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भारतीय मानक मसौदा

आई से 'सी' हुक की लिफ्टिंग — 25 टन की क्षमता तक — विशिष्टि

(आई एस 4164 का दूसरा पुनरीक्षण)

Draft Indian Standard

**LIFTING 'C' HOOKS WITH EYE — CAPACITY UP TO 25 TONNES
— SPECIFICATION**

(Second Revision of IS 4164)

ICS 61.080

Cranes, Lifting Chains and Related
Equipment Sectional Committee, MED 14

Last date for receipt of comments is
14 June 2025

FOREWORD

(Formal clause will be added later)

This standard was first published in 1967 and subsequently revised in 1976. This standard has been brought out to keep pace with the latest technological developments and international practices. Also, in this revision, the standard has been brought into the latest style and format of Indian Standards, and references, wherever applicable have been updated. BIS certification marking clause has been modified to align with the revised *Bureau of Indian Standards Act, 2016*. The following major modifications have been incorporated in this revision of the standard:

- a) The international classification for standards (ICS) number has been added; and
- b) The reference standards have been updated.

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.

Draft Indian Standard

**LIFTING ‘C’ HOOKS WITH EYE — CAPACITY UP TO 25 TONNES
—SPECIFICATION**

(Second Revision)

1 SCOPE

1.1 This standard covers basic requirements, material and dimensions of ‘c’ hooks with eye of lifting capacity up to 25 tonnes.

1.1.1 This standard has been restricted to ‘C’ hooks of Grades L, M and S suitable for use with chains of Grades 30, 40 and 63 respectively.

1.1.2 The requirements of ‘C’ hooks of trapezoidal section only have been covered in this standard.

2 REFERENCES

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

<i>IS No</i>	<i>Title</i>
IS 3469 (Part 1 to Part 3) : 1974	Tolerances for closed die steel forgings (<i>first revision</i>)
IS 7847 : 1975	General characteristics of lifting hooks
IS 1875 : 1992	Carbon steel billets, blooms, slabs and bars for forgings — Specification (<i>fifth revision</i>)
IS 4367 : 1991	Alloy steel forgings for general industrial use — Specification (<i>first revision</i>)
IS 2853 : 1964	Methods of determining austenitic grain size in steel (Withdrawn)
IS 1500 : 2005	Method for brinell hardness test for metallic materials (Withdrawn)

3 TERMINOLOGY

3.1 For the purpose of this standard the definitions given in (*see* IS 7847) shall apply.

4 GRADE OF HOOKS

4.1 The grade of hook is determined by the mechanical properties of the finished hook and not simply by the strength of the material. Each grade is identified by a letter in the series L, M, P, S, T and V.

4.1.1 For Grade L the mean stress at the specified minimum breaking load is 300 N/mm², for Grade M 400 N/mm², for Grade S 630 N/mm², for Grade T 800 N/mm², and for Grade V 1000 N/mm². Grades L, M, P, S, T and V hooks are to be used with chains of Grades 30, 40, 63, 80 and 100 respectively only.

5 MATERIAL

5.1 The steel shall be produced by the open hearth or electric process or by any oxygen top blown process.

5.2 In its finished state as supplied to the hook maker, the steel shall be fully killed and shall meet the maximum sulphur and phosphorus content limits as under:

Sl No.		Cast analysis percent, Max	Check analysis percent, Max
(1)	(2)	(3)	(4)
i)	a) <i>For Grades L and M Hooks:</i>		
	Sulphur	0.050	0.055
	Phosphorus	0.050	0.055
	b) <i>For Grade S Hooks:</i>		
	Sulphur	0.035	0.040
	Phosphorus	0.035	0.040

5.2.1 Class 1 and Class 2 steels of (*see* IS 1875) may be used for Grades L and M hooks respectively. Any other steel meeting with the mechanical properties requirement of the finished hook specified in this specification may be used.

5.2.2 Alloy steels conforming to (*see* IS 4367) suitably heat treated to meet with the mechanical properties of the hook may be used for Grade S hooks.

5.3 The steel shall be made in conformity with a suitable de-oxidation practice to obtain an austenitic grain size of 5 or finer when tested in accordance with (*see* IS 2853).

5.3.1 This could be accomplished, for example by ensuring that it contains sufficient aluminium, or equivalent element to enable the manufacture of hooks stabilized against strain age embrittlement during service; a minimum of 0.020 percent of metallic aluminium is quoted for guidance.

5.4 Within the above limitations it is the responsibility of the hook maker to select the steel so that the finished hook suitably heat treated, meets the mechanical properties required by this specification.

6 SHAPE AND DIMENSIONS

6.1 The shape and dimensions of 'C' hooks of Grades L, M and S shall be in accordance with Table 1.

6.1.1 For hammer forged hooks, the dimensions given shall be complied with as far as possible, especially those dimensions determining the strength of hook.

6.1.2 It is not intended that these 'C' hooks be fitted with safety catches. If required, however, a safety catch may be added to a 'C' hook and for this purpose it is permissible to flatten the upper point of nose of the hook as shown in Fig. 1.

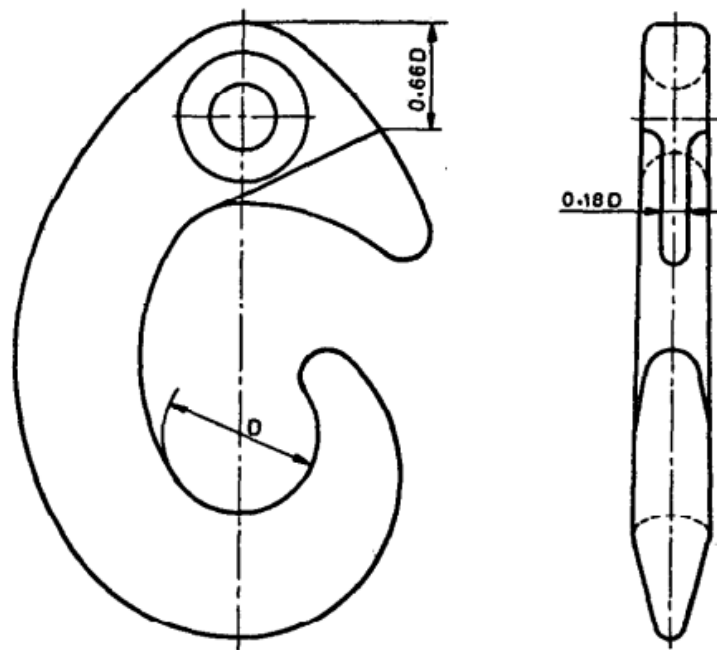


FIG. 1 FLATTENED 'C' HOOK TO TAKE SAFETY CATCH

6.3 For die making, the construction of hook profile may be carried out by using the dimensions given in Table 1. The order of operations is given in Annex A.

7 WORKMANSHIP AND FINISH

7.1 The hook shall be free from defects and shall be cleanly forged in such a manner that the macroscopic flow lines follow the body outline of the hook. The finished hook shall be clean and free from coating of any description unless otherwise specified by the purchaser.

8 HEAT TREATMENT

8.1 All hooks shall, before proof testing, be subjected to one of the following heat treatments as agreed to between the purchaser and the manufacturer:

- a) Normalizing by heating to a temperature within 50 °C above the upper critical point of the steel used followed by cooling in still air; and
- b) Hardening by heating to a temperature within 50 °C above the upper critical point of the steel used followed by quenching in oil or water and tempering.

8.1.1 Normalizing treatment shall be permitted up to Grade M hooks only grade S hooks shall be hardened and tempered necessarily.

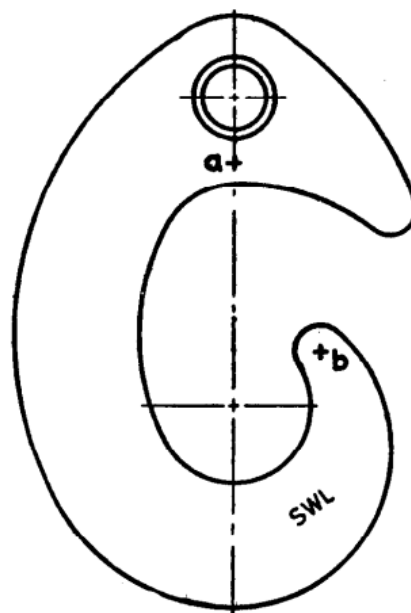
8.1.2 The minimum hardness of the hook after heat treatment when tested according to the method given in (*see IS 1500*) shall be 175 HB. This test shall be carried out on the hook selected for destructive testing.

8.2 Details of heat treatment given to the hooks during manufacture shall be endorsed on the maker's test certificate.

9 PROOF TESTING

9.1 The testing machine shall conform to the requirements specified in Annex B.

9.2 After heat treatment and other processing, the finished hooks shall be subjected to proof load of twice the safe working load as given in Table 1. Prior to the application of the proof load, each hook shall bear two center punch marks at positions *a* and *b* as shown in Fig. 2. The change in distance between *a* and *b* before applying proof load and after removal of the proof load will be the amount of permanent set and shall not exceed 0.25 percent of the initial distance. After removal of the proof load and determination of the permanent set, each hook shall be thoroughly examined by a competent person and shall be accepted as complying with this standard if no permanent deformation or visible defect is observed on the hook.



NOTE — Location of point *a* shall be within 10 mm from the edge on the center line and that of point *b* at the center of the nose radius.

FIG. 2 MARKING ON HOOKS

10 DESTRUCTION TEST

10.1 A sample hook shall be selected out of a lot of every 50 hooks or less and tested to destruction by the application of the test load. The load shall be applied as specified in **8.3** of (*see* IS 7847). The hook shall, at any load less than four times the safe working load, neither fracture nor so distort as to be incapable of retaining the load.

10.2 Micro-Structure Test

After destruction test, a portion of the hook, which has not undergone deformation shall be taken and micro-structure test shall be carried out to ensure that hooks have been given proper heat-treatment.

10.3 Hardness Testing

The hook of Grade S selected for destructive testing shall be tested for hardness value as given in **8.1.2**. The hardness shall be checked at least 10 mm away from the surface.

10.4 Other Test

If required by the purchaser, the hooks may also be subjected to radiographic/ultrasonic examination.

11 INSPECTION, CERTIFICATE OF TEST AND EXAMINATION

11.1 The representative of the purchaser shall have access to the works of the manufacturer at all reasonable times for the purpose of witnessing the specified tests and inspecting the machine and methods of examination. The manufacturer shall give the inspector copies of the reports of the tests made in his presence.

11.2 The manufacturer shall supply a certificate of test and examination in accordance with **9.2** and **9.3** of (*see* IS 7847).

12 MARKING

12.1 Provided that the hook passes the proof test, each hook shall be legibly and indelibly marked on parts not highly stressed. This marking shall include at least the following information:

- a) The pattern number,
- b) The grade letter,
- c) Safe working load, and

d) Manufacturer's identification mark.

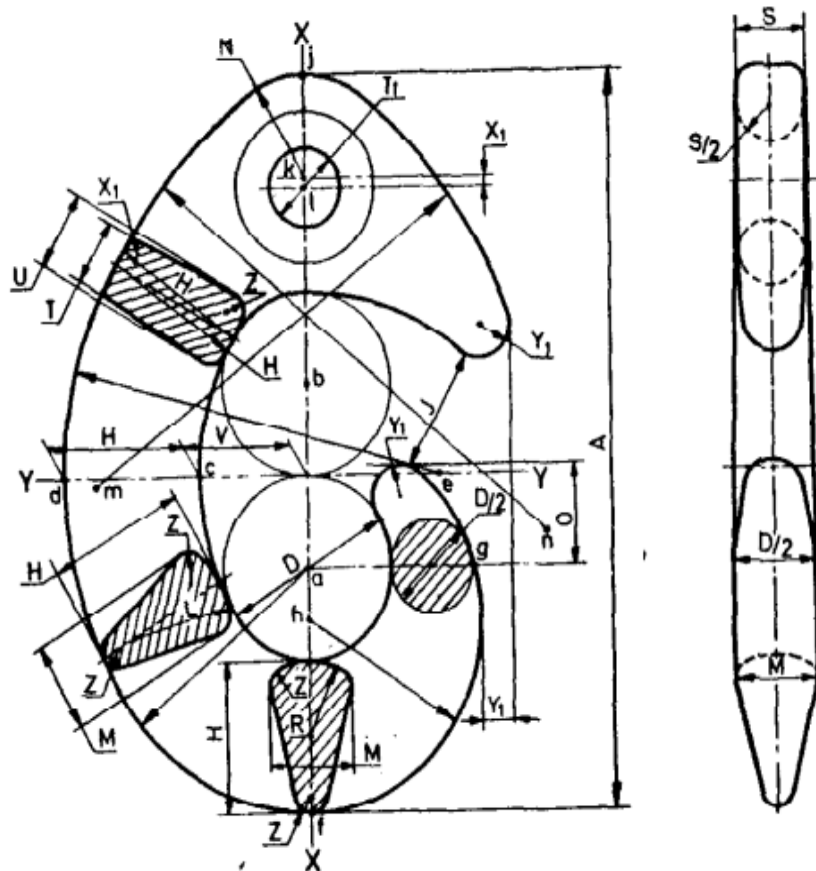
12.2 BIS Certification Marking

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 product(s) may be marked with the Standard Mark.

TABLE 1 'C' HOOKS WITH EYE

(Clauses 0.6, 6.1, 6.3, 9.2 and A-7)

All dimensions in millimeters.



Pattern No.	Lifting Capacity C_p in Tonnes Grades			Size of Chain	Proof Load F_e in kN Grades			D^* 7.5 $\sqrt{F_e}$	A 4 D	H^* 0.8 D	J^* 0.71 D	L 0.6 D	M^* 0.515 D	N^* 0.56 D	O 0.545 D	R & S 0.4 D	T 0.345 D	T_l & U 0.425 D	V^* 0.63 D	X^* 0.05 D	Y_l 0.18 D	Z 0.1 D
	L	M	S		L	M	S															
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
19	0.5	0.63	1.0	6.3	1	12.5	20	26.5	109	22.4	19.5	16	14	15	15	10.9	9.5	11.2	17	1.5	5	2.5
20	0.63	0.8	1.25	7.1	12.5	16	25	30	122	24.3	21.8	18	16	17	17	12.2	10.3	12.8	19	1.5	6	3
21	0.8	1	1.6	8	16	20	31.5	33.5	130	27.2	24.3	20	18	19	19	13.6	11.8	14.5	21.2	2	6	3
22	1	1.25	2	9	20	52	40	37.5	150	30	27.2	22.4	20	21.2	20	15	13.2	16	23.6	2	6.7	4
23	1.25	1.6	2.5	10	25	31.5	50	42.5	170	34.5	30	25	22.4	23.6	23.6	17	15	18	27.2	2	7.5	4
24	1.6	2	3.2	11.2	31	40	63	47.5	190	38.7	34.5	28	25	26.5	25	19	16.5	20	30	2.5	8.5	5
25	2	20.5	4	12.5	40	50	80	53	212	42.5	38.7	31.5	28	29	30	21.8	18.5	22.4	33.5	3	9.9	5
26	2.5	3.2	5	14	50	63	100	60	243	48.7	42.5	37.5	31.5	33.5	33.5	24.3	21.2	25	37.5	3	11	6
27	3.2	4	6.3	16	63	80	125	67	263	54.5	47.5	40	35.5	37.5	37.5	27.2	23.6	29	42.5	4	12.5	6
28	4	5	8	18	80	100	160	75	300	60	53	50	40	42.5	40	30	25.8	32.5	47.5	4	14	8
29	5	6.3	10	20	100	125	200	85	335	69	60	53	43.7	47.5	47.5	34.5	30	36.5	34.5	5	15	8
30	6.3	8	12.5	22.4	125	160	250	95	375	77.5	67	56	48.7	53	53	38.7	32.5	41.2	60	5	17	9
31	8	10	16	25	160	200	315	100	425	85	75	63	54.5	60	60	42.5	38.7	45	67	5	19	10
32	10	12.5	20	28	200	250	400	118	475	95	85	71	60	67	65	47.5	41.2	50	75	6	21.2	12.5
33	12.5	16	25	32	250	315	500	132	530	106	95	80	69	75	73	53	46.2	56	85	7.5	25	14
34	16	20	—	36	315	400	—	150	600	122	106	90	77.5	85	82.5	60	51.5	63	95	8	28	15
35	20	25	—	40	400	500	—	165	670	132	118	100	85	92.5	90	67	58	71	103	9	30	17

* These dimensions shall have normal drop forging tolerances, as per IS 3469. These dimensions shall be strictly adhered to as they determine the strength and endurance of the hook.

NOTE — Other dimensions are given for guidance during the die-making process.

ANNEX A

(Clause 6.3 and Table 1)

GEOMETRICAL CONSTRUCTION OF HOOK

A-1 Plot the vertical axis XX and the horizontal axis YY . With centers a and b on XX draw two circles each of diameter D with YY as their common tangent. The lower circle, center a , defines the seat of the hook and the upper circle, center b , defines the upper part of the intrados of the hook.

A-2 Mark off points c and d on YY at distances V and $H + V$ respectively from axis XX . With centre c on YY draw a circular arc to pass through c and touch the circles drawn centre a and b . With the same centre c draw a circular arc to pass through d . The back of the hook is thus defined.

A-3 Mark off point f on XX such that the depth of the section of the hook below the seat is H , that is, at a distance $D + H$ from axis YY . With center a draw a circular arc from f to join the arc drawn through point d .

A-4 Through the centre a of the seat diameter circle draw a horizontal line and mark off point g at a distance of D from a . Draw the perpendicular bisector of fg to meet the YY axis at h . With centre h and radius hf draw a circular arc to pass through f and g continuing it to the YY axis. Define the upper limit of the lower point of the hook by a horizontal line drawn at a distance 0 from centre a . Draw the tip circle of radius Y within the limit prescribed by this line, the arc with centre h and the seat diameter circular with centre a .

A-5 Draw a vertical line parallel to XX and distance Y from the outermost part of the lower point of the hook (distance $hf + r$,) to determine the outer limit of the upper point of the hook. Draw the locus of the lower part of the upper point so as to maintain a hook opening of j . Draw an arc with centre a and radius 1.50 to define the underside of the upper point. Dis-continue this arc at a point where the minimum opening j is achieved. Draw the tip circle radius r_1 to conform with these limits.

A-6 Mark off point j on axis XX at a distance A from point f . With centre k on XX draw an arc of radius N to pass through j . Mark the centre of the eye l at a distance X_1 below k and draw the eye of diameter T_1 . With suitable centres m and n complete the profile of the upper portion of the hook circular arcs.

A-7 Construction of the cross section; these are specified in the figure in Table 1.

ANNEX B

(Clause 9.1)

REQUIREMENTS OF TESTING MACHINES

B-1 The machine shall be accurate enough to take measurements within tolerance of ± 5 percent of the proof load applied.

B-2 Machines measuring the load by levers and weights or by pendulum shall be verified and adjusted, as necessary by a competent independent person at intervals not greater than one year. For machines measuring the load other than by levers and weights or by pendulum, the interval shall be not greater than three months. The testing machine shall be balanced in the presence of the inspector before the tests are made.

B-3 A signed certificate of the last examination shall be prominently and splayed adjacent to the machine.