



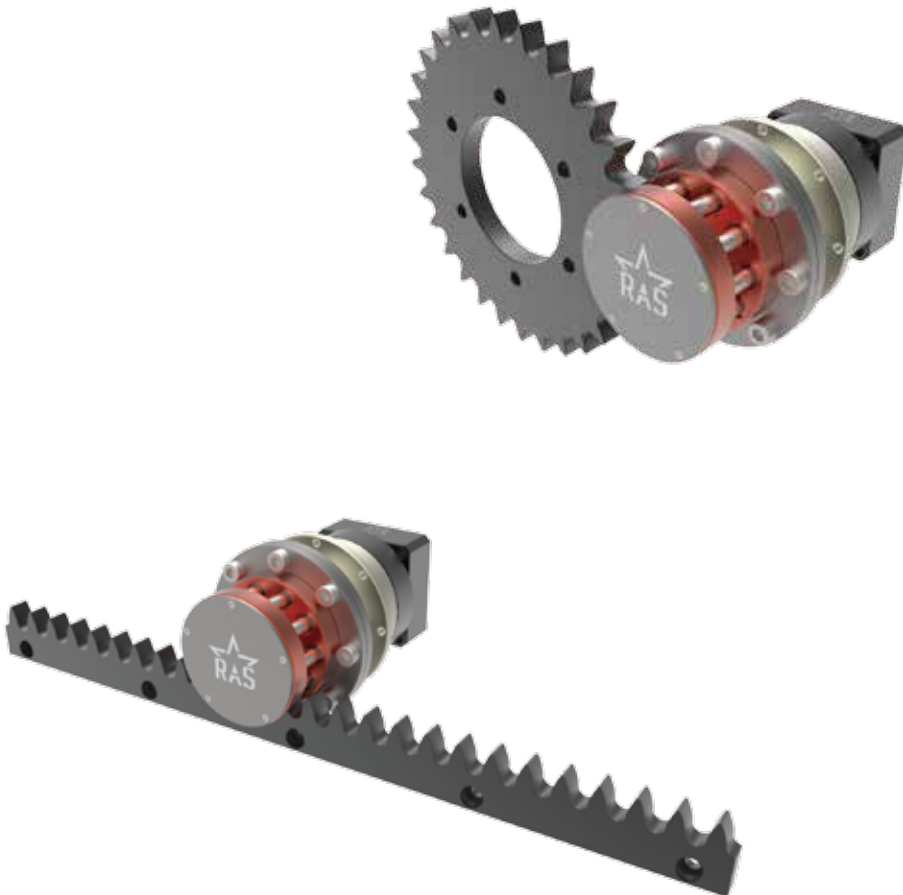
Dealing for Specials

瑞星整合科技有限公司

CPA & CRA & CGA

直線·旋轉驅動系統/無背隙·免保養自動化設備

Linear and curvilinear Non backlash and
Maintenance free machine elements.



無背隙

CRA / CGA & Roller Pinion

★ 無背隙 Non-backlash

因為常態下就有2~3個接觸面，所以正反轉都不會產生背隙。

Trochoidal profiled tooth enables us to make a plurality of mutual teeth mesh at one time. The teeth always mesh via two or three portions and eliminate backlash when rotated in one or another direction.

★ 高精度 High accuracy

在進給精度(回轉與線性比)與定位精度方面可媲美精密級滾珠螺桿。

Instead of gears, a combination of cam and roller makes a positioning accuracy and feeding accuracy (rotation-linearity ratio) as nearly as that of the ball-screw structure.

★ 免保養 Maintenance Free

不須上油保養。(※用於一般環境)

Thereby realizes complete maintenance-free operation. (※for use in general environment)

★ 低噪音・低振動 Low noise and low vibration

在最適化的軌跡線曲線齒形上，以軸承所支撐的滾輪很平滑的轉動，因此齒打音、轉送音的產生非常微小，噪音的產生與振動也都非常低。

Rollers smoothly mesh with the optimized trochoidal tooth surface so as to avoid rattling noise, tooth striking noise and rotating noise from being induced together with the least amount of vibration.

★ 低發塵 Low dust

利用平滑的滾動運轉，回轉部分是小徑低速，故低摩擦且發熱和發塵非常少。

Due to the smooth rotation, the structure dispenses with a least amount of heat and dust generated and cope with a clean room operation.

★ **長距離・高速移動(Cam Rack)**
Extended length line and high speed rolling (Cam Rack)

使用接續治具延長長度。高速移動距離可達180mm以上。

Extendable with use of addition jig. Capable of high speed rolling of 180 m/minute or more.

★ **弧形齒圈・大直徑(Cam Ring)**
The circular arc ring and large-diameter ring (Cam Ring)

弧形齒圈經由精密加工切割。

使用組合所需角度的弧形齒圈，可形成直徑數十米的大直徑齒圈。

The circular arc ring has been realized by the precision processing.

Ring diameter up to tens of meters can be realized by combining the circular arc rings or can use only the necessary degree.

★ **擺線滾輪與精密減速機(HDR)**
Precision reducers equipped with roller pinions (HDR)

模組化設計，搭配標準HDR系列減速機，可以與HDR減速機快速結合，避免繁雜的組裝校正，並可避免側向力產生。

It can be paired with the general-purpose reducer HDR series and has a modular design.

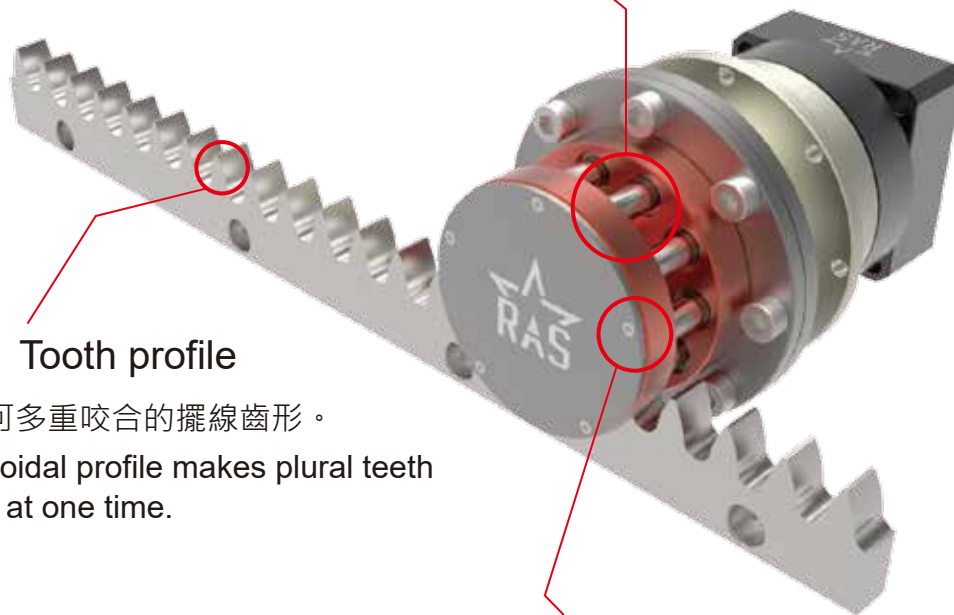
Combined with reducer HDR series, Installation is convenient and prevents the generation of lateral forces.

滾針 Roller pins

雙面軸承支撐，滾針滾動順暢。
Roller pins supported by bearing at both ends smoothly roll.

齒形 Tooth profile

採用可多重咬合的擺線齒形。
Trochoidal profile makes plural teeth mesh at one time.



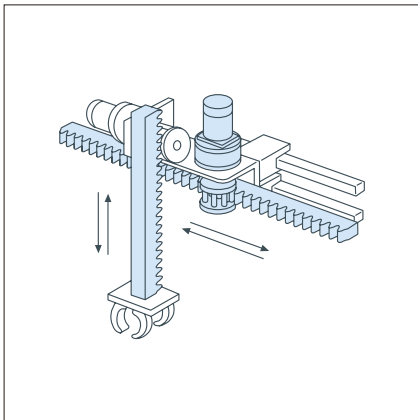
接觸部位 Contact Region

有2~3處接觸部位，正、反轉時不會產生背隙。

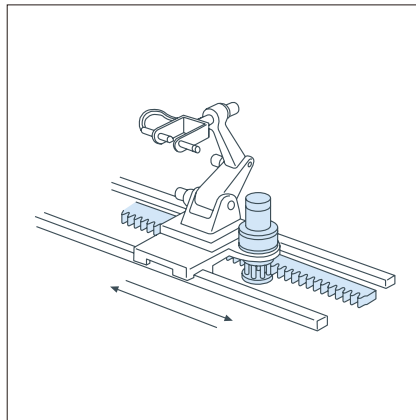
All-time engagement against two or three roller pins eliminates backlash in dual direction.

- **應用範例** 05~06
Example of use
- **擺線滾輪與擺線齒條系列** 07~09
CPA & CRA series
- **擺線滾輪與擺線齒圈系列** 10~15
CPA & CGA series
- **擺線滾輪與擺線齒條 選型 · 安裝程序** 16~27
CPA & CRA Runner Selection Installation Procedure Technical data
- **擺線滾輪與擺線齒圈 選型 · 安裝程序** 28~35
CPA & CGA Runner Selection Installation Procedure Technical data

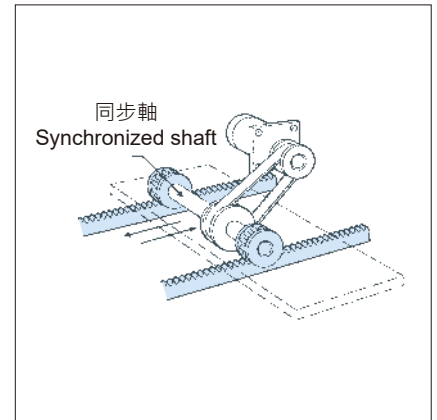
應用範例 Example Of Use



起重台架
Gantry loader

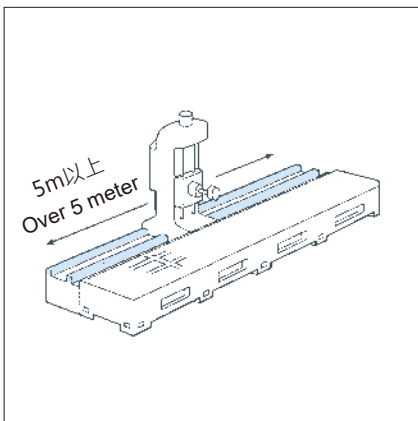


機器手臂長行程移動
Robotic run at long stroke



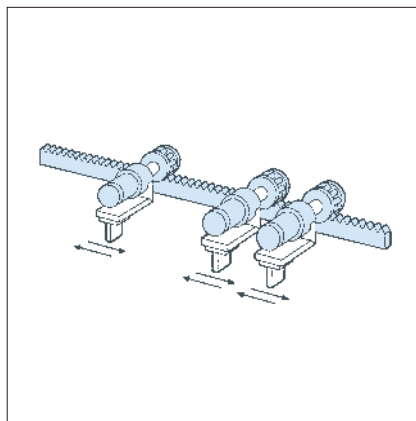
同步軸
Synchronized shaft

同步軸・同步輸送
(寬軌式組合的振動防止)
Synchronized feeding
(Prevent cogging interference with a wide breadth unit)

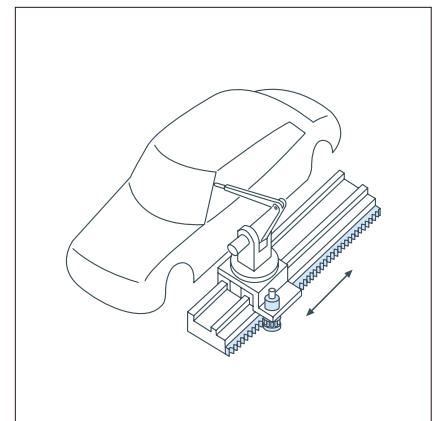


5m以上
Over 5 meter

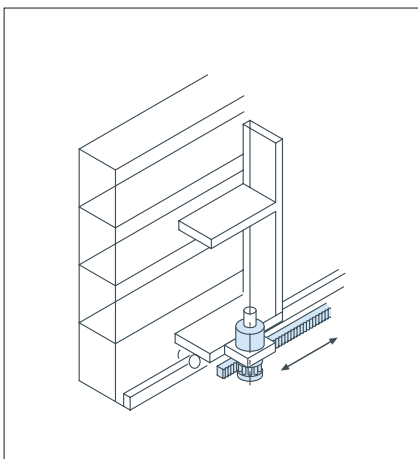
工作機具長距離移動
Long stroke type machining tool



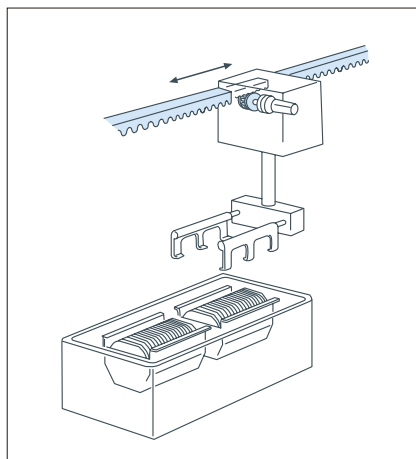
多頭式(縱割機應用例)
A plurality of heads
(Applied to a slitter apparatus)



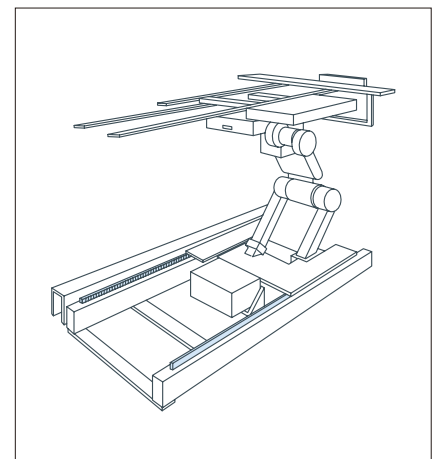
測定器移動
Measurement device feeding



自動送料輸送系統
Stocker transfer



洗淨設備輸送
Transfer to washing bath

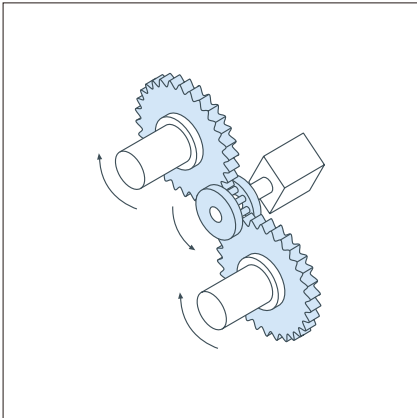


機械手臂輸送
Robot transfer in clean room

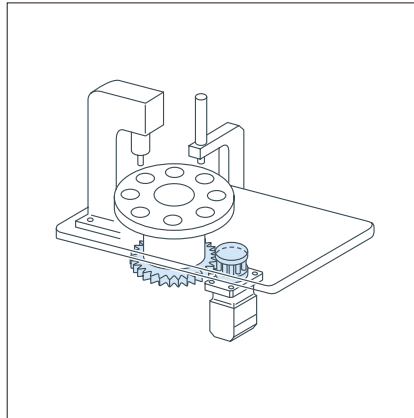
可製作型錄外的特殊形狀、特殊材質等客製化產品。有任何需求歡迎隨時與我們聯繫！



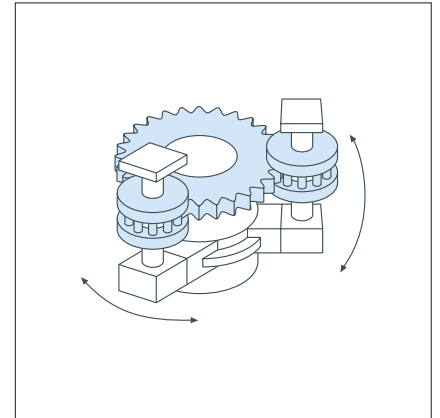
We can make the product by the special shape, special material and out of the catalogue dimensions etc. Please feel free to contact us.



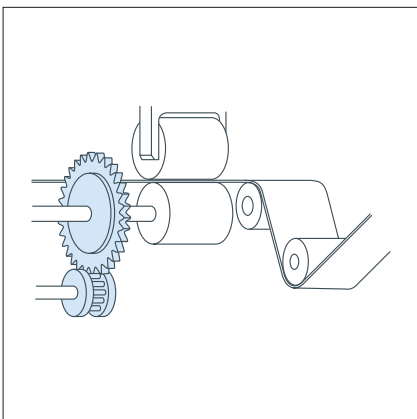
2 軸同步驅動
Synchronized dual shaft drive



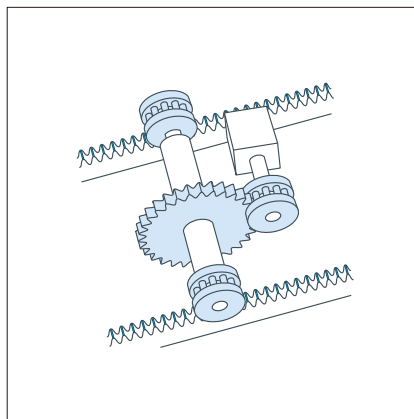
條件自由設定的分度盤
(正・逆轉・穿越)
Index table usable under flexible conditions <Normal & reverse rotation & jumping over>



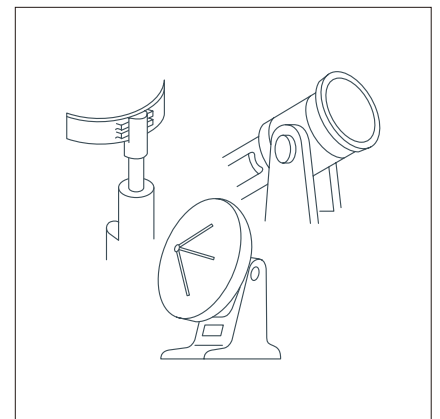
驅動數個工作台
Device for driving a plurality of tables



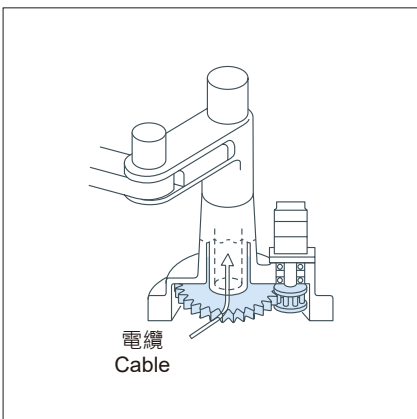
輕脈動的傳送・捲取
(底片・紙張・薄板・細線)
Winding & feeding device with less pulsations <Film, Paper, Sheet & Thin wire>



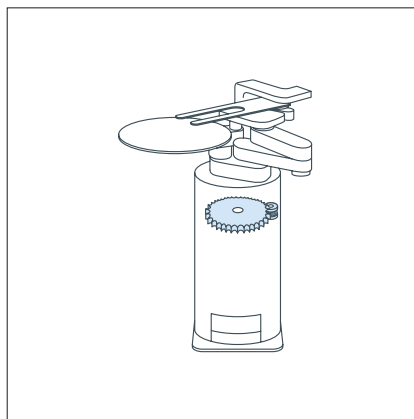
與CGA滾輪組合使用
Combination with CGA Runner



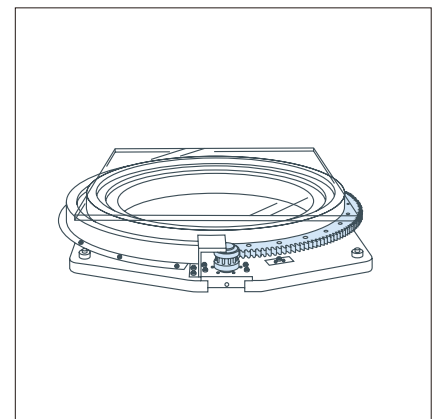
雷達、天線、監視器
驅動觀測機械
Device for driving radar, antenna, surveillance camera, observatory equipment



機械手臂的迴旋驅動(中空)
Pivotal drive device for robot
<Hollow>



機器人的迴旋驅動
Pivotal drive device for robot



CGA齒圈(大型面板)
反轉裝置
CGA Ring Unit (Large-scale)
turn table

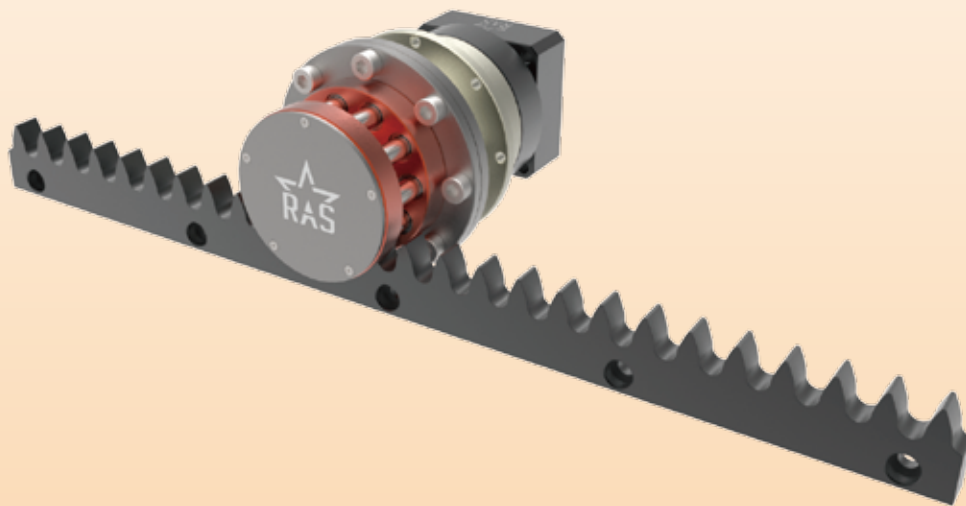
CPA & CRA 系列

型號 1010 / 1610 / 2010 / 2510 / 3212 / 4012

Roller Pinion & Cam Rack

齒數 3~12

長度 992~1000 mm

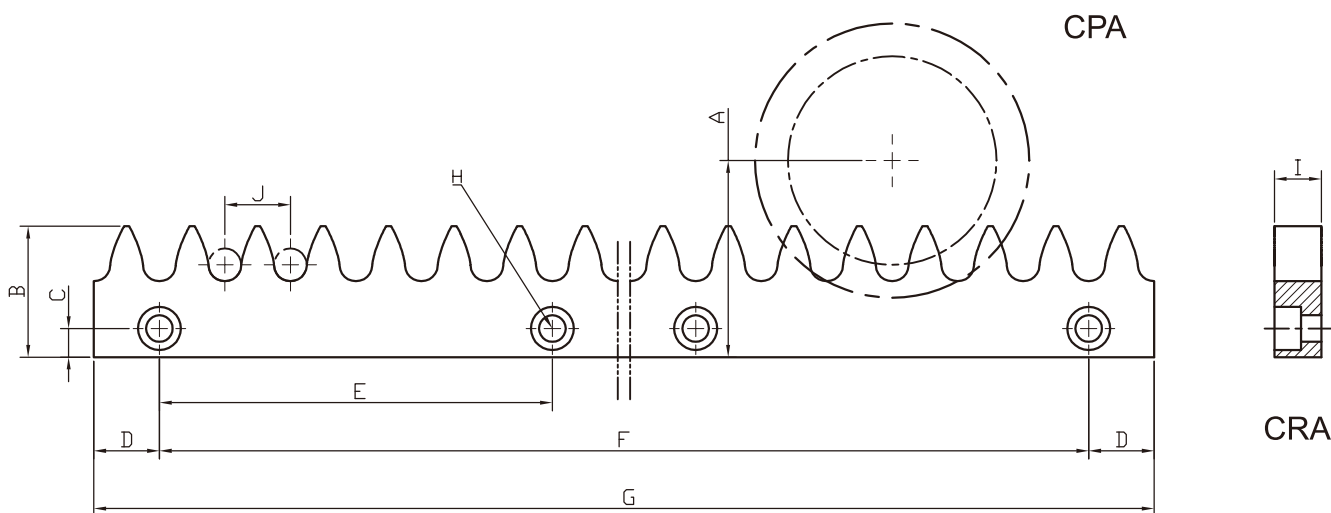


CPA & CRA



擺線滾輪(CPA)
Roller Pinion

擺線齒條(CRA)
Cam Rack



NUMBER OF TOOTH : K

中華民國專利證書編號M597347

Unit : mm

Type Code	1010	1610	2010	2510	3212	4012
A	37.5	48	64	75	102	129
B	27	30.5	42	48	57	72.6
C	7	7	10	12	14	16
D	30	16	50	50	16	80
E	60	96	100	100	96	120
F	7x60	10x96	9x100	9x100	10x96	7x120
G	480	992	1000	1000	992	1000
H	8-Ø6	11-Ø7	10-Ø9	10-Ø11	11-Ø14	8-Ø18
I	5.7	11.5	15.5	18.5	24.5	31.5
J	10	16	20	25	32	40
K	48	62	50	40	31	25

性能表 Performance Information

項目 Items	規格 Model No.	單位 Unit	滾輪/齒條 系列 CPA / CRA Series					
			1010	1610	2010	2510	3212	4012
滾輪(CPA) Roller Pinion	容許動額定轉矩 Allowable Dynamic Rated Torque	Nm	4	25.5	47.7	87.5	220	458.4
	容許靜額定轉矩 Allowable Static Rated Torque	Nm	6	50.9	95.5	175.1	440	916.7
	最大動額定轉矩 Max Dynamic Output Torque	Nm	22.05	81.46	120.54	224.18	776.45	1305.36
	滾輪轉一圈移動距離 Displacement Distance Of Pinion Per Rotation	mm / 圈 mm / revolution	100	160	200	250	384	480
	等效模數 Module	mm	3	4.75	6	7.5	9.5	12
	外徑 Outer Diameter	mm	41	67	84	101	148	190
	節圓直徑(理論值) Diameter Of Pitch Circle	mm	31.8	50.9	63.7	79.6	122.2	152.8
	齒數 Number Of Tooth	齒 teeth	10	10	10	10	12	12
	慣性矩 Inertia Moment	$\times 10^{-4} \text{kgm}^2$	0.41	3.93	10.5	25.5	169	594
齒條(CRA) Cam Rack	容許動額定轉矩 Allowable Dynamic Rated Torque	Nm	4	25.5	47.7	87.5	220	458.4
	容許靜額定轉矩 Allowable Static Rated Torque	Nm	6	50.9	95.5	175.1	440	916.7
	滾輪轉一圈移動距離 Displacement Distance Of Pinion Per Rotation	mm / 圈 mm / revolution	100	160	200	250	384	480
	等效模數 Module	mm	3	4.75	6	7.5	9.5	12
	齒距 Pitch	mm	10	16	20	25	32	40
	長度 Predetermined Length	mm	480	992	1000	1000	992	1000
	齒數 Number Of Tooth	齒 teeth	48	62	50	40	31	25
	重量 Mass weight	kg	0.6	2.2	4.1	5.4	8.3	13

CPA & CGA 系列

型號 1610 / 2510 / 3212 / 4012

齒數 4.75~12

長度 3~10

Roller Pinion & Cam Gear



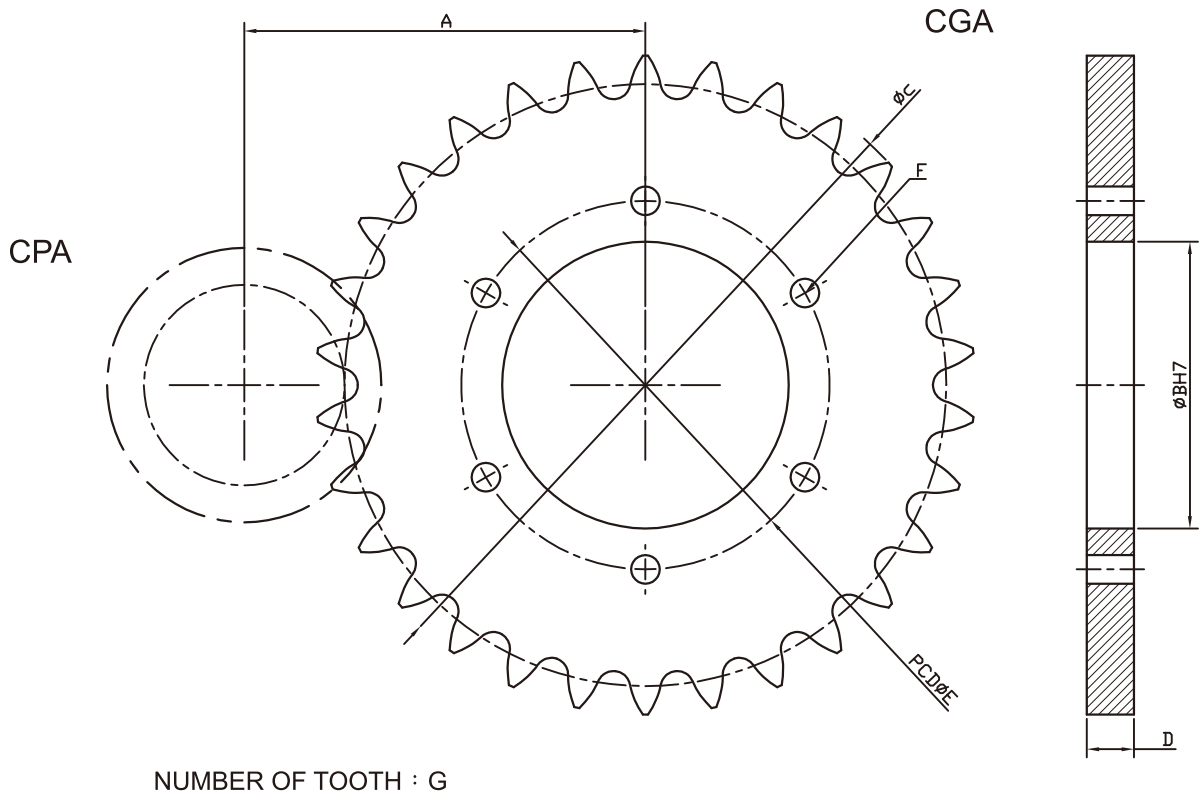
CPA & CGA



齒圈(CGA)
Cam Gear



滾輪(CPA)
Roller Pinion



中華民國專利證書編號M597347

Unit : mm

Model Ratio Code	1610							2510					3212			4012	
	3	4	5	6	7	8	10	3	4	5	6	7	3	4	5	3	4
A	98	122	146	170	193.5	220	268	154	193	230	268	308	235	292	351	297	369
B	70	120	160	190	260	280	360	120	190	260	330	400	220	330	400	320	390
C	161	209	257	305	352	405	501	254	331	404	480	560	380	493	610	480	622
D	11.5	11.5	11.5	11.5	11.5	11.5	11.5	18.5	18.5	18.5	18.5	18.5	24.5	24.5	24.5	31.5	31.5
E	90	145	180	220	285	305	390	145	220	285	360	430	250	360	430	360	430
F	6-Ø7	8-Ø7	12-Ø7	12-Ø9	12-Ø9	12-Ø9	12-Ø9	6-Ø9	12-Ø9	12-Ø9	16-Ø11	16-Ø11	12-Ø11	16-Ø11	16-Ø11	8-Ø18	12-Ø18
G	30	40	50	60	70	80	100	30	40	50	60	70	36	48	60	36	48



性能表 Performance Information





項目 Items	規格 Model No.	單位 Unit	滾輪/齒圈 系列 CPA / CGA Series																
			1610				2510				3212				4012				
滾輪(CPA) Roller Pinion	容許動額定轉矩 Allowable Dynamic Rated Torque	Nm	25.5				87.5				220				458.4				
	容許靜額定轉矩 Allowable Static Rated Torque	Nm	38.2				131.3				329.9				687.6				
	等效模數 Module	mm	4.75				7.5				9.5				12				
	外徑 Outer Diameter	mm	67				101				148				190				
	節圓直徑 Diameter Of Pitch Circle	mm	50.9				79.6				122.2				152.8				
	齒數 Number Of Tooth	齒 teeth	10				10				12				12				
	慣性矩 Inertia Moment	X10 ⁻⁴ kgm ²	3.93				25.5				169				594				
齒圈(CGA) Cam Gear	速比 Ratio	-	3	4	5	6	7	8	10	3	4	5	6	7	3	4	5	3	4
	容許動額定轉矩 Allowable Dynamic Rated Torque	Nm	73	97	120	145	165	195	240	250	335	420	505	590	630	840	1050	1330	1770
	容許靜額定轉矩 Allowable Static Rated Torque	Nm	146	194	240	290	330	390	480	500	670	840	1010	1180	1260	1680	2100	2660	3540
	等效模數 Module	mm	47.5				7.5				9.5				12				
	外徑 Outer Diameter	mm	161	209	257	305	352	405	501	254	331	404	480	560	380	493	610	480	622
	齒數 Number Of Tooth	齒 teeth	30	40	50	60	70	80	100	30	40	50	60	70	36	48	60	36	48
	慣性矩 Inertia Moment	X10 ⁻⁴ kgm ²	41.7	115	261	538	780	1564	3568	407	1182	2543	4852	8709	2628	7054	17821	7257	24220

CPA & CRA Accuracy Comparison Table

擺線滾輪齒條精度比較表

			
擺線齒條精度 Cam Rack Accuracy	精密等級 Precision Grade	經濟等級 Economy Grade	一般齒條 General Purpose Grade
齒尖高度誤差(mm) Tooth Tip Height Error (mm)	0.02	0.06	0.13
齒尖方向彎曲度(mm/1M) Tooth Tip Direction Curvature (mm/1M)	0.15	0.45	-
齒條單一齒距誤差(mm) Cam Rack Single Pitch Error (mm)	0.02	0.05	0.05
齒條累積齒距誤差(mm/1M) Cam Rack Cumulative Pitch Error (mm/1M)	0.06	0.15	0.17
齒條重複定位精度(mm) Cam Rack Rack Repeat Positioning Accuracy (mm)	0.005	0.05	0.08
最高線速度(mm/s) Maximum Linear Speed (mm/s)	3000	3000	600

			
擺線齒圈精度 Cam Gear Accuracy	精密等級 Precision Grade	經濟等級 Economy Grade	一般齒條 General Purpose Grade
滾輪高度誤差(mm) Roller Pinion Height Error (mm)	0.02	0.06	-
齒圈單一齒距誤差(mm) Cam Gear Single Pitch Error (mm)	0.02	0.05	0.05
齒圈累積齒距誤差(mm/500mm) Cumulative Pitch Error Of Cam Gear	0.06	0.15	0.12
齒圈重複定位精度(arcsec) Cam Gear Repeatability (arcsec)	15	60	100
最高盤面轉速(rpm) Maximum Board Speed (rpm)	200	200	30

CPA & CRA Maximum Torque Comparison Table

擺線滾輪最大扭力比較表



項目 Items	規格 Model No.	單位 Unit	擺線滾輪型號 CPA Series					
			1010	1610	2010	2510	3212	4012
擺線滾輪 CPA系列 Roller Pinion Series	轉一圈距離 One Circle Distance	mm	100	160	200	250	384	480
	節圓直徑 Pitch Circle Diameter	mm	31.83	50.93	63.66	79.58	122.23	152.79
	實際半徑 Actual Radius	mm	15.0	23.75	30.0	37.5	57	72
	鋼針直徑 Steel Needle Diameter	mm	4	8	10	12	16	22
	軸承型號 Bearing Specifications	-	HK-0408	HK-0810	HK-1010	HK-1212	TA-1620	TA-2225
	軸承荷重 Bearing Load	kg	150	350	410	610	1390	1850
	最大扭力 Maximum Torque	Nm	22.05	81.46	120.54	224.18	776.45	1305.36

型號標示 Model Indication

● CPA1610B~CPA3212B

擺線滾輪型號

Roller pinion type number

CPA □□□□ B-□□

框號
Frame number

1010
1610
2010
2510
3212

表面處理 Surface treatment
0.表面處理 No surface treatment
1.標準：鍍銀色硬鉻處理 Silver chrome plating (standard)
2.鍍黑色硬鉻處理 Black chrome plating

精度 Accuracy
A：普通級（標準） Standard grade (standard)
B：精密等級 Premium grade

● CRA1010A~CRA1210A

擺線齒條型號

Cam Rack type number

CRA □□□□ A-□□□□ -L1000
-L500

擺線齒條1支的長度 (mm)
Length of Cam Rack (mm)

框號
Frame number

1010
1610
2010
2510
3212

表面處理 Surface treatment
0.表面處理 No surface treatment
1.標準：鍍銀色硬鉻處理 Silver chrome plating (standard)
2.鍍黑色硬鉻處理 Black chrome plating

精度 Accuracy
A：普通級（標準） Standard grade (standard)
B：精密等級 Premium grade

安裝孔 Mounting hole
F：側孔（標準） Side mount hole only (standard)
Y：+追加底面螺栓 +Tap at bottom surface

※標準長度為480、992、1000L

標準長度以外的切斷面不會有表面處理。

The standard cam rack lengths are 480mm, 992mm, and 1,000mm.

For lengths other than the standard, there will be no surface treatment on the cut surfaces.

※表面處理，鍍鉻、陽極亮銀。

As a general rule, the surface treatment will be chrome plating and silver anodized.

CPA & CRA

選型・安裝程序

CRA Runner Selection Installation Procedure

技術資料

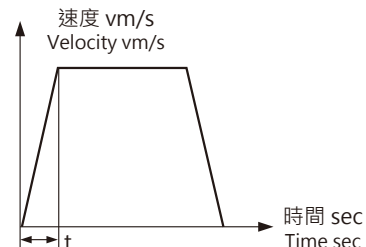
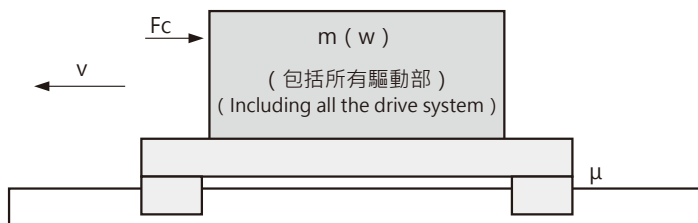
Technical Data

型號選定 Selection Of Type Number

運用下列計算方式選出型號。

Calculate the load by the method mentioned below.

● 選型案例 Selection Example



● 規格 Specifications

- 重量 Mass : $m = 300kg$ (重量Weight : $w = 300kg f$)
- 速度 Velocity : $v = 1 m / sec$
- 加速時間 Acceleration : $t = 0.4sec$
- 外力 Outer force : $F_c = 100N$
- 摩擦係數 Coefficient of friction : $\mu = 0.01$ (Table1)
- 負載係數 Coefficient of weight : $f_w = 1.5$ (Table2)
- 重力加速度 Gravitational acceleration : $g = 9.80665m / sec^2$

(Table1) 摩擦係數 Coefficient of friction (μ)

滾動導軌 Rolling guide	0.005~0.02
滑動導軌 Swliding guide	0.1~0.2

(Table2) 負載係數 Coefficient of weight (f_w)

無衝擊的圓滑的運轉 Smooth operation with no impact	1.0~1.2
普通的運轉 Normal operation without excessive impact	1.2~1.5
有衝擊的運轉 Operation with impact	1.5~3.0

● 計算 Calculation

SI單位制 SI unit system	
1.負載加速度 Load acceleration	$A_w = \frac{v}{t} = \frac{1}{0.4} = 2.5m/sec^2$
2.加速時負載 Load applied at acceleration	$F_a = m \cdot A_w = 300 \times 2.5 = 750N$
3.摩擦負載 Frictional resistance load	$F_b = g \cdot m \cdot \mu = 9.80665 \times 300 \times 0.01 = 29.4N$
4.總負載重量 Total load weight	$F = f_w \times (F_a + F_b + F_c) = 1.5 \times (750 + 29.4 + 100) = 1.5 \times 879.4 = 1319.1N$
5.選定型號 Selection	根據F的結果選定 [CPA1610B/CRA1610A] 允許動額定負載 1700N From the result of F, the rack runner is selected as [CPA1610B/CRA1610A] Runner, and allowable dynamic rated load as 1700N.

壽命計算 Life Calculation



CPA & CRA使用回轉數計算出壽命時間。

For CPA & CRA Runner, the life is calculated from the number of revolutions of the roller pinion.

< 設定條件 >

額定壽命 1010型 ~ 1210型 270×10^6 回轉(基本動態額定扭力負載下)(滾輪300rpm對應15,000小時壽命)

額定壽命 1610型 ~ 4012型 60×10^6 回轉(基本動態額定扭力負載下)(滾輪100rpm對應10,000小時壽命)

< Setting conditions >

Rated life 1010~1210 = 270×10^6 revolutions (under the load of basic dynamic rated torque) (300rpm of the roller pinion is correspondent to 15,000 hours of life.)

Rated life 1610~4012 = 60×10^6 revolutions (under the load of basic dynamic rated torque) (100rpm of the roller pinion is correspondent to 10,000 hours of life.)

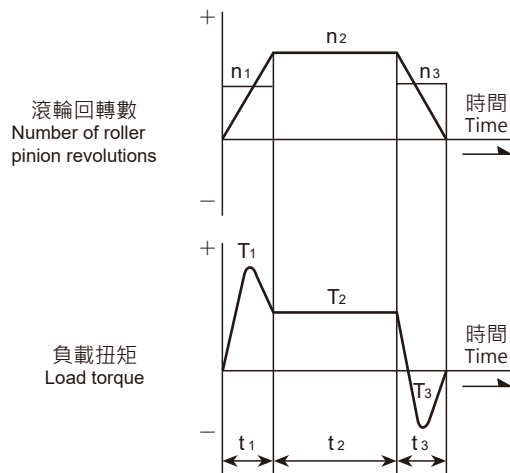
● 運轉條件(參考) Operating Conditions (Reference)

< 速度類型 >

Velocity pattern

< 負載類型 >

Load pattern



	起動時 Starting	定速時 Steady operation	停止時 Stoppage
負載扭矩(Nm) Load torque	T ₁	T ₂	T ₃
滾輪回轉數(rpm) Number of roller pinion revolutions	n ₁ (=0.5n ₂)	n ₂	n ₃ (=0.5n ₂)
時間(sec) Time	t ₁	t ₂	t ₃

● 平均負載扭矩 Average Load Torque T_m (N · m)

$$T_m = \sqrt[10/3]{\frac{n_1 \cdot t_1 \cdot T_1^{10/3} + n_2 \cdot t_2 \cdot T_2^{10/3} + n_3 \cdot t_3 \cdot T_3^{10/3}}{n_1 \cdot t_1 + n_2 \cdot t_2 + n_3 \cdot t_3}}$$

● 平均回轉數 Average Number of Revolutions Nm (rpm)

$$N_m = \frac{t_1 n_1 + t_2 n_2 + t_3 n_3}{t_1 + t_2 + t_3}$$

壽命計算 Life Calculation

● 壽命時間 Life Length Lh (H)

$$Lh = Lh_0 \times \frac{N_0}{Nm} \times \left(\frac{T_0}{fd \cdot fset \cdot Tm} \right)^{10/3}$$

$$= \frac{4.5 \times 10^6}{Nm} \times \left(\frac{T_0}{fd \cdot fset \cdot Tm} \right)^{10/3} \quad (1010\text{型} \sim 1210\text{型})$$

$$= \frac{10^6}{Nm} \times \left(\frac{T_0}{fd \cdot fset \cdot Tm} \right)^{10/3} \quad (1610\text{型} \sim 4012\text{型})$$

額定壽命時間	Rated life length	: Lh ₀ (Table1)
滾輪基本回轉數	Basic number of roller pinion revolutions	: N ₀ (Table1)
基本動額定扭矩(N · m)	Basic dynamic rated torque	: T ₀ (Table2)
平均負載扭矩(N · m)	Average load torque	: T _m
滾輪平均回轉數(rpm)	Average number of roller pinion revolutions	: N _m
負載係數	Coefficient of load	: fd (Table3)
安裝精度係數	Coefficient of installation precision	: fset (Table4)

(Table1) 額定壽命 Rated life

型式 Model	Lh ₀ (H)	N ₀ (rpm)
1010~1210	15000	300
1610~4012	10000	100

(Table2) 基本動額定扭矩 Basic dynamic rated torque

型式 Model	T ₀ (N · m)
CPA 1010	4.0
CPA 1210	9.5
CPA 1610 / CPS 1610	25.5
CPA 2010 / CPS 2010	47.7
CPA 2510 / CPS 2510	87.5
CPA 3212 / CPS 3212	220.0
CPC 3212	366.6
CPC 4012	1146.0
CPS 4012	458.4

(Table3) 負載係數 Coefficient of load

運轉條件 Operating conditions	fd
無衝擊的圓滑運轉 Smooth operation with no impact	1.0~1.2
普通運轉 Normal operation without excessive impact	1.2~1.5
有衝擊的運轉 Operation with impact	1.5~3.0

(Table4) 安裝精度係數 Coefficient of installation precision

安裝精度 Installation precision	fset
推薦安裝精度 以內 Recommended installation precision (within)	1.0
動作允許範圍 以內 Allowable operation range (within)	1.2

■ 計算案例 Calculation Example

● 平均負載扭矩 Average Load Torque T_m (N · m)

$$T_m = \sqrt[10/3]{\frac{n_1 \cdot t_1 \cdot T_1^{10/3} + n_2 \cdot t_2 \cdot T_2^{10/3} + n_3 \cdot t_3 \cdot T_3^{10/3}}{n_1 \cdot t_1 + n_2 \cdot t_2 + n_3 \cdot t_3}}$$

$$= \sqrt[10/3]{\frac{150 \times 0.1 \times 30^{10/3} + 300 \times 5 \times 10^{10/3} + 150 \times 0.1 \times 30^{10/3}}{150 \times 0.1 + 300 \times 5 + 150 \times 0.1}}$$

$$= 11.8 \text{ (N} \cdot \text{m)}$$

使用條件 Working conditions

	起動時 Starting	定速時 Steady operation	停止時 Stoppage
負載扭矩(Nm) Load torque	$T_1=30$	$T_2=10$	$T_3=30$
滾輪回轉數(rpm) Number of roller pinion revolutions	n_1 ($=0.5n_2$) $=150$	$n_2=300$	n_3 ($=0.5n_2$) $=150$
時間(sec) Time	$t_1=0.1$	$t_2=5$	$t_3=0.1$

● 平均輸入回轉數 Average Input Rotational Frequency N_m (rpm)

$$N_m = \frac{t_1 n_1 + t_2 n_2 + t_3 n_3}{t_1 + t_2 + t_3} = \frac{0.1 \times 150 + 5 \times 300 + 0.1 \times 150}{0.1 + 5 + 0.1} = 294.2 \text{ (rpm)}$$

● 壽命時間 Life Length L_h (H)

從起動時扭矩 T_1 值(使用時最大扭矩)根據(Table2)的 T_0 值來選擇滾輪型號(CPA1610B)
從使用條件選定負載系數 $f_d=1.5$ (Table3) · 安裝精度系數選擇為 $f_{set}=1.0$ (Table4)的話：

Select the roller pinion model number “CPA1610B” from the specified maximum working torque based on the starting torque T_1 (maximum working torque).

When $T_0 = 25.5$ from Table 2, and the coefficient of load $f_d = 1.5$ (Table 3) and the coefficient of installation precision $f_{set} = 1.0$ (Table 4) from the working conditions.

$$L_h = \frac{10^6}{N_m} \times \left(\frac{T_0}{f_d \cdot f_{set} \cdot T_m} \right)^{10/3} = \frac{10^6}{294.2} \times \left(\frac{25.5}{1.5 \times 1.0 \times 11.8} \right)^{10/3} = 11479 \text{ (H)}$$

How to CPA & CRA Runner

CPA & CRA安裝方法

● 請將齒條貼緊在安裝基面上 **Secure Cam Rack tightly to reference surface**

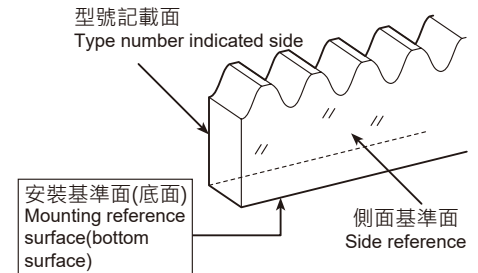
為了校正齒條的彎曲度，請紮實地將齒條固定在非常平直的安裝面上。

否則齒面本身的彎曲沉浮會保持原樣，這會是發生精度誤差和產生背隙的原因。

型號記載面的反面為側面基準面。

In order to correct warp of Cam Rack, firmly secure to straight surface of mounting portion. Undulation of tooth surface leads to feeding error, reduced cessation precision and appearance of backlash.

Side reference surface is placed opposite to where type number is depicted.



● 直線導軌為必需品 **Linear guide is one of necessities**

在與齒條安裝基準面平行的平面上安裝直線導軌。

Set linear guide to straight surface to be parallel with reference surface where Cam Rack is mounted.



● 滾輪的回轉軸保持與齒面平行！與前進方向保持直角！

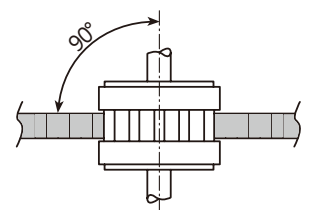
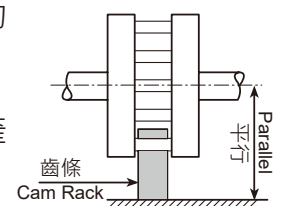
Set rotary shaft of roller pinion in roller parallel with tooth of Cam Rack to be perpendicular to advancing direction!

如果滾輪軸相對於齒條發生傾斜的話，那麼滾銷和齒面的接觸為“單側接觸”，此情況會對精度、噪音、振動、壽命帶來負面影響。另外在重載的情況下，滾輪軸會彎曲上浮，所以滾輪軸為兩側支持的結構最為理想。

另外，滾輪與滾輪驅動軸，安裝時盡可能保證同心。滾輪的偏心回轉會產生精度不穩定、產生背隙等情況。特別需要注意軸套的安裝。

When shaft of roller pinion inclines against Cam Rack, partial engagement occurs between teeth to affect on precision, noise, vibration and service life span. As high load would curve shaft to float it upward, it is better to support at both ends of shaft to avoid upward float.

Concentrically set roller pinion with drive shaft of roller pinion as much as possible. Eccentrical rotation may affect on feeding precision and occurrence of backlash. Especially pay attention upon tightening clamping tool.



Assembling Procedures for CPA & CRA Runner 精密CPA & CRA安裝方式



● 順序 Assembling Procedures

1. 請將精密齒條固定於基準面，利用虎鉗或齒條底部螺絲等確實固定於基準面。
(請參照圖1，以齒條固定螺絲進行暫鎖。〈建議扭力的50%左右。請參照建議扭力表〉)

Set Cam Rack to reference surface of base, and tightly attach Cam Rack to reference surface with use of clamp, base bolt or the like.

(Refer to Fig. 1, provisionally tighten mounting bolt for Cam Rack. 〈approx. 50 % of recommended torque refer to list of recommended tightening torque〉)

2. 調整線性支撐導軌與齒條的平行度。(請參照圖2)

對於支撐齒條滑塊的行走軸，使用千分錶確認齒條齒尖平面部(或是底部)與側面變化幅度，調整到齒條建議裝配精度值以下。

(請參照P26-27裝配精度表)

Check parallelism between linear guide and Cam Rack (refer to Fig. 2).

Confirm shifted width between guide block and tooth tip of Cam Rack (tooth surface) and adjust it below mounting precision of Cam Rack.

(refer to list of mounting precision P.26-27)

3. 將齒條固定用螺絲依規定的扭力鎖緊。(請參照下述建議扭力表)

Finally tighten mounting bolt for Cam Rack with recommended tightening torque (refer to list of recommended tightening torque.)

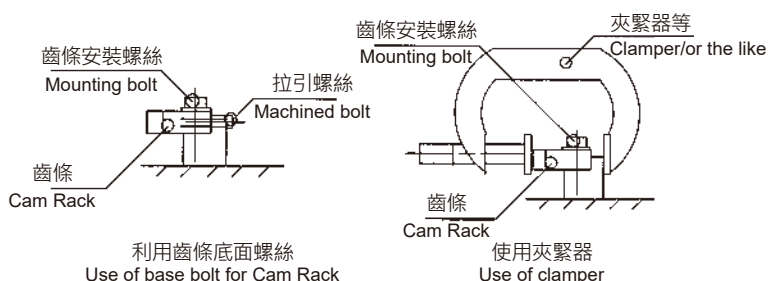


圖1 齒條平行的調整方式

Fig. 1 Setting procedures for parallelism of Cam Rack

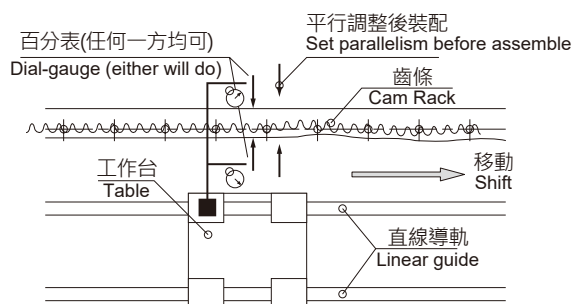


圖2 齒條平行度測量方式

Fig. 2 Measuring procedures for parallelism of Cam Rack

■ 建議扭力表 List of recommended tightening torque

● 內六角螺絲

Bolt with hex hole

螺絲強度區分：10.9~12.9 時

Strength division for bolt for 10.9~12.9 (N·m)

螺絲名稱 Nominal designation of bolt	對方材質 Mated material	鎖緊扭力 Tightening torque		
		鋼 Steel	鑄件 Cast metal	鋁合金 Aluminum
M5		8.2	5.4	4
M6		14	9.2	6.8
M8		31	20	14.5
M10		68	45	33
M12		120	78	58
M14		157	105	78
M16		196	131	98

● 不鏽鋼製六角螺絲

Hex bolt of stainless steel

螺絲強度區分：6.8~8.8 時

Strength division for bolt for 6.8~8.8 (N·m)

螺絲名稱 Nominal designation of bolt	對方材質 Mated material	鎖緊扭力 Tightening torque		
		鋼 Steel	鑄件 Cast metal	鋁合金 Aluminum
M5		5	5	4
M6		8.5	8.5	6.8
M8		19	19	14.5
M10		41	41	33
M12		70	70	58
M14		110	105	78
M16		137	131	98

Splicing Procedures For Cam Rack 齒條接續方法

連結齒條時，請使用專用接續治具
Use special jig when splicing Cam Rack.

為達長行程定位行程之需求而進行多支齒條的接續時，請務必要確認好其齒條間的相鄰齒距，因此請您採用專用接續治具的配件。

Upon splicing Cam Rack for an extended stroke, it is necessary to determine neighboring pitch size. We are in supply with jigs. Contact us when you need jig.

1.請以基準側的第一支齒條為基準，使用專用接續治具，來進行第2支以上的齒條接續。
Use jig to splice second and third Cam Rack pieces with first one Cam Rack piece in the reference side as an original member.

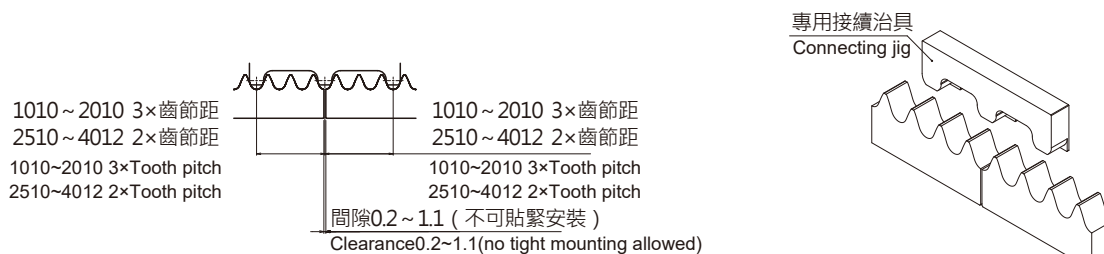
2.請將裁斷後的齒條放置於所有齒條的最尾端處。
Use severed Cam Rack piece with severed surface as an end portion.

3.原則上請勿把裁斷後的齒條當成第一支齒條，或者是置於數支齒條中間來進行安裝。
Don't set severed Cam Rack piece generally as first or middle Cam Rack piece.

4.如果一定須將裁斷後的齒條當成第一支齒條或者置於數支齒條中間來進行安裝之情形時，其齒條的裁斷長度公差與裁斷面，則有需要再重新進行檢討。即如標準尺寸圖以外的加工尺寸。(請與本公司進行商量)

When severed Cam Rack piece has to be set as first or middle Cam Rack piece, it is necessary to check severed length allowance and severed surface.

It belongs to non-standard assemble, and requires meeting about its design with us in advance.



Splicing Procedures For Cam Rack 齒條接續方法



● 精密齒條的接續順序 Splicing procedures for Cam Rack

1. 將第1根齒條按照安裝順序(P.22)進行安裝調整。

Set and adjust first Cam Rack piece of reference side in accordance with assembling procedures (P.22).

2. 將第2根齒條在基座上與第1根端面對齊。

Abut second Cam Rack piece on first Cam Rack piece on base surface.

3. 把齒條安裝螺絲輕輕擰上，進行假裝配。(齒條可以輕輕推動的程度假裝配)

Provisionally tighten mounting bolt for Cam Rack (with Cam Rack kept lightly shiftable).

4. 將靠模按在連接縫的上側，用手進行按住，用螺絲或夾緊器進行固定。
(注意靠模的傾斜以及偏斜)

Push jig on Cam Rack pieces. Hold them by hand, otherwise fix them with clamp or the like (Be attentive to inclination and shift of jig).

5. 將第2根齒條跟第1根齒條同樣按照安裝順序(P.22)進行調整安裝。

Set and adjust second Cam Rack piece as done by first Cam Rack piece in accordance with assembling procedures (P.22).

6. 拆卸夾具。

Remove jig.

7. 在齒條上再次用手按住夾具，確認夾具沒有間隙或者晃動。

(如果夾具有間隙或者晃動的情況，意味著齒條的連接節距或者平行度不合格。再次從順序3開始糾正。)

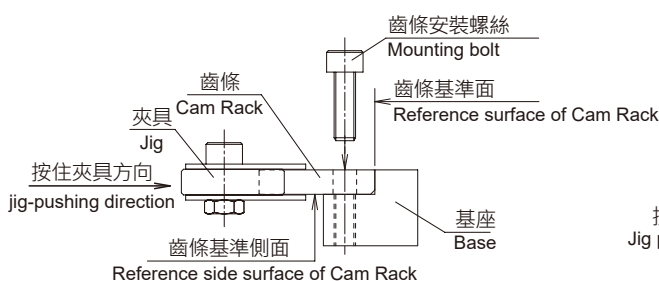
Push jig on Cam Rack by hand again and confirm that Cam Rack has no useless play.

8. 第3根以後採用同樣方式進行連接。

Set and splice third Cam Rack piece as done by second Cam Rack piece.

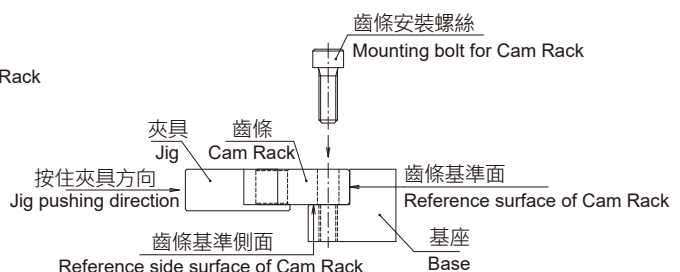
● CRA1010A ~ CRA1210A 的情況下

For CRA1010A~CRA1210A



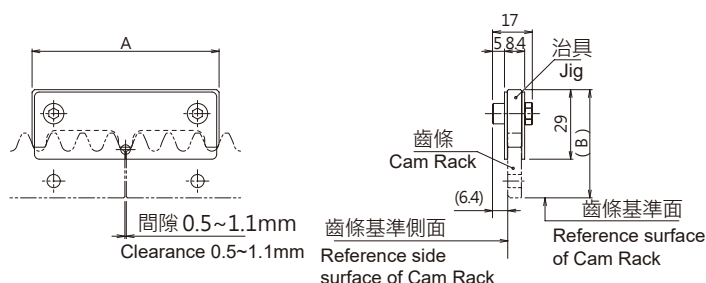
● CRA1610A ~ CRA3212A、 CRC3212A ~ CRC4012A、 CRS1610A ~ CRS4012A 的情況下

For CRA1610A~CRA3212A、
CRC3212A~CRC4012A、
CRS1610A~CRS4012A

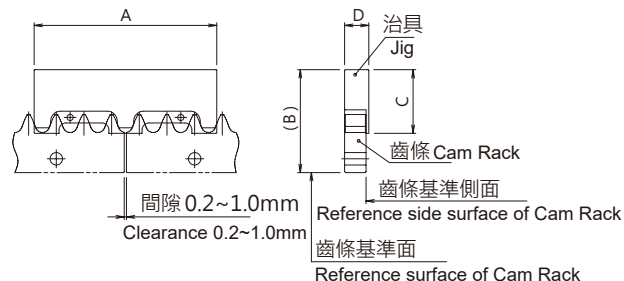


Dimensional Drawing Of Connecting Jig 齒條接續治具尺寸表

- CJ10A ~ CJ12A 為如下
For CJ10A~CJ12A



- CJ16B ~ CJ40B 為如下
For CJ16B~CJ40B



齒條接續治具尺寸圖

Dimensional sizes for connecting jig

接續治具型號 Jig model	A	B	C	D
CJ10A	65	46.2	-	-
CJ12A	78	45.1	-	-
CJ16B	106	53.4	34	13.5
CJ20B	132	74.4	46	17.5
CJ25B	114	76.7	46	20.5
CJ32B	150	85	46	20.5
CJ40B	190	98.4	46	20.5

List Of Mounting Precision For CRA Runner

CRA安裝精度表



① 推薦安裝精度 Recommended mounting precision

為達到CRA的精度、性能所必要的安裝精度。

All catalogue precisions required for CRA Runner and mounting precision to which design brochure is referred (mm)

型號 Model	齒條安裝精度 Mounting precision of Cam Rack				滾輪安裝精度 Mounting precision of roller pinion
	齒頂部(或齒底面)的平行度 Parallelism of addendum or dedendum	側面的平行度 Parallelism of side surface			軸跳動 Off-center oscillation
		全衝程 Whole	1根齒條 Cam Rack 1pc	全衝程 Whole	
CRA1010	0.05	0.2	0.6	0.4	0.03
CRA1210					
CRA1610/CRS1610					
CRA2010/CRS2010					
CRA2510/CRS2510					
CRA3212/CRS3212					
CRC3212					
CRC4012/CRS4012	0.05	0.2	0.8	0.6	

List Of Mounting Precision For CRA Runner

CRA安裝精度表

②動作允許範圍 Allowable range of operation

CRA可以使用的安裝精度。

Mounting precision for CRA Runner to be usable

(mm)

型號 Model	齒條安裝精度 Mounting precision of Cam Rack				滾輪安裝精度 Mounting precision of roller pinion
	全衝程 Whole	1根齒條 Cam Rack 1pc	全衝程 Whole	連接部高度差 Difference in grade at connector pieces	軸跳動 Off-center oscillation
CRA1010	0.1	0.4	0.8	0.4	0.05
CRA1210					
CRA1610/CRS1610					
CRA2010/CRS2010					
CRA2510/CRS2510					
CRA3212/CRS3212					
CRC3212					
CRC4012/CRS4012	0.1	0.4	1	0.6	

< 注意 >

按照②動作允許範圍內的組裝精度來進行安裝的情況下，CRA的傳動精度、背隙、允許負載能力有所影響。影響的程度大致估值如下：

對背隙的影響 大約： $(\text{齒頂平行度}(\text{mm}) + \text{滾輪的軸跳動}(\text{mm})) \times 0.8(\text{mm})$

對於允許負載能力的影響，需考量齒條選型計算的安裝精度係數。

但是，上述數值只是CRA單體的數值，根據設備構成、剛性、安裝方法等不同，可能會受到更大的影響。

< Note >

Upon mounting according to assemble precision within (②allowable range of operation,) torque-transmission precision, backlash, and allowable capacity of CRA Runner are influenced.

Indications of influences are as follows :

Influence indication of backlash : $[\text{addendum parallelism (mm)} + \text{off-center oscillation of roller pinion (mm)}] \times 0.8 \text{ (mm)}$

Influence indication of allowable capacity : refer to mounting precision coefficient used at Cam Rack selection calculation.

Note that above values are for CRA Runner itself, and may be further influenced depending on structure, rigidity and mounting methods.

CPA & CGA

選型·安裝程序

CGA Runner Selection Installation Procedure

技術資料

Technical Data

型號選定 Selection Of Type Number

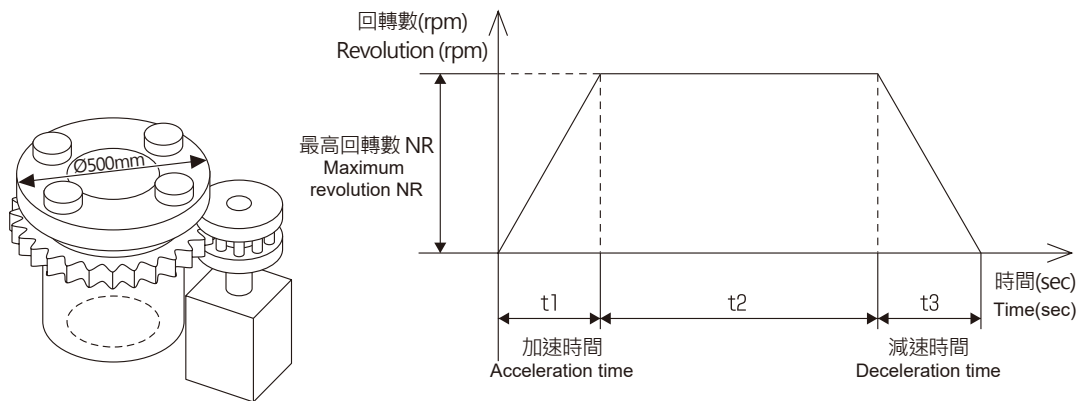
● 選型案例 Selection Example

使Ø500 · 20kg圓盤進行回轉的情況下

Upon rotating a disk (Ø500mm , 20kg)

重 量 Mass weight : 20kg

總 重 量 Moment of inertia : 0.9kgm²



● 負載條件 Load Condition

重 量	Mass weight	: m	= 20 (kg)
慣 量	Moment of inertia	: J	= 0.9 (kgm ²)
最高回轉數	Maximum number of revolution	: NR	= 100 (rpm)
加速時間	Acceleration time	: t1	= 0.1 (sec)
外力扭矩 (包含摩擦扭矩)	Outer force torque including frictional torque	: Tc	= 30 (Nm)
負載係數	Coefficient of load	: fw	= 1.5

無衝擊的圓滑運轉	Smooth operation with no impact	1.0~1.2
普通運轉	Normal operation without excessive impact	1.2~1.5
有衝擊的運轉	Operation with impact	1.5~3.0

● 選型計算 Calculation

角 速 度	Angular velocity	: ω	= NR×2 · π / 60 = 100×2×3.14 / 60 = 10.47 (rad/sec)
角 加 速 度	Angular acceleration	: $\dot{\omega}$	= ω / t1 = 10.47 / 0.1 = 104.7 (rad/sec ²)
加 速 扭 矩	Accelerative torque	: Ta	= J× $\dot{\omega}$ = 0.9×104.7 = 94.2 (Nm)
最大負載扭矩	Maximum load torque	: Tmax	= fw×(Ta+Tc) = 1.5×(94.2+30) = 186.3 (Nm)

型號選定 Selection Of Type Number



● 齒圈型號假定 Provisional Cam Ring Selection

在樣式表中，根據允許扭矩假定CGA2510A-C30
根據CGA2510A-C30樣式表：

CGA2510A-C30 is provisionally selected from the maximum working torque in the specification.

最大可用扭矩 Maximum working torque		360 (Nm)
齒圈的重量 Moment of inertia	Jg Jg	397×10^{-4} (kgm ²)

● 再計算 Calculation

考慮齒圈部份再次進行計算

Re-calculation upon considering the Cam Ring portion

加速扭矩 Accelerative torque : $Ta' = (J+Jg) \times \dot{\omega}$
 $= (0.9+397 \times 10^{-4}) \times 104.7$
 $= 98.4$ (Nm)

最大負載扭矩 Maximum load torque : $Tmax' = fw \times (Ta' + Tc)$
 $= 1.5 \times (98.4 + 30)$
 $= 192.6$ (Nm)

CGA2510A-C30 Maximum working torque : 360 (Nm)
 的最大可用扭矩 of CGA2510A-C30

所以 OK

This re-calculation shows that type of CGA2510A-C30 is appropriate.

● 選定 Selection

通過以上選定CGA2510A-C30

CGA2510A-C30 is selected.

壽命計算 Life Calculation

CGA使用回轉數計算出壽命時間。

For CGA Ring, the life is calculated from the number of revolutions of the roller pinion.

< 設定條件 >

額定壽命 1010型 ~ 1210型 270×10^6 回轉(基本動態額定扭力負載下)(滾輪300rpm對應15,000小時壽命)

額定壽命 1610型 ~ 4012型 60×10^6 回轉(基本動態額定扭力負載下)(滾輪100rpm對應10,000小時壽命)

< Setting conditions >

Rated life 1010~1210 = 270×10^6 revolutions (under the load of basic dynamic rated torque) (300rpm of the roller pinion is correspondent to 15,000 hours of life.)

Rated life 1610~4012 = 60×10^6 revolutions (under the load of basic dynamic rated torque) (100rpm of the roller pinion is correspondent to 10,000 hours of life.)

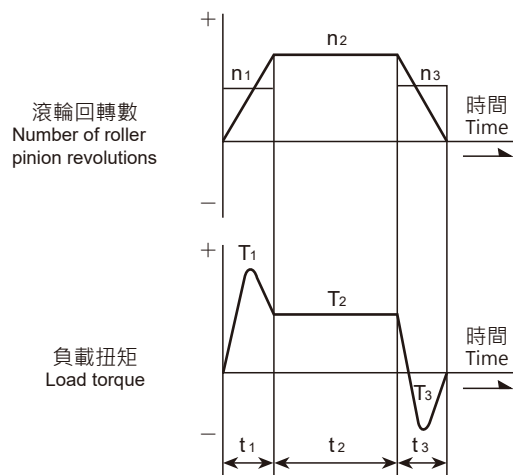
● 運轉條件(參考) Operating Conditions (Reference)

< 速度類型 >

Velocity pattern

< 負載類型 >

Load pattern



	起動時 Starting	定速時 Steady operation	停止時 Stoppage
負載扭矩(Nm) Load torque	T ₁	T ₂	T ₃
滾輪回轉數(rpm) Number of roller pinion revolutions	n ₁ (=0.5n ₂)	n ₂	n ₃ (=0.5n ₂)
時間(sec) Time	t ₁	t ₂	t ₃

● 平均負載扭矩 Average Load Torque T_m (N · m)

$$T_m = \sqrt[10/3]{\frac{n_1 \cdot t_1 \cdot T_1^{10/3} + n_2 \cdot t_2 \cdot T_2^{10/3} + n_3 \cdot t_3 \cdot T_3^{10/3}}{n_1 \cdot t_1 + n_2 \cdot t_2 + n_3 \cdot t_3}}$$

● 平均回轉數 Average Number of Revolutions Nm (rpm)

$$N_m = \frac{t_1 n_1 + t_2 n_2 + t_3 n_3}{t_1 + t_2 + t_3}$$

● 壽命時間 Life Length Lh (H)

$$L_h = L_{h0} \times \frac{N_0}{N_m} \times \left(\frac{T_0}{f_d \cdot f_{set} \cdot T_m} \right)^{10/3}$$

$$= \frac{4.5 \times 10^6}{N_m} \times \left(\frac{T_0}{f_d \cdot f_{set} \cdot T_m} \right)^{10/3} \quad (1010\text{型} \sim 1210\text{型})$$

$$= \frac{10^6}{N_m} \times \left(\frac{T_0}{f_d \cdot f_{set} \cdot T_m} \right)^{10/3} \quad (1610\text{型} \sim 4012\text{型})$$

額定壽命時間	Rated life length	: L _{h0} (Table1)
滾輪基本回轉數	Basic number of roller pinion revolutions	: N ₀ (Table1)
基本動額定扭矩(N·m)	Basic dynamic rated torque	: T ₀ (規格表)
平均負載扭矩(N·m)	Average load torque	: T _m
滾輪平均回轉數(rpm)	Average number of roller pinion revolutions	: N _m
負載係數	Coefficient of load	: f _d (Table2)
安裝精度係數	Coefficient of installation precision	: f _{set} (Table3)

(Table1) 額定壽命 Rated life

型式 Model	L _{h0} (H)	N ₀ (rpm)
1010~1210	15000	300
1610~4012	10000	100

(Table2) 負載係數 Coefficient of load

運轉條件 Operating conditions	f _d
無衝擊的圓滑運轉 Smooth operation with no impact	1.0~1.2
普通運轉 Normal operation without excessive impact	1.2~1.5
有衝擊的運轉 Operation with impact	1.5~3.0

(Table3) 安裝精度係數 Coefficient of installation precision

安裝精度 Installation precision	f _{set}
推薦安裝精度 以內 Recommended installation precision (within)	1.0
動作允許範圍 以內 Allowable operation range (within)	1.2

壽命計算 Life Calculation

■ 計算例 Calculation Example

● 平均負載扭矩 Average Load Torque T_m (N · m)

$$T_m = \sqrt[10/3]{\frac{n_1 \cdot t_1 \cdot T_1^{10/3} + n_2 \cdot t_2 \cdot T_2^{10/3} + n_3 \cdot t_3 \cdot T_3^{10/3}}{n_1 \cdot t_1 + n_2 \cdot t_2 + n_3 \cdot t_3}}$$

$$= \sqrt[10/3]{\frac{50 \times 0.1 \times 128.6^{10/3} + 100 \times 0.5 \times 30^{10/3} + 50 \times 0.1 \times 68.6^{10/3}}{50 \times 0.1 + 100 \times 0.5 + 50 \times 0.1}}$$

$$= 64.5 \text{ (N} \cdot \text{m)}$$

使用條件 Working conditions

	起動時 Starting	定速時 Steady operation	停止時 Stoppage
負載扭矩(Nm) Load torque	$T_1=128.6$	$T_2=30$	$T_3=68.6$
滾輪回轉數(rpm) Number of Cam Ring revolutions	n_1 ($=0.5n_2$) $=50$	$n_2=100$	n_3 ($=0.5n_2$) $=50$
時間(sec) Time	$t_1=0.1$	$t_2=0.5$	$t_3=0.1$

● 平均輸入回轉速 Average Input Rotational Frequency N_m (rpm)

$$N_m = \frac{t_1 n_1 + t_2 n_2 + t_3 n_3}{t_1 + t_2 + t_3} \times i = \frac{0.1 \times 150 + 0.5 \times 100 + 0.1 \times 50}{0.1 + 0.5 + 0.1} \times 3 = 257.1 \text{ (rpm)}$$

※ i 是齒圈與滾輪之間的減速比。

CGA2510A-C30 為前一頁「型號選定」中所選定的，所以 $i=30 \div 10=3$

“ i ” is a reduction ratio between Cam Ring gear and roller pinion.

CGA2510A-C30 is selected at previous paragraph, there fore “ i ” = $30 \div 10=3$

● 壽命時間 Life Length L_h (H)

根據使用條件，若負載係數 $f_d=1.5$ (表2)，安裝精度係數 $f_{set}=1.0$ (表3)

Select the roller pinion model number “CPA2510” from the T_0 value (Table2) based on the starting torque T_1 (max. working torque).

When the coefficient of load $f_d = 1.5$ (Table3) and the coefficient of installation precision $f_{set} = 1.0$ (Table4) from the working conditions.

$$L_h = \frac{10^6}{N_m} \times \left(\frac{T_0}{f_d \cdot f_{set} \cdot T_m} \right)^{10/3} = \frac{10^6}{257.1} \times \left(\frac{250}{1.5 \times 1.0 \times 64.5} \right)^{10/3} = 92086 \text{ (H)}$$

Assembling Procedures For CPA & CGA Ring

CPA & CGA安裝方法



- 1.請清除在安裝基準面、齒圈內徑以及齒圈基準面上附著的髒東西。
Remove dust and dirt settled on reference surface, inner surface of Cam Rings and basal spigot joint.
- 2.齒圈可以輕微被推動的程度，進行螺栓假裝配。
Tighten fastening bolts provisionally so that Cam Rings can lightly moves.
- 3.確認齒圈的齒尖跳動，進行調整(參照P35頁安裝精度表)
請確認齒圈齒尖部以及齒圈內徑軸回轉時的跳動量。
Adjust Cam Rings and make sure that Cam Rings do not shake (refer to mounting precision shown in Table P.35).
Make sure how much Cam Rings shake their tooth tip and inner diameter when rotated around their axial direction.
- 4.將齒圈安裝螺栓按照對角線的順序慢慢均勻的鎖緊(按照建議轉矩30%左右)、慢慢的增加轉矩將其鎖緊。
Slowly and evenly tighten Cam Ring-fastening bolts along a diagonal direction with around 30% of recommended torque, and gradually increase the torque to tighten the fastening bolts.
- 5.將齒圈安裝螺栓按照建議轉矩進行最終鎖緊(參照P22頁建議轉矩一覽表)。
Completely tighten fastening bolts with recommended torque (refer to recommended torques shown at Table P.22).
- 6.請再次確認齒圈的齒尖跳動。
Reassure that Cam Rings do not shake.

List Of Mounting Precision For CPA & CGA Ring

CPA & CGA安裝精度表

● 建議安裝精度 Recommended mounting precision

型錄精度、規格所需要的裝配精度。

All Catalogue precisions required for Cam Ring and mounting precision to which design brochure is referred.

型號 Frame number	齒圈安裝精度 Mounting precision of Cam Ring				滾輪安裝精度 Mounting precision of pinion
	齒尖跳動 Oscillation of addendum	側面平行度 Parallelism of side surface			軸心振動 Off-center oscillation
	全周(弧形齒圈與圓弧齒圈) Whole(For Circular arc Ring and Full Ring)	單片弧形齒圈(弧形) 1pcs (For Circular arc Ring)	弧形齒圈相接部分(適用於弧形齒圈) Connect portion (For Circular arc Ring)	全周(弧形齒圈與圓弧齒圈) Whole (For Circular arc Ring and Full Ring)	
1010	0.05	-	-	0.6	0.03
1210					
1610	0.05	0.2	0.4	0.6	
2510					
3212					
4012	0.05	0.2	0.6	0.8	

● 動作許容範圍 Allowable range of operation

齒圈可以使用的安裝精度

Mounting precision for Cam Ring to be usable.

型號 Frame number	齒圈安裝精度 Mounting precision of Cam Ring				滾輪安裝精度 Mounting precision of pinion
	齒尖跳動 Oscillation of addendum	側面平行度 Parallelism of side surface			軸心振動 Off-center oscillation
	全周(弧形齒圈與圓弧齒圈) Whole(For Circular arc Ring and Full Ring)	單片弧形齒圈(弧形) 1pcs (For Circular arc Ring)	弧形齒圈相接部分(適用於弧形齒圈) Connect portion (For Circular arc Ring)	全周(弧形齒圈與圓弧齒圈) Whole (For Circular arc Ring and Full Ring)	
1010	0.1	-	-	0.8	0.05
1210					
1610	0.1	0.4	0.4	0.8	
2510					
3212					
4012	0.1	0.4	0.6	1.0	

< 注意 >

按照②動作允許範圍內的組裝精度來進行安裝的情況下，會對CGA的傳動精度、背隙、允許負載能力有所影響。影響的程度大致估算如下：

對背隙的影響大約：(齒頂平行度(mm)+滾輪的軸跳動(mm))×0.8(mm)

對於允許負載能力的影響，需考量齒條選型計算的安裝精度係數。

然而，上述數值只是CGA單體的數值，根據設備構成、剛性、安裝方法等不同，可能會受到更大的影響。

< Note >

Upon mounting according to assemble precision within (②allowable range of operation,) torque-transmission precision, backlash, and allowable capacity of CGA Cam Rings & Roller Pinion are influenced.

Indications of influences are as follows :

Influence indication of backlash : [tooth tip deflection (mm) +off-center oscillation of roller pinion (mm)] ×0.8 (mm)

Influence indication of allowable capacity : refer to mounting precision coefficient used at Cam Rings selection calculation.

Note that above values are for CGA Cam Rings & Roller Pinion itself, and may be further influenced depending on structure, rigidity and mounting methods.



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