

320 Steering and Wheel Alignment

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GENERAL

This repair group covers servicing of the mechanical and hydraulic components of the steering system, including wheel alignment information.

The variable-assist power steering system consists of an engine-driven hydraulic pump, a rack-and-pinion steering gear assembly with an integral hydraulic control valve, and connecting linkage to the road wheels.

At low speeds, maximum power assist is provided to ease parking and city driving. At high speeds, assist is reduced to ensure stability. The power steering system varies assist based on engine speed.

WARNING —

- Do not reuse self-locking nuts. They are designed to be used only once and may fail if re-used. Always replace them with new locking nuts.
- Do not install bolts and nuts coated with undercoating wax, as correct tightening torque cannot be assured. Always clean the threads with solvent before installation, or install new parts.
- Do not attempt to weld or straighten any steering components. Always replace damaged parts.

NOTE —

For information on steering column-mounted switches and the ignition lock, see **612 Switches and Electrical Accessories**.

STEERING WHEEL

The BMW E36 is equipped with an SRS airbag mounted in the steering wheel. Improper handling of the airbag could cause serious injury. The airbag is an explosive device and should be treated with extreme caution. Always follow the airbag removal procedure as outlined in **721 Airbag System (SRS)**.

WARNING —

- The BMW Supplemental Restraint System (SRS) is complex and special precautions must be observed when servicing. Serious injury may result if system service is attempted by persons unfamiliar with the BMW SRS and its approved service procedures. BMW specifies that all inspection and service should be performed by an authorized BMW dealer.
- BMW Supplemental Restraint Systems (SRS) are equipped with a back-up power supply inside the SRS control module. A 10 minute waiting should be observed after the battery cable has been disconnected. This will allow the reserve power supply to discharge.

Steering wheel, removing and installing

1. Center steering wheel. Make sure front wheels are pointed straight ahead.
2. Disconnect negative (–) cable from battery and cover terminal with insulating material.

CAUTION —

Prior to disconnecting the battery, read the battery disconnection cautions given at the front of this manual on page viii.

STEERING WHEEL

- Carefully remove airbag from front of steering wheel. See **721 Airbag System (SRS)**. Store airbag unit in a safe place.

WARNING—

Improper handling of the airbag could cause serious injury. Store the airbag with the horn pad facing up. If stored facing down, accidental deployment could propel it violently into the air, causing injury.

- Remove steering wheel center bolt. Lightly punch mark or scribe position of steering wheel to steering column shaft. See Fig. 1.



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Fig. 1. Steering wheel center bolt (arrow).

- Unlock steering wheel by turning ignition key on. Remove steering wheel.

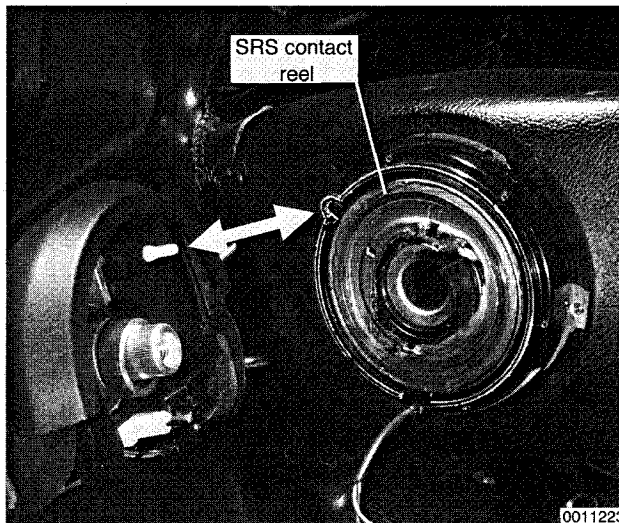
WARNING—

The SRS contact reel is mounted to the rear of the steering wheel hub. The contact reel is a wound coil of wire that ensures continuous electrical contact for the air bag unit. Once the steering wheel mounting nut or bolt is removed the contact reel is locked in the center position and its position must not be altered.

- Install steering wheel while aligning matching marks. Make sure airbag contact ring locking pin engages cut out in contact reel. Install steering column center nut. Do not over-torque. See Fig. 2.
- The remainder of installation is reverse of removal. Carefully install airbag from front of steering wheel. See **721 Airbag System (SRS)**.

Tightening Torque

- Steering wheel to steering column spindle 63 Nm (46 ft-lb)



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Fig. 2. Install steering wheel so that locking pin in column aligns with cutout in contact reel (arrow). Contact reel on late model steering wheel may vary from that shown.

POWER STEERING SYSTEM

Power assist is provided by a belt-driven pump on the lower left front of the engine, just below the alternator. The power steering fluid reservoir is located on the lower left front of the engine.

Power steering pump, removing and installing

- Empty power steering fluid reservoir using clean syringe. Do not reuse fluid.
- Raise front of car.

WARNING—

Make sure the car is firmly supported on jack stands designed for the purpose. Place the jack stands beneath a structural chassis point. Do not place jack stands under suspension parts.

- Remove fluid hoses from pump. Plug openings in pump and in hose ends.
- Remove drive belt from power steering pump. See **020 Maintenance Program**.
- Remove pump mounting bolts and remove pump. See Fig. 3.

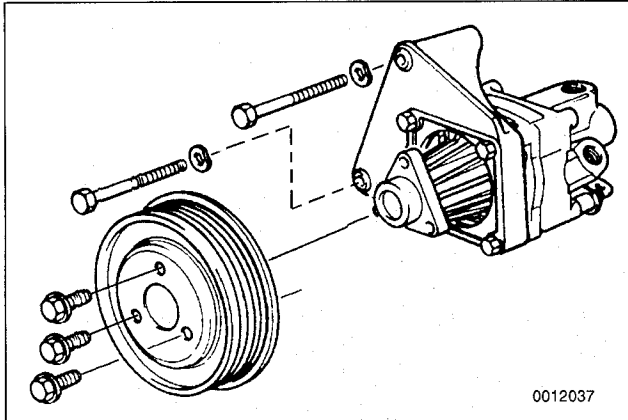


Fig. 3. Power steering pump and pulley mounting bolts.

6. Installation is reverse of removal, noting the following:

- Make sure all thread bores, bolts, nuts, fluid couplings and mating surfaces are clean, and that inside surface of multi-ribbed-belt is free of grease and dirt.
- Use new sealing washers when reattaching power steering pressure lines.
- Make sure hoses have adequate clearance from chassis. Do not over-torque banjo bolts.
- Fill and bleed power steering system as described below.

Tightening Torques

- Hydraulic hoses to power steering pump
 - M10 banjo bolt 12 Nm (9 ft-lb)
 - M14 banjo bolt 35 Nm (26 ft-lb)
 - M16 banjo bolt 40 Nm (30 ft-lb)
- Power steering pump to bracket (self-locking nuts) 22 Nm (16 ft-lb)
- Power steering pump bracket to engine block or oil pan (self-locking nuts) 22 Nm (16 ft-lb)

Power steering system, bleeding and filling

1. With engine off, fill power steering fluid reservoir with clean fluid. Fill level to **MAX** mark on dipstick.
2. Start engine. Slowly turn steering wheel from lock to lock a minimum of two times.
3. Turn engine off and check fluid level, adding fluid if necessary.

STEERING GEAR

A cutaway of the power-assisted rack-and-pinion power steering gear is shown in Fig. 4. The rack is designed to be maintenance free.

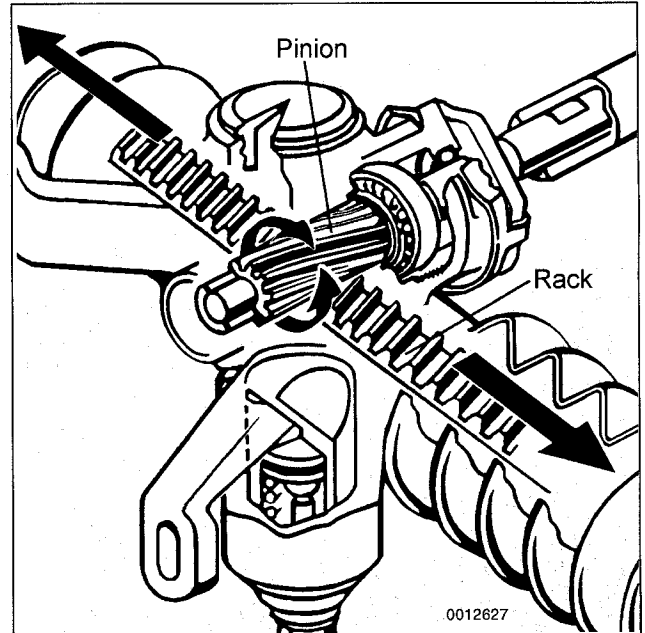


Fig. 4. Cutaway of rack-and-pinion steering gear.

The steering gear and linkage require no maintenance other than alignment and a periodic inspection for worn components.

Steering gear rack, removing and installing

1. Empty power steering fluid reservoir using clean syringe. Do not reuse fluid.
2. Disconnect negative (–) cable from battery and cover terminal with insulating material.

CAUTION—

Prior to disconnecting the battery, read the battery disconnection cautions given at the front of this manual on page viii.

3. Carefully remove airbag from front of steering wheel. See **721 Airbag System (SRS)**. Store airbag unit in a safe place.
4. Make sure front wheels are pointed straight ahead.
5. Remove outer tie rod ball joint nuts, then separate outer tie rod ends from steering arms using appropriate press tools.
6. Disconnect power steering hose from fluid reservoir.

7. Remove fluid line banjo bolt from steering gear. See Fig. 5.

CAUTION—

Plug the openings in the pump and hose ends to prevent dirt from entering the hydraulic system.

NOTE—

It may be necessary to remove other components to gain access to the steering gear.

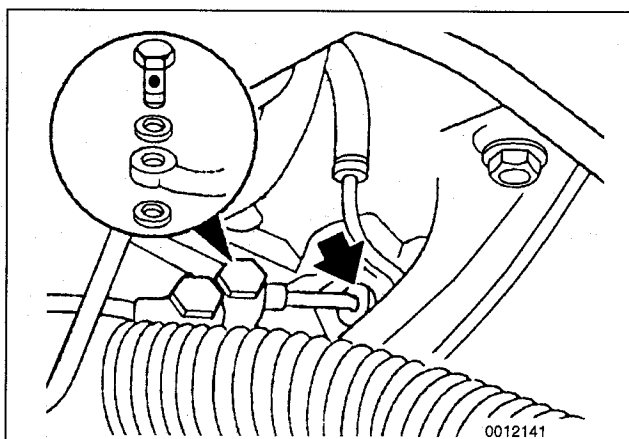


Fig. 5. Fluid hoses and banjo bolts at steering gear (arrows).

8. Remove lower steering shaft universal joint pinch bolt, then pull universal joint half way off steering gear shaft. Mark relationship between shaft and universal joint, then remove universal joint from steering gear. See Fig. 6.

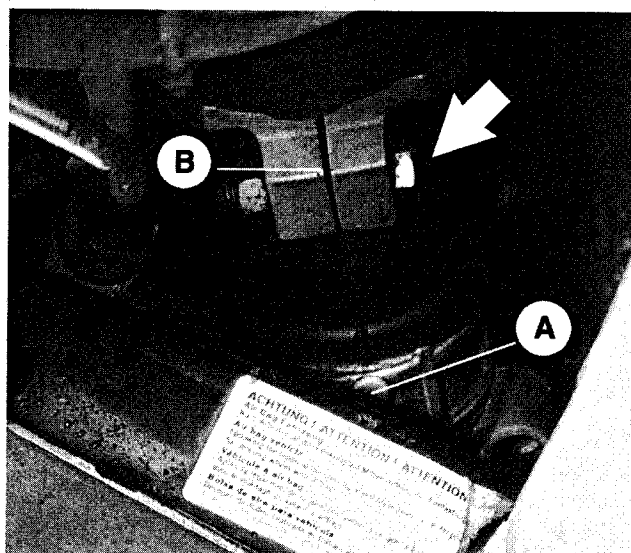


Fig. 6. Steering column universal joint pinch bolt (arrow). Mark U-joint to shaft before disconnecting. With wheels in straight ahead position, mark on steering gear (A) should align with split seam in universal joint (B).

STEERING GEAR

9. Remove steering gear mounting bolts. See Fig. 7. Remove steering gear from subframe crossmember by pulling it forward.

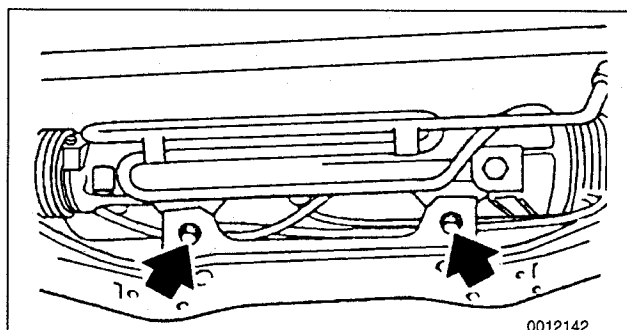


Fig. 7. Steering gear mounting bolts (arrows).

10. Installation is reverse of removal, noting the following:

- Make sure all thread bores, bolts, nuts, splines and mating surfaces are clean. Use new self-locking nuts wherever applicable.
- Use marks made during removal to reassemble steering column universal joint to steering stub shaft. Make sure wheels are straight ahead.
- Use a new sealing washer on banjo fitting. Do not over-torque banjo bolt.
- Install airbag to the steering wheel as described in **721 Airbag System (SRS)**.
- Fill and bleed power steering system as described earlier.
- Have the car professionally aligned.

Tightening Torques

- Outer tie rod end to steering arm 45 Nm (33 ft-lb)
- Steering column universal joint to steering gear shaft (self-locking nut) 19 Nm (14 ft-lb)
- Steering gear to subframe crossmember
M10 bolt 42 Nm (32 ft-lb)
- Steering fluid lines
M10 banjo bolt 12 Nm (9 ft-lb)
M14 banjo bolt 35 Nm (26 ft-lb)
M16 banjo bolt 40 Nm (30 ft-lb)

Outer tie rod end, replacing

1. Raise car, remove outer tie rod ball joint nut, and press out outer tie rod end ball joint as described above.
2. Make a reference measurement of outer tie rod end to tie rod. See Fig. 8. Record measurement.

NOTE—

Accurate measuring of the tie rod end in reference to the tie rod will help approximate correct wheel alignment when new parts are installed.

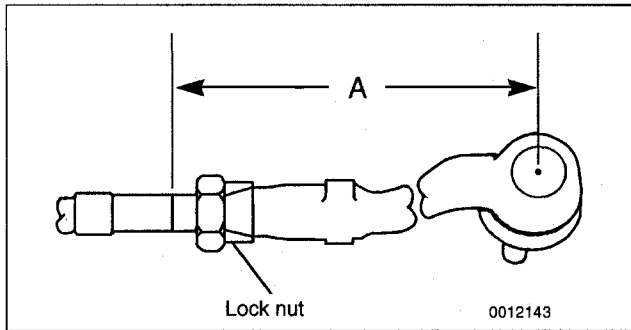


Fig. 8. Measuring tie rod end position (for reference only).

3. Loosen outer tie rod end lock nut. See Fig. 9.

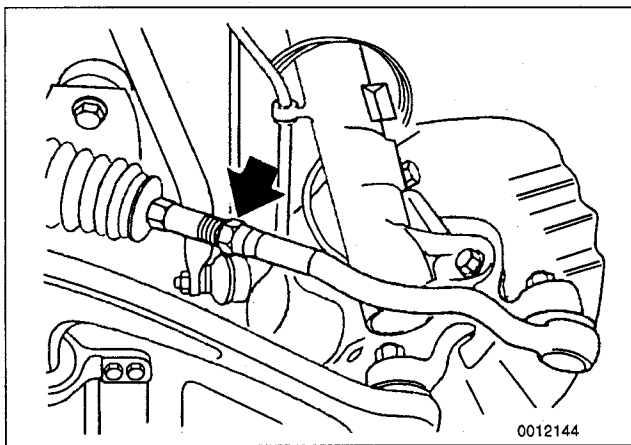


Fig. 9. Outer tie rod end lock nut (arrow).

4. Unscrew tie rod end from steering gear.
5. Installation is reverse of removal. Make sure all threaded parts are clean. Have the car professionally aligned.

Tightening Torques

- Outer tie rod end to steering arm 45 Nm (33 ft-lb)
- Outer tie rod end lock nut 35 Nm (26 ft-lb)

Tie rod, replacing

1. Raise car, remove outer tie rod end ball joint nut, and press out outer tie rod end ball joint as described above.
2. Make a reference measurement of outer tie rod end to tie rod. See Fig. 8. Record measurement

NOTE—

Accurate measuring of the tie rod end in reference to the tie rod will help to approximate wheel alignment when new parts are installed.

3. Loosen rack boot bellows clamp and slide bellows back. Inspect boot for any sign of damage. Replace if necessary.

4. Unlock inner tie rod end lockplate using pliers.

5. Using special tool, unscrew inner tie rod end from steering rack. See Fig. 10.

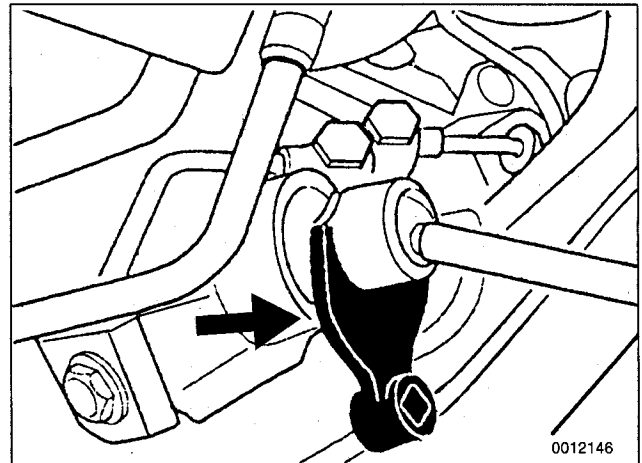


Fig. 10. Special tool (arrow) installed on inner tie rod end.

6. Installation is reverse of removal, noting the following:
 - Make sure all threaded parts are clean. Replace self-locking nuts and inner tie rod lockplate.
 - Install outer tie rod end to new tie rod using reference measurement recorded earlier.
 - Have car professionally aligned.

Tightening Torques

- Outer tie rod end to steering arm 45 Nm (33 ft-lb)
- Outer tie rod end lock nut 35 Nm (26 ft-lb)
- Inner tie rod to steering gear 71 Nm (52 ft-lb)

WHEEL ALIGNMENT

Proper handling, stability, tire wear, and driving ease depend upon the correct alignment of all four wheels. The front axle is aligned in relation to the rear axle, then the front wheels are aligned in relation to one another. This is known as a four-wheel or thrust-axis alignment.

The BMW E36 uses a sophisticated multi-link suspension at the front and rear of the car. Proper alignment requires computerized alignment equipment.

Caster and Camber

Front and rear caster and camber are both fixed by the design of the car. Any deviations are usually the result of worn or damaged suspension or body parts.

Front Toe-in and Toe Difference Angle

Toe-in is the difference in the distance between the front of the front wheels and the rear of the front wheels. It is adjusted by altering the length of the outer tie rods.

Toe-in adjustments should only be made on alignment equipment with the car in normal loaded position as described below under **Wheel Alignment Specifications**.

Toe difference angle determines the progressively different paths taken by the front wheels as the car is turning. It is fixed by the steering gear, but depends on accurate setting of the toe-in.

Rear Toe-in

There is no provision for routine rear wheel toe-in adjustment. If any alignment angles deviate from specifications, carefully inspect the rear trailing arms, rear suspension sub-frame and all associated bushings and flexible mounts for wear or damage. After replacing any parts that appear worn or damaged, re-check the toe measurements.

Wheel Alignment Specifications

Alignment specifications for the E36 are listed in **Table a** and **Table b**. The specifications only apply under the following conditions:

- Correct wheels and tires are installed, in good condition, and are at the correct inflation pressures.
- All steering and suspension parts and bushings are undamaged and show no signs of abnormal wear.
- Wheel bearings are in good condition.
- Ride height is in accordance with specifications. See **310 Front Suspension** and **330 Rear Suspension**.
- Car is in normal loaded position.

Normal loaded position

- Each front seat 68 Kg (150 lb)
- Rear seat (center) 68 Kg (150 lb)
- Trunk 21 Kg (46 lb)
- Fuel tank full

Table a. Front Wheel Alignment Specifications

Model	318/325	318/325 sport suspension	M3 3.0 liter	M3 3.2 liter
Toe angle (total)	0° 18' ±8'	0° 18' ±8'	0° 10' ±5'	0° 10' ±5'
Camber				
To 1995	-0° 40' ±30'	-0° 58' ± 30'	-0° 55' ±30'	—
1995 on	-0° 30' ±30'	-0° 51' ±30'	-0° 55' ±30'	-0° 46' ±30'
Caster				
@ 10° wheel lock	3° 41' ±30'	3° 50' ±30'	6° 38' ±30'	9° 35' ±30'
@ 20° wheel lock	3° 52' ±30'	3° 57' ±30'	6° 52' ±30'	7° 50' ±30'
Front Wheel Displacement	0° ±15'	0° ±15'	0° ±15'	0° ±15'

Table b. Rear Wheel Alignment Specifications

Model	318/325	318/325 sport suspension	M3 3.0 liter	M3 3.2 liter
Toe angle (total)	0° 24' ±6'	0° 24' ±6'	0° 30' ±6'	0° 30' ±6'
Camber	-1° 40' ±15'	-2° 0' ±15'	-1° 45' ±10'	-1° 45' ±10'
Maximum allowable deviation between sides	0° ±3'	0° ±3'	0° ±3'	0° ±3'

