

Steering and Suspension

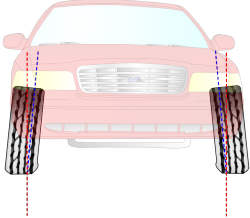
Wheel Alignment

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Steering and Suspension

Camber Angle

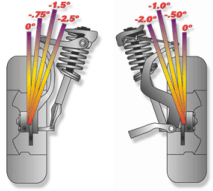
- Camber is the amount that the centerline of the wheel tilts away from true vertical when viewed from the front of the vehicle
- Camber places the tire tread flat on the road reducing tire wear and improving vehicle handling
- Excessive camber will cause wear on the edge of the tire's tread



Steering and Suspension

Camber Split

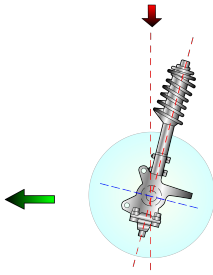
- Camber split is the difference between the left and right camber settings
- Excessive camber split will cause a vehicle to pull to the most positive side
- Camber split should be limited to 1/2 a degree or less to prevent vehicle pull



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Caster Angle

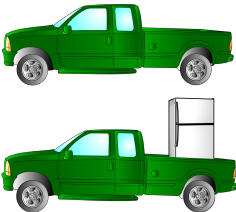
- Positive caster is the rearward tilt of the steering axis
- Negative caster is the forward tilt of the steering axis
- The vehicle will pull to the least positive side
- Not a tire wear angle
- Caster aides in directional stability and steering wheel return



Steering and Suspension

Caster and Ride Height

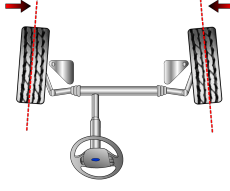
- It is important to consider normal vehicle loading when performing alignment checks and adjustments
- What effect does loading the truck have on caster?



Steering and Suspension

Toe Angle

- Inward or outward variation of tires from a straight ahead position
 - Toe in is referred to as positive toe
 - Toe out is referred to as negative toe
- Not a directional control angle
- Toe is a critical tire wear angle that commonly causes feathered tire tread wear



Steering and Suspension

SAI and Included Angle

- SAI - Steering Axis Inclination
- Angle between the steering knuckle pivot points and true vertical
- Included Angle
 - Sum of SAI and camber

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Scrub Radius

- Scrub radius is the distance between the tread centerline and the point where a projection of the steering axis angle would contact the road surface

Steering and Suspension

Scrub Radius & Wheel Offset

Original design with negative scrub radius Offset wheel with positive scrub radius

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Toe Out On Turns

- Toe out on turns is the difference in turning angles between the two front tires measured at a specific turning angle
- Customers concerns about toe out on turns are usually related to tire squeal during low speed parking maneuvers
- Improper toe out on turns is commonly caused by bent or damaged steering linkage and/or steering knuckles

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Thrust Angle

- Thrust angle is the difference between the centerline of the vehicle and the thrustline of the rear axle
- Negative - rear wheels point left
- Positive - rear wheels point right

Steering and Suspension


Suspension System Service

- Alignments are often considered part of routine vehicle maintenance
- A vehicle's alignment should always be checked and adjusted after performing any steering or suspension system service that could impact alignment angles
- Proper wheel alignment affects vehicle handling, control, ride quality and tire life

Steering and Suspension

Alignment Pre-Checks

- Tire pressure and condition
- Evidence of recent collision damage
- Ride height
- Wheel bearings
- Steering linkage
- Suspension components



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Tire Inspection

- Check and adjust tire pressure to the vehicle manufacturer's specifications
- Inspect the tires for abnormal wear such as
 - Center wear
 - Wear on both outer edges
 - Wear on one outer edge
 - Feathering
 - Cupping or damage



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Bearing Adjustment Inspection

- Wheel bearings should be inspected for proper adjustment or excessive wear
- Attempt to rock the tire from top to bottom



Steering and Suspension

Steering Linkage Inspection

- Steering linkage should be inspected for excessive wear or damage
- Attempt to rock the tire from left to right
- Carefully inspect the linkage for evidence of damage



Steering and Suspension

Suspension Inspection


- Inspect all bushings for evidence of damage, cracking and wear
- Inspect control arms, springs, ball joints, etc. for evidence of damage and wear
- Inspect shock absorbers and struts for leakage and damage



Steering and Suspension

Types of Alignments

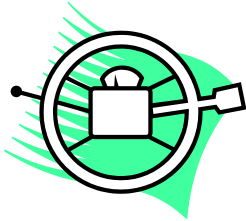
- Center line alignment
 - The vehicle's front wheels are aligned to the vehicle's center line
- Thrust angle alignment
 - The vehicle's front wheels are aligned to match the rear wheel's thrust angle
- Four wheel alignment
 - All four wheels are aligned to the vehicle's center line



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Alignment Procedure

- Perform alignment pre-checks
- Set up the alignment computer as per the equipment manufacturer's instructions
- Mount and compensate the alignment sensor heads
- Measure caster



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Alignment Adjustments

- Compare the alignment specifications to the vehicle's actual settings and adjust in the following order
- Rear camber
- Rear toe
- Front caster
- Front camber
- Front toe

Specifications	Left Front	Right Front
Caster	2.8	2.5
Camber	-0.4	-0.4
Toe	0.1	0.1
SAI	12.9	12.9
Included Angle	12.5	12.5
Toe out on turns	2.0	2.0
	Left Rear	Right Rear
Camber	-1.2	-1.2
Toe	0.1	0.1
Results	Left Front	Right Front
Caster		
Camber		
Toe		
SAI		
Included Angle		
Toe out on turns		
	Left Rear	Right Rear
Camber		
Toe		

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Camber and Caster Adjustment

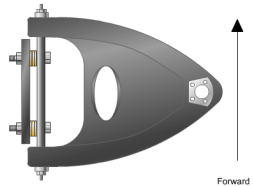
- Camber is adjusted by moving the top of the tire inward or outward
- Caster is adjusted by moving the upper steering pivot point forward or backward



Steering and Suspension

Control Arm Shims

- Adding shims between the control arm and frame as shown moves the upper ball joint inward
- Changing the shim pack dimensions allows the technician to change caster and camber
- Some vehicles use shims to move the control arm outward



Steering and Suspension

Moveable MacPherson Strut

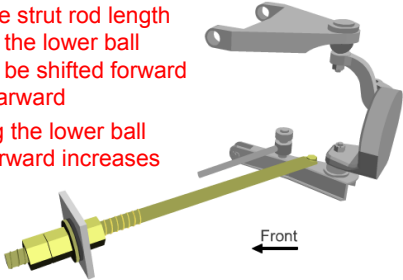
- Elongated strut mounting holes may allow the strut to be moved to change caster and/or camber
- Some vehicles require you to rotate the strut in mount holes to make changes in caster and/or camber



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Adjustable Strut Rod

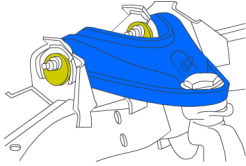
- Change strut rod length moves the lower ball joint to be shifted forward and rearward
- Moving the lower ball joint forward increases caster



Steering and Suspension

Control Arm Cams


- Eccentric cams allow the technician to move the upper ball joint in and out
- Moving both eccentrics equally changes only camber
- Moving one cam in and the other cam out an equal amount changes only caster



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Toe Adjustment

- Toe is adjusted to set the tires parallel to one another while the vehicle is moving
- Toe is adjusted by increasing or decreasing tie rod length



Steering and Suspension

Toe Adjustment Procedure

- Set the steering wheel straight ahead and lock the wheel
- Parallelogram
 - Loosen the clamps
 - Rotate the adjuster sleeve
 - Tighten the clamps
- Rack and pinion
 - Loosen the tie rod end lock nut
 - Rotate tie rod
 - Tighten tie rod end lock nut

