

SECTION 3A

WHEEL ALIGNMENT

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

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GENERAL DESCRIPTION

Tire and wheel assembly alignment refers to the angular relationship between the tire and wheel assemblies, the suspension attaching parts and the ground.

CASTER

Figures 1 and 2

Caster is the tilting of the front steering axis (at the top) either forward or backward from the vertical. A backward tilt is positive (+) and a forward tilt is negative (-). Caster influences directional control of the steering but does not affect tire wear and is adjustable only at the front tire and wheel assemblies.

Caster is affected by vehicle height; therefore, it is important to keep the body at its designated trim height. Overloading the vehicle or a weak or sagging rear spring will affect caster. When the rear of the vehicle is lower than its designated trim height, the front suspension moves to a more positive caster. If the rear of the vehicle is higher than its designated trim height, the front suspension moves to a less positive caster. For trim height information, refer to SECTION 3.

CAMBER

Figures 1 and 3

Camber is the tilting of the front tire and wheel assemblies from the vertical when viewed from the front of the vehicle. When the tire and wheel assemblies tilt outward at the top, the camber is positive (+). When the tire and wheel assemblies tilt inward at the top, the camber is negative (-). The amount of tilt is measured in degrees from the vertical and is called the camber angle. Camber setting influences directional control and tire wear.

When tire and wheel assemblies are set to a positive camber angle, they will tend to roll in a path away from the vehicle's true path. The effect of each tire and wheel assembly tends to cancel the other. The suspension geometry and camber setting are designed to keep the tire tread flat on the road through bumps or dips.

TOE

Figures 1 and 4

Toe is a measurement of how much the front tire and wheel assemblies are turned in or out from a straight-ahead position. When the tire and wheel assemblies are turned in, toe is positive (+). When the tire and wheel assemblies are turned out, toe is negative (-). The actual amount of toe is normally only a fraction of a degree. The purpose of toe is to ensure that the tire and wheel assemblies roll parallel.

Toe also serves to offset the small deflections of the tire and wheel assembly support system which occur when the vehicle is rolling forward. In other words, even when the tire and wheel assemblies are set to toe in or out slightly when the vehicle is standing still, they tend to roll parallel on the road when the vehicle is moving. Toe affects tire wear.

THRUST ANGLE

Figure 5

The front tire and wheel assemblies aim or steer the vehicle, but the rear tire and wheel assemblies control tracking. This tracking action is relative to thrust angle. Thrust angle is defined as the path that the rear tire and wheel assemblies will take. Ideally, the thrust angle is geometrically aligned with the body centerline.

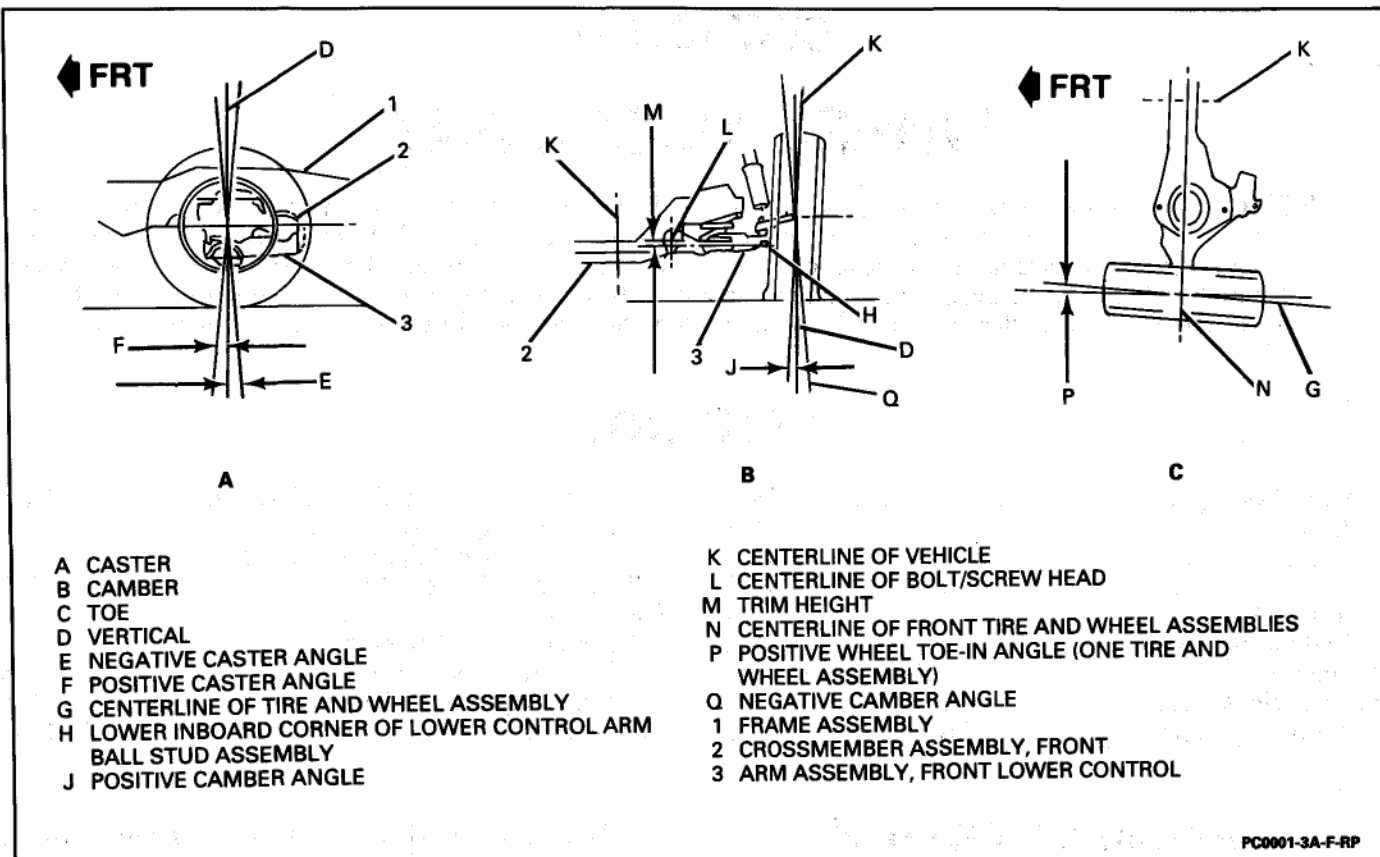


Figure 1 - Caster, Camber and Toe

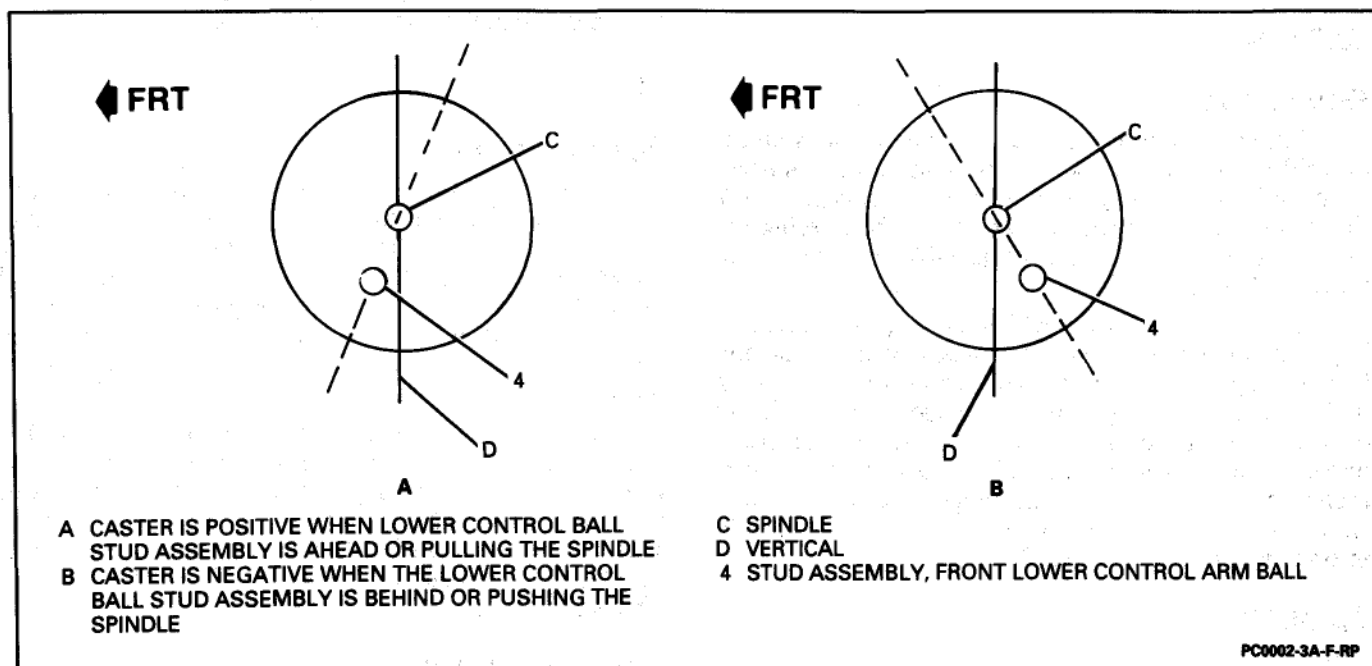


Figure 2 - Caster

PRELIMINARY INSPECTIONS

Steering and vibration complaints are not always the result of improper alignment. Another possibility is tire "lead" due to worn or improperly manufactured tires. "Lead" is the vehicle deviation from a straight path on a

level road without pressure on the steering wheel assembly. To determine if the vehicle has a tire lead problem, refer to SECTION 3.

Before making any adjustment affecting tire and wheel assembly alignment, make the following inspection:

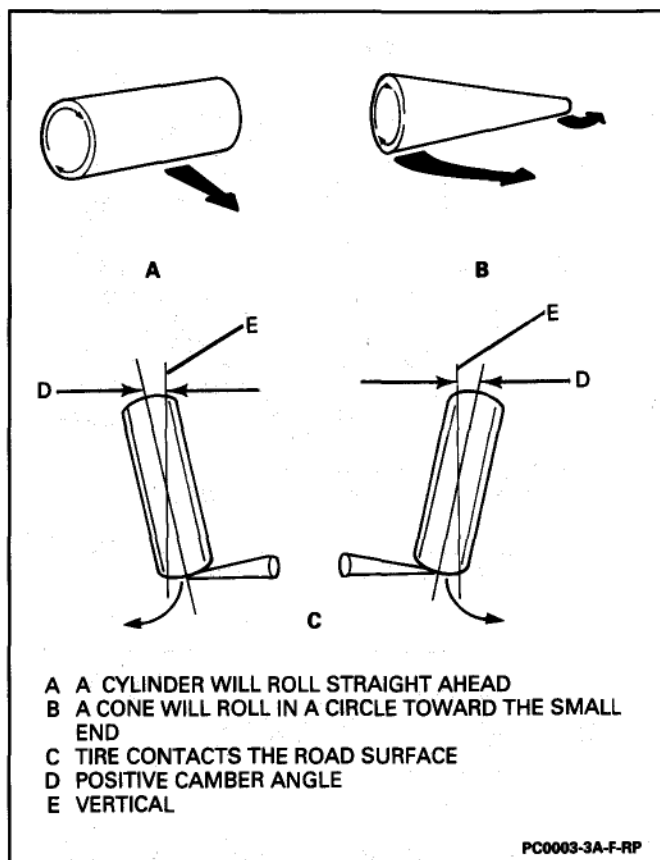


Figure 3 - Camber

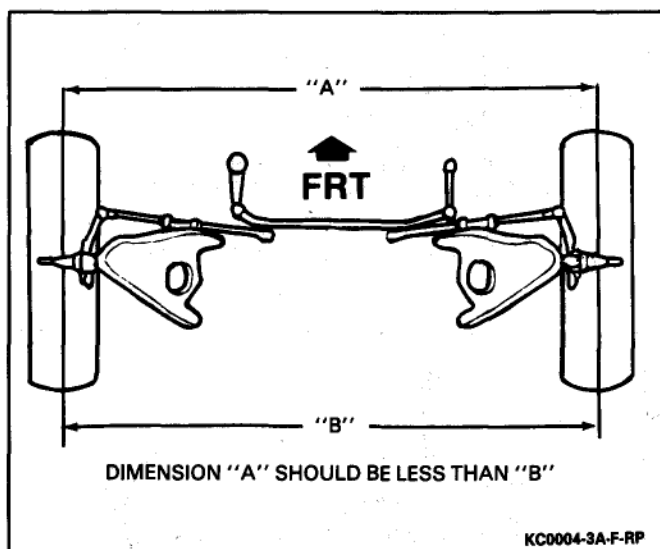


Figure 4 - Toe

tions to ensure correct alignment readings and alignment adjustments.

Inspect

- All tires for proper inflation pressures. Also check that all tires have about the same tread wear.
- Control arm ball stud assemblies. If they are loose, correct them before adjusting tire and wheel assembly alignment. Refer to SECTION 3C.

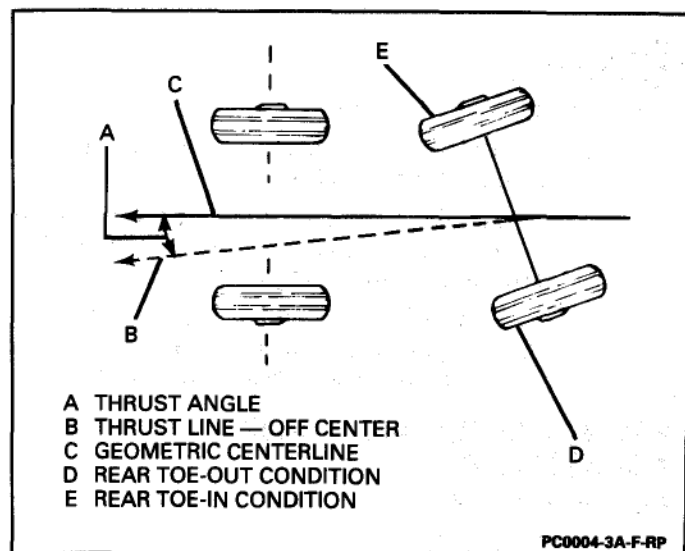


Figure 5 - Thrust Angle

- Tie rod ends. If they are loose, correct them before adjusting tire and wheel assembly alignment. Refer to SECTION 3B.
- Runout of tire and wheel assemblies. Refer to SECTION 3.
- Vehicle trim height. If out of limits and a correction is to be made, do so before adjusting alignment. Refer to SECTION 3 for trim height chart.
- Steering gear assembly for looseness at frame assembly.
- Control arm assemblies for loose bushing assemblies.
- Stabilizer shaft for loose or missing parts.
- Improperly operating shock absorber and spring assemblies.
- Suspension and steering components for damage. Replace parts as necessary.
- Vehicle for stability. The fuel tank assembly should be full, or the vehicle should have compensating ballast.
- Jounce vehicle lightly three times rear and three times front.

Consideration must be given to excess loads, such as tool boxes, sample cases, etc. If these items are normally carried in the vehicle, they should remain in the vehicle during alignment adjustments.

Consideration should also be given to the condition of the equipment being used to adjust alignment. Be sure to follow the equipment manufacturer's instructions. Regardless of the equipment used to adjust alignment, the vehicle must be on a level surface, both front-to-rear and side-to-side.

ON-VEHICLE SERVICE

MEASURING FRONT ALIGNMENT ANGLES

Satisfactory vehicle operation may occur over a wide range of alignment settings. However, should the settings vary beyond the specifications shown at the end of this section, the alignment angles should be corrected.

**Measure**

- Front alignment angles.
 - A. Install alignment equipment according to the manufacturer's instructions.
 - B. Jounce the front and rear bumper assemblies lightly three times to normalize suspension prior to measuring angles.
 - C. Measure alignment angles and record the readings. If adjustments are required, make them in the following order: caster, camber and toe.

FRONT CASTER AND CAMBER ADJUSTMENT

Figures 6 and 7

Tool Required:

J 38658 Camber/Caster Adjuster

**Adjust**

1. Jounce front bumper assembly three times to allow vehicle to return to normal height before making any adjustments in caster.
2. Raise and suitably support vehicle. Refer to SECTION 0A.
3. Loosen front lower control arm nuts. Refer to SECTION 3C.
4. Install J 38658 to slot holes in lower control arm assembly (3) and front crossmember assembly (2) (Figure 6).
5. Caster by rotating turnbuckle on J 38658.
 - Rotating turnbuckle clockwise will increase caster.
 - Rotating turnbuckle counterclockwise will decrease caster.
6. Install J 38658 to slot holes in lower control arm assembly (3) and front crossmember assembly (2) (Figure 7).
7. Camber by rotating turnbuckle on J 38658.
 - Rotating turnbuckle clockwise will increase camber.
 - Rotating turnbuckle counterclockwise will decrease camber.
8. Remove J 38658 from slot holes.
9. Tighten front lower control arm nuts. Refer to SECTION 3C.
10. Lower vehicle.

FRONT TOE ADJUSTMENT

Figure 8

**Adjust**

NOTICE: See "Notice" on page 3A-1 of this section.

- Toe

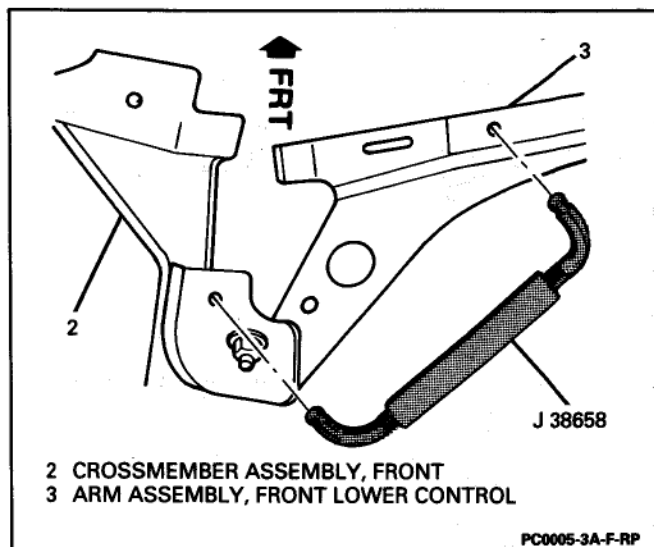


Figure 6 – Front Caster Adjustment

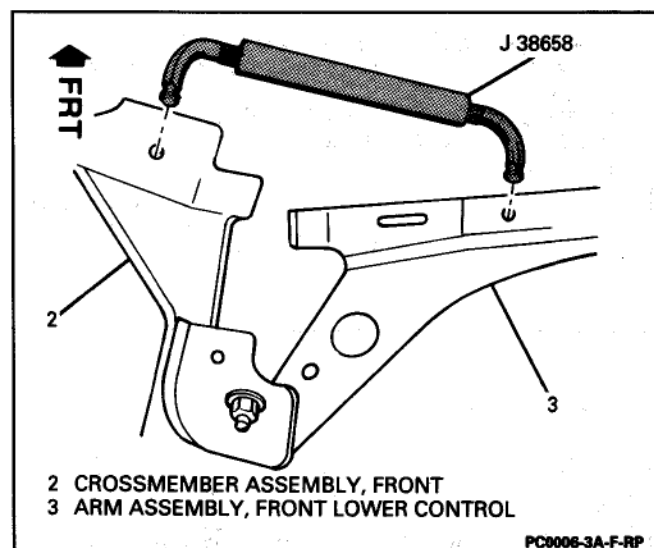


Figure 7 – Front Camber Adjustment

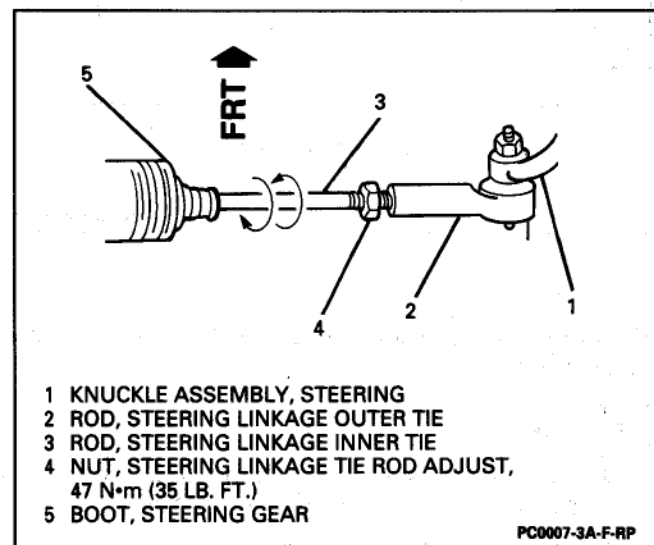


Figure 8 - Front Toe Adjustment

- A. Make sure steering wheel assembly is set in a straight-ahead position within ± 3.5 degrees.
- B. Toe adjustments are made separately at each individual tire and wheel assembly.
- C. Loosen nut (4) on inner tie rod (3).
- D. Toe to specification by turning inner tie rod (3). Refer to "Alignment Specifications" in this section.
 - Left and right toe adjustment should be equal within ± 0.2 degrees.
- E. Check steering gear boot seal is not twisted.



Tighten

- Nut (3) to 47 N•m (35 lb. ft.).
- F. Check specifications for adjustment. Readjust by repeating steps if necessary.

MEASURING REAR ALIGNMENT ANGLES

Figure 9

After front tire and wheel assembly alignment has been completed, the rear alignment angles should be checked if there is excessive rear tire wear or tire and wheel assemblies do not track properly. Rear tire and wheel assemblies (14) should be parallel to and the same distance from the vehicle's centerline..

If tires do not track correctly after a front tire and wheel assembly alignment, no amount of adjustment will correct the problem. Poor tracking or excessive rear tire wear after a front tire and wheel assembly alignment usually indicates that the axle housing assembly, frame assembly or suspension arms have been bent.

Rear alignment angles can be checked as follows:



Measure

- Rear alignment angles.
 - A. Back vehicle squarely onto alignment machine.

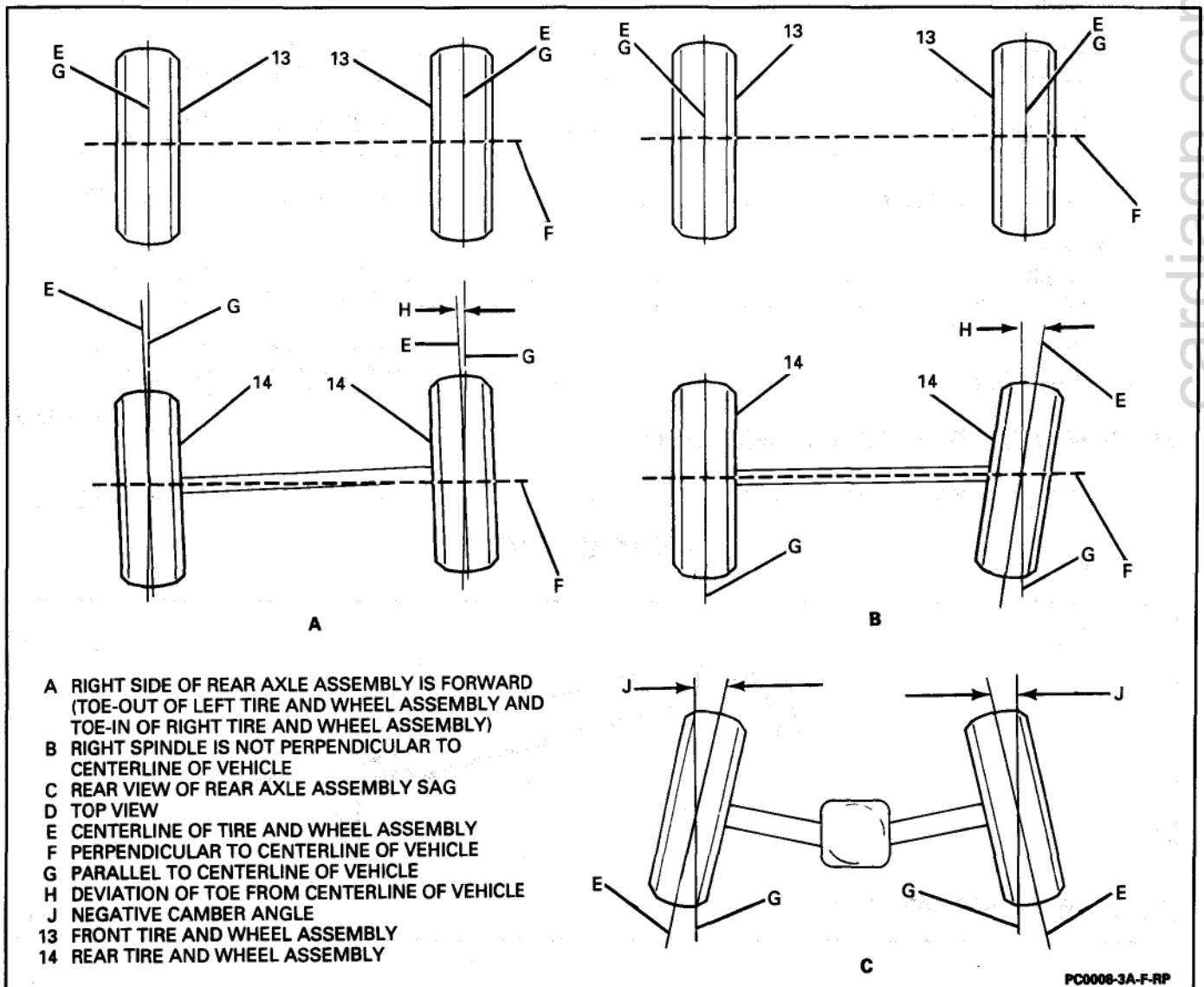


Figure 9 - Rear Tire and Wheel Assemblies

- B. Compensate for tire and wheel assembly run-out the same as for checking front tire and wheel assembly toe-in.
- C. Check camber reading which should be 0.0 degrees $\pm$ 0.6 degrees.
- D. Check amount of toe which should be 0.0 degrees $\pm$ 0.3 degrees.

- When using an alignment machine to measure toe-out, the measurement will read as toe-in on the scale.

- When checking toe-in with a tram gage, the measurement will read correctly as toe-out. However, when using a tram gage, it will still be necessary to perform steps A and B to check camber

REAR THRUST ANGLE ADJUSTMENT

If the thrust angle is not within specifications, inspect the upper and lower control arm assemblies for damage. If the control arm assemblies are not damaged, then check the frame dimensions. Refer to SECTION 10-3.

SPECIFICATIONS

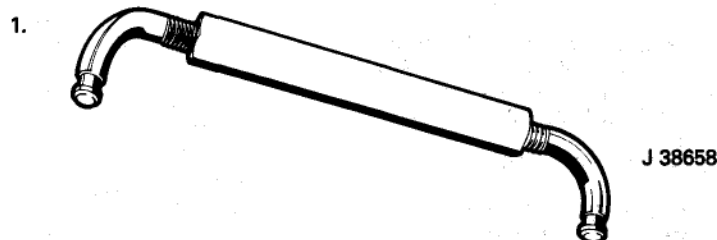
TIRE AND WHEEL ASSEMBLY ALIGNMENT SPECIFICATIONS

	SET	CHECK
Front		
Caster	4.4° $\pm$ 0.5°	4.4° $\pm$ 1.0°
Cross Caster	0.0° $\pm$ 0.7°	0.0° $\pm$ 0.7°
Camber	0.4° $\pm$ 0.5°	0.4° $\pm$ 1.0°
Cross Camber	0.0° $\pm$ 0.7°	0.0° $\pm$ 0.7°
Individual Toe	0.0° $\pm$ 0.1°	0.0° $\pm$ 0.1°
Total Toe	0.0° $\pm$ 0.2°	0.0° $\pm$ 0.2°
Steering Wheel Angle	0.0° $\pm$ 3.5°	0.0° $\pm$ 3.5°
Rear		
Camber	0.0° $\pm$ 0.6°	0.0° $\pm$ 0.6°
Cross Camber	0.0° $\pm$ 0.6°	0.0° $\pm$ 0.6°
Total Toe	0.0° $\pm$ 0.3°	0.0° $\pm$ 0.3°
Thrust Angle	0.0° $\pm$ 0.15°	0.0° $\pm$ 0.15°

FASTENER TIGHTENING SPECIFICATIONS

Steering Linkage Tie Rod Adjust Nut 47 N•m (35 lb. ft.)

SPECIAL TOOLS



1. CAMBER/CASTER ADJUSTER

PC0009-3A-F-RP