

# INTERNATIONAL STANDARD

# ISO 6972

Second edition  
2002-09-15

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## **Cranked-link mill chains of welded construction, attachments and sprockets**

*Chaînes en acier, de construction soudée, à maillons coudés, plaques-  
attaches et roues dentées*

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Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.ch](mailto:copyright@iso.ch)  
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## 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. 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.

ISO 6972 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 6972:1982), which has been technically revised. In particular, the references and terminology have been revised to bring them into conformity with other International Standards and current practice. Technical revisions comprise the addition of chain W855, in acknowledgement of the increased use of this type of chain, and the deletion of H1, H2, R1 and R2 attachments, which are no longer used. Furthermore, in clause 5, the pitch line clearance of sprockets has been altered for consistency with current industry practice.

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# Cranked-link mill chains of welded construction, attachments and sprockets

## 1 Scope

This International Standard specifies the characteristics of cranked-link<sup>1)</sup> mill chains of welded construction suitable for conveying bulk materials, together with associated attachments and chain sprockets. The chain dimensions specified in this International Standard ensure interchangeability of both complete chains and individual links for repair purposes.

This International Standard is applicable to sprockets with between 5 and 36 teeth.

Specifications are also given for eight types of attachment for use with the conveyor chains conforming to this International Standard.

## 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 286-2, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

## 3 Chains

### 3.1 General

The chain is designed to operate with the closed end of each link in the forward direction to produce the maximum scraping action against the material to be conveyed.

### 3.2 Nomenclature

The nomenclature of the chains and their component parts is specified in Figures 1 and 2.

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1) In the USA, the term “offset sidebar” is used in place of “cranked link”.

### 3.3 Dimensions

Conveyor chain dimensions shall conform to those given in Table 1 (see Figure 3). Both maximum and minimum dimensions are specified to ensure interchangeability of links made by different chain manufacturers. Although these represent limits for interchangeability, they shall not necessarily be regarded as limits of tolerance for manufacture.

### 3.4 Tensile strength

#### 3.4.1 Minimum tensile strength

The minimum tensile strength is that value which shall be exceeded when a tensile force is applied to a sample which is tested to destruction in accordance with 3.4.2.

NOTE This minimum tensile strength is not a working force. It is intended primarily as a comparative figure between chains of different construction. For application information, it is necessary to consult the manufacturers or their published data.

#### 3.4.2 Tensile testing

A tensile force, not less than the minimum tensile strength specified in Table 1, shall be applied slowly to the ends of a chain, containing a minimum of three free pitches, by means of shackles so designed as to allow universal movement. The actual test method is at the discretion of the manufacturer.

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

Any test in which failure occurs adjacent to the shackles shall be disregarded.

### 3.5 Length accuracy

Finished chains shall be measured either in the dry state or after light lubrication.

The standard nominal length for measurement shall be that nearest to 3 048 mm.

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

The finished chain length shall be equal to the nominal chain length  $+0,32\%$ .

Chains that work in parallel may be matched by agreement between the purchaser and the manufacturer.

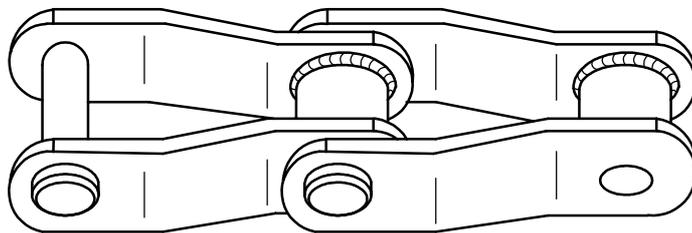
### 3.6 Designation

The designation numbers for welded-steel-type cranked link mill chains are based on the ISO chain numbers given in Table 1. These numbers are derived from those given to the cast pintle or steel engineering type which they replace and have been given the prefix W to indicate that they are of welded design.

### 3.7 Marking

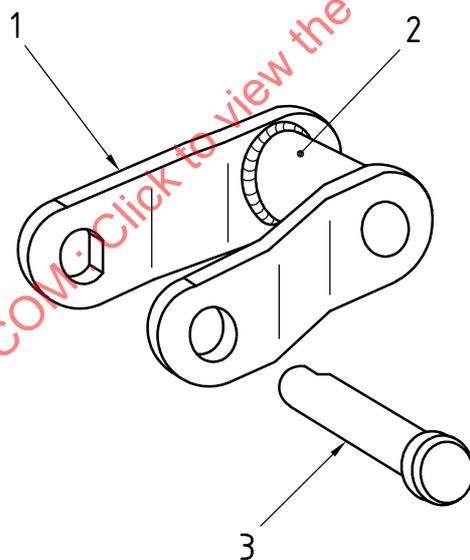
The chains shall be marked with the manufacturer's name or trademark and in addition should be marked with the appropriate ISO chain number given in Table 1.

The marking of the chain shall not be obscured by the attachments.



NOTE The illustration does not define the actual form of the cranked link.

Figure 1 — Cranked link chain assembly

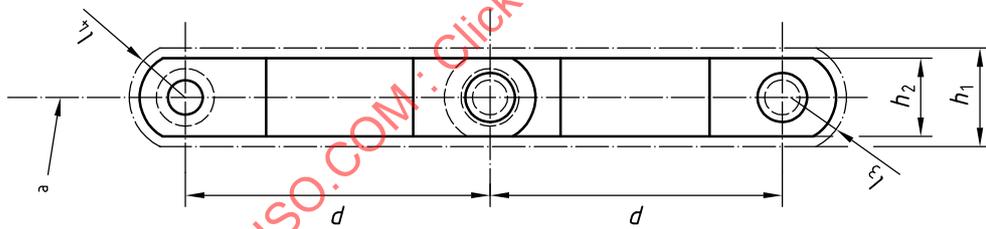


**Key**

- 1 Cranked plate
- 2 Bush
- 3 Connecting pin

NOTE The illustration does not define the actual form of the cranked link.

Figure 2 — Typical cranked link components



The overall width of connecting links is

$b_5 + b_6$ , when riveted

$b_4 + b_5$ , when there is a fastener at one side

$2 b_4$ , when there is a fastener at both sides

The line of cranking, or offset, between  $l_1$  and  $l_2$  is straight.

NOTE The illustration does not define the actual form of the cranked link.

a Pitch line

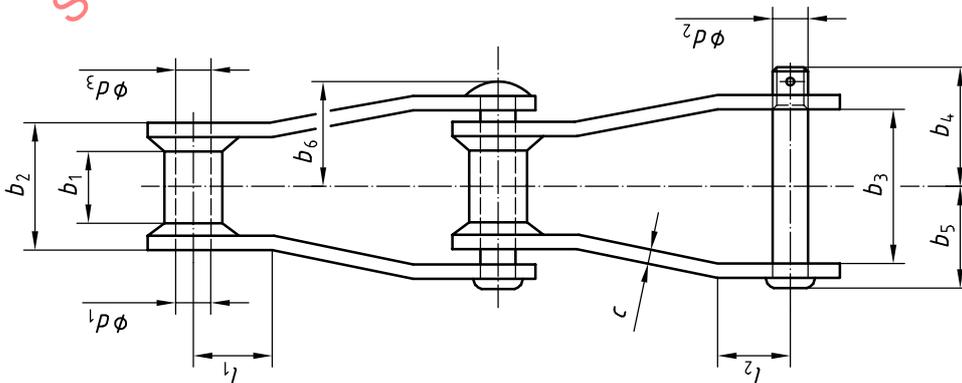


Figure 3 — Chain dimensions and symbols (see Table 1)

Table 1 — Chain dimensions, measuring forces and tensile strengths

ISO chain number	Pitch $p^a$	Bush diameter $d_1$ max.	Width between plates for sprocket contact at inner end $b_1$ min.	Connecting pin body diameter $d_2$ max.	Bush bore $d_3$ min.	Chain path depth $h_1$ max.	Plate depth $h_2$ max.	Crank clearance dimensions			Plate end clearance dimensions		Width over link at inner end $b_2$ max.	Width between plates at outer end $b_3$ min.	Width over pin fastening to centreline $b_4$ max.	Width over pin head to centreline $b_5$ max.	Width over rivet to centreline $b_6$ max.	Chain plate thickness $c$ nom.	Measuring force	Tensile strength		
								$l_1$ min.	$l_2$ min.	$l_3$ max.	$l_4$ max.	min.								max.	min.	max.
																					kN	
W78	66,27	22,9	28,4	12,78	12,9	30	28,4	16,5	17	16,8	16,8	51	51,6	45,2	39,6	42,7	6,4	0,9	93	107		
W82	78,1	31,5	31,8	14,35	14,48	33,5	31,8	19,8	21,1	19,6	20,8	57,4	57,9	48,3	41,7	45,2	6,4	1,33	100	131		
W106	152,4	37,1	41,2	19,13	19,25	39,6	38,1	22,9	27,2	26,4	26,9	71,6	72,1	62,2	56,4	59,4	9,6	1,78	169	224		
W110	152,4	32	46,7	19,13	19,25	39,6	38,1	22,9	27,2	26,4	26,9	76,5	77	62,2	54,9	59,4	9,6	1,33	169	224		
W111	120,9	37,1	57,2	19,13	19,25	39,6	38,1	22,9	27,2	22,6	26,9	85,6	86,4	69,8	63,5	64,3	9,6	1,78	169	224		
W124	101,6	37,1	41,2	19,13	19,25	39,6	38,1	22,9	27,2	22,6	26,9	71,6	72,1	62	56,4	59,4	9,6	1,78	169	224		
W124H	103,2	41,7	41,2	22,3	22,43	52,3	50,8	28,2	30,5	27,9	30,2	76,5	77	70,6	62,5	65,8	12,7	3,11	275	355		
W132	153,67	44,7	69,85	25,48	25,6	52,3	50,8	30	30,5	30	30,2	111,8	112,3	88,1	79,2	83,3	12,7	3,11	275	378		
W855	153,67	44,7	69,85	28,57	28,78	65	63,5	37,1	38,1	36,5	37,8	118,64	118,87	94,5	84,8	88,9	15,87	4,44	—	552		

<sup>a</sup> The pitch,  $p$ , is a theoretical reference dimension used in the calculation of chain lengths and sprocket dimensions, and is not intended for use in the inspection of individual links.

## 4 Attachments

### 4.1 Types

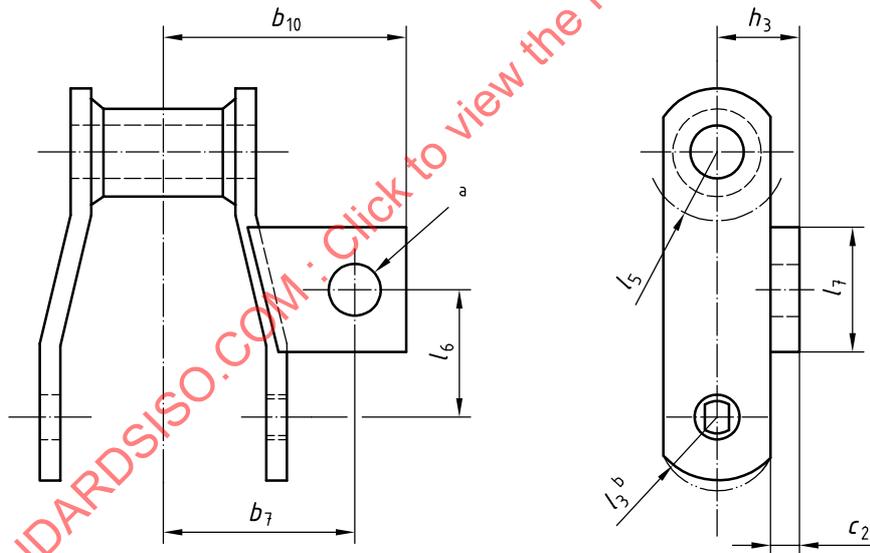
This International Standard specifies eight types of attachment designated A1, A2, A22, F2, F4, K1, K2 and W1 with the following characteristics:

- A1, A2 and A22 have a mounting plate, with mounting holes, attached parallel to the pitch line on one cranked plate, as shown in Figures 4, 5 and 6;
- F2 and F4 have an angle section, with mounting hole, attached to the edge of each cranked plate, as shown in Figures 7 and 8;
- K1 and K2 have mounting plates, with mounting holes, attached parallel to the pitch line on both cranked plates, as shown in Figures 9 and 10;
- W1 has an angle section attached to the outer face of each cranked plate, as shown in Figure 11.

### 4.2 Dimensions

The respective dimensions of the attachments shall be as specified in Tables 2 to 9.

NOTE The actual form of the attachments is at the discretion of the manufacturer.



- a Hole for  $d_4$  bolt.
- b For this dimension, see Table 1.

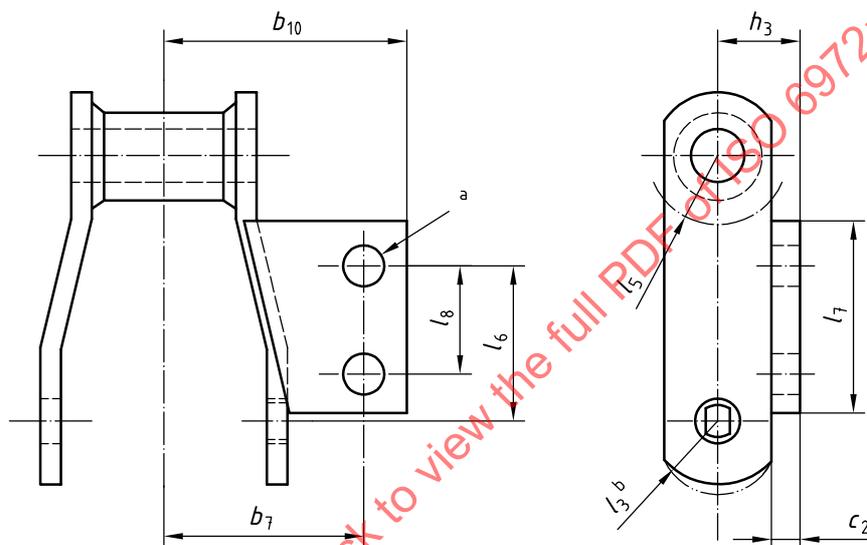
Figure 4 — A1 attachment

Table 2 — Dimensions of A1 attachment

Dimensions in millimetres

ISO chain number	$b_7$	$l_6$	$l_7$ max.	$h_3$ max.	$b_{10}$ max.	$c_2$	$l_5$	Bolt diameter $d_4^a$
W78	50,8	31,8	36,6	22,4	65	6,4	16,8	9,7
W82	53,3	38,1	46	23,9	71,4	6,4	20,3	9,7

<sup>a</sup> The actual hole diameter shall be large enough to provide adequate clearance for the specified bolt diameter.



<sup>a</sup> Hole for  $d_4$  bolt.

<sup>b</sup> For this dimension, see Table 1.

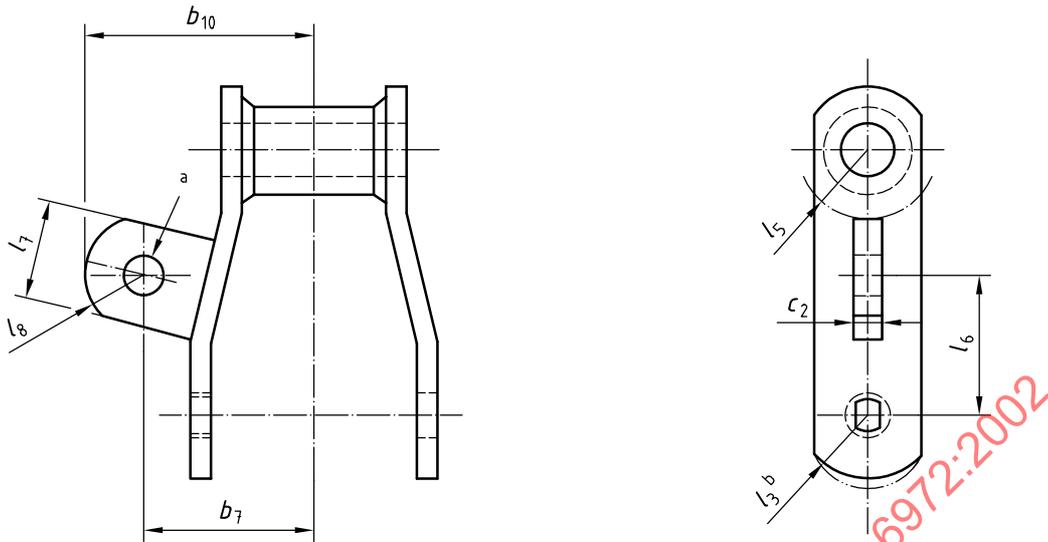
Figure 5 — A2 attachment

Table 3 — Dimensions of A2 attachment

Dimensions in millimetres

ISO chain number	$b_7$	$l_6$	$l_7$ max.	$l_8$	$h_3$ max.	$b_{10}$ max.	$c_2$	$l_5$	Bolt diameter $d_4^a$
W78	50,8	38,9	52,3	28,4	22,4	65	6,4	16,8	9,7
W82	54,1	52,3	62	33,3	23,9	71,4	6,4	20,3	9,7
W110	67,6	98,6	84,1	44,4	30	84,1	9,7	23,1	9,7
W111	79,5	89,9	90,4	58,7	30	96,8	9,7	23,1	12,7
W124	66,8	71,4	77,7	49,3	30	90,4	9,7	23,1	9,7
W124H	66,8	73,2	80,8	49,3	39,6	82,8	12,7	28,4	12,7
W132	95,2	111,3	106,2	69,8	39,6	117,3	12,7	30,2	12,7

<sup>a</sup> The actual hole diameter shall be large enough to provide adequate clearance for the specified bolt diameter.



- a Hole for  $d_4$  bolt.
- b For this dimension, see Table 1.

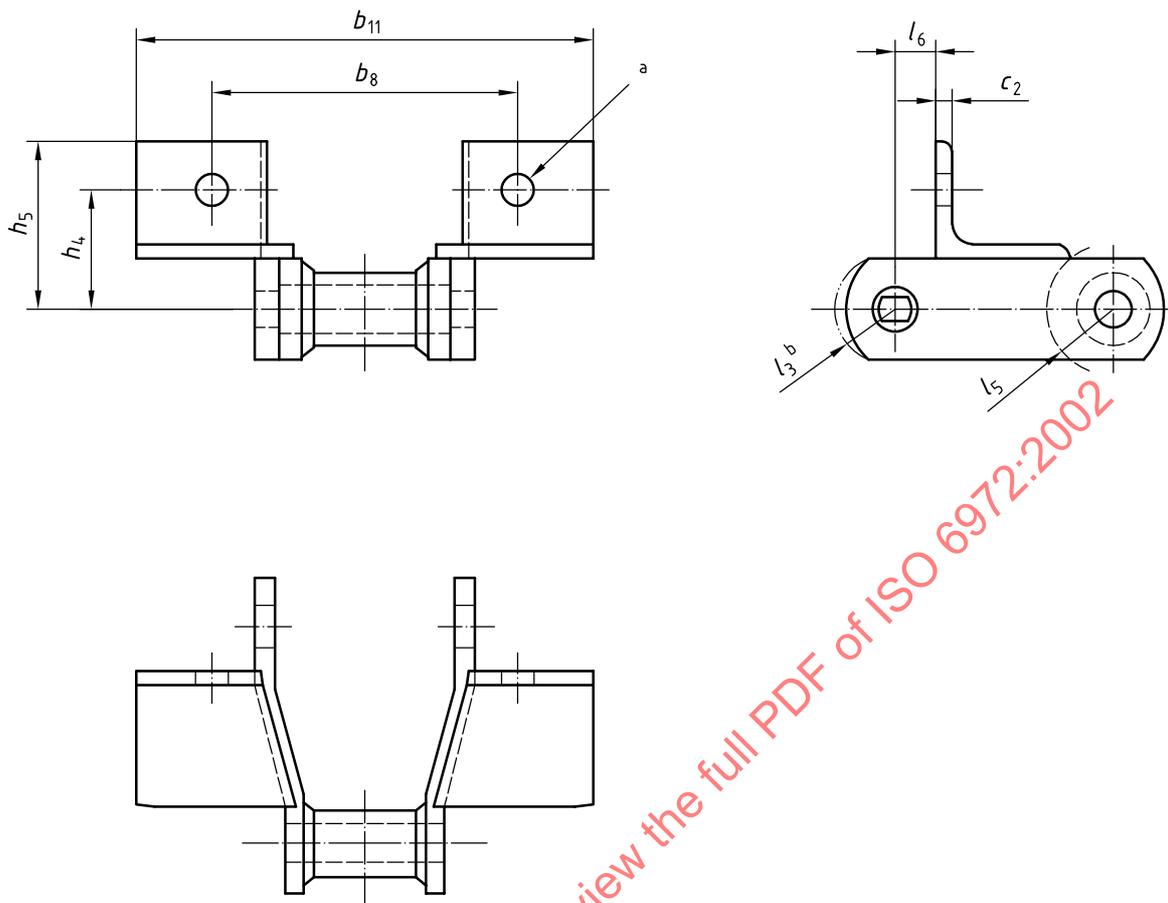
Figure 6 — A22 attachment

Table 4 — Dimensions of A22 attachment

Dimensions in millimetres

ISO chain number	$b_7$	$l_6$	$l_7$ max.	$l_8$ max.	$b_{10}$ max.	$c_2$	$l_5$	Bolt diameter $d_4^a$
W78	47,8	33,3	30	18,3	65	9,7	16,8	9,7

<sup>a</sup> The actual hole diameter shall be large enough to provide adequate clearance for the specified bolt diameter.



- a Holes for  $d_4$  bolts.
- b For this dimension, see Table 1.

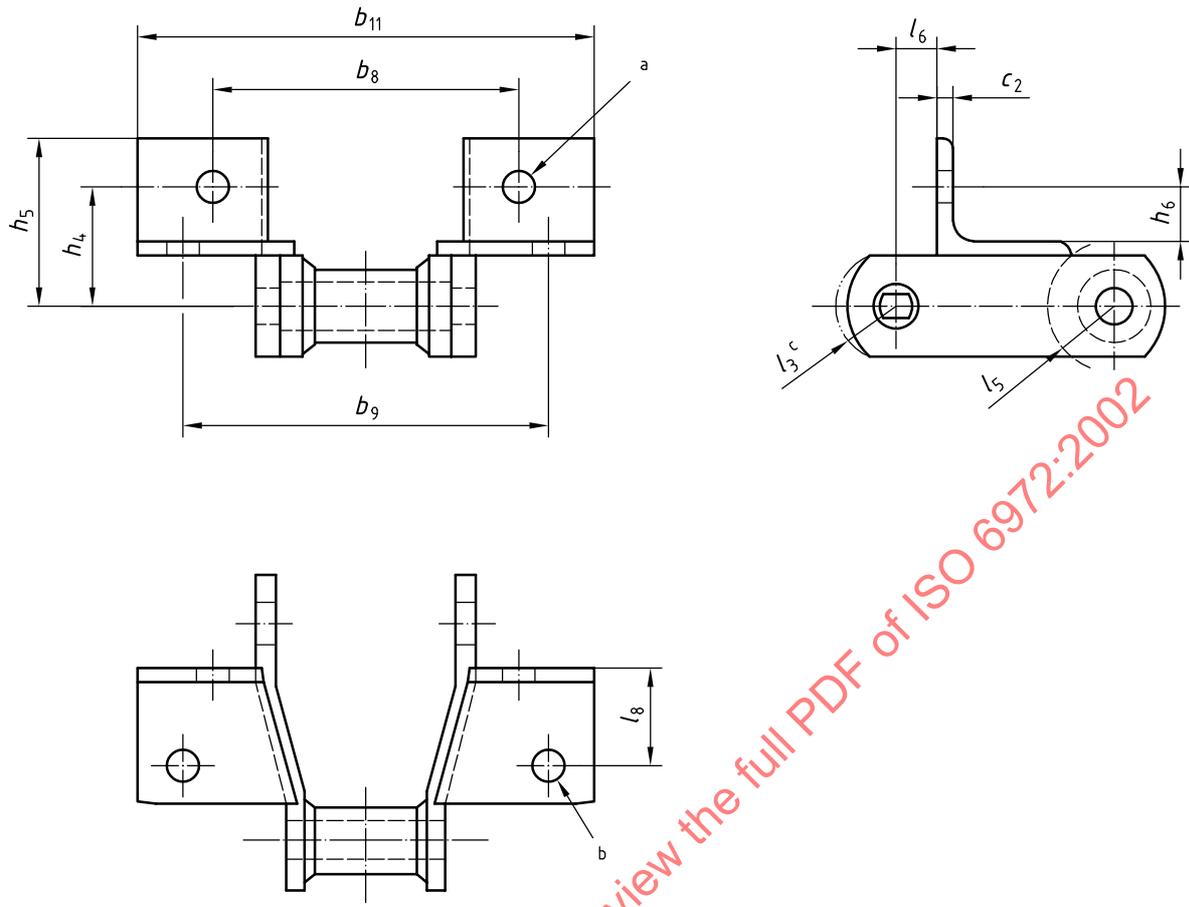
Figure 7 — F2 attachment

Table 5 — Dimensions of F2 attachment

Dimensions in millimetres

ISO chain number	$b_8$	$l_6$	$h_4$	$h_5$ max.	$b_{11}$ max.	$c_2$	$l_5$	Bolt diameter $d_4^a$
W78	95,6	15,7	36,6	60,5	138,2	6,4	16,8	9,7

<sup>a</sup> The actual hole diameter shall be large enough to provide adequate clearance for the specified bolt diameter.



- a Two holes for  $d_4$  bolts.
- b Two holes for  $d_5$  bolts.
- c For this dimension, see Table 1.

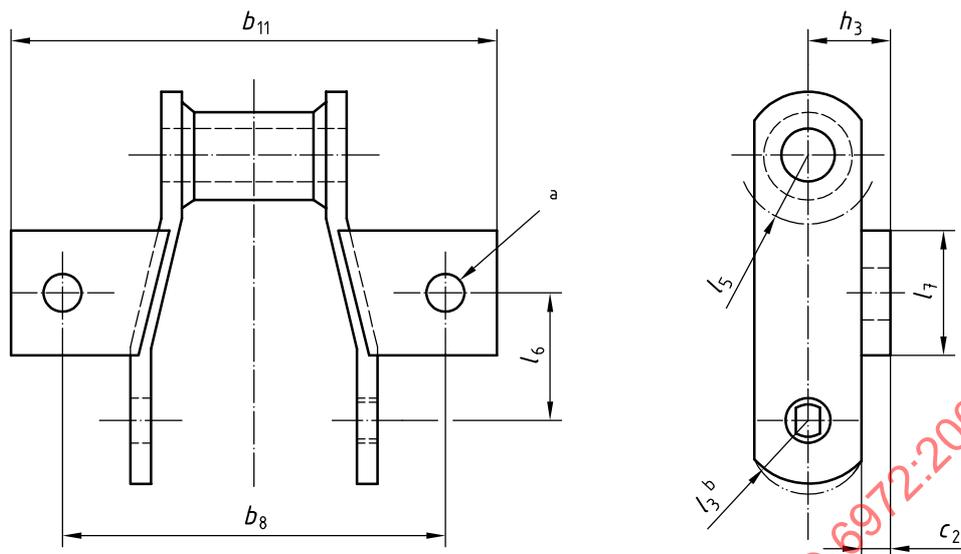
Figure 8 — F4 attachment

Table 6 — Dimensions of F4 attachment

Dimensions in millimetres

ISO chain number	$b_8$	$b_9$	$l_6$	$l_8$	$h_4$	$h_5$ max.	$h_6$	$b_{11}$ max.	$c_2$	$l_5$	Bolt diameter $d_4^a$	Bolt diameter $d_5^a$
W78	95,2	114,3	17,3	31,8	44,4	60,5	23,8	141,2	6,4	16,8	9,7	9,7
W82	104,6	127	20,6	28,4	46,2	62,5	23,8	150,9	6,4	20,3	9,7	9,7
W124	111,3	133,6	22,4	36,6	52,3	73,2	23,6	157	9,7	23,1	9,7	9,7

<sup>a</sup> The actual hole diameter shall be large enough to provide adequate clearance for the specified bolt diameter.



- a Holes for  $d_4$  bolts.
- b For this dimension, see Table 1.

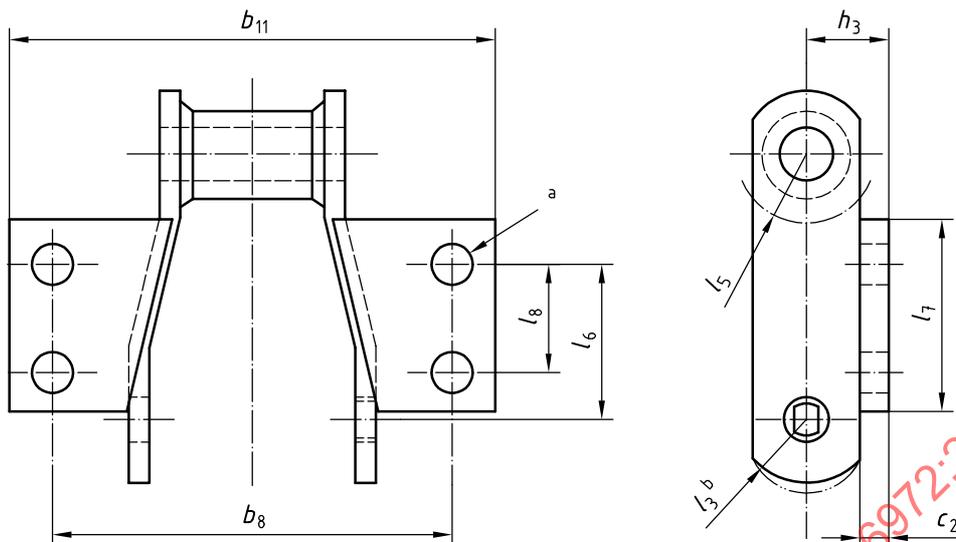
Figure 9 — K1 attachment

Table 7 — Dimensions of K1 attachment

Dimensions in millimetres

ISO chain number	$b_8$	$l_6$	$l_7$ max.	$h_3$ max.	$b_{11}$ max.	$c_2$	$l_5$	Bolt diameter $d_4^a$
W78	101,6	31,8	36,6	22,4	130	6,4	16,8	9,7
W82	106,7	38,1	46	23,9	142,7	6,4	20,3	9,7

<sup>a</sup> The actual hole diameter shall be large enough to provide adequate clearance for the specified bolt diameter.



- a Holes for  $d_4$  bolts.
- b For this dimension, see Table 1.

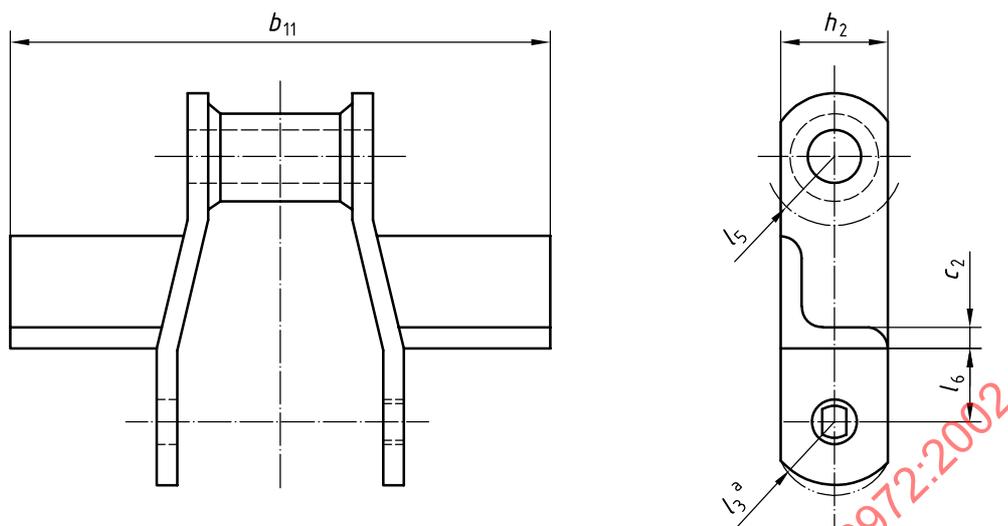
Figure 10 — K2 attachment

Table 8 — Dimensions of K2 attachment

Dimensions in millimetres

ISO chain number	$b_8$	$l_6$	$l_7$ max.	$l_8$	$h_3$ max.	$b_{11}$ max.	$c_2$	$l_5$	Bolt diameter $d_4^a$
W78	101,6	38,9	52,3	28,4	22,4	130	6,4	16,8	9,7
W82	108,2	52,3	62	33,3	23,9	142,7	6,4	20,3	9,7
W110	135,1	98,6	84,1	44,4	30	168,1	9,7	23,1	9,7
W111	159	89,9	90,4	58,7	30	193,5	9,7	23,1	12,7
W124	133,6	71,4	77,7	49,3	30	180,8	9,7	23,1	9,7
W124H	133,6	73,2	80,8	49,3	39,6	165,6	12,7	28,4	12,7
W132	190,5	111,3	106,2	69,8	39,6	234,7	12,7	30,2	12,7

<sup>a</sup> The actual hole diameter shall be large enough to provide adequate clearance for the specified bolt diameter.



<sup>a</sup> For this dimension, see Table 1.

Figure 11 — W1 attachment

Table 9 — Dimensions of W1 attachment

Dimensions in millimetres

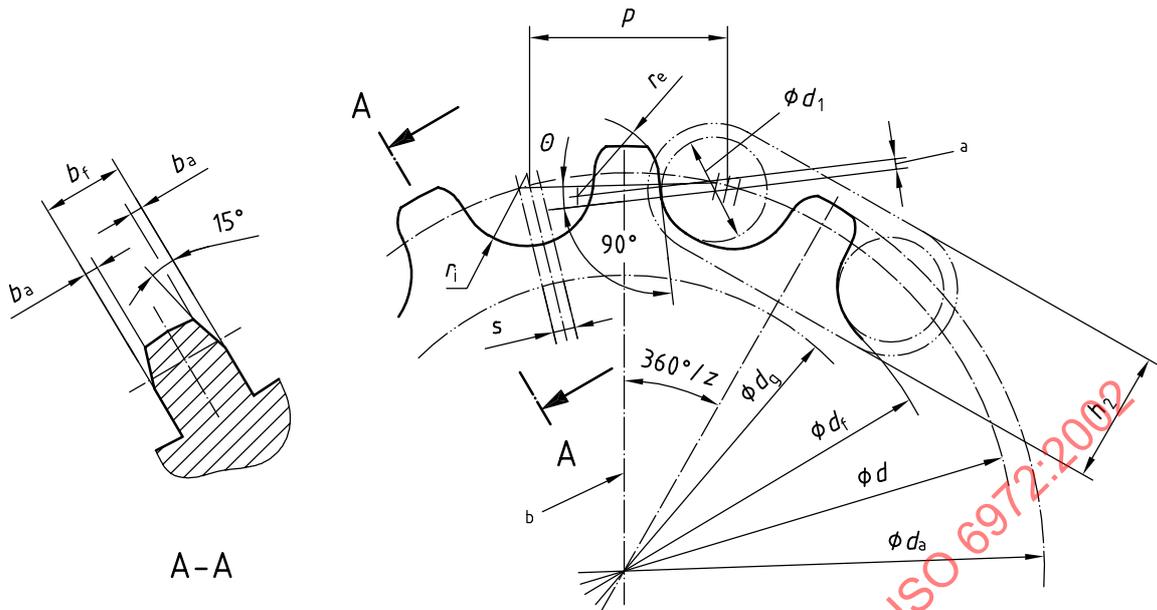
ISO chain number	$l_6$	$h_2$ max.	$b_{11}$ max.	$c_2$	$l_5$
W78	19,1	26,9	153,9	6,4	16,8
W82	23,9	33,3	166,6	6,4	20,3
W124	30	39,6	217,4	6,4	23,1
W124H	35,1	52,3	217,4	9,7	28,4
W132	38,1	52,3	316	9,7	30,2

## 5 Sprockets

### 5.1 Diametral dimensions

#### 5.1.1 General

The sprocket diametral dimensions are shown in Figure 12 and specified in 5.1.2 to 5.1.6.



**Key**

- |  |   |
|--|---|
| $b_a$ tooth side relief                | $h_2$ plate depth (maximum)             |
| $b_t$ tooth width                      | $p$ chordal pitch, equal to chain pitch |
| $d$ pitch circle diameter              | $r_e$ tooth flank (topping radius)      |
| $d_a$ tip diameter                     | $r_i$ bush seating radius               |
| $d_t$ root diameter                    | $s$ pitch line clearance                |
| $d_g$ maximum chain clearance diameter | $z$ number of teeth                     |
| $d_1$ bush diameter (maximum)          | $\theta$ pressure angle                 |
| $a$ Working face                       |   |
| $b$ Centreline of tooth                |   |

**Figure 12 — Diametral dimensions and tooth form**

**5.1.2 Pitch circle diameter,  $d$**

$$d = p \times p_{cf}$$

where  $p_{cf}$  is the pitch diameter factor according to the number of teeth, as specified in 5.2.4 and Table 10.

**5.1.3 Tip diameter,  $d_a$**

$$d_a = (p \times d_{gf}) + h_2$$

where  $d_{gf}$  is the chain clearance diameter and outside diameter factor according to the number of teeth, as specified in 5.2.5 and Table 10.

The tip diameter may be increased to give a full height tooth when the top of the chain is clear of scrapers flights, pans, buckets, etc.

#### 5.1.4 Measuring pin diameter, $d_R$

$$d_R = d_1$$

where  $d_1$  is the bush diameter, as specified in Table 1.

#### 5.1.5 Root diameter, $d_f$

$$d_f \text{ max.} = (p \times p_{cf}) - d_1$$

NOTE Root diameters exceeding the maximum obtained from this equation result in improper chain and sprocket action and excessive chain loads.

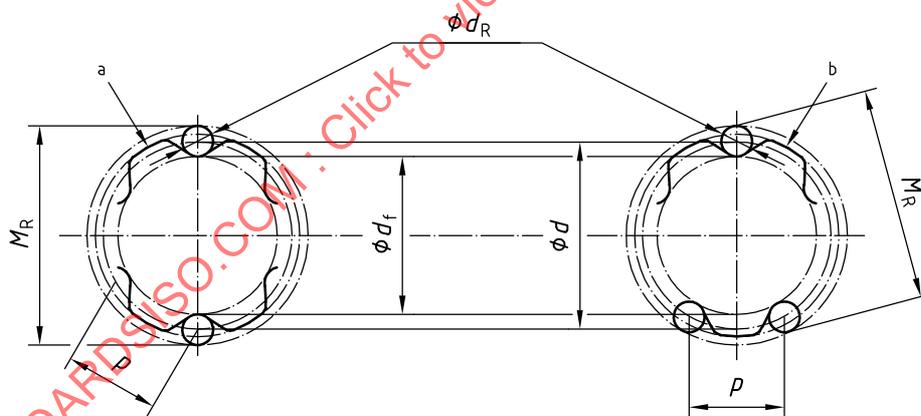
#### 5.1.6 Measurement over measuring pins, $M_R$

The measurement over measuring pins is illustrated in Figure 13.

$$M_R \text{ for even numbers of teeth} = d + d_R \text{ min.}$$

$$M_R \text{ for odd numbers of teeth} = d \cos \frac{90^\circ}{z} + d_R \text{ min.}$$

For a sprocket having an even number of teeth, measurement shall be made over the appropriate pins inserted in diametrically opposed tooth spaces. For a sprocket having an odd number of teeth, measurement shall be made over pins inserted in the two tooth spaces most nearly diametrically opposite with respect to each other. During measurement, the pins shall remain in contact with the root diameter of the corresponding teeth.



#### Key

- $d$  pitch circle diameter
- $d_f$  root diameter
- $d_R$  diameter of measuring pins
- $M_R$  measurement over measuring pins
- $p$  chordal pitch, equal to chain pitch
- a Even number of teeth
- b Odd number of teeth

Figure 13 — Measurement over measuring pins