

2003-05 BRAKES**Brakes - Repair Procedures - Z4/E85****BRAKES TESTING AND BLEEDING****34 00... GENERAL INFORMATION**

The brake system is one of the most important safety systems on any motor vehicle. It is therefore essential to act with utmost care when working on the brake system and to follow the instructions below.

General:

- Ensure cleanliness and only use rags which do not lose lint.
- Wash away or vacuum up brake dust, do not clear it away using compressed air. This dust is a health hazard.
- Do not under any circumstances allow any oil or grease to get into the brake system. This would result in a complete malfunction of the brake system.
- When cleaning brake components with brake cleaner, do not allow brake cleaner to get into in the brake system.
- Even the most minute traces of brake cleaner must be avoided.

Brake fluid:

- Replace brake fluid at least every two years.
- Never re-use drained brake fluid.
- Always use BMW-approved brake fluid, refer to **OPERATING FLUIDS - BRAKES** .
- Dispose of brake fluid in approved appliances only.
- Do not allow brake fluid to drain into drain pipes, into the outside environment or into unsuitable facilities. This would create the risk of groundwater contamination since brake fluid is classed as a fluid that is hazardous to water.
- Do not allow brake fluid to come into contact with paintwork as this will destroy the paint.
- Brake fluid must not be allowed to remain on bare skin too long in order to avoid skin problems. Wash skin coated with brake fluid with water and soap.
- If brake fluid makes contact with eyes, immediately flush with large quantity of clean water and visit eye doctor.

Wheel brakes:

- Brake linings:

Brake linings must be replaced when the warning threshold of the brake lining wear indicator is reached.
See **BRAKES - TECHNICAL DATA** .

Brake linings must always be replaced on both sides of any axle.

The friction surfaces of the brake linings must not come into contact with oil or grease. The brake linings must be replaced if they are fouled by such substances.

In the case of rotation-dependent brake linings, make sure the arrow marking points in the direction of rotation of the brake disk for when the vehicle is moving forward.

Brake linings with left/right markings must be fitted on the relevant side of the vehicle.

One-sided angled areas on the brake linings must be located on the disk contact side of the brake caliper for when the vehicle is moving forward.

- Brake discs:

Brake disks must not be scored or cracked. Furthermore, minimum brake disk thickness, disk runout, parallelism and surface roughness of the friction surfaces must not exceed or drop below the permitted values. See **BRAKES - TECHNICAL DATA** .

Always strip preservative off new parts before installation. With the rear brake discs, also strip preservative off brake drum on parking brake.

- Always strip preservative off new parts before installation.
- Brake calipers:

Only approved pastes on the basis of glycine must be used for repairs on brake calipers.

All moving parts on the brake caliper must move freely: note grease specifications.

Use only BMW-approved lubricants to grease caliper guides. Refer to **OPERATING FLUIDS - BRAKES** .

Brake lines, brake hoses:

- Brake lines and brake hoses must be correctly routed and must not abut with body or components in a way which would cause chafing.
- To prevent damage, release and tighten brake line couplings with a special brake line wrench only.
- The system must be bled each time any brake lines have been detached.
- All connection points must be checked for leaks.
- Only tighten down brake hoses on the front axle when wheels are in straight-ahead position.
- Seal off open connections of brake lines and individual components to prevent dirt from getting into the brake system.
- When tightening down brake line couplings, observe tightening torque. For torque, see 34 32 1AZ in **BRAKES - TIGHTENING TORQUES** .

Wheel-slip control system:

The wheel-slip control system is essentially maintenance-free; however the following must be observed:

- When carrying out welding work with electric welding equipment, be sure to disconnect the plug from the electronic control unit (ignition turned off).
- During painting work, the control unit may be subjected for brief periods to loads of max. 95°C and for long periods (approx. 2 hours) to loads of max. 85°C.
- Terminals must be completely tight on end poles of battery.
- Brake lines on hydraulic unit must not be swapped over: if applicable, mark them prior to disassembly.

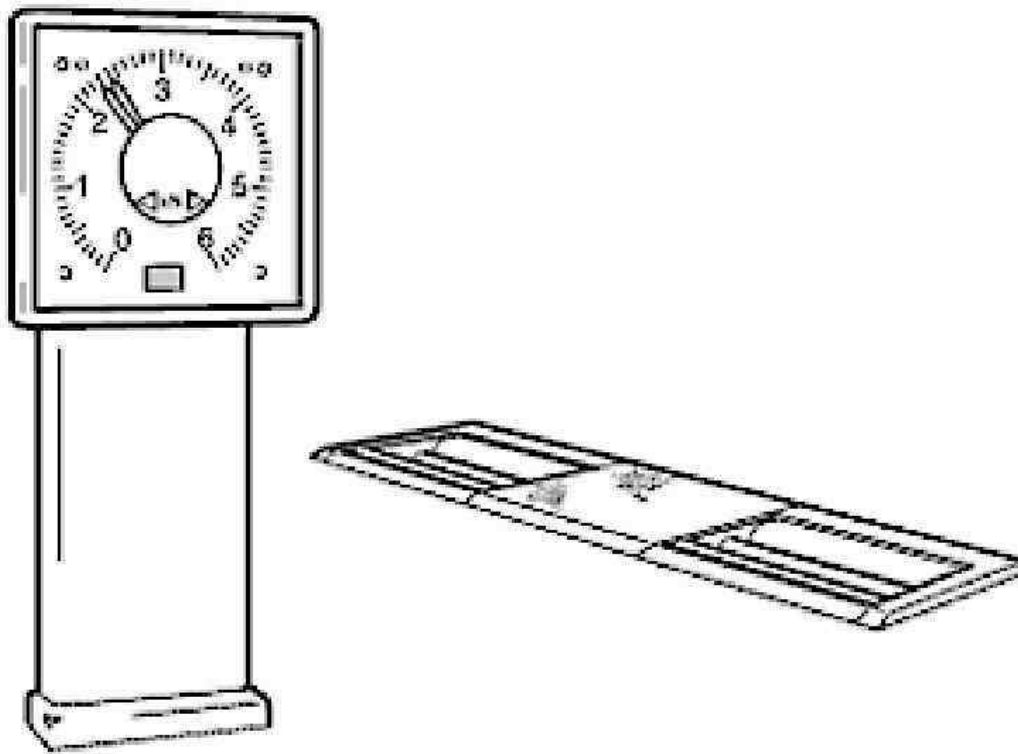
On completion of repair work, carry out swap-over test with the DIS diagnosis system.

34 00 009 CHECKING BRAKES ON TEST STAND**NOTE:**

- 1. Check tires for damage**
- 2. Check tire treads**
- 3. Check tire pressures**

In the case of vehicles with ASC+T or DSC, the system must be deactivated with the switch. The ASC+T / DSC indicator lamp in the instrument cluster must light up!

The brakes must be at normal operating temperature. To do so, gently warm up the brake disks/brake drums while dry by braking the vehicle several times.



G03297683

Fig. 1: View Of Brake Test Stand

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Use only dynamic brake analyzers whose test speed is LESS THAN EQUAL TO 5 km/h.

You must follow without fail the guidelines contained in the operating instructions of the relevant test stand manufacturer.

Failure to do so may result in damage to the vehicle and the system and also personal injury.

The maximum test duration for four-wheel drive vehicles is 3 minutes per axle! If it has to be repeated, it will be necessary in the meantime to drive the vehicle a distance of at least 1 km in order to achieve sufficient lubrication of the transfer case.

34 00 010 CHECKING THICKNESS OF BRAKE LINING

Special tools required:

- 34 1 260

NOTE: **The thickness of the outer brake linings can be determined without removing the wheels.**

If necessary, move car until opening for brake lining wear indicator (brake lining) can be seen through rim styling.

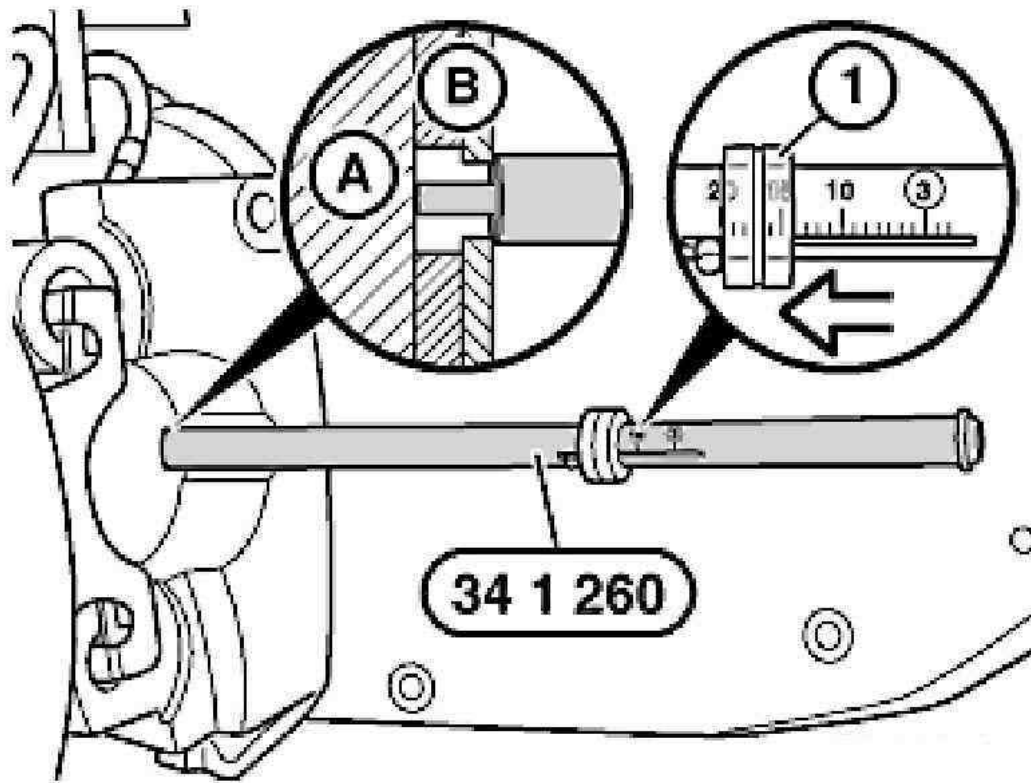
Insert special tool 34 1 260 through rim into opening for brake lining wear indicator.

Press special tool onto brake lining. Slide ring (1) in direction of arrow up to stop and read off measured value.

NOTE: **A. Brake disk**
 B. Brake lining with backplate

Safe limit for lining wear, front brake. See **BRAKES - TECHNICAL DATA** .

Safe limit for lining wear, rear brake. See **BRAKES - TECHNICAL DATA** .



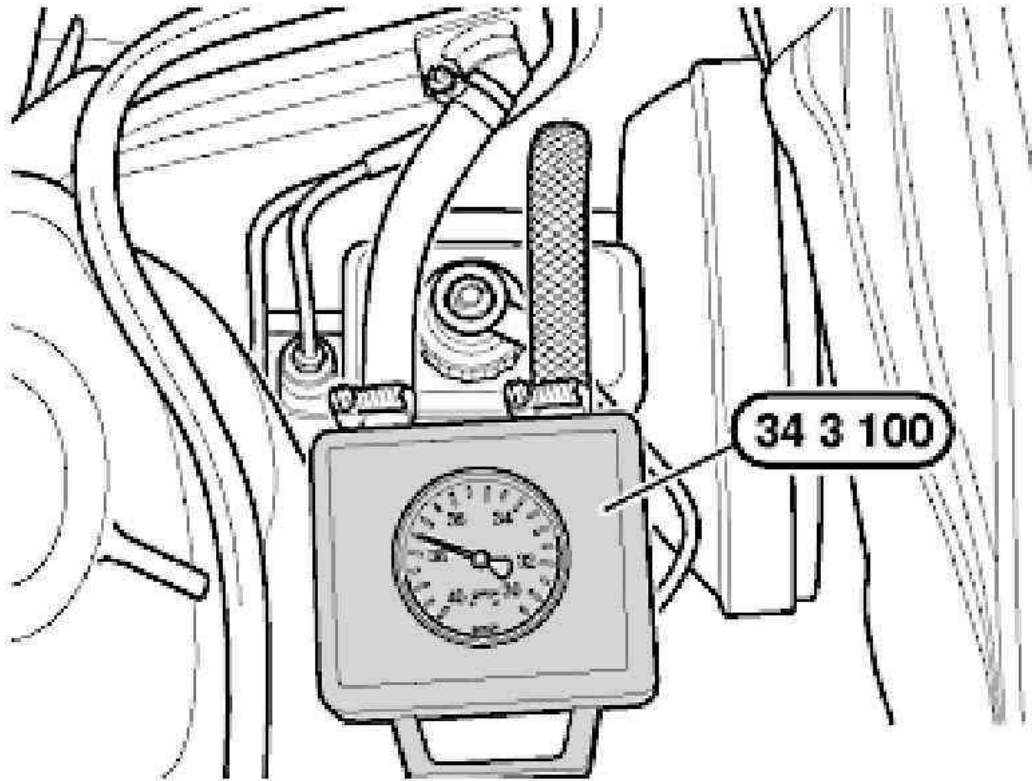
G03297684

Fig. 2: Inserting Special Tool 34 1 260 Through Rim Into Opening For Brake Lining Wear Indicator
Courtesy of BMW OF NORTH AMERICA, INC.

34 00 017 CHECKING BRAKE BOOSTER (LOW-PRESSURE TEST)

Special tools required:

- 34 3 100
 - Detach hose from connection piece. Install vacuum tester 34 3 100 between connection piece and vacuum hose of non-return valve.
 - Start engine.
 - Check buildup of partial vacuum.
 - Switch off engine.
 - Press the brake pedal to set a vacuum pressure of not more than 0.8 bar and wait for the value to stabilize.
 - When the brake pedal is not pressed, the vacuum pressure is permitted to drop over a test period of 1 minute by max. 0.06 bar.



G03297685

Fig. 3: Installing Vacuum Tester 34 3 100 Between Connection Piece And Vacuum Hose Of Non-Return Valve

Courtesy of BMW OF NORTH AMERICA, INC.

If specified values are not reached:

- Check line connections for vacuum seal.
- Replace vacuum non-return valve.
- Check seal between brake booster and brake master cylinder (sealing ring) for perfect condition and correct seating.
- If the specified values are not achieved when the test is repeated, you must replace the brake booster.

34 00 025 REPLACING FLUID IN ABS/ASC+T BRAKE SYSTEM

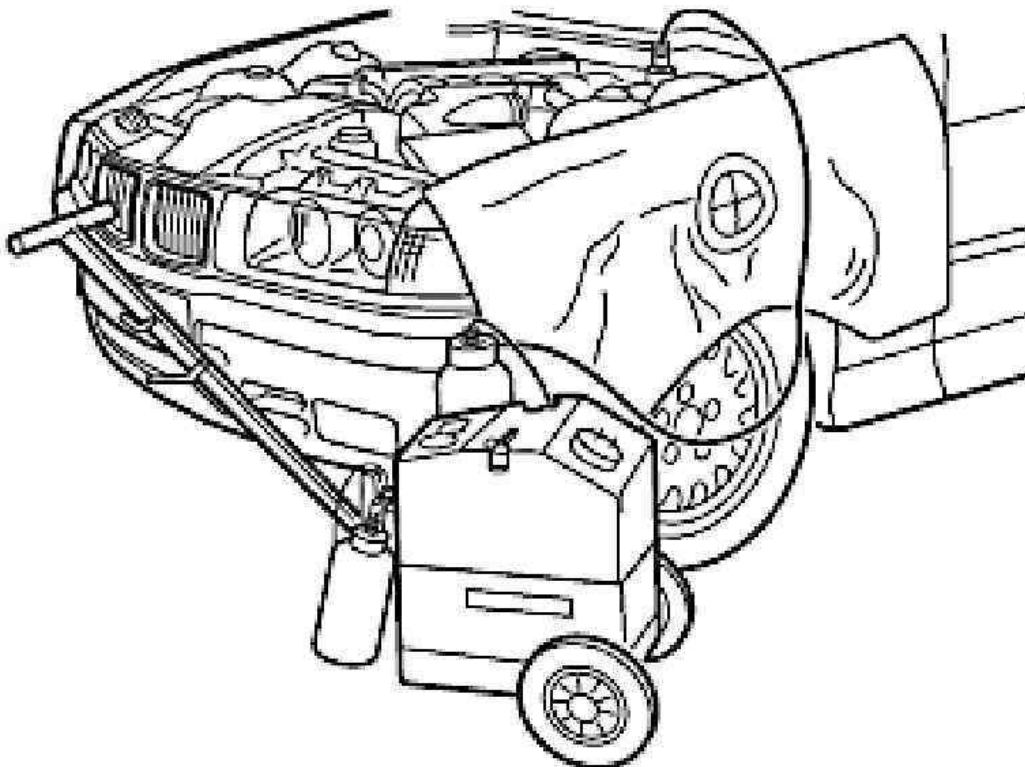
NOTE: Read and comply with General Information .

IMPORTANT: When carrying out repairs to the brake system, follow the procedure set out in

Bleeding Brake System With DSC .

Connect brake fluid changer to expansion tank and switch on.

NOTE: **Check relevant operating instructions for each device.
Charging pressure should not exceed 2 bar.**



G03297686

Fig. 4: Connecting Brake Fluid Changer To Expansion Tank
Courtesy of BMW OF NORTH AMERICA, INC.

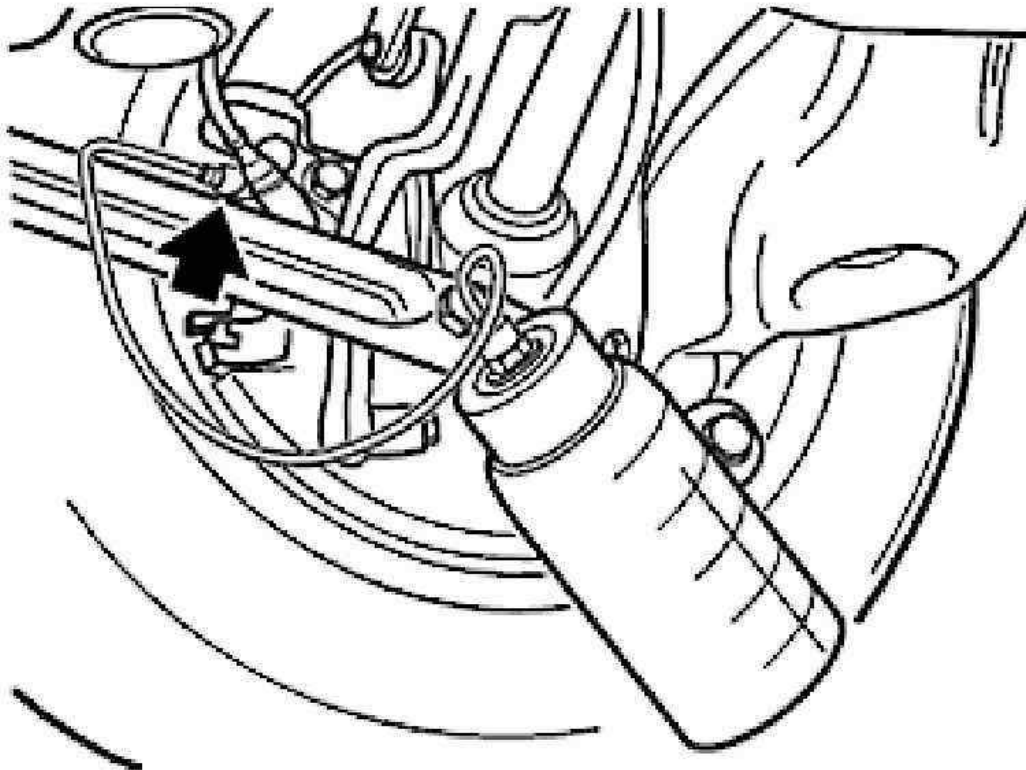
Flushing Brake System Completely

Connect bleeder hose with collecting tray to bleeder valve on rear right brake caliper.

Open bleeder valve and purge until clear, bubble-free brake fluid emerges.

Close bleed valve.

Follow same procedure on rear left, front right and front left wheel brake.



G03297687

Fig. 5: Connecting Bleeder Hose With Collecting Tray To Bleeder Valve On Rear Right Brake Caliper
Courtesy of BMW OF NORTH AMERICA, INC.

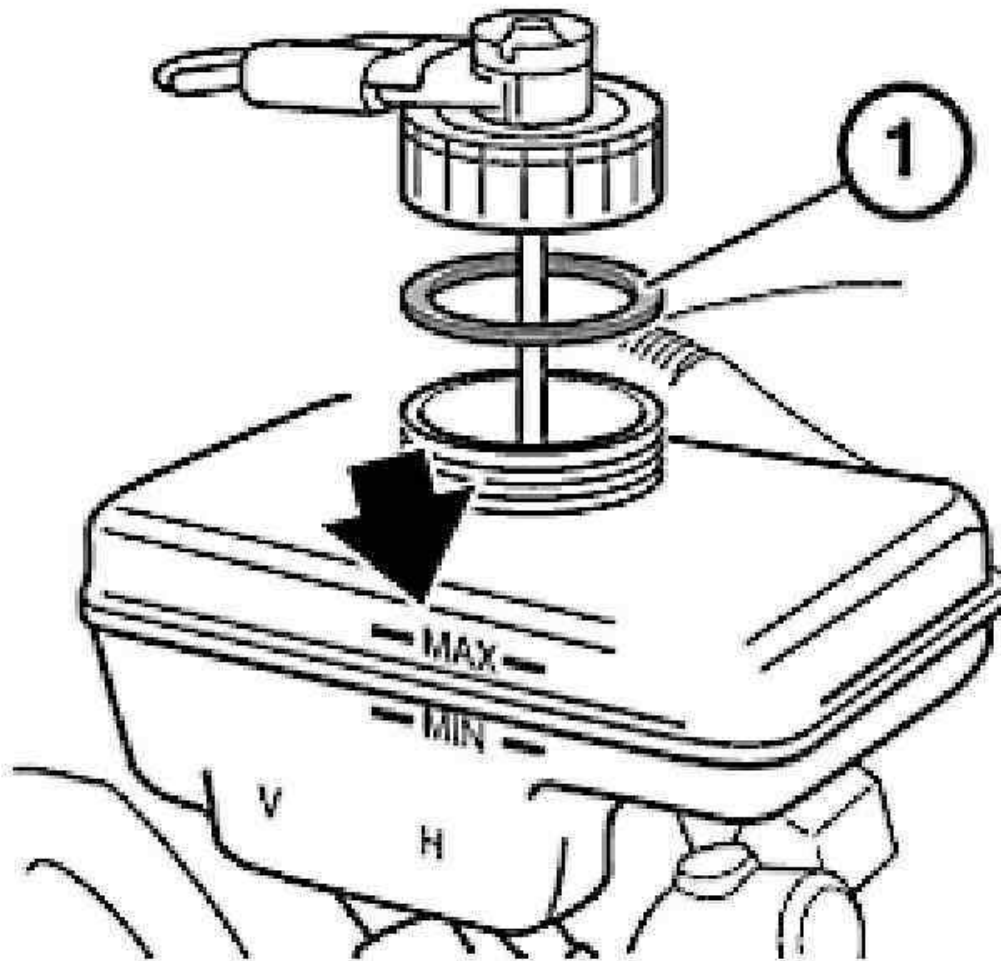
The clutch slave cylinder must also be scavenged in vehicles with manual transmissions.

Switch off brake fluid changer and remove from expansion tank.

Check brake fluid level.

Close expansion tank.

NOTE: Pay attention to rubber seal (1) in sealing cap.



G03297688

Fig. 6: Identifying Fluid Level Marks On Expansion Tank
Courtesy of BMW OF NORTH AMERICA, INC.

34 00 050 BLEEDING BRAKE SYSTEM WITH DSC

NOTE: Read and comply with General Information .
When replacing or repairing, observe the filling and bleeding instructions for the following parts:

1. Tandem brake master cylinder
2. Hydraulic unit DSC3

- 3. and components/connecting lines which are fitted between these assemblies.**

After work has been completed on the precharging pump, only the front-axle brake circuit has to be bled. Activate precharging pump once with Diagnosis and Information System (DIS).

(Brake fluid changer connected to max. 2 bar filling pressure).

After completing work: Carry out final check with DIS under menu item "Service functions".

Contrary to the instructions in the DIS, the bleeding routine must be restarted on each wheel.

A second person is needed to help carry out this work.

Connect DIS.

Call up service function "Bleeding ABS/DSC3 Hydraulics".

Connect brake fluid changer to expansion tank and switch on.

**NOTE: Check relevant Operating Instructions for each device.
Charging pressure should not exceed 2 bar.**

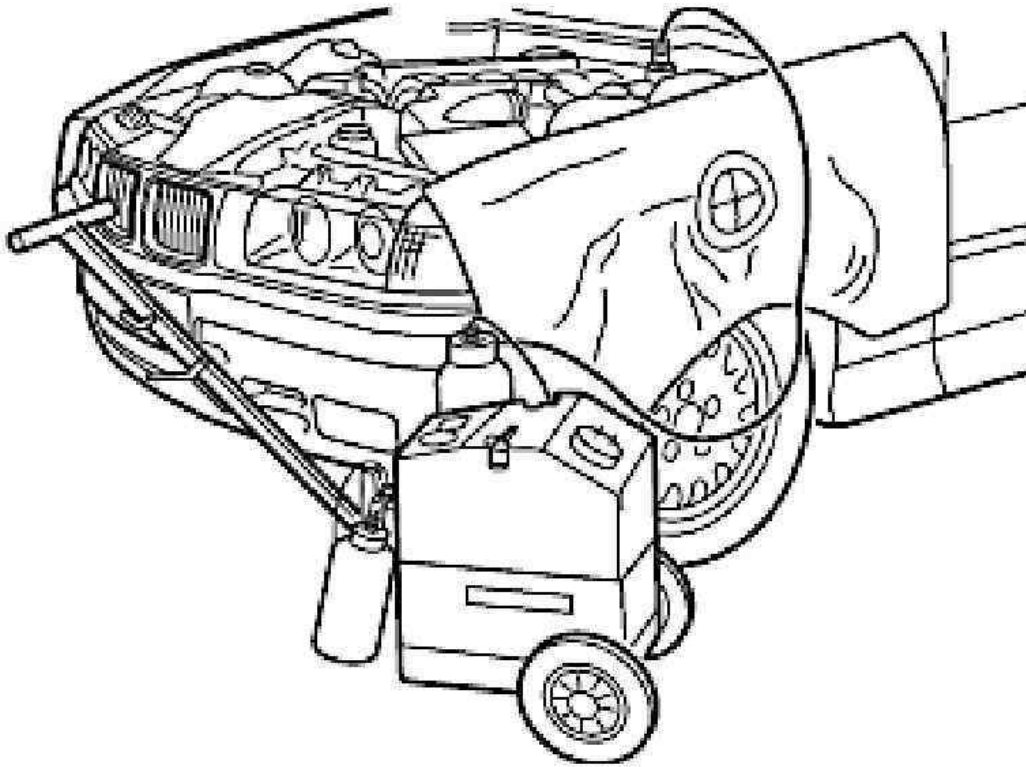
**G03297689**

Fig. 7: Connecting Brake Fluid Changer To Expansion Tank
Courtesy of BMW OF NORTH AMERICA, INC.

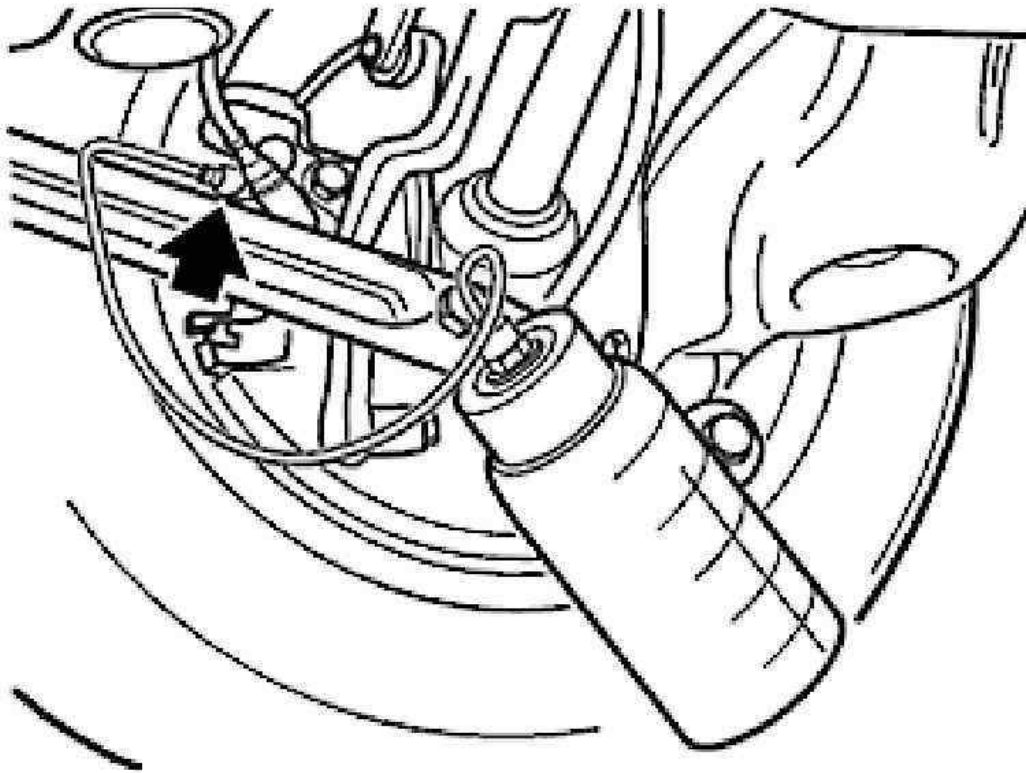
Flushing Brake System Completely

Connect bleeder hose with collecting tray to bleeder valve on rear right brake caliper.

Open bleeder valve and purge until clear, bubble-free brake fluid emerges.

Close bleed valve.

Follow same procedure on rear left, front right and front left wheel brake.



G03297690

Fig. 8: Connecting Bleeder Hose With Collecting Tray To Bleeder Valve On Rear Right Brake Caliper
Courtesy of BMW OF NORTH AMERICA, INC.

Bleeding Rear-Axle Brake Circuit

Connect bleeder hose with collecting tray to bleeder valve on rear right brake caliper.

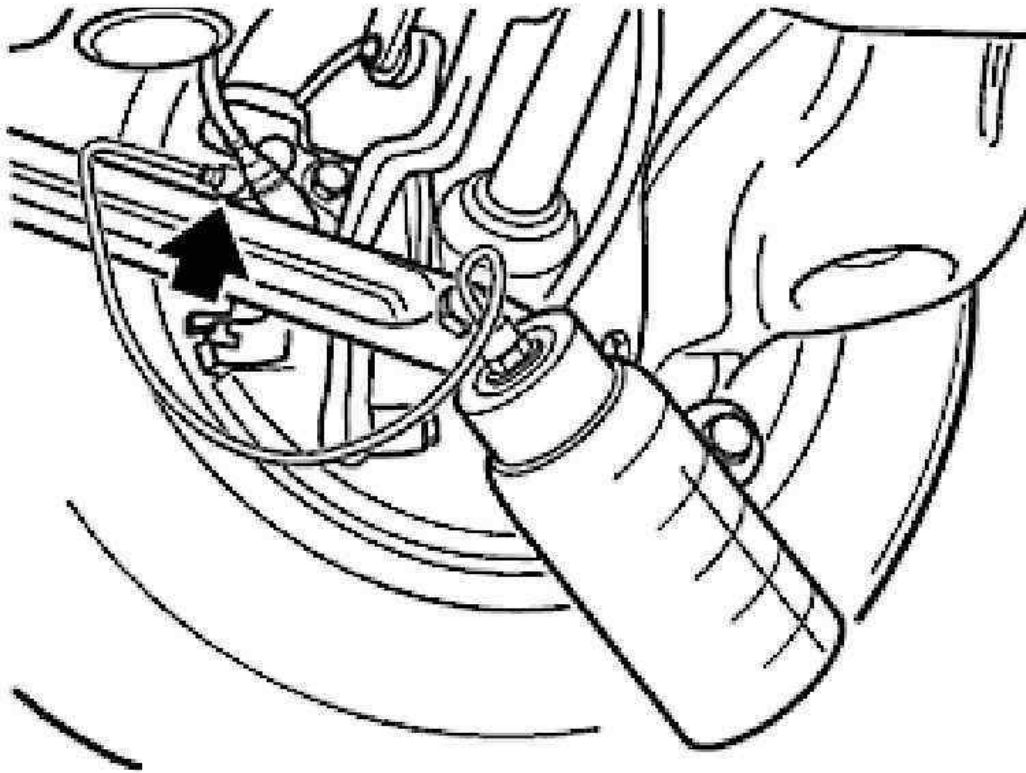
Close bleeder valve.

Run bleeding routine with DIS with bleeder valve open.

After completing routine, press brake pedal 5 times to floor; clear and bubble-free brake fluid must flow out.

Close bleed valve.

Repeat procedure at rear left.



G03297691

Fig. 9: Connecting Bleeder Hose With Collecting Tray To Bleeder Valve On Rear Left Brake Caliper
Courtesy of BMW OF NORTH AMERICA, INC.

Bleeding Front-Axle Brake Circuit

Connect bleeder hose with collecting tray to bleeder valve on front right brake caliper.

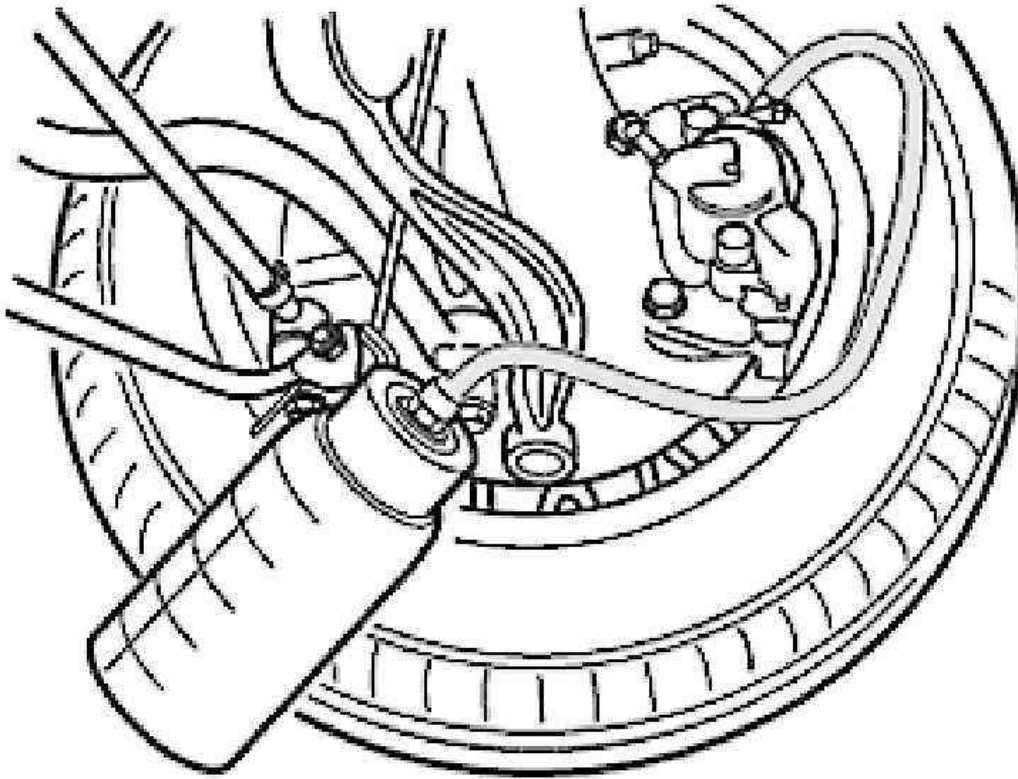
Close bleeder valve.

Run bleeding routine with DIS with bleeder valve open.

After completing routine, press brake pedal 5 times to floor, clear and bubble-free brake fluid must flow out.

Close bleed valve.

Repeat procedure at front left.



G03297692

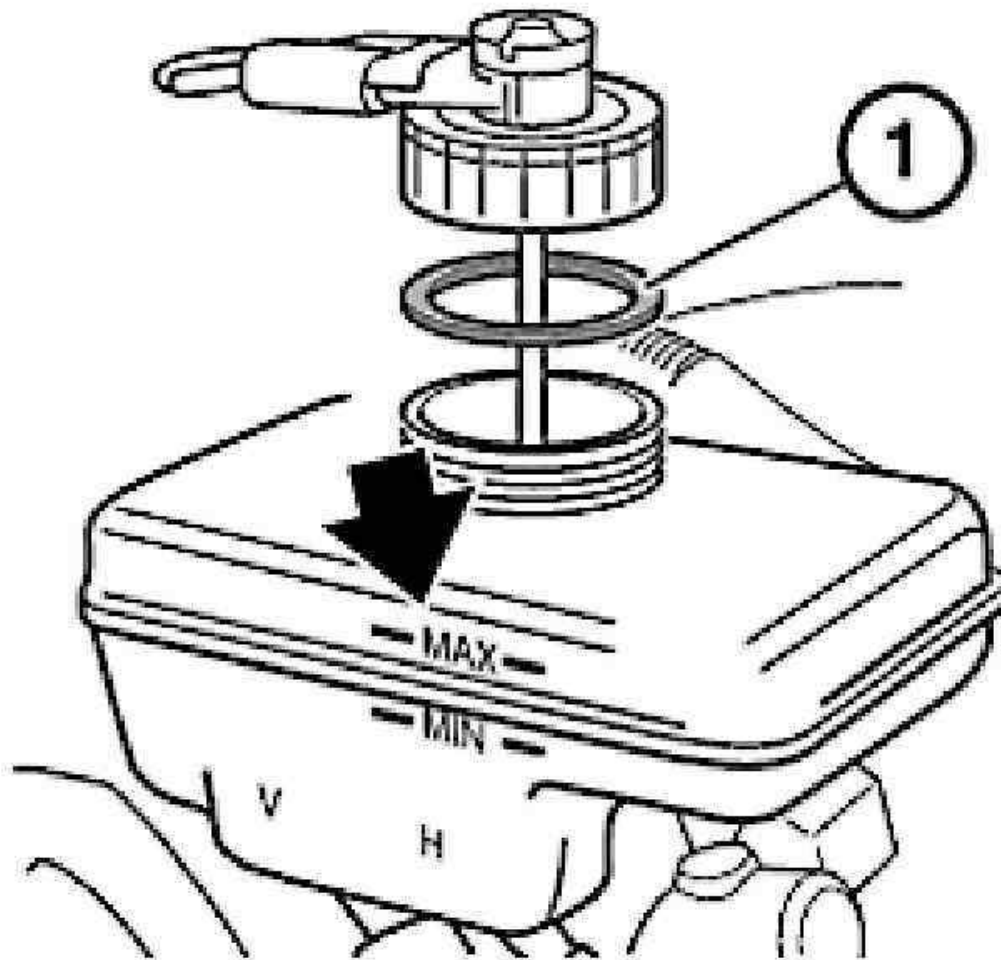
Fig. 10: Connecting Bleeder Hose With Collecting Tray To Bleeder Valve On Front Right Brake Caliper
Courtesy of BMW OF NORTH AMERICA, INC.

Switch off brake fluid changer and remove from expansion tank.

Check brake fluid level.

Close expansion tank.

NOTE: Pay attention to rubber seal (1) in sealing cap.



G03297693

Fig. 11: Identifying Brake Fluid Level Marks On Expansion Tank
Courtesy of BMW OF NORTH AMERICA, INC.

34 00 519 CHECKING SERVICE BRAKE: HIGH- AND LOW PRESSURE TESTS

IMPORTANT: The high/low-pressure test (leakage test) must be carried out with the engine switched off.

Observe safety instructions on raising the vehicle. See **00..... LIFTING VEHICLE WITH A LIFTING PLATFORM**.

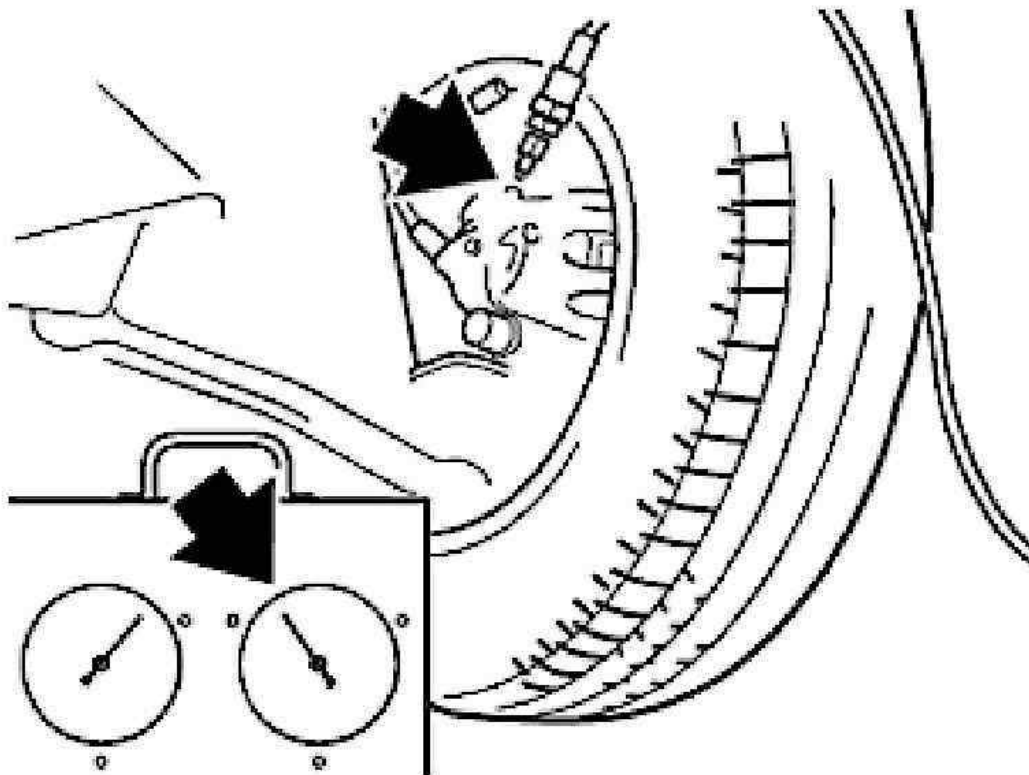
High-pressure test (leakage test):

Perform test on both brake circuits.

1st brake circuit, front axle.

2nd brake circuit, rear axle

Remove bleeder screw, connect pressure tester and bleed.



G03297694

Fig. 12: Connecting Pressure Tester

Courtesy of BMW OF NORTH AMERICA, INC.

Load brake pedal with a force and block brake pedal with pedal support, see **BRAKES - TECHNICAL DATA** .

After 2 minutes, pressure is permitted to drop by max. 8 %.

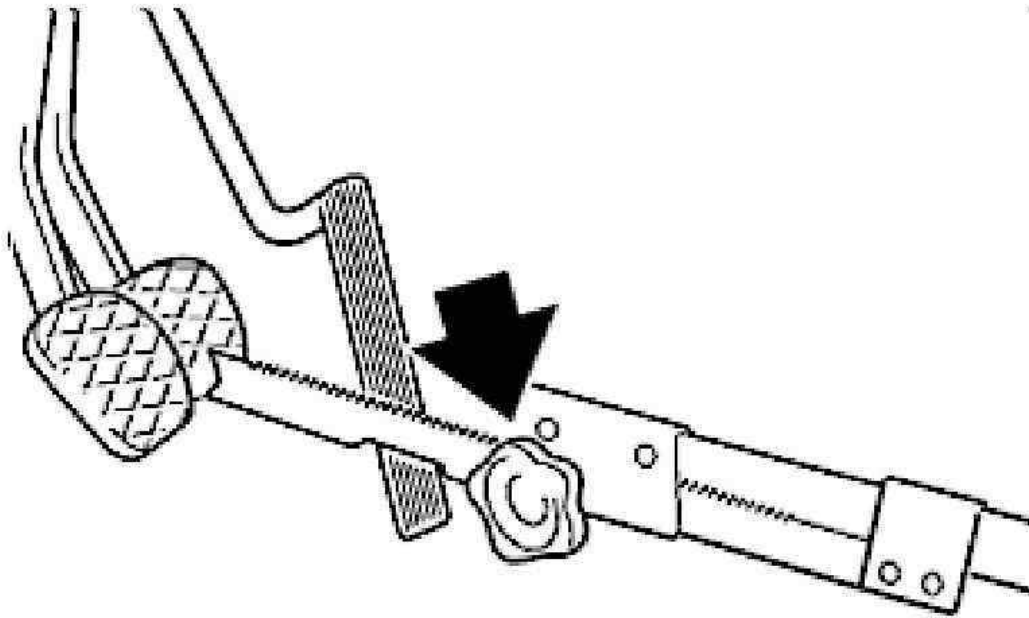
**G03297695**

Fig. 13: Identifying Brake Pedal With Pedal Support
Courtesy of BMW OF NORTH AMERICA, INC.

Low-pressure test:

Perform test on both brake circuits.

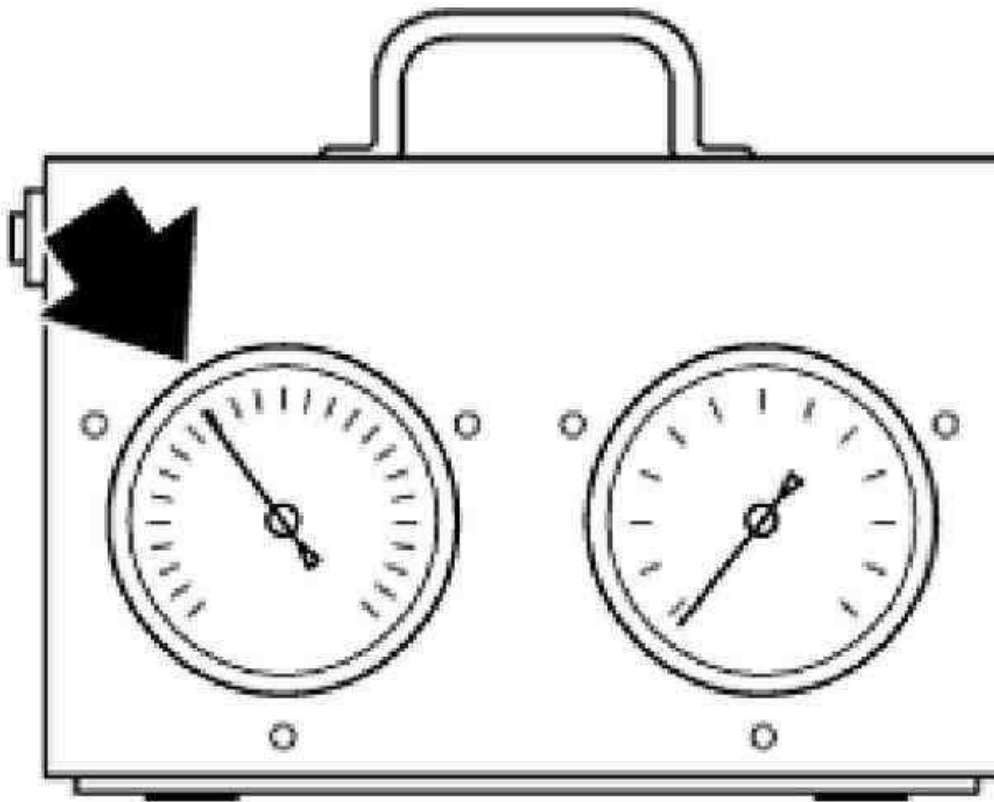
Reset pedal support until test pressure in braking system is 2... 5 bar.

Vehicle and measuring apparatus must remain steady as vibrations will distort the result.

Pressure must remain constant for a test period of 5 minutes.

Check all rubber parts in case of excessive pressure drop.

Bleed brake calipers and wheel brake cylinders after finishing test.

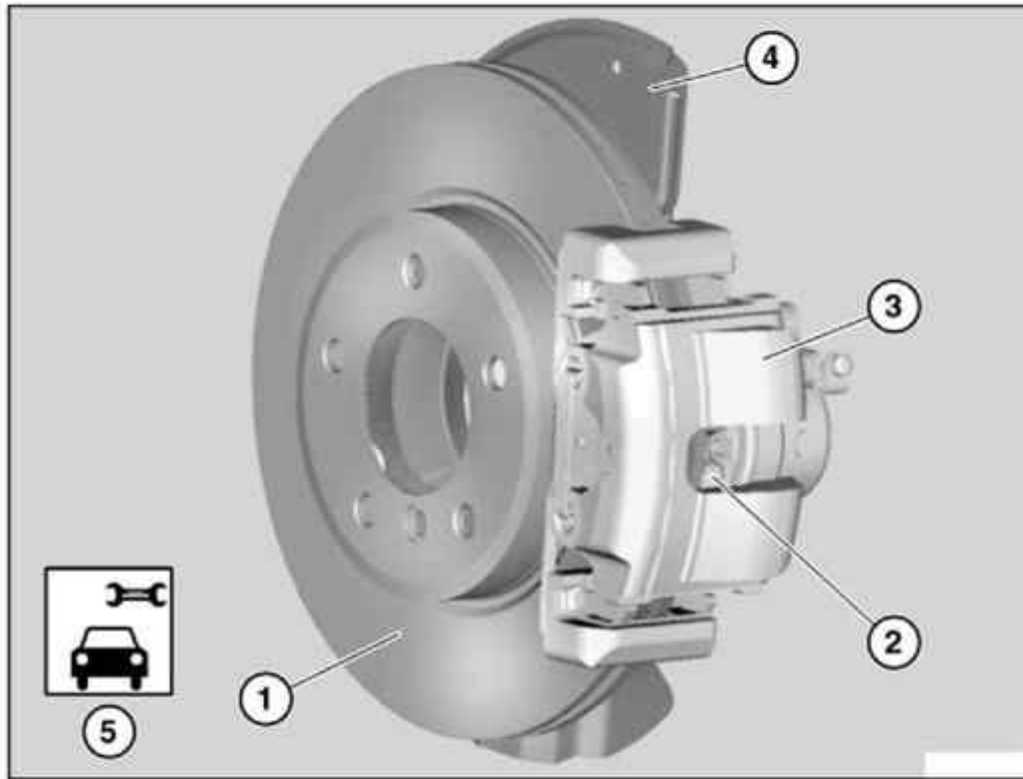


G03297696

Fig. 14: Identifying Pressure On Brake Tester
Courtesy of BMW OF NORTH AMERICA, INC.

FRONT BRAKES

34 11... OVERVIEW OF FRONT BRAKES

1 Brake disk2 Brake pad3 Brake caliper4 Brake guard plate5 Checking thickness of brake lining

G03297697

Fig. 15: Identifying Front Brake Components

Courtesy of BMW OF NORTH AMERICA, INC.

34 11 000 REMOVING AND INSTALLING/REPLACING BRAKE LININGS OF BOTH FRONT DISK BRAKES

NOTE: After completing the tasks, press brake pedal several times to the floor so that brake linings contact brake disks.
When installing new brake linings on front and rear axles, check brake fluid level; top up to "MAX" marking if necessary.

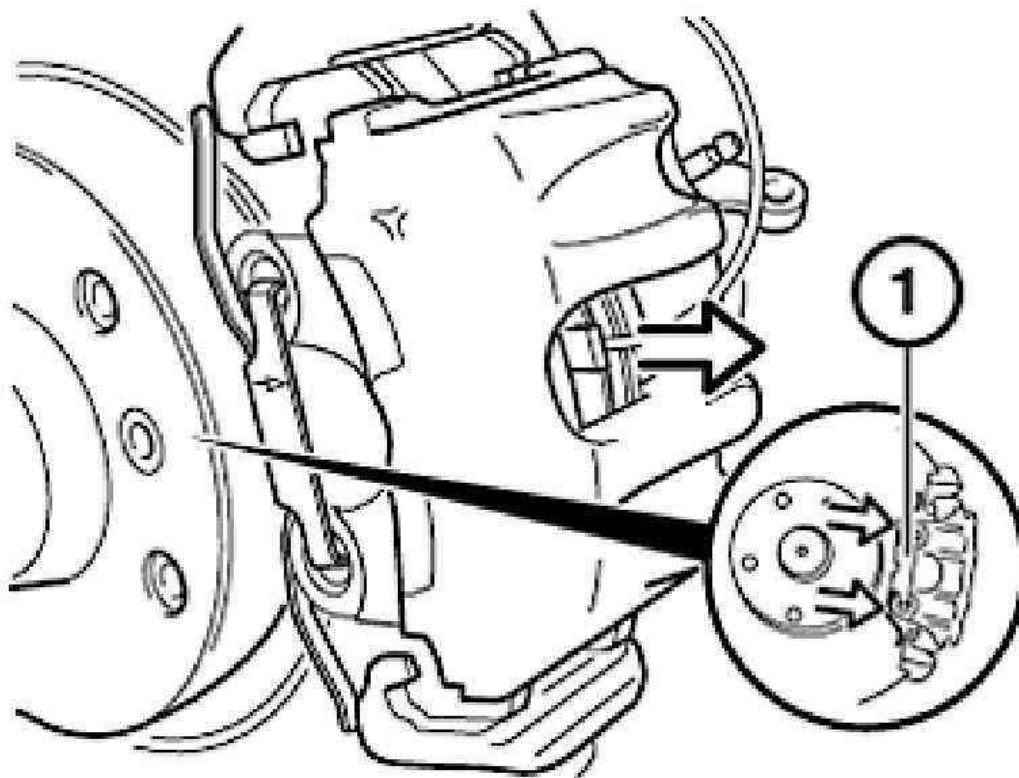
Remove wheels. See WHEEL AND TIRES - REPAIR INSTRUCTIONS .

Lift out retaining spring (1).

Left:

Disconnect plug connection for brake lining wear sensor.

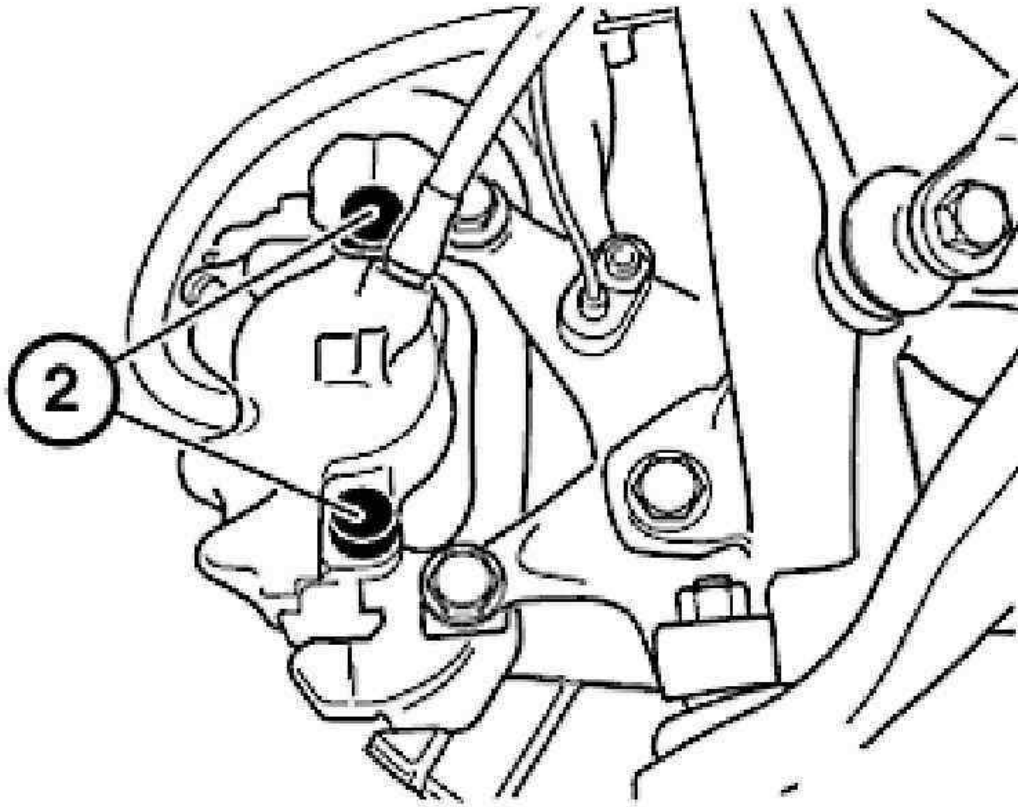
If necessary, replace **Brake Lining Wear Sensor** .



G03297698

Fig. 16: Lifting Out Retaining Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Remove plastic plugs (2).



G03297699

Fig. 17: Removing Plastic Plugs**Courtesy of BMW OF NORTH AMERICA, INC.**

Unfasten guide screws (1) and lift out brake caliper towards rear of vehicle. Do not allow brake caliper to hang from brake hose, risk of damage to brake hose.

Installation:

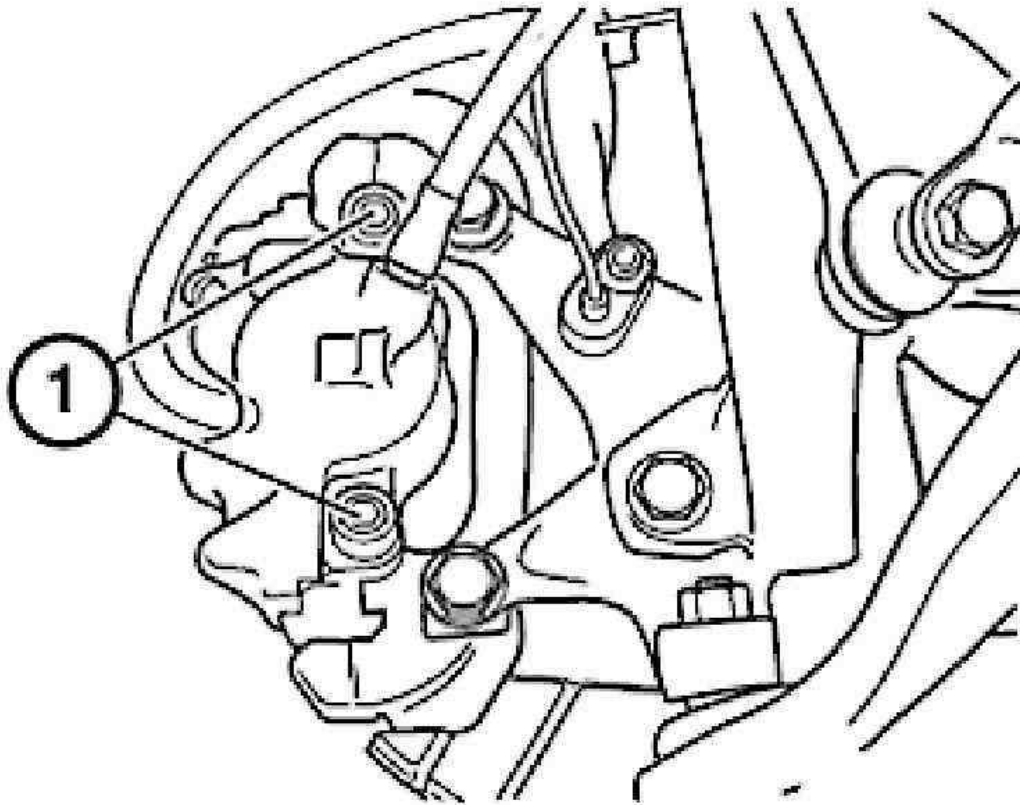
Only clean guide screws; do not grease.

Check threads.

Replace all guide screws which are not in perfect condition.

Installation:

Tightening torque, see 34 11 3AZ in **BRAKES - TIGHTENING TORQUES** .



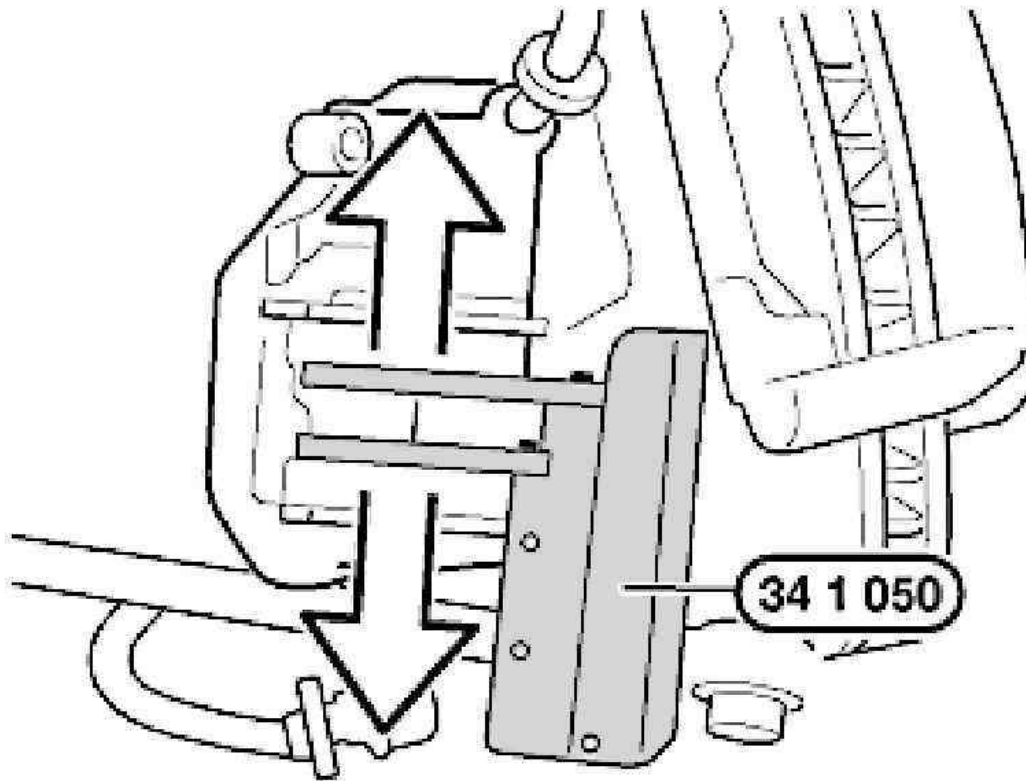
G03297700

Fig. 18: Identifying Guide Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Turn piston fully back with special tool 34 1 050.

IMPORTANT: When turning back the piston, watch the brake-fluid level in the expansion tank, as overflowing brake fluid will destroy the paintwork.



G03297701

Fig. 19: Turning Piston Using Special Tool 34 1 050
Courtesy of BMW OF NORTH AMERICA, INC.

Remove outer brake lining.

Inner brake lining is located with its spring in the piston.

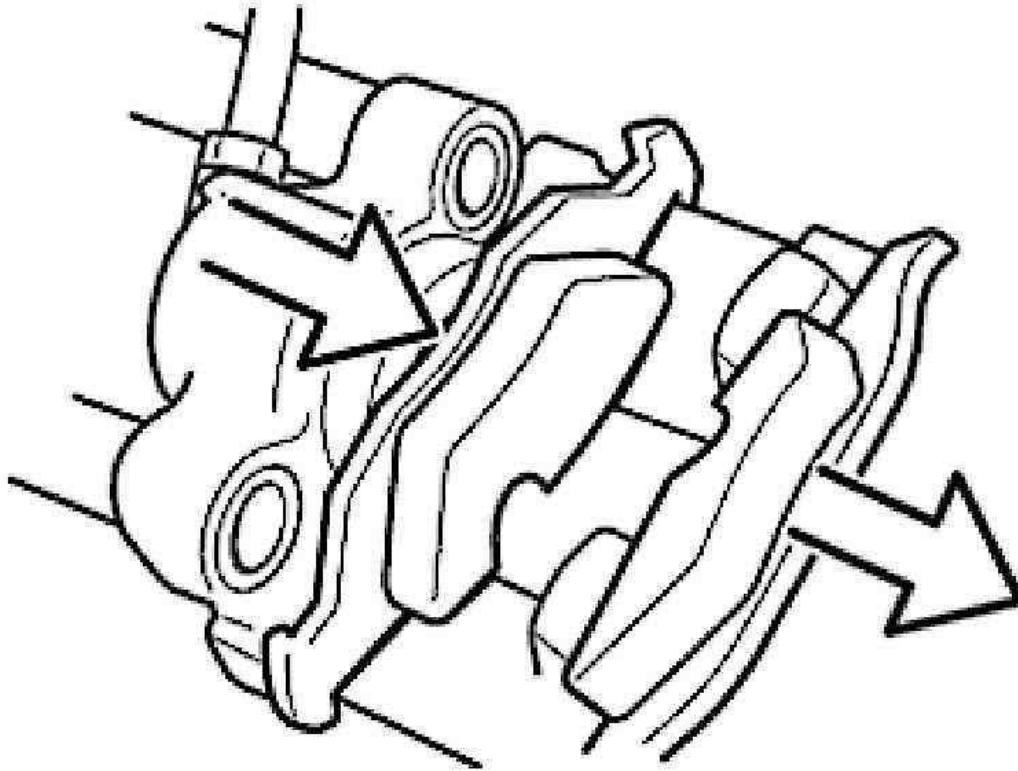
IMPORTANT: Mark any worn brake linings.

In the event of one-sided brake lining wear, do not change brake linings round.

New brake linings may only be installed if the brake disk thickness is greater than or equal to the minimum brake disk thickness (MIN TH). . See **BRAKES - TECHNICAL DATA** .

Observe minimum thickness of brake linings, . See **BRAKES - TECHNICAL DATA** . Clean brake linings.

Do not grease backs of brake linings sleeve.



G03297702

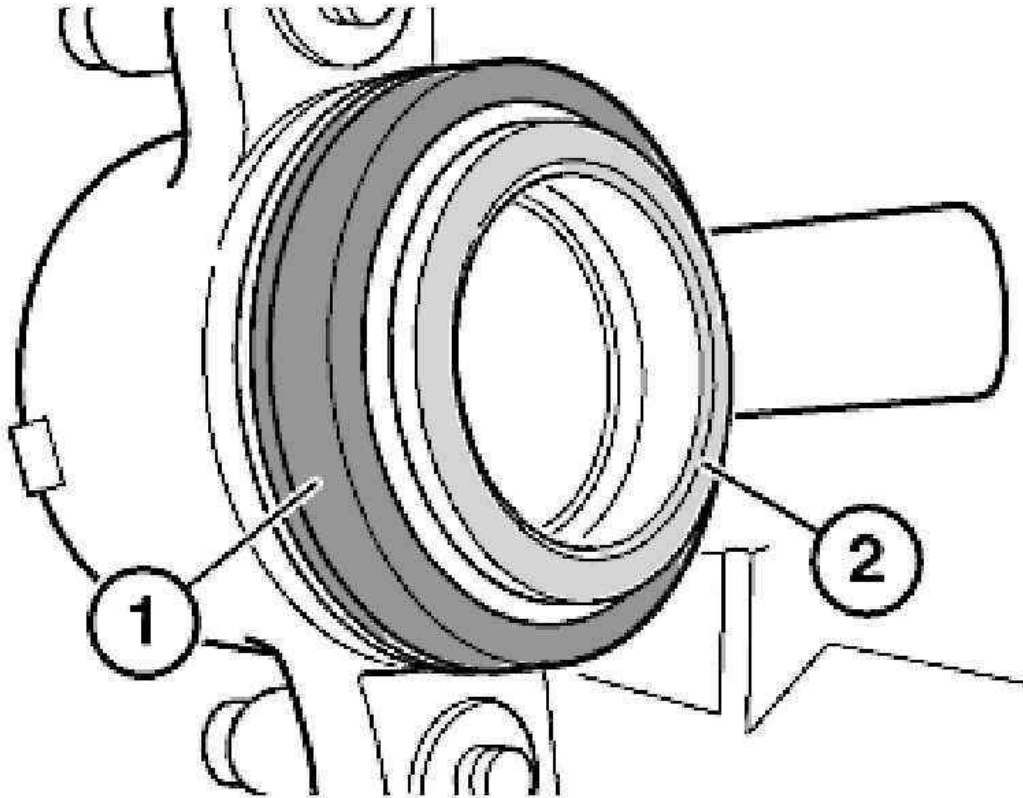
Fig. 20: Removing Outer Brake Lining
Courtesy of BMW OF NORTH AMERICA, INC.

Check dust sleeve (1) for damage and replace if necessary.

Clean contact face (2) of brake piston and apply a thin coating of anti-squeak compound.

Anti-squeak compound, refer to **OPERATING FLUIDS - BRAKES** .

IMPORTANT: Dust sleeve must not come into contact with anti-squeak compound as this may cause the dust sleeve to swell.



G03297703

Fig. 21: Identifying Dust Sleeve And Contact Face Of Brake Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Clean contact faces (1...2) of brake lining hammer heads/brake caliper housing and coat with anti-squeak compound.

Anti-squeak compound, refer to **OPERATING FLUIDS - BRAKES** .

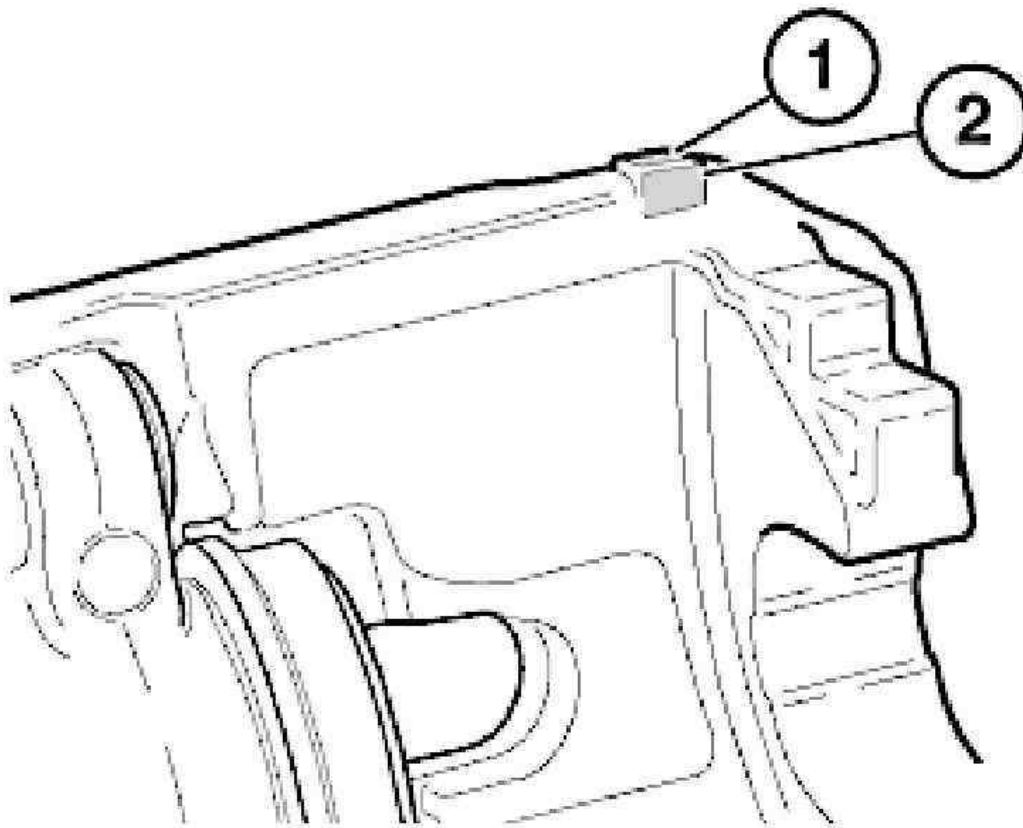
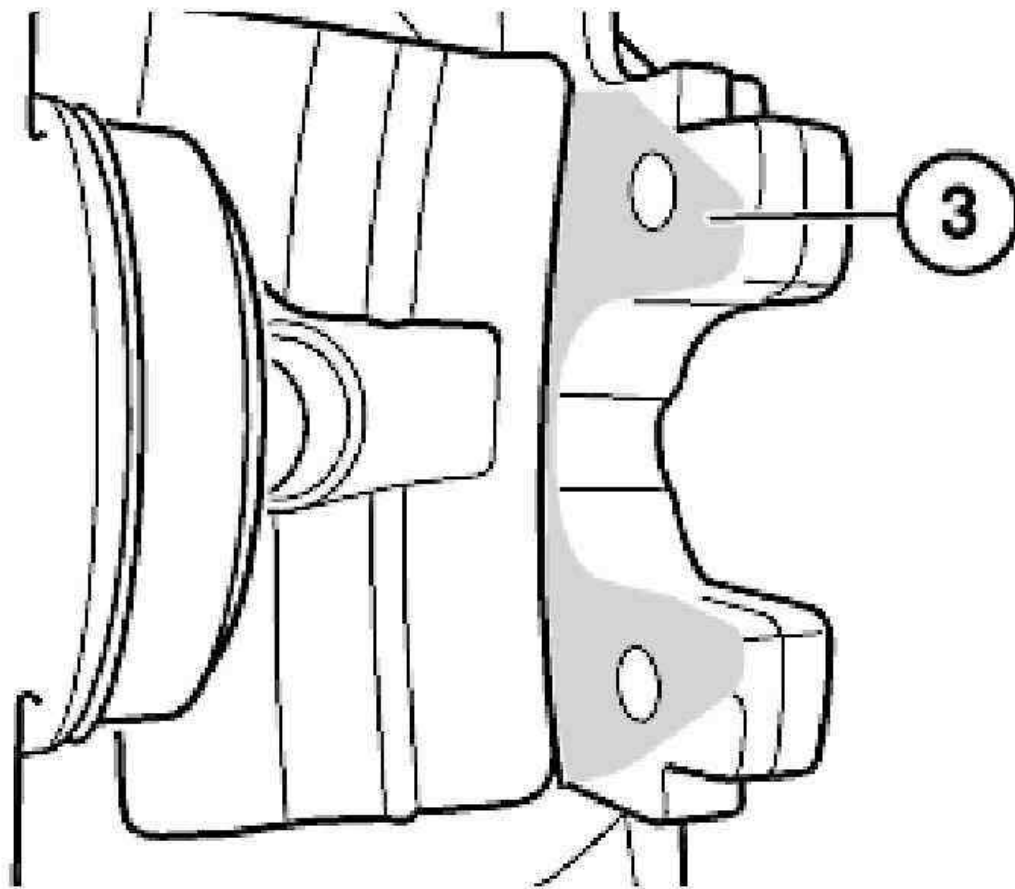
**G03297704**

Fig. 22: Identifying Contact Faces Of Brake Lining Hammer Heads/Brake Caliper Housing
Courtesy of BMW OF NORTH AMERICA, INC.

Clean contact face (3) of brake caliper and apply a thin coating of anti-squeak compound.

Anti-squeak compound, refer to **OPERATING FLUIDS - BRAKES** .



G03297705

Fig. 23: Identifying Contact Face Of Brake Caliper
Courtesy of BMW OF NORTH AMERICA, INC.

Clean contact face of brake caliper mounting bracket and apply a thin coating of anti-squeak compound.

Anti-squeak compound, refer to **OPERATING FLUIDS - BRAKES** .

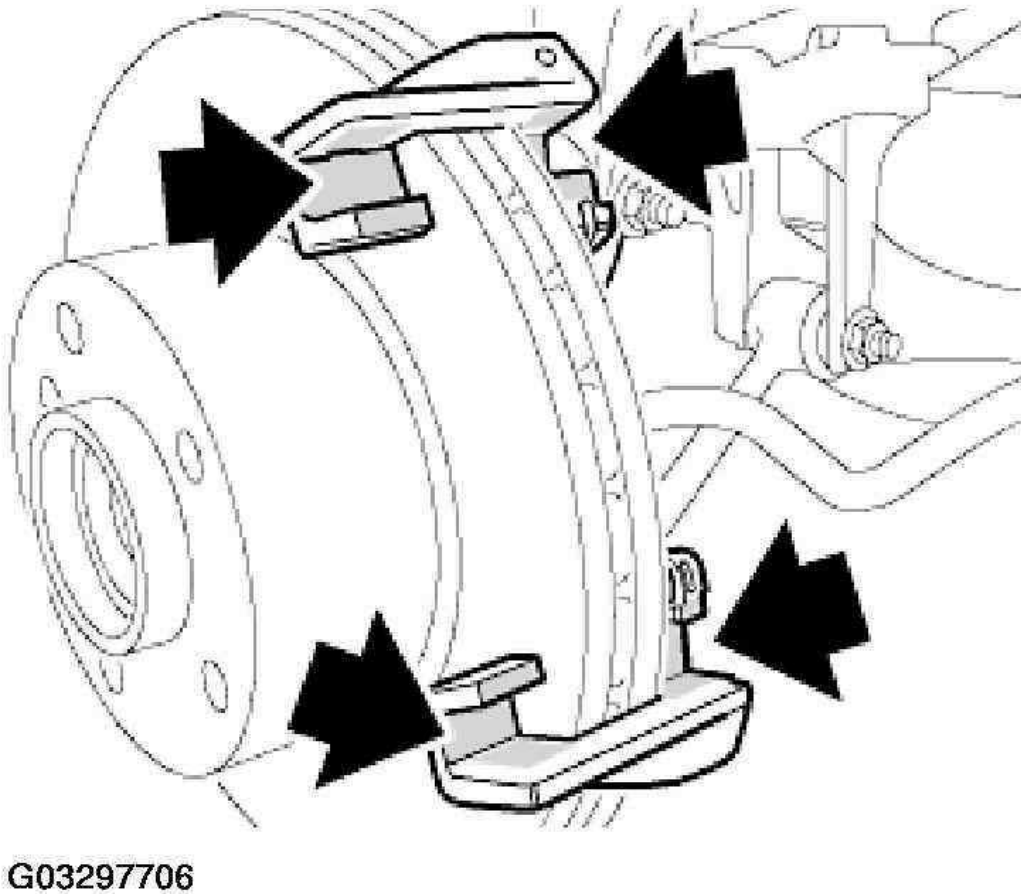


Fig. 24: Locating Contact Face Of Brake Caliper Mounting Bracket
Courtesy of BMW OF NORTH AMERICA, INC.

34 11 220 REMOVING AND INSTALLING/REPLACING BOTH FRONT BRAKE DISKS

Remove wheels. See **WHEEL AND TIRES - REPAIR INSTRUCTIONS** .

If necessary, remove and clean brake linings.

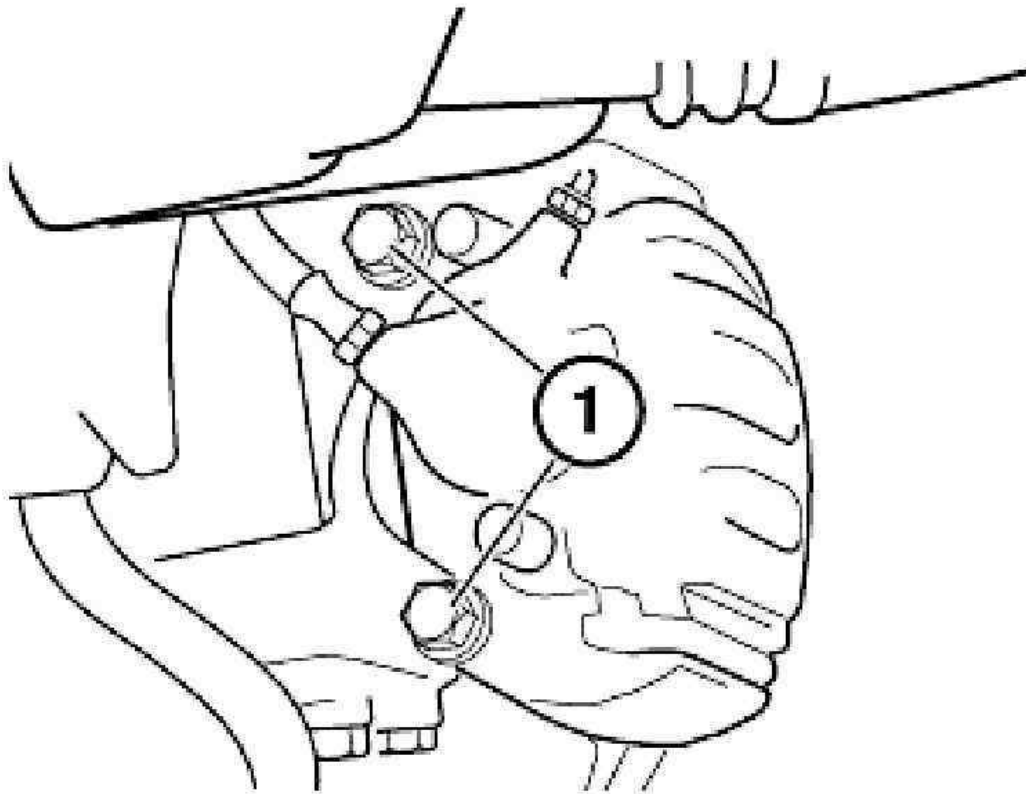
IMPORTANT: The brake disks must be replaced if their thickness is below the minimum thickness (MIN TH).
Brake disks may only be replaced in pairs (for each axle).
If the brake disks are replaced, you must also fit new brake linings.
The brake disks of M models are tied to the direction of travel:
The uneven part number denotes the left brake disk, the even part number the right brake disk!

Unfasten screws (1), remove brake caliper and fasten up.

NOTE: Brake hose remains connected.

Installation:

Tightening torque, see 34 11 2AZ in **BRAKES - TIGHTENING TORQUES** .



G03297707

Fig. 25: Identifying Brake Caliper Removing Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew bolts and take off brake disk.

CAUTION: To release brake disk: Do not under any circumstances strike friction ring with a hammer or similar! If necessary, carefully tap on base of brake disk chamber with a rubber mallet.

Installation:

Replace brake disk retaining screw.

Thoroughly clean contact surface of wheel hub, remove traces of corrosion if necessary.

Unevenness on contact surface may result in distortion of brake disk!

Tightening torque, see 34 11 1AZ in **BRAKES - TIGHTENING TORQUES** .

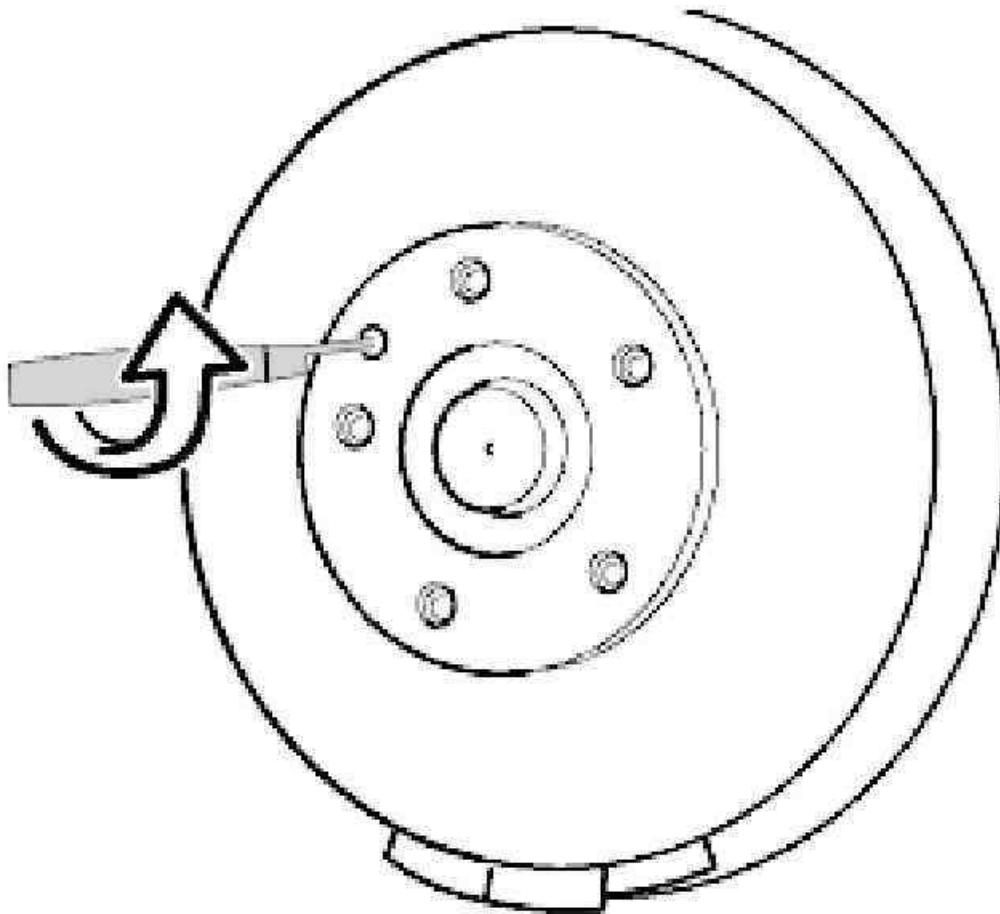
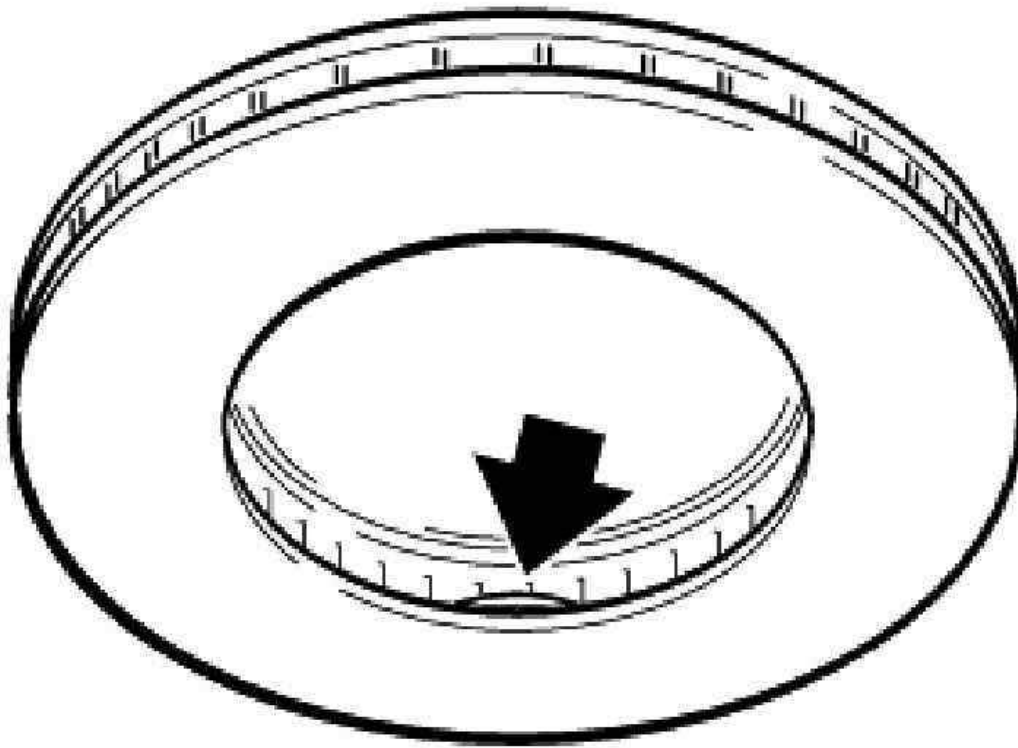
**G03297708**

Fig. 26: Removing Brake Disk Retaining Screw Using Screw Driver
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Inboard-vented brake disks are balanced.

Never remove or reposition balance clips.



G03297709

Fig. 27: Identifying Balance Clips

Courtesy of BMW OF NORTH AMERICA, INC.

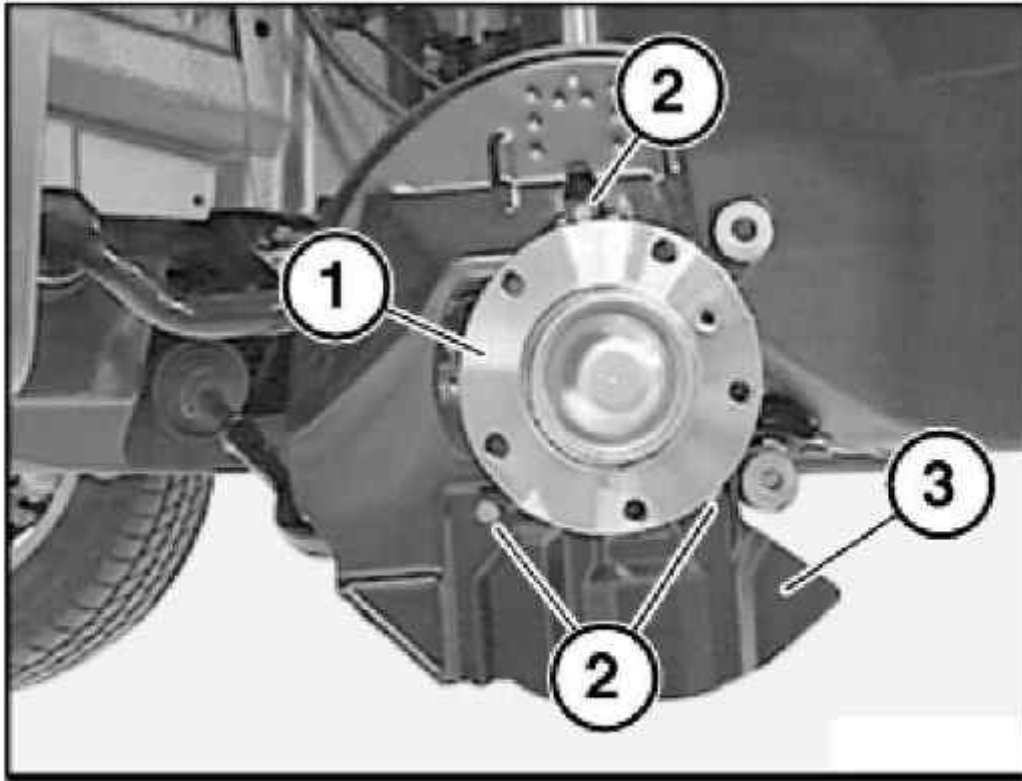
34 11 250 REMOVING AND INSTALLING/REPLACING A FRONT BRAKE ANCHOR PLATE/BRAKE GUARD PLATE

Remove wheel hub (1). See Replacing Bearings (Wheel Hub) For Front Wheel .

Release screws (2) and remove brake guard plate (3).

Installation:

Tightening torque, see 34 11 5AZ in **BRAKES - TIGHTENING TORQUES** .



G03297710

Fig. 28: Removing Brake Guard Plate
Courtesy of BMW OF NORTH AMERICA, INC.

34 11 519 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT FRONT BRAKE CALIPER

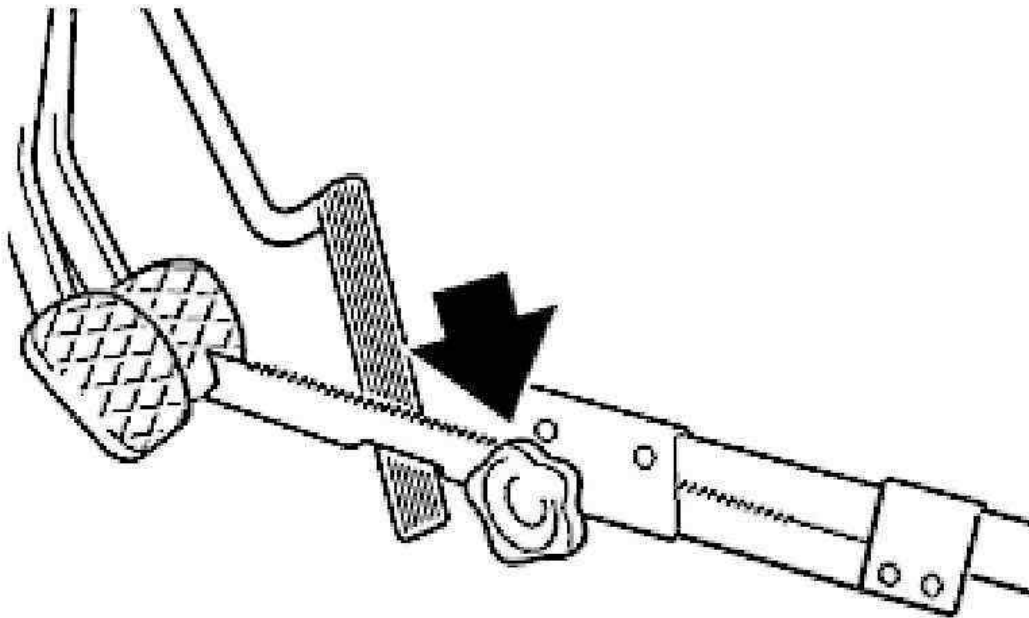
Necessary preliminary tasks:

Remove wheels. See **WHEEL AND TIRES - REPAIR INSTRUCTIONS** .

After completing tasks, bleed brake system. See **34 00 050 Bleeding Brake System With DSC** .

Apply pedal prop and depress brake pedal slightly. This prevents brake fluid from emerging from the expansion tank and air from entering the brake system after the brake lines have been detached.

Disconnect brake pipe from connection with brake hose.



G03297711

Fig. 29: Identifying Brake Pedal With Pedal Support
Courtesy of BMW OF NORTH AMERICA, INC.

Left:

Remove connector for wear indicator.

Installation:

Tighten brake hose on brake caliper.

Tightening torque, see 34 32 2AZ in **BRAKES - TIGHTENING TORQUES** .

Set steering to straight-ahead setting.

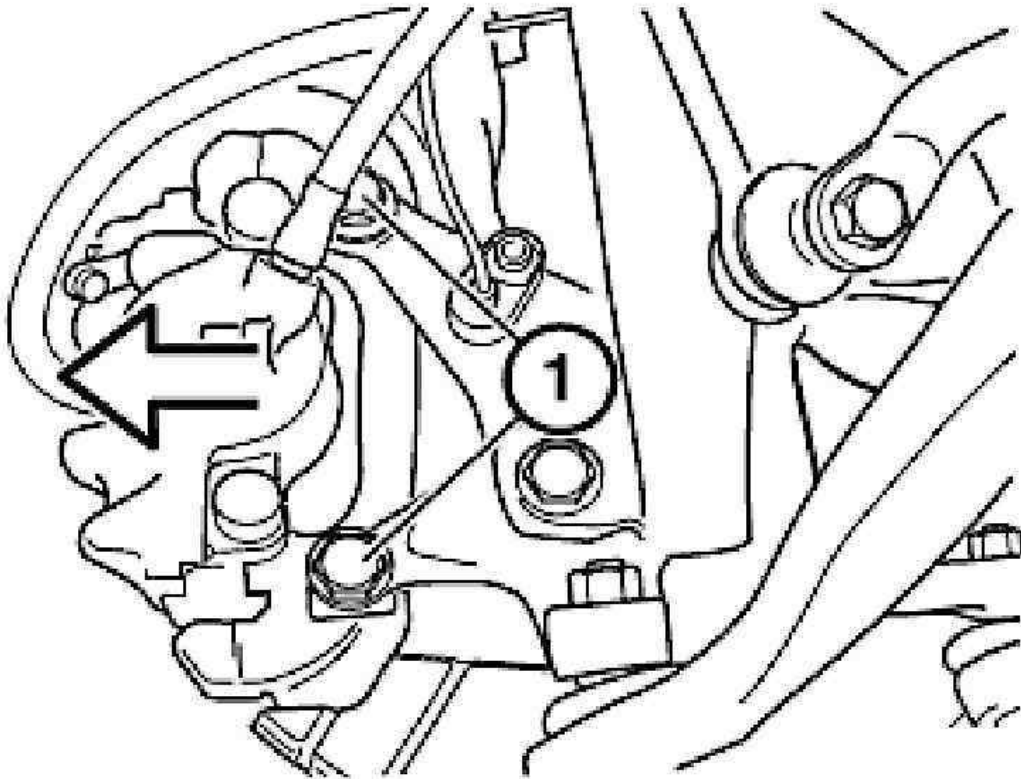
Screw brake hose to brake line, ensuring that brake hose is not twisted.

Tightening torque, see 34 32 1AZ in **BRAKES - TIGHTENING TORQUES** .

Release screws (1) and remove brake caliper.

Installation:

Tightening torque, see 34 11 2AZ in **BRAKES - TIGHTENING TORQUES** .



G03297712

Fig. 30: Removing Brake Caliper

Courtesy of BMW OF NORTH AMERICA, INC.

34 11 552 OVERHAULING LEFT OR RIGHT FRONT-BRAKE CALIPER (BRAKE CALIPER REMOVED)

NOTE: Use repair kit, refer to BMW Parts Service.

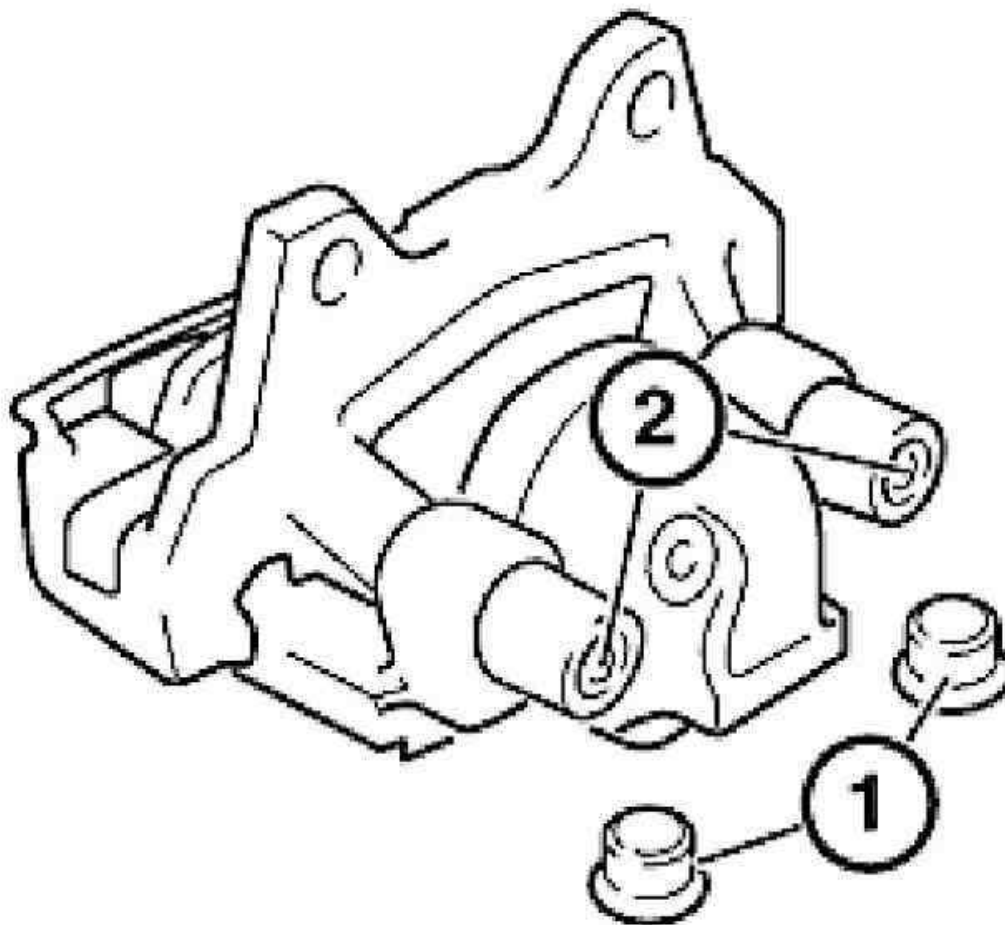
Take off plastic caps (1).

Unscrew guide bolts (2).

Installation:

Only clean guide screws; do not grease. Check guide bolts, replace if necessary.

Tightening torque, see 34 11 3AZ in **BRAKES - TIGHTENING TORQUES** .



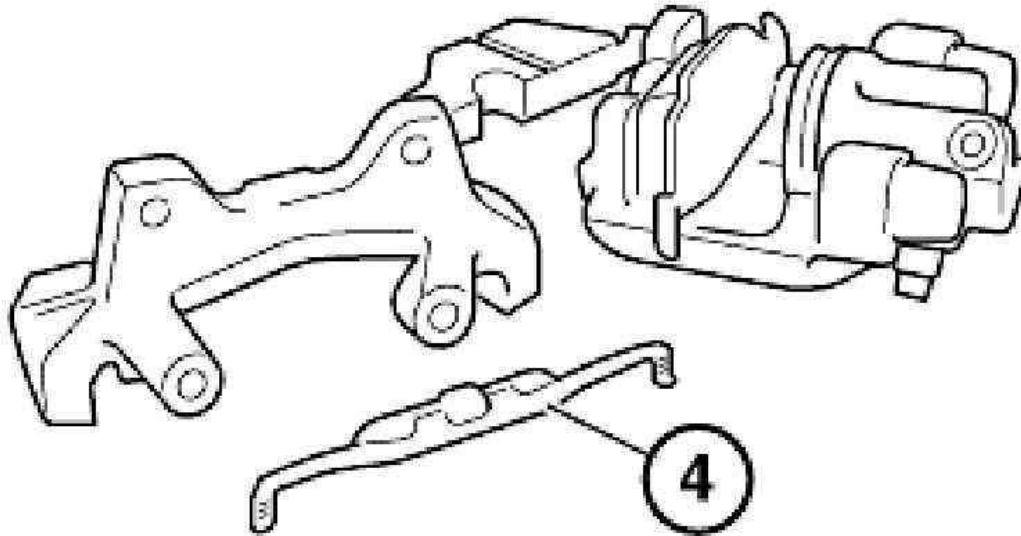
G03297713

Fig. 31: Identifying Plastic Caps And Guide Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Dismantle brake caliper and remove brake linings.

Installation:

Press brake lining fully outwards and insert spring (4).



G03297714

Fig. 32: Identifying Spring

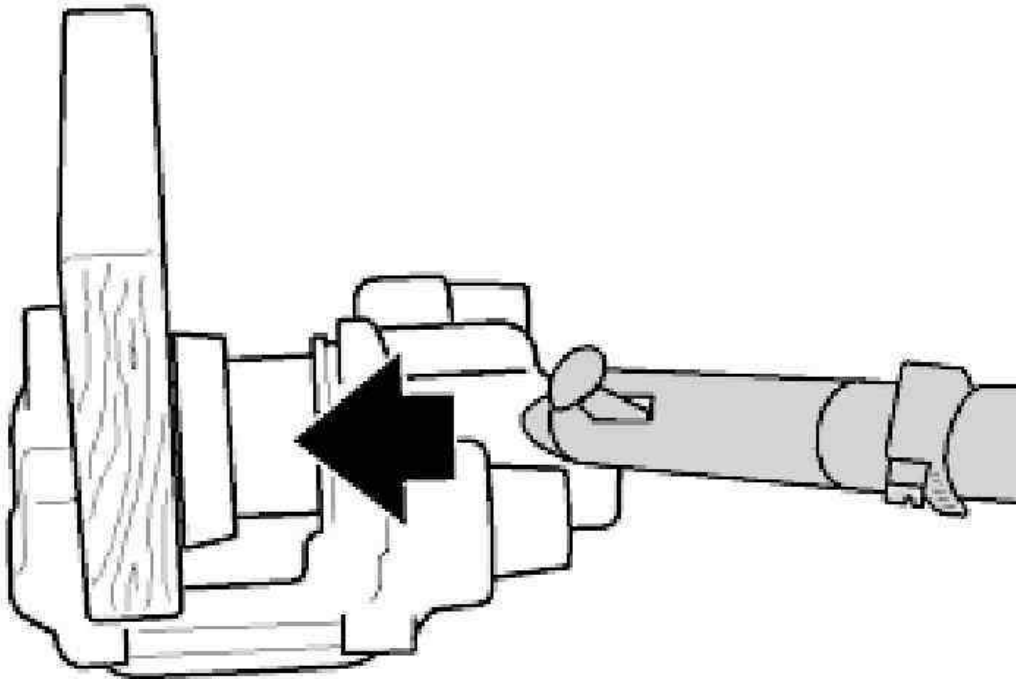
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: In the following work step, large forces occur at the brake caliper piston (up to more than 2800 N).
Danger of injury!

Carefully force piston out through connection bore with compressed air.

To protect piston, place a protective plate (e.g. hard wood or hard felt) in caliper recess.

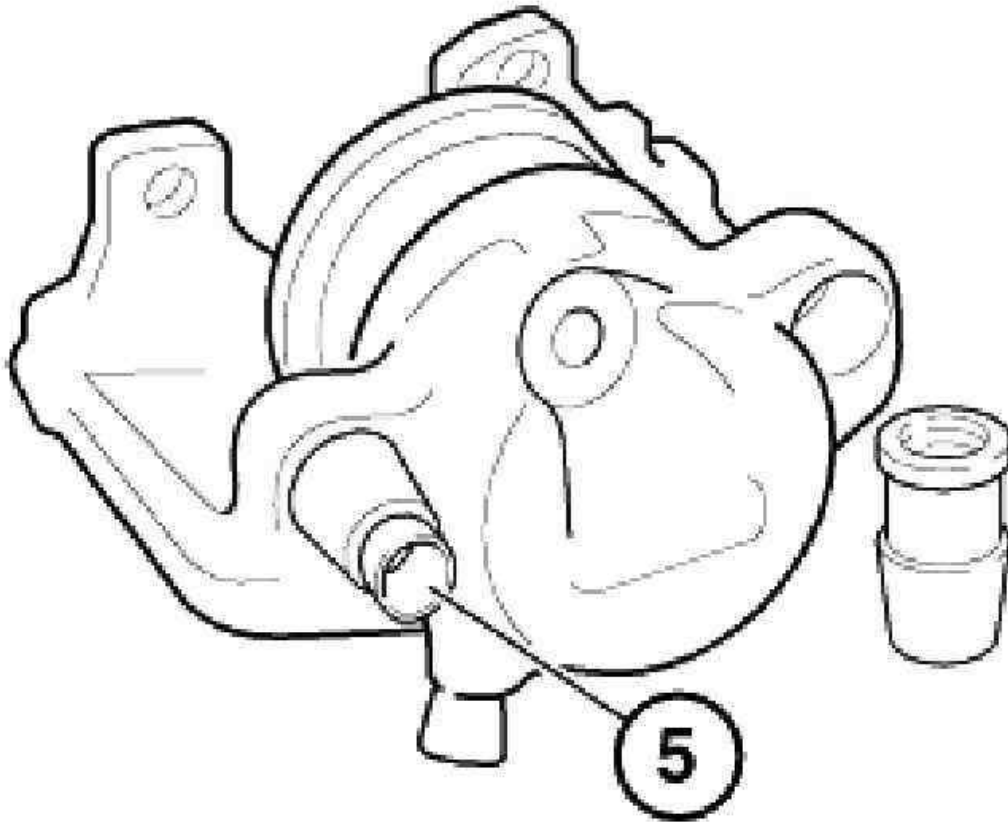
Do not grip piston with fingers - risk of trapping!



G03297715

Fig. 33: Protecting Piston Using Protective Plate
Courtesy of BMW OF NORTH AMERICA, INC.

Check guide sleeves (5), fitting repair-kit guide sleeve if necessary.

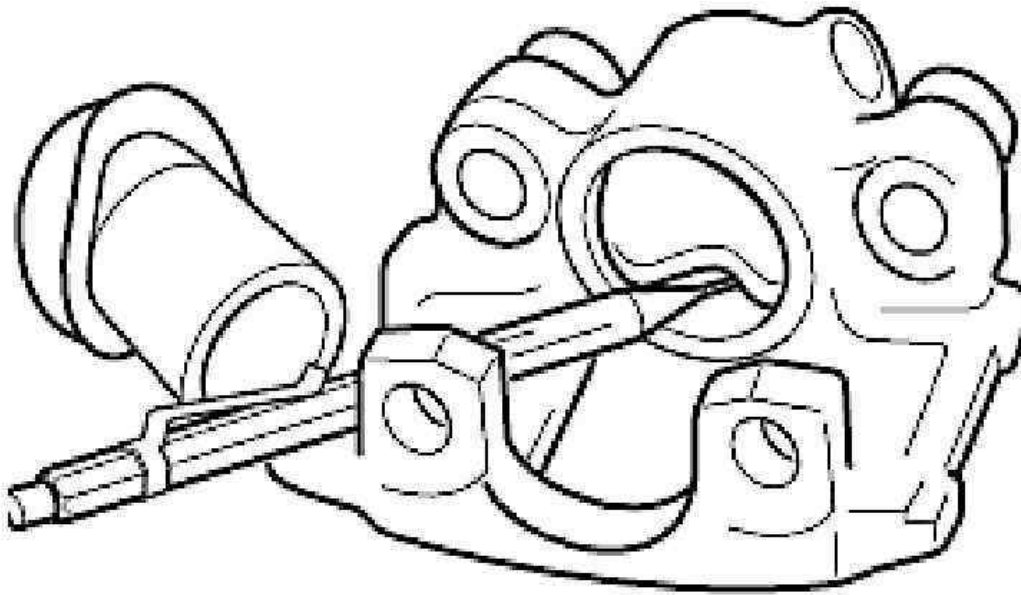
**G03297716****Fig. 34: Locating Guide Sleeves****Courtesy of BMW OF NORTH AMERICA, INC.**

Remove sealing ring carefully with a plastic needle.

Clean cylinder bores and parts with alcohol and dry with compressed air.

Thoroughly inspect cylinder bore, piston and flange surfaces.

Machining of cylinders and pistons is not permitted.



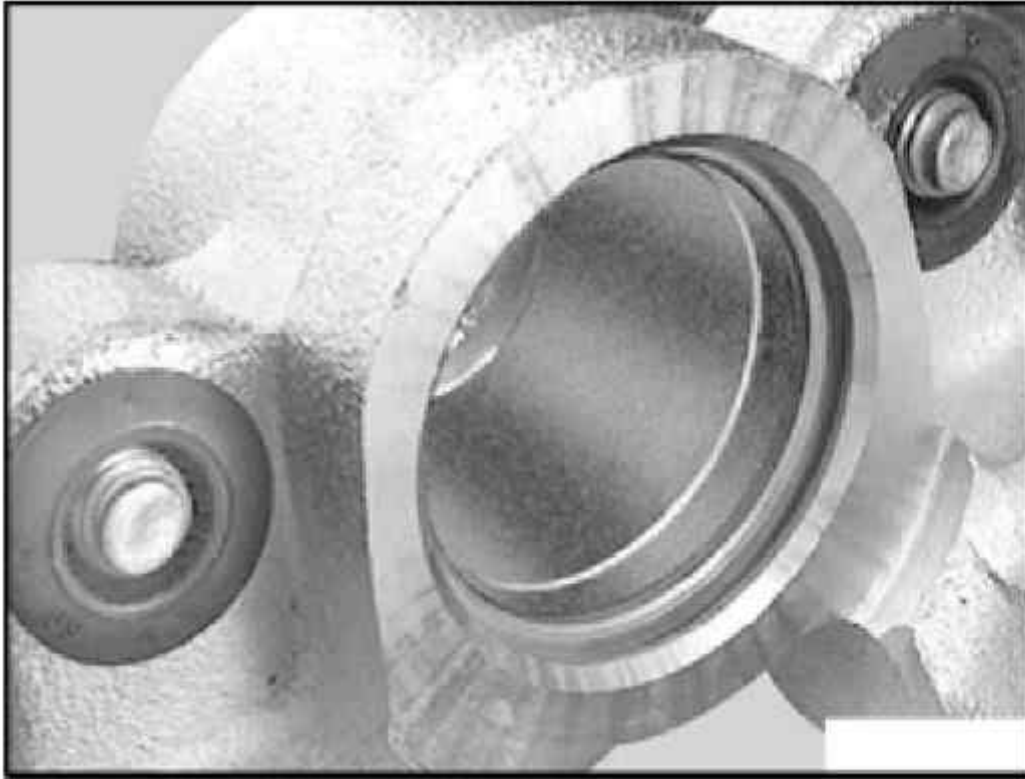
G03297717

Fig. 35: Removing Sealing Ring Using Plastic Needle
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Apply a light coat of Ate brake cylinder paste to cylinder bore, piston and sealing sleeve, Refer to **OPERATING FLUIDS - BRAKES** .

Install sealing cover in rear annular groove of cylinder bore.



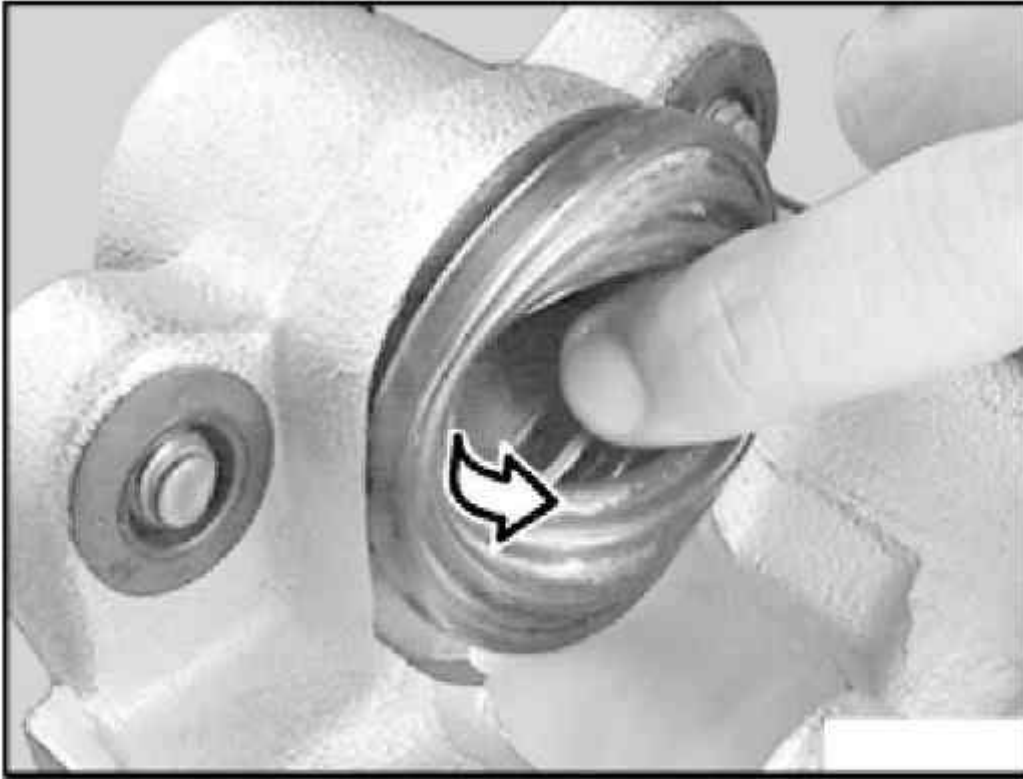
G03297718

Fig. 36: View Of Cylinder Bore Annular Groove
Courtesy of BMW OF NORTH AMERICA, INC.

Insert dust sleeve in front annular groove and press into annular groove over entire diameter.

Installation:

The area between the dust sleeve and the brake caliper housing must be kept dry. It must not come into contact with Ate brake cylinder paste or brake fluid so as to ensure that the dust sleeve is perfectly seated.



G03297719

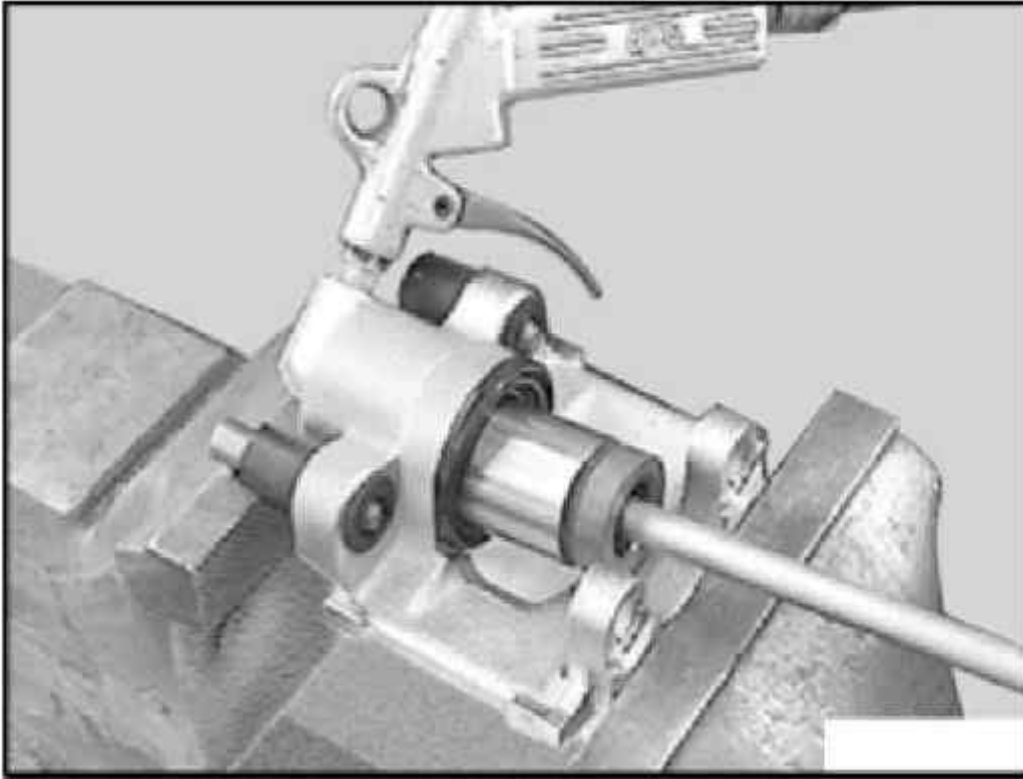
Fig. 37: Inserting Dust Sleeve In Front Annular Groove
Courtesy of BMW OF NORTH AMERICA, INC.

Take up brake piston with a commercially available extension and socket and gently press onto dust sleeve.

Blow up sleeve with compressed air (max. 3 bar). Sleeve jumps over brake piston.

Installation:

Coat dust sleeve and brake piston with brake fluid to facilitate installation of dust sleeve.



G03297720

Fig. 38: Removing Brake Piston

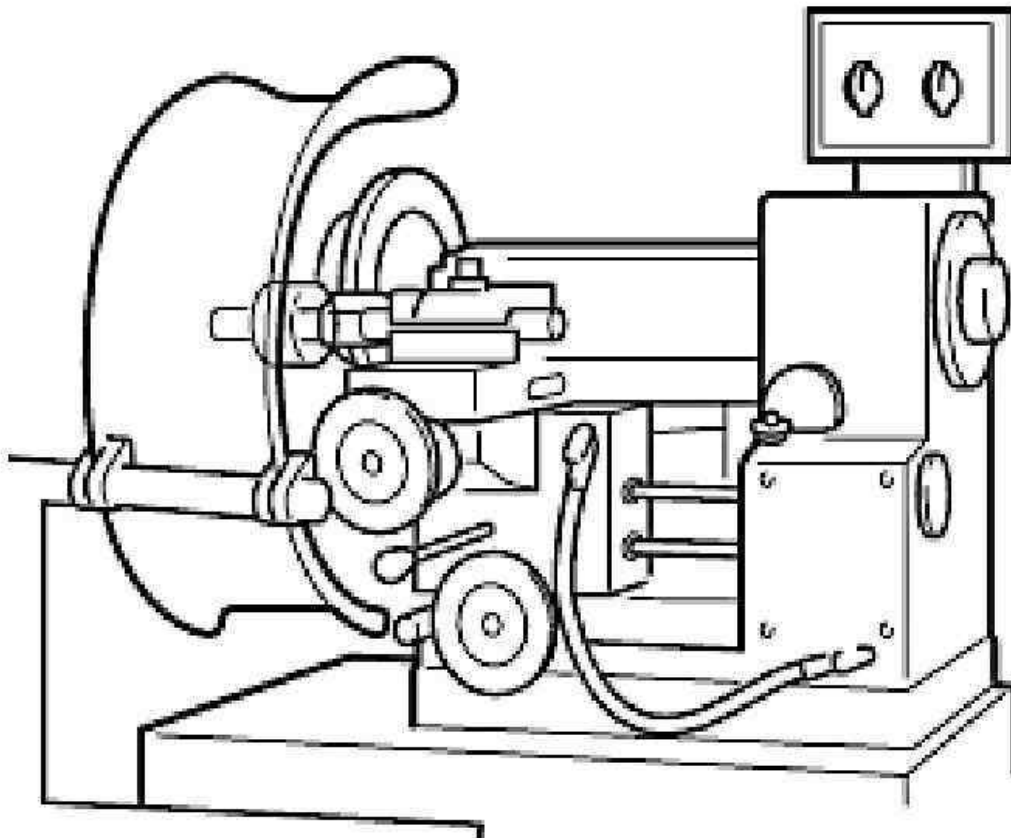
Courtesy of BMW OF NORTH AMERICA, INC.

34 11 667 FINE-GRINDING BOTH SIDES OF BOTH FRONT BRAKE DISKS (BRAKE DISKS REMOVED)

IMPORTANT: Always fine-grind both sides of both brake disks on one axle.
Observe Max. machining dimension per friction ring side Minimum brake disk thickness (MIN TH)
Surface roughness of brake surfaces.
Brake disks of M models (Compound brake disks) must not be machined!

NOTE: Only one brake lining set may be used up on brake disks which have been lathe-turned to minimum thickness (MIN TH).

Follow the machine manufacturer's operating instructions.

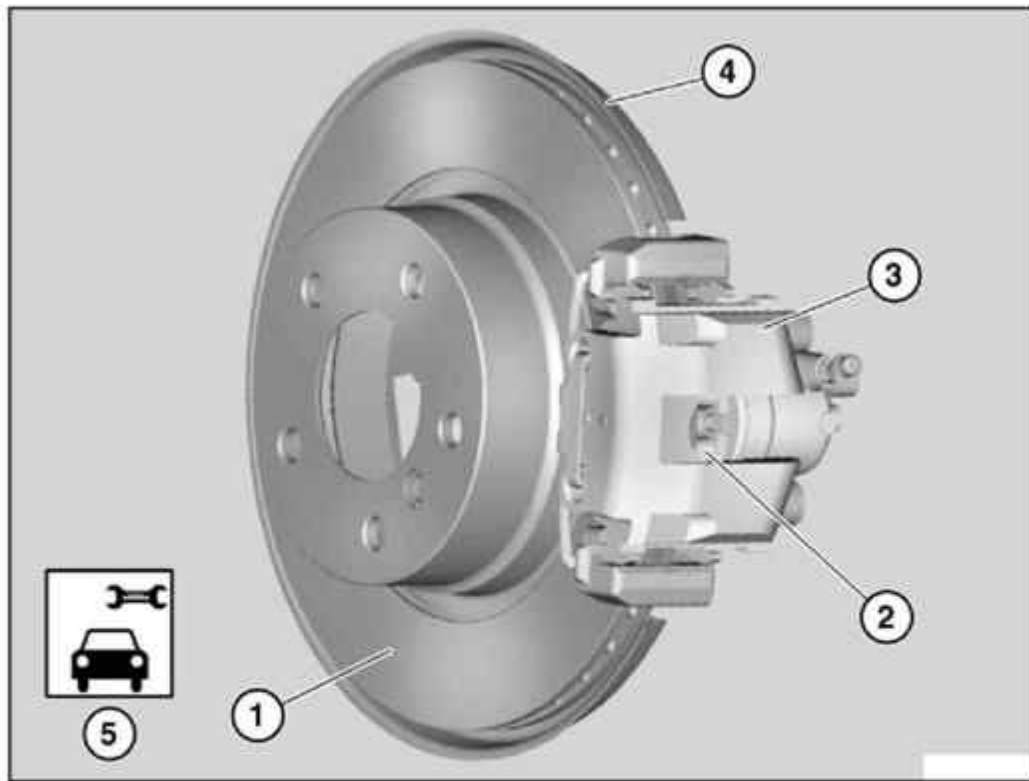


G03297721

Fig. 39: View Of Grinding Machine
Courtesy of BMW OF NORTH AMERICA, INC.

REAR BRAKES

34 21... OVERVIEW OF REAR BRAKE



- | | | | |
|---|---------------|---|------------------------------------|
| 1 | Brake disk | 4 | Brake guard plate |
| 2 | Brake pad | 5 | Checking thickness of brake lining |
| 3 | Brake caliper | | |

G03297722

Fig. 40: Identifying Rear Brakes Components

Courtesy of BMW OF NORTH AMERICA, INC.

34 21 171 REMOVING AND INSTALLING/REPLACING A BRAKE CARRIER/BRAKE GUARD AT REAR

NOTE: After completing tasks, adjust handbrake.

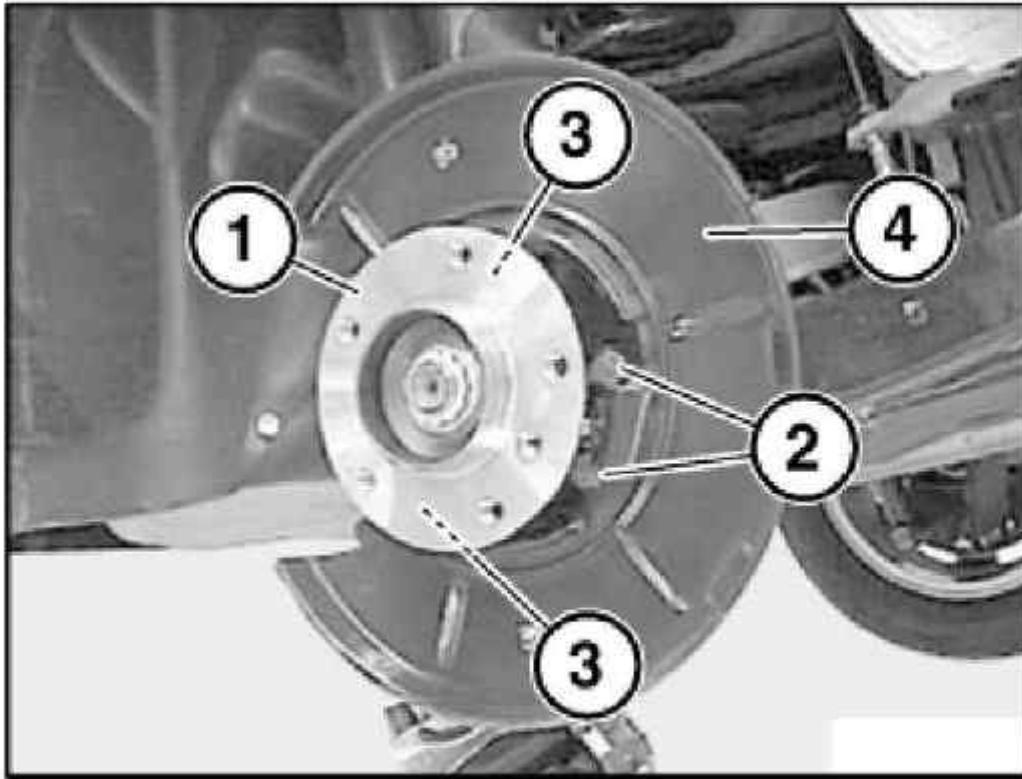
Remove expander lock for handbrake shoes.

Remove wheel hub (1). See Replacing Bearings (Wheel Hub) For Front Wheel .

Release screws (2...3) and remove brake plate (4).

Installation:

Tightening torque, see 34 21 6AZ in **BRAKES - TIGHTENING TORQUES** .



G03297723

Fig. 41: Removing Brake Guard

Courtesy of BMW OF NORTH AMERICA, INC.

34 21 200 REMOVING AND INSTALLING/REPLACING BOTH REAR DISK BRAKES

Special tools required:

- 34 1 050

NOTE: After completing the tasks, press brake pedal several times to the floor so that brake linings contact brake disks.
When installing new brake linings on front and rear axles, check brake fluid level; top up to "MAX" marking if necessary.

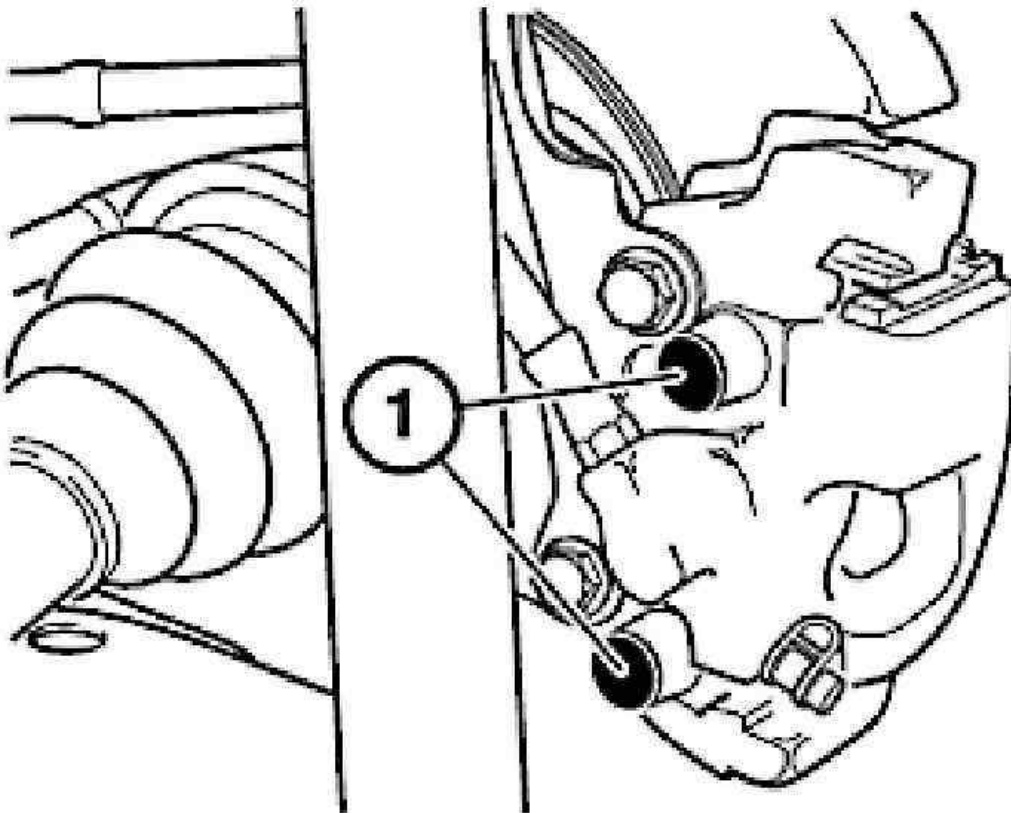
Remove wheels. See WHEEL AND TIRES - REPAIR INSTRUCTIONS .

Remove cover plug (1).

Right side:

Disconnect plug connection for brake lining wear sensor.

If necessary, replace **Brake Lining Wear Sensor** .



G03297724

Fig. 42: Locating Cover Plug

Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew guide screws (2).

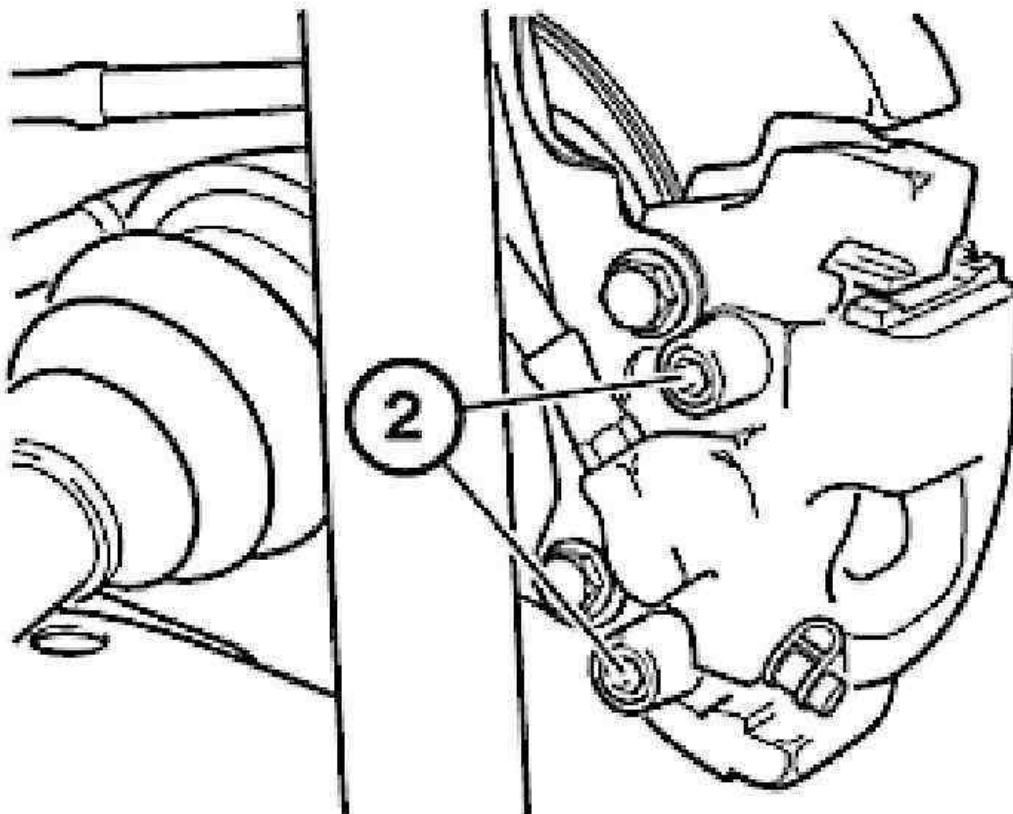
Installation:

Only clean guide screws; do not grease.

Check threads.

Replace all guide screws which are not in perfect condition.

Tightening torque, see 34 21 5AZ in **BRAKES - TIGHTENING TORQUES** .



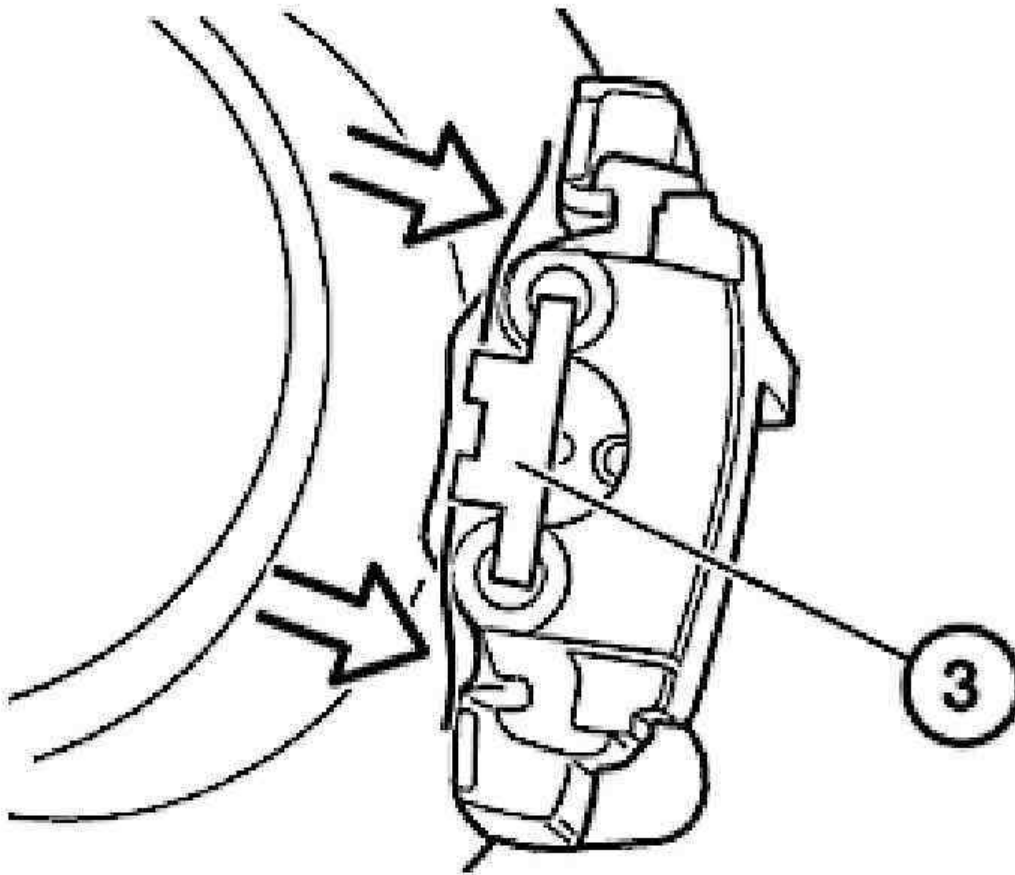
G03297725

Fig. 43: Locating Guide Screws

Courtesy of BMW OF NORTH AMERICA, INC.

Lift out retaining spring (3).

Withdraw brake caliper backwards.

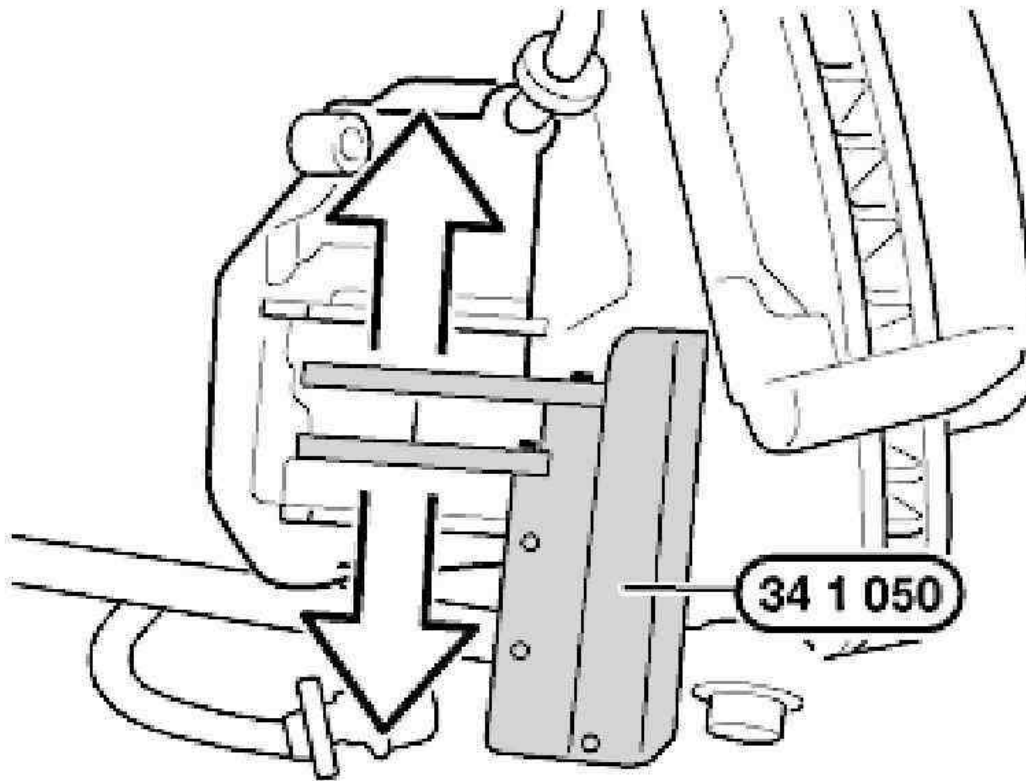


G03297726

Fig. 44: Lifting Out Retaining Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Turn piston fully back with special tool 34 1 050.

IMPORTANT: When turning back the piston, watch the brake-fluid level in the expansion tank, as overflowing brake fluid will destroy the paintwork.



G03297727

Fig. 45: Turning Piston Using Special Tool 34 1 050
Courtesy of BMW OF NORTH AMERICA, INC.

Remove outer brake lining.

Inner brake lining is located with its spring in the piston.

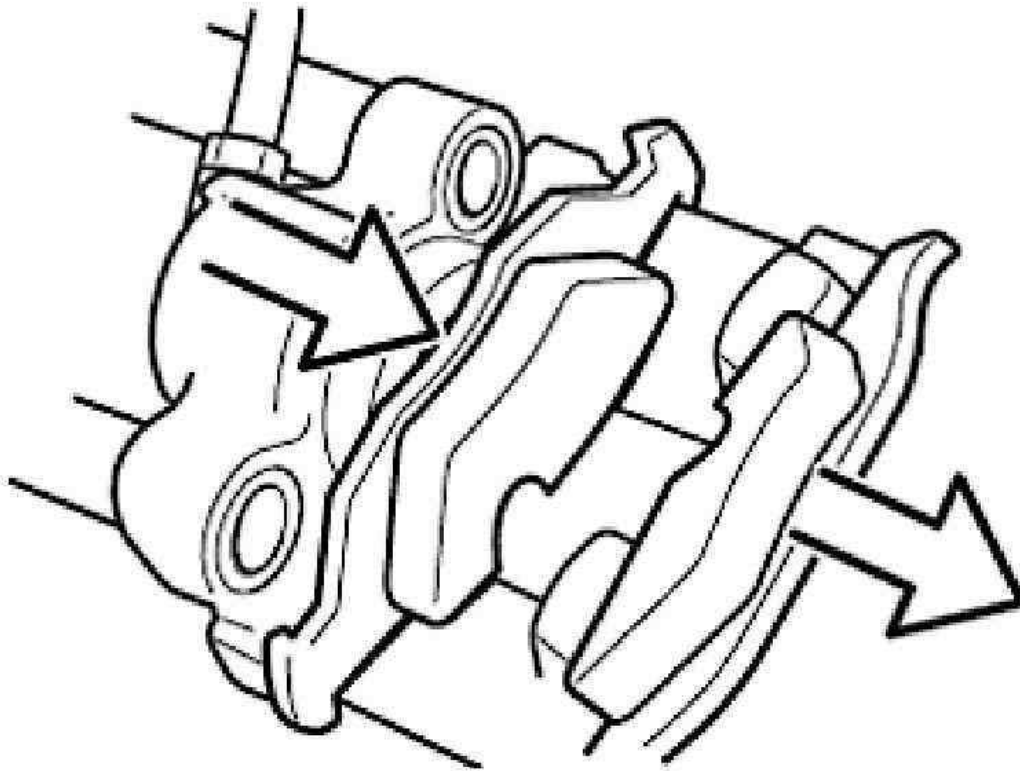
IMPORTANT: Mark any worn brake linings.

In the event of one-sided brake lining wear, do not change brake linings round.

New brake linings may only be installed if the brake disk thickness is greater than or equal to the minimum brake disk thickness (MIN TH).

Observe minimum thickness of brake linings, Clean brake linings.

Do not grease backs of brake linings sleeve.



G03297728

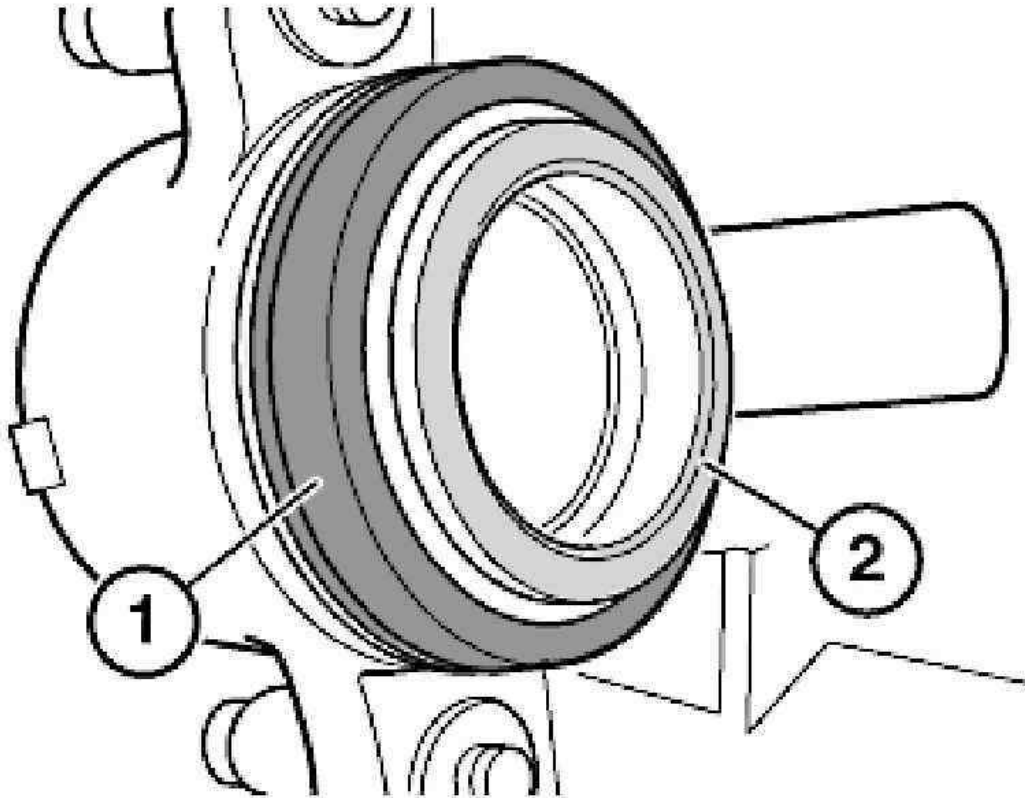
Fig. 46: Removing Outer Brake Lining
Courtesy of BMW OF NORTH AMERICA, INC.

Check dust sleeve (1) for damage and replace if necessary.

Clean contact face (2) of brake piston and apply a thin coating of anti-squeak compound.

Anti-squeak compound, refer to **OPERATING FLUIDS - BRAKES** .

IMPORTANT: Dust sleeve must not come into contact with anti-squeak compound as this may cause the dust sleeve to swell.

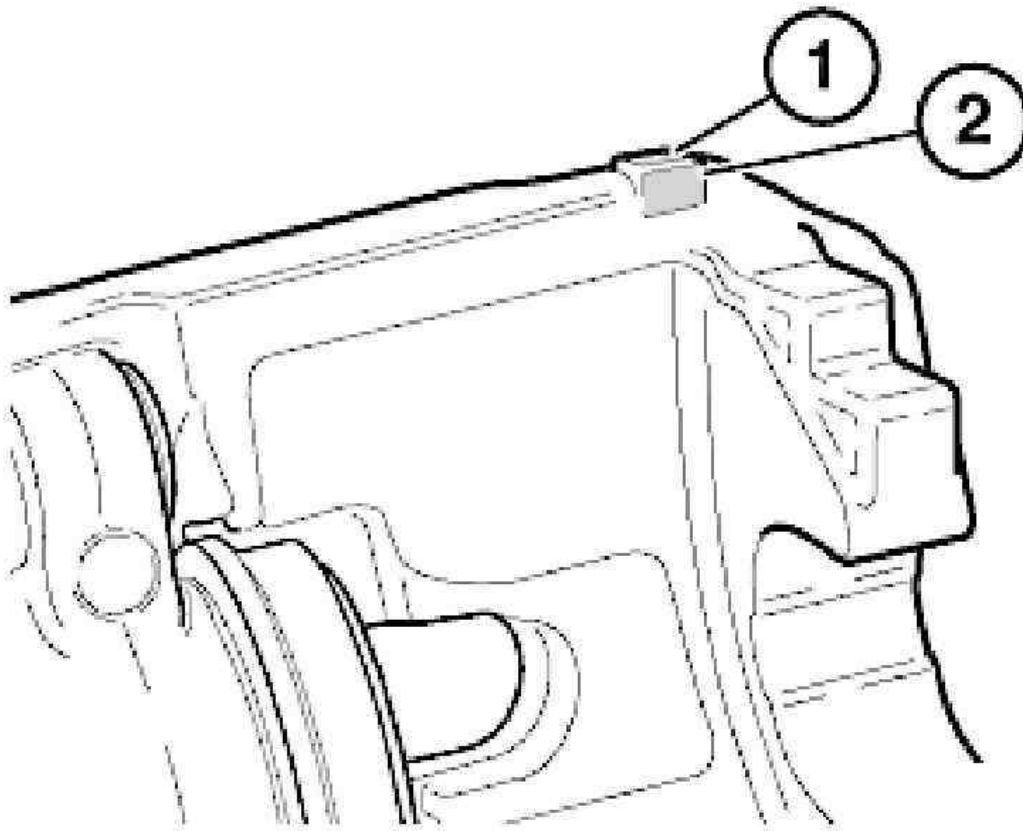


G03297729

Fig. 47: Identifying Dust Sleeve And Contact Face Of Brake Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Clean contact faces (1...2) of brake lining hammer heads/brake caliper housing and coat with anti-squeak compound.

Anti-squeak compound, refer to **OPERATING FLUIDS - BRAKES** .

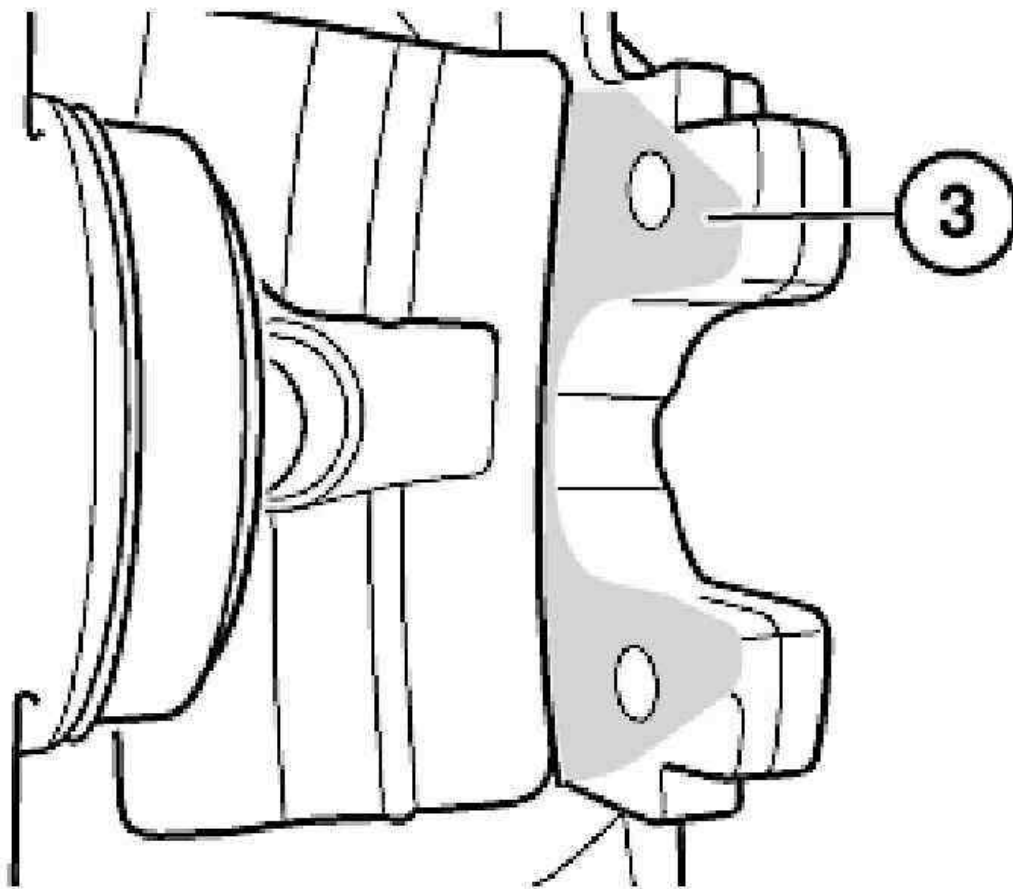


G03297730

Fig. 48: Identifying Contact Faces Of Brake Lining Hammer Heads/Brake Caliper Housing
Courtesy of BMW OF NORTH AMERICA, INC.

Clean contact face (3) of brake caliper and apply a thin coating of anti-squeak compound.

Anti-squeak compound, refer to **OPERATING FLUIDS - BRAKES** .



G03297731

Fig. 49: Identifying Contact Face Of Brake Caliper
Courtesy of BMW OF NORTH AMERICA, INC.

Clean brake caliper mounting bracket at hammer head guides and apply a thin coating of anti-squeak compound.

Anti-squeak compound, refer to **OPERATING FLUIDS - BRAKES** .

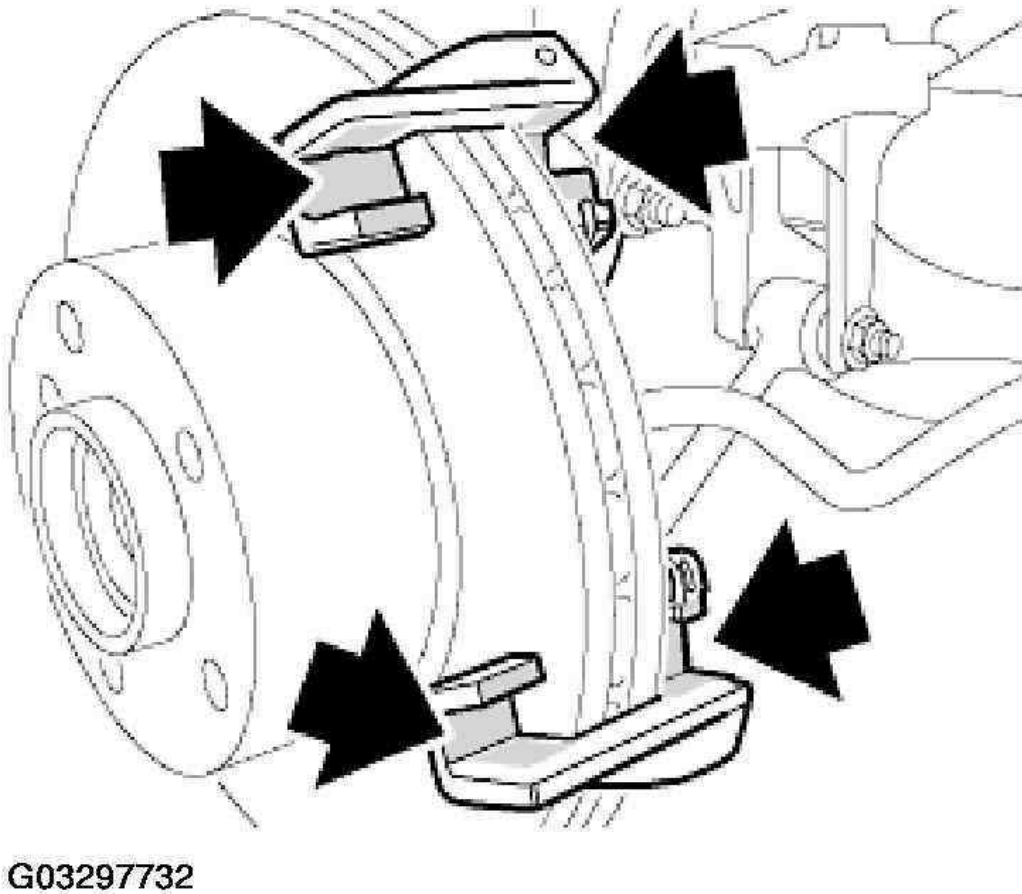


Fig. 50: Locating Brake Caliper Mounting Bracket
Courtesy of BMW OF NORTH AMERICA, INC.

34 21 320 REMOVING AND INSTALLING/REPLACING BOTH BRAKE DISKS

IMPORTANT: The brake disks must be replaced if their thickness is below the minimum thickness (MIN TH).
Always replace brake disks in pairs.
If the brake disks are replaced, you must also fit new brake linings.

Remove wheels. See WHEEL AND TIRES - REPAIR INSTRUCTIONS .

If necessary, remove and clean brake linings. . See 34 11 000 Removing And Installing/Replacing Brake Linings Of Both Front Disk Brakes or 34 21 200 Removing And Installing/Replacing Both Rear Disk Brakes .

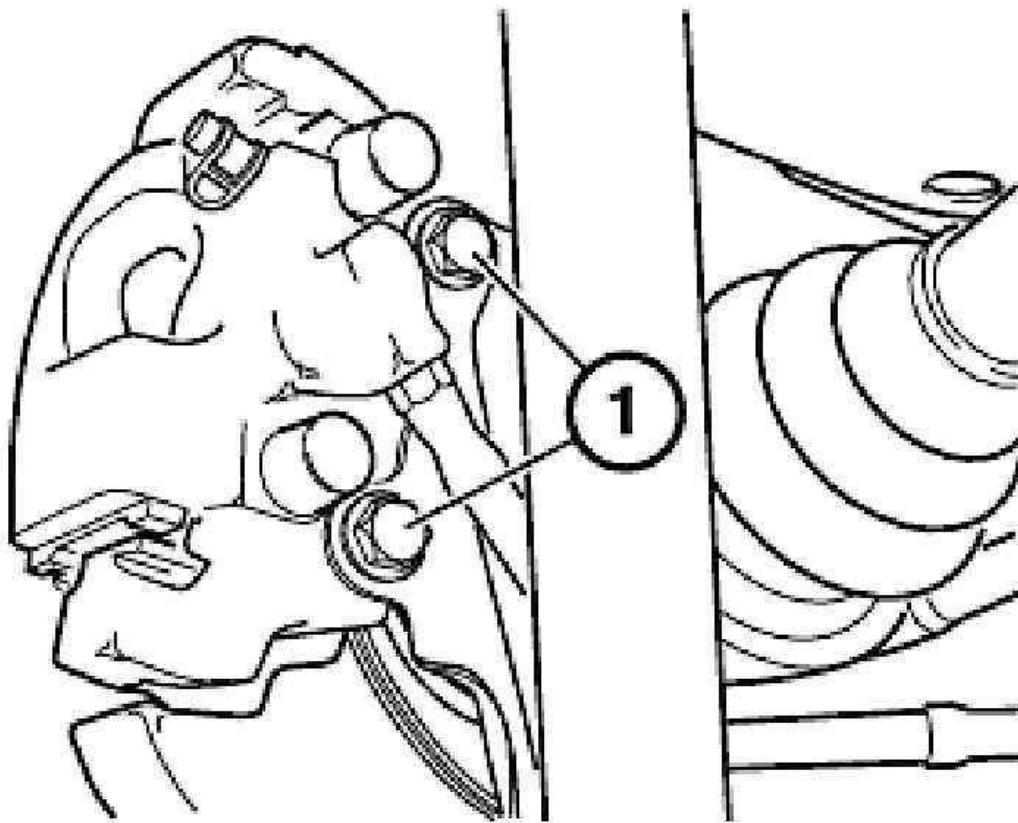
After completing tasks, adjust handbrake. . See **34 10 014 Adjusting Handbrake** .

Release screws (1). Remove and suspend brake caliper from vehicle.

NOTE: Brake hose remains connected.

Installation:

Tightening torque, see 34 21 3AZ in **BRAKES - TIGHTENING TORQUES** .



G03297733

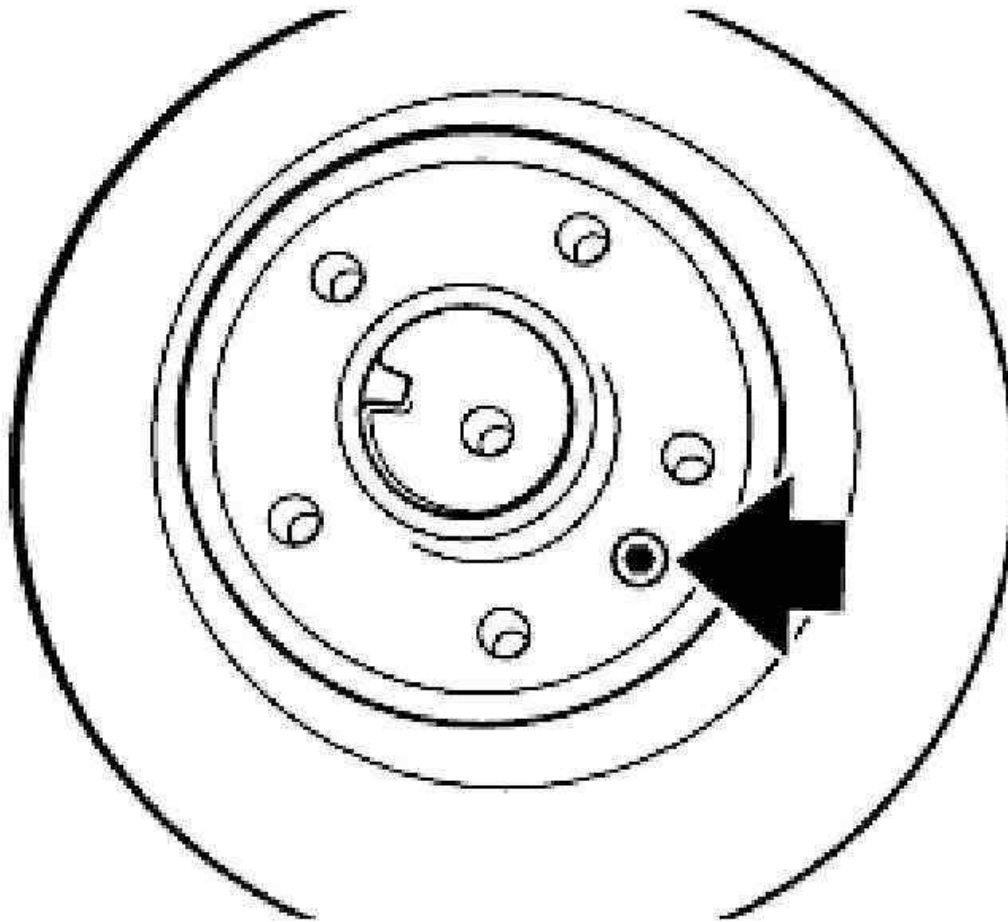
Fig. 51: Identifying Brake Caliper Releasing Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew bolts and take off brake disk.

Installation:

Replace brake disk retaining screw.

Tightening torque, see 34 21 1AZ in **BRAKES - TIGHTENING TORQUES** .



G03297734

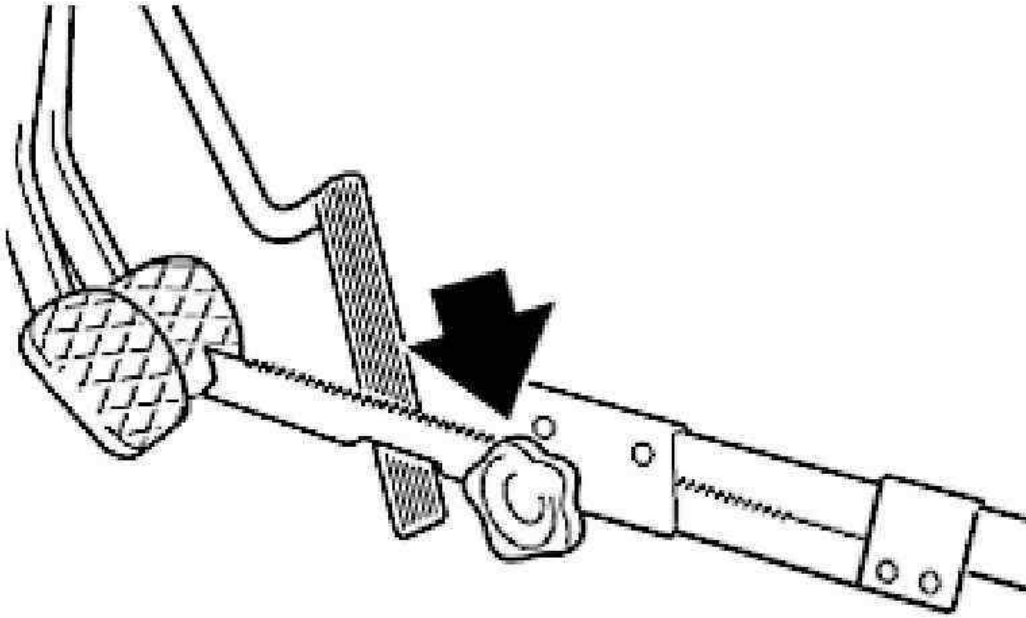
Fig. 52: Identifying Brake Disk Retaining Screw
Courtesy of BMW OF NORTH AMERICA, INC.

34 21 745 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT REAR BRAKE CALIPER

Remove rear wheel. See **WHEEL AND TIRES - REPAIR INSTRUCTIONS** .

After completing tasks, bleed brake system. See **34 00 050 Bleeding Brake System With DSC** .

Apply pedal prop and depress brake pedal slightly. This prevents brake fluid from emerging from the expansion tank and air from entering the brake system when the brake lines are opened.



G03297735

Fig. 53: Depressing Brake Pedal

Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Installation:

Tightening torque, see 34 21 3AZ in **BRAKES - TIGHTENING TORQUES** .

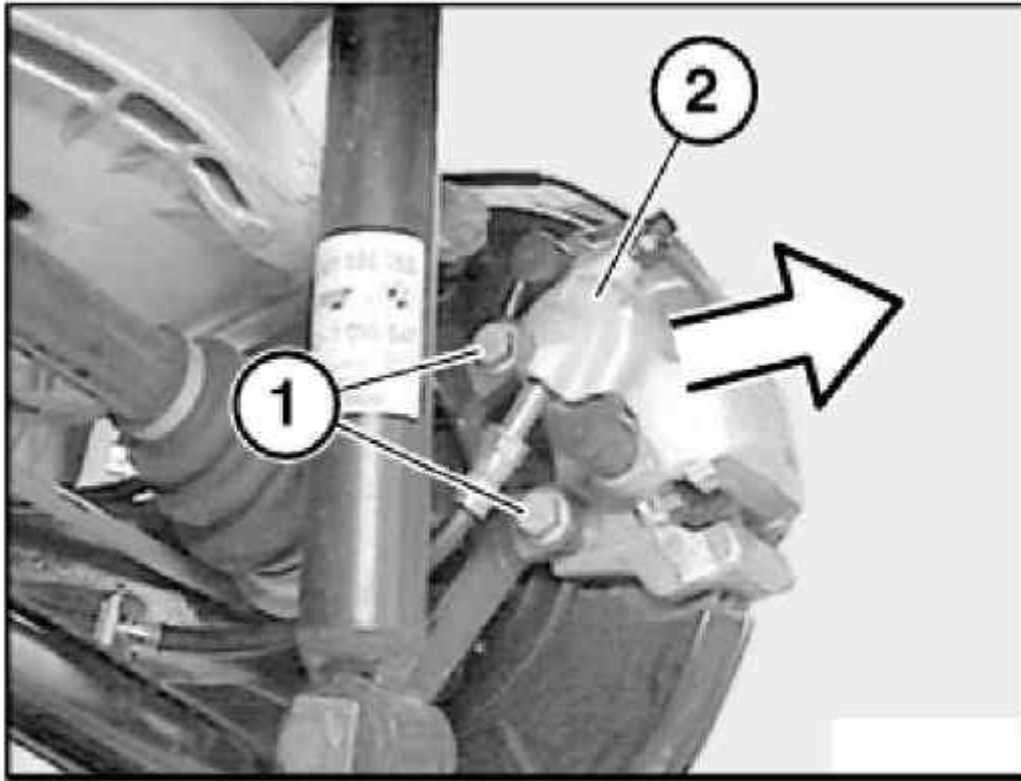
Disconnect brake hose (2).

Unfasten brake hose on connection point to brake line.

Right side:

Disconnect plug connection for brake lining sensor.

Pull off fist caliper towards rear of vehicle.



G03297736

Fig. 54: Identifying Brake Hose Releasing Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Install brake hose without torsional stress.

First tighten the brake hose on the brake cover, then tighten connection on brake line.

Tightening torque, see 34 32 1AZ in **BRAKES - TIGHTENING TORQUES** .

IMPORTANT: Check routing and securing of brake-pad-wear indicator cable. Check for correct securing with tab of dust cap. It is absolutely essential to prevent the cable on the rim from being scuffed.

34 21 812 OVERHAULING LEFT OR RIGHT REAR BRAKE CALIPER (BRAKE CALIPER REMOVED)

NOTE: Use repair kit, refer to BMW Parts.

Take off plastic caps (1). Unscrew guide screws (2).

Installation:

Only clean guide screws; do not grease. Check guide bolts, replace if necessary.
Tightening torque, see 34 21 5AZ in **BRAKES - TIGHTENING TORQUES** .

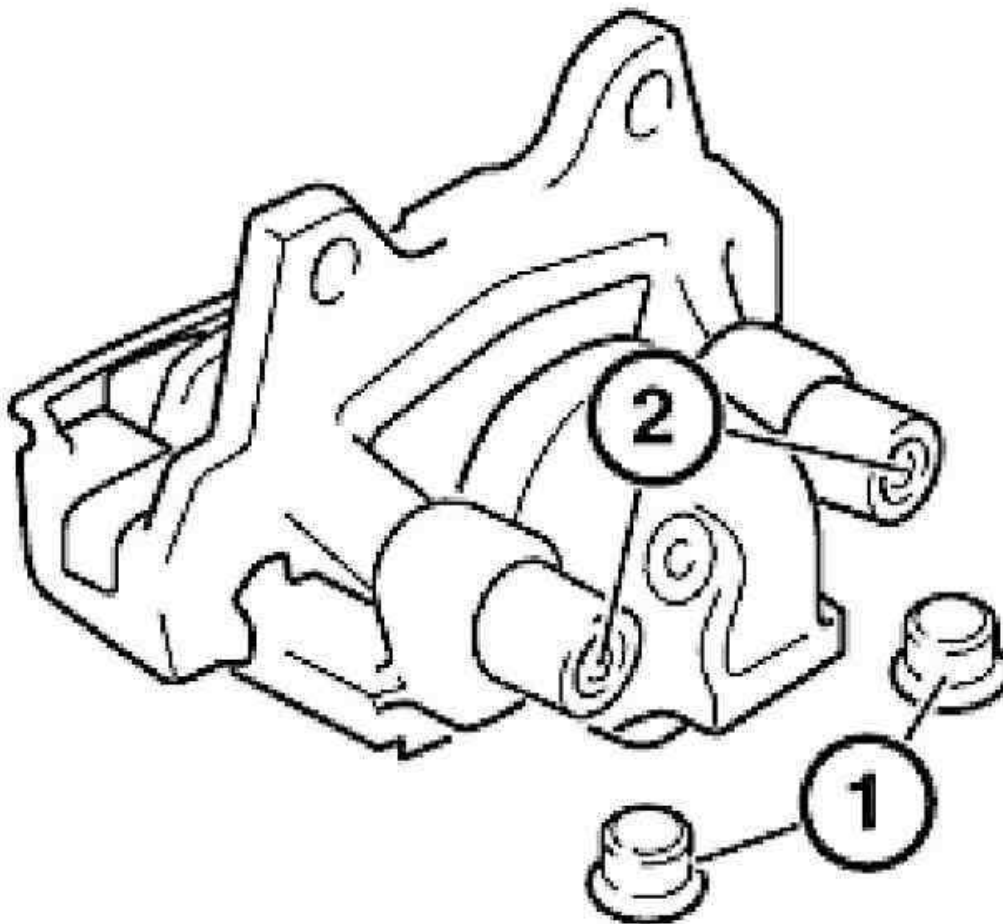
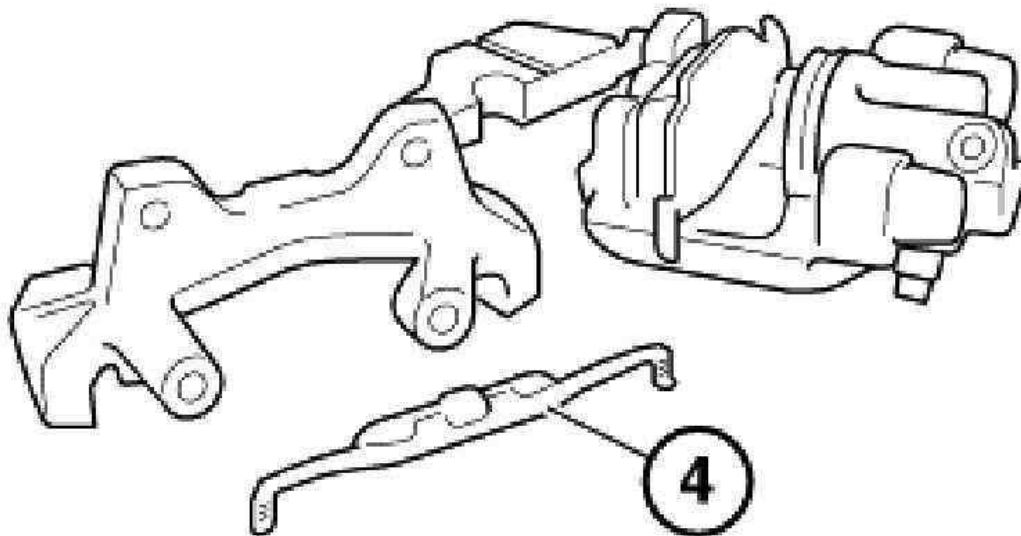
**G03297737**

Fig. 55: Identifying Plastic Caps And Guide Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Dismantle brake caliper and remove brake linings.

Installation:

Press brake lining fully outwards and insert spring (4).



G03297738

Fig. 56: Identifying Spring

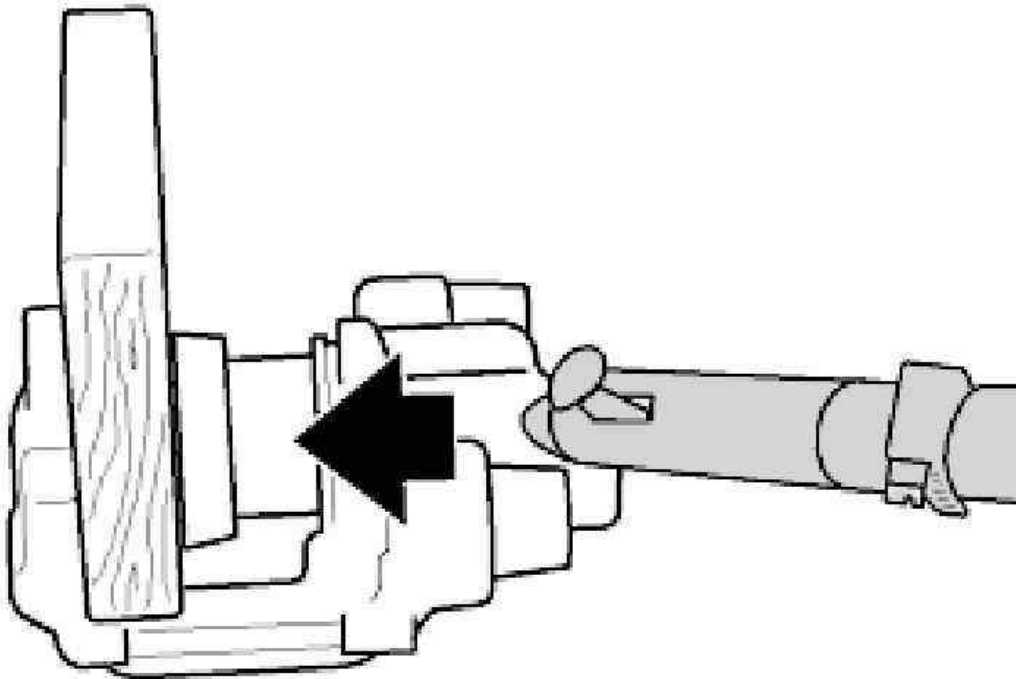
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: In the following work step, large forces occur at the brake caliper piston (up to more than 2800 N!).
Danger of injury!

Carefully force piston out through connection bore with compressed air.

To protect piston, place a protective plate (e.g. hard wood or hard felt) in caliper recess.

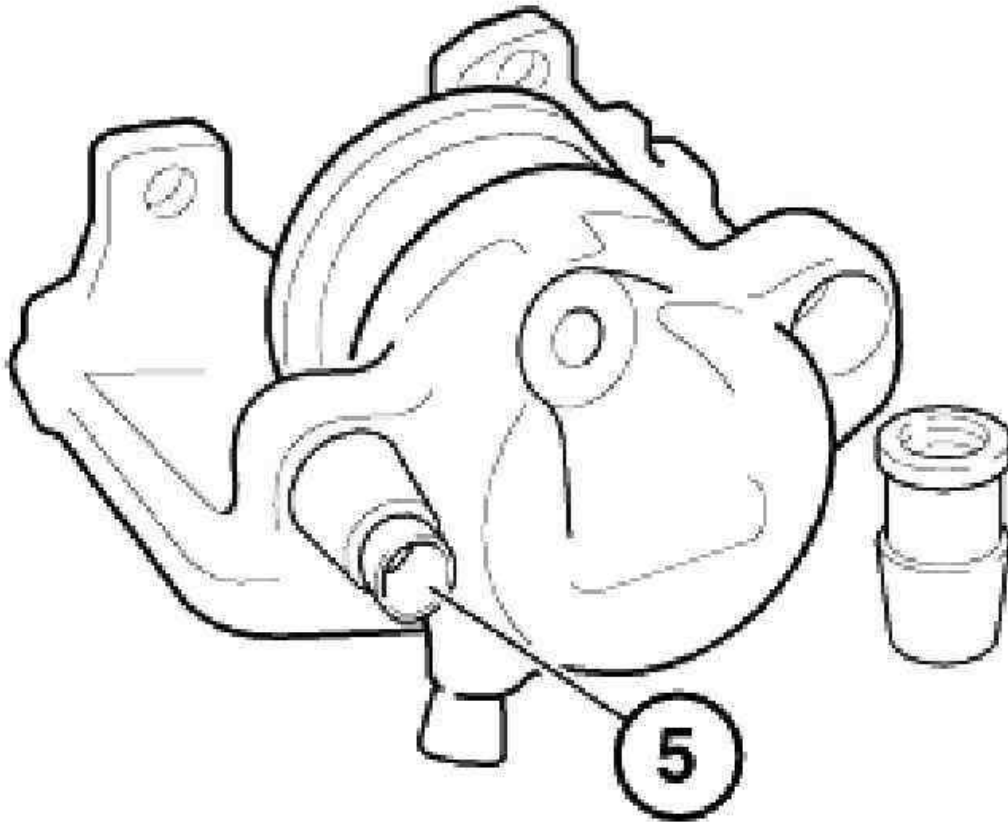
Do not grip piston with fingers - risk of trapping!



G03297739

Fig. 57: Protecting Piston Using Protective Plate
Courtesy of BMW OF NORTH AMERICA, INC.

Check guide sleeves (5), fitting repair-kit guide sleeve if necessary.

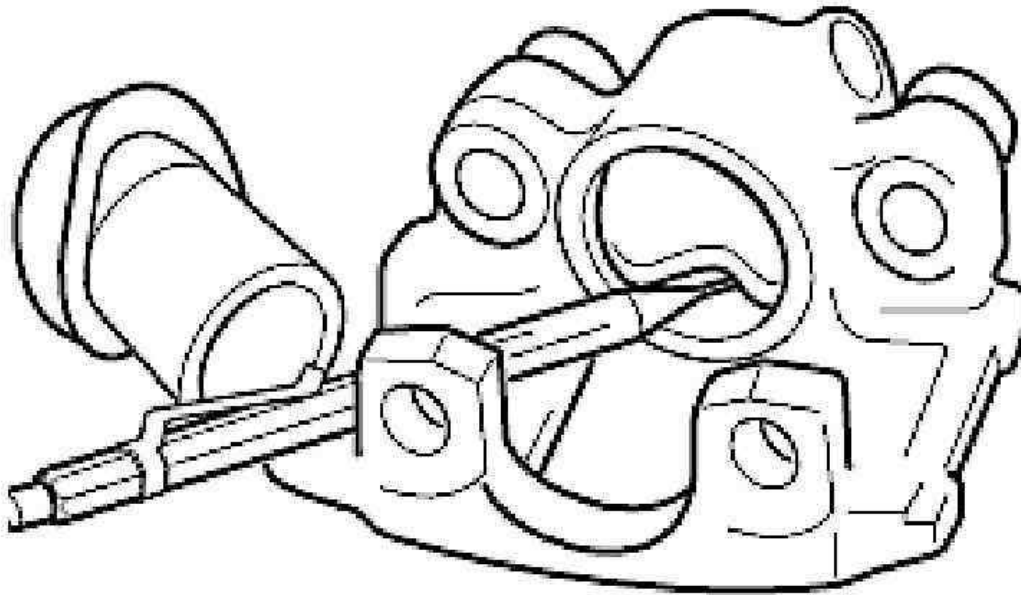
**G03297740****Fig. 58: Identifying Guide Sleeves****Courtesy of BMW OF NORTH AMERICA, INC.**

Remove sealing ring carefully with a plastic needle.

Clean cylinder bores and parts with alcohol and dry with compressed air.

Thoroughly inspect cylinder bore, piston and flange surfaces.

Machining of cylinders and pistons is not permitted.



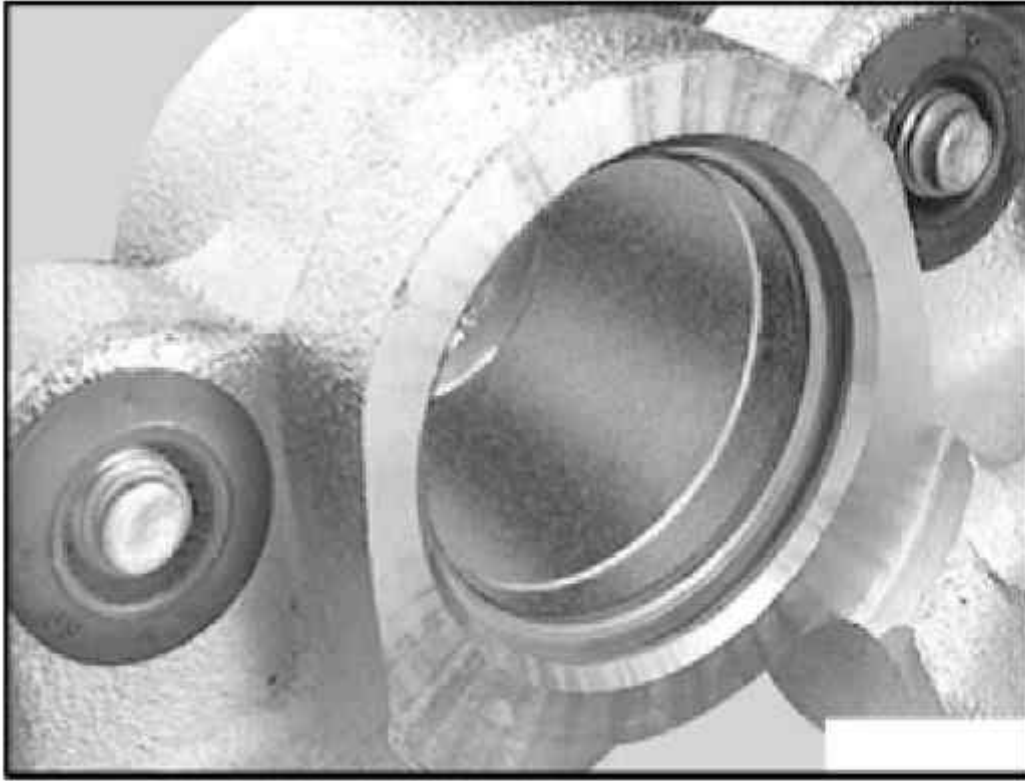
G03297741

Fig. 59: Removing Sealing Ring Using Plastic Needle
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Apply a light coat of Ate brake cylinder paste to cylinder bore, piston and sealing sleeve, Refer to **OPERATING FLUIDS - BRAKES** .

Install sealing cover in rear annular groove of cylinder bore.



G03297742

Fig. 60: View Of Cylinder Bore Annular Groove
Courtesy of BMW OF NORTH AMERICA, INC.

Insert dust sleeve in front annular groove and press into annular groove over entire diameter.

Installation:

The area between the dust sleeve and the brake caliper housing must be kept dry. This area must not come into contact with Ate brake cylinder paste or brake fluid so as to ensure that the dust sleeve is perfectly seated.

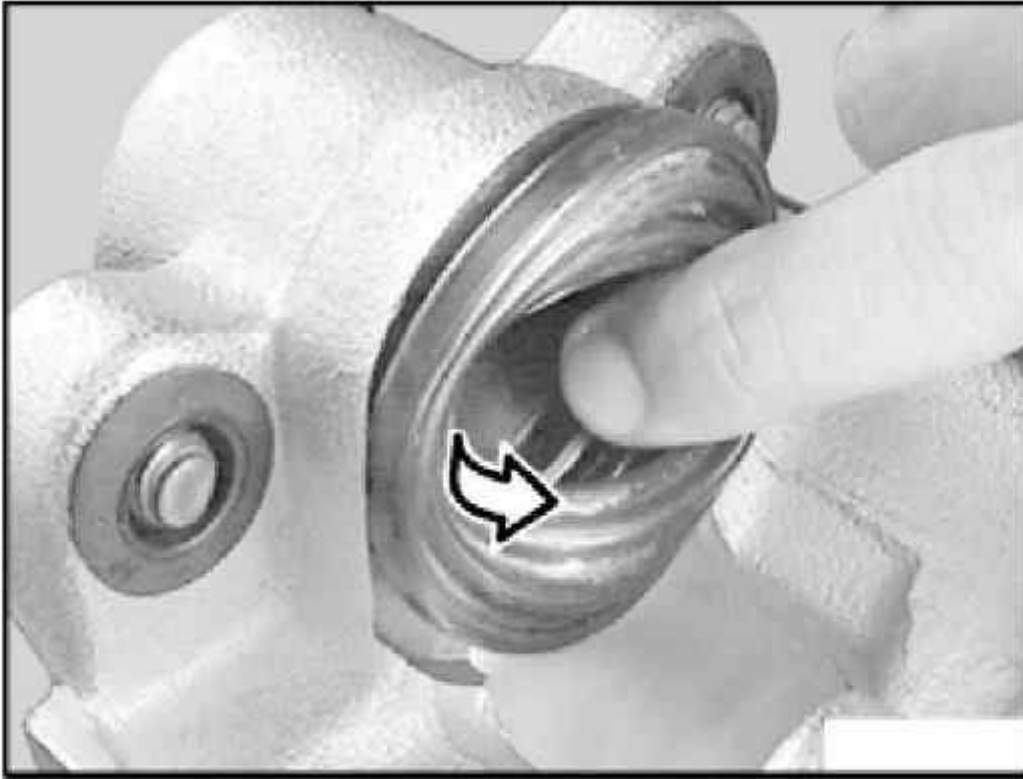
**G03297743**

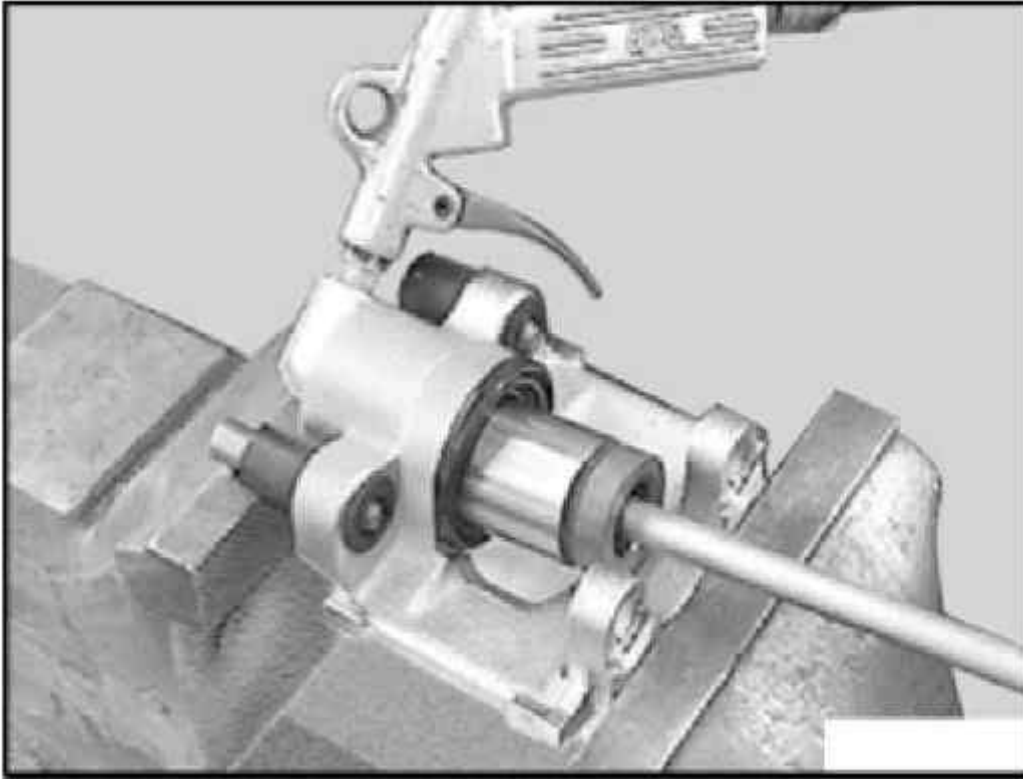
Fig. 61: Inserting Dust Sleeve In Front Annular Groove
Courtesy of BMW OF NORTH AMERICA, INC.

Take up brake piston with a commercially available extension and socket and gently press onto dust sleeve.

Blow up sleeve with compressed air (max. 3 bar). Sleeve jumps over brake piston.

Installation:

Coat dust sleeve and brake piston with brake fluid to facilitate installation of dust sleeve.



G03297744

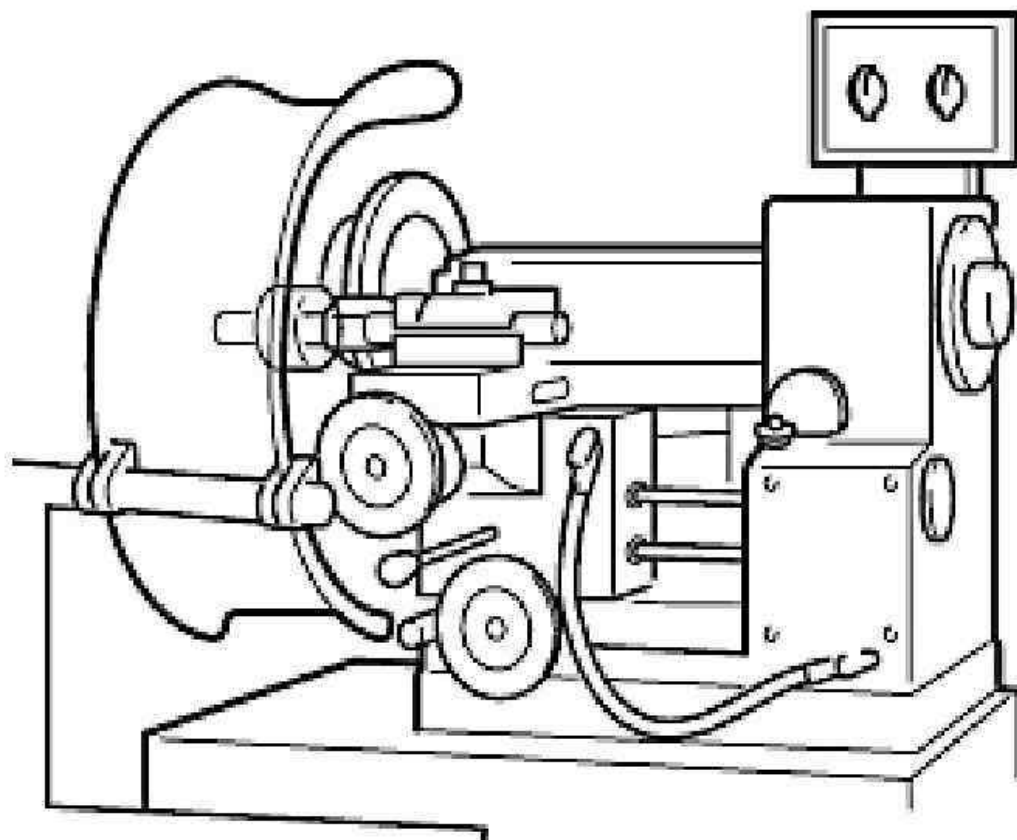
Fig. 62: Removing Brake Piston

Courtesy of BMW OF NORTH AMERICA, INC.

34 21 947 FINE-GRINDING BOTH SIDES OF BOTH REAR BRAKE DISKS (BRAKE DISKS REMOVED)

IMPORTANT: Always fine-grind both sides of both brake disks on one axle.
Observe max. machining dimension per friction ring side, minimum brake disk thickness (MIN TH) and Observe surface roughness of brake surfaces.
Only one brake lining set may be used up on brake discs which have been lathe-turned to minimum thickness (MIN TH).
Brake disks of M models (Compound brake disks) must not be machined!

Follow the machine manufacturer's operating instructions.

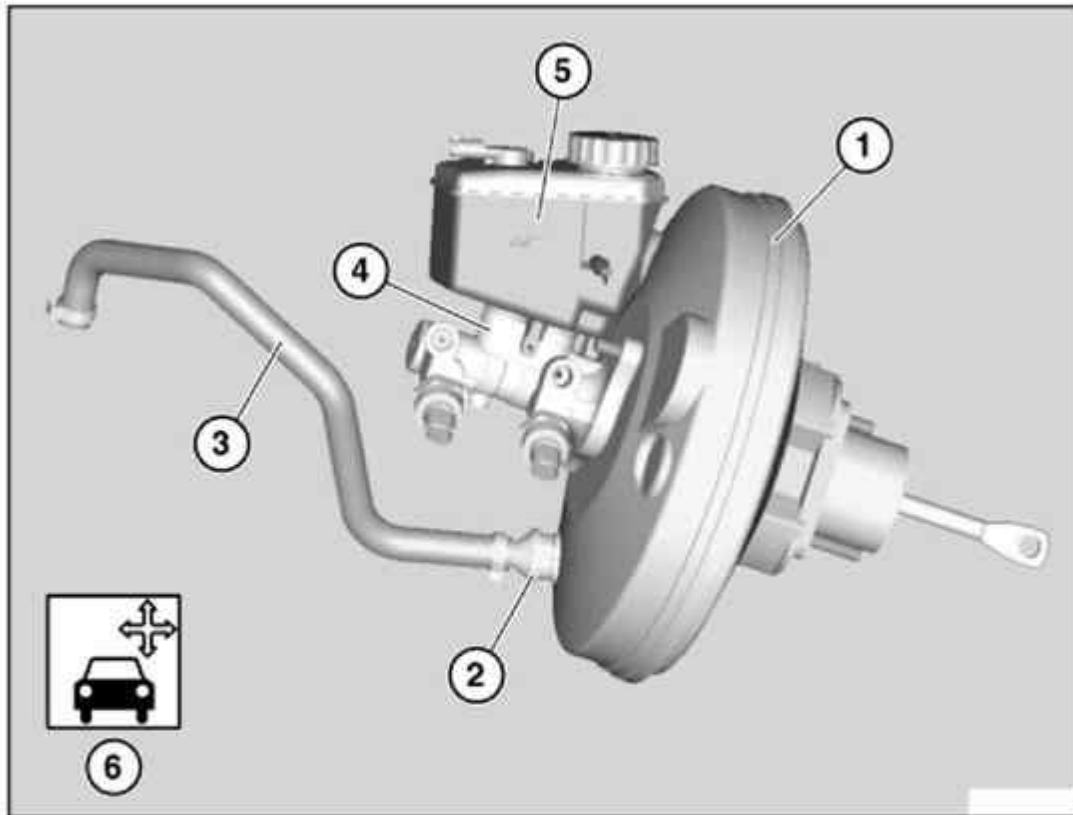


G03297745

Fig. 63: View Of Grinding Machine
Courtesy of BMW OF NORTH AMERICA, INC.

MASTER BRAKE CYLINDER

34 31... OVERVIEW OF BRAKE MASTER CYLINDER / BRAKE BOOSTER



- 1 Brake booster
- 2 Non-return valve
- 3 Vacuum hose

- 4 Brake master cylinder
- 5 Expansion tank
- 6 Bleeding braking system

G03297746

Fig. 64: Identifying Brake Booster Components
Courtesy of BMW OF NORTH AMERICA, INC.

34 31 181 REMOVING AND INSTALLING/REPLACING EXPANSION TANK FOR HYDRAULIC BRAKE ACTUATION

NOTE: Follow general instructions:

Suck the brake fluid out of the expansion tank. Use a suction bottle used exclusively for drawing off brake fluid.

Do not reuse drawn out brake fluid.

Unfasten plug connection (1) and disconnect.

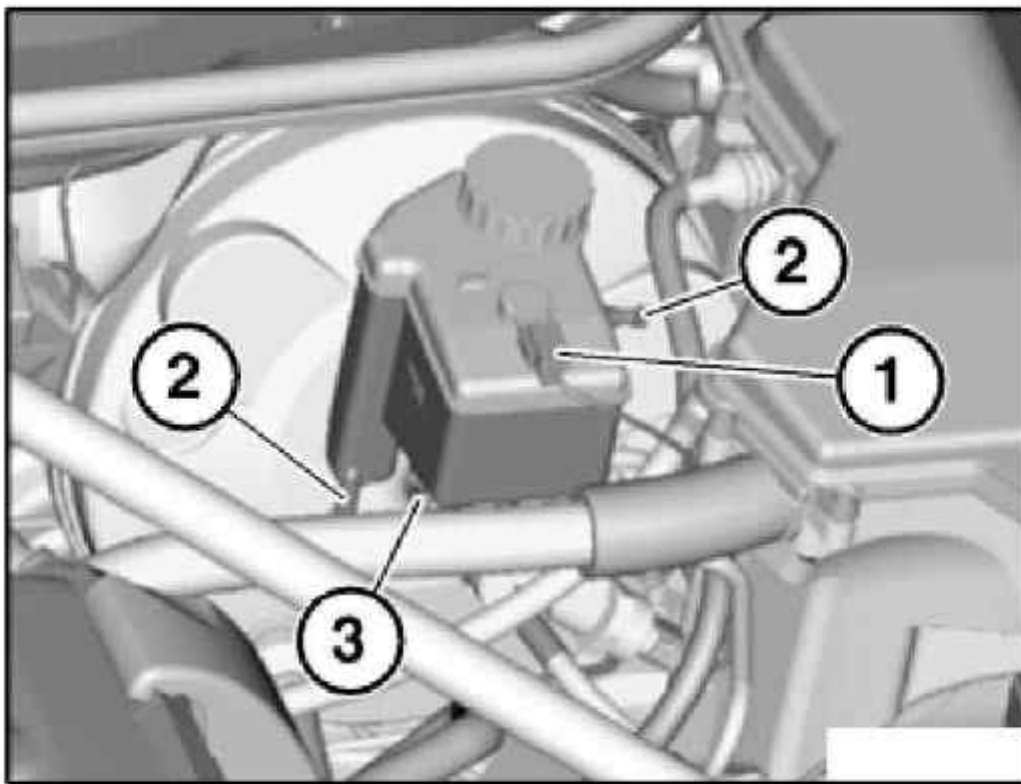
If necessary, detach supply hoses (2) of clutch hydraulics and precharging pump.

Release retaining screw (3).

Installation:

Tightening torque, see 34 31 3AZ in **BRAKES - TIGHTENING TORQUES** .

Pull expansion tank vertically out of brake master cylinder.



G03297747

Fig. 65: Replacing Expansion Tank For Hydraulic Brake Actuation

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Feed hoses must be secured in vertical position so that no fluid can escape.

IMPORTANT: Check rubber plug in brake master cylinder for damage and replace if necessary.

Push the expansion tank vertically onto the master brake cylinder.



G03297748

Fig. 66: Pushing Expansion Tank On To Master Brake Cylinder
Courtesy of BMW OF NORTH AMERICA, INC.

34 31 505 REMOVING AND INSTALLING/REPLACING BRAKE MASTER CYLINDER FOR DSC (MK60)

DSC (Dynamic Stability Control)

NOTE: Read and comply with General Information .
 After completing work:
 Bleed brake system. See 34 00 050 Bleeding Brake System With DSC .
 Remove expansion tank.
 Remove pressure sensor "V" for DSC.
 Remove pressure sensor "H" for DSC.

Unfasten brake lines (1).

Installation:

Tightening torque, see 34 32 1AZ in **BRAKES - TIGHTENING TORQUES** .

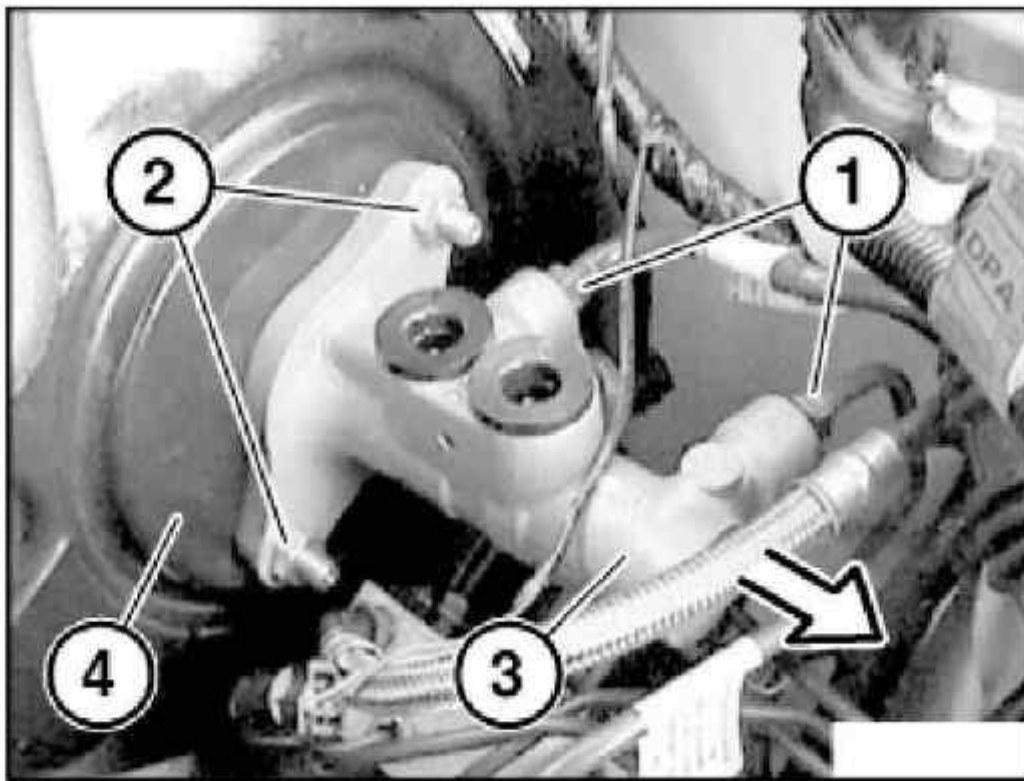
Unfasten hex nuts (2).

Withdraw brake master cylinder (3) from brake booster (4).

Installation:

Replace self-locking nuts.

Tightening torque, see 34 31 1AZ in **BRAKES - TIGHTENING TORQUES** .

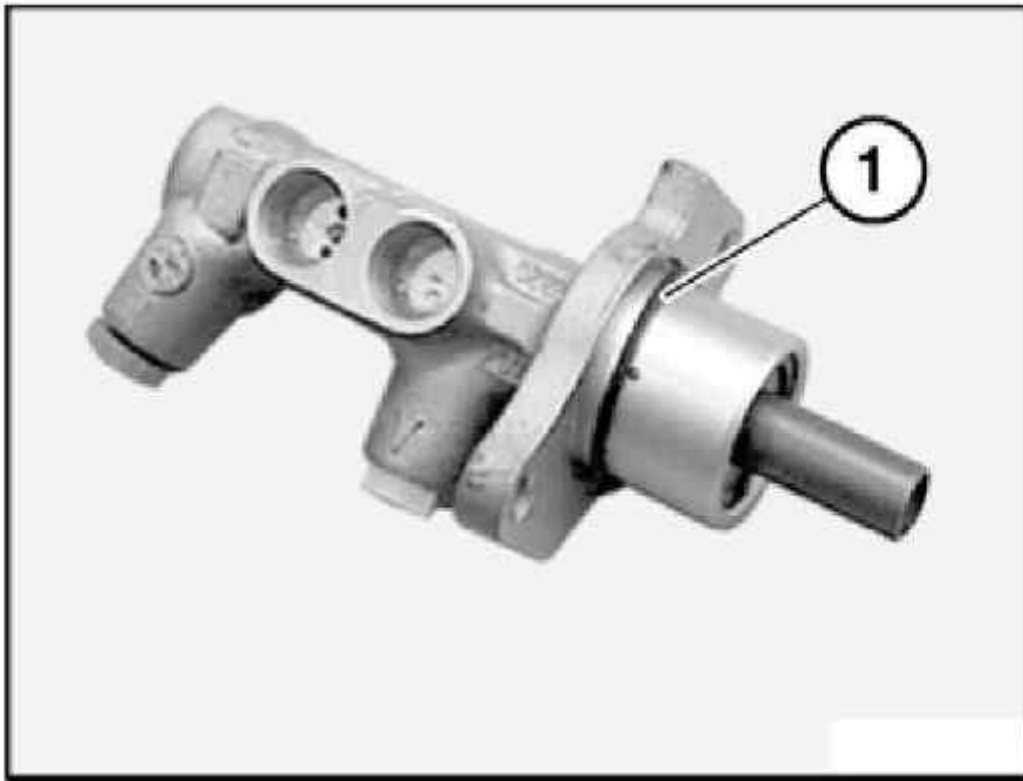


G03297749

Fig. 67: Removing Brake Master Cylinder From Brake Booster
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace sealing ring in O-shape (1).



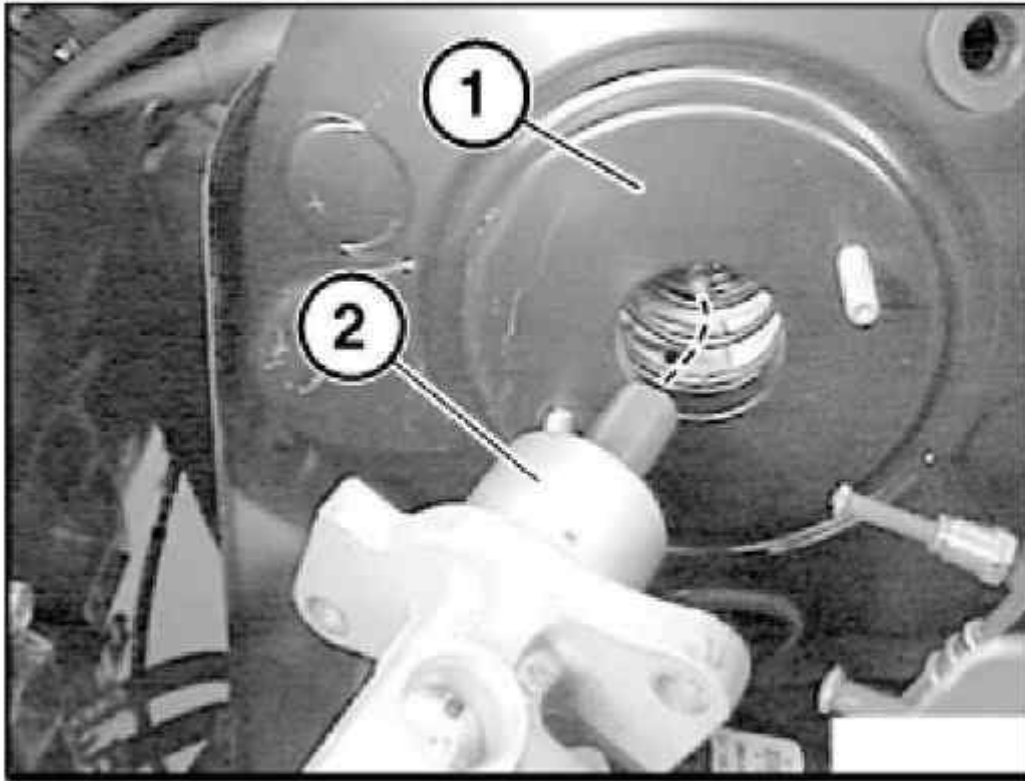
G03297750

Fig. 68: Identifying Sealing Ring

Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

When inserting the brake master cylinder (2) into the brake booster (1), make sure the pressure rod of the brake booster (1) and that of the brake master cylinder (2) are on one level.



G03297751

Fig. 69: Installing Brake Master Cylinder To Brake Booster
Courtesy of BMW OF NORTH AMERICA, INC.

BRAKE LINES

34 32... OVERVIEW OF BRAKE LINES

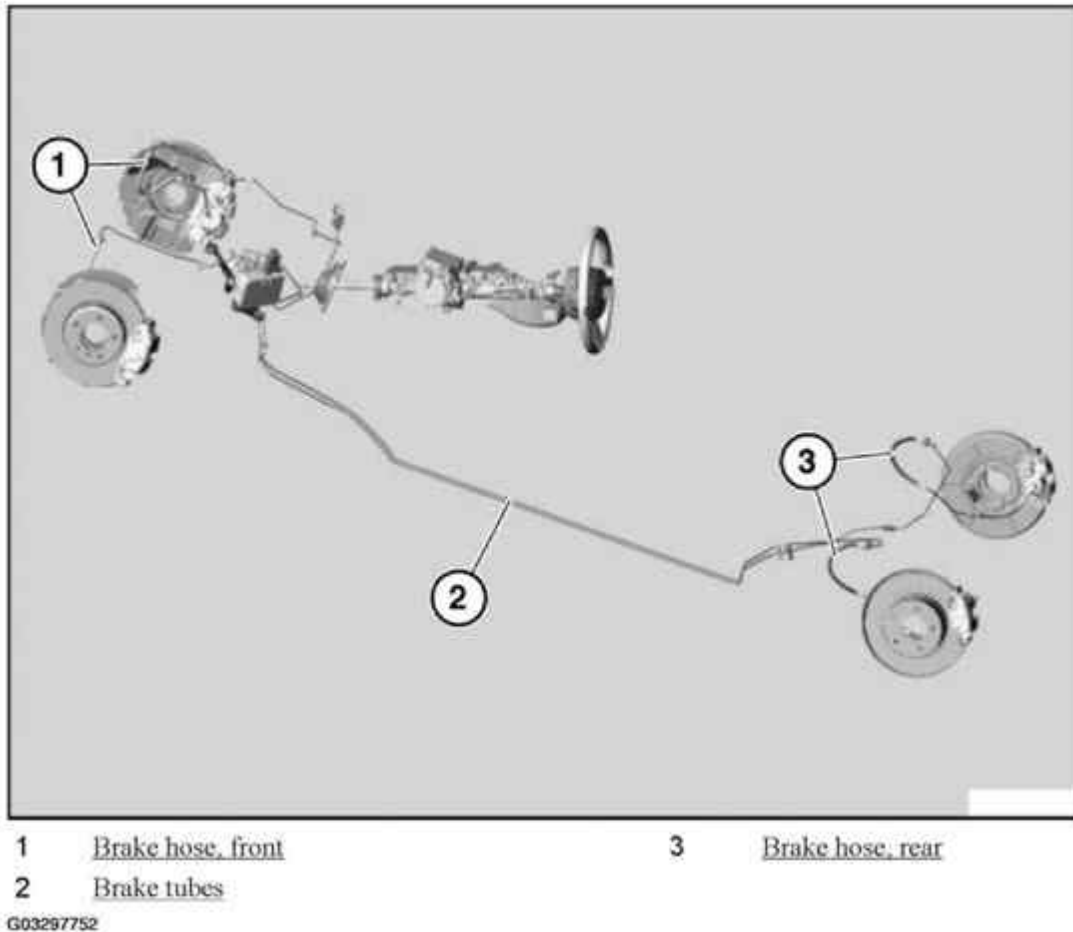


Fig. 70: Exploded View Of Brake Lines
Courtesy of BMW OF NORTH AMERICA, INC.

34 32 861 REPLACING ALL BRAKE PIPES

Special tools required:

- 34 5 100

NOTE: The brake lines are only supplied in the straight version and correct length with connecting nipple.

Read and comply with General Information .

After completing work, bleed brake system. See 34 00 050 Bleeding Brake System With DSC .

Observe safety instructions on raising the vehicle. See 00..... LIFTING VEHICLE WITH A LIFTING PLATFORM .

2005 BMW Z4

2003-05 BRAKES Brakes - Repair Procedures - Z4/E85

New brake lines are bent into shape with bending tool 34 5 100.

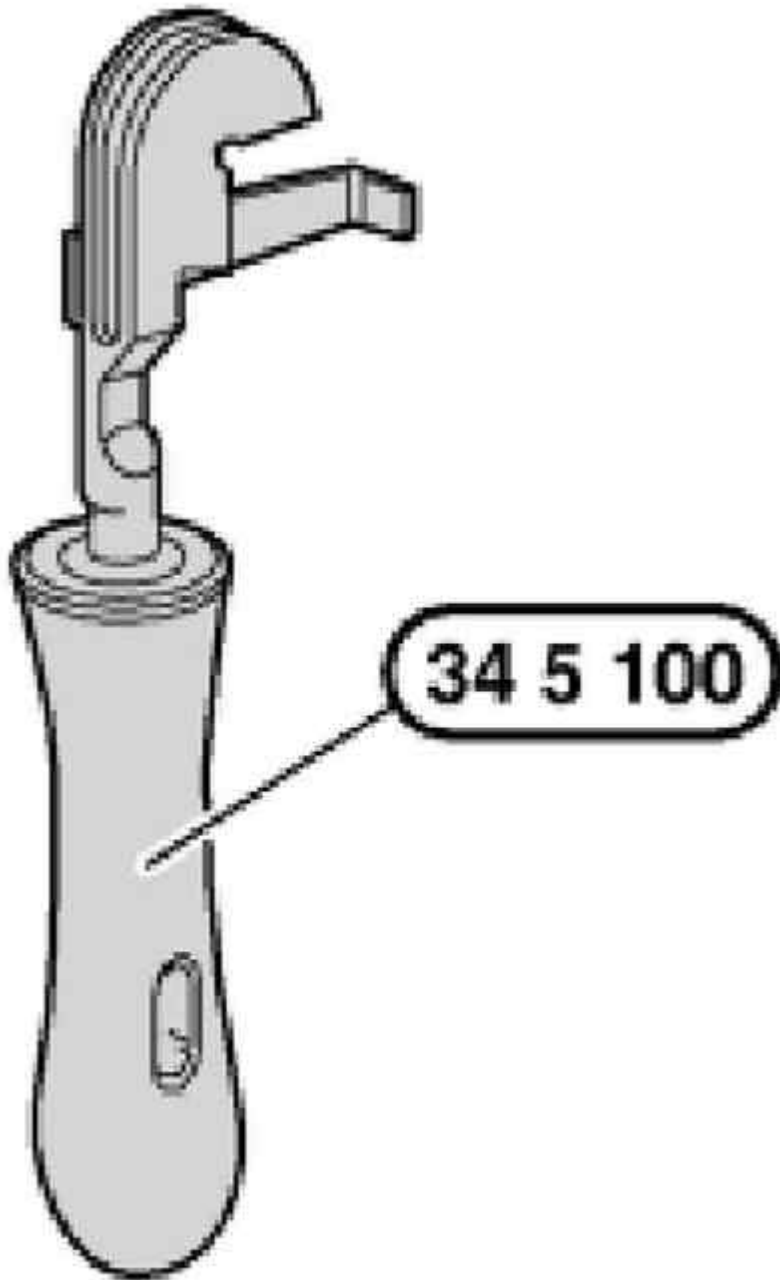
Removed brake pipes can be used as templates for bending.

IMPORTANT:

- **Protective coating of brake line must not be damaged during bending.**
- **Do not kink or bend back brake lines.**
- **Watch distances to rigid and movable vehicle parts. Brake lines may not make contact or rub.**
- **Tighten down brake line couplings with torque wrench.**

Installation:

Tightening torque, see 34 32 1AZ in **BRAKES - TIGHTENING TORQUES** .



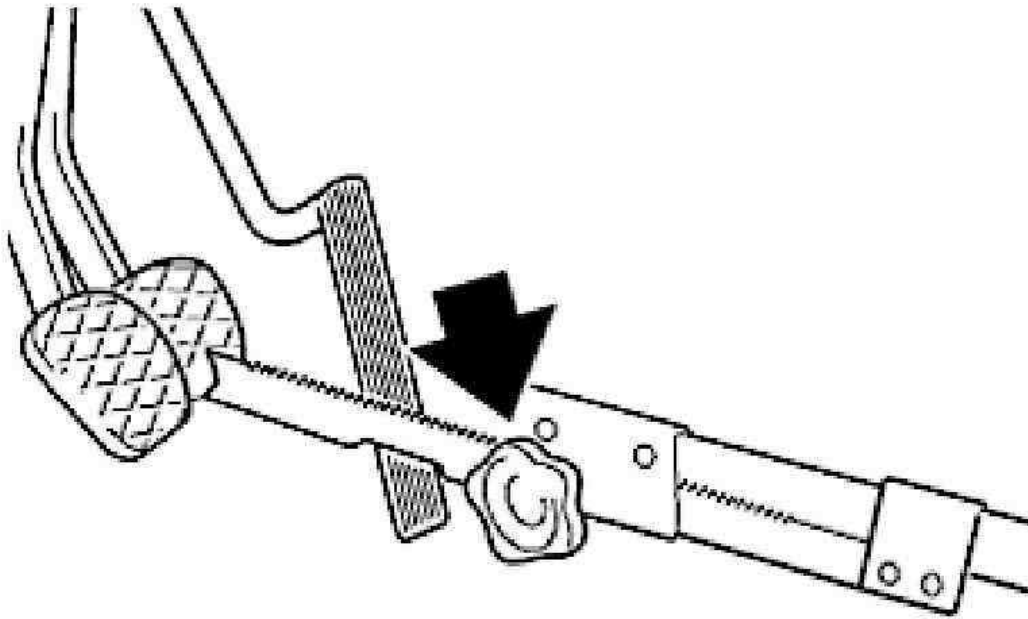
G03297753

Fig. 71: View Of Bending Tool 34 5 100
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Read and comply with General Information .

After completing tasks, bleed brake system. See 34 00 050 Bleeding Brake System With DSC .

Apply pedal prop and depress brake pedal slightly. This prevents brake fluid from emerging from the expansion tank when the brake lines are opened.



G03297754

Fig. 72: Depressing Brake Pedal

Courtesy of BMW OF NORTH AMERICA, INC.

Pull brake hose out of holder (1).

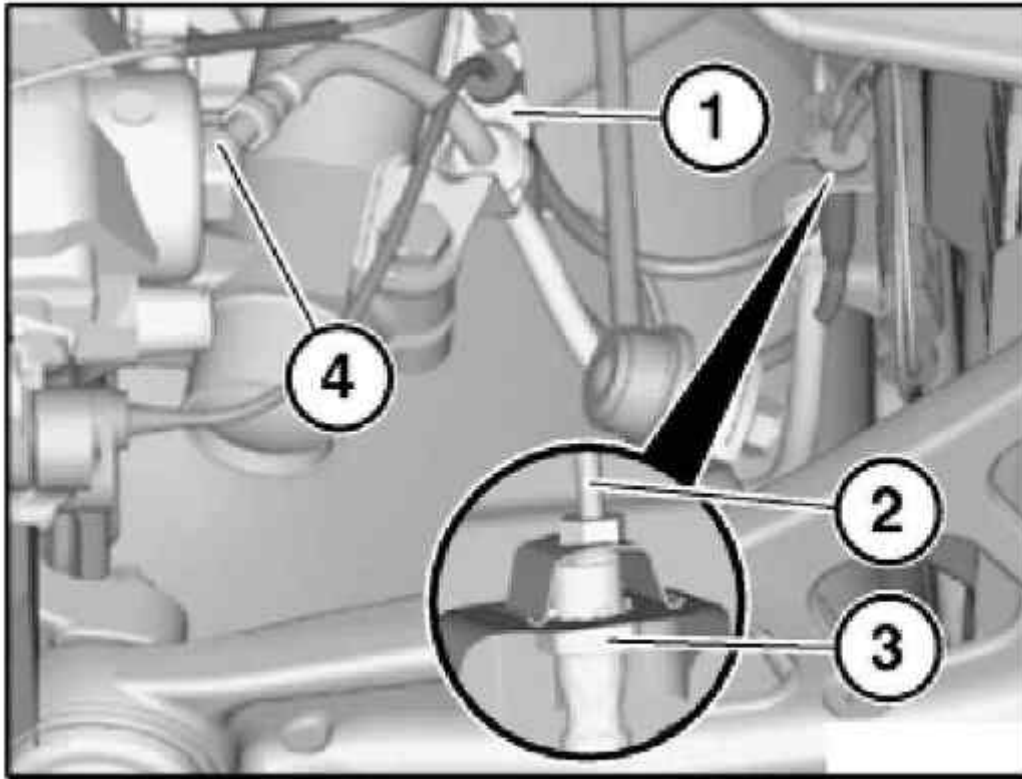
Disconnect brake hose from brake line (2).

IMPORTANT: Grip brake hose at square (3) to prevent connecting piece from turning in retaining bracket.

Installation:

Tightening torque, see 34 32 1AZ in BRAKES - TIGHTENING TORQUES .

Detach brake hose from brake caliper (4).



G03297755

Fig. 73: Replacing Front Brake Hoses

Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*Tightening torque, see 34 32 2AZ in **BRAKES - TIGHTENING TORQUES** .**NOTE:** First tighten brake hose on brake caliper.

Move wheels into straight-ahead position.

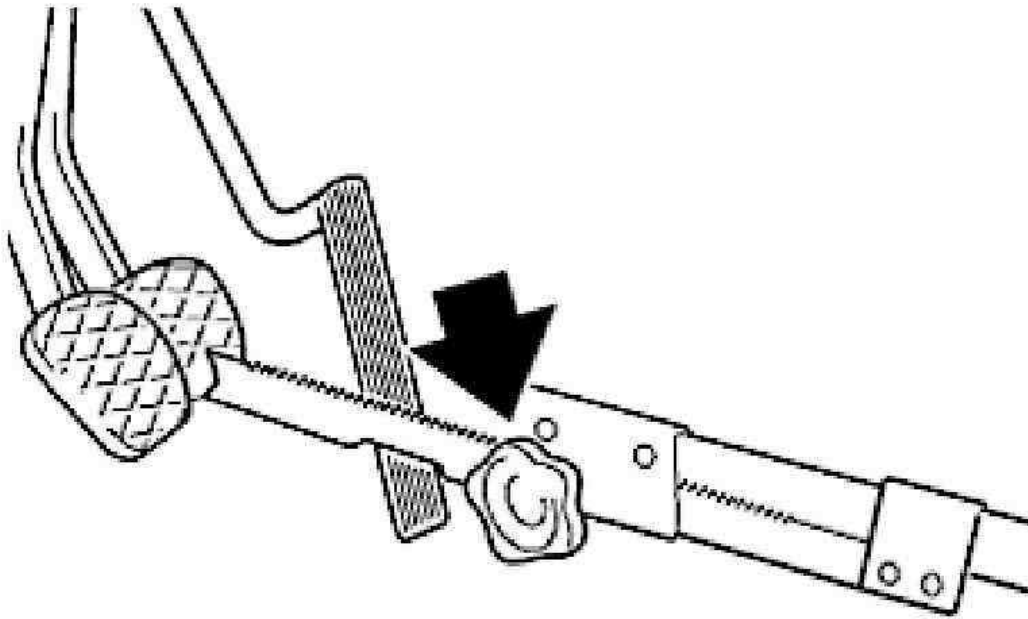
Insert brake hose in bracket and screw onto brake pipe.

IMPORTANT: Never twist brake hose when installing it and avoid all contact with parts attached rigidly to the body.**34 32 971 REPLACING BOTH REAR BRAKE HOSES**

NOTE: Read and comply with General Information .

After completing tasks, bleed brake system. See 34 00 050 Bleeding Brake System With DSC .

Apply pedal prop and depress brake pedal slightly. This prevents brake fluid from emerging from the expansion tank and air from entering the system when the brake lines are opened.



G03297756

Fig. 74: Depressing Brake Pedal

Courtesy of BMW OF NORTH AMERICA, INC.

Release union nut (1); to do so, grip brake hose at square (2).

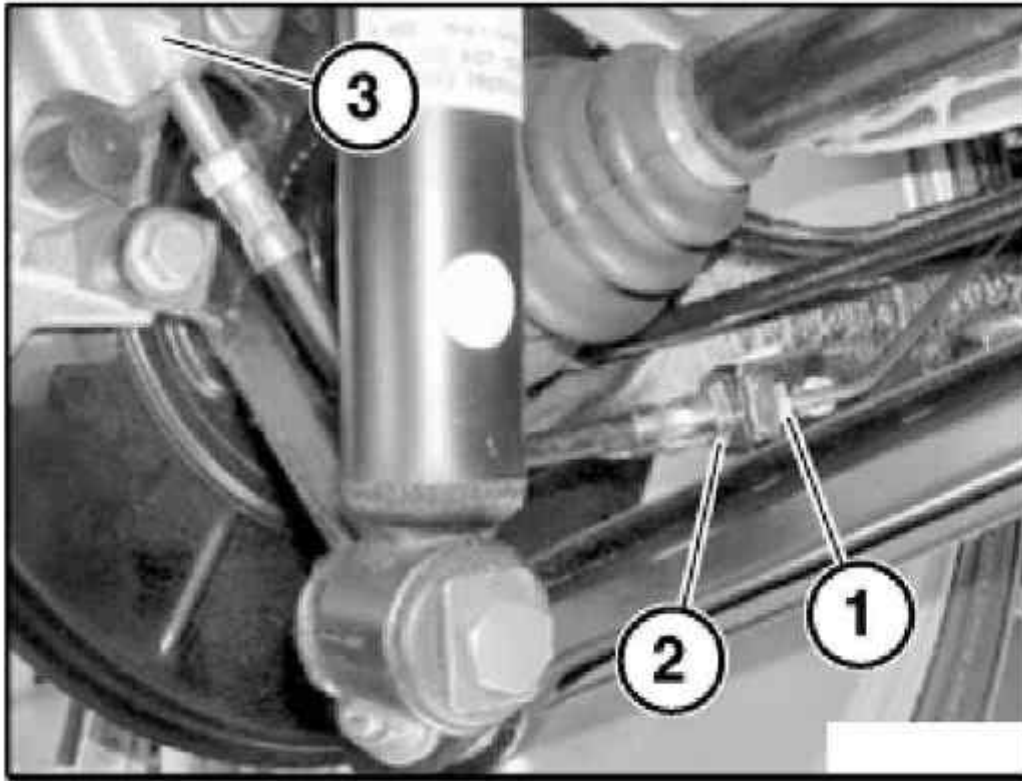
Installation:

Tightening torque, see 34 32 1AZ in BRAKES - TIGHTENING TORQUES .

Disconnect brake hose from brake caliper (3).

Installation:

Tightening torque, see 34 32 2AZ in BRAKES - TIGHTENING TORQUES .



G03297757

Fig. 75: Disconnecting Brake Hoses From Brake Caliper
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Mount and tighten brake hose on brake caliper first, then on brake line/brake hose point of connection.

IMPORTANT: Never twist brake hose when installing it and avoid all contact with parts attached rigidly to the body.

BRAKE BOOSTER

34 33 051 REMOVING AND INSTALLING / REPLACING NON RETURN VALVE FOR BRAKE BOOSTER

NOTE: This operation is described in the section headed Removing and installing vacuum hose for brake booster.

34 33 071 REPLACING VACUUM HOSE FOR BRAKE BOOSTER

NOTE: **Read and comply with General Information .**
 Before beginning work, fully press the brake pedal several times to reduce the
 vacuum pressure in the brake booster.
 This makes it easier to detach the vacuum hose.
 The non-return valve and the molded hose are permanently connected to each
 other are replaced together as a single unit.

Pull non-return valve (1) out of brake booster.

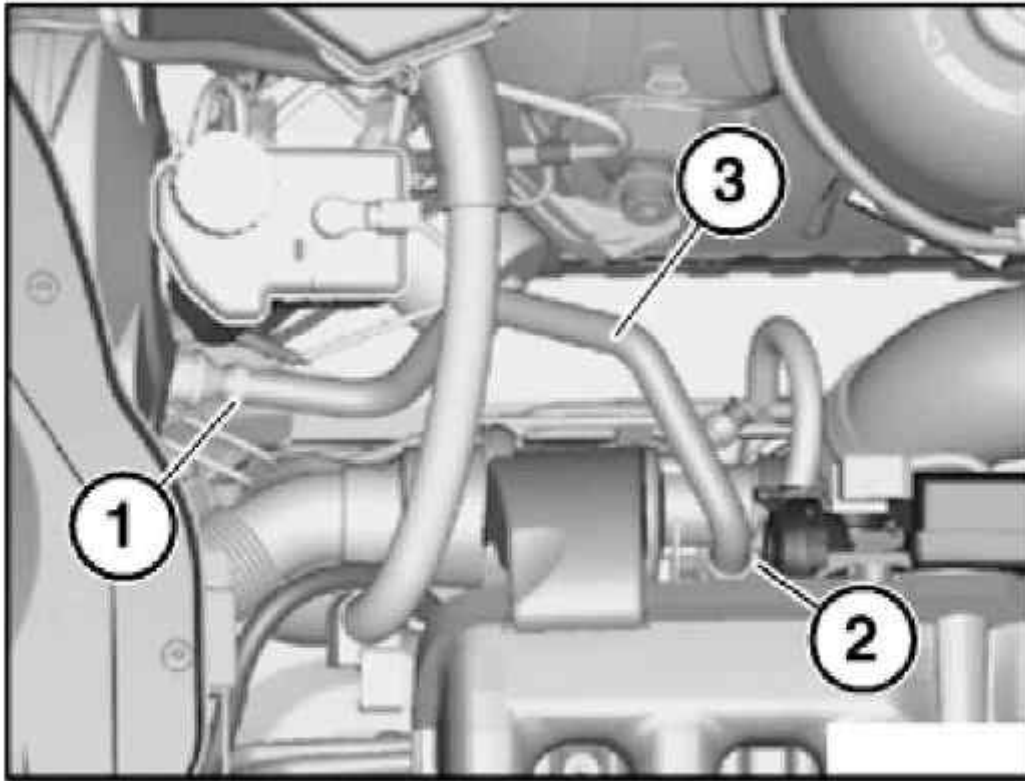
Open hose clip (2).

Pull off vacuum hose (3).

Installation:

Check seal for non-return valve, replace if necessary.

Replace hose clamp (2).



G03297758

Fig. 76: Replacing Vacuum Hose For Brake Booster
Courtesy of BMW OF NORTH AMERICA, INC.

34 33 505 REMOVING AND INSTALLING/REPLACING BRAKE UNIT (MK60)

DSC (Dynamic Stability Control)

NOTE: **General Information** .

Remove brake master cylinder for DSC (MK60). See **Master Brake Cylinder** .

Remove brake pedal. See **PEDALS - REPAIR INSTRUCTIONS** .

Remove vacuum hose for brake booster. See **BRAKE BOOSTER VACUUM HOSE** .

Remove sound generator. (Applicable to Z4 3.0 only) See **EXHAUST SYSTEM - REPAIR INSTRUCTIONS** .

After completing work:

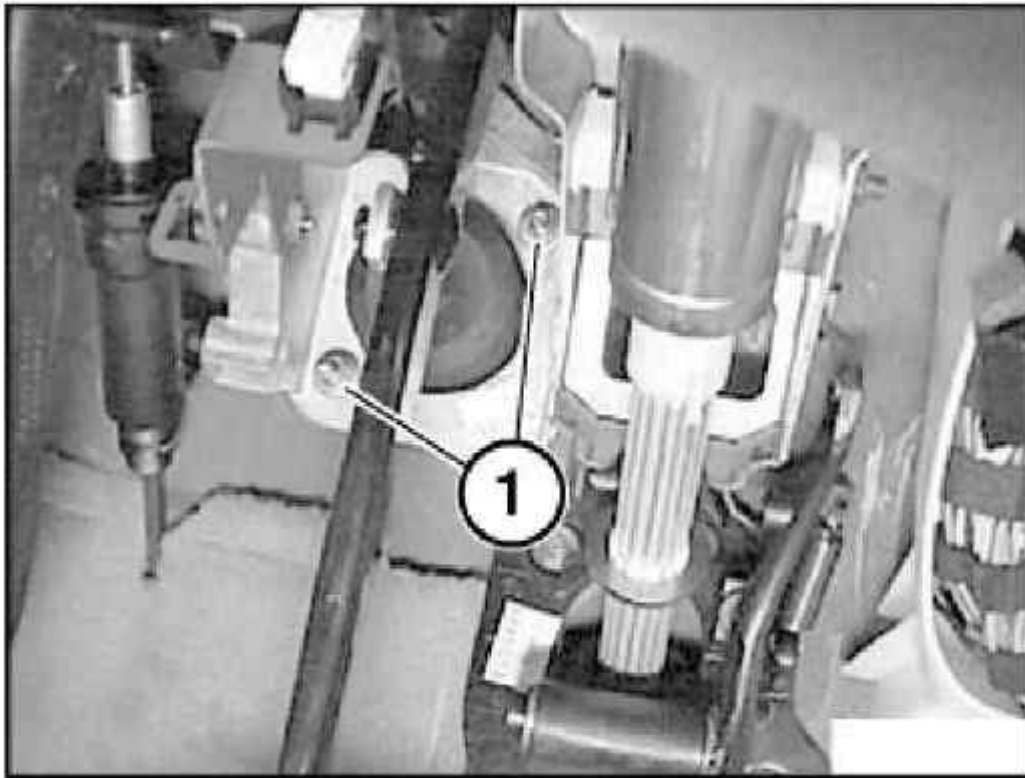
Bleed Brake System With DSC .

Release nuts (1).

Installation:

Replace self-locking nuts.

Tightening torque, see 34 33 12AZ in **BRAKES - TIGHTENING TORQUES .**



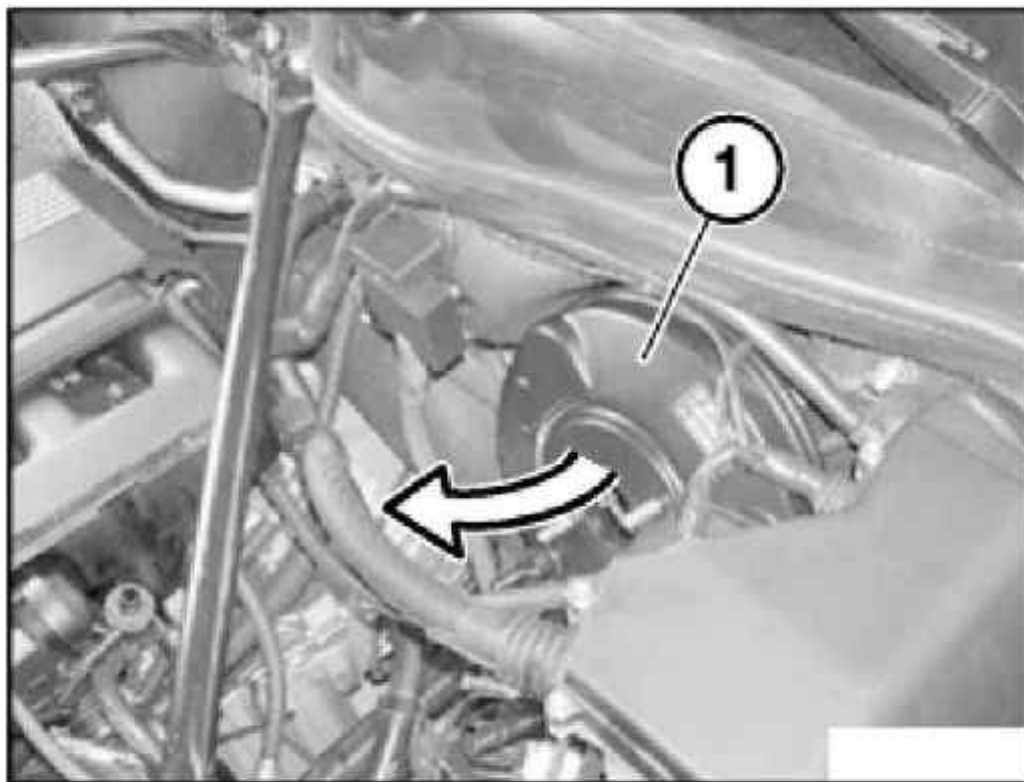
G03297759

Fig. 77: Releasing Nuts

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Do not use any force when removing and installing the brake unit; the brake unit can be damaged under certain circumstances.

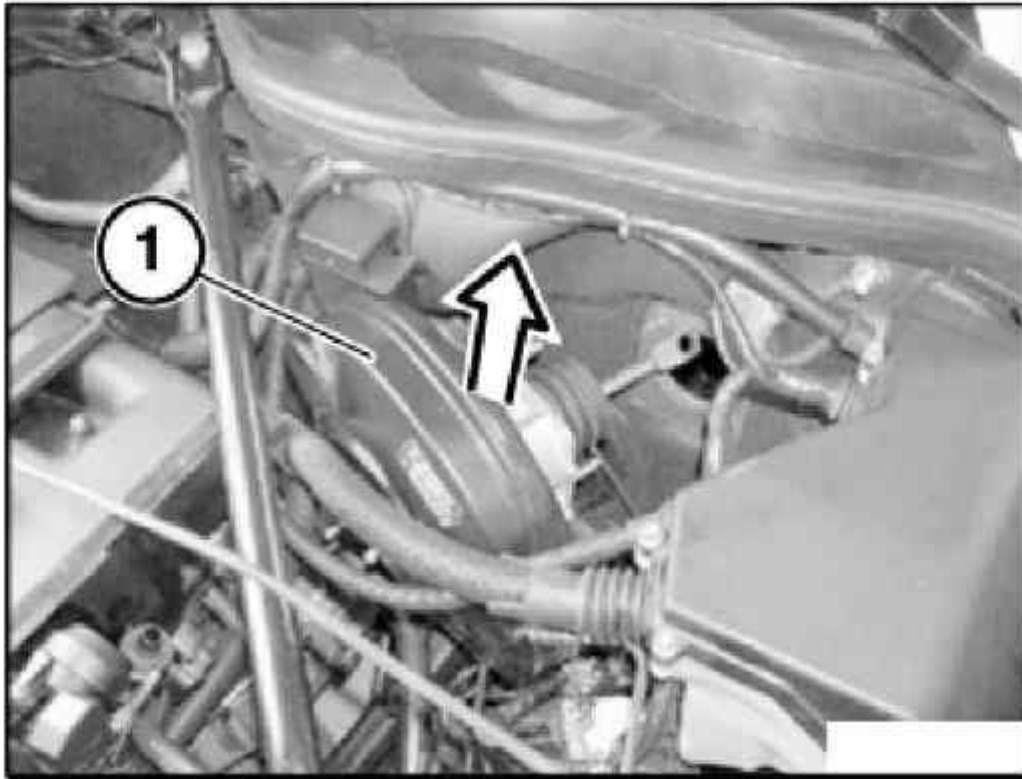
Carefully remove brake unit (1) from bulkhead and tilt out in direction of engine.



G03297760

Fig. 78: Removing Brake Unit From Bulkhead
Courtesy of BMW OF NORTH AMERICA, INC.

Remove brake unit vertically upwards out of equipment compartment.



G03297761

Fig. 79: Removing Brake Unit Out Of Equipment Compartment
Courtesy of BMW OF NORTH AMERICA, INC.

ELECTRICAL COMPONENTS

34 35 001 REPLACING A BRAKE LINING SENSOR

Necessary preliminary tasks:

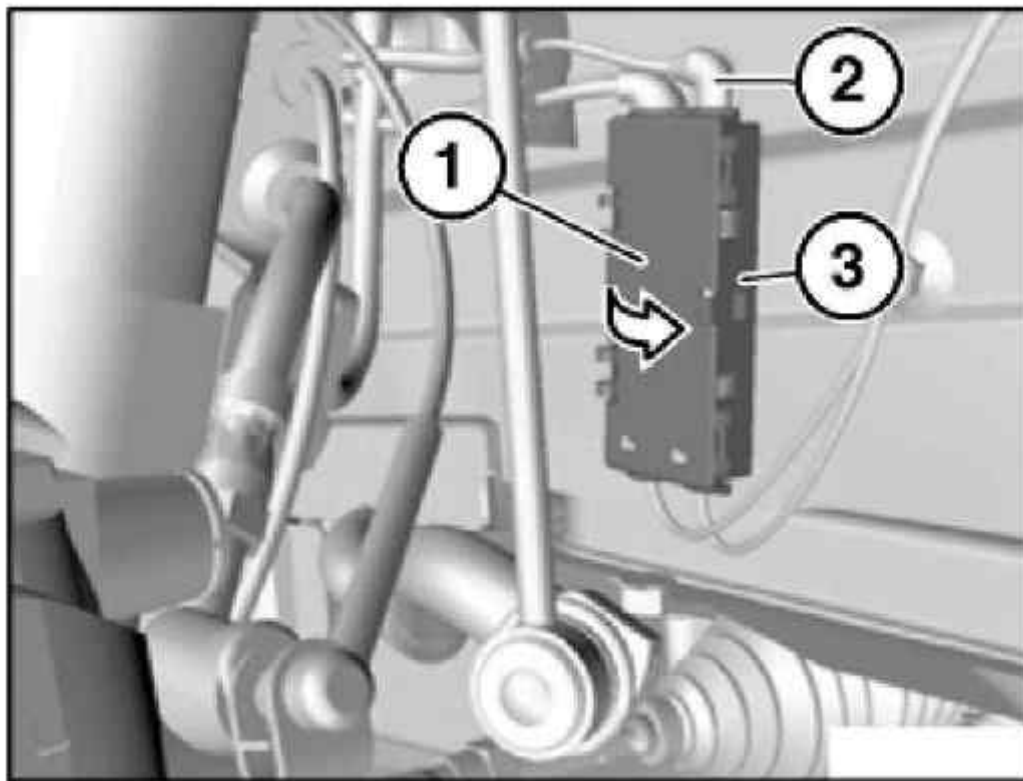
- Remove wheel . See **WHEEL AND TIRES - REPAIR INSTRUCTIONS** .

Open plug housing (1).

Unclip lead of brake lining sensor (2) from plug housing (1).

Disconnect associated plug connection of lead from brake lining sensor (2).

Feed lead from brake lining sensor (2) out of fixtures.



G03297762

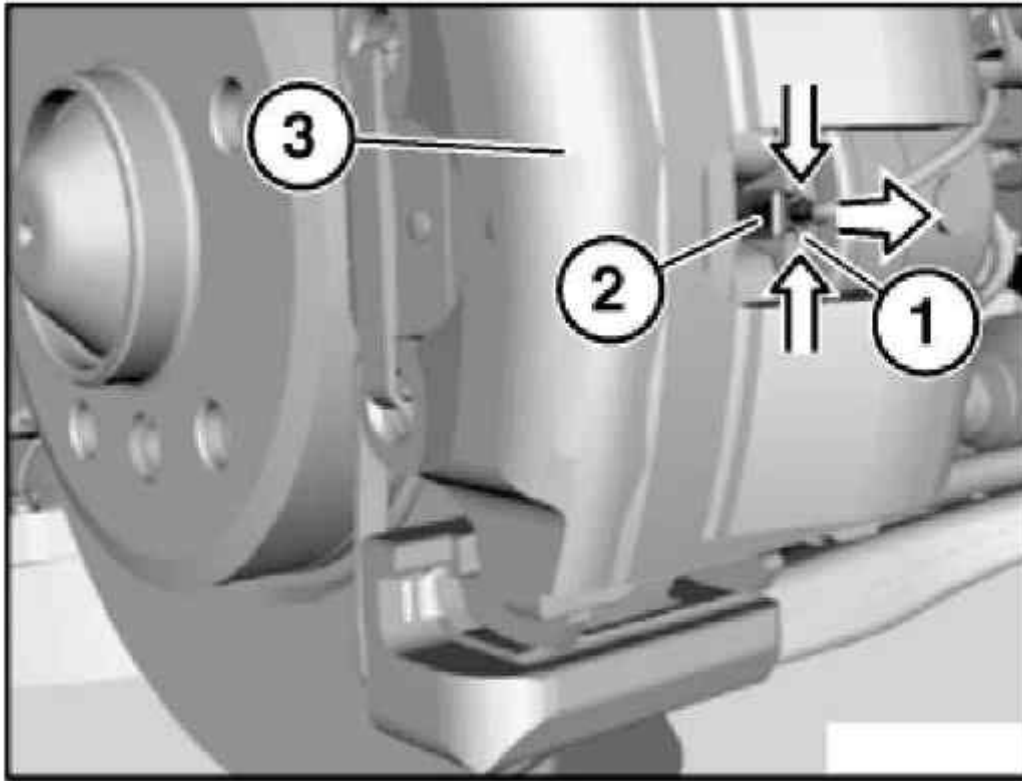
Fig. 80: Opening Plug Housing

Courtesy of BMW OF NORTH AMERICA, INC.

Press clip (1) together and detach brake lining sensor (2) in direction of arrow from brake caliper (3).

Installation:

Make sure clip (1) and brake lining sensor (2) are correctly seated in brake caliper (3).



G03297763

Fig. 81: Disconnecting Brake Lining Sensor From Brake Caliper
Courtesy of BMW OF NORTH AMERICA, INC.

PARKING BRAKE

34 10 014 ADJUSTING HANDBRAKE

Special tools required:

- 32 1 030

Perform inspection in the following manner:

When 1st ratchet is engaged, no braking force should be exerted.

The difference in wheel circumferential forces between the left and right wheels may deviate by max. 30 % from the greater value (measured on brake analyzer).

The handbrake must be readjusted in the event of greater deviations in the wheel circumferential force!

It must be possible to brake with locked wheels with the handbrake.

The handbrake must be readjusted whenever the actuation stroke is greater than 10 teeth.

NOTE: **The handbrake can only be adjusted correctly when the parking brake Bowden cables and all moving handbrake parts are free to move and fully operational. Basic handbrake adjustment is necessary:**

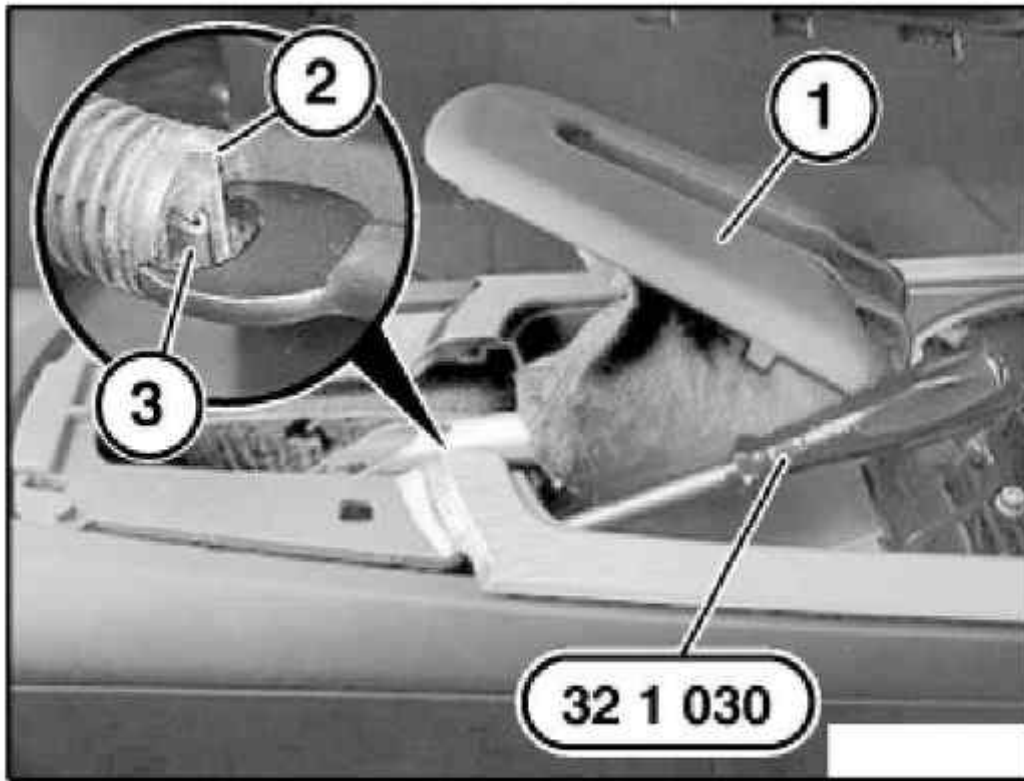
- **When replacing parking brake shoes.**
- **When replacing brake disks.**
- **In event of excessive actuation stroke (10 teeth).**
- **When replacing parking brake Bowden cables**

1. Setting instruction for brake shoes (basic setting)

Unclip handbrake lever trim (1) at rear and tilt forwards.

Lock adjuster unit (ASZE).

Using special tool 32 1 030, press stop (2) of adjusting spring back to such an extent that retaining hook (3) engages in stop (2).



G03297764

Fig. 82: Pressing Stop Using Special Tool 32 1 030
Courtesy of BMW OF NORTH AMERICA, INC.

Completely unscrew one wheel stud on each rear wheel.

Installation:

Tightening torque, see 36 10 1AZ in **WHEEL AND TIRES - TIGHTENING TORQUES**.

Turn wheel until adjustment screw is visible in tapped hole.

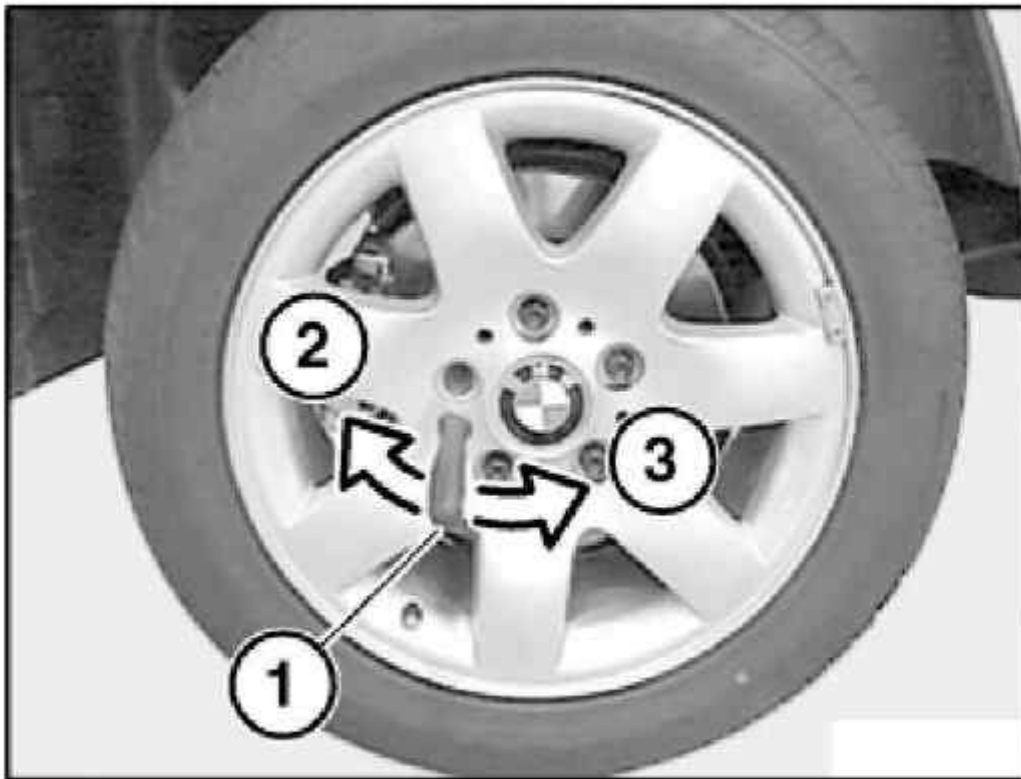


G03297765

Fig. 83: Identifying Wheel Stud
Courtesy of BMW OF NORTH AMERICA, INC.

Turn adjusting screw with a screwdriver until the wheel is no longer able to turn.

Then unfasten the adjusting screw 9 notches.



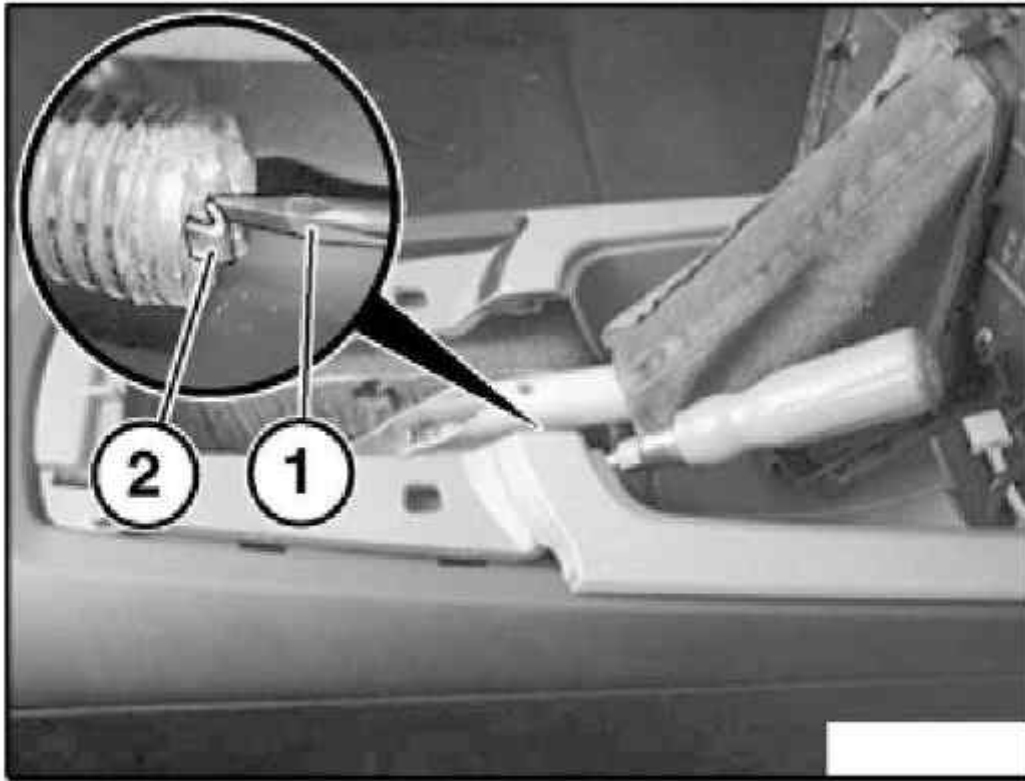
G03297766

Fig. 84: Turning Adjusting Screw Using Screwdriver
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock adjuster unit (ASZE).

Lever restraint hook (2) outwards with a suitable screwdriver (1).

Restraint hook (2) must disengage from stop of adjusting spring.



G03297767

Fig. 85: Levering Restraint Hook Using Screwdriver
Courtesy of BMW OF NORTH AMERICA, INC.

2. Setting instruction for parking brake Bowden cables

The handbrake lever must be applied 5 times to approx. 400N actuating force.

2.1 On brake analyzer

0th tooth (handbrake released): Vehicles with manual transmission: Shift lever in neutral position.

Vehicles with automatic transmission: Selector lever in N position.

- Without locking differential LESS THAN EQUAL TO 50 ace;N.
- With locking differential = 200 ace;N (possibly odd display).

1st tooth: No increase in braking force with regard to 0th tooth. Indicator lamp can be lit.

2nd tooth: Indicator lamp must be lit.

3rd tooth: Increase in braking force.

5th tooth: The brake force display must have reached GREATER THAN EQUAL TO 400 ace;N.

Checking brake force differential at wheel:

Apply handbrake until a wheel circumferential force (brake force display) of min. 1000 N is reached.

Max. permitted brake force differential right/left ace; LESS THAN EQUAL TO 35 ace; &perc; (referred to greater brake value).

3. Braking in the duo-servo parking brake

The following braking-in procedures are applicable in case of insufficient braking effect or after replacing brake disks and/or brake shoes.

3.1 On brake analyzer

Apply handbrake lever until wheel circumferential force on first wheel is 800 N.

Lock lever in next lower tooth.

Release handbrake lever after approx. 2 minutes.

3.2 When driving on road

(If possible inside the company grounds or on an unused road) At approx. 40 km/h, apply handbrake lever until braking action can be felt.

Pull up handbrake lever into next notch and drive on for approx. 400 m.

A basic requirement is that handbrake is adjusted uniformly.

NOTE: **If necessary, repeat braking-in procedure.**

Allow brake to cool down sufficiently.

34 41... OVERVIEW OF PARKING BRAKE

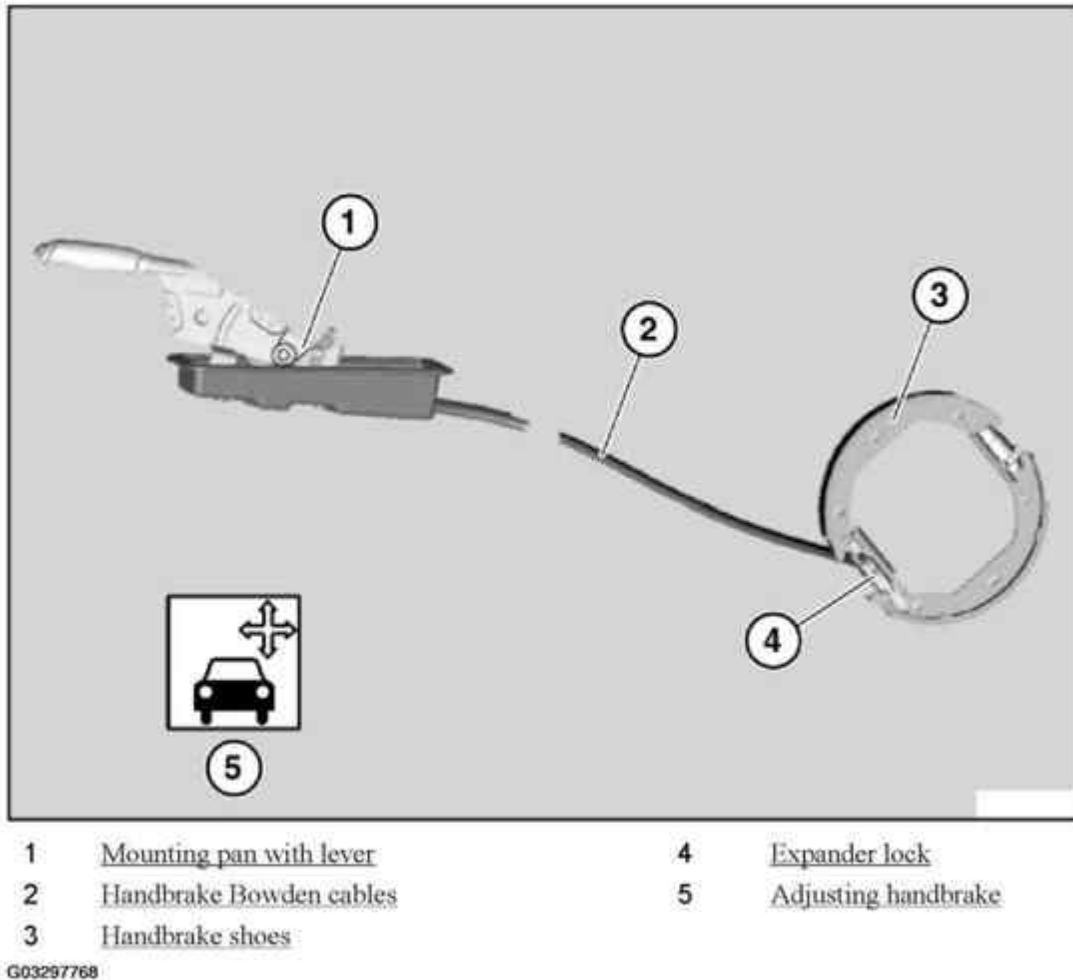


Fig. 86: Identifying Parking Brake Components
 Courtesy of BMW OF NORTH AMERICA, INC.

34 41 003 REMOVING AND INSTALLING/REPLACING HANDBRAKE LEVER WITH MOUNTING PAN

Special tools required:

- 32 1 030

NOTE: After completing tasks, adjust handbrake.

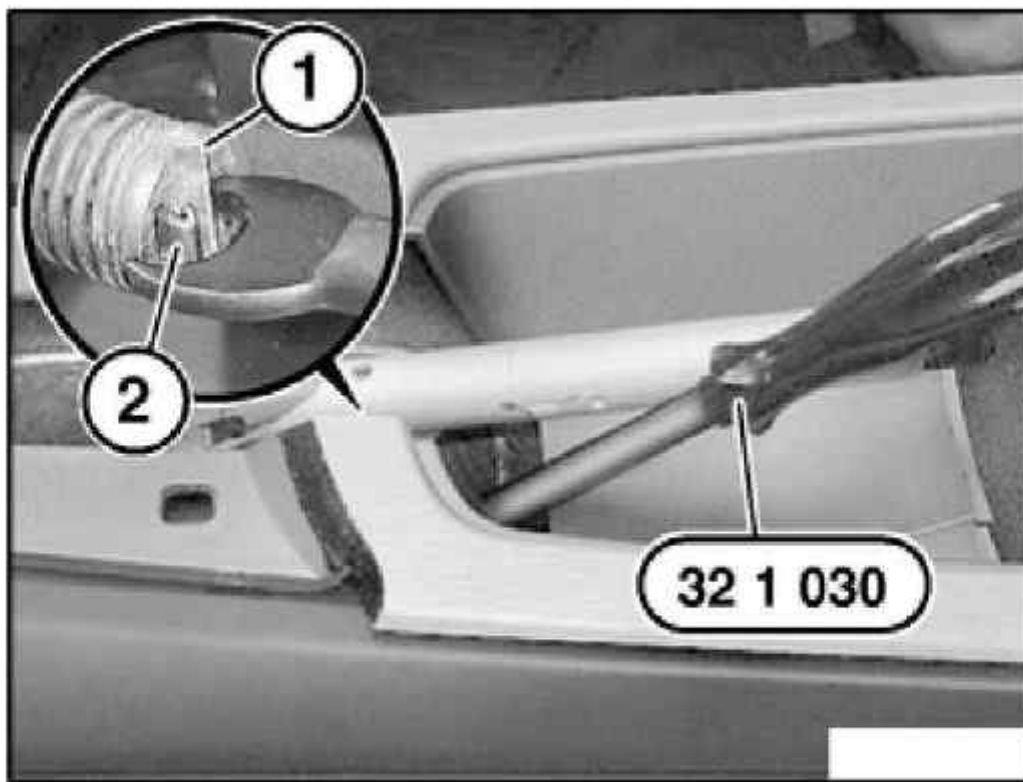
Necessary preliminary tasks:

- Remove propeller shaft. See **PROPELLER SHAFT - REPAIR INSTRUCTIONS**.
- Remove handbrake lever trim.

IMPORTANT: The handbrake handle must be protected against damage when the mounting pan is fed out downwards.
The handbrake handle must also be replaced when the adjuster unit (ASZE) is replaced.

Lock adjuster unit (ASZE).

Using special tool 32 1 030, press stop (1) of adjusting spring back until restraining hook (2) snaps into place in stop (1).



G03297769

Fig. 87: Pressing Stop Of Adjusting Spring Using Special Tool 32 1 030
Courtesy of BMW OF NORTH AMERICA, INC.

Release one wheel stud.

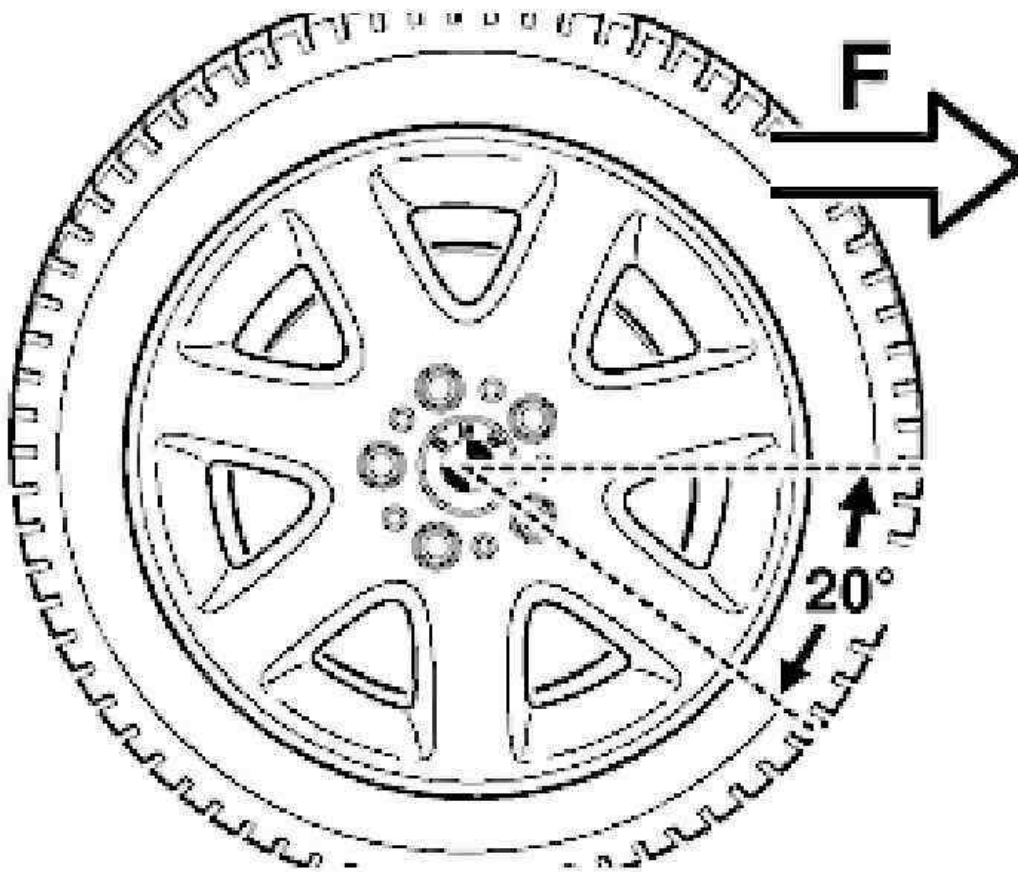
Bring wheel into position (tapped hole turned down approx. 20° from horizontal).

F = direction of travel

Installation:

Reinstall wheel stud only after handbrake has been adjusted.

Tightening torque, see 36 10 1AZ in **WHEEL AND TIRES - TIGHTENING TORQUES**.



G03297770

Fig. 88: Identifying Direction Of Travel

Courtesy of BMW OF NORTH AMERICA, INC.

Nipple (1) and expander lock (2) are visible through tapped hole.

Push in core of handbrake cable in direction of expander lock as far as it will go and grip firmly.

Press nipple (1) downwards through tapped hole with a screwdriver.

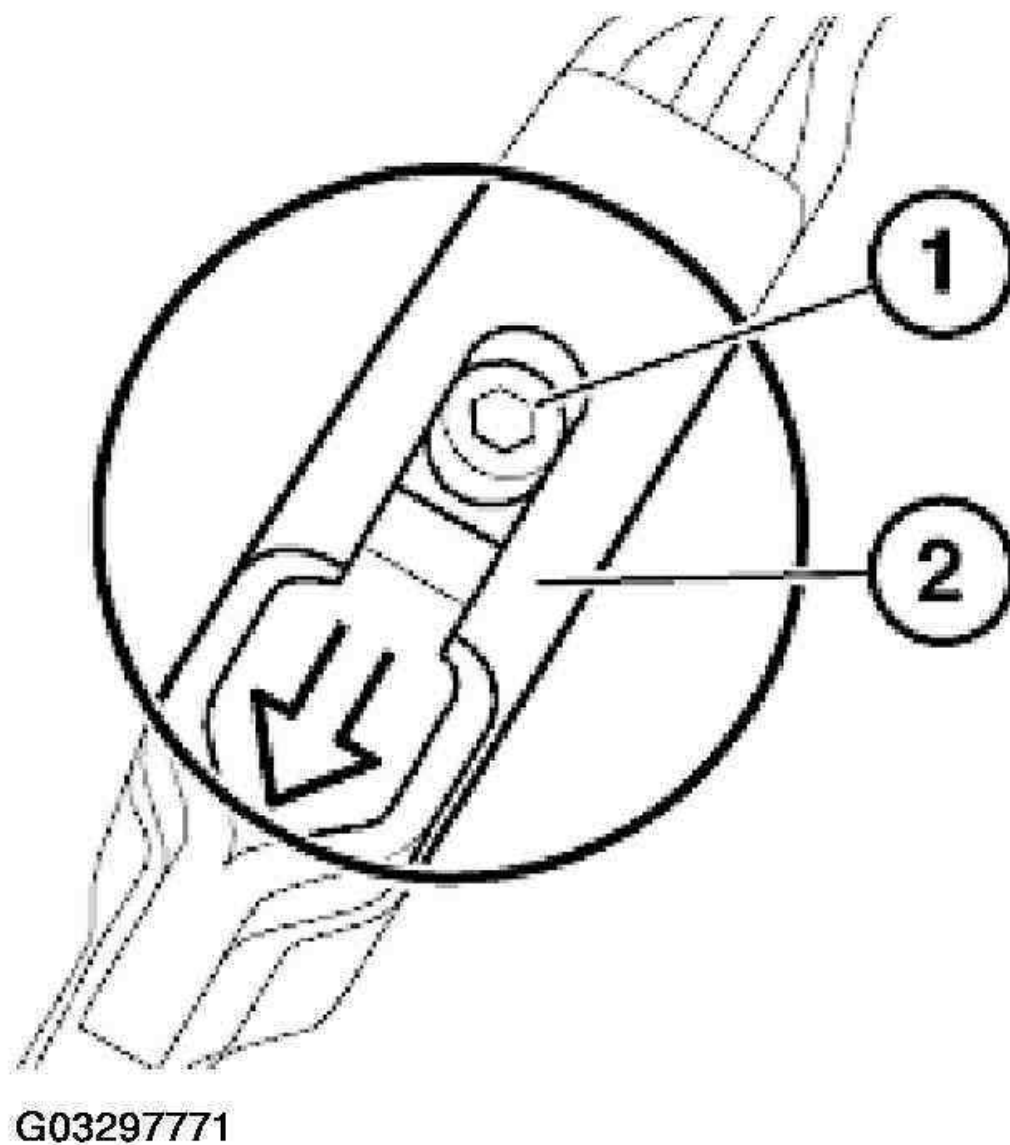


Fig. 89: Pushing In Core Of Handbrake Cable In Direction Of Expander Lock
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Insert handbrake cable in brake carrier/brake guard plate.

Sleeve must be inserted up to stop.

Nipple of handbrake cable must audibly snap into place in expander lock.

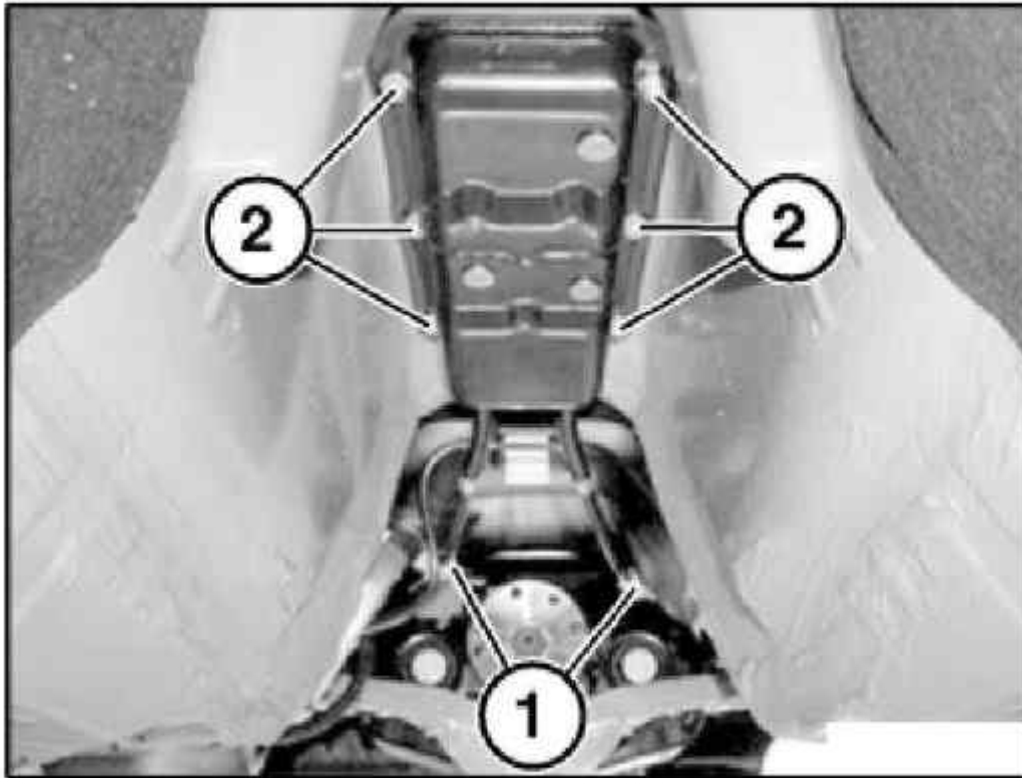
Unclip handbrake cables from fixture (1).

Release screws (2) and lower mounting pan a little.

Installation:

Replace self-locking nuts.

Tightening torque, see 34 41 4AZ in **BRAKES - TIGHTENING TORQUES** .



G03297772

Fig. 90: Identifying Handbrake Cables Fixture
Courtesy of BMW OF NORTH AMERICA, INC.

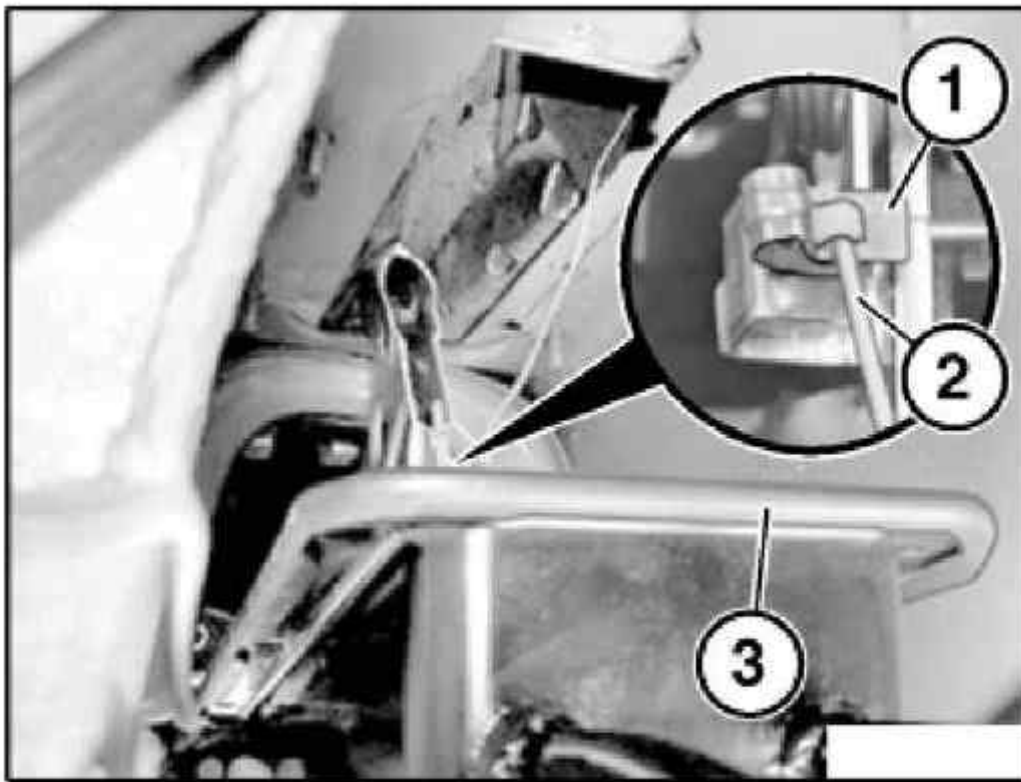
Press retaining lug (1) downwards and pull out cable (2).

Feed out mounting pan towards bottom.

Pull handbrake cables out of rear axle guide.

Installation:

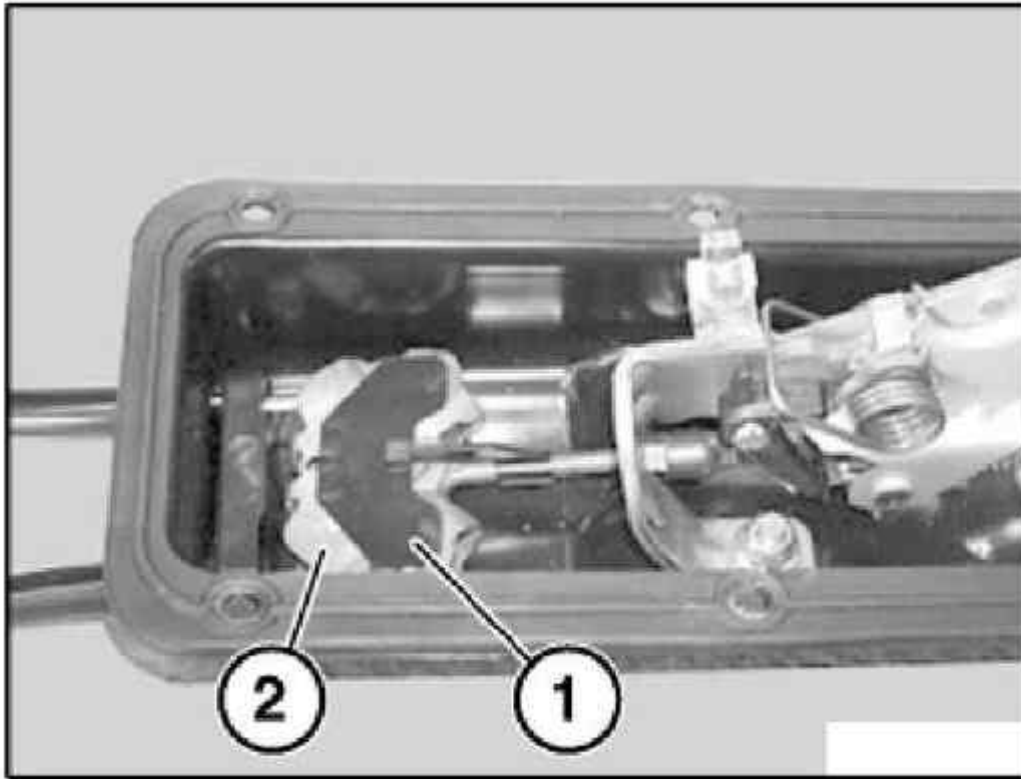
Replace seal (3).



G03297773

Fig. 91: Identifying Retaining Lug And Cable
Courtesy of BMW OF NORTH AMERICA, INC.

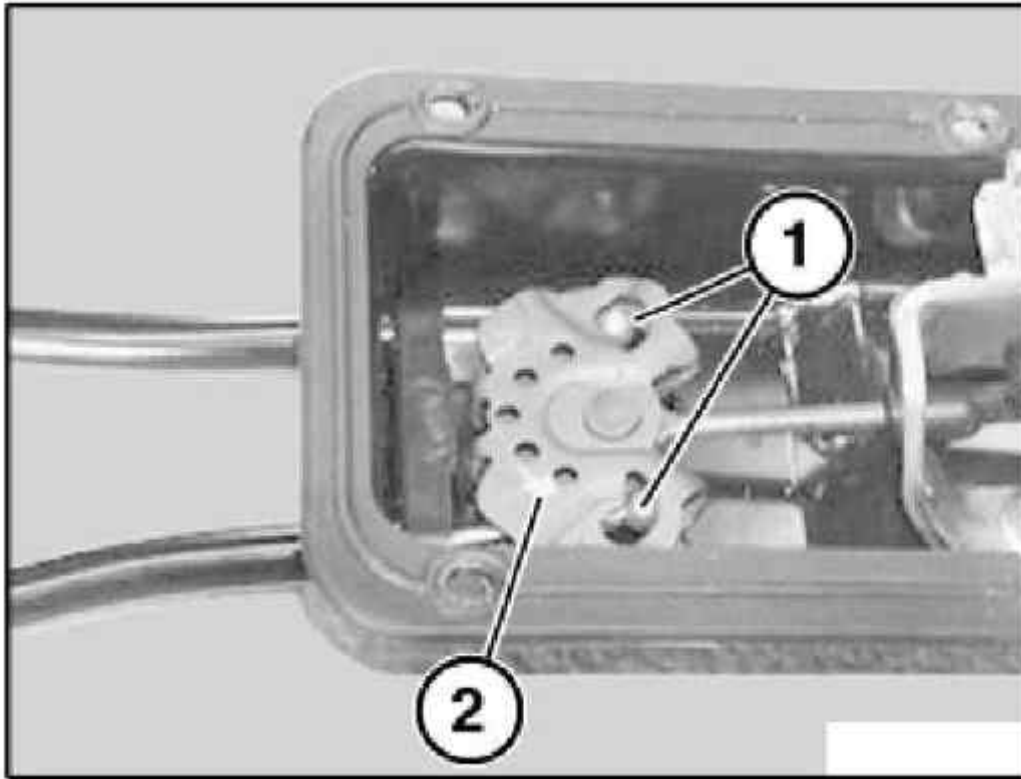
Unclip mounting clip (1) upwards out of balance arm (2).



G03297774

Fig. 92: Unclipping Mounting Clip Out Of Balance Arm
Courtesy of BMW OF NORTH AMERICA, INC.

Feed handbrake cables (1) inwards with a screwdriver and pull out of balance arm (2).



G03297775

Fig. 93: Feeding Handbrake Cables Inwards Using Screwdriver
Courtesy of BMW OF NORTH AMERICA, INC.

34 41 120 REMOVING AND INSTALLING/REPLACING BOTH HANDBRAKE BOWDEN CABLES

NOTE: This operation is described in the section headed Removing and installing handbrake lever with mounting pan.

34 41 220 REMOVING AND INSTALLING/REPLACING ALL HANDBRAKE SHOES

Special tools required:

- 32 1 030
- 34 4 000

NOTE: Remove rear brake disk. See **34 21 320 Removing And Installing/Replacing Both Brake Disks** .

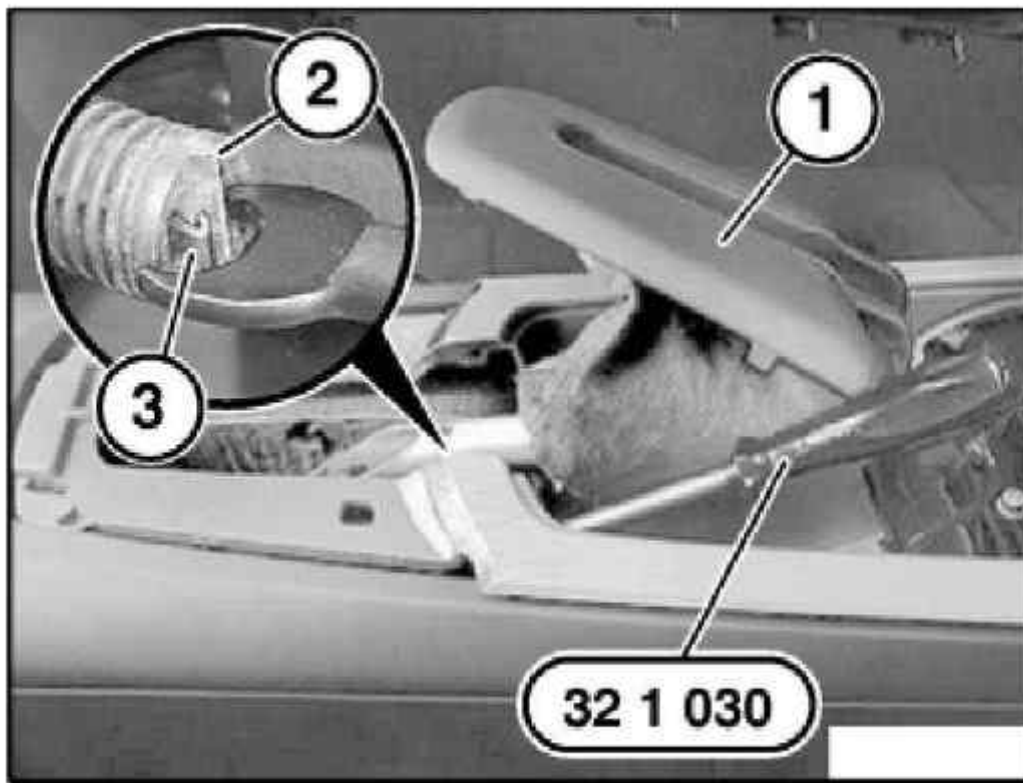
Installation:

After completing tasks, adjust handbrake. See **34 10 014 Adjusting Handbrake** .

Unclip handbrake lever trim (1) at rear and tilt forwards.

Lock adjuster unit (ASZE).

Use special tool 32 1 030 to press back the stop (2) of the adjusting spring until the restraining hook (3) snaps into place in the stop (2).



G03297776

Fig. 94: Pressing Back Stop Of Adjusting Spring Using Special Tool 32 1 030
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect return spring (1) with brake spring pliers.

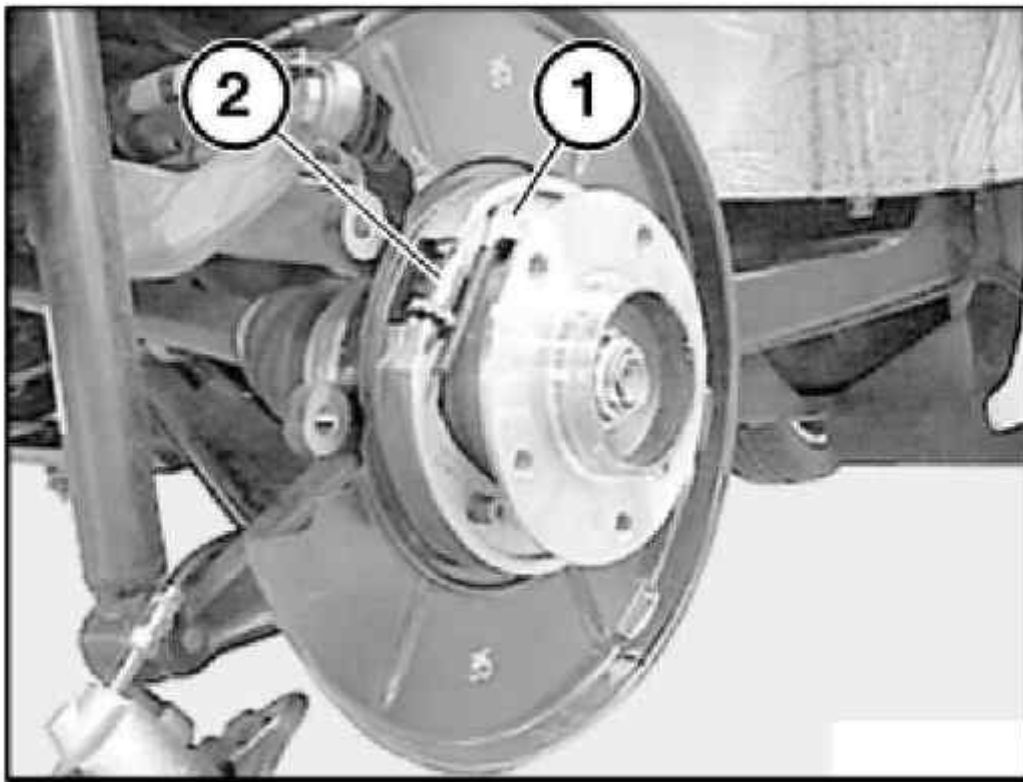
Installation:

Check return spring (1), replace if necessary.

Figure illustrates right side: left side is mirror image of this.

Pay attention to installation position of adjustment screw (2).

Apply a thin coat of grease to bush and screw threads, Refer to **OPERATING FLUIDS - BRAKES** .



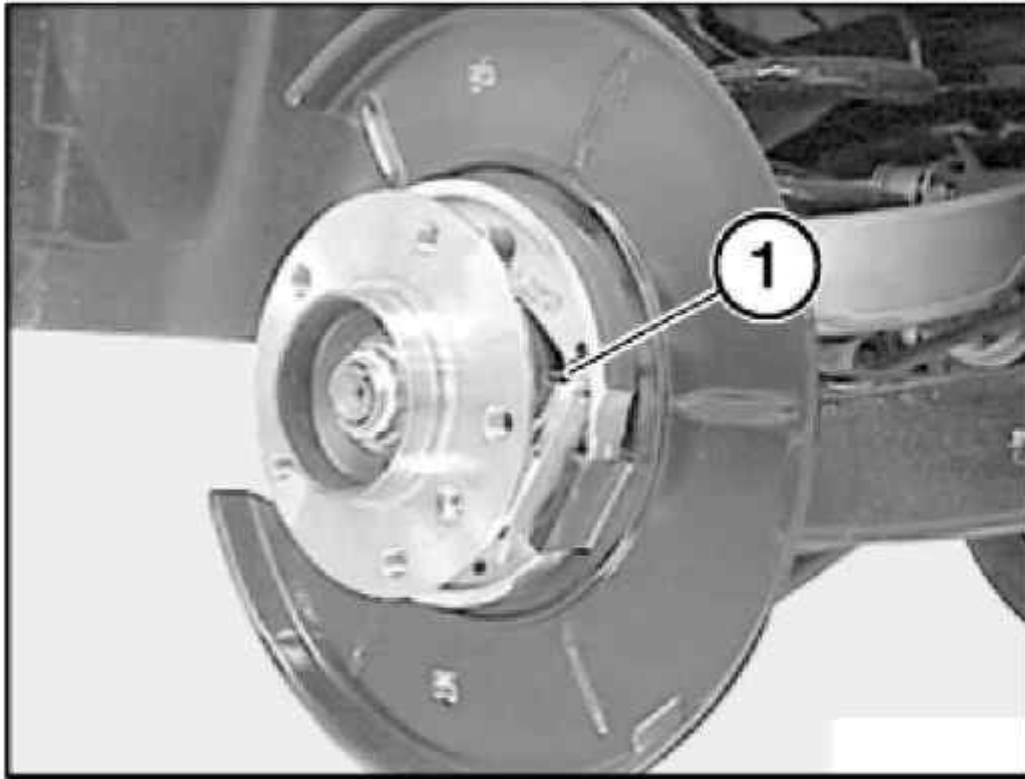
G03297777

Fig. 95: Identifying Return Spring And Adjustment Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect return spring (1) with brake spring pliers.

Installation:

Check return spring (1), replace if necessary.



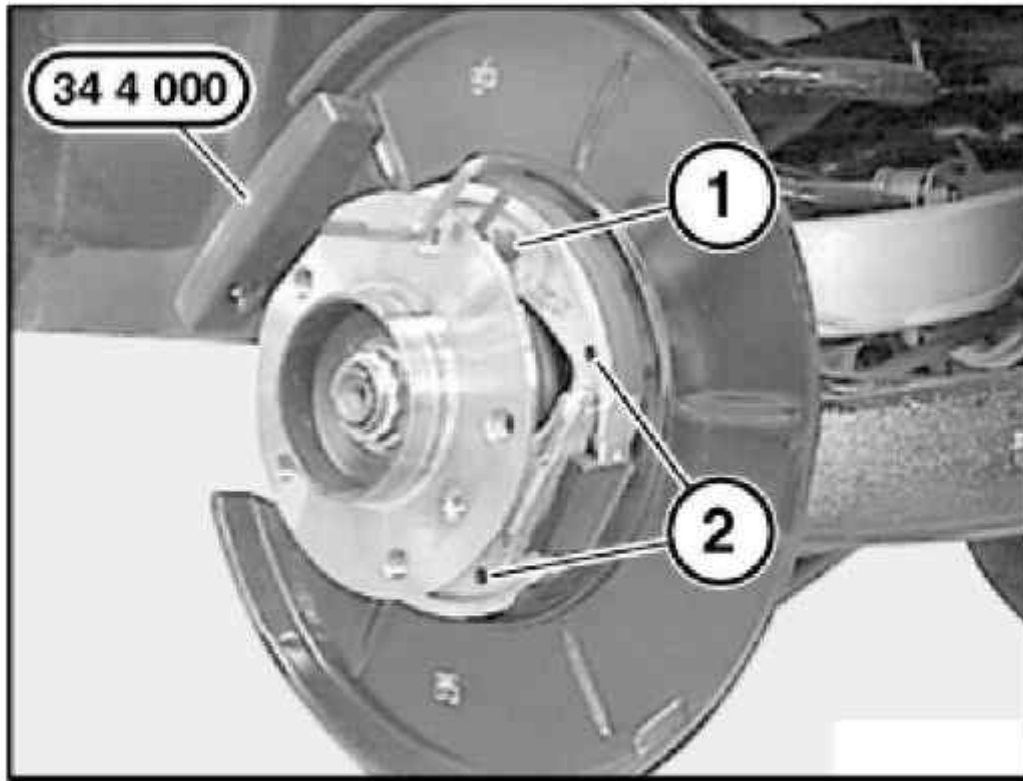
G03297778

Fig. 96: Checking Return Spring

Courtesy of BMW OF NORTH AMERICA, INC.

Turn clamping pins (1) with special tool 34 4 000 through 90° and disconnect.

Remove brake shoes (2).



G03297779

Fig. 97: Turning Clamping Pins Using Special Tool 34 4 000
Courtesy of BMW OF NORTH AMERICA, INC.

34 41 250 REMOVING AND INSTALLING/REPLACING EXPANDER LOCK FOR HANDBRAKE SHOES

Special tools required:

- 32 1 030

NOTE: Remove handbrake shoes. See PARKING BRAKE SHOES .

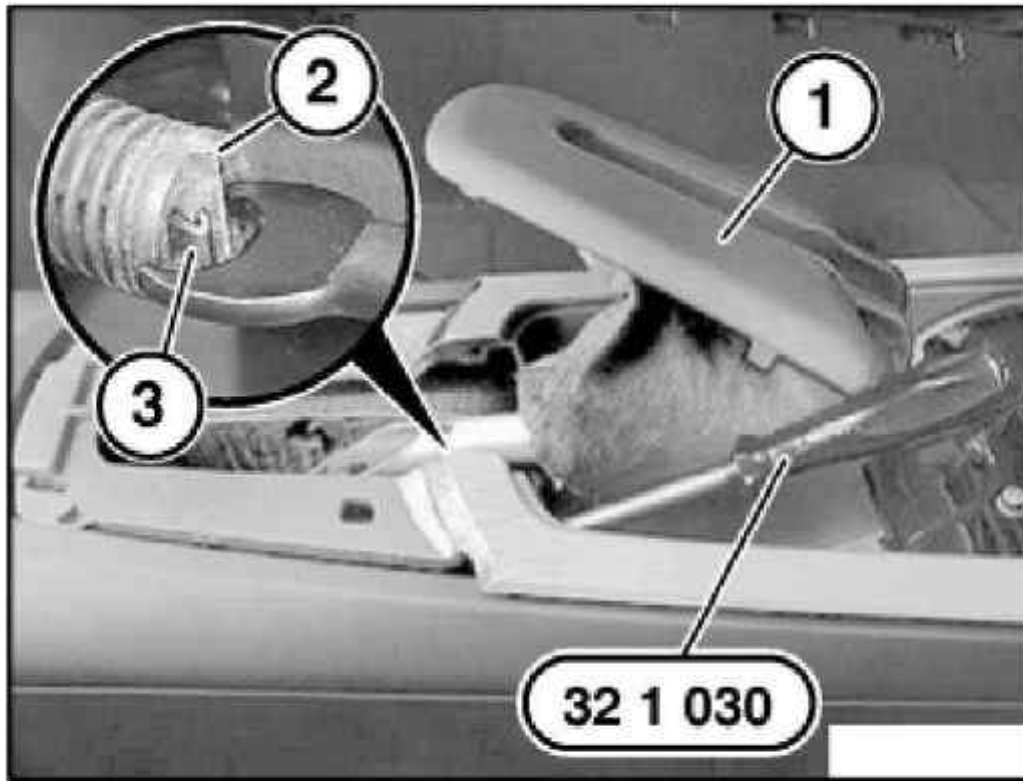
Installation:

After completing tasks, adjust handbrake. See 34 10 014 Adjusting Handbrake .

Unclip handbrake lever trim (1) at rear and tilt forwards.

Lock adjuster unit (ASZE).

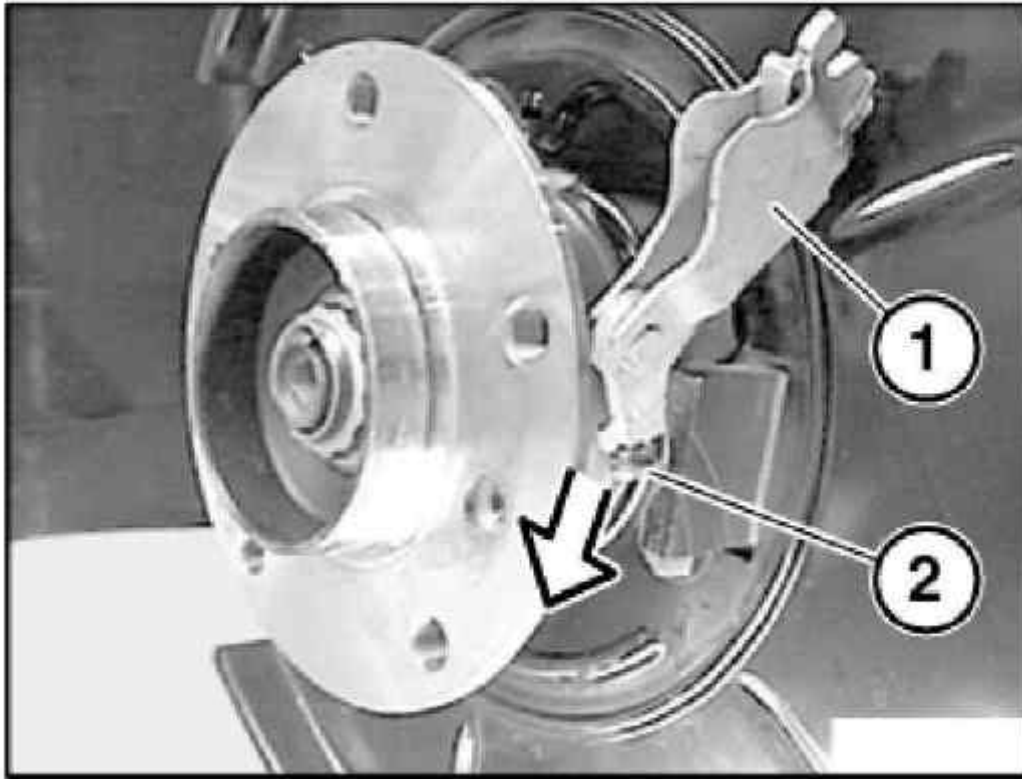
Use special tool 32 1 030 to press back the stop (2) of the adjusting spring until the restraining hook (3) snaps into place in the stop (2).



G03297780

Fig. 98: Pressing Back Stop Of Adjusting Spring Using Special Tool 32 1 030
Courtesy of BMW OF NORTH AMERICA, INC.

Pull expander lock (1) forwards, disconnect handbrake cable (2) and remove expander lock.



G03297781

Fig. 99: Removing Expander Lock

Courtesy of BMW OF NORTH AMERICA, INC.

MECHANICAL/HYDRAULIC COMPONENTS

34 51 527 REMOVING AND INSTALLING / REPLACING DSC HYDRAULIC UNIT (MK60)

Necessary preliminary tasks:

- Read and comply with General Information

Vehicles with M54 engines:

- Remove front left wheel . See WHEEL AND TIRES - REPAIR INSTRUCTIONS .
- Remove front left wheel arch trim . 51 71 038 REMOVING AND INSTALLING/REPLACING FRONT WHEEL ARCH TRIM .

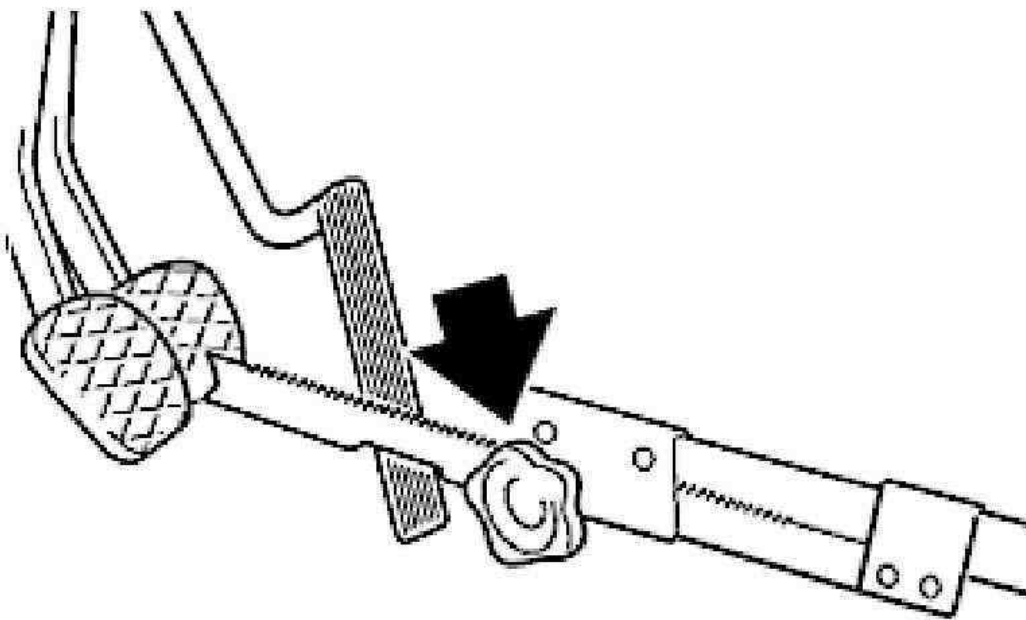
All:

After completing tasks, bleed brake system. See **34 00 050 Bleeding Brake System With DSC** .

Replacement:

- Using scan tool, carry out programming/coding.
- Adjustment of steering angle sensor
- Mix-up check of brake lines
- Function check, hydraulic unit

Apply pedal prop and depress brake pedal slightly. This prevents brake fluid from emerging from the expansion tank and air from entering the brake system after the brake lines have been detached.



G03297782

Fig. 100: Depressing Brake Pedal
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Do not mix up brake lines, mark prior to removal if necessary.
Seal off connection bores with plugs.**

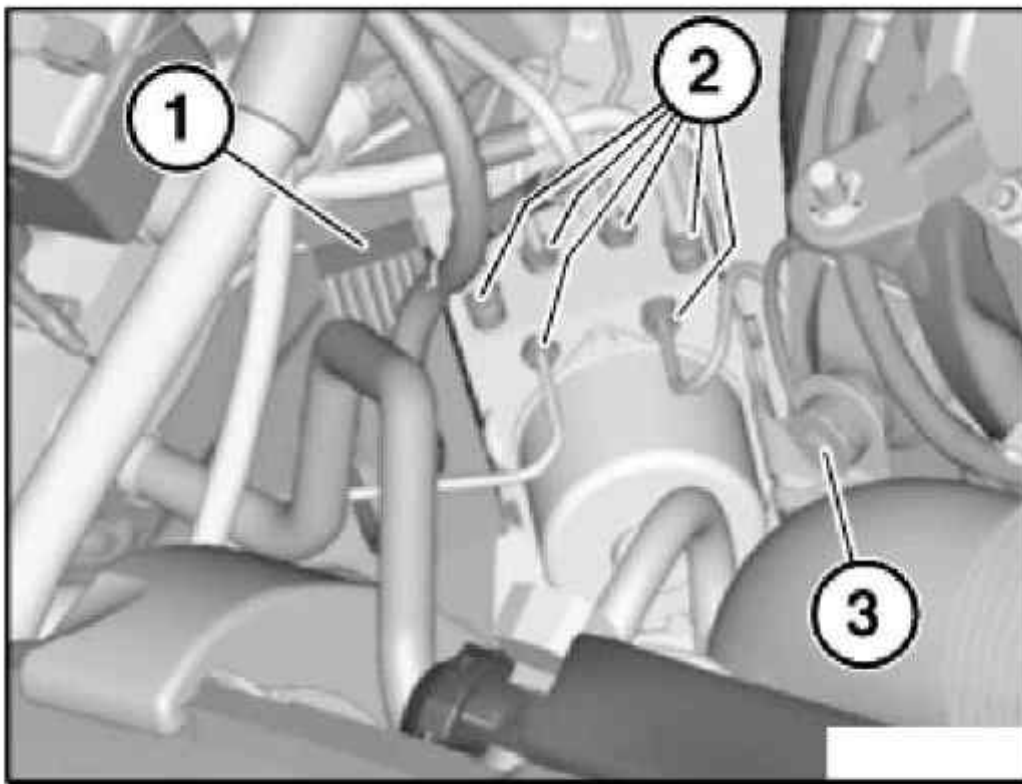
Disconnect plug connection (1) to control unit.

Unfasten brake lines (2).

Installation:

Tightening torque, see 34 32 1AZ.see **BRAKES - TIGHTENING TORQUES** .

Release screw (3).



G03297783

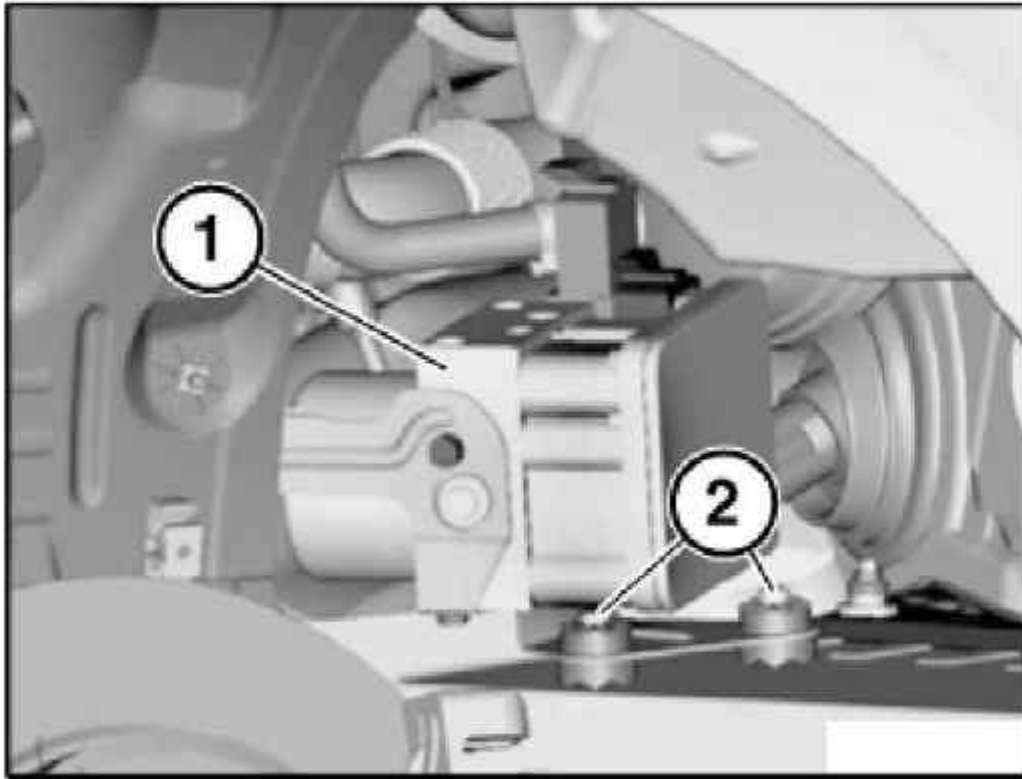
Fig. 101: Removing Brake Lines

Courtesy of BMW OF NORTH AMERICA, INC.

Pull hydraulic unit (1) up and out of rubber grommets (2).

Remove hydraulic unit (1) through wheel arch.

NOTE: **The holder must be modified if the hydraulic unit is replaced.**

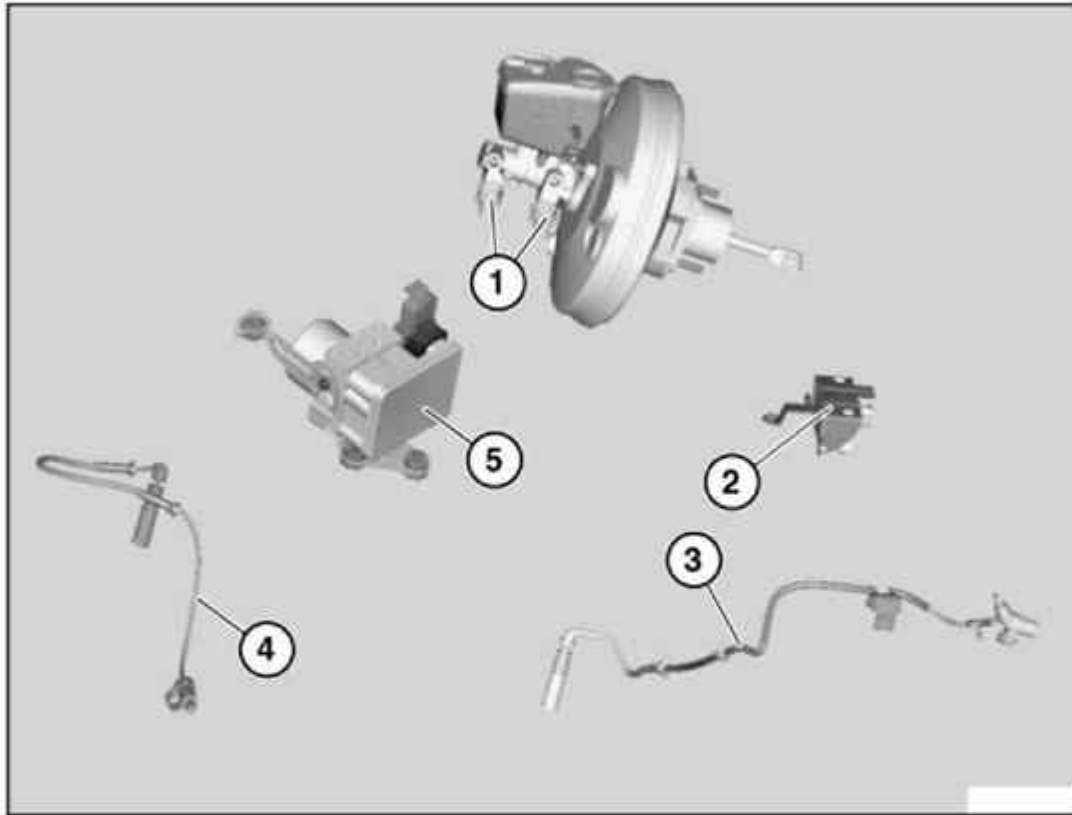


G03297784

Fig. 102: Removing Hydraulic Unit
Courtesy of BMW OF NORTH AMERICA, INC.

ELECTRONIC COMPONENTS

34 52... OVERVIEW OF ELECTRONIC COMPONENTS



1 Pressure sensors

2 DSC sensor

3 Pulse generator, rear

4 Pulse generator, front

5 DSC control unit

G03297785

Fig. 103: Identifying Electronic Components

Courtesy of BMW OF NORTH AMERICA, INC.

34 52 516 REMOVING AND INSTALLING/REPLACING CONTROL UNIT FOR DSC (MK60)

Special tools required:

- 32 1 280

IMPORTANT: Read and comply with notes on protection against electrostatic damage (ESD protection).

DSC (Dynamic Stability Control)

NOTE: Read and comply with General Information .
Remove front left wheel.

Remove front left wheel arch trim.

First read out fault memory of control unit and if necessary print diagnostic record.

Installation:

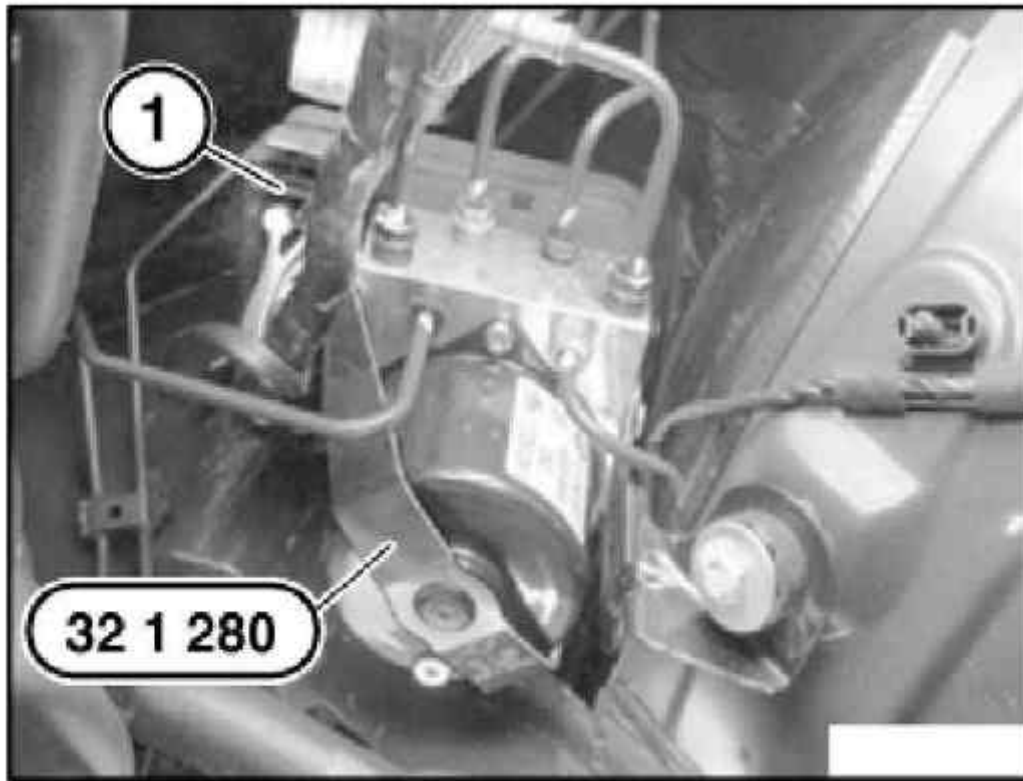
On completion, carry out following tasks with the DIS (Diagnosis and Information System):

- If control unit is new:
 - Coding
 - Adjustment of steering angle sensor
 - Adjustment of pressure sensors
 - Adjustment of transversal acceleration sensors
 - Function check, hydraulic unit

IMPORTANT: Removing pump motor from valve block is not permitted!

Disconnect plug connection (1).

Attach special tool 32 1 280 over pump motor and valve block.



G03297786

Fig. 104: Connecting Special Tool 32 1 280 Over Pump Motor And Valve Block
Courtesy of BMW OF NORTH AMERICA, INC.

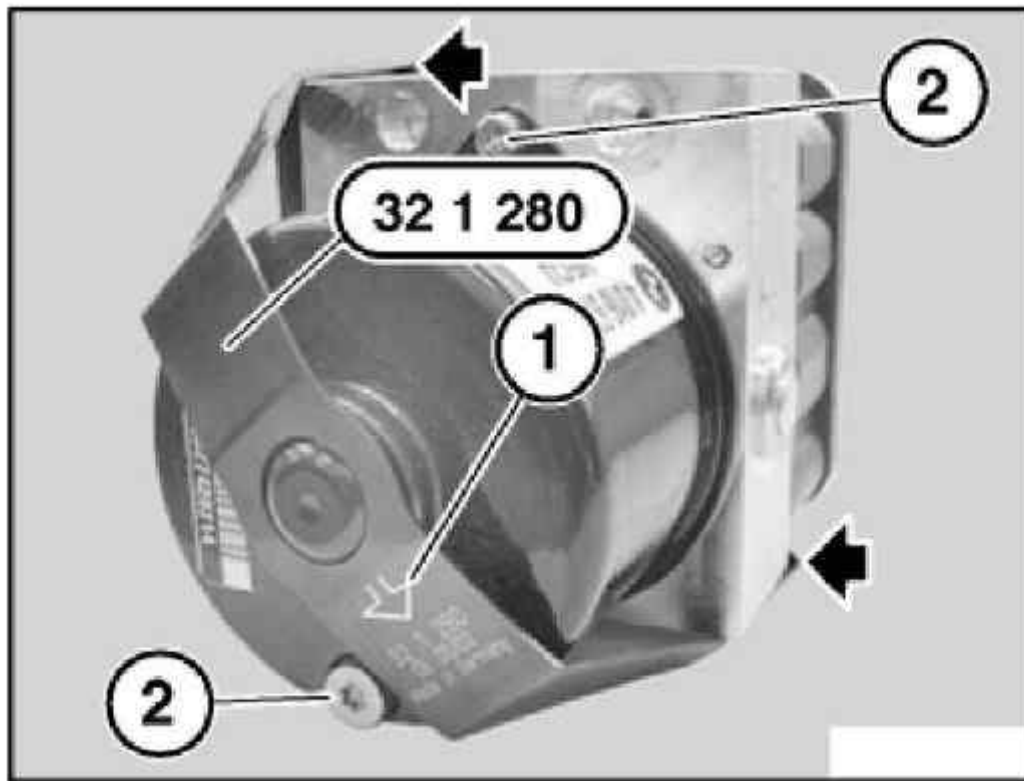
Attach retaining clip 32 1 280 first at bottom and then at top over valve block.

NOTE: **Arrow (1) on special tool 32 1 280 must point downwards.**

Release screws (2) and remove.

Installation:

Tightening torque, see 34 51 1AZ in **BRAKES - TIGHTENING TORQUES** .

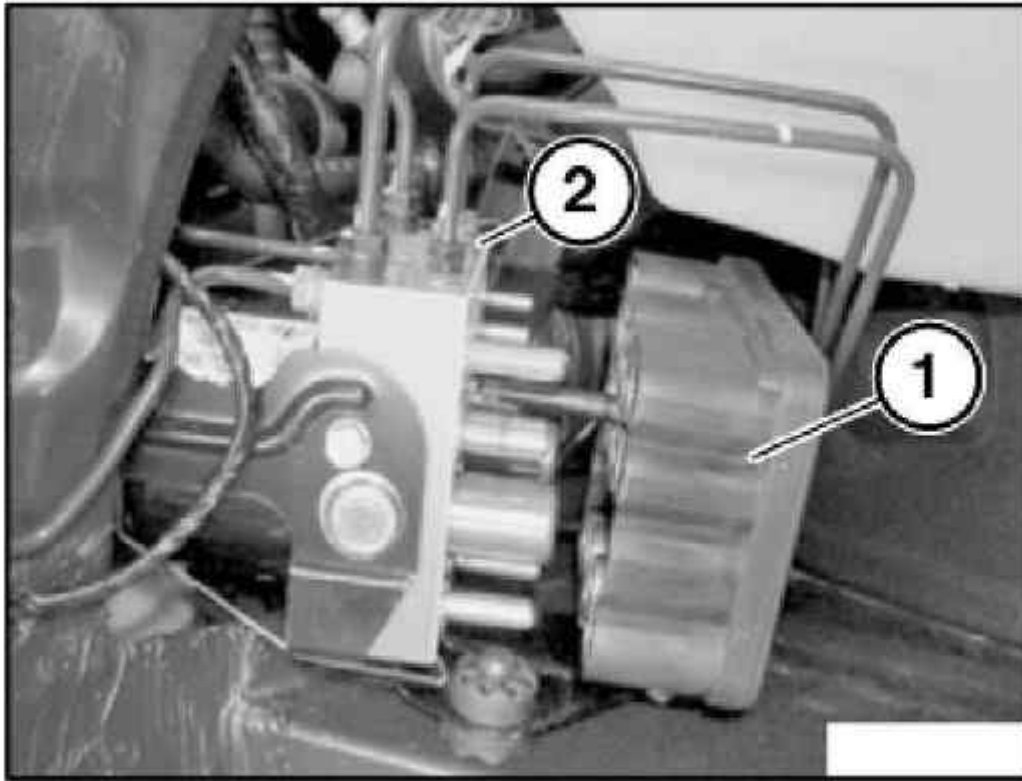


G03297787

Fig. 105: Identifying Special Tool Arrow Point
Courtesy of BMW OF NORTH AMERICA, INC.

Carefully detach control unit (1) from valve block (2).

Move control unit to rear and then remove to the side through wheel arch.



G03297788

Fig. 106: Disconnecting Control Unit From Valve Block
Courtesy of BMW OF NORTH AMERICA, INC.

34 52 525 REMOVING AND INSTALLING/REPLACING FRONT PULSE GENERATOR

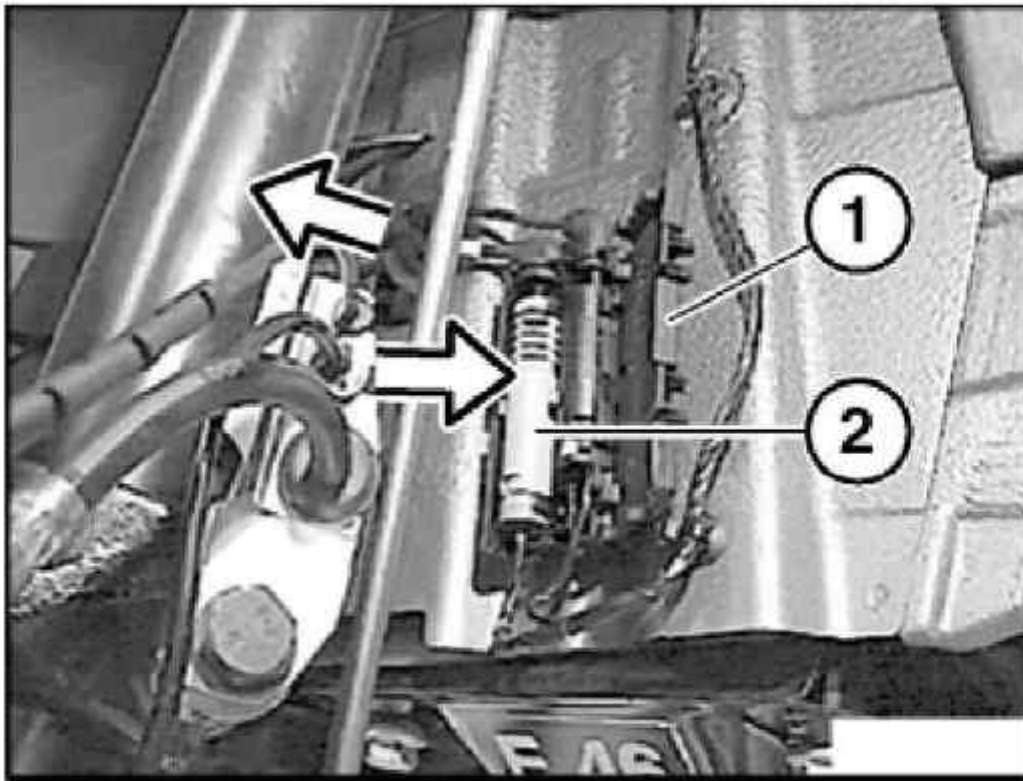
IMPORTANT: Read and comply with notes on protection against electrostatic damage (ESD protection).

Open plug housing (1), pull plug connection (2) out of fixture and disconnect.

Pull cable with rubber grommet out of fixture on spring strut and on body.

Installation:

Ensure proper locking of plug connector and proper seating of rubber grommets.



G03297789

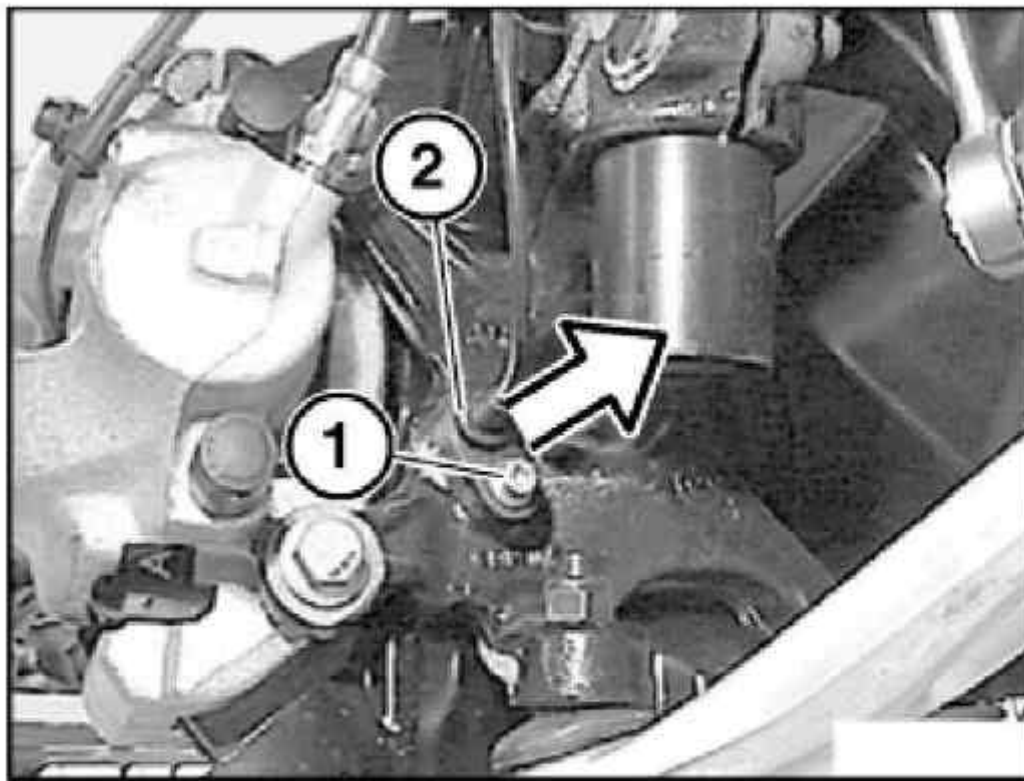
Fig. 107: Disconnecting Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Release hexagon socket screw (1).

Withdraw wheel speed sensor (2) from bore hole.

Installation:

Tightening torque, see 34 51 6AZ in **BRAKES - TIGHTENING TORQUES** .

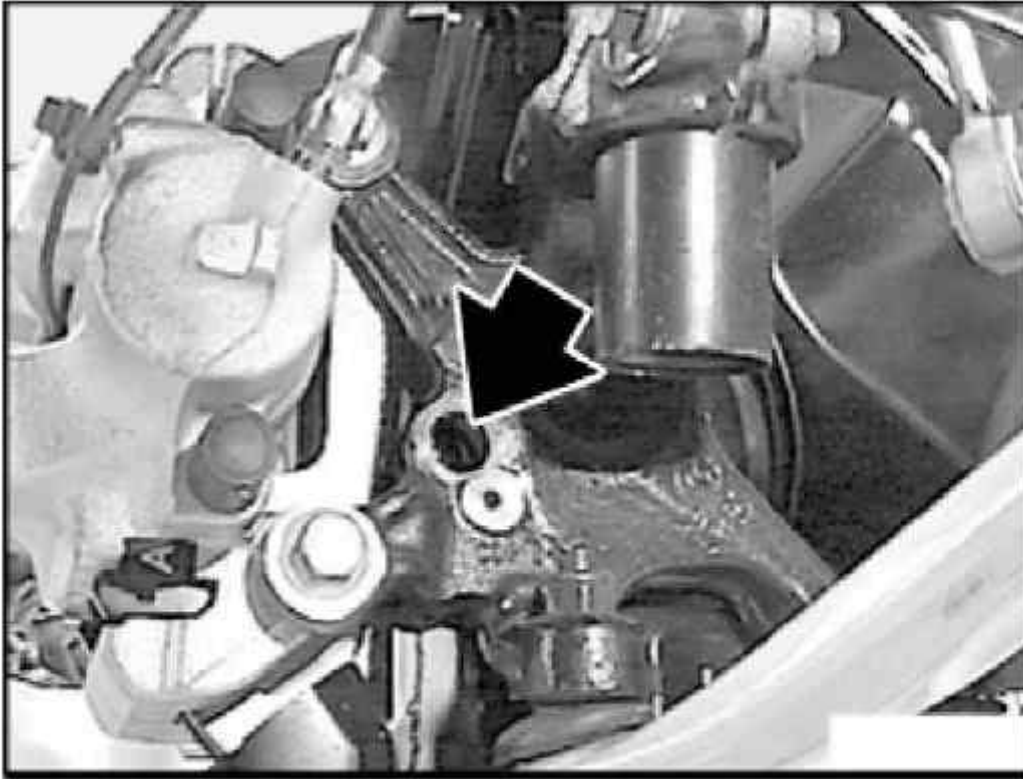


G03297790

Fig. 108: Withdrawing Wheel Speed Sensor From Bore Hole
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean bore hole for pulse generator and grease with Staburags NBU 12/K lubricating grease (refer to **OPERATING FLUIDS - BRAKES** .



G03297791

Fig. 109: Identifying Bore Hole For Pulse Generator
Courtesy of BMW OF NORTH AMERICA, INC.

34 52 535 REMOVING AND INSTALLING/REPLACING REAR PULSE GENERATOR

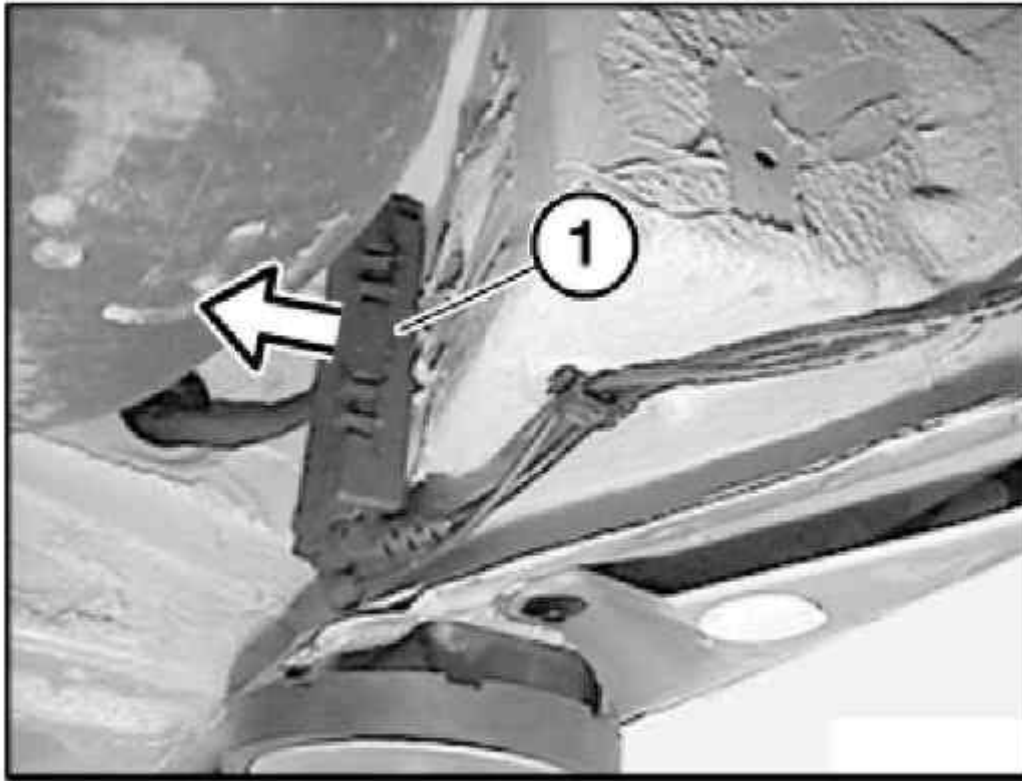
IMPORTANT: Read and comply with notes on protection against electrostatic damage (ESD protection).

Necessary preliminary tasks:

- Read and comply with **General Information** .
- Remove wheel. See **WHEEL AND TIRES - REPAIR INSTRUCTIONS** .
- If necessary, remove tank cover.

Open plug housing (1).

Pull plug connection for wheel speed sensor out of fixture and disconnect.



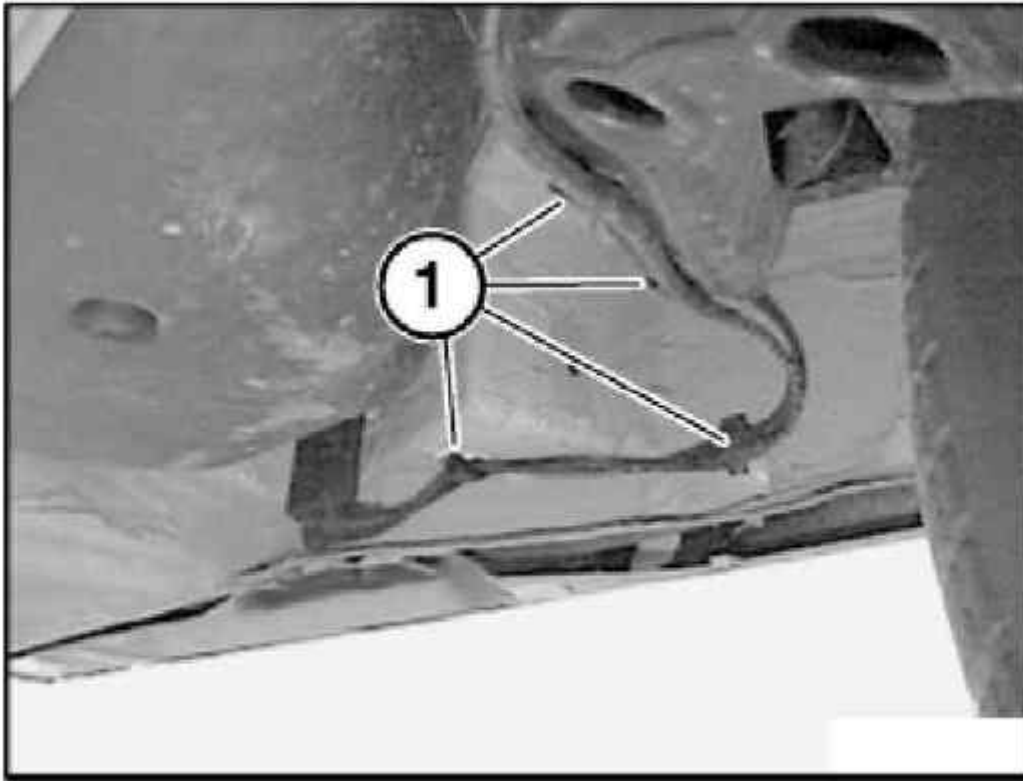
G03297792

Fig. 110: Opening Plug Housing

Courtesy of BMW OF NORTH AMERICA, INC.

Open cable holders (1).

Pull cable out of fasteners on rear swinging fork.

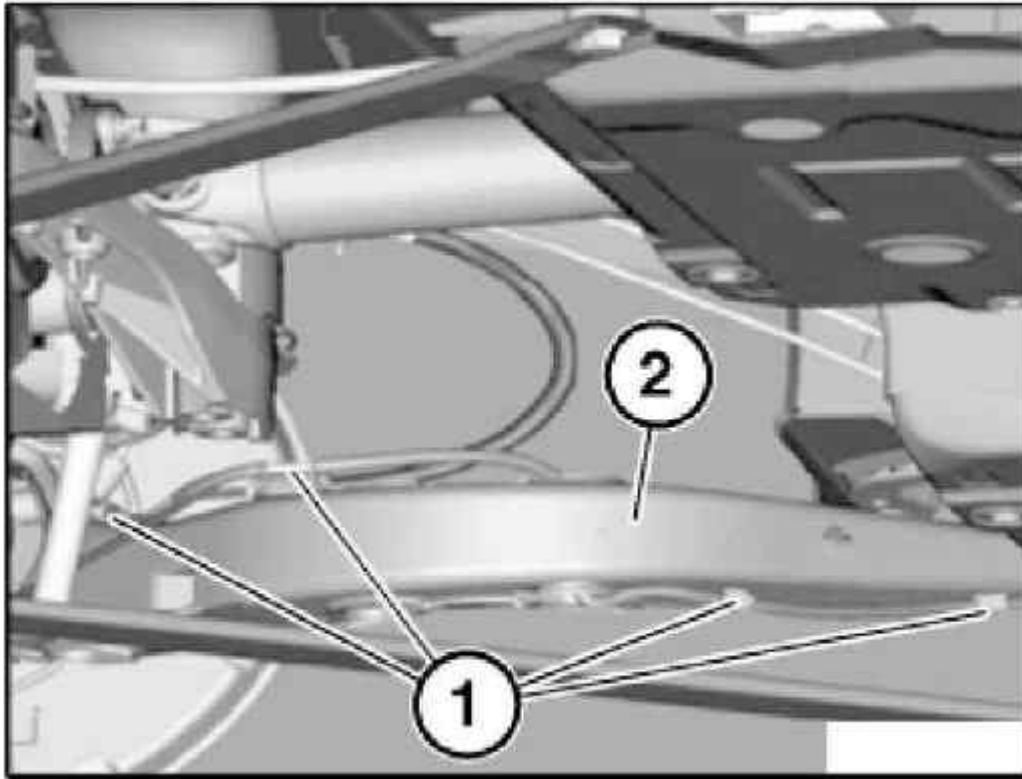


G03297793

Fig. 111: Identifying Cable Holders

Courtesy of BMW OF NORTH AMERICA, INC.

Open cable holders (1). Feed cable out of fasteners and rear swinging fork (2).



G03297794

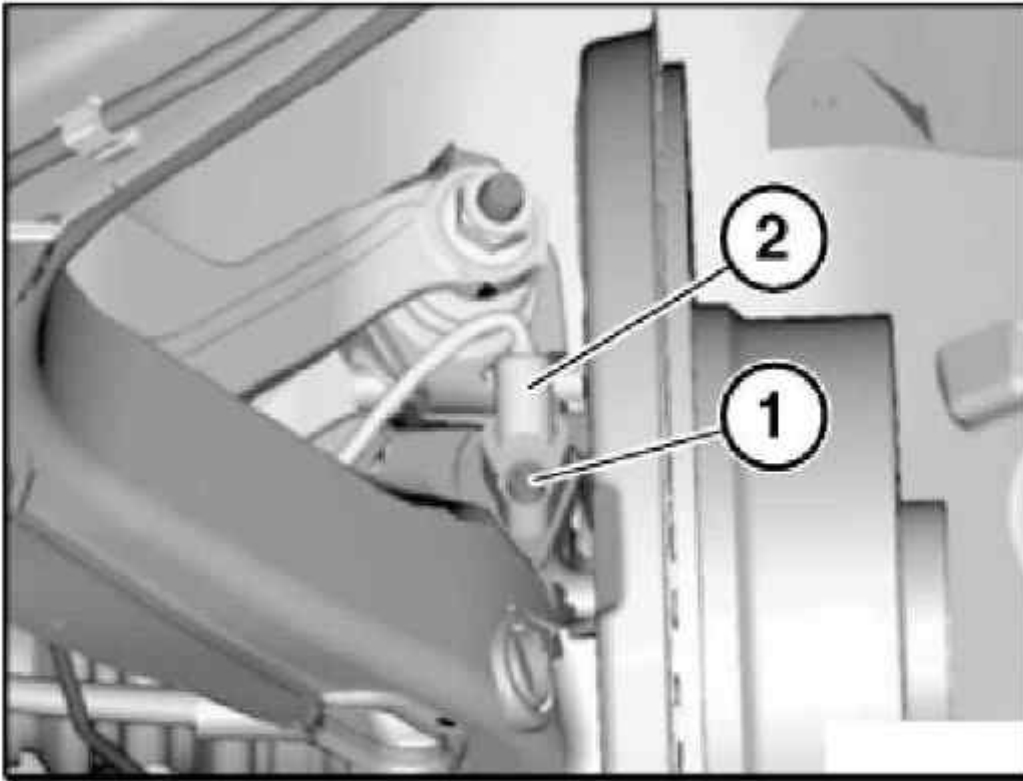
Fig. 112: Identifying Rear Swinging Fork
Courtesy of BMW OF NORTH AMERICA, INC.

Release hexagon socket screw (1). Withdraw wheel speed sensor (2) from bore hole.

Installation:

Clean bore hole for pulse generator and grease with Staburags NBU 12/K lubricating grease (refer to **OPERATING FLUIDS - BRAKES** .

Tightening torque, see 34 51 6AZ in **BRAKES - TIGHTENING TORQUES** .



G03297795

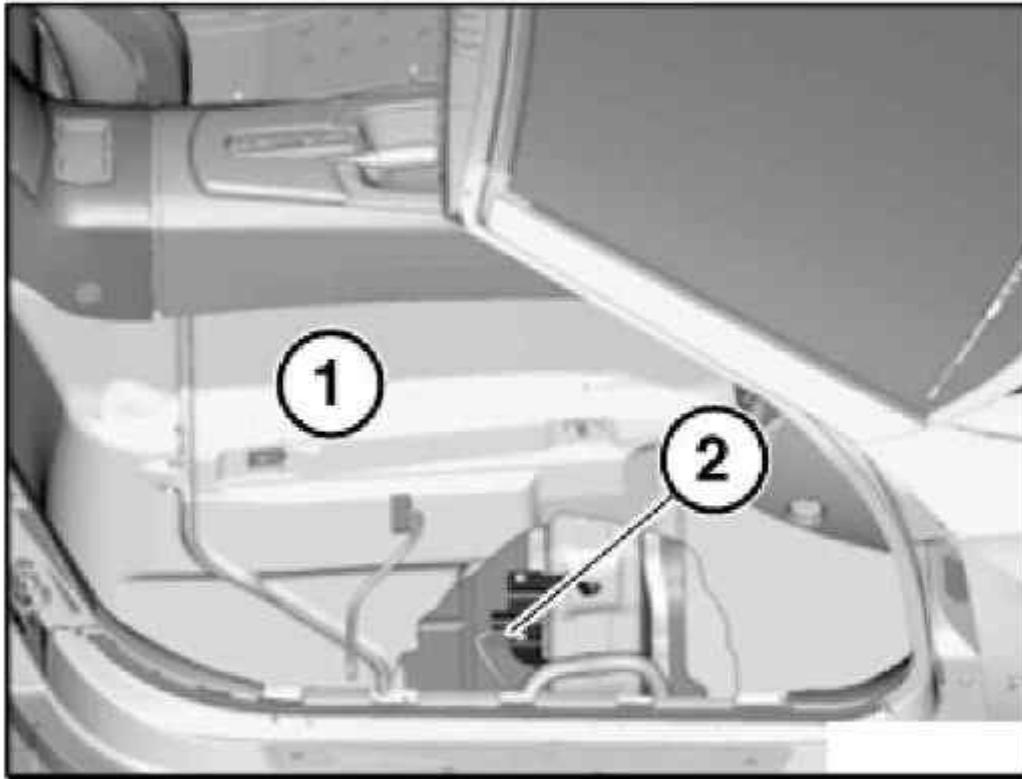
Fig. 113: Identifying Hexagon Socket Screw And Wheel Speed Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

34 52 550 REMOVING AND INSTALLING/REPLACING DSC III YAW SENSOR (DSC SENSOR)

IMPORTANT: Read and comply with notes on protection against electrostatic damage (ESD protection).

NOTE: Remove right front seat.
Remove front right entrance cover strip.
The DSC sensor contains the functions of the transversal acceleration sensor and the yaw sensor.

Fold carpet (1) to one side and expose DSC sensor (2).



G03297796

Fig. 114: Identifying DSC Sensor

Courtesy of BMW OF NORTH AMERICA, INC.

Unlock and disconnect plug (1).

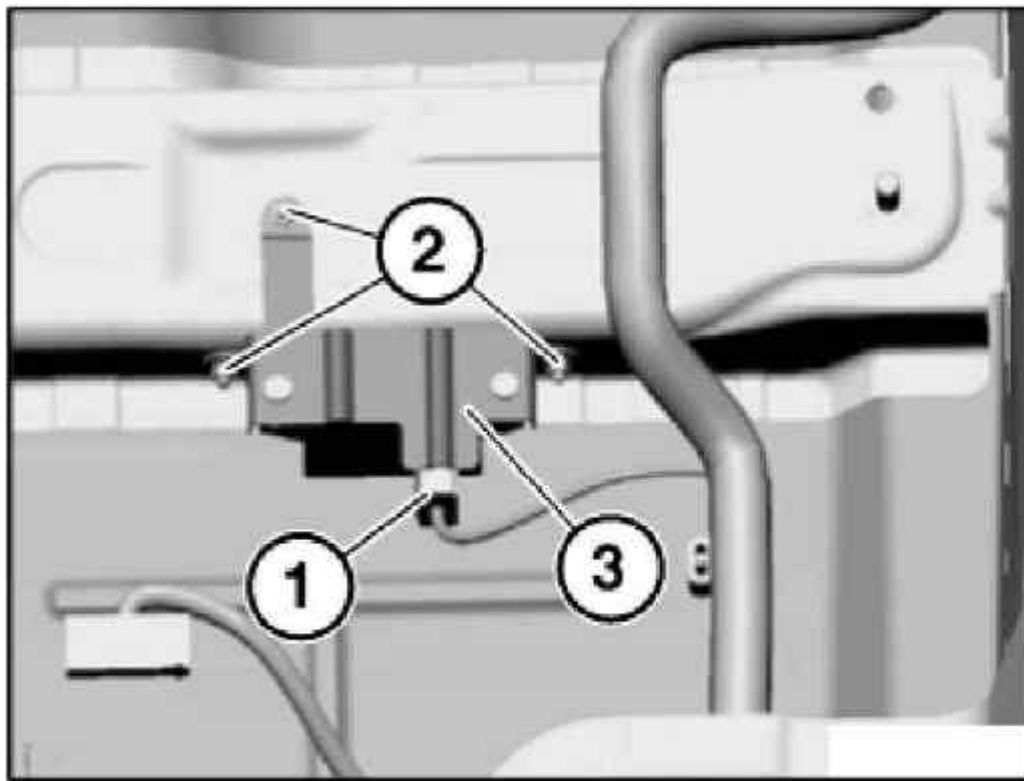
Release screws (2) and remove DSC sensor (3) with holder.

Installation:

Tightening torque, see 34 51 4AZ in **BRAKES - TIGHTENING TORQUES** .

IMPORTANT: Vibration-sensitive component.

Implement screw connection correctly, otherwise there may be malfunctions in the DSC.



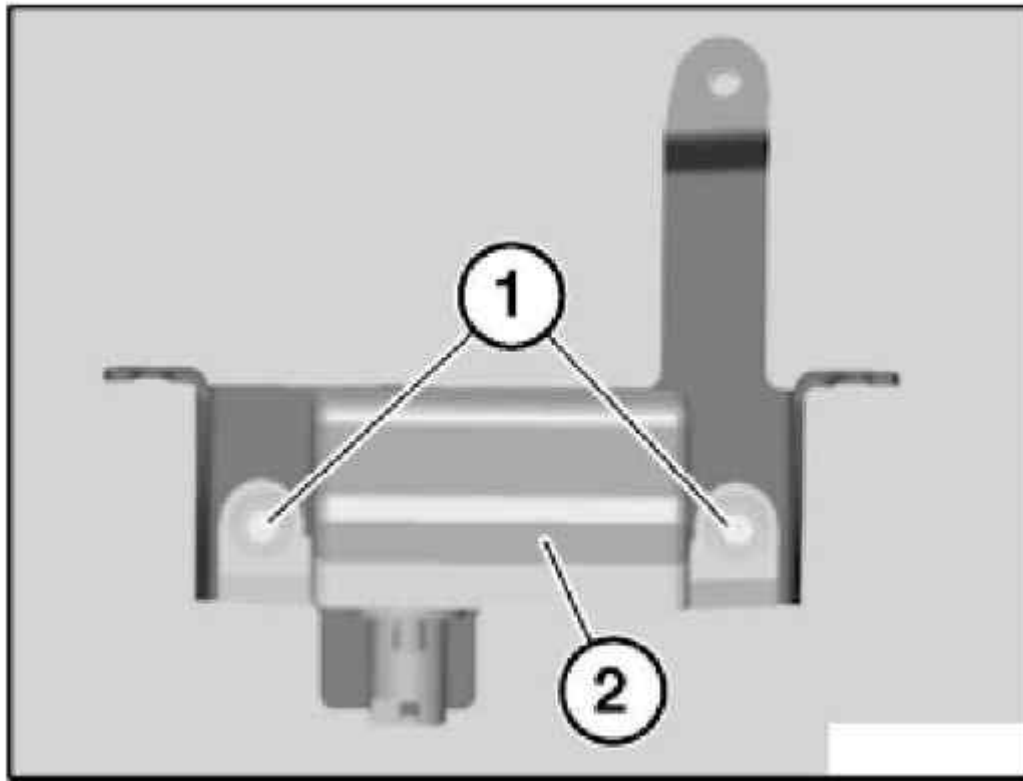
G03297797

Fig. 115: Removing DSC Sensor With Holder
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts (1) and detach DSC sensor (2) from holder.

Installation:

Tightening torque, see, 34 51 3AZ in **BRAKES - TIGHTENING TORQUES** .



G03297798

Fig. 116: Disconnecting DSC Sensor From Holder
Courtesy of BMW OF NORTH AMERICA, INC.

34 52 555 REMOVING AND INSTALLING/REPLACING PRESSURE SENSOR "H" FOR DSC

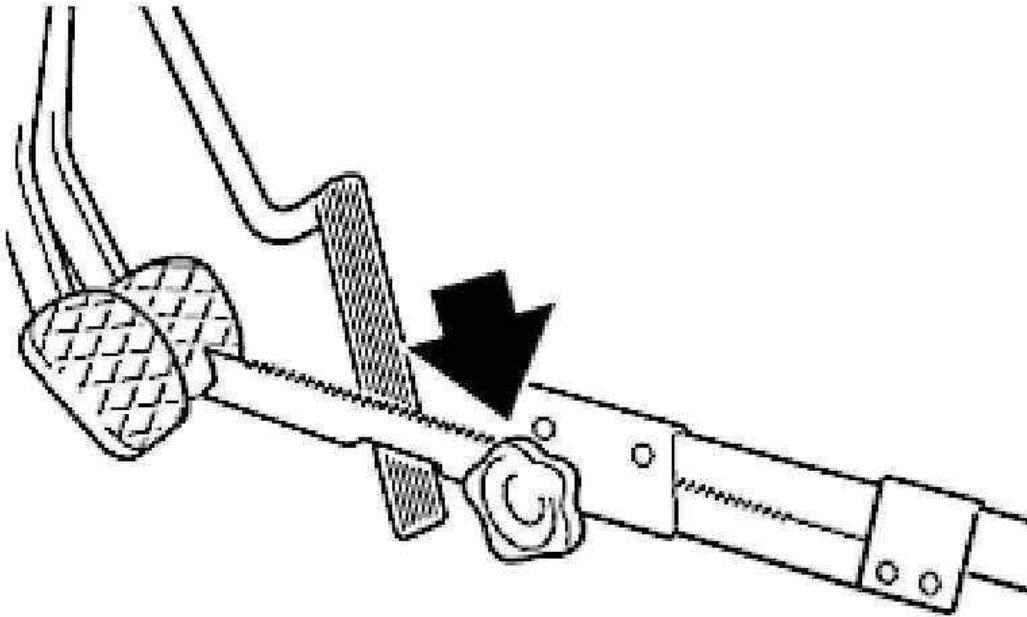
NOTE: Read and comply with General Information .

IMPORTANT: After replacing the pressure sensor, carry out an adjustment with DIS (Diagnosis and Information System) under menu item "Service functions".

After completing tasks, bleed brake system. See 34 00 050 Bleeding Brake System With DSC .

Apply pedal prop and depress brake pedal slightly. This prevents brake fluid from emerging from the expansion tank and air from entering the brake system after the brake lines have been detached.

Disconnect brake pipe from connection with brake hose.



G03297799

Fig. 117: Depressing Brake Pedal

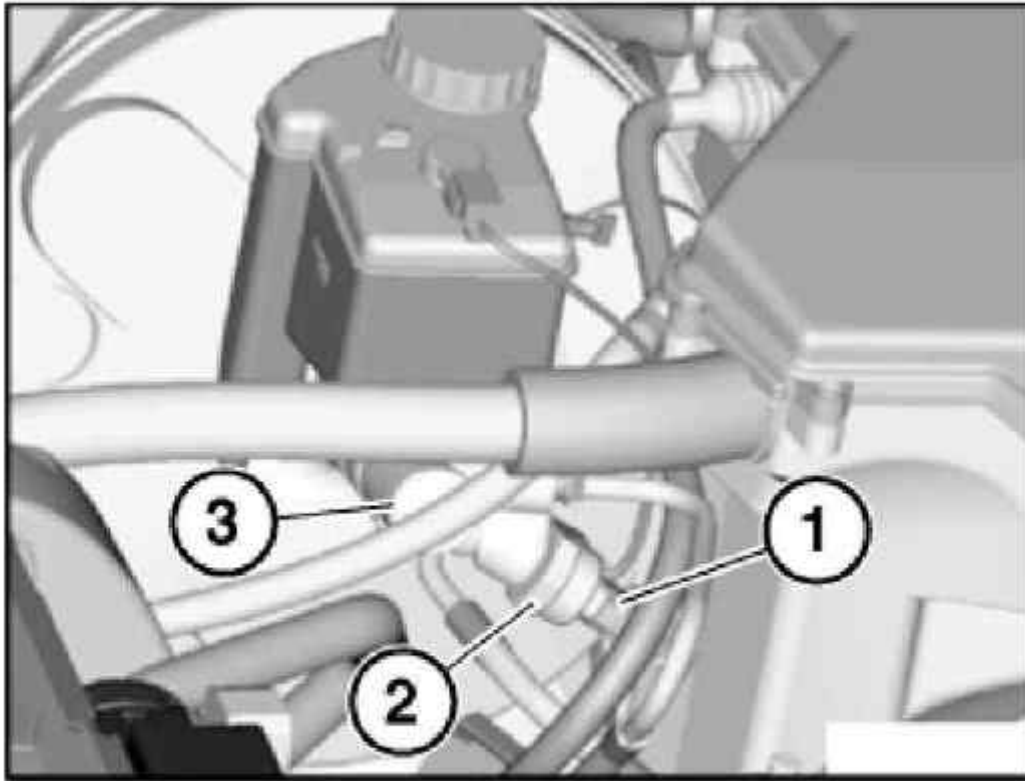
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten plug connection (1).

Detach pressure sensor (2) from master brake cylinder (3).

Installation:

Tightening torque, see 34 51 2AZ in **BRAKES - TIGHTENING TORQUES** .



G03297800

Fig. 118: Disconnecting Pressure Sensor From Master Brake Cylinder
Courtesy of BMW OF NORTH AMERICA, INC.

34 52 560 REMOVING AND INSTALLING/REPLACING PRESSURE SENSOR "V" FOR DSC

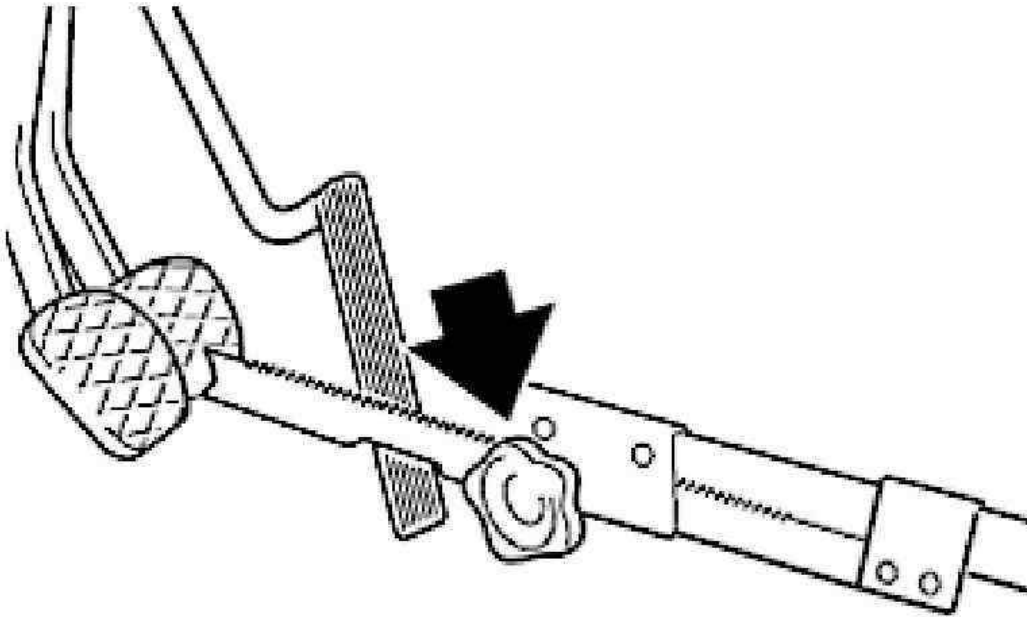
NOTE: Read and comply with General Information .

IMPORTANT: After replacing the pressure sensor, carry out an adjustment with DIS (Diagnosis and Information System) under menu item "Service functions".

After completing tasks, bleed brake system. See Bleed Brake System With DSC .

Apply pedal prop and depress brake pedal slightly. This prevents brake fluid from emerging from the expansion tank and air from entering the brake system after the brake lines have been detached.

Disconnect brake pipe from connection with brake hose.



G03297801

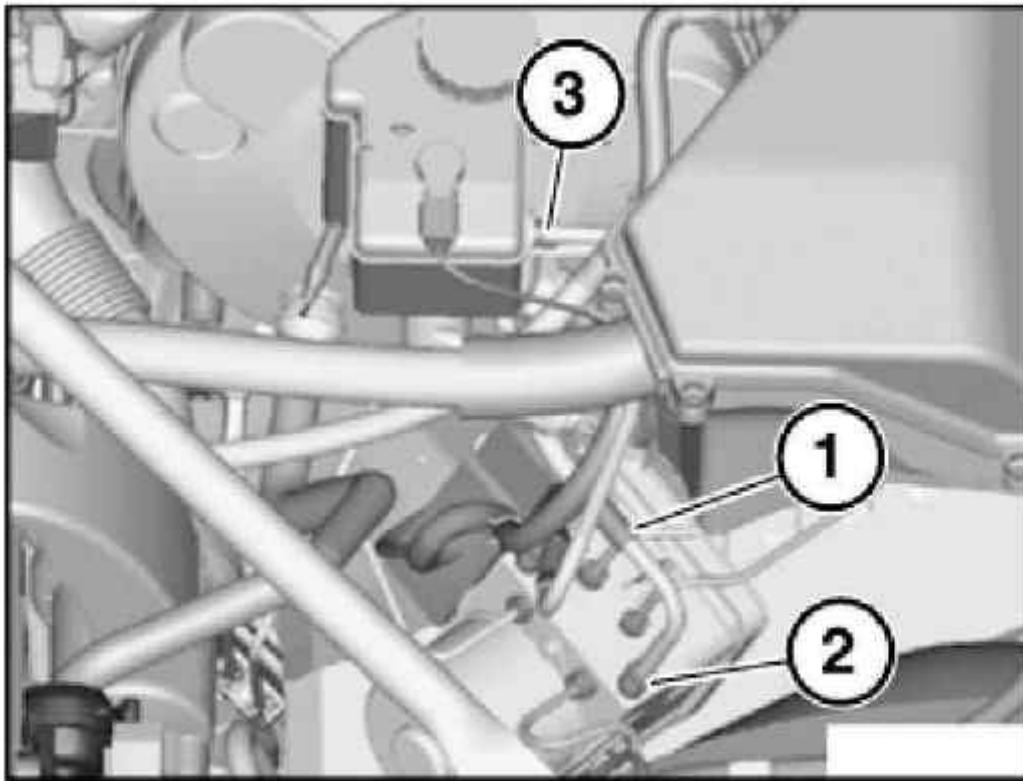
Fig. 119: Depressing Brake Pedal

Courtesy of BMW OF NORTH AMERICA, INC.

Release and remove pipe (1) from hydraulic unit (2) and from brake master cylinder (3).

Installation:

Tightening torque, see 34 32 1AZ in **BRAKES - TIGHTENING TORQUES** .



G03297802

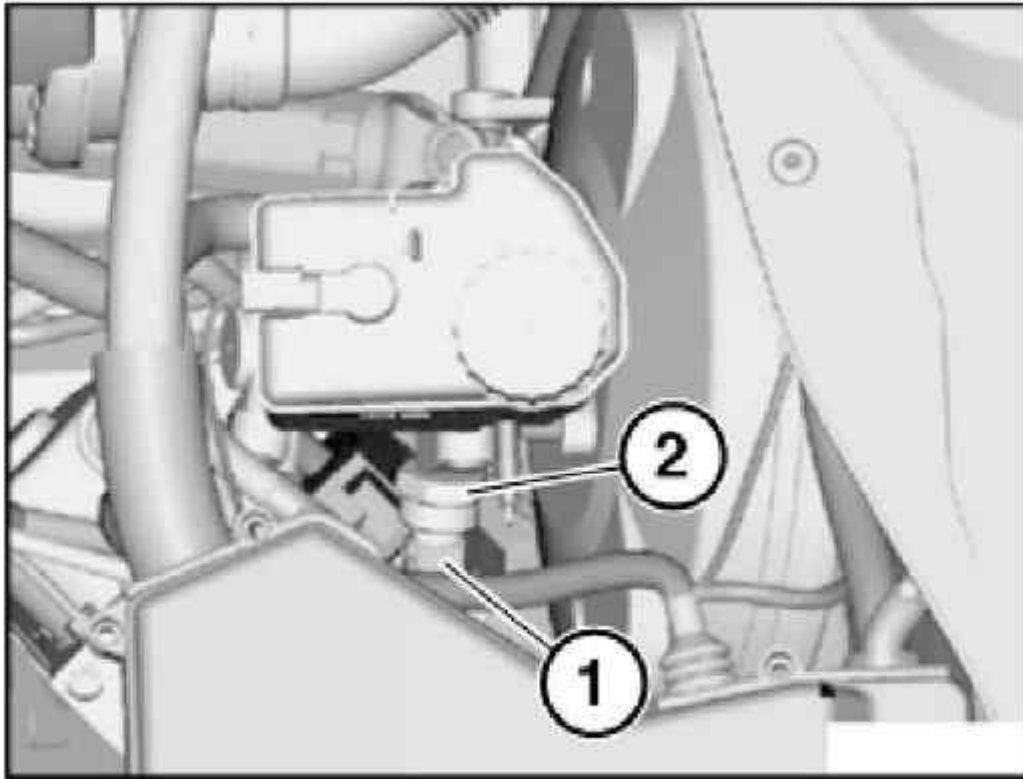
Fig. 120: Identifying Hydraulic Unit And Master Cylinder Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten plug connection (1).

Detach pressure sensor (2) from brake master cylinder.

Installation:

Tightening torque, see 34 51 2AZ in **BRAKES - TIGHTENING TORQUES** .



G03297803

Fig. 121: Disconnecting Pressure Sensor From Brake Master Cylinder
Courtesy of BMW OF NORTH AMERICA, INC.

TROUBLESHOOTING

34 90... TROUBLESHOOTING THE BRAKE SYSTEM

TROUBLESHOOTING THE BRAKE SYSTEM

Fault	Cause	Remedy
	a. Tyre pressure incorrect b. Unevenly worn tire treads c. Oil on pads/liners d. Wrong type of pads/liners	a. Correct tire pressure b. Change or replace tyres c. Replace brake linings , Check for causes d. Replace brake linings , Check for causes e. Remove and install/clean

2005 BMW Z4

2003-05 BRAKES Brakes - Repair Procedures - Z4/E85

Brakes pull to one side	e. Dirty floating caliper recesses f. Guide bolts dirty or damaged g. Axle geometry not correct h. Corrosion in floating calipers i. No shock absorber action j. Pad of one caliper worn k. Pad glazed	- floating calipers f. Replace guide bolts g. Check wheel alignment h. Remove and install, repair or replace floating calipers i. Check shock absorber, replacing if necessary j. Replace brake linings, check floating caliper k. Replace brake linings, check floating caliper
Brakes excessively hot while driving	a. Compensating port in master cylinder blocked b. No play between push rod and master cylinder piston c. Swollen rubber parts due to use of wrong brake fluid d. Bleeder hole on expansion tank blocked e. Corroded floating calipers f. Handbrake lever not released fully	a. Replace brake master cylinder b. Adjust push rod c. Replace brake master cylinder d. Clean expansion tank e. Remove and install, repair or replace floating calipers f. Check handbrake and handbrake Bowden cables , repair if necessary
Fault	Cause	Remedy
Poor braking effect in spite of great force on pedal Travel at brake pedal normal	Brake pads oil-splattered or burnt; wrong type of brake pads	Replace brake linings
Poor braking effect in spite of great force on pedal Travel at brake pedal too short	Brake booster malfunctions - engine vacuum	- Check brake booster - o Check engine (valves, cylinder head gasket etc.)
Poor braking effect in spite of great force on pedal Travel at brake pedal too long	One brake circuit failed due to leaks or damage	Leakage test of brake system
Brake pedal can be pressed down softly and springily	a. Air in brake system b. Not enough brake fluid in expansion tank c. Overheated brake fluid - vapour lock due to excessive water content	a. Bleed brakes b. Top up or change brake fluid Bleed brakes c. Top up brake fluid Bleed

2005 BMW Z4

2003-05 BRAKES Brakes - Repair Procedures - Z4/E85

	in brake fluid or excessive brake loads	brakes
Brake is bled and readjusted, but brake pedal can be pressed down too far	a. Primary cup in master cylinder damaged b. Leaking separating sleeves on floating piston of tandem master cylinder c. Leak in brake system	a. Replace master brake cylinder b. Replace master brake cylinder c. Leakage test of brake system
Fault	Cause	Remedy
Uneven pad wear	a. Wrong type of pads/liners b. Dirty fist caliper recesses, damaged caps c. Corrosion in floating calipers d. Swollen rubber ring for piston control	a. Replace brake linings b. Remove and install, repair or replace floating calipers c. Remove and install, repair or replace floating calipers d. Remove and install, repair or replace floating calipers
Brake pads worn at angle	a. Wheel-bearing play excessive b. Brake disk not aligned with fist caliper c. Corrosion in floating calipers d. Angular brake-disk wear e. Pads worn to less than minimum thickness f. Spring force insufficient g. Guide bolts damaged	a. Replace wheel bearings b. Check floating caliper installation c. Remove and install, repair or replace floating calipers d. Grind or replace brake disks e. Replace brake linings f. Replace spring g. Replace guide bolts
Seized brake pads, pad does not move off brake disk	a. Dirty fist caliper recesses, damaged caps b. Corrosion in floating calipers c. Compensating port in master cylinder blocked	a. Remove and install, repair or replace floating calipers b. Remove and install, repair or replace floating calipers c. Replace master brake cylinder
Fault	Cause	Remedy
Brakes squeal or rattle	a. Wrong type of pads/liners b. Dirty floating caliper recesses c. Spring force insufficient d. Brake disk not aligned with fist caliper e. Brake-disk runout f. Excessive thickness deviation within braking surface	a. Replace brake linings b. Remove and install/clean floating calipers c. Replace spring d. Check floating caliper installation e. Check brake disks for runout, replacing if necessary f. Measure brake disk thickness

2005 BMW Z4

2003-05 BRAKES Brakes - Repair Procedures - Z4/E85

	g. Liner wear excessive or onesided h. Rust edges on brake disks i. Pad loose j. Wheel-bearing play excessive	- Grind or replace disks g. Replace brake shoes h. Grind or replace brake disks i. Replace brake linings j. Replace wheel bearings
Brake-pedal dead travel excessive	a. Wheel-bearing play excessive b. Brake disk not aligned with fist caliper c. Brake-disk runout d. Excessive thickness deviation within braking surface e. Brake system leaking f. Air in brake system g. Wrong type of pads/liners	a. Replace wheel bearings b. Check floating caliper installation c. Check brake disk for runout, replacing if necessary d. Measure brake disk thickness Grind or replace disks e. Leakage test of brake system f. Bleed brakes g. Replace brake linings
Fault	Cause	Remedy
Jammed piston in brake caliper	a. Dirty fist caliper recesses, damaged caps b. Brake disk not aligned with fist caliper c. Pistons corroded in floating calipers	a. Remove and install, repair or replace floating caliper b. Check floating caliper installation c. Remove and install, repair or replace floating caliper
Pulsating effect on brake pedal	a. Wheel-bearing play excessive b. Brake disk not aligned with fist caliper c. Brake-disk runout d. Excessive thickness deviation within braking surface	a. Replace wheel bearings b. Check floating caliper installation c. Check brake disk for runout, replacing if necessary d. Measure brake disk thickness Grind or replace disks
Handbrake effect insufficient	a. Brake shoes oil-splattered b. Excessive dead travel between brake shoes and brake drums c. Corroded transmitting elements	a. Replace brake shoes, determine cause b. Adjusting handbrake c. Remove and install handbrake and expander locks Check Bowden cables, replacing if necessary