INTERNATIONAL STANDARD 3512

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Heavy duty cranked link transmission chains

Chaînes de transmission à maillons coudés de haute résistance

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3512 was drawn up by Technical Committee ISO/TC 100, *Chains and chain wheels for power transmission and conveyors,* and circulated to the Member Bodies in October 1974.

It has been approved by the Member Bodies of the following countries :

Austria	India	Turkey
Belgium	Italy	United Kingdom
Bulgaria	Japan	U.S.A.
Finland	Romania	Yugoslavia
France	South Africa, Rep. of	
Germany	Sweden	

The Member Bodies of the following countries expressed disapproval of the document on technical grounds :

Australia
Czechoslovakia

Printed in Switzerland

Heavy duty cranked link transmission chains

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies dimensions, tolerances, measuring loads and minimum breaking loads, together with the tooth gap forms and rim profiles of the associated chain wheels, for cranked link[1)] roller chains suitable for the mechanical transmission of power and allied applications under onerous conditions.

The dimensions of chain specified ensure complete interchangeability of any given size and provide interchangeability of individual links of chain for repair purposes.

2 CHAINS

2.1 Nomenclature

The illustrations shown below and in the key to tables 1 and 1M do not define the actual form of the chain plates.

2.2 Designation

Heavy duty cranked link roller chains are designated by the standard ISO numbers given in tables 1 and 1M : the first two digits express the pitch in eighths of an inch, while the second (last) two digits express the bearing pin diameter in sixteenths of an inch.

2.3 Dimensions

Chains shall conform to the dimension given in tables 1 and 1M. Maximum and minimum dimensions are specified to ensure interchangeability of links as produced by different makers of chain. They represent limits for interchangeability, but are not the actual tolerances that should be used in manufacture.

Pitch p is a theoretical reference dimension used in calculating strand lengths and chain wheel dimensions; it is not intended for inspection of individual links.

2.4 Breaking loads

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 so designed as to allow universal movement; the actual method to be used is left to the discretion of the manufacturer.

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

The minimum tensile breaking loads shall be those given in tables 1 and 1M.

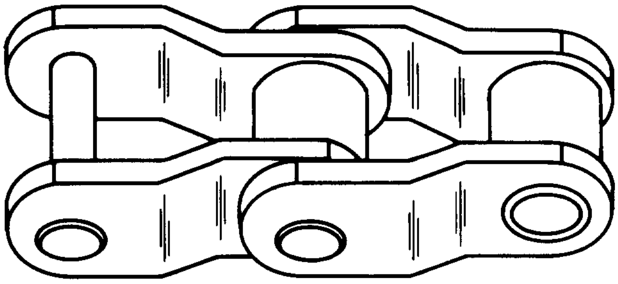

FIGURE 1 – **Cranked link chain assembly**

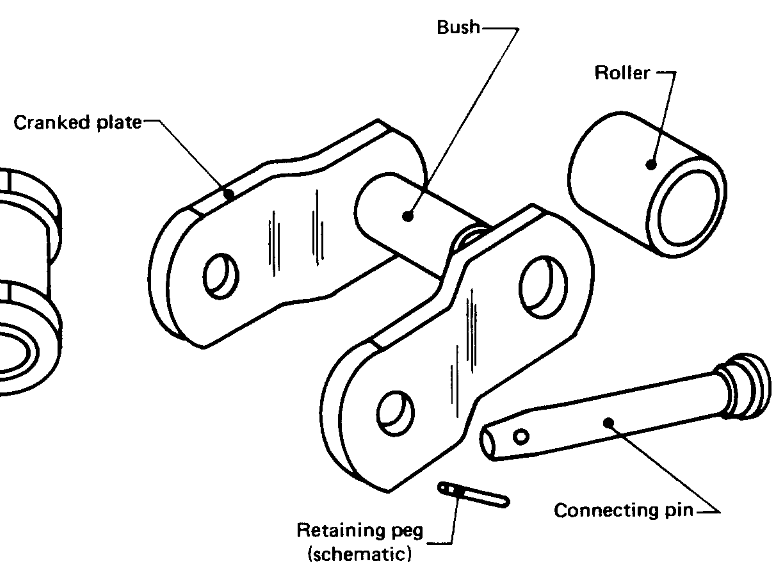

FIGURE 2 – **Typical cranked link components**

1) In the U.S.A., the term "offset sidebar" is used in place of "cranked link".

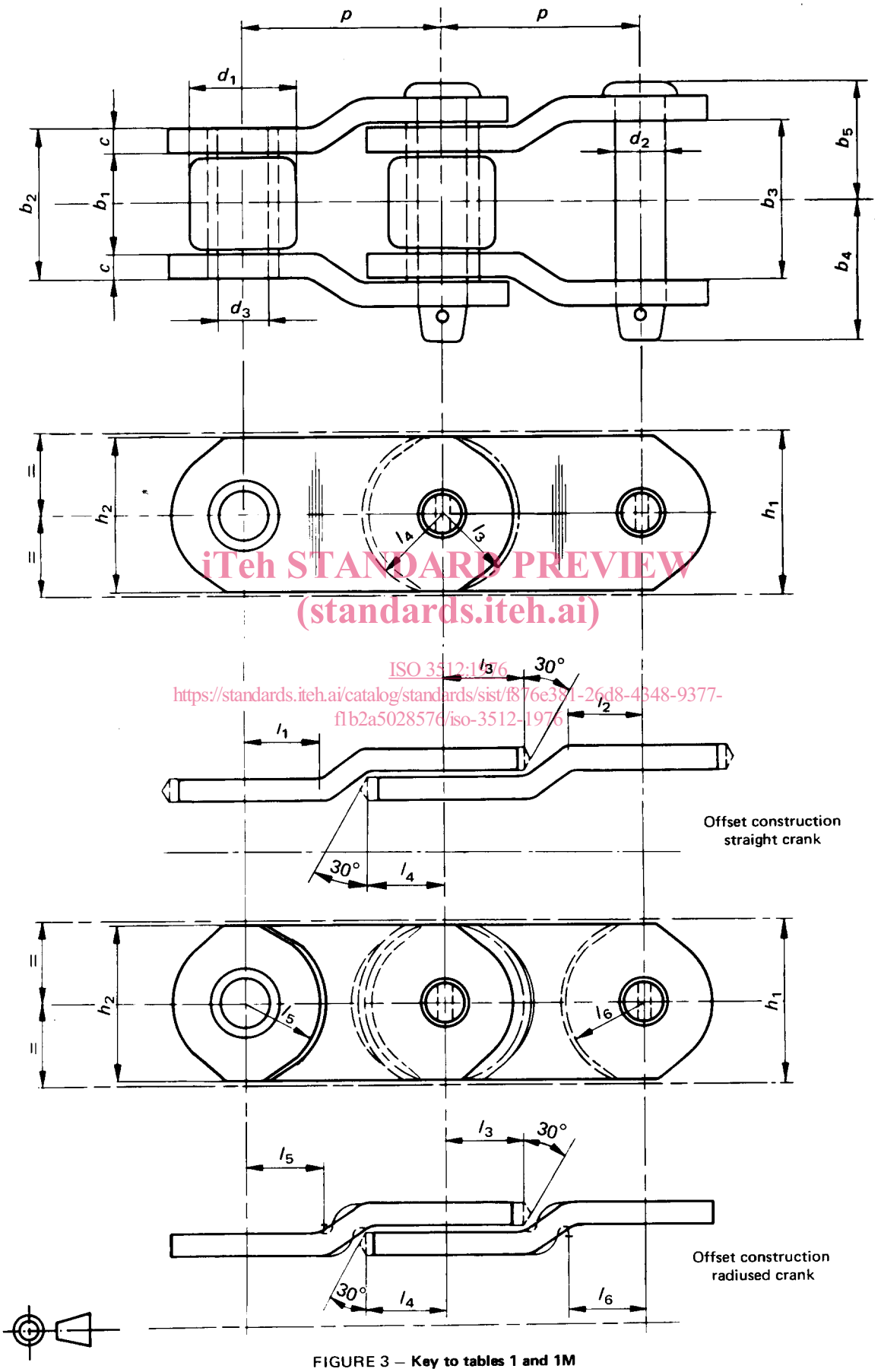

FIGURE 3 – **Key to tables 1 and 1M**

TABLE 1 — **Chain dimensions, measuring loads and breaking loads** (Inch-pound units)

1	2	3	4	5	6	7	8	9		10	11	12	13	14	15	16
ISO chain number	**Pitch**	**Roller diameter**	**Width between plates at inner end**	**Bearing pin body diameter**	**Bush bore**	**Chain path depth**	**Plate depth**	**Crank clearance dimensions**		**Width over link at inner end**	**Width between plates at outer end**	**Width over pin fastening to centre line**	**Width over pin head to centre line**	**Chain plate thickness**	**Measuring load**	**Breaking load**
	p	d_1 max.	b_1* nom.	d_2 max.	d_3 min.	h_1 min.	h_2 max.	l_1 min.	l_2 min.	b_2 max.	b_3 min.	b_4 max.	b_5 max.	c nom.		min.
	in	in	in	in	in	in	in	in	in	in	in	in	in	in	lbf	lbf
2 010	2.500	1.250	1.50	0.626	0.628	1.90	1.88	0.88	0.94	2.141	2.146	1.88	1.69	0.31	200	59 000
2 512	3.067	1.625	1.56	0.751	0.753	2.40	2.38	1.06	1.16	2.328	2.333	2.19	1.88	0.38	300	85 000
2 814	3.500	1.750	1.50	0.876	0.879	2.40	2.38	1.25	1.31	2.520	2.525	2.44	2.19	0.50	400	116 000
3 315	4.073	1.781	1.94	0.939	0.942	2.52	2.50	1.31	1.38	3.082	3.087	2.81	2.50	0.56	500	134 000
3 618	4.500	2.250	2.06	1.101	1.105	3.15	3.12	1.56	1.62	3.207	3.212	3.00	2.56	0.56	600	183 000
4 020	5.000	2.500	2.75	1.251	1.255	3.66	3.62	1.88	2.06	4.031	4.036	3.56	3.06	0.62	800	237 000
4 824	6.000	3.000	3.00	1.501	1.506	4.16	4.12	2.19	2.31	4.531	4.536	3.88	3.50	0.75	1 100	342 000
5 628	7.000	3.500	3.25	1.751	1.757	5.30	5.25	2.56	2.68	5.031	5.036	4.50	4.00	0.88	1 500	465 000

TABLE 1M — **Chain dimensions, measuring loads and breaking loads** (Metric units)

	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	daN	daN
2 010	63,50	31,75	38,1	15,90	15,95	48,3	47,8	22,4	23,9	54,38	54,51	47,8	42,9	7,9	90	26 200
2 512	77,90	41,28	39,6	19,08	19,13	61,1	60,5	26,9	29,5	59,13	59,26	55,6	47,8	9,7	130	37 800
2 814	88,90	44,45	38,1	22,25	22,33	61,1	60,5	31,8	33,3	64,01	64,14	62,0	55,6	12,7	180	51 600
3 315	103,45	45,24	49,3	23,85	23,93	64,1	63,5	33,3	35,1	78,28	78,41	71,4	63,5	14,2	220	59 600
3 618	114,30	57,15	52,3	27,97	28,07	80,0	79,2	39,6	41,2	81,46	81,58	76,2	65,0	14,2	270	81 400
4 020	127,00	63,50	69,9	31,78	31,88	93,0	91,9	47,8	52,3	102,39	102,51	90,4	77,7	15,7	360	105 400
4 824	152,40	76,20	76,2	38,13	38,25	105,7	104,6	55,6	58,7	115,09	115,21	98,6	88,9	19,0	500	152 100
5 628	177,80	88,90	82,6	44,48	44,63	134,6	133,4	65,0	68,1	127,79	127,91	114,3	101,6	22,4	680	206 800

* Minimum width = 0,95 b_1

l_1 min. = l_3 max. l_2 min. = l_4 max.

Overall width of the connecting link = $b_4 + b_5$

In the case of a fastener on both sides, overall width = 2 b_4

2.5 Length accuracy

Finished chains shall be measured either dry or after only light lubricating.

The standard nominal length for measurement shall be that nearest to 3 048 mm (120 in).

The chain shall be supported throughout its entire length and the measuring load given in tables 1 and 1M applied. To comply with this International Standard, the length shall be the nominal length subject to the limits of tolerance of $^{+\,0,32\ \%}_{0}$.

The length accuracy of chains which have to work in parallel shall be within the above limits but matched by agreement with the manufacturer.

2.6 Working clearances (see figure 3)

The form of the line of cranking, or offset, across the width of the link may be curved or straight.

If straight, the distance from the pitch point is l_1 or l_2.

If curved, this distance is l_5 or l_6. Radii l_5 and l_6 shall be sufficient to allow clearance over the adjacent plate nose contained by the clearance radii l_3 and l_4 during chain articulation round a seven-tooth wheel.

Side plates may be extended, provided that the extension is within a 30° included angle with respect to the sidebar, as indicated in figure 3. The chain link construction shall always allow for this extension to be adopted.

2.7 Marking

The chain should be marked with

a) the manufacturer's name or trade mark;

b) the ISO number (see 2.2).

3 CHAIN WHEELS

3.1 Nomenclature

The nomenclature for basic chain dimensions on which all wheel data are based will be found in the keys to tables 1 and 1M. Chain wheel nomenclature is covered under the respective headings.

3.2 Diametral dimensions of wheel rim

3.2.1 *Nomenclature*

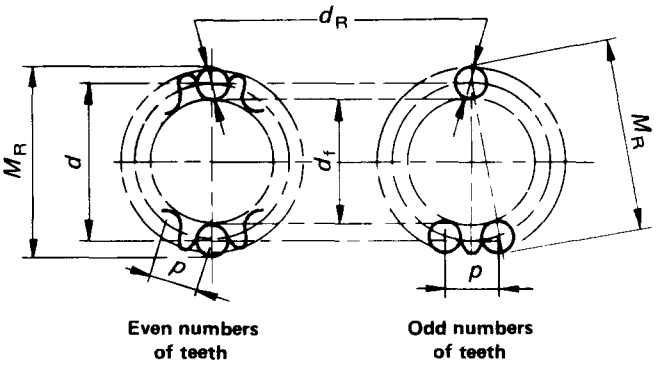

FIGURE 4 – **Diametral dimensions**

p = chordal pitch, equal to chain pitch

d_R = measuring pin diameter

z = number of teeth

d = pitch circle diameter

d_f = root diameter

M_R = measurement over pins

3.2.2 *Dimensions*

3.2.2.1 PITCH CIRCLE DIAMETER

$$d = \frac{p}{\sin \frac{180^\circ}{z}}$$ (see the annex for nominal dimensions of the normal range of teeth)

3.2.2.2 MEASURING PIN DIAMETER

$d_R = d_1$ (see 3.3.1) subject to tolerance limits $^{+\,0,01\ \text{mm}}_{0}$ $^{+\,0.000\,5\ \text{in}}_{0}$

3.2.2.3 ROOT DIAMETER

$d_f = d - d_1$ subject to the following tolerance limits :

Root diameter	Tolerance for machined teeth
$d_f \leqslant$ 305 mm (12 in)	$^{0}_{-\,0,38\ \text{mm}}$ $\left(^{0}_{-\,0,015\ \text{in}}\right)$
$d_f \leqslant$ 1 215 mm (48 in)	$^{0}_{-\,0,50\ \text{mm}}$ $\left(^{0}_{-\,0,020\ \text{in}}\right)$
$d_f >$ 1 215 mm (48 in)	$^{0}_{-\,0,77\ \text{mm}}$ $\left(^{0}_{-\,0,030\ \text{in}}\right)$

Root diameter	Tolerance for non-machined teeth
$d_f \leqslant 305$ mm (12 in)	$\begin{matrix}0\\-1{,}52\text{ mm}\end{matrix}$ $\left(\begin{matrix}0\\-0{,}06\text{ in}\end{matrix}\right)$
$d_f \leqslant 508$ mm (20 in)	$\begin{matrix}0\\-2{,}54\text{ mm}\end{matrix}$ $\left(\begin{matrix}0\\-0{,}10\text{ in}\end{matrix}\right)$
$d_f \leqslant 914$ mm (36 in)	$\begin{matrix}0\\-3{,}81\text{ mm}\end{matrix}$ $\left(\begin{matrix}0\\-0{,}15\text{ in}\end{matrix}\right)$
$d_f > 914$ mm (36 in)	$\begin{matrix}0\\-6{,}35\text{ mm}\end{matrix}$ $\left(\begin{matrix}0\\-0{,}25\text{ in}\end{matrix}\right)$

M_R for EVEN numbers of teeth $= d + d_R$

M_R for ODD numbers of teeth $= d \cos \dfrac{90^\circ}{z} + d_R$

The measurement over pins of wheels with EVEN numbers of teeth shall be carried out over pins inserted in opposite tooth gaps.

The measurement over pins of wheels with ODD numbers of teeth shall be carried out over pins in the tooth gaps most nearly opposite.

During measurement the pins shall always be in contact with the corresponding working faces of the respective teeth.

The limits of tolerance for the measurement over pins are identical with those for the corresponding root diameter.

3.3 Wheel tooth gap forms

3.3.1 *Nomenclature* (see figure 5)

p = chordal pitch, equal to chain pitch

d = pitch circle diameter

d_1 = roller diameter, maximum

r_i = roller seating radius

s = pitch line clearance

θ = pressure angle

β = tooth thickness angle (see the annex)

r_e = tooth flank (topping) radius

d_f = root diameter

d_g = chain clearance diameter

z = number of teeth

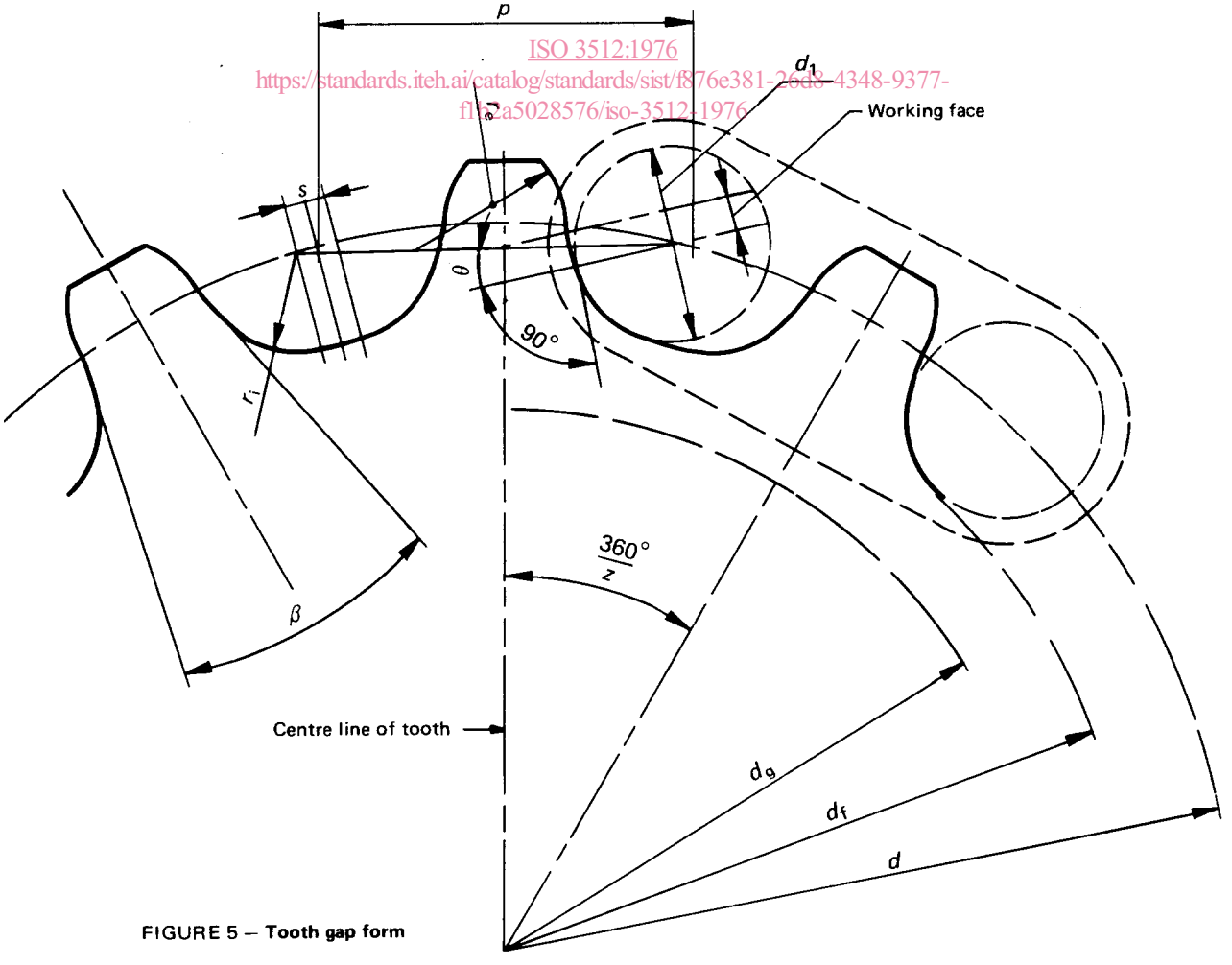

FIGURE 5 – **Tooth gap form**

3.3.2 *Dimensions*

The actual tooth gap form which is provided by cutting or by an equivalent method shall have tooth flanks of a form defined by the tooth flank (topping) radius, the working face length and roller seating curve, with a smooth blending from one portion to the next, taking into account the criteria set out as follows :

3.3.2.1 WORKING FACE

This is the functional part of the tooth form having a length given by the following :

working face length $= 0{,}01 \times p \times z$

unless reduced by the limitation imposed by having all lines perpendicular to the tooth form pass inside the adjacent pitch point on the pitch circle.

The working face may be straight or convex.

NOTE – The above relationship allows for a chain pitch elongation of approximately 6 % where z is less than 40, progressively decreasing to under 2 % at $z = 100$.

3.3.2.2 PRESSURE ANGLE θ

This 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 values of θ at any point on the working face length vary according to the value of z, and are set out in the annex.

3.3.2.3 MAXIMUM CLEARANCE DIAMETER

$$d_g = p \cot \frac{180^\circ}{z} - 1{,}05\, h_2 - 2\, r_a \text{ (actual)}$$

where h_z = plate depth (see figure 3 and table 1)

The circle defines the limit beyond which no portion of the hubs, beads, lugs or fillets shall extend in the proximity of the chain side plates.

3.3.2.4 PITCH LINE CLEARANCE

$s = 0{,}1\, p$ for wheels of NON-MACHINED form or in a dirty environment.

or $s = 0{,}003\, p$ for wheels of MACHINED form or in clean environment.

3.3.2.5 ROLLER SEATING RADIUS

$$r_i \text{ max.} = \frac{d_1}{2}$$

3.3.2.6 TOOTH FLANK (TOPPING) RADIUS

$$r_e = \frac{p}{2}$$

3.4 Wheel rim profile

3.4.1 *Nomenclature*

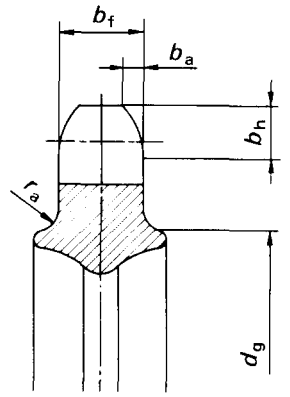

FIGURE 6 – **Wheel rim profile**

b_f = tooth width

b_a = tooth-side relief

b_h = tooth-side relief depth

d_g = maximum clearance diameter

r_a = maximum shroud fillet radius

3.4.2 *Dimensions*

b_f max. $= 0{,}9\, b_1$

$b_a \approx 0{,}2\, b_f$

$b_h \approx 0{,}5\, d_1$

3.5 Radial run-out

The radial run-out, measured on one revolution, between the bore and the root diameter shall not exceed the values indicated below :

0,005 d_f, or 1,5 mm (0.06 in) for NON-MACHINED teeth. The larger of the two values shall be taken, but in no case shall the radial run-out exceed 10 mm (0.40 in).

0,001 d_f, or 0,2 mm (0.008 in) for MACHINED teeth. The larger of the two values shall be taken, but in no case shall the radial run-out exceed 5 mm (0.20 in).

3.6 Axial run-out

Axial run-out, measured with reference to the bore and the flat part of the side face of the teeth, shall not exceed the value for total indicator reading as stipulated for radial run-out in 3.5.

3.7 Range of teeth

These recommendations apply primarily to a range of teeth from 7 to 100 inclusive.

3.8 Marking

Wheels should be marked with :

– maker's name or trade mark;

– number of teeth;

– chain designation (ISO number or maker's equivalent).

ANNEX

PITCH CIRCLE DIAMETERS

The table below gives correct pitch circle diameters for wheels to suit a chain of unit pitch (for example 1 mm, 1 in). The pitch circle diameters for wheels to suit a chain of any other pitch are directly proportional to the pitch of the chain (see 3.1).

The last digit is rounded down to avoid the risk of oversize root diameters.

Number of teeth z	Pitch circle diameter	Pressure angle θ degrees $\pm 2^\circ$	Tooth thickness angle β approximately degrees
7	2,304	10	25
8	2,613	11	26
9	2,923	12	28
10	3,236	13	30
11	3,549	14	31
12	3,863	15	33
13	4,178	16	35
14	4,494	17	36
15	4,809	18	38
16	5,125	19	40
17	5,442	20	42
18	5,758	20	42
19	6,075	21	44
20	6,392	21	44
21	6,709	22	46
22	7,026	22	46
23	7,343	22	46
24	7,661	23	47
25	7,978	23	47
26	8,296	23	47
27	8,613	23	47
28	8,931	24	49
29	9,249	24	49
30	9,566	24	49
31	9,884	24	49
32	10,202	24	49
33	10,520	25	51
34	10,837	25	51
35	11,155	25	51
36	11,473	25	51
37	11,791	25	51
38	12,109	25	51
39	12,427	25	51
40	12,745	25	51
41	13,063	26	53
42	13,381	26	53
43	13,699	26	53
44	14,017	26	53
45	14,335	26	53
46	14,653	26	53
47	14,971	26	53
48	15,289	26	53
49	15,607	26	53
50	15,926	26	53
51	16,244	26	53
52	16,562	26	53
53	16,880	27	55
54	17,198	27	55
55	17,516	27	55
56	17,834	27	55
57	18,152	27	55
58	18,471	27	55
59	18,789	27	55
60	19,107	27	55
61	19,425	27	55
62	19,743	27	55
63	20,061	27	55
64	20,380	27	55
65	20,698	27	55
66	21,016	27	55
67	21,334	27	55
68	21,652	27	55
69	21,971	27	55
70	22,289	27	55
71	22,607	28	56
72	22,925	28	56
73	23,243	28	56
74	23,562	28	56
75	23,880	28	56
76	24,198	28	56
77	24,516	28	56
78	24,834	28	56
79	25,153	28	56
80	25,471	28	56
81	25,789	28	56
82	26,107	28	56
83	26,426	28	56
84	26,744	28	56
85	27,062	28	56
86	27,380	28	56
87	27,699	28	56
88	28,017	28	56
89	28,335	28	56
90	28,653	28	56
91	28,971	28	56
92	29,290	28	56
93	29,608	28	56
94	29,926	28	56
95	30,244	28	56
96	30,563	28	56
97	30,881	29	58
98	31,199	29	58
99	31,518	29	58
100	31,836	29	58