ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 1395

SHORT PITCH TRANSMISSION

PRECISION BUSH CHAINS AND CHAIN WHEELS

1st EDITION

August 1970

For each individual country the only valid standard is the national standard of that country.

Printed in Switzerland

Also issued in French and Russian. Copies to be obtained through the national standards organizations.

BRIEF HISTORY

The ISO Recommendation R 1395, *Short pitch transmission precision bush chains and chain wheels,* was drawn up by Technical Committee ISO/TC 100, *Chains and chain wheels for power transmission and conveyors,* the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question led to the adoption of Draft ISO Recommendation No. 1395, which was circulated to all the ISO Member Bodies for enquiry in November 1967. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Austria	Greece	Sweden
Belgium	India	Switzerland
Brazil	Israel	Thailand
Czechoslovakia	Italy	Turkey
Chile	Japan	United Kingdom
Finland	Korea, Rep. of	Yugoslavia
France	Romania	
Germany	South Africa, Rep. of	

The following Member Bodies opposed the approval of the Draft :

U.S.A.
U.S.S.R.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

CONTENTS

ISO Recommendation	R 1395	August 1970

SHORT PITCH TRANSMISSION

PRECISION BUSH CHAINS AND CHAIN WHEELS

1. SCOPE

This ISO Recommendation applies to short pitch precision bush chains of simple and multiplex construction suitable for the mechanical transmission of power and allied applications, together with the tooth gap forms and rim profiles of their associated chain wheels. It covers dimensions, tolerances, measuring loads and minimum breaking loads.

It includes chains of two pitches only, namely 0.25 in (6.35 mm) and 0.375 in (9.525 mm).

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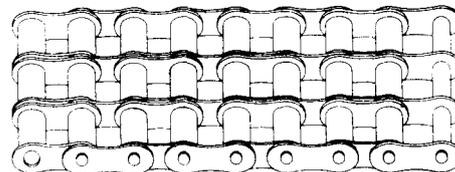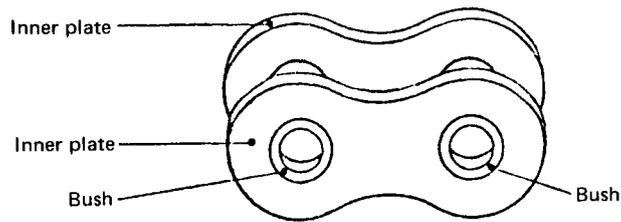
2. CHAINS

2.1 Nomenclature

The illustrations shown in this clause and in the Key to Tables 1 and 1M do not define the actual form of the chain plates. Dimensional definitions are contained in the Key (page 9) to Tables 1 and 1M.

Bush chain, simple

Bush chain, multiple (triplex)

Inner plate

Inner plate

Bush   Bush

Inner link

Outer plate

Bearing
pins

Outer plate

Outer link, simple

Outer plate

Intermediate
plates

Bearing pins

Outer
plate

Outer link, duplex

Outer plate

Fixed
connecting
pins

Detachable
plate
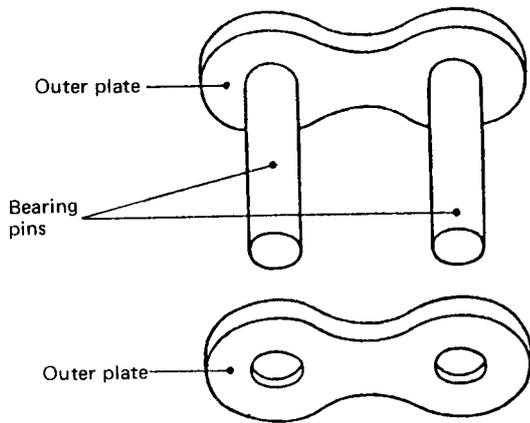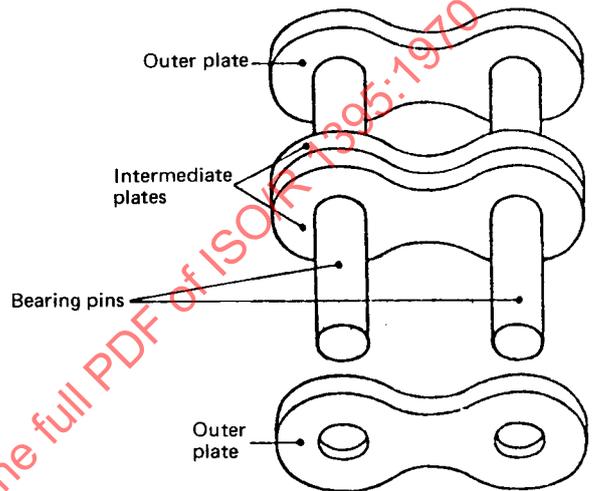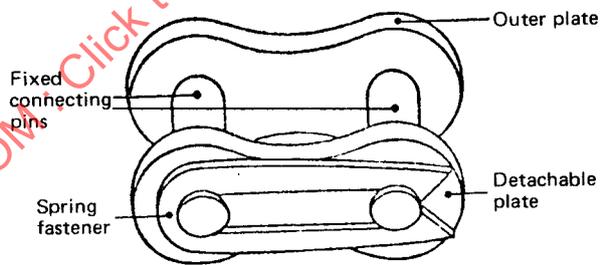
Spring
fastener

Connecting link with spring fastener

Cranked
plate

Detachable
connecting
pin

Bush

Cranked
plate

Fastener
(schematic)

Inner
plate

Bush

Cranked
plate

Bearing
pin
(riveted)
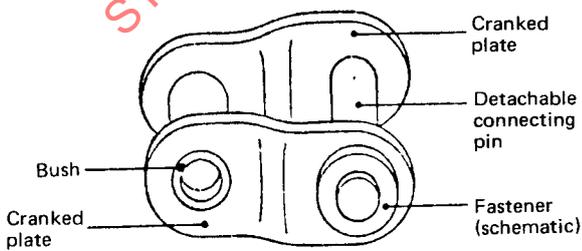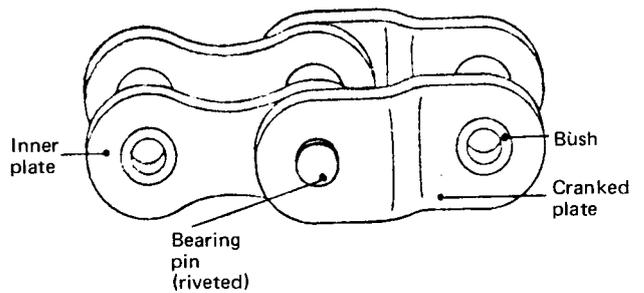
Cranked link, single   **Cranked link, double**

2.2 Designation

Transmission precision bush chains are designated by the standard ISO chain numbers given in the Tables 1 and 1M, first column, the first two digits expressing the pitch in sixteenths of an inch. The chain numbers in Tables 1 and 1M are supplemented by a hyphenated suffix, 1 for simple chain, 2 for duplex chain, 3 for triplex chain, etc. (for example 04C – 1, 04C –2, 04C – 3, etc.).

2.3 Dimensions

Chains should conform to the dimensions given in Tables 1 and 1M. The 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 to be used in manufacture.

2.4 Breaking loads

The test length should have a minimum of five free pitches. The ends should be attached to the testing machine shackles by a pin through the plate holes or through the bushes or by the bush common to an inner and outer link; the actual method to be used is left to the discretion of the manufacturer. The shackles should be so designed as to allow universal movement.

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

The minimum tensile breaking loads should be those given in Tables 1 and 1M.

2.5 Proof loading

It is recommended that all chains should be proof loaded to one-third of the minimum tensile breaking load given in Tables 1 and 1M.

2.6 Length accuracy

Finished chains should be measured after proof loading (where applicable) but before lubricating.

The standard length for measurement should be 49 times the pitch of the chain and should terminate at each end in an inner link.

The chain should be supported throughout its entire length, and the measuring load given in Tables 1 and 1M should be applied.

To comply with this ISO Recommendation, the length should be the nominal length subject to the tolerance :
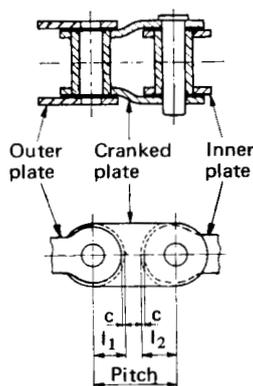
$$+ 0.15\%$$
$$0$$

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

2.7 Marking
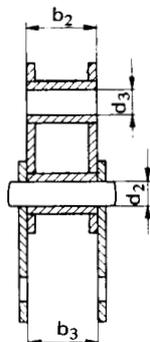
It is recommended that the chains should be marked with

(a)   manufacturer's name or trade mark;

(b)   the ISO chain number (column 1 of Tables 1 and 1M).

KEY TO TABLES 1 AND 1M

Cranked link

Dimension c represents the clearance between the cranked link plates and the straight plates available during articulation.

Section through chain
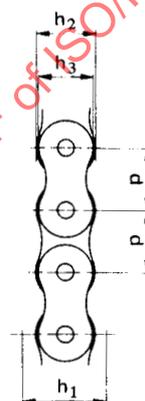
Depths and pitch

The chain path depth h_1 is the minimum depth of channel through which the assembled chain should be able to pass.
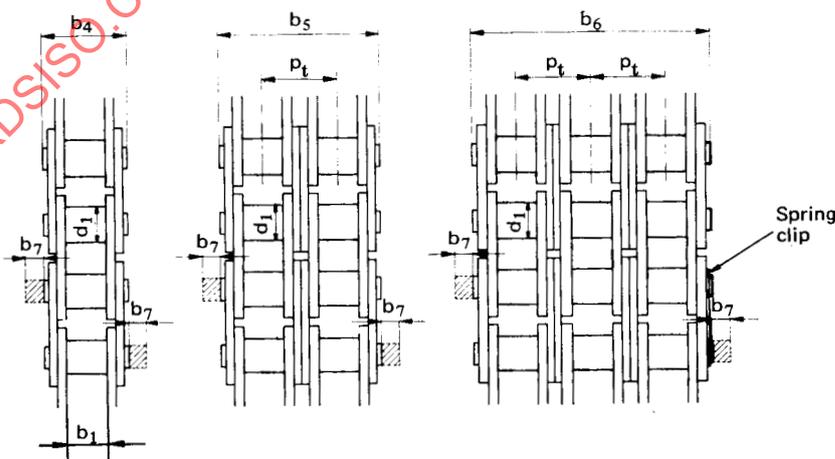
Simple   Duplex   Triplex

The overall width of a chain with a joint-fastener is equal to the width over the bearing pins, b_4, b_5 or b_6, plus b_7, for riveted pin (or plus 1.6 b_7 for headed pin end) if fastener is on one side only, or plus 2 b_7, if fastener is on both sides.

The width over bearing pins for chains wider than triplex = b_4 + p_t (number of strands in chain − 1).

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

1	2	3	4	5	6	7	8	9	10	11	12	13
ISO chain number	Pitch	Bush diameter	Width between inner plates	Bearing pin body diameter	Bush bore	Chain path depth	Inner plate depth	Outer/ intermediate plate depth	Cranked link dimensions*			Trans-verse pitch
	p	d_1 max.	b_1 min.	d_2 max.	d_3 min.	h_1 min.	h_2 max.	h_3 max.	l_1 min.	l_2 min.	c	p_t
	in	in	in	in	in	in	in	in	in	in	in	in
04 C	0.250	0.130	0.125	0.091	0.092	0.247	0.237	0.205	0.104	0.121	0.003	0.252
06 C	0.375	0.200	0.188	0.141	0.143	0.366	0.356	0.307	0.156	0.181	0.003	0.399

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

	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
04 C	6.35	3.30	3.18	2.311	2.34	6.27	6.02	5.21	2.64	3.06	0.08	6.40
06 C	9.525	5.08	4.77	3.580	3.63	9.30	9.05	7.80	3.96	4.60	0.08	10.13

* Cranked links are not recommended for use on chains which are intended for onerous applications.

14	15	16	17	18	19	20	21	22	23	24	25
Width over inner link	Width between outer plates	Width over bearing pins			Additional width for joint fastener	Measuring load			Breaking load		
b_2 max.	b_3 min.	Simple b_4 max.	Duplex b_5 max.	Triplex b_6 max.	b_7 max.	Simple	Duplex	Triplex	Simple min.	Duplex min.	Triplex min.
in	in	in	in	in	in	lbf	lbf	lbf	lbf	lbf	lbf
0.189	0.194	0.36	0.61	0.86	0.10	10	20	30	780	1560	2340
0.294	0.299	0.52	0.92	1.32	0.13	16	32	48	1750	3500	5250

mm	mm	mm	mm	mm	mm	daN	daN	daN	daN	daN	daN
4.80	4.93	9.1	15.5	21.8	2.5	5	10	15	350	700	1050
7.47	7.60	13.2	23.4	33.5	3.3	7	14	21	790	1580	2370

3. ATTACHMENTS

Standard attachments for use with 06 C size chain are shown in Figures 1, 2 and 3. Dimensions should conform to those shown in Tables 2, 3 and 4.
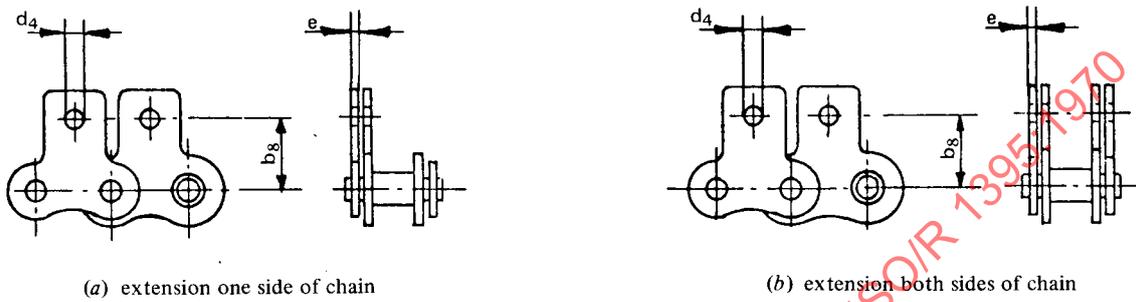

(a) extension one side of chain   (b) extension both sides of chain

FIG. 1 — Straight link plate extension

TABLE 2 — Dimensions of straight link plate extension

ISO chain number	d_4 min.		b_8		e	
	in	mm	in	mm	in	mm
06 C	0.102	2.59	0.375	9.53	0.050	1.27

(a) extension one side of chain   (b) extension both sides of chain
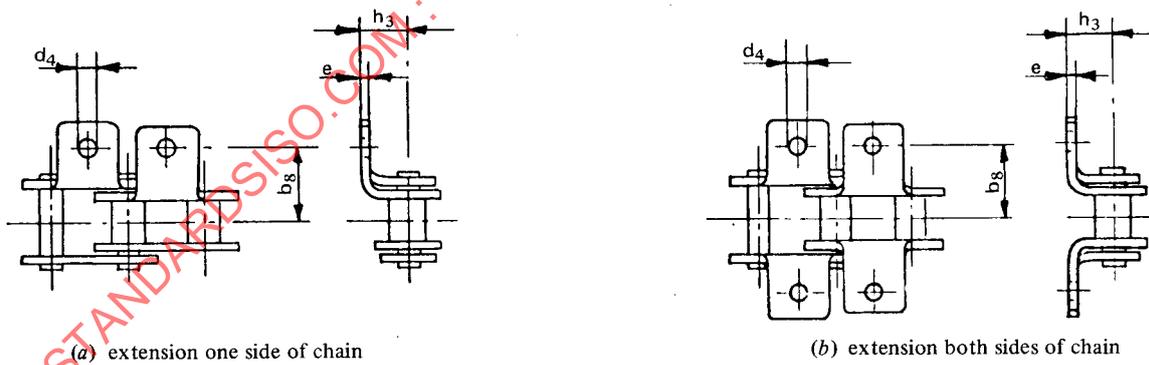
FIG. 2 — Bent link plate extension

TABLE 3 — Dimensions of bent link plate extension

ISO chain number	d_4 min.		h_3		b_8		e	
	in	mm	in	mm	in	mm	in	mm
06 C	0.102	2.59	0.25	6.35	0.375	9.53	0.050	1.27
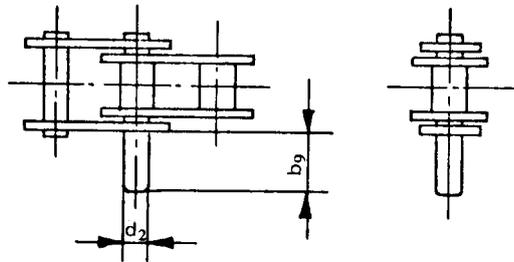
FIG. 3 — Extended pin on one side of chain

TABLE 4 — Dimensions of extended pin

| ISO chain number	d_2		b_9	
	in	mm	in	mm
06 C	0.141	3.58	0.375	9.53

4. CHAIN WHEELS

4.1 Nomenclature

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

4.2 Diametral dimensions of wheel rim

4.2.1 *Nomenclature*

Even numbers   Odd numbers
of teeth   of teeth
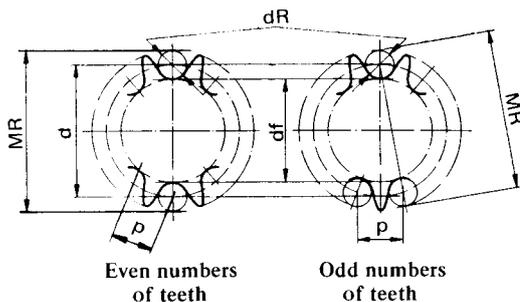
p = chordal pitch and is equal to chain pitch
dR = measuring pin diameter
z = number of teeth
d = pitch circle diameter
df = root diameter
MR = measurement over pins

FIG. 4 – Diametral dimensions

4.2.2 *Dimensions*

dR = d_1 (see clause 4.3.1) subject to tolerance limits

$$+ 0.0005 \text{ in } (0.01 \text{ mm})$$
$$0$$

d = $\dfrac{p}{\sin \dfrac{180°}{z}}$ (see the Appendix for pitch circle diameters in relation to the number of teeth)

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

Root diameter	Upper deviation	Lower deviation
$df \leqslant 5$ in (127 mm)	0	0.010 in (0.25 mm)
$df \leqslant 9.85$ in (250 mm)	0	0.012 in (0.30 mm)
$df > 9.85$ in (250 mm)	0	h11*

MR for *even* numbers of teeth = $d + dR_{\min}$

MR for *odd* numbers of teeth = $d \cos \dfrac{90°}{z} + dR_{\min}$

The measurement over pins of wheels with *even* numbers of teeth should be carried out over pins inserted in opposite tooth gaps.

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

The limits of tolerance for the measurement over pins are identical to those for corresponding root diameters.

---

* See ISO Recommendation R 286, *ISO system of limits and fits – Part I : General, tolerances and deviations.*

4.3   Wheel tooth gap forms

4.3.1   *Nomenclature*
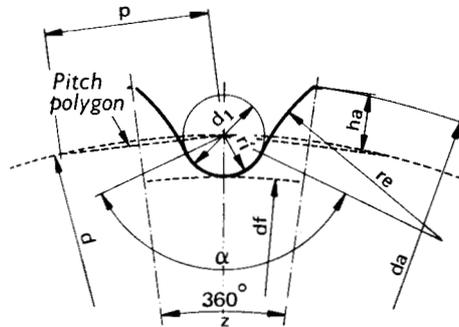
p = chordal pitch and is equal to chain pitch
d = pitch circle diameter
d_1 = bush diameter, maximum
ri = bush seating radius
α = bush seating angle
re = tooth flank radius
ha = height of tooth above pitch polygon
da = tip diameter
df = root diameter
z = number of teeth

FIG. 5 – **Tooth gap forms**

4.3.2   *Dimensions.*

The limits of the tooth gap form are determined by the minimum and maximum tooth gap forms. The actual tooth gap form provided by cutting or equivalent method should have tooth flanks of a form lying between the minimum and maximum flank radii and blending smoothly with the bush seating curve subtending the respective angles.
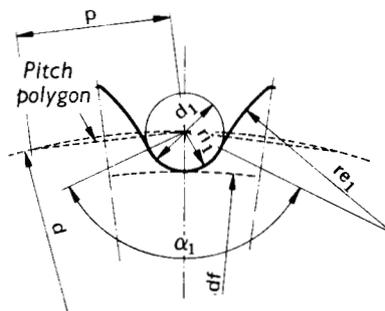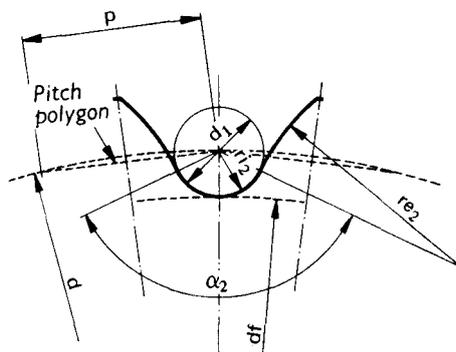

$$ri_1 = 0.505\, d_1$$

$$\alpha_1 = 140^\circ - \frac{90^\circ}{z}$$

$$re_1 = 0.12\, d_1\, (z + 2)$$

FIG. 6 – **Minimum tooth gap form**

$$ri_2 = (0.505\, d_1 + 0.008\, \sqrt[3]{d_1})\ \text{in} \quad (\text{where } d_1 \text{ is expressed in inches})$$

$$\quad\ \ = (0.505\, d_1 + 0,069\, \sqrt[3]{d_1})\ \text{mm} \quad (\text{where } d_1 \text{ is expressed in millimetres})$$

$$\alpha_2 = 120° - \frac{90°}{z}$$

$$re_2 = 0.008\, d_1\, (z^2 + 180)$$

FIG. 7 – **Maximum tooth gap form**

4.4 Tooth heights and tip diameters

4.4.1 *Nomenclature.* This is as given in clause 4.3.

4.4.2 *Dimensions*

$$da_{\max} = d + 1.25\, p - d_1$$

$$da_{\min} = d + p\ (1 - \frac{1.6}{z}) - d_1$$

It should be noted that $da_{\min}$ and $da_{\max}$ can be applied arbitrarily both to the minimum and maximum gap forms, subject to the limitations imposed by the cutter on $da_{\max}$

To facilitate the construction of the tooth gap form to a large scale on a drawing board, the tooth height above the pitch polygon can be obtained from the following formulae :

$$ha_{\max} = 0.625p - 0.5\, d_1 + \frac{0.8\, p}{z}$$

$$ha_{\min} = 0.5\, (p - d_1)$$

Note that $ha_{\max}$ is related to $da_{\max}$, and $ha_{\min}$ to $da_{\min}$.