1992-2002 BRAKES

Anti-Lock/Traction Control (E36)

IDENTIFICATION

ENGINE & CHASSIS IDENTIFICATION

Model (Chassis Code)	Engine Size (Code)
1992-1995	
318i, ic, is, ti (E36)	1.8L (M42)
1991-1995	
325i, ic, is (E36)	2.5L (M50)
1995	
M3 (E36)	3.0L (S50)
1996-1998	
318i, ic, is (E36)	1.9L (M44)
Z3 (E36)	1.9L (M44)
1996-1999	
318 ti	1.9L (M44)
328i, is (E36)	2.8L (M52)
M3 (E36)	3.2L (S52)
1997-2000	
Z3 (E36)	2.8L (M52)
1998-1999	
323i, is (E36)	2.5L (M52)
1998-2002	
M Roadster	3.2L (S52)
1999	
Z3 (E36)	2.5L (M52)
Z3 (E36)	2.8L (S52)
1999-2002	
M Coupe (E36)	3.2L (S52)
2000	
Z3 (E36)	2.5L (M52TU)
Z3 (E36)	2.8L (M52TU)
2001-2002	
Z3 (E36)	2.5L (M54)
Z3 (E36)	3.0L (M54)

DESCRIPTION

CAUTION: See ANTI-LOCK BRAKE SAFETY PRECAUTIONS article in GENERAL INFORMATION.

NOTE: For additional information, see appropriate DISC article.

ABS

Anti-Lock Brake System (ABS) consists of a hydraulic unit with 4 solenoid switching valves, 4 speed sensors, an Electronic Control Unit (ECU), relays and wiring harness. See Fig. 1 .

ABS light on the instrument panel comes on when ignition is turned on. ABS light goes out once engine is started, indicating ABS is ready for operation.

The ABS activates at speeds greater than 8 MPH. When vehicle speed is greater than 3 MPH, the built-in electronic test monitor will start checking ABS. If a fault is found, the warning light will come on. When ABS light is on, ABS is switched off. Vehicle will then convert to conventional braking.

If battery voltage is less than 10.5 volts with ignition on and test speed is exceeded, ABS will remain off until alternator increases voltage output to more than 10.5 volts. ABS warning light will then go out.

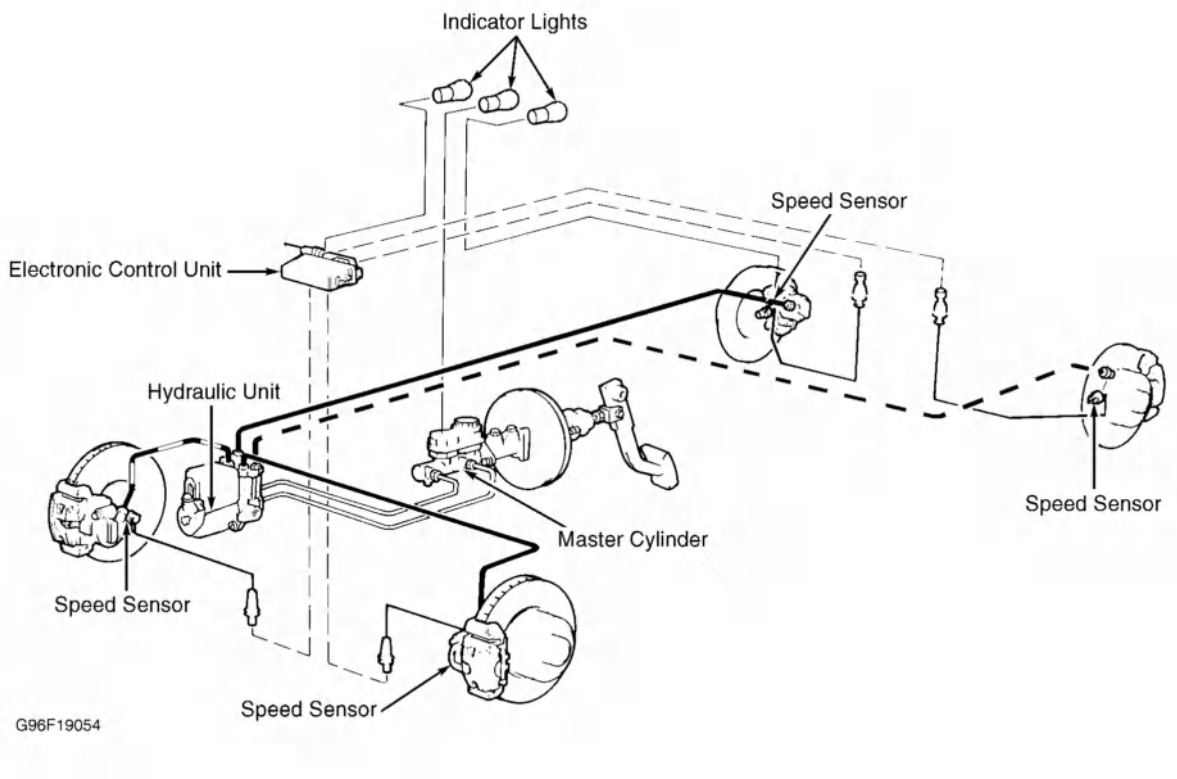

Fig. 1: Identifying Anti-Lock Brake System Components (Typical)
Courtesy of BMW OF NORTH AMERICA, INC.

ASC & ASC+T

Automatic Stability Control (ASC) and Automatic Stability Control with Traction Control (ASC+T) controls wheel slip by providing traction control (while driving off and at slow speeds) and stability control (while driving at cruising speeds and while cornering). By controlling wheel slip, frictional contact is maximized between the tires and the road surfaces under a variety of driving conditions.

The Teves ABS/ASC+T is a four channel, front/rear split system. Each rear brake caliper has its own hydraulic line from the hydraulic unit.

The ASC+T control determines the degree of slip based on the signals from the wheel speed sensors. The control module averages the speeds of the two front wheels to determine vehicle speed. The speeds of the front and rear wheels on each side are monitored to determine the degree of slip.

During ASC+T regulation the ASC Control Module has the ability to pulse the rear brakes individually or together. This depends on the degree of control required to restore traction as determined by the control module.

In addition to the traction control, the ASC+T Control Module interfaces with the DME control module. This will further reduce the engine's output torque. The total scope of engine control is the same as other ASC systems and includes engine intake air regulation, ignition timing retard, and ignition/injection fade out.

On vehicles equipped with automatic transmissions, the ASC+T system interfaces with the EGS control

module. This will delay or inhibit shifts during ASC regulation to prevent instability.

For a complete picture of the inputs and outputs of the system see Fig. 2 .

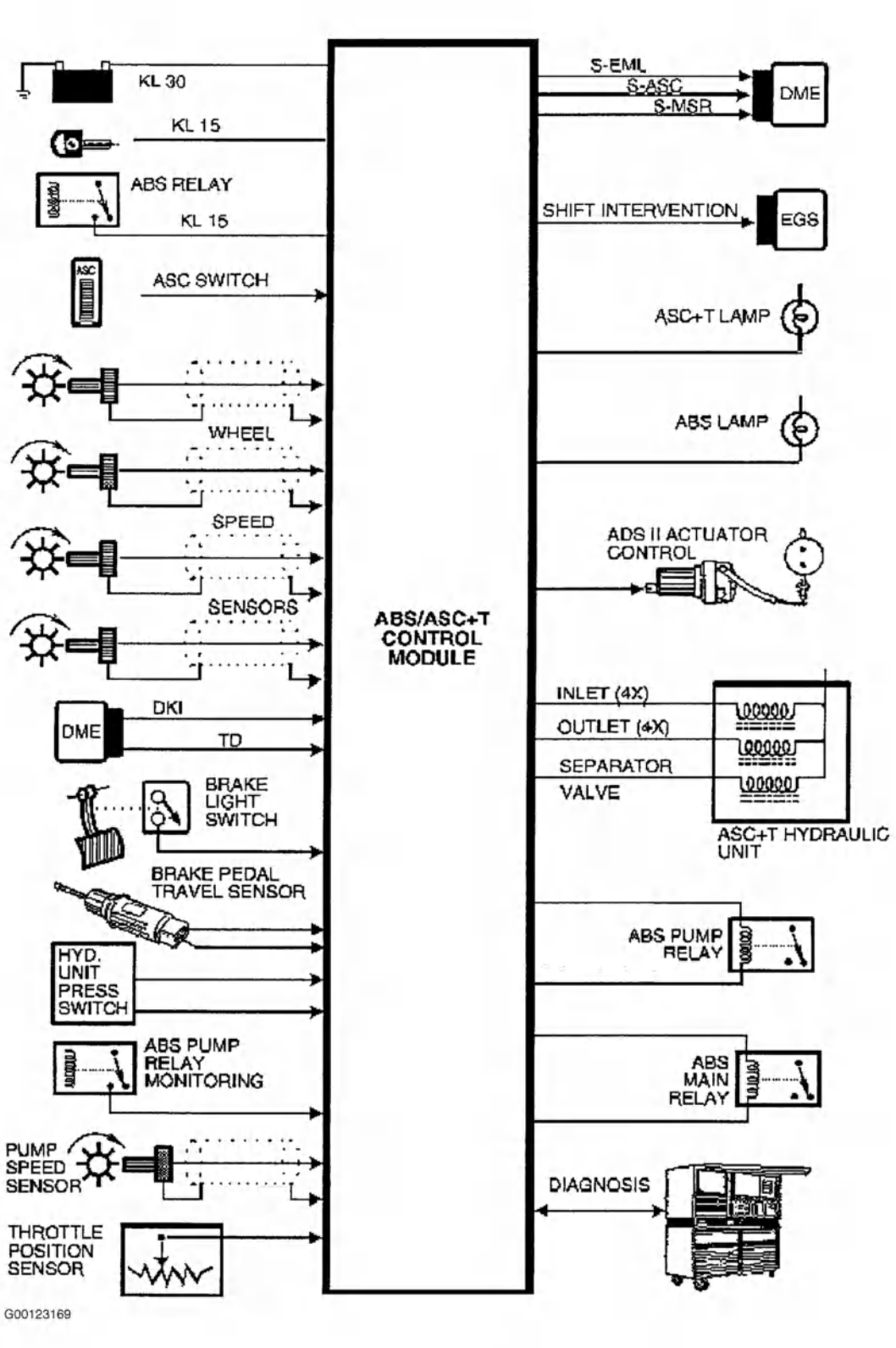

Fig. 2: Identifying ABS/ASC+T Control Module Inputs & Outputs
Courtesy of BMW OF NORTH AMERICA, INC.

OPERATION

ABS/ASC+T WARNING LAMPS

Both the ABS and ASC warning lamps illuminate when the ignition is switched on. The lamps go out after

approximately 2 seconds (self test check).

The ASC lamp will flash during regulation. It will be on permanently with a faulted system or if the ASC is manually switched off.

The ABS and ASC lamps will be on permanently with faults that affect the ABS system (both systems off line).

ADS II MOTOR

On vehicles so equipped, the ADS II motor is located just above the hydraulic unit mounted to the left front shock tower. It is connected to the throttle valve through a bowden cable. See Fig. 3 .

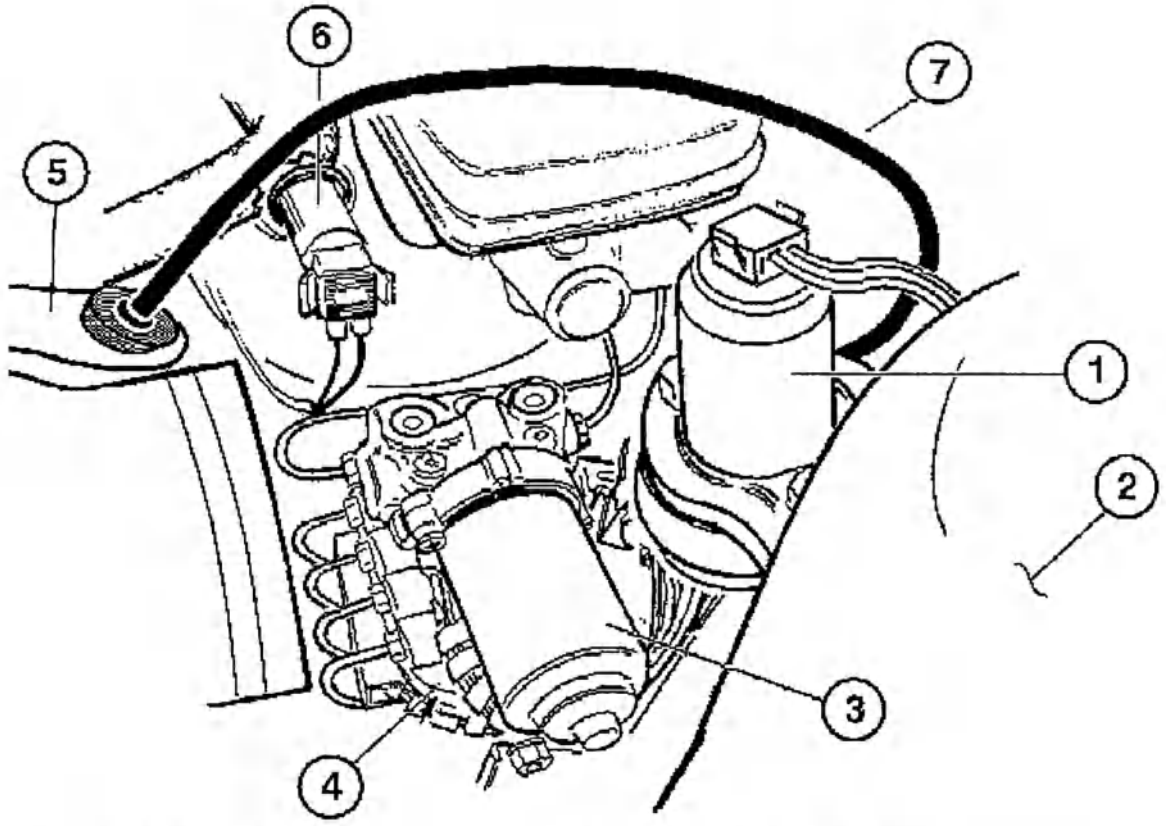

Fig. 3: Identifying Hydraulic Unit Components
Courtesy of BMW OF NORTH AMERICA, INC.

ADS II THROTTLE CONTROL

The ADS II motor is controlled by a modulated signal (PWM) from the ASC+T control module. As the accelerator pedal (1) is depressed, power is applied to the rear wheels. If slip is detected by the ASC+T control module, ASC regulation commences. The degree of closure is dependent on the degree of slip and the control module programming. The ADS motor (2) closes the throttle (3) through the bowden cable. The ASC+T control module receives feedback acknowledgment of ADS operation from the potentiometer mounted on the throttle housing. In addition to the ADS position of the throttle, the ASC+T control module also receives the DKI signal (5) from the DME as a plausibility input. See Fig. 4 .

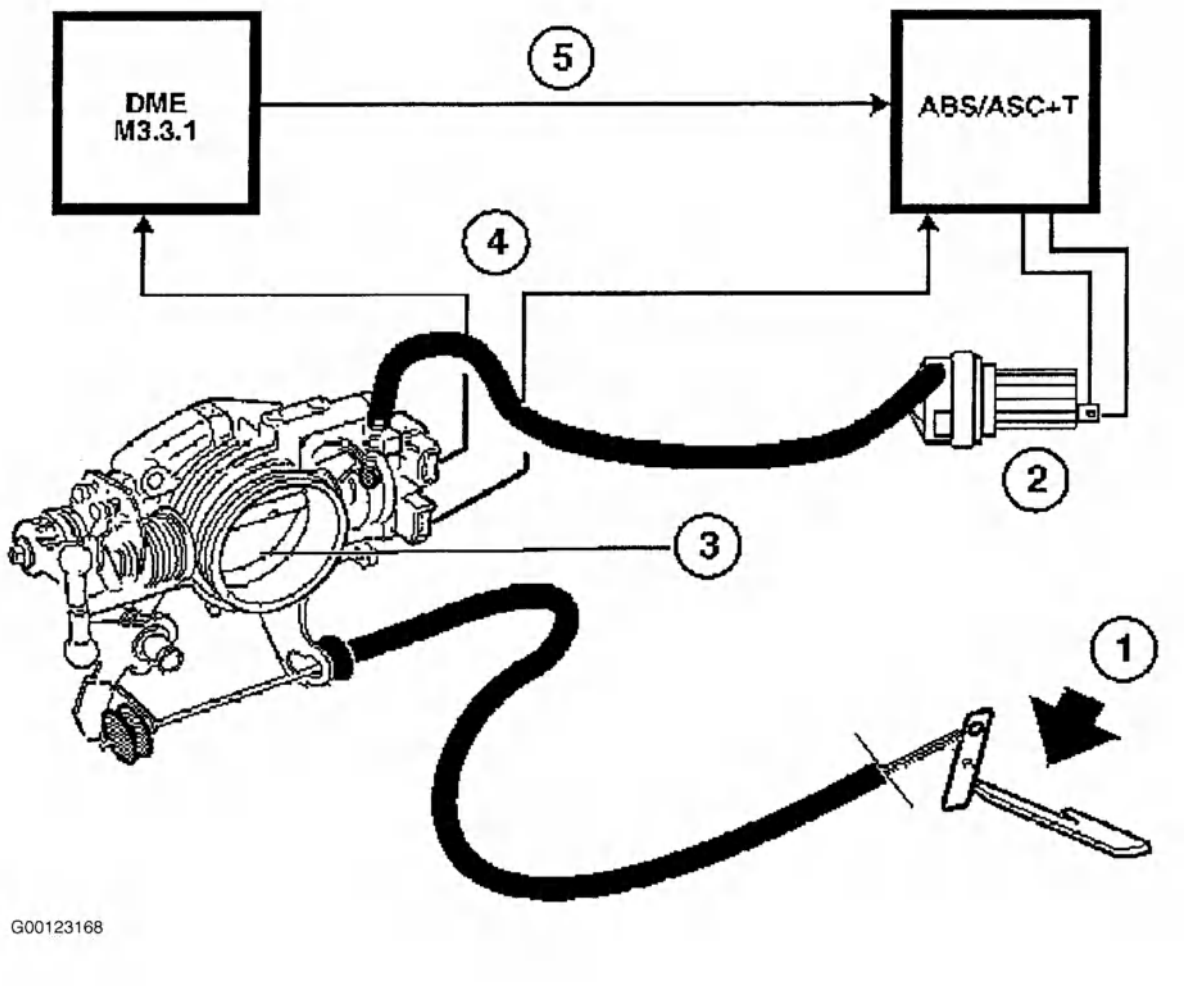

Fig. 4: Identifying ADS II Throttle Control Components
Courtesy of BMW OF NORTH AMERICA, INC.

ASC+T - DME/EGS INTERFACES

The signals between the ASC+T control module and the DME control module for slip control regulation are switched high/low signals. In addition to the DKI signal, the ASC+T interfaces with the DME over three signal paths:

1. S-EML - Signal to DME of ADS throttle regulation.
2. S-MSR (ZWV) - During slip control regulation, this is a signal to the DME to retard the ignition timing.
3. S-ASC (ZA) - During slip control regulation, this is a signal to the DME to briefly fade out the ignition/injection.

Another signal may be SHIFT INTERVENTION. This is a signal from the ASC+T control module to the EGS control module to suppress shifting during ASC regulation.

ELECTRONIC CONTROL UNIT (ECU)

ECU computes acceleration, deceleration and slip factors as generated from rotating wheels via speed sensors. ECU program can determine correct response behavior of the system based on these computations. ECU response is sent by electronic signals to electromagnetically operated valves in ABS hydraulic unit.

The ECU contains electronic monitoring circuits. These monitoring circuits ensure proper operation of the ABS. If control unit detects a defect in wiring harness or any electrical part of the equipment, the monitoring circuit will switch off ABS, permitting normal use of standard brake system. ANTI-LOCK indicator light will glow.

ECU is located behind glove box.

HYDRAULIC UNIT

NOTE: Hydraulic units are model specific and not interchangeable.

To control braking system pressure, brake hydraulic unit has a 3-way valve which permits 3 separate brake pressure conditions. Pressure build-up, pressure retention and pressure drop are 3 pressure phases that adapt to vehicle braking requirements. For components see Fig. 3 .

Control procedures are as follows:

- As soon as wheel lock-up is indicated, brake fluid pressure is reduced. If the wheel still tends to lock, pressure will be further reduced until wheel acceleration or the slip limit is detected. The pressure is then raised and the control phases repeated. These pressure changes occur in milliseconds.
- The return delivery pump returns brake fluid from the wheel brake cylinder, while dropping the pressure to the appropriate brake circuit. The pump is a 2-piston pump design so circuits of a dual brake circuit system remain separated.
- Two relays are located under hydraulic control unit cover: an engine relay and a valve relay. The engine relay is the larger relay.

SPEED SENSORS

Speed sensors are installed at each wheel. Speed sensors measure the rate at which teeth on pulse wheel rotate. The sensors then relay signal to the ECU, which computes actual wheel speed. Pulse wheels, which run past the permanently magnetized edge of speed sensor, are attached to hub.

THROTTLE VALVE WITH DUAL FEEDBACK POTENTIOMETER

Throttle Valve

The throttle valve is operated via cable from the accelerator pedal as in the past. An additional tension spring allows the ADS motor to close the throttle valve regardless of how far the accelerator is being pressed.

Dual Feedback Potentiometer

The throttle potentiometer is a dual potentiometer. One potentiometer is the throttle position input signal to the DME as in the past. The second potentiometer is the actual throttle valve position input to the ASC+T control module during ASC regulation. See Fig. 5 .

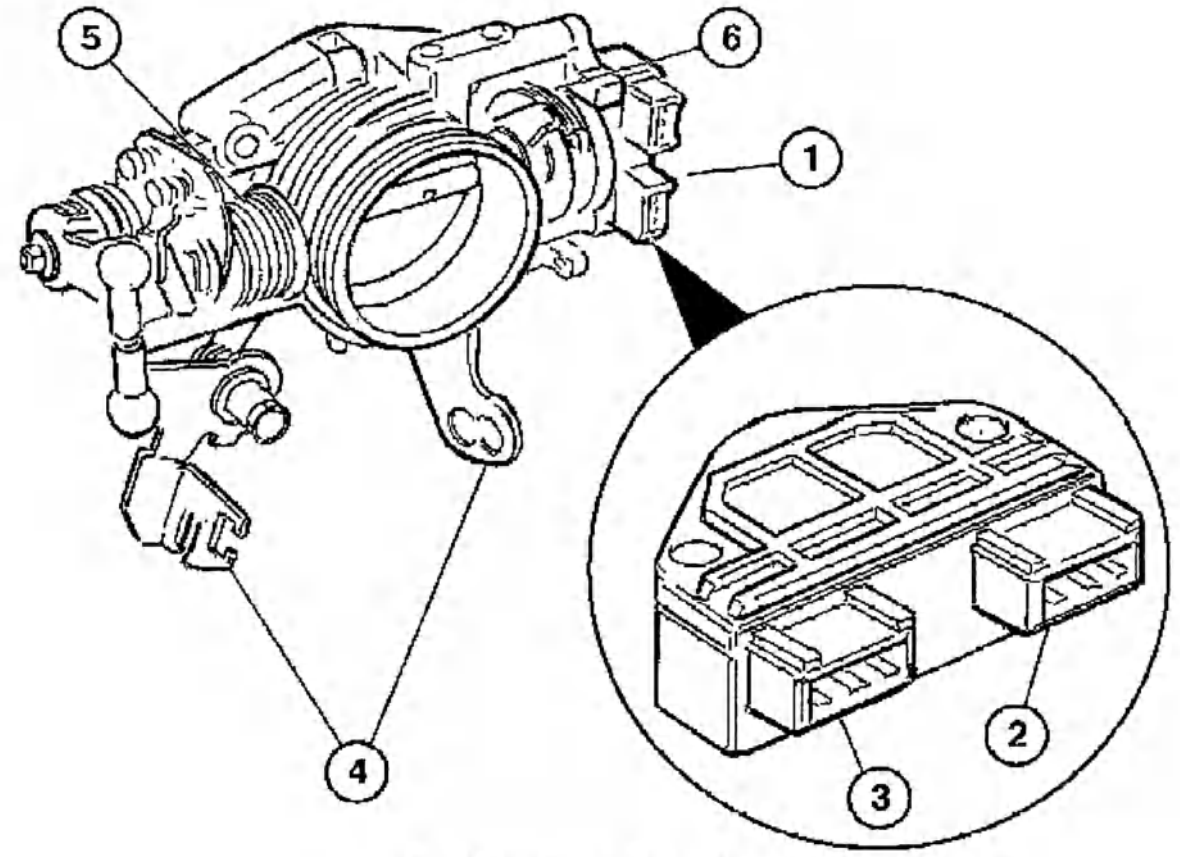

Fig. 5: Locating Throttle Pontentiometer Components
Courtesy of BMW OF NORTH AMERICA, INC.

SERVICING

Brake fluid should be replaced every 2 years. Brake fluid tank has a vent hole. Brake fluid will retain moisture from air and could cause brake fluid boiling point to drop from 464Â°F (240Â°C) to 320Â°F (160Â°C).

BLEEDING BRAKE SYSTEM

See appropriate DISC article.

DIAGNOSIS & TESTING

Always use the latest diagnostic software available when testing or troubleshooting ABS/ASC problems.

RETRIEVING CODES

Use BMW scan tool connected to diagnostic connector to retrieve ABS diagnostic trouble codes. See Fig. 6 . See DIAGNOSTIC TROUBLE CODES table.

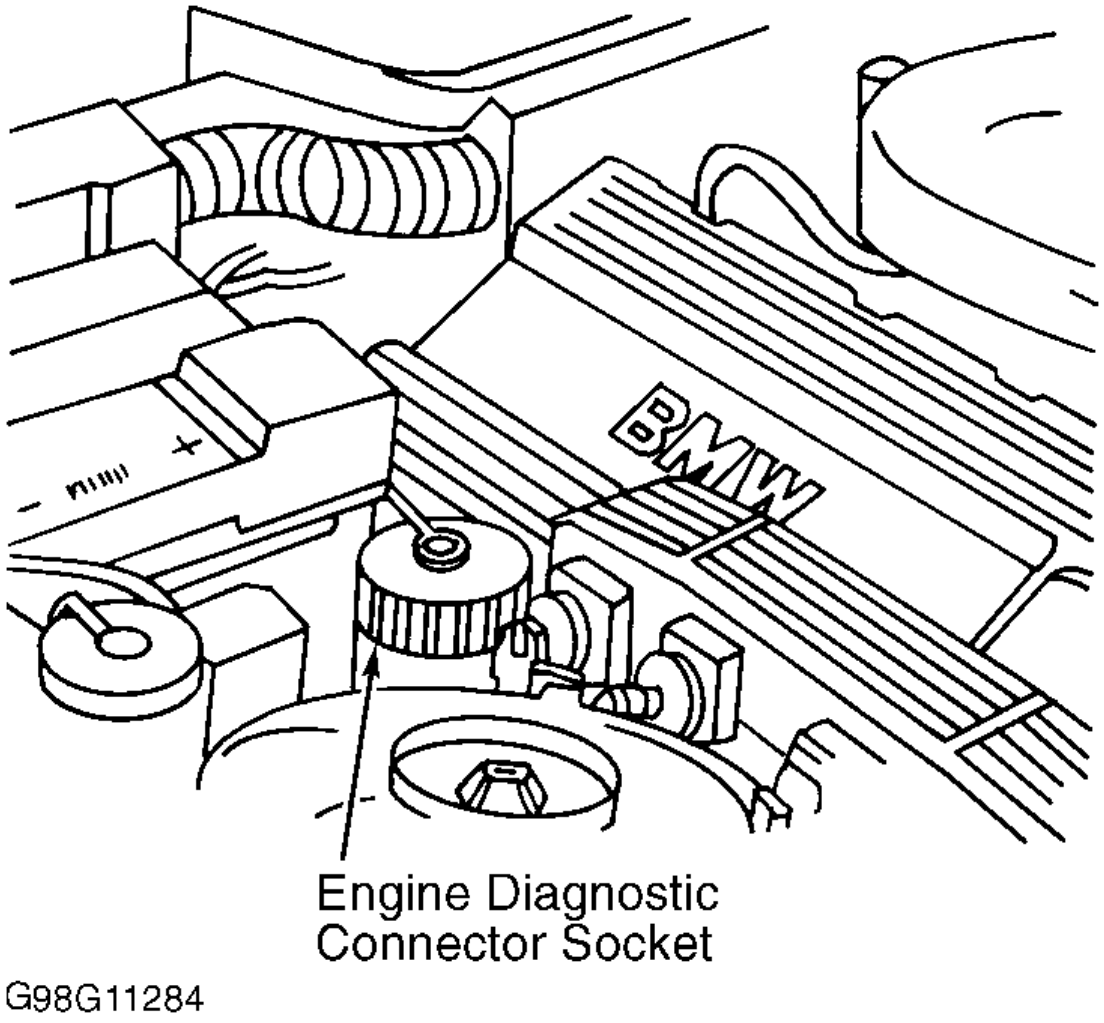

Fig. 6: Locating BMW Engine Diagnostic Connector Socket (4-Cylinder Shown)
Courtesy of BMW OF NORTH AMERICA, INC.

DIAGNOSTIC TROUBLE CODES

DTC	Possible Cause	Diagnosis
17	Front Left Inlet Valve Faulty	See Fig. 13 .
18	Front Left Outlet Valve Faulty	See Fig. 13 .
20	Front Right Inlet Valve Faulty	See Fig. 13 .
24	Front Right Outlet Valve Faulty	See Fig. 13 .
33	Rear Axle Inlet Valve Faulty	See Fig. 13 .
34	Rear Axle Outlet Valve Faulty	See Fig. 13 .
68	Microprocessor In Control Unit Faulty Or Defective	See Fig. 13 .
72	Internal Defect In Control Unit	See Fig. 13 .
81	Front Left Speed Sensor Not Connected Or Faulty	See Fig. 13 .
82	Front Right Speed Sensor Not Connected Or Faulty	See Fig. 13 .
84	Rear Left Speed Sensor Not Connected Or Faulty	See Fig. 13 .
88	Rear Right Speed Sensor Not Connected Or Faulty	See Fig. 13 .
97	Front Left Speed Signal Not Plausible	See Fig. 13 .
98	Front Right Speed Signal Not Plausible	See Fig. 13 .
100	Rear Left Speed Signal Not Plausible	See Fig. 13 .

104	Rear Right Speed Signal Not Plausible	See Fig. 13 .
113	Front Left Speed Information Not Detected	See Fig. 13 .
114	Front Right Speed Information Not Detected	See Fig. 13 .
116	Rear Left Speed Information Not Detected	See Fig. 13 .
120	Rear Right Speed Information Not Detected	See Fig. 13 .
132	Speed Position Sensor Signal Faulty Or Not Connected	See Fig. 13 .
136	Serious Defect In Brake Hydraulic System	See Fig. 14 .
145	Pump Not Operating	See Fig. 14 .
152	Warning Brake Hydraulic/Pedal Position Sensor Defective	See Fig. 14 .
161	Front Left Outlet Valve Malfunction	See Fig. 14 .
162	Front Right Outlet Valve Malfunction	See Fig. 14 .
164	Rear Axle Outlet Valve Malfunction	See Fig. 14 .
255	Access To Memory In Control Unit Defective	See Fig. 14 .

CLEARING CODES

Use BMW scan tool to clear code.

CONNECTOR TERMINAL IDENTIFICATION

NOTE: For pin voltage identification of 55-pin ABS connector and 12-pin ABS hydraulic connector, see Fig. 7 -Fig. 10 .

Pin	Type	Description/function	Connection	Type of signal	Measurement notes
1	E	Control unit ground	Chassis ground	Ground	None
2	A	Activation front left outlet valve	ABS hydraulic block	approx. 12V / < 1V	Rest position / activated with BMW Diagnostic System
3	E	Voltage monitoring, hydraulics	ABS hydraulic block	approx.12V	None
4	Not used				
5	Not used				
6	Not used				
7	Not used				
8	Not used				
9	Not used				
10	Not used				
11	Not used				
12	Not used				
13	Not used				
14	Not used				
15	A	Pump relay activation	Pump relay	approx. 12V / < 1V	Rest position/activated with BMW Diagnostic system
16	E		Pedal position sensor	approx. 1V .. 3V	Pedal not depressed...fully depressed, hydr. system OK.
17	Not used				
18	Not used				
19	E	Control unit ground	Chassis ground	Ground	None
20	A	Activation, front left inlet valve	ABS hydraulic block	approx. 12V / < 1V	Rest position/activated with BMW diagnostic system

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Fig. 7: 55-Pin ABS Connector Pin Voltage Identification (1 Of 3)
Courtesy of BMW OF NORTH AMERICA, INC.

Pin	Type	Description/function	Connection	Type of signal	Measurement notes
21	A	Activation, front right outlet valve	ABS hydraulic block	approx. 12V / < 1V	Rest position/activated with BMW Diagnostic system
22	Not used				
23	E	Diagnostic link RxD	Diagnostic connector	> 11.5V	None
24	Not used				
25	Not used				
26	Not used				
27	A	Speed sensor ground RR	Speed sensor RR	Ground	None
28	A	Speed sensor ground RL	Speed sensor RL	Ground	None
29	A	Speed sensor ground FR	Speed sensor FR	Ground	None
30	A	Speed sensor ground FL	Speed sensor FL	Ground	None
31	E	Signal, pump motor sensor	ABS hydraulic block	approx. 0V AC / 0.5V AC	Pump motor OFF/activated with BMW diagnostic system
32	E	Terminal 54	Brake light switch	approx. 12V	Brake operated
33	E	Operating voltage	Main relay	approx. 12V	Pin 34 < 1.5V
34	A	Main relay activation	Main relay	approx. 1V	None
35	Not used				
36	A	Activation, rear outlet valve	ABS hydraulic block	approx. 12V / < 1V	Rest position/activated with BMW Diagnostic system
37	Not used				
38	A	Activation, front right inlet valve	ABS hydraulic block	approx. 12V / < 1V	Rest position/activated with BMW Diagnostic system
39	Not used				
40	Not used				
41	E	Pedal position sensor ground	Pedal position sensor	Ground	None

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Fig. 8: 55-Pin ABS Connector Pin Voltage Identification (2 Of 3)
Courtesy of BMW OF NORTH AMERICA, INC.

Pin	Type	Description/function	Connection	Type of signal	Measurement notes
42	E	Diagnostic link TxD	Diagnostic connector	> 2V	Diagnostic socket not closed
43	Not used				
44	Not used				
45	E	Signal speed sensor RR	Speed sensor RR	1 ... 2V	Wheel stationary
46	E	Signal speed sensor RL	Speed sensor RL	1 ... 2V	Wheel stationary
47	E	Signal speed sensor FR	Speed sensor FR	1 ... 2V	Wheel stationary
48	E	Signal speed sensor FL	Speed sensor FL	1 ... 2V	Wheel stationary
49	E	Signal Pumpenmotorsensor	Hydraulic unit	approx. 0 V AC / approx. 0.5V AC	Pump off/activated with BMW Diagnostic system
50	Not used				
51	Not used				
52	A	Activation, ABS warning lamp	ABS warning lamp	approx. 12V / 2V	ABS lamp OFF/ON
53	E	Terminal 15	Ignition switch	approx. 12V	Ignition ON
54	A	Activation, rear axle inlet valve	Hydraulic unit	approx. 12V / < 1V	Rest position/activated with BMW Diagnostic system
55	Not used				

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Fig. 9: 55-Pin ABS Connector Pin Voltage Identification (3 Of 3)
Courtesy of BMW OF NORTH AMERICA, INC.

Pin	Type	Description/function	Connection	Type of signal	Measurement notes
1	–	Pump motor activation	–	approx. 12V	Motor OFF
2	–	FL inlet valve activation	–	approx. 12V	Valve not activated
3	–	Signal, pump motor sensor	–	Alternating voltage	Pump motor ON
4	–	+12V	Main relay	approx. 12V	
5	–	Signal, pump motor sensor	–	Alternating voltage	Pump motor ON
6	–	FR inlet valve activation	–	approx. 12V	Valve not activated
7	–	Ground	–	Ground	None
8	–	FL outlet valve activation	–	approx. 12V	Valve not activated
9	–	FR outlet valve activation	–	approx. 12V	Valve not activated
10	–	Rear axle outlet valve activation	–	approx. 12V	Valve not activated
11	–	Rear axle inlet valve activation	–	approx. 12V	Valve not activated
12	–	Voltage supply monitoring	–	approx. 12V	None

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Fig. 10: 12-Pin ABS Hydraulic Unit Pin Voltage Identification
Courtesy of BMW OF NORTH AMERICA, INC.

SYMPTOM TESTS

SYSTEM INOPERABLE/SYSTEM CHECK

NOTE: For test, see Fig. 11 .

Disconnect control unit.

Measure resistance of the speed sensor. It must be between 1.04 and 1.16 kΩ.

Check pulse wheel for damage, ease of movement and eccentricity faults.

Check clearance (air gap) and set if necessary:

Nominal value front 0.27...1.24 mm

Nominal value rear 0.48...1.23 mm

Connect oscilloscope of BMW Service Tester as follows:

– Terminal D+ blue to speed sensor signal
– Frequency (–) black to speed sensor ground
– Frequency (+) blue to terminal 1 black

Select frequency and enter 80 Hz

Select oscilloscope

Uniformly turn wheel by hand. A sinusoidal curve must be displayed whose amplitude and period duration change dependent on the rotary speed. (See example in drawing)

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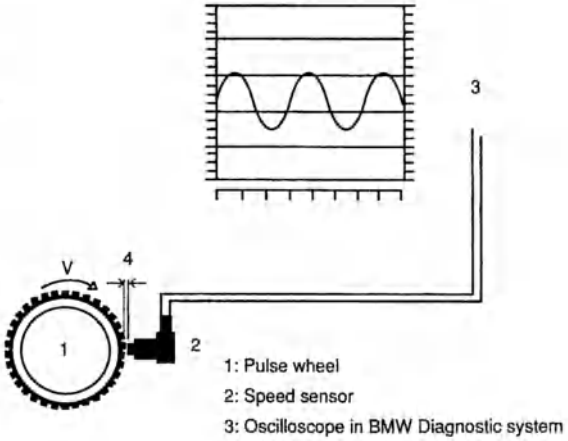


Fig. 11: ABS System Inoperable/System Check
Courtesy of BMW OF NORTH AMERICA, INC.

ABS WARNING LIGHT DOES NOT LIGHT WHEN IGNITION SWITCHED ON

NOTE: For test, see Fig. 12 .

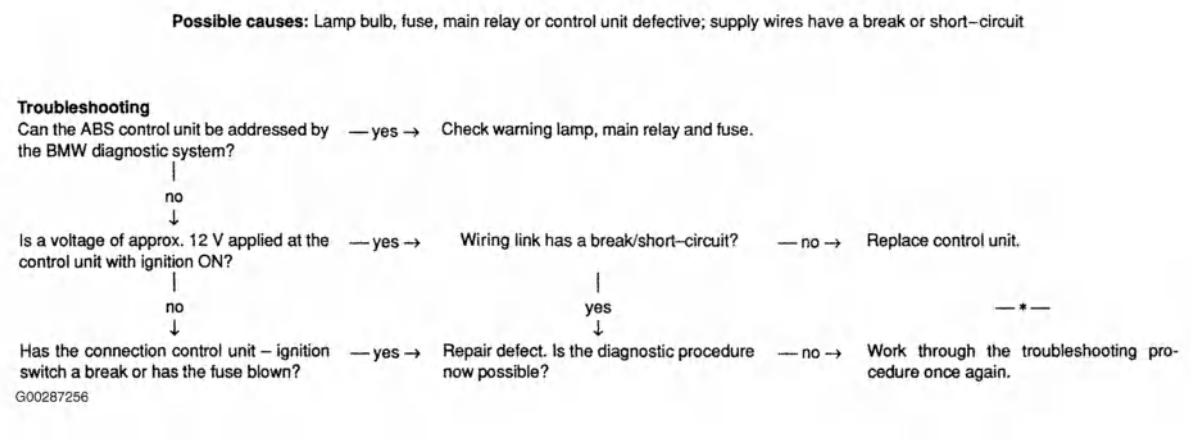


Fig. 12: ABS Warning Light Does Not Light When Ignition Switched On
Courtesy of BMW OF NORTH AMERICA, INC.

DIAGNOSTIC TESTS

NOTE: For tests, see Fig. 13 and Fig. 14 .

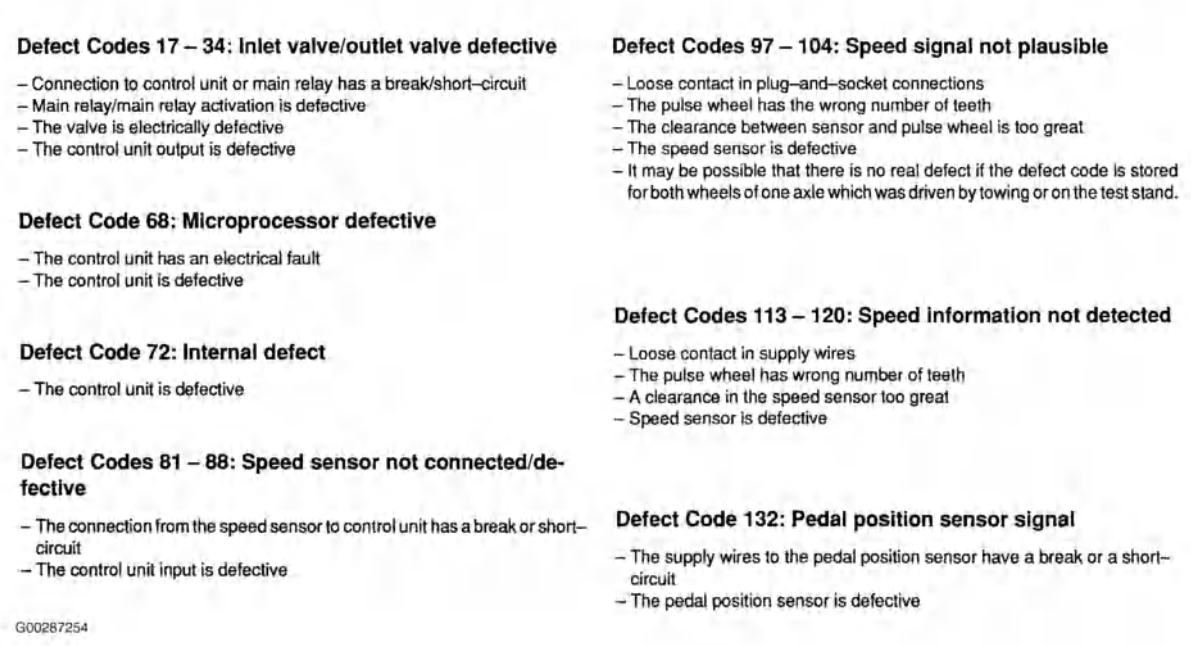


Fig. 13: ABS Diagnostic Trouble Codes (17 To 132)
Courtesy of BMW OF NORTH AMERICA, INC.

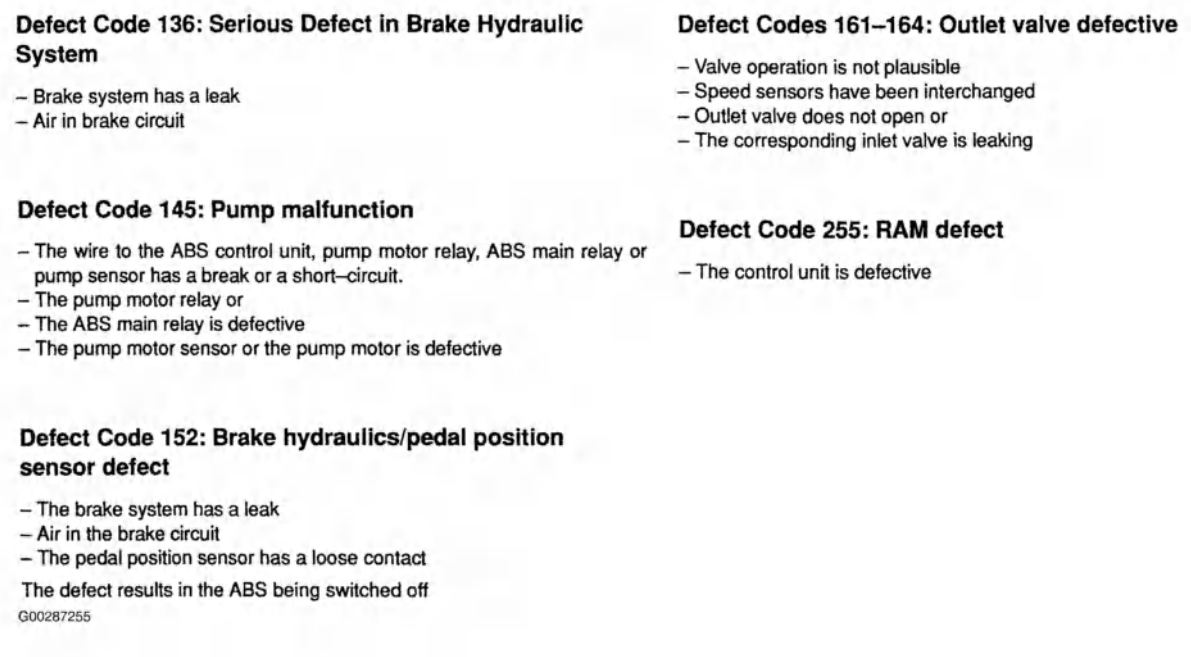


Fig. 14: ABS Diagnostic Trouble Codes (136 To 255)
Courtesy of BMW OF NORTH AMERICA, INC.

REMOVAL & INSTALLATION

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES - 1992-98 , COMPUTER RELEARN PROCEDURES - 1999 , COMPUTER RELEARN PROCEDURES - 2000 , COMPUTER RELEARN PROCEDURES - 2001 , COMPUTER RELEARN PROCEDURES - 2002 or COMPUTER RELEARN PROCEDURES - 2003 article in GENERAL INFORMATION before disconnecting battery.

ASC+T ACCUMULATOR

Removal & Installation

1. Remove liner of left front side panel. See Fig. 15 .

   CAUTION: Pressure in accumulator will be approx. 1740.5 psi (120 bar).

2. Discharge accumulator by connecting bleeder hose with bottle and carefully loosen bleeder screw. See Fig. 16 .
3. Unlock and pull off cable connector. See Fig. 17 .
4. Unscrew brake pipe. See Fig. 18 .
5. Unscrew screws and remove accumulator. See Fig. 19 .
6. To install, reverse removal procedure. Tighten brake hoses to specification. See TORQUE SPECIFICATIONS .
7. Bleed accumulator. See appropriate DISC article.

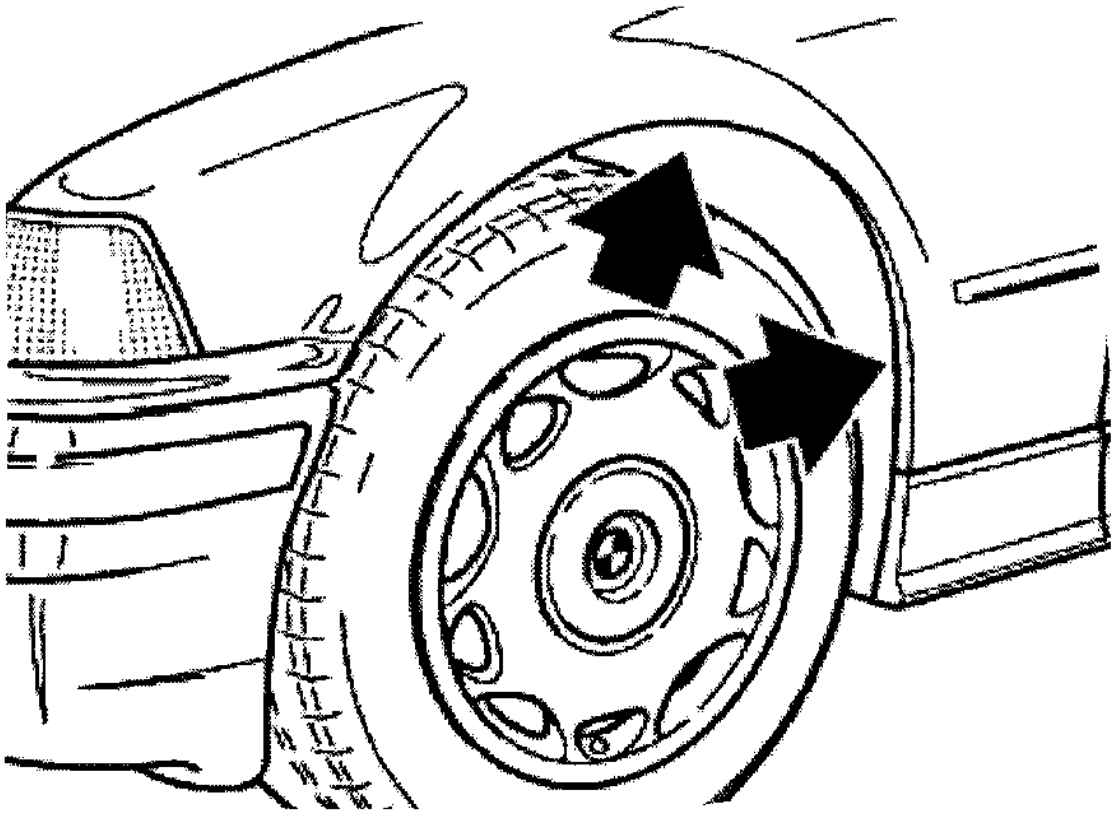


Fig. 15: Removing Liner
Courtesy of BMW OF NORTH AMERICA, INC.

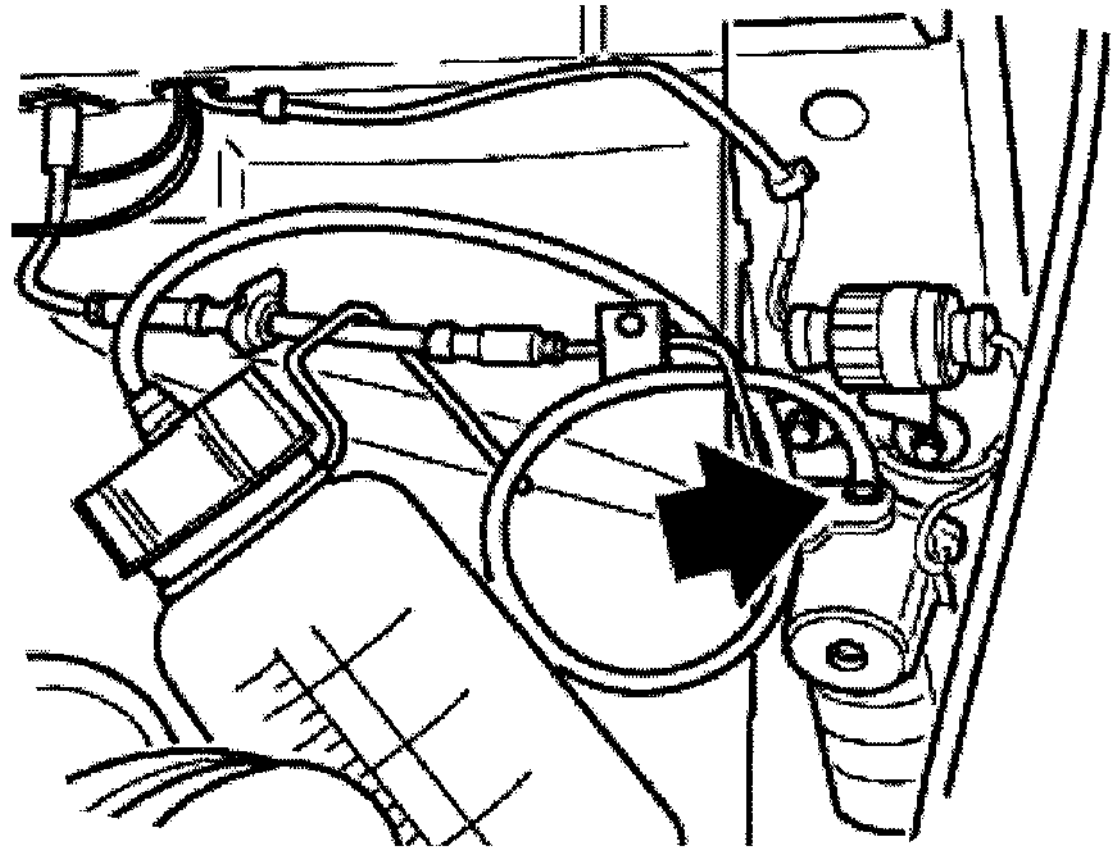


Fig. 16: Discharging Accumulator
Courtesy of BMW OF NORTH AMERICA, INC.

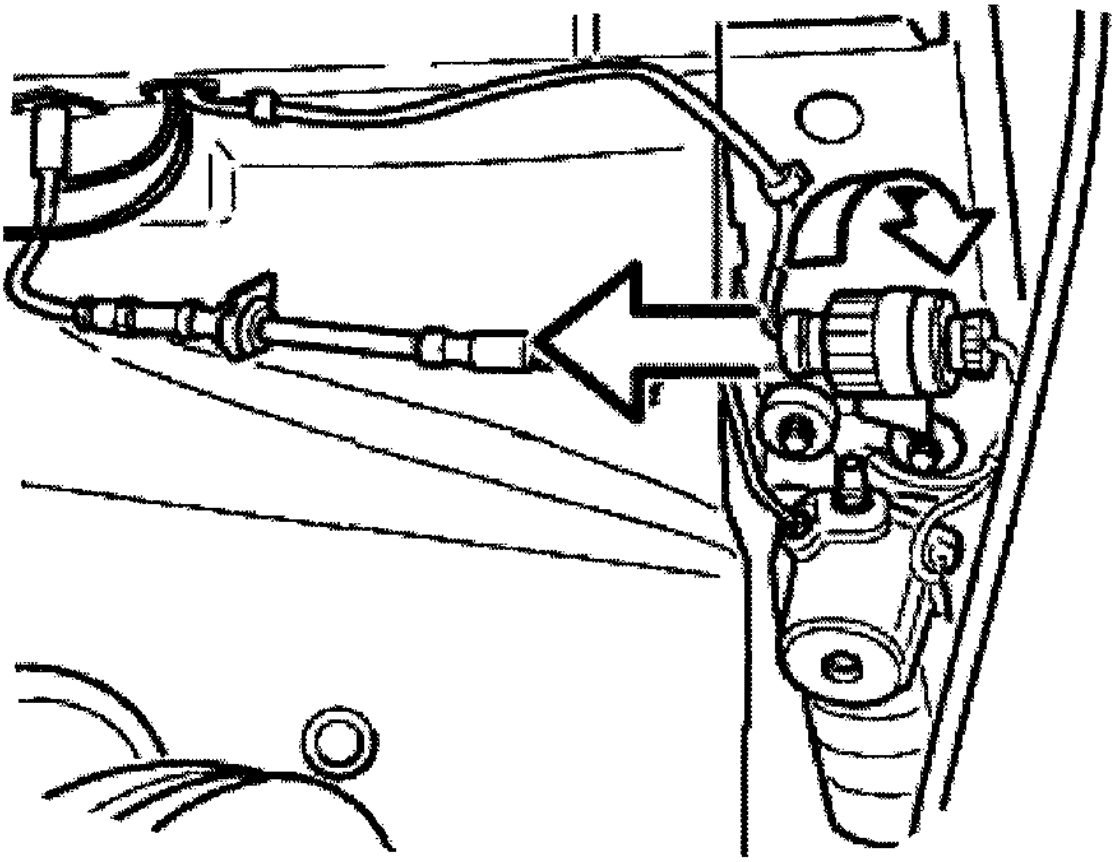


Fig. 17: Pulling Off Cable Connector
Courtesy of BMW OF NORTH AMERICA, INC.

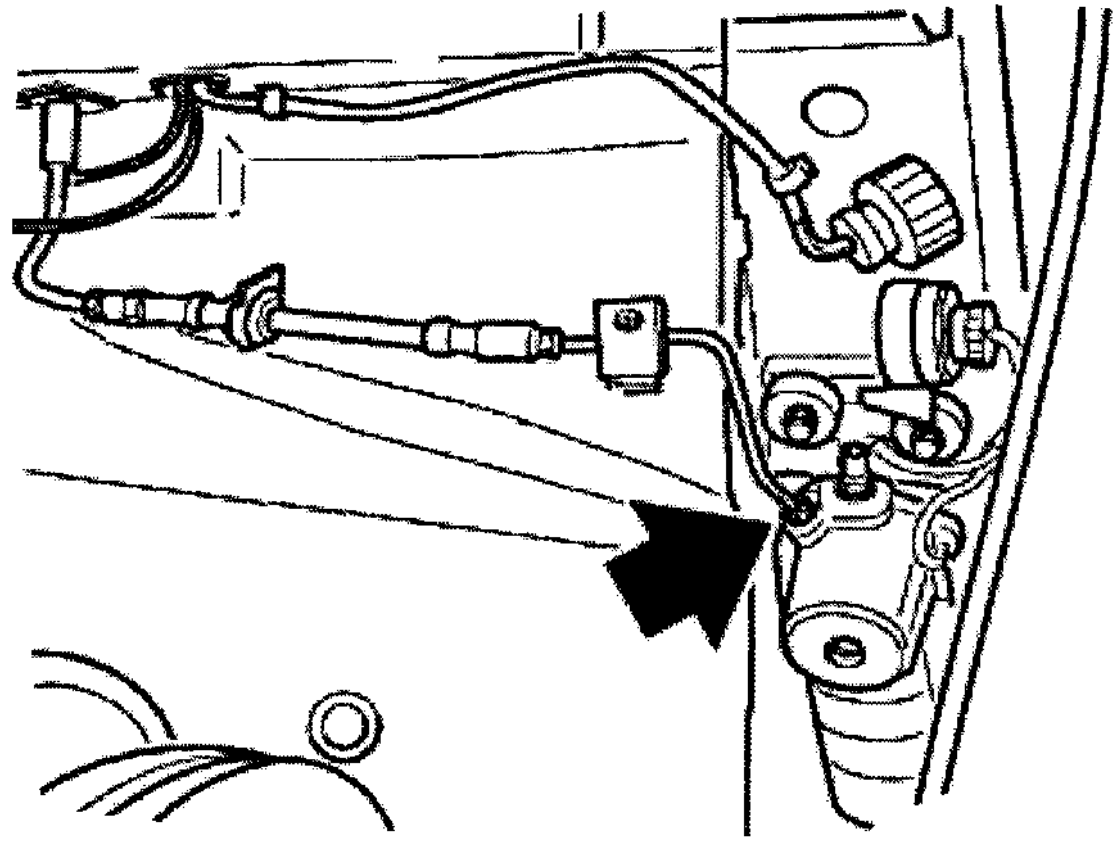


Fig. 18: Locating Brake Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

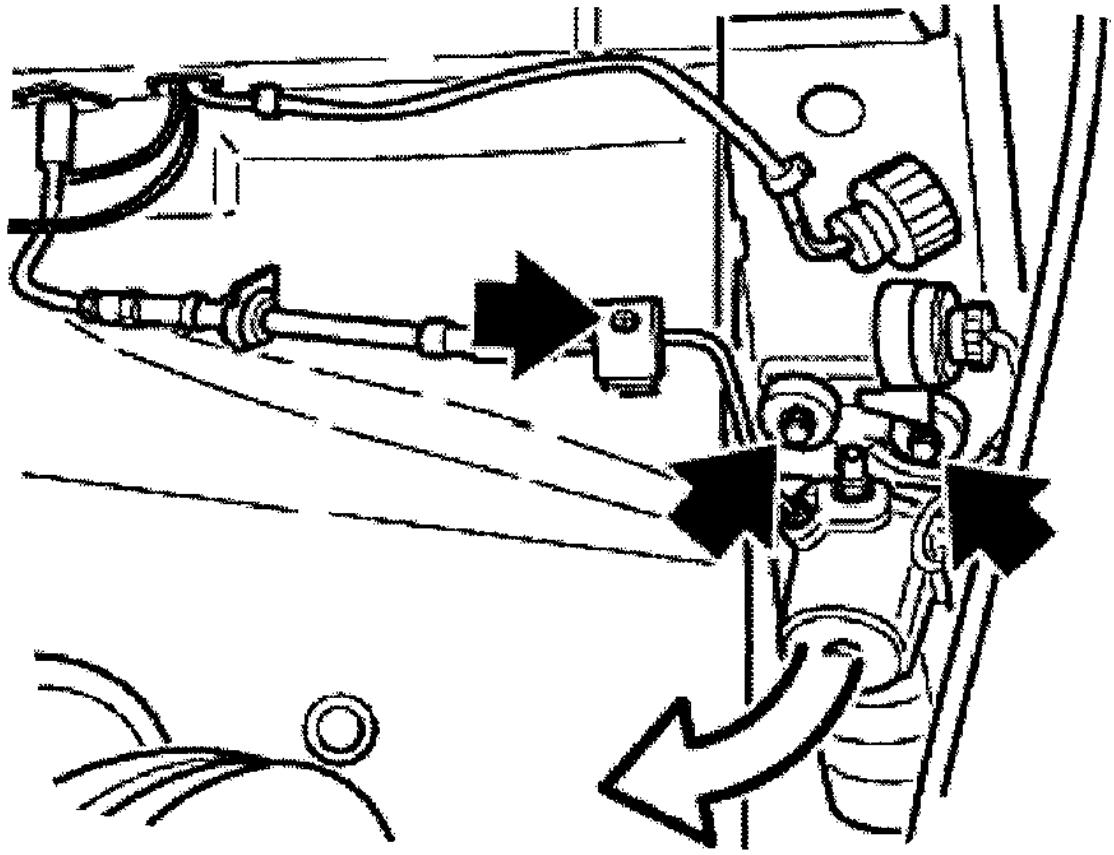


Fig. 19: Removing Accumulator
Courtesy of BMW OF NORTH AMERICA, INC.

CONTROL UNIT FOR ABS

CAUTION: Control unit must only be removed and installed after switching ignition off.

NOTE: ECU is located behind glove box.

Removal

1. Remove bottom paneling and glove compartment.
2. Unlock control unit connector. Fold out clamp (1), pull off connector (2) on right side and disconnect on left side. See Fig. 20 .
3. Unscrew mounting bolts and remove control unit together with holder. See Fig. 21 .
4. Unscrew bolts and take control unit off holder.

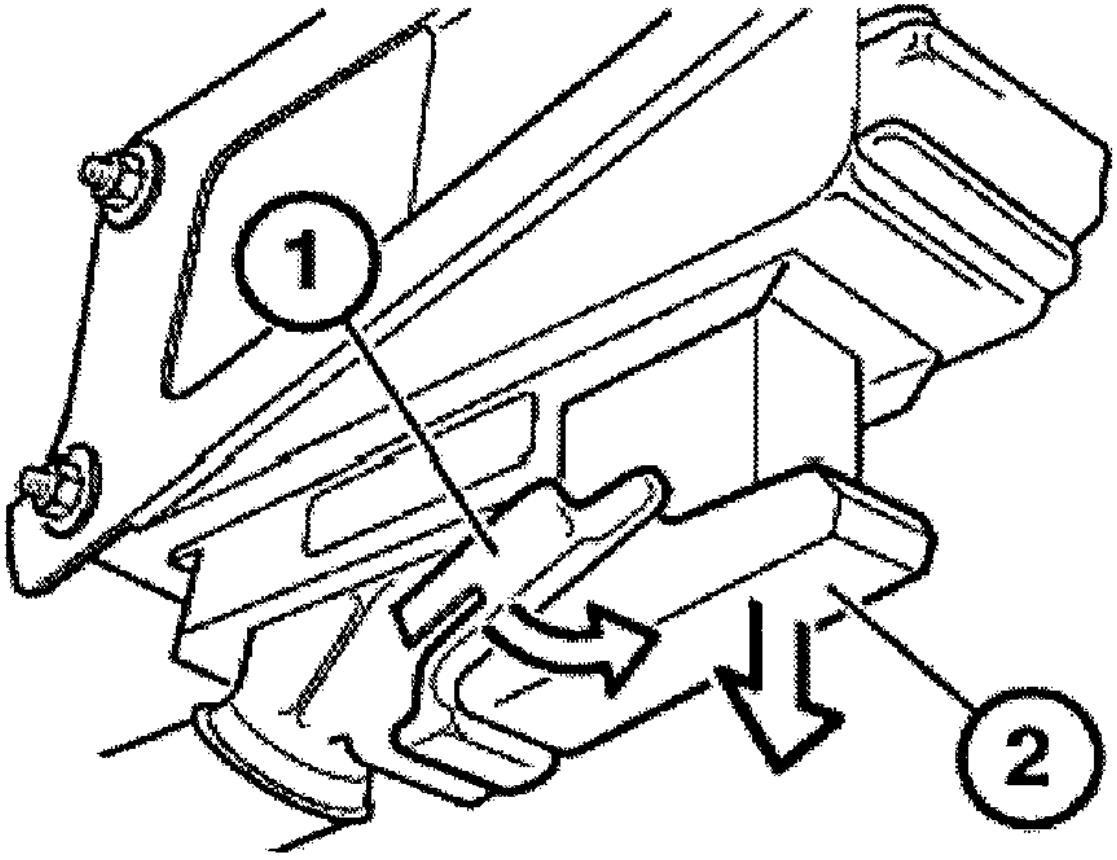


Fig. 20: Unlocking Control Unit Connector
Courtesy of BMW OF NORTH AMERICA, INC.

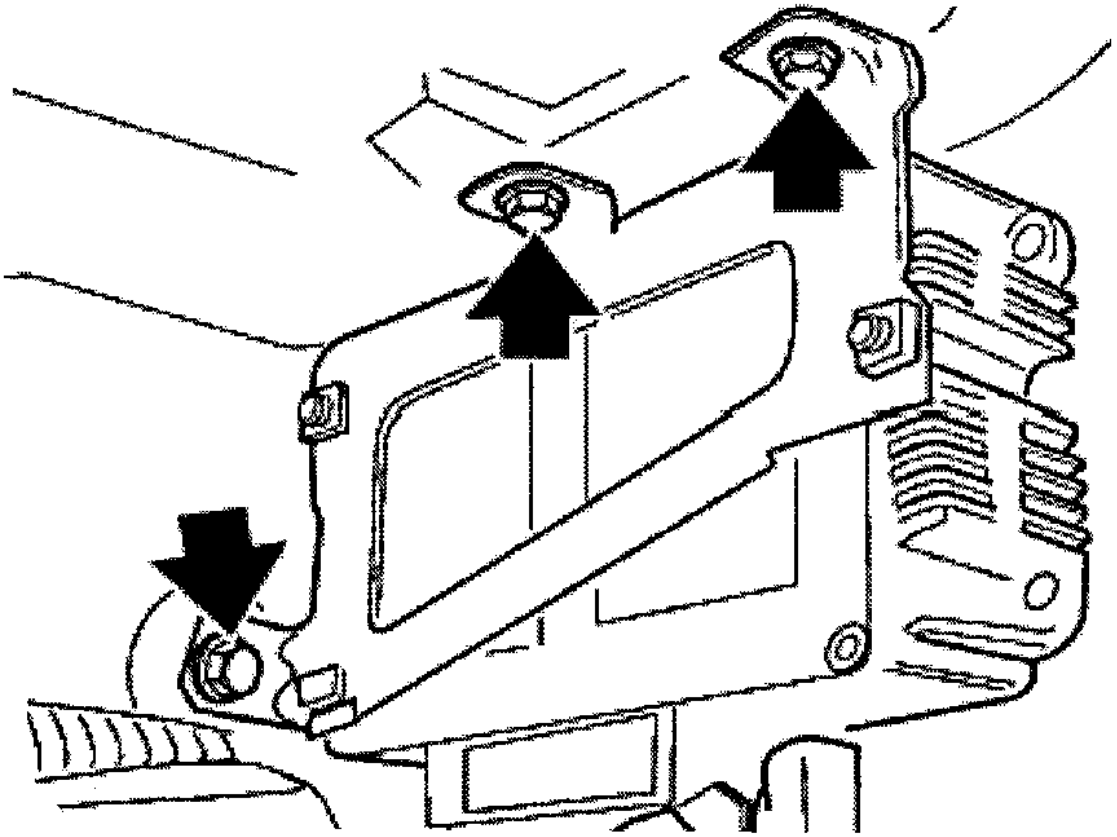


Fig. 21: Locating Mounting Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Installation

1. Mount unit on holder.
2. Install control unit and holder.
3. connect connector on left side, then press in on right side and fold in clamp.
4. In vehicles with ASC+T, the new control unit must be activated in throttle-valve idle position.
5. Replace glove compartment and bottom paneling.

CONTROL UNIT FOR ABS/ASC+T

Removal & Installation

NOTE: There is a repair kit for this procedure.

1. Before starting work, read out fault memory of ABS/ASC+T control unit and print out diagnostic record.
2. Remove the ABS/ASC+T hydraulic unit. See HYDRAULIC CONTROL UNIT .
3. Seal the line connections with the plugs provided in the repair kit. This prevents brake fluid from being discharged from the hydraulic unit, which in turn makes it easier to bleed the brake system later.
4. Release screws (1) and carefully detach control unit (2) from hydraulic unit (3). See Fig. 22 .
5. Attach new control unit and replace micro-encapsulated screws and tighten to specification. See TORQUE SPECIFICATIONS .
6. Remove plugs and install hydraulic unit.

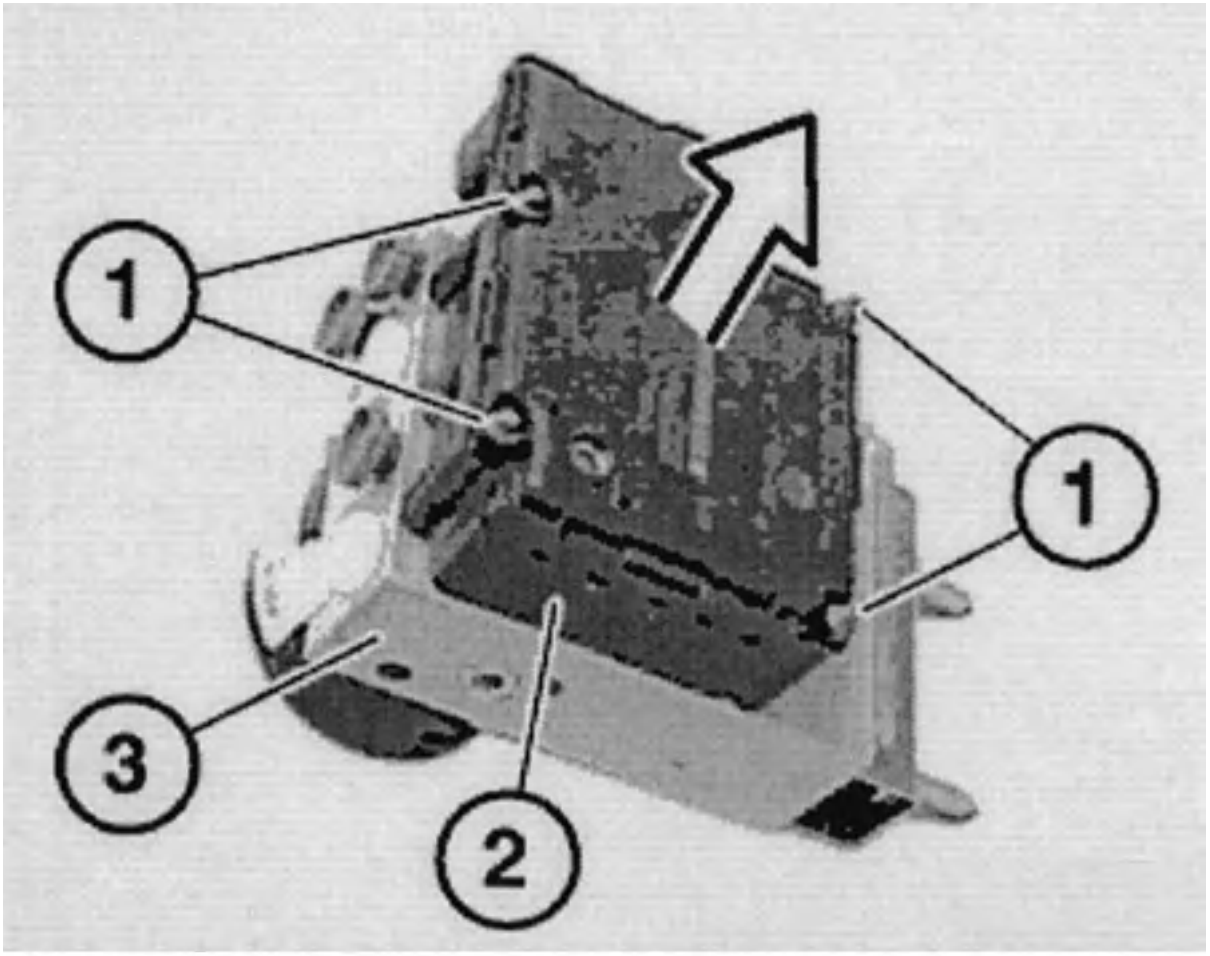


Fig. 22: Removing ABS/ASC+T Control Unit
Courtesy of BMW OF NORTH AMERICA, INC.

IMPULSE SENSORS

Removal & Installation

1. Remove respective wheel.
2. Open protective box for ABS sensor. See Fig. 23 .
3. Lift out plug-in connection. See Fig. 24 .
4. Disconnect plug-in connection.
5. Unscrew hexagon screw. Lift out sensor. See Fig. 25 .
6. Clean and lubricate dowel-pin bore with Starborax NBU 12/k or equivalent.
7. To install, reverse removal procedure.

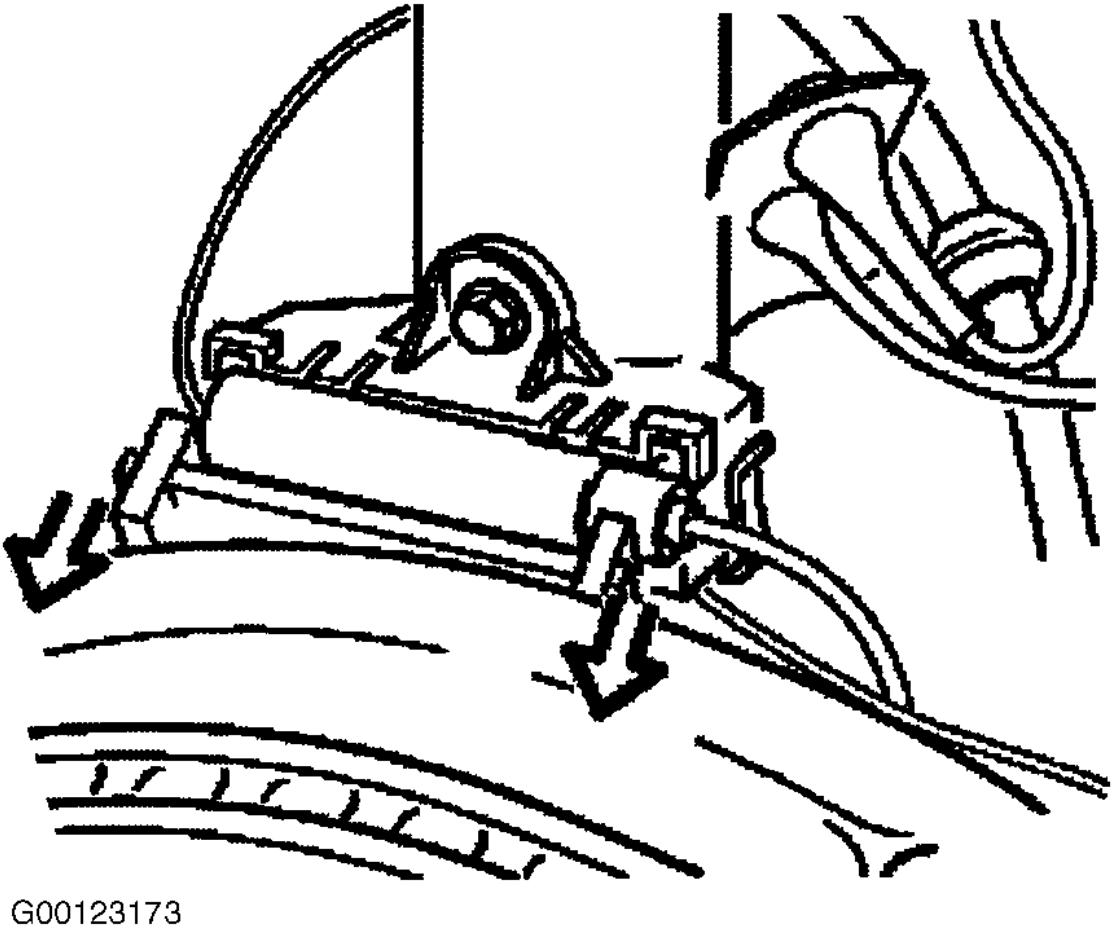


Fig. 23: Opening Protective Box For ABS Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

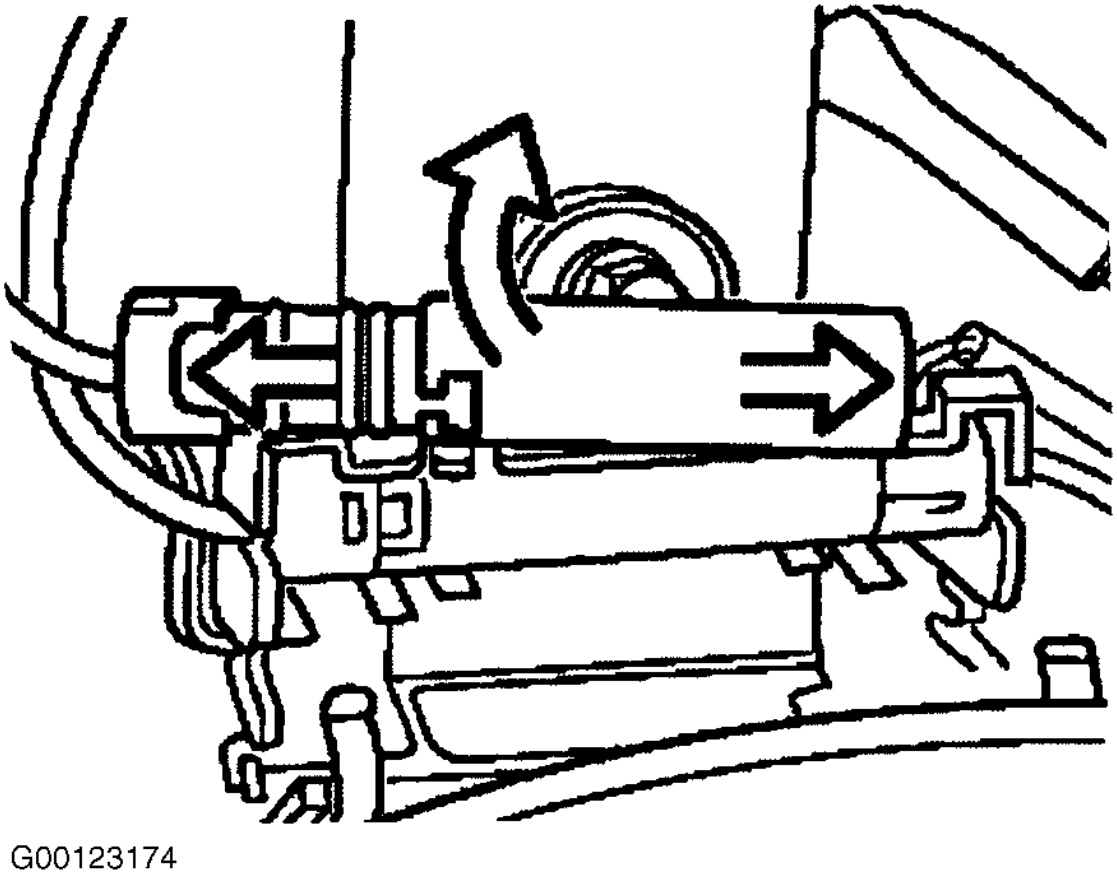


Fig. 24: Lifting Out Plug-In Connection
Courtesy of BMW OF NORTH AMERICA, INC.

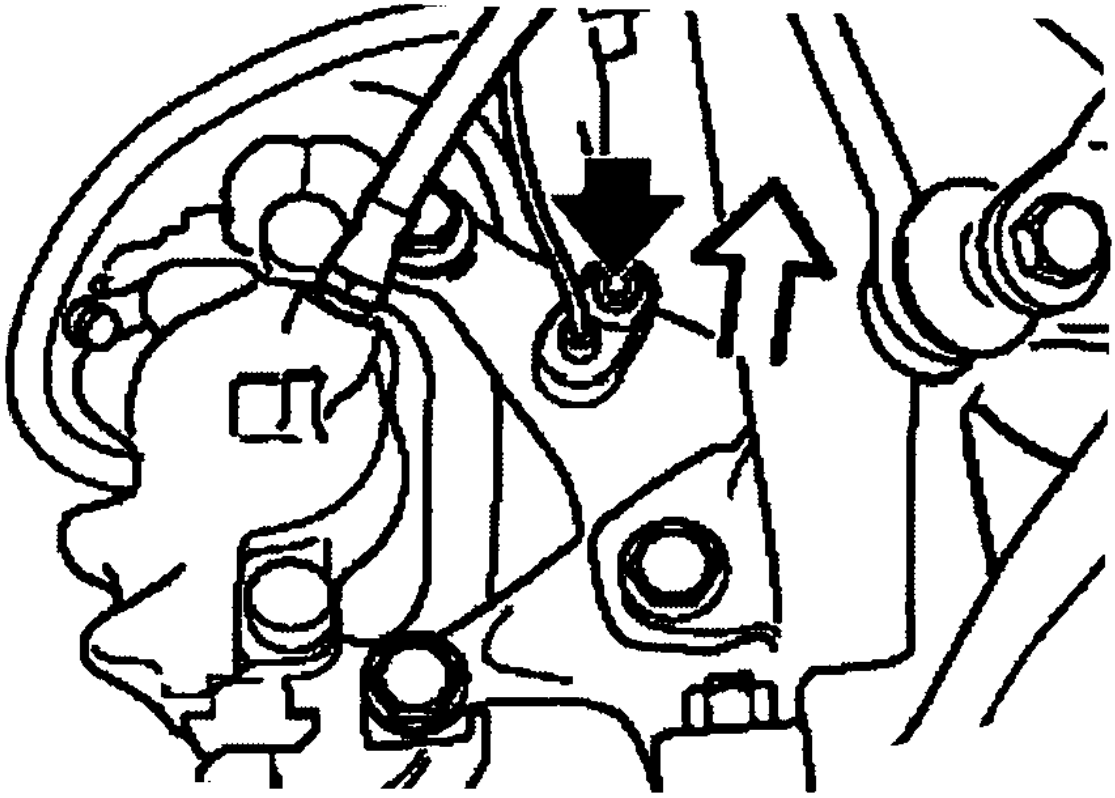


Fig. 25: Locating Hexagon Screw
Courtesy of BMW OF NORTH AMERICA, INC.

HYDRAULIC CONTROL UNIT

Removal

1. Switch off ignition.
2. Remove negative battery cable.
3. On some models it is necessary to remove air-mass sensor from air-filter housing. On others remove air intake hose.
4. Unscrew drive motor in vehicles with cruise control.
5. On M3, if necessary, unfasten heating valves and pipes from brackets and press to one side.
6. On all models, draw brake fluid out of expansion tank with a suction bottle reserved for exclusive use with brake fluid.

NOTE: Keep brake fluid out of cable connector.

7. Unlock and pull off central connector. See Fig. 26 .

CAUTION: Do not interchange brake leads and pipes.

8. Before removing, mark brakelines for reassembly reference.

NOTE: Suction hoses were only fitted until 09/94.

9. On vehicles so equipped, pull suction hoses off elbow on pump body and catch escaping brake fluid. See

Fig. 27 .

NOTE: Unscrew carbon filter for tank ventilation in vehicles equipped with cruise control.

10. Unscrew mounting nut and lift hydraulic unit out of console. See Fig. 28 .

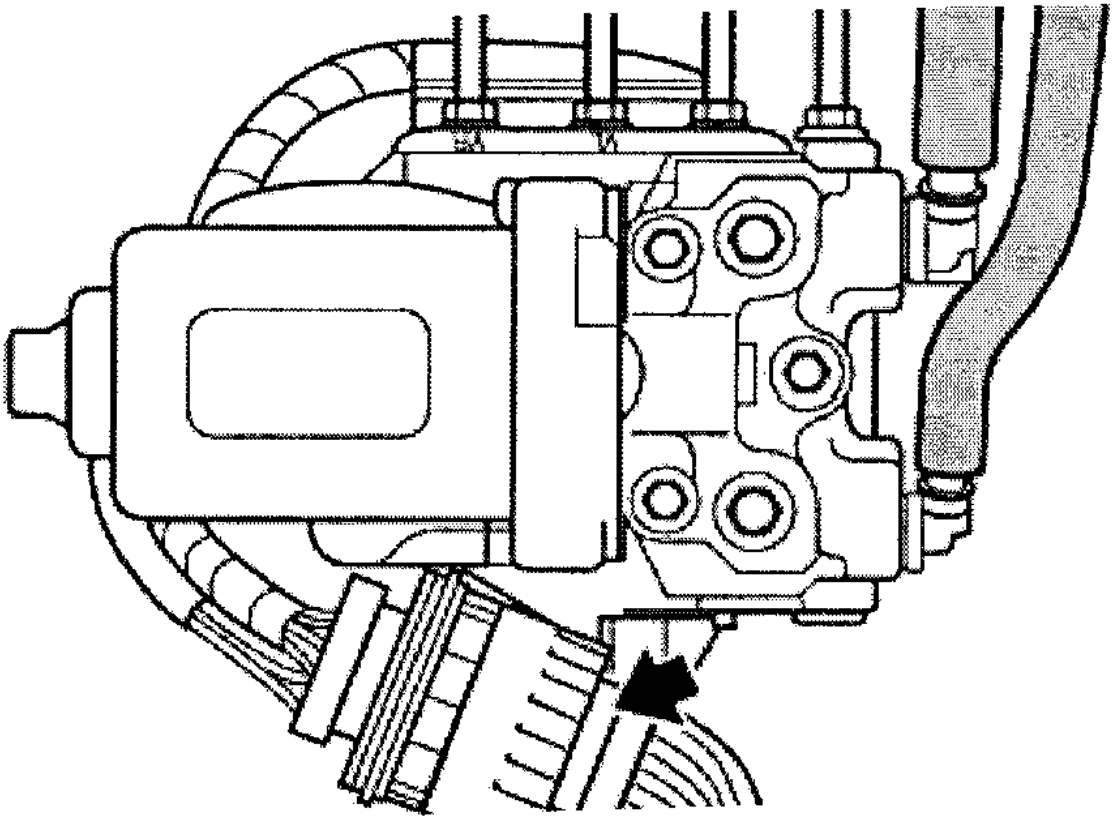


Fig. 26: Locating Central Connector
Courtesy of BMW OF NORTH AMERICA, INC.

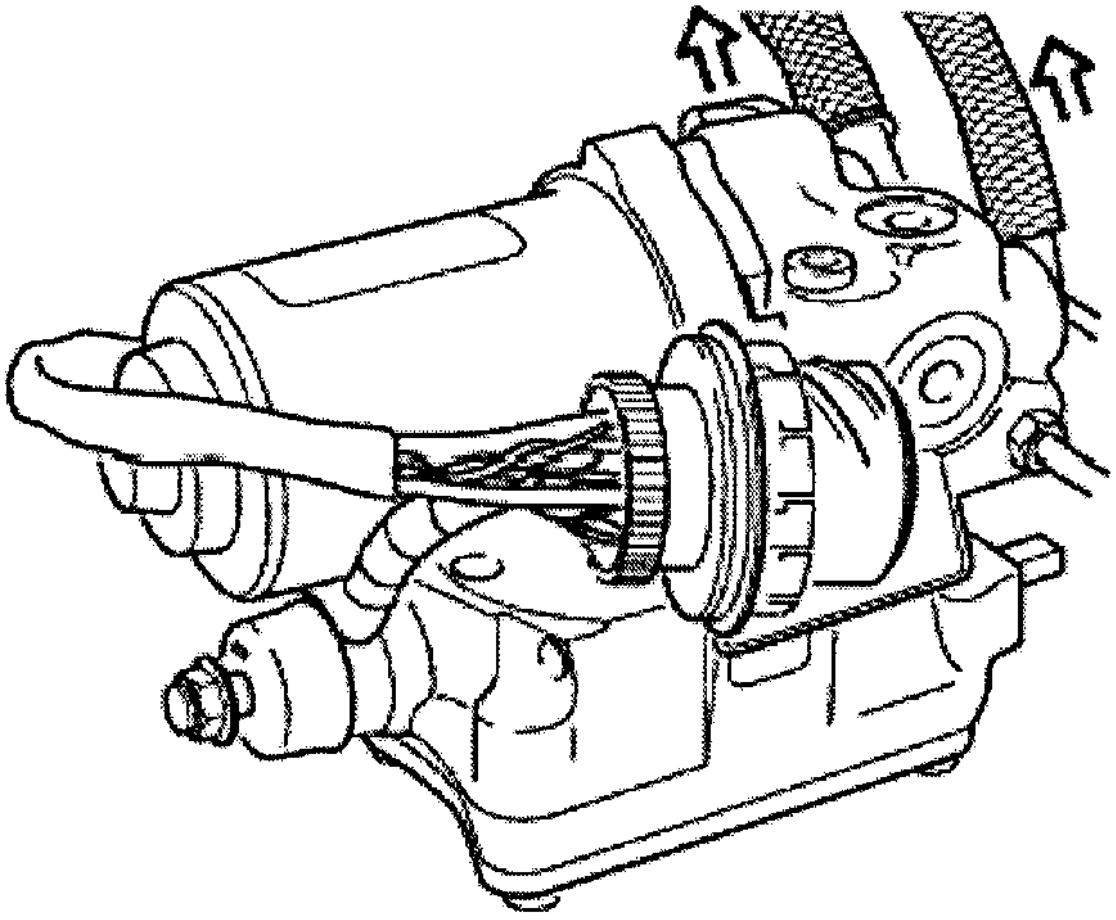


Fig. 27: Pulling Suction Hoses
Courtesy of BMW OF NORTH AMERICA, INC.

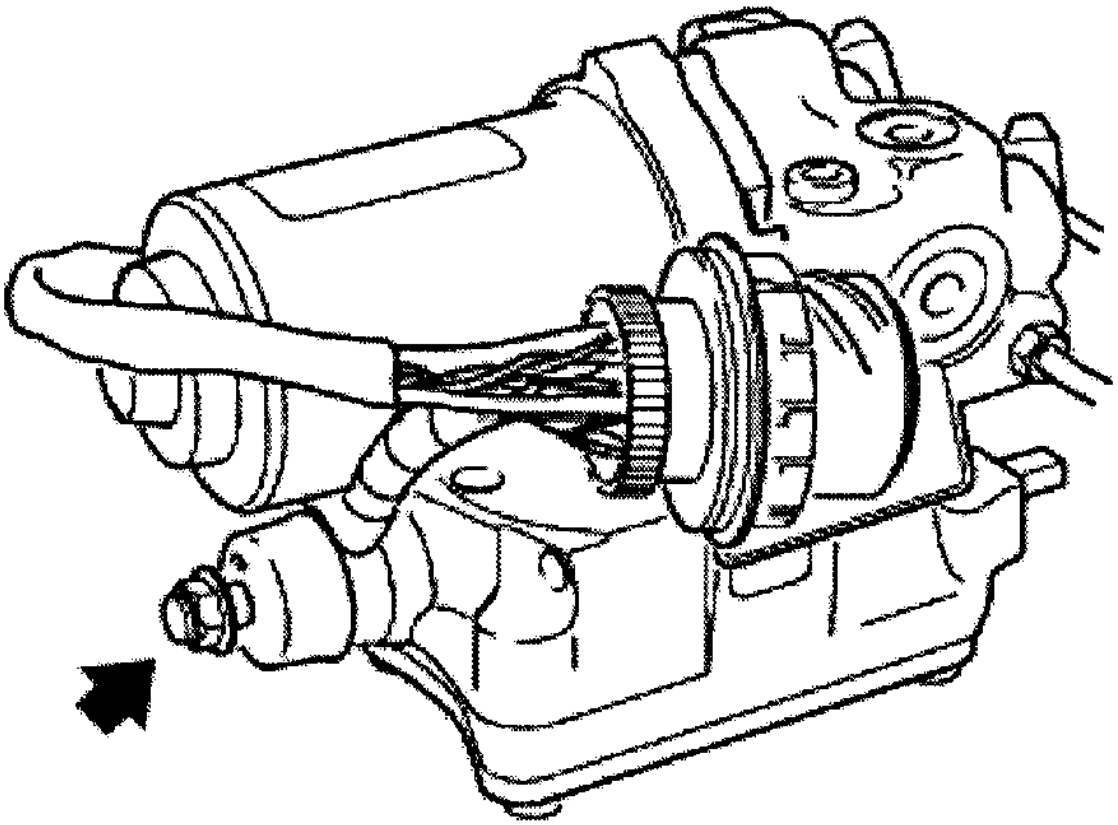


Fig. 28: Locating Mounting Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Installation

1. To install, reverse removal procedure.
2. Fasten brake pipes and lines to specification. See TORQUE SPECIFICATIONS .
3. Bleed brakes. See appropriate DISC article.
4. Check function of hydraulic unit.

WIRING HARNESS

Removal

1. Remove and insulate battery cable terminals. Disconnect ground lead on body. Remove wire clamps on body and wire clip on heater wall. Disconnect both front pulse sensor plugs.
2. Remove hydraulic unit. Remove multiple pin plug from hydraulic unit. Disconnect ground wire. Remove rear seat and left "B" pillar trim. Detach left entrance for rail covers. Raise vehicle.
3. Pull down and disconnect plugs for both pulse sensors. DO NOT damage rubber grommets. Route wire inward. Remove carpet and trim on left side as necessary. Pull wire forward in vehicle. Remove left trim lower section.
4. Disconnect harness plugs. Pull wires forward into engine compartment. Remove cap from ABS control unit and plug. Remove firewall trim. Fold open hydraulic unit plug. Pull wiring harness through firewall from engine compartment.

Installation

To install, reverse removal procedure. When connecting multiple pin plug, connect left side and then press right side into clamp. Check ABS for proper operation.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m.)
Brake Hose Couplings	23-26 (17-19)
	Inch Lbs. (N.m.)
Control Unit On Hydraulic Unit	44 (5)

WIRING DIAGRAMS

For wiring diagrams, see appropriate SYSTEM WIRING DIAGRAMS article.

Article GUID: A00046202

1992-2001 BRAKES

Disc - 3, 5 & 7-Series

BRAKE PAD WARNING LIGHT RESET

NOTE: For brake pad warning light reset, see BRAKE PAD WARNING LIGHT .

WARNING: Brake friction materials such as brake linings or pads contain abrasive fibers which can lead to illnesses. Do not create dust by grinding or sanding, or cleaning the pads with compressed air. Wash away or vacuum up brake dust. Avoid breathing any brake friction fibers or dust.

WARNING: Brake fluid is poisonous, highly 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. Use a siphon system dedicated to brake fluid only. Immediately clean away any fluid spilled on painted surfaces and wash with water. Dispose of brake fluid properly.

CAUTION: Do not reuse self-locking nuts, bolts or fasteners. They are designed to be used only once and may fail if reused. Always replace them with new self-locking nuts. Ensure cleanliness and only use rags which do not lose lint. Ensure that no oils or grease enter the brake system. These substances would cause complete failure of the entire brake system. When cleaning brake components with brake cleaning fluid, none must enter the brake system.

NOTE: For information on Anti-Lock Brake Systems (ABS), see appropriate ANTI-LOCK article.

DESCRIPTION & OPERATION

The brake system is one of the most important safety systems on any motor vehicle. For this reason it is necessary to exercise particular caution when working on the brake system and to comply with all instructions.

Brake system is hydraulically-operated, using a tandem master cylinder and power brake booster. Some models use a power steering pump driven booster. All models are equipped with single piston front and rear disc brake calipers. A brake pressure regulator is used to reduce fluid pressure to rear brakes.

Parking brake is cable actuated on rear brake and consists of internally mounted parking brake shoes. Basic adjustment of the parking brake is required whenever:

1. Brake shoes are replaced.
2. Brake discs are replaced.
3. Bowden cable is replaced.
4. Bowden cable guide tube is replaced.
5. Adjusting unit is reset.
6. Actuating stroke is excessive.

BLEEDING BRAKE SYSTEM

BASIC BLEEDING PROCEDURES

CAUTION: Use only clean brake fluid. Ensure no dirt or other foreign matter contaminates brake fluid. DO NOT mix different brands of brake fluid, as they may not be compatible. DO NOT spill brake fluid on car, as it will damage paint. If brake

fluid contacts paint, immediately flush with water.

1. If using a bleeder device, refer to documentation. Attach to expansion tank. Charging pressure must not exceed 29 PSI (2 bar).

CAUTION: With fixed caliper, bleed both sides of brake caliper, removing wheel if necessary.

2. Reservoir on master cylinder must be full at start of bleeding procedure. Connect bleeder hose with bottle to rear-right brake caliper. Open bleed valve and fully depress brake pedal at least 12 times. Brake fluid must emerge without bubbles.
3. Apply steady pressure and close bleeder valve.
4. Switch off bleeder unit and disconnect from expansion tank. Check brake fluid level. Close expansion tank. Take care of rubber gasket in lid.
5. Repeat procedure on left-rear brake caliper, right-front brake caliper and left-front brake caliper.

VEHICLES WITH ABS/ASC+T

Perform the following filling and bleeding procedure when exchanging or repairing tandem-brake master cylinder, hydraulic unit ABS/ASC+T and components, or connecting lines installed between these units. If work is performed on components involving entire system see FLUSH ENTIRE BRAKING SYSTEM.

If work is performed on componets involving only the rear sytem see BLEED REAR-AXLE BRAKE CIRCUIT.

If work is performed on componets involving only the front sytem see BLEED FRONT-AXLE BRAKE CIRCUIT.

When carrying out any other work on the brake system (e.g. replacing brake calipers), see BASIC BLEEDING PROCEDURES.

Flush Entire Braking System

NOTE: Bleeding unit is connected with maximum 29 PSI (2 bar) filling pressure.

1. Connect BMW Diagnosis and Information System (DIS).
2. Call up service function Bleeding ABS/ASC hydraulics.

NOTE: Check relevant operating instructions for each device.

3. Connect bleeding unit to expansion tank and switch on.
4. Connect bleeder hose with container to bleed valve on rear right brake caliper.
5. Open bleed valve and flush until clear, bubble-free brake fluid emerges.
6. Close bleeder valve.
7. Follow same procedure on wheel brakes rear left, front right and front left, in that order.
8. Switch off bleeder unit and disconnect from expansion tank.
9. Check brake fluid level.

NOTE: Take care of rubber gasket in lid.

10. Close expansion tank.

Bleed Rear-Axle Brake Circuit

NOTE: Bleeding unit is connected with maximum 29 PSI (2 bar) filling pressure.

1. Connect BMW Diagnosis and Information System (DIS).
2. Call up service function Bleeding ABS/ASC hydraulics.

NOTE: Check relevant operating instructions for each device.

3. Connect bleeding unit to expansion tank and switch on.
4. Connect bleeder hose with container to bleed valve on right brake caliper.
5. Open bleed valve.
6. Run bleeding routine with BMW Diagnosis and Information System (DIS) with bleeder valve open.
7. After running routine, press brake pedal 5 times to stop. Clear, bubble-free brake fluid must flow out.
8. Close bleeder valve.
9. Repeat procedure at left rear caliper.
10. Switch off bleeder unit and disconnect from expansion tank.
11. Check brake fluid level.

NOTE: Take care of rubber gasket in lid.

12. Close expansion tank.

Bleed Front-Axle Brake Circuit

CAUTION: With fixed caliper, bleed both sides of brake caliper, removing wheel if necessary.

NOTE: Bleeding unit is connected with maximum 29 PSI (2 bar) filling pressure.

1. Connect BMW Diagnosis and Information System (DIS).
2. Call up service function Bleeding ABS/ASC hydraulics.

NOTE: Check relevant operating instructions for each device.

3. Connect bleeding unit to expansion tank and switch on.
4. Connect bleeder hose and bottle to bleed valve on front right brake caliper.
5. Open bleed valve.
6. Fully depress brake pedal at least 12 times. Brake fluid must emerge clear and free of bubbles.
7. Hold down brake pedal in fully depressed position.
8. Close bleeder valve.
9. Release brake pedal.
10. Follow same procedure on front left wheel brake.
11. Switch off bleeder unit and disconnect from expansion tank.
12. Check brake fluid level.

NOTE: Take care of rubber gasket in lid.

13. Close expansion tank.

VEHICLES WITH DSC 5.7 OR DSC3 FROM 09/96, 750I/IL TO 09/98

Perform the following filling and bleeding procedure when exchanging or repairing tandem-brake master cylinder, hydraulic control unit DSC3 and components, or connecting lines installed between these units. When carrying out any other work on the brake system (e.g. replacing brake calipers), see BASIC BLEEDING PROCEDURES.

After working on the pre-boost pump, it is only necessary to bleed the front axle circuit. Here, before flushing the brake system, activate the pre-boost pump with the diagnosis and information system (DIS). Bleeding unit is connected with maximum 29 PSI (2 bar) filling pressure.

1. Connect BMW Diagnosis and Information System (DIS).
2. Call up service function Bleeding ABS/DSC3 Hydraulics.

NOTE: Check relevant operating instructions for each device.

3. Connect bleeding unit to expansion tank and switch on.
4. Flush entire braking system.
   - Connect bleeder hose with container to bleed valve on rear right brake caliper.
   - Open bleed valve and flush until clear, bubble-free brake fluid emerges.
   - Close bleeder valve.
   - Follow same procedure on wheel brakes rear left, front right and front left in that order.
5. Bleed front or rear-axle brake circuit
   - Connect bleeder hose with container to bleed valve on right brake caliper.
   - Open bleed valve.
   - Run bleeding routine with BMW Diagnosis and Information System (DIS) with bleeder valve open.
   - After running routine, press brake pedal 5 times to stop. Clear, bubble-free brake fluid must flow out.
   - Close bleeder valve.
   - Repeat procedure at left caliper.
6. Switch off bleeder unit and disconnect from expansion tank.
7. Check brake fluid level.

NOTE: Take care of rubber gasket in lid.

8. Close expansion tank.
9. After completing work, a final inspection must be carried out with the Diagnosis and Information System (DIS) under the menu item "Service function."

ADJUSTMENTS

PARKING BRAKE

NOTE: Accurate adjustment of the parking brake is only possible if the Bowden cables and all moving parts move easily and function correctly.

1. Raise vehicle and support safely.
2. Release parking brake and check cables for free operation. On 735i and 745i, release parking brake with push-button switch on left next to steering wheel.
3. On all models, completely loosen adjusting nut on left Bowden cable.
4. Completely unscrew one wheel stud on each rear wheel.
5. Rotate wheel until threaded bore on right wheel reaches 7 o'clock and left wheel reaches 5 o'clock setting.
6. Insert screwdriver into rotor inspection hole and turn adjusting screw until it is no longer possible to turn wheel. See Fig. 1.
7. Back off adjusting screw 8 notches.
8. Tighten adjusting nut on left Bowden cable until parking brake holds vehicle securely before fifth ratchet stop is reached. Both rear wheels should rotate freely and evenly with parking lever released.

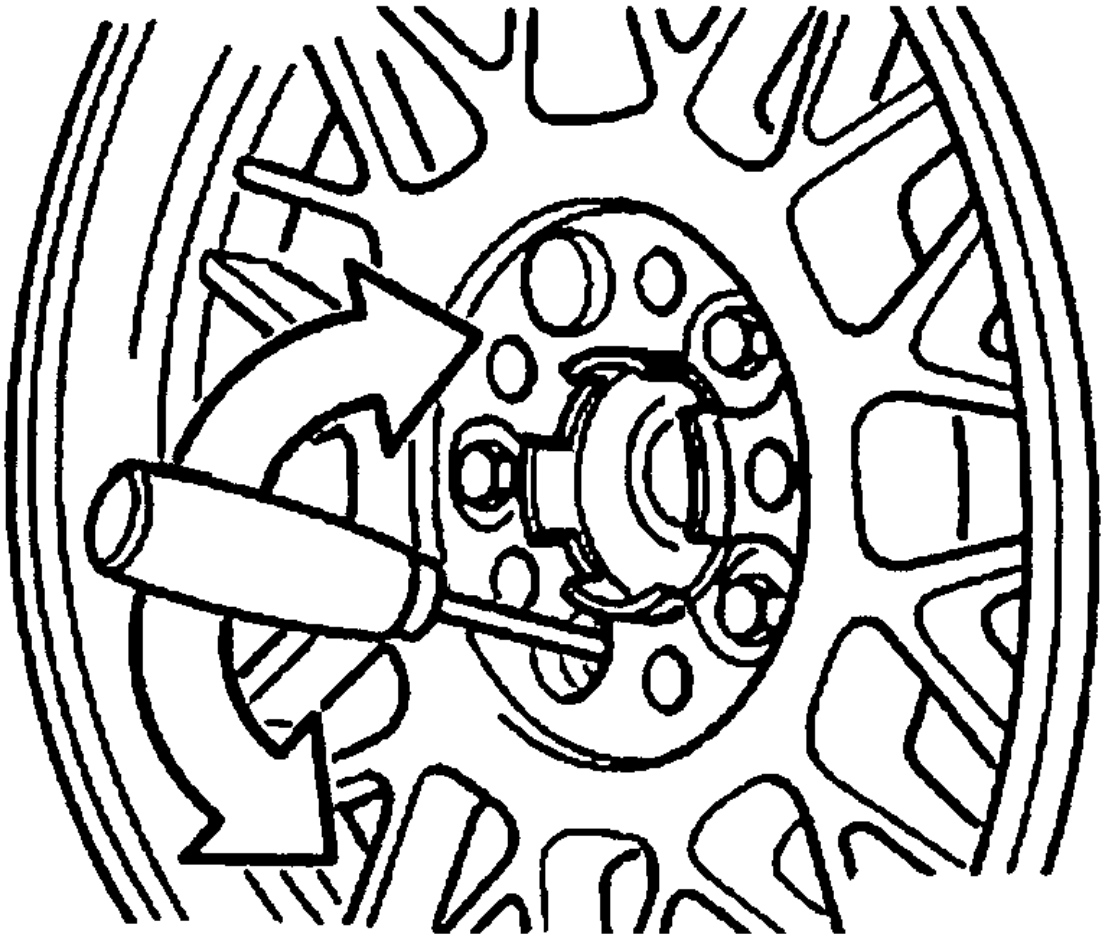


Fig. 1: Turning Adjusting Screw
Courtesy of BMW OF NORTH AMERICA, INC.

TROUBLESHOOTING

Brake performance is mainly affected by 3 things: the level and condition of the brake fluid, the brake system's ability to create and maintain hydraulic pressure, and condition of the friction components. Tires and wheels are important parts of the braking system. Check tires for wear, flat spots, trueness and proper inflation. Visually check the hydraulic system starting at the master cylinder. Check all brake fluid lines and couplings for leaks, kinks, chafing and corrosion.

On vehicles with vacuum brake booster, check brake booster by pumping brake pedal approximately 10 times with the engine off. Then hold down brake pedal and start engine. Pedal should fall slightly. If not, check for any visible faults before suspecting a faulty brake booster. Check for strong vacuum at vacuum hose fitting on booster. Ensure vacuum check valve has one-way flow. For trouble shooting symptoms, see SYMPTOM INDEX table.

SYMPTOM INDEX

Symptom	See Symptom Table
Brakes Pull To One Side	A
Brakes Excessively Hot While Driving	B
Poor Braking Effect In Spite Of Great Force On Pedal, Brake Pedal Travel Normal	C

Poor Braking Effect In Spite Of Great Force On Pedal, Brake Pedal Travel Short	C
Poor Braking Effect In Spite Of Great Force On Pedal, Brake Pedal Travel Long	C
Brake Pedal Motion Too Soft & Spongy	D
Brake Pedal Travel Is Excessive Even Though Brakes Have Been Bled & Adjusted	E
Uneven Pad Wear	F
Brake Pads Worn At Angle	G
Seized Brake Pads, Pad Does Not Move Off Brake Disc	H
Brakes Squeal Or Rattle	I
Brake Pedal Dead Travel Excessive	J
Jammed Piston In Brake Caliper	K
Pulsating Effect On Brake Pedal	L
Handbrake Effect Insufficient	M

SYMPTOM A: BRAKES PULL TO ONE SIDE

SYMPTOM A: BRAKES PULL TO ONE SIDE

Possible Cause	Solution
Tire Pressure Incorrect	Bring Tire To Correct Pressure
Unevenly Worn Tire Treads	Change Or Replace Tires
Oil On Pads/Liners	Replace Brake Pads, Check For Source Of Oil
Wrong Type Of Pads/Liners	Replace Brake Pads
Dirty Floating Caliper Recesses	Remove & Install Clean Floating Calipers
Guide Bolts Dirty Or Damaged	Replace Guide Bolts
Rear Wheel Alignment Adjusted Incorrectly	Check Wheel Alignment
Corrosion In Floating Calipers Or Wheel Cylinders	Remove & Install, Repair Or Replace Floating Calipers Or Wheel Cylinders
No Shock Absorber Action	Check Shock Absorbers & Replace If Necessary
Pad Of One Caliper Worn	Replace Brake Pads, Check Floating Caliper
Pad Glazed	Replace Brake Pads, Check Floating Caliper

SYMPTOM B: BRAKES EXCESSIVELY HOT WHILE DRIVING

SYMPTOM B: BRAKES EXCESSIVELY HOT WHILE DRIVING

Cause	Solution
Vent Bore In Master Cylinder Clogged	Overhaul Master Brake Cylinder
No Play Between Push Rod & Master Cylinder Piston	Adjust Push Rod
Swollen Rubber Parts Due To Use Of Wrong Brake Fluid	Overhaul Master Brake Cylinder, Or Replace If Necessary
Vent Bore In Expansion Tank Clogged	Clean Expansion Tank
Corroded Floating Calipers	Remove & Install, Repair Or Replace Floating Calipers
Cross Spring Broken	Replace Cross Spring
Handbrake Lever Not Released Fully	Check Handbrake & Handbrake Cables, Repair If Necessary

SYMPTOM C: POOR BRAKING EFFECT

SYMPTOM C: POOR BRAKING EFFECT

Travel	Cause	Solution
Normal	Brake Pads Oil-Splattered Or Burnt, Wrong Type Of Brake Pads	Replace Brake Pads
Short	Brake Booster Malfunctions- Engine Vacuum	Check Brake Booster System - Check Engine (Valves, Cylinder Head Gasket, Etc.
Long	One Brake Circuit Failed Due To Leaks Or Damage	Find & Repair Leak(s) Or Damage

SYMPTOM D: BRAKE PEDAL MOTION TOO SOFT & SPONGY

SYMPTOM D: BRAKE PEDAL MOTION TOO SOFT & SPONGY

Cause	Solution
Air In Braking System	Top Up Or Change Brake Fluid, Bleed Brake System
Insufficient Brake Fluid In Expansion Tank	Top Up Or Change Brake Fluid, Bleed Brake System
Overheated Brake Fluid, Vapor Lock Due To Excessive Water Content In Brake Fluid Or Excessive Brake Loads	Top Up Or Change Brake Fluid, Bleed Brake System

SYMPTOM E: BRAKE PEDAL TRAVEL EXCESSIVE

SYMPTOM E: BRAKE PEDAL TRAVEL EXCESSIVE

Cause	Solution
Primary Cup In Master Cylinder Damaged	Overhaul Or Replace Brake Master Cylinder
Separating Cups On Floating Piston Of Tandem-Brake, Master Cylinder Leak	Overhaul Or Replace Brake Master Cylinder
Leak In Braking System	Find & Repair Leak(s)

SYMPTOM F: UNEVEN PAD WEAR

SYMPTOM F: UNEVEN PAD WEAR

Cause	Solution
Wrong Type Of Pads/Liners	Replace Brake Pads
Dirty Floating Caliper Recesses, Damaged Caps	Remove & Install, Repair Or Replace Floating Calipers
Corrosion In Floating Calipers	Remove & Install, Repair Or Replace Floating Calipers
Swollen Rubber Ring For Piston Control	Remove & Install, Repair Or Replace Floating Calipers

SYMPTOM G: BRAKE PADS WORN AT ANGLE

SYMPTOM G: BRAKE PADS WORN AT ANGLE

Cause	Solution
Wheel-Bearing Play Excessive	Replace Wheel Bearings
Brake Disc Not Aligned With Floating Caliper	Check Floating Caliper Installation
Corrosion In Floating Calipers	Remove & Install, Repair Or Replace Floating Calipers
Angular Brake-Disc Wear	Grind Or Replace Brake Discs
Pads Worn To Less Than Minimum Thickness	Replace Brake Pads
Spring Force Insufficient	Replace Spring
Guide Bolts Damaged	Replace Guide Bolts

SYMPTOM H: SEIZED BRAKE PADS

SYMPTOM H: SEIZED BRAKE PADS

Cause	Solution
Dirty Floating Caliper Recesses, Damaged Caps	Remove & Install, Repair Or Replace Floating Calipers
Corrosion In Floating Calipers	Remove & Install, Repair Or Replace Floating Calipers
Vent Bore In Master Cylinder Clogged	Overhaul Or Replace Brake Master Cylinder

SYMPTOM I: BRAKES SQUEAL OR RATTLE

SYMPTOM I: BRAKES SQUEAL OR RATTLE

Cause	Solution
Wrong Type Of Pads	Replace Brake Pads
Dirty Floating Caliper Recesses	Remove & Install Clean Floating Calipers
Spring Force Insufficient	Replace Spring
Brake Disc Not Aligned With Floating Caliper	Check Floating Caliper Installation
Brake-Disc Runout	Check Brake Disc for Runout, Replace If Necessary
Excessive Thickness Deviation Within Braking Surface	Measure Thickness Of Brake Disc, Grind Down Discs Or Replace
Pad Wear Excessive Or One-Sided	Replace Brake Pads
Rust Edges On Brake Discs	Grind Or Replace Brake Discs
Pad Loose	Replace Brake Pads
Wheel Bearing Play Excessive	Replace Wheel Bearings

SYMPTOM J: BRAKE PEDAL DEAD TRAVEL EXCESSIVE

SYMPTOM J: BRAKE PEDAL DEAD TRAVEL EXCESSIVE

Cause	Solution
Wheel Bearing Play Excessive	Replace Wheel Bearings
Brake Disc Not Aligned With Floating Caliper	Check Floating Caliper Installation
Brake Disc Runout	Check Brake Disc For Runout, Replacing If Necessary
Excessive Thickness Deviation Within Braking Surface	Measure Thickness Of Brake Disc, Grind Down Discs Or Replace
Brake System Leaking	Find & Repair Leak(s)
Air In Braking System	Bleed Brakes
Wrong Type Of Pads	Replace Brake Pads

SYMPTOM K: JAMMED PISTON IN BRAKE CALIPER

SYMPTOM K: JAMMED PISTON IN BRAKE CALIPER

Cause	Solution
Dirty Floating Caliper Recesses, Damaged Caps	Remove & Install, Repair Or Replace Floating Calipers
Brake Disc Not Aligned With Floating Caliper	Check Floating Caliper Installation
Corrosion On Pistons In Floating Calipers	Remove & Install, Repair Or Replace Floating Caliper

SYMPTOM L: PULSATING EFFECT ON BRAKE PEDAL

SYMPTOM L: PULSATING EFFECT ON BRAKE PEDAL

Cause	Solution
Wheel Bearing Play Excessive	Replace Wheel Bearings
Brake Disc Not Aligned With Floating Caliper	Check Floating Caliper Installation
Brake Disc Runout	Check Brake Disc For Runout, Replace If Necessary
Excessive Thickness Deviation Within Braking Surface	Measure Thickness Of Brake Disc, Grind Down Discs Or Replace

SYMPTOM M: HANDBRAKE EFFECT INSUFFICIENT

SYMPTOM M: HANDBRAKE EFFECT INSUFFICIENT

Cause	Solution
Handbrake Shoes Oil-Splattered	Replace Handbrake Shoes, Determine Cause Of Splattering
Excessive Dead Travel Between Brake Shoes & Brake Drums	Adjust Handbrake
Excessive Dead Travel In Cables	Adjust Handbrake
Cables Adjusted Incorrectly	Adjust Handbrake
Corroded Transmitting Elements	Remove & Install Handbrake & Expanding Locks, Check Bowden Cables & Replace If Necessary

TESTING

BRAKE WARNING LIGHT

Brake warning light is mounted on instrument panel. Turn ignition on and release parking brake. Verify light is off. Remove master cylinder filler cap. Warning light should come on. If warning light does not come on, check bulb and circuit connections.

PARKING BRAKE

NOTE: This test may set the ABS and ASC warning lights on the instrument cluster. The lights are illuminated because the system sees an implausible speed differential between the spinning rear wheels, and the stationary front wheels. Vehicles equipped with DSC3 will not set the lights.

On 735i and 745i vehicles connect BMW Diagnosis and Information System (DIS) or MoDiC. Call up "Workshop braking-in" service function and start braking-in program.

Parking brake must be tested on roller dynamometer as follows:

1. With parking brake released wheel circumferential force is no more than 300 N.
2. At the first tooth, do not allow braking force to increase.
3. At the 2nd tooth, braking action can begin and the indicator light may be lit.
4. At the 3rd, tooth, braking action must begin and the indicator light must be lit.
5. At the 4th tooth, braking action increases.
6. At the 5th tooth, wheel circumferential force must be at least 1100 N at one of the two rear wheels, and at least 1000 N at the other wheel. Wheel circumferential force differential (left to right) maximum 30% from highest value (shortly before wheel lockup). A readjustment must be carried out in event of larger deviations of wheel circumferential force. See PARKING BRAKE under ADJUSTMENTS.
7. Braking with locked wheels must be possible with the parking brake.
8. The ABS/ASC warning lights, if on, will automatically switch off by switching off engine, waiting at least 30 seconds, restart engine and drive away. Warning lights will go out when speed exceeds 8 mph.

(Fault codes will be retained in memory.)

POWER BRAKE BOOSTER

Low Pressure Test

1. Remove left microfilter for interior ventilation.
2. Pull hose off connection. Install Vacuum Tester (34 3 100) between connection and vacuum hose on non-return valve. See Fig. 2.
3. Start engine and check buildup of partial vacuum. Stop engine.
4. Press brake pedal to set a partial vacuum of no more than 11.6 PSI (.8 bar) and wait for value to stabilize.
5. When the brake pedal is not pressed, the partial vacuum is allowed to drop by maximum .8 PSI (.06 bar) over a test period of 1 minute. 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, replace the brake booster.

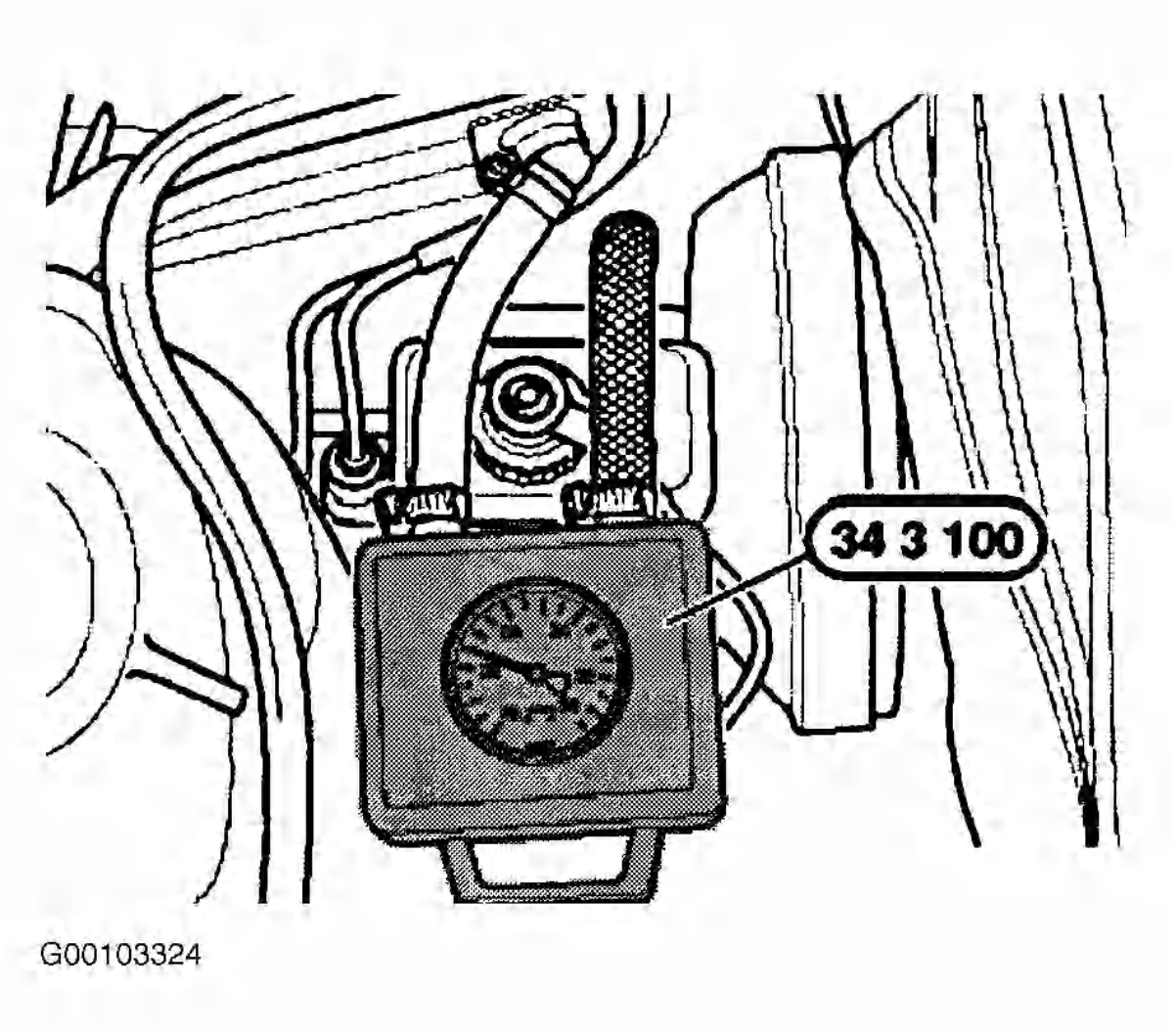


Fig. 2: Installing Vacuum Tester
Courtesy of BMW OF NORTH AMERICA, INC.

SERVICE BRAKE

NOTE: High-pressure and low-pressure tests (leakage test) must be performed with

the engine switched off.

High-Pressure Test

NOTE: Perform test on both brake circuits, front and rear.

1. Unscrew vent plug, connect pressure tester and vent. See Fig. 3.
2. Load brake pedal with a force of approximately 112 lbs. (500 N), and block pedal with pedal support.
3. After 2 minutes, pressure must not drop by more than 8%.
4. Perform low-pressure test.

Low-Pressure Test

NOTE: Perform test on both brake circuits, front and rear.

1. Unscrew vent plug, connect pressure tester and vent. See Fig. 3.
2. Load brake pedal with a force of 30-72 PSI (2-5 bar), and block pedal with pedal support. Car and measuring equipment must remain perfectly still as vibrations will distort the result.
3. Pressure should remain constant during five minute test.
4. Check all rubber parts in case of excessive pressure drop.
5. Bleed brake calipers and wheel brake cylinders after finishing test.

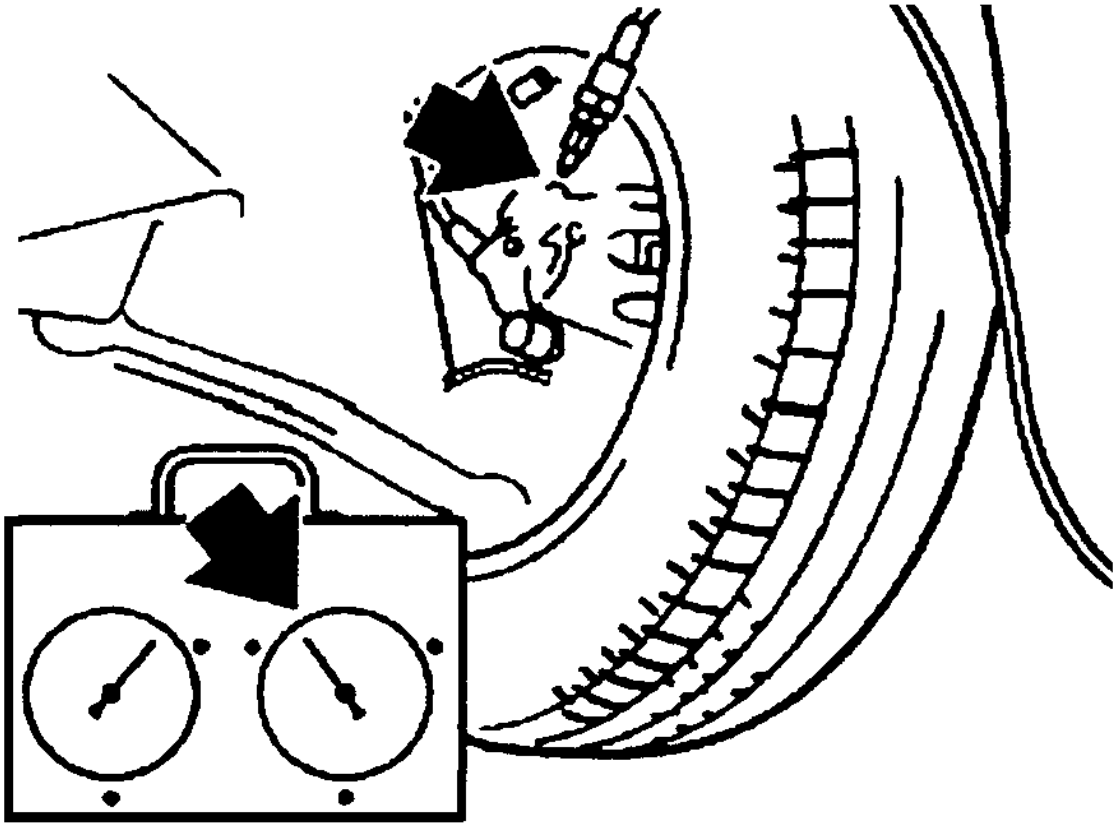


Fig. 3: Connecting Pressure Tester
Courtesy of BMW OF NORTH AMERICA, INC.

On Test Stand

WARNING: Use only brake dynamometers whose test speed is 3 mph (5 km/h) or less. 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.

CAUTION: The maximum test duration for four-wheel drive vehicles is 3 minutes per axle. If the test has to be repeated, the vehicle must be driven over a distance of at least .6 miles (1 km) to ensure the transfer case is sufficiently lubricated.

Follow testing procedures contained in the operating instructions.

On cars equipped with ASC+T or DSC, the system must be deactivated with the switch. ASC+T/DSC indicator lamp in instrument cluster must light up.

The brakes must be at normal operating temperature. To achieve this, brake the car several times to slightly warm and dry brake disks and drums.

On E65, carry out function check on parking brake.

Check tires for damage. Check tire treads and pressures.

THICKNESS OF BRAKE LINING

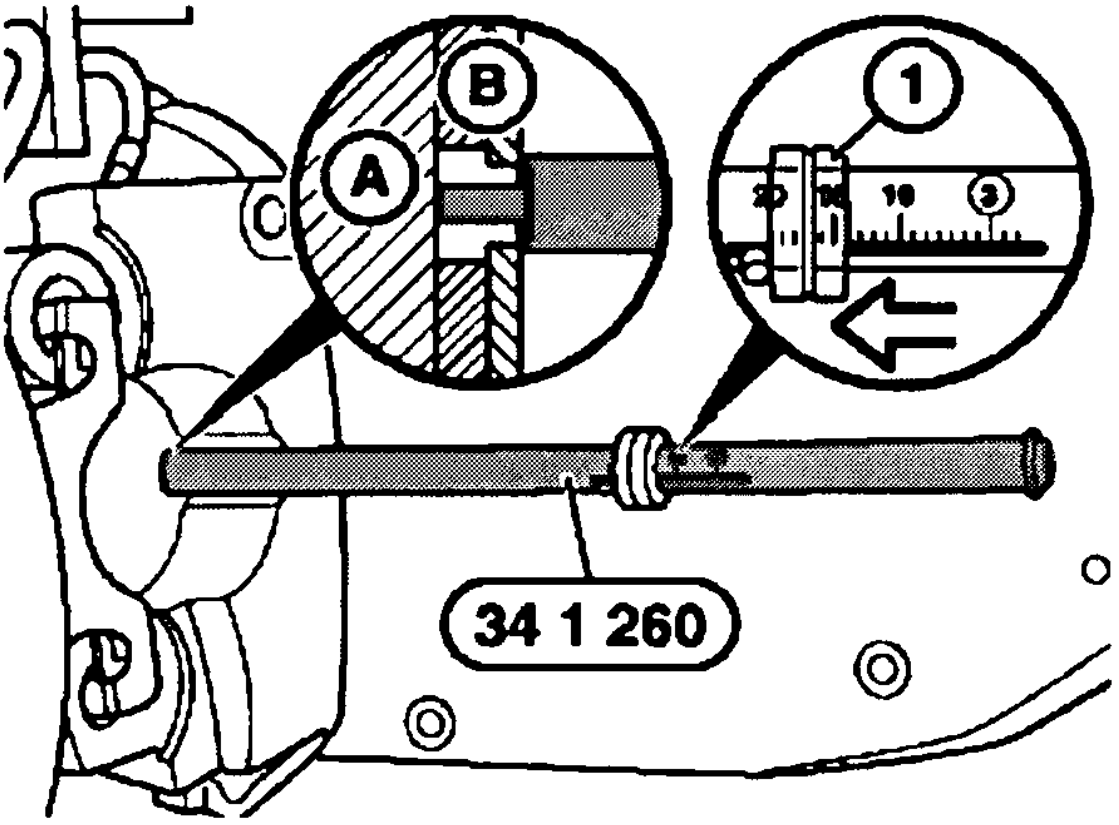
NOTE: The thickness of the outer brake linings can be determined without removing the wheels except on 7-Series prior to 1997.

1. If necessary, move car until opening for brake lining wear indicator can be seen through rim styling.
2. Insert special tool (34 1 260) through rim into opening for brake lining wear indicator.
3. Press special tool onto brake lining. Slide ring (1) in direction of arrow as far as it will go and read off measured value. See Fig. 4.
4. Minimum thickness for all models is stamped in brake disc shell. Wear warning from residual lining thickness is 3 mm. Maximum machining limit per friction ring side is .8 mm. For minimum thickness see BRAKE LINING MINIMUM THICKNESS table.

BRAKE LINING MINIMUM THICKNESS

Vehicle	Location	Minimum Thickness In MM
3-Series	Front	20.4
3-Series, Solid	Rear	8.4
3-Series, Ventilated	Rear	17.4
5-Series Ventilated	Front	20.4
540i	Front	28.4
5-Series, Solid	Rear	8.4
5-Series Ventilated	Rear	20.4
728i, 730i	Front	26.4
728, 730i, 740i	Rear	10.4
735i, 745i	Rear	(1)
735i, 745i	Front	(1)
740i	Front	28.4
750i	Front	30.4
750i	Rear	18.4

(1) Information not available from manufacturer.



(A) Brake disk

(B) Brake lining with backplate

G00103326

Fig. 4: Measuring Thickness Of Brake Lining
Courtesy of BMW OF NORTH AMERICA, INC.

REMOVAL & INSTALLATION

BRAKE BOOSTER

Removal

1. Remove the master cylinder. See MASTER CYLINDER.
2. Remove left windshield wiper arm.
3. Move the hood lid into assembly position.
4. Pull off the rubber seal (1). Remove the securing clamps of the cowl cover (2) up until the middle of the windshield. Pull the cover upwards and away. See Fig. 5.
5. Release screws and remove cowl cover. See Fig. 6.
6. Remove the cover (1) behind booster. Remove the line feed-through (2). Pull the vacuum hose (3) off of the brake unit. See Fig. 7.
7. Remove the brake light switch. See BRAKE LIGHT SWITCH.
8. Pull off retainer (1). Unhinge the recoil spring (2). See Fig. 8.
9. Withdraw pin (3). See Fig. 9.

10. Loosen the pedal assembly nuts (1) and bolts (2). See Fig. 10.
11. Pull the pedal assembly slightly away from the bulkhead.

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

12. Carefully swing out the brake unit and remove from the bulkhead.

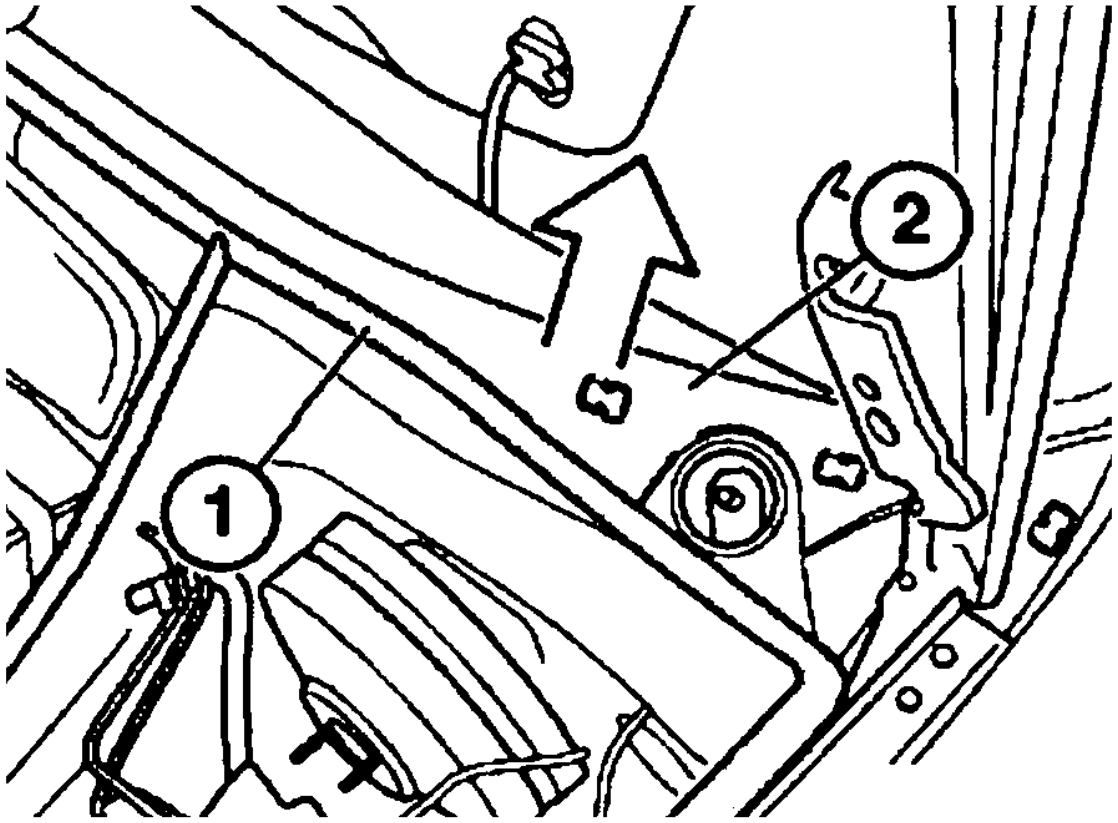


Fig. 5: Removing Rubber Seal & Securing Clamps
Courtesy of BMW OF NORTH AMERICA, INC.

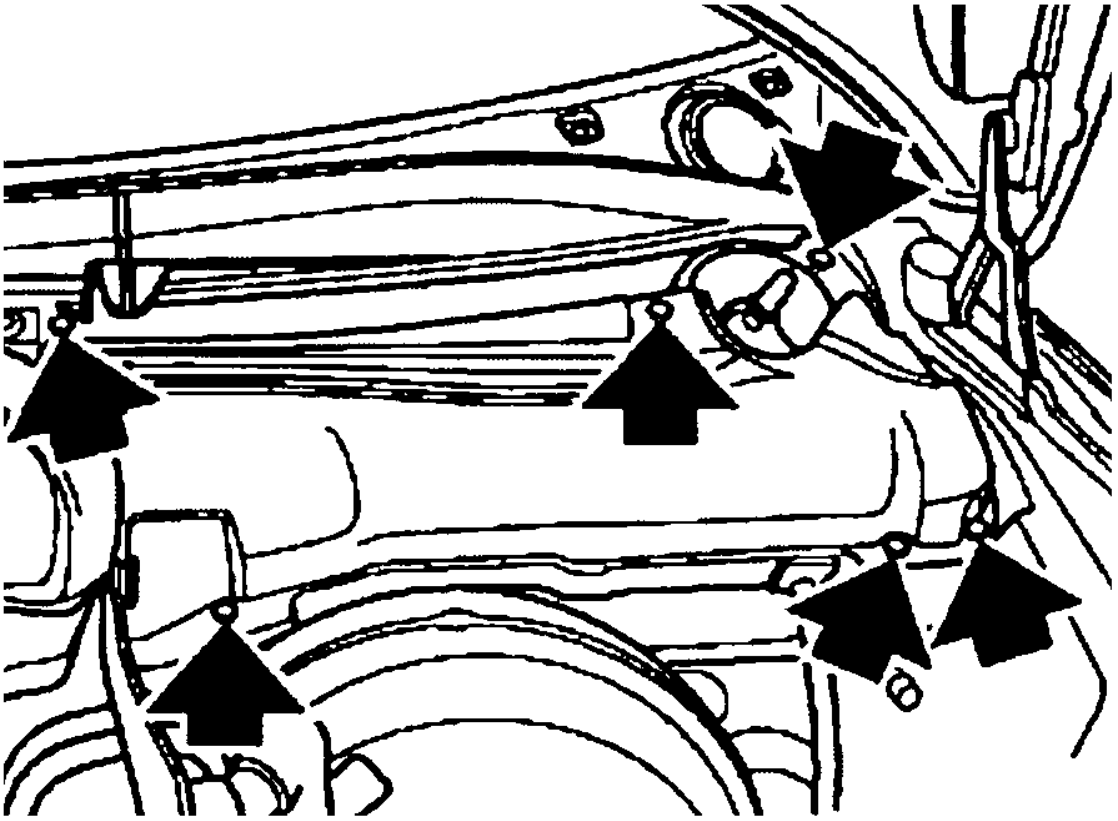


Fig. 6: Locating Cover Screws
Courtesy of BMW OF NORTH AMERICA, INC.

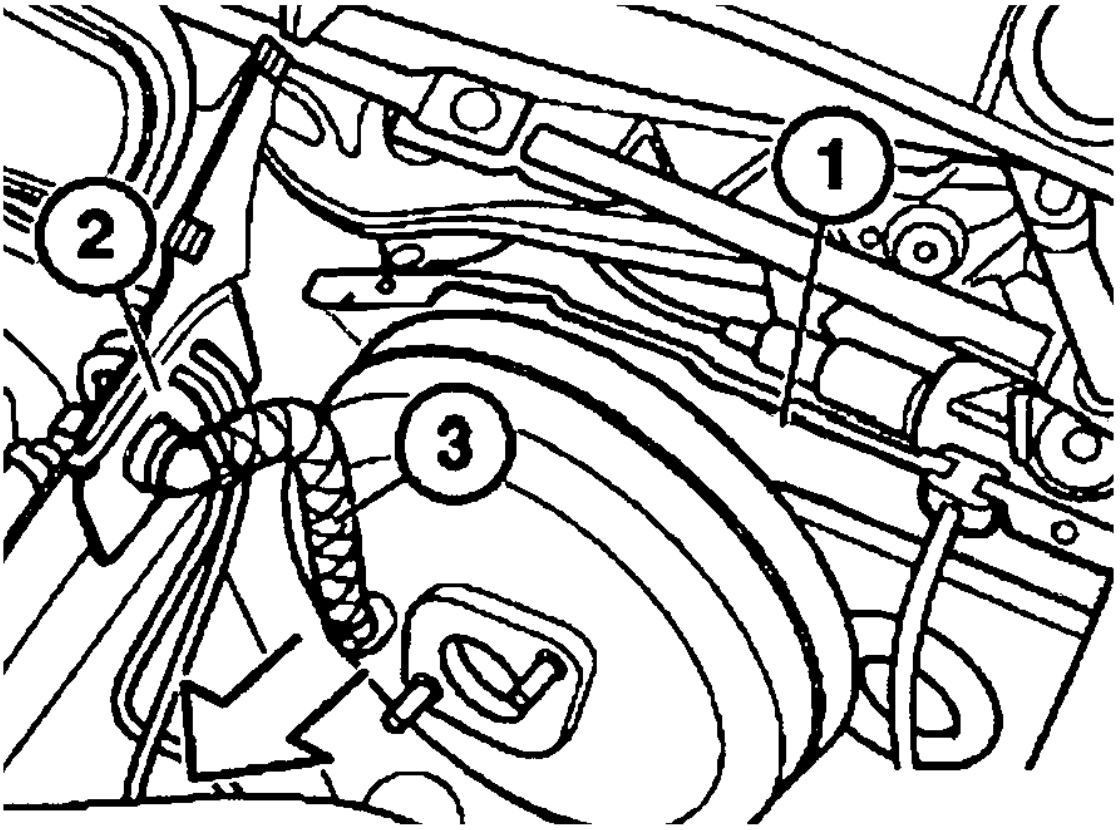


Fig. 7: Removing Booster Components
Courtesy of BMW OF NORTH AMERICA, INC.

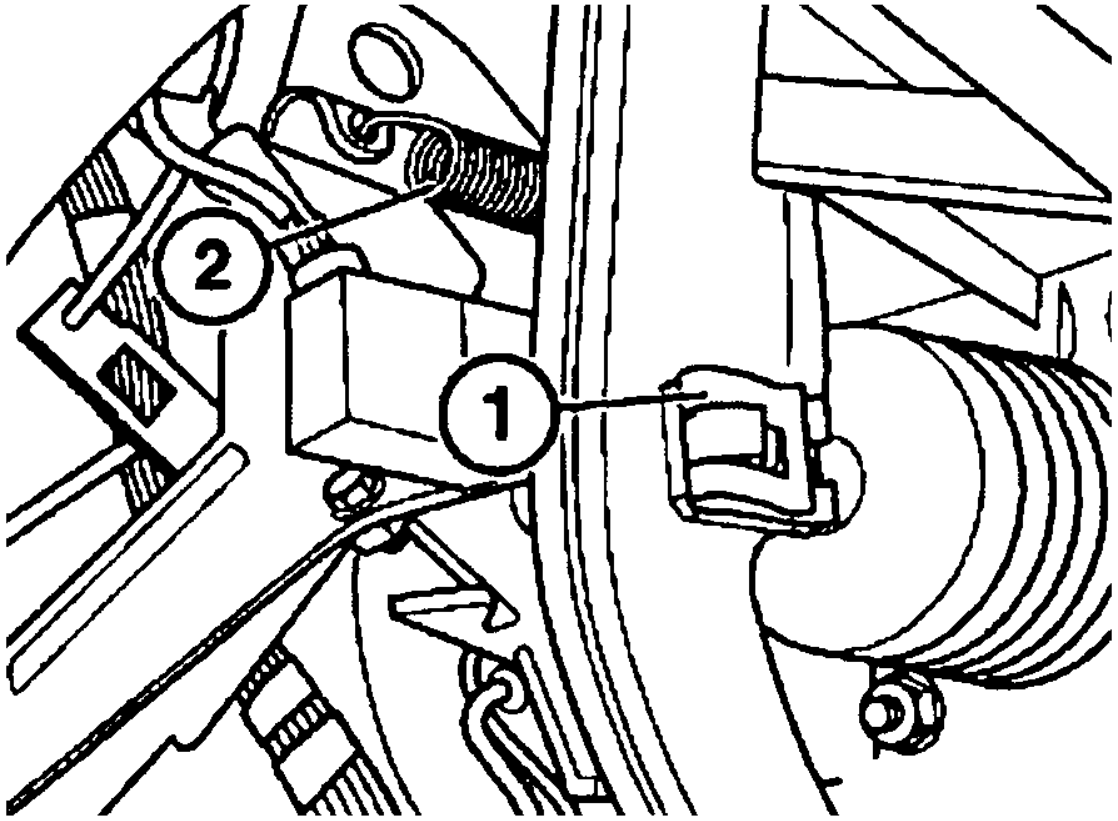


Fig. 8: Locating Retainer & Recoil Spring
Courtesy of BMW OF NORTH AMERICA, INC.

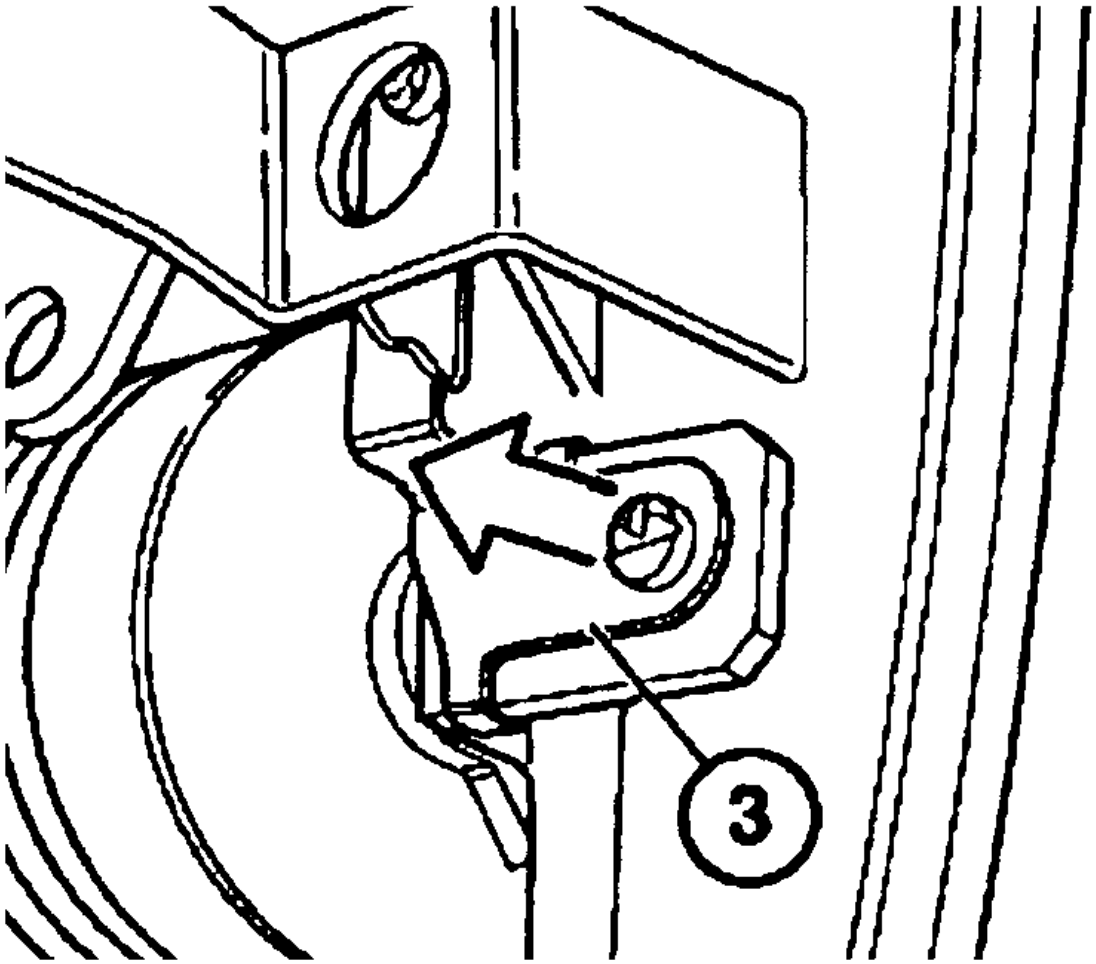


Fig. 9: Locating Pin
Courtesy of BMW OF NORTH AMERICA, INC.

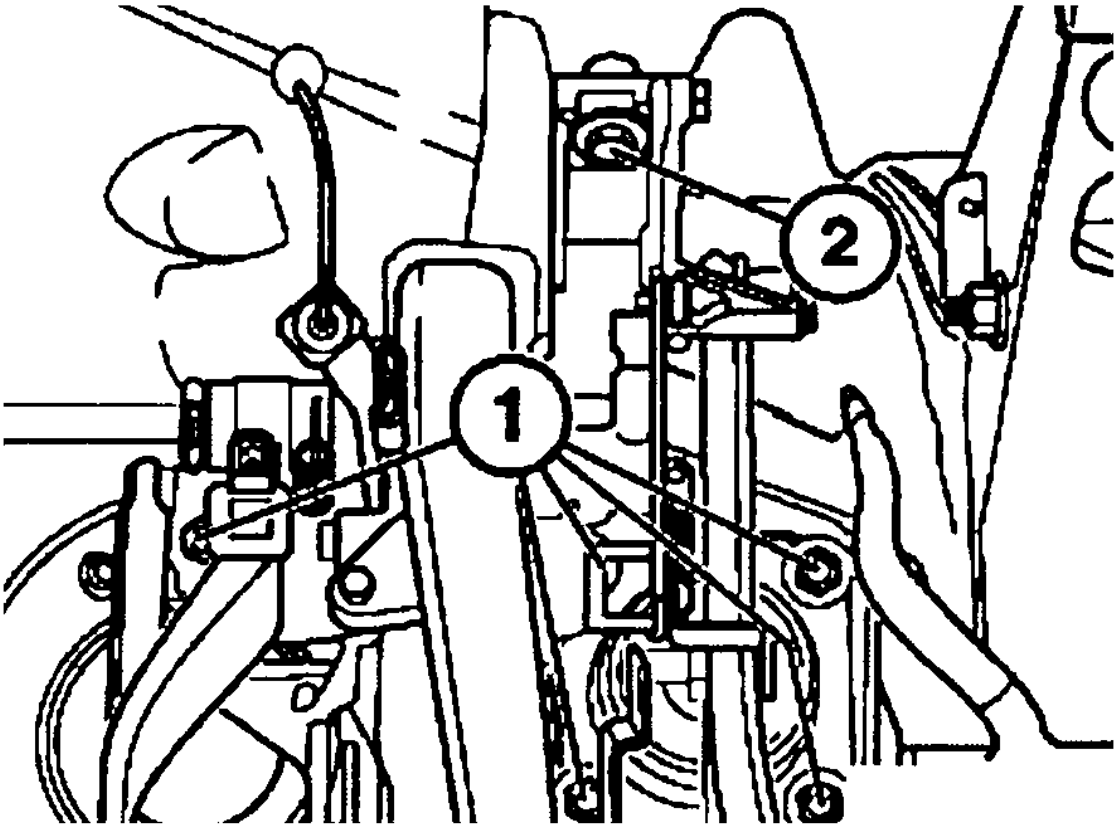


Fig. 10: Locating Pedal Assembly Nuts & Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Installation

CAUTION: Region (3) of the brake unit is very susceptible to damage that could lead to the breakdown of the brake unit. See Fig. 11.

1. Install adapter plate (1), replacing gasket (2) if necessary. See Fig. 11.
2. Carefully insert brake booster unit into place.
3. Push pedal assembly into place and replace self-locking nuts.
4. Balance of assembly is reverse of removal.

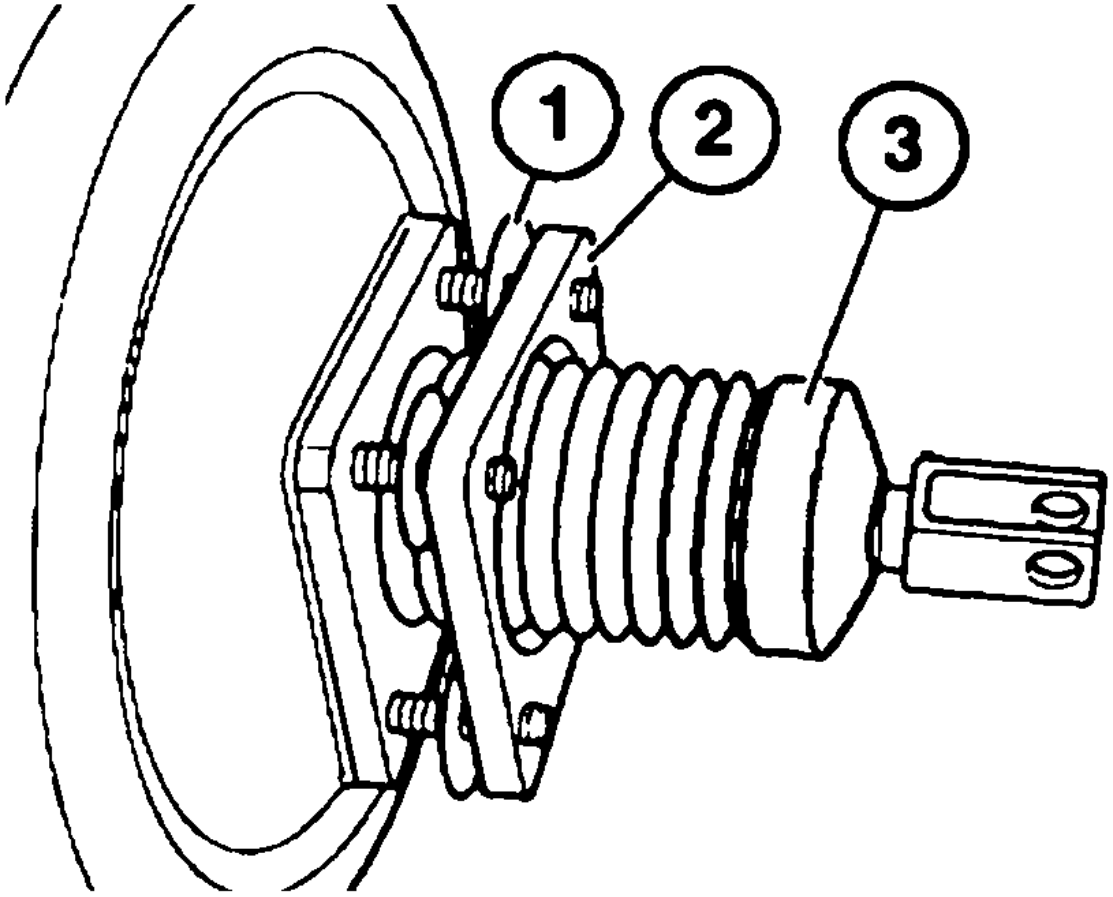


Fig. 11: Locating Brake Booster Components
Courtesy of BMW OF NORTH AMERICA, INC.

BRAKE BOOSTER NON-RETURN VALVE

Removal & Installation

1. Actuate the brake pedal several times to reduce the vacuum in the brake booster, making it easier to pull off the vacuum hose.
2. Open hose clips (1, 2) and pull off vacuum hoses. See Fig. 12.
3. Pull off the rubber seal (1). See Fig. 13.
4. Unfasten catches (4 pieces), and pull upper section of separating wall seal upward and off.
5. Pull non-return valve with rubber gasket upward out of lower section of separating wall seal.
6. When installing, ensure that rubber gasket is correctly seated and retaining hooks are properly locked.
7. Installation is reverse of removal.

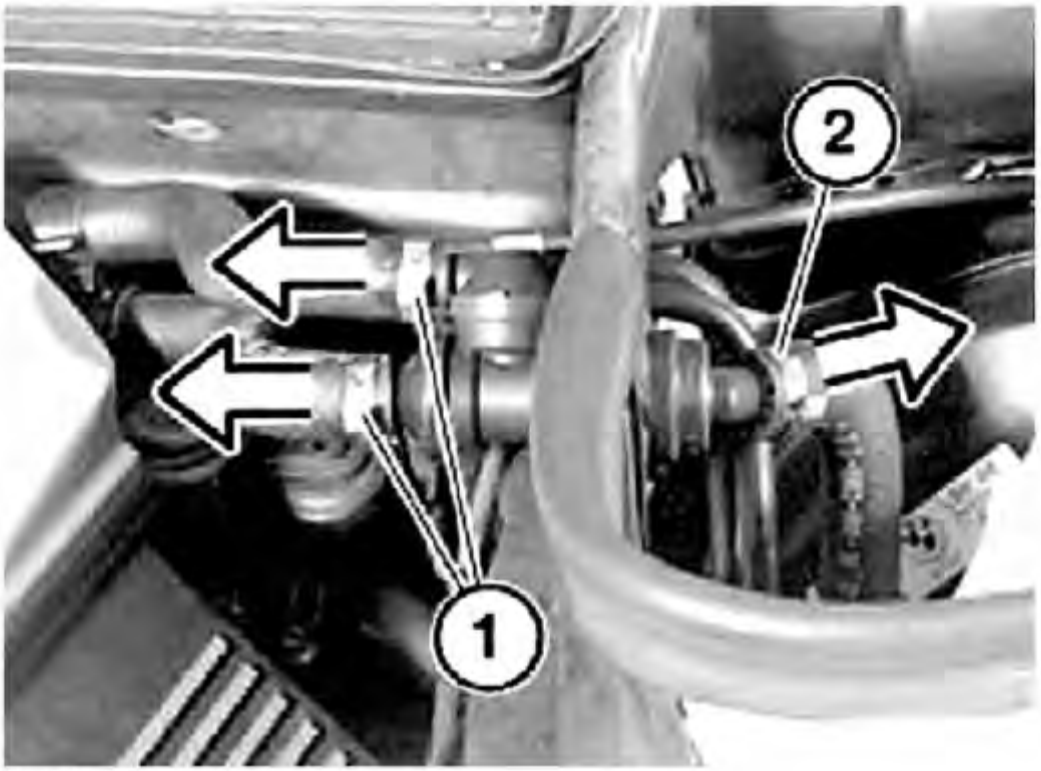


Fig. 12: Locating Hose Clips
Courtesy of BMW OF NORTH AMERICA, INC.

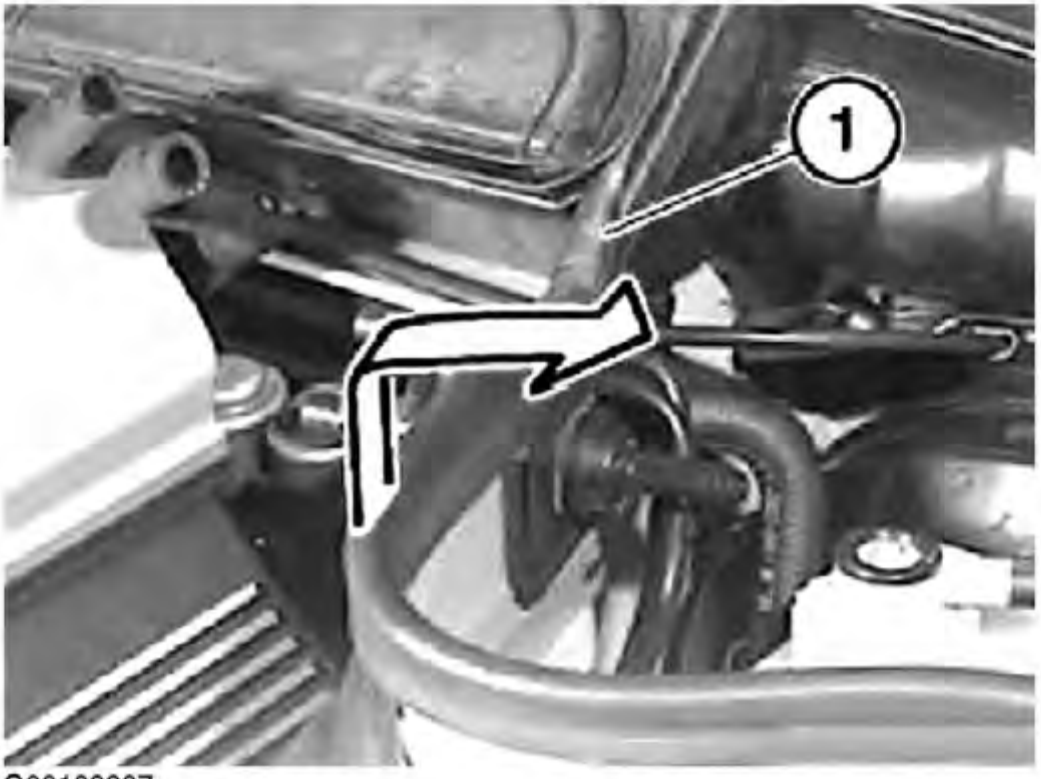


Fig. 13: Pulling Off Rubber Seal

Courtesy of BMW OF NORTH AMERICA, INC.

BRAKE EXPANSION TANK

Removal & Installation

1. Suck the brake fluid out of the expansion tank. Use a suction device used exclusively for drawing off brake fluid.
2. Pull supply hose (1) off of clutch hydraulic system, if necessary. See Fig. 14.
3. On vehicles with a precharging pump for DSC, the supply hose must be secured in a vertical position to prevent fluid from emerging.
4. On all models, lift out the expansion tank from the master brake cylinder by tilting it laterally.
5. Check rubber plug in master brake cylinder. No damage may be present.
6. Push the expansion tank vertically onto the master brake cylinder.
7. Connect hoses, fill expansion tank, and bleed system. See BLEEDING BRAKE SYSTEM.

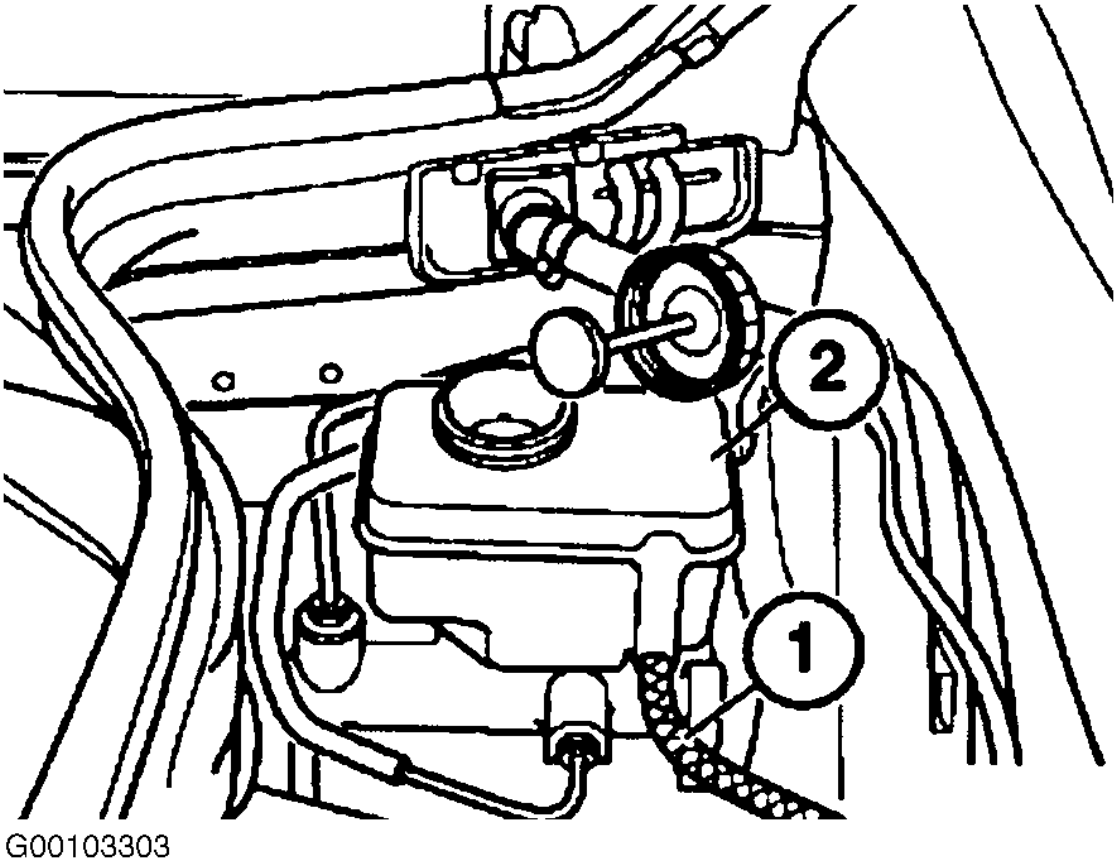


Fig. 14: Locating Supply Hose Of Clutch Hydraulic System
Courtesy of BMW OF NORTH AMERICA, INC.

BRAKE LIGHT SWITCH

Removal & Installation

1. Remove trim for pedal assembly.
2. On 7 series up to 09/98, disconnect plug connection. See Fig. 15.
3. On all models, depress brake pedal as far as possible, using pedal support if necessary.
4. Pull tappet and sleeve forward completely (1). Press together clips and pull back switch (2). See Fig. 16.

5. Installation is reverse of removal.
6. Slowly bring brake pedal into initial position.

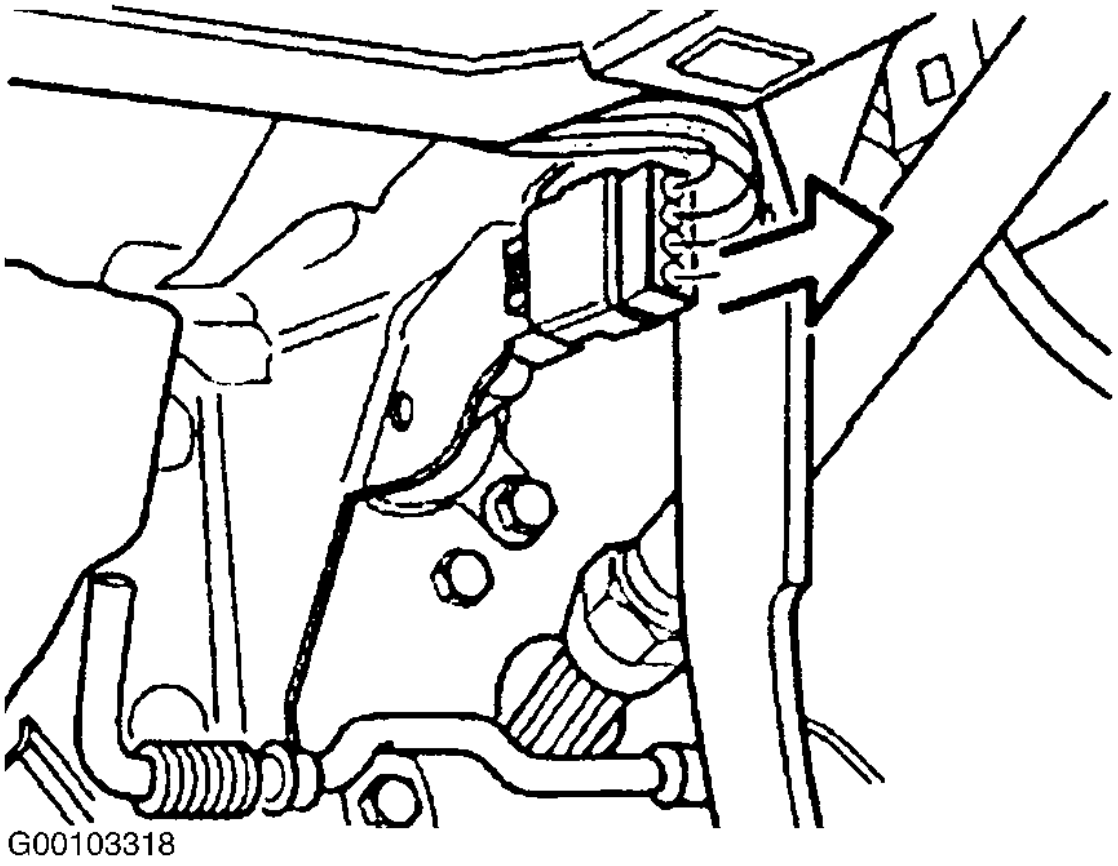


Fig. 15: Disconnecting Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

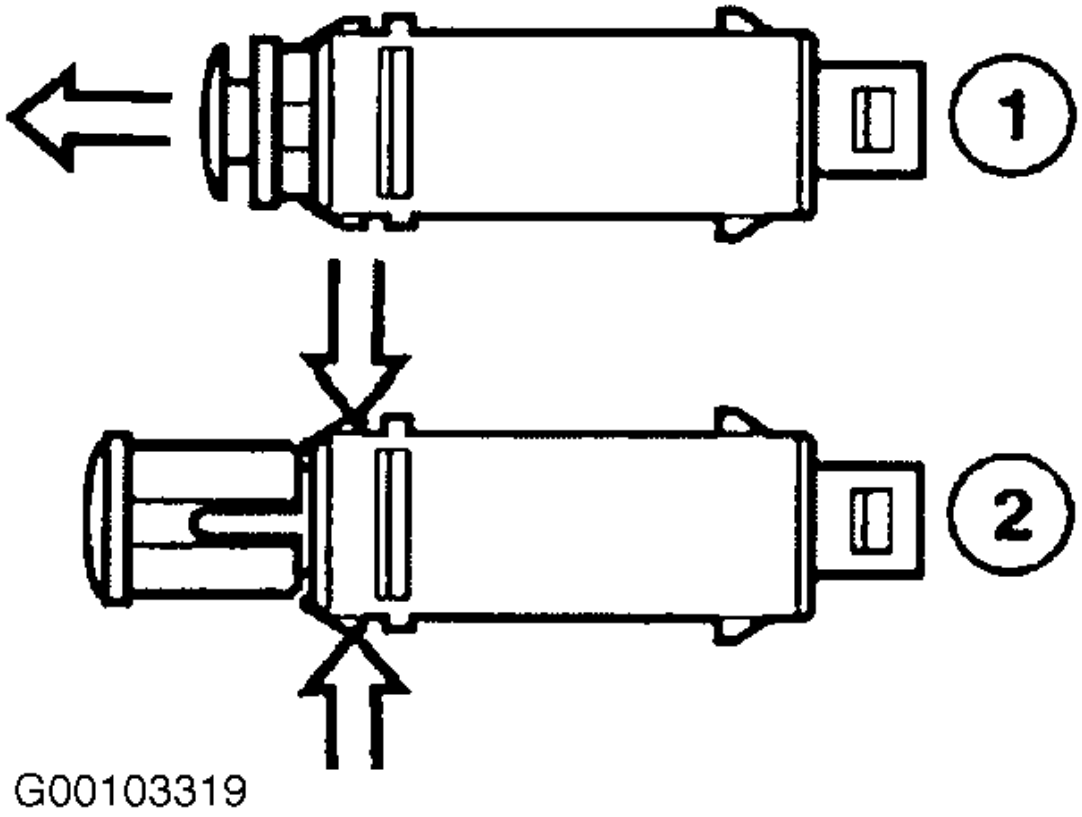


Fig. 16: Removing Brake Light Switch
Courtesy of BMW OF NORTH AMERICA, INC.

DISC PAD

Removal & Installation

1. Raise and support vehicle. Remove wheel(s).
2. Remove caliper. See CALIPER ASSEMBLY.
3. Remove outer brake pad. Inner brake pad is located with its spring in the piston. See Fig. 17.
4. Mark any worn brake pads. In the event of one-sided brake pad wear, do not change brake pads around. New brake pads may only be installed if the brake disc thickness is greater than or equal to the minimum thickness. See BRAKE LINING MINIMUM THICKNESS table under TESTING.
5. Clean brake pads. Do not apply grease to brake pad backplate.

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

6. 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. See Fig. 18.
7. In 5-Series/touring models, make sure the insulating ring (1) is installed on the brake piston. See Fig. 19.
8. Reassemble caliper.
9. Install caliper. See CALIPER ASSEMBLY.
10. Install wheel(s).
11. Lower vehicle.

12. Fully depress brake pedal several times so that brake pads contact brake discs.
13. When new brake pads are fitted on the front and rear axles, the brake fluid level must be brought up to the "MAX" marking.
14. Hold ignition key for at least 30 seconds in position "1" without starting engine. This clears a fault entry in the RAM. This prevents the brake wear indicator lamp from lighting up again.

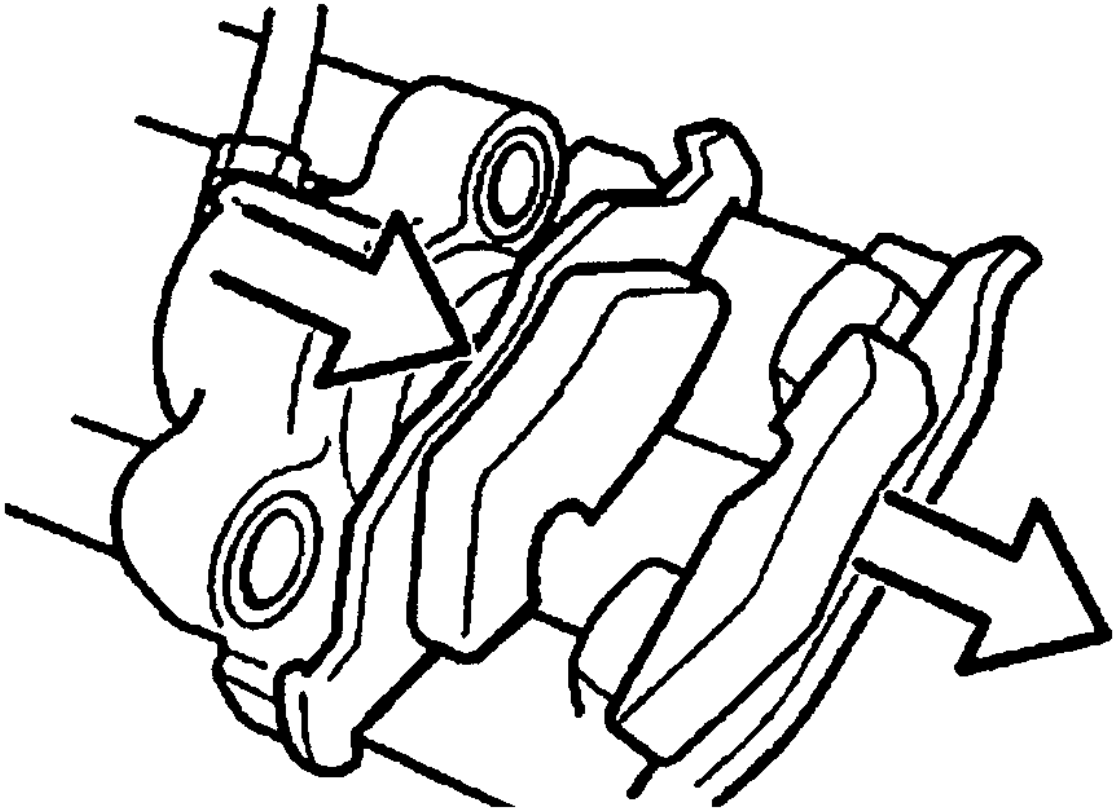


Fig. 17: Removing Brake Pads
Courtesy of BMW OF NORTH AMERICA, INC.

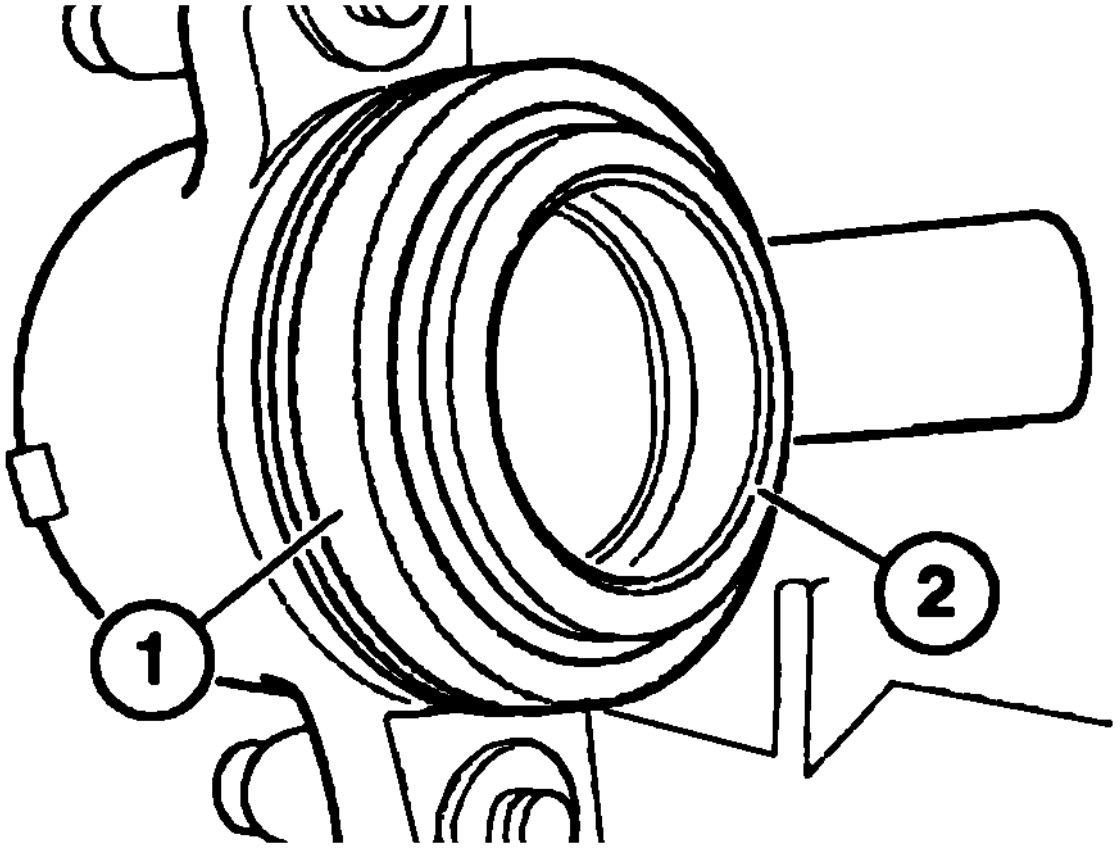


Fig. 18: Locating Dust Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

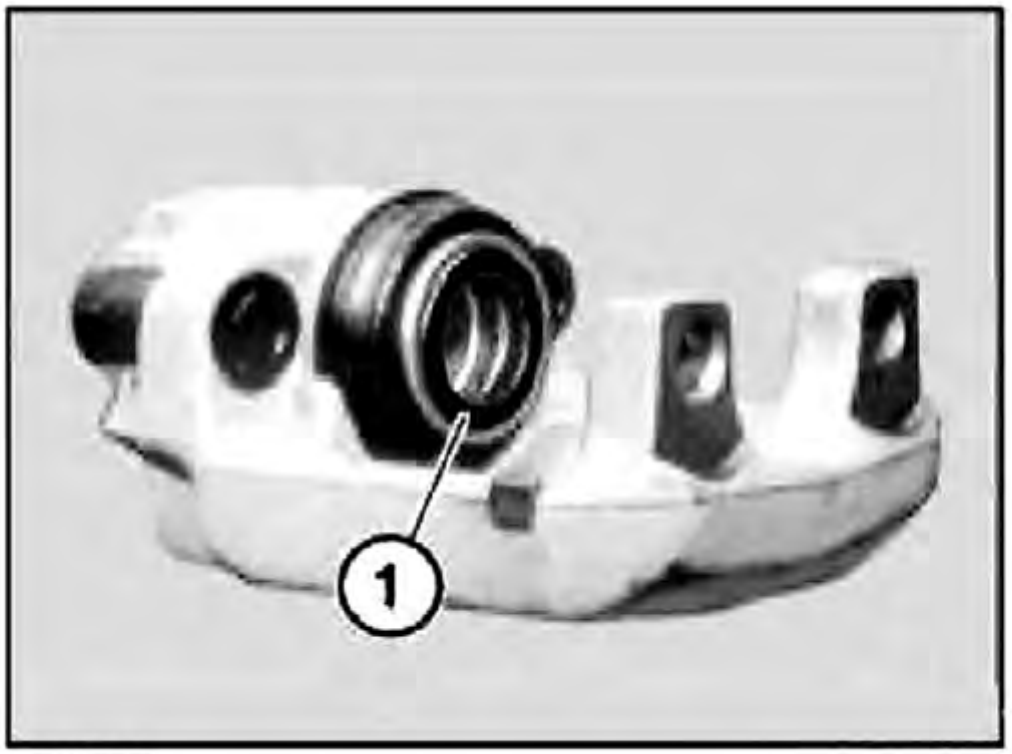


Fig. 19: Locating Insulating Ring
Courtesy of BMW OF NORTH AMERICA, INC.

CALIPER ASSEMBLY

Removal

1. Raise and support vehicle. Remove wheel(s).
2. Lift out retaining spring (1). See Fig. 20.
3. Disconnect pad wear sensor electrical lead. On the rear it is on the right side. On the front it is on the left.
4. Remove plastic plugs (2). See Fig. 21.
5. Lift brake hose out of bracket.
6. Release guide screws located under plastic plugs with special tool (34 1 080). Withdraw brake caliper backwards.

NOTE: When forcing piston back, observe brake fluid level in supply tank. Overflowing brake fluid will damage the paintwork.

7. Turn piston fully back with special tool 34 1 050. See Fig. 23.
8. Remove outer brake lining. See DISC LINING.

NOTE: Grease contact surfaces on brake caliper at top and bottom.

9. Clean contact faces (1,2) of brake lining hammer heads/brake caliper housing and coat with anti-squeak compound. See Fig. 24.
10. Clean contact face (3) of brake caliper and apply a thin coating of anti-squeak compound. See Fig. 25.
11. Clean brake caliper mounting bracket at hammer head guides and apply a thin coating of anti-squeak compound.

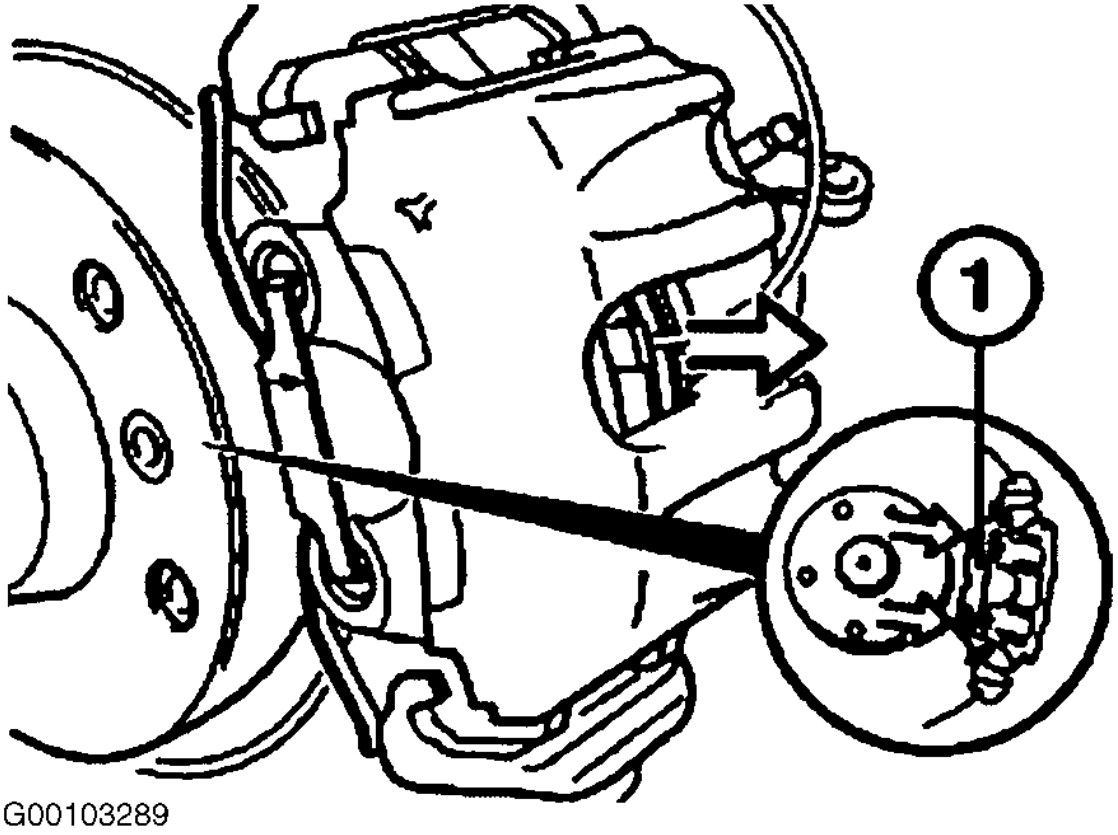


Fig. 20: Locating Retaining Spring
Courtesy of BMW OF NORTH AMERICA, INC.

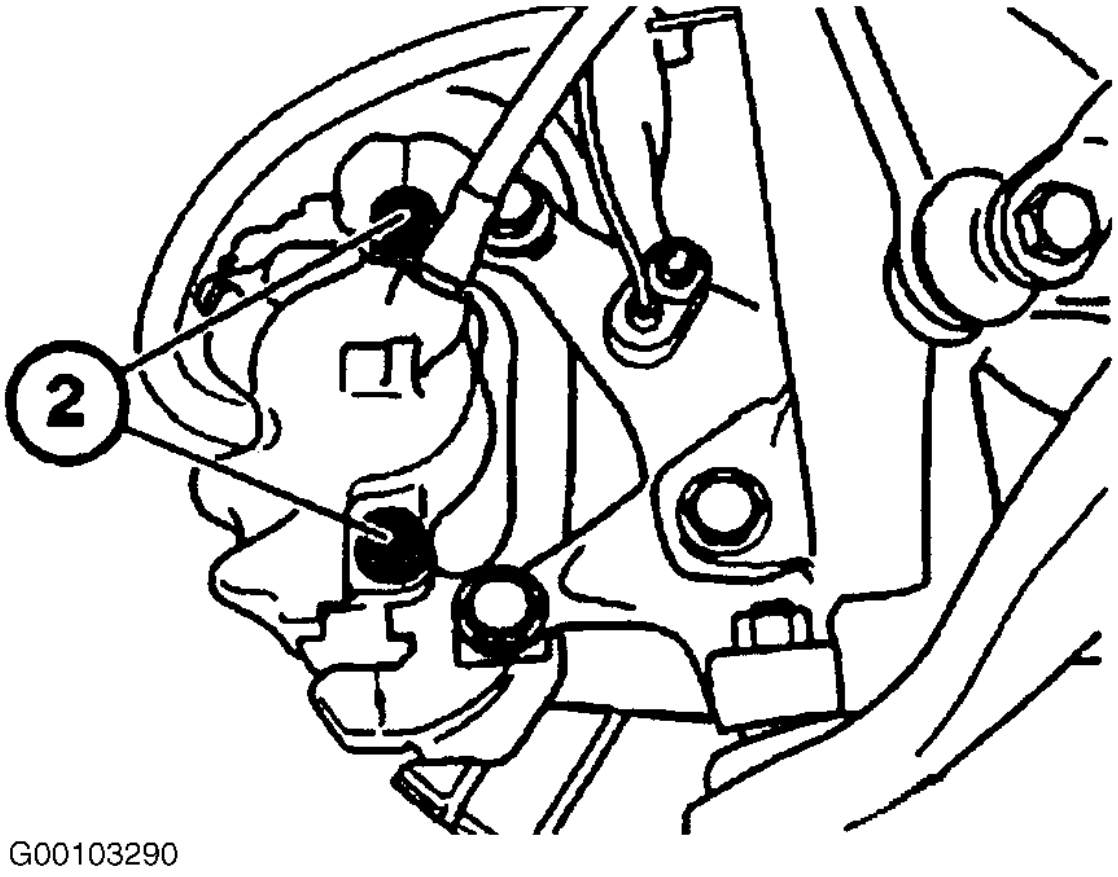


Fig. 21: Locating Plastic Plugs
Courtesy of BMW OF NORTH AMERICA, INC.

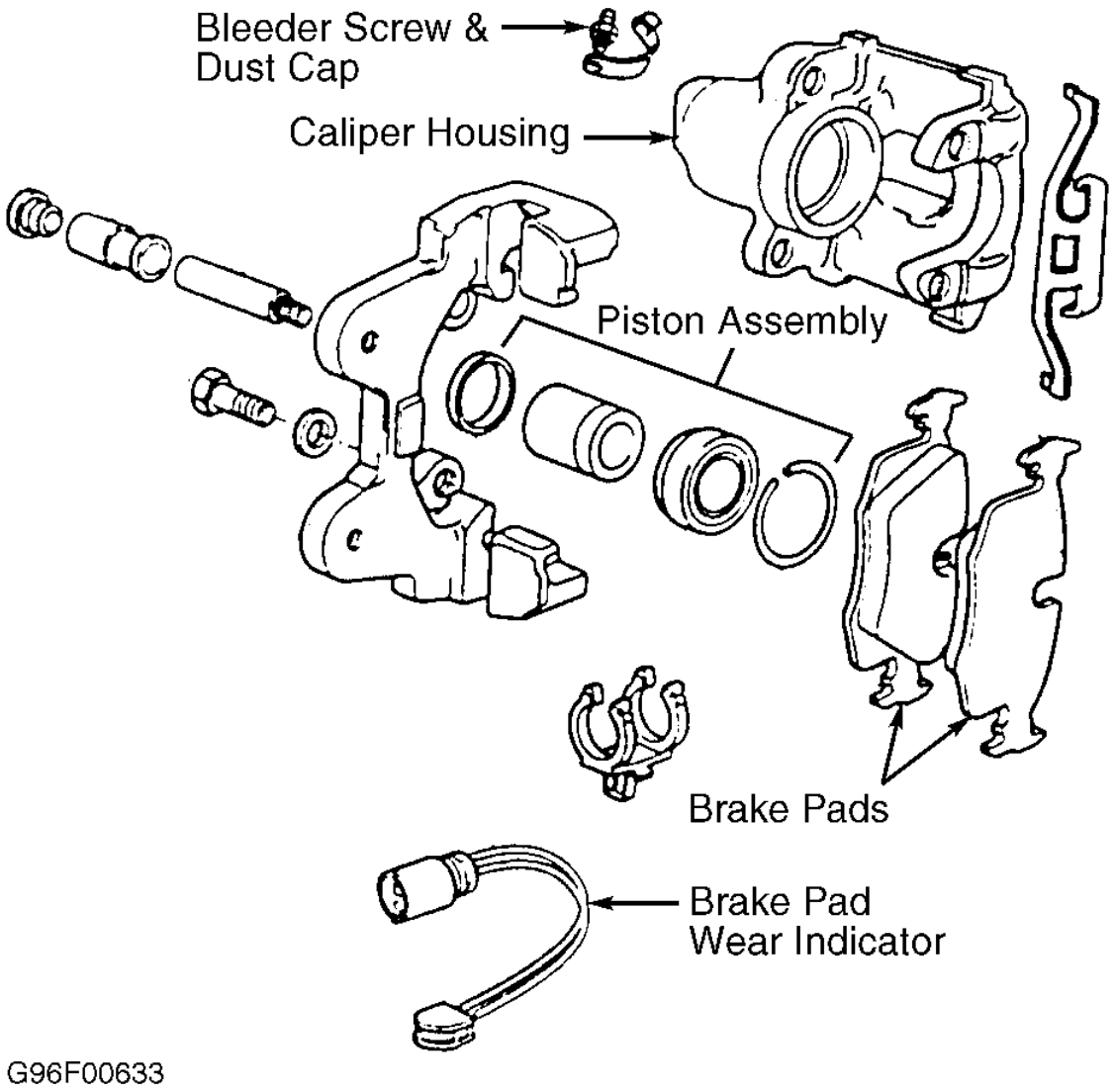


Fig. 22: Exploded View Of Single Piston Caliper
Courtesy of BMW OF NORTH AMERICA.

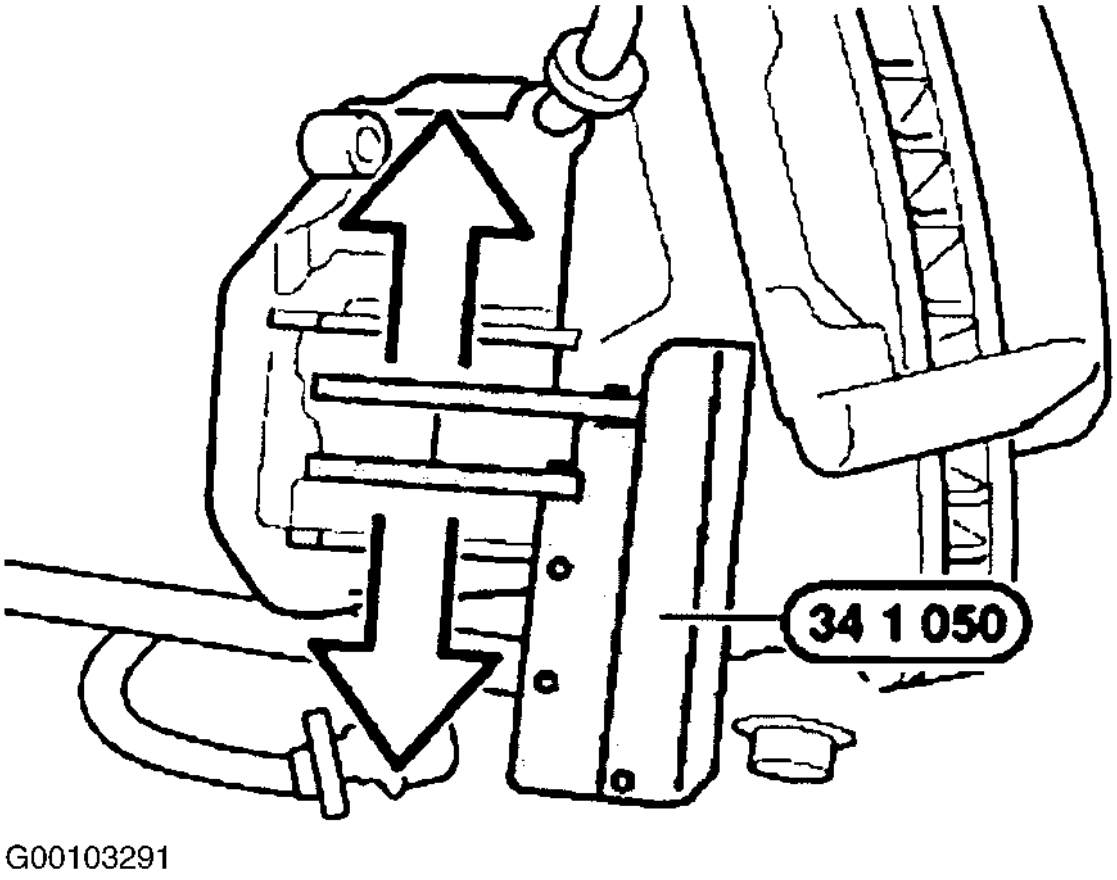


Fig. 23: Forcing Piston Back
Courtesy of BMW OF NORTH AMERICA, INC.

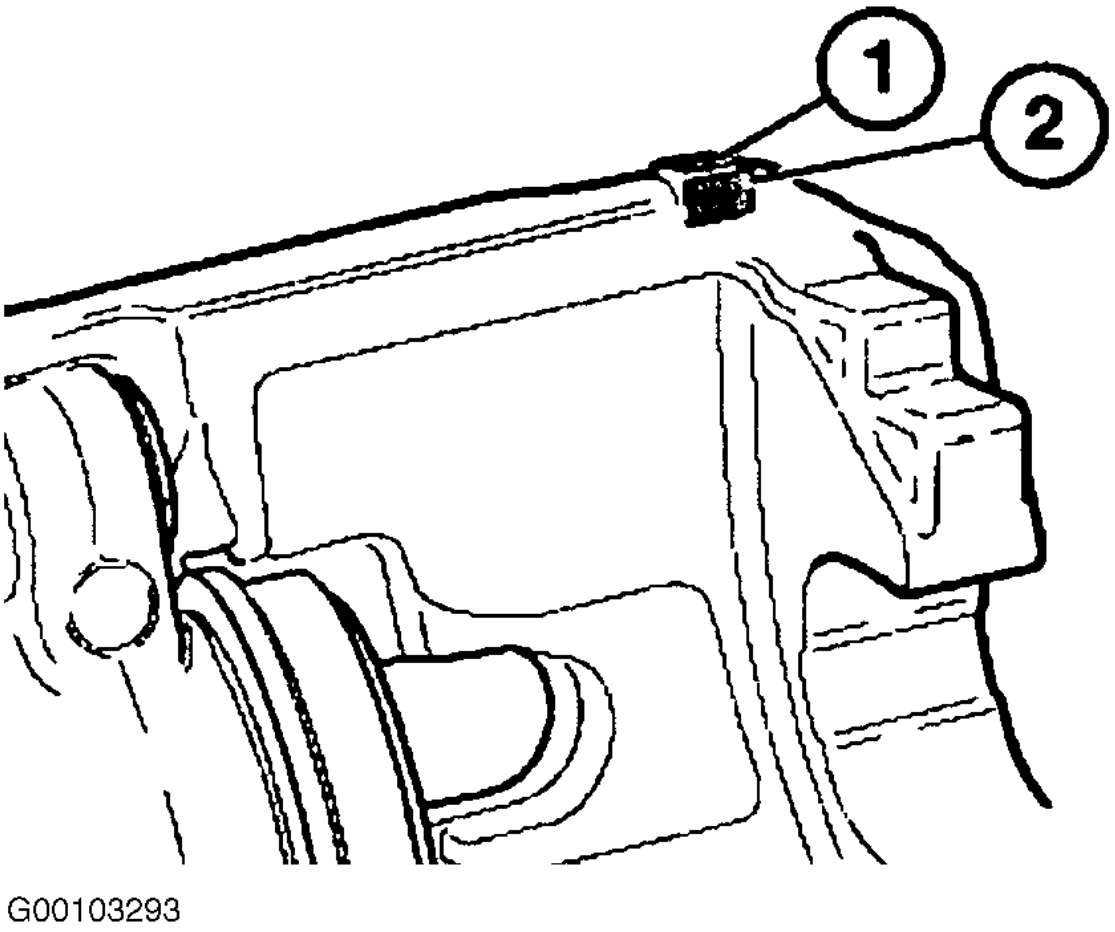


Fig. 24: Locating Contact Faces
Courtesy of BMW OF NORTH AMERICA, INC.

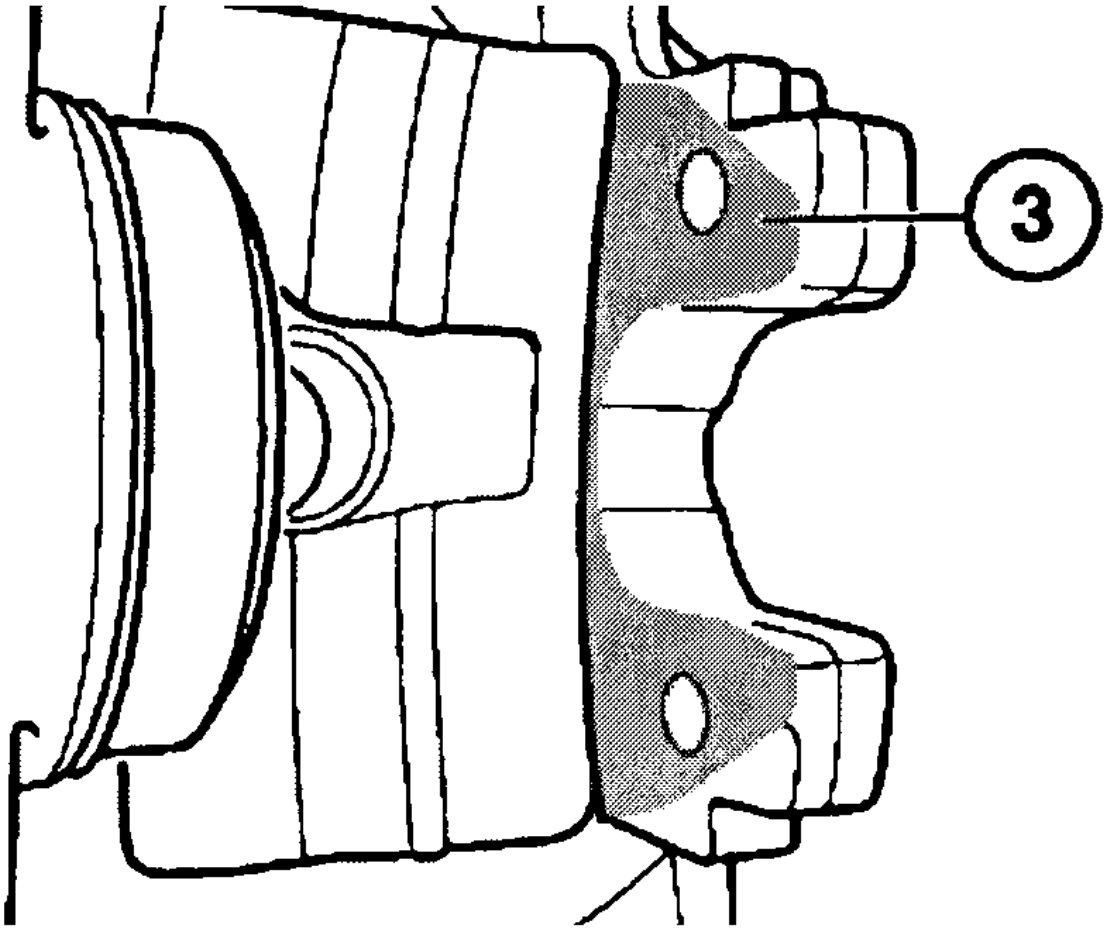


Fig. 25: Locating Contact Face Three
Courtesy of BMW OF NORTH AMERICA, INC.

Installation

1. To install, reverse removal procedure.
2. Only clean guide screws. Do not grease. Check threads. Replace all guide screws which are not in perfect condition.
3. Tighten caliper mounting bolts to specification. See TORQUE SPECIFICATIONS.
4. Bleed hydraulic system. See BLEEDING BRAKE SYSTEM.
5. Install and tighten wheel bolt. See TORQUE SPECIFICATIONS.

BRAKE DISC

Removal

1. Raise and support vehicle. Remove wheel(s).
2. If necessary, remove and clean disc linings. See DISC LINING.

NOTE: Brake hose remains connected.

3. Remove caliper mounting bolts and raise caliper off mounting assembly and suspend from vehicle with wire.

CAUTION: To release brake disc, do not strike friction ring with a hammer or similar. If necessary, carefully tap on base of brake disc chamber with a rubber mallet.

4. Unscrew bolts and take off brake disc. See Fig. 26.

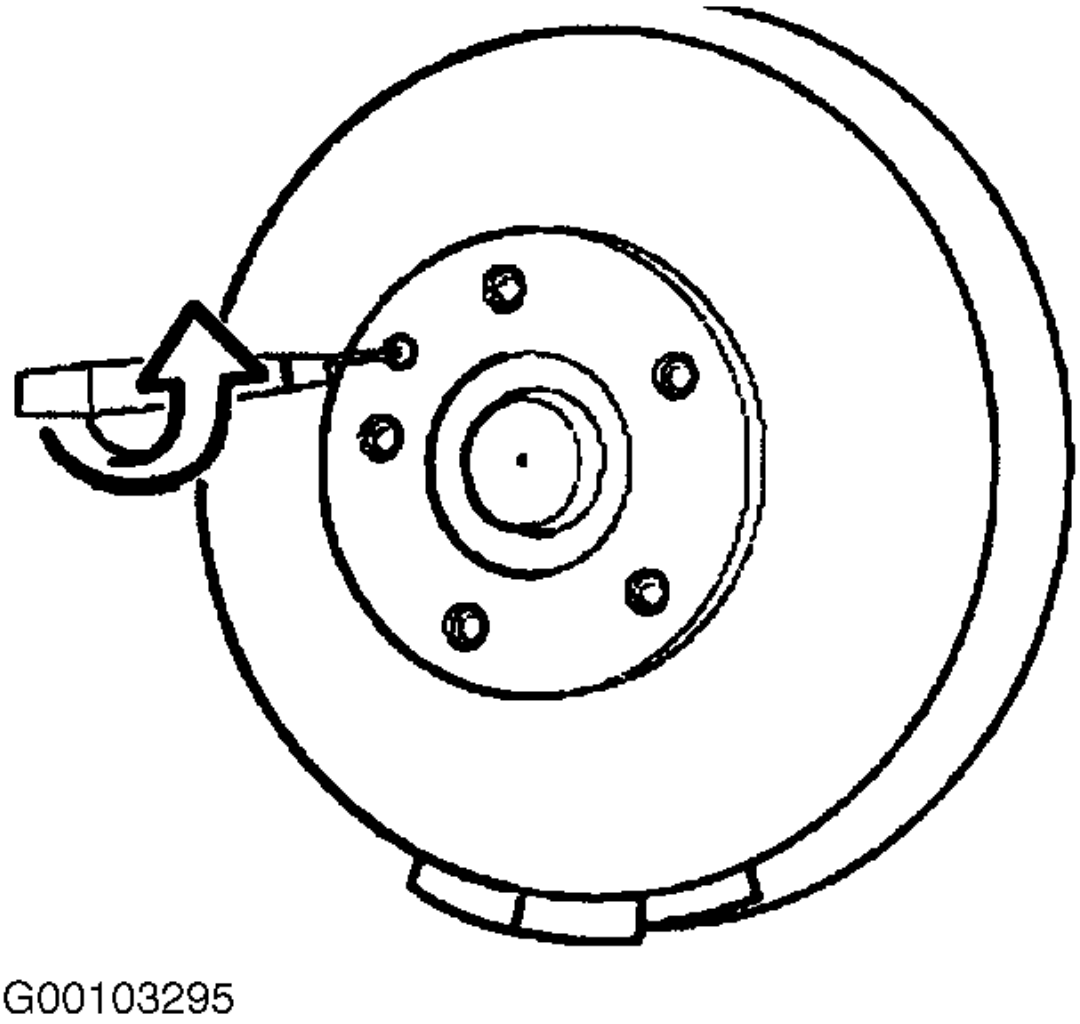


Fig. 26: Removing Brake Disc
Courtesy of BMW OF NORTH AMERICA, INC.

Installation

CAUTION: Internally ventilated brake discs are balanced. Never remove or reposition balance clips.

1. Thoroughly clean contact surface of brake disc at wheel hub. Remove traces of corrosion if necessary. Unevenness on contact surface may result in distortion of brake disc.
2. Install brake disc and tighten bolts to specification. See TORQUE SPECIFICATIONS.
3. If removed, replace brake linings.
4. Check that brake hose has not been disconnected. If disconnected make sure it is positively attached when installed.

5. Replace caliper and tighten screws to specification. See TORQUE SPECIFICATIONS.
6. Install wheels and bleed brakes if brake hose was disconnected. See BLEEDING BRAKE SYSTEM.
7. If work was on rear brakes, adjust handbrake. See PARKING BRAKE under ADJUSTMENTS.

BRAKE LINES

Removal & Installation

1. Apply pedal prop and depress brake pedal slightly. This prevents brake fluid from flowing out of expansion tank and into brake system when brake lines are opened.
2. Suck the brake fluid out of the expansion tank. Use a suction device used exclusively for drawing off brake fluid.

NOTE: Ensure that square head screw on brake hose does not rotate in metal bracket. If necessary, brace the brake hose with mold grips.

3. Unfasten brake hose from brake caliper.

NOTE: Brake pipes are only supplied straight, in correct length and fitted with connecting nipples.

4. Bend new pipe as required using bending tool 34 5 100. Removed pipe can be used as template.

CAUTION: Never twist brake pipe when installing and avoid all contact with parts attached rigidly to the body.

5. If replacing front brake pipe, move wheels into straight-ahead position. Install new pipe and tighten to specification. See TORQUE SPECIFICATIONS.
6. Remove pedal prop and bleed brake system. See BLEEDING BRAKE SYSTEM.

PARKING BRAKE SHOES

Removal & Installation

1. Raise and support vehicle. Remove rear wheel(s).
2. Remove rear brake disc. See BRAKE DISC.
3. Disconnect return springs with brake spring pliers. See Fig. 27.
4. Twist clamping pins with special tool 34 4 000 through 90 degrees and disconnect. See Fig. 28.
5. Remove brake shoes.
6. If necessary, remove or replace expander by pulling part (A) backwards, press out pin (B), and pull out part (C). See Fig. 29.
7. To install, reverse removal procedure. Coat thread of adjusting bush (1) and screw (2) with grease. Notice installation position of adjusting screws. See Fig. 30.
8. Check return springs and replace if necessary.
9. Adjust parking brake and check operation. See PARKING BRAKE under ADJUSTMENTS.

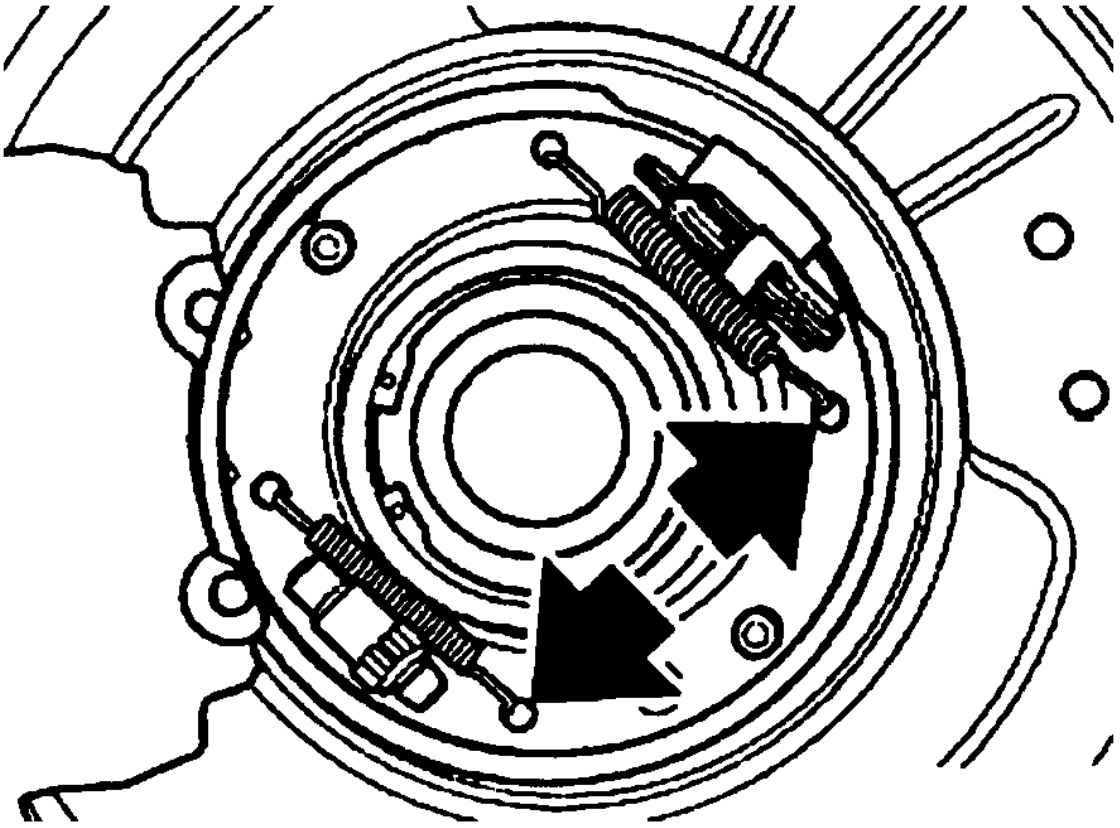


Fig. 27: Locating Return Springs
Courtesy of BMW OF NORTH AMERICA, INC.

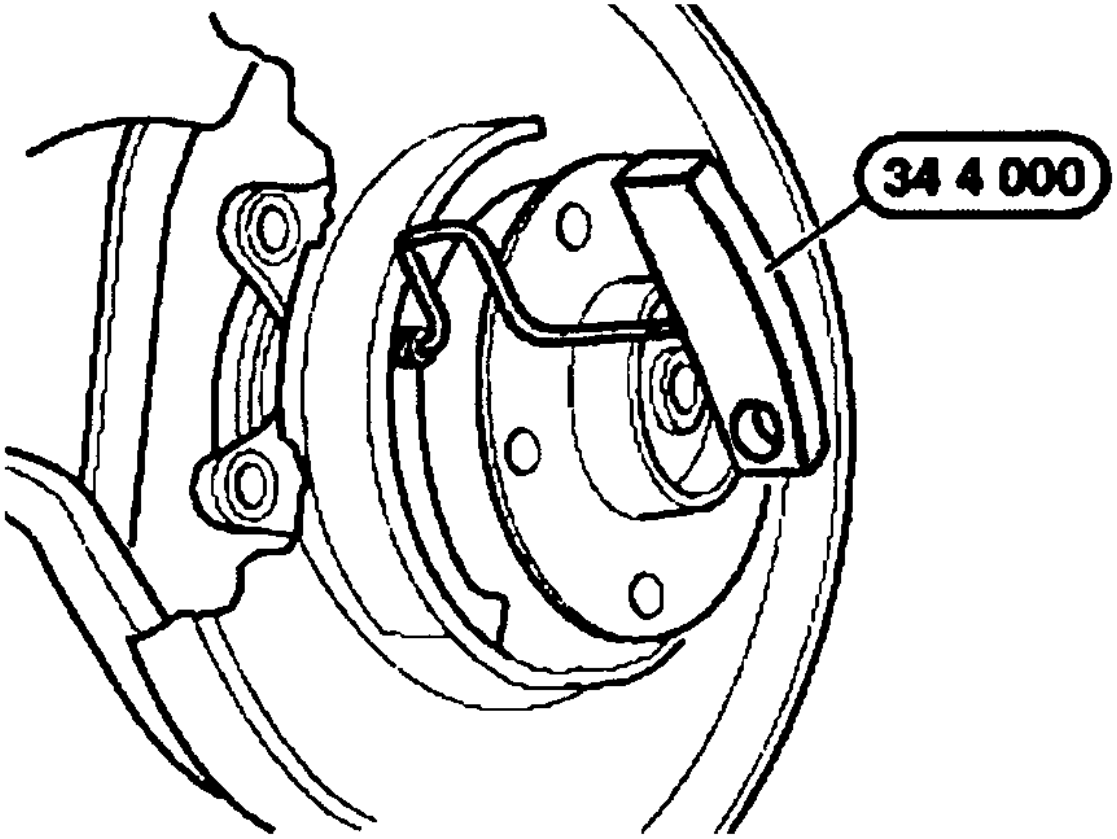


Fig. 28: Removing Parking Brake Shoes
Courtesy of BMW OF NORTH AMERICA, INC.

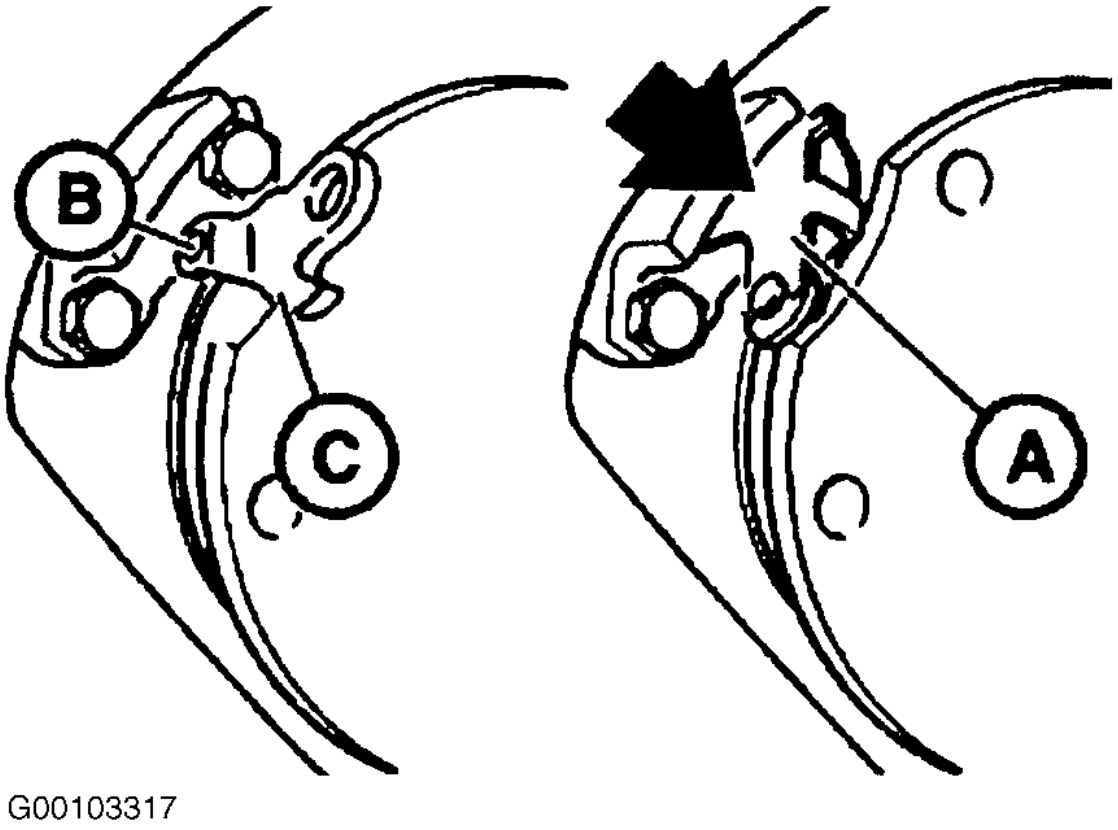


Fig. 29: Locating Brake Shoe Expander Components
Courtesy of BMW OF NORTH AMERICA, INC.

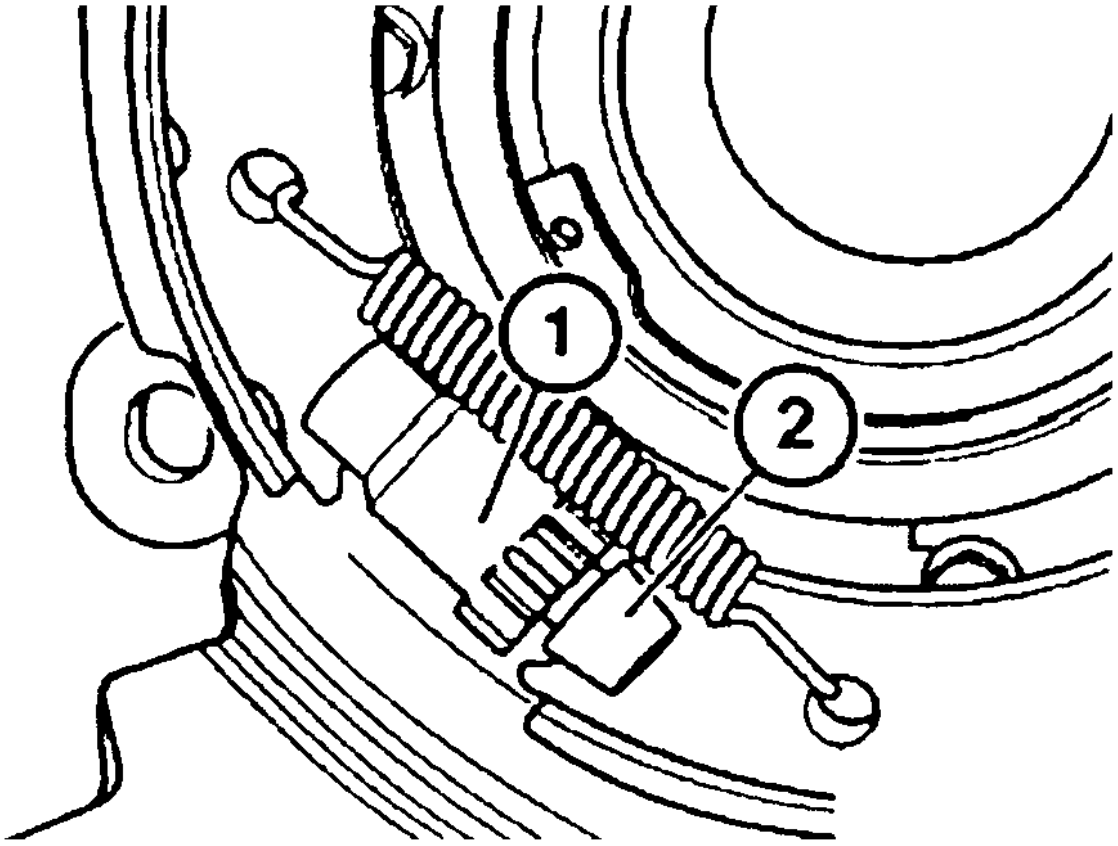


Fig. 30: Locating Adjusting Screws
Courtesy of BMW OF NORTH AMERICA, INC.

MASTER CYLINDER

Removal

1. Suck the brake fluid out of expansion tank. Use a suction device used exclusively for drawing off brake fluid.
2. Remove brake fluid expansion tank. See BRAKE EXPANSION TANK.
3. On all models, disconnect all hydraulic lines from master cylinder. Close off the brake lines and the master brake cylinder using appropriate seal plugs. See Fig. 31.
4. Remove master cylinder-to-power booster nuts. Remove support and master cylinder.
5. Replace O-ring. See Fig. 32.

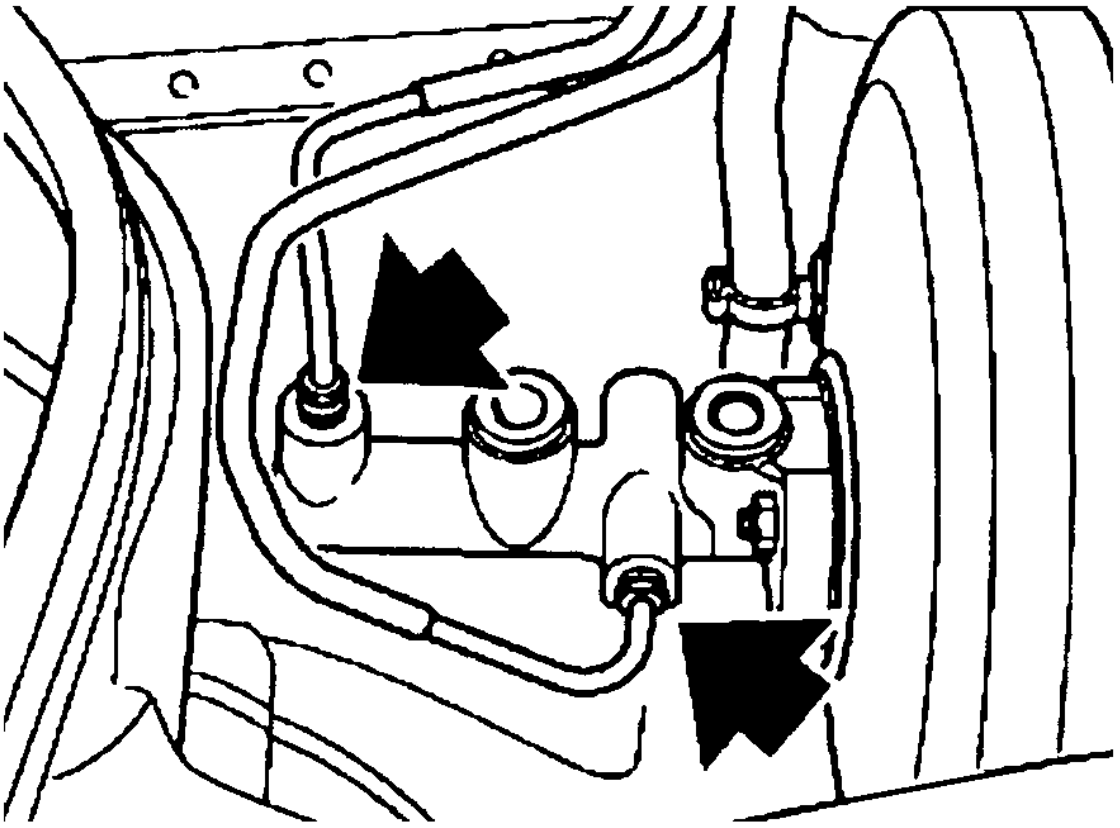


Fig. 31: Locating Screw Connections
Courtesy of BMW OF NORTH AMERICA, INC.

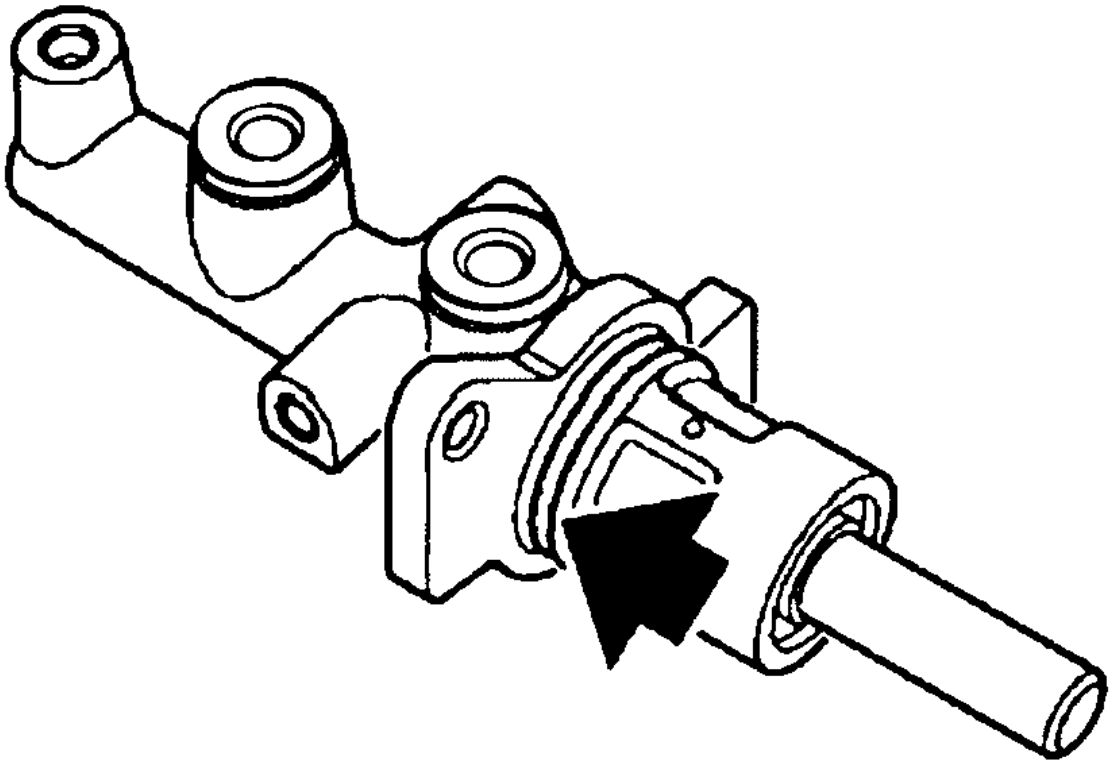


Fig. 32: Locating O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Installation

1. Install master brake cylinder to brake unit. Replace self-locking nuts and tighten to specification. See TORQUE SPECIFICATIONS.
2. Attach and tighten screw connections of brake lines and tighten to specification. See TORQUE SPECIFICATIONS.
3. Push the expansion tank vertically onto the master brake cylinder.
4. Refill brake fluid and bleed the system. See .

FRONT AXLE SEALS & BEARINGS

See appropriate FRONT article in SUSPENSION.

REAR AXLE SEALS & BEARINGS

3-Series (Except M3, M Roadster, M Coupe, 318ti & Z3)

1. Raise and support vehicle. Remove wheel(s).
2. Remove axle shaft. See appropriate AXLE SHAFTS article.
3. Remove brake disc. See BRAKE DISC.
4. Screw special tool (33 2 116) onto drive flange with wheel studs. Drive out drive flange with special tool (33 4 201/202/203). See Fig. 33.
5. If necessary, pull off bearing inner race using special tool (00 7 500) and a thrust piece. See Fig. 34.
6. It may be necessary to remove inner wheel bearing race with the following procedure:

- Detach wheel bearing inner race with special tool (33 4 400) through groove in bearing inner race.
- According to outside diameter of bearing inner race, use special tool 33 4 401 with: 33 4 405 for dia. 45-51 mm, 33 4 406 for dia. 50-55 mm and 33 4 407 for dia. 55-61 mm in groove. See Fig. 35.
- Tension special tool 33 4 401 with wrenches 33 4 403 and 33 4 404 until it can still just be turned in groove. See Fig. 36.
- Screw in special tool 33 4 402. Detach inner bearing race.

7. Remove circlip. See Fig. 37.
8. Remove wheel bearing with special tool 33 4 031/ 041/ 042/ 043/ 045. See Fig. 38.

CAUTION: Do not reuse old wheel bearing.

9. Draw in new wheel bearing with special tool 33 4 041/ 042/ 043/ 047. For inner bearing race 42 mm use special tool 33 4 049 and for 39 mm use 33 4 046. See Fig. 39.
10. Installation is reverse of removal.
11. Replace stretched or damaged circlip. Ensure correct seating.
12. Pull in drive flange using special tool 33 4 041/ 042/ 043/ 045/ 048. See Fig. 40.
13. Install brake disc.
14. Install axle shaft.

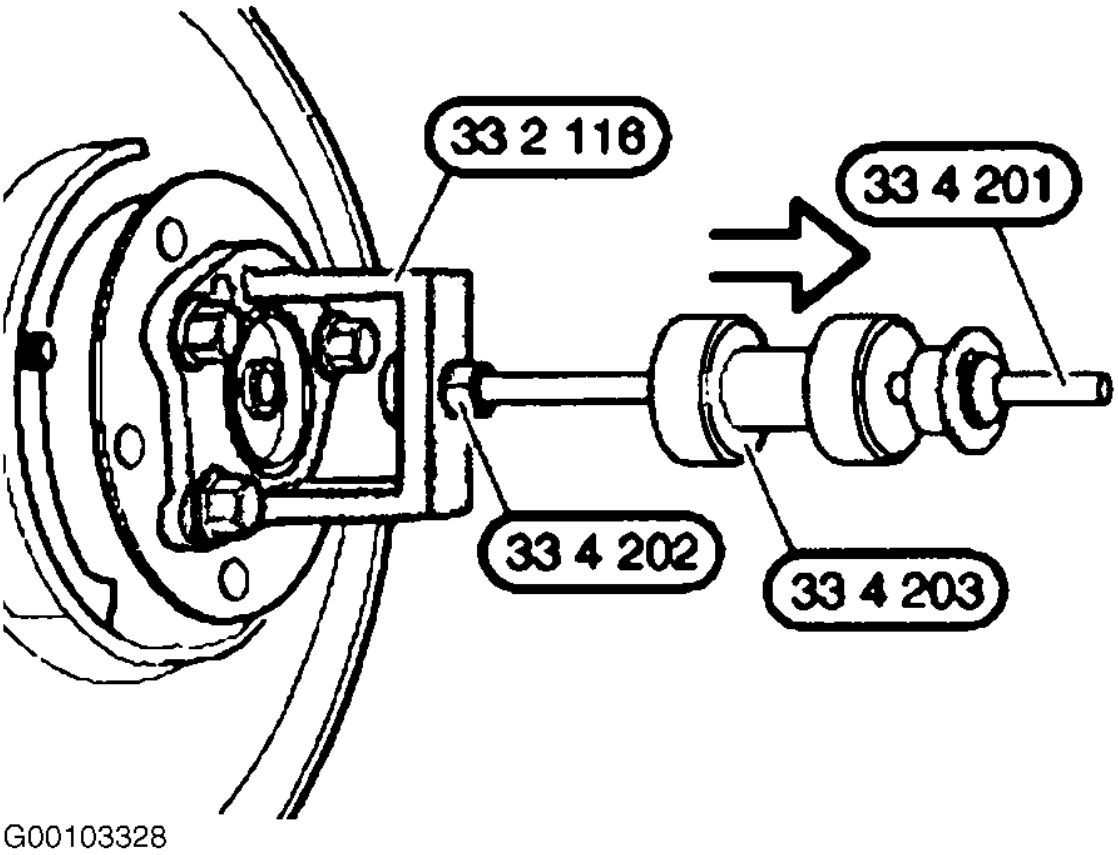


Fig. 33: Removing Drive Flange
Courtesy of BMW OF NORTH AMERICA, INC.

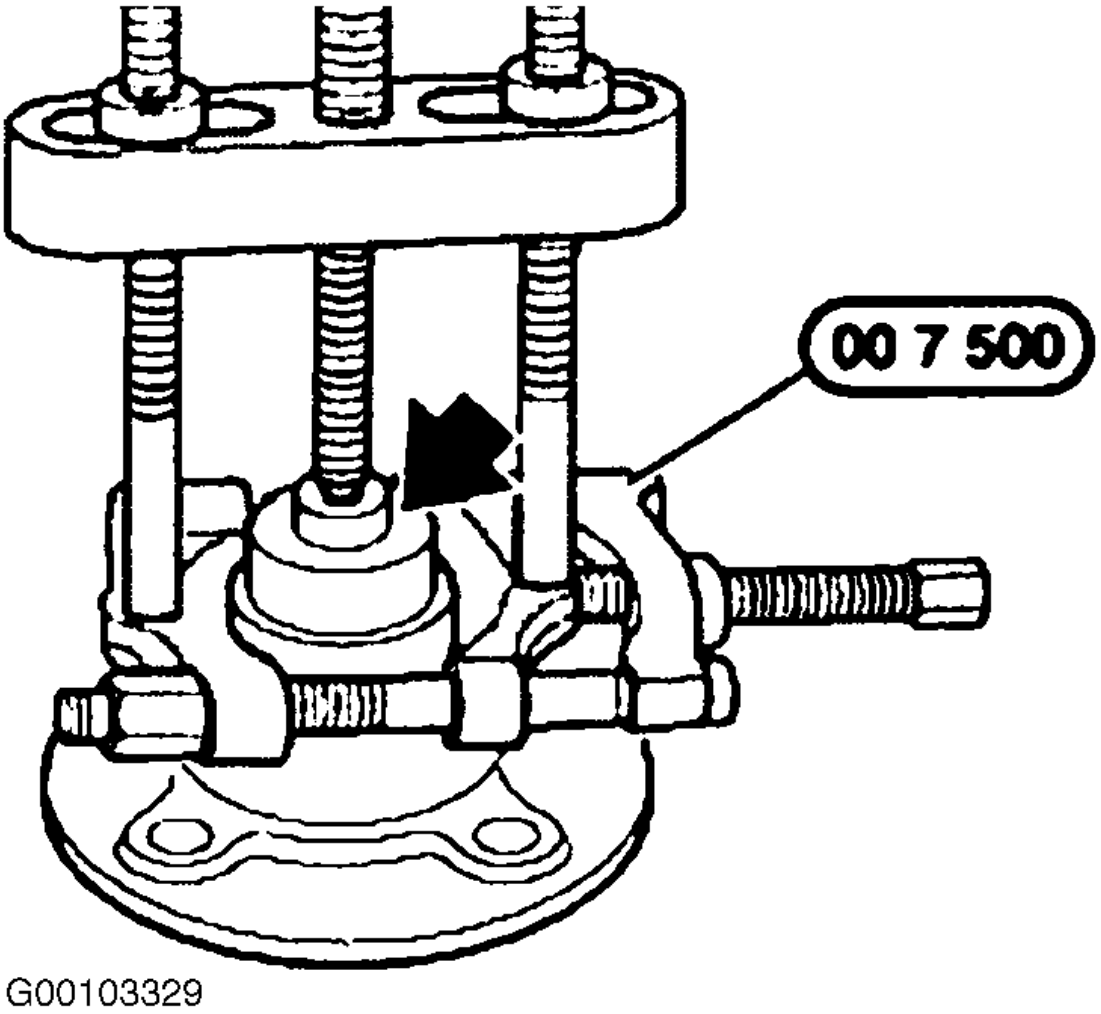


Fig. 34: Pulling Off Bearing Inner Race
Courtesy of BMW OF NORTH AMERICA, INC.

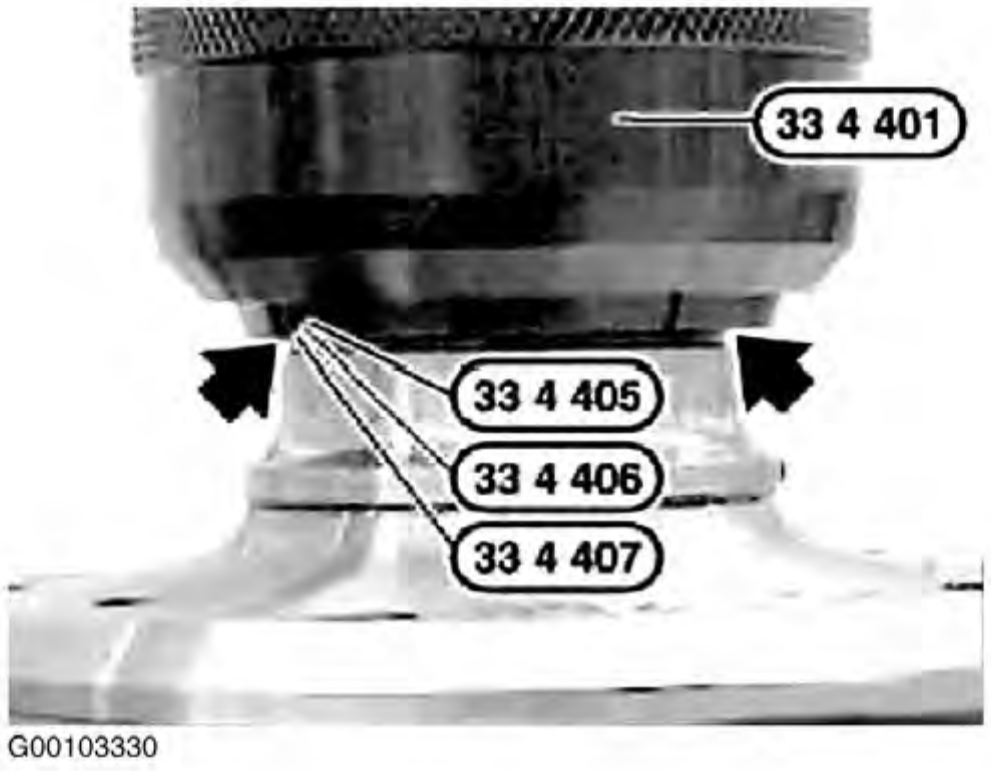


Fig. 35: Detaching Wheel Bearing Inner Race
Courtesy of BMW OF NORTH AMERICA, INC.

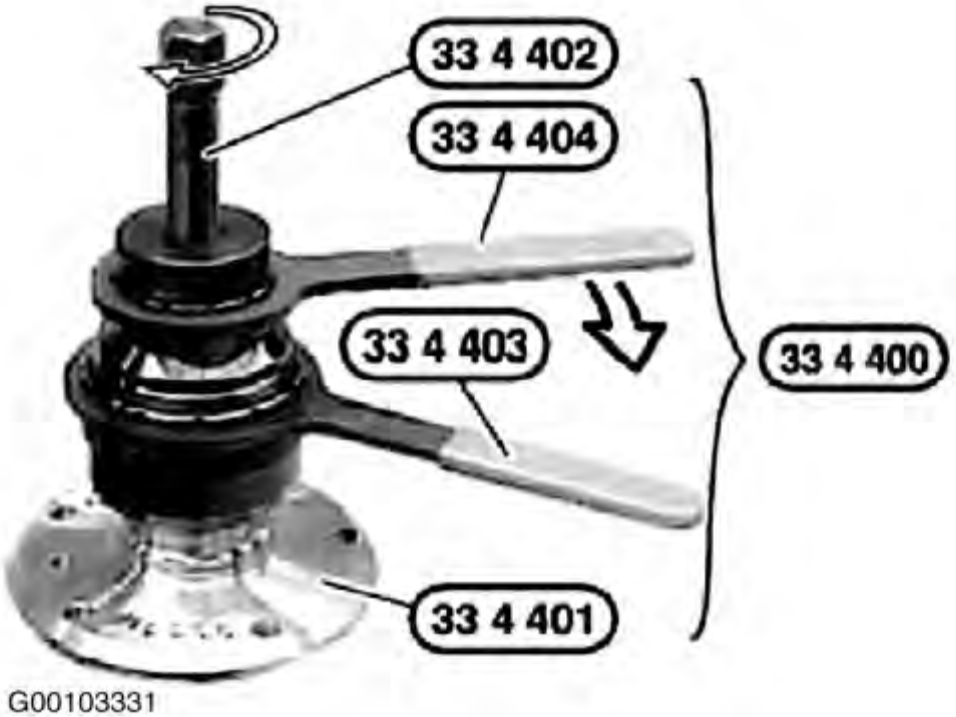


Fig. 36: Using Special Tool 33 4 402
Courtesy of BMW OF NORTH AMERICA, INC.

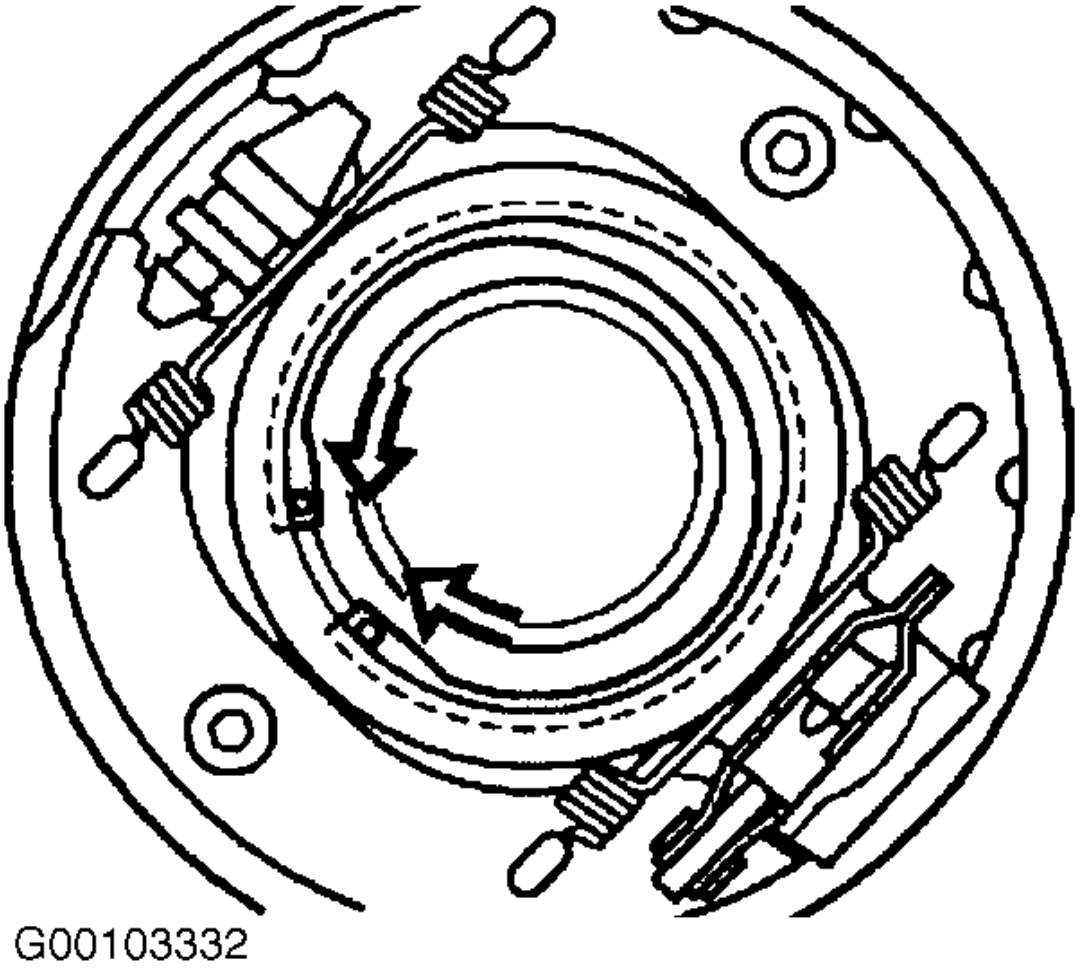


Fig. 37: Locating Circlip
Courtesy of BMW OF NORTH AMERICA, INC.

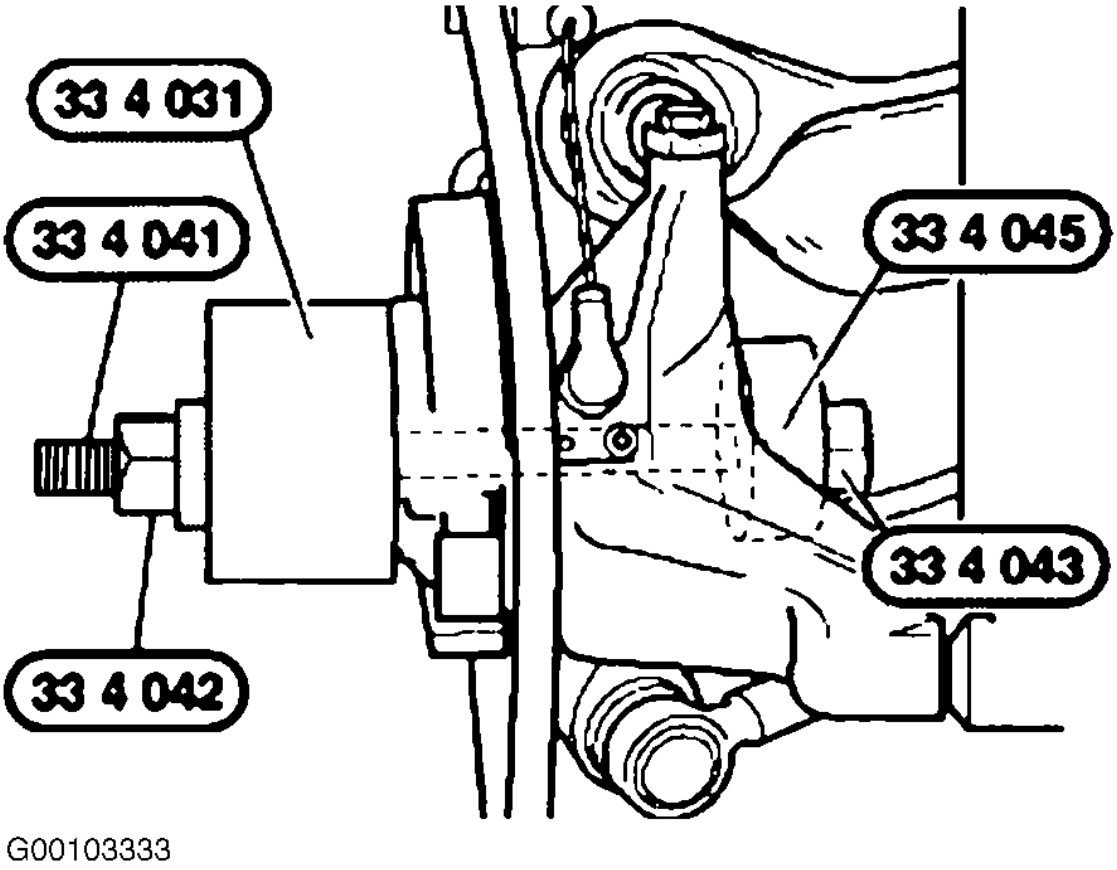


Fig. 38: Removing Wheel Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

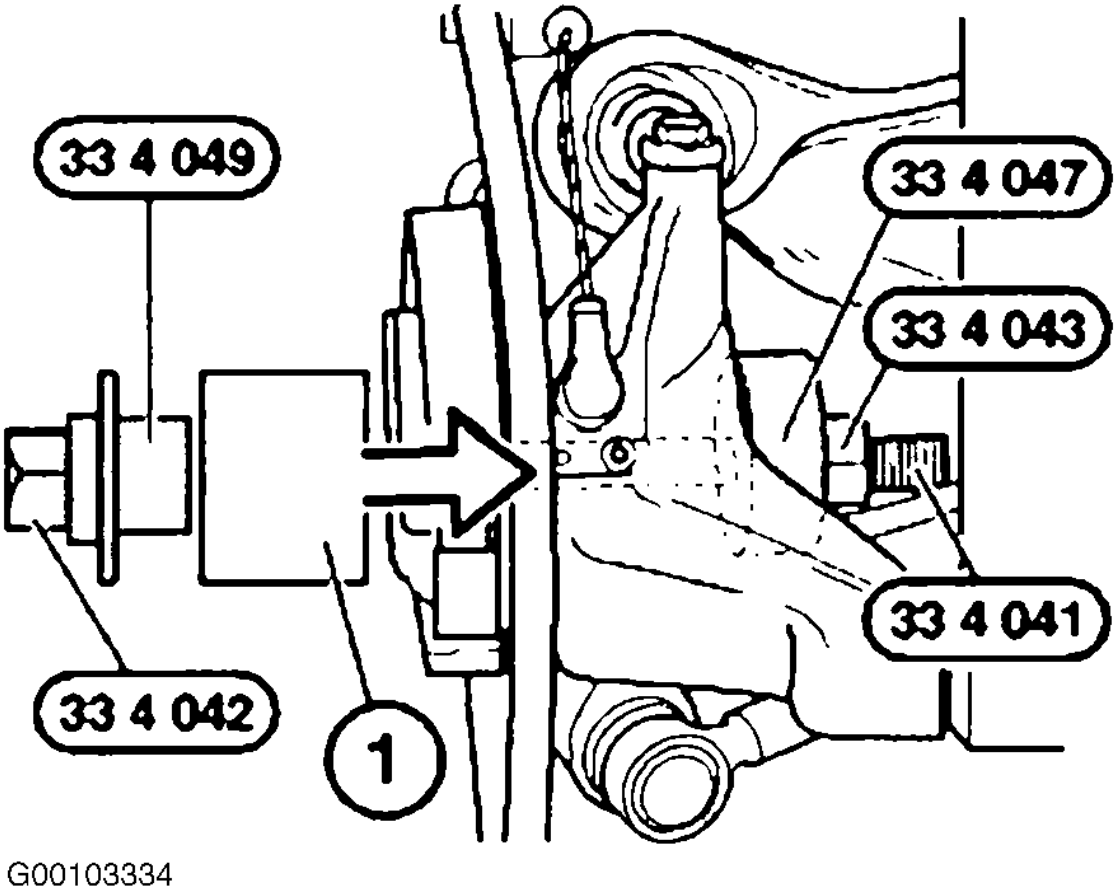


Fig. 39: Pulling In New Wheel Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

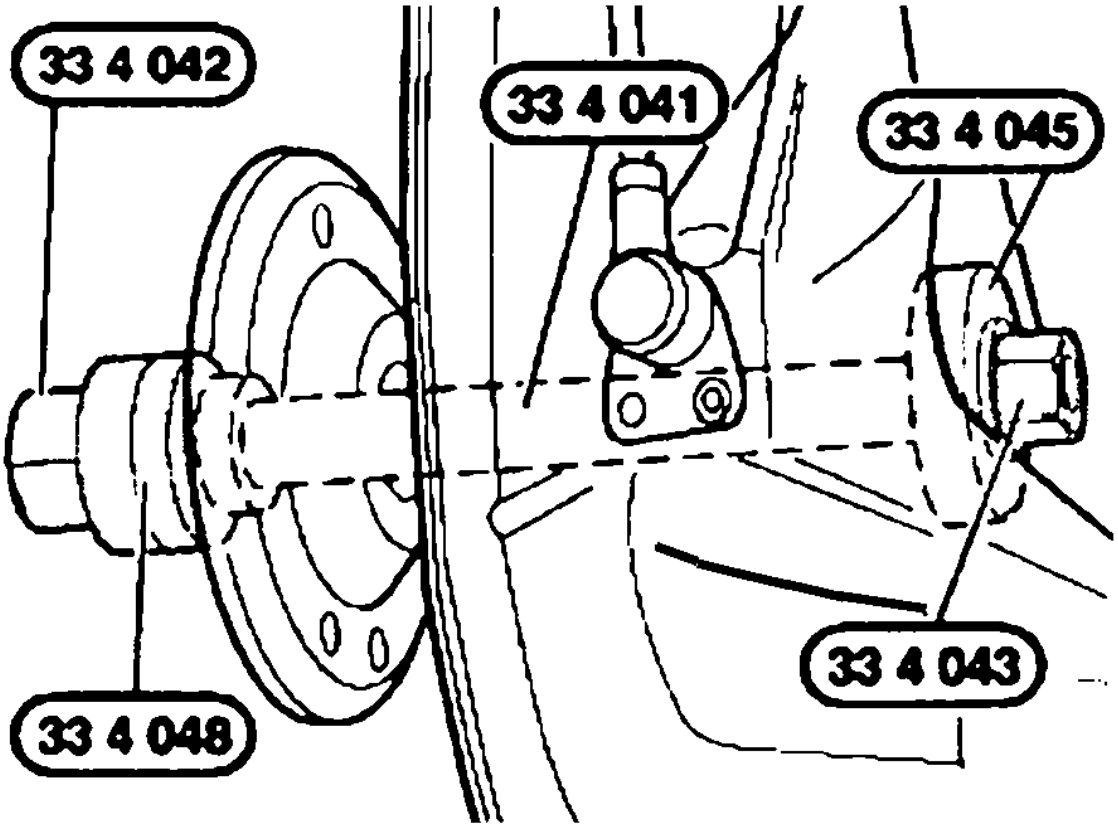


Fig. 40: Pulling In Drive Flange
Courtesy of BMW OF NORTH AMERICA, INC.

M3, M Roadster & M Coupe

1. Raise and support vehicle. Remove wheel(s).
2. Remove axle shaft. See appropriate AXLE SHAFTS article.
3. Remove brake disc. See BRAKE DISC.
4. Screw special tool 33 2 116 onto drive flange with wheel studs. Drive out drive flange with special tool 33 4 201/202/203. See Fig. 33.
5. Remove inner bearing race using special tool 33 3 240. See Fig. 41.
6. It may be necessary to remove inner wheel bearing race with the following procedure:
   - Detach wheel bearing inner race with special tool 33 4 400 through groove in bearing inner race.
   - According to outside diameter of bearing inner race, use special tool 33 4 401 with: 33 4 405 for dia. 45-51 mm, 33 4 406 for dia. 50-55 mm and 33 4 407 for dia. 55-61 mm in groove. See Fig. 35.
   - Tension special tool 33 4 401 with wrenches 33 4 403 and 33 4 404 until it can still just be turned in groove. See Fig. 36.
   - Screw in special tool 33 4 400. Detach inner bearing race.
7. Remove circlip. See Fig. 37.
8. Remove wheel bearing with special tool 33 3 261/ 262/ 263. See Fig. 42.

CAUTION: Do not reuse old wheel bearing. Note installation direction of wheel bearing. The red sealing ring must face outwards. Otherwise, ABS function is not assured by the impulse sensor integrated in the bearing.

9. Draw in new wheel bearing with special tool 33 3 261/ 264/ 265. See Fig. 43.
10. Installation is reverse of removal.
11. Replace stretched or damaged circlip. Ensure correct seating.
12. Pull in drive flange using special tool (33 3 261/ 262/ 263). See Fig. 44.
13. Install brake disc.
14. Install axle shaft.

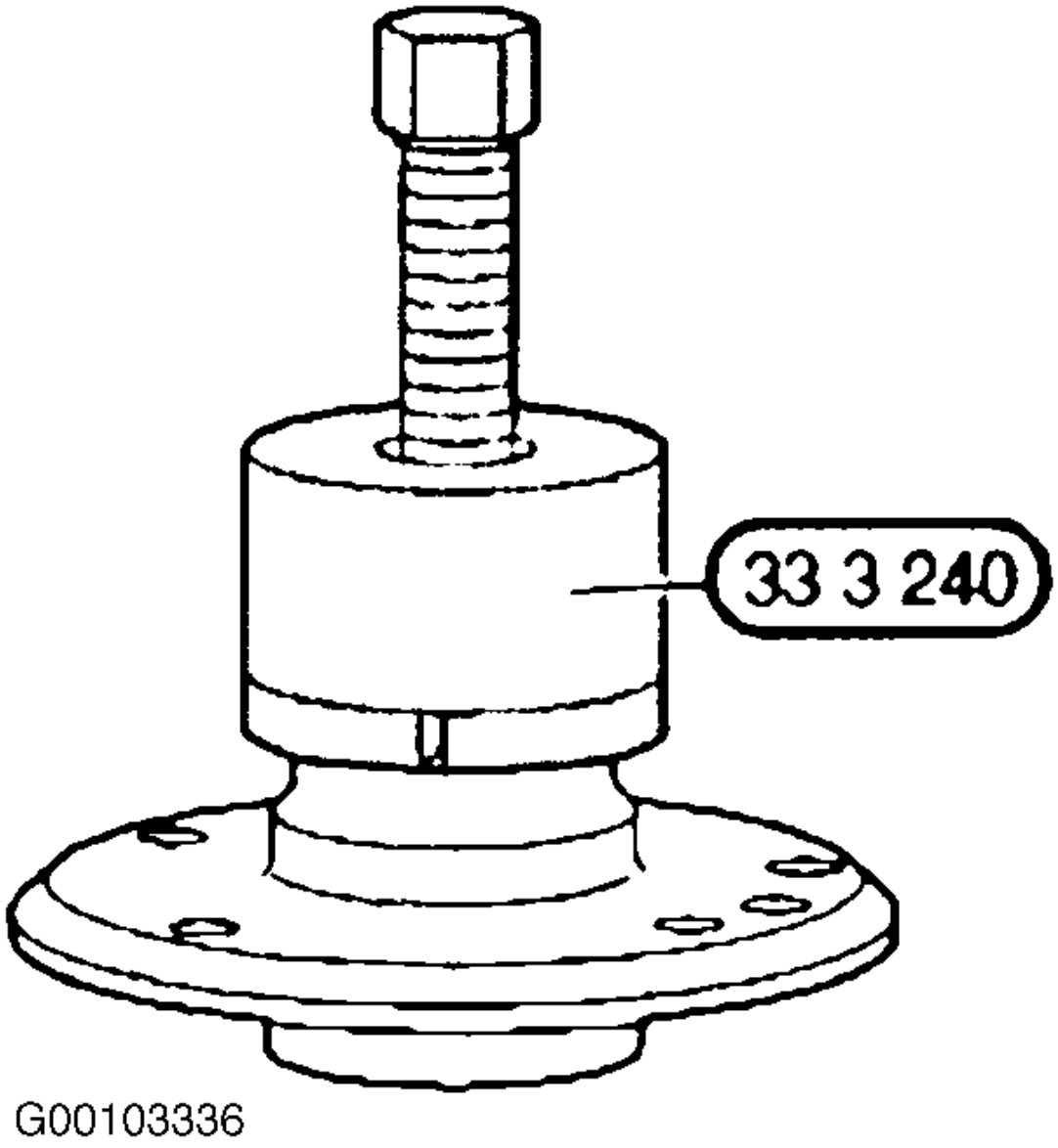


Fig. 41: Removing Inner Bearing Race From Drive Flange
Courtesy of BMW OF NORTH AMERICA, INC.

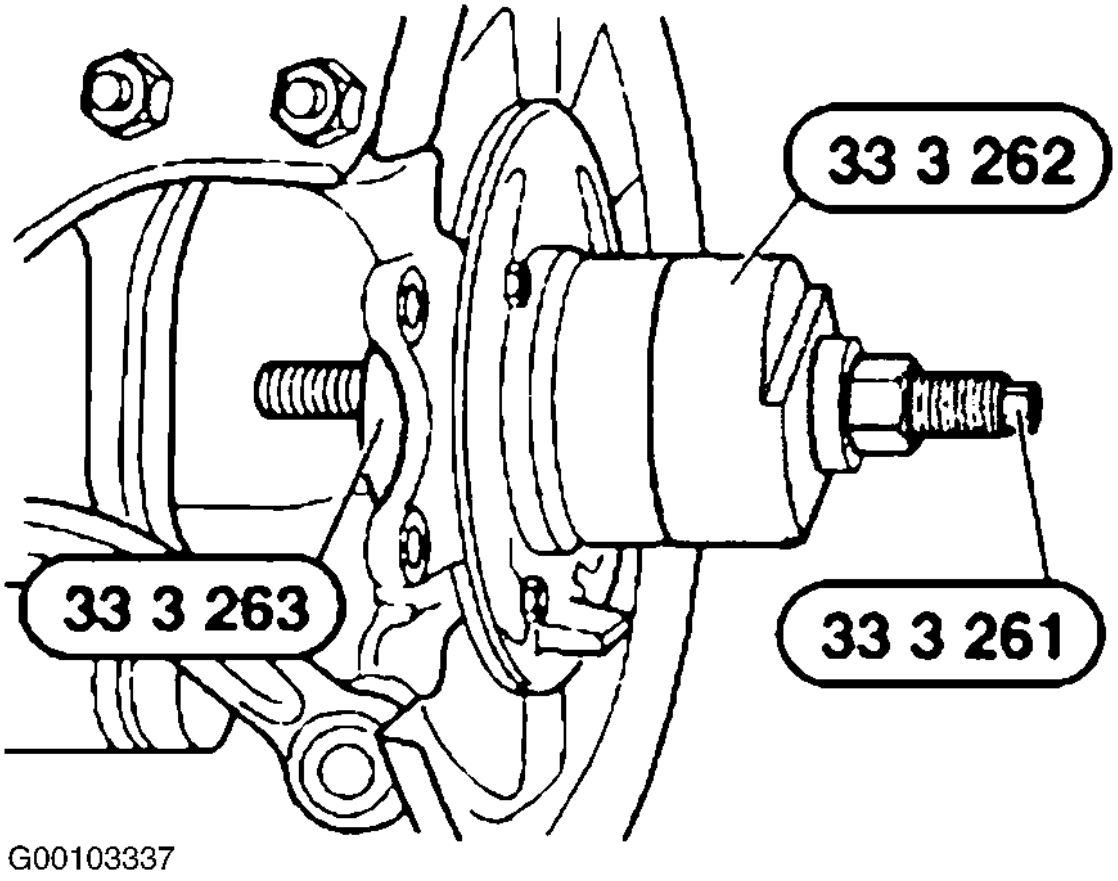


Fig. 42: Pulling Out Wheel Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

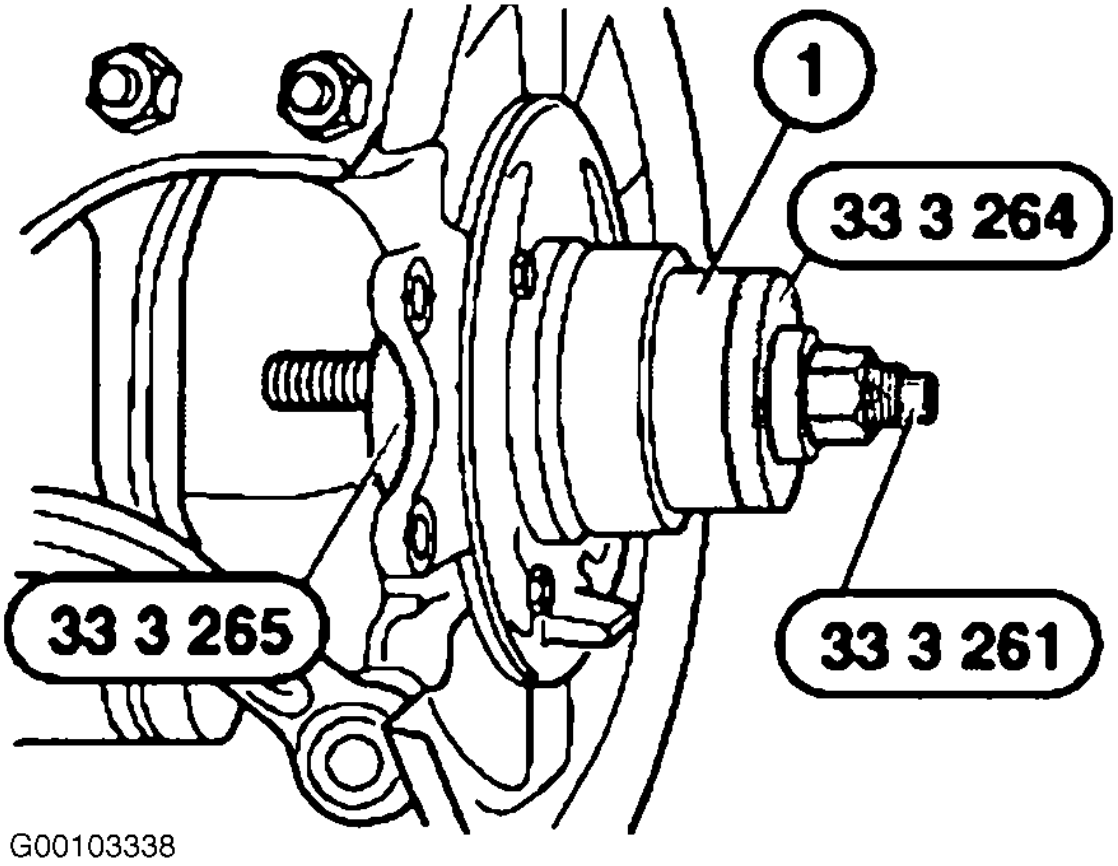


Fig. 43: Pulling In New Wheel Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

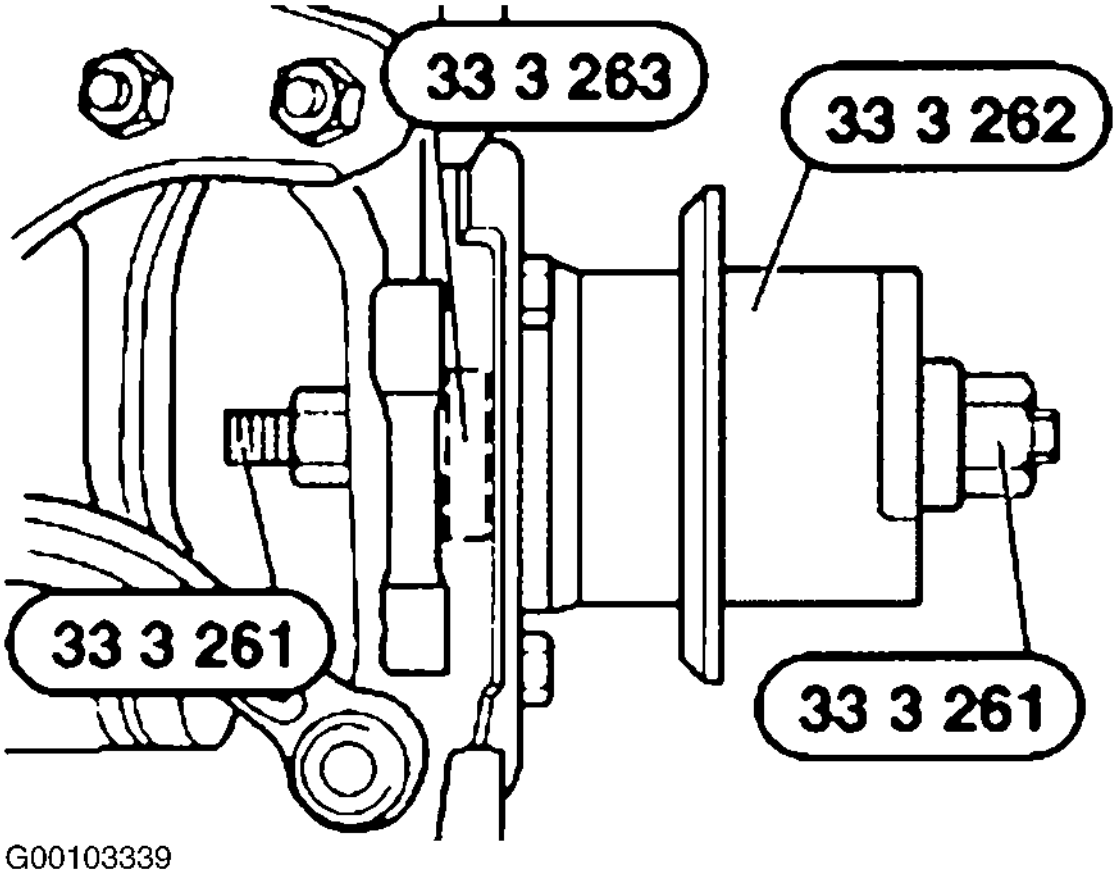


Fig. 44: Pulling In Drive Flange
Courtesy of BMW OF NORTH AMERICA, INC.

318ti & Z3

1. Raise and support vehicle. Remove wheel(s).
2. Remove axle shaft. See appropriate AXLE SHAFTS article.
3. Remove brake disc. See BRAKE DISC.
4. Screw special tool 33 2 116 onto drive flange with wheel studs. Drive out drive flange with special tool 33 4 201/202/203. See Fig. 33.
5. If necessary, remove inner bearing race using special tool 00 7 500/33 1 307. See Fig. 45. For Z3 2.8 see Fig. 46.
6. It may be necessary to remove inner wheel bearing race with the following procedure:
   - Detach wheel bearing inner race with special tool 33 4 400 through groove in bearing inner race.
   - According to outside diameter of bearing inner race, use special tool 33 4 401 with: 33 4 405 for dia. 45-51 mm, 33 4 406 for dia. 50-55 mm and 33 4 407 for dia. 55-61 mm in groove. See Fig. 35.
   - Tension special tool 33 4 401 with wrenches 33 4 403 and 33 4 404 until it can still just be turned in groove. See Fig. 36.
   - Screw in special tool 33 4 402. Detach inner bearing race.
7. Remove circlip. See Fig. 37.
8. Remove wheel bearing with special tool 33 4 041/042/043/044/045. See Fig. 47. For Z3 2.8 use 33 4 031/032/033/038/039. See Fig. 48.

CAUTION: Do not reuse old wheel bearing.

9. Draw in new wheel bearing with special tool 33 4 041/042/043/046/047. See Fig. 49. For Z3 2.8 use 33 4 032/034/035/038/039. See Fig. 50.
10. Installation is reverse of removal.
11. Replace stretched or damaged circlip. Ensure correct seating.
12. Pull in drive flange using special tool 33 4 041/042/045/048. See Fig. 51. For Z3 2.8 use 33 4 041/0424/045/048. See Fig. 52.
13. Install brake disc.
14. Install axle shaft.

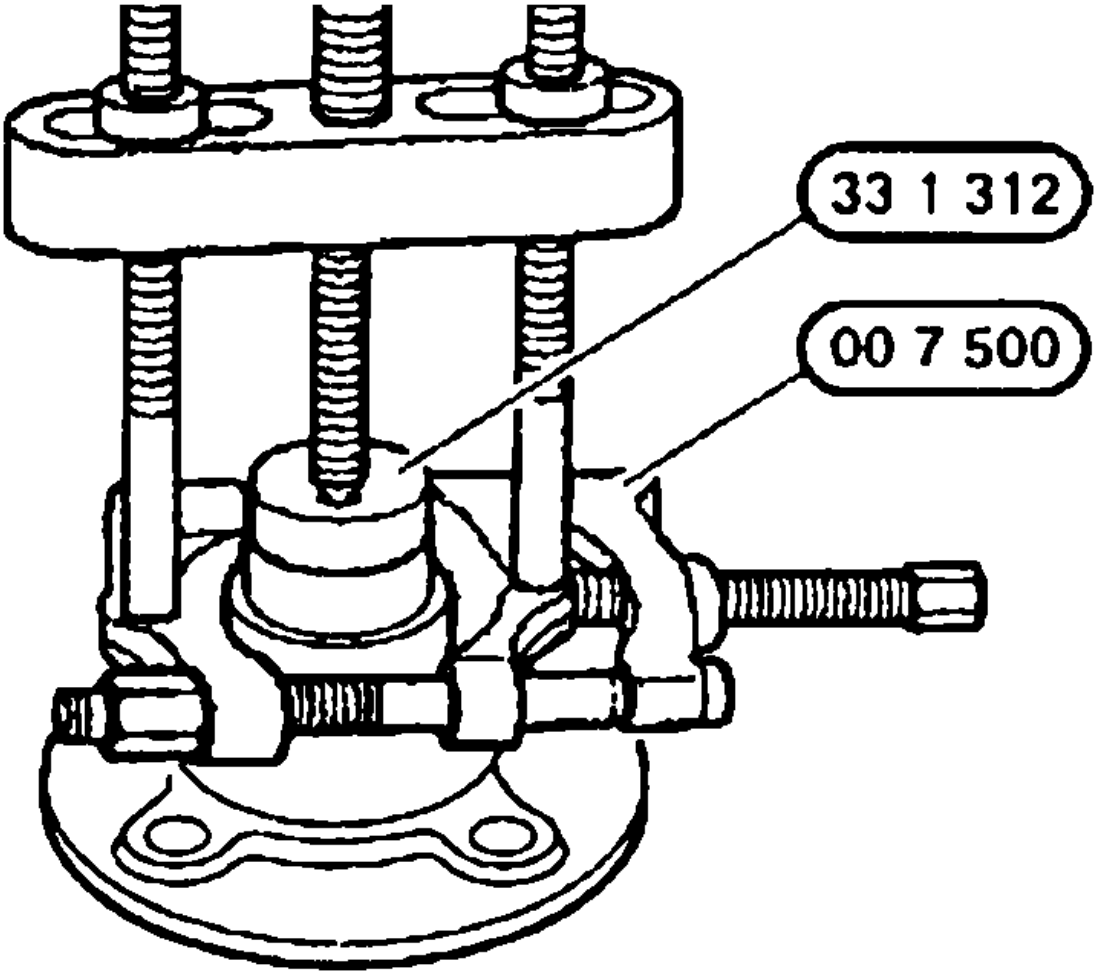


Fig. 45: Pulling Off Bearing Inner Race
Courtesy of BMW OF NORTH AMERICA, INC.

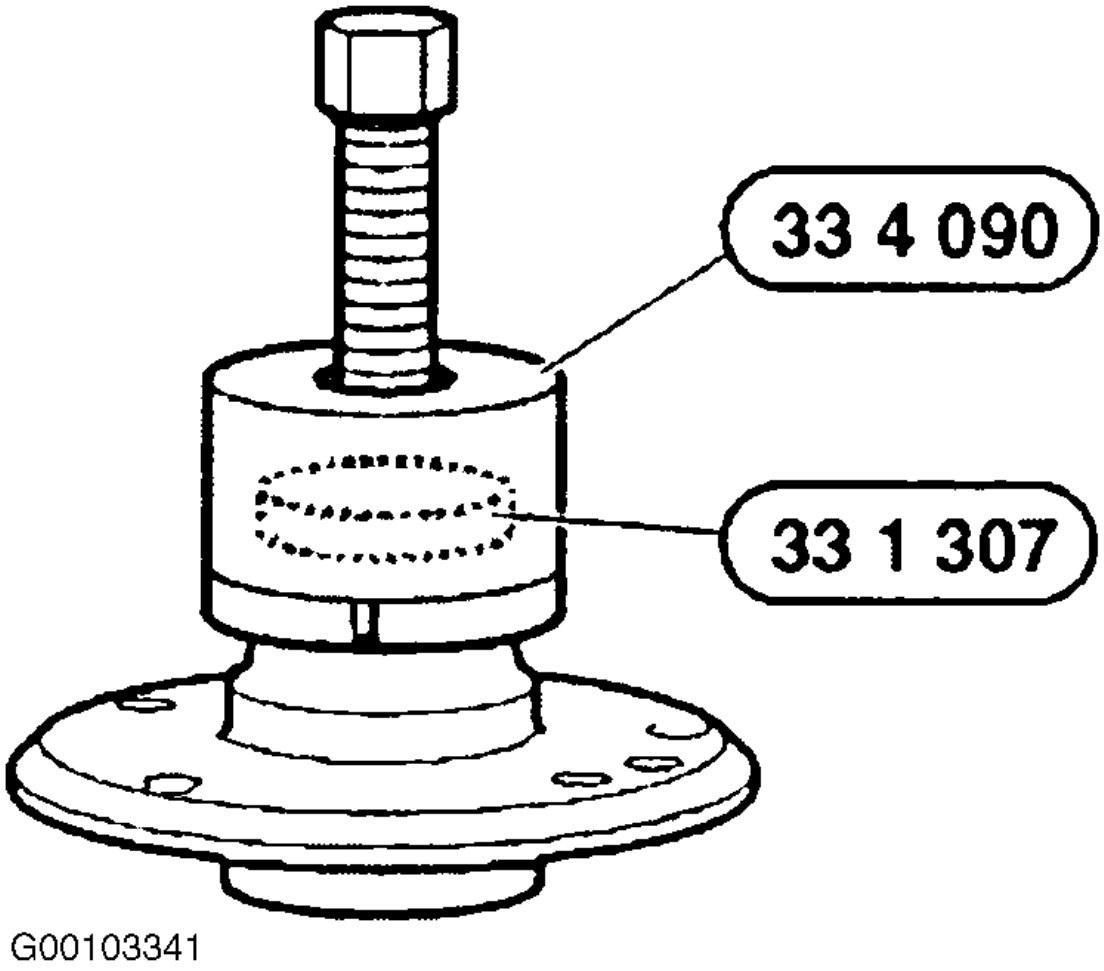


Fig. 46: Pulling Off Bearing Inner Race (Z3 2.8)
Courtesy of BMW OF NORTH AMERICA, INC.

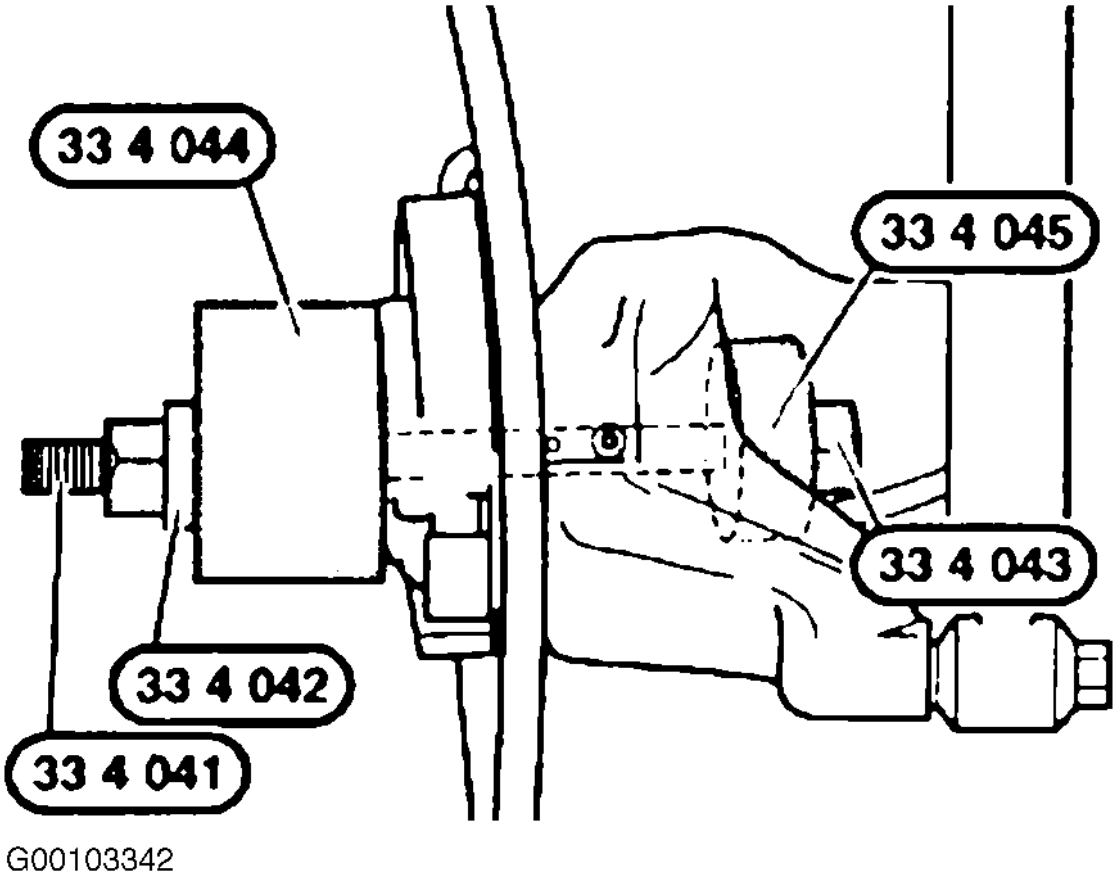


Fig. 47: Removing Wheel Bearing (318ti, Z3 Except 2.8)
Courtesy of BMW OF NORTH AMERICA, INC.

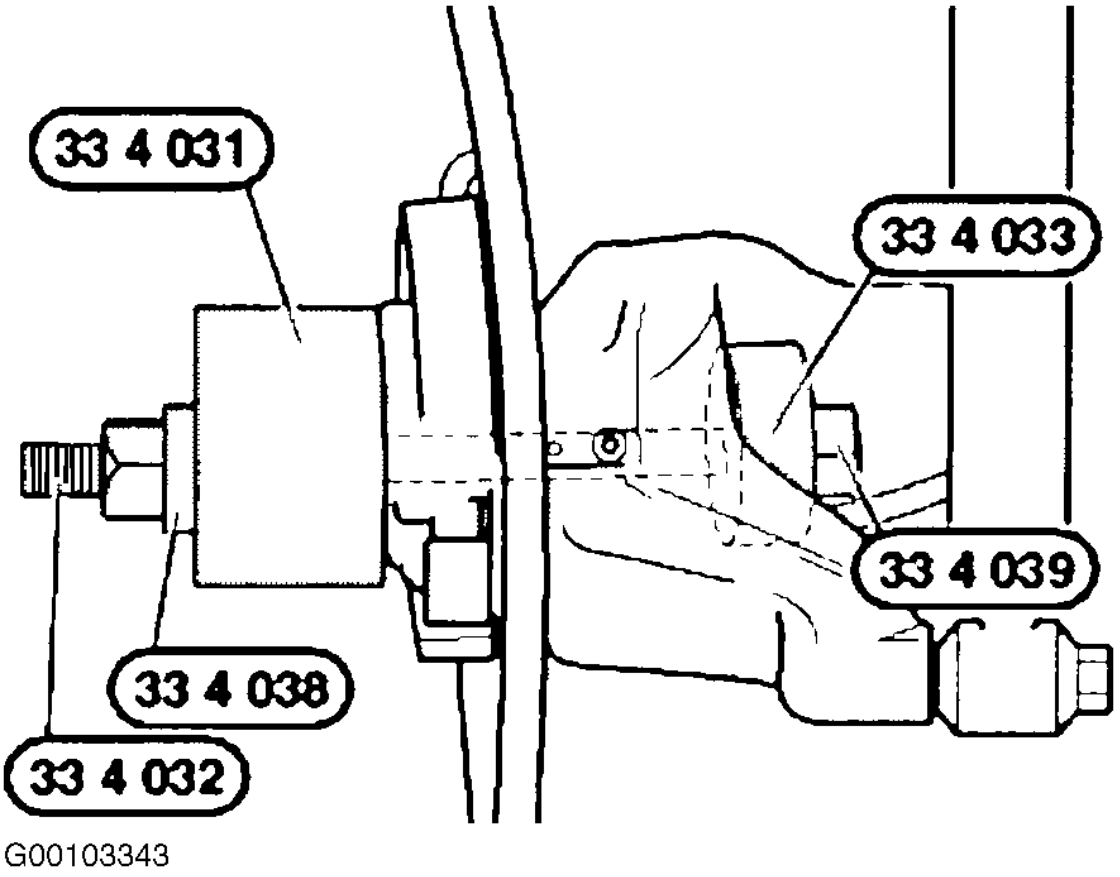


Fig. 48: Removing Wheel Bearing (Z3 2.8)
Courtesy of BMW OF NORTH AMERICA, INC.

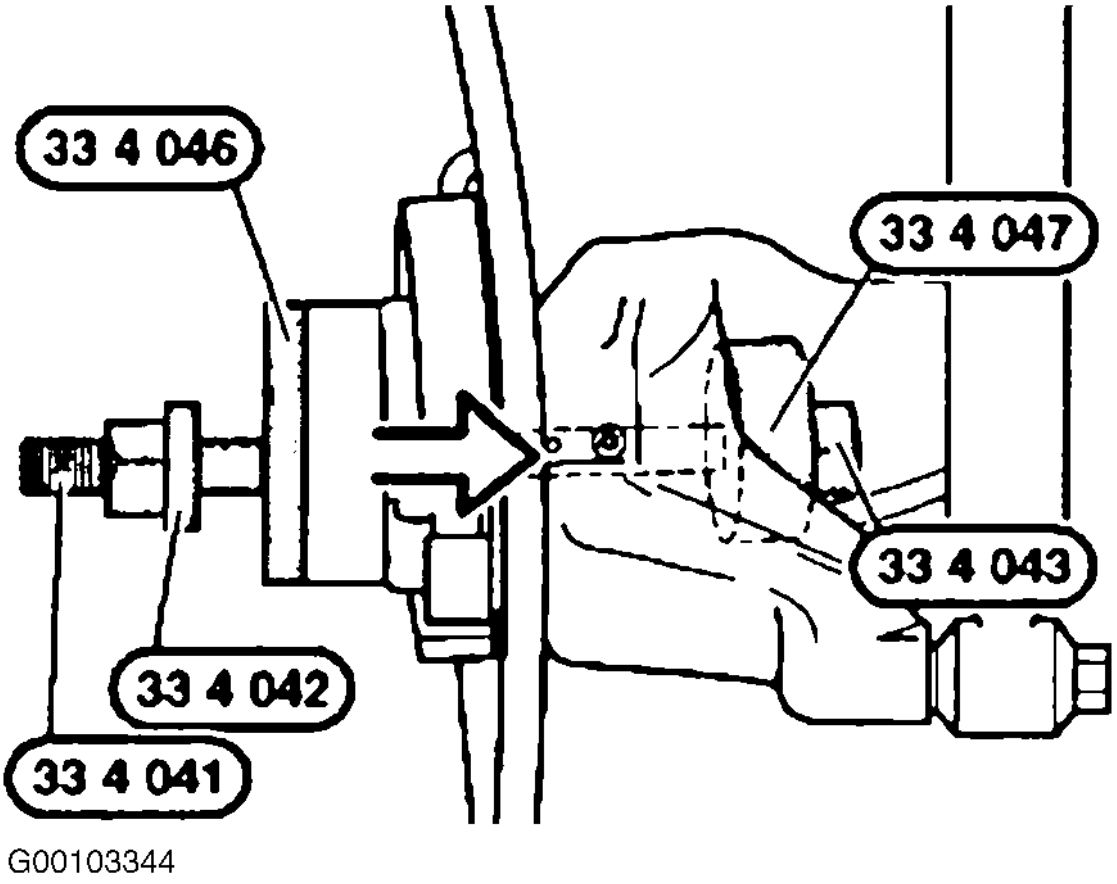


Fig. 49: Pulling In New Wheel Bearing (318ti, Z3 Except 2.8)
Courtesy of BMW OF NORTH AMERICA, INC.

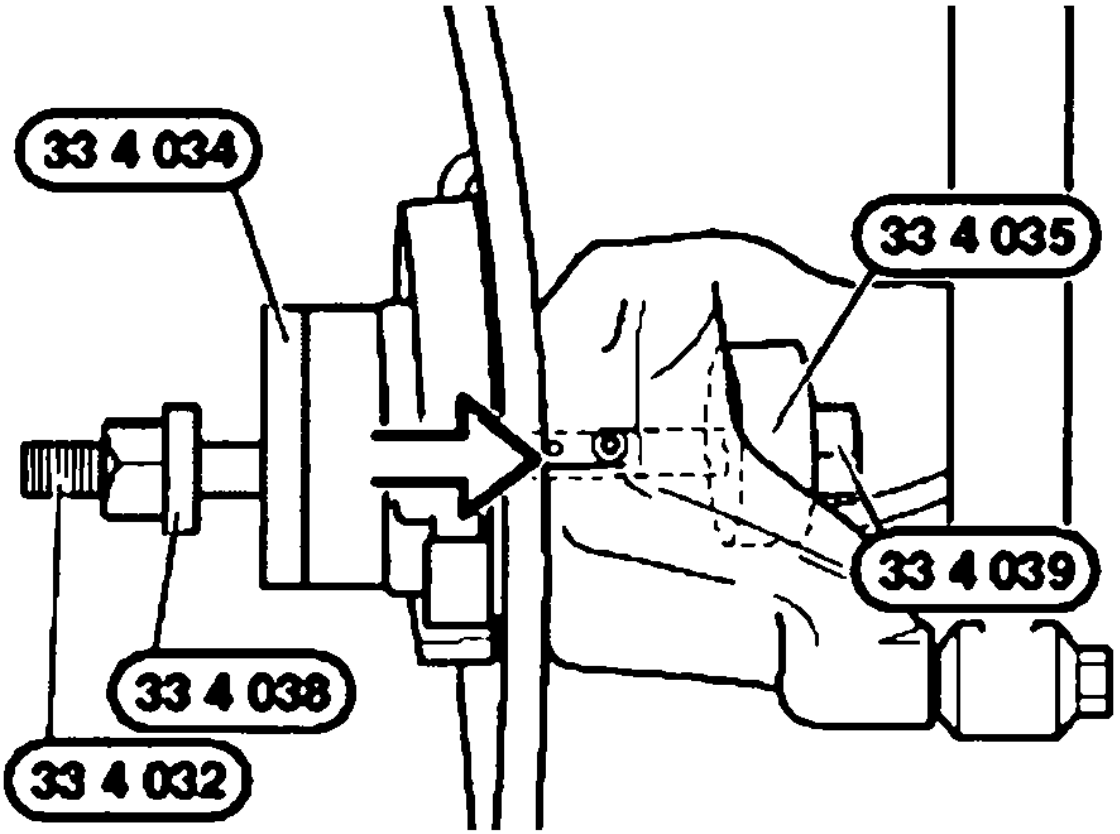


Fig. 50: Pulling In New Wheel Bearing (Z3 2.8)
Courtesy of BMW OF NORTH AMERICA, INC.

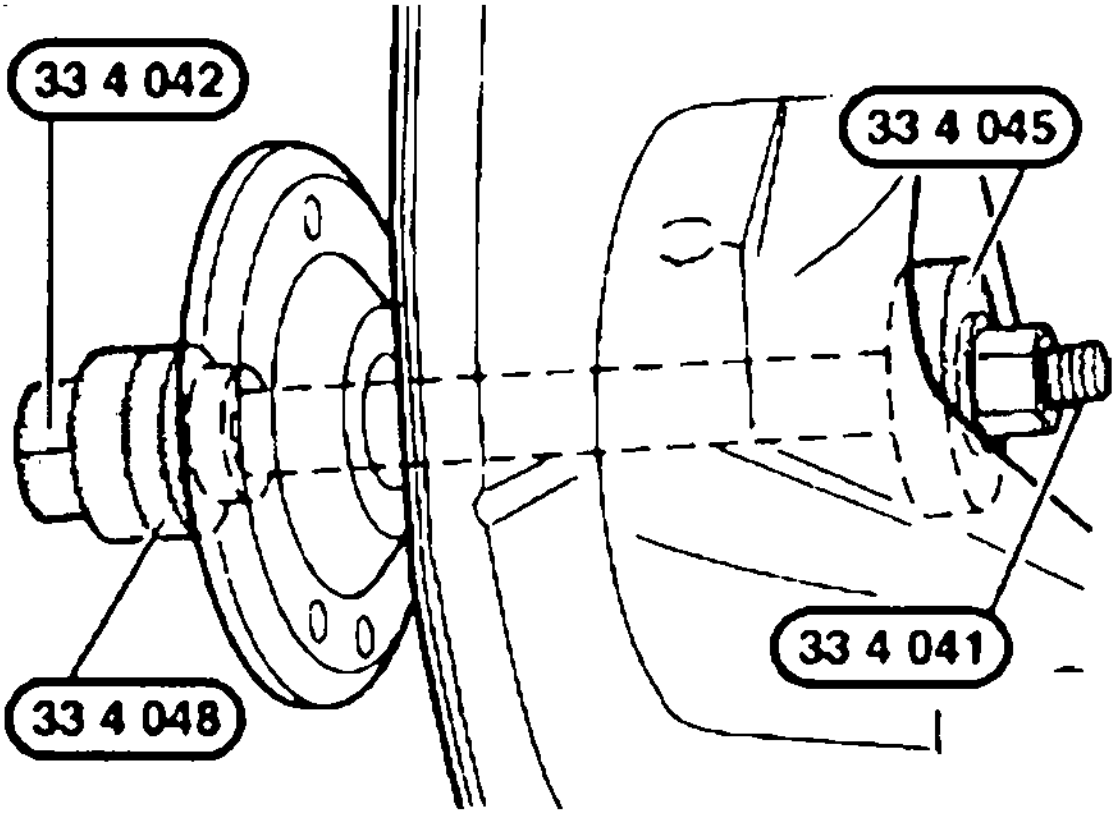


Fig. 51: Pulling In Drive Flange (318ti, Z3 Except 2.8
Courtesy of BMW OF NORTH AMERICA, INC.

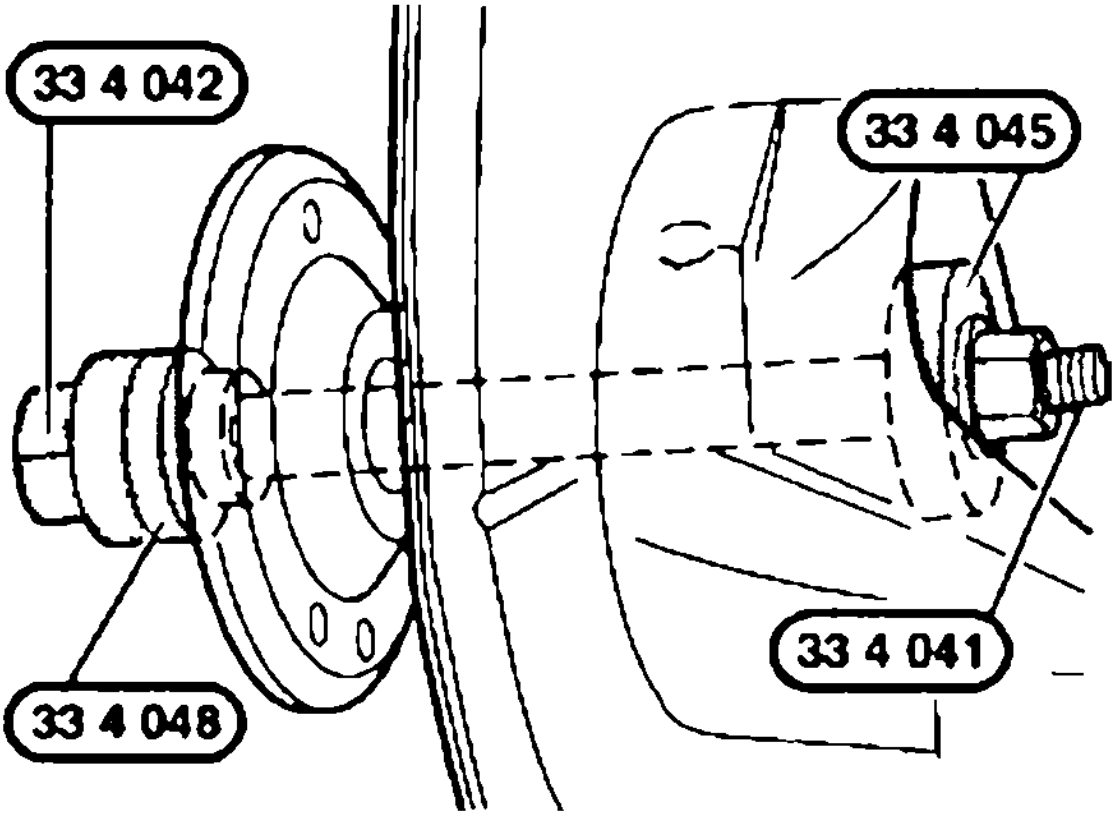


Fig. 52: Pulling In Drive Flange (Z3 2.8)
Courtesy of BMW OF NORTH AMERICA, INC.

5-Series

1. Raise and support vehicle. Remove wheel(s).
2. Unfasten collar nut (1). See Fig. 53.
3. Remove brake disc. See BRAKE DISC.
4. Screw special tool 33 2 116 onto drive flange with wheel studs. Drive out drive flange with special tool 33 4 201/202/203. See Fig. 33.
5. If necessary, pull off bearing inner race using special tool 33 1 312/ 00 7 500 from groove in bearing race. See Fig. 45.
6. It may be necessary to remove inner wheel bearing race with the following procedure:
   - Detach wheel bearing inner race with special tool 33 4 400 through groove in bearing inner race.
   - According to outside diameter of bearing inner race, use special tool 33 4 401 with: 33 4 405 for dia. 45-51 mm, 33 4 406 for dia. 50-55 mm and 33 4 407 for dia. 55-61 mm in groove. See Fig. 35.
   - Tension special tool 33 4 401 with wrenches 33 4 403 and 33 4 404 until it can still just be turned in groove. See Fig. 36.
   - Screw in special tool 33 4 402. Detach inner bearing race.
7. Unfasten screws and remove wheel bearing. See Fig. 54.

CAUTION: Do not reuse old wheel bearing.

8. Install new wheel bearing. The contact faces (2) of wheel bearing and wheel carrier and the tapped bores (1) must be clean and free of grease. See Fig. 55.

9. For bottom screws use 1/2" socket wrench with joint. For upper screws use 1/2" socket wrench with extension. Tighten to specification. See TORQUE SPECIFICATIONS.
10. Apply light coat of oil to drive flange (1). Attach drive flange on spline of axle shaft and tighten it down using special tool 33 2 115/ 116/ 118. See Fig. 56.
11. Install brake disc.
12. Lightly oil and replace collar nut. Tighten to specification. See TORQUE SPECIFICATIONS.
13. Secure collar nut by peening in flat areas of axle shaft.

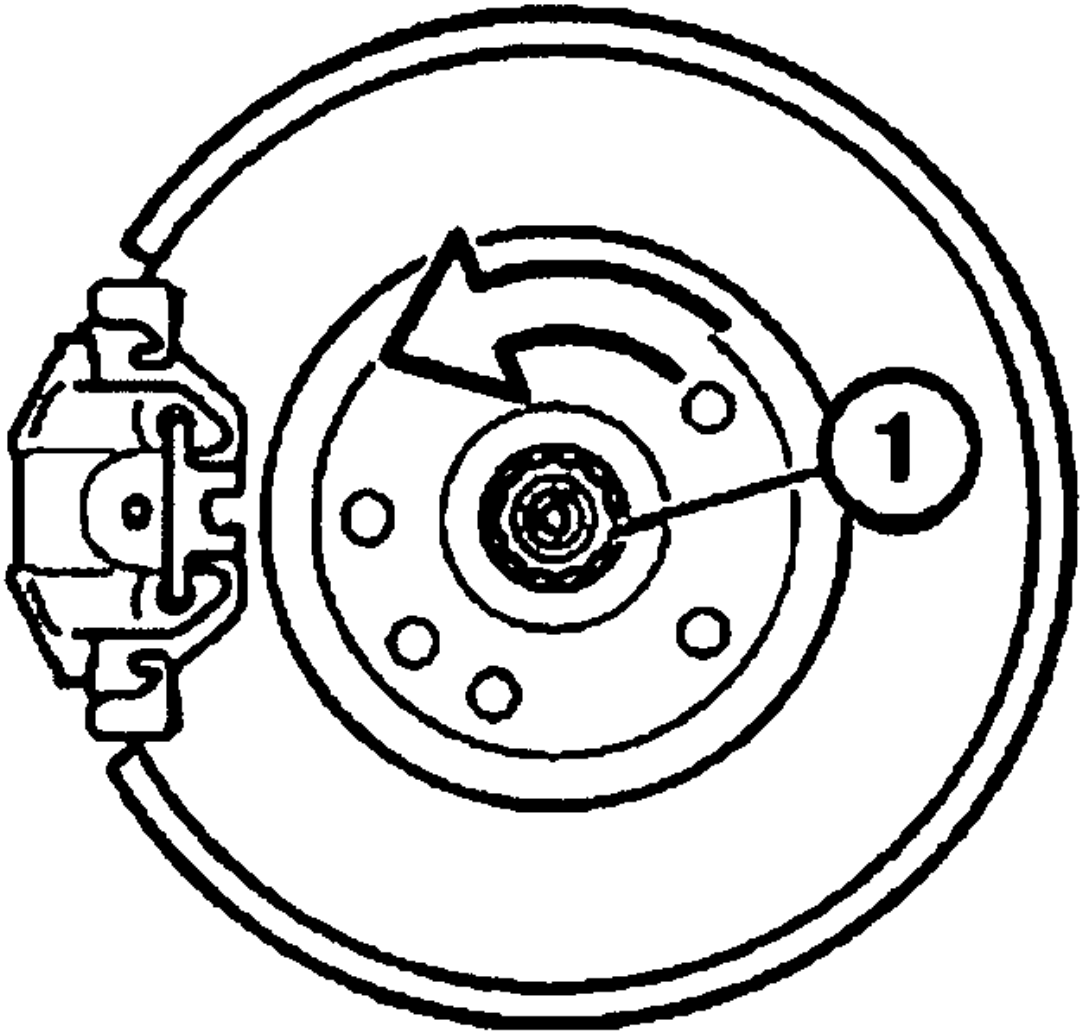


Fig. 53: Locating Collar Nut
Courtesy of BMW OF NORTH AMERICA, INC.

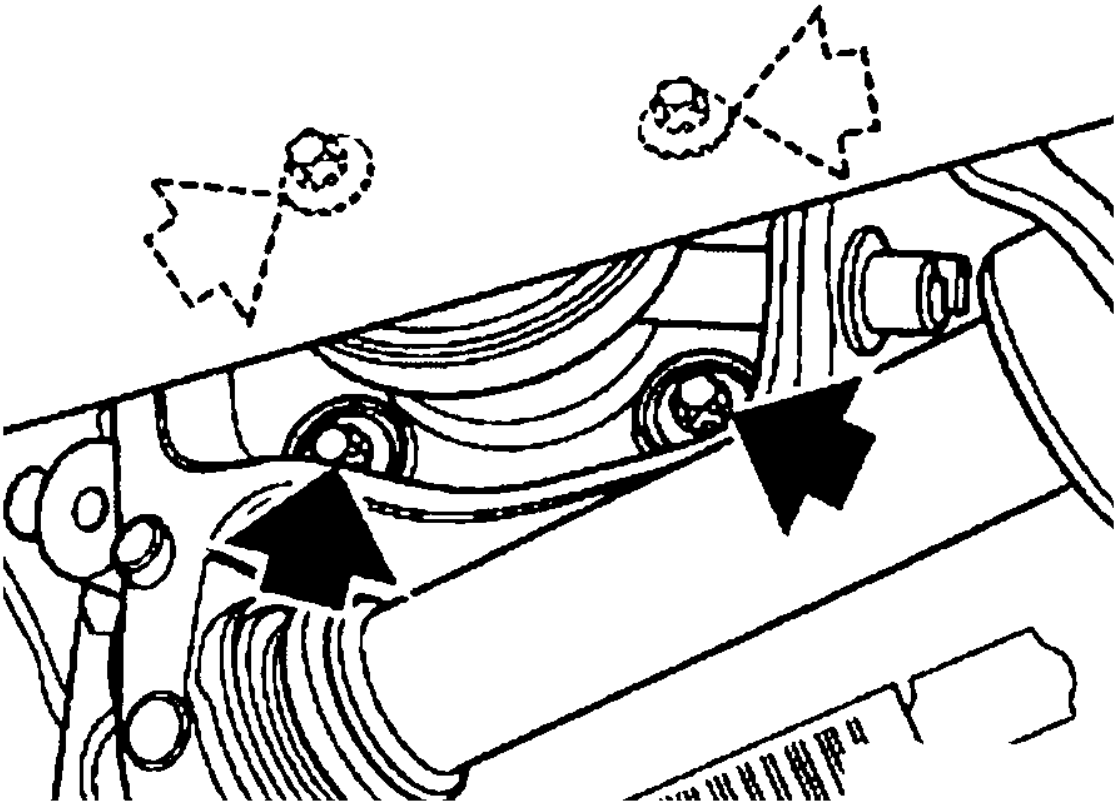


Fig. 54: Locating Wheel Bearing Screws
Courtesy of BMW OF NORTH AMERICA, INC.

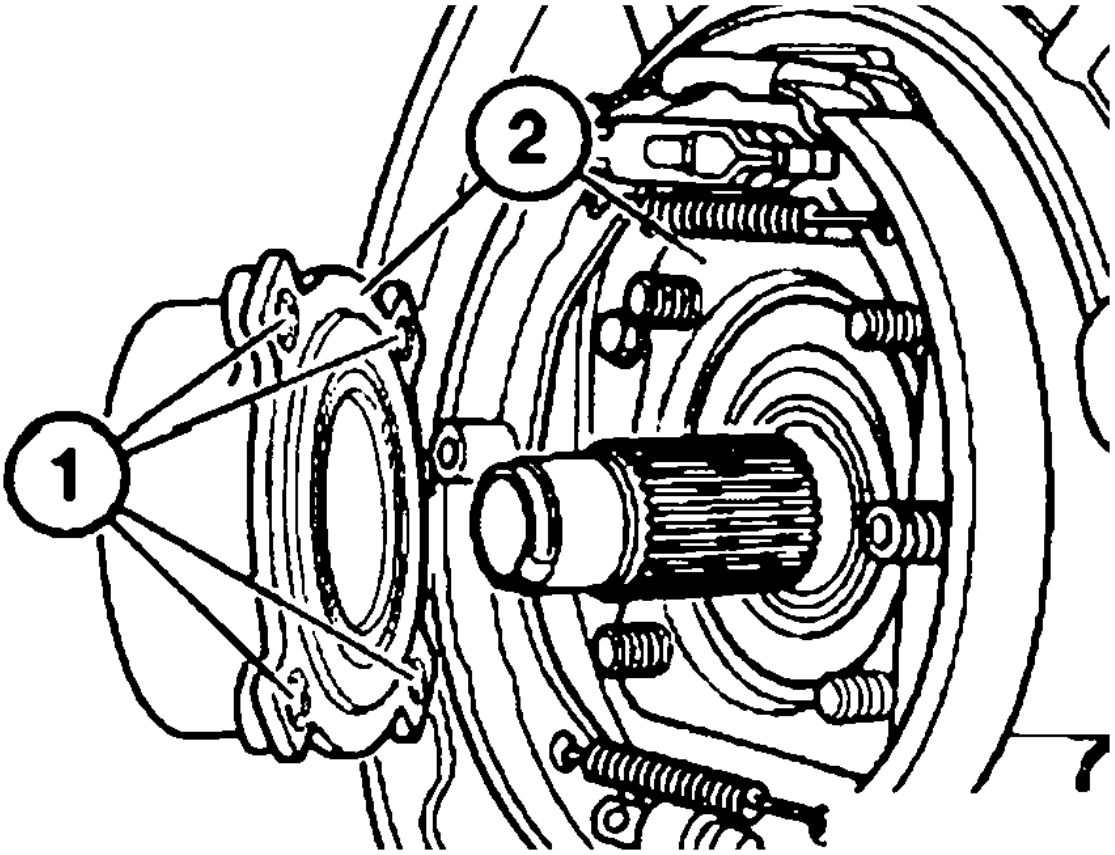


Fig. 55: Locating Contact Faces
Courtesy of BMW OF NORTH AMERICA, INC.

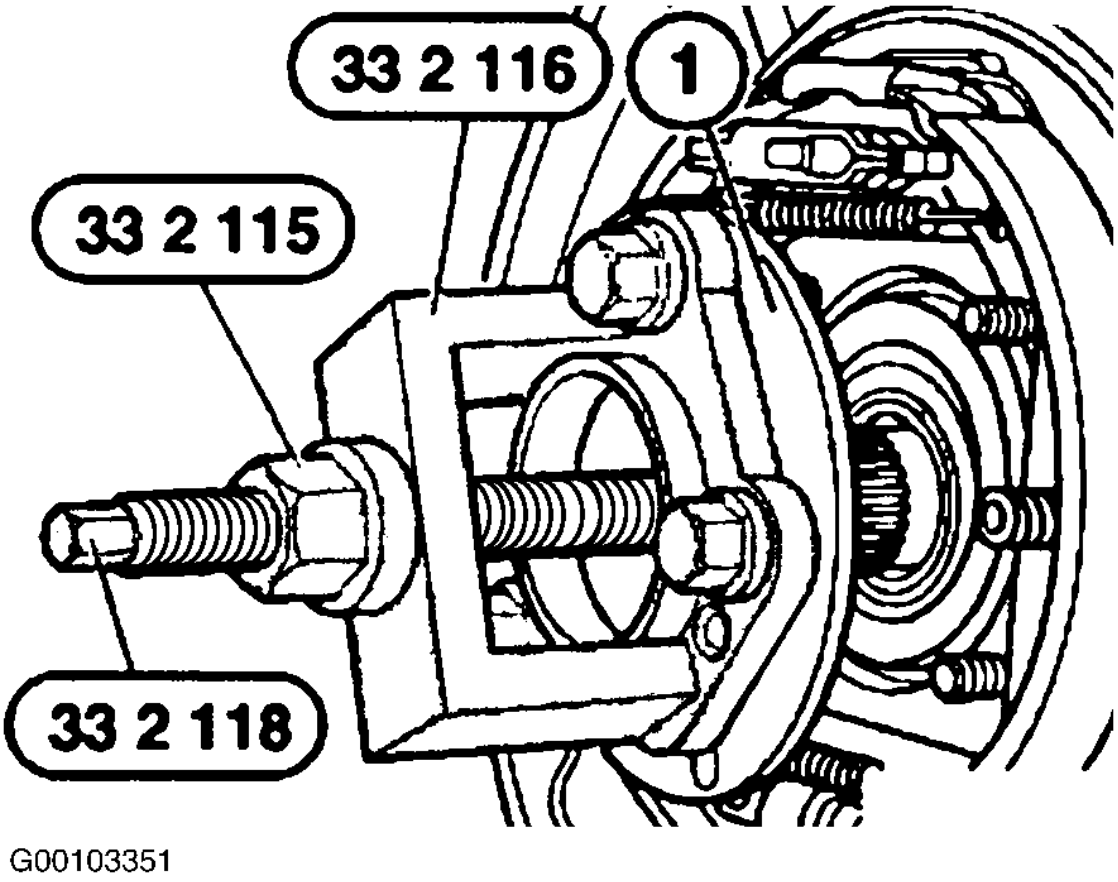


Fig. 56: Attaching Drive Flange
Courtesy of BMW OF NORTH AMERICA, INC.

7-Series (Except 735i & 745i)

1. Raise and support vehicle. Remove wheel(s).
2. Remove axle shaft. See appropriate AXLE SHAFTS article.
3. Remove brake disc. See BRAKE DISC.
4. Remove ABS pulse generator.
5. Screw special tool 33 2 116 onto drive flange with wheel studs. Drive out drive flange with special tool 33 4 201/202/203. See Fig. 33.
6. If necessary, detach wheel bearing inner race from drive flange.
7. Remove circlip. See Fig. 37.
8. Remove wheel bearing with special tool 33 3 261/ 262/ 266. See Fig. 57.

CAUTION: Note installation direction of wheel bearing. The red sealing ring must face outwards. Otherwise, ABS function is not assured by the impulse sensor integrated in the bearing.

9. Draw in new wheel bearing (1) with special tool 33 3 261/ 264/ 268. See Fig. 58.
10. Insert new circlip.
11. Pull in drive flange using special tool 33 3 261/ 266/ 267. See Fig. 59.
12. Draw in axle shaft with special tool 33 2 115/ 116/ 118. See Fig. 60.
13. Install wheel(s).

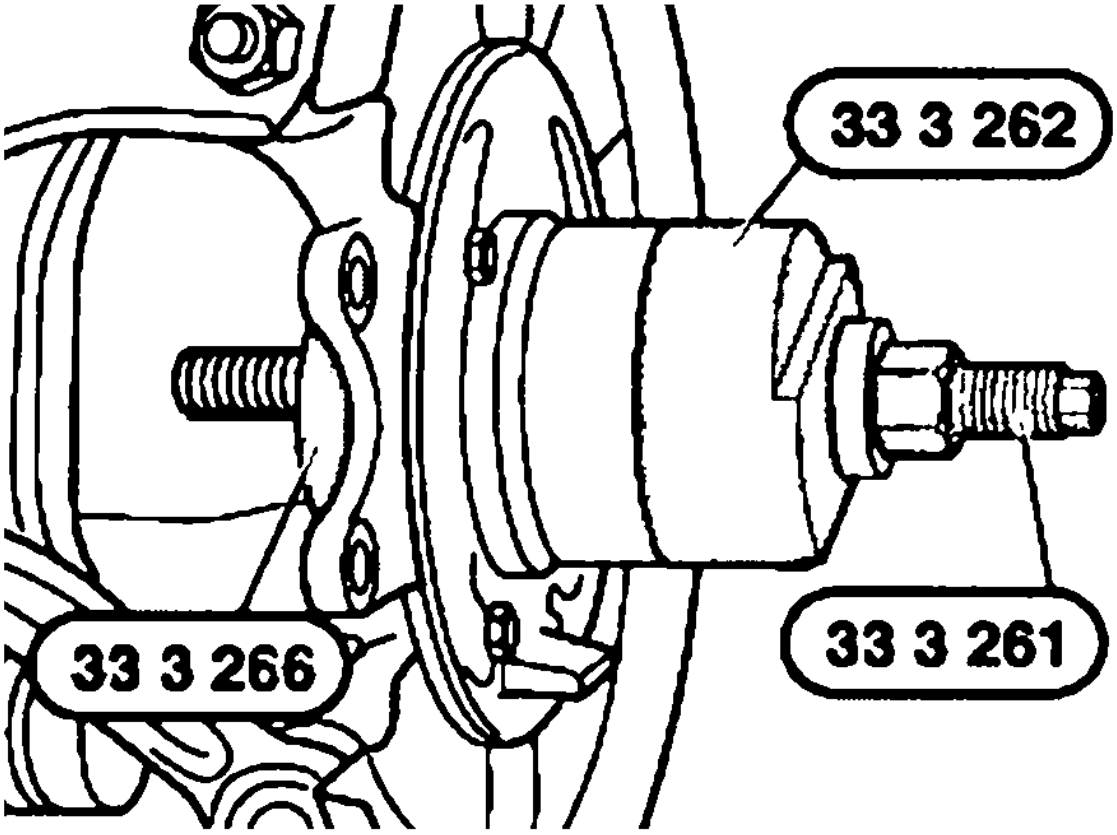


Fig. 57: Removing Wheel Bearing (7-Series)
Courtesy of BMW OF NORTH AMERICA, INC.

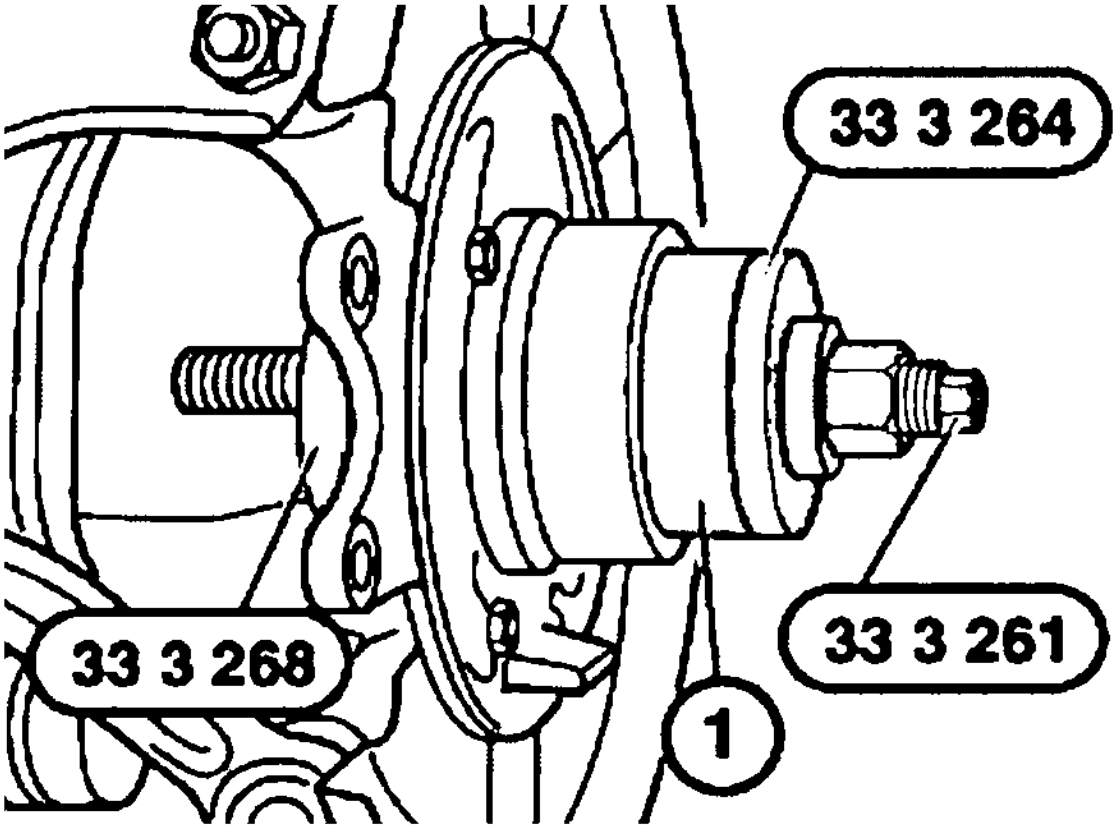


Fig. 58: Drawing In Wheel Bearing (7-Series)
Courtesy of BMW OF NORTH AMERICA, INC.

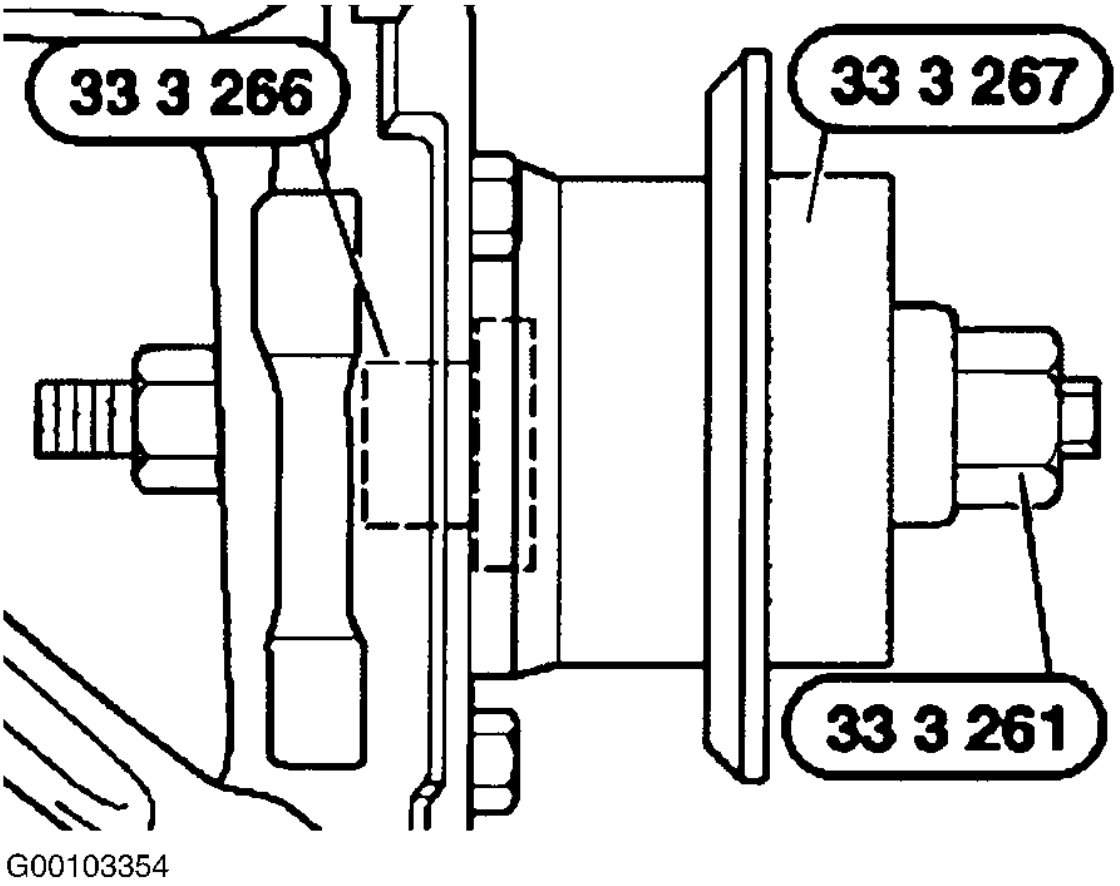


Fig. 59: Pulling In Drive Flange (7-Series)
Courtesy of BMW OF NORTH AMERICA, INC.

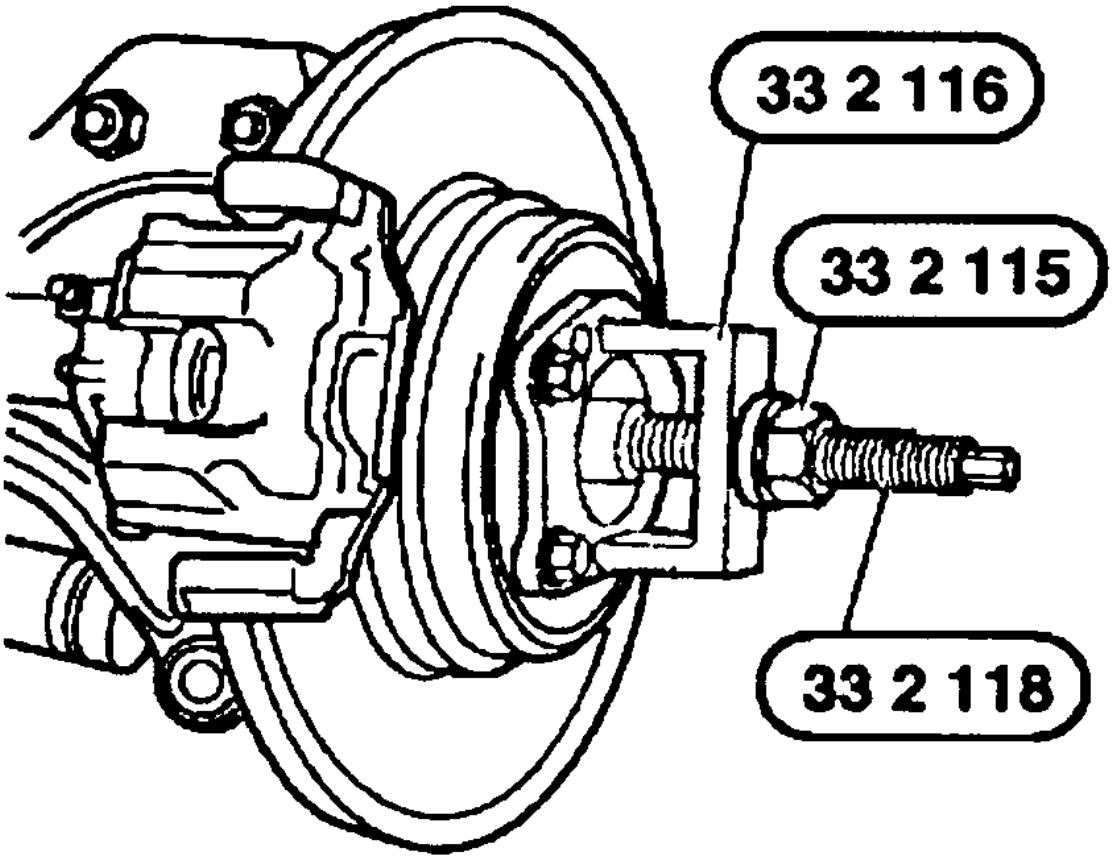


Fig. 60: Drawing In Axle Shaft (7-Series)
Courtesy of BMW OF NORTH AMERICA, INC.

735i & 745i

1. Raise and support vehicle. Remove wheel(s).
2. Unfasten collar nut (1). Operate brake to do so. See Fig. 53.
3. Remove brake disc. See BRAKE DISC.
4. Screw special tool 33 2 116 onto drive flange with wheel studs. Drive out drive flange with special tool 33 4 201/202/203. See Fig. 33.
5. If necessary, pull off bearing inner race from drive flange.
6. Unfasten screws and remove wheel bearing. See Fig. 54.

CAUTION: Do not reuse old wheel bearing.

7. Install new wheel bearing. The contact faces (2) of wheel bearing and wheel carrier and the tapped bores (1) must be clean and free of grease. See Fig. 55.
8. For bottom screws use 1/2" socket wrench with joint. For upper screws use 1/2" socket wrench with extension. Tighten to specification. See TORQUE SPECIFICATIONS.
9. Apply light coat of oil to drive flange (1). Attach drive flange on spline of axle shaft and tighten it down using special tool 33 2 115/ 116/ 118. See Fig. 56.
10. Install brake disc.
11. Lightly oil and replace collar nut. Tighten to specification. See TORQUE SPECIFICATIONS.
12. Secure collar nut by caulking it at flat areas of axle shaft.

OVERHAUL

LEFT OR RIGHT FRONT BRAKE CALIPER

Disassembly

1. Remove caliper. See CALIPER ASSEMBLY.
2. Remove pads from caliper. Remove caliper piston retaining ring (if equipped) and dust boot. Insert wooden block in caliper cavity. See Fig. 61.

WARNING: When pressing out brake caliper piston large forces occur. Be careful of fingers.

3. Slowly apply air pressure to fluid inlet of caliper to force out piston. To protect piston, place a protective plate (hard wood or hard felt) in caliper recess.
4. Check guide sleeves (5), fitting repair-kit guide sleeve if necessary. See Fig. 62.
5. Remove sealing ring carefully with a plastic needle. See Fig. 63.
6. Thoroughly inspect cylinder bore, piston and flange surfaces. Machining of cylinders and pistons is not permitted.

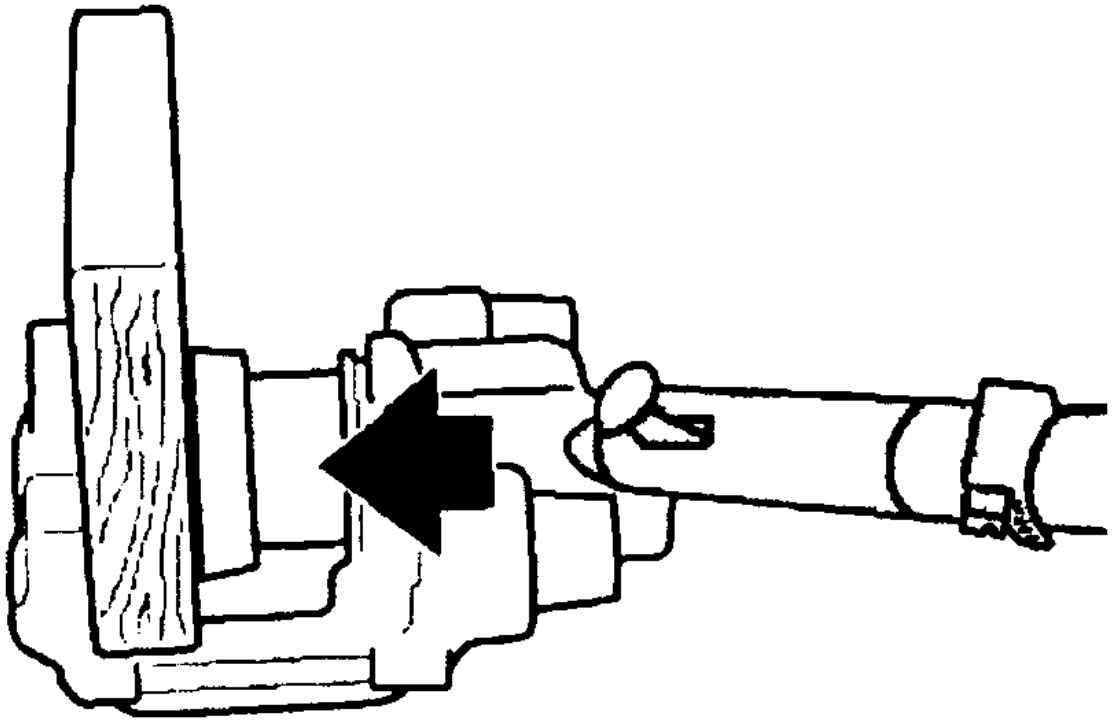


Fig. 61: Pressing Out Piston
Courtesy of BMW OF NORTH AMERICA, INC.

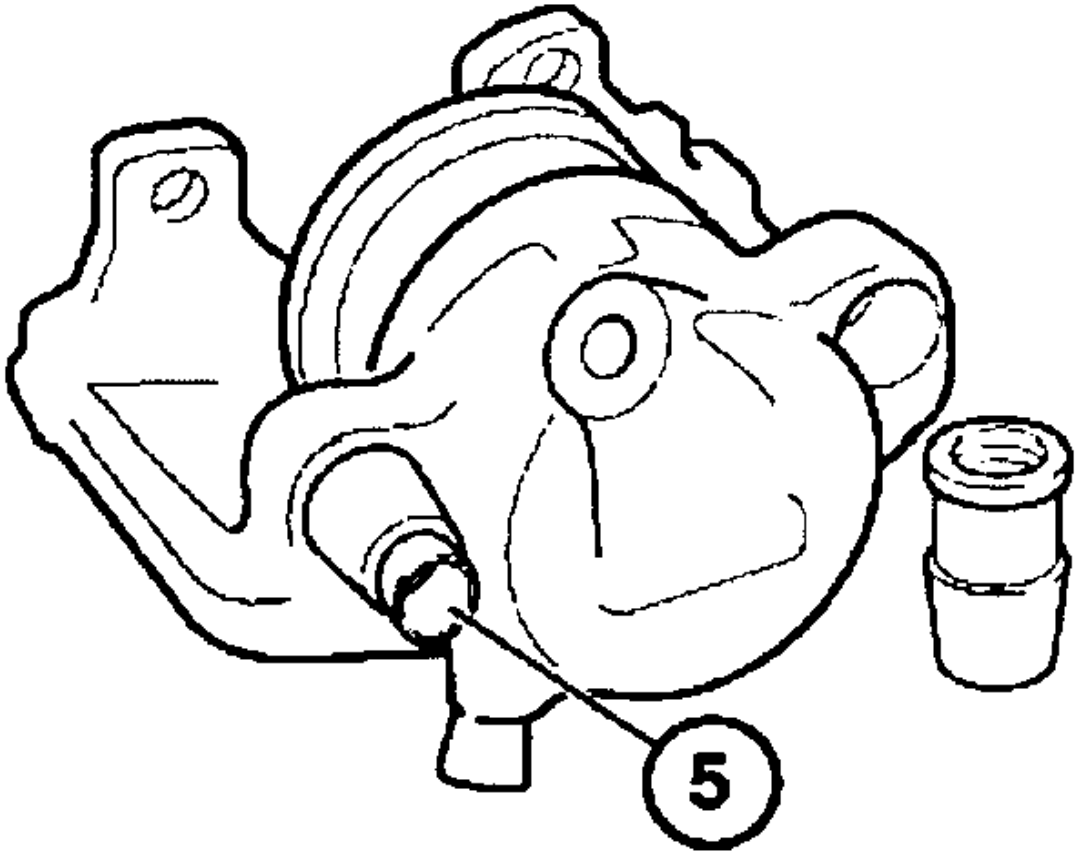


Fig. 62: Locating Guide Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

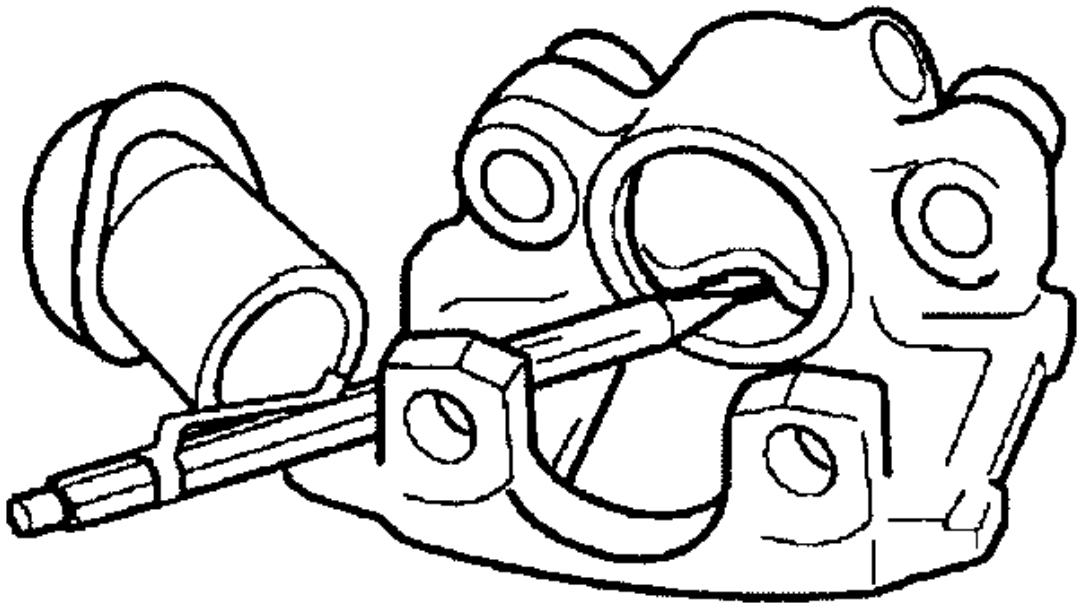


Fig. 63: Removing Sealing Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Cleaning & Inspection

Clean components in alcohol and dry with compressed air. Inspect caliper bore and pistons for wear or damage. Replace caliper assembly if cylinder bore is corroded or worn. DO NOT hone.

Reassembly

1. Coat cylinder bore, piston, dust sleeve and sealing ring with a light coat of brake cylinder paste.
2. Install sealing ring in rear annular groove of cylinder bore.

NOTE: Ensure piston is not tilted when installing.

3. Install dust boot on piston. Using wooden block, install piston and dust boot. See Fig. 64.
4. On 750i/iL ensure proper installation position of guide sleeves. Teflon socket (white insert) is located on disc inlet (bottom). Guide sleeve in standard version (black) is located on disc outlet (top).
5. Press brake lining fully outwards and insert spring (4). See Fig. 65.
6. Only clean guide screws, do not grease. Check and replace if necessary. Tighten to specification. See TORQUE SPECIFICATIONS.
7. Install caliper. See CALIPER ASSEMBLY.

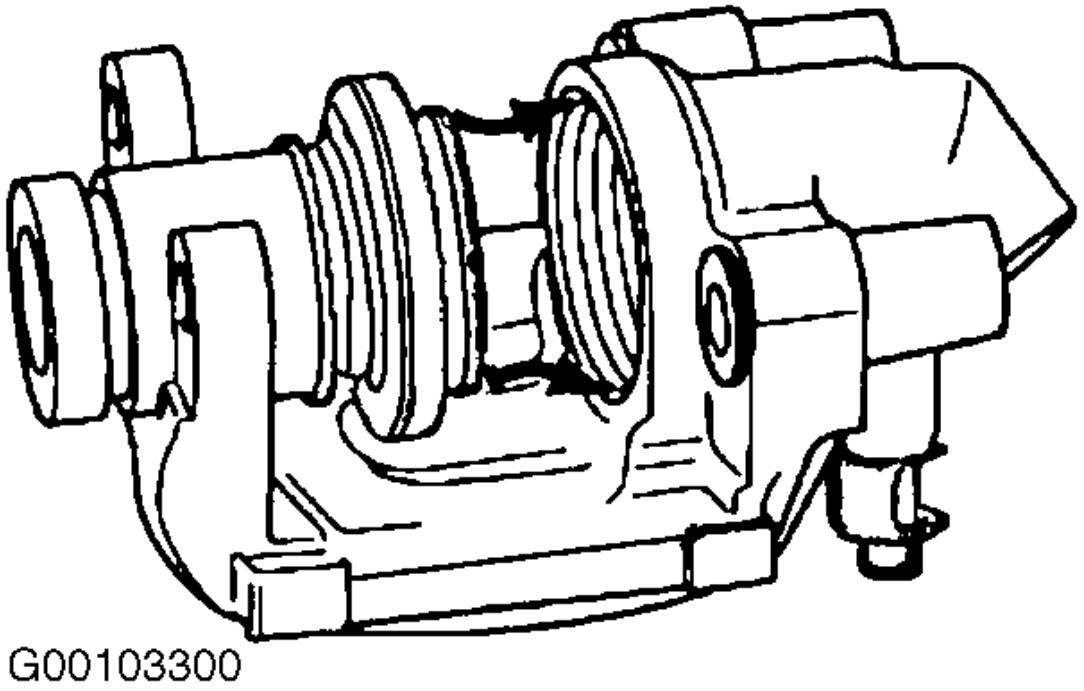


Fig. 64: Pressing In Piston
Courtesy of BMW OF NORTH AMERICA, INC.

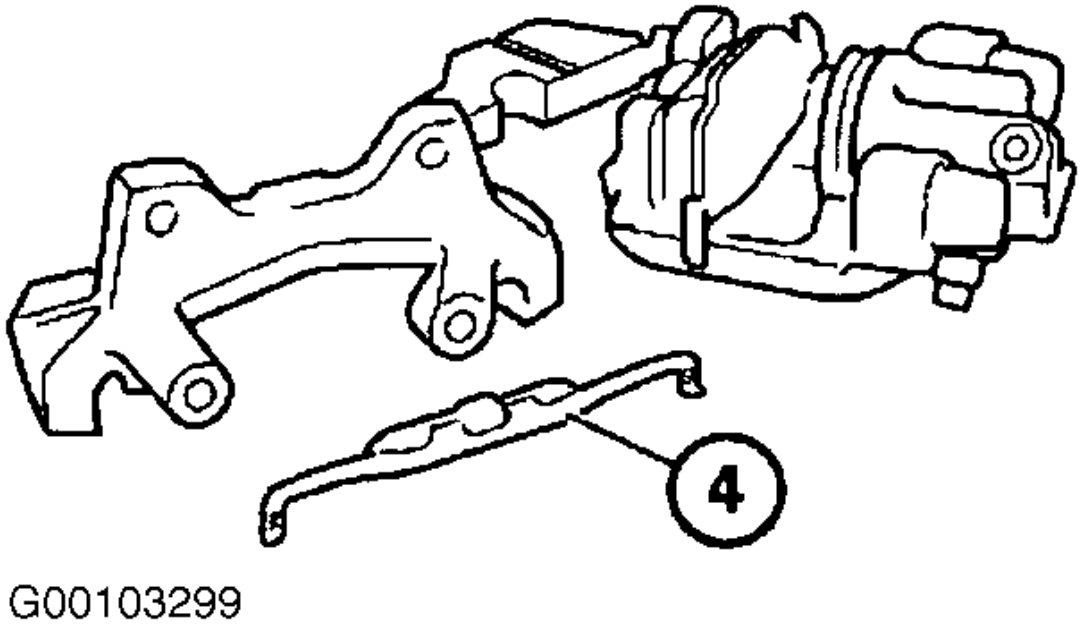


Fig. 65: Identifying Retaining Spring
Courtesy of BMW OF NORTH AMERICA, INC.

MASTER CYLINDER

Disassembly

Push in primary piston and remove plug. See Fig. 66. Remove retaining ring from end of cylinder. Remove primary and secondary piston assemblies and stopper washer. Disassemble piston assemblies, noting number and position of parts used for reassembly reference. See Fig. 66.

NOTE: Replace master cylinder if cylinder bore is scored.

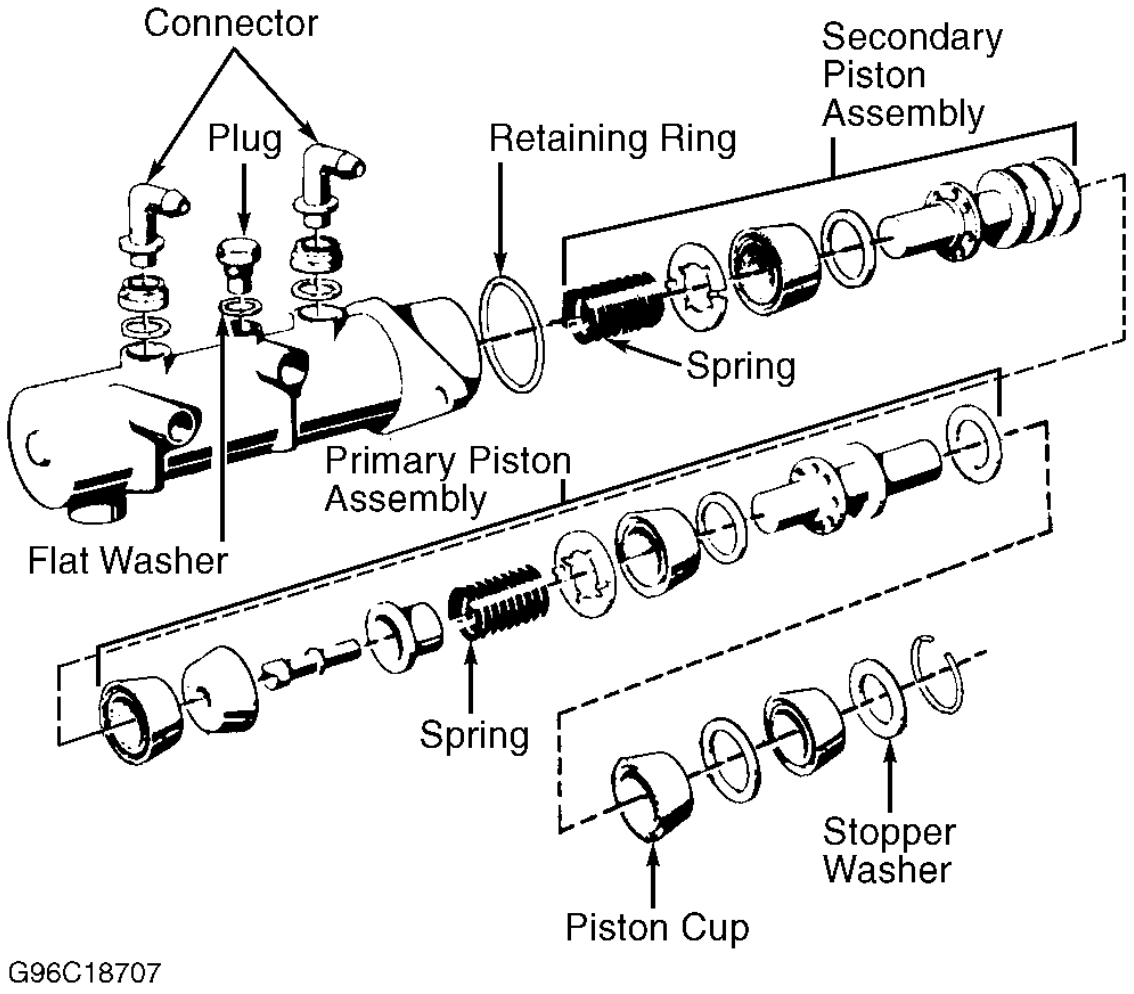


Fig. 66: Exploded View Of Master Cylinder Assembly
Courtesy of BMW OF NORTH AMERICA.

Reassembly

1. Reassemble piston assemblies using thin coating of brake assembly lubricant. Install piston assemblies into cylinder bore, using Guide Sleeve (34-3-000) to prevent seal damage.
2. Push piston fully forward and install plug. Install retaining ring in master cylinder bore. Replace "O" ring between master cylinder and brake booster. Bench bleed master cylinder before installation.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Adapter To Power Flow Regulator	11.8 (16)

Axle Collar Nut	
735i, 745i	309.8 (420)
E36 & E46 2WD	213 (290)
E46 4WD	310 (420)
22 mm	147.5 (200)
24 mm	184.4 (250)
27 mm	221.3 (300)
Bearing Pedestal To Brake Assembly & Body	
3 Series	18.4 (25)
5 & 7 Series Except 735i & 745i	22.8 (31)
735i & 745i	19 (26)
Bleed Screw	
7 mm	2.6-3.7 (3.5-5)
11 mm	8.9-11.8 (12-16)
Brake Booster To Pedal Assembly Console	16.2 (22)
Brake Caliper On Semi-Trailing Arm/Wheel Carrier	49.4 (67)
Brake Caliper To Steering Knuckle	81 (110)
Brake Carrier On Semi-Trailing Arm/Wheel Carrier	
735i & 745i	81 (110)
All Others	48 (65)
Brake Disc To Wheel Hub	Â 11.8 (16)
Brake Hose Couplings	
735i & 745i	8.8-11.8(12-16)
All Others	12.5-25.7 (17-19)
Brake Master Cylinder To Brake Booster (Hydraulic)	
Replace Hexagon Socket Cap Screw With A Hexagon Screw (Early 1995 5 Series)	38 (28)
Brake Master Cylinder To Brake Booster (Vacuum)	
740iL (Early 1995)	15.5 (21)
Retighten After 30 Minutes (735i & 745i)	19 (26)
All Others	19 (26)
Expansion Tank To Brake Master Cylinder	
3 Series	2.5 (3.5)
Guide Bolt (Front)	22 (30)
Guide Bolt (Rear)	20.6 (28)
Hydraulic Pipe Coupling To Brake Booster	22.8 (31)
Hydraulic Pipe From Power Steering Pump On Power Flow Regulator	29.5 (40)
Hydraulic Pipe To Brake Booster On Power Flow Regulator	22.8 (31)
Hydraulic Pipe To Pressure Reservoir	29.5 (40)
Hydraulic Pipe To Pressure Reservoir On Power Flow Regulator	34.6 (47)
Hydraulic Pipe To Steering Gear On Power Flow Regulator	36.8 (50)
Hydraulic Switch (Warning Switch) To Power Flow Regulator	13.2 (18)
Master Cylinder-To-Power Booster Nut	18-21 (25-29)
Orifice Valve To Brake Booster	25.8 (35)
Reservoir To Power Flow Regulator	36.8 (50)
Return Pipe To Oil Tank On Power Flow Regulator	11.8 (16)
Wheel Bearing Unit On Wheel Carrier	22.1 (30)

Wheel Lugs	
All Except E53 & E65	81.1-95.5 (110-130)
E53 & E65	95.5-110.6 (130-150)
	INCH Lbs. (N.m)
Actuating Unit & Control Unit Of Parking Brake	35.4 (4)
Housing Cover To Parking Brake (735i & 745i)	17.7 (2)
Wheel Cylinder To Brake Backplate	88.5 (10)

DISC BRAKE SPECIFICATIONS

DISC BRAKE SPECIFICATIONS

Application	In. (mm)
Front	
Diameter	
3-Series (Non-M3)	11.25 (286)
3-Series (M3)	12.40 (315)
5-Series	11.90 (302)
740i & 740il	12.76 (324)
750il	13.15 (334)
Lateral Runout	.008 (.20)
Parallelism	.0008 (.020)
Minimum Refinish Thickness	
3-Series (Non-M3)	
Solid	.409 (10.40)
Vented	.803 (20.40)
3-Series (M3)	
Vented	1.03 (26.40)
5-Series	.803 (20.40)
740i & 740il	1.118 (28.4)
750il	1.197 (30.4)
Discard Thickness (1)	
Rear	
Diameter	
3-Series Solid (Non-M3 Or Roadster)	11.0 (280)
3-Series Vented (Non-M3 Or Roadster)	10.86 (276)
3-Series (M3)	12.28 (312)
3-Series (Roadster)	10.70 (272)
5-Series	11.8 (300)
740i & 740il	12.8 (324)
750il	12.9 (328)
Lateral Runout	.008 (.20)
Parallelism	.0008 (.020)
Minimum Refinish Thickness	
740i & 740il	.409 (10.40)
All Others	.724 (18.4)
Discard Thickness	
Except 7-Series	.315 (8.00)
7-Series	(1)

Parking Brake	
Diameter	
3-Series	63.0 (160)
5-Series & 7-Series	70.8 (180)
(1) Information is stamped on disc rotor.	

SPECIAL TOOLS

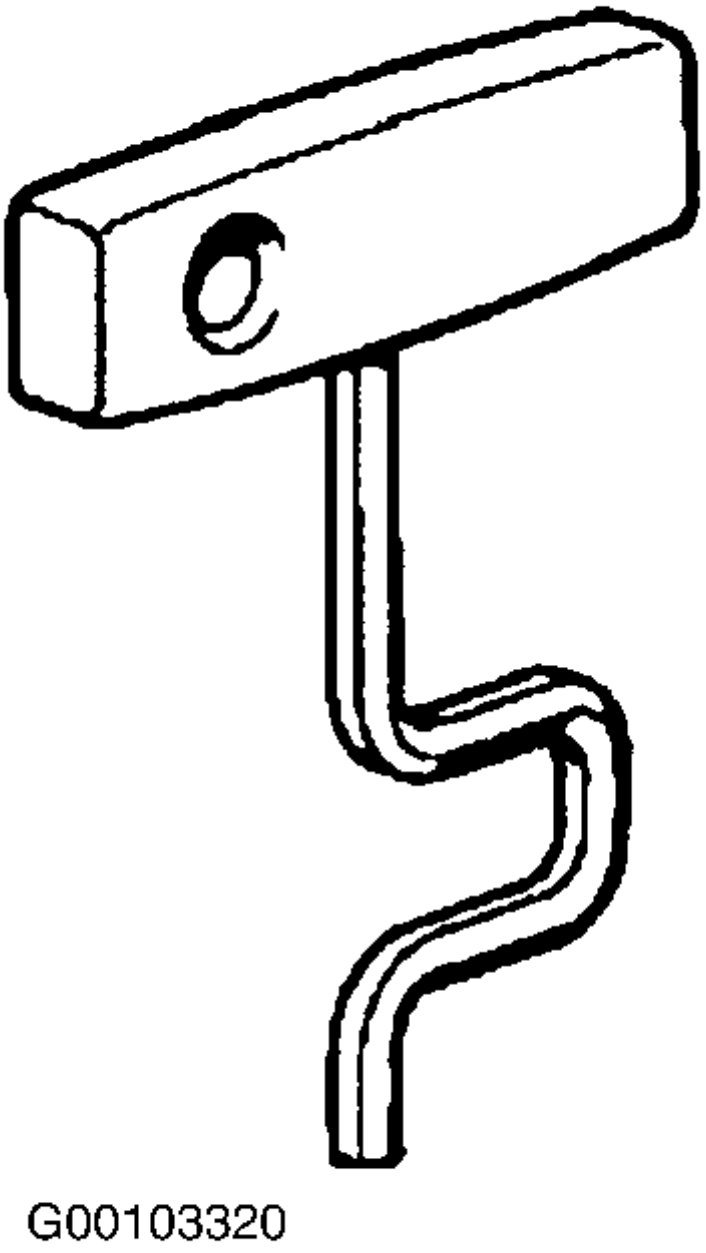


Fig. 67: Identifying Allen Key (34 4 000)
Courtesy of BMW OF NORTH AMERICA, INC.

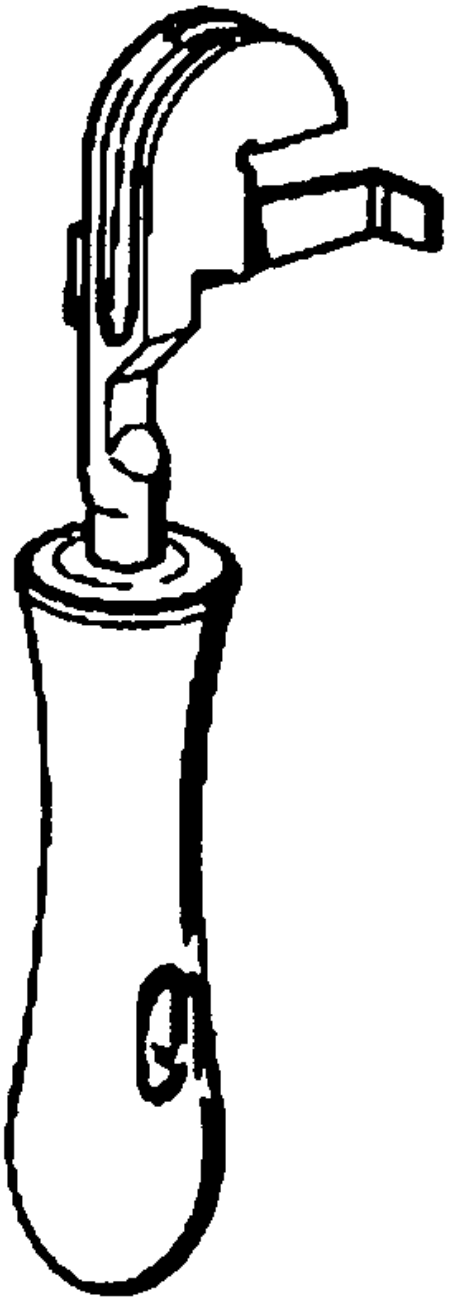


Fig. 68: Identifying Bending Tool (34 5 100)
Courtesy of BMW OF NORTH AMERICA, INC.

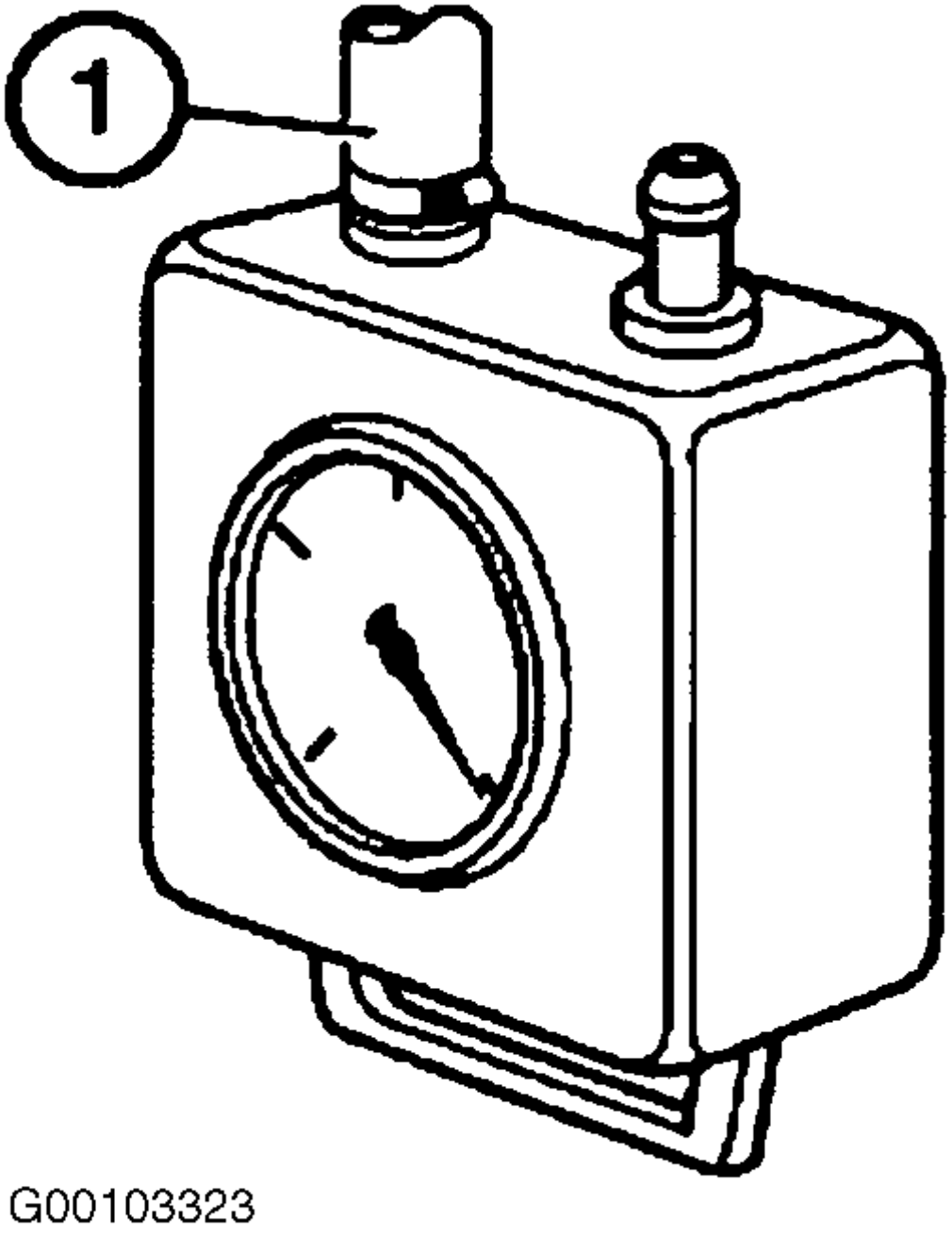


Fig. 69: Identifying Brake Booster Tester (34 3 100)
Courtesy of BMW OF NORTH AMERICA, INC.

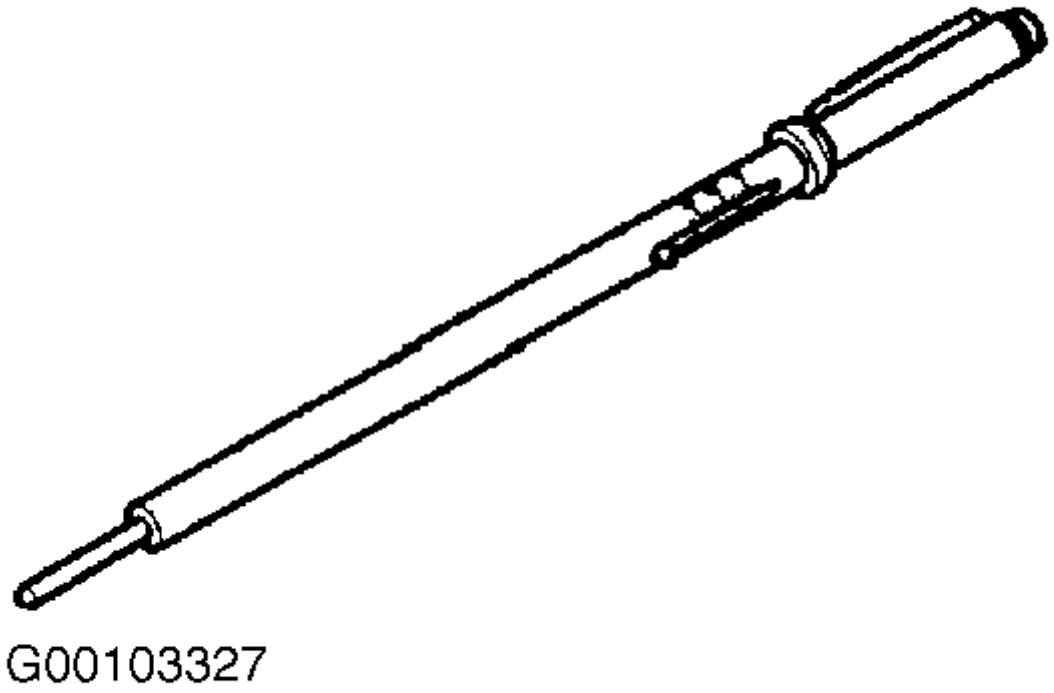


Fig. 70: Identifying Brake Lining Measuring Gauge (34 1 260)
Courtesy of BMW OF NORTH AMERICA, INC.

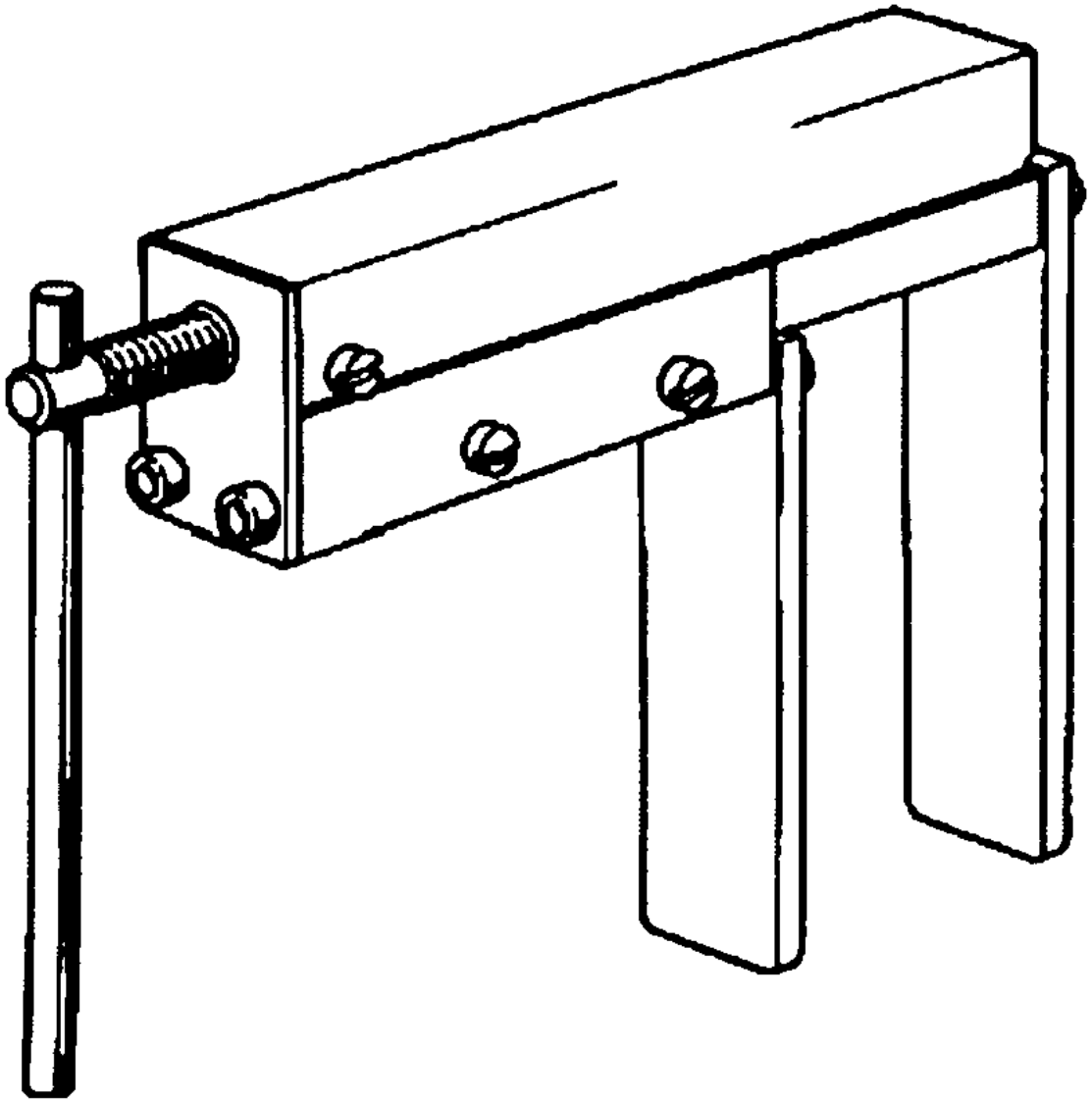
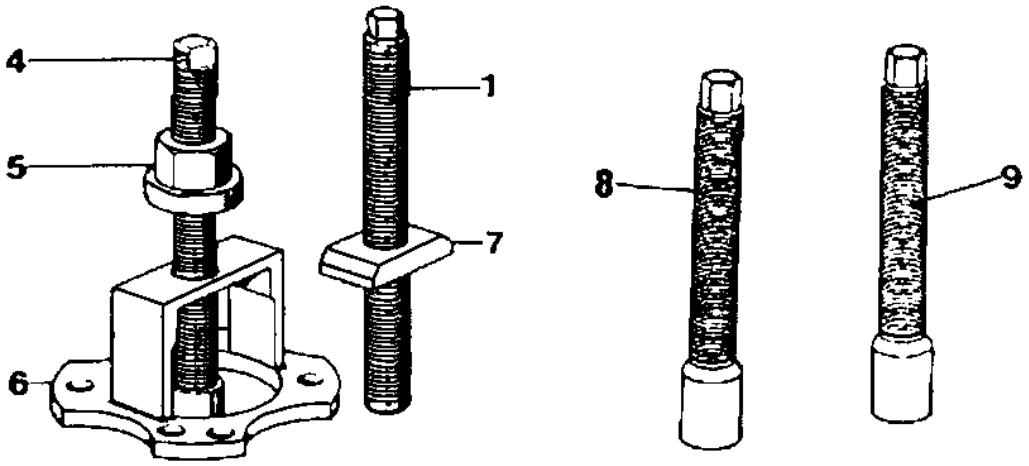


Fig. 71: Identifying Fixture (34 1 050)
Courtesy of BMW OF NORTH AMERICA, INC.



1	= 33 2 111	Pressure spindle	7	= 33 2 117	Threaded piece
4	= 33 2 114	Spindle	8	= 33 2 118	Spindle for fitting
5	= 33 2 115	Nut with bearing	9	= 33 2 119	Spindle
6	= 33 2 116	Bridge			

G00103357

Fig. 72: Identifying Removal & Installation Tool (33 2 110)
Courtesy of BMW OF NORTH AMERICA, INC.

Article GUID: A00039421

Pedal Assembly - Tightening Torques - Z3 Roadster & Coupe (3.0L/E36)

PEDALS MOUNTING BLOCK

35 11 PEDAL ASSEMBLY CONSOLE

PEDAL ASSEMBLY CONSOLE - TIGHTENING TORQUE SPECIFICATIONS

Application	Type	Thread	Tightening Specification	Measure
1AZ Bearing pedestal to brake assembly and body	E38, E39, E52	Â	Â	31 Nm
Â	E36, E46	Â	Â	25 Nm
Â	E53, E65, E66, E67, E60, E61, E63, E64, E83	Â	Retighten 1x on brake booster after 30 min.	26 Nm
Â	E85	M8	Retighten 1x on brake booster after 30 min	22 Nm
2AZ Bracket to bearing block	E85	M6	Â	9 Nm

BRAKE PEDAL AND LINKAGE

35 21 BRAKE PEDAL AND LINKAGE

BRAKE PEDAL AND LINKAGE - TIGHTENING TORQUE SPECIFICATIONS

Application	Type	Measure
1AZ Piston rod lock nut	All	27 Nm
2AZ Nut on shaft	All	27 Nm
3AZ Pull rod Nut for pivot	All	27 Nm
4AZ Left and right reversing lever Nut on shaft bolt	All	27 Nm
5AZ Support to console Brake booster	All	22 Nm
6AZ Support to console Reversing lever	All	27 Nm

CLUTCH PEDAL AND LINKAGE

35 31 CLUTCH PEDAL AND LINKAGE

CLUTCH PEDAL AND LINKAGE - TIGHTENING TORQUE SPECIFICATIONS

Application	Type	Measure
1AZ Piston rod lock nut	All	6 Nm
2AZ Spring lock nut	All	6 Nm
3AZ Piston rod shaft bolt	All	22 Nm
5AZ Bearing pin, spring pedal	All	22 Nm
6AZ Clutch pedal Nut on eccentric bolt	All	22 Nm

ACCELERATOR PEDAL

34 41 PARKING BRAKE

PARKING BRAKE - TIGHTENING TORQUE SPECIFICATIONS

Application	Type	Thread	Measure

1AZ Handbrake lever to body	E52, E53, E60, E61, E63, E64	Â	21 Nm
2AZ Housing cover to parking brake	E65, E66, E67	Â	2 Nm
3AZ Actuating unit and control unit of parking brake	E65, E66, E67	Â	4 Nm
4AZ Mounting pan to tunnel	E85	M6	8 Nm
5AZ Spring clip to wheel carrier	E60, E61, E63, E64	M6	8 Nm
6AZ Support Duo-Servo to wheel carrier, rear	E60, E61, E63, E64	M10	60 Nm

35 11 PEDAL ASSEMBLY CONSOLE

PEDAL ASSEMBLY CONSOLE - TIGHTENING TORQUE SPECIFICATIONS

Application	Type	Thread	Tightening Specification	Measure
1AZ Bearing pedestal to brake assembly and body	E38, E39, E52	Â	Â	31 Nm
Â	E36, E46	Â	Â	25 Nm
Â	E53, E65, E66, E67, E60, E61, E63, E64, E83	Â	Retighten 1x on brake booster after 30 min.	26 Nm
Â	E85	M8	Retighten 1x on brake booster after 30 min	22 Nm
2AZ Bracket to bearing block	E85	M6	Â	9 Nm

35 40 PEDALS

PEDALS - TIGHTENING TORQUE SPECIFICATIONS

Application	Type	Thread	Measure
1AZ Accelerator pedal module to body	All	Â	19 Nm
Â	E65, E66, E83, E85	M6	9 Nm
Â	E60, E61, E63, E64, E67	M6	8 Nm

KICK - DOWN

35 41 ACCELERATOR PEDAL AND LINKAGE

ACCELERATOR PEDAL AND LINKAGE - TIGHTENING TORQUE SPECIFICATIONS

Application	Type	Measure
1AZ Accelerator travel stop	All	10 Nm

Article GUID: A00202657

2001-2002 BRAKES

Pedal Assembly - Z3 Roadster & Coupe

GENERAL

35 00... PEDAL ASSEMBLY

Inspection dimensions for gaps beside pedal:

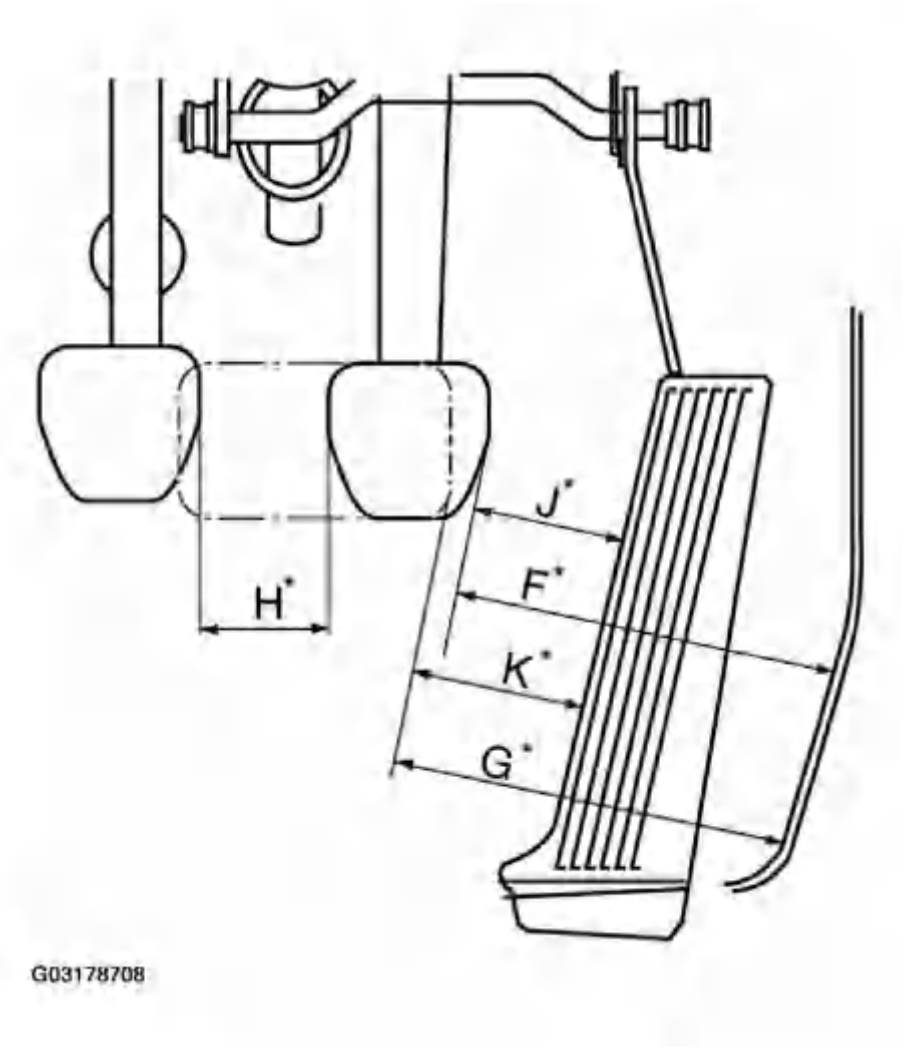


Fig. 1: Identifying Dimensions For Pedal Gaps
Courtesy of BMW OF NORTH AMERICA, INC.

Dimension H, J, K, F, G, refer to 35 00 REAR AXLE IN GENERAL E36 .

Inspection dimension (B) from underside of pedal to face wall for:

Clutch pedal (dimension B), refer to 35 31 CLUTCH PEDAL AND LINKAGES E36 .

Brake pedal (dimension A), refer to 35 21 BRAKE PEDAL AND LINKAGES E36 .

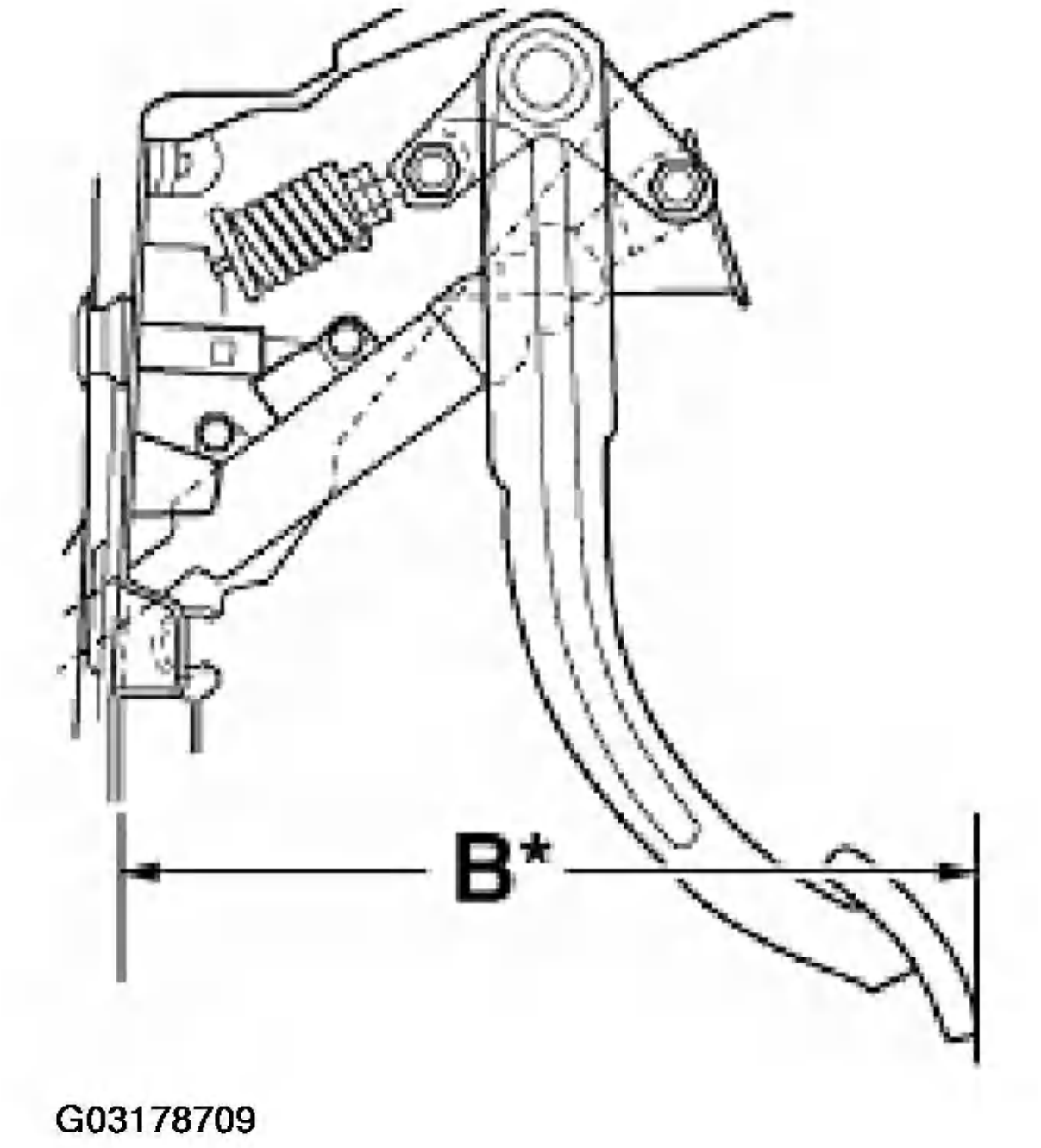


Fig. 2: Identifying Dimension B (Underside Of Pedal To Face Wall)
Courtesy of BMW OF NORTH AMERICA, INC.

Inspection dimension (C) for accelerator pedal, refer to 35 41 ACCELERATOR PEDAL AND LINKAGES E36 .

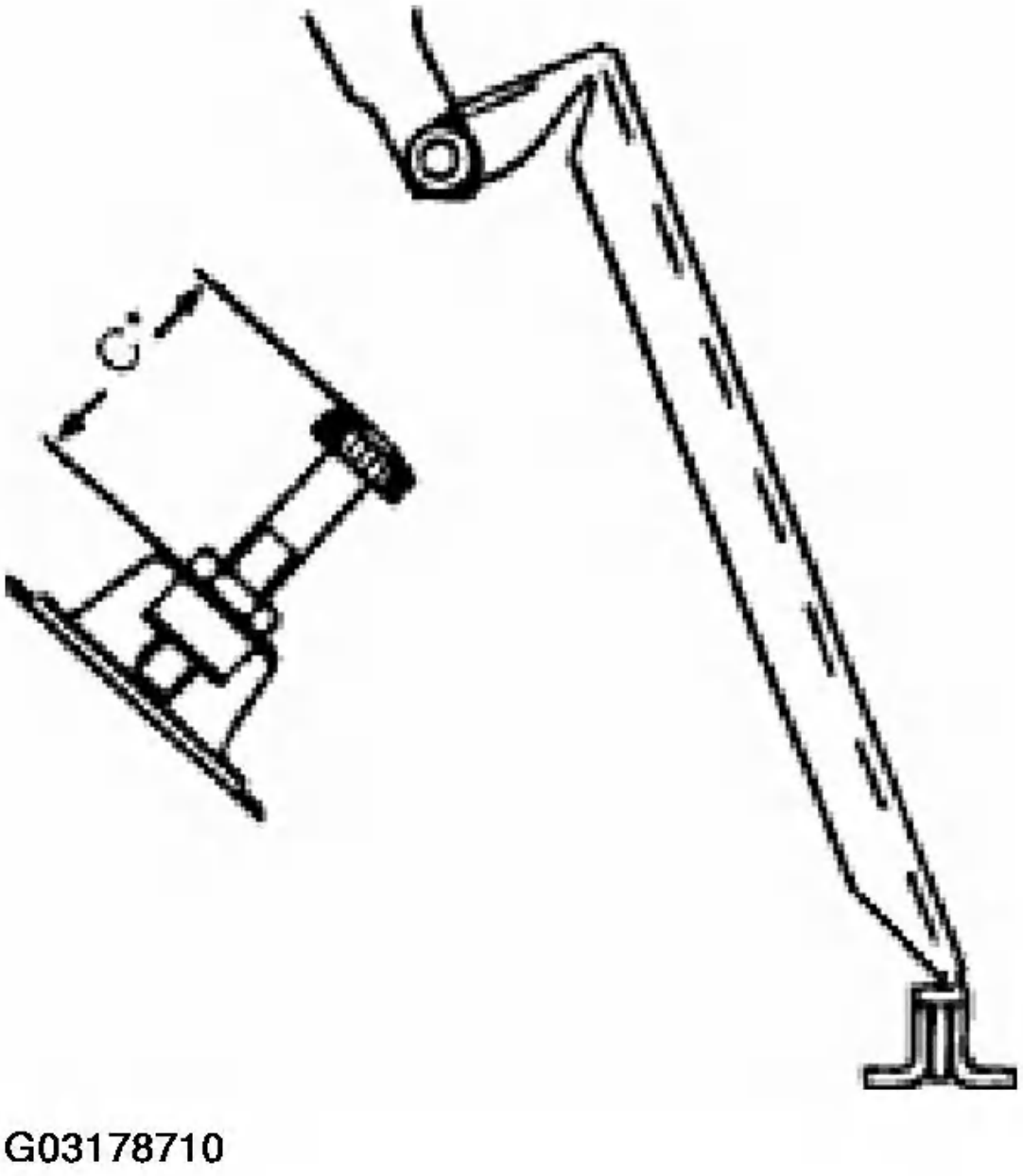


Fig. 3: Identifying Dimension C (Accelerator Pedal)
Courtesy of BMW OF NORTH AMERICA, INC.

PEDAL MOUNTING BLOCK

35 11 000 REMOVING AND INSTALLING MOUNTING BLOCK FOR PEDALS

NOTE: Remove and install panel for instrument panel, refer to 51 45 180 REMOVING AND INSTALLING/REPLACING TRIM FOR INSTRUMENT PANEL, BOTTOM LEFT (Z3 ROADSTER, M ROADSTER, Z3 COUPE, M COUPE) . Remove brake light switch, if necessary remove clutch switch, refer to 61 31 310 REPLACING BRAKE-LIGHT SWITCH .

Unscrew and pull out screws (1 and 3). Take off holder for brake-light and clutch switches.

Place clutch cylinder to one side.

Installation:

Replace self-locking nut of screw (1).

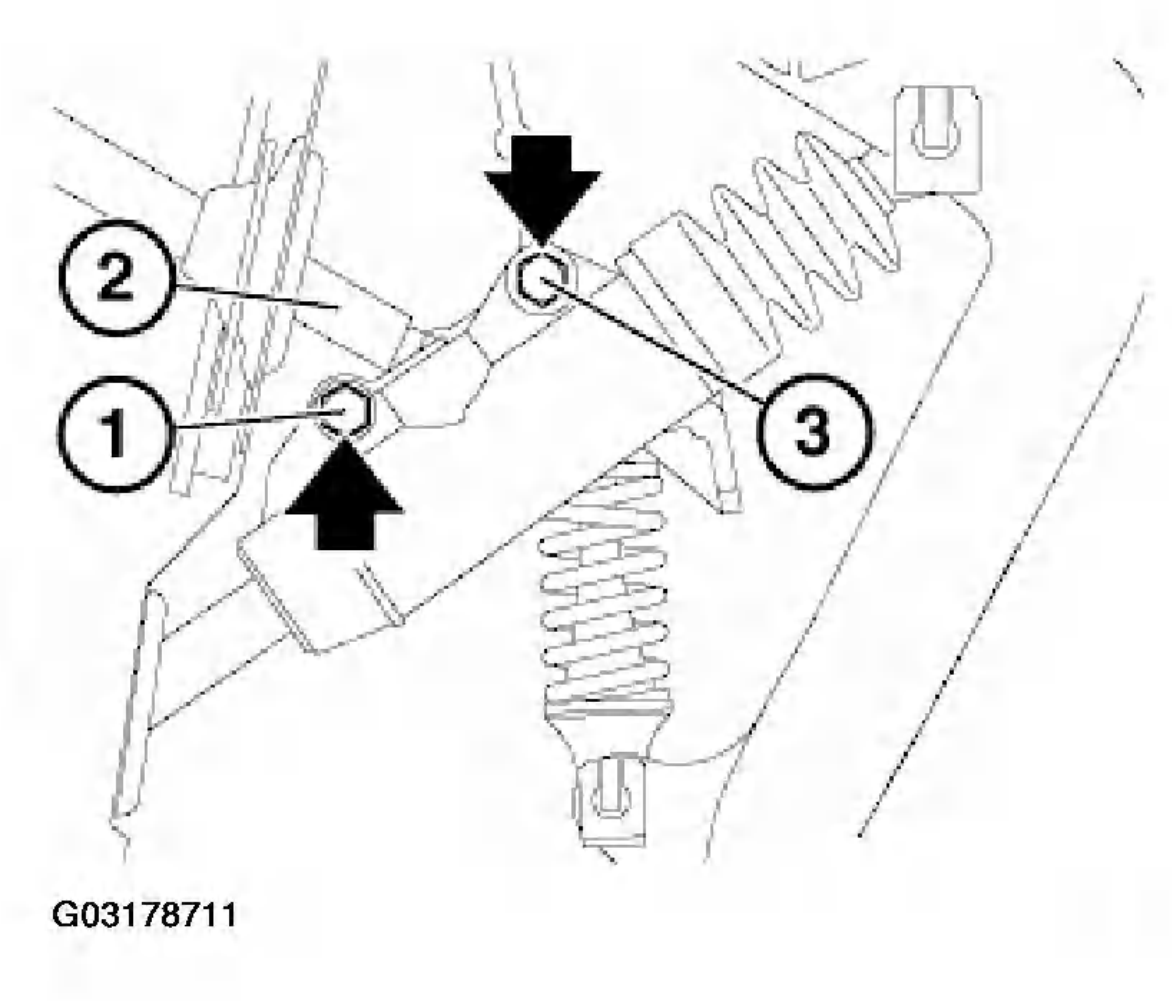


Fig. 4: Removing Switch Holder Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Screw (3) holds retaining plate for clutch and brake-light switches.

Installation:

Make sure line (2) is laid without kinks.

(1) and (3) = clutch-cylinder screws.

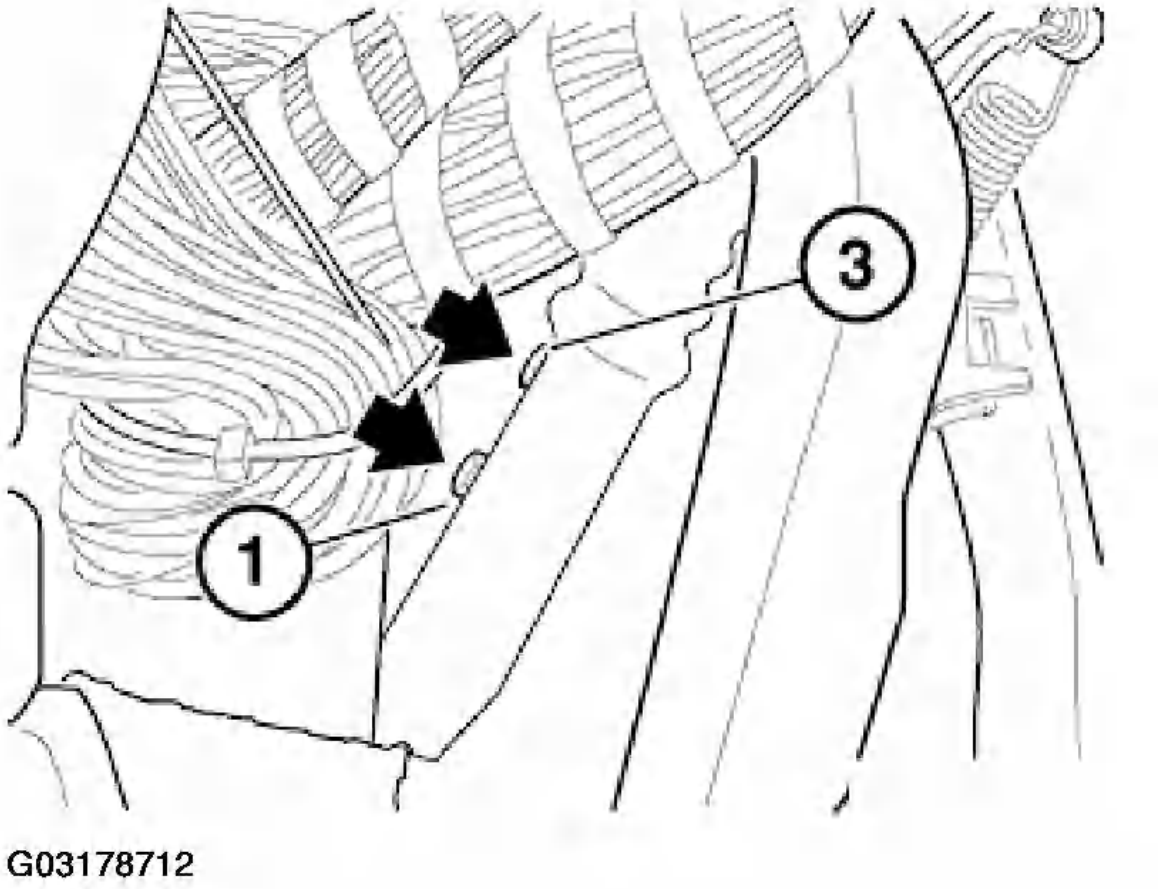


Fig. 5: Identifying Clutch-Cylinder Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Remove locking clip for shaft pin of clutch cylinder.

Version with return spring for clutch pedal:

Disconnect return spring.

Push out shaft pin.

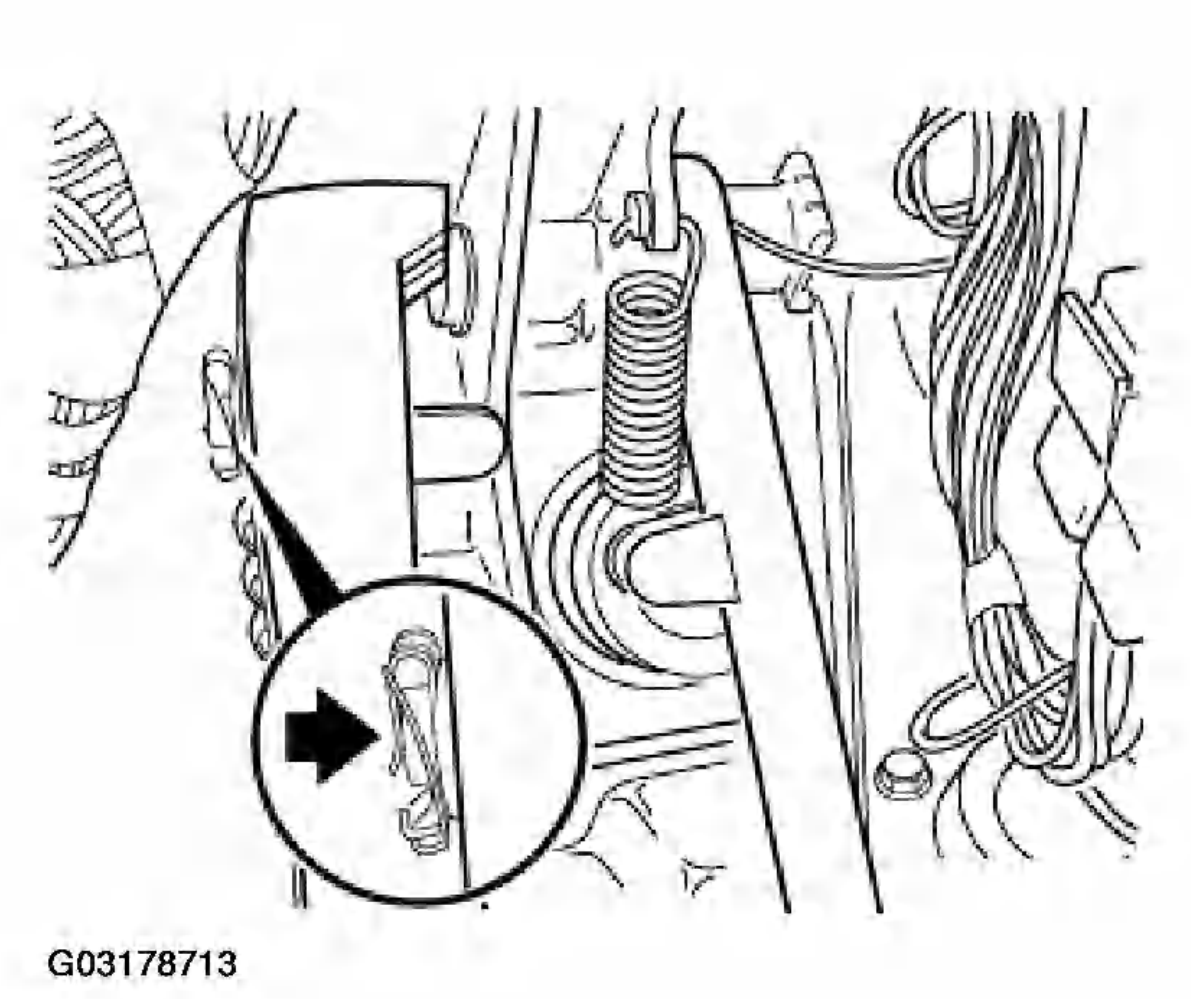


Fig. 6: Identifying Clutch Cylinder Locking Clip And Clutch Pedal Return Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Grease sliding surfaces, refer to 35 41 ACCELERATOR PEDAL AND LINKAGES E36 .

Version with over-center helper spring for clutch pedal:

Hold clutch pedal tightly.

Push out shaft pin.

Pull up clutch pedal slowly.

Take off over-center helper spring.

Installation:

Grease sliding surfaces, refer to 35 41 ACCELERATOR PEDAL AND LINKAGES E36 .

Make sure spring holder is seated correctly in mounting block.

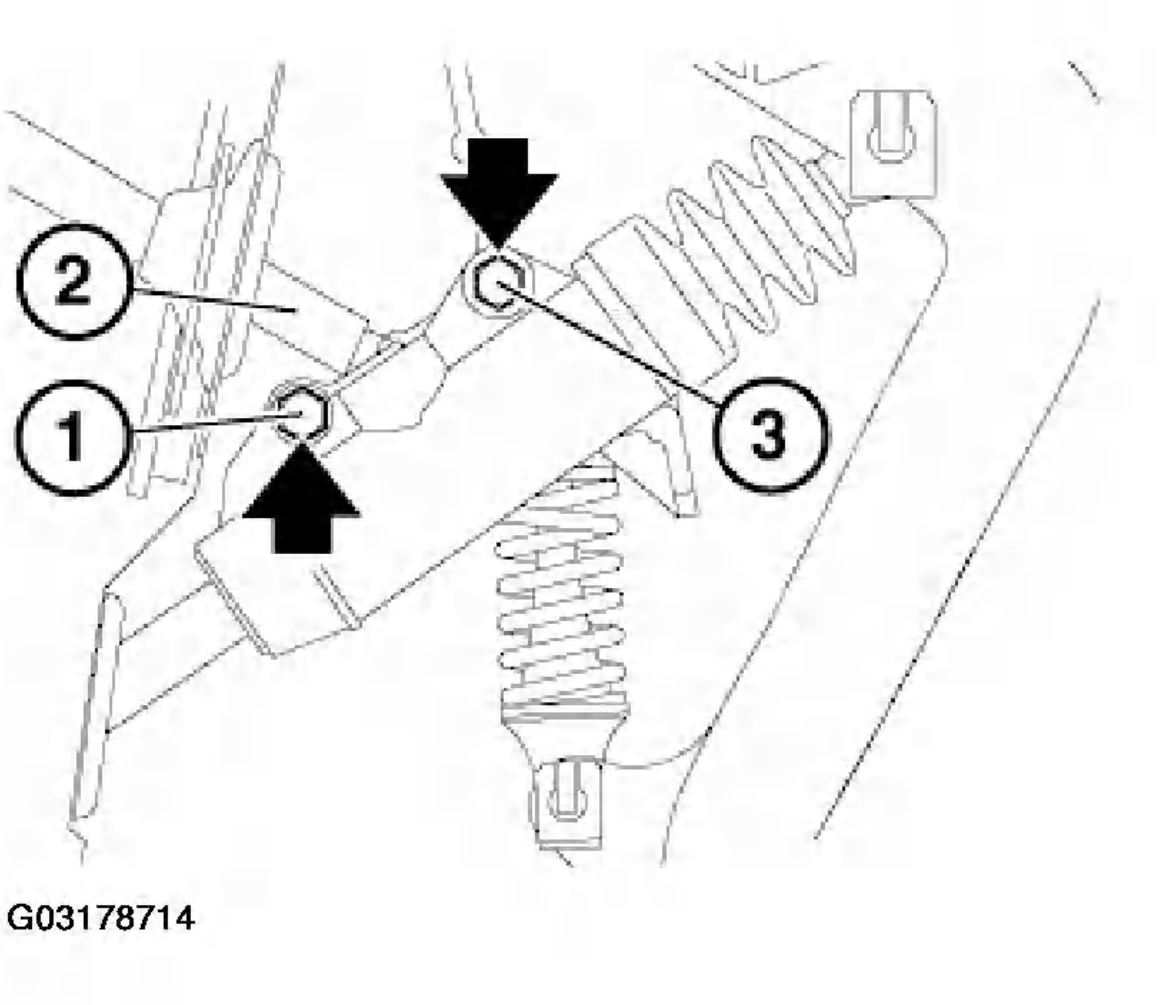


Fig. 7: Identifying Switch Holder Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Assembly of over-center helper spring:

1. Spring retainer.
2. Over-center helper spring.
3. Guide pin.
4. Bearing shaft.
5. Locking clip.

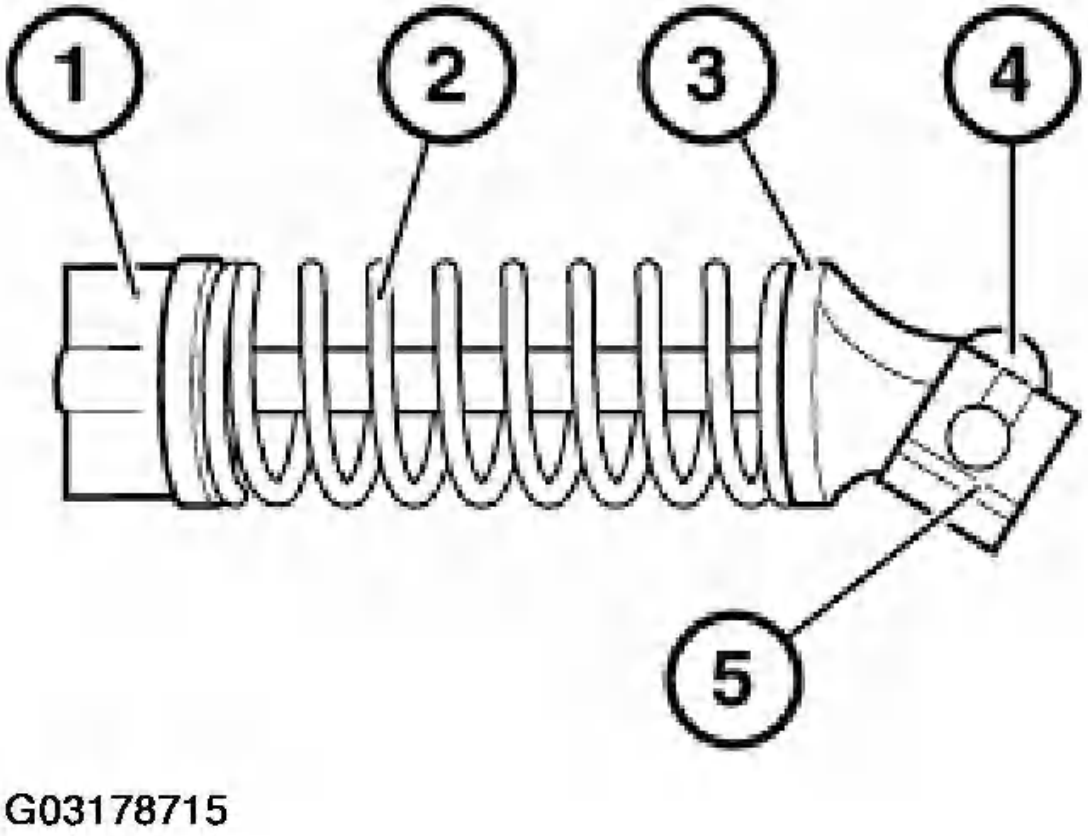


Fig. 8: Identifying Over-Centre Helper Spring Components
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect return spring for brake pedal.

Take off locking clip for shaft pin of brake pedal.

Push out shaft pin.

Installation:

Grease sliding surfaces, refer to 35 41 ACCELERATOR PEDAL AND LINKAGES E36 .

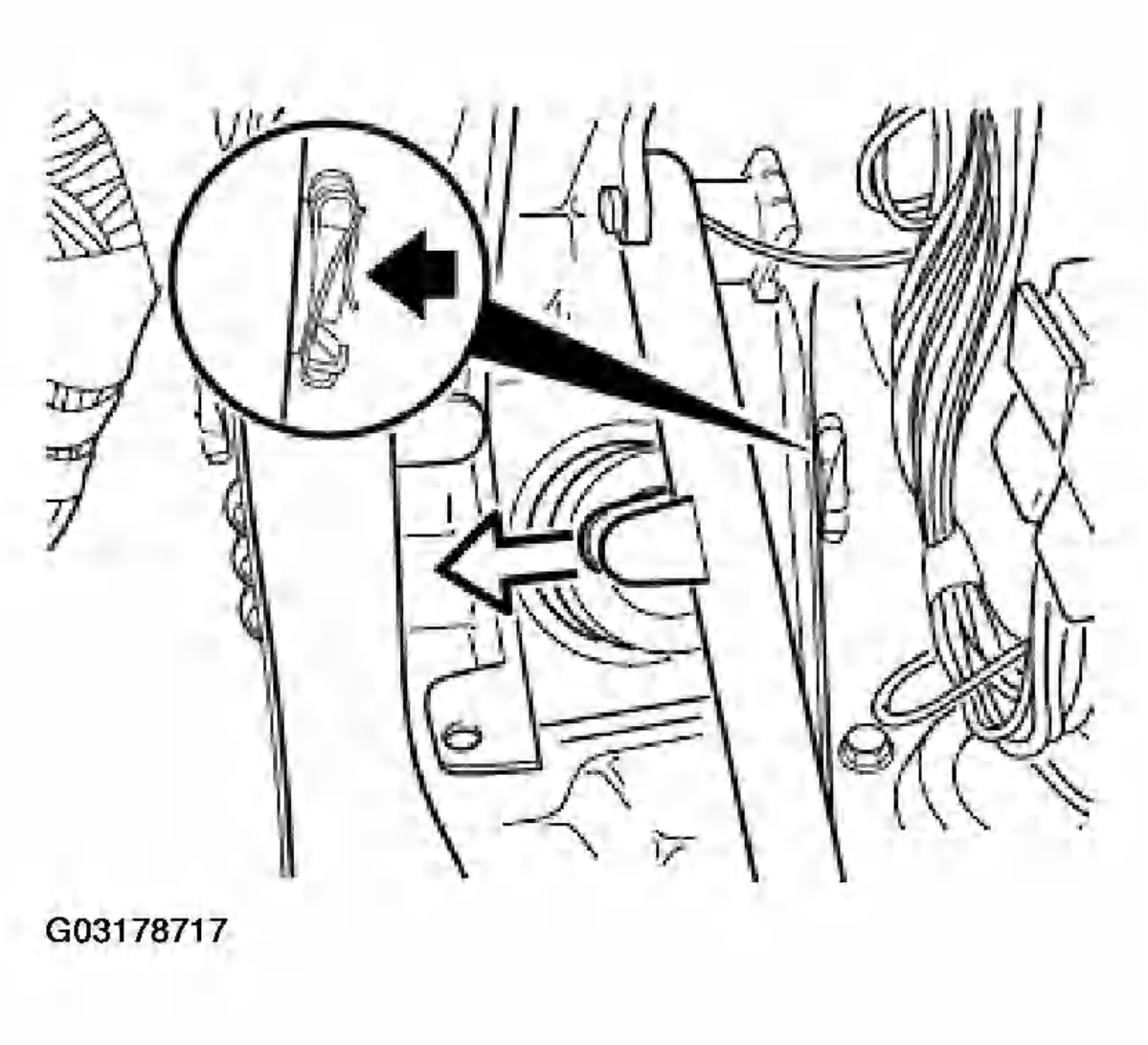


Fig. 9: Disconnecting Return Spring For Brake Pedal
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew screw.

Installation:

Tightening torque, 35 11 1AZD. Refer to 35 11 PEDAL ASSEMBLY CONSOLE .

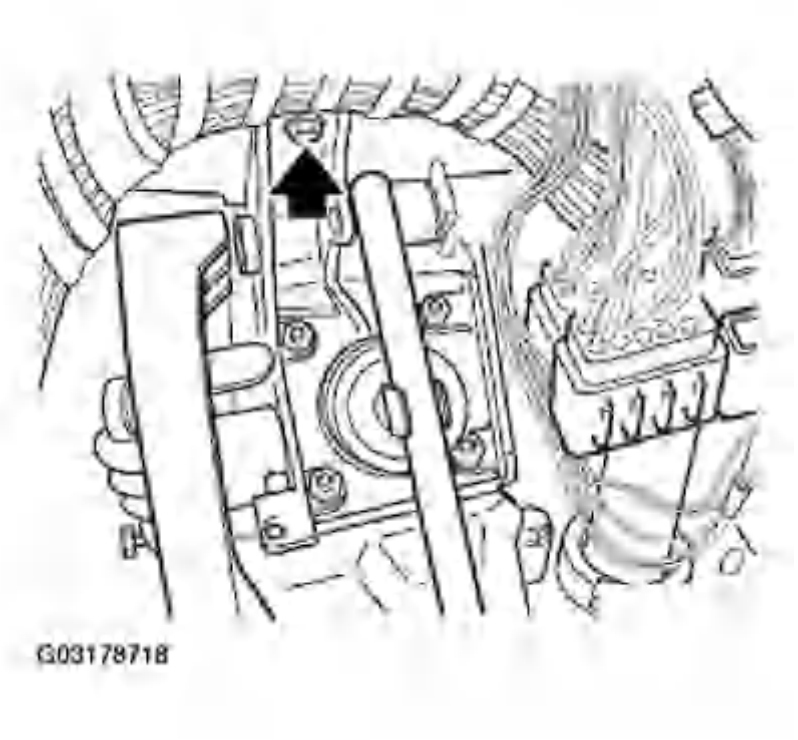


Fig. 10: Removing Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew self-locking nuts.

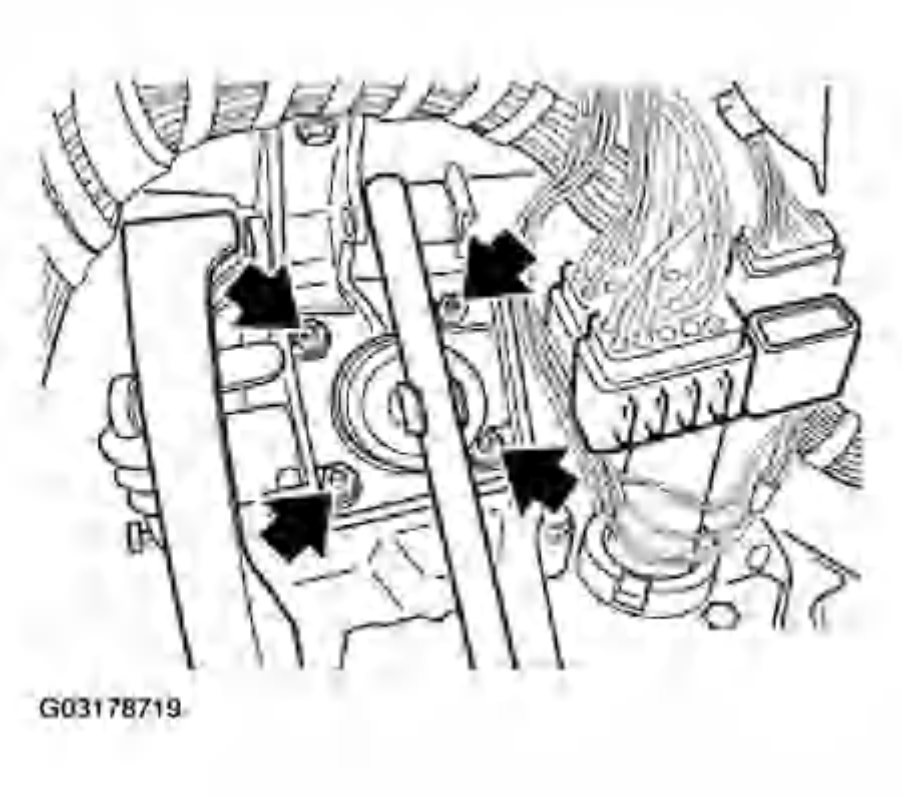


Fig. 11: Removing Self-Locking Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Remove mounting block.

Installation:

Replace self-locking nuts.

Tightening torque, 35 11 1AZD. Refer to 35 11 PEDAL ASSEMBLY CONSOLE .

35 11 001 REPLACING MOUNTING BLOCK FOR PEDAL ASSEMBLY

NOTE: Remove and install mounting block for pedal assembly, see 35 11 000 REMOVING AND INSTALLING MOUNTING BLOCK FOR PEDALS .

Take off locking clips.

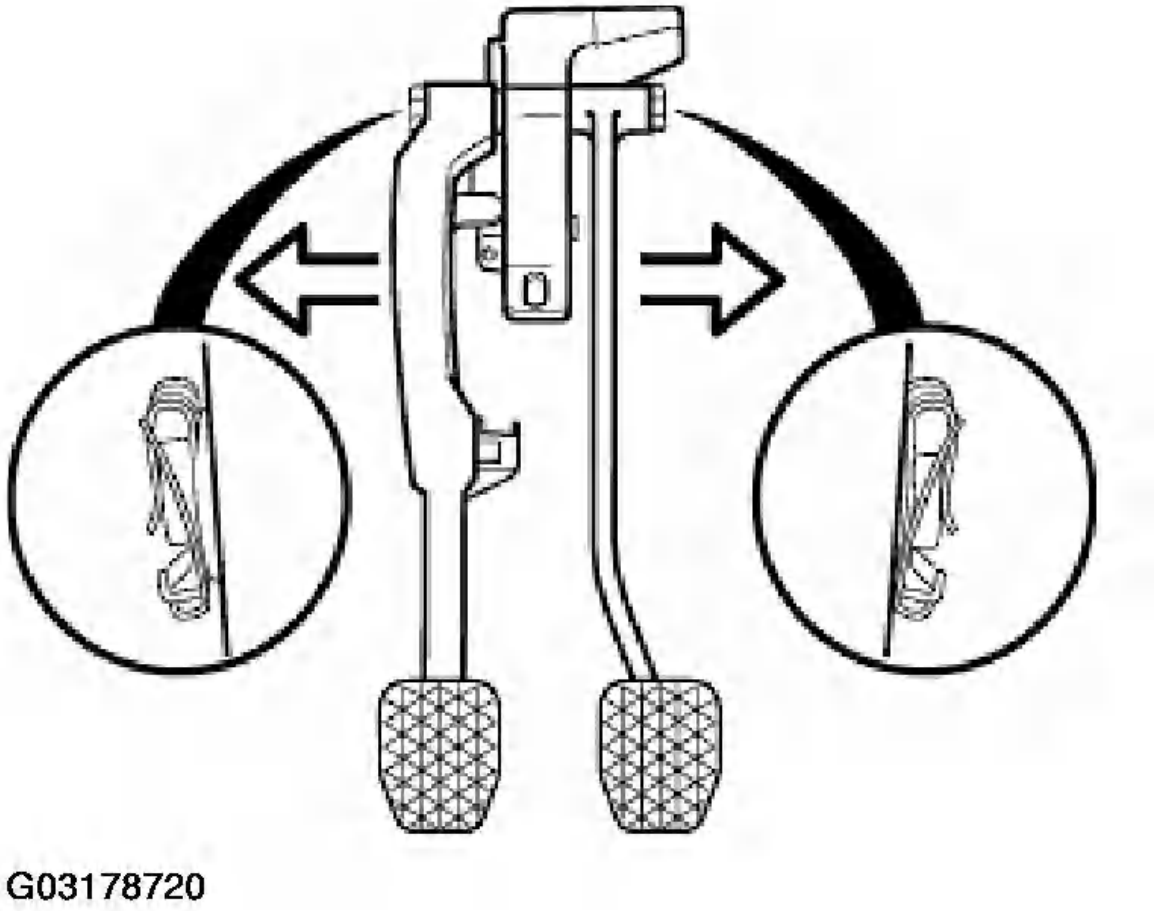


Fig. 12: Removing Locking Clips
Courtesy of BMW OF NORTH AMERICA, INC.

Pull brake and clutch pedals off shaft.

Installation:

Make sure locking clips are seated correctly.

Clutch-pedal assembly:

1. Bearing sleeves - check or replace.
2. Locking clip.
3. Clutch pedal.
4. Grommet for clutch-pedal return spring.
5. Mounting block.

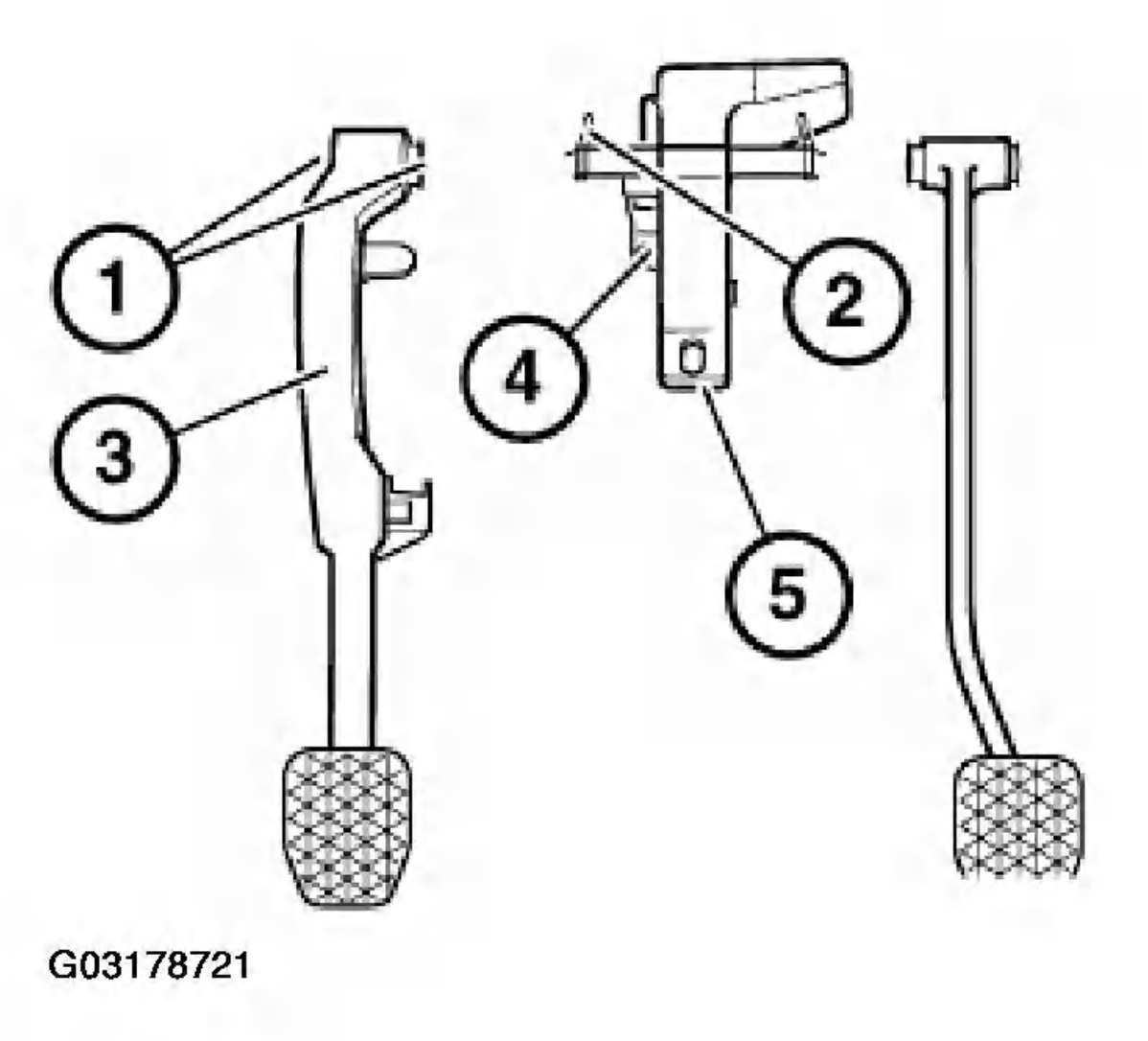


Fig. 13: Identifying Clutch-Pedal Assembly
Courtesy of BMW OF NORTH AMERICA, INC.

Brake-pedal assembly:

1. Bearing sleeves - check or replace.
2. Brake pedal.
3. Locking clip.
4. Grommet.
5. Mounting block.

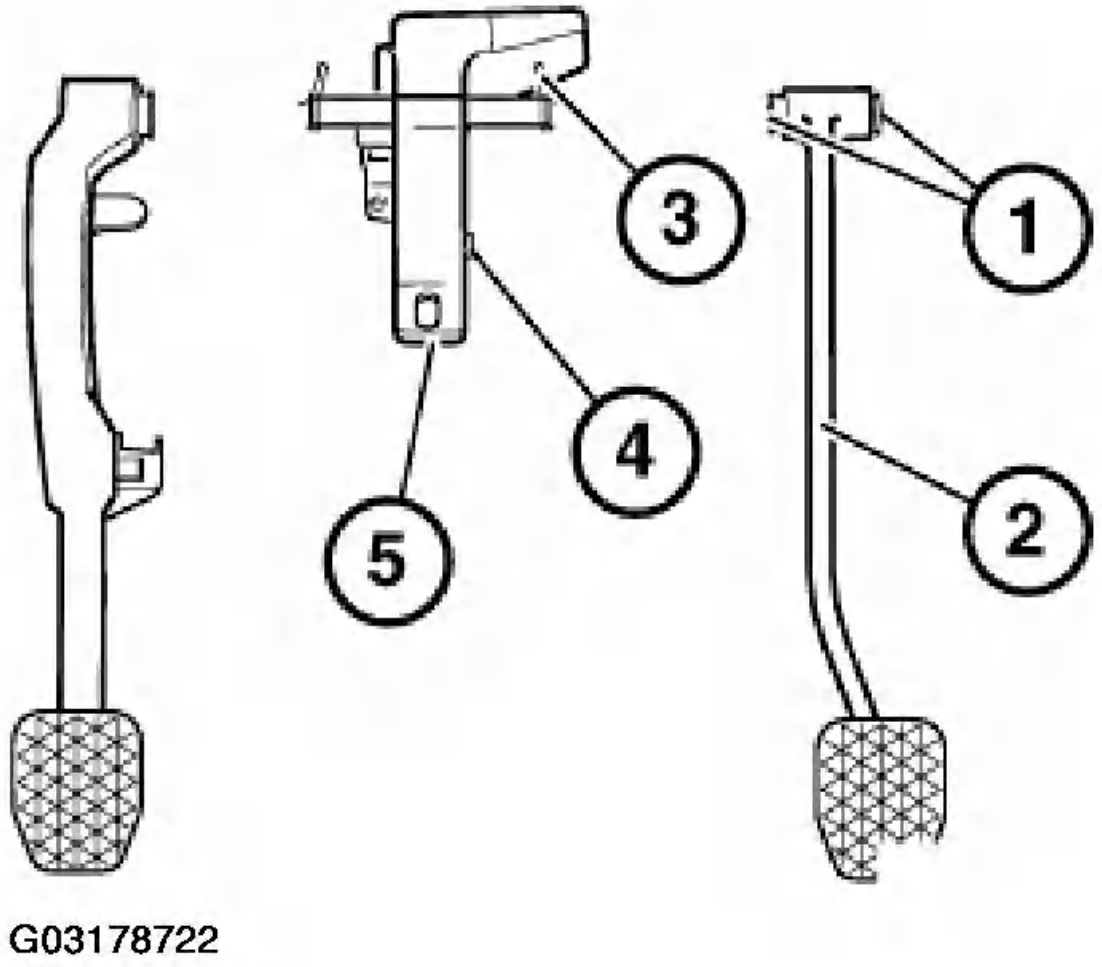


Fig. 14: Identifying Brake-Pedal Assembly
Courtesy of BMW OF NORTH AMERICA, INC.

Assembly of over-center helper spring.

1. Spring retainer.
2. Over-center helper spring.
3. Guide pin.
4. Bearing shaft.
5. Locking clip.

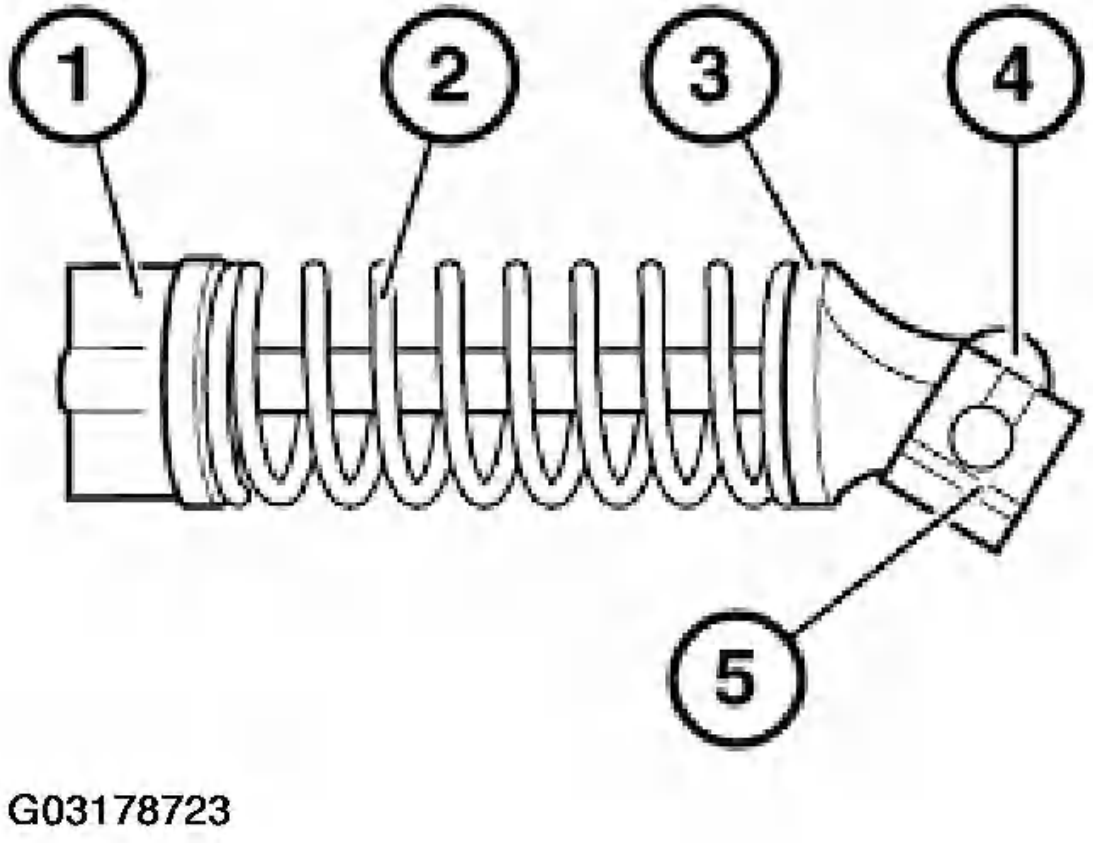


Fig. 15: Identifying Over-Center Helper Spring Assembly
Courtesy of BMW OF NORTH AMERICA, INC.

Check grommet on clutch pedal, replacing if necessary.

Check grommet on shaft for brake pedal, replacing if necessary.

Transfer brake and clutch pedals with bearing sleeves. Check grommets on pedals, replacing if necessary.

Transfer grommet for brake pedal return spring, replacing if necessary.

Transfer grommet for clutch pedal return spring, replacing if necessary.

Grease sliding faces, see 35 41 ACCELERATOR PEDAL AND LINKAGES E36 .

BRAKE PEDAL WITH LINKAGE

35 21 000 REMOVING AND INSTALLING BRAKE PEDAL

NOTE: Remove and install panelling for instrument panel, see 51 45 180 REMOVING AND INSTALLING/REPLACING TRIM FOR INSTRUMENT PANEL, BOTTOM LEFT (Z3 ROADSTER, M ROADSTER, Z3 COUPE, M COUPE) . Remove brake-light switch, see 61 31 310 REPLACING BRAKE-LIGHT SWITCH .

Disconnect return spring for brake pedal.

Take off locking clip for shaft pin of brake pedal.

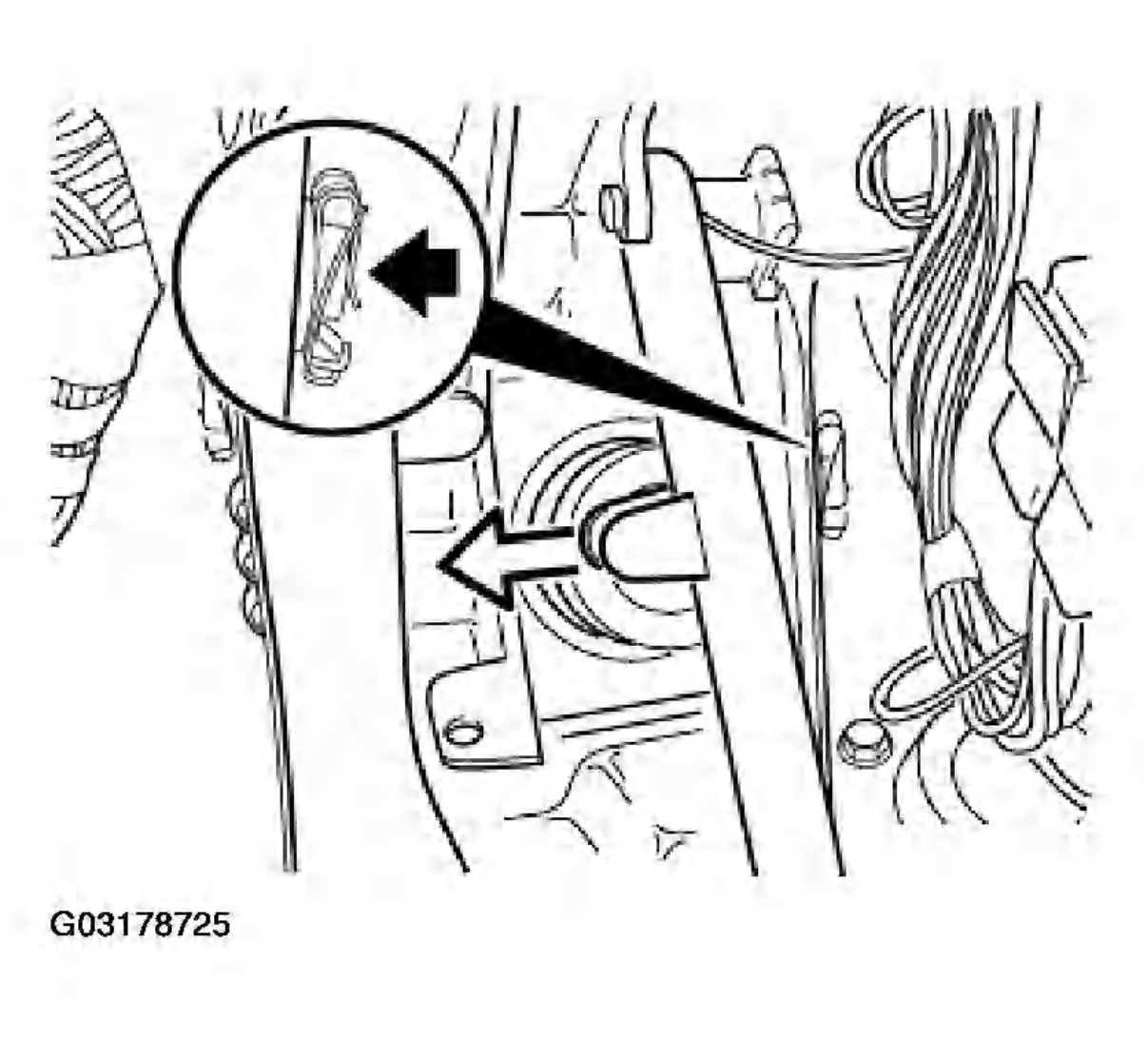


Fig. 16: Removing Locking Clip For Shaft Pin Of Brake Pedal
Courtesy of BMW OF NORTH AMERICA, INC.

Push out shaft pin.

Installation:

Lubricate sliding surfaces with grease, see 35 41 ACCELERATOR PEDAL AND LINKAGES E36 .

Take off locking clip (1) for brake pedal.

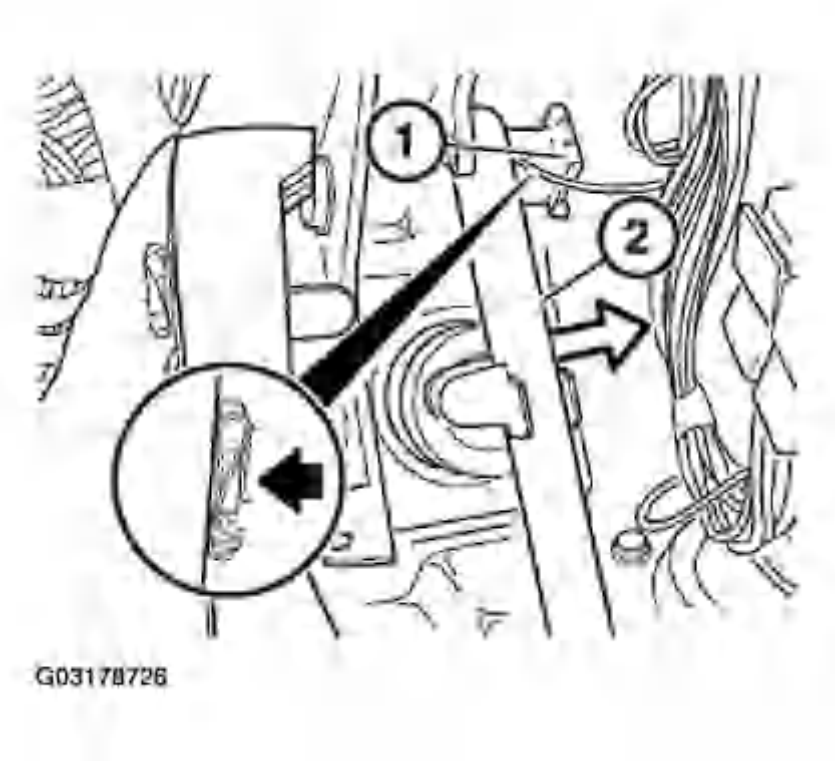


Fig. 17: Removing Locking Clip For Brake Pedal
Courtesy of BMW OF NORTH AMERICA, INC.

Pull off brake pedal (2).

Installation:

Check bearing sleeves (1), replacing if necessary.

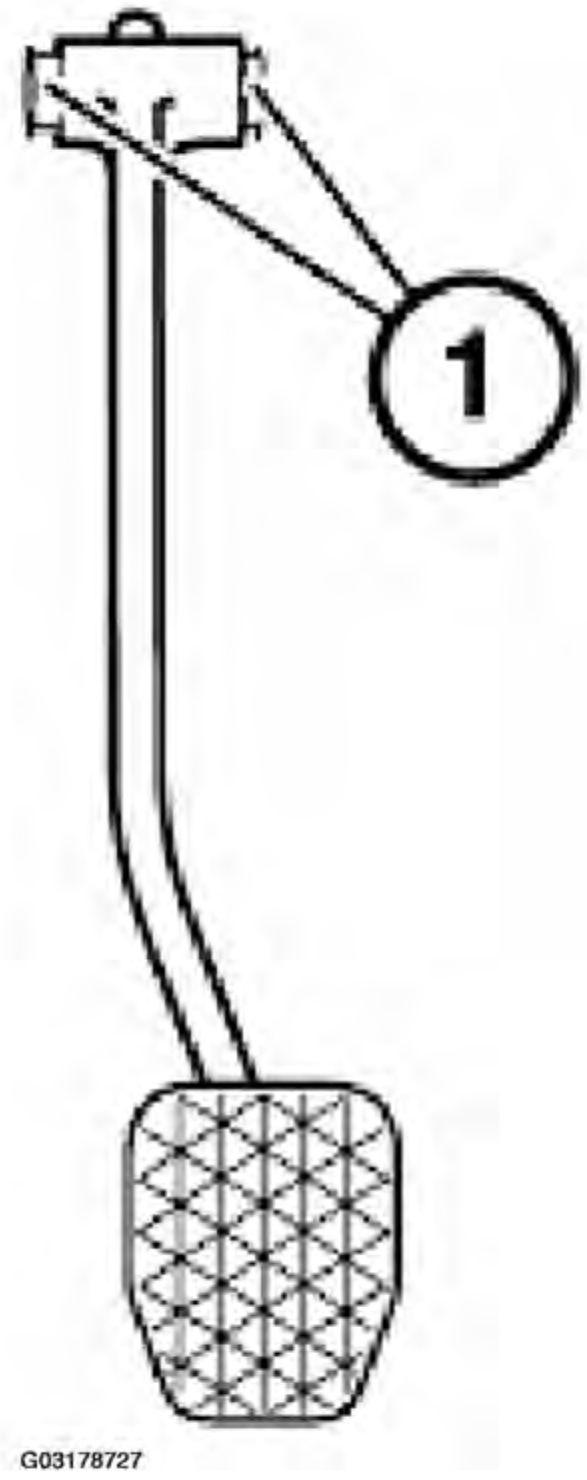


Fig. 18: Checking Bearing Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

Lubricate sliding surfaces with grease, see 35 41 ACCELERATOR PEDAL AND LINKAGES E36 .

CLUTCH PEDAL WITH LINKAGE

35 31 000 REMOVING AND INSTALLING CLUTCH PEDAL

NOTE: Remove brake light switch, refer to 61 31 310 REPLACING BRAKE-LIGHT SWITCH . If applicable, remove clutch switch. Remove retaining plate, refer to 35 11 000 REMOVING AND INSTALLING MOUNTING BLOCK FOR PEDALS .

Take off locking clip for shaft pin of clutch-sensor cylinder.

Version with return spring for clutch pedal:

Disconnect return spring. Push out shaft pin.

Installation:

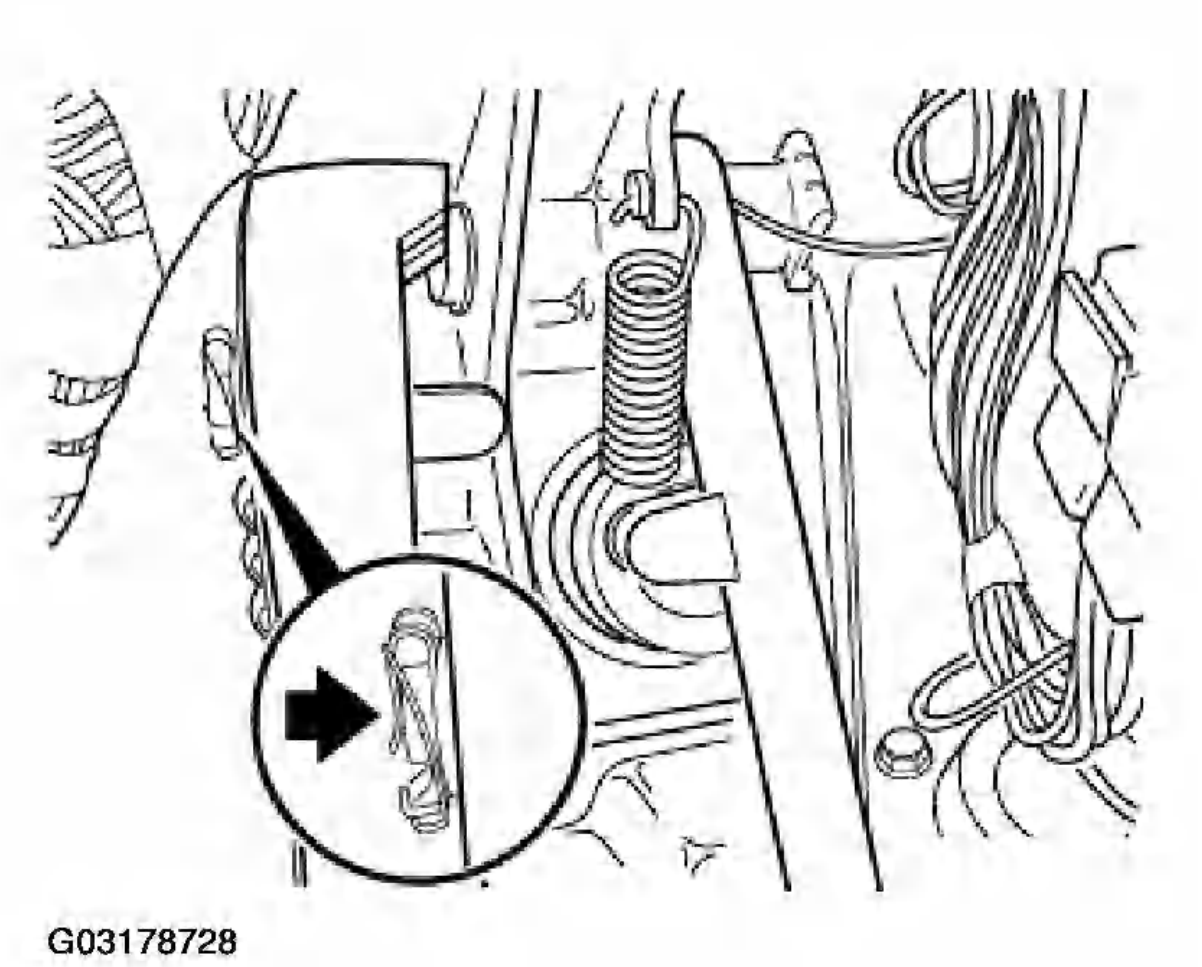


Fig. 19: Removing Locking Clip For Shaft Pin Of Clutch-Sensor Cylinder
Courtesy of BMW OF NORTH AMERICA, INC.

Version with over-center helper spring:

Hold clutch pedal tightly, push out shaft pin, pull up clutch pedal slowly and take off over-center helper spring.

Installation:

Check for correct seating of spring holder in mounting block!

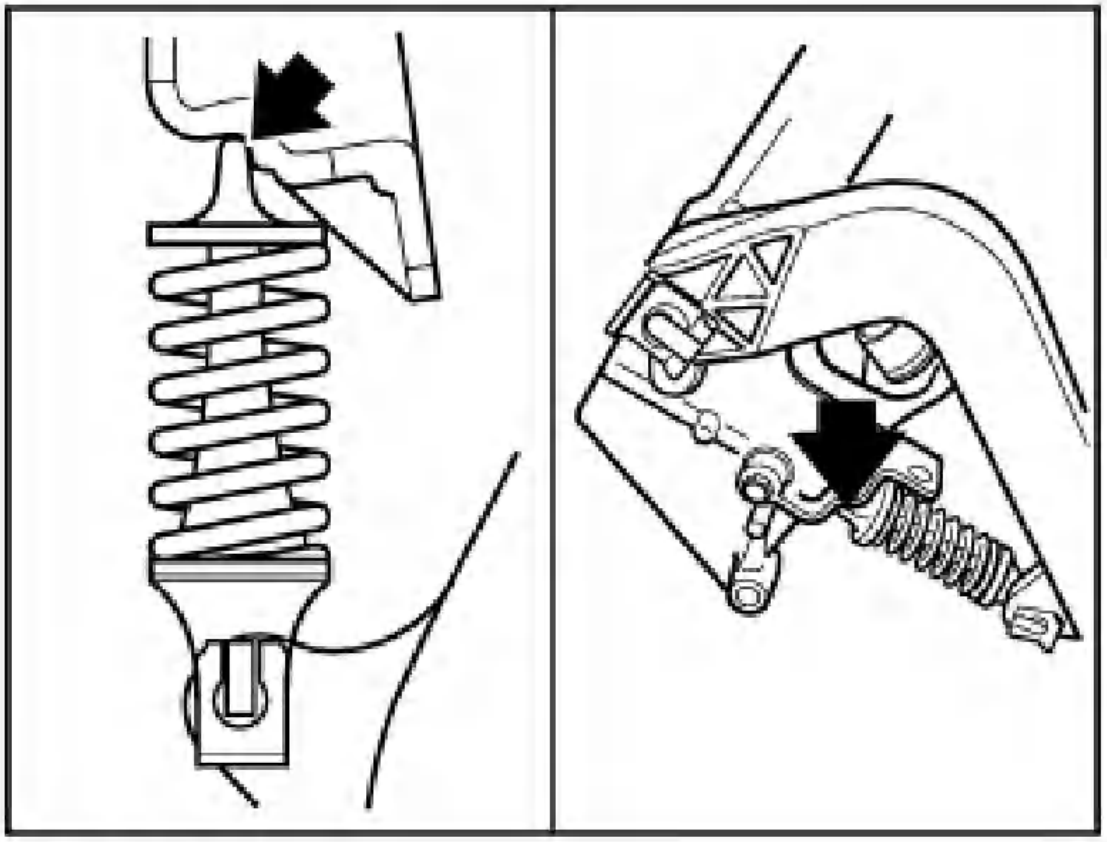


Fig. 20: Identifying Over-Centre Helper Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Assembly of over-center helper spring:

1. Spring retainer.
2. Over-Center Helper Spring.
3. Guide Pin.
4. Bearing Pin.
5. Locking Clip.

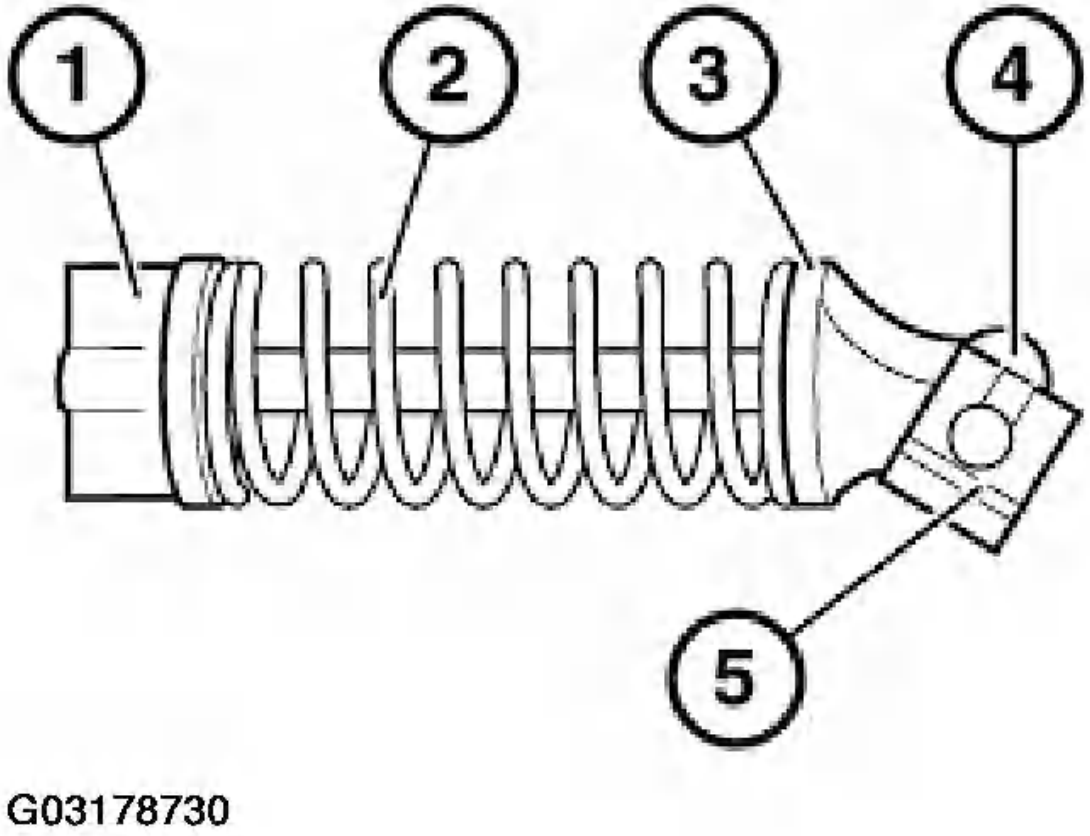


Fig. 21: Identifying Over-Centre Helper Spring Assembly
Courtesy of BMW OF NORTH AMERICA, INC.

Take off locking clip (1) for clutch pedal.

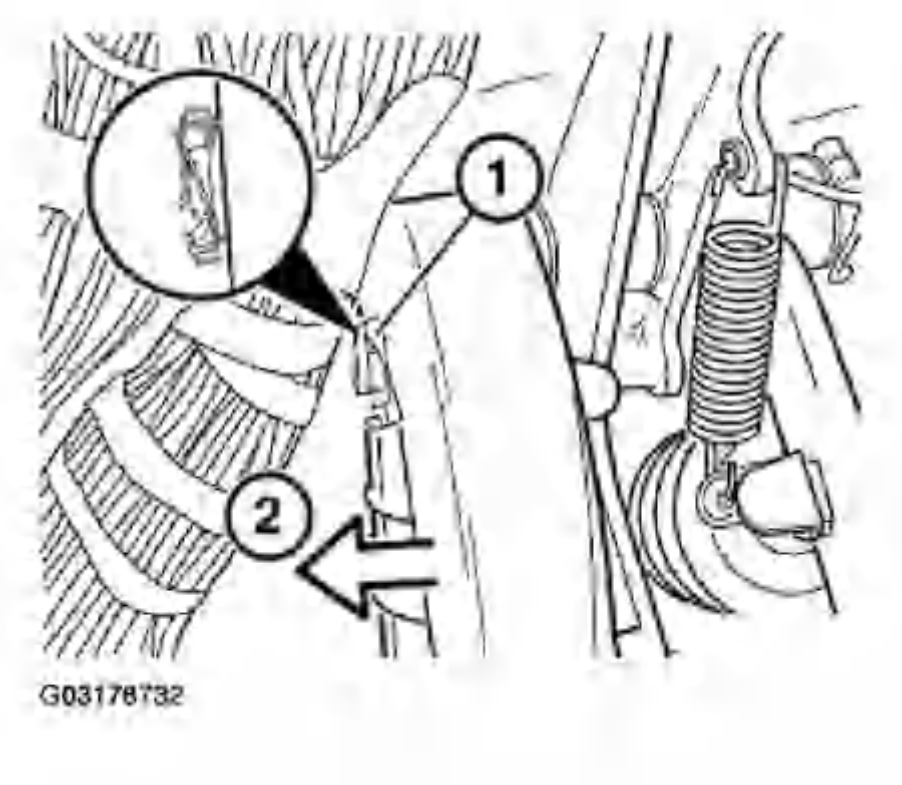


Fig. 22: Removing Locking Clip For Clutch Pedal
Courtesy of BMW OF NORTH AMERICA, INC.

Pull off clutch pedal (2).

Installation:

Check bearing sleeves, replacing if necessary.

KICK-DOWN

35 41 ... THROTTLE-CABLE ADJUSTING PROCEDURES

Adjusting Instruction For Throttle Cable:

For Vehicles With Manual Transmission:

1. Accelerator-pedal plate in idling position (accelerator pedal on idling stop).
2. Throttle in idling position.
3. Adjust throttle cable so that it is free from tension (adjusting screw on throttle cable).
4. Adjust adjustment screw on "full-throttle stop of pedal assembly" so that it rests against accelerator-pedal plate when engine is at full load and there is still play of 0.5 mm at throttle full-load stop.

   Unscrewing adjusting screw by 1.5 turns is equal to 0.5 mm play.

5. Lock with M8 nut.

For Vehicles With Automatic Transmission:

1. to 3., refer to manual transmission.

Without override element:

4. Adjust pressed full-throttle stop so that it rests against accelerator-pedal plate when transmission is at

full load and there is still play of 0.5 mm at throttle full-load stop.

Unscrewing adjusting screw by 1.5 turns is equal to 0.5 mm play.

5. Lock with M8 nut.

35 41 000 REPLACING ACCELERATOR PEDAL

CAUTION: A removed accelerator pedal must always be replaced as removing will damage the retaining clips. This would allow the pedal to slide out of its holder and could cause an accident!

Press off locking washer (1).

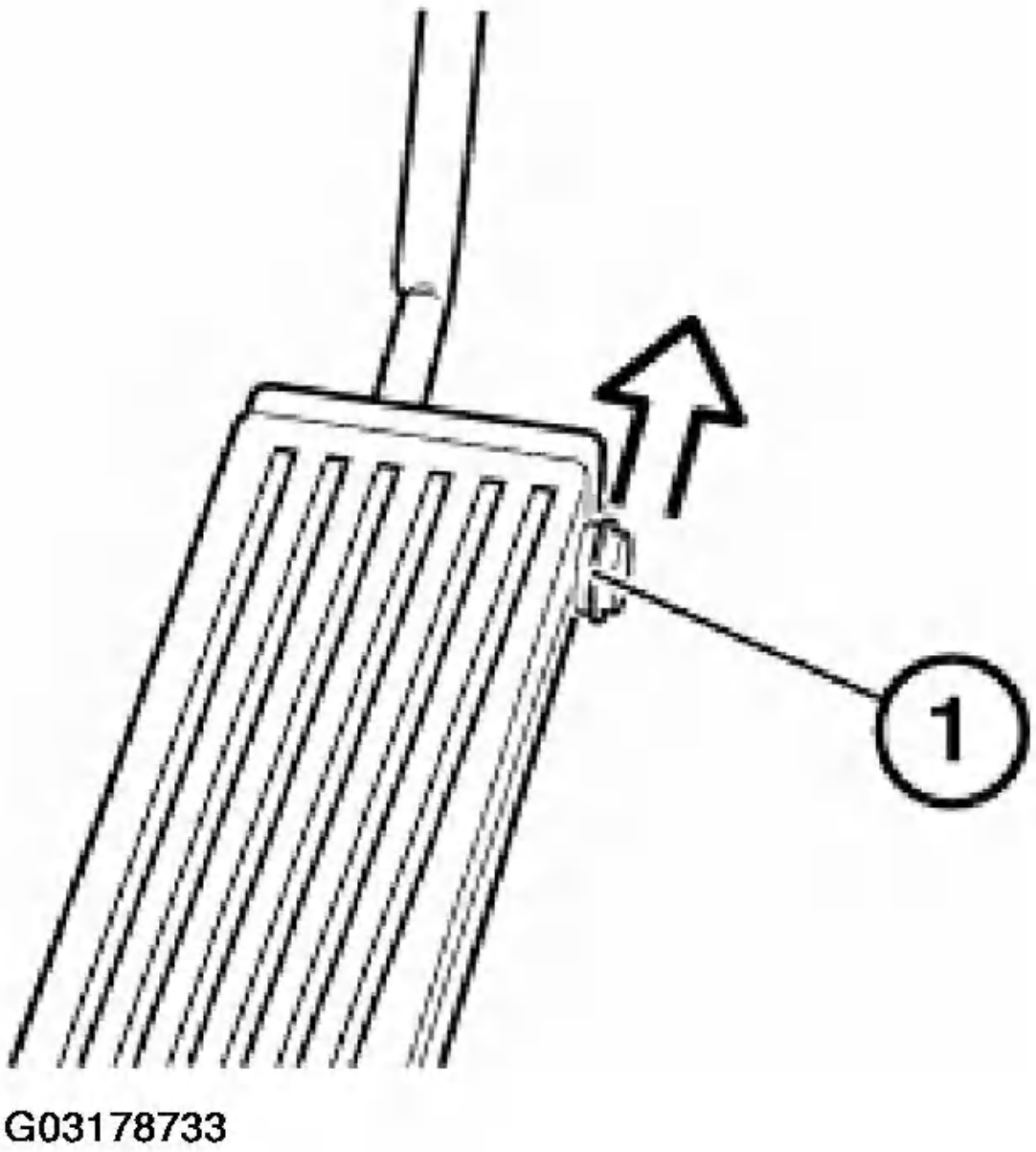


Fig. 23: Removing Locking Washer From Accelerator Pedal
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect pedal.

Installation:

Lubricate sliding surfaces with grease, refer to 35 41 ACCELERATOR PEDAL AND LINKAGES E36 .

Press down on carpet, unbend retaining clips and lever out accelerator pedal in upwards direction.

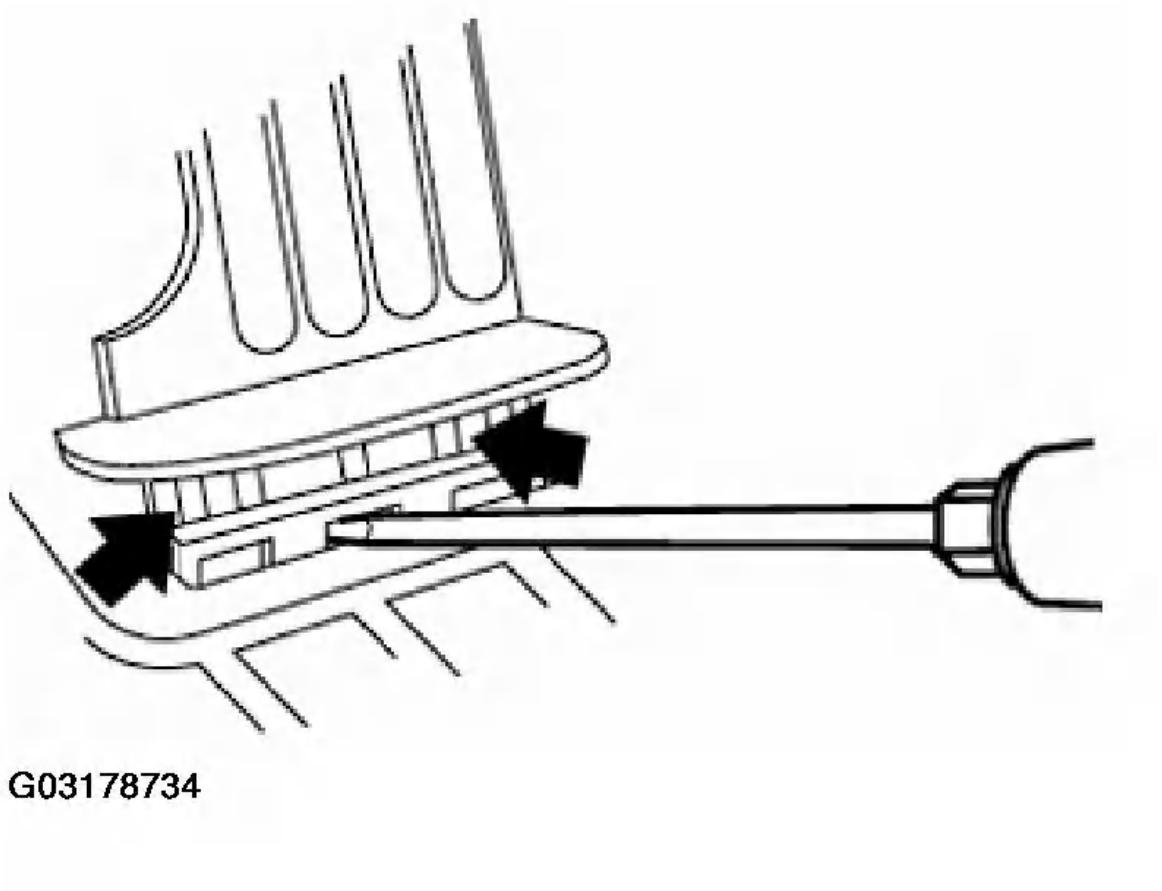


Fig. 24: Removing Accelerator Pedal Using Screwdriver
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Install accelerator pedal with pocket on holder on floor plate and snap retaining clips into place.

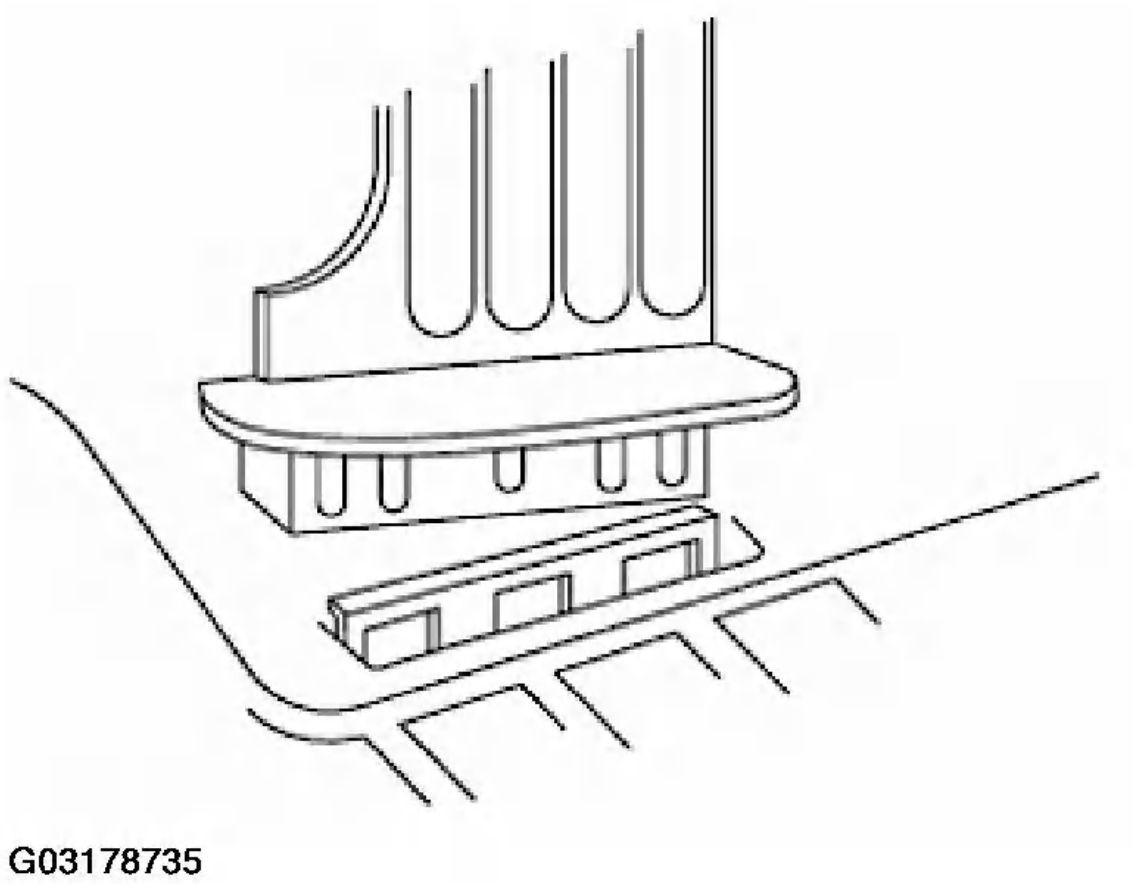


Fig. 25: Installing Accelerator Pedal
Courtesy of BMW OF NORTH AMERICA, INC.

CAUTION: To be absolutely sure, check that retaining clips have snapped into place.

35 41 010 REMOVING AND INSTALLING OR REPLACING ACCELERATOR LEVER

NOTE: Remove paneling for instrument panel, see 51 45 180 REMOVING AND INSTALLING/REPLACING TRIM FOR INSTRUMENT PANEL, BOTTOM LEFT (Z3 ROADSTER, M ROADSTER, Z3 COUPE, M COUPE) .

Disconnect Bowden cable on accelerator-lever shaft.

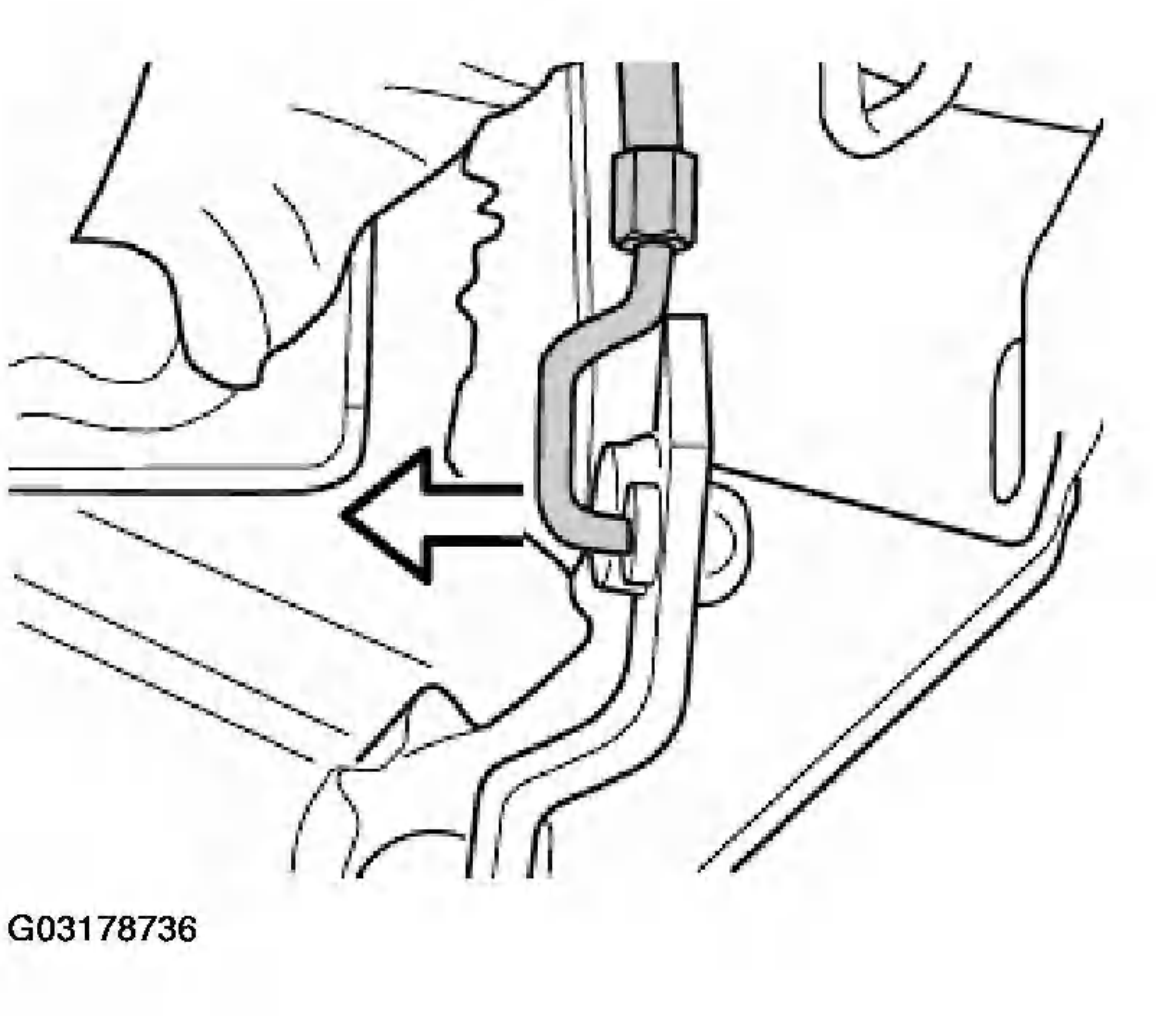


Fig. 26: Disconnecting Bowden Cable On Accelerator-Lever Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check rubber grommet, replacing if necessary.

Press off locking washer (1).

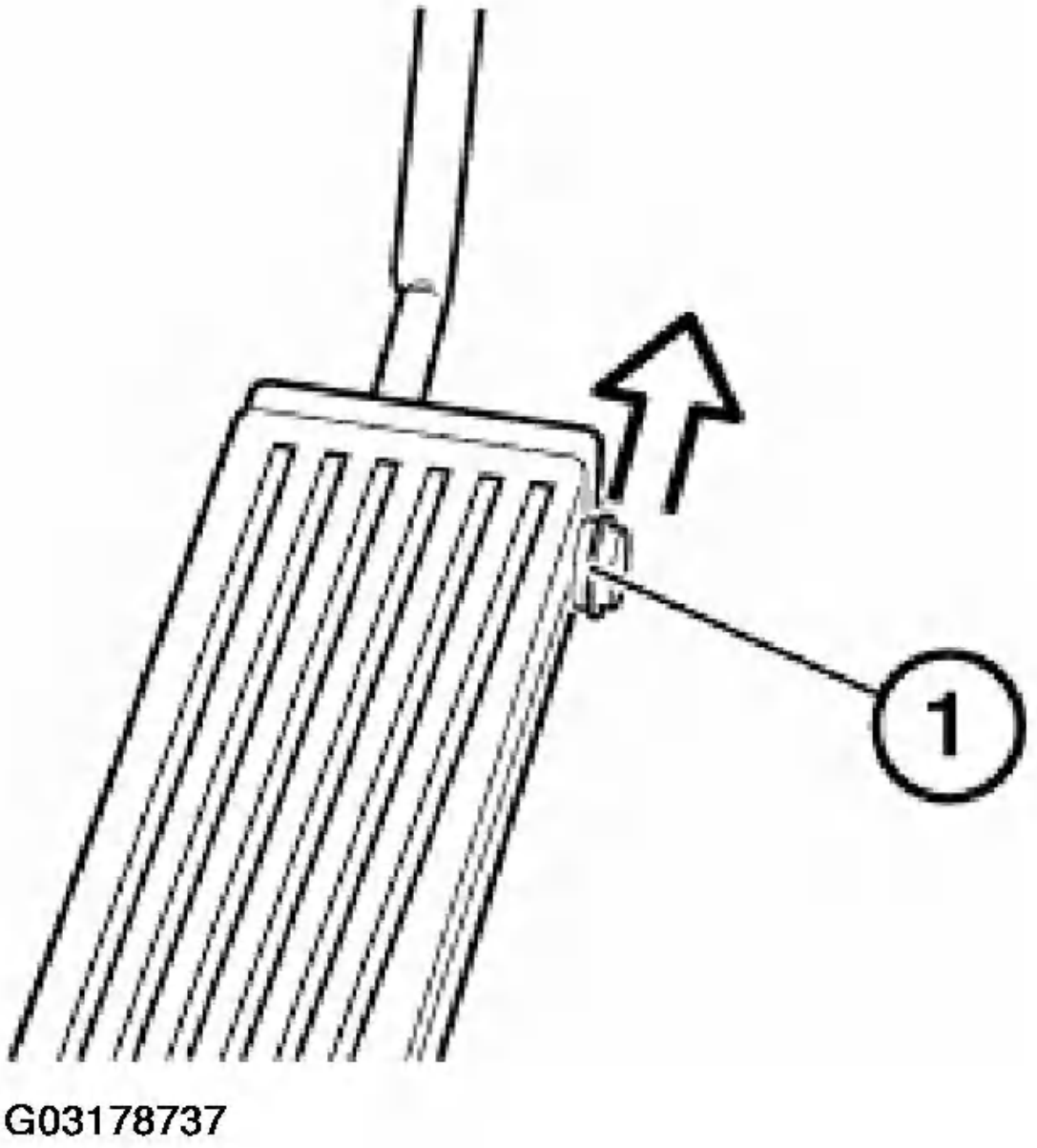


Fig. 27: Removing Locking Washer From Accelerator Pedal
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect pedal.

Installation:

Grease anti-friction faces, refer to 35 41 ACCELERATOR PEDAL AND LINKAGES E36 .

Take off locking clip.

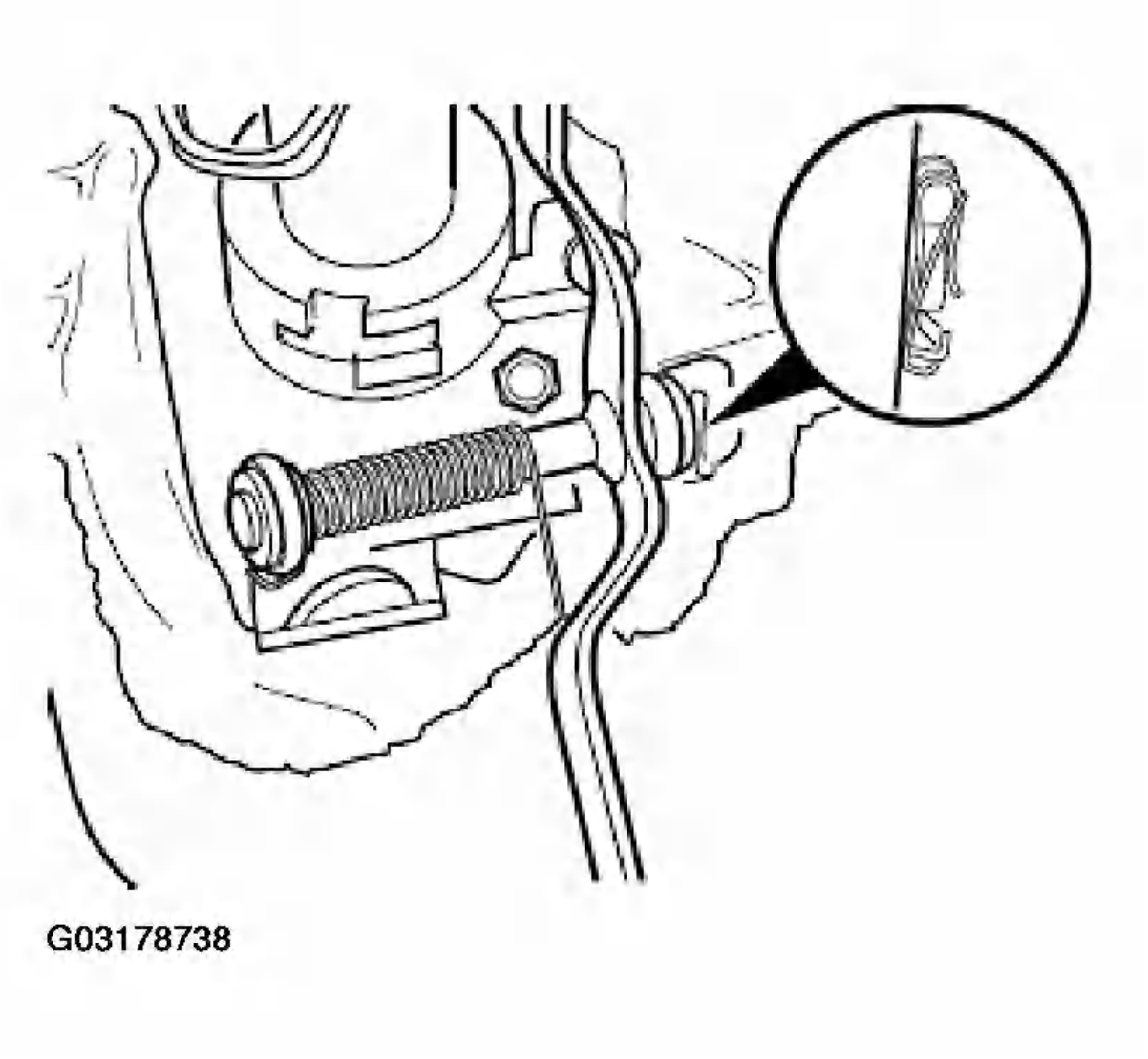


Fig. 28: Removing Locking Clip
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check for correct seating of locking clip.

Disconnect return spring.

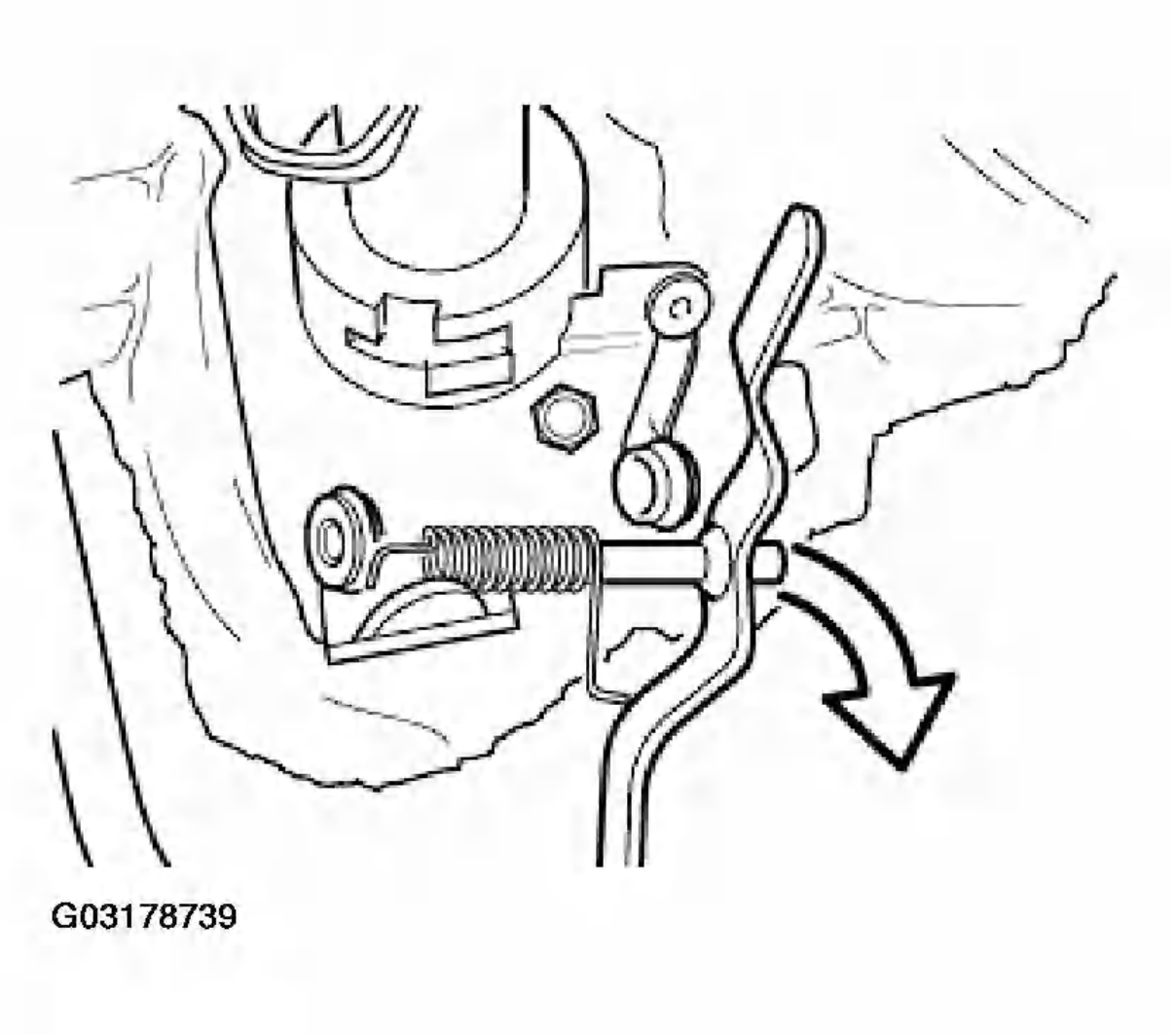


Fig. 29: Disconnecting Return Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Slide accelerator-lever shaft to the left and remove.

Installation:

Check for correct installation position of return spring.

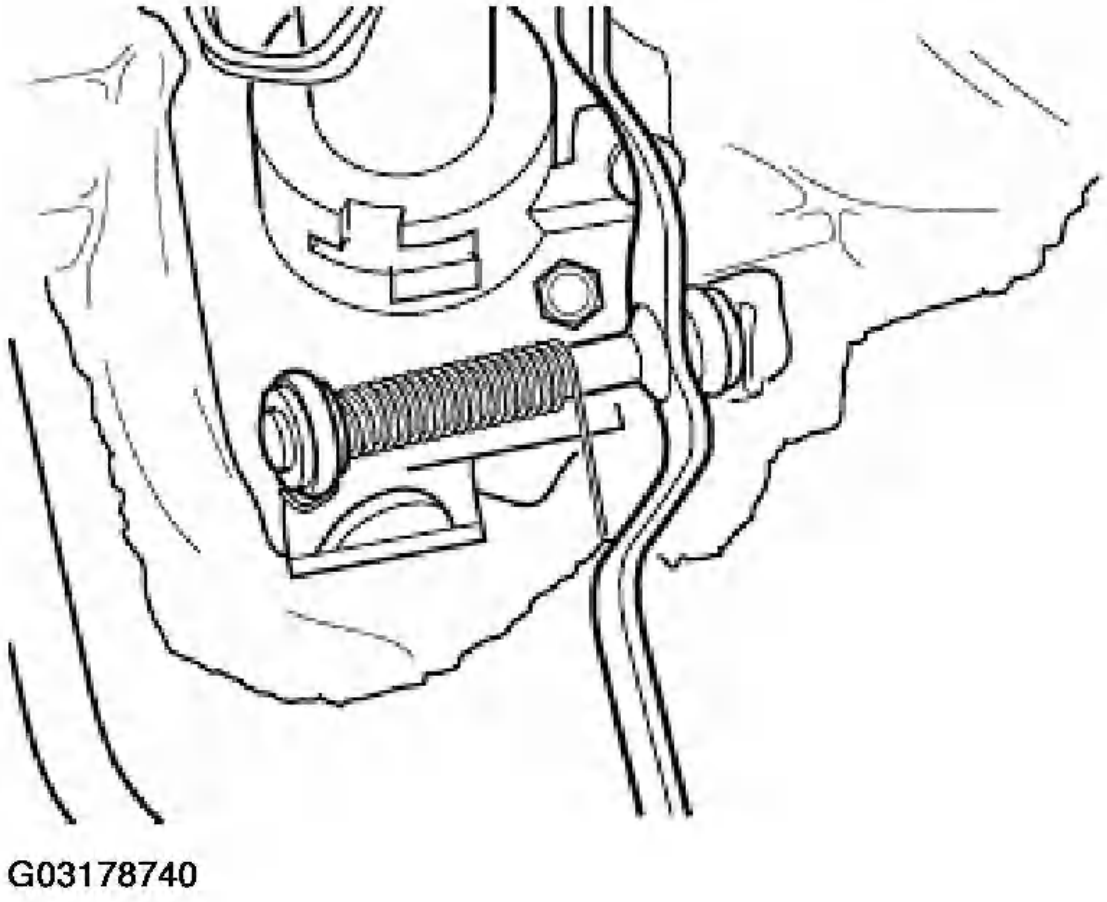


Fig. 30: Checking Return Spring Installation Position
Courtesy of BMW OF NORTH AMERICA, INC.

35 41 421 REPLACING BOWDEN CABLE FOR THROTTLE VALVE ACTUATION

CAUTION: Adjust throttle cable after installation, refer to 35 41 ... THROTTLE-CABLE ADJUSTING PROCEDURES .

Remove and install panelling for instrument panel, refer to 51 45 180 REMOVING AND INSTALLING/REPLACING TRIM FOR INSTRUMENT PANEL, BOTTOM LEFT (Z3 ROADSTER, M ROADSTER, Z3 COUPE, M COUPE) .

Disconnect Bowden cable on accelerator-lever shaft.

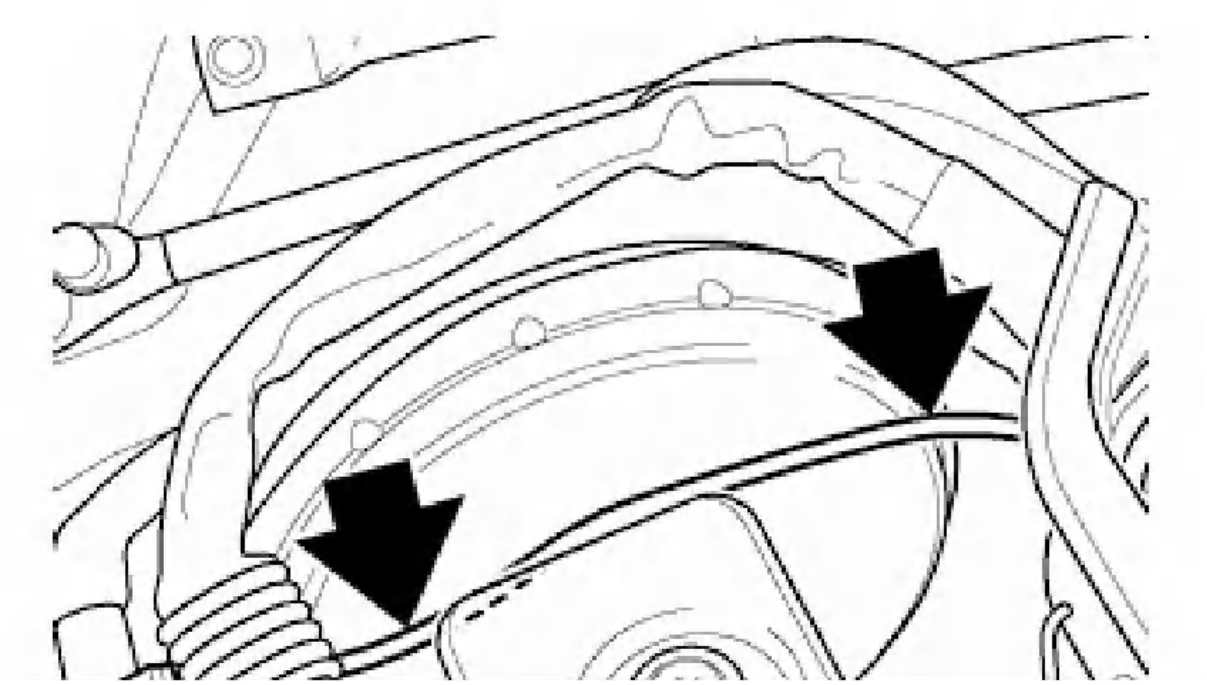


Fig. 31: Disconnecting Bowden Cable On Accelerator-Lever Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check rubber grommet (1), replace if necessary.

Compress retaining hook and pull Bowden cable out of engine-compartment wall.

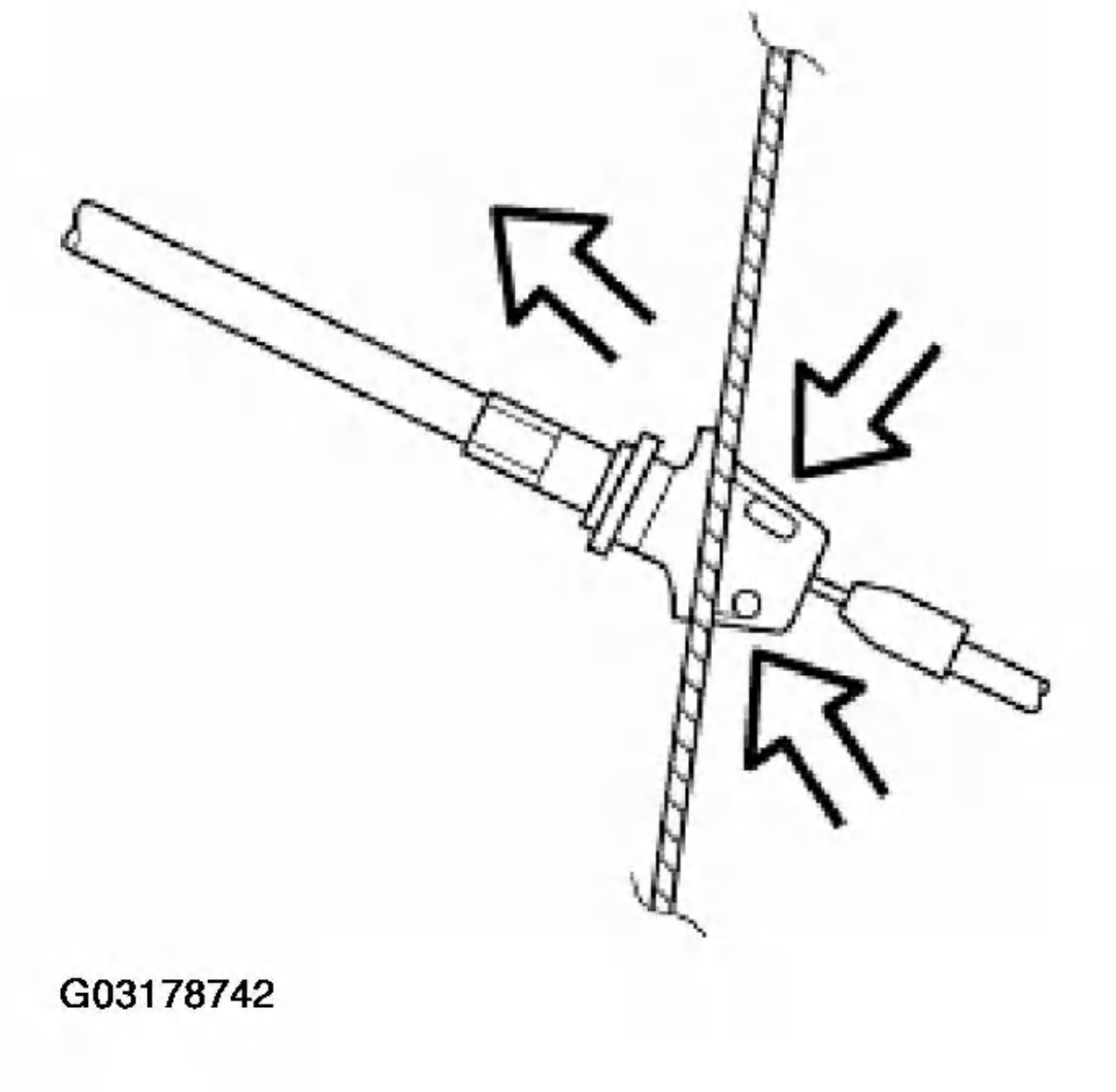


Fig. 32: Removing Bowden Cable Out Of Engine-Compartment Wall
Courtesy of BMW OF NORTH AMERICA, INC.

6-Cylinder:

Compress nipple mounts on both lugs and press out of operating lever.

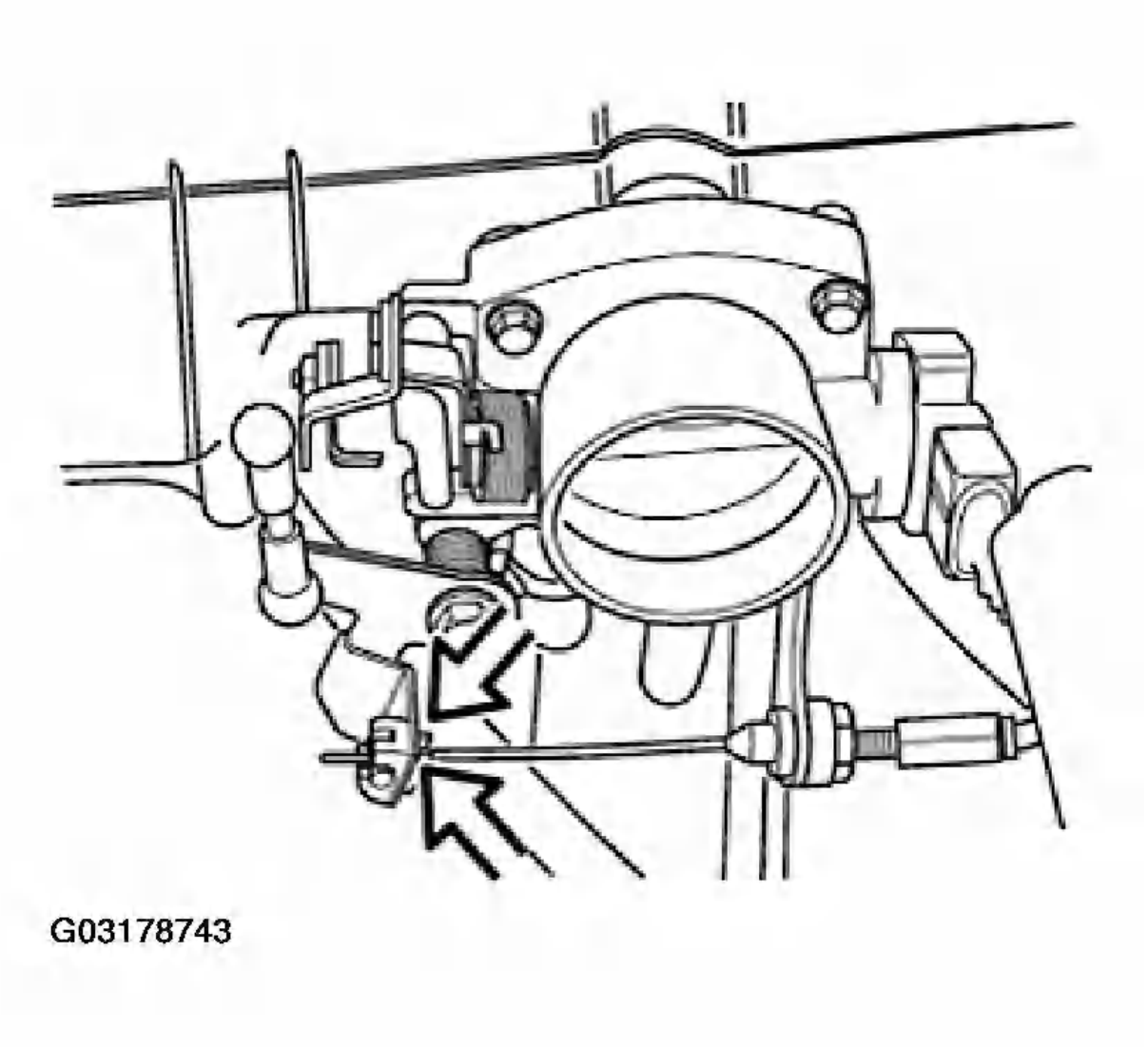


Fig. 33: Locating Nipple Mounts
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Intake pipe was removed for demonstration purposes.

Press nipple out of nipple mounts.

Take Bowden cable out of nipple mounts.

Fig. 34: Removing Bowden Cable Out Of Nipple Mounts
Courtesy of BMW OF NORTH AMERICA, INC.

Remove protective cap using a screwdriver.

Pull out Bowden cable towards rear of vehicle.

Fig. 35: Removing Bowden Cable Towards The Rear
Courtesy of BMW OF NORTH AMERICA, INC.

Take rubber pad out of retainer.

Installation:

Guide in Bowden cable as far as stop.

Overview of throttle cable to throttle-valve assembly:

1. Nipple.
2. Accelerator Bowden cable.
3. Protective cap.
4. Rubber mount.
5. Sleeve.
6. Adjusting screw.

Fig. 36: Identifying Throttle Cable To Throttle-Valve Assembly Components
Courtesy of BMW OF NORTH AMERICA, INC.

4-Cylinder:

Unscrew screw.

Fold up cover.

Fig. 37: Removing Cover And Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Press nipple mount apart at both lugs and press out of operating lever.

Fig. 38: Removing Nipple Mount
Courtesy of BMW OF NORTH AMERICA, INC.

Press nipple out of nipple mounts.

Installation:

Check installed position (rear take-up)

Fig. 39: Removing Nipple From Nipple Mounts
Courtesy of BMW OF NORTH AMERICA, INC.

Unbend nipple mounts using a screwdriver and remove Bowden cable.

Fig. 40: Removing Bowden Cable
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace nipple mounts.

Remove protective cap using a screwdriver.

Pull out Bowden cable towards rear of vehicle.

Fig. 41: Removing Bowden Cable Towards The Rear
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Guide in Bowden cable as far as stop.

35 41 480 REPLACING KICKDOWN SWITCH (EH TRANSMISSION)

Testing - see Status List Diagnosing Program 03 EGS and use BMW SERVICE TESTER or MODIC.

Pull off flat male connector (1).

Fig. 42: Removing Flat Male Connector
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew nut (2).

Unscrew switch.

Installation:

Adjust nut to control distance C, see 35 41 ACCELERATOR PEDAL AND LINKAGE .

Fig. 43: Adjusting Nut To Control Distance C
Courtesy of BMW OF NORTH AMERICA, INC.

Make final adjustment after installation.

Article GUID: A00202361

GENERAL

35 00 REAR AXLE IN GENERAL E36

REAR AXLE IN GENERAL E36 TECHNICAL SPECIFICATION

Spacing between accelerator pedal and Brake pedal Measuring points, refer to 35 00... PEDAL ASSEMBLY .	.....	.....
Manual transmission J	mm	50
Autom. transmission K	mm	60
Distance tunnel-brake pedal Measuring points, refer to 35 00... PEDAL ASSEMBLY .	.....	.....
Manual transmission F	mm	135 +/- 5
Automatic transmission G	mm	145 +/- 5
Spacing H between brake pedal and Clutch pedal Measuring points, refer to 35 00... PEDAL ASSEMBLY .	mm	50
Specified distances are reference values only and do not account for installation tolerances. Distances without consideration for carpets.	.....	.....

BRAKE PEDAL WITH LINKAGE

35 21 BRAKE PEDAL AND LINKAGES E36

BRAKE PEDAL AND LINKAGES E36 TECHNICAL SPECIFICATION

Distance A pedal underside - bulkhead Measuring points, refer to 35 00... PEDAL ASSEMBLY .	mm	225 + 10

35 31 CLUTCH PEDAL AND LINKAGES E36

CLUTCH PEDAL AND LINKAGES E36 TECHNICAL SPECIFICATION

Distance B pedal underside - bulkhead Measuring points, refer to 35 00... PEDAL ASSEMBLY .	mm	260 + 10
Specified distances are reference values only and do not account for installation tolerances. Distances without consideration for carpets.	.....	.....

CLUTCH PEDAL WITH LINKAGE

35 31 CLUTCH PEDAL AND LINKAGES E36

CLUTCH PEDAL AND LINKAGES E36 TECHNICAL SPECIFICATION

Distance B pedal underside - bulkhead Measuring points, refer to 35 00... PEDAL ASSEMBLY .	mm	260+10
Specified distances are reference values only and do not account for installation tolerances. Distances without consideration for carpets.	.....	.....

KICK-DOWN

35 41 ACCELERATOR PEDAL AND LINKAGES E36

ACCELERATOR PEDAL AND LINKAGES E36 TECHNICAL SPECIFICATION

Thread adjustment dimension C at full throttle stop Measuring points, refer to 35 00... PEDAL ASSEMBLY .	.....	.....
Manual transmission	mm	62
Automatic transmission	mm	54
EH transmission	mm	51
Lubricant for bearings: Renocal FN 745 Fa. Fuchs Mannheim	.....	.....
Specified distances are reference values only and do not account for installation tolerances. Distances without consideration for carpets.	.....	.....

Article GUID: A00202377

OPERATING FLUIDS

Operating Fluids - Brakes - All Models

1.0 GENERAL INFORMATION

Brake fluid, (glycol-based) as used in BMW brake systems, must conform with the following requirements:

- High boiling point
- Good low temperature resistance
- Low compressibility
- Corrosion inhibition for all metal parts inside of brake system
- Compatibility with all rubber parts used in brake system

These requirements are fulfilled by reputable brand name DOT 4 brake fluids.

Silicone-based brake fluid has better compressibility, but because it cannot absorb moisture, is subject to vapor lock at temperatures above 212Â°F/ 100Â°C. At lower temperatures, it may even ice-up. Silicone-based brake fluid is not approved by BMW .

Glycol-based brake fluid absorbs moisture from the atmosphere (hygroscopicity) through the brake fluid reservoir, brake hoses, etc. This absorption of water lowers the original boiling point of brake fluid and active safety of the entire system. If there is extended use of the brakes while driving downhill at high speeds, the thermal loads could cause vapor bubbles in the brake fluid. This situation could lead to reduced braking effectiveness.

The original boiling point of factory-approved brake fluids is approximately 500Â°F/260Â°C. Due to the hygroscopic behavior of brake fluid, 2% of water within one year is permissible. The boiling point of brake fluid will drop by 100Â°C with 3% water absorption. It is essential to conform with brake fluid changing intervals in order to guarantee the safety and maximum effectiveness of a brake system.

It would not be sufficient simply to replace the brake fluid in the reservoir. Experience has shown that vapor bubbles will occur first on areas of the brake caliper. This area is subjected to high thermal loads and also exposed to heat transmission.

When replacing the brake fluid, the brake fluid used as the working fluid in the hydraulic clutch should also be replaced. This is done by draining the clutch operation system or bleeding with the help of the clutch slave cylinder.

The brake fluid should be replaced by filling the brake fluid reservoir. Make sure that each bleeder valve of all wheel cylinders or brake calipers is kept open until the escaping brake fluid is clear and without air bubbles. Never use brake fluid that has been drained from the system.

Storage of brake fluids also deserves your special attention. The aging process begins with the initial contact between the brake fluid and the atmosphere. This means immediately after a new container is opened.

To keep the boiling point of stored brake fluids as high as possible, we recommend conforming with the following points:

- Close all containers tightly.
- Select small size containers, which can be used up quickly.
- Avoid pouring contents of one container into a different container.

2.0 HANDLING BRAKE FLUIDS

Brake fluids could be mixed up accidentally with mineral oil products so it is important to leave them in their original containers and not pour them into a different container.

CAUTION

If brake fluid accidentally comes into contact with your skin, wash it off with soap and water immediately. Eyes should be thoroughly flushed with cold water if contacted by brake fluid. Vomiting should be induced if brake fluid is internally consumed and a physician should be consulted.

If brake fluid is spilled or drips on a painted surface, wash it off with water immediately to prevent damage to the paint finish. Never rub it off. Brake fluids should not have contact with grease or oil. Wash hands to remove grease and oil before working with brake fluids. Also make sure that grease cannot enter the brake system.

Drained brake fluid must never be discarded in the garbage, oil disposal tanks or water drains.

Read instructions on container label prior to use.

3.0 BMW TESTED AND APPROVED BRAKE FLUIDS

BMW Tested and Approved DOT 4 ESL Brake Fluid is available as follows:

BRAKE FLUID SPECIFICATION

12 fl. oz. bottle	BMW Part No. 81 22 0 142 156
1 gallon container	BMW Part No. 81 22 0 142 155

See S.I. Bulletin B 34 09 01.

4.0 BRAKE FLUID CHANGE INTERVALS

All Models Brake fluid change interval every 2 years.

5.0 OTHER OPERATING FLUIDS

ANTI-SQUEAK/CORROSION PASTE

Bostik NEVER-SEEZ(R) to prevent disc brake squeaking. It is applied on cleaned recesses, pressure surfaces of piston crowns, brake pad backplates and possibly transfer plates - but not on friction liners.

To prevent corrosion between the ABS impulse sensor and the hole in the wheel suspension component, apply a thin coat of Bostik NEVER-SEEZ(R) to cleaned sensor and hole before assembly.

Bostik NEVER-SEEZ(R) Part No. NSBT-16

See S.I. Bulletins B 34 02 94, B 34 05 98, and B 34 03 00.

BRAKE CLEANER SPRAY

Non-CFC spray (former BMW Part No. 81 22 9 407 704) for cleaning brakes, brake pads, brake shoes, drums, disks and other brake components. Also suitable for clutch pressure plates.

NON-CFC SPRAY SPECIFICATION

3M	Part No. 8895
Loctite	Part No. 82220
CRC	Part No. 08088

Article GUID: A00217936