Appendix A

MINIMUM REQUIREMENTS FOR MOTOR VEHICLE BRAKE LININGS-SAE J998

SAE Recommended Practice

1. **Scope -** This specification covers brake linings used on motor vehicles operated on the public ways, except those used only for parking brakes. The performance requirements outlined in this SAE Recommended Practice are base on currently available engineering data. It is intended that all portions of this recommended practice will be reviewed periodically and revised additional knowledge regarding brake lining performance is developed.
2. **Purpose -** The purpose of this SAE Recommended Practice is to establish minimum coefficient of friction requirements for brake linings used in the service brake system of a motor vehicle. Linings that meet these minimum friction requirements may not be suitable for use on all vehicles because of differences in brake design or application.
3. **Test Procedure -** Five complete tests shall be conducted on each brake lining in accordance with the SAE J661.
4. **Brake Lining Evaluation -** Brake linings shall be evaluated for normal and hot friction coefficients in accordance with SAE J866.
5. **Minimum Requirements -** To meet minimum requirements a brake lining shall have:

    5.1 A normal friction coefficient over .25 based on the average of five tests.

    5.2 A hot friction coefficient over .15 based on the average of five tests.

    5.3 A coefficient of friction of .15 or over on each of the five tests at the following points:

    5.3.1 Between 200F and 550F, inclusive, on the second fade run.

    5.3.2 Between 300F and 200F, inclusive, on the second recovery run.

    5.4 Not more than a 20% or .050 variation of coefficient of friction, whichever is greater, below the average value of all five tests at each temperature point specified in paragraph 5.3

(Report of SAE Brake Committee approved January 1968.)

Appendix B

MOTORCYCLE AND MOTOR VEHICLE CYCLE ELECTRICAL SYSTEM (Maintenance of Design Voltage) SAE J392

SAE Recommended Practice

1. **Purpose -** This SAE Recommended Practice provides minimum illumination voltage values for motorcycle and motor driven cycle electrical systems and accompanying test procedures. *(**NOTE:** Where the word "motorcycle" appears in the report, it is understood to include "motor driven cycle.")*
2. **Scope -** This recommended practice pertains to both battery-equipped and batteryless motorcycle electrical systems.
3. **Test Apparatus.**

    3.1 Voltmeter - 0-20 V maximum full-scale deflection, accuracy +1/2% *(two voltmeters required).*

    3.2 Ammeter - Capable of carrying full system load current. Accuracy +3%FS.

    3.3 Means for Measuring Engine RPM - Accuracy +3%.

4. Test Procedure

4.1 Install fully charged original equipment battery on the motorcycle (if motorcycle is battery equipped).

4.1.1 Battery temperature to be 80+ or -10F.

4.2 Connect one voltmeter between the headlamp low beam terminal and the ground; connect the other voltmeter between the tail lamp terminal and the ground.

4.3 Connect the ammeter in series with the battery. (**NOTE:** Disregard paragraph 4.3 for batteryless machines.)

4.4 Start engine and turn on headlamp(s).

4.4.1 Switch headlamp to the low beam position.

4.4.2 External fan cooling may be applied to the motor cycle engine.

4.5 Run the engine at an RPM equivalent to 30 MPH in top gear for 10 minutes.

4.5.1 Record the lowest and highest head-lamp voltage and taillamp voltage observed during the 10 minute period.

4.6 Increase speed to manufacturer's suggested maximum RPM.

4.6.1 Record the highest and lowest head-lamp and taillamp voltages observed during a 5-second period.

4.7 Run the engine at manufacturer's rated idle speed for 10-minutes.

4.7.1 Record the lowest and highest taillamp voltage observed during the 10-minute period.

4.7.2 Record the lowest and highest headlamp voltage observed during the 10-minute period.

4.8 Slowly increase the engine speed until generating equipment cancels the system load, indicated by "0" reading on the ammeter. (**NOTE:** Disregard paragraph 4.8 for batteryless motorcycles.)

4.8.1 Record the engine RPM at ammeter zero point.

5. Test Limits

5.1 Voltages recorded in paragraphs 4.5.1, 4.6.1 and 4.7.1 shall be between 80% and 120% of the rated headlamp design voltage.

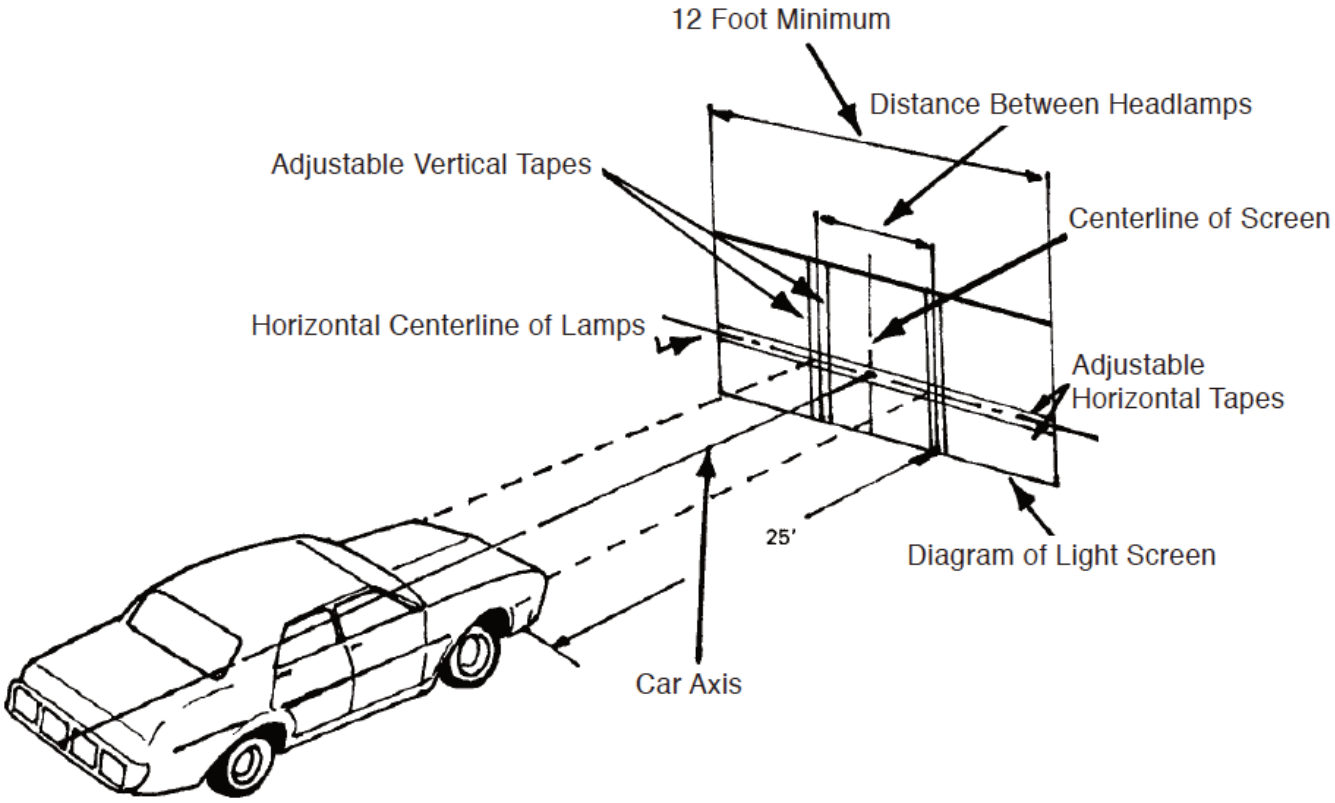
5.2 Voltages observed in paragraph 4.7.2 shall be between 40% and 120% of the rated headlamp design voltage.

5.3 Engine RPM observed in paragraph 4.8.1 shall be less than the motorcycle equivalent speed at 30 MPH in top gear operation.

(Report of Motorcycle Committee and Lighting Committee approved December 1969. Editorial change November 1971.)

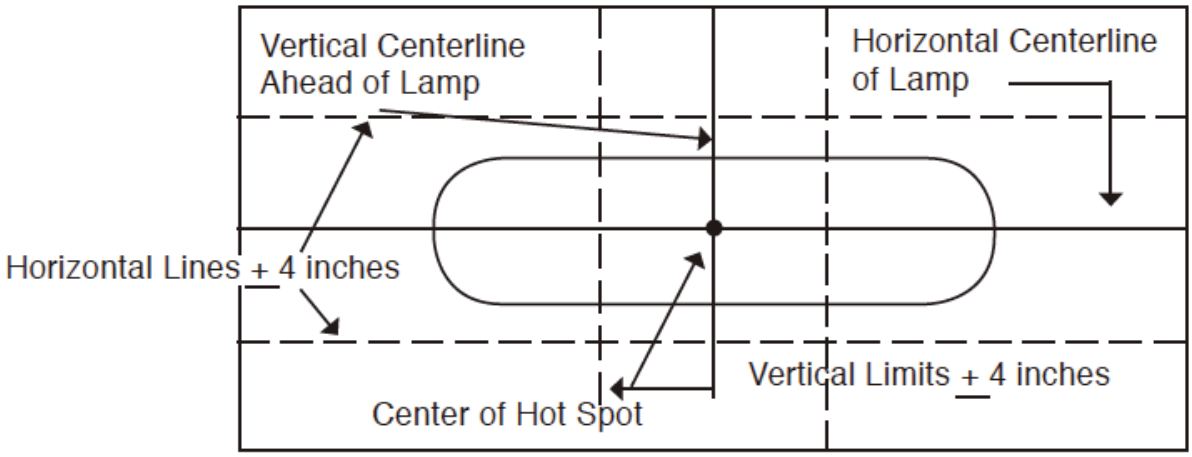
CHART 1

Headlight Aiming Screen
Distance and Marking Identification



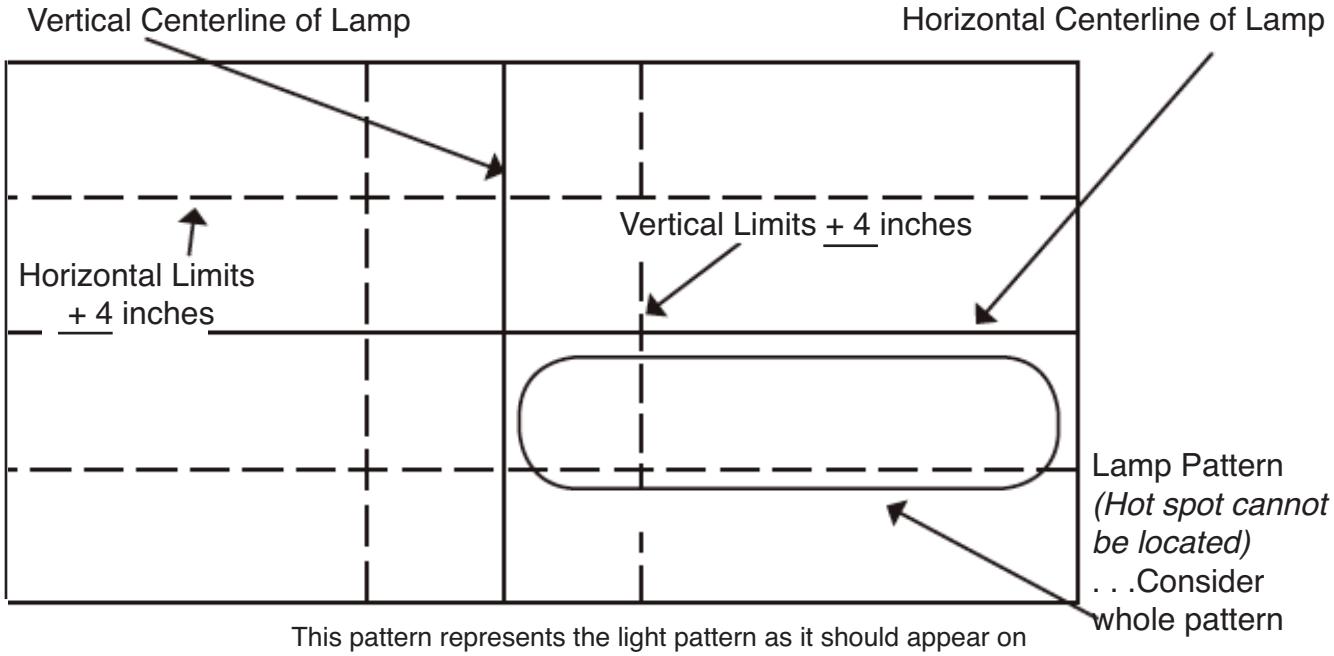
VISUAL HEADLAMP AIM, ADJUSTMENT AND INSPECTION

CHART 2
High Beam Inspection Limits



This pattern represents the light pattern as it should appear on the view screen of approved photo-electric aimers.

CHART 3
Low Beam Inspection Limits



This pattern represents the light pattern as it should appear on the view screen of approved photo-electric aimers.

CHART 4
Brake Chamber Push Rod Travel (Typical)

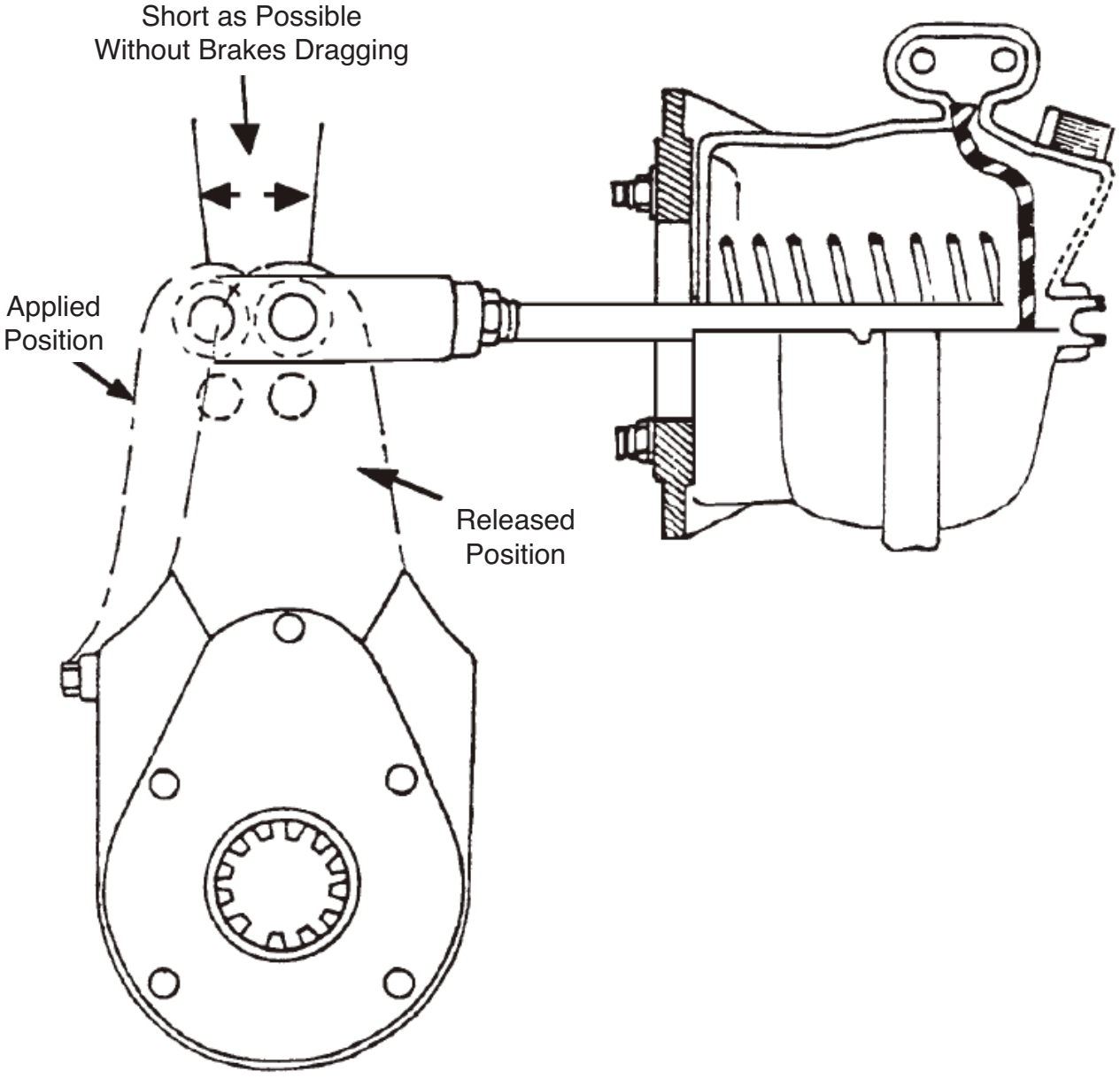


CHART 5
Scrub Line

(STREET RODS, SPECIALLY CONSTRUCTED AND RECONSTRUCTED VEHICLES)

A scrub line is an imaginary surface created if lines were drawn from bottom of wheel rim on one side to bottom of tire on other side. When lines are drawn from both sides an “X” under the vehicle suspension is created. No suspension or chassis component shall be below top portion of this imaginary “X”.

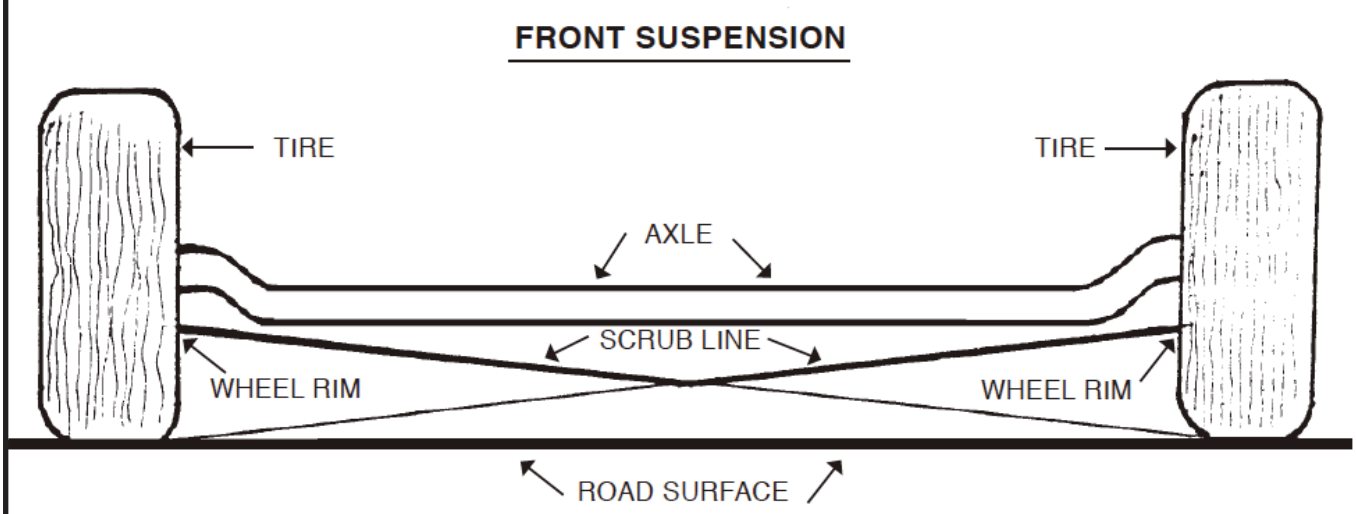
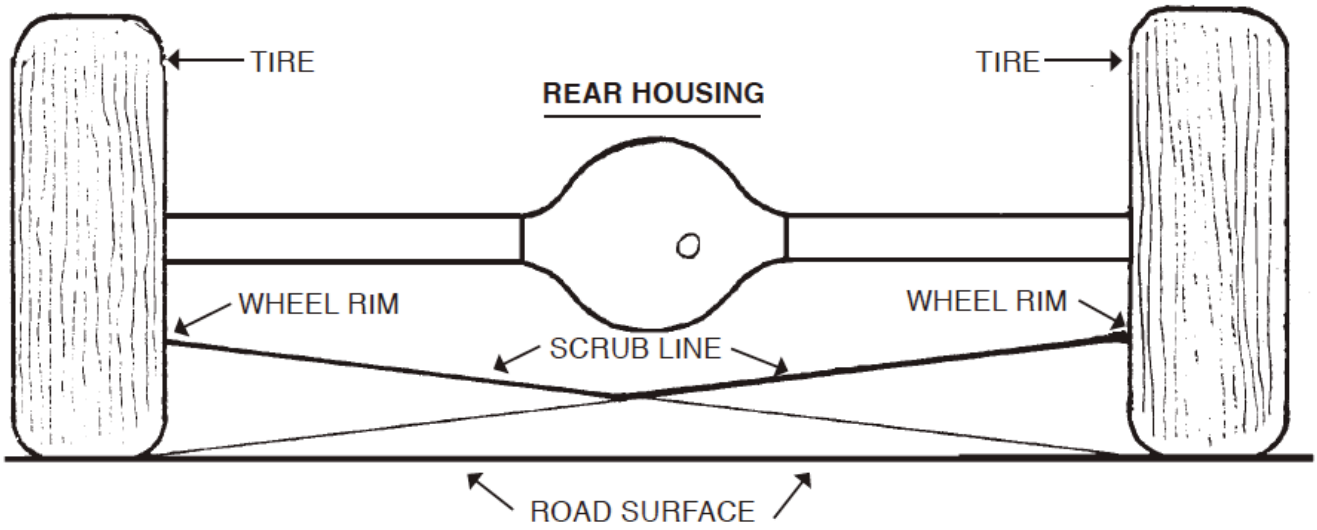
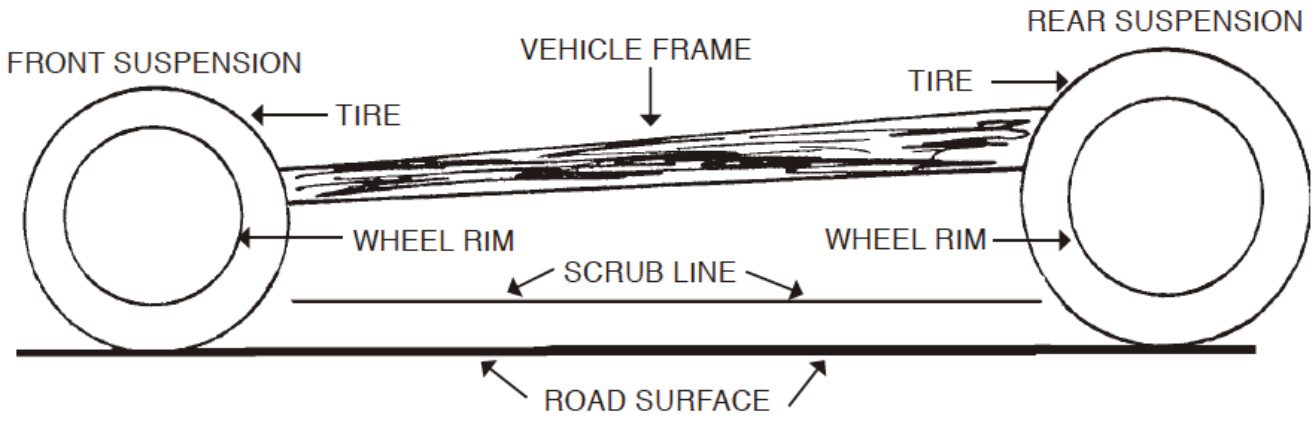


CHART 5 (Continued)

DIAGRAM OF THE REAR SUSPENSION, AND HOW TO CHECK SCRUB LINE



(SCRUB LINE THAT EXISTS FROM FRONT TO REAR SUSPENSION)



Brakes

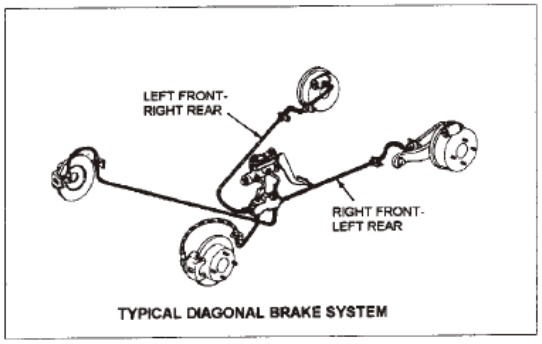
Brake failure ranks as the leading mechanical cause of highway crashes. Brakes require special care to ensure that the braking system is operating properly. The major brake inspection defect items are:

- Hydraulic hoses or tubing
- Wheel cylinders and calipers
- Brake drums or rotors
- Brake linings

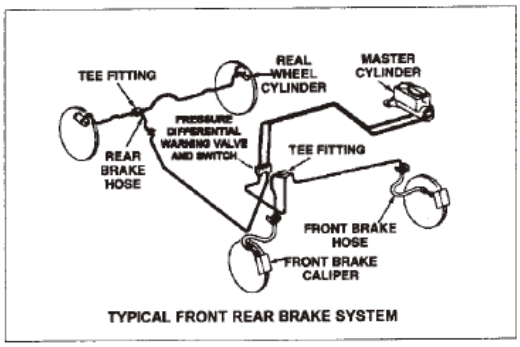
The following illustrations will provide the inspector with additional guidance for inspection of these components.

Figure 1 shows typical brake system configurations including hydraulic brake system tubes and lines and anti-lock brake (ABS) system electronic controls and sensors. The hoses and tube should be visually checked for leaks, cracks, chafing, flattened or restricted sections, or improper retention.

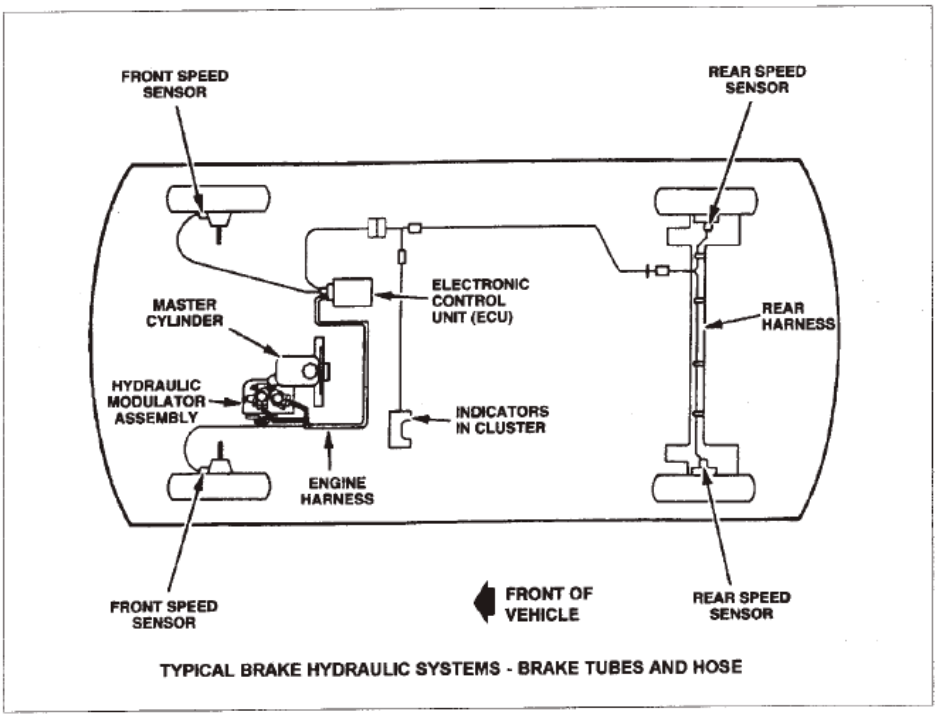
TYPICAL BRAKE CONFIGURATIONS



TYPICAL DIAGONAL BRAKE SYSTEM



TYPICAL FRONT REAR BRAKE SYSTEM



TYPICAL BRAKE HYDRAULIC SYSTEMS - BRAKE TUBES AND HOSE

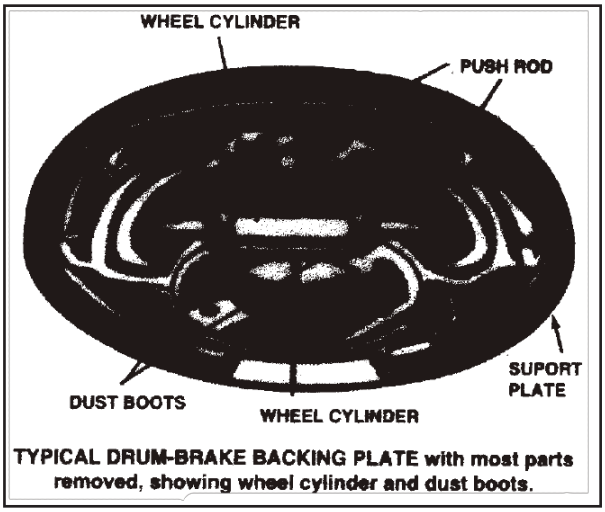


Figure 2 Shows a typical drum brake. When the drum is removed, the wheel cylinder should be checked for leakage, damaged, loose or missing parts, retention and dust boot condition.

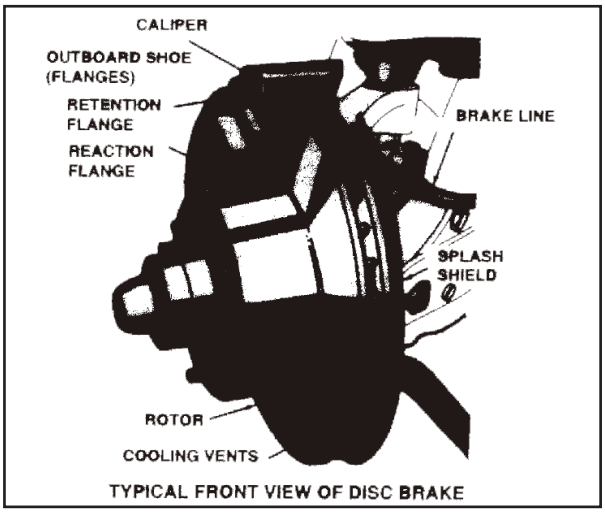


Figure 3 Shows a typical caliper drum brake. The caliper assembly should be checked for leakage, missing parts and retention.

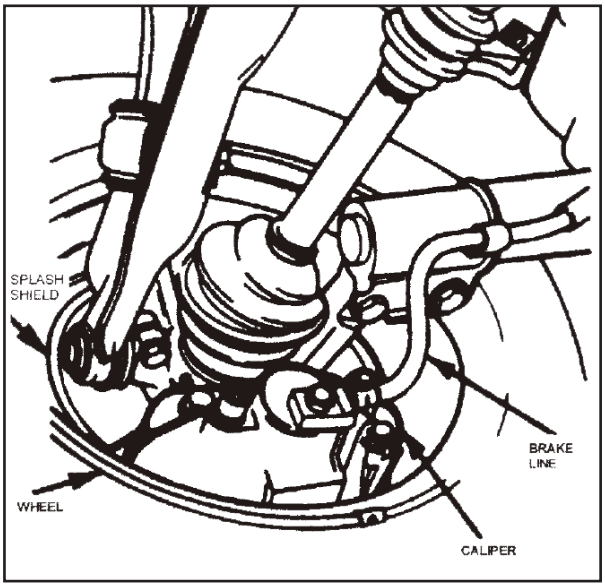
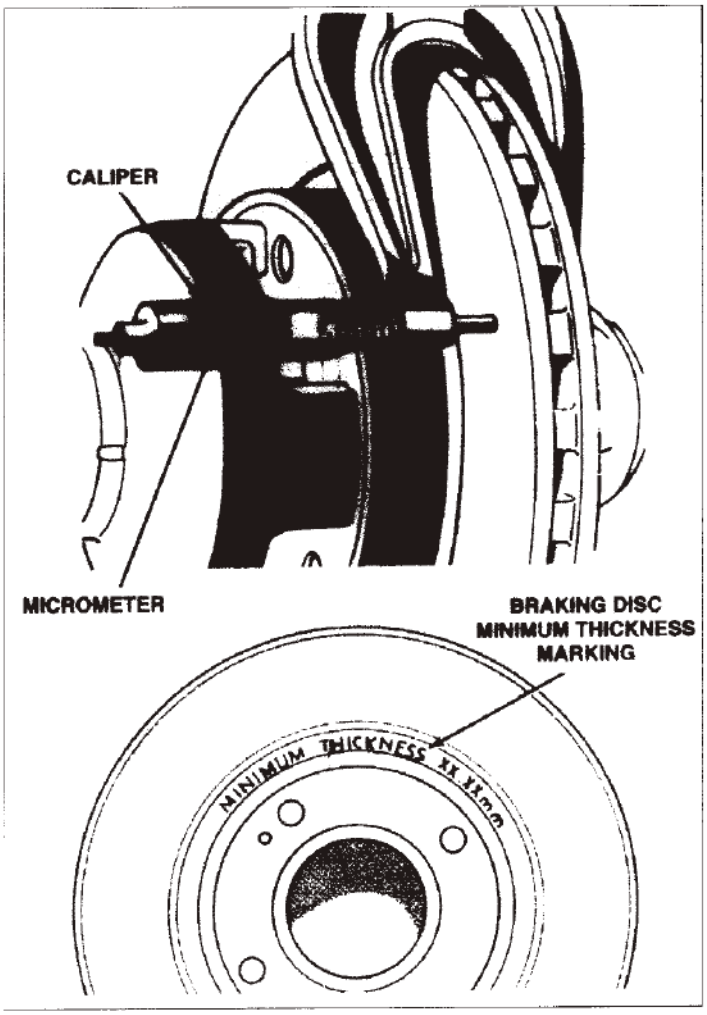
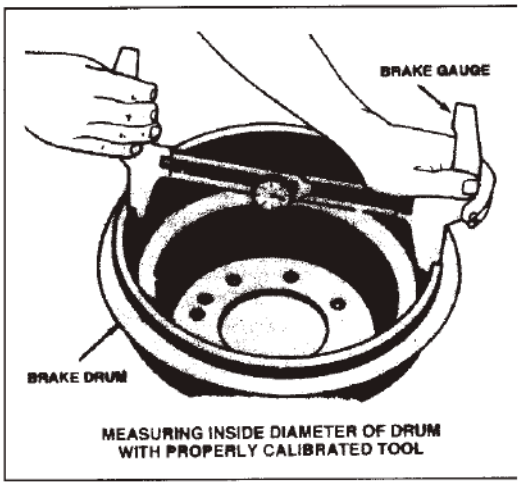


Figure 4 Illustrates a typical disc brake assembly for a front wheel drive vehicle.

Figure 5 Illustrates marking and measurements of brake rotors and brake drums. The maximum allowable drum diameters and minimum rotor thickness are cast into the parts. Drums or rotors must not be scored deeper than 0.015 inches.





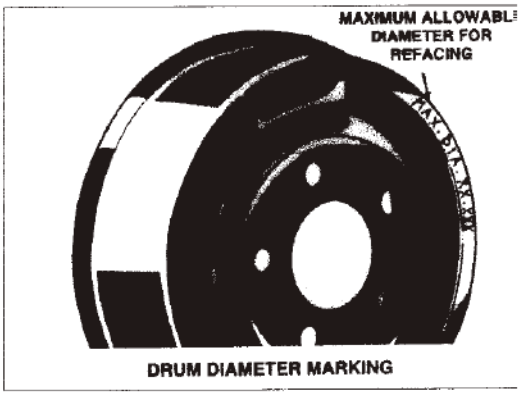


FIGURE 5

Figure 6 Illustrates disc brake pads and **FIgure 7** illustrates typical drum brakes. Visually inspect the lining to see if it is broken, not firmly attached, or contaminated with oil, grease or any other substances that would affect operation. Use the proper measuring device to measure the linings and pads. Bonded linings must be no less than 2/32 inch and riveted linings must be no less than 1/32 inch above the rivet head at the thinnest point.

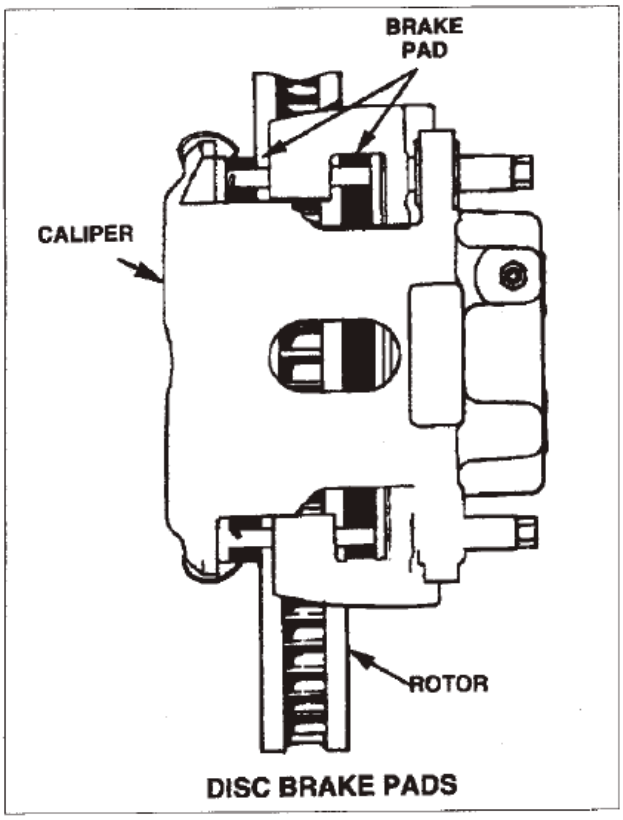
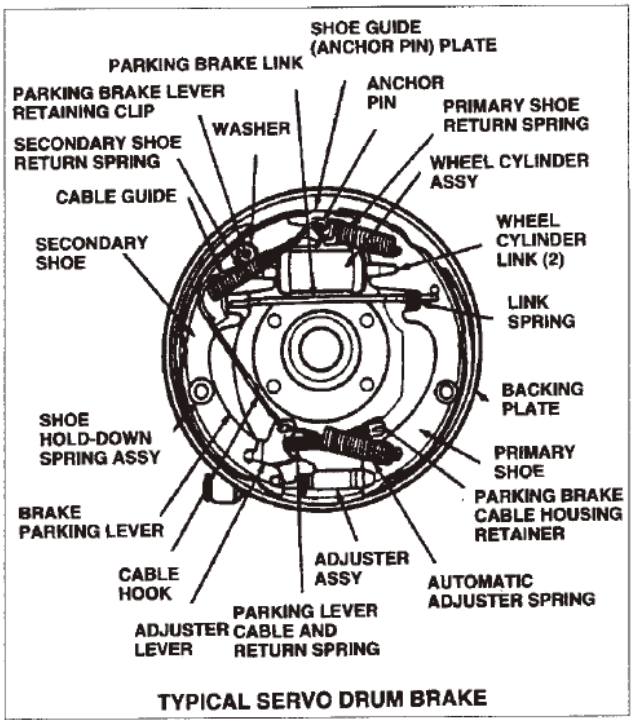


FIGURE 6



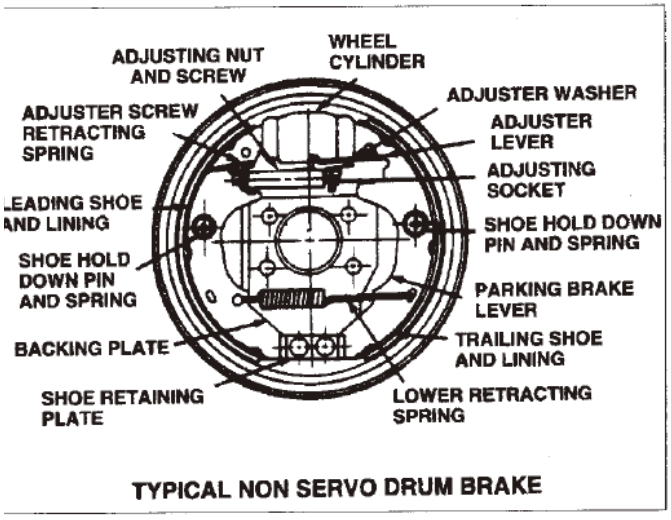


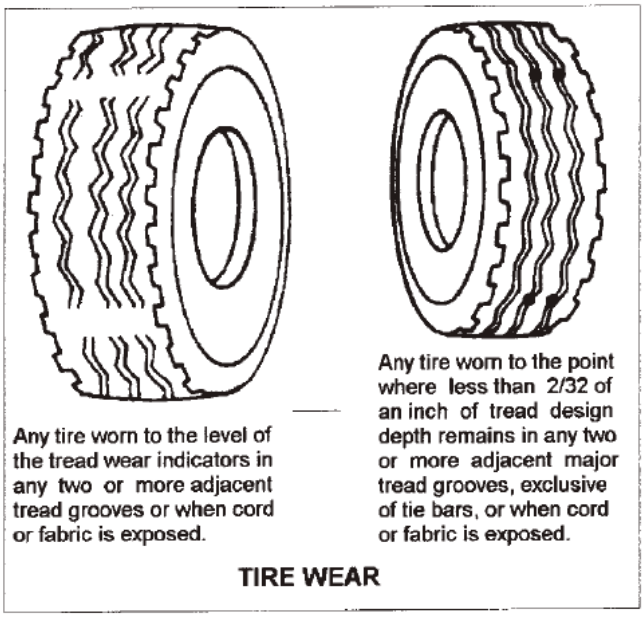
FIGURE 7

Tires

Defective tires cause or contribute to a significant number of crashes. Worn tires reduce ride performance, affect vehicle handling and decrease fuel efficiency. Tire wear is identified by the following characteristics:

- ✓ any two adjacent grooves have less than 2/32 inch of tread
- ✓ tread wear indicators contacting road on any two adjacent grooves
- ✓ exposed ply or cord
- ✓ tire repair using blow-out patch or boot
- ✓ bumps, bulges or separations on surface of tire

Figure 8 illustrates tire wear and how to measure acceptable tire thread depth.



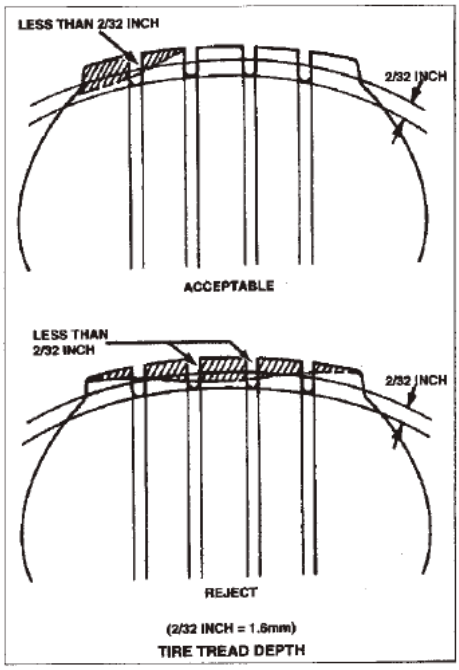


FIGURE 8

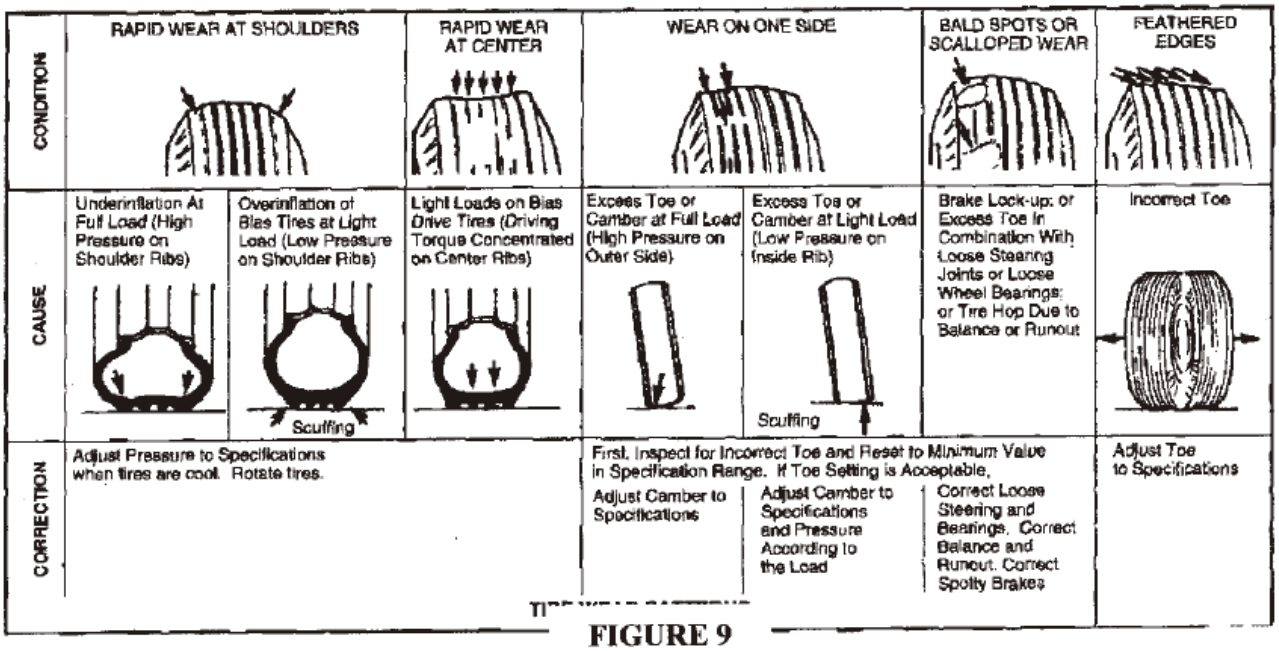


FIGURE 9

Steering System

Steering system defects affect the driver's control of the vehicle. The steering column must be checked completely. This includes the following items:

- ✓ Free play of the steering wheel
- ✓ Gear box fastening
- ✓ Energy absorbing column condition
- ✓ Steering wheel size conformance
- ✓ Steering wheel travel to full right and left position without binding
- ✓ Proper alignment of the flexible steering coupler.

Loose steering, especially coupled with excessive tire wear, tight steering in any direction or rubbing noises, indicates a potential defect. **Figure 10** illustrate how to measure free play movement on the steering wheel. The maximum free play permitted varies based upon the diameter of the wheel as follows:

Wheel Diameter	Free Play
16 inches or less	2 inches
18 inches	2 1/4 inches
20 inches	2 1/2 inches
22 inches	2 3/4 inches

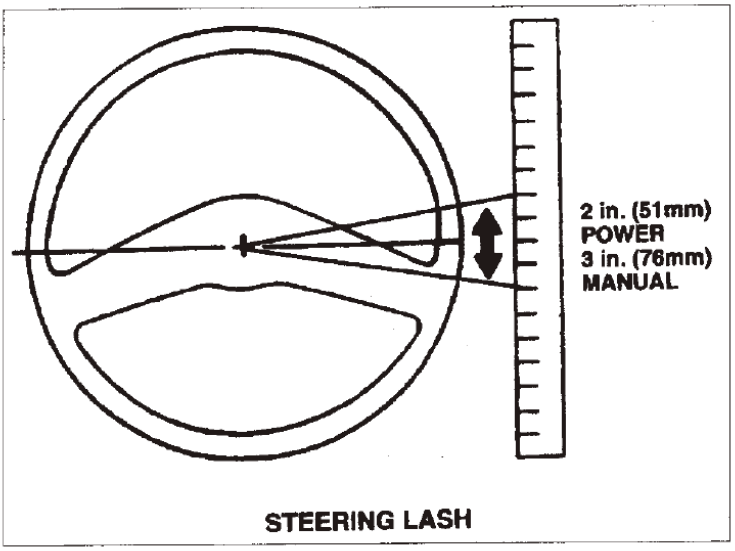


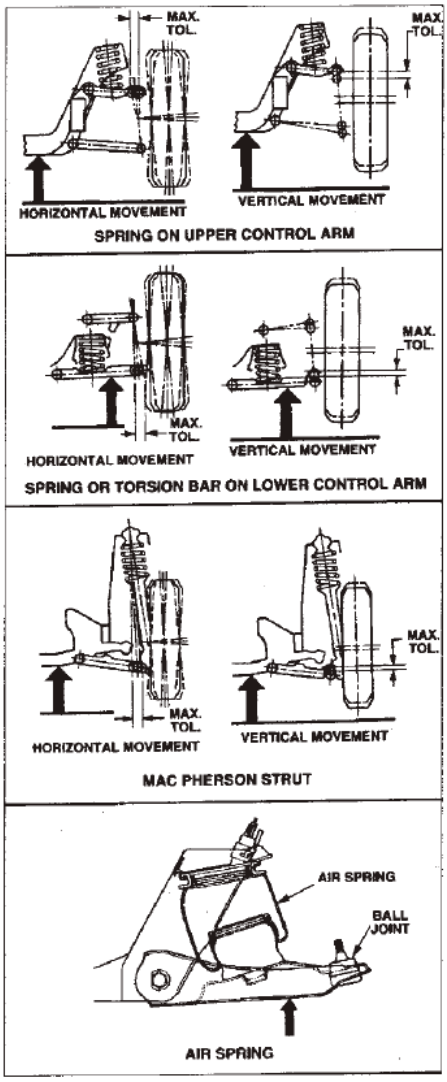
FIGURE 10

Suspension System

Suspension system defects can affect vehicle performance and compromise safety. Defective shocks or struts will cause the vehicle to dive when brakes are applied, to sway on turns, and to bottom out on rough pavement. The following suspension system components are inspected for defects:

- ✓ Ball joint movement
- ✓ Shock absorbers
- ✓ Sway or stabilizer bar
- ✓ Coil spring or main leaf spring
- ✓ Spring attaching parts

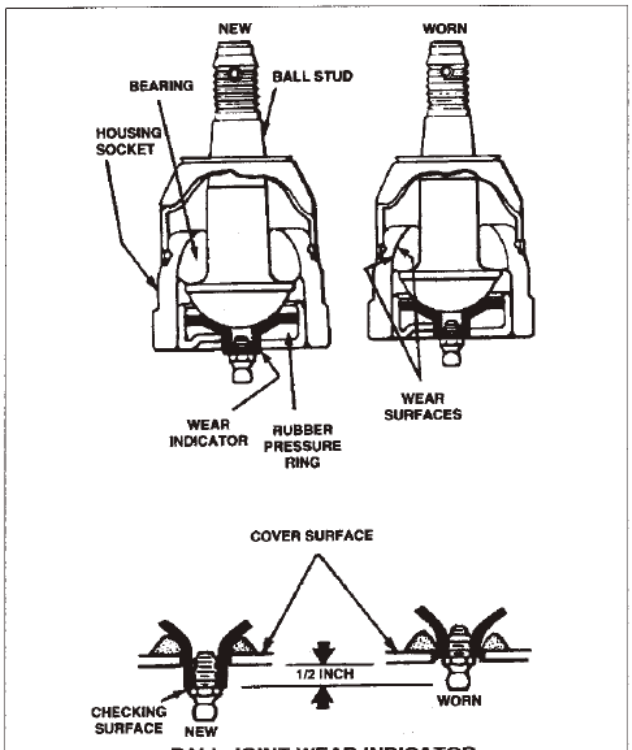
Ball joint movement is inspected to determine wear defects. Manufacturer's specifications provide maximum tolerances for both vertical and horizontal movement of the ball joint. The trend among U.S. automobile manufacturers is toward the use of "wear-indicating " ball joints; however many vehicles do not have these useful indicators.



RAISING POSITIONS FOR SUSPENSION SYSTEMS

FIGURE 11

Figure 11 illustrates raising positions for suspension systems to check tolerances. **Figure 12** illustrates ball joint wear indicators.



BALL JOINT WEAR INDICATOR

Wear is indicated by the protrusion of the 1/2" diameter boss, (exaggerated for illustration) into which the grease fitting is threaded for greaseable ball joints. This same boss exists and should be used to indicate wear in non-greaseable ball joints. This round boss projects 1/2" beyond the surface of the ball joint cover on a new, unworn joint.

To inspect for wear, support vehicle by wheels so that the lower ball joints are in a loaded condition. Wipe the grease fitting or boss free of dirt and grease. Observe or scrape a scale, screwdriver or fingernail across the cover. If the grease fitting boss is flush or inside the cover surface reject vehicle.

FIGURE 12