Brake System - General Information - Brake System

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Diagnosis and Testing

General Equipment

Ford diagnostic equipment

Principles of Operation

The brake system operates by transferring effort applied to the brake pedal by the driver to the brakes at each wheel.

The braking effort is distributed to each wheel, using an hydraulic system. The system is assisted using a vacuum brake booster that reduces pedal effort and increases hydraulic pressure. The parking brake operates on the rear wheels and is applied using a hand operated control.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

VISUAL INSPECTION CHART

Mechanical
• Tire pressure • Wheels and tires • Fluid leak from brake line(s) • Fluid level • Fluid contamination

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Road Test

Carry out a road test to compare actual vehicle braking performance with the performance standards expected by the driver. The ability of the test driver to make valid comparison and detect performance deficiencies will depend on experience.

The driver should have a thorough knowledge of brake system operation and accepted general performance guidelines to make good comparisons and detect performance concerns.

An experienced brake technician will always establish a route that will be used for all brake diagnosis road tests. The roads selected will be reasonably smooth and level. Gravel or bumpy roads are not suitable because the surface does not allow the tires to grip the road equally. Crowned roads should be avoided because of the large amount of weight shifted to the low set of wheels on this type of road. Once the route is established and consistently used, the road surface variable can be eliminated from the test results.

Before a road test, obtain a complete description of the customer concerns or suspected condition. From the description, the technician's experience will allow the technician to match possible causes with symptoms. Certain components will be tagged as possible suspects while other will be eliminated by the evidence. More importantly, the customer description can reveal unsafe conditions which should be checked or corrected before the road test. The description will also help form the basic approach to the road test by narrowing the concern to specific components, vehicle speed or conditions.

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Begin the road test with a general brake performance check. Keeping the description of the concern in mind, test the brakes at different vehicle speeds using both light and heavy pedal pressure. To determine if the concern is in the front or rear braking system, use the brake pedal and then use the parking brake control. If the condition (pull, vibration, isolation) occurs only with the parking brake, the concern is in the rear brake system.

Avoid locking the brakes and sliding the tires. Locked brakes and sliding tires do not indicate brake efficiency. A heavily braked and turning wheel will stop the vehicle in a shorter distance than locked brakes.

If the concern becomes evident during this check, verify it fits the description given before the road test. If the concern is not evident, attempt to duplicate the condition using the information from the description.

If a concern exists, use the Symptom Chart in order to isolate it to a specific sub-system and condition description. From this description, a list of possible sources can be used to further narrow the cause to a specific component or condition.

Symptom Chart

The following table provides all the possible symptoms and sources related to the Brake System. For the actual diagnosis, proceed to use the Ford diagnostic equipment.

Symptoms	Possible Sources
Brakes pull or drift	Wheel alignment angles
	Brake pads
	Brake disc
	Brake caliper
The red brake warning indicator is always on	Brake fluid level sensor
	Parking brake control
	Excessively worn brake pads
	Brake master cylinder primary piston cup
Vibration when the brakes are applied	Brake pads
	Brake caliper
	Brake disc
Pedal goes down fast	Air in system
	Brake master cylinder
	Brake disc
	Brake pads
Pedal eases down slowly	Brake caliper
	Brake master cylinder
Pedal is low or feels spongy	Brake pads
	Air in the system
	Brake booster
Brake lockup during light brake pedal force	Brake pads
	Brake disc
	Brake booster
Excessive or erratic pedal travel	Insufficient grease on sliding parts
	Brake pads
	Brake disc
	Wheel bearing
	Brake pedal
Brake drag	Brake booster
	Brake caliper
	Brake pedal
	Stability assist system (if equipped)
Slow or incomplete brake pedal return	Brake master cylinder
	Stability assist system (if equipped)
	Brake pedal

Component Tests

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Brake Booster

1. Inspect all hoses and connections. All unused vacuum connectors should be capped. Hoses and their connections should be correctly secured and in good condition with no holes and no collapsed areas. Inspect the brake booster check valve for damage.

2. Check the hydraulic brake system for leaks or low fluid.

3. With the transmission in PARK (automatic transmission), stop the engine and operate the parking brake. Operate the brake pedal several times to exhaust all vacuum in the system.

4. With the engine turned OFF and all vacuum in the system exhausted operate the brake pedal and hold it down. Start the engine. If the vacuum system is operating, the brake pedal will tend to move downward under constant foot pressure. If no motion is felt, the vacuum booster system is not functioning.

5. Remove the vacuum hose from the brake booster. Manifold vacuum should be available at the brake booster end of the hose with the engine at idle speed and the transmission in PARK or NEUTRAL. Make sure that all unused vacuum outlets are correctly capped, hose connectors are correctly secured and vacuum hoses are in good condition. When it is established that manifold vacuum is available to the brake booster, connect the vacuum hose to the brake booster and repeat Step 3. If no downward movement of the brake pedal is felt, the vacuum booster system is not functioning.

6. Run the engine for a minimum of 10 seconds at fast idle. Stop the engine and let the vehicle stand for 10 minutes. Then, operate the brake pedal with approximately 98N (20 lb) of force. The pedal feel (brake applications) should be the same as noted with the engine running. If the brake pedal feels hard (no power assist), install a new check valve and then repeat the testing. If the brake pedal still feels hard, install a new brake booster. If the brake pedal movement feels spongy, bleed the brake system. Refer to General Procedures.

Brake Master Cylinder

Usually, the first and strongest indicator of anything wrong in the brake system is a feeling through the brake pedal. In diagnosing the condition of the brake master cylinder, check brake pedal feel as evidence of a brake concern.

Check for brake warning indicator illumination and the brake fluid level in the brake fluid reservoir.

Normal Conditions

The following conditions are considered normal and are not indications that the brake master cylinder is in need of repair.

1. New brake systems are not designed to produce as hard a pedal effort as in the past. Complaints of light pedal efforts should be compared to pedal efforts of another vehicle, same model and year.

2. During normal operation of the brake master cylinder, the brake fluid level in the reservoir will rise during brake application and fall during release. The net brake fluid level (after brake application and release) will remain unchanged.

3. A trace of brake fluid exists on the brake booster shell below the master cylinder mounting flange. This results from the normal lubricating action of the master cylinder bore end seal.

4. Brake fluid level will fall with brake pad wear.

Abnormal Conditions

Changes in brake pedal feel or travel are indicators that something could be wrong in the brake system. The diagnostic procedure and techniques are brake pedal feel, brake warning indicator illumination and low brake fluid level as indicators in diagnosing brake system concerns. The following condition are considered abnormal and indicate that the brake master cylinder is in need of repair.

1. Brake pedal goes down fast. This could be caused by an external or internal leak.
2. Brake pedal eases down slowly. This could be caused by an external or internal leak.
3. Brake pedal is low or feels spongy. This condition may be caused by no fluid in the brake master cylinder reservoir, brake fluid reservoir cap vent holes blocked or air in the hydraulic system.
4. Brake pedal effort is excessive. This may be caused by a bind or obstruction in pedal or linkage, blocked fluid control valve or insufficient brake booster vacuum.
5. Rear brakes lock up during light pedal force. This may be caused by grease or fluid on brake pads, damaged brake pads and linings, incorrectly adjusted parking brakes, damaged or contaminated brake pressure control valve.
6. Brake pedal effort is erratic. This condition could be caused by the brake booster being in operative, extreme brake caliper piston knock back or incorrectly installed brake pads.
7. Brake warning indicators is always ON. This may be caused by low fluid level, ignition wire routing too close to the fluid level indicator, or float assembly damage.

Bypass Condition Test

1. Check the brake fluid level in the brake fluid reservoir. Fill the brake fluid reservoir to the MAX mark if low or empty.
2. Observe the brake fluid level in the brake fluid reservoir. If after several brake applications, the brake fluid level remains the same, measure the wheel turning torque required to rotate the wheels with rearward with brakes applied as follows:

Place the transmission in NEUTRAL and raise and support the vehicle.
REFER to: Jacking and Lifting (100-02 Jacking and Lifting, Description and Operation).

With the aid of another technician, operate the brakes with a minimum of 445N (100 lb) and hold for approximately 15 seconds. With the brakes still applied, exert torque on the front wheels to 10.1 Nm (75 lbf.ft). If either wheel rotates, install a new brake master cylinder.

Non-Pressure Leaks

Any empty brake fluid reservoir condition may be the result of two types of non-pressure external leaks.

Type 1: An external leak may occur at the brake fluid reservoir cap because of incorrect positioning of the gasket and cap.

Reposition the gasket and cap.

Type 2: An external leak may occur at the brake fluid reservoir mounting seals. Repair such a leak by installing new seals.