Custom Design Clutches and Brakes

Selection

Clutches

SF (Stationary Field Clutch)

Model Number	Max. Rated Torque	Outside Diameter (inches)	Overall Length (inches)	Page No.
SF-120	5 lb.in.	1-1/4	1-3/8	14, 16
SF-170	15 lb.in.	1-3/4	1-7/8	18, 20
SF-250	70 lb.in.	2-5/8	3-1/2	22, 24
SF-400	270 lb.in.	4-1/4	3-3/4	26, 28
SF-500	50 lb. ft.	5-1/4	4	30
SF-650	95 lb. ft.	6-3/4	3-3/8	32, 34
SF-825FM*	125 lb. ft.	8-5/8	3	36, 40
SF-825BM*	150 lb. ft.	8-5/8	2-3/4	38, 42
SF-1000FM*	240 lb. ft.	10-3/8	3-1/8	44, 48
SF-1000BM*	240 lb. ft.	10-3/8	3-1/8	46, 50
SF-1225FM*	465 lb. ft.	12-3/4	3-3/4	52, 54
SF-1225BM*	465 lb. ft.	12-3/4	3-3/4	56, 58
SF-1525FM*	700 lb. ft.	15-3/4	4-1/4	60, 62
SF-1525BM*	700 lb. ft.	15-3/4	4-1/4	64, 66
SF-1525HTFM	1,350 lb. ft.	15-3/4	5	68
SF-1525HTBM	1,350 lb. ft.	15-3/4	5	70

Clutch Couplings

SFC (Stationary Field Clutch Coupling)

Model Number	Max. Rated Torque	Outside Diameter (inches)	Overall Length (inches)	Page No.
SFC-120	5 lb.in.	1-1/4	1	90, 92
SFC-170	15 lb.in.	1-3/4	1-3/8	94, 96
SFC-250	70 lb.in.	2-5/8	2-1/4	98, 100
SFC-400	270 lb.in.	4-1/4	2-3/4	102, 104
SFC-500*	50 lb. ft.	5-1/4	3-7/8	106, 108
SFC-650	95 lb. ft.	6-3/4	3-5/8	110, 112
SFC-825FM	125 lb. ft.	8-5/8	4-3/8	114
SFC-825BM	150 lb. ft.	8-5/8	4-5/8	116
SFC-1000FM	240 lb. ft.	10-3/8	5-7/8	118
SFC-1000BM	240 lb. ft.	10-3/8	5-7/8	120
SFC-1225FM	465 lb. ft.	12-3/4	6-3/8	122
SFC-1225BM	465 lb. ft.	12-3/4	6-3/8	124
SFC-1525FM	700 lb. ft.	15-3/4	6-1/2	126
SFC-1525BM	700 lb. ft.	15-3/4	6-1/2	128
SFC-1525HTFM	1,350 lb. ft.	15-3/4	6-1/2	130
SFC-1525HTBM	1,350 lb. ft.	15-3/4	6-1/2	132

PC (Primary Clutch)

Model Number	Max. Rated Torque	Outside Diameter (inches)	Overall Length (inches)	Page No.
PC-500	40 lb. ft.	6	3-1/4	72
PC-825*	125 lb. ft.	9-1/4	3-1/2	74, 76
PC-1000*	240 lb. ft.	10-7/8	3-7/8	78, 80
PC-1225*	465 lb. ft.	12-7/8	4-1/2	82, 84
PC-1525*	700 lb. ft.	16-1/8	4-3/4	86, 88

PCC (Primary Clutch Coupling)

Model Number	Max. Rated Torque	Outside Diameter (inches)	Overall Length (inches)	Page No.
PCC-500*	40 lb. ft.	6	4-1/4	134, 136
PCC-825	125 lb. ft.	9-1/4	4-3/8	138
PCC-1000	240 lb. ft.	10-7/8	5-7/8	140
PCC-1225	465 lb. ft.	12-7/8	6-1/2	142
PCC-1525	700 lb. ft.	16-1/8	6-3/4	144

All model numbers are Normal Duty unless otherwise designated.

See Nomenclature Table on next page for more detailed information on offerings.

*Available in Normal Duty (ND) or Heavy Duty (HD)

Brakes

PB (Primary Brakes)

Model Number	Max. Rated Torque	Outside Diameter (inches)	Overall Length (inches)	Page No.
PB-120	5 lb.in.	1-1/4	1	146
PB-170	15 lb.in.	1-3/4	1-3/16	148
PB-250	70 lb.in.	2-5/8	2	150
PB-400	270 lb.in.	4-1/4	2-1/4	152
PB-500*	40 lb. ft.	5-1/8	3	154, 156
PB-650	95 lb. ft.	6-1/2	2-7/8	158
PB-825*	125 lb. ft.	8-5/8	3-1/2	160, 162
PB-1000*	240 lb. ft.	10-1/4	4-1/8	164, 166
PB-1225*	465 lb. ft.	12-5/8	5-3/8	168, 170
PB-1525*	700 lb. ft.	15-1/2	4-1/2	172, 174

MB Motor Brakes

Model Number	Max. Rated Torque	Outside Diameter (inches)	Overall Length (inches)	Page No.
MB-825*	80 lb. ft.	11-1/2	4-1/4	176, 178
MB-1000*	160 lb. ft.	13-1/4	4-3/4	180, 182
MB-1225*	260 lb. ft.	15-3/4	5	184, 186

Nomenclature:

BM Bearing Mount

FM Flange Mount

HT High Torque

MB Motor Break

PB Brake—Primary

PC Clutch—Primary. Current is carried through the brushes and collector ring.

PCC Clutch Coupling—Primary

PCB Clutch Brake— Primary

PCBC Clutch Brake Coupling—Primary

SF Clutch—Stationary Field Style. Does not have brushes or collector ring.

SFC Clutch Coupling—Stationary Field

SFPBC Clutch Brake Coupling—Stationary Field

*Available in Normal Duty (ND) or Heavy Duty (HD)

Clutch/Brake Combinations

PCB Clutch/Brake (Primary Clutch Brake)

Model Number	Max. Rated Torque	Outside Diameter (inches)	Overall Length (inches)	Page No.
PCB-825*	125 lb. ft.	9-1/4	5-1/2	188, 190
PCB-1000*	240 lb. ft.	10-7/8	6	192, 194
PCB-1225/1000*	465/240 lb. ft.	12-7/8	6-1/4	196, 198
PCB-1225*	465 lb. ft.	12-7/8	6-7/8	200, 202
PCB-1525/1225*	700/465 lb. ft.	12-7/8	7-1/6	204, 206

SFPBC Clutch/Brake Coupling (Stationary Clutch Brake Coupling)

Model Number	Max. Rated Torque	Outside Diameter (inches)	Overall Length (inches)	Page No.
SFPBC-500*	50/40 lb. ft.	5-1/4	5-3/8	208, 210
SFPBC-650	95 lb. ft.	6-3/4	5-1/4	212

PCBC Clutch/Brake Coupling (Primary Clutch Brake Coupling)

Model Number	Max. Rated Torque	Outside Diameter (inches)	Overall Length (inches)	Page No.
PCBC-500*	40 lb. ft	6	6	214, 216
PCBC-825	125 lb. ft.	9-1/4	6-1/4	218
PCBC-1000	240 lb. ft.	10-7/8	7-7/8	220
PCBC-1225	465 lb. ft.	12-7/8	8-3/4	224
PCBC-1225/1000	465/240 lb. ft.	16-1/8	8	220
PCBC-1525/1225	700/465 lb. ft.	16-1/8	9	226

Selection

Clutch Selection

Determine the shaft speed at the clutch location. The number listed at the intersection of the horsepower and speed lines is the size unit you require.

EXAMPLE:
START APPLICATION

Function: To couple the output shaft of a motor in line with the input shaft of a reducer.

Type: A clutch coupling will couple two in line shafts.

Size: The motor horsepower is 1/2 and the speed is 1800 rpm. On the clutch chart opposite follow across the 1/2 HP line to the 1800 rpm column. A size 250 clutch coupling will handle this application.

SELECTION CHARTS

The clutch selection charts are based on the following common power transmission formula:

CLUTCH TORQUE

$$T = \frac{K \times 5250 \times HP}{RPM}$$

Where: T = Torque (lb. ft.)

HP = Horsepower

RPM = Speed at clutch location

K = Motor overload factor

IF THERE IS A CHOICE OF LOCATIONS FOR THE CLUTCH OR BRAKE SELECT THE HIGHEST SPEED SHAFT. THE HIGHER THE SPEED – THE SMALLER THE CLUTCH OR BRAKE REQUIRED.

Unit installation at speeds below 100 rpm is not recommended, see page 244.

Clutch – Horsepower vs. Shaft Speed

HP ▼	SHAFT SPEED AT CLUTCH (IN RPM)																				
	100	200	300	400	500	600	700	800	900	1000	1100	1200	1500	1800	2000	2400	3000	3600	4000	4600	5000
1/50																					
1/20											170										
1/12																					
1/8																					
1/6											250										
1/4																					
1/3																					
1/2											400										
3/4																					
1											500										
1-1/2																					
2											650										
3																					
5											825										
7-1/2																					
10											1000										
15																					
20											1225										
25											1525										
30											1525 HT										
40																					

MOTOR OVERLOAD FACTOR

The motor overload factor K is the maximum or "pull-out" torque capacity of an electric motor. K is expressed as a percentage of the full load running torque. NEMA Design B motor are the standard general purpose design. The maximum torque of Design B motors has been used in the formulation of our selection charts.

Example: The maximum torque of a 2 HP, 1800 rpm, Design B motor is 275% of the full load running torque. In the clutch torque formula a motor overload factor of 2.75 would be used for K.

Clutches selected will therefore handle the maximum capacity of the motor. The motor would actually stall before the clutch would slip.

For determining the torque capacity required when the prime mover is not an electric motor the peak torques that could be encountered must be considered. Gasoline or diesel engines and compressors may require a K factor of 5.

NOTES ON SELECTION

In some instances a clutch selection can be made from the brake chart, page 9, if the maximum capacity of the clutch is not required until AFTER the load is accelerated to normal running speed. An example would be a lathe where the tool starts to cut AFTER the work piece is brought up to speed.

See page 6 for Index of available sizes.

See page 234 for Torque Curves.

See page 237 for Heat Dissipation Curves.

Brake Selection

Determine the shaft speed at the brake location. The number listed at the intersection of the horsepower and speed lines is the size unit you require. MOTOR BRAKE Frame Sizes are listed on product specification sheets.

EXAMPLES:

STOP APPLICATION

Function: To stop a lathe spindle.

Type: A brake will provide either a rapid or cushioned stop.

Size: The motor horsepower is 2 and the speed at the brake location is 1100 rpm. On the brake chart opposite follow across the 2 HP line to the 1100 rpm column. A size 500 brake will handle this application.

START-STOP APPLICATION

Function: To index a conveyor along a packing line.

Type: A clutch-brake will provide the start-stop index motion required. For this example the clutch-brake will be mounted on a jackshaft.

Size: The motor horsepower is 15 and the speed of the jackshaft is 900 rpm. From the clutch chart on page 8 a size 1225 clutch is required. From brake chart a size 1000 brake is required. Therefore, a size 1225/1000 clutch-brake combination would handle this application.

SELECTION CHARTS

The clutch selection charts are based on the following common power transmission formula:

BRAKE TORQUE

$$T = \frac{5250 \times HP}{RPM}$$

Where: T = Torque (lb. ft.)

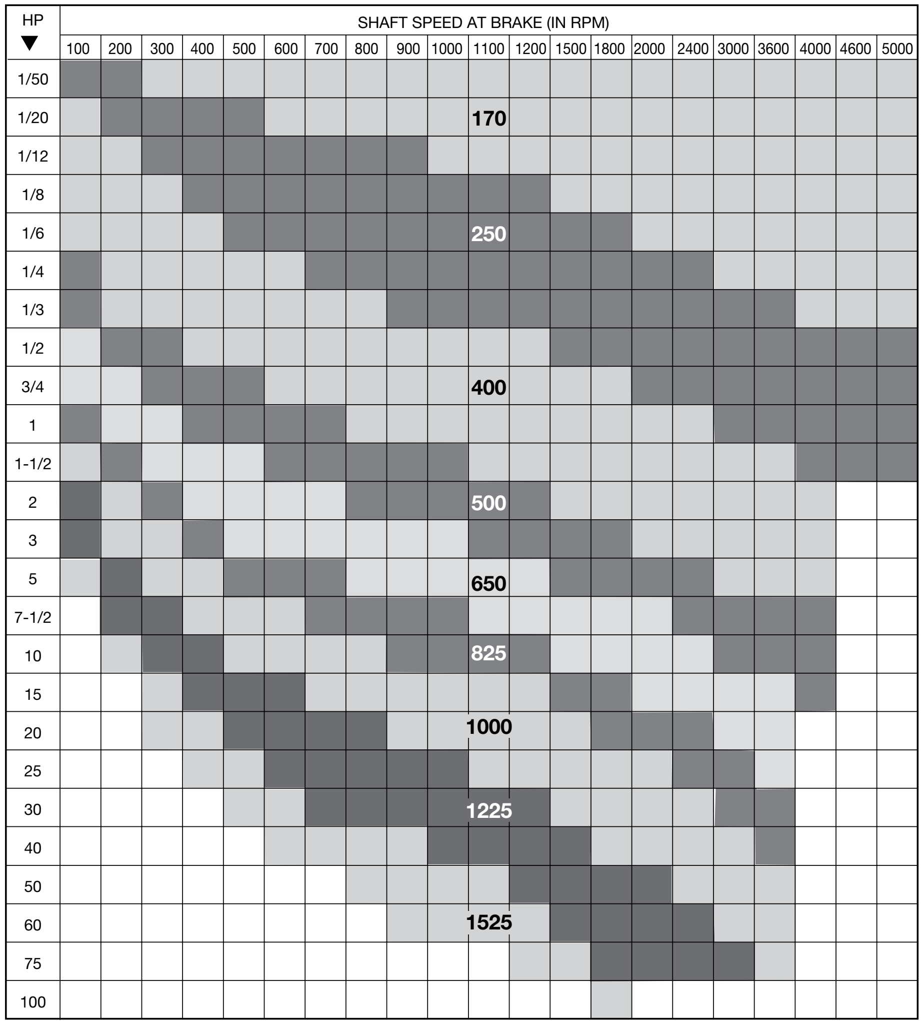
HP = Horsepower

RPM = Speed at brake location

NOTE: Motor overload factor K does not apply for brakes.

A brake selected will stop the load at least as fast as the time it takes the motor to bring the load up to speed.

Brake – Horsepower vs. Shaft Speed



IF THERE IS A CHOICE OF LOCATIONS FOR THE CLUTCH OR BRAKE SELECT THE HIGHEST SPEED SHAFT. THE HIGHER THE SPEED – THE SMALLER THE CLUTCH OR BRAKE REQUIRED.

NOTES ON SELECTION:

See page 234 for Torque Curves.

See page 237 for Heat Dissipation Curves.

Selection

Torque Calculations

Based on Load Inertia and Time

$$T_{av} = \frac{WR^2N}{308t}$$

Where:

WR^2 = inertial load in terms of lb.ft.^{2} referred to at the unit location.

N = RPM

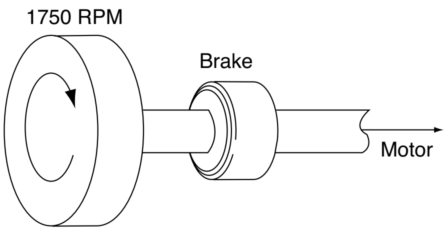
t = time allowed for the engagement

Tav = Average Torque (lb.ft.)

This formula gives us the torque (T) and is the average amount of torque required to accelerate a part from rest to a rotation of N revolutions per minute, about its axis, in t seconds, or decelerate a part from a rotation of N revolutions per minute about its axis to rest in t seconds.

Example Based on Inertia and Time

What is the average torque required to decelerate a total load of 1.0 lb.ft.^{2} from 1750 rpm in .2 seconds?



WR^2 total =

= WR^2 load + WR^2 clutch + components

WR^2 = 1 lb.ft.^{2}

$$T_{av} = \frac{WR^2N}{308t} = \frac{1(1750)}{308(.2)} = 28.4 \text{ lb.ft.}$$

Based on average torque,

A size 500 brake should be used. (T_{av} = 32 lb.ft.)

Based on Motor HP of Drive

The formula to use when calculating clutch torque requirement based on motor HP is:

$$T = \frac{5{,}250 \times HP \times 2.75^*}{N}$$

Where:

HP = name plate HP of the motor

*K = motor overload factor = 2.75

N = RPM at the shaft where the clutch is located

All electric motors can exceed their rated torque for short periods of time during overload conditions. For a clutch to work properly in a system, therefore, the clutch must be designed to handle this overload torque without slipping. A ‘K’ factor of 2.75 is based on an average motor overload capability of common electric motors. Failure to include motor overload in clutch designs can lead to premature clutch failures as the clutch will have too little torque capacity to handle the overload output torque of the motor. The K factor is only used when calculating clutch torque. When selecting a brake, the K factor can be ignored since the brake is not stopping a driving motor. Therefore, the brake calculation for torque will be:

$$T = \frac{5{,}250 \times HP}{N}$$

Where:

HP = name plate HP of the motor

N = RPM must indicate the speed at the shaft where the brake will be mounted. This will account for torque changes as the result of speed reductions or increases.

Selection

Torque and Horsepower Relationship

When selecting clutches and brakes Warner Electric disregards efficiency or frictional losses in pulley, sprocket or gearing drive trains. Torque on a clutch or brake will be greater or lesser than the torque at the motor shaft based on the speed differences between the motor shaft and the shaft where the clutch or brake is located. This is an inverse 1:1 relationship. A clutch at the slow speed side of a 10:1 ratio speed reduction will need to accelerate 10 times the torque as a clutch at the motor shaft. Conversely, a clutch at the high speed side of a 2:1 speed increase will accelerate half of the torque of a clutch at the motor shaft. Therefore, in selecting the best location to install a clutch and/or brake, the highest speed shaft that is available will allow for the smallest clutch or brake selection.

Example:
Find Tc:

Speed at load

$$\frac{\text{Motor Speed}}{\text{Reduction}} = \frac{1{,}800}{20(2)} = 45 \text{ RPM}$$

$$T = \frac{5{,}250 \times HP \times K}{N} =$$

$$T = \frac{5{,}250 \times 10 \times 2.75}{20(2)} = 3{,}208 \text{ lb.ft.}$$

However, if clutch is located between motor and reducer:

$$T = \frac{5{,}250 \times 10 \times 2.75}{1{,}800} = 80.2 \text{ lb.ft.}$$

The selected clutch position should be made at the motor rather than the load. A size 1000 unit would do the job. (T = 90 lb.ft. at 1,800 RPM.)

For most installations, Warner Electric has devised simple selection charts on pages 8 and 9. The supporting data on each specific size clutch is on pages 234 and 235.

Other considerations

Inertia

Complete information begins on page 239.

Heat Dissipation

Complete information begins on page 236.

Dynamic Torque

Complete information begins on page 234.