

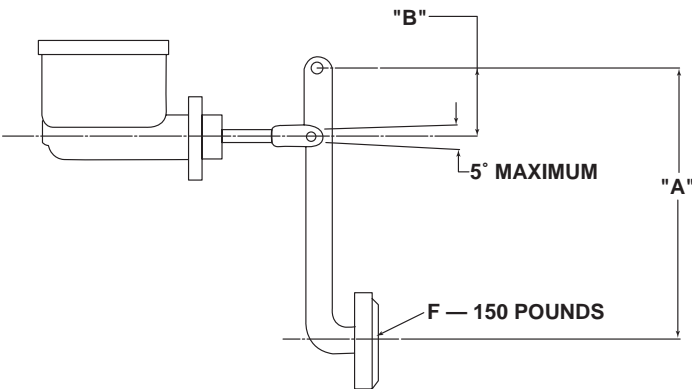
# How to Select a Master Cylinder

## Cylinder Selection

In putting together a good vehicular braking system, selecting the correct master cylinder is important.

Master cylinder requirements *are linked to pedal ratio*. The recommended pedal ratios are based on 150 pounds maximum force on the lever to attain the maximum rated pressure for the master cylinder. The mechanical advantage or pedal ratio, is the "A" dimension divided by the "B" dimension.

The recommended push rod cone angle is 5 degrees maximum.



If the bore size of the master cylinder is decreased and the mechanical advantage (pedal ratio) and push on the pedal remain the same, the fluid pressure (PSI) and the stroke both increase.

For example, a 100 pound push on the pedal and 4:1 mechanical advantage (pedal ratio) gives a 400 pound push on the master cylinder.

With a 7/8-inch bore master cylinder, the piston area is 0.60 square inches and the pressure developed is  $\frac{400}{0.60} = 667$  PSI.

The stroke to move 0.6 cubic inches of fluid is  $\frac{0.6}{0.60} = 1$  inch.

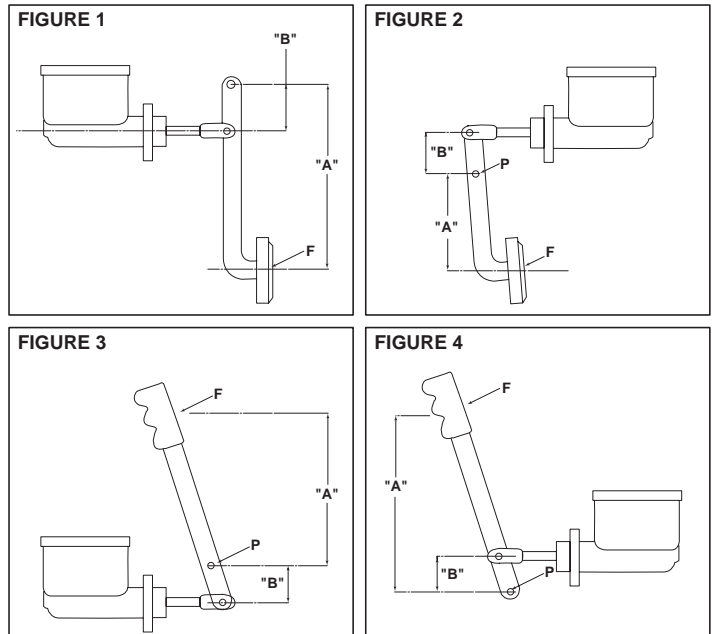
With a 3/4-inch bore master cylinder, the piston area is 0.44 square inches and the pressure developed is  $\frac{400}{0.44} = 909$  PSI.

The stroke to move 0.6 cubic inches of fluid is  $\frac{0.64}{0.44} = 1.4$  inches.

**As a general rule, a person is able to exert approximately 150 pounds of pedal pressure, 75 pounds of lever pressure and 50 pounds of grip pressure.**

## Mechanical advantage of pedal ratio

Pedal ratio is best explained by referring to the following series of drawings. Figures 1 and 2 are two basic types of "swing" pedal mounts. Figures 3 and 4 are the basic lever or floor mount pedals.



In each figure, the following values are:

- A — Distance from pivot to mid-point of push or pull;
- B — Distance from pivot to point of push on the master cylinder;
- P — Pivot point;
- F — Force of push.

The distance in every case is from the pivot to the point of push on the master cylinder or pedal regardless of which type of installation is used.

The mechanical advantage or pedal ratio is the ratio of A to B (A:B). As A:B increases (that is as B gets smaller or A gets larger) with the same push on the pedal (or pull on the handle) pressure will increase, but so will the stroke.

An example is a 1-inch master cylinder stroke and a 100 pound push on the pedal. With a 4:1 ratio, the pressure is  $4 \times 100 = 400$ , and the stroke is  $4 \times 1 = 4$  inches. With a 5:1 ratio, the pressure is  $5 \times 100 = 500$ , and the stroke is  $5 \times 1 = 5$  inches.



## Residual pressure

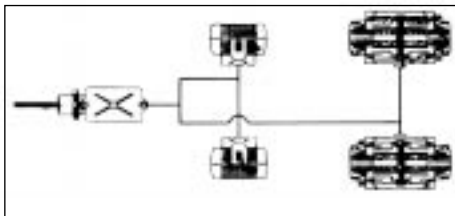
Residual pressure of 8 to 12 PSI must be used with drum brakes and is recommended with caliper disc brakes incorporating mechanical retraction such as Airheart hydraulic brakes. Calipers that depend on seal deflection for retraction (such as all American manufactured automobile calipers) must not have residual pressure in the system.

Residual pressure is provided by a valve which is either a component of the master cylinder or as an external valve plumbed into the line between the master cylinder and the brakes.

When the caliper is at the same level or higher than the master cylinder, a 2 PSI Residual Pressure Valve is necessary (if an 8-12 PSI valve is not used) to prevent backflow fluid evacuation from the caliper and, in turn, causing greater pedal travel to actuate the brakes.

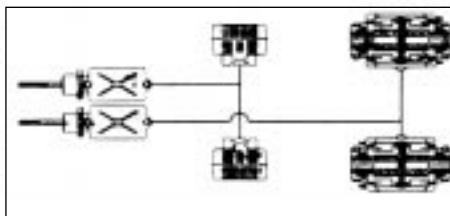
The following diagram shows typical drag race brake systems with a master cylinder recommendations.

## TYPICAL DRAG BRAKE SYSTEMS WITH RECOMMENDED MASTER CYLINDER



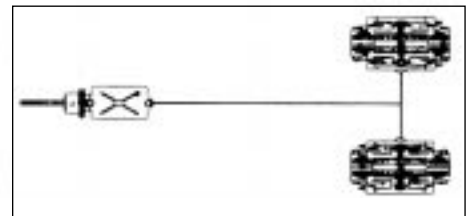
### SYSTEM 1 COMPONENTS

Master Cylinders: One 1-inch bore  
Front Calipers: Two 175H brakes  
Rear Calipers: Two 175X2QCII brakes



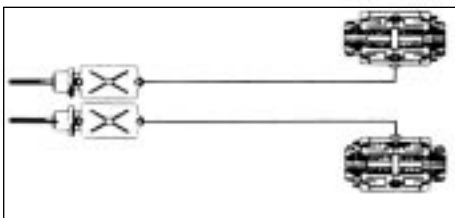
### SYSTEM 2 COMPONENTS

Master Cylinders: One 3/4-inch and 7/8-inch bore  
Front Calipers: Two 175H brakes  
Rear Calipers: Two 175X2QCII brakes



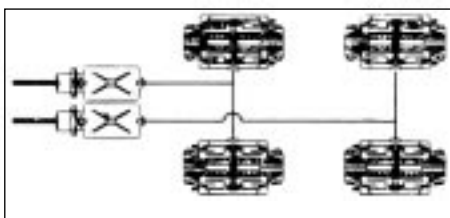
### SYSTEM 3 COMPONENTS

Master Cylinders: One 7/8-inch bore  
Front Calipers: NONE  
Rear Calipers: Two 175X2QCII brakes



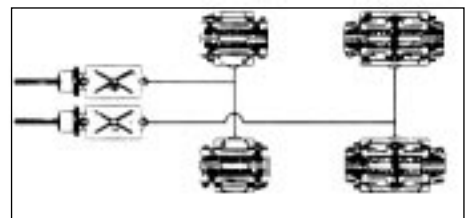
### SYSTEM 4 COMPONENTS

Master Cylinders: Two 3/4-inch bores  
Front Calipers: NONE  
Rear Calipers: Two 175X2QCII brakes



### SYSTEM 5 COMPONENTS

Master Cylinders: Two 7/8-inch bores  
Front Calipers: Two 175X2QCII brakes  
Rear Calipers: Two 175X2QCII brakes



### SYSTEM 6 COMPONENTS

Master Cylinders: One 3/4-inch and 7/8-inch bore  
Front Calipers: Two 175X2QCII brakes  
Rear Calipers: Two 175X2QCII brakes

