(Reaffirmed 1998)

Indian Standard

SPECIFICATION FOR MOULD STEELS

(First Revision)

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INDIAN STANDARDS INSTITUTION
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Indian Standard

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Indian Standard

SPECIFICATION FOR MOULD STEELS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 15 January 1979, after the draft finalized by the Alloy Steels and Special Steels Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard was first published in 1966. As a result of the experience gained in the production and use of steels, the concerned sectional committee has decided to undertake its revision.

0.3 The major modifications made in the revision relate to the following:

a) Change in the Steel designation according to IS : 1762 (Part I)-1974*. However, for the convenience of the user, old designations have also been given within brackets.

b) Modifications in the limits for residual elements keeping in view the international practice.

c) Permissible variation in check analysis has been specified.

0.4 Although most of the steels covered in this specification are low in carbon, they are generally classified as tool steels. After suitable heat treatment they exhibit wear resistance and hardness characteristics of tool steels. Properties required depend upon the service application. One or more of the following properties are essential:

a) Hobbability;

b) Machinability;

c) Polishability;

d) High-core strength;

e) Toughness;

f) Wear resistance;

g) High surface hardness; and

h) Cleanliness, the most important.

*Code for designation of steels : Part I Based on letter symbols (*first revision*).

0.5 For the benefit of the purchaser of steels covered by this specification, two informative appendices have been included. Appendix A gives particulars to be specified by the purchaser while ordering for steels and Appendix B gives the recommended annealing temperatures.

0.6 This standard contains clauses **4.1**, **6.2**, **9.3**, **10.3**, **10.4**, **10.5**, **11.1**, **13.1** and **14.2** which call for agreement between the buyer and the seller and permit the purchaser to use his option for selection to suit his requirements.

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard covers mould steels in wrought condition. These are generally used for moulds for plastics and for die casting of low melting non-ferrous alloys.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in various parts of IS : 1956† shall apply.

3. SUPPLY OF MATERIAL

3.1 General requirements relating to the supply of material shall conform to IS : 1387-1967‡.

3.2 Steels covered in this standard shall be ordered and delivered to any of the following conditions of delivery:

a) Chemical composition, or

b) Chemical composition and hardness in the spherodised annealed condition, or

c) Chemical composition and mechanical properties.

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*Rules for rounding off numerical values (*revised*).
†Glossary of terms relating to iron and steel.
‡General requirements for the supply of metallurgical materials (*first revision*).

4. MANUFACTURE

4.1 Steel shall be made by the electric or any other approved process as agreed to between the purchaser and the manufacturer.

4.2 Sufficient reductions and discards shall be made from each ingot to ensure freedom from piping, segregation and other harmful defects.

5. FREEDOM FROM DEFECTS

5.1 The finished material shall be free from all internal and surface defects, such as seams, cracks, flakes, pipe and segregation.

6. CHEMICAL COMPOSITION

6.1 The ladle analysis of the steel when made in accordance with the relevant part of IS: 228* shall be as given in Table 1.

6.1.1 Elements not quoted in Table 1 shall not be added to the steel, except when agreed to, other than for the purpose of finishing the heat and shall not exceed the following limits:

Element	*Percent*
Chromium	0·25 *Max*
Nickel	0·25 *Max*
Molybdenum	0·25 *Max*
Copper	0·35 *Max*
Cobalt	0·10 *Max*
Tungsten	0·25 *Max*
Vanadium	0·05 *Max*

6.2 The purchaser may specify a more restricted chemical analysis in the range as agreed.

6.3 Check Analysis — The check analysis shall be carried out on the finished product. The permissible variation in case of such check analysis from the limits specified in Table 1 shall be as given in Table 2.

7. HEAT TREATMENT

7.1 Recommended annealing temperatures are given in Appendix B.

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*Methods of chemical analysis of steels. (Issued in 12 parts).

TABLE 1 CHEMICAL COMPOSITION

(*Clauses* 6.1, 6.1.1 *and* 6.3)

Designation		C Per-cent	Si Per-cent	Mn Per-cent	Ni Per-cent	Cr Per-cent	Mo Per-cent	V Per-cent	W Per-cent	S Per-cent *Max*	P Per-cent *Max*
New	Old										
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
T90Mn6WCr2	(T90Mn2W$_{50}$Cr$_{45}$)	0·85-0·95	0·10-0·35	1·25-1·75	—	0·30-0·60	—	0·25 *Max* Optional	0·40-0·60	0·035	0·035
T30Ni16Cr5	(T30Ni4Cr1)	0·26-0·34	0·10-0·35	0·40-0·70	3·90-4·30	1·10-1·40	—	—	—	0·035	0·035
T55Ni6CrMo3	(T55Ni2Cr$_{65}$Mo$_{30}$)	0·50-0·60	0·10-0·35	0·50-0·80	1·25-1·75	0·50-0·80	0·25-0·35	—	—	0·035	0·035
XT215Cr12	(T215Cr12)	2·00-2·30	0·10-0·35	0·25-0·50	—	11·0-13·0	0·80 *Max* Optional	0·80 *Max* Optional	—	0·035	0·035
10T4	(T10)	0·15 *Max*	0·10-0·35	0·30-0·60	—	—	—	—	—	0·035	0·035
T15Cr3	(T15Cr65)	0·12-0·18	0·10-0·35	0·40-0·60	—	0·50-0·80	—	—	—	0·035	0·035
T10Cr20Mo8V2	(T10Cr5Mo$_{75}$V$_{23}$)	0·15 *Max*	0·10-0·35	0·25-0·50	—	4·75-5·25	0·50-1·00	0·15-0·30	—	0·035	0·035
T16Ni3Cr2	(T16Ni$_{80}$Cr$_{60}$)	0·12-0·20	0·10-0·35	0·60-1·00	0·60-1·00	0·40-0·80	—	—	—	0·035	0·035
T15Ni5Cr4Mo	(T15NiCr1Mo$_{12}$)	0·12-0·18	0·10-0 35	0·60-1·00	1·00-1·50	0·75-1·25	0·08-0·15	—	—	0·035	0·035
T16Ni8Cr6Mo2	(T16NiCr2Mo$_{20}$)	0·12-0·20	0·10-0·35	0·40-0·70	1·80-2·20	1·40-1·70	0·15-0·25	—	—	0·035	0·035
15Ni16Cr5	(15Ni4Cr1)	0·12-0·18	0·10-0·35	0·40-0·70	3·80-4·30	1·00-1·40	—	—	—	0·035	0·035

TABLE 2 PERMISSIBLE VARIATION FOR CHECK ANALYSIS

(*Clause* 6.3)

Sl No.	Constituent	Limits or Maximum of Specified Range, Percent Including	Permissible Variation from the Limits Specified in Table 1
(1)	(2)	(3)	(4)
			±
i)	Carbon	≤ 0.50	0·02
		$> 0.50 < 1.45$	0·03
ii)	Silicon	≤ 0.40	0·03
iii)	Manganese	≤ 1.00	0·04
		> 1.00	0·06
iv)	Nickel	≤ 1.00	0·03
		Over 1·00-2·20	0·05
v)	Chromium	≤ 2.00	0·05
		$> 2.00 \leq 2.50$	0·07
		$> 2.50 < 11.0$	0·10
vi)	Molybdenum	≤ 0.60	0·04
		$> 0.60 \leq 1.00$	0·05
		> 1.00	0·10
vii)	Vanadium	< 0.30	0·02
		≥ 0.30	0·04
viii)	Tungsten	< 0.80	0·04
		≥ 0.80	0·05
ix)	Sulphur	0·035	+ 0·005
x)	Phosphorus	0·035	+ 0·005

NOTE — Variations shall not be applicable both over and under the specified limits in several determinations in a heat.

8. DIMENSIONAL TOLERANCES

8.1 In the case of rolled products, the dimensional tolerances shall be in accordance with IS : 3739-1972*. For forgings, the tolerances given in IS : 3469 (Parts I to III)-1974† shall apply.

9. SELECTION OF TEST SAMPLES

9.1 Samples for check analysis shall be taken midway between the centre and outside of the material.

9.2 For tensile tests, the sample shall be taken parallel to the direction of fibre.

*Dimensional tolerances for carbon and alloy constructional steel products.

†Tolerances for closed die steel forgings (*first revision*).

9.3 For inclusion counts, the specimen shall be taken from an area half way between the centre and outside surface of billet. The polished face shall be longitudinal to the direction of working. Number and location of samples shall be as agreed (generally top and middle of first two and last two and middle ingots).

10. TESTING

10.1 Chemical Composition — Ladle analysis shall be given by the supplier. If check analysis is required, at least one sample product shall be taken from each cast from each size lot.

10.2 For material supplied in annealed condition at least one sample shall be taken from each cast from each size group from each heat-treatment batch. If the material is continuously heat-treated, one sample shall be taken from each 10t or part thereof, but at least one sample product shall be taken from each cast and each size grouping.

10.3 Brinell Hardness Test — Brinell hardness test shall be conducted in accordance with IS : 1500-1968*. Acceptance limits shall be as agreed to between the supplier and the purchaser.

10.4 Ultrasonic Testing — Subject to mutual agreement between the manufacturer and the purchaser all material over 65 mm may be ultrasonically tested. When such tests are carried out, tops and bottoms of all ingots shall be etched. The acceptance limits shall be mutually agreed.

10.5 Non-metallic Inclusion Content — This test may be carried out by mutual agreement between the purchaser and the manufacturer. If this test is carried out, the average of inclusion rating of the specimen, when determined in accordance with IS : 4163-1967† shall not exceed the limits specified in Table 3.

TABLE 3 INCLUSION RATING

TYPE	THIN SERIES	HEAVY SERIES
A (sulphides)	A — 2	A — 1½
B (alumina)	B — 2	B — 1½
C (silicate)	C — 2	C — 1½
D (globular-oxide)	D — 1½	D — 1½

*Method for Brinell hardness test for steel (*first revision*).
†Method for determination of inclusion content in steel by microscopic method.

11. ADDITIONAL TESTS

11.1 Subject to mutual agreement between the supplier and the purchaser any one or more of the following tests may be agreed upon at the time of enquiry and order:

a) Grain size,

b) Micro-structure, and

c) Macrostreak flaw test.

12. RETESTS

12.1 Should any of the test pieces fail for the tests specified, two further test pieces shall be selected for testing in respect of each failure.

12.2 For a single bar, the test piece for retest shall be cut adjacent to the original test piece.

12.3 For bars in batches, one of the test pieces for retest shall be taken from the same position as for the original test piece and the other from any position.

12.4 If any of the tests from these additional test pieces fail, the steel shall be deemed as not conforming to this standard. However, if the failure is with respect to hardness, the batch or bar may be further heat-treated and offered for further testing.

13. TEST CERTIFICATE

13.1 The supplier shall supply a test certificate giving the method of manufacture, composition and results of other tests as agreed.

14. MARKING

14.1 All products over 50 mm diameter or of equivalent cross-sectional area shall be stamped or painted at the extreme end with the following:

a) Name or trade-mark of the manufacturer,

b) Grade, and

c) The cast number or any other identification mark by which the steel can be traced to the cast from which it was made.

14.1.1 The colour scheme given in IS : 2049-1963* may be adopted to mark the grade of material.

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*Colour code for the identification of wrought steels for general engineering purposes.

14.2 Products below 50 mm diameter shall the bundled as agreed and a metal tag attached giving the information as specified in **14.1**.

14.3 The material may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

APPENDIX A

(*Clause* 0.5)

INFORMATION TO BE GIVEN BY THE PURCHASER

A-1. BASIS FOR ORDER

A-1.1 While placing order for steels covered by this standard, the purchaser should specify clearly the following:

a) Grade;

b) Size;

c) Condition of delivery;

d) Tests required;

e) Special requirements, such as marking, bundling and packing;

f) Method of manufacture; and

g) Test report, if required.

APPENDIX B

(Clauses 0.5 and 7.1)

LIMITS OF ANNEALING TEMPERATURES

Grade		Recommended Annealing Temperature °C	Hardness Annealed Expected, *Max* HB
New	Old		
T90Mn6WCr2	T90Mn2W$_{50}$Cr$_{45}$	780 to 800	230
T30Ni16Cr5	T30Ni4Cr1	630 to 670	249
T55Ni6CrMo3	T55Ni2Cr$_{65}$Mo$_{30}$	680 to 720	249
XT215Cr12	T215Cr12	850 to 880	260
10T4	T10	780 to 850	130
T15Cr3	T15Cr$_{65}$	870 to 900	170
T10Cr20Mo8V2	T10Cr5Mo$_{75}$V$_{23}$	840 to 870	197
T16Ni3Cr2	T16Ni$_{80}$Cr$_{60}$	850 to 880	184
T15Ni5Cr4Mo	T15NiCr1Mo$_{12}$	860 to 880	217
T16Ni8Cr6Mo2	T16NiCr2Mo$_{20}$	850 to 880	229
15Ni16Cr5	15Ni4Cr1	860 to 880	241

INDIAN STANDARDS

ON

ALLOY STEELS AND SPECIAL STEELS

IS :

963-1958 Chrome-molybdenum steel bars and rods for aircraft purposes

1570-1961 Schedules for wrought steels for general engineering purposes

1570 (Part V)-1972 Schedules for wrought steels for general engineering purposes: Part V Stainless and heat resisting steels (*first revision*)

1870-1965 Comparison of Indian and overseas standards for wrought steels for general engineering purposes

1871-1965 Commentary on Indian Standard schedules for wrought steels for general engineering purposes

3739-1972 Dimensional tolerances for carbon and alloy constructional steel products

3748-1978 Tool and die steels for hot work (*first revision*)

3749-1978 Tool and die steels for cold work (*first revision*)

3930-1966 Flame and induction hardening steel

4397-1973 Cold rolled carbon steel strips for ball and roller bearing cages (*first revision*)

4398-1973 Carbon chromium steel for the manufacture of balls, rollers and bearing races (*first revision*)

4430-1979 Mould steels (*first revision*)

4431-1978 Carbon and carbon-manganese free-cutting steels (*first revision*)

4432-1967 Case hardening steels

4882-1968 Low carbon steel wire for rivets for use in bearing industry

5489-1975 Carburizing steel for use in bearing industry (*first revision*)

5517-1978 Steels for hardening and tempering (*first revision*)

5518-1969 Steels for die blocks for drop forgings

5522-1978 Stainless steel sheets and coils (*first revision*)

5651-1970 Steel for pneumatic tools

6527-1972 Stainless steel wire rod

6528-1972 Stainless steel wire

6529-1972 Stainless steel blooms, billets and slabs for forgings

6603-1972 Stainless steel bars

6911-1972 Stainless steel sheet, strip and plate

7291-1974 High speed steel

7494-1974 Steel for valves for internal combustion engines

AMENDMENT NO. 1 APRIL 1980
TO
IS : 4430 - 1979 SPECIFICATION FOR MOULD STEELS

(First Revision)

Alteration

(*Page* 7, *Table* 2) — Substitute the following for the existing table:

TABLE 2 PERMISSIBLE VARIATION FOR CHECK ANALYSIS

(*Clause* 6.3)

Sl No.	Constituent	Limits or Minimum of Specified Range, Percent Including	Permissible Variation from the Limits Specified in Table 1
(1)	(2)	(3)	(4)
			±
i)	Carbon	< 0·50	0·02
		⩾ 0·50 < 2·00	0·03
		⩾ 2·00	0·04
ii)	Silicon	⩽ 0·35	0·03
iii)	Manganese	⩽ 1·00	0·04
		> 1·00	0·06
iv)	Nickel	⩽ 1·00	0·03
		> 1·00 ⩽ 2·20	0·05
		> 2·20	0·07
v)	Chromium	⩽ 2·00	0·05
		> 2·00 ⩽ 2·50	0·07
		> 2·50 ⩽ 13·0	0·10
vi)	Molybdenum	⩽ 0·60	0·04
		> 0·60 ⩽ 1·00	0·05
		> 1·00	0·10
vii)	Vanadium	< 0·30	0·02
		⩾ 0·30	0·04
viii)	Tungsten	⩽ 0·60	0·04
ix)	Sulphur	0·035	+0·005
x)	Phosphorus	0·035	+0·005

Note — Variations shall not be applicable both over and under the specified limits in several determinations in a heat.

(SMDC 19)

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AMENDMENT NO. 2 MARCH 1983

TO

IS:4430-1979 SPECIFICATION FOR MOULD STEELS

(First Revision)

Alteration

(*Page 5, clause 6.1*) - Substitute the following for the existing clause:

'6.1 The ladle analysis of steel shall be as given in Table 1. The analysis of steel shall be carried out either by the method specified in IS:228* and its relevant parts or any other established instrumental/chemical method. In case of dispute the procedure given in IS:228* and its relevant parts shall be referee method. However, where the method is not given in IS:228* and its relevant parts, the referee method shall be agreed to between the purchaser and the manufacturer.'

(SMDC 19)

Reprography Unit, ISI, New Delhi, India