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IS 2429-1 (1987): Specification for Round Steel Short Link Chains (Electric Butt Welded), Grade L(3) Part 1
Non-Calibrated Load Chain for Lifting Purposes [MED 14:
Cranes, Lifting Chains and Related Equipment]



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Indian Standard
SPECIFICATION FOR
ROUND STEEL SHORT LINK CHAINS
(ELECTRIC BUTT WELDED), GRADE L(3)
**PART I NON-CALIBRATED LOAD CHAIN FOR LIFTING
PURPOSES**

(Third Revision)

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Indian Standard

**SPECIFICATION FOR
ROUND STEEL SHORT LINK CHAINS
(ELECTRIC BUTT WELDED), GRADE L(3)**

**PART 1 NON-CALIBRATED LOAD CHAIN FOR LIFTING
PURPOSES**

(Third Revision)

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Indian Standard

SPECIFICATION FOR ROUND STEEL SHORT LINK CHAINS (ELECTRIC BUTT WELDED), GRADE L(3)

PART 1 NON-CALIBRATED LOAD CHAIN FOR LIFTING PURPOSES

(Third Revision)

0. F O R E W O R D

0.1 This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards on 14 September 1987, 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 (Part 1) originally issued in 1965 was first revised in 1967 and then in 1970. This revision has been necessitated to align the pattern of requirements with Indian Standards covering other grades of chains. Other major changes in this revision relate to rationalizing the nominal sizes of the chain to bring them in line with international practice. Also, under mechanical properties, the minimum energy absorption factor has been deleted and in place of guaranteed minimum elongation at fracture, the concept of minimum total ultimate elongation has been introduced.

0.3 The reliability of chains is an important factor and, therefore, it is recommended that supplies should be obtained from manufacturers possessing adequate facilities for heat treatment and testing, and employing competent staff for detailed inspection.

0.4 Users are warned that a chain shall not be taken as complying with this standard, unless the specified tests have been made and the test requirements obtained in the presence of a competent person representing the purchaser. Where the quantity of chain ordered is insufficient to warrant the expense of special inspection, it is recommended that the chain should be sent to a recognized test house for the specified tests and examination.

0.5 Repairs to a chain shall be performed, where possible, by the original chain makers. Where this is not possible, they shall be performed by a qualified chain maker or chain tester according to the instructions of the maker.

0.6 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 rounding off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part 1) covers the requirements for lifting chains, Grade L(3), non-calibrated for lifting purposes. These are electric resistance or flash butt welded round steel short link chains fully tested and heat treated, and complying with the general conditions of acceptance of IS : 5616-1982†. The sizes from 6 to 45 mm are covered in this standard.

1.1.1 Arc welded chains are not covered in this specification.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 5616-1982† shall apply.

3. DIMENSIONS

3.1 Material Diameter (*d*) — The material diameter, defined and measured in accordance with the requirements of IS : 5616-1982†, shall be as given in Table 1.

3.1.1 Tolerance on Material Diameter — For sizes up to and including 18 mm, the diameter *d* of the material in the finished link shall nowhere differ from the nominal diameter by more than ± 0.5 mm or — 6 percent, except at the weld. For sizes above 18 mm, the diameter *d* of the material in the finished link shall nowhere differ from the nominal diameter by more than ± 5 percent except at the weld.

3.1.2 Tolerance at the Weld — The dimensions of the steel at the weld shall nowhere be less than the diameter *d* of the steel adjacent to the weld or exceed it by more than the following tolerances (see Fig. 1) :

*Rules for rounding off numerical values (revised).

†Short link chain for lifting purposes : General conditions of acceptance (first revision).

TABLE 1 DIMENSIONS OF GRADE L(3) NON-CALIBRATED CHAIN

(Clauses 3.1 and 3.2)

All dimensions in millimetres.

NOMINAL SIZE d_n	DIAMETER TOLERANCE ($d - d_n$)	MAXIMUM TOLERANCE AT THE WELD			OUTSIDE LINK LENGTH LIMITS (l)		MAXIMUM OUTSIDE LINK WIDTH AWAY FROM WELD w $3.5 d_n$
		Type 1 ($d_w - d$)	Type 2 ($d_w - d$)	Type 2 ($G - d$)	LENGTH LIMITS (l)		
					Max $5d_n$	Min $4.75 d_n$	
6	$\pm 0.5 - 0.36$	0.6	1.2	2.1	30	28	21
7.1*	$\pm 0.5 - 0.43$	0.71	1.42	2.5	36	34	25
8	$\pm 0.5 - 0.48$	0.8	1.6	2.8	40	38	28
9*	$\pm 0.5 - 0.54$	0.9	1.8	3.15	45	43	32
10	$\pm 0.5 - 0.60$	1.0	2.0	3.5	50	47	35
11	$\pm 0.5 - 0.66$	1.1	2.2	3.85	55	52	39
12	$\pm 0.5 - 0.72$	1.2	2.4	4.2	60	57	42
14	$\pm 0.5 - 0.84$	1.4	2.8	4.9	70	66	49
16	$\pm 0.5 - 0.96$	1.6	3.2	5.6	80	76	56
18	± 0.90	1.8	3.6	6.3	90	85	63
20	± 1.0	2.0	4.0	7.0	100	95	70
22	± 1.1	2.24	4.4	7.7	110	105	77
25	± 1.25	2.5	5.0	8.75	125	119	88
28	± 1.4	2.8	5.6	9.8	140	133	98
32	± 1.6	3.2	6.4	11.2	160	152	112
36	± 1.8	3.6	7.2	12.6	180	171	126
40	± 2.0	4.0	8.0	14.0	200	190	140
45	± 2.25	4.5	9.0	15.75	225	214	158

*These sizes will be supplied subject to agreement between the manufacturer and the purchaser.

Type 1 — 10 percent of the nominal diameter in any direction; and

Type 2 — 20 percent of the nominal diameter in the direction perpendicular to the plane of the link and 35 percent in other planes.

NOTE — Type 1 eliminates functional problems such as kinking or locking by severely limiting the weld oversize to 10 percent of the nominal diameter. Type 2 ensures freedom from these hazards by allowing the oversize beyond the 10 percent allowed in Type 1 to certain areas of the link only (see Fig. 1), thus providing clearance, where required.

3.1.3 Area Affected Dimensionally by Welding — The weld or welds are positioned in the centre of one or both legs of the link. The area affected dimensionally by welding shall not extend by more than 0.6 times the material diameter to either side of the centre of the link.

3.2 Length and Width — Dimensions of the link shall be according to the values given in Table 1 (see also Fig. 2).

4. MATERIAL

4.1 The steel used shall be produced by the open hearth or electric process or by oxygen-blown process. In its finished state, as supplied to the chain maker, the steel shall meet the following requirements as determined by check analysis on the rod, wire or finished link. It shall be fully killed, shall possess reliable welding quality and, when heat-treated, be capable of producing in the finished chain the specified mechanical properties. Its sulphur and phosphorus contents shall be restricted as follows:

Cast Analysis (Percent)

Sulphur, *Max* 0.045

Phosphorus, *Max* 0.040

Check Analysis (Percent)

0.050

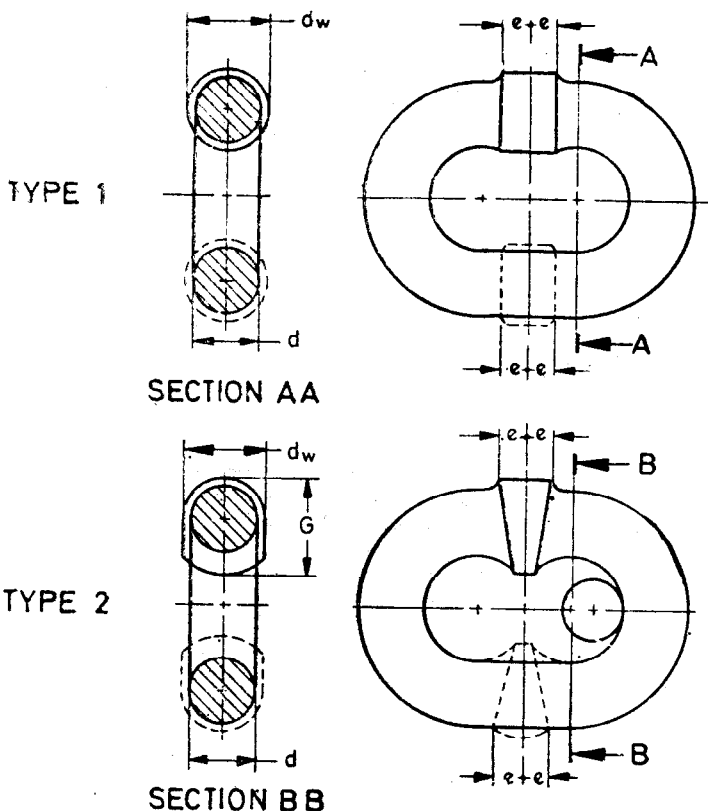
0.045

The steel shall be made in conformity with a suitable deoxidization practice to obtain an austenitic grain size of 5 or finer, when tested in accordance with IS : 2853-1964*. This could be accomplished, for example, by ensuring that it contains sufficient aluminium or an equivalent element to permit the manufacture of chains stabilized against strain and age-embrittlement during service; a minimum value of 0.02 percent metallic aluminium is given for guidance. Within the above limitations, it is the responsibility of the chain maker to select steel so that the finished chain, suitably heat-treated, meets the specified mechanical properties.

5. HEAT TREATMENT

5.1 All chains for lifting purposes shall be stress relieved, normalized or hardened and tempered before being subjected to proof force.

*Method of determining austenitic grain size of steel.



d_n = size (nominal diameter of the material),
 d = measured diameter of the material except at the weld,
 d_w = measured diameter of the material at the weld (Type 1 welded chain) or
 weld dimension perpendicular to the plane of the link (Type 2 welded chain),
 G = dimensions in other plane (Type 2 welded chain), and
 e = length affected by welding on either side of the centre of the link.

For all welds

$$e \leq 0.6 d_n$$

$$\text{For } d_n \leq 18 \text{ mm, } d = d_n + 0.5 \text{ mm} \\ - 6 \text{ percent}$$

$$\text{For } d_n > 18 \text{ mm, } d = d_n \pm 5 \text{ percent}$$

Weld tolerances for lifting chains

$$\text{Type 1 } d_w = d + \begin{matrix} 0.10 d_n \\ 0 \end{matrix}$$

$$\text{Type 2 } d_w = d + \begin{matrix} 0.20 d_n \\ 0 \end{matrix}$$

$$G = d + \begin{matrix} 0.35 d_n \\ 0 \end{matrix}$$

FIG. 1 MATERIAL AND WELD TOLERANCES

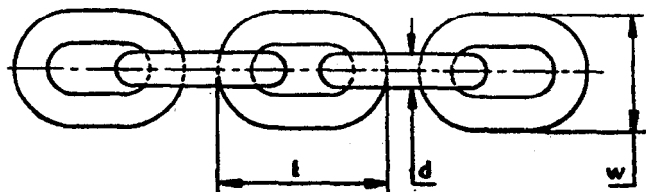


FIG. 2 LINK DIMENSIONS

6. PROOF LOADING

6.1 After manufacture, heat treatment and other processing, the finished chain shall be subjected to the proof force given in Table 2 as specified in IS : 5616 - 1982*.

TABLE 2 GRADE L(3) TEST REQUIREMENTS AND WORKING LOAD LIMITS

NOMINAL SIZE d_n	PROOF FORCE TO WHICH THE WHOLE CHAIN IS SUBJECTED	MINIMUM BREAKING FORCE	WORKING LOAD LIMIT
(1)	(2)	(3)	(4)
mm	kN	kN	tonnes
6	8.9	17.8	0.44
7.1	12.5	25.0	0.63
8	15.9	31.8	0.8
9	20.1	40.2	1.0
10	24.8	49.6	1.25
11	30.0	60.0	1.5
12	35.7	71.4	1.8
14	48.6	97.2	2.4
16	63.5	127.0	3.2
18	80.0	160.0	4.0
20	99.0	198.0	5.0
22	120.0	240.0	6.0
25	155.0	310.0	7.8
28	194.5	389.0	9.7
32	254.0	508.0	12.7
36	321.5	643.0	16.0
40	397.0	794.0	19.8
45	502.0	1 004.0	25.0

*Short link chain for lifting purposes: General conditions of acceptance (first revision).

7. TEST REQUIREMENTS

7.1 General — Actual test forces for each size are given in Table 2. The mechanical properties required for this grade of chain are summarized in Table 3.

TABLE 3 MECHANICAL PROPERTIES

MECHANICAL PROPERTIES (1)	REQUIREMENT (2)
Mean stress at specified minimum breaking force $\frac{2F_m \text{ Min}}{\pi d_n^2}$	315 MPa
Mean stress at proof force $\frac{2F_e}{\pi d_n^2}$	157.5 MPa
Ratio of proof force to specified minimum breaking force	50 percent
Specified minimum total ultimate elongation	20 percent
Mean stress at working load limit	78.75 MPa

NOTE — The stresses quoted in the table are obtained by dividing the force by the total cross-section of both sides of the link, that is, they are mean stresses. The stress is, in fact, not uniform and particularly at the extrados, the maximum fibre stress is considerably greater.

7.2 Selection of Samples — Samples shall be selected as specified in IS : 5616 - 1982*. The length of the lot from which a sample is selected by the inspector is 200 m or part thereof.

7.3 Static Tensile Test

7.3.1 The breaking force determined in accordance with IS : 5616 - 1982* shall not be less than that specified in Table 2.

7.3.2 The total ultimate elongation, as defined in IS : 5616 - 1982*, shall not be less than 20 percent.

8. INSPECTION

8.1 Acceptance Procedure — The acceptance procedure specified in IS : 5616 - 1982* shall be followed to determine the acceptability or otherwise of the chain.

*Short link chain for lifting purposes: General conditions of acceptance (*first revision*).

9. MARKING

9.1 Quality Marking — The chain shall be marked with 'L' or '3' in a circle, that is, (L) or (3), as recommended in IS : 5616 - 1982*.

9.2 Identification Marking — The identification marking shall comply with the requirements of IS : 5616 - 1982*.

9.3 Inspection Marking — Inspection marking shall comply with the requirements of IS : 5616 - 1982*.

10. TEST CERTIFICATE

10.1 The manufacturer shall supply a certificate of test and examination with every supply of tested lifting chain. A typical form is given in Appendix B of IS : 5616 - 1982*. The certificate shall give the following information:

- a) Name of the chain maker;
- b) Grade of material;
- c) Size of chain;
- d) Identification marking;
- e) Proof force applied to the whole chain;
- f) Number of test samples taken;
- g) Breaking force of each sample; and
- h) Total ultimate elongation at fracture.

NOTE — All testing shall be done in the presence of a competent person or in an approved testing establishment.

10.2 The certificate shall state that the whole of the chain was subjected to the specified proof force, and it was subsequently examined by a competent person and that it complies with this standard. It shall also state the name and address of the testing establishment, and the status of the signatory.

*Short link chain for lifting purposes: General conditions of acceptance (*first revision*).

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