1. 基本公式 Basic Equations

1.1 输入功率 Input Power

主动链轮所传递的功率是输入功率P，用千瓦表示。假如已知输入扭矩，则P可由下式计算:

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

$$P = \frac{Mn_1}{9550} \tag{1}$$

1.2 修正功率 Corrected Power

鉴于传动系统的不同特性以及所传递载荷的不同类型，将输入功率P乘以系数后得到修正功率Pc:

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 corredcted power Pc.

$$P_C = P f_1 f_2 \tag{2}$$

表1–符号、定义及单位
Table 1–Symbol,Designations And Units

符 号 Symbol	定 义 Designation	单 位 Unit
a	最大中心距　　　　　　　　　　　Maximum centre distance	mm
a_0	近似中心距　　　　　　　　　　　Approximate centre distance	mm
f_1	操作条件应用系数，见表2　　　　Application factor to allow for the operating conditions(see Table 2)	–
f_2	小链轮齿数系数，见图4和公式5　Factor for number of teeth on small sprocket(see Figure4 and equation 5)	–
f_3	由链轮齿数差决定的链节数计算系数（见表5） Factor for calculation of the number of links with different number of teeth(see Table 5)	–
f_4	由链轮齿数差决定的中心距计算系数（见表6） Factor for the calculation of the centre distance with different number of teeth(see Table 6)	–
i	传动比　　　　　　　　　　　　　Speed ratio	–
M	输入扭矩　　　　　　　　　　　　Input torque	Nm
n_1	输入轴转数　　　　　　　　　　　Speed of input sprocket	min^{-1}
n_2	输出轴转数　　　　　　　　　　　Speed of output sprocket	min^{-1}
n_s	小链轮转数　　　　　　　　　　　Speed of small sprocke	min^{-1}
p	链条节距　　　　　　　　　　　　Chain pitch	mm
P	输入功率　　　　　　　　　　　　Input power	kW
P_C	修正功率　　　　　　　　　　　　Corrected power	kW
v	链条速度　　　　　　　　　　　　Chain speed	m/s
X	链长节数　　　　　　　　　　　　Number of pitches in chain	–
X_0	计算链长齿数　　　　　　　　　　Calculated number of pitches in chain	–
z_1	主动链轮齿数　　　　　　　　　　Number of teeth on imput sprocket	–
z_2	从动链轮齿数　　　　　　　　　　Number of teeth on output sprocket	–
z_s	小链轮齿数　　　　　　　　　　　Number of teeth on small sprocket	

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2. 链传动设计规定 Drive Design Specifications

在选择链条链轮之前，应确定下列参数：

a) 所要传递的功率；
b) 主从动机械的类型；
c) 主从动轴转数和直径；
d) 链轮中心距和轴系的布置；
e) 环境条件。

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.

注：轴的尺寸、中心距的长短或复杂的轴系布置通常会影响链传动选择。
NOTE: Shaft sizes,unusually long or short centre distances and/or a complex layout may influence the drive selection.

3. 选择链轮 Sprocket Selection

按下述程序确定链轮的齿数：

a) 选择主动链轮的适当齿数；
b) 使用下式确定传动比：

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

c) 使用下式确定从动链轮的齿数：
$$z_2=iz_1$$

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

a) select the desired number of teeth for the input sprocket;
b) determine the speed ratio i, using the equation:

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

(3)

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

$$z_2=iz_1$$

推荐齿数范围为：17~114。
It is good practice to use sprockets with not less than 17 teeth and not more than 114 teeth.

(4)

对于高速或承受冲击载荷的链传动，则小链轮至少应选择25个齿，并且齿面应淬硬。
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.

4. 计算选择链轮 Chain Calculations And Selection

4.1 链条正常的操作条件和传动能力 Normal Operating Conditions And Drive Capacities For Chains

本标准（图1、2和3）提供的是典型的链传动额定功率曲线图，它们适用于下列操作条件：
Typical capacity charts shown in this standard（Figures 1,2 and 3）apply to chain drives operating under the following conditions;

a) 安装在水平平行轴上的两链轮链传动；
b) 小链轮齿数为19;
c) 没有弯板链节的单排链条；
d) 链条长度为120个节距（不同的链条长度将影响链条的适用寿命）
e) 传动比从1:3到3:1;
f) 预期使用寿命为15000小时;
g) 工作温度在–5℃~+70℃ 之间；
h) 链轮正确对中，链条保持正确调整；
i) 运转平稳，绝无过载、振动或频繁起动现象；
j) 在链传动的有效寿命期间保持清洁和适当的润滑。

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℃and +70℃;
h) sprockets correctly aligned and chain maintained in correct adjustment;
i) uniform operation without overload, shocks or frequent starts;
j) clean and adequate lubrication throughout the chain's life.

使用图1、2和3来选择适用的链条规格，图中曲线是修正功率P_c和小链轮转束n_s的函数。

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

图1、2和3中给出的额定功率曲线代表了链条制造商们发布的数据。个别链条制造商的数据可能不同于本标准，建议在使用他们的链条时应向他们咨询。

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

5. 对链条不同操作条件的修正 Correction For Other Operating Conditions For Chains

5.1 应用系数f_1 Application Factor f_1

系数f_1是一动载荷系数，它取决于引起链传动超负荷运行的操作条件和操作效应，特别是与主从动机械的特性有关。系数f_1的值可直接从表2选取，或结合表3或表4中的定义再从表2中选取。

Factor $f_1$takes into account dynamic overloads depending on the chain drive operating conditions and resulting,in particular,from the nature of the driver and driven elements.The value of factor f1 can be selected directly or by analogy using Table 2 in conjunction with the definitions given in Tables 3 and 4.

5.2 系数f_2 Factor f_2

系数f_2是关于小链轮的齿数系数，相对于额定功率曲线上由链板疲劳限制的部分。其数值由公式（5）确定。从11齿到45齿的f_2值可由图4查得。

Factor f_2 takes account of the number of teeth on the small sprocket only for the portion of the power ratings limited by plate fatigue.Its value shall be determined by equation(5).Values of f_2 for 11 through 45 teeth are shown in Figure 4.

$$f_2 = \frac{19^{1.08}}{z_s^{1.08}} \tag{5}$$

表2–应用系数f_1
Table 2–Application Factor f_1

从动机械特性（见表4）Characteristics of driven machine (see Table 4)	主动机械特性（见表3）Characteristics of driven machine(see Table 3)		
	平稳运转 Smooth running	轻微振动 Slight shocks	中等振动 Moderate shocks
平稳运转 Smooth running	1.0	1.1	1.3
中等振动 Moderate shocks	1.4	1.5	1.7
严重振动 Heavy shocks	1.8	1.9	2.1

表3–主动机械特性定义
Table 3–Definitions Of Characteristics Of Driver Machines

平稳运转 Smooth running	电动机、汽轮机和燃气轮机、带夜力变矩器的内燃机 Electric motors、Steam and gas turbines、Internal combustion engines with hydraulic coupling
轻微振动 Slight shocks	带机械联轴器的六缸以上内燃机、频繁起动的电动机（每天大于两次）Internal combustion engines with six cylinders or more with mechanical coupling、Electric motors subjected to frequent starts(more than two per day)
中等振动 Moderate shocks	带机械联轴器的六缸以下内燃机 Internal combustion engines with less than six cylinders with mechanical coupling

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表4-从动机械特性定义
Table 4-Definitions Of Characteristics Of Driver Machines

平稳运转 Smooth running	离心式的泵和压缩机、印刷机、平稳载荷的皮带输送机、纸张压光机、自动扶梯、液体搅拌机和混料机、旋转干燥机、风机 Centrifugal pumps and compressors, Printing machines, Uniformly loaded belt conveyors, Paper calendars, Escalators, Liquid agitators and mixers, Rotary dryers, Fans
中等振动 Moderate shocks	三缸以上往复式泵和压缩机、混凝土搅拌机、载荷不均匀的输送机、固体搅拌机和混合机 Reciprocating pumps and compressors with three or more cylinders,Concrete mixing machines, Non-uniformity loaded conveyors, Solid agitators and mixers
严重振动 Heavy shocks	电铲、轧机和球磨机、橡胶加工机械、刨床、压床和剪床、单缸和双缸泵的压缩机、石油钻采设备 Excavators, Roll and ball mills, Rubber processing machines, Planers, presses and shears, Pumps and compressors with one or two cylinders, Oil drilling rigs

5.3 选择链条 Chain Selection

从链条承载能力曲线（见图1、2和3）来选择能满足小边轮的转速和所要传递的功率的最小节距的单排链。
From the chain capacity charts(see Figures 1,2and3),select the smallest pitch of simplex chain that will transmit the required power at the required speed of the small sprocket.

但速度超过了最小节距单排链的限制时，或要求较紧凑的传动布置的场合，应考虑选用较小节距的多排链，根据链条承载能力图（见图1、2和3）下面注1和注2提供的排数系数。
Where the speed exceeds the limit of the smallest pitch simplex chain, or a more compact drive is necessary,a amultiplex chain of smaller pitch should be considered. Select multiplex chains from the capactiy charts (see Figures 1,2and3) using the factors provided in NOTE 1 and NOTE 2 with each chart.

5.4 链长 Chain Length

对于一个两个链轮的链传动，已知链条的节距p和初选项中心距a_0，使用公式（6）和（7）计算链条节距数X_0。
For a drive with two sprockets, having a known chain pitch p and approximate centre distance a0,calculate the number of chain pitches X_0 using equations (6) and (7).

将计算出的链条节距数X_0圆整成整数X，最好是偶数以避免使用弯板链节。
The calculated number of pitches X_0 should be rounded up to a whole even number X to avoid the use of cranked links.

当两链轮齿数相等时（$z=z_1=z_2$）：
For sprockets with the same number of teeth($z=z_1=z_2$)

$$X_0=2\frac{a_0}{p}+z \tag{6}$$

当两链轮齿数不相等时
For sprockets with different number of teeth：

$$X_0=2\frac{a_0}{p}+\frac{z_1+z_2}{2}+\frac{f_3p}{a_0} \tag{7}$$

式中系数 where factor $f_3=\left[\dfrac{|z_2-z_1|}{2\pi}\right]$

f_3的计算值可由表5直接查得。
Calculated values for f_3 are given in Table 5.

5.5 链速 Chain Speed

链速使用公式（8）计算：
Calculate the chain speed using equation(8)

$$V=\frac{n_1z_1p}{60000} \tag{8}$$

6 链轮最大中心距 Maximum Sprocket Centre Distance

将按5.4条计算出的链条节距数X代入公式（9）或（10）即可确定两链轮的最大中心距。
For the number of chain pitches X derived in 5.4,determine the maximum distance between centres of the sprockets a using equations (9) or (10).

当两链轮齿数相等时(z=z₁=z₂)：
For sprookets with the same number of teeth(z=z₁=z₂)：

$$a=p\left[\frac{X-z}{2}\right] \tag{9}$$

当两链轮齿数不相等时：
For sprookets with different number of teeth：

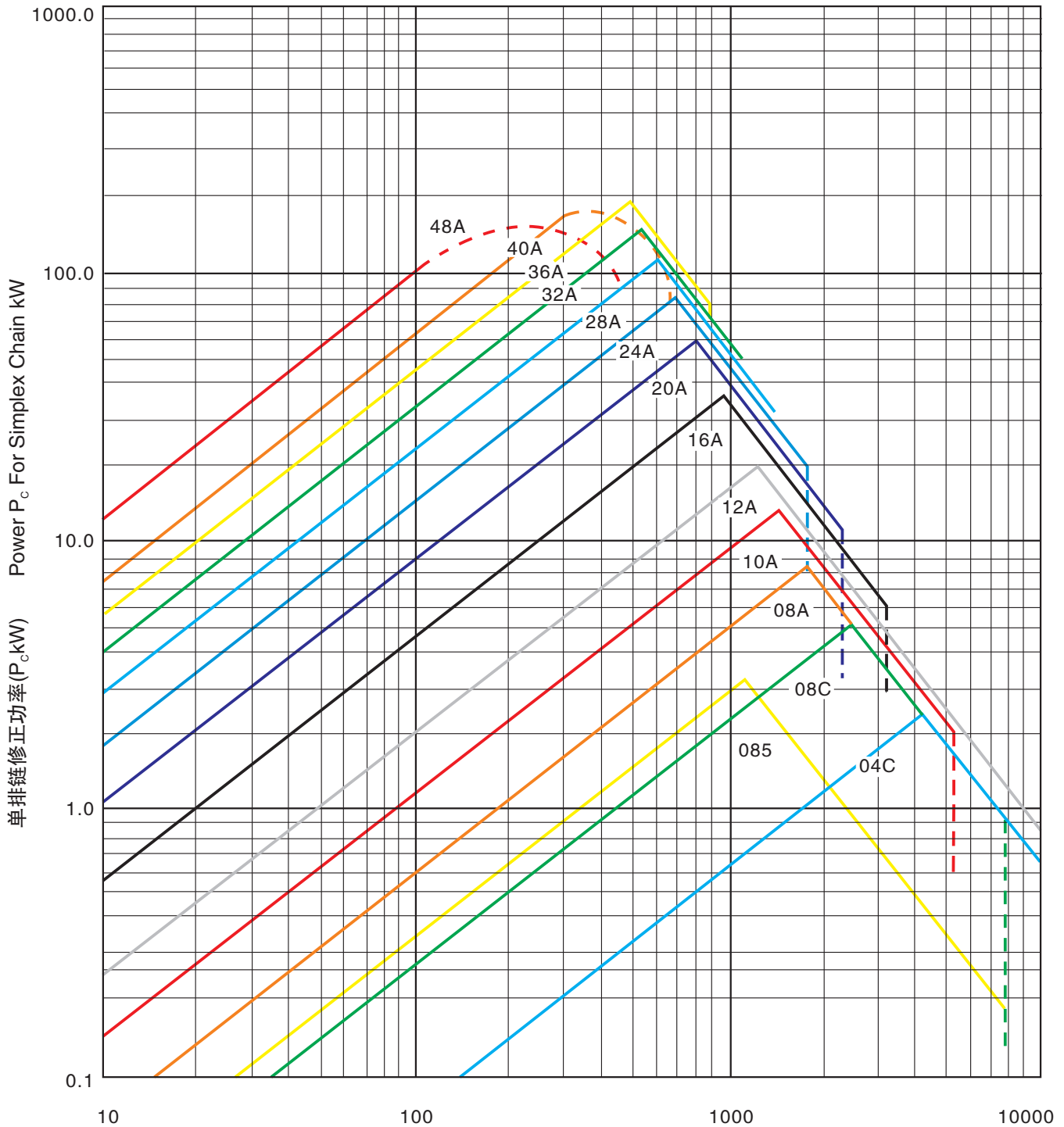$$a=f_4 p[2X-(z_1+z_2)] \tag{10}$$

系数f₄的值见表6。
Factor f_4 see Table 6.

表5–系数f₃的计算值　Table 5–Calculated Values Of Factor f₃

$\lvert Z_2-Z_1\rvert$	f_3	$\lvert Z_2-Z_1\rvert$	f_3	$\lvert Z_2-Z_1\rvert$	f_3	$\lvert Z_2-Z_1\rvert$	f_3	$\lvert Z_2-Z_1\rvert$	f_3
1	0.0253	21	11.171	41	42.580	61	94.254	81	166.191
2	0.1013	22	12.260	42	44.683	62	97.370	82	170.320
3	0.2280	23	13.400	43	46.836	63	100.536	83	174.500
4	0.4053	24	14.590	44	49.040	64	103.753	84	178.730
5	0.6333	25	15.831	45	51.294	65	107.021	85	183.011
6	0.912	26	17.123	46	53.599	66	110.339	86	187.342
7	1.241	27	18.466	47	55.955	67	113.708	87	191.724
8	1.621	28	19.859	48	58.361	68	117.128	88	196.157
9	2.052	29	21.303	49	60.818	69	120.598	89	200.640
10	2.533	30	22.797	50	63.326	70	124.119	90	205.174
11	3.065	31	24.342	51	65.884	71	127.690	91	209.759
12	3.648	32	25.938	52	68.493	72	131.313	92	214.395
13	4.281	33	27.585	53	71.153	73	134.986	93	219.081
14	4.965	34	29.282	54	73.863	74	138.709	94	223.187
15	5.699	35	31.030	55	76.624	75	142.483	95	228.605
16	6.485	36	32.828	56	79.436	76	146.308	96	233.443
17	7.320	37	34.677	57	82.298	77	150.184	97	239.333
18	8.207	38	36.577	58	85.211	78	154.110	98	243.271
19	9.144	39	38.527	59	88.175	79	158.087	99	248.261
20	10.132	40	40.529	60	91.189	80	162.115	100	253.302

表5–系数f₄的计算值　Table 5–Calculated Values Of Factor f₄

$\left\lvert\frac{X-z_S}{z_2-z_1}\right\rvert$	f_4	$\left\lvert\frac{X-z_S}{z_2-z_1}\right\rvert$	f_4	$\left\lvert\frac{X-z_S}{z_2-z_1}\right\rvert$	f_4	$\left\lvert\frac{X-z_S}{z_2-z_1}\right\rvert$	f_4
13	0.24991	2.7	0.24735	1.54	0.23758	1.26	0.22520
12	0.24990	2.6	0.24708	1.52	0.23705	1.25	0.22443
11	0.24988	2.5	0.24678	1.50	0.23648	1.24	0.22361
10	0.24986	2.4	0.24643	1.48	0.23588	1.23	0.22275
9	0.24983	2.3	0.24602	1.46	0.23524	1.22	0.22185
8	0.24978	2.2	0.24552	1.44	0.23455	1.21	0.22090
7	0.24970	2.1	0.24493	1.42	0.23381	1.20	0.21990
6	0.24958	2.0	0.24421	1.40	0.23301	1.19	0.21884
5	0.24937	1.95	0.24380	1.39	0.23259	1.18	0.21771
4.8	0.24931	1.90	0.24333	1.38	0.23215	1.17	0.21652
4.6	0.24925	1.85	0.24281	1.37	0.23170	1.16	0.21526
4.4	0.24917	1.80	0.24222	1.36	0.23123	1.15	0.21390
4.2	0.24907	1.75	0.24156	1.35	0.23073	1.14	0.21245
4.0	0.24896	1.70	0.24081	1.34	0.23022	1.13	0.21090
3.8	0.24883	1.68	0.24048	1.33	0.22968	1.12	0.20923
3.6	0.24868	1.66	0.24013	1.32	0.22912	1.11	0.20744
3.4	0.24849	1.64	0.23977	1.31	0.22854	1.10	0.20549
3.2	0.24825	1.62	0.23938	1.30	0.22793	1.09	0.20336
3.0	0.24795	1.60	0.23897	1.29	0.22729	1.08	0.20104
2.9	0.24778	1.58	0.23854	1.28	0.22662	1.07	0.19848
2.8	0.24758	1.56	0.23807	1.27	0.22593	1.06	0.19564

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图1–功率曲线表(A系列滚子链)
Figure 1–Power Rating Graph(A Series Roller Chain)

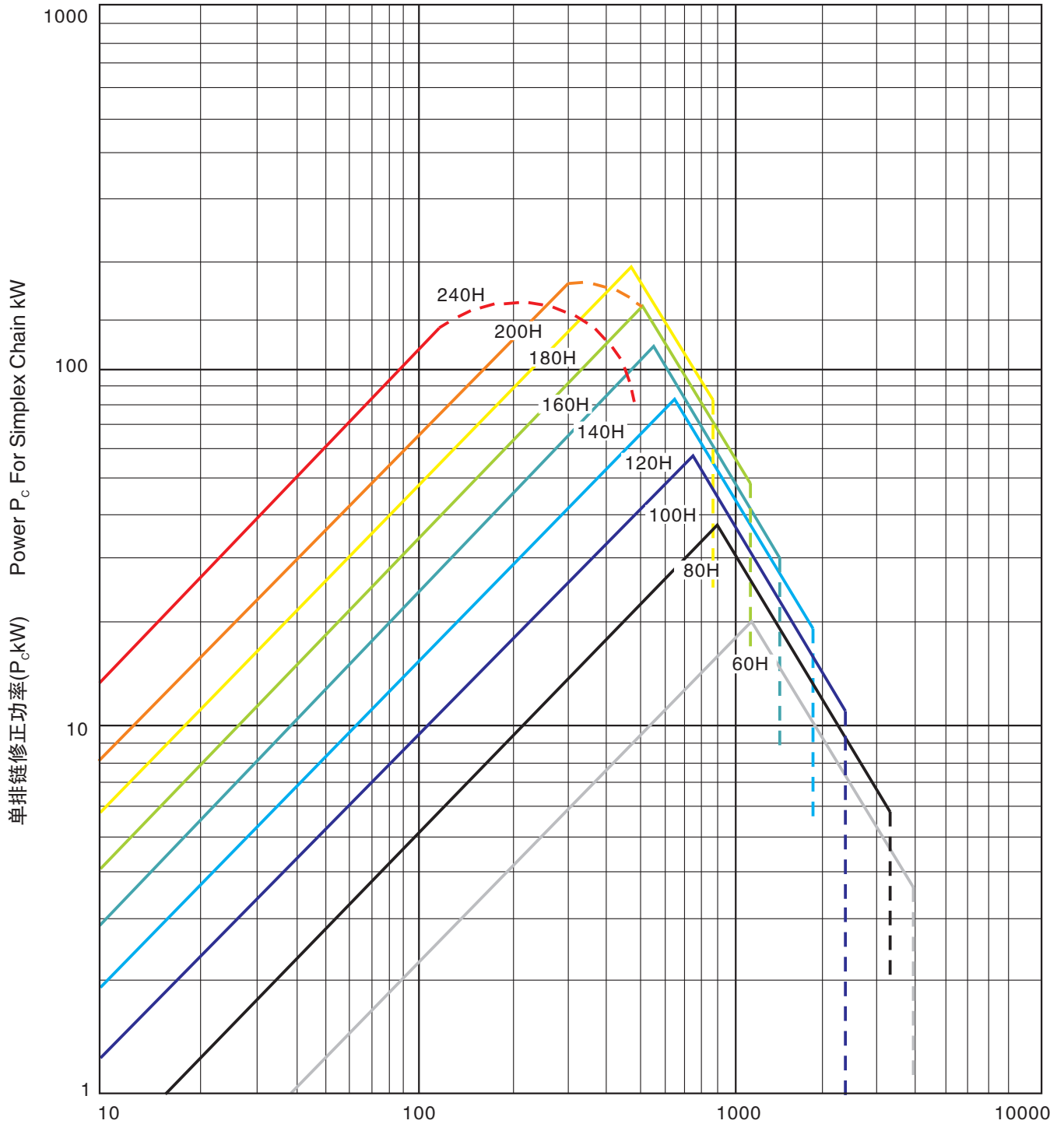具有19齿的小链轮每分钟转速（n_s） Rotational Speed n_s Of Small(19–Tooth)Sproket min^{-1}

注1: 双排链的额定功率可由单排链的P_c值乘以1.7得到。　　Note 1：Double Strand Power=1.7 Times Simplex

注2: 三排链的额定功率可由单排链的P_c值乘以2.5得到。　　Note 2：Triple Strand　Power=2.5 Times Simplex

图2-功率曲线表(加重系列滚子链)
Figure 2-Power Rating Graph(H Series Roller Chain)

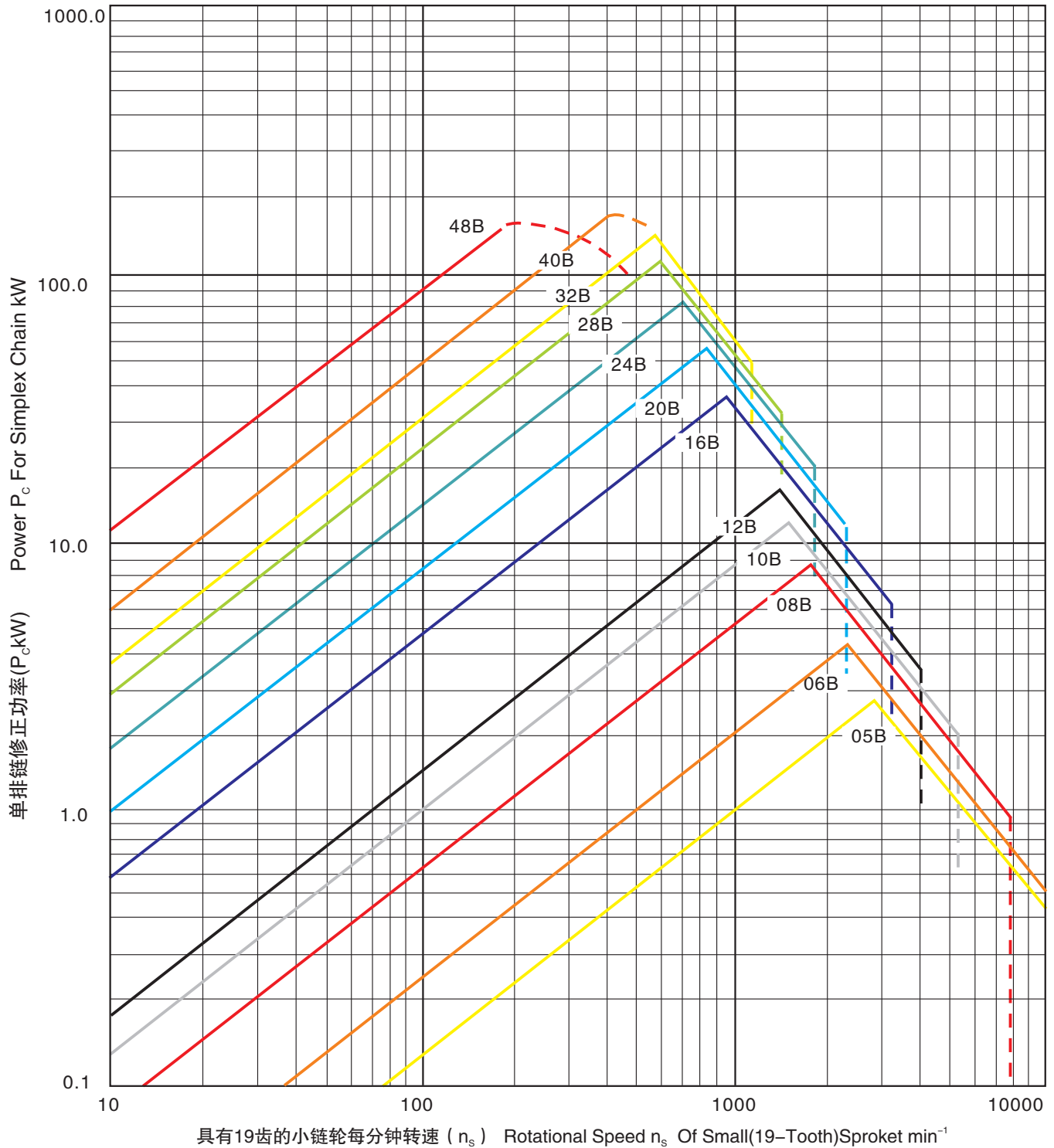具有19齿的小链轮每分钟转速（n_s） Rotational Speed n_s Of Small(19-Tooth)Sproket min^{-1}

注1: 双排链的额定功率可由单排链的P_c值乘以1.7得到。　　Note 1：Double Strand Power=1.7 Times Simplex

注2: 三排链的额定功率可由单排链的P_c值乘以2.5得到。　　Note 2：Triple Strand Power=2.5 Times Simplex

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图3−功率曲线表(B系列滚子链)
Figure 3−power Rating Graph(B Series Roller Chain)

具有19齿的小链轮每分钟转速（n_s） Rotational Speed n_s Of Small(19−Tooth)Sproket min^{-1}

注1: 双排链的额定功率可由单排链的P_c值乘以1.7得到。　　Note 1：Double Strand Power=1.7 Times Simplex
注2: 三排链的额定功率可由单排链的P_c值乘以2.5得到。　　Note 2：Triple Strand　Power=2.5 Times Simplex

图4–小链轮齿数系数f2
Figure 4–Factor f2 Allowing For The Number Of Teeth OnThe Small Sprocket

系数f2　Factor f2

小链轮齿数。Number Of Teeth On Small Sprocket