BRITISH STANDARD

BS ISO
9633:2001

Cycle chains — Characteristics and test methods

ICS 43.160;21.220.30

National foreword

This British Standard reproduces verbatim ISO 9633:2001 and implements it as the UK national standard.

The UK participation in its preparation was entrusted to Technical Committee MCE/1, Chains and chain wheels for power transmission, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 September 2001

Summary of pages

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Cycle chains — Characteristics and test methods

Chaînes pour cycles — Caractéristiques et méthodes de contrôle

Reference number
ISO 9633:2001(E)

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Annex

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 9633 was prepared by Technical Committee ISO/TC 100, *Chains and chain wheels for power transmission and conveyors*.

This second edition cancels and replaces the first edition (ISO 9633:1992), which has been revised to reflect improvements in the design and manufacture of cycle chains. This edition specifies a lower minimum tensile strength for 082 C chains and deals with the measurement of pin push-out resistance.

Annex A of this International Standard is for information only.

Cycle chains — Characteristics and test methods

1 Scope

This International Standard specifies the dimensions and mechanical properties of cycle chains, as well as test methods for determining these mechanical properties (i.e. twist, lateral deviation, stiff link and side bow).

NOTE The dimensions of sprockets for cycle chains are specified in ISO 606.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 606:1994, *Short-pitch transmission precision roller chains and chain wheels*.

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1
lateral deviation
condition when the actual centreline of the chain is not straight

3.2
side bow
condition characterized by the height of an arc assumed by the chain in a plane parallel to the plane of the chain pins, when the chain is laterally deflected to the maximum extent permitted by its internal tolerances

3.3
stiff link
condition when a chain link cannot be articulated smoothly through an angle of 60°, to the right and to the left, from the alignment axis of the two adjacent links

3.4
twist
condition when the axes of articulation of the chain links are not in the same plane

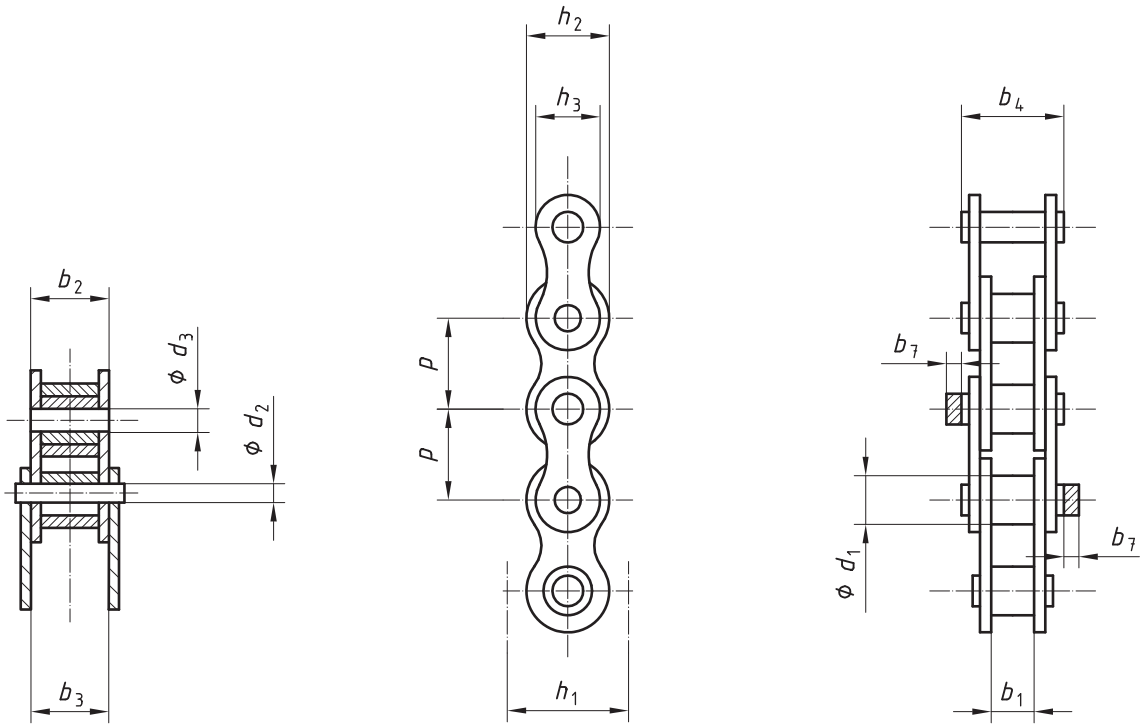
4 Cycle chains

4.1 Designation

Chains complying with all the requirements of this International Standard are exclusively intended for use on cycles. Cycle chains, denoted by the suffix C, shall be designated by the standard ISO chain numbers given in Table 1.

4.2 Dimensions

Cycle chains shall comply with the dimensions shown in Figure 1 and specified in Table 1. These dimensions ensure interchangeability of complete chains produced by different manufacturers.



Type I: regular roller chain

Type II: non-bush chain

Figure 1 — Chain (see Table 1)

Table 1 — Principal dimensions, measuring forces, push-out forces and tensile strengths of chains (Figure 1)

ISO chain number	Chain structure	Pitch	Roller diameter	Width between inner plates	Bearing pin body diameter	Bush bore	Chain path depth	Inner plate depth	Outer plate depth	Clearance between inner and outer link	Width over bearing pins[a]	Additional width for joint fastener[b]	Measuring force	Push-out force	Tensile strength
		p	d_1	b_1	d_2	d_3	h_1	h_2	h_3	$b_3 - b_2$	b_4	b_7			
			max.	min.	max.	min.	min.	max.	max.	min.	max.	max.		min.	min.
		mm											N		
081 C	Type I	12,7	7,75	3,3	3,66	3,69	10,2	9,9	9,9	0,05	10,2	1,5	125	—	8 000
082 C	Type I	12,7	7,75	2,38	3,66	3,69	10,2	9,9	9,9	0,1	8,2	—	125	780	8 000[c]
082 C	Type II	12,7	7,75	2,38	3,66	3,69	9	8,7	8,7	0,05	7,4	—	125	780	8 000[c]

[a] The actual dimensions of 082 C chain will depend on the type of derailleur used but should not exceed the given dimension, details of which should be obtained by the purchaser from the manufacturer.

[b] The actual dimension will depend on the type of fastener used but should not exceed the given dimension, details of which should be obtained by the purchaser from the manufacturer.

[c] Chains having a higher minimum tensile strength may be supplied if agreed between the purchaser and manufacturer.

4.3 Tensile testing

The minimum tensile strength of each chain shall be as specified in Table 1. The values are only valid for the following test lengths and conditions.

A tensile force, not less than the minimum tensile strength specified in Table 1, shall be applied slowly to the ends of a chain length containing at least five free pitches, by means of shackles permitting free movement on both sides of the chain centreline in the normal plane of articulation.

Failure shall be considered to have occurred at the first point where increasing extension is no longer accompanied by increasing load, i.e. the summit of the force/extension diagram.

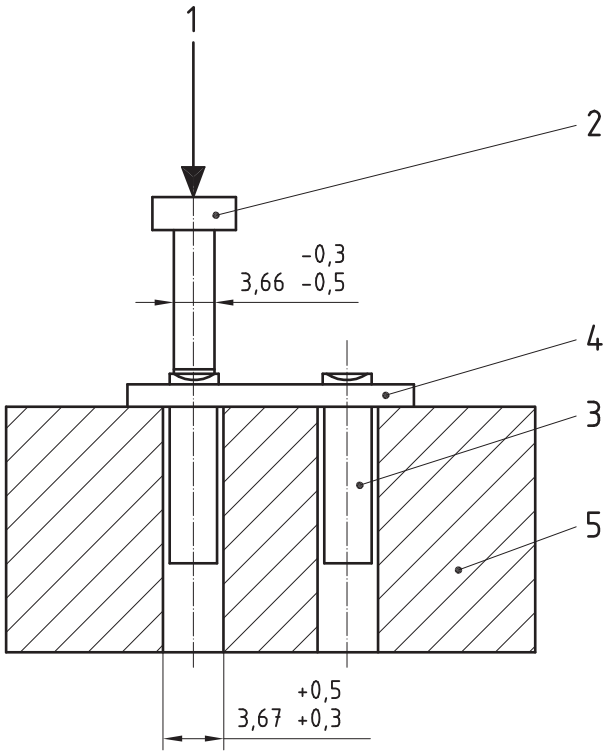
Tests in which failures occur adjacent to the shackles shall be disregarded.

The tensile test shall be considered a destructive test and the tested sample shall be discarded.

4.4 Push-out force

4.4.1 Select a pin link from a finished chain.

4.4.2 Place the pin link, consisting of an outer plate and two riveted pins, on the test apparatus shown in Figure 2.



Key

1 Load
2 Pusher
3 Bearing pins (2)
4 Outer plate
5 Tool

Figure 2 — Test apparatus for measurement of pin push-out resistance

4.4.3 Apply the load slowly to the pusher until the pin is pushed out of the outer plate.

4.4.4 The minimum load for pushing out a pin from an outer plate of 082 C chain shall be as specified in Table 1.

4.4.5 When taking a sample from a chain, care shall be taken to ensure that there is no extra strain between the outer plate and the two riveted pins.

4.5 Pre-loading

Chains manufactured in accordance with this International Standard shall be pre-loaded by the application of a tensile force equivalent to one-third of the minimum tensile strength specified in Table 1.

4.6 Length accuracy

The length of finished chains shall be measured after pre-loading (see 4.5) but before lubricating or after degreasing.

The standard length for measurement shall be a minimum of 610 mm and the chain shall terminate with an inner link at each end.

The chain shall be supported throughout its entire length and the measuring force given in Table 1 shall be applied.

The measured length shall be the nominal length $^{+0,15}_{0}$ % for chain 081 C and $^{+0,15}_{-0,08}$ % for chain 082 C.

4.7 Marking

The chain shall be marked with the manufacturer's name or trademark.

It is recommended that the ISO chain number specified in Table 1 be marked on the package.

5 Determination of twist

5.1 Visual detection of twist

To detect twist visually, suspend the chain by one end and observe the alignment of the links.

NOTE This visual check detects localized faults, whereas the procedure described in 5.2 permits the determination of twist and gives an evaluation of the chain's ability to be twisted.

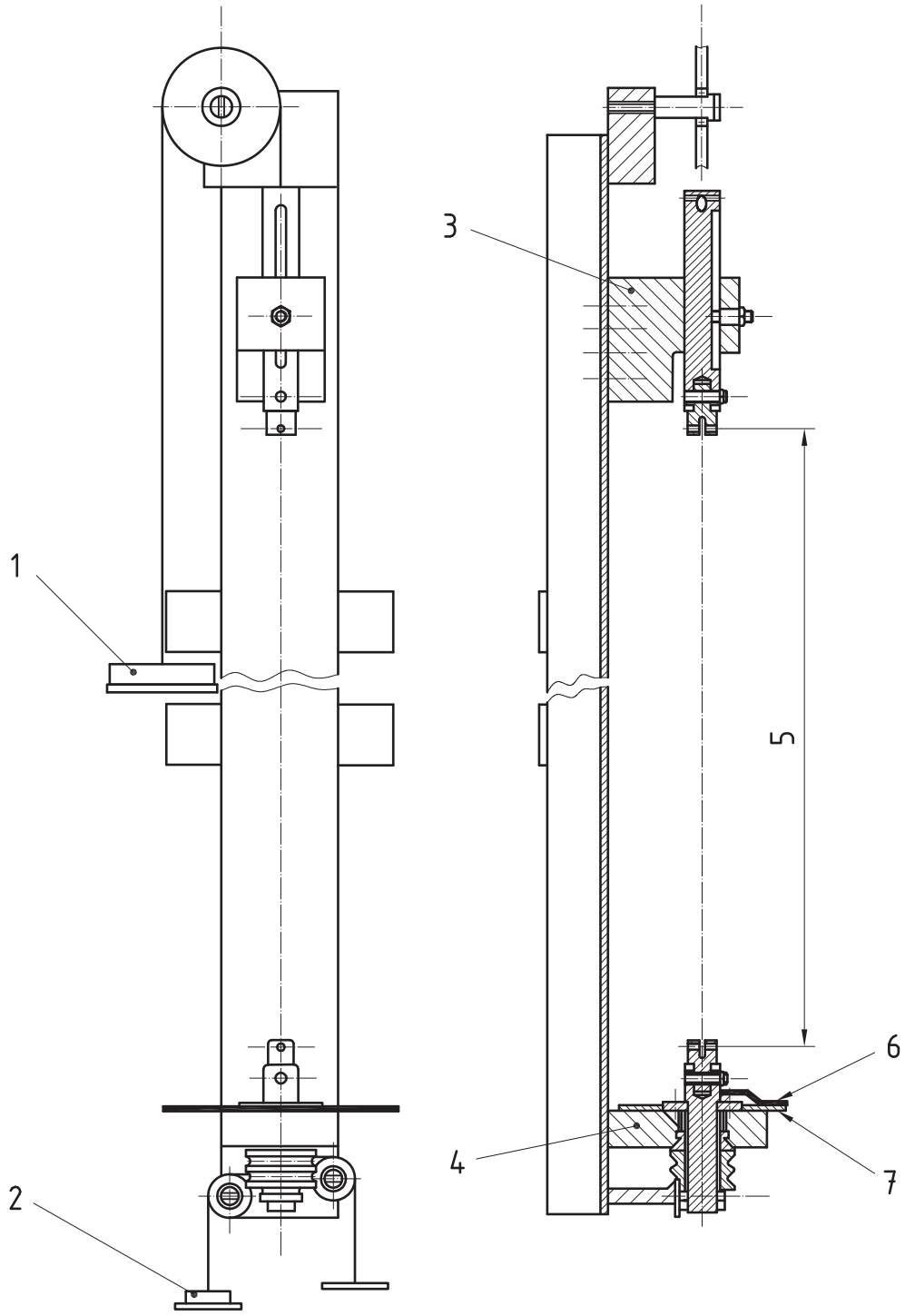
5.2 Method of measuring twist

5.2.1 Apparatus

The apparatus for measuring twist shall be as shown in Figure 3 and shall meet the geometric requirements demonstrated in Figure 4.

5.2.2 Test sample

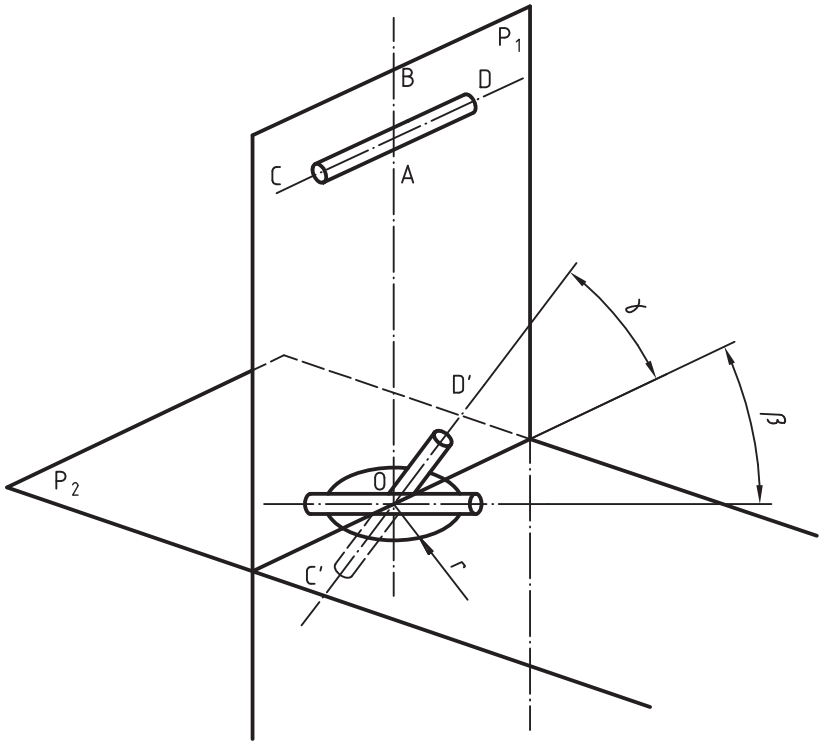
Choose a length of cycle chain 49 links long and free from grease, each end of which consists of an inner link.



Key

1	Balancing weight
2	Torque balance weight
3	Sliding head
4	Fixed shackle head
5	49 links of 12,7 mm pitch
6	Pointer
7	Protractor scale

Figure 3 — Test apparatus for determination of twist



P_1 is the vertical plane defined by the axis of displacement AB of the sliding head and the pin CD of the upper attachment of the chain.

NOTE Pins CD and C′D′ are not the end pins of the chain; they are the attachment pins of the test apparatus.

P_2 is a horizontal plane perpendicular to P_1.

O is the projection of the axis AB in the plane P_2. It is the origin and the point of intersection of axis AB and the line of intersection of P_1 and P_2.

O′ is the centrepoint of symmetry of pin C′D′ of the lower attachment of the chain. It may

a) coincide with O,

b) lie on the line of intersection of P_1 and P_2 at a maximum distance r from O, or

c) lie in P_2 but not on the line of intersection of P_1 and P_2; in that case, O′ should not lie outside a circle of radius r, the centre of which coincides with O.

β is in P_2 and is the angle through which pin C′D′ can rotate in P_2.

γ is in P_1. If O′ lies on the line of intersection of P_1 and P_2, γ is the angle through which pin C′D′ can rotate in P_1; if O′ does not lie on the line of intersection of P_1 and P_2, γ lies in any plane P′ parallel to P_1 and crossing the area of the circle of radius r and centre O in P_2.

Figure 4 — Geometry of test apparatus and geometric requirements

5.2.3 Test sample installation

Suspend the chain by the upper pin CD of the attachment (see Figure 4) by means of a shackle on the sliding head permitting free rotational movement on both sides of the chain centreline of 1° max.

The alignment of the attachment pins before commencement of the test shall be as follows:

$$-1^\circ \leqslant \beta \leqslant +1^\circ$$

$$-1^\circ \leqslant \gamma \leqslant +1^\circ$$

The inner link of the lower end of the test chain shall be gripped in the first shackle head.

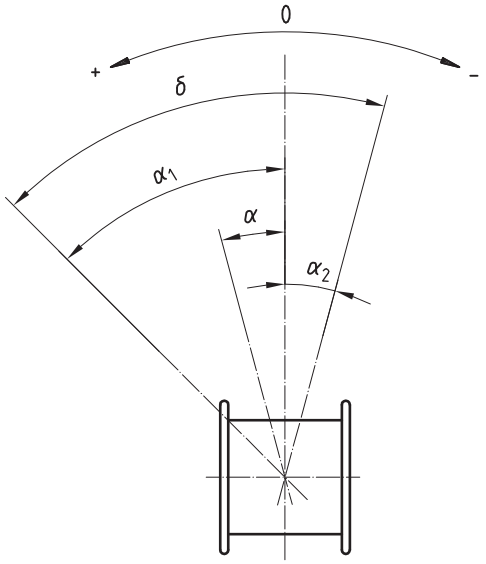
5.2.4 Test procedure

5.2.4.1 Apply a tensile force of 5 N to the lower end of the chain by setting the balance weight.

5.2.4.2 Apply a torque of 0,2 N·m to the lower link of the chain, first in one angular direction then in the other.

5.2.4.3 Measure the angular displacement at both sides of the apparatus zero (see Figure 5).

NOTE Angle α is a measure of the net twist of the chain under test about the apparatus zero in a clockwise or anticlockwise direction. The angle α is in an anticlockwise direction from the apparatus zero, viewed from above, when positive, and is in a clockwise direction from the apparatus zero, viewed from above, when negative. The net twist value α is calculated as half the difference between α_1 and α_2. A negative value of α or τ only indicates a net clockwise twist in the chain under test, viewed from above; it does not indicate a negative algebraic quantity. Examples of the calculation of the twist value are given in Annex A.



$$\alpha = \frac{\alpha_1 - \alpha_2}{2}$$

$$\tau = \frac{\alpha}{\delta}$$

Twist total value $\delta = \alpha_1 + \alpha_2$

Figure 5 — Measurement of twist

5.2.5 Acceptance criteria

The values of α and τ shall be within the following limits:

$$\alpha \leqslant \pm 15^{\circ}$$

where $\alpha = \frac{\alpha_1 - \alpha_2}{2}$

$$\tau \leqslant \pm 0{,}17$$

where $\tau = \frac{\alpha}{\delta}$ and $\delta = \alpha_1 + \alpha_2$

6 Determination of lateral deviation

6.1 Visual detection of lateral deviation

To visually detect any lateral deviation, suspend the chain by one end and observe the alignment of the links.

6.2 Method of determining lateral deviation

6.2.1 Apparatus

The apparatus for measuring lateral deviation shall comprise a straightedge (see Figure 6) whose surfaces are ground to the dimensions specified in Table 2.

Table 2 — Dimensions of straightedges (see Figure 6)

ISO chain number	L $\pm$ 0,5	L' $\pm$ 0,2	l $-0{,}02$ $-0{,}04$	l' 0 $-0{,}1$	h min.
081 C	355,6	6,3	3,17	2,8	3,17
082 C	355,6	6,3	2,28	1,8	2,28
NOTE Length L corresponds to 28 chain links.					

For convenience of handling, a straightedge for each size of chain may be incorporated into a holder (see Figure 7).

6.2.2 Test procedure

6.2.2.1 Place a sample chain comprising a minimum of 49 links in a horizontal plane with its axes horizontal and fix it at one of its ends. Apply a tensile force of 12,5 N at the other end (see Figure 8).

6.2.2.2 From the fixing point of the chain, slide the measuring straightedge inside the inner plates of the chain over the whole length of the sample, to ensure that the chain is correctly located.

6.2.2.3 Increase the tensile force to 1 kN and, from the fixing point of the chain, again slide the straightedge along the plates of the inner links over the entire length of the sample chain.

6.2.3 Acceptance criteria

If the straightedge can be moved freely over the entire length of the sample chain by a regular hand movement, the test is positive.

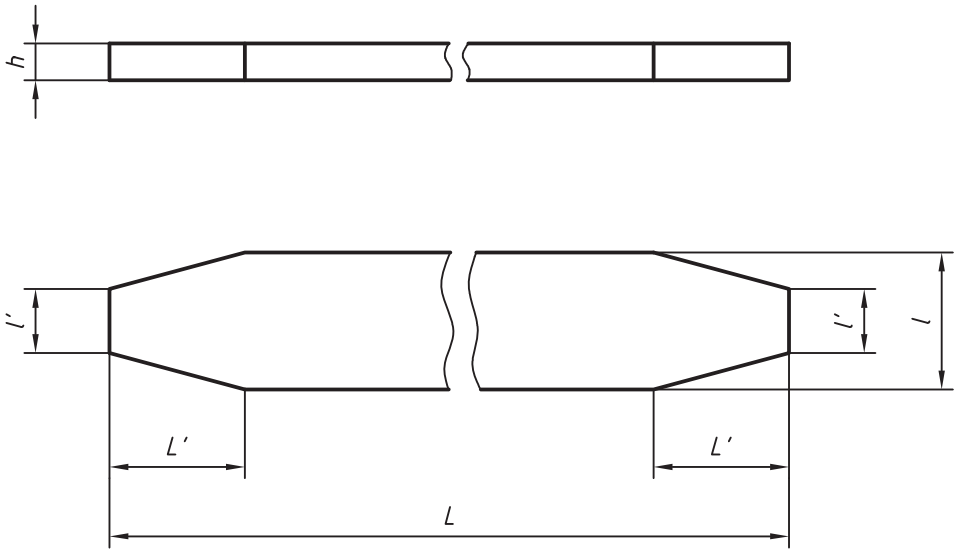
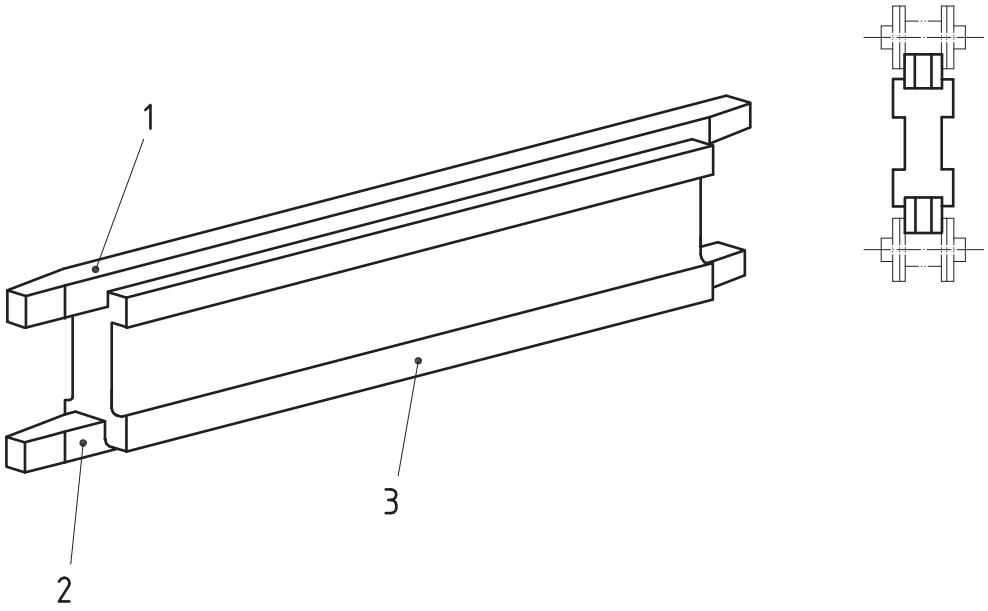


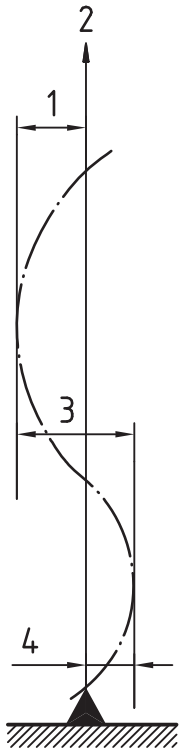
Figure 6 — Straightedge holder assembly



Key

1 Straightedge for 081 C chain
2 Straighedge for 082 C chain
3 Holder

Figure 7 — Straightedges



Key

1	Left-hand deviation
2	Tension
3	Total deviation
4	Right-hand deviation

Figure 8 — Diagrammatic plan of lateral deviation test

7 Detection of a stiff link

7.1 Test procedure

7.1.1 Lay a length of chain on a surface plate with the connecting pins parallel to the surface. Fix one end and move a 25,4 mm diameter test rod slowly and continuously beneath the whole length of the chain to its free end.

7.1.2 Turn the chain over and repeat 7.1.1.

7.1.3 Any link in either test which does not fall back flat onto the surface shall be declared a stiff link. If the check result is dubious, the chain should be degreased and the test should be repeated.

7.2 Acceptance criteria

There shall be no stiff links in the chain.

8 Determination of side bow

8.1 Method of measuring side bow

8.1.1 Lay a degreased chain length of 49 links, each end of which consists of an inner link, on a surface plate with the pins parallel to the surface, and apply a force of 3 N, as shown in Figure 9.

8.1.2 Gradually release the force and measure the arc height F.

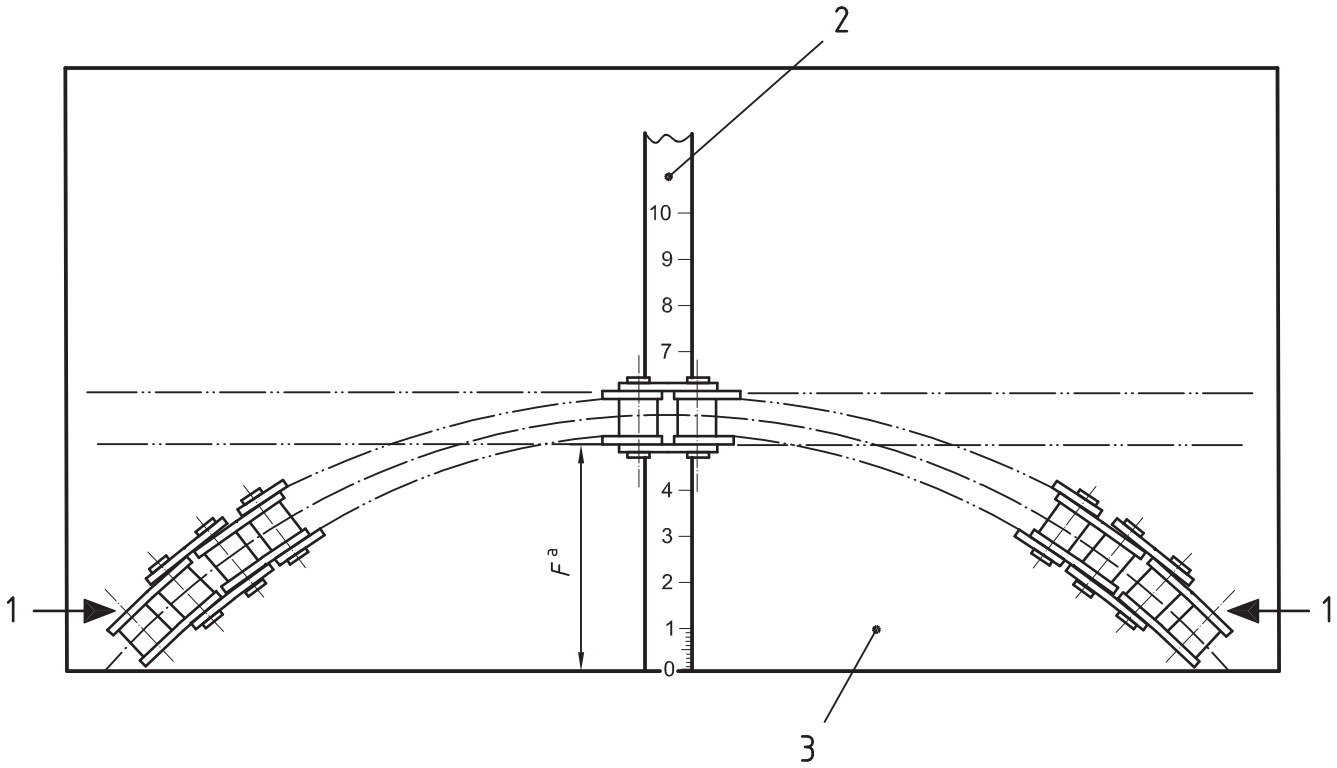
8.1.3 Turn the chain over and repeat 8.1.1 and the measurement of 8.1.2.

8.1.4 The smallest of these two measurements is considered as the side bow value F for this chain.

8.2 Acceptance criteria

The values of both measurements carried out according to 8.1.1 and 8.1.2 shall be within the following limits:

$$40 \text{ mm} \leqslant F \leqslant 120 \text{ mm}$$



Key

1 Applied force
2 Measuring rule
3 Surface plate

[a] Arc height

Figure 9 — Side bow measurement

Annex A
(informative)

Examples of calculation of twist value

Examples of calculation are given in Table A.1.

Table A.1 — Examples of calculation of twist value

Formulae	Case 1	Case 2	Case 3	Case 4
$\alpha = \frac{\alpha_1 - \alpha_2}{2}$	$\alpha_1 = 80^\circ$	$\alpha_1 = 10^\circ$	$\alpha_1 = 45^\circ$	$\alpha_1 = 35^\circ$
	$\alpha_2 = 10^\circ$	$\alpha_2 = 80^\circ$	$\alpha_2 = 35^\circ$	$\alpha_2 = 45^\circ$
	$\alpha = 35^\circ$	$\alpha = -35^\circ$	$\alpha = 5^\circ$	$\alpha = -5^\circ$
$\alpha \leqslant \pm 15^\circ$ [a]	$\alpha > \pm 15^\circ$	$\alpha > \pm 15^\circ$	$\alpha < \pm 15^\circ$	$\alpha < \pm 15^\circ$
$\delta = \alpha_1 + \alpha_2$	$\delta = 90^\circ$	$\delta = 90^\circ$	$\delta = 80^\circ$	$\delta = 80^\circ$
$\tau = \frac{\alpha}{\delta}$	$\tau = \frac{35^\circ}{90^\circ} = 0{,}39$	$\tau = \frac{-35^\circ}{90^\circ} = -0{,}39$	$\tau = \frac{5^\circ}{80^\circ} = 0{,}06$	$\tau = \frac{-5^\circ}{80^\circ} = -0{,}06$
$\tau \leqslant \pm 0{,}17$ [a]	$\tau > \pm 0{,}17$	$\tau > \pm 0{,}17$	$\tau < \pm 0{,}17$	$\tau < \pm 0{,}17$
	The chain is outside the limits specified in 5.2.5	The chain is outside the limits specified in 5.2.5	The chain is within the limits specified in 5.2.5	The chain is within the limits specified in 5.2.5

[a] A negative sign indicates a net clockwise twist in the chain under test; it does not indicate a negative algebraic quantity; α_2 is a real measurement of the angle of twist in a clockwise direction; α is a real angle in a clockwise direction on the test apparatus when shown positive and in an anticlockwise direction when shown negative.

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