

Suspension & Wheel Alignment

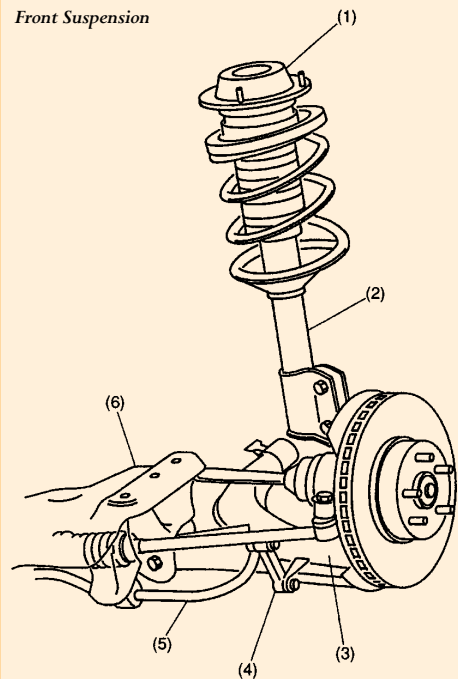
The front suspension is a strut-type independent suspension, with cylindrical double-acting oil dampers and coil springs. The top of the strut assembly is attached to the body through the upper strut mount. This suspension design maintains a wide distance between the upper and lower supporting points and makes caster adjustment unnecessary.

The transverse link utilizes an “L” arm design to increase steering stability and reduce road noise. The transverse link has a maintenance-free ball joint with a nut fitting at the outer end. The inner end at the front side of the transverse link is fitted to the front crossmember through a bushing. The rear side of the inner end is bolted to the vehicle body through a fluid-filled bushing.

The front crossmember is bolted to the vehicle body. The front stabilizer bar is attached to the front crossmember through cushion rubbers, and its ends are connected to the stabilizer links through rubber bushings. The lower end of the stabilizer link is connected to the transverse link through rubber bushings.

A camber angle adjustment mechanism, which uses eccentric bolts, is provided at the joint of the damper strut and the housing.

Front Suspension

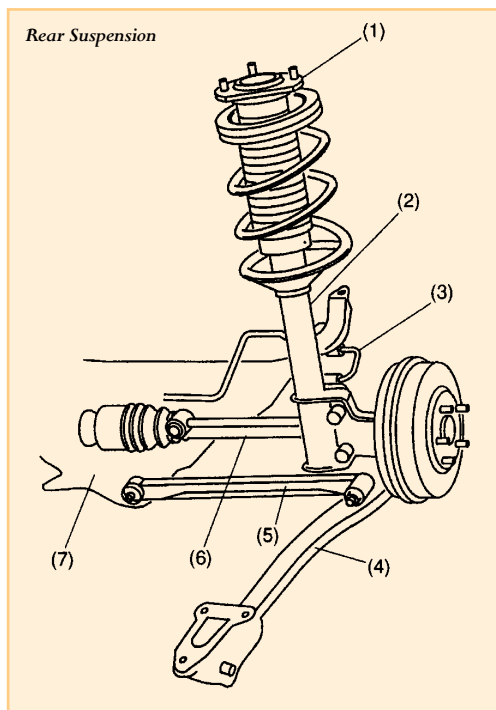


- | | |
|--------------------|----------------------|
| 1. Strut mount | 4. Stabilizer link |
| 2. Strut | 5. Stabilizer |
| 3. Transverse link | 6. Front crossmember |

Rear Suspension Design and Construction

The rear suspension on Subaru models prior to the 2000 model year is an independent, dual link strut type. It consists of two parallel lateral links, a trailing link and strut assemblies. The strut assembly consists of a cylindrical double-acting oil damper and coil spring. The respective component parts of this suspension are designed to act in response to vertical, lateral and longitudinal loads transmitted from the tires. Thus, riding comfort and steering stability are substantially enhanced.

- Longitudinal loads act on the trailing link.
- Vertical loads act on the coil spring, strut and rubber mount (located on top of the strut).
- Lateral loads act on the two lateral links. The crossmember is installed on the body frame via bushings. The stabilizer, which extends to the rear of the crossmember, is installed on the body frame via a bracket, and to the rear lateral link on the wheel side via a stabilizer link.



- | | |
|------------------|-----------------------|
| 1. Strut mount | 5. Front lateral link |
| 2. Strut | 6. Rear lateral link |
| 3. Stabilizer | 7. Rear crossmember |
| 4. Trailing link | |

Some 2000 model year and later Subaru vehicles employ a multi-link rear suspension not addressed in this article. However, rear alignment procedures for these newer models are very similar to the procedures described here.

Suspension Inspection and Wheel Alignment

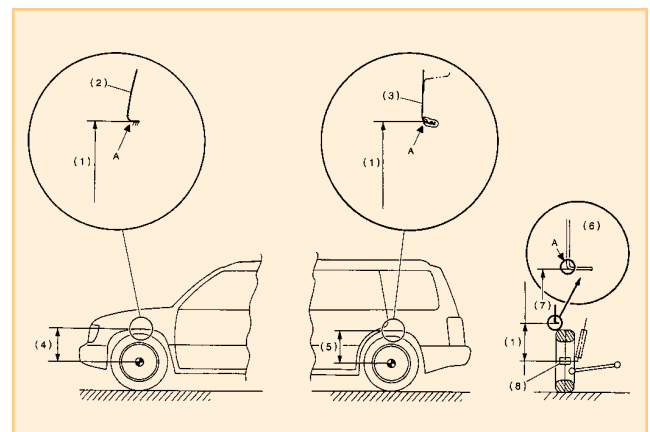
Vehicle ride height as well as front and rear wheel alignment should be inspected at 30 month/30,000 mile intervals. Chuckholes and other road hazards may necessitate shortening that maintenance interval for some drivers. While inspecting wheel alignment, also check for obvious signs of damage to suspension components, tightness of bolts and nuts and the condition of other undercar components. Excessive or irregular tire wear is often a sign of misalignment. Studying tire wear can often aid in diagnosing suspension problems.

Check, measure and adjust the wheel alignment in the following sequence:

- Front and Rear Vehicle Ride Height
- Front and Rear Camber
- Front Caster
- Front Toe
- Rear Toe
- Thrust Angle
- Wheel Steering Angle.

Vehicle Ride Height

- Adjust the tire pressures to specifications.
- Set the vehicle under curb weight conditions (empty luggage compartment, install spare tire, jack, service tools, and top up the fuel tank).
- Set the steering wheel in the straight-ahead position.
- Suspend a plumb line from the wheel arch to determine a point directly above the center of the spindle.
- Measure the distance between the measuring point and the center of spindle.
- Consult the service manual for vehicle ride height specifications.



Ride height

Suspension & Wheel Alignment

Camber and Caster

Camber is the angle between a line vertically intersecting the tire tread centerline and a line perpendicular to the road surface. If the top of the tire leans outward, positive camber exists. If the top leans inward, a negative camber condition exists. Improper camber alignment results in rapid tire wear on one side of the tire. Excessive positive camber will wear the outer tread. Excessive negative camber will wear the inner tread.

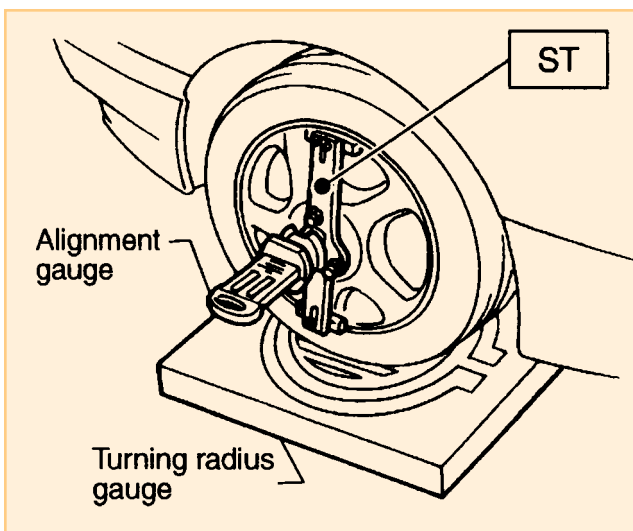
Caster determines the tendency of a wheel to follow the strut centerline. The caster angle is the angle produced by the fore-and-aft tilt of the strut with respect to vertical. Positive caster exists when the top of the strut tilts backward. Negative caster exists when the strut tilts forward. Improper caster alignment can result in pulling, wander, or excessive steering effort.

Note: Front and rear toe and front camber can be adjusted. If toe or front camber exceed specifications, adjust to the specification. Other items indicated in the specification table in the service manual (caster, scrub radius, etc.) can't be adjusted. If any of these items exceeds specifications, check suspension parts for damage and replace with new ones as required.

Front Camber Inspection

- Place the front wheel on a turning radius gauge. Make sure the ground contacting surfaces of the front and rear wheels are set at the same height.
- Attach the wheel adapter to the center of the wheel, then install a wheel alignment gauge or other electronic wheel alignment equipment to the adapter.

Note: Refer to the "Specifications And Service Data" section in the applicable service manual for the camber and caster values.



Alignment gauge

Front Camber Adjustment

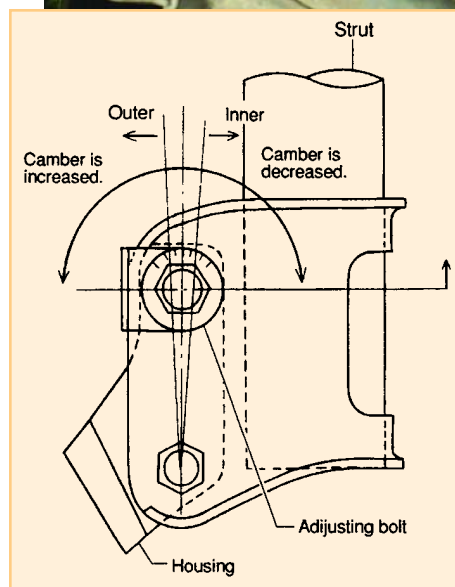
Camber is adjusted by rotating the eccentric adjusting bolt located at the base of the strut (upper bolt).

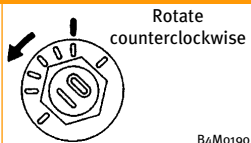
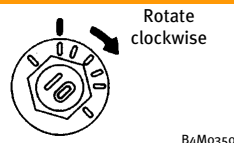
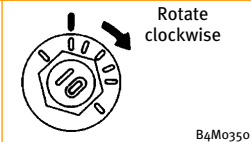
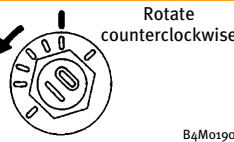
- Loosen the two self-locking nuts located at the lower front portion of the strut.

Caution: When an adjusting bolt needs to be loosened or tightened, hold its head with a wrench and turn the self-locking nut. Discard the loosened self-locking nut and replace it with a new one.



Front camber adjustment



	Left Side	Right Side
Camber is increased	 <p>Rotate counterclockwise</p> <p>B4M0190</p>	 <p>Rotate clockwise</p> <p>B4M0350</p>
Camber is decreased	 <p>Rotate clockwise</p> <p>B4M0350</p>	 <p>Rotate counterclockwise</p> <p>B4M0190</p>

Front camber adjustment key

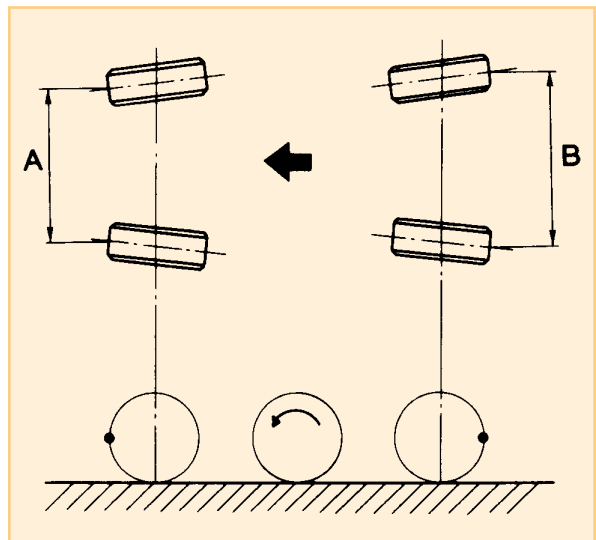
- Turn the camber adjusting bolt until the camber is set to specification.

Note: Moving the adjusting bolt by one scale graduation changes camber by approximately $0^{\circ}10'$.

- Tighten the two self-locking nuts.

Front Wheel Toe

Toe is the angle formed by the horizontal centerlines of the front wheels. If the tires are parallel, the toe angle is zero. Toe-out is the opposite of toe-in.

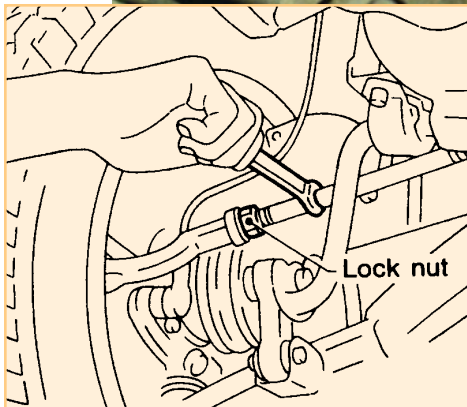


Manual front toe measurement

Suspension & Wheel Alignment

Improper toe alignment can result in excessive, rapid wear of the tire tread. Instead of rolling or tracking straight ahead, a tire with excessive toe will slip across the road surface, feathering the tire tread as it goes.

If toe is not within the specified range, set and lock the steering wheel in a straight-ahead position. Then, loosen the lock nuts on the left and right tie-rod ends, and turn the tie-rods equal amounts until the toe is within the specified range. Then, tighten the lock nuts to the specified torque.



Front toe adjustment

Front Toe Adjustment

- Loosen the left and right side steering tie-rods' lock nuts.
- Turn the left and right tie-rods equal amounts until the toe-in is at the specification.
- Using a toe gauge, measure front wheel toe in.

Note: Refer to the "Specifications And Service Data" section in the applicable service manual for toe specifications.

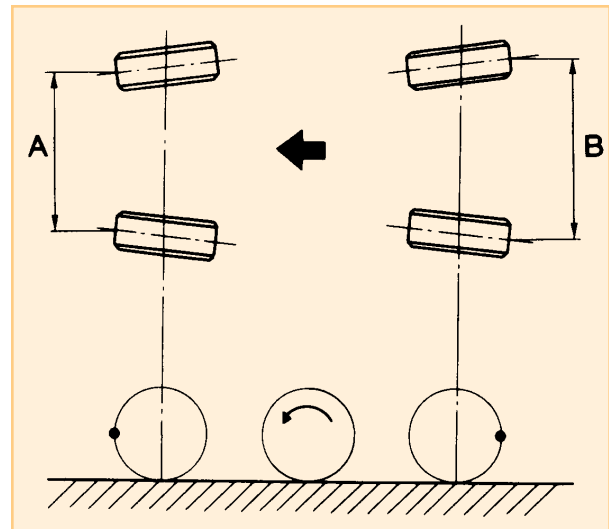
- To manually measure toe, mark the rear sides of the left and right tires at a height corresponding to the center of the spindles and measure the distance between marks.
- Move the vehicle forward so the marks line up with the front sides of the tires at a height corresponding to the center of the spindles.
- Measure the distance between the left and right marks. Toe-in can then be obtained by subtracting the second measurement from the first.

Note: Both the left and right tie-rods are right-hand thread. To increase toe-in, turn both tie-rods clockwise equal amounts (as viewed from the inside of the vehicle).

- Tighten the tie-rod lock nuts.

Caution: Straighten the tie-rod boots if they are twisted.

Note: Make sure the left and right wheel steering angle is within specifications.



Manual rear toe measurement

Rear Wheel Toe (Front Wheel Drive Models)

The rear toe angle on front wheel drive Legacy models is adjusted with a two piece bolt/adjusting wheel located in the lateral link. For every incremental change made on the adjustment bolt, the adjusting wheel must be rotated in the opposite direction by the same increment.

Rear Toe Inspection

- Using an alignment machine, measure the rear wheel toe in.
- To manually measure rear toe, mark the rear sides of the left and right tires at height corresponding to the center of the spindles and measure the distance between the marks.
- Move the vehicle forward so the marks line up with the front sides of the tires at a height corresponding to the center of spindles.

- Measure the distance between the left and right marks. Toe-in can then be obtained by subtracting the second measurement from the first.

Adjustment

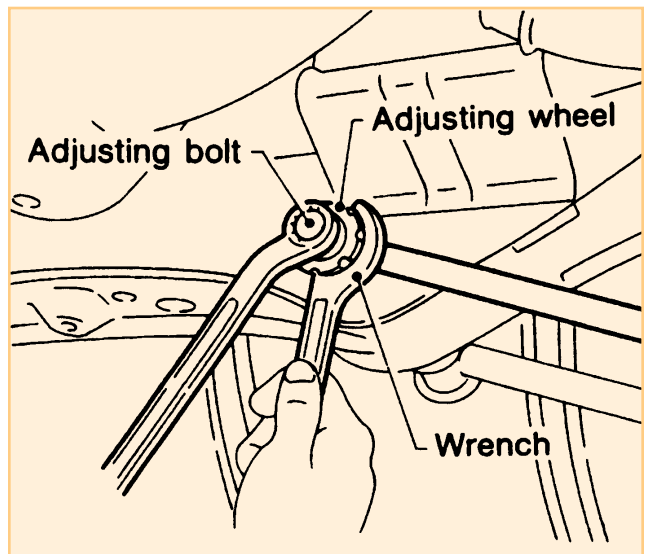
- Remove the cap from the lateral link and loosen the self-locking nut.

Caution: When loosening or tightening adjusting bolt, hold the bolt head and loosen self-locking nut. Replace self-locking nut with a new one.

- Using two wrenches, turn the adjusting wheel and adjusting bolt equally in opposite directions so that toe-in is at the specification.

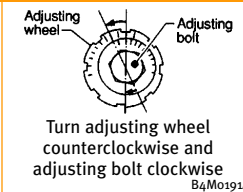
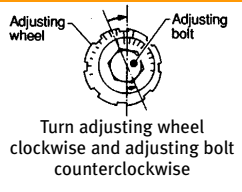
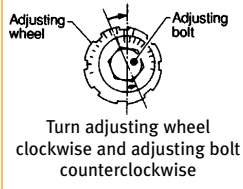
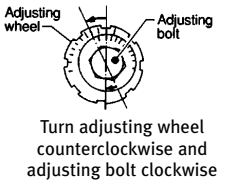
Note: When left and right wheels are adjusted for toe at the same time, moving one scale graduation changes toe-in by approximately 4 mm (0.16 in.). Turn the adjusting wheel and adjusting bolt equally in opposite directions so the same scale graduations are positioned directly above center of the adjusting bolt.

- Tighten the self-locking nut.



Front wheel drive rear toe adjustment

Suspension & Wheel Alignment

	Left Side	Right Side
Toe is increased	 <p>Turn adjusting wheel counterclockwise and adjusting bolt clockwise B4Mo191A</p>	 <p>Turn adjusting wheel clockwise and adjusting bolt counterclockwise</p>
Toe is decreased	 <p>Turn adjusting wheel clockwise and adjusting bolt counterclockwise</p>	 <p>Turn adjusting wheel counterclockwise and adjusting bolt clockwise</p>

AWD rear toe adjustment key

Rear Wheel Toe (AWD Models)

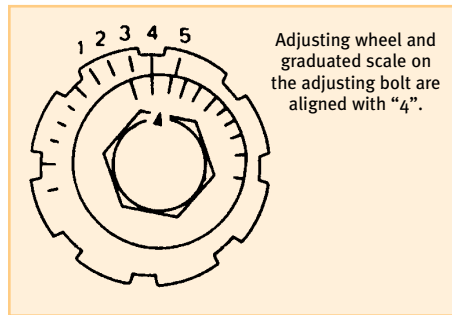
The rear toe on all wheel drive Legacy, Impreza or Forester models is adjusted by a one-piece cam bolt which is located in the lateral link.

Rear Toe Inspection

- Using an alignment machine, measure the rear wheel toe.
- To manually measure the rear toe, mark the rear sides of the left and right tires at a height corresponding to the center of the spindles and measure the distance between the marks.



Rear toe adjuster



Rear toe adjustment increments

- Move the vehicle forward so the marks line up with the front sides of the tires at a height corresponding to the center of the spindles.
- Measure the distance between the left and right marks.
- Toe can be determined by subtracting the second measurement from the first.

Rear Toe Adjustment

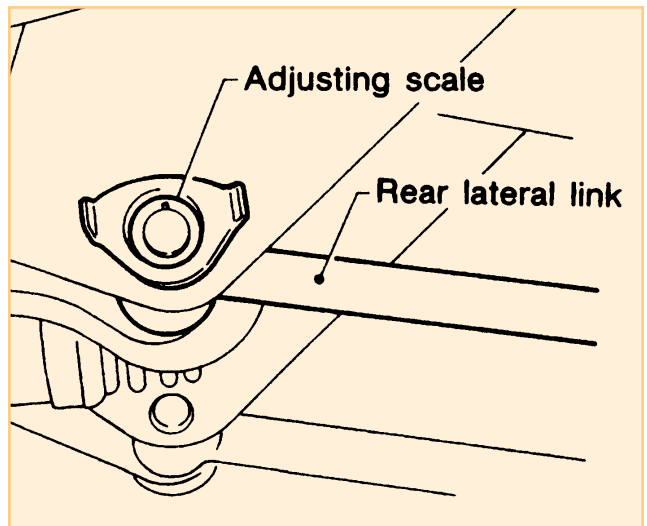
- Loosen the self-locking nut on the inner side of the rear lateral link.

Caution: When loosening or tightening the adjusting bolt, hold the bolt head and turn the self-locking nut. Discard the loosened self-locking nut and replace it with a new one.

- Turn the adjusting bolt head until toe is at the specification.

Note: When left and right wheels are adjusted for toe at the same time, the movement of one scale graduation changes toe by approximately 3 mm (0.12 in.).

- Tighten the self-locking nut.



AWD rear toe adjustment scale

Thrust Angle

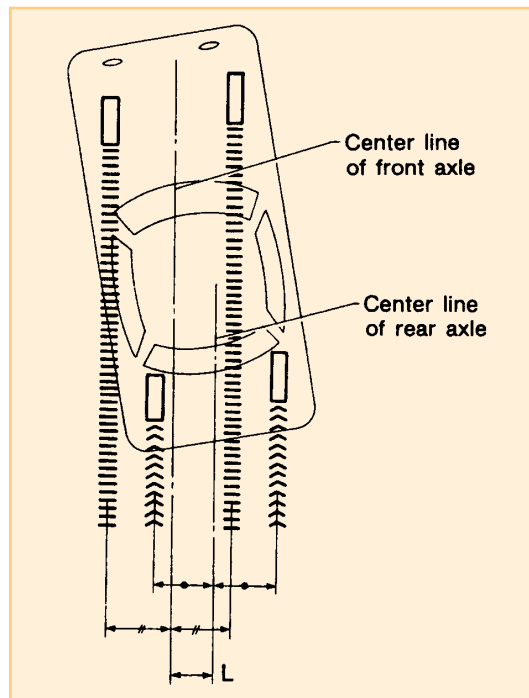
The rear wheels of a vehicle should follow the track of the front wheels. If the horizontal centerlines of the rear wheels are not aligned with the centerlines of the front wheels, the thrust angle of the vehicle will not be parallel with the centerline of the vehicle. This condition will result in excessive steering effort and poor directional control.

Thrust angle is the angle between the centerline of the vehicle and average toe of the rear wheels. Ideally, that should be zero. In reality, most cars are off by a degree or so.

Thrust angle = r

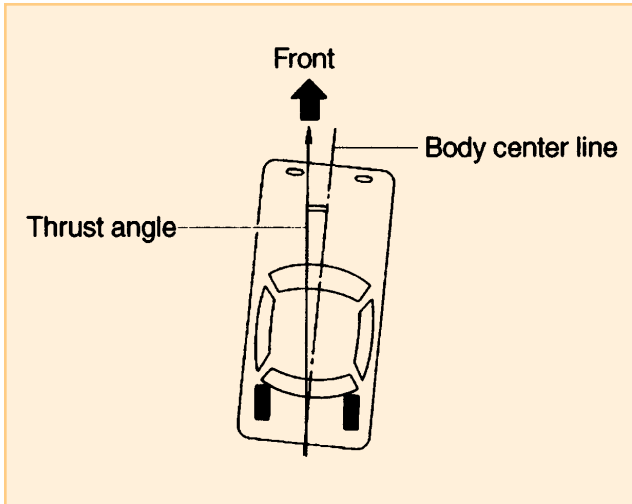
$$r = \frac{\text{right rear wheel toe angle} - \text{left rear wheel toe angle}}{2}$$

Note: Use only positive toe-in values from each wheel.



Thrust angle measurement

Suspension & Wheel Alignment



Thrust angle

Thrust Angle Inspection

- Position the vehicle on a level surface.
- Thrust angle can be computed automatically with the appropriate wheel alignment equipment.
- To manually determine thrust angle, move the vehicle 3-4 meters directly forward.
- Determine the centerline of both front and rear axles.
- Measure the distance between the center line of the axles.

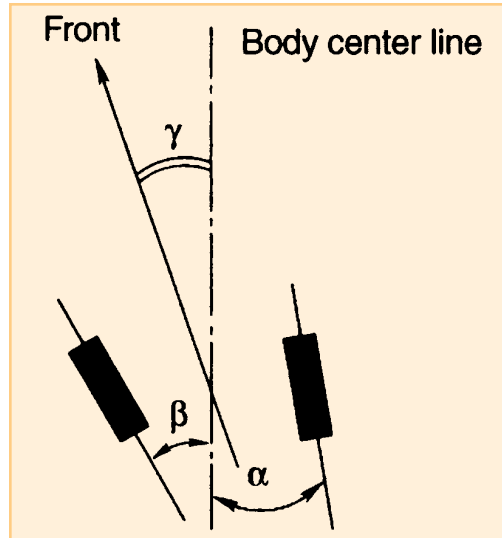
For reference: Thrust angle is less than 20' when this measurement is equal to or less than 15 mm (0.59 in.).

Thrust Angle Adjustment

- Make thrust angle adjustments by turning the toe-in adjusting bolts of the rear suspension equally in the same direction.

Note: On front wheel drive models, turn the adjusting wheels one by one, by the same amount in the opposite direction of the adjusting bolts. For reference: When one rear wheel is adjusted in a toe-in direction, adjust the other rear wheel equally in a toe-out direction to make the thrust angle adjustment.

- When left and right adjusting bolts are turned incrementally by one graduation in the same direction, the thrust angle of the AWD model will change approximately 10'.



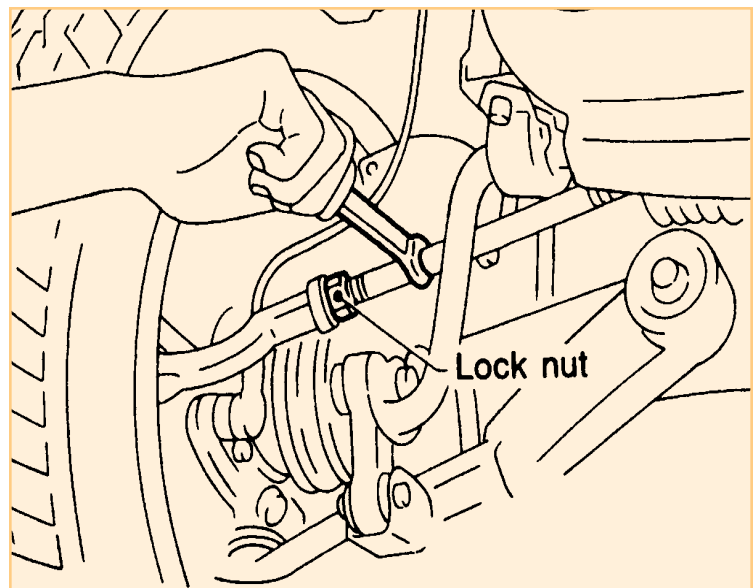
Toe-out in turns

Toe-Out in Turns

Toe-Out in Turns Inspection

- Place the vehicle on a turning radius gauge.
- While depressing the brake pedal, turn the steering wheel fully to the left and right. With the steering wheel held at each fully turned position, measure the inner and outer wheel steering angles.

Toe-Out in Turns:
Inner wheel $37.6^\circ \pm 1.5^\circ$
Outer wheel $32.6^\circ \pm 1.5^\circ$



Toe-out in turns adjustment

Toe-Out in Turns Adjustment

- Turn the tie-rod to adjust the toe-out in turns of both inner and outer wheels.

Caution: After completing the toe-out in turns adjustment, recheck toe-in. Straighten the steering rack tie-rod boots if they have become twisted.

Scrub Radius

Scrub radius is the distance between the centerline of the strut and the centerline of the tire tread where these lines intersect the road surface. If the centerline of the strut falls inside the centerline of the tire, positive scrub radius exists. If the centerline of the strut falls outside of the centerline of the tire, negative scrub radius exists. Some of the effects of improper scrub radius are increased road shock through the steering wheel, excessive tire wear and turning instability.

Scrub radius is not adjustable. If it is not within specifications, look for damaged steering or suspension components.

Identifying and Eliminating Front End Vibration

Determining the source of front end vibration occurring at cruising speed can be difficult. The trouble may lie in the suspension system or the steering system, or the cause may be tire out-of-round or wheel imbalance. Discovering the vibration source is often a process of elimination. Begin by checking potential problem areas such as steering gear backlash, tie-rod ends, wheel bearings, ball joints, tire mounting lugs, leading rod bushings, etc.

If the search does not turn up any problems, check the tires and wheels for imbalance. Be sure the wheel balancing equipment is properly calibrated by rotating a balanced wheel 180 degrees on the balancer shaft and rechecking the balance. The balance should remain unchanged if the balancer is properly set. ■

visit our website:
www.endwrench.com