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ISO 1977

Second edition
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Conveyor chains, attachments and sprockets

Chaînes de manutention, plaques-attaches et roues dentées

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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 2.

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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 1977 was prepared by Technical Committee ISO/TC 100, *Chains and chain sprockets for power transmission and conveyors*.

This second edition cancels and replaces the first edition (ISO 1977:2000), Figures 2 and 5, as well as 5.4 and 5.5, of which have been technically revised.

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Introduction

ISO 1977 combines into a single document ISO 1977-1, ISO 1977-2 and ISO 1977-3, which covered metric-series chains and attachments, and chain wheels, while at the same time revising their technical content.

The principle technical changes are: a reduction in the flanged roller dimensions and the width between outer plates in the MC series of chains, an increase in the width between inner plates in M-series, MC56, MC112 and MC224 chains, and the addition of the small roller diameter to the MC series. New information on the calculation of sprocket tip diameters and tooth heights above root diameters is also given.

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Conveyor chains, attachments and sprockets

1 Scope

This International Standard specifies the characteristics of bush, plain and flanged roller chains of both solid and hollow bearing pin types designed for general conveying and mechanical handling duties, together with associated chain sprockets and attachments. The chain dimensions specified in this International Standard will ensure interchangeability of complete chains and individual links for repair purposes.

This International Standard is applicable to sprockets with from 6 to 40 teeth. Control criteria for sprockets are defined to ensure correct meshing, operation and transmission of load in use under normal operating conditions.

NOTE Controls do not necessarily determine sprocket design parameters.

Specifications are also given for K attachments and deep plates for use with the conveyor chains conforming to this International Standard.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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 Nomenclature

The nomenclature of the chains and their component parts is presented in Figure 1.

3.2 Dimensions

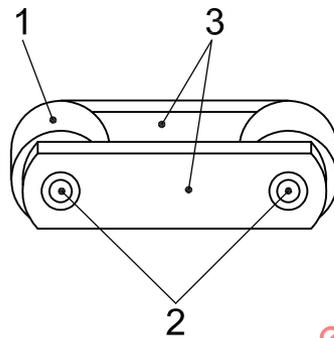
Conveyor chain dimensions shall conform to those given in Table 1 or Table 2 (see Figure 2). Both maximum and minimum dimensions are specified to ensure the interchangeability of links made by different chain manufacturers. Although these represent limits for interchangeability, they are not necessarily to be regarded as limits of tolerance for manufacture.



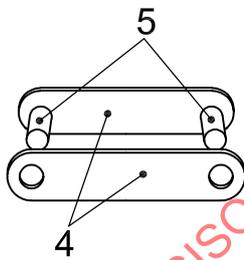
a) Solid bearing pin chain



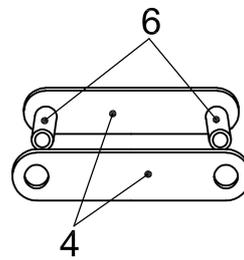
b) Hollow bearing pin chain



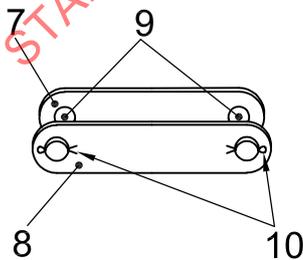
c) Inner link



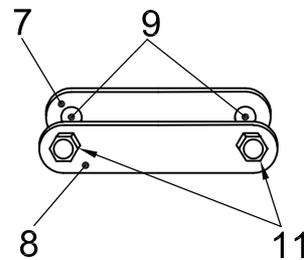
d) Outer link (solid bearing pins)



e) Outer link (hollow bearing pins)

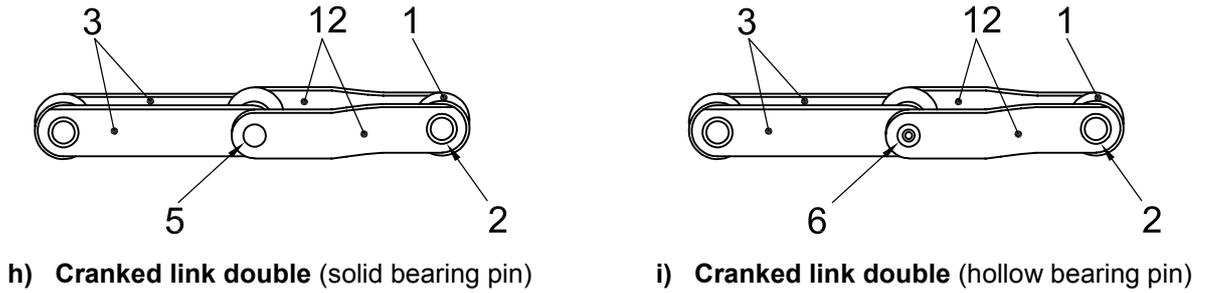


f) Connecting link (cotter pin fasteners)



g) Connecting link (nut fasteners)

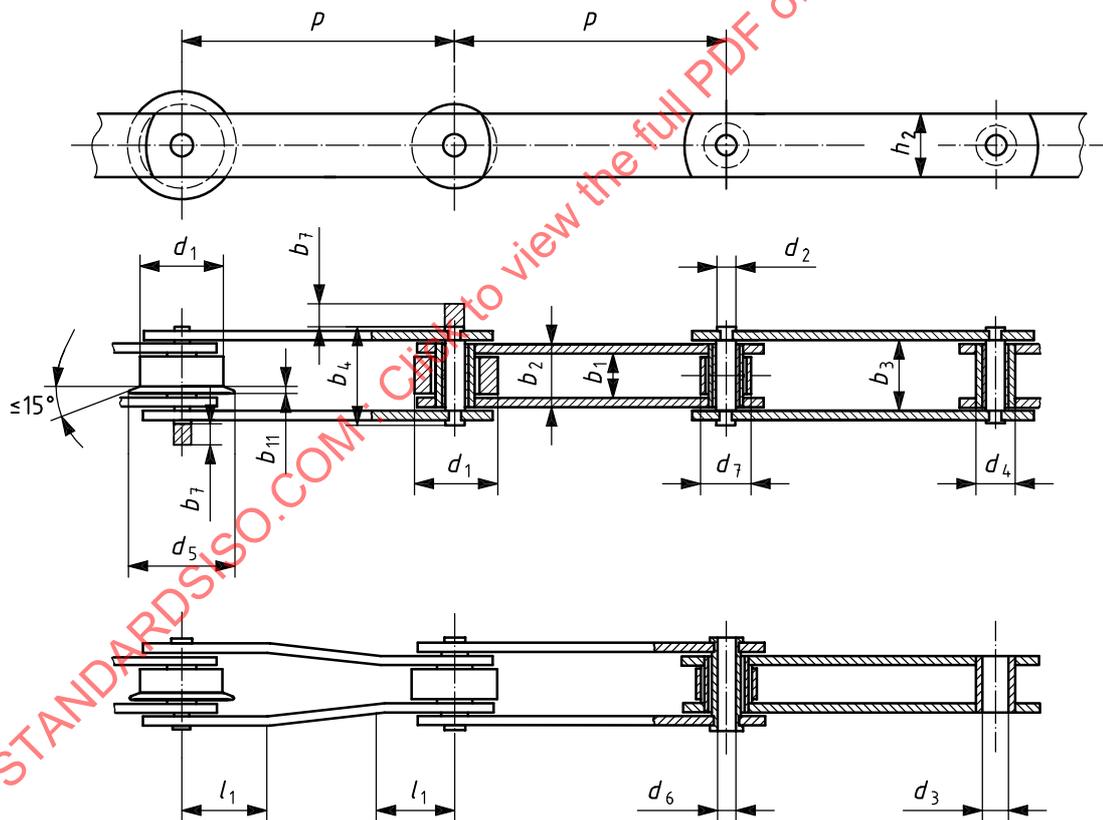
Figure 1 — Chain parts



Key

- | | | |
|---------------|-------------------------|--------------------------------------|
| 1 roller | 5 bearing pins (solid) | 9 connecting pins |
| 2 bush | 6 bearing pins (hollow) | 10 cotter pin fasteners ^a |
| 3 inner plate | 7 fixed outer plate | 11 nut fasteners ^a |
| 4 outer plate | 8 detachable plate | 12 cranked plate |
- ^a The type of fastener (cotter pin, nut, etc.) is optional.

Figure 1 (continued)



- | | | |
|----------------------------------|---|------------------------------|
| d_1 plain roller diameter | b_2 width over inner links | d_5 flange roller diameter |
| d_2 bearing pin body diameter | b_3 width between outer plates | b_{11} flange roller width |
| d_3 bush bore | b_4 width over bearing pins | d_6 hollow pin bore |
| d_4 bush diameter | b_7 additional width for joint faster | d_7 small roller diameter |
| h_2 plate depth | l_1 cranked link dimension | |
| b_1 width between inner plates | p pitch | |

NOTE 1 Bearing pins can be of necked design, as shown here, or plain as in Figure 1.

NOTE 2 These illustrations do not define the true form of the chain plates, pins, bushes or rollers.

Figure 2 — Chain dimensions and symbols (see Tables 1 and 2)

3.3 Tensile testing

The test length shall have a minimum of three free pitches. The ends shall be attached to the testing-machine shackles by a pin through the plate holes or the bushes. The shackles shall be designed so as to allow universal movement. The actual test method shall be left to the manufacturer's discretion. Tests in which failures occur adjacent to the shackles shall be disregarded.

3.4 Length accuracy

3.4.1 General

When measured in accordance with the requirements given in 3.4.2, 3.4.3 and 3.4.4, the finished chain shall be accurate to within ${}_{0}^{0,25}$ % of the nominal chain length.

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

3.4.2 Standard test-measurement length

The length of chain for measurement shall be that nearest to 3 000 mm with an odd number of pitches, terminating with inner links at each end.

3.4.3 Support

The chain, in unlubricated condition, shall be supported throughout its entire length.

3.4.4 Measuring force

A force equal to 1/50 of the appropriate tensile strength given in Table 1 or Table 2 shall be applied.

3.5 Cranked links

In order to obtain an odd number of pitches in an endless chain, a cranked link is used [see Figure 1 h) and 1 i)]. The cranked link dimension of a chain shall correspond to its respective l_1 as given in Table 1 or Table 2 and as appropriate.

3.6 Designation

The designation numbers for conveyor chains are based on the ISO numbers given in Table 1 and Table 2. These numbers are derived from the minimum tensile strength (in kilonewtons) and have been given the prefixes M, to indicate a solid bearing pin chain, and MC, to indicate a hollow bearing pin chain.

EXAMPLE M80 signifies a solid bearing pin chain of 80 kN tensile strength.

MC224 signifies a hollow bearing pin chain of 224 kN tensile strength.

The addition of the letter B, F, P or S indicates type: bush, flanged roller, plain or small roller, respectively. The addition of further digits indicates the pitch in millimetres.

EXAMPLE MC224 chain with flanged roller and pitch of 200 mm:

MC224-F-200

3.7 Marking

The chains shall be marked with the manufacturer's name or trademark, and should be marked with the respective ISO chain number given in Table 1 or Table 2.

4 Attachments

4.1 K attachments

4.1.1 Dimensions

K attachments are shown in Figure 3, and their respective dimensions are given in Table 3.

4.1.2 Designation

This International Standard specifies three types of K attachment:

- K1, which has one attachment hole centrally disposed in each plate;
- K2, which has two attachment holes disposed in each plate (see Figure 3);
- K3, which has two attachment holes disposed in each plate and a third hole centrally positioned between the two.

Attachments may be fitted on one or both sides of the chain.

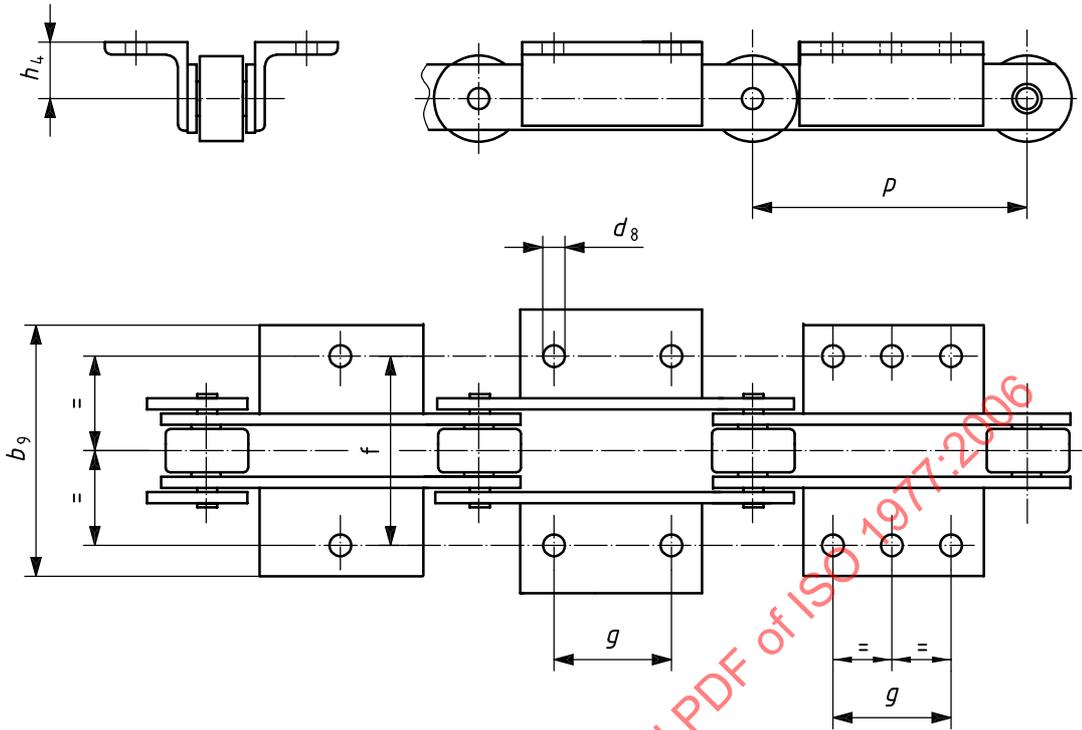
4.1.3 Manufacture

For convenience, the K attachments are shown in Figure 3 as being made of rolled steel angle section. However, their construction shall be at the discretion of the manufacturer and may be of integral form, whereby the actual chain plates will be bent over to form the platform.

The attachment length shall be at the discretion of the manufacturer.

4.2 Deep plates

The deep plate height, h_6 , is shown in Figure 4, with respective heights given in Table 4. All other data, including chain tensile strengths, are specified in Tables 1 and 2.



- d_8 hole diameter
- h_4 platform height
- f transverse distance between hole centres
- b_9 width over attachments
- g longitudinal distance between hole centres
- p pitch

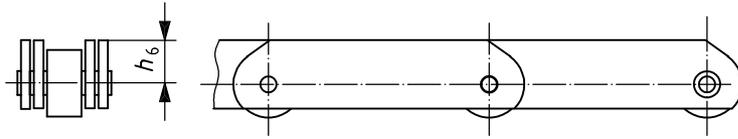
Figure 3 — K attachment dimensions and symbols (see Table 3)

Table 3 — K attachment dimensions

Dimensions in millimetres

ISO chain number	d_8	h_4	f	b_9 max.	Longitudinal distance between hole centres					
					short		medium		long	
					p^a min.	g	p^a min.	g	p^a min.	g
M20	6,6	16	54	84	63	20	80	35	100	50
M28	9	20	64	100	80	25	100	40	125	65
M40	9	25	70	112	80	20	100	40	125	65
M56	11	30	88	140	100	25	125	50	160	85
M80	11	35	96	160	125	50	160	85	200	125
M112	14	40	110	184	125	35	160	65	200	100
M160	14	45	124	200	160	50	200	85	250	145
M224	18	55	140	228	200	65	250	125	315	190
M315	18	65	160	250	200	50	250	100	315	155
M450	18	75	180	280	250	85	315	155	400	240
M630	24	90	230	380	315	100	400	190	500	300
M900	30	110	280	480	315	65	400	155	500	240
MC28	9	25	70	112	80	20	100	40	125	65
MC56	11	35	88	152	125	50	160	85	200	125
MC112	14	45	110	192	160	50	200	85	250	145
MC224	18	65	140	220	200	50	250	100	315	155

^a Minimum chain pitch for longitudinal distance between hole centres g .



h_6 plate height

Figure 4 — Deep plate height (see Table 4)

Table 4 — Deep plate heights

Dimensions in millimetres

ISO chain number	h_6
M20	16
M28	20
M40	22,5
M56	30
M80	32,5
M112	40
M160	45
M224	60
M315	65
M450	80
M630	90
M900	120
MC28	22,5
MC56	32,5
MC112	45
MC224	65

NOTE All other data, including those relating to tensile strength, are as those given for the basic chain plates in Clause 3.

5 Sprockets

5.1 Diametral dimensions

5.1.1 General

The sprocket diametral dimensions are shown in Figure 5, and specified in 5.1.2 to 5.1.6.

5.1.2 Pitch circle diameter (d)

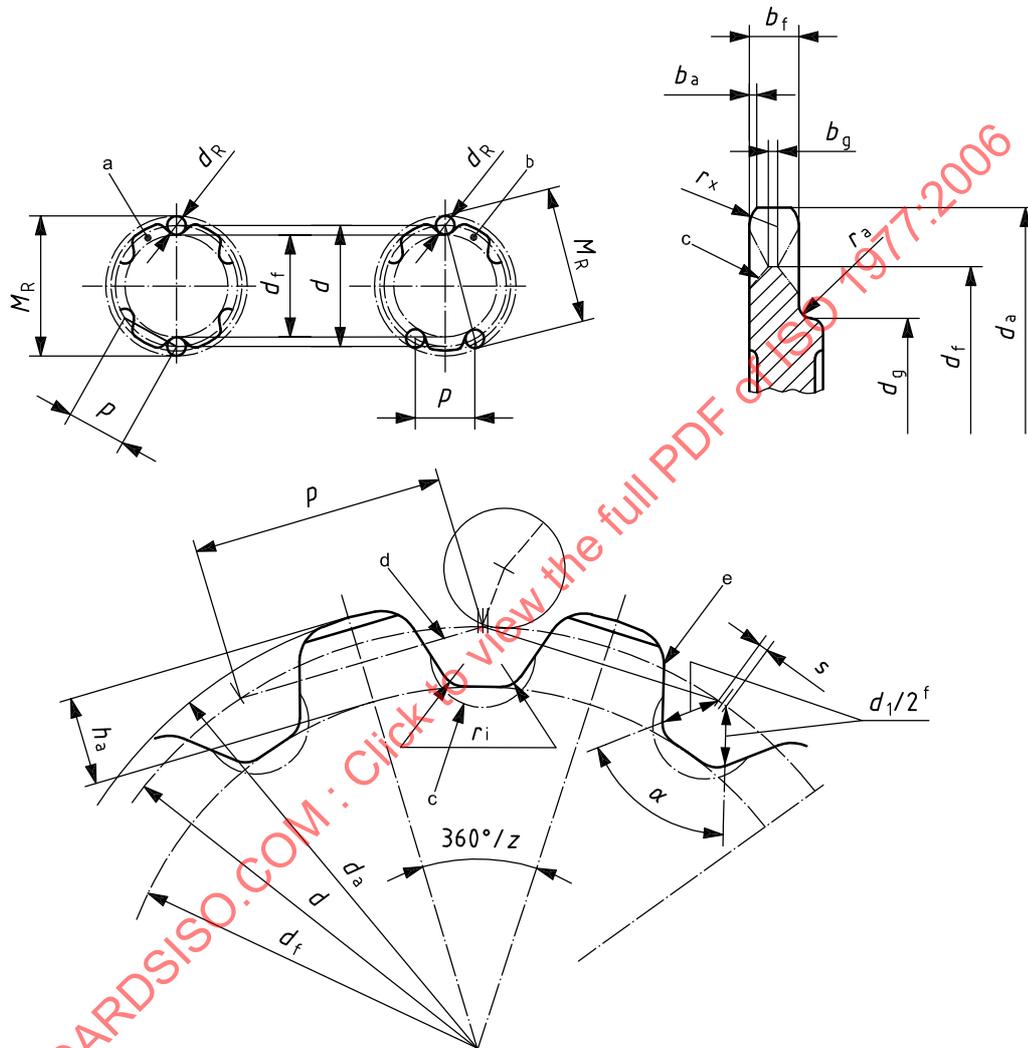
$$d = \frac{p}{\sin \frac{180^\circ}{z}}$$

The unitary dimensions of the normal range of teeth are given in Annex A.

5.1.3 Tip diameter (d_a)

$$d_a \text{ max} = d + d_1$$

The minimum tip diameter shall ensure a tooth working face according to 5.2.2.



b_a tooth side relief	d_R measuring-pin diameter	r_1 roller seating radius
b_f tooth width	d_1 plain roller diameter	r_x minimum tooth side radius
b_g relieved tooth width minimum	d_2 bearing pin body diameter	s pitch line clearance
d pitch circle diameter	h_a tooth height above root diameter	z number of teeth
d_a tip diameter	M_R measurement over measuring pins	α roller seating angle
d_f root diameter	p chordal pitch (= chain pitch)	
d_g absolute maximum shroud diameter	r_a shroud radius	

For other than roller chains, replace the term “roller” by the term “bush”.

- | | |
|--------------------------|--|
| a Even numbers of teeth. | d Pitch polygon. |
| b Odd numbers of teeth. | e Tooth flank. |
| c Roller seating relief. | f Depending on the type of roller, d_1 may be replaced with d_4 or d_7 . |

Figure 5 — Sprocket parts and dimensions

5.1.4 Measuring pin diameter (d_R)

As appropriate, $d_R = d_1, d_4$ or d_7 , subject to tolerance h_{11} , as specified in ISO 286-2.

5.1.5 Root diameter (d_f)

As appropriate, $d_f \text{ max.} = d - d_1$ or $d - d_4$ or $d - d_7$.

The minimum root diameter shall be selected by the manufacturer to provide good chain operation.

5.1.6 Measurement over measuring pins (M_R)

For even numbers of teeth, measurement over measuring pins, $M_R = d + d_R \text{ min.}$, and measurement shall be made over the appropriate pins inserted in diametrically opposed tooth spaces.

For odd numbers of teeth, $M_R = d \cos(90^\circ/z) + d_R \text{ min.}$, and measurement shall be made over pins inserted in the tooth spaces most nearly diametrically opposite.

During measurement, the pins shall always be in contact with the root diameter of the corresponding teeth.

5.2 Sprocket tooth gap form

5.2.1 General

The tooth gap shall be defined according to the criteria of 5.2.2 to 5.2.7 (see Figure 5).

5.2.2 Working face

The working face, the functional part of the tooth form, is the area between the lines of contact of two rollers, with the centreline of the one roller lying on the pitch circle, and that of the other on a circle of diameter equal to:

$$\frac{p + 0,25d_2}{\sin \frac{180^\circ}{z}}$$

That is, except when this is reduced owing to the limitation imposed on the tooth height, as given in 5.2.4.

The working face may be straight or convex.

5.2.3 Pressure angle

The pressure angle is the angle between the pitch line of the chain link and the line perpendicular to the working face at the point of roller contact. The pressure angle at any point on the working face shall be in accordance with Table 5.

5.2.4 Tooth height above root diameter (h_a)

$$h_a = \frac{d_a - d_f}{2}$$

When slats are attached to the K attachment platforms and the slats bridge the chain link, the tip of the tooth shall not project above the chord of the pitch circle by any more than $0,8h_a$, where h_a is the platform height of the attachment according to Table 3.