

# Basic Design and Operation

## 基本結構及動作

- 任何磁粉離合器、剎車器使用Powder（磁性鐵粉）來傳達扭力，因此兼具流體離合器的柔軟性及摩擦離合器連結時的高效率等各項優點。本公司為專業生產各式電磁式離合剎車器的公司，具有豐富的應用經驗及實績，累積了相當多的技術知識，足以因應顧客的各種要求。本公司活用為數眾多的特長所開發出的產品，成為紙類、絲類、電線、各種薄片、膠帶類的長尺物之捲取及取出用促動器等、在張力控制方面不可或缺之物。另外也可做為緩衝啓動、動力吸引之用，同時也適用於防止負載超過的安全裝置（扭力限制器）等。

Chain Tail powder-type clutch and brake units utilize magnetic powder to transmit torque. This offers the advantages of more streamlined and softer clutch operation and greater effectiveness during engagement of clutch friction surfaces.

Chain Tail produces a diverse range of clutches and is widely experienced in their applications.

The company has accumulated extensive technology and know-how and can meet the needs of any client. The many products available are used to control winding machines used in producing paper, fiber, wire and cable and plastic items, and are indispensable parts of any production line.

These units can also be used in low-impact start and drive applications and to prevent overload during operations as torque.

### 1 輕鬆進行大範圍的控制 Easy, wide-ranging controls

激磁電流及傳達扭力的關係大致成一定的比例，傳達扭力可以輕鬆進行極大範圍的控制。

The close correlation between magnetic current and torque makes it easy to control transmitted torque over a very broad range.

### 2 可以做到連續滑動運轉 Enables seamless, continuous operation

藉由磁粉的使用，可以使動作面進行連續滑動，並且不受滑動旋轉速度的影響，時常保持安定的滑動扭力。

The use of magnetic powder makes it possible to maintain continuous operation with no effect on turning speeds, with stable torque levels over long periods.

### 3 可以得到安定的扭力 Steady torque

動作面的形狀、曲折形狀等可以使磁粉一直保持正常的動作，即使電流不斷重複地開和關，極為安定的扭力也可以重新出現。

The work surfaces and the curved shape contribute to proper operation of the magnetic powder, and a steady level of torque is available even when power is repeatedly turned on and off.

## 基本結構及動作 Basic Design and Operation

磁粉離合器的基本結構如圖1所示，主動構件（輸入側）和從動構件（輸出側）配置於同心的圓筒上，中間隔著一條磁粉間隙。此二構件由軸承支撐住，可以自由旋轉。

該磁粉間隙中，放入了透磁率極高的鐵粉（磁性鐵粉），其外圍配置了激磁用的線圈，以利磁束通過。

The basic layout of the powder-type clutch is shown in Figure 1. The primary driver (input side) and the driven element (output side) are located on aligned cylinders and separated by a gap filled with magnetic powder. The two structures are firmly supported by bearings and can turn independently.

The powder space is filled with highly magnetized iron powder, with magnetic coils on the outer rim which achieve fast magnetization.

主動構件在無激磁的狀態下旋轉的話，離心力會將鐵粉附著於主動構件的動作面，主動構件和從動構件就無法產生連結、及鐵粉與動作面的摩擦力會使扭力進行傳達。因此本離合器也可以說是一鐵粉為媒介的摩擦離合器。

另外，該製品將輸出側固定的話，就成了鐵粉剎車器。

When the primary driver turns under non-magnetized conditions, centrifugal force pushes the magnetic powder onto the work surface of the primary driver so that the driver and driven components cannot make contact, and friction between the powder and the driver allows transmission of torque. This type of clutch is also a friction clutch which uses magnetic powder as an interface. In addition, if the output side of the unit is fixed in place it can also act as a powder-type brake.

### 4 無鳴叫音 No chirping

動作面的滯滑現象會發生於摩擦板方式，但是在此不會出現，而且也不會發出連結音，所以運轉相當安靜。

This design avoids the development of slick spots on friction surfaces which can cause squeaks and chirping, resulting in ultra-quiet operation

### 5 熱容量很大 Extra heat capacity

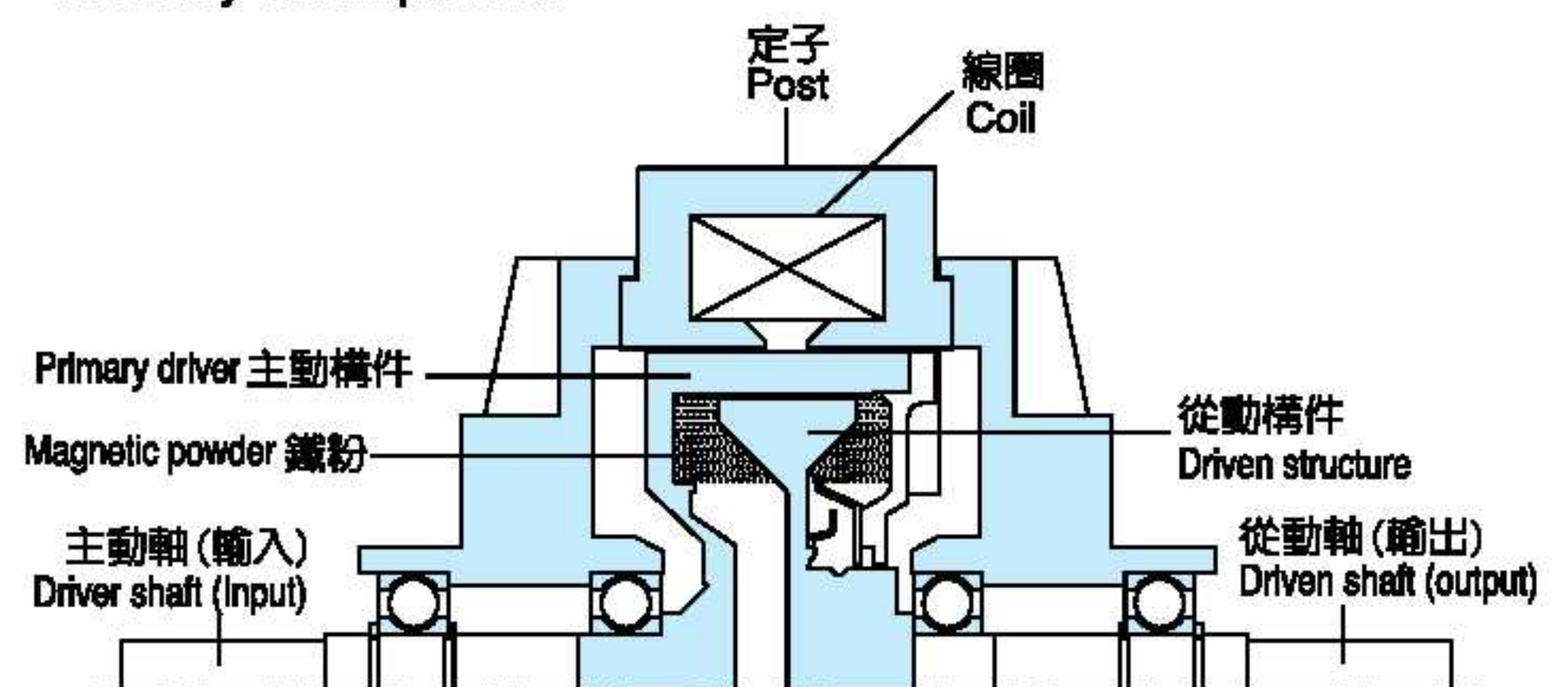
由於使用了耐熱性優越的磁粉及運用了理想的冷卻方法，即使是過於嚴酷的連續滑動運轉，也可以安心使用。

The heat-resistant magnetic powder and superior cooling design make this unit ideal for long, strenuous operation with no problems.

### 6 可以達到平順的連結及驅動狀態 Smooth engagement and transmission

由於靜摩擦係數和動摩擦係數幾乎一樣，所以完全連結時不會產生震盪，可以因應負載加減速度。

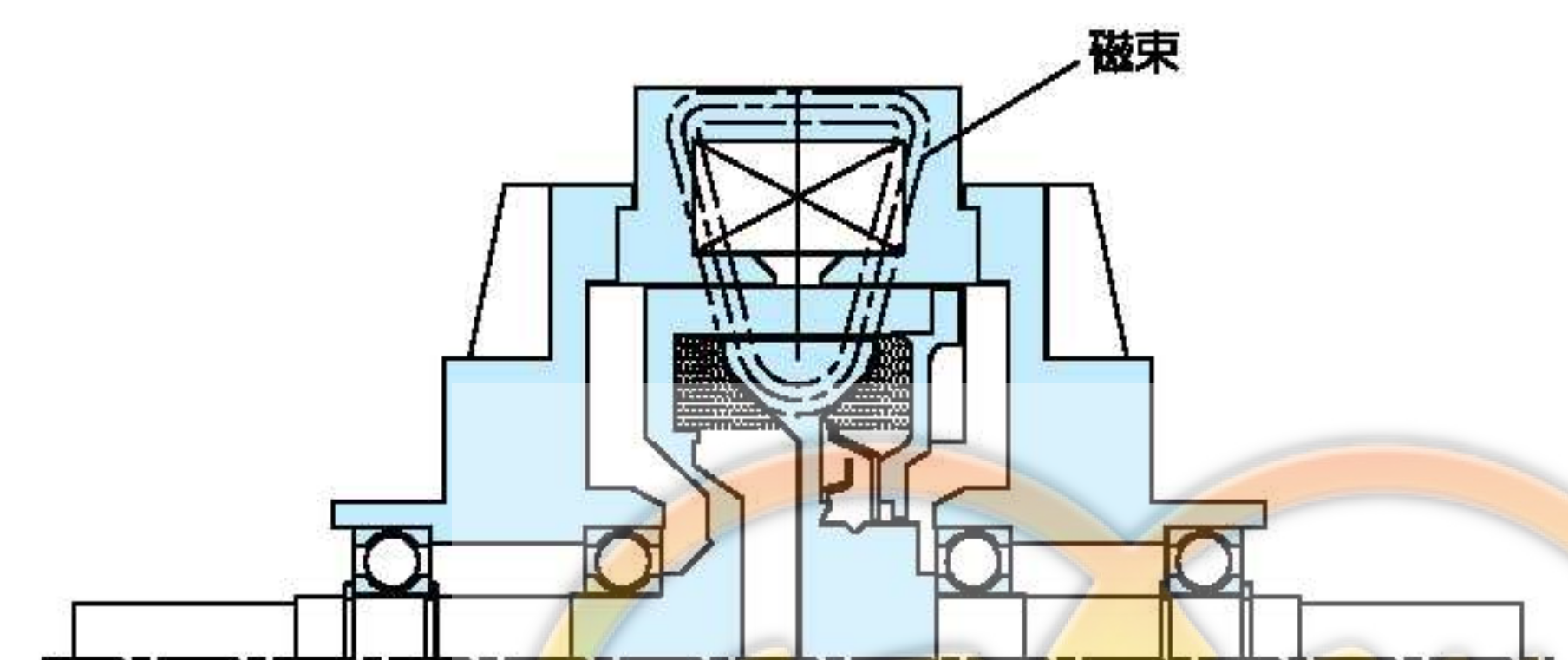
The static and dynamic friction rates for this model are virtually identical, which means very little vibration when contact is made. Acceleration and speed reduction to meet torque demands are also smoothly accomplished.



#### 阻斷時 Under power-off condition

不使電流通過激磁盤管時，離合器會呈解放狀態，不會傳達扭力。此時，離心力會使鐵粉附著於鐵粉間隙的外圍部位。

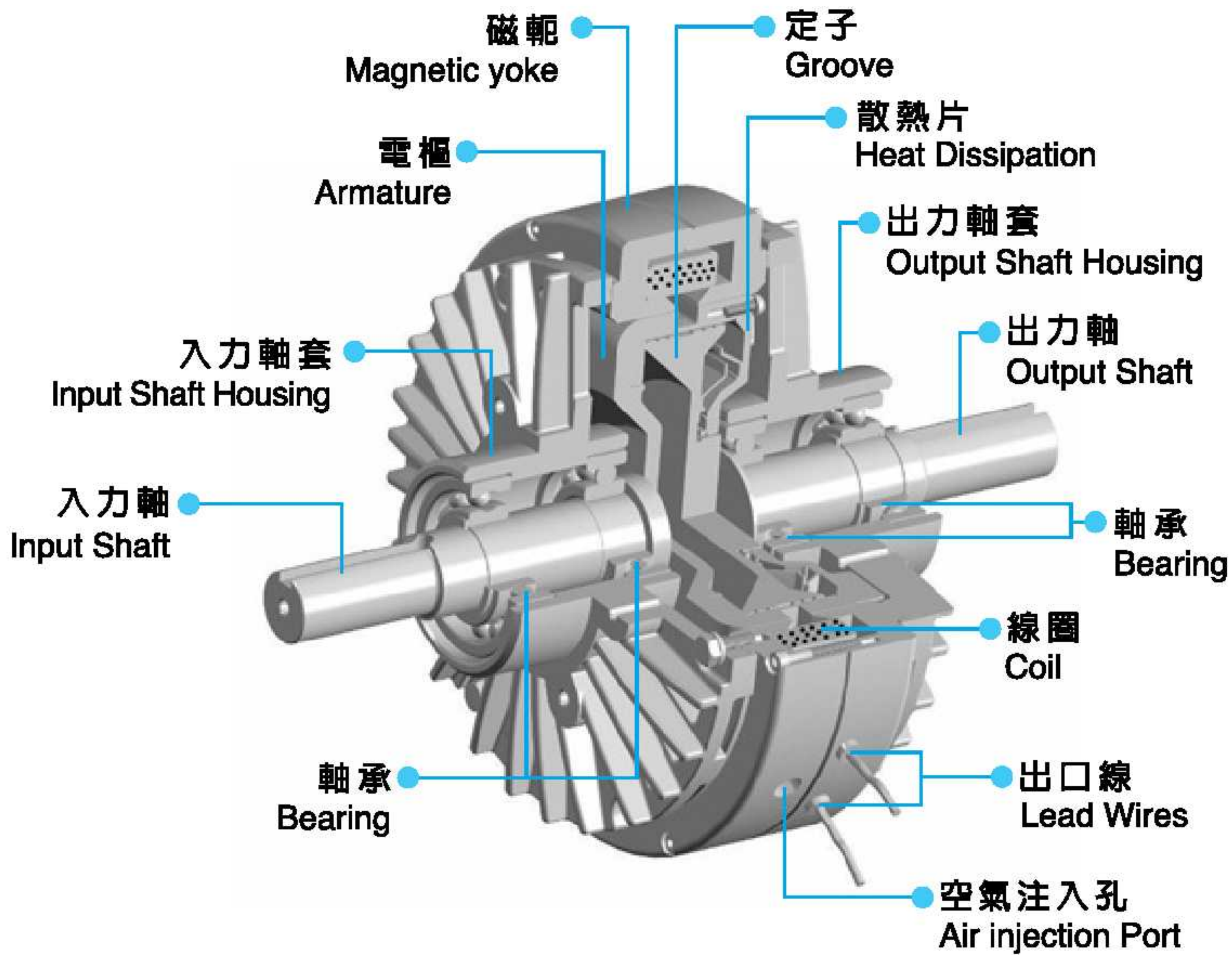
When the coil is not energized and magnetized, the clutch is disengaged. During this condition the centrifugal force will drive the magnetic powder to the outside of the gap.



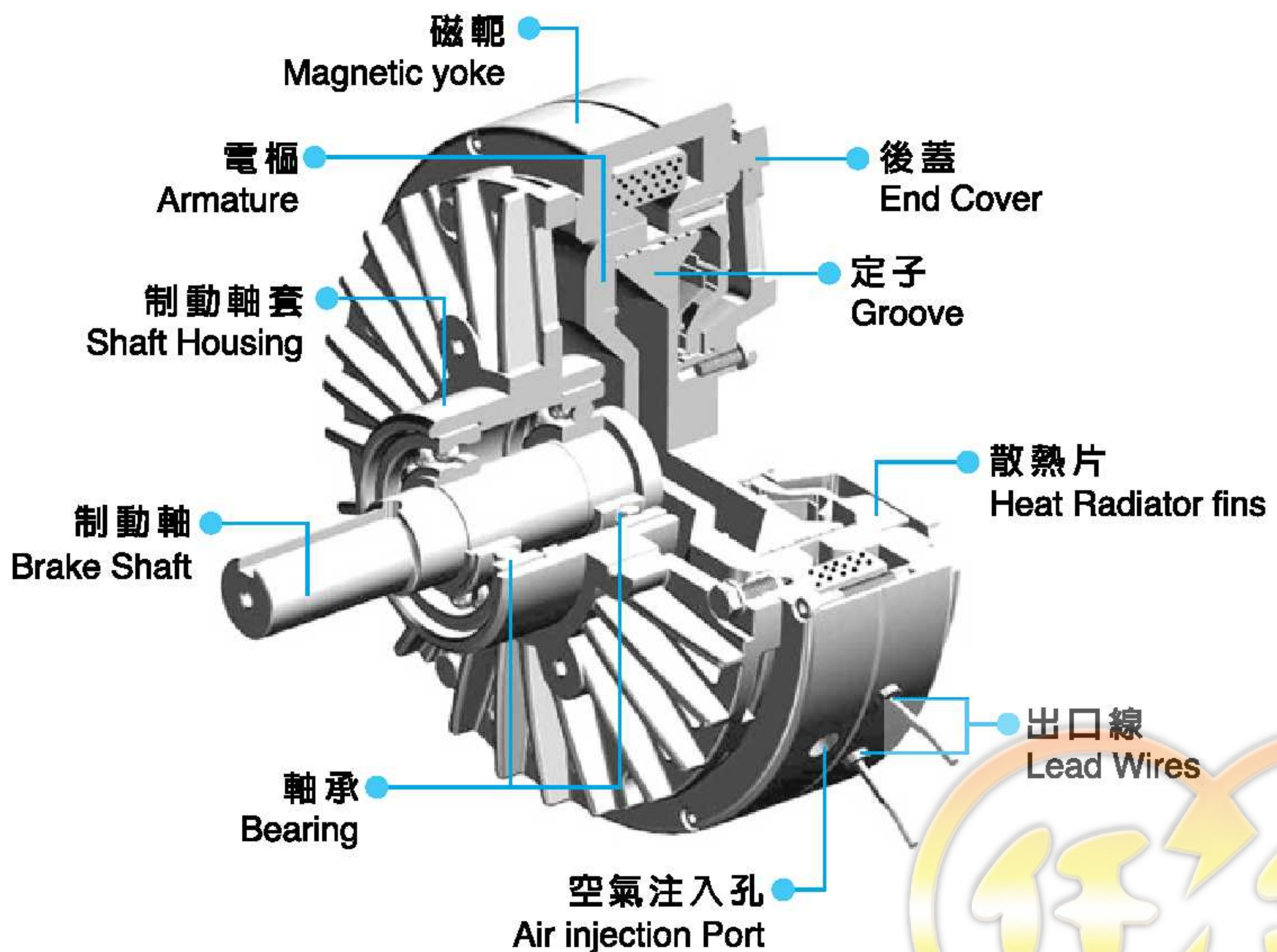
#### 連結時 Under contact conditions

盤管受到激磁時強力的磁束會鐵粉在間隙內結成一束，變成固體狀來傳達扭力。When the coil is energized and magnetized, strong magnetic forces draw the magnetic powder into one clump in the gap, forming a solid mass which can transmit torque.

基本構造 Basic Construction



基本構造 Basic Construction

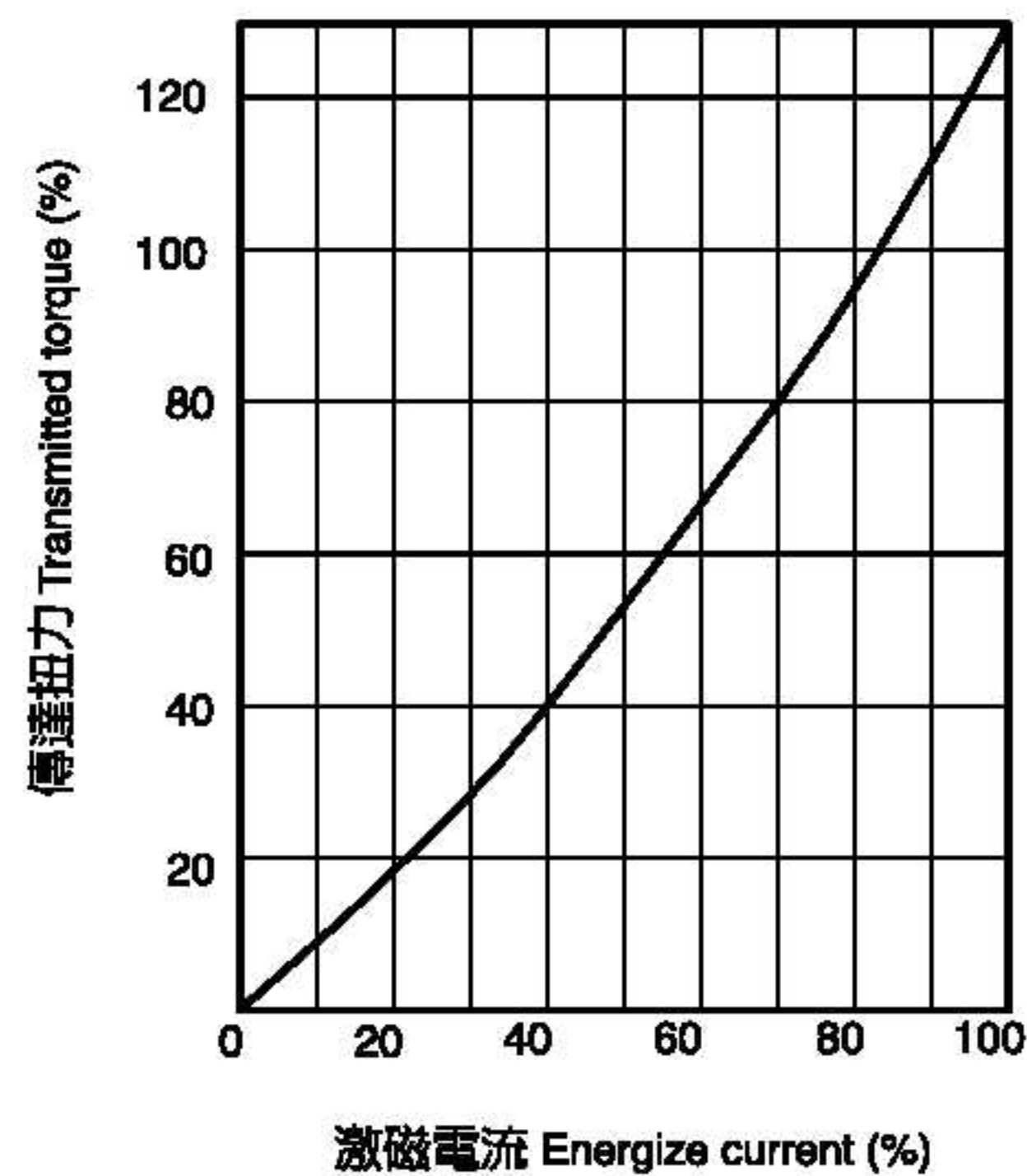


## 1 激磁電流對扭力的特性 Energize current and torque

下圖 a 為鐵粉離合器的激磁電流對扭力之特性。由此圖可以看出，在廣泛的範圍中，扭力和激磁電流呈一定的比例，而且扭力的控制性極佳。不同的機種多少有一點差異，但是扭力和電源大致呈一定比例，其範圍是定格扭力的6~98%。

Figure a below depicts the relationship between energize current and torque in the particle clutch. The fixture shows how the two values maintain a set ratio over a wide range. This means that torque can be closely controlled. There is a slight degree of variation in the ratio from unit to unit, but the ratio can be maintain from 6 to 98% of the rated specifications.

【激磁電流對扭力的特性(代表範例)】  
Energize current and torque (for reference only)



## 2 滑動旋轉速度對扭力的特性 Turning speeds and torque

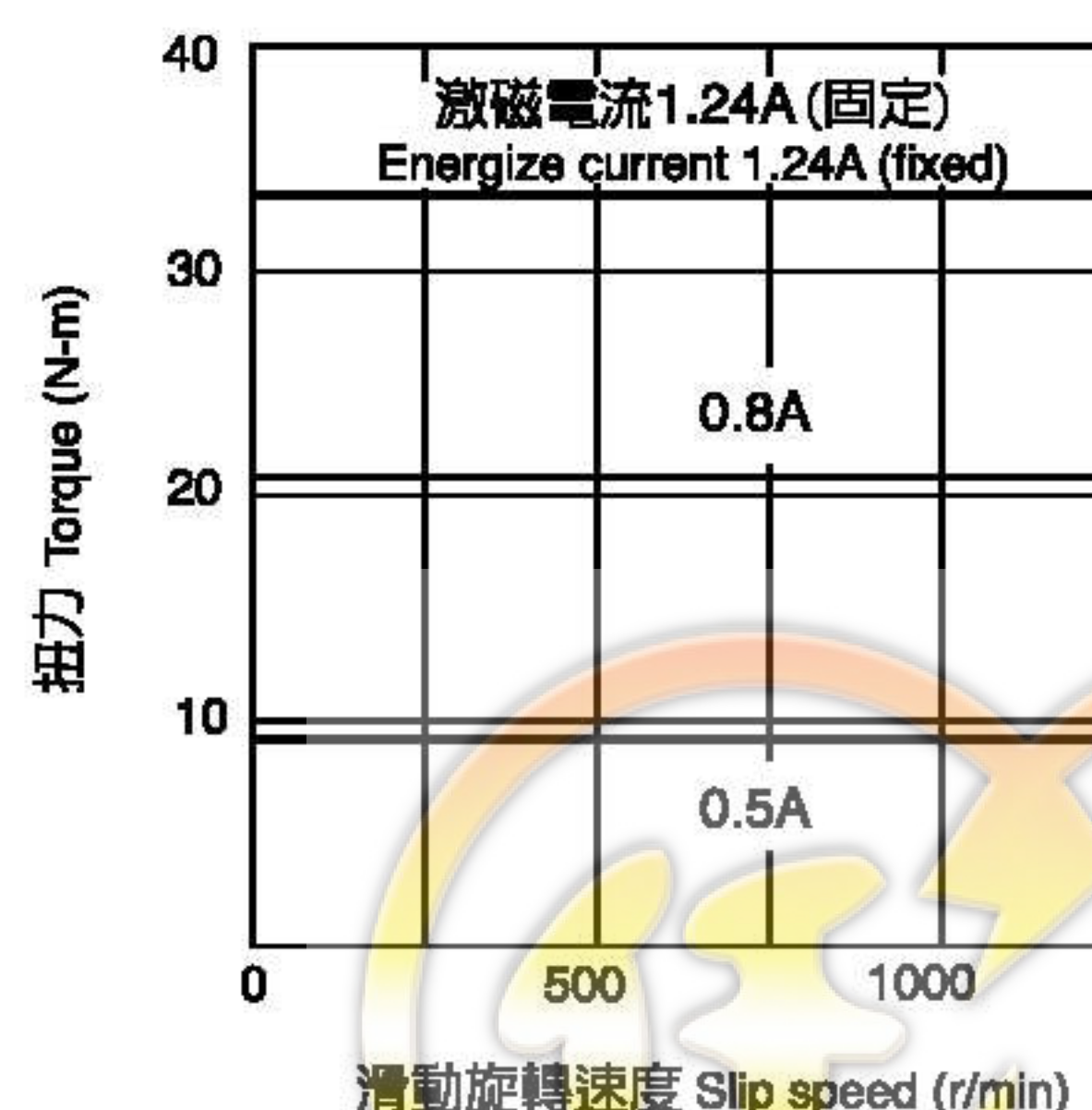
圖2為以電流為參數的滑動旋轉速度對扭力之特性。使電流保持固定的話，不會受到滑動旋轉速度（驅動側主動構件與從動構件的旋轉速度之差）的影響，扭力會保持固定。這是因為使用了Powder（磁性鐵粉，也可以說是半固體）做為動力傳達的媒介之故。換個說法還形容這個特性的話，可以說是「靜摩擦扭力和動摩擦扭力沒有落差，使扭力容易控制」。

Figure 2 shows the relationship between turning speed and torque. If the power level can be maintained, the slip turning speed (the difference between the speeds of the driving side component and the driven side component) will not be affected and the torque will be steady. This is due to the use of powder (which can be considered a solid) as the medium for transmitting power. Put another way, there is no difference between static friction torque and dynamic friction torque, so the torque is easily controlled.

該特性可以使用於連續滑動，在配合極大的熱容量，就可以擴大到張力控制、緩衝啟動等鐵粉離合器、剎車器的應用範圍。例如，張力控制的情況時，隨著捲取徑的大小，離合器、剎車器的滑動旋轉速度會產生變化。但是與滑動旋轉速度沒有關係，只要單單控制激磁電流，就可以簡單又正確地控制扭力。

This feature is useful in sustain slip where large amounts of heat are generated and can be extended to tension control, soft impact and other applications of powder clutches and brakes. For example, when tension is controlled, the slip speed of the clutch and brake will vary in accordance with the diameter of the winding reel. This has no connection with the slip speed, and simple regulation of the applied current can be used to control the amount of torque.

【滑動旋轉速度對扭力的特性】  
Slip speed and torque



## 3 動作特性 Motion characteristics

在此說明欲控制啟動時間時、及欲檢討高頻率的重複動作時所需的動作特性。  
圖3所示的是鐵粉離合器在連結時及開放時的動作。將電壓加於激磁盤管時，激磁電流會因時間常數 ( $T=L/R$ ) 的變化、呈現函數性上升。該時間常數決定於激磁盤管的抵抗  $R$  及感應係數  $L$ 。扭力的上升狀況只比激磁電流慢了一些，其與驅動側及從動側的滑動旋轉速度無關，會跟激磁電流一直上升到所設定的扭力。該扭力會使負載持續加速。

換言之，即使驅動側及從動側沒有完全連結，也可以啟動到所設定的扭力。該特性搭配離合器的極大熱容量，對緩衝啟動、停止及高速啟動停止而言，是很理想的特性。

特別是被要求急速地連結及制動時，激磁盤管可以加入直列抵抗以減少時間常數，或只在扭力啟動時間使2~3倍於定格電壓的電壓進行過度激磁，就可以加快扭力的啟動。在進行定格激磁時，盤管的時間常數  $T$  約4~5 T，就可以使扭力完全啟動。相反地，將激磁阻斷時，扭力到消滅為止，約需1 T 左右的時間。各機能的盤管之時間常數請參考各個規格表。

This section describes desired control of start-up times as well as the actions necessary when performing repeated high frequency operations.

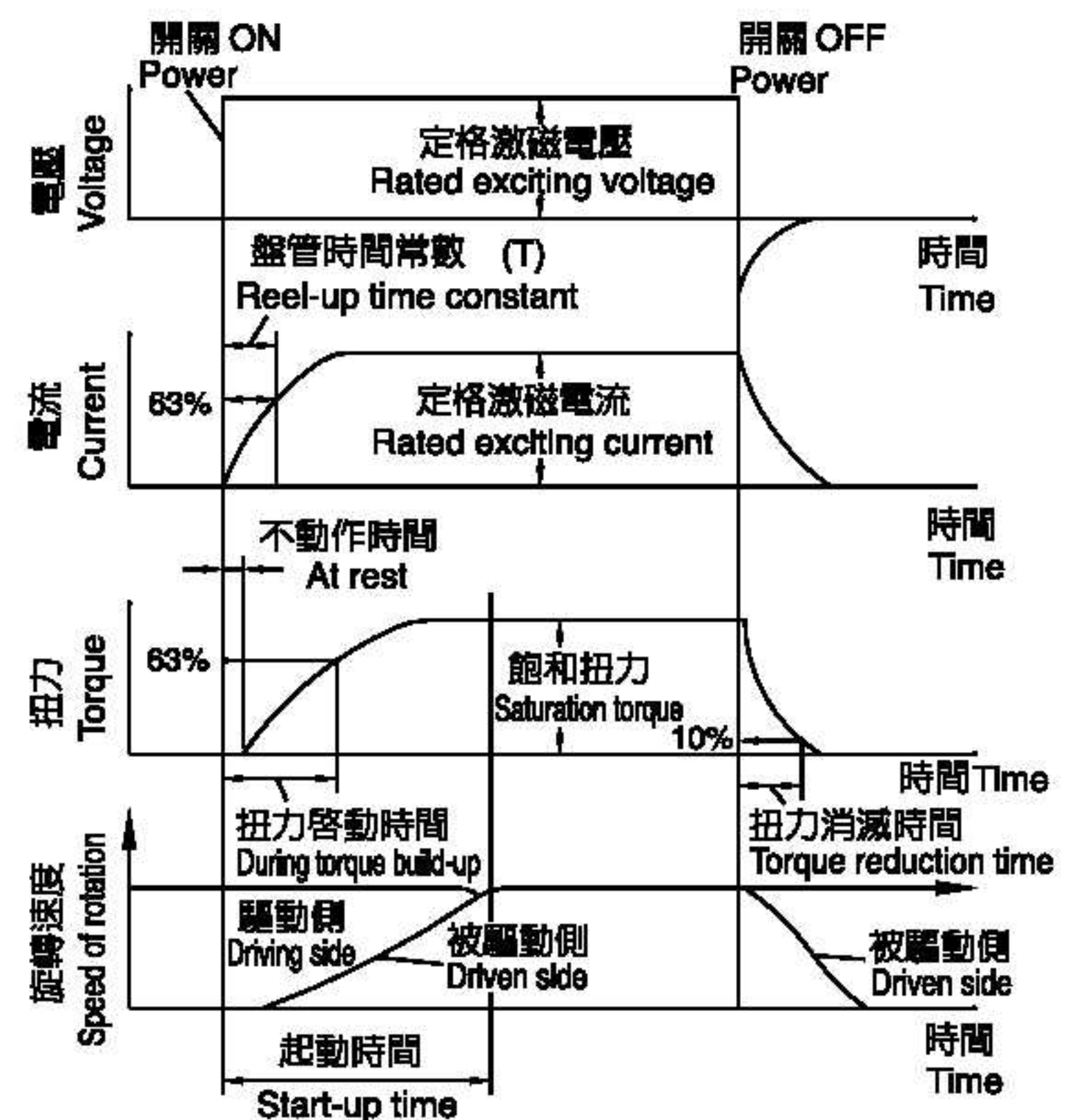
Figure 3 depicts how the powder clutch functions during engagement and release. When voltage is delivered to the coil, the energizing current changes and exhibits numerical increases in accordance with the time factor ( $T = L/R$ ). This time factor is determined by the basic resistance  $R$  of the coil and the induction index  $L$ .

The increase in torque is only slightly slower than the rise in magnetic current and has nothing to do with the slip between the driver and driven sides; it will continue to rise until it reaches a set level. The torque also causes the load level to rise steadily.

In other words, although the driver and driven sides are not directly connected, the desired level of torque can still be achieved. This feature is connected to the large heat capacity of the clutch and offers several advantages where low-impact starts and stops or high-speed starts and stops are concerned.

This feature is helpful when emergency connection and drive are needed. Low resistance can be added into the coil to reduce the time factor; and when torque start-up causes two to three times the rated voltage to flow in, resulting in excessive magnetism, torque build-up is accelerated. When the rated voltage is applied, the coil time factor  $T$  may rise to 4~5 T, which will cause torque to build up fully. On the other hand, when the magnetism is cut off and all torque is gone, about one T of time will be needed.

Consult the various specification charts for time factors for coils.



磁粉式電磁離合器動作特性  
Special features of the particle-type magnetic clutch

## 4 所容許的連續滑動工作率 Allowable sustained slip rates

鐵粉離合器、剎車器雖然可以用於連續滑動，但是滑動所造成的熱量會限制以鐵粉為首的離合器、剎車器各部位的溫度上升。所以必須設定各個機種所容許的連續滑動工作率，使用時必須保持在這個範圍內。

Although powder clutches and brakes can be used with sustained slip, the heat generated by slip will be confined to a rise in the temperature of the powder in the first clutch and brake. Thus the allowable continuous slip rate for each type of machine must be determined, and the machine must be maintained within the set range during operation.

另外，自然冷卻、強制汽冷等動作會使所容許的連續滑動工作率之數值有所差異。該數值雖然會標示於各個機種上，但是遇到自然冷卻時，輸入旋轉速度會使該數值有所差異，請注意。

In addition, natural and forced-air cooling can also change the continuous slip rate. Although this rate is generally shown on the case of the unit, natural cooling and the input turning speed may cause variations in the rate.

## 5 所容許的連結工作量 Allowable engagement workloads

在離合器剎車器中，具有慣性的負載在啟動或制動時，鐵粉及動作面會滑動，而且會產生摩擦熱。所產生的熱量會使以鐵粉為首的離合器、剎車器的各部位的溫度上升。

When a clutch or brake endures an abnormal load during start-up or drive, the powder and the work surface may slip and generate frictional heat. This heat can cause the temperature in the first clutch and brake to rise.

該摩擦熱過大時，摩擦部位的溫度會異常上升。為了防止這種狀況，各種機種都必須訂定各自所容許的連結工作量，而且使用時必須保持在這個範圍內。

When frictional heat becomes excessive the temperature of the affected parts will rise significantly. To prevent this from happening each machine must have its particular allowable contact workload determined, and this range must be observed during operation.

## 性能 Features

### 6 空轉扭力 No-load torque

即使將激磁電流完全阻斷，鐵粉所殘留的磁性、軸承的潤滑油、薄膜等摩擦所產生的機械損失，都會造成空轉扭力。

Even when the energize current is completely shut off, the residual magnetism in the powder, lubricating oil in the bearings, linings and other sources of friction can cause mechanical loss, a feature called no-load torque.

不同的機種會發生不同的空轉扭力，增速比變大的話，該增速機構的機械損失等有時會使扭力無法達到正確的控制，請注意。

No-load torque varies from machine to machine, and if the acceleration rate become excessive, mechanical losses in the accelerating portion may keep the torque from reaching proper levels.

### 7 請進行適應運轉 Test run

運送中的震盪會使離合器、剎車器內部的鐵粉偏掉，故在正規的運轉前，請進行適應運轉。

During shipment the powder in a clutch or brake may be lost or displaced, thus it is necessary to carry out a test run of the parts before engaging in full use.

### 8 強制汽冷時 Under forced-air cooling

#### (1) 請設置空氣濾網

作為冷卻空氣用的壓縮空氣中，一般都不含水份或油分，所以一定要設置空氣濾網（完全脫油式），使用清淨的乾燥空氣。（使用了沒有經過空氣濾網的壓縮空氣時，水份及油分會使鐵粉受潮，性能會大為降低。）

The air used for compressed air cooling should be free from water and oil, and a filter system with complete oil removal should be installed to remove vapors and deliver dry, clean air. (If moist air is used with a compressed air blower it will make the machinery damp, and decrease the efficiency of the system).

#### (2) 配管很長而且設有分出去的支管時，請確認出來的風量是否符合規定量。

If the blower system uses hoses that are long or complex, ensure that a sufficient flow of air is being delivered

### 9 關於熱阻斷、熱導管冷卻式 Heat blocks and heat cooling coils

#### (1) 即使安裝了軸流扇（鼓風機），若該軸流扇性能降低時，散熱效果當然不佳，導致滑動工作率的降低，故安裝軸流扇的附近要多留一些空間。尤其是周圍環境惡劣，軸流扇的葉片可能會附著異物，應該定期進行清掃。

Even when blowers are installed, they may lose their capacity and ability to dissipate heat, causing a drop in the operating efficiency of machines. A generous amount of space should be reserved around blower fans, especially in more adverse environments. The blades of blower fans can pick up impurities from the air and should be thoroughly cleaned on a regular basis.

#### (2) 定子的外圍安裝了一個可以檢測溫度的熱能開關，一定要連線到警報系統，加以檢測。

A heat sensor should be fitted to the outside of the unit with a thermostatic switch and a warning system, which must be regularly checked.

### 10 關於選擇 Options

#### (1) 即使位於容許的滑動工作率以內，使用時也不可以超過定格扭力。

Rated torque levels should not be exceeded even if they lie within the range of acceptable operating efficiencies.

#### (2) 當張力的控制範圍很廣時，可以安裝數個離合器來切換使用。此時，沒有在使用的離合器支輸出側要強制其不要空轉，故要將電磁離合器等切離。

When the tension control range is too broad, several different clutches may be installed and used interchangeably. In such cases the clutches must be isolated from each other to ensure that clutches that are not engaged will not run freely.

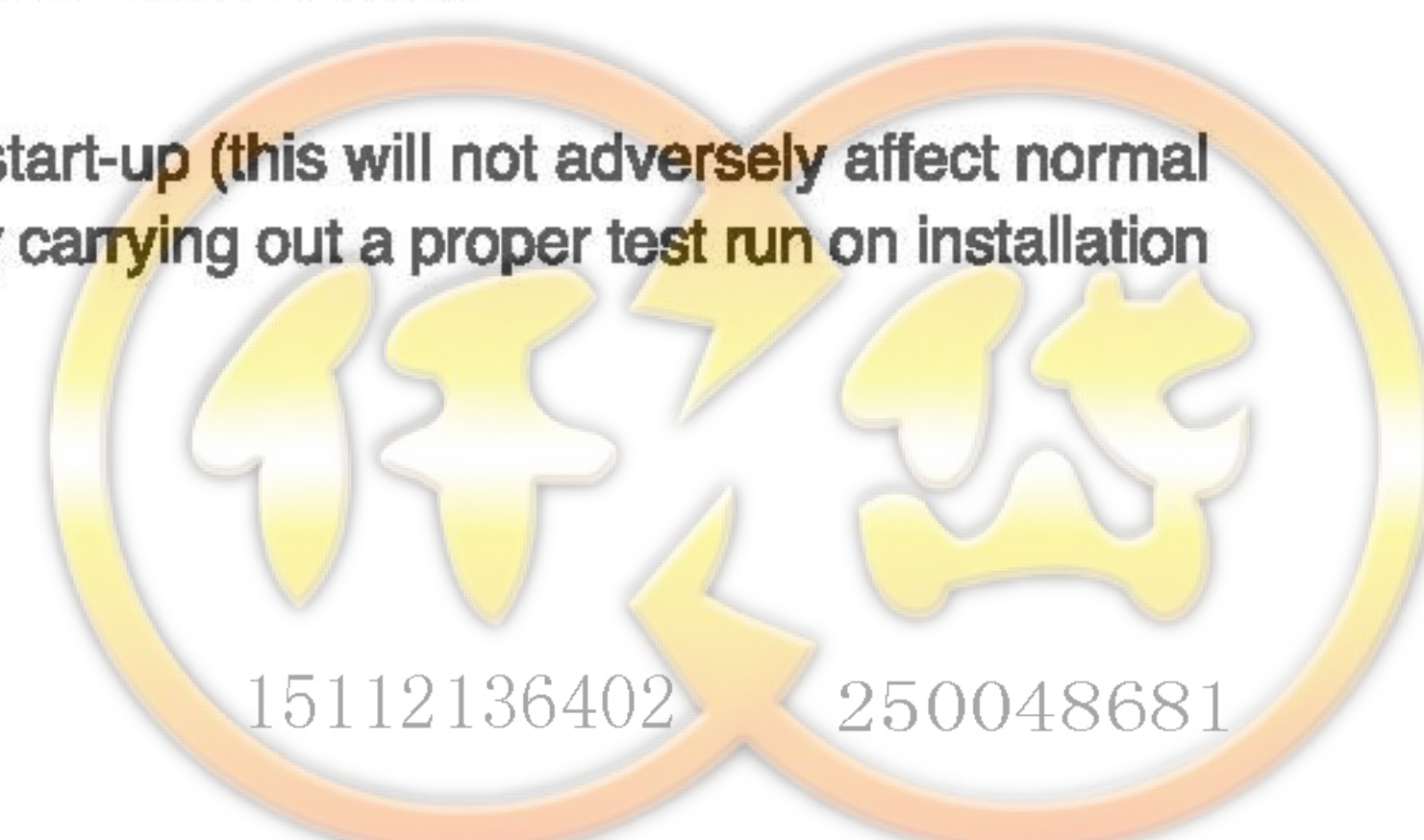
### 11 關於啟動時的異常扭力 Abnormal torque on start-up

有的運轉模式（※）在啟動時可能會傳達比規定還高的扭力。（這個值對一般的運轉不會有任何的障礙，但是鐵粉偏位或受潮時，影響會變大）防止這種現象的對策是，進行充分的適應運轉，即使在停止時也給予弱激磁。

（※激磁ON之後、輸入旋轉時，或同時）

Some types of operation（\*） may cause torque levels to exceed specifications during start-up (this will not adversely affect normal operations unless the powder in the units is damp). This possibility can be minimized by carrying out a proper test run on installation and applying low levels of magnetism even when the system is stopped.

（\* applying input after or at the same time the unit is magnetized.）



# Operating Guidelines

## 使用注意事項

### 1 產品壽命 Product life

- (1) 當做捲取、捲出的連續滑動之用時，產品壽命會因使用條件（相對滑動速度等）的不同而有差異。但是一般而言，鐵粉在定格電流中降低到定格扭力時的壽命約為4500~7500小時。然而，有的情況是可用於定格扭力以下，故可以繼續使用，壽命就可更加延長。不過，即使是相同的滑動工作率，滑動旋轉速度、意即相對旋轉速度連續處於較高的狀態時，壽命有減少的傾向，故設定時，應該致力於減少相對旋轉速度。

The useful life of the product will vary when it is used for long periods of winding and unwinding operation, depending on the speeds and other factors involved. Generally speaking the expected of magnetic powder under rated current and torque conditions is about 4500 to 7500 hours of operation. In some cases operating at lower -than-rated torque may help to extend the life of the powder. At the same time, given the same operating efficiencies, the speed of rotation and continuous operation at high speed may result in shorter life expectancy. Thus designs should take into consideration the lowest feasible operating speeds.

- (2) 為了延長鐵粉的壽命，使用時讓容許滑動工作率較為充裕也是一種方式。例如，以容許滑動工作率的50%來使用的話，壽命約可延長為雙倍。

Life expectancy of the powder can also be extended by operating at lower than accepted efficiencies. For example, operation at 50% of the most efficient speed can sometimes double the life of magnetic powder.

- (3) 將從動構件當作輸入側的話，會長時間持續空轉，鐵粉受到攪拌，壽命會大幅減短，請盡量避免這種方法。如果在結構上無論如何都無法避免時，使用時請將電流設定為弱激磁狀態。

If the driven component is used as the input side and runs under no load for long periods of time, the powder may lose effectiveness with excessive agitation; thus this type of operation should be avoid. If such operations are unavoidable, the current level should be modulated to minimize the magnetic effect.

### 2 以低速旋轉(16RPM以下)進行運轉時 Operation at low speed (under 16RPM)

用於張力控制等連續運轉時，會產生穩定的扭力特性。但是，伴隨有空轉的斷續旋轉時，加入電壓之後，扭力的啟動有時會有點延遲，為了避免這種狀況，請依照下述使用。

This type of operation delivers steady torque with controlled tension over long periods. With extended periods of non-load operation, however, torque may be slow in building up with more voltage is applied. Please use the following methods to avoid this problem.

- (1) 即使捲出終了時，也持續給予弱激磁（定格的7-15%電流），使鐵粉不要從動作面落下。

Maintain a low level of power (7 - 15% of rated current) after winding operations have finished, so that the powder will not fall away from the work surface.

- (2) 請將增速後的最低旋轉速度設為16RPM。

Maintain a minimum speed of 16RPM following each period of acceleration.



# Operating Guidelines

## 使用注意事項

### 3 一般項目 Routine checkpoints

#### (1) 請注意輸入側及輸出側

請以正規的安裝方法（將高速旋轉側當作輸入側）來使用鐵粉離合器。如果機械的結構非得要輸出入軸反安裝的話，請務必以1000r/min以下來使用。另外，多連多軸、轉塔捲取等連續空轉的使用方式是屬於輸出入軸反安裝之較高速旋轉，不利於扭力特性及鐵粉壽命，故不推薦使用。另外，離合器及剎車器原則上在水平軸上使用，不可使用於垂直型。

Perform installation according to instructions (using the high-speed end for input) for the powder clutch. If the layout of the system necessitates counter-installation of the output shaft, operating speeds should be kept below 1000RPM. In addition, when multiple shafts are used or the turret turns under no load for long periods so that a counter-installed shaft runs at high speed, torque and the useful life of the powder may be adversely affected. Thus use under these conditions is not advised. In principle, the clutch and brake should be used in a horizontal installation only and not vertically.

#### (2) 請注意溼氣 Wet conditions

鐵粉受潮的話，性能會變得不穩定，所以要特別小心，不要讓油或水分侵入內部。特別是安裝於齒輪箱時，油分會透過軸部侵入內部，所以要用薄膜完全封住。

Moisture can adversely affect the effectiveness of the magnetic powder, thus extra caution is needed to avoid contamination by oil or liquids. Pay special attention during installation of the gear box to insure that oil does not penetrate the inside of the clutch. Wrapping the unit in plastic during installation is advisable.

#### (3) 請注意表面溫度 Surface temperatures

連續運轉所造成的表面最高溫度，最高為運轉時90°C以下，超過該數值時，耐久性會大為降低。請以上述的界限溫度為標準，使用時務必保持在所容許的滑動工作率之內。

Continuous operation may raise temperature levels on surfaces. Maximum temperature should not exceed 90°C; sustained operation at higher temperatures may shorten the useful life of the unit.

Please observe the above temperature limits to keep the clutch with acceptable efficiency parameters.

### 4 定格扭力及定格電流的關係 Correlation between rated torque and rated power

#### (1) 在出貨時（適應運轉），當定格電流通過時，扭力會大幅超過定格扭力，這是因為事先預測鐵粉會隨著時間產生劣質化，才將扭力設高一點。使用時，請減少電流，使其不要超過定格扭力。

When the rated power is delivered during production (applied operation) the amount of torque may rise higher than the rated level. This is to compensate for a loss in quality of the magnetic powder over a long period of time. Thus the power should be slightly reduced to keep torque from exceeding the rated value.

#### (2) 隨著時間而產生的劣質化會使扭力降低，但是增加電流的話，扭力也會增加，故可以達到穩定的扭力傳達。但是，請勿使電流通過定格值。

Torque may decrease gradually due to abrasion over a period of time, but this can be compensated for by increasing the voltage of the power supply. In such a case, however, the current should not exceed stated power limits.

### 5 關於扭力 Torque

#### (1) 電流對扭力的特性記載了初期及200r/RPM時的標準值。鐵粉會隨著時間產生劣質化，所以該標準特性也會有所變化，請以電流來進行補正。

The initial rating for current and torque is set at 200RPM. Because the magnetic powder deteriorates over time, this rated value will also change, and additional power should be applied to make up for the difference.

#### (2) 電流可以輕鬆地控制扭力，但是大型機種（扭力108Nm以上）進行高速旋轉且使用低電流時，扭力有時會變得不穩定，請注意。

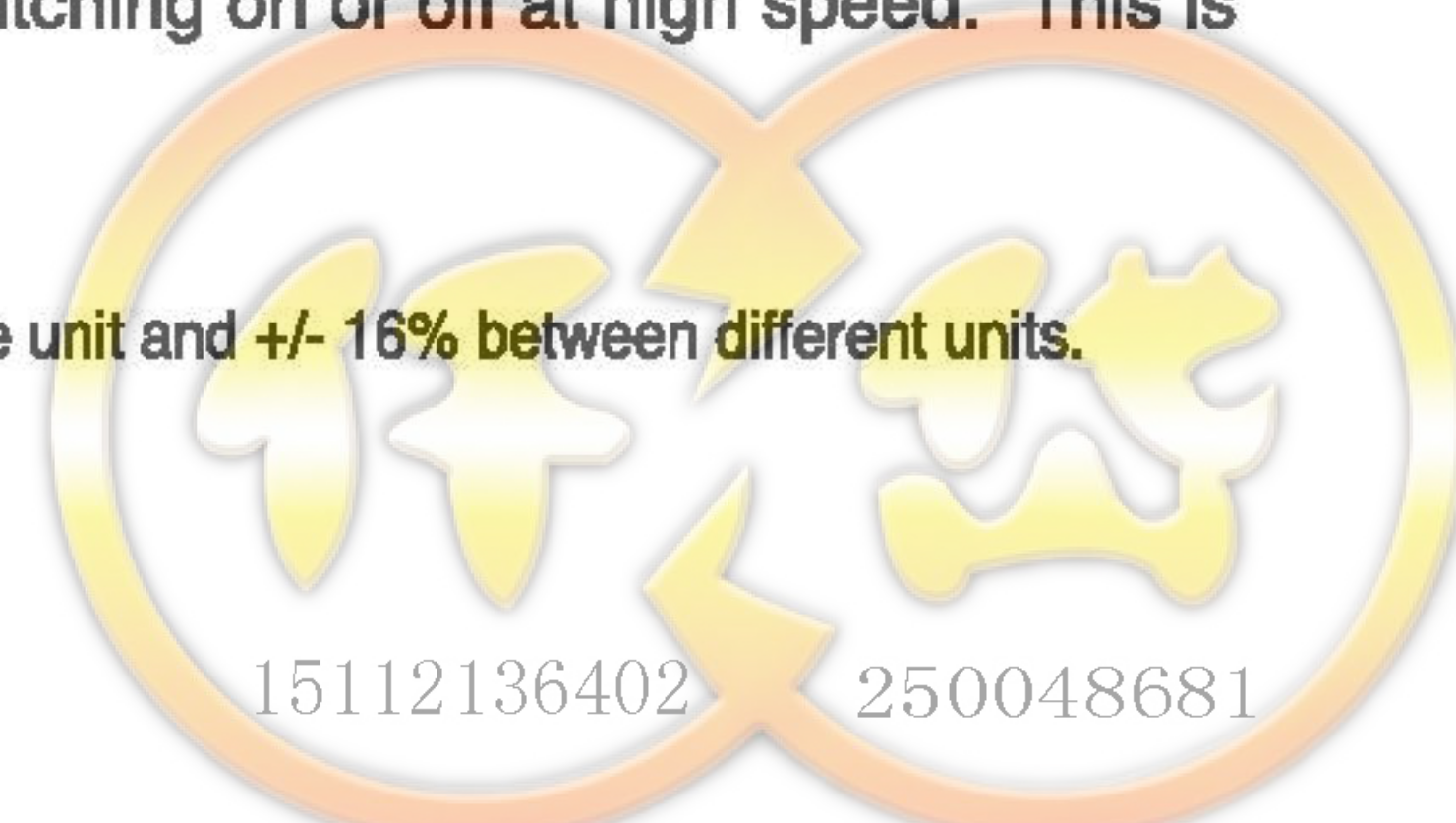
Adjusting power levels provides an easy way to control torque, but with large machinery (108KGM or more), torque may vary when running at high speed with low power levels.

#### (3) 以高速旋轉進行ON/OFF控制時，有時需要花很長的時間才能達到所要的扭力，請注意。特別是大型機種，這種現象相當明顯。

It may take a relatively long time to reach desired torque levels when switching on or off at high speed. This is especially true for heavy machinery.

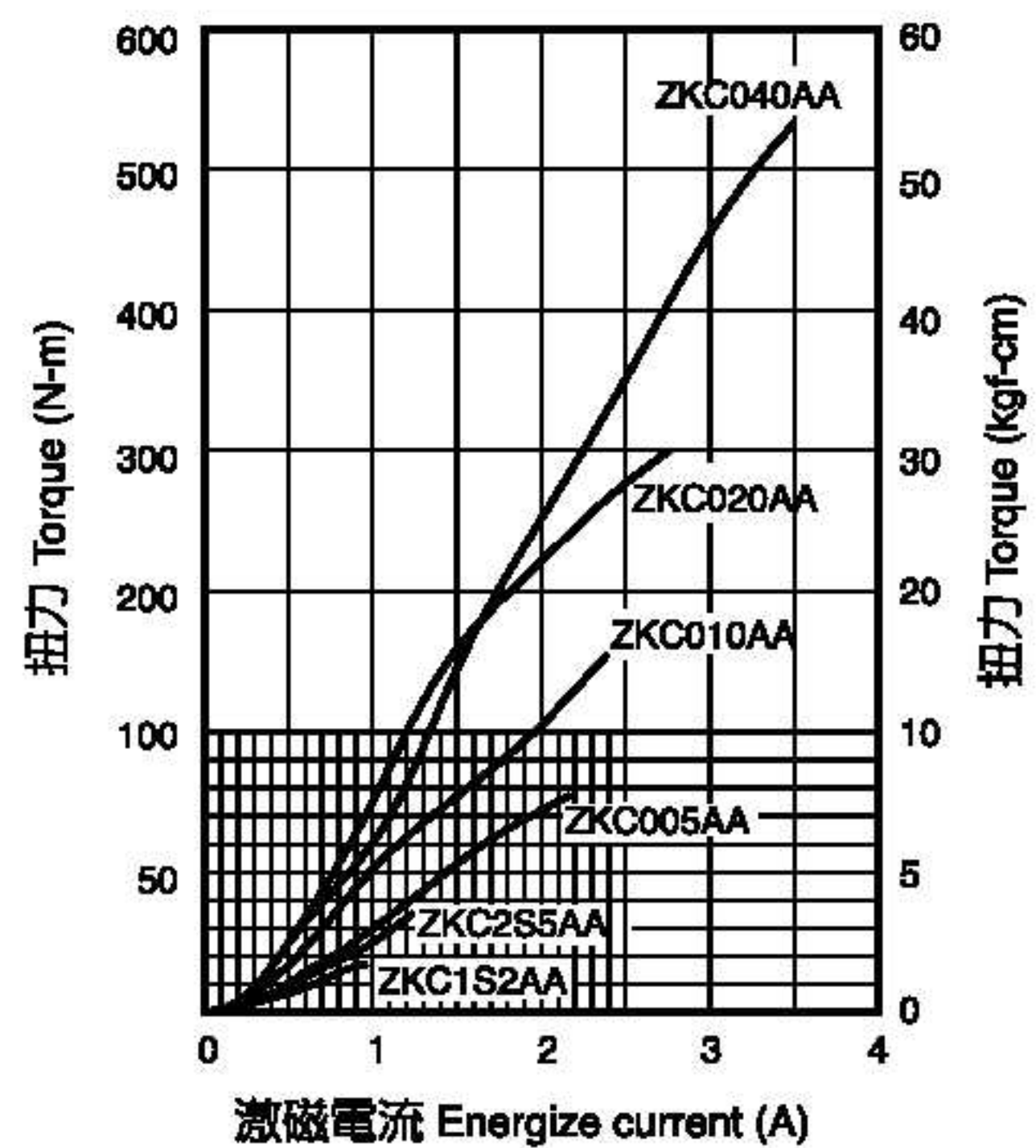
#### (4) 關於定格電流附近的扭力變異程度，每個產品約為±11%，但產品和產品約為±16%。

Variations in the amount of rated current to rated torque may be as much as +/- 11% in one unit and +/- 16% between different units.

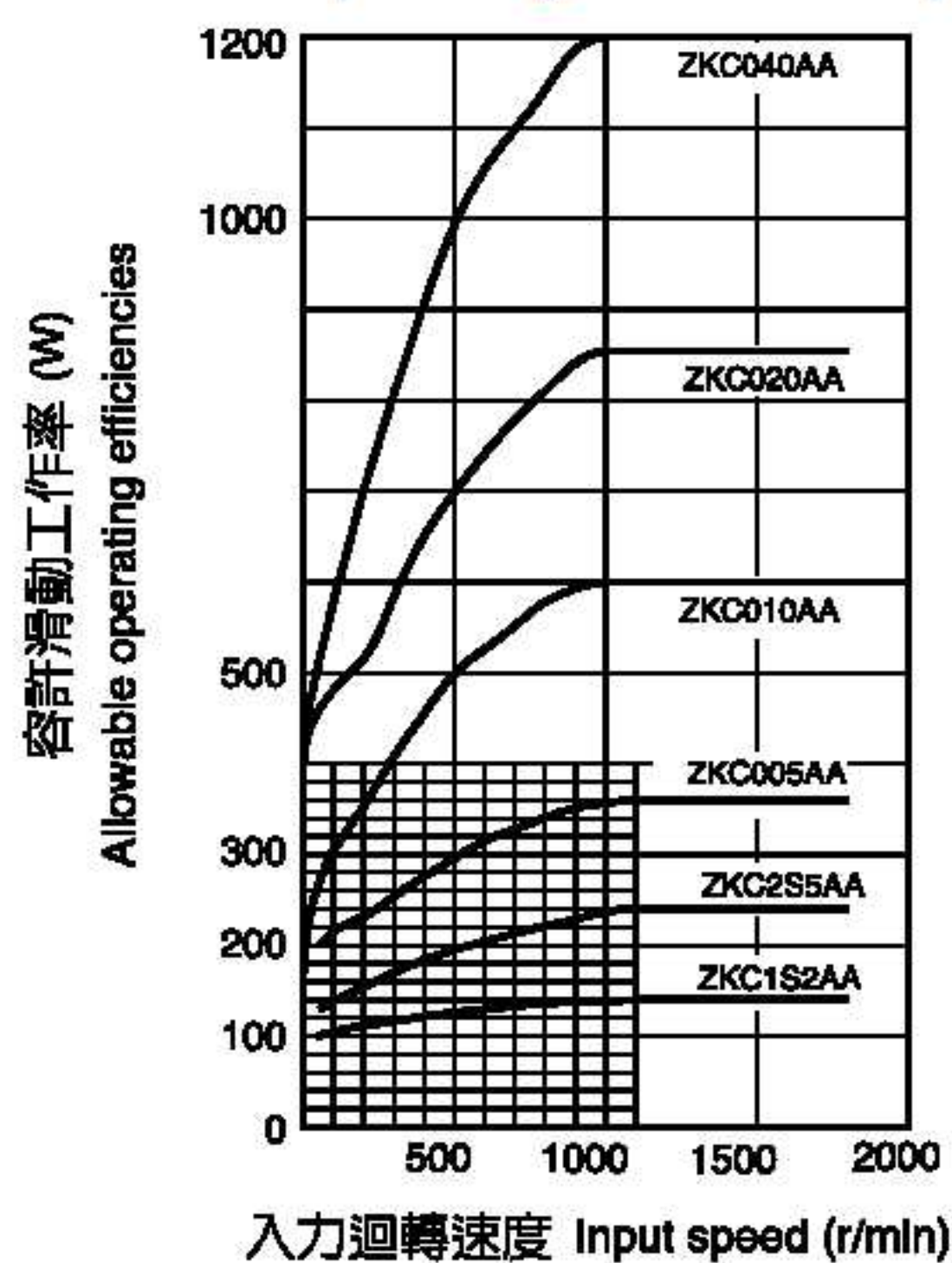


## 特性 Special Features

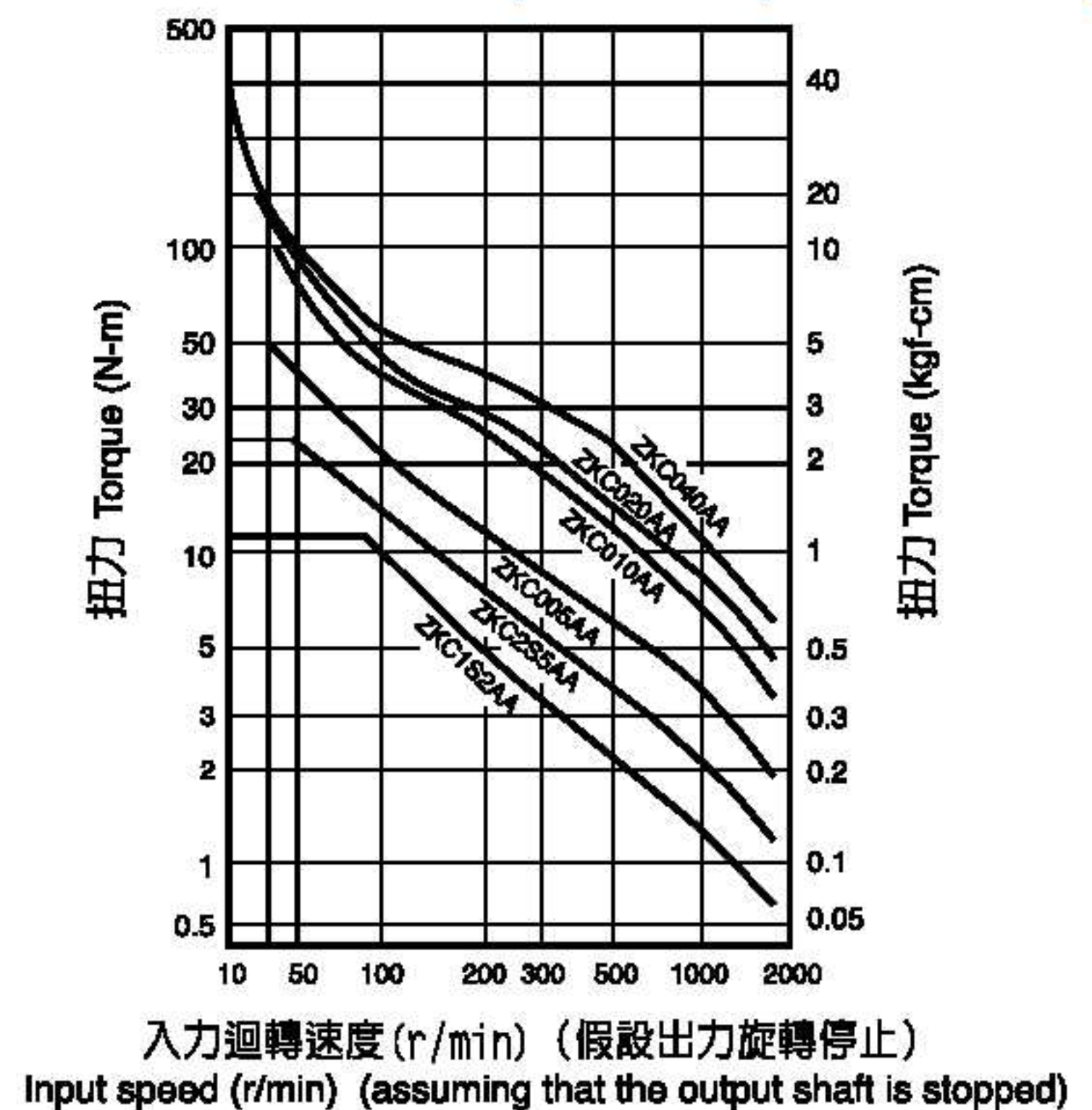
【標準扭力特性】（代表範例）  
Special features of standard torque (reference only)



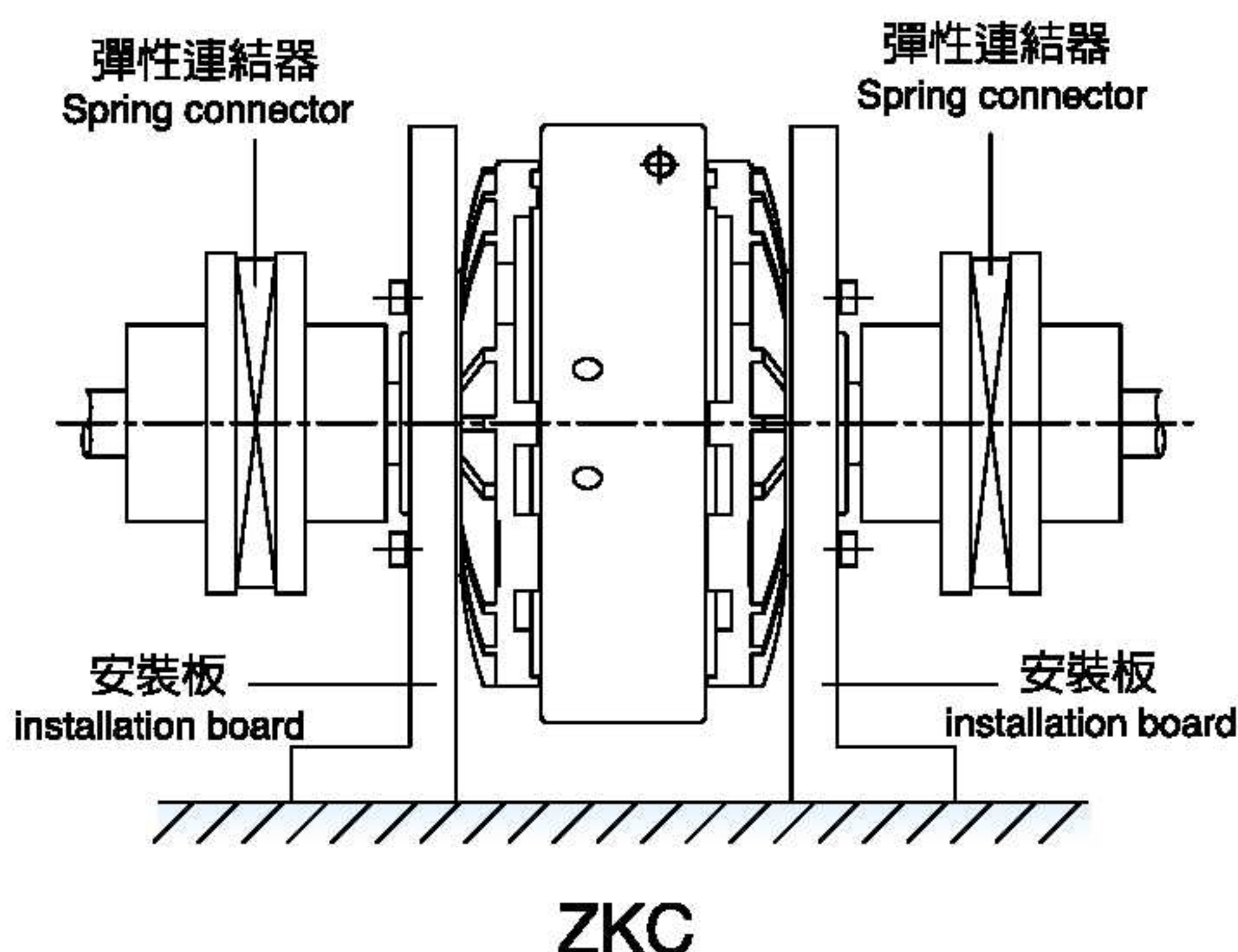
【所容許的連續滑動工作率特性（自然冷卻時）】  
Allowable sustained operating efficiencies (natural cooling)



【所容許的連續滑動扭力特性（自然冷卻時）】  
Allowable Sustained torque levels (natural cooling)



## 安裝範例 Examples of installation



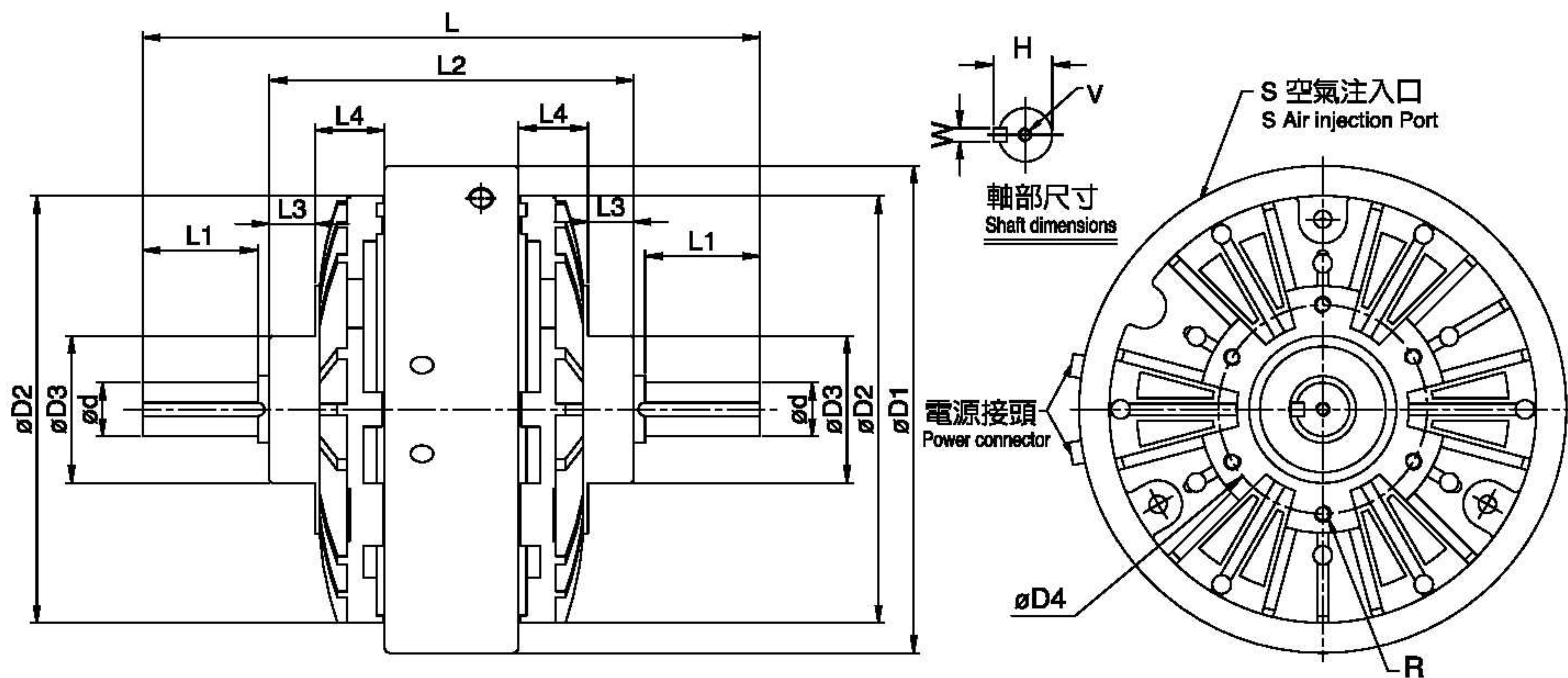
1. 請將托座的嵌合部位嵌入安裝板、加以固定。
2. 離合器軸和負載軸的連結一定要使用彈性耦合器，而且軸與軸之間的同軸度、直角度等必須保持在所使用的彈性耦合器之容許值範圍內。
3. 進行皮帶盤等的安裝時，請保持在容許軸負重的範圍內。
4. ZKC005AA的話，要在兩側設置安裝板。

1. Insert tray assembly into the installation board to hold it in place.
2. The spring coupler must be used to main contact between the clutch shaft and the load shaft. In addition, the alignment and angles between shafts must be maintained with the allowable range for spring coupler.
3. Stay within permitted load ranges when installing a belt pan
4. Installation plates must be installed at either end of the shaft for the ZKC005AA.



# ZKC Series

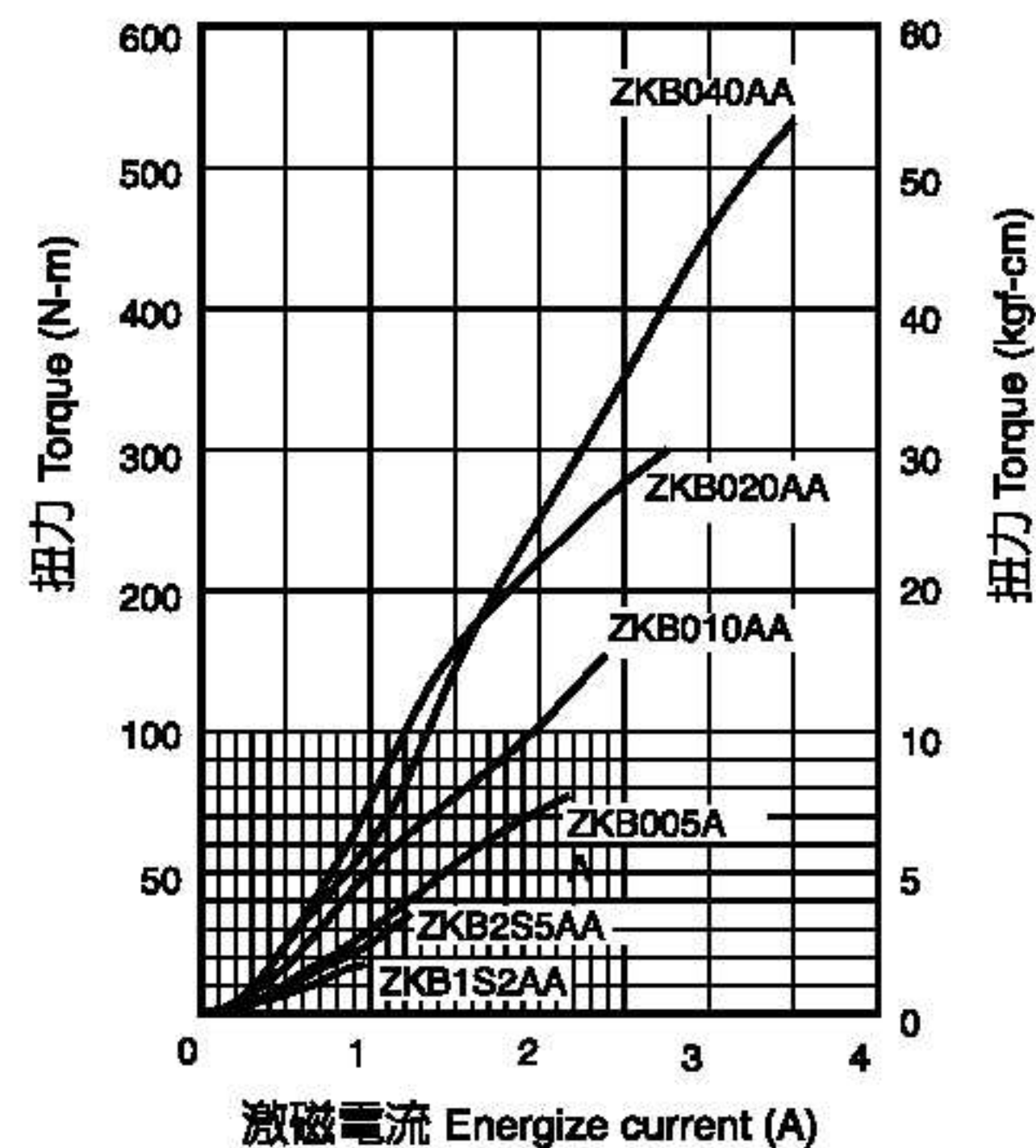
## 磁粉式電磁離合器 Magnetic Particle Clutch



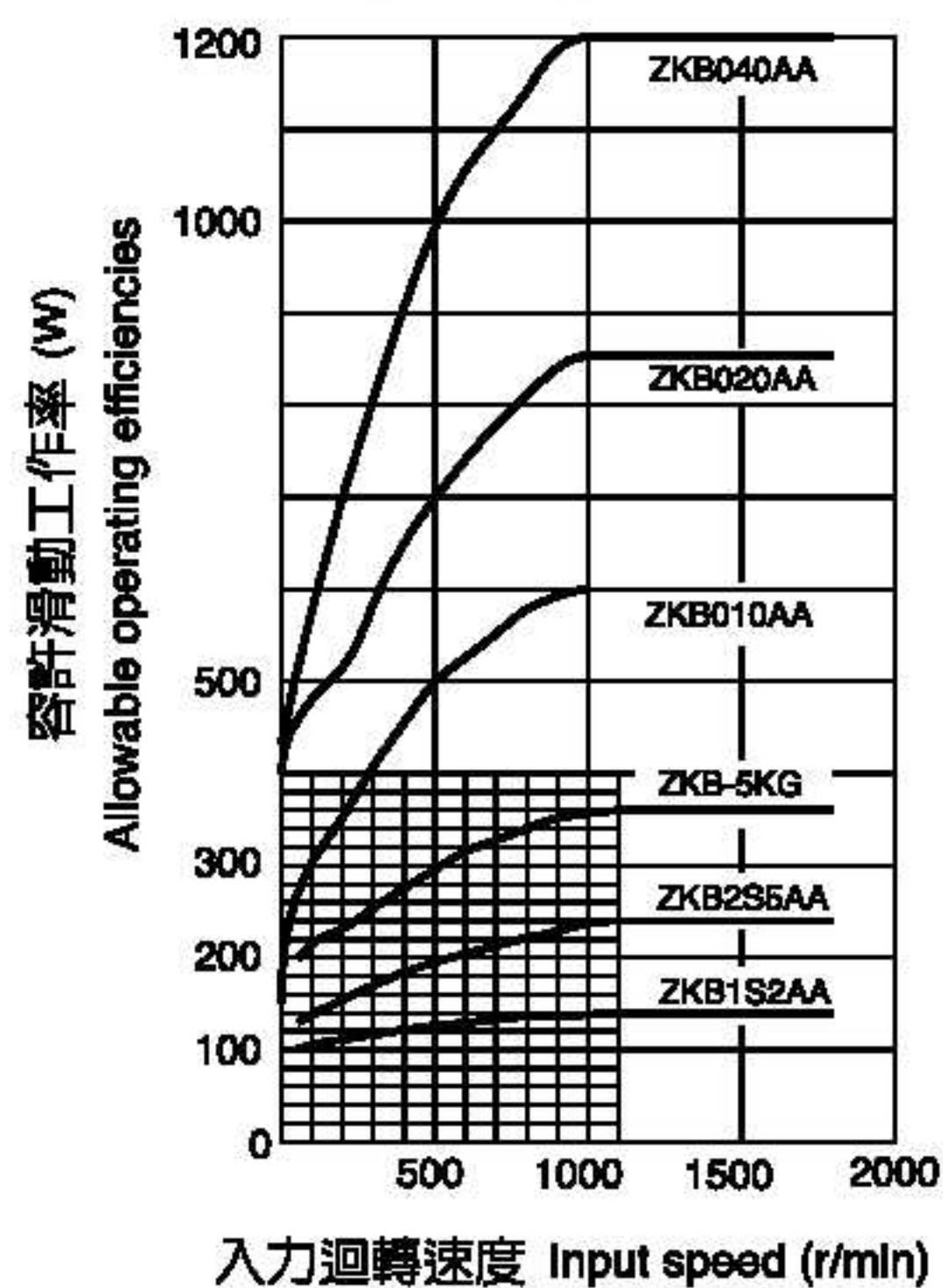
型號 MODEL	ZKC1S2AA	ZKC2S5AA	ZKC005AA	ZKC010AA	ZKC020AA	ZKC040AA	
定格轉距 [kgm](Nm) Rated torque	1.2 (12)	2.5 (25)	5 (50)	10 (100)	20 (200)	40 (400)	
容量 Capacity DC24V (75°C)	電流 (A) Current	0.94	1.24	2.15	2.4	2.7	3.5
	電力 (W) Power	22.5	30	51.5	57.6	64.8	84
	時定數 (S) Number of hours set	0.1	0.12	0.13	0.25	0.37	0.4
慣性矩 J Moment of inertia (kgm <sup>2</sup> )	入力側 Input side	$1.34 \times 10^{-3}$	$3.8 \times 10^{-3}$	$9.5 \times 10^{-3}$	$3.5 \times 10^{-2}$	$9.15 \times 10^{-2}$	$2.4 \times 10^{-1}$
	出力側 Output side	$4.90 \times 10^{-4}$	$1.49 \times 10^{-3}$	$4.8 \times 10^{-3}$	$2.5 \times 10^{-2}$	$6.89 \times 10^{-2}$	$2.2 \times 10^{-1}$
強制空冷容 許滑動功率 Allowable slippage rate with forced-air cooling	風壓 (Pa) Air pressure	$3 \times 10^4$	$5 \times 10^4$	$1 \times 10^5$	$6 \times 10^4$	$5 \times 10^4$	$2 \times 10^5$
	風量 (m <sup>3</sup> /min) Air volume	0.2	0.4	0.6	1.1	1.6	2.0
	功率 (W) Power	250	380	700	1100	1900	2800
重量 Weight (kg)	5.2	9	14.5	37	53	100	
最高轉速 Maximum speed (r/min)	1800						
磁粉重量 Weight of powder (g)	20	33	60	140	225	370	
外型尺寸 Exterior dimensions	D1	152	182	219	276	325	395
	D2	126	159.5	195	260.5	301	360
	D3 (g7)	42	55	74	100	110	130
	D4	64	78	100	140	150	200
	L	191.7	230	293.9	359	407.2	500.4
	L1	29.5	43	55	65	69	92
	L2	124	136	172	216	250	291
	L3	15	17	30	28	30	35
	L4	25.5	26	28	46	56	66.5
	d (h7)	15	20	25	30	35	45
	H ( $\frac{0}{-0.2}$ )	17	22	28	33	38.5	48.5
	W(p7)	5		7		10	12
	V	M4*0.7P*8L	M5*0.8P*10L	M6*1P*12L	M10*1.5P*20L		
	R	6-M6*1P*10L			6-M10*1.5P*15L		8-M10*1.5P*15L
S	1/8		1/4		3/8		

## 特性 Special Features

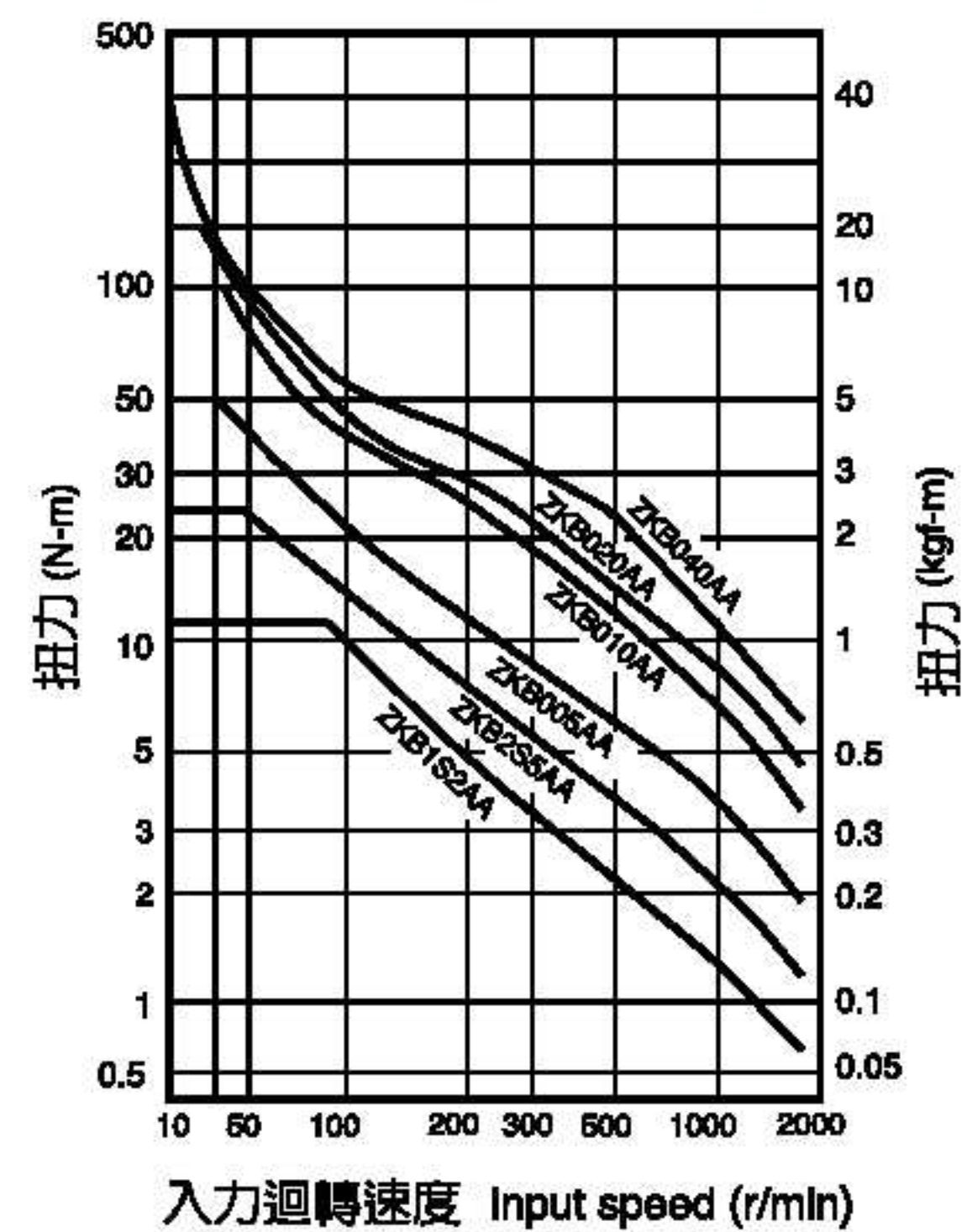
【標準扭力特性】（代表範例）  
Special features of standard torque (reference only)



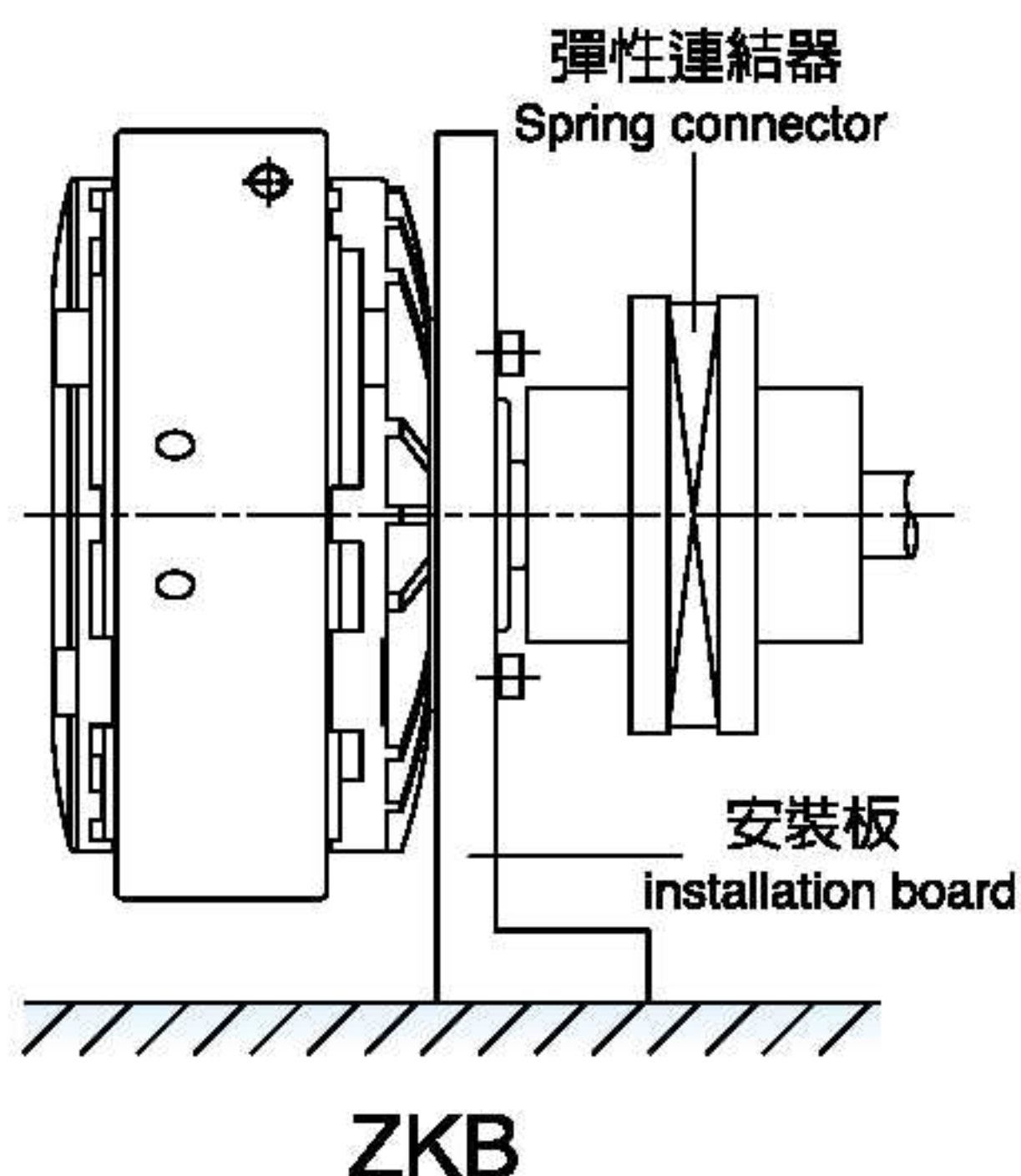
【所容許的連續滑動工作率特性（自然冷卻時）】  
Allowable sustained operating efficiencies (natural cooling)



【所容許的連續滑動扭力特性（自然冷卻時）】  
Allowable Sustained torque levels (natural cooling)



## 安裝範例 Examples of installation

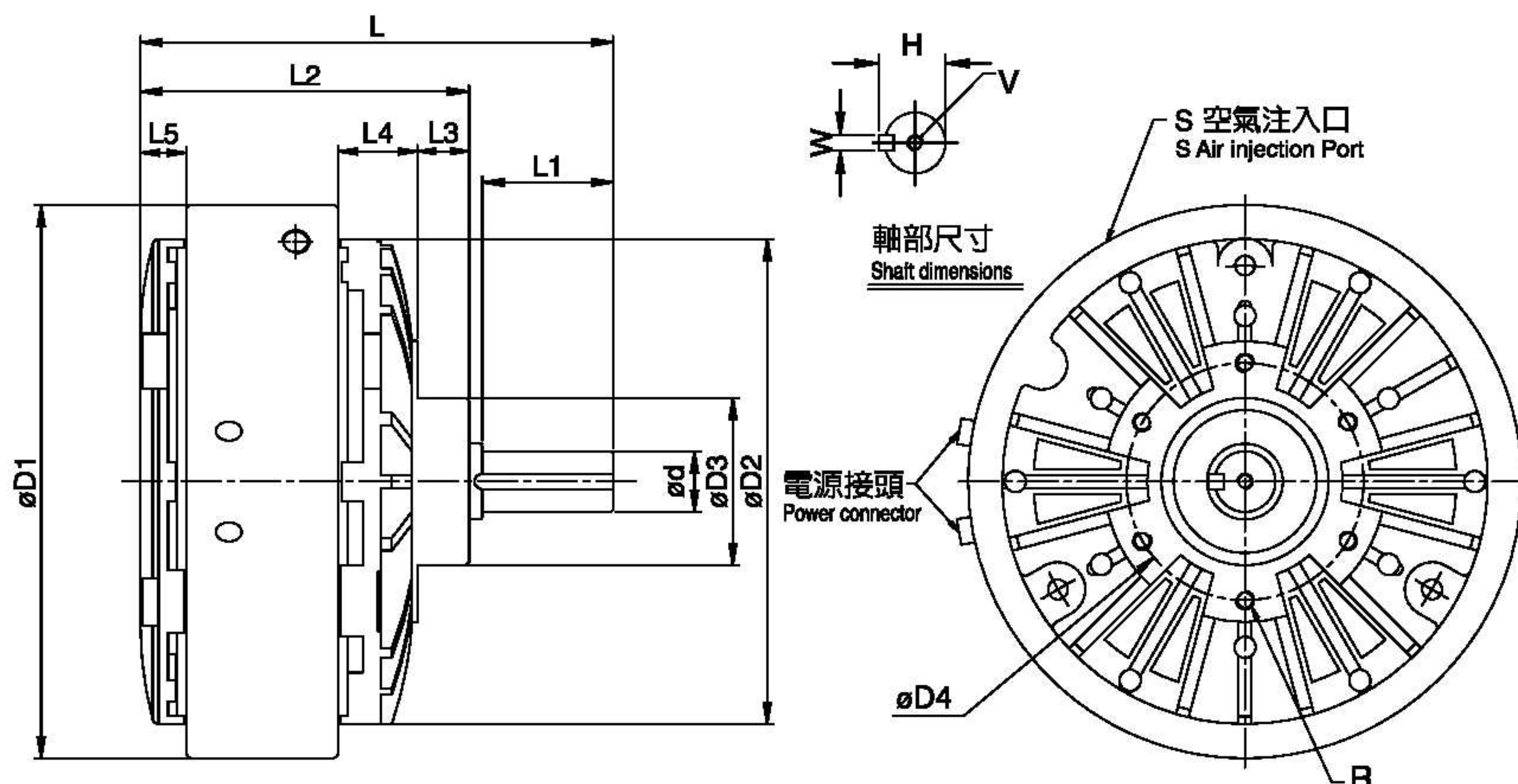


1. 請將托座的嵌合部位嵌入安裝板、加以固定。
2. 離合器軸和負載軸的連結一定要使用彈性耦合器，而且軸與軸之間的同心度、直角度等必須保持在所使用的彈性耦合器之容許值範圍內。
3. 進行皮帶盤等的安裝時，請保持在容許軸負重

1. Insert tray assembly into the installation board to hold it in place.
2. The spring coupler must be used to main contact between the clutch shaft and the load shaft. In addition, the alignment and angles between shafts mush be maintained with the allowable range for spring coupler.
3. Stay within permitted load ranges when installing a belt pan

# ZKB Series

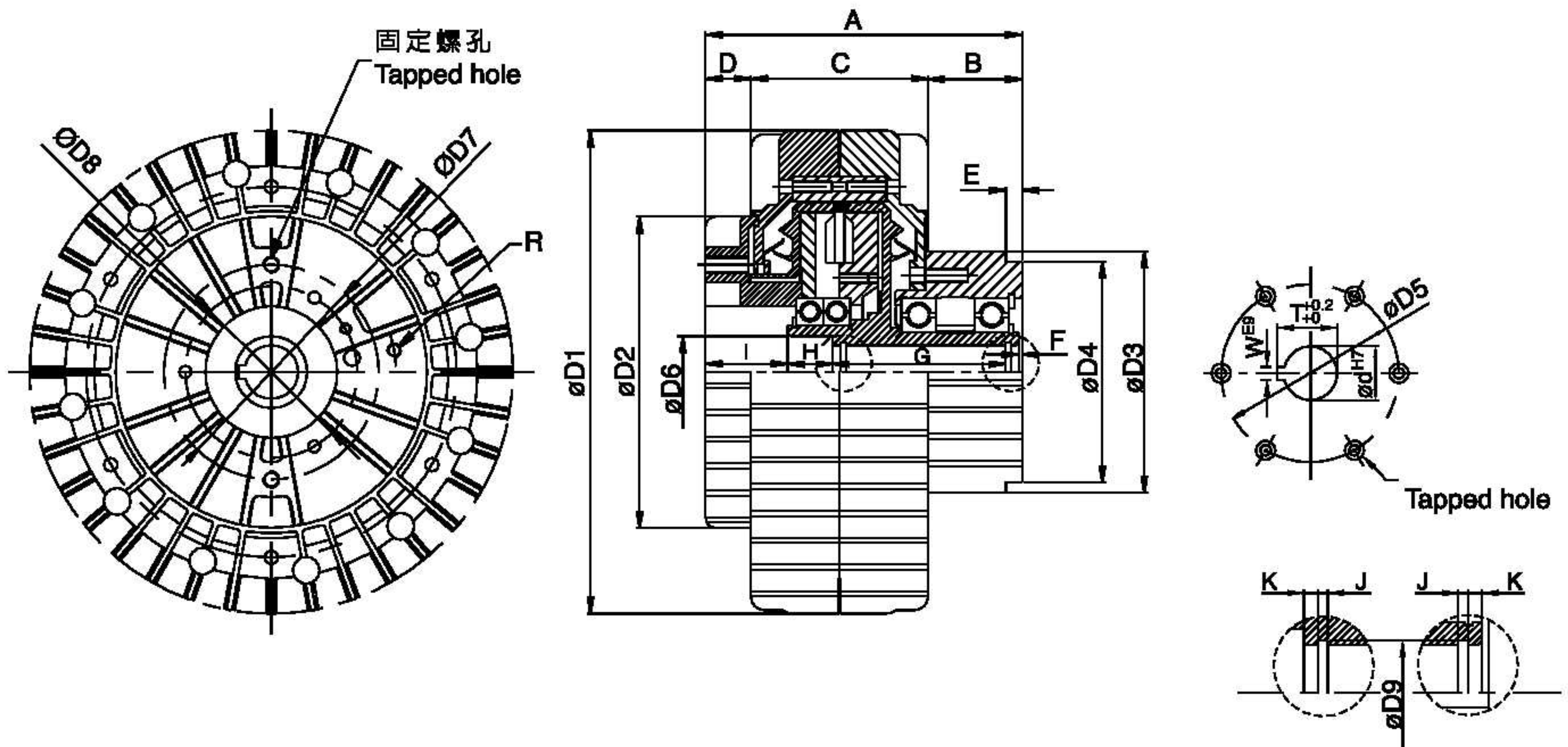
## 磁粉式電磁煞車器 Magnetic Particle Brake



型號 MODEL	ZKB1S2AA	ZKB2S5AA	ZKB005AA	ZKB010AA	ZKB020AA	ZKB040AA	
定格轉距 [kgm](Nm) Rated torque	1.2 (12)	2.5 (25)	5 (50)	10(100)	20 (200)	40 (400)	
容量 Capacity DC24V (75°C)	電流 (A) Current	0.94	1.24	2.15	2.4	2.7	3.5
	電力 (W) Power	22.5	30	51.5	57.6	64.8	84
	時定數 (S) Number of hours set	0.1	0.12	0.13	0.25	0.37	0.4
慣性矩 J Moment of inertia (kgm <sup>2</sup> )	1.34*10 <sup>-3</sup>	3.8*10 <sup>-3</sup>	9.5*10 <sup>-3</sup>	3.5*10 <sup>-2</sup>	9.15*10 <sup>-2</sup>	2.4*10 <sup>-1</sup>	
強制空冷容 許滑動功率 Allowable slippage rate with forced-air cooling	風壓 (Pa) Air pressure	3*10 <sup>4</sup>	5*10 <sup>4</sup>	1*10 <sup>5</sup>	6*10 <sup>4</sup>	5*10 <sup>4</sup>	2*10 <sup>5</sup>
	風量 (m <sup>3</sup> /min) Air volume	0.2	0.4	0.6	1.1	1.6	2.0
	功率 (W) Power	250	380	700	1100	1900	2800
重量 Weight (kg)	5.2	9	14.5	34	53	100	
最高轉速 Maximum speed (r/min)	1800						
磁粉重量 Weight of powder	20	33	60	140	225	370	
外型尺寸 Exterior dimensions	D1	152	182	219	276	325	395
	D2	126	159.5	195	260.5	301	360
	D3 (g7)	42	55	74	100	110	130
	D4	64	78	100	140	150	200
	L	131.8	155	192.4	235	274.45	336.7
	L1	29.5	43	55	64.8	69	92
	L2	98.1	108	131.3	163.5	195.85	232
	L3	15	17	30	28	30	35
	L4	25.5	26	28	46	56	66.5
	L5	14.6	15	17.3	21.5	31.85	40
	d (h7)	15	20	25	30	35	45
	H ( <sup>0</sup> / <sub>-0.2</sub> )	17	22	28	33	38.5	48.5
	W(p7)	5		7		10	12
	V	M4*0.7P*8L	M5*0.8P*10L	M6*1P*12L		M10*1.5P*20L	
R	6-M6*1P*10L			6-M10*1.5P*15L		8-M10*1.5P*15L	
S	1/8		1/4		3/8		

# ZKM Series

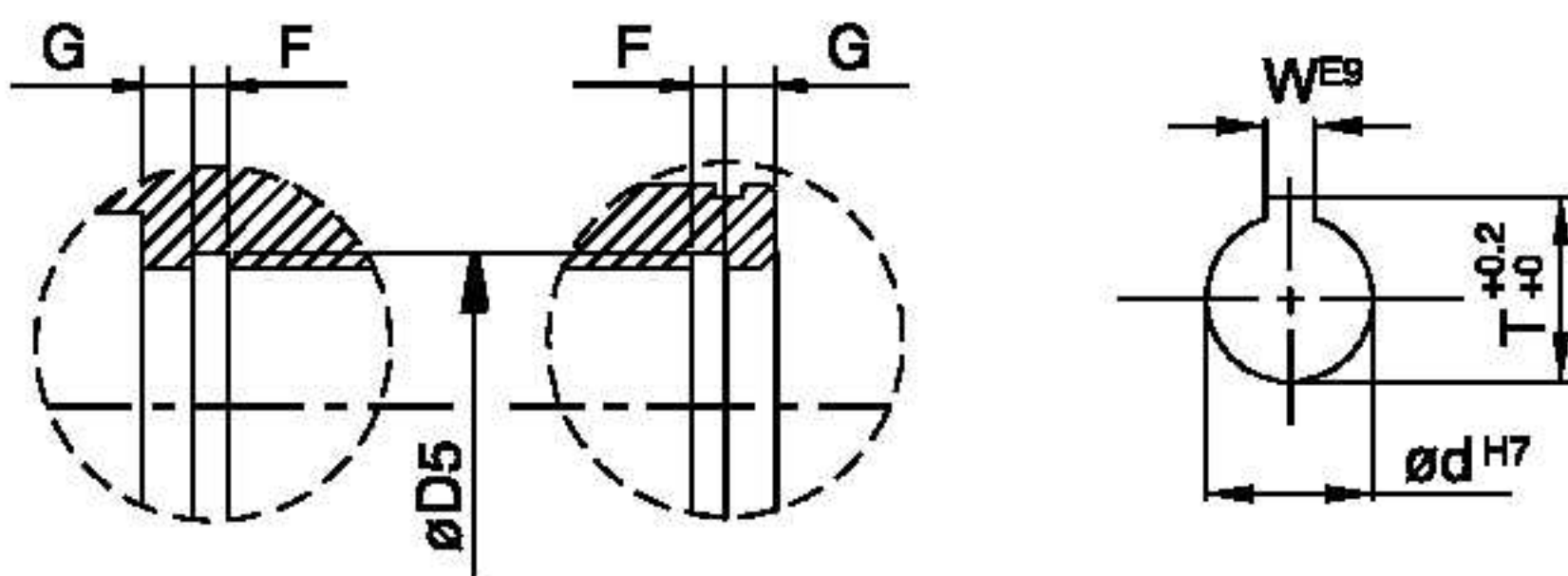
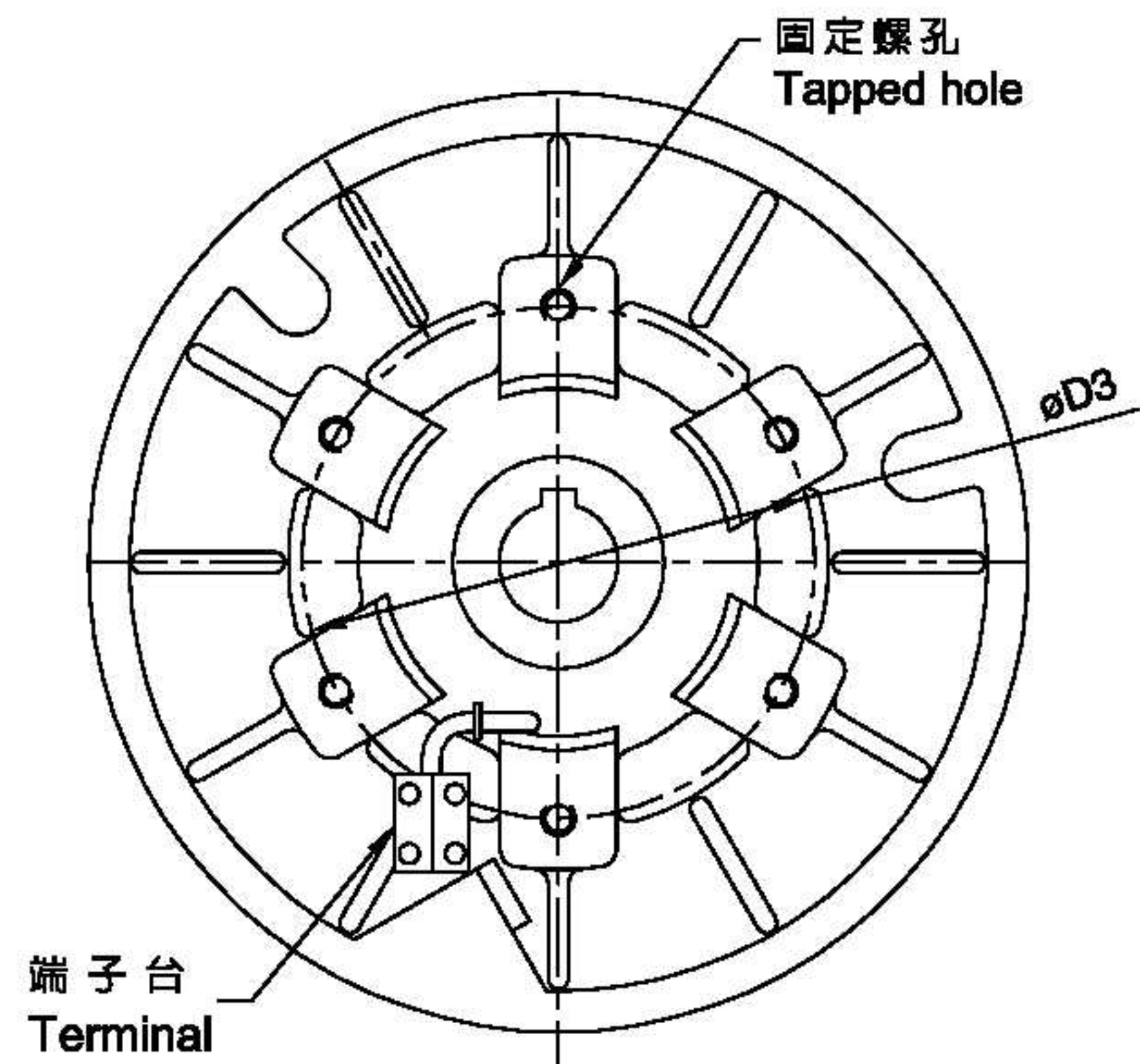
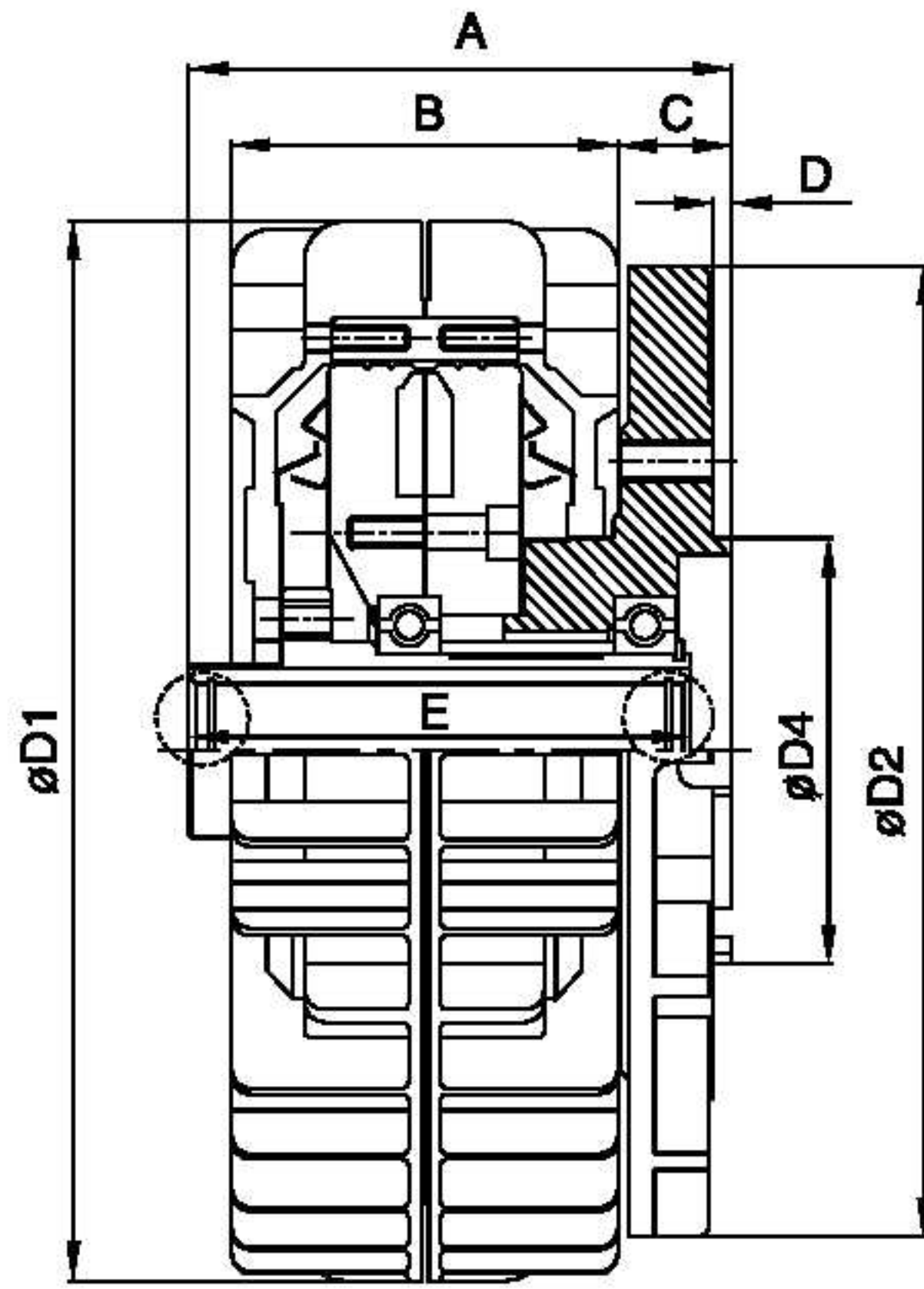
## 磁粉式電磁離合器 Magnetic Particle Clutch



型號 MODEL	ZKM2S5AA	ZKM005AA	ZKM010AA	
定格扭力 (Nm) Rated torque	25	50	100	
容量 Capacity DC24V (75°C)	電流 (A) Current	1.1	2	
	電力 (W) Power	26.4	48	
	時定數 (S) Number of hours set	0.06	0.09	
慣性矩 J Moment of inertia (kgm <sup>2</sup> )	入力軸 Input	1.2*10 <sup>-2</sup>	7.0*10 <sup>-2</sup>	
	出力軸 Output	2.3*10 <sup>-3</sup>	1.5*10 <sup>-2</sup>	
外型尺寸 Exterior dimensions	A	119	141	166
	B	36	47	49
	C	66	74	100
	D	17	20	17
	E	20	30	30
	F	2	3	4
	G	69	103	122
	H	17	-	-
	I	31	35	40
	J	1.1	1.3	1.65
	K	4	5	5
	D1	180	220	275
	D2	114	140	176
	D3	-	-	130
	D4	90	110	125
	D5	80	95	110
	D6	27	-	-
	D7	80	95	110
	D8	64	78	95
	D9	21	31.4	37
d	20	30	35	
P	M6*12L	M8*15L	M10*20L	
R	M4*10L	M6*12L	M6*12L	
Q	M6*12L	M8*12L	M10*18L	
鍵槽 Keyway	W	5	10	
	T	22.3	33.3	38.8

# ZKE Series

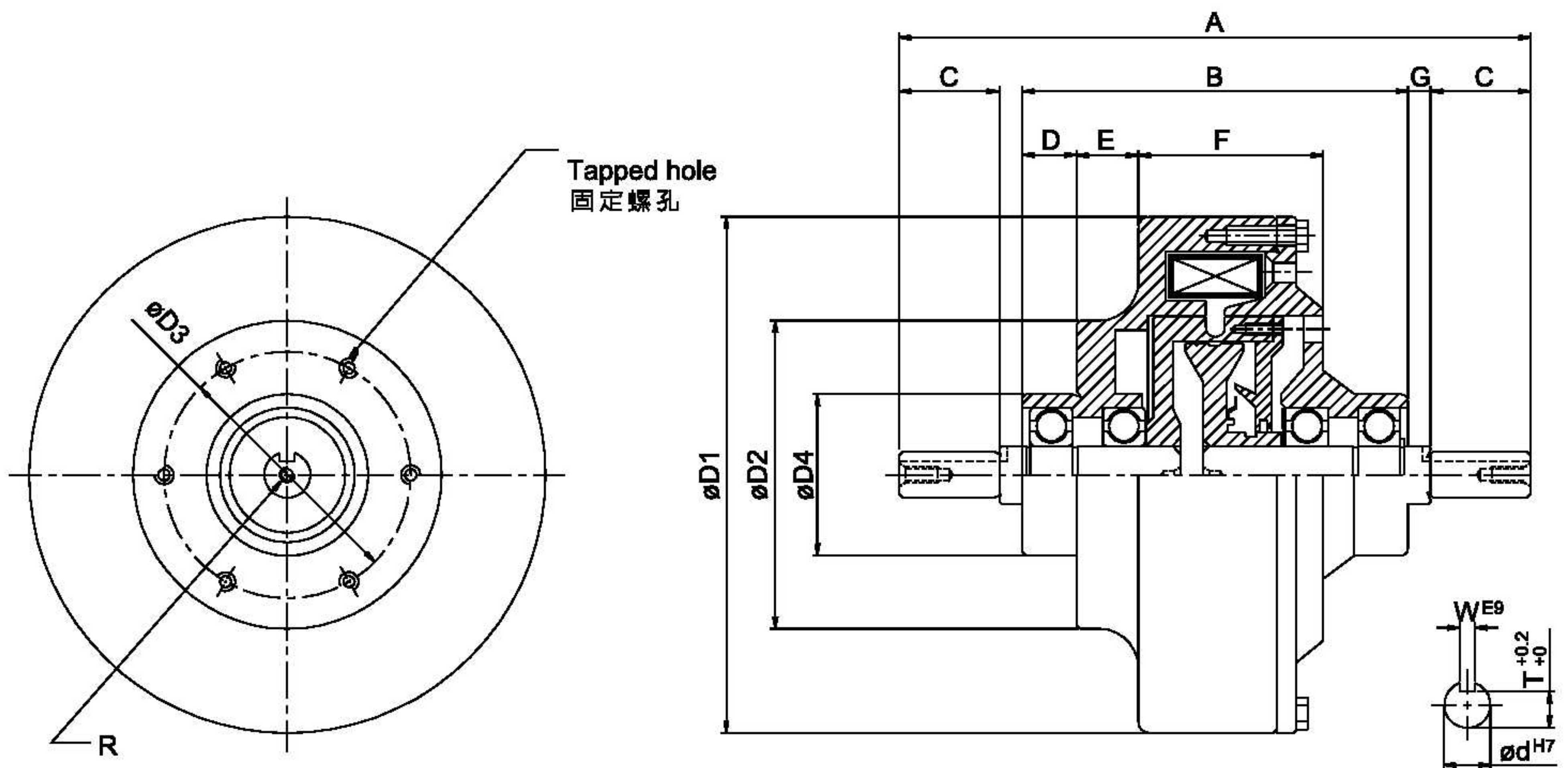
## 磁粉式電磁煞車器 Magnetic Particle Brake



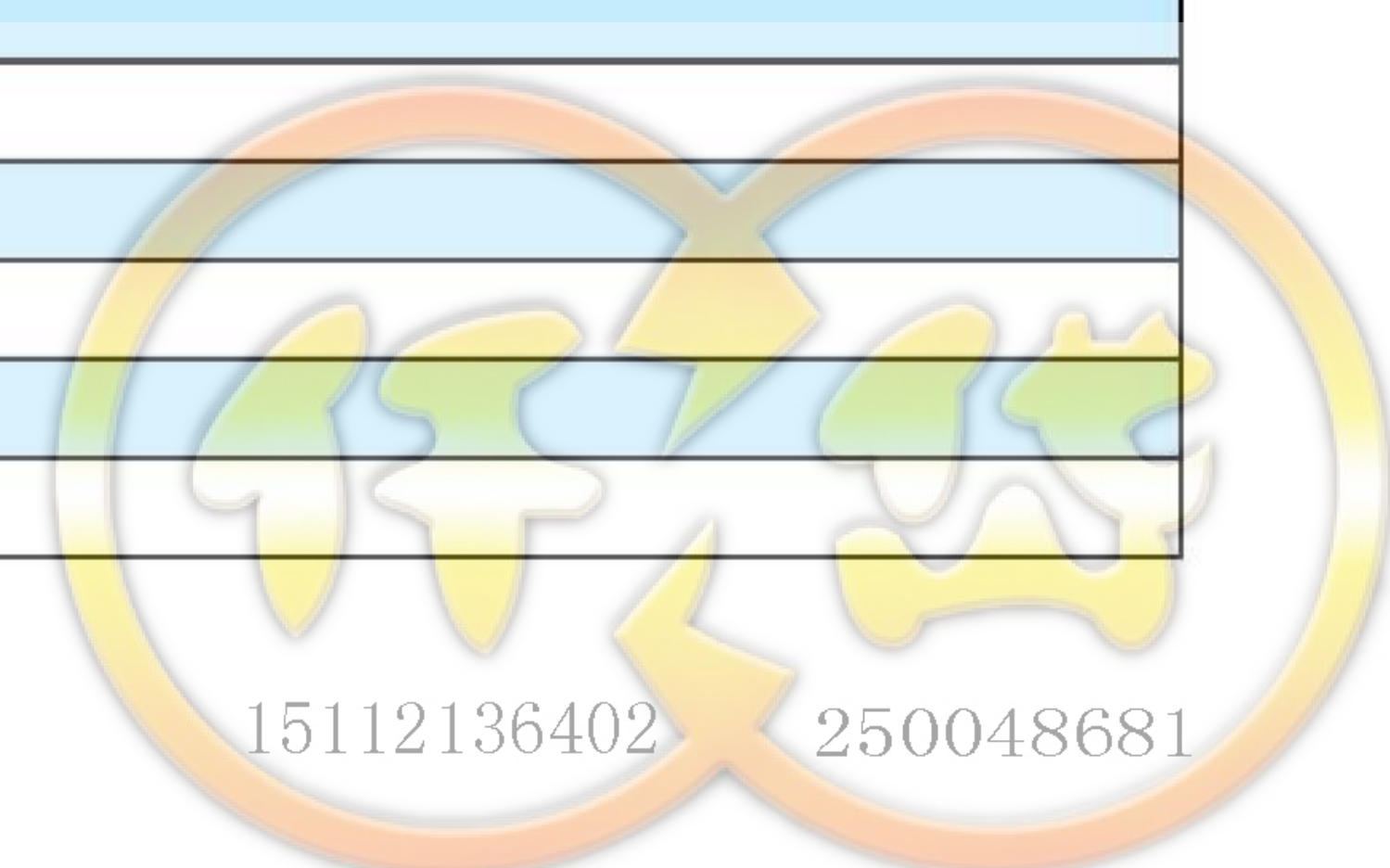
型號 MODEL	ZKE2S5AA	ZKE005AA	ZKE010AA	
定格扭力 (Nm) Rated torque	25	50	100	
容量 Capacity DC24V (75°C)	電流 (A) Current	0.73	1.21	
	電力 (W) Power	17.5	28.8	
	時定數 (S) Number of hours set	0.1	0.3	
慣性矩 J Moment of inertia (kgm <sup>2</sup> )	$9.4 \times 10^{-3}$	$2.3 \times 10^{-2}$	$6.6 \times 10^{-2}$	
外型尺寸 Exterior dimensions	A	100	106	141
	B	66	74	100
	C	28	27	29.6
	D	5	5	5
	E	92	101	130
	F	1.1	1.3	1.65
	G	4	5	5
	D1	180	220	274
	D2	170	195	251
	D3	140	145	150
	D4	100	110	110
	D5	21	31.4	37
	d	20	30	35
	P	3-M10*19L	6-M10*19L	6-M10*22L
鍵槽 Keyway	W	5	7	10
	T	22.3	33.3	38.8

# ZKF Series

## 磁粉式電磁煞車器 Magnetic Particle Brake

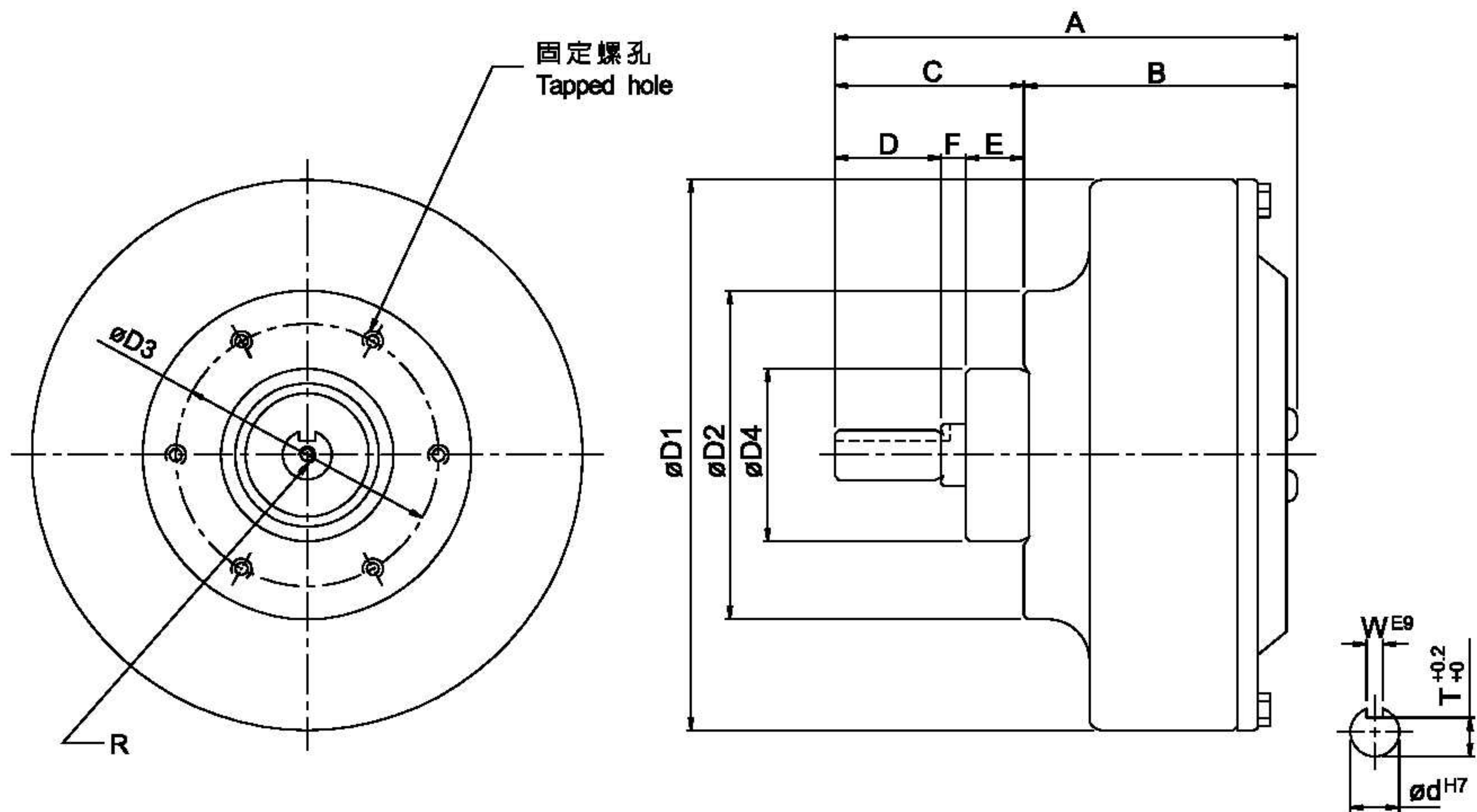


型號 MODEL		ZKF0S6AA
定格扭力 (Nm) Rated torque		6
容量 Capacity DC24V (75°C)	電流 (A) Current	0.81
	電力 (W) Power	19.4
	時定數 (S) Number of hours set	0.08
慣性矩J Moment of inertia (kgm <sup>2</sup> )	入力軸 Input	0.6*10 <sup>-3</sup>
	出力軸 Output	0.183*10 <sup>-3</sup>
最高回轉速(r/min) Max speed		1800
外型尺寸 Exterior dimensions	A	163.8
	B	100
	C	26
	D	14
	E	16
	F	48
	G	5.8
	D1	134
	D2	80
	D3	64
D4	42	
d(h7)	12	
P	M5*10L	
R	M4*8L	
鍵座 Keyseat	T	9.5
	W	4



# ZKN Series

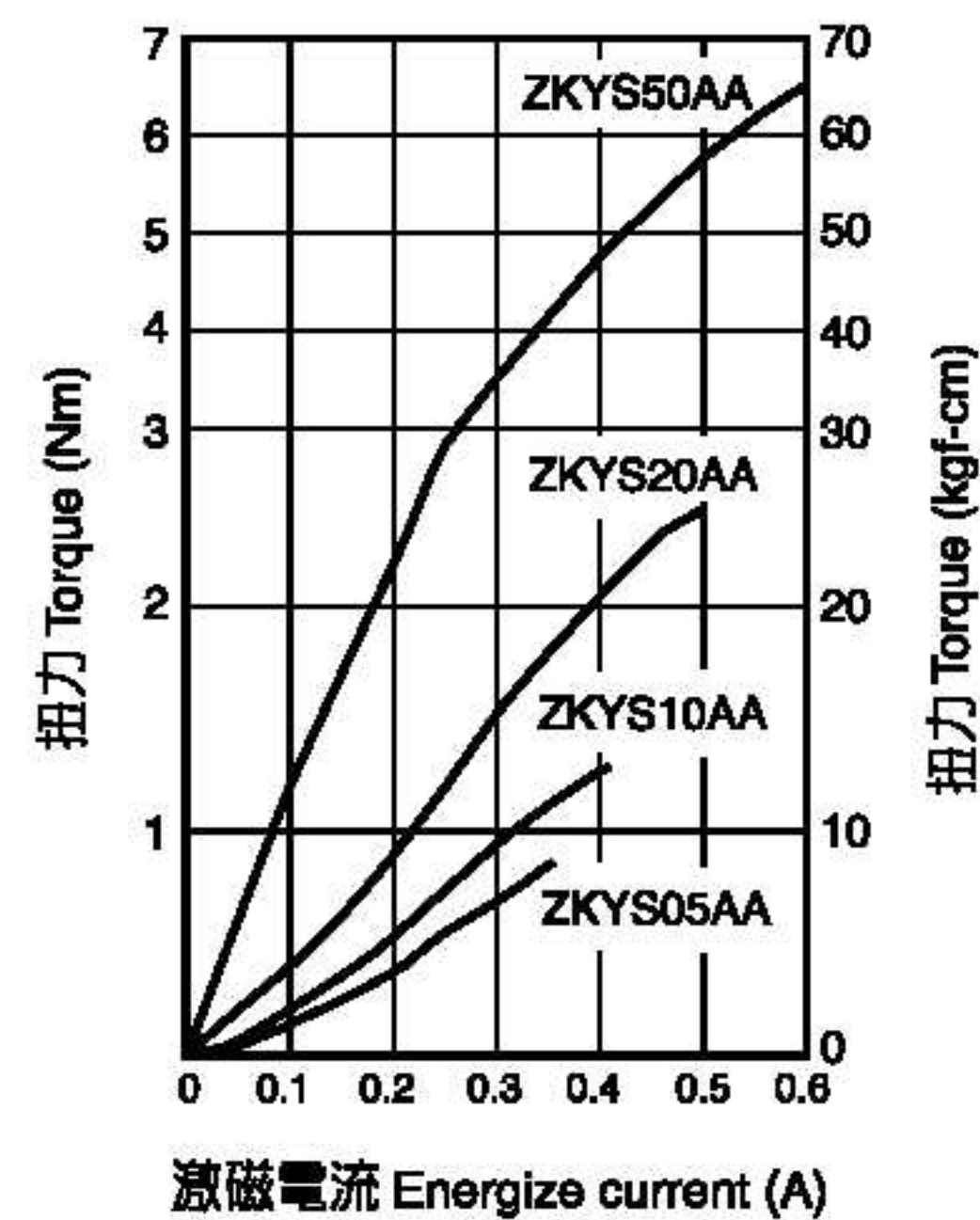
## 磁粉式電磁煞車器 Magnetic Particle Brake



型號 MODEL		ZKN0S3AA	ZKN0S6AA
定格扭力 (Nm) Rated torque		3	6
容量 Capacity DC24V (75°C)	電流 (A) Current	0.53	0.81
	電力 (W) Power	12.7	19.4
	時定數 (S) Number of hours set	0.08	0.08
慣性矩J Moment of inertia (kgm <sup>2</sup> )		0.3*10 <sup>-3</sup>	0.6*10 <sup>-3</sup>
最高回轉速(r/min) Max speed		1800	1800
外型尺寸 Exterior dimensions	A	102	112.5
	B	60	66.5
	C	42	46
	D	22	25
	E	14	14
	F	6	6
	D1	120	134
	D2	75	80
	D3	64	64
	D4	42	42
	d	10	12
	P	M5*10L	M5*10L
	R	M3*8L	M4*12L
鍵座 Keyseat	T	7.5	9.5
	W	4	4

## 特性 Special Features

【標準扭力特性】（代表範例）  
Special features of standard torque (reference only)

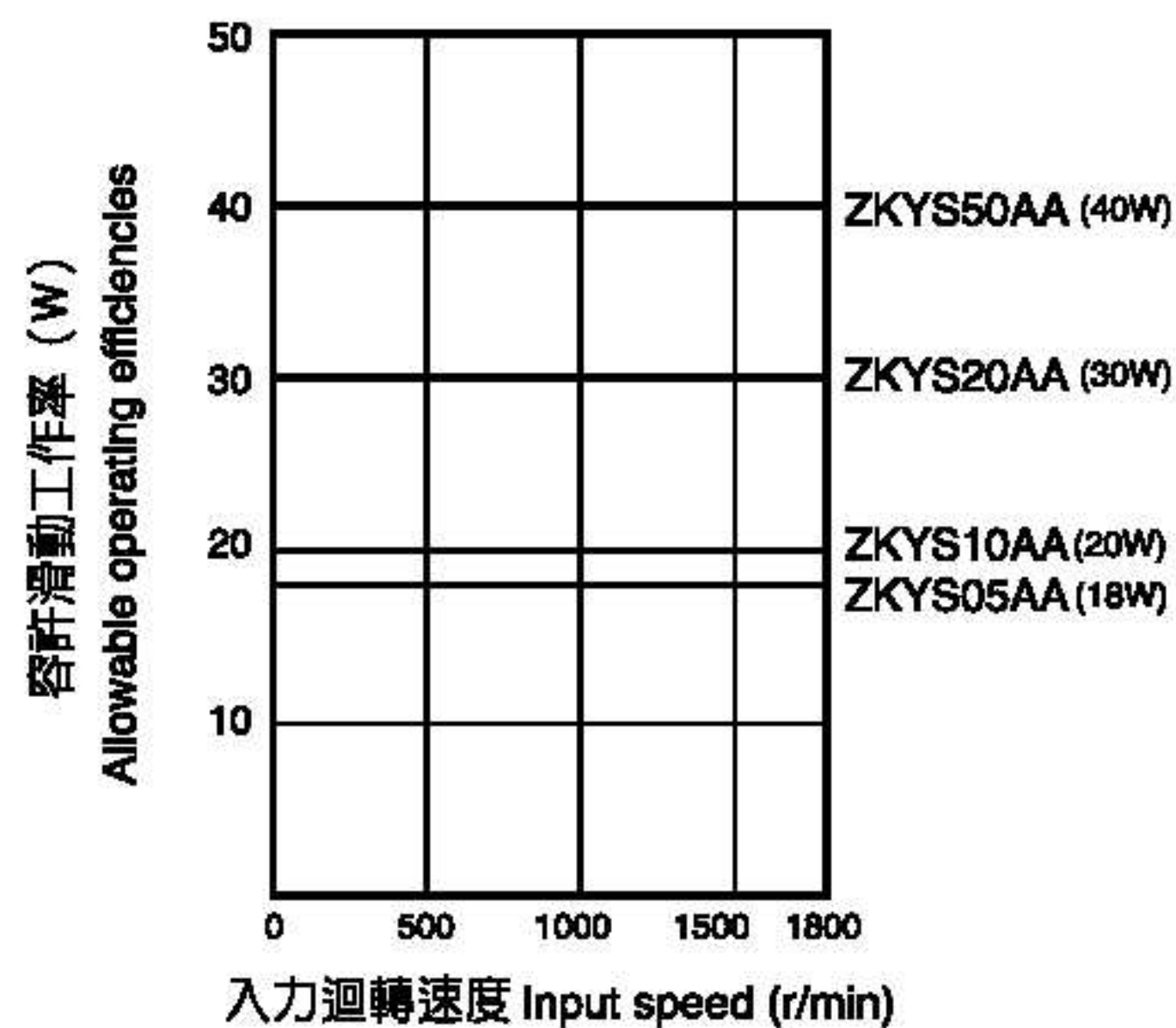


Heat dissipating area of the QU FU BAN is at least

【所容許的連續滑動工作率特性】  
(取付板散熱面積在350cm<sup>2</sup>以上)

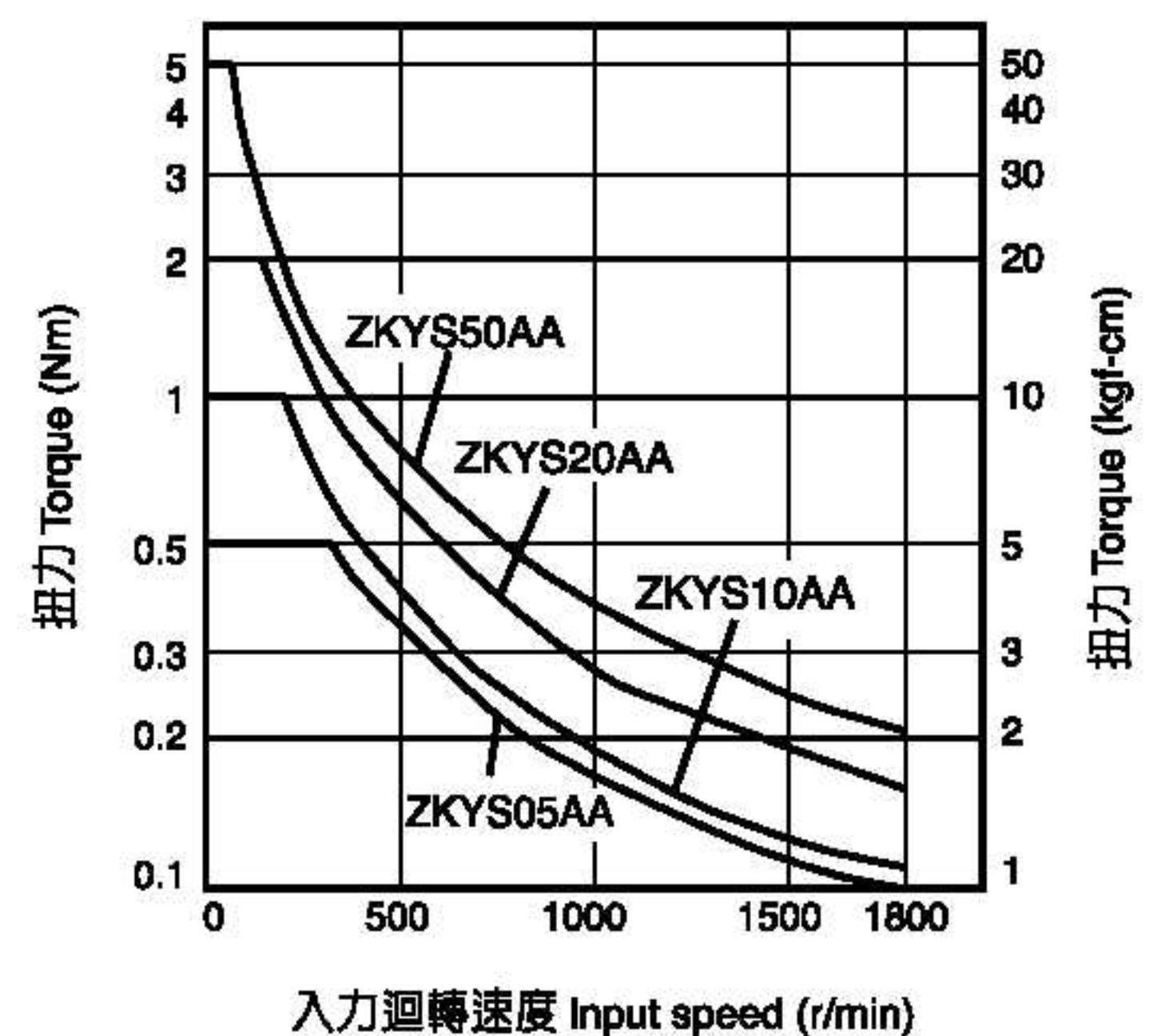
Allowable sustained operating efficiencies

Heat dissipation board for installation should have an area of 350cm<sup>2</sup>~ or more

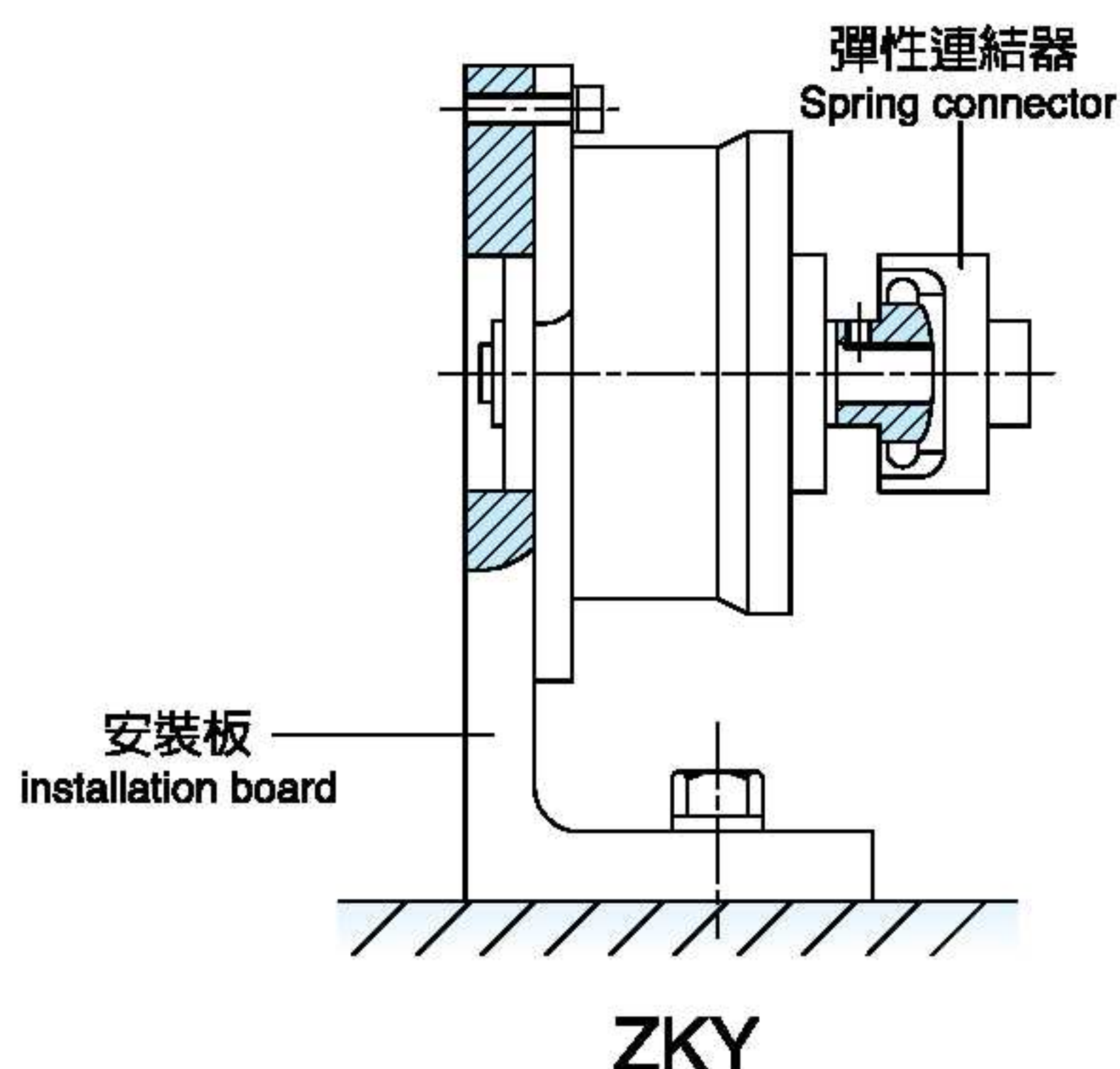


【所容許的連續滑動扭力特性】

Allowable Sustained torque levels



## 安裝範例 Examples of installation



1. 安裝用凸緣的嵌合部位必須以安裝板加以嵌合固定。
2. 制動軸與負載軸的連結一定要使用彈性耦合器，而且此時軸與軸之間的同心度、直角度等必須在所使用的彈性耦合器之容許值範圍內。
3. 安裝皮帶盤時，請保持在容許的軸負重的範圍內。
4. 安裝板的散熱面積請保持在350cm<sup>2</sup>以上。

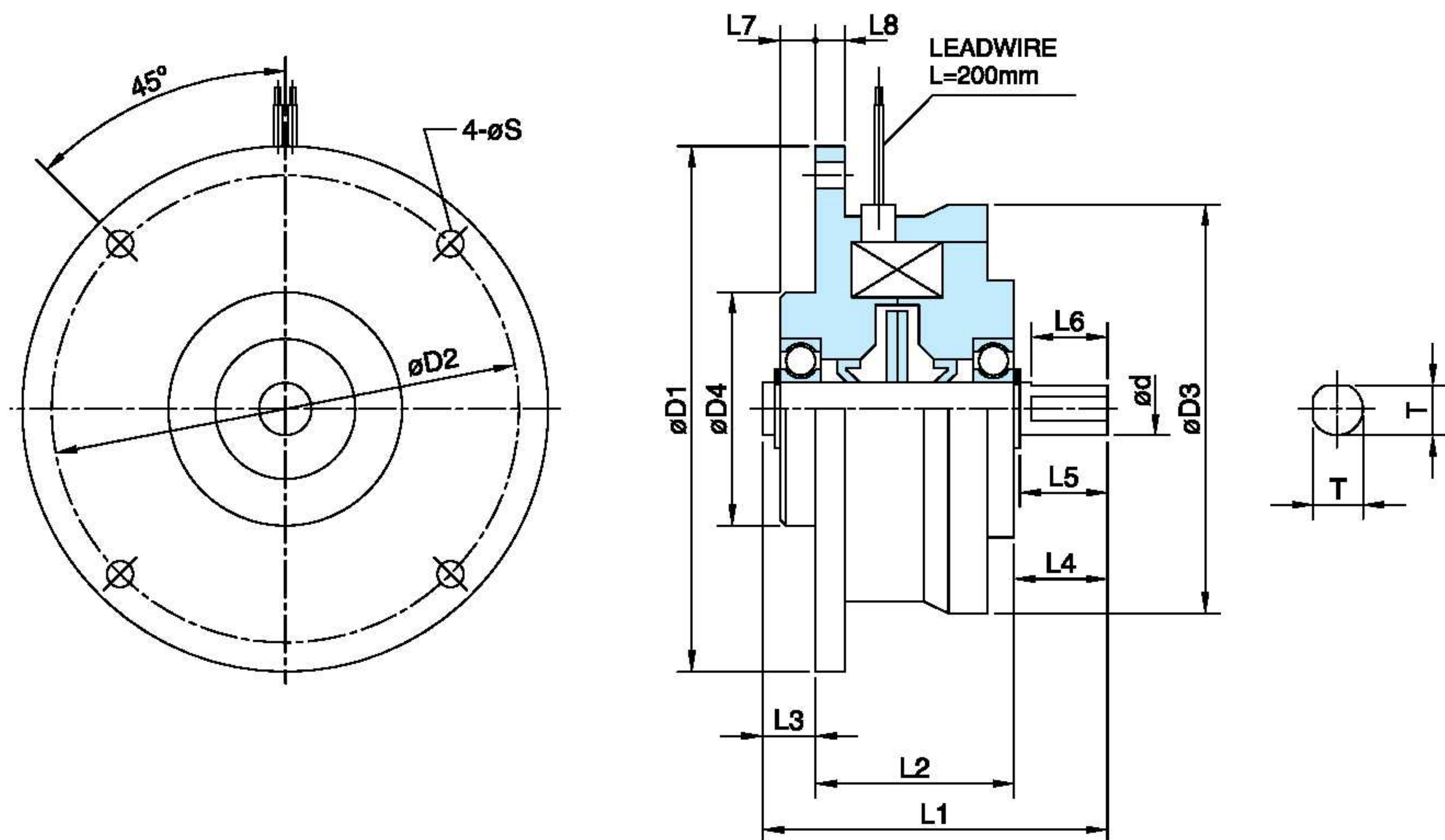
Installation environment

1. Installation flange must be firmly attached to the installation board.
2. Driving and driven shaft must be connected by a flexible clutch, and factors such as shaft concentricity, right angles, etc., must be within the specified limits of the clutch
3. When installing a belt pan, stay within permitted load ranges.
4. Minimum surface area for an installed heat dissipation panel is 350cm<sup>2</sup>



# ZKY Series

## 磁粉式小型電磁煞車器 Micro Magnetic Particle Brake

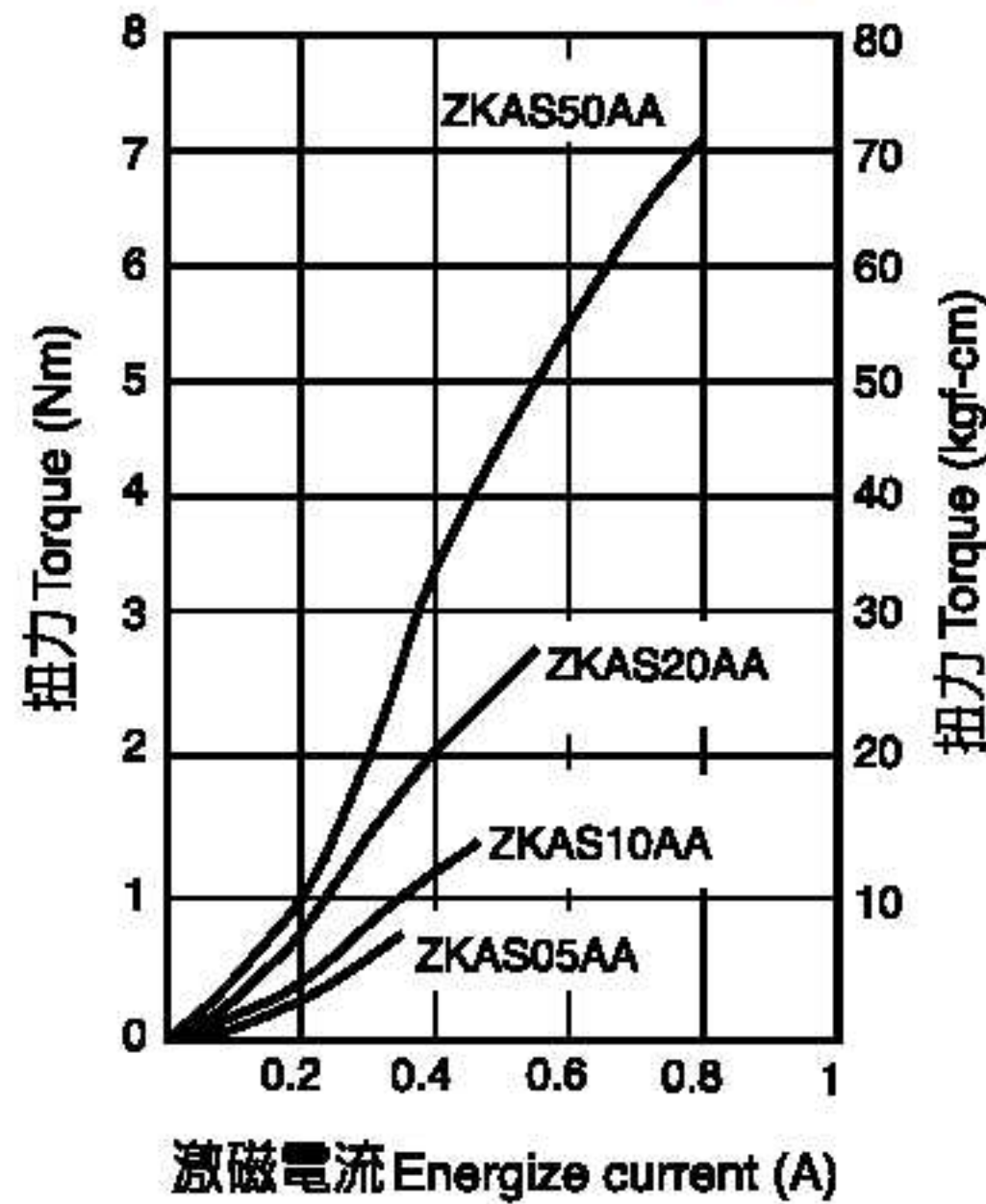


型號 MODEL	ZKYS05AA	ZKYS10AA	ZKYS20AA	ZKYS50AA	
定格轉距 [kgcm](Nm) Rated torque	0.05(0.5)	0.1(1.0)	0.2(2.0)	0.5(5.0)	
容量 Capacity DC24V (75°C)	電流 (A) Current	0.35	0.42	0.5	
	電力 (W) Power	8.4	10	12	
	時定數 (S) Number of hours set	0.02	0.02	0.034	
慣性矩J Moment of inertia (kgm <sup>2</sup> )	9.4*10 <sup>-3</sup>	2.75*10 <sup>-2</sup>	5.25*10 <sup>-2</sup>	1.25*10 <sup>-1</sup>	
重量 Weight (kg)	0.4	0.54	0.96	1.3	
最高轉速 Maximum speed (r/min)	1800				
外型尺寸 Exterior dimensions	D1	70	76	90	108
	D2	60	66	80	95
	D3	50	56	70	82
	D4 (g7)	24	30	40	44
	d (g7)	5	7	9	15
	L1	45	50	59	66
	L2	29	30	34	36
	L3	5	7	9	11
	L4	11	13	16	19
	L5	10	12.2	15	18
	L6	9	10	13	16
	L7	3	4	6	8
	L8	4	4	5	5
S	4.5	4.5	4.5	6	
T	4.5	6.5	8.5	14	

# 特性 Special Features

## 【標準扭力特性（代表範例）】

Special features of standard torque (reference only)

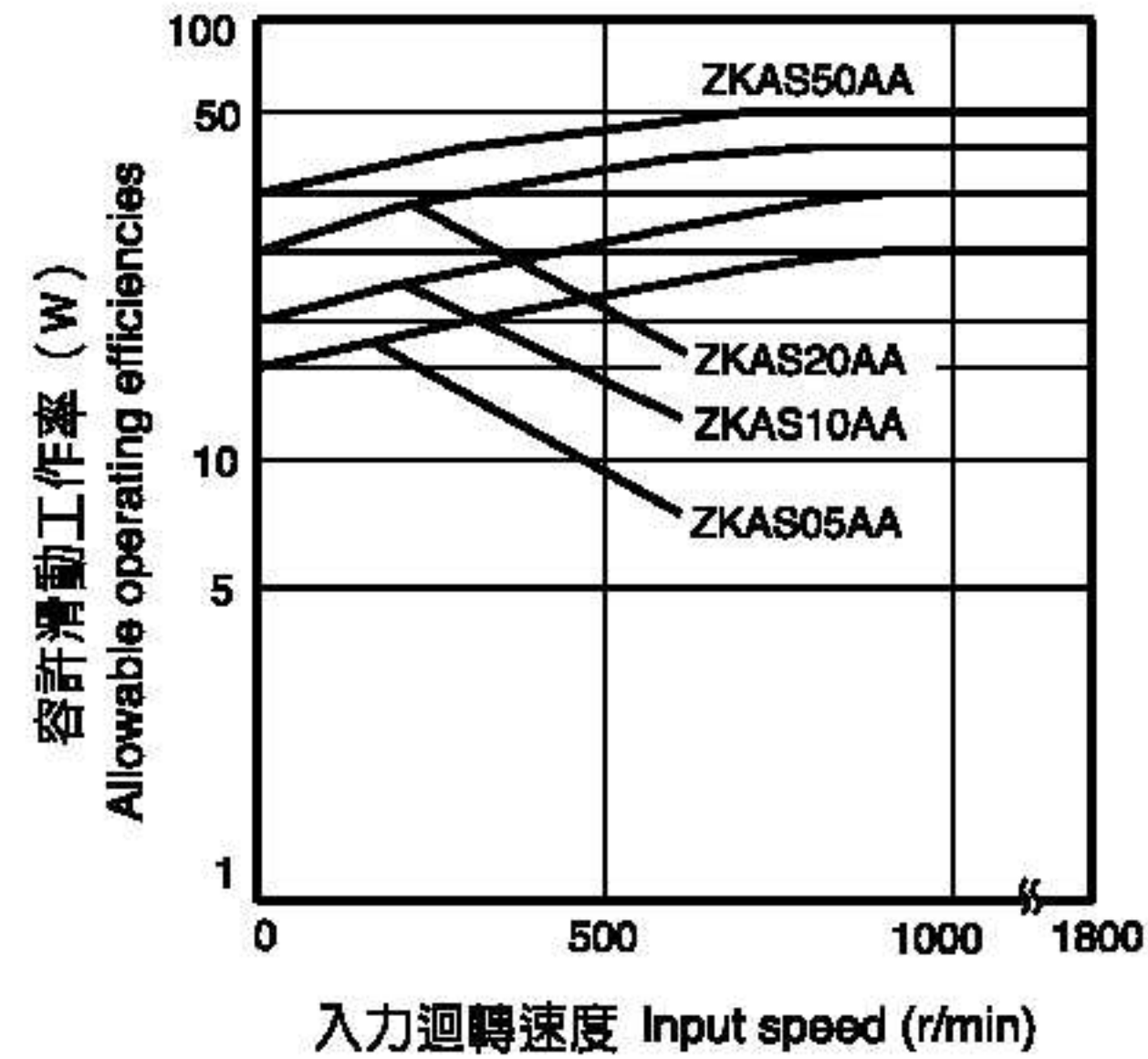


## 【所容許的連續滑動工作率特性】

(散熱面積請根據安裝範例的第四項)

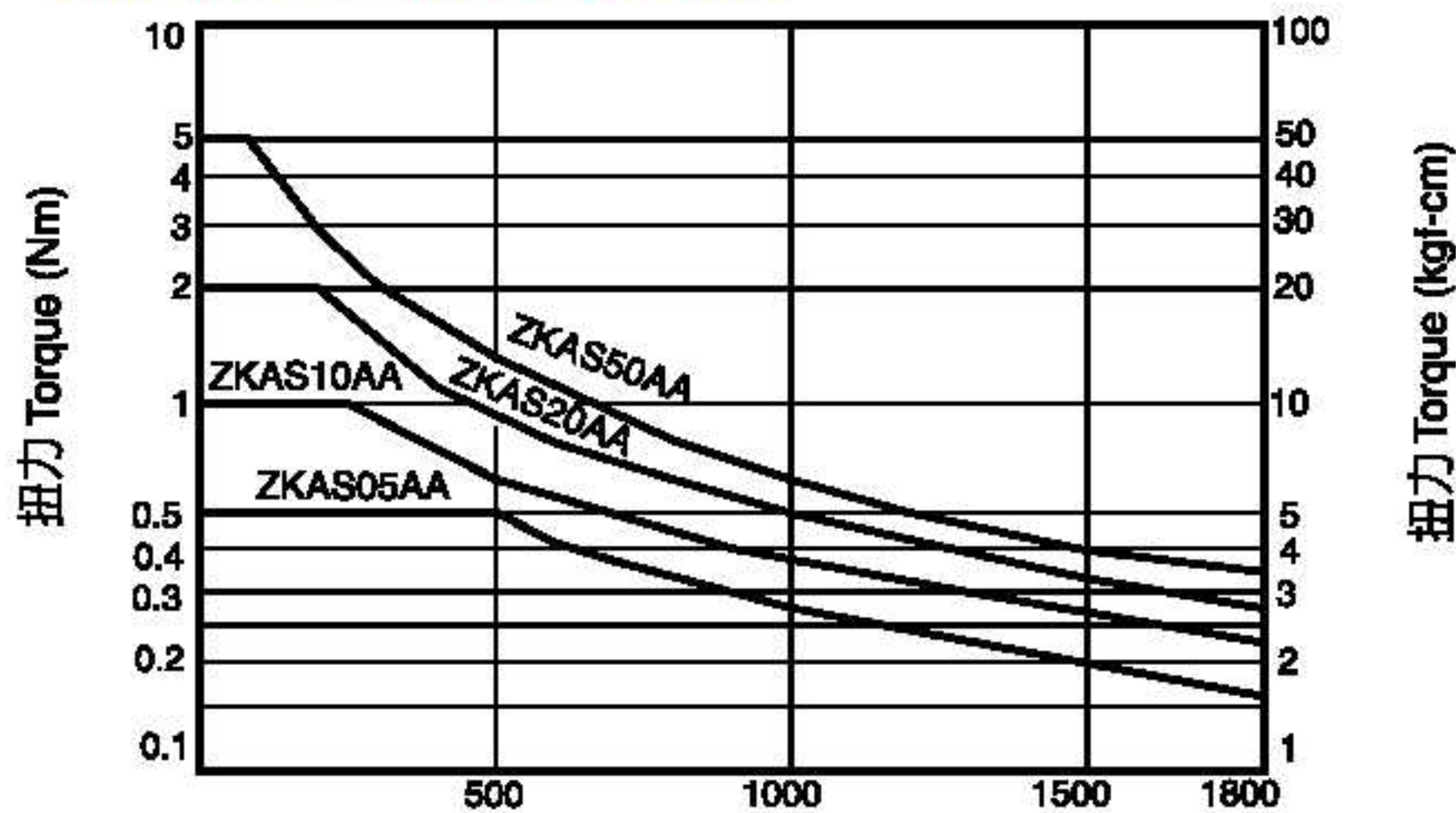
Allowable sustained torque levels (natural cooling)

Consult item 4 of the installation specifications regarding the size of the heat dissipation panel



## 【所容許的連續滑動扭力特性】 (取付板散熱面積須350cm<sup>2</sup>以上)

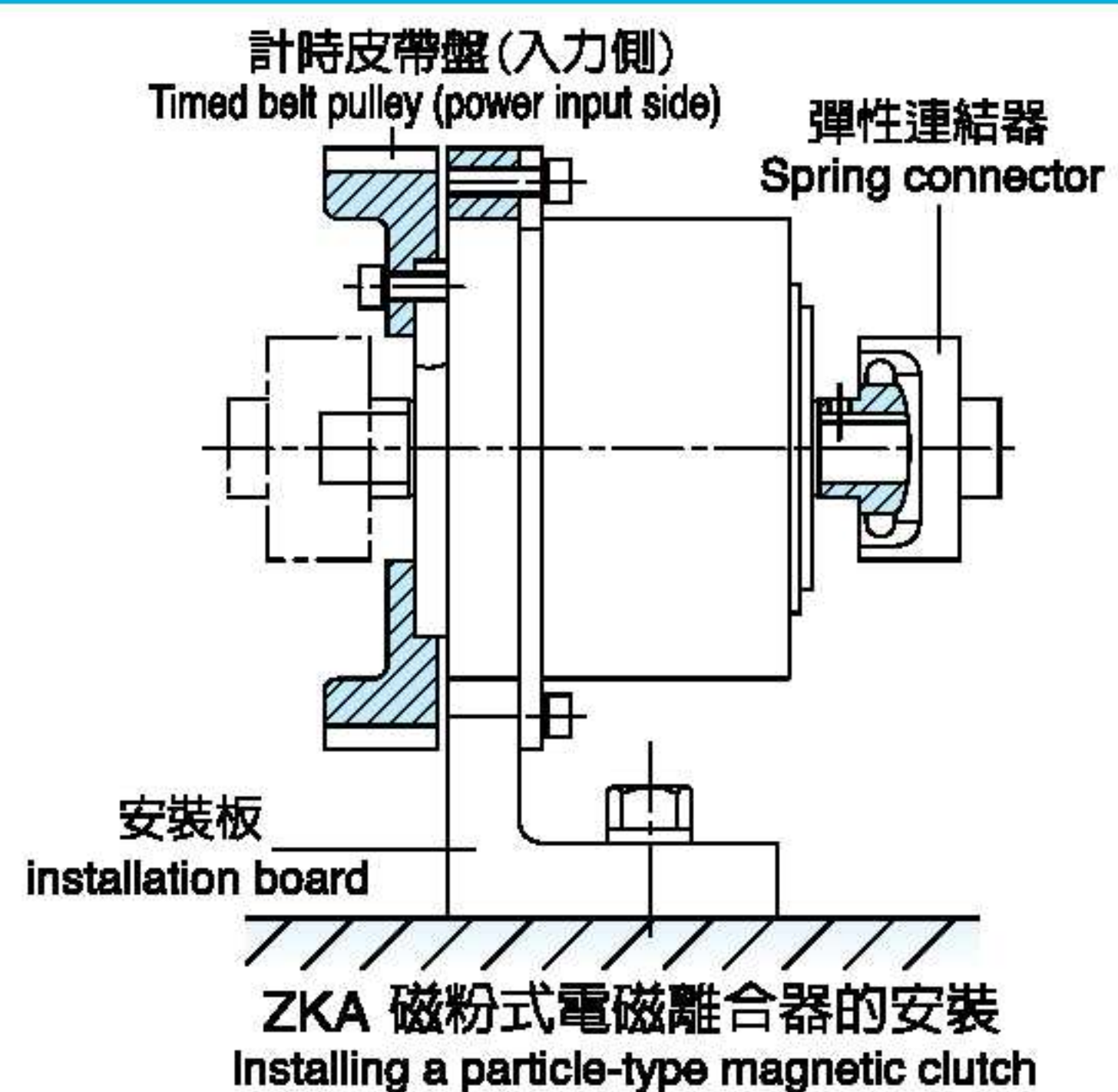
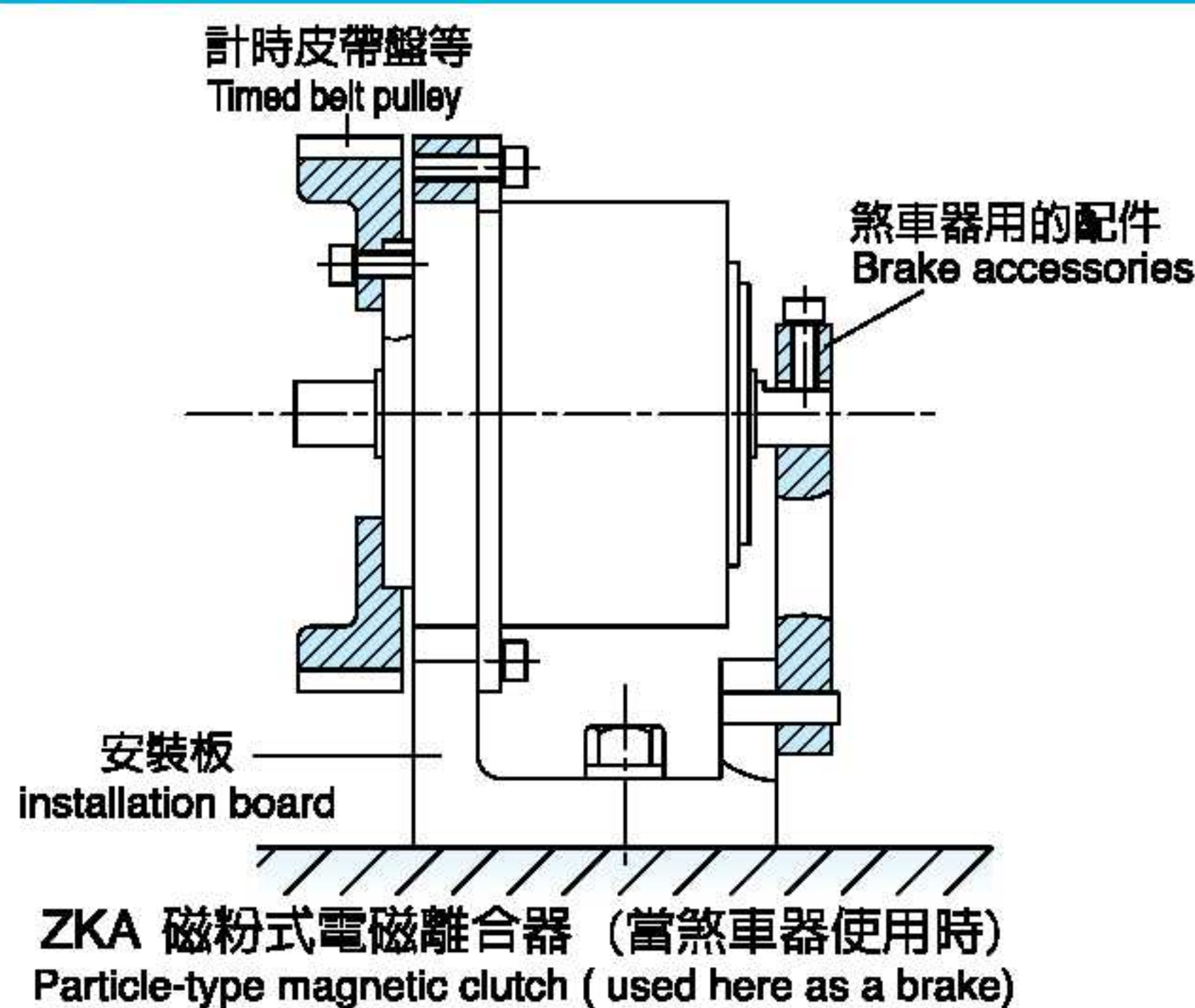
Allowable Sustained torque levels Heat dissipation board for installation should have an area of 350cm<sup>2</sup>- or more



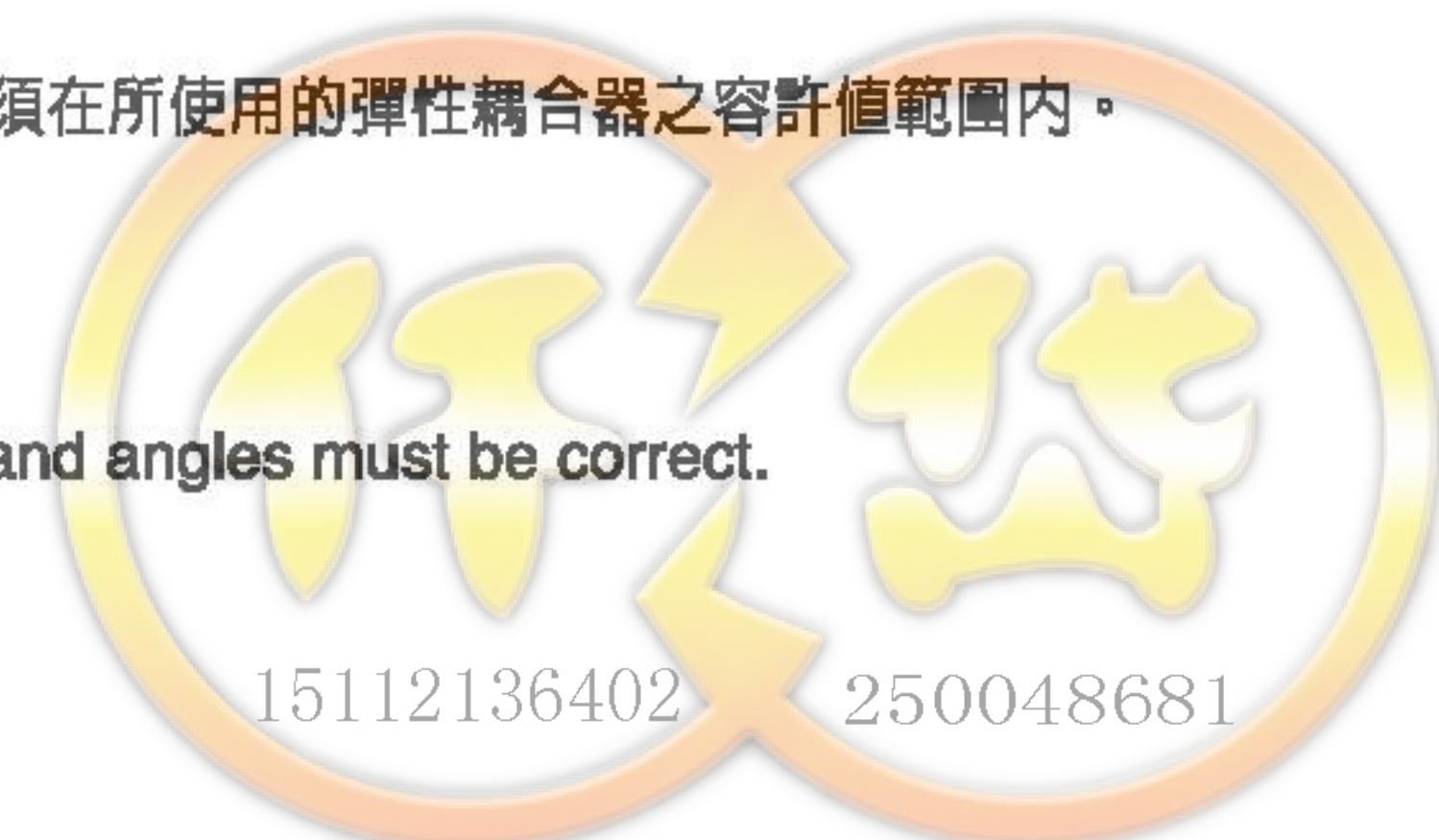
入力迴轉速度 (r/min) (假設出力旋轉停止)

Input speed (r/min) (assuming that the output shaft is stopped)

# 安裝範例 Examples of installation



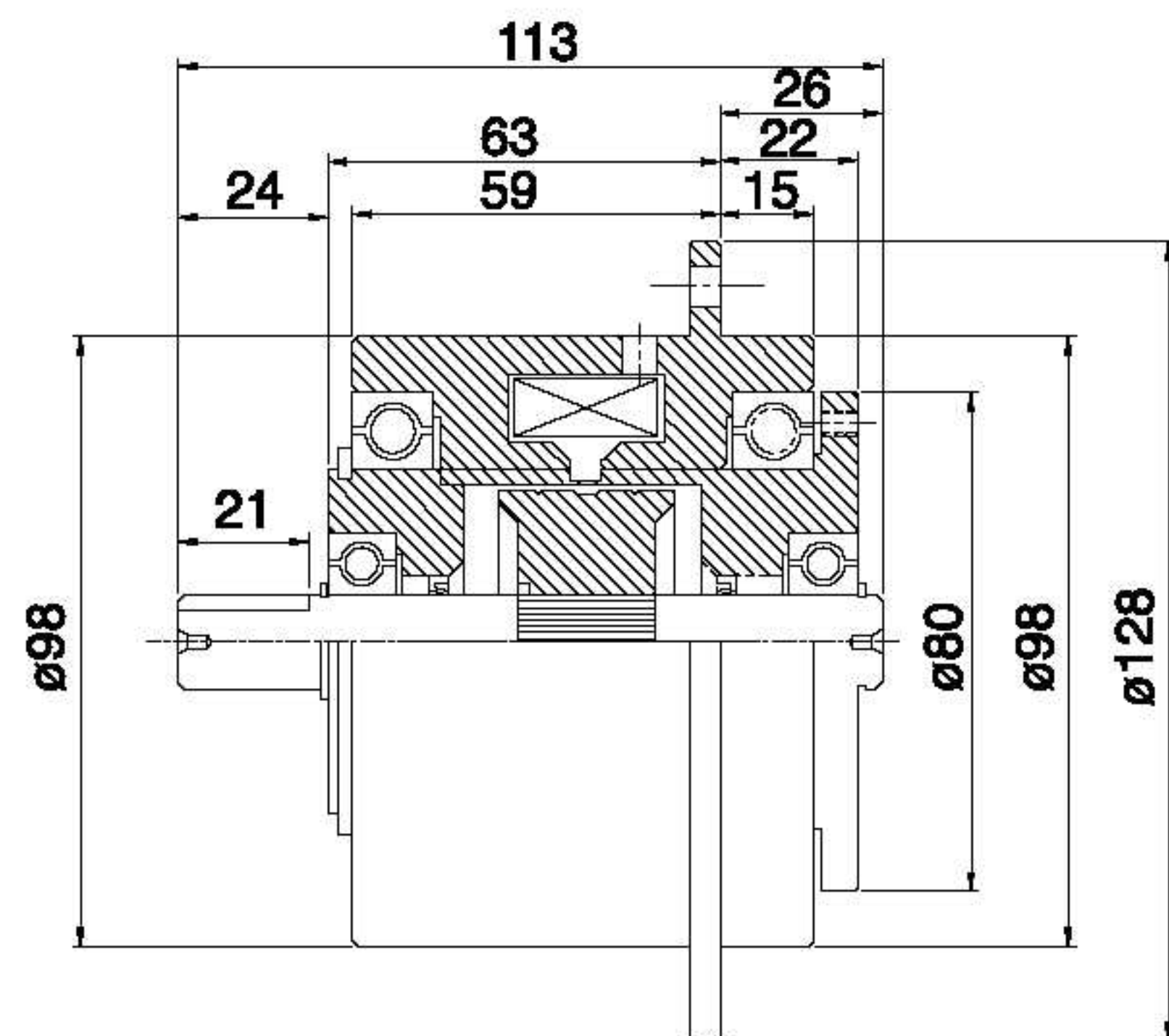
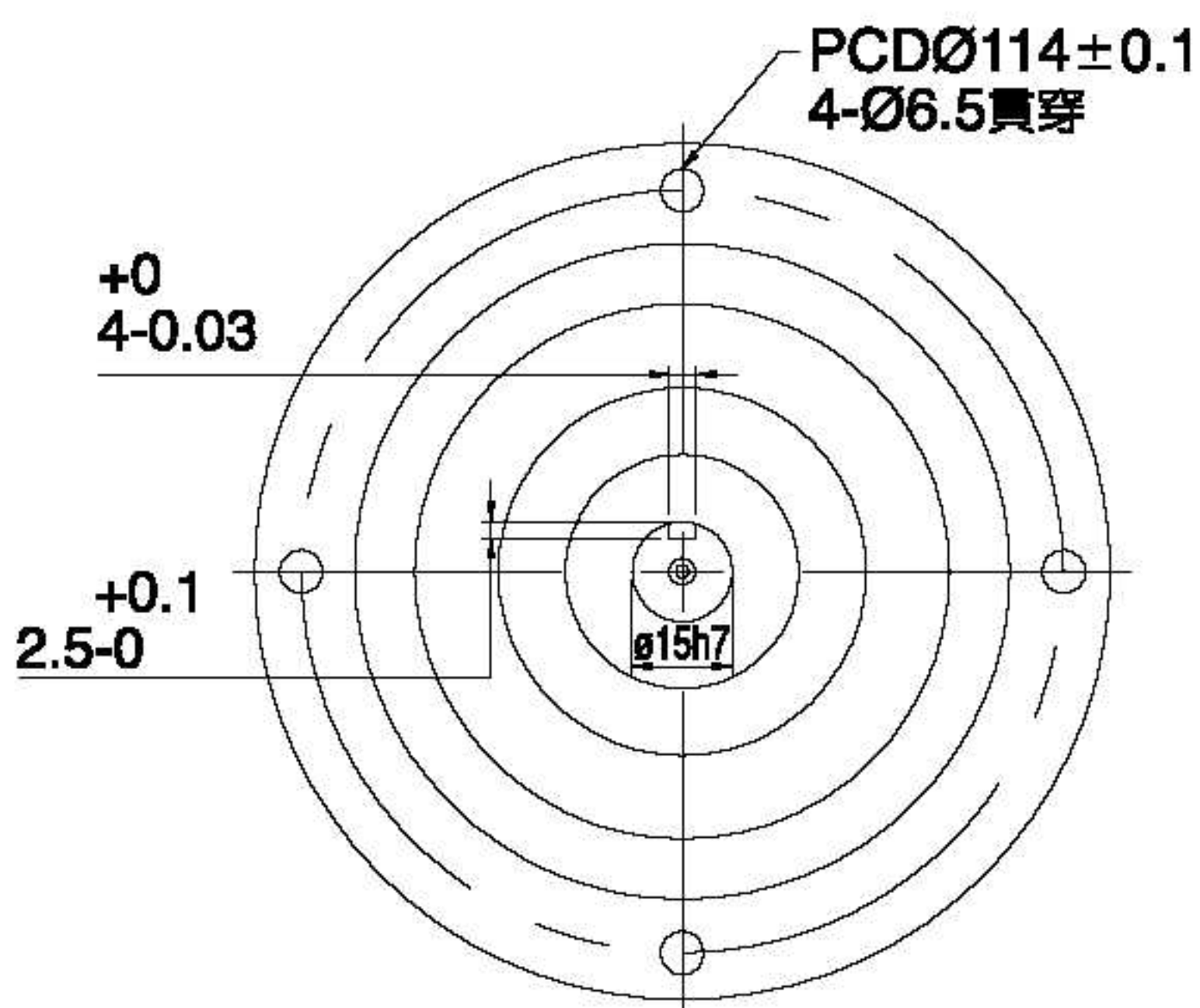
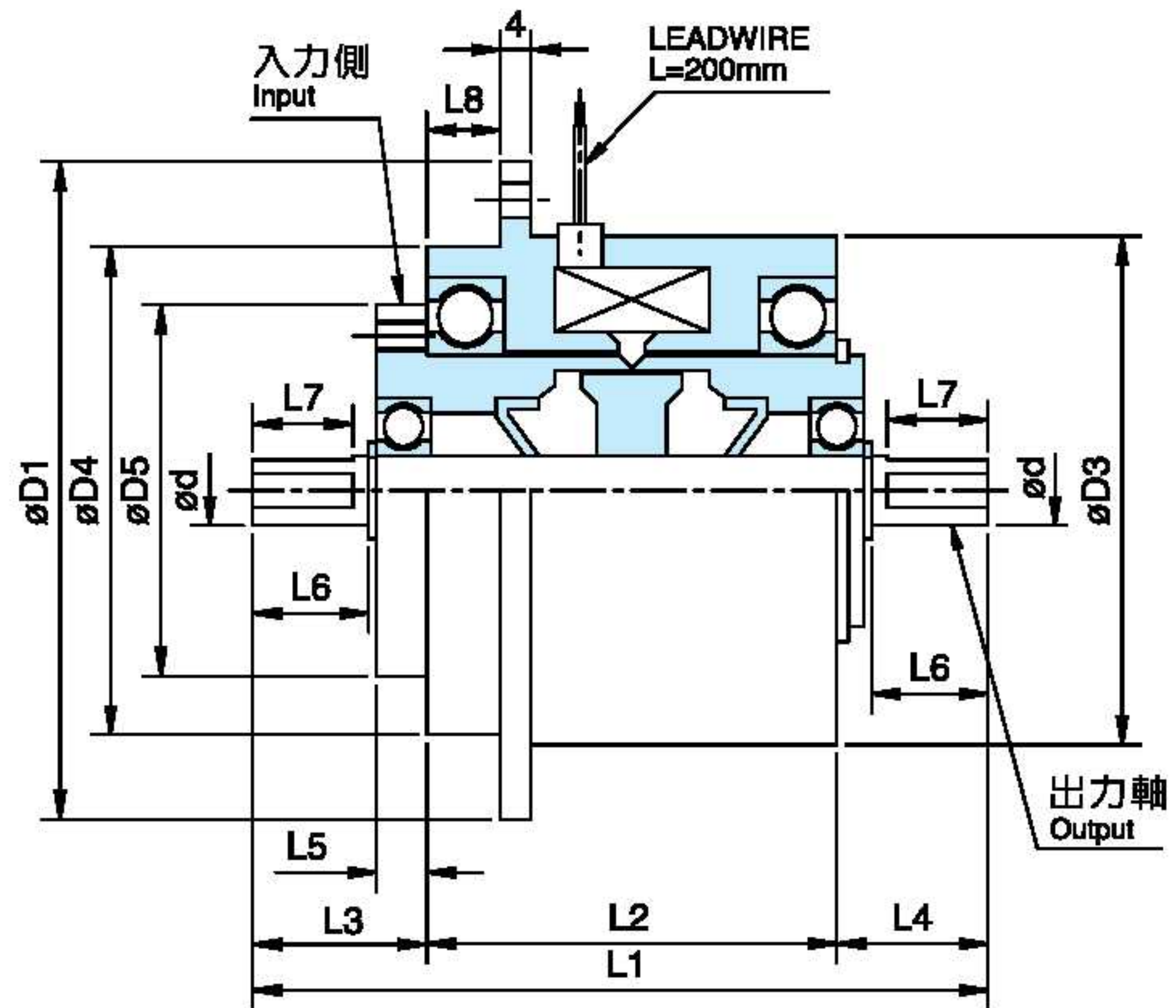
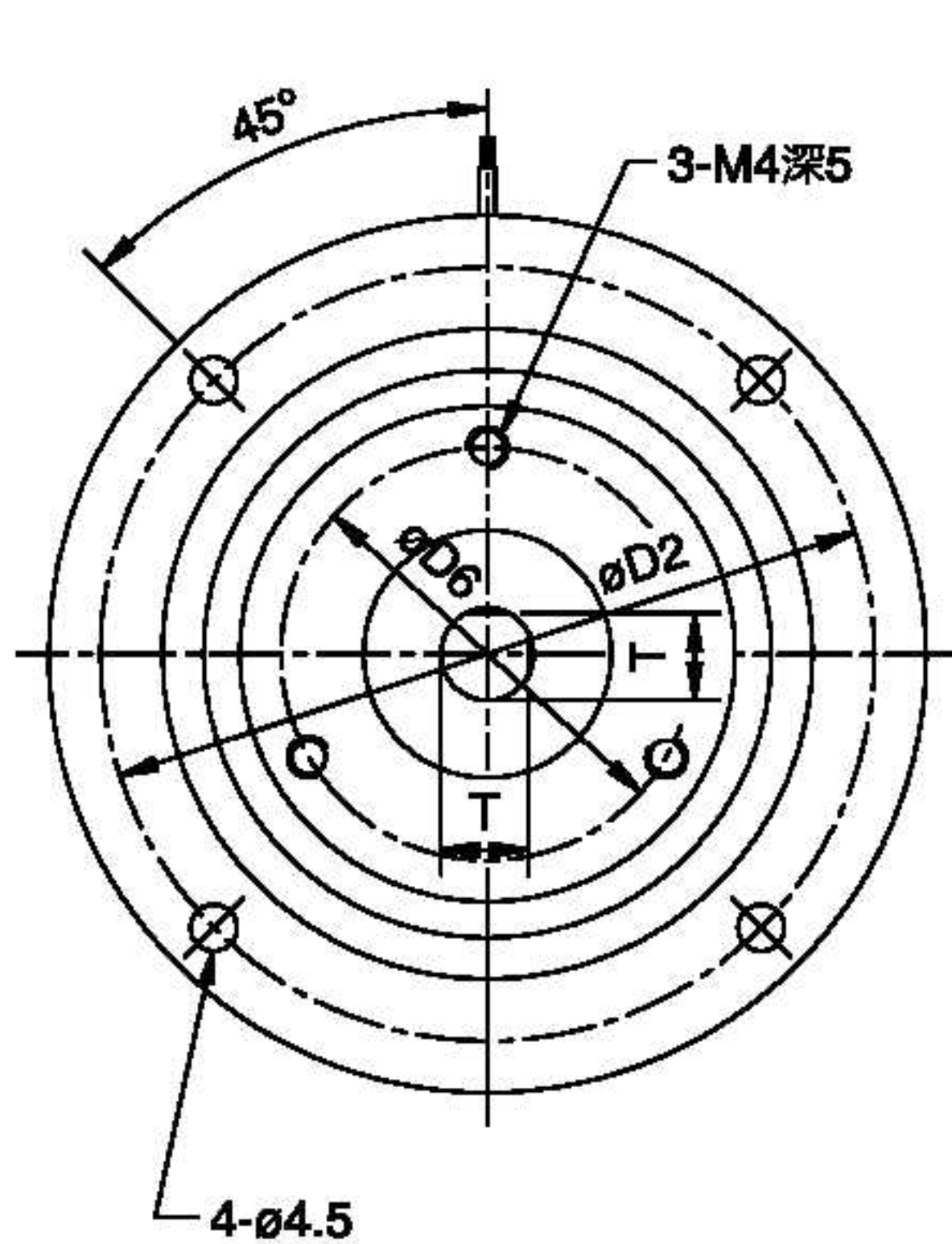
1. 安裝用凸緣的嵌合部位必須以安裝板加以嵌合固定。
  2. 離合器與負載軸的連結一定要使用彈性耦合器，而且此時軸與軸之間的同心度、直角度等必須在所使用的彈性耦合器之容許值範圍內。
  3. 安裝皮帶盤時，請保持在容許的軸負重的範圍內。
  4. 安裝板的散熱面積請保持在350cm<sup>2</sup>。
1. Installation flange must be firmly attached to the installation board.
  2. Drive shaft and load shaft must be connected by a spring coupler, and the alignment and angles must be correct.
  3. When installing a belt pan, stay within permitted load ranges.
  4. Minimum surface area for an installed heat dissipation panel is 350cm<sup>2</sup>.



# ZKA Series

## 磁粉式小型電磁離合器 Micro Magnetic Particle Clutch

型號 MODEL	定格轉矩 Rated torque [kgm](Nm)	容量 Capacity DC24V(75°C)			慣性矩 J Moment of inertia (kgcm <sup>2</sup> )		重量 Weight (kg)	最高轉速 Maximum speed (r/min)
		電流 (A) Current	電力 (W) Power	時定數 (S) Number of hours set	入力側 Input side	出力側 Output side		
ZKAS05AA	0.05	0.35	8.4	0.02	$2.1 \times 10^{-1}$	$1.7 \times 10^{-2}$	0.67	1800
ZKAS10AA	0.1	0.47	11.3	0.03	$3.46 \times 10^{-1}$	$4.6 \times 10^{-2}$	0.88	
ZKAS20AA	0.2	0.55	13	0.055	$6.8 \times 10^{-1}$	$1.03 \times 10^{-1}$	1.27	
ZKAS50AA	0.5	0.8	19	0.055	1.85	$4.0 \times 10^{-1}$	2.3	
ZKA001AA	100(10)	1.0	8.24	0.09	5.3	1.1	4.1	

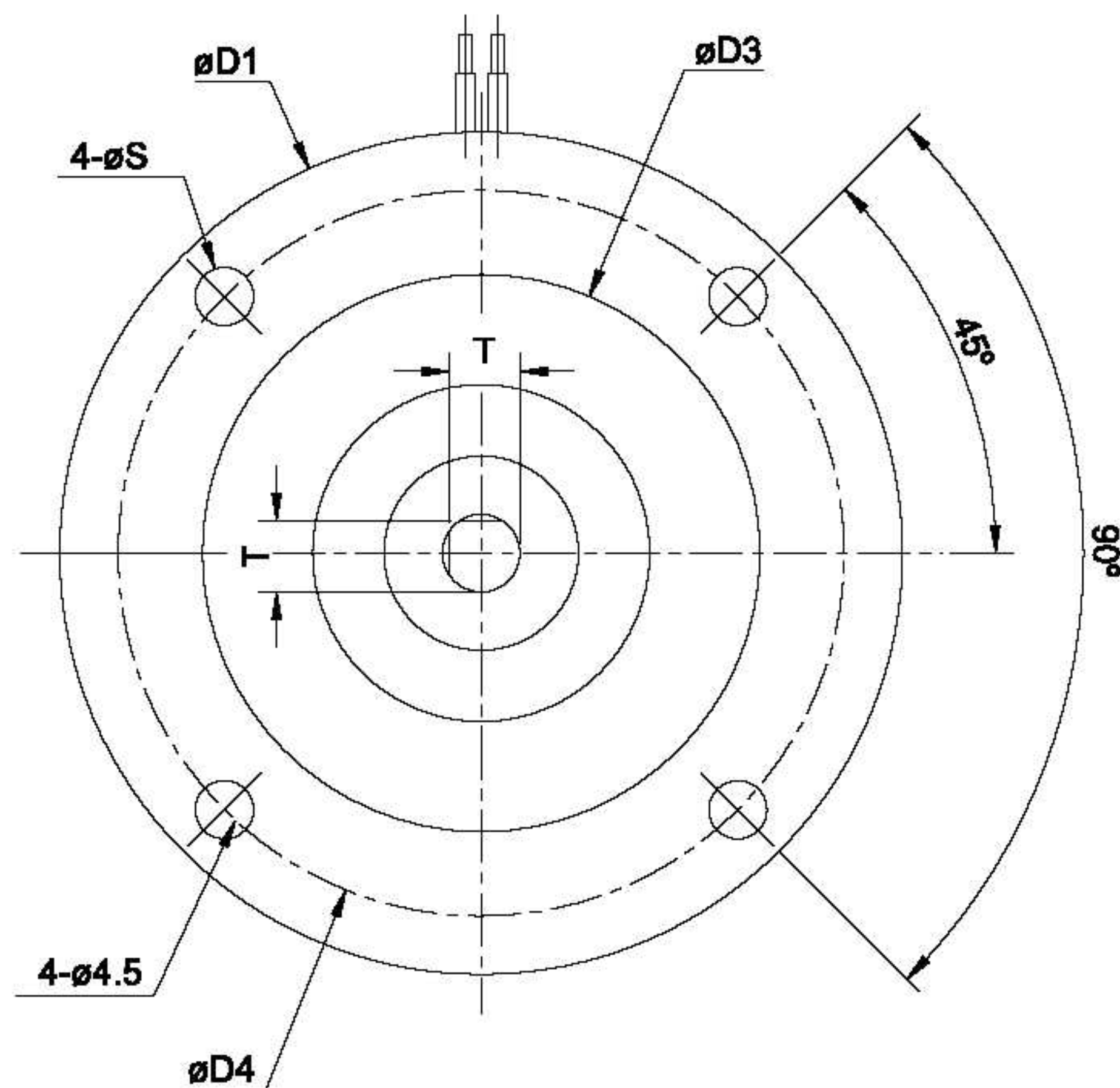
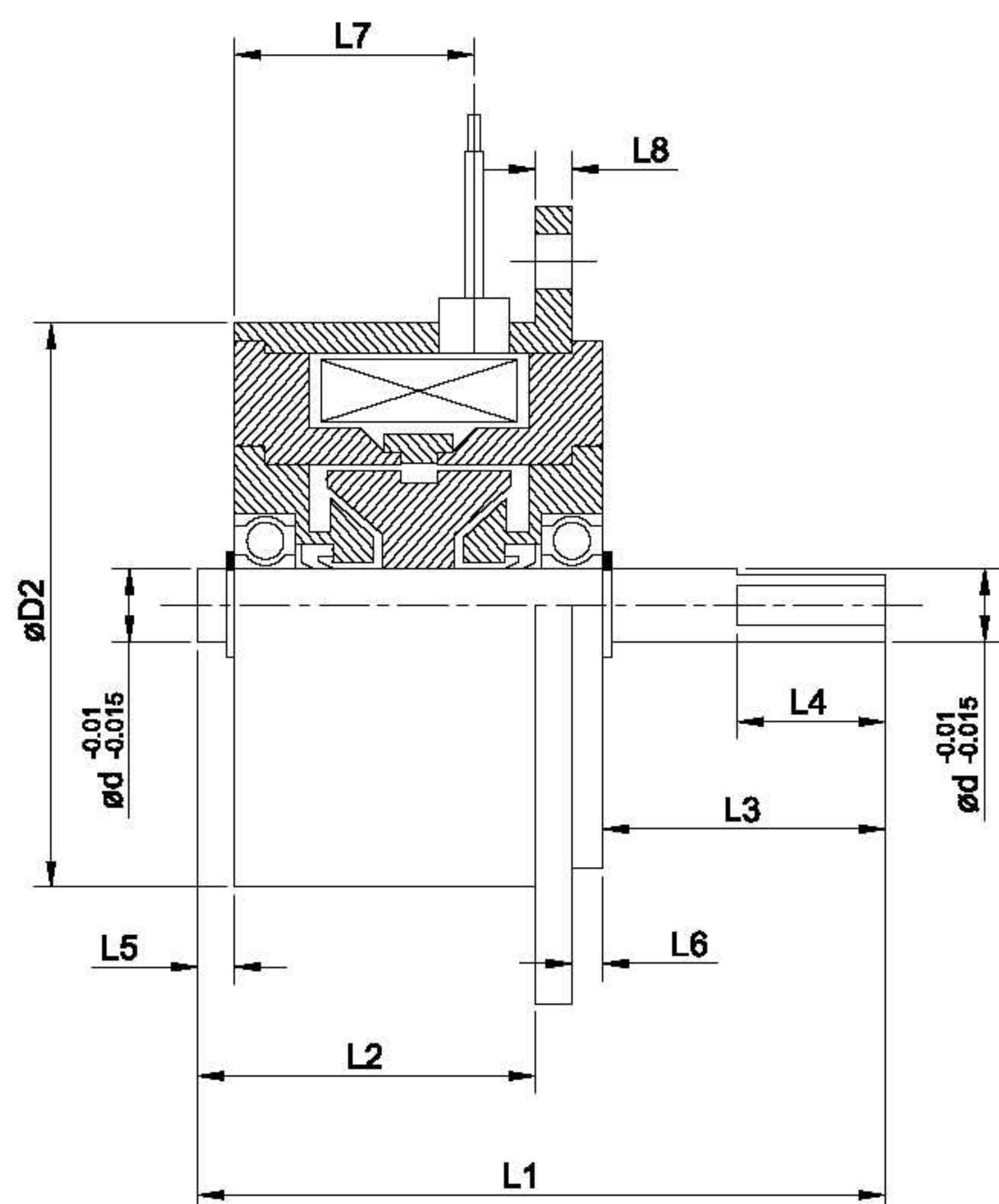


[ ZKA001AA ]

型號 MODEL	外型尺寸 Exterior dimensions															
	D1	D2	D3	D4(h7)	D5(g7)	D6	d(g6)	L1	L2	L3	L4	L5	L6	L7	L8	T
ZKAS05AA	70	60	50	48	40	30	5	77.2	47	16.6	13.6	5.5	10.5	9	8.5	4.5
ZKAS10AA	76	66	56	54	42	34	7	83	48.5	18.5	16	5.5	12	10	8.5	6.5
ZKAS20AA	85	75	65	63	48	40	9	95	53	22.5	19.5	6.5	15	13	9.5	8.5
ZKAS50AA	100	90	80	78	60	50	12	111	64	25	22	6	18	16	12	11.5

# ZOP Series

## 磁粉式小型電磁煞車器 Micro Magnetic Particle Brake



型號 MODEL	ZOPS05AA	ZOPS10AA	ZOPS20AA	
定格轉距 [kgm](Nm) Rated torque	0.5	1.0	2.0	
容量 Capacity DC24V	電流 (A) Current	0.26	0.37	
	電力 (W) Power	6.3	8.9	
慣性矩 GD <sup>2</sup> (kgcm <sup>2</sup> ) Moment of inertia	0.28	0.71	1.1	
重量 Weight (kg)	0.4	0.5	1.0	
最高轉速 Maximum number of turns (r/min)	1800	1800	1800	
外型尺寸 Exterior dimensions	D1	65	75	92
	D2	46	56	69
	D3	43	54	69
	D4	56	66	82
	d	6	7	10
	L1	56	61	71.5
	L2	27.5	31.3	32.5
	L3	23	22.7	33
	L4	12	12	30
	L5	3	2.3	2.5
	L6	2.5	3	3
	L7	19.5	23	25
	L8	3	4	4
T	5.5	6.5	9	