

# General technical explanations



The most important factor for selection of a centrifugal clutch is the amount of power to be transmitted. Knowing the power available from the drive motor and the operating speed, the torque to be transmitted can be calculated and the size of the clutch determined.

For the vast majority of drives, there is a wide range of clutch types and designs. Our sizes 01 to 13 cover – depending on engagement and operating speeds – a torque range up to ca. 2000 Nm.

To be sure that clutches operate correctly, grease, oil and moisture must be kept away from their friction surfaces.

### Calculating the torque:

$M_d$  = torque [Nm]  
 $n$  = speed of rotation [rpm]  
 $P$  = power

$$P = \frac{M_d \cdot n}{9550} \text{ [kW]}$$

$$M_d = 9550 \cdot \frac{P}{n} \text{ [kW]}$$

[1Nm~10 kpcm]

[1 kW = 1.36 hp]

[1 hp = 0.7355 kW]

$$P = \frac{M_d \cdot n}{7162} \text{ [hp]}$$

$$M_d = 7162 \cdot \frac{P}{n} \text{ [hp]}$$

**Performance factor for torque transmission:**

The performance factor for torque transmission is a measure of the capacity of a clutch to provide sufficient friction to transmit the power applied to it when the flyweights are in contact with the drum.

Whereas a W-Type clutch has a performance factor of 1.0, an F-Type clutch of the same size with self-increasing effect is capable of transmitting a torque approximately 2.5 times greater at the same speed and with the same flyweight mass.

The asymmetric pivot clutch achieves a power factor of ca. 1.75 or ca. 1.25 depending on the direction of rotation.

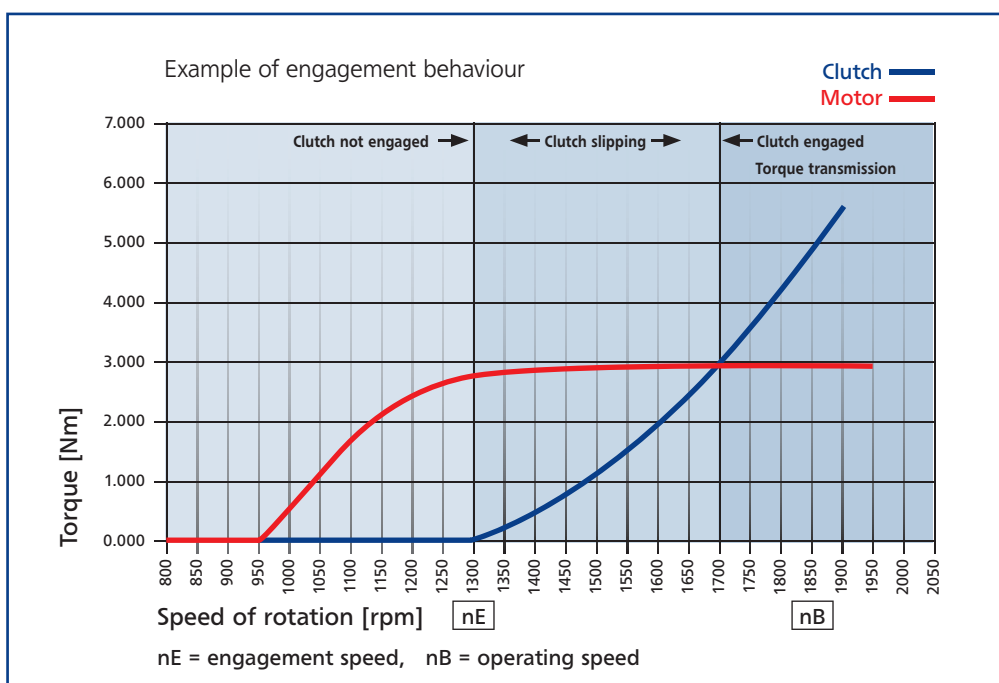
**Engagement speed:**

The engagement speed of a centrifugal clutch indicates the speed at which centrifugal force acting on the mass of the flyweights overcomes the force exerted by the tension springs that restrain them. The flyweights are forced outwards and the friction surfaces start to rub on the inner surface of the clutch drum. The full torque is only transmitted at a higher speed at which the friction surfaces of the flyweights are fully in contact with the clutch drum.

Wear of the friction linings can be minimised by passing quickly through the engagement speed band. The engagement speed is influenced by the strength of the springs that restrain the flyweights – the stronger the spring the longer the flyweights are held back. The engagement speed is chosen to suit the operating speed of the drive motor and the power that is to be transmitted. Because the power a centrifugal clutch can transmit rises as the speed of rotation increases, there will be a minimum operating speed for a drive system. This will depend on the application, but is frequently in the order of 600 rpm.

The engagement speed and the springs required are determined individually using the knowledge and experience we have built up at SUCO. The engagement speed  $n_E$  is selected so that the transmissible torque at operating speed  $n_B$  is higher than theoretically necessary. This safety factor protects the clutch from slipping if the speed drops for a short period.

*For an explanation of the operation of centrifugal brakes, see page 18 et seq.*



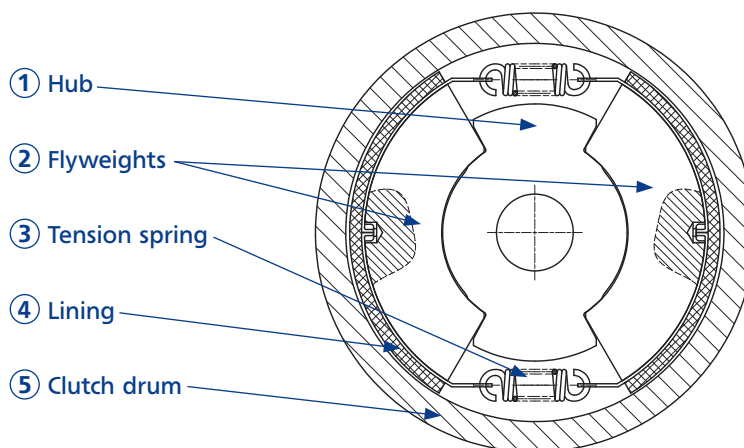
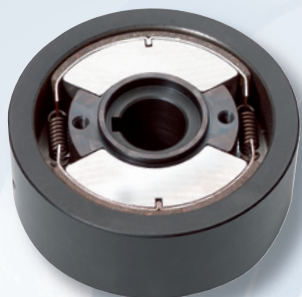
# F-Type

# Self-increasing clutch

## Construction and mode of operation

The flyweights (2) are seated on the profiled hub (1) and are held against it by tension springs (3), which are hooked into the linings (4). Discs locate the flyweights axially. Each lining has a crimping (3) on its inner surface to locate it on the flyweight. This prevents the linings from moving sideways.

As the profiled hub rotates, the centrifugal force acting on the flyweights overcomes the spring force. When the speed is high enough, the linings contact the clutch drum (5), and friction between the linings and the drum allows torque to be transmitted between the two.

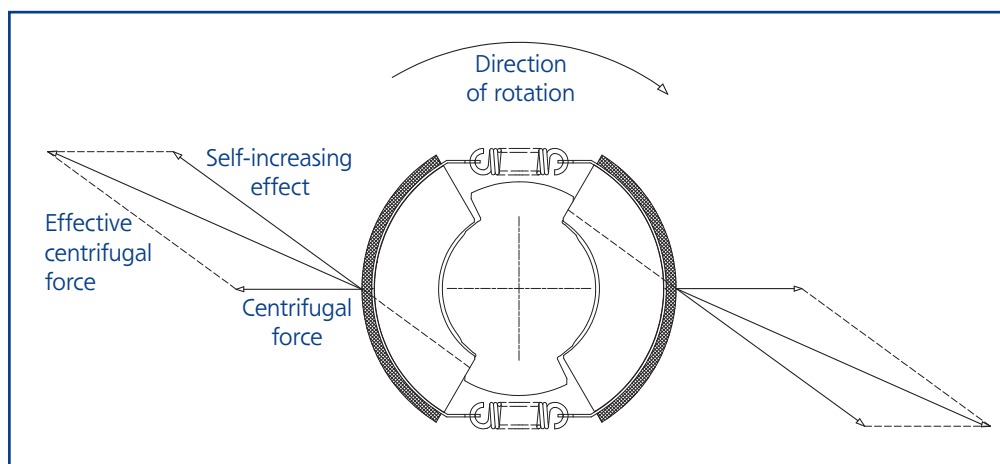


## Advantages

The compact design and self-increasing effect allow this clutch to transmit remarkably high torques while needing very little space, resulting in a performance factor of ca. 2.5.

Because the tension springs are easily accessible and the linings removable, the parts subject to wear are easy to replace. Because the linings are not secured to the flyweights, some noise is possible in service, but normally not sufficient to cause a nuisance.

Self-increasing effect: the profiled hub has a special form which causes a wedging effect between the profile and the flyweights when torque is applied to the clutch. This results in an additional force on the linings and allows a higher torque to be transmitted.

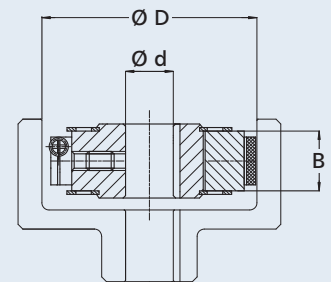


## Performance data and dimensions:

Size	D [mm]	B [mm] <sup>1)</sup>	d max. [mm]	Standard bore diameter d [mm] (inch) <sup>2)</sup>	Md at nE 750 and nB 1500 [Nm]	Recommended motor power <sup>3)</sup> [kW]	Md at nE 1250 and nB 2500 [Nm]	Recommended motor power <sup>3)</sup> [kW]	Md at nE 1500 and nB 3000 [Nm]	Recommended motor power <sup>3)</sup> [kW]
01	50	10	14	12			1.3	0.17	2	0.3
02	60	15	18	15 (5/8)			4	0.5	5	0.8
03	70	15	22	15; 20 (7/8)			7	0.9	10	1.6
04	80	15	28	14 - 25 (3/4; 7/8)	4	0.3	11	1.4	16	2.5
05	90	20	35	18; 20; 25 (3/4; 1)	10	0.8	26	3.4	40	6.3
06	100	20	35	20; 24; 28 (3/4; 1)	16	1.3	42	5.5	60	9.4
07	110	20	40	28; 35; 40 (1)	25	2.0	70	9.0	100	15.7
08	125	20	50	25; 38; 49; (3/4; 1)	40	3.2	120	15.7	180	28.3
09	138	25	55	30; 38; 48 (1)	90	7.0	240	31.0	320	50.0
10	150	25	60	38; 48; 49	125	10.0	340	44.5	470	74.0
11	165	30	65	42; 50; 55 (1 7/16)	220	17.2	620	81.0	870	136.0
12	180	40	75	50; 60 (2 3/8)	460	36.0	1200	157.0	1700	267.0
13	200	30	75	35; 55; 65 (2 3/8)	520	41.0	1300	170.0	1850	290.0

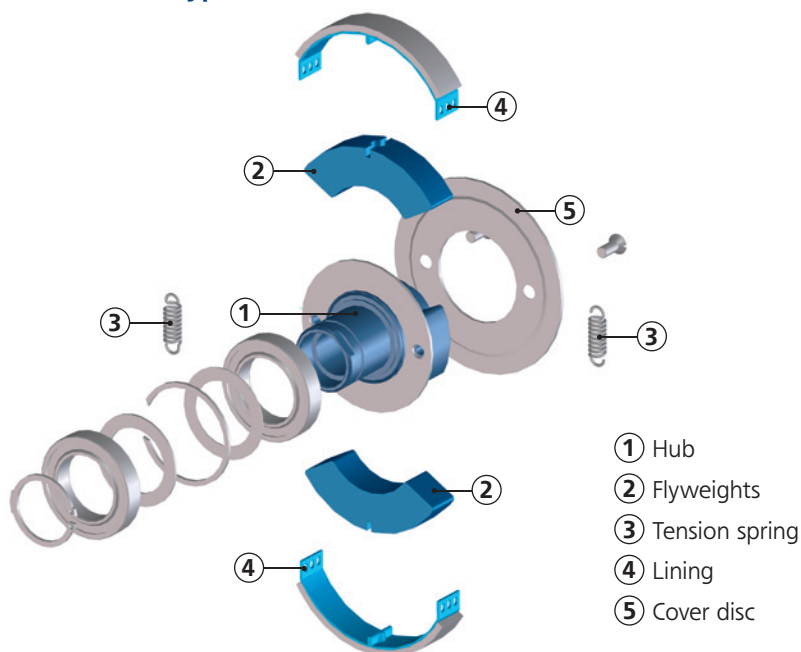
- 1) The transmitted power increases as the width B is increased.  
 2) Tapered bores and special dimensions can be manufactured on request.  
 3) Motor power is calculated using a safety factor of 2.  
 Final selection of the clutch should be carried out by SUCO!

d max. = max. bore dia.  
 Md = torque  
 nE = engagement speed  
 nB = operating speed



d = bore dia.  
 D = inside dia. of drum  
 B = flyweight width

### Exploded view of F-Type





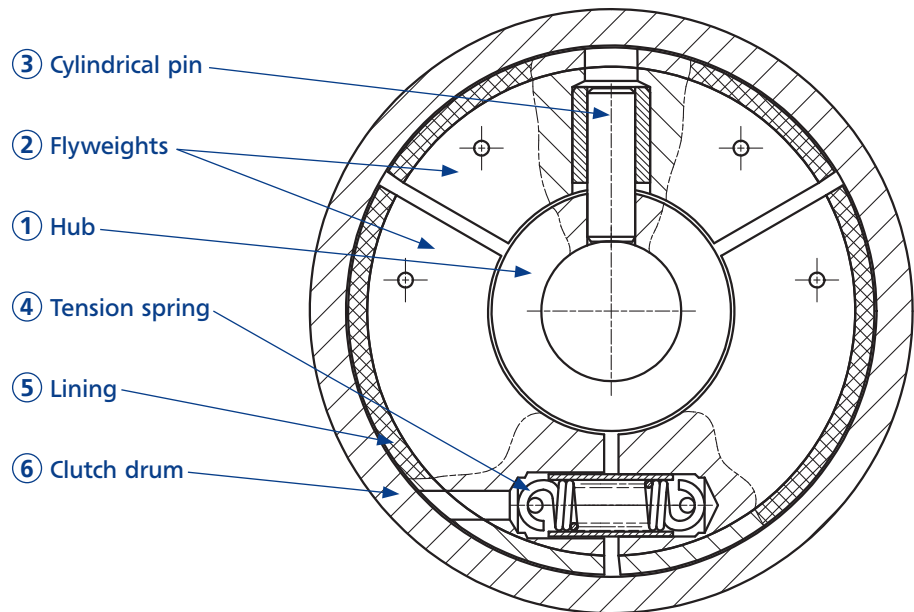
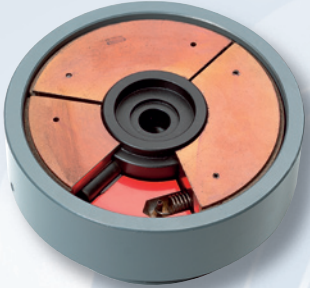
# S-Type

## Centrifugal clutches and brakes

# Pin-guided clutch with three flyweights

### Construction and mode of operation

The cylindrical hub ① carries three flyweights ② which are located by and can slide on cylindrical pins ③. Inside the flyweights, there are tension springs ④ which restrain neighbouring flyweights until centrifugal force overcomes the spring force. Then the flyweights lift from their seats and the linings ⑤ on the flyweights contact the inside diameter of the clutch drum ⑥. Friction between the linings and the clutch drum allows torque to be transmitted.



### Advantages

In contrast to F-Type clutches, the linings of pin-guided clutches are permanently bonded to the flyweights instead of being mounted on loose carriers. The guide pins of W-Type clutches provide accurate guidance for the flyweights, which ensures quiet operation of the clutch.

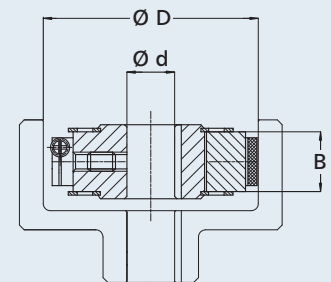
For this type of clutch, the performance factor for torque transmission is ca. 1.5.

### Performance data and dimensions:

Size	D [mm]	B [mm] <sup>1)</sup>	d max. [mm]	Standard bore diameter d [mm] (inch) <sup>2)</sup>	Md at nE 750 and nB 1500 [Nm]	Recommended motor power <sup>3)</sup> [kW]	Md at nE 1250 and nB 2500 [Nm]	Recommended motor power <sup>3)</sup> [kW]	Md at nE 1500 and nB 3000 [Nm]	Recommended motor power <sup>3)</sup> [kW]
04	80	25	24	15 (3/4 ; 5/8)	4.3	0.3	12	1.6	17.5	2.8
05	90	25	30	14; 30 (5/8)	7.5	0.6	21	2.8	31	4.9
06	100	25	24	20; 24; 28 (3/4; 7/8)	11	0.8	30	4.0	43	7.0
07	110	25	30	28; 30 (1)	15	1.2	45	6.0	64	10.0
08	125	25	40	20; 30 (1 1/2)	30	2.4	85	11.0	124	20.0
09	138	25	30	17; 30 (1; 1 1/8)	40	3.0	112	15.0	160	25.0
10	150	35	40	38 (1 1/8)	78	6.0	216	28.0	310	49.0

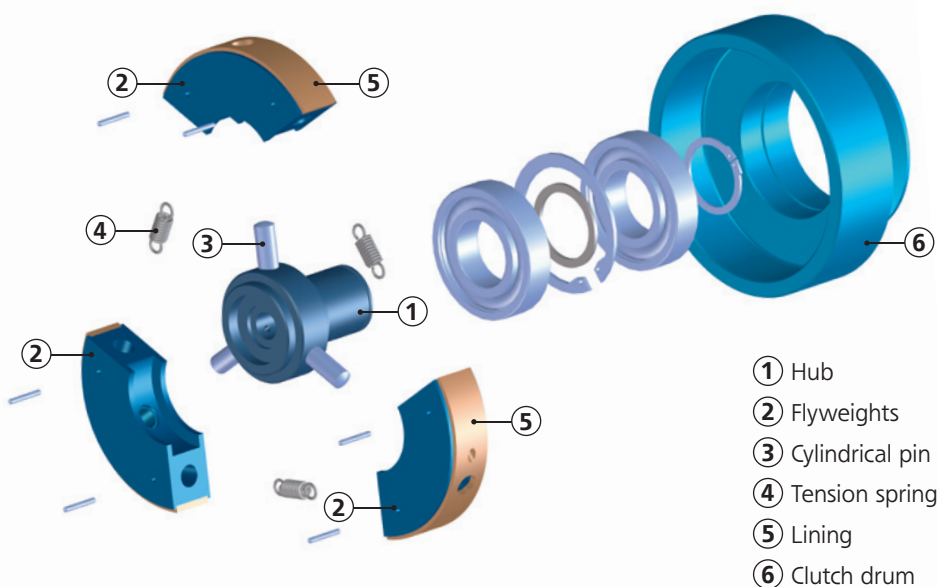
- 1) The transmitted power increases as the width B is increased.
- 2) Tapered bores and special dimensions can be manufactured on request.
- 3) Motor power is calculated using a safety factor of 2.  
Final selection of the clutch should be carried out by SUCO!

d max. = max. bore dia.  
Md = torque  
nE = engagement speed  
nB = operating speed



d = bore dia.  
D = inside dia. of drum  
B = flyweight width

#### Exploded view of S-Type



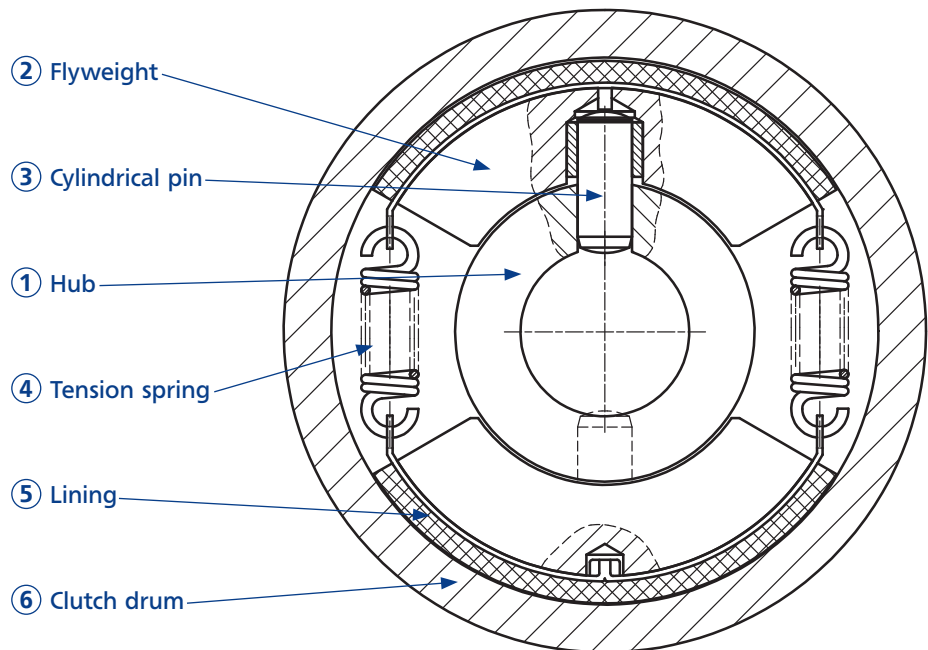
# W-Type

## Centrifugal clutches and brakes

# Pin-guided clutch with two flyweights

### Construction and mode of operation

The cylindrical hub ① carries two flyweights ②, which are located by and can slide on cylindrical pins ③. The tension springs ④ are attached outside the flyweights to lining carriers ⑤. The tension springs restrain the flyweights until centrifugal force overcomes the spring force. Then the flyweights lift from their seats and the linings contact the inside diameter of the clutch drum ⑥. Friction between the linings and the clutch drum allows torque to be transmitted.



### Advantages:

The W-Type combines the advantages of F-Type and S-Type clutches. Because the tension springs are easily accessible and the linings removable, the parts subject to wear are easy to replace.

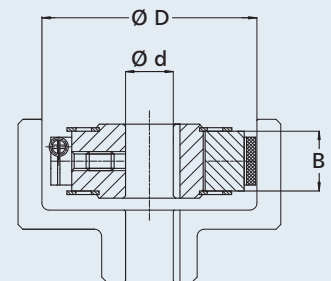
As with the S-Type, the guide pins provide accurate guidance for the flyweights, which ensures quiet operation of the clutch. For this type of clutch, the performance factor for torque transmission is 1.0.

## Performance data and dimensions:

Size	D [mm]	B [mm] <sup>1)</sup>	d max. [mm]	Standard bore diameter d [mm] (inch) <sup>2)</sup>	Md at nE 750 and nB 1500 [Nm]	Recommended motor power <sup>3)</sup> [kW]	Md at nE 1250 and nB 2500 [Nm]	Recommended motor power <sup>3)</sup> [kW]	Md at nE 1500 and nB 3000 [Nm]	Recommended motor power <sup>3)</sup> [kW]
04	80	15	15	15	1.7	0.14	4.6	0.6	6.6	1.0
05	90	20	25	14 (5/8)	3.7	0.3	10.3	1.4	14.8	2.3
06	100	20	30	30	5.7	0.45	16.0	2.0	23.0	3.6
07	110	20	40	-	8.6	0.7	24.0	3.2	34.5	5.5
08	125	20	40	20; 30 (1 1/2)	14.0	1.0	38.5	5.0	55	8.5
09	138	25	55	-	27.0	2.2	75.0	9.8	110	17
10	150	25	60	38 (1 1/8)	36.5	3.0	102	13	145	23

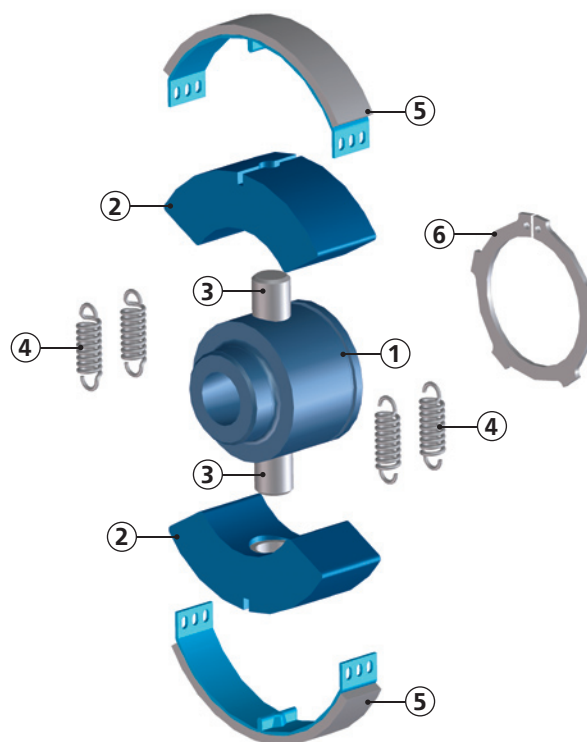
- 1) The transmitted power increases as the width B is increased.  
 2) Tapered bores and special dimensions can be manufactured on request.  
 3) Motor power is calculated using a safety factor of 2.  
 Final selection of the clutch should be carried out by SUCO!

d max. = max. bore dia.  
 Md = torque  
 nE = engagement speed  
 nB = operating speed



d = bore dia.  
 D = inside dia. of drum  
 B = flyweight width

### Exploded view of W-Type



- ① Hub
- ② Flyweight
- ③ Cylindrical pin
- ④ Tension spring
- ⑤ Lining
- ⑥ Circlip



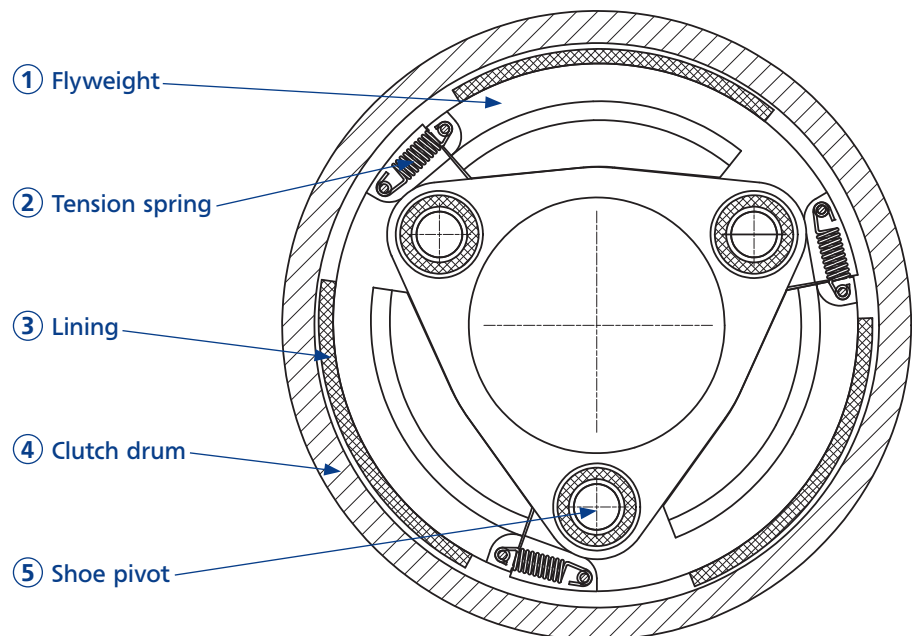
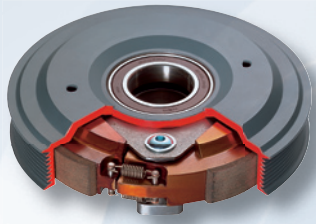
# P-Type

## Asymmetric pivot clutch

### Construction and mode of operation

Flyweights ① are normally mounted so that they can pivot on pins ⑤, which are fitted to a flange. There are tension springs ② which restrain neighbouring flyweights until centrifugal force overcomes the spring force. Then the flyweights lift from their seats and the bonded linings ③ contact the inside diameter of the clutch drum ④.

Due to the asymmetric arrangement of the flyweights, the torque that can be transmitted by this type of clutch depends on the direction of rotation.



### Advantages:

P-Type clutches are extremely narrow.

In addition, the asymmetric pivot clutch is the quietest-running clutch in the SUCO product range. For this type of clutch, the performance factor for torque transmission is ca. 1.75 or ca. 1.25 depending on the direction of rotation.

## Performance data and dimensions:

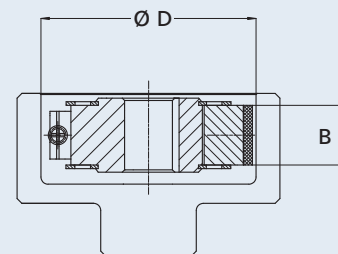
P-Type clutches are flange mounted; for this reason standard bore diameters are not given. Possible bore sizes will be given on request.

Size	D [mm]	B [mm] <sup>1)</sup>	Md bei nE 400 and nB 1400 [Nm]	Recommended motor power <sup>2)</sup> [kW]	Md at nE 1250 and nB 2500 [Nm]	Recommended motor power <sup>2)</sup> [kW]
11	187.5	30	175	13	460	60
12	193	30	180	14	500	70

Other sizes are available on request.

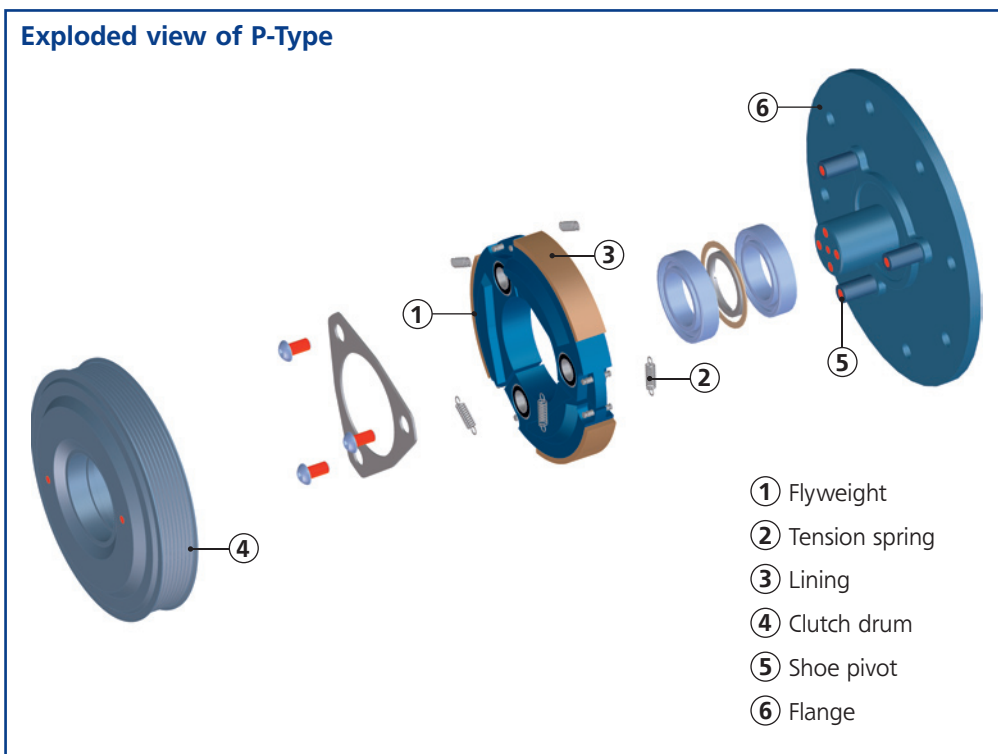
- 1) The transmitted power increases as the width B is increased.
- 2) Motor power is calculated using a safety factor of 2.  
Final selection of the clutch should be carried out by SUCO!

Md = torque  
nE = engagement speed  
nB = operating speed



D = inside dia. of drum  
B = flyweight width

### Exploded view of P-Type



## Centrifugal clutches and brakes

# Different solutions, driven-side

To accommodate the torque transmission needs of a wide variety of drives, there are many different versions in the SUCO product programme. Both axial and radial drives can be supplied.

**All versions can only be used in conjunction with a suitable drum or belt pulley. The operation of a clutch or brake without a suitable drum or belt pulley is forbidden. Non-compliance can result in injury to persons.**

### Model K

#### Core version -K-

This version without a drum is supplied when a clutch or brake drum already exists in the customer's set up, or a suitable component for this purpose is available on the output side. The drum must be accurately centred and securely mounted. For higher torque transmission, a clutch can be equipped with several rows of flyweights. The shaft diameter can be varied and tapered mountings are possible.

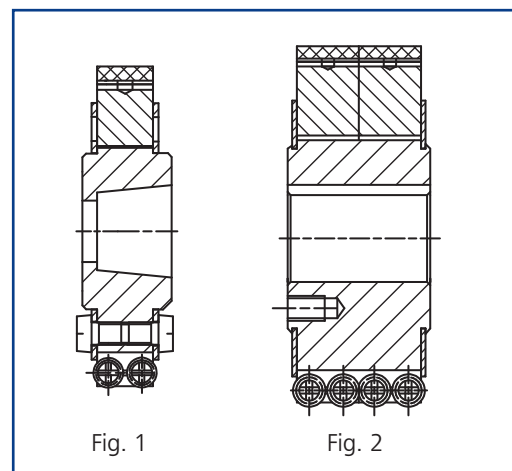


Fig. 1

Fig. 2

### Model G

#### Core version with drum -G-

This version can be used to connect two shaft ends.

It is important that the installation has the lowest possible misalignment in both radial and angular directions.

Excessive misalignment can result in premature wear of the linings or complete failure of the clutch.

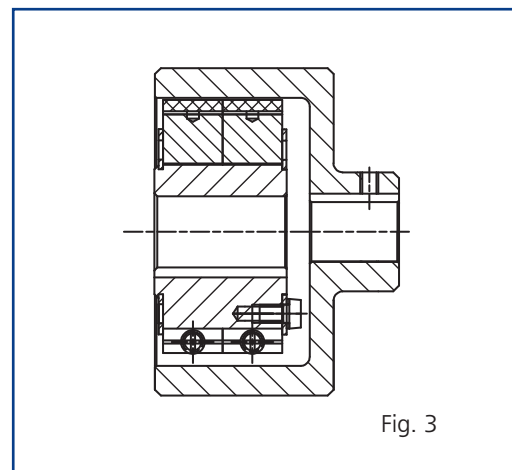


Fig. 3

### Model E

#### Unit version -E-

Where it is not practical to locate both shaft ends or one shaft end and the drum, a bearing can be used between hub and drum. As shown in Fig. 4, the output drive can be through a tolerance ring on to which a belt pulley, a timing-belt pulley, or a mounting flange can be pressed.

Figure 5 shows a go kart clutch with a drive flange for a chain sprocket.

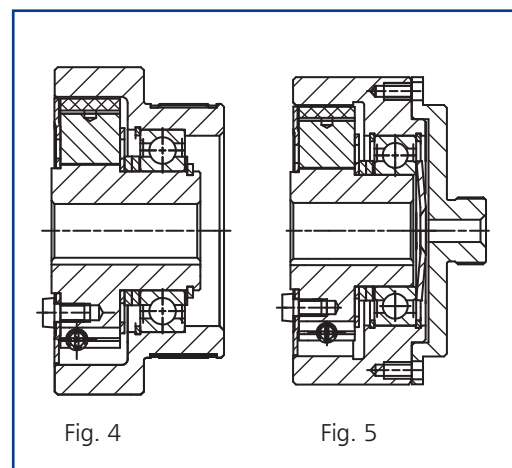


Fig. 4

Fig. 5

**Unit version with flexible coupling -A-**

The easiest way of compensating for radial and angular misalignment between two shafts is to use a flexible shaft coupling. The flexible coupling can be installed and located either radially or axially.

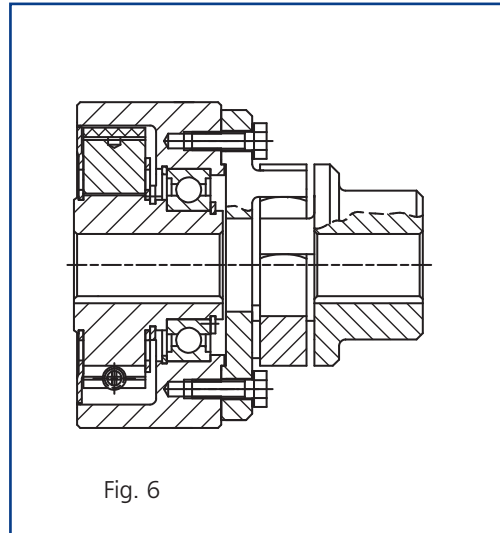


Fig. 6

**Belt-pulley version -R-**

Where torque is transmitted through a V-belt, the belt groove or grooves can be machined in the drum. Single, duplex or multiple groove pulleys can be produced in this way. Depending on the clutch size, effective pulley diameters from ca. 80 to 270 mm can be incorporated.

Common groove forms are: SPA, SPB, SPZ, and Poly-V to DIN/EN.

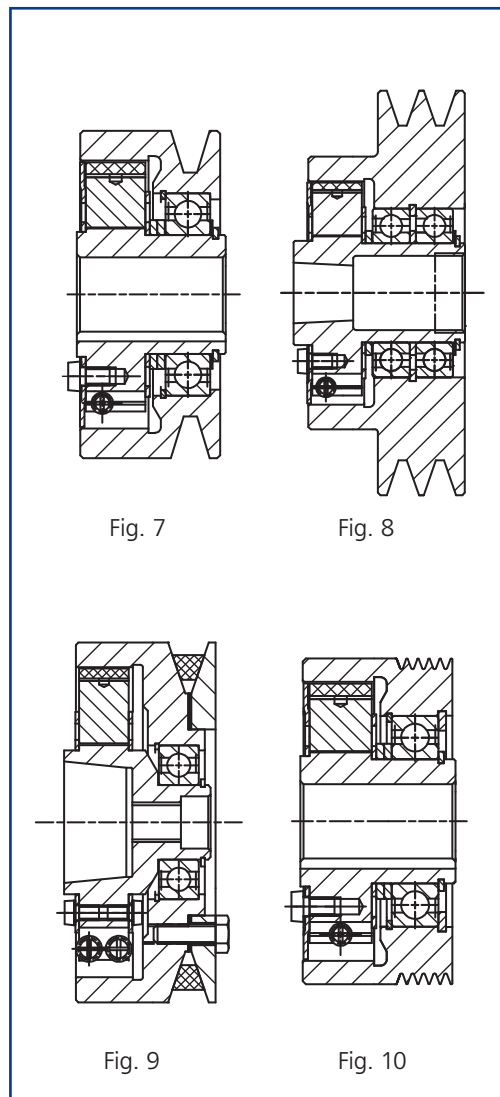


Fig. 7

Fig. 8

Fig. 9

Fig. 10

Figures 7 to 10 show different belt-drive clutch versions.

The clutch shown in Fig. 9 with a split pulley allows elimination of a tensioning pulley. The V-belt is tensioned by changing the spacer shims between the two pulley halves.

Model A

Model R



# Centrifugal brakes

Besides centrifugal clutches, centrifugal brakes are becoming increasingly important.

A decisive advantage of centrifugal brakes over conventional brakes is that they operate without an external power supply.

The brake, mounted on a shaft, starts to brake a drive shaft at a defined speed. Centrifugal force causes the flyweights to lift from the hub so that their linings contact the inside diameter of the brake drum. This action creates a braking torque.

As soon as the speed of rotation of the system falls, the tension springs return the flyweights to their initial positions.

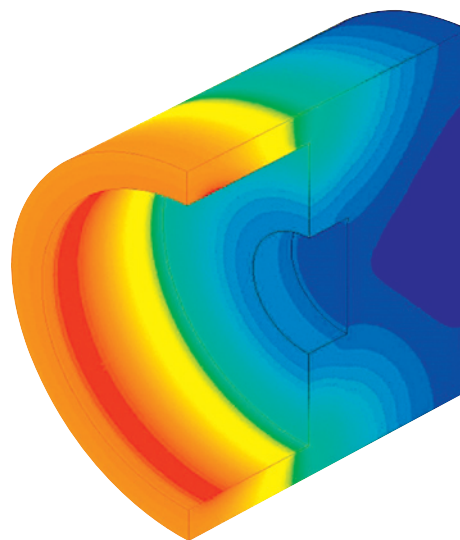
It is a fundamental principle of centrifugal brakes that they cannot brake a system to a standstill, i.e. the system speed searches for an equilibrium condition between the speeds determined by load torque and braking torque.

Although centrifugal brakes are governed by the same technical principles as centrifugal clutches and also use similar components, brakes call for additional investigation of their conditions of use.

The most important principle governing the use of centrifugal brakes is:

### FRICION PRODUCES HEAT

Centrifugal brakes convert mechanical energy into heat, which is generated between the lining and the brake drum, and mostly heats up the latter.



The temperature distribution illustrated above on a sectioned brake drum clearly shows the higher heating of the drum in the region over the flyweights.

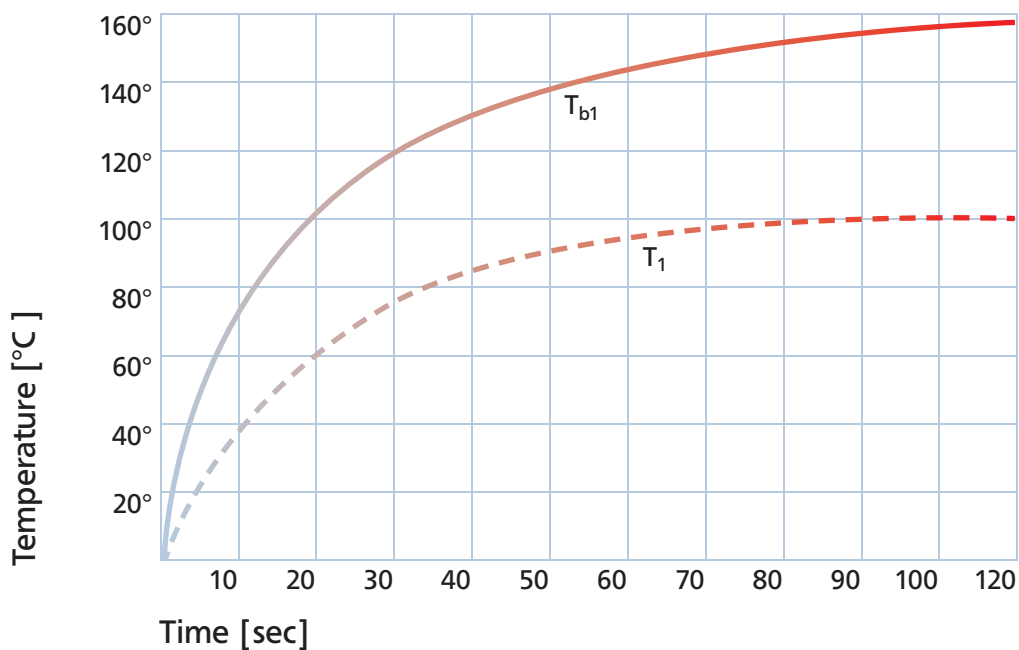
The amount of heat generated depends on various factors:

- Transmitted brake torque
- Brake speed
- Duration of the braking operation
- Size of the friction surface
- The mass of the brake drum that has to be heated

*For special designs that deviate from this principle, see page 34 et seq.*

*For further technical advice and explanations, see page 6 et seq.*

Over the braking time, the temperature curve rises very steeply at the start and then gradually approaches a maximum. The temperature at the friction surface ( $T_{b1}$ ) is substantially higher than the temperature ( $T_1$ ) at the outer surface of the brake drum. Nevertheless, the brake drum can become very hot during operation and is a source of danger. The authority responsible for operation of the machine is solely responsible for ensuring that suitable protective measures are taken.



### Types of centrifugal brake

#### F-Type

see page 8 et. seq.

#### S-Type

see page 10 et. seq.

#### W-Type

see page 12 et. seq.

#### P-Type

see page 14 et. seq.

The maximum temperature must not exceed the manufacturer's maximum permitted temperature for the friction material, otherwise the linings may be damaged. This can lead to a loss of effectiveness of the brake and, in the worst case, destruction of the brake.

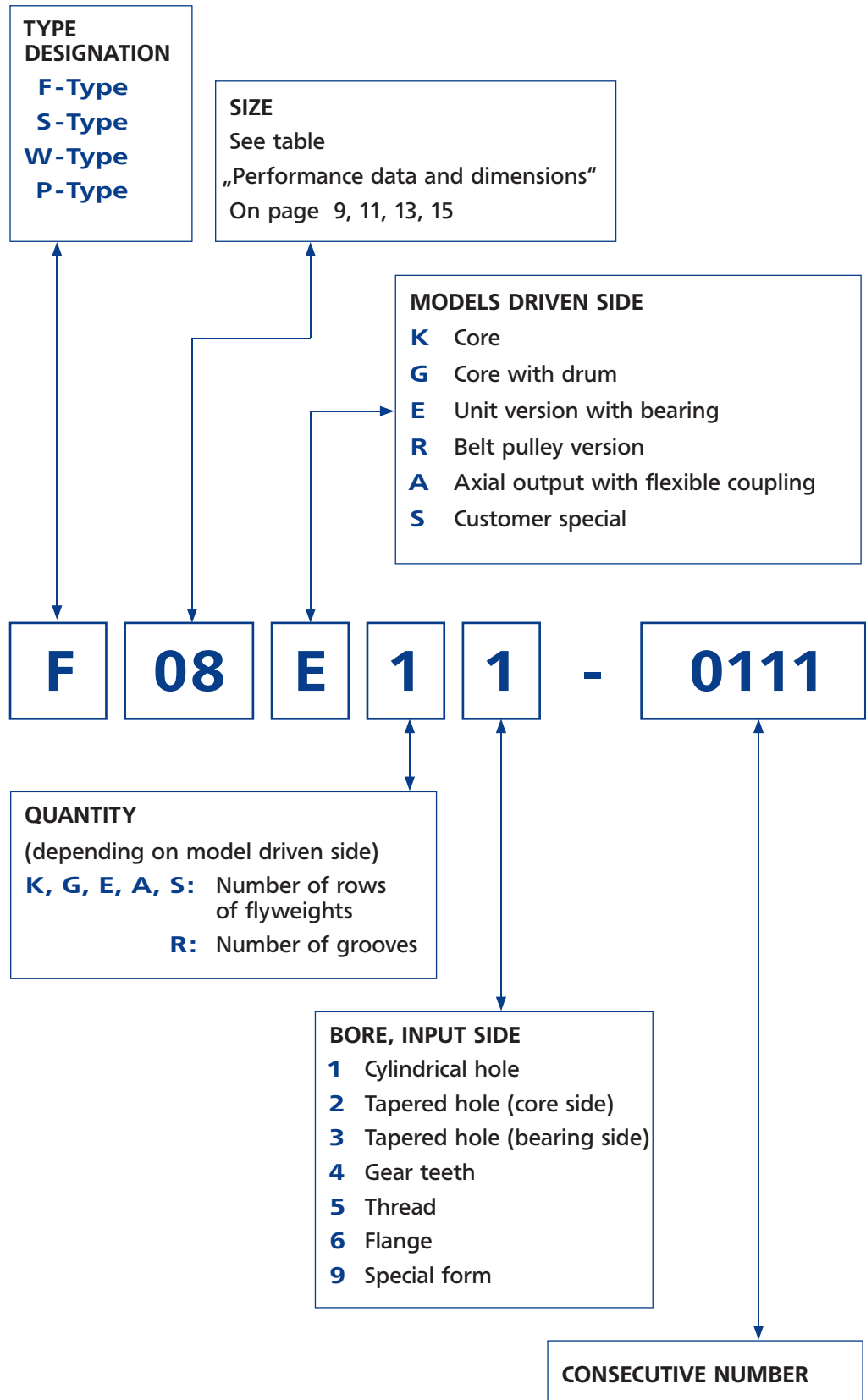
To prevent this, detailed data about the application are required when laying out a centrifugal brake, among others:

- Operating speed of the system to be braked
- Engagement speed of the centrifugal brake
- Braking torque required at the braking speed
- Changes in the braking torque
- Braking times and frequency
- Field of application

Centrifugal brakes are speed limiting devices and are finding increased use in lowering equipment. In such cases, the speed of lowering corresponds to the equilibrium condition between the speed governed by load torque and the speed governed by braking torque.

## Centrifugal clutches and brakes

# Key to model codes

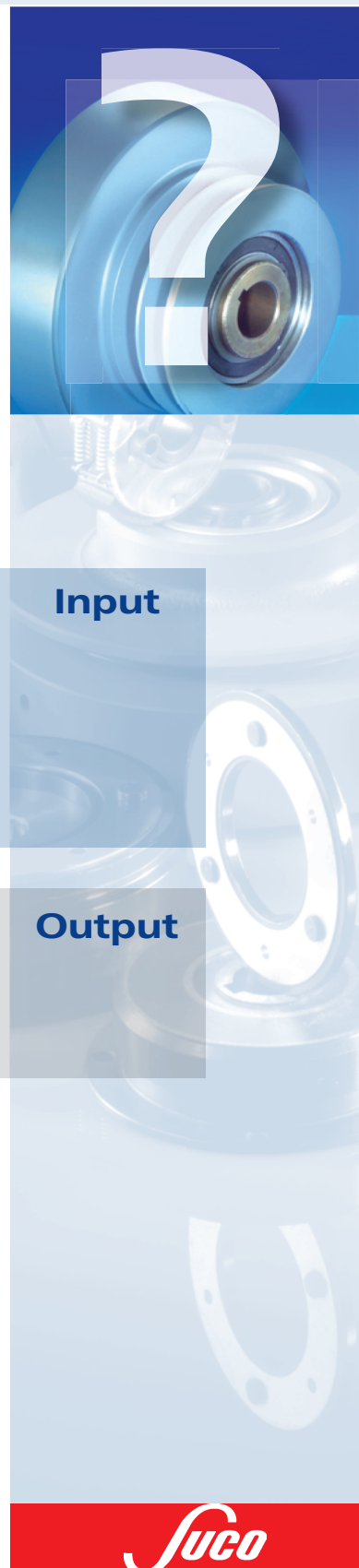


# Questionnaire

For customer's requirements

You will find the telephone and fax numbers of your contact on pages 38 to 40.

Company \_\_\_\_\_  
 Contact \_\_\_\_\_  
 Department \_\_\_\_\_  
 Street \_\_\_\_\_  
 Country, post code, town or city \_\_\_\_\_  
 Telephone \_\_\_\_\_  
 Fax \_\_\_\_\_  
 E-mail \_\_\_\_\_



	Clutch	Brake	
Type	_____	_____	
Power	_____	_____	kW
Engagement speed	_____	_____	rpm
Operating speed	_____	_____	rpm
Shaft diameter	_____	_____	mm
Load	-----	_____	kg
Braking time	-----	_____	sec.
Shaft diameter	_____	-----	mm
Flexible coupling (Ø)	_____	-----	mm
Belt-pulley diameter	_____	-----	mm
Number of grooves	_____	-----	

**Input**

**Output**

Quantity/year: \_\_\_\_\_  
 Special operating conditions: \_\_\_\_\_

Installation diagram: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_