Design of Drum Brake

Principle of Disc brake.

* The disc brake consist of circular plate disc mounted on to and rotated by the wheel hub and a bridge member termed as caliper

* The caliper straddles the disc and is attached to the suspension carrier, stub axle or axle casing.

* The caliper incorporates a pair of piston and friction pads, which clamp the rotating disc during brake application

* Consequently reduction of speed, proportional to the hydraulic pressure acting on each piston produced by the pedal effort.

* The normal clamping thrust N on each side of the disc produces a frictional force $F = \mu N$, at the interface of disc and pad on both sides of the disc

If the resultant frictional force acts through the center of the frictionpad then the mean distance between the Centre pad of pressure and the center of disc becomes

$$(R_2 + R_1)/2 = R$$

where,

R_1 → Inner diameter of pad

R_2 → Outer diameter of pad.

Accordingly, the frictional braking torque is doubled due to the action of frictional force, N on both sides of the disc and depends upon the distance the pad is located from the disc centre of rotation.

$$\text{Braking Torque} = T_B = 2\mu N \frac{(R_2 + R_1)}{2}$$

$$T_B = 2\mu NR$$

Hydraulic Acteated Disc brake

Non-Servo unit

If P = brake fluid pressure

Then, P = $\frac{\text{force produced by master cylinder position}}{\text{area of master cylinder piston}}$

= $\frac{\text{pedal effort} \times \text{leverage} \times \text{efficiency}}{\text{area of master cylinder piston}}$

Therefore,

Braking Torque $T_B = 2Pa\mu Rn$

where,

P = line pressure

a = area of one piston per ~~cylinder~~ caliper

μ = Coefficient of friction, of pad material

R = mean radius of caliper unit to disc axis

n = number of caliper unit

Hence,

Power absorbed = $2Pa\mu Rn \times \frac{2\pi N}{60}$

where, N = Revolution of disc per minute

Servo-Assisted Unit:

If, P_s = Servo pressure

$$P_s = \frac{\text{Force produced by Servo piston}}{\text{Area of slave cylinder piston}}$$

$$= \frac{\text{pressure difference across Servo piston} \times \text{Area of piston}}{\text{Area of slave cylinder piston.}}$$

Therefore,

"Braking Torque $T_B = 2(P_s + P)\, a\, \mu R n$

Power absorbed $= 2(P_s + P)\, a\, \mu R n \times \frac{2\pi N}{60}$