

Specification for

Higher tensile steel hooks for chains, slings, blocks and general engineering purposes

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British Ports Association	Machine Made Chain Manufacturers' Association
British Railways Board	Ministry of Aviation Supply
Chain Testers Association of Great Britain	National Association of Drop Forgers and Stampers
Corporation of Trinity House	Individual technical experts
Department of Industry (National Physical Laboratory)	
Federation of Civil Engineering Contractors	
Federation of Wire Rope Manufacturers of Great Britain	

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Foreword

This revision of BS 2903, prepared under the direction of the Mechanical Engineering Standards Committee, has been prepared to up-date the standard in the light of current requirements.

It includes a series of higher tensile steel hooks in metric sizes, with safe working loads conforming to the R 10 series of preferred numbers. The ILO provision in respect of the ratio of proof load to working load for hooks of capacity in excess of 25 t has been implemented.¹⁾

In the previous edition (1970) the maximum stress in the hook body under the safe working load was increased from 247 N/mm² to 309 N/mm² ²⁾. The implications of this up-rating of the hooks in respect of both proof loading and of subsequent use in service are explained in Appendix A.

The safe working loads given in the tables are the maxima for normal conditions of service; for arduous duty conditions it is desirable that the hook be de-rated and its safe working load correspondingly reduced.

Shank hooks are not specified beyond the safe working load of 63 t. If hooks are required outside the range specified in this standard, such hooks can be designed from the information given in Appendix A. The use of the term "British Standard hook" is, however, restricted to the actual forged hook sizes and forms laid down in the tables and figures of this standard.

The forged dimensions of the hooks are proportional to each other and are related to the internal diameter of the hook (dimension C). The proportions are given, to two decimal places, at the head of each column in the tables. The actual dimensions are to the nearest millimetre.

This standard does not recognize any design of hook in which welding has been incorporated because such welding would introduce unnecessarily a potential source of danger.

Optional provision has been made for lugs to facilitate the fitting of safety catches (see Appendix E and Appendix F).

It is essential for the safe and efficient operation of lifting gear that the chains used should at the design stage be considered in conjunction with the hooks used. Appendix G gives figures for the safe working loads of hook and chain assemblies for Grade M chain (see BS 4942-1, BS 4942-2 and BS 4942-3).

The trapezoidal section hooks with shank (see Table 1) complying with the requirements of this standard have performance characteristics which are similar to hooks complying with the requirements of ISO 2141 and ISO 2766 in Grade M, although they are not dimensionally identical. Work is continuing on the revision of the ISO standards for hooks and the preparation of new standards for eyehooks, and these will be taken into account in subsequent revisions of BS 2903.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 26, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

¹⁾ International Labour Office (ILO) Code of Practice on Safety and Health in Dock Work. Appendix D, revised edition, 1977.

²⁾ 1 N/mm² = 1 MPa.

1 Scope

This British Standard provides specifications for six types of hand forged or drop forged trapezoidal section hooks of two forms, the point hook and the “C” hook. Each form of hook is specified with a screwed shank, or alternatively with an eye for use with chain or wire rope thimbles, the “C” hook in the latter case being supplied with a link.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Rating

Hooks shall be rated according to the safe working loads given in Table 1 to Table 6.

3 Types of hook

Each hook shall be of one of the following types:

- Type 1.* Point hook with shank (see Table 1).
- Type 2.* Point hook with shank, alternative to type 1, having increased internal diameter for small loads (see Table 2).
- Type 3.* Point hook with eye, for use with chain (see Table 3).
- Type 4.* Point hook with eye, for use with wire rope thimbles (see Table 4).
- Type 5.* “C” hook with shank (see Table 5).
- Type 6.* “C” hook with eye, for use with chain (see Table 6). Fitted with link for use with wire rope thimbles (see Table 6A).

4 Special hooks

Special (or unscheduled) trapezoidal section point hooks whose dimensions differ from those in Table 1 to Table 4 may be designed and described as “Special point hooks to BS 2903”, provided that they comply with the relevant requirements given in Appendix A.

5 Material

The material used in the manufacture of the hook shall comply with the relevant requirements of BS 970, grades 080A27, 080A30, 150M19 or 150M28.

It shall be the responsibility of the manufacturer of the hook to choose the material and to ensure that the heat treatment (see clause 13) given to the hook is suitable.

When analysis of the steel in the hook is required by the purchaser, he shall state so in the enquiry or order (see Appendix B).

6 Hardness test

The maximum Brinell hardness of a hook shall be 230.

Where practicable, the test shall be made in accordance with BS 240-1, using a 10 mm steel ball, and a force of 3 000 kgf (29 420 N). If another method is employed, conversion shall be made in accordance with BS 860.

The surface on which the impression is to be made shall be obtained by filing, grinding, or smooth machining.

NOTE Suitable precautions should be taken to ensure that the surface tested is representative of the material and that its hardness is not affected by decarburization, carburization or by the method used for the preparation of the test surface.

7 Destruction test

If required by the purchaser in the enquiry and order, a sample hook shall be selected by the representative of the purchaser and opened out by the application of a test load.

The hook shall, at any load less than twice the proof load, neither fracture nor so distort as to be incapable of retaining the load.

8 Form and dimensions

The form and dimensions of the hook shall be in accordance with the diagrams accompanying Table 1 to Table 6 and the forged dimensions, subject to the tolerances in clause 9, shall be in accordance with Table 1 to Table 6.

9 Tolerances on forged dimensions

9.1 Tolerances on drop forged hooks. BS 4114 quality F tolerances shall be applied to drop forging dimensions.

9.2 Tolerances on hand forged hooks.

Hand-forged dimensions shall be not less than the values in the tables and shall not exceed them by more than the following amounts:

33 $\frac{1}{3}$ % on the radius, dimension *Z*

7 $\frac{1}{2}$ % on all other dimensions.

In shank hooks to Table 1 and Table 2 the tolerance on dimension *A* may be increased to 12 $\frac{1}{2}$ % and dimension *B* is allowed a consequential increase according to the measured dimensions of *A* and *D*.

The oversize on dimension *C* shall not exceed the oversize on dimension *H*.

10 Diameter and length of shank
(types 1, 2 and 5)

A plus allowance shall be made when forging the shank to allow for machining the diameter of the shank, and the diameter at the top of the thread. The machined diameter shall be toleranced to suit the bearing fitted.

Requirements for ball or roller thrust bearings are given in Appendix D.

NOTE The length of shank required, from the shoulder to its end, should be specified by the purchaser with the enquiry or order (see Appendix B).

11 Screw threads and undercut

The screw threads on the shanks of the hooks shall comply with the requirements of BS 3643, (coarse series) modified when required (see Table 1 and Appendix C). Unless otherwise specified they shall be class 6g (medium fit).

The portion of the shank adjacent to the shoulder shall have an undercut in accordance with Figure 1. The dimensions of the undercut shall be as follows:

Minimum transition radii, r .	$0.1G$, where G is the minimum diameter of the machined shank, (see Table 1, Table 2 and Table 5).
Minimum width of undercut, f , from the shoulder of the shank to the crest of the last full thread.	$2P$, where P is the pitch of the thread, (see Table 1, Table 2 and Table 5).
Minimum diameter of undercut.	The core diameter (see Appendix C) less 0.3 mm for additional clearance.

NOTE The transition radii adjacent to the shoulder need not be complete quadrants of a circle and it is desirable that there be a parallel portion in the undercut.

The undercut shall be machined with a form-ground tool to ensure that it is free from machining marks, imperfections or defects which could become stress-raisers. Where a specific surface is required by the purchaser, this shall be the subject of agreement between the purchaser and the manufacturer at the time of the enquiry or order.

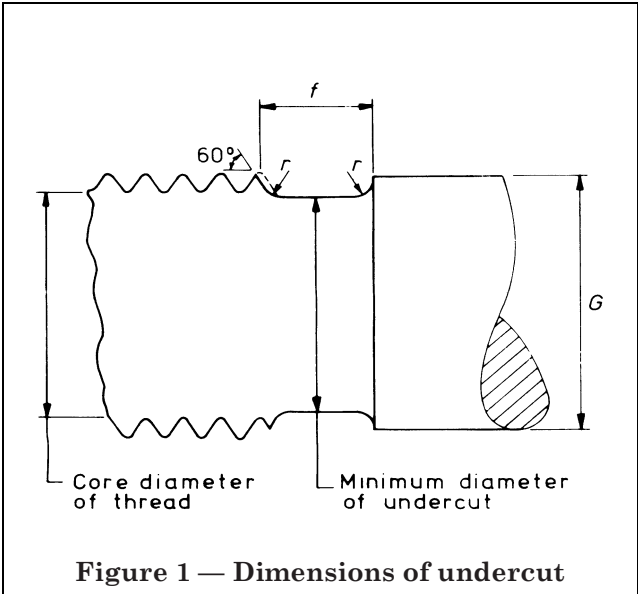


Figure 1 — Dimensions of undercut

It is recommended that the screw threads be gauged by gauges made in accordance with the requirements of BS 919.

The length of the screwed portion of the shank, excluding the undercut, shall be not less than the major diameter of the screw thread. If the shank and nut which secures it are drilled to take a fixing or retaining pin, or for any other purpose, there shall remain a continuous threaded length of shank engaged by the nut on the load side equal to at least three-quarters of the major diameter.

12 Workmanship

The hooks shall be free from patent defect and shall be cleanly forged in one piece. No welding shall be carried out at any stage of manufacture. Profile cutting from the slab or plate is not permissible since it is desirable that the macroscopic flow lines of the forging follow the body outline of the hook.

13 Heat treatment

All hooks shall be subjected to the following heat treatment:

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.

14 Quality marking

Each hook shall be legibly marked as indicated in Figure 2 or Figure 3, as appropriate, with the symbol “M” appearing within a circle.

NOTE In the previous issue the symbol “04” was used for this grade, and hooks with this marking may still be available complying with the requirements of this standard.

The recommended maximum sizes of stamp are as follows:

Safe working load of hook	Size of mark
t	mm
Up to and including 2	3.5
Over 2, up to and including 8	5.0
Over 8	6.5

15 Proof loading

Each hook forging covered by this standard (and the link given in Table 6A when fitted), after manufacture and subsequent heat treatment, shall be subjected to a proof load in accordance with the tables. [For hooks up to 25 t lifting capacity the proof load is double the maximum safe working load. For hooks over 25 t lifting capacity the proof load, in tonnes, is calculated according to the formula $(1.22 \times \text{max. safe working load}) + 20 \text{ t}$.]

Shank hooks supplied unmachined shall be proof loaded after machining. This may be done by the purchaser.

The hook shall withstand the proof load without showing a permanent set exceeding one-quarter of 1 % of the distance “a” to “b” (see Figure 2 and Figure 3). After removal of the proof load and determination of the permanent set (if any), each hook shall be thoroughly examined by a competent person and shall be deemed to comply with the requirements of this standard only if found free from visible flaw or defect.

Prior to the application of the proof load each hook shall bear a centre punch mark at position “b”, from which a scribed line shall be trammelled to position “a” (see Figure 2 and Figure 3). After removal of the proof load, the hook shall be re-scribed with the trammel unaltered, and the difference (if any) between the two scribed lines shall be the amount of permanent set.

The plus or minus tolerance of the testing machine shall not exceed $2\frac{1}{2}$ % of the proof load applied.

Figure 2 and Figure 3 show points “a” and “b” between which the hook shall be measured before and after proof loading to ascertain the amount of permanent set and the recommended position for marking the hook with the safe working load, and for marking identification and quality symbols on the reverse side of the hook (see clauses 14 and 19 respectively).

16 Testing facilities

Unless otherwise required by the purchaser, the manufacturer shall supply the necessary labour and appliances for the tests required by this standard. In the absence of facilities at his own works for making the specified proof test the manufacturer shall bear the cost of carrying out such proof test at a public test house.

17 Additional tests

If, in addition to the destruction test of the sample hook referred to in clause 7 and the proof loading of the finished hook specified in clause 15, the purchaser requires further tests, such further tests shall be clearly stipulated in the enquiry and order (see Appendix B) and, if so desired, the samples shall be selected by a person representing or approved by the purchaser.

18 Inspection

The representative of the purchaser shall have access to the works of the manufacturer at any reasonable time. He shall be at liberty to inspect the hooks at any stage of manufacture. He shall also be at liberty to inspect the testing machine and method of examination, and to reject any hooks being made to his order which do not comply with the requirements of this standard.

19 Identification marking

Each hook shall, after proof testing be permanently and legibly stamped on a non-vital part (see Figure 2 and Figure 3) with such individual marks or symbols as will allow identification with the manufacturer’s certificate of test and examination.

Where specified by the purchaser, each hook shall additionally be marked with the safe working load in tonnes (t) or such lesser value as may be specified by the purchaser. Safe working loads below 1 t may be marked in kilogrammes (kg).

For recommended maximum sizes of marks see clause 14.

20 Manufacturer's certificate

The manufacturer shall provide a certificate with each consignment of hooks giving the following information for each one:

- distinguishing mark (to enable the particular hook to be identified);
- type of hook (see clause 3);
- proof loading applied (see clause 15);
- safe working load (see Table 1 to Table 6).

The certificate shall state the material of which the hooks are made (see clause 5), and that they comply in all respects with the requirements of BS 2903. It shall also state the name and address of the testing establishment, and the status of the signatory.

The certificate may be the appropriate statutory form, provided the required information is given.

Certificates giving the results of any additional tests which have been carried out shall also be supplied by the manufacturer, and where any complementary British Standard stipulates the form of the certificate that shall be given, the results shall be given in that form.

NOTE The mark BS 2903 on or in relation to the product is a claim by the manufacturer that it complies with the requirements of this standard.

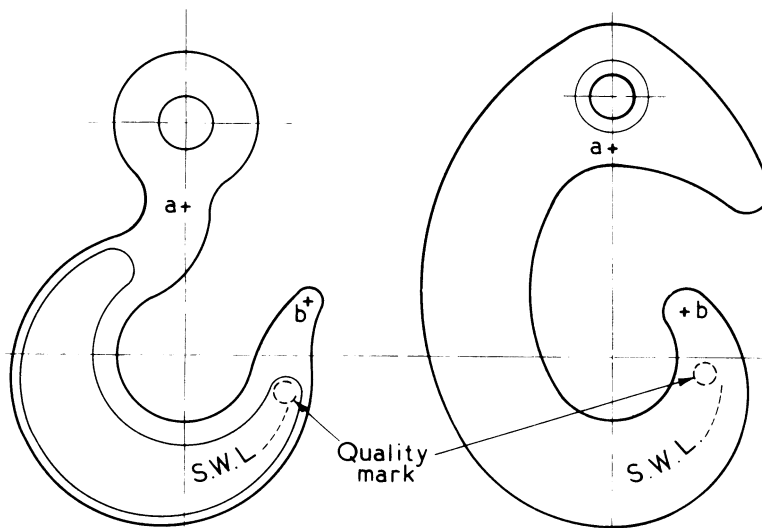
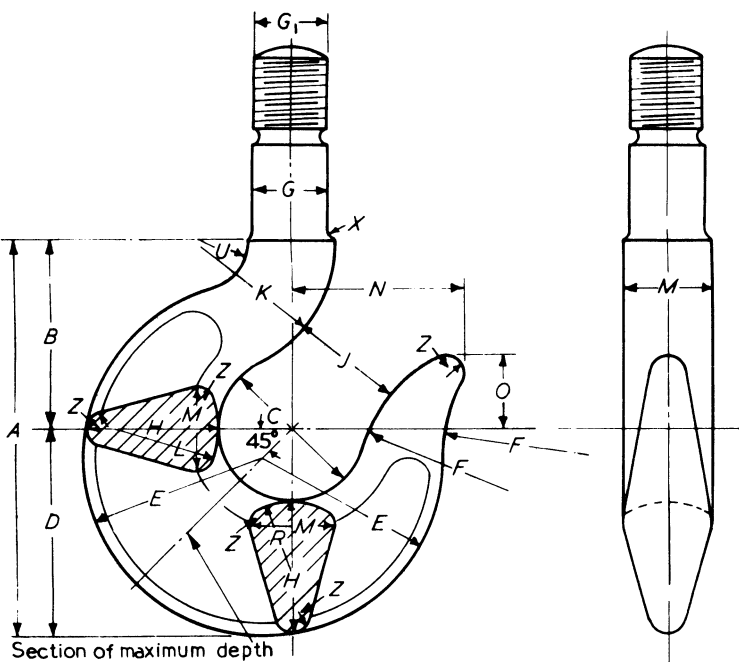


Figure 2 — Point hook, showing points “a” and “b” and recommended positions for marking

Figure 3 — “C” hook, showing points “a” and “b” and recommended positions for marking

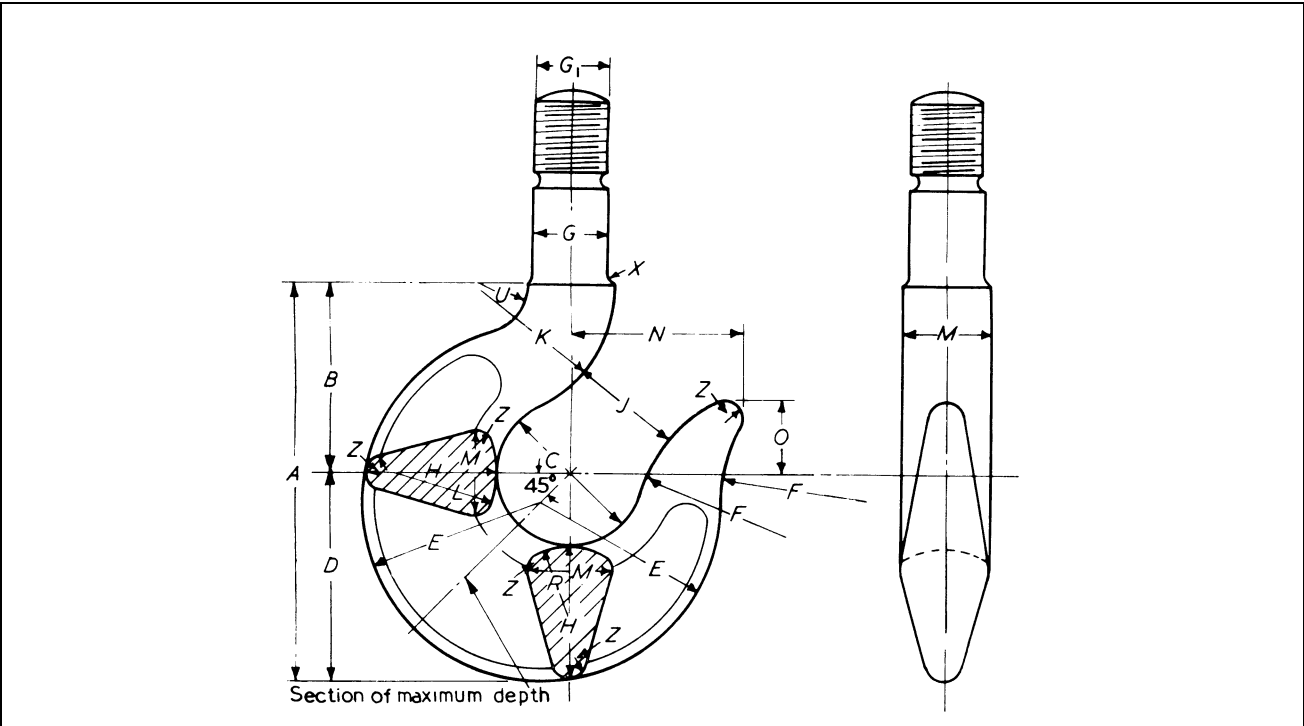
Table 1 — Point hook with shank



Safe working load (max.)	Proofload		$C = 6.6/P$	$A = 2.75C$	$B = 1.31C$	$D = 1.44C$	$E = 1.25C$	$F = 1.00C$	Recommended forged diameter of shank ^a	G Machined shank diameter minimum	G_1 Diameter at top of thread	Pitch of thread	$H = 0.93C$	$J = 0.75C$	$K = 0.92C$
	Mass	Force P													
t	t	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
0.8	1.6	15.7	26	72	34	38	32	26	17	15	14	2	24	20	24
1.6	3.2	31.4	37	102	48	54	46	37	23	20	20	2.5	34	28	34
2.5	5	49	46	126	60	66	58	46	28	25	24	3	43	34	42
4	8	78	58	160	76	84	72	58	33	30	30	3.5	54	44	53
5	10	98	65	179	85	94	81	65	38	35	33	3.5	60	49	60
6.3	12.5	123	73	201	96	105	91	73	44	40	39	4	68	55	67
8	16	157	83	228	109	119	104	83	50	45	42	4.5	77	62	76
10	20	196	92	253	121	132	115	92	55	50	48	5	86	69	85
12.5	25	245	103	283	135	148	129	103	60	55	52	5	96	77	95
16	32	314	117	322	153	169	146	117	65	60	60	5.5	109	88	108
20	40	392	131	360	171	189	164	131	75	70	68	6	122	98	120
25	50	490	146	401	191	210	182	146	85	80	72	6	136	110	134
32	59	579	159	437	208	229	199	159	90	85	80	6	148	119	146
40	69	677	173	476	227	249	216	173	105	100	90	6	161	130	159
50	81	795	191	525	250	275	239	191	115	110	100	8	178	143	176
63	97	952	205	564	269	295	256	205	125	120	110	8	191	154	189

^a Owing to the difficulty of machining it may be advantageous to increase the forged diameter of very long shanks.

Table 1 — Point hook with shank



Safe working load (max.)	Proof load		$L = 0.70C$	$M = 0.60C$	$N = 1.20C$	$O = 0.50C$	$R = 0.50C$	$U = 0.30C$	$X = 0.1G$	$Z = 0.12C$	Ball bearings ^a			
	Mass	Force P									Bore	Dimension series	Outside diameter	Height
t	t	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm		mm	mm
0.8	1.6	15.7	18	16	31	13	13	8	2	3	15	11	28	9
1.6	3.2	31.4	26	22	44	18	18	11	2	4	20	11	35	10
2.5	5	49	32	28	55	23	23	14	3	6	25	12	47	15
4	8	78	41	35	70	29	29	17	3	7	30	13	60	21
5	10	98	46	39	78	32	32	20	4	8	35	13	68	24
6.3	12.5	123	51	44	88	36	36	22	4	9	40	13	78	26
8	16	157	58	50	100	42	42	25	5	10	45	13	85	28
10	20	196	64	55	110	46	46	28	5	11	50	13	95	31
12.5	25	245	72	62	124	52	52	31	6	12	55	13	105	35
16	32	314	82	70	140	58	58	35	6	14	60	13	110	35
20	40	392	92	79	157	66	66	39	7	16	70	13	125	40
25	50	490	102	88	175	73	73	44	8	18	80	13	140	44
32	59	579	111	95	191	80	80	48	9	19	85	13	150	49
40	69	677	121	104	208	86	86	52	10	21	100	13	170	55
50	81	795	134	115	229	95	95	57	11	23	110	13	190	63
63	97	952	144	123	246	102	102	62	12	25	120	13	210	70

^a See BS 292 for details concerning single direction thrust ball bearings.