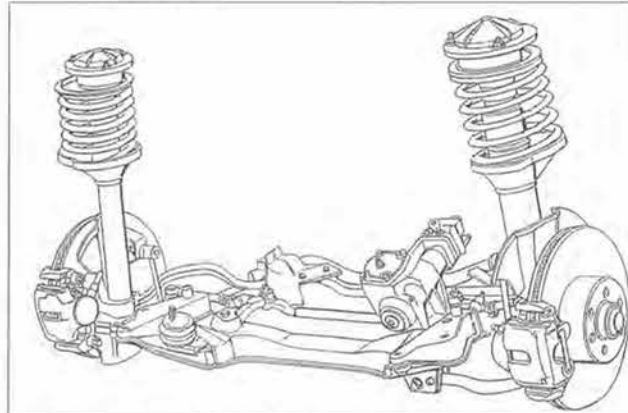


310 Front Suspension

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GENERAL

For a general description of the front suspension and components, see **300 Suspension, Steering and Brakes—General**.

Special service tools are required for most of the work described in this repair group. Read the procedures through before beginning any job.

WARNING—

- Physical safety will be impaired if procedures described here are undertaken without the proper service tools and equipment. Be sure to have the right tools on hand before beginning any job.
- Do not reuse self locking nuts or bolts. They are designed to be used only once and may fail if reused. Always replace self locking fasteners any time they are loosened or removed.
- Do not install bolts and nuts coated with undercoating wax, as the 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 suspension components. Replace damaged parts.

GENERAL

310-2 FRONT SUSPENSION

SHOCK ABSORBERS AND SPRINGS

Electronic damping control (EDC III) is installed as an option in some E32 cars. EDC III cars do not have conventional struts. A separate replacement procedure is given below for these struts. For further information on EDC III, see **370 Integrated Suspension Systems**.

NOTE—

- *Most assembly components are available as replacement parts, although the most commonly replaced parts are the strut cartridges, the upper strut mounts and the coil springs.*
- *Shock absorber cartridges and springs should always be replaced in pairs.*

Strut assembly, removing and installing (except on cars with EDC III)

NOTE —

For EDC III strut removal procedures, see **Strut assembly, removing and installing (cars with EDC III)** later in this group.

- Raise car and remove front wheel.

WARNING —

Make sure that 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.



- Unbolt brake caliper assembly, keeping brake hose connected. Secure brake caliper with wire and do not let it hang from brake hose. See **340 Brakes**.

- Remove ABS pulse sensor mounting bolt (arrow) and pull sensor from housing.

- Disconnect brake fluid line, ABS sensor wire harness, and brake pad wear sensor wire harness from strut housing.

- Disconnect stabilizer bar link from strut assembly.

- Remove strut-to-steering arm mounting bolts (arrows). Disconnect steering arm from strut assembly.

- Support strut assembly from below and then remove strut mounting nuts on strut tower. Remove strut assembly from car.

NOTE —

Store removed strut assembly upright. Do not allow it to lie horizontally or upside-down for any length of time. If incorrect storage has occurred, place the strut assembly upright with rod fully extended for at least 24 hours.

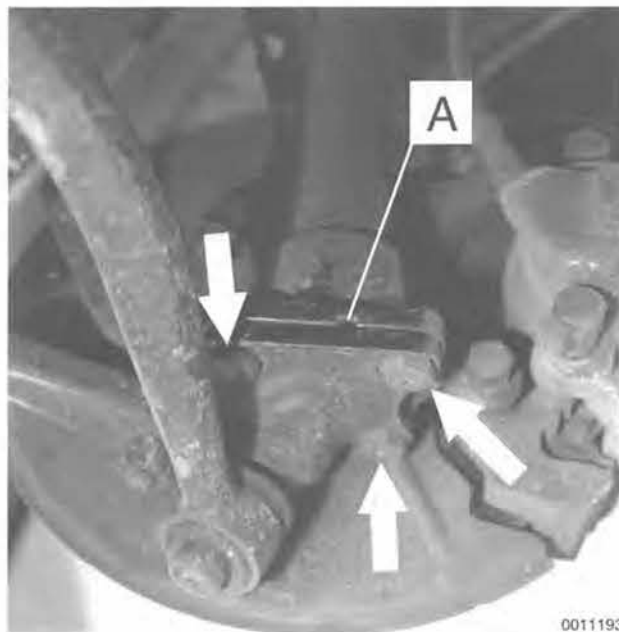
- Make sure all thread bores, bolts, nuts and mating surfaces are clean.

- Install strut assembly to strut tower using new self locking nuts.

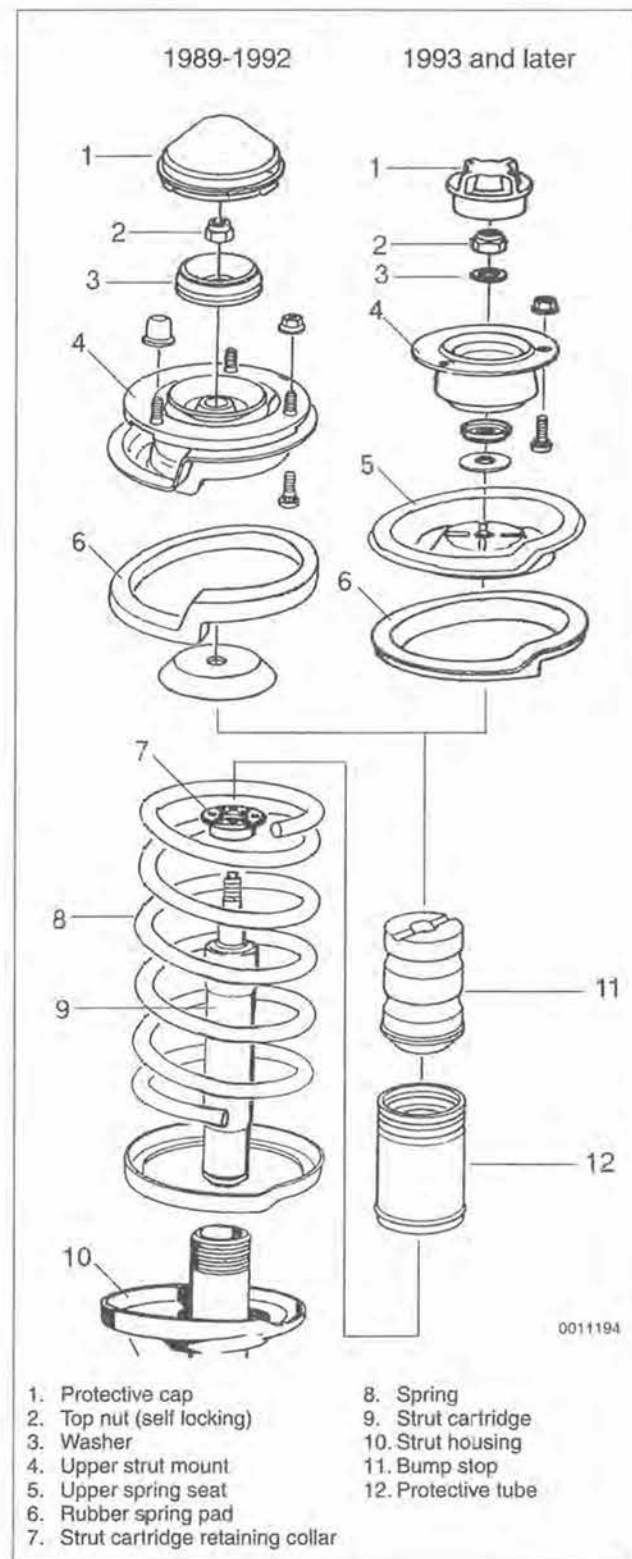
Tightening Torques

- Strut assembly to body
(self locking nuts) 22 Nm (16 ft-lb)

- Install steering arm to strut assembly, making sure mating notches are aligned.



310-4 FRONT SUSPENSION



Tightening Torques

- Steering arm to strut housing 110 Nm (81 ft-lb)
(use Loctite 270® or equivalent. 110 Nm (81 ft-lb))

- The remainder of installation is reverse of removal.

Tightening Torques

- Brake caliper to strut housing 110 Nm (81 ft-lb)
- Road wheel to hub 100 ± 10 Nm (74 ± 7 ft-lb)
- Stabilizer link to strut housing 59 Nm (43 ft-lb)

Strut, disassembling and assembling

Replacing the upper strut mount, spring and strut cartridge requires that the strut first be disassembled. This procedure requires a spring compressor specifically designed for the purpose.

WARNING—

Do not attempt to disassemble the struts without a spring compressor designed specifically for this job.

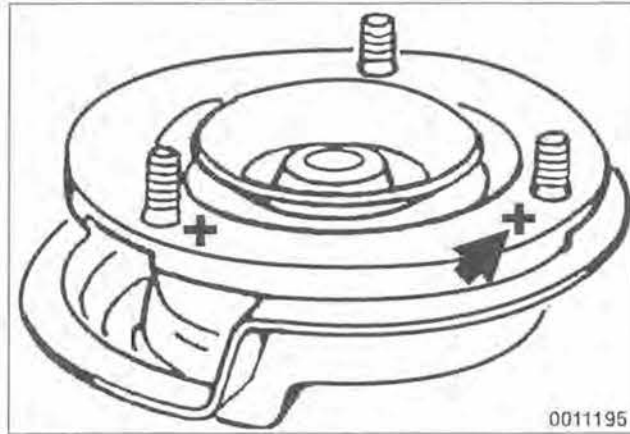
Springs and strut cartridges should always be replaced in pairs.

- Remove strut assembly from car as described above.
- Using a spring compressor, compress spring until spring force on upper mount is relieved.

WARNING—

Make sure the spring compressor grabs the spring evenly and securely before compressing it.

- Pry protective cap off top of strut assembly. Then remove top (center) nut and washer while holding strut shaft stationary.
- Remove upper strut mount and related components.



- ◀ Inspect strut mounts to determine if they are special camber correcting type mounts. These special mounts are marked with a "+" or "-" near a mounting stud. When replacing mount, be sure to replace it with same type of mount to maintain front wheel alignment settings.
- Release spring compressor carefully and evenly, allowing spring to slowly expand.
- Remove rubber stop and protective tube from strut cartridge shaft.
- Loosen strut cartridge retaining collar and remove cartridge from housing.
- If there is oil in housing pour it out. Clean out housing.

NOTE—

- Hydraulic-type strut cartridges are installed in the strut housing with a small amount of oil for cooling. Gas-pressure strut cartridges do not require oil.
- Store the removed strut assembly/shock absorber standing upright. Do not allow it to lie horizontally or upside-down for any length of time. If incorrect storage has occurred, place the strut assembly upright with the rod fully extended for at least twenty four hours.
- Assembly is reverse of disassembly. If installing hydraulic-type strut cartridges, pour 30 ml (1 fl. oz.) of motor oil into housing before installing new cartridge. Be sure to use a new self locking top (center) nut.

WARNING—

Make sure the self locking top nut is fully tightened before releasing the spring compressor. Always use a new nut.

Tightening torques

- Shock cartridge retaining collar
 - to strut housing 130 Nm (96 ft-lb)
- Stabilizer to strut 59 Nm (44 ft-lb)
- Upper strut mount to strut cartridge shaft
 - (self locking nut - always replace)
 - shaft with external hexagon 65 Nm (48 ft-lb)
 - shaft with internal hexagon 45 Nm (33 ft-lb)
- Road wheel to hub 100 ± 10 Nm (74 ± 7 ft-lb)

310-6 FRONT SUSPENSION

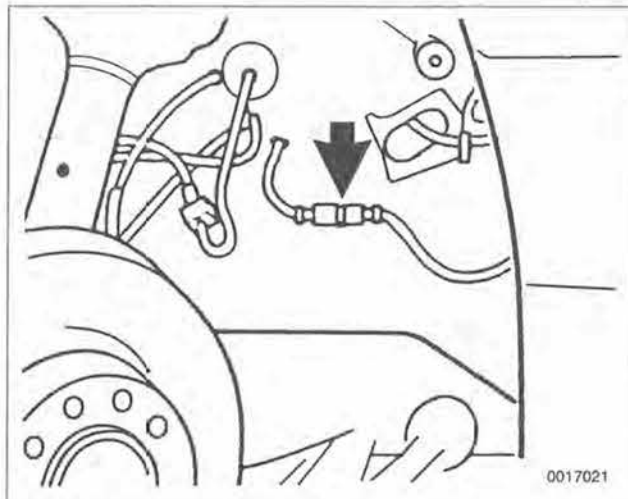
Strut assembly, removing and installing (cars with EDC III)

- Raise car and remove front wheel.

WARNING—

Make sure that 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.

- ◀ Disconnect EDC harness connector (**arrow**) in front wheel well.



- ◀ EDC III solenoids on front strut housing—**Do not remove.**

CAUTION—

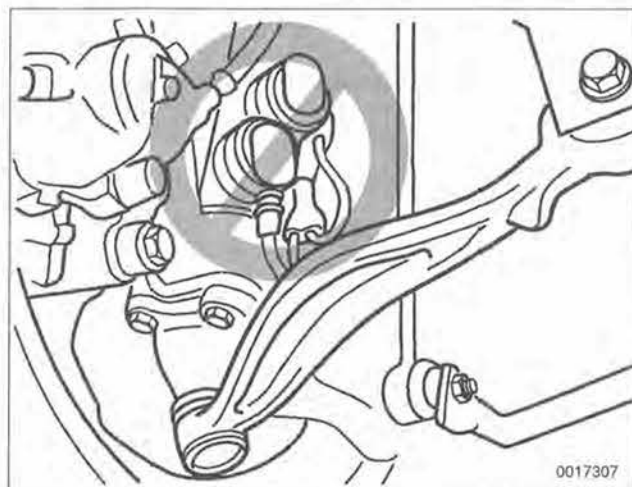
Do not remove sealing covers from EDC III solenoid valves on strut housing. The strut will be permanently damaged.

- Disconnect brake pad wear sensor wiring harness connector on strut housing.
- Remove caliper bolts and hang caliper to one side. Remove brake rotor and hub assembly. See **340 Brakes**.

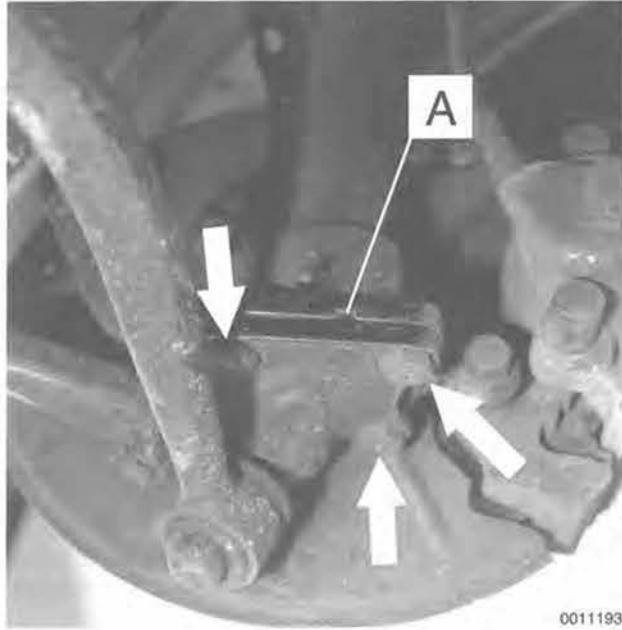
NOTE—

It is not necessary to disconnect brake hydraulic line from caliper.

- Detach stabilizer bar link from strut.



FRONT SUSPENSION 310-7



0011193

- Remove strut-to-steering arm mounting bolts (arrows) and separate steering arm from strut.

NOTE—

Note mating notch (A) when installing steering arm to strut assembly.

- Working at top of strut tower in engine compartment, remove strut bearing cap. Then detach electrical harness connector from top of strut.
- While supporting strut housing, remove three strut mount nuts at top and slide strut out.

CAUTION—

- Always store struts in the upright position.
- Be very careful not to damage the EDC III solenoid valves or their connections on the strut housing.

- Installation is reverse of removal.

Tightening Torques

- Brake caliper to strut housing 110 Nm (81 ft-lb)
- Brake rotor to hub 16 Nm (12 ft-lb)
- Hub collar nut to stub axle 290 Nm (214 ft-lb)
- Road wheel to hub 100 ± 10 Nm (74 ± 7 ft-lb)
- Stabilizer bar link to strut housing 59 Nm (43 ft-lb)
- Steering arm to strut housing
(use Loctite®270 or equivalent) 110 Nm (81 ft-lb)
- Strut assembly to body 22 Nm (16 ft-lb)

Ride Height

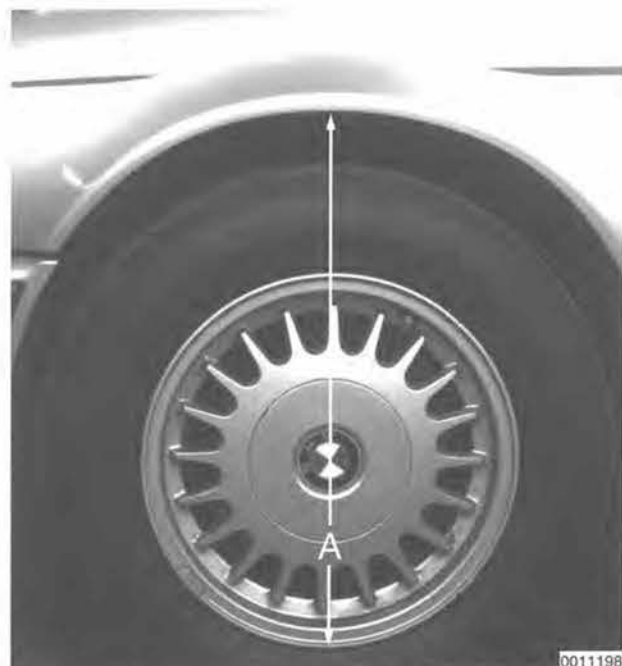
- Ride height measurement (A) is taken from center of wheel arch to bottom of wheel rim. Measure ride height with car in normal loaded position on the ground.

If ride height is outside specification listed, new springs should be installed.

Table a lists front suspension ride height specifications for the cars covered by this manual. These specifications apply to a car in a normally loaded position. When checking ride height or installing suspension components that require the car to be "normally loaded," load the car as follows:

Normal loaded position

- Each front seat 68 kg (150 lb)
- Center of rear seat 68 kg (150 lb)
- Trunk 21 kg (46 lb)
- Fuel tank full



0011198

Table a. Front Ride Height Specifications

Wheel (rim) installed	Ride Height
15 in. standard suspension	588 mm (23 ¹ / ₈ in.)
TRX 390 standard suspension	592 mm (23 ³ / ₄ in.)
TRX 415 standard suspension	602 mm (23 ³ / ₄ in.)

CONTROL ARMS

The control arms are attached to the front crossmember through rubber bushings and to the steering arm by ball joints. If worn, the control arm ball joint can only be replaced as part of an entire control arm assembly.

Some special tools may be required to remove the control arms and to replace the control arm bushings. Read the procedure through before beginning the job.

Control arm, removing and installing

- Raise car and remove wheel.

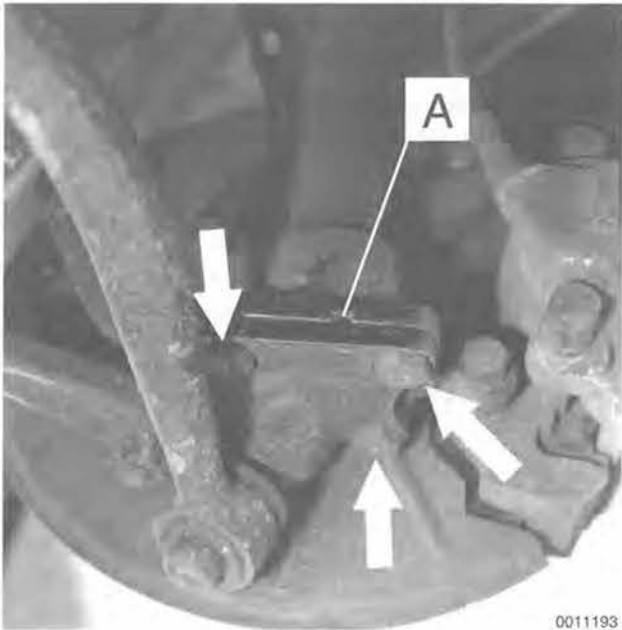
WARNING —

Make sure that 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 strut-to-steering arm mounting bolts (arrows) and separate steering arm from strut.

NOTE —

Note mating notch (A) when installing steering arm to strut assembly.

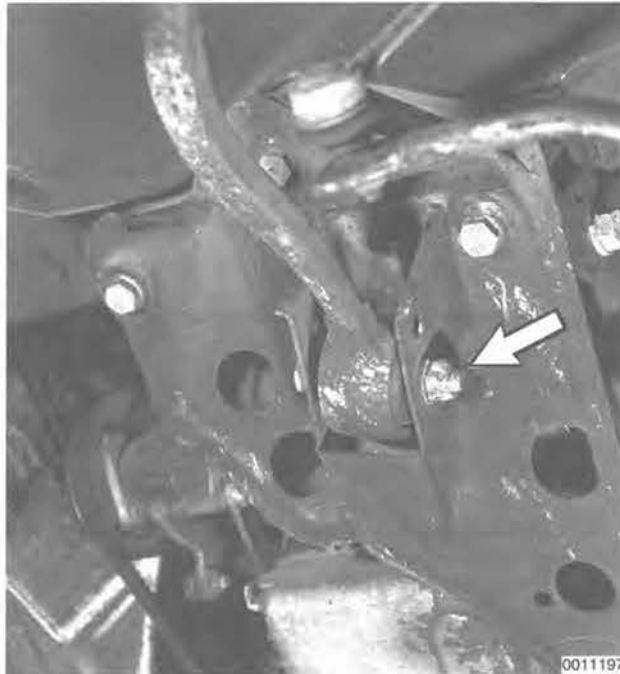


FRONT SUSPENSION 310-9

- Working at removed steering arm, remove ball joint nut from inside of steering arm. Lightly tap ball joint from steering arm.

CAUTION—

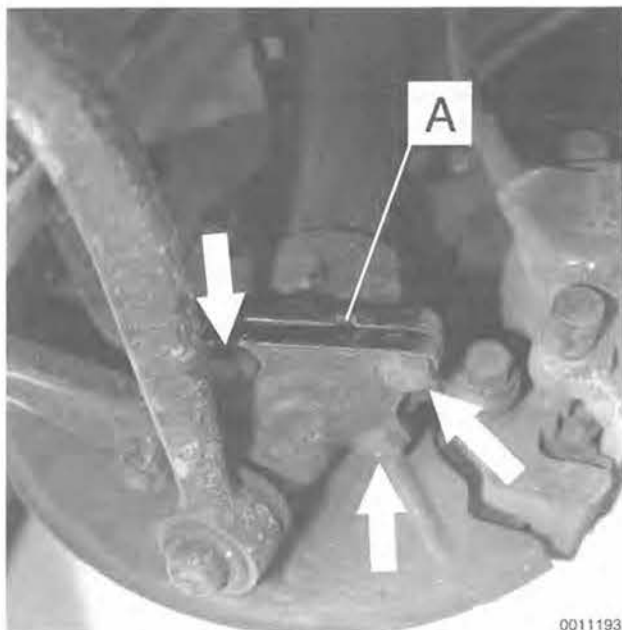
Take care not to damage the ball joint threads if the control arm is to be reused. If necessary, press the ball joint out using BMW special tool no. 31 1 110 or an equivalent press.



- Working at other end of control arm, remove through-bolt attaching control arm to crossmember.
- When installing control arm, make sure all thread bores, bolts, nuts and mating surfaces are clean.
- Install bushing-end of control arm to crossmember, using washers on both sides of bolt and a new self locking nut. Do not tighten nut at this time.
- Install control arm ball joint to steering arm using a new self locking nut and tighten fully.

Tightening Torques

- Control arm ball joint to steering arm 93 Nm (68 ft-lb)



- Install steering arm to strut, making sure mating notch (A) is aligned.

Tightening Torques

- Strut housing to steering arm (use Loctite 270® or equivalent. 110 Nm (81 ft-lb)

- Install wheel and lower car.
- Load car to normal loaded position as described earlier under **Ride Height**. Jounce suspension a few times.
- With car on ground and loaded, tighten control arm bushing through-bolt.

Tightening Torques

- Control arm to crossmember (car in normal loaded position) 78 Nm (57 ft-lb)
- Road wheel to hub 100 ± 10 Nm (74 ± 7 ft-lb)

CONTROL ARMS

310-10 FRONT SUSPENSION

Control arm bushings, replacing (steel control arms only)

Control arm bushings should always be replaced in pairs.

NOTE—

Two types of control arms are installed on the E32 cars; aluminum construction and steel construction. On cars with aluminum control arms, the entire control arm must be replaced if the bushing is worn.

- Raise car and remove wheel.

WARNING—

Make sure that 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 control arm from car as described earlier.

NOTE—

The control arm bushings can be replaced with the control arm installed in the car if BMW special press tools 31 1 051 and 33 3 141/142/144 are available.

- Using a service press and appropriate press tools, press bushing out of control arm.
- Clean bushing bore and install new bushing from chamfered side of bushing bore in arm.
- Install control arm as described earlier.

CAUTION—

Tighten the control arm bushing through-bolt to its final torque only with car on the ground and the suspension normally loaded as described earlier.

FRONT WHEEL BEARINGS

The front wheel bearings are permanently sealed and require no maintenance. The bearing is integral with the wheel hub and pressed onto the strut assembly stub axle.

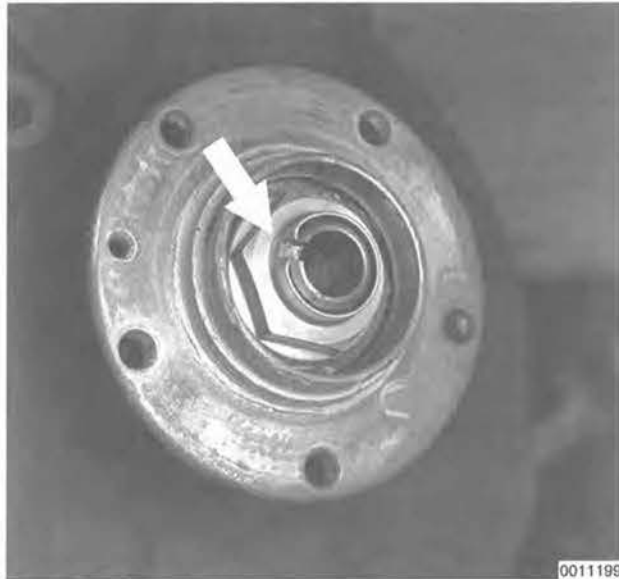
Special press tools are required to replace the front wheel bearings. Read the procedure through before beginning the job.

Wheel bearing, replacing

- Raise car and remove wheel.

WARNING—

Make sure that 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.



- Pry off grease cap from center of wheel hub.

- Bend back staked part of wheel hub collar nut (arrow).

- Remount wheel and lower car to ground to gain leverage in loosening collar nut.

- Loosen collar nut. Do not remove nut completely.

NOTE—

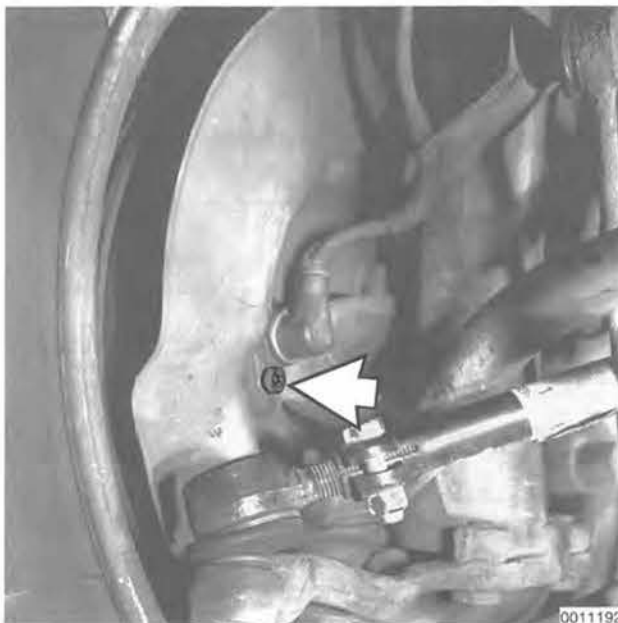
The wheel hub collar nut is tightened to a torque of 290 Nm (214 ft-lb). Make sure the car is firmly on the ground and use heavy-duty tools when loosening the nut.

- Raise car and remove wheel.

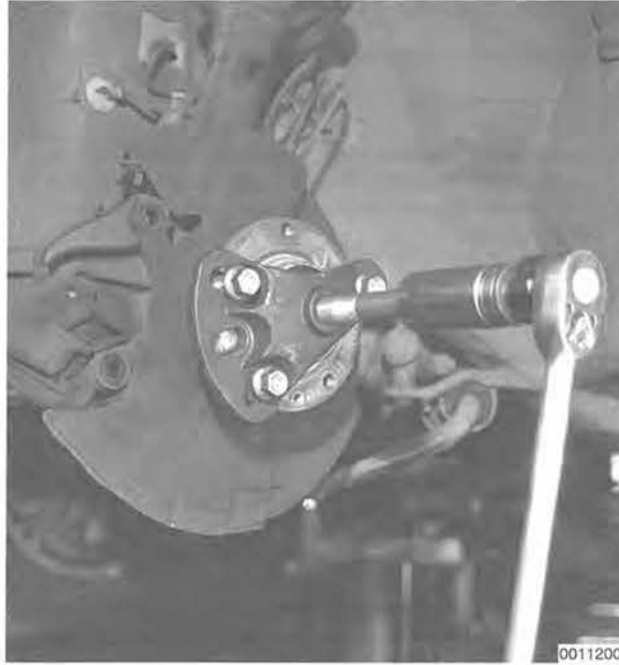
- Remove ABS pulse sensor mounting bolt (arrow) and pull sensor from housing.

- Remove wheel hub collar nut.

- Unbolt brake caliper assembly and rotor as described in **340 Brakes**. Leave brake hose connected to caliper. Suspend caliper assembly from chassis with strong wire.



310-12 FRONT SUSPENSION



- Remove wheel hub with integral wheel bearing from stub axle using a puller (BMW special tool nos. 31 2 102/105/106 or equivalents).

NOTE—

If bearing inner race stays on stub axle, remove splash guard and use a two-jaw puller (BMW special tool no. 31 2 102 or equivalent) to remove race.

- Install splash guard and a new dust shield behind bearing. Press new wheel hub/bearing assembly on using BMW special tool no. 31 2 110 or an equivalent pressing tool.

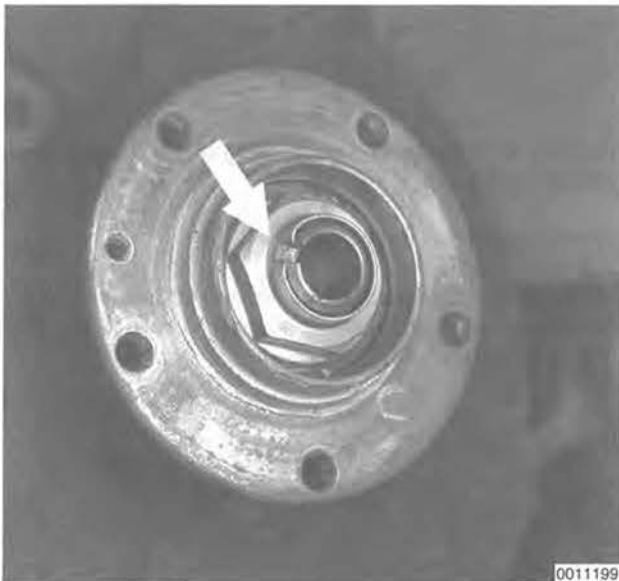
NOTE—

When pressing wheel hub/bearing on, apply force only to the bearing inner race.

- Install a new collar nut. Do not tighten nut to its final torque at this time.
- Install brake rotor and mount wheel and lug nuts. Lower car to ground to gain leverage.

Tightening Torque

- Brake rotor to wheel bearing/hub assembly 16 Nm (12 ft-lb)



- Tighten collar nut and then stake nut to axle (**arrow**).

Tightening Torque

- Collar nut to stub axle 290 Nm (214 ft-lb)

- Raise car and remove wheel.
- Install brake caliper as described in **340 Brakes**.

Tightening Torque

- Brake caliper to strut housing 110 Nm (81 ft-lb)

- Install a new grease cap, using Loctite®638 sealant or equivalent.
- Install wheel and lower car.

Tightening Torque

- Road wheel to hub 100 ± 10 Nm (74 ± 7 ft-lb)

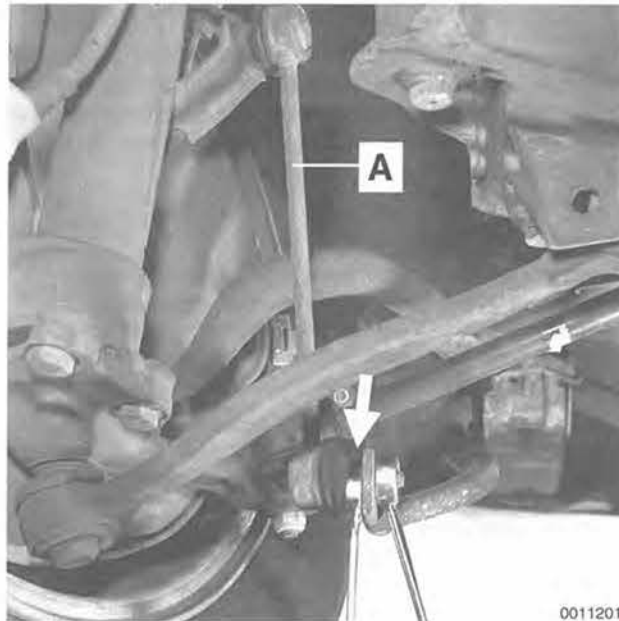
STABILIZER BAR

Stabilizer bar, removing and installing

- Raise car and remove both wheels.

WARNING —

Make sure that 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.



0011201

- ◀ Disconnect stabilizer bar connecting link (A) from stabilizer bar on left and right sides.

- Counterhold link (arrow) when removing nut. Remove lower connecting link nuts and tap links out of stabilizer bar.



0011202

- ◀ Unbolt left and right stabilizer bar bushing brackets and remove bar.

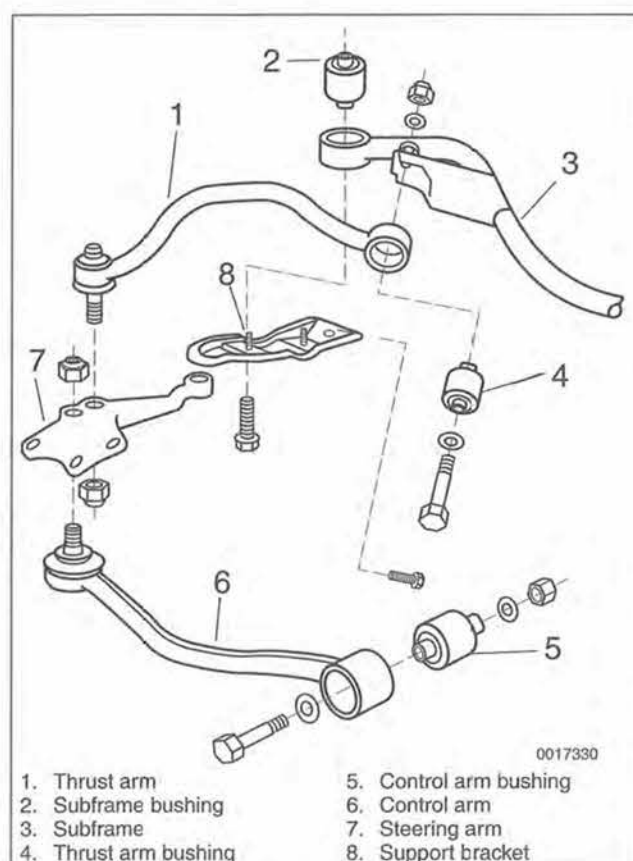
- Installation is reverse of removal. Use new self locking nuts on connecting links.

NOTE —

Installation of the stabilizer bar is easiest with the car level (front wheels at the same height), and as near to normal ride height as possible.

Tightening Torques

- Connecting link to strut housing/stabilizer bar (counterhold when tightening) . . . 59 Nm (43 ft-lb)
- Stabilizer bar mounting brackets to subframe 22 Nm (16 ft-lb)



THRUST ARMS

THRUST ARMS

The thrust arms are attached to the connecting subframe crossmember through hydraulic bushings and to the steering arms by ball joints.

Inspect the ball joints for wear and looseness. Inspect the bushings for fluid leaks. The ball joint can only be replaced as part of an entire thrust arm assembly. The hydraulic bushings are available as individual replacement parts and should always be replaced in pairs.

NOTE—

- Steering wheel vibration during braking (usually at road speeds of 50 to 60 m.p.h.) can often be caused by faulty thrust arm bushings and not out-of-true brake rotors. Be sure to inspect the bushings for leaking fluid and replace them if any fluid leaks are present.
- Some very early 1988 cars may be equipped with the old-style rubber bushings. These rubber bushings should have been removed and replaced with the newer hydraulic bushings during the new car pre-delivery inspection or during the first service visit. The hydraulic bushings can be identified by plastic clips on either side of the bushing. If the old-style rubber bushings are still installed, they should be replaced with the later-style hydraulic bushings.

Thrust arm, removing and installing

- Raise car and remove wheel.

WARNING—

Make sure that 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.

Unscrew ball joint nut from steering arm. Lightly tap ball joint out of steering arm.

CAUTION—

Take care not to damage the ball joint threads if the thrust arm is to be reused. If necessary, press the ball joint out using BMW special tool no. 31 2 140 or an equivalent press.

FRONT SUSPENSION 310-15



➤ Remove through-bolt (**arrow**) attaching thrust arm to connecting crossmember.

- When installing thrust arm, make sure all thread bores, bolts, nuts and mating surfaces are clean.

- Install bushing-end of thrust arm to crossmember using washers on both sides of bolt and a new self locking nut. Do not tighten nut at this time.
- Install thrust arm ball joint to steering arm using a new self locking nut.

Tightening Torques

- Thrust arm ball joint to steering arm 93 Nm (68 ft-lb)

- Install wheel and lower car.

- Load car to normal loaded position as described earlier under **Ride Height**. Jounce suspension a few times.
- With car on ground and loaded, tighten thrust arm bushing through-bolt.

Tightening Torques

- Road wheel to hub 100 ± 10 Nm (74 ± 7 ft-lb)
- Thrust arm to connecting crossmember (car in normal loaded position) 127 Nm (94 ft-lb)

Thrust arm bushings, replacing

Thrust arm bushings should always be replaced in pairs.

- Raise car and remove wheel.

WARNING—

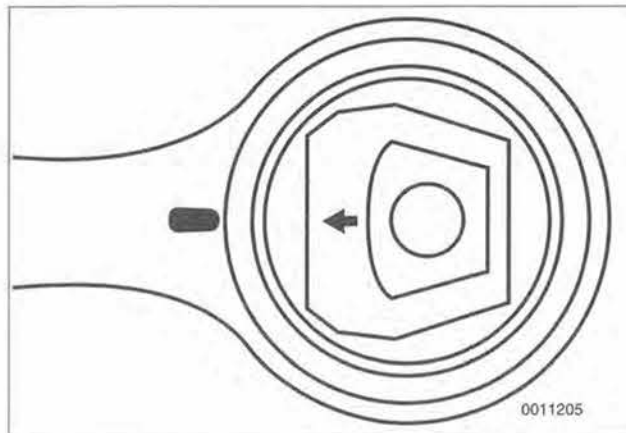
Make sure that the car is firmly supported on jack stands designed for the purpose. Place the jack stands beneath a structural chassis point. Do not place jack stands under suspension parts.

- Remove thrust arm from car as described earlier.
- Using a service press and appropriate press tools (BMW special tool no.s 31 1 052/053 or equivalent), press bushing out of thrust arm.

➤ Clean bushing bore and press in new bushing while aligning arrow on bushing with mark on thrust arm. Press bushing in so it protrudes equally from both sides of thrust arm.

CAUTION—

To avoid damaging the new hydraulic bushing, press only on the outer steel sleeve during installation.



THRUST ARMS

310-16 FRONT SUSPENSION

- Install thrust arm as described earlier.

CAUTION—

Tighten the thrust arm bushing through-bolt to its final torque only with car on the ground and the suspension normally loaded as described earlier.

SUBFRAME CROSSMEMBER

The subframe crossmember provides rigid mounting points for the engine, suspension and steering components.

Removing the subframe crossmember requires engine lifting equipment to support the weight of the engine so that the subframe can be removed from below.

WARNING—

Removal or replacement of the subframe crossmember may affect suspension and steering geometry, including front wheel alignment. Make appropriate matching marks during removal and be sure to have the front end professionally aligned after installation.

Subframe crossmember, removing

- Using an engine hoist (BMW special tool no. 00 0 200 and 11 0 020), slightly raise engine just until weight of engine is supported. See **110 Engine Removal and Installation**.
- Working in engine compartment, remove top nut from right engine mount.
- Raise car and remove front wheels.

WARNING—

Make sure that the car and the engine are 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.

- ◀ Working beneath car, remove lower nuts from the left (arrow) and right engine mounts.
- Unbolt left and right control arm through-bolts. Remove bolts and support control arm from chassis using stiff wire.

WARNING—

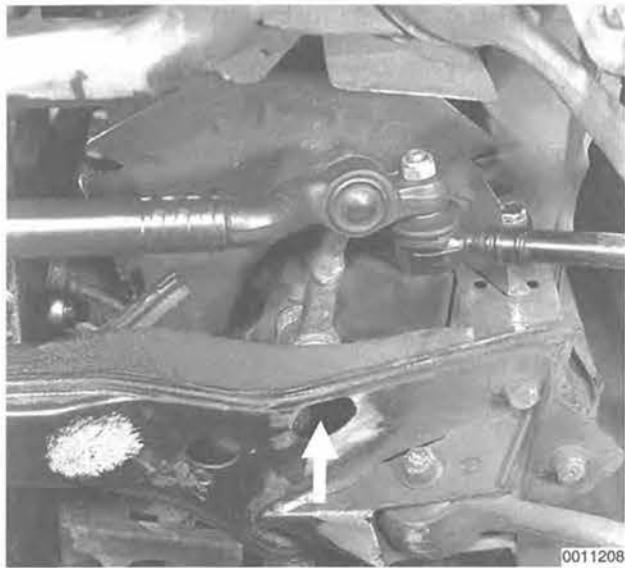
Do not allow the control arm to hang from the ball joint. This can damage the ball joint.

- Unbolt steering gearbox from subframe. See **320 Steering**. Suspend gearbox from body using stiff wire.

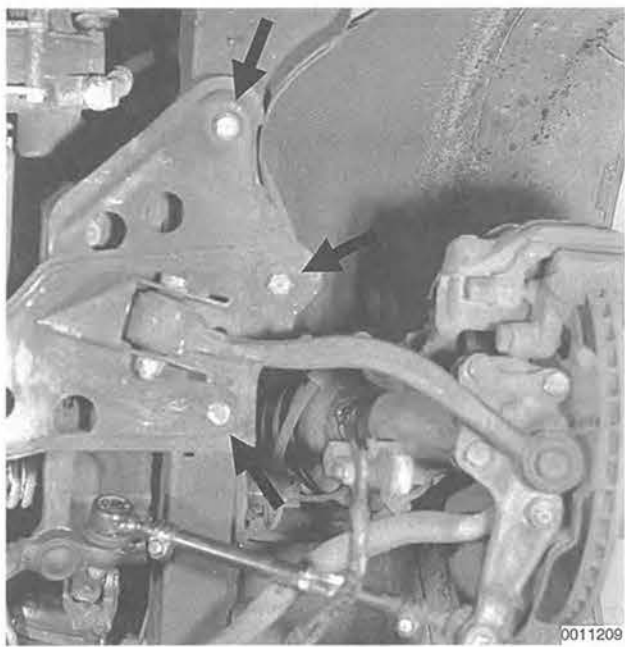


SUBFRAME CROSSMEMBER

FRONT SUSPENSION 310-17



- Unbolt steering idler arm from crossmember (arrow).
- Using an appropriate jack, support crossmember from below.



- Unbolt crossmember from chassis on left and right sides.
- Slowly lower crossmember, making sure all electrical leads and suspension components are clear during removal.

SUBFRAME CROSSMEMBER

310-18 FRONT SUSPENSION

Subframe crossmember, installing

- Make sure all bolts, bolt holes, and mating surfaces are clean to ensure proper tightening and alignment.
- Using a jack, raise crossmember into position and install mounting bolts.

Tightening Torques

- Subframe crossmember to chassis
 - M10-8.8 bolts 42 Nm (31 ft-lb)
 - M10-9.8 bolts 47 Nm (35 ft-lb)
 - M12 bolts 77 Nm (57 ft-lb)

- Install idler arm and steering gearbox to crossmember using new self locking nuts.

Tightening Torques

- Idler arm to subframe crossmember (self locking nut)
 - M10 bolt 42 Nm (32 ft-lb)
 - M12 bolt 85 Nm (63 ft-lb)
- Steering gear box to subframe crossmember (self-locking nuts)
 - M10-10.9 bolts 42 Nm (31 ft-lb)
 - M12 bolts 80 Nm (59 ft-lb)

- Install control arms to crossmember. Do not tighten control arm through-bolts and new self locking nuts to their final torque at this time.
- Lower engine onto engine mounts, allowing it to settle fully before tightening engine mount bolts.

Tightening Torque

- Engine mounts to engine bracket or main crossmember 45 Nm (33 ft-lb)

- Install wheels and lower car to ground. Load car to normal loaded position as described earlier under **Ride Height** and tighten control arm through-bolts.

Tightening Torque

- Control arm throughbolts to main crossmember (car in normal loaded position) 78 Nm (57 ft-lb)

- Remainder of installation is reverse of removal. When job is completed have wheels professionally aligned.

