機型選用
Selection of Machine Models

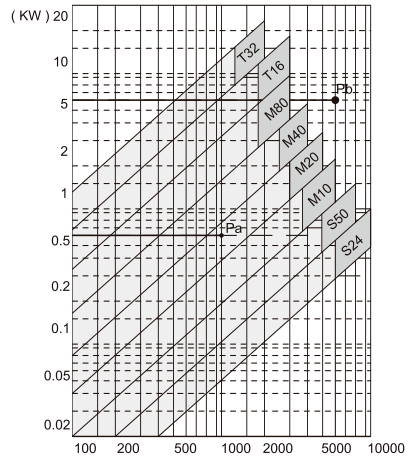
在一般的使用環境下離合器與制動器的選用是一件單純簡易的工作。為了能迅速的找到所適用的型式，請善用右邊之型式選定圖。圖中淺顏色部份為正常使用範圍，在深顏色部份就必須注意工作量，散熱能力及摩耗量。

In normal condition, selection of clutch and brake is a very simple and easy task. In order to select the desired ones, please consult the selection chart on the right side. Light color in the chart shows normal use range while dark color indicates attention must be paid to the workload, heat dissipation capability and attribution.

離合器／制動器選定之負荷係數f
Load Co-efficient f of Clutch/brake

負荷型態 Load Type	機械種類 Type of Machinery	負荷係數f Load Co-efficient f
定負荷 Fixed load 低慣性 Low inertia 低頻度 Low frequency	小型工作母機、小型紡織機、小型高速幫浦、小型木工機器、事務機器 Small machine tool, small textile machinery, mini-high speed pump, small carpenter machine, business machine.	1.5
變動負荷 Variable load 低慣性 Low inertia 低頻度 Low frequency	中型工作母機、小型沖床、木工機器、絞盤、小型幫浦、紡織機、空氣壓縮機、送風機 Medium machine tool,mini-lathe, carpenter machinery, capstan, mini-pump, textile machinery, air compressor, draught blower	2.0
變動負荷 高慣性 High inertia 低頻度 Low frequency	工作母機、中型沖床、紡織機、印刷機、包裝機、輸送機、製藥機器、吊車、攪拌機、攻牙機 Machine tool, medium lathe, textile machinery, packaging machine, transmission machinery, pharmaceutical machinery, crane, mixer, Tapping Machine	2.5
重負荷 Heavy load 高慣性 High inertia 高頻度 High frequency	大型沖床、大型銑床、壓延機、造紙機、其他大型工作母機 Giant lathe, giant milling machine, rolling machine, paper machine, other giant machine tool.	3.5

型式選定圖
Selection Chart



離合器、制動器轉速 r. p. m
Revolution of clutch and brake r.p.m.

例一、
馬達額定出力0.75KW的感應馬達，使用於低慣性、低頻度之變動負荷，離合器迴轉數為1000 r. p. m.，離合器／制動器額定動轉矩計算如下：

Example 1:
An induction motor with rated horsepower of 0.75W under variable load of low inertia and low frequency and revolution of the clutch is 1,000 r.p.m., computation of the rated dynamic torque of the clutch/brake is as follows:

$$0.75 \times \frac{2}{2.5} = 0.6\ (KW)\ ...Pa$$ (參照左圖) (Reference Fig. left)

由圖例0.6KW與1000 r. p. m. 的交點，選用型號M20離合器
By the cross point of 0.6KW and 1,000 r. p. m. as indicated in the chart, the desired model should be M20 clutch.

例二、
馬達額定出力7.5KW的感應馬達，使用於低慣性、低頻度之變動負荷，離合器設計迴轉數為5,500 r. p.m.，離合器／制動額定動轉矩計算如下：

Example 2:
An induction motor with rated horsepower of 0.75W under variable load of low inertia and low frequency and revolution of the clutch is 5,500 r.p.m., computation of the rated dynamic torque of the clutch/brake is as follows:

$$7.5 \times \frac{2}{2.5} = 6\ (KW)\ ...Pb$$ (參照左圖) (Reference Fig. left)

由圖例6KW與5,500 r. p. m的交點，超出選用範圍，為不正確之設計。
By the cross point of 0.6KW and 5,500 r. p. m. as indicated in the chart, the desired range is selected and we note that the design is not correct.

C

乾式單板電磁離合器 制動器的優點：

- 操作性能好
- 可靠性高
- 靈敏度高
- 結構簡單、經濟

ADVANTAGE OF DRY SINGLE PANEL ELECTROMAGNETIC CLUTCH, BRAKE

- Excellent performance
- High reliability
- High precision
- Simple structure and compact size

電磁離合器 制動器的基本使用方法：

連接與切離動作
驅動部位與起動部位之間安裝離合器、則不須停止驅動處、起動處會依必要反應做連接與切離的動作

保持制動
為了維持於慣性負荷、緊急狀況、作業途中時的機器中斷而使用制動器

變速
作業途中時有相互轉換速度的情形、此時使用離合器、則不須關閉驅動處即可變速

正反轉
負荷點的正反轉切換時、配合離合器使用則驅動處只要順向回轉即可

高頻運轉
在快速循環中的斷續運轉、反覆利用馬達上的 ON 、OFF 所提供的頻度有限、因此使用離合制動器、使之迅速反應、高精度的制動

位置推算
停留於測定位置或定量的傳送都須仰賴高精度定位裝置、使用離合制動器便能達到定位或定量功能

寸動
機械開始作動與位置接合時、只須以離合器瞬時作動即可

緩衝起動、制動
減少對負荷的衝擊之起動、停止，可調節轉速使用但如發熱過大、應把滑差的時間縮短

BASIC USE METHOD FOR ELECTROMAGNETIC CLUTCH, BRAKE

Connection and disconnection
To install clutch between driving location and starting location, there is no need to stop the driving and the starting point will be connection and disconnection just in accordance with necessary reaction.

Keep brake in action
Brake is used to maintain inertia load, or in case of emergency or abrupt stop during operation.

Speed change
During operation there are times that requires change of speed where the clutch comes to play. Transmission can then be made without turning off the driving point.

Reciprocal turn
Reciprocal turn switchover of the load point may be made with the use of the clutch by turning the driving point clockwise.

High frequency operation
In a fast cyclic intermittent run of the clutch brake, use the frequency as shown on ON, OFF of the motor repeatedly to achieve rapid reaction and high precision brake.

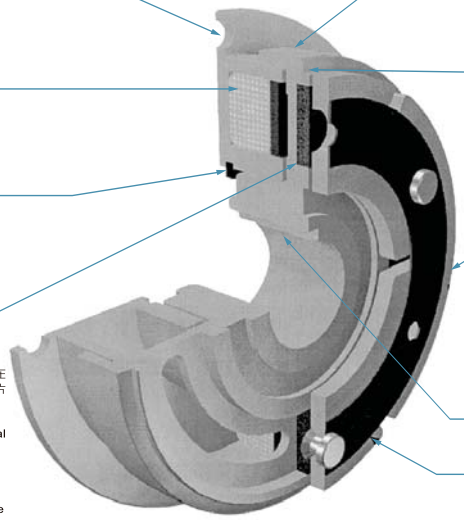
Position reckoning
Stop in a setting-out position or quantitative transmission all requires high precision positioning device. Use of the clutch brake can achieve this purpose.

Short movement
When machinery begins to move and connect the position, all needed is an instant action of the clutch.

Slow start and brake
Can be used to adjust the speed to reduce the impact upon the load starting or stopping. If it is overheating, shorten the time for the slipping difference.

B

離合器構造
Structure of Clutch



磁軛
Magnetic yoke core
內裝線圈，採用法蘭式固定式方式
With built-in coil by fixed flange method

線圈
Coil
產生強力之電磁場
To create strong electromagnetic field.

C型扣環槽
C-buckle ring fillister
在安裝時，可扣上 C 型扣環，作為軸承定位用
During installation, snap the C-buckle ring fillister for positioning the bearing.

來令片
Lining plate
高摩擦係數材質固定於轉軛上，在電磁發生時電樞片被吸持時電樞片與其之間可產生大的摩擦轉矩
Material of high friction co-efficient is fixed on the transitional yoke core and, when electromagnetism is generated that absorbs the armature plate, between the transitional yoke core and the armature plate there may generate huge friction torque.

轉軛
Transitional yoke core
經由鍵固定於軸上當磁軛上之磁場形成時，透過電樞的吸引而作動
Fixed on the axle by virtue of key; when magnetic field on the magnetic yoke core is formed, it moves through the attraction of armature.

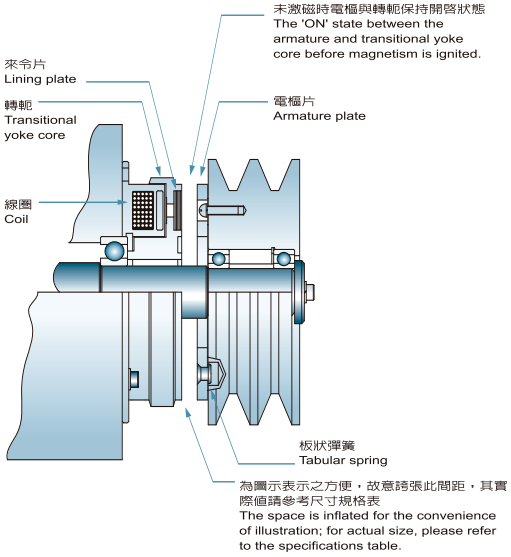
作動間隙
Movement clearance
磁軛與轉子及電樞片之微小空隙，在電磁回路產生或解放，電樞片與轉子間之作動間隙
The movement clearance between the armature plate and rotator generated or released in the electromagnetic loop that allows the tiny clearance between the magnetic yoke core and rotator and the armature plate.

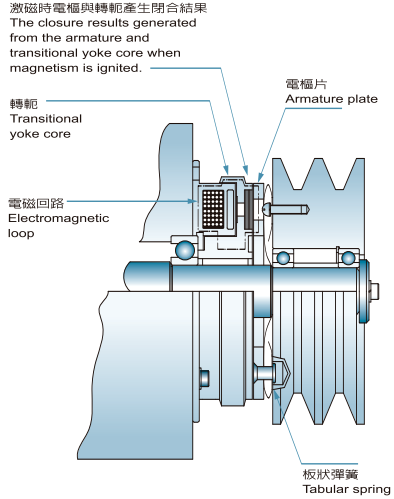
電樞片
Armature plate
線圈通電產生電磁回路被轉子吸引藉由轉子上之來令片傳達轉矩
Once the coil is electrified, it generates electromagnetic loop, which is absorbed by the rotator and, through the lining plate of the rotator, electricity is transmitted to the torque.

鍵槽
Key fillister

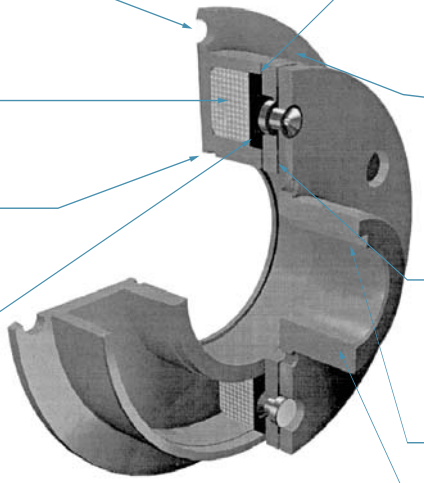
板狀彈簧
Tabular spring
在電流斷電，電磁回路結束時，以其彈性將電樞回歸正常位置結束轉矩之傳動
When electrical current is disrupted and electromagnetic loop is discontinued, the flexibility of the spring will return the armature to its normal position and end the torque movement.

動作原理
Movement theory





制動器構造
Structure of Brake



磁軛
Magnetic yoke core
內裝線圈，採用法蘭式固定式方式
With built-in coil by fixed flange method

線圈
Coil
產生強力之電磁場
To create strong electromagnetic field

C型扣環槽
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在安裝時，可扣上 C 型扣環，作為軸承定位用
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Lining plate
高摩擦係數材質固定於磁軛上，在電磁發生時電樞片被吸持時電樞片與其之間可產生大的摩擦轉矩
Material of high friction co-efficient is fixed on the transitional yoke core and, when electromagnetism is generated that absorbs the armature plate, between the transitional yoke core and the armature plate there may generate huge friction torque.

電樞片
Armature plate
線圈通電產生電磁回路被磁軛吸引藉由磁軛上之來令片傳達轉矩
Once the coil is electrified, it generates electromagnetic loop, which is absorbed by the magnetic yoke core and, through the lining plate of the magnetic yoke core, electricity is transmitted to the torque.

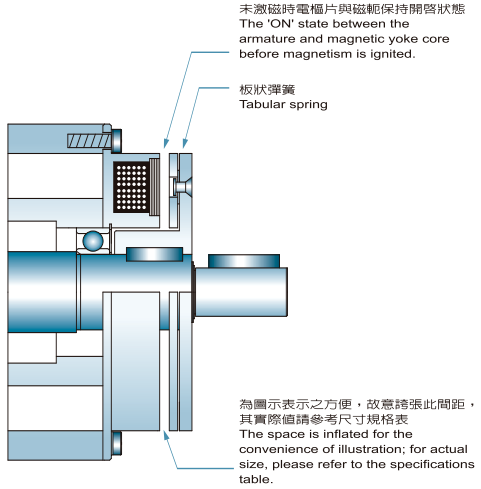
作動間隙
Movement clearance
磁軛與電樞片之微小空隙，在電磁回路激磁或消磁，電樞片與磁軛間之作動間隙
The movement clearance between the armature plate and magnetic yoke core ignited or de-ignited in the electromagnetic loop that allows the tiny clearance between the magnetic yoke core and armature plate.

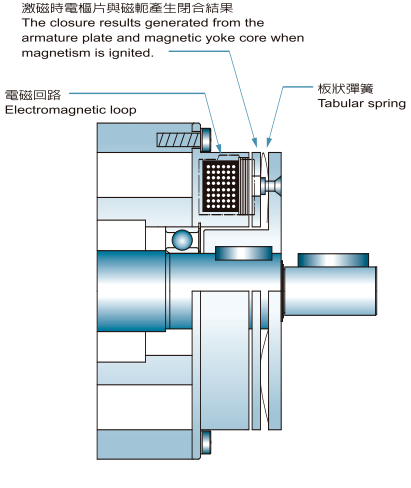
板狀彈簧
Tabular spring
在電流斷電，電磁回路結束時，以其彈性將電樞片回歸正常位置結束轉矩之傳動
When electrical current is disrupted and electromagnetic loop is discontinued, the flexibility of the spring will return the armature to its normal position and end the torque movement.

鍵槽
Key fillister

導座
Guide seat
經由鍵固定於軸上當磁軛上之磁場形成時，透過電樞的吸引而作動
Fixed on the axle by virtue of key; when magnetic field on the magnetic yoke core is formed, it moves through the attraction of armature.

動作原理
Movement theory





簡易計算 － 選用法
Simplified computation for selection

選用法所依據的準則如下：
The standard rules for selection are as follows:

準則（一）：
Rule 1:
Td需大於離合器之最大動摩擦轉矩
Td must be bigger than the maximum dynamic friction torque

於連結時
Under connection

準則（二）：
Rule 2:
Td需大於離合器之最大靜摩擦轉矩
Td must be bigger than the maximum static friction torque

於連結後
After connection

準則（三）：
Rule 3:
n 不得大於容許最高迴轉數
n must not be bigger than the maximum allowable number of revolutions

以“簡易計算–選用法”作為離合器／制動器轉矩選定之參考
Use the simplified computation for selection as a reference for selection of clutch/brake torque.

公式 = Formula

$$T_d\ (kgf\text{-}m) = 973 \cdot \frac{KW}{n} \cdot f = 726 \cdot \frac{Hp}{n} \cdot f = 716 \cdot \frac{PS}{n} \cdot f$$

Td：離合器或制動器額定動轉矩(Kgf-m)
Td： The rated dynamic torque of clutch or brake
KW：馬達出力(KW)
KW：Motor horsepower (KW)
f：負荷系數
f：Load co-efficient

HP：馬達出力(Hp)
HP：Motor horsepower
PS：馬達出力(PS)
PS：Motor horsepower (PS)

例三、
馬達額定出力0.75KW的感應馬達，使用於低慣性、低頻度之變動負荷，離合器迴轉數為1000 r. p. m.，離合器／制動器額定動轉矩計算如下：
Example 3:
An induction motor with rated horsepower of 0.75W under variable load of low inertia and low frequency and revolution of the clutch is 1,000 r.p.m., computation of the rated dynamic torque of the clutch/brake is as follows:

$$T_d = 973 \times \frac{0.75}{1000} \times 2.0 = 1.5\ (kgf\text{-}m)$$

依據準則（一）、（二）選取M20離合器By Rules 1 and 2, we select M20 clutch.

例四、
馬達額定出力7.5KW的感應馬達，使用於低慣性、低頻度之變動負荷，離合器設計迴轉數為5,500 r. p.m.，離合器／制動器額定動轉矩計算如下：
Example 4:
An induction motor with rated horsepower of 0.75W under variable load of low inertia and low frequency and revolution of the clutch is 5,500 r.p.m., computation of the rated dynamic torque of the clutch/brake is as follows:

$$T_d = 973 \times \frac{7.5}{5500} \times 2.0 = 2.65\ (kgf\text{-}m)$$

若依準則（一）、（二）選取M40離合器，但是因為本離合器設計迴轉數5,500 r. p. m大於M40離合器容許最高迴轉數4,000 r. p. m，是為不正確之設計。但若以M20取代，則可符合需求，唯間隙調整壽命及工作量應加以檢討。
By Rules 1 and 2, we should select M40. However, since the designed number of revolutions of the clutch is 5,500 r.p.m., which is bigger than the maximum allowable number of revolutions M40 operates, this is an incorrect design. If replaced by M20, it could meet the requirements, although clearance adjustment and service life and workload must be subject to review.

TECHNICAL DATA
PeeiMoger
技術資料

GD^2 慣性矩計算
Computation of GD2inertia torque

● 實心圓棒之簡易_計算法
Simplified computation for solid pole

$$GD^2 = 3.0827 \times 10^{-12} \times D^4 \cdot L \cdot K$$ 實心圓棒 solid pole

$$GD^2 = 3.0827 \times 10^{-12} \times (D^4 - d^4) \cdot L \cdot K$$ 空心圓棒 Hollow pole

D：圓棒直徑(mm) D：Pole diameter
L：圓棒長度(mm) L：Pole length
K：材料因數 K：Material factor
鋼鐵=1 Steel=1
鋁材=0.34 Aluminum=0.34
鑄鐵=0.93 Cast iron=0.93
銅材=1.13 Cooper=1.13

例一、
直徑109mm，長度100mm的鋁棒，GD^2 為何？
Example:
An aluminum pole with a diameter of 109mm and length of 100mm, what is its GD^2 ?

簡算法：
Simplified computation method:

$$GD^2 = 3.0827 \times 10^{-12} \times D^4 \cdot L \cdot K$$
$$= 3.0827 \times 10^{-12} \times 109^4 \times 100 \times 0.34 = 0.014795\ (kgf\text{-}m^2)$$

例二、
內徑100mm，外徑200mm，長度100mm的空心鋼鐵圓棒，GD^2 為何？
Example:
A hollow steel oscillation pole with an internal diameter of 100mm and outer diameter of 200 mm and length of 100mm, what is its GD^2 ?

簡算法：
Simplified computation method:

$$GD^2 = 3.0827 \times 10^{-12} \times (D^4 - d^4)$$
$$= 3.0827 \times 10^{-12} \times (200^4 - 100^4) \times 100 \times 1 = 0.4624\ (kgf\text{-}m^2)$$

GD^2 公式
GD2formula

● 迴轉體的GD^2
Gyro-rotor's GD^2

$$GD^2 = \frac{W \cdot D^2}{2 \times 10^6}\ (kgf\text{-}m^2) \qquad W = \frac{\pi D^2}{4 \times 10^6} \cdot L \cdot \gamma\ (kgw)$$ 實心圓柱體 Solid circular column

D：圓柱體的直徑或外徑(mm) D：Diameter or outer diameter of solid circular column
γ：材料比重 γ：Material proportion
鋼鐵=7.85 Steel=7.85
鋁材=2.7 Aluminum=2.7
鑄鐵=7.25 Cast iron=7.25
銅材=8.9 Cooper=8.9

$$GD^2 = \frac{W(D^2 + d^2)}{2 \times 10^6}\ (kgf\text{-}m^2) \qquad W = \frac{(D^2 - d^2)}{4 \times 10^6} \cdot L \cdot \gamma\ (kgw)$$ 空心圓柱體 Hollow circular column

d：空心圓柱體的內徑(mm)
d：Internal diameter of hollow circular column

● 質量慣性矩（I）與重量慣性矩(GD^2)換算
Conversion of quality solid moment (I) and weight inertia moment (GD^2) :

$$GD^2 = 4gI_x = 39.24I_x$$

g = 重力加速度 9.81 (m/sec^2)
g = gravity plus velocity 9.81 (m/sec^2)
I = 質量慣性矩 ($kgf\text{-}m\text{-}sec^2$)
I = weight inertia moment ($kgf\text{-}m\text{-}sec^2$)

● 水平 / 重直運動體
Level/vertical motion body

$$GD^2 = W \cdot \frac{D^2}{10^6}\ (kgf\text{-}m^2)$$

C

TECHNICAL DATA
PeeiMoger
技術資料

機型選用
Selection of Machine Models

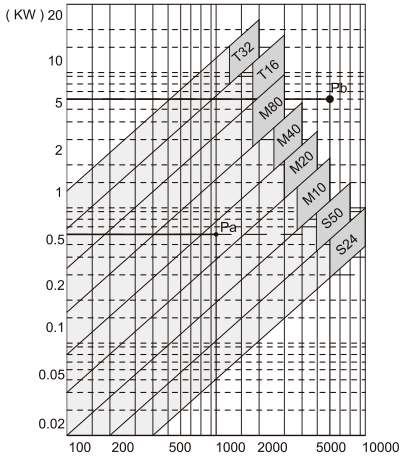
在一般的使用環境下離合器與制動器的選用是一件單純簡易的工作。為了能迅速的找到所適用的型式，請善用右邊之型式選定圖。圖中淺顏色部份為正常使用範圍，在深顏色部份就必須注意工作量，散熱能力及摩耗量。

In normal condition, selection of clutch and brake is a very simple and easy task. In order to select the desired ones, please consult the selection chart on the right side. Light color in the chart shows normal use range while dark color indicates attention must be paid to the workload, heat dissipation capability and attribution.

離合器／制動器選定之負荷係數f
Load Co-efficient f of Clutch/brake

負荷型態 Load Type	機械種類 Type of Machinery	負荷係數f Load Co-efficient f
定負荷 Fixed load 低慣性 Low inertia 低頻度 Low frequency	小型工作母機、小型紡織機、小型高速幫浦、小型木工機器、事務機器 Small machine tool, small textile machinery, mini-high speed pump, small carpenter machine, business machine.	1.5
變動負荷 Variable load 低慣性 Low inertia 低頻度 Low frequency	中型工作母機、小型沖床、木工機器、絞盤、小型幫浦、紡織機、空氣壓縮機、送風機 Medium machine tool,mini-lathe, carpenter machinery, capstan, mini-pump, textile machinery, air compressor, draught blower	2.0
變動負荷 高慣性 High inertia 低頻度 Low frequency	工作母機、中型沖床、紡織機、印刷機、包裝機、輸送機、製藥機器、吊車、攪拌機、攻牙機 Machine tool, medium lathe, textile machinery, packaging machine, transmission machinery, pharmaceutical machinery, crane, mixer, Tapping Machine	2.5
重負荷 Heavy load 高慣性 High inertia 高頻度 High frequency	大型沖床、大型銑床、壓延機、造紙機、其他大型工作母機 Giant lathe, giant milling machine, rolling machine, paper machine, other giant machine tool.	3.5

型式選定圖
Selection Chart



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Example 1:

An induction motor with rated horsepower of 0.75W under variable load of low inertia and low frequency and revolution of the clutch is 1,000 r.p.m., computation of the rated dynamic torque of the clutch/brake is as follows:

$$0.75 \times \frac{2}{2.5} = 0.6\ (KW)\ ...Pa$$ (參照左圖) (Reference Fig. left)

由圖例0.6KW與1000 r. p. m. 的交點，選用型號M20離合器

By the cross point of 0.6KW and 1,000 r. p. m. as indicated in the chart, the desired model should be M20 clutch.

例二、

馬達額定出力7.5KW的感應馬達，使用於低慣性、低頻度之變動負荷，離合器設計迴轉數為5,500 r. p.m.，離合器／制動額定動轉矩計算如下：

Example 2:

An induction motor with rated horsepower of 0.75W under variable load of low inertia and low frequency and revolution of the clutch is 5,500 r.p.m., computation of the rated dynamic torque of the clutch/brake is as follows:

$$7.5 \times \frac{2}{2.5} = 6\ (KW)\ ...Pb$$ (參照左圖) (Reference Fig. left)

由圖例6KW與5,500 r. p. m的交點，超出選用範圍，為不正確之設計。

By the cross point of 0.6KW and 5,500 r. p. m. as indicated in the chart, the desired range is selected and we note that the design is not correct.

C

簡易計算 － 選用法
Simplified computation for selection

選用法所依據的準則如下：
The standard rules for selection are as follows:

準則（一）：
Rule 1:
Td需大於離合器之最大動摩擦轉矩
Td must be bigger than the maximum dynamic friction torque

於連結時
Under connection

準則（二）：
Rule 2:
Td需大於離合器之最大靜摩擦轉矩
Td must be bigger than the maximum static friction torque

於連結後
After connection

準則（三）：
Rule 3:
n 不得大於容許最高迴轉數
n must not be bigger than the maximum allowable number of revolutions

以“簡易計算–選用法”作為離合器／制動器轉矩選定之參考
Use the simplified computation for selection as a reference for selection of clutch/brake torque.

公式 = Formula

$$T_d\ (kgf\text{-}m) = 973 \cdot \frac{KW}{n} \cdot f = 726 \cdot \frac{Hp}{n} \cdot f = 716 \cdot \frac{PS}{n} \cdot f$$

Td：離合器或制動器額定動轉矩(Kgf-m)
Td： The rated dynamic torque of clutch or brake
KW：馬達出力(KW)
KW：Motor horsepower (KW)
f：負荷系數
f：Load co-efficient

HP：馬達出力(Hp)
HP：Motor horsepower
PS：馬達出力(PS)
PS：Motor horsepower (PS)

例三、
馬達額定出力0.75KW的感應馬達，使用於低慣性、低頻度之變動負荷，離合器迴轉數為1000 r. p. m.，離合器／制動器額定動轉矩計算如下：
Example 3:
An induction motor with rated horsepower of 0.75W under variable load of low inertia and low frequency and revolution of the clutch is 1,000 r.p.m., computation of the rated dynamic torque of the clutch/brake is as follows:

$$T_d = 973 \times \frac{0.75}{1000} \times 2.0 = 1.5\ (kgf\text{-}m)$$

依據準則（一）、（二）選取M20離合器By Rules 1 and 2, we select M20 clutch.

例四、
馬達額定出力7.5KW的感應馬達，使用於低慣性、低頻度之變動負荷，離合器設計迴轉數為5,500 r. p.m.，離合器／制動器額定動轉矩計算如下：
Example 4:
An induction motor with rated horsepower of 0.75W under variable load of low inertia and low frequency and revolution of the clutch is 5,500 r.p.m., computation of the rated dynamic torque of the clutch/brake is as follows:

$$T_d = 973 \times \frac{7.5}{5500} \times 2.0 = 2.65\ (kgf\text{-}m)$$

若依準則（一）、（二）選取M40離合器，但是因為本離合器設計迴轉數5,500 r. p. m大於M40離合器容許最高迴轉數4,000 r. p. m，是為不正確之設計。但若以M20取代，則可符合需求，唯間隙調整壽命及工作量應加以檢討。
By Rules 1 and 2, we should select M40. However, since the designed number of revolutions of the clutch is 5,500 r.p.m., which is bigger than the maximum allowable number of revolutions M40 operates, this is an incorrect design. If replaced by M20, it could meet the requirements, although clearance adjustment and service life and workload must be subject to review.

TECHNICAL DATA
PeeiMoger
技術資料

GD^2 慣性矩計算
Computation of GD2inertia torque

● 實心圓棒之簡易_計算法
Simplified computation for solid pole

$$GD^2 = 3.0827 \times 10^{-12} \times D^4 \cdot L \cdot K$$ 實心圓棒 solid pole

$$GD^2 = 3.0827 \times 10^{-12} \times (D^4 - d^4) \cdot L \cdot K$$ 空心圓棒 Hollow pole

D：圓棒直徑(mm) D：Pole diameter
L：圓棒長度(mm) L：Pole length
K：材料因數 K：Material factor
鋼鐵=1 Steel=1
鋁材=0.34 Aluminum=0.34
鑄鐵=0.93 Cast iron=0.93
銅材=1.13 Cooper=1.13

例一、
直徑109mm，長度100mm的鋁棒，GD^2 為何？
Example:
An aluminum pole with a diameter of 109mm and length of 100mm, what is its GD^2 ?

簡算法：
Simplified computation method:

$$GD^2 = 3.0827 \times 10^{-12} \times D^4 \cdot L \cdot K$$
$$= 3.0827 \times 10^{-12} \times 109^4 \times 100 \times 0.34 = 0.014795\ (kgf\text{-}m^2)$$

例二、
內徑100mm，外徑200mm，長度100mm的空心鋼鐵圓棒，GD^2 為何？
Example:
A hollow steel oscillation pole with an internal diameter of 100mm and outer diameter of 200 mm and length of 100mm, what is its GD^2 ?

簡算法：
Simplified computation method:

$$GD^2 = 3.0827 \times 10^{-12} \times (D^4 - d^4)$$
$$= 3.0827 \times 10^{-12} \times (200^4 - 100^4) \times 100 \times 1 = 0.4624\ (kgf\text{-}m^2)$$

GD^2 公式
GD2formula

● 迴轉體的GD^2
Gyro-rotor's GD^2

$$GD^2 = \frac{W \cdot D^2}{2 \times 10^6}\ (kgf\text{-}m^2) \qquad W = \frac{\pi D^2}{4 \times 10^6} \cdot L \cdot \gamma\ (kgw)$$ 實心圓柱體 Solid circular column

D：圓柱體的直徑或外徑(mm) D：Diameter or outer diameter of solid circular column
γ：材料比重 γ：Material proportion
鋼鐵=7.85 Steel=7.85
鋁材=2.7 Aluminum=2.7
鑄鐵=7.25 Cast iron=7.25
銅材=8.9 Cooper=8.9

$$GD^2 = \frac{W(D^2 + d^2)}{2 \times 10^6}\ (kgf\text{-}m^2) \qquad W = \frac{(D^2 - d^2)}{4 \times 10^6} \cdot L \cdot \gamma\ (kgw)$$ 空心圓柱體 Hollow circular column

d：空心圓柱體的內徑(mm)
d：Internal diameter of hollow circular column

● 質量慣性矩（I）與重量慣性矩(GD^2)換算
Conversion of quality solid moment (I) and weight inertia moment (GD^2) :

$$GD^2 = 4gI_x = 39.24I_x$$

g = 重力加速度 9.81 (m/sec^2)
g = gravity plus velocity 9.81 (m/sec^2)
I = 質量慣性矩 ($kgf\text{-}m\text{-}sec^2$)
I = weight inertia moment ($kgf\text{-}m\text{-}sec^2$)

● 水平 / 重直運動體
Level/vertical motion body

$$GD^2 = W \cdot \frac{D^2}{10^6}\ (kgf\text{-}m^2)$$

C

離合器產品規範
Clutch - product specifications

離 合 器 / Clutch							
型號 Model	轉矩 Torque (kgfm)	電壓 Voltage(DC-V)	線圈 Coil			保護素子 Protective Prime Factor	最高回轉數 Maximum Number of Revolutions(r/min)
			容量 Capacity(W)	電流 Current(A)	電阻 Resistance(Ω)		
C-S24-F □□-□□	0.24	24	10	0.42	58	TNR9G820K	10000
C-S24-R □□-□□							500
C-S50-F □□-□□	0.50		11	0.46	52	TNR9G820K	8000
C-S50-R □□-□□							
C-M10-F □□-□□	1.0		15	0.63	38	TNR9G820K	6000
C-M10-R □□-□□							
C-M20-F □□-□□	2.0		20	0.83	29	TNR9G820K	5000
C-M20-R □□-□□							
C-M40-F □□-□□	4.0		25	1.04	23	TNR9G820K	4000
C-M40-R □□-□□							
C-M80-F □□-□□	8.0		35	1.46	16	TNR9G820K	3000
C-M80-R □□-□□							
C-T16-F □□-□□	16		45	1.88	13	TNR9G820K	2500

制動器產品規範
Brake - Production Specifications

制 動 器 / Brake							
型號 Model	轉矩 Torque (kgfm)	電壓 Voltage(DC-V)	線圈 Coil			保護素子 Protective Prime Factor	最高回轉數 Maximum Number of Revolutions(r/min)
			容量 Capacity(W)	電流 Current(A)	電阻 Resistance(Ω)		
B-S24-F □□-□□	0.24	24	10	0.42	58	TNR9G820K	10000
B-S50-F □□-□□	0.50		11	0.46	52	TNR9G820K	8000
B-M10-F □□-□□	1.0		15	0.63	38	TNR9G820K	6000
B-M20-F □□-□□	2.0		20	0.83	29	TNR9G820K	5000
B-M40-F □□-□□	4.0		25	1.04	23	TNR9G820K	4000
B-M80-F □□-□□	8.0		35	1.46	16	TNR9G820K	3000
B-T16-F □□-□□	16		45	1.88	13	TNR9G820K	2500

重量/GD²
Weight / GD²

離合器 / Clutch				離 合 器 (軸 承 型) / Clutch (Bearing Type)			
型號 Model	重量 Weight (kgf)	GD² (kgf-cm²)		型號 Model	重量 Weight (kgf)	GD² (kgf-cm²)	
		轉軛 Transitional Yoke Core	電樞片 Armature Plate			轉軛 Transitional Yoke Core	電樞片 Armature Plate
C-S24-F01	0.310	1.26	3.63×10^{-1}	C-S24-R01	0.321	1.16	3.63×10^{-1}
-F02	0.325		5.50×10^{-1}	-R02	0.336		5.50×10^{-1}
-F04	0.335		5.50×10^{-1}	-R04	0.346		5.50×10^{-1}
C-S50-F01	0.460	2.94	1.69	C-S50-R01	0.500	2.94	1.69
-F02	0.500		2.41	-R02	0.540		2.41
-F04	0.660		4.19	-R04	0.700		4.19
C-M10-F01	0.830	8.94	4.72	C-M10-R01	0.870	8.94	4.72
-F02	0.910		6.83	-R02	0.950		6.83
-F04	1.190		1.20 x 10	-R04	1.230		1.20 x 10
C-M20-F01	1.500	2.71 x 10	1.91 x 10	C-M20-R01	1.570	2.71 x 10	1.91 x 10
-F02	1.660		2.65 x 10	-R02	1.730		2.65 x 10
-F04	2.110		3.78 x 10	-R04	2.180		3.78 x 10
C-M40-F01	2.760	8.56 x 10	5.22 x 10	C-M40-R01	2.890	8.56 x 10	5.22 x 10
-F02	3.050		7.22 x 10	-R02	3.180		7.22 x 10
-F04	3.800		1.10×10^{2}	-R04	3.930		1.10×10^{2}
C-M80-F01	5.100	2.52×10^{2}	1.92×10^{2}	C-M80-R01	5.300	2.52×10^{2}	1.92×10^{2}
-F02	5.400		2.54×10^{2}	-R02	5.600		2.54×10^{2}
-F04	6.900		3.62×10^{2}	-R04	7.100		3.62×10^{2}
C-T16-F01	9.300	7.70×10^{2}	5.48×10^{2}	C-T16-R01	11.20	7.70×10^{2}	5.48×10^{2}
-F02	10.50		7.59×10^{2}	-R02	12.40		7.59×10^{2}
-F04	13.00		1.06×10^{3}	-R04	14.90		1.06×10^{3}

制 動 器 / Brake			制 動 器 / Brake		
型號 Model	重量 Weight (kgf)	GD² (kgf-cm²) 電樞片 Armature Plate	型號 Model	重量 Weight (kgf)	GD² (kgf-cm²) 電樞片 Armature Plate
B-S24-F01	0.200	3.63×10^{-1}	B-M40-F01	1.680	5.22 x 10
-F02	0.215	5.50×10^{-1}	-F02	1.970	7.22 x 10
-F03	0.215	5.50×10^{-1}	-F03	1.970	7.22 x 10
B-S50-F01	0.280	1.69	B-M80-F01	3.150	1.92×10^{2}
-F02	0.320	2.41	-F02	3.450	2.54×10^{2}
-F03	0.320	2.41	-F03	3.450	2.54×10^{2}
B-M10-F01	0.500	4.72	B-T16-F01	5.900	5.48×10^{2}
-F02	0.580	6.83	-F02	7.100	7.59×10^{2}
-F03	0.580	6.83	-F03	7.100	7.59×10^{2}
B-M20-F01	0.910	1.91 x 10			
-F02	1.070	2.65 x 10			
-F03	1.070	2.65 x 10			

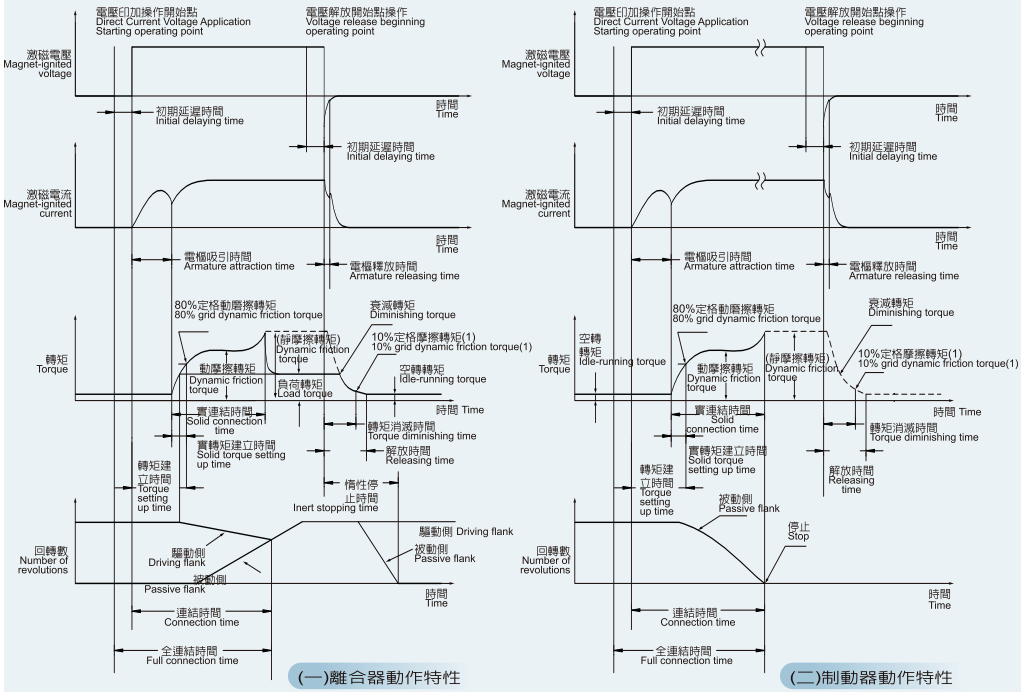
THE MOTION CHARACTERISTICS OF CLUTCH, BRAKE

PeeiMoger

離合器、制動器的動作特性

電磁離合器、制動器功能，除扭矩傳遞、制動以外，其電樞片吸引釋放時間，是否能在規定時間內完成機械動作更形重要。
Except transmission and braking, the function of electromagnetic clutch and brake seems more important hinging on whether the time it takes to attract and release the armature plate in time to complete the mechanic movement.

圖(一)(二)為激磁動作形電磁離合器、制動器，電壓、電流波形。
Fig. 1 and Fig. 2 show magnet-motion electromagnetic clutch, brake, voltage and current wave.



測試電路控制方式，是利用電磁繼電器接點控制直流側，使其產生ON-OFF動作。直流電源採用DC24V，線圈並接保護素子(TNR9G820K)吸收突波電壓，保護接點壽命及避免線圈絕緣被破壞。
The method to test circuit control is to use electromagnetic relay junction to control the direct current flank, making it create ON-OFF movement. The power source of direct current uses DC24V and coil connected with protective prime factor (TNR9G820K) to attract abrupt voltage so as to protect the service life of the coil insulation.

離合器、制動器之電樞片吸引釋放時間
Attraction and Releasing Time of Armature Plate in Clutch and Brake

	轉矩代碼 Torque Code	動摩擦轉矩 Torque in Dynamic Friction(kgf-m)(Td)	激磁電阻 Magnet-ignited Resistor(Ω)	線圈電流 Coil Current(A)	電樞吸引時間 Armature attraction time(ms)	電樞釋放時間 Armature releasing time(ms)	調整間隙 Adjustment of clearance(mm)
離合器 Clutch	S24	0.24	57.6	0.42	10.0	13.0	0.2±0.05
	S50	0.50	52.4	0.46	13.6	14.4	0.2±0.05
	M10	1.00	38.4	0.63	21.0	15.2	0.2±0.05
	M20	2.00	28.8	0.83	18.4	58.0	0.2±0.05
	M40	4.00	23.0	1.04	36.0	70.0	0.3±0.05
	M80	8.00	16.5	1.46	80.0	98.0	0.3±0.05
	T16	16.0	12.8	1.88	115	210	0.5±0.05
制動器 Brake	S24	0.24	57.6	0.42	8.0	10.0	0.2±0.05
	S50	0.50	52.4	0.46	10.4	11	0.2±0.05
	M10	1.00	38.4	0.63	12.8	16	0.2±0.05
	M20	2.00	28.8	0.83	13.2	26	0.2±0.05
	M40	4.00	23.0	1.04	24.0	28.0	0.3±0.05
	M80	8.00	16.5	1.46	44.0	62.0	0.3±0.05
	T16	16.0	12.8	1.88	85.0	125	0.5±0.05

BASIC CONTROL CIRCUIT

PeeiMoger

基本控制電路

直流電源
Direct Current (DC) power source

離合器、制動器直流電源一般採用交流電路整流，可分為半波整流及全波整流。
The DC power source of clutch and brake generally uses alternating current (AC) circuit commutation, which is classified as half-wave commutation and full-wave commutation.

1.半波整流電路
Half-wave commutation circuit

半波整流電路是使用一個矽二極體當做整流子，電路構造較簡單且價格便宜，但因連波因素較大，所以電流波形變動大，相對扭矩也變動大，較不切實用。
Half-wave commutation circuit uses diode as commutator, the structure of which is rather simple and the price is cheap. However, due to the ripple factor, the current wave tends to vary greatly, causing rather huge variation relatively in torque. That makes it not practical in use.

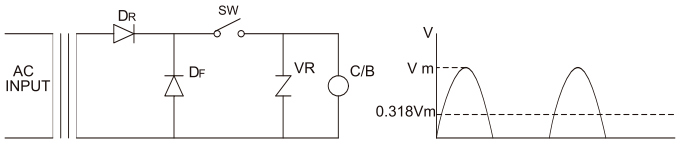


圖1 圖2

V_{DC}=0.318Vm
= 0.318 √2 Vrms = 0.45Vrms

Vm= 交流電壓最大峰值
Vm= maximum AC voltage peak value

Vrms= 交流電壓均方根值(Vm=√2 Vrms)
Vrms= AC voltage root-mean-square value

2.全波整流電路
Full-wave commutation circuit

一般離合器、制動器直流電源供應都使用此方式，是利用變壓器降壓後做橋式整流，而達到連波因素較小較平滑電壓波形，所以電流波形變動小，扭矩也較穩定。
Generally speaking, clutch and brake use this manner in their DC power supply. In practice, it uses transformer to depress the voltage and make bridge commutation in order to achieve rather smooth voltage wave to circumvent the ripple factor. Consequently, variation of current wave is nominal and torque can be comparatively steady.

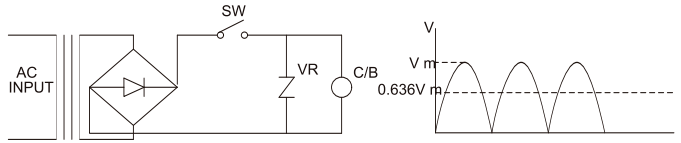


圖3 圖4

V_{DC}=0.636Vm
= 0.636 √2 Vrms = 0.90Vrms

Vm=交流電壓最大峰值
Vm= maximum AC voltage peak value

Vrms=交流電壓均方根值(Vm=√2 Vrms)
Vrms= AC voltage root-mean-square value

電壓調節控制
Voltage regulation and control

離合器、制動器在有些場合須要控制扭矩大小，可使用電壓調節方式控制。
On some occasions, torque of clutch and brake needs to be regulated and controlled and the method used relies on voltage regulation and control.

1.固定電阻式或可變電阻式
Fixed resistor or variable resistor method

固定電阻式是數個固定電阻與離合器、制動器線圈串聯，利用切換開關控制不同電阻值之壓降而達到調整電壓之方法。(圖5)可變電阻式是利用可變電阻VR，調整不同電阻值而達到變動連續電壓。圖6)
The fixed resistor method is several fixed resistors in series with coil of clutch, brake, using the switch to control voltage depression from different resistor values and thereby achieve the goal of voltage adjustment. Fig. 5 show how variable resistor (VR) at work, adjusting different values to reach the goal of varying continuous voltage.Fig. 6

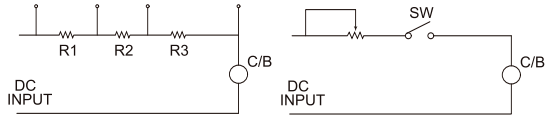


圖5 圖6

2.可變電壓調整器方式
Variable voltage regulator method

是利用自藕變壓器裝置在變壓器一次側，來調整電壓，使變壓器二次側電壓可由零開始調整起。(圖7)
The method installs auto-transformer on the primary transformer flank to regulate voltage, making the second transformer flank to adjust from zero (see Fig.7).

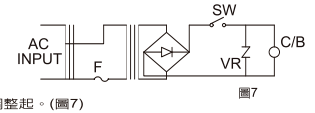


圖7

3.相位控制
SCR phase control

是利用相位控制回路(如UJT等)產生觸發脈波來控制SCR輸出電壓相位角度。(圖8)(圖9)
The method uses phase to control loops such as UJT to create trigger pulse wave in order to control the transmitted phase angle of voltage.

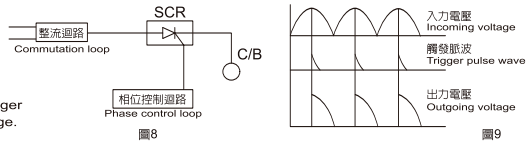


圖8 圖9

電流調整控制
Current regulation and control

是利用晶體控制回路可以得到較穩定扭力輸出。(圖10)
Crystal is used to control the loop to have steady torque output.

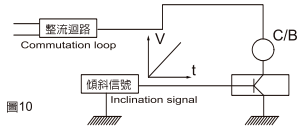


圖10

突波吸收回路
Abrupt wave absorption route

離合器、制動器在ON-OFF會有突波電壓產生，突波電壓大約為正常電壓數拾倍以上，此突波電壓會造成電磁繼電器接點磨耗，若用半導體元件會超過尖峰倒壓而破損，如果長時間使用上述情形線圈絕緣很容易破壞，因此離合器、制動器在ON-OFF時須加置突波吸收器，一般突波吸收回路有下列幾種方式。
Either the clutch or brake is ON or OFF, there tends to occur abrupt wave voltage at times, which is several times higher than normal voltage. This abrupt wave voltage could cause attrition of the electromagnetic relay junction. If semi-conductor component is used, it would exceed the peak inverting voltage and result in damage. For a long period of use as described above, the insulation coil can be easily damaged. Therefore, there should be an added device of abrupt wave absorber installed at the position of ON-OFF. In general abrupt wave absorption can be in the following manners:

1.非線性素子
Non-linear primary factor

電壓低時電阻大，電壓高時電阻急速減小，不會消耗電力吸收突波電壓效果良好，並對釋放時間無不良影響，目前北譯均採用此種突波吸收器。(圖11)
When voltage is low, the resistance is high. On the contrary, when voltage is high, resistance would rapidly lessen. It would not consume much power and the abrupt wave voltage effect is excellent, creating no ill effect upon the releasing time. At PEI-EI, we use this sort of abrupt wave absorber (Fig.11).

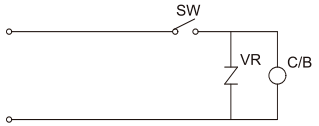


圖11

2.二極體方式
Diode method

此方式常用於電晶體開關，做突波吸收之用，因為理想二極體電阻值趨近於零，所以突波吸收效果最好，但唯其使用時應特別注意，釋放時間長，會產生干涉現象，造成磨耗加快。(圖12)
This method is usually seen used in the switch of transistor as absorption of abrupt wave. The ideal diode resistor value is proximate to zero, which results in the best absorption effect of abrupt wave. But, it must be noted that in actual use, there will be disturbances because of the long releasing time that quickens attrition. (Fig.12)

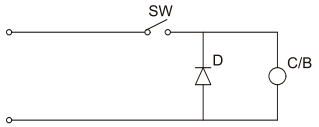


圖12

3.電阻、二極體方式
Resistor and diode method

是採用約為線圈電阻值10倍的電阻與離合器、制動器並聯使用，但因分壓結果會損失一部分電力，所以亦有採用電阻加二極體，以補償電力損失部份。(圖13)
The method uses the resistor approximately 10 times the coil resistance value in joint use with the clutch or brake. Since division of voltage will result in loss of part of power, some also use resistor plus diode to compensate loss of part of the power (Fig.13).

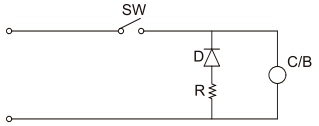


圖13

4.電容器方式
Condenser method

將電容器與線圈電感並聯產生共振，利用此方式選擇適當容量的電容器來吸收逆向電壓並使其釋放時間加快。**大容量離合器、制動器需裝置大容量電容器時需串聯電阻以抑制突入電流。**(圖14)
The method is to induce the condenser coil and create resonance. In actual use, condenser with adequate capacity must be selected so as to absorb the inverting voltage and quicken the releasing time. With large-capacity clutch or brake, there requires installation of string resistors to curb the abrupt intrusion of current (Fig.14).

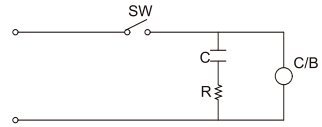


圖14

一般控制電路
General control circuit

圖15 為控制離合器、制動器最基本回路，是由變壓器、整流器、突波吸收器及開關所構成。
圖16 電磁繼電器接點在直流側，所以接點容量應選用標準負荷10倍左右。
Fig.15 Basic loop to control clutch or brake constituted by transformer, commutator, abrupt wave absorber and switch.
Fig.16 As the electromagnetic relay contact is at the direct current flank, the standard load of the contact capacity can be 10 times higher.

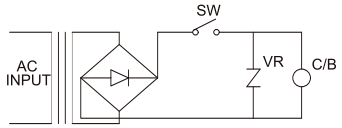


圖15

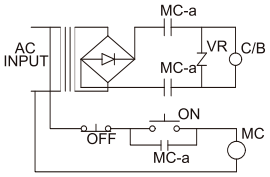


圖16

圖17 電磁繼電器接點在交流側，所以接點容量可選用小容量，但釋放時間較在直流側長。
圖18 此電路常為離合器，制動器組所使用，是以電磁繼電器a、b接點來切換，若均保持離合器、制動器OFF，須加裝開關來控制。
Fig.17 As the electromagnetic relay contact is at the AC flank, the capacity of contactor may use smaller ones, but the releasing time is longer compared to one at the direct current flank.
Fig.18 The circuit is often used by clutch and brake, switching over by electromagnetic condenser a, b contacts to keep the cluth and brake OFF, will need additional switch to control.

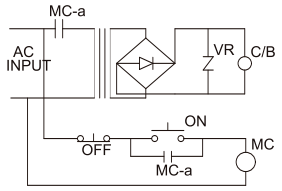


圖17

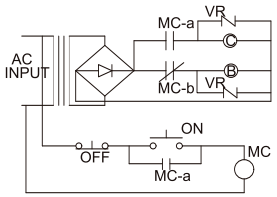


圖18

圖19 此電路為互鎖電路，為防止離合器，制動器動作重疊而導致危險，MC1b、MC2b接點做為MC1、MC2互鎖接點。
Fig.19 The circuit is an off-setting circuit. To prevent overlapping movement of the clutch and brake that causes danger, contacts MC1b, MC2b change to reciprocal interlock MC1 and MC2.

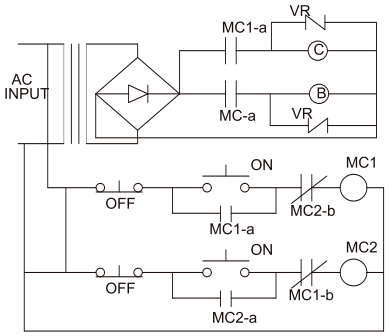


圖19

高速控制回路
High-speed control loop

1.急速激磁回路
Rapid magnet-ignited loop

利用線圈與電阻串聯，可減少充放電時間(T)圖20。
線圈之時間常數 T c = L / R c .....(6 · 1)
回路之時間常數 T = L / (R c + R s) .....(6 · 2)
V c = V s （R c / R s + R c).....分壓法則 Principle for division of voltage
V s = V c （1 + R s / R c) .....(6 · 3)
By the series of coil and resistor may reduce discharging time (T), see Fig. 20 for details. Coil time and loop time both are constant.

由6 · 2式看出Rs值對線圈電阻比例越大則可改善應答性及電流建立時間，但因串聯Rs之故線圈電壓Vc會降低，所以輸入電壓Vs須提高，例如R s =3 R c， V c = 24 V代入6 · 3式 V s = 96 V。
From 6.2, we note that the larger ratio of the Rs value toward coil resistor, the bigger improvement can be made in the response time and setting of current time. Because of Rs series, the coil voltage (Vc) will be reduced. Consequently, input of voltage must be elevated, for instance:
R s =3 R c， V c = 24 V replaced by 6.3 formula where V s = 96 V。

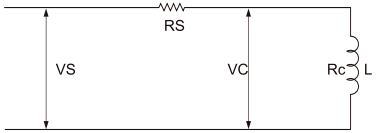


圖20

2.過激磁回路
Anaphylactic magnetic loop

此方式利用電容器充放電特性，提早建立初期電流。但大型離合器、制動器線圈電感較大，電流建立較遲緩，使用此方式較不理想。電容器使用方法有如圖21與線圈串聯，及圖22與線圈並聯。
The method uses the charging and discharging characteristics of condenser to set up initial current at the earliest possible time. This method is not suitable for large clutch and brake as induction of the coil is bigger and is slow in setting up the current. How to use condenser and make parallel connection with the coil is illustrated in Fig. 21.
Fig. 22 in parallel with coil.

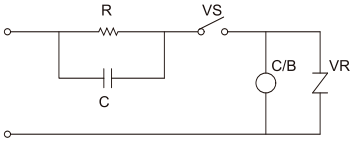


圖21

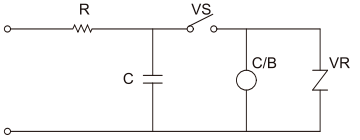


圖22

3.過電壓回路
Overvoltage gyromagnetism

此方式為通電初期，以較高額定之電壓加於線圈，提早建立電流及改善應答性。連續通較高額定之電壓線圈會發熱，所以須利用計時器在一定時間後，恢復原來之額定電壓。圖23
In the initial energizing period, this method adds higher rated voltage to the coil so as to set up the current and improve the response as early as possible. Continuous energizing higher rated voltage can make the voltage line create heat. Therefore, a timer must be used so that after a certain time, the originally rated voltage may be resumed. Fig. 23

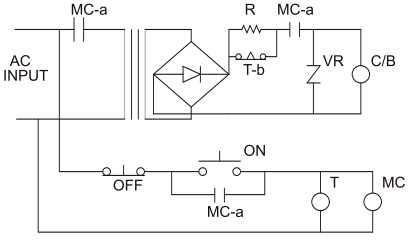


圖23

USE CONDITIONS AND CAUTION WHEN IN USE

PeeiMoger

使用條件與注意事項

電源系統
Power Source System

激磁電壓之正確使用，激磁電壓之標準為DC24V，而在高、低性能上之影響，以不超過 ±10%為原則
Please note the standard magnet-ignited voltage is DC24V while under the influence of high and low performance should not in principle exceed ±10%. This is the correct use of magnet-ignited voltage.

電氣接點保護
Electric contact protection

離合器與制動器 ON-OFF之電氣接點，應以本公司所提供之突波吸收器並聯，以保護控制接點及系統。若以電晶體或固態電驛控制，除需注意離合器與制動器切換干涉狀況，亦應加裝突波吸收裝置，以保護接點。
The electric contact ON-OFF of clutch and brake is recommended connected in parallel using the abrupt wave absorber we provide so that the electric contact and system may be duly protected. If controlled by transistor or solid relay, attention must be given to the switching disturbance of the clutch and brake. However, for better protection, additional installation of the abrupt wave absorber is recommended.

使用環境
Use Environment

- 使用溫度40°C以下室外使用時，要有良好之防護。儘量避免暴露在雨水或腐蝕性較高的氣體下作業。
- When used outdoors under temperature 40°C, excellent protection is needed. Try to avoid operations exposed in rains or to highly erosive gas.
- 於高負荷作業下，應注意通風及冷卻之問題，摩擦面摩擦時，可能會有少許火花發送，於有塵爆或防爆顧慮的場合，不可使用。
- When operating with high load, be careful with ventilation and cooling issues. A spark of fire may ignite when the friction surface is in friction and it is not suitable on occasions when dust may rise or anti-explosion preparation is in progress.

摩擦間隙調整
Friction Clearance Adjustment

來令片與電樞片的間隙，會隨著摩耗的發生而增大，應將間隙調整至“規格間隙”，以免失效。
The clearance between lining plate and armature plate may become bigger with the occurrence of friction. To avoid ineffectiveness, adjust the clearance to the 'specified clearance specifications."

汙染
Pollution

本產品為乾式單板激磁性結構，其傳動靠兩高摩擦係數平面，傳動扭矩。絕對避免水、粉塵、油脂類產品之附著。
This product is of dry single-panel magnet-ignited structure, the driving of which relies on the friction coefficient of the two quotients and driving torque. It is absolutely necessary to avoid water, dust or grease to be attached to the product.

安裝
Installation

離合器制動器為精密之傳動組件，在安裝組配上，請採用適當之工具，並避免不當之外力強行安裝。
Clutch and brake are precision driving components. So, when installed, please use adequate tools and avoid forced foreign installation.

摩擦轉矩
Friction torque

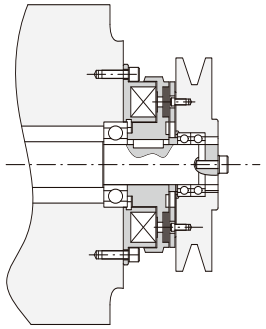
乾式單板電磁離合器與制動器的靜摩擦扭矩，依各機型有別，大約成一定值。但動摩擦係數，會隨使用的轉速(r. p. m.)提高而略成遞減。
The static friction torque of dry single-panel magnet-ignited clutch and brake is not the same, but approximately have a fixed value. However, the dynamic friction co-efficient will slightly reduce progressively with the elevation of the r.p.m. used.
使用初期，由於兩相對應摩擦面尚不十分平滑，初期的摩擦轉矩約為額定靜摩擦轉矩的70%-80%，經使用後自然磨合達額定轉矩，為必經過程。諸如以上的定轉矩使用場合，請洽本公司技術諮詢部門，以利協助設計。
In the initial stage of use when friction of the two phases has not become smooth, the initial friction torque ranges approximately 70% to 80% of the rated value. The process that must go through calls for natural abrasion after use before the rated torque value is reached.

APPLIED MODEL EXAMPLES OF CLUTCH AND BRAKE

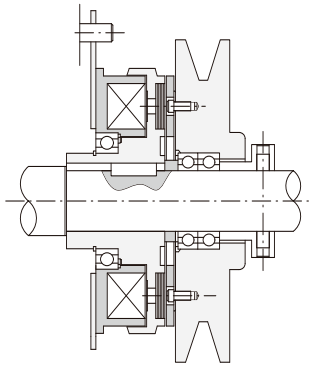
PeeiMoger

離合器制動器應用範例

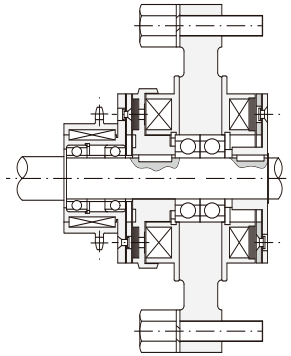
C-F01 應用範例/Applied Model Examples



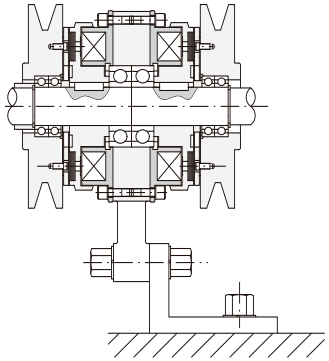
C-R01 應用範例/Applied Model Examples



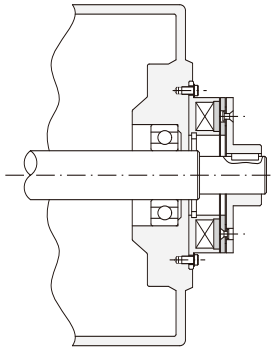
C-F04 & B-F03 應用範例/Applied Model Examples



C-F01 應用範例/Applied Model Examples



B-F02 應用範例/Applied Model Examples



B-F03 應用範例/Applied Model Examples