

2014 SUSPENSION

Wheel Alignment - Acadia, Enclave And Traverse

SPECIFICATIONS

WHEEL ALIGNMENT SPECIFICATIONS

Alignment Condition: Full tank of fuel, no passengers and placed on flat level surface.

Wheel Alignment Specifications

RPO Restriction	Wheels	Caster ± 0.8°		Cross Caster ± 0.8°	Camber ± 0.8°		Cross Camber ± 0.8°	Total Toe ± 0.2°	Steering Wheel Angle ± 3.5°	Thrust Angle ± 0.3°
		Left	Right	(Left - Right)	Left	Right	(Left - Right)	(Left + Right)		(Left - Right)/2
Without QPR	Front	4.7°	4.7°	0.0°	-0.9°	-0.9°	0.0°	0.0°	0.0°	-
	Rear	-	-	-	-0.9°	-0.9°	-	0.1°	-	0.0°
QPR	Front	4.7°	4.7°	0.0°	-0.9°	-0.9°	0.0°	0.0°	0.0°	-
	Rear	-	-	-	-0.9°	-0.9°	-	0.0°	-	0.0°

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Adjustment Link Nuts	140 N.m	103 lb ft
Front Suspension Strut Nuts	195 N.m	144 lb ft
Rear Suspension Upper Control Arm Nuts	140 N.m	103 lb ft
Steering Linkage Outer Tie Rod Jam Nuts	75 N.m	55 lb ft

REPAIR INSTRUCTIONS

WHEEL ALIGNMENT MEASUREMENT

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. Refer to **Radial Tire Lead/Pull Correction** in order to determine if the vehicle has a tire lead problem.

Before performing any adjustment affecting wheel alignment, perform the following inspections in order to ensure correct alignment readings:

- Inspect for visible damage to the suspension components and replace as necessary.
- Inspect the tires for the proper inflation and irregular tire wear. Refer to **Vehicle Certification, Tire Placard, Anti-Theft and Service Parts ID Label** and **Tire Diagnosis - Irregular or Premature Wear**.
- Inspect the runout of the wheels and the tires. Refer to **Tire and Wheel Runout Specifications**.
- Inspect the wheel bearings for backlash and excessive play. Refer to **Wheel Bearings Diagnosis**.
- Inspect the ball joints for looseness or wear.
- Inspect the 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. Refer to **Fastener Tightening Specifications**.
- Inspect the struts/shock absorbers for wear, leaks and any noticeable noises. Refer to **Suspension Strut and Shock Absorber Testing - On Vehicle**.
- Inspect the vehicle trim height. Refer to **Trim Height Inspection**.
- Inspect the steering wheel for excessive drag or poor return due to stiff or rusted linkage or suspension components.
- 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. Refer to **Wheel Alignment Specifications**.

Perform the following steps in order to measure the front and rear alignment angles:

1. Install the alignment equipment according to the manufacturer's instructions.
2. Jounce the front and the rear bumpers 3 times prior to checking the wheel alignment.
3. Measure the alignment angles and record the readings.
4. Adjust alignment angles to vehicle specification, if necessary. Refer to **Wheel Alignment Specifications**.

NOTE:

- Record the "Before" and "After" alignment measurements.
- When performing adjustments to vehicles requiring a 4-wheel alignment, set the rear toe adjustment first in order to obtain proper front alignment angles.

FRONT CAMBER ADJUSTMENT

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle**.
2. Remove the tire and wheel. Refer to **Tire and Wheel Removal and Installation**.
3. Remove the strut lower bolt in order to inspect for an oblong strut lower hole (3). If the strut lower hole is

oblong, loosen the strut upper bolt in order to allow for camber adjustment.



ROUTINE INSPECTION CHECKSHEET

Date: _____
 Name: _____
 Address: _____
 City: _____ State: _____ Zip Code: _____
 Year: _____ Make: _____ Model: _____
 Mileage: _____ License: _____ VIN: _____ Eng Code: _____

Customer Interview:

Reason Code Explanation

Code Reason

Reason

- A Part No Longer Performs Intended Purpose
- B Part Does Not Meet A Design Specification (Regardless Of Performance)
- C Part Is Missing
- Suggested/Optional
- 1 Part Is Close To The End Of Its Useful Life
- 2 To Address A Customer Need, Convenience Or Request
- 3 To Comply With Maintenance Recommended By The Vehicle's Original Equipment Manufacturer
- 4 Technician's Recommendation Based On Substantial And Informed Experience
- 5 To Comply With Maintenance Recommended By AMRAMAP



Your vehicle has been inspected following the Uniform Inspection and Communication Standards developed by the Motorist Assurance Program. MAP produces materials that give motorists the information and encouragement to take greater responsibility for their vehicles—through proper maintenance. We encourage participating service and repair shops to adopt the MAP Pledge of Assurance to their Customers and the Motorist Assurance Program Standards of Service. All participating service providers have agreed to subscribe to this Pledge and to adhere to the promulgated Standards of Service demonstrating to their customers that they are serious about customer satisfaction. For more information visit: www.motorist.org

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Fig. 1: Adjusting Front Camber
 Courtesy of GENERAL MOTORS COMPANY

If the strut lower hole is NOT oblong, perform the following steps:

1. Remove the upper strut bolt and separate lower part of the strut from the steering knuckle.
2. File the strut lower hole laterally (3) in order to allow for camber adjustment.
3. Move the strut back in to position with the steering knuckle.
4. Install the strut bolts, but do not fully tighten them.
5. Adjust the camber and tighten the strut nuts.

CAUTION: Refer to Fastener Caution .

Tighten

Tighten the strut lower nuts to 195 N.m (144 lb ft).

6. Install the tire and wheel. Refer to Tire and Wheel Removal and Installation .
7. Lower the vehicle.

WHEEL ALIGNMENT - STEERING WHEEL ANGLE AND/OR FRONT TOE ADJUSTMENT

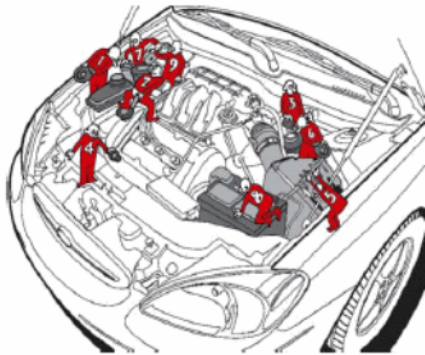
1. Remove the power steering gear seal small clamps.
2. Verify that the steering wheel is centered and the wheels are in the straight ahead position.
3. Loosen the left and right tie rod jam nuts (2).

2014 GMC Acadia Denali

2014 SUSPENSION Wheel Alignment - Acadia, Enclave And Traverse

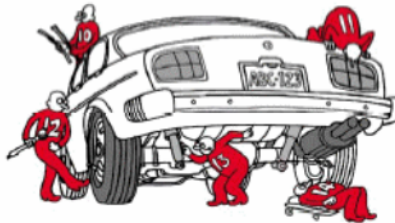
State Inspection Due / / **ROUTINE INSPECTION CHECKSHEET**

UNDERHOOD				
Component	OK	S	R	Condition
Coolant				
Coolant Hoses				
Belts (Except Timing Belt)				
Tensioner				
Transmission Fluid				
Engine Oil				
Engine Air Filter				
Cabin Air Filter				
Brake Fluid				
Clutch Fluid (M/T)				
Washer Fluid				
Battery				
Battery Hold Down				
Battery Box				
Battery Cables / Ends				
Power Steering Fluid				
Wiper Blades				
UNDER VEHICLE				
Shocks / Struts				
Exhaust				
Notes: _____				



1. Coolant
2. Belts
3. Transmission Fluid
4. Engine Oil
5. Air Filter
6. Brake Fluid
7. Washer Fluid
8. Battery
9. Power Steering Fluid

Lights/Lamps	OK	S	R	Location
Headlights				
Parking				
Turn Signal				
Brake				
License Plate				



10. Wiper Blades
11. Lights
12. Tire Pressure
13. Shocks / Struts
14. Exhaust

CHECK TIRES

Tire Size (Placard) Actual TPMS Warning On Off n/a



Tire Pressure			Wear Pattern / Damage			
Front Spec: <u> </u>	Before	After	OK	S	R	Wear Type
Left Front						
Right Front						
Rear Spec: <u> </u>						
Left Rear						
Right Rear						
Spare Tire						
Tread Depth	Left Front	Right Front	Left Rear	Right Rear		

- Wear Type**
- 1.) Edge wear
 - 2.) Cupped
 - 3.) Cut
 - 4.) Irregular wear
 - 5.) Other

OK

Suggested
1, 2, 3, 4, 5

Required
A, B, C

Automotive Maintenance & Repair Assn © 2009

Fig. 2: Identifying Tie Rod & Jam Nut
Courtesy of GENERAL MOTORS COMPANY

4. Rotate the inner tie rods in order to obtain the proper toe angle of 0°.

NOTE: Verify that the number of threads showing on both inner tie rod ends are

approximately equal.

5. Tighten the tie rod end jam nuts.

CAUTION: 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.

Tighten

Tighten the left and right tie rod jam nuts (2) to 75 N.m (55 lb ft).

6. Install the power steering gear seal small clamps.

NOTE: Verify that the power steering gear seal is not twisted.

REAR CAMBER ADJUSTMENT

1. Loosen the adjuster cam nut (1).

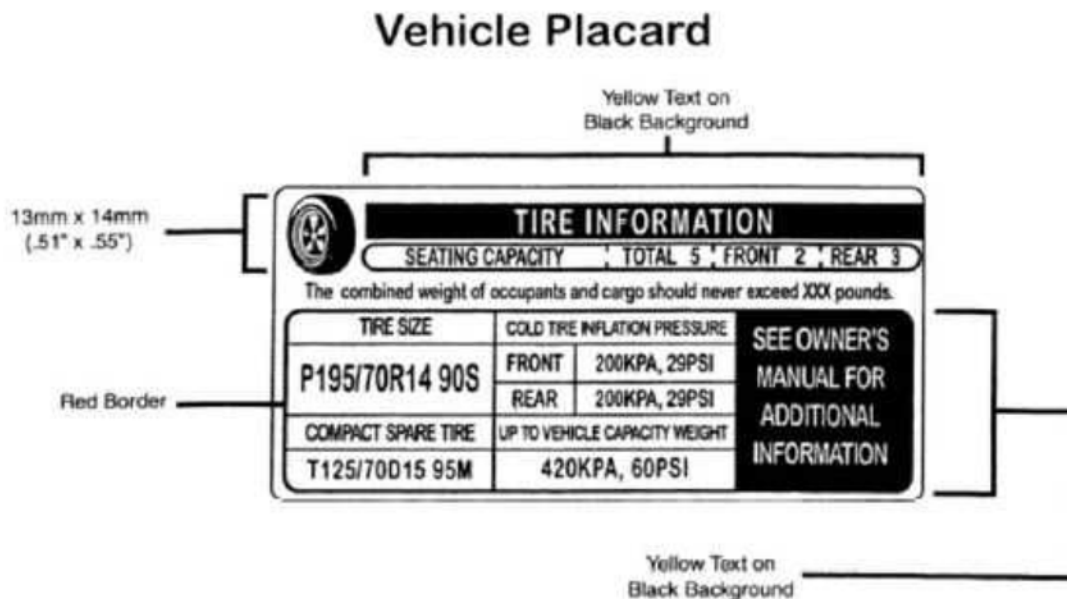


Fig. 3: Identifying Adjuster Cam Nut**Courtesy of GENERAL MOTORS COMPANY**

2. Using a wrench to rotate the adjuster bolt (2), adjust the cam (3) to specifications.
3. Using a wrench to hold the adjuster bolt (2), tighten the adjuster nut (1).

NOTE: **Ensure that the camber settings have not changed after torquing the adjuster nut to specifications. Readjust if necessary.**

CAUTION: Refer to Fastener Caution .

Tighten

Tighten the nut to 140 N.m (103 lb ft).

4. Check the toe alignment and adjust if required. Refer to Rear Toe Adjustment.
5. Test drive the vehicle.

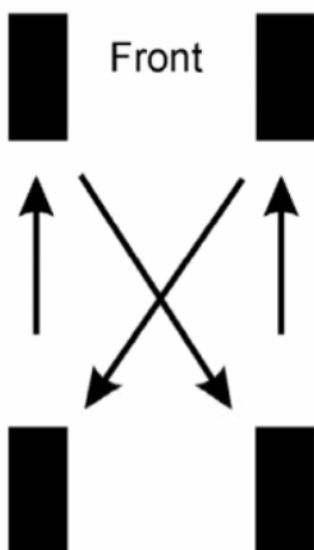
REAR TOE ADJUSTMENT

1. Loosen the adjuster nut (1).

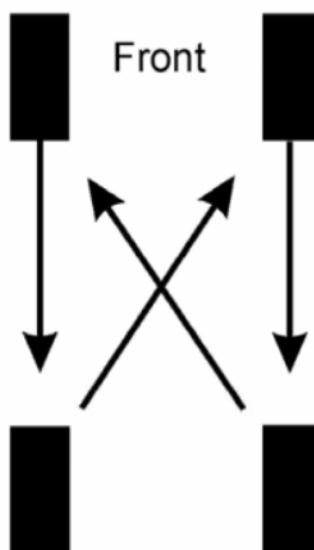
POPULAR TIRE ROTATION PATTERNS

(Only Where Tires Are Same Type & Size)

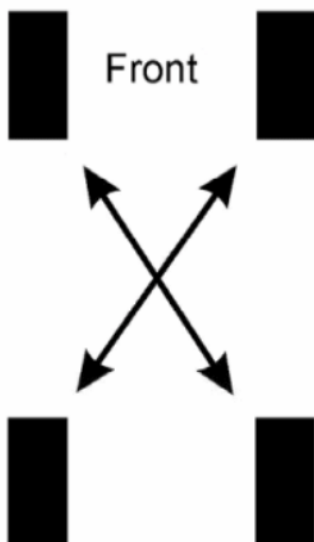
Rear- and Four-Wheel-Drive Vehicles



Front-Wheel-Drive Vehicles



All Vehicles



All Vehicles

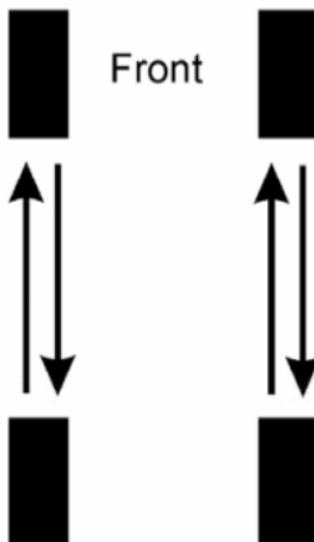


Fig. 4: Identifying Toe Adjuster Nut

Courtesy of GENERAL MOTORS COMPANY

NOTE: Make any adjustments to camber before setting toe.

NOTE: Left side toe adjustment is shown, right side toe adjustment is similar.

2. Using a wrench to rotate the adjuster bolt (2), adjust the cam (3) to specifications.
3. Using a wrench to hold the adjuster bolt (2), tighten the adjuster nut (1).

NOTE: Ensure that the toe settings have not changed after torquing the adjuster nut to specifications. Readjust if necessary.

CAUTION: Refer to Fastener Caution .

Tighten

Tighten the nut to 140 N.m (103 lb ft).

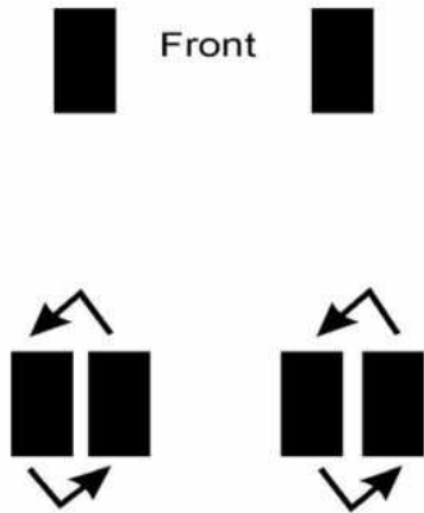
4. Check the toe alignment and adjust if required. Refer to Rear Toe Adjustment.
5. Test drive the vehicle.

DESCRIPTION AND OPERATION

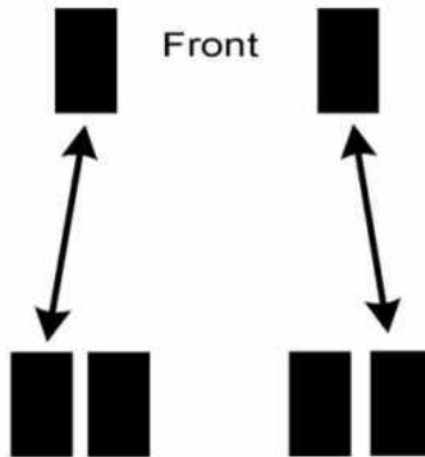
CAMBER DESCRIPTION

Vehicles With Dual Rear Wheels

Rear Tire Irregular Wear



Front Tire Irregular Wear



Six-Tire Rotation

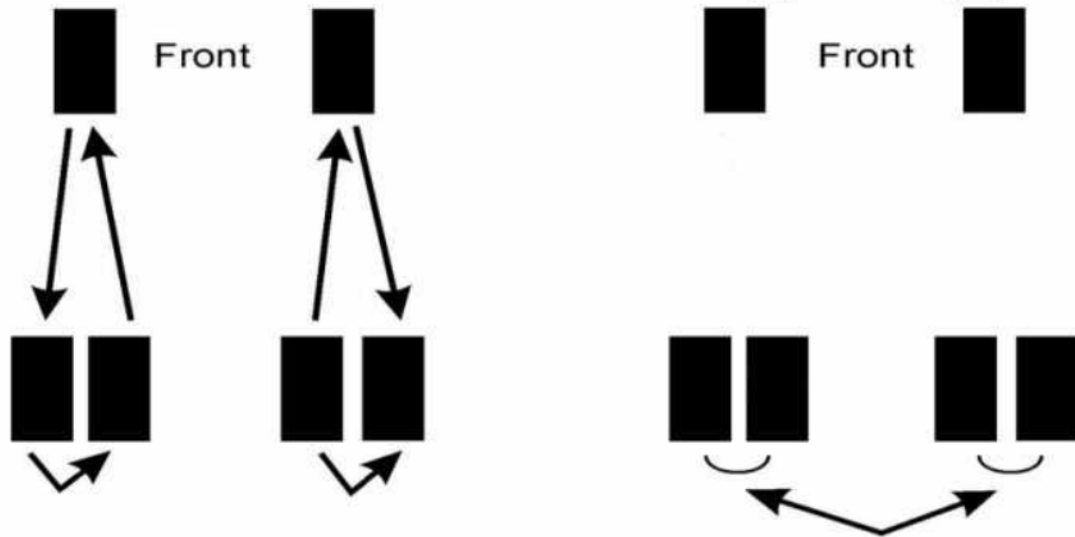


Fig. 5: Illustrating Camber Angle

Courtesy of GENERAL MOTORS COMPANY

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

Too much positive camber will result in premature wear on the outside of the tire and cause excessive wear on

the suspension parts.

Too much negative camber will result in premature wear on the inside of the tire and cause excessive wear on the suspension parts.

Unequal side-to-side camber of 1° or more will cause the vehicle to pull or lead to the side with the most positive camber.

Cross Camber is the difference between the left camber value and the right camber value.

Cross Camber = L camber - R camber

CASTER DESCRIPTION

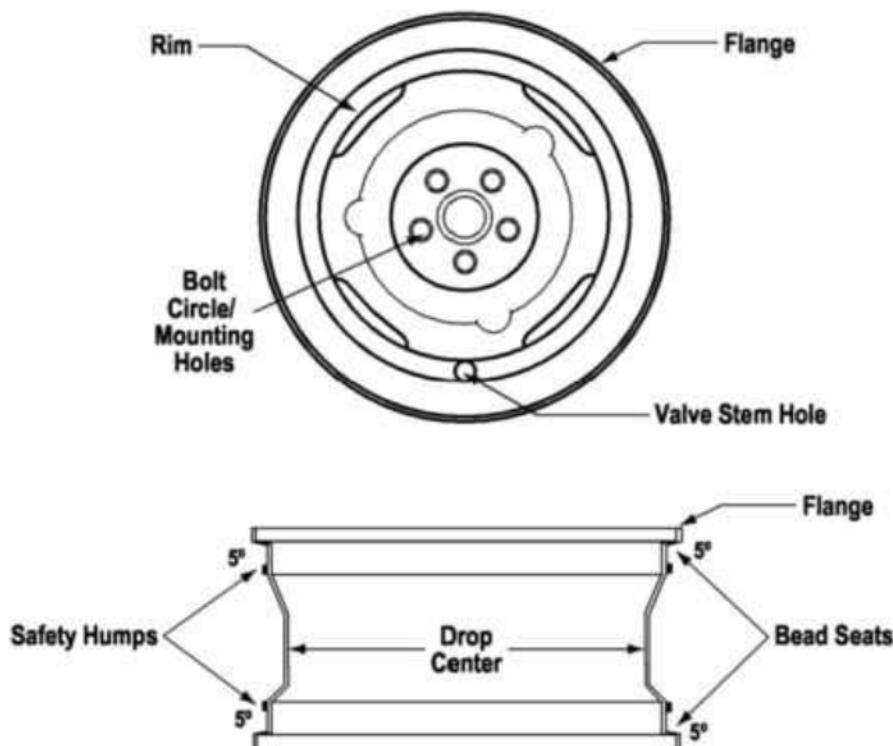


Fig. 6: Illustrating Caster Angle

Courtesy of GENERAL MOTORS COMPANY

Caster is the tilting of the uppermost point of the steering axis either forward or backward, when viewed from the side of the vehicle. A backward tilt is positive (+) and a forward tilt is negative (-). Caster influences directional control of the steering but does not affect the tire wear. Caster is affected by the vehicle height, therefore it is important to keep the body at its designed 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.

With too little positive caster, steering may be touchy at high speed and wheel returnability may be diminished

when coming out of a turn. If one wheel has more positive caster than the other, that wheel will pull toward the center of the vehicle. This condition will cause the vehicle to pull or lead to the side with the least amount of positive caster.

Cross Caster is the difference between the left caster value and the right caster value.

Cross caster = L caster - R caster

LEAD/PULL DESCRIPTION

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.

IMPORTANT: Vehicles will tend to lead/pull in the direction of the road slope as part of normal operation.

Lead/pull is usually caused by the following factors:

- Road slope
- Variability in tire construction
- Wheel alignment (front cross caster and camber)
- Unbalanced steering gear
- Electronic Power Steering (EPS) steering position and torque sensors not calibrated correctly, if equipped.

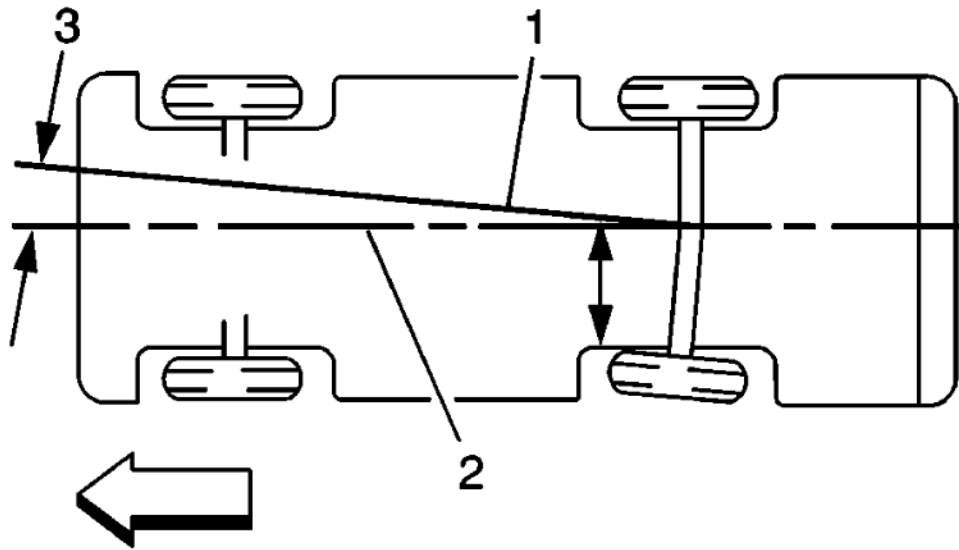
SCRUB RADIUS DESCRIPTION

Ideally, the scrub radius is as small as possible. Normally, the SAI angle and the centerline of the tire and the wheel intersect below the road surface, causing a positive scrub radius. With struts, the SAI angle is much larger than the long arm/short arm type of suspension. This allows the SAI angle to intersect the camber angle above the road surface, forming a negative scrub radius. The smaller the scrub radius, the better the directional stability. Installing aftermarket wheels that have additional offset will dramatically increase the scrub radius. The newly installed wheels may cause the centerline of the tires to move further away from the spindle. This will increase the scrub radius.

A large amount of scrub radius can cause severe shimmy after hitting a bump. Four-wheel drive vehicles with large tires use a steering damper to compensate for an increased scrub radius. Scrub radius is not directly measurable by the conventional methods. Scrub radius is projected geometrically by engineers during the design phase of the suspension.

SETBACK DESCRIPTION

Setback applies to both the front and the rear wheels. Setback is the amount that one wheel may be aligned behind the other wheel. Setback may be the result of a road hazard or a collision. The first clue is a caster difference from side-to-side of more than 1 degree.

THRUST ANGLES DESCRIPTION**Fig. 7: Illustrating Thrust Angles**

Courtesy of GENERAL MOTORS COMPANY

The front wheels aim or steer the vehicle. The rear wheels control tracking. This tracking action relates to the thrust angle (3). The thrust angle is the path that the rear wheels take. Ideally, the thrust angle is geometrically aligned with the body centerline (2).

In the illustration, toe-in is shown on the left rear wheel, moving the thrust line (1) off center. The resulting deviation from the centerline is the thrust angle.

If the thrust angle is not set properly the vehicle may "dog track", the steering wheel may not be centered or it could be perceived as a bent axle. Thrust angle can be checked during a wheel alignment.

Positive thrust angle means the thrust line is pointing to the right hand side (RHS) of the vehicle.

Negative thrust angle means the thrust line is pointing to the left hand side (LHS) of the vehicle.

If the thrust angle is out of specification, moving the axle to body relationship will change the thrust angle reading.

If the vehicle is out in the Positive (+) direction-moving the RHS forward and/or LHS rearward will move the thrust angle towards 0°.

If the vehicle is out in the Negative (-) direction-moving the RHS rearward and/or LHS forward will move the thrust angle towards 0°.

TOE DESCRIPTION

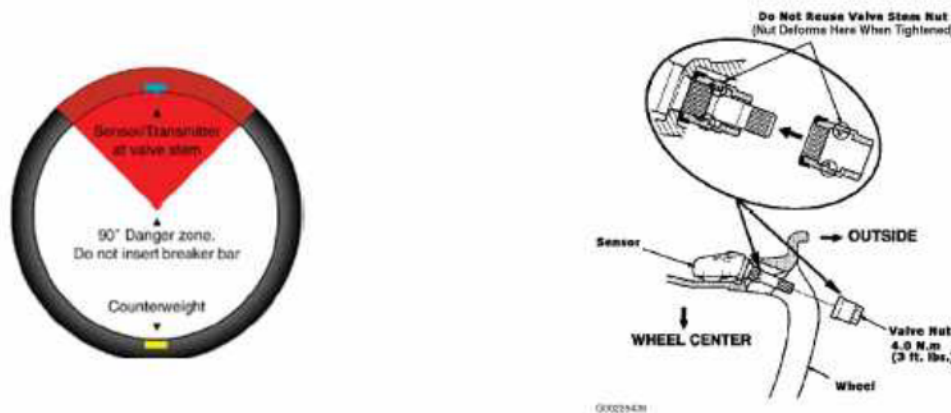


Fig. 8: Illustrating Toe Angle

Courtesy of GENERAL MOTORS COMPANY

Toe is a measurement of how much the front and/or rear wheels are turned in or out from a straight-ahead position. When the wheels are turned in, toe is positive (+). When the wheels 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 wheels roll parallel.

Toe also offsets the small deflections of the wheel support system that occur when the vehicle is rolling forward. In other words, with the vehicle standing still and the wheels set with toe-in, the wheels tend to roll parallel on the road when the vehicle is moving.

Improper toe adjustment will cause premature tire wear and cause steering instability.

TORQUE STEER DESCRIPTION



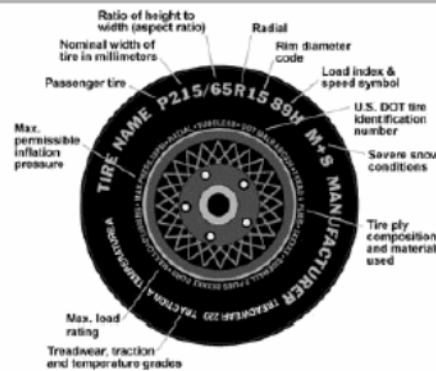
WHEELS & TIRES CHECKSHEET

Date: _____
 Name: _____
 Address: _____
 City: _____ State: _____ Zip Code: _____
 Year: _____ Make: _____ Model: _____
 Mileage: _____ License: _____ VIN: _____ Eng Code: _____

Customer Interview:

Reason Code Explanation

Code	Reason
<u>Required</u>	
A	Part No Longer Performs Intended Purpose
B	Part Does Not Meet A Design Specification (Regardless Of Performance)
C	Part Is Missing
<u>Suggested/Optional</u>	
1	Part Is Close To The End Of Its Useful Life
2	To Address A Customer Need, Convenience Or Request
3	To Comply With Maintenance Recommended By The Vehicle's Original Equipment Manufacturer
4	Technician's Recommendation Based On Substantial And Informed Experience
5	To Comply With Maintenance Recommended By AMRAMAP



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Fig. 9: Identifying Torque Steer
 Courtesy of GENERAL MOTORS COMPANY

A vehicle pulls or leads in one direction during hard acceleration. A vehicle pulls or leads in the other direction during deceleration.

The following factors may cause torque steer to be more apparent on a particular vehicle:

- A slightly smaller diameter tire on the right front increases a right torque lead. Inspect the front tires for differences in the brand, the construction or the size. If the tires appear to be similar, change the front tires from side-to-side and retest the vehicle. Tire and wheel assemblies have the most significant effect on torque steer correction.
- A large difference in the right and left front tire pressure
- Left-to-right differences in the front view axle angle may cause significant steering pull in a vehicle. The pull will be to the side with the most downward sloping axle from the differential to the wheels. Axles typically slope downward from the differential. The slope of the transaxle pan to level ground may be used as an indication of bias axle angles. The side with the higher transaxle pan (shown on the left side of the illustration) has the most downward sloping axle angle.

WANDER DESCRIPTION

Wander is the undesired drifting or deviation of a vehicle to either side from a straight path with hand pressure on the steering wheel. Wander is a symptom of the vehicle's sensitivity to external disturbances, such as road crown and crosswind and accentuated by poor on-center steering feel.