General

Technical Section Y of the Catalog contains useful information pertaining to the selection, mounting, alignment and control of clutches and brakes in general. Formulas, symbols and units are also identified. It is recommended that Section Y be reviewed before attempting to size a specific product for an application.

Frictional Force Adjustment

Dynamic frictional force ratings **F_r** are given for calipers furnished with either standard or low coefficient friction linings. The ratings are based upon an effective pressure **p_r** of 1000 psi (69 bar) for standard linings and 100 psi (6,9 bar) for low coefficient linings. Low coefficient linings are intended for applications which slip continuously and as a result are not recommended for use at pressures over 100 psi (6,9 bar).

Friction force ratings must be adjusted for operating pressure **p_o** and the parasitic loss p_p which represents the pressure to overcome piston seal friction and friction shoe release springs. The effective friction force **F_e** is calculated from:

$$F_e = \frac{p_o - p_p}{p_r} \cdot F_r$$

Torque Calculations

Braking torque is calculated from:

$$M_e = 0.5 \cdot N \cdot F_e\,(D\text{-}C_t)$$

where M_e is the effective brake torque (lb·in or N·m)

N = number of calipers

F_e = effective frictional force (lb or N)

D = disc outside diameter (in or m)

C_t = disc constant

Parameter	225 DP 100		HC3 and HD3	
	English Units	SI Units	English Units	SI Units
Dynamic Frictional Force F_r			,	
Standard linings @ 1000 psi (69 bar)	2540 lb	11300 N	5300 lb	23600 N
Lo-co linings @ 100 psi (6,0 bar)	190 lb	845 N	400 lb	1780 N
Static Friction Force			,	
Standard linings @ 1000 psi (69 bar)	3170 lb	14100 N	6620 lb	29440 N
Parasitic Loss p_p	8 psi	0,6 bar	10 psi	0,7 bar
Disc Constants			,	
C_d	8.25	2095	10.21	2593
C_t	3.2	0,08	4.1	0,10
Minimum Disc Diameter	9.63 in	0,24 m	18.63 in	0,47 m
Friction Area	12.5 in^2	80 cm^2	39 in^2	252 cm^2
Typical Disc Running Clearance per Side	0.03 in	0,8	0.06 in	1,6
Displacement to Engagement	0.5 in^3	0,008 dm^3	1.1 in^3	0,018 dm^3
Cylinder Volume - Engaged			,	
New lining and disc	0.9 in^3	0,015 dm^3	3.5 in^3	0,06 dm^3
Worn lining and disc	4.0 in^3	0,07 dm^3	12.5 in^3	0,21 dm^3
Lining Thickness			,	
New	0.65 in	17 mm	0.56 in	14 mm
Worn	0.37 in	9 mm	0.06 in	1,5 mm
Weight/Mass	17 lb	7,7 kg	85 lb	39 kg

Example

What combinations of disc diameters and number of 225DP100 calipers will produce a dynamic torque of 5000 lb·in. Air pressure of 80 psi is available.

$$F_e = \frac{p_o - p_p}{p_r} \cdot F_r$$

$$= \frac{80 - 8}{1000} \cdot 2540$$

$$= 183 \text{ lb}$$

$$M_e = 0.5 \cdot N \cdot F_e(D\text{-}C_t)$$

$$D = \frac{M_e}{0.5 \cdot N \cdot F_e} + C_t$$

$$= \frac{5000}{0.5 \cdot 183 \cdot N} + 3.2$$

$$= \frac{54 \cdot 64}{N} + 3.2$$

No. Calipers N	Disc Diameter (in)
One	58
Two	30.5
Three	21.5
Four	17

Thermal Capacity

Non-cyclic thermal capacity is determined by the caliper's friction area and/or the swept area of the braking disc. For good life, it is recommended that the peak thermal power not exceed 75 HP (56 kW) for the 225DP100 and 235 HP (175 kW) for the HC3 and HD3 calipers. Disc swept area loading should not exceed 0.3 HP/in² (0.035 kW/cm²). The swept area can be approximated from:

$$A_s = Cd \cdot (D\text{-}Ct)$$

where A_s = disc swept area in² (cm²)

C_d = disc constant

D = disc outside diameter in (m)

C_t = disc constant

The following graph illustrates the continuous thermal power dissipation for the 225DP100 caliper with low coefficient friction linings and a 15 inch (0.38 m) diameter ventilated disc.

Example

A 1,5 m diameter disc will be used with a HC3 caliper. What is the disc's thermal capacity?

$$As = C_d \cdot (D\text{-}C_1)$$

$$= 2593 \cdot (1{,}5 - 0{,}10)$$

$$= 3630 \frac{kW}{cm^2} \cdot 3630 cm^2 = 127$$