INTERNATIONAL STANDARD

ISO 10823

Second edition
2004-02-01

Guidelines for the selection of roller chain drives

Méthode de sélection des transmissions par chaîne à rouleaux

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ISO 10823:2004
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Reference number
ISO 10823:2004(E)

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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 10823 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 10823:1996), which has been technically revised.

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Guidelines for the selection of roller chain drives

1 Scope

This International Standard gives guidelines for the selection of chain drives, composed of a roller chain and sprockets conformant with ISO 606, for industrial applications.

The selection procedures and the chain ratings it describes provide for roller chain drives operating under specified conditions, as defined in 9.1, 9.2 and in Clause 10, with a life expectancy of approximately 15 000 h.

Owing to the wide variations in loading characteristics, environmental conditions and achieved maintenance, it is desirable that the supplier of the chains and sprockets be consulted to ensure that the performance of the product meets the requirements specified both by the user and by this International Standard.

2 Normative references

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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 606, *Short-pitch transmission precision roller chains and chain wheels*

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3 Symbols

The symbols and units used in this International Standard are given in Table 1.

4 Basic equations

4.1 Input power

The power to be transmitted is the input P, in kilowatts, to the drive sprocket. If input torque is the known requirement, then P can be derived from the following equation:

$$P = \frac{M \times n_1}{9\,550} \tag{1}$$

4.2 Corrected power

To allow for the characteristics of the drive system and the type of load to be transmitted, the input power, P, is multiplied by factors to obtain the corrected power, P_c.

$$P_c = P \times f_1 \times f_2 \tag{2}$$

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Table 1 — Symbols, designations and units

Symbol	Designation	Unit
a	Maximum centre distance	mm
a_0	Approximate centre distance	mm
f_1	Application factor to allow for the operating conditions (see Table 2)	—
f_2	Factor for number of teeth on small sprocket [see Figure 4 and Equation (5)]	—
f_3	Factor for calculation of the number of links with different number of teeth (see Table 5)	—
f_4	Factor for the calculation of the centre distance with different numbers of teeth (see Table 6)	—
i	Speed ratio	—
M	Input torque	N·m
n_1	Input sprocket speed	min^{-1}
n_2	Output sprocket speed	min^{-1}
n_s	Small sprocket speed	min^{-1}
p	Chain pitch	mm
P	Input power	kW
P_c	Corrected power	kW
v	Chain speed	$m·s^{-1}$
X	Number of pitches in chain	—
X_0	Calculated number of pitches in chain	—
z_1	Number of input sprocket teeth	—
z_2	Number of output sprocket teeth	—
z_s	Number of small sprocket teeth	—

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5 Drive design specifications

The following design features should be specified before the chain and sprockets are selected:

a) power to be transmitted;

b) type of driver and driven machinery;

c) speeds and sizes of the driver and driven shafts;

d) centre distance and layout of the shafts;

e) environmental conditions.

NOTE Shaft sizes, unusually long or short centre distances, and/or a complex layout could influence the drive selection.

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6 Sprocket selection

Determine the number of teeth on the sprockets using the following procedure:

a) select the desired number of teeth for the input sprocket;

b) determine the speed ratio, i, using the equation:

$$i = \frac{n_1}{n_2} \tag{3}$$

c) determine the number of teeth on the output sprocket, z_2, using the equation:

$$z_2 = i \times z_1 \tag{4}$$

It is good practice to use sprockets with not less than 17 teeth and not more than 114 teeth.

If the chain drive operates at high speed or if it is subjected to impulse loads, the small sprocket should have at least 25 teeth and the teeth should be hardened.

7 Chain calculations and selection

7.1 Normal operating conditions and drive capacities for chains

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The typical capacity rating charts shown in Figures 1, 2 and 3 apply to chain drives operating under the following conditions:

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a) a chain drive with two sprockets on parallel horizontal shafts;

b) a small sprocket with 19 teeth;

c) a simplex chain without cranked link;

d) a chain length of 120 pitches (different chain lengths will affect chain life);

e) a speed ratio of from 1:3 to 3:1;

f) an expected life of 15 000 h;

g) an operating temperature between –5 °C and +70 °C;

h) sprockets correctly aligned and chain maintained in correct adjustment (see Clause 10);

i) uniform operation without overload, shocks or frequent starts;

j) clean and adequate lubrication throughout the chain's life (see Clause 9).

Figures 1, 2 and 3 can be used to select the size of chain suitable for a chain drive as a function of the corrected power, P_c, and the small sprocket rotational speed, n_s.

The capacity rating charts given in Figures 1, 2 and 3 are representative of those published by chain manufacturers. Individual manufacturers can rate their chains differently. It is therefore recommended that the appropriate manufacturer's rating chart be consulted.

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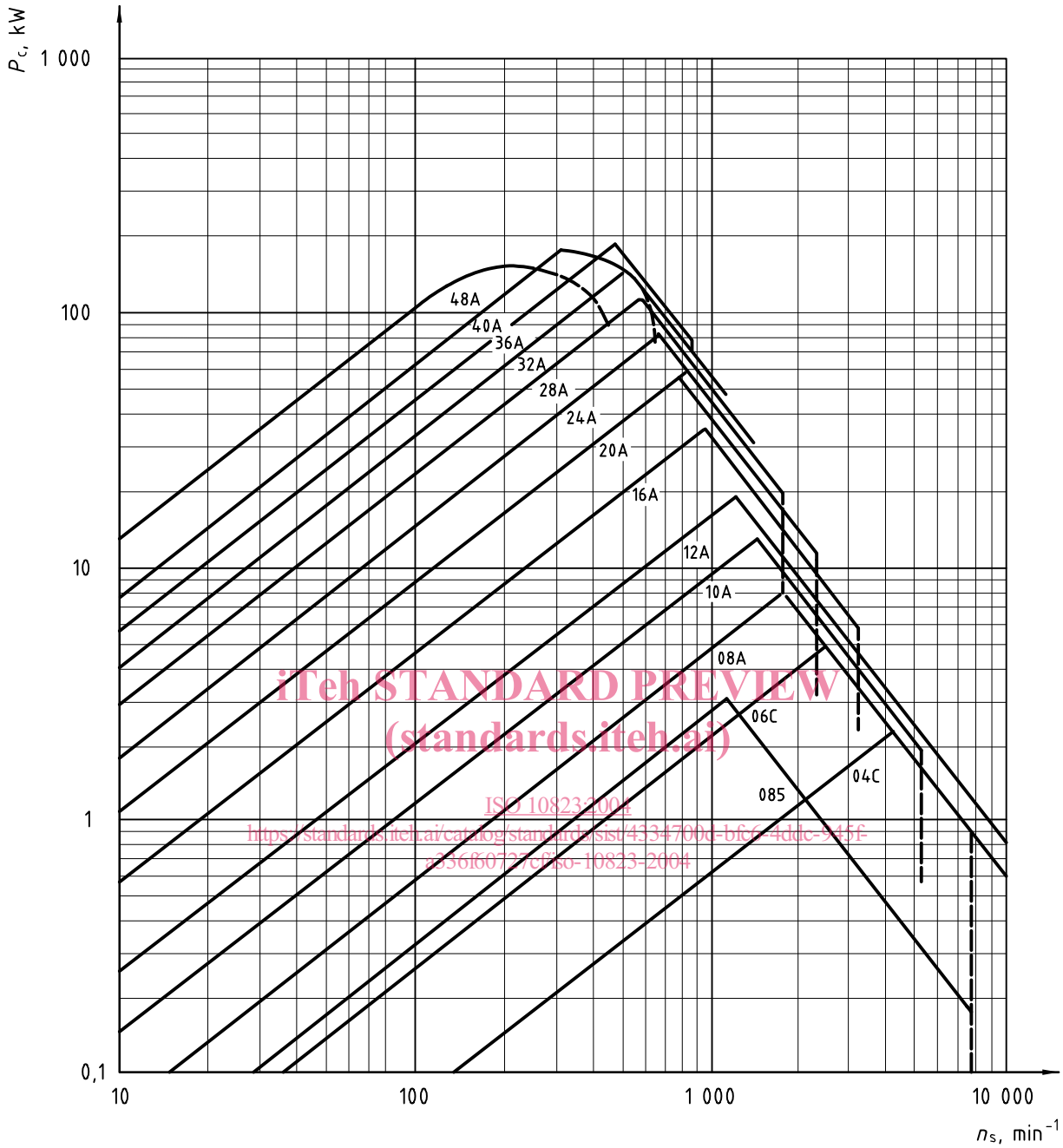

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Key

P_c corrected power

n_s small sprocket speed

NOTE 1 The power rating of duplex chain can be calculated by multiplying the value of P_c for simplex chain by 1,7.

NOTE 2 The power rating of triplex chain can be calculated by multiplying the value of P_c for simplex chain by 2,5.

Figure 1 — Typical capacity chart for selection of Type A simplex chains based on a 19-tooth sprocket conforming with ISO 606

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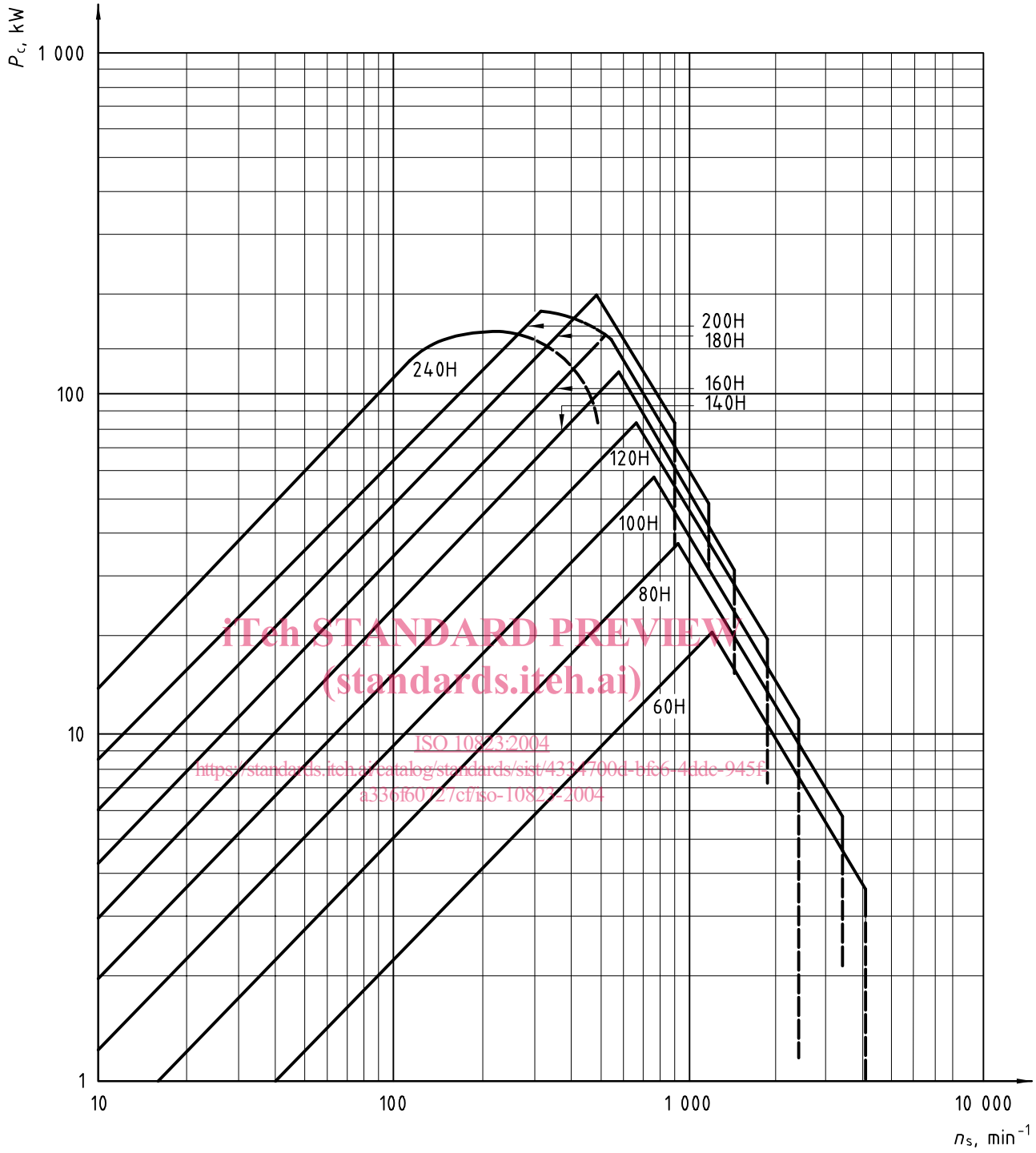

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Key

P_c corrected power

n_s small sprocket speed

NOTE 1 The power rating of duplex chain can be calculated by multiplying the value of P_c for simplex chain by 1,7.

NOTE 2 The power rating of triplex chain can be calculated by multiplying the value of P_c for simplex chain by 2,5.

Figure 2 — Typical capacity chart for selection of Type A heavy-series simplex chains based on a 19-tooth sprocket conforming with ISO 606

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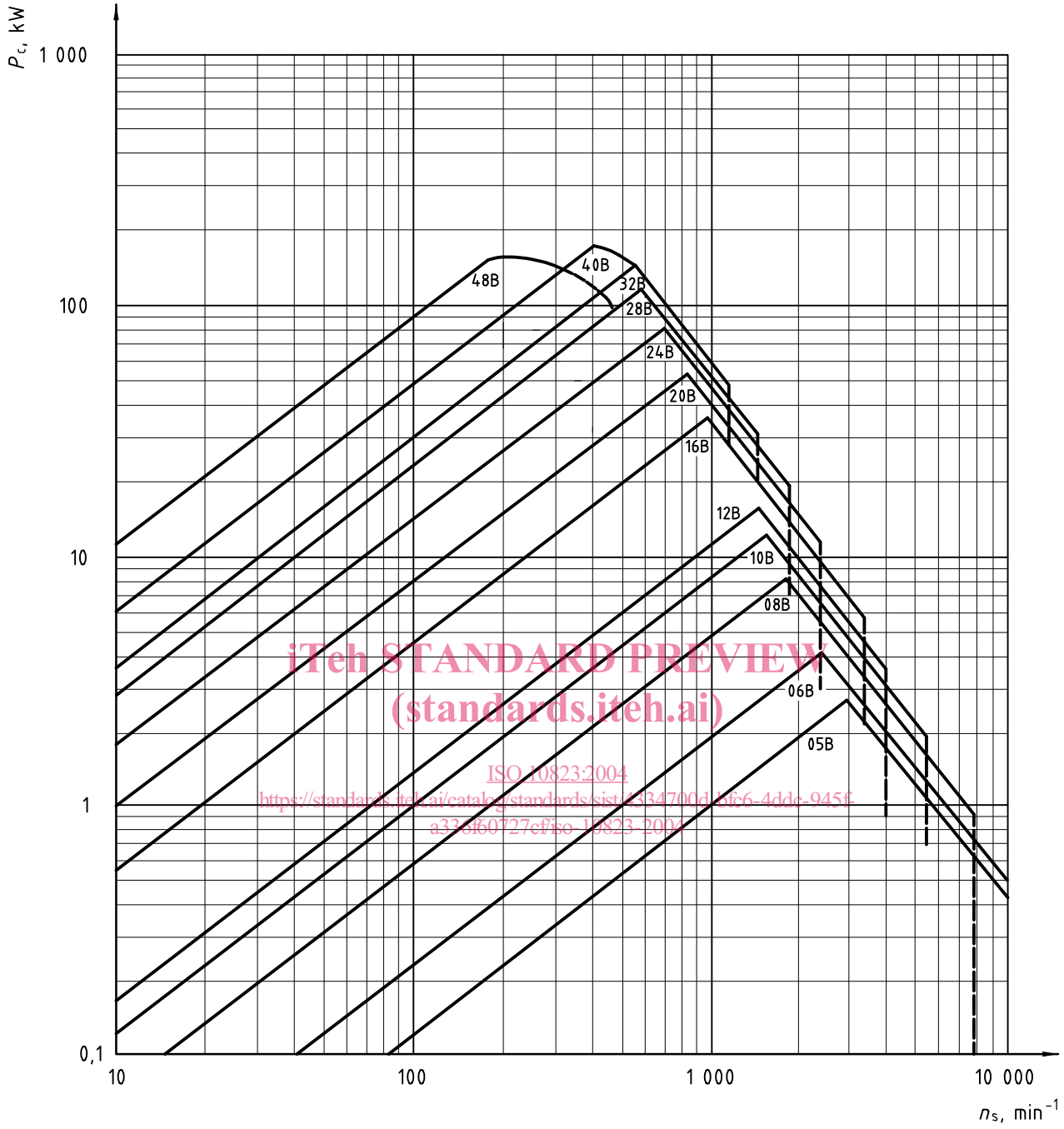

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Key

P_c corrected power

n_s small sprocket speed

NOTE 1 The power rating of duplex chain can be calculated by multiplying the value of P_c for simplex chain by 1,7.

NOTE 2 The power rating of triplex chain can be calculated by multiplying the value of P_c for simplex chain by 2,5.

Figure 3 — Typical capacity chart for selection of Type B simplex chains based on a 19-tooth sprocket conforming with ISO 606

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7.2 Correction for other operating conditions for chains

7.2.1 Power correction

If the characteristics of the chain drive and its operating conditions are different from those described in 7.1, the transmitted power shall be corrected by using Equation (2).

The derivation of factors f_1 and f_2 are given in 7.2.2 and 7.2.3.

7.2.2 Application factor f_1

Factor f_1 takes into account dynamic overloads dependant on the chain drive operating conditions and resulting, in particular, from the nature of the driver and driven elements. The value of factor f_1 can be selected directly or by analogy using Table 2 in conjunction with the definitions given in Tables 3 and 4.

Table 2 — Application factor f_1

Driven machine characteristics (see Table 4)	**Driver machine characteristics** (see Table 3)		
	Smooth running	**Slight shocks**	**Moderate shocks**
Smooth running	1,0	1,1	1,3
Moderate shocks	1,4	1,5	1,7
Heavy shocks	1,8	1,9	2,1

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Table 3 — Definitions of characteristics of driver machines

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Driver machine characteristics	**Machine type examples**
Smooth running	Electric motors, steam and gas turbines and Internal combustion engines with hydraulic coupling
Slight shocks	Internal combustion engines with six cylinders or more with mechanical coupling, electric motors subjected to frequent starts (more than two per day)
Moderate shocks	Internal combustion engines with less than six cylinders with mechanical coupling

Table 4 — Definitions of characteristics of driven machines

Characteristics of driven machine	**Machine type examples**
Smooth running	Centrifugal pumps and compressors, printing machines, uniformly loaded belt conveyors, paper calendars, escalators, liquid agitators and mixers, rotary dryers, fans
Moderate shocks	Reciprocating pumps and compressors with three or more cylinders, concrete mixing machines, non-uniformity loaded conveyors, solid agitators and mixers
Heavy shocks	Excavators, roll and ball mills, rubber-processing machines, planers/presses/shears/pumps/compressors with one or two cylinders, oil drilling rigs

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