Brake Systems

Mid-Term Review

Brake Systems

- Kinetic energy is energy in motion.
- Disc brakes should NOT experience brake fade.
- The antilock brake system prevents wheels from locking up.

Brake Systems

- Brake drum “out-of-round” is a variation in drum diameter at various locations around the drum.

- Non-directional finish on the rotor friction surfaces follows the arc of rotor rotation.

Brake Systems

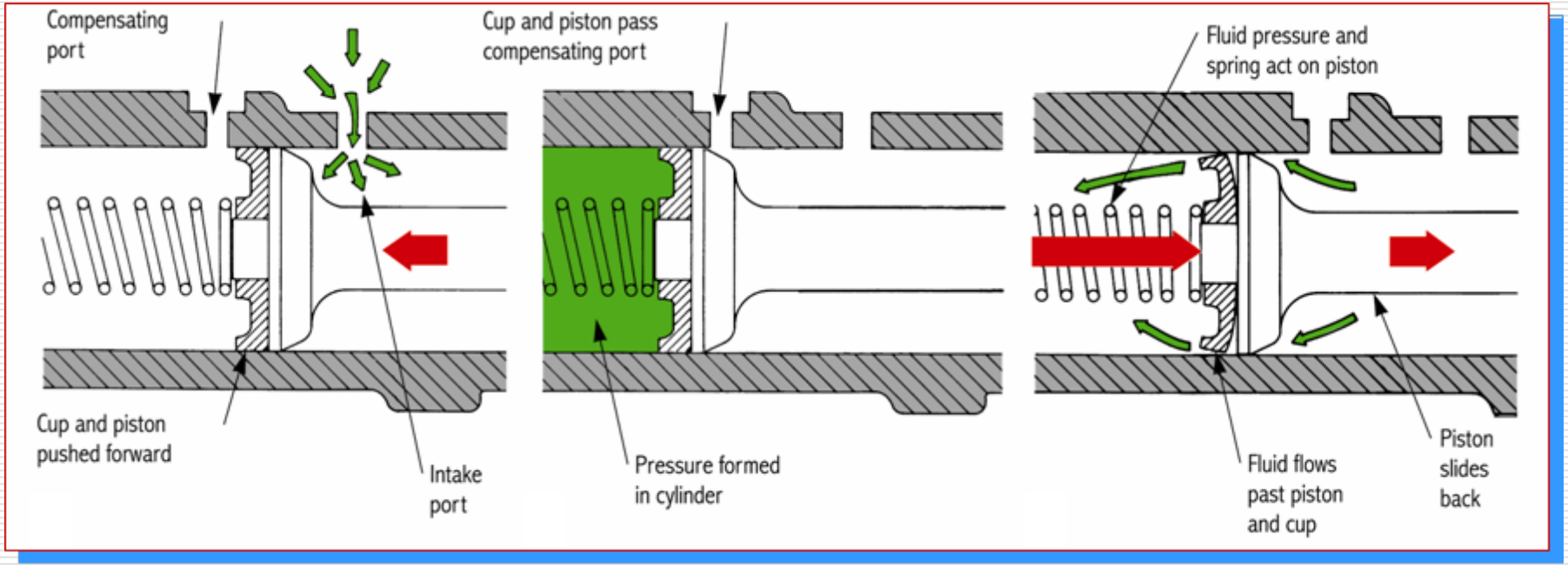
- When 250 pounds of force is applied to the master cylinder piston and the master cylinder piston has an area of .8 square inch, the force exerted by the fluid in the master cylinder is **312.5** psi.

$$F = A \times P$$

$$250 = .8 \times 312.5$$

250 pounds of Force = .8 inch cup x 312.5 lbs. Pressure

Piston and Cup

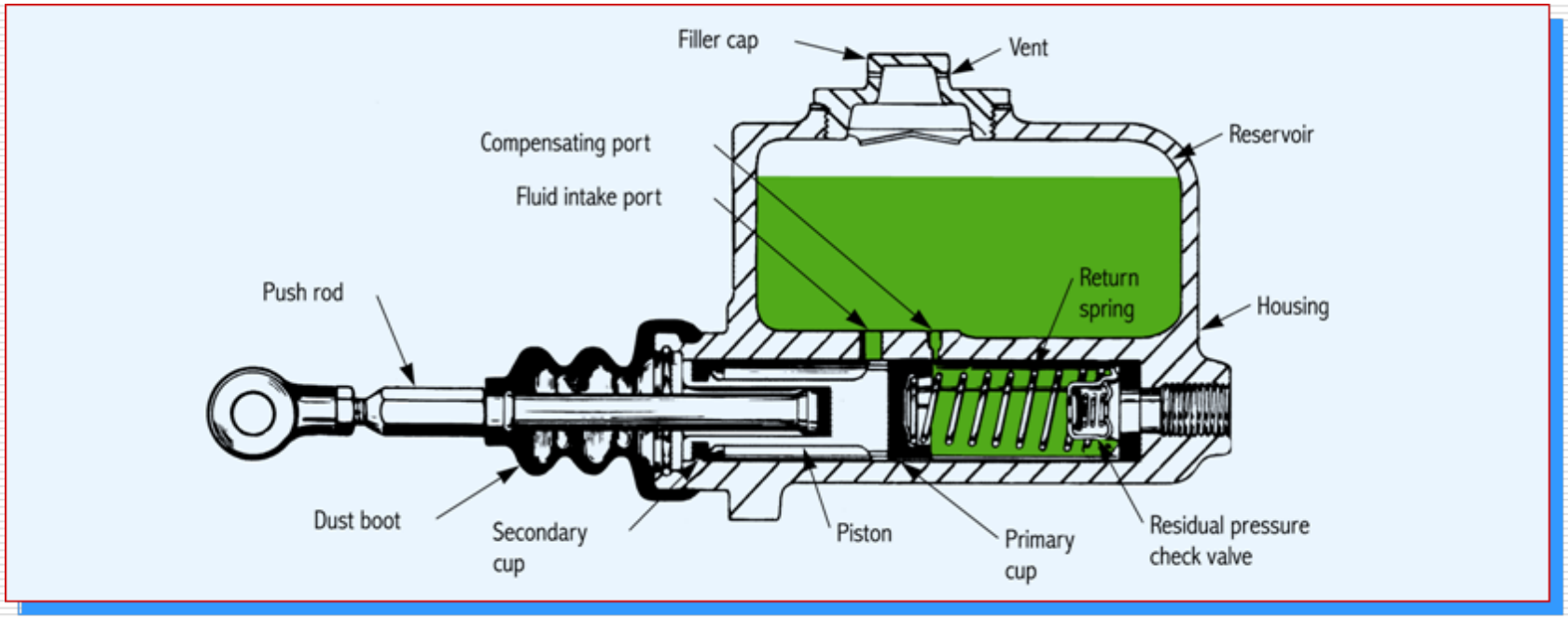


Brake Systems

- When the brake pedal is depressed, the primary piston moves down the **master cylinder bore** and the primary cup seals the vent port.

- Drum brake shoes are made from **stamped steel**.

Master Cylinder Components



Brake Systems

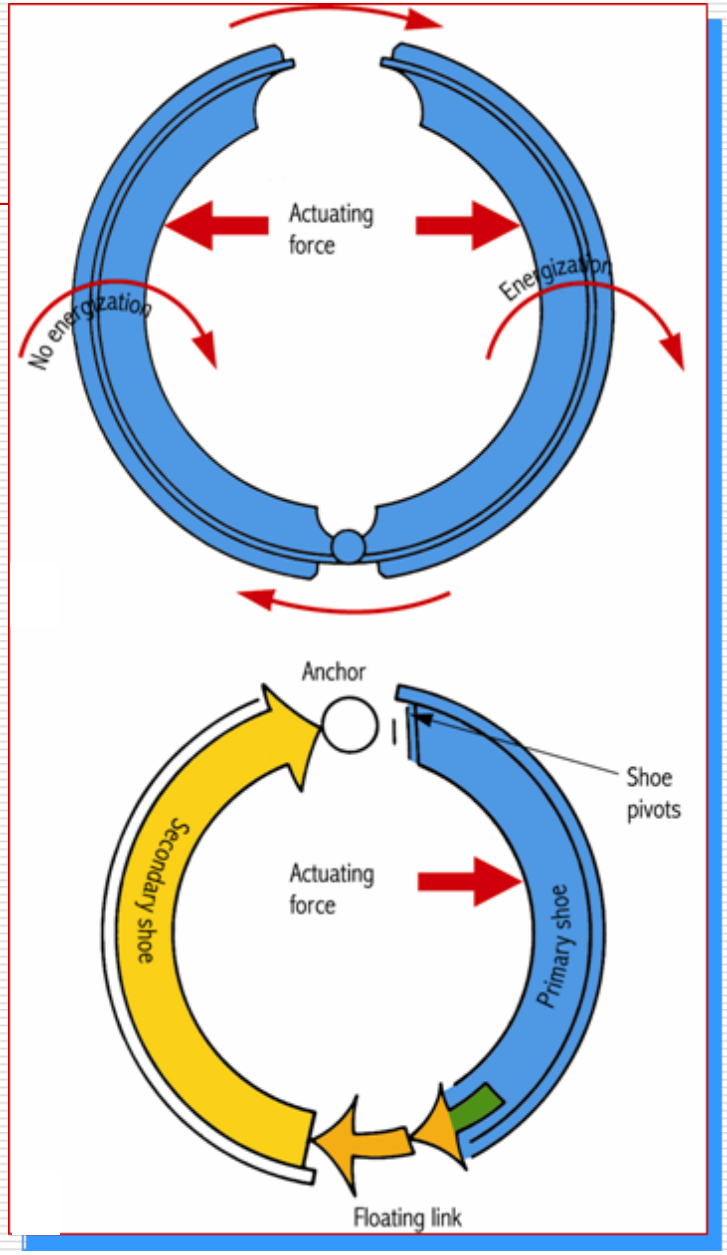
- **Servo action** occurs when the operation of the primary shoe applies mechanical force to the secondary shoe to assist in its application.

- A **floating caliper** is mounted over a rotor so that it is free to slide sideways on the mounting bolts.

Brake Shoe Energization

Self-Energizing Action. Primary shoe is self-energized

Servo Action. Less wheel cylinder hydraulic pressure is needed to apply the brakes

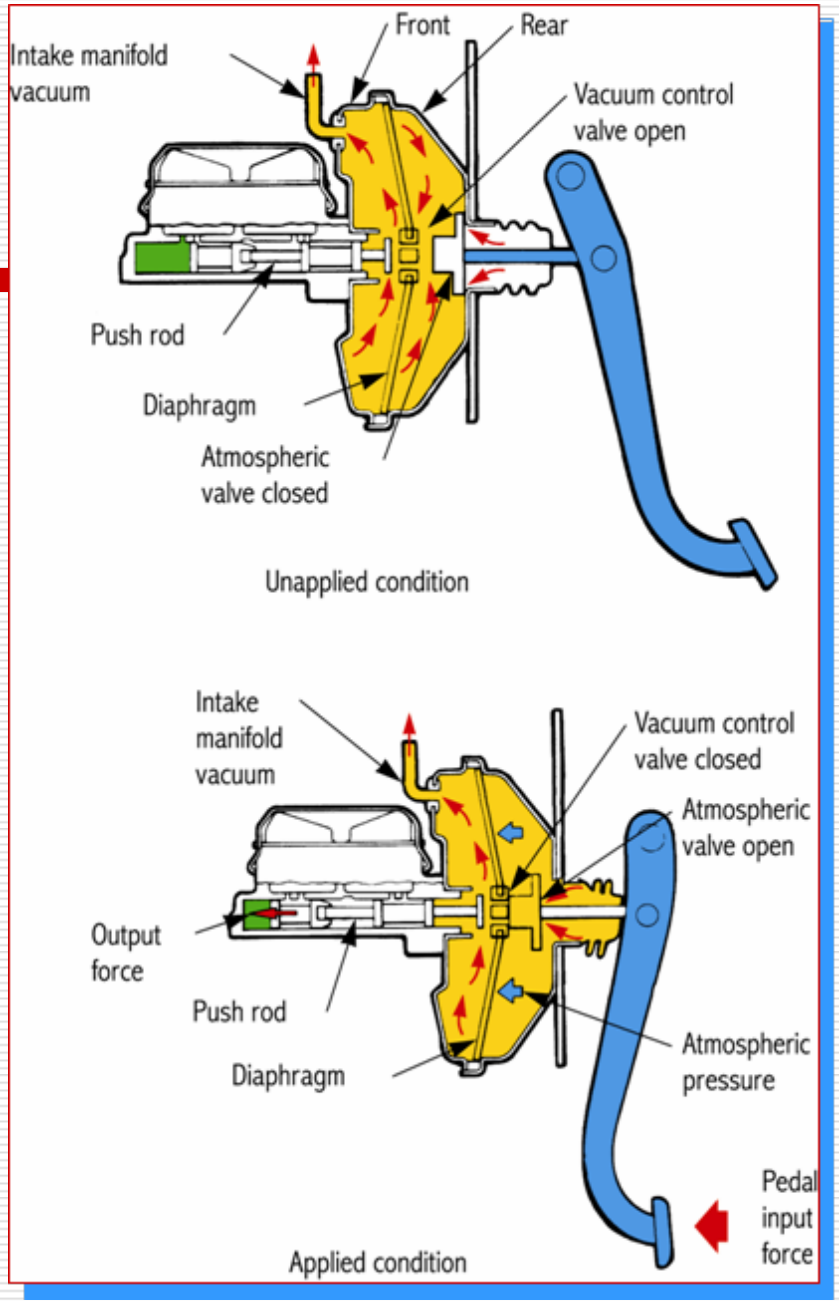


Brake Systems

- During a brake application, the **proportioning** valve modulates pressure to the rear brakes to prevent rear wheel lock-up.

- In **apply** mode, the diaphragm in a vacuum booster moves the pushrod and supplies force to the master cylinder pistons to provide brake assist.

Vacuum Booster Operation

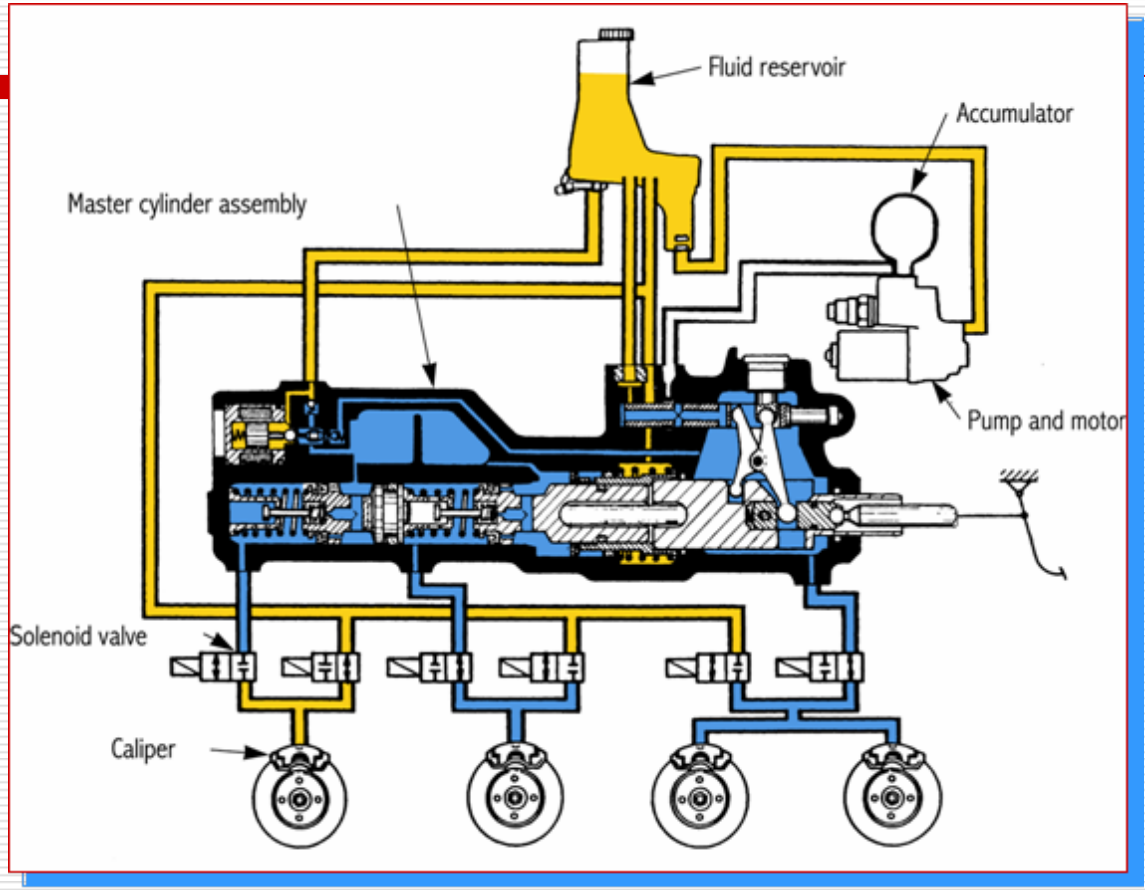


Brake Systems

- In a **four** channel ABS (antilock braking system), both front wheels are controlled individually and both rear wheels are controlled individually.

- In an ABS, the function of the **hydraulic control unit (HCU)** is to modulate the pressure to each of the wheels.

ABS Hydraulics



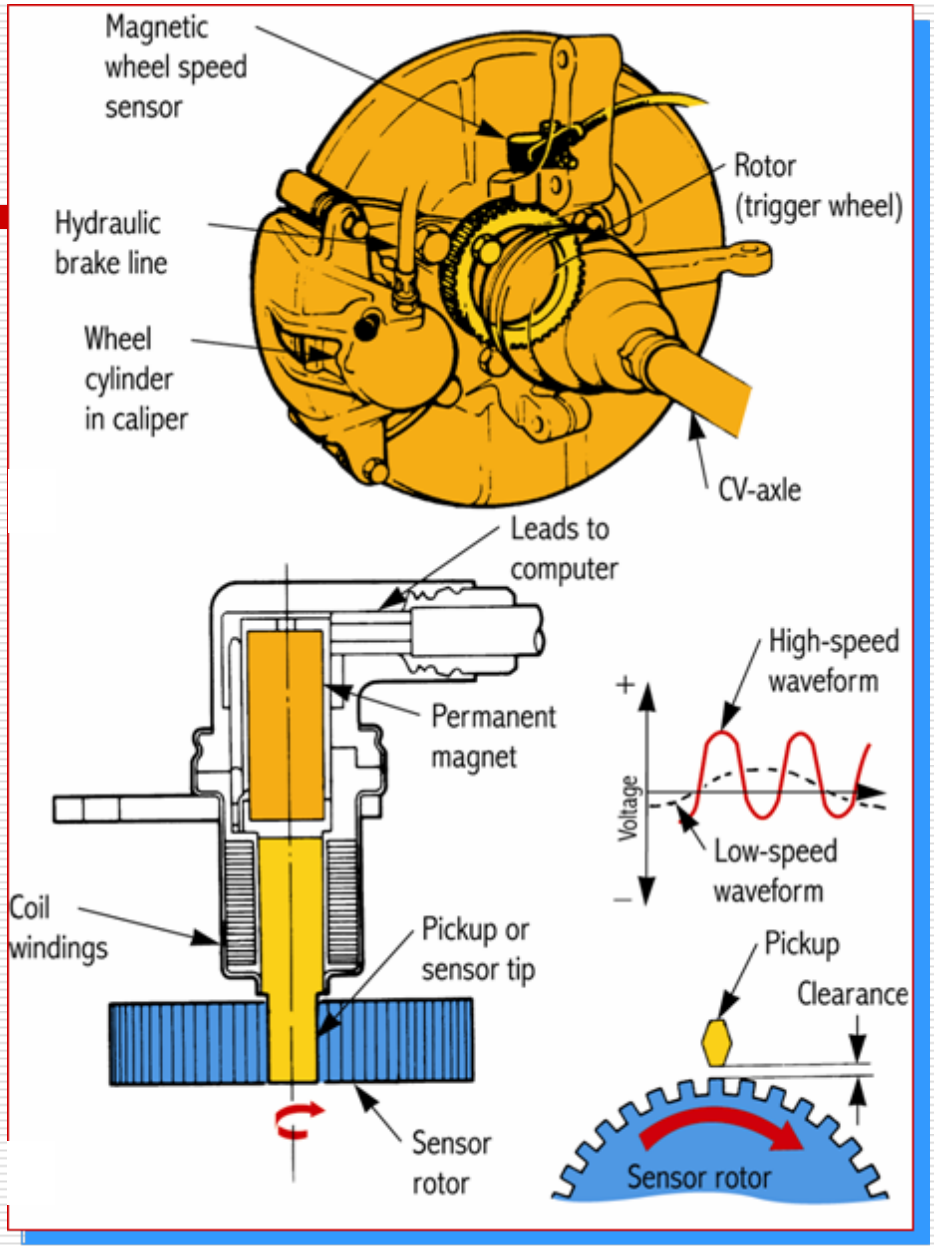
Brakes are applied, pressure is dumped from one wheel to prevent lockup

Brake Systems

- When a wheel speed sensor signal indicates wheel lock-up is about to occur, the control module energizes the **isolation** valve.

- Brake pedal **free-play** is the amount of pedal movement before the booster pushrod contacts the master cylinder piston.

Wheel Speed Sensor



Brake Systems

- If you observe a low spongy pedal and excessive pedal travel with the red brake warning light on, you can identify **air in the hydraulic system** as the most likely cause.

- If you observe premature rear wheel lockup, you can identify **a defective proportioning valve** as the most likely cause.

Brake Systems

- When you perform **reverse** bleeding, brake fluid is forced into the brake bleeders and flows through the brake system as if it were brake fluid traveling back to the master cylinder when the brakes were released.

Brake Systems

- If a brake drum taper or out-of-round exceeds 0.152 millimeters, the drum must be machined or replaced.

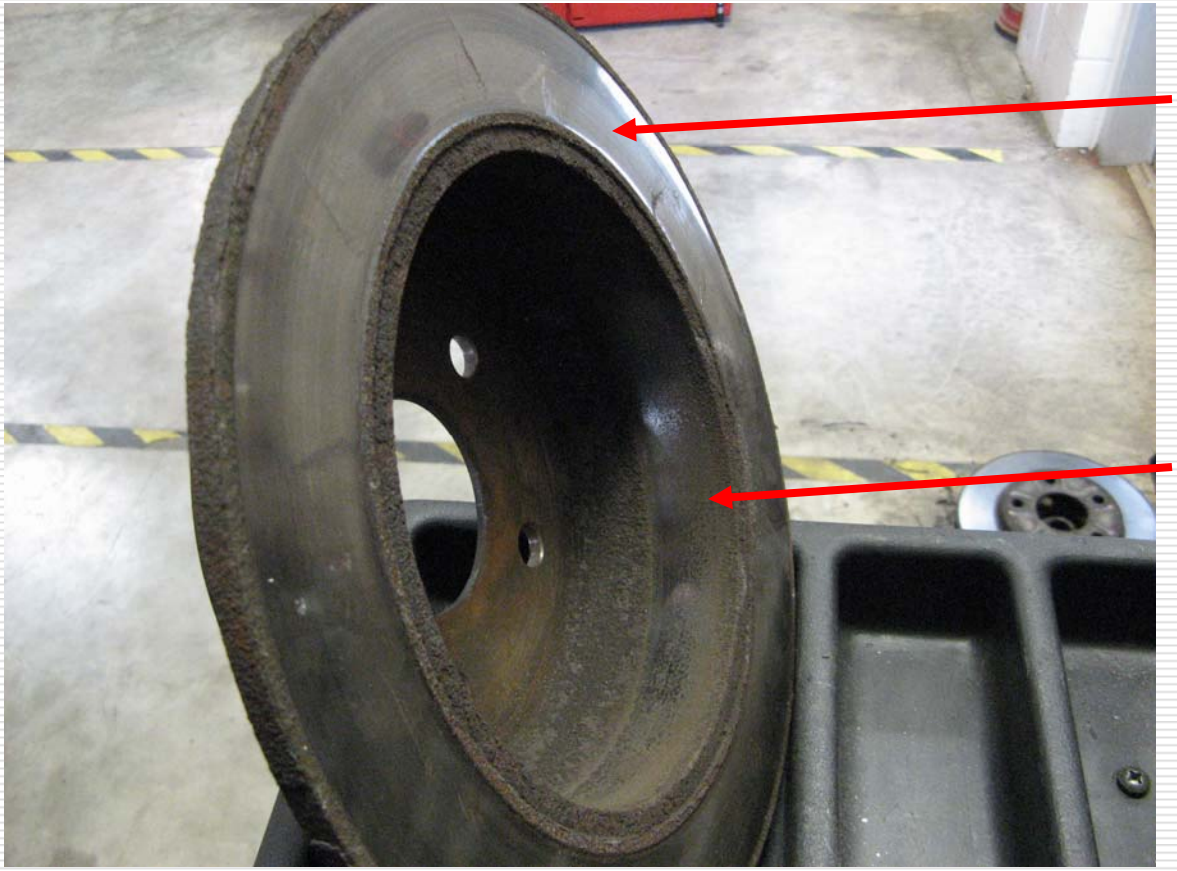
$$1\,\text{inch} = 25.40mm$$

$$0.152mm = .006$$

- The rotor discard thickness is stamped on the **rotor.**

Brake Drum Specifications

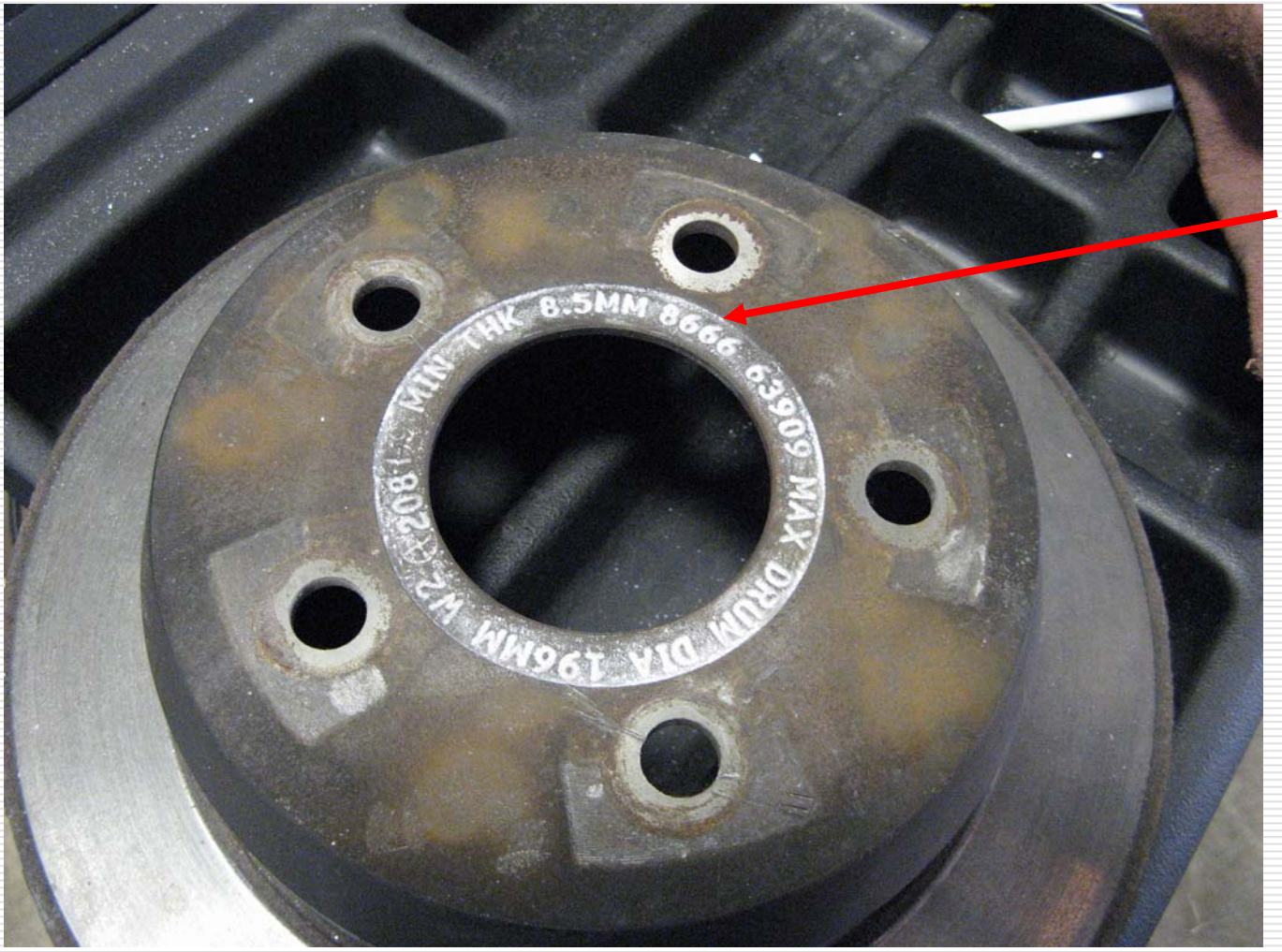
Combination Brake Rotor/Drum



Rear Disc Brake Rotor

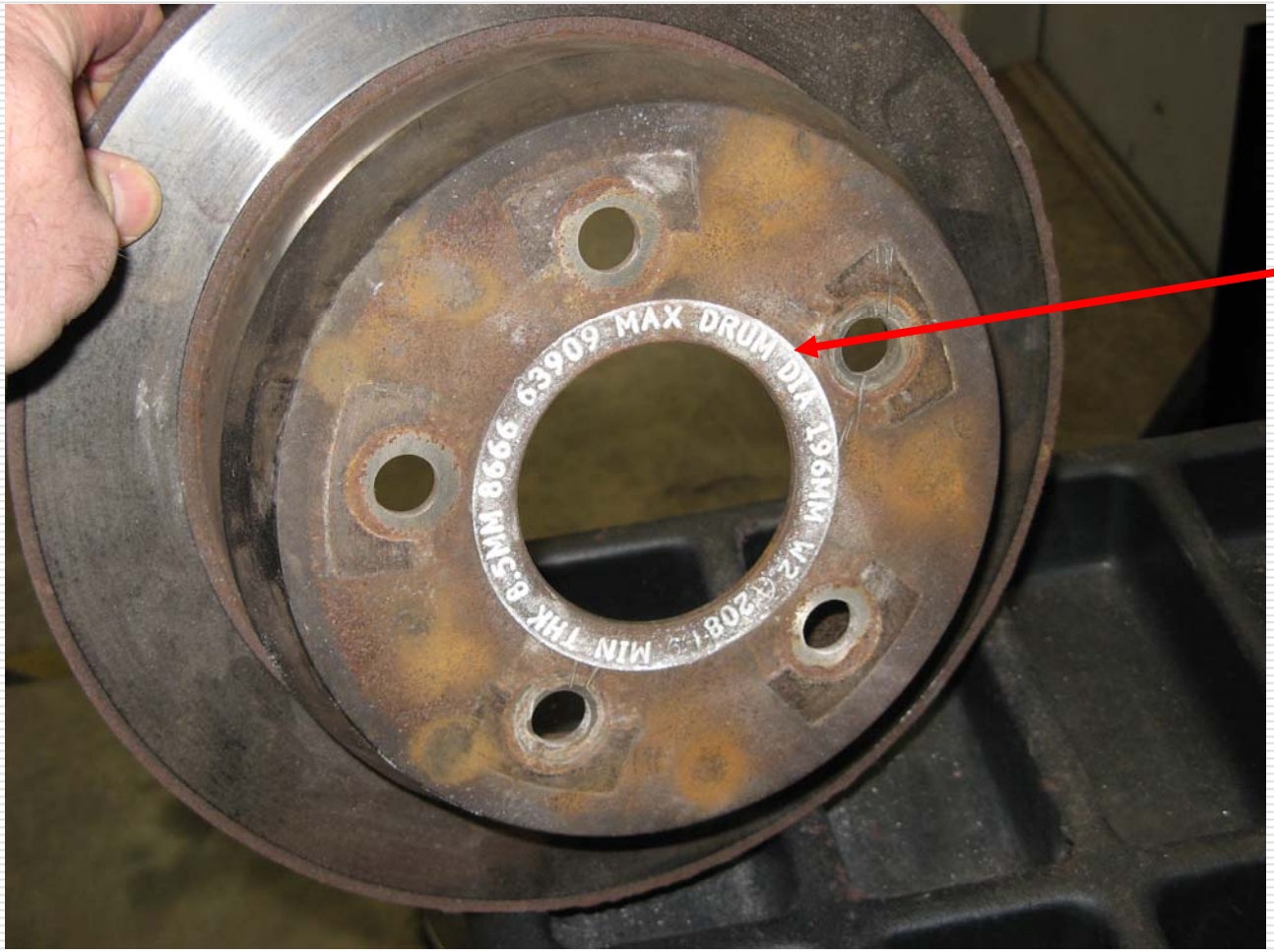
Rear “Drum” for
Parking Brake Shoes

Rotor Specifications



Minimum Thickness

Drum Specifications



"Drum" Specification

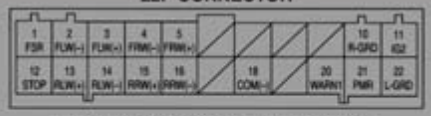
Brake Systems

- The ABS warning light should remain on for approximately **4** seconds after the engine starts.

- When diagnosing ABS on OBD 1 vehicles, connect a jumper wire between two terminals in the DLC or ABS DLC to retrieve **diagnostic trouble codes** (DCT) from the ABS computer.

Pinpoint Test Chart

22P CONNECTOR



TERMINAL SIDE OF MALE TERMINALS

22P CONNECTOR

NOTE: Standard voltage is 12 V

Terminal number	Wire color	Terminal name	Description	Signal	
1	YEL/GRN	FSR (Fail-safe relay)	Drives fail-safe relay. (Fail-safe relay is turned OFF to shut off the power source to the solenoid when problem occurs.)	ON: 12 V OFF: 0 V	
2	BRN	FLW (–) (Front-left wheel sensor, negative)	Detects left-front wheel speed. (Ground level)	No. 2 - 3 terminals	When the wheel is turned at 1 turn/second: 70 mV or above on digital tester (AC range) (Reference) 200 mVP-P or above on oscilloscope
3	GRN/BLU	FLW (+) (Front-left wheel sensor, positive)	Detects left-front wheel speed.		
4	GRN	FRW (–) (Front-right wheel sensor, negative)	Detects right-front wheel speed. (Ground level)	No. 4 - 5 terminals	
5	GRN/BLK	FRW (+) (Front-right wheel sensor, positive)	Detects right-front wheel speed.		
10	BLK	R-GND (Rear solenoid valve ground)	Ground for rear inlet and outlet solenoid valves.		
11	YEL/BLK	IG2 (IG2 power source)	Detects ignition switch IG2 signal. (When IG2 is input, +B2 power source is switched to the power source for the ABS control unit (Vcc). Also IG2 monitors P-SW and MCK lines, and drives fail-safe relay.)	ON: 12 V OFF: 0 V	
12	GRN/WHT	STOP (Foot brake)	Detects brake switch signal. (Prevents unnecessary ABS operation when the brake pedal is not depressed.	ON: 12 V OFF: 0 V	
13	LT BLU	RLW (+) (Rear-left wheel sensor, positive)	Detects left-rear wheel speed.	No. 13 - 14 terminals	When the wheel is turned at 1 turn/second: 70 mV or above on digital tester (AC range) (Reference) 200 mVP-P or above on oscilloscope
14	GRY	RLW (–) (Rear-left wheel sensor, negative)	Detects left-rear wheel speed. (Ground level)		
15	GRN/YEL	RRW (+) (Rear-right wheel sensor, positive)	Detects right-rear wheel speed.	No. 15 - 16 terminals	
16	BLU/YEL	RRW (–) (Rear-right wheel sensor, negative)	Detects right-rear wheel speed. (Ground level)		
18	BLK/ORN	COM (–) (Common negative)	Ground for ALB checker when it is connected.		
20	BLU/WHT	WARN 1 (Warning lamp)	Drives ABS indicator light. (Shuts off the indicator light ground circuit inside the ABS control unit to turn off the light when the system is normal.)	Light ON: 0 V Light OFF: 12 V	
21	YEL/RED	PMR (Pump motor relay)	Drives pump motor relay. (Pump motor relay is turned ON to drive the pump motor when P-SW OFF signal is detected.)	ON: 0 V OFF: 12 V	
22	BLK	L-GND (Logic ground)	Ground for the ABS control unit control circuits.		

Brake Systems

- The brake fluid level should be about a **1/4”** from the top of the master cylinder reservoir.

- An ohmmeter displays a lower than specified resistance for a **shorted** winding in a wheel-speed sensor.