

340 Brakes

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GENERAL

This repair group covers service for the brake system and for electronic braking and stability control (traction control) systems.

See also:

- **020 Maintenance** for basic brake system checks
- **300 Suspension, Steering and Brakes-General**
- **612 Switches** for brake light switch and steering angle sensor
- **ECL Electrical Component Locations** for fuse and component access
- **ELE Electrical Wiring Diagrams**

340-2 Brakes

Brake system



Brake system

- 5 Series models are equipped with vacuum power-assisted four-wheel disc brakes with integral antilock braking system (ABS). Single-piston calipers act on vented front and rear rotors. Two-stage brake pad wear sensors work along with condition based service (CBS) system to indicate when brake pads need replacement. The first stage is activated when brake pad linings reach a thickness of 6 mm ($\frac{1}{4}$ in), the second is activated at a thickness of 4 mm ($\frac{1}{8}$ in). The dual drum-type parking brake system is integrated with the rear brake rotors.

Electronic braking and stability control

5 Series models are equipped with dynamic stability control (DSC). DSC is a computer controlled traction control system that uses the ABS system in conjunction with engine management controls to control wheel spin during acceleration and maintain vehicle stability while braking.

Troubleshooting

Brake performance is mainly affected by three factors:

- Level and condition of brake fluid
- Ability of brake system to create and maintain pressure
- Condition of friction components

Air in brake fluid makes the brake pedal feel spongy during braking or increases the brake pedal force required to stop. Fluid contaminated by moisture or dirt corrodes the system. Inspect the brake fluid inside the reservoir. If it is dirty or murky, or is more than two years old, replace fluid. See **Brake system, bleeding** in this repair group.

To check the function of the brake master cylinder, hold the brake pedal down hard with the engine running. If the pedal slowly falls to the floor, either the master cylinder is leaking internally or fluid is leaking externally.

Inspect the brake rotors for glazing, discoloration and scoring. Steering wheel vibration while braking at speed is often caused by warped rotors, but can also be caused by worn suspension components.

When troubleshooting, keep in mind that tire inflation, wear and temperature can all have an affect on braking. See **300 Suspension, Steering and Brakes-General** for additional suspension and brake system troubleshooting.

Table a lists symptoms of brake problems, probable causes, and suggested corrective actions. Unless noted otherwise, relevant repairs are described later in this repair group.

Table a. Brake system troubleshooting

Symptom	Probable cause	Repairs
Brake squeal	Brake pad carriers dirty or corroded or pads loose (poor fit) in pad carrier	Remove brake pads and clean calipers. Use original equipment pads for proper fit and use BMW anti-squeal compound during installation.
	Brake pads heat-glazed or oil-soaked	Replace brake pads. Clean rotors. Replace leaking calipers as required.
	Wheel bearings worn (noise most pronounced when turning)	Replace worn bearings. See 310 Front Suspension or 330 Rear Suspension .
	Incorrectly installed brake pads, parking brake shoes, or brake parts	Check component installation. Check anti-rattle springs. Replace as necessary.
Pedal goes to floor when braking	Brake fluid loss due to system leaks	Check fluid level and inspect for signs of leakage.
	Master cylinder or traction control system faulty	Replace master cylinder. Diagnose traction control system using scan tool.
Low pedal after system bleeding	Master cylinder faulty	Replace master cylinder.
Pedal spongy or brakes work only when pedal is pumped	Air in brake fluid	Bleed system using scan tool.
	Master cylinder or traction control system faulty	Replace master cylinder. Diagnose traction control system using scan tool.
Excessive braking effort	Brake pads wet	Use light pedal pressure to dry pads while driving.
	Brake pads heat-glazed or fluid-soaked	Replace brake pads and rotors. Replace leaking calipers.
	Vacuum pump, vacuum booster, or vacuum hose connections to booster faulty	Inspect vacuum lines. Test vacuum booster and replace as required. Test brake booster check valve for one-way flow.
Brakes pulsate, chatter or grab	Warped brake rotors	Resurface or replace rotors.
	Brake pads worn	Replace brake pads.
	Brake pads heat-glazed or fluid-soaked	Clean rotors. Replace leaking calipers.
Uneven braking, car pulls to one side, rear brakes lock	Incorrect tire pressures or worn tires	Inspect tire condition. Check and correct tire pressures.
	Brake pads on one side of car heat-glazed or fluid-soaked	Replace brake pads. Clean rotors. Replace leaking calipers.
	Brake caliper or brake pads binding	Clean and recondition brakes.
	Worn suspension components	Inspect for worn or damaged suspension components. See 310 Front Suspension or 330 Rear Suspension .
Brakes drag, bind or overheat	Brake caliper or brake pads binding	Clean or replace caliper.
	Master cylinder or traction control system faulty	Replace master cylinder. Diagnose traction control system using scan tool.

Warnings and Cautions

WARNING—

- Make sure that the brake system is bled using a BMW scan tool or equivalent. See **Bleeding Brakes** in this repair group.
- Semi-metallic and metallic brake friction materials in brake pads or shoes produce dangerous dust. Treat all brake dust as a hazardous material. Do not create dust by grinding, sanding, or cleaning brake friction surfaces with compressed air.
- Brake fluid is poisonous, corrosive and dangerous to the environment. Wear safety glasses and rubber gloves when working with brake fluid. Do not siphon brake fluid with your mouth. Dispose of brake fluid properly.
- Do not reuse self-locking nuts, bolts or fasteners. They are designed to be used only once and may fail if reused. Replace them with new self-locking fasteners.
- A car with electronic stability control is still subject to normal physical laws. Avoid excessive speeds for the road conditions encountered.

CAUTION—

- Brake fluid damages paint. Immediately clean brake fluid spilled on painted surfaces and wash with water.
- Use new brake fluid from a fresh, unopened container. Brake fluid absorbs moisture from the air. This can lead to corrosion problems in the braking system and also lowers the fluid boiling point.
- When working on brake fluid lines:
 - Do not mix up fluid lines at the master cylinder or hydraulic unit. Label unions before disconnecting.
 - Do not kink brake lines.
 - Plug open lines and brake fluid ports to prevent contamination.
- Tighten brake hoses on front wheels with wheels in straight ahead position.
- If carrying out electric welding work, be sure to disconnect electrical harness connector from electronic control module.
- Do not expose electronic control modules to high sustained heat. Maximum heat exposure:
 - 95°C (203°F) for short periods of time
 - 85°C (185°F) for long periods of time (approx. 2 hours)
- Replace brake pad sensor with new if sensor is removed. Loss of spring tension in the sensor may cause it to fall off the pads.

BLEEDING BRAKES

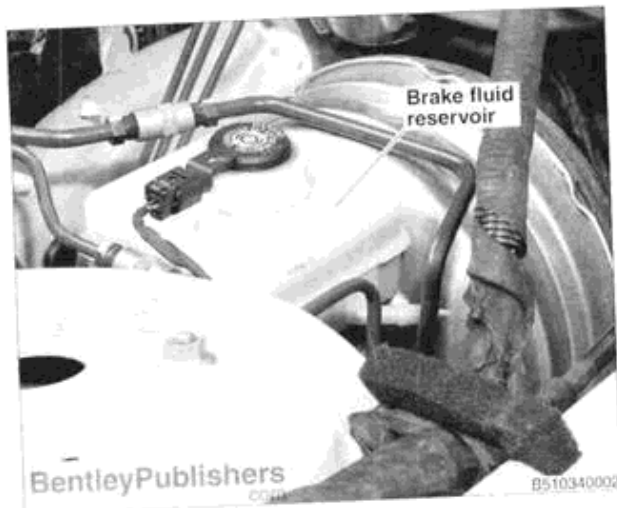
WARNING —

- The BMW traction control system uses electronic controls and a sophisticated hydraulic unit in the brake system. Once air enters the hydraulic unit, it is very difficult to remove using traditional methods. For this reason, use BMW scan tool or equivalent to pressure bleed brakes.
- When flushing brake fluid from the system, use extreme care to not let the brake fluid reservoir run dry. If air enters the hydraulic unit, use the BMW scan tool to bleed the brake system before the vehicle is driven.

Brake bleeding is usually done for one of two reasons:

- To replace old brake fluid as part of routine maintenance
- To expel trapped air in the system that resulted from opening the brake hydraulic system during repairs.

BMW recommends completely replacing the brake fluid in the entire brake system, including the brake fluid reservoir, at least once every two years. When replacing brake fluid or bleeding brakes, use the correct specification brake fluid.

**Brake fluid application**

BMW preferred fluid	Low viscosity DOT 4 brake fluid
Low viscosity DOT 4 brake fluid may be used in all 5 Series vehicles. DOT 4 and low viscosity DOT 4 brake fluid can be mixed.	

When adding or replacing brake fluid, add new brake fluid from an unopened container. It is important to bleed the entire system when any part of the hydraulic system is opened.

If you are certain no air was introduced into the master cylinder or DSC hydraulic unit, bleed the brakes at the calipers using a pressure bleeder. See **Brake calipers, bleeding** in this repair group.

However, if air enters the DSC hydraulic unit, bubbles may adhere to the edges and internal valves of the unit and these cannot be removed via conventional flushing. In that case it is necessary to bleed brakes using a BMW scan tool or equivalent. The special tool creates pulsations or vibrations which loosen and flush the bubbles.

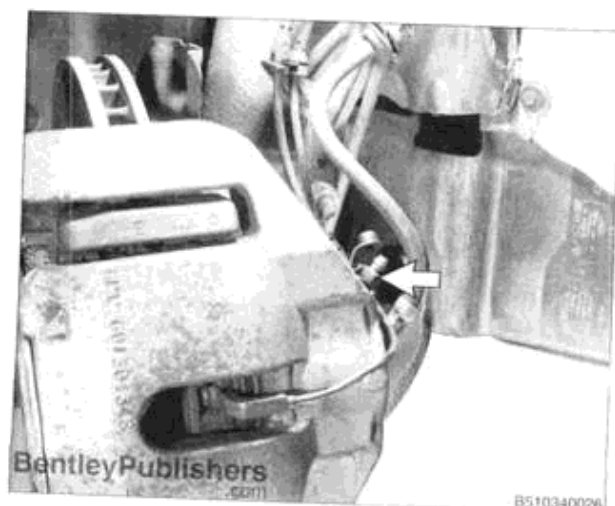
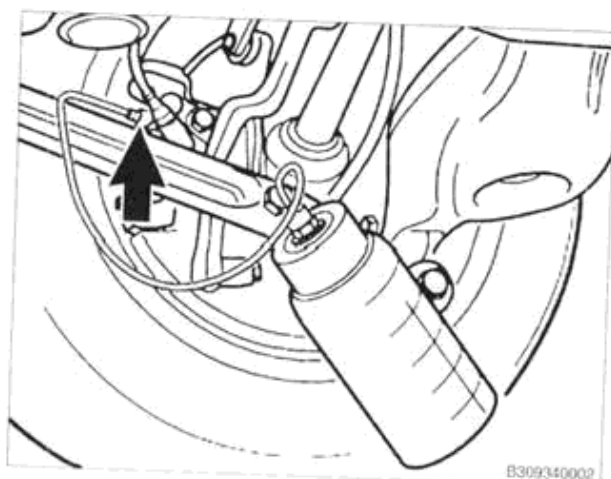
Therefore, if you are in any doubt about introduced air into the brake system, use BMW scan tool to bleed the system or have the brakes bled by a BMW workshop. See **Brake system, bleeding** in this repair group.

When bleeding the brakes, start at the wheel farthest from the master cylinder and progress in the following order:

- right rear brake
- left rear brake
- right front brake
- left front brake

340-6 Brakes

Brake calipers, bleeding



Brake calipers, bleeding

- Remove left side cabin microfilter housing (at left rear engine compartment) to access brake fluid reservoir. See **020 Maintenance**.

➤ Top off brake fluid to **MAX** marked on reservoir.

- Connect pressure bleeder to reservoir. Pressurize system to approximately 2 bar (29 psi).

CAUTION—

- Do not exceed a pressure of 2 bar (29 psi) when pressure bleeding the brake system. Excessive pressure damages the brake fluid reservoir.

➤ Connect bleeder hose and bottle to **right rear** caliper bleeder screw (arrow). Have a helper hold brake pedal down.

➤ Open bleeder screw (arrow). Have helper slowly pump brakes about 10 times with bleeder screw open, holding pedal down on last pump. When escaping fluid is free of air bubbles, close bleeder screw. (Photo illustrates front brake caliper. Rear caliper is similar.)

CAUTION—

- Make sure bleeder hose remains submersed in clean brake fluid whenever the bleeder valve is open.

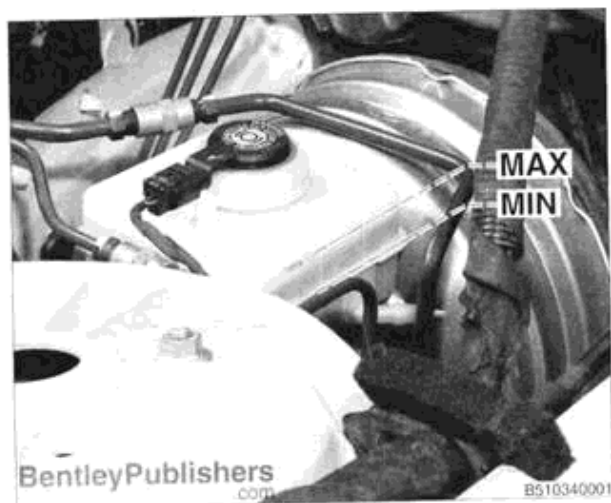
- Close bleeder screw and release brake pedal. Refill brake fluid reservoir and proceed to left rear wheel.

- Continue bleeding remaining wheels in the following order:

- left rear
- right front
- left front

Tightening torques

Bleeder to caliper:	
• 9 mm screw	7 - 11 Nm (5 - 8 ft-lb)
• 11 mm screw	12 - 16 Nm (9 - 12 ft-lb)



Brake system, bleeding

The procedure below requires the use of BMW scan tool.

- Remove left side cabin microfilter housing (at left rear engine compartment) to access brake fluid reservoir. See **020 Maintenance**.

➤ Top off brake fluid to **MAX** marked on reservoir.

- Connect pressure bleeder to reservoir. Pressurize system to approximately 2 bar (29 psi).

CAUTION—

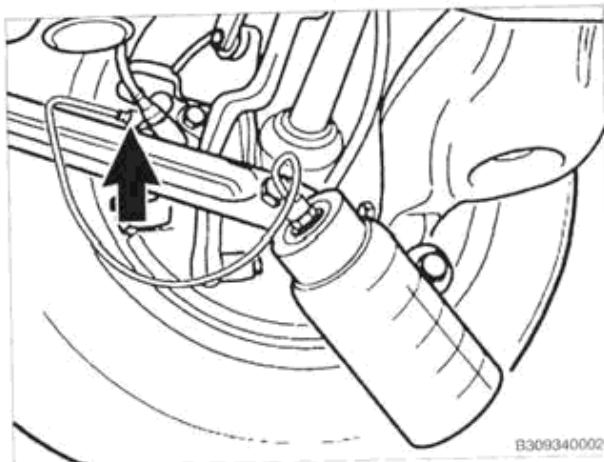
- Do not exceed a pressure of 2 bar (29 psi) when pressure bleeding the brake system. Excessive pressure damages the brake fluid reservoir.

- Connect BMW scan tool or equivalent to OBD II plug on left door post.

➤ Set tool to service function Bleeding ABS / DSC.

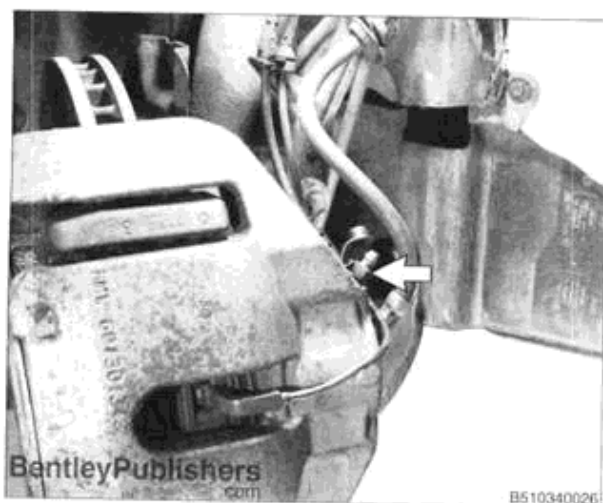


- Connect bleeder hose and bottle to **right rear** caliper bleeder screw (arrow). Have a helper hold brake pedal down.



340-8 Brakes

Brake system, bleeding



➤ Open bleeder screw (**arrow**). Carry out bleeding procedure using BMW scan tool on-screen instructions until clear, bubble-free fluid flows. (Photo illustrates front brake caliper. Rear caliper is similar.)

- After BMW scan tool bleeding routine has finished, press brake pedal to floor 5 times until clear, bubble-free fluid flows. Close bleeder.

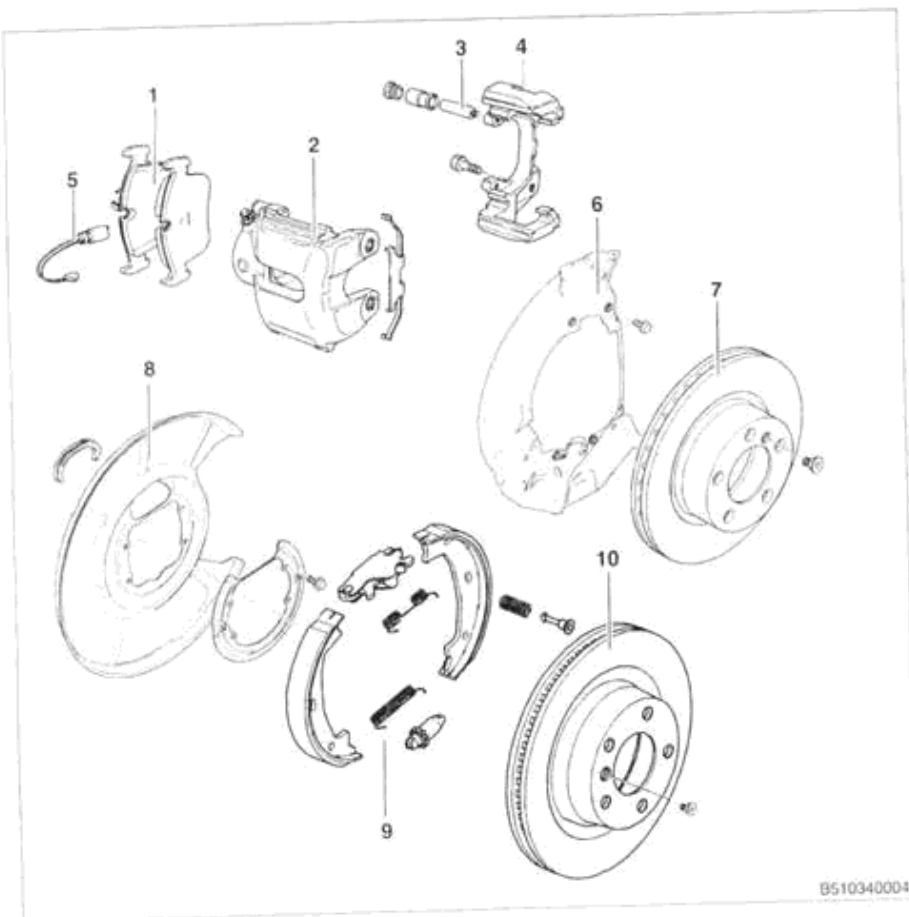
CAUTION—

- Make sure bleeder hose remains submersed in clean brake fluid whenever the bleeder valve is open.

- Repeat procedure at **left rear** brake.
- Repeat procedure at **right front** brake.
- Repeat procedure at **left front** brake.
- Remove brake bleeding apparatus and disconnect BMW scan tool. Top off brake fluid. Check to make sure brake fluid reservoir cap seal is intact.

Tightening torques

Bleeder to caliper:	
• 9 mm screw	7 - 11 Nm (5 - 8 ft-lb)
• 11 mm screw	12 - 16 Nm (9 - 12 ft-lb)

BRAKE PADS, CALIPERS AND ROTORS**Braking system components**

1. Brake pads
 - Wear limit: 3 mm (0.12 in).
 - Follow directional marking when installing.
2. Brake caliper
3. Brake caliper guide bolt
4. Caliper carrier
5. Brake pad wear sensor
 - On left front, right rear inner pad.
 - Replace with new pads.
 - Replace if brake pad wear warning light illuminated.
6. Front brake backing plate
7. Front brake rotor
 - See **Table c** for brake rotor specifications.
 - Clean off preservative before installing new rotor.
8. Rear brake backing plate
9. Parking brake shoes with hardware
10. Rear brake rotor
 - See **Table c** for brake rotor specifications.
 - Clean off preservative before installing new rotor.

Brake pads, checking and replacing

Brake pads can be replaced without disconnecting the brake fluid hose from the caliper or having to bleed the brakes. The rotors can be replaced without disassembling wheel hub and bearing. Front and rear brake pad replacement procedures are similar.

Replace pads in axle sets.

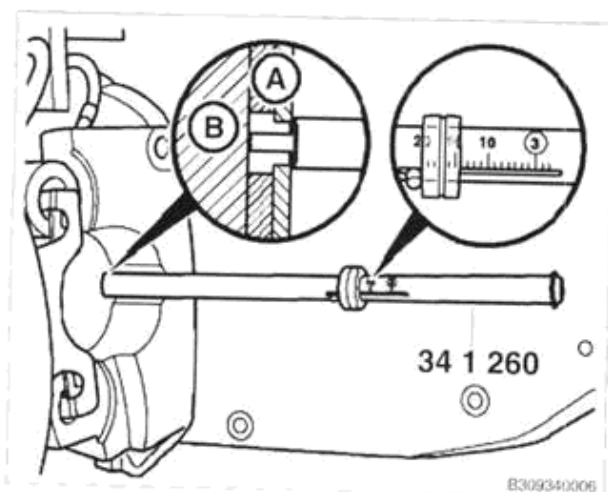
- Raise car and support safely. Remove wheels.

WARNING —

- Make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.

340-10 Brakes

Brake pads, checking and replacing

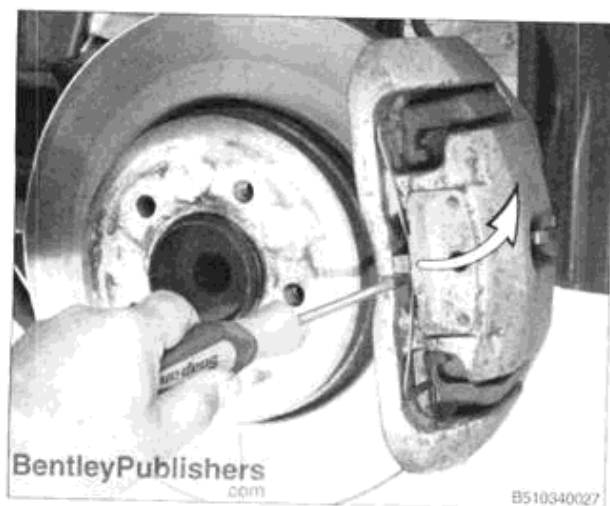


➤ To measure brake pad lining thickness, insert BMW special tool 34 1 260 at either right front or left rear wheel.

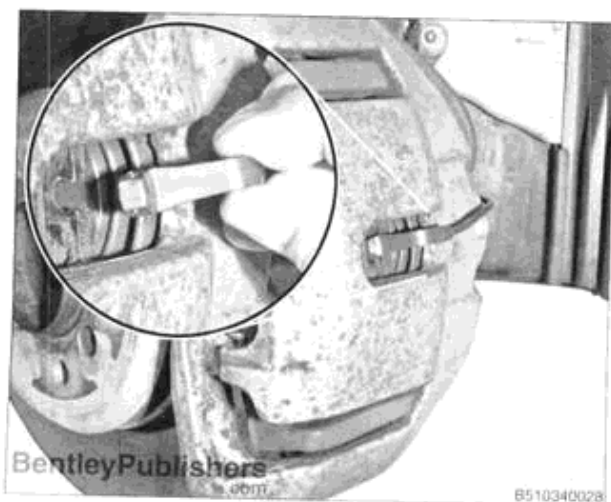
- Move wheel until notch for brake wear indicator can be seen through wheel opening.
- Insert tip of tool into notch so that body of tool rests on brake pad backing plate (A), and tip touches brake rotor (B).
- Replace pads if at minimum thickness. See **Table b**.

Table b. Brake pad lining minimum thickness

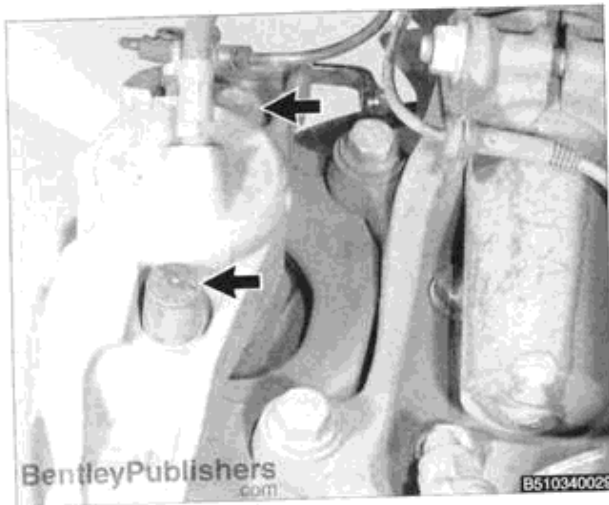
Minimum pad thickness, front or rear	3 mm (0.12 in)
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➤ Pry off brake caliper anti-rattle spring (arrow).



➤ Left front or right rear: Pull pad wear sensor off inner brake pad.



- Remove plastic caps (**arrows**) from caliper guide bolts.



- Using 7 mm Allen wrench, remove caliper guide bolts. Remove caliper from pad carrier.
 - If there is a ridge on brake rotor edge, press caliper pistons back into caliper before removing caliper.

CAUTION—

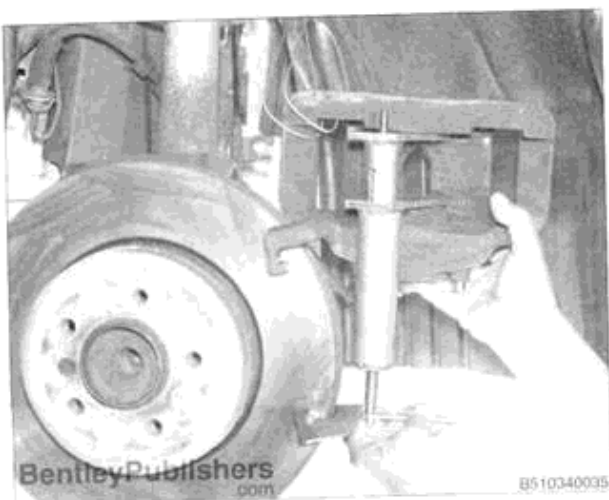
- Before pressing in caliper pistons, siphon some fluid out of brake fluid reservoir in order to avoid paint-damaging spillover.
- Do not let the brake caliper assembly hang from the brake hose. Support caliper from chassis with strong wire.

- Remove brake pads from caliper.
- Check brake rotor thickness. Inspect for rust or damage. If necessary replace or machine brake rotors. See **Brake rotor specifications** and **Brake rotor, removing and installing** in this repair group.
- Compress caliper piston using BMW special tool 34 1 050 or equivalent.

CAUTION—

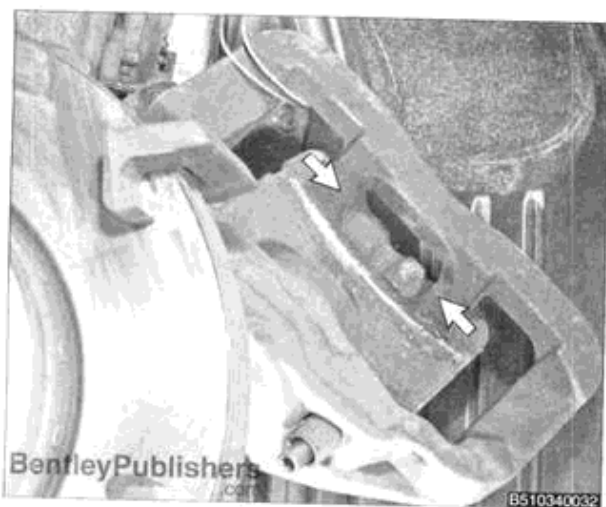
- Before pressing in caliper pistons, siphon some fluid out of brake fluid reservoir in order to avoid paint-damaging spillover.

- Check caliper dust boots for damage and replace if necessary.
- Clean contact surfaces between caliper and caliper carrier.



340-12 Brakes

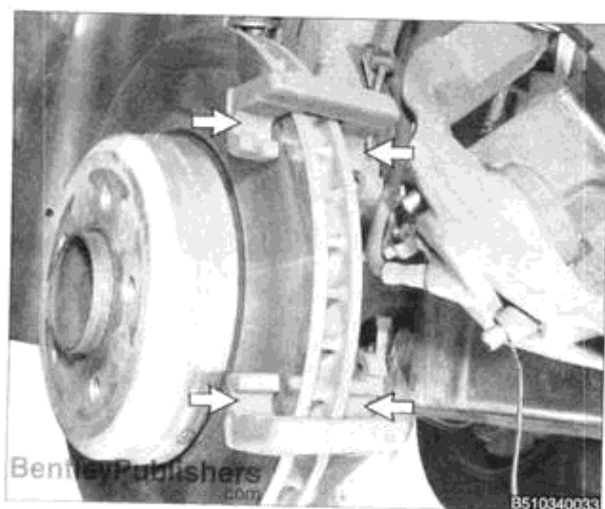
Brake pads, checking and replacing



- Apply thin coating of BMW anti-squeal compound to caliper contact face (**arrows**).

CAUTION—

- Do not let caliper rubber dust sleeve come in contact with anti-squeal compound. The compound causes rubber to swell and deteriorate.
- Do not apply grease to brake pad backing plate.



- Apply thin coating of BMW anti-squeal compound to brake pad rests (**arrows**) on pad carrier.

CAUTION—

- In order to preserve brake caliper surface coating use brake cleaner only to clean.

- If installing directional pads, be sure to install them as indicated by manufacturer.
- Where applicable, insert brake pad wear sensor into cutout in new pad. Push sensor into pad cutout until it locks into place.

CAUTION—

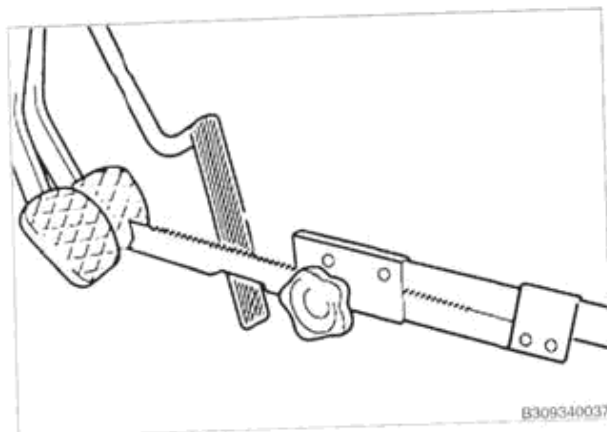
- If brake pad wear sensor light illuminated prior to brake pad replacement, replace wear sensor and reset CBS data.
- Brake pad sensor can only be installed once, then needs replacing. See **020 Maintenance**.
- Brake pad wear sensor is fragile. Be careful not to damage during installation.

- Route pad wear sensor wiring through caliper opening and under bleeder dust cap.
- Remainder of installation is reverse of removal.
 - Clean brake caliper guide bolts (7 mm Allen). Replace ones which are not in perfect condition. Do not grease.
 - Before driving car, pump brake pedal several times so that brake pads contact brake rotors.
 - Check that brake fluid level is correct. Top off to MAX marking.
 - Hold ignition key for at least 30 seconds in accessory position without starting engine. This clears fault codes in memory and turns brake pad warning light OFF. If light remains ON, reset condition based service (CBS) system. See **020 Maintenance**.

Tightening torques

Brake caliper to pad carrier (7 mm Allen)	30 ± 2 Nm (22 ± 1 ft-lb)
Road wheel to hub	120 ± 10 Nm (89 ± 7 ft-lb)

Brake caliper and pad carrier, removing and installing

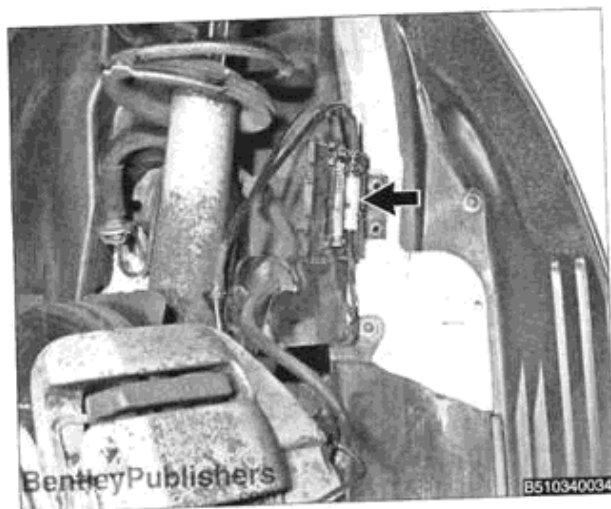


Brake caliper and pad carrier, removing and installing

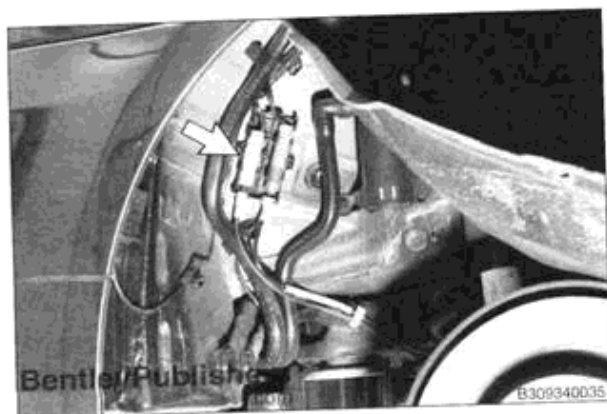
- Insert pedal prop and depress brake pedal slightly. This prevents brake fluid from escaping when brake lines are detached.
- Raise car and support safely. Remove wheels.

WARNING—

- Make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.



- Left front wheel: Working in junction box in wheel housing, separate brake pad warning sensor electrical harness (arrow).

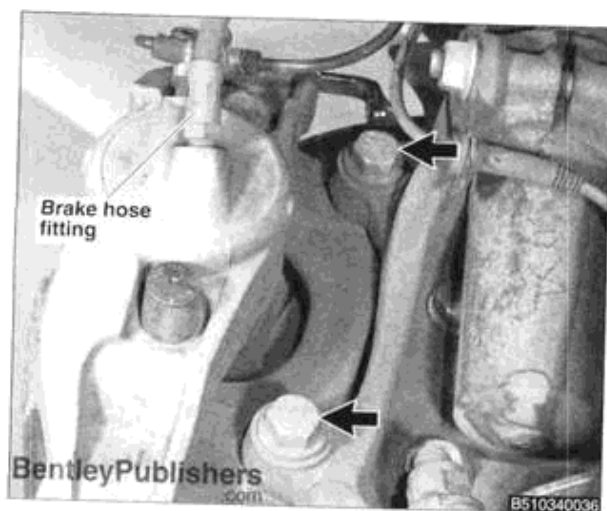


- Right rear wheel: Remove right rear wheel housing liner. See 410 Fenders, Engine Hood.

- Working in junction box in wheel housing, separate brake pad warning sensor electrical harness (arrow).

340-14 Brakes

Brake rotor specifications



Working at brake caliper:

- Loosen brake hose fitting at caliper. Use shop towel to catch dripping brake fluid.
 - Remove pad carrier and caliper mounting bolts (**arrows**) from steering knuckle (front caliper) or from wheel bearing carrier (rear caliper).
- Lift off caliper and spin assembly off hose. Plug open fluid lines and ports.
- Inspect brake caliper for signs of leakage. Check that caliper piston slides smoothly into caliper. Replace caliper if any faults are found.
- Installation is reverse of removal. Keep in mind the following:
- Tighten front caliper hoses with front wheel pointing dead ahead.
 - Make sure brake hoses are not twisted or tensioned in any way.
 - Make sure brake pad warning sensor harness does not chafe on wheel or other moving parts.
 - Bleed entire brake system before driving car. See **Brake calipers, bleeding** in this repair group.

Tightening torques

Brake caliper to pad carrier (7 mm Allen)	30 ± 2 Nm (22 ± 1 ft-lb)
Brake fluid hose to caliper	24 Nm (18 ft-lb)
Brake fluid hose to steel line	16 Nm (12 ft-lb)
Front brake caliper to steering knuckle (replace M12 x 1.5 x 43 mm ZNS3 bolts with new)	110 Nm (81 ft-lb)
Rear brake caliper to wheel bearing carrier (M12 x 1.5 x 41 mm ZNS3 bolts)	110 Nm (81 ft-lb)
Road wheel to hub	120 ± 10 Nm (89 ± 7 ft-lb)

Brake rotor specifications

When inspecting brake rotors and pads, replace pads only if brake rotor thickness is greater than or equal to minimum thickness (MIN TH) stamped on edge of brake rotor. This thickness is nominal thickness (when new) minus 1.6 mm (0.06 in). Otherwise, replace brake pads and rotors together.

Brake rotor dimensions vary based on model, engine size and drive configuration (rear-wheel drive or xDrive). When replacing rotors, match new parts to old parts on vehicle. If in doubt, check with BMW parts department.

Table c. Brake rotor specifications

Model	Parameter	Front: mm (in)	Rear: mm (in)
525i 525xi	Diameter	310 (12.2)	320 (12.6)
	MIN TH	22.4 (0.88)	18.4 (0.72)

Table c. Brake rotor specifications

Model	Parameter	Front: mm (in)	Rear: mm (in)
528i	Diameter	324 (12.8)	320 (12.6)
528xi	MIN TH	28.4 (1.11)	18.4 (0.72)
530i			
530xi			
535xi			
535i Sedan	Diameter	348 (13.7)	345 (13.6)
545i	MIN TH	28.4 (1.11)	22.4 (0.88)
550i			
Max. machine limit per friction ring side		0.8 (0.03)	

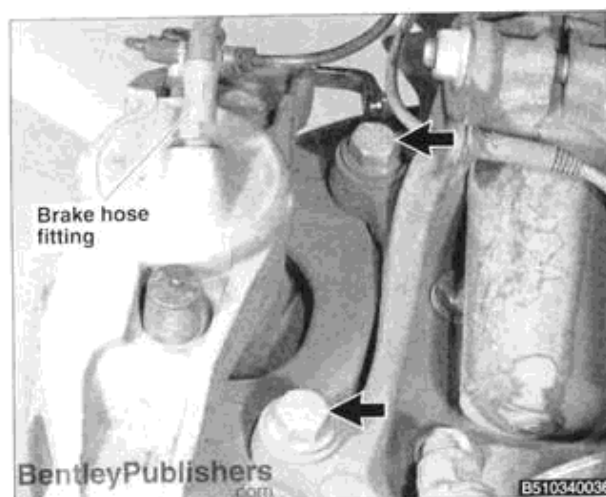
Brake rotor, removing and installing

Machine or replace brake rotors in pairs per axle.

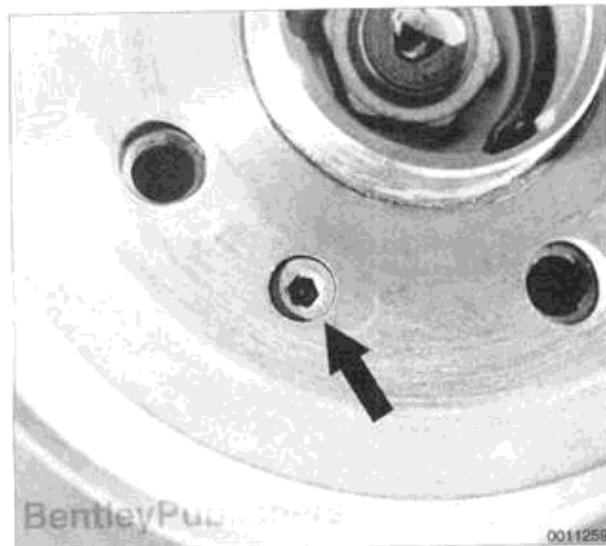
- Raise car and support safely. Remove wheels.

WARNING —

- Make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.



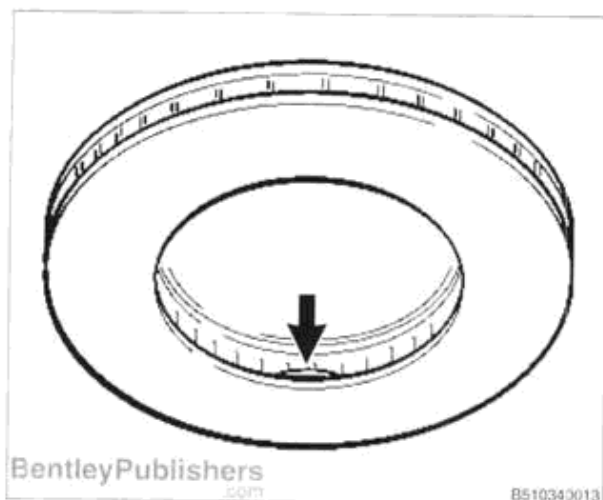
- Remove brake caliper carrier bolts (arrows). Suspend brake caliper from chassis using stiff wire. Do not detach brake hydraulic line.



- Remove brake rotor mounting screw (arrow) and remove rotor.
- Inspect rotor for cracks, signs of overheating and scoring.
- Minimum allowable thickness (MIN TH) is stamped on rotor hub. Measure rotor braking surface with a micrometer at eight to ten different points and use the smallest measurement. Compare to specifications in Table c.
- If rotor does not pass minimum thickness requirements or is damaged, replace rotor.

340-16 Brakes

Brake master cylinder, removing and installing



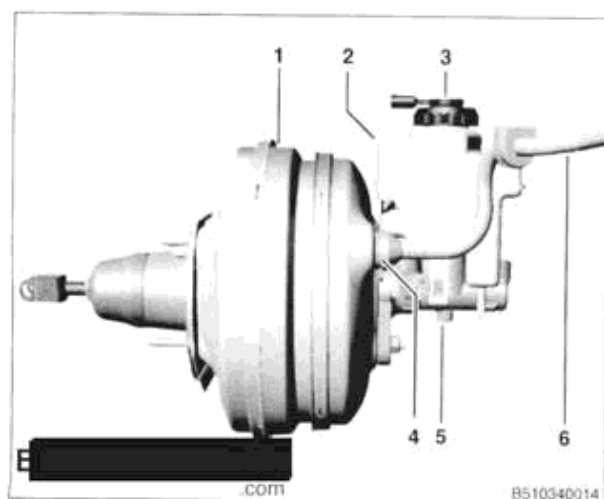
- Vented brake rotors are equipped with an integrated balance weight (arrow). Do not remove or reposition weight.
- Clean rotor with brake cleaner before installing.
- If new rear brake rotors are installed, adjust parking brake. See **Parking brake, adjusting** in this repair group.

Tightening torques

Brake rotor to wheel hub (replace M8 x 14 mm Allen bolt with new)	16 Nm (12 ft-lb)
Front brake caliper to steering knuckle (replace M12 x 1.5 x 43 mm ZNS3 bolts with new)	110 Nm (81 ft-lb)
Rear brake caliper to wheel bearing carrier (M12 x 1.5 x 41 mm ZNS3 bolts)	110 Nm (81 ft-lb)
Road wheel to hub	120 ± 10 Nm (89 ± 7 ft-lb)

BRAKE MASTER CYLINDER

- The brake master cylinder is mounted to the front of the vacuum booster on the driver side bulkhead.
1. Brake vacuum booster
 2. Brake fluid reservoir
 3. Brake fluid level sensor
 4. Vacuum line check valve
 5. Brake master cylinder
 6. Vacuum line from intake manifold or auxiliary vacuum pump



Brake master cylinder, removing and installing

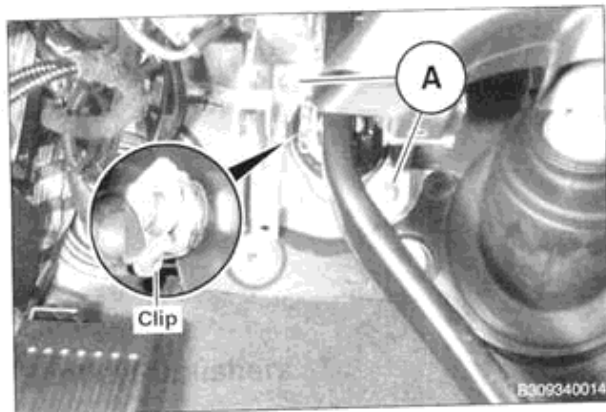
CAUTION—

- Brake fluid is highly corrosive and dangerous to the environment. Dispose of it properly.

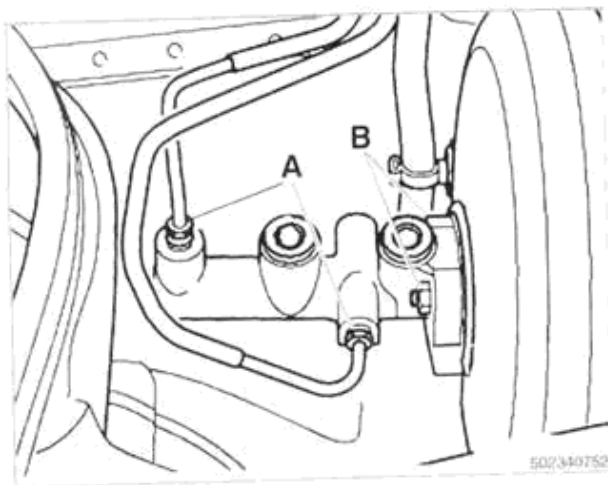
- Remove left side cabin microfilter housings. See **020 Maintenance**.
- Remove left lower dashboard trim. See **513 Interior Trim**.
- Working at brake fluid reservoir at left rear of engine compartment:
 - Detach brake fluid level sensor connector (arrow).
 - Remove reservoir cap.
 - Using a clean syringe, empty brake fluid reservoir.
- Remove brake fluid reservoir by tilting sideways out of grommets.



Brake master cylinder, removing and installing



- Working in passenger compartment underneath left side dashboard:
- Remove brake booster mounting fasteners (A).
 - Remove brake booster push rod pin clip (inset) and detach booster pushrod from brake pedal.



- Disconnect master cylinder brake lines (A).
- Plug open brake lines to prevent contamination.
 - Remove master cylinder mounting nuts (B) and remove master cylinder.
- During reinstallation, make sure fluid couplings, thread bores and mating surfaces are clean.
- Mount master cylinder to brake booster using new sealing O-ring and new self-locking nuts.

CAUTION—

- Be sure to align master cylinder pushrod and booster pushrod.
- Do not over-torque master cylinder mounting nuts. This could damage the brake booster and prevent proper vacuum build-up.
- After 30 minutes, retighten master cylinder mounting nuts.

Tightening torque

Brake master cylinder to brake booster	26 Nm (19 ft-lb)
--	------------------

- Connect brake fluid lines to master cylinder.

Tightening torques

Brake fluid line to master cylinder	14 Nm (10 ft-lb)
• M10 x 1 union nut	17 Nm (13 ft-lb)
• M12 x 1 union nut	

- Reinstall fluid reservoir using new sealing grommets.
- Fasten brake booster. After 30 minutes, retighten.

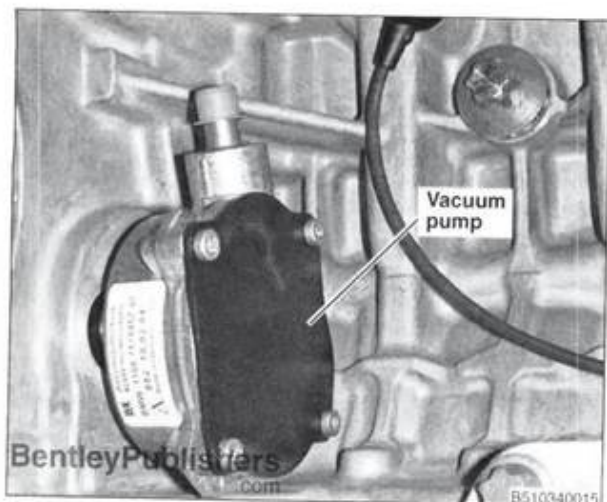
Tightening torque

Brake booster to body panel (M8 nuts)	21 Nm (15 ft-lb)
---------------------------------------	------------------

- Remainder of installation is reverse of removal. Remember to:
- Top up with fresh brake fluid.
 - Bleed entire brake system. See **Brake system, bleeding** in this repair group.

340-18 Brakes

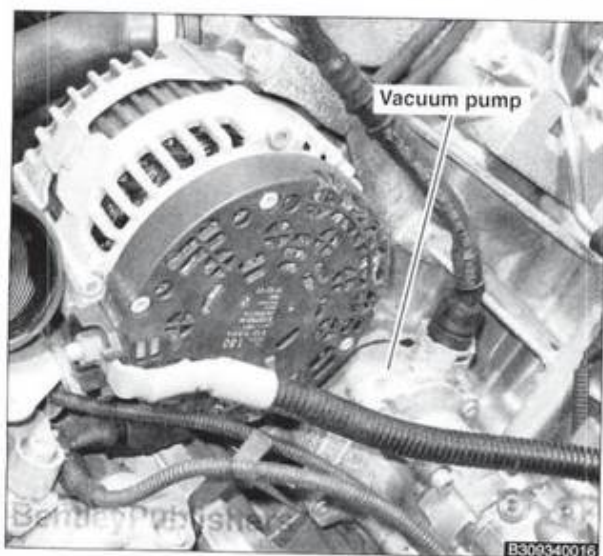
Auxiliary brake booster vacuum pump



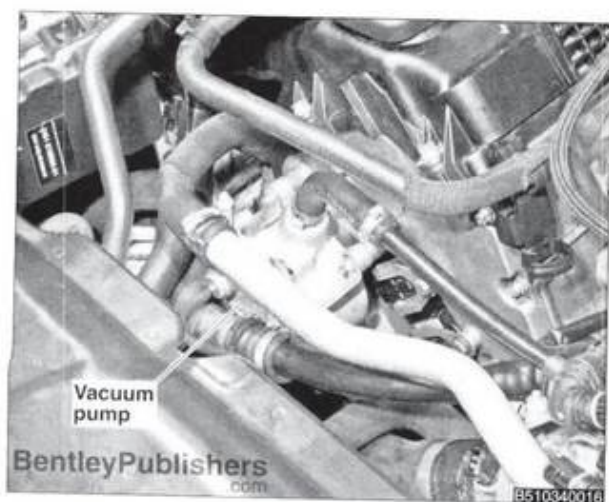
Auxiliary brake booster vacuum pump

5 Series models with N52, N54 or V8 engine use an auxiliary pump to supply vacuum to the brake booster, rather than using traditional manifold vacuum.

◀ **N52 engine:** Vacuum pump, in front lower left of engine, is driven by oil pump chain.



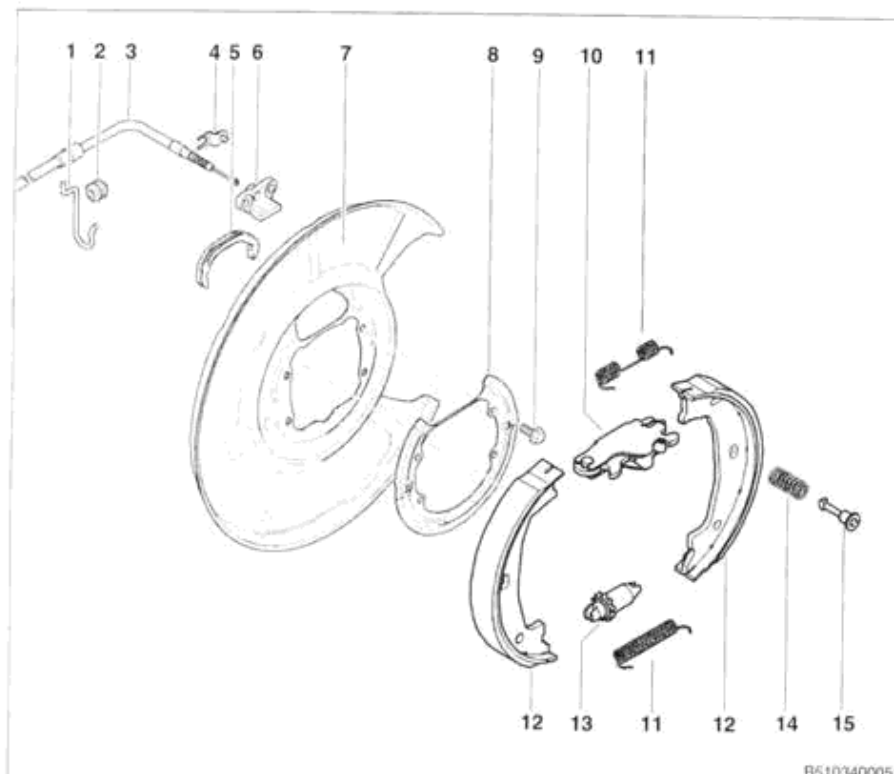
◀ **N54 engine:** Vacuum pump operates in tandem with high-pressure fuel pump, both driven by oil pump chain in front lower left of engine



◀ **V8 engine:** Vacuum pump at right front of engine is driven by right exhaust camshaft.

PARKING BRAKE

Parking brake components



1. Bracket
2. Grommet
3. Parking brake Bowden cable
4. Bracket
5. Gasket
6. Support
7. Backing plate
8. Reinforcement
9. Bolt
10. Brake shoe expander
11. Return spring
12. Parking brake shoe
13. Brake shoe adjuster
14. Hold-down spring
15. Hold-down pin

B510340005

Parking brake, adjusting

The parking brake is a brake drum system integrated into the rear brake rotors. Adjust with rear of car raised off the ground and the wheels installed. Make sure parking brake Bowden cables move freely.

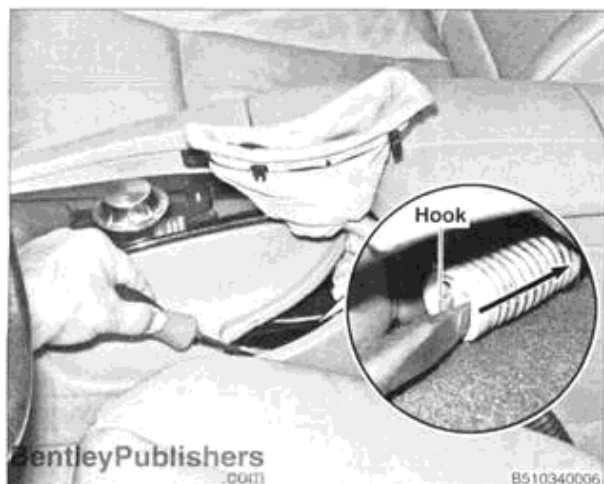
Adjust parking brake under the following circumstances:

- After replacing parking brake shoes
- After replacing rear brake rotors
- Excessive stroke of parking brake handle required for actuation (more than 10 clicks)
- After replacement of brake shoe adjuster or parking brake cable(s)

— Disengage parking brake handle boot from center console.

➤ Relieve parking brake cable tension: Using a screwdriver, lock parking brake handle adjuster by pressing spring back to engage hook. **Inset** shows hook engaged.

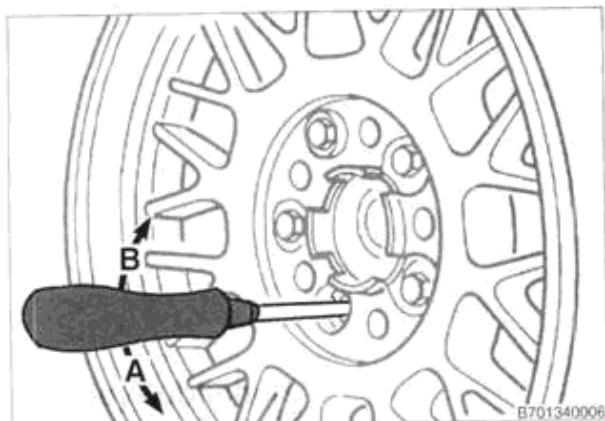
— Raise rear of car.

**WARNING—**

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

340-20 Brakes

Parking brake shoes, removing and installing



- Remove one rear wheel lug bolt and rotate wheel until parking brake adjuster is visible through lug bolt hole.
 - Use flat-bladed screwdriver to reach into brake drum through bolt hole and turn brake adjuster.
 - Left rear wheel: Turn adjuster in direction **A** to spread brake shoes.
 - Right rear wheel: Turn adjuster in direction **B** to spread brake shoes.
- Turn adjuster until wheel no longer turns. Back adjuster off 8 teeth.

Parking brake adjusting (initial)

Back off adjuster through wheel lug bolt hole	8 teeth
---	---------

- Working at parking brake handle in center console, use screwdriver to release hook at brake cable spring.
- Set parking brake several times to seat brakes.
- Release lever and make sure rear wheels turn freely. If any binding is noticed, back off adjuster(s) one tooth at a time.
- Switch ignition ON. Pull up parking brake lever 1 notch and make sure that parking brake warning light switches ON. If not, adjust parking brake warning light contact switch.
- Install parking brake lever boot. Install road wheel lug bolt.

Tightening torque

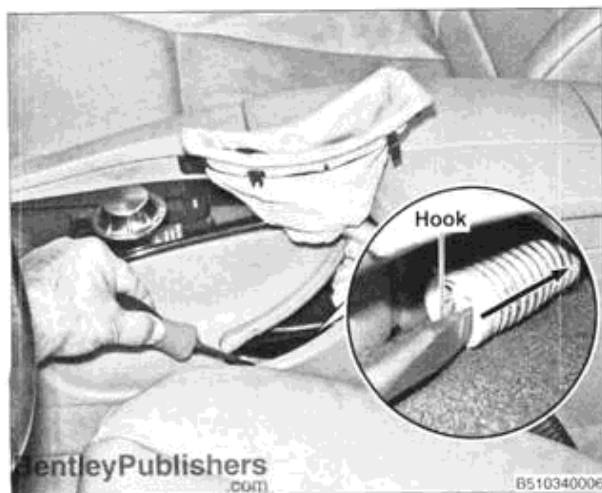
Road wheel to hub	120 ± 10 Nm (89 ± 7 ft-lb)
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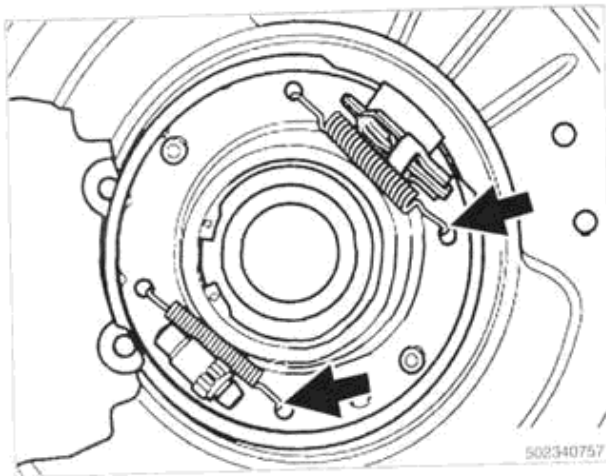
Parking brake shoes, removing and installing

- Disengage parking brake handle boot from center console.
- Relieve parking brake cable tension: Using a screwdriver, lock parking brake handle adjuster by pressing spring back to engage hook. **Inset** shows hook engaged.
- Raise rear of car and remove wheels.

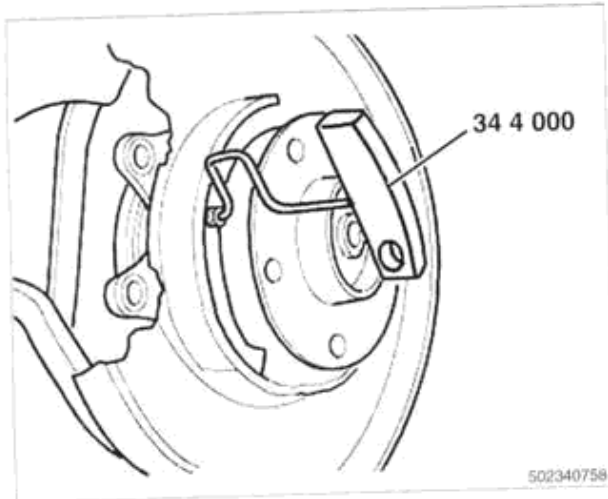
WARNING—

- Make sure that the car is firmly supported on jack stands designed for the purpose. Place jack stands beneath structural chassis points. Do not place jack stands under suspension parts.
- Remove brake calipers and brake discs. Hang brake calipers aside with stiff wire. Do not disconnect brake fluid hoses. See **Brake rotor, removing and installing** in this repair group.

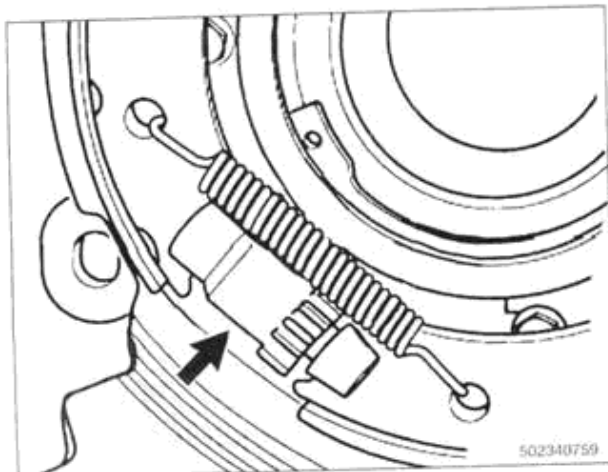




- Unhook return springs (**arrows**) from brake shoes.



- Remove brake shoe hold-down pins using BMW special tool 34 4 000 or 6 mm Allen wrench.
 - Rotate hold-down pin $\frac{1}{4}$ turn to release.
 - Spread shoes apart and lift out.



- Note position of brake shoe adjuster (**arrow**). Right side is illustrated. Left is mirror image of this.
- Installation is reverse of removal. Keep in mind the following:
 - Apply thin coat of grease to sliding parts and pins before reassembly.
 - Be sure to adjust parking brake. See **Parking brake, adjusting** in this repair group.

Tightening torques

Brake caliper to wheel bearing carrier (M12 x 1.5 x 41 mm ZNS3 bolts)	110 Nm (81 ft-lb)
Brake rotor to hub (M8 x 14 mm Allen bolt)	16 Nm (12 ft-lb)
Road wheel to hub	120 $\pm$ 10 Nm (89 $\pm$ 7 ft-lb)

340-22 Brakes

Parking brake cable, replacing

Parking brake cable, replacing

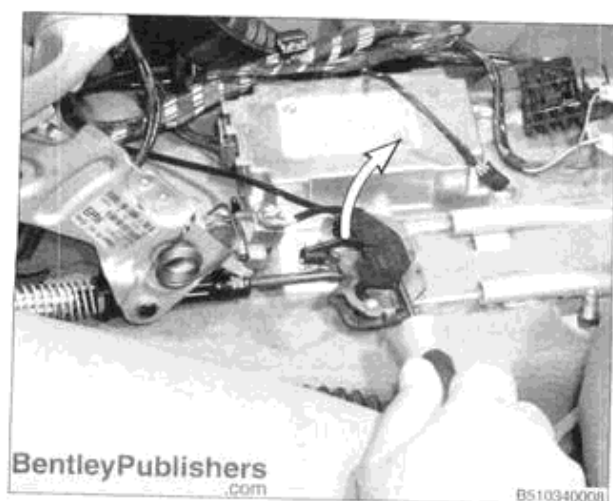
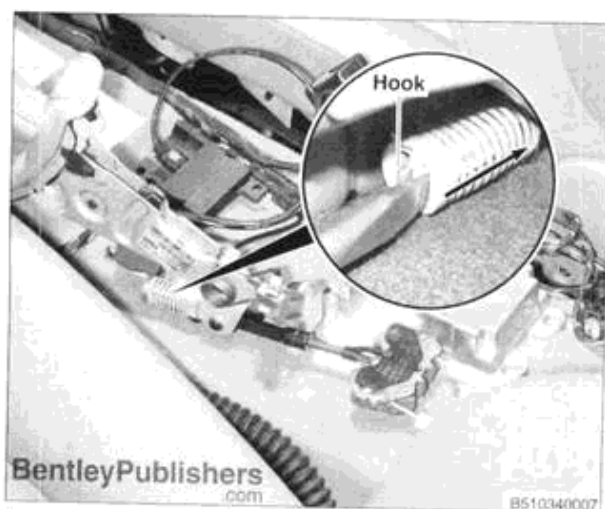
The parking brake is actuated by two separate Bowden cables. Each cable can be replaced separately.

- Raise vehicle and remove rear wheel.

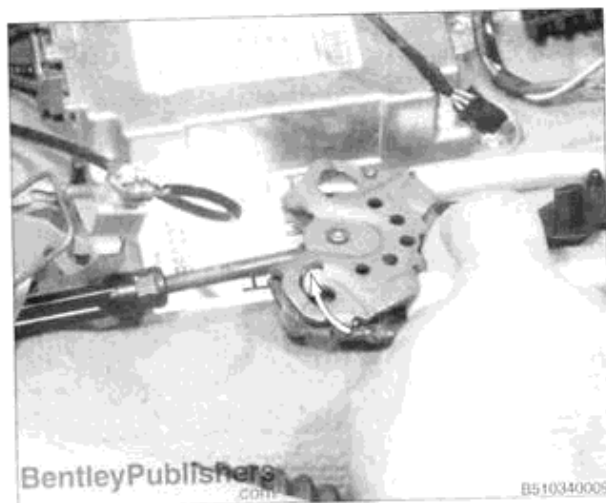
WARNING—

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

- Remove brake calipers and brake discs. Hang brake calipers aside with stiff wire. Do not disconnect brake fluid hoses. See **Brake rotor, removing and installing** in this repair group.
- Remove exhaust system and heat shield. See **180 Exhaust System**.
- Working inside car, gain access to base of parking brake handle by removing center console. See **513 Interior Trim**.
- ◀ Relieve parking brake cable tension: Using a screwdriver, lock parking brake handle adjuster by pressing spring back to engage hook. **Inset** shows hook engaged.

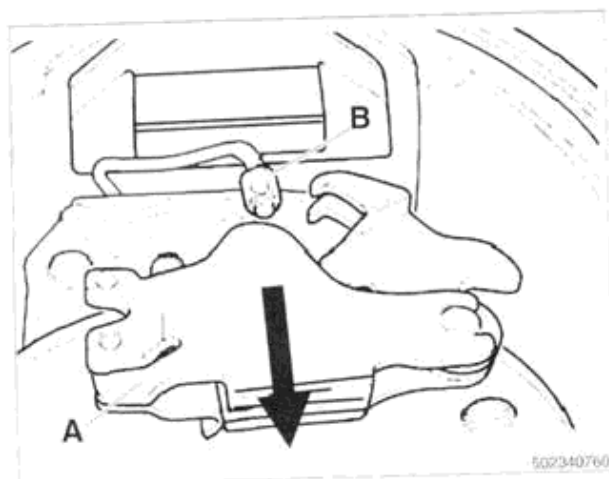


- ◀ Use screwdriver to pry plastic clip off parking brake balance bar (arrow).



➤ Slide Bowden cable ball end toward center of balance bar (arrow) and out toward rear of vehicle.

- Remove parking brake shoes. See **Parking brake shoes, removing and installing** in this repair group.



➤ Pull shoe expander (A) forward and disconnect parking brake cable (B).



➤ Working at wheel bearing carrier, remove fastener and cable hold down (arrow).

- Working underneath vehicle, detach cable from brackets. Pull cable out of brake backing plate and out of tube guide underneath vehicle.
- Installation is reverse of removal. Adjust parking brake. See **Parking brake, adjusting** in this repair group.

Tightening torques

Brake cable bracket to wheel bearing carrier (M6 bolt)	8 Nm (6 ft-lb)
Brake caliper to wheel bearing carrier (M12 x 1.5 x 41 mm ZNS3 bolts)	110 Nm (81 ft-lb)
Brake rotor to hub (M8 x 14 mm Allen bolt)	16 Nm (12 ft-lb)
Road wheel to hub	120 ± 10 Nm (89 ± 7 ft-lb)

340-24 Brakes

Antilock brake system (ABS)

ANTILOCK BRAKE AND STABILITY CONTROL

5 Series vehicles are equipped with antilock brakes (ABS) with dynamic stability control (DSC). This manual refers to these systems as ABS. DSC is specified when necessary.

Antilock brake system (ABS)

The electronically controlled antilock brake system (ABS) maintains vehicle stability and control during emergency braking by preventing wheel lock-up. ABS provides optimum deceleration and stability during adverse conditions. It automatically adjusts brake system hydraulic pressure at each wheel to prevent wheel lock-up.

Dynamic stability control (DSC)

DSC works in conjunction with ABS and the engine management system to enhance vehicle control. The main DSC function is to maintain contact between the tires and the road surface under all driving conditions. This is achieved through exact application and management of braking and drivetrain forces.

DSC is active throughout the driving range, helping to stabilize the vehicle in cornering and avoidance maneuvers by adjusting engine controls such as throttle, ignition, fuel injection and the application of brake pressure individually to the wheels.

The DSC control module uses various inputs to determine vehicle instability during braking, cornering, or reduced traction situations. Based upon these inputs the ABS / DSC control module sends outputs to the engine control module and the ABS / DSC hydraulic unit to activate torque reduction protocols and braking intervention.

The ABS / DSC control module, operating through the hydraulic unit, modulates braking force at the wheels. In addition, DSC overrides throttle opening to reduce engine torque and maintain vehicle traction. Because throttle is controlled electronically, the driver cannot increase engine power output during DSC intervention regardless of how far the accelerator pedal is pushed.

Traction control also comes into operation during deceleration. Decelerating on snowy or icy road surfaces can lead to rear wheel slip. If a rear wheel starts to drag or lock up, DSC can limit the problem by adjusting throttle, fuel injection and ignition timing.

◀ DSC can be toggled ON and OFF by a switch labeled DSC or DTC in the center console switching center. Turning DSC OFF does not disable ABS functions.



Bus systems and traction control

Serial bus systems connect the engine control module (ECM), transmission control module (TCM), ABS / DSC control module, active steering control module, active stabilizer (dynamic drive) control module, longitudinal management system (LDM) and active cruise control (ACC). Bus systems allow control modules to share sensor information and other electronic data. See **600 Electrical System-General** for additional details.

DSC acceleration sensor

The DSC acceleration sensor utilizes two yaw rate sensor elements to detect yaw (rotation about the vertical axis) rate and lateral acceleration (G-force) rate.

- For rotational acceleration (yaw), the sensor produces a reference signal and a linear voltage signal. The sensor also produces a linear voltage signal for lateral acceleration. The DSC control module uses this input to determine rotational and side forces acting on the vehicle.

Steering angle sensor

- The steering angle sensor is located in the steering column switch cluster (SZL). It optically measures the angle of rotation of the steering wheel to determine steering angle and rate of steering.

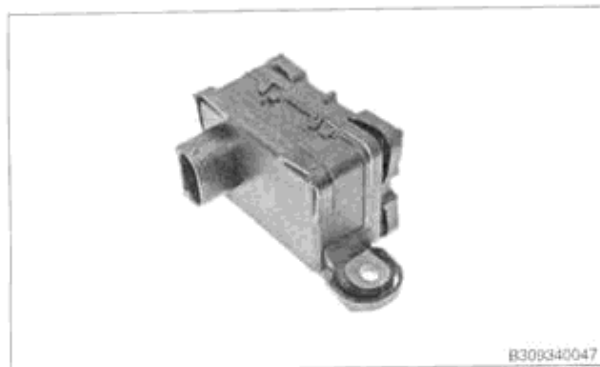
After repairs to the steering or suspension system, use a BMW scan tool or equivalent to calibrate the sensor. Once calibration is complete, the sensor sends an identification number over the CAN-bus to the DSC control module. The ID confirms that the sensor is calibrated correctly.

DSC control module logic checks the plausibility of the steering angle sensor signal against other inputs such as wheel speeds and acceleration inputs.

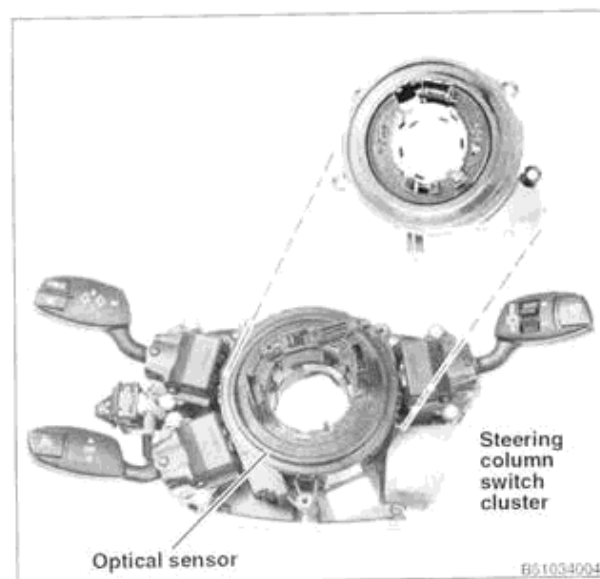
If battery voltage is interrupted, steering wheel angle of rotation is recalculated by the DSC control module evaluating wheel speeds. If replacing steering angle sensor, remember to recalibrate sensor.

Wheel speed sensors

- A wheel speed sensor (A) is mounted at each wheel along with a ring of magnets (B) used to measure direction of wheel rotation and speed. The electrical resistance of the wheel speed sensor changes under the influence of the magnetic field. Each increment generates 2 pulses in the wheel speed sensor (96 pulses / revolution of wheel). When the vehicle is stationary the sensor sends one pulse every 0.75 second.

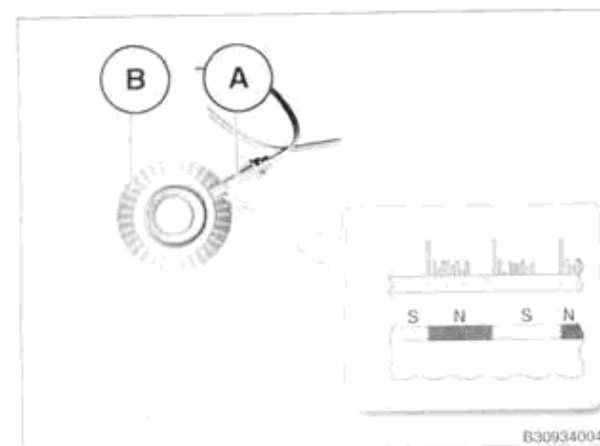


B309340047



Optical sensor

B510340040



B309340049

DSC and xDrive

xDrive (all-wheel drive system) uses information from the DSC system to control a multi-plate clutch in the transfer case. The multi-plate clutch varies torque split between front and rear wheels.

xDrive calculates the necessary torque split from information supplied by DSC:

- Accelerator pedal position
- Engine torque
- Dynamic state of vehicle (drive dynamic state)

DSC COMPONENTS AND REPAIRS

CAUTION—

- If the tires on the car are of different makes, the DSC system may overreact. Only fit tires of the same make and tread pattern.
- In adverse conditions, such as trying to rock the car out of deep snow or other soft surface, or when snow chains are fitted, switch traction control OFF and allow the car driveline to operate conventionally.

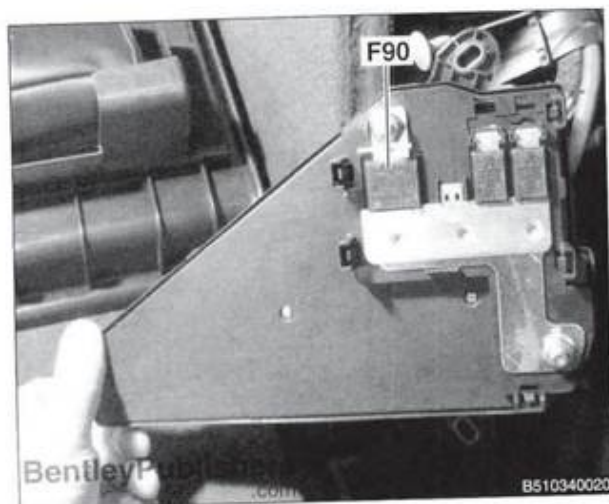
DSC faults

DSC systems are self-diagnosing and store fault codes (diagnostic trouble codes or DTCs) in the DSC control module. For information on how to access DTCs, see **020 Maintenance**.

ABS / DSC components are coded to each other and to the vehicle using BMW scan tool. If you do not have access to a scan tool, be sure to have newly installed ABS / DSC components coded at a qualified BMW workshop with the correct equipment.

- ◀ The driver is alerted to DSC faults by a warning icon and a Check Control warning triangle in instrument cluster. A gong also sounds.



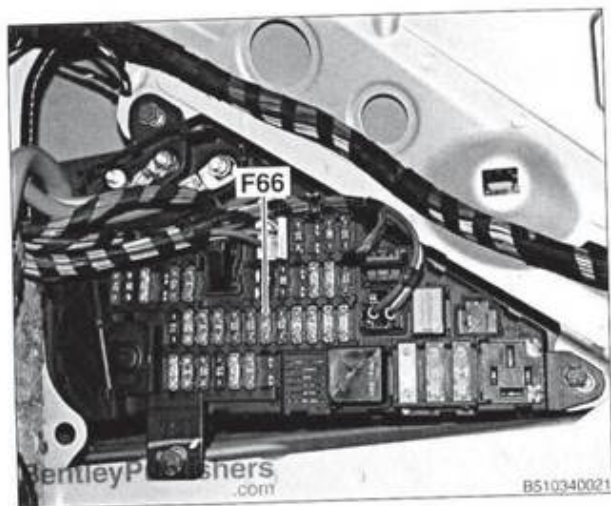


DSC power supply

See **ECL Electrical Component Locations** for fuse panel access information.

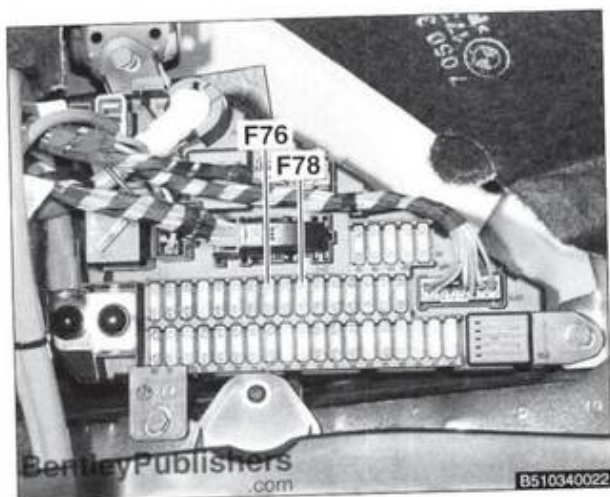
- Fusible links in back of rear fuse panel, right rear trunk or cargo compartment:

- **F90 200A:** Supplies power to fuses F1 - F33



- Rear fuse panel, right rear trunk or cargo compartment, to 09 / 2005:

- **F66 5A:** DSC control module

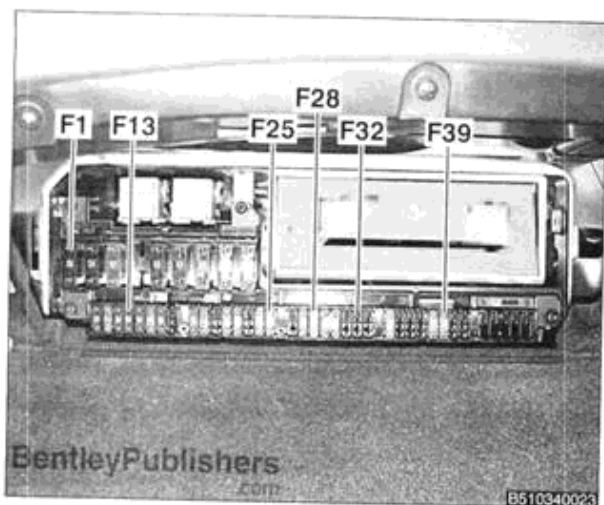


- Rear fuse panel, right rear trunk or cargo compartment, from 09 / 2005:

- **F76 10A:** Active stabilizer (dynamic drive)
- **F78 5A:** DSC control module, transfer case

340-28 Brakes

DSC controls



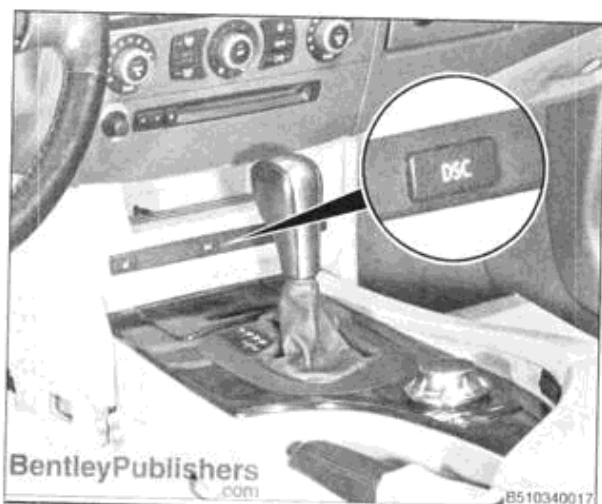
Front fuse panel, behind glove compartment:

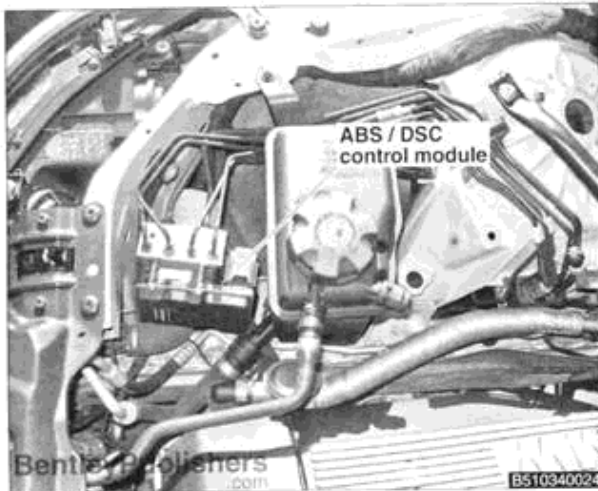
- F1 50A: DSC control module
- F13 30A: Transfer case
- F25 30A: DSC control module
- F28 20A: Steering column switch cluster (SZL)
- F32 10A: Active stabilizer (dynamic drive)
- F39 5A: Steering column switch cluster (SZL)

DSC controls

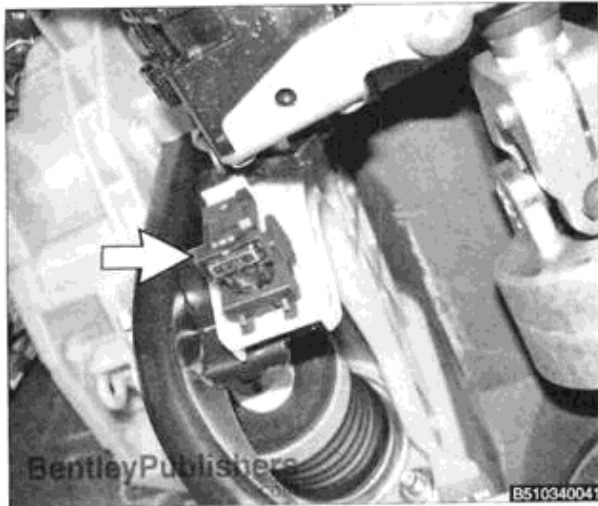
Lower center dashboard above center console:

- DSC (dynamic stability control) switch
- DTC (dynamic traction control) switch





- Right front engine compartment:
- A65 ABS / DSC control module

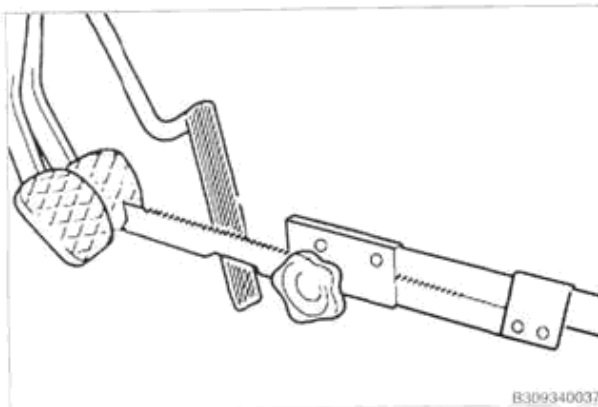


- Above brake pedal, underneath left side dashboard (arrow):
- S29 Brake light switch

DSC control module, removing and installing

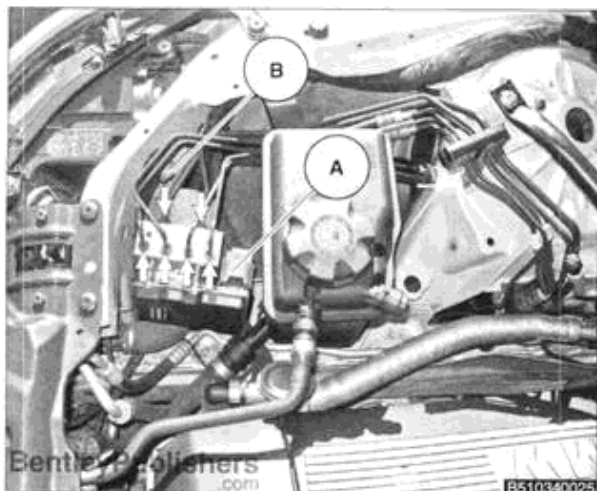
DSC electronic control module and DSC hydraulic unit are combined in one assembly in right front engine compartment.

- Use BMW scan tool to read out and record DSC control module fault memory.
- Using a syringe, remove brake fluid from master cylinder reservoir.
- Insert pedal prop and depress brake pedal slightly. This prevents brake fluid from escaping when brake lines are detached.



340-30 Brakes

Wheel speed sensor, replacing



Working at DSC module:

- Mark brake line positions (**arrows**) at hydraulic unit. Detach brake lines. Be prepared to catch dripping fluid. Plug open ports and lines.
- Disconnect electronic module electrical connector (**A**).
- Remove control module bracket mounting bolt (**B**). Lift module out of engine compartment.

CAUTION—

- Do not bend brake lines.

- Installation is reverse of removal.

Tightening torques

Brake fluid line to master cylinder (M10 x 1 or M12 x 1 union nut)	17 Nm (13 ft-lb)
--	------------------

- Bleed brake system. See **Brake system, bleeding** in this repair group.
- Use BMW scan tool to:
 - Code DSC module.
 - Adjust steering angle sensor.
 - Adjust brake pressure sensor.
 - Adjust acceleration sensors.

Wheel speed sensor, replacing

- Raise car and support safely.

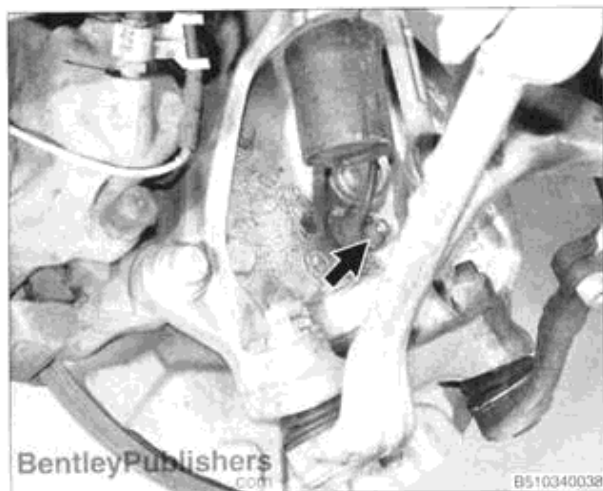
WARNING—

- Make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.

Front wheel speed sensor

- Working in junction box in wheel housing, separate wheel speed sensor electrical harness (**arrow**). (Left front junction box illustrated. Right front contains single harness connector.)



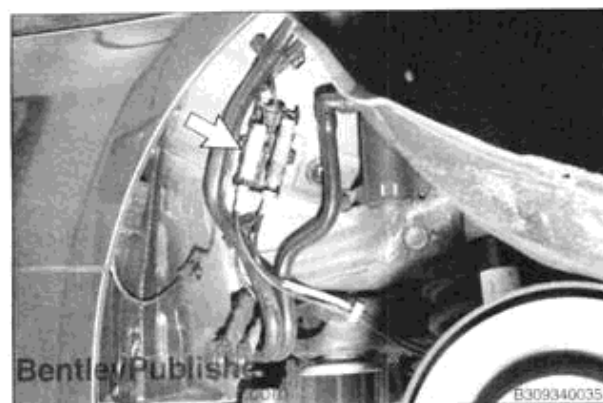


- Unscrew sensor mounting bolt (**arrow**) at steering knuckle and remove sensor.

- Installation is reverse of removal. Apply thin coat of Staburags®NBU 12/K or equivalent grease to speed sensor and housing.

Tightening torque

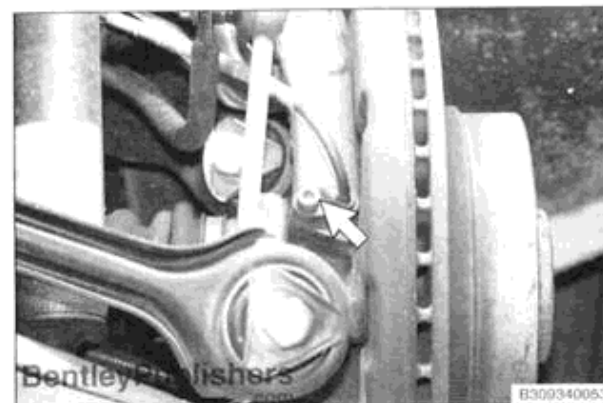
ABS wheel speed sensor to steering knuckle	8 Nm (6 ft-lb)
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Rear wheel speed sensor

- Remove rear wheel well housing liner. See **410 Fenders, Engine Hood**.

- Working in junction box in wheel housing, separate wheel speed sensor electrical harness (**arrow**).



- Unscrew sensor mounting bolt (**arrow**) in rear wheel bearing carrier.

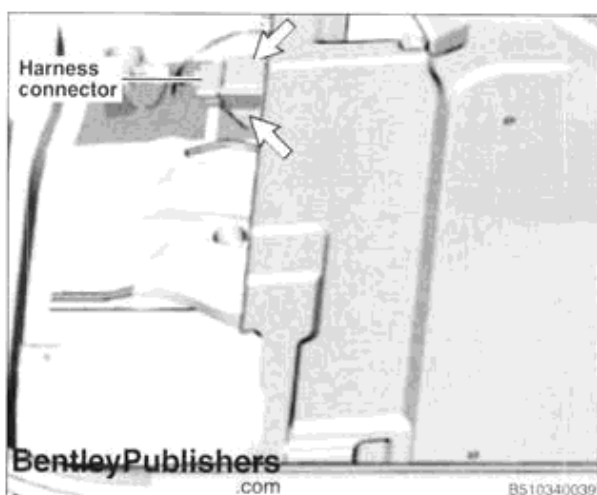
- Installation is reverse of removal. Apply thin coat of Staburags®NBU 12/K or equivalent grease to speed sensor and housing.

Tightening torque

ABS wheel speed sensor to rear wheel bearing carrier	8 Nm (6 ft-lb)
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340-32 Brakes

ABS impulse wheel



ABS impulse wheel

The front and rear ABS impulse wheels are integral with the inner wheel bearing seal and not available as separate parts. See **310 Front Suspension** or **330 Rear Suspension** for wheel bearing replacement procedures.

DSC acceleration sensor, removing and installing

- Remove right front seat. See **520 Seats**.
- Remove right door sill trim. See **513 Interior Trim**.
- Fold right front carpet, lay aside and remove carpet underlay.



Working at sensor:

- Detach electrical sensor.
- Remove mounting screws (**arrows**) and lift out sensor.

- Installation is reverse of removal.

CAUTION—

- Be sure to tighten the DSC acceleration sensor to specified torques. The sensor is vibration sensitive and causes DSC malfunctions if installed improperly.

Tightening torque

DSC acceleration sensor to body	8 Nm (6 ft-lb)
---------------------------------	----------------

- Program using BMW scan tool.

Steering angle sensor

The steering angle sensor is integral with the steering column switch cluster (SZL). For more information, including removal and installation of the SZL, see **612 Switches**.

- To reset steering angle sensor, connect vehicle to BMW scan tool and carry out steering angle sensor adjustment system function.

