## CONTENTS / оглавление / 目录

## Giriş gücü ve servis faktörü

### Giriş gücü ve servis faktörü

Her bir uygulama için gerekli giriş gücü, hesaplama ile saptanır. Motor anma gücü (P) , bu giriş gücünden sonra seçilir. Normal olarak, belirli uygulama özel çalıştırma koşullarına ait güvenlik faktörleri gözleneceği ve anma motor çıkış seviyeleri genellikle standart çıkış seviyesi aralığında olduğu için motorun anma gücü istenilen güçten biraz daha yüksektir.

Montajı yapılacak 3 fazlı bir AC motorun anma gücünü seçerken kısa dönem ve seyrek tork tesirini göz önüne almak gerekmez. Bir frekans inventörü üzerindeki 3 fazlı bir AC motor çalıştırırken ilave faktörler anma çıkış gücünün seçimini etkiler. Motorun aksine, kısa dönem ve seyrek tork tesiri önemli derecede dişli ünitesinin seçimini etkiler. Dişli ünitesi servis faktörü $f_B$ bu kısa dönem ve seyrek tork tesirini ve ayrıca yeterli doğrulukla dişli ünitesi üzerinde etkileri göz önüne alır.

4. sayfadaki **diyagram 1** çalışma saatine veya güne bağlı olarak yük sınıflandırması, devir ve minimum servis faktörü arasındaki ilişkiyi sunmaktadır.

## Input power and service factor

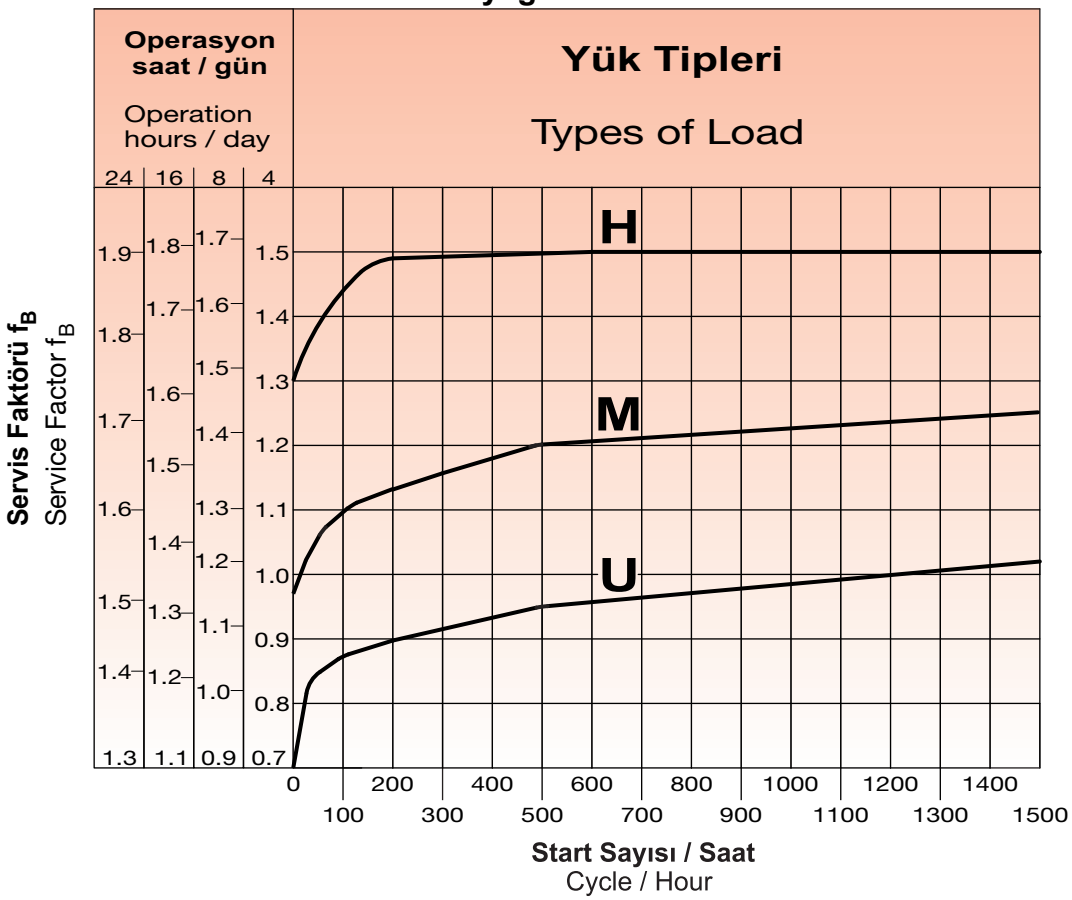
### Input power and service factor

For every application requiring input power could be detected or determined by calculation. After determination input power, rated motor power (P) is defined. Motor power is greater than require input power due to safety factor is used according to operating conditions.

Selecting a motor type is important for right calculation for instance; three phase AC motor which is mounted to gear unit, affecting infrequent torque could not be considered but if you mount three-phase AC motor on frequency inverter latest available factor effects the output power. Besides of motor type short and infrequent torque impression effects selecting gear unit for that service factor is considered.

**Diagram 1** which is shown below, presents relation between types of load, revolution per hour and minimum service factor depend on operation hours or day.

**Diyagram - 1**




Diyagram 1, günlük çalışma zamanına bağlı gerekli minimum servis faktörü $f_{B\,min}$'Z' saatteki çevrimleri, ve uygulama yükü sınıflandırması 'U', 'M', 'H' gösterir. Çalışma düzgünlüğüne ve kütle hız faktörüne bağlı olarak, üç yük sınıflandırması belirlenmiştir. Hareket ettiren makineden gelen etkiler çalışma düzgünlüğü sınıflandırmasında tanımlanırken, kütle hız faktörü en fazla olan yük üzerinde etkili olur.

**Not :** Elde edilen servis faktörü $f_B$ kullanılan sürücü (tahrik) tipine göre "k" katsayısı ile çarpılır.

k = 1 ; elektrik motoru veya hidromotor,
k = 1.25 ; çok silindirli içten yanmalı motor,
k = 1.50 ; tek silindirli içten yanmalı motor

Diagram 1 shows requiring minimum service factor depend on revolution per hours 'Z' and types of load 'U', 'M' or 'H'. In following information mass acceleration factor will be explained how it effects to or relation between load classification. Forces or loads which are applied from driven machine to gear unit while determine load classification, mass acceleration factor is played important role on the high load classification which is designated with 'H' sign.

**Note :** Service factor $f_B$ which is acquired from diagram should be modified with factor "k" that, depends on driver type.

k = 1 ; hydraulic motor and electrical motor
k = 1.25 ; multi-cylinder engine
k = 1.50 ; single-cylinder engine

# Dişli Ünitesini Seçme (1/2)

# Selecting a Gear Unit (1/2)

## Dişli Ünitesini Seçme

Bir çalışmanın sınıflandırılması :

**a) Düzgün çalışma**

Küçük karıştırıcılar, asansörler, konveyörler, montaj bantları, doldurma makinaları, bantlı konveyörler, temizleme makinaları, fanlar, test makinaları.

**b) Yumuşak şoklar, düzgün olmayan çalışma**

Ağır konveyör bantları, değirmenler, ahır gübre makinaları, vinç hareketli mekanizmalar, bükme makinaları, çimento karıştırıcılar, dişli makinaları, ahşap işleme makinaları için sürücüler, vinçler, kayar kapılar, dengeleme makinaları.

**c) Ağır şoklar, aşırı düzgün olmayan çalışma**

Taş kırıcılar, eksantrik presler, doğrayıcılar, presler, taşlama milleri, çekiçli kırıcılar, kağıt öğütücüler, ağır karıştırıcılar, delme makinaları, katlama makinaları, dönen tezgahlar, yatay karıştırıcılar, kesiciler, vibratörler, santrifüj makinaları, döner tablalar.

Yük sınıflandırması, çalışma düzgünlüğünden ve aşağıdaki tabloya göre kütle hız faktörü ' $m_{af}$' den belirlenir. Burada, çalışma veya kütle hız faktöründen gelen daha yüksek sınıf yük sınıflandırmasında geçerlidir. ( Örnek: aşırı düzgün olmayan çalışma ve $m_{af} = 2,8$ gibi durumda yük sınıfı 'H' olarak belirlenir.

| Yük Sınıfı | Çalışma | Kütle hız faktörü |
|---|---|---|
| **U** | Düzgün çalışma | $m_{af} \leq 0.25$ |
| **M** | Düzgün olmayan çalışma | $0.25 < m_{af} \leq 3$ |
| **H** | Aşırı düzgün olmayan çalışma | $3 < m_{af} \leq 10$ |

## Selecting a Gear Unit

Operation classification;

**a) Uniform application**

Small agitators, elevators, conveyors, assembly belts,filling machines, conveyor belts, cleaning machines, fans, testing machines.

**b) Moderate shocks, non-uniform application**

Heavy conveyors belts, mills, stall dunging machines, crane traveling mechanisms, bending machines, cement mixers, gear pumps, decoilers, tapping units, packaging machines, feed drives for wood processing machines, hoists, winches sliding doors, balancing machines.

**c) Heavy shocks, extreme non-uniform application**

Stone crusher, eccentric presses, choppers, presses, grinding mills, hammer mills, shredders, heavy mixers, punching machines, folding machines, rolling stands, tumbling barrels, shears, vibrators, centrifuges, roller tables.

Load classification is obtained from operation class and mass acceleration factor ( $m_{af}$). For this reason in any situation which factor is greater than other you must take for calculation. (Eg; heavy - shock and $m_{af} = 2,8$ load classification must be 'H' .)

| Load Classification | Operation | Mass Acceleration Factor |
|---|---|---|
| **U** | Uniform application | $m_{af} \leq 0.25$ |
| **M** | Non-uniform application | $0.25 < m_{af} \leq 3$ |
| **H** | Extreme non-uniform application | $3 < m_{af} \leq 10$ |

$$m_{af} = \frac{J_{ex.red}}{J_{mot}} = \frac{J_{ex}}{J_{mot}} \times \left(\frac{1}{i_{ges}}\right)^2$$

$i_{ges}$ = Toplam dişli ünitesi oranı
$J_{ex.red}$ = Hareket motoru üzerindeki azaltılmış tüm dış kütle atalet momenti
$J_{ex}$ = Tüm dış kütle atalet momenti
$J_{mot}$ = Motorun kütle atalet momenti

Kütle hız faktörü $m_{af}$, çıkış tarafındaki dış kütleler ile giriş tarafındaki yüksek hız kütlelerin arasındaki ilişkiyi gösterir.Kütle hız faktörü, başlatma ve frenleme işlemlerine ve titreşime göre dişli ünitesindeki tork tesir seviyesini önemli derecede etkiler. Örneğin; bantlı konveyör sistemlerinde dış kütle atalet momenti taşınan ürün kadar yük uygular. $m_{af} > 10$ ise, transfer elemanlarında büyük bir oynama, yük sınıflamasında belirsizlik varsa veya şüphedeyseniz, PGR'e danışınız.

Servis faktörü $f_B$ , maksimum dişli ünitesi çıkış momenti $M_{amax}$ ile montajlanmış motor gücü P, çıkış hızı n ve dişli ünitesi verimi ( ) sonucu ortaya çıkan momenti $M_a$ arasındaki ilişkidir.

$i_{ges}$ = Total gear unit ratio
$J_{ex.red}$ = All external mass moment of inertia on the drive motor, reduced
$J_{ex}$ = All external mass moment of inertia
$J_{mot}$ = Mass moment of inertia of the motors

Technically mass acceleration factor $m_{af}$ mass different between external output-side and high speed input-side. $m_{af}$ is played important role at the level of torque propulsive in the gear unit. It is mostly effected at start-up, braking operation and vibration. Please contact with PGR where $m_{af}$ is greater than 10 and large play in transfer elements and vibration in the system.

Calculation of service factor is illuminated below. It depends on maximum output moment of gear unit and the output moment which is calculated from motor power, rotation speed and efficiency.

$$M_a = \frac{9550 \cdot P1.}{n_2} \text{ [Nm]} \qquad P1 \text{ [kW]}, \; n_2 \text{ [min}^{-1}\text{]}$$

$$f_B = \frac{M_{amax}}{M_a}$$

## Dişli Ünitesini Seçme (2/2) — Selecting a Gear Unit (2/2)

$$P = \frac{M_a \cdot n_2}{9550} \; [kW] \qquad M_a \; [Nm], \; n_2 \; [min^{-1}]$$

Dişli ünitesini doğru şekilde seçtiğinizde, çıkış ve hız genel açıklamalarından alınan servis faktörü $f_B$, diyagram 1'e göre minimum servis faktörü $f_{B\,min}$ 'den büyük veya eşittir.

If the selecting gear unit is right, service factor which is taken from selection of gear motors table, must be greater than minimum service factor $f_{B\,min}$ which is taken from diagram-1 (see page 4) according to types of load.

$$f_B \geq f_{Bmin}$$

Helisel, parallel mil ve helisel konik dişli ünitelerinde herbir kademe için çok yüksek bir seviyede verimlilik vardır ( herbir kademe için yaklaşık %98 veya = 0,98 ). Bu yüzden hesaplamalarda verim =1,0 alınması yeterli doğru sonuçlara ulaşılmasına yardımcı olur. Helisel sonsuz dişliler ile ilgili dişli ünitesi verimliliği, herbir çıkış hızı n ‘ye ait çıkış ve diş oran tablolarında listelenmiştir. W kovanı montajlı (serbest hareket mili) redüktörde çıkış gücü aşağıdaki formülden hesaplanır.

Efficiency is approximately 98 % at helical, helical bevel parallel shaft gear units. For that reason efficiency could be taken = 1 it shows that efficiency does not effect the calculation. But, for helical worm gear efficiency is given at table which is depended on output speed and gear ratio.

With W cylinder (free drive shafts) ;

$$P_1 = \frac{M_{amax} \cdot n_2}{9550 \cdot f_{Bmin}} \; [kW] \qquad M_{amax} \; [Nm], \; n_2 \; [min^{-1}]$$

Burada, azami hareket gücü $P_{1max}$ aşılamaz.

Value which calculated from equation $P_1$, must be less than $P_{1max}$ which is taken from the selection of W cylinder tables.

$$P_1 \leq P_{1max}$$

W ve IEC tipi redüktörler için performans tablosunda herbir çıkış devri $n_2$, maksimum çıkış momenti $M_{amax.}$, maksimum motor gücü $P_{1max.}$ listelenmiştir.

$P_{1max}$ is shown at performance table for W cylinder (with free input shaft) and IEC adapter.

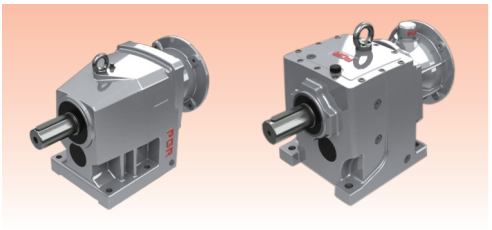
Hareketli tarafa fren bağlandığında,(frenli motorlar gibi) fren momenti de bir dişli ünitesini seçmede göz önüne alınmalıdır. Gezinti hareketleri, çember dişliler, döner tablalar, kapı hareketleri, karıştırıcılar ve yüzey havalandırıcı ile ilgili uygulamalarda sıkça karşılaşılan yüksek dış kütle atalet momentli ( $m_{af} \geq 2$ ) kullanımlarda frenleme momentinin, seçilen anma momentinin 1,2 katını aşmamasını öneririz. Daha yüksek frenleme torkları kullanılacaksa, bu durum dişli ünitesini seçerken göz önünde bulundurulmalıdır. Lütfen PGR'e danışınız.

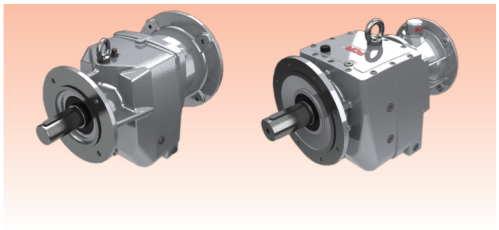
However in selecting gear units brake can be equipped optionally and it is attached to the shaft or solid. It must be considered because of break torque. Application which have high external mass moment of inertia such as $m_{af} > 2$. We suggest break torque does not overrun 1,2 times motor torque.

| | PA | PF |
|---|---|---|

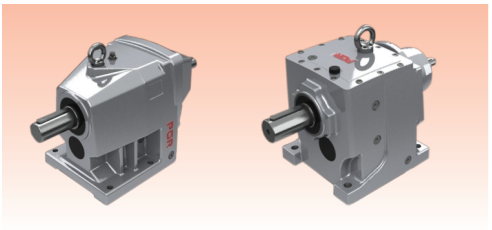
## Input type / Тип ввода / 输入类型

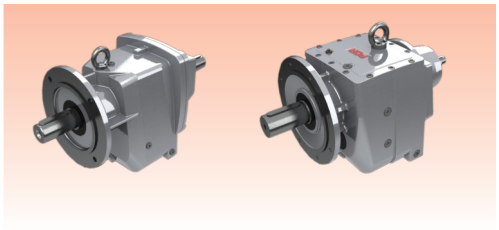
**IEC**
Coupling for electric motor
Соединение с электромотором
联轴器



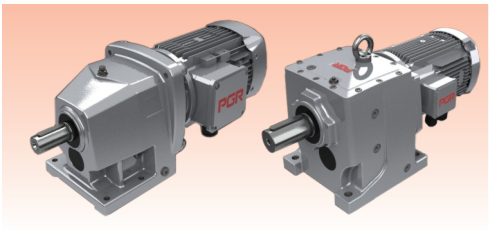


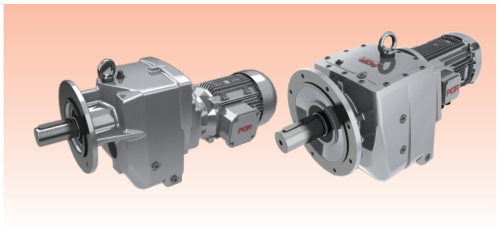
**W**
Input shaft
Первичный вал
输入轴



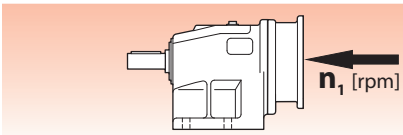


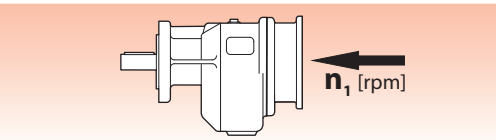
**MOTOR**
Compact gearmotor
мотор-редуктор
减速电机





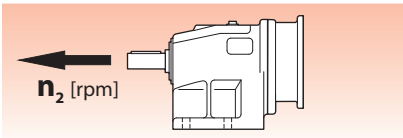
## Input speed/ Выбор входа / 输入速率

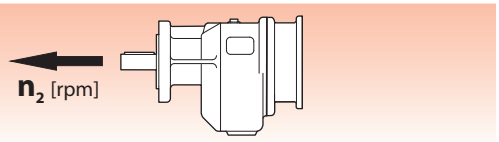


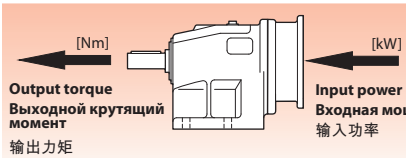

## Output speed / Скорость на выходе / 输出速率

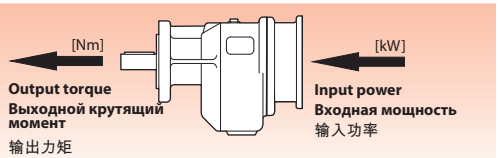
$$n_2 = \frac{n_1}{i \text{ (ratio)}}$$



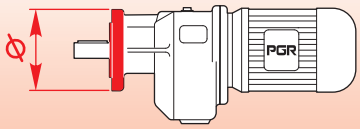

## Select by / Выбор по / 选择



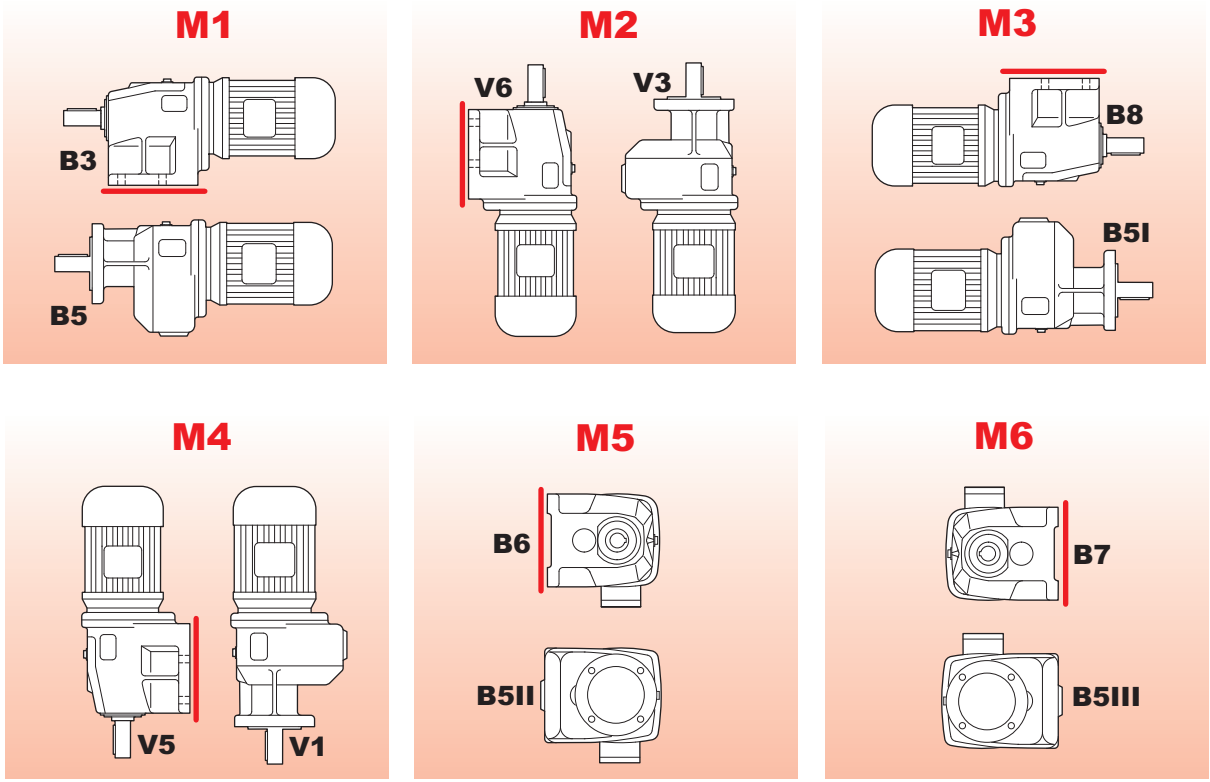



# PA - PF

## Fixing /Фиксация / 安装

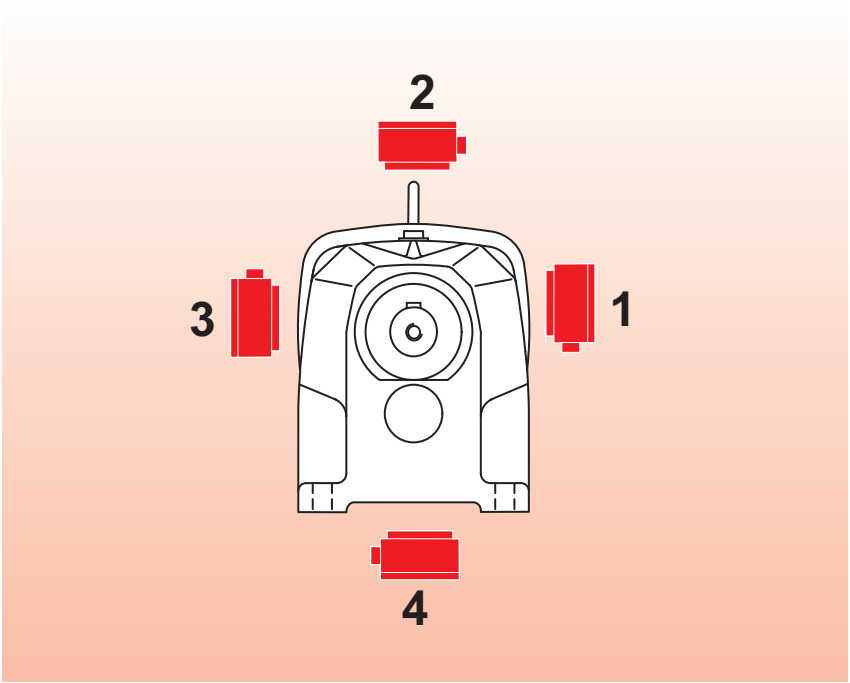



## Mounting position / *Монтажное положение* / 安装方向



# PA - PF

## Terminal box position / Позиция клеемной коробки / 接线盒位置



# PKD

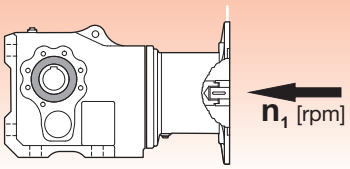
## Input type / Тип ввода / 输入类型

**IEC**
Coupling for electric motor
Соединение с электромотором
联轴器

**W**
Input shaft
Первичный вал
输入轴

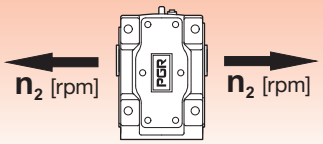
**MOTOR**
Compact gearmotor
мотор-редуктор
减速电机

## Input speed/ Выбор входа / 输入速率




## Output speed / Скорость на выходе / 输出速率

$$n_2 = \frac{n_1}{i\ (ratio)}$$

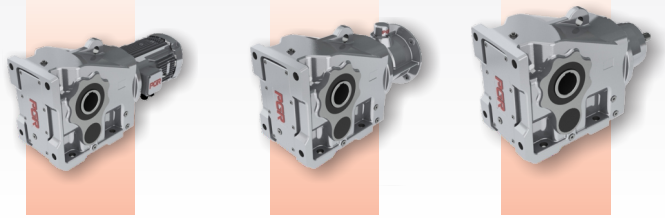



## Select by / Выбор по / 选择

# PKD

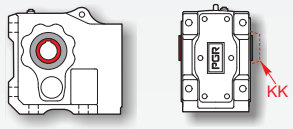
## Mounting / Тип установки / 安装

**Foot mounted / Крепление на лапы / 卧式安装**



## Fixing /Фиксация / 安装

### DA

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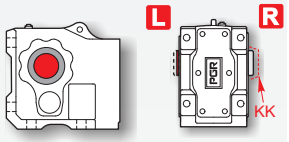


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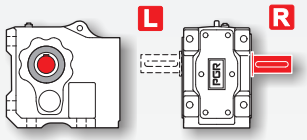


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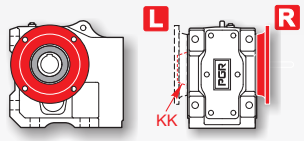


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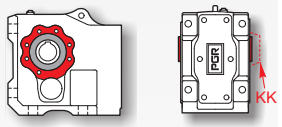


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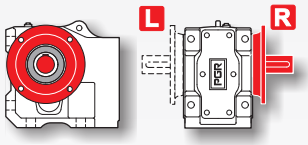


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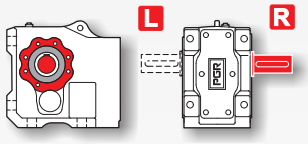
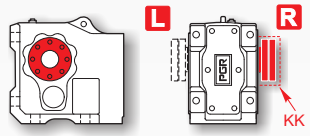
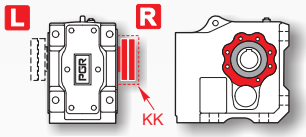


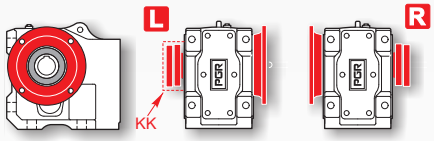

### DA/KS
### DA/GKS



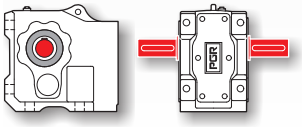

### DA/KS-B14
### DA/GKS-B14



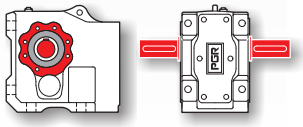

### DA/KS-B5
### DA/GKS-B5



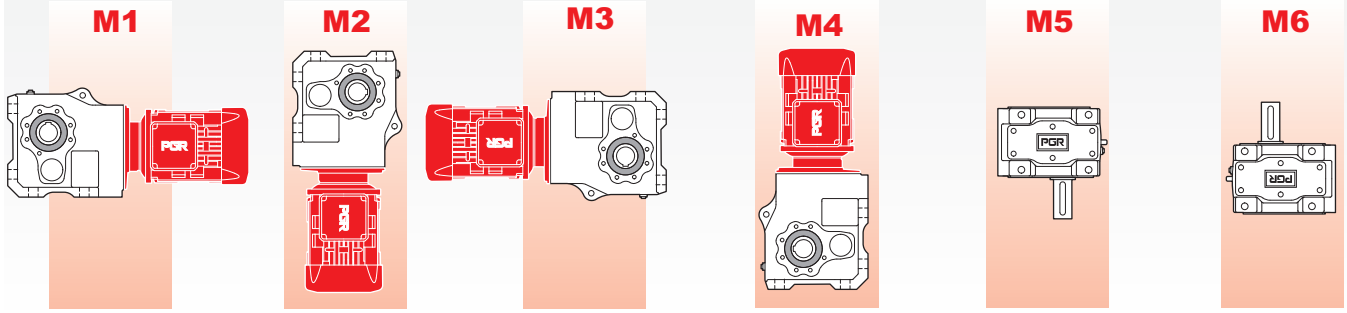

### ÇMA



### ÇMA/B14



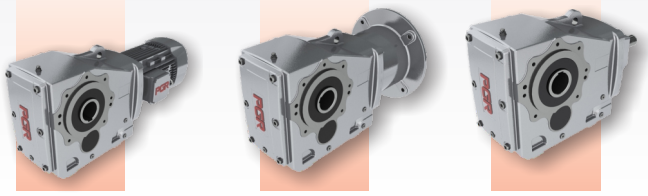
## Mounting position / *Монтажное положение* / 安装方向



# PKD

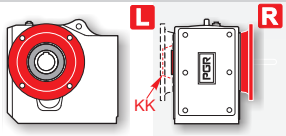
## Mounting / Тип установки / 安装

**Case mounted / Крепление корпусом / 立式安装**

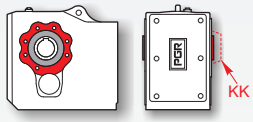


## Fixing /Фиксация / 安装

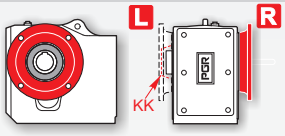
**DG/B5**
**DG/DIN5480-B5**



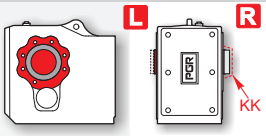

**DG/B14**
**DG/DIN5480-B14**



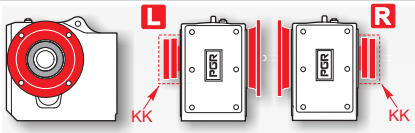

**DG/Ç-B5**



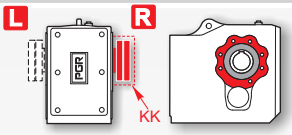

**DG/Ç-B14**



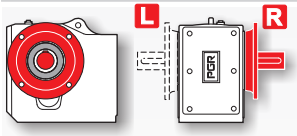

**DG/KS-B5**



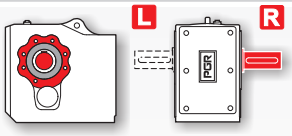

**DG/KS-B14**
**DG/GKS-B14**



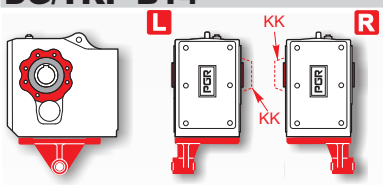

**TMG/B5**



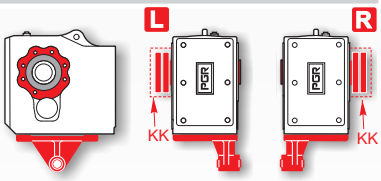

**TMG/B14**



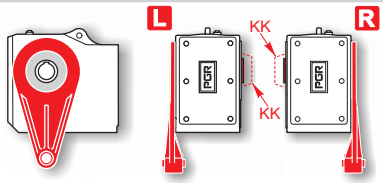

**DG/TKP-B14**



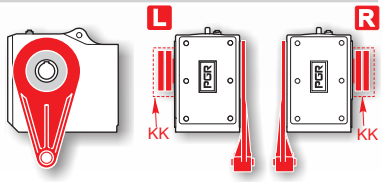

**DG/KS-TKP-B14**




**DG/TK**

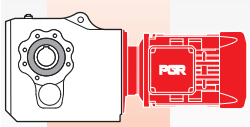



**DG/KS-TK**

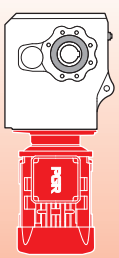



## Mounting position / *Монтажное положение* / 安装方向

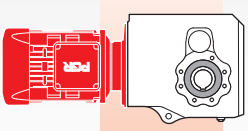
**M1**



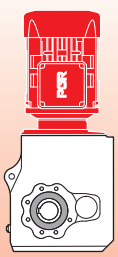
**M2**



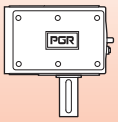
**M3**



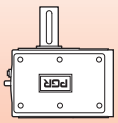
**M4**



**M5**

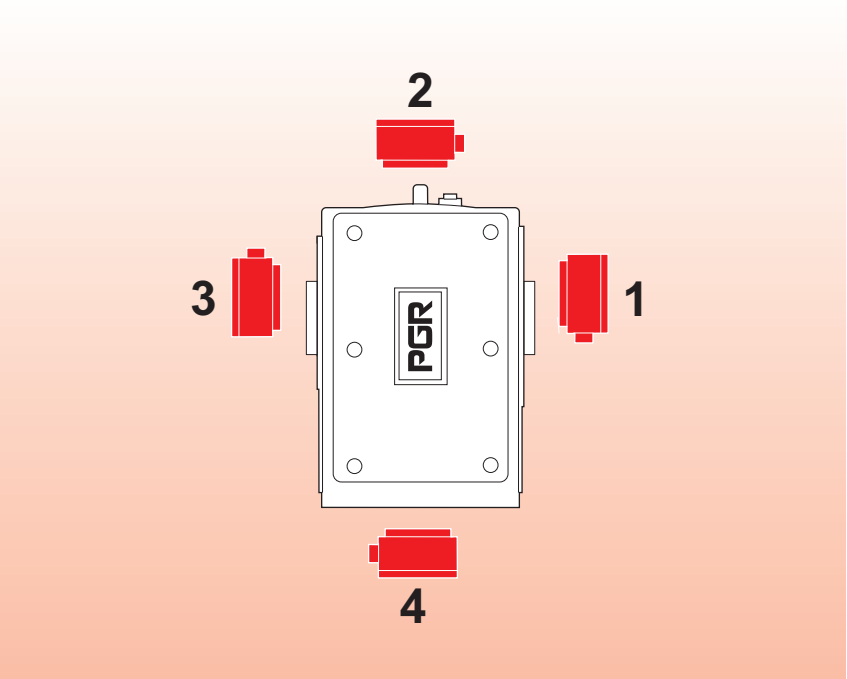


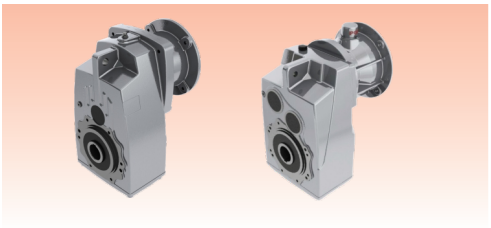
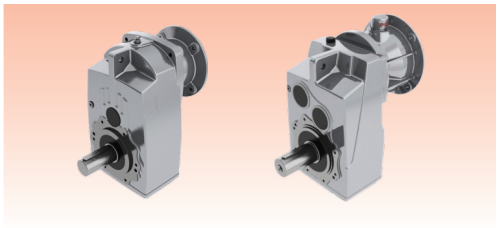
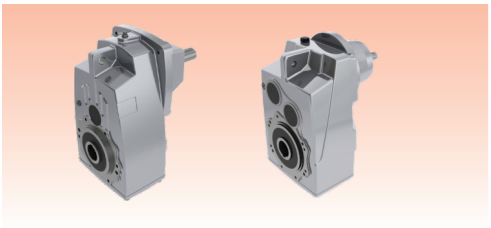
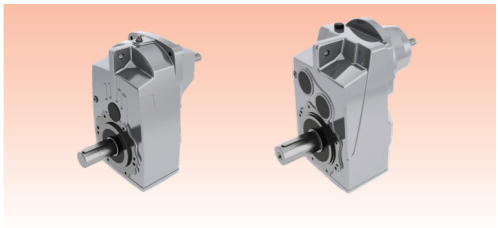
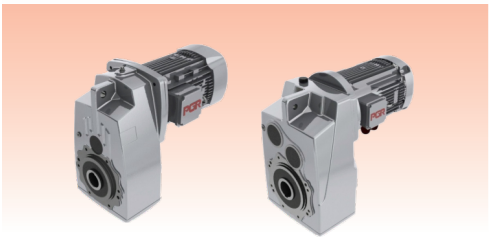
**M6**



# PKD

## Terminal box position / Позиция клеемной коробки / 接线盒位置



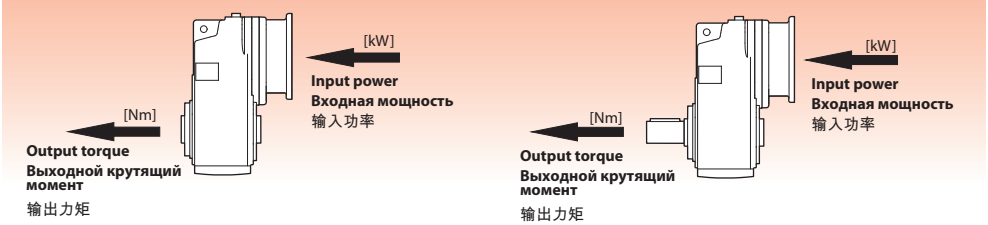
| | PD | PM |
|---|---|---|
| **Input type / Тип ввода / 输入类型** | | |
| **IEC**<br>Coupling for electric motor<br>Соединение с электромотором<br>联轴器 |  |  |
| **W**<br>Input shaft<br>Первичный вал<br>输入轴 |  |  |
| **MOTOR**<br>Compact gearmotor<br>мотор-редуктор<br>减速电机 |  |  |

## Input speed/ Выбор входа / 输入速率


## Output speed / Скорость на выходе / 输出速率

$$n_2 = \frac{n_1}{i\ (ratio)}$$

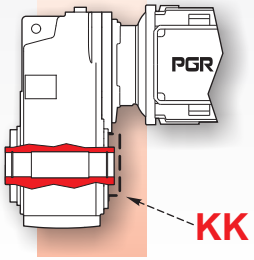

## Select by / Выбор по / 选择



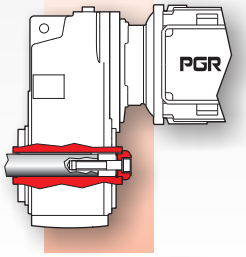
# PD

## Output shaft / Выходной вал / 输出轴

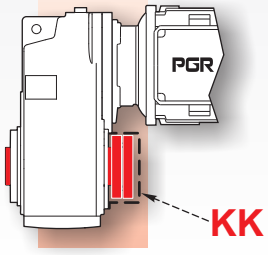
PD.. —
PD.. DIN5480




PD.. Ç

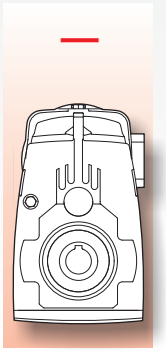



PD.. KS
PD.. GKS

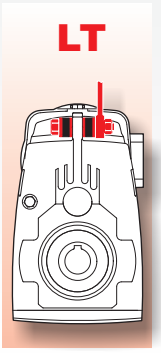



## Fixing /Фиксация / 安装

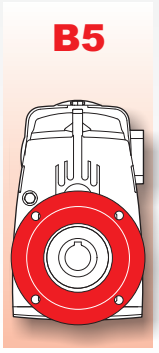
—



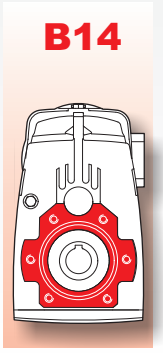
LT



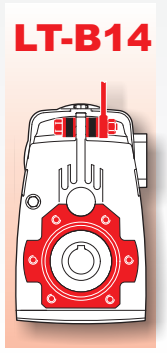
B5



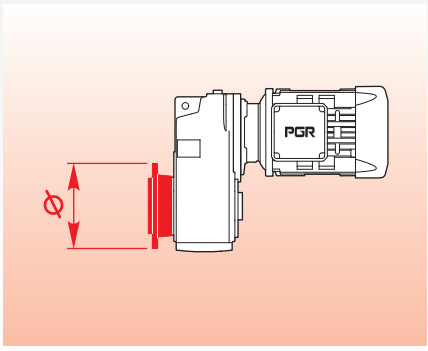
B14



LT-B14

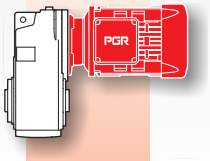


## Output flange / Крепление фланцем / 法兰

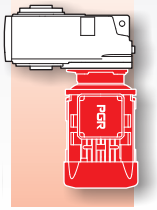



## Mounting position / *Монтажное положение* / 安装方向

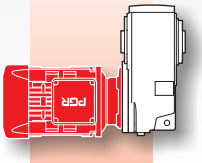
M1
H1



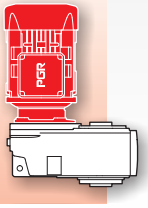

M2
H6



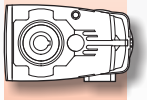

M3
H2



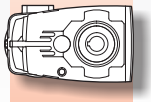

M4
H5




M5
H4

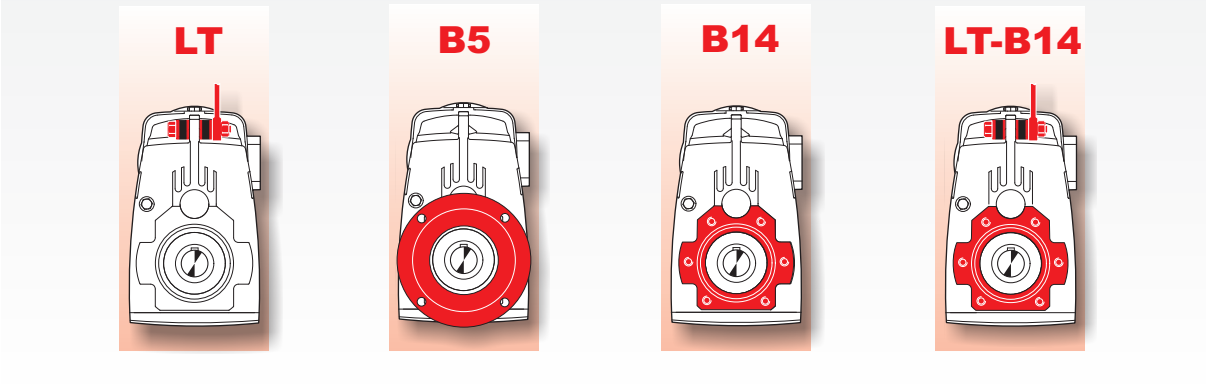


M6
H3

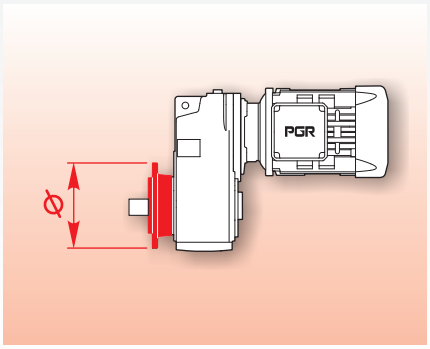


# PM

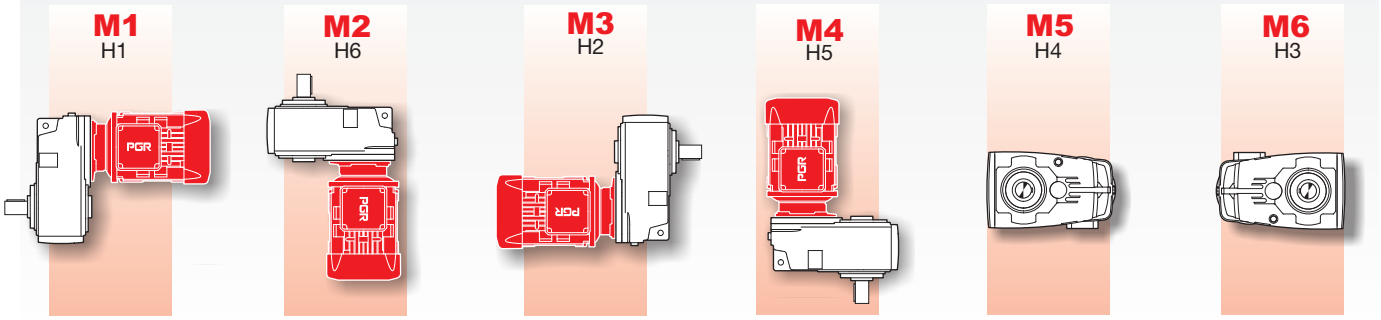
## Fixing /Фиксация / 安装




## Output flange / Крепление фланцем / 法兰

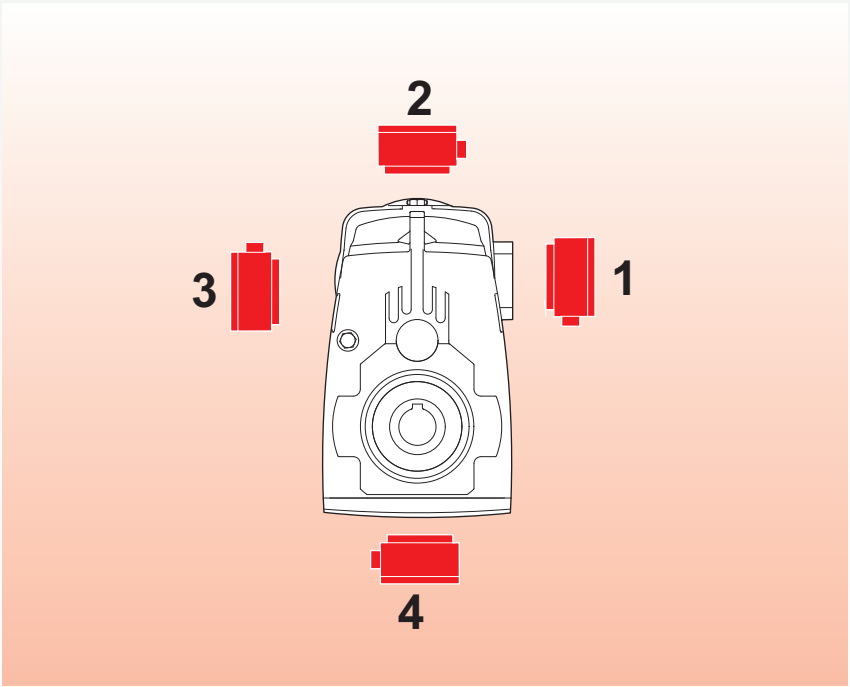



## Mounting position / *Монтажное положение* / 安装方向



# PD - PM

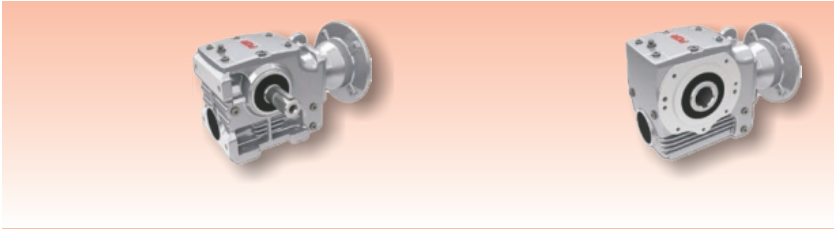
## Terminal box position / Позиция клеемной коробки / 接线盒位置



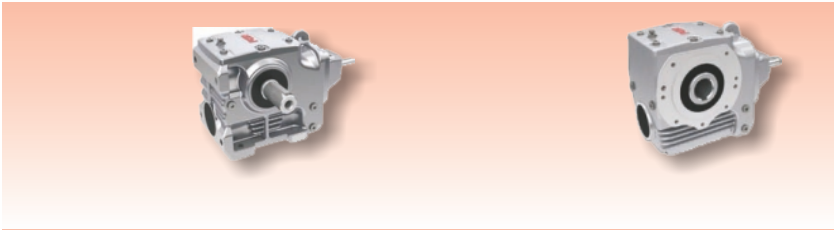
# PSH

## Input type / Тип ввода / 输入类型

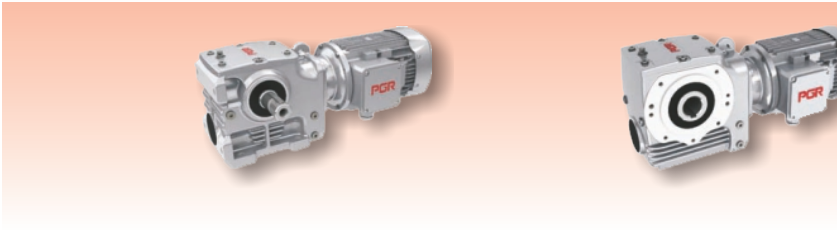
**IEC**
Coupling for electric motor
Соединение с электромотором
联轴器



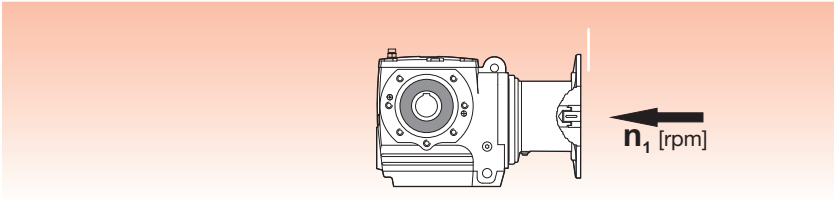
**W**
Input shaft
Первичный вал
输入轴



**MOTOR**
Compact gearmotor
мотор-редуктор
减速电机

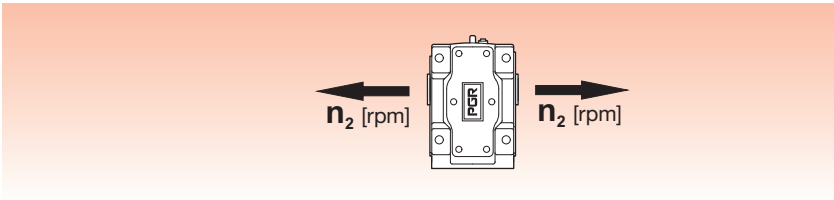


## Input speed/ Выбор входа / 输入速率

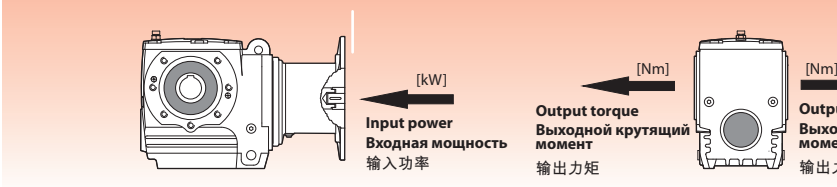



## Output speed / Скорость на выходе / 输出速率

$$n_2 = \frac{n_1}{i\ (ratio)}$$




## Select by / Выбор по / 选择



# PSH

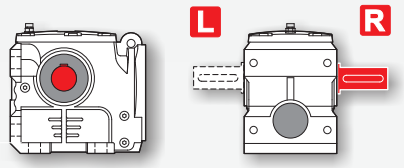
## Mounting / Тип установки / 安装

Case mounted / Крепление корпусом / 立式安装

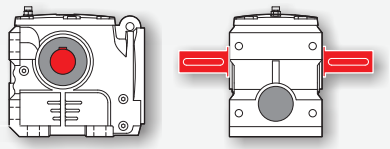
Foot mounted / Крепление на лапы / 卧式安装

## Fixing /Фиксация / 安装

### TMA

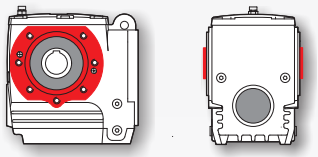



### ÇMA

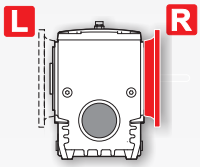


### DG/B14

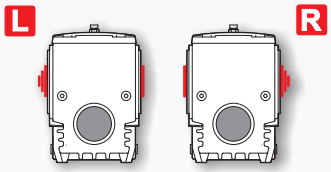




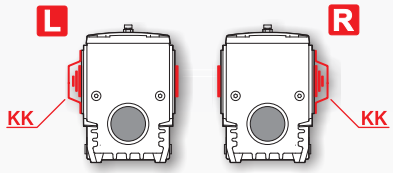
### DG/B5



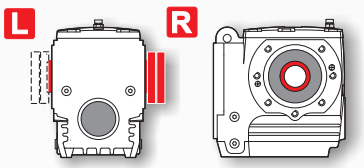

### DG/Ç



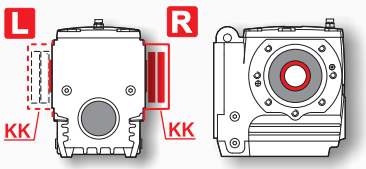

### DG/Ç-KK



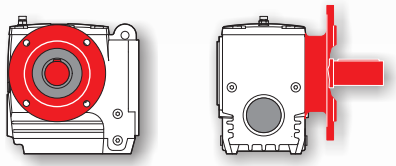

### DG/KS



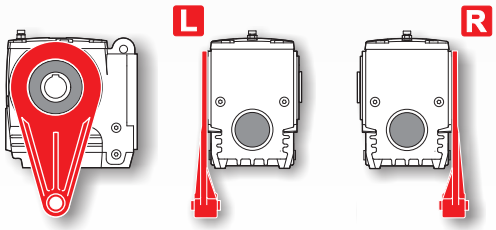

### DG/KS-KK




### TMG/B5

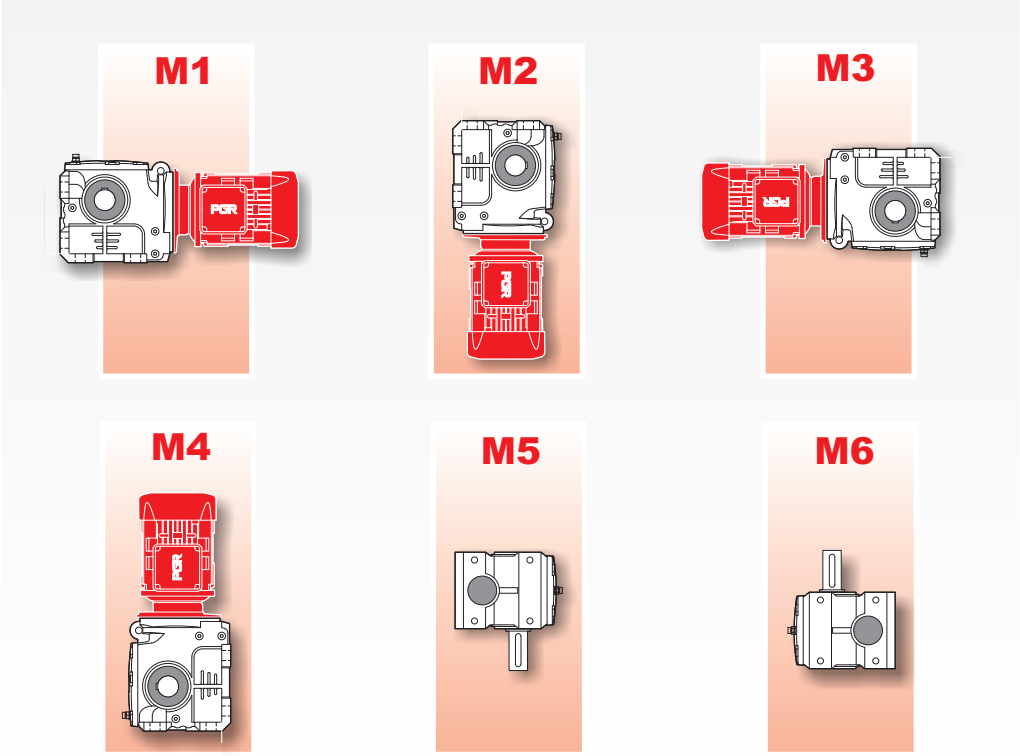


### DG/TK



# PSH

## Mounting position / *Монтажное положение* / 安装方向




## Terminal box position / Позиция клеемной коробки / 接线盒位置