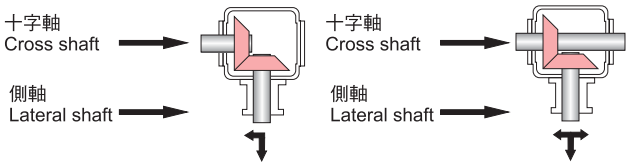
■結構•特性•應用　Structure•Character•Application

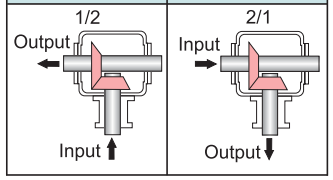
機殼：高剛性FC-20鑄鐵鑄造。(另有特殊材質鑄鋼)
齒輪：鉻鉬鋼螺線傘齒輪、表面經硬化處理及研磨。
主軸：碳鋼經高精度研磨處理、高懸重負荷能力。
軸承：配備重負荷能力的滾錐軸承。
油封：雙封唇片的油封、兼具防塵及防漏油的能力。

Housing :High tensile strength cast iron (FC-20).(Special material cast steel)
Gear :Cr-Mo-Steel Spiral Bevel Gear, surface hardened and polished.
Main shaft :Carbon alloy steel with precision grinding, high capacity of overhung and thrust loading.
Bearing :Taper roller bearings for high load capacity.
Sealer :Double lip oil sealer, prevent both dust and leakage.

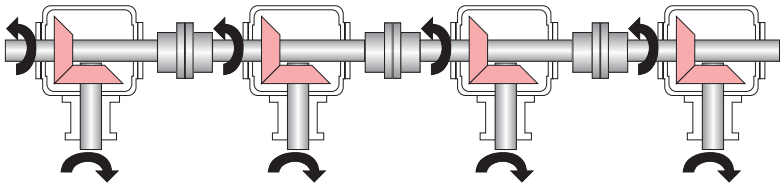
轉向機基本傳動方式
Basic type of transmission of Miter Gear box:



減速 Reduced	增速 Speed-up
1/2	2/1

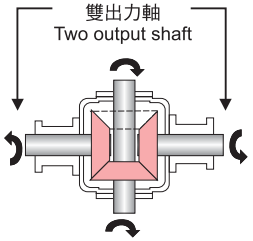


轉向機應用例
Examples of Applications for Miter Gear box:

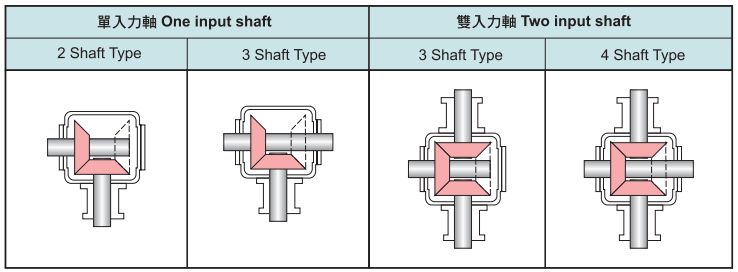


特殊品
Special Design:

兩側旋向相反
sides rotate in opposite directions



單入力軸 One input shaft		雙入力軸 Two input shaft	
2 Shaft Type	3 Shaft Type	3 Shaft Type	4 Shaft Type

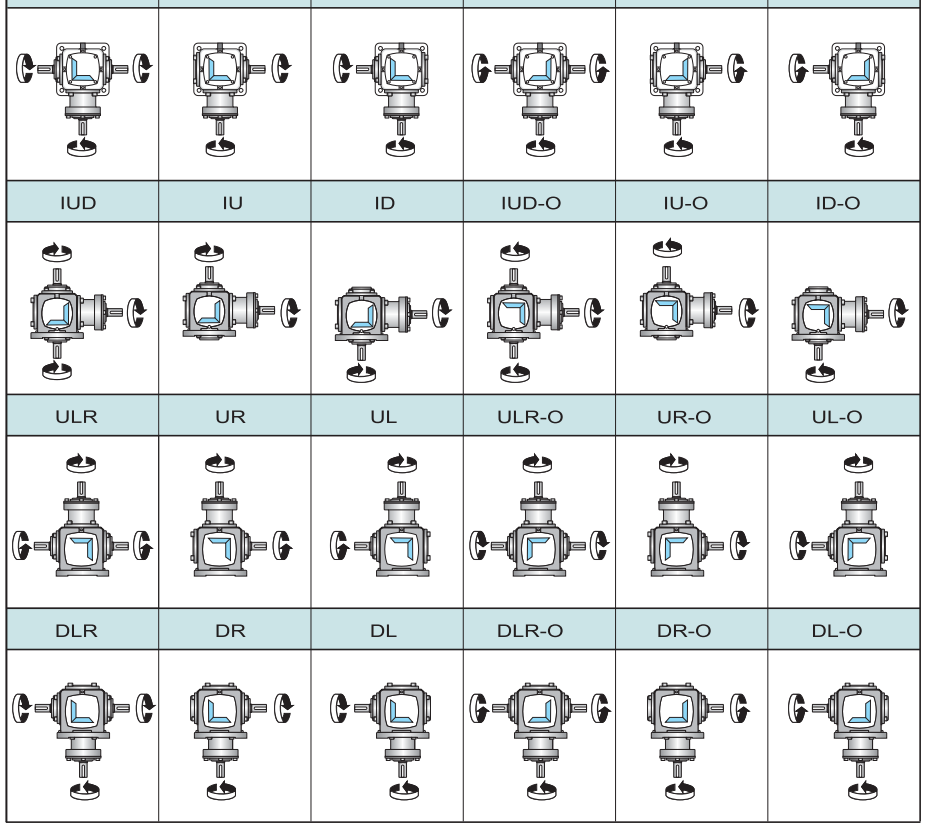


■型號說明　Model explantion

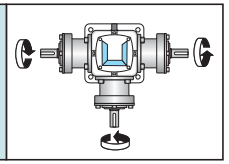
GM 02 - 10 ILR - O

- 轉向 Direction of rotation
- 軸配置 Shaft arrangement
- 速比 Speed ratio
- 規格 Size
- 產品別 Model

ILR	IR	IL	ILR-O	IR-O	IL-O
IUD	IU	ID	IUD-O	IU-O	ID-O
ULR	UR	UL	ULR-O	UR-O	UL-O
DLR	DR	DL	DLR-O	DR-O	DL-O

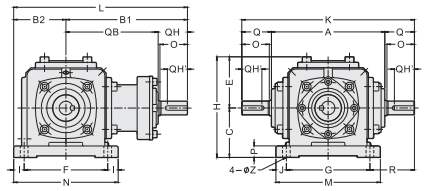


特殊機種 III Special model III	

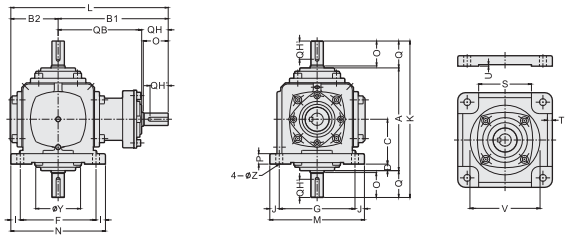


■尺寸表 Dimension form

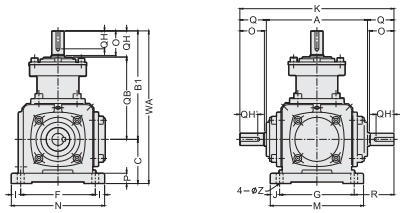
ILR
ILR-O



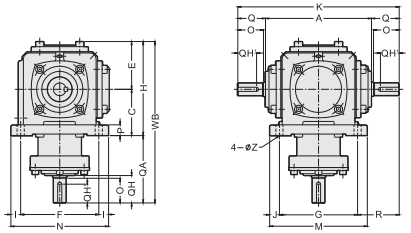
IUD
IUD-O



ULR
ULR-O



DLR
DLR-O

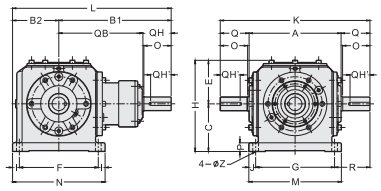


單位:Unit:(mm)

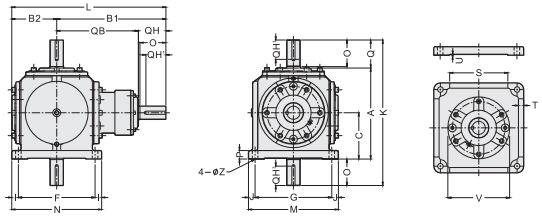
型　式 Size	A	B1	B2	C	*D	E	F,G	H	I,J	K	L	M,N	P	Q	QA	Q,B	QH	QH'	R
GM0210	110	123	52	52	2.85	50	84	102	10	180	175	104	10.5	35	71	89	34	23	48
GM0410(GM0420)	152	179.5	79	76	0	73	125	149	16.5	232	258	158	14	40	103	140	39.5	28	53.5
GM0610(GM0620)	206	222	95	90	13	93	152	183	19	314	316	190	21	54	131	168	54	37	81
GM0810(GM0820)	260	307	117.5	115	15	113	195	227	20	416	424.5	235	22	78	192	228	79	55.5	110.5
GM1010(GM1020)	289	360	142.5	140	4.5	137	240	277	22.5	480	502.5	285	25	95	220	264.5	95	68.5	120

型　式 Size	WA	WB	Y	Z	U	S	T	V	側軸Lateral shaft			十字軸Cross shaft			GD^2 (Kgf-m^2)	重量 Weight (Kgf)
									øSD	O	Key	øSD	O	Key		
GM0210	175	173	48	9	-	-	-	80	15	33	5x5	15	33	5x5	0.0002	1.9
GM0410(GM0420)	255.5	252	58	10.5	3	92	9	110	19(16)	38	6x6(5x5)	19	38	6x6	0.0006(0.00048)	9.5
GM0610(GM0620)	312	314	84	14	3	106	10	140	25	50	8x7	25	50	8x7	0.0054(0.00266)	20
GM0810(GM0820)	422	419	118	14	4	147	14.5	172	40	75	12x8	40	75	12x8	0.019(0.014)	47
GM1010(GM1020)	500	496.8	137	16	4	128	19.5	210	45	90.5	14x9	45	90.5	14x9	0.092(0.027)	60

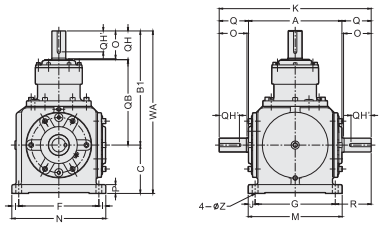
ILR
ILR-O



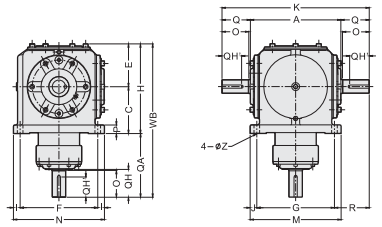
IUD
IUD-O

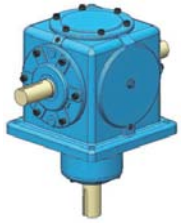


ULR
ULR-O



DLR
DLR-O





單位:Unit:(mm)

型　式 Size	A	B1	B2	C	*D	E	F,G	H	I,J	K	L	M,N	P	Q	QA	QB	QH	QH'	R
GM1210 (GM1220)	338	417	170	175	-	160	290	335	25	550	587	340	32	106	242	309	108	75.5	130

型　式 Size	WA	WB	Y	Z	U	S	T	V	側軸Lateral shaft			十字軸Cross shaft			**GD^2 (Kgf-m^2)**	重量Weight (Kgf)
									øSD	O	Key	øSD	O	Key		
GM1210 (GM1220)	592	577	134	21	3	220	20	234	50	100	14x9	50	100	14x9	0.10 (0.056)	117

■轉向機機型選用

步驟1：決定補正係數<表一>。
步驟2：選擇適當轉向機需滿足扭力或kw值需求在<表二>指示速比及出力軸轉速。

■To select correct model for miter gear box

Step1:Determine the service factor (table 1)
Step2:Select the proper gear box which satisfies both torque or kw requirement at the specified speed ratio and shaft rpm (table 2,3)

表(一) Table(1)

負荷性質 load conditions \ 馬達 motor	使用時間 operation time			
	0.5	2	10	24
均一負荷 uniform load	0.8	0.9	1.00	1.25
	(0.9)	(1.00)	(1.25)	(1.50)
中負荷 moderate load	0.9	1.00	1.25	1.50
	(1.00)	(1.25)	(1.50)	(1.75)
重負荷 heavy load	1.00	1.25	1.50	1.75
	(1.25)	(1.50)	(1.75)	(2.00)

扭力需求 ≥ 使用扭力 X 補正係數
kw值需求 ≥ 使用kw值 X 補正係數
Torque requirement ≥ Applied torque X Service factor
kw Requirement ≥ Applied kw X Service factor

註一：均一負荷及連續運轉期補正係為1.0
註二：每小時起動停止10回合以上採用( )內數值
note 1: the service factor for uniform load and continuous operation is 1.0
note 2: use the number in ( ) for start and stop over 10 cycles per hour.

表(二) Table(2)

速比 RATIO	型號 Size	轉速 R.P.M	3600	2750	1900	1750	1460	1150	870	580	400	300	200	150	100	50	10
1:1	GM02	kw	3.493	2.641	1.92	1.757	1.447	1.211	0.905	0.596	0.532	0.399	0.266	0.199	0.133	0.066	0.013
		kgf-m	0.945	0.935	0.984	0.978	0.965	1.026	1.013	1.001	1.295	1.295	1.295	1.295	1.295	1.295	1.295
	GM04	kw	6.015	5.15	3.75	3.44	2.843	2.202	1.767	1.159	0.791	0.771	0.514	0.385	0.257	0.128	0.025
		kgf-m	1.627	1.824	1.922	1.914	1.896	1.865	1.978	1.947	1.928	2.504	2.504	2.504	2.504	2.504	2.504
	GM06	kw	-	19.87	15.338	14.082	11.677	9.731	7.248	5.075	3.445	2.561	2.208	1.656	1.104	0.552	0.11
		kgf-m	-	7.037	7.863	7.838	7.79	8.242	8.115	8.523	8.39	8.317	10.754	10.754	10.754	10.754	10.754
	GM08	kw	-	-	32.092	29.559	24.66	22.014	16.419	11.459	8.324	6.166	4.059	3.942	2.628	1.314	0.262
		kgf-m	-	-	16.451	16.451	16.451	18.645	18.381	19.244	20.27	20.019	19.771	25.597	25.597	25.597	25.597
	GM10	kw	-	-	-	46.957	39.176	34.972	26.457	18.898	14.035	10.447	6.867	5.114	4.431	2.215	0.443
		kgf-m	-	-	-	26.135	26.135	29.62	29.62	31.735	34.177	33.919	33.444	33.207	43.158	43.158	43.158
	GM12	kw	-	-	-	-	63.248	49.818	42.714	30.51	21.041	16.995	11.33	8.497	7.364	3.682	0.736
		kgf-m	-	-	-	-	42.194	42.194	47.82	51.236	51.236	55.177	55.177	55.177	71.73	71.73	71.73
1:2	GM04	kw	3.058	2.468	1.667	1.645	1.358	1.058	0.792	0.68	0.469	0.351	0.234	0.175	0.117	0.058	0.011
		kgf-m	0.827	0.874	0.854	0.915	0.906	0.896	0.887	1.142	1.142	1.142	1.142	1.142	1.142	1.142	1.142
	GM06	kw	7.809	6.692	4.866	4.466	3.68	3.074	2.294	1.507	1.34	1.005	0.67	0.502	0.335	0.167	0.033
		kgf-m	2.112	2.37	2.494	2.485	2.455	2.604	2.568	2.531	3.264	3.264	3.264	3.264	3.264	3.264	3.264
	GM08	kw	16.194	12.243	9.457	8.669	7.678	5.964	4.772	3.121	2.127	2.063	1.375	1.031	0.687	0.343	0.068
		kgf-m	4.381	4.336	4.848	4.825	5.122	5.051	5.342	5.242	5.18	6.698	6.698	6.698	6.698	6.698	6.698
	GM10	kw	-	21.691	16.728	15.366	12.701	10.599	7.864	5.526	3.76	2.799	2.422	1.817	1.211	0.605	0.121
		kgf-m	-	7.682	8.575	8.552	8.473	8.977	8.804	9.281	9.157	9.089	11.799	11.799	11.799	11.799	11.799
	GM12	kw	-	33.378	22.738	23.659	19.616	16.352	12.185	8.528	5.788	4.303	3.707	2.78	1.853	0.926	0.185
		kgf-m	-	11.822	11.656	13.168	13.086	13.85	13.641	14.322	14.095	13.97	18.055	18.055	18.055	18.055	18.055
1:3	GM06	kw	4.125	3.33	2.419	2.217	1.832	1.428	1.071	0.921	0.635	0.476	0.317	0.238	0.158	0.08	0.016
		kgf-m	1.116	1.179	1.24	1.234	1.222	1.21	1.19	1.546	1.546	1.546	1.546	1.546	1.546	1.546	1.546
	GM08	kw	8.991	6.795	4.936	4.518	4.01	3.117	2.33	1.534	1.37	1.028	0.685	0.514	0.342	0.171	0.034
		kgf-m	2.432	2.406	2.53	2.514	2.675	2.64	2.609	2.577	3.337	3.337	3.337	3.337	3.337	3.337	3.337
	GM10	kw	11.358	9.737	7.078	6.496	5.348	4.47	3.337	2.193	1.953	1.464	0.976	0.732	0.488	0.244	0.048
		kgf-m	3.073	3.448	3.628	3.615	3.568	3.786	3.735	3.684	4.755	4.755	4.755	4.755	4.755	4.755	4.755
	GM12	kw	23.072	19.749	13.442	12.327	10.925	8.468	6.785	4.445	3.032	2.946	1.964	1.473	0.982	0.491	0.098
		kgf-m	6.242	6.995	6.891	6.861	7.288	7.172	7.596	7.464	7.383	9.567	9.567	9.567	9.567	9.567	9.567

■潤滑

適當的潤滑油使用，可以發揮轉向機的效率，並提高其運轉的壽命。

- 初期使用二週或100-200小時，為初摩耗期，這之間可能有少許金屬摩耗粉粒，請務必清潔內部，並換新潤滑油。
- 長期使用時，每半年-一年或者1000-2000小時，更換一次潤滑油。

■Lubrication

Proper application of lubricating oil will raise the efficiency and prolong the life of the Miter Gears.

- The first two weeks or first 100 to 200 hours are break-in period.There might be some tiny metal powders during this time. Please clean interior and replace with new lubricating oil after break-in.
- For normal operation, replace lubricating oil every six months to one year or 1000 to 2000 hours whichever comes sooner.

■潤滑油種類

本產品潤滑油採用中國石油全效齒輪油90#-120#，低轉速、輕負荷條件，建議採用全效齒輪油90#，重負荷、高溫的條件，建議採用全效齒輪油120#。

*如有特殊使用條件，請示先與本公司洽商。

■The choices of lubricating oil

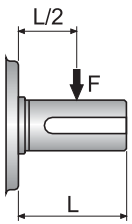
The product use Universal Gear Oil 90# to 120# by China Petroleum Corp. Use Universal Gear Oil 90# for low speed and light load. Use Universal Gear Oil 120# for heavy load and high temperature.

Note: For special operation. please contact the manufacturer or our dealer.

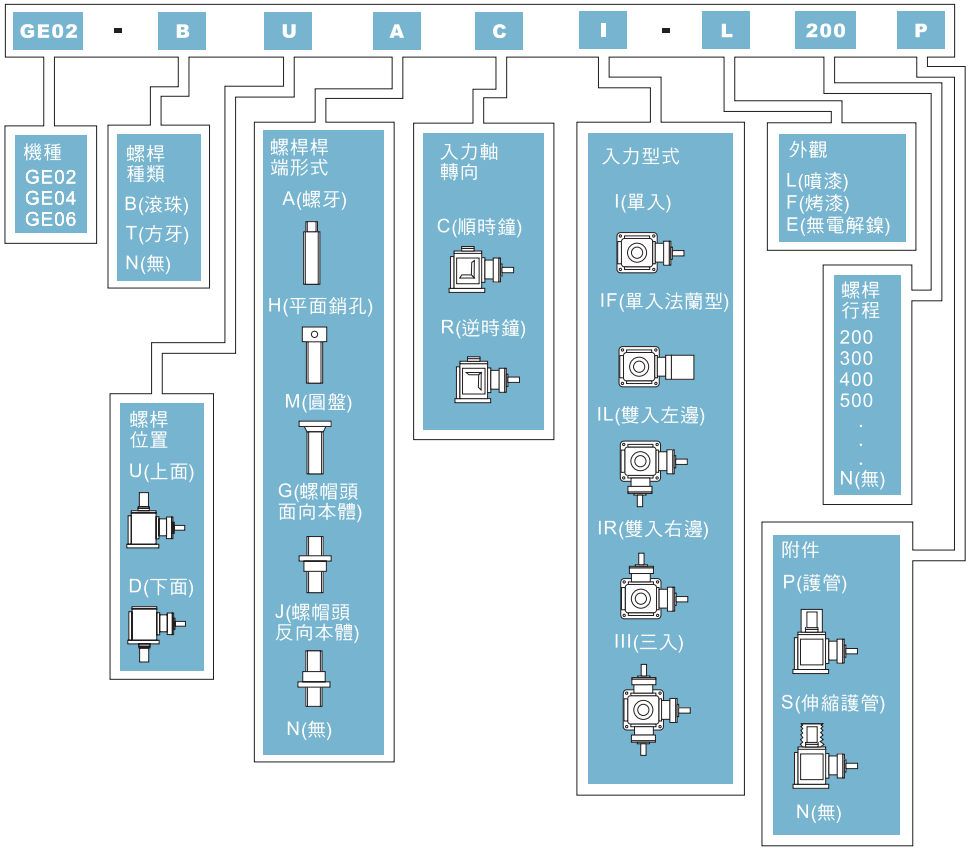
■懸吊荷重 Suspension loading

單位:Unit:(kg)

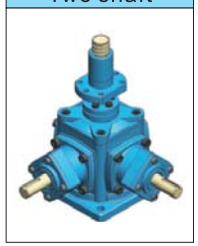
速比 RATIO	型號 Size	轉速 R.P.M	1900	1750	1460	1150	870	580	300	100	10
1:1	GM02	入力軸	14.4	17.6	21.6	26.4	32.8	44.8	56.8	80	80
		出力軸	13.6	16	17.6	19.2	20.8	25.6	32	48	48
	GM04	入力軸	57.7	64	68	72	78.4	88	124	156	156
		出力軸	66.8	73.6	77.6	84	92	108	160	160	160
	GM06	入力軸	133	148	156	168	180	204	280	280	280
		出力軸	167.2	188	200	212	232	260	288	288	288
	GM08	入力軸	228	252	264	284	308	348	428	688	688
		出力軸	235.6	264	276	296	324	364	568	720	720
	GM10	入力軸	-	324	340	364	396	448	548	816	816
		出力軸	-	348	368	396	432	480	652	960	960
	GM12	入力軸	-	-	416	448	480	548	672	928	968
		出力軸	-	-	456	496	536	596	740	1028	1184
1:2	GM04	入力軸	64.6	88	88	88	88	88	88	88	88
		出力軸	136.8	160	160	160	160	160	160	160	160
1:2 1:3	GM06	入力軸	140.6	180	208	248	280	280	280	280	280
		出力軸	193.8	224	232	252	272	288	288	288	288
	GM08	入力軸	266	312	356	416	496	624	688	688	688
		出力軸	532	592	652	720	720	720	720	720	720
	GM10	入力軸	323	364	424	504	608	780	816	816	816
		出力軸	608	672	752	856	960	960	960	960	960
	GM12	入力軸	-	416	488	592	724	936	968	968	968
		出力軸	-	752	856	992	1184	1184	1184	1184	1184



■型號說明 Model explantion



■種類外觀 Type outward appearance

單軸 One shaft	雙軸 Two shaft	三軸 Three shaft	附加剎車 Additional brake
			

■昇降機機型選用

步驟1：決定補正係數<表一>。
步驟2：選擇適當轉向機需滿足扭力或kw值需求在<表二>指示速比及出力軸轉速。

■To select correct model for miter gear box which linear movement

Step1:Determine the service factor (table 1)
Step2:Select the proper gear box which satisfies both torque or kw requirement at the specified speed ratio and shaft rpm (table 2,3)

表(一) Table(1)

負荷性質 load conditions \ 馬達 motor	使用時間 operation time 0.5	2	10	24
均一負荷 uniform load	0.8	0.9	1.00	1.25
	(0.9)	(1.00)	(1.25)	(1.50)
中負荷 moderate load	0.9	1.00	1.25	1.50
	(1.00)	(1.25)	(1.50)	(1.75)
重負荷 heavy load	1.00	1.25	1.50	1.75
	(1.25)	(1.50)	(1.75)	(2.00)

扭力需求 ≥ 使用扭力 X 補正係數
kW值需求 ≥ 使用kW值 X 補正係數
Torque requirement ≥ Applied torque X Service factor
kw Requirement ≥ Applied kw X Service factor

註一：均一負荷及連續運轉期補正係為1.0
註二：每小時起動停止10回合以上採用( )內數值
note 1: the service factor for uniform load and continuous operation is 1.0
note 2: use the number in ( ) for start and stop over 10 cycles per hour.

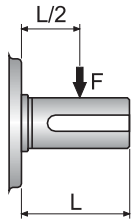
表(二) Table(2)

速比 RATIO	型號 Size \ 轉速 R.P.M		3600	2750	1900	1750	1460	1150	870	580	400	300	200	150	100	50	10
1:2	GE02	kw	2.134	1.725	1.251	1.147	0.948	0.74	0.555	0.478	0.33	0.247	0.165	0.123	0.082	0.041	0.008
		kgf-m	0.577	0.611	0.641	0.638	0.633	0.627	0.621	0.803	0.803	0.803	0.803	0.803	0.803	0.803	0.803
1:2.5	GE04	kw	5.543	4.181	3.03	2.775	2.466	1.919	1.437	0.947	0.848	0.636	0.424	0.318	0.212	0.106	0.021
		kgf-m	1.5	1.48	1.553	1.544	1.645	1.626	1.608	1.59	2.065	2.065	2.065	2.065	2.065	2.065	2.065
1:3	GE06	kw	5.654	4.566	3.086	2.827	2.513	1.957	1.465	0.966	0.866	0.649	0.433	0.324	0.216	0.108	0.021
		kgf-m	1.53	1.617	1.582	1.573	1.677	1.658	1.641	1.623	2.11	2.11	2.11	2.11	2.11	2.11	2.11

■懸吊荷重 Suspension loading

單位:Unit:(kg)

速比 RATIO	型號 Size \ 轉速 R.P.M		1900	1750	1460	1150	870	580	300	100	10
1:2	GE02	入力軸	16.1	24.2	28.1	34.3	35.2	35.2	35.2	35.2	35.2
		出力軸	27.8	31.8	35.2	38.4	45.7	45.7	45.7	45.7	45.7
1:2.5	GE04	入力軸	64.6	88	88	88	88	88	88	88	88
		出力軸	136.8	160	160	160	160	160	160	160	160
1:3	GE06	入力軸	140.6	180	208	248	280	280	280	280	280
		出力軸	193.8	224	232	252	272	288	288	288	288



■潤滑油種類

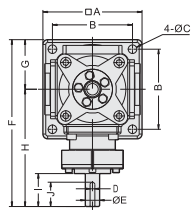
潤滑油脂 DUPLEX EPS SPECIAL

■The choices of lubricating oil

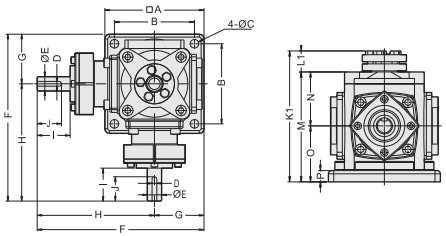
Lubricating oil DUPLEX EPS SPECIAL.

■尺寸表 Dimension form

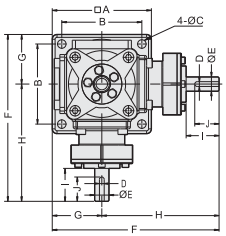
GE□□-NUNCI
GE□□-NUNRI



GE□□-NUNCIL
GE□□-NUNRIL



GE□□-NUNCIR
GE□□-NUNRIR



單位:Unit:(mm)

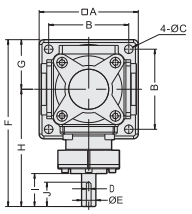
型 式Size	A	B	C	D	E	F	G	H	I	J	K1	K2	L1	L2	M	N	O	P
GE02	104	84	9	5	15	175	52	123	34.55	25.5	121.55	119.6	19.5	17.55	102.05	50.05	52	10.5
GE04	158	125	10.5	6	19	258.5	79	179.5	39.775	30	174	170	26	22	148	72	76	14
GE06	190	152	14	8	25	317	95	222	54.3	40.5	205.5	202.5	28.5	25.5	177	87	90	21

■滾珠螺桿外徑
Ballscrews outer diameter

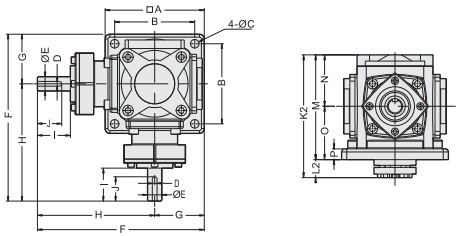
單位:Unit:(mm)

型 式Size	外徑 Outer diameter
GE02	Ø20
GE04	Ø32
GE06	Ø40

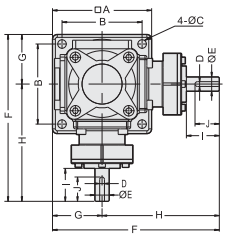
GE□□-NDNCI
GE□□-NDNRI

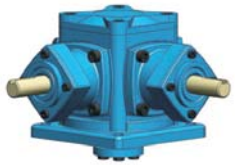


GE□□-NDNCIL
GE□□-NDNRIL



GE□□-NDNCIR
GE□□-NDNRIR





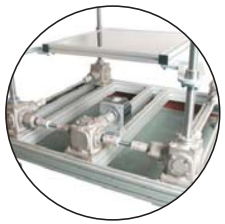
單位:Unit:(mm)

型 式Size	A	B	C	D	E	F	G	H	I	J	K1	K2	L1	L2	M	N	O	P
GE02	104	84	9	5	15	175	52	123	34.55	25.5	121.55	119.6	19.5	17.55	102.05	50.05	52	10.5
GE04	158	125	10.5	6	19	258.5	79	179.5	39.775	30	174	170	26	22	148	72	76	14
GE06	190	152	14	8	25	317	95	222	54.3	40.5	205.5	202.5	28.5	25.5	177	87	90	21

■滾珠螺桿外徑
Ballscrews outer diameter

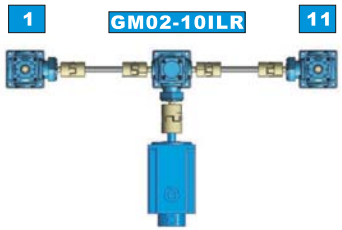
單位:Unit:(mm)

型 式Size	外徑 Outer diameter
GE02	Ø20
GE04	Ø32
GE06	Ø40



■應用範例 Application example

二點同步昇降



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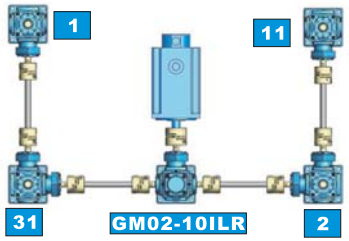

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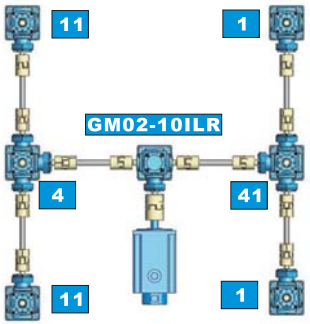

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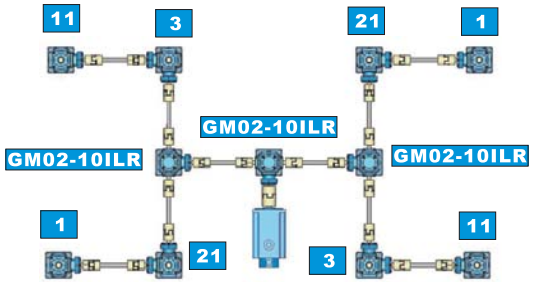
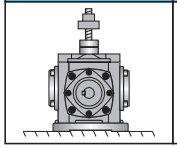
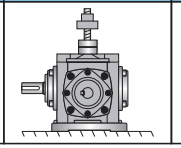
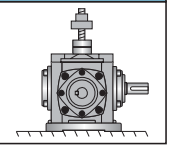
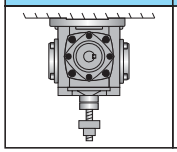
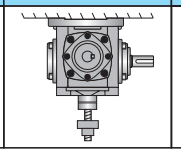
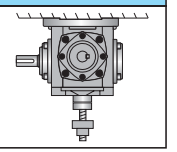


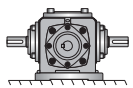
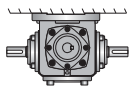
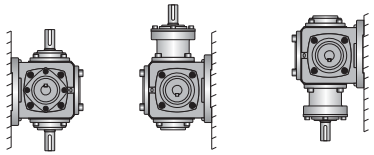
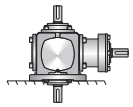
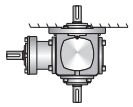
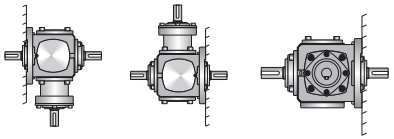
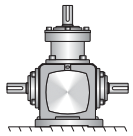
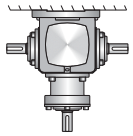
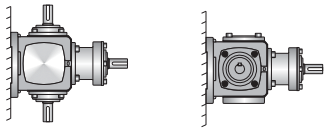
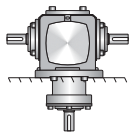
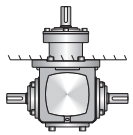
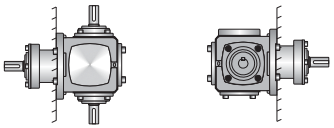
1 GE02-BUGCI-□	2 GE02-BUGCIL-□	3 GE02-BUGCIR-□	4 GE02-BUGCIII-□
11 GE02-BUGRI-□	21 GE02-BUGRIL-□	31 GE02-BUGRIR-□	41 GE02-BUGRIII-□
5 GE02-BDGCI-□	6 GE02-BDGCIL-□	7 GE02-BDGCIR-□	8 GE02-BDGCIII-□
51 GE02-BDGRI-□	61 GE02-BDGRIL-□	71 GE02-BDGRIR-□	81 GE02-BDGRIII-□

■十字轉向昇降機安裝 Miter gear box which linear movement mounting

臥式 Horizontal		
GE□□-BUGCI GE□□-BUGRI	GE□□-BUGCIL GE□□-BUGRIL	GE□□-BUGCIR GE□□-BUGRIR
		

吊掛式 Over hung		
GE□□-BUGCI GE□□-BUGRI	GE□□-BUGCIL GE□□-BUGRIL	GE□□-BUGCIR GE□□-BUGRIR
		

■十字轉向機安裝 Miter gear box mounting

軸配置 Shaft arrangement	臥式 Horizontal	吊掛式 Over hung	側壁式 Side wall
ILR ILR-O IR IR-O IL IL-O			
IUD IUD-O IU IU-O ID ID-O			
ULR ULR-O UR UR-O UL UL-O			
DLR DLR-O DR DR-O DL DL-O			

■計算實例 Calculated example

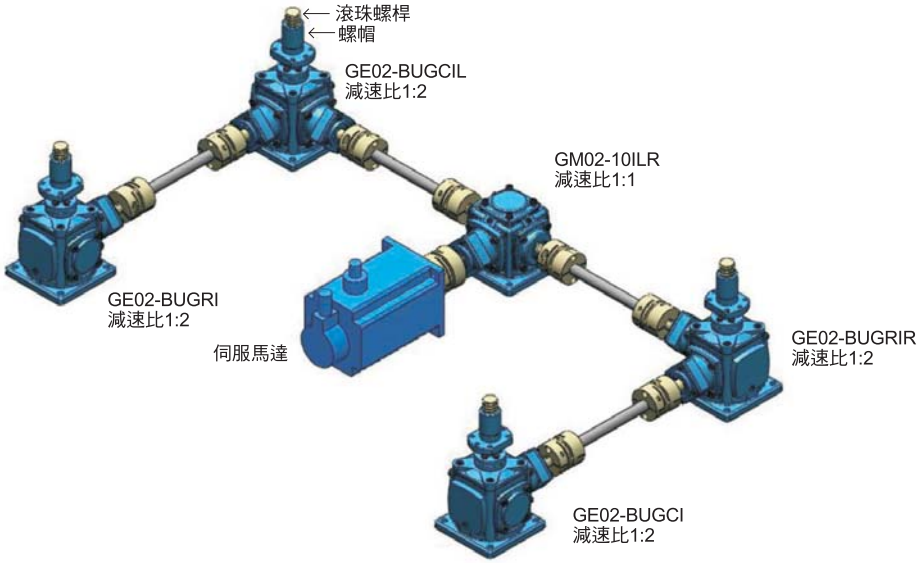
昇降設備選用計算說明:

假設有一GE02的4點組合昇降設備(參考左圖),其載重為300kg,
昇降速度為100mm/s,搭配伺服馬達轉速設為1500rpm,則伺服馬達應選用多少kw?
螺桿導程為多少?

公式:1.$F=F_A+m(\sin a+u\cos a)$
2.$F_0=F/3$
3.$N_1=N/i$
4.$Pitch=V/N_1$
5.$T=[F*Pitch/(2\pi\eta)+u*F_0*Pitch/(2\pi)]/1000$
6.$Tm=T/(\eta_1*\eta_2*i)$
7.$P=Tm*N/973.5$

相關計算如下:
V=100(mm/s)
=6000(mm/min)
滾珠螺桿的負載:
$F=F_A+m(\sin a+u\cos a)$
$=0+300(\sin 90^o+0.05*\cos 90^o)$
=300(kg)
滾珠螺桿的預壓負載:
$F_0=F/3$
=300/3=100(kg)
滾珠螺桿轉速:
$N_1=N/i$
=1500/2=750(rpm)
滾珠螺桿導程:
$Pitch=V/N_1$
=6000/750
=8(mm) 因為沒有導程8mm,故選用導程10mm
昇降機負載轉矩$T=[F*Pitch/(2\pi\eta)+u*F_0*Pitch/(2\pi)]/1000$
$=[300*10/(2\pi*0.9)+0.05*100*10/(2\pi)]/1000$
=(530.78+7.96)/1000
=0.538(kgfm)
伺服馬達扭矩$Tm=T/(\eta_1*\eta_2*i)$
=0.538/(0.9*0.9*2)
=0.33(kgfm)
伺服馬達輸出功率$P=Tm*N/973.5$
=0.33*1500/973.5
=0.5(kw)
設安全因數為2倍,0.5*2=1(kw),故選用1(kw)的伺服馬達
**如果要把十字轉向機換成中空渦輪減速機,減速比1:5的話,
將會使螺桿的外徑及導程變大,導致成本增加許多,故不建議

F:軸方向載重(kg)
F_A:外力(kg)
m:載重(kg)
A:傾斜角度(90°)
u:滑動面的摩擦係數(0.05)
F_0:預壓載重約軸方向載重的1/3(kg)
N_1:滾珠螺桿轉速(rpm)
N:伺服馬達轉速(rpm)
i:昇降機減速比
Pitch:螺桿導程(mm)
V:昇降速度(mm/s)
T:昇降機負載轉矩(kgfm)
π:圓周率(3.14)
η:滾珠螺桿效率(0.9)
Tm:伺服馬達扭矩(kgfm)
η_1:轉向機效率(0.9)
η_2:昇降機效率(0.9)
P:伺服馬達功率(kw)



■應用實例 Application example

昇降系統

轉向系統