

# LAB - Brake Inspection



Students: 1. \_\_\_\_\_  
 2. \_\_\_\_\_  
 3. \_\_\_\_\_

Fill in each box with the appropriate information.

Be sure to have the Instructor's initials before moving on to the next step. These are there to ensure everything is SAFE and CORRECT. Each team member must be able to answer questions from your instructor to receive credit for this lab.

VEHICLE IDENTIFICATION			
Year:		Make:	
Model:		Mileage:	
Lug Nut Torque:		Caliper Torque:	(F):            (R):
Min. Brake Rotor Thickness:	(F):            (R):	Max. Brake Drum Diameter:	(F):            (R):
VIN Number:			
BEFORE YOU BEGIN			
<div style="border: 2px solid black; padding: 10px; margin: 10px auto; width: 80%;"> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">CAUTION!</p> </div> <p><b>IMPROPER USE OF THE HOIST or JACK STANDS CAN BE FATAL!</b></p> <p><b>CORRECT SETUP IS CRITICAL FOR YOUR SAFETY AND THE SAFETY OF OTHERS!</b></p> <p><b>GET YOUR INSTRUCTOR TO HELP!</b></p>		<div style="border: 2px solid black; padding: 10px; margin: 10px auto; width: 80%;"> <p style="text-align: center; font-weight: bold; font-size: 1.2em;">CAUTION!</p> </div> <p><b>Brake dust may contain ASBESTOS: a very fine, cancerous particle that NEVER leaves your body. Make extra effort to ensure the brake dust does not become airborne.</b></p> <p><b>NO FINGERPRINTS on Brake Rotors or Brake Pads</b></p>	
EMERGENCY BRAKE			
<p><b>THE EMERGENCY BRAKE</b></p> <p>All vehicles are required to have a mechanically-operated Emergency Brake that will apply the brakes, should the hydraulic system fail.</p> <p>While most people with Automatic Transmissions never use the E-Brake, they should!! If the E-Brake is not used, it usually seizes and then either never works, or once applied never comes off.</p> <p>Most E-Brakes also self-adjust drum brakes when they are used. <b>USE YOUR E-BRAKE REGULARLY!</b></p>			

Back when I was a mechanic, some clown lost control of their car in the parkinglot and destroyed my parked car.

They claimed they shouldn't have to pay for the repairs to my vehicle, because they had "forgotten to release the parking brake."

The judge did not agree.

## TEST #1: EMERGENCY BRAKE SYSTEM

- Apply the Emergency Brake
- Try to drive away just normal or gently

### ✓ FINDINGS (check):

\_\_\_\_\_ Vehicle does not move  
*(This is normal)*

\_\_\_\_\_ Vehicle drives with little or no difficulty  
*(Indicates a faulty E-Brake System - 90% of the time it is poorly adjusted drum brakes. Next likely is seized E-Brake cables)*

**STOP!!!**

**INSTRUCTOR'S INITIALS:**

**TESTING**

This is an easy test you can do when you're looking at a vehicle to buy

The Brake System has two parts - a hydraulic component to transfer your braking foot force to each wheel, and a mechanical component to apply the friction material against the rotors.

## THE HYDRAULIC SYSTEM

### TEST #2: BRAKE PEDAL FEEL

- Step on the brake pedal ONCE with "normal" effort.

**Do this with the engine running**

**DO NOT WEAR COVERALLS IN THE VEHICLE!**

### ✓ FINDINGS (check):

\_\_\_\_\_ The brake pedal travels only a couple inches and is firm  
*(This is normal)*

\_\_\_\_\_ The brake pedal travels excessively, but is firm  
*(Indicates poorly adjusted drum brakes - easy fix)*

\_\_\_\_\_ The brake pedal travels excessively, but is mushy  
*(Indicates air bubbles in the brake fluid, fluid must be bled - easy fix)*

This is an easy test you can do when you're looking at a vehicle to buy

The rubber "cup seals" don't flex well as they age, and instead of creating pressure...

...they slip THROUGH the fluid, and the pedal is on the floor and the car is moving!

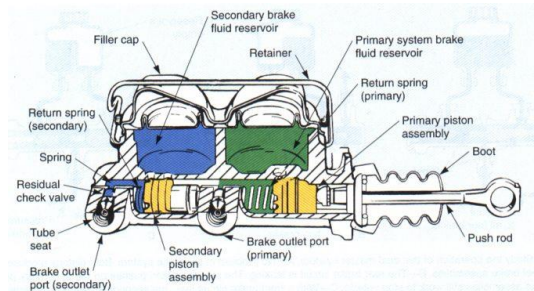
### TEST #3: MASTER CYLINDER OPERATION

- The Master Cylinder converts the Brake Pedal force to hydraulic pressure. It is kind of like a Syringe - it has a moveable pistons inside a cylinder
- Step on the brake pedal LIGHTLY, maintaining LIGHT pressure

#### ✓ FINDINGS (check):

\_\_\_\_\_ The brake pedal doesn't move (*This is normal*)

\_\_\_\_\_ The brake pedal slowly sinks to the floor (*Indicates the seals inside the master cylinder are leaking internally*)



**STOP!**

**INSTRUCTOR'S INITIALS:**

## BRAKE FLUID

Brake fluid is a hydraulic fluid.

It is **HYGROSCOPIC** - it absorbs moisture out of the air, which would then boil under heavy braking, creating air in the system and a spongy pedal.

Moisture can also cause the brake components to rust together. Because of this, brake fluid should be **CHANGED EVERY TWO YEARS MINIMUM** (race car guys change their fluid EVERY race).



*It is also a fantastic paint stripper - so NEVER let any get on the paint of the car, WASH IT OFF IMMEDIATELY!*

It is also **VERY BITTER TASTING**. If you have a leak and you don't know what it is, old-school mechanics would taste it. If it's bitter, it's brake fluid.

*(Brake fluid is poisonous – don't taste it)*

Back when I was a mechanic, I tasted:

- Antifreeze
- Brake Fluid
- Engine Oil
- Fuel Treatment
- Gear oil
- Grease
- Trans Fluid
- Never-Seize

I can't imagine where all my short-term memory problems are coming from....

STREAKS OF RUST indicate the rear seal of the Master is leaking.

A bad master cylinder seal requires either a rebuild, or replacement.

#### TEST #4: MASTER CYLINDER & FLUID RESERVOIR LEAKS

- Inspect the back of the master cylinder for leaks
- Inspect the line fittings for leaks



#### ✓ FINDINGS (check)

\_\_\_\_\_ No leaks  
*(This is normal. Duh)*

\_\_\_\_\_ Leaks at fittings  
*(Could be loose - try snugging them up. Otherwise it's likely a damaged fitting)*

\_\_\_\_\_ Leaks at back, dripping down brake booster  
*(Indicates bad Master Cylinder Seal)*

#### TEST #5: BRAKE FLUID

- OPEN the reservoir lid
- Note the colour of the fluid
- Run your finger along the bottom of reservoir (yes, in the fluid) to check the level of crud at bottom



#### ✓ FINDINGS (check)

\_\_\_\_\_ Fluid is fairly clear or only slightly coloured  
*(This is normal)*

\_\_\_\_\_ Fluid is very dark  
*(Needs changing)*

\_\_\_\_\_ No crud in bottom of reservoir  
*(This is normal)*

\_\_\_\_\_ Heavy crud in bottom of reservoir  
*(Imagine how much crud is down at the wheels?? Ewww! Needs changing)*

Brake fluid is  
**HYGROSCOPIC**

(ABSORBS  
moisture)

Moisture  
**RUSTS**

Moisture  
**BOILS**, which  
turns into **AIR**,  
which makes  
the pedal  
**MUSHY**

### TEST #6: BRAKE FLUID MOISTURE

- OPEN the reservoir lid
- Place the probe of the Brake Fluid Tester into the fluid enough to contact the two silver sensors.
- Push the button.
- What colour lit up?



\_\_\_\_\_ Green (*Good!*)

\_\_\_\_\_ Yellow (*Consider doing a Brake Bleeding Lab*)

\_\_\_\_\_ Red (*Pick up some brake fluid today, and bleed the brakes next day*)

**STOP!**

**INSTRUCTOR'S INITIALS:**

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### RAISING THE VEHICLE

2



Jack Stands



2-Post



4-Post

- Raise and support the vehicle properly – see you instructor if you are unsure
- NOTE: You will be removing some wheels – "still on the ground" is a good time to crack wheel nuts loose.**

#### Jack Stands:

Raise the vehicle with jack in correct place

ALWAYS use jack stands in correct place



#### 2-Post Hoists:

Position and LOCK arms, get me to check, raise car slightly, check stability, continue raising, rest on locks.



#### 4-Post Hoists:

In Gear/Park, E-Brake on, wheel chocks, raise, and then rest on locks.



5

You may now remove a front and rear wheel from **ONE** side of the vehicle

The **FRONT** is likely **DISC** brakes  
Does the **REAR** have **DRUM** brakes?

Y / N
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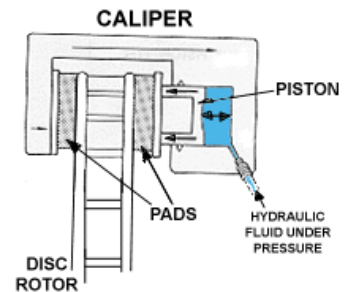
*Let's look at **DISC BRAKES** first:*

## **BRAKE CALIPERS**

Brake calipers convert the hydraulic pressure created by the Master Cylinder into **FORCE** to squeeze Brake **PADS** against a Brake Rotor, much like the hand brakes on your bicycle.

### **FLOATING CALIPERS**

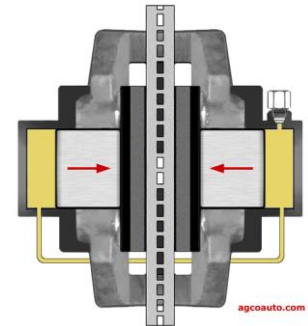
The cheaper brakes have one piston, and the caliper itself **FLOATS** on pins. Brake fluid pushes the Caliper Piston and Brake Pad towards one side of the rotor, **AND** the fluid pushes the caliper in the opposite direction, to apply the other Brake Pad



**NOTE: the PISTON and the CALIPER must move.**

### **FIXED CALIPERS**

The more expensive brakes have a piston on either side of the caliper, and the caliper itself is **FIXED**.



### **TEST #7: CALIPER PISTONS & SLIDERS**

- Rotate the brake rotor by hand
- Wiggle the caliper and see if it can move (it's ok to be forceful)

#### ✓ **FINDINGS (check)**

\_\_\_\_\_ Brake rotor turns

*(This is normal)*

\_\_\_\_\_ Brake rotor does not turn or takes unusual effort)

*(Did you leave it in gear? May indicate seized piston(s) and/or seized sliders)*

# BRAKE PADS

Brake pads may contain **ASBESTOS**, which is cancerous and never leaves the body. **TRY NOT TO GET ANY BRAKE DUST AIRBORN!**

Brake pads are consumable and do not last forever. They can be made from a variety of materials, with a balance of GRIP versus LIFE. Really grippy brakes do not last long. Long life pads may not grip, or may eat the rotor instead. There is nothing for free.

## TIP

*I gently wash the brake dust off the brakes with a garden hose.*

*The dust tends to stay in the water and out of the air.*

## TEST #8: BRAKE PADS

- Remove the Brake Caliper and **HANG BY A WIRE** off the frame or suspension **NEVER BY THE BRAKE LINE**
- Remove and inspect the brake pads



## ✓ FINDINGS (check)

\_\_\_\_\_ Friction materials is **GLUED** to the backing plate  
*(This is normal)*

\_\_\_\_\_ Friction material is **RIVETED** to the backing plate  
*(This is normal)*

Remaining Friction Material Thickness (mm): \_\_\_\_\_

Brake pads are usually worn out when the friction material is about as thick as the plate it is glued or riveted to.

Is the friction material the same thickness as the backing plate? [YES] [NO]

**RETURN  
THE WIRE  
TO THE  
TOOL  
ROOM!!!**

**DO NOT  
LEAVE ON  
THE  
VEHICLE!!!**

**THAT'S  
DUMB!!!**

**STOP!**

**INSTRUCTOR'S INITIALS:**

# BRAKE ROTORS

Brake rotors need to be strong, and they must be able to dissipate heat.

They are also, to a certain extent, consumable.



They may attach by SLIPPING onto the hub (slides right off the wheel studs)



Or they may BOLT onto the hub (often bolted behind the hub)



Or they may be ONE PIECE with the hub (requires undoing the wheel bearing)

How are your Brake Rotors attached?

If rotors cannot get rid of the heat, they warp ("vibration" in pedal and/or steering wheel).

If they are TOO THIN, they will either WARP, or BREAK!

Rotors may be SOLID or VENTED. They become thinner and thinner as they wear. The rotor on the right above is vented – see the slots, or vents?

Are your rotors SOLID or VENTED?

\_\_\_\_\_

What is the MINIMUM thickness of the Brake Rotors? (Usually cast into the rotor, else Google it) \_\_\_\_\_ (in. or mm)

What is the EXISTING thickness of your brake rotors? (measure with a micrometer or dial caliper) \_\_\_\_\_ (in. or mm)

**STOP!**

**INSTRUCTOR'S INITIALS:**

**SAFETY STOP!!!!**

Spray the Brake Pads and the Rotor Friction Surface with Brake Clean to remove ALL FINGER PRINTS (oil on brakes is bad, mm'kay?)

Replace the Brake Pads & Calipers on the vehicle.

**YOU MUST** have this inspected **BEFORE** you put the wheels on.



**STOP STOP STOP!**

**INSTRUCTOR'S INITIALS:**



# If you have REAR DISC BRAKES, DO THIS PAGE Otherwise, skip ahead to *THE NEXT SECTION*

## REAR DISC PARKING BRAKE

All vehicles must have a parking brake. I have always seen it in the rear brakes.

If you have REAR DRUM BRAKES, the parking brake operates the existing Brake Shoes.

If you have REAR DISC BRAKES, the parking brake is applied in one of two ways:

- By mechanically applying the caliper pistons
- OR**
- By mechanically applying a mini drum brake inside the "hat" of the rotor.

Inspect the Rear Disc Brakes just like you did for the front brakes.

Minimum Allowed Rotor Thickness: \_\_\_\_\_

Measured Rotor Thickness: \_\_\_\_\_

Remaining Friction Material Thickness: \_\_\_\_\_

Friction Material is as thin as the backing plate? [YES] [NO]

If the Parking Brake cable goes into the back of the Caliper, it MOVES THE PISTON to apply the parking brake. The lever should move.



If the Parking Brake cable goes into a small backing plate inside the "hat" of the rotor, it has a MINI DRUM BRAKE as the parking brake. In this case, remove the rotor and have a look inside. The shoes should have friction material on them, and everything should NOT be rusted solid.

What did you find?

# THE NEXT SECTION

## BRAKE DRUMS

Brake drums are usually held on in two ways:

	
<p><b>Slip onto Hub</b> Once wheel is removed, brake drum slips off wheel studs and hub</p>	<p><b>One-Piece with Hub</b> Wheel bearing retaining nut must be removed, and entire hub/drum slid off spindle.</p>

How are your Brake Drums attached?

Brake Drums need to be strong, and they must be able to dissipate heat.

Drums may be FINNED (for extra cooling). They become thinner and thinner as they wear. If they cannot dissipate enough heat, they usually warp ("vibration" in pedal and/or steering wheel). If they are TOO THIN, they will either WARP, or BREAK.

**REMOVE YOUR BRAKE DRUMS - SEE YOUR INSTRUCTOR FOR TIPS & HELP**

Use a Brake Drum Micrometer to measure the INSIDE DIAMETER of the brake drum

What is the MAXIMUM allowable diameter of the Brake Drums?  
(Usually cast into the drum, or Google it) \_\_\_\_\_ (in. or mm)

What is the EXISTING diameter of your Brake Drums? \_\_\_\_\_ (in. or mm)

## TEST #9: BRAKE DRUM

- Inspect the friction surface inside
- Inspect the casting inside and outside

### TIP

*I gently wash the brake dust off the brakes with a garden hose.*

*The dust tends to stay in the water and out of the air.*

### ✓ FINDINGS (check)

\_\_\_\_\_ Smooth and solid

*(This is normal)*

\_\_\_\_\_ Gouges, grooves or cracks in friction surface

*(Indicates severe wear)*

\_\_\_\_\_ Blue discolouration or heat-checks

*(indicates severe overheating - may be abuse, overloaded, or seized wheel cylinder, or e-brake left on whilst driving)*

\_\_\_\_\_ Entire brake system is coated with wet, black, fibrous yuck all over everything

*(Indicates severely leaking wheel cylinder or axle seal – REQUIRES FIX NOW!)*

## STOP!

## INSTRUCTOR'S INITIALS:

6

Ever follow a big rig down a steep hill?

That's the smell of BRAKES COOKING

## BRAKE SHOES

Brake shoes may contain **ASBESTOS**, which is cancerous and never leaves the body. **TRY NOT TO GET ANY BRAKE DUST AIRBORN!**

Brake Shoes are consumable and do not last forever. They can be made from a variety of materials, with a balance of GRIP versus LIFE. Really grippy brakes do not last long. Long life shoes may not grip, or may eat the drum instead. There is nothing for free.


Brake Shoes are usually worn out when the friction material is about as thick as the plate it is glued or riveted to.



<b>Either/Or NOT Both!</b>	<b>TEST #9: BRAKE SHOES</b> <ul style="list-style-type: none"> <li>Inspect the brake pads thickness, note distance to rivets (if applicable)</li> </ul>
	<b>✓ FINDINGS (check)</b> <input type="checkbox"/> Friction materials is <b>GLUED</b> to the backing plate (This is normal) <input type="checkbox"/> Friction material is <b>RIVETED</b> to the backing plate (This is normal)

Remaining Friction Material Thickness (in mm): \_\_\_\_\_

<b>STOP!</b>	<b>INSTRUCTOR'S INITIALS:</b>	
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<b>5</b>	<p style="text-align: center;"><b>WHEEL CYLINDER</b></p> <p>The Wheel Cylinder is a hydraulic cylinder where hydraulic fluid enters the center, pushing pistons out at either end. The piston seals can wear, causing <b>LEAKS</b>. Moisture in the brake fluid can cause corrosion, and <b>RUST</b> the wheel cylinder solid.</p> <div style="text-align: right;">  </div>
<b>Leaking Brake Fluid WILL DESTROY your friction material!</b>	<p><b>TEST #8: WHEEL CYLINDERS</b></p> <ul style="list-style-type: none"> <li>Gently peel back just a bit of the rubber Dust Seal to check for leaks</li> <li>Smack one brake shoe with your hand, so force transfers <b>THROUGH</b> the wheel cylinder to move the <i>other</i> brake shoe</li> </ul> <p><b>✓ FINDINGS (check)</b></p> <input type="checkbox"/> No brake fluid leaks out <i>(This is normal)</i> <input type="checkbox"/> Brake fluid leaks out <i>(Indicates worn wheel cylinder seals – should be rebuilt or replaced)</i> <input type="checkbox"/> Force travels through the wheel cylinder; other brake shoe moves <i>(This is normal)</i> <input type="checkbox"/> Force does not travel through <i>(May indicate a seized wheel cylinder, or normal for non-self-energizing brakes – talk to your Instructor)</i>

<b>STOP!</b>	<b>INSTRUCTOR'S INITIALS:</b>	
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**Chlorinated  
Brake  
Cleaner turns  
into  
PHOSGENE  
GAS when  
burned -  
even through  
a cigarette!**

**PHOSGENE  
is FATALLY  
TOXIC  
It can kill  
you dead.**



Phosgene

Spray the Brake Shoes and the Drum Friction Surface with Brake Clean to remove ALL FINGER PRINTS (oil on brakes is bad, mmkay?)



Replace the drums on the vehicle.

**NOTE:**

For Drums that are one-piece with the hub, there are certain procedures that must be followed:

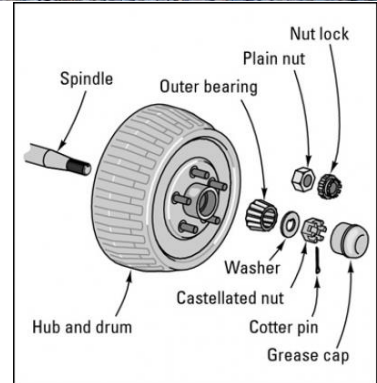
Some hubs are secured by a highly-torqued lock-nut.

- Torqued to the correct specification with a **TORQUE-WRENCH**
- Re-stake the locknut (if designed so).



Some hubs are secured by a hand-tight castellated nut and cotterpin.

- Tighten the nut very tightly with a wrench whilst rotating the drum (this seats the bearings)
- Back off the nut
- Re-tighten the nut as tight as you can with your **FINGERS ONLY**
- Install stamped sheet metal nut and a **NEW** cotterpin
- Yes, your entire wheel AND brake is held on by one nut done up finger-tight.



**STOP! STOP! STOP! INSTRUCTOR'S INITIALS:**

**STOP STOP  
STOP STOP**

Replace the wheels, TORQUED in a criss-cross pattern to SPECIFICATION and GET ME TO CHECK!!!



**FINAL  
INITIALS:**

What was the most fascinating part of this lab for you?

