

29 MAY 1991

JIS G 4401
(1972)

Carbon Tool Steels*

1. Scope This standard specifies carbon tool steels manufactured by hot rolling or forging, hereinafter referred to as the "steel".

3. Method of Manufacture

3.1 The steel shall be manufactured from killed steel ingot.

3.2 Unless otherwise specified, the steel shall be rolled or forged to the forging ratio of higher than 4S. When it is unavoidable to make it higher than 4S on account of the dimensions of steel, it can be overcome by upsetting.

3.3 Unless otherwise specified, the steel shall be treated with annealing process.

4. Chemical Composition The chemical composition of steel shall be made by ladle analysis to the value as indicated in Table 2.

Table 2

Kind of steel	Notation	Chemical composition					Reference
		C	Si	Mn	P	S	
Class 1	SK 1	1.30-1.50	0.35 max.	0.50 max.	0.030 max.	0.030 max.	Hard cutting tool, razor blade, blade file, file set
Class 2	SK 2	1.10-1.30	0.35 max.	0.50 max.	0.030 max.	0.030 max.	Cutting tool, milling cutter, drill, small punch, razor, file
Class 3	SK 3	1.00-1.10	0.35 max.	0.50 max.	0.030 max.	0.030 max.	Hacksaw blade, chisel, gauge, spring, razor, trimming die
Class 4	SK 4	0.90-1.00	0.35 max.	0.50 max.	0.030 max.	0.030 max.	Carpenter's drill, hatchet, chisel, spring, pen nib, trimming die
Class 5	SK 5	0.80-0.90	0.35 max.	0.50 max.	0.030 max.	0.030 max.	Steel stamp, snap, press die, spring, band saw, circular saw, pen nib, mimeograph file, hand saw
X Class 6	SK 6	0.70-0.80	0.35 max.	0.50 max.	0.030 max.	0.030 max.	Steel stamp, snap, circular saw, spring, mimeograph file
Class 7	SK 7	0.60-0.70	0.35 max.	0.50 max.	0.030 max.	0.030 max.	Steel stamp, snap, press die, knife

Remark: As impurities, the excess of Cu 0.25%, Cr 0.20% and Ni 0.25% shall not be exceeded from each kind of steel.

5. Annealed Hardness The annealed hardness of steel shall be as given in Table 3. For the material for which the measurement of hardness by Brinell is difficult, however, Rockwell B hardness or Vickers hardness may be supplemented. The value in this case, shall be determined by agreement of parties concerned.

Table 3

Notation	Annealing temperature °C	Annealed hardness H _B
Sk 1	750-780 slow cooling	217 max.
Sk 2	750-780 slow cooling	212 max.
Sk 3	750-780 slow cooling	212 max.
Sk 4	740-760 slow cooling	207 max.
Sk 5	730-760 slow cooling	207 max.
Sk 6	730-760 slow cooling	201 max.
Sk 7	730-760 slow cooling	201 max.

6. Hardened and Tempered Hardness The hardened and tempered hardness of test piece of material representing the steel after selecting a suitable temperature range indicated in Table 4, shall be as indicated in the Table 4.

Table 4

Notation	Heat treatment temperature °C			Hardened and temper hardness H _{RC}
	Annealing	Hardening	Tempering	
Sk 1	750-780 slow cooling	760-820 water cooling	150-200 air cooling	63 min.
Sk 2	750-780 slow cooling	760-820 water cooling	150-200 air cooling	63 min.
Sk 3	750-780 slow cooling	760-820 water cooling	150-200 air cooling	63 min.
Sk 4	740-760 slow cooling	760-820 water cooling	150-200 air cooling	61 min.
Sk 5	730-760 slow cooling	760-820 water cooling	150-200 air cooling	59 min.
Sk 6	730-760 slow cooling	760-820 water cooling	150-200 air cooling	56 min.
Sk 7	730-760 slow cooling	760-820 water cooling	150-200 air cooling	54 min.

Remark: The hardening process may be eliminated if considered not necessary.

7. Dimension and Tolerance

7.1 Standard Dimension The standard diameter of round steel shall be as given in Table 5.

7.2 Tolerance on Dimension T be as given in Table 6.

Diameter	
Over 10 and under 16	
16 and over and under 30	
30 and over and under 150	

7.3 The dimension and tolerance shall be determined by agreement between the parties.

8. Appearance and Decarburization

8.1 The steel shall be of superior quality.

8.2 The steel shall be without appearance of decarburization. The permissible range of decarburization shall be as given in Table 7.

Table 3

Temperature °C	Annealed hardness H _B
low cooling	217 max.
low cooling	212 max.
low cooling	212 max.
low cooling	207 max.
low cooling	207 max.
low cooling	201 max.
low cooling	201 max.

The hardened and tempered hardness of test
or selecting a suitable temperature range
in the Table 4.

Table 4

Heat treatment °C			Hardened and temper hardness HRC
Quenching	Tempering		
Air cooling	150-200	air cooling	63 min.
Air cooling	150-200	air cooling	63 min.
Air cooling	150-200	air cooling	63 min.
Air cooling	150-200	air cooling	61 min.
Air cooling	150-200	air cooling	59 min.
Air cooling	150-200	air cooling	56 min.
Air cooling	150-200	air cooling	54 min.

Eliminated if considered not necessary.

diameter of round steel shall be as given

Table 5

Unit: mm				
10	20	30	46	90
11	21	32	48	95
12	22	34	50	100
13	23	35	55	110
14	24	36	60	120
15	25	38	65	130
16	26	40	70	140
17	27	42	75	150
18	28	44	80	
19	29	45	85	

7.2 Tolerance on Dimension The tolerance on dimension of hot rolled round steel shall
be as given in Table 6.

Table 6

Unit: mm		
Diameter	Tolerance on diameter	Eccentricity
Over 16 and under 16	+ 0.6 - 0.3	Under 70% of permissible tolerance range
16 and over and under 30	+ 0.7 - 0.3	
30 and over and under 150	+ 2.5 - 1.0	

7.3 The dimension and tolerance of steel other than those specified in 7.1 and 7.2
shall be determined by agreement between parties concerned.

8. Appearance and Decarburization

8.1 The steel shall be of superior finish without harmful defects in use.

8.2 The steel shall be without appreciable decarburization.

The permissible range of decarburization depth of hot rolled round steel shall be
as given in Table 7.

Table 7

Diameter	Unit: mm Permissible tolerance
Under 15	0.30
15 and over, and under 25	0.50
25 and over, and under 50	0.80
50 and over, and under 75	1.10
75 and over, and under 100	1.40
100 and over, and under 130	1.80
130 and over, and under 150	2.00

9.2 Hardness Test

9.2.1 The measurement of hardness of steel subjected to annealing shall be made on any arbitrary place of the steel.

9.2.2 The sample for hardening and tempering test shall be one per ingot.

9.2.3 The test piece for hardening and tempering test shall be finished to the size of about 15 mm diameter or square and about 20 mm long. When it is not convenient to finish to this size, it shall be arranged by agreement between parties concerned.

9.3 The Measurement of Decarburization Depth The measurement of decarburization depth shall be made by microscopic measuring method specified in 3.2 of JIS G 0558-Method of Decarburized Depth for Steel, to the total decarburized depth of (Dm-T).

High Speed

1. Scope

This standard specifies the high speed steel as the "steel", manufactured by hot rolling.

3. Method of Manufacture

3.1 The steel shall be manufactured by open hearth furnace.

3.2 The steel, unless otherwise specified, shall be forged with a forging ratio not less than 6 S. But, in case of 6 S for certain reason, upset forging may be permitted.

3.3 The steel shall be annealed.

4. Appearance and Decarburization

The steel shall be well finished, free from surface defects or remarkable decarburization.

5. Chemical Composition

The chemical composition of the steel shall conform to Table 2.

Symbol	Chemical composition					
	C	Si	Mn	P	S	Cr
SKH 2	0.70 ~ 0.85	0.40 max.	0.40 max.	0.030 max.	0.030 max.	3.80 ~ 4.50
SKH 3	0.70 ~ 0.85	0.40 max.	0.40 max.	0.030 max.	0.030 max.	3.80 ~ 4.50
SKH 4 A	0.70 ~ 0.85	0.40 max.	0.40 max.	0.030 max.	0.030 max.	3.80 ~ 4.50
SKH 4 B	0.70 ~ 0.85	0.40 max.	0.40 max.	0.030 max.	0.030 max.	3.80 ~ 4.50
SKH 5	0.20 ~ 0.40	0.40 max.	0.40 max.	0.030 max.	0.030 max.	3.80 ~ 4.50
SKH 10	1.45 ~ 1.60	0.40 max.	0.40 max.	0.030 max.	0.030 max.	3.80 ~ 4.50
SKH 9	0.80 ~ 0.90	0.40 max.	0.40 max.	0.030 max.	0.030 max.	3.80 ~ 4.50
SKH 52	1.00 ~ 1.10	0.40 max.	0.40 max.	0.030 max.	0.030 max.	3.80 ~ 4.50
SKH 53	1.10 ~ 1.25	0.40 max.	0.40 max.	0.030 max.	0.030 max.	3.80 ~ 4.50
SKH 54	1.25 ~ 1.40	0.40 max.	0.40 max.	0.030 max.	0.030 max.	3.80 ~ 4.50
SKH 55	0.80 ~ 0.90	0.40 max.	0.40 max.	0.030 max.	0.030 max.	3.80 ~ 4.50
SKH 56	0.80 ~ 0.90	0.40 max.	0.40 max.	0.030 max.	0.030 max.	3.80 ~ 4.50
SKH 57	1.15 ~ 1.30	0.40 max.	0.40 max.	0.030 max.	0.030 max.	3.80 ~ 4.50

Remarks: Each class shall not contain more than 0.005% of impurities.