# Selection of Braking system for go cart

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## I. Introduction

Go-kart is a simple four-wheeled, small engine, single Seated racing car. For proper movement of any vehicle, brakes play a very important role. The vehicle has independent hydraulic systems and a single brake pedal actuates it. The pedal directly actuates the master cylinder. Here no cables are used for this purpose. All rigid brake pipes are mounted securely along the roll cage or along other members. The brake system design includes the single disc at the rear axle to stop the vehicle. It is mounted in the one third part position of the axle with opposing the position of drive train sprocket hence also enables the good balancing requirement. Master cylinder is used at the front near the brake pedal providing the occupant to easily accessible space

The operation of the braking system is to retard the speed of the moving vehicle or bring it to rest in a very shortest attainable distance whenever needed. The vehicles are often hung on associate degree inclined surface against the pull of gravity by the appliance of brake. Brakes are mechanical devices for increasing the resistance that retards the turning motion of the vehicle wheels. It absorbs either K.E. or P.E. or each whereas remaining in action and this absorbed energy seems within the sort of heat. Whereas moving down a steep gradient the vehicle is controlled by the appliance of brakes. During this case brakes stay in action for an extended amount creating it imperative to dissipate the braking heat to atmosphere as quickly as attainable. The brakes should be capable of decelerating a vehicle at a quicker rate than the engine is ready to accelerate it. Unremarkably, brakes have to be compelled to absorb thrice the number of engines H.P. energy in its equivalent kind.

### Working of Breaking System:

In a hydraulic brake system, when the brake pedal is pressed, a linkage exerts force on the piston in the master cylinder, causing fluid from the brake fluid reservoir to flow into a pressure chamber through a compensating port. This results in an increase in the pressure of the entire hydraulic system, forcing fluid through the hydraulic lines toward one or more calipers where it acts upon one or more caliper pistons sealed by one or more seated O-rings or copper washer (which prevent leakage of the fluid).

The brake caliper pistons then apply force to the brake pads, pushing them against the spinning rotor, and the friction between the pads and the rotor causes a braking torque to be generated, slowing the vehicle. Heat generated by this friction is either dissipated through vents and channels in the rotor or is conducted through the pads, which are made of specialized heat-tolerant materials such as Kevlar or sintered glass.

Subsequent release of the brake pedal/lever allows the spring in the master cylinder assembly to return the master piston back into position. This action first relieves the hydraulic pressure on the caliper, then applies suction to the brake piston in the caliper assembly, moving it back into its housing and allowing the brake pads to release the rotor.

The hydraulic braking system is designed as a closed system: unless there is a leak in the system, none of the brake fluid enters or leaves it, nor does the fluid get consumed through use. Leakage may happen, however, from cracks in the O-rings or from a puncture in the brake line. Cracks can form if two types of brake fluid are mixed or if the brake fluid becomes contaminated with water, alcohol, antifreeze, or any number of other liquids.

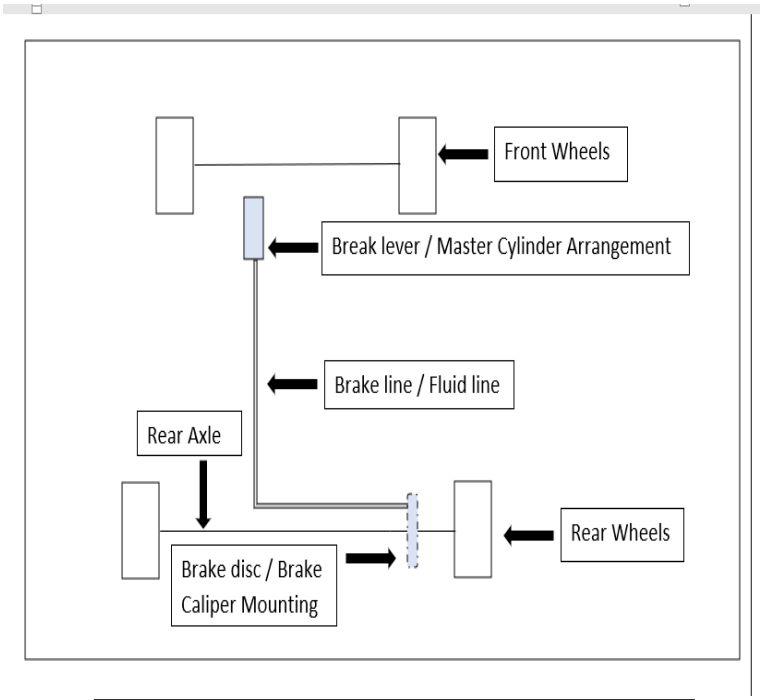


**Fig : Layout of go-kart breking system**

## CONSIDERATIONS FOR BRAKING SYSTEM SELECTION

Discs, calipers and master cylinders which were used for considering suitable for our vehicle after market survey.

Various brakes disc available in market:

| Sr. no. | Vehicle name | Dia. Of front brake disc | Dia. Of rare brake disc |
|---|---|---|---|
| 1 | Apache 180 RTR | 270 mm | 200 mm |
| 2 | Pulsar 200 NS | 280 mm | 230 mm |
| 3 | Honda Active 125 | 190 mm | X |
| 4 | Bajaj Discover 125 | 200 mm | X |
| 5 | Honda CB Shine | 240 mm | X |

Various calipers available in market:

| Sr. no. | Caliper brand | No. of Piston | Arrangement of piston | Dia. Of piston |
|---|---|---|---|---|
| 1 | Apache 180 RTR | 2 | Single Side | 28.5 mm |
| 2 | Pulsar 200 NS | 2 | Single Side | 40 mm |
| 3 | Honda Active 125 | 1 | Single Side | 26 mm |
| 4 | Bajaj Discover 125 | 1 | Single Side | 28 mm |

Various master cylinders available in market:

| Sr. No. | Master cylinder brand | Output of Cylinder | Dia. Of cylinder |
|---|---|---|---|
| 1 | Apache 180 RTR | Single Output | 15.87 mm |
| 2 | Bajaj Discover 125 | Single Output | 19.4 mm |
| 3 | Pulsar 200 NS | Single Output | 17.9 mm |

### Selection of Brakes:

We had used a Hydraulic Disc Brake considering the following advantages, availability, and their limitations. For selection of best braking system in go-kart you have to kept some points in your mind.

a) Hydraulic system

b) Disc brake - apache RTR 180

c) Master cylinder- apache RTR 180 rear master cylinder
d) Brake lines- Metallic beak lines
e) Caliper- apache front double piston caliper

**Table 1: Parts and Specifications**

| Sr. No. | Parts | Specifications |
|---|---|---|
| 1 | Mass of Go kart | 137.8 Kg |
| 2 | Master Cylinder | Diameter - 15.87mm<br>Area - 0.000197mm2 |
| 3 | Caliper | Diameter – 40 mm<br>Area – 1256 mm2 |
| 4 | No. of Caliper Piston | 2 |
| 5 | Pedal Ratio | 6:1 |
| 6 | Coefficient of Friction between Tire & Road (μ1) | 0.7 |
| 7 | Coefficient of Friction between Brake pad & Disc Rotor (μ2) | 0.4 |
| 8 | Rotor / Disc | Diameter -190mm Thickness – 4mm<br>Material – high centric carbon |
| 9 | Brake Fluid type | Dot 4 |
| 10 | Weight Distribution | Front - 40%<br>Rear - 60% |
| 11 | Static laden radius (L) | 134.11 mm |

**Calculations:**

Normal force at front and rear axle
Nfront = mass * g * C (where C is weight distribution)
= 137.8 * 9.81 * 0.4
= 540.727 N
NRear = mass * g * c
= 1378 * 9.81* 0.6
= 811.09 N

2) Friction force at front and rear axle.
Ffront = μ1 * N front
= 0.7 * 540.72
= 378.504 N
Frear = μ1 * N rear
= 0.7 * 811.09
= 567.76 N

3) Acceleration of Go-kart
Total Friction force (Front + Rear)
F = 378.50 + 567.76
= 946.26 N

According to newtons second law of motion
F = ma
a = F / m
a = 946.26 / 137.8
a = 6.86 m/s2

4) Stopping time and Distance
Go- Kart is starting from rest
Therefore V = 0
According to newtons first equation of motion

Final Velocity = initial velocity + acceleration *time
V = U + at
t = (V - u) / a
= 13.8 / 6.86
t = 2.02 sec

In accordance to newtons third equation of motion
2 * acceleration * distance = (final velocity)2 – (Initial velocity)2
Therefore,
d = V 2 / 2a
= (13.8)2 / 2 * 6.86
= 13.8 m

5) brake fluid pressure
Peddle ratio = 6:1
Force on the master cylinder = 2500 N
Force = pressure * area of master cylinder
P = F / a
= 2500 / 0.000197
= 12.69 N/mm2

6) clamping force = fluid pressure * area of calliper
= 13.54 * 1256
= 17006.24 N

7) friction on rear tyre
Frear = μ2 * Clamping force
= 0.4 * 17006.24
= 6802.49 N

8) Braking Torque
B.T. = Frear * L
= 6802.49 * 134.11
= 9122.81 N-m

9) Stopping distance
d = v2 / 2a
= (13.8)2 / 2 * 6.86
= 13.88 m (Maximum)

*A. Use a zero before decimal points: "0.25," not ".25." Use "cm3," not "cc." (*bullet list*)*

## Conclusion:

The purpose of studying behind designing the braking system is to get the better and safe braking abilities with minimum stopping time at the considerable distance. There are various mathematical formulae, which are derived from the fundamental in order to calculate the parameters needed for the go-kart braking system. Thus, after verifying the calculations we conclude that our design is safe for fabrication.

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