INTERNATIONAL STANDARD 2141

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Lifting hooks — General characteristics

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2141 was drawn up by Technical Committee ISO/TC 111, *Round steel link chains, chain wheels, lifting hooks and accessories.*

It was approved in June 1971 by the Member Bodies of the following countries:

Australia	Greece	New Zealand
Austria	India	South Africa, Rep. of
Belgium	Ireland	Spain
Bulgaria	Israel	Sweden
Canada	Italy	Thailand
Egypt, Arab Rep. of	Japan	Turkey
France	Korea, Rep. of	United Kingdom
Germany	Netherlands	U.S.A.

The Member Body of the following country expressed disapproval of the document on technical grounds:

Romania

Printed in Switzerland

Lifting hooks — General characteristics

1 GENERAL

1.1 Scope

This International Standard defines the general characteristics of lifting hooks, as well as the test methods for inspecting new hooks.

1.2 Field of application

This International Standard applies to steel hooks used on lifting appliances of all kinds and on their accessories, except for laminated hooks.

1.3 References

1.3.1 ISO/R 1837, *Nomenclature of lifting hooks.*

1.3.2 *Safety and health in dockwork,* International Labour Office.

1.3.3 EUROFORGE Standards.

1.3.4 *Tolerances for impression die forgings,* Forging Industry Association, 55, Public Square — Cleveland — OHIO, 44114.

1.4 Definitions

1.4.1 lifting capacity; working load limit; C_p : Maximum value of the mass which the hook is authorized to support in general service when its axis of traction is vertical.

1.4.2 working load; safe working load : Maximum value of the mass which the hook is authorized to support in a particular stated service, when its axis of traction is vertical.

1.4.3 proof load; F_e : Force applied in a static tensile test which the hook must sustain without showing permanent deformation or other visible defects.

1.4.4 grade of hook : The grade of hook is determined by the mechanical properties of the finished hook, as specified in the ISO International Standard for each type of hook.

1.5 Designation

A complete hook is characterized

a) by a group of letters or numbers indicating the shape of the hook and its dimensions (die) (i.e. pattern number);

b) by a letter corresponding to the grade of hook. The letters in ascending order of strength are M, P, S, T and V.

1.6 Nomenclature of hooks

The nomenclature of hooks is given in ISO/R 1837.

2 LIFTING CAPACITIES AND BASIC DESIGN LOADS

2.1 Lifting capacities (C_p)

The lifting capacities are expressed in tonnes; they follow the R 10 series of preferred numbers (see Table 1).

Above 100 tonnes, lifting capacities are from the R 20 series, but with a preference for the R 10 terms.

2.2 Basic design loads

The basic design loads of lifting hooks are equal to the proof loads (F_e); they are expressed in kilonewtons and are given in Table 1, indicating the correspondence with the lifting capacity.

2.3 Lifting capacities and proof loads

Lifting capacities are in accordance with the R 10 series of preferred numbers. The corresponding proof load is given in Table 1, in which C_p is the lifting capacity in tonnes and F_e the proof load in kilonewtons.

TABLE 1

C_p tonnes	F_e kN
(0.100)	(2)
0.125	2.5
(0.160)	(3.2)
(0.200)	(4)
0.250	5
0.320	6.3
(0.400)	(8)
0.500	10
(0.630)	(12.5)
(0.800)	(16)
1	20
(1.25)	(25)
(1.6)	(32)
2	40
(2.5)	(50)
(3.2)	(63)
(4)	(80)
5	100
6.3	125
8	160
10	200
12.5	250
16	315
20	400
25	500
32	600
40	700
50	850
63	1 000
80	1 200
100	1 430

NOTES

1 Certain hooks are very little used. Their lifting capacities and proof loads are given in brackets.

2 This Table is in accordance with ILO Recommendations (see reference 1.3.2 and Appendix).

3 FORMS AND DIMENSIONS

The forms and dimensions are defined in the ISO International Standard for each type of hook.

In principle, the dimensions are calculated from the basic design loads defined in 2.2, and are such that the hook as a whole does not show any permanent deformation when subjected to the proof load. Any change in section shall be made by fillets of appropriate form.

4 MATERIAL AND MANUFACTURE

4.1 Quality of material

The steel shall be fully killed, capable of being hammer-forged or drop-forged, and shall not be liable to strain age embrittlement. It shall be in conformity with the requirements of the ISO International Standard for each type of hook.

Within these limitations the manufacturer is responsible for the choice of steel of such type that the finished hook, after suitable heat treatment, has the required mechanical properties.

If so required by the purchaser, the manufacturer shall supply a copy of the steelworks cast analysis. When an analysis of the steel in the hook is required by the purchaser, such analysis shall be made on millings taken from a complete transverse section of a hook. The latter can be a hook which has been submitted to a destructive test. The cost of such an analysis shall be borne by the purchaser.

4.2 Method of manufacture and workmanship

The hook should be hammer-forged or drop-forged hot in one piece, but other methods of manufacture are not precluded, provided that the hook so produced fully meets the conditions required by this document and by the ISO International Standard for each type of hook. It shall be free of any harmful surface defects including cracks[1]. When machining is necessary, special care should be taken at the transition between the forged surface and the machined surface to minimize stress concentrations.

4.3 *Tolerances on forged dimensions*

The tolerances on the dimensions of a hook shall be such that

a) the dimensions of the section of the hook are not smaller than the dimensions given in the ISO International Standard relating to that particular type of hook;

b) if D is the nominal diameter of the seat and y the tolerance, the diameter of the seat may not be smaller than D-y, nor greater than D, y being specified in the relevant ISO International Standard.

Tolerances on other dimensions of a hammer-forged or drop-forged hook shall be those specified in national standards or alternatively those specified by professional organizations, provided that they do not contradict paragraphs a) and b) above[2].

4.4 Heat treatment

After hammer-forging or drop-forging, the hook shall be heat treated in accordance with the quality of the material.

4.5 Finish

The hook shall have a smooth surface.

4.6 Marking

Each hook should be legibly and indelibly marked on parts not highly stressed. This marking shall include at least the following information placed on the hook by the manufacturer :

– the pattern number;

– the grade letter;

– any marking required by national standards, statutory regulations or by agreement between the manufacturer and the purchaser.

1) The particular ISO International Standards may refer as appropriate to other relevant specifications.

2) See the professional documents concerning drop-forgings and hand-forgings, for example references 1.3.3 and 1.3.4.

5 CERTIFICATION, TESTS AND INSPECTION

5.1 Certification

Hooks manufactured in conformity with this document or the relevant ISO International Standard which specifies their dimensions are exempted from tests, individual or on samples, unless the national standards or regulations provide otherwise.

However, the manufacturer of the hook-forging should supply a certificate giving the information indicated in 5.4.1.

The certification given by the hook manufacturer covers the following points :

— the conformity of the forged hook to the relevant specifications;

— the absence of any visible defect or deformation exceeding 0.25 % across the throat of the hook after application and removal of the proof load;

— the ability of the hook to securely retain the load at any value less than twice the proof load.

5.2 Optional tests

When, with the agreement of the interested parties, it is decided to check the certification mentioned in 5.1, tensile tests should be carried out according to the following terms and conditions :

5.2.1 *Test under proof load*[1)]

After application and then removal of the proof load (see Table 1), a lifting hook shall not show permenent deformation, nor any other visible defects. For the purposes of this International Standard, the hook shall be deemed to comply with this requirement if the opening does not deform by more than 0.25 % measured across the throat.

5.2.2 *Overload test (test to destruction)*

A lifting hook subjected to a load equal to at least twice the proof load should not break or open out to the point of not being able to retain the load. This test should be carried out by sampling according to the instructions given in the order.

5.2.3 *Test procedure*

The tests specified in 5.2.1 and 5.2.2 shall be made on a hammer-forged or drop-forged hook as required in the relevant ISO International Standard, by tension applied axially without shock through the intermediary of a link of diameter approximately equal to a third of the seat diameter of the hook ($D/3$). A machined hook shall be fully machined in its finished state before testing.

5.2.4 *Other tests*

As required by the purchaser.

5.3 General inspection

An order or national standard can include a clause of inspection. In that case, the inspector should have access at all reasonable times to that part of the manufacturer's works where the hooks are being made, to inspect or test the hooks as specified, and to supervise the method of examination. The manufacturer should give the inspector copies of the reports of the tests made in his presence.

5.4 Certificates

5.4.1 *Certificate of conformity*

The certificate of conformity should as a minimum include the information given in the example below; the language is normally that of the purchaser or a language agreed by both parties. It may contain other information, for example, reference to national standards.

> We hereby certify that the hooks provided conform in all particulars to the requirements of ISO . . .
>
> Designation . . . . . .
> Quantity . . . . . .
> Batch . . . . . .
> Name of manufacturer . . . . . .
> Manufacturer's identification mark . . . . . .
> Date . . . . . Signature . . . . . .

5.4.2 *Test and inspection certificates*

If the purchaser requires optional tests, a certificate must be provided for each test.

5.4.3 *Certificate for test under proof load*

For this test, the certificate must give the information indicated below :

> We hereby certify that the hooks provided conform in all particulars to the requirements of ISO . . .
>
> These hooks met the requirements under proof load.
>
> Designation . . . . . .
> Quantity . . . . . .
> Batch . . . . . .
>
> Name of manufacturer . . . . . .
> Manufacturer's identification mark . . . . . .
> Date . . . . . Signature . . . . . .

1) This test is compulsory in certain countries; it provides a better stress distribution.

APPENDIX

COMPARISON BETWEEN ILO RECOMMENDATIONS AND PROOF LOADS GIVEN IN TABLE 1

TABLE 2

Lifting capacity Working load limit C_p		Calculation of proof load in accordance with ILO requirements					Proof load F_e Table 1
		Excess load (minimum)			Proof load (minimum)		
mass	force						
tonnes	kN	% of C_p	tonnes	kN	tonnes	kN	kN
0.100	0.98	100	0.100	0.98	0.200	1.96	2
0.125	1.225	100	0.125	1.225	0.250	2.45	2.5
0.160	1.568	100	0.160	1.568	0.32	3.136	3.2
0.200	1.96	100	0.200	1.96	0.4	3.92	4
0.250	2.45	100	0.250	2.45	0.5	4.9	5
0.320	3.138	100	0.320	3.138	0.64	6.28	6.3
0.400	3.92	100	0.400	3.92	0.8	7.84	8
0.500	4.9	100	0.500	4.9	1	9.8	10
0.630	6.17	100	0.630	6.17	1.25	12.34	12.5
0.800	7.84	100	0.800	7.84	1.60	15.68	16
1	9.8	100	1	9.8	2	19.6	20
1.25	12.25	100	1.25	12.25	2.50	24.5	25
1.6	15.68	100	1.6	15.68	3.15	31.36	32
2	19.6	100	2	19.6	4	39.2	40
2.5	24.5	100	2.5	24.5	5	49	50
3.2	31.38	100	3.2	31.38	6.4	62.8	63
4	39.2	100	4	39.2	8	78.4	80
5	49	100	5	49	10	98	100
6.3	61.7	100	6.3	61.7	12.5	122.5	125
8	78.4	100	8	78.4	16	156.8	160
10	98	100	10	98	20	196	200
12.5	122.5	100	12.5	122.5	25	245	250
16	156.8	100	16	156.8	32	313.6	315
20	196	100	20	196	40	392	400
25	245	100	25	245	50	490	500
32	313.8	85	27.2	266.7	59.2	580.5	600
40	392	75	30	294	70	686	700
50	490	65	35	343	85	833	850
63	617	60	38	372	101	989	1 000
80	784	50	40	392	120	1 176	1 200
100	980	45	45	441	145	1 421	1 430

NOTE

Above 100 tonnes, where the lifting capacities follow the R 20 series, the following percentage excess loads apply :

Lifting capacity (tonnes)	Excess load (%)
112	41
125	38
140	35
160 and above	33