Total Quality

ISO 9001 REGISTERED

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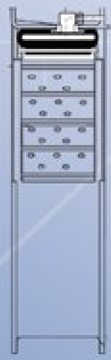
MGMT. SYS. RvA C024

DNV Certification B.V., The Netherlands

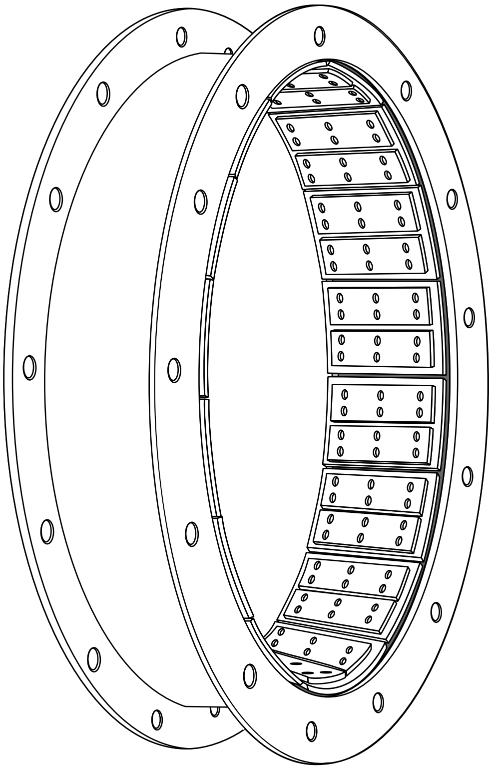
GUMMI

# Pneumatic clutches and brakes

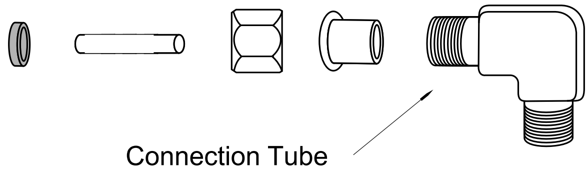
## Type FM



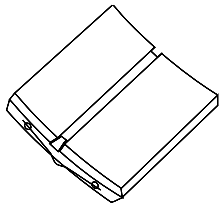
# FM Element
## Construction and Characteristics



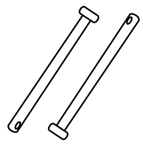
Rim and Tube



Connection Tube



Friction Shoe Assembly



Shoe Pins

| Torque Ratings | | | |
|---|---|---|---|
| Size | lb in @ 75 psi | Size | N.m @ 5,2 bar |
| 26FM475 | 120000 | 26FM475 | 13600 |
| 30FM500 | 171000 | 30FM500 | 19300 |
| 35FM500 | 240000 | 35FM500 | 27100 |
| 40FM550 | 336000 | 40FM550 | 38000 |
| 48FM650 | 558000 | 48FM650 | 63100 |

The FM elements have the same features as the FK, but with the characteristic that it dissipates heat much quicker.
The FM elements are used in applications where moderate slippage is encountered, which would resulting the shortened operating life of a FK type element.
The rubber tube is vulcanized on a steel rim, which has male and female keys in order to facilitate the assembly of dual and triple elements. The ventilated friction shoes are mounted to the rubber tube by using a two shoe pins that are locked in place by cotter pins.
The capacity of the element to transmit torque depends upon the air pressure being applied and on the speed of revolutions. The ratings shown in the catalog are given at a pressure of 75 psi. (5,2 bar) and 0 r.p.m. The construction of the rubber tube of the FM element allows it to work a higher operating pressure than the type FK element. The maximum recommended pressure is 150 psi (10.3 bar). Adjustments for speed or pressure are explained under the Selection Procedure section of the catalog.
FM elements are available in 5 different sizes that are identified by the drum diameter in inches in which they constrict upon, and the width in inches of its friction shoe. For example, the element **26FM475** is designed to constrict on a drum with a diameter of 26" and with a width of 4,75". The smallest size of FM elements will constrict on a drum with 26" of diameter (660 mm.), and the largest on a 48" (1219 mm) diameter drum.
The FM elements can be bolted together in dual or triple elements, resulting with the capacity to double or triple its capacity to transmit torque compared to that of a single FM elements. Due to the fact that the rubber tube is the connecting element between the driven and driving shafts, the FM design offers the following additional aspects to the ones described in this last paragraph.

**One single moving component**
The tube is the only moving component element; there are no sliding parts.
**Cushioning effect**
Due to the fact that the tube transmits the torque through its sidewalls, it acts as a shock absorber, cushioning the charging impacts and shock loads, protecting the transmissions components. The rubber tube also dampens and reduces the effects of the tensional vibrations.
**Flexible connection**
The flexibility of the tube is able to compensate for minor shaft misalignment and absorbs axial movement.
**Ventilated construction**
The ventilated construction of the friction shoe allows for greater heat dissipation and thermal capacity.

**Industry Used In:**
**Marine Propulsion**

| ENGLISH | | lb.in @ 75 psi | rpm | rsi/rpm² | lb/ft² | lb | in² | Inches new | Inches worn | in² | Inches |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **26FM475** | 103212 | 120000 | 1030 | 40 | 280 | 160 | 302 | 0.30 | 0.21 | 120 | 125.81 |
| **30FM500** | 103252 | 171000 | 915 | 48 | 430 | 190 | 379 | 0.33 | 0.18 | 210 | 29.81 |
| **35FM500** | 103291 | 240000 | 790 | 58 | 760 | 250 | 433 | 0.33 | 0.18 | 250 | 34.81 |
| **40FM550** | 103312 | 336000 | 700 | 68 | 1150 | 310 | 540 | 0.33 | 0.18 | 320 | 39.81 |
| **45FM650** | 103335 | 558000 | 605 | 79 | 2020 | 400 | 752 | 0.33 | 0.18 | 430 | 47.75 |
| **Size** | **Part number (1)** | **M. Torque rating** | **Max. speed** | **Cs Centrifugal Loss constant** | **Wk² / J** | **Weight / Mass** | **Friction area** | **Friction Lining Thickness** | | **Air Cavity volume (5)** | **Minimun Drum diameter** |
| **26FM475** | 103212 | 13600 | 1030 | 2.8 | 11.76 | 72 | 2099 | 8 | 5 | 1.97 | 656 |
| **30FM500** | 103252 | 19300 | 915 | 3.3 | 18.06 | 86 | 2634 | 8 | 5 | 3.44 | 757 |
| **35FM500** | 103291 | 27100 | 790 | 4.0 | 31.92 | 113 | 3009 | 8 | 5 | 4.10 | 884 |
| **40FM550** | 103312 | 38000 | 700 | 4.7 | 48.30 | 140 | 3753 | 8 | 5 | 5.25 | 1011 |
| **45FM650** | 103335 | 63100 | 605 | 5.5 | 84.84 | 181 | 5226 | 8 | 5 | 7.05 | 1213 |
| **SI** | | N.m @ 5.2 bar | rpm | bar/rpm² | kg.m² | kg | cm² | Milimeters nuevo | Milimeters usado | dm² | mm |

* The data displayed in the catalog is current and subject to change without previous notice.

**NOTES:**

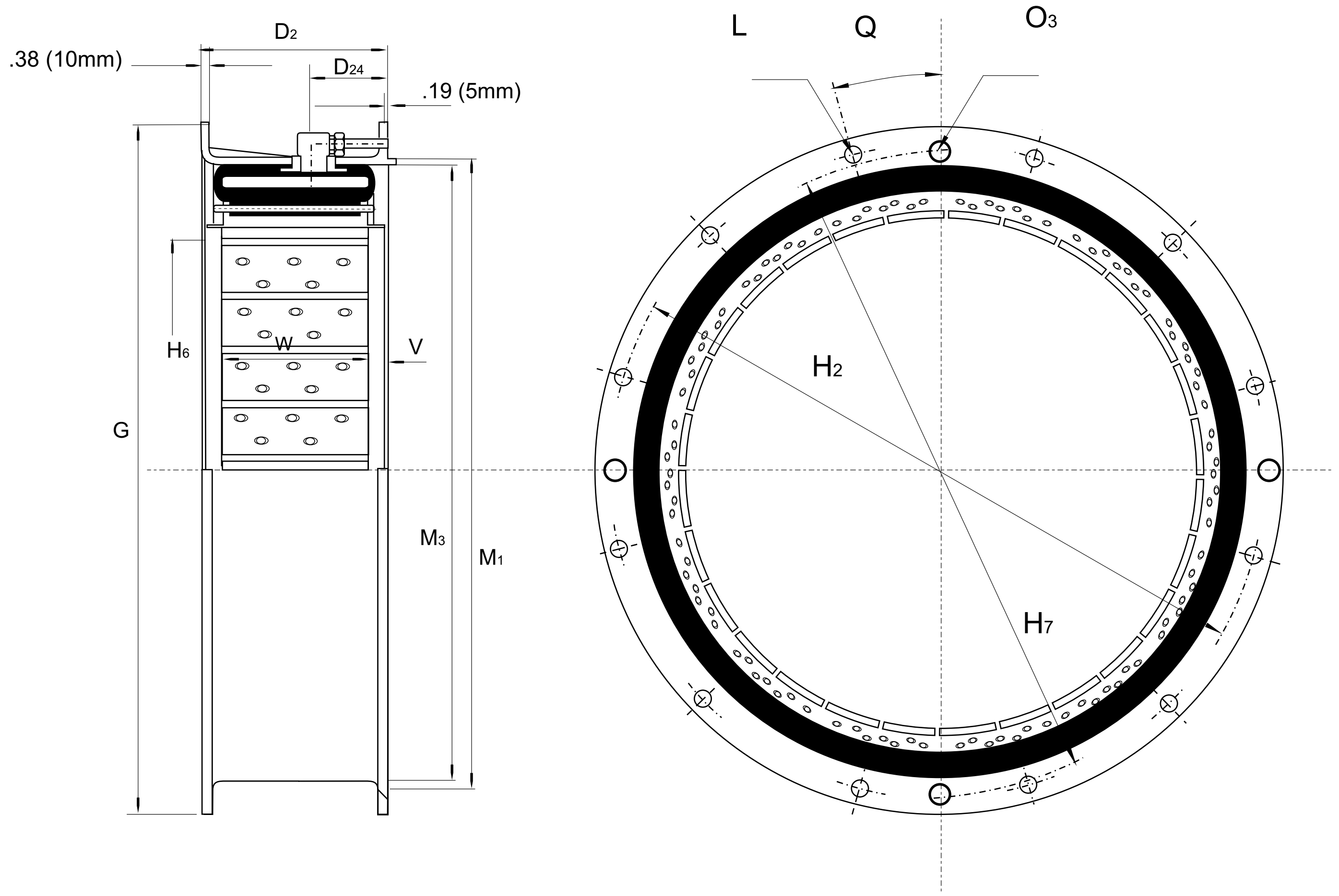
1- The indicted torque is dynamic, the static torque is approximately 25% greater. The torque in each application depends upon the air pressure and the speed.

2- Tolerance + 0,000/-0,006 inches.
(+ 0,00/-0,15 mm).

3- Tolerance + 0,005/-0,000 inches.
(+ 0,13/-0,00 mm).

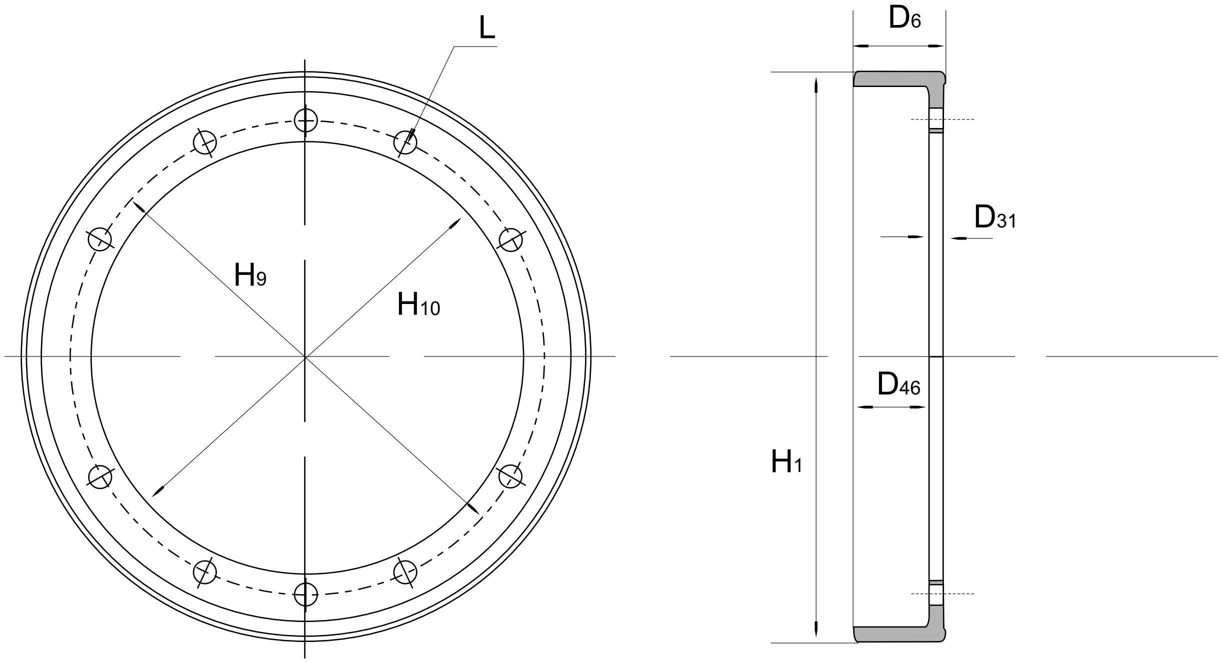
4- NPT thread.

5- Drum contact with installed drum and worn shoes.




| Size | Part number | M. Torque rating [1] | $D_2$ | $D_{24}$ | G [2] | $H_2$ | $H_6$ | $H_7$ | L No. | L Día | $M_1$ [2] | $M_3$ [3] | $O_3$ | $O_4$ [4] | Q (Deg) | V | W | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ENGLISH | lb.in @75 psi | Dimensions in inches | | | | | | | | | | | | | | | | |
| 26FM475 | 103212 | 120000 | 6.94 | 3.38 | 34.750 | 33.438 | 26.19 | 32.88 | 12 | 0.69 | 31.500 | 31.125 | 0.38 | 3/8-18 | 15.000 | 1.00 | 4.75 | 12 |
| 30FM500 | 103252 | 171000 | 7.19 | 3.50 | 39.375 | 38.000 | 30.19 | 37.50 | 12 | 0.81 | 35.750 | 35.380 | 0.50 | 1/2-14 | 15.000 | 1.00 | 5.00 | 14 |
| 35FM500 | 103291 | 240000 | 7.69 | 3.75 | 45.875 | 44.375 | 35.19 | 43.75 | 12 | 0.81 | 42.000 | 41.380 | 0.63 | 3/4-14 | 15.000 | 1.25 | 5.00 | 16 |
| 40FM550 | 103312 | 336000 | 8.44 | 4.13 | 51.375 | 49.875 | 40.19 | 49.25 | 12 | 0.81 | 47.375 | 46.755 | 0.63 | 3/4-14 | 15.000 | 1.38 | 5.50 | 18 |
| 48FM650 | 103335 | 558000 | 9.06 | 4.44 | 59.500 | 58.000 | 48.19 | 57.25 | 16 | 0.81 | 55.375 | 54.760 | 0.63 | 3/4-14 | 11.250 | 1.19 | 6.50 | 21 |
| 26FM475 | 103212 | 13600 | 176 | 86 | 882.7 | 849.3 | 665 | 835 | 12 | 18 | 800.1 | 790.6 | 10 | 3/8-18 | 15.000 | 25 | 121 | 12 |
| 30FM500 | 103252 | 19300 | 183 | 89 | 1000.1 | 965.2 | 767 | 953 | 12 | 21 | 908.1 | 898.7 | 13 | 1/2-14 | 15.000 | 25 | 127 | 14 |
| 35FM500 | 103291 | 27100 | 195 | 95 | 1165.2 | 1127.1 | 894 | 1111 | 12 | 21 | 1066.8 | 1051.1 | 16 | 3/4-14 | 15.000 | 32 | 127 | 16 |
| 40FM550 | 103312 | 38000 | 214 | 105 | 1304.9 | 1266.8 | 1021 | 251 | 12 | 21 | 1203.3 | 1187.6 | 16 | 3/4-14 | 15.000 | 35 | 140 | 18 |
| 48FM650 | 103335 | 63100 | 230 | 113 | 1511.3 | 1473.2 | 1224 | 1454 | 16 | 21 | 1406.5 | 1390.9 | 16 | 3/4-14 | 11.250 | 30 | 165 | 21 |
| SI | N.m @ 5,2 bar | Dimensions in milimeters | | | | | | | | | | | | | | | | |

The data displayed in catalog is indicative and subject to modification without previous warning.




NOTES:

1- Tolerance + 0,000/-0.010 in.
(+ 0,00/-0,25 mm).

2- Tolerance + 0,003/-0.000 in.
(+ 0,08/-0,00 mm).

| Size | $D_{31}$ | $H_1$ (1) | L: N° | L: Día | Drum front condition: $D_6$ | Drum front condition: $D_{46}$ | Drum front condition: $H_9$ (1) | Drum front condition: $H_{10}$ (2) | Drum back condition: $D_6$ | Drum back condition: $D_{46}$ | Drum back condition: $H_9$ (1) | Drum back condition: $H_{10}$ (2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ENGLISH** | Dimensions in inches | | | | | | | | | | | |
| **26FM475** | 0.75 | 26 | 10 | 0.81 | 5.25 | 3.25 | 16.130 | 14.750 | 5.25 | 4.19 | 21.630 | 20.250 |
| **30FM500** | 0.75 | 30 | 10 | 0.88 | 5.50 | 3.75 | 20.130 | 18.750 | 5.50 | 3.88 | 25.630 | 24.250 |
| **35FM500** | 1.00 | 35 | 10 | 1.00 | 6.50 | 4.25 | 23.505 | 21.875 | 6.69 | 4.25 | 30.005 | 28.375 |
| **40FM550** | 1.25 | 40 | 10 | 1.06 | 6.50 | 4.00 | 26.255 | 24.375 | 6.50 | 3.50 | 33.755 | 31.875 |
| **48FM650** | 1.25 | 48 | 12 | 1.06 | 7.00 | 3.06 | 37.760 | 35.875 | 7.00 | 4.50 | 42.010 | 40.000 |
| **SI** | Dimensions in milimeters | | | | | | | | | | | |
| **26FM475** | 19 | 660 | 10 | 21 | 133 | 83 | 409.7 | 374.7 | 133 | 106 | 549.4 | 514.4 |
| **30FM500** | 19 | 762 | 10 | 22 | 140 | 95 | 511.3 | 476.3 | 140 | 99 | 651.0 | 616.0 |
| **35FM500** | 25 | 889 | 10 | 25 | 165 | 108 | 597.0 | 555.6 | 170 | 108 | 762.1 | 720.7 |
| **40FM550** | 32 | 1016 | 10 | 27 | 165 | 102 | 666.9 | 619.1 | 165 | 89 | 857.4 | 809.6 |
| **48FM650** | 32 | 1219 | 12 | 27 | 178 | 78 | 959.1 | 911.2 | 178 | 114 | 1067.1 | 1016.0 |

* The data displayed in the catalog is current and subject to change without previous notice.

**Drum front condition**

| Size | Part number | ENGLISH: Weight lb | ENGLISH: Wk² lb- ft² | SI: Mass Kg | SI: J Kg-m² |
|---|---|---|---|---|---|
| **26FM475** | 217014 | 190 | 170 | 86 | 7.14 |
| **30FM500** | 217016 | 210 | 280 | 95 | 11.76 |
| **35FM500** | 217090 | 310 | 570 | 140 | 23.94 |
| **40FM550** | 217039 | 460 | 990 | 208 | 41.58 |
| **48FM650** | 217120 | 590 | 1970 | 267 | 82.74 |

**Drum back condition**

| Size | Part number | ENGLISH: Weight lb | ENGLISH: Wk² lb- ft² | SI: Mas Kg | SI: J Kg-m² |
|---|---|---|---|---|---|
| **26FM475** | 217015 | 145 | 150 | 66 | 6.30 |
| **30FM500** | 217121 | 175 | 250 | 79 | 10.50 |
| **35FM500** | 217040 | 245 | 490 | 111 | 20.58 |
| **40FM550** | 217091 | 350 | 830 | 159 | 34.86 |
| **48FM650** | 217017 | 500 | 1750 | 227 | 73.50 |

## General

The technical section of the catalog contains information that corresponds to the selection, assembly, alignment and control of brakes and clutches in general. The formulas, symbols and units are also identified. It is recommended to review the technical section before trying to classify a specific product for specific application.

## Torque of adjustment of elements

The nominal torque of each element indicated in the catalog, belongs to an effective pressure **Pr** of 75 psi (5.2 bar).
The nominal torque must be adjusted for the operating pressure of **Po**, parasitic loss **Pp** and operating speed.
The maximum allowable operating pressure depends the element construction and the frequency of the engagement of the element. In general, the pressures indicated in the following table should not be exceeded.

| Maximum permissible pressure | | |
|---|---|---|
| **Model** | **Psi** | **Bar** |
| **FK** | 110 | 7.6 |
| **FM** | 150 | 10.3 |
| **FKT** | 125 | 8.6 |

The elements have an inherent parasitic pressure **Pp** required to cause contact between the friction shoes and the drum, which represent the pressure to surpass the resistance of the actuating tube; for FKT element, the pressure to surpass the resistance of the release springs of the aluminum shoes. The parasitic pressure is indicated in the following table and must be deducted from the operation pressure.

| Parasitic Pressure | | |
|---|---|---|
| **Size** | **Psi** | **Bar** |
| **3 FK** | 20 | 1.38 |
| **4 y 5 FK** | 15 | 0.34 |
| **6 y 8 FK** | 5 | 1.10 |
| **10 al 45 FK** | 2 | 0.14 |
| **All FM** | 5 | 0.34 |
| **All FKT** | 4 | 0.28 |

The torque rating of a rotating element must be adjusted, to compensate the effects of the centrifugal force that acting upon the friction shoes.
The method used, is to calculate the pressure of compensating operation **Pc,** and deduct its value from the operating pressure.

Where **Pc**: compensating pressure (psi or bar).
**Cs**: constant speed (obtained of page of the element catalogue).
The adjusted element torque **Me**, is then calculated:

$$Me = \frac{Po - Pp - Pc}{Pr} \cdot Mr$$

The adjusted element toque **Me,** must be equal or greater to than the required clutch torque for **Mc** clutch or for the **Mb** brake.
Examples 1, 2 and 3 illustrate the use of these formulas.

## Continuous Thermal Capacity

The pneumatic constricting elements are generally not recommended for applications where continuous slip is common. The expanding and water-cooled product lines better suit those types of applications.

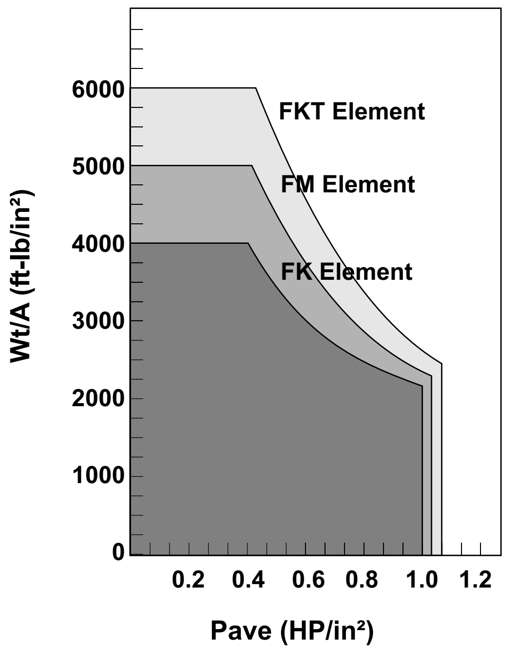
## Non-cyclic capacity

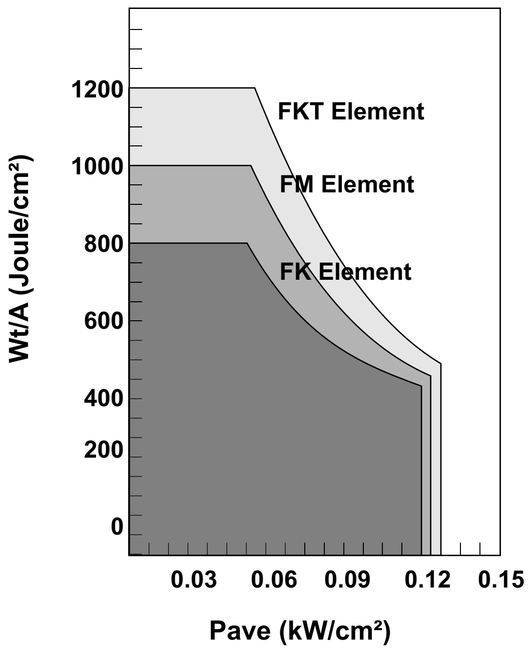
The non-cyclic capacity is determined by the surface of the elements friction area, the mass of the drum, and the capacity for the absorption of the heat and thermal conductivity. The properties of our standard steel iron drum are indicated ones in the graph.
The calculated thermal energy for the load is adjusted to include the energy associated with the acceleration and deceleration of the components of the clutches and/or brakes that are from a tentative calculation. The adjustment of the thermal energy **Wt** is divided by the friction area of each element **A**. Then the average power loading **Pave** average is calculated by:

**Pave:** $\frac{pt}{A}$

The point (**W t/A, Pave**) is drawn on the graph. If the point falls below the limit line that determines the appropriate product, the selection will handle the thermal load. If does not, an element with a greater friction surface area is required
.
Example 4 at the end of this section illustrates the use of the graph.

**Non-Cyclical Thermal Capacities (Gray Smelting Bell)**



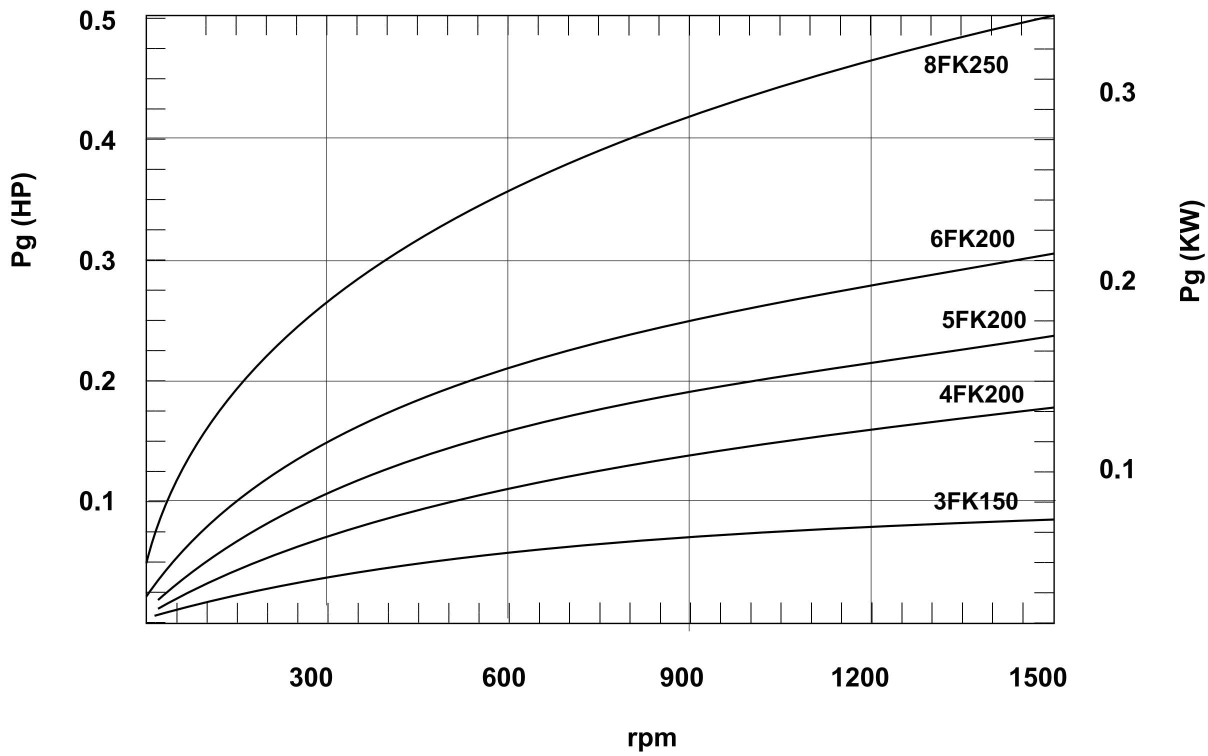
## Cyclical Thermal Capacity

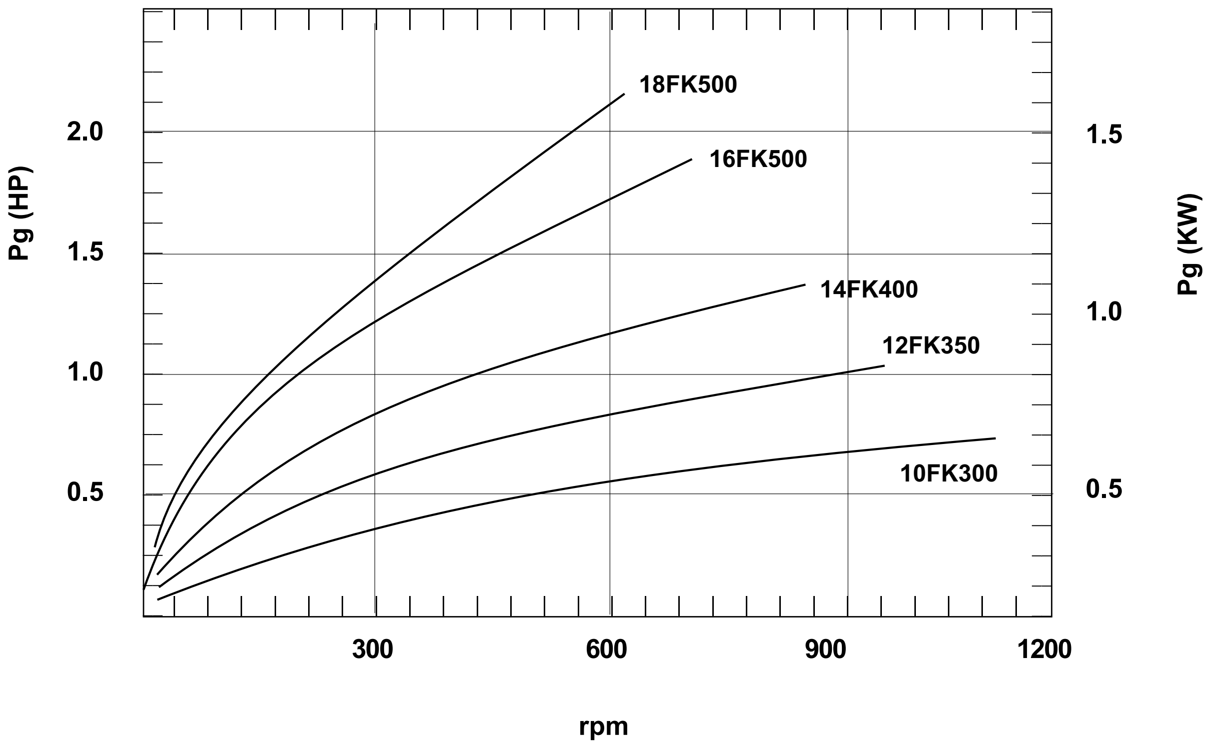
The thermal capacity of a clutch or brake depends on the design and arrangement of the assembly of their mounting components and the operating speed at which it works.
The components with small inertia should be mounted on the shaft where each cycle begins and stops.
The protective defenses and or guards should be designed to assure an adequate air circulation. The thermal cyclical capacity **Pc** for FK and FKT elements are determined in the following graphics.
The FM elements are not recommended for cyclic duty because the thermal requirement can be handled with greater effectiveness with by a small diameter FKT element. The capacities are for the applications having a drum and hub on the driven side of the installation. The elements should have the maximum allowed number of tube inlets. The obtained **Pg** capacity in these graphics must be multiplied by an appropriate disposition arrangement factor of **Kt** given in the table
.
**Pc = Pg.Kt**

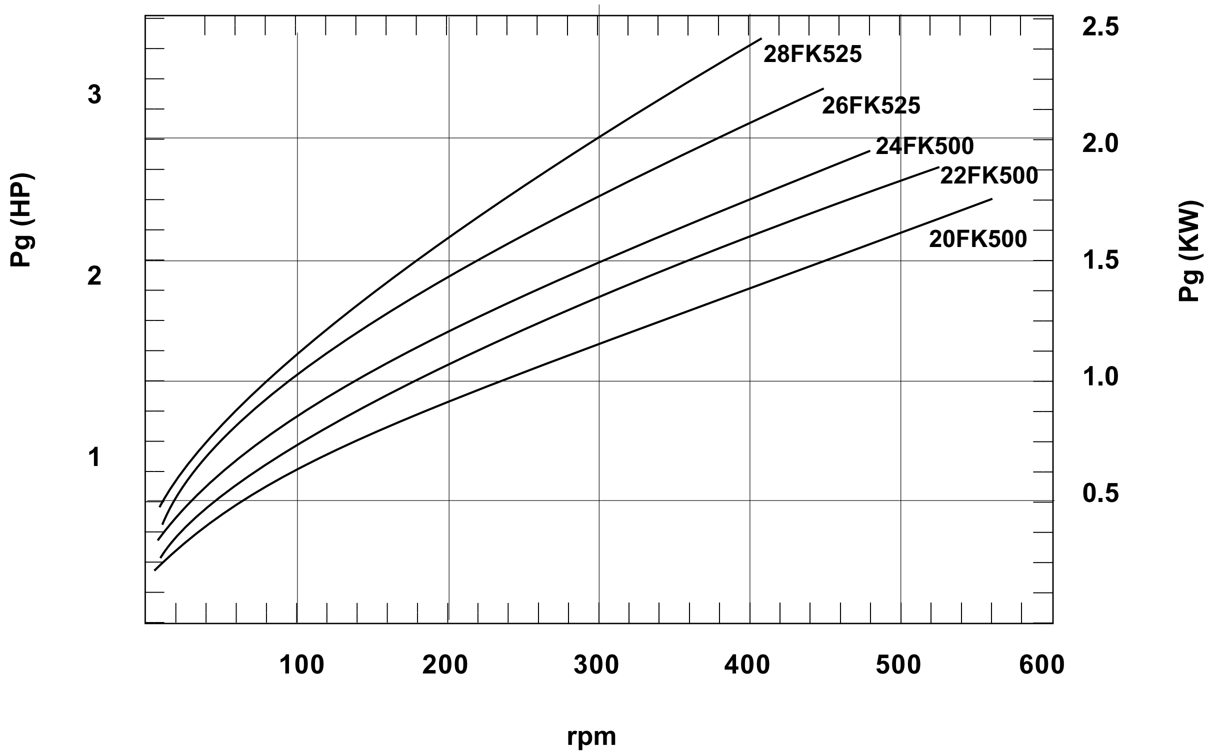
| Disposition Assembly Kt Factor | | |
|---|---|---|
| Disposition | Single Element | Dual Element |
| Spider | 1.0 | 1.6 |
| Ventilated Adapter | 1.67 | 2.67 |
| Brake | 0.5 | 0.8 |

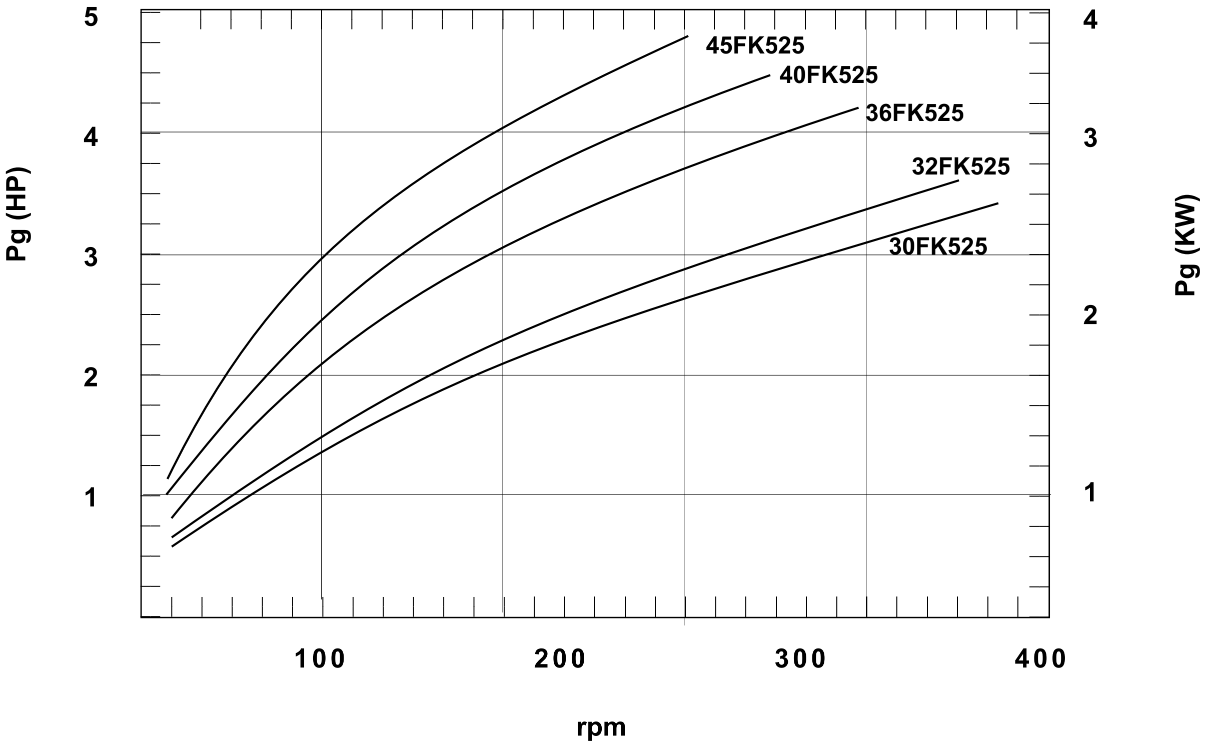
The **Pc** cyclical thermal capacity of the element must be greater than or equal to the required thermal capacity.

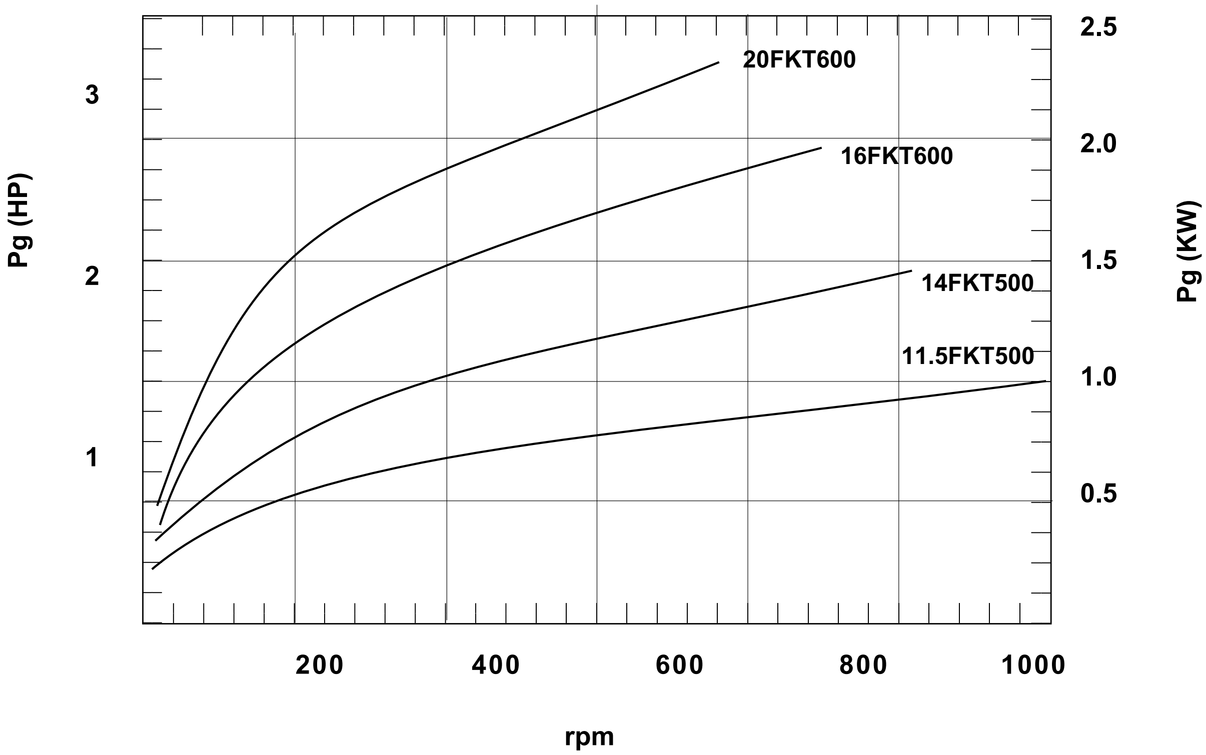
Example 5 at the end of this section illustrates the use of the graphic.

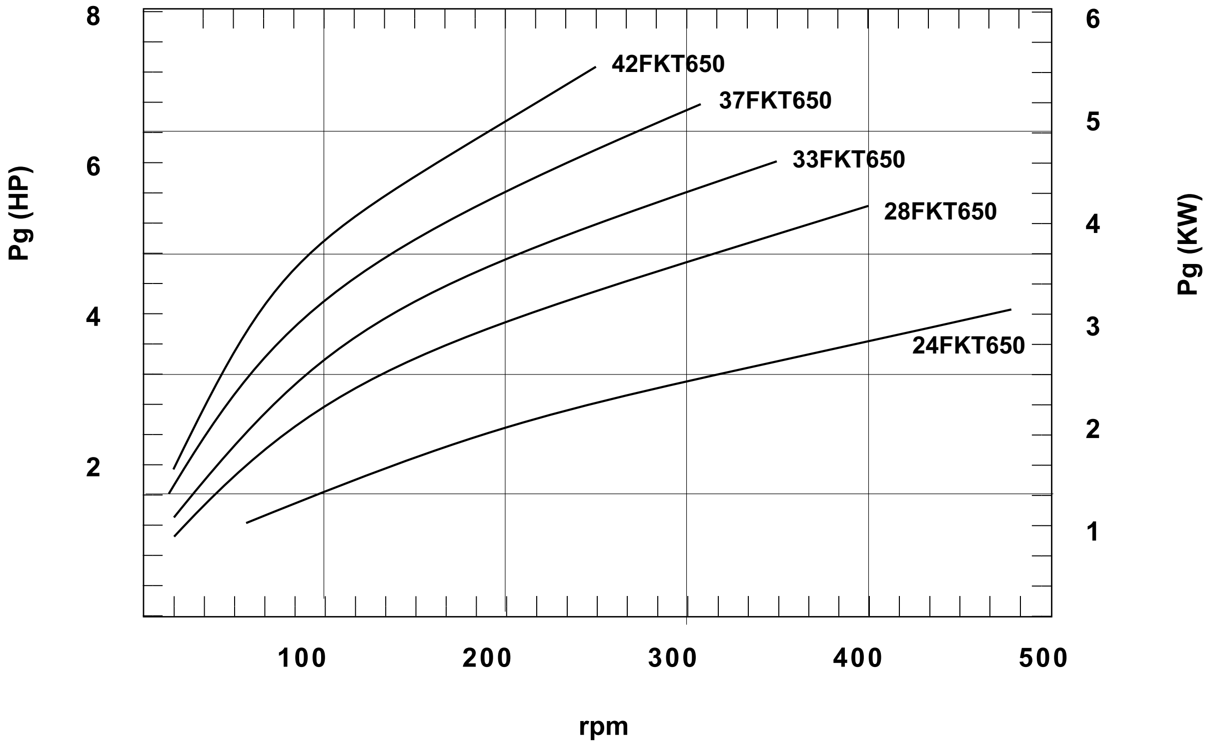


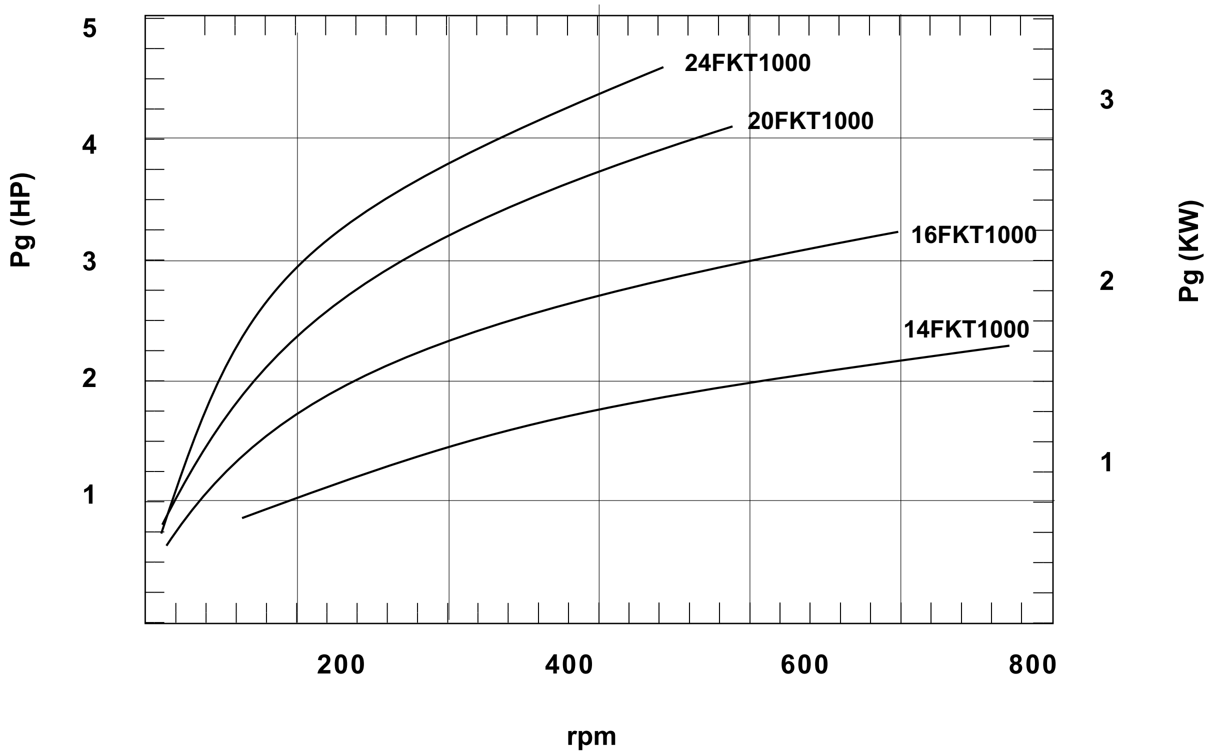

18FK500
16FK500
14FK400
12FK350
10FK300
Pg (HP)
2.0
1.5
1.0
0.5
Pg (KW)
1.5
1.0
0.5
300
600
900
1200
rpm

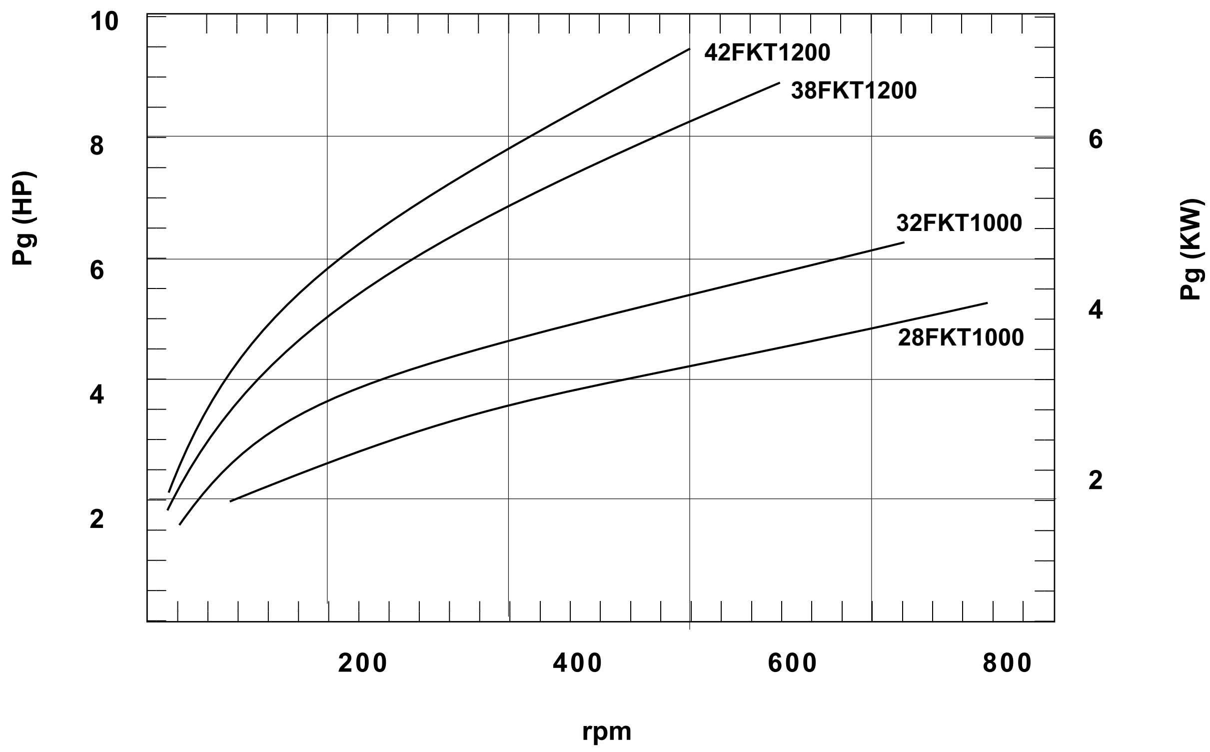

28FK525
26FK525
24FK500
22FK500
20FK500
Pg (HP)
3
2
1
Pg (KW)
2.5
2.0
1.5
1.0
0.5
100
200
300
400
500
600
rpm

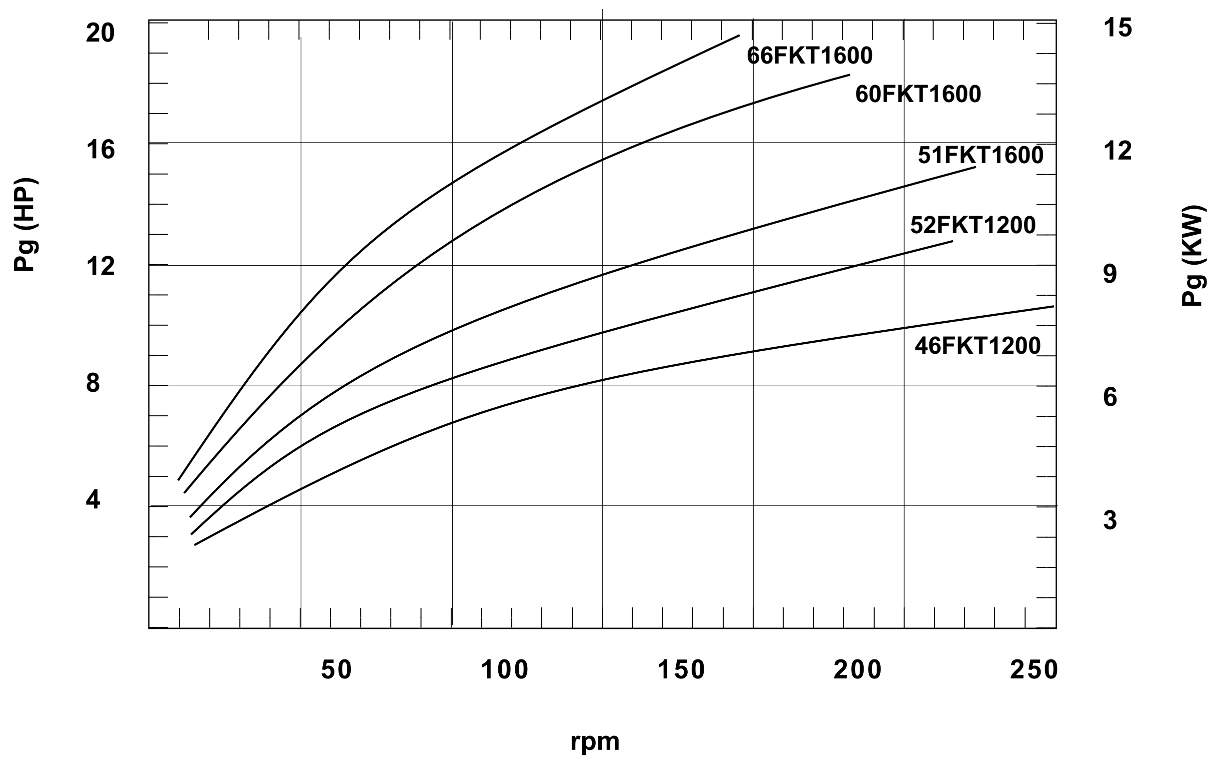

5
4
3
2
1
Pg (HP)
4
3
2
1
Pg (KW)
45FK525
40FK525
36FK525
32FK525
30FK525
100
200
300
400
rpm


3
2
1
Pg (HP)
2.5
2.0
1.5
1.0
0.5
Pg (KW)
20FKT600
16FKT600
14FKT500
11.5FKT500
200
400
600
800
1000
rpm


Pg (HP)
8
6
4
2
42FKT650
37FKT650
33FKT650
28FKT650
24FKT650
6
5
4
3
2
1
Pg (KW)
100
200
300
400
500
rpm


Pg (HP)
5
4
3
2
1
24FKT1000
20FKT1000
16FKT1000
14FKT1000
3
2
1
Pg (KW)
200
400
600
800
rpm


Pg (HP)
10
8
6
4
2
42FKT1200
38FKT1200
32FKT1000
28FKT1000
6
4
2
Pg (KW)
200
400
600
800
rpm


Pg (HP)
20
16
12
8
4
66FKT1600
60FKT1600
51FKT1600
52FKT1200
46FKT1200
15
12
9
6
3
Pg (KW)
50
100
150
200
250
rpm

## Peripheral Speed of the Components

The speed of the components must be below the values given in the table. In some applications the components must be required to freewheel at speeds much faster than their engaged speed. This must be taken in consideration when their velocities are calculated.

| Maximum peripheral speed | | |
|---|---|---|
| Components | fpm | mps |
| Spider | 8500 | 43 |
| Drum | 8500 | 43 |
| Hub | 8500 | 43 |
| Ventilated Adapter | 6500 | 33 |

## Method of Selection

There are two ways to arrive at the selection. The analytical method, which is the gives an optimum selection for the drives, where as the service factor method may result in the selection of an under or oversized unit. Whenever possible, the analytical method must be used.

## Analytical method

The steps are:

1- Determine the required torque.

2- Determine the thermal requirement.

3- Determine the assembly mounting arrangement, available space and diameter and the shaft diameters.

4- Make a tentative selection using steps 1, 2 and 3.

5- Adjust the nominal torque of the tentative selection for the pressure and speed of operation and determine if is still meet the requirement.

6- Adjust the thermal requirement to include the energy of the components of the clutch or brake which are accelerated and decelerated and determine if it is within the capacity of the tentative selection.

7- Check the peripheral speed of the spider and drum to determine if they are within the operational limits of the components given in the table.

Step 3 requires some measurements to assure that it will not be interfered within the assigned space (long, wide, turn over). If the attempt selection does not meet the requirements of steps 5, 6 and 7, a larger single element or a smaller dual element should be considered. Steps 4 to 7 will be repeated for the new selection. If the new selection does not meet the requirements of steps 5 and 6 a product from a different line needs to be considered. If the selection does not need the requirements of step 7, it is possible to manufacture the components in other materials, which can resist the difficulties and stresses associated with the high operating speeds.

## Method of Selection by factor of service "fs".

Select the **fs** from the appropriate table if the machine or equipments is not shown or listed used the service factor of a machine that performs a similar function and has similar characteristics. Multiply the prime mover **PP** by the **Fs** in order to obtain the powers of calculation **Pd.**

**Pd = Pp.'s**

For clutch applications, since the work pressure is at 75 psi (5.2 bar), use the calculation from the power graphs to select to an element, which has the design power capacity at the elements operating speed.

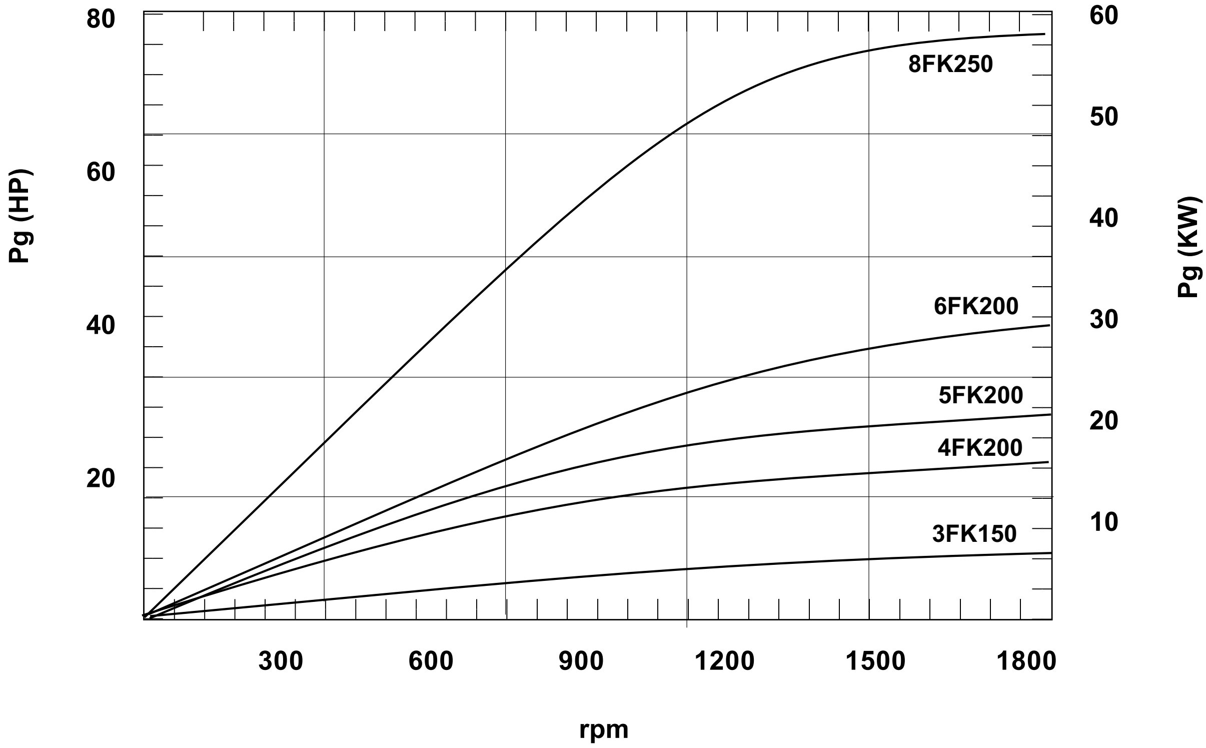
These graphs are for simple single elements; for dual elements, the illustrated capacity is doubled.

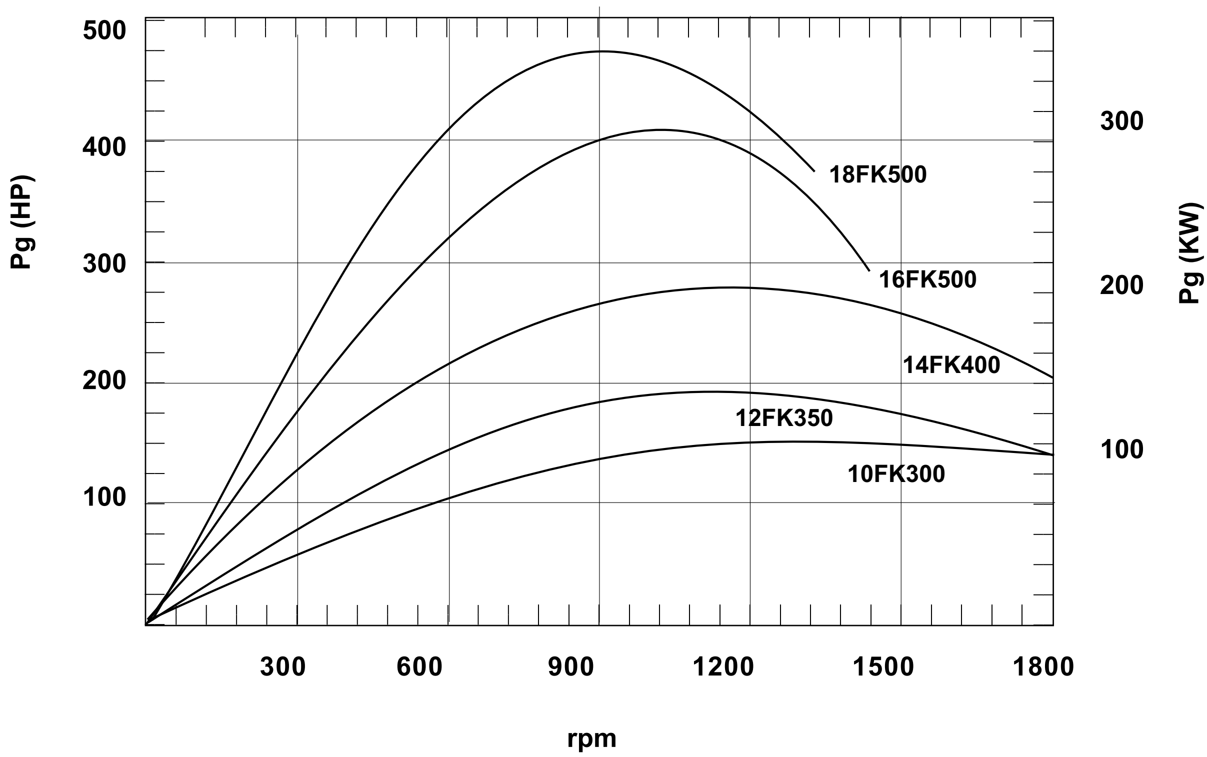
For clutches that operate with another rank of pressure, or for stationary brakes, the service factor is applied to the prime movers torque **Map** referred to the shaft of the clutch or brake.

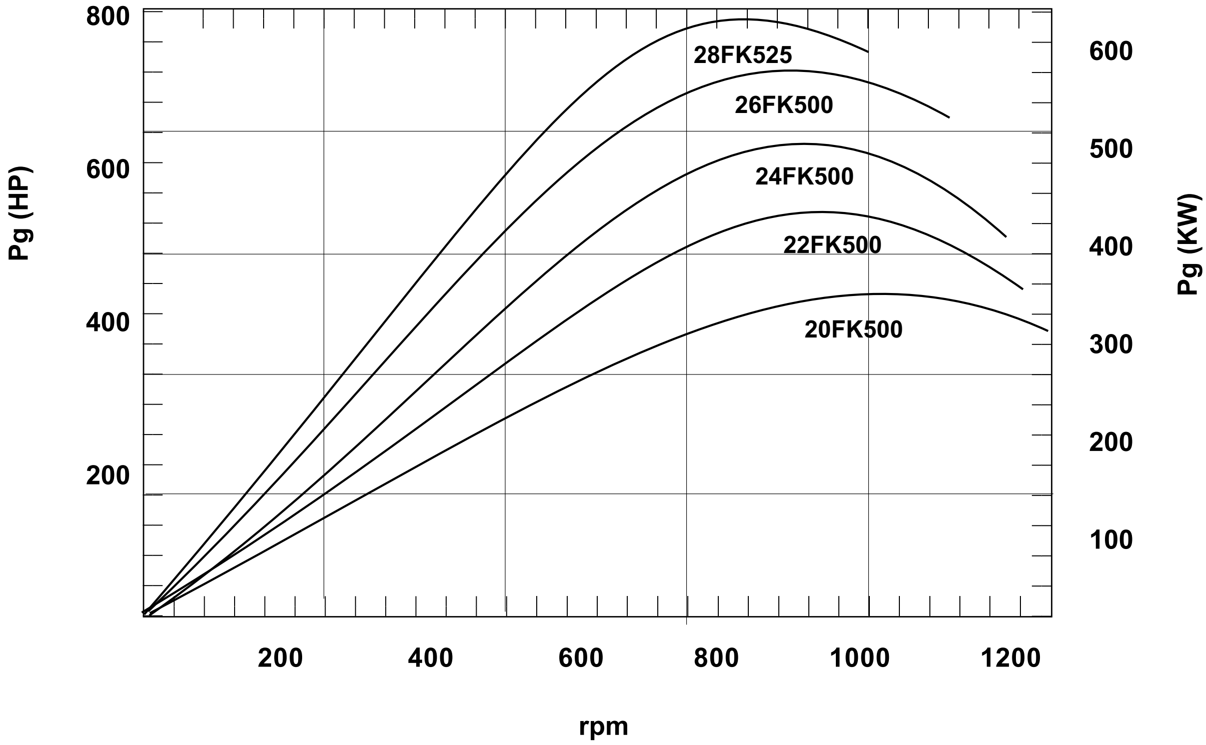
The required torque for **GMC** clutches or brake torque **Mb** is used to make a tentative selection of the element.

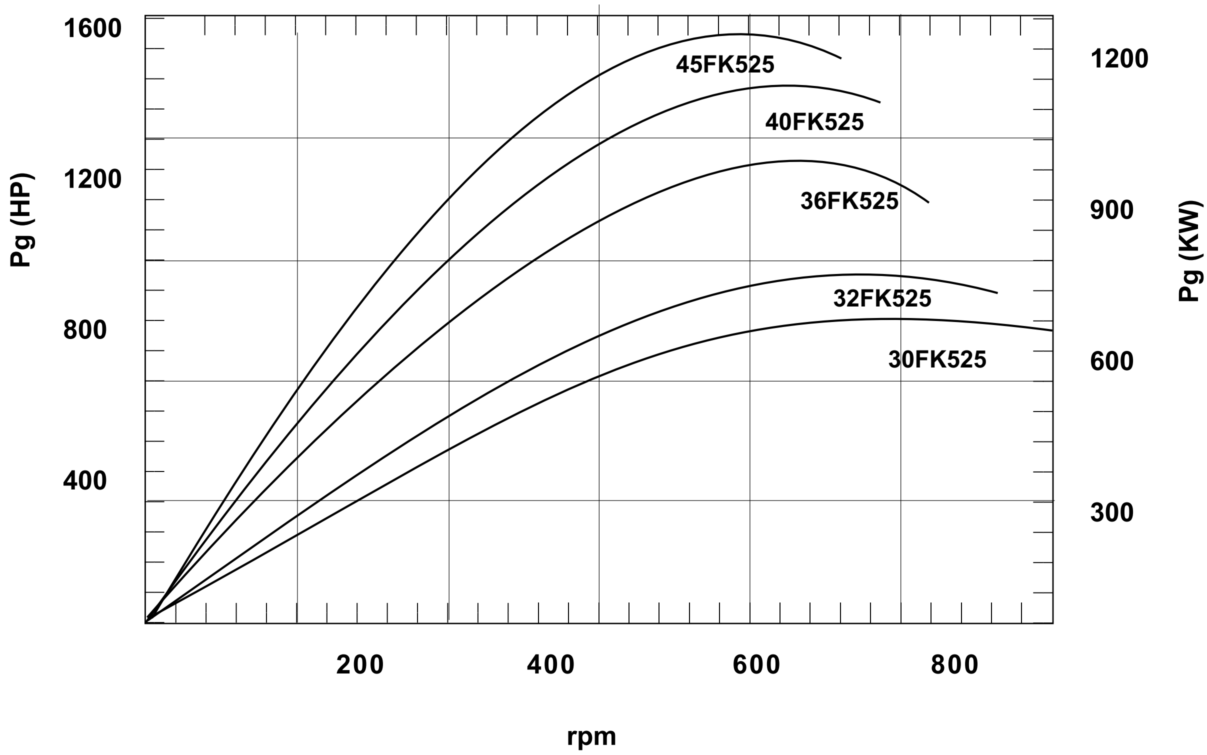
The indicted **GMC** torque for an element is adjusted according to the speed of revolutions and the air pressure being applied.

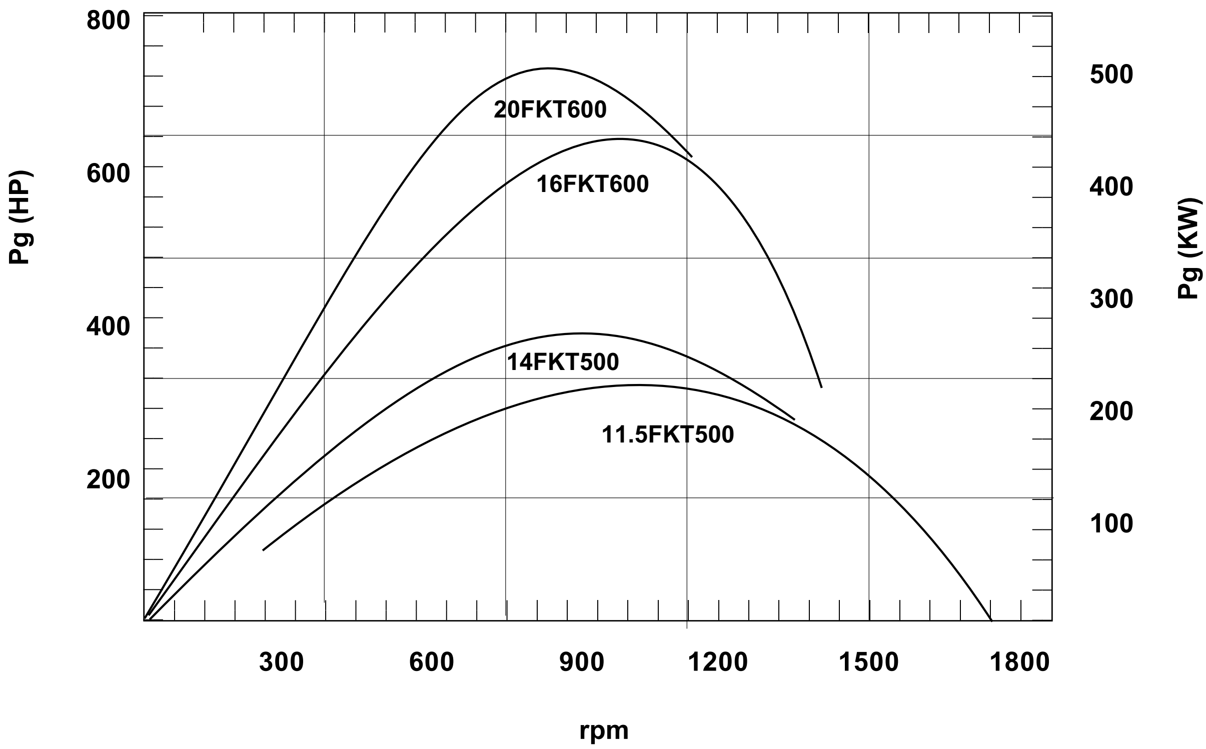
The adjusted **Me** torque must be equal or greater than **GMC** or **Mb.**

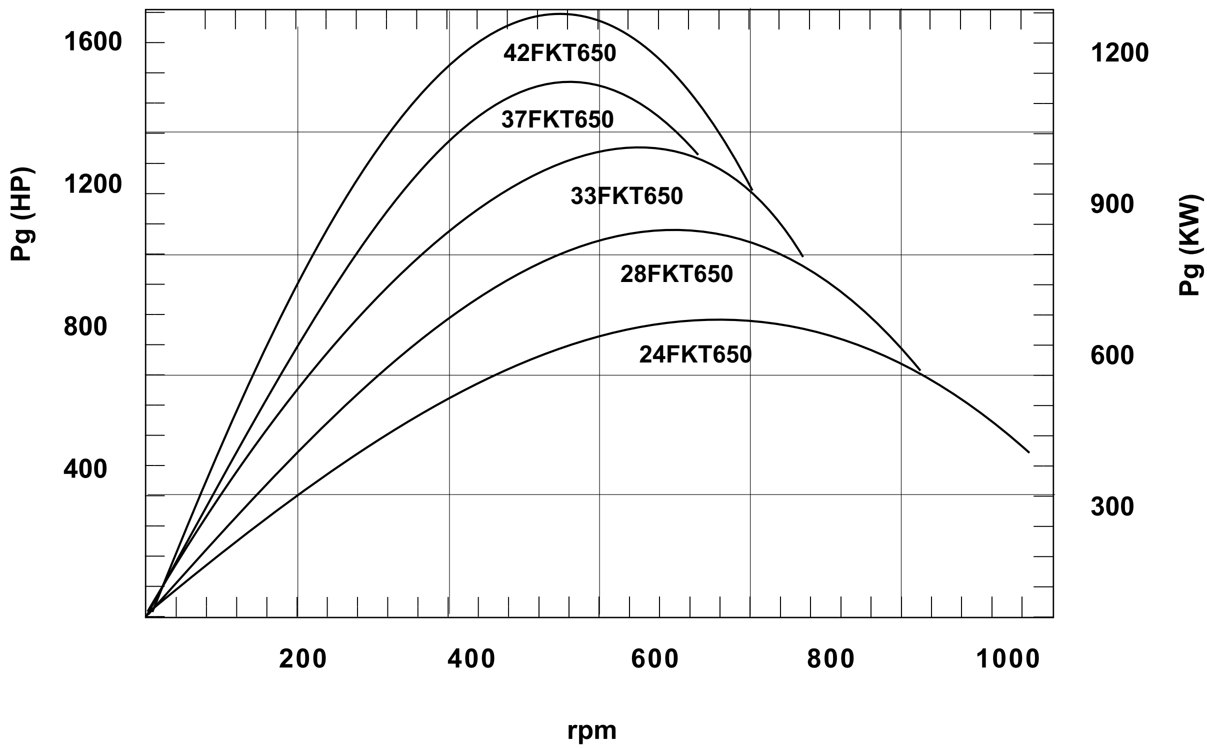

80
60
40
20
Pg (HP)
60
50
40
30
20
10
Pg (KW)
8FK250
6FK200
5FK200
4FK200
3FK150
300
600
900
1200
1500
1800
rpm

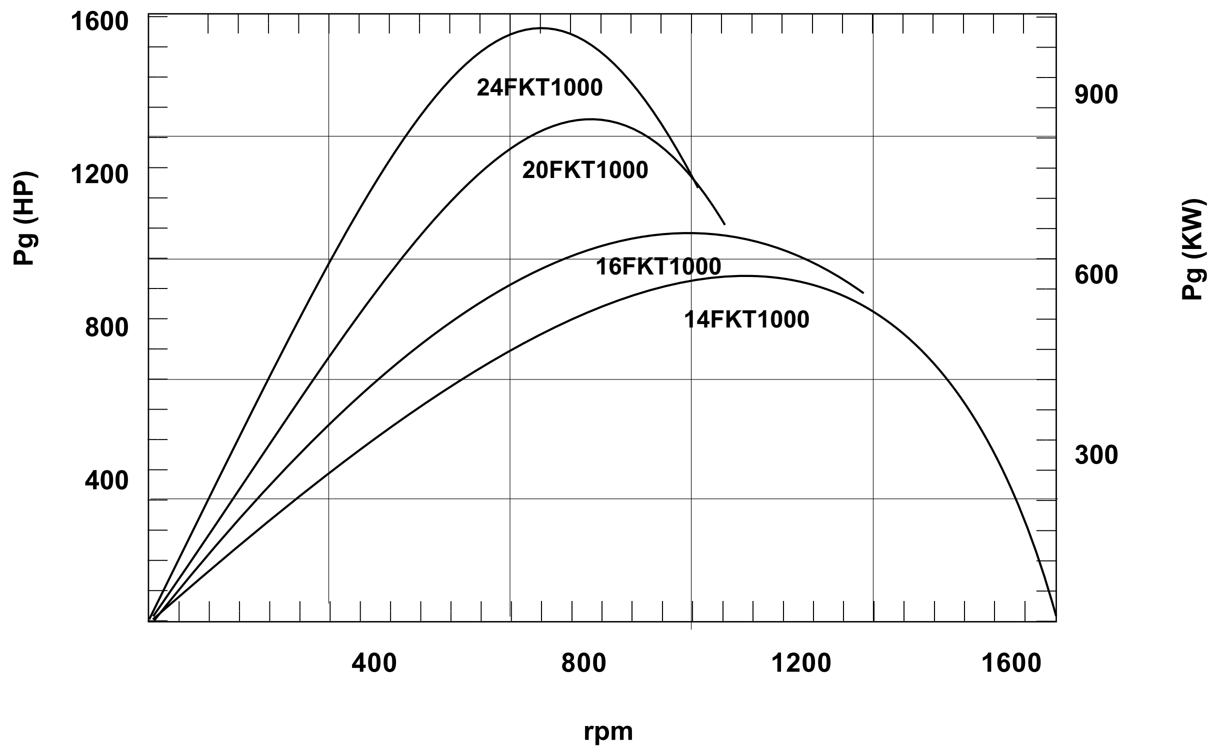

500
400
300
200
100
Pg (HP)
300
200
100
Pg (KW)
18FK500
16FK500
14FK400
12FK350
10FK300
300
600
900
1200
1500
1800
rpm

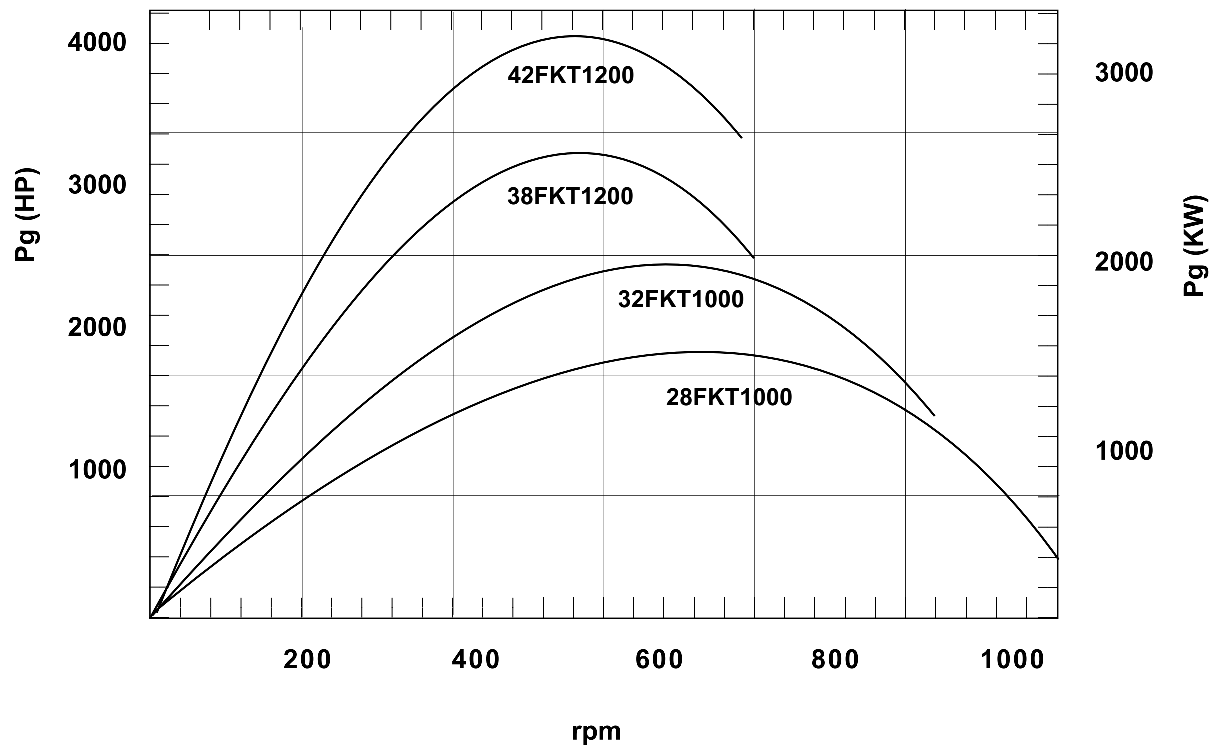

800
600
400
200
Pg (HP)
600
500
400
300
200
100
Pg (KW)
28FK525
26FK500
24FK500
22FK500
20FK500
200
400
600
800
1000
1200
rpm

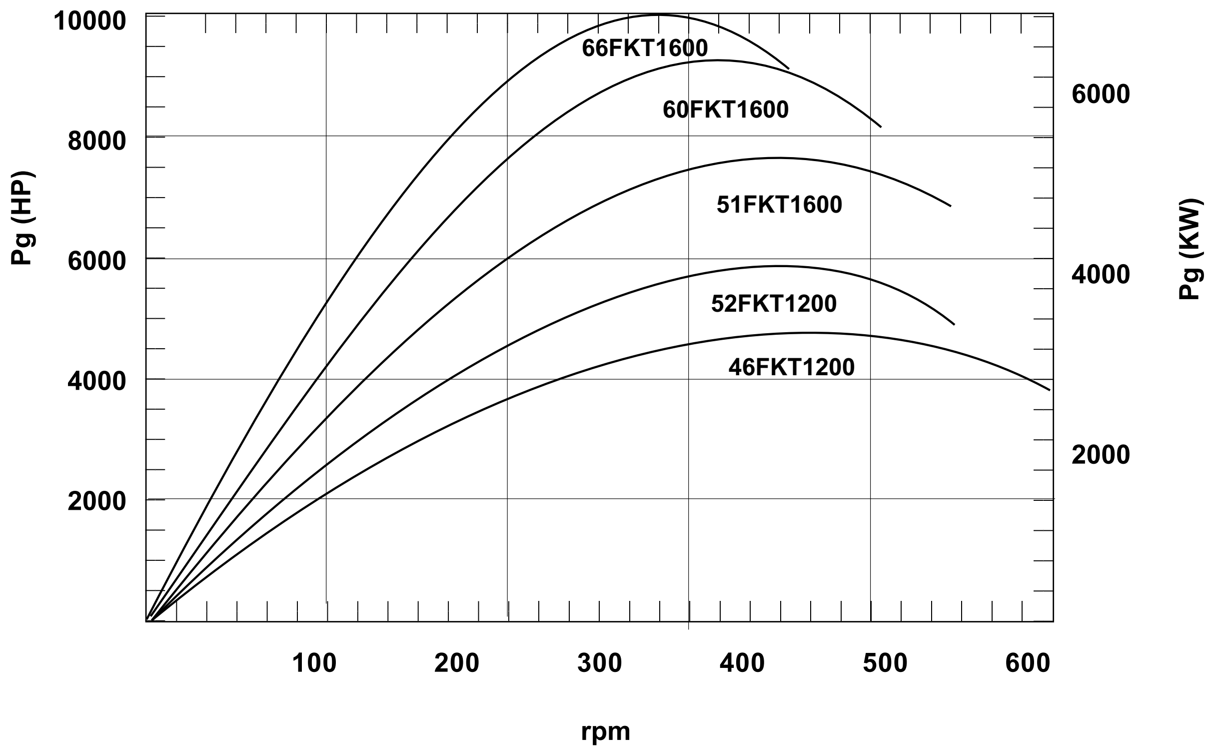

1600
1200
800
400
Pg (HP)
1200
900
600
300
Pg (KW)
45FK525
40FK525
36FK525
32FK525
30FK525
200
400
600
800
rpm

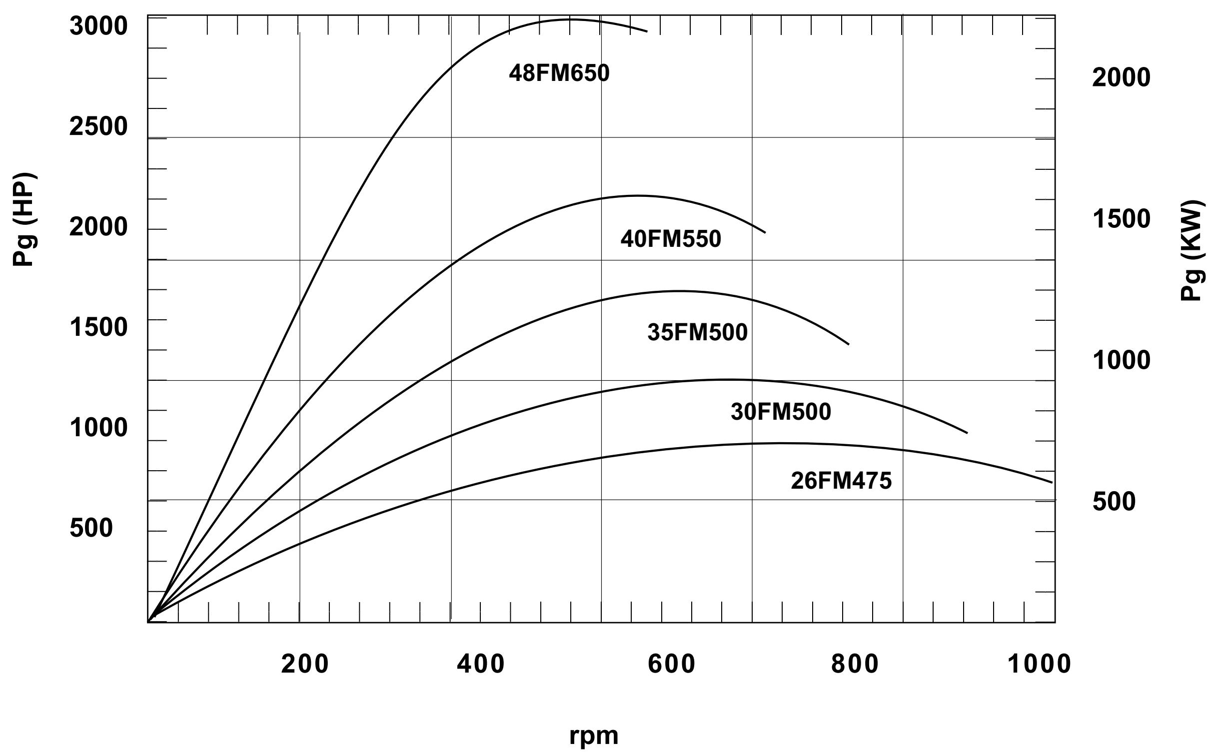

800
600
400
200
Pg (HP)
500
400
300
200
100
Pg (KW)
20FKT600
16FKT600
14FKT500
11.5FKT500
300
600
900
1200
1500
1800
rpm


1600
1200
800
400
Pg (HP)
1200
900
600
300
Pg (KW)
42FKT650
37FKT650
33FKT650
28FKT650
24FKT650
200
400
600
800
1000
rpm


1600
1200
800
400
Pg (HP)
900
600
300
Pg (KW)
24FKT1000
20FKT1000
16FKT1000
14FKT1000
400
800
1200
1600
rpm


4000
3000
2000
1000
Pg (HP)
3000
2000
1000
Pg (KW)
42FKT1200
38FKT1200
32FKT1000
28FKT1000
200
400
600
800
1000
rpm


10000
8000
6000
4000
2000
Pg (HP)
6000
4000
2000
Pg (KW)
66FKT1600
60FKT1600
51FKT1600
52FKT1200
46FKT1200
100
200
300
400
500
600
rpm


3000
2500
2000
1500
1000
500
Pg (HP)
2000
1500
1000
500
Pg (KW)
48FM650
40FM550
35FM500
30FM500
26FM475
200
400
600
800
1000
rpm

# Selection Procediture

## Examples

### Example 1

Determine the dynamic torque of a **16-FK-500**, which rotates to 1000 r.i.p. with a pressure of 100 pi (6.9 bar).

$$Me = \frac{Po - Pp - Pe}{75} . Mr$$

$$Pp = 2 \text{ psi}$$

$$Pc = Cs.n^2.E - 06$$

$$= 20.1000^2.E - 06 = 20 \text{ psi}$$

$$Me = \frac{100 - 2 - 20}{75} . 35200$$

$$= 36.600 \text{ lb.pulg}$$

### Example 2

What is the minimum pressure that would have to be applied to 12-FK-350 element that rotates to 1200 r.p.m and that transmits dynamic torque of 1000 lb.pulg (1130 Nm)?

$$Me = \frac{Po - Pp - Pe}{75} . Mr$$

$$Po = 75. \frac{Me}{Mr} + Pp + Pc$$

$$Pp = 2 \text{ psi}$$

$$Pc = Cs.n^2.E - 06$$

$$= 20 . 1200^2.E - 06 = 17 \text{ psi}$$

$$Po = 75 . \frac{10000}{13300} + 2 + 17$$

$$= 75 \text{ psi}$$

### Example 3

What is the holding torque of a dual 20FK500 stationary element when pressurized to 50 psi (3,4 bar)?

$$Me = \frac{Po - Pp - Pe}{5,2} . Mr . 1,25$$

$$= \frac{3,4 - 0,14 - 0}{5,2} . 12120 . 1,25$$

$$= 9500 \text{ N.m}$$

### Example 4

A **20-FKT-600** element is selected to accelerate a load up to operating speed in 5 seconds. The thermal energy that must absorb is 1.7 E + ft´lb (2.3 and + 06J). Will the 20 FKT 600 handle the thermal load?

$$\frac{W t}{A} = \frac{1,7E + 06}{380} = 4500 . \frac{ft.lb}{in^2}$$

$$Pt = \frac{W t}{550.t} = \frac{1,7E + 06}{550.5} = 618 \text{ HP}$$

$$Pave = \frac{Pt}{A} = \frac{618}{380}$$

$$= 1,63 \frac{HP}{pulg^2}$$

The point **(Wt/A, Pave**) is outside of the FKT line in the graphic of capacity of non-cyclical energy. Therefore a **20-fkt-600** element is not able to handle the thermal load, it would be necessary to select a simple element of greater diameter, than they have a greater surface of friction.

**The 24-FKT-1000 element:**

$$W t = 2360 . \frac{Ft.lb}{in^2} , \quad Pave = 0,86 \frac{hp}{in^2}$$

**Or Dual 20-FKT-600 element:**

$$\frac{W t}{A} = 2240 . \frac{Ft.lb}{in^2} , \quad Pave = 0,81 \frac{hp}{in^2}$$

The thermal requirements will have to be handled with care.

### Example 5

For a given application the cyclic thermal power **Pc** is 3HP (2,2 KW). What size clutch operating at 500 rpm will handle this requirement?

$$Pc = Pg.kt \; ; \; Pg = \frac{Pc}{Kt}$$

**Pg** is determined by dividing the cyclic thermal power by the arrangement factor. Using the **Pg** value and the cyclic thermal graphs the following clutch sizes and arrangement could be used:

**In a clutch spider arrangement:**
**20-FKT-600 or Single 20-FKT1000**
**20-FKT-500, 16-FKT-600 or Dual 16-FKT-1000**

**In a ventilated adapter arrengement:**
**Single 16-FKT-600**
**Dual 11,5-FKT-500**