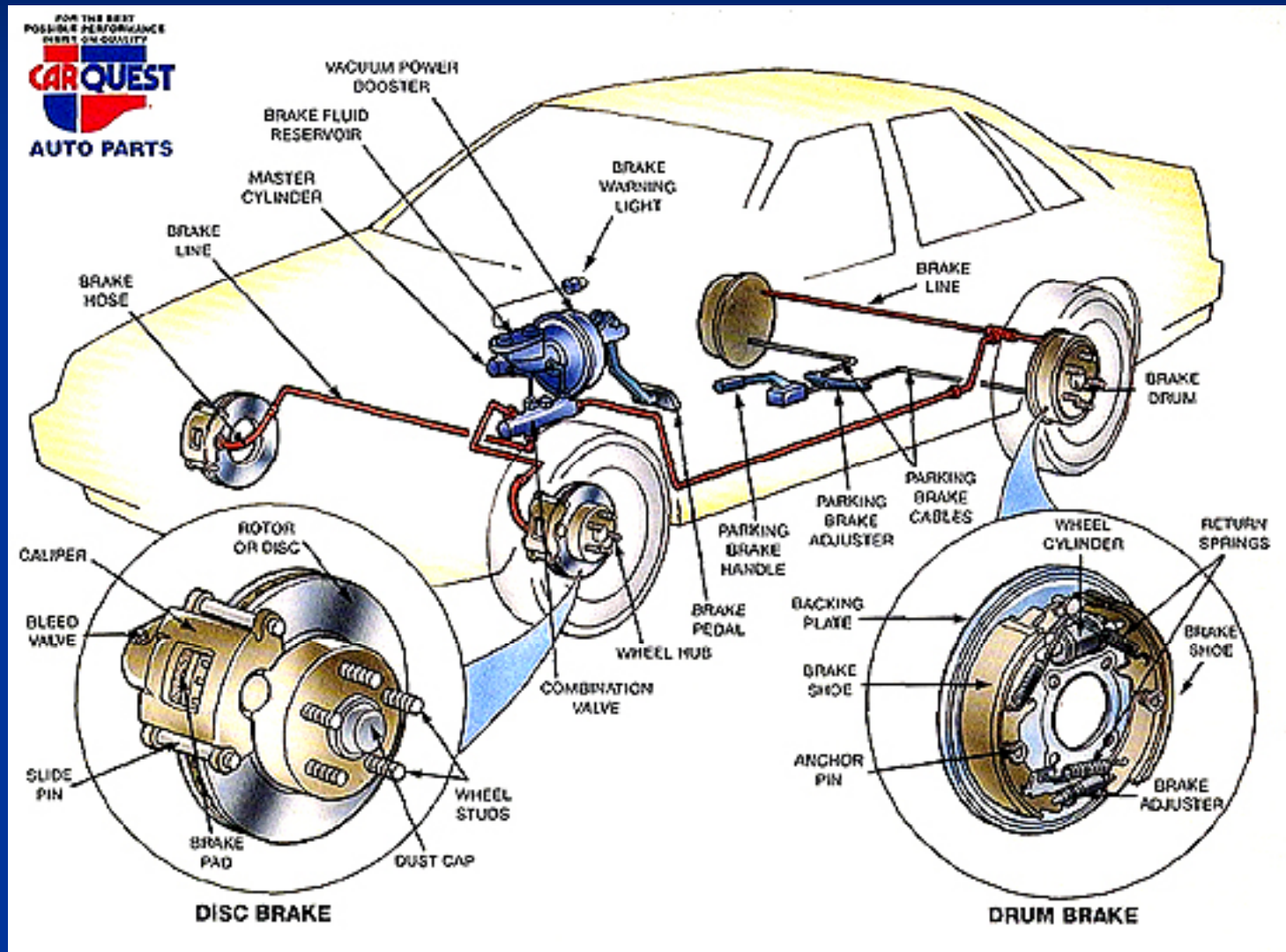


Brake Fundamentals

Brake System



The Science of Brakes

- Knowing what happens when vehicles goes down the road and what happens when the brakes are needed- is the first steps you need to understand brakes.
- Terms we need to know:
 - Kinetic Energy– energy that wants to stay in motion.
 - Coefficient of Friction --- A ratio that tells how much power it take to move an object across a surface.
 - Friction- a force that resists movement between any two contacting surfaces.

More Science

- Centrifugal Force- The expression centrifugal **force** is used to express that if an object is being swung around on a string the object seems to be pulling on the string.
- Weight Transfer- When the weight shifts to the front, this is the reason the front wheel drive vehicle's brake system provides 80% of its power to the front brakes and 20% to the rear (60% front-40% rear for rear wheel drive vehicles).

Friction



Brake Linings

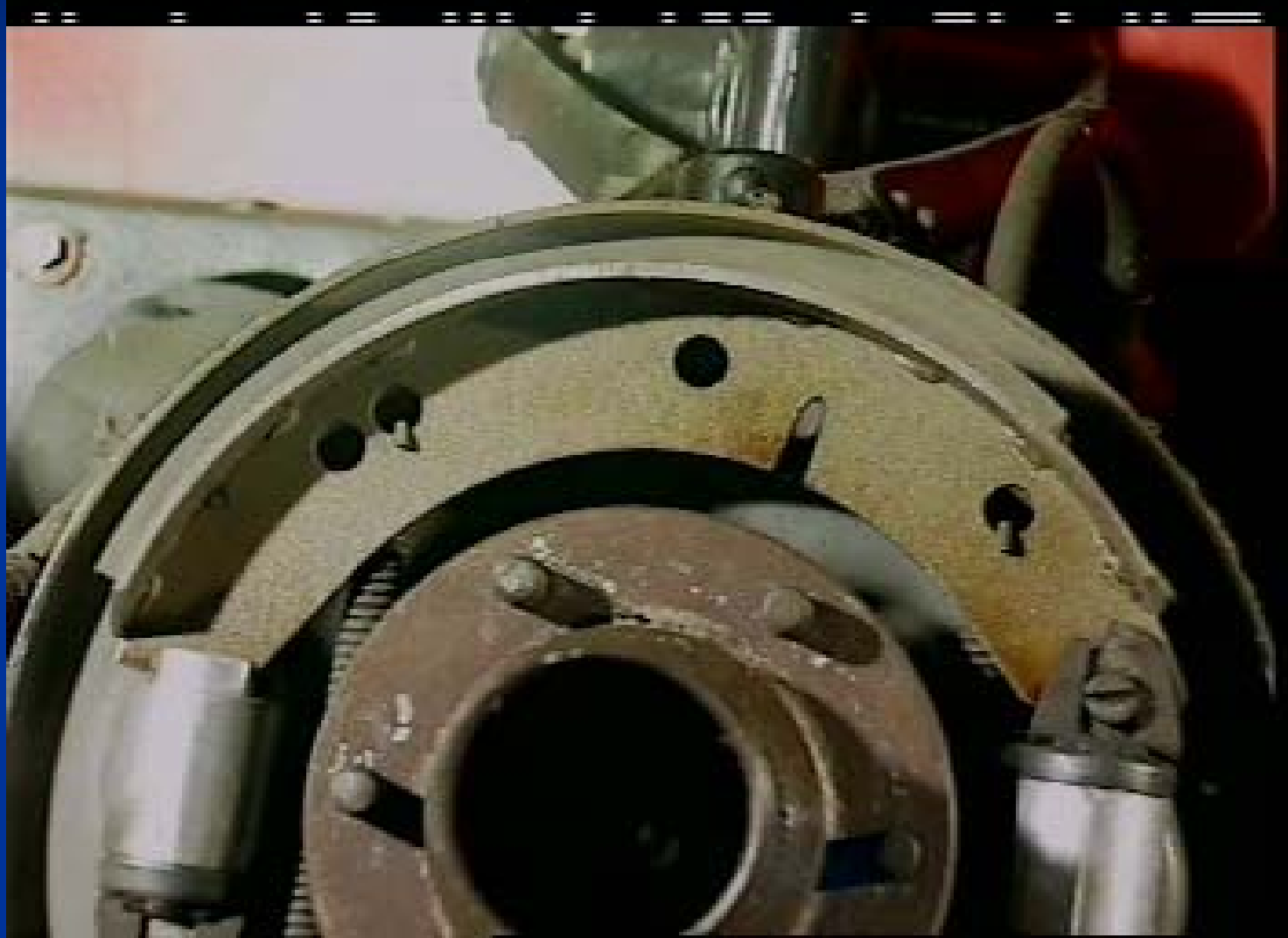
- These are the friction materials that a vehicle uses.
- They can be bonded (glued), riveted, and injection molded to the backing pad or shoes.



Types of Linings

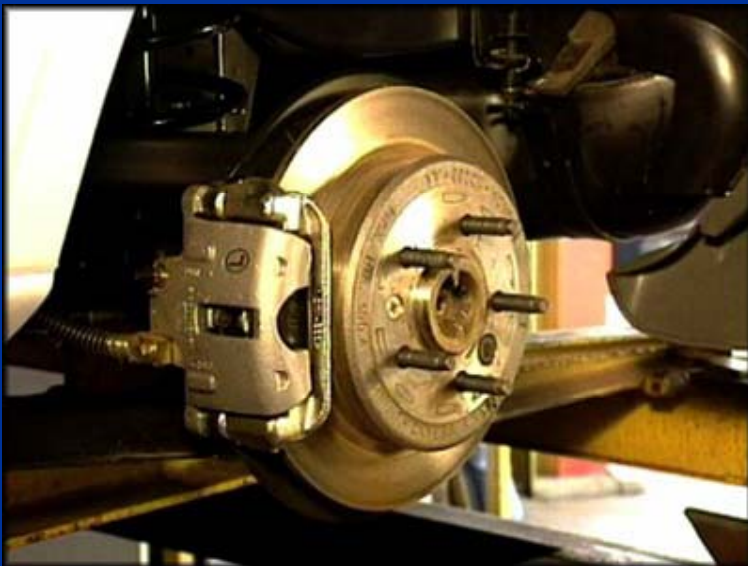
- **Asbestos**- these have phased out, very hazardous to breath the dust.
- **Organic**- mixture of asbestos and organic materials with a resin binder
- **Semi-metallic**- organic mixed with metal shavings, last longer and very good at dissipating heat.
- **Ceramic** – low dust output, provide exceptional braking performance
- **Carbon/Kevlar**- Motor sports application, not used on road vehicles because of cost and they take time to warm up.
 - *This is why we don't use a bow gun to clean brakes or brake parts (asbestos is hazardous in the airborne form)*

Linings

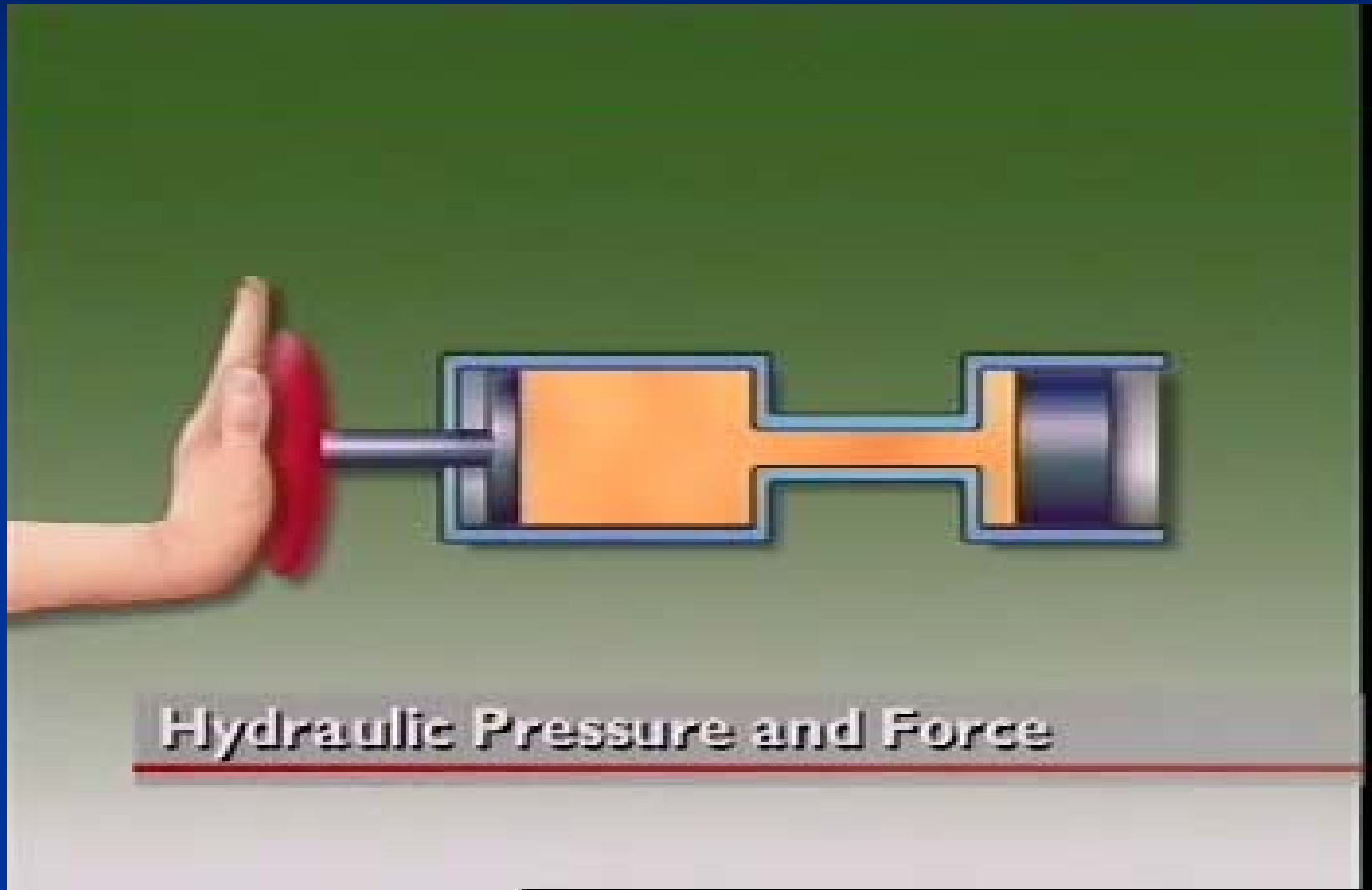


Disc and Drum Brakes

- Disc brakes are found on almost all vehicles now.
- Older cars and trucks had a combination of disc and drum brakes.
- At one time vehicles came with drum brakes only (1970 and older)



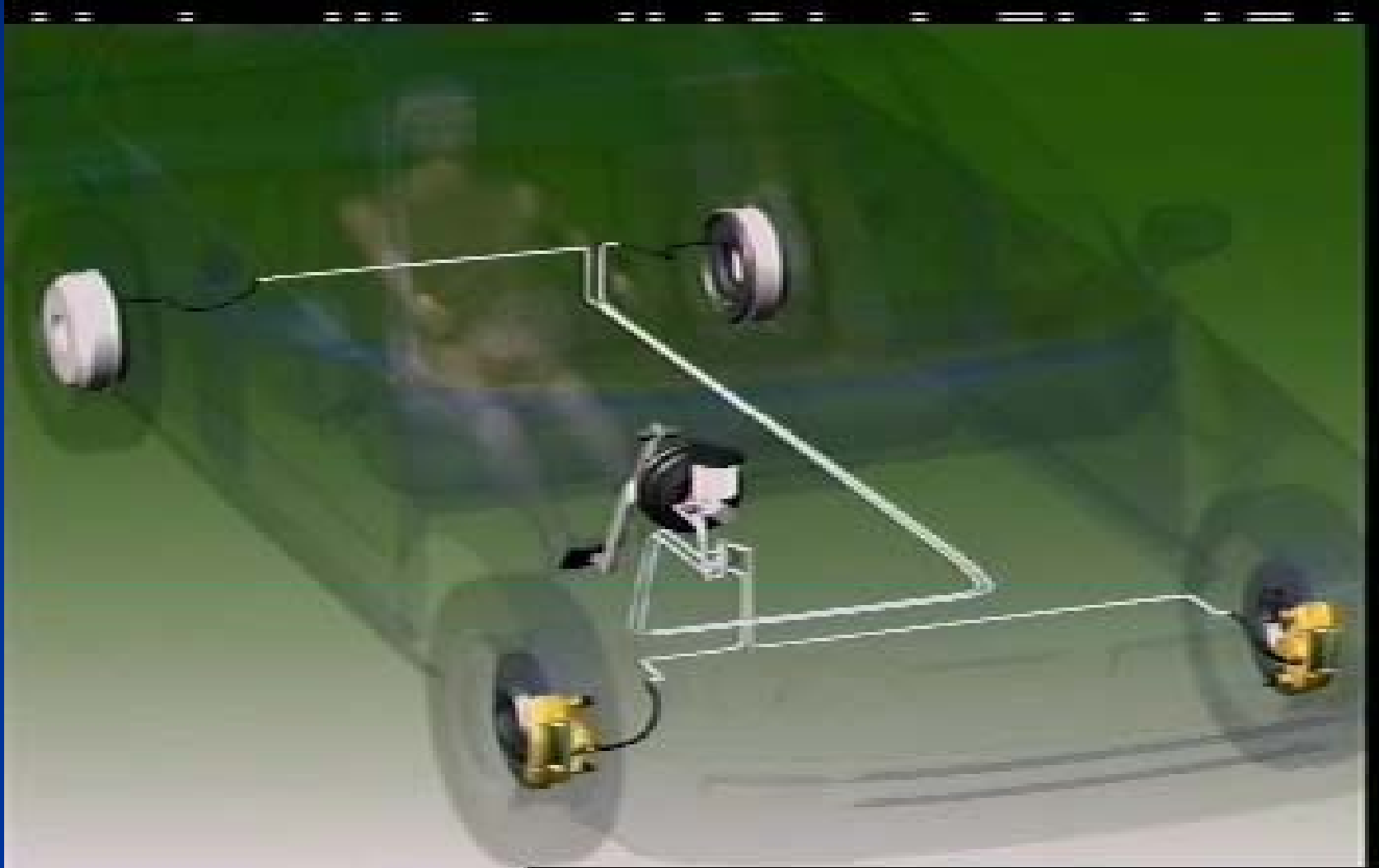
Hydraulics



Brake Fluid

- DOT (Department of Transportation)
 - Type 3 boils at 401 degrees
 - Type 4 boils at 446 degrees
 - Type 5 synthetic boils at 500 + degrees
- Can mix 3+4 but not 5 with the other two. Read what the brake system cap says to use.

Brake Hoses and Lines



Master Cylinder



Drum Brakes



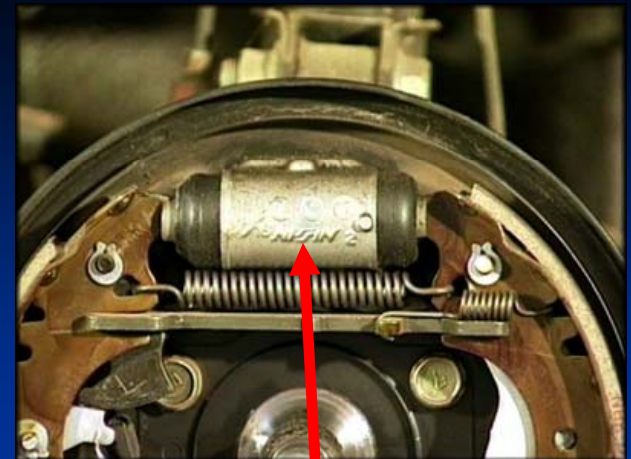
Drum Parts



Adjusting Screw



Wheel
Cylinder



Hardware



Backing plate



Drum

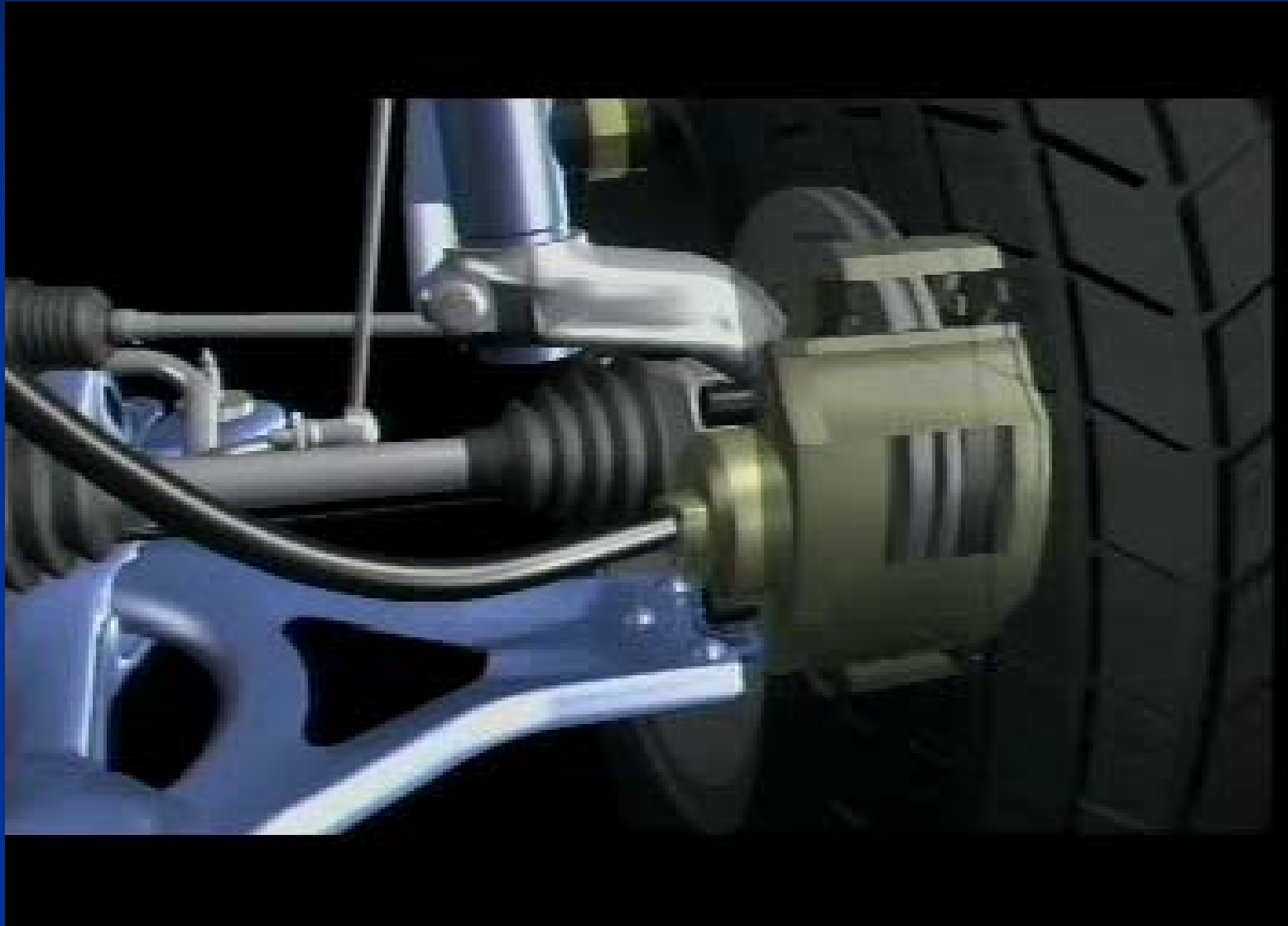
Wheel Cylinders



Backing Plate



Disc Brakes



Disc Parts



Cross-Drilled Rotors



Bearings



Caliper

Rubber Hoses



Backing Plate and Spindle



Pads

Metering and Proportioning Valves

- Metering Valve lets the rear brakes build 125 psi before the front brakes apply--- keeps from wearing out as soon and keeps the front brakes from doing as much light braking (prevents nose diving).
- Proportioning Valve prevents the rear wheels from locking up when the weight shifts forward on stopping.
- Combination Valve incorporates both of the above with a safety switch. (tells if a tandem system fails to keep equalized.) (front to back or diagonal systems)

Power Brakes (Boosters)



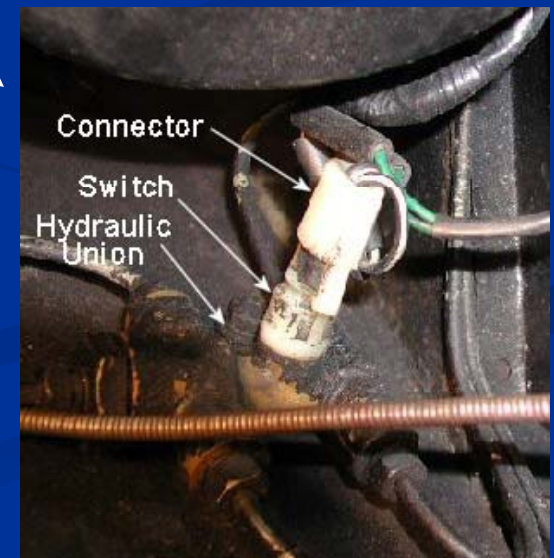
Parking Brakes (Emergency)

Lever and Foot Types



Brake Switch

- Mounted at the top of the brake pedal
- Activates the brake lights in the rear of vehicle
- Is not incorporated with brake warning light on the dash.--- (That is for the tandem brake safety switch and e-brake position switch)



Control Unit



Wheel Sensors

