



**Auto Care USA**  
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## Complete Procedure for Non-Electronic Alignment

### Selecting and Preparing the Area:

The importance of closer wheel alignment tolerances is recognized by leading alignment technicians and car manufacturers alike. Accurate results can best be obtained by following a standard, proven procedure, using the same settings wherever possible. For best results, find a space that is easy to get to and reasonably level, and mark the spaces for each wheel. Then set the turntables in place, level them both crosswise and diagonally, and number each plate and corresponding rectangle so the settings are consistent.



### Making the preliminary Inspection

Before starting an alignment job, check the vehicle for loose wheel bearings, worn kingpin bushings and ball socket joints, tie rod ends, inactive shock absorbers, faulty struts, sagging or broken springs and badly or irregularly worn tires. Corrections or replacement should be made before proceeding with alignment. All tires should be inflated to the correct air pressure. The front tires should be of the same size and of equal wear.

### Caution

Locking pins on turntables must be engaged when driving a vehicle on or off the passenger car or heavy-duty Truck Turnplates

### Cleaning/Lubrication

Turntables, both the passenger car/light truck and the heavy duty truck, must be cleaned periodically as work area conditions dictate. The top plates must be removed, the ball bearings cleaned, and the bearing retainers cleaned as well as both the top plates and the bases.

After cleaning the parts above, lubricate **with a thin film of motor oil (do not use grease)** on the machined underside of the top plates and the top of the bases.

## Alignment Procedure

Drive the car forward to the edge of the rectangles you have already marked on the floor. With the locking pins in place, firmly wedge the tapered edge of a turntable under the front of each tire. Slowly drive the vehicle forward until it is centered on the turntables. (The car should not be backed into checking position as inaccurate readings may result.) Apply the brakes gently to prevent the turntables from sliding. If sliding occurs, use a piece of rubber mat under each turntable. (Level the plates to compensate for the mat.)

Next, hold the brakes with a brake pedal depressor. This is important, as any rolling of the wheel on the turntable will cause an inaccurate caster and kingpin inclination reading. Raise the back end of the car and place a rear wheel platform with slip plate under the center of each rear wheel. Lower the jack and you are ready to take your readings.



1. Remove the locking pins from the turntables. Grasp the center of the front bumper and bounce the front end up and down vigorously. Let the car settle back slowly and equally from the top of the final bounce. Make certain that both of the turntable pointers read  $0^{\circ}$  on the dial. If

necessary, loosen the dial plate screws and adjust the dials to  $0^{\circ}$ .

2. Using a suitable tool remove both wheel disks and dust caps. Wipe off the machined end of the flange. Your magnetic gauge will rest on this surface. It is machined to a close tolerance and is the only machined surface on the outside of the wheel.

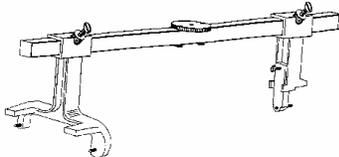
Place the magnetic gauge in position. Rotate the gauge back and forth several times to provide a good seating. The gauge should now be firmly seated and no rocking motion should be evident.



## Use of Adapters

If the Magnetic Gauge does not fit directly onto the hub, it is necessary to use one of the adapters:

1. The Magnetic Transfer Adapter does not require removal of spindle nut and can be directly attached to magnetic gauge and placed directly on the hub. The magnetic Transfer Adapter is reversible to accommodate 2-1/4" and 2'5/8" hubs.



2. The Magnetic Gauge Rim Adapter is to be used where machined surface of hub is not accessible to the Magnetic Caster/Camber Gauge and/or the Magnetic Transfer Adapter.

3. The No-Mar Rim Adapter is for use on Mag, aluminum and custom wheels, mounting on the outside of the wheel.



The Magnetic Caster/Camber Gauge is attached to the mounting ring after the adapter is fitted to the tire rim.

NOTE: It is suggested that a *chart* be made and all of the readings listed before making any corrections. (SEE last page for a blank chart.)

The front end should be checked in the following order, starting with the left wheel:  
Note, left and right refer to someone sitting in the driver's seat.

A. With the wheels straight ahead and the kingpin inclination bubble centered on 0°, you can now take the Camber reading directly from the center of the bubble on the Camber Scale on the left side of the gauge. Write down the reading for the left wheel, indicating positive or negative.

B. Caster, Kingpin Inclination and Toe-Out on Turns are read at the same time. With both turntable pointers indicating 0°, turn the front of the left wheel to the right to the specified turning angle on the turntable dial. Go to the right front wheel and read the turntable dial. The amount indicated on the turntable dial is the "toe-out on turns" reading for the turning angle for the opposite wheel. Write down reading.



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C. Go back to the left wheel. Rotate the gauge until the center of the kingpin inclination bubble reads 0 degrees and adjust the knob on the underside of the gauge until the center of the Caster bubble reads 0 degrees. Then turn the front of the wheel out to the specified turning angle. The center of the bubble at the top of the gauge will now indicate the correct kingpin inclination and the center of the bubble on the caster scale on the right side of the gauge will indicate the amount of caster and whether negative or positive. Write down the readings. Repeat the same operation at the right wheel and write down the readings.

For the proper setting, consult your Service Manual or the specifications. A preliminary Toe-In check may be desirable for a general alignment check. Make all the corrections necessary before proceeding with the final Toe-In check, as other changes may affect Toe-In.

## Checking and Adjusting Toe-In

Some vehicles use a single tie-rod that connects the steering arms and has a right-hand thread on one end and a left-hand thread on the other. Read the amount of Toe-In by measuring the distance at the back of the front wheels and comparing this with the measurement taken at the front of the front wheels. (See below for several types of Toe Gauges.) Alignment is made by loosening the clamp bolts and lengthening or shortening the tie-rod as necessary.

More recent model cars use the "Divided Tie-Rod" system, but regardless of whether a single tie-rod or two tie-rods are used, the steering gear must first be located on center, or the "high spot," when the front wheels are in the straight-ahead driving position. This should place the steering wheel in the straight-ahead position, and then the steering wheel should be held in place with the Steering Wheel Holder.



Toe-In should be checked and adjusted on a level floor or with the front wheels on the Turntables and the lock pins removed. The wheels should first be spread apart at the front to compensate for any looseness, using the Front Wheel Spreader.



Wheel Spreader 1



## Chain Toe Gauge

Pull vehicle forward at least three feet before placing Chain Toe Gauge in position. Press out on front of wheels to take up play. Set the gauge in position between the tires at the front of the wheels, with ends bearing on tires. Chains must just touch floor. Spring pressure will hold gauge in position. Set moveable scale so pointer is at 0.

Leaving gauge between wheels, move vehicle forward until gauge comes into position at back of wheels with chains just touching floor. Pointer will then show amount of Toe-In or Toe-Out.

## Trammel Type Toe Gauge

1. Drive the vehicle forward onto the Turntables. Remove the turntable locking pins.

2. With the unit assembled as shown, place it at the front of the vehicle so that the bar rests against both tire treads and the solid check stand rests against the outside of the left tire. Lock the small check bar at zero and move the traveling gauge until the small check bar rests against the outside of the right tire. Tighten the thumb screw. This is the distance across the front of the front wheels. Draw chalk marks where the top of each check bar contacts the tire. The chalk marks simply avoid any possible inaccurate readings caused by "wobble or runout" in the wheels or tires, by making sure that the operator uses the same contact point on the sidewall for both the front and the rear reading.



3. Raise the front of the vehicle and rotate both front wheels until the chalk marks are at the proper check stand height to touch the check-stand arm and the small check bar when the gauge is placed at the rear of the tires. Lower the vehicle and use the steering wheel to move the front wheels back and forth rapidly several times to help settle them in their normal driving ahead position.

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4. Spread the wheels apart using the Wheel Spreader to compensate for any looseness.
5. Carefully slide the Toe Gauge under the car behind the front wheels, turning it on its side if necessary. Loosen the thumb screw that locks the small check bar. Place the unit in its reading position with the bar resting against both tire treads and the solid check stand outside the outside of the right tire. Move the small check bar until it rests against the outside of the left tire. The reading indicated on the dial is the amount of Toe-In or Toe-Out.

## **Scribe Type Toe Gauge**



It is preferable to check toe with the wheels on Turntables since wheels are permitted to move freely during adjustments. **The Locking Pins should not be in place.** Work the steering wheel back and forth rapidly several times to settle the wheels in their normal driving position.

1. Raise vehicle to free front wheels. Hold handle of scriber, set on floor, close enough to rotating tire to scribe a line around circumference at center of tire. Lower the vehicle onto the turntables.
2. Go to the front of the vehicle and spread the wheels by pushing outward against the inside walls of both tires, using the Front Wheel Spreader.
3. Adjust height of both pointers so that they are as close to spindle height as possible.
4. With the unit assembled as shown, set the right indicator so that the indicator pin is in line with the zero on the dial on the bar. Lock it by tightening the thumb screw.

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5. Carefully slide the Toe Gauge under the car behind the front wheels, turning it on its side if necessary. The pointers should be facing upward so that they will not be damaged. Place the unit in the proper position so that the pointer on the right end at the zero on the indicator is against the scribed mark on the rear of the right tire. Being careful not to move the bar, adjust the left pointer assembly so that the pointer is against the scribed mark on the rear of the left tire. Tighten the thumb screw to lock it in position. This is the distance across the *back* of the front wheels.

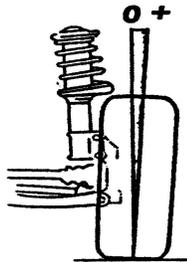
6. Being careful not to jar the pointer out of position, remove the Toe Gauge from behind the front wheels and place it at the front of the front wheels so that the pointer at the left end is against the scribed mark. Keeping the pointer in position, release the thumb screw of the right pointer assembly and align the pointer with the scribed mark on that tire. The indicator now shows the Toe-In or Toe-Out of the vehicle being checked.

### **For All Vehicles with Divided Tie-Rods**

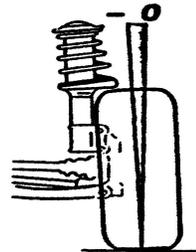
Place the Toe Bar, any Trammel or Scribe-Type Toe Gauge, against the front of both tires with the ends of the bar extended beyond the tires. Set the Toe Angle Comparative Gauge on the bar and against the side of the left front tire. If the Gauge does not indicate zero, adjust the left tie-rod until it does. Make certain that the steering wheel remains in the straight-ahead position by using the Steering Wheel Holder to hold the steering wheel. Repeat the operation at the right wheel. Now that both wheels are straight ahead, turn both tie-rods equally to set the correct Toe-In.

## Definitions

**Camber:** The tilt of the top of the wheel. Camber is said to be zero when the wheel is straight up and down.



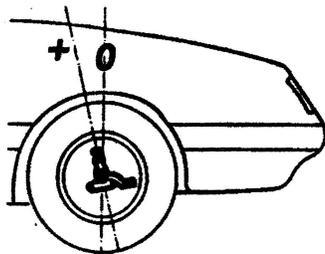
**Positive Camber:** When the top of the wheel and tire assembly is tilted out, or away from the engine.



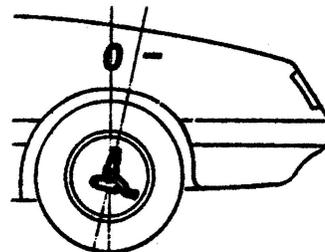
**Negative Camber:** The top of the wheel and tire assembly is tilted in, toward the engine.

Camber is adjustable to compensate for spring sag and road crown. Readings should be kept within manufacturer's specifications and the variation between the wheels should not be more than 3/8".

**Caster:** The tilt of the top of the support arm toward or away from the driver. Caster is said to be zero when the support arm is straight up and down.



**Positive Caster:** The upper ball joint or top strut bearing is toward the rear of the vehicle in relationship to the lower ball joint.

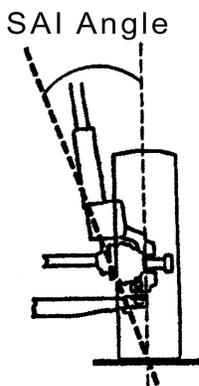


**Negative Caster:** The upper ball joint or top strut is toward the front of the vehicle in relationship to the lower ball joint.

Caster is adjustable to improve directional stability. Readings should be kept within manufacturer's specifications and the variation between the wheels should not be more than 3/8".

Excessive caster may cause wandering, weaving, shimmying or hard steering. Unequal caster will cause pulling to one side.

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**Kingpin Inclination or Steering Axis Inclination:** The inward tilt of the top of the kingpin as compared to a line at right angles to the spindle.

Kingpin inclination is a most important directional stability factor. In addition to minimizing the stress on the kingpins and bushing, it also resists any outside force turning the wheels and is responsible for the wheels returning to the straight ahead position after they have been turned.

Kingpin inclination should be within manufacturer's specifications. Since it is not adjustable, incorrect readings indicate bent parts, usually the spindle, which should be replaced.

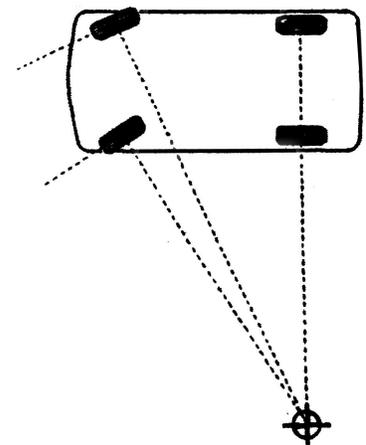
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## Toe-Out on Turns

When a vehicle is making a turn, the inside wheel travels in a smaller circle than the outside wheel. The inside wheel, therefore, turns at a greater angle.

Since toe-out on turns is controlled by the proper position of the steering arms and is not adjustable, inaccurate readings would indicate bent parts, usually the steering arm. Correction is made by replacing the bad arm.

No matter how accurately the front wheels are positioned for straight-ahead driving, they may still be out of their correct relative position on turns.



The average car is turning to some degree at least 60% of the time. Inaccurate turning radius results in abnormal and excessive tire wear.

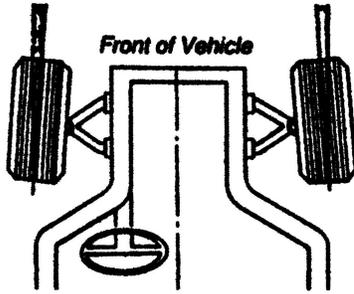
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## **Toe-In**



The difference in distance between the front of the front wheels as compared to the back of the front wheels.

Readings should be kept within manufacturer's specifications. Toe-Out may cause wandering or weaving.

Incorrect Toe-in or Toe-Out is certain to cause abnormal and excessive tire wear.

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## **ALIGNMENT READINGS**

*NOTE: You may want to make copies of a blank chart for future readings.*

	LEFT WHEEL	RIGHT WHEEL	DESIRED READING
CAMBER			
CASTER			
KINGPIN			
TOE-OUT ON TURNS			
TOE-IN			