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Indian Standard
SPECIFICATION FOR
LIFTING 'C' HOOKS WITH EYE — CAPACITY
UP TO 25 TONNES
(*First Revision*)

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

Indian Standard

SPECIFICATION FOR LIFTING 'C' HOOKS WITH EYE—CAPACITY UP TO 25 TONNES (*First Revision*)

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Indian Standard

SPECIFICATION FOR LIFTING 'C' HOOKS WITH EYE—CAPACITY UP TO 25 TONNES (*First Revision*)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 30 November 1976, after the draft finalized by the Lifting Chains, Associated Fittings and Components Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

0.2 This standard was first published in 1967. The major changes in this revision relate to the grading of hooks and marking of their lifting capacities according to the international practice. Requirements for material have been revised to give option to the manufacturer of hooks to achieve the desired mechanical strength of the hooks using different types of steels including alloy steels. Hooks of lifting capacity up to 25 tonnes are now covered in this standard.

0.3 'C' hooks are characterized by their shape which is designed to prevent the fouling of the hook against obstructions and reduced risk of displacement of the load during hoisting and lowering operations. The hooks are suitable for general lifting operations and for the loading and unloading of ships and crafts.

0.4 The reliability of 'C' hooks is an important factor and, therefore, supply of hooks should be obtained from manufacturers possessing adequate facilities for heat-treatment and testing equipment, and employing competent staff for inspection.

0.5 Users are warned that the hooks, provided these are marked with the ISI mark, shall not be taken as complying with this standard unless specified tests have been made and the test requirements met in the presence of the person representing or approved by the purchaser.

0.6 When the conditions of working are extremely hazardous or severe the permissible working load should be substantially less than the corresponding loads specified in Table 1.

0.7 The hooks are numbered according to their dimensional characteristics which are such that, for a given grade of hook, the maximum lifting capacities are in accordance with the R 10 series of preferred numbers. The number

thus defined is called the 'pattern number', to make clear that it does not correspond with the lifting capacity.

0.8 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*. 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

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. TERMINOLOGY

2.1 For the purpose of this standard the definitions given in IS : 7847-1975† shall apply.

3. GRADE OF HOOKS

3.1 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.

3.1.1 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 1 000 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.

4. MATERIAL

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

4.2 In its finished state as supplied to the hook maker, the steel shall be

*Rules for rounding off numerical values (revised).

†General characteristics of lifting hooks.

fully killed and shall meet the maximum sulphur and phosphorus content limits as under:

	<i>Cast analysis percent, Max</i>	<i>Check analysis percent, Max</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

4.2.1 Class 1 and 2 steels of IS : 1875-1971* 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.

4.2.2 Alloy steels conforming to IS : 4367-1967† suitably heat treated to meet with the mechanical properties of the hook may be used for Grade S hooks.

4.3 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 IS : 2853-1964‡.

4.3.1 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.

4.4 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.

5. SHAPE AND DIMENSIONS

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

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

5.2 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.

*Specification for carbon steel billets, blooms, slabs and bars for forgings (*third revision*).

†Specification for alloy and tool steel forgings for general industrial use.

‡Method of determining austenitic grain size of steel.

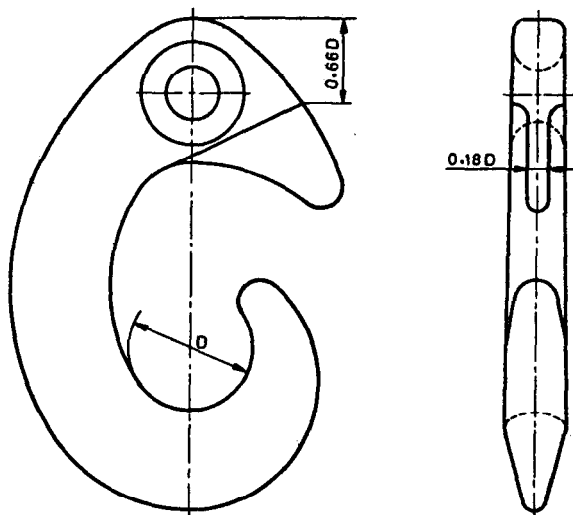


FIG. 1 FLATTENED 'C' HOOK TO TAKE SAFETY CATCH

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 Appendix A.

6. WORKMANSHIP AND FINISH

6.1 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.

7. HEAT TREATMENT

7.1 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.

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

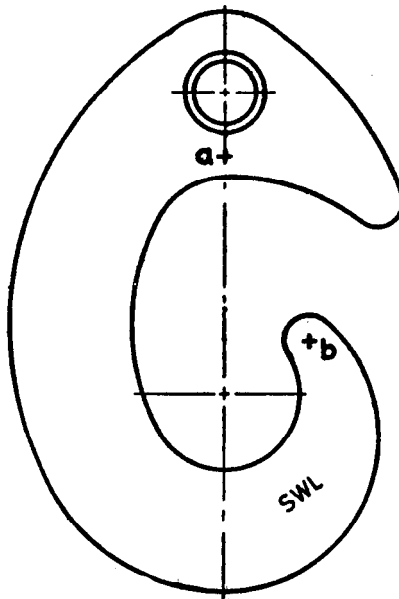
7.1.2 The minimum hardness of the hook after heat treatment when tested according to the method given in IS : 1500-1968* shall be 175 HB. This test shall be carried out on the hook selected for destructive testing.

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

8. PROOF TESTING

8.1 The testing machine shall conform to the requirements specified in Appendix B.

8.2 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 centre 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 centre line and that of point *b* at the centre of the nose radius.

FIG. 2 MARKING ON HOOKS

*Method for Brinell hardness test for steel (first revision).

9. DESTRUCTION TEST

9.1 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 **7.3** of IS : 7847-1975*. 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.

9.2 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.

9.3 Hardness Testing — The hook of Grade S selected for destructive testing shall be tested for hardness value as given in **7.1.2**. The hardness* shall be checked at least 10 mm away from the surface.

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

10. INSPECTION, CERTIFICATE OF TEST AND EXAMINATION

10.1 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.

10.2 The manufacturer shall supply a certificate of test and examination in accordance with **8.2** and **8.3** of IS : 7847-1975*.

11. MARKING

11.1 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.

11.2 BIS Certification Marking

The product may also be marked with Standard Mark.

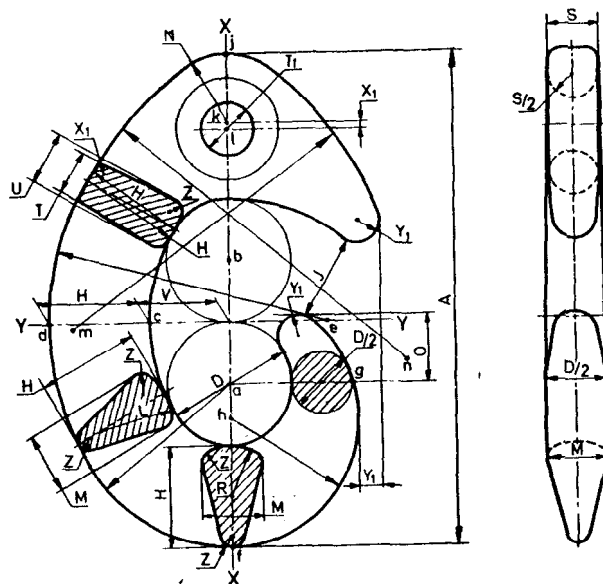
11.2.1 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from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

*General characteristics of lifting hooks.

TABLE 1 'C' HOOKS WITH EYE

(Clauses 0.6, 5.1, 5.3, 8.2 and A-7)

All dimensions in millimetres.



PATT- ERN 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 $4D$	H^* $0.8D$	J^* $0.71D$	L $0.6D$	M^* $0.515D$	N^* $0.56D$	O $0.545D$	R & S^* $0.4D$	T $0.345D$	T_1 & U^* $0.425D$	V^* $0.63D$	X_1 $0.05D$	Y_1 $0.18D$	Z $0.1D$
	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)
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	136	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	25	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	2.5	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	53.5	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	106	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 : 3469-1966 Specification for tolerances for steel drop forgings, upset forgings, press forgings and forged bars. 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.

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APPENDIX A

(Clause 5.3 and Table 1)

GEOMETRICAL CONSTRUCTION OF HOOK

A-1. Plot the vertical axis XX and the horizontal axis YY . With centres a and b on XX draw two circles each of diameter D with YY as their common tangent. The lower circle, centre a , defines the seat of the hook and the upper circle, centre 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 with centres 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 centre 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 O 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 $hf+Y_1$) 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 $1.5D$ to define the underside of the upper point. Discontinue this arc at a point where the minimum opening J is achieved. Draw the tip circle radius Y_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.

APPENDIX B

(Clause 8.1)

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 displayed adjacent to the machine.

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