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Edition 5

SOUTH AFRICAN NATIONAL STANDARD

Long-link and extra-long-link medium tolerance steel chains for general purposes

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SANS 251:2006
Edition 5

Table of changes

Change No.	Date	Scope

Abstract

Specifies the requirements for electrically welded long-link and extra-long-link medium tolerance steel chains ranging in size from 4 mm to 50 mm (inclusive), of grades 3, 4, 5, 6, 8 and 9, and intended for use as hand chains and for general purpose applications. The chains are not recommended for lifting purposes.

Keywords

breaking load, chains, chemical composition, dimensions, link chains, marking, materials handling equipment, mechanical components, mechanical properties of materials, specification.

Foreword

This South African standard was approved by National Committee StanSA TC 5120.22, *Lifting equipment*, in accordance with procedures of Standards South Africa, in compliance with annex 3 of the WTO/TBT agreement.

This edition cancels and replaces edition 4 (SABS 251:1993).

In the note to table 1 in 5.1, reference is made to the "relevant authority". In South Africa this means the Department of Labour or the Department of Mineral and Energy Affairs.

Annex A forms an integral part of this standard. Annex B is for information only.

3.4
factor of safety
FOS
allowance stresses made for possible accidental loads of high magnitude, in order to provide a margin of safety, and to protect against failure from unpredictable causes (see table 1)

3.5
grade of chain
number that represents the minimum mean stress at failure of a chain

NOTE For example, a grade 4 chain is, therefore, a chain in which the mean stress at failure will be approximately equal to 400 MPa when the chain is subjected to a tensile force equal to the specified minimum breaking strength appropriate to its size.

3.6
material diameter
d
diameter (in millimetres) of the material as measured at points other than at the weld or on the barrel opposite the weld and that is the mean of two measurements taken at right angles in that plane of the section (see figure 1)

3.7
pitch
p
inside length (in millimetres) of a chain link (see figure 1)

3.8
processing
treatment of a chain after it has been welded

NOTE Examples of the processing of a chain are heat treatment and polishing.

3.9
minimum proof force
P_f
specified force (in kilonewtons) to which an entire chain is subjected after complete processing

3.10
minimum specified elongation
specified extension of a gauge length of a chain at the actual breaking force, expressed as a percentage increase of the original gauge length

3.11
minimum total elongation
total extension of a gauge length of a chain after fracture, expressed as a percentage increase of the original gauge length

3.12
working load limit
WLL
maximum mass that can be safely handled at a specified position and under specific conditions

5.3.2 Dimensions of long-link chains

The dimensions of a long-link chain shall be as given in table 3, appropriate to the chain size (see also figure 2).

5.3.3 Dimensions of extra-long-link chains

The dimensions of an extra-long-link chain shall be as given in table 4, appropriate to the chain size (see also figure 2).

5.3.4 Diameter at the weld

The diameter of the steel at the weld d_w, measured at right angles to the plane of the link, shall be at least equal to the material diameter d and shall not exceed it by more than the following tolerances (see figures 2 and 3 and tables 3 and 4):

a) type 1 welds: 10% of the chain size in any direction;

b) type 2 welds: 20% of the chain size in any direction; and

c) type 3 welds: 20% of the chain size at right angles to the plane of the link and 30 % in other planes.

5.3.5 Area affected dimensionally by welding

The area affected dimensionally by welding shall not extend by more than 0,6 times the chain size d_n, on either side of the centre of the link (dimension e in figure 3).

5.4 Workmanship

5.4.1 General

The weld shall be positioned in the centre of one of the legs of a link. The weld metal shall not be so displaced as to undercut the contours of the link. Grades 4, 5, 6, 8 and 9 shall be mechanically trimmed. Undercutting of the weld shall not be permitted (see figure 4).

5.4.2 Smooth-welded chains (type 1 and type 2 welds)

Any fins caused by welding shall have been removed and the weld shall be smoothly finished all round (see figures 3 and 5).

5.4.3 Asymmetric-welded chains (type 3 weld)

Any fins caused by welding shall have been so removed from the exterior (but not necessarily from the interior) of a link that the weld has a smooth exterior (see figures 3 and 5).

Table 3 — Dimensions of long-link chains

1	2	3	4	5	6
Chain size, d_n		Pitch, p		Minimum inside width, w_1 mm	Maximum outside width, w_2, away from weld mm
Nominal mm	Tolerance, (±) mm	Nominal mm	Tolerance, (±) mm		
4,0	0,16	16,0	0,64	5,2	14,0
4,8	0,19	19,2	0,77	6,2	16,8
5,0	0,20	20,0	0,80	6,5	17,5
5,6	0,22	22,4	0,90	7,3	19,6
6,0	0,24	24,0	0,96	7,8	21,0
6,3	0,25	25,2	1,01	8,2	22,1
7,0	0,28	28,0	1,12	9,1	24,5
7,1	0,28	28,4	1,14	9,2	24,9
8,0	0,32	32,0	1,28	10,4	28,0
9,0	0,36	36,0	1,44	11,7	31,5
10,0	0,40	40,0	1,60	13,0	35,0
11,2	0,45	44,8	1,79	14,6	39,2
13,0	0,52	52,0	2,08	16,9	45,5
14,0	0,56	56,0	2,24	18,2	49,0
16,0	0,64	64,0	2,56	20,8	56,0
20,0	1,00	80,0	3,20	26,0	70,0
26,0	1,30	104,0	4,16	33,8	91,0
32,0	1,60	128,0	5,12	41,6	112,0
40,0	2,00	160,0	6,14	52,0	140,0
45,0	2,25	180,0	7,20	58,5	157,5
50,0	2,50	200,0	8,00	65,0	175,0

10.6 削後

Table 4 — Dimensions of extra-long-link chains

1	2	3	4	5	6
Chain size, d_n		Pitch, p		Inside width, w_1 mm	Maximum outside width, w_2, away from weld mm
Nominal mm	Tolerance, (±) mm	Nominal mm	Tolerance,(±) mm		
4,0	0,15	20,0	0,80	6,8 – 8,0	16,0
4,8	0,15	24,0	0,96	8,2 – 9,6	19,2
5,6	0,20	28,0	1,12	9,5 – 11,4	22,4
7,1	0,20	42,6	1,70	12,1 – 14,2	28,4
10,0	0,20	60,0	2,40	17,0 – 20,0	40,0
14,0	0,25	84,0	3,36	23,8 – 28,0	56,0
16,0	0,35	96,0	3,84	25,0 – 27,5	60,2

20×96.3×27 LL M重量 7.34 kg、

Bibliography

ASTM A 751, *Standard test methods, practices, and terminology for chemical analysis of steel products.*

DIN 763, *Tested, non-calibrated, long-link round steel chains.*

DIN 5685-1, *Round steel link chains non-proof loaded – Part 1: Long link.*

DIN 5685-2, *Round steel link chains non-proof loaded – Part 2: Semi-long link.*

DIN 5685-3, *Round steel link chains non-proof loaded – Part 3: Short link.*

SANS 9001/ISO 9001, *Quality management systems – Requirements.*

4 Symbols

The symbols used in the figures and tables in this standard are as follows:

B_{fb} Actual breaking force

B_{fm} Minimum breaking force

C_b Working load limit (WLL)

d Diameter of the material, measured at points other than at the weld (see figure 1)

d_n Chain size (nominal diameter of the original steel rod or wire)

d_w Diameter of the material, measured at right angles to the plane of the link

e Length of a link affected by welding on either side of the geometric centre of the link

G Diameter of the material at type 3 weld, measured in the plane of the link

P_f Minimum proof force

p Pitch (inside length of the link) (see figure 1)

w_1 Inside width of the link (next to the weld) (see figure 1)

w_2 Outside width of the link (next to the weld) (see figure 1)

5 Requirements

5.1 Material

5.1.1 General

A chain shall be of grade 3, 4, 5, 6, 8 or 9, as required (see annex A). The completed chain shall have the mechanical properties given in table 1.

5.1.2 Grain size

When tested in accordance with ISO 643, the steel shall have an austenitic grain size of 5 or finer.

NOTE For grade 3, this could be accomplished by ensuring that the steel contains sufficient aluminium or an equivalent element, to permit the manufacture of chain that is stabilized against strain age embrittlement during service; a minimum value of 0,02 % metallic aluminium is given for guidance.

5.1.3 Composition

When determined in accordance with 7.3, the sulfur, phosphorus and aluminium content shall not exceed the values given in table 2.

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Table 1 — Mechanical properties

1	2	3	4	5	6	7
Mechanical property	Requirement					
	Grade of chain					
	3	4	5	6	8	9
Minimum mean stress at a specified minimum breaking force, $\frac{2B_{fm}}{\pi d_n^2}$	300 MPa	400 MPa	500 MPa	630 MPa	800 MPa	900 MPa
Minimum mean stress at minimum proof force, $\frac{2P_f}{\pi d_n^2}$	120 MPa	200 MPa	250 MPa	315 MPa	400 MPa	450 MPa
Ratio of minimum proof force to specified minimum breaking force	0,40	0,50	0,50	0,50	0,50	0,50
Total ultimate elongation, min.	17 %					
Minimum mean stress at working load limit (at an FOS of 4:1)	60 MPa	100 MPa	125 MPa	157,5 MPa	200 MPa	225 MPa
Factor of safety (FOS)	5 : 1	4 : 1	4 : 1	4 : 1	4 : 1	4 : 1
NOTE Unless otherwise authorized by the relevant authority (see foreword), the working load limit should not exceed the values given in table B.1.						

Table 2 — Chemical composition

1	2	3	4	5	6	7	8	9	10	11	12	13
Element	Maximum content (in terms of mass) %											
	Cast analysis						Check analysis					
	Grade of chain											
	3	4	5	6	8	9	3	4	5	6	8	9
Sulfur	0,045	0,035	0,035	0,035	0,035	0,035	0,050	0,050	0,040	0,040	0,040	0,040
Phosphorus	0,050	0,035	0,035	0,035	0,035	0,035	0,055	0,045	0,040	0,040	0,040	0,040
Aluminium	–	0,025 – 0,080					–	0,025 – 0,080				

5.2 Heat treatment

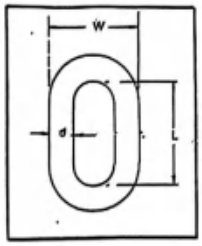
Where applicable, a chain shall have been acceptably heat treated before being subjected to the minimum proof force (see 5.5.1). For grades 5, 6, 8 and 9, heat treatment shall be hardening from a temperature above the AC3 point and being tempered at a temperature of 250 °C or higher before being subjected to the minimum proof force (see 5.5.1).

5.3 Chain dimensions

5.3.1 Size

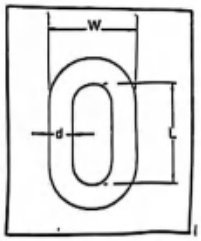
The chain size shall be one of those given in column 1 of table 3 or in column 1 of table 4, as appropriate and as required (see annex A).

CODE	CHAIN SIZE (mm)	WORKING LOAD LIMIT *(tons)	LINK DIMENSIONS mm			LINKS PER METRE	MASS PER METRE (kg)
			d	L	W		
1530LL0056	5,6	0,3	5,6	22,4	19,6	44,6	0,62
1530LL0063	6,3	0,4	6,3	25,2	22,1	39,7	0,79
1530LL0071	7,1	0,5	7,1	28,4	24,9	35,2	1,00
1530LL0090	9,0	0,8	9,0	36,0	31,5	27,8	1,61
1530LL0100	10,0	1,0	10,0	40,0	35,0	25,0	1,98
1530LL0112	11,2	1,2	11,2	44,8	39,2	22,3	2,49
1530LL0125	13,0	1,6	13,0	52,0	45,5	19,2	3,30
1530LL0140	14,0	1,9	14,0	56,0	48,0	17,9	3,89
1530LL0160	16,0	2,5	16,0	64,0	56,0	15,6	[illegible]
1530LL0200	20,0	3,8	20,0	80,0	70,0	12,5	7,93
1530LL0250	26,0	6,5	26,0	104,0	91,0	9,6	13,23



Sizes up to 50,0 mm

CODE	CHAIN SIZE (mm)	WORKING LOAD LIMIT *(tons)	LINK DIMENSIONS mm			LINKS PER METRE	MASS PER METRE (kg)
			d	L	W		
1530EL0071	7,1	0,5	7,1	43,0	28,0	23,0	0,90
1530EL0100	10,0	1,0	10,0	61,0	39,0	16,4	1,75
1530EL0140	14,0	1,9	14,0	80,0	49,0	12,5	3,44
1530EL0160	16,0	2,5	16,0	90,0	56,0	11,1	4,52



* 1 ton = 1000 kg

Stud link anchor chains also available

Contents

Annex A
(normative)

Notes to purchasers

A.1 The following requirements shall be specified in the tender invitations and in each order or contract:

a) the grade of the chain (see 5.1.1);

b) the size of the chain (see 5.3.1);

c) the length or the mass (or both) of the chain (see 5.8); and

d) whether certification is required (see 5.8).

A.2 The following requirement shall be agreed upon between the supplier and the purchaser:

when relevant, the finish of the chain (see 5.7).

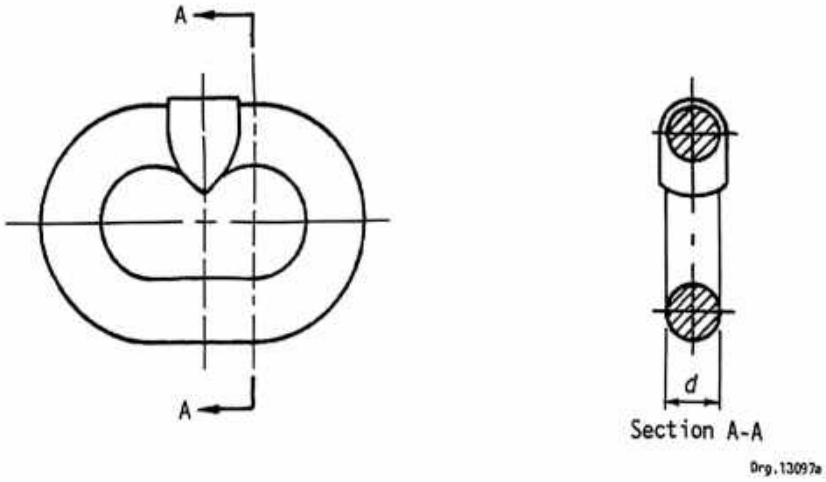


Figure 5(a) — Asymmetric welded type

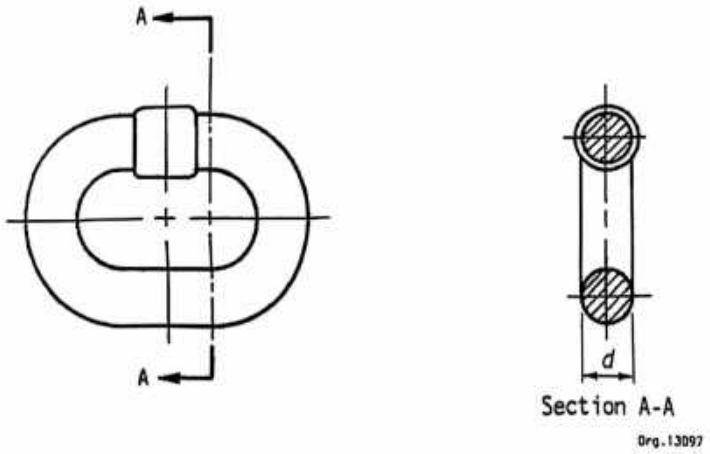
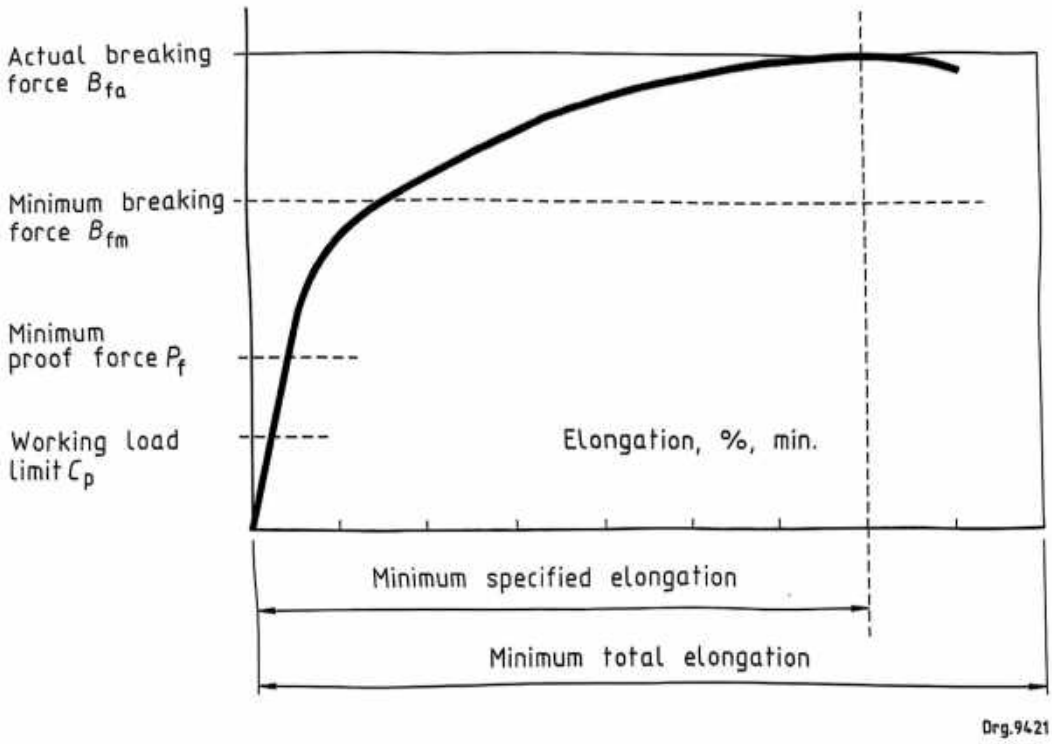


Figure 5(b) — Smooth welded type

Figure 5 — Types of welding of links



NOTE The purpose of this diagram is to illustrate the terms used; the shape of the curve is schematic and it is not intended to relate to any particular size of chain.

Figure 6 — Force/extension diagram

a) the stroke of the straining mechanism used for proof testing the chain is such that it will allow a chain of length equal to the full length of the testing bed to be tested, without the need for taking a fresh hold;

b) the machine is provided with grips that are so designed as to prevent slipping, and with an autographic recorder to enable a force/extension diagram (see figure 6) to be produced during the breaking force/tensile test (see 7.4.3); and

c) the machine has been calibrated in accordance with the conditions of ISO 7500-1 for a grade 1 machine.

7.4.2 Minimum proof force

So secure a piece of the chain of length not exceeding 30 m in the testing machine that the piece is not twisted, and subject it to the appropriate minimum proof force given in table 5. Repeat this procedure until the entire length of the chain has been tested, and examine it for compliance with 5.5.1.

7.4.3 Breaking force/tensile test

7.4.3.1 Test piece

From the chain cut a test piece consisting of at least five links. If necessary, include two more links for engagement in the jaws of the testing machine or use half links for this purpose, or use any other acceptable method.

7.4.3.2 Procedure

7.4.3.2.1 Measure the initial sum of the pitches of the test piece, excluding the pitches of any additional links (see 7.4.3.1).

7.4.3.2.2 So grip the test piece in the machine that the links can be freely loaded, then, using the autographic recorder (see 7.4.1 (b)) to produce a force/extension graph (see figure 6), increase the load at an even rate until fracture occurs (a recommended rate is 10 N/mm^2 per second). Read off the value for the breaking strength, and check for compliance with 5.5.2.

7.4.3.2.3 Read off the value for the total extension at fracture and express it as a percentage of the initial sum of the pitches of the test piece. Record this as the minimum total elongation and check for compliance with 5.5.3.

7.4.3.2.4 Should the first test piece fail to comply with 5.5.3, repeat the test on two further test pieces cut from the same chain and deem the chain to comply with 5.5.3 if both the additional test pieces comply.

a) the manufacturer's name, trade name or trademark;

b) the grade marking:

1) for a grade 3 chain: 3; or

2) for a grade 4 chain: 4; or

3) for a grade 5 chain: 5; or

4) for a grade 6 chain: 6; or

5) for a grade 8 chain: 8; or

6) for a grade 9 chain: 9.

c) the batch number; and

d) the date of manufacture.

Table 7— Size of marking areas on links

1	2
Chain size mm	**Diameter of marking area** mm
4,0 < 8,0 9,0 < 13,0 14,0 < 50,0	2,0 3,0 4,5

7 Inspection and methods of test

7.1 Inspection

Visually examine each chain in the sample for compliance with those requirements of the standard for which tests to assess compliance are not given in 7.3 and 7.4.

7.2 General

Test each chain in the completed condition, and ensure that it is clean and free from oil, grease and paint.

7.3 Chemical analysis

Use any recognized and acceptable method to determine the chain's sulfur and phosphorus content, and check for compliance with the relevant requirements of 5.1.3.

7.4 Strength tests

7.4.1 Apparatus

Tensile testing machine, that has been inspected and calibrated not more than six months before the tests and for which a certificate covering the most recent calibration is available for inspection purposes, and that incorporates the following features:

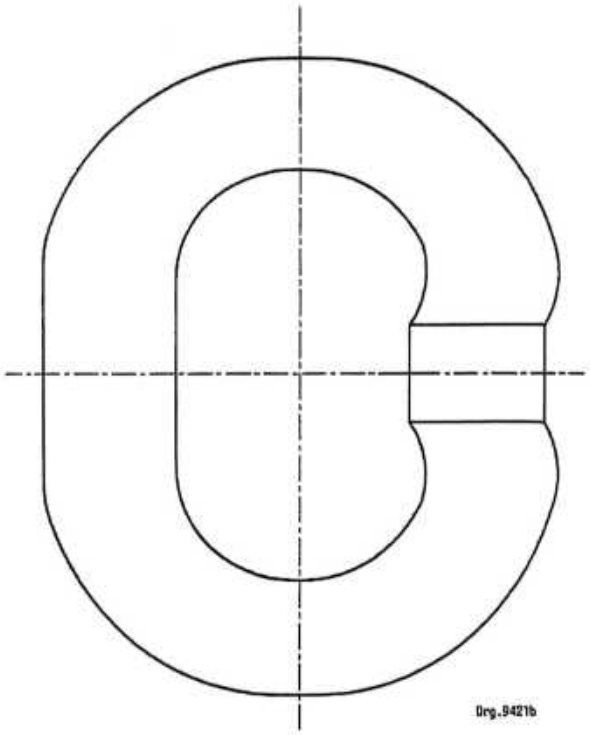


Figure 4 — Undercut at the weld (not permitted)

5.6 Inserted links

5.6.1 General

Replacement links that are inserted into a chain before or after proof testing of the chain shall have been so processed as to ensure that every link in the completed chain is in the same condition.

5.6.2 Links inserted after proof testing

Replacement links that are inserted into a chain after proof testing of the chain, and that portion of the chain affected by any processing, shall be subjected to the minimum proof test (see 7.4.2) and re-examined.

Table 6 — Minimum breaking force

1	2	3	4	5	6	7
Chain size, d_n mm	Minimum breaking strength, B_{fm} kN					
	Grade of chain					
	3	4	5	6	8	9
4,0	7,5	10,1	12,6	15,8	20,1	22,6
4,8	10,9	14,6	13,1	22,0	23,0	32,6
5,0	11,8	15,7	19,6	24,7	31,4	35,3
5,6	14,8	19,7	24,6	31,0	39,4	44,3
6,0	17,0	22,6	28,3	35,6	45,2	50,9
6,3	18,7	24,9	31,2	39,3	49,9	56,1
7,0	23,1	30,8	38,5	48,5	61,6	69,3
7,1	23,8	31,7	39,6	49,9	63,4	71,3
8,0	30,2	40,2	50,3	63,3	80,4	90,5
9,0	38,2	50,9	63,6	80,2	102,0	115,0
10,0	47,1	62,8	78,6	99,0	126,0	141,0
11,2	59,1	78,8	98,5	124,0	158,0	177,0
13,0	79,6	106,0	133,0	167,0	212,0	239,0
14,0	92,4	123,0	154,0	194,0	246,0	277,0
16,0	121,0	161,0	201,0	253,0	322,0	362,0
20,0	189,0	251,0	314,0	396,0	503,0	565,0
26,0	319,0	425,0	531,0	669,0	850,0	956,0
32,0	483,0	643,0	804,0	1 013,0	1 287,0	1 448,0
40,0	754,0	1 005,0	1 257,0	1 584,0	2 011,0	2 262,0
45,0	954,0	1 273,0	1 591,0	2 004,0	2 545,0	2 863,0
50,0	1 175,0	1 571,0	1 964,0	2 474,0	3 124,0	3 534,0

5.7 Finish

Unless otherwise agreed upon (see annex A), a completed chain shall be self-coloured, i.e. free from coating of any description.

5.5 Strength

5.5.1 Resistance to minimum proof force

All the links in a chain shall be subjected, in accordance with 7.4.2, to the appropriate minimum proof force given in columns 2 to 7 in table 5. After the minimum proof force has been removed, the links shall not have developed any faults, such as deformation or cracks, and, when manipulated, shall articulate freely.

5.5.2 Breaking force

The breaking strength of a chain, determined in accordance with 7.4.3.2.2, shall be at least that given in columns 2 to 7 in table 6, as appropriate.

5.5.3 Total ultimate elongation

The total ultimate elongation, determined in accordance with 7.4.3.2.3, shall be at least that given in table 1.

Table 5 — Minimum proof force

1	2	3	4	5	6	7
Chain size, d_n mm	Minimum proof force[a], P_f, kN					
	Grade of chain					
	3	4	5	6	8	9
4,0	3,0	5,0	6,3	7,9	12,6	11,3
4,8	4,3	7,2	9,0	11,4	18,1	16,3
5,0	4,7	7,9	9,8	12,4	19,6	17,7
5,6	5,9	9,9	12,3	15,5	24,6	22,2
6,0	6,8	11,3	14,1	17,8	28,3	25,4
6,3	7,5	12,5	15,6	19,6	31,2	28,1
7,0	9,2	15,4	19,2	24,2	38,5	34,6
7,1	9,5	15,8	19,8	24,9	39,6	35,6
8,0	12,1	20,1	25,1	31,7	50,3	45,2
9,0	15,3	25,5	31,8	40,1	63,6	57,3
10,0	18,9	31,4	39,3	49,5	78,6	70,7
11,2	23,6	39,4	49,3	62,1	98,5	88,7
13,0	31,9	53,1	66,4	83,6	133,0	119,0
14,0	36,9	61,6	77,0	97,0	154,0	139,0
16,0	48,3	80,4	101,0	127,0	201,0	181,0
20,0	75,4	126,0	157,0	198,0	314,0	283,0
26,0	127,0	212,0	265,0	335,0	531,0	478,0
32,0	193,0	322,0	402,0	507,0	804,0	724,0
40,0	302,0	503,0	628,0	792,0	1 257,0	1 131,0
45,0	382,0	636,0	795,0	1 002,0	1 591,0	1 431,0
50,0	471,0	786,0	982,0	1 237,0	1 964,0	1 767,0

[a] The entire chain shall be subjected to this minimum proof force.

5.8 Test certificate

When so required (see annex A), the manufacturer shall supply a certificate with each chain that gives at least the following information:

a) a description of the chain, i.e. grade and type of weld;

b) the length or mass (or both) of the chain;

c) the identification of the chain manufacturer;

d) the chain size, in millimetres;

e) the minimum proof force, in kilonewtons;

f) the breaking force, in kilonewtons (i.e. certification that the specified minimum breaking strength was achieved or exceeded);

g) the total elongation at fracture, as a percentage (i.e. certification that the specified minimum total elongation was achieved or exceeded);

h) the working load limit, in tonnes;

i) the date of manufacture and the batch number of the chain;

j) the date of the tests;

k) the name of the testing authority; and

l) the signature of the responsible person.

6 Marking

6.1 Position of marking

6.1.1 Grade 3 chains shall bear identification marks as given in 6.2, legibly embossed, in one or more of the following positions:

a) on each end link;

b) on a substantial metal tag firmly attached to one end link; and

c) on at least each twentieth link, or on links at intervals of 1 m apart (whichever is the shortest distance between marked links).

The size of the marking area for the grade marking shall comply with the appropriate value given in table 7.

6.1.2 Grades 4, 5, 6, 8 and 9 shall bear identification marks as given in 6.2, legibly embossed, on at least every twentieth link, or on links at intervals of 1 m apart (whichever is the shortest distance between marked links).

6.2 Identification marking

The chain shall be identified by means of at least the following marking:

Long-link and extra-long-link medium tolerance steel chains for general purposes

1 Scope

This standard specifies the requirements for electrically welded long-link and extra-long-link medium tolerance steel chains ranging in size from 4 mm to 50 mm (inclusive), of grades 3, 4, 5, 6, 8 and 9, and intended for use as hand chains and for general purpose applications. Chains covered by this standard are not recommended for lifting purposes.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. All standards are subject to revision and, since any reference to a standard is deemed to be a reference to the latest edition of that standard, parties to agreements based on this standard are encouraged to take steps to ensure the use of the most recent editions of the standards indicated below. Information on currently valid national and international standards can be obtained from Standards South Africa.

ISO 643, *Steels – Micrographic determination of the apparent grain size.*

ISO 7500-1, *Metallic materials – Verification of static uniaxial testing machines – Part 1: Tension/compression testing machines – Verification and calibration of the force-measuring system.*

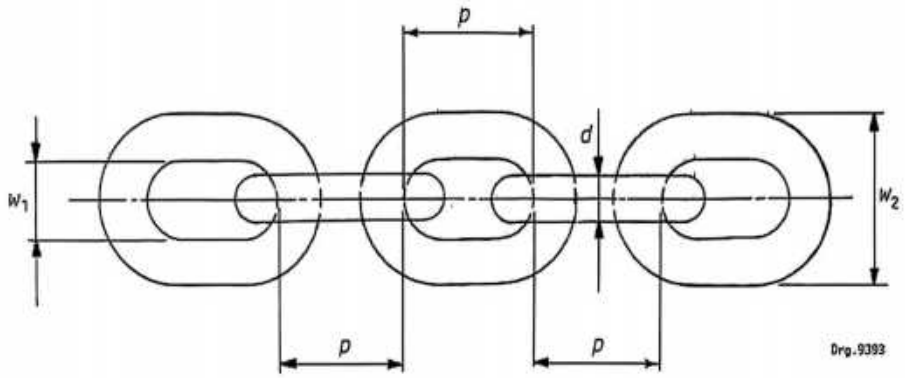
3 Definitions

For the purposes of this standard, the following definitions apply:

3.1
acceptable
acceptable to the authority administering this standard or to the parties concluding the purchase contract, as relevant

3.2
breaking force
B_f
when a chain is subjected to a static tensile test, the maximum force (in kilonewtons) that the chain can withstand, before destruction

3.3
chain size
d_n
nominal diameter (in millimetres) of the steel wire or bar from which a chain is made



p pitch (inside length) of a link

d material diameter of a link

w_1 inside width of a link

w_2 outside width of a link

Figure 1 — Chain and link dimensions

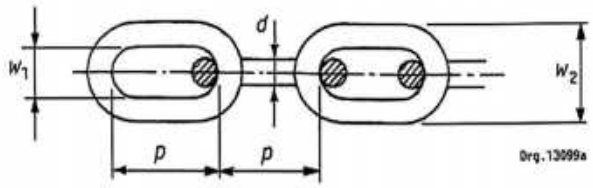


Figure 2(a) — Long link

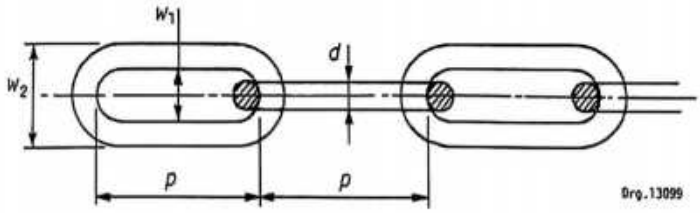


Figure 2(b) — Extra-long link

Figure 2 — Types of link

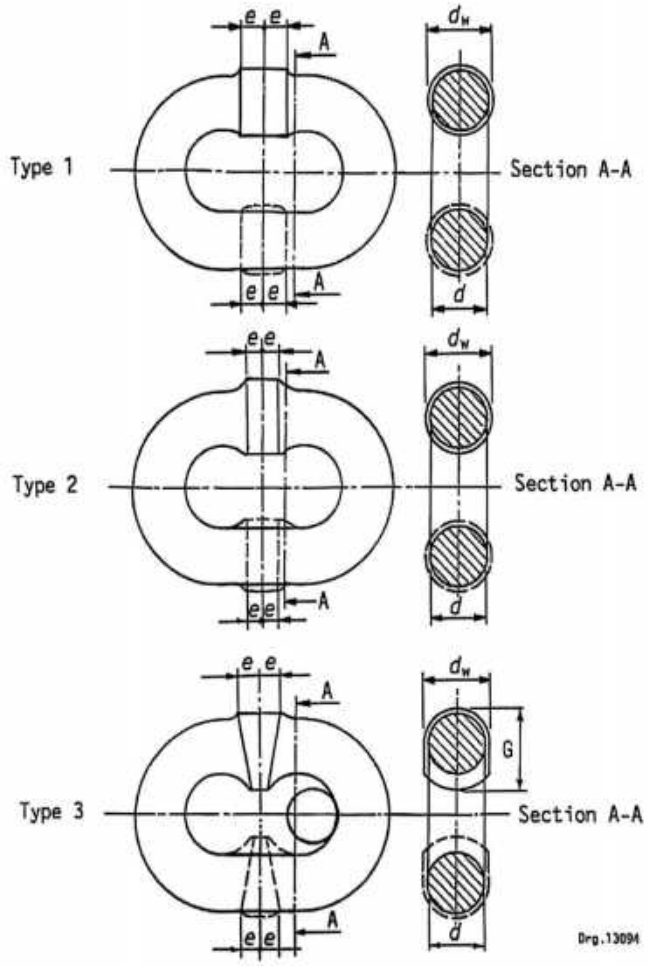
Annex B
(informative)

Working load limits

The working load limits in table B.1 are based on an FOS of 4 and are given merely for guidance.

Table B.1 — Working load limits

1	2	3	4	5	6	7
Chain size, d_n mm	Working load limit, C_p t					
	Grade of chain					
	3	4	5	6	8	9
4,0	0,15	0,26	0,32	0,40	0,51	0,58
4,8	0,22	0,37	0,46	0,58	0,74	0,83
5,0	0,24	0,40	0,50	0,63	0,80	0,90
5,6	0,30	0,50	0,63	0,79	1,00	1,13
6,0	0,35	0,58	0,72	0,91	1,20	1,30
6,3	0,38	0,64	0,80	1,00	1,30	1,43
7,0	0,47	0,79	1,00	1,20	1,60	1,77
7,1	0,48	0,81	1,00	1,30	1,60	1,82
8,0	0,62	1,00	1,30	1,60	2,10	2,30
9,0	0,78	1,30	1,60	2,00	2,60	2,90
10,0	1,00	1,60	2,00	2,50	3,20	3,60
11,2	1,20	2,00	2,50	3,20	4,00	4,50
13,0	1,60	2,70	3,40	4,30	5,40	6,10
14,0	1,90	3,10	3,90	4,90	6,30	7,10
16,0	2,50	4,10	5,10	6,50	8,20	9,20
20,0	3,80	6,40	8,00	10,10	12,80	14,00
26,0	6,50	10,80	13,50	17,10	21,70	24,00
32,0	9,80	16,40	20,50	25,90	32,80	37,00
40,0	15,40	25,60	32,10	40,40	51,30	58,00
45,0	19,50	32,50	40,60	51,10	64,90	73,00
50,0	24,00	40,10	50,10	63,10	80,20	90,00



For all welds:

$e \leq 0{,}6\ d_n$

For $d_n < 18$ mm, $d = d_n {}^{+2\%}_{-6\%}$

For $d_n \geq 18$ mm, $d = d_n \pm 5\ \%$

Weld tolerance:

Type 1 weld: $d_w = d {}^{+0{,}10dn}_{0{,}00}$

Type 2 weld: $d_w = d {}^{+0{,}20dn}_{0{,}00}$

Type 3 weld: $d_w = d {}^{+0{,}20dn}_{0{,}00}$

$G = d {}^{+0{,}35dn}_{0{,}00}$

Figure 3 — Material and weld tolerances