

## Alloy tool steels

**Introduction** This Japanese Industrial Standard has been prepared based on the corresponding International Standard, **ISO/FDIS 4957 : 1998 *Tool steels*** at the “Modified” level of **ISO/IEC Guide 21 : 1999** on the occasion of reviewing **JIS G 4404 : 1983** in accordance with **JIS Z 8301 *Rules for the drafting and presentation of Japanese Industrial Standards***.

**1 Scope** This Standard specifies the alloy tool steels (hereafter referred to as “steels”) manufactured by hot-rolling or forging.

Remarks : The International Standard corresponding to this Standard is as follows.

In addition, designation indicating the degree of correspondence is IDT (identical), MOD (modified), and NEQ (not equivalent) in accordance with **ISO/IEC Guide 21**.

ISO/FDIS 4957 *Tool steels* (MOD)

**2 Normative references** The standards given in Attached Table 1 contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) shall apply.

**3 Grade and designation** The steels shall be classified into 32 grades and the designation shall be as given in Table 1.

**Table 1 Designation of grade**

Designation of grade	Application
SKS 11 SKS 2 SKS 21 SKS 5 SKS 51 SKS 7 SKS 81 SKS 8	Mainly used for cutting tool
SKS 4 SKS 41 SKS 43 (105V) SKS 44	Mainly used for impact resistance tool
SKS 3 SKS 31 SKS 93 SKS 94 SKS 95 SKD 1 (X210Cr12) SKD 2 (X210CrW12) SKD 10 (X153CrMoV12) SKD 11 SKD 12 (100CrMoV5)	Mainly used for cold working mold
SKD 4 SKD 5 (X30WCrV9-3) SKD 6 SKD 61 (X40CrMoV5-1) SKD 62 (X35CrWMoV5) SKD 7 (32CrMoV3-3) SKD 8 (X38CrCoWV4-4-4) SKT 3 SKT 4 (55NiCrMoV7) SKT 6 (45NiCrMo16)	Mainly used for hot forming mold

Remarks : The designation in parentheses in the column of designation of grade in Table 1 indicates the designation of the **ISO** steel grade specified in **ISO/FDIS 4957** and the specified values of chemical composition given in Tables 2 to 5 are equivalent to those in **ISO**.

**4 Method of manufacture** The method of manufacture shall be as follows:

- a) The steel shall be made of killed steel.
- b) Unless otherwise specified, the steel shall be rolled or forged with a forming ratio of 4S or over. However, if this forming ratio is under 4S owing to the dimension of the steel, it may be overcome by upset forging.
- c) Unless otherwise specified, the steel shall be subjected to annealing.

**5 Chemical composition** The chemical composition of the steel shall be determined by the test of 11.1 and the values obtained by the cast analysis shall conform to Tables 2 to 5.

**Table 2 Chemical composition (for cutting tools)**

Unit: %

Designation of grade	Chemical composition									Example of application (informative)
	C	Si	Mn	P	S	Ni	Cr	W	V	
SKS 11	1.20 to 1.30	0.35 max.	0.50 max.	0.030 max.	0.030 max.	—	0.20 to 0.50	3.00 to 4.00	0.10 to 0.30	Cutting tool, dies for cold drawing, center drill
SKS 2	1.00 to 1.10	0.35 max.	0.80 max.	0.030 max.	0.030 max.	—	0.50 to 1.00	1.00 to 1.50	( <sup>1</sup> )	Tap, drill, cutter, die for press, die for thread cutting
SKS 21	1.00 to 1.10	0.35 max.	0.50 max.	0.030 max.	0.030 max.	—	0.20 to 0.50	0.50 to 1.00	0.10 to 0.25	
SKS 5	0.75 to 0.85	0.35 max.	0.50 max.	0.030 max.	0.030 max.	0.70 to 1.30	0.20 to 0.50	—	—	Circular saw, band saw
SKS 51	0.75 to 0.85	0.35 max.	0.50 max.	0.030 max.	0.030 max.	1.30 to 2.00	0.20 to 0.50	—	—	
SKS 7	1.10 to 1.20	0.35 max.	0.50 max.	0.030 max.	0.030 max.	—	0.20 to 0.50	2.00 to 2.50	( <sup>1</sup> )	Hack saw
SKS 81	1.10 to 1.30	0.35 max.	0.50 max.	0.030 max.	0.030 max.	—	0.20 to 0.50	—	—	Spare cutting tool, cutting tool, hack saw
SKS 8	1.30 to 1.50	0.35 max.	0.50 max.	0.030 max.	0.030 max.	—	0.20 to 0.50	—	—	Blade file, file set

Note (<sup>1</sup>) SKS 2 and SKS 7 may be added V not exceeding 0.20 %, respectively.

Remarks: The contents of Ni (excluding SKS 5 and SKS 51) and Cu for each grade shall not exceed 0.25 %, respectively, as the impurities.

**Table 3 Chemical composition (for impact resistance tools)**

Unit : %

Designation of grade	Chemical composition								Example of application (informative)
	C	Si	Mn	P	S	Cr	W	V	
SKS 4	0.45 to 0.55	0.35 max.	0.50 max.	0.030 max.	0.030 max.	0.50 to 1.00	0.50 to 1.00	—	Chisel, punch, shear knife
SKS 41	0.35 to 0.45	0.35 max.	0.50 max.	0.030 max.	0.030 max.	1.00 to 1.50	2.50 to 3.50	—	
SKS 43	1.00 to 1.10	0.10 to 0.30	0.10 to 0.40	0.030 max.	0.030 max.	—	—	0.10 to 0.20	Piston for rock borer, heading die
SKS 44	0.80 to 0.90	0.25 max.	0.30 max.	0.030 max.	0.030 max.	—	—	0.10 to 0.25	Chisel, heading die

Remarks 1 The contents of Ni and Cu for each grade shall not exceed 0.25 %, respectively, as the impurities.

2 SKS 43 and SKS 44 shall not contain over 0.20 % Cr as the impurity.

**Table 4 Chemical composition (for cold working mold)**

Unit : %

Designation of grade	Chemical composition									Example of application (informative)
	C	Si	Mn	P	S	Cr	Mo	W	V	
SKS 3	0.90 to 1.00	0.35 max.	0.90 to 1.20	0.030 max.	0.030 max.	0.50 to 1.00	—	0.50 to 1.00	—	Gauge, shear knife, die for press, die for thread cutting
SKS 31	0.95 to 1.05	0.35 max.	0.90 to 1.20	0.030 max.	0.030 max.	0.80 to 1.20	—	1.00 to 1.50	—	Gauge, die for press, die for thread cutting
SKS 93	1.00 to 1.10	0.50 max.	0.80 to 1.10	0.030 max.	0.030 max.	0.20 to 0.60	—	—	—	Shear knife, gauge, die for press
SKS 94	0.90 to 1.00	0.50 max.	0.80 to 1.10	0.030 max.	0.030 max.	0.20 to 0.60	—	—	—	
SKS 95	0.80 to 0.90	0.50 max.	0.80 to 1.10	0.030 max.	0.030 max.	0.20 to 0.60	—	—	—	
SKD 1	1.90 to 2.20	0.10 to 0.60	0.20 to 0.60	0.030 max.	0.030 max.	11.00 to 13.00	—	—	( <sup>2</sup> )	Wire drawing die, die for press, die for brick press, die for powder press
SKD 2	2.00 to 2.30	0.10 to 0.40	0.30 to 0.60	0.030 max.	0.030 max.	11.00 to 13.00	—	0.60 to 0.80	—	
SKD 10	1.45 to 1.60	0.10 to 0.60	0.20 to 0.60	0.030 max.	0.030 max.	11.00 to 13.00	0.70 to 1.00	—	0.70 to 1.00	
SKD 11	1.40 to 1.60	0.40 max.	0.60 max.	0.030 max.	0.030 max.	11.00 to 13.00	0.80 to 1.20	—	0.20 to 0.50	Gauge, die for thread rolling, cutting tool for metal, forming roll, die for press
SKD 12	0.95 to 1.05	0.10 to 0.40	0.40 to 0.80	0.030 max.	0.030 max.	4.80 to 5.50	0.90 to 1.20	—	0.15 to 0.35	

Note (<sup>2</sup>) SKD 1 may be added V not exceeding 0.30 %.

**Table 5 Chemical composition (for hot forming mold)**

Unit : %

Designation of grade	Chemical composition											Example of application (informative)
	C	Si	Mn	P	S	Ni	Cr	Mo	W	V	Co	
SKD 4	0.25 to 0.35	0.40 max.	0.60 max.	0.030 max.	0.020 max.	—	2.00 to 3.00	—	5.00 to 6.00	0.30 to 0.50	—	Die for press, die for die-casting, die for extruding, shear knife
SKD 5	0.25 to 0.35	0.10 to 0.40	0.15 to 0.45	0.030 max.	0.020 max.	—	2.50 to 3.20	—	8.50 to 9.50	0.30 to 0.50	—	
SKD 6	0.32 to 0.42	0.80 to 1.20	0.50 max.	0.030 max.	0.020 max.	—	4.50 to 5.50	1.00 to 1.50	—	0.30 to 0.50	—	
SKD 61	0.35 to 0.42	0.80 to 1.20	0.25 to 0.50	0.030 max.	0.020 max.	—	4.80 to 5.50	1.00 to 1.50	—	0.80 to 1.15	—	
SKD 62	0.32 to 0.40	0.80 to 1.20	0.20 to 0.50	0.030 max.	0.020 max.	—	4.75 to 5.50	1.00 to 1.60	1.00 to 1.60	0.20 to 0.50	—	Die for press, die for extruding
SKD 7	0.28 to 0.35	0.10 to 0.40	0.15 to 0.45	0.030 max.	0.020 max.	—	2.70 to 3.20	2.50 to 3.00	—	0.40 to 0.70	—	Die for press, die for extruding
SKD 8	0.35 to 0.45	0.15 to 0.50	0.20 to 0.50	0.030 max.	0.020 max.	—	4.00 to 4.70	0.30 to 0.50	3.80 to 4.50	1.70 to 2.10	4.00 to 4.50	Die for press, die for die-casting, die for extruding
SKT 3	0.50 to 0.60	0.35 max.	0.60 max.	0.030 max.	0.020 max.	0.25 to 0.60	0.90 to 1.20	0.30 to 0.50	—	( <sup>3</sup> )	—	Die for forging, die for press, die for extruding
SKT 4	0.50 to 0.60	0.10 to 0.40	0.60 to 0.90	0.030 max.	0.020 max.	1.50 to 1.80	0.80 to 1.20	0.35 to 0.55	—	0.05 to 0.15	—	
SKT 6	0.40 to 0.50	0.10 to 0.40	0.20 to 0.50	0.030 max.	0.020 max.	3.80 to 4.30	1.20 to 1.50	0.15 to 0.35	—	—	—	

Note (<sup>3</sup>) SKT 3 may be added V not exceeding 0.20 %.

**6 Hardness in annealed condition** The annealed hardness for the steel shall conform to Table 6. Pertaining to the steel for which the measurement by Brinell hardness is difficult, however, it may be made by Rockwell hardness or Vickers hardness. In this case, the values of Rockwell or Vickers hardness shall be agreed upon between the purchaser and the manufacturer.

**Table 6 Annealed hardness of steel**

Category	Designation of grade	Annealing temperature °C	Annealed hardness HB
Steel for cutting tool	SKS 11	780 to 850 slow cooling	241 max.
	SKS 2	750 to 800 slow cooling	217 max.
	SKS 21	750 to 800 slow cooling	217 max.
	SKS 5	750 to 800 slow cooling	207 max.
	SKS 51	750 to 800 slow cooling	207 max.
	SKS 7	750 to 800 slow cooling	217 max.
	SKS 81	750 to 800 slow cooling	212 max.
	SKS 8	750 to 800 slow cooling	217 max.
Steel for impact resistance tool	SKS 4	740 to 780 slow cooling	201 max.
	SKS 41	760 to 820 slow cooling	217 max.
	SKS 43	750 to 800 slow cooling	212 max.
	SKS 44	730 to 780 slow cooling	207 max.
Steel for cold working mold	SKS 3	750 to 800 slow cooling	217 max.
	SKS 31	750 to 800 slow cooling	217 max.
	SKS 93	750 to 780 slow cooling	217 max.
	SKS 94	740 to 760 slow cooling	212 max.
	SKS 95	730 to 760 slow cooling	212 max.
	SKD 1	830 to 880 slow cooling	248 max.
	SKD 2	830 to 880 slow cooling	255 max.
	SKD 10	830 to 880 slow cooling	255 max.
	SKD 11	830 to 880 slow cooling	255 max.
	SKD 12	830 to 880 slow cooling	241 max.
Steel for hot forming mold	SKD 4	800 to 850 slow cooling	235 max.
	SKD 5	800 to 850 slow cooling	241 max.
	SKD 6	820 to 870 slow cooling	229 max.
	SKD 61	820 to 870 slow cooling	229 max.
	SKD 62	820 to 870 slow cooling	229 max.
	SKD 7	820 to 870 slow cooling	229 max.
	SKD 8	820 to 870 slow cooling	262 max.
	SKT 3	760 to 810 slow cooling	235 max.
	SKT 4	740 to 800 slow cooling	248 max.
	SKT 6	720 to 780 slow cooling	285 max.

Remarks : For hot-rolled steel plate and sheet in coils and cut lengths, the hardness value in annealed condition shall be agreed upon between the purchaser and the manufacturer.

**7 Hardness in quenched and tempered condition** The test piece which is the representative of the steel to be quenched and tempered shall be subjected to heat treatment at the temperature given in Table 7 and the hardness on the test piece in quenched and tempered condition shall conform to Table 7, provided that the allowable temperature range of the test piece shall be  $\pm 10$  °C of the temperature given in Table 7 for both quenching and tempering treatments.

Table 7 Quenched and tempered hardness of test piece

Category	Designation of grade	Heat treatment temperature °C		Quenched and tempered hardness HRC
		Quenching	Tempering	
Steel for cutting tool	SKS 11	790 water quenching	180 air cooling	62 min.
	SKS 2	860 oil quenching	180 air cooling	61 min.
	SKS 21	800 water quenching	180 air cooling	61 min.
	SKS 5	830 oil quenching	420 air cooling	45 min.
	SKS 51	830 oil quenching	420 air cooling	45 min.
	SKS 7	860 oil quenching	180 air cooling	62 min.
	SKS 81	790 water quenching	180 air cooling	63 min.
	SKS 8	810 water quenching	180 air cooling	63 min.
Steel for impact resistance tool	SKS 4	800 water quenching	180 air cooling	56 min.
	SKS 41	880 oil quenching	180 air cooling	53 min.
	SKS 43	790 water quenching	180 air cooling	63 min.
	SKS 44	790 water quenching	180 air cooling	60 min.
Steel for cold working mold	SKS 3	830 oil quenching	180 air cooling	60 min.
	SKS 31	830 oil quenching	180 air cooling	61 min.
	SKS 93	820 oil quenching	180 air cooling	63 min.
	SKS 94	820 oil quenching	180 air cooling	61 min.
	SKS 95	820 oil quenching	180 air cooling	59 min.
	SKD 1	970 air cooling	180 air cooling	62 min.
	SKD 2	970 air cooling	180 air cooling	62 min.
	SKD 10	1 120 air cooling	180 air cooling	61 min.
	SKD 11	1 030 air cooling	180 air cooling	58 min.
	SKD 12	970 air cooling	180 air cooling	60 min.
Steel for hot forming mold	SKD 4	1 080 oil quenching	600 air cooling	42 min.
	SKD 5	1 150 oil quenching	600 air cooling	48 min.
	SKD 6	1 050 air cooling	550 air cooling	48 min.
	SKD 61	1 020 air cooling	550 air cooling	50 min.
	SKD 62	1 020 air cooling	550 air cooling	48 min.
	SKD 7	1 040 air quenching	550 air cooling	46 min.
	SKD 8	1 120 oil cooling	600 air cooling	48 min.
	SKT 3	850 oil quenching	500 air cooling	42 min.
	SKT 4	850 oil quenching	500 air cooling	42 min.
	SKT 6	850 oil quenching	180 air cooling	52 min.

Remarks : For the steel which has not been annealed, it shall be subjected to annealing according to Table 6 and subsequently quenching and tempering.

**8 Appearance** The steel shall have a well workmanlike finish, and shall be free from defects that are detrimental to practical use.

**9 Dimension and tolerances**

**9.1 Standard dimension** The standard diameter of the hot-rolled round steel bar shall be as given in Table 8.

**Table 8 Standard diameter**

Unit : mm

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

**9.2 Dimensional tolerances** The tolerances on diameter for the hot-rolled round steel bar shall conform to Table 9.

**Table 9 Tolerances on diameter**

Unit : mm

Specified diameter	Tolerance on diameter	Allowable deviation on diameter
10 or over to and excl. 16	+0.6 -0.3	Up to and incl. 70 % of the full range of tolerance on diameter
16 or over to and excl. 30	+0.7 -0.3	
30 or over up to and incl. 150	+2.5 % -1.0 %	

Remarks : The tolerances on diameter for the round steel bar whose diameter is under 10 mm and over 150 mm shall be agreed upon between the purchaser and the manufacturer.

**9.3** The dimensions and the tolerances for the steels other than the hot-rolled round steel bar shall be agreed upon between the purchaser and the manufacturer.

**10 Decarburization** The steel shall be free from appreciable decarburization. In this case, the allowable limit of decarburized depth of the hot-rolled round steel bar shall conform to Table 10.



**Table 10 Decarburized depth of the hot-rolled round steel bar**

Unit : mm

Specified diameter	Allowable limit
Under 15	0.30
15 or over to and excl. 25	0.50
25 or over to and excl. 50	0.80
50 or over to and excl. 75	1.10
75 or over to and excl. 100	1.40
100 or over to and excl. 130	1.80
130 or over to and excl. 135	2.00

Remarks : The allowable limit of decarburized depth for the steel plate and sheet in coils and cut lengths shall be agreed upon between the purchaser and the manufacturer.

## 11 Test

### 11.1 Chemical analysis

**11.1.1 General requirement for chemical analysis and sampling method of specimen for analysis** The chemical composition shall be determined by the cast analysis. The general requirement for chemical analysis and sampling method of specimen for analysis shall be in accordance with the specification of 8 in **JIS G 0404**.

**11.1.2** The analytical method shall comply with appropriate standard among the following ones:

**JIS G 1211, JIS G 1212, JIS G 1213, JIS G 1214, JIS G 1215, JIS G 1216, JIS G 1217, JIS G 1218, JIS G 1219, JIS G 1220, JIS G 1221, JIS G 1222, JIS G 1253, JIS G 1256, JIS G 1257**

### 11.2 Hardness test

**11.2.1** The measurement of hardness on the annealed steel shall be made at arbitrary place of the steel.

**11.2.2** Pertaining to the sampling plan, one test specimen for quenched and tempered hardness test shall be taken from each same heat of the steel, each given range of dimension and each same heat treatment condition.

**11.2.3** The test piece for quenched and tempered hardness test shall be machined from the test specimen prepared according to **11.2.2** to furnish approximately 15 mm square or circle, and approximately 20 mm length. When it is difficult to apply these dimensions of the test piece, it shall be agreed upon between the purchaser and the manufacturer.

11.2.4 The test method shall conform to any one of the following standards:

**JIS Z 2243, JIS Z 2244, JIS Z 2245**

**11.3 Measurement of decarburized depth** The measurement of decarburized depth shall be made by the total decarburized depth (DM-T) according to 4.1 of **JIS G 0558**. However, when it is difficult to carry out microscopic measurement of the steel other than that for hot forming mold, it is recommended to apply the practical decarburized depth (DH-P) according to 4.2 of **JIS G 0558**. In this case, the heat treatment of the test piece shall be in accordance with Table 7 and the practical decarburized depth shall be the depth from the surface obtained when the hardness reaches that given in Table 7.

## 12 Inspection

**12.1 Inspection** Inspection shall be as follows:

- a) General requirements given in **JIS G 0404** shall apply.
- b) Chemical composition shall comply with 5.
- c) Annealed hardness of steel shall comply with 6.
- d) Hardness in quenched and tempered condition shall comply with 7.
- e) Appearance shall comply with 8.
- f) Dimension and tolerances shall comply with 9.
- g) The test result on decarburization shall comply with 10.

**12.2 Other inspection** In addition to the inspection items specified in 12.1, any necessary items among those special requirements as given in the following may be designated. In this case, the purchaser shall previously agree with the manufacturer on the inspection items, sampling method, test method and acceptance criteria.

Macro-structure examination

Micro-structure examination

Non-metallic inclusions examination

Macro-streak-flaw examination

Magnetic particle examination

Ultrasonic flaw detection examination

However, the sampling method of the test specimen, test piece, test method, etc. shall conform to the following standards:

**JIS G 0416, JIS G 0553, JIS G 0555, JIS G 0556, JIS G 0565, JIS Z 2344**

## 13 Marking

**13.1 Steel bar, flat steel bar and steel wire rod** Pertaining to the marking on the steel bar, flat steel bar and steel wire rod, the following items shall be marked by suitable means on each steel product. However, the steel product whose diameter

or width across flats is under 30 mm may be bundled, and the items may be marked on each bundle by suitable means. Furthermore, a part of the following items may be omitted, when approved by the purchaser.

- a) Designation of grade
- b) Heat number or alternative manufacturing (inspection) number
- c) Dimension
- d) Quantity or mass
- e) Manufacturer's name or identifying brand

**13.2 Steel plate and sheet in coils and cut lengths** Pertaining to the marking on the steel plate and sheet in coils and cut lengths the following items shall be legibly marked by suitable means on each steel product or each bundle. When approved by the purchaser, however, a part of the items may be omitted.

- a) Designation of grade
- b) Heat number or alternative manufacturing (inspection) number
- c) Dimension
- d) Quantity or mass
- e) Manufacturer's name or identifying brand

**14 Report** The manufacturer shall submit to the purchaser the report in which the designation of grade, heat number or alternative manufacturing number, chemical composition, dimension and delivery conditions for the steel are entered. However, pertaining to submission of the test results report prepared according to 12.2, it shall be agreed upon between the purchaser and the manufacturer.

**Attached Table 1 Normative references**

- JIS G 0404 *Steel and steel products—General technical delivery requirements*
- JIS G 0416 *Steel and steel products—Location and preparation of samples and test pieces for mechanical testing*
- JIS G 0553 *Macrostructure detecting method for steel*
- JIS G 0555 *Microscopic testing method for the non-metallic inclusions in steel*
- JIS G 0556 *Method of macro-streak-flaw test for steel*
- JIS G 0558 *Methods of measuring decarburized depth for steel*
- JIS G 0565 *Method for magnetic particle testing of ferromagnetic materials and classification of magnetic particle indication*
- JIS G 1211 *Iron and steel—Methods for determination of carbon content*
- JIS G 1212 *Iron and steel—Methods for determination of silicon content*
- JIS G 1213 *Methods for determination of manganese in iron and steel*
- JIS G 1214 *Iron and steel—Methods for determination of phosphorus content*
- JIS G 1215 *Iron and steel—Methods for determination of sulfur content*
- JIS G 1216 *Iron and steel—Methods for determination of nickel content*
- JIS G 1217 *Methods for determination of chromium in iron and steel*
- JIS G 1218 *Iron and steel—Methods for determination of molybdenum content*
- JIS G 1219 *Iron and steel—Methods for determination of copper content*
- JIS G 1220 *Iron and steel—Methods for determination of tungsten content*
- JIS G 1221 *Iron and steel—Methods for determination of vanadium content*
- JIS G 1222 *Iron and steel—Methods for determination of cobalt content*
- JIS G 1253 *Iron and steel—Method for spark discharge atomic emission spectrometric analysis*
- JIS G 1256 *Iron and steel—Method for X-ray fluorescence spectrometric analysis*
- JIS G 1257 *Iron and steel—Methods for atomic absorption spectrometric analysis*
- JIS Z 2243 *Brinell hardness test—Test method*
- JIS Z 2244 *Vickers hardness test—Test method*
- JIS Z 2245 *Rockwell hardness test—Test method*
- JIS Z 2344 *General rule of ultrasonic testing of metals by pulse echo technique*

Annex (informative)  
Comparison table between JIS and corresponding International Standard

JIS G 4404 : 2000 Alloy tool steels		ISO/FDIS 4957 : 1998 Tool steels				(V) Reason why the conformity between JIS and International Standard is difficult and measures to be taken in the future	
(I) Content specified in JIS		(II) International Standard number	(III) Content specified in International Standard		(IV) Evaluation for each clause and content of technical difference between JIS and International Standard		
Clause number	Content		Clause number	Content	Evaluation for each clause	Content of technical difference	
1 Scope	Steels manufactured by hot-rolling or forging • Alloy tool steels	ISO/FDIS 4957	1	Scope: Applies to hot-rolled, forged, cold-drawn or cold-rolled products. a) non-alloy cold-work tool steels b) alloy cold-work tool steels c) alloy hot-work tool steels d) high-speed tool steels	MOD/deletion	JIS specifies carbon tool steels in JIS G 4401, high-speed tool steels in JIS G 4403. This comes from difference of Standard system.	This comes from the usability of Standard and does not give any problems when comparing difference between both Standards. For the time being difference should not be modified. This Table provides comparison focusing on carbon tool steels based on JIS.

Annex (informative)  
Comparison table between JIS and corresponding International Standard (concluded)

(I) Content specified in JIS		(II) International Standard number	(III) Content specified in International Standard		(IV) Evaluation for each clause and content of technical difference between JIS and International Standard		(V) Reason why the conformity between JIS and International Standard is difficult and measures to be taken in the future
Clause number	Content		Clause number	Content	Evaluation for each clause	Content of technical difference	
4	Method of manufacture <ul style="list-style-type: none"> <li>• Killed steel</li> <li>• Forming ratio of 4S or over</li> <li>• Unless otherwise specified, the steel shall be subjected to annealing.</li> </ul>	ISO/FDIS 4957	5.1	Manufacturing process a) The manufacturing process of the steels is left to the discretion of the manufacturer. b) When the purchaser so requests, he shall be informed what steel making process is being used. c) Unless otherwise specified in the order, the tool steels are delivered in the annealed condition except below. C45U, 35CrMo7, X38CrMo16, 40CrMnNiMo8-6-4, 55NiCrMoV7	MOD/ addition	<ul style="list-style-type: none"> <li>• a) and b) of ISO are general and ordinary. They should be described in ISO 404. This idea will be proposed when reviewing ISO 404 next time.</li> <li>• Forming ratio should be specified in light of domestic needs although it is not strict and widely satisfied.</li> <li>• JIS specifies the plate and sheet in coils and cut lengths because they are not generally cut or cold-worked as they are. This will be also proposed when reviewing ISO next time.</li> </ul>	The JIS description relating to forming ratio will be proposed when reviewing ISO next time.

Annex (informative)  
Comparison table between JIS and corresponding International Standard (concluded)

(I) Content specified in JIS		(II) International Standard number	(III) Content specified in International Standard		(IV) Evaluation for each clause and content of technical difference between JIS and International Standard		(V) Reason why the conformity between JIS and International Standard is difficult and measures to be taken in the future
Clause number	Content		Clause number	Content	Evaluation for each clause	Content of technical difference	
5	Chemical composition Specifies grades of steels by application such as for cutting tool, for impact resistance tool, for cold working mold and for hot forming mold. Consists of the conventional JIS and ISO grades.	ISO/FDIS 4957	5.2	Specifies 26 grades of steels as alloy cold-work tool steels, alloy hot-work tool steels.	Combination of MOD/deletion and MOD/addition	Among 32 grades of steels of JIS, 12 grades of steels of ISO are adopted which are adaptable to domestic market needs. 20 grades of steels of the conventional JIS widely used in the market are also specified.	Harmonization to ISO grades of steels will be promoted, while grades of steels indispensable for domestic market needs are left as they are. JIS-specific grades of steels will be proposed to be incorporated into ISO.
6	Hardness in annealed condition Specifies the maximum hardness for each grade in the standard annealing heat treatment.	ISO/FDIS 4957	5.2	Mechanical properties: Specifies the maximum hardness in the usual annealed condition at delivery.	Combination of MOD/deletion and MOD/addition	Specification is linked with grades of steels. However, ISO Standard has no description on the annealed condition.	ISO Standard specifies only the guaranteed value of the maximum hardness in the annealed condition at delivery with the annealed condition randomly chosen. This differs from JIS which specifies the cold-work after annealing carried out by the user side, but for the time being JIS-specific content developed based on the domestic dealings is adopted as the JIS values are equivalent to ISO values.

**Annex (informative)**  
**Comparison table between JIS and corresponding International Standard (concluded)**

(I) Content specified in JIS		(II) International Standard number	(III) Content specified in International Standard		(IV) Evaluation for each clause and content of technical difference between JIS and International Standard		(V) Reason why the conformity between JIS and International Standard is difficult and measures to be taken in the future
Clause number	Content		Clause number	Content	Evaluation for each clause	Content of technical difference	
7	Hardness in quenched and tempered condition	ISO/FDIS 4957	5.2	Hardness in quenched and tempered condition: Specifies the minimum hardness in the standard quenched and tempered condition.	Combination of MOD/deletion and MOD/addition	Specification is linked with grades of steels.	
8	Dimension, and tolerances	ISO/FDIS 4957	5.4	Tolerances on shape and dimension: Subject to the agreement between the purchaser and the manufacturer.	MOD/addition	ISO does not provide any specification explicitly. JIS provides the specification satisfied with domestic market needs explicitly.	JIS specification satisfied with domestic needs is employed.
9	Decarburization	ISO/FDIS 4957	—	Not specified.	MOD/addition	For hot-rolled round steel bar, JIS specifies the concrete allowable limits of decarburized depth.	The conventional JIS specification is employed in accordance with market needs. The additional modification will be proposed when reviewing ISO next time.

Entire evaluation on the degree of correspondence between JIS and International Standard: MOD

Remarks 1 Symbols in sub-columns of evaluation for each clause in the above Table indicate as follows:

— MOD/deletion: Deletes the specified items and contents of International Standard.

— MOD/addition: Adds the specified items and contents which are not included in International Standard.

2 Symbols in sub-columns of entire evaluation on the degree of correspondence between JIS and International Standard in the above Table indicate as follows:

— MOD: Modifies International Standard.