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भारतीय मानक मसौदा

खदानों में उपयोगी छत की छड़े — विशिष्टि

(आई एस 8473 का दूसरा पुनरीक्षण)

Draft Indian Standard

ROOF BARS USED IN MINES — SPECIFICATION

(Second Revision of IS 8473)

ICS 73.100.01

**Mining Techniques and Equipment
Sectional Committee, MED 08**

**Last date for receipt of
comments is 03 December 2022**

FOREWORD

(Formal clause to be added later)

This standard was first published in 1977 and consequently revised in 1988. This standard is being revised again to keep pace with the latest technological developments and international practices. In this revision, the following major changes have been made:

1. A reference clause has been added mentioning the latest version of all the referred standards.
2. Editorial corrections have been done.

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 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded-off value should be the same as that of the specified value in this standard.

1 SCOPE

Covers the requirements of roof bars (both link bars and uncoupled bars) used in mines.

2 REFERENCES

The standards listed below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to the agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
2062 : 2011	Hot rolled medium and high tensile structural steel – Specification (<i>seventh revision</i>)
1570 (Part 2) Sec 1: 1979	Schedules for wrought steels: Part 2 carbon steels (Unalloyed Steels) : Sec 1 wrought products (Other Than Wires) with specified chemical composition and related properties (<i>first revision</i>)
1570 (Part 4) : 1988	Schedules for wrought steels: Part 4 alloy steels (Alloy Constructional And Spring Steels) with specified chemical composition and mechanical properties (<i>first revision</i>)
1875 : 1992	Carbon steel billets, blooms, slabs and bars for forgings – Specification (<i>fifth revision</i>)
4368 : 1967	Specification for alloy steel billets, blooms and slabs for forging for general engineering purposes
12464 : 1988	Methods of test for roof bars used in mines.

3 TYPES AND CLASSIFICATION

The roof bars shall be of two types, link bars, and uncoupled bars. The link bars shall be four classes 1, 2, 3 and 4. The roof bars are classified according to the strength of the bar section at the support point (or points in case of multiple positions for prop support). The nominal bending moments for various roof bars shall be as given in Table 1.

Table 1 Bending Moments for Bars
(*Clause 3*)

Type of Bars	Class	Nominal bending Moment	
		kN.m	Tonne-cm
Link bars	1	40	408
	2	60	612
	3	70	714
	4	80	816
Uncoupled bar	-	60	612
NOTE — The various classes of roof bars shall be used with suitable matching props only, keeping the bending moment within the nominal values specified.			

4 NOMENCLATURE

The nomenclature of parts of the roof bar shall be as given in Fig. 1.

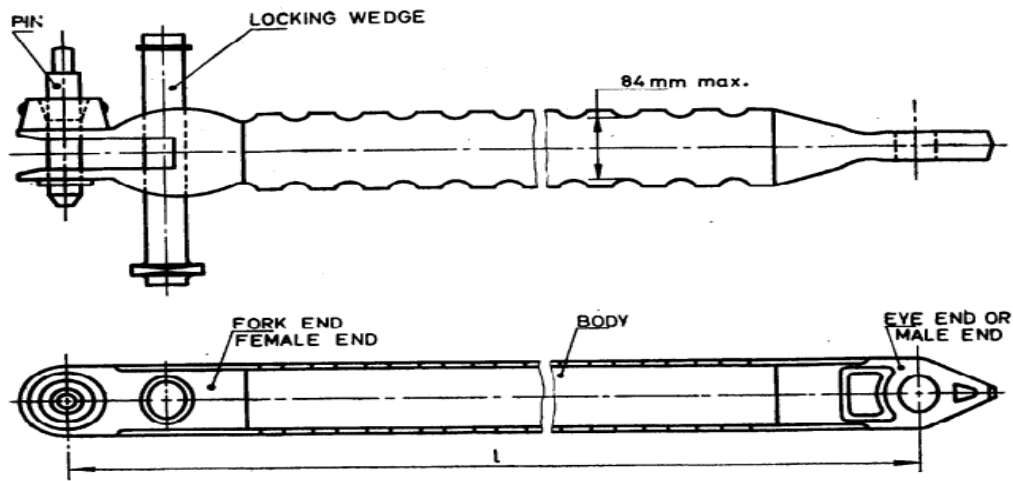
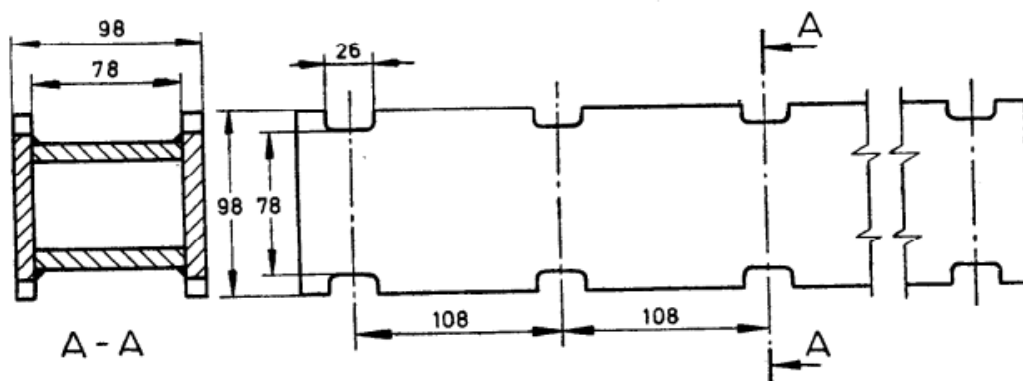


FIG. 1 NOMENCLATURE OF PARTS OF LINK BAR

4.1 Nominal length (I)

The nominal length of a roof bar is the distance between the centre of the hole at the eye end (or the centre of the pin at the male end in case of roof bars with shackles) and the centre of the corresponding matching hole at the fork end (or female end). The nominal length of an uncoupled bar (Fig. 2) is the length between its end points.



All dimensions in millimeters.

FIG. 2 UNCOUPLED BAR BODY ILLUSTRATION

NOTE — Fig. 1 and 2 are intended to illustrate the nomenclatures of parts and stipulated dimensions. These are not intended to specify any particular construction or design.

5 DIMENSIONS

In addition to the dimension stipulated in Fig. 1, the nominal length L of the link bar shall be one of the following:

Nominal length L mm	1 000	1 250	1 500	3 000
Tolerance on L mm	± 5	± 5	± 5	± 5

5.1 Uncoupled bars (*see* Fig. 2) may have nominal lengths as in 4 and more than 3 000 mm as agreed to between the purchaser and the manufacturer.

6 CONSTRUCTION

6.1 The body of the roof bar shall be manufactured by either one or a combination of any two of the following processes:

- a) Welding of rolled steel section;
- b) Casting; and
- c) Forging.

6.2 The cross-section of the roof bar body may be of different shapes, for example, 1-section, box-section, etc.

7 MATERIAL

7.1 Materials used in the construction of roof bar bodies shall be as follows:

Process of Construction	Material
Fabrication by welding	a) E 410 of IS 2062 b) 20Mn2 and 27 Mn2 of IS 1570 (Part 2) Sec 1
Casting	Grade 1 and 2 of IS 2708
Forging	a) Class 3, 3A and 4 of IS 1875 b) 20Mn2 of IS 4368 c) 11Mn2, and 27Mn2 of IS 1570 (Part 2) Sec 1

NOTE — Aluminium, magnesium or their alloy shall not be used for the construction of any part of roof bar including the wedge and the pin.

7.1.1 The material for eye and fork end pieces, when cast or forged separately and welded to the main body, shall be of weldable quality or otherwise appropriate precautions shall be taken during welding.

7.1.2 Material of the weld shall, as far as possible, have the same properties as the constituent parts of the main bar section.

7.1.3 Other materials having a minimum elongation of 10 percent on a gauge length of $5.65 \sqrt{S_0}$ and a minimum izod impact value of 35 kN.m may also be used.

7.2 Wedges shall be cast or forged from the materials specified in **6.1** for respective process of construction. Pins shall be forged or fabricated from the materials specified in **6.1** for respective process of construction.

8 HARDNESS

- a) For locking wedges : 210-370 *HV* (200-350 *HB*)
- b) For pins : 300-350 *HV* (285-330 *HB*)

9 GENERAL REQUIREMENTS

9.1 External surfaces of the roof bar shall not have any sharp corners or edges which may injure human body while handling the bar.

9.2 Roof bars may have one or more points of support but the construction of the roof bar shall be such as to prevent the crown of prop from shifting.

9.3 The width of roof bar at the support point shall not be more than 84 mm excluding the elements provided to prevent the shifting of the crown of prop.

9.4 The top and the bottom surfaces of roof bar shall be flat, without any projection, to have proper contact with the roof and the seat of the crown of prop.

9.5 In case of link bars having single-point support, the support point for props shall be at about one-third the nominal length from the eye-end (or male end).

9.6 The attachment to connect two identical link bars shall consist either of pin and locking wedge or of pin and shackle (bar shoe).

9.7 All coupling elements of a link bar, for example, pin, locking wedge, etc, shall be made captive to the bar to avoid unintentional loss of small loose components during use in underground mines. However, in case of roof bar having a coupling with pin or shackle (bar shoe), the shackle may be made a separate complete unit.

9.8 The joint between the two link bars shall allow the roof bars to be set with a minimum angular displacement of 5° in vertical plane and 3° in horizontal plane in either direction.

9.9 Link bars, identical in all respects, shall have interchangeable mating parts.

9.10 Uncoupled bars of lengths more than 3 000 mm shall not be used as cantilever support.

10 DESIGNATION

10.1 A Class 4 link bar of welded construction and nominal length 1 250 mm shall be designated as:

Link Bar W4-1250 IS 8473

10.2 An uncoupled bar of forged construction and nominal length 3 000 mm shall be designated as:

Uncoupled Bar F-3000 IS 8473

NOTE — Symbols W, C and F shall be used for roof bars of welded, cast and forged construction, respectively.

11 TESTS AND TEST REQUIREMENTS

11.1 Type Tests

At least one group of four bars, numbered as 1, 2, 3 and 4 along with their coupling Parts, shall be subjected to tests as may be applicable to link bars and uncoupled bars laid down in 10.3 to 10.10 in the sequence indicated below:

Bar Numbers	Sequence of Tests to be Carried Out
1, 2 and 3	10.6.1
1	10.3
1 and 2	10.9, 10.4 and 10.8
2	10.5
3	10.6.2, 10.7
4	10.10

11.2 Routine Tests

11.2.1 All the roof bars manufactured shall be subjected to crushing test (*see 11.6.1*).

11.2.2 Roof bars as specified in col 2 of Table 2 shall be subjected to tests specified in **11.3**, **11.4**, **11.5**, **11.6.2**, and **11.9**.

11.2.3 No bar shall fail in any of the tests.

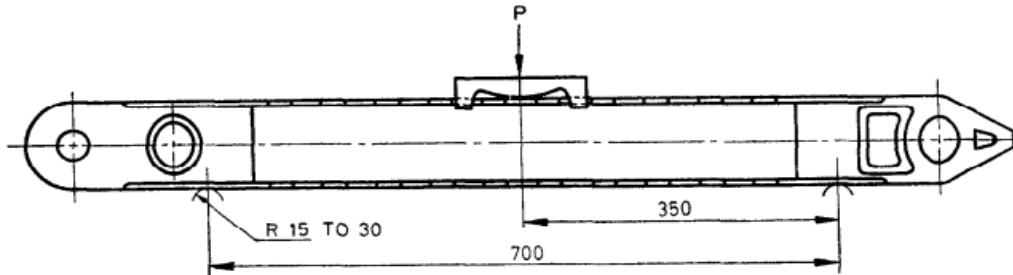
Lot Size	Sample Size
Up to 100	2
101 to 150	3
151 to 500	6
501 to 3 000	13
3 001 and above	20

11.3 Bend Test on Bar Section

The roof bar tested in accordance with 3.1 of IS 12464 with a span of 700 mm and gradual loading up to load P specified in Table 3, shall not have deflection of the bar at the centre, that is, at the point of application of load, by more than 10 mm.

Table 3 Loads for Bend Test on Bar Section of Roof Bars
(Clause 11.3 and 11.5)

All dimensions in millimeters.



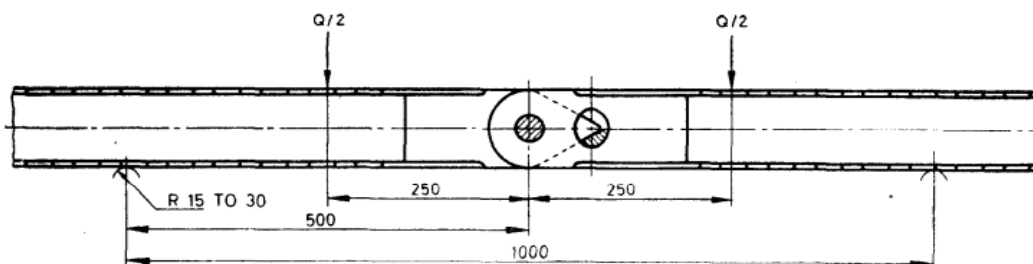
Type of Roof Bar	Class	Nominal Bending Moment kN.m	Load, P kN
Link bar	1	40	229
	2	60	343
	3	70	400
	4	80	457
Uncoupled bar	-	60	343

11.4 Bend Test on Joint

The link bars tested in accordance with 3.2 of IS 12464 with a span of 1 000 mm and gradual loading up to load Q specified in Table 4, shall not have deflection of the bars at the hinge pin more than 20 mm.

Table 4 Loads for Bend Test on Joints of Link Bars
(Clause 11.4)

All dimensions in millimeters.



Class of Link Bar	Bending Moment at Joint kN.m	Load, Q kN
1	22	176
2	27	216

3	30	240
4	32	256

11.5 Reverse Bend Test on Bar Section

The roof bar tested in accordance with 3.3 of IS 12464 and figure in Table 3 with a gradual load until the central deflection is 10 mm or until the load reaches a value R as specified in Table 5, whichever occurs first, shall withstand without failure 25 cycles of loading for link bars and uncoupled bars.

11.5.1 If any permanent deformation is noted during testing for reverse bend test on bar section, the bar shall be straightened before further tests are conducted in the reverse direction.

Table 5 Loads for Reverse Bend Test on Bar Section
(Clause 11.5)

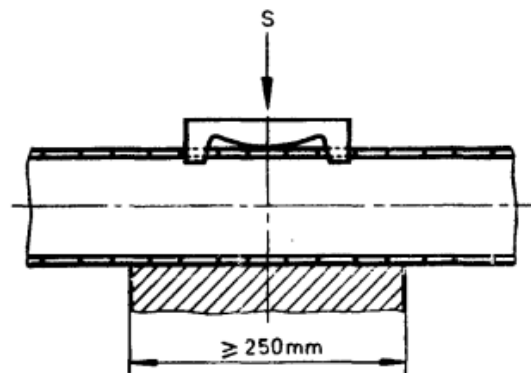
Type of Roof Bar	Class	Load, R kN
Link	1	200
	2	300
	3	350
	4	400
Uncoupled bar	—	300

11.6 Crushing Test

11.6.1 The roof bars tested in accordance with 3.4.1 of IS 12464 with a minimum length of 250 mm and a load S as specified in Table 6 shall not show any permanent deformation after the test.

11.6.2 The roof bar tested in accordance with 3.4.2 of IS 12464 shall withstand the crushing load S as specified in Table 6.

Table 6 Loads for Crushing Test on Roof Bars
(Clause 11.6.2)



Type of Roof Bar	Class	Load, R kN
Link	1	300
	2	450
	3	525
	4	600
Uncoupled bar	–	500

11.7 Destruction Test on Bar Section

The roof bar tested in accordance with 3.5 of IS 12464 shall withstand at least the bending moment specified in Table 7, before failure.

Table 7 Minimum Bending Moment for Roof Bars in Destruction Test on Bar Section
(Clause 11.7)

Type of Roof Bar	Class	Bending Moment kNm
Link bar	1	60
	2	90
	3	98
	4	112
Uncoupled bar	–	90

11.8 Destruction Test on Joint

The link bars tested in accordance with 3.6 of IS 12464 shall withstand at least the bending moment specified in Table 8 before failure.

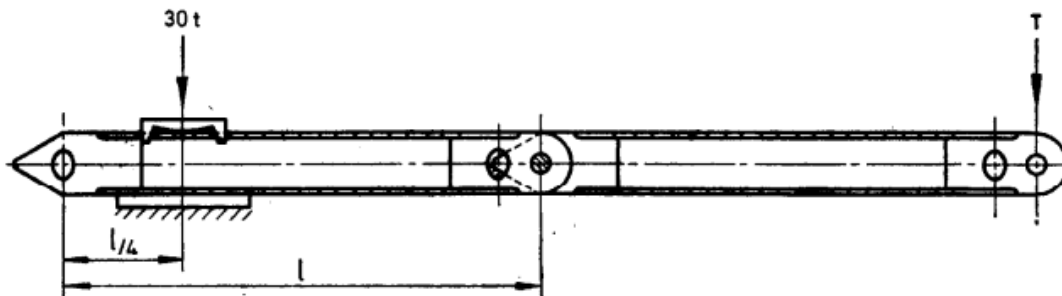
Table 8 Minimum Bending Moment of Joints of Link Bars
(Clause 11.8)

Class of Link Bar	Bending Moment kNm
1	33
2	41
3	44
4	45

11.9 Cantilever Test

The roof bar tested in accordance with 3.7 of IS 12464 with an end load T as specified in Table 9 gradually applied, shall sustain this load before deflecting 50 mm measured at the end of the bar. The distance between the point of load application and the nearest edge of the prop head for the uncoupled bar shall be 1 500 mm.

Table 9 Loads for Cantilever Tests
(Clause 11.9)



Type of Roof Bars	Class	Load, T , kN		
		$l < 1\ 250$ mm	$l > 1\ 250$ m	$l < 3\ 000$ mm
	1	5.0	3.0	–
	2	7.5	4.5	–
	3	8.75	5.25	–
	4	10.00	6.0	–
Uncoupled bar	–	–	–	10.00

11.10 Flaw Sensitivity Test

The roof bars tested in accordance with 3.8 of IS 12464 shall not show fracture before the deflection limit of 10 mm is reached.

11.11 Mode of Failure

Shall meet the requirements of 3.9 of IS 12464

12 MARKING

The roof bars shall be marked with the designation and manufacturer's name and/or his recognized trade-mark.

13.1 BIS Certification Marking.

Roof bars may also be marked with the Standard Mark.

13.1.1 The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016*

and the Rules and Regulations framed thereunder, and the products may be marked with the standard mark.