इंटरनेट मानक

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Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

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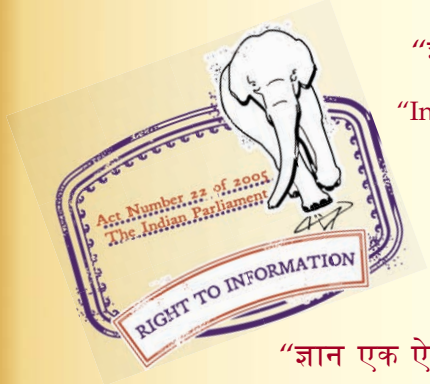
IS 3195 (1992): Steel for the manufacture of volute and helical springs (for railway rolling stock) [MTD 4: Wrought Steel Products]



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"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS 3195 : 1992
(Reaffirmed 2001)

भारतीय मानक

वोल्यूट तथा कुण्डलीनुमा कमानियां के निर्माण के लिए स्पात (रेल डिब्बे) — विशिष्ट

(तीसरा पुनरीक्षण)

Indian Standard

STEEL FOR THE MANUFACTURE OF VOLUTE AND HELICAL SPRINGS (FOR RAILWAY ROLLING STOCK) — SPECIFICATION

(Third Revision)

Third Reprint MAY 2004

UDC 669·14 : 621 — 272·272·273 : 625·2

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

June 1992

Price Group 2

Wrought Steel Products Sectional Committee, MTD 4

FOREWORD

This Indian Standard (Third Revisicn) was adcpted by the Bureau of Indian Standards, after the draft finalized by the Wrought Steel Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was originally published in 1965 and revised in 1975 and in 1982. While reviewing this standard in the light of further experience gained with the usage of this standard it was found necessary to revise the standard with the following modifications:

a) One more grade (51CrMoV4) has been added,

b) Requirements of inclusion rating have been added and

c) Secondary refining or vacuum melting shall be adopted while manufacturing steel.

This standard covers the requirements for steel to be used in the manufacture of volute and helical springs for railway stock. While making springs from these steels, they are worked hot and heat-treated.

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 or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

AMENDMENT NO. 2 SEPTEMBER 2000
TO
IS 3195 : 1992 STEEL FOR THE MANUFACTURE OF VOLUTE AND HELICAL SPRINGS (FOR RAILWAY ROLLING STOCK) — SPECIFICATION

(Third Revision)

(*Page* 2, *Table* 1 (*see also Amendment No.* 1)] — Substitute the existing with '52Cr4Mo2V' in col 2 for Designation at Sl No. 8 and Note (f).

(MTD 4)

Printed at Dee Kay Printers, New Delhi

AMENDMENT NO. 1 APRIL 1995
TO
IS 3195 : 1992 STEEL FOR THE MANUFACTURE OF VOLUTE AND HELICAL SPRINGS (FOR RAILWAY ROLLING STOCK) — SPECIFICATION
(Third Revision)

(*Second cover page, Foreword, line* 7) – Substitute '51CrMoV' *for* '51CrMoV4'.

(*Page* 2, *Table* 1) – Substitute the following for the existing table:

Table 1 Chemical Composition
(*Clauses* 3, 6.1 *and* 6.2)

Grade	Designation [see IS 1762 (Part 1) : 1974]	Constituents, Percent							
		Carbon	Silicon	Manganese	Sulphur *Max*	Phosphorus *Max*	Chromium	Vanadium	Molybdenum
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	98C6	0.90 to 1.05	0.15 to 0.35	0.50 to 0.80	0.050	0.050	—	—	—
2	113C6	1.05 to 1.20	0.15 to 0.35	0.50 to 0.80	0.050	0.050	—	—	—
3	55Si7	0.50 to 0.60	1.50 to 2.00	0.80 to 1.00	0.030	0.030	—	—	—
4	60Si7	0.55 to 0.65	1.50 to 2.00	0.80 to 1.00	0.030	0.030	—	—	—
5	65Si7	0.60 to 0.70	1.50 to 2.00	0.80 to 1.00	0.030	0.030	—	—	—
6	50Cr4V2	0.45 to 0.55	0.15 to 0.35	0.50 to 0.80	0.030	0.030	0.90 to 1.20	0.15 to 0.30	—
7	60Cr4V2	0.55 to 0.65	0.15 to 0.35	0.80 to 1.00	0.030	0.030	0.90 to 1.20	0.15 to 0.30	—
8	51CrMoV	0.48 to 0.56	0.15 to 0.40	0.70 to 1.10	0.030	0.030	0.90 to 1.20	0.07 to 0.12	0.15 to 0.25

NOTE – The limiting diameters for bars for the manufacture of springs are indicated below for guidance.

a) 55Si7 : Recommended for bars up to 32 mm dia
b) 60Si7 : Recommended for bars up to 32 mm dia
c) 65Si7 : Recommended for bars up to 32 mm dia
d) 50Cr4V2 : Recommended for bars up to 32 mm dia
e) 60Cr4V2 : Recommended for bars up to 47.5 mm dia
f) 51CrMoV : Recommended for bars up to 47.5 mm dia

(*Page* 2, *Table* 2, *headed under Grade*) – Substitute '51CrMoV' *for* '51CrMoV4'.

(*Page* 3, *clause* **8.6.1**, *line* 3) – Substitute 'plain' *for* 'plane'.

(*Page* 3, *clause* **8.6.2**, *line* 2) – Substitute '60Cr4V2, 51CrMoV' *for* '60Cr4V3, 51CrMoV4'.

(*Page* 3, *clause* **9**, *line* 2) – Substitute '2.0' *for* '2.5'.

(*Page* 3, *clause* **10.2**, *line* 1; and *clause* **10.3**, *line* 6) – Substitute 'peeled' *for* 'pealed'.

[*Page* 3, *clause* **11.4** (b), *line* 1] – Substitute 'Peeled' *for* 'Pealed'.

(MTD 4)

Printed at Dee Kay Printers, New Delhi-110015, India.

Indian Standard

STEEL FOR THE MANUFACTURE OF VOLUTE AND HELICAL SPRINGS (FOR RAILWAY ROLLING STOCK) — SPECIFICATION

(Third Revision)

1 SCOPE

1.1 This standard covers the requirements for steel in the form of flats and rounds intended to be used for the manufacture of volute and helical springs for railway rolling stock.

1.2 Steel ingots and billets conforming to IS 8052 : 1976 may be used for the manufacture of flats and rounds conforming to this standard.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard.

IS No.	*Title*
228	Methods for chemical analysis of steel (*second revision*)
1500 : 1983	Brinell hardness for metallic materials (*second revision*)
1762 (Part 1) : 1974	Code for designation of steel : Part 1 Based on letter symbols
4163 : 1982	Method for determination of inclusion content in steel by microscopic method
6396 : 1983	Method of measuring decarburized depth of steel
8052 : 1976	Steel ingots and billets for the production of volute and helical springs (for railway rolling stock)
8910 : 1978	General technical delivery requirements for steel and steel products

3 GRADES

Steel shall be of eight grades as specified in Table 1.

4 SUPPLY AND MATERIAL

General requirements relating to the supply of material shall conform to IS 8910 : 1978 'General technical delivery requirements for steel and steel products'.

5 MANUFACTURE

5.1 Steel shall be manufactured by any process of steel making except the bessemer process. It shall be followed by secondary refining or vacuum melting.

5.2 The size of ingots, billets or continuous cast billets for any given size of finished steel product shall be such that a minimum reduction ratio of 16 : 1 from the minimum cross sectional area of the ingot billet or continuous cast billets to the maximum cross sectional area of the product is ensured. However, reduction ratio other than that specified may be agreed subject to mutual agreement between the purchaser and the manufacturer.

6 CHEMICAL COMPOSITION

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

6.2 Incidental Elements

Elements not quoted in Table 1 shall not be intentionally added to the steel without the agreement of the purchaser, other than for the purpose of finishing the heat. All reasonable precautions shall be taken to prevent the addition from scrap or other materials used in manufacture of such elements which effect the hardenability, mechanical properties and applicability.

6.3 Product Analysis

The permissible variation in the case of product analysis from the limits specified in Table 1 shall

Table 1 Chemical Composition
(*Clauses* 3, 6.1 *and* 6.2)

Sl No.	Grade Designation [*see* IS 1762 (Part 1) : 1974]	Constituents, Percent							
		Carbon	Silicon	Manganese	Sulphur *Max*	Phosphorus *Max*	Chromium	Vanadium	Molybdenum
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1)	98C6	0·90 to 1·05	0·15 to 0·35	0·50 to 0·80	0·050	0·050	—	—	—
2)	113C6	1·05 to 1·20	0·15 to 0·35	0·50 to 0·80	0·050	0·050	—	—	—
3)	55Si7	0·50 to 0·60	1·50 to 2·00	0·80 to 1·00	0·040	0·040	—	—	—
4)	60Si7	0·55 to 0·65	1·50 to 2·00	0·80 to 1·00	0·040	0·040	—	—	—
5)	65Si7	0·60 to 0·70	1·50 to 2·00	0·80 to 1·00	0·040	0·040	—	—	—
6)	50Cr4V2	0·45 to 0·55	0·15 to 0·35	0·50 to 0·80	0·040	0·040	0·90 to 1·20	0·15 to 0·30	—
7)	60Cr4V2	0·55 to 0·65	0·15 to 0·35	0·80 to 1·00	0·040	0·040	0·90 to 1·20	0·15 *Min*	—
8)	51CrMoV	0·48 to 0·56	0·15 to 0·40	0·70 to 1·1	0·035	0·035	0·90 to 1·20	0·07 to 0·12	0·15 to 0·25

NOTE — The limiting diameters for bars for the manufacture of springs are indicated below for guidance.

a) 55Si7 : Recommended for bars up to 32 mm dia
b) 60Si7 : Recommended for bars up to 35 mm dia
c) 65Si7 : Recommended for bars up to 45 mm dia
d) 50Cr4V2 : Recommended for bars up to 33 mm dia
e) 60Cr4V2 : Recommended for bars up to 38 mm dia, and up to 47·5 mm dia
f) 51CrMoV4 : Recommended for bars up to 38 mm dia and up to 47·5 mm dia

be as Follows:

Constituent	*Permissible Variation Over Specified Limit Percent*
Carbon	± 0·03
Manganese	± 0·04
Silicon (up to and including 0·40)	± 0·03
(above 0·40)	± 0·05
Sulphur	± 0·005
Phosphorus	± 0·005
Chromium	± 0·03
Vanadium	± 0·02
Molybdenum	± 0·03

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

7 HARDNESS

7.1 The hardness of the material when tested in accordance with IS 1500 : 1983 shall be as given at Table 2.

Table 2 Brinell Hardness
(*Clause* 7.1)

Grade	Hardnes HB	
	Untreated Condition (For Guidance Only)	Annealed Condition *Max*
98C6	—	240
113C6	—	240
55Si7	≈ 270	245
60Si7	≈ 255	245
65Si7	≈ 255	245
50Cr4V2	≈ 310	245
60Cr4V2	≈ 310	255
51CrMoV4	≈ 310	255

7.1.1 In case of hot rolled material limits for hardness other than those given in Table 2 may be mutually agreed upon between the manufacture and the consumer at the time of enquiry and order.

8 DECARBURIZATION

8.1 Complete Decarburized Depth

Complete decarburized depth is the depth measured at right angles to the surface of the zone which contains at least 90 percent ferrite.

8.2 Partial Decarburized Depth

Partial decarburized depth is the depth measured at right angles to the surface, of the zone, which contains less carbon than the general carbon content of the core. The limit of this zone is the point where a micro structural change between the surface and core is apparent.

8.3 Total Decarburized Depth

Total decarburized depth is the sum of the complete and the partial decarburized depths.

8.4 For round bar, wherever possible, a full cross-sectional specimen shall be examined, whilst for flat bar a longitudinal or cross-sectional specimen shall be taken from the central width region of the bar. In each case five worst areas shall be examined.

8 5 The decarburization shall be examined at a magnification of × 100 on test specimen suitably etched and cut from a full cross section of the test bar showing at least 25 mm of the original perimeter, as per IS 6396 : 1983.

8.6 Depth of Decarburization

8.6.1 The average total depth of decarburization (partial plus complete) of five deepest uniformly decarburized zones for plane carbon and Silicon-Manganese spring steels shall be limited to 0·15 mm + 1·0 percent of the bar diameter.

8.6.2 For the high grade steels (50Cr4V2, 60Cr4V3, 51CrMoV4) the maximum values of decarburization depth (only partial) in the hot-rolled condition shall be as given in Table 3. Complete decarburization is not permissible.

Table 3 Permissible Depth of Decarburization

(*Clause* 8.6.2)

Nominal Dimension	Permissible Decarburization Depth, *Max*
n m	mm
Diameter	Products, with round cross-section
> 3 < 10	0·15
> 10 < 18	0·20
> 18 < 30	0·30
> 30 < 50	0·55
> 50 < 80	0·80
Thickness	Products with rectangular cross-section
< 7	0·20
> 7 < 15	0·30
> 15 < 25	0·40
> 25 < 35	0·55
> 35 < 80	0·80

8.6.3 No decarburization (partial or total) shall be permitted on centreless ground bars.

9 INCLUSION RATING

The inclusion rating when determined as per IS 4163 : 1982 shall not be worse than 2·5 A, B, C, D both for thick and thin series given at Fig 2 of IS 4163 : 1982.

10 FREEDOM FROM DEFECTS

10.1 The surface of the hot-rolled material shall be reasonably smooth and free from distortion twist, and kinks, and shall be substantially straight.

10.2 The precision ground and pealed bars shall be free from surface defects, such as folds, laps, cracks, pits and grooves. The surface shall be bright, straight, smooth and free from scales distortion, twist and kinks.

10.3 The hot rolled bars shall be free from harmful defects namely seams, folds, lapses, cracks deep pits, grooves, excessive scaling, etc; which may lead to cracking during hardening or impair the serviceability. The material (hot-rolled, as well as, pealed and centreless ground bars) shall be free from harmful internal defects, such as piping and segregation, which may impair serviceability.

11 DIMENSIONS AND TOLERANCES

11.1 Dimensions of bars for springs shall be, as specified by the purchaser.

11.2 Tolerances on hot-rolled bars shall be as follows:

		Tolerance, Percent
a) Flats	Thickness	+ 2·0 − 1·5
	Width	± 1·0
b) Rounds	Diameter	+ 1·0 percent with a minimum of 0·20 mm − 0·8 percent with a minimum of 0·15 mm
c) Bevels		+ 1·5 percent with a minimum of 0·40 mm − 1·0 percent with a minimum of 0·30 mm

11.3 For centreless ground and precision hot-rolled bars, the tolerances shall be as follows:

Type of Bar	*Tolerance on Diameter* mm
Centreless ground bars	± 0·05
Precision hot-rolled bars	
a) 10 mm and above	± 0·20
b) Below 10 mm	± 0·10

11.4 The material shall be supplied in straightened condition and the requirements for out-of-straightness shall be as given below:

a) Hot-rolled bars	1·5 mm per metre length, *Max*
b) Pealed and centreless ground bars	1·0 mm per metre length, *Max*

12 CALCULATION OF MASS

The mass of the material shall be calculated on the basis, that the steel weighs 7·85 g/cm³.

13 SAMPLING

13.1 Chemical Analysis

One bar for every 20 tonnes or part thereof the material from the same cast and section shall be analysed as per requirements given in 6. The analysis results obtained shall meet the requirements of product analysis as stipulated in 6.3.

13.2 Hardness Test

Two percent of the bars of the same section and cast shall be tested for hardness in accordance with IS 1500 : 1983. The average of three readings for hardness shall comply with requirements given in Table 2.

13.3 Dimensional Check

Three percent of bars selected at random shall be checked for conformity with the requirement of dimensions and tolerances as specified in 11.

13.4 Decarburization

Two percent of the bars (by number) of the same section and if annealed two percent from each annealed batch (by number) selected at random, shall be tested for decarburization.

13.5 Inclusion Rating

Two sample of the same section and cast selected at random shall be tested for inclusion rating.

14 DELIVERY

14.1 The material shall be supplied in any one of the following conditions subject to mutual agreement between the purchaser and the supplier:

a) As-rolled and straightened,

b) Annealed and straightened, and

c) Precision ground and pealed.

14.2 The surface of the material may be coated with a thin layer of anti-rust oil, when agreed to between the purchaser and the supplier.

15 MARKING

15.1 Each bar over 15 mm diameter or of equivalent cross-section shall be stamped with the name or trade-mark of the manufacturer, grade and the cast number or identification mark by which the steel may be traced to the cast from which it has been made. Such marking shall be made at the extreme end of each bar.

15.2 Bars of 12 mm diameter or of equivalent cross-section, and below shall be bundled as agreed to between the purchaser and the supplier and a metal tag attached to each bundle shall bear similar marks as described in 14.1.

15.3 The material may also be marked with Standards Mark. Details available with the Bureau of Indian Standards.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc : No. **MTD 4 (3465)**

Amendments Issued Since Publication

Amendment No.	Date of Issue	Text Affected

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