HOW TO OPTIMIZE YOUR CARS BRAKING SYSTEM

Trying to optimize your brakes can be a daunting task to say the least. Below is some basic information on what to expect from various components in designing your system. This is general information so it's always well advised to consult those in the brake industry when finalizing the design and purchase.

1. The efffect of booster size on pressure output.

The effectiveness of your braking will ultimately be determined by the amount of hydraulic pressure being pushed out to the wheels. The primary factor is how much power assist your booster will provide.

As a general rule the pressure output of a booster is directly proportional to it's diameter, the bigger the booster the more assist it will give. Other factors will enter into the equation such as vacuum level or booster design. Low vacuum will diminish your boosters assist. anything lower than 18" will begin to diminish the performance of your booster so it's necessary that you have **at least 18" of vacuum from your engine.** The smaller the booster diameter the greater the negative effect of low vacuum will have on the booster. NEVER GO BELOW 16"!

Booster performance can be enhanced by modifying the design. By adding an additional internal diaphragm you can generate additional assist giving you the performance of a larger booster in a smaller space.

Below is some test data to illustrate the effect of booster size on the amount of pressure output. **All this data is taken with a vacuum level of 20" and a master cylinder bore size of 1-1/8" and a pedal ratio of 6:1**

Booster style	Pedal	PSI out	Maximum Attainable
7" single diaphragm	120	800	800
7" dual diaphragm	120	900	1200
8" dual diaphragm	120	1000	1400
9" single diaphragm	120	900	1200
9' dual diaphragm	120	1200	1500

These 120 readings are with a fairly firm amount of pedal pressure, the amount you would apply if you wanted to stop quickly. The maximum is the most we were able to get out of the booster.

2. The effect of master cylinder bore size on pressure output.

By changing the bore size of the master cylinder you can adjust the amount of pressure output. The smaller the bore of the master the more pressure it puts out. The trade off is pedal travel. too small a bore will stop you nicely but you may be very uncomfortable with the travel. **The following data is with 20" vacuum and a dual diaphragm 8" booster.**

Bore size	Pedal pressure	PSI out
1-1/8"	120	1000
1"	120	1250

So typically you can gain a 25% increase in pressure output by dropping to a 1" bore master from 1-1/8"

So what does this pressurre increase mean? Well to stop a car with disc brakes you will need to clamp a spinning rotor. The greater the clamping force, the better and quicker the vehicle will stop. Simple. But there's more.

3. The effect of caliper size on clamping force and stopping.

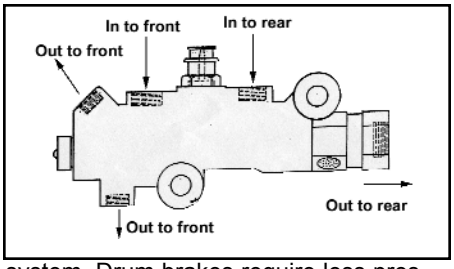
The larger the caliper piston, the greater the clamping force on the rotor. The greater the clamping force, the better the stopping. Below is data on the effect of caliper bore size on clamping force with a **pressure of 800 psi**

Caliper style	Bore	Clamping force
GM metric	2-3/8"	2800 psi
GM large	2-7/8"	4600 psi

So by increasing your caliper size from the small GM to the large GM you will gain a 65% increase in clamping force as well as an increased pad surface area generating tremendous force.

4. Balancing your system correctly with a combination valve.

Without the valving to balance your system correctly you will have the same pressure to both the front and the rear of the car. This will be fine for four wheel disc brakes but if your system is a disc/drum set up you will need to use a combination valve to synchronize the



system. Drum brakes require less pressure to lock up than disc brakes. To limit the pressure to the rear drum brakes use a combination valve. The following data shows how the combination valve works.

PSI into valve	PSI out
800 in to front	800 out to front
800 in to rear	600 out to rear

So you can see that the combination valve will limit the pressure to the rear drum brakes preventing rear wheel lockup while still allowing enough pressure for the drums to work effectively.

So what does it all mean?

It's always good to try to use a larger caliper. This will allow you to spec a smaller booster if space is a consideration. It's best to think in terms of using at least an 8" dual diaphragm with a 1-1/8" bore master for a vehicle thats heavier than 2500 lbs. With a larger caliper and and 1-1/8" bore master you will have good pedal feel, minimal pedal travel and good stopping. If you cant fit an 8" booster and are required to go to a 7", use the dual diaphragm 7" booster. If you need more pressure and are willing to accept more pedal travel you can drop the bore size to 1".

If your vehicle is lighter than 2500 lbs you can use the 7" booster with larger calipers. If the calipers are smaller on the light vehicle either increase the size of the booster or drop the bore size of the master.

Always use an original equipment pad it will make a tremendous difference in stopping!

For help with your system call engineering at 888-533-1199.