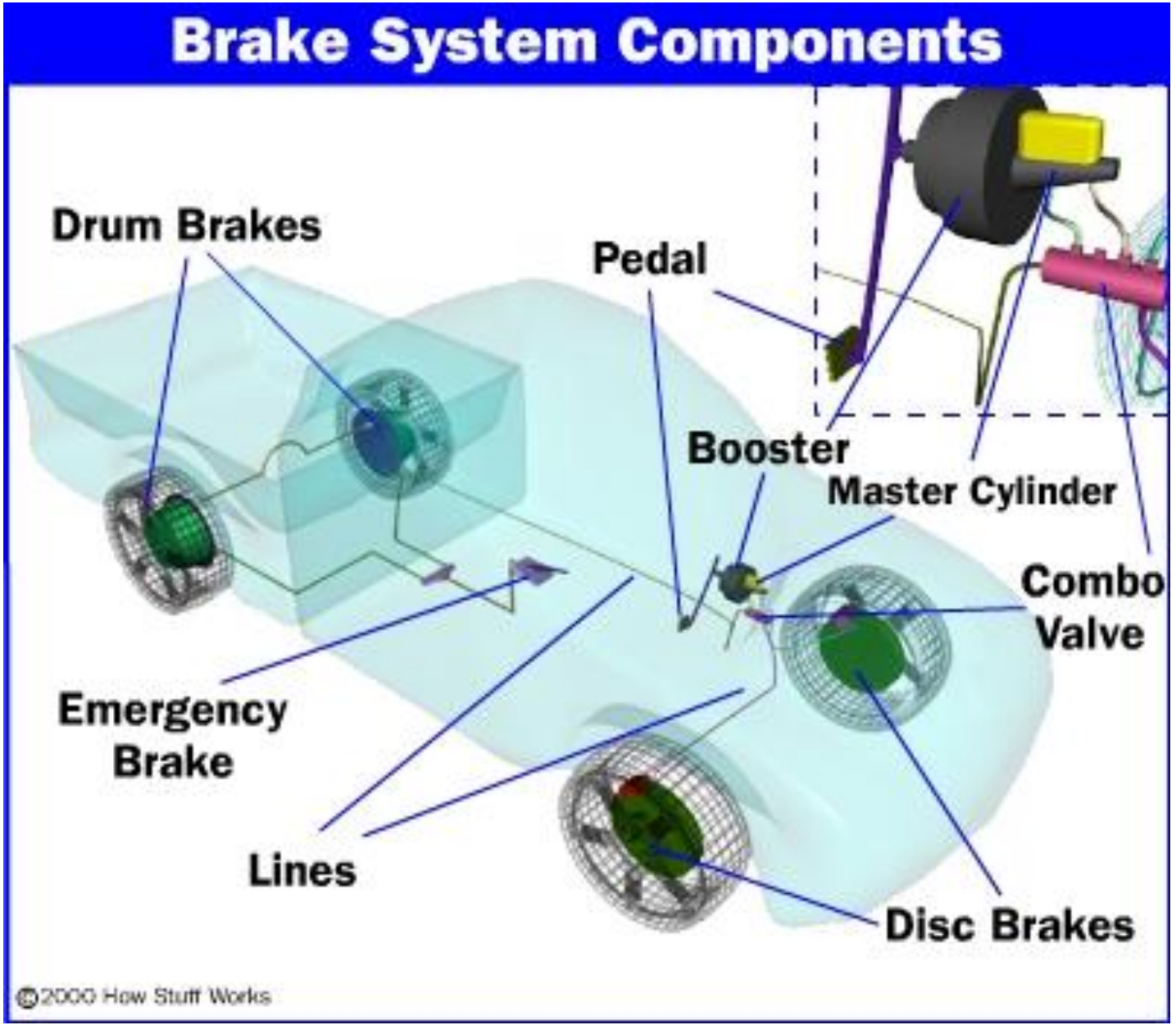
BRAKES


Brake System Components
Drum Brakes
Pedal
Booster
Master Cylinder
Combo Valve
Emergency Brake
Lines
Disc Brakes
©2000 How Stuff Works

BRAKES

Friction is the resistance to motion between two objects in contact with each other.

- Dry friction (*Brakes)*

- Greasy Friction (*Wheel bearings)*

- Viscous (*Crank main bearings)*

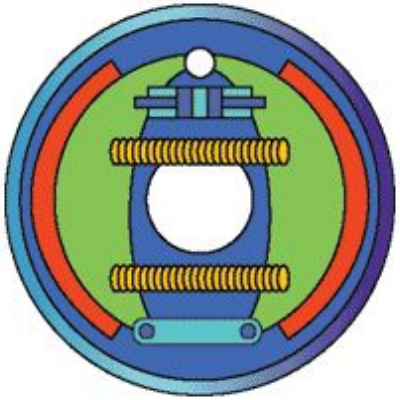
Friction varies with the roughness of the surfaces.

Kinetic (*Motion)* Friction

Static (*Rest)* Friction

BRAKES

Friction between *Drums & Shoes* or *Pads & Rotors* slows the car.



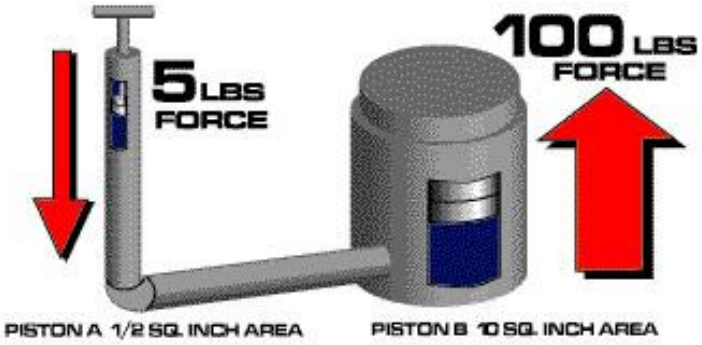
Friction between TIRES and ROAD stops the car.

BRAKES

- **Air Brakes**. (*Pneumatic)*
- **Hydraulic Brakes** use hydraulic fluid pressure to transmit power. *(Incompressible)*

- Two pistons of same size will travel the same distance, with the same force.

- If the small piston acts on a large piston, the large piston will travel with more force, but a shorter distance.



- If the larger piston acts on a small piston, the small piston will travel a longer distance, but with less force.

BRAKES

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BRAKES

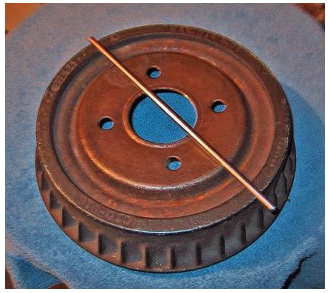
Brake Action

•Brake ***Pedal*** is connected to the ***Master Cylinder.***

•Each wheel has a ***Wheel cylinder*** (Rear)

Or ***Caliper*** (Front)

•Each wheel has a brake ***Drum*** (Rear)



Or ***Disk*** (Front)

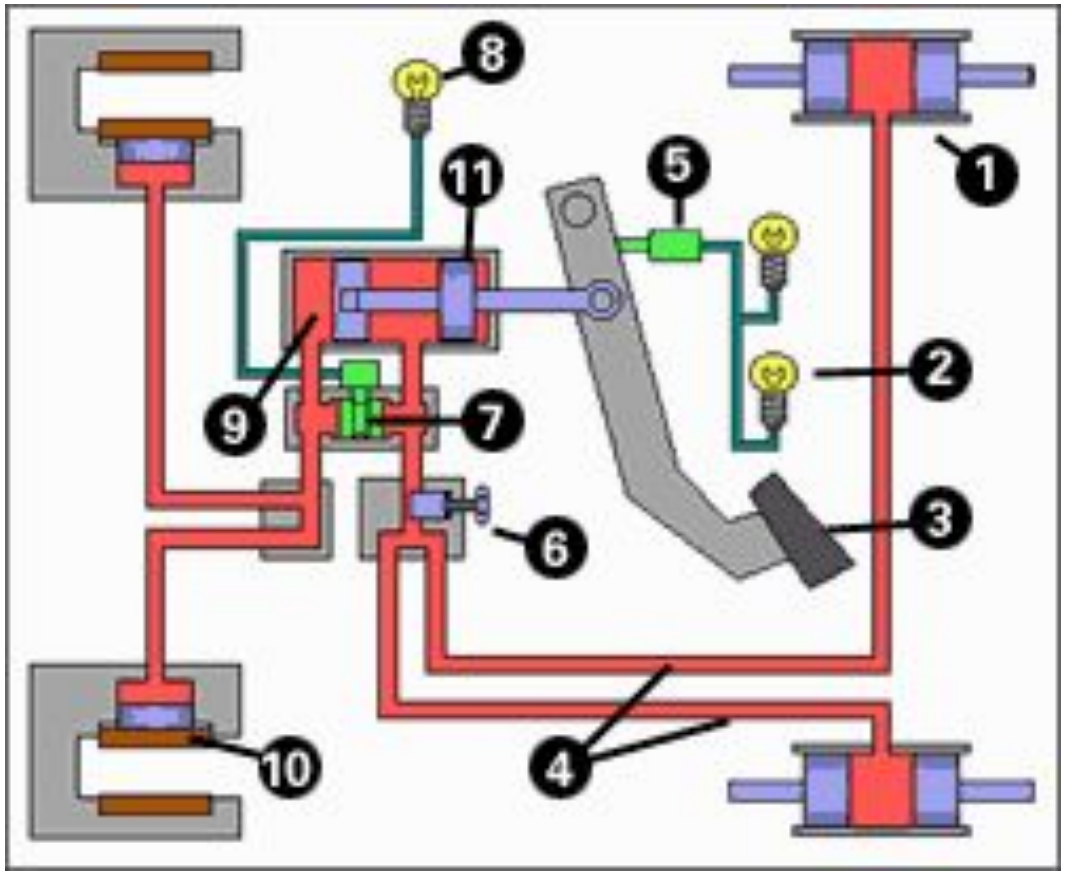
•Each wheel has ***Shoes*** (Rear)

Or ***Pads*** (Front)

BRAKES

Brake Action

When the Brake pedal is pressed, brake fluid travels from Master cylinder to the Caliper or Wheel cylinder, pushing the pistons out. In turn this action pushes the shoes against the drum or the pads against the rotor.



BRAKES

When the vehicle comes to a stop, most of the weight is shifted to the front

70% - 80% of the work is done by the front brakes

BRAKES

Brake Lining

Brake lining is made of various materials (Asbestos)

Some are bonded or glued to a metal plate.

Some are riveted to a metal plate.

Brake lining must be strong enough to absorb the heat and last a long time, yet save the drums and rotors from wearing too quickly.

BRAKES

Disk brakes found on front of most vehicles as well as at rear of four wheel Disk brakes vehicles.

- Has a rotor/disk between two pads
- Caliper squeezes the pads against the disk when the brakes are applied
- Disk brakes work much better then the drum brakes, as they cool better and apply more pressure.

CHOICES

- Metallic(last longer, but bad for rotor)
- Semi-metallic
- Ceramic

BRAKES

Wear Sensors

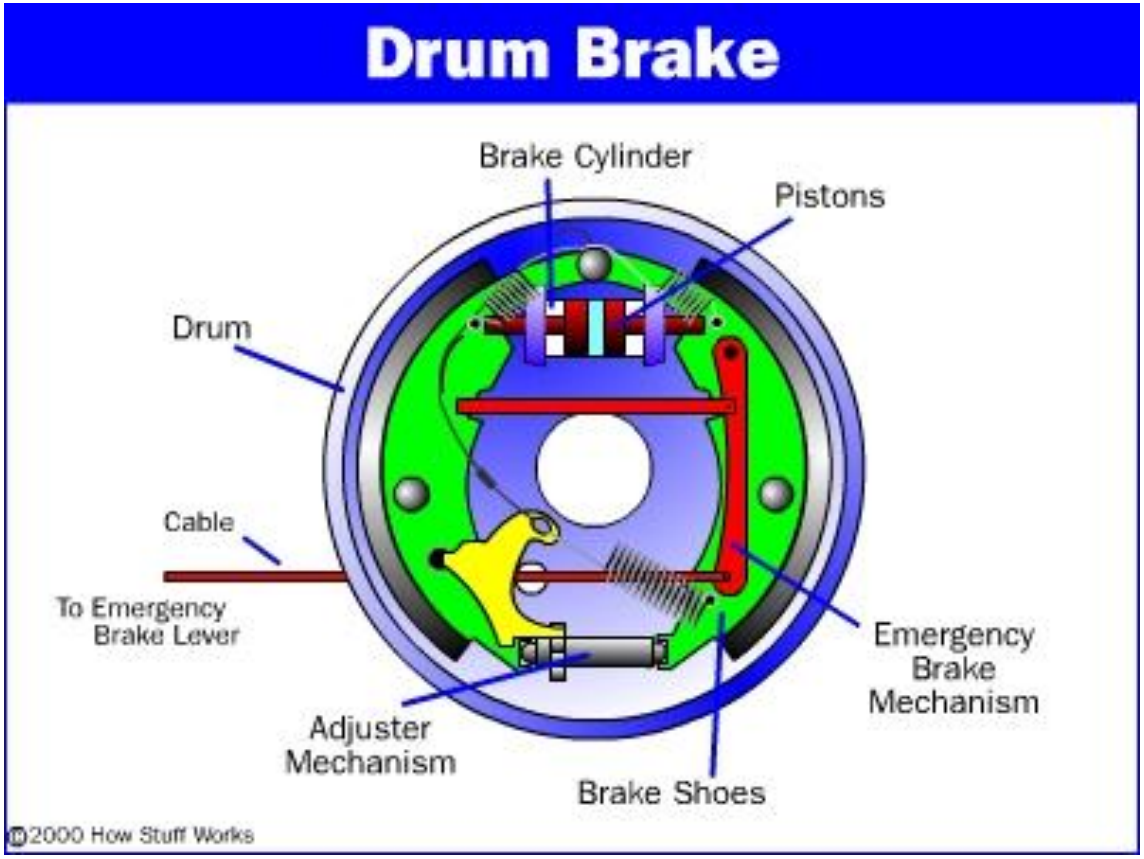
Some pads have wear warning sensors.

- Squeals without stepping on the brakes.
- Replace when the pad is down to 1/8” at any point.

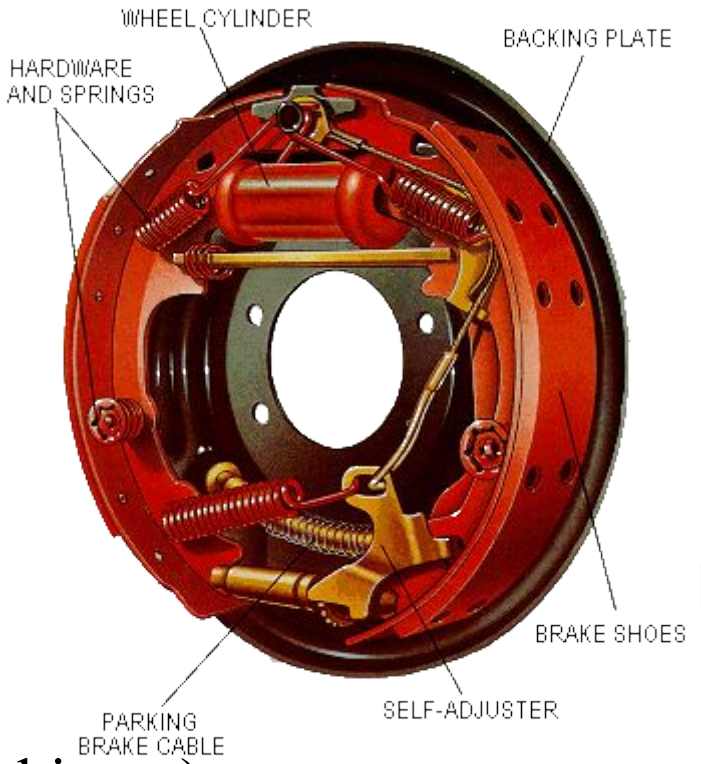
BRAKES

<u>Drum Brakes</u> on the rear wheels of the vehicle.

- When brakes are applied, the wheel cylinder pushes the brake shoes against the rotating drum.



BRAKES



- Rear brakes are self adjusting.
- They adjust when the vehicle is reversed and brakes are applied.

- Can be manually adjusted by turning the star-wheel.

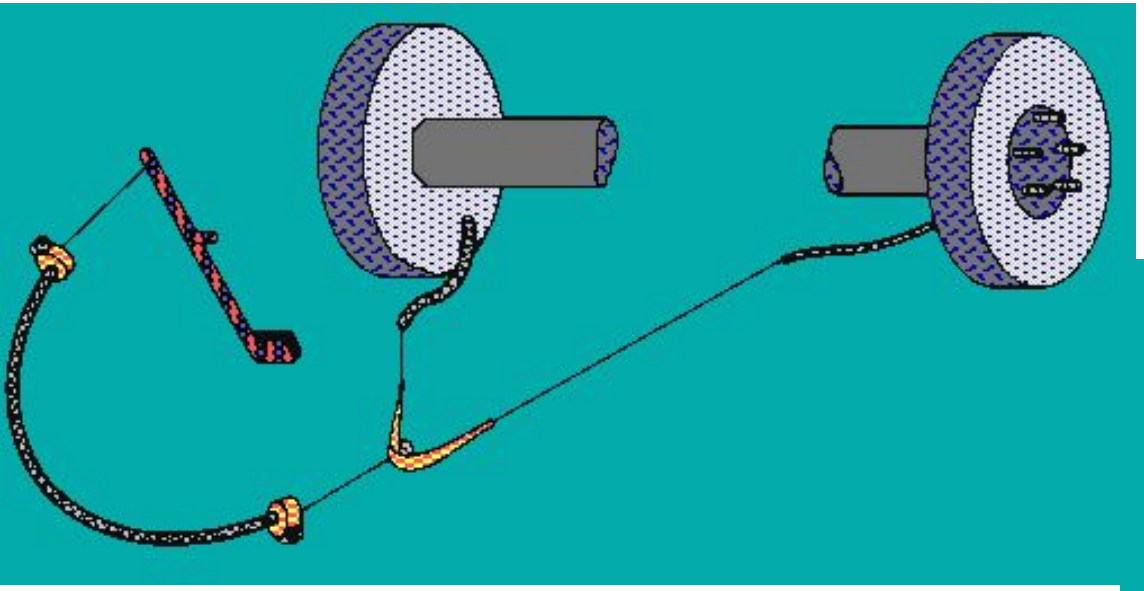
- Primary shoe sits at the front (smaller/thinner), and secondary shoe sits towards the rear (bigger/thicker).

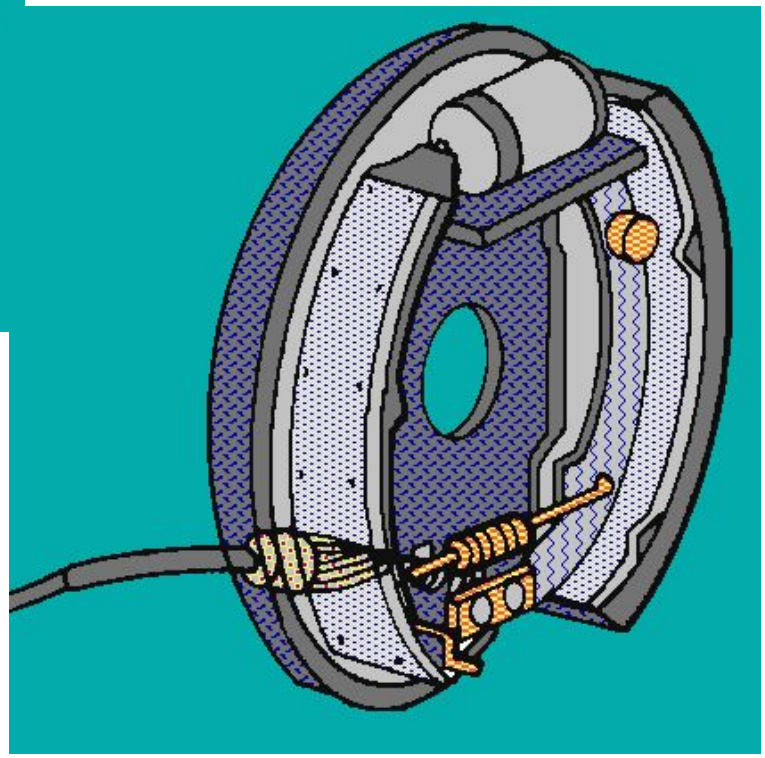
- Replace shoes when they are down to 1/16” at any point.

BRAKES

BRAKES

<u>Parking brakes</u> are part of the rear brakes and are operated mechanically with the help of a leaver and cables.





BRAKES

BRAKES

Master Cylinder

- Reservoir for brake fluid.
- Connected to the brake pedal.
- Pressurizes the system when brakes are applied.
- Cheaper to replace.
- Bench bleed when installing new.

PROBLEMS

- Internal leak – Pedal slowly goes down to the floor when stopped at a red light. (No visible leak)
- External leak – Between Master cylinder and power booster.

BRAKES

Dual Brake system

- Is a safety feature. If one system fails the other will still work.
- Front brakes are on different lines then the rear.
- Master cylinder has two compartments for brake fluid.
- Bigger for front and smaller for rear.

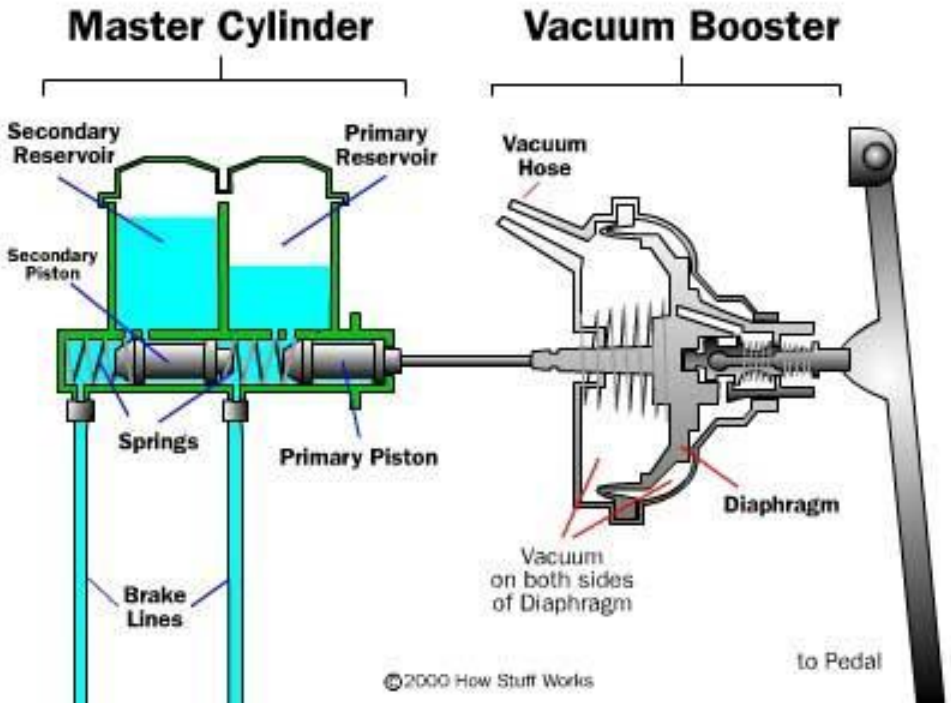
BRAKES

- **Power Brakes** assists in braking when the pedal is pressed.

Hydraulic booster hydraulic pressure is applied by power-steering pump

Vacuum Booster works with the vacuum from the vehicle's manifold.

To Check press on the brake pedal and start the vehicle, if working properly the pedal should go down.



BRAKES

Pressure Differential Valve

Warning light (Dash mounted) will light up, in case difference of pressure is detected in either system due to a leak.

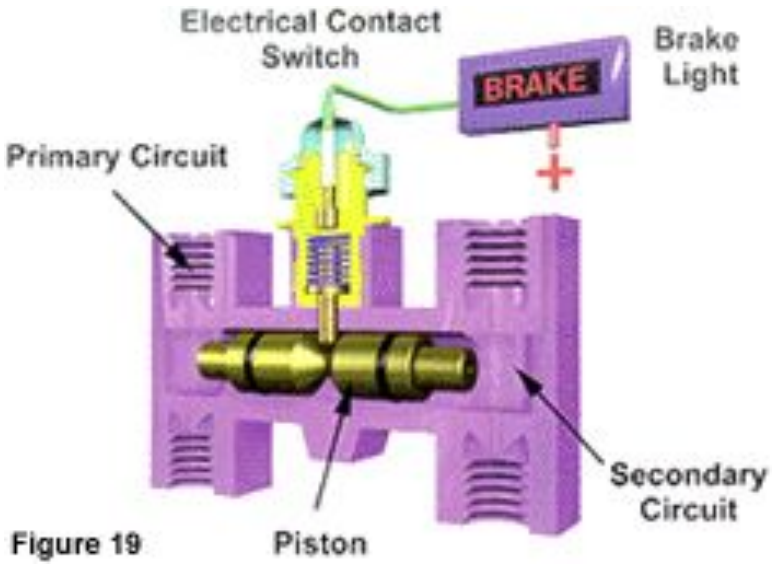


Figure 19

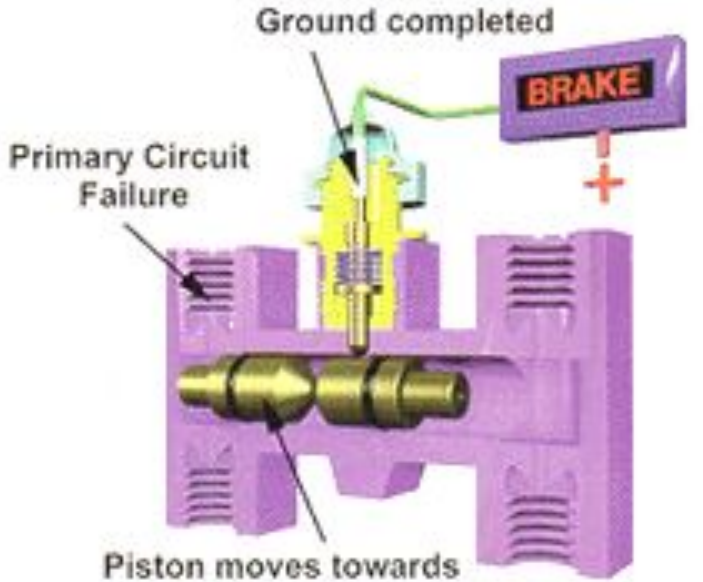


Figure 20

BRAKES

Metering Valve

- On vehicles with front disk and rear drum brakes.
- In hydraulic line to front brakes.
- During **light brake** application, metering valve prevents front brakes from applying until after the rear brakes shoes are in contact with the drums.

BRAKES

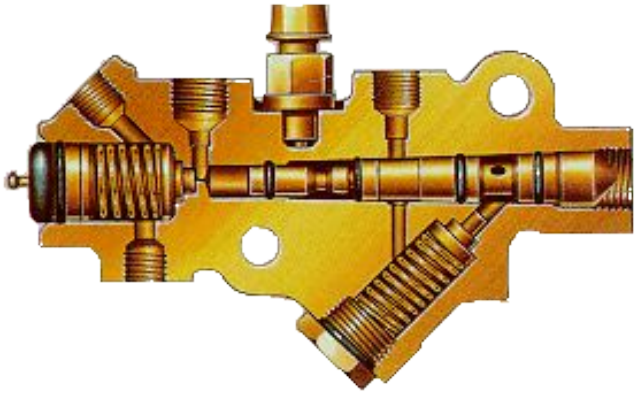
Proportioning Valve

- ON front disk & rear drum system.
- Installed in hydraulic lines to the rear brakes.
- Reduces pressure to the rear brakes during hard braking
- During **hard braking**, vehicle weight is transmitted to the front, resulting in the need of more braking at front.

BRAKES

Combination Valve

Pressure Differential Switch, Proportioning Valve & Metering Valve are all combined in one.



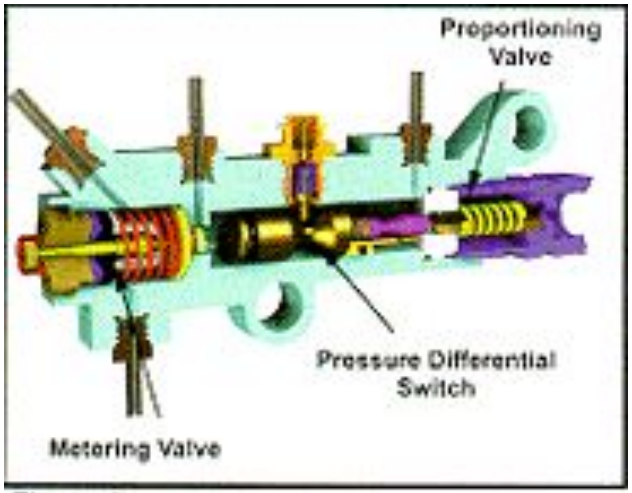


Figure 1

BRAKES

Brake Fluid

- Use the one recommended by the manufacturer.
  - DOT3
  - DOT4
  - DOT5

Brake parts can be cleaned with brake fluid.

Properties

- High Boiling point
- Water Tolerance
- Low Freezing Point
- Non-corrosive (rubber, plastic, metal).
- Lid should be always covered in order to prevent moisture in the system.

BRAKES

Problems

- Spongy brakes are caused if air gets in the system, hence brake bleeding is required.

- Dragging brakes are caused if vehicle is driven with partially brakes applied and overheated. (Seized parking brake cables)

- Bent or run-out rotor can be ground to make it true.

- Loss of brake pedal
  - Master cylinder
  - Leak in the system

BRAKES

Problems

- One rear wheel locks up
  - Adjustment
  - Oil on the brake lining
  - Seized brake cable

- Pull to one side
  - Seized brake caliper
  - Blocked brake line
  - Bad tires (alignment)

BRAKES

Credits

- Google search engine
- “How stuff works”

BRAKES

BRAKES