

Suspension

Wheel Alignment - CTS Coupe & Wagon

SPECIFICATIONS

WHEEL ALIGNMENT SPECIFICATIONS

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

Wheel Alignment Specifications

[illegible]

AWD FE2, FE3, FE5	Rear	-	-	-	-1.0°	-1.0°	-	0.2° (Individual toe to be 0.1°, must be greater than or equal to 0.0°)	-	0.0°
FE4	Front	5.8°	5.8°	0.0°	-0.9°	-0.9°	0.0°	0.2°	0.0°	-
	Rear	-	-	-	-1.4°	-1.4°	-	0.2° (Individual toe spec = 0.1°, each must be greater than or equal to 0.00°)	-	0.0°

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Adjustment Link Nut	75 N.m	55 lb ft
Front Lower Control Arm to Cradle Nut (With All Wheel Drive AWD) - Front Nuts		
First Pass	90 N.m	66 lb ft
Final Pass	plus 140°	
Front Lower Control Arm to Cradle Nut (With All Wheel Drive AWD) - Rear Nuts		
First Pass	90 N.m	66 lb ft
Final Pass	plus 95°	
Front Lower Control Arm to Cradle Bolt- Front bolts (With Rear Wheel Drive RWD)	200 N.m	148 lb ft
Front Lower Control Arm to Cradle Bolt- Rear bolts (With Rear Wheel Drive RWD)	320 N.m	236 lb ft
Rear Lower Control Arm Bolt	165 N.m	122 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.

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.**

4. Adjust alignment angles to vehicle specification, if necessary. Refer to **Wheel Alignment Specifications**.

FRONT CASTER AND CAMBER ADJUSTMENT

The caster and camber adjustments are made by loosening the lower control arm adjustment bolts and repositioning the lower control arm.

NOTE: Before adjusting the caster and camber angles, jounce the front bumper 3 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 and the rear suspension D dimension are indicated in Trim Heights. Refer to Trim Height Inspection .

1. For an accurate reading, do not push or pull on the tires during the alignment process.

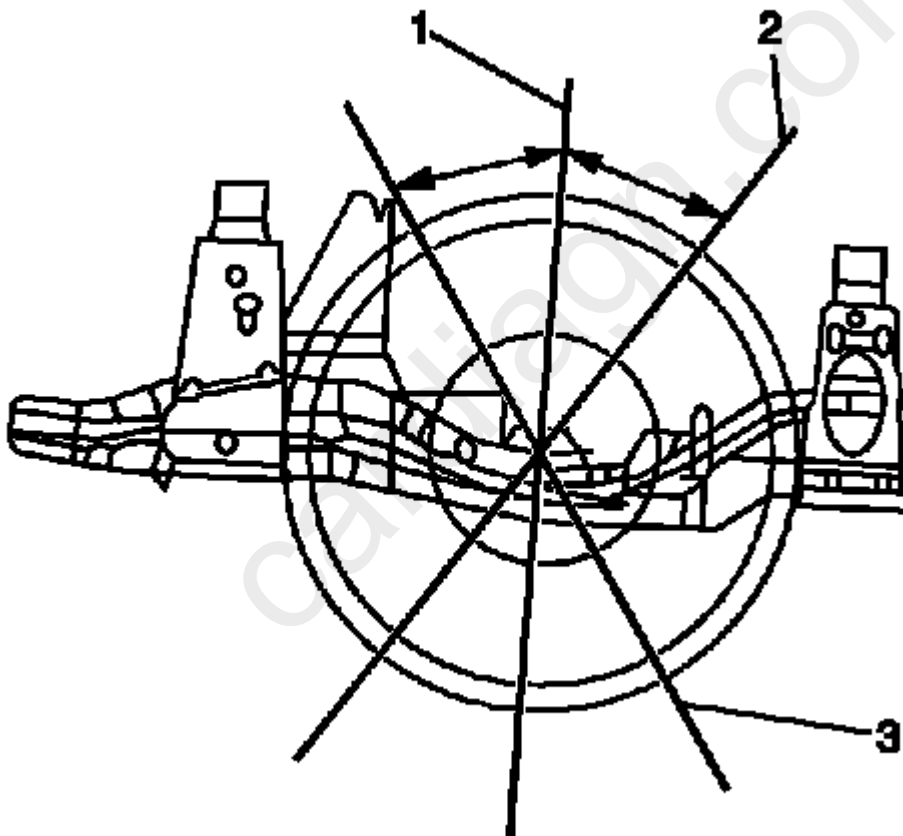


Fig. 1: Determining Caster Angle
Courtesy of GENERAL MOTORS COMPANY

2. Determine the caster angle (2, 3).

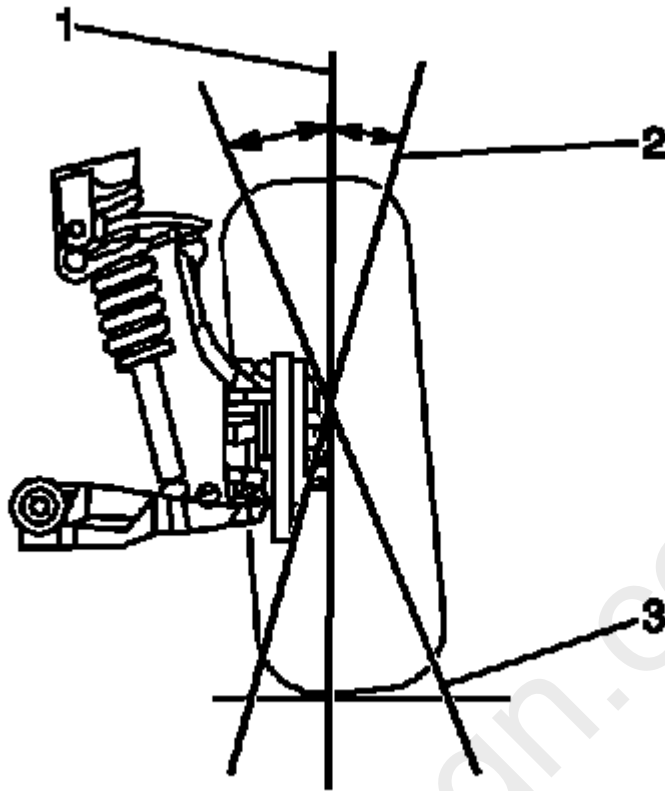


Fig. 2: Determining Camber Angle
Courtesy of GENERAL MOTORS COMPANY

3. Determine the camber angle (2, 3).
4. Loosen the lower control arm adjustment nuts.

CAUTION: Refer to Fastener Caution .

5. Adjust the caster and the camber angle by repositioning the lower control arm until the specifications have been met.

When the adjustments are complete, hold the lower control arm in position so that the specifications do not change while tightening the lower control arm adjustment bolts.

Tighten

Tighten the lower control arm adjustment bolts to 135 N.m (96 lb ft).

6. Verify that the caster and the camber are still within specifications. Refer to **Wheel Alignment Specifications**.

When the caster and camber are within specifications, adjust the toe. Refer to Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment.

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

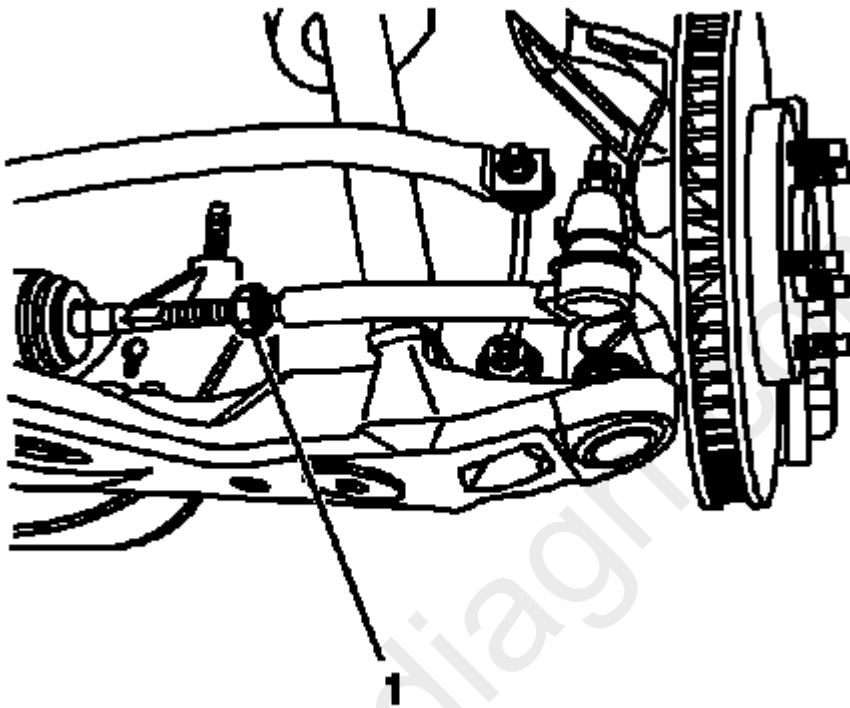


Fig. 3: View Of Outer Tie Rod Jam Nut
Courtesy of GENERAL MOTORS COMPANY

1. Loosen the steering linkage inner tie rod nut (1) on the outer tie rod.

CAUTION: Care must be taken that the boots are not twisted when rotating the inner tie rods, or damage to the boots may result.

2. Rotate the inner tie rod to the required toe specification setting. Refer to Wheel Alignment Specifications.
3. Tighten the steering linkage inner tie rod nut. Refer to Wheel Alignment - Steering Wheel Angle and/or Front Toe Adjustment.
4. Check the toe setting after tightening. Refer to Wheel Alignment Specifications.
5. Re-adjust the toe setting if necessary.

REAR CAMBER ADJUSTMENT

Special Tools

- **J 45845** Caster and Camber Adjusting Tool
- **J 45845-10** Caster and Camber Adjusting Rod

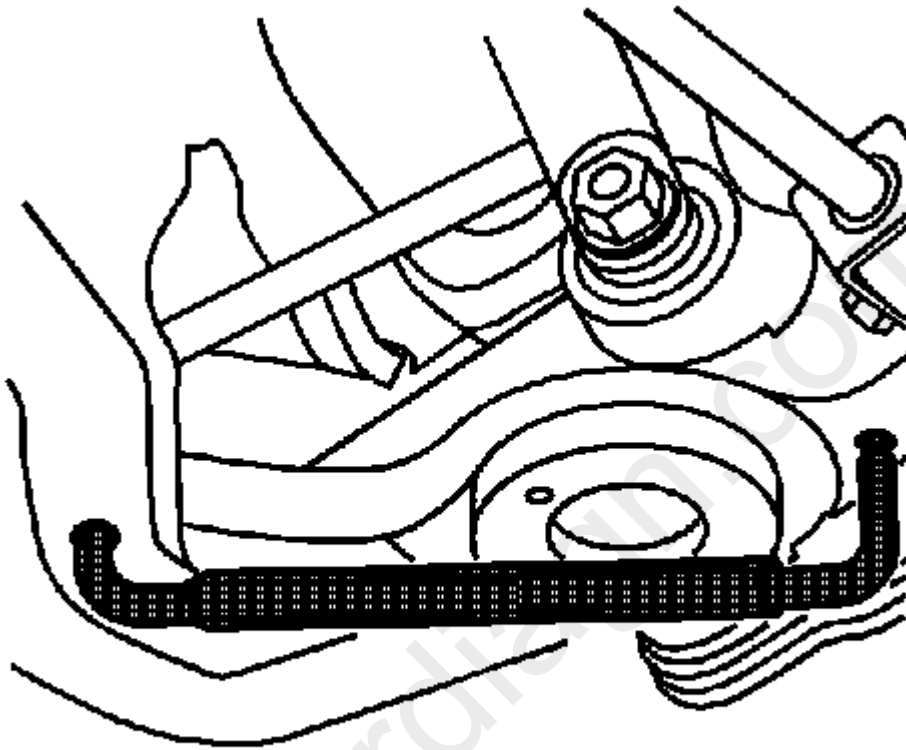


Fig. 4: Caster & Camber Adjusting Tool
Courtesy of GENERAL MOTORS COMPANY

1. Position the **J 45845** tool and the **J 45845-10** rod on the lower control arm to the frame.
2. Loosen the lower control arm to frame bolt.

CAUTION: Refer to Fastener Caution .

3. Using the **J 45845** tool and the **J 45845-10** rod , adjust the camber angle until the specifications have been met and tighten the bolt to 165 N.m (122 lb ft).
4. Verify that the camber is still with specifications. Refer to **Wheel Alignment Specifications**.
5. Adjust the rear toe. Refer to **Rear Toe Adjustment**.

REAR TOE ADJUSTMENT

NOTE: Adjust the rear toe on each rear wheel separately.

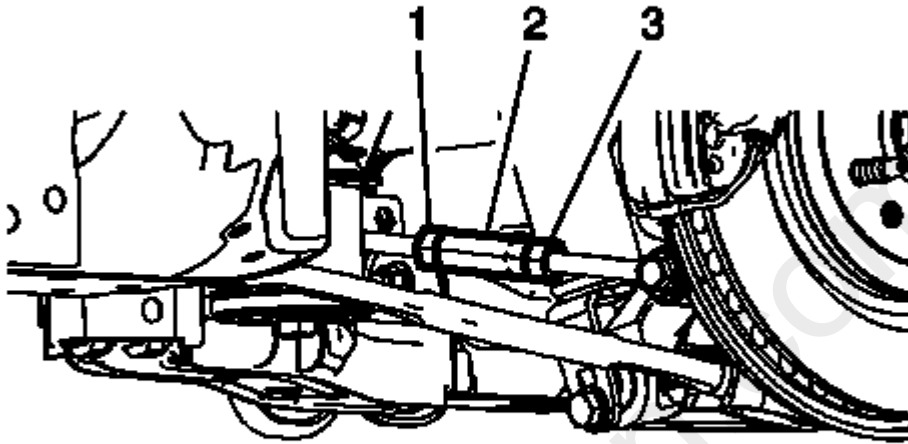


Fig. 5: Rear Suspension Adjust Link & Nuts
Courtesy of GENERAL MOTORS COMPANY

1. Loosen the rear suspension adjust link nuts (1) and (3).
2. Adjust the toe by rotating the rear suspension adjust link (2) until the proper specification as been reached. Refer to **Wheel Alignment Specifications**.

CAUTION: Refer to **Fastener Caution** .

3. Using a backup wrench to hold the rear suspension adjust link (2), tighten the rear suspension adjust link nuts (1) and (3) to 75 (55 lb ft).
4. Recheck the toe setting.

NOTE: Adjust the rear toe on each rear wheel separately.

5. If necessary, readjust the toe specifications.

DESCRIPTION AND OPERATION

CAMBER DESCRIPTION

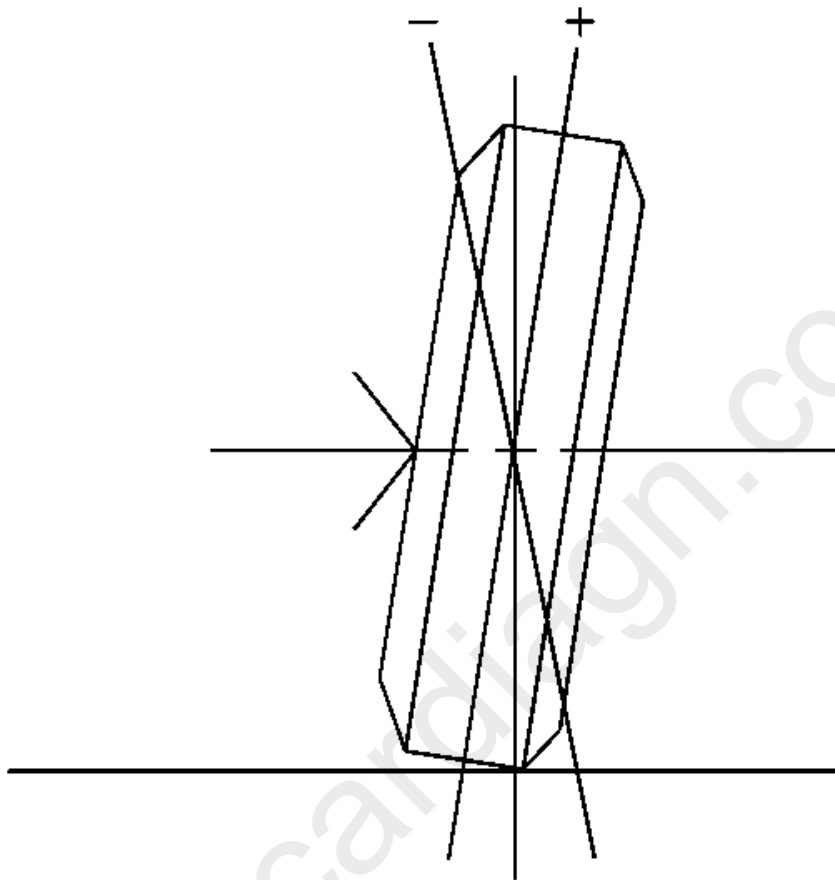


Fig. 6: Illustrating Camber Angle

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 degree 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

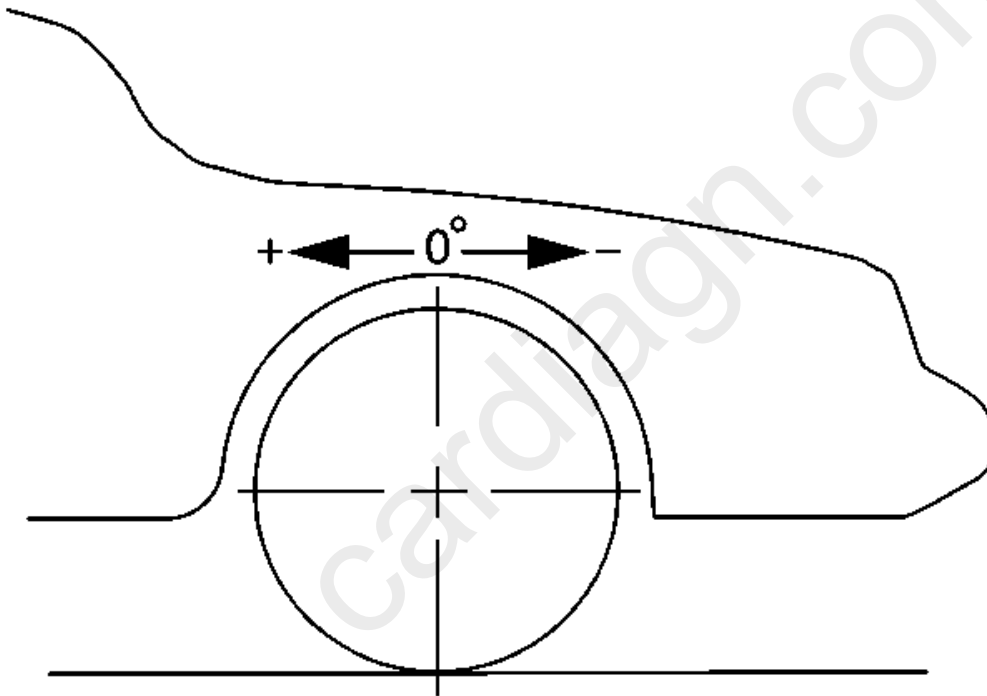


Fig. 7: Illustrating Caster Angle
Courtesy of GENERAL MOTORS COMPANY

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.

MEMORY STEER DESCRIPTION

Memory steer is when the vehicle wants to lead or pull in the direction the driver previously turned the vehicle. Additionally, after turning in the opposite direction, the vehicle will want to lead or pull in that direction.

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

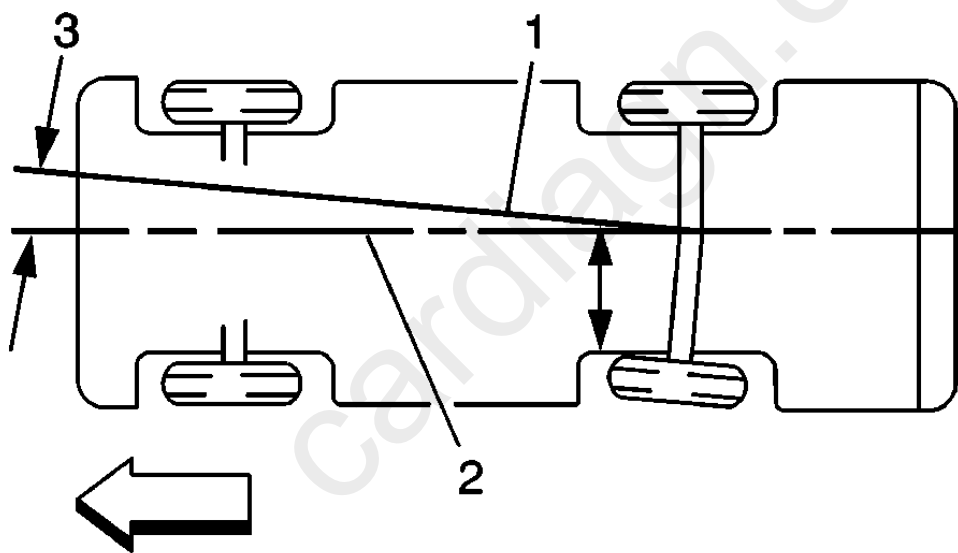


Fig. 8: Illustrating Thrust Angles
Courtesy of GENERAL MOTORS COMPANY

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 zero degrees.

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

TOE DESCRIPTION

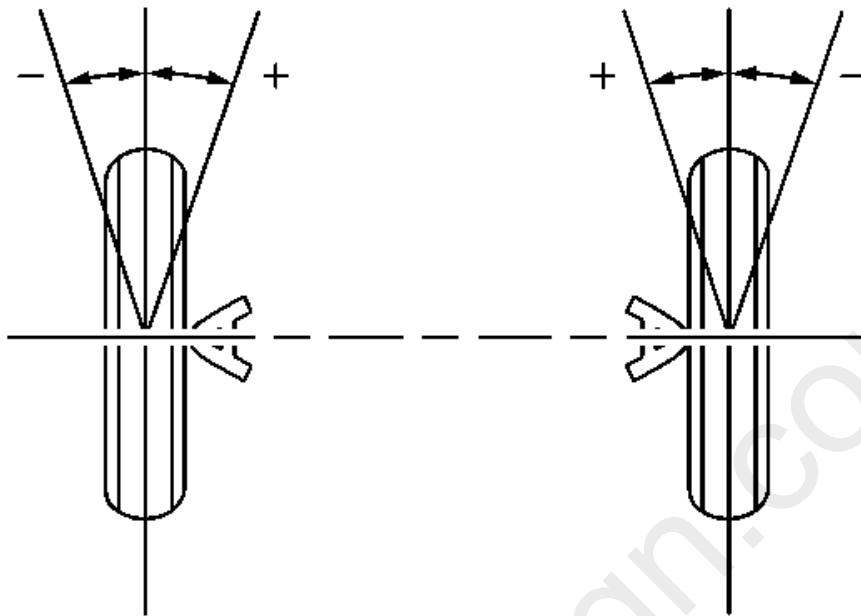


Fig. 9: Illustrating Toe Angle
Courtesy of GENERAL MOTORS COMPANY

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.

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.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Illustration	Tool Number/ Description
	J 45845 Caster and Camber Adjusting Tool

J 45845-10
Caster and
Camber
Adjusting
Rod

