■ Steel and Non-Ferrous Metal Symbols Chart

● Carbon Steels

JIS	AISI	DIN
S10C	1010	C10
S15C	1015	C15
S20C	1020	C22
S25C	1025	C25
S30C	1030	C30
S35C	1035	C35
S40C	1040	C40
S45C	1045	C45
S50C	1049	C50
S55C	1055	C55

● Ni-Cr-Mo Steels

SNCM220	8620	21NiCrMo2
SNCM240	8640	—
SNCM415	—	—
SNCM420	4320	—
SNCM439	4340	—
SNCM447	—	—

● Cr Steels

SCr415	—	—
SCr420	5120	—
SCr430	5130	34Cr4
SCr435	5132	37Cr4
SCr440	5140	41Cr4
SCr445	5147	—

● Cr-Mo Steels

SCM415	—	—
SCM420	—	—
SCM430	4131	—
SCM435	4137	34CrMo4
SCM440	4140	42CrMo4
SCM445	4145	—

● Mn Steels and Mn-Cr Steels for Structurer Use

SMn420	1522	—
SMn433	1534	—
SMn438	1541	—
SMn443	1541	—
SMnC420	—	—
SMnC443	—	—

● Cr-Mo Steels

SK1	—	—
SK2	W1-11 1/2	—
SK3	W1-10	C105W1
SK4	W1-9	—
SK5	W1-8	C80W1
SK6	—	C80W1
SK7	—	C70W2

● High Speed Steels

JIS	AISI	DIN
SKH2	T1	—
SKH3	T4	S18-1-2-5
SKH10	T15	S12-1-4-5
SKH51	M2	S6-5-2
SKH52	M3–1	—
SKH53	M3–2	S6-5-3
SKH54	M4	—
SKH56	M36	—

● Alloy Tool Steels

SKS11	F2	—
SKS51	L6	—
SKS43	W2-9 1/2	—
SKS44	W2-8	—
SKD1	D3	X210Cr12
SKD11	D2	—

● Grey Cast Iron

FC100	No20B	GG-10
FC150	No25B	GG-15
FC200	No30B	GG-20
FC250	No35B	GG-25
FC300	No45B	GG-30
FC350	No50B	GG-35

● Nodular Cast Iron

FCD400	60-40-18	GGG-40
FCD450	—	GGG-40.3
FCD500	80-55-06	GGG-50
FCD600	—	GGG-60
FCD700	100-70-03	GGG-70

● Ferritic Stainless Steels

SUS405	405	X10CrAl13
SUS429	429	—
SUS430	430	X6Cr17
SUS430F	430F	X7CrMo18
SUS434	434	X6CrMo17 1

● Martensitic Stainless Steels

SUS403	403	—
SUS410	410	X10Cr13
SUS416	416	—
SUS420JI	420	X20Cr13
SUS420F	420F	—
SUS431	431	X20CrNi17 2
SUS440A	440A	—
SUS440B	440B	—
SUS440C	440C	—

● Austenitic Stainless Steels

JIS	AISI	DIN
SUS201	201	—
SUS202	202	—
SUS301	301	X12CrNi17 7
SUS302	302	—
SUS302B	302B	—
SUS303	303	X10CrNiS18 9
SUS303Se	303Se	—
SUS304	304	X5CrNiS18 10
SUS304L	304L	X2CrNi19 11
SUS304NI	304N	—
SUS305	305	X5CrNi18 12
SUS308	308	—
SUS309S	309S	—
SUS310S	310S	—
SUS316	316	X5CrMo17 12 2
SUS316L	316L	X2CrNiMo17 13 2
SUS316N	316N	—
SUS317	317	—
SUS317L	317L	X2CrNiMo18 16 4
SUS321	321	X6CrNiTi18 10
SUS347	347	X6CrNiNb18 10
SUS384	384	—

● Heat Resisting Steels

SUH31	—	—
SUH35	—	—
SUH36	—	X53CrMnNi21 9
SUH37	—	—
SUH38	—	—
SUH309	309	—
SUH310	310	CrNi2520
SUH330	N08330	—

● Ferritic Heat Resisting Steels

SUH21	—	CrAl1205
SUH409	409	X6CrTi12
SUH446	446	—

● Martensitic Heat Resisting Steels

SUH1	—	X45CrSi9 3
SUH3	—	—
SUH4	—	—
SUH11	—	—
SUH600	—	—

■ Steel and Non-Ferrous Metal Symbols Chart

● Classifications and Symbols of Steels

Class	Material	Symbol	Symbol's Rationale
Structual Steels	Rolled Steels for welded structures	SM	"M" for "Marine"-Usually used in welded marine structures
	Re-rolled Steels	SRB	"R" for "Re-rolled" and "B" for "Bar"
	Rolled Steels for general structures	SS	"S" for "Steel" and for "Structure"
	Light gauge sections for general structures	SSC	"C" for "Cold"
Steel Sheets	Hot rolled mild steel sheets / plates in coil form	SPH	"P" for "Plate" and "H" for "Hot"
Steel Tubes	Carbon steel tubes for piping	SGP	"GP" for "gas Pipe"
	Carbon teel tubes for boiler and heat exchangers	STB	"T" for "Tube" and "B" for "Boiler"
	Seamless steel tubes for high pressure gas cylinders	STH	"H" for "High Pressure"
	Carbon steel tubes for general structures	STK	"K" for "Kozo"-Japanese word meaning "structure"
	Carbon steel tubes for machine structural usese	STKM	"M" for "Machine"
	Alloy steel tubes for structures	STKS	"S" for "Special"
	Alloy steel tubes for pipings	STPA	"P" for "Piping" and "A" for "Alloy"
	Carbon steel tubes for pressure pipings	STPG	"G" for "General"
	Carbon steel tubes for high temperature pipings	STPT	"T" for "Temperatures"
	Carbon steel tubes for high pressure pipings	STS	"S" after "SP" is abbreviation for "Special"
	Stainless steel tubes for pipings	SUS-TP	"T" for "Tube" and "P" for "Piping"
Steel for Machine Structures	Carbon steels for machine structural uses	SxxC	"C" for "Carbon"
	Aluminium Chromium Molybdenum steels	SACM	"A" for "Al", "C" for "Cr" and "M" for "Mo"
	Chromium Molybdenum steels	SCM	"C" for "Cr" and "M" for "Mo"
	Chromium steels	SCr	"Cr" for "Chromium"
	Nickel Chromium steels	SNC	"N" for "Nickel" and "C"for "Chromium"
	Nickel Chromium Molybdenium steels	SNCM	"M" for "Molybdenium"
	Manganese steels for structural use Manganese Chromium steels	SMn SMnC	"Min" for "Manganese" "C" for "Chromium"
Special Steels — Tool Steels	Carbon tool steels	SK	"K" for "Kogu"-Japanese word meaning "tool"
	Hollow drill steels	SKC	"C" for "Chisel"
	Alloy tool steel	SKS SKD SKT	"S" for "Special" "D" for "Die" "T" for "Tanzo"-Janpanese word for "forging"
	High speed tool steels	SKH	"H" for "High speed"
Special Steels — Free Cutting Steels	Free cutting sulfuric steels	SUM	"M" for "Machinability"
Special Steels — Stainless Steels	High Carbon Chromium bearing steels	SUJ	"J" for "Jikuuke"-Japanese word meaning "bearing"
	Spring steels	SUP	"P" for "Spring"
	Stainless steels	SUS	"S" after "SU" is abbreviation for "Stainless"
Special Steels — Heat-resistant Steels	Heat-resistant steels	SUH	"U" for "Special Usage" and "H" for "Heat"
	Heat-resistant steel bars	SUH-B	"B" for "Bar"
	Heat-resistant steels sheets	SUHP	"P" for "Plate"
Forged Steels	Carbon steel forgings for general use	SF	"F" for "Forging"
	Carbon steel booms and billets for forgings	SFB	"B" for "Billet"
	Chromium Molybdenium steel forgings	SFCM	"C" for "Chromium" and "M" for "Molybdenium"
	Nickel Chromium Molybdenium steel forgings	SFNCM	"N" for "Nickel"
Cast Irons	Grey cast irons	FC	"F" for "Ferrous" and "C" for "Casting"
	Spherical graphite / Ductile cast irons	FCD	"D" for "Ductile"
	Blackheart malleable cast irons	FCMB	"M" for "Malleable" and "B" for "Black"
	Whiteheart malleable cast irons	FCMW	"W" for "White"
	Pearlite malleable cast irons	FCMP	"P" for "Pearlite"
Cast Steels	Carbon cast steels	SC	"C" for "Casting"
	Stainless cast steels	SCS	"S" for "Stainless"
	Heat-resistant cast steels	SCH	"H" for "Heat"
	High Manganese cast steels	SCMnH	"Mn" for "Manganese" and "H" for "High"

● Non-Ferrous Metals

Class	Material	Symbol
Copper and Copper Alloys	Chopper and Copper alloys -Sheets, plates and strips	CxxxxP
		CxxxxPP
		CxxxxR
	Chopper and Copper alloys -Welded pipes and tubes	CxxxxBD
		CxxxxBDS
		CxxxxBE
		CxxxxBF
Aluminium and Aluminium Alloys	Aluminium and Al alloys -Sheets, plates and strips	AxxxxP
		AxxxxPC
	Aluminium and Al alloys -Rods, bars and wires	AxxxxBE
		AxxxxBD
		AxxxxW
	Aluminium and Al alloys-Extruded shapes	AxxxxS
	Aluminium and Al alloys forgings	AxxxxFD
		AxxxxFH
Mangnesium Alloys	Magnesium alloy sheets and plates	MP
Nickel Alloys	Nickel-opper alloy sheets and plates	NCuP
	Nickel-opper alloy rods and bars	NCuB
Wrough Titanium	Titanium rods and bars	TB
Castings	Brass castings	YBsCx
	High strength Brass castings	HBsCx
	Bronze castings	BCx
	Phosphorus Bronze castings	PBCx
	Aluminium Bronze castings	AlBCx
	Aluminium alloy castings	AC
	Magnesium alloy castings	MC
	Zinc alloy die castings	ZDCx
	Aluminium alloy die castings	ADC
	Magnesium alloy die castings	MDC
	White metals	WJ
	Aluminium alloy castings for bearings	AJ
	Copper-Lead alloy castings for bearings	KJ

■ Hardness Scale Comparison Chart

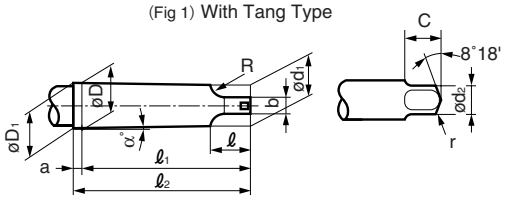
Brinell Hardness (HB) 3,000kg	Rockwell Hardness				Vickers Hardness 50kg	Shore Hardness	Traverse Rupture Strength (GPa)
	A Scale 60kg brale	B Scale 100kg 1/10inBall	C Scale 150kg brale	D Scale 100kg brale			
—	85.6	—	68.0	76.9	940	97	—
—	85.3	—	67.5	76.5	920	96	—
—	85.0	—	67.0	76.1	900	95	—
767	84.7	—	66.4	75.7	880	93	—
757	84.4	—	65.9	75.3	860	92	—
745	84.1	—	65.3	74.8	840	91	—
733	83.8	—	64.7	74.3	820	90	—
722	83.4	—	64.0	73.8	800	88	—
712	—	—	—	—	—	—	—
710	83.0	—	63.3	73.3	780	87	—
698	82.6	—	62.5	72.6	760	86	—
684	82.2	—	61.8	72.1	740	—	—
682	82.2	—	61.7	72.0	737	84	—
670	81.8	—	61.0	71.5	720	83	—
656	81.3	—	60.1	70.8	700	—	—
653	81.2	—	60.0	70.7	697	81	—
647	81.1	—	59.7	70.5	690	—	—
638	80.8	—	59.2	70.1	680	80	—
630	80.6	—	58.8	69.8	670	—	—
627	80.5	—	58.7	69.7	667	79	—
601	79.8	—	57.3	68.7	640	77	—
578	79.1	—	56.0	67.7	615	75	—
555	78.4	—	54.7	66.7	591	73	2.06
534	77.8	—	53.5	65.8	569	71	1.98
514	76.9	—	52.1	64.7	547	70	1.89
495	76.3	—	51.0	63.8	528	68	1.82
477	75.6	—	49.6	62.7	508	66	1.73
461	74.9	—	48.5	61.7	491	65	1.67
444	74.2	—	47.1	60.8	472	63	1.59
429	73.4	—	45.7	59.7	455	61	1.51
415	72.8	—	44.5	58.8	440	59	1.46
401	72.0	—	43.1	57.8	425	58	1.39
388	71.4	—	41.8	56.8	410	56	1.33
375	70.6	—	40.4	55.7	396	54	1.26
363	70.0	—	39.1	54.6	383	52	1.22
352	69.3	(110.0)	37.9	53.8	372	51	1.18
341	68.7	(109.0)	36.6	52.8	360	50	1.13
331	68.1	(108.5)	35.5	51.9	350	48	1.10
321	67.5	(108.0)	34.3	50.1	339	47	1.06
311	66.9	(107.5)	33.1	50.0	328	46	1.03
302	66.3	(107.0)	32.1	49.3	319	45	1.01
293	65.7	(106.0)	30.9	48.3	309	43	0.97
285	65.3	(105.5)	29.9	47.6	301	—	0.95
277	64.6	(104.5)	28.8	46.7	292	41	0.92
269	64.1	(104.0)	27.6	45.9	284	40	0.89
262	63.6	(103.0)	26.6	45.0	276	39	0.87
255	63.0	(102.0)	25.4	44.2	269	38	0.84
248	62.5	(101.0)	24.2	43.2	261	37	0.82
241	61.8	100.0	22.8	42.0	253	36	0.80
235	61.4	99.0	21.7	41.4	247	35	0.78
229	60.8	98.2	20.5	40.5	241	34	0.76
223	—	97.3	(18.8)	—	234	—	—
217	—	96.4	(17.5)	—	228	33	0.73
212	—	95.5	(16.0)	—	222	—	0.71
207	—	94.6	(15.2)	—	218	32	0.69
201	—	93.8	(13.8)	—	212	31	0.68
197	—	92.8	(12.7)	—	207	30	0.66
192	—	91.9	(11.5)	—	202	29	0.64
187	—	90.7	(10.0)	—	196	—	0.62
183	—	90.0	(9.0)	—	192	28	0.62
179	—	89.0	(8.0)	—	188	27	0.60
174	—	87.8	(6.4)	—	182	—	0.59
170	—	86.8	(5.4)	—	178	26	0.57
167	—	86.0	(4.4)	—	175	—	0.56
163	—	85.0	(3.3)	—	171	25	0.55
156	—	82.9	(0.9)	—	163	—	0.52
149	—	80.8	—	—	156	23	0.50
143	—	78.7	—	—	150	22	0.49
137	—	76.4	—	—	143	21	0.46
131	—	74.0	—	—	137	—	0.45
126	—	72.0	—	—	132	20	0.43
121	—	69.8	—	—	127	19	0.41
116	—	67.6	—	—	122	18	0.40
111	—	65.7	—	—	117	15	0.38

1) Figures within the ( ) are not commonly used
2) Rockwell A, C and D scales utilises a diamond brale

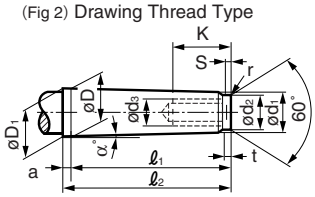
■ Standard of Tapers

● Morse Taper

(Fig 1) With Tang Type



(Fig 2) Drawing Thread Type



(Units : mm)

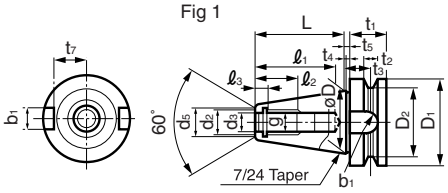
Morse Taper Number	Taper(1)		Taper Angle (α°)	Taper						Tang						Shape
				D	a	D1(2) (Estimated)	d1(2) (Estimated)	ℓ1 (Max)	ℓ2 (Max)	d2 (Max)	b	C (Max)	e (Max)	R	r	
0	1/19.212	0.05205	1°29'27"	9.045	3	9.2	6.1	56.5	59.5	6.0	3.9	6.5	10.5	4	1	Fig 1
1	1/20.047	0.04988	1°25'43"	12.065	3.5	12.2	9.0	62.0	65.5	8.7	5.2	8.5	13.5	5	1.2	
2	1/20.020	0.04995	1°25'50"	17.780	5	18.0	14.0	75.0	80.0	13.5	6.3	10	16	6	1.6	
3	1/19.922	0.05020	1°26'16"	23.825	5	24.1	19.1	94.0	99.0	18.5	7.9	13	20	7	2	
4	1/19.245	0.05194	1°29'15"	31.267	6.5	31.6	25.2	117.5	124.0	24.5	11.9	16	24	8	2.5	
5	1/19.002	0.05263	1°30'26"	44.399	6.5	44.7	36.5	149.5	156.0	35.7	15.9	19	29	10	3	
6	1/19.180	0.05214	1°29'36"	63.348	8	63.8	52.4	210.0	218.0	51.0	19.0	27	40	13	4	
7	1/19.231	0.05200	1°29'22"	83.058	10	83.6	68.2	286.0	296.0	66.8	28.6	35	54	19	5	

Morse Taper Number	Taper(1)		Taper Angle (α°)	Taper						Thread					Shape
				D	a	D1(2) (Estimated)	d1(2) (Estimated)	ℓ1 (Max)	ℓ2 (Max)	d2 (Max)	d3	K (Min)	t (Max)	r	
0	1/19.212	0.05205	1°29'27"	9.045	3	9.2	6.4	50	53	6	—	—	4	0.2	Fig 2
1	1/20.047	0.04988	1°25'43"	12.065	3.5	12.2	9.4	53.5	57	9	M 6	16	5	0.2	
2	1/20.020	0.04995	1°25'50"	17.780	5	18.0	14.6	64	69	14	M10	24	5	0.2	
3	1/19.922	0.05020	1°26'16"	23.825	5	24.1	19.8	81	86	19	M12	28	7	0.6	
4	1/19.254	0.05194	1°29'15"	31.267	6.5	31.6	25.9	102.5	109	25	M16	32	9	1	
5	1/19.002	0.05263	1°30'26"	44.399	6.5	44.7	37.6	129.5	136	35.7	M20	40	9	2.5	
6	1/19.180	0.05214	1°29'36"	63.348	8	63.8	53.9	182	190	51	M24	50	12	4	
7	1/19.231	0.05200	1°29'22"	83.058	10	83.6	70.0	250	260	65	M33	80	18.5	5	

(1) The fractonal values are the taper standards.
(2) Diameters (D1) and (d1) are calculated from the values of (D) and other values of the taper. (values are rounded up to one decimal place)

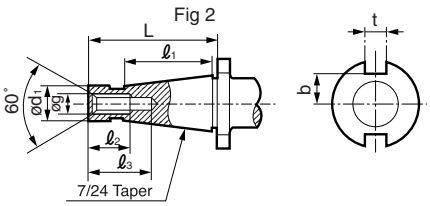
● Bottle Grip Taper

Fig 1



● American Standard Taper (National Taper)

Fig 2



● Bottle Grip Taper

(Units : mm)

Taper No.	D (Standard)	D1	D2	t1	t2	t3	t4	t5	d2	d3	L	ℓ2	ℓ3	ℓ4	g	b1	t7	Reference d5	Reference ℓ1	Shape
BT40	44.45	63	53	25	10	16.6	2	2	19	17	65.4	30	8	21	M16	16.1	22.6	25.3	70	Fig 1
BT45	57.15	85	73	30	12	21.2	3	3	23	21	82.8	38	9	26	M20	19.3	29.1	33.1	70	
BT50	69.85	100	85	35	15	23.2	3	3	27	25	101.8	45	11	31	M24	25.7	35.4	40.1	90	
BT60	107.95	155	135	45	20	28.2	3	3	33	31	161.8	56	12	34	M30	25.7	60.1	60.7	110	

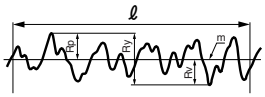
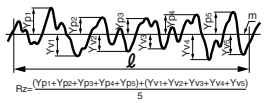
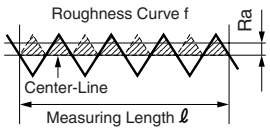
● American Standard Taper (National Taper)

(Units : mm)

Taper No.	Nominal Diameter	D	d1		L	ℓ1	ℓ2	ℓ3	g	a	t	b	Shape
30	1 1/4"	31.750	17.40	$^{-0.29}_{-0.36}$	68.4	48.4	24	34	1/2"	1.6	15.9	16	Fig 2
40	1 3/4"	44.450	25.32	$^{-0.30}_{-0.384}$	93.4	65.4	32	43	5/8"	1.6	15.9	22.5	
50	2 3/4"	69.850	39.60	$^{-0.31}_{-0.41}$	126.8	101.8	47	62	1"	3.2	25.4	35	
60	4 1/4"	107.950	60.20	$^{-0.34}_{-0.46}$	206.8	161.8	59	76	1 1/4"	3.2	25.4	60	

■ Finished Surface Roughness

● Type of Surface Roughness Measurements

Types	Symbol	Method of Determination	Descriptive Figure
Maximum Height	Rz	This is the value (expressed in μm) measured from the deepest valley to the highest peak of the reference line, ℓ, extracted from the profile. (μm = 0.001mm) (Disgregard unusually high peaks and deep valleys as they are considered as flaws.)	
Ten-point Mean roughness	RzJIS	From the profile, extract a portion to be the reference line, ℓ. select the 5 highest peak and 5 deepest valleys. Measure the distance between the two lines and express it in μm.	
Calculated Roughness	Ra	This method is to obtain a center line between the peaks and valleys within the reference line, ℓ. Fold along the center line to superimpose the valleys against the peaks. (Shaded protions with dashed outline on the right figure). Take the total shaded area and divided it by ℓ in μm.	

Designated values of the above types of surface roughness, standard reference length values and the triangular symbol classifications are shown on the table on the right.

Designated values for ※1) Rz	Designated values for ※2) RzJIS	Designated values for Ra	Standard reference length values, ℓ (mm)	Triangular Symbols
(0.05S) 0.1S 0.2S 0.4S	(0.05Z) 0.1Z 0.2Z 0.4Z	(0.012a) 0.025a 0.05a 0.10a	—	▽▽▽▽
0.8S	0.8Z	0.20a	0.25	
1.6S 3.2S 6.3S	1.6Z 3.2Z 6.3Z	0.40a 0.80a 1.6a	0.8	▽▽▽
12.5S (18S) 25S	12.5Z (18Z) 25Z	3.2a 6.3a	2.5	▽▽
(35S) 50S (70S) 100S	(35Z) 50Z (70Z) 100Z	12.5a 25a	—	▽
(140S) 200S (280S) 400S (560S)	(140Z) 200Z (280Z) 400Z (560Z)	(50a) (100a)	—	—

Remarks: The designated values in the brackets do not apply unless otherwise stated.