MEASURING WHEEL ALIGNMENT

Steering and vibration complaints are not always the result of improper alignment. One possible cause is wheel and tire imbalance. Another possibility is tire lead due to worn or improperly manufactured tires. Lead/pull is defined as follows: At a constant highway speed on a typical straight road, lead/pull is the amount of effort required at the steering wheel to maintain the vehicle's straight path. Lead is the vehicle deviation from a straight path on a level road without pressure on the steering wheel. Before performing any adjustment affecting wheel alignment, perform the following inspections and adjustments in order to ensure correct alignment readings:

- Inspect the tires for the proper inflation and irregular tire wear.
- Inspect the runout of the wheels and the tires.
- Inspect the wheel bearings for backlash and excessive play.
- Inspect the ball joints and tie rod ends for looseness or wear.
- Inspect the control arms and stabilizer shaft for looseness or wear.
- Inspect the steering gear for looseness at the frame.
- Inspect the struts/shock absorbers for wear, leaks, and any noticeable noises.
- Inspect the vehicle trim height.
- Inspect the steering wheel for excessive drag or poor return due to stiff or rusted linkage or suspension components.
- Inspect vehicle load: Inspect the fuel level. The fuel tank should be full or the vehicle should have a compensating load added. Give consideration to excess loads, such as tool boxes, sample cases, etc. If normally carried in the vehicle, these items should remain in the vehicle during alignment adjustments. Give consideration also to the condition of the equipment being used for the alignment. Follow the equipment manufacturer's instructions. Satisfactory vehicle operation may occur over a wide range of alignment settings. However, if the setting exceeds the service allowable specifications, correct the alignment to the service preferred specifications.
- Install the alignment equipment according to the manufacturer's instructions. Jounce the front and the rear bumpers 3 times prior to checking the wheel alignment. Measure the alignment angles and record the readings.

TRIM HEIGHT

TRIM HEIGHT MEASUREMENTS

Trim height is a predetermined measurement relating to vehicle ride height. Incorrect trim heights can cause bottoming out over bumps, damage to the suspension components and symptoms similar to wheel alignment problems. Check the trim heights when diagnosing suspension concerns and before checking the wheel alignment. Perform the following before measuring the trim heights:

1. Set the tire pressures to the pressure shown on the certification label.
2. Check the fuel level. Add additional weight if necessary to simulate a full tank.
3. Make sure the rear compartment is empty except for the spare tire.
4. Make sure the vehicle is on a level surface, such as an alignment rack.

Z Height Measurement

1. By hand, lift the front bumper of the vehicle up about 1.5 in. (38 mm).
2. Release vehicle.
3. Allow the vehicle to settle into position.
4. Repeat this jouncing operation 2 more times for a total of 3 times.
5. Measure from the pivot bolt center line (3) down to the lower corner (5) of the lower ball joint (1) in order to obtain the Z height measurement (4). See **Fig. 1** .
6. Push the front bumper of the vehicle down about 1.5 in. (38 mm).
7. Release vehicle.
8. Allow the vehicle to rise.
9. Repeat the operation for a total of 3 times.
10. Measure the Z dimension.
11. The true Z height dimension number is the average of the high and the low measurements. See **TRIM HEIGHT SPECIFICATIONS** .

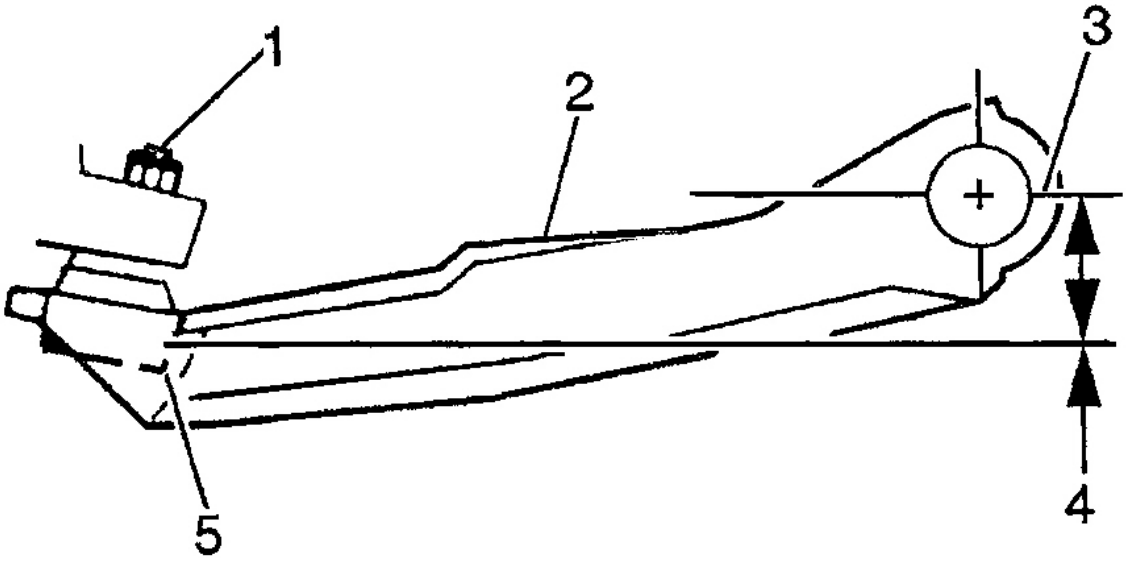

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Fig. 1: Measuring Z Height
Courtesy of GENERAL MOTORS CORP.

Z Height Adjustment

1. For vehicles equipped with a torsion bar suspension turn the bolt (1) that contacts the torsion arm clockwise to raise the and counterclockwise to lower the height adjustment. See **Fig. 2** . One revolution of the bolt (1) into the nut increases the Z height by approximately 0.2 in. (6.0 mm).
2. For vehicles without torsion bars, replace damaged or worn components as necessary.

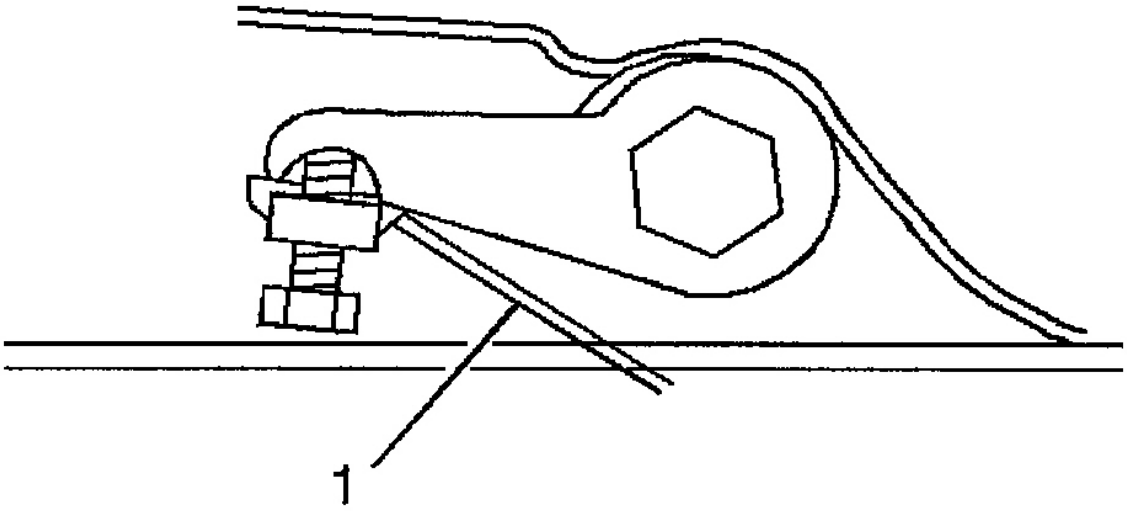

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Fig. 2: Adjusting Z Height
Courtesy of GENERAL MOTORS CORP.

D Height Measurement

NOTE: The D height dimension measurement determines the proper rear end ride height. There is no adjustment procedure. Repair may require replacement of suspension components.

1. With the vehicle on a flat surface, lift upward on the rear bumper 1.5 in. (38 mm).
2. Release vehicle.
3. Allow the vehicle to settle into position.
4. Repeat the jouncing operation 2 more times for a total of 3 times.
5. The D height is obtained by measuring the distance between the edge of the jounce cup along the jounce bumper center line and the jounce pad on the rear axle. See **Fig. 3** .
6. If these measurements are out of specifications, inspect for the following conditions:
    - Sagging front suspension. May need to replace torsion bar.
    - Sagging rear coil springs. May need to replace rear suspension Coil Springs.
    - Proper air suspension operation.
    - Worn rear suspension components.
    - Improper tire inflation.
    - Improper weight distribution.
    - Collision damage.

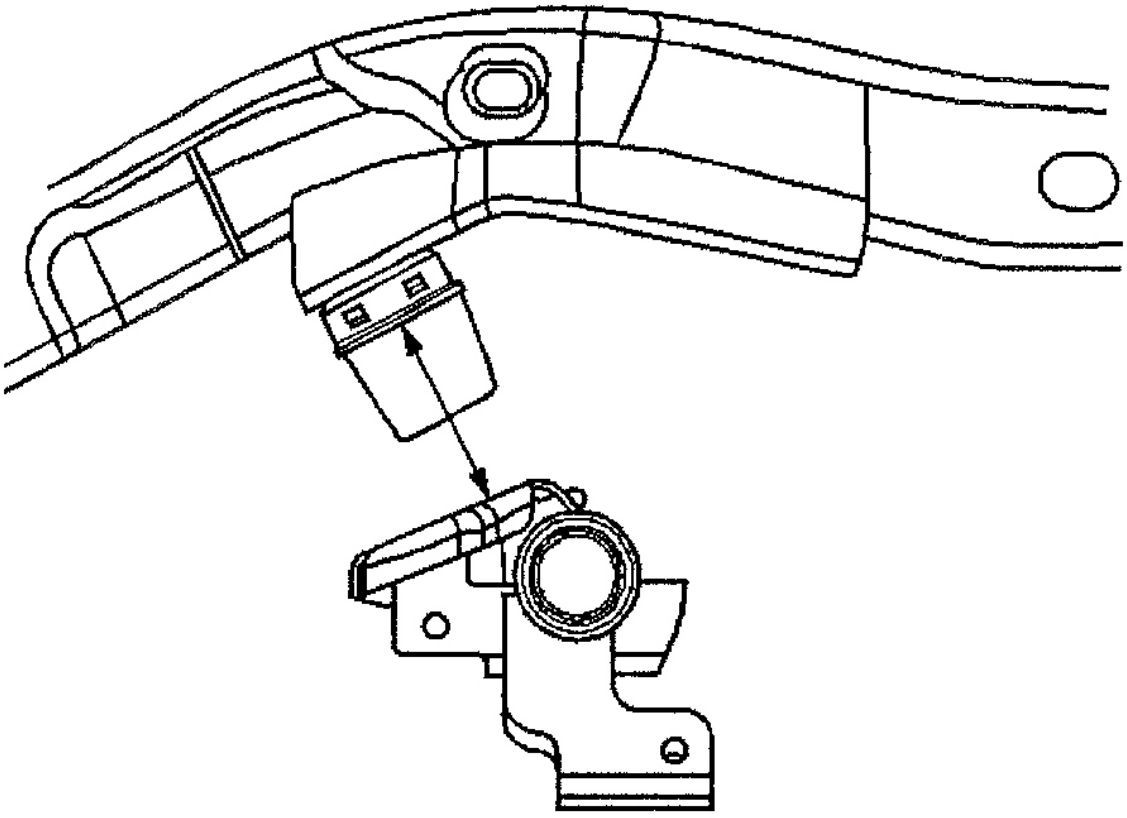

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Fig. 3: Measuring D Height
Courtesy of GENERAL MOTORS CORP.

ADJUSTMENTS

FRONT CASTER & CAMBER ADJUSTMENT

1. Caster is relative to frame, the caster values must be compensated for the measured frame angle by using a digital protractor or equivalent on a flat portion of the frame in front of the rear tire.
2. Frame angle is positive when higher in the rear. Measure both sides of the frame and take an average from those measurements. Then add the average frame angle to the caster reading when making adjustments.
3. Frame angle is negative when lower in the rear. Measure both sides of the frame and take an average from the measurements. Then subtract the average frame angle from the caster reading when making adjustments.
4. The caster and camber adjustments are made by rotating the offset cam bolt and the cam in the slotted frame bracket in order to reposition the control arm

NOTE: Before adjusting the caster and camber angles, jounce the front bumper three times to allow the vehicle to return to normal height. Measure and adjust the caster and the camber with the vehicle at curb height. The front suspension Z dimension is indicated in Trim Heights. See TRIM HEIGHT .

5. For an accurate reading, do not push or pull on the tires during the alignment process.
6. Determine the caster angle (2). Be sure to compensate for frame angle where required. See **Fig. 4** .
7. Determine the positive camber (2) or negative camber (3) angle. See **Fig. 5** .
8. Remove the pinned adjusting cam insert. Do not reinstall the cam insert.
9. Loosen the upper control arm cam adjustment bolts. See **Fig. 6**
10. Adjust the caster and the camber angle by turning the cam bolts until the specifications have been met. When the adjustments are complete, hold the cam bolt head in order to ensure the cam bolt position does not change while tightening the nut. Tighten cam nuts to specification. See **TORQUE SPECIFICATIONS** .
11. Verify that the caster and the camber are still within specifications. See **WHEEL ALIGNMENT SPECIFICATIONS** . When the caster and camber are within specifications, adjust the toe. See **FRONT TOE ADJUSTMENT** .

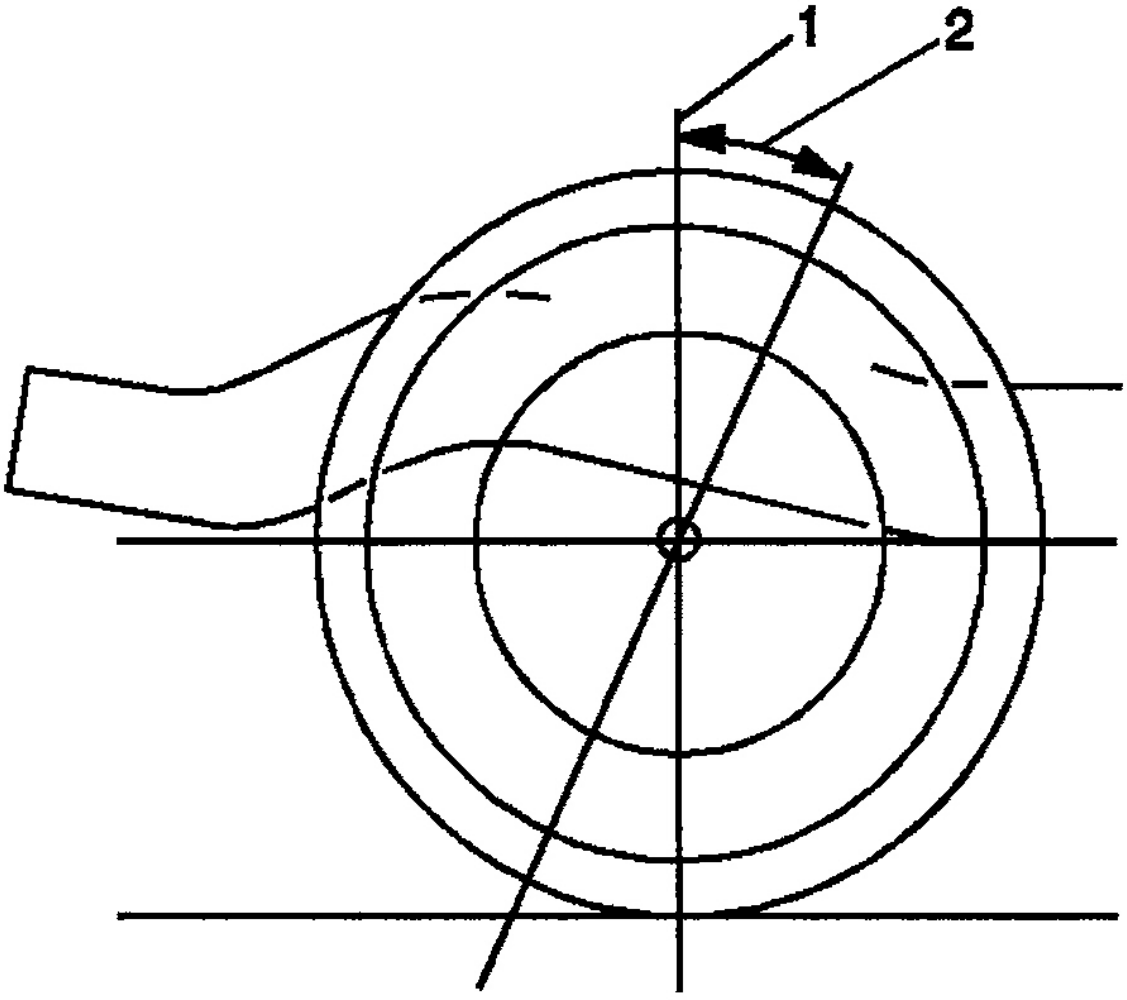

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Fig. 4: Checking Caster
Courtesy of GENERAL MOTORS CORP.

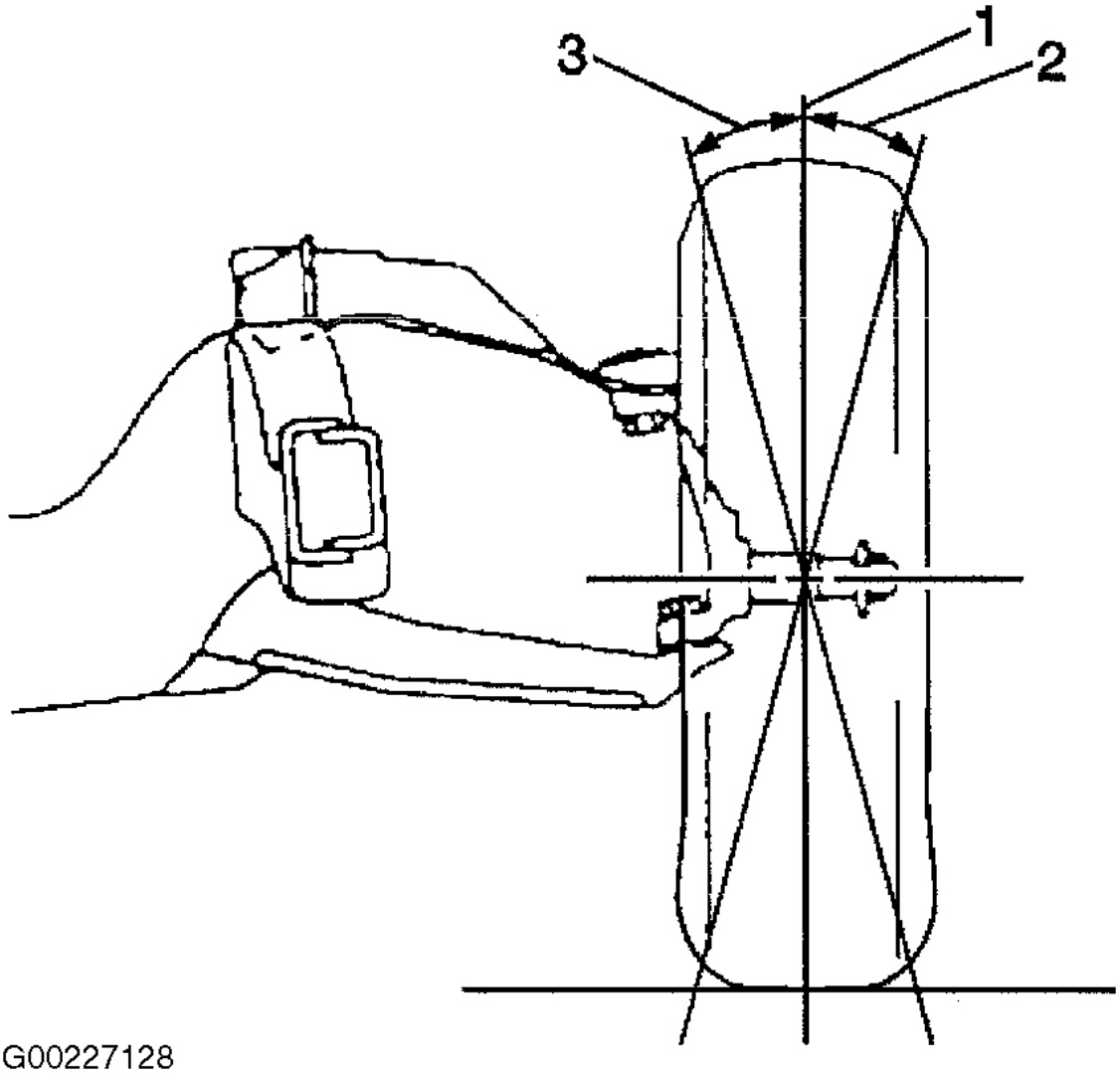

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Fig. 5: Checking Positive & Negative Camber
Courtesy of GENERAL MOTORS CORP.

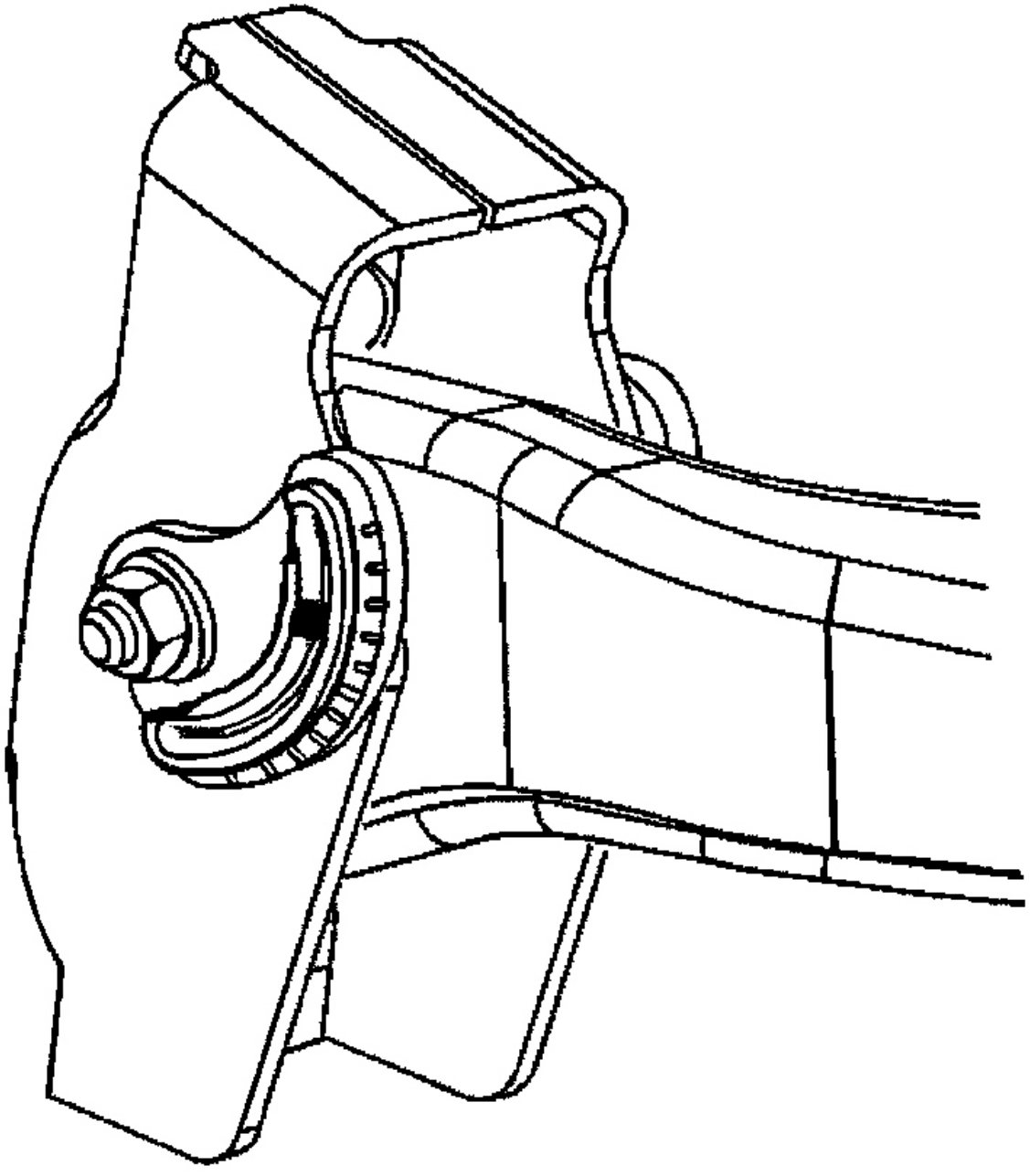

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Fig. 6: Locating Cam Adjuster Bolt
Courtesy of GENERAL MOTORS CORP.

FRONT TOE ADJUSTMENT

1. Loosen the jam nut on the tie rod.
2. Rotate the inner tie rod to the required toe specification setting. See **WHEEL ALIGNMENT SPECIFICATIONS** .

NOTE: **Use the correct fastener in the correct location. Replacement fasteners must be the correct part number for that application. Fasteners requiring replacement or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. Do not use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.**

3. Tighten the jam nut on the tie rod. See **TORQUE SPECIFICATIONS** .
4. Check the toe setting after tightening.
5. Readjust the toe setting if necessary.

SPECIFICATIONS

WHEEL ALIGNMENT SPECIFICATIONS

Use illustration for wheel alignment specifications. See **Fig. 7** .

Suspension Options	Caster		Cross Caster (L - R)	Camber	Cross Camber (L-R)	Total Toe	Steering Wheel Angle
	Left	Right					
Important Caster is relative to frame. The caster values must be compensated for the measured frame angle. Frame angle is positive when higher in the rear and negative when lower in the rear. Refer to Front Caster and Camber Adjustment .							
With RPO ZM6	4.25 ± 1.00	4.75 ± 1.00	-0.5 ± 0.50	+0.25 ± 0.50	0.00 ± 0.50	+0.10 ± 0.20	-1.0 ± 3.5
Without RPO ZM6	4.25 ± 1.00	4.75 ± 1.00	-0.5 ± 0.50	+0.25 ± 0.50	0.00 ± 0.50	+0.10 ± 0.20	-1.0 ± 3.5

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Fig. 7: Wheel Alignment Specifications
Courtesy of GENERAL MOTORS CORP.

TRIM HEIGHT SPECIFICATIONS

Use illustration for trim height specifications. See **Fig. 8** .

Suspension	Z Height	D Height
Trim Height must be verified and adjusted before aligning the vehicle.		
With RPO ZM6	122 mm (4.8 in) ±6 mm (0.24 in)	132 mm (5.2 in) ±6 mm (0.24 in)
Without RPO ZM6	122 mm (4.8 in) ±6 mm (0.24 in)	140 mm (5.5 in) ±6 mm (0.24 in)

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Fig. 8: Trim Height Specifications

Courtesy of GENERAL MOTORS CORP.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs (N.m)
Tie Rod Jam Nut	50 (68)
Upper/Lower Control Arm Cam Bolt Nuts	140 (190)