

General

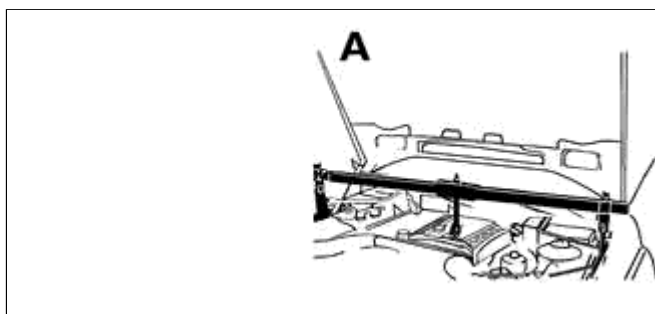
This repair group covers the repair and replacement of components that make up the front suspension of E46 cars.

See ⇒ [300 Suspension, Steering and Brakes-General](#) for a description of the front suspension and components, as well as specification for setting ride height.

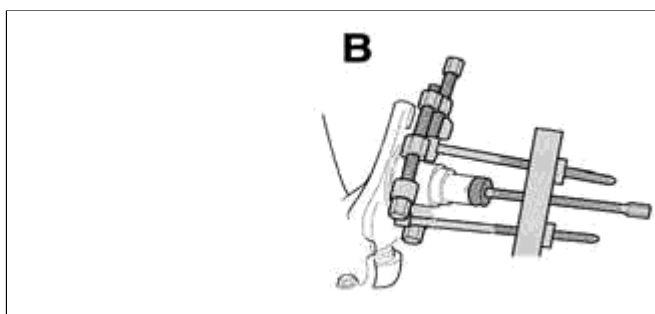
Special tools

Special service tools are required for most of the work described in this repair group. In addition to the tools depicted in the illustrations, a variety of press tools are necessary for control arm bushing replacement.

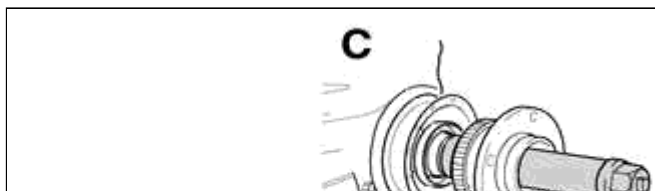
Read the procedures through before beginning any job.



- ◀ Engine support bracket BMW 00 0 200/00 0 205



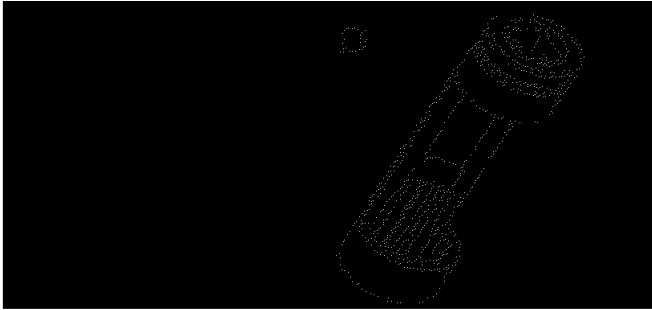
- ◀ Bearing puller BMW 00 7 500/31 2 106



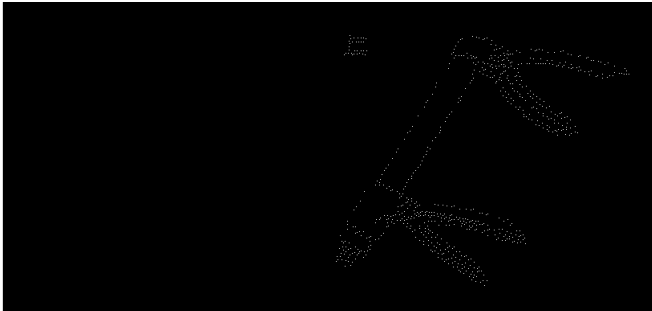
- ◀ Wheel bearing installation tool BMW 31 2 110



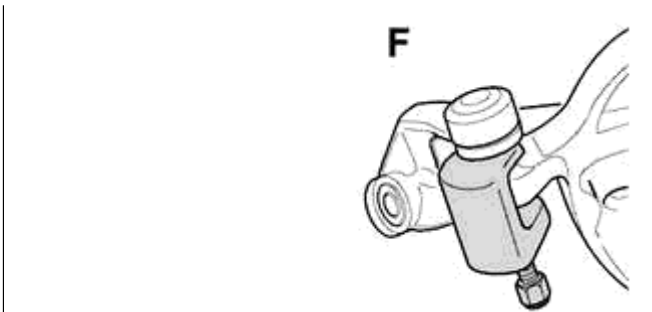
- Upper strut nut removal socket BMW 31 2 210



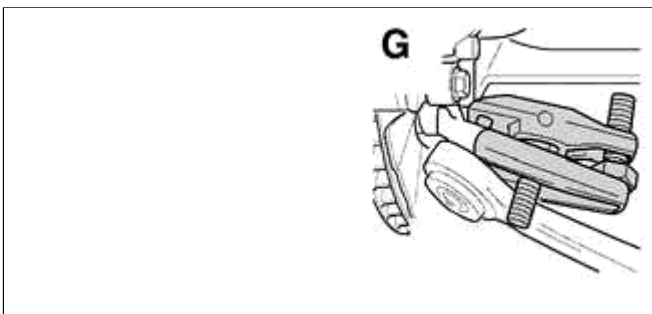
- Front coil spring compressor BMW 31 3 120



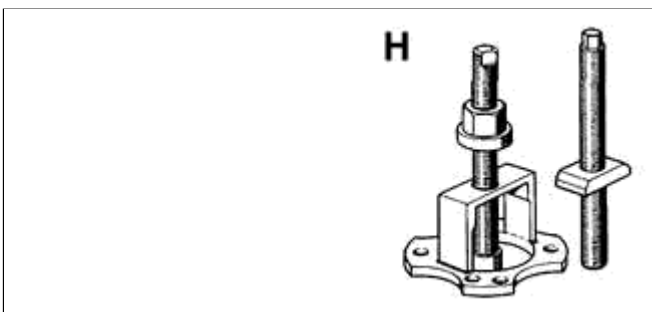
- Ball joint puller (all wheel drive BMW 32 2 040)

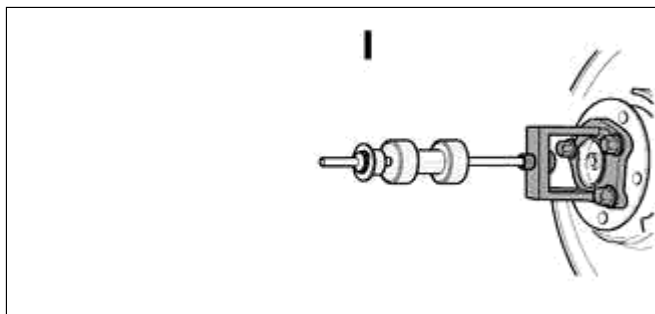


- Ball joint puller BMW 32 3 090

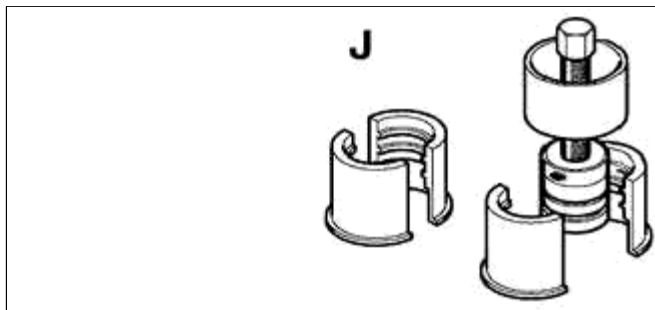


- Outer CV joint removal tool BMW 33 2 111/116/117





- ✦ Slide hammer with adapter BMW 33 4 201/202/203 33 2 116



- ✦ Inner bearing race puller set BMW 33 4 400

Front suspension construction

Some front suspension components are constructed of weight saving materials. For example, the control arms (in rear wheel drive models) are forged aluminum. This allows for weight reduction in the car, as well as a lower unsprung mass for better handling. However, the aluminum construction prevents removal or replacement of the pressed-in ball joints.

WARNING!

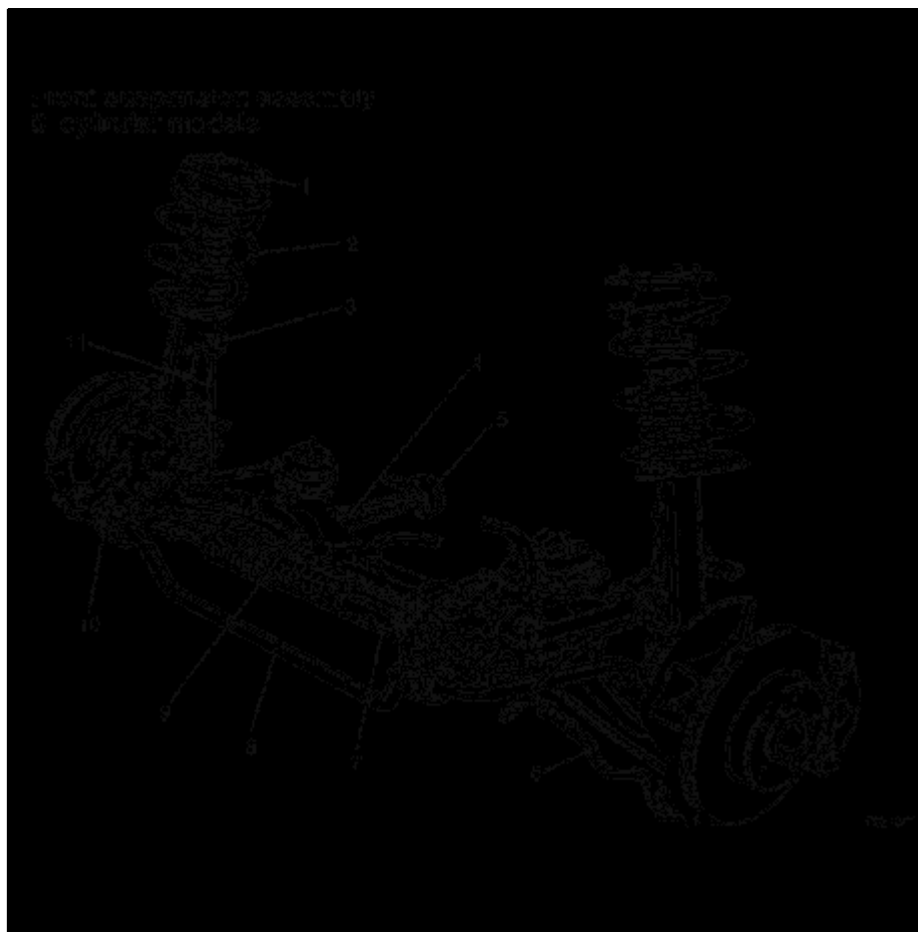
- ✦ ***Physical safety could be impaired if procedures described here are undertaken without the proper service tools and equipment. Be sure to have the right tools on hand before beginning any job.***
- ✦ ***Do not reuse self-locking nuts or bolts. They are designed to be used only once and may fail 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.***

CAUTION!

- ♦ ***Due to the aluminum construction of the control arms, great care must be taken when working on and around the front suspension:***
- ♦ ***When replacing any damaged front end components, always check the condition of the control arms***
- ♦ ***Do not clean control arms with wire brushes made of brass or iron. Only use brushes made of stainless steel.***
- ♦ ***Do not expose control arms to temperatures exceeding 80°C (176°F); sparks created by grinding; battery acid or other highly corrosive materials; or steel welding splashes.***

**assembly (6 cylinder models)**

- 1 - Upper strut mount**
- 2 - Coil spring**
- 3 - Strut assembly**
- 4 - Control arm**
- 5 - Control arm bushing and mount**
- 6 - Tie rod**
- 7 - Steering rack**
- 8 - Front stabilizer bar**
- 9 - Front suspension subframe**
- 10 - Steering arm**
- 11 - Stabilizer bar link**

Shock Absorbers and Springs

Note:

Setting the ride height is covered in ⇒ [300 Suspension, Steering and Brakes-General.](#)

The front suspension shock absorbers in E46 cars are McPherson struts. The strut is a major component of the suspension and supports the spring. Most strut assembly components are available as replacement parts. Struts and/or springs should always be replaced in pairs.

Front strut, upper strut mount or spring replacement is a two-step procedure:

- ◆ Removal of strut assembly from vehicle
- ◆ Disassembly and replacement of components on workbench

Strut assembly, removing and installing

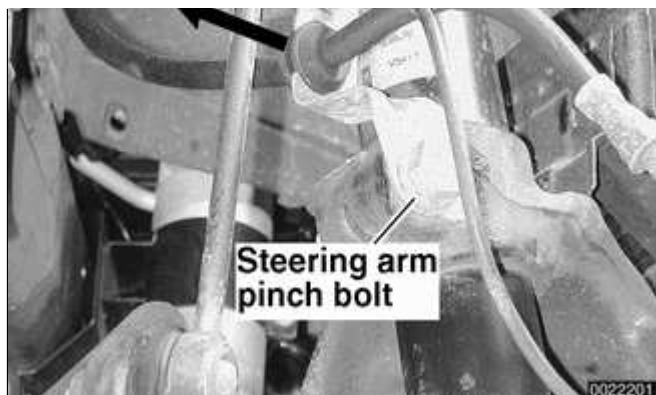
- Raise car and remove front wheel.

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.



- ✦ Pull brake fluid hose and ABS sensor wire harness off bracket at steering arm pinch bolt.

**Note:**

Right side shown is in illustration. Left side bracket also holds brake pad wear sensor wire.

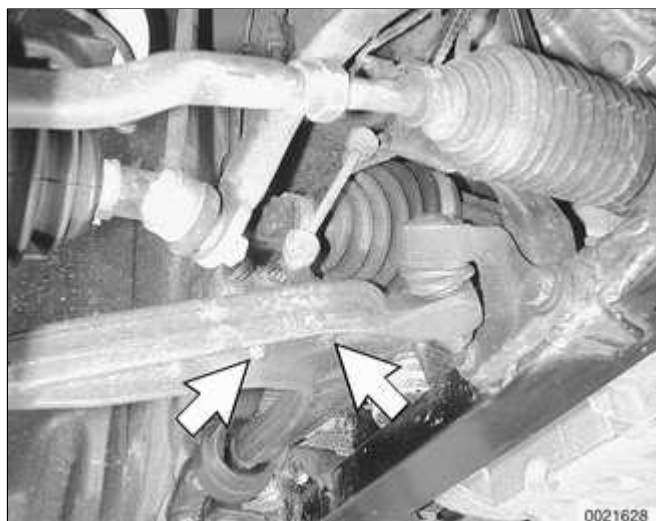
- Unbolt brake caliper assembly, keeping brake hose connected. Suspend brake caliper from chassis using stiff wire. See ⇒ [340 Brakes](#).



- Remove ABS wheel speed sensor mounting bolt (**arrow**). Slide sensor out of steering arm and lay aside.

Note:

Rear wheel drive vehicle shown in illustration.



- On cars equipped with xenon headlights: Remove headlight vertical aim sensor link bracket mounting nuts (**arrows**) from right control arm.



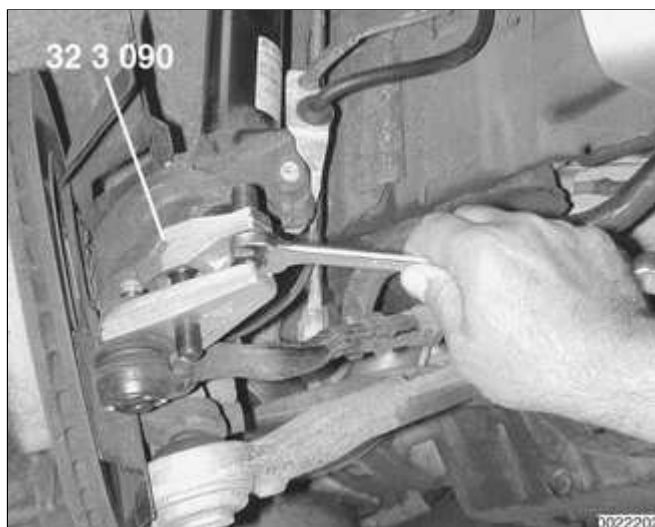
- Loosen and remove stabilizer bar link mounting nut (**arrow**) from strut. Detach link from strut housing.

Note:

Use a thin wrench to counterhold shaft

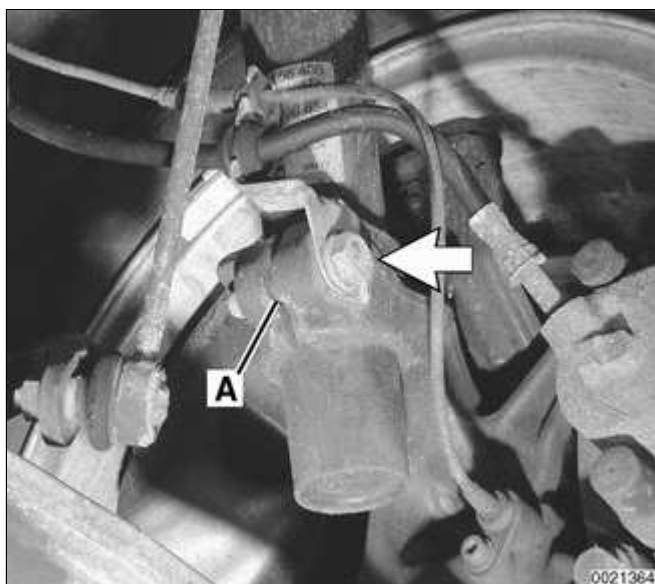


of stabilizer bar link ball joint while removing mounting nut.

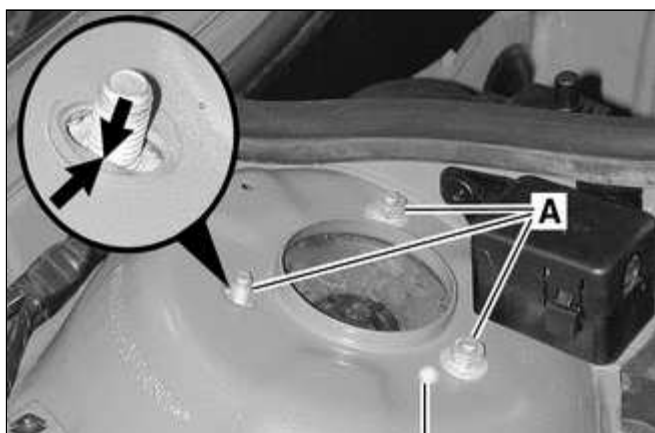


- Remove tie rod outer end nut. Use BMW special tool 32 3 090 or equivalent to press tie rod end off steering arm.

- Remove lower ball joint nut. Use BMW special tool 32 3 090 or equivalent to separate steering arm from control arm.



- Support steering arm from below. Loosen pinch bolt (**arrow**) at top of steering arm. Spread clamping collar at slot **A**, if necessary, to slide steering arm off strut assembly.



- Support strut assembly from below.
 - ◆ Working in engine compartment at strut tower, remove three strut mounting nuts (**A**) on strut tower.
 - ◆ If factory alignment locating pin (**B**) is missing, be sure to mark location of strut mounting studs in



strut tower slots (**arrows**).

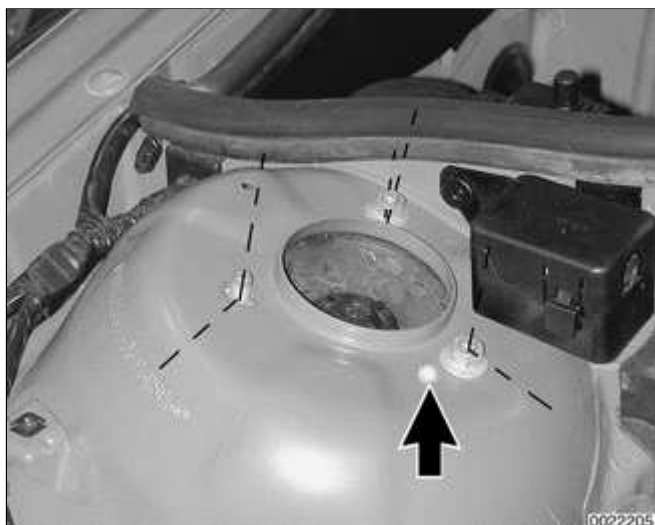
CAUTION!

Do not remove center strut retaining nut.

- Lower strut assembly from car.

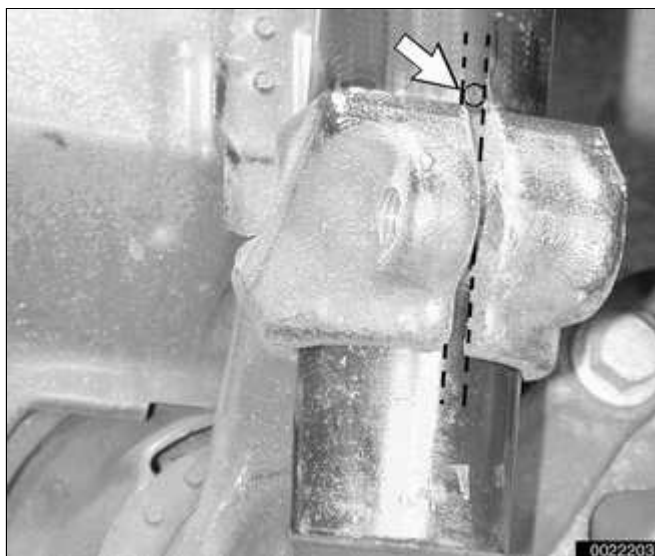
⚠ When installing strut assembly into car:

- ◆ Make sure locating pin (**arrow**) of strut bearing is positioned correctly in strut tower.
- ◆ If factory alignment locating pin is missing, make sure three upper mounting studs are positioned correctly in slotted holes according to marks made previously.



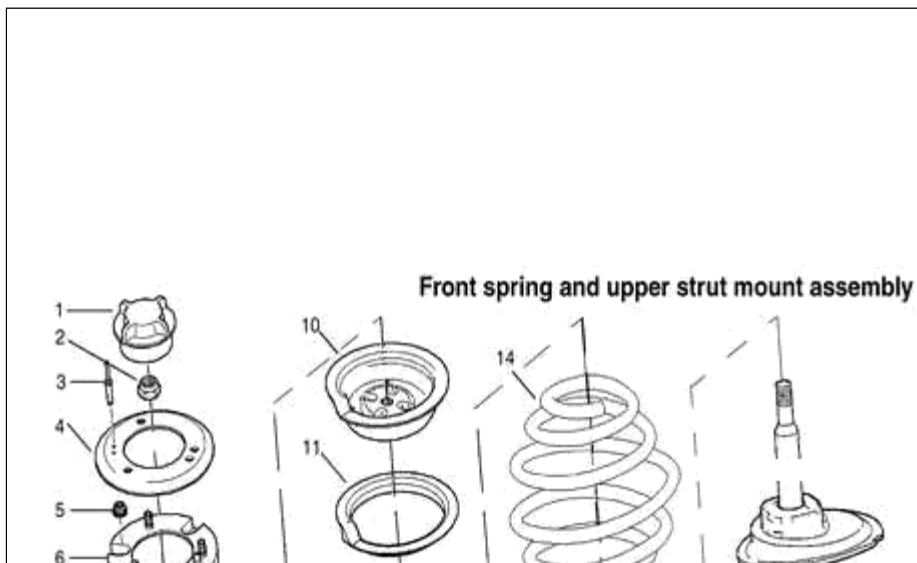
⚠ When installing steering arm to strut assembly, insert positioning pin (**arrow**) of strut into slot of steering arm clamping collar. To ensure proper alignment specifications, slide steering arm up on strut until stop is reached.

- Remainder of installation is reverse of removal.
- ◆ Be sure to use new self-locking nuts and bolts.
- ◆ Use new steering arm mounting bolts, or clean bolts and use Loctite® 270 or equivalent thread-locking compound.
- ◆ When attaching stabilizer link to strut, use a thin wrench to counterhold hold link ball joint while tightening nut.



- ◆ Have car professionally aligned when job is complete.

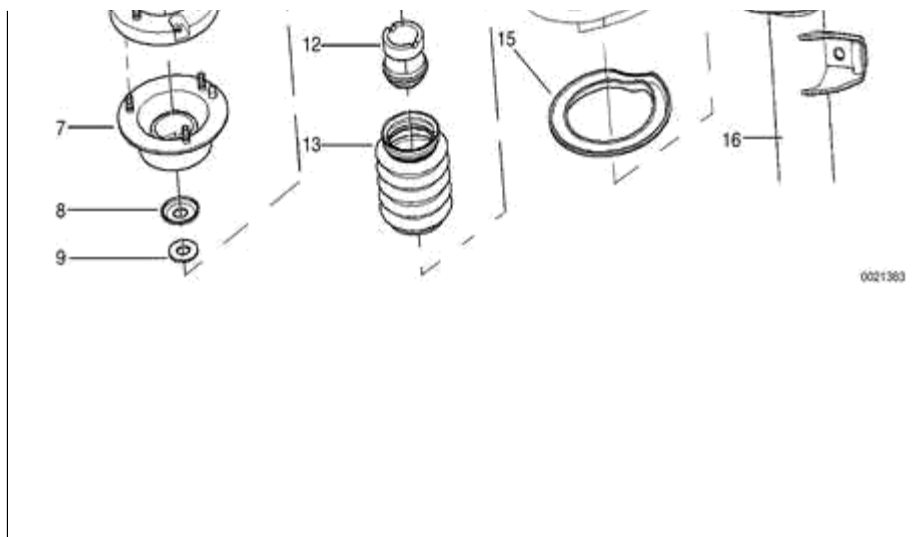
Tightening torques	
Brake caliper to steering arm	110 Nm (81 ft-lb)
Road wheel to hub	100 ± 10 Nm (74 ± 7 ft-lb)
Stabilizer bar link to strut	59 Nm (44 ft-lb)
Steering tie rod to steering arm	65 Nm (48 ft-lb)
Steering arm to control arm	65 Nm (48 ft-lb)
Steering arm pinch bolt at strut housing	81 Nm (60 ft-lb)
Strut assembly to strut tower (self-locking nuts)	24 Nm (18 ft-lb)
Upper strut mount to strut tower, self-locking M8 flanged nut:	
18 mm flange	24 Nm (18 ft-lb)
21 mm flange	34 Nm (25 ft-lb)



Front spring and upper strut mount assembly

- 1 - Cap
- 2 - Upper strut self locking nut M14

- ◆ tighten to 64 Nm (47 ft-lb)



3 - Rivet (all wheel drive or rough road package only)

4 - Strut bearing reinforcement (all wheel drive or rough road package only)

5 - Self locking flanged nut M8

◆ tighten to:

◆ 24 Nm (18 ft-lb) (18 mm flange)

◆ 34 Nm (25 ft-lb) (21 mm flange)

6 - Spacer plate (all wheel drive or rough road package only)

7 - Upper strut bearing

8 - Sealing ring

9 - Flat washer

10 - Upper spring seat

11 - Upper spring pad

12 - Rubber stop

13 - Dust seal

14 - Spring

15 - Lower spring

pad

16 - Strut

Strut assembly, disassembling and assembling

Replacing the strut, upper strut mount or spring requires that the strut assembly first be removed from the car and disassembled. For a guide to parts used during component replacement, see the accompanying diagram.

- Remove strut assembly as described earlier. Place in shop vice, or support securely.
- Using spring compressor, compress spring until spring force on upper mount is relieved.

WARNING!

- ♦ ***Do not attempt to disassemble the struts without a spring compressor designed specifically for this job.***
- ♦ ***Make sure the spring compressor grabs the spring fully and securely before compressing it.***
- Pry protective cover off top of strut assembly. Use BMW special tool 31 2 210 or equivalent socket to remove strut top (center) nut. Counterhold strut shaft using 6 mm Allen wrench.
- Remove upper strut bearing and

related components.

- Replace strut, upper strut mount or spring, as needed.

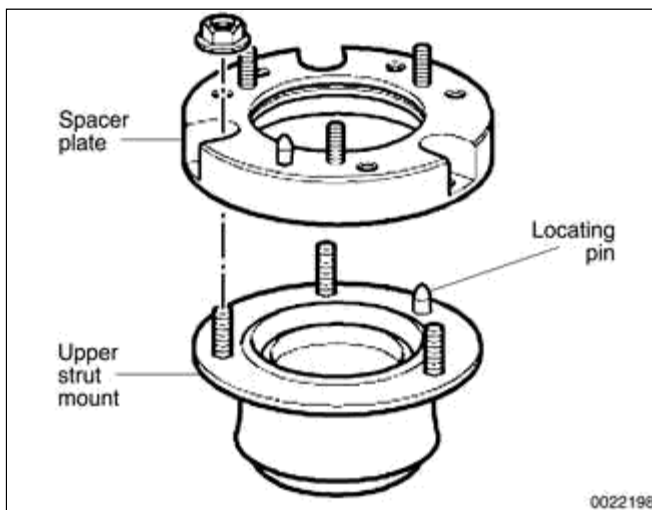
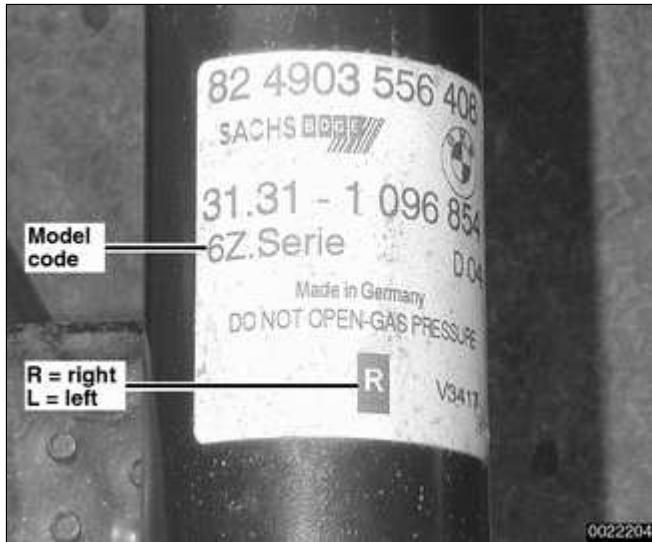
Note:

Springs and/or struts should always be replaced in pairs.

- ⚡ Be sure that replacement struts are marked with the same code as the ones being removed.

Note:

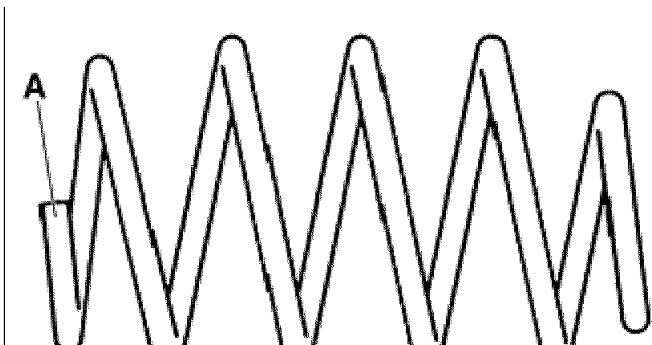
Aftermarket struts are not marked.



- ⚡ Vehicles with "rough road" package are equipped with a spacer plate above the upper strut mount. Make sure the strut mount locating pin fits in the corresponding bore of the spacer plate.

Note:

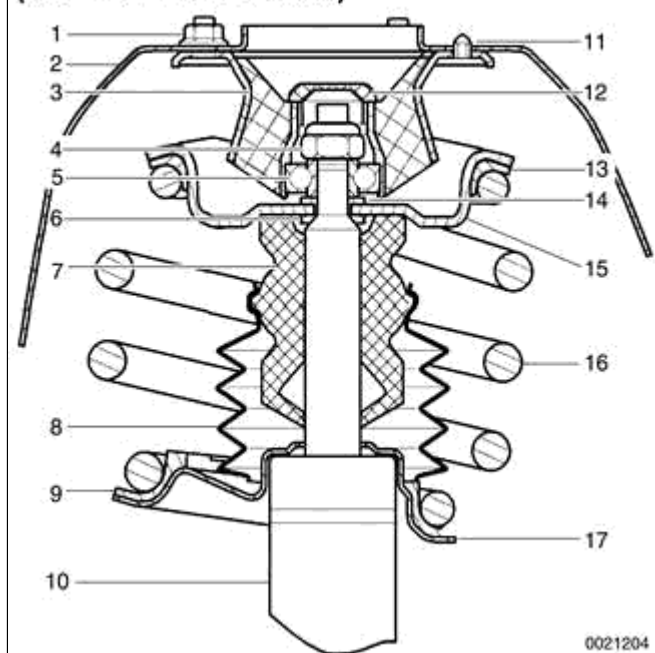
If there is no locating bore in the strut tower for the pin in the replacement upper strut mount to fit, drive out the pin before installing the new mount.



- ⚡ Replace springs in pairs only. The part number (**A**) is stamped near the large end of the spring.



**Front strut top mount assembly
(rear wheel drive models)**



◀ Assembly is reverse of disassembly, noting the following:

- ◆ Line up slot in spring pad with corresponding slot in lower spring seat.
- ◆ Use a new upper strut self locking nut. Tighten nut fully before releasing spring compressor.
- ◆ Be sure upper spring pad is correctly installed to upper spring seat and spring end is correctly seated in upper and lower spring seats.
- ◆ Release spring compressor carefully and evenly, allowing spring to expand slowly.
- ◆ Have car professionally aligned when job is complete.

- 1 - Self locking nut M8 -tighten to: 24 Nm (18 ft-lb) (18 mm flange) 34 Nm (25 ft-lb) (21 mm flange)
- 2 - Strut tower
- 3 - Upper strut mount
- 4 - Upper strut self locking nut M14 -tighten to 64 Nm (47 ft-lb)
- 5 - Upper strut bearing
- 6 - Sealing ring
- 7 - Rubber bump-stop
- 8 - Dust shield
- 9 - Lower spring pad

10 - Strut housing

11 - Locating pin

12 - Protective cap

13 - Upper spring pad

14 - Washer

15 - Upper spring seat

16 - Spring

17 - Lower spring seat

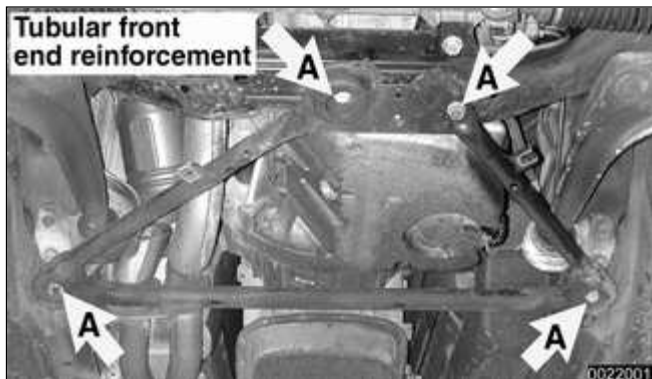
Tightening torque	
Upper strut mount to strut shaft M14 self-locking nut	64 Nm (47 ft-lb)

Front End Reinforcement

In rear wheel drive models, a front end reinforcement is bolted to the rear of the subframe and attached to the frame rails.

CAUTION!

Do not drive vehicle without the front end reinforcement in place. Damage to the front suspension may result.



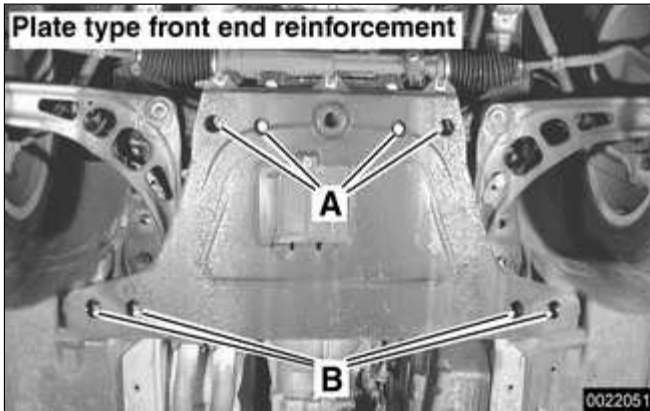
The tubular front end reinforcement is installed with 4 bolts (A) in the following cars:

- ◆ Rear wheel drive Sedan and Sport Wagon models manufactured until production date 12/2000.
- ◆ Coupe models manufactured until production date 11/1999.
- The aluminum plate type front end reinforcement is installed in the following cars:
 - ◆ All Convertible models
 - ◆ Coupe models manufactured from production date 11/1999.
 - ◆ Rear wheel drive Sedan and Sport Wagon models manufactured from production date 12/2000.

CAUTION!

After 2/2001, the front reinforcement plate was produced with larger cast depressions to accommodate the

larger (66 mm) front control arm bushings. The difference in the early production and later plates can only be discerned by removing the plate.



In order to safely use an early production plate in a car with larger bushings, insert appropriate sized washers between frame rails and reinforcement plate at bolts **B**.

- When reinstalling front end reinforcement:
 - ◆ Replace mounting bolts.
 - ◆ Torque bolts in 2 stages, as shown below. Use BMW special tool 00 9 120 or equivalent torque angle protractor.

Tightening torque	
Front end reinforcement to front subframe or body frame rails: M10 bolt (A or B) (always replace)	
Stage 1	59 Nm (43 ft-lb)
Stage 2	torque angle 90° + 30°

Front Subframe

The front subframe provides rigid mounting points for the engine, suspension, and steering components. The subframe is not normally subject to wear and should only be replaced if structurally damaged.

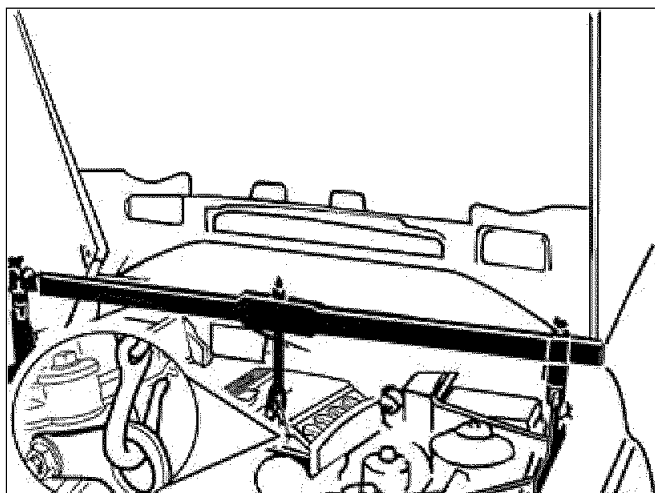
Rear wheel drive and all wheel drive models differ significantly in the design of the front subframe.

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

CAUTION!

Removal or replacement of the subframe may affect suspension and steering geometry, including front wheel alignment. Make appropriate matching marks during removal and have the front end aligned once repairs are complete.

Front subframe, removing and installing (rear wheel drive models)



- ✦ Using engine support equipment, raise engine until weight of engine is supported.

- Raise car and remove front wheels.

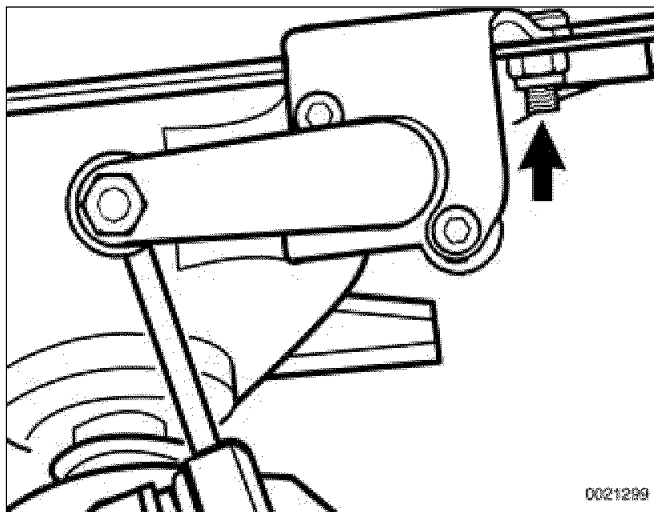
WARNING!

Make sure that the car is firmly supported on jack stands designed for the purpose. Place the jack

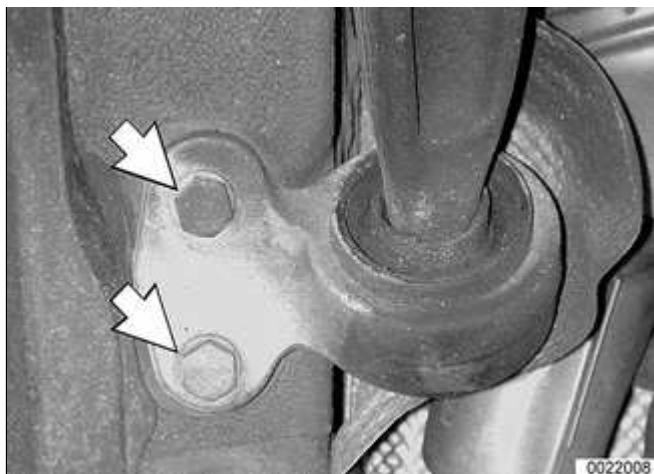


stands beneath a structural chassis point. Do not place jack stands under suspension parts.

- Remove splash shield under engine compartment.
- Remove front end reinforcement. See ⇒ [Front End Reinforcement](#) earlier in this group.



- ⚡ On cars equipped with xenon headlights: Remove front ride level sensor mounting fastener (**arrow**) and lay sensor aside.



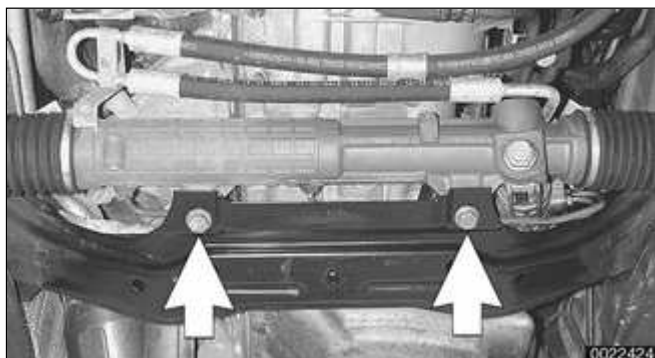
- ⚡ Remove right front control arm bracket bolts (**arrows**) from frame rail.
- Repeat for left side.



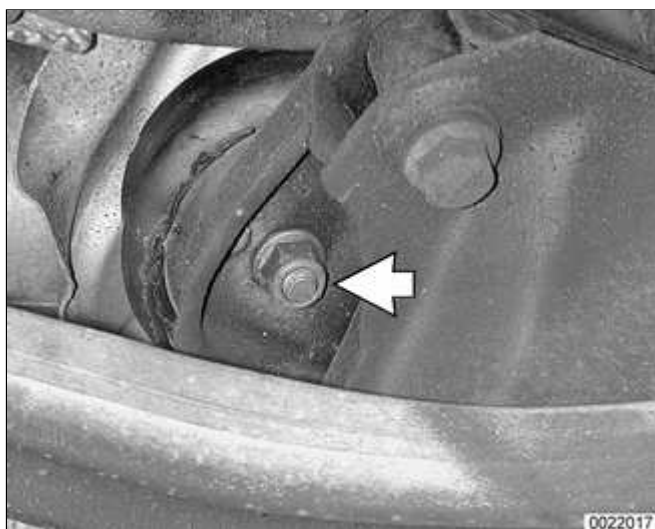
- ⚡ Remove right inner control arm ball joint mounting nut (**arrow**) at subframe.
- ◆ Drive ball joint shaft out of subframe using soft hammer.
- ◆ Push control arm aside.



- ◆ Repeat for left side.

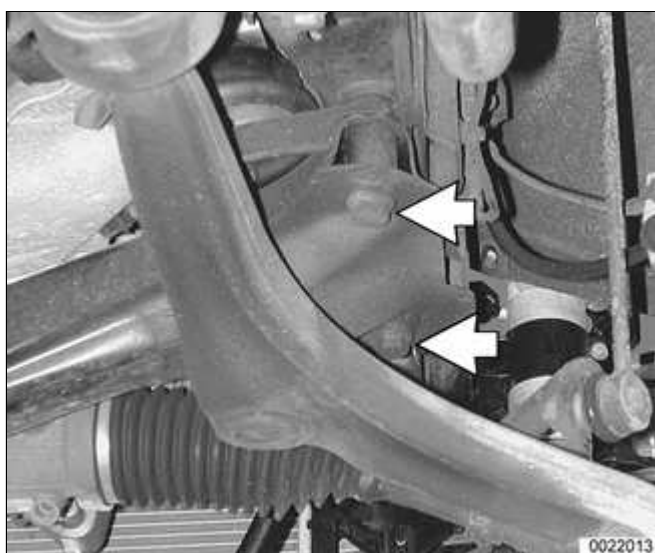


- ✦ Remove steering rack mounting bolts (**arrows**) at front of subframe. Suspend rack out of the way with stiff wire.



- ✦ Remove right lower engine mount fastener (**arrow**).

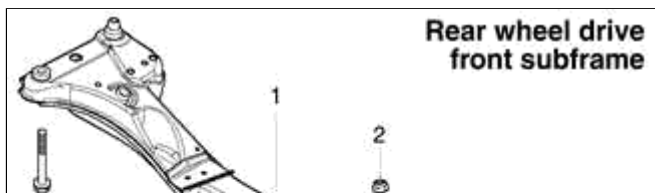
- Repeat on left side



- ✦ Support suspension subframe from below using appropriate jacking equipment. Remove subframe mounting bolts (**arrows**). Remove subframe.

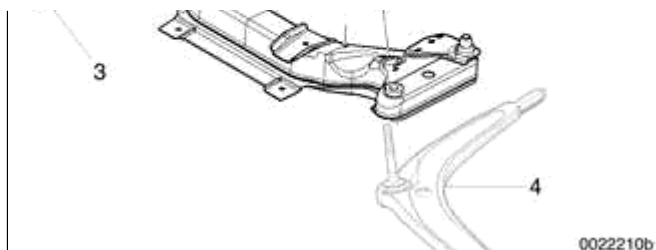
Note:

Right side is shown in photo. Left is similar.



- ✦ Installation is reverse of removal, noting the following:

- ◆ Make sure all bolts, bolt holes,



and mating surfaces are clean to ensure proper tightening and alignment. Use new self-locking nuts or bolts, where applicable.

◆ Lower engine onto engine mounts, allowing it to settle fully before tightening engine mount bolts.

◆ When the job is completed, have front end professionally aligned.

1 - Front subframe

2 - inner ball joint nut -tighten to 90 Nm (66 ft-lb)

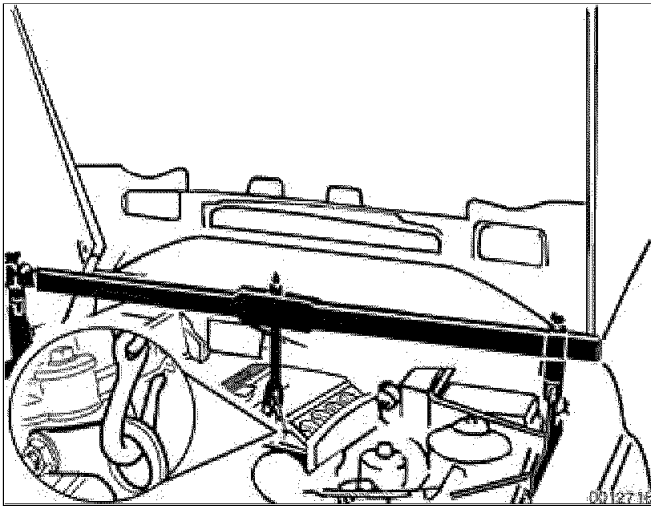
3 - Subframe mounting bolt (See torque table.)

4 - Control arm

Tightening torques	
Control arm ball joint to subframe M14 self-locking nut (always replace)	90 Nm (66 ft-lb)
Control arm bushing carrier to body M10 bolt (always replace)	59 Nm (43 ft-lb)
Front end reinforcement to front subframe or body frame rails: M10 bolt (always replace)	
Stage 1	59 Nm (43 ft-lb)
Stage 2	torque angle 90° + 30°
Steering rack to subframe (M10 bolt)	42 Nm (31 ft-lb)
Subframe to body	
M12-8.8 bolts	77 Nm (57 ft-lb)

Tightening torques	
M12-10.9 bolts	110 Nm (81 ft-lb)
M12-12.9 bolts	105 Nm (77 ft-lb)

Front subframe, removing and installing (all wheel drive models)



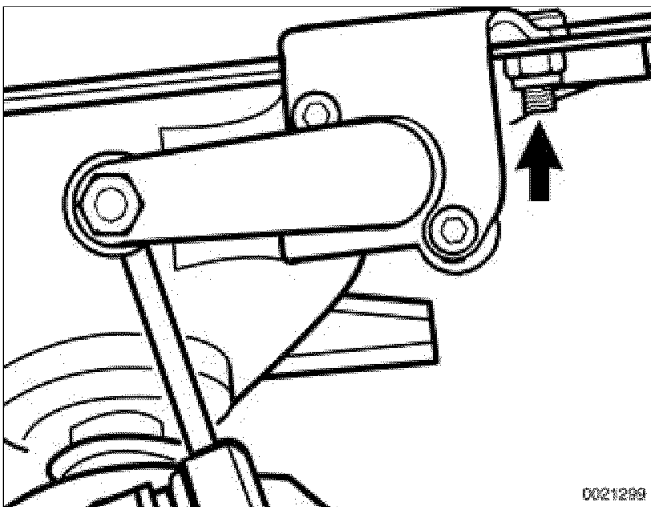
- Using engine support equipment, raise engine until weight of engine is supported.

- Raise car and remove front wheels.

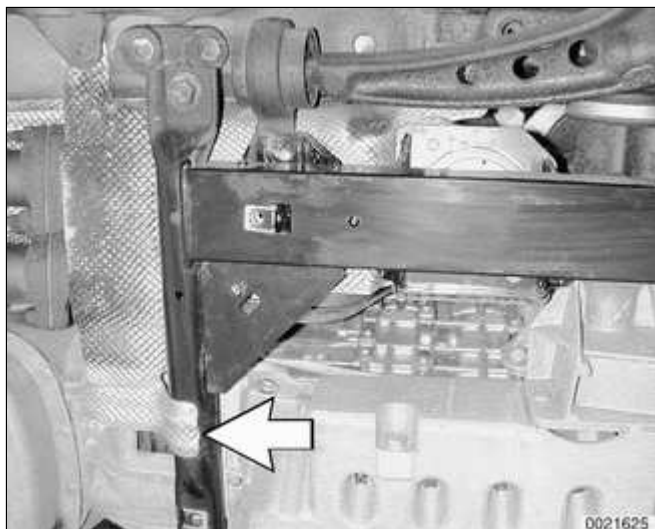
WARNING!

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.

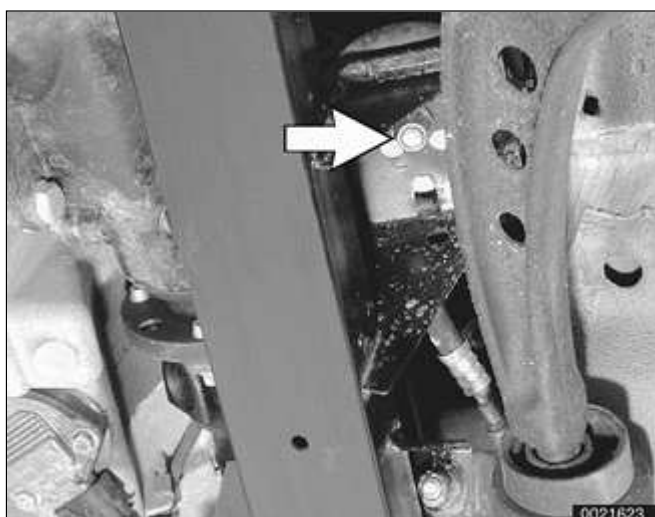
- Remove splash shield under engine compartment.



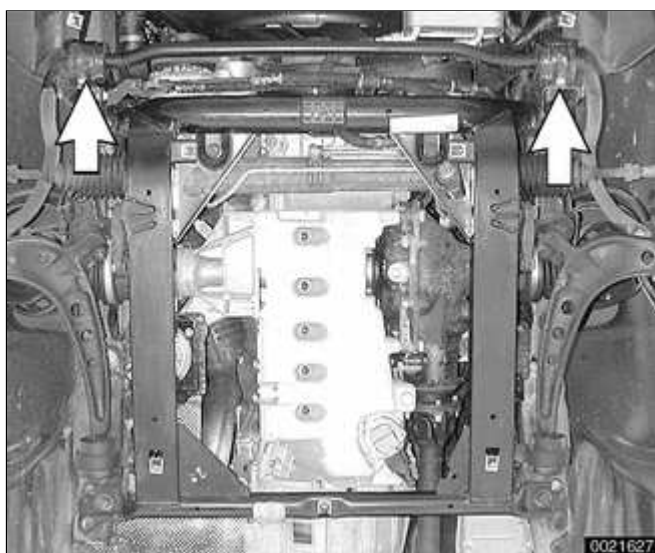
- On cars equipped with xenon headlights: Remove front ride level sensor mounting fastener (**arrow**) and lay sensor aside.



- Working at rear right corner of front subframe, unhook heatshield from subframe (**arrow**).



- Remove left engine mount fastener (**arrow**).
- Repeat for right side.
- Working at right front of subframe, detach power steering lines.



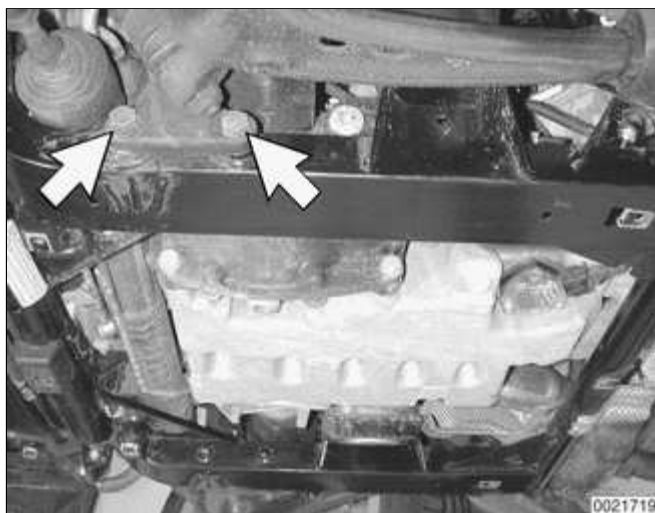
- Remove stabilizer bar anchor fasteners (**arrows**) from front corners of subframe. Suspend stabilizer bar from chassis using stiff wire.



- Working at left rear corner of subframe, remove control arm rear bracket mounting bolts (**arrows**).



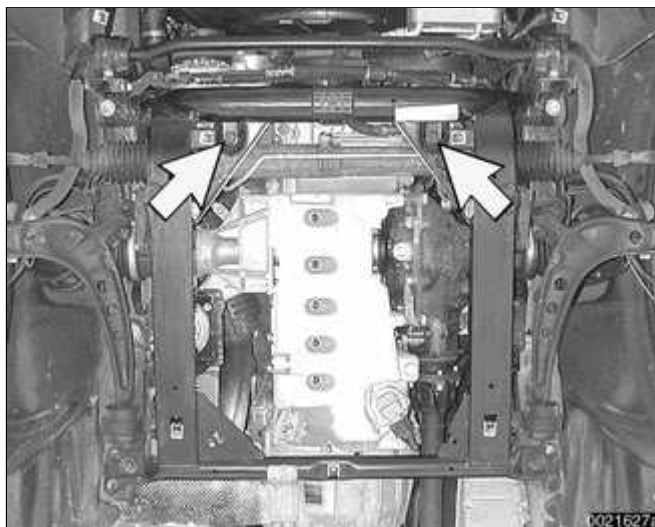
- Repeat for right side.



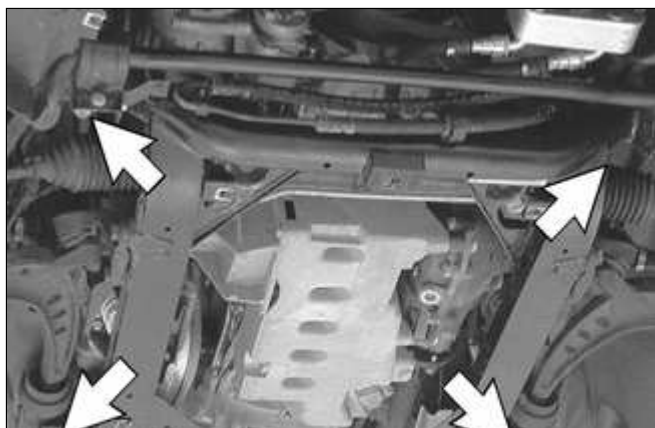
- ✦ Working at left side of subframe, remove inner control arm ball joint mounting bracket bolts (**arrows**) from subframe. Hang control arm using stiff wire.

WARNING!

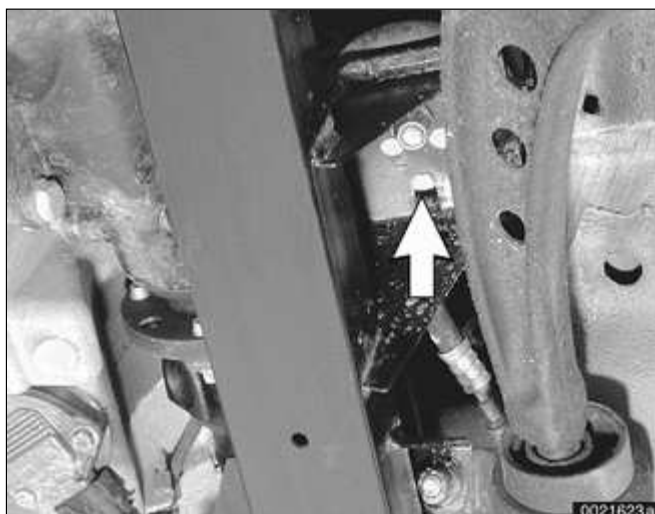
Do not allow the control arm to hang from the outer (steering arm) ball joint. This can damage the ball joint.



- ✦ Working underneath subframe, remove steering rack mounting bolts (**arrows**). Suspend rack with stiff wire.



- ✦ Support subframe from below. Remove subframe mounting bolts (**arrows**).
 - Slowly lower subframe, making sure heat shields, wiring harnesses and other underbody components are clear during removal.

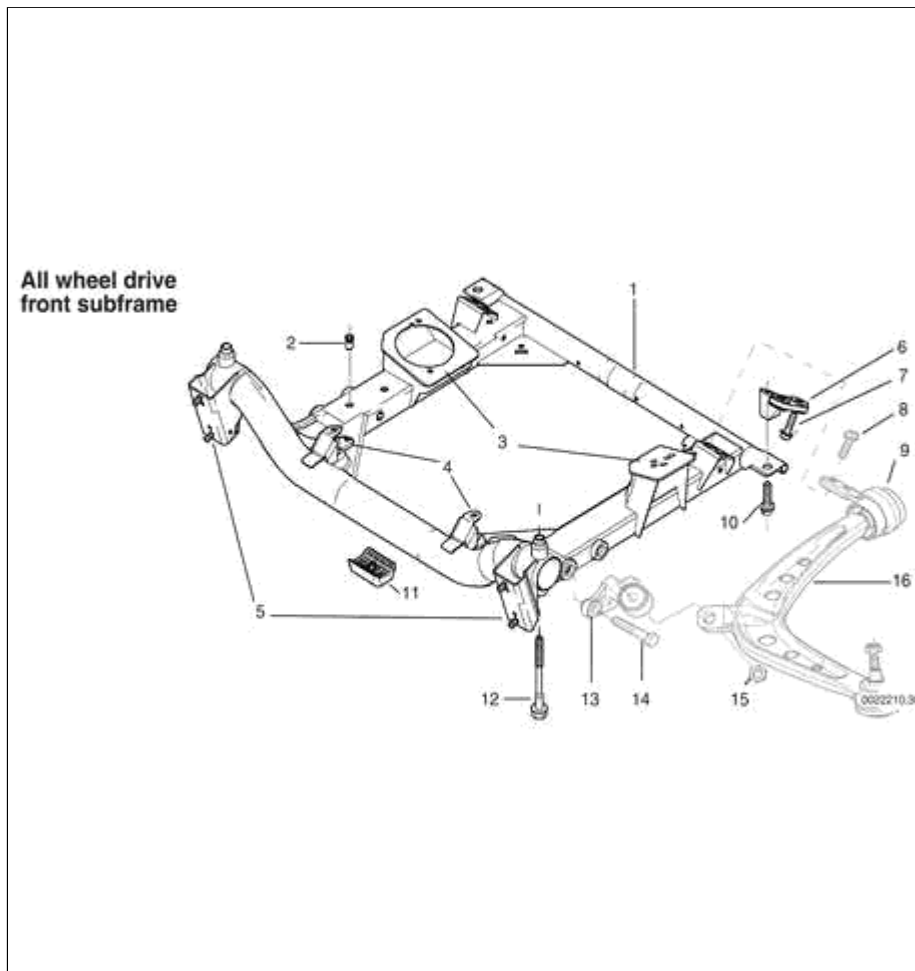


Installation is reverse of removal, noting the following:

- ◆ Make sure all bolts, bolt holes, and mating surfaces are clean to ensure proper tightening and alignment. Use new self-locking nuts or bolts, where applicable.
- ◆ Lower engine onto engine mounts, making sure locating pin on left mount (**arrow**) seats correctly in slot of subframe boss.
- ◆ Allowing engine to settle fully on mounts before tightening engine mount fasteners.
- ◆ When the job is completed have front end professionally aligned.

Tightening torques	
Control arm rear bracket to subframe M10 bolt (always replace)	59 Nm (44 ft-lb)
Engine mount to subframe M10 self locking nut	45 Nm (33 ft-lb)
Inner ball joint to control arm M14 self-locking nut (always replace)	80 Nm (59 ft-lb)
Inner ball joint mount to subframe M12 bolt	77 Nm (57 ft-lb)
Stabilizer anchor to subframe (M8)	22 Nm (16 ft-lb)

Tightening torques	
Steering rack to subframe (M10 bolt)	42 Nm (31 ft-lb)
Subframe adapter to body M10 bolt (always replace)	59 Nm (44 ft-lb)
Subframe front to body	
M12-8.8 bolt	77 Nm (57 ft-lb)
M12-10.9 bolt	110 Nm (81 ft-lb)
M12-12.9 bolt	105 Nm (77 ft-lb)
Subframe rear to adapter M12 bolt (always replace)	110 Nm (81 ft-lb)



All wheel drive front subframe

- 1 - Front subframe
- 2 - Blind rivet nut
- 3 - Engine mounting flange
- 4 - Steering rack mounting flange
- 5 - Stabilizer bar mounting
- 6 - Subframe to body adapter
- 7 - Bolt M10 (always replace)

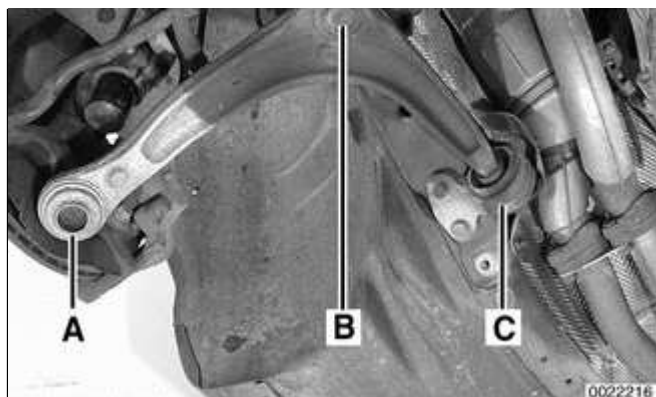
◆ tighten to 59 Nm (44-ft-lb)

- 8 - **Bolt M10**
(always replace)
- ◆ tighten to 59 Nm (44 ft-lb)
- 9 - **Control arm rear bracket**
- 10 - **Bolt M12**
(always replace)
- ◆ tighten to 110 Nm (81 ft-lb)
- 11 - **Jack point**
- 12 - **Subframe mounting bolt M12 (see torque table)**
- 13 - **Control arm inner ball joint**
- 14 - **Bolt M12**
- ◆ tighten to 77 Nm (57 ft-lb)
- 15 - **Self locking nut M14 (always replace)**
- ◆ tighten to 80 Nm (59 ft-lb)

Control Arms



In all models each front control arm has three attachment points:



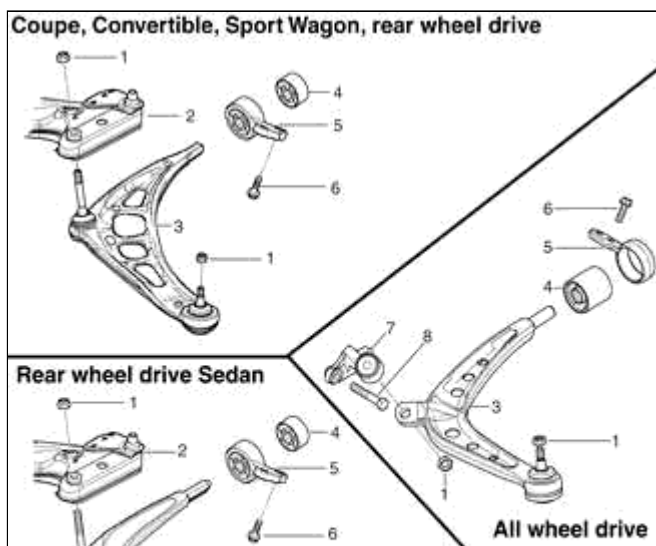
- ◆ **A** Outer ball joint attached to steering arm
- ◆ **B** Inner ball joint attached to front subframe
- ◆ **C** Bushing and bracket attached to the frame rail (rear wheel drive models) or front subframe (all wheel drive models)

Note:

Rear wheel drive front control arm is shown in the illustration.

On all models the rear bushing of the control arm is available as a replacement part.

On rear wheel drive models, both ball joints are pressed into the control arm at the factory. On all wheel drive models, the outer (steering arm) ball joint is pressed in. Because of the aluminum construction of the control arm, pressed-in ball joints are not removable. In case of pressed-in ball joint wear or damage, the complete control arm must be replaced. The control arm with ball joint(s) is available as a replacement unit from BMW.



- ⚡ E46 cars have been equipped with three different styles of control arm. Make sure a replacement control arm is identical to the original.

- 1 - Ball joint nut
- 2 - Front subframe
- 3 - Control arm
- 4 - Bushing
- 5 - Bushing bracket



- 6 - Bracket mounting bolt
- 7 - Inner ball joint (all wheel drive only)
- 8 - Ball joint mounting bolt

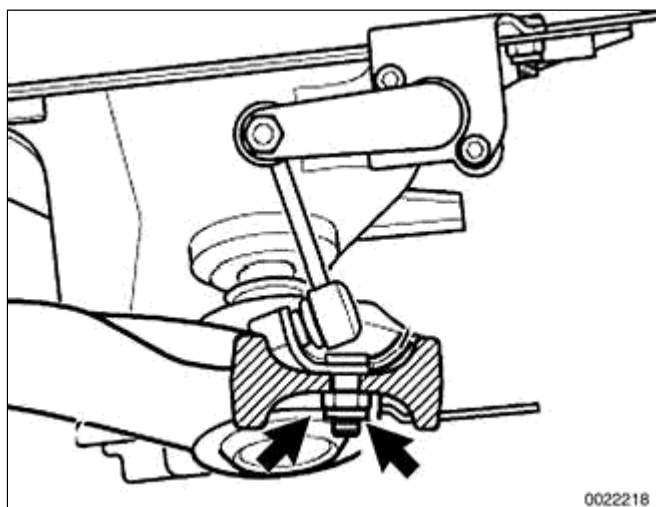
Control arm, removing and installing (rear wheel drive models)

- 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.

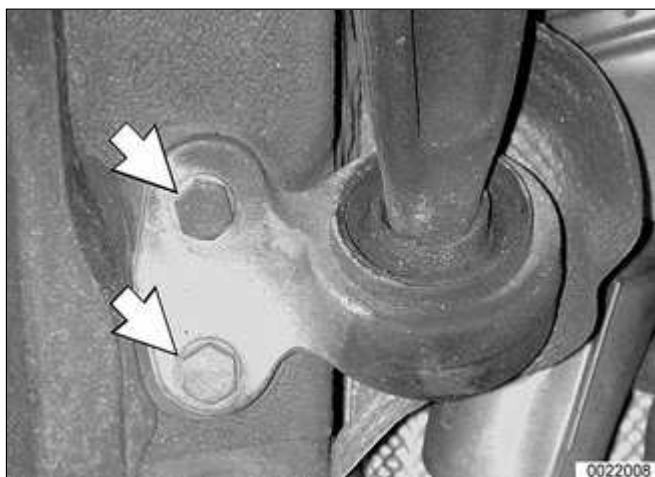
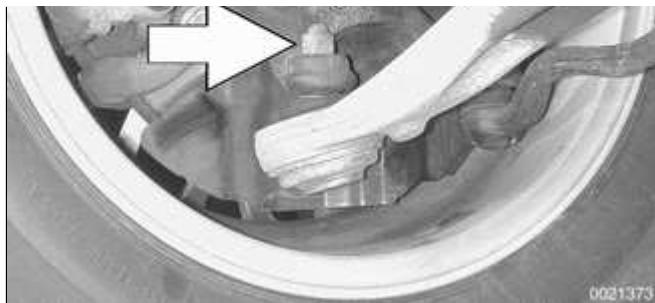
- Remove splash shield under engine compartment.
- Remove front end reinforcement.



- On cars equipped with xenon headlights: Remove self levelling headlight sensor mounting nuts (**arrows**) from right control arm.



- Working at steering arm, remove outer ball joint nut (**arrow**). Use BMW special tool 32 3 090 or equivalent to separate steering arm from control arm.



- ✦ Remove control arm inner ball joint mounting nut (**arrow**) at subframe.
- ◆ Drive ball joint shaft out of subframe using soft faced hammer.

- ✦ Support control arm while removing control arm bracket bolts (**arrows**) from frame rail.
- Remove control arm.
- ◆ Inspect rear bracket rubber bushing for wear.
- ◆ Check ball joints for damage, looseness, or torn boots.
- ◆ Replace control arm if ball joints are damaged.

CAUTION!

- ◆ ***If a control arm is deformed due to an accident, inspect the inner ball joint mounting bore in the subframe for damage or eccentricity.***

- ♦ ***If one control arm rear rubber bushing is damaged, bushings on both sides must be replaced.***

Note:

Control arm rear bushing replacement is covered later in this group.

- Installation is reverse of removal, noting the following:
- ♦ Make sure all thread bores, bolts, nuts and mating surfaces are clean.
- ♦ Use new self-locking nuts or bolts, where applicable.
- ♦ Have vehicle alignment checked after assembly. nothing

WARNING!

Do not reuse self-locking nuts or bolts. They are designed to be used only once and may fail if reused.

Tightening torques	
Control arm rear bracket to frame rails M10 bolt (always replace)	59 Nm (44 ft-lb)
Front end reinforcement to front subframe or body frame rails: M10 bolt (always replace)	
Stage 1	59 Nm (44 ft-lb)
Stage 2	torque angle 90° + 30°
Inner ball joint to subframe M14 self-locking nut (always replace)	90 Nm (66 ft-lb)

Tightening torques

Outer ball joint to steering arm M12 self-locking nut (always replace)	65 Nm (48 ft-lb)
Road wheel to hub	100 ± 10 Nm (74 ± 7 ft-lb)

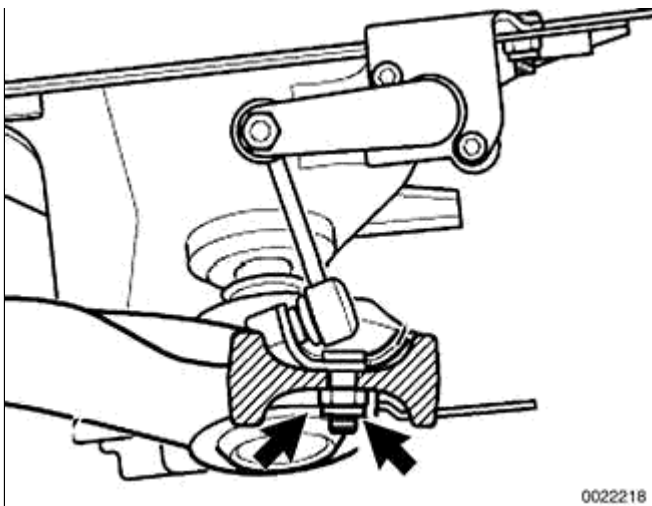
Control arm, removing and installing (all wheel drive models)

- 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 splash shield under engine compartment.



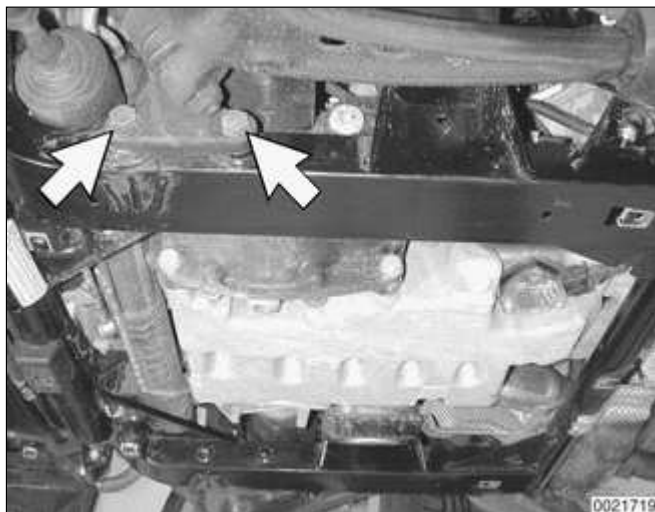
- ◀ On cars equipped with xenon headlights: Remove headlight vertical aim sensor mounting nuts (**arrows**) from right control arm.



- ◀ Working at steering arm, remove outer ball joint nut (**arrow**). Use BMW special tool 32 3 090 or equivalent to separate steering arm from control arm.

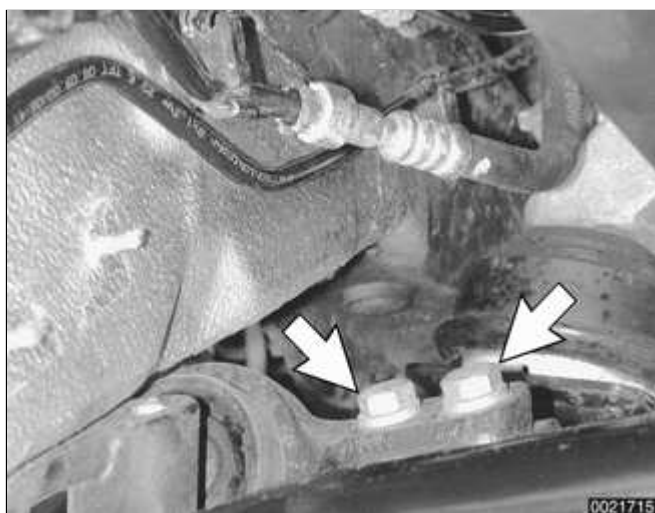


- Remove inner ball joint mounting bracket bolts (**arrows**) from subframe.



- Support control arm. Working at rear of subframe, remove control arm rear bracket mounting bolts (**arrows**).

- Remove control arm.
- ◆ Inspect rear bracket rubber bushing for wear.
- ◆ Check ball joints for damage, looseness, or torn boots.
- ◆ Replace control arm if outer (steering arm) ball joint is damaged.



CAUTION!

If a control arm rear rubber bushing is damaged, both bushings must be replaced.

Note:

Inner ball joint and control arm rear bushing replacement is covered later in this group.

- Installation is reverse of removal, noting the following:
- ◆ Make sure all thread bores, bolts, nuts and mating surfaces are clean.
- ◆ Use new self-locking nuts or bolts, where applicable.
- ◆ Have vehicle alignment checked after assembly. nothing

WARNING!

Do not reuse self-locking nuts or bolts. They are designed to be used only once and may fail if reused.

Tightening torques	
Control arm rear bracket to subframe M10 bolt (always replace)	59 Nm (44 ft-lb)
Inner ball joint mount to subframe M12 bolt	77 Nm (57 ft-lb)
Outer ball joint to steering arm M12 self-locking nut (always replace)	65 Nm (48 ft-lb)
Road wheel to hub	100 ± 10 N (74 ± 7 ft-lb)

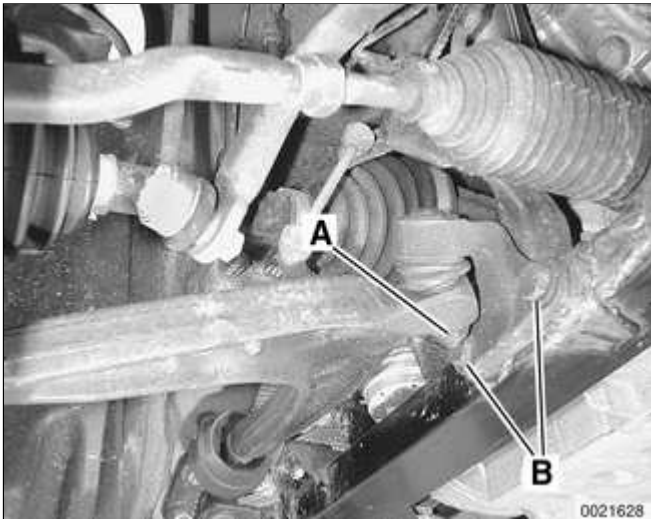
Inner ball joint, replacing (all wheel drive models)

- Raise car and support safely

WARNING!

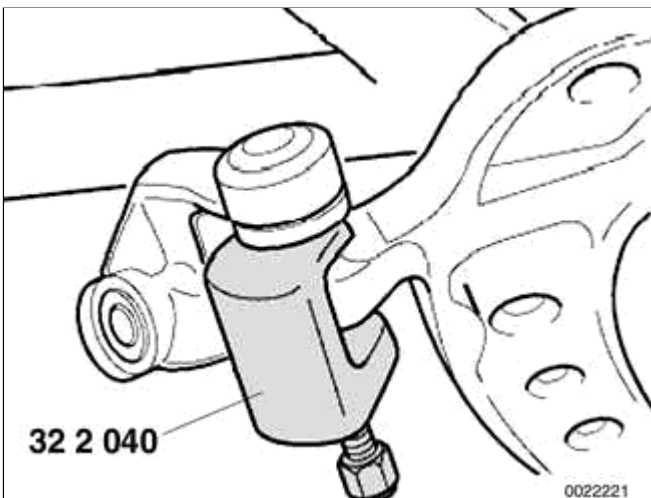
Make sure that the car is firmly supported on jack stands designed for the purpose. Place the jack stands beneath a structural chassis point. Do not place jack stands under suspension parts.

- Remove splash shield under engine compartment.



- Remove inner ball joint fasteners from control arm and subframe.

- ◆ Remove nut (A) from ball joint shaft.
- ◆ Remove bolts (B) from subframe.



- Use BMW special tool 32 2 040 or equivalent to separate ball joint from control arm.

- Installation is reverse of removal, noting the following:
- ◆ Make sure thread bores, bolts, nuts and mating surfaces are clean.
- ◆ Use new self-locking nuts or bolts.

Tightening torques

Inner ball joint mount to subframe M12 bolt	77 Nm (57 ft-lb)
--	------------------

Tightening torques

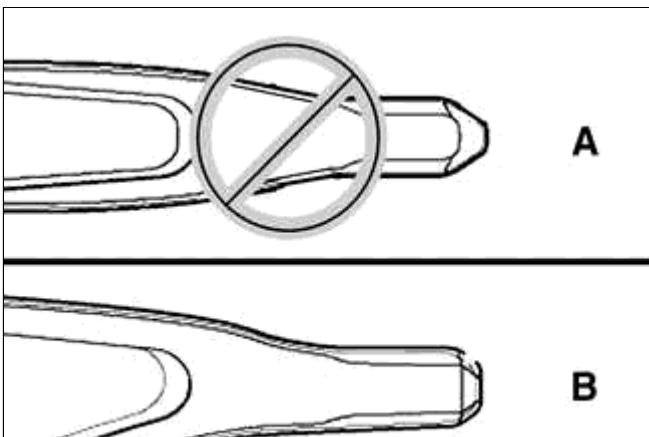
Inner ball joint to control arm M14 self-locking nut (always replace)	80 Nm (59 ft-lb)
---	------------------

Control arm bushings, rear wheel drive**CAUTION!**

- ♦ **Never reuse a rubber bushing that has been pulled off the control arm. The rubber coated inner sleeve is destroyed when it is pulled off dry.**
- ♦ **Check with an authorized BMW parts dealer for the latest information about control arm bushing applications on E46 cars.**

Control arm bushings should always be replaced in pairs. The two bushings and bushing carriers should have the same markings, indicating same manufacturer.

- To gain access to bushing, remove control arm as described earlier.
- Use puller to remove rear bracket and bushing from control arm.



- ◀ Inspect pin (rubber bushing) end of control arm. Replace control arm with end **A**.

Note:

*Control arms with pin shape **A** have been superseded by parts with pin shape **B**.*



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- Inspect bushing bracket. Replace bracket if there is a center punch mark at boss **A**.

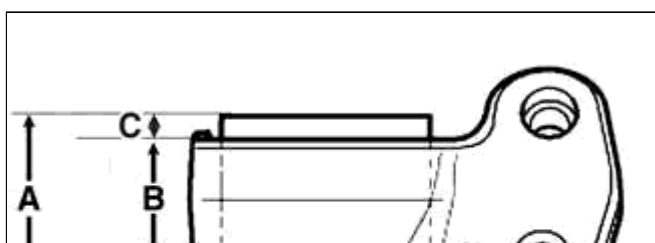
WARNING!

If a bushing bracket with the center punch mark is reused with a new bushing, the bushing may fall out.



- Use press tools to remove old bushing and press in new. Be sure to line up marks on new bushing with boss on bracket. Depending on manufacturer, mark on bushing may consist of:

- ◆ Extra buffer on inner part of bushing (**A**)
- ◆ Arrow on rubber webbing of bushing (**B**)
- ◆ Indent on outer casing of bushing (**C**)



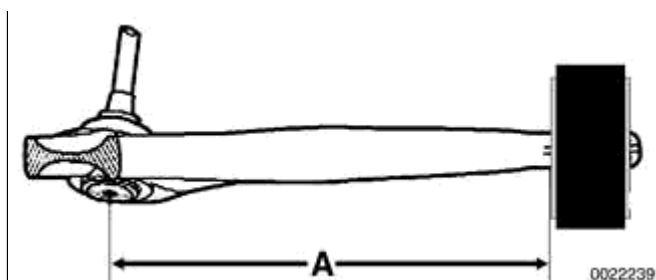
- New bushing must be pressed in so that it protrudes the correct distance from edges of bracket. See ⇒ [Table a](#).

Table a. Control arm bushing



protrusion (rear wheel drive models)

Dimension	60 mm bushing	66 mm bushing
A = Total bushing length (nominal)	50.5 mm (1.99 in.)	53.5 mm (2.11 in.)
B = Bracket width (nominal)	34.0 mm (1.36 in.)	
C = Fixed measurement	8.5 mm (0.33 in.)	12.0 mm (0.47 in.)
D = Protrusion	8.0 mm (0.31 in.)	7.5 mm (0.29 in.)

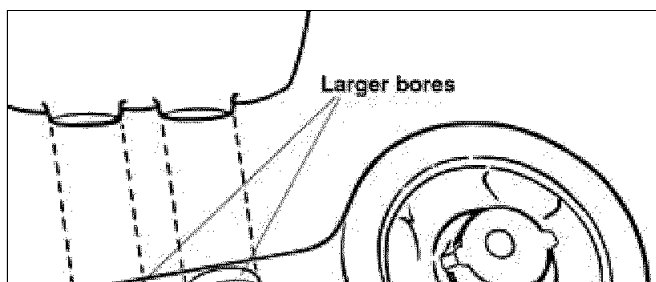


⚡ When installing bushing on control arm:

- ◆ Use soapy water on control pin and rubber bushing to facilitate assembly.
- ◆ Make sure dimension **A**(distance from inner ball joint to edge of control arm bushing) is correct after assembly. See ⇒ [Table b.](#)

Table b. rear wheel drive models)

Bushing diameter or model	Bushing distance A
60 mm	289 ± 1 mm (11.38 ± 0.04 in.)
66 mm	290.9 ± 1 mm (11.45 ± 0.04 in.)



⚡ Be sure to reinstall bushing bracket to frame rail correctly, with larger centering bores facing up toward body.

Tightening torque

Control arm rear	59 Nm (44 ft-lb)
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Tightening torque

bracket to frame rail M10 bolt (always replace)	
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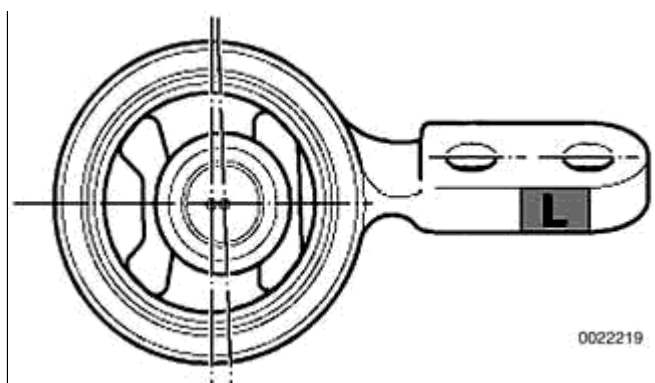
Control arm bushings, all wheel drive

CAUTION!

- ♦ *Never reuse a rubber bushing that has been pulled off the control arm. The rubber coated inner sleeve is destroyed when it is pulled off dry.*
- ♦ *Check with an authorized BMW parts dealer for the latest information about control arm bushing applications on E46 cars.*

Control arm bushings should always be replaced in pairs. The two bushings and bushing carriers should have the same markings, indicating same manufacturer.

- To gain access to bushing, remove control arm as described earlier.
- Use puller to remove rear bracket and bushing from control arm.



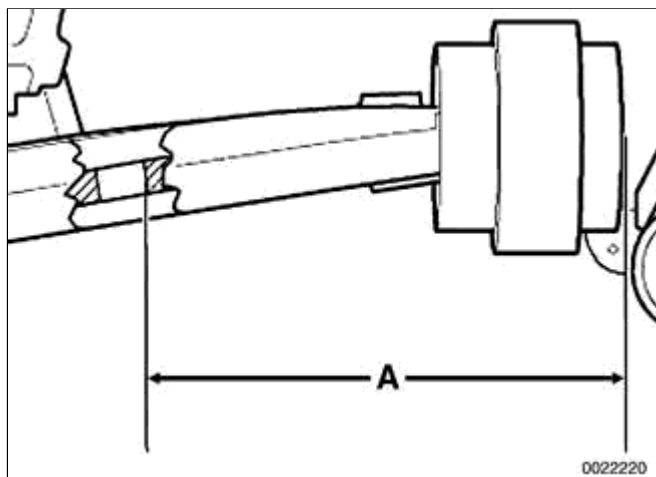
- ◀ Use press tools to remove old bushing and press in new.
- ♦ Align bushing with bracket as shown in accompanying illustration.

Note:

Brackets are marked L or R for left or right.

CAUTION!

Never reuse a rubber bushing that has been pulled off the control arm. The rubber coated inner sleeve is destroyed when it is pulled off dry.



⚡ When installing bushing on control arm:

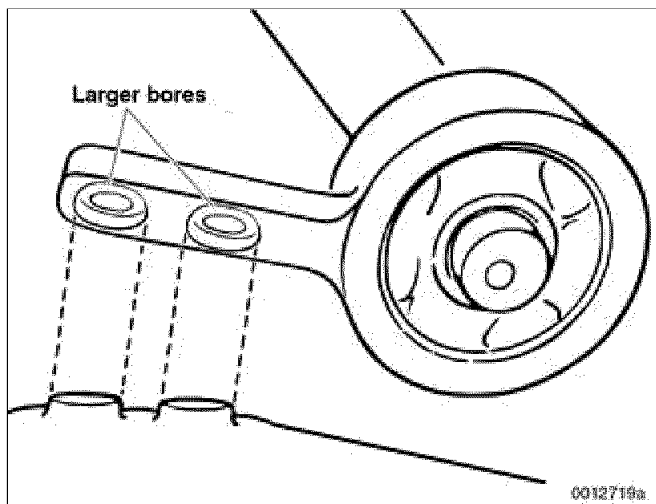
- ◆ Coat control arm pin and rubber mount with appropriate lubricant to facilitate installation.
- ◆ Make sure dimension **A**(distance from first bore in control arm to outer edge of control arm bushing) is correct after assembly. See ⇒ [Table c.](#)

Note:

Slacken pressing tool when measuring installation distance. Rubber bushing must be allowed to relax for measurement to be accurate,.

Table c. Control arm bracket installation distance (all wheel drive models)

Measurement A	170 ± 1 mm (6.69 ± 0.04 in.)
---------------	---------------------------------



⚡ Bolt bracket and control arm to front subframe and steering arm immediately after pressing on bushing. Be sure to reinstall bushing bracket to subframe correctly, with larger centering bores facing subframe surface.

Tightening torque

Control arm rear bracket to subframe M10 bolt (always replace)	59 Nm (44 ft-lb)
---	------------------

WARNING!

- ♦ *After installation, the car must be left undisturbed for a minimum of 30 minutes. Leave car on the ground but avoid major movement.*
- ♦ *After approx. 30 minutes, the lubricant used to slide on the bushing will have evaporated and the control arm will be correctly seated in the rubber.*
- ♦ *Serious handling problems could result if these instructions are not carried out.*

Stabilizer Bar

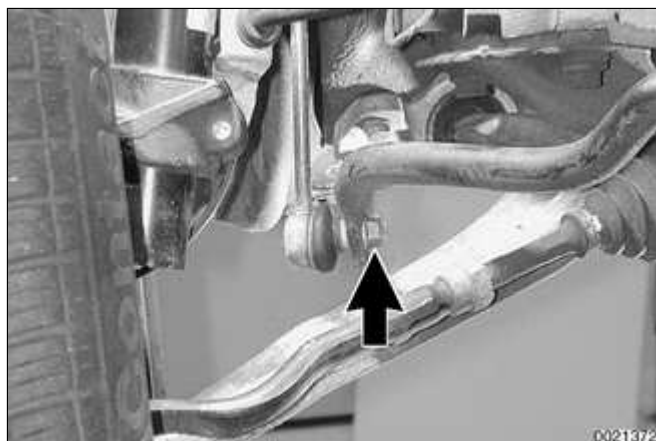
Stabilizer bar, removing and installing

On E46 models the stabilizer bar links attach to the strut assemblies.

- Raise car and support safely.

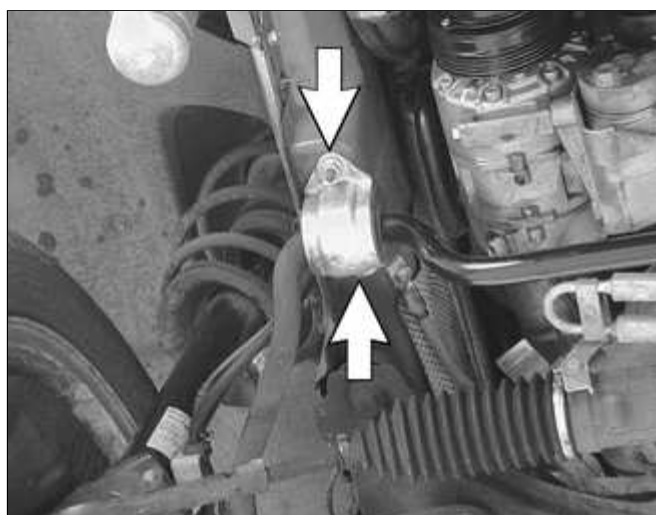
WARNING!

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 stabilizer bar connecting link mounting nut (**arrow**) from stabilizer bar on right side. Counterhold ball joint with flat wrench. (Rear wheel drive model shown.)

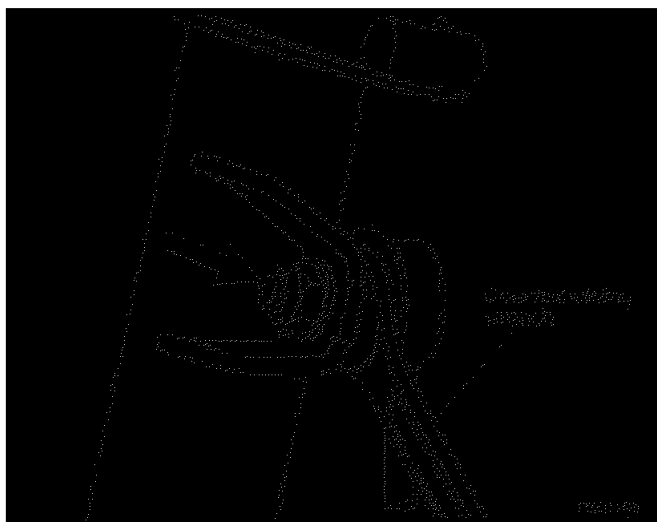
- Repeat on left side.



- ✦ Remove stabilizer bar bushing anchor nuts (**arrows**) on right side.

- Repeat on left side.

- Remove bar.



- ◀ If necessary, loosen and remove stabilizer bar link mounting nut (**arrow**) from strut. Detach link from strut housing.

Note:

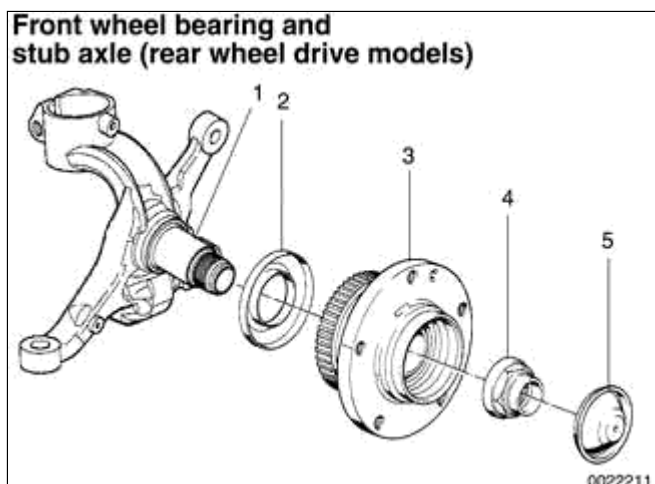
Use a thin wrench to counterhold shaft of stabilizer bar link ball joint while removing mounting nut.

- Installation is reverse of removal, noting the following
- ◆ Use new self-locking nuts on connecting links.
- ◆ When attaching stabilizer link to strut or bar, use a thin wrench to counterhold ball joints on link while tightening nut.
- ◆ Installation of stabilizer bar is easiest with car level (front wheels at the same height) and as near to normal ride height as possible.

Tightening torques	
Stabilizer bar bushing brackets to subframe	22 Nm (16 ft-lb)
Stabilizer bar link to stabilizer bar M10 self locking nut (always replace)	65 Nm (48 ft-lb)
Stabilizer bar link to strut M10 self locking nut (always replace)	65 Nm (48 ft-lb)

Front Wheel Bearings

The front wheel bearings are permanently sealed and require no maintenance.



On rear wheel drive models, the bearing is integral with the wheel hub and ABS pulse wheel and pressed on the steering arm stub axle.

- 1 - Steering arm and stub axle
- 2 - Dust guard
- 3 - Wheel hub, bearing and ABS pulse wheel
- 4 - Stub axle collar nut -tighten to 290 Nm (214 ft-lb)
- 5 - Dust cap

On all wheel drive models, the front wheel bearing is pressed into the steering arm. The wheel hub is pressed into the bearing and the outer CV joint stub axle is pressed into the hub.

The ABS front pulse wheel in all wheel drive models is the inner (ridged) seal of the front wheel bearing.

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

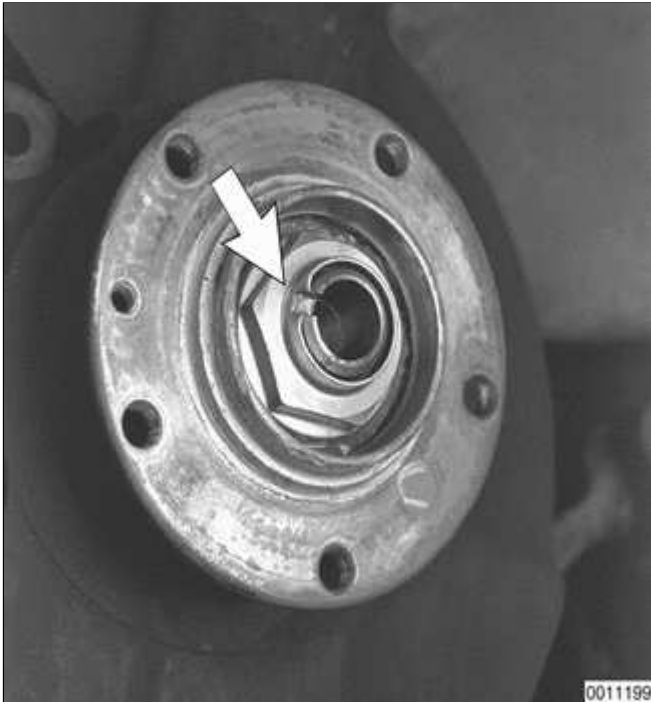
Front wheel bearing, replacing (rear wheel drive models)

- 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.



- ✦ Pry off dust cap from center of wheel hub. Bend back staked part (**arrow**) of wheel hub (axle) collar nut.

- Remount wheel and lug bolts.
- Lower car to ground. With an assistant applying brakes, loosen collar nut. Do not remove completely.

CAUTION!

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.

- Raise car and remove wheel.



- ✦ Remove ABS wheel speed sensor (**arrow**).

- Remove brake caliper assembly and brake rotor as described in ⇒ [340 Brakes](#). Leave brake hose connected to caliper. Suspend caliper assembly from chassis using stiff wire.
- Remove wheel hub collar nut.



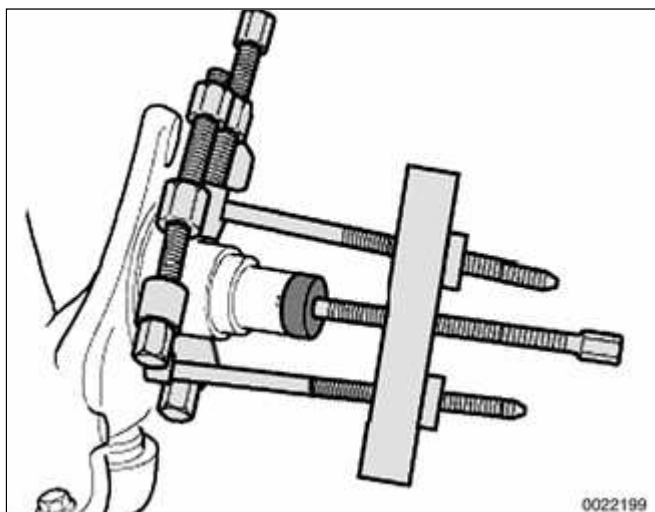
- ✦ Remove wheel hub with integral wheel bearing from steering arm using a slide hammer puller (BMW special tools 33 4 201, 33 4 202, 33 4 203 and 33 2 116) or conventional puller as illustrated.



- If outermost bearing inner race stays on steering arm stub axle, use BMW special tool set 33 4 400 or two-jaw puller to remove race.

CAUTION!

Do not reuse a wheel bearing assembly once it has been removed. The removal process destroys the bearing.



- To remove innermost inner race:
 - ◆ Unbolt brake rotor dust shield.
 - ◆ Bend back wheel bearing dust guard.
 - ◆ Use BMW special tools 00 7 500 and 31 2 106 to pull race off stub axle.
- Install splash guard and new dust shield behind bearing. Press new wheel hub/bearing assembly on stub axle using BMW special tool 31 2 110 or equivalent.

CAUTION!

The BMW special tool insures that only the inner bearing race is used to press on the hub and bearing assembly. The bearing is damaged if it is not pressed on using the inner race.

- Install new collar nut. Do not tighten nut to its final torque at this time.
- ◆ Install brake rotor and brake caliper. See ⇒ [340 Brakes](#).

- ◆ Mount wheel and lug bolts. Lower car to ground to gain leverage.

Tightening torques	
Brake caliper to steering arm	110 Nm (81 ft-lb)
Brake rotor to wheel hub	16 Nm (12 ft-lb)
Road wheel to hub	100 ± 10 Nm (74 ± 7 ft-lb)

- With an assistant applying brakes, tighten collar nut.

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

- Raise car and remove wheel.
- Stake axle nut and caulk threads of stub axle.
- Install a new grease cap, using Loctite® 638 sealant or equivalent. Install wheel and lower car.
- Install ABS pulse sensor.

Tightening torques	
ABS pulse sensor to steering arm	8 Nm (71 in-lb)

Front wheel bearing, replacing (all wheel drive models)

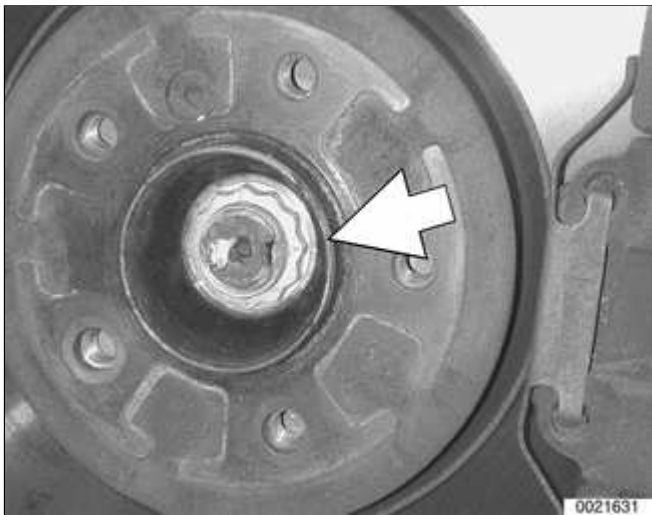
Removal and installation of the all wheel drive front wheel bearing is best

accomplished by removing the steering arm and wheel hub from the car and separating the components on the bench.

- 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.



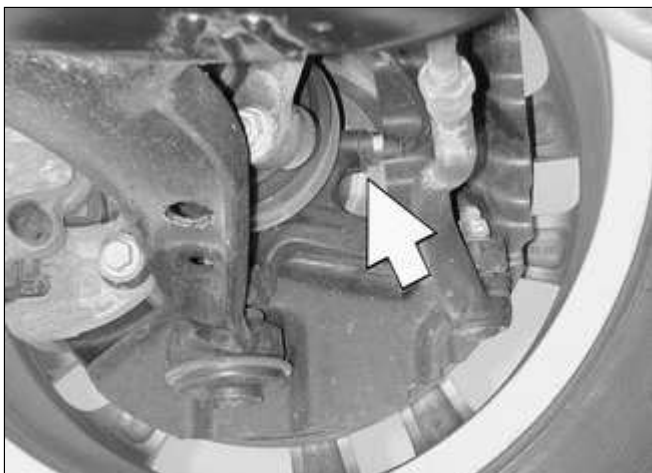
- ✦ Bend back staked part of wheel hub (axle) collar nut (**arrow**).

- Remount wheel and lug bolts.
- Lower car to ground. With an assistant applying brakes, loosen collar nut. Do not remove completely.

CAUTION!

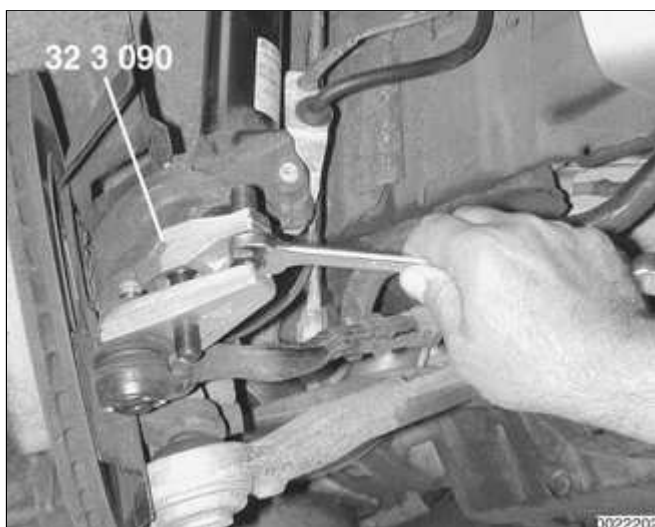
The wheel hub collar nut is tightened to a torque of 420 Nm (310 ft-lb). Make sure the car is firmly on the ground.

- Raise car and remove front wheel.

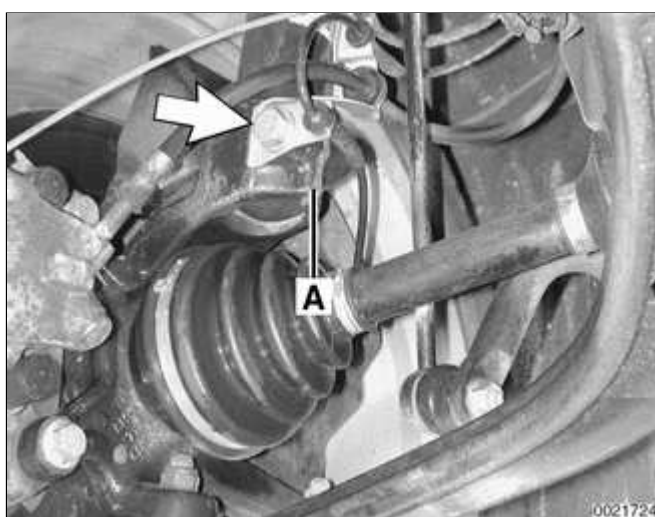


- ✦ Remove ABS wheel speed sensor (**arrow**).

- Remove brake caliper assembly and brake rotor as described in ⇒ [340 Brakes](#). Leave brake hose connected to caliper. Suspend caliper assembly from chassis using stiff wire.



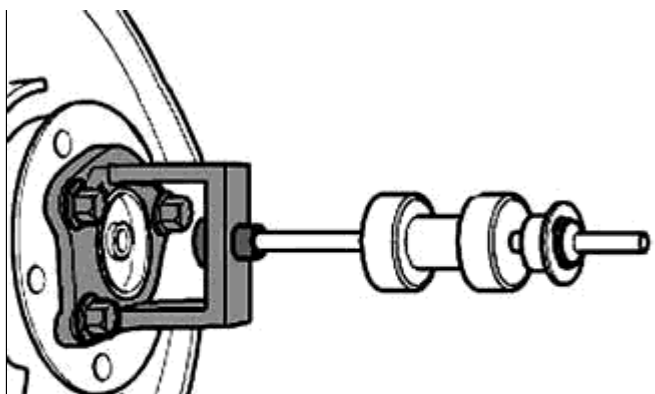
- ✦ Remove tie rod outer end nut. Use BMW special tool 32 3 090 or equivalent to press tie rod end off steering arm.
 - Detach control arm from front axle subframe as described earlier.
 - Remove outer ball joint nut. Use BMW special tool 32 3 090 or equivalent to separate steering arm and strut assembly from control arm.
 - Attach BMW special tool 33 2 111 /116 /117, or equivalent puller, to steering arm using five lug bolts and press outer CV joint stub axle inward, out of steering arm.



- ✦ Support steering arm from below. Loosen pinch bolt (**arrow**) at top of steering arm. Spread clamping collar at slot **A**, if necessary, to slide steering arm off strut assembly.
 - Working at bench, clamp steering arm in a vise.

CAUTION!

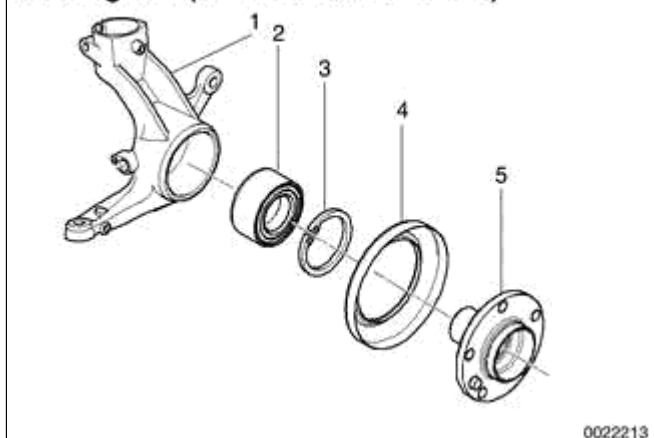
Use a vise with aluminum jaws, or protect steering arm from damage when clamping in vise.



- ✦ Remove wheel hub with integral wheel bearing from steering arm using a slide hammer puller (BMW special tools 33 4 201, 33 4 202, 33 4 203 and 33 2 116).
 - If bearing inner race stays on wheel hub, use BMW special tool set 33 4 400 or two-jaw puller to remove race.



Front wheel bearing and steering arm (all wheel drive models)



➤ Remove circlip (3) from steering arm.

- 1 - Steering arm
- 2 - Wheel bearing
- 3 - Circlip (always replace)
- 4 - Dust guard
- 5 - Wheel hub

- Drive wheel bearing out of steering arm using a press with appropriate adapters.

CAUTION!

Do not reuse a wheel bearing assembly once it has been removed. The removal process destroys the bearing.

- Press in bearing using a press with appropriate adapters.

Note:

- ◆ *When installing the front wheel bearing into the steering arm, be sure that the ridged bearing seal (ABS impulse wheel) is facing inboard. Start the bevelled edge of the bearing into the bore first.*
- ◆ *Coat bearing seat in steering arm over 50% of its length with Loctite® 648.*
- ◆ *Make sure press fit surfaces are clean and free of grease.*

- Replace circlip, making sure ring is correctly seated.
- Place dust guard over steering arm hub.
- Drive wheel hub into bearing using a shop press.

CAUTION!

Press only on the inner race. The bearing is damaged if it is not pressed on using the inner race.

- Installation of steering arm to car is reverse of removal, noting the following:
 - ◆ Replace control arm bracket bolts.
 - ◆ Torque stub axle collar nut with vehicle on the ground. Stake nut and caulk stub axle threads.
 - ◆ Have vehicle professionally aligned.

Tightening torques	
Ball joint to steering arm	65 Nm (48 ft-lb)
Brake caliper to steering arm	110 Nm (81 ft-lb)
Brake rotor to wheel hub	16 Nm (12 ft-lb)
Collar nut to wheel hub	420 Nm (310 ft-lb)
Control arm bracket to subframe	59 Nm (44 ft-lb)

Tightening torques	
Steering arm pinch bolt at strut housing	81 Nm (60 ft-lb)
Road wheel to hub	100 ± 10 Nm (74 ± 7 ft-lb)
Tie rod to steering arm	65 Nm (48 ft-lb)