SECTION 2B

WHEEL ALIGNMENT

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DESCRIPTION AND OPERATION

FOUR WHEEL ALIGNMENT

The first responsibility of engineering is to design safe steering and suspension systems. Each component must be strong enough to withstand and absorb extreme punishment. Both the steering system and the front and the rear suspension must function geometrically with the body mass.

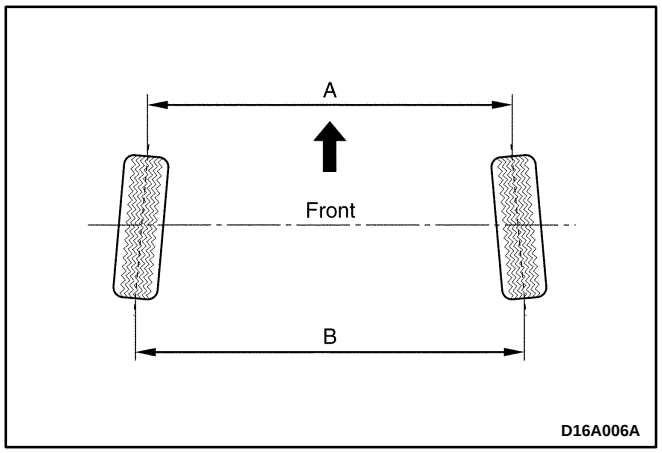
The steering and the suspension systems require that the front wheels self-return and that the tire rolling effort and the road friction be held to a negligible force in order to allow the customer to direct the vehicle with the least effort and the most comfort.

A complete wheel alignment check should include measurements of the rear toe and camber.

Four-wheel alignment assures that all four wheels will be running in precisely the same direction.

When the vehicle is geometrically aligned, fuel economy and tire life are at their peak, and steering and performance are maximized.

TOE



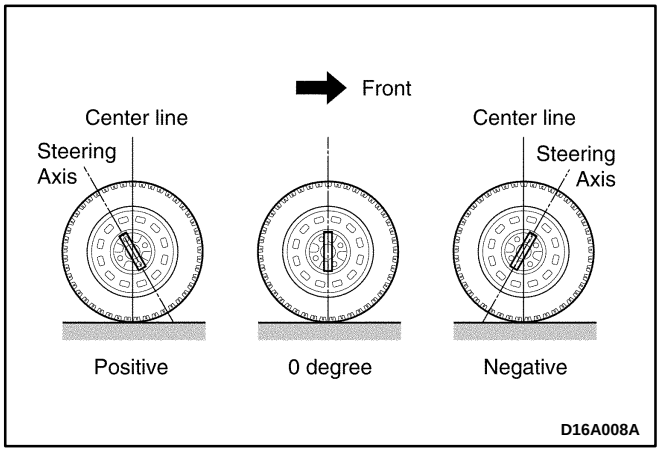
Toe–in is the turning in of the tires, while toe–out is the turning out of the tires from the geometric centerline or thrust line. The toe ensures parallel rolling of the wheels.

The toe serves to offset the small deflections of the wheel support system which occur when the vehicle is rolling forward. The specified toe angle is the setting which achieves–degrees (0°) of toe when the vehicle is moving.

Incorrect toe-in or toe-out will cause tire wear and reduced fuel economy. As the individual steering and suspension components wear from vehicle mileage, additional toe will be needed to compensate for the wear.

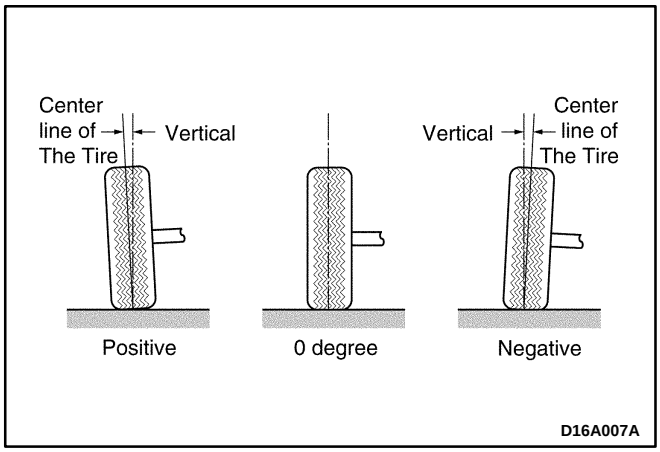
Always correct the toe dimension last.

CASTER



Caster is the tilting of the uppermost point of the steering axis either forward or backward from the vertical 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 tire wear. Weak springs or overloading a vehicle will affect caster. One wheel with more positive caster will pull toward the center of the car. This condition will cause the car to move or lean toward the side with the least amount of positive caster. Caster is measured in degrees and is not adjustable.

CAMBER



Camber is the tilting of the top of the tire from the vertical when viewed from the front of the vehicle. When the tires tilt outward, the camber is positive. When the tires tilt inward, the camber is negative. The camber angle is measured in degrees from the vertical. Camber influences both directional control and tire wear.

If the vehicle has too much positive camber, the outside shoulder of the tire will wear. If the vehicle has too much negative camber, the inside shoulder of the tire will wear. Camber is measured in degrees and is not adjustable.

STEERING AXIS INCLINATION

Steering Axis Inclination (SAI) is the tilt at the top of the steering knuckle from the vertical. Measure the SAI angle from the true vertical to a line through the center of the strut and the lower ball joint as viewed from the front of the vehicle.

SAI helps the vehicle track straight down the road and assists the wheel back into the straight ahead position. SAI on front wheel drive vehicles should be negative.

INCLUDED ANGLE

The included angle is the angle measured from the camber angle to the line through the center of the strut and the lower ball joints as viewed from the front of the vehicle.

The included angle is calculated in degrees Most alignment racks will not measure the included angle directly. To determine the included angle, subtract the negative or add the positive camber readings to the Steering Axis Inclination (SAI).

SCRUB RADIUS

The scrub radius is the distance between true vertical and the line through the center of the strut and lower ball joint to the road surface. Scrub radius is bulit into the design of the vehicle. Scrub radius is not adjustable.

SETBACK

The setback is the distance in which one front hub and bearing assembly may be rearward of the other front hub and bearing assembly. Setback is primarily caused by a road hazard or vehicle collision.

TURNING ANGLE

The turning angle is the angle of each front wheel to the vertical when the vehicle is making a turn.

DIAGNOSTIC INFORMATION AND PROCEDURES

TIRE DIAGNOSIS

Condition	Probable cause	Correction
Irregular and Excessive Tire Wear	● Incorrect inflation pressure.	● Inflate the tires to the proper pressure.
	● Inbalanced wheel.	● Balance the wheel. ● Replace the wheel.
	● A lack of regular rotation.	● Rotate the tires.
	● Incorrect alignment.	● Align the front and rear wheels.
Premature Tire Wear	● Excessive inflation pressure.	● Inflate the tires to the proper pressure.
	● High speed driving with the low inflation pressure.	● Inflate the tires to the proper pressure.
Uneven Braking	● Inbalanced inflation pressure.	● Inflate the tires to the proper pressure.
	● Irregular tire wear.	● Replace the tires.
Noise and Vibration of The Body	● Low inflation pressure.	● Inflate the tires to the proper pressure.
	● Inbalanced wheel.	● Balance the wheel. ● Replace the wheel.
	● Damaged wheel or tire.	● Replace the wheel and the tire.
	● Irregular tire wear.	● Replace the tire.
Vibration of The Steering Wheel	● Irregular tire wear.	● Replace the tire.
	● Inbalanced inflation pressure.	● Inflate the tires to the proper pressure.
	● Damaged tire.	● Replace the tire.
	● Bent or damaged wheel.	● Replace the wheel.

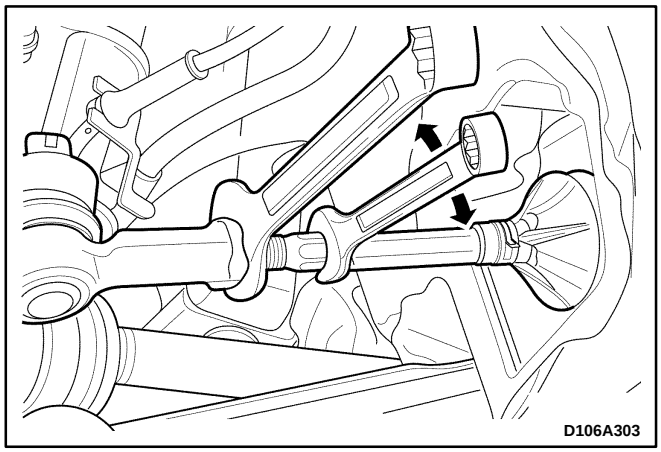
FRONT TOE ADJUSTMENT

1. Separate the clamps from the both rack and pinion boots.
2. Loosen the right and the left tie rod end lock nuts.
3. Turn the right and the left tie rod to align the toe.

In this adjustment, the right and left tie rods must be equal in length.

Front Toe–In	10′ ± 10′

Rotation Number of Tie Rod	Difference of Toe–In
1/2	0.75 mm (0.03 in.)
1	1.5 mm (0.06 in.)



4. Tighten the tie rod end lock nut to 45 N•m (33 lb-ft).
5. Install the rack and pinion boots clamp.

FRONT CAMBER AND CASTER CHECK

The front camber and caster are not adjustable. Refer to “Wheel Alignment Specifications” in this section. Jounce the bumper three times before measuring the camber or the caster in order to prevent an incorrect reading. If the front camber or caster measurements deviate from the specifications, locate and replace or repair any damaged, loose, bent, dented, or worn suspension part. If the problem is body related, repair the body.

REAR CAMBER CHECK

The rear camber is not adjustable. Refer to “Wheel Alignment Specifications” in this section. If the rear camber deviates from the specification, locate the cause and correct it. If damaged, loose, bent, dented, or worn suspension parts are found, they should be repaired or replaced. If the problem is body related, repair the body.

REAR TOE CHECK

The rear toe is not adjustable. Refer to “Wheel Alignment Specifications” in this section. If the toe deviates from the specification, check the rear axle assembly and the wheel spindle on vehicles without an anti–lock braking system (ABS) or the rear axle assembly and the hub and bearing assembly on vehicles with ABS for possible damage.

SPECIFICATIONS

WHEEL ALIGNMENT SPECIFICATIONS

Application	Front	Rear
Camber	0°30′ ± 0°30′	0° ± 20′
Caster–Manual Steering	2°48′ ± 30′	–
Caster–Power Steering	2°48′ ± 30′	–
Toe–in (2–person load)	10′ ± 10′	20′ ± 20′

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb-Ft	Lb-In
Tie Rod End Lock Nut	45	33	–