3 02-MF	CPMT 3(2.5)0-MF	DCMW 11 T3 04S01020E	DCMW 3(2.5)1 S0320E
CNMG 19 06 08-MR	CNMG 642-MR	CPMT 09 T3 02-PF	CPMT 3(2.5)0-PF	DCMW 11 T3 08FP	DCMW 3(2.5)2FP
CNMG 19 06 08-PM	CNMG 642-PM	CPMT 09 T3 04-KF	CPMT 3(2.5)1-KF	DCMW 11 T3 08S01020E	DCMW 3(2.5)2 S0320E
CNMG 19 06 08-PR	CNMG 642-PR	CPMT 09 T3 04-KM	CPMT 3(2.5)1-KM	DCMX 07 02 04-WF	DCMX 2(1.5)1-WF
CNMG 19 06 08-QM	CNMG 642-QM	CPMT 09 T3 04-MF	CPMT 3(2.5)1-MF	DCMX 07 02 08-WF	DCMX 2(1.5)2-WF
CNMG 19 06 12-23	CNMG 643-23	CPMT 09 T3 04-MM	CPMT 3(2.5)1-MM	DCMX 11 T3 04-WF	DCMX 3(2.5)1-WF
CNMG 19 06 12-KM	CNMG 643-KM	CPMT 09 T3 04-PF	CPMT 3(2.5)1-PF	DCMX 11 T3 04-WM	DCMX 3(2.5)1-WM
CNMG 19 06 12-KR	CNMG 643-KR	CPMT 09 T3 04-PM	CPMT 3(2.5)1-PM	DCMX 11 T3 08-WF	DCMX 3(2.5)2-WF
CNMG 19 06 12-MM	CNMG 643-MM	CPMT 09 T3 04-UM	CPMT 3(2.5)1-UM	DCMX 11 T3 08-WM	DCMX 3(2.5)2-WM
CNMG 19 06 12-MR	CNMG 643-MR	CPMT 09 T3 08-KF	CPMT 3(2.5)2-KF	DNGA 110404S01020A	DNGA 331S0320A
CNMG 19 06 12-PR	CNMG 643-PR	CPMT 09 T3 08-KM	CPMT 3(2.5)2-KM	DNGA 110404T01020A	DNGA 331T0320A
CNMG 19 06 12-QM	CNMG 643-QM	CPMT 09 T3 08-MF	CPMT 3(2.5)2-MF	DNGA 110408S01020A	DNGA 332S0320A
CNMG 19 06 16-23	CNMG 644-23	CPMT 09 T3 08-MM	CPMT 3(2.5)2-MM	DNGA 110408T01020A	DNGA 332T0320A
CNMG 19 06 16-KM	CNMG 644-KM	CPMT 09 T3 08-PF	CPMT 3(2.5)2-PF	DNGA 15 04 08T01020	DNGA 432T0320
CNMG 19 06 16-KR	CNMG 644-KR	CPMT 09 T3 08-PM	CPMT 3(2.5)2-PM	DNGA 15 04 08T02520	DNGA 432T0820
CNMG 19 06 16-MM	CNMG 644-MM	CPMT 09 T3 08-UM	CPMT 3(2.5)2-UM	DNGA 15 04 12T01020	DNGA 433T0320
CNMG 19 06 16-MR	CNMG 644-MR	DCGT 07 02 01-UM	DCGT 2(1.5)03-UM	DNGA 15 04 12T02520	DNGA 433T0820
CNMG 19 06 16-PM	CNMG 644-PM	DCGT 07 02 02-UM	DCGT 2(1.5)01-UM	DNGA 15 04 16T01020	DNGA 434T0320
CNMG 19 06 16-PR	CNMG 644-PR	DCGT 07 02 04-UM	DCGT 2(1.5)1-UM	DNGA 15 04 16T02520	DNGA 434T0820
CNMG 19 06 16-QM	CNMG 644-QM	DCGT 07 02 08-UM	DCGT 2(1.5)2-UM	DNGA 150404S01030A	DNGA 431S0330A
CNMG 19 06 16-SR	CNMG 644-SR	DCGT 11 T3 01-UM	DCGT 3(2.5)03-UM	DNGA 150404S01525	DNGA 431S0625
CNMG 19 06 24-PR	CNMG 646-PR	DCGT 11 T3 02-UM	DCGT 3(2.5)01-UM	DNGA 150408S01030A	DNGA 432S0330A
CNMG 25 09 24-PR	CNMG 866-PR	DCGT 11 T3 04-UM	DCGT 3(2.5)1-UM	DNGA 150408S01525	DNGA 432S0625
CNMM 12 04 08-MR	CNMM 432-MR	DCGT 11 T3 08-UM	DCGT 3(2.5)2-UM	DNGA 150408T01525	DNGA 432T0625
CNMM 12 04 08-PR	CNMM 432-PR	DCGT 11 T3 08-UM	DCGT 3(2.5)2-UM	DNGA 150412S01030A	DNGA 433S0330A
CNMM 12 04 08-QR	CNMM 432-QR	DCGX 07 02 02-AL	DCGX 2(1.5)0-AL	DNGA 150412S01525	DNGA 433S0625
CNMM 12 04 08-WR	CNMM 432-WR	DCGX 07 02 04-AL	DCGX 2(1.5)1-AL	DNGA 150604S01525	DNGA 441S0625
CNMM 12 04 12-MR	CNMM 433-MR	DCGX 11 T3 02-AL	DCGX 3(2.5)0-AL	DNGA 150608S01525	DNGA 442S0625
CNMM 12 04 12-PR	CNMM 433-PR	DCGX 11 T3 04-AL	DCGX 3(2.5)1-AL	DNGA 150608T01525	DNGA 442T0625
CNMM 12 04 12-QR	CNMM 433-QR	DCGX 11 T3 08-AL	DCGX 3(2.5)2-AL	DNGA 150612S01525	DNGA 443S0625
CNMM 12 04 12-WR	CNMM 433-WR	DCMT 07 02 02-KF	DCMT 2(1.5)0-KF	DNGN 15 04 16T01020	DNG 434T0320
CNMM 12 04 16-MR	CNMM 434-MR	DCMT 07 02 02-MF	DCMT 2(1.5)0-MF	DNGN 15 07 08T01020	DNG 452T0320
CNMM 12 04 16-PR	CNMM 434-PR	DCMT 07 02 02-PF	DCMT 2(1.5)0-PF	DNGN 15 07 08T02520	DNG 452T0820
CNMM 12 04 16-QR	CNMM 434-QR	DCMT 07 02 02-UF	DCMT 2(1.5)0-UF	DNGN 15 07 12T01020	DNG 453 T-0320
CNMM 12 04 16-WR	CNMM 434-WR	DCMT 07 02 04-KF	DCMT 2(1.5)1-KF	DNGN 15 07 12T02520	DNG 453T0820
CNMM 16 06 08-MR	CNMM 542-MR	DCMT 07 02 04-KM	DCMT 2(1.5)1-KM	DNGN 15 07 16K07015	DNG 454K3015
CNMM 16 06 08-PR	CNMM 542-PR	DCMT 07 02 04-MF	DCMT 2(1.5)1-MF	DNGN 15 07 16T01020	DNG 454T0320
CNMM 16 06 08-QR	CNMM 542-QR	DCMT 07 02 04-MM	DCMT 2(1.5)1-MM	DNGN 15 07 16T02520	DNG 454T0820
CNMM 16 06 12-MR	CNMM 543-MR	DCMT 07 02 04-PF	DCMT 2(1.5)1-PF	DNGN 15 07 16T07015	DNG 454T3015
CNMM 16 06 12-PR	CNMM 543-PR	DCMT 07 02 04-PM	DCMT 2(1.5)1-PM	DNGP 15 06 04	DNGP 441-DS
CNMM 16 06 12-QR	CNMM 543-QR	DCMT 07 02 04-UF	DCMT 2(1.5)1-UF	DNGP 15 06 08	DNGP 442-DS
CNMM 16 06 12-WR	CNMM 543-WR	DCMT 07 02 04-UM	DCMT 2(1.5)1-UM	DNGP 15 06 08	DNGP 442-DS
CNMM 16 06 16-MR	CNMM 544-MR	DCMT 07 02 08-KM	DCMT 2(1.5)2-KM	DNGQ 150708 T02520	DNGQ 452T0820
CNMM 16 06 16-PR	CNMM 544-PR	DCMT 07 02 08-MM	DCMT 2(1.5)2-MM	DNGQ 150712 T02520	DNGQ 453T0820
CNMM 16 06 16-QR	CNMM 544-QR	DCMT 07 02 08-PM	DCMT 2(1.5)2-PM	DNGQ 150716 T02520	DNGQ 454T0820

ISO	ANSI	ISO	ANSI	ISO	ANSI
DNMA 15 04 04S01020E	DNMA 431S0320E	DNMG 15 06 08-KF	DNMG 442-KF	KNUX 16 04 05F L12	
DNMA 15 04 08-KR	DNMA 432-KR	DNMG 15 06 08-KM	DNMG 442-KM	KNUX 16 04 05F R12	
DNMA 15 04 08S01020E	DNMA 432S0320E	DNMG 15 06 08-KR	DNMG 442-KR	KNUX 16 04 05L11	
DNMA 15 04 12-KR	DNMA 433-KR	DNMG 15 06 08L-K	DNMG 442L-K	KNUX 16 04 05L12	
DNMA 15 04 16-KR	DNMA 434-KR	DNMG 15 06 08-MF	DNMG 442-MF	KNUX 16 04 05R11	
DNMA 15 06 08-KR	DNMA 442-KR	DNMG 15 06 08-MM	DNMG 442-MM	KNUX 16 04 05R12	
DNMA 15 06 12-KR	DNMA 443-KR	DNMG 15 06 08-MR	DNMG 442-MR	KNUX 16 04 10F L12	
DNMA 15 06 16-KR	DNMA 444-KR	DNMG 15 06 08-PF	DNMG 442-PF	KNUX 16 04 10F R12	
DNMA 150412S01020E	DNMA 433 S0320E	DNMG 15 06 08-PM	DNMG 442-PM	KNUX 16 04 10L11	
DNMG 11 04 04-23	DNMG 331-23	DNMG 15 06 08-PR	DNMG 442-PR	KNUX 16 04 10L12	
DNMG 11 04 04-KF	DNMG 331-KF	DNMG 15 06 08-QM	DNMG 442-QM	KNUX 16 04 10R11	
DNMG 11 04 04-MF	DNMG 331-MF	DNMG 15 06 08R-K	DNMG 442R-K	KNUX 16 04 10R12	
DNMG 11 04 04-PF	DNMG 331-PF	DNMG 15 06 08-SM	DNMG 442-SM	KNUX 16 04 15F R13	
DNMG 11 04 04-PM	DNMG 331-PM	DNMG 15 06 12-23	DNMG 443-23	RCGX 06 02 M0-AL	
DNMG 11 04 04-QF	DNMG 331-QF	DNMG 15 06 12-KM	DNMG 443-KM	RCGX 06 06 00E	RCGX 24A
DNMG 11 04 04-QM	DNMG 331-QM	DNMG 15 06 12-KR	DNMG 443-KR	RCGX 06 06 00T01020	RCGX 24 T-0320
DNMG 11 04 08-KF	DNMG 332-KF	DNMG 15 06 12-MF	DNMG 443-MF	RCGX 060600 E	RCGX 24A
DNMG 11 04 08-KM	DNMG 332-KM	DNMG 15 06 12-MM	DNMG 443-MM	RCGX 08 03 M0-AL	
DNMG 11 04 08-MF	DNMG 332-MF	DNMG 15 06 12-MR	DNMG 443-MR	RCGX 09 07 00E	RCGX 35A
DNMG 11 04 08-MM	DNMG 332-MM	DNMG 15 06 12-PF	DNMG 443-PF	RCGX 09 07 00T01020	RCGX 35T0320
DNMG 11 04 08-PF	DNMG 332-PF	DNMG 15 06 12-PM	DNMG 443-PM	RCGX 09 07 00T07015	RCGX 35T3015
DNMG 11 04 08-PM	DNMG 332-PM	DNMG 15 06 12-PR	DNMG 443-PR	RCGX 10 T3 M0-AL	
DNMG 11 04 08-QF	DNMG 332-QF	DNMG 15 06 12-QM	DNMG 443-QM	RCGX 12 04 M0-AL	
DNMG 11 04 08-QM	DNMG 332-QM	DNMG 15 06 12-SM	DNMG 443-SM	RCGX 12 07 00E	RCGX 45A
DNMG 11 04 12-KM	DNMG 333-KM	DNMG 15 06 16-KR	DNMG 444-KR	RCGX 12 07 00K15015	RCGX 45K6015
DNMG 11 04 12-MF	DNMG 333-MF	DNMG 15 06 16-MR	DNMG 444-MR	RCGX 12 07 00T01020	RCGX 45T0320
DNMG 11 04 12-MM	DNMG 333-MM	DNMG 15 06 16-PM	DNMG 444-PM	RCGX 12 07 00T02520	RCGX 45T0820
DNMG 11 04 12-PF	DNMG 333-PF	DNMG 15 06 16-PR	DNMG 444-PR	RCGX 12 07 00T15015	RCGX 45T6015
DNMG 11 04 12-PM	DNMG 333-PM	DNMG 15 06 16-QM	DNMG 444-QM	RCGX 15 10 00T20015	RCGX 5(6.3)T8015
DNMG 11 04 12-QM	DNMG 333-QM	DNMG 150404-QM	DNMG 431-QM	RCGX 19 10 00K20015	RCGX 6(6.3)K8015
DNMG 15 04 04-23	DNMG 431-23	DNMM 15 04 08-MR	DNMM 432-MR	RCGX 19 10 00T20015	RCGX 6(6.3)T8015
DNMG 15 04 04-KF	DNMG 431-KF	DNMM 15 04 08-QR	DNMM 432-QR	RCGX 25 12 00K20015	RCGX 8(7.6)K8015
DNMG 15 04 04L-K	DNMG 431L-K	DNMM 15 04 12-QR	DNMM 433-QR	RCGX 25 12 00T20015	RCGX 8(7.6)T8015
DNMG 15 04 04-MF	DNMG 431-MF	DNMM 15 06 08-MR	DNMM 442-MR	RCMT 05 02 M0	
DNMG 15 04 04-PF	DNMG 431-PF	DNMM 15 06 08-PR	DNMM 442-PR	RCMT 06 02 M0	
DNMG 15 04 04-PM	DNMG 431-PM	DNMM 15 06 08-QR	DNMM 442-QR	RCMT 08 03 M0	
DNMG 15 04 04-QM	DNMG 431-QM	DNMM 15 06 12-MR	DNMM 443-MR	RCMT 08 03 M0-SM	
DNMG 15 04 04-QM	DNMG 431-QM	DNMM 15 06 12-PR	DNMM 443-PR	RCMT 10 T3 M0	
DNMG 15 04 04R-K	DNMG 431R-K	DNMM 15 06 12-QR	DNMM 443-QR	RCMT 10 T3 M0-SM	
DNMG 15 04 04-SM	DNMG 431-SM	DNMM 15 06 16-MR	DNMM 444-MR	RCMT 12 04 M0	
DNMG 15 04 08-23	DNMG 432-23	DNMM 15 06 16-PR	DNMM 444-PR	RCMT 12 04 M0-SM	
DNMG 15 04 08-KF	DNMG 432-KF	DNMM 15 06 16-QR	DNMM 444-QR	RCMT 16 06 M0	
DNMG 15 04 08-KM	DNMG 432-KM	DNMX 11 04 04-WF	DNMX 331-WF	RCMT 16 06 M0-SM	
DNMG 15 04 08-KR	DNMG 432-KR	DNMX 11 04 08-WF	DNMX 332-WF	RCMT 20 06 M0	
DNMG 15 04 08L-K	DNMG 432L-K	DNMX 11 04 08-WM	DNMX 332-WM	RCMT 25 07 M0	
DNMG 15 04 08-MF	DNMG 432-MF	DNMX 11 04 12-WM	DNMX 333-WM	RCMT 32 09 M0	
DNMG 15 04 08-MM	DNMG 432-MM	DNMX 15 04 04-WF	DNMX 431-WF	RCMX 10 03 00	
DNMG 15 04 08-MR	DNMG 432-MR	DNMX 15 04 08-WF	DNMX 432-WF	RCMX 10 03 00E	
DNMG 15 04 08-PF	DNMG 432-PF	DNMX 15 04 08-WM	DNMX 432-WM	RCMX 12 04 00	
DNMG 15 04 08-PM	DNMG 432-PM	DNMX 15 04 12-WF	DNMX 433-WF	RCMX 12 04 00E	
DNMG 15 04 08-PR	DNMG 432-PR	DNMX 15 04 12-WM	DNMX 433-WM	RCMX 16 06 00	
DNMG 15 04 08-QM	DNMG 432-QM	DNMX 15 04 16-WM	DNMX 434-WM	RCMX 16 06 00E	
DNMG 15 04 08R-K	DNMG 432R-K	DNMX 15 06 04-WF	DNMX 441-WF	RCMX 20 06 00	
DNMG 15 04 08-SM	DNMG 432-SM	DNMX 15 06 08-WF	DNMX 442-WF	RCMX 25 07 00	
DNMG 15 04 12-23	DNMG 433-23	DNMX 15 06 08-WM	DNMX 442-WM	RCMX 32 09 00	
DNMG 15 04 12-KF	DNMG 433-KF	DNMX 15 06 12-WF	DNMX 443-WF	RNGA 09 03 00S01020D	RNGA 32S0320D
DNMG 15 04 12-KM	DNMG 433-KM	DNMX 15 06 12-WM	DNMX 443-WM	RNGA 12 04 00T01020	RNGA 43T0320
DNMG 15 04 12-KR	DNMG 433-KR	DNMX 15 06 16-WM	DNMX 444-WM	RNGN 09 03 00T01020	RNG 32T0320
DNMG 15 04 12-MF	DNMG 433-MF	DPMT 07 02 02-MF	DPMT 2(1.5)0-MF	RNGN 12 04 00FD	RNG 43FD
DNMG 15 04 12-MM	DNMG 433-MM	DPMT 07 02 02-PF	DPMT 2(1.5)0-PF	RNGN 12 04 00T01020	RNG 43T0320
DNMG 15 04 12-MR	DNMG 433-MR	DPMT 07 02 04-KF	DPMT 2(1.5)1-KF	RNGN 12 04 00T02520	RNG 43T0820
DNMG 15 04 12-PF	DNMG 433-PF	DPMT 07 02 04-KM	DPMT 2(1.5)1-KM	RNGN 12 07 00E	RNG 45A
DNMG 15 04 12-PM	DNMG 433-PM	DPMT 07 02 04-MF	DPMT 2(1.5)1-MF	RNGN 12 07 00K15015	RNG 45K6015
DNMG 15 04 12-PR	DNMG 433-PR	DPMT 07 02 04-MM	DPMT 2(1.5)1-MM	RNGN 12 07 00T01020	RNG 45T0320
DNMG 15 04 12-QM	DNMG 433-QM	DPMT 07 02 04-PF	DPMT 2(1.5)1-PF	RNGN 12 07 00T02520	RNG 45T0820
DNMG 15 04 12-SM	DNMG 433-SM	DPMT 07 02 04-PM	DPMT 2(1.5)1-PM	RNGN 12 07 00T15015	RNG 45T6015
DNMG 15 04 16-MF	DNMG 434-MF	DPMT 07 02 08-KM	DPMT 2(1.5)2-KM	RNGN 15 07 00T01020	RNG 55T0320
DNMG 15 04 16-MR	DNMG 434-MR	DPMT 07 02 08-MM	DPMT 2(1.5)2-MM	RNGN 15 07 00T02520	RNG 55T0820
DNMG 15 04 16-PR	DNMG 434-PR	DPMT 07 02 08-PM	DPMT 2(1.5)2-PM	RNGN 15 07 00T20015	RNG 55T8015
DNMG 15 04 16-QM	DNMG 434-QM	DPMT 11 T3 04-KM	DPMT 3(2.5)1-KM	RNGN 19 07 00K20015	RNG 65K8015
DNMG 15 06 04-23	DNMG 441-23	DPMT 11 T3 04-KM	DPMT 3(2.5)1-KM	RNGN 19 07 00T01020	RNG 65 T-0320
DNMG 15 06 04-KF	DNMG 441-KF	DPMT 11 T3 04-MM	DPMT 3(2.5)1-MM	RNGN 19 07 00T20015	RNG 65T8015
DNMG 15 06 04L-K	DNMG 441L-K	DPMT 11 T3 04-PM	DPMT 3(2.5)1-PM	RNGN 190700 T01020	RNG 65 T-0320
DNMG 15 06 04-MF	DNMG 441-MF	DPMT 11 T3 08-KM	DPMT 3(2.5)2-KM	RNGN 25 07 00K20015	RNG 85K8015
DNMG 15 06 04-PF	DNMG 441-PF	DPMT 11 T3 08-MM	DPMT 3(2.5)2-MM	RNGN 25 07 00T20015	RNG 85T-8015
DNMG 15 06 04-PM	DNMG 441-PM	DPMT 11 T3 08-PM	DPMT 3(2.5)2-PM	RNMGM 09 03 00	RNMGM 32
DNMG 15 06 04-QM	DNMG 441-QM	KNMX 16 04 05 L-71		RNMGM 12 04 00	RNMGM 43
DNMG 15 06 04R-K	DNMG 441R-K	KNMX 16 04 05 R-71		RNMGM 15 06 00	RNMGM 54
DNMG 15 06 04-SM	DNMG 441-SM	KNMX 16 04 10 L-71		RNMGM 19 06 00	RNMGM 64
DNMG 15 06 08-23	DNMG 442-23	KNMX 16 04 10 R-71		RNMGM 19 06 00-SR	RNMGM 64-SR

ISO	ANSI	ISO	ANSI	ISO	ANSI
RNMG 25 09 00	RNMG 86	SNGN 15 07 12T01020	SNG 553T0320	SNMG 15 06 16-MM	SNMG 544-MM
RPGN 09 03 00T01020	RPG 32T0320	SNGN 15 07 16T01020	SNG 554T0320	SNMG 15 06 16-MR	SNMG 544-MR
RPGX 060600 E	RPGX 24 A	SNGN 15 07 16T02520	SNG 554T0820	SNMG 15 06 16-PM	SNMG 544-PM
RPGX 09 07 00E		SNGN 19 07 24T01020	SNG 566T-0320	SNMG 15 06 16-PR	SNMG 544-PR
RPGX 09 07 00T01020	RPGX 35T0320	SNGN 19 07 24T01020	SNG 566T-0320	SNMG 15 06 16-QM	SNMG 544-QM
RPGX 12 07 00E	RPGX 45A	SNGN 19 07 24T02520	SNG 566T0820	SNMG 15 06 24-PR	SNMG 546-PR
RPGX 12 07 00T01020	RPGX 45T-0320	SNGN 190716 T01020	SNG 654T0320	SNMG 19 06 08-MR	SNMG 642-MR
SCGX 09 T3 08-AL	SCGX 3(2.5)2-AL	SNGQ 120708 T02520	SNGQ 452T0820	SNMG 19 06 08-PR	SNMG 642-PR
SCMT 09 T3 04-KM	SCMT 3(2.5)1-KM	SNGQ 120712 T02520	SNGQ 453T0820	SNMG 19 06 08-QM	SNMG 642-QM
SCMT 09 T3 04-MF	SCMT 3(2.5)1-MF	SNGQ 120716 T02520	SNGQ 454T0820	SNMG 19 06 12-23	SNMG 643-23
SCMT 09 T3 04-MM	SCMT 3(2.5)1-MM	SNMA 09 03 08-KR	SNMA 322-KR	SNMG 19 06 12-KM	SNMG 643-KM
SCMT 09 T3 04-PF	SCMT 3(2.5)1-PF	SNMA 12 04 04S01020E	SNMA 431S0320E	SNMG 19 06 12-MM	SNMG 643-MM
SCMT 09 T3 04-PM	SCMT 3(2.5)1-PM	SNMA 12 04 08-KR	SNMA 432-KR	SNMG 19 06 12-MR	SNMG 643-MR
SCMT 09 T3 08-KM	SCMT 3(2.5)2-KM	SNMA 12 04 08S01020E	SNMA 432S0320E	SNMG 19 06 12-PR	SNMG 643-PR
SCMT 09 T3 08-KR	SCMT 3(2.5)2-KR	SNMA 12 04 12-KR	SNMA 433-KR	SNMG 19 06 12-QM	SNMG 643-QM
SCMT 09 T3 08-MF	SCMT 3(2.5)2-MF	SNMA 12 04 12S01020E	SNMA 433 S0320E	SNMG 19 06 16-23	SNMG 644-23
SCMT 09 T3 08-MM	SCMT 3(2.5)2-MM	SNMA 12 04 16-KR	SNMA 434-KR	SNMG 19 06 16-KM	SNMG 644-KM
SCMT 09 T3 08-MR	SCMT 3(2.5)2-MR	SNMA 15 06 12-KR	SNMA 543-KR	SNMG 19 06 16-KR	SNMG 644-KR
SCMT 09 T3 08-PF	SCMT 3(2.5)2-PF	SNMA 15 06 16-KR	SNMA 544-KR	SNMG 19 06 16-MM	SNMG 644-MM
SCMT 09 T3 08-PM	SCMT 3(2.5)2-PM	SNMA 19 06 08-KR	SNMA 642-KR	SNMG 19 06 16-MR	SNMG 644-MR
SCMT 09 T3 08-PR	SCMT 3(2.5)2-PR	SNMA 19 06 12-KR	SNMA 643-KR	SNMG 19 06 16-PR	SNMG 644-PR
SCMT 09 T3 08-UM	SCMT 3(2.5)2-UM	SNMA 19 06 16-KR	SNMA 644-KR	SNMG 19 06 16-QM	SNMG 644-QM
SCMT 09 T3 08-UR	SCMT 3(2.5)2-UR	SNMA 25 07 24-KR	SNMA 856-KR	SNMG 19 06 16-SR	SNMG 644-SR
SCMT 09 T3 12-KR	SCMT 3(2.5)3-KR	SNMG 09 03 04-MF	SNMG 321-MF	SNMG 19 06 24-MR	SNMG 646-MR
SCMT 09 T3 12-MR	SCMT 3(2.5)3-MR	SNMG 09 03 04-PM	SNMG 321-PM	SNMG 19 06 24-PR	SNMG 646-PR
SCMT 09 T3 12-PR	SCMT 3(2.5)3-PR	SNMG 09 03 04-QM	SNMG 321-QM	SNMG 25 07 16-PR	SNMG 854-PR
SCMT 12 04 04-MM	SCMT 431-MM	SNMG 09 03 08-KM	SNMG 322-KM	SNMG 25 07 24-KR	SNMG 856-KR
SCMT 12 04 04-PM	SCMT 431-PM	SNMG 09 03 08-MF	SNMG 322-MF	SNMG 25 07 24-MR	SNMG 856-MR
SCMT 12 04 08-KM	SCMT 432-KM	SNMG 09 03 08-PM	SNMG 322-PM	SNMG 25 09 24-MR	SNMG 866-MR
SCMT 12 04 08-KR	SCMT 432-KR	SNMG 09 03 08-QM	SNMG 322-QM	SNMG 25 09 24-PR	SNMG 866-PR
SCMT 12 04 08-MM	SCMT 432-MM	SNMG 09 03 12-MF	SNMG 323-MF	SNMM 12 04 08-MR	SNMM 432-MR
SCMT 12 04 08-MR	SCMT 432-MR	SNMG 09 03 12-QM	SNMG 323-QM	SNMM 12 04 08-PR	SNMM 432-PR
SCMT 12 04 08-PM	SCMT 432-PM	SNMG 12 04 04-23	SNMG 431-23	SNMM 12 04 08-QR	SNMM 432-QR
SCMT 12 04 08-PR	SCMT 432-PR	SNMG 12 04 04-MF	SNMG 431-MF	SNMM 12 04 12-MR	SNMM 433-MR
SCMT 12 04 08-UR	SCMT 432-UR	SNMG 12 04 04-PM	SNMG 431-PM	SNMM 12 04 12-PR	SNMM 433-PR
SCMT 12 04 12-KR	SCMT 433-KR	SNMG 12 04 04-QF	SNMG 431-QF	SNMM 12 04 12-QR	SNMM 433-QR
SCMT 12 04 12-MM	SCMT 433-MM	SNMG 12 04 04-QM	SNMG 431-QM	SNMM 12 04 16-MR	SNMM 434-MR
SCMT 12 04 12-MR	SCMT 433-MR	SNMG 12 04 08-23	SNMG 432-23	SNMM 12 04 16-QR	SNMM 434-QR
SCMT 12 04 12-PM	SCMT 433-PM	SNMG 12 04 08-KM	SNMG 432-KM	SNMM 15 06 08-QR	SNMM 542-QR
SCMT 12 04 12-PR	SCMT 433-PR	SNMG 12 04 08-KR	SNMG 432-KR	SNMM 15 06 12-MR	SNMM 543-MR
SCMW 09 T3 04	SCMW 3(2.5)1	SNMG 12 04 08-MF	SNMG 432-MF	SNMM 15 06 12-PR	SNMM 543-PR
SCMW 09 T3 08	SCMW 3(2.5)2	SNMG 12 04 08-MM	SNMG 432-MM	SNMM 15 06 12-QR	SNMM 543-QR
SCMW 12 04 08	SCMW 432	SNMG 12 04 08-MR	SNMG 432-MR	SNMM 15 06 16-MR	SNMM 544-MR
SNGA 090304S01020A	SNGA 321S0320A	SNMG 12 04 08-PF	SNMG 432-PF	SNMM 15 06 16-PR	SNMM 544-PR
SNGA 090304T01020A	SNGA 321T0320A	SNMG 12 04 08-PM	SNMG 432-PM	SNMM 15 06 16-QR	SNMM 544-QR
SNGA 090308S01020A	SNGA 322S0320A	SNMG 12 04 08-PR	SNMG 432-PR	SNMM 15 06 24-MR	SNMM 546-MR
SNGA 090308T01020A	SNGA 322T0320A	SNMG 12 04 08-QF	SNMG 432-QF	SNMM 15 06 24-QR	SNMM 546-QR
SNGA 12 04 08S01020A	SNGA 432S0320A	SNMG 12 04 08-QM	SNMG 432-QM	SNMM 19 06 08-QR	SNMM 642-QR
SNGA 12 04 08T01020	SNGA 432T0320	SNMG 12 04 08-SM	SNMG 432-SM	SNMM 19 06 12-MR	SNMM 643-MR
SNGA 12 04 08T01020A	SNGA 432T0320A	SNMG 12 04 12-23	SNMG 433-23	SNMM 19 06 12-PR	SNMM 643-PR
SNGA 12 04 08T02520	SNGA 432T0820	SNMG 12 04 12-KM	SNMG 433-KM	SNMM 19 06 12-QR	SNMM 643-QR
SNGA 12 04 12S01020A	SNGA 433S0320A	SNMG 12 04 12-KR	SNMG 433-KR	SNMM 19 06 16-HR	SNMM 644-HR
SNGA 12 04 12T01020	SNGA 433T0320	SNMG 12 04 12-MF	SNMG 433-MF	SNMM 19 06 16-MR	SNMM 644-MR
SNGA 12 04 12T01020A	SNGA 433T0320A	SNMG 12 04 12-MM	SNMG 433-MM	SNMM 19 06 16-PR	SNMM 644-PR
SNGA 12 04 12T02520	SNGA 433T0820	SNMG 12 04 12-MR	SNMG 433-MR	SNMM 19 06 16-QR	SNMM 644-QR
SNGA 12 04 16T01020	SNGA 434T0320	SNMG 12 04 12-PF	SNMG 433-PF	SNMM 19 06 24-HR	SNMM 646-HR
SNGA 12 04 16T02520	SNGA 434T0820	SNMG 12 04 12-PM	SNMG 433-PM	SNMM 19 06 24-MR	SNMM 646-MR
SNGA 120408S01525	SNGA 432S0625	SNMG 12 04 12-PR	SNMG 433-PR	SNMM 19 06 24-PR	SNMM 646-PR
SNGA 120408T01525	SNGA 432T0625	SNMG 12 04 12-QM	SNMG 433-QM	SNMM 19 06 24-QR	SNMM 646-QR
SNGA 120412S01525	SNGA 433S0625	SNMG 12 04 12-SM	SNMG 433-SM	SNMM 19 06 32-MR	SNMM 648-MR
SNGN 09 03 08T01020	SNG 322T0320	SNMG 12 04 16-KM	SNMG 434-KM	SNMM 25 07 24-HR	SNMM 856-HR
SNGN 09 03 12T01020	SNG 323T0320	SNMG 12 04 16-KR	SNMG 434-KR	SNMM 25 07 24-MR	SNMM 856-MR
SNGN 12 04 08FD	SNG 432FD	SNMG 12 04 16-MF	SNMG 434-MF	SNMM 25 07 24-QR	SNMM 856-QR
SNGN 12 04 08T01020	SNG 432T0320	SNMG 12 04 16-MM	SNMG 434-MM	SNMM 25 07 32-HR	SNMM 858-HR
SNGN 12 04 08T02520	SNG 432T0820	SNMG 12 04 16-MR	SNMG 434-MR	SNMM 25 07 32-MR	SNMM 858-MR
SNGN 12 04 12FD	SNG 433FD	SNMG 12 04 16-PM	SNMG 434-PM	SNMM 25 09 24-HR	SNMM 866-HR
SNGN 12 04 12T01020	SNG 433T0320	SNMG 12 04 16-PR	SNMG 434-PR	SNMM 25 09 24-MR	SNMM 866-MR
SNGN 12 04 12T02520	SNG 433T0820	SNMG 12 04 16-QM	SNMG 434-QM	SNMM 25 09 32-HR	SNMM 868-HR
SNGN 12 04 16FD	SNG 434FD	SNMG 15 06 08-PR	SNMG 542-PR	SNMM 25 09 32-MR	SNMM 868-MR
SNGN 12 04 16T01020	SNG 434T0320	SNMG 15 06 08-QM	SNMG 542-QM	SNUN 09 03 08	
SNGN 12 04 16T02520	SNG 434T0820	SNMG 15 06 12-KM	SNMG 543-KM	SPGN 12 04 08T01020	SPG 432T0320
SNGN 12 07 08T01020	SNG 452T0320	SNMG 15 06 12-KR	SNMG 543-KR	SPGN 12 04 12T01020	SPG 433T0320
SNGN 12 07 08T02520	SNG 452T0820	SNMG 15 06 12-MM	SNMG 543-MM	SPUN 12 03 04FP	SPU 421FP
SNGN 12 07 12T01020	SNG 453T0320	SNMG 15 06 12-MR	SNMG 543-MR	TCGT 06 T1 02L-K	TCGT 1.2(1.2)0L-K
SNGN 12 07 12T02520	SNG 453T0820	SNMG 15 06 12-PM	SNMG 543-PM	TCGT 06 T1 02R-K	TCGT 1.2(1.2)0R-K
SNGN 12 07 16K15015	SNG 454K6015	SNMG 15 06 12-PR	SNMG 543-PR	TCGT 06 T1 04L-K	TCGT 1.2(1.2)1L-K
SNGN 12 07 16T01020	SNG 454T0320	SNMG 15 06 12-QM	SNMG 543-QM	TCGT 06 T1 04R-K	TCGT 1.2(1.2)1R-K
SNGN 12 07 16T02520	SNG 454T0820	SNMG 15 06 16-KM	SNMG 544-KM	TCGT 09 02 02L-K	TCGT 1.8(1.5)0L-K
SNGN 12 07 16T15015	SNG 454T6015	SNMG 15 06 16-KR	SNMG 544-KR	TCGT 09 02 02R-K	TCGT 1.8(1.5)0R-K
SNGN 15 07 08T01020	SNG 552T0320	SNMG 15 06 16-MF	SNMG 544-MF	TCGT 09 02 04L-K	TCGT 1.8(1.5)1L-K

ISO	ANSI	ISO	ANSI	ISO	ANSI
TCGT 09 02 04R-K	TCGT 1.8(1.5)1R-K	TCMT 11 03 04-KM	TCMT 221-KM	TCMX 16 T3 08-WM	TCMX 3(2.5)2-WM
TCGT 09 02 04-UM	TCGT 1.8(1.5)1-UM	TCMT 11 03 04-MF	TCMT 221-MF	TCMX 16 T3 08-WM	TCMX 3(2.5)2-WM
TCGT 09 02 04-UM	TCGT 1.8(1.5)1-UM	TCMT 11 03 04-MM	TCMT 221-MM	TNGA 110304S01020A	TNGA 221S0320A
TCGT 11 02 01-UM	TCGT 2(1.5)03-UM	TCMT 11 03 04-PF	TCMT 221-PF	TNGA 110304T01020A	TNGA 221T0320A
TCGT 11 02 02L-K	TCGT 2(1.5)0L-K	TCMT 11 03 04-PM	TCMT 221-PM	TNGA 110308S01020A	TNGA 222S0320A
TCGT 11 02 02R-K	TCGT 2(1.5)0R-K	TCMT 11 03 08-KM	TCMT 222-KM	TNGA 110308T01020A	TNGA 222T0320A
TCGT 11 02 02-UM	TCGT 2(1.5)0-UM	TCMT 11 03 08-KR	TCMT 222-KR	TNGA 16 04 04S01020A	TNGA 331S0320A
TCGT 11 02 04L-K	TCGT 2(1.5)1L-K	TCMT 11 03 08-MF	TCMT 222-MF	TNGA 16 04 04T01020A	TNGA 331T0320A
TCGT 11 02 04R-K	TCGT 2(1.5)1R-K	TCMT 11 03 08-MM	TCMT 222-MM	TNGA 16 04 08S01020A	TNGA 332S0320A
TCGT 11 02 04R-K	TCGT 2(1.5)1R-K	TCMT 11 03 08-MR	TCMT 222-MR	TNGA 16 04 08T01020	TNGA 332T0320
TCGT 11 02 04-UM	TCGT 2(1.5)1-UM	TCMT 11 03 08-PF	TCMT 222-PF	TNGA 16 04 08T01020A	TNGA 332T0320A
TCGT 11 02 08-UM	TCGT 2(1.5)2-UM	TCMT 11 03 08-PM	TCMT 222-PM	TNGA 16 04 08T01525	TNGA 332T0625
TCGT 11 03 01-UM	TCGT 22(03)-UM	TCMT 11 03 08-PR	TCMT 222-PR	TNGA 16 04 08T02520	TNGA 332T0820
TCGT 11 03 02L-K	TCGT 220L-K	TCMT 11 03 12-KR	TCMT 223-KR	TNGA 16 04 12S01020A	TNGA 333S0320A
TCGT 11 03 02R-K	TCGT 220R-K	TCMT 11 03 12-PM	TCMT 223-PM	TNGA 16 04 12T01020	TNGA 333T0320
TCGT 11 03 02-UM	TCGT 220-UM	TCMT 11 03 12-PR	TCMT 223-PR	TNGA 16 04 12T01020A	TNGA 333T0320A
TCGT 11 03 04L-K	TCGT 221L-K	TCMT 16 T3 04-KF	TCMT 3(2.5)1-KF	TNGA 16 04 12T02520	TNGA 333T0820
TCGT 11 03 04R-K	TCGT 221R-K	TCMT 16 T3 04-KM	TCMT 3(2.5)1-KM	TNGA 16 04 16T01020	TNGA 334T0320
TCGT 11 03 04-UM	TCGT 221-UM	TCMT 16 T3 04-MF	TCMT 3(2.5)1-MF	TNGA 16 04 16T02520	TNGA 334T0820
TCGT 11 03 08-UM	TCGT 222-UM	TCMT 16 T3 04-MM	TCMT 3(2.5)1-MM	TNGA 160404S01525	TNGA 331S0625
TCGT 16 T3 04-UM	TCGT 3(2.5)1-UM	TCMT 16 T3 04-PF	TCMT 3(2.5)1-PF	TNGA 160408S01525	TNGA 332S0625
TCGT 16 T3 08-UM	TCGT 3(2.5)2-UM	TCMT 16 T3 04-PM	TCMT 3(2.5)1-PM	TNGA 160412S01525	TNGA 333S0625
TCGX 06 T1 04-AL	TCGX 1.8(1.2)1-AL	TCMT 16 T3 04-PM	TCMT 3(2.5)1-UM	TNGA 22 04 08T01020	TNGA 432T0320
TCGX 06 T1 04L-WK	TCGX 1.2(1.2)1L-WK	TCMT 16 T3 04-UR	TCMT 3(2.5)1-UR	TNGA 22 04 12T01020	TNGA 433T0320
TCGX 06 T1 04R-WK	TCGX 1.2(1.2)1R-WK	TCMT 16 T3 08-KM	TCMT 3(2.5)2-KM	TNGA 22 04 16T01020	TNGA 434T0320
TCGX 09 02 02-AL	TCGX 1.8(1.5)0-AL	TCMT 16 T3 08-KR	TCMT 3(2.5)2-KR	TNGN 11 03 08T01020	TNG 222T0320
TCGX 09 02 04-AL	TCGX 1.8(1.5)1-AL	TCMT 16 T3 08-MM	TCMT 3(2.5)2-MM	TNGN 11 03 12T01020	TNG 223T0320
TCGX 09 02 04L-WK	TCGX 1.8(1.5)1L-WK	TCMT 16 T3 08-MR	TCMT 3(2.5)2-MR	TNGN 16 04 08T01020	TNG 332T0320
TCGX 09 02 04R-WK	TCGX 1.8(1.5)1R-WK	TCMT 16 T3 08-PM	TCMT 3(2.5)2-PM	TNGN 16 04 12T01020	TNG 333T0320
TCGX 11 02 02-AL	TCGX 2(1.5)0-AL	TCMT 16 T3 08-PR	TCMT 3(2.5)2-PR	TNGN 16 04 12T02520	TNG 333T0820
TCGX 11 02 04-AL	TCGX 2(1.5)1-AL	TCMT 16 T3 08-UF	TCMT 3(2.5)2-UF	TNGN 16 04 16T01020	TNG 334T0320
TCGX 11 02 04L-WK	TCGX 2(1.5)1L-WK	TCMT 16 T3 08-UM	TCMT 3(2.5)2-UM	TNGN 16 07 08T01020	TNG 352T0320
TCGX 11 02 04R-WK	TCGX 2(1.5)1R-WK	TCMT 16 T3 08-UR	TCMT 3(2.5)2-UR	TNGN 16 07 12T01020	TNG 353T0320
TCGX 11 02 08-AL	TCGX 2(1.5)2-AL	TCMT 16 T3 12-KM	TCMT 3(2.5)3-KM	TNGN 22 04 08T01020	TNG 432T0320
TCGX 11 03 02-AL	TCGX 220-AL	TCMT 16 T3 12-KR	TCMT 3(2.5)3-KR	TNGN 22 04 12FD	TNG 433FD
TCGX 11 03 04-AL	TCGX 221-AL	TCMT 16 T3 12-MM	TCMT 3(2.5)3-MM	TNGN 22 07 12T01020	TNG 453T0320
TCGX 11 03 04L-WK	TCGX 221L-WK	TCMT 16 T3 12-MR	TCMT 3(2.5)3-MR	TNGN 220408 E	TNG 432 A
TCGX 11 03 04R-WK	TCGX 221R-WK	TCMT 16 T3 12-PM	TCMT 3(2.5)3-PM	TNMA 16 04 04-KR	TNMA 331-KR
TCGX 11 03 08-AL	TCGX 220-AL	TCMT 16 T3 12-PR	TCMT 3(2.5)3-PR	TNMA 16 04 04S01020E	TNMA 331S0320E
TCGX 16 T3 04-AL	TCGX 3(2.5)1-AL	TCMT 22 04 08-KM	TCMT 432-KM	TNMA 16 04 08-KR	TNMA 332-KR
TCGX 16 T3 08-AL	TCGX 3(2.5)2-AL	TCMT 22 04 08-KR	TCMT 432-KR	TNMA 16 04 08S01020E	TNMA 332S0320E
TCMT 06 T1 02-KF	TCMT 1.2(1.2)0-KF	TCMT 22 04 08-KR	TCMT 432-KR	TNMA 16 04 12-KR	TNMA 333-KR
TCMT 06 T1 02-MF	TCMT 1.2(1.2)0-MF	TCMT 22 04 08-MM	TCMT 432-MM	TNMA 16 04 12S01020E	TNMA 333S0320E
TCMT 06 T1 02-PF	TCMT 1.2(1.2)0-PF	TCMT 22 04 08-MR	TCMT 432-MR	TNMA 16 04 16-KR	TNMA 334-KR
TCMT 06 T1 02-UF	TCMT 1.2(1.2)0-UF	TCMT 22 04 08-PM	TCMT 432-PM	TNMA 22 04 04-KR	TNMA 431-KR
TCMT 06 T1 04-KF	TCMT 1.2(1.2)1-KF	TCMT 22 04 08-PR	TCMT 432-PR	TNMA 22 04 08-KR	TNMA 432-KR
TCMT 06 T1 04-KF	TCMT 1.2(1.2)1-KF	TCMT 22 04 08-UM	TCMT 432-UM	TNMA 22 04 08S01020E	TNMA 432S0320E
TCMT 06 T1 04-MF	TCMT 1.2(1.2)1-MF	TCMT 22 04 12-56	TCMT 433-56	TNMA 22 04 12-KR	TNMA 433-KR
TCMT 06 T1 04-PF	TCMT 1.2(1.2)1-PF	TCMT 22 04 12-KR	TCMT 433-KR	TNMA 22 04 12S01020E	TNMA 433S0320E
TCMT 06 T1 04-UF	TCMT 1.2(1.2)1-UF	TCMT 22 04 12-KR	TCMT 433-KR	TNMA 22 04 16-KR	TNMA 434-KR
TCMT 06 T1 08-KF	TCMT 1.2(1.2)2-KF	TCMT 22 04 12-MR	TCMT 433-MR	TNMA 27 06 16-KR	TNMA 544-KR
TCMT 06 T1 08-MF	TCMT 1.2(1.2)2-MF	TCMT 22 04 12-PR	TCMT 433-PR	TNMG 11 03 02-MF	TNMG 220-MF
TCMT 06 T1 08-PF	TCMT 1.2(1.2)2-PF	TCMT 22 04 12-UR	TCMT 433-UR	TNMG 11 03 04-MF	TNMG 221-MF
TCMT 09 02 02-KF	TCMT 1.8(1.5)0-KF	TCMW 09 02 04FP	TCMW 1.8(1.5)1FP	TNMG 11 03 04-QM	TNMG 221-QM
TCMT 09 02 02-MF	TCMT 1.8(1.5)0-MF	TCMW 09 02 04S01020E	TCMW 1.8(1.5)1S0320E	TNMG 11 03 08-MF	TNMG 222-MF
TCMT 09 02 02-PF	TCMT 1.8(1.5)0-PF	TCMW 11 02 04	TCMW 2(1.5)1	TNMG 11 03 08-QM	TNMG 222-QM
TCMT 09 02 02-UF	TCMT 1.8(1.5)0-UF	TCMW 11 02 04FP	TCMW 2(1.5)1FP	TNMG 11 03 12-MF	TNMG 223-MF
TCMT 09 02 04-KF	TCMT 1.8(1.5)1-KF	TCMW 11 02 04S01020	TCMW 2(1.5)1 S0320	TNMG 16 03 04-QM	TNMG 321-QM
TCMT 09 02 04-KM	TCMT 1.8(1.5)1-KM	TCMW 11 02 08FP	TCMW 2(1.5)2FP	TNMG 16 03 08-QF	TNMG 322-QF
TCMT 09 02 04-MF	TCMT 1.8(1.5)1-MF	TCMW 11 02 08S01020E	TCMW 2(1.5)2 S0320E	TNMG 16 04 04-23	TNMG 331-23
TCMT 09 02 04-MM	TCMT 1.8(1.5)1-MM	TCMW 11 03 04	TCMW 221	TNMG 16 04 04-KF	TNMG 331-KF
TCMT 09 02 04-PF	TCMT 1.8(1.5)1-PF	TCMW 110204S01020E	TCMW 2(1.5)1 S0320E	TNMG 16 04 04L-K	TNMG 331L-K
TCMT 09 02 04-PF	TCMT 1.8(1.5)1-PF	TCMW 110304FP	TCMW 221FP	TNMG 16 04 04-MF	TNMG 331-MF
TCMT 09 02 04-PM	TCMT 1.8(1.5)1-PM	TCMW 110304S01020E	TCMW 221 S0320E	TNMG 16 04 04-PF	TNMG 331-PF
TCMT 09 02 04-UF	TCMT 1.8(1.5)1-UF	TCMW 110308FP	TCMW 222FP	TNMG 16 04 04-PM	TNMG 331-PM
TCMT 09 02 04-UM	TCMT 1.8(1.5)1-UM	TCMW 110308S01020E	TCMW 222 S0320E	TNMG 16 04 04-QF	TNMG 331-QF
TCMT 09 02 08-KM	TCMT 1.8(1.5)2-KM	TCMW 16 T3 04	TCMW 3(2.5)1	TNMG 16 04 04-QF	TNMG 331-QF
TCMT 09 02 08-MM	TCMT 1.8(1.5)2-MM	TCMW 16 T3 04FLP	TCMW 3(2.5)1FLP	TNMG 16 04 04-QM	TNMG 331-QM
TCMT 09 02 08-PM	TCMT 1.8(1.5)2-PM	TCMW 16 T3 04FP	TCMW 3(2.5)1FP	TNMG 16 04 04R-K	TNMG 331R-K
TCMT 11 02 02-UF	TCMT 2(1.5)0-UF	TCMW 16 T3 04FRP	TCMW 3(2.5)1FRP	TNMG 16 04 04-SM	TNMG 331-SM
TCMT 11 02 04-UF	TCMT 2(1.5)1-UF	TCMW 16 T3 08	TCMW 3(2.5)2	TNMG 16 04 08-23	TNMG 332-23
TCMT 11 02 04-UM	TCMT 2(1.5)1-UM	TCMW 16 T3 08FP	TCMW 3(2.5)2FP	TNMG 16 04 08-KF	TNMG 332-KF
TCMT 11 02 04-UR	TCMT 2(1.5)1-UR	TCMX 09 02 04-WF	TCMX 1.8(1.5)1-WF	TNMG 16 04 08-KM	TNMG 332-KM
TCMT 11 02 08-UF	TCMT 2(1.5)2-UF	TCMX 09 02 08-WF	TCMX 1.8(1.5)2-WF	TNMG 16 04 08-KR	TNMG 332-KR
TCMT 11 02 08-UM	TCMT 2(1.5)2-UM	TCMX 11 03 04-WF	TCMX 221-WF	TNMG 16 04 08L-K	TNMG 332L-K
TCMT 11 02 08-UR	TCMT 2(1.5)2-UR	TCMX 11 03 04-WM	TCMX 221-WM	TNMG 16 04 08-MF	TNMG 332-MF
TCMT 11 03 02-KF	TCMT 220-KF	TCMX 11 03 08-WF	TCMX 222-WF	TNMG 16 04 08-MM	TNMG 332-MM
TCMT 11 03 02-MF	TCMT 220-MF	TCMX 11 03 08-WM	TCMX 222-WM	TNMG 16 04 08-MR	TNMG 332-MR
TCMT 11 03 02-PF	TCMT 220-PF	TCMX 16 T3 04-WF	TCMX 3(2.5)1-WF	TNMG 16 04 08-PF	TNMG 332-PF
TCMT 11 03 04-KF	TCMT 221-KF	TCMX 16 T3 08-WF	TCMX 3(2.5)2-WF	TNMG 16 04 08-PM	TNMG 332-PM

ISO	ANSI	ISO	ANSI	ISO	ANSI
TNMG 16 04 08-PR	TNMG 332-PR	TNMM 22 04 16-PR	TNMM 434-PR	VBMT 11 03 12-PF	VBMT 223-PF
TNMG 16 04 08-PR	TNMG 332-PR	TNMM 22 04 16-QR	TNMM 434-QR	VBMT 16 04 02-KF	VBMT 330-KF
TNMG 16 04 08-QF	TNMG 332-QF	TNMM 27 06 12-MR	TNMM 543-MR	VBMT 16 04 02-MF	VBMT 330-MF
TNMG 16 04 08-QM	TNMG 332-QM	TNMM 27 06 12-QR	TNMM 543-QR	VBMT 16 04 02-PF	VBMT 330-PF
TNMG 16 04 08R-K	TNMG 332R-K	TNMM 27 06 16-HR	TNMM 544-HR	VBMT 16 04 04-KF	VBMT 331-KF
TNMG 16 04 08-SM	TNMG 332-SM	TNMM 27 06 16-MR	TNMM 544-MR	VBMT 16 04 04-KM	VBMT 331-KM
TNMG 16 04 12-23	TNMG 333-23	TNMM 27 06 16-QR	TNMM 544-QR	VBMT 16 04 04-MF	VBMT 331-MF
TNMG 16 04 12-KM	TNMG 333-KM	TNMM 27 06 24-HR	TNMM 546-HR	VBMT 16 04 04-MM	VBMT 331-MM
TNMG 16 04 12-KR	TNMG 333-KR	TNMM 27 06 24-MR	TNMM 546-MR	VBMT 16 04 04-PF	VBMT 331-PF
TNMG 16 04 12-MF	TNMG 333-MF	TNMX 16 04 04-WF	TNMX 331-WF	VBMT 16 04 04-PM	VBMT 331-PM
TNMG 16 04 12-MM	TNMG 333-MM	TNMX 16 04 08-WF	TNMX 332-WF	VBMT 16 04 04-UM	VBMT 331-UM
TNMG 16 04 12-MR	TNMG 333-MR	TNMX 16 04 08-WM	TNMX 332-WM	VBMT 16 04 04-UR	VBMT 331-UR
TNMG 16 04 12-PF	TNMG 333-PF	TNMX 16 04 12-WM	TNMX 333-WM	VBMT 16 04 08-KF	VBMT 332-KF
TNMG 16 04 12-PM	TNMG 333-PM	TNMX 22 04 12-WR	TNMX 433-WR	VBMT 16 04 08-KM	VBMT 332-KM
TNMG 16 04 12-PR	TNMG 333-PR	TNMX 22 04 16-WR	TNMX 434-WR	VBMT 16 04 08-KR	VBMT 332-KR
TNMG 16 04 12-QF	TNMG 333-QF	TPGN 11 03 04T01020	TPG 221T0320	VBMT 16 04 08-MF	VBMT 332-MF
TNMG 16 04 12-QF	TNMG 333-QF	TPGN 11 03 08T01020	TPG 222T0320	VBMT 16 04 08-MM	VBMT 332-MM
TNMG 16 04 12-QM	TNMG 333-QM	TPGN 16 03 04T01020	TPG 321T0320	VBMT 16 04 08-MR	VBMT 332-MR
TNMG 16 04 12-SM	TNMG 333-SM	TPGN 16 03 08E	TPG 322A	VBMT 16 04 08-PF	VBMT 332-PF
TNMG 16 04 16-KR	TNMG 334-KR	TPGN 16 03 08T01020	TPG 322T0320	VBMT 16 04 08-PM	VBMT 332-PM
TNMG 16 04 16-MF	TNMG 334-MF	TPGN 16 03 12T01020	TPG 323T0320	VBMT 16 04 08-PR	VBMT 332-PR
TNMG 22 04 04-MF	TNMG 431-MF	TPMT 06 T1 02-MF	TPMT 1.2(1.2)0-MF	VBMT 16 04 08-UM	VBMT 332-UM
TNMG 22 04 04-PM	TNMG 431-PM	TPMT 06 T1 02-PF	TPMT 1.2(1.2)0-PF	VBMT 16 04 08-UR	VBMT 332-UR
TNMG 22 04 04-QF	TNMG 431-QF	TPMT 06 T1 04-KF	TPMT 1.21.21-KF	VBMT 16 04 12-KM	VBMT 333-KM
TNMG 22 04 04-QM	TNMG 431-QM	TPMT 06 T1 04-MF	TPMT 1.2(1.2)1-MF	VBMT 16 04 12-KR	VBMT 333-KR
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TNMG 22 04 08-KM	TNMG 432-KM	TPMT 09 02 02-MF	TPMT 1.8(1.5)0-MF	VBMT 16 04 12-MF	VBMT 333-MF
TNMG 22 04 08-KR	TNMG 432-KR	TPMT 09 02 02-PF	TPMT 1.8(1.5)0-PF	VBMT 16 04 12-MM	VBMT 333-MM
TNMG 22 04 08-MF	TNMG 432-MF	TPMT 09 02 04-KF	TPMT 1.81.51-KF	VBMT 16 04 12-MR	VBMT 333-MR
TNMG 22 04 08-MM	TNMG 432-MM	TPMT 09 02 04-KM	TPMT 1.8(1.5)1-KM	VBMT 16 04 12-PF	VBMT 333-PF
TNMG 22 04 08-MR	TNMG 432-MR	TPMT 09 02 04-MF	TPMT 1.8(1.5)1-MF	VBMT 16 04 12-PM	VBMT 333-PM
TNMG 22 04 08-PF	TNMG 432-PF	TPMT 09 02 04-MM	TPMT 1.8(1.5)1-MM	VBMT 16 04 12-PR	VBMT 333-PR
TNMG 22 04 08-PM	TNMG 432-PM	TPMT 09 02 04-PF	TPMT 1.8(1.5)1-PF	VBMT 16 04 12-UR	VBMT 333-UR
TNMG 22 04 08-PR	TNMG 432-PR	TPMT 09 02 04-PM	TPMT 1.8(1.5)1-PM	VBMT 16 04 12-UR	VBMT 333-UR
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TNMG 22 04 12-QM	TNMG 433-QM	TPMT 11 03 08-PM	TPMT 222-PM	VBMT 16 04 12-UR	VBMT 333-UR
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SI Unit Conversion Table / Cutting Symbol

SI Derived Units Conversion Chart

(Bold lined units are the ones by SI Derived Unit.)

(Extracted from JIS Handbook "Steel")

● Force

N	kgf	dyn
1	$1.019\ 72 \times 10^{-1}$	1×10^5
9.806 65	1	$9.806\ 65 \times 10^5$
1×10^{-5}	$1.019\ 72 \times 10^{-6}$	1

● Stress

1Pa=1N/m², 1MPa=1N/mm²

Pa or N/m ²	MPa or N/mm ²	kgf/mm ²	kgf/cm ²	kgf/m ²
1	1×10^{-6}	$1.019\ 72 \times 10^{-7}$	$1.019\ 72 \times 10^{-5}$	$1.019\ 72 \times 10^{-1}$
1×10^6	1	$1.019\ 72 \times 10^{-1}$	$1.019\ 72 \times 10$	$1.019\ 72 \times 10^5$
$9.806\ 65 \times 10^6$	9.806 65	1	1×10^2	1×10^6
$9.806\ 65 \times 10^4$	$9.806\ 65 \times 10^{-2}$	1×10^{-2}	1	1×10^4
9.806 65	$9.806\ 65 \times 10^{-6}$	1×10^{-6}	1×10^{-4}	1

● Pressure

1Pa=1N/m²

Pa	kPa	Mpa	bar	kgf/cm ²
1	1×10^{-3}	1×10^{-6}	1×10^{-5}	$1.019\ 72 \times 10^{-5}$
1×10^3	1	1×10^{-3}	1×10^{-2}	$1.019\ 72 \times 10^{-2}$
1×10^6	1×10^3	1	1×10	$1.019\ 72 \times 10$
1×10^5	1×10^2	1×10^{-1}	1	1.019 72
$9.806\ 65 \times 10^4$	$9.806\ 65 \times 10$	$9.806\ 65 \times 10^{-2}$	$9.806\ 65 \times 10^{-1}$	1

Symbols of cutting conditions

● Cutting conditions below are indicated by the new symbols listed in 2nd column.

1) Turning

Cutting Condition	New symbol	(Previous symbol)	Unit
Cutting speed	Vc	V	m/min
Feed rate	f	f	mm/rev
Depth of cut	ap	d	mm
Edge width	W	W	mm
Workpiece diameter	Dm	D	mm
Power required at spindle	Pc	Pkw	kW
Specific cutting resistance	kc	Ks	MPa
Theoretical surface roughness	h	Rz	μm
Corner radius	re	R	mm
Revolution	n	N	min ⁻¹

Note: 're' is read as 'r epsilon'

3) Drilling

Cutting Condition	New symbol	(Previous symbol)	Unit
Cutting speed	Vc	V	m/min
Feed speed	Vf	F	mm/min
Feed rate	f	f	mm/rev
Drill diameter	Dc	D (Ds)	mm
Power required at spindle	Pc	Pkw	kW
Specific cutting resistance	kc	Ks	MPa
Depth of hole	H	d	mm
Revolution	n	N	min ⁻¹

2) Milling

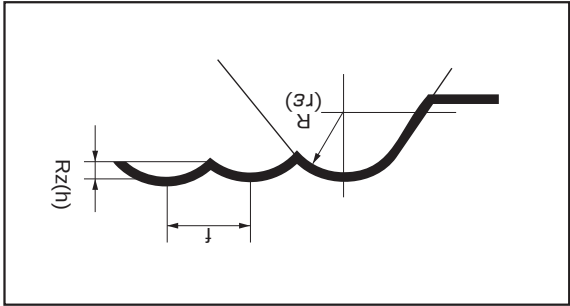
Cutting Condition	New symbol	(Previous symbol)	Unit
Cutting speed	Vc	V	m/min
Feed speed	Vf	F	mm/min
Feed per tooth	fz	f	mm/t
Feed rate	f	f	mm/rev
Number of inserts	Z	Z	teeth
Depth of cut	ap	d	mm
Width of cut	ae	w	mm
Pick feed	Pf	Pf	mm
Power required at spindle	Pc	Pkw	kW
Specific cutting resistance	kc	Ks	MPa
Metal Removal Rate	Q	Q	cm ³ /min
Revolution	n	N	min ⁻¹

Theoretical (Geometrical) Surface Roughness

Theoretical Surface Roughness at Turning indicates the minimum roughness value from the cutting conditions and it is shown by the formula as follows:

$$Rz(h) = \frac{f^2}{8R(re)} \times 10^3$$

Rz(h) : Theoretical Surface Roughness (μm)
f : Feed Rate (mm/rev)
R(re) : Corner Radius of Insert (mm)



How to Obtain Surface Roughness Values

Type	Symbol	How to Obtain	Explanation
Max. Height Roughness	Rz	Ry is obtained from the distance in micron meter between the highest peak and the lowest valley in the range of sampled reference length (l) to the direction of mean line of the roughness curve. $Rz = Rp + Rv$	
Ten Points Mean Roughness	Rzjis	Rz is obtained from the total in micron meter of the mean value of the each distance between the mean line and 5 peaks (Yp) from the highest one, and the mean value of the 5 valleys (Yv) from the lowest one, and the sampled reference length "l". $Rzjis = \frac{(Yp1+Yp2+Yp3+Yp4+Yp5) + (Yv1+Yv2+Yv3+Yv4+Yv5)}{5}$	
Arithmetical Mean Roughness	Ra	Ra is obtained from the following formula in micron meter when the roughness curve is expressed by y=f(x), taking X-axis to the mean line direction and Y-axis to the vertical magnification of the roughness curve in the range of sampled reference length "l". $Ra = \frac{1}{l} \int_0^l f(x) dx$	

Relationship with Triangle Symbol

Arithmetical Mean Roughness	Max. Height Roughness	Rz(μm)	Rzjis(μm)	Ra(μm)
0.025	0.1	0.1	0.1	0.025
0.05	0.2	0.2	0.2	0.05
0.1	0.4	0.4	0.4	0.1
0.2	0.8	0.8	0.8	0.2
0.4	1.6	1.6	1.6	0.4
0.8	3.2	3.2	3.2	0.8
1.6	6.3	6.3	6.3	1.6
3.2	12.5	12.5	12.5	3.2
6.3	25	25	25	6.3
12.5	50	50	50	12.5
25	100	100	100	25

Note: Finishing symbol (Triangle△ and Wave~) was abolished from JIS standard from 1994 Revision.

Example

① When Ra is 1.6μm→1.6μmRa
② When Rz is 6.3μm→6.3μmRz
③ When Rzjis is 6.3μm→6.3μmRzjis

How to Indicate

Indication in JIS Standard

Example of Ra Indication	Example of Ry, (Rz) Indication
① When indicating the upper limit only (when upper limit is 6.3μmRa) 	① When indicating upper limit only indicate surface roughness following the parameter symbol.
② When indicating both lower and upper limit (when upper limit is 6.3μmRa, lower limit is 1.6μmRa) 	② When indicating both lower and upper limit indicate surface roughness as (upper limit ~ lower limit) following the parameter symbol.

Note: The indications of Ra and Rz are different.

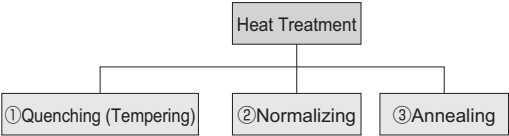
Surface Roughness Symbol Caution

The above information is based on JIS B 0601-2001. However, some symbols were revised as shown in the right table in accordance with ISO Standard from JIS B 0601-2001 version. Ten Points Mean Roughness (Rz) was eliminated from 2001 version but it still remains as Rzjis reference, since it was popular in Japan.

Type	Symbol of JIS B 0601-1994	Symbol of JIS B 0601-2001
Max. Height Roughness	Ry	Rz
Mean Roughness	Rz	(Rzjis)
Arithmetical Mean Roughness	Ra	Ra

Heat Treatment

One of the ways to determine the hardness of steel is the heat treatment and it is classified to 3 types.



	• Quenching (Tempering)	After heating to over 727°C, cool rapidly down to 550°C in water or oil.	Quenching makes steel hard because it cools down red-hot steel very rapidly in water or oil, but it may promote internal stress. In order to remove such internal stress, tempering is used. (After cooled down once, reheat it to 200°C~600°C)
	• Normalizing	After heating to over 727°C, cool down rapidly to 600°C and then to normal temperature.	It miniaturizes the crystals. (Steel is also composed of small cells.) It is used to improve the mechanical character or machinability.
	• Annealing	After heating to over 727°C, cool down very slowly to 600°C, then to normal temperature.	It miniaturizes the crystals like the process of normalizing, but the crystal size is bigger than that of normalizing. It targets machinability improvement and distortion correction.

Hardness Value

Hardness	Reference Standard	Example	Explanation of Example
Brinell Hardness	JIS Z 2243 : 1992	250HB	Hardness Value : 250, Hardness Symbol : HB
		200~250HB	When the hardness has the range
Vickers Hardness	JIS Z 2244 : 1998	640HV	Hardness Value : 640, Hardness Symbol : HV
Rockwell Hardness	JIS Z 2245 : 1992	60HRC	Hardness Value : 60, Hardness Symbol : HRC
Shore Hardness	JIS Z 2246 : 1992	50HS	Hardness Value : 50, Hardness Symbol : HS



Vickers Hardness Conversion Chart

Vickers Hardness (HV)	Brinell Hardness 10mm Dia. Ball Load: 3000kgf (HB)		Rockwell Hardness ⁽²⁾			Shore Hardness (HS)	Tensile Strength Mpa ⁽³⁾
	Standard Ball	Tungsten Carbide Ball	A Scale Load: 60kgf Diamond Point (HRA)	B Scale Load: 100kgf 1.6mm Dia. Ball (HRB)	C Scale Load: 150kgf Diamond Point (HRC)		
940	-	-	85.6	-	68.0	97	
920	-	-	85.3	-	67.5	96	
900	-	-	85.0	-	67.0	95	
880	-	(767)	84.7	-	66.4	93	
860	-	(757)	84.4	-	65.9	92	
840	-	(745)	84.1	-	65.3	91	
820	-	(733)	83.8	-	64.7	90	
800	-	(722)	83.4	-	64.0	88	
780	-	(710)	83.0	-	63.3	87	
760	-	(698)	82.6	-	62.5	86	
740	-	(684)	82.2	-	61.8	84	
720	-	(670)	81.8	-	61.0	83	
700	-	(656)	81.3	-	60.1	81	
690	-	(647)	81.1	-	59.7	-	
680	-	(638)	80.8	-	59.2	80	
670	-	630	80.6	-	58.8	-	
660	-	620	80.3	-	58.3	79	
650	-	611	80.0	-	57.8	-	
640	-	601	79.8	-	57.3	77	
630	-	591	79.5	-	56.8	-	
620	-	582	79.2	-	56.3	75	
610	-	573	78.9	-	55.7	-	
600	-	564	78.6	-	55.2	74	
590	-	554	78.4	-	54.7	-	2055
580	-	545	78.0	-	54.1	72	2020
570	-	535	77.8	-	53.6	-	1985
560	-	525	77.4	-	53.0	71	1950
550	505	517	77.0	-	52.3	-	1905
540	496	507	76.7	-	51.7	69	1860
530	488	497	76.4	-	51.1	-	1825
520	480	488	76.1	-	50.5	67	1795
510	473	479	75.7	-	49.8	-	1750
500	465	471	75.3	-	49.1	66	1705
490	456	460	74.9	-	48.4	-	1660
480	448	452	74.5	-	47.7	64	1620
470	441	442	74.1	-	46.9	-	1570
460	433	433	73.6	-	46.1	62	1530
450	425	425	73.3	-	45.3	-	1495
440	415	415	72.8	-	44.5	59	1460
430	405	405	72.3	-	43.6	-	1410
420	397	397	71.8	-	42.7	57	1370
410	388	388	71.4	-	41.8	-	1330
400	379	379	70.8	-	40.8	55	1290
390	369	369	70.3	-	39.8	-	1240
380	360	360	69.8	(110.0)	38.8	52	1205
370	350	350	69.2	-	37.7	-	1170
360	341	341	68.7	(109.0)	36.6	50	1130
350	331	331	68.1	-	35.5	-	1095
340	322	322	67.6	(108.0)	34.4	47	1070
330	313	313	67.0	-	33.3	-	1035

Vickers Hardness (HV)	Brinell Hardness 10mm Dia. Ball Load: 3000kgf (HB)		Rockwell Hardness ⁽²⁾			Shore Hardness (HS)	Tensile Strength Mpa ⁽³⁾
	Standard Ball	Tungsten Carbide Ball	A Scale Load: 60kgf Diamond Point (HRA)	B Scale Load: 100kgf 1.6mm Dia. Ball (HRB)	C Scale Load: 150kgf Diamond Point (HRC)		
320	303	303	66.4	(107.0)	32.2	45	1005
310	294	294	65.8	-	31.0	-	980
300	284	284	65.2	(105.5)	29.8	42	950
295	280	280	64.8	-	29.2	-	935
290	275	275	64.5	(104.5)	28.5	41	915
285	270	270	64.2	-	27.8	-	905
280	265	265	63.8	(103.5)	27.1	40	890
275	261	261	63.5	-	26.4	-	875
270	256	256	63.1	(102.0)	25.6	38	855
265	252	252	62.7	-	24.8	-	840
260	247	247	62.4	(101.0)	24.0	37	825
255	243	243	62.0	-	23.1	-	805
250	238	238	61.6	99.5	22.2	36	795
245	233	233	61.2	-	21.3	-	780
240	228	228	60.7	98.1	20.3	34	765
230	219	219	-	96.7	(18.0)	33	730
220	209	209	-	95.0	(15.7)	32	695
210	200	200	-	93.4	(13.4)	30	670
200	190	190	-	91.5	(11.0)	29	635
190	181	181	-	89.5	(8.5)	28	605
180	171	171	-	87.1	(6.0)	26	580
170	162	162	-	85.0	(3.0)	25	545
160	152	152	-	81.7	(0.0)	24	515
150	143	143	-	78.7	-	22	490
140	133	133	-	75.0	-	21	455
130	124	124	-	71.2	-	20	425
120	114	114	-	66.7	-	-	390
110	105	105	-	62.3	-	-	-
100	95	95	-	56.2	-	-	-
95	90	90	-	52.0	-	-	-
90	86	86	-	48.0	-	-	-
85	81	81	-	41.0	-	-	-

• Extracted from JIS Handbook "Iron & Steel" (SAE J 417)
Note (1) 1MPa = 1N/mm²
(2) Value in () is not in practical use, but reference only

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Technical
Information

Material List (JIS)

Metal

Classification		Name of JIS Standard	Symbol
Structural Steel		Rolled Steel for Welded Structure	SM
		Re-Rolled Steel	SRB
		Rolled Steel for General Structure	SS
		Light Guage Steel for General Structure	SSC
		Hot-Rolled Steel Plate, Sheet and Strip for Automobile Structural Use	SAPH
Steel Sheet		Cold-Rolled Steel Plate, Sheet and Strip	SPC
		Hot-Rolled Soft Steel Plate, Sheet and Strip	SPH
Steel Pipe		Carbon Steel Pipe for Ordinary Piping	SGP
		Carbon Steel Pipe for Boiler / Heat Exchanger	STB
		Seamless Steel Pipe for High Pressure Gas Cylinder	STH
		Carbon Steel Pipe for General Structural Use	STK
		Carbon Steel Pipe for Machine Structural Use	STKM
		Alloy Steel Pipe for Structural Use	STKS
		Stainless Steel Pipe for Machine Structural Use	SUS-TK
		Steel Square Pipe for General Structural Use	STKR
		Alloy Steel Pipe for Ordinary Piping	STPA
		Carbon Steel Pipe for Pressure Service	STPG
		Carbon Steel Pipe for High-Temperature Service	STPT
		Carbon Steel Pipe for High-Pressure Service	STS
		Stainless Steel Pipe for Ordinary Piping	SUS-TP
	Steel for Machine Structural Use		Carbon Steel for Machine Structural Use
		Aluminium Chromium Molybdenum Steel	SACM
		Chromium Molybdenum Steel	SCM
		Chromium Steel	SCr
		Nickel Chromium Steel	SNC
		Nickel Chromium Molybdenum Steel	SNCM
		Manganese Steel and Manganese Chromium Steel for Machine Structural Use	SMn, SMnC
Special Steel	Tool Steel	Carbon Tool Steel	SK
		Hollow Drill Steel	SKC
		Alloy Tool Steel	SKS, SKD, SKT
		High Speed Tool Steel	SKH
	Special Steel	Free Cutting Carbon Steel	SUM
		High Carbon Chromium Bearing Steel	SUJ
		Spring Steel	SUP
	Stainless Steel	Stainless Steel Bar	SUS-B
		Hot-Rolled Stainless Steel Plate, Sheet and Strip	SUS-HP, SUS-HS
		Cold-Rolled Stainless Steel Plate, Sheet and Strip	SUS-CP, SUS-CS
		Heat-Resisting Steel Bar	SUH-B, SUH-CB
		Heat-Resisting Steel Plate and Sheet	SUH-HP, SUH-CP
	Super Alloy	Corrosion-Resisting and Heat-Resisting Superalloy Bar	NCF-B
Corrosion-Resisting and Heat-Resisting Superalloy Plate and Sheet		NCF-P	
Forged Steel		Carbon Steel Forging	SF
		Chromium Molybdenum Steel Forging	SFCM
		Nickel Chromium Molybdenum Steel Forging	SFNCM
Cast Iron		Gray Cast Iron	FC
		Spheroidal Graphite Cast Iron	FCD
		Blackheart Malleable Cast Iron	FCMB
		Whiteheart Malleable Cast Iron	FCMW
		Pearlitic Malleable Cast Iron	FCMP
Cast Steel		Carbon Cast Steel	SC
		High Tensile Strength Carbon Cast Steel & Low Alloy Cast Steel	SCC
		Stainless Cast Steel	SCS
		Heat-Resisting Cast Steel	SCH
		High Manganese Cast Steel	SCMnH
		Cast Steel for High Temperature and High Pressure Service	SCPH

Non-ferrous Metal

Classification	Name of JIS Standard	Symbol
Copper	Copper and Copper Alloy Sheet / Strip	CxxxxP CxxxxPP CxxxxR
	Copper and Copper Alloy Rod and Bar	CxxxxBD CxxxxBDS CxxxxBE
Aluminum Alloy and Aluminum Alloy Expanded Material	Aluminum and Al. Alloy Sheet / Strip	AxxxxP AxxxxPC
	Aluminum and Al. Alloy Rod, Bar, and Wire	AxxxxBE AxxxxBES AxxxxBD AxxxxBDS AxxxxW AxxxxWS
	Aluminum and Al. Alloy Extruded Shape	AxxxxS
	Aluminum and Al. Alloy Forging	AxxxxFD AxxxxFH
Magnesium Alloy Expanded Material	Magnesium Alloy Sheet and Plate	MP
	Magnesium Alloy Rod and Bar	MB
Nickel Alloy	Nickel Copper Alloy Sheet and Plate	NCuP
	Nickel Copper Alloy Rod and Bar	NCuB
Titanium Expanded Material	Titanium Rod and Bar	TB
Casting	Brass Casting	CAC20x
	High Strength Brass Casting	CAC30x
	Bronze Casting	CAC40x
	Phosphoric Bronze Casting	CAC50x
	Aluminum Bronze Casting	CAC70x
	Aluminum Alloy Casting	AC
	Magnesium Alloy Casting	MC
	Zinc Alloy Die Casting	ZDCx
	Aluminum Alloy Die Casting	ADC
	Magnesium Alloy Die Casting	MD
	White Metal	WJ



Material Cross Reference Table

● Steel

Classification	Germany	UK	France	Russia	USA	Japan	China
	DIN	BS	NF	ГОСТ	AISI / SAE	JIS	GB
Carbon Steel for Machine Structural Use	C10E C10R	040A10 045A10 045M10	XC10		1010	S10C	08 10
		040A12	XC12		1012	S12C	
	C15E C15R	055M15			1015	S15C	15
			XC18		1017	S17C	
	C22 C22E C22R	070M20 C22 C22E C22R	C22 C22E C22R		1020	S20C	20
					1023	S22C	
	C25 C25E C25R	C25 C25E C22R	C25 C25E C25R		1025	S25C	25
				25Г	1029	S28C	
	C30 C30E C30R	080A30 080M30 C30 C30E C30R	C30 C30E C30R	30Г	1030	S30C	30
				30Г		S33C	
	C35 C35E C35R	C35 C35E C35R	C35 C35E C35R	35Г	1035	S35C	35
				35Г	1038	S38C	
	C40 C40E C40R	080M40 C40 C40E C40R	C40 C40E C40R	40Г	1039 1040	S40C	40
		080A42		40Г	1042 1043	S43C	
	C45 C45E C45R	C45 C45E C45R	C45 C45E C45R	45Г	1045 1046	S45C	45
		080A47		45Г		S48C	
	C50 C50E C50R	080M50 C50 C50E C50R	C50 C50E C50R	50Г	1049	S50C	50
				50Г	1050 1053	S53C	
	C55 C55E C55R	070M55 C55 C55E C55R	C55 C55E C55R		1055	S55C	55
	C60 C60E C60R	C60 C60E C60R	C60 C60E C60R	60Г	1059 1060	S58C	60
	C10E	045A10 045M10	XC10			S09CK	
	C15E		XC12			S15CK	15F
			XC18			S20CK	

Material Cross Reference Table

● Steel

Classifi- cation	Germany	UK	France	Russia	USA	Japan	China
	DIN	BS	NF	ГОСТ	AISI / SAE	JIS	GB
Nickel Chromium Steel				40XH		SNC236	
						SNC415	
				30XH3A		SNC631	
	15NiCr13	655M13				SNC815	
						SNC836	
Nickel Chromium Molybdenum Steel	20NiCrMo2 20NiCrMoS2	805A20 805M20 805A22 805M22	20NCD 2		8615 8617 8620 8622	SNCM220	
					8637 8640	SNCM240	
						SNCM415	
				20XH2M (20XHM)	4320	SNCM420	
						SNCM431	
					4340	SNCM439	
						SNCM447	
						SNCM616	
						SNCM625	
						SNCM630	
						SNCM815	
	17Cr3 17CrS3			15X 15XA		SCr415	15Cr 15CrA
				20X	5120	SCr420	20Cr
Chromium Steel	34Cr4 34CrS4	34Cr4 34CrS4	34Cr4 34CrS4	30X	5130 5132	SCr430	30Cr
	37Cr4 37CrS4	37Cr4 37CrS4	37Cr4 37CrS4	35X	5132	SCr435	35Cr
	41Cr4 41CrS4	530M40 41Cr4 41CrS4	41Cr4 41CrS4	40X	5140	SCr440	40Cr
				45X		SCr445	45Cr 50Cr
Chromium Molybdenum Steel	15CrMo4					SCM415	15CrMo
	18CrMo4 18CrMoS4			20XM		SCM418	20CrMo
	20CrMo4	708M20		20XM		SCM420	
						SCM421	
				30XM 30XMA	4131	SCM430	30CrMo 30CrMoA
						SCM432	
	34CrMo4 34CrMoS4	34CrMo4 34CrMoS4	34CrMo4 34CrMoS4	35XM	4137	SCM435	35CrMo
	42CrMo4 42CrMoS4	708M40 709M40 42CrMo4 42CrMoS4	42CrMo4 42CrMoS4		4140 4142	SCM440	42CrMo
					4145 4147	SCM445	
						SCM822	

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Technical
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● Steel

Classification	Germany	UK	France	Russia	USA	Japan	China
	DIN	BS	NF	ГОСТ	AISI / SAE	JIS	GB
Manganese Chromium Steel Manganese Steel		150M19			1522	SMn420	20Mn2
		150M36		30Г2 35Г2	1534	SMn433	30Mn2 35Mn2
		150M36		35Г2 40Г2	1541	SMn438	40Mn2
				40Г2 45Г2	1541	SMn443	45Mn2
						SMnC420	
						SMnC443	
Structural Steel with Specified Hardenability Band (H-Shape Steel)					1522H	SMn420H	
						SMn433H	
					1541H	SMn438H	
					1541H	SMn443H	
						SMnC420H	
						SMnC443H	
	17Cr3 17CrS3			15X		SCr415H	
				20X	5120H	SCr420H	
	34Cr4 34CrS3	34Cr4 34CrS4	34Cr4 34CrS4	30X	5130H 5132H	SCr430H	
	37Cr4 34CrS4	37Cr4 37CrS4	37Cr4 37CrS4	35X	5135H	SCr435H	
	41Cr4 41CrS4	41Cr4 41CrS4	41Cr4 41CrS4	40X	5140H	SCr440H	
						SCN415H	
	18CrMo4 18CrMoS4					SCM418H	
		708H20				SCM420H	
	34CrMo4 34CrMoS4	34CrMo4 34CrMoS4	34CrMo4 34CrMoS4		4135H 4137H	SCM435H	
	42CrMo4 42CrMoS4	42CrMo4 42CrMoS4	42CrMo4 42CrMoS4		4140H 4142H	SCM440H	
					4145H 4147H	SCM445H	
						SCM822H	
						SNC415H	
						SNC631H	
	15NiCr13	655H13				SNC815H	
		805H17 805H20 805H22	20NCD 2		8617H 8620H 8622H	SNCM220H	
					4320H	SNCM420H	

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Technical
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Material Cross Reference Table

● Steel

Classification	Germany	UK	France	Russia	USA		Japan	China
	DIN	BS	NF	ГОСТ	UNS	AISI	JIS	GB
Stainless Steel			Z12CMN17-07Az		S20100	201	SUS 201	1Cr17Mn6Ni5N
		284S16		12X17T9AH4	S20200	202	SUS 202	1Cr18Mn8Ni5N
	X12CrNi17 7	301S21	Z11CN17-08	07X16H6	S30100	301	SUS 301	1Cr18Mn10Ni5Mo3N 1Cr17Ni7
	X2CrNiN18-7						SUS 301L	
	X12CrNi17 7						SUS 301J1	
		302S25	Z12CN18-09	12X18H9	S30200	302	SUS 302	1Cr18Ni9
					S30215	302B	SUS 302B	
	X10CrNiS18 9	303S21	Z8CNF18-09		S30300	303	SUS 303	Y1Cr18Ni9
		303S41		12X18H10E	S30323	303Se	SUS 303Se	Y1Cr18Ni9Se
	X5CrNi18 10	304S31	Z7CN18-09	08X18H10	S30400	304	SUS 304	0Cr18Ni9
	X2CrNi19 11	304S11	Z3CN19-11	03X18H11	S30403	304L	SUS 304L	00Cr18Ni10
			Z6CN19-09Az		S30451	304N	SUS 304N1	0Cr18Ni9N
					S30452		SUS 304N2	0Cr19Ni10NbN
	X2CrNiN18 10		Z3CN18-10Az		S30453	304LN	SUS 304LN	00Cr18Ni10N
							SUS 304J1	
							SUS 304J2	
					S30431	S30431	SUS 304J3	
	X5CrNi18 12	305S19	Z8CN18-12	06X18H11	S30500	305	SUS 305	1Cr18Ni12
							SUS 305J1	
			Z10CN24-13		S30908	309S	SUS 309S	0Cr23Ni13
		310S31	Z8CN25-20	10X23H18	S31008	310S	SUS 310S	0Cr25Ni20
	X5CrNiMo17 12 2	316S31	Z7CND17-12-02		S31600	316	SUS 316	0Cr17Ni12Mo2
	X5CrNiMo17 13 3		Z6CND18-12-03					
	X2CrNiMo17 13 2	316S11	Z3CND17-12-02		S31603	316L	SUS 316L	00Cr17Ni14Mo2
	X2CrNiMo17 14 3		Z3CND17-13-03	03X17H14M3				
					S31651	316N	SUS 316N	0Cr17Ni12Mo2N
	X2CrNiMoN17 12 2		Z3CND17-11Az		S31653	316LN	SUS 316LN	00Cr17Ni13Mo2N
	X2CrNiMoN17 13 3		Z3CND17-12Az					
	X6CrNiMoTi17 12 2		Z6CNDT17-12	08X17H13M2T	S31635		SUS 316Ti	
							SUS 316J1	0Cr18Ni12Mo2Cu2
							SUS 316J1L	00Cr18Ni14Mo2Cu2
		317S16			S31700	317	SUS 317	0Cr19Ni13Mo3
	X2CrNiMo18 16 4	317S12	Z3CND19-15-04		S31703	317L	SUS 317L	00Cr19Ni13Mo3
			Z3CND19-14Az		S31753		SUS 317LN	
							SUS 317J1	0Cr18Ni16Mo5
							SUS 317J2	
							SUS 317J3L	
					N08367		SUS 836L	
		904S14	Z2NCUDU25-20		N08904	N08904	SUS 890L	
	X6CrNiTi18 10	321S31	Z6CNT18-10	08X18H10T	S32100	321	SUS 321	1Cr18Ni9Ti 0Cr18Ni10Ti
	X6CrNiNb18 10	347S31	Z6CNNb18-10	08X18H12B	S34700	347	SUS 347	0Cr18Ni11Nb
			Z6CN18-16		S38400	384	SUS 384	
		394S17	Z2CNU18-10		S30430	304Cu	SUS XM7	0Cr18Ni9Cu3
			Z15CNS20-12		S38100		SUS XM15J1	0Cr18Ni13Si4
					S32900	329	SUS 329J1	0Cr26Ni5Mo2
			Z3CNDU22-05Az	08X21H6M2T	S39240	S31803	SUS 329J3L	
			Z3CNDU25-07Az		S39275	S31260	SUS 329J4L	

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Technical
Information

● Steel

Classification	Germany	UK	France	Russia	USA		Japan	China
	DIN	BS	NF	ГОСТ	UNS	AISI	JIS	GB
Stainless Steel	X6CrAl13	405S17	Z8CA12		S40500	405	SUS 405	0Cr13Al 0Cr13
			Z3C14				SUS 410L	00Cr12
					S42900	429	SUS 429	
	X6Cr17	430S17	Z8C17	12X17	S43000	430	SUS 430	1Cr17
	X7CrMoS18		Z8CF17		S43020	430F	SUS 430F	Y1Cr17
	X6CrTi17		Z4CT17		S43035		SUS 430LX	
	X6CrNb17							
			Z4CNb17				SUS 430J1L	
	X6CrMo17 1	434S17	Z8CD17-01		S43400	434	SUS 434	1Cr17Mo
					S43600	436	SUS 436L	
							SUS 436J1L	
			Z3CDT18-02		S44400	444	SUS 444	
					S44700		SUS 447J1	00Cr30Mo2
			Z1CD26-01		S44627		SUS XM27	00Cr27Mo
					S40300	403	SUS 403	1Cr12
	X10Cr13	410S21	Z13C13		S41000	410	SUS 410	1Cr13
	X6Cr13	403S17	Z8C12	08X13	S41008	410S	SUS 410S	
							SUS 410F2	
					S41025		SUS 410J1	1Cr13Mo 1Cr12Mo
		416S21	Z11CF13		S41600	416	SUS 416	Y1Cr13
	X20Cr13	420S29	Z20C13	20X13	S42000	420	SUS 420J1	2Cr13
	X30Cr13	420S37	Z33C13	30X13	S42000	420	SUS 420J2	3Cr13
			Z30CF13		S42020	420F	SUS 420F	Y3Cr13
							SUS 420F2	
							SUS 429J1	
	X20CrNi17 2	431S29	Z15CN16-02	20X17H2	S43100	431	SUS 431	1Cr17Ni2
			Z70C15		S44002	440A	SUS 440A	7Cr17
					S44003	440B	SUS 440B	8Cr17
			Z100CD17	95X18	S44004	440C	SUS 440C	9Cr18 11Cr17 9Cr18Mo
					S44020	S44020	SUS 440F	Y11Cr17
			Z6CNU17-04		S17400	S17400	SUS 630	0Cr17Ni4CuNb
	X7CrNiAl17 7		Z9CNA17-07	09X17H7 IO	S17700	S17700	SUS 631	0Cr17Ni7Al
							SUS 632J1	

● Representative Classification of Stainless Steel

- Stainless Steel (Austenitic related) ● Stainless Steel (Ferritic related) ● Stainless Steel: (Precipitation Hardening related)

JIS	
SUS201	SUS309S
SUS202	SUS310S
SUS301	SUS316
SUS302	SUS316L
SUS302B	SUS316N
SUS303	SUS317
SUS303Se	SUS317L
SUS304	SUS321
SUS304L	SUS347
SUS304N1	SUS384
SUS304N2	SUSXM7
SUS305	SUSXM15J1
SUS308	

JIS
SUS405
SUS429
SUS430
SUS430F
SUS434
SUSXM27

- Stainless Steel (Martensitic related)

JIS
SUS403
SUS410
SUS410S
SUS416
SUS420J1
SUS420F
SUS431
SUS440A
SUS440B
SUS440C
SUS440F

JIS
SUS630
SUS631

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Technical
Information

Material Cross Reference Table

● Steel

Classification	Germany	UK	France	Russia	USA		Japan	China
	DIN	BS	NF	ГОСТ	UNS	AISI	JIS	GB
Heat Resisting Steel		331S42	Z35CNWS14-14	45X14H14B2M			SUH 31	
		349S52	Z52CMN21-09Az				SUH 35	
	X53CrMnNi21.9	349S54	Z55CMN21-09Az	55X20 Г 9AH4	S63008		SUH 36	5Cr21Mn9Ni4N
		381S34			S63017		SUH 37	2Cr21Ni12N
							SUH 38	
		309S24	Z15CN24-13		S30900	309	SUH 309	2Cr23Ni13
	CrNi2520	310S24	Z15CN25-20	20X25H20C2	S31000	310	SUH 310	2Cr25Ni20
			Z12NCS35-16		N08330	N08330	SUH 330	1Cr16Ni35
			Z6NCTV25-20		S66286		SUH 660	0Cr15Ni25Ti2MoAlNb
					R30155		SUH 661	
	CrAl1205						SUH 21	
	X6CrTi12	409S19	Z6CT12		S40900	409	SUH 409	
			Z3CT12				SUH 409L	
			Z12C25	15X28	S44600	446	SUH 446	2Cr25N
	X45CrSi9.3	401S45	Z45CS9		S65007		SUH 1	4Cr9Si2
			Z40CSD10	40X10C2M			SUH 3	4Cr10Si2Mo
		443S65	Z80CSN20-02				SUH 4	8Cr20Si2Ni
				40X 9C2			SUH 11	
				20X12BHMБФР			SUH 600	2Cr12MoVNbN
					S42200		SUH 616	2Cr12NiMoWV

● Representative Classification of Heat Resisting Steel

● Heat Resisting Steel (Austenitic related)

JIS
SUH31
SUH35
SUH36
SUH37
SUH38
SUH309
SUH310
SUH330
SUH660
SUH661

● Heat Resisting Steel (Ferritic related)

JIS
SUH21
SUH409
SUH446

● Heat Resisting Steel (Martensitic related)

JIS
SUH1
SUH3
SUH4
SUH11
SUH600
SUH616

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Technical
Information

● Steel

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Technical Information

Material Cross Reference Table

● Steel

Classification	Germany	UK	France	Russia	USA	Japan	China
	DIN	BS	NF	ГОСТ	AISI / ASTM	JIS	GB
Spring Steel				75 80 85	1075 1078	SUP3	
			60Si7	60C2		SUP6	
			60Si7	60C2Г	9260	SUP7	
	55Cr3		55Cr3		5155	SUP9	
			60Cr3		5160	SUP9A	
	50CrV4	735A51, 735H51	51CrV4	ХΦА50ХГΦА	6150	SUP10	
				50ХГР	51B60	SUP11A	
	54SiCr6	685A57, 685H57	54SiCr6		9254	SUP12	
Free Cutting Carbon Steel		705A60, 705H60	60CrMo4		4161	SUP13	
					1110	SUM11	
					1108	SUM12	Y12
					1212	SUM21	
	9SMn28	(230M07)	S250		1213	SUM22	Y15
	9SMnPb28		S250Pb		12L13	SUM22L	Y12Pb
					1215	SUM23	
						SUM23L	
	9SMnPb28		S250Pb		12L14	SUM24L	Y15Pb
	9SMn36		S300			SUM25	
	15S10				1117	SUM31	
						SUM31L	
		210M15, 210A15	(13MF4)			SUM32	Y20
			(35MF6)		1137	SUM41	Y30 Y35
			(45MF6.1)		1141	SUM42	Y40Mn
Carbon Chromium Bearing Steel		(226M44)	(45MF6.3)		1144	SUM43	
					51100	SUJ1	
	100Cr6		100Cr6	ИІХ15	52100	SUJ2	Cr2
					ASTM A 485 Grade 1	SUJ3	
						SUJ4	
						SUJ5	

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Technical
Information



● Cast Iron

Classification	Germany	UK	France	Russia	USA	Japan	China
	DIN	BS	NF	ГОСТ	AISI / SAE	JIS	GB
Gray Cast Iron		100		CY10	NO.20	FC100	HT100
	GG15	150	FGL150	CY15	NO.30	FC150	HT150
	GG20	200	FGL200	CY20	NO.35	FC200	HT200
	GG25	250	FGL250	CY25	NO.45	FC250	HT250
	GG30	300	FGL300	CY30	NO.50	FC300	HT300
	GG35	350	FGL350	CY35	NO.60	FC350	HT350
	GG40		FGL400	CY40			
Nodular Cast Iron	GGG40	400 / 17	FGS370-17	BY40	60-40-18	FCD400	QT400-18
		420 / 12	FGS400-12	BY45	65-45-12	FCD450	QT450-10
	GGG50	500 / 7	FGS500-7	BY50	70-50-05	FCD500	QT500-7
	GGG60	600 / 7	FGS600-2	BY60	80-60-03	FCD600	QT600-3
	GGG70	700 / 2	FGS700-2	BY70	100-70-03	FCD700	QT700-2
	GGG80	800 / 2	FGS800-2	BY80	120-90-02	FCD800	QT800-2
		900 / 2		BY100			QT900-2

● Non-ferrous Metal

Classification	Germany	UK	France	Russia	USA	Japan	China
	DIN	BS	NF	ГОСТ	ASTM	JIS	GB
Aluminum Alloy	A199.99R			A99	1199		1A99
	A199.98R			A97			1A97
				A95			1A95
	A199.90	1080(1A)	1080A	A8		A1080	1A80
	A199.50	1050(1B)	1050A	A5	1050	A1050	1A50
	AlMg2.5	NS4	5052	Amg	5052	A5052	5A02
		NS5		AMg3			5A03
	AlMg5	NB6		AMg5V	5056	A5056	5A05
		NG61	5957		5456	A5556	5A30
	AlCu2.5Mg0.5		2117	D18	2036	A2117	2A01
	AlCuMg1	HF15	2017S	D1		A2017	2A11
	AlCuMg2		2024	D16AVTV	2124	A2024	2A12
					2319		2B16
				AK4		A2N01	2A80
				AK2	2218	A2018	2A90
	AlCuSiMn		2014	AK8	2014	A2014	2A14
	AlZnMgCu1.5		7075	V95P	7175	A7075	7A09
Aluminum Alloy Casting	G-AlSi7Mg	LM25			356.2	AC4C	ZAISi7Mn
	G-Al12	LM6	A-S12-Y4	AL2	413.2	AC3A	ZAISi12
				AL5	355.2		ZAISi5Cu1Mg
	G-Al12(Cu)				413.0	AC8A	ZAISi2Cu2Mg1
				AL19			ZAICu5Mn
					201.0		ZAICu5MnCdVA
	G-ALMg10	LM10	AG11	AL8	520.2		ZAIMg10
	G-ALMg5Si			AL13			ZAIMg5Si

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Technical
Information

Insert Cross Reference Table

CVD Coated Carbide (Turning)

· This table is Kyocera's own estimation based on publications and is not authorized by companies mentioned in it.

Classification		Kyocera	Hitachi	Iscar	Kennametal WIDIA	Mitsubishi	NTK	Sandvik	Seco	Sumitomo	Tungaloy
Class	Symbol										
P (Steel)	P01	CA5505	HC5000 HG3305	IC9015 IC9150	KC910	UE6005		GC4005 GC4205	TP1000 TX100	AC700G	T9005
	P10	CA5505 CA5515	GM10 GM20 GM8015 HG8010	IC9015 IC9150 IC9250	KC9010 KC9110	UC6010 UE6005 UE6010 UE6020	CP2 CP5	GC4015 GC3115 GC4215	TP1000 TP100 TX150	AC700G AC2000 AC820P	T9005 T9015
	P20	CA5515 CA5525 CR9025	GM20 GM8020 HG8025	IC9015 IC9025 IC9250 IC9350	KC8050 KC9025 KC9125	UC6010 UE6110 UE6020 F7030	CP2 CP5 CP7	GC4020 GC4025 GC4215 GC4225	TP200 CP250	AC2000 AC3000 AC820P	T9015 T9025
	P30	CA5525 CA5535 CR9025	GM25 GM8035 HG8025 HG8035	IC635 IC9025 IC9350	KC5025 KC9040 KC9140	UE6035 UH6400 F7030		GC4030 GC4225 GC4230 GC4235	TP200 CP300	AC3000 AC630M AC830P	T9025 T9035 T3130
	P40	CA5535	GX30	IC635	KC9045 KC9240	UE6035 UH6400		GC4235 GC4240	TP40 TP300	AC630M AC830P	T9035
M (Stainless Steel)	M10	CA6515	GM10	IC9250 IC9350	KC5010 KC9010 KC9110 KC9215	US7020	CP2 CP5	GC2015	TP100	AC610M	T9015
	M20	CA6525	GM8020 HG8025	IC9025 IC9250 IC9350	KC8050 KC9025 KC9125 KC9225	UC7020 F7030	CP2 CP5	GC2025 GC2030	TP200	AC610M AC630M	T6020 T9025
	M30		GM25 GM8035 HG8035	IC4050	KC9040 KC9240	US735 F7030		GC2040 GC2135	TP300	AC630M	T6030 T3130
	M40		GX30 GF30		KC9045 KC9245				TP40		
K (Cast Iron)	K01	CA4010 CA4505 CA5505	HC5000 GM3005 HG3305	IC428 IC9007 IC9150	KC5410 KC9315 KC910	UC5005 UC5015		GC3205 GC3210	TX100	AC300G	T5105 T5010
	K10	CA4010 CA4115 CA4505 CA4515 CA5505	GM10 GM8015 HG8010 HG3315	IC418 IC428 IC9015 IC9150	KC5010 KC7310 KC9010	UC5015 UC5115 UE6010	CP2 CP5	GC3205 GC3210 GC3215	TX150	AC700G AC410K	T5105 T5115 T5010 T1015
	K20	CA4115 CA4120 CA4515	GM8020 HG8025	IC418 IC9015 IC9150	KC8050 KC9025 KC9120 KC9325	UE6010	CP5	GC3020 GC3215 K20W	TX150 TP200	AC700G AC820P	T5115 T5125 T5020
	K30							GC3040	TP200		T5125

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Technical
Information

PVD Coated Carbide (Turning)

· This table is Kyocera's own estimation based on publications and is not authorized by companies mentioned in it.

Classification		Kyocera	Hitachi	Iscar	Kennametal WIDIA	Mitsubishi	NTK	Sandvik	Seco	Sumitomo	Tungaloy
Class	Symbol										
P (Steel)	P01	PR915 PR1005								ACZ150	
	P10	PR915 PR930 PR1005 PR1025 PR1115	CY15 CY150 IP2000	IC507 IC907	KC5010 KC5510 KU10T	VP10MF		GC1025	CP200	ACZ150 ACZ310	AH710
	P20	PR930 PR1025 PR1115	CY150 IP2000	IC507 IC570 IC907 IC908	KC5025 KC5525 KC7215 KC7315 KU25T	VP15TF VP20MF UP20M	QM1 VM1 TA1 TAS	GC1020 GC1025 GC4125	CP250	ACZ310 ACZ330 AC520U	AH710 AH730
	P30		CY250 CY9020 HC844 IP3000	IC328 IC928 IC3028	KC7015 KC7020 KC7235 KU25T	VP15TF VP20MF UP20M	ZM3 QM3 TAS		CP500	ACZ330 ACZ350 AC530U	GH330 AH120 AH740
	P40		CY250 HC844	IC328 IC3028	KC7030 KC7040 KC7140		ZM3 QM3 TAS	GC1120 GC2145	CP500	ACZ350	AH140
M (Stainless Steel)	M10	PR915 PR1025	IP50S	IC507 IC907	KC5010 KC5510 KC6005 KC6015	VP10MF		GC1005 GC1025	CP200	EH510Z ACZ150 AC510U	AH710
	M20	PR915 PR930 PR1025 PR1125	IP100S	IC308 IC507 IC907 IC908 IC3028	KC5025 KC5525 KC7020 KC7025	VP15TF VP20MF UP20M	QM1 VM1 TA1 TAS	GC2030 GC4125	CP200 CP500	EH520Z ACZ150 ACZ310 AC520U	AH730 GH330 GH730 SH730
	M30	PR1125	GF30 CY250 CY9020	IC908 IC1008 IC1028 IC3028	KC7030 KC7225	VP15TF VP20MF UP20M	ZM3 QM3 TAS	GC1020 GC1120 GC2035	CP500	ACZ330 ACZ350 AC530U	AH120
	M40			IC928			ZM3 QM3 TAS	GC2145		ACZ350	AH140
K (Cast Iron)	K01									EH10Z	AH110
	K10	PR905	CY100H CY10H	IC507 IC908	KC5010 KC7210	VP05RT		GC1010	CP200	EH10Z EH510Z AC510U	GH110 AH110
	K20	PR905	GF30 CY9020	IC507 IC908	KC7015 KC7215 KC7315	VP10RT VP15TF	QM1 TA1	GC1020 GC1120	CP200 CP250	EH20Z ACZ310	AH120
	K30			IC508 IC3028	KC7225	VP15TF	QM3 TA3	GC4125	CP500	ACZ310	

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Technical
Information

Insert Cross Reference Table

Cermet (Turning)

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Classification		Kyocera	Hitachi	Iscar	Kennametal WIDIA	Mitsubishi	NTK	Sandvik	Seco	Sumitomo	Tungaloy
Class	Symbol										
P (Steel)	P01	TN30 PV30 TN6010 PV7010	CH350	IC20N IC520N	KT125 HTX	NX1010	T3N T15			T110A	NS520 GT520 GT720
	P10	TN60 TN6010 TN6020 PV7010 PV7020	CH350 CZ25	IC20N IC520N IC530N IC75T	KT315 KT175 HT2	NX2525 AP25N	T15 C7Z	CT5015 CT525	CM	T2000Z T1200A	NS520 AT530 GT720 GT730
	P20	TN90 TN6020 PV7020	CH550 CH7030 CZ1025	IC20N IC520N IC530N IC75T IC30N	PS5	NX2525 NX3035 AP25N UP35N	C7X C7Z	CT530 GC1525		T1200A T2000Z T3000Z	NS530 NS730 AT530 GT530 GT730
	P30			IC75T IC30N		NX4545 VP45N	N40 C7X			T250A T3000Z	NS530 NS540 NS730 NS740
M (Stainless Steel)	M10	TN60 TN6020 PV7020	CH350		KT315 KT125	NX2525 AP25N	T15 C7X C7Z	CT5015 CT525	CM	T110A	NS520 AT530 GT530 GT730
	M20	TN90 TN6020 PV7020	CH550 CH7030 CZ1025		KT175 HT2 PS5	NX2525 NX3035 AP25N	C7X C7Z	CT530 GC1525		T1200A T2000Z	NS530 NS730
	M30					NX4545				T250A T3000Z	NS540 NS730
K (Cast Iron)	K01	TN30 PV30 PV7005				NX1010	T3N T15			T110A	NS520 AT520 GT520 GT720
	K10	TN60 TN6010 PV7005 PV7010	CH350		KT315 HTX	NX2525 AP25N	T15 C7X C7Z	CT5015		T1200A T2000Z	NS530 NS730 GT530 GT730
	K20					NX2525 AP25N					

· **Boldface** grade shows PVD Coated Cermet.

Carbide

Classification		Kyocera	Hitachi	Iscar	Kennametal WIDIA	Mitsubishi	NTK	Sandvik	Seco	Sumitomo	Tungaloy
Class	Symbol										
P (Steel)	P10		WS10	IC70	K2885	STi10T		S1P		ST10P	TX10S
	P20		EX35	IC70 IC50M	K125M	STi20		SMA	S10M	ST20E	TX20 TX25
	P30	PW30	EX35 EX40	IC50M IC54	KMF			SM30	S25M	A30N A30 ST30E	TX30 UX30
	P40		EX45	IC54	PVA			S6	S60M	ST40E	TX40
K (Cast Iron)	K01		WH02 WH05	IC04	K68 K313	HTi05T		H1P		H2 H1	TH03
	K10	KW10 GW15	WH10	IC20	KMI K8735	HTi10		H1P H10 HM		EH10 EH510	G1F TH10 H10T
	K20	GW25	WH20	IC20 IC10	KMF	HTi20T	KM1	H13A	883 890 HX	G10E EH20 EH520	G2F G2 KS20
	K30			IC10 IC28			KM3			G3	G3
V (Wear and Shock Resistant Tool)	V40		WH50			GTi30				G5	D40
	V50	VW50	WH60			GTi35 GTi40 GTi30S				G6	D50
	V60		WB60			GTi40S GTi50S				G7 G8	D60

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Technical
Information

Coated (Milling)

· This table is Kyocera's own estimation based on publications and is not authorized by companies mentioned in it.

Classification		Kyocera	Hitachi	Iscar	Kennametal WIDIA	Mitsubishi	NTK	Sandvik	Seco	Sumitomo	Tungaloy
Class	Symbol										
P (Steel)	P10	PR730 PR830 PR1025	JX1020		KC715M			GC1025		ACP100	
	P20	PR730 PR830 PR1025	CY150 TB6020 JX1015	IC250 IC520M IC950	KC522M KC525M	F7030 UP20M		GC1030 GC4220 GC4020 GC4030	T250M T25M T20M	ACP200	
	P30	PR660	CY250 CY9020 HC844 TB6045 JX1045	IC328 IC635 IC908 IC928	KC994M KC725M KC792M KC530M	F7030 VP15TF VP30RT		GC4040 GC4230	T250M T25M F25M F30M	AC230 ACP300	T325 GH330 AH120 AH330 AH740
	P40		CY250 HC844 TB6060 JX1060	IC635 IC928 IC4050	KC735M			GC4040 GC4240	T60M T25M	AC230 ACZ330 ACZ350	AH120
M (Stainless Steel)	M10	PR730 PR1025	CY9020 JX1020		KC522M			GC1025 GC1030		EH10Z	
	M20	PR660 PR730 PR1025	CY150 TB6020 JX1015	IC908 IC928	KC730M KC525M	F7030 UP20M VP30RT		GC2030	T250M T25M F20M F25M F30M	ACP200 EH20Z	GH330 AH330
	M30	PR660	CY250 TB6045 JX1045	IC328	KC994M KC725M	F7030 VP15TF		GC2040	T250M T25M F40M	ACP300 ACZ350	AH120
	M40									ACZ350	AH140
K (Cast Iron)	K01		TB6005	IC4100							AH110
	K10	PR905	CY10H CY100H CY9020	IC4010 IC910 DT7150	KC915M	F5010 VP10RT		GC3220	T150M F15M	AC211	T1015 T1020 AH110
	K20	PR905	CY150 TB6020 JX1015	IC328 KC4050	KC920M KC925 KC992M	F5020		GC1020 GC3020	T150M T250M T25M	EH20Z ACZ310 ACK300	AH120
	K30			IC328	KC930			GC3040 GC4040	T250M T25M		

Cermet (Milling)

· This table is Kyocera's own estimation based on publications and is not authorized by companies mentioned in it.

Classification		Kyocera	Hitachi	Iscar	Kennametal WIDIA	Mitsubishi	NTK	Sandvik	Seco	Sumitomo	Tungaloy
Class	Symbol										
P (Steel)	P10	TN60			KT530M KT195M	NX2525			C15M		NS530 NS730
	P20	TN60 TN100M	CH550 CH570 CH7030	IC30N	HT7 KT530M KT605M	NX2525	C7X C7Z	CT530	C15M	T250A	NS530 NS730
	P30			IC30N		NX4545					NS540
M (Stainless Steel)	M10	TN60				NX2525			C15M		
	M20	TN60 TN100M	CH550 CH570 CH7030		KT7 KT530M KT605M	NX2525		CT530	C15M	T250A	NS530 N308
	M30					NX4545			C15M		NS530
K (Cast Iron)	K01										
	K10			IC30N		NX2525					
	K20					NX2525					

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Technical
Information

Insert Cross Reference Table

Ceramic

• This table is Kyocera's own estimation based on publications and is not authorized by companies mentioned in it.

Classification		Kyocera	Iscar	Kennametal WIDIA	Mitsubishi	NTK	Sandvik	Seco	Sumitomo	Tungaloy
Class	Symbol									
K (Cast Iron)	K01	KA30 A65 KT66 PT600M		KW80 KY1615 AC5		HC1 HC2 HC5 HC6 HW2	CC620 CC650		NB90S NB90M WX120	LX11 LX21
	K10	A65 KT66 A66N PT600M		KB90 KB90X KY3000		WA1 SX1 SP2 SX9	CC690 CC6090 GC1690		WX120 NS260C	WG300
	K20	KS6000		KY1310 KY3400 KY3500		SX1 SX8 SP2	CC690 CC6090 GC1690		NS260C NS260	FX105 CX710
S (Difficult-to-Cut Material)	S01									
	S10	CF1		KY4300 KY1525 KY1540		WA1 SX9	CC670 CC6080		WX120	WG300
	S20									
H (Hardened Material)	H01	A65 KT66 A66N PT600M				HC4 HC7 ZC4	CC650 CC670		NB100C	LX11
	H10	A65 KT66 A66N PT600M		KY4300		ZC4 WA1				

• **Boldface** grade shows PVD Coated Ceramic.

CBN

Classification		Kyocera	Hitachi	Iscar	Kennametal WIDIA	Mitsubishi	NTK	Sandvik	Seco	Sumitomo	Tungaloy
Class	Symbol										
K (Cast Iron)	K01	KBN60M		IB85	KD120 PB100	MB710	B20 B22	CB50 CB7050	CBN050C	BN500	BX930 BX950 BX90S
	K10	KBN60M KBN900	BH200		KB9610	MB710 MB730	B22		CBN20 CBN300	BN600 BN700	BX950 BXC90
	K20	KBN900	BH250		KB9640	MB730 MBS140			CBN350	BNS800	
H (Hardened Material)	H01	KBN510 KBN10C KBN05M KBN10M			KD050 KD081	MBC010 MB810	B20 B24	CB20 CB7020	CBN10 CBN100 CBN100P	BNX10 BNC80 BNC160	BXA30 BX310 BXC30
	H10	KBN525 KBN25C KBN25M	BH200	IB50	KD050 KD120 KB1615 KB9610	MBC020 MB820 MB825 MB8025	B24	CB50 CB7050	CBN150 CBN200 CBN300P	BNX20 BN250 BN300 BNC200	BXA40 BX330 BX360 BXC50
	H20	KBN30M KBN35M KBN900	BH250	IB55	KB1340 KB5625 KB9640	MBC020 MB835 MB8025	B26		CBN350	BNX25 BN350 BNC300	BX380 BXC50
Iron Sintered Metal	-	KBN65B KBN65M KBN70M								BN700 BN7500	

• **Boldface** grade shows PVD Coated CBN.

PCD

Classification		Kyocera	Hitachi	Iscar	Kennametal WIDIA	Mitsubishi	NTK	Sandvik	Seco	Sumitomo	Tungaloy
Class	Symbol										
N (Non-ferrous Material)	N01	KPD001			PD100 KD1405	MD205	PD1		PD10	DA90 DA1000 DA2200	DX180 DX160
	N10	KPD001 KPD010 KPD230		ID5	KD100 KD1415	MD220		CD10	PD20	DA150 DA1000 DA2200	DX140
	N20	KPD001 KPD010 KPD230				MD230			PD30	DA200 DA1000 DA2200	DX120

Molded Chipbreaker Cross Reference Table

This table is Kyocera's own estimation based on publications and is not authorized by companies mentioned in it.

Negative Inserts

Cutting Range		Kyocera		Hitachi	Iscar	Kennametal WIDIA	Mitsubishi	NTK	Sandvik	Seco	Sumitomo	Tungaloy
		General Chip- breaker	Chipbreaker for Sticky Material / Soft Steel									
Carbon Steel / Alloy Steel	Finishing (With Wiper Edge)	WP				FW	SW		WF	MF2	LUW	AFW
	Finishing - Medium (With Wiper Edge)	WQ			WG	MW	MW		WM	M3	GUW	ASW
	Finishing	DP GP VF	XP XP-T	BE BH FE	SF	FF UF	F FH FS FY PK	WM ZF1	QF PF	FF1	SU FP SP FA FL LU	TF 01 AS TSF
	Finishing - Medium	HQ CQ CJ	XQ	AB B CE CT	NF	FN	SH C SA MV SY	WV WR	QM	MF2	EX GU SK SJ SX UU UJ	TS NS NM CB 11 17 27 ZF
	Medium - Roughing	GS CS HS PS	XS	AE DE AH	TF	MN	MA MH	Z5 ZW1	SM PM	M3 MF3	UA UG	DM TM ZM
	Medium-Roughing High Feed Rate	PT GT HT		AR AY	NR	P	GH	GS	MR	M5 MR5	MU UX	TH 32Y 32 37
	Roughing	Standard PH		RE	GN	PR MG RN	MT Standard	G	Standard 23	MR7	MC MU MX UZ	31 33 F-K
	Roughing One Side / High Feed Rate	PX		H HX HE TE UE	NM	RH RM	HV HX HZ HXD		QR PR HR	R4 R5 R6 R7 RP	HG HP MP	TU 57 65
Stainless Steel	Finishing	GU MQ		BH MP		FP	FS SH FJ	ZF1	MF		SU	SS
	Medium - Roughing	MS MU TK		DE SE PV	TF PP	MP	MS MA MJ ES MH GH GJ	ZP WS	MM MR	MF1 MF3 A3 A5	EX MU UP	SM SA S
Cast Iron	Medium	C Standard		AH VA VY			Standard		KF KM		GZ UX UJ	Standard 33 CF
	Roughing	GC ZS				UN	GH		KR		UZ	CM CH
Non ferrous Metals	Medium - Roughing	AH			PP	GP MS			AL	95	AG	P

Positive Inserts

Cutting Range		Kyocera		Hitachi	Iscar	Kennametal WIDIA	Mitsubishi	NTK	Sandvik	Seco	Sumitomo	Tungaloy
		General Chip- breaker	Chipbreaker for Sticky Material / Soft Steel									
Carbon Steel / Alloy Steel	Minute ap	CF										01
	Finishing	DP GP VF	XP		PF SM	11 GF UF	FV SQ SV SMG	AZ3 AZ7	PF UF	FF1	FC FK FP LU	PF 23
	Finishing - Medium ①	HQ	XQ	JE	14	LF	MQ MV	AF1	PM UM	F1	SF SU	PS 24
	Finishing - Medium ②	GK		JQ			No Indication	QD	PF PM			
	Medium	Standard		J	Standard	GM MR	Standard	AM3	PR UR KM	F2	MU SC	PM
Stainless Steel	Finishing	MQ			WF	FW MW	FV		MF		LU	PF SS
Non ferrous Metals	Finishing - Medium	AH			AF AS	HP	AZ		AL		AG AW	AL

Positive Inserts (Automatic Lathe)

Cutting Range		Kyocera	Hitachi	Iscar	Kennametal WIDIA	Mitsubishi	NTK	Sandvik	Seco	Sumitomo	Tungaloy
Carbon Steel / Alloy Steel	Minute ap	CF									01
	Finishing	CK GF	JQ MP	PF SM	11 UF	FV SV SMG	AZ7 ZR	PF	FF1	FC	PF
	Finishing - Medium	GQ	JE	14	LF	AM MV	AM3	PM	F1	SU	PS
	Medium	GK	J	Standard	MF	Standard	QD	PR	F2	SC	PM
Stainless Steel	Finishing	MQ		WF	FW MW	FV		MF		LU	PF
Non ferrous Metals	Finishing - Medium	AH		AF AS	HP	AZ		AL		AG AW	AL

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Technical
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Insert Cross Reference Table

Milling Insert Description Cross Reference Table

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Kyocera	Class	Appli- cation	Hitachi	Iscar	Mitsubishi	Sandvik	Sumitomo	Tungaloy
SDMR1203AUER-H SDKR1203AUEN-S	M K	Steel	SDKR42TN	SDKR1203AUTR-HS SDKR1203AUN-76	SDNR1203AEEN-JS		SDMR1203AEEN SDMR1203AETN	SDMR1203AETN-MJ SDKR1203AESR-MJ SDKR1203AETN-MJ SDKR1203AEPN-MS SDKR42ZSR-MJ SDKR42ZPN-MS
SDCN1203AUTN	C		SDC42TN-C9					SDCN1203AETN-12 SDCN42ZTN (SDEN1203AETNCR) (SDEN42ZTNCR)
SDKN1203AUTN	K		SDK42TN-C9	SDKN1203AETN	SDKN1203AEN SDKN1203AETN (SDNN1203AETN1)		SDKN42MT (SDNN1203AETN)	SDKN1203AETN-12 SDKN42ZTN
SDKN1203AUFN	K	Cast Iron	SDK42FN-C9				SDKN42M (SDNN1203AEEN)	SDKN1203AEFN-12 SDKN42ZFN
		Non-Ferrous Metal					SDKN42M	(SDCN1203AEFN-D) (SDCN42ZFN-DIA)
SDCN1504AUTN	C	Steel	SDC53TN-C9					SDCN1504AETN SDCN53ZTN
SDKN1504AUTN	K		SDK53TN-C9	SDKN1504AETN	SDKN1504AEN SDKN1504AETN		SDKN53MT	SDKN1504AETN SDKN53ZTN
SEMR1203AFER-H SEKR1203AFEN-S	M K	Steel	SEKR42TN	SEKR1203AFTR-HS SEKR1203AFR-HS SEKR1203AFN-76 SEKR1203AFN-42	(SEER1203AFEN-JS)	SEKR1203AZ-WM (SEER1203AZ-WL)	SEMR1203AFEN (SEER1203AFEN)	SEMR1203AFN-MJ SEKR1203AFSR-MJ SEKR1203AFN-MJ SEKR1203AFN-MS
SEMR1204AFER-H	M			(SEKR1204AFTR-HS) (SEKN1204AFTN)		SEKR1204AZ-WM (SEER1204AZ-WL)	SEMR1204AFEN (SEER1204AFEN)	
SEEN1203AFTN	E		SEE42TN-C9		SEEN1203AFTN1		SEEN42MT	SEEN1203AFTNCR-14
SEKN1203AFTN	K		SEK42TN-C9		SEKN1203AFTN1 (SENN1203AFTN1)	SEKN1203AZ (SEMN1203AZ)	SEKN42MT (SENN1203AFTN)	SEKN1203AFTN SEKN1203AFTN-16 SEKN42AFTN SEKN42AFTN16
SEKN1203AFFN	K	Cast Iron	SEK42FN-C9		(SEEN1203AFFN1)	SEKN1203AZ (SEMN1203AZ)	SEKN42M (SENN1203AFEN)	SEKN1203AFFN SEKN42AFFN
SEEN1203AFFN	E	Non-Ferrous Metal			(SECN1203AFFR1)			
SEKN1203EFTR	K	Steel	SEK42TR-G3		SEKN1203EFTR1	(SECN1203EER)		SEKN1203EFTR SECN1203EFTR SEEN1203EFTR SECN42EFTRCR SEEN42EFTRCR
SPEN1203EESR	E	Cast Iron	(SPK42FR-A3E)		SPEN42EFSR1 SPEN1203EESR1 (SPEN1203EEER1) (SPNN1203EEER1)			
SPMR1203EDER-H SPKR1203EDER-S	M K	Steel		SPKR1203EDR-76 SPKR1203EDTR-HS	SPER1203EDER-JS	SPKN1203EDR- WH		SPKR1203EDSR-MJ SPKR42SSR-MJ
SPCN1203EDTR	C					SPAN1203EDR	SPCH42TR-R	SPCN1203EDTR SPCN42STR
SPKN1203EDTR	K		SPK42TR-A3	SPKN1203EDTR SPKN1203EDTR-42	SPKN1203EDR	SPKN1203EDR	(SPCH42TR) (SPCH42TR-R)	SPKN1203EDTR SPKN42STR (SPEN1203EDTR) (SPEN42STR)
SPKN1203EDFR	K	Cast Iron	SPK42FR-A3	SPKN1203EDFR		SPKN1203EDR	(SPCH42R)	SPKN1203EDFR SPKN42SFR
SPKN1504EDTR	K	Steel	SPK53TR-A3	SPKN1504EDTR	SPKN1504EDR	SPKN1504EDR	(SPCH53TR-R)	SPKN1504EDTR SPKN53STR (SPCN1504EDTR) (SPCN53STR)
SPKN1504EDFR	K	Cast Iron	SPK53FR-A3	SPKN1504EDFR			(SPCH53R-R) (SPCH53TR-R)	SPKN1504EDFR (SPKN53SFR)

Note1. Tolerance is different for description in ().

2. Since edge shape of Milling insert is slightly different by each maker, please adjust edges (Z axis direction) during operation.

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Milling Insert Description Cross Reference Table

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Kyocera	Class	Appli- cation	Hitachi	Iscar	Mitsubishi	Sandvik	Sumitomo	Tungaloy
SPCN1203XPTR	C		SPC42TR-A5					SPCN1203ZPTR SPCN42ZTR
SPKN1203XPTR	K	Steel	SPK42TR-A5					SPKN1203ZPTR SPKN42ZTR (SPEN1203ZPTR) (SPEN42ZTR)
SPKN1203XPFR	K	Cast Iron	SPK42FR-A5					SPKN1203ZPFR SPKN42ZFR
SPKN1504XETR	K	Steel			SPK53C2SR			
TPMR1603PDER-H	M			(TPKR1603PPTR-HS)	TPER1603PPER-JS	TPKN1603PPR-WH		
TPKN1603PDTR	K	Steel	TPK32TR-E0 TPK32TR-G0	TPKN1603PPTR	TPKN1603PPR	TPKN1603PPR	TPKN32TR	
TPKN1603PDFR	K	Cast Iron		TPKN1603PPFR		TPKN1603PPR	TPKN32R	
TPMR2204PDER-H TPKR2204PDER-S	M K			TPKR2204PDTR-HS TPKR2204PDR-76	TPER2204PDER-JS	TPKN2204PDR-WH		TPMR2204PDSR-MJ TPKR2204PDSR-MJ TPKR43ZSR-MJ
TPKN2204PDTR	K	Steel	TPK43TR-E0 TPK43TR-G0	TPKN2204PDTR TPKN2204PDTR-42	TPKN2204PDR	TPKN2204PDR	(TPCH43TR)	TPKN2204PPTR TPKN43ZTR (TPCN2204PPTR) (TPCN43ZTR)
TPKN2204PDFR	K	Cast Iron	TPK43FR-E0	TPKN2204PDFR		TPKN2204PDR	(TPCH43R)	TPKN2204PPFR TPKN43ZFR (TPCN2204PPFR) (TPCN43ZFR) (TPEN2204PPTR-16) (TPEN43ZTR)
TEMR1603PTER-H	M				TEER1603PEER-JS			TEKR1603PEPR-MS
TEKN1603PTTR	K	Steel	TEK32TR-G0 (TEE32TR-G0)		(TEEN1603PETR1)		TEKN32TR	(TECN1603PETR) (TEEN1603PETR) (TECN32ZTR) (TEEN32ZTR)
TEKN1603PTFR	K	Cast Iron	TEK32FR-G0 (TEE32FR-G0)		(TEEN1603PEFR1)		TEKN32R	(TEEN1603PEFR) (TEEN32ZFR)
TEEN1603PTFR	E	Non-ferrous Metal			(TECN1603PEFR1)		TEEN32R	(TECN1603PEFR-D) (TECN32ZFR-DIA)
TEMR2204PTER-H TEKR2204PTER-S	M K				TEER2204PEER-JS			TEKR2204PEPR-MS
TEEN2204PTTR	E	Steel	TEK43TR-G0E		TEEN2204PETR1		TEEN43TR	TEEN2204PETR (TECN2204PETR) TEEN43ZTR (TECN43ZTR)
TEKN2204PTTR	K		TEK43TR-G0E		TEKN2204PETR1		TEKN43TR	(TEEN2204PETR) (TECN2204PETR) TEEN43ZTR (TECN43ZTR)
TEKN2204PTFR	K	Cast Iron	TEK43FR-G0E		(TEEN2204PEFR1)		TEKN43R	(TEEN2204PEFR) (TEEN43ZFR)
		Non-ferrous Metal			(TECN2204PEFR1)		(TEEN43R)	(TECN2204PEFR-D) (TECN43ZFR-DIA)
SNCN1204XNTN	C	Steel	SNC43TN-D5		SNC43B2S		(CSN43MT)	SNCN1204ZNTN (SNCN43ZTN)
SNKN1204XNTN	K		SNK43TN-D5		SNK43B2S		(CSN43MT)	SNKN1204ZNTN (SNKN43ZTN)
SNCN1204ENTN	C	Steel			(SNKN1204EN)	(SNKN1204ENN)		
SNMF1204XNTN	M	Steel	(SNKF43TN-D5)		(SNKF43B2S)		(CSNB43MT)	(SNKF1204ZNTN) (SNKF43ZFN)

Note1. Tolerance is different for description in ().

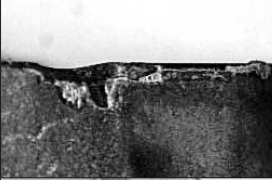
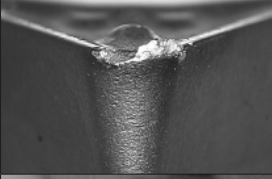
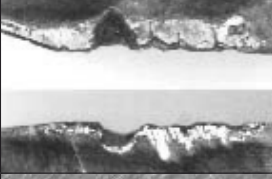
2. Since edge shape of Milling insert is slightly different by each maker, please adjust edges (Z axis direction) during operation.

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Technical
Information

Cutting Edges Figuration and Countermeasures

Typical Cutting Edge Figuration		Observation	Causes	Countermeasures
Nose Wear		Deterioration of surface roughness and dimensional accuracy	- Too high V_c - End of tool life	- Reduce V_c - Change to higher wear resistant grade
Notching		- Burr formation - Cutting force increase	Too high f and V_c	- Sharper cutting performance - Reduce V_c - Change to higher heat resistant grade
Crater Wear		- Chip control deterioration - Surface finish deterioration (peeled surface)	Too high V_c	- Reduce V_c - Change to high speed type like Cermet or Al_2O_3 coated insert
Plastic Deformation		- Workpiece dimension's change - Crack at nose	- Too high cutting load - Inappropriate tool grade	- Change to harder grade - Reduce f and ap
Crack from Wear		- Surface finish's sudden deterioration - Workpiece dimension	Too high V_c	- Reduce the pre-set tool life - Change to higher wear resistant grade
Chipping		- Cutting force increase - Surface roughness deterioration	- Too high f - Chattering - Lack of insert toughness	- Reduce f and ap - Change to more rigid toolholder - Change to tougher grade
Crack from Welding or Built-up Edge		- Surface finish deterioration - Cutting force increase	Too low V_c	- Increase V_c - Improve sharp cutting performance (rake angle, chamfer)
Mechanical Fracture		- Sudden cracking - Unstable tool life	- Too high f and ap - Chattering	- Change to tougher grade - Enlarge chamfer - Enlarge Corner-$R(r_\epsilon)$ - Change to more rigid toolholder
Fracture from Thermal Crack		- Cracking by heat cycle - Possible in interrupted cutting and milling	Too high V_c and f	- Reduce f - Reduce V_c - Change to dry cutting
Flaking		- Possible in high-hardness material cutting - Possible in machining with chattering	- Lack of insert toughness - Lack of toolholder's rigidity	- Change to harder grade (TiC-base ceramic to CBN.) - Change to more rigid toolholder - Change edge preparation

Turning

Trouble			Check Item	Insert Grade				Cutting Conditions						Tool Geometry							Setting		Machine					
			Measures	Change to Harder Grade	Change to Tougher Grade	Change to More Thermal Shock Resistant Grade	Change to More Welding Resistant Grade	Vc	f	ap	Tool Path Review	Coolant		Chipbreaker Review	Rake Angle	Corner-R (rε)	Approach Angle	Edge Strength / Honing	Change to Higher Tolerance (M→G)	Toolholder Rigidity	Workpiece / Tool Installation	Overhang Length	Power, Rigidity					
												Wet	Dry															
								Trouble Item	Higher (Larger) ↑ Lower (Smaller)↓	Larger ↑ Smaller ↓																		
Unstable Dimension	Unstable Workpiece Dimension	Unsuitable Insert Tolerance																	●									
		Tool and Workpiece Evacuation											●	●	↑	●	↓	●	↓		●	●	●	●				
	Frequent Offset during Cutting	Flank Wear Increase	●													●	↑											
		Unsuitable Cutting Conditions					●	↓	●	↑																		
		Built-up Edge				●	●	↑																				
Surface Roughness	Poor Surface Roughness	Poor Cutting by Tool Wear	●			●	●	↓				●		●	●	↑	●	↑		●	↓	●						
		Chipping		●					●	↓	●	↓			●		●	↑		●	↑		●	●	●			
		Welding, Built-up Edge				●	●	↑				●		●	●	↑			●	↓	●							
		Unsuitable Cutting Conditions					●	↑	●	↓	●	↓	●															
		Unsuitable Tool Geometry												●		●	↑		●	↓	●							
		Vibration, Chattering		●			●	↓	●	*1 ↓	●	↓			●	●	↑	●	↓	●	↓	●	↓	●	●	●		
Heat	Deterioration of Accuracy or Tool Life by Cutting Heat	Unsuitable Cutting Conditions					●	↓	●	↓	●	↓	●															
		Unsuitable Tool Geometry	●											●	●	↑			●	↓								
Bur, Chipping	Burr	Unsuitable Cutting Conditions					●	↓	●	↑		●	●															
		Unsuitable Tool Geometry	●											●	●	↑	●	↓	●	↓	●	↓						
	Workpiece Chip Off	Unsuitable Cutting Conditions							●	↓	●	↓	●															
		Unsuitable Tool Geometry	●												●	●	↑	●	↑	●	↑	●	↓		●	●	●	●
	Scuffing	Unsuitable Cutting Conditions					●	↑	●	*2 ↓		●																
		Unsuitable Tool Geometry	●			●								●	●	↑			●	↓								
Edge Damage	Wear Increase at Relief Face, Rake Face	Flank Wear	●				●	↓				●		●	●	↑	●	↑		●	↓							
		Rake Face Wear	●					●	↓	●	↓	●	↓	●		●	↑		●	↑								
	Notching	Notching				●	●	↓				●																
	Chipping	Vibration, Chattering		●				●	↓	●	↓			●			●	↑	●	↑		●	●	●	●			
	Crack	Unsuitable Tool Geometry		●	●			●	↓	●	↓			●		●	↑	●	↑	●	↑		●	●	●	●		
	Thermal Crack	Work Hardness, Unsuitable Cutting Conditions			●		●	↓	●	↓	●	↓		●	●	●	↑			●	↓							
	Edge Nose Deformation	Edge Nose Deformation at Interrupted Cutting	●					●	↓	●	↓	●	↓		●	●	↓	●	↑	●	↑	●	↑			●	●	●
	Built-up Edge	Work Hardness, Unsuitable Cutting Conditions				●	●	↑	●	↑			●		●	●	↑			●	↓	●						
Chip Control	Long, Tangling Chips	Unsuitable Cutting Conditions					*3 ●	↓	●	↑	●	↑	●		●													
		Unsuitable Tool Geometry												●		●	↓	●	↓									
	Chips scattering	Unsuitable Cutting Conditions							●	↓	●	↓			●													
		Unsuitable Tool Geometry													●		●	↑	●	↑								

*1) To prevent chattering, the higher f may be suitable.

*2) To prevent scuffing, the higher f may be suitable.

*3) When using X-chipbreaker insert for soft steel and low carbon steel, the higher Vc cuts chips short.

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Technical Information

Troubleshooting

Milling

Trouble			Check Item	Tool Grade			Cutting Conditions						Tool Geometry										Setting	Machine		
			Measures	Change to Harder Grade	Change to Tougher Grade	Change to More Thermal Shock Resistant Grade	Change to More Welding Resistant Grade	Vc	fz	ap	Cutter Dia. Cutting Width Review	Tool Path Review	Coolant		Insert with Chipbreaker	Relief Angle	Corner Angle	Edge Strength / Honing	Insert Number	Insert Pocket	Wiper Edge (Relief Angle) Review	Insert Runout Check	Cutter Rigidity	Workpiece / Tool Installation	Overhang Length	Power, Rigidity
													Usage of Mist	Dry												
Trouble Item																										
Edge Damage	Flank Wear Increase	Unsuitable Cutting Conditions					● ↓					●														
		Unsuitable Tool Geometry	●												● ↑		● ↓			●						
	Rake Face Wear Increase	Unsuitable Cutting Conditions					● ↓	● ↓	● ↓			●														
		Unsuitable Tool Geometry	●												● ↑	● ↑	● ↓									
	Chipping, Cracking	Unsuitable Cutting Conditions						● ↓	● ↓	●	●															
		Unsuitable Tool Geometry		●											● ↓	● ↑	● ↑			●	●	●	●	●	●	
	Edge Breakage by Thermal Shock	Unsuitable Cutting Conditions					● ↓	● ↓	● ↓				●													
		Unsuitable Tool Geometry			●										● ↑		● ↓									
	Built-up Edge	Unsuitable Cutting Conditions					● ↑	● ↑				●														
		Unsuitable Tool Geometry				●									● ↑		● ↓									
Machining Accuracy	Poor Surface Finish	Unsuitable Cutting Conditions					● ↑	● ↓	● ↓			●														
		Unsuitable Tool Geometry	●			●											● ↓	● ↓		●	●		●	●	●	
	Burr	Unsuitable Cutting Conditions					● ↓	● ↓	● ↓	●	●															
		Unsuitable Tool Geometry													● ↑	● ↓	● ↓			●						
	Workpiece Chip Off	Unsuitable Cutting Conditions						● ↓	● ↓		●															
		Unsuitable Tool Geometry													● ↑	● ↑	● ↓	● ↑		●						
	Poor Planeness / Parallelness	Tool and Workpiece Evacuation						● ↓	● ↓			*5 ●		●	● ↑	● ↓	● ↓	● ↓		●	●	●	●	●	●	
Others	Heavy Chattering, Vibration	Unsuitable Cutting Conditions, Installation					● ↓	*1 ● ↓	*2 ● ↓	●	*4 ●			●	● ↑	● ↓	● ↓	● ↓			●	●	●	●		
	Damaging Chips	Unsuitable Cutting Conditions					● ↑	*3 ● ↓		●		*6 ●	●													
		Unsuitable Tool Geometry												●	● ↑			● ↓	●							

- *1) To prevent chattering, the higher fz may be suitable.
 *2) To prevent chattering, the larger ap may be suitable.
 *3) Higher fz may be suitable.
 *4) Down-cut method is recommended for Helical Endmilling.
 *5) If the surface is warped by cutting heat.
 *6) Compressed air is recommended.

R



Technical
Information

Drilling

Trouble		Check Item	Grade Selection		Cutting Conditions			Tool Geometry			Setting				Machine
		Measures	Change to Harder Grade	Change to Tougher Grade	Vc	f	Coolant Discharge Condition	Chipbreaker Review	Inner Edge's Center Height Check (Core Dia. Check)	Tool Rigidity Improvement (Short Type)	Workpiece / Tool Installation	Insert Installation	Offset Check	Adjustable Sleeve Usage	Power, Rigidity
		Trouble Item													
Edge Damage	Unusual Wear	Unsuitable Cutting Speed (too high)	●		● ↓										
		Unsuitable Cutting Speed (too low)		●	● ↑										
		Unsuitable Coolant Discharge					●								
		Poor Rigidity of Machine / Workpiece									●				●
		Small Hole Dia.											*1	●	
		Unsuitable Tool Grade	●												
	Inner Edge Cracking	No core, Too Small Core							● ↑						
		Poor Rigidity of Machine / Workpiece								●	●				●
		Unstable Drilling Start				● ↓									
		High Hardness Workpiece	●		● ↓	● ↓									
		Clogged Chips			● ↑				● ↓						
		Unstable Insert Installation										●			
	Outer Edge Cracking	Poor Rigidity of Machine / Workpiece									●				●
		Unstable Drilling Start				● ↓									
		High Hardness Workpiece	●		● ↓	● ↓									
		Poor Chip Control		●	● ↑										
		Unstable Insert Installation										●			
Toolholder, Others	Scratches on Tool Body	Poor Rigidity of Machine / Workpiece									●				●
		Inaccurate Tool Installment											*1	●	
		Clogged Chips			● ↑	● ↓									
		Unstable Drilling Start				● ↓									
	Poor Hole Dia. Accuracy / Surface Finish	Poor Rigidity of Machine / Workpiece									●				●
		Poor Rigidity of Toolholder								●		●			
		Inaccurate Tool Installment											*1	●	
		Clogged Chips			● ↑	● ↓			● ↓						
		Large Core Dia.							● ↓						
		Unstable Drilling Start				● ↓									
		Unsuitable Coolant Discharge					●								
	Large Chattering / Vibration	Unsuitable Cutting Conditions, Installation			● ↑	● ↓				●	●				●
	Long Chips	Unsuitable Cutting Conditions			● ↑										
		Unsuitable Chipbreaker						●							
	Machine Failure	Lack of Machine Power			● ↓	● ↓		●							●

*1) For lathe operation

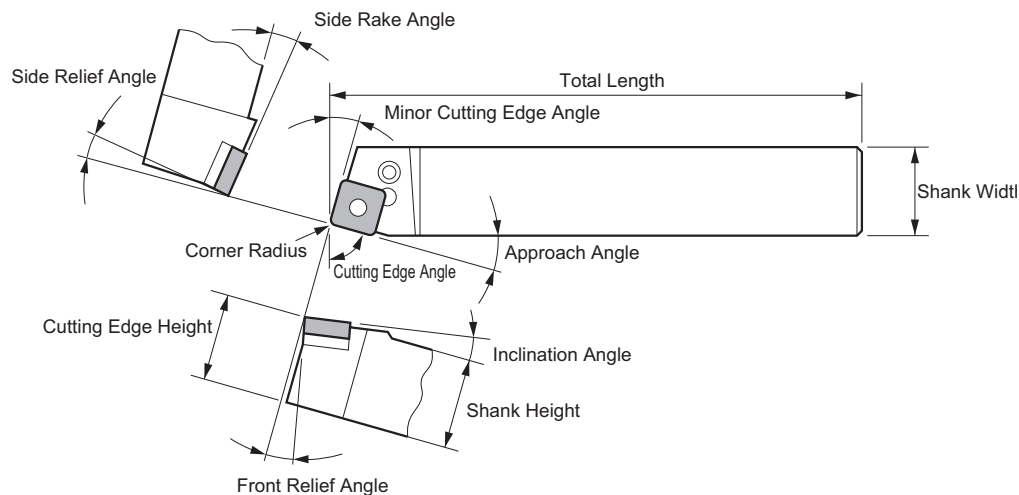
R



Technical Information

Terms and Angles of Toolholder

Terms and Angles of Turning Toolholder



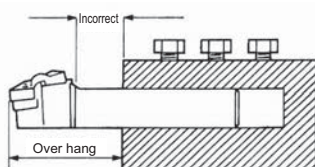
Function of Tool Angle

Tool Angle	Name	Function	Effect
Rake Angle	Side Rake Angle	Affects cutting force, cutting heat, chip evacuation and tool life.	- If it is positive (+) angle, sharper cutting performance is obtained. (less cutting resistance, less edge strength) - Positive (+) angle is recommended for easy to machine workpieces or thin workpieces. - Smaller rake angle or negative (-) angle is recommended when a stronger edge is required like scale cutting or interrupted cutting.
	Inclination Angle		
Relief Angle	Front Relief Angle Side Relief Angle	Prevents the tool's contact to the workpiece surface, except the cutting edge.	When it is small, the cutting edge becomes strong, but the wear at relief faces may shorten the tool life.
Cutting Edge Angle	Cutting Edge Angle	Affects chip control and the direction of cutting force.	When it is large, chip thickness becomes thick and chip control improves.
	Approach Angle	Affects chip control and the direction of cutting force.	- When it is large, chip thickness becomes thin and chip control worsens, but cutting force is dispersed and edge strength improves. - When it is small, chip control ability improves.
	Minor Cutting Edge Angle	Prevents friction between cutting edge and work surface.	When it is large, edge strength deteriorates.

Toolholder Rigidity

1. Flexure of Toolholder

$$\delta = \frac{4 \times F \times L^3}{E \times b \times h^3} = \frac{4 \times k \times d \times f \times L^3}{E \times b \times h^3}$$



Symbol	Name	Measure
δ (Delta)	Deflection	mm
b	Shank Width	mm
h	Shank Height	mm
E	Young ratio	N/mm ²
d	ap	mm
f	Feed rate	mm/rev
k	Specific Cutting Resistance	N/mm ²
L	Over hang	mm
F	Cutting force	N

$$(F = k \times d \times f)$$

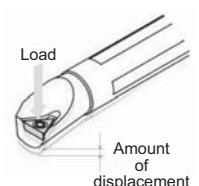
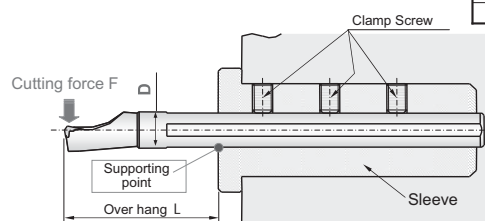
The flexure of toolholder will decrease by increasing of shank height by third root and will decrease of reducing over hang by third root. Minimizing toolholder shank over hang as much as possible is important as well as shank's sectional square measure.

2. Flexure of Boring Bar

$$\delta = \frac{64 \times F \times L^3}{3 \times E \times \pi \times D^4} = \frac{64 \times k \times d \times f \times L^3}{3 \times E \times \pi \times D^4}$$

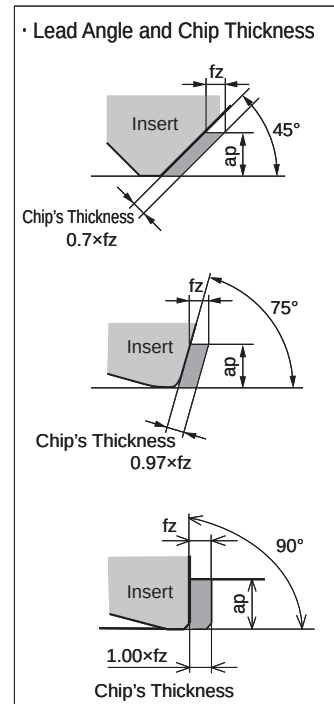
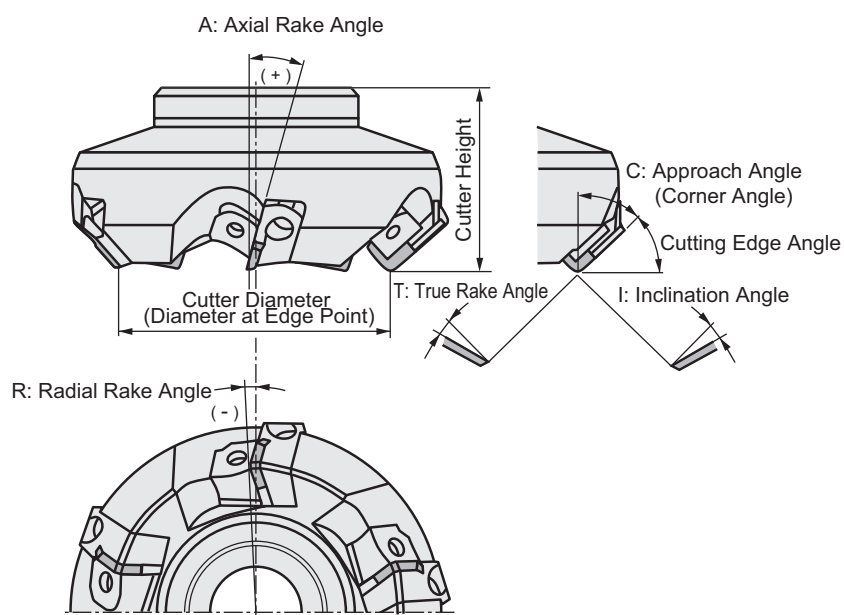
Symbol	Name	Measure
δ (Delta)	Deflection	mm
D	Shank Dia.	mm
E	Young ratio	N/mm ²
d	ap	mm
f	Feed rate	mm/rev
k	Specific Cutting Resistance	N/mm ²
L	Over hang	mm
F	Cutting force	N

$$(F = k \times d \times f)$$



Technical Information

Terms and Angles of Milling Cutter



Function of Tool Angle

Symbol	Name	Function	Effect
A	Axial Rake Angle: A.R.	Controls chip flow direction and cutting force	When it is positive --- Good cutting performance and less chip welding
R	Radial Rake Angle: R.R.	Controls chip flow direction and cutting force	When it is negative--- Good chip evacuation
C	Approach Angle	Controls chip thickness and chip flow direction	When it is large --- Thinner chip thickness Less cutting load
T	True Rake Angle	Actual rake angle	When it is positive --- Good cutting performance and less chip welding, but lower edge strength When it is negative--- Higher edge strength but easier to weld
I	Inclination Angle	Controls chip flow direction	When it is positive --- Good chip evacuation Less cutting resistance Lower edge strength at corner part

$$\tan T = \tan R \times \cos C + \tan A \times \sin C$$

$$\tan I = \tan A \times \cos C - \tan R \times \sin C$$

Basic Formulas

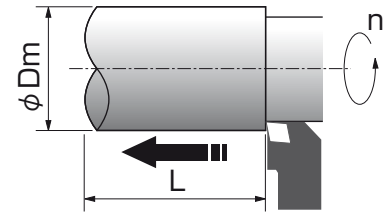
Turning Cutting Speed

$$V_c = \frac{\pi \times D_m \times n}{1000}$$

V_c : Cutting Speed [m/min]

D_m : Workpiece Diameter [mm]

n : Spindle Revolution [min^{-1}]



Power Requirement

$$P_c = \frac{K_s \times V_c \times a_p \times f}{6120 \times \eta}$$

P_c : Power Requirement [kW]

P_{HP} : Power Requirement (Horse Power) [HP]

V_c : Cutting Speed [m/min]

a_p : Depth Of Cut [mm]

f : Feed Rate [mm/rev]

K_s : Specific Cutting Resistance [kgf/mm^2]

η : Mechanical Efficiency (0.7 ~ 0.8)

Ks Figure	
Low Carbon Steel	190
Medium Carbon Steel	210
High Carbon Steel	240
Low Alloy Steel	190
High Alloy Steel	245
Cast Iron	93
Malleable Cast Iron	120
Bronze, Brass	70

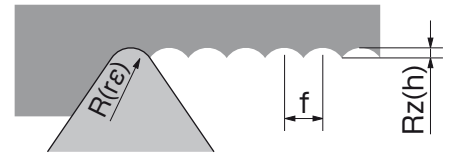
Surface Roughness

$$R_z = h = \frac{f^2}{8 \times R(r\epsilon)} \times 1000$$

$R_z = h$: Theoretical Surface Roughness [μm]

f : Feed Rate [mm/rev]

$R(r\epsilon)$: Corner Radius of Insert [mm]



Chip Removal Volume

$$Q = V_c \times a_p \times f$$

Q : Chip Removal Volume [cm^3/min]

V_c : Cutting Speed [m/min]

a_p : Depth Of Cut [mm]

f : Feed Rate [mm/rev]

Edge position Compensation

$$\Delta X = (R - R') \times \left\{ \frac{\cos\left(\frac{\alpha}{2} + (\beta - 90^\circ)\right)}{\sin\frac{\alpha}{2}} - 1 \right\}$$

$$\Delta Z = (R - R') \times \left\{ \frac{\sin\left(\frac{\alpha}{2} + (\beta - 90^\circ)\right)}{\sin\frac{\alpha}{2}} - 1 \right\}$$

ΔX : X-axis Direction Edge Position Compensation [mm]

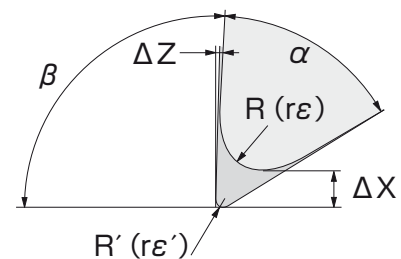
ΔZ : Z-axis Direction Edge Position Compensation [mm]

R : Corner-R before Change [mm]

R' : Corner-R after Change [mm]

α : Insert Corner Angle [$^\circ$]

β : Toolholder's Cutting Edge Angle [$^\circ$]



Toolholder Type	Insert Corner Angle α	Cutting Edge Angle β	ΔX	ΔZ
PCLN	80°	95°	$0.100 \times (R - R')$	$0.100 \times (R - R')$
PTGN	60°	91°	$0.714 \times (R - R')$	$0.030 \times (R - R')$
PDJN	55°	93°	$0.866 \times (R - R')$	$0.099 \times (R - R')$
PDHN	55°	107.5°	$0.531 \times (R - R')$	$0.531 \times (R - R')$
PVLN	35°	95°	$2.072 \times (R - R')$	$0.273 \times (R - R')$
PVPN	35°	117.5°	$1.351 \times (R - R')$	$1.351 \times (R - R')$
PSBN	90°	75°	$0.225 \times (R - R')$	$-0.293 \times (R - R')$

Example: Compensation when changing corner-R from 0.8 to 0.4, using PCLN type toolholder,
 $\Delta X = 0.100 \times (0.8 - 0.4) = 0.04(\text{mm})$
 $\Delta Z = 0.100 \times (0.8 - 0.4) = 0.04(\text{mm})$

■ Turning (Cutting Time)

● Cutting Time (External Turning Case 1: 1 Pass machining)

- At Constant Revolution

$$T = \frac{60 \times L}{f \times n}$$

- At Constant Cutting Speed

$$T = \frac{60 \times \pi \times L \times D_m}{1000 \times f \times V_c}$$

T : Cutting Time [second]

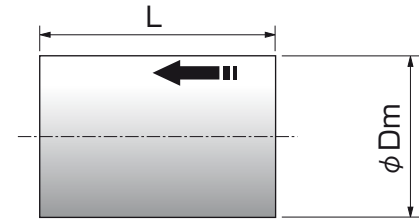
L : Cutting Length [mm]

f : Feed Rate [mm/rev]

n : Spindle Revolution [min^{-1}]

D_m : Workpiece Diameter [mm]

V_c : Cutting Speed [m/min]



● Cutting Time (External Turning Case 2: Multi-Pass machining)

- At Constant Revolution

$$T = \frac{60 \times L}{f \times n} \times N$$

- At Constant Cutting Speed

$$T = \frac{60 \times \pi \times L \times (D_1 + D_2)}{2 \times 1000 \times f \times V_c} \times N$$

T : Cutting Time [second]

L : Cutting Length per Pass [mm]

ap : Depth Of Cut per Pass [mm]

f : Feed Rate [mm/rev]

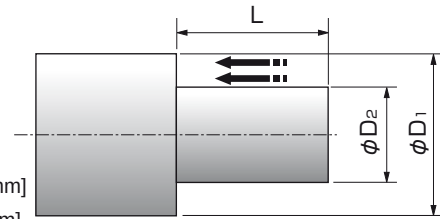
n : Spindle Revolution [min^{-1}]

D₁ : Max. Diameter of Workpiece [mm]

D₂ : Min. Diameter of Workpiece [mm]

V_c : Cutting Speed [m/min]

N : Number of Passes = $(D_1 - D_2)/ap/2$ (if it is indivisible, obtain integer by rounding up one place of decimals.)



● Cutting Time (Facing)

- At Constant Revolution

$$T = \frac{60 \times (D_1 - D_2)}{2 \times f \times n} \times N$$

- At Constant Cutting Speed

$$T_1 = \frac{60 \times \pi \times (D_1 + D_2) \times (D_1 - D_2)}{4000 \times f \times V_c} \times N$$

T : Cutting Time [second]

T₁ : Machining Time before reaching Max.

Spindle Revolution [second]

L : Cutting Length [mm]

ap : Depth Of Cut per Pass [mm]

f : Feed Rate [mm/rev]

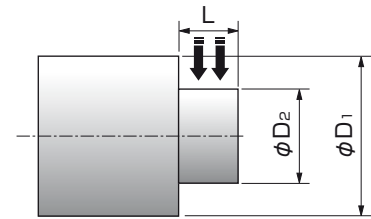
n : Spindle Revolution [min^{-1}]

D₁ : Max. Diameter of Workpiece [mm]

D₂ : Min. Diameter of Workpiece [mm]

V_c : Cutting Speed [m/min]

N : Number of Passes = L/ap (if it is indivisible, obtain integer by rounding up one place of decimals.)



● Cutting Time (Grooving)

- At Constant Revolution

$$T = \frac{60 \times (D_1 - D_2)}{2 \times f \times n}$$

- At Constant Cutting Speed

$$T_1 = \frac{60 \times \pi \times (D_1 + D_2) \times (D_1 - D_2)}{4000 \times f \times V_c}$$

T : Cutting Time [second]

T₁ : Machining Time before reaching Max.

Spindle Revolution [second]

L : Cutting Length [mm]

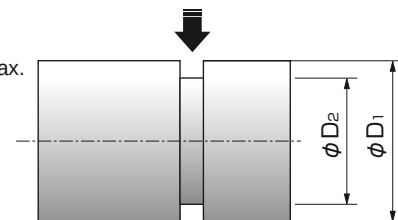
f : Feed Rate [mm/rev]

n : Spindle Revolution [min^{-1}]

D₁ : Max. Diameter of Workpiece [mm]

D₂ : Min. Diameter of Workpiece [mm]

V_c : Cutting Speed [m/min]



● Cutting Time (Cut-Off)

- At Constant Revolution

$$T = \frac{60 \times D_1}{2 \times f \times n}$$

- At Constant Cutting Speed

$$T_1 = \frac{60 \times \pi \times (D_1 + D_3) \times (D_1 - D_3)}{4000 \times f \times V_c}$$

$$T_3 = T_1 + \frac{60 \times D_3}{2 \times f \times n_{\max}}$$

T : Cutting Time [second]

T₁ : Machining Time before reaching Max.

Spindle Revolution [second]

T₃ : Machining Time when reaching Max. Spindle Revolution [second]

f : Feed Rate [mm/rev]

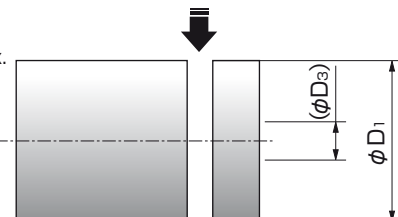
n : Spindle Revolution [min^{-1}]

n_{max} : Max. Spindle Revolution [min^{-1}]

D₁ : Max. Diameter of Workpiece [mm]

D₃ : Diameter when reaching Max. Spindle Revolution [mm]

V_c : Cutting Speed [m/min]



Basic Formulas

Milling

Cutting Speed

$$V_c = \frac{\pi \times D_s \times n}{1000}$$

V_c : Cutting Speed [m/min]

D_s : Cutter Diameter [mm]

n : Spindle Revolution [min^{-1}]

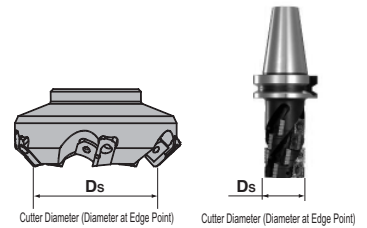


Table Feed & Feed per Tooth

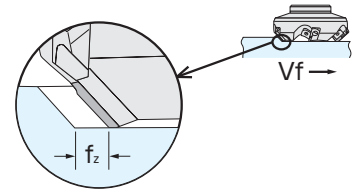
$$f_z = \frac{V_f}{Z \times n}$$

f_z : Feed per Tooth [mm/t]

V_f : Table Feed [mm/min]

Z : Number of Inserts

n : Spindle Revolution [min^{-1}]



Power Requirement

$$P_c = \frac{K_s \times Q}{6120 \times \eta} = \frac{K_s \times a_e \times V_f \times a_p}{6120000 \times \eta}$$

$$= \frac{K_s \times a_e \times f_z \times Z \times n \times a_p}{6120000 \times \eta}$$

$$P_{HP} = \frac{6120}{4500} \times P_c$$

P_c : Power Requirement [kW]

P_{HP} : Power Requirement (Horse Power) [HP]

a_e : Width of Cut [mm]

V_f : Table Feed [mm/min]

f_z : Feed per Tooth [mm/t]

Z : Number of Inserts

n : Spindle Revolution [min^{-1}]

a_p : Depth Of Cut [mm]

K_s : Specific Cutting Resistance [kgf/mm²]

η : Mechanical Efficiency (0.7 ~ 0.8)

Ks Figure	
Low Carbon Steel	190
Medium Carbon Steel	210
High Carbon Steel	240
Low Alloy Steel	190
High Alloy Steel	245
Cast Iron	93
Malleable Cast Iron	120
Bronze, Brass	70

Chip Removal Volume

$$Q = \frac{a_e \times V_f \times a_p}{1000} = \frac{a_e \times f_z \times Z \times n \times a_p}{1000}$$

Q : Chip Removal Volume [cm³/min]

a_e : Width of Cut [mm]

V_f : Table Feed [mm/min]

f_z : Feed per Tooth [mm/t]

Z : Number of Inserts

n : Spindle Revolution [min^{-1}]

a_p : Depth Of Cut [mm]

Cutting Time

$$T = \frac{60 \times L'}{V_f} = \frac{60 \times L'}{f_z \times Z \times n}$$

T : Cutting Time [second]

L' : Total Table Transfer Length [mm]

($=L + D_s + 2\alpha$)

L : Work Length [mm]

D_s : Cutter Diameter [mm]

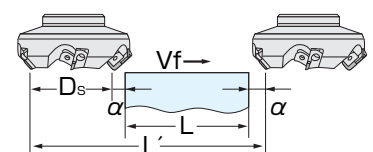
α : Idling Distance [mm]

V_f : Table Feed [mm/min]

f_z : Feed per Tooth [mm/t]

Z : Number of Inserts

n : Spindle Revolution [min^{-1}]



R



Technical
Information



● True Rake Angle

$$\tan T = \tan R \times \cos C + \tan A \times \sin C$$

● Inclination Angle

$$\tan I = \tan A \times \cos C - \tan R \times \sin C$$

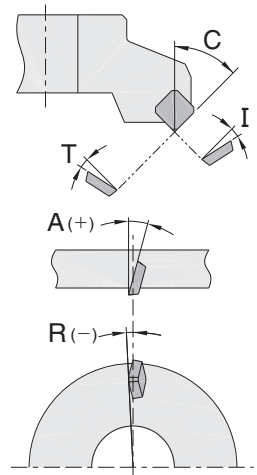
A : Axial Rake Angle A.R. [°] (-90° < A < 90°)

R : Radial Rake Angle R.R. [°] (-90° < R < 90°)

C : Approach Angle [°] (0° < C < 90°)

T : True Rake Angle [°] (-90° < T < 90°)

I : Inclination Angle [°] (-90° < I < 90°)



● Ball-Nose Endmill Cutting & Revolution

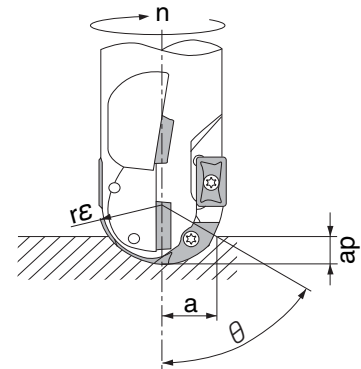
$$n = \frac{1000 \times V_a}{2 \times \pi \times \sqrt{a(2r_\epsilon - a_p)}}$$

n : Revolution [min⁻¹]

r_ε : Radius of Ball-Nose Endmill (Ball Part's radius [mm])

a_p : Depth Of Cut [mm]

V_a : Cutting Speed at Point "a" [m/min]



■ Drilling

● Cutting Speed

$$V_c = \frac{\pi \times D_c \times n}{1000}$$

V_c : Cutting Speed [m/min]

D_c : Drill Diameter [mm]

n : Spindle Revolution [min⁻¹]

● Feed Rate (Milling)

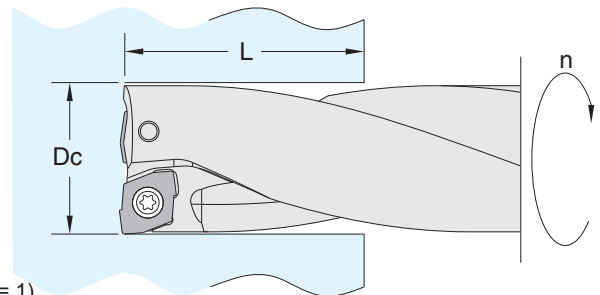
$$V_f = f_z \times Z \times n$$

V_f : Table Feed [mm/min]

f_z : Feed per Tooth [mm/t]

Z : Number of Insert (Number of Insert = 1)

n : Spindle Revolution [min⁻¹]



● Cutting Time

$$T = \frac{60 \times L}{f \times n} = \frac{60 \times \pi \times D_c \times L}{1000 \times V_c \times f}$$

T : Cutting Time [second]

L : Drilling Depth [mm]

f : Feed Rate [mm/rev]

n : Spindle Revolution [min⁻¹]

D_c : Drill Diameter [mm]

V_c : Cutting Speed [m/min]

● Power Requirement (Reference Value)

$$P_c = \frac{D_c}{20} \times \frac{V_c}{100} \times \left(1 + \left(\frac{2.5 \times f}{0.1} \right) \right)$$

P_c : Power Requirement [kw]

D_c : Drill Diameter [mm]

V_c : Cutting Speed [m/min]

f : Feed Rate [mm/rev]

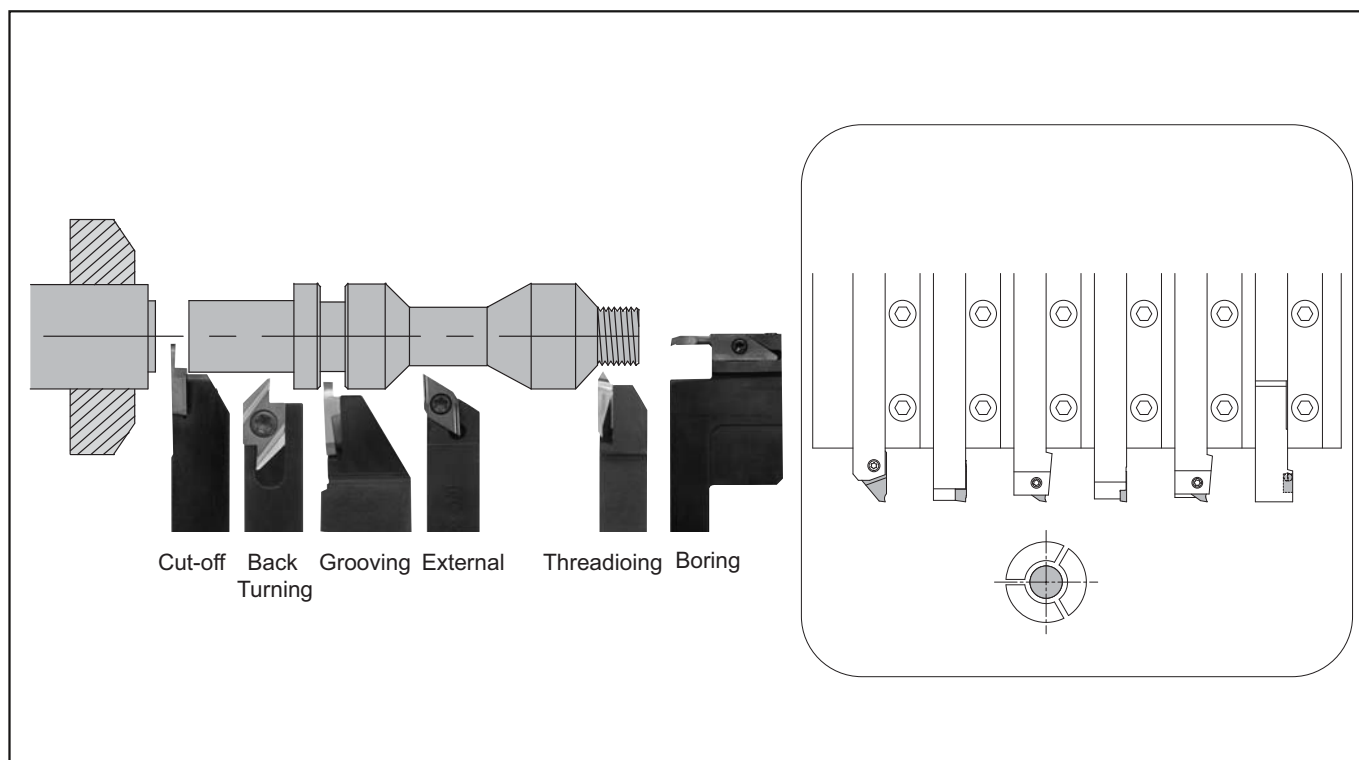
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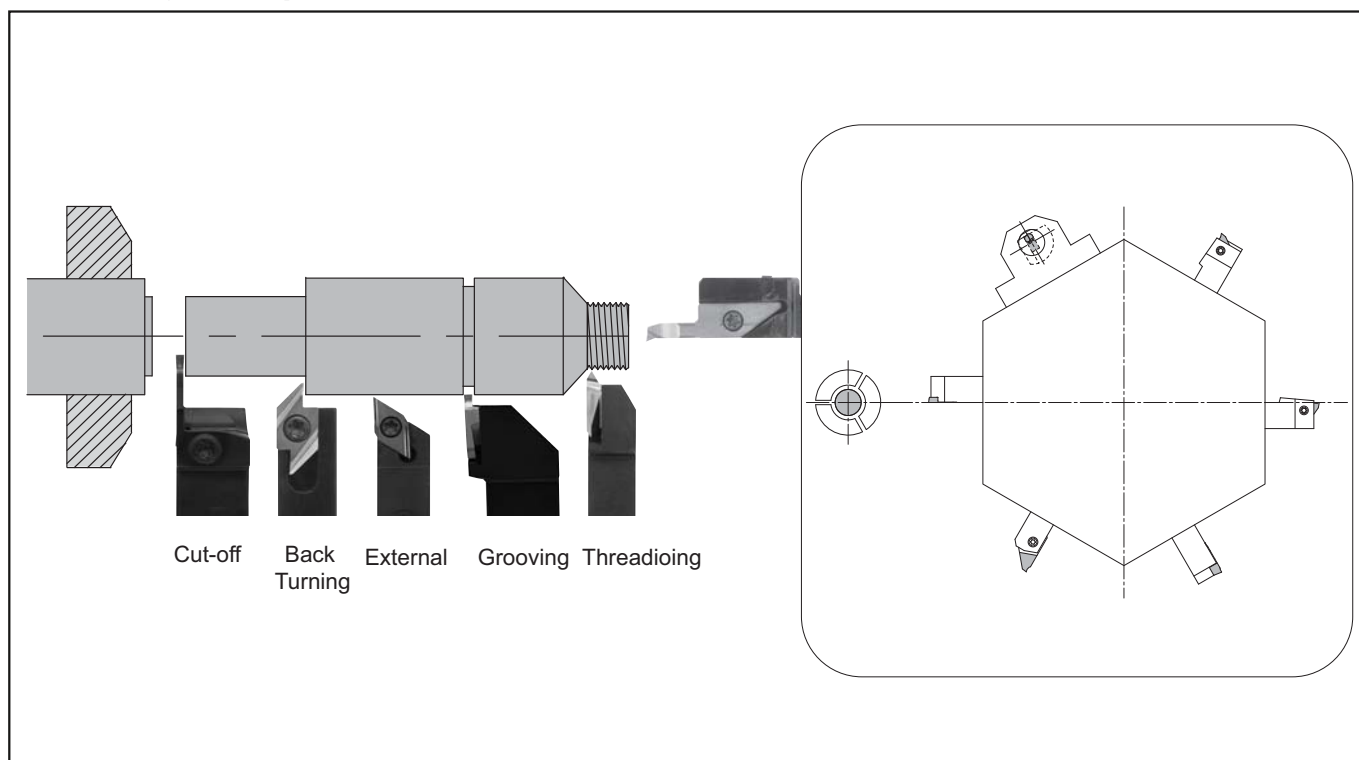
Technical
Information

Tooling Examples of Small Tools

Tooling Example ① CNC Automatic Lathe (Gang Type)



Tooling Example ② CNC Automatic Lathe (Turret Type)

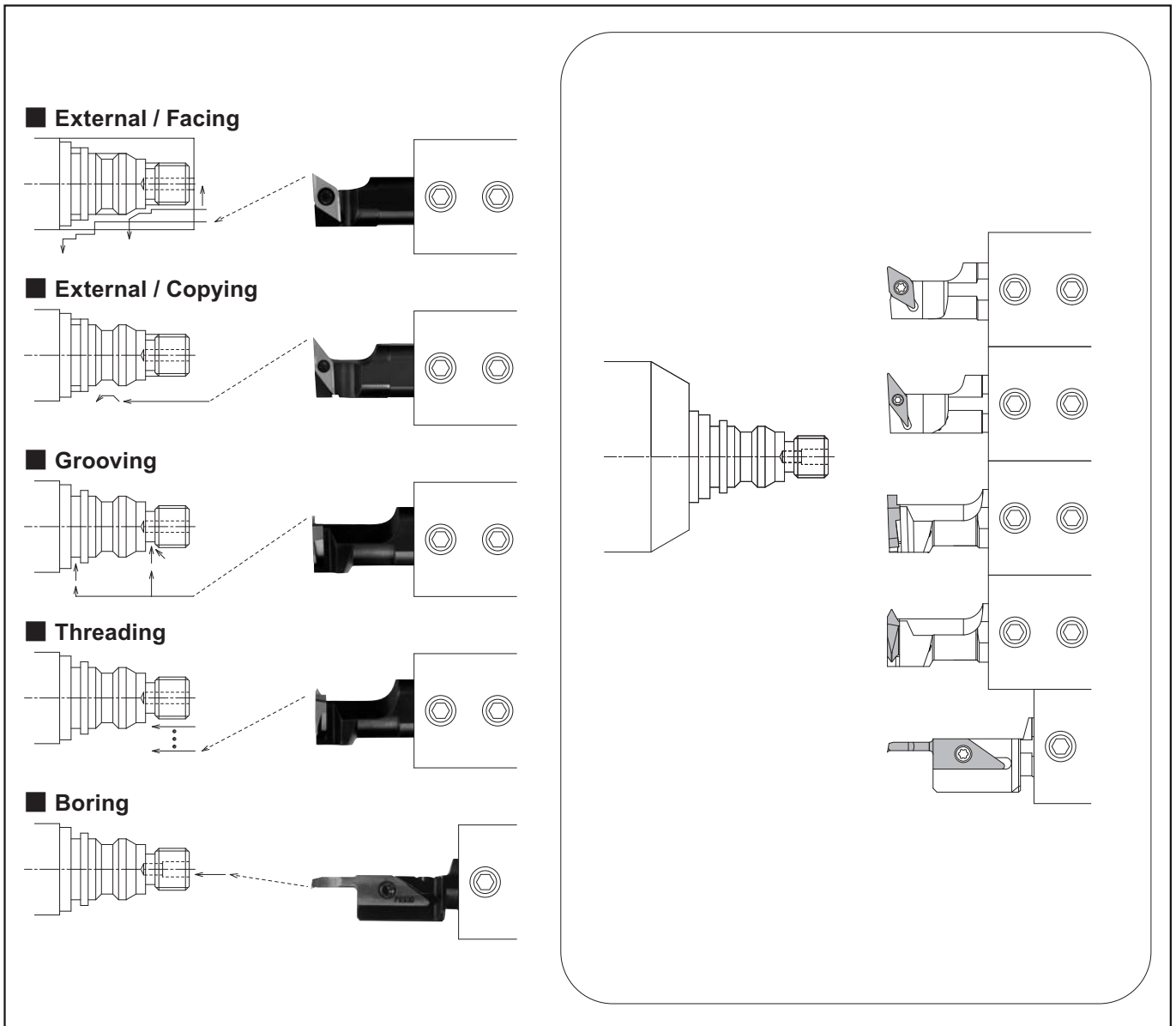


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Technical
Information

Tooling Example ③ CNC Automatic Lathe (Opposed Gang Type)



Automatic Lathe List by Manufacturer

Citizen Machinery

Model	Toolholder Dimensions (Gang-Type)	Number of tools	Toolholder Dimensions (Turret-Type)	Number of tools	Sleeve Dia.	Number of tools	Max. Cutting Dia.	Remarks
A12	10×10×100	5			ø19.05 / ø20		ø12	
A16	10×10×100	5			ø19.05 / ø20		ø16	
A20	12(13)×12(13)×120*1	7			ø25.4		ø20	
B12	10×10×100	5			ø19.05 / ø20		ø12	
B20	12(13)×12(13)×120	6			ø19.05 / ø20		ø20	
BL12	10×10×60~120	5			ø20(ø19.05)		ø12	
BL20	12(13)×12(13)×120	4~7			ø20(ø19.05)		ø20	
BL25	12(13)×12(13)×120	4~7			ø20(ø19.05)		ø25	
C12	10×10×120	6			ø19.05		ø12	
C16	10×10×120	6			ø19.05		ø16	
C32	16×16×130	5			ø25.4		ø32	
E16	10×10×60	20			ø19.05		ø16	
E20	16×16×90	20			ø25.4		ø20	
E25	16×16×90	20			ø25.4		ø25	
E32			16(19)×16(13)×90	20	ø25.4		ø32	
F10			10×10×60	10	ø19.05		ø10	
F12			10×10×60	10	ø19.05		ø12	
F16			10×10×60	10	ø19.05		ø16	
F20			16(19)×16(13)×90	10	ø25.4		ø20	
F25			16(19)×16(13)×90	10	ø25.4		ø25	
FL25			16×16×90	12	ø16		ø25	
FL42			16×16×90	12	ø16		ø42	
G32			16(19)×16(19)×90	10	-		ø32	
K12	12×12×100	6			ø19.05 / ø20		ø12	
K16	12×12×100	6			ø19.05 / ø20		ø16	
L10	8×8×100~130	5			ø15.875		ø10	
L16	12(10)×12(10)×130	5			ø19.05		ø16	
L20	12×12×130	5			ø19.05		ø20	
L25	16×16×130	5			ø25.4		ø25	
L32	16×16×130	5			ø25.4		ø32	
M212, M312	10×10×120	5	10×10×60	10	ø19.05		ø12	
M216, M316	10×10×120	5	10×10×60	10	ø19.05		ø16	
M220, M320	16×16×130	5	16×16×90	10	ø25.4		ø20	
M232, M332	16×16×130	5	16×16×90	10	ø25.4		ø32	
M20	13(12)×13(12)×130	5	10×10×60	10	ø19.05		ø20	
MSL12	10×10×120				-		ø12	
R04	8×8×120	5			ø15.875		ø4	
R07	8×8×120	5			ø15.875		ø7	
RL01	10(8)×10(8)×90				ø16(ø20)		ø10	
RL02	16×16×90				ø20		ø20	
RL21	10(12)×10(12)×90				ø19.05		ø35	

· This table is approved by machine manufacturers.
· Manufacturers are in no particular order.

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Technical
Information

Star Micronics

Model	Toolholder Dimensions (Gang-Type)	Number of tools	Toolholder Dimensions (Turret-Type)	Number of tools	Sleeve Dia.	Number of tools	Max. Cutting Dia.	Remarks
ECAS-12	10×10×95~150	6	-	-	ø22		ø13	
ECAS-20	12×12×80~150	6	-	-	ø22		ø20	
	16×16×80~144		-	-				
ECAS-32T	16×16×80~120	4	16×16×60~78	St.10	ø22 / ø32		ø32	
			16×16×80~88	St.10				
JNC-10			8×8×80~120	5	ø22		ø10	
JNC-16			10×10×80~120	5	ø22		ø16	
JNC-25 / 32			10×10×78~120	1×St.10	ø22			
KJR-16B / 25B								
KNC-16 / 20								
KNC-25 II / 32 II								
RNC-10 / 16								
RNC-16 / 16B II								
SA-16R								
SB-16 TYPE-A / C / D	12×12×95~130	5	-	-	ø22 / (ø22)	4		
	12(10)×12(10)×95~130	6	-	-	ø22 / ø22	4/4		
SC20	12×12×95~130	5	-	-	ø22	4		
	12(10)×12(10)×95~130	6	-	-		4/4		
SE-12 / 12B·16 / 16B								
SH-7								
SH-12 / 16								
SI-12 / 12C								
SR-10J	8×8×67~110	6			ø16	4		
SR-16 / 20								
SR-20R II	12×12×100~135	6			ø22			
SR-20R III / 20J	12×12×95~135	6	2 (For opposed SP side, deep hole machining)	4/4			ø20, ø30 (ø24)	
SR-25J / 32J	16×16×95~155	6						
SR-32								
SV-12 / 20	12×12×95~135	5	12×12×70~78	St.8	ø22 / ø32			
	16×16×95~135	4	16×16×65~70					
SV-32	16×16×95~135	4	16×16×60~70 / 80~88	St.8	ø22 / ø32			
SV-32J / 32J II	16×16×95~135	4	16×16×65~70	St.8	ø22 / ø32			
SW-7								
VNC-12								
VNC-20								
VNC-32								

• This table is approved by machine manufacturers.
• Manufacturers are in no particular order.

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Technical
Information

Automatic Lathe List by Manufacturer

Tsugami

Model	Toolholder Dimensions (Gang-Type)	Number of tools	Toolholder Dimensions (Turret-Type)	Number of tools	Sleeve Dia.	Number of tools	Max. Cutting Dia.	Remarks
B007- II	7×7×85	8			ø25		ø7	
	(8)×(8)×(85)							
	(10)×(10)×(85)							
B012- III / V	12×12×85	9			ø20		ø12	
B018- III	12×12×85	9			ø20		ø18	
B020- V	12×12×85	9			ø20		ø20	
BA20	12×12×85	6			ø25		ø20	
BA26	12(16)×12(16)×85	6			ø25		ø26	
BC18	12×12×85	10			ø25 / ø10		ø18	
BC25	12×12×85	10			ø10 / ø25		ø25	
BE12	12×12×85	9			ø20		ø12	
BE18	12×12×85	9			ø20		ø18	
BH20	12×12×85	4	12×12×90 16×16×90	St.12	ø25 / ø32		ø20	
BH38	16×16×100	7	20×20×125	St.12	ø25 / ø32		ø38.1	
BM07	8×8×85	9			ø20		ø7	
BM16	12×12×85	9			ø20		ø16	
BM16E	12×12×85	9			ø20		ø16	
BN12	12×12×85	7			ø20		ø12	
BN20	12(16)×12(16)×85	7			ø20		ø20	
BS12- III	12×12×85	7 or 10			ø14 / ø25		ø12	
BS12- V	12×12×85	8 or 12			ø20 / ø25		ø12	
BS18- III	12×12×85	7 or 10			ø14 / ø25		ø18	
BS20- III	16×16×100	7 or 10			ø16 / ø25		ø20	
BS20- V	12×12×85	8 or 12			ø20 / ø25		ø20	
BS26- III	16×16×100	7 or 10			ø16 / ø25		ø26	
BS32- III	16×16×100	6			ø16 / ø25		ø32	
BU12	12×12×85	4	12×12×80	St.8	ø20		ø51	
BU20	12×12×85	4	12×12×80	St.8	ø20		ø20	
BU26	16×16×100	7	20×20×90	St.8	ø20 / ø32		ø26	
BU38	16×16×100	7	20×20×90	St.8	ø20 / ø32		ø38	
BW07	12×12×85	7			ø20		ø7	
BW12	12×12×85	7			ø20		ø12	
BW20	12(16)×12(16)×85	7			ø20		ø20	
C004- II / III	12×12×60~100	6~8			-		ø100	
C15	10×10×60~100	10~14			-		ø75	
C150	12×12×60~100	4~6			-		ø75	
C220	12×12×60~100	6~8			-		ø100	
C300	16×16×100~130	6~10			-		ø150	
M34J	-	-	20×20×125	St.12	ø20 / ø32		ø34	
M42J	-	-	20×20×125	St.12	ø25 / ø32		ø42	
M42SD	-	-	20×20×125	St.12	ø25 / ø32		ø42	
M50	-	-	20×20×100	St.12	ø32		ø51	
M50J	-	-	20×20×100	St.12	ø20 / ø32		ø51	
MB35	-	-	20×20×90	2×St.8	ø20 / ø32		ø35	
MB38	-	-	20×20×90	2×St.8	ø20 / ø32		ø38	
MB50	-	-	20×20×90	2×St.8	ø20 / ø32		ø50	
MU26	-	-	20×20×90	2×St.8	ø20 / ø32		ø26	
MU38	-	-	20×20×90	2×St.8	ø20 / ø32		ø38	
NU50	-	-	20×20×100	St.12	ø20 / ø32		ø51	
TMA8- II	20×20×100~125	1			ø25 / ø32		ø65	
TMU1	20×20×100~125	1	20×20×125	St.16	ø25 / ø32		ø38	

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· Manufacturers are in no particular order.

Nomura VTC

Model	Toolholder Dimensions (Gang-Type)	Number of tools	Toolholder Dimensions (Turret-Type)	Number of tools	Sleeve Dia.	Number of tools	Max. Cutting Dia.	Remarks
NN-10C	10×10×130	6			ø17		ø10	
NN-10CS	10×10×130	5			ø17		ø10	
NN-10SB5	10×10×130	5			ø23		ø10	
NN-10S II	10×10×130	5			ø23		ø10	
NN-10T	10×10×130	7			ø23		ø10	
NN-16SB5	10×10×130	5			ø23		ø16	
NN-16H III	12×12×130	6			ø23		ø16	
NN-16UB5	12×12×130	5			ø23		ø16	
NN-16U III	12×12×130	5			ø23		ø16	
NN-16J	12×12×130	6			ø23		ø16	
NN-20H III	12×12×130	6			ø23		ø20	
NN-20UB5	12×12×130	5			ø23		ø20	
NN-20UB7	12×12×130	6			ø23		ø20	
NN-20U III	12×12×130	5			ø23		ø20	
NN-20YB	12×12×130	8			ø23		ø20	
NN-25YB / 32YB	16×16×130	8			ø23 / ø32		ø25	
NS-P1053A	9.5×9.5×130	5			-		ø10	
NN-20J	12×12×130	6			ø23		ø20	
NN-16SB6	12×12×130	5			ø22		ø16	

Miyano

Model	Toolholder Dimensions (Gang-Type)	Number of tools	Toolholder Dimensions (Turret-Type)	Number of tools	Sleeve Dia.	Number of tools	Max. Cutting Dia.	Remarks
ABX-51TH3			20×20×125	St.36	ø25	72	ø51	
ABX-64TH3			20×20×125	St.36	ø25	72	ø64	
ABX-51SY			20×20×125	St.24	ø25	48	ø51	
ABX-64SY			20×20×125	St.24	ø25	48	ø64	
BNC-34C ₅			20×20×125	St.8	ø25	16	ø34	
BNC-42C ₅			20×20×125	St.8	ø25	16	ø42	
BND-34C ₅			20×20×125	St.12	ø25	24	ø34	
BND-34S ₅			20×20×125	St.12	ø25	24	ø34	
BND-42C ₅			20×20×125	St.12	ø25	24	ø42	
BND-42S ₅			20×20×125	St.12	ø25	24	ø42	
BND-51S ₂			20×20×125	St.12	ø25	24	ø51	
BND-51SY2			20×20×125	St.12	ø25	24	ø51	
BNE-34S5			20×20×125	St.24	ø25	48	ø34	
BNE-34SY5			20×20×125	St.24	ø25	48	ø34	
BNE-51S5			20×20×125	St.24	ø25	48	ø51	
BNE-51SY5			20×20×125	St.24	ø25	48	ø51	
BNJ-34S			20×20×125	St.18	ø25	30	ø34	
BNJ-34SY			20×20×125	St.18	ø25	30	ø34	
BNJ-42S			20×20×125	St.18	ø25	30	ø42	
BNJ-42SY			20×20×125	St.18	ø25	30	ø42	
BNJ-51SY2			20×20×125	St.18	ø25	30	ø51	
BX-20S	16×16×120	9			ø20	8	ø20	
BX-26S	16×16×120	9			ø20	8	ø26	
B6-16	12×12×80	6	12×12×80 (Cross Slide)	St.6	ø38		ø16	
G6-26		6	13×13×120 (Cross Slide)	St.6	ø41.275		ø26	Multi-Spindle Automatic Lathe
F6-26		6	13×13×120 (Cross Slide)	St.6	ø41.275		ø26	
MZ-32		6	13×13×120 (Cross Slide)	St.6	ø41.275		ø32	
E6-C62		6	13×13×120 (Cross Slide)	St.6	ø41.275		ø62	

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Technical
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Automatic Lathe List by Manufacturer

Eguro

Model	Toolholder Dimensions (Gang-Type)	Number of tools	Toolholder Dimensions (Turret-Type)	Number of tools	Sleeve Dia.	Number of tools	Max. Cutting Dia.	Remarks
SANAX-6	12×12	5 (Max.)		5	ø16		ø15	
SANAX-8	16×16	5 (Max.)		5	ø25 / ø30		ø20	
	12×12	7 (Max.)		5	ø25 / ø30		ø20	
SANAX-10	16×16	5 (Max.)		5	ø25 / ø30		ø25.5	
EBN-10EX	12×12	6 (Max.)			ø20		ø25.5	
NUCBOY-8EX	12×12	6 (Max.)			ø20		ø20	
NUCLET-10EX	16×16	10 (Max.)			ø20		ø25.5	
NUCPAL-10EX	16×16	10 (Max.)			ø20		ø25.5	

Amada Wasino

Model	Toolholder Dimensions (Gang-Type)	Number of tools	Toolholder Dimensions (Turret-Type)	Number of tools	Sleeve Dia.	Number of tools	Max. Cutting Dia.	Remarks
G05	16×16				ø20		ø50×40	
G06	16×16				ø20		ø60×60	
G07	16×16				ø20		ø100×100	
G07M	16×16				ø20		ø100×100	
G07F	20×20				ø20		ø120×120	
GG5	16×16				ø20		ø50×40	
GS04	16×16				ø20		ø30×20	
J1			20×20	8	ø25		ø120×120	
J3			25×25	8	ø32		ø170	
J5			25×25	8	ø32		ø240	
JJ1			20×20	8	ø25		ø50×50	
JJ3			25×25	8	ø32		ø100×100	
JJ3M			25×25	12	ø32		ø100×100	
Ai8			20×20	8	ø25		ø50×50	
A12				12	ø25		ø50×80	
A18S				18	ø25		ø50×80	
AD12				9	ø25		ø50×80	
AD18S				15	ø25		ø50×80	
AA1			20×20	8	ø25		ø50×50	

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1 - Free Cutting Steel

China	Russia	Japan	USA	British	Germany	France	ISO
GB 8731-88	GOST 1414-75	JIS G4804-83	ASTM A297-93 ASTM A108-95	BS 970 port1-96	DIN 1651-88	NF A35-562-92	683-988
Y12	A12	SUM 12	1108	210M15	10S20	13MF4	10S20
		SUM 21	1211				
Y12Pb	-	SUM 22L	12L13	-	10SPb20	-	10SPb20
							11SMnPb28
Y15	-	SUM 22	1213	230Mo7	10S20	S250Si	11SMn28
			G12130				
Y15Pb	-	SUM 24L	12L13	-	9SMnPb28	S300Pb	11SMnPb28
		SUM 22L	12L14				12SMnPb35
Y20	A20	SUM 32	1117	210M15	C22	C22	-
			G11170	C22			
Y30	A30	-	1132	C30	C30	C30	35S20
Y35	A35	SUM 41	1137	C35	C35	C35	35S20
			G 11370				
Y40Mn	A40G	SUM 43	1144	226M44	-	45MF6-3	44SMn28
			G11440				
Y45Ca	-	-	1145	C45	C45	C45	-

[illegible]

2 - Cold Rolled Steel Sheets/Coil/Strip

Country	Standard	Steel grade	Analysis %							Physical properties										
			C max.	Si max.	Mn max.	P max.	S max.	N max.	Others	Yield strength N/mm ²	Tensile strength N/mm ²	Elongation %			Test direction	Hardness HB	Bend test 180°	Deoxy-dation		
China	GB699-88	08	0.05-0.12	0.17-0.37	0.35-0.65	0.035	0.040	-	-	200	Min. 330	33			-	131	-	-		
		08F	0.05-0.11	0.03	0.25-0.50		0.035			180	Min. 300	35								
		08Al	0.05-0.12		0.25-0.65		0.02			-	-	-								
		10	0.02-0.14		0.17-0.37					0.35-0.65	0.040	210	Min. 340	51						
		10F	0.07-0.14		0.07					0.25-0.50	0.035	-	190	Min. 320					33	
Russia	Gost 19904-90 Gost 1050-88	08YU	0.07	0.03	0.35	0.020	0.025	-	-	195	250-350	-			-	-	-	-		
		08KP	0.05-0.12		0.25-0.50	0.035	0.040			-	-	-	-	-	-	-				
		08PS	0.05-0.11		0.05-0.17	0.35-0.65	0.040			0.050	-	-	-	-	-	-				
Japan	JIS G 3141	Class 1 SPCC	0.12	-	0.50	0.040	0.045	-	-	Not specified	Not usually applied for Class 1	L = 50 mm	39/32	Dependent on thickness	long.	Refer to JIS table	Close contact	Not specified		
		Class 2 SPCD	0.10		0.45	0.035	0.035						41/34							
		Class 3 SPCE	0.08		0.40	0.030	0.030						43/36							
USA	SAE 1006 SAE 1008 SAE 1010	-	0.08	-	0.45	0.030	0.035	-	-	-	-	-			-	-	-	-		
			0.10		0.50															
			0.08-0.13		0.60	0.30														
British	BS 1449	CR4	0.12	-	0.60	0.050	1.020	-	-	(140)	(280)	L = 50 mm	-	-	-	-0 t	-			
		CR3	0.10		0.50	0.040	0.040						(34)							
		CR2	0.08		0.45	0.035	0.030						36							
	BS970 Part 1 96	040°10	0.08-0.13	0.10-0.40	0.30-0.50	0.05	0.05	-	-	-	-	-			-	-	-	-		
		040°12	0.10-0.15	-																
Germany	DIN 1623, Part 1 (2.83)	St 12	0.10	-	-	-	-	0.007	Not solved N ₂	0.02 Al min	280 max.	270 to 370	L = 80 mm	28	trans v.	Refer to DIN table	No bend test but cupping test required	Not specified		
		Ust 13						250 max.			32			Rimmed						
		RRSt 13						-			-			-				-	240 max. 210 max. (225 fort>=1.5 mm)	34

Remarks: () : For reference - t: Thickness - L: Length - f : Diameter

3 - Cold Heading Steels

China GB/T 6478-86	Russia GOST 10702-78 GOST 1050-88	Japan JIS G 357-91	USA ASTM A29M-93a	British BS3111-1-87	Germany DIN1654-2-89	France NFA35-564-83 NFA35-053-84	ISO 4954-93(E)
ML08	08KP	SWRCH 8R SWRCH 10R	1010	0/1	QST34-3	XC6,FB8,FR8	CC8X(A2R)
ML10	10KP	SWRCH 10R SWRCH 12R	1012	0/2	QST36-2	XC10,FB10, FR10	CC11X(A3R)
ML15	15PS	SWRCH 15R SWRCH 17R	1015	0/3	QST38	XC18,FB18 FR18,FR15	CC15X
ML20	20PS	SWRCH 17R	1020	0/4	-	XC18,FR20	CC21A(A5A0)
ML25	25	SWRCH 25K	1025	-	-	XC25,FR28	CE28E4(C2)
ML30	30	SWRCH 30K SWRCH 33K	1030	-	-	XC32,FR32	CE28E4(C2)
ML35	35	SWRCH 35K SWRCH 38K	1034	-	CQ35	XC38H1,FR36	CE28E4(C3)
ML40	40	SWRCH 38K SWRCH 40K	1040	-	-	XC38H1,FR38	CE40E4
ML45	45	SWRCH 45K SWRCH 48K	1044	-	CQ45	-	CD45E4(C6)
ML25Mn	-	SWRCH 30K SWRCH 33K	1030	1/1	-	1C32	CD28E4(C2)
ML35Mn	-	SWRCH 35K SWRCH 38K	1034	-	CQ35	1C38	CD35E4(C3)
ML40Mn	40G GOST4543-71	SWRCH 40K SWRCH 43K	1040	-	-	XC38H1,FR38	CE40E4
ML45Mn	45G	SWRCH 45K SWRCH 48K	1045	BS1506-90 1/2	CQ45	-	CE45E4 (C6)
ML15Cr	15KH	-	5115	-	17Cr3	-	20CrE4(B10)
ML20Cr	20KH	-	5120	-	-	-	20CrE4(B10)
ML40Cr	40KH	-	5140	3/2	37Cr4	41Cr4	41CrE4(16)
ML15MnB	-	JISG3508-91 SWRCHB620	1518	-	-	-	CE20 BG2 (E2)
ML30CrMo	30KHMA	-	4130	34CrMo4	34CrMo4	34CrMo4 34CD4	34CrMo4 (C31)
ML35CrMo	-	-	4135	34CrMo4	34CrMo4	34CrMo4 34CD4	34CrMo4 (C31)
ML42CrMo	-	-	4140	42CrMo4	4CrMo4	42CrMo4 42CD4	42CrMo4 (C32)

4 - Alloy structural steel

China GB/T 3077-88	Russia GOST 4543-71	Japan JIS G4160-79	USA ASTM A29-93a	British BS EN10028-2-92	Germany DIN EN10028-2-92	France NF EN10028-2-92	ISO 682-1-87(E)
20Mn2	-	SMn420	1524	P355GH	P355GH	P355GH	22Mn6
30Mn2	30G2	SMn433	1330	28Mn6	28Mn6	28Mn6	28Mn6
35Mn2	35G2	SMn438	1335	150M36	-	-	36Mn6
40Mn2	40G2	SMn443	1340	150M36	-	-	42Mn6
45Mn2	45G2	SMn443	1345	-	-	-	42Mn6
50Mn2	50G2	-	1345	-	-	-	-
40B	-	-	1040B	-	-	-	-
45B	-	-	1045B	-	-	-	-
50B	-	-	1050B	-	-	-	-
40MnB	-	-	1541B	39MnCr-B6-2	39MnCr-B6-2	39MnCr-B6-2	-
45MnB	-	-	1547B	-	-	-	-
15Cr	15KH	SCr415	5115	527A17	17Cr3	-	-
15CrA	15KHA	SCr415	5115	527A17	17Cr3	-	-
20Cr	20KH	SCr420	5120	BS970 Part1-96	DIN17210-86	-	20Cr4
-	-	-	-	590H17	20Cr4	-	-
				590M17			
30Cr	30KH	SCr430	5130	BSEN10083-1-91	DIN EN100831-91	NF EN10083-1-91	34Cr4
-	-	-	-	34Cr4	34Cr4	34Cr4	-
35Cr	35KH	SCr435	5135	34Cr4	34Cr4	34Cr4	37Cr4
40Cr	40KH	SCr440	5140	41Cr4	41Cr4	41Cr4	41Cr4
45Cr	45KH	SCr445	5145	-	-	-	41Cr4
38CrSi	38KHS	-	-	-	-	-	-
15CrMo	15KHM	-	-	-	-	-	-
20CrMo	20KHM	SCM420	-	BS970 Part1	25CrMo4	25CrMo4	18CrMo4
				708H20			
				708M20			
30CrMo	30KHM	SCM430	4130	25CrMo4	25CrMo4	25CrMo4	25CrMo4
30CrMoA	30KHMA	SCM430	4130	34CrMo4	34CrMo4	34CrMo4	34CrMo4
35CrMo	35KHM	SCM435	4137	34CrMo4	34CrMo4	34CrMo4	34CrMo4
42CrMo	38KHM	SCM440	4140	42CrMo4	42CrMo4	42CrMo4	42CrMo4
38CrMoAl	38KH2MYUA	SACM645	-	BS970Part1-96 905M39	-	-	41CrAlMo74
40CrV	40KHF	-	-	-	-	-	-
50CrVA	50KHF	JIS G4801-84	6150	51CrV4	51CrB4	51CrV4	51CrV4
		SUPIO					
20CrMn	18KHG	-	-	DIN17210-86	DIN17210-86	NF A35-551-86	20MnCr5
				20MnCr5	20MnCr5	20MCS	
40CrMn	-	-	-	41Cr4	41Cr4	41Cr4	41Cr4
20CrMnSi	20KHGSA	-	-	-	-	-	-
25CrMnSi	25KHGSA	-	-	-	-	-	-
30CrMnSi	30KHGS	-	-	-	-	-	-
30CrMnSiA	30KHGSA	-	-	-	-	-	-
35CrMnSiA	35KHGS	-	-	-	-	-	-
20CrMnMo	-	JIS G4102179	-	-	-	NF A35-551-86	-
		SCM421				18CD4	
40CrMnMo	-	-	4140	42CrMo4	42CrMo4	42CrMo4	42CrMo4
20CrMnTi	18KHGT	-	-	-	-	-	-
30CrMnTi	30KHGT	-	-	-	-	-	-
20CrNi	20KHH	-	-	637H17	-	-	-
40CrNi	40KHH	SNC236	-	-	-	-	-
45CrNi	45KHH	-	-	-	-	-	-
50CrNi	50KHH	-	-	-	-	-	-
C2CrNi	12KHH2	-	-	-	-	-	-
12CrNi3	12KHH3A	SNC815	-	655M13	-	14NC11	15NiCr13

20CrNi3	20KHH3A	-	-	-	-	-	-
30CrNi3	30KHH3A	SNC631	-	-	-	-	-
12CrNi4	12KH2H4A	-	-	-	-	-	-
20CrNi4	20KH2H4A	-	-	-	-	-	-
20CrNiMo	-	JISG4103-79	8615	BS970 Part3-91	BS970 Part3-91	NF A35-551-86	20NiCrMo2
		SNM220		805 M20	805 M20	20NCD2	
40CrNiMoA	40KHH2MA	-	-	-	-	-	-
45CrNiMoVA	45KHH2MFA	-	-	-	-	-	-
18Cr2Ni4WA	18KH2H4MA	-	-	-	-	-	-
25Cr2Ni4WA	25KH2H4MA	-	-	-	-	-	-

5 - Alloy Tool Steel							
China GB1299-85	Russia GOST 5950-73	Japan JIS G4401-83	USA ASTM 681-94	British BS 4659-89	Germany DIN 17350-80	France NF A35-590-92	ISO 4957
9SiCr	9KHS	-	-	-	90CrSi5	-	-
8MnSi	-	-	-	BW1A	C75W	-	-
Cr06	KH05	SKS8	-	-	140Cr3	130Cr3	-
Cr2	KH	SUJ2	L3	BL1	100Cr6	100Cr6	100Cr2
9Cr2	9KH1	-	-	BL3	90Cr3	-	-
W	V1	~SKS21	F1	BF1	120W4	100WC10	-
4CrW2Si	4KHV2S	~SKS41	-	-	35WCrV7	-	-
5CrW2Si	5KHV2S	-	S1	BS1	45WCrV7	45WCrV8	45WCrV2
6CrW2Si	6KHV2S	-	-	-	60WCrV7	(55WC20)	60WCrV2
Cr12	KH12	SKD1	D3	BD3	X210Cr12	X200Cr12	210Cr12
Cr12MoV	KH12M	SKD11	-	-	X165CrMoV12	-	-
Cr12MoV	-	SKD11	D2	BD2	X155CrMoV12-1	X160CrMoV12	160CrMoV12
Cr5Mo1V	-	SKD12	A2	BA2	X100CrMoV5-1	X100CrMoV5	100CrMoV5
9Mn2V	-	-	O2	B02	90MnCrV8	90MnV8	90MnV2
CrWMn	KHVG	SKS31	-	-	105WCr6	105WCr5	105WCr1
9CrWMn	9KHVG	SKS3	01	B01	100MnCrW4	90MnWCrV5	95MnWCr1
5CrMnMo	5KHGM	-	-	-	40CrMnMo7	-	-
5CrNiMo	5KHNM	SKT4	L6	BH224/5	55NiCrMoV6	55NiCrMoV7	55NiCrMoV2
3Cr2W8V	3KH2V8F	SKD5	H21	BH21	X30WCrV9-3	X30WCrV9	30WCrV9
8Cr3	8KH3	-	-	-	-	-	-
4Cr3Mo3SiV	3KH3M3F	-	H10	BH10	X32CrMoV3-3	32CrMoV12-28	-
4Cr5MoSiV	4KH5MFS	SKD6	H11	BH11	X38CrMoV5-1	X38CrMoV5	35CrMoV5
4Cr5MoSiV1	4KH5MF1S	SKD61	H13	BH13	X40CrMoV5-1	X40CrMoV5	40CrMoV5
4Cr5W2VSi	4KH5V2FS	-	-	-	-	-	-
3Cr2Mo	-	-	P20	BP20	35CrMo4	35CrMo8	35CrMo2
-	-	-	-	-	X210CrW12	210CrW12-1	210CrW12
-	-	SKD4	-	-	X30WCrV5-3	X32WCrV5	30WCrV5
-	-	SKD62	H12	BH12	X37CrMoW5-1	X35CrWMoV5	-

6 - Carbon Tool Steel

China GB 1298-86	Russia GOST 1435-90	Japan JIS G4401-83	USA ASTM A686-92	British BS 970-96	Germany DIN 17350-80	France NF A35-590-92	ISO 4957-80
T7	U7	SK7	-	060A67 060A72	C70W2	C70E2U	TC70
T8	U8	SK5	W1A-8	060A78 060A81	C80W1	C80E2U	TC80
		SK6		?	?		
T8Mn	U8G	SK5	W1A-8	060A81	C85W	X75	-
T9	U9	SK4 SK5	W1A-9	-	-	C90E2U	TC90
T10	U10	SK3 SK4	W1A-9	1407 -	C105W1 -	C105E2U	TC105
T11	U11	SK3	W1A-10	1407	C105W1	C105E2U	TC105
T12	U12	SK2	W1A-11	1407	C125W2	C120E3U	TC120
T13	U13	SK1	-	-	C130W2	C140E3U	TC140

7 - Carbon Structural Steel

China GB 700-88	Russia GOST 380-94	Japan JIS G3101-95	USA ASTM A283-93 ASTM A573-93	British BJ 970 Part 1-96 BS EN 10025-93	Germany DIN 17100 DIN EN 10025-94	France NF EN 10025-93	ISO 630-95
Q195	ST1KP ST1SP ST1PS	SS300 JIS G3131-96 SPHC SPHD	Gr. B Gr. C	040A10 S185	S185	S185	-
Q215A	ST2KP-2 ST2PS-2 ST2SP-2	SS330 SPHC SPHD	Gr. C Gr. 58	040A12	USt34-2 RSt34-2	-	-
Q215B	ST2KP-3 ST2PS-3 ST2SP-3	SS300 SPHC SPHD	Gr. 58	040A12	-	-	-
Q235A	ST3KP-2 ST3PS-2 ST3SP-2	SS400 JIS G3106-95 SM 400A	Gr. D	080A15	-	-	E235B
Q235B	ST3KP-3 ST3PS-3 ST3SP-3	SS400 SM400A	Gr. D	080A15 S235JR S235JRG1 S235JRG2	S235JR S235JRG1 S235JRG2	S235JR S235JRG1 S235JRG2	E235B
Q235C	ST3KP-4 ST3PS-4 ST3SP-4	SM400A SM400B	Gr. D Gr. 65	080A15 S235J0	S235J0	S235J0	E235C
Q255A	ST4KP-2 ST4PS-2 ST4SP-2	SS400 SM400A	-	-	-	-	-
Q255B	ST4KP-3 ST4PS-3 ST4SP-3	SS400 SS400A	-	-	-	-	-
Q275	ST5PS-2 ST5SP-2	SS490	-	-	-	-	E275A

8 - Cast Iron						
China	Russia	Japan	USA	British	Germany	France
GB 1348	GOST 7293	JIS G5502	ASTM A536	BS 2789	DIN 1693	NF A32-201
QT400-18	VT38-17	FCD40	60-40-18	Cr.370-17	GGG40	FGS370-17
QT450-10	VT42-12	-	65-45-12	Cr.420-12	-	FGS400-12
QT500-7	VT50-7	FCD45	80-55-06	Cr500-7	GGG50	FGS500-7
	VT50-2	FCD50				
QT600-3	VT60-2	FCD60	80-55-06	Cr.600-3	GGG60	FGS600-3
QT700-2	VT70-2	FCD70	100-70-03	Cr.700-2	GGG70	FGS700-2
QT800-2	VT80-2	-	120-90-02	Cr.800-2	GGG80	FGS800-2

9 - Cold Rolled Grain-Oriented Magnetic Steel Sheet Strip									
Nominal Thickness (mm)	China GB 2521-96	Russia GOST 21427.1-83	Japan JS G2553-86	USA ASTM A876M-92	British		Germany DIN EN10107-96	France NF EN 10107-96	ISO IEC 329-71
					BS 640418.7	BSEN 10107-96			
0.27	27QG100	3414	27P100	-	-	M103-27P	M103-27P	M103-27P	-
	27QG110	3408	27P110	27P146M	-	M103-27P	M103-27P	M103-27P	-
	27QG120	3407	27G120	27H163M	-	-	-	-	-
	27QG130	3406	27G130	27H163M	130-275	M130-275	M130-27S	M130-27S	C-Core
	27QG140	3405	27G140	-	089-27N5	M089-27N	M089-27N	M089-27N	-
0.3	30QG110	3408	30P110	30P154M	-	M111-30P	M111-30P	M111-30P	-
	30QG120	3408	30P120	30P154M	-	M117-30P	M117-30P	M117-30P	-
	30QG130	3405	-	30H183M	-	-	-	-	C-Core
	30Q130	3406	30G130	30H183M	-	-	-	NFC-28-920	C-Core
								FEM140-30-3	
	30Q140	3405	30G140	30H183M	140-30S5	M140-30S	M140-30S	M140-30S	C-Core
	30Q150	3404	30G150	-	097-30-N5	M098-30N	M097-30N	M097-30N	-
0.35	35QG125	3408	35P125	-	-	-	-	-	C-Core
	35QG135	3407	35P135	-	-	-	-	-	C-Core
	35Q135	3407	-	-	-	-	-	-	C-Core
	35Q145	3406	35G145	-	-	M15035S	M150-35S	M150-35S	-
	35Q155	3405	35G155	35H207M		M15035S	M150-35S	M150-35S	-
	35Q165	3404	35G165	-	111-35-N5	M111-35N	M111-35N	M111-35N	-

10 - Gray Cast Iron						
China	Russia	Japan	USA	British	Germany	France
GB 9439	GOST 1412	JIS G5501	ASTM A48	BS 1452	DIN 1491	NF A32-101
HT150	ST15-32	FC15	20B	Cr.150	GG15	FGL150
HT200	ST18-36	FC20	25B	Cr.180	GG20	FGL200
-	ST21-40	-	30B	Cr.220	-	-
HT250	ST24-44	FC25	35B	-	GG25	FGL250
-	ST28-48	-	40B	Cr.260	-	-
HT300	ST32-52	FC30	45B/50B	Cr.300	GG30	FGL300
HT350	ST36-56	FC35	55B	Cr.350	GG35	FGL350
-	ST40-60		60B	Cr.400	GG40	FGL400

11 - Hot Rolled Steel Sheet/Coil/Strip/Plate

Country	Standard	Steel grade		Analysis %						Physical properties					
				C max.	Si max.	Mn max.	P max.	S max.	Others	Yield strength	Tensile strength	Elongation %	-	Direction of test	Radius bend Tests 180°
										N/mm ² min	N/mm ² min				
China	GB 700-88	Q195		0.06 - 0.12	0.30	0.25 - 0.50	0.045	0.05		195	315-390	-	-	-	-
		Q235		0.14 - 0.22	0.12 - 0.30	0.30 - 0.65	0.045	0.050	-	235	375-406	24	21	-	1.5 t
		Q255		0.18 - 0.28	0.30	0.40 - 0.70				255	410-510	22	19	-	2.0 t
Russia	Gost 380-88	3KP			0.05	0.30 - 0.60									2.0 t
		3PS		0.14 - 0.22	0.05 - 0.15	0.40 - 0.65				-	-	22			-
		3SP			0.15 - 0.30	0.65	0.040	0.050	-			?	td >	-	-
		5PS		0.28 - 0.37	0.05 - 0.15	0.50 - 0.80				285	490-630	20			3.0 t
		5SP			0.15 - 0.30					295					
Japan	JIS G 3101	Thickness (t)													
		t ≤ 16 mm								206	333 to 431	26	21	Dependent on thickness and test piece	0.5 t
		Class 1 SS 330		-		-	0.050	0.050							
		Class 2 SS 400			-				-	245	402 to 510	21	17		1.5 t
		Class 3 SS 490								284	490 to 608	19	15		2.0 t
		Class 4 SS 540		0.30		1.60	0.040	0.040		402	539	16	13		
	JIS G 3131	SPH C	-	0.15		0.60	0.050	0.050							
		SPH D	-	0.10	-	0.50	0.040	0.040	-	-	270	-	-	-	In rolling direction
		SPH E	-				0.030	0.035							-
USA	ASTM A 570	Grade 30	Thickness (t) t = 5.8mm max.							210	340	25/21	19/17	Dependent on thickness and test piece	1 t
		Grade 33							0.20 Cu when specified	230	360	23/18	18/16		
		Grade 36		0.25	-	0.90	0.040	0.050		250	365	22/17	17/15		1.5 t
		Grade 40								280	380	21/15	16/14		2 t
		Grade 45				1.35				310	410	19/13	14/12		

		Grade 50								340	450	17/1 1	12/1 0			2.5 t
British	BS 1449	HR 34/20	0.15	-	1.20	0.05 0	0.05 0	-	200	340	29	21	-	-	2.0 t	
		HR 37/23	0.20						230	370	28	20				
		HR 43/25	0.25						250	430	25	16			3.0 t	
Germany	DIN 17100	t<=16 mm	0.17	-	-	0.05 0	0.05 0	0.009	235	340 to 470	24	L = 5 t		Transv.	1 t	
		St 37.2						N max	275	410 to 540	20				1.5 t	
		St 44.2	0.21													
		St 52.3	0.20	0.55	1.60	0.04 0	0.04 0	0.02 Al min	355	490 to 630						

12 - Low Carbon Structural Steel

China GB 699-88	Russia GOST 1050/88	Japan JIS G3131/96	USA ASTM A29M/93	British BS 970 part1-96	Germany	France NF A35-511/86	ISO 683-11/87
08F	08KP	SPHD SPHE	1008 1010	040A10	-	-	-
10F	10KP	SPHD SPHE	1008 1010	040A10	-	-	-
15F	15KP	-	1015	-	-	-	-
08	08	SPHE	1008 1010	040A10	-	-	-
10	10	JIS G4051/79 S10C	1010	040A12	-	XC10	C101
15	15	S15C S17C	1015	BS970 Part 3 080M15	-	XC12	C15E4
20	20	S20C S22C	1020	BS EN10083-2/96 1C22	DIN EN100832/96 C22	NF EN10083-2/97 C22	-
25	25	S25C S28C	1025	1C25	C25	C25	C25E4

13 - Seamless Steel Pipe for High Pressure Gas Cylinder

China GB 13447-92	Russia GOST 4543-71	Japan JIS G3429-88	U.S.A. ASTM A372M-95	British BS EN10083:1	Germany DIN EN10083-1-96	France NF A36-211-90	ISO
40Mn2	40G2	STH11	Gr.C	-	-	-	-
40Mn2A	40G2A	STH12	Cr.D	-	-	-	-
34Mn2V	-	STH11,12	-	-	-	-	-
30CrMo	30KHM	STH21	-	30CrMo4	30CrMo4	30GrMo4	-

14 - Seamless Steel Tube for High Pressure Boilers

China GB 5310-95	Russia GOST 1050-88	Japan JIS G3461-88	U.S.A ASTM A192M-91	British	Germany	France NF49-215-81	ISO 260412-75
20G	20	STB410	A192M	-	-	TU42C	TS9, TS9H
20MnG	20G	JIS G3416-88 STB510	-	BS3059 Part-2 90 440	-	NF49-215-81 TU48C	TS9, TS9H
25MnG	25G	JIS G3461-88 STB410	-	-	-	-	-
15CrMoG	-	-	-	BS3059 Part-2 243	DIN1715-79 15Mo3	NF A36-602-88 15D3	TS26
20MoG	-	JIS G3462-88 STBA13	ASTM A209M-95 G1:T1a	-	-	-	-
12CrMoG	-	JIS G3462-88 STBA20	ASTM A213M-95 T2	-	-	NF A36-602-88 15CD2,05	-
10Cr9Mo1VNb	-	-	T91	-	-	-	-
1Cr18Ni9	GOST 5632-72 12KHN9	JIST G3463-94 SUS304HTB SUS304TB	ASTM A213M-95 TP304H TP304	304S51	-	NF A49-117-85 TU6CN18-09	ISO 2604/2-75 TS48
1Cr19Ni11Nb	08KH18N12	SUS347HTB SUS347TB	TP347H TP347	347S51	-	-	TS50 TS56

15 - Spring Steel

China GB1222-84	Russia GOST 14959-79	Japan JIS G 4801-84	USA ASTM A29-93	British BS 1429-80	Germany DIN 17222-79	France NF A35-057-79	ISO 8458-3-92
65	65	Sup2	1064	060A67	C67 CK 67	FMR 66 FMR 68	Type DC
70	70	-	1070	070A72	C67	FMR 70	Type DC
85	85	Sup3	1080	060A86	CK85	FMR 86	Type DC
65Mn	65G	-	1066	080A67	-	-	Type DC
55Si 2Mn	55S2G	Sup6	ASTM A304/95	BS 970-Part 2-98	60SiCr7	NF A35571/96	ISO 683-14/92
		Sup 7	H92600	251H60		61SiCr7	56SiCr7
60Si2Mn	60S2A	Sup6	H92600	251H60	60SiCr7	61SiCr7	59SiCr7 ISO 683-14/92
60Si2MnA	60S2G	Sup7		-	-		
60Si2CrA	60S2HA	Sup12	-	685H57	60SiCr7	60SC7	55SiCr63
55CrMnA	-	Sup9	H51550	525A58	55Cr3	55Cr3	55Cr3
			G51550	-	-		
60CrMnA	-	Sup9A	H51600	527A60	55Cr3	55Cr3	55Cr3
			G51600	-	-		
60CrMnMoA	-	Sup13	H41610	705H60	51CrMoV4	60CrMo4	60CrMo33
			G41610	-	-		
50CrVA	50HFA	Sup10	H61500	735A51	50CrV4	50CrV4	51CrV4
			G61500	735h51	-		
60CrMnBA	55XGP	Sup11A	H51601	-	58CrMnB4	-	60CrB3

16 - Stainless Steel

China GB 1220-92	Russia GOST 5632-72	Japan JIS G4303-91	USA ASTM A276-96	British BS970Part1 BSEN10088-1-95	Germany DIN17400-96 DINEN10088-1-95	France NFA35-578-91 NFEN10088-1-95	ISO 683/13-86 TR4956/84
1Cr17Mn6Ni5N	-	SUS201	201	X12CrMnNiN 17-7-5	X12CrMnNiN 17-7-5	X12CrMnNiN 17-7-5	A-2
1Cr18Mn8Ni5N	12KH17G9AH4	SUS202	202	X12CrMnNiN 18-9-5	X12CrMnNiN 18-9-5	X12CrMnNiN 18-9-5	A-3
1Cr17Ni7	-	SUS301	301	BS970Part1-96 301S21	-	NFA35-574-95 Z12CN17.07	14
1Cr18Ni9	12KH18H9	SUS302	302	302S31	DIN17440-96 X12CrNi18-9	Z10CN18.09	12
Y1Cr18Ni9	-	SUS303	303	303S31	X12CrNiS18-9	Z10CNF18.09	17
Y1Cr18Ni9Se	12KH18H10E	SUS303Se	303Se	303S42	-	-	17a
0Cr18Ni9	08KH18H10	SUS304	304	304S31	X5CrNi18-10	Z7CN18.09	11
00Cr19Ni11	03KH18H11	SUS304L	304L	304S11	X2CrNi19-11	X2CrNi19-11	10
0Cr19Ni9N	-	SUS304N1	304N	-	-	-	-
0Cr19Ni10NbN	-	SUS304N2	XM21	-	-	-	-
00Cr18Ni10N	-	SUS304LN	-	X2CrNiN18-10	X2CrNiN18-10	X2CrNiN18-10	10N
1Cr18Ni12	12KH18H12T	SUS305	305	X4CrNi18-12	X4CrNi18-12	X4CrNi18-12	13
0Cr23Ni13	-	SUS309S	309S	-	-	NFA35-578-91 Z15CN23-13	15
0Cr25Ni20	-	SUS310S	310S	310S31	-	Z8CN25-20	16
0Cr17Ni12Mo2	08KH17H13M2T	SUS316	316	316S31	X5CrNiMo17-12-2	Z7CND17-12-2	20 20a
0Cr18Ni12Mo2Ti	08KH17H13M2T	SUS316Ti	316Ti S31635	320S31	X6CrNiMoTi17-12-2	X6CrNiMoTi17-12-2	21
00Cr17Ni14Mo2	03KH17H14M2	SUS316L	316L	316S13	X2CrNiMo18-14-3	X2CrNiMo17-12-2	19 19a
0Cr17Ni12Mo2N	-	SUS316N	316N	X5CrNiMo17-12-2	X5CrNiMo17-12-2	X5CrNiMo17-12-2	-
00Cr17Ni13Mo2N	-	SUS316LN	316LN	X2CrNiMo17-11-2	X2CrNiMoN17-11-2	X2CrNiMo17-11-2	19N 19aN
0Cr18Ni12Mo2Cu2	-	SUS316J1	-	-	-	-	-
00Cr18Ni14Mo2Cu2	-	SUS316J1L	-	-	-	-	-
0Cr19Ni13Mo3	08KH17H15M3T	SUS317	317	316S33	X5CrNiMo17-13-3	-	-
00Cr19Ni13Mo3	03KH16H15M3	SUS317L	317L	Part-4 317S12	X2CrNiMo18-15-4	X2CrNiMo18-15-4	24
0Cr18Ni16Mo5	-	SUS317J1	-	-	-	-	-
1Cr18Ni9Ti	12KH18H10T	-	321	321S31	X6CrNiTi18-10	X6CrNiTi18-10	11
0Cr18Ni10Ti	08KH18H10T	SUS321	321	321S31	X6CrNiTi18-10	X6CrNiTi18-10	15
0Cr18Ni11Nb	08KH18H12B	SUS347	347	347S31	X6CrNiNb18-10	X6CrNiNb18-10	16
0Cr18Ni9Cu3	-	SUSXM7	XM7	X3CrNiCu18-9-4	X3CrNiCu18-9-4	X3CrNiCu18-9-4	-
0Cr18Ni13Si4	-	SUSXM15J1	XM15	-	-	-	-
0Cr26Ni5Mo2	-	SUS329J1	-	-	-	-	-
1Cr18Ni11Si4AlTi	15KH18H12G4TYU	-	-	-	-	-	-
0Cr13Al	-	SUS405	405	405S31	X6CrAl13	X6CrAl13	5

00Cr12	-	SUS410L	-	-	-	Z3CT12	-
1Cr17	12KH17	SUS430	430	430S17	X6Cr17	X6Cr17	8
YCr17	-	SUS430F	-	-	X6CrMoS17	-	8a
1Cr17Mo	-	SUS434	-	X6CrMo17-1	X6CrMo17-1	X6CrMo17-1	9c
00Cr30Mo2	-	SUS447J1	-	-	-	-	-
00Cr27Mo	-	SUSXM27	XM27	-	-	-	-
1Cr12	-	SUS403	403	410S21	X6Cr13	X6Cr13	3
1Cr13	12KH13	SUS410	410	410S21	X12Cr13	-	3
0Cr13Ae	-	SUS405	405	403S17	X6Cr13	X6Cr13	1
Y1Cr13	-	SUS416	-	416S21	-	X12CrS13	7
1Cr13Mo	-	SUS410J1	-	-	-	-	X12CrM126
2Cr13	20KH13	SUS420J1	420	420S37	X20Cr13	X20Cr13	4
3Cr13	30KH13	SUS420J2	420	420S37	X30Cr13	X30Cr13	5
Y3Cr13	-	SUS420F	-	-	-	-	-
4Cr13	40KH13	-	-	X46Cr13	X46Cr13	X46Cr13	-
1Cr17Ni2	14KH17H2	SUS431	431	431S29	X17CrNi16-2	X17CrNi16-2	96
7Cr17	-	SUS440A	-	-	-	-	-
8Cr17	-	SUS440B	-	-	-	-	-
9Cr17	95KH18	SUS440C	-	-	-	-	-
11Cr17	-	SUS440C	-	-	-	-	-
Y11Cr17	-	SUS440F	-	-	-	-	-
9Cr18Mo	-	SUS440C	440C	-	-	-	-
9Cr18MoV	-	-	-	X90CrMoV18	X90CrMoV18	X90CrMoV18	-
0Cr17Ni4Cu4Nb	-	SUS630	ASTM A564M-95 S17400		-	-	ISO683/16-76
							1
0Cr17Ni7Al	09KH17H7YU	SUS631	17700	X7CrNiAl17-7	X7CrNiAl17-7	X7CrNiAl17-7	2

17 - Steel Bars for Concrete Reinforcement (Deformed Bars and Plain Bars)

Country	Standard	Steel grade	Analysis (product analysis) %						Physical properties					Surface condition	
			C max.	Mn	P max.	S max.	Si	Others	Yield strength N/mm ²	Tensile strength N/mm ²	Elongation %	Bend test dia./180°			
Russia	Gost 5781-82	3SP/PS							440	550	16				
	Class A400S	3SP/PS	0.22	1.60	0.05	0.05	0.09	-	500	600	14	90°;a=3d		deformed	
	Class A500S														
China		20MnSi	0.17-0.25	1.20-1.60	0.045	0.045	0.40-0.80		335	510	16				
	20MnSi V	0.20-0.80					V:0.04-0.12	400	570	14	a=3d		deformed		
		25MnSi	0.20-0.30			0.60-1.00									
USA	ASTM A 615-96 hot rolled (equiv. metric standard ASTM A 615 M-96)	40	*	*	0.050	*	-	-	300	500	L=200mm	12/7	4 d/5 d	Dependent on nominal dia.	deformed or plain
		(0.062)													
		60			0.050				400	600	9/7	4 d/8 d			
		400 (=equiv. Metric)	(0.062)												
		75													
		520 (=equiv. Metric)	-	-	-	520	-	-	-	-	-				
Japan		SR235 SR 24 = Type 1	-	-				C + Mn/6 max.	235	382 to 520		20 (24)	3 d	Plain	
		SR295 SR 30 = Type 2						294	480 to 618	16 (20)		4 d			
	JIS G 3112 (1975)	SD345 SD35 = Type 3	0.27	1.60	-	-	-	0.50	343	490	L=8 d OR (L = 4 d)	18 (20)	4 d/5 d*		
		SD390 SD40 = Type 4	0.29	1.80				0.55	392	559		16 (18)	5 d	deformed	
		SD490 SD50 = Type 5	0.32	1.80				0.60	490	618		12 (14)	90° 5 d/6 d*		
British	BS 4449 (1988) Hot	250	0.25	-	0.060 (0.068)	0.060 (0.068)	-	-	250 to 425	1.15 x ReH	L=5.65L ₀	22	2 d	plain	

	Rolled				0.050	0.050		CE max.	460 (dEQ16mm)			12 (dEQ16)		
		460/425	0.40		(0.058)	(0.058)		0.51	425 (dEQ16mm)			14 (dEQ16)	3 d	deformed
Germany	DIN 488	BSt 420 S	0.22		0.050	0.050		0.12	Nitrogen	420	500	L = 10 d	10	plain or deformed
		BSt 500 S	(0.24)		(0.055)	(0.055)		(0.13)		500	550			
	DIN 17100 (1980)	St 37-2 fEQ16 mm	0.17 (0.21)	-	0.050	0.050	-	N	0.009 (0.010)	235	340 to 470	L=5.65L ₀	26	plain
		f>16 mm	0.20 (0.25)		(0.065)	(0.065)				225				

18 - Steel Wire Rods								
Country	Standard	Steel grade	Analysis %					
			C max.	Mn	P max.	S max.	N max.	Si: max.
China	GB 701-88	Q195	0.06-0.12	0.25-0.50	0.045	0.050		0.30
		Q215	0.09-0.15	0.25-0.55				
		Q235	0.14-0.22	0.30-0.65				
Russia	GOST 380-88	1KP	0.06-0.12	0.25-0.50	0.040	0.050	-	-
		2KP	0.09-0.15	0.25-0.50				
		3KP	0.14-0.22	0.30-0.60				
Japan	JIS G 3505-1980	SWRM 6	0.08	0.60 max.	0.045	0.045	-	-
		SWRM 8	0.10					
		SWRM 10	0.08-0.13	0.30-0.60				
		SWRM 12	0.10-0.15					
		SWRM 15	0.13-0.18					
		SWRM 17	0.15-0.20					
		SWRM 20	0.18-0.23					
SWRM 22	0.20-0.25							
USA	SAE J 403 identical with ASTM A 510-82	SAE/AISI No. 1005	0.06	0.35	0.040	0.050	-	-
		1006	0.08	0.25-0.40				
		1010	0.08-0.13	0.30-0.50				
		1008	0.10	0.30-0.50				
		SAE/AISI No. 1010 G 1010	0.08-0.13	0.30-0.60				
			(0.06-0.15)	(0.27-0.63)	(0.048)	(0.058)		
Germany	DIN 17100	St 37.2EQ16mm	0.17	-	0.050	0.050	0.009	-
			(0.21)		0.065	(0.065)	(0.010)	

Stainless steel

FERRITIC

EN 10088 - 1		AISI	NF A 35-573**	UNE 36016**	DIN 17440**
Steel names	Numerical		NF A 35-574**		
X2 Cr Ti 12	1.4512	409	Z 3 CT 12	-	X2CrTi12
X6 Cr 17	1.4016	430	Z 8 C 17	X8Cr17	X6Cr17
X 3Cr Ti 17	1.4510	430Ti	Z 4 CT 17	X8CrTi17	X3CrTi17
X6 Cr Mo 17-1	1.4113	434	Z 8 CD 17.01	-	X6CrMo17-1
X6 Cr Mo S17	1.4105	430 F	Z 8 CF 17	-	X4CrMoS18
X2 Cr Ti Nb 18	1.4509	441	Z3CTNb18	-	-
X2 Cr Mo Ti 18-2	1.4521	444	Z3CDT18-02	-	X2CrMoTi18-2
.	.	.	.	.	.

AUSTENTIC CHROMIUM-NICKEL

EN 10088-1		AISI	NF A 35-573**	UNE 36016**	DIN 17440**
Steel names	Numerical		NF A 35-574**		
X10 Cr Ni 18-8	1.4310	301	Z 11 CN 18.08	X12 Cr Ni 17-07	-
X8 Cr Ni 18-9	1.4305	303	Z 8 CNF 18.09	X140 CrNiS 18-09	X10 CrNiS 18-9
X5 Cr Ni 18-10	1.4301	304	Z 7 CN 18.09	X6 CrNi 19-10	X5 CrNi 18-10
X2 Cr Ni 19-11	1.4306	304L	Z 3 CN 19.11	X2 CrNi 19-10	X2 CrNi 19-11
X2 Cr Ni 18-9	1.4307	304L	Z 3 CN 19.09	-	-
X6 Cr Ni Ti 18-10	1.4541	321	Z 6 CNT 18.10	X6 CrNiTi 18-11	X6 CrNiTi 18-10
.	.	.	.	.	.

MARTENSITIC

EN 10088-1		AISI	NF A 35-573**	UNE 36016**	DIN 17440**
Steel names	Numerical		NF A 35-574**		
X12Cr13	1.4006	410	Z 10 C 13	-	X10Cr13
X20Cr13	1.4021	420	Z 20 C 13	X20Cr13	X20Cr13
X30Cr13	1.4028	420	Z 33 C 13	X30Cr13	X30Cr13
X17CrNi 16.2	1.4057	431	Z 15 CN 16.02	-	X20CrNi17-2
X29CrS13	1.4029	420 F	Z 29 CF 13	-	-
.	.	.	.	.	.

AUSTENITQUES CHROMIUM-NICKEL MOLYBDENUM

EN 10088-1		AISI	NF A 35-573**	UNE 36016**	DIN 17440**
Steel names	Numerical		NF A 35-574**		
X5CrNiMo 17-12-2	1.4401	316	Z 7 CND 17.11.2	X6CrNiMo 17-12-03	X5CrNiMo 17-12-2
X3CrNiMo 17-13-3	1.4436	316	Z 7 CND 18.12.03	X6CrNiMo 17-12-03	X5CrNiMo 17-12-3
X2CrNiMo 17-12-2	1.4404	316L	Z 7 CND 17.12.02	X2CrNiMo 17-12-03	X2CrNiMo 17-13-2
X2CrNiMo 17-12-3	1.4432	316L	Z 3 CND 17.13.03	-	X2CrNiMo 17-12-2
X6CrNiMo 17-12-2	1.4571	316Ti	Z 6 CNDT 17.12	X6CrNiMo 17-12-03	X6CrNiMo 17-12-2

X2CrNiMo 18-15-4		1.4438	317L	Z 3 CND 19.15.04		-		X2CrNiMo 17-16-4	
X1NiCrMoCu 25-20-5		1.4539	904L	Z 2 NCDU 25.20		-		-	
.	.	.	.	.	.	.	.	.	.
AUSTENITIC-FERRITIC									
EN 10088-1				AISI		NF A 35-573**			DIN**
Steel names		Numerical				NF A 35-574**			
X2CrNiMoN23-4		1.4362		-		Z 3 CN 23.04 Az			-
X2CrNiMoN22-5-3		1.4462		-		Z 3 CND 22.05 Az			-
X2CrNiMoN257-4		1.4410		-		Z 3 CND 25.06 Az			-
.	.	.	.	.	.	.	.	.	.
heat-resisting steels									
.	.	.	.	.	.	.	.	.	.
EN 10095				NF A 35-578**		AISI		DIN**	
Steel names		Numerical							
X8CrNi 25-21		1.4845		Z 8 CN 25.20		310S		X12CrNi 25-21	
X12CrNi 23-13		1.4843		Z 15 CN 23.13		309S		X7CrNi 23-14	
X15CrNiSi 20-12		1.4828		Z 17 CNS 20.12		-		X15CrNiSi 20-12	
X15CrNiSi 25-21		1.4841		Z 15 CNS 25.20		314		X15CrNiSi 25-20	
.	.	.	.	.	.	.	.	.	.

СТАЛЬ КОНСТРУКЦИОННАЯ

СНГ ГОСТ	США AISI, ASTM, ASME	Германия DIN	Япония JIS	Китай GB	Великобритания B.S.	Италия UNI	Франция AFNOR NF
03X17H14M3	316L SA-240TP316L	X2CrNiMo18-14-3	SUS 316L	00Cr17Ni14Mo2 00Cr17Ni14Mo3	316S13 LW 22	X2CrNiMo 18-14-3 X2CrNiMo1713KG	Z 3 CND 17-12-03
03X18H11	304 L SA-240TP304L	X2 Cr Ni 19 11 GX2 Cr Ni 19-11	SUS304 L	-	304S11 LW 20 LWCF 20 S 536 304 C12 (LT 196) 305 S 11	X2 CrNi 18 11 X 3 CrNi 18 11 GX 2 CrNi 19 10	Z 1 CN 18-12 Z 2 CN 18-10 Z 3 CN 19-10M Z 3CN 18-10 Z 3 CN 19-11 Z 3 CN 19-11FF
03XH28МДТ 06X28МДТ	-	X3NiCrCuMoTi2730	-	-	-	-	-
06X18H11	305 3008	X4CrNi18-12	SUS 305 SUS 305J1	-	305S17 305S19	X7 CrNi18 10 X8 CrNi 19 10	Z 5 CN 18-11FF
07X16H6	301 A 167 301 A 240 301 A 666 301	X12CrNi17-7 X10CrNi18-8	SUS 301	-	301 S 21 301 S 22 Cr Ni 17/7	X10CrNi18-8 X12CrNi17-07	Z 11 CN 17-08 Z 11 CN 18-08 Z 12 CN 18-09
08кп	A 622	St 50-2	SPHE	-	BS 1449 1 HR	-	3C
08X13	403 409 410 S 429 SA-240 TP 410S	X6 Cr 13 X7 Cr 14	SUS 403 SUS 410S SUS429	-	403 S17	X6 Cr 13	Z6 C13 Z8 C12 Z8 C13FF
08X17H13M2Т 10X17H13M2Т	316 Ti A 167 316Ti A 213 F316H A 240 316Ti A 368 316Ti SA-240	X6CrNiMoTi 12122 X 10 CrNiMoTi 18-12	SUS 316Ti	0Cr18Ni12Mo3Ti 1Cr18Ni12Mo3Ti	320 S 33 CrNiMo 17/12/2 1/4 Ti	X 6 CrNiMoTi 17 13	Z6 CNDT 17.12

	TP 316Ti SA-479 316Ti							
08X17T	430Ti 439	X 6 CrTi 17 X3CrTi17	SUS 430LX	-	-	X 3 CrTi 17 X 6 CrTi 17	Z 4 CT 17	
08X18H10	304 304 H SA-240 TP 304	X5 Cr Ni 18 10	SUS 304	-	304S11 304S15 304S16 304S17 304S31 LW21 LWCF 21	X 5 Cr Ni 18 10	Z4 CN 19-10 FF Z5 CN 17-06 Z6CN18. 09 Z7 CN 18-09	
08X18H12B	347 A 167 347 A 240 347 A 313 347 A 580 347	X 6 CrNiNb 18 10 X6CrNiNb18-10	SUS 347	0Cr18Ni11Nb 1Cr18Ni11Nb 1Cr19Ni11Nb	347 S 20 347 S 31 ANC 3 Grade B Cr Ni 18/9/Nb CrNi 18/9 0.10C/Nb	X 6 CrNiNb 18 11	Z 6 CNNb 18-10	
08IOA	A 620	DC 04 DC04+ZE Fe P04 / St 14 St 14 St 4	SPCE	-	DC 04 / FeP 04 HR 1 HR 2	DC 04/FeP 04	DC 04 / FeP 04	
09I2C	A 516-55 A 516-60 A 516-65 A 561 Gr70	-	SM41B SB49	-	-	-	-	
09X17H7IO	-	X 7 CrNiAl 17 7 X7CrNiAl17-7	SUS 631	0Cr17Ni7Al	301 S 81	-	Z 9 CNA 17-07	
10	C1010 A 108 1010 A 29 M1010 A 510 1010 A 575 M1010 SA-29 M1010	C 10 C10E Ck 10	S 10 C S 9 CK SACM 1	10	040 A 10 045 M 10 En2A En32A HS 10	1 C 10 2 C 10 2 C 15 C 10	C 10 RR XC 10	
10X13CIO	A 268 TP405	X10CrAl13 X10CrAlSi13	-	-	-	X 10 CrAl 12	Z 13 C 13	
10X23H18 20X23H18	SA-240 TP 310S	-	-	-	-	-	-	
12K	A 201 Gr AFx	ASt 35	-	-	-	-	-	

12X13 15X13Л	410 430 A 183 F6 A 193 B6 A 479 410	X 10 Cr 13 X12 Cr13 GX 12 Cr 12	SUS 410	-	410C21 410S21 ANC 1A	X 10 Cr13 X 12 Cr13	Z10C13 Z12C13	
12X17	430 A 182 F 430 A 240 430 SA-182 Grade F 430 SA-240 Type 430	X6Cr17	SUS 430	1Cr15 1Cr17 ML1Cr17	17Cr 430S17 430S18	X 6 Cr 17 X 8 Cr 17	Z 8 C 17	
12X18H10T 06X18H10T 08X18H10T 09X18H10T	321 A 213 TP321H SA-240 TP 321	X6 Cr Ni Ti 18 10 X10 Cr Ni Ti 189	SUS 321	-	321S12	-	Z6 CNT 18.10	
12XM	A 182 grade F12 A213 Grade T12 A 335 Grade P12 A 387A,B, C	13CrMo-44	-	-	-	-	-	
12X2M	A 182 Grade F22 A335 Grade P22 387 Grade D	10CrMo910	-	-	-	-	-	
12X1MΦ	-	14MoV63	-	-	-	-	-	
14Г2	A414 Gr F,G A 515 Gr70 A516 Gr70	17 Mn4	SB 46 SB 49 SG V 46 SG V 49 SP V 32	-	-	-	A 48CP	
15	C1015 A 108 1015 A 512 1015 A 576	C15 C15E Ck 15	S 15 C S 15 CK	15 H15A ZG200-400 (ZG 15)	-	-	C 18 RR XC 15 XC 18	

	1015							
15кп	A 621 FS Type A A 621 FS Type B	DD 11 (StW 22)	SPHD	-	-	-	1 C	
15пс	A 29 1015	QSt 38-3	SWRCH1 5A SWRCH1 6R	ML15	-	CB 15	-	
15H2M 15HM	4615	-	-	-	-	-	-	
15X	-	15Cr3	-	-	-	-	-	
15X5M	A 182 Grade F5 A 193 Grade B5	-	-	-	-	-	-	
15X25T 15X28	A 268 TP446	10CrAl24	-	-	-	-	-	
15XΦ	6117	-	-	-	-	-	-	
15XM	A 182 grade F12 A213 Grade T12 A 335 Grade P12	13CrMo-44	-	-	-	-	-	
16K	A 414 Grade E	H II St42-2 C22N ASt41 P 265 GH	SG 295 SG 30 SM 53 B SM 53 C SPV 315 SPV 32 SPV 355 SPV 36	-	P 265 GH	Fe 410 KW P 265 GH	-	
17ГC	-	S355J2G3 / Fe 510 D1 St 52-3 St 52-3 / S355J2G3 St 52-3 G	SM 490 A SM 520 C SM 53 C	16Mn	-	Fe 510 Fe E 420 S 355 J 2 G 3	S 355 J 2 G 3	
18XГ	SA-29 Grade 5115	16 MnCr 5	-	15CrMn 20CrMn	527 M 17 590 H 17 590 M 17	16 MnCr 5	16 MC 5 16 MnCr 5 RR	
20	C1020 A 105 Gr1 A 106 GrA B	C 22 C 22N C 22.3 Ck 22 St35 8	S 20 C S 20CK	-	040A20 070 M 20 070 M 26 1 C 22 C 22	C 20 C 21 C 22	C 20 XC 25	

	A 659 CS Type 1020 A 794 CS Type 1020	St45.8			En3A En3B En3C En3D			
20K	A 283-C A 285- A,B,c A 414 Grade E A 515-5 A 515-60 A 515-70	H II P 265 GH	SG 295 SG 30 SM 53 B SM 53 C SPV 315 SPV 32 SPV 355 SPV 36	-	P 265 GH	Fe 410 KW P 265 GH	-	
20nc	A 29 1020	-	SWRCH1 7R	ML20	0/4	-	-	
20H2M 20HM	4621	-	-	-	-	-	-	
20X	5120	-	-	-	-	-	-	
20XΦ	6120	22CrV4	-	-	-	-	-	
20X13	420 A 276 420 A 580 420	X 20 Cr 13	SUS 420J1	2Cr13	420 S 37 En56C	X 20 Cr 13	Z 20 C 13	
20X17H2	431 A 493 431 A 580 431 SA-479 Type 431	X17CrNi16-2 X17CrNi16-2 (X 20 CrNi 17 2)	SUS 431	1Cr17Ni2 ML1Cr17Ni2	431 S 29 En57	X 16 CrNi 1	Z 15 CN 16-02 Z 15 CN 16.02 CI	
20X25H20C 2	310 314	X15CrNiSi25-20 X15CrNiSi25-21	SUS Y 310	2Cr25Ni20	-	X 16 CrNiSi 25 20	Z 15 CNS 25- 20	
20XM	4130 SA-29 Grade 4130	25 CrMo 4 GS-25 CrMo 4	SCM 420 SCM 430	ML30CrMo ML30CrMoA	25 CrMo 4	25 CrMo 4	25 CrMo 4	
20XH	3120	-	-	-	-	-	-	
22K	1022 1518	20Mn5	S Mn C 420	-	120M19	-	20M5	
25	C1025	-	-	-	-	-	-	
25Γ	1025 A 108 1025 A 510 1025 A 512	GS-Ck 25	S 25 C	25 25Z ZG230-450 (ZG 25)	070 M 26 080 A 25	-	-	

	1025 A 513 1025 A 576 1025							
25X1MΦ	A 193 B14 A 540 B21	24CrMoV55	-	-	-	-	-	
30	C1030 A 29 1030 SA-29 1030	-	SWRCH3 0K SWRCH3 3K	ML25Mn ML30	1/1	-	-	
30X	5130	-	-	-	-	-	-	
30XM	4130 A 302 Gr B A 304	25CrMo4	-	-	-	-	-	
30X13	420F	X30Cr13	SUS 420J2	3Cr13	420 S 45 En56D	G X 30 Cr 13 X 30 Cr 13	Z 30 C 13 Z 33 C 13	
30XM	-	34 CrMo 4 GS-34 CrMo 4	SCM 435 SCM 435 H	35CrMo	34 CrMo 4	34 CrMo 4	34 CrMo 4	
30Г2	-	36 Mn 5	SCMn 3 SMn 438 SMn 438 H	-	150 M 36 En15 En15A	-	40 M 5	
35	C1035 C1034 A 107	C 35 Ck 35	S 35C	-	080M36	-	XC 38	
35X	5132	34Cr4	-	-	-	-	-	
35XM	-	34CrMo4	-	-	-	-	-	
40	1040	C40 Ck40	S 40C	-	080A40 060A40	-	XC 42	
40X	5140	41 Cr 4	S Gr 440	-	530A40 530M40	-	42C4	
40X13	-	X38Cr13 X39Cr13 X46Cr13	SUS 420J2	-	420S45	X 40 Cr 14 X 46 Cr 13	Z 38 C 13 M Z 40 C 13 Z 40 C 14 Z 44 C 14 Z 50 C	

							14	
40X2H2MA	4340 SA-29 Grade 4340	40 NiCrMo 6	SNCM 439 STPT 38	40CrNiMoA ML40CrNiMo A	818 M 40	-	-	
40XH	3135 3140	40Ni Cr 6	-	-	640M40	-	-	
40XH2MA	9840	36 CrNiMo 4	-	-	36 CrNiMo 4	36 CrNiMo 4	36 CrNiMo 4 40 NCD 3	
45	1045 A 107 A 29 1044 SA-29 1044	C 45 Ck 45 Cq 45	S 45C SWRCH4 5K	ML45	080M 080M46	-	XC48	
45T	1045 A 108 1045 A 29 1045 A 311 1045 A 576 1045 SA-29 1045 SA-311 1045	C45E Ck 45 GS-Ck 45	S 45 C S 48 C	45 ZG310-570 (ZG 45)	C 45 E	C 45 E	C 45 E XC 45	
45X	5145	-	-	-	-	-	-	
50	C1050 A 108 1050 A 29 1050 A 311 1050 A 510 1050 A 576 1050 SA-29 1050 SA-311 1050	C 50 E Ck 50	-	50	080 M 50 C 50 E	C 50 E	C 50 E XC 50	
50X	5147	-	-	-	-	-	-	
55	C1055 A 29 1055 A 576	C 55 Ck 53	S 55 C S 55 C- CSP	-	070 M 55 C 55 En9 En9K	C 55	AF 70 C 54 C 55	

	1055 SA-29 1055							
60 60Г	C1060 A 29 1060 A 576 1060 SA-29 1060	C 60	S 58 C S 60 C- CSP S 65 C- CSP	-	060 A 62 C 60 CS 60 HS 60	C 60	C 60	
Ст0 Ст1кп	A 283 Grade A	S185 / Fe 310-0 St 33	SS 330	Q195 Q195-F Q195-Z Q195-b	HR 15	S 185	-	
Ст2пс Ст2сп	A53 Gr A A192 Gr A	St 35	-	Q215B Q215B-F Q215B-Z Q215B-b	S360	-	-	
Ст3кп	A 107 A 283 Grade C SA-283 C	USt 37-2 USt 37-2 G RSt37-2	-	A3 Q235A Q235A-F Q235A-Z Q235A-b	-	-	-	
Ст3сп	A 414 Grade A A 570 Grade 36	S235J2G3 / Fe 360 D1 St 37-3 St 37-3 G UZSt 37-2	SS34	-	HS 37/23 S 235 J 2 G 3 40C BS4360	S 235 J 2 G 3	S 235 J 2 G 3 E 24- 2NE	
Ст5сп	A 570 Grade 50	St 50-2	SS 50	-	-	-	A 50-2	
Ст6пс Ст6сп	A 572 Grade 65	E335 / Fe 590-2 St 60-2 St 60-2 G	SM 570 SM 58	-	55 C E 335	E 335 Fe 590	E 335	

Источник: gosts.org

Марка стали			Аналоги в стандартах США
Страны СНГ ГОСТ	Еврономы		
10	C10E	1.1121	1010
10ХГН1	10 ХГН1	1.5805	-
14 ХН3 М	14 NiCrMo1-3-4	1.6657	9310
15	C15 E	1.1141	1015
15 Г	C16 E	1.1148	1016
16 ХГ	16 MnCr5	1.7131	5115
16ХГР	16Mn CrB5	1.7160	-
16 ХГН	16NiCr4	1.5714	-
17 Г1 С	S235J2G4	1.0117	-

17 ХН3	15NiCr13	1.5752	E3310
18 ХГМ	18CrMo4	1.7243	4120
18 Х2 Н2 М	18CrNiMo7-6	1.6587	-
20	C22E	1.1151	1020
20 ХМ	20MoCr3	1.7320	4118
20 ХГНМ	20MoCr2-2	1.6523	8617
25	C25E	1.1158	1025
25 ХМ	25CrMo4	1.7218	4130
28 Г	28Mn6	1.1170	1330
30	C30E	1.1178	1030
34 Х	34Cr4	1.7033	5130
34 Х2 Н2 М	34CrNiMo6	1.6582	4340
35	C35E	1.1181	1035
36 ХНМ	36CrNiMo4	1.6511	9840
36 Х2 Н4 МА	36NiCrMo16	1.6773	-
40	C40E	1.1186	1040
42 ХМ	42CrMo4	1.7225	4140
45	C45E	1.1191	1045
46 Х	46Cr2	1.7006	5045
50	C50E	1.1206	1050
50 ХГФ	50CrV4	1.8159	6150

Источник: metaltrade.ru

Марка стали			Аналоги в стандартах США
Страны СНГ ГОСТ	Евроноормы		
10 X2 M	10CrMo9-10	1.7380	F22
13 XM	13CrMo4-4	1.7335	F12
14 XMФ	14MoV6-3	1.7715	-
15 M	15Mo3	1.5415	F1
17 Г	17Mn4	1.0481	-
20	C22.8	1.0460	-
20 Г	20Mn5	1.1133	-
20 X11 MNФ	X20CrMoV12-1	1.4922	-

Источник: metaltrade.ru

Сталь конструкционная углеродистая

Страны СНГ (ГОСТ 1050-88)

Зарубежные аналоги

	Германия (DIN)		США (ASTM)
10	1.0301	C 10/Ск 10	1010
15	1.0401	C15/Ск 15	1015
20	1.0402	C 22/Ск 22	1020
30	-	-	1030
35	1.0501	C 35/Ск 35	1035
40	1.0511	C 40/Ск 40	1040
45	1.0503	C 45/Ск 45	1045
50	1.0540	C 50/Ск 50	1050
55	1.0535	C 55/Ск 55	1055
60	1.0601	C 60/Ск 60	1060

Источник: metallopt.ru

Сталь конструкционная легированная

Страны СНГ (ГОСТ, ТУ)	Зарубежные аналоги		
	Германия (DIN)		США (AISI)
12ХН3А	1.5732	14NiCr10	-
12Х2Н4А			E3310
15ХМ	1.7335	13CrMo44	-
17Г1С	1.0570	St52-3	-
18ХГ	1.7131	16MnCr5	5120
20ХМ	1.7218	25CrMo4	4130
27ХГР	1.5526	30MnB4	-
30Х3МФ	1.8519	31CrMoV9V	-
30Х2Н2М	1.6580	30CrNiMo8V	-
34Х2НМЮ	1.8550	34CrAlNi7V	-
38Х2Н2МА	1.6582	34CrNiMo6	4330
40Х	1.7045	42Cr4	5140
40ХГМ	1.7225	42CrMo4	4140
40ХН2МА	1.6565	40NiCrMo6	4340
40ХГНМ	1.6546	40NiCrMo22	8640
45Г	1.0912	46Mn7	-

Источник: metallopt.ru

Сталь конструкционная подшипниковая

Марка стали			Аналоги в стандартах США
Страны СНГ ГОСТ	Еврономры		
ШХ4	100Cr2	1.3501	50100

ШХ15	100Cr6	1.3505	52100
ШХ15 СГ	100CrMn6	1.3520	A 485 (2)
ШХ20 М	100CrMo7	1.3537	A 485 (3)

Источник: metaltrade.ru

Сталь конструкционная рессорно-пружинная

Марка стали			Аналоги в стандартах США
Страны СНГ ГОСТ	Евронормы		
38 С2 А	38Si7	1.5023	-
50 ХГФА	50CrV4	1.8159	6150
52 ХГМФА	51CrMoV4	1.7701	-
55 ХС2 А	54SiCr6	1.7102	-
55 ХГА	55Cr3	1.7176	5147
60 С2 ХГА	60SiCR7	1.7108	9262

Источник: metaltrade.ru

Страны СНГ (ГОСТ, ТУ)	Зарубежные аналоги		
	Германия (DIN)	США (AISI)	
70	1.1231	Ck 67	1070
75	1.0605	C 75	1074
85	1.1269	Ck 85	1086
50ХФА	1.8159	50CrV4	6150
55С2	1.5026	55Si7	-
60Г	1.0601	C 60	1060
60С2	1.5027	60Si7	9260
60С2ГХ	1.5092	60SiCr7	9262
70С2ХА	1.5029	71Si 7	-

Источник: metallopt.ru

СТАЛЬ ИНСТРУМЕНТАЛЬНАЯ

Сталь инструментальная углеродистая

Страны СНГ (ГОСТ, ТУ)	Зарубежные аналоги		
	Германия (DIN)	США (AISI/ASTM)	
У 7	1.1620	C 70W2	-
У 7А	1.1520	C 70W1	-
У 8	1.1625	C 80W2	-
У 8А	1.1525	C 80W1	W 108
У 10	1.1645	C 105W2	-

У 10А	1.1545	С 105W1	W 110
У 11	1.1654	С 110W	-
У 13	1.1663	С 125W	W 112

Источник: metallopt.ru

Сталь инструментальная легированная

Страны СНГ (ГОСТ, ТУ)	Зарубежные аналоги		
	Германия (DIN/BOHLER)	США (AISI/ASTM)	
X12	1.2080	X210Cr12	D3
X12B	1.2436	X210CrW12	-
X12МФ*	1.2379	X155CrVMo12-1	D2
X12МФ4-МП	-	K190PM	-
95ХФ	1.2210	115CrV 3	L2
9Х1Ф	1.2067	102Cr 6	L3
9Г2Ф	1.2842	90MnCrV 8	O2
95ХГВФ	1.2510	100MnCrW 4	O1
3Х3В9Ф	1.2581	X30WCrV9-3	H21
95Х5ГМ	1.2363	X100CrMoV5-1	A2
95ХМ	1.2303	100CrMo 5	L7
95Х18	1.4125	X105CrMo17	A473 (440C)
5ХНМ	1.2713	55NiCrMoV 6	L6
5ХВ2СФ	1.2550	60WCrV 7	S1
5Х3М2Ф	-	-	S7
5ХН2МФ	1.2714	56NiCrMoV 7	-
3Х3М3Ф	1.2365	X32CrMoV3 3	H10
4Х5МФС	1.2343	X38CrMoV5-1	H11
4Х5МФ1С	1.2344	X40CrMoV5-1	H13

*возможно производство методом порошковой металлургии

Источник: metallopt.ru

Сталь инструментальная быстрорежущая

Марка стали			Аналоги в стандартах США
Страны СНГ ГОСТ	Еврономы		
P0 M2 CФ10-МП	-	-	A11
P2 M9-МП	S2-9-2	1.3348	M7
P2 M10 K8-МП	S2-10-1-8	1.3247	M42
P6 M5-МП	S6-5-2	1.3343	M2
P6 M5 K5-МП	S6-5-2-5	1.3243	-

P6 M5 Ф3-МП	S6-5-3	1.3344	M3
P6 M5 Ф4-МП	-	-	M4
P6 M5 Ф3 K8-МП	-	-	M36
P10 M4 Ф3 K10-МП	S10-4-3-10	1.3207	-
P6 M5 Ф3 K9-МП	-	-	M48
P12 M6 Ф5-МП	-	-	M61
P12 Ф4 K5-МП	S12-1-4-5	1.3202	-
P12 Ф5 K5-МП	-	-	T15
P18-МП	-	-	T1

Источник: metaltrade.ru

Страны СНГ (ГОСТ, ТУ)	Зарубежные аналоги		
	Германия (DIN)	BOHLER (D-016)	США (AISI/ASTM)
P18*	1.3355	S 200	T 1
P6M5*	1.3343	S600/S601	M 2
P6M5K5*	1.3243	S 705	-
P6M5Ф3 - МП	1.3342/1.3344	S 790PM	M 3
P6M5Ф4 - МП	-	S 690PM	M 4
P6M5Ф3K8 - МП	-	S 590PM	M 36
P10M2Ф5K8-МП	-	S 390PM	-
P10M3Ф4K8-МП	-	-	-
P12Ф3	1.3318	-	-
P12MФ4 - МР	-	S 207PM	-
P12K5Ф4 - МП	-	S 308PM	-
P12M6Ф5 - МП	-	-	M 61
P12MФ5K5 - МП	1.3202	-	T 15
P0M2CФ10 - МП	-	CPM 10V	A 11

*возможно производство методом порошковой металлургии

Источник: metallopt.ru

Сталь для отливок

Страны СНГ (ГОСТ)	Аналог	Страна, Стандарт
20ГЛ	A352 Gr LCC	США, ASTM A352
20ГЛ	A757 Gr A2Q	США, ASTM A757
20ГЛ	A216 Gr WCC	США, ASTM A216
30ГСЛ	A304(1330H)	США, ASTM A304
30ГСЛ	A322 (1330)	США, ASTM A322
20Л	A732 (1A)	США, ASTM A732
25Л	A352 Gr LCA	США, ASTM A352

25Л	A732 (2A)	США, ASTM A732
25Л	A216 Gr WCB	США, ASTM A216
30Л	A352 Gr LCB	США, ASTM A352
30Л	A216 Gr WCB	США, ASTM A216
35Л	A356 Gr1	США, ASTM A356
40Л	A732 (3A)	США, ASTM A732

Источник: www.td-ksz.com

Страны СНГ (ГОСТ)	Аналог	Страна, Стандарт
20ГЛ	1.1120	Германия, DIN 17182
30ГСЛ	1.1165	Германия, DIN 17205
15Л	1.0420	Германия, DIN 1681
20Л	1.0619	Германия, DIN EN 10213-2
25Л	1.0446	Германия, DIN 1681
35Л	1.0552	Германия, DIN 1681
45Л	1.0558	Германия, DIN 1681

Источник: www.td-ksz.com

Страны СНГ (ГОСТ)	Аналог	Страна, Стандарт
30ГСЛ	AO35 MnSi5	Венгрия, MSZ 8272
30ГСЛ	30 GSL	Болгария, BDS 6550
30ГСЛ	T30 Si Mn12	Румыния, STAS 1773
15Л	15ЛII	Болгария, BDS3492
15Л	AM1	Великобритания, B.S.3100 (91)
15Л	Ао 400 FK	Венгрия, MSZ 8276
15Л	L II 400	Польша, PN/H 83152
15Л	OT 400-3	Румыния, STAS 600
15Л	422630	Чехия, Словакия, CSN 422630
25Л	161 grade 430	Великобритания, B.S. 1504 (76)
25Л	25 LII	Болгария, BDS 3492
25Л	Ао 450 FK	Венгрия, MSZ 8276
25Л	OT 450-3	Румыния, STAS 600
25Л	25LI	Болгария, BDS 3492
25Л	422640	Чехия, Словакия, CSN 422640
25Л	L 450	Польша, PN/H 83152
30Л	1505	Швеция, SS
35Л	35LII	Болгария, BDS 3492
35Л	A2	Великобритания, B.S.3100 (91)
35Л	Ао 500 FK	Венгрия, MSZ 8276
35Л	L500	Польша, PN/H8 3152
35Л	OT 500-1	Румыния, STAS 600
35Л	35LI	Болгария, BDS3492
35Л	422650	Чехия, Словакия, CSN 422650
35Л	G-30-57	Финляндия, SFS 350

35Л	SCC	Япония, JIS G5111 (91)
40Л	35Л1	Болгария, BDS 3492
40Л	OT 550-1	Румыния, STAS 600
40Л	CLA1 grade C	Великобритания, B.S. 3146 Part 1(74)
40Л	CLA8 grade C	Великобритания, B.S. 3146 Part 1(74)
40Л	G-30-57	Финляндия, SFS 350
45Л	45Л1	Болгария, BDS 3492
45Л	A3	Великобритания, B.S.3100 (91)
45Л	Ao550FK	Венгрия, MSZ 8276

Источник: www.td-ksz.com

СТАЛЬ, СПЛАВ ЖАРОПРОЧНЫЕ

Европа (EN)	Германия (DIN)	США (AISI)	Япония (JIS)	СНГ (GOST)
1.4713	X10CrAl7			10X17CЮ
1.4724	X10CrAl13	405		10X13CЮ
1.4742	X10CrAl18	442		
1.4762	X10CrAl24	446		
1.4878	X12CrNiTi18-9	321 H		12X18H10T
1.4828	X15CrNiSi20-12	309		20X20H14C2
1.4845	X12CrNi25-21	310 S		20X23H18
1.4841	X15CrNiSi25-20	314		20X25H20C2

Источник: www.uvis.ua

СТАЛЬ, СПЛАВ КОРРОЗИОННО-СТОЙКИЕ

Европа (EN)	Германия (DIN)	США (AISI)	Япония (JIS)	СНГ (GOST)
1.4003	X2CrNi12			
1.4512	X2CrTi12	409	SUH 409	
1.4000	X6Cr13	410S	SUS 410 S	08X13
1.4002	X6CrAl13	405	SUS 405	
1.4006	X12CrN13	410	SUS 410	12X13
1.4024	X15Cr13	(410)	SUS 410 J1	
1.4021	X20Cr13	(420)	SUS 420 J1	20X13
1.4028	X30Cr13	(420)	SUS 420 J2	30X13
1.4031	X39Cr13		SUS 420 J2	40X13
1.4034	X46Cr13	(420)		40X13
1.4016	X6Cr17	430	SUS 430	12X17
1.4520	X2CrTi17			
1.4510	X3CrTi17	439	SUS 430 LX	08X17T
1.4113	X6CrMo17-1	434	SUS 434	
1.4509	X2CrTiNb18	441		
1.4521	X2CrMoTi18-2	444	SUS 444	
1.4589	X5CrNiMoTi15-2			
1.4310	X10CrNi18-8	(301)	SUS 301	
1.4318	X2CrNiN18-7	301 LN	SUS 301 LN	

1.4301	X5CrNi18-10	304	SUS 304	08X18H10
1.4303	X4CrNi18-12	(305)	SUS 305	12X18H12
1.4306	X2CrNi19-11	304 L	SUS 304 L	03X18H11
1.4541	X6CrNiTi18-10	321	SUS 321	08X18H10T
1.4550	X6CrNiNb18-10	347	SUS 347	
1.4401	X5CrNiMo17-12-2	316	SUS 316	
1.4404	X2CrNiMo17-12-2	316 L	SUS 316 L	
1.4571	X6CrNiMoTi17-12-2	316 Ti	SUS 316 Ti	10X17H13M2T
1.4561	X1CrNiMoTi18-13-2			
1.4435	X2CrNiMo18-14-3	316 L	SUS 316 L	03X17H14M2
1.4439	X2CrNiMoN17-13-5	S 31726	SUS 317	
1.4539	X1NiCrMoCu25-20-5	N 08904		
1.4565	X3CrNiMnMoNbN 23-17-5-3	S 34565		
1.4462	X2CrNiMoN22-5-3	S 31803	SUS 329 J3L	
Европа (EN)	Германия (DIN)	США (AISI)	Япония (JIS)	СНГ (GOST)

Источник: www.uvis.ua

СНГ (ГОСТ)	Еврономы (EN)	Германия (DIN)	США (AISI)
03 X17 H13 M2	1.4404	X2 CrNiMo 17-12-2	316 L
03 X17 H14 M3	1.4435	X2 CrNiMo 18-4-3	-
03 X18 H11	1.4306	X2 CrNi 19-11	304 L
03 X18 H10 T-Y	1.4541-MOD	-	-
06 XH28 МДТ	1.4503	X3 NiCrCuMoTi 27-23	-
06 X18 H11	1.4303	X4 CrNi 18-11	305 L
08 X12 T1	1.4512	X6 CrTi 12	409
08 X13	1.4000	X6 Cr 13	410S
08 X17 H13 M2	1.4436	X5CrNiMo 17-13-3	316
08 X17 H13 M2 T	1.4571	X6 CrNiMoTi 17-12-2	316Ti
08 X17 T	1.4510	X6 CrTi 17	430Ti
08 X18 H10	1.4301	X5 CrNi 18-10	304
08 X18 H12 T	1.4541	X6 CrNiTi 18-10	321
10 X23 H18	1.4842	X12 CrNi 25-20	310S
10X13	1.4006	X10 Cr13	410
12 X18 H10 T	1.4878	X12 CrNiTi 18-9	-
12 X18 H9	-	-	302
15 X5 M	1.7362	X12 CrMo 5	501
15 X25 T	1.4746	X8 CrTi 25	-
20X13	1.4021	X20 Cr 13	420
20 X17 H2	1.4057	X20 CrNi 17-2	431
20 X23 H13	1.4833	X7 CrNi 23-14	309

20 X23 H18	1.4843	X16 CrNi 25-20	310
20 X25 H20 C2	1.4841	X56 CrNiSi 25-20	314
03 X18 AH11	1.4311	X2 CrNiN 18-10	304LN
03 X19 H13 M3	1.4438	X2 18-5-4	317L
03 X23 H6	1.4362	X2 CrNiN 23-4	-
02 X18 M2 БТ	1.4521	X2 CrMoTi 18-2	444
02 X28 H30 МДБ	1.4563	X1 NiCrMoCu 31-27-4	-
03 X17 H13 AM3	1.4429	X2 CrNiMoN 17-13-3	316LN
03 X22 H5 AM2	1.4462	X2 CrNiMoN 22-5-3	-
03 X24 H13 Г2 С	1.4332	X2 CrNi 24-12	309L
08 X16 H13 M2 Б	1.4580	X1 CrNiMoNb 17-12-2	316 Cd
08 X18 H12 Б	1.4550	X6 CrNiNb 18-10	347
08 X18 H14 M2 Б	1.4583 X10 CrNiMoNb	X10 CrNiMoNb 18-12	318
08X19AH9	-	-	304N
08X19H13M3	1.4449	X5 CrNiMo 17-13	317
08X20H11	1.4331	X2 CrNi 21-10	308
08X20H20ТЮ	1.4847	X8 CrNiAlTi 20-20	334
08X25H4M2	1.4460	X3 CrNiMoNb 27-5-2	329
08X23H13	-	-	309S
09X17H7 Ю	1.4568	X7 CrNiAl 17-7	631
1X16H13M2 Б	1.4580	X6 CrNiMoNb 17-12-2	316Cd
10X13 СЮ	1.4724	X10 CrAlSi 13	405
12X15	1.4001	X7 Cr 14	429
12X17	1.4016	X6 Cr17	430
12X17M	1.4113	X6 CrMo 17-1	434
12X17МБ	1.4522	X2 CrMoNb	436
12X18H12	1.3955	GX12 CrNi 18-11	305
12X17 Г9 АН4	1.4373	X12 CrMnNiN 18-9-5	202
15X9M	1.7386	X12 CrMo 9-1	504
15X12	-	-	403
15X13H2	-	-	414
15X17H7	1.4310	X12 CrNi 17-7	301

Источник: metaltrade.ru

АЛЮМИНИЙ, СПЛАВ АЛЮМИНИЯ

Марка сплава по
ГОСТ 1583-93

Европейский
стандарт

США

Япония

Франция

Италия

Велико-
британия

	EN 1676	ASTM, B179, B26, B85, AA, SAE	JIS, H5202, H2211, H2118	NFA57- 702	UN14514	BS14
AK8 (АЛ34)	ENAB-42100 (ENAB AlSi7Mg0.3)	358.0 356.2 (A03562)	AC4C.1	A-S7G	-	-
AK7	ENAB-42000 (ENAB AlSi7Mg)	357.0 356.1 (A03561)	AC4C.1	-	AlSi7Mg	-
AK7ч (АЛ9)	ENAB-42000 (ENAB AlSi7Mg)	356.0 356.1 (A03561) SG70A	AC4C.1	A-S7GU3	AlSi7MgTi	LM2
AK7пч (АЛ9-1)	ENAB-42100 (ENAB AlSi7Mg0.3)	356.2 (A03562)	AC4C.2	A-S7G	AlSi7Mg	-
AK12 (АЛ2)	ENAB-44100 (ENAB AlSi12(b))	A413.1 (A4131)	AC3C.1	A-S12G A-S13	G-Al-Si13	LM6