Automotive Brake Systems

Brake System Diagnosis and Service

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Automotive Brake Systems

Brake System Inspection

- Road test
- Hydraulic system
  - Leaks
  - Fluid condition
- Disc brakes
  - Rotors and pads
- Drum brakes
  - Drums and linings
- Parking brake

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Road Test

- Brake fluid level
- Brake lamp operation
- Antilock lamp operation
- Pedal feel and travel
- Power assist operation
- Brake pull
- Brake vibration
- Excessive brake noise
- Parking brake operation

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Brake Pedal Reserve

- Check for proper pedal operation
- The pedal should feel firm not spongy
- Low pedal could indicate a leak or improper brake adjustment
- Some vehicles have specific brake pedal free height and travel specifications

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Hydraulic System Inspection

- Inspect the brake fluid level and condition
- A low brake pedal or red brake lamp could indicate a hydraulic system failure
- Check for evidence of external brake fluid leaks

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Brake Lines

- Never attempt to repair a damaged brake line
- Brake lines are made from steel tubing
  - Double flare
  - ISO flare
  - Allow 1/8" of additional length for each flare
- Always use line wrenches when working with brake line fittings

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Brake Hoses

- Brake hoses are designed to handle the high hydraulic pressures of braking
- Never attempt to repair a brake hose
- Always use line wrenches when working with brake hose fittings
- Be certain not to twist the hose during installation
- Do not reuse the copper washers

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Common Brake Service Tools

- Caliper socket set
- Brake shoe hold down spring tool
- Return spring tool
- Bleeder wrenches
  - Metric vs. Standard
- Caliper piston compression tool

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Disc Brakes Inspection

- Inspect caliper assemblies for leakage
- Check pads for contamination and wear
- Check rotors for excessive run out and excessive parallelism variance

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Brake Rotor Inspection

- Brake rotors should be checked for:
  - Lateral run out
  - Parallelism
  - Excessive scoring
  - Hot spots or heat checking
  - Minimum thickness

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Replacing Brake Pads

- Remove excessive brake fluid
- Remove and inspect the caliper assembly
- Service the rotor as required
- Retract the piston
- Install new pads
- Check and lubricate caliper mounting pins

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Caliper Service

- Calipers should be serviced if leakage is present or the piston is binding
- Overhaul kits include the piston seal and dust boot
- The caliper's bore may be cleaned with crocus cloth or a hone
- Components should be cleaned with alcohol
- Components may be lubricated with brake fluid or brake assembly lube

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Servicing Wheel Bearings

- Remove the dust cap, cotter pin, nut, rotor, bearings and grease seal
- Clean and inspect the bearings and races
- Pack the bearings with a long soap fiber grease
- Reassemble and adjust the bearings as per manufacturer specifications

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Drum Brake Inspection

- Inspect the wheel cylinder
- Inspect linings for wear and contamination
- Inspect springs and hardware
- Inspect and measure brake drum

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Brake Drum Inspection

- Brake drums should be checked for:
  - Excessive wear
  - Scoring
  - Barrel shaped
  - Out of round
  - Bell mouthed wear
  - Tapered wear
  - Hot spots or cracking

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Servicing Drum Brakes

- Clean and inspect all installation hardware
- Replace contaminated linings or excessively worn linings
- Lubricate the backing plate, anchor posts and self adjuster as appropriate during assembly
- Pre-adjust the shoes

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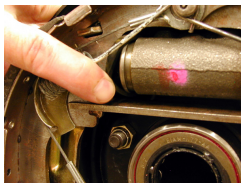
Wheel Cylinder Service

- Wheel cylinders should be serviced if leakage is present
- Check for frozen bleeder screws before attempting service
- Overhaul kits include the cup seals and dust boots
- Check the service manual for information on honing
- Components should be cleaned with alcohol
- Components may be lubricated with brake fluid or brake assembly lube



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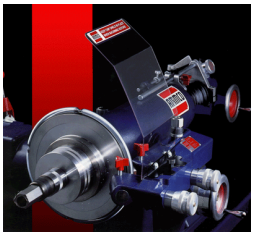
Machining Drums and Rotors

- Brake lathes are used to restore original surface finish and tolerances
- Drums and rotors are mounted on the brake lathe with bearing race or hub flange adapters
- Follow equipment the manufacturer's instructions
- Always use the appropriate anti-chatter belt or pad



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Brake Machining Practices

- Remove the least amount of metal possible to achieve the proper finish
- Never turn the drum or rotor on one side of the vehicle without turning the other side
- Rotors should be within 0.002 inch to 0.003 inch side to side
- Drum diameters should be within 0.005 inch of each other

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On Car Brake Lathe

- Allows rotor machining on the vehicle spindle center line which is the axis of rotation for the rotor
- Eliminates the stack-up tolerance of related parts from affecting rotor lateral run out
- Bench units machine rotors to the center line of the lathe's spindle

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Bleeding Brakes

- Brakes are bled to remove air and contaminated brake fluid
  - Manual bleeding
  - Pressure bleeding
  - Vacuum bleeding
- Brake systems must be bled in the proper order
- Always use six point sockets or wrenches on bleeder screws

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Bleeding and Flushing Brakes

- The brake's hydraulic system should be flushed and bled anytime major brake work is performed or contamination is suspected
- Brake fluid can be checked for moisture galvanic reaction with a DVOM
  - Hook a voltmeter between the brake fluid and a brake line
  - Voltage should not exceed 0.3 volts

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Parking Brake Adjustment

- Parking brake operation should be checked after any brake service is performed
- Parking brakes are commonly adjusted at at one of two places
  - The parking brake pedal or handle
  - Under the car

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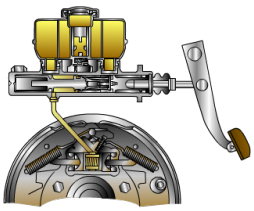
Air Entrapment Test

- Pump the brakes rapidly 20 times and hold the brake pedal depressed
- Observe the fluid reservoir when the pedal is released
- A geyser or squirt in either reservoir indicates air is trapped in the system



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Master Cylinder By-Pass Test

- Press the brake pedal all the way down one stroke
- If the fluid rises as the pedal is depressed and falls when the pedal is released the master cylinder is leaking internally
- As a further check hold the brake pedal down firmly for two minutes
- If the brake pedal continues to move down over time it may also indicate an internal master cylinder leak

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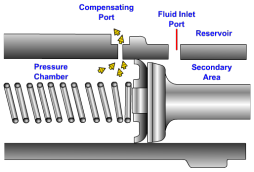
Compensator Port Test

- A small squirt geyser should appear in both reservoirs while depressing the brake pedal
- If no geysers are present the master cylinder cup seals may be covering the compensating ports
- This may cause the brakes to lock up



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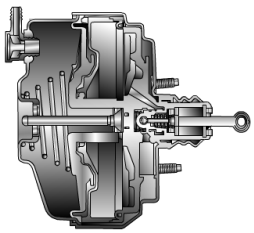
Power Brake Function Test

- With the engine off pump the brake pedal several times to exhaust vacuum
- Depress the brake pedal with approximately 15 pounds of force
- Start the engine
- The brake pedal should move down



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Brake Pedal Pulsation

- Check for damaged wheel bearings
- Check for proper tire balance and tread wear
- Inspect the rotors/drums for cracks, scoring and heat checks
- Inspect for damaged/contaminated brake pads/shoes
- Inspect the caliper slides or pins for corrosion and/or poor lubrication
- Check for rotor runout and rotor parallelism
- Check for drum concentricity
- Turn the rotors/drums if necessary

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Brake Pull

- Check tire pressure
- Inspect steering and suspension system
- Inspect the brake pads
- Inspect rotors
- Check for seized calipers
- Check for equal hydraulic pressure at front calipers
- Check wheel bearing preload

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Brake Light Stays On

- Make sure that the parking brake is fully released
- Check the fluid level in the master cylinder reservoir
- Check for external leaks
- Check for internal master cylinder leaks
- Check for a shorted brake warning indicator circuit or a faulty switch

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Poor Brake Pedal Return

- Check the brake pedal bushings and linkage
- Unbolt the master cylinder from the brake booster, depress the brake pedal and release it
  - If the brake pedal does not return to its original position, replace the power booster
  - If the brake pedal now returns to its original position, replace the master cylinder

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Low or Spongy Brake Pedal

- Low brake fluid level
- External brake system leaks
- Internal master cylinder failure
- Air in the hydraulic system
- Improperly adjusted rear drum brakes

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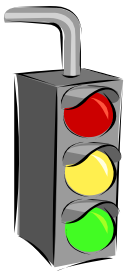
Brakes Locking Up

- Contaminated brake linings
- Defective proportioning valve
- Compensating ports not uncovered with brake pedal fully released



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Excessive Pedal Effort

- Inspect for binding and wear at the brake pedal bushing
- Check brake booster operation
- Check for proper vacuum signal to booster
- Insect vacuum brake booster check valve for proper operation
- Check brake pressure control valve for contamination

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Brakes Drag

- Drum brakes
  - Improperly adjusted brakes
  - Sticking wheel cylinders
  - Damaged of improperly installed springs or hardware
  - Improperly adjusted parking brake
- Disc brakes
  - Sticking caliper
  - Binding caliper pins or slides
  - Misadjusted paring brake
- Power booster push rod alignment and adjustment

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Brake Noise

- Brake noise is more noticeable when the brakes are cold, but some noise may be heard anytime while braking
  - Semi metallic brake linings extend brake pad life but are may exhibit additional noise during braking
- Abnormal brake noise may be caused by:
  - Excessively worn brake linings
  - Substandard brake linings
  - Improper rotor finish
  - Improper drum brake hardware installation