IS 8081 (1976): slotted sections [CED 7: Structural Engineering and structural sections]

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IS : 8081-1976
(Reaffirmed 2010)

Indian Standard

SPECIFICATION FOR SLOTTED SECTIONS

(Third Reprint SEPTEMBER 1998)

UDC 669-423-45

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110 002

Gr 4 *September* 1976

Indian Standard

SPECIFICATION FOR SLOTTED SECTIONS

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(*Continued on Page* 13)

AMENDMENT NO. 1 DECEMBER 1979

TO

IS:8081-1976 SPECIFICATION FOR SLOTTED SECTIONS

Alterations

(*Page 4, clause 2.1*) - Substitute the following for the existing clause:

'2.1 Slotted Section— A structural member cold formed from a metal strip, extrusion (in case of aluminium only) generally of angle, channel, flat and tee sections. These sections have a repetitive pattern of perforation and are fastened together by bolts/screws and nuts. The shape of the perforations should be continuous curve free of a corner or a notch.'

(*Page 5, clause 5.4, line 3*) - Delete the words 'shall be given as even finish'.

(*Page 9, clause 6.6.2.1, line 1*) - Substitute 'shall' *for* 'will'.

(SMBDC 7)

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Indian Standard

SPECIFICATION FOR SLOTTED SECTIONS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 14 May 1976, after the draft finalized by the Structural Engineering Sectional Committee had been approved by the Structural and Metals Division Council and Civil Engineering Division Council.

0.2 Slotted sections have come into use to a large extent because of their ease in erection, dismantling and re-erection and facility in transport. They have been used successfully in a number of applications like:

a) *single and multi-tier storage equipment;*
b) light framed structures;
c) material handling equipment;
d) partitioning;
e) display equipment;
f) access equipment;
g) walkways and platforms; and
h) suspended ceiling, etc.

0.3 This standard has been prepared to guide the industries in the manufacture and use of slotted sections.

0.4 Some design considerations have also been incorporated to facilitate the design of structures with slotted sections.

0.5 This standard keeps in view the manufacturing and trade practices being followed in the country in this field.

0.6 In the formulation of this standard, assistance has been derived from BS 4345 : 1968 ' Specification for slotted angles ' issued by British Standards Institution.

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.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard covers the requirements, such as materials, workmanship, finish, strength tests, general design provisions, tolerances on dimensions and marking for slotted sections.

1.2 This standard does not apply to steel sections used for the fabrication of metal shelving cabinet (adjustable type) and metal shelving racks (adjustable type) which are covered by IS : 3312-1974* and IS : 1883-1975† respectively.

2. DEFINITION

2.1 Slotted Section — A structural member cold formed from a metal strip, extrusion generally of angle, channel, flat and tee sections. These sections have a repetitive pattern of perforation and are fastened together by bolts/screws and nuts. The shape of the perforations should be continuous curve free of a corner or a notch.

3. MATERIALS

3.1 Steel — Steel for the manufacture of slotted sections shall conform to any one of the grades shown in Table 1.

TABLE 1 STEELS FOR MANUFACTURE OF SLOTTED SECTIONS

Steel Conforming to	Grades
(1)	(2)
IS : 513-1973*	O, D, DD, EDD
IS : 1079-1973†	O, D, DD, EDD
	St 34
	St 42
	St 50
	St 52
IS : 4030-1973‡	Half hard
	Quarter hard

*Specification for cold rolled carbon steel sheets (*second revision*).
†Specification for hot rolled carbon steel sheet and strip (*third revision*).
‡Specification for cold rolled carbon steel strip for general engineering purposes (*first revision*).

3.2 Aluminium — Aluminium for slotted sections shall conform to IS : 733-1975‡ or IS : 737-1974§ as appropriate.

*Specification for steel shelving cabinets (adjustable type) (*first revision*).
†Specification for metal shelving racks (adjustable type) (*second revision*).
‡Specification for wrought aluminium and aluminium alloy bars, rods and sections (for general engineering purposes) (*second revision*).
§Wrought aluminium and aluminium alloys, sheet and strip (for general engineering purposes) (*second revision*).

3.3 Quality of Material — One tensile test and one bend test shall be conducted according to the procedure specified in IS : 1663-1972* (IS : 1816-1961† for aluminium) and IS 1692-1974‡ (IS : 4598-1968§ for aluminium) for each 10t of material from which the sections are formed.

3.3.1 These tests may be carried out on the strip supplied by the steel/aluminium supplying mill or by the manufacturer of slotted sections, at the stage immediately prior to punching and forming

4. WORKMANSHIP

4.1 Sections shall be supplied free from all burrs.

5. FINISHES

5.1 The manufacturer shall state the finish applied.

5.2 Before any paint finish is applied, all surfaces shall be free from scale, grease, rust or other surface imperfections. A coat of anti-rust treatment shall be applied before painting the steel surfaces.

5.3 If galvanizing is carried out, it shall comply with IS : 4759-1968‖. Anodizing of aluminium sections, if required, shall comply with IS : 1868-1968¶.

5.4 All finishes shall cover evenly all exposed surfaces, including punched edges (this applies only to standard lengths of sections and not to sections cut after finishing) shall be given as even finish.

6. METHODS OF TEST FOR STRENGTH OF SLOTTED SECTIONS

6.1 General

6.1.1 Tests shall be carried out by the manufacturer according to the provisions contained in this standard These tests shall be proved and authorized by an independent authority.

6.1.2 All sections shall be tested in the manner described in this specification. Further tests may be specified for applications not covered in this standard For these tests, conditions of loading shall be representative of those applying in practice. The requirements specified in **6.1.3** and **6.1.4** shall be complied with

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*Method for tensile testing of steel sheet and strip of thickness 0 5 mm to 3 mm (*first revision*).

†Method for tensile test for light metals and their alloys

‡Method of simple bend testing of steel sheet and strip less than 3 mm thick (*first revision*).

§Method for simple bend test for aluminium and aluminium alloy sheet and strip of thickness between 0 2 mm and 7 mm.

‖Specification for hot-dip zinc coatings on structural steel and other allied products

¶Specification for anodic coatings on aluminium (*first revision*)

6.1.3 Evaluation of test results shall be made on the basis of the mean value obtained from not less than three identical specimens, provided the deviation of any individual test results from the mean value does not exceed ± 10 percent. If such deviation from the mean value does exceed 10 percent, at least three more tests of the same kind shall be made. The average of the three lowest values of all tests made shall then be regarded as the result of the series of tests.

6.1.4 To determine the minimum yield stress (0·2 percent proof stress in case of aluminium section) of the test pieces, a coupon shall be cut from a section produced from the same strip as the specimens and shall be loaded in tension in accordance with IS : 1663-1972* (IS : 1816-1961† for aluminium). Failure loads as determined in **6.1.3** shall be reduced in the following ratio:

$$\frac{\text{Minimum yield stress of material (minimum 0·2\% proof stress in case of aluminium sections)}}{\text{Yield stress of test piece (0·2\% proof stress in case of aluminium sections)}}$$

In no case shall this ratio be greater than one Any results obtained from test pieces with a yield stress (0 2 percent proof stress in case of aluminium section) lower than the specified minimum shall be ignored.

NOTE — For the purpose of this standard the minimum yield stress of material (other than aluminium sections) shall be taken as given in Table 2.

TABLE 2 MINIMUM YIELD STRESS VALUES FOR STEELS TO BE USED FOR MANUFACTURE OF SLOTTED SECTIONS

STEEL CONFORMING TO	GRADES	MINIMUM YIELD STRESS IN N/mm²
(1)	(2)	(3)
IS : 513-1973*	O, D, DD, EDD	140
IS : 1079-1973†	O, D, DD, EDD	170
	St 34	205
	St 42	235
	St 50	295
	St 52	355
IS : 4030-1973‡	Half hard	370
	Quarter hard	245

*Specification for cold rolled carbon steel sheets (*second revision*).

†Specification for hot rolled carbon steel sheet and strip (*third revision*).

‡Specification for cold rolled carbon steel strip for general engineering purposes (*first revision*).

*Method for tensile testing of steel sheet and strip of thickness 0·5 mm to 3 mm (*first revision*).

†Method for tensile test for light metals and their alloys.

6.1.5 The pattern and pitch of stitching bolts in tests on compound sections shall be specified by the manufacturer and shall conform to his normal constructional practice.

6.2 Compression Test — Struts shall be tested to failure in two ways as given below:

a) *Concentrically Loaded* — The struts shall be ball loaded at each end through the calculated centre of area of the minimum net cross section.

Ball seatings shall be such as to offer no torsional or rotational resistance to the ends of the member. The thickness of ball seatings shall be a minimum. The length of the member shall be taken to the centre of the balls.

b) *Eccentrically Loaded* — The line of load shall coincide with the centre line of a specified line of holes. The end of the member shall be free to rotate about one axis and restrained at right angles to it (*see* Fig. 1).

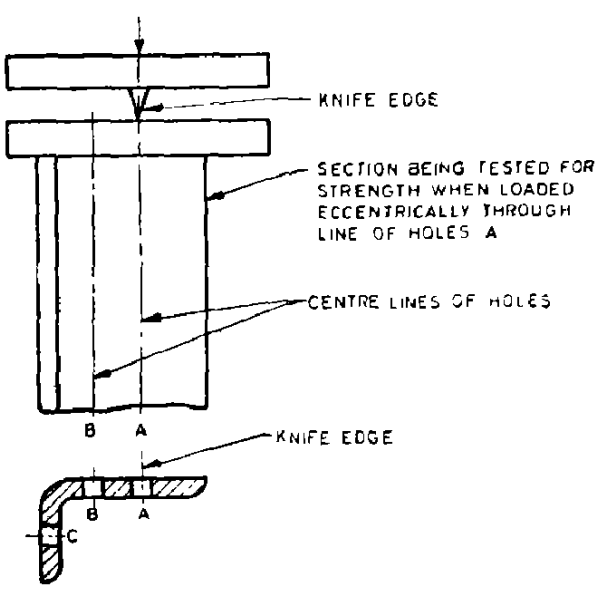

FIG. 1 END CONDITIONS FOR ECCENTRIC STRUT TEST
(OTHER END SIMILAR)

6.3 Bending Tests — Beams shall be supported at each end with the manufacturer's specified bolt pattern (the bolts may have to be high tensile in order to avoid being sheared). The effective span of the beam shall be taken centre-to-centre of the bolt group. Loading shall be point loads applied at one-third points of the effective span. Loading shall be through balls centred over the flanges of sections as shown in Fig. 2 and be such as to offer no restraint to torsion, lateral buckling or other deformation of the section. The deflection of the point marked *A* at the centre of the beam shall be measured. Loading shall be to failure. Load deflection graphs shall be plotted (*see* Fig. 3), and the flexural rigidity of the section (based on the effective span) calculated. Where the load deflection curve is not straight, a secant value for flexural rigidity may be taken to whatever value of deflection is considered limiting for general design. Based on the moments of resistance and flexural rigidity measured in the point load test, loads and deflections may be calculated for any other system of loading.

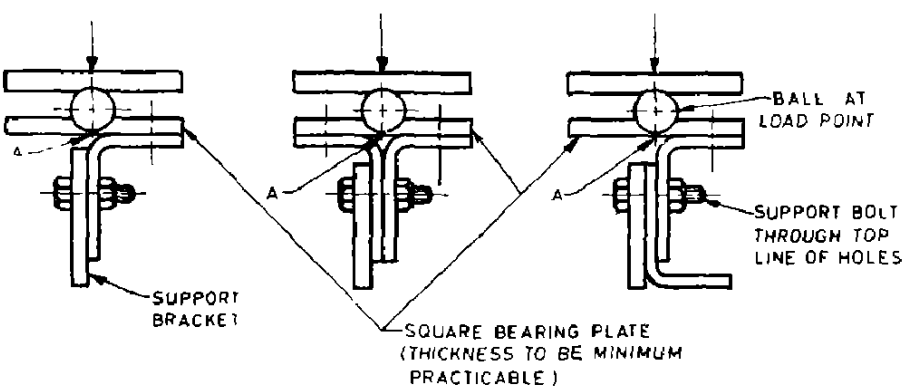

FIG. 2 METHOD OF SUPPORT AND LOAD APPLICATION IN BENDING TESTS

6.4 Tension Tests — Tensile strengths of members shall be determined under both concentric and eccentric conditions of loadings. Eccentric ties shall be loaded through one flange only, the line of load coinciding with a specified line of holes

6.5 Bearing Test — Bearing strength of section shall be determined for the different sized bolts to be used with the sections

6.6 Presentation of Test Results

6.6.1 The report of the independent supervising engineer shall quote all conditions of test, failure loads of specimens and yield stresses (0·2 percent proof stress in case of aluminium sections) of specimen material.

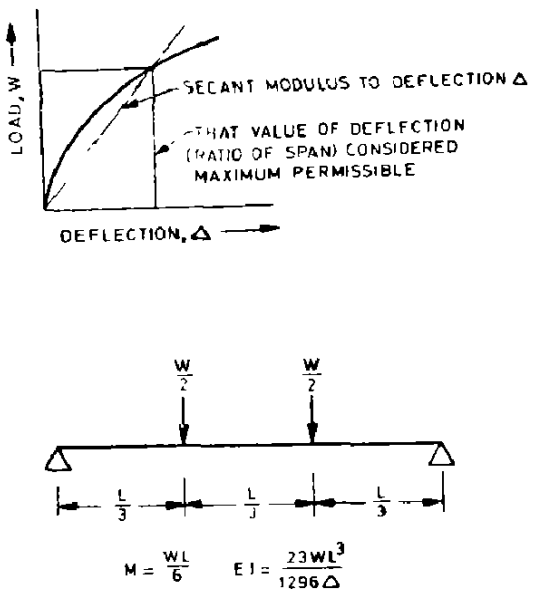

FIG 3 TYPICAL LOAD/DEFLECTION GRAPH FROM BENDING TEST AND EXPRESSIONS FOR BENDING MOMENT AND FLEXURAL RIGIDITY

6.6.2 Technical data sheets giving safe working loads for design purposes shall state clearly the applicability and limitations of all information including minimum factor of safety on collapse. Information should be given on the design and construction of connections so that these can be effected in such a way that the conditions of loading on a section in practice are similar to, or less severe than, the conditions imposed in the tests. Design strengths shall be given for:

a) concentrically loaded struts with an effective length factor of one,

b) simply supported beams carrying a uniformly distributed load in accordance with **7.3**,

c) concentrically loaded ties, and

d) bearing strength.

Any other information based on test procedures described in **6.1.3** and **6.1.4**, which the manufacturer may consider relevant shall be given.

6.6.2.1 The manufacturer will be responsible for the values of safe working loads for design purposes and other information furnished by him.

6.6.3 Design strength should be quoted for not more than increments of 30 cm length. Design strengths in **6.6.2** (a), (b) and (c) shall be obtained from tests specified in **6.2, 6.3** and **6.4** respectively. Any additional information if required shall be supplied by the manufacturer regarding the tests prescribed in **6.2, 6.3** and **6.4**.

6.6.4 The safe load values shall be certified as having been obtained from tests in accordance with the relevant clauses of this standard and adjusted for the minimum specified yield stress (0·2 percent of proof strees in case of aluminium section) for the material. The certificate shall be signed by an independent qualified engineer supervising the tests.

7. GENERAL DESIGN PROVISIONS

7.1 Permissible Loads and Factors of Safety — For design purpose the safe working loads shall be obtained by dividing failure load value (based on the procedure described in **6.1.3** and **6.1.4**) by the minimum factor of safety as given below:

Steel Conforming to	*Factor of Safety*
IS : 513-1973* and IS : 1079-1973†	2·1
(IS : 733-1975‡ and IS : 737-1974§) for aluminium	
IS : 4030-1973‖	1·85

7.1.1 For permissible stresses in aluminium alloys, reference may be made to IS : 8147¶.

7.2 Limiting Beam Deflection — The deflection of member shall not be such as to impair the strength or efficiency of the structure or lead to damage. Generally the deflection should not exceed 1/180 of the span.

7.3 The safe load values for beams shall be determined as given in **7.1** and **7.2**. The lesser of the two values shall be specified as safe working load for beams. However, in case of loads which are determined purely on the basis of the deflection, this value should be given in different colour or

*Specification for cold rolled carbon steel sheets (*second revision*).

†Specification for hot rolled carbon steel sheet and strip (*third revision*).

‡Specification for wrought aluminium and aluminium alloy bars, rods and sections (for general engineering purposes) (*second revision*).

§Specification for wrought aluminium and aluminium alloys, sheet and strip (for general engineering purposes) (*second revision*).

‖Specification for cold rolled carbon steel strip for general engineering purposes (*first revision*).

¶Code of practice for use of aluminium alloys in structures (*Under print*).

different type of print. In no case shall the design loads exceed the safe working load limits.

8. TOLERANCES ON DIMENSIONS

8.0 Tolerances on dimensions shall be as given in **8.1** to **8.9**.

8.1 Flange Sectional Dimensions — The tolerances on sum of the dimensions of all flanges shall not exceed the following:

Nominal Size		*Tolerance* percent
Over	Up to and Including	
mm	mm	
—	40	±5
40	50	±4
50	75	±3
75	—	±2

8.2 Flange Thickness — The tolerances on the thickness of the section, for three grades of steel and for aluminium section shall conform to the respective specification as appropriate.

8.3 Internal Radius of Bend — The internal radius of bend shall be not less than the thickness, and shall have a tolerance of 1·00 mm on the nominal radius.

8.4 Angle of Bend — The angle of bend shall be ±2° throughout the width of the flange

8.5 Size of Holes — The tolerance on size of holes shall be ±0·1 mm.

8.6 Pitch of Holes — The deviation in the pitch of holes shall be ±0·1 mm.

8.7 Overall Length

8.7.1 *Standard Length* — The tolerance on standard lengths shall be ±1·6 mm.

8.7.2 *Overall Centre-to-Centre of End Holes* — The tolerance on overall centre-to-centre of end holes shall be ±1·6 mm.

8.8 Straightness — The offset shall not be more than 1/600 of the length.

8.9 Twist of Section — The twist of section shall not be more than 40 minutes of angle per metre.

9. BOLTS AND NUTS

9.1 Bolts or screws and nuts used in conjunction with slotted section shall generally be of hexagonal type. The detail specification of fastening may be mutually decided between manufacturer and the purchaser.

10. MARKING

10.1 The slotted sections shall be marked with manufacturer's identification at suitable intervals not exceeding 300 mm. The cutting mark may be provided at appropriate intervals not exceeding 100 mm.

10.1.1 The product may also be marked with Standard mark

10.2 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

(*Continued from page* 2)

Panel for Slotted Sections, SMBDC 7 : P 28

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53/5 Ward No 29, R G Barua Road, 5th By-lane, GUWAHATI 781003	54 11 37
5-8-56C, L N Gupta Marg, Nampally Station Road, HYDERABAD 500001	20 10 83
E-52, Chitaranjan Marg, C-Scheme, JAIPUR 302001	37 29 25
117/418 B, Sarvodaya Nagar, KANPUR 208005	21 68 76
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