# ADJUSTMENTS

## VEHICLES WITH TWO POLY-V BELTS

An accessory component rotary drive is accomplished with two poly-V type drive belts. Once correctly installed the belts are self-adjusting with automatic hydraulic tensioners and are maintenance free.

## VEHICLES WITH SINGLE V BELT

1. Tension should be checked using a V-belt tension gauge special tool 11 5 020. Tension is adjusted through a toothed rack mechanism (3). See Fig. 1.
2. Adjust belt by first loosening mounting nuts/bolts (1, 2) until unit pivots freely. See Fig. 1.

CAUTION: Do not over tighten the V-belt to prevent shaft bearings from failing prematurely.

3. Use a torque wrench and a crowfoot wrench to turn tensioning gear bolt (3). Hold wrench steady and tighten locknut on rear of tensioning gear bolt.
4. Tighten all other mounting nuts to specification. See.

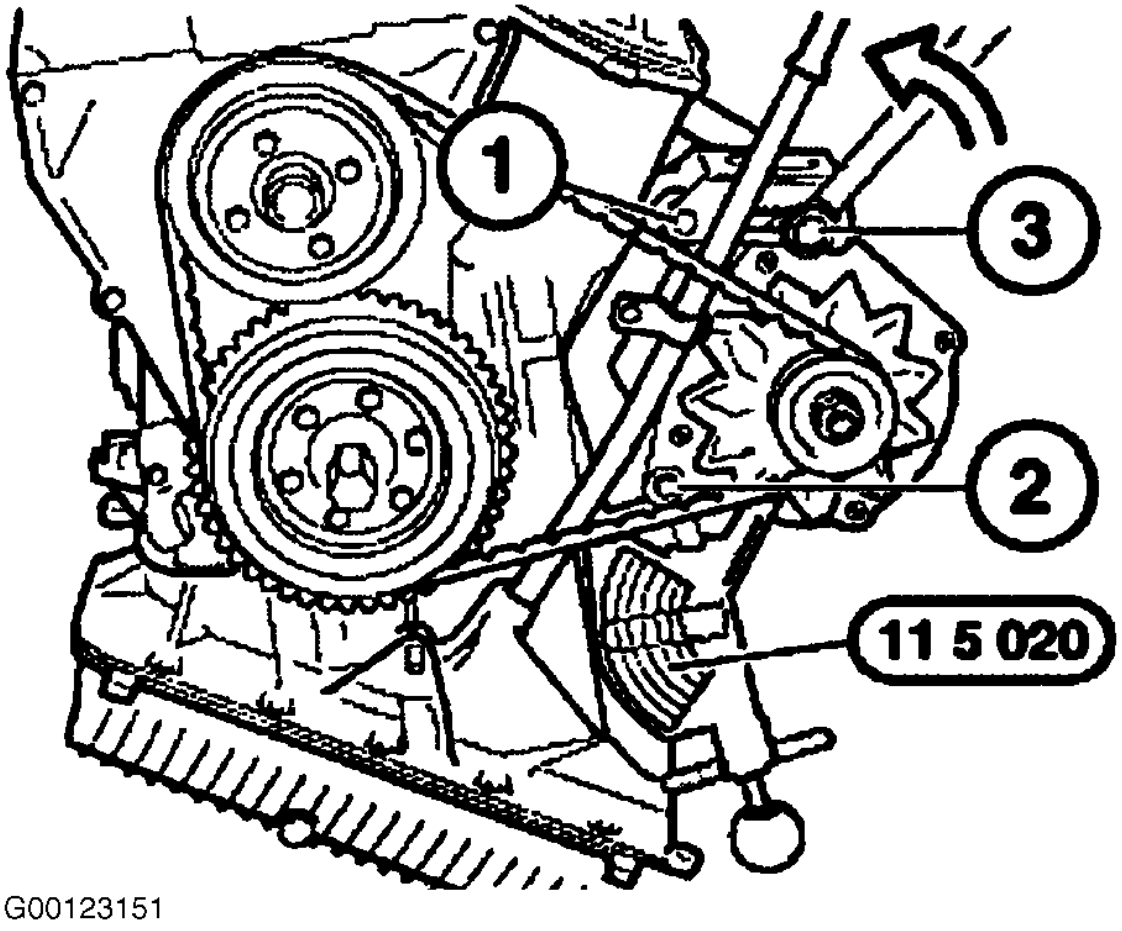



Fig. 1: Adjusting V-belt Tension
Courtesy of BMW OF NORTH AMERICA, INC.

# DRIVE BELT ROUTING

## VEHICLES WITH SINGLE V BELT

1. On M20, M30, M42, S14 and S38 routing will be similar. See Fig. 1.
2. On M43 and M44, see Fig. 2.

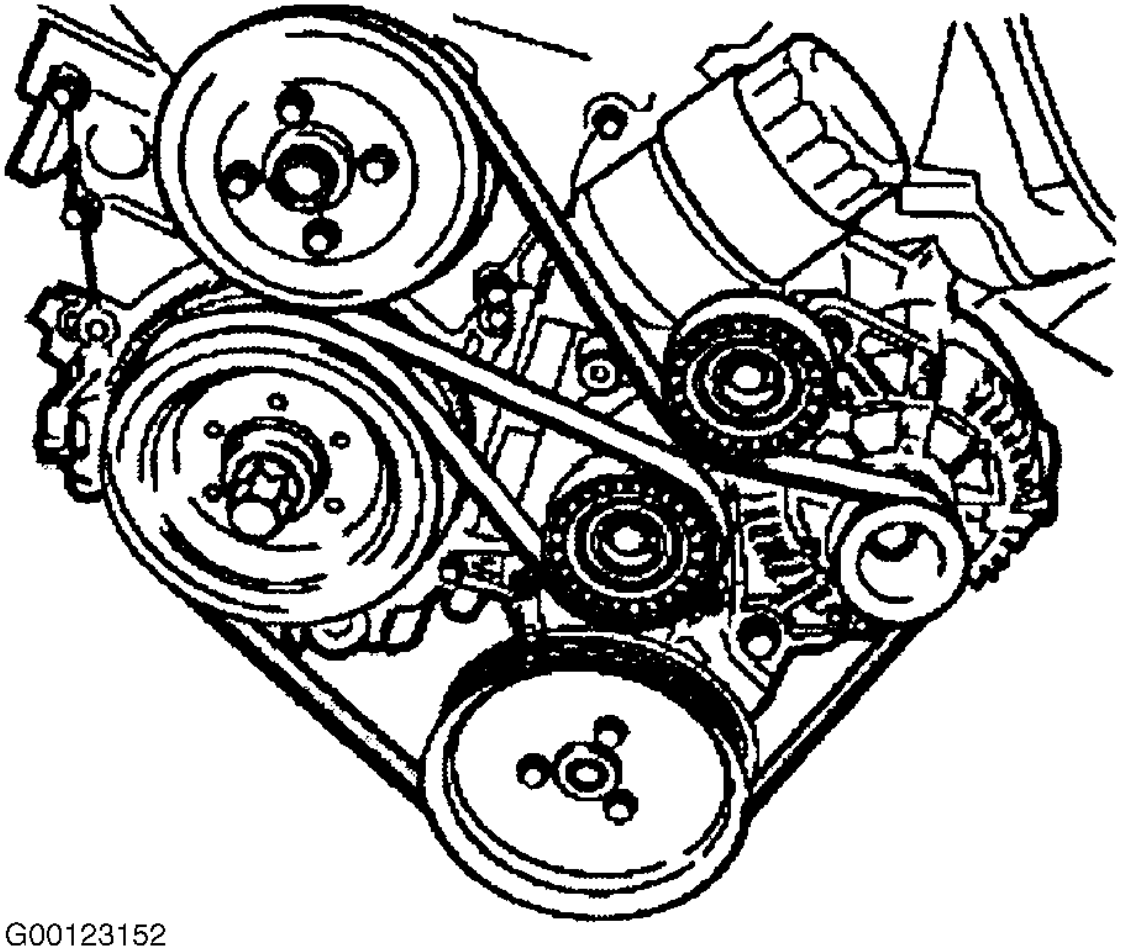



Fig. 2: Drive Belt Routing (M43 & M44)
Courtesy of BMW OF NORTH AMERICA, INC.

## VEHICLES WITH TWO POLY-V BELTS

DRIVE BELT ROUTING IDENTIFICATION

| Engine | See |
|---|---|
| M50, S50 & S54 | Fig. 3 |
| M52, S52 & M54 | |
| Alternator Drive Belt | |
| Without Auxiliary Tensioning Roller | Fig. 4 |
| With Auxiliary Tensioning Roller | Fig. 5 |
| A/C Compressor Drive Belt | |
| With Hydraulic Drive Belt & Tension Jack | Fig. 6 |
| With Mechanical Drive Belt & Tension Jack | Fig. 7 |
| N62 | |
| Alternator Drive Belt | Fig. 8 |

| | |
|---|---|
| A/C Compressor Drive Belt | Fig. 9 |
| S62 | |
| Alternator Drive Belt | Fig. 10 |
| A/C Compressor Drive Belt | Fig. 11 |

Drive Belt Routing (M50, S50 & S54)




Fig. 3: Drive Belt Routing (M50, S50 & S54)
Courtesy of BMW OF NORTH AMERICA, INC.

Drive Belt Routing (M52, M54 & S52)

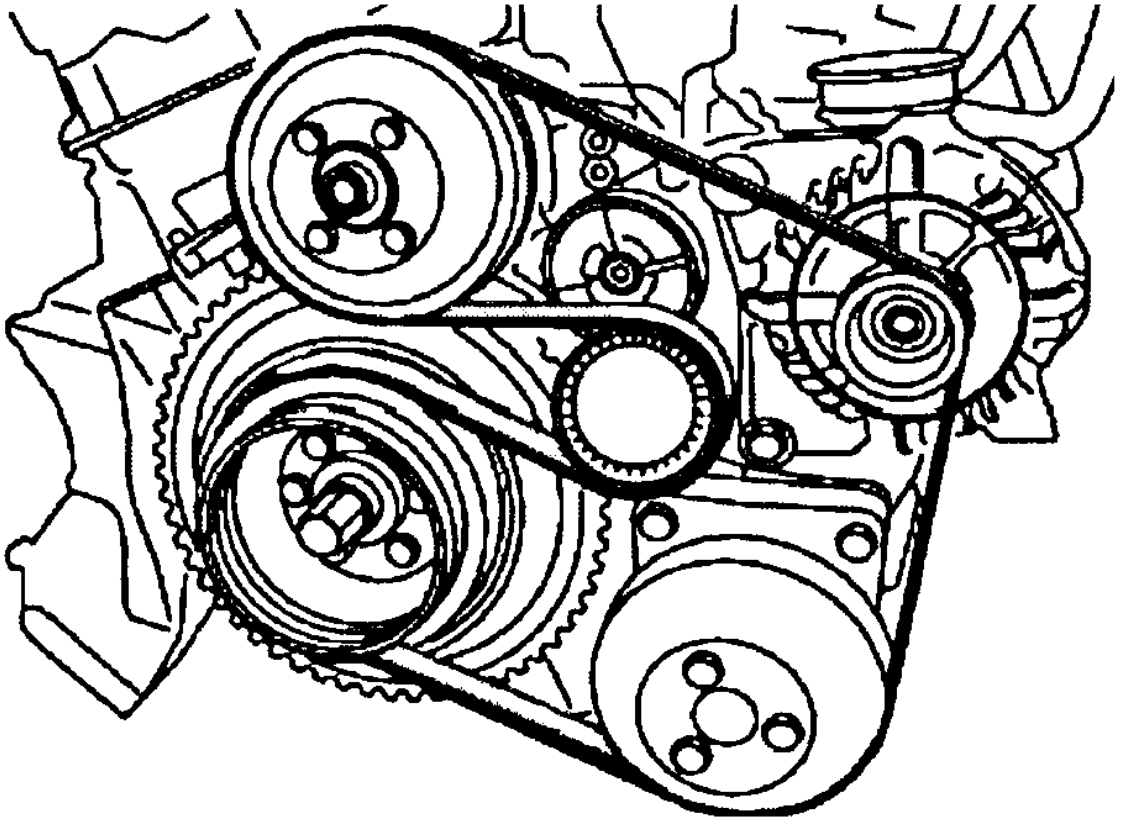



Fig. 4: Alternator Drive Belt Routing Without Auxiliary Tensioning Roller (M52, M54 & S52)
Courtesy of BMW OF NORTH AMERICA, INC.



Fig. 5: Alternator Drive Belt Routing With Auxiliary Tensioning Roller (M52, M54 & S52)
Courtesy of BMW OF NORTH AMERICA, INC.




Fig. 6: A/C Compressor Drive Belt Routing With Hydraulic Tension Jack (M52, M54 & S52)
Courtesy of BMW OF NORTH AMERICA, INC.

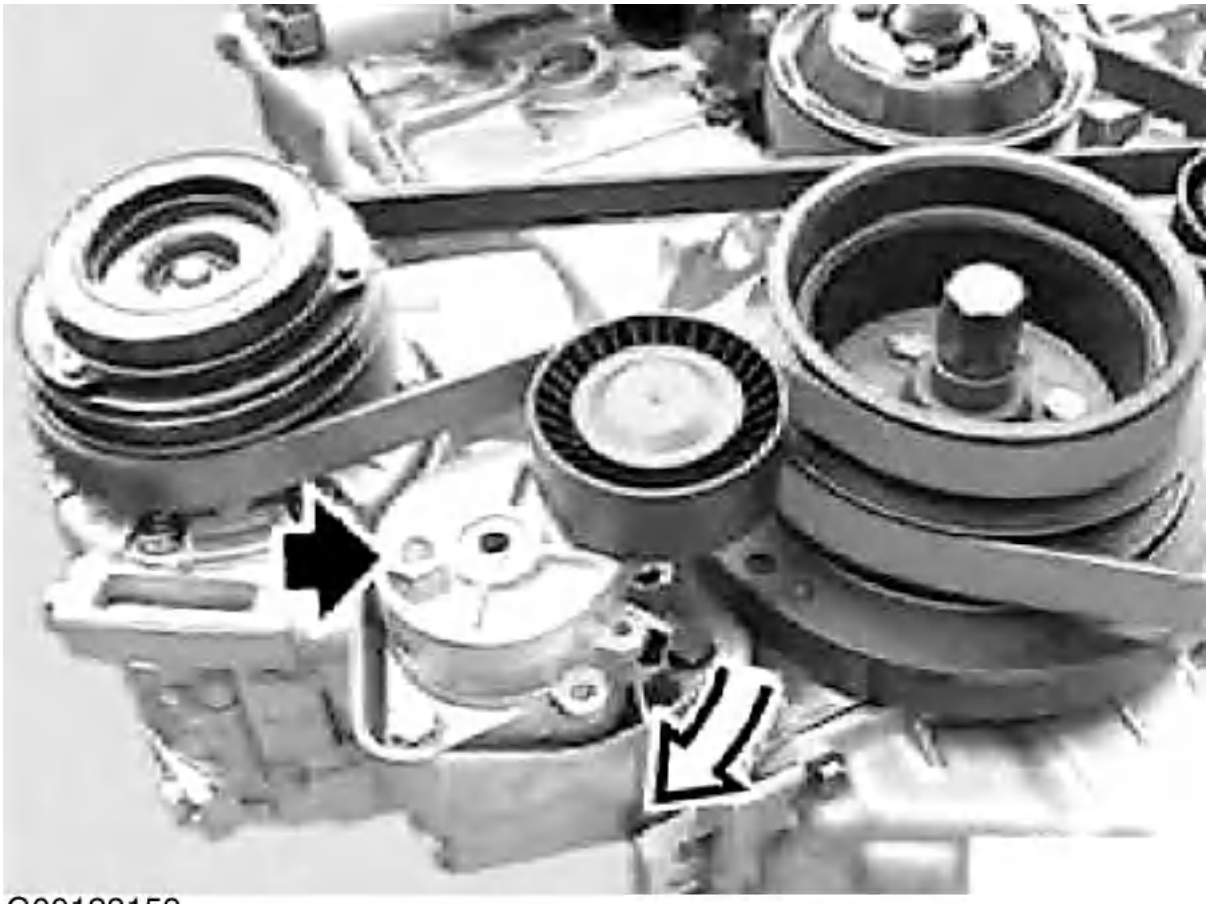



Fig. 7: A/C Compressor Drive Belt Routing With Mechanical Tension Jack (M52, M54 & S52)
Courtesy of BMW OF NORTH AMERICA, INC.

Drive Belt Routing (N62)




Fig. 8: Alternator Drive Belt Routing (N62)
Courtesy of BMW OF NORTH AMERICA, INC.



Fig. 9: A/C Compressor Drive Belt Routing (N62)
Courtesy of BMW OF NORTH AMERICA, INC.

Drive Belt Routing (S62)

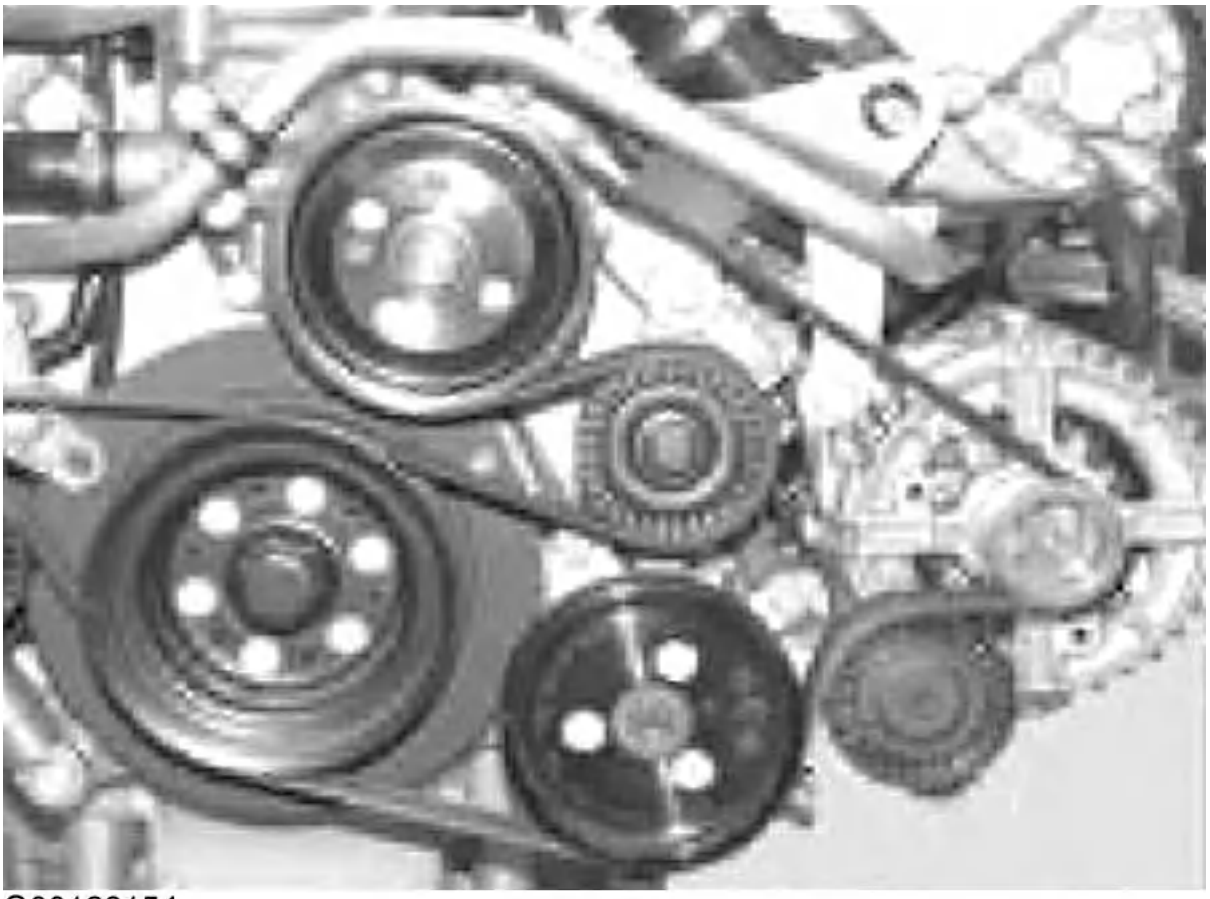



Fig. 10: Alternator Drive Belt Routing (S62)
Courtesy of BMW OF NORTH AMERICA, INC.

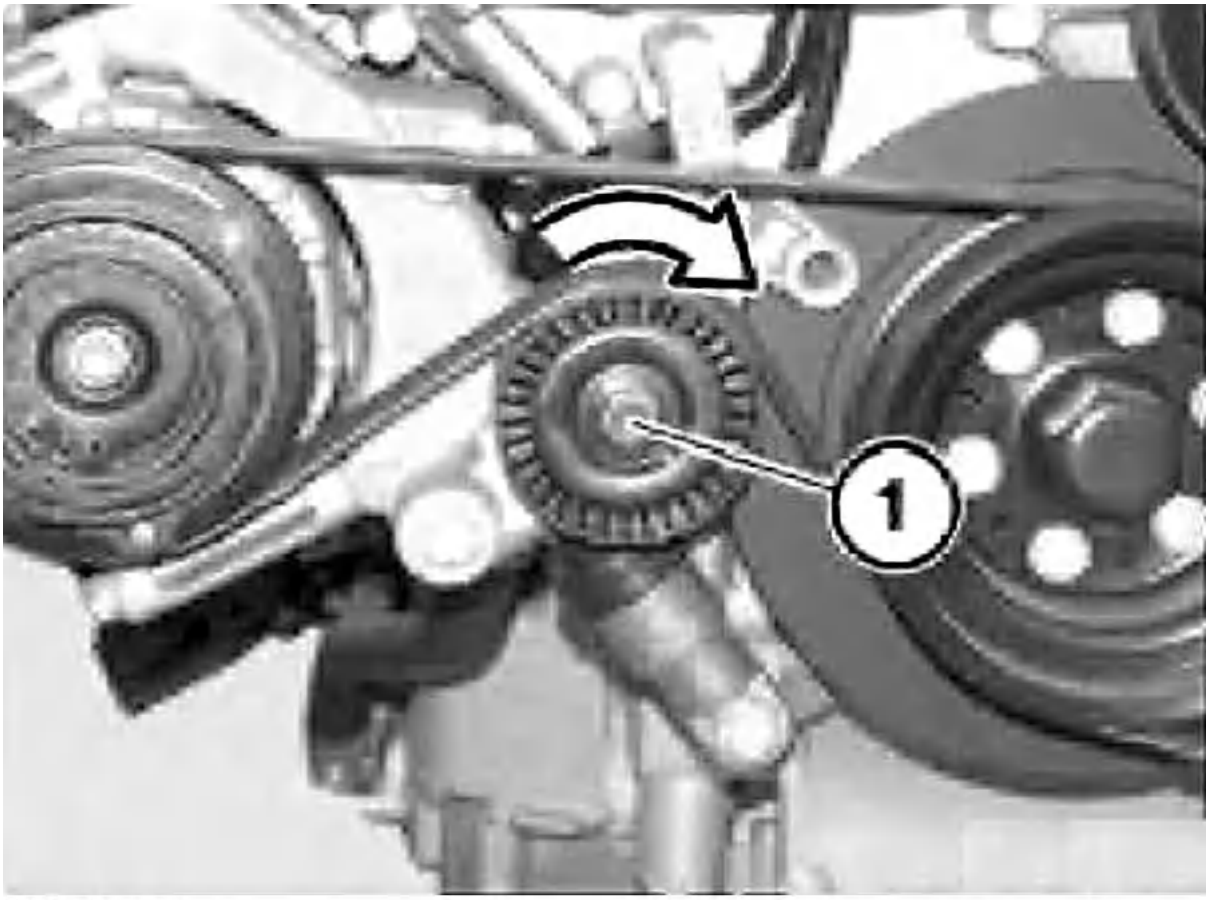



Fig. 11: A/C Compressor Drive Belt Routing (S62)
Courtesy of BMW OF NORTH AMERICA, INC.

## TROUBLE SHOOTING

NOTE: For electric cooling fan diagnosis and testing, see appropriate ELECTRIC COOLING FANS article. For cooling system removal and installation procedures, see appropriate REMOVAL & INSTALLATION article.

## SPECIFICATIONS

COOLING SYSTEM SPECIFICATIONS

| Application | Specification |
|---|---|
| Coolant Replacement Interval | 36 Months |
| Coolant Capacity | |
| M20 | 11.0 Qts. (10.5L) |
| M30 (Including Heater) | 12.7 Qts. (12.0L) |
| M30 (With Integrated Air Conditioner) | 13.2 Qts. (12.5L) |
| M42 & M44 (Including Heater) | 6.7 Qts. (6.5L) |
| M42 & M44 (With Integrated Air Conditioner) | 7 Qts. (6.7L) |
| M50 (Including Heater) | 11.1 Qts. (10.5L) |
| M50 (With Integrated Air Conditioner) | 11.6 Qts. (11.0L) |
| M54 | 8.9 Qts. (8.4L) |
| M52 (Including Heater) | 10.6 Qts. (10.0L) |
| N62 | 14.8 Qts. (14.0L) |
| S14 | 10.0 Qts. (9.5L) |
| S38 | 14 Qts. (13.3L) |

| | |
|---|---|
| S50 | 11.2 Qts. (10.75L) |
| S52 | 11.4 Qts. (10.8L) |
| S54 | 10.6 Qts. (10.0L) |
| S62 (With Latent Heat Accumulator) | 14.3 Qts. (13.5L) |
| S62 (Without Latent Heat Accumulator) | 12.7 Qts. (12.0L) |
| Fan Clutch | |
| Fan On Temperature | |
| M30 | 172-187Â° F (78-86Â° C) |
| S14, M20, M50, M52, S52 & M54 | 194Â° F (90Â° C) |
| S38 & S50 | 198Â° F (92Â° C) |
| M42 & M44 | 190-205Â° F (88-96Â° C) |
| S62 | 196-210Â° F (91-99Â° C) |
| Fan Off Temperature | |
| S14 | 113Â° F (45Â° C) |
| M20, M30, M42, M44, M50, M52, S38, S50, S52, M54 & S62 | 140Â° F (60Â° C) |
| Pressure Relief Valve Opens | 26.1-30.5 psi (1.8-2.1 bar) |
| Test Pressure For Cooling System | |
| M20, M30, M42, M44, M50, M52, M54, S14, S38, S50 & S52 | 14.5 psi (1 Bar) |
| M52, M54, N62, S62 & S54 | 21.8 psi (1.5 Bar) |
| Thermostat Opening Temperature (Stamped In Thermostat) | |
| S38 & S62 | 174Â° F (79Â° C) |
| S14, S50, M30, M20 & M50 | 176Â° F (80Â° C) |
| M42, M52 & S52 | 198Â° F (92Â° C) |
| M44 | 203Â° F (95Â° C) |
| M54 | 207Â° F (97Â° C) |

## TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

| Application | Ft. Lbs. (N.m) |
|---|---|
| Tensioning Gear Lock Nut | 18 (24) |
| | In. Lbs. (N.m) |
| A/C Belt Tension | 62-75 (7-8.5) |
| Alternator Belt Tension | 62 (7) |
| Power Steering Belt Tension | 71-75 (8-8.5) |

# Electric Cooling Fans - 3-Series (E36 & E36/7)

## DESCRIPTION & OPERATION

Cooling fan is controlled by Digital Motor Electronics (DME) control unit, and is located in front of radiator. See WIRING DIAGRAMS.

## SYSTEM TESTS

NOTE: Testing information is not available from manufacturer.

## REMOVAL & INSTALLATION

### COOLING FAN

NOTE: The following procedure and figures refer to E36 models. The E36/7 models (M Coupe, M Roadster and Z3) are similar. Numbers in text refer to numbers in figures.

#### Removal & Installation

1. Remove cover from top of radiator. See Fig. 1. Remove underbody protection from front of vehicle. See Fig. 2. See UNDERBODY PROTECTION (EXCEPT M COUPE & M ROADSTER) or UNDERBODY PROTECTION (M COUPE & M ROADSTER) .
2. On version 1, remove screws (1, 2, 3) from fan carrier. See Fig. 3. Disconnect electrical connector. See Fig. 4. Remove fan bracket and fan from retaining shoe. See Fig. 5. Lift out fan and bracket.
3. On version 2, remove front bumper. See FRONT BUMPER (EXCEPT M COUPE, M ROADSTER & Z3) or FRONT BUMPER (M COUPE, M ROADSTER & Z3). Disconnect electrical connector. See Fig. 6. Remove bolts from fan carrier. Remove fan carrier from underneath vehicle. See Fig. 7. To install, reverse removal procedure.

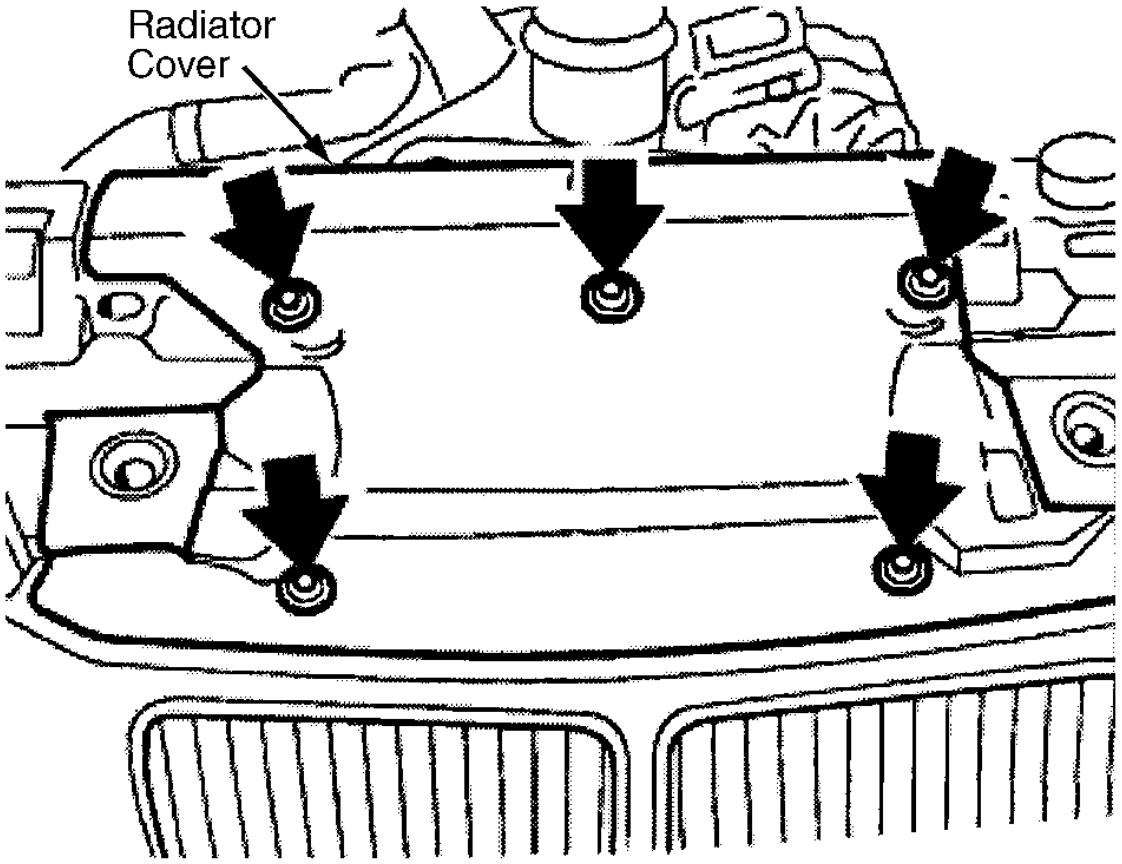



Fig. 1: Removing Cover From Top Of Radiator
Courtesy of BMW OF NORTH AMERICA, INC.

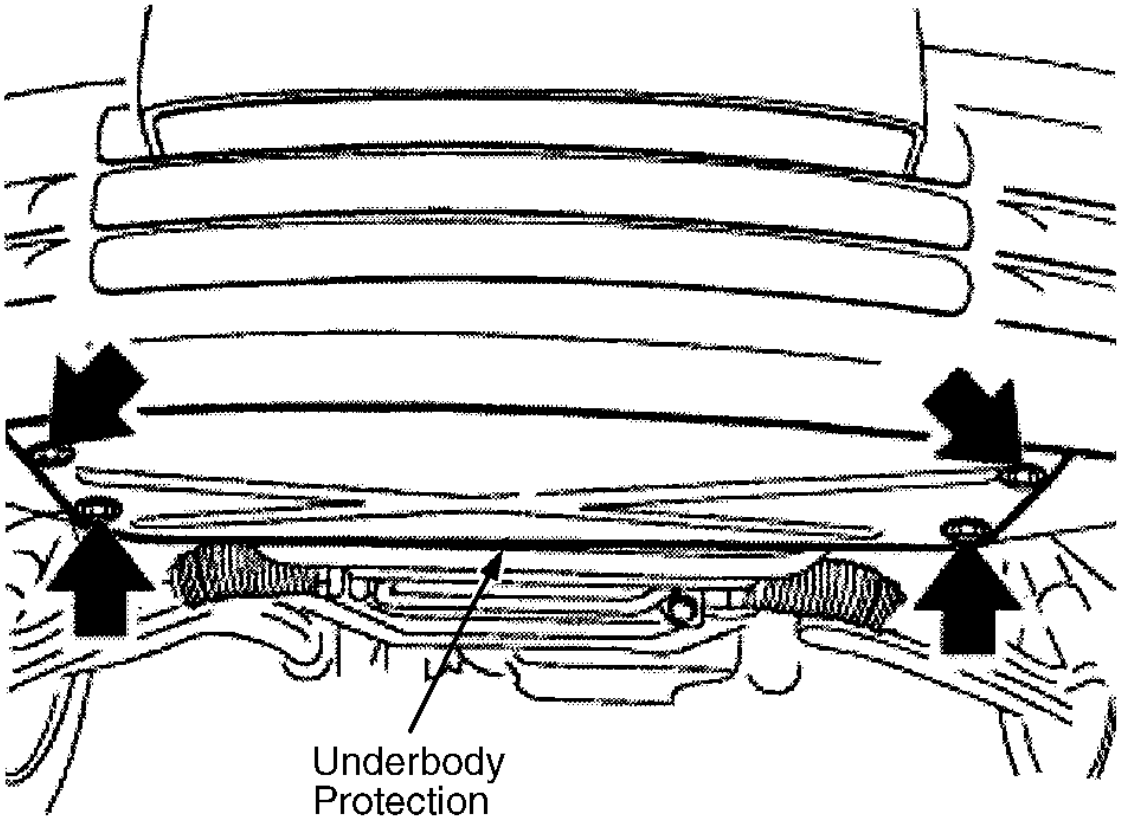
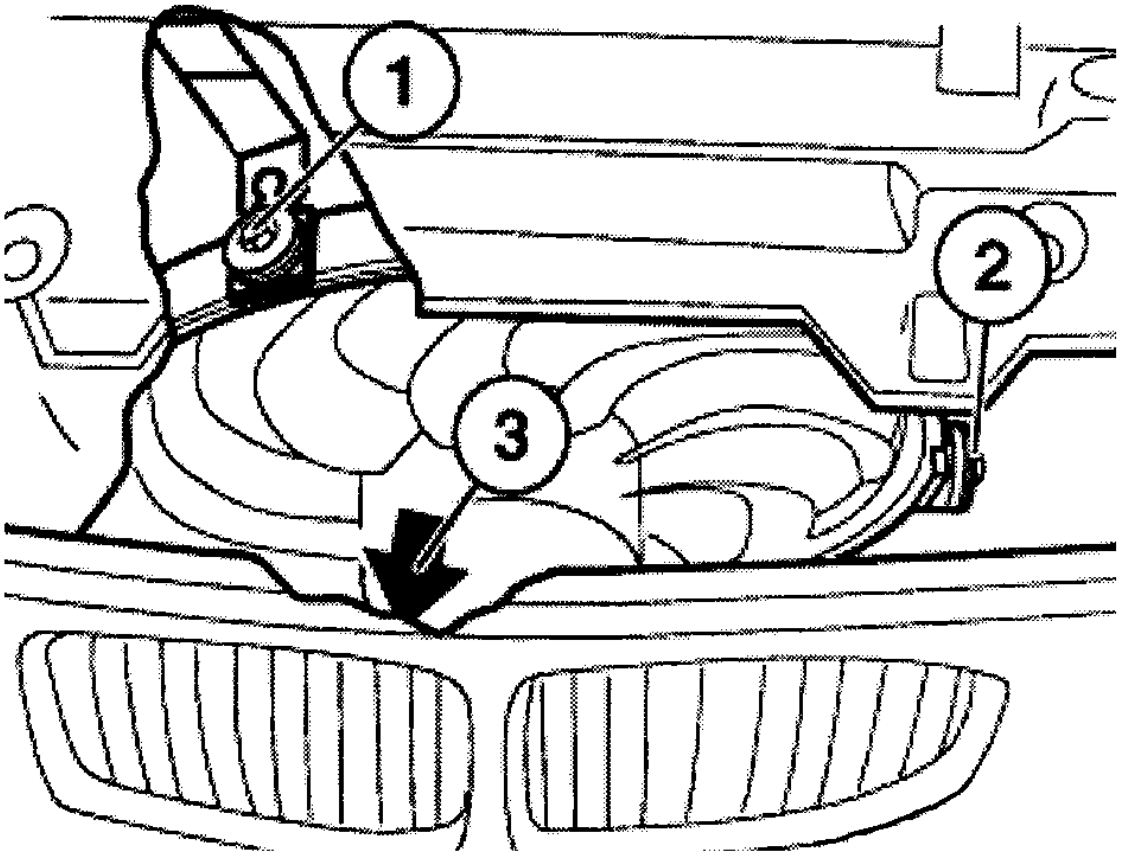



Fig. 2: Removing Underbody Protection From Front
Courtesy of BMW OF NORTH AMERICA, INC.




1. Fan Carrier Screws
2. Fan Carrier Screws
3. Fan Carrier Screws

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Fig. 3: Removing Screws From Fan Carrier
Courtesy of BMW OF NORTH AMERICA, INC.

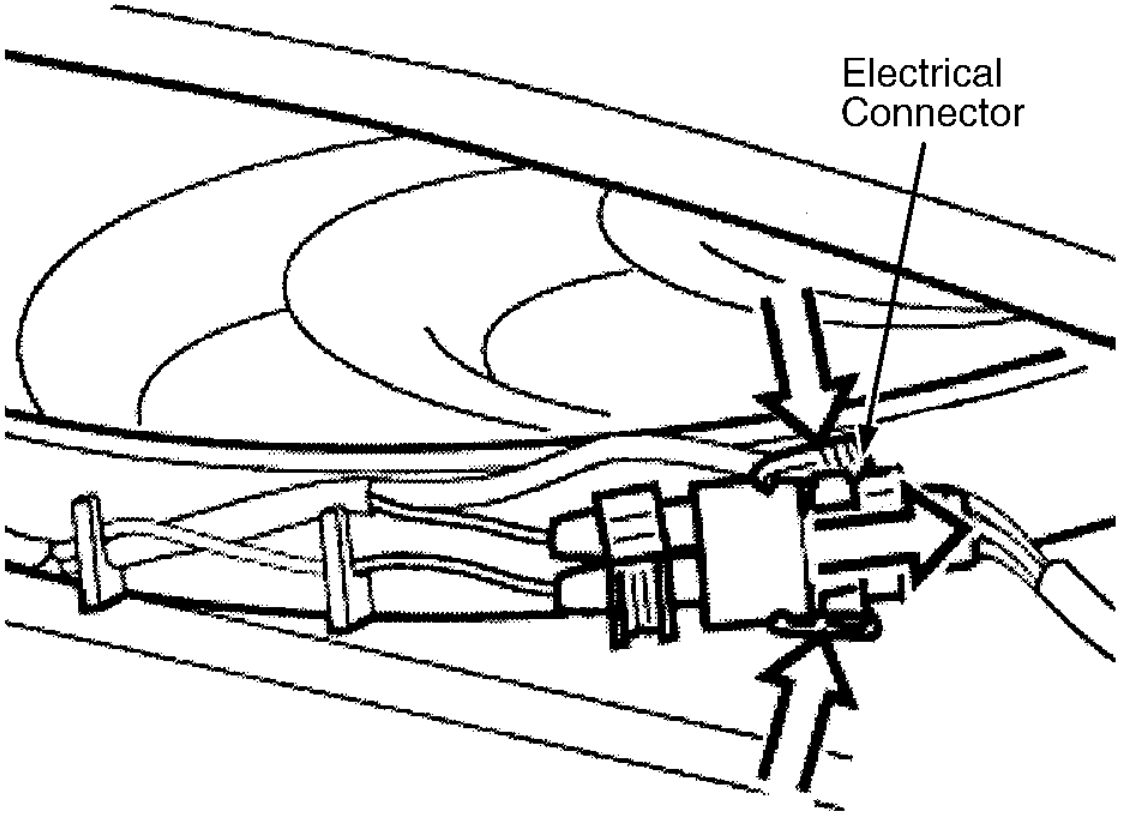



Fig. 4: Disconnecting Electrical Connector (Version 1)
Courtesy of BMW OF NORTH AMERICA, INC.

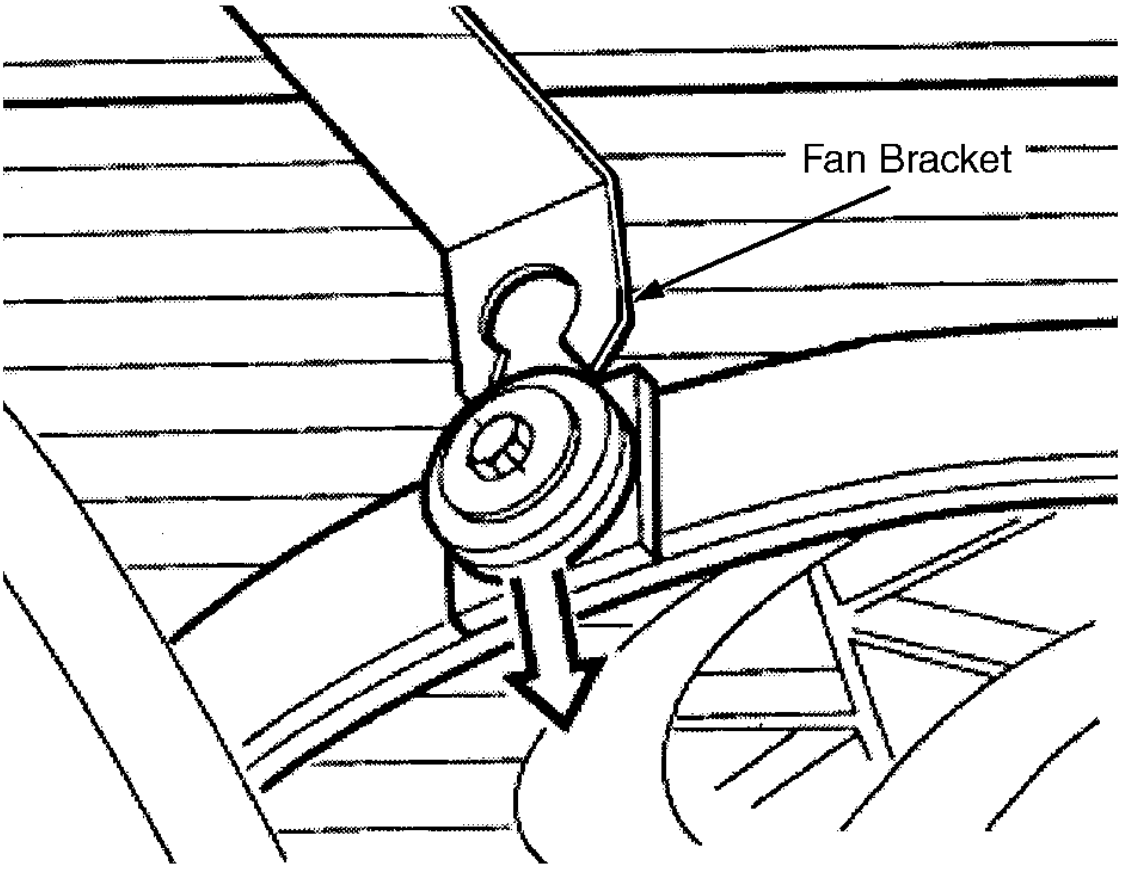



Fig. 5: Removing Fan Bracket & Fan From Retaining Shoe
Courtesy of BMW OF NORTH AMERICA, INC.

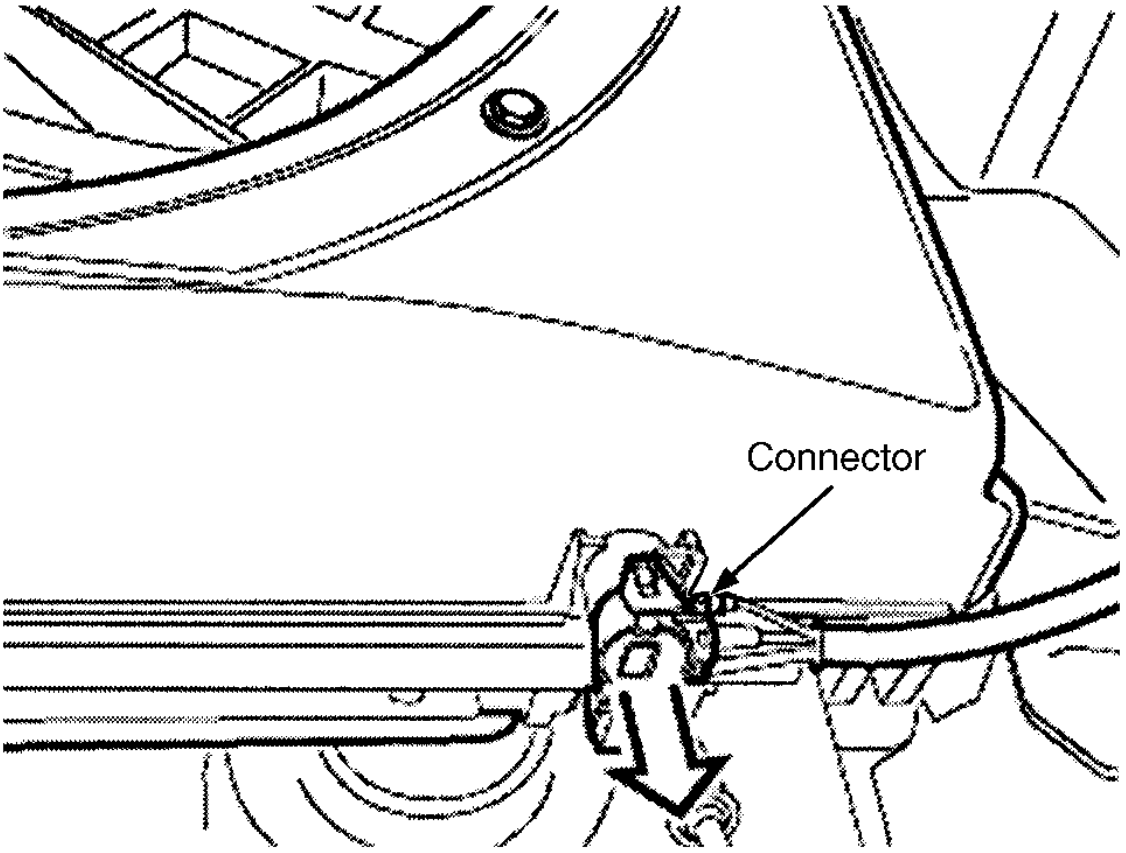



Fig. 6: Disconnecting Electrical Connector (Version 2)
Courtesy of BMW OF NORTH AMERICA, INC.

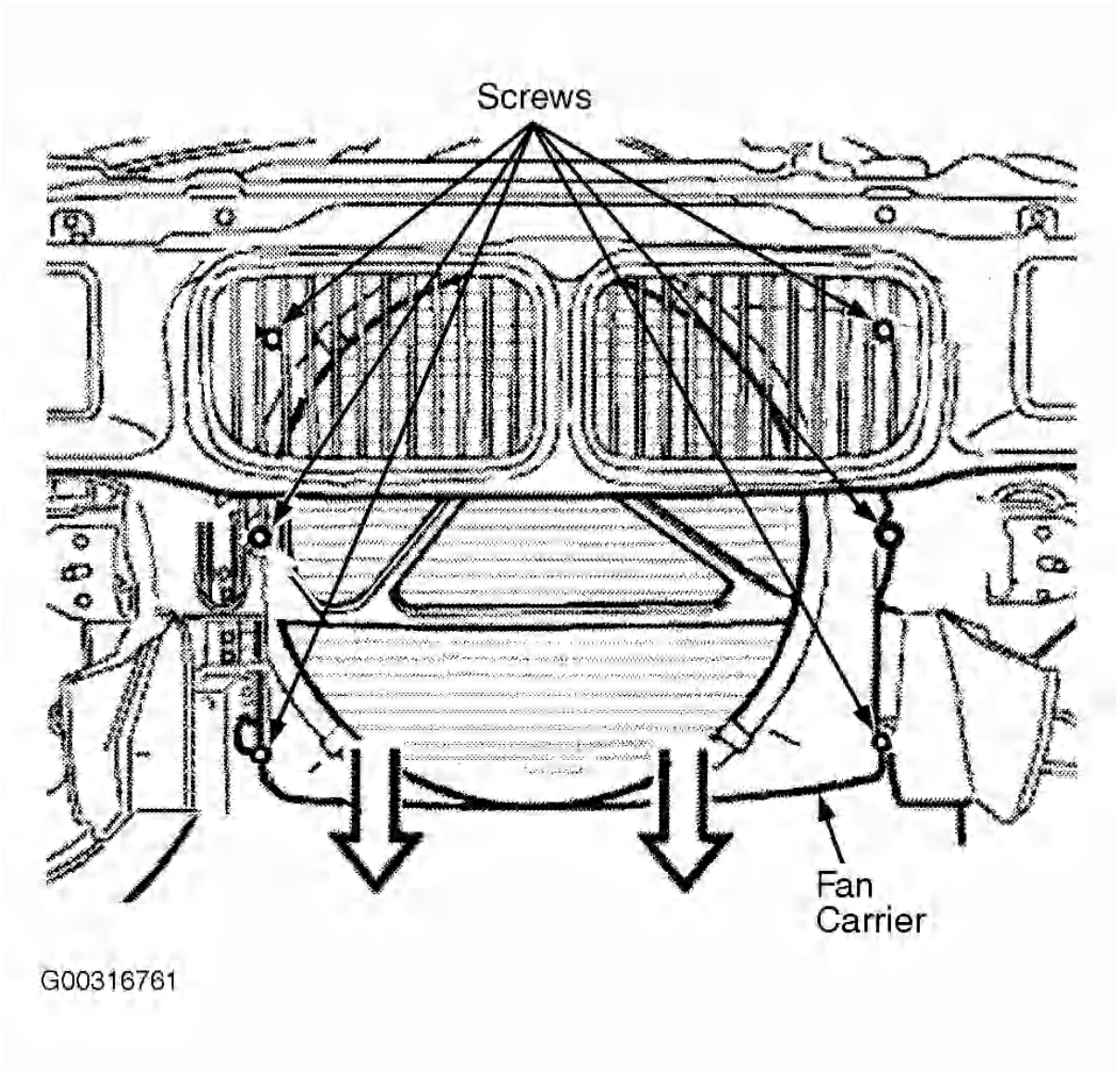



Fig. 7: Removing Fan Carrier
Courtesy of BMW OF NORTH AMERICA, INC.

## FRONT BUMPER (EXCEPT M COUPE, M ROADSTER & Z3)

NOTE: Numbers in text refer to numbers in figures.

### Removal & Installation

1. Unclip left rubber guard. See Fig. 8. Pull off rubbing strip toward front and unfasten nuts. See Fig. 9. Unclip towing eye cover and remove nuts. See Fig. 10. Remove screws and remove left and right covers. See Fig. 11. On vehicles with foglights, remove electrical connector from foglights. On vehicles with external temperature display, remove external temperature sensor from left brake air duct. See Fig. 12. On vehicles with heated spray nozzles (outside heated mirrors), unclip temperature switch from right brake air duct. See Fig. 13. Remove bolts in left and right wheel housing. See Fig. 14.
2. On all vehicles except M3 with sequential M-transmission (SMG), pull bumper forward to remove. On M3 with sequential M-transmission, pull bumper forward slightly. Remove bolts (1) and expanding rivet (2). See Fig. 15. Remove water container off bumper and allow it to hang on hoses. Pull bumper forward to remove.
3. To install, reverse removal procedure. If bumper bracket is defective, remove screws and replace bumper bracket. See Fig. 16. Apply adhesive tape to rubber guard prior to installation.

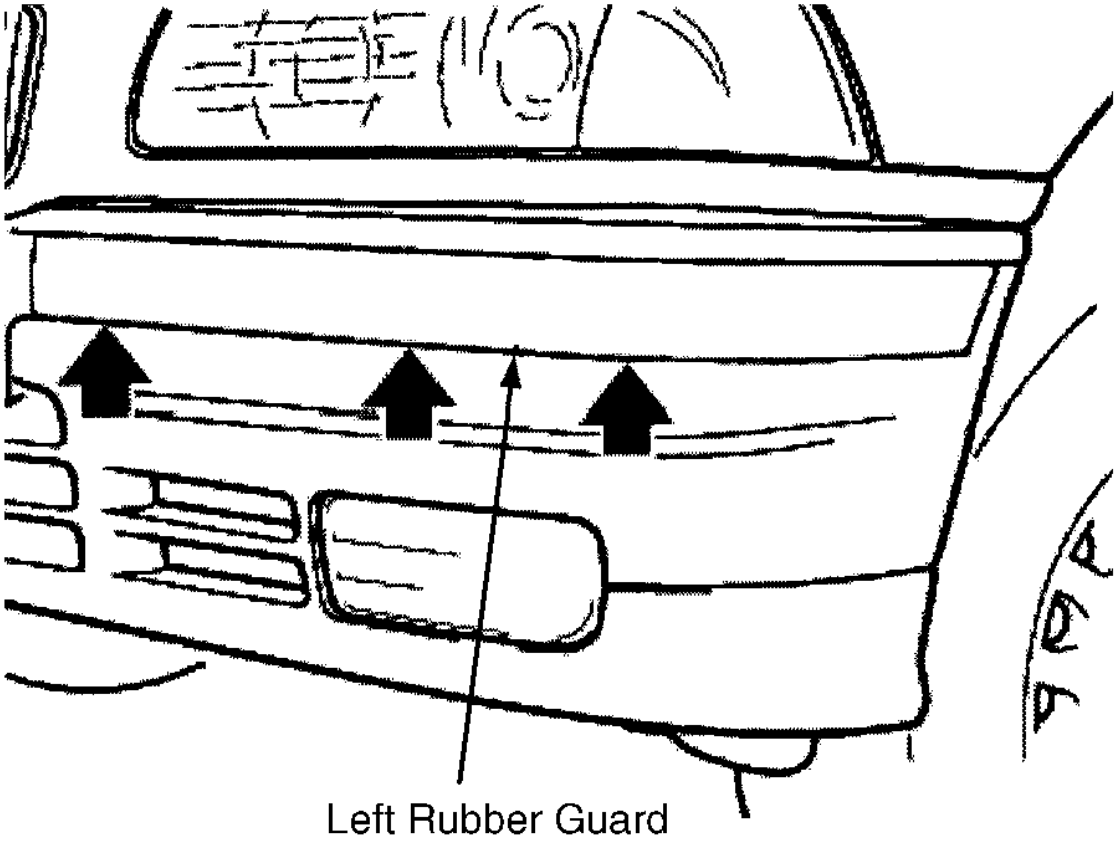



Fig. 8: Unclipping Left Rubber Guard
Courtesy of BMW OF NORTH AMERICA, INC.

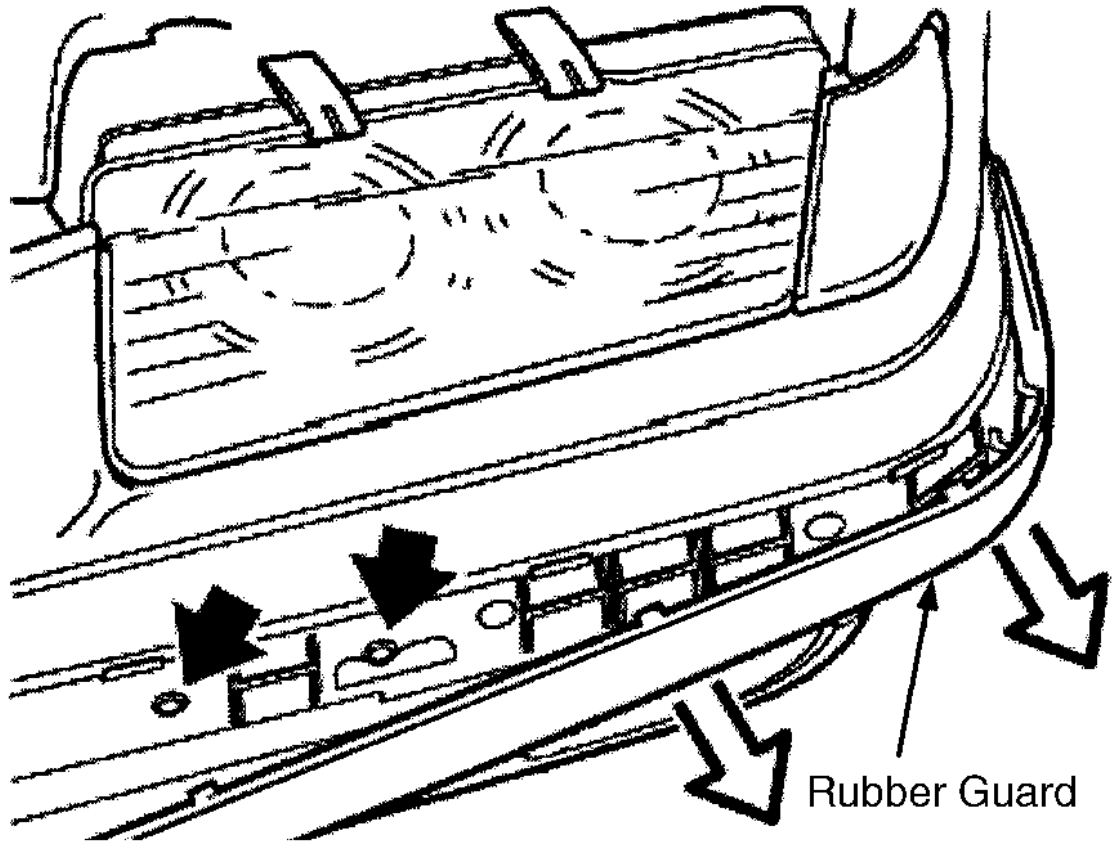



Fig. 9: Pulling Off Rubber Strip Toward Front
Courtesy of BMW OF NORTH AMERICA, INC.

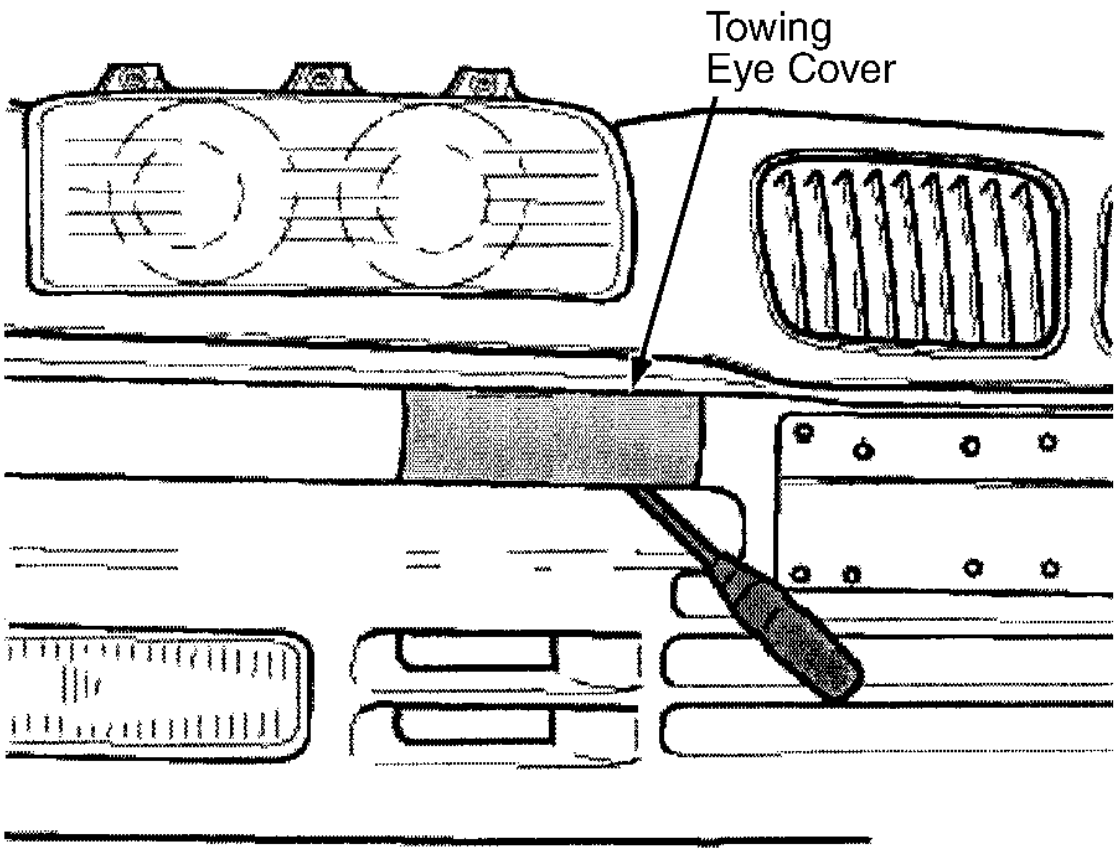



Fig. 10: Unclipping Towing Eye Cover & Removing Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

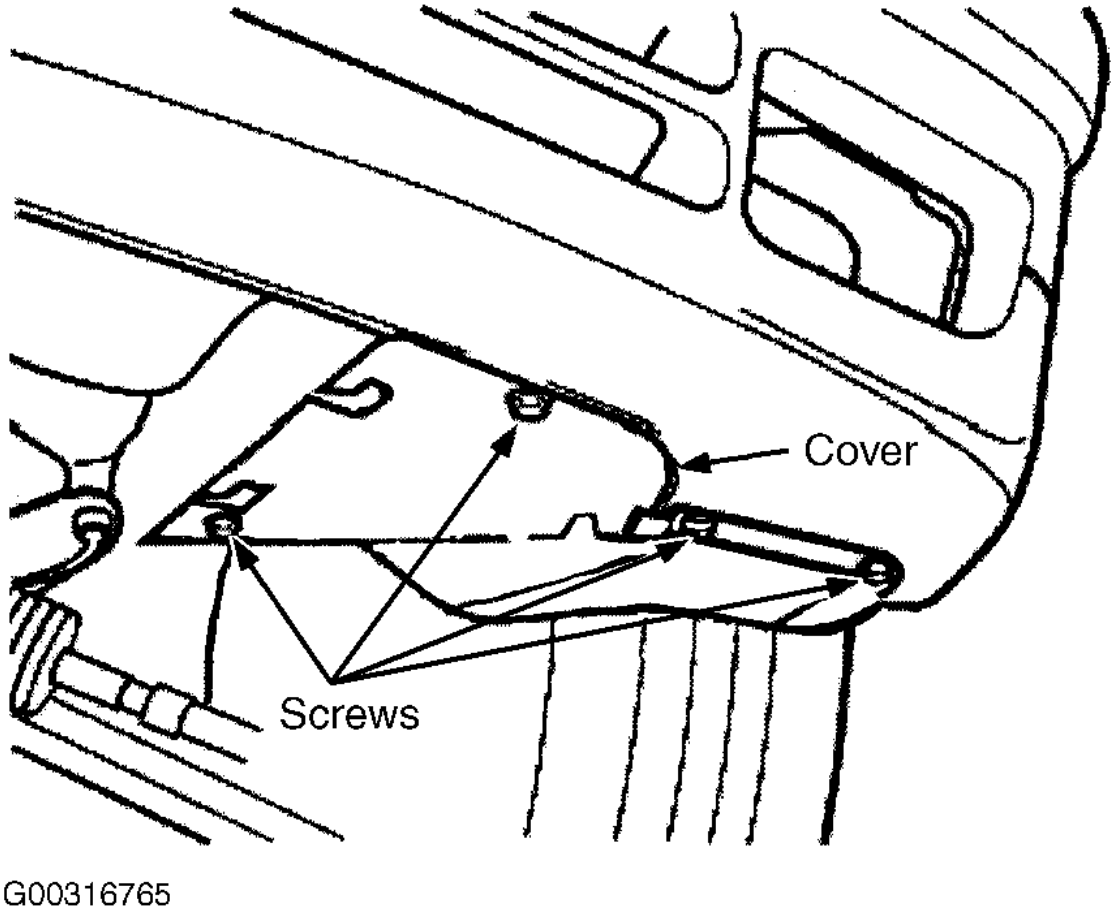



Fig. 11: Removing Left & Right Covers
Courtesy of BMW OF NORTH AMERICA, INC.

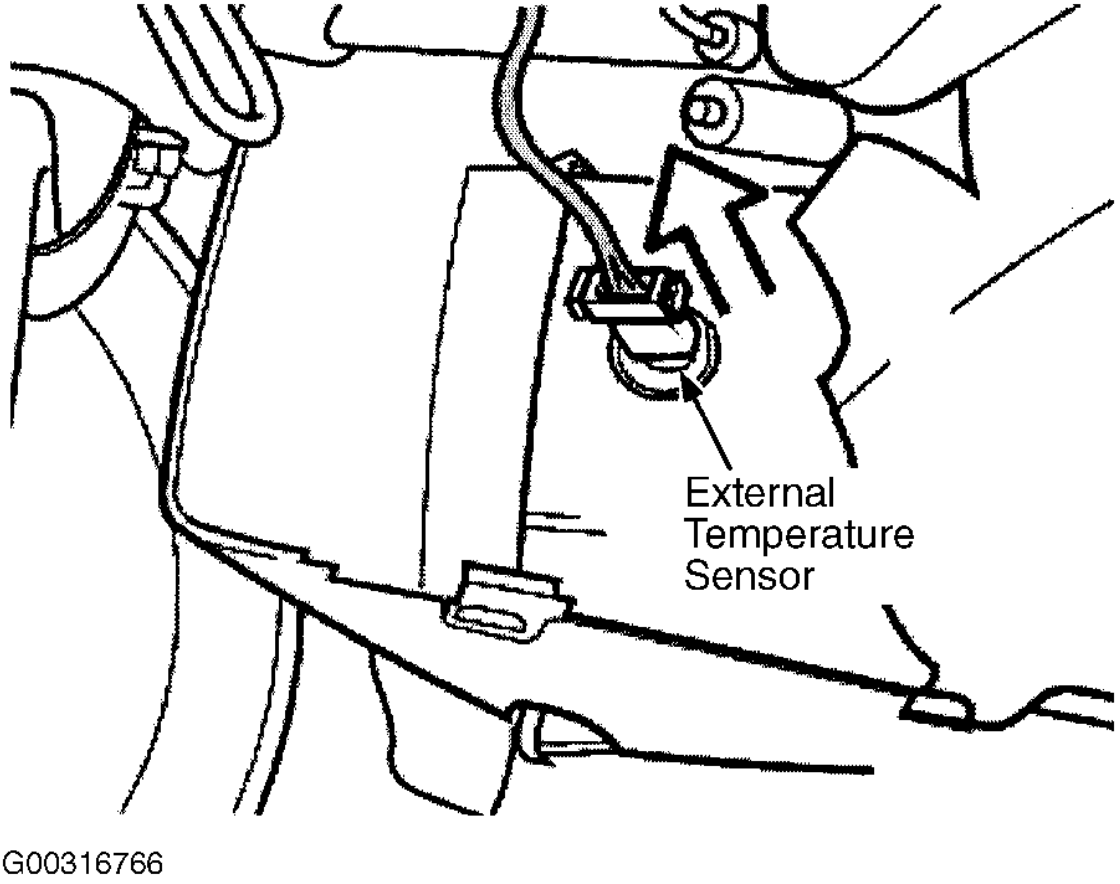



Fig. 12: Removing External Temperature Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

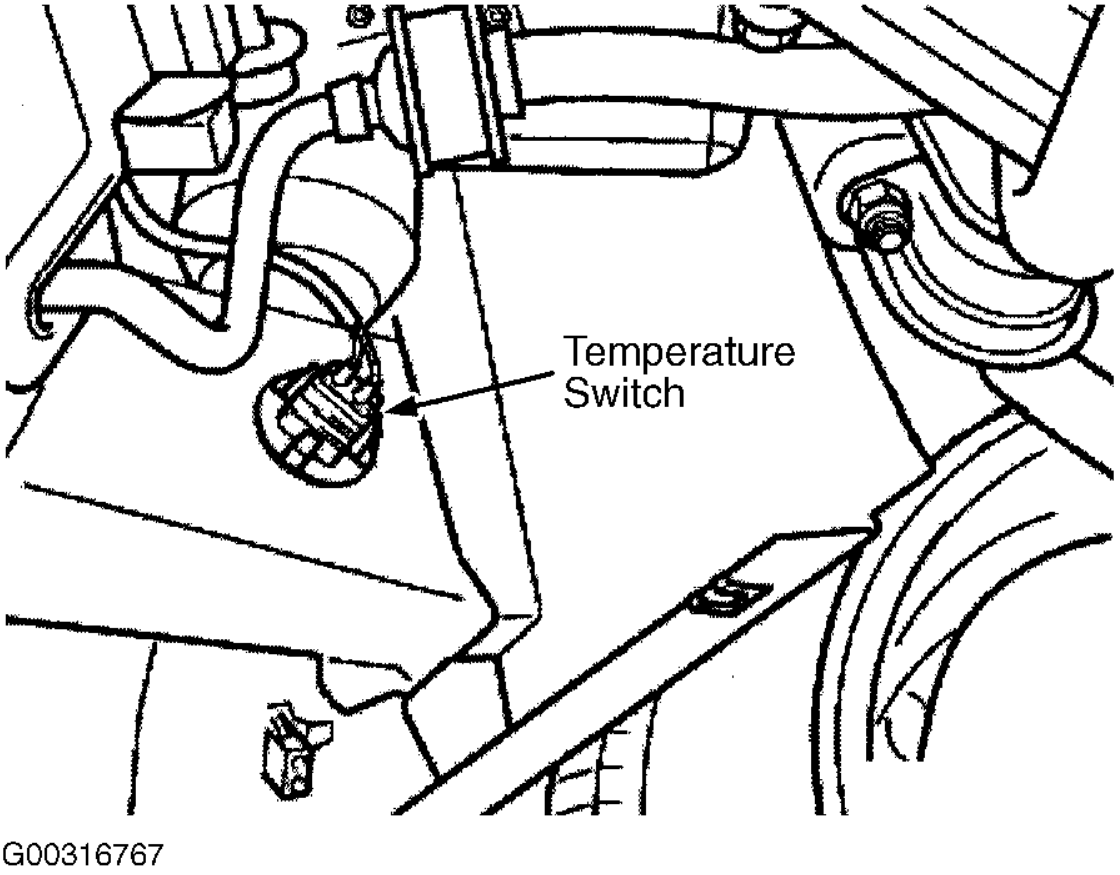



Fig. 13: Removing Temperature Switch From Right Brake Air Duct
Courtesy of BMW OF NORTH AMERICA, INC.

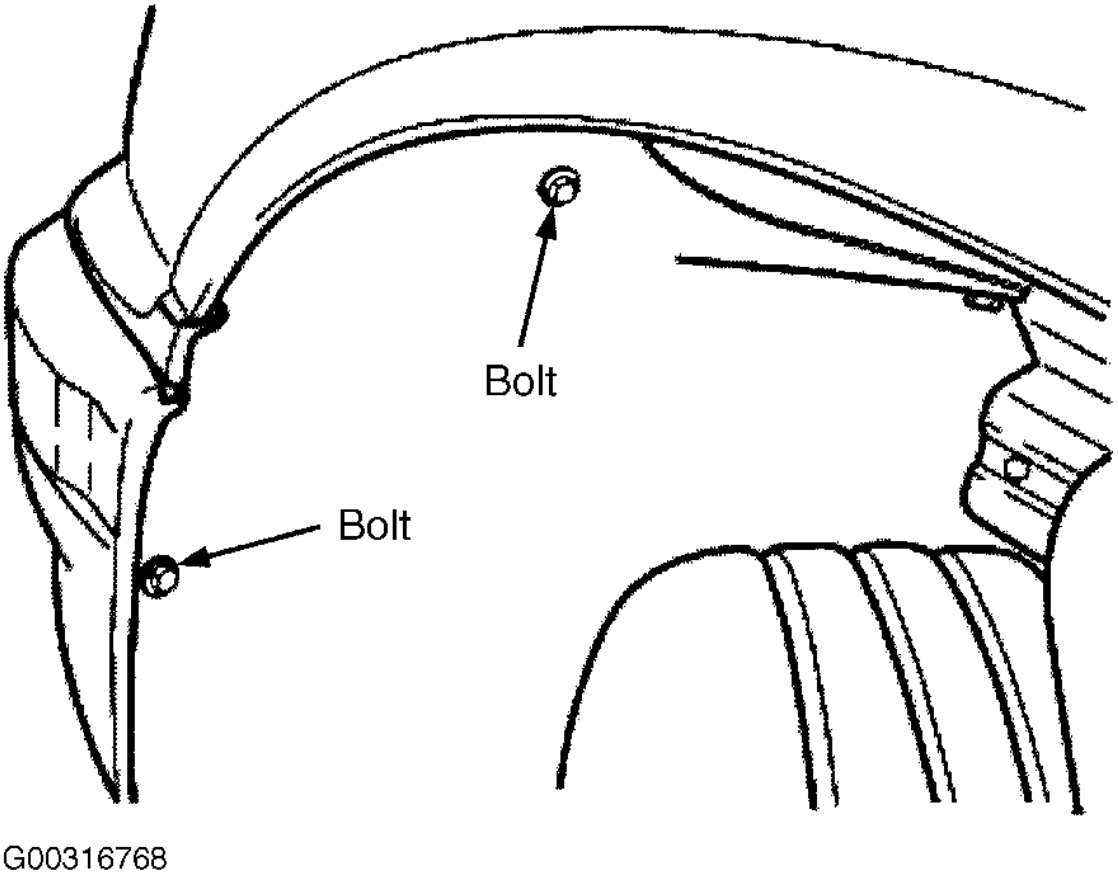
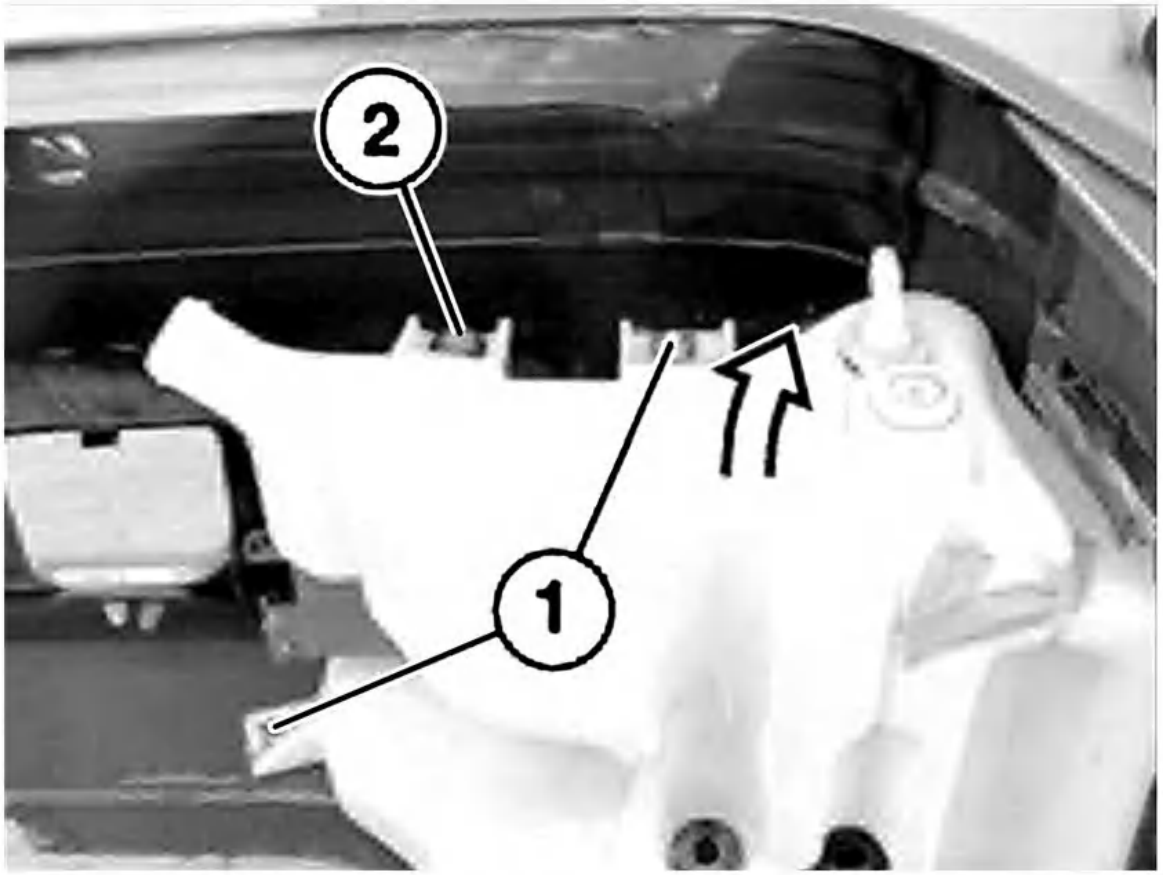



Fig. 14: Removing Wheelhousing Bolts
Courtesy of BMW OF NORTH AMERICA, INC.




1. Bolts
2. Expanding Rivet

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Fig. 15: Removing Bolts & Expanding Rivet
Courtesy of BMW OF NORTH AMERICA, INC.

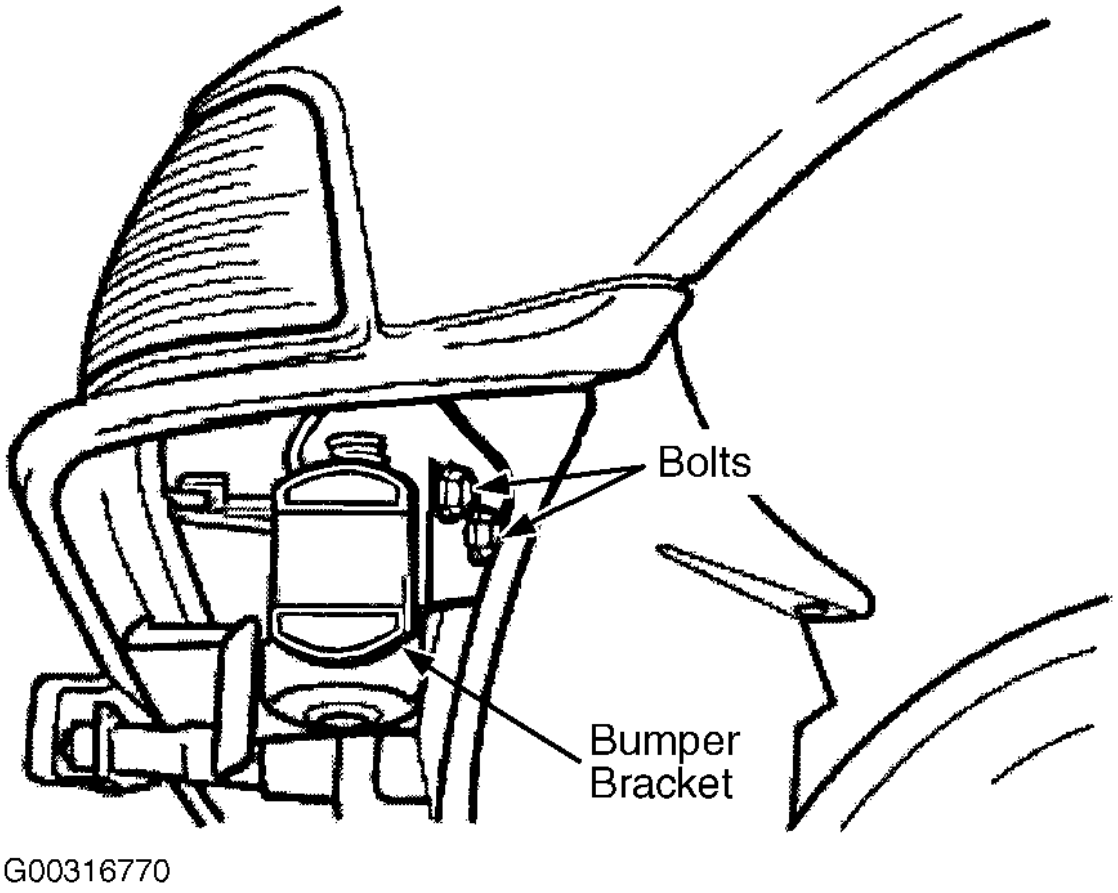



Fig. 16: Replacing Bumper Bracket
Courtesy of BMW OF NORTH AMERICA, INC.

## FRONT BUMPER (M COUPE, M ROADSTER & Z3)

NOTE: Numbers in text refer to numbers in figures.

### Removal & Installation

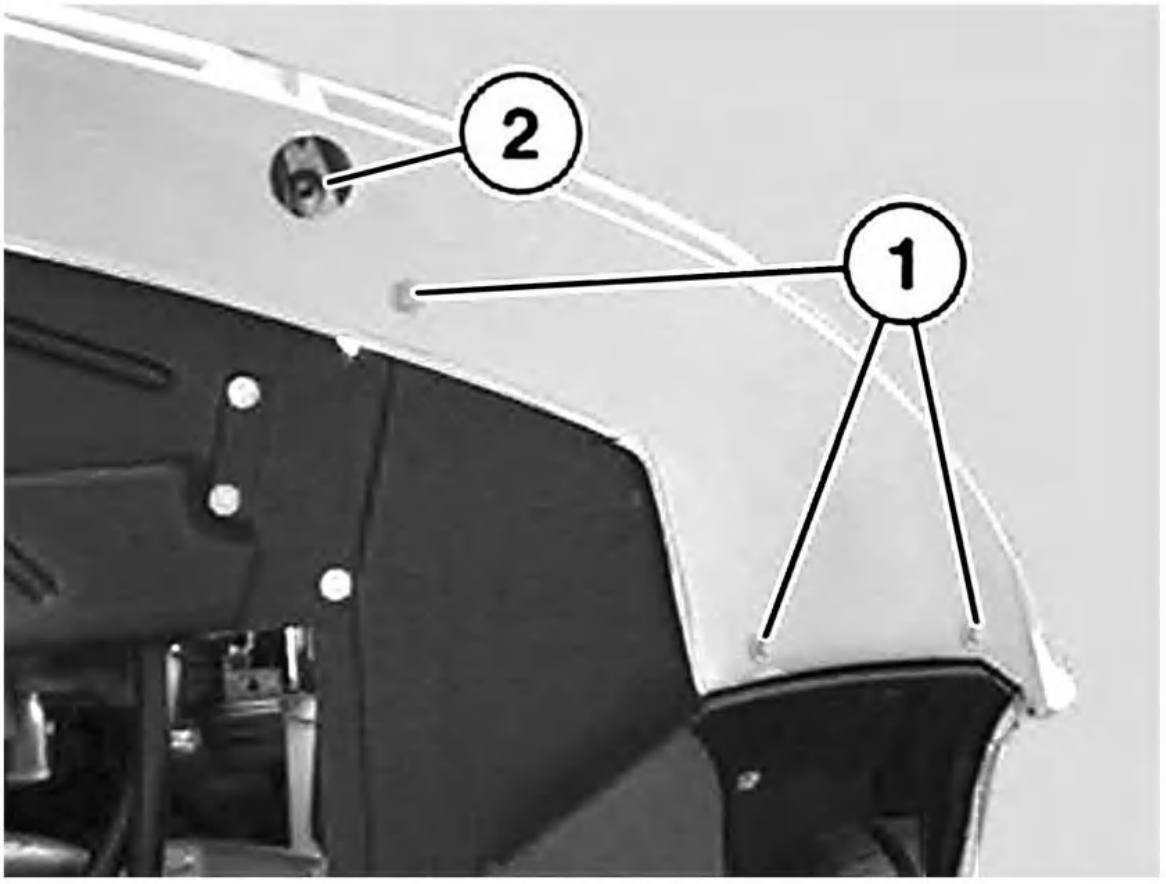
1. On M Coupe and M Roadster, remove front underbody protection. See UNDERBODY PROTECTION (M COUPE & M ROADSTER). On all models, remove left and right hexagon bolts (1) and Torx screws (2). See Fig. 17. Note that mounting screw (2) for impact absorber is a Torx T50 screw. On vehicles without fog lights and/or headlight cleaning system, pull bumper forward to remove. On vehicles with foglights, disconnect foglight left and right electrical connections (1), if necessary. On vehicles with headlight cleaning system, unfasten hose clip (2) and seal hose firmly, if necessary. See Fig. 18. Pull bumper forward to remove.
2. To install, reverse removal procedure. On M Coupe and M Roadster, pull hose (1) off bracket (2) if necessary. See Fig. 19. This is because engagement of groove (3) is not possible in installed state. Engage hose (1) in air guide (2), if necessary. See Fig. 20. Push hose (1) onto bracket (2), if necessary. See Fig. 21.
3. On all models, adjust bumper. See Fig. 22. Loosen nut (1) from wheel arch and adjust bracket (2). See Fig. 23.

   NOTE: Bracket adjustment is possible with bumper installed.

4. To adjust bumper, loosen left and right hexagon bolts (1). Loosen left and right screws (2).See Fig. 17. Install Special Tool (51 1 130) to standard extension (1) with reversible handle (2) and insert through

bore (3) in bumper (4) of shock absorber (5). See Fig. 25. Height of bumper (in front area) is now adjusted by turning socket head cap screw (1) in shock absorber (2). See Fig. 26.

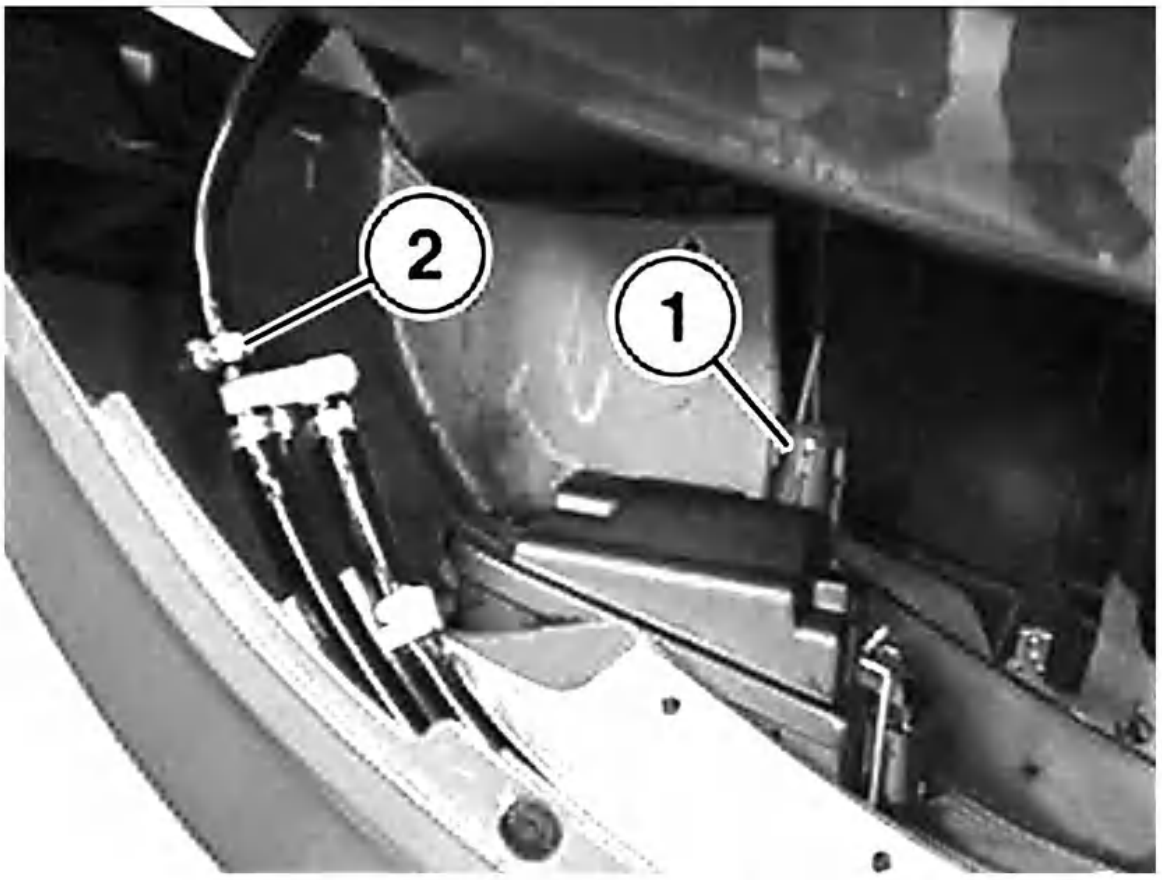
NOTE: Adjustment is only possible when bumper is fitted using Special Tool (51 1 130).




1. Hexagon Bolts
2. Torx Screw

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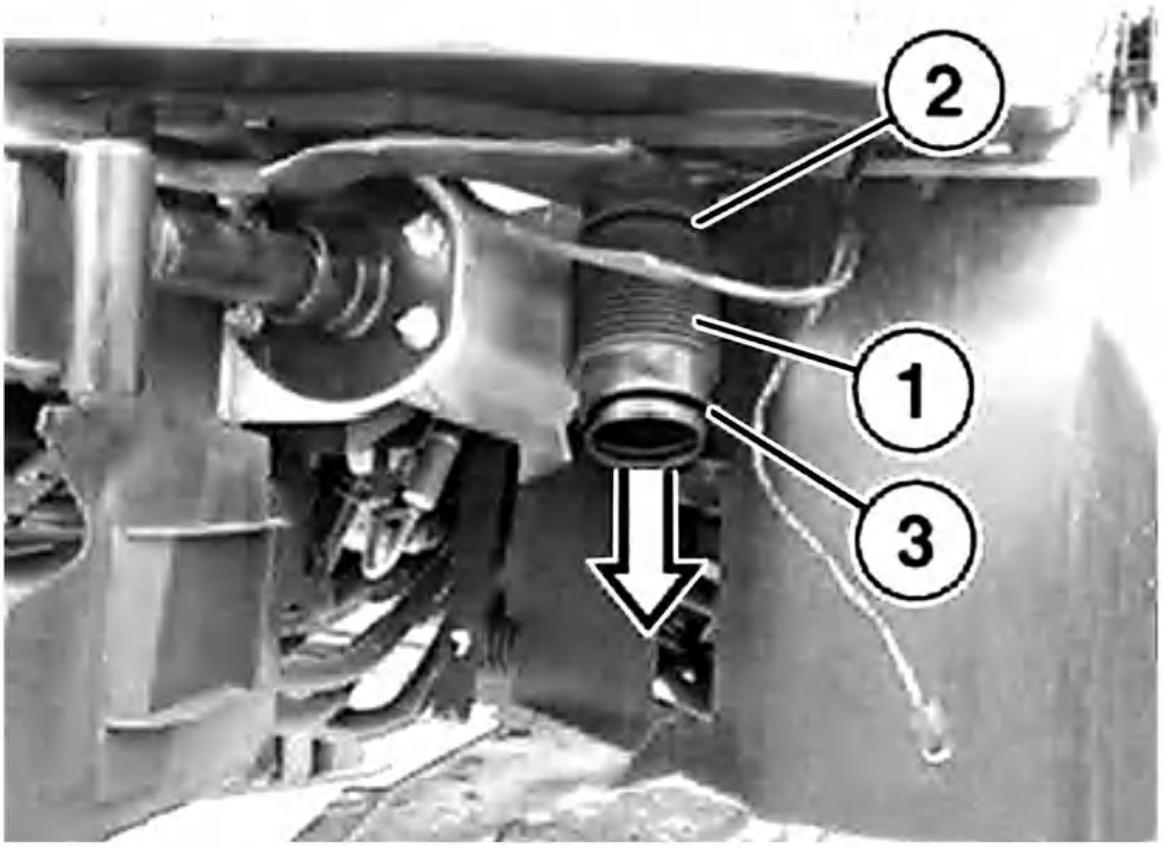
Fig. 17: Removing Hexagon Bolts (1) & Torx Screws (2)
Courtesy of BMW OF NORTH AMERICA, INC.




1. Foglight & Electrical Connector
2. Hose Clip

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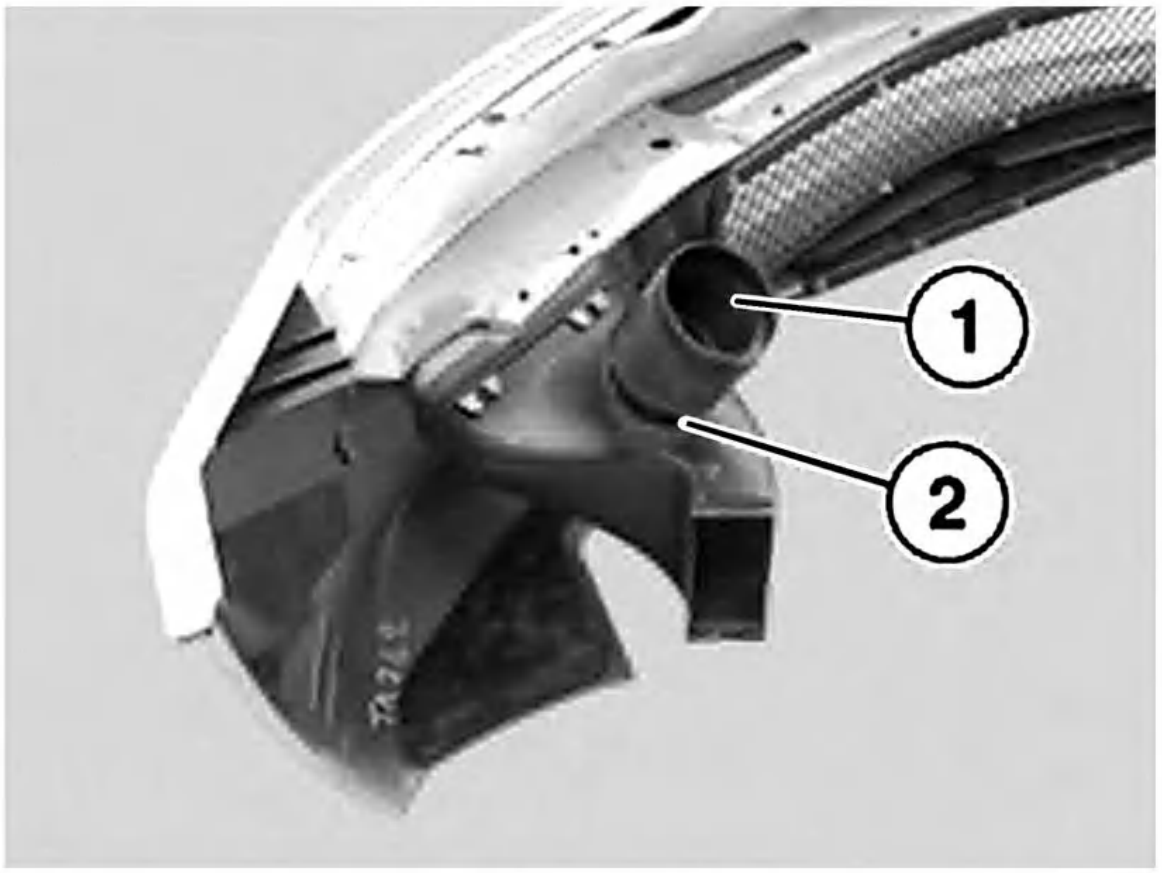
Fig. 18: Disconnecting Foglights & Unfastening Hose Clip
Courtesy of BMW OF NORTH AMERICA, INC.




1. Hose
2. Bracket
3. Groove

G00316778

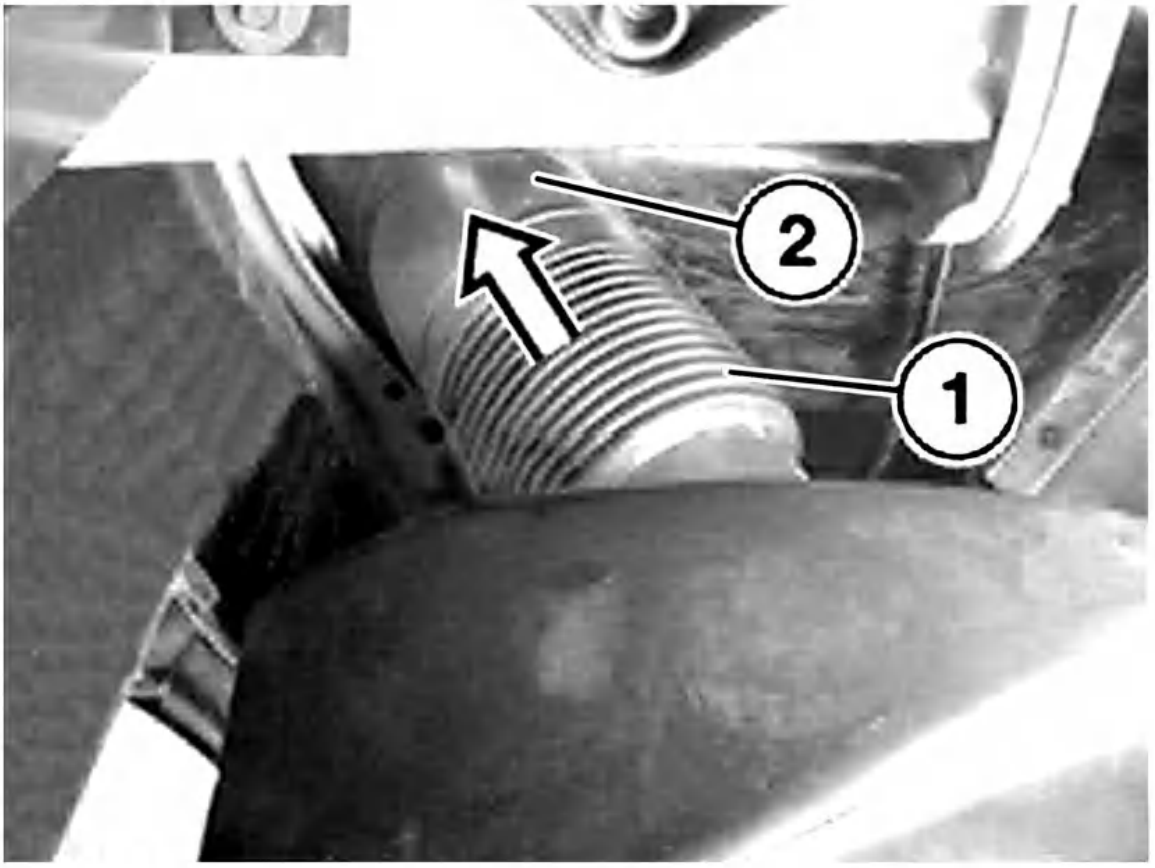
Fig. 19: Removing Hose From Bracket
Courtesy of BMW OF NORTH AMERICA, INC.




1. Hose
2. Air Guide

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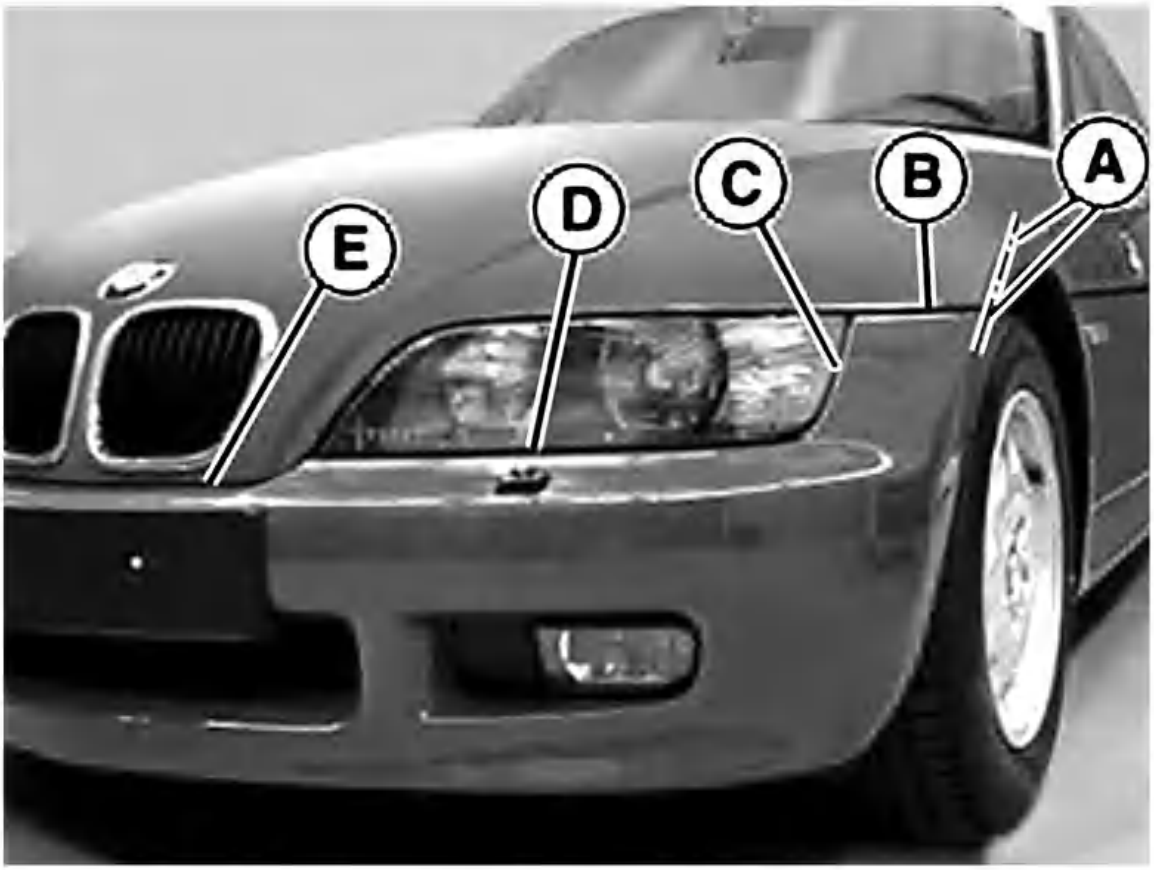
Fig. 20: Engaging Hose In Air Guide
Courtesy of BMW OF NORTH AMERICA, INC.




1. Hose
2. Bracket

G00316780

Fig. 21: Pushing Hose Onto Bracket
Courtesy of BMW OF NORTH AMERICA, INC.




Transition (A) should be flush on left/right side.

(B) 5 mm (tolerance + 0.5/ -1 mm)

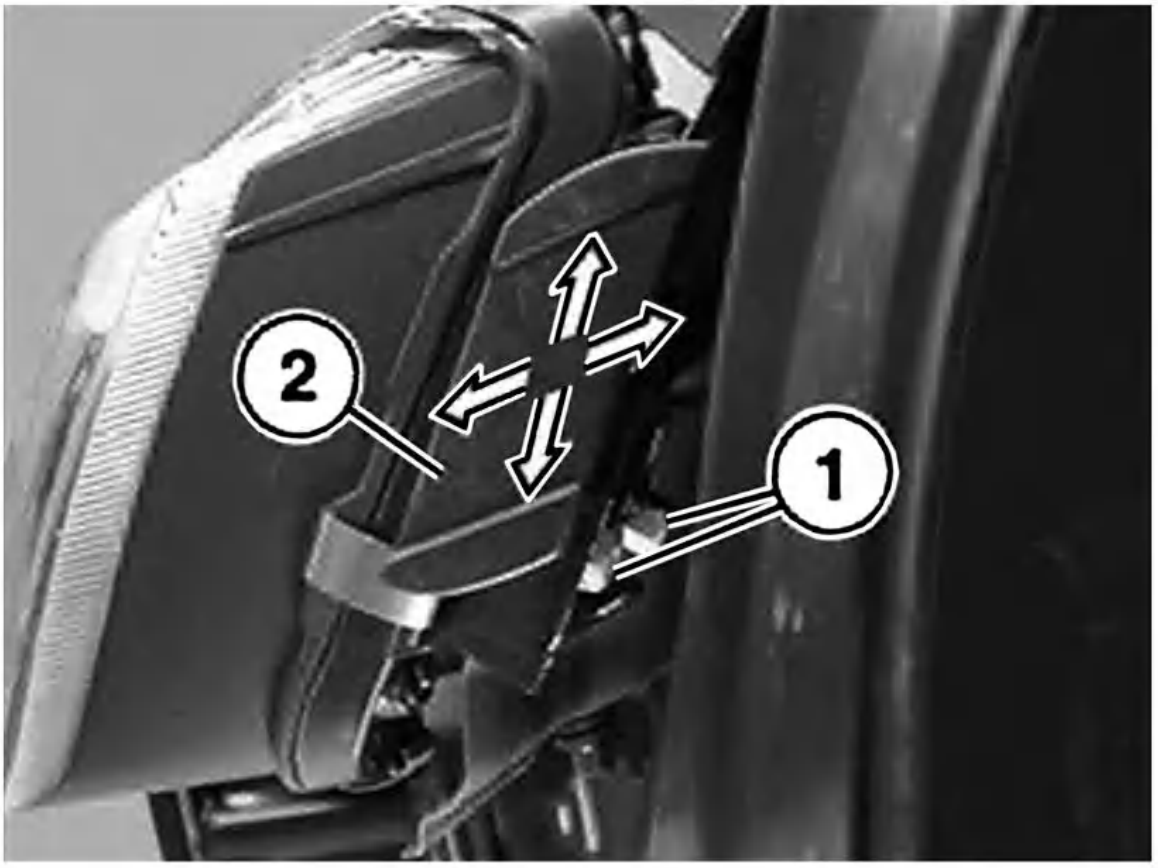
(C) Transition from below 5 mm (tolerance + 1/ -0.5 mm) upwards to 2.5 mm (tolerance + 0.5/ -1 mm)

(D) 5 mm (tolerance + 1/ -0.5 mm)

(E) 5 mm (tolerance + 1/ -0.5 mm)

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Fig. 22: Adjusting Bumper
Courtesy of BMW OF NORTH AMERICA, INC.




1. Nut
2. Bracket

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Fig. 23: Loosening Nut From Wheel Arch & Adjusting Bracket
Courtesy of BMW OF NORTH AMERICA, INC.

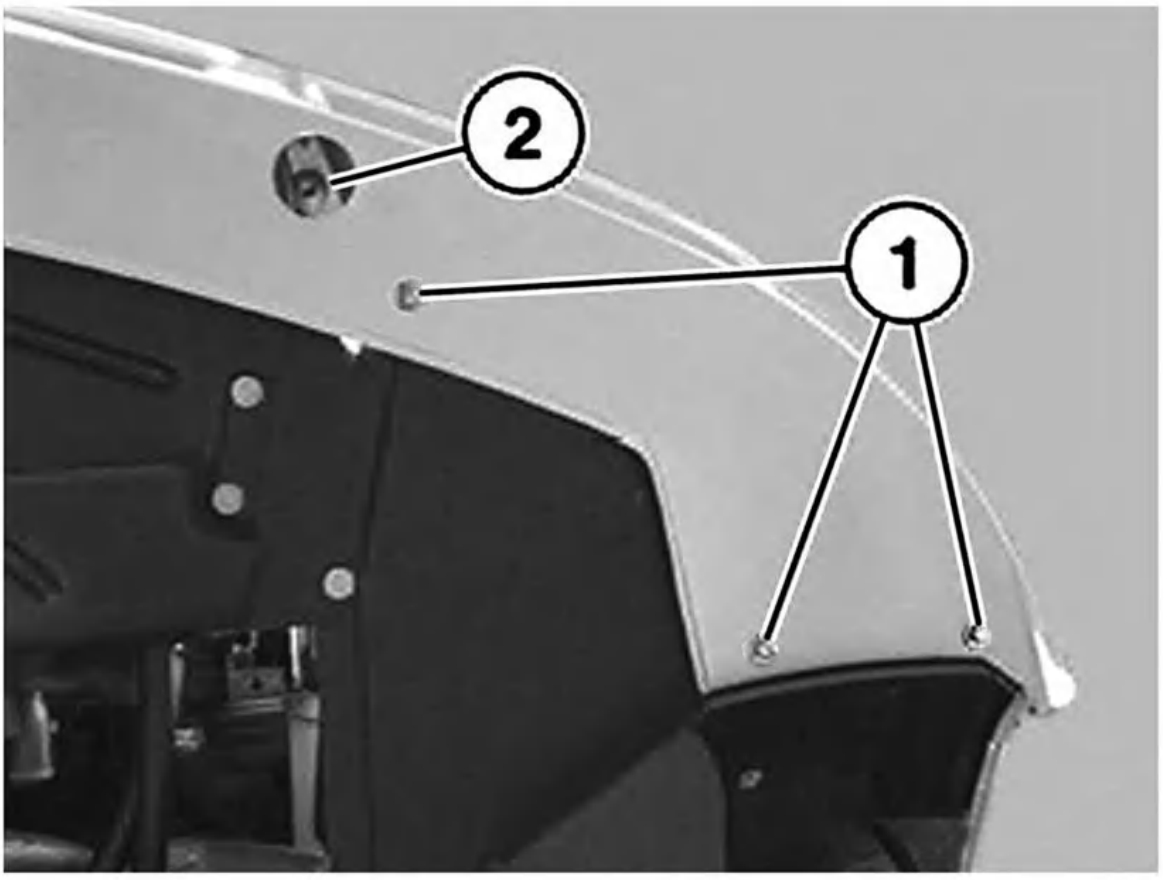
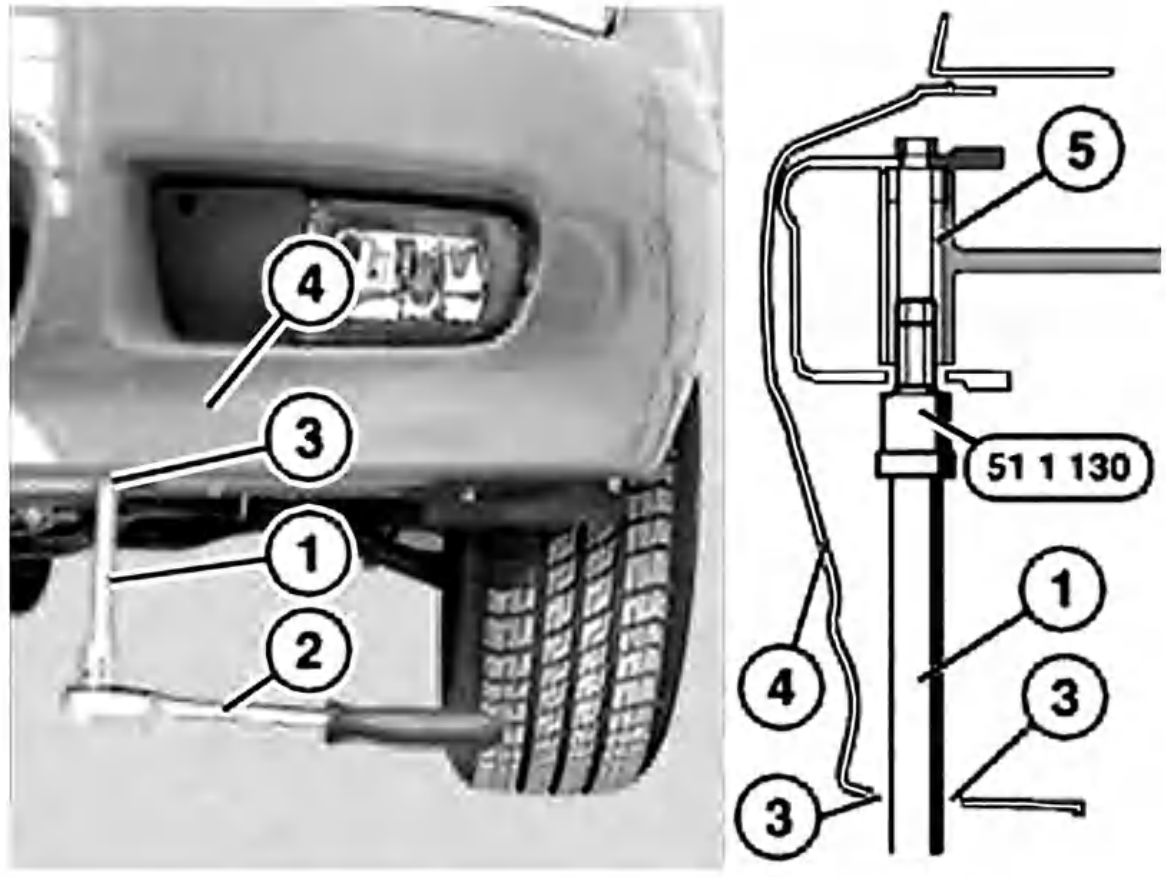



Fig. 24: Loosening Left/Right Hexagon Bolts & Screws
Courtesy of BMW OF NORTH AMERICA, INC.




1. Standard Extension
2. Reversible Handle
3. Bore
4. Bumper
5. Shock Absorber

G00316784

Fig. 25: Adjusting Bumper Height With Special Tool (51 1 130)
Courtesy of BMW OF NORTH AMERICA, INC.

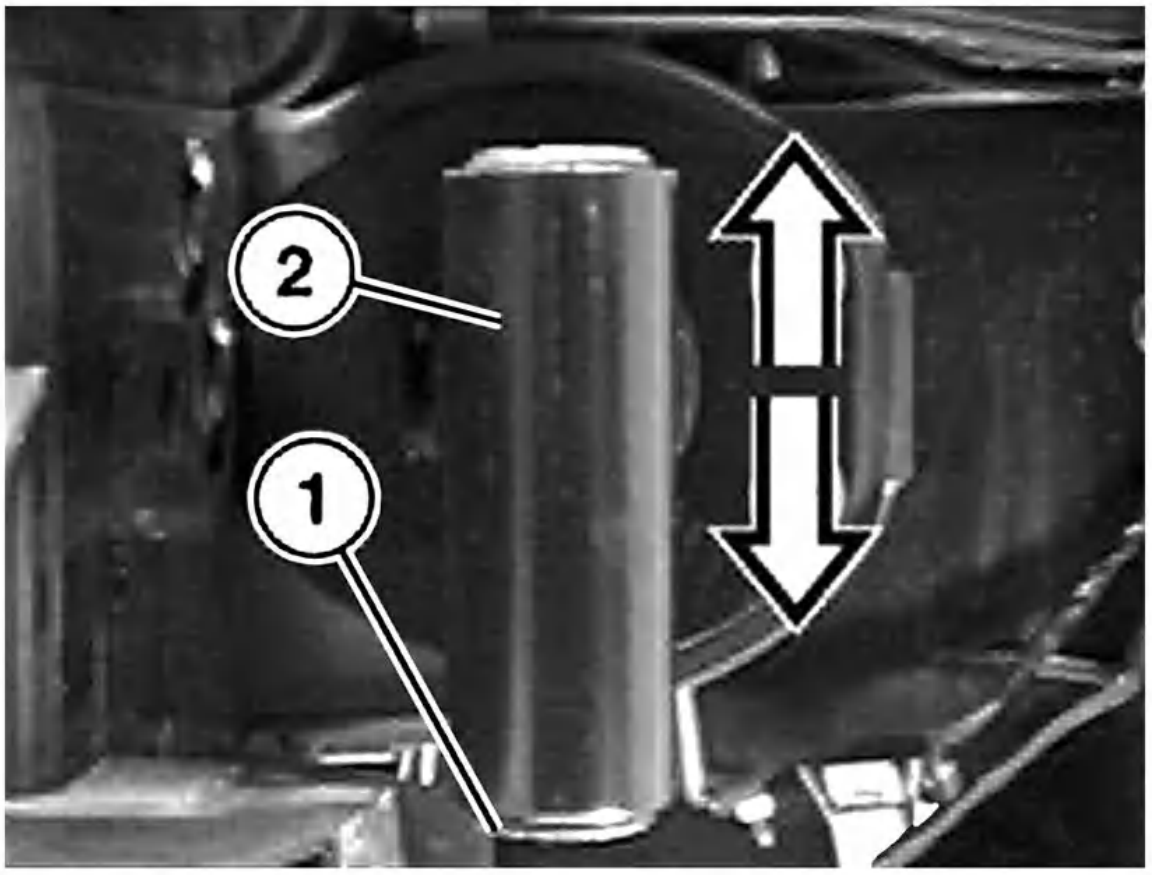



Fig. 26: Adjusting Front Bumper Height
Courtesy of BMW OF NORTH AMERICA, INC.

## UNDERBODY PROTECTION (EXCEPT M COUPE & M ROADSTER)

NOTE: Numbers in text refer to numbers in figures.

### Removal & Installation

1. Remove screws and remove underbody protection. See Fig. 27. On M3 with S50 engine, lift out expansion rivets. See Fig. 28. Remove screws on left and right covers. Remove covers. See Fig. 29. On all vehicles, remove air temperature sensor (1) from left brake air duct. Remove left and right screws (2) and remove underbody protection. See Fig. 30.
2. To install, reverse removal procedure. When installing underbody protection, ensure air duct for oil cooler is correctly positioned (inserted between radiator and oil cooler).

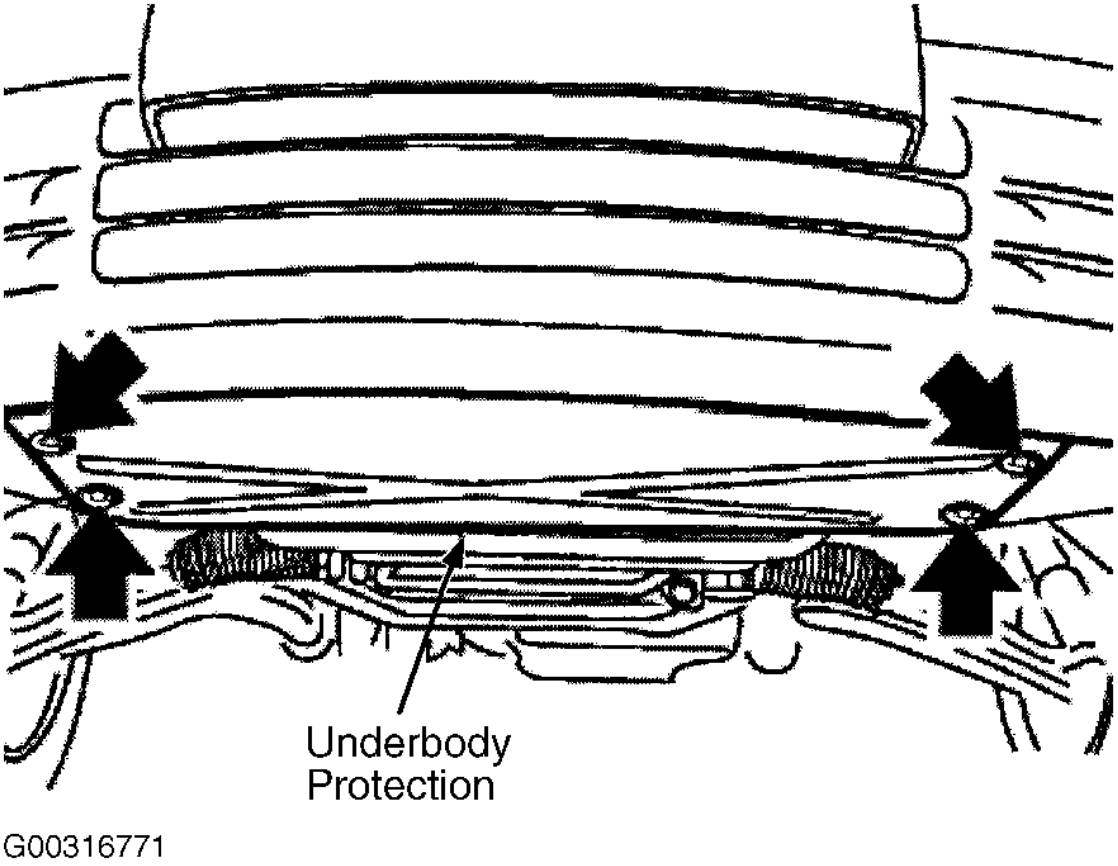



Fig. 27: Removing Screws & Underbody Protection
Courtesy of BMW OF NORTH AMERICA, INC.

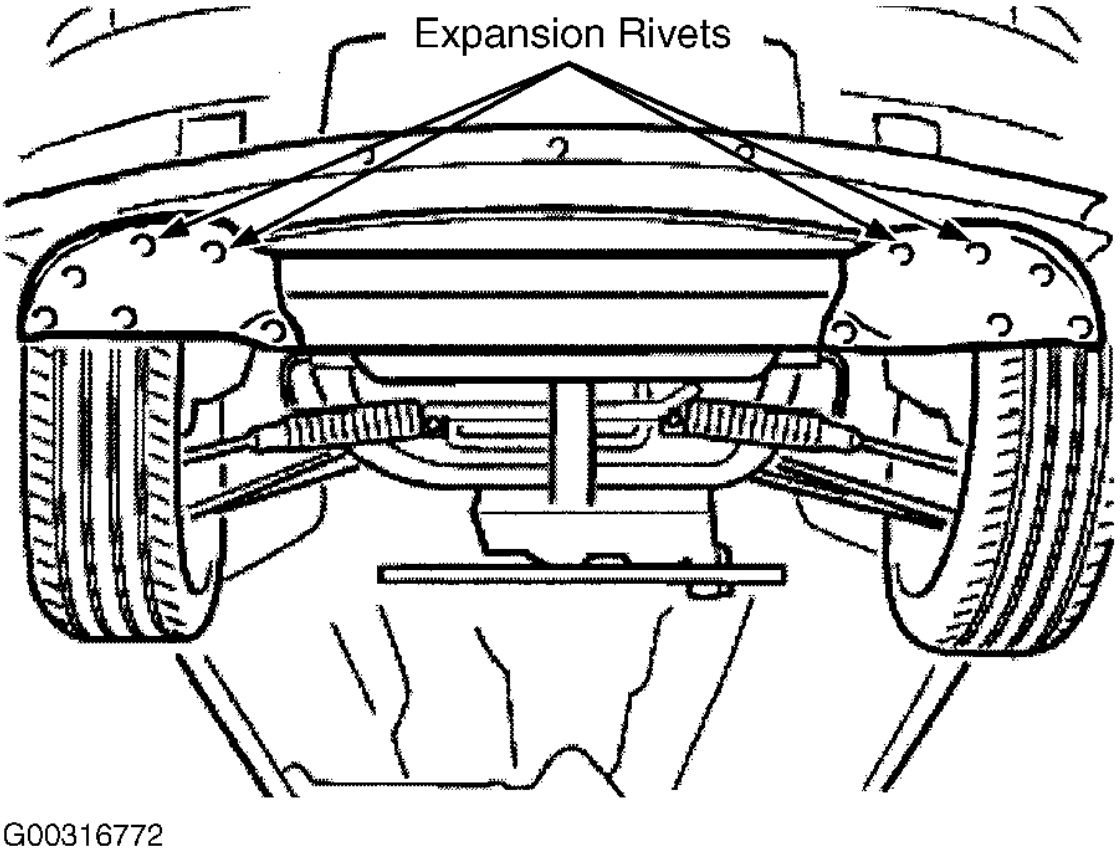



Fig. 28: Removing Expansion Rivets (M3)
Courtesy of BMW OF NORTH AMERICA, INC.

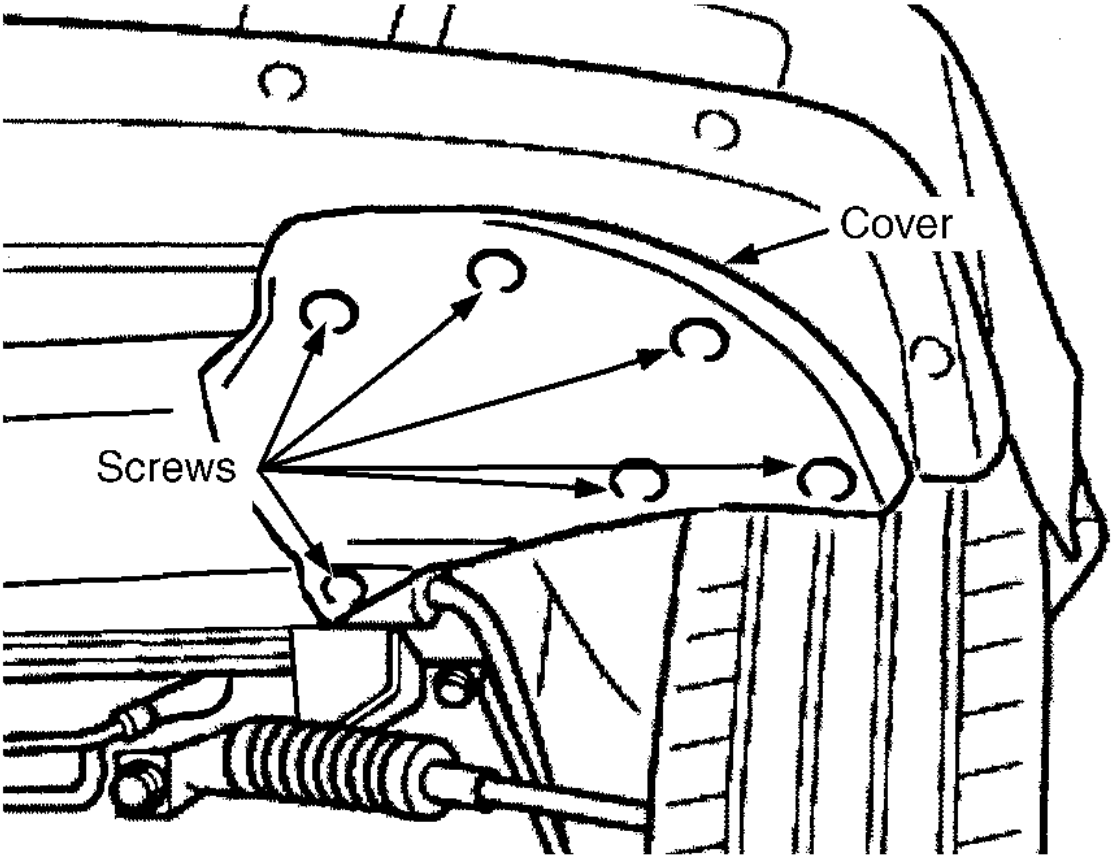



Fig. 29: Removing Left & Right Covers
Courtesy of BMW OF NORTH AMERICA, INC.

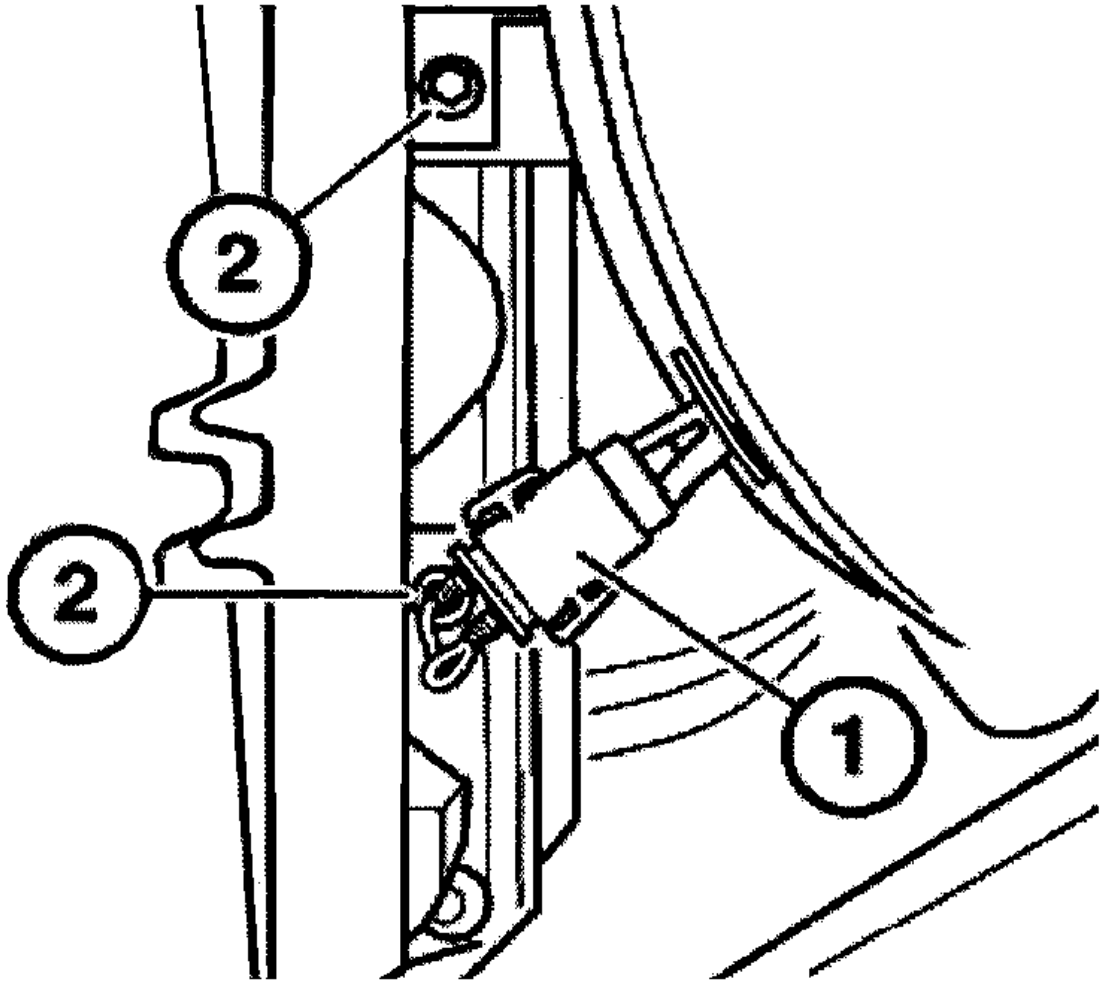



Fig. 30: Removing Air Temperature Sensor & Underbody Protection Screws
Courtesy of BMW OF NORTH AMERICA, INC.

## UNDERBODY PROTECTION (M COUPE & M ROADSTER)

NOTE: Numbers in text refer to numbers in figures.

### Removal & Installation

Remove screws (1, 2) and remove underbody protection (3). To install, reverse removal procedure. First tighten screws (1), then center underbody protection (3) and tighten screws (2).

NOTE: Use care when tightening screws.

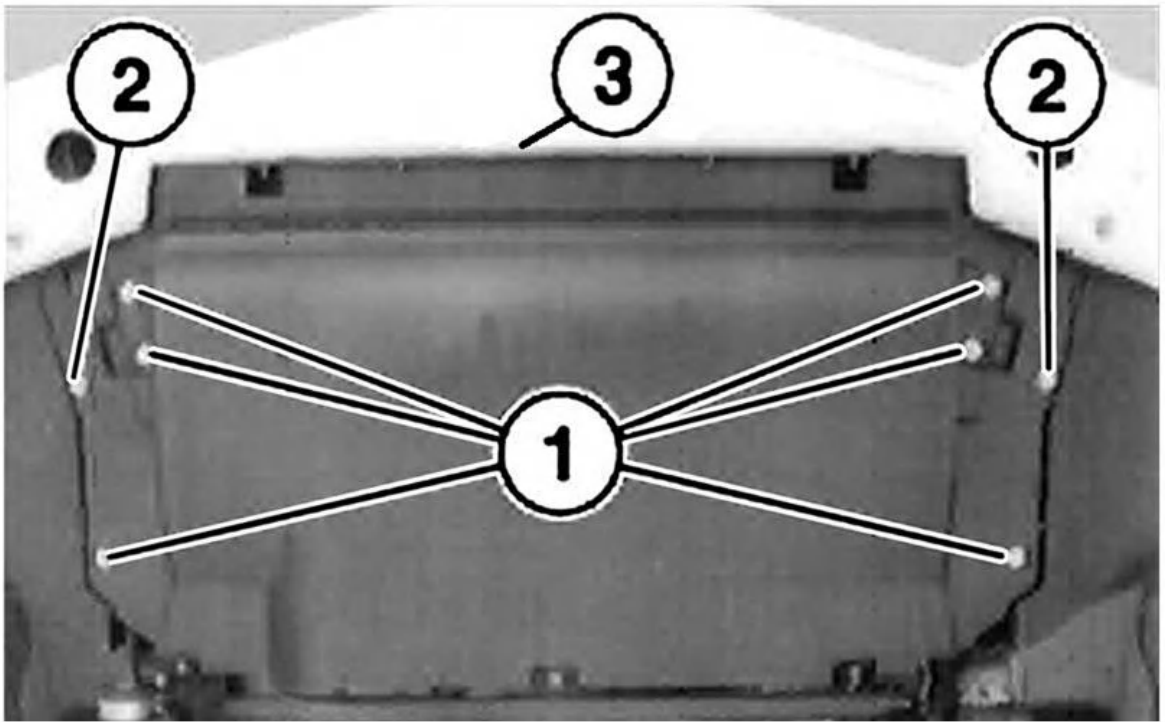



Fig. 31: Removing Underbody Protection (M Coupe & M Roadster)
Courtesy of BMW OF NORTH AMERICA, INC.

## WIRING DIAGRAMS

### 1991

#### 318i & 318is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

### 1992

#### 318i & 318is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

#### 325i & 325is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

1993

318i

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

325i

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

325i Convertible

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

325is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

1994

318i

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318i Convertible

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

325i

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

325i Convertible

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

325is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

1995

318ti

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318i

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318i Convertible

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

325i

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

325i Convertible

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

325is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

1996

Z3

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318i

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318i Convertible

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318ti

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

328i

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

328i Convertible

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

328is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

1997

Z3

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318i

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318i Convertible

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318ti

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

328i

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

328i Convertible

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

328is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

1998

M3

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

M Roadster & Z3

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318i

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318ti

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

323i Convertible

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

323is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

328i

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

328i Convertible

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

328is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

1999

M3

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

M Coupe, M Roadster & Z3

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

318ti

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

323i Convertible

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

323is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

328i Convertible

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

328is

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

2000

M Coupe, M Roadster & Z3

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

2001

M Coupe, M Roadster & Z3

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

2002

M Coupe, M Roadster & Z3

For system wiring diagram, see COOLING FAN in SYSTEM WIRING DIAGRAMS article.

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Article GUID: A00163904

# DESCRIPTION

Bosch starter is a brush-type, series-wound electric motor with an overrunning clutch. Field frame carries pole shoes and field coils, and is enclosed by commutator end frame and drive bushing. Armature shaft drive end drives a reduction gear.

# OPERATION

On 7-series and 540i with automatic transmission, starter is controlled by Digital Motor Electronic (DME) control module. After the DME control unit receives the input signals from the ignition switch and neutral safety switch, it energizes the starter relay, which in turn energizes terminal No. 50 at the starter motor. After the DME control unit receives a signal from the crankshaft position sensor that the engine is running (920 RPM cold; 680 RPM at normal operating temperature), the DME control unit switches off the starter relay.

On all other models, starter is controlled by electronic immobilizer control unit. Turning ignition switch to START position energizes terminal No. 3 at electronic immobilizer control unit. When clutch is depressed (M/T) or gear selector is in Park or Neutral (A/T), a signal is sent to terminal No. 9 at electronic immobilizer control unit. When both these signals are received by electronic immobilizer control unit, terminal No. 50 is energized at starter motor.

# TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING article in GENERAL INFORMATION.

# REMOVAL & INSTALLATION

## STARTER

### Removal & Installation (6-Cylinder)

1. Disconnect negative battery cable. Pull throttle cable upward, out of retainer, and unhook from throttle actuator. Remove air filter housing, and disconnect mass airflow sensor. Detach vacuum line from air intake hose. Remove air intake hose from throttle assembly and idle-speed control valve. Raise vehicle and remove lower engine cover.
2. Disconnect plastic fuel lines at connections. Disconnect wires going to starter. Remove starter mounting bolts from transmission output end with a long extension and a universal joint. Remove starter toward bottom, past fuel lines. Check starter pinion and starter crown gear for damage. See Fig. 1. To install, reverse removal procedure.

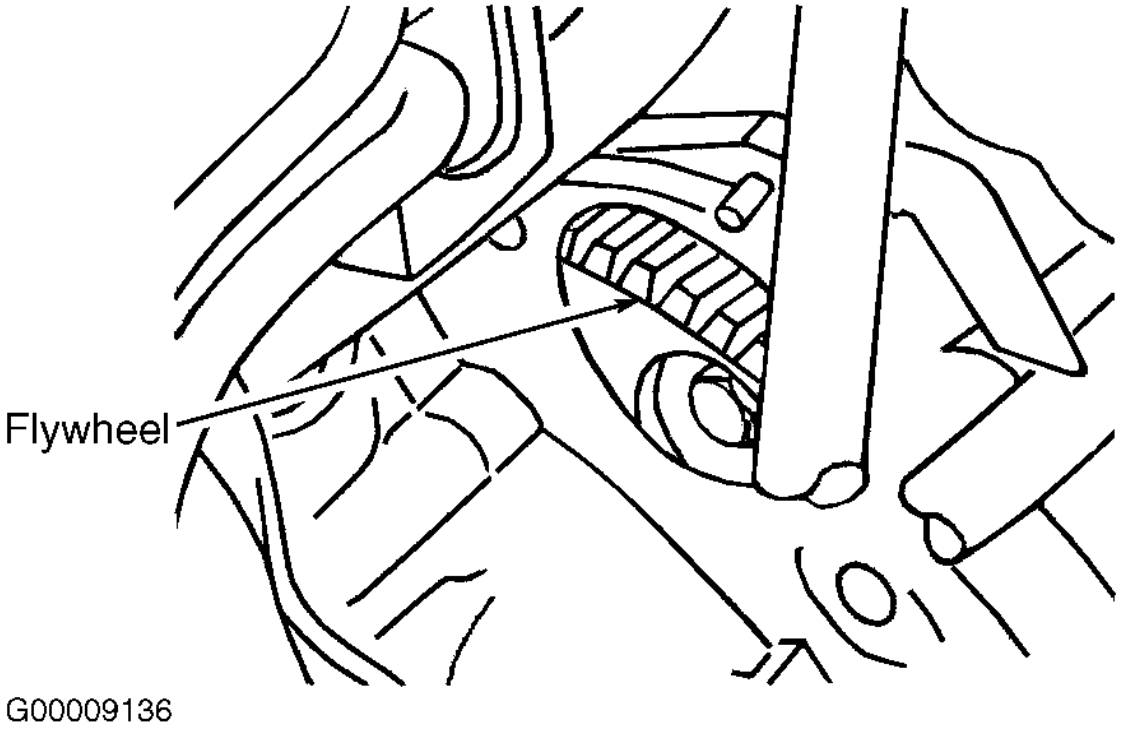



Fig. 1: Checking Flywheel For Damage
Courtesy of BMW OF NORTH AMERICA, INC.

### Removal & Installation (8-Cylinder)

Disconnect negative battery cable. Remove front and rear covers under engine. Remove battery cable guide retaining bolt and move guide off to side. Remove heat shields around starter. Disconnect wires from starter. Remove bolts from starter. Slide starter forward, and lower starter from vehicle. Check starter pinion and starter crown gear for damage. To install, reverse removal procedure.

## OVERHAUL

For overhaul, see exploded view of starter. See Fig. 2. Ensure insulation between commutator plates is 0.2-0.3" (0.5-0.7 mm) below commutator plate surface. Grind insulation down if necessary.

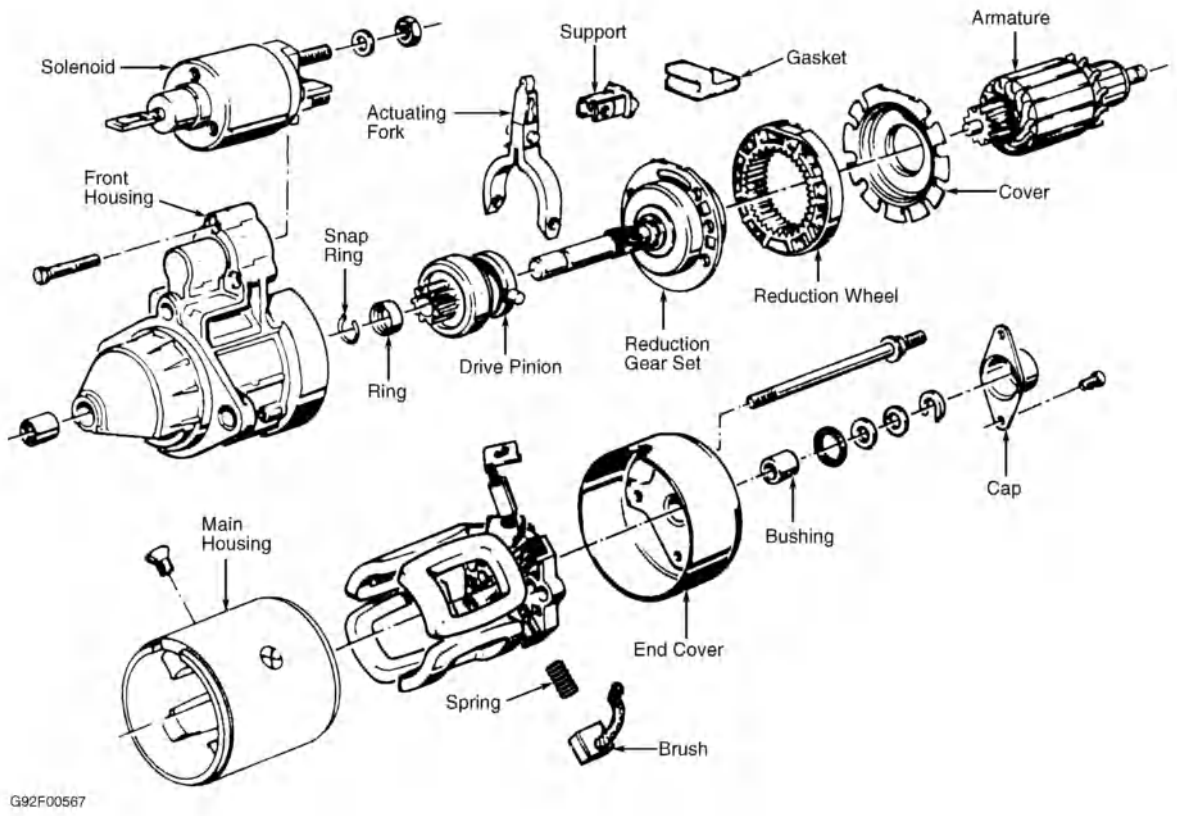



Fig. 2: Exploded View Of Bosch Reduction Gear Starter (Typical)
Courtesy of BMW OF NORTH AMERICA, INC.

## STARTER SPECIFICATIONS

STARTER SPECIFICATIONS

| Application | Specification |
|---|---|
| Axial Armature Play | .1-.2 mm |
| Brush Length | 13 mm (minimum) |
| Testing Voltage | 11.7-12.3 Volts |
| Rated Power | |
| M50, M52, S52 | 1.7 kW |
| M51 | 2.2 kW |
| M60, M62 | 1.7 kW |
| M70, M73 | 2.2 kW |
| M57 | 2.2 kW |
| M67 | 2.6 kW |
| S62 | 1.7 kW |
| Current Consumption At Terminal 50 (Rated Power Of 1.4 kW) | |
| Pull-In Winding | 54.5 A |
| Hold-In Winding | 10.5 A |
| Current Consumption At Terminal 50 (Rated Power Of 1.7 kW with Intermediate Transmission) | |
| Pull-In Winding | 51 A |
| Hold-In Winding | 9.5 A |
| Current Consumption At Terminal 50 (Rated Power Of 1.8 kW) | |
| Pull-In Winding | 50 A |
| Hold-In Winding | 12 A |
| Current Consumption At Terminal 50 (Rated Power Of 2.0 kW) | |
| | |

| | |
|---|---|
| Pull-In Winding | 54.5 A |
| Hold-In Winding | 10.5 A |
| Current Consumption At Terminal 50 (Rated Power Of 2.2 kW) | |
| Pull-In Winding | 58 A |
| Hold-In Winding | 13 A |
| Current Consumption At Terminal 50 (Rated Power Of 2.2 kW with Intermediate Transmission) | |
| Pull-In Winding | 60 A |
| Hold-In Winding | 10 A |
| Current Consumption At Terminal 50 (Rated Power Of 2.6 kW with Intermediate Transmission) | |
| Pull-In Winding | 50 A |
| Hold-In Winding | 12 A |

## TORQUE SPECIFICATIONS

STARTER AND MOUNTING PARTS

| Type | | Thread | Measure |
|---|---|---|---|
| Starter motor mounting to transmission bell housing | All, except N51, N52, N52K, N53, N54 | Â | 45 Nm |
| Support to starter | All | M5 | 5 Nm |
| Support to crankcase | All | Â | 47 Nm |
| Electrical leads to starter | Â | Â | Â |
| All | | M5 | 5 Nm |
| All | | M6 | 7 Nm |
| All | | M8 | 13 Nm |
| Bolt connection, pole tube | All | M6 | 6 Nm |
| Heat shield to starter motor | Â | M6 | 6 Nm |

## WIRING DIAGRAMS

NOTE: Wiring diagrams not shown here may be available in appropriate STARTING/CHARGING article under SYSTEM WIRING DIAGRAMS in ELECTRICAL.

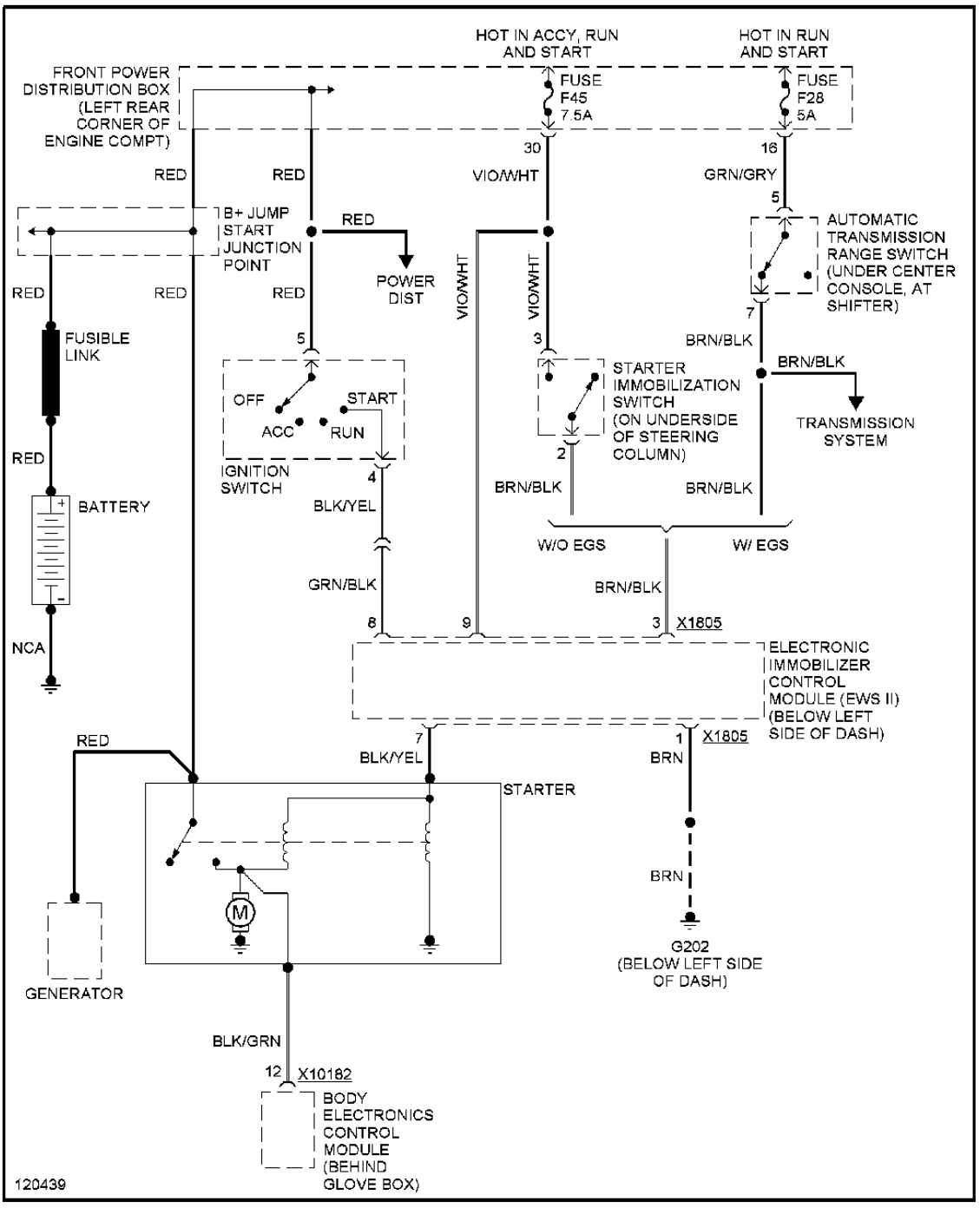



Fig. 3: Starting System Wiring Diagram (1999 318ti)

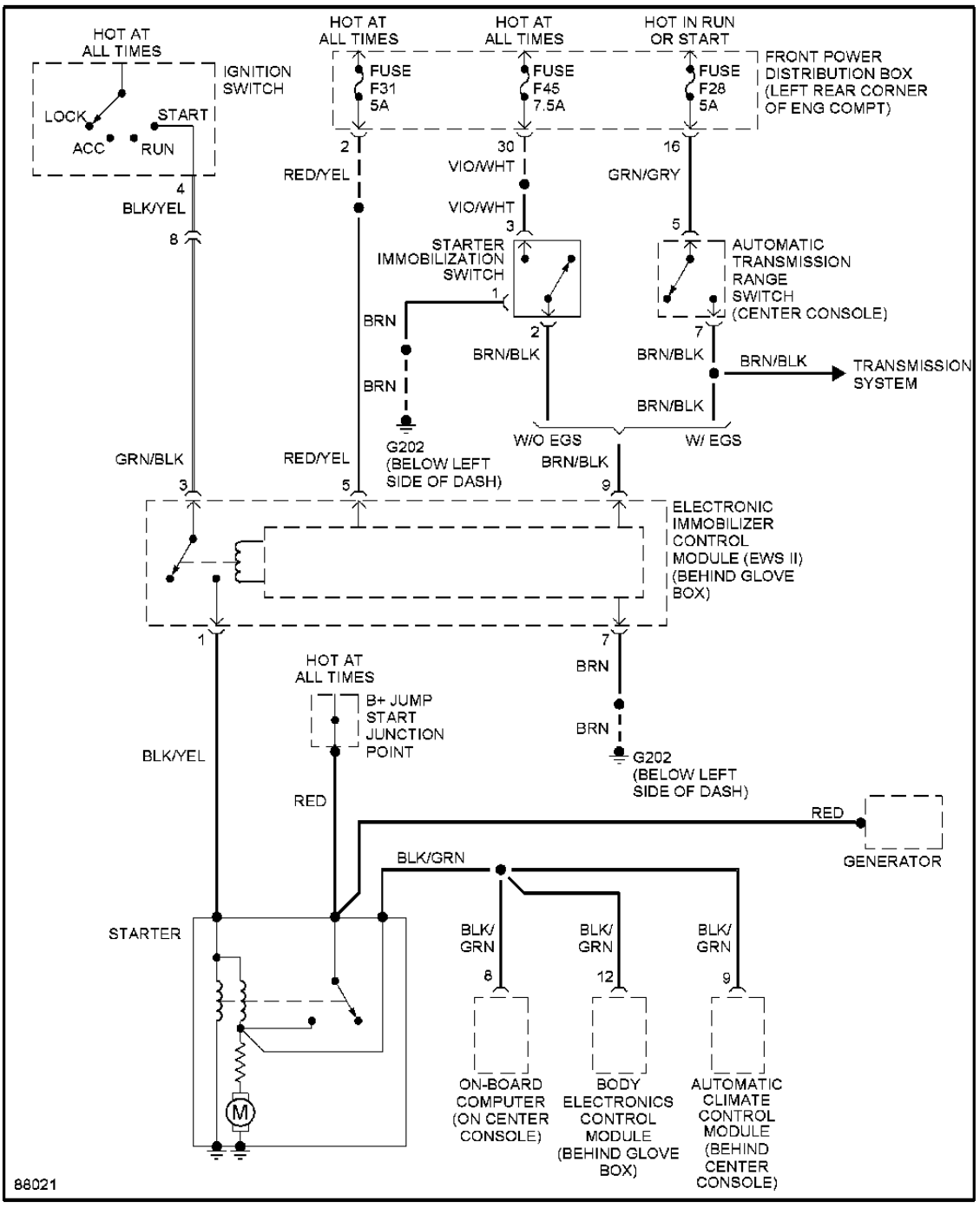



Fig. 4: Starting System Wiring Diagram (1999-2000 323i Convertible, 323is, 1999 328i Convertible, 328is & 1999 M3)

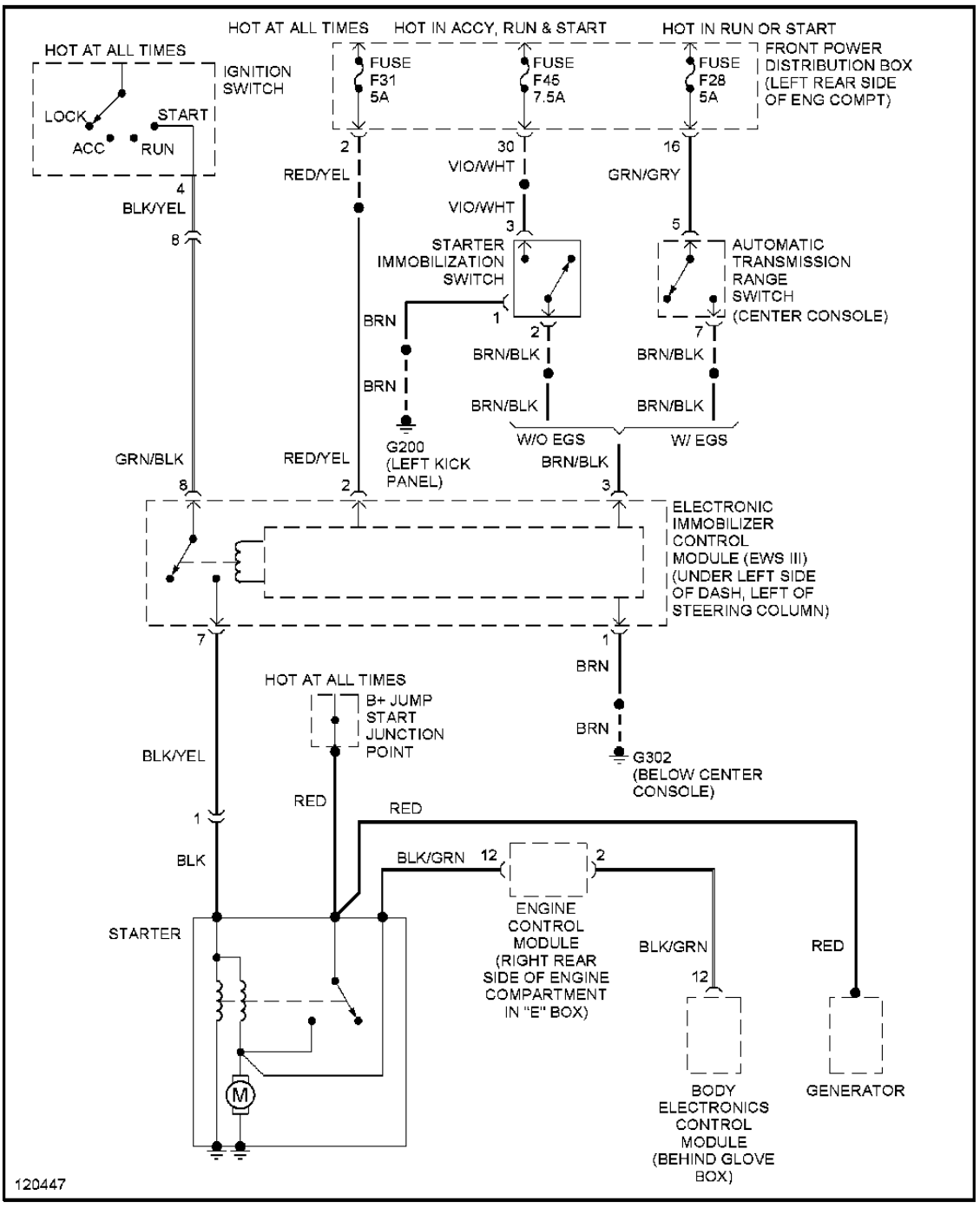



Fig. 5: Starting System Wiring Diagram (1999-2000 M Coupe, M Roadster & Z3)

Article GUID: A00002919

# CHECKING/SETTING ENGINE/EMISSION

## 13 00 002 CHECKING FUNCTION OF DIGITAL ENGINE ELECTRONICS (DME)

Connect BMW SERVICE TESTER or MoDiC or DIS to diagnosis connector in engine compartment.

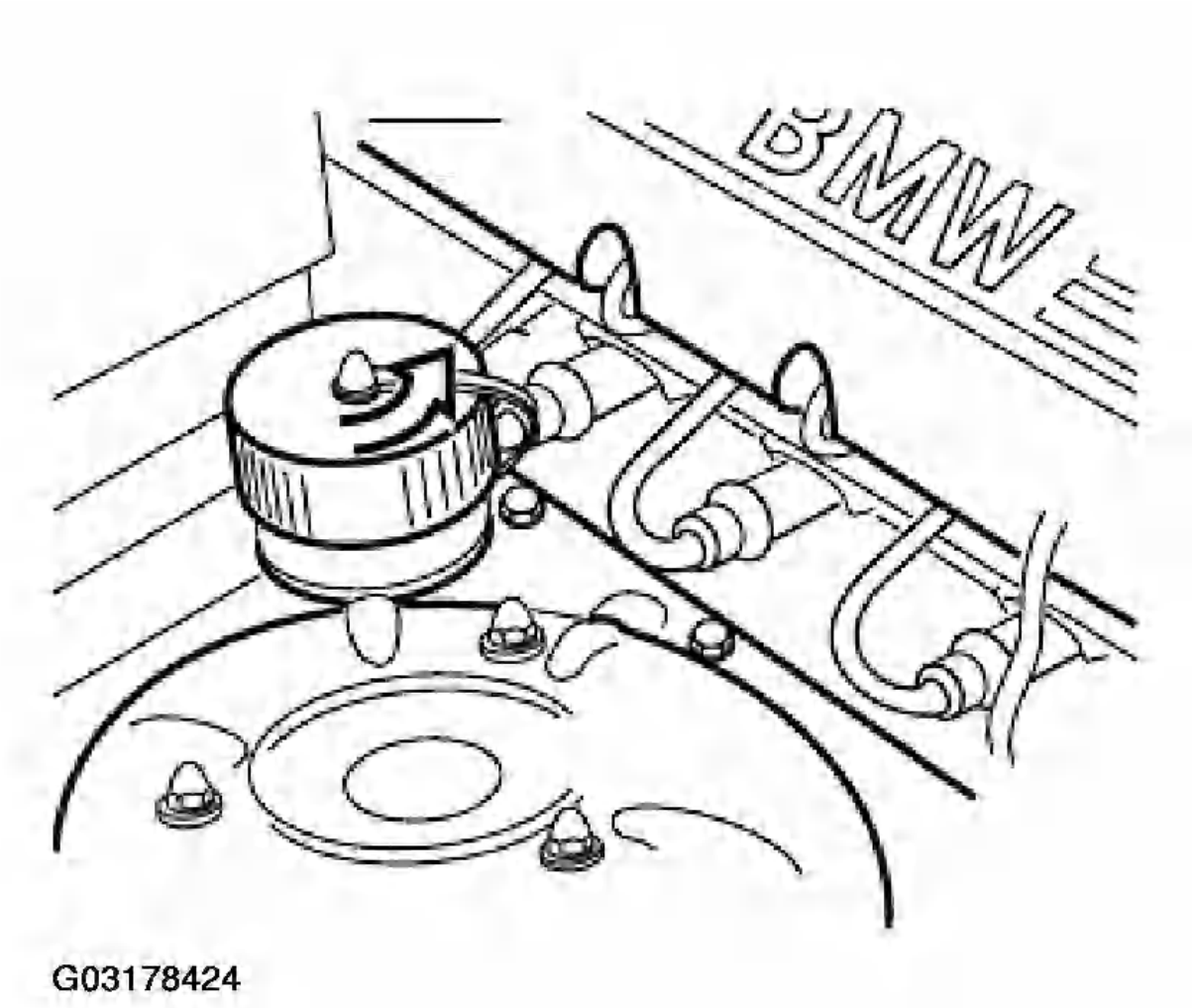



Fig. 1: Connecting Tester To Connector
Courtesy of BMW OF NORTH AMERICA, INC.

Carry out brief test.

Read fault memory.

Note down any faults stored in memory.

# FUEL PUMP WITH DRIVE AND LINE

## 13 31 ... NOTES ON FUEL PRESSURE CHECK (REFERENCE PRESSURE: ENVIRONMENT)

Feature Of This Version With Ambient Pressure:

The connection for the vacuum hose of the fuel pressure regulator is located between the throttle and the air

cleaner or on the air cleaner.

Test Precondition:

The correct fuel pressure regulator is fitted.

- Using the EPC, check whether the fuel pressure regulator suitable for the car is fitted:

  Connect test adapter. Refer to 13 31 029 CHECKING FUEL PUMP DELIVERY PRESSURE (M54) .

Description Of Operation:

The control function of the fuel pressure regulator must be guaranteed under all operating conditions. The fuel pump must always be able to generate a higher fuel pressure than the pressure regulated by the pressure regulator.

The injection rate is adjusted by means of the injection time; the injection time is controlled by the DME.

Description Of Operation: Fuel Return Line:

When the engine is at a standstill and the ignition key is in position 0, the fuel return line after the pressure regulator is at zero pressure.

Description Of Operation: Pressure Retaining Function:

The pressure regulator closes when the engine is at a standstill and the ignition key is in position 0. The fuel pressure in the delivery line is retained over an extended period. A non-return valve closes in the fuel pump. These measures help to retain the fuel pressure in the fuel system. Extended starting times are thus avoided.

Complaint: Drive Characteristic Faults, Lack Of Power:

- Run engine at idle speed and measure fuel pressure.

If The Measured Value Is Less Than The Nominal Value - 0.2 Bar:

- Line cross-sections in fuel feed are constricted or fuel filter is clogged or.
- Fuel pump voltage supply is not O.K.: e.g. as a result of high contact resistance (corrosion) in plug connection between wiring harness and fuel pump.

If The Measured Value Is Greater Than The Nominal Value + 0.2 Bar:

- Turn off engine stop and then observe measured value.
- If measured value drops to nominal value, then line cross-sections in fuel return are constricted or clogged.
- Check the fuel lines for kinks.

  If no kinks are visible:

- Replace return lines.

If measured value remains too high, then pressure regulator is in all probability faulty.

IMPORTANT: With less likelihood, the return line may be completely blocked. When the pressure regulator is removed, fuel could escape under pressure!

- Have a cleaning cloth ready and catch and dispose of escaping fuel.
- Replace the return line but not the pressure regulator.

Complaint: Starting Problems:

- Run engine briefly at idle speed and switch off.
- Note down measured value while engine is stopped.
- Read off measured value again after approx. 20 to 30 minutes while engine is stopped.

Special tool 13 3 010 (hose clamp) is required for the following test.

If The Measured Value Has Dropped By More Than 0.5 Bar:

- Start engine and wait briefly for a stable pressure increase.
- Switch off the engine and immediately pinch off the delivery line just before the pressure gauge with the special tool 13 3 010.
- Note down measured value.
- Read off measured value again after approx. 20 to 30 minutes while engine is stopped.

If The Measured Value Has Now Dropped By Less Than 0.5 Bar, The Following Faults Can Be Present:

- Fault in delivery lines.
- Fault in in-tank delivery hose.
- Faulty pressure-holding non-return valve in fuel pump.

Check components. Replace faulty components.

If The Measured Value Has Dropped By More Than 0.5 Bar Again:

- Replace pressure regulator.

NOTE:

- All the fuel hoses and hose clips which were detached within the framework of the checks must be replaced.
- Interrogate fault memory of DME control unit. Check stored fault messages. Rectify faults. Now clear the fault memory.

## 13 31 029 CHECKING FUEL PUMP DELIVERY PRESSURE (M54)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 (M54) .

Special Tools Required:

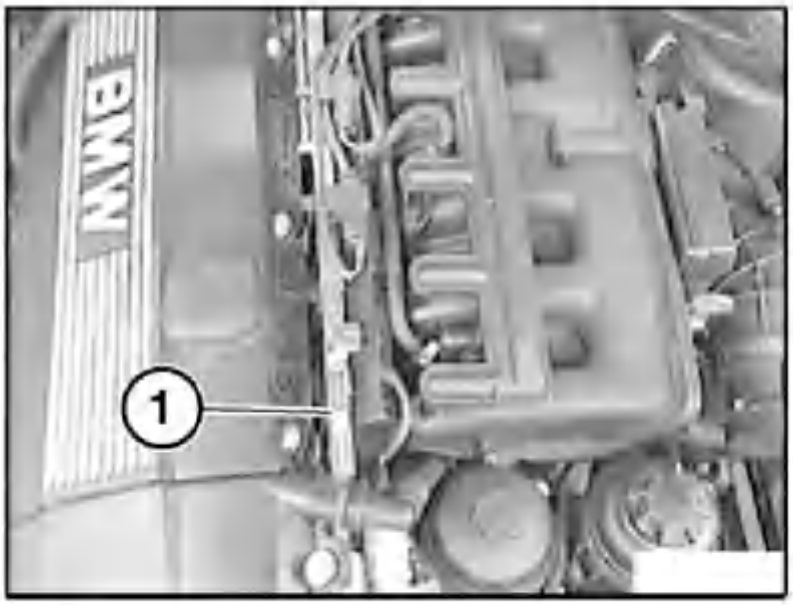
- 13 3 010
- 13 5 220
- 61 3 050

Switch off ignition.

CAUTION: The fuel in the fuel lines is under pressure (approx. 3 bar)! Catch and dispose of escaping fuel.

Remove cover from fuel injectors. Refer to FUEL RAIL & INJECTORS .

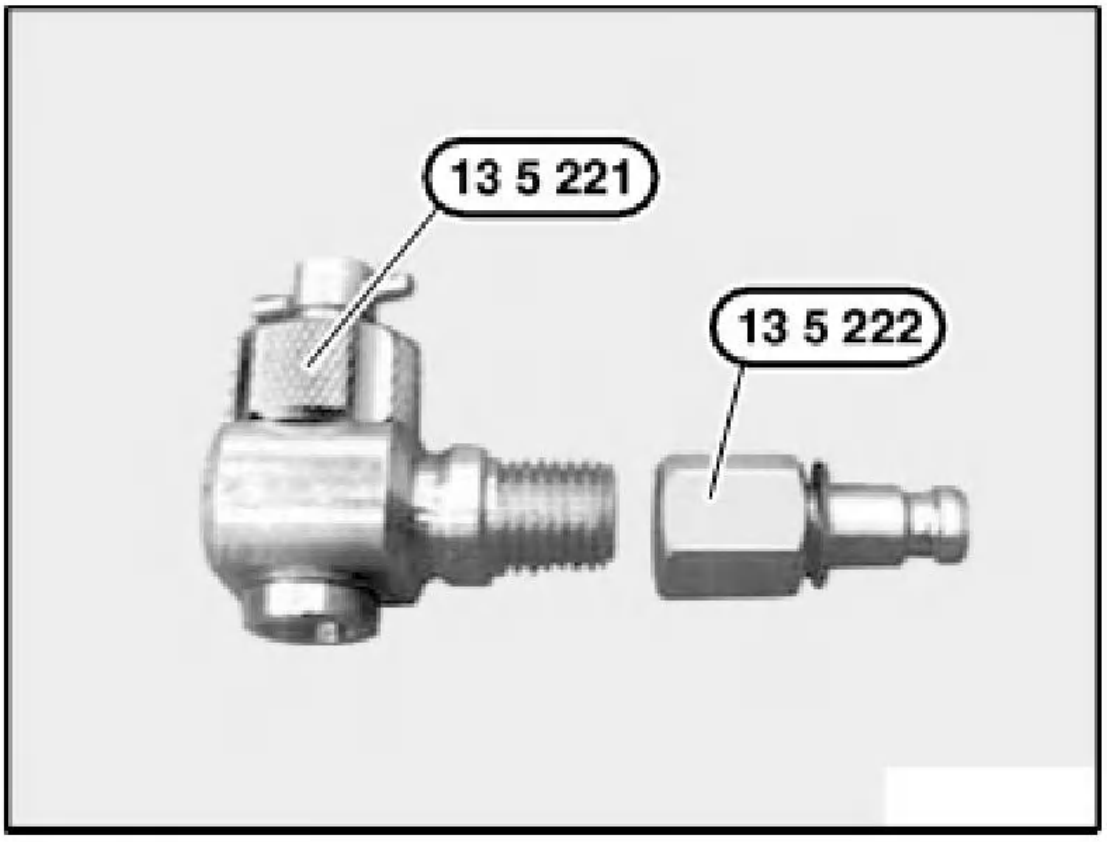
Remove dust cap (1) from measuring valve on fuel rail.



G03178425

Fig. 2: Removing Dust Cap From Measuring Valve
Courtesy of BMW OF NORTH AMERICA, INC.

Prepare special tool kit 13 5 220 (consisting of 13 5 221 and 13 5 222).



G03178426

Fig. 3: Identifying Special Tool Kit 13 5 220
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew check valve (1) on special tool kit 13 5 220.

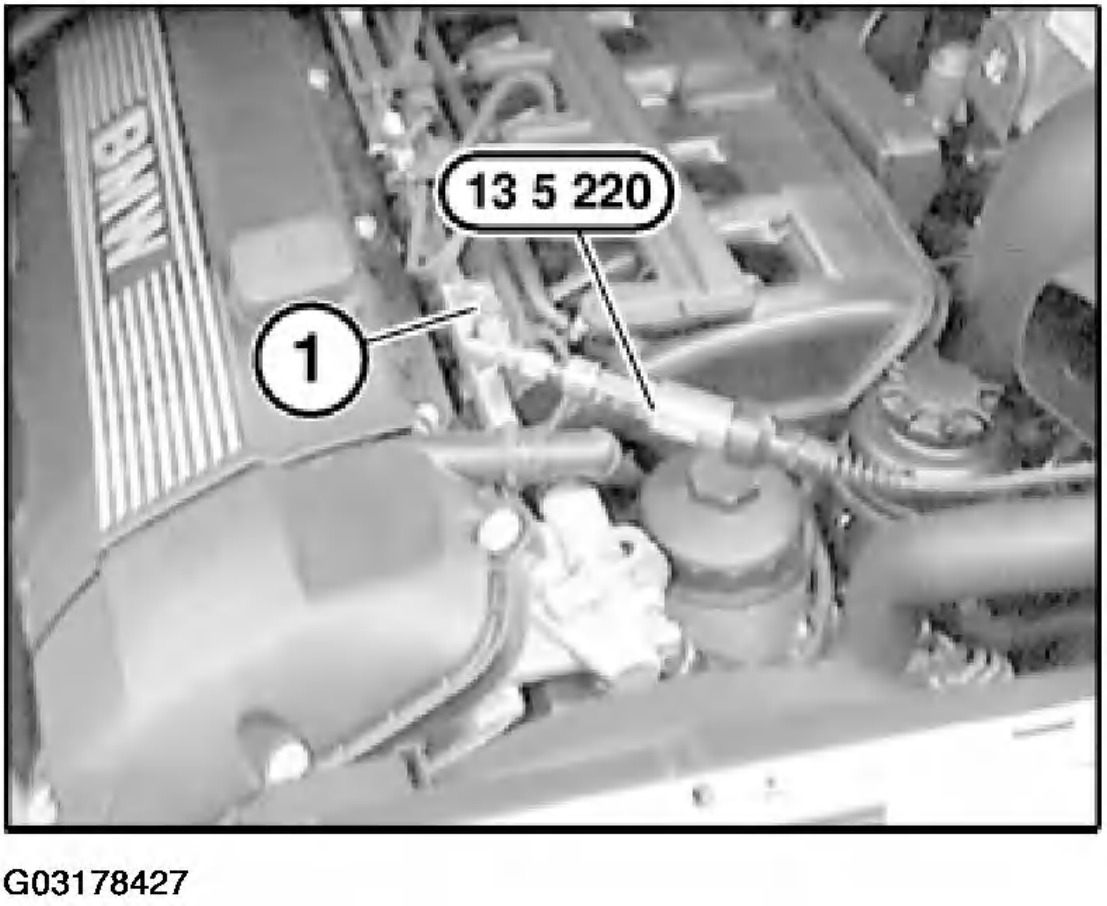



Fig. 4: Installing Special Tool Kit 13 5 220
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool kit 13 5 220 on measuring valve and tighten knurled nut until hand-tight.

Start engine.

Screw in check valve (1) until a pressure reading is indicated on DIS Tester.

CAUTION: Do not under any circumstances screw in the check valve up to the mechanical stop. This could damage the valve in the pressure regulator housing.

Measuring Fuel Pressure:

- Connect pressure sensor to DIS Tester.
- Start engine.
- Select Measurement.
- Multimeter function appears.
- Select Pressure test.

- Read off fuel pressure.

Compare actual value of test pressure with specified value. Test pressure/nominal value: bar +/- 0.2-3.5.

Switch off engine.

Checking Fuel Pump:

Detach fuel pump relay. Refer to13 63 590 REPLACING FUEL PUMP RELAY (Z3 / M54) .

NOTE: Check whether fuel pump no longer starts up during engine starting procedure (engine fails to start).

Connect special tool 61 3 050 to terminal (87) and terminal (30).

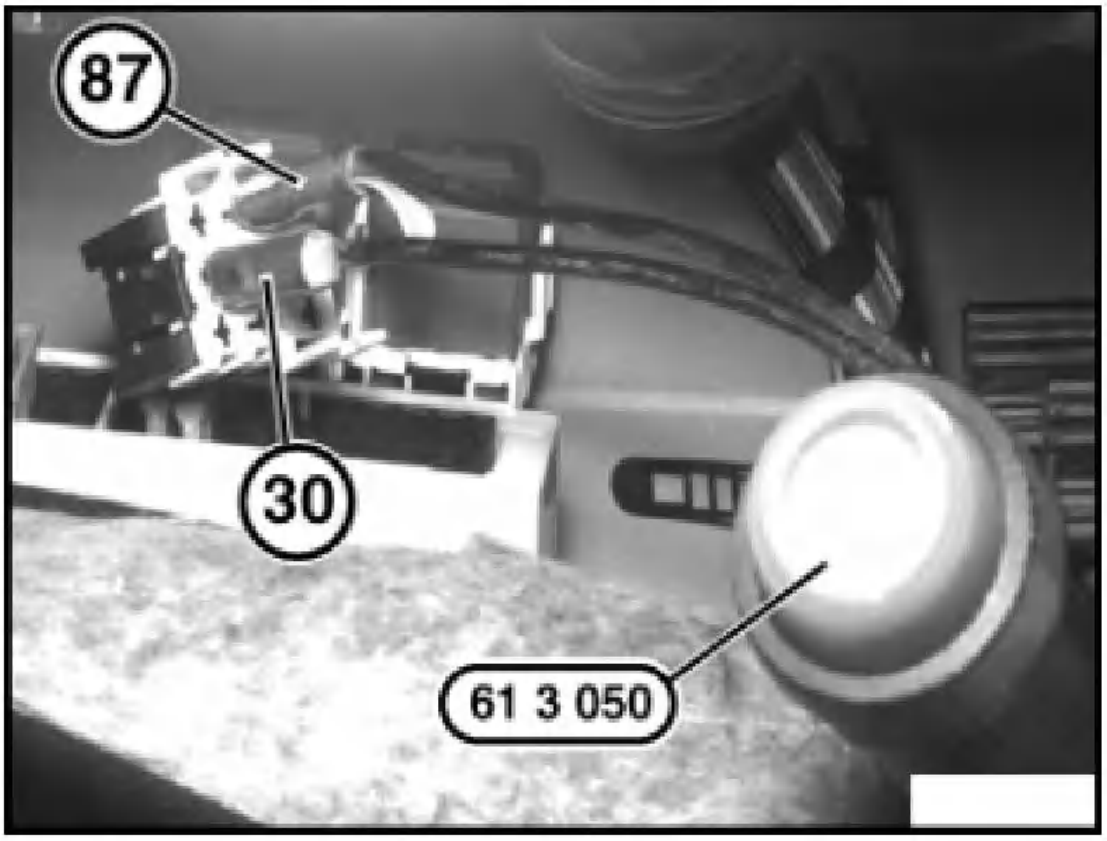



Fig. 5: Connecting Bypass Switch To Terminals
Courtesy of BMW OF NORTH AMERICA, INC.

Press button and read off fuel pump delivery pressure on DIS Tester.

Compare actual Value With specified value of delivery pressure.

Keep special tool 13 3 010 ready for further tests.

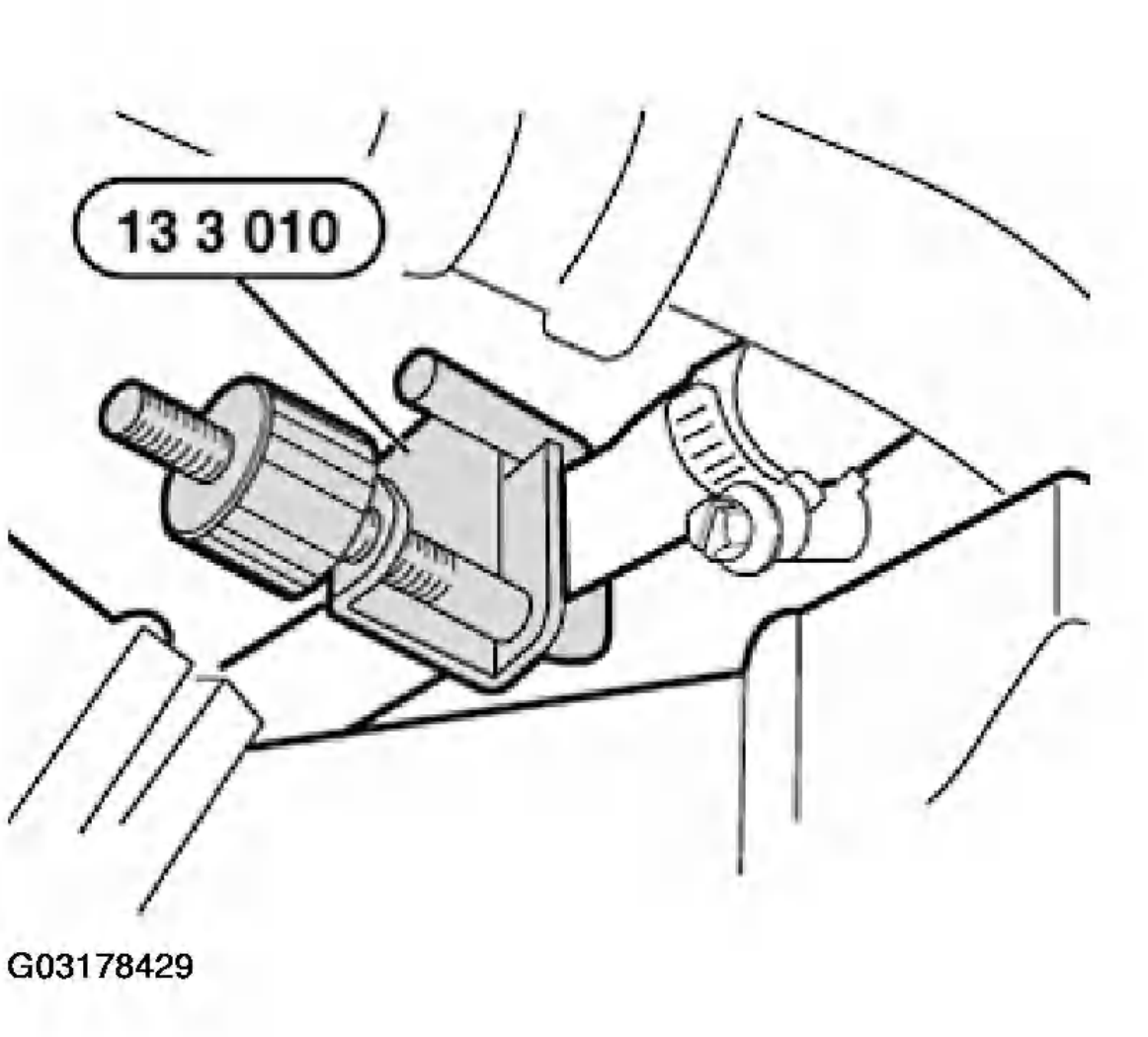



Fig. 6: View Of Hose Clip 13 3 010
Courtesy of BMW OF NORTH AMERICA, INC.

Further tests are described in 13 31 ... NOTES ON FUEL PRESSURE CHECK (REFERENCE PRESSURE: ENVIRONMENT) .

NOTE: Interrogate fault memory of DME control unit. Check stored fault messages. Rectify faults. Then clear fault memory.

## FUEL FILTER

### 13 32 051 REPLACING FUEL FILTER (Z3 / M54)

CAUTION: The fuel in the fuel lines is under pressure (approx. 3-5 bar)! Catch and dispose of escaping fuel. Switch off ignition.

Release screws.

Remove cover (1) on floor plate.

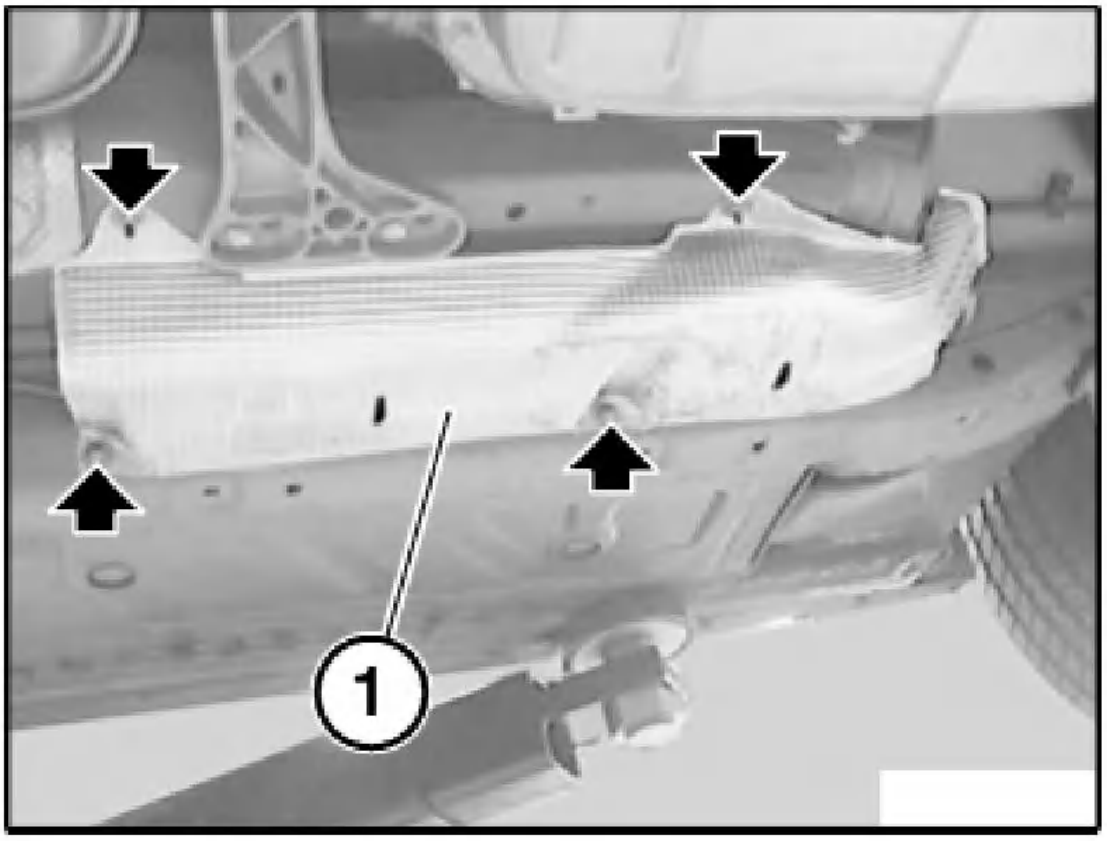



Fig. 7: Removing Cover On Floor Plate
Courtesy of BMW OF NORTH AMERICA, INC.

Detach vacuum hose (1) from fuel pressure regulator (2).

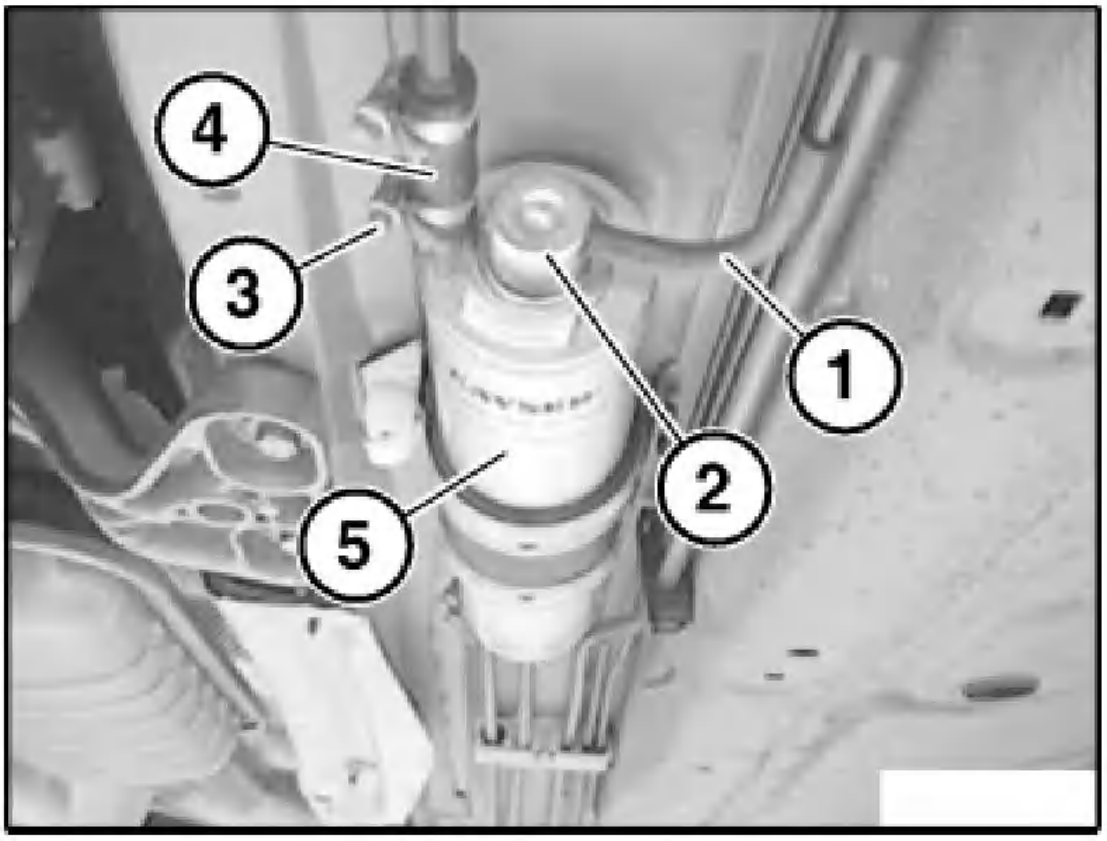



Fig. 8: Locating Vacuum Hose And Fuel Pressure Regulator
Courtesy of BMW OF NORTH AMERICA, INC.

Release clamp (3) and detach fuel line (4) from fuel filter (5).

Release clamps (1) and (2) and detach fuel lines.

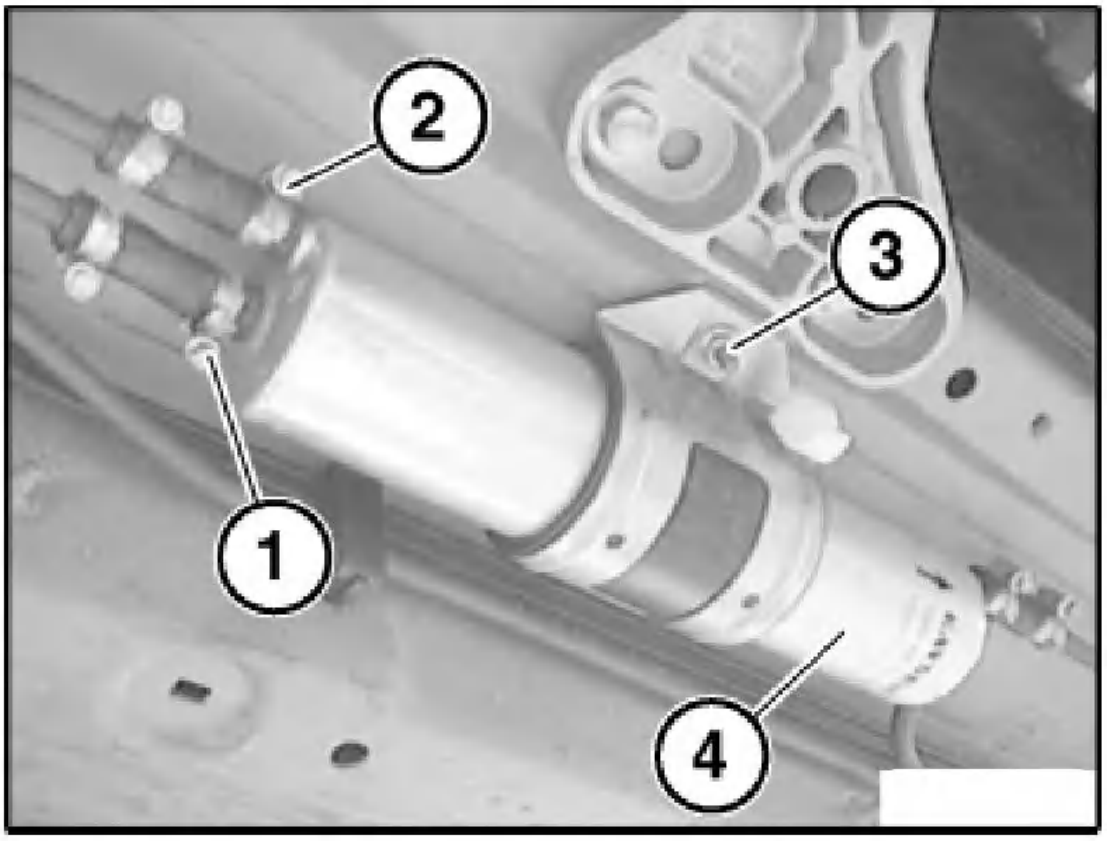



Fig. 9: Releasing Clamps And Detaching Fuel Lines
Courtesy of BMW OF NORTH AMERICA, INC.

Catch and dispose of escaping fuel.

Installation:

Replace clips.

Release nut (3) on holder.

Remove fuel filter (4).

## SPEED GOVERNOR

### 13 41 500 REPLACING IDLE SPEED CONTROL VALVE (M52TU, M54)

Necessary Preliminary Tasks:

- Switch off ignition.
- Disconnect battery ground wire.
- Observe instructions for disconnecting and connecting battery. Refer to 12 00 ... DISCONNECTING AND CONNECTING BATTERY .

M54 E46/E53 Only:

Remove complete intake hose (between intake filter housing and throttle assembly). Refer to 13 54 250 REPLACING INTAKE HOSE (BETWEEN AIR-MASS FLOW SENSOR AND CONNECTING PIECE) (M54) and 13 54 251 REPLACING INTAKE HOSE (BETWEEN CONNECTING PIECE AND THROTTLE ASSEMBLY) (M54) .

M52TU And M54:

Unfasten following plug connections:

1. Resonance flap.
2. Idle speed control valve.

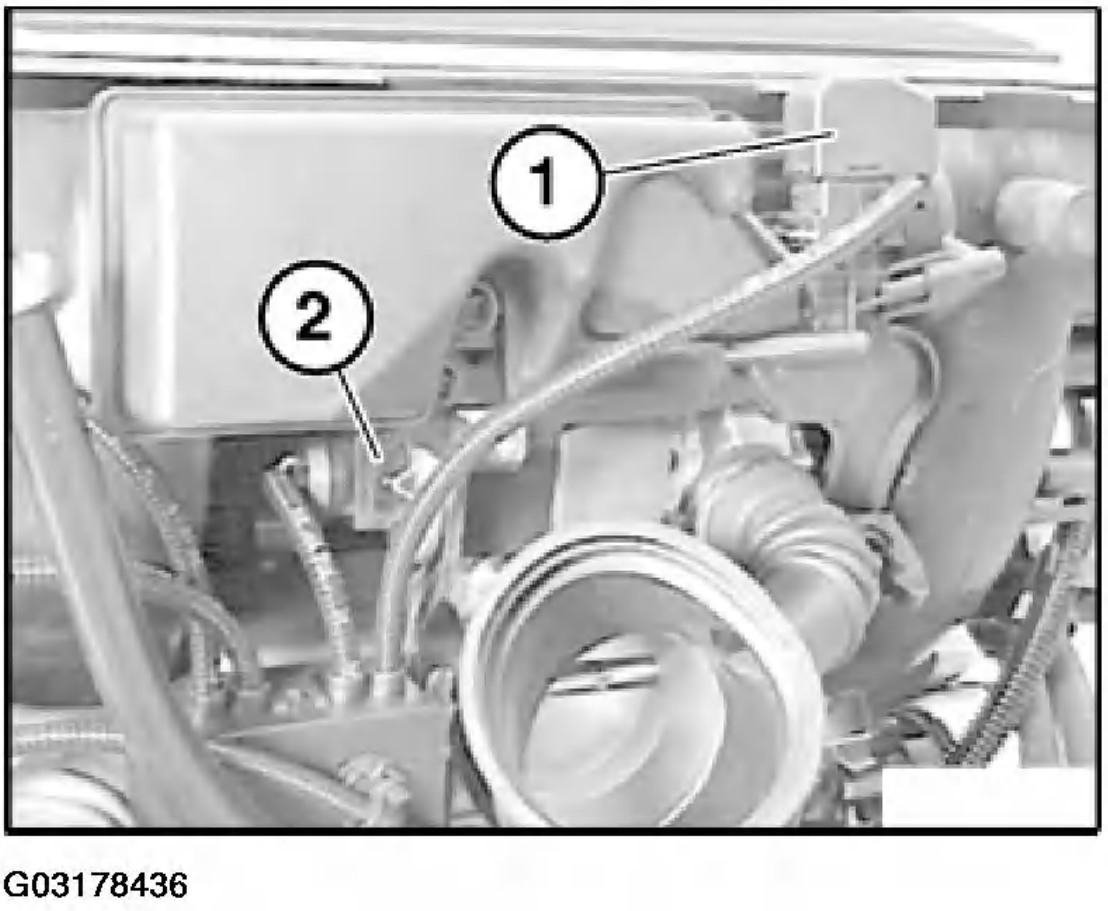



Fig. 10: Identifying Idle Speed Control Valve And Resonance Flap
Courtesy of BMW OF NORTH AMERICA, INC.

Installation Location:

Idle actuator (2) is fitted below intake air manifold, directly above throttle (1).

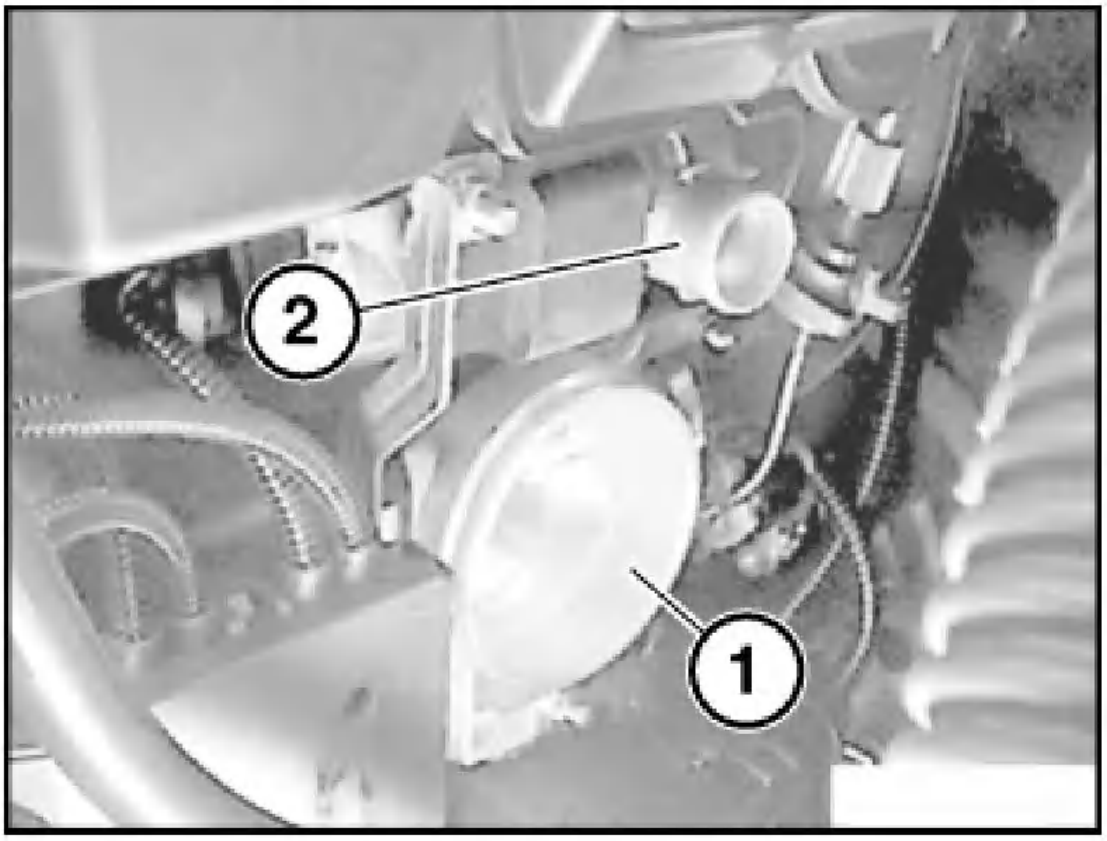



Fig. 11: Locating Idle Actuator Below Intake Air Manifold
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1) on cable duct mounting.

Release screws (2) on holder of idle actuator (3).

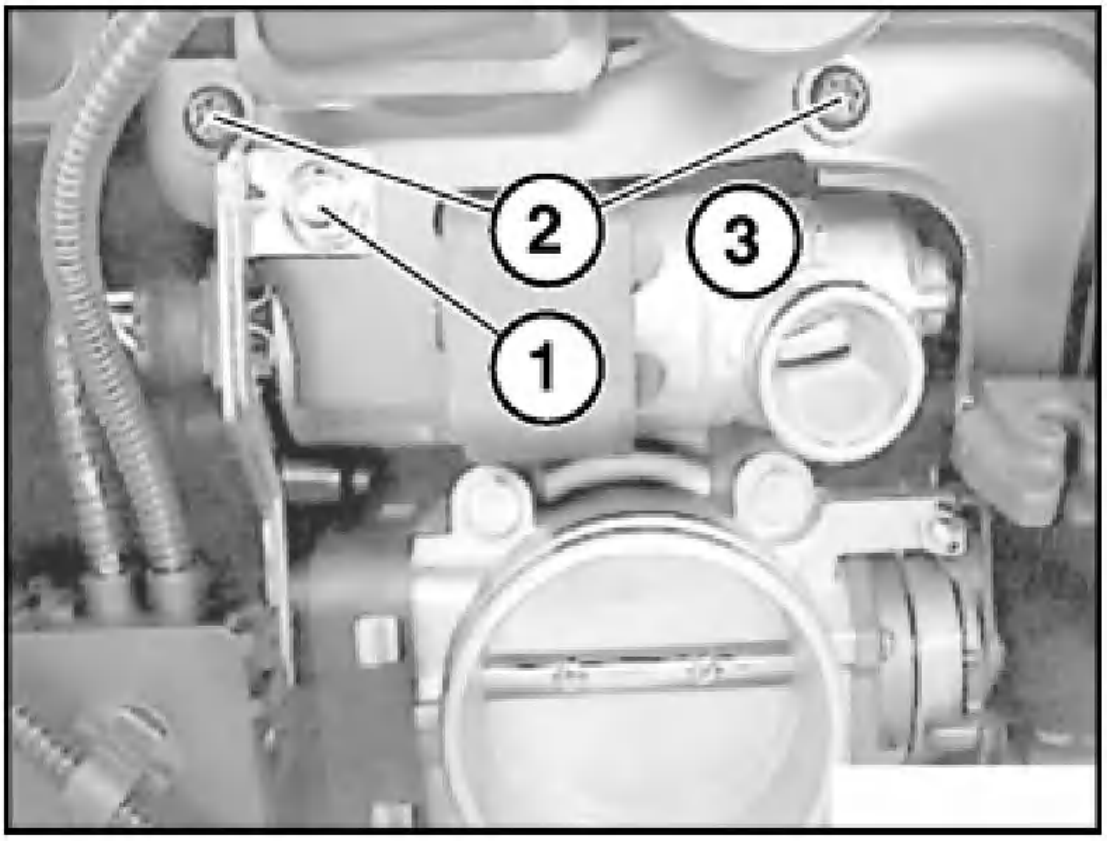



Fig. 12: Identifying Idle Actuator Holder Retaining Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Remove idle actuator with holder from intake air manifold.

Detach idle actuator (2) from rubber retainer (4).

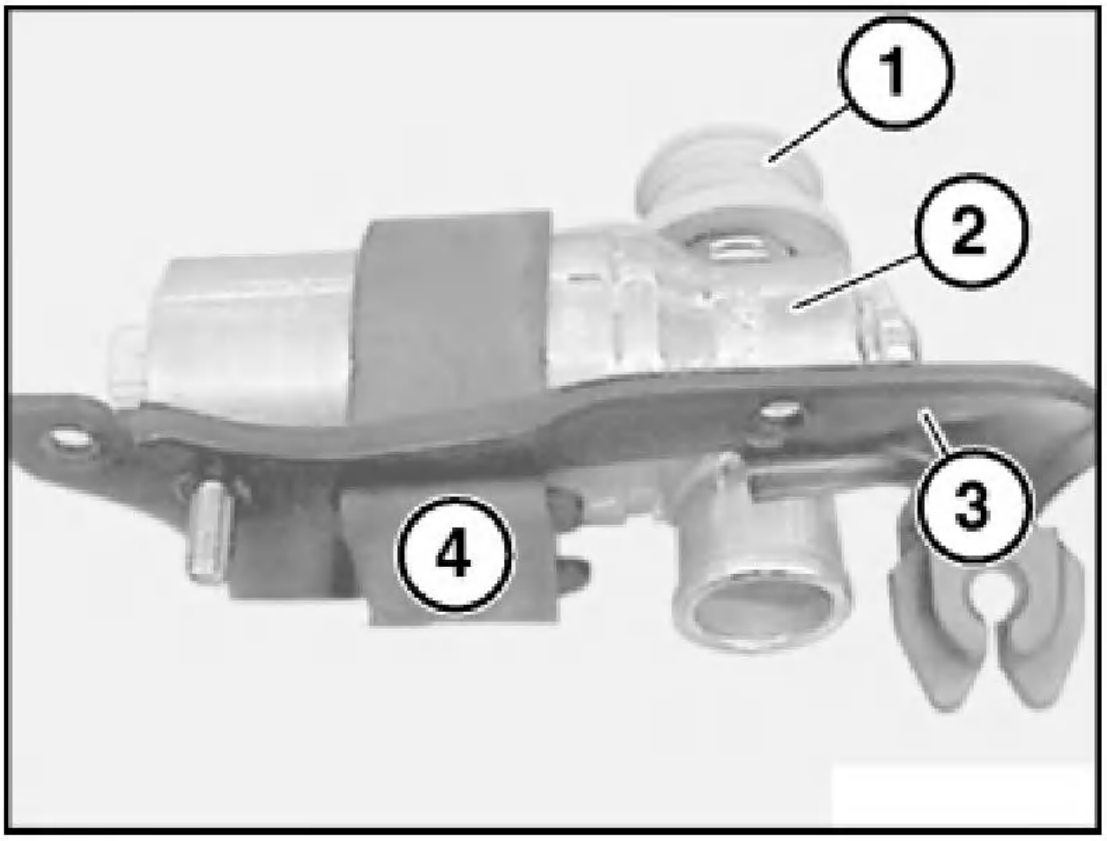



Fig. 13: View Of Idle Actuator Holder In Rubber Retainer
Courtesy of BMW OF NORTH AMERICA, INC.

Always replace gasket (1) from idle actuator (2) to intake air manifold. However, during reinstallation, do not fit gasket on idle actuator but install first in intake air manifold.

Installation:

Replace seal (1).

Coat gasket (1) on inside with antiseize agent.

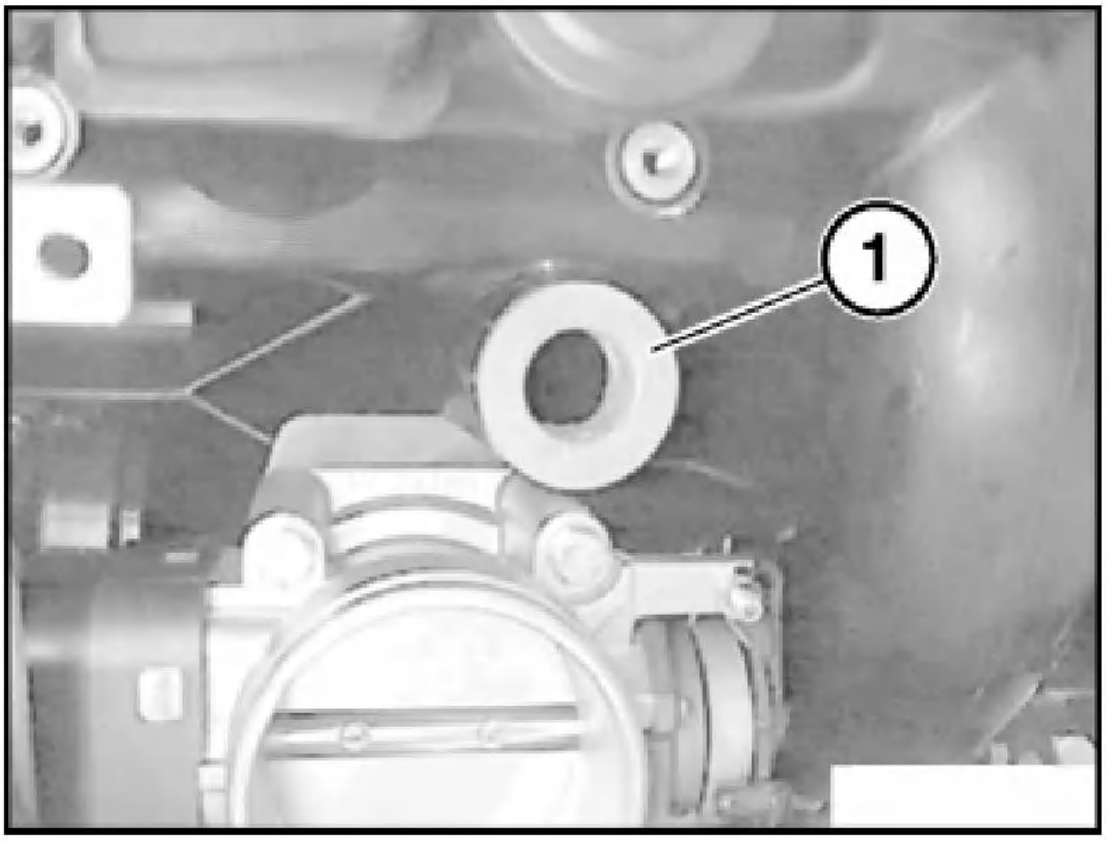



Fig. 14: Locating Idle Actuator Seal
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Interrogate fault memory of DME control unit. Check stored fault messages. Rectify faults. Then clear fault memory.

## INJECTION NOZZLE AND LINES

### 13 53 240 REPLACING COMPLETE INJECTION PIPE (M54)

Necessary Preliminary Tasks:

- Switch off ignition.
- Remove cover for fuel injectors.

CAUTION: Mark plug connections (1) of oxygen monitor sensors for cylinder banks 1-3 and 4-6 to prevent them from being mixed up when they are installed later.

Unclip plug connections (1) from holders and disconnect.

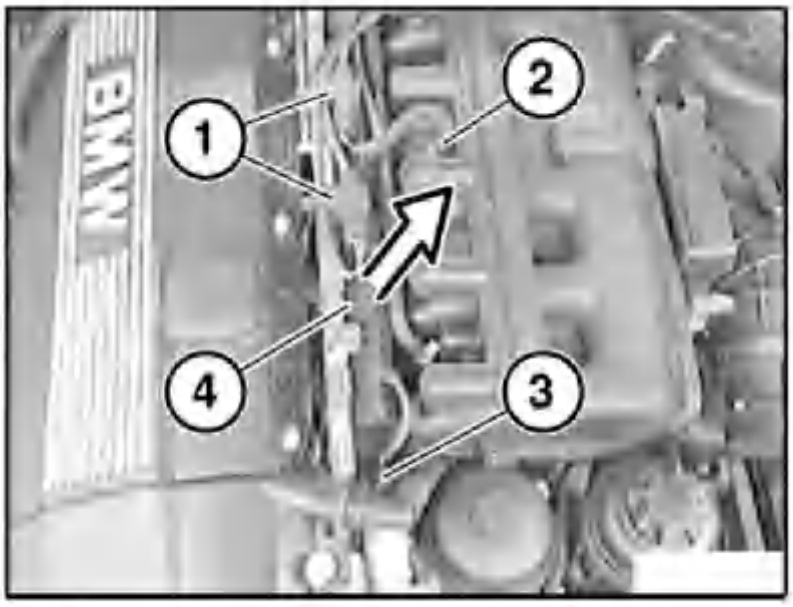



Fig. 15: Removing Plug Connections From Holders
Courtesy of BMW OF NORTH AMERICA, INC.

When replacing injection pipe:

Remove both holders for plug connections (1) from injection pipe.

Disconnect plug connection of intake air temperature sensor (2).

Disconnect plug connection (3) on solenoid valve of VANOS adjustment unit.

Detach terminal strip (4) for fuel injectors from injection pipe.

Recycling.

Fuel in fuel lines is under pressure (approx. 3-5 bar). Fuel escapes when fuel lines are detached. Catch and dispose of escaping fuel.

Observe country-specific waste-disposal regulations.

Z3 Only:

Remove cable strip for battery positive lead and engine wiring harness from bulkhead.

Z3, E85, E39, E46 And E53:

NOTE: For a better overview, this work step is shown on an engine that has been removed.

Unclip fuel line (1) from holder (2).

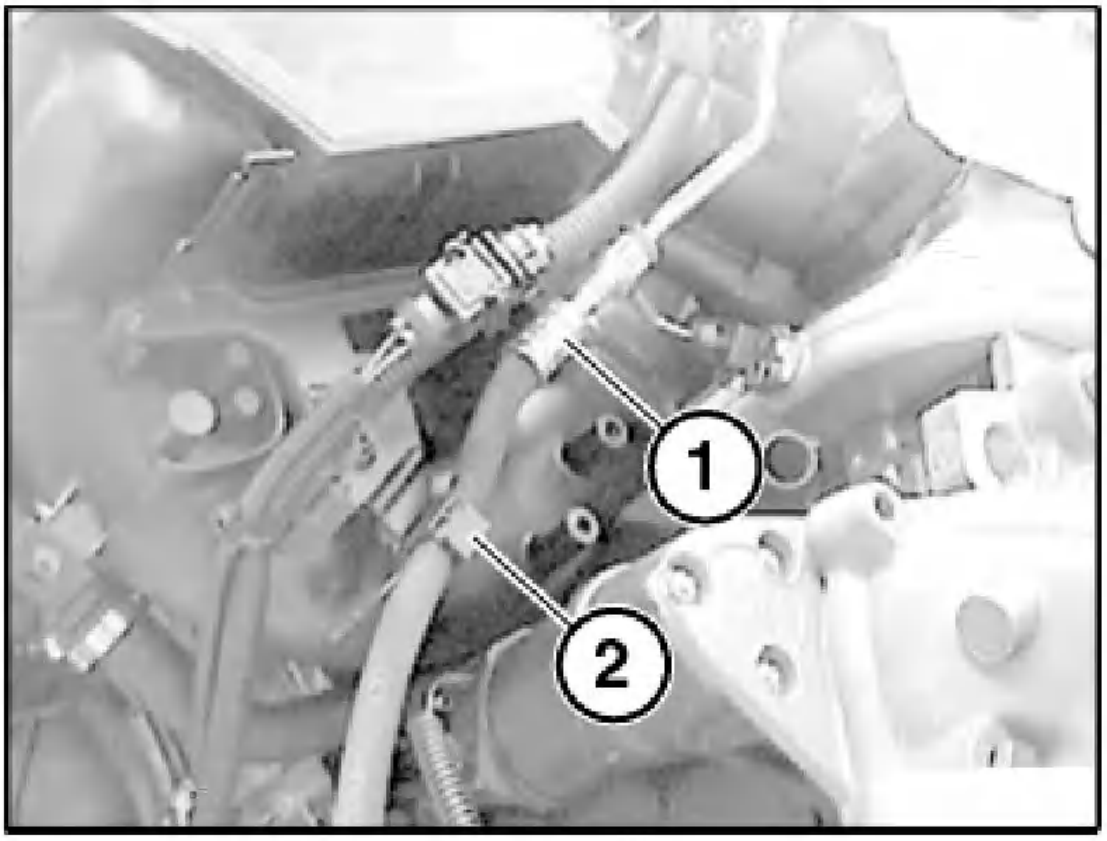



Fig. 16: View Of Fuel Line And Holder
Courtesy of BMW OF NORTH AMERICA, INC.

Follow instructions for unlocking fuel line. Refer to 13 53 540 REPLACING, SEALING FUEL HOSES .

Unlock fuel line (1) from cylinder head at rear.

Release screws (1) and remove injection pipe with fuel injectors.

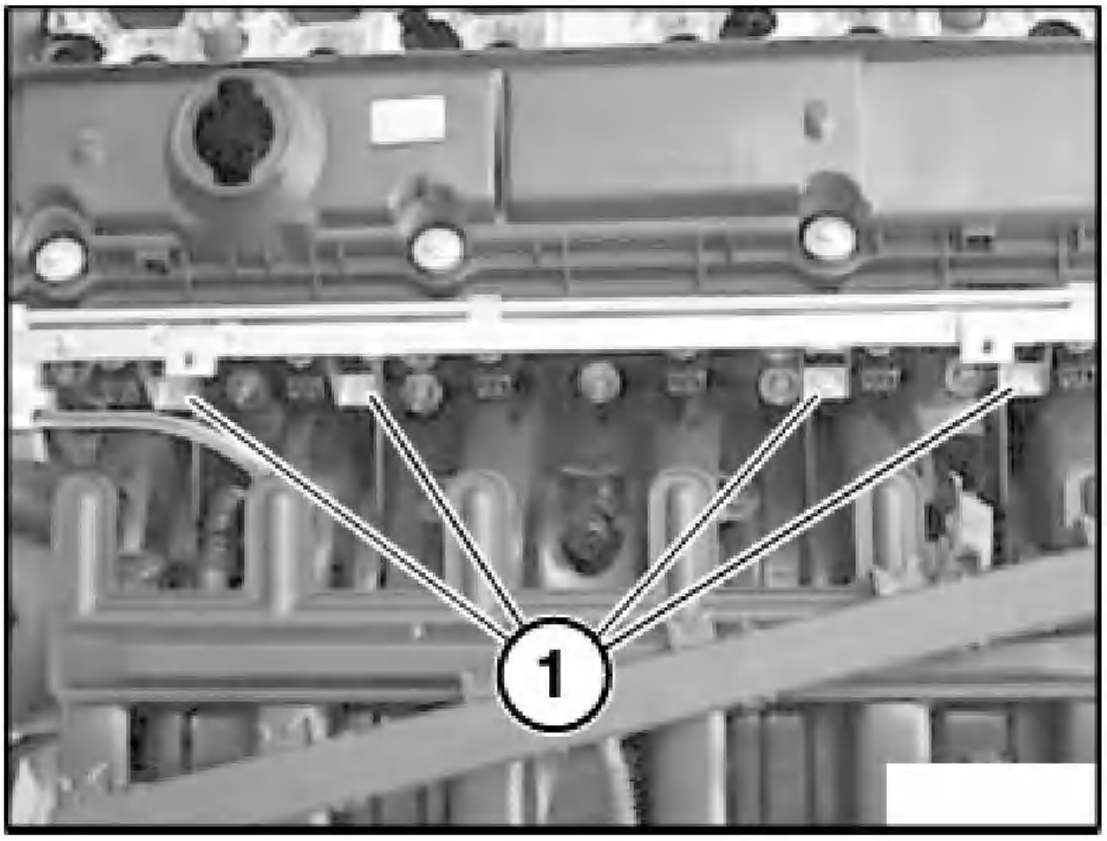



Fig. 17: Locating Injection Pipe Retaining Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Coat sealing rings of fuel injectors with anti-seize agent to facilitate fitting of injection pipe.

## 13 53 540 REPLACING, SEALING FUEL HOSES

**WARNING:** The fuel in the fuel lines is under pressure (approx. 3-5 bar)!

Recycling:

Catch and dispose of escaping fuel.

Observe country-specific waste-disposal regulations.

Version With Hose Clamps:

Release hose clamps.

Remove hoses (1) and (2).

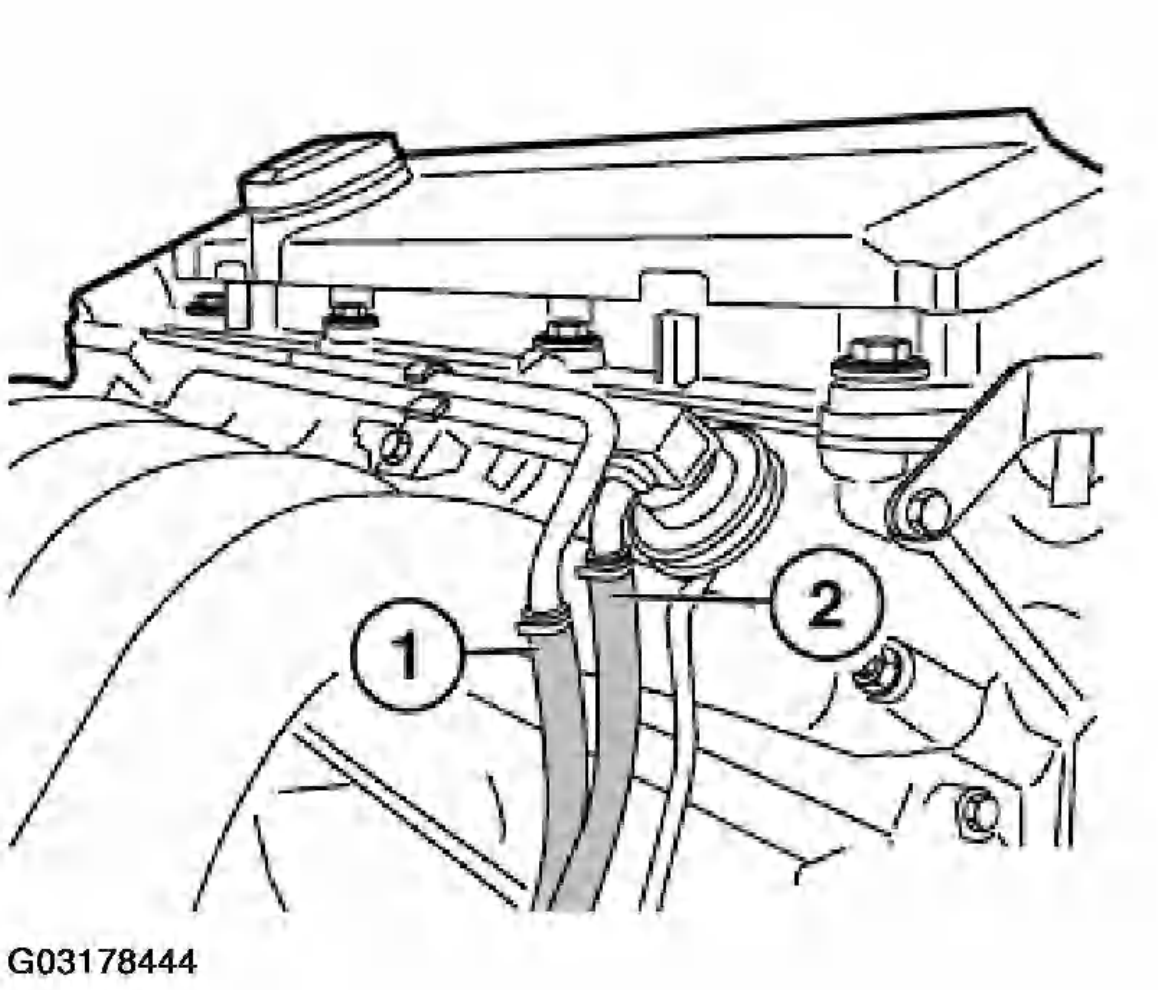



Fig. 18: Locating Fuel Hose Clamps
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Fuel hoses and hose clamps must be replaced each time they are removed!

Version With Compressed Air Connection:

Blow fuel back into tank with a short blast of compressed air (max. 3 bar) at compressed air connection (1).

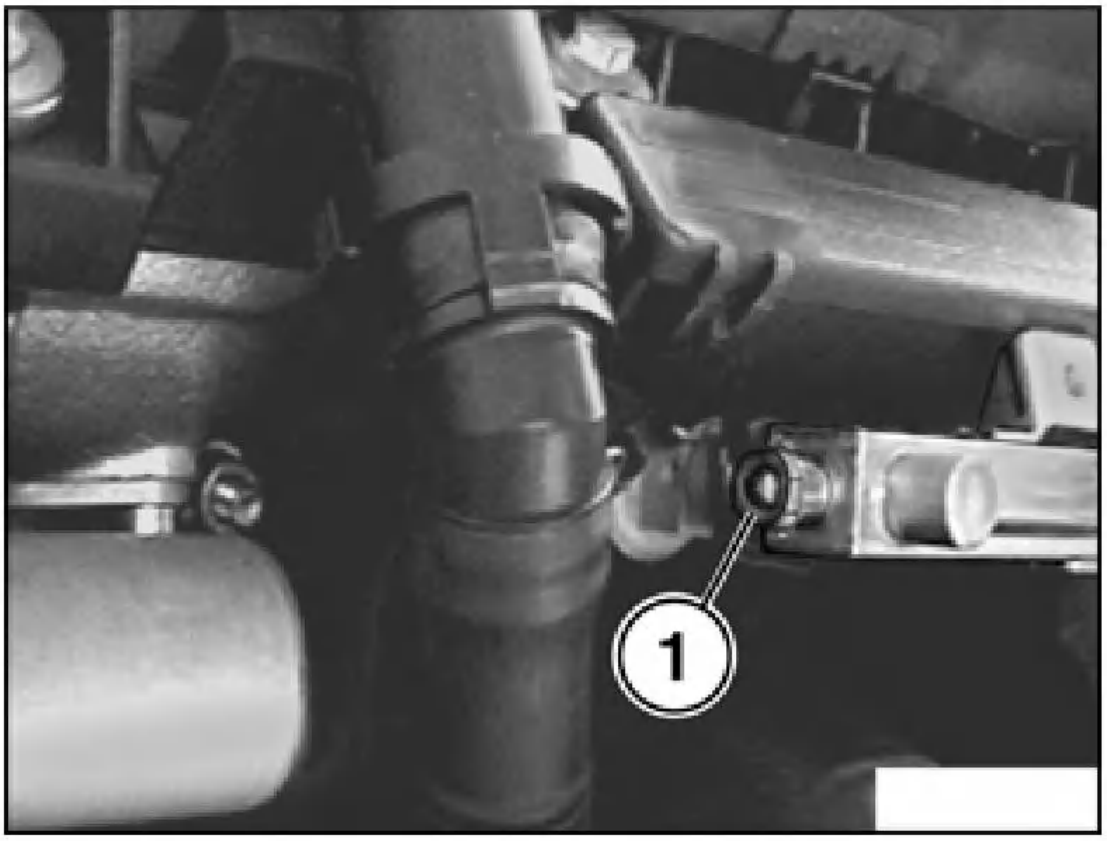



Fig. 19: Identifying Compressed Air Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Version, Fuel Hoses Without Integrated Unlocking Facility:

Unlock fuel hoses with special tool 16 1 050 and detach hoses.

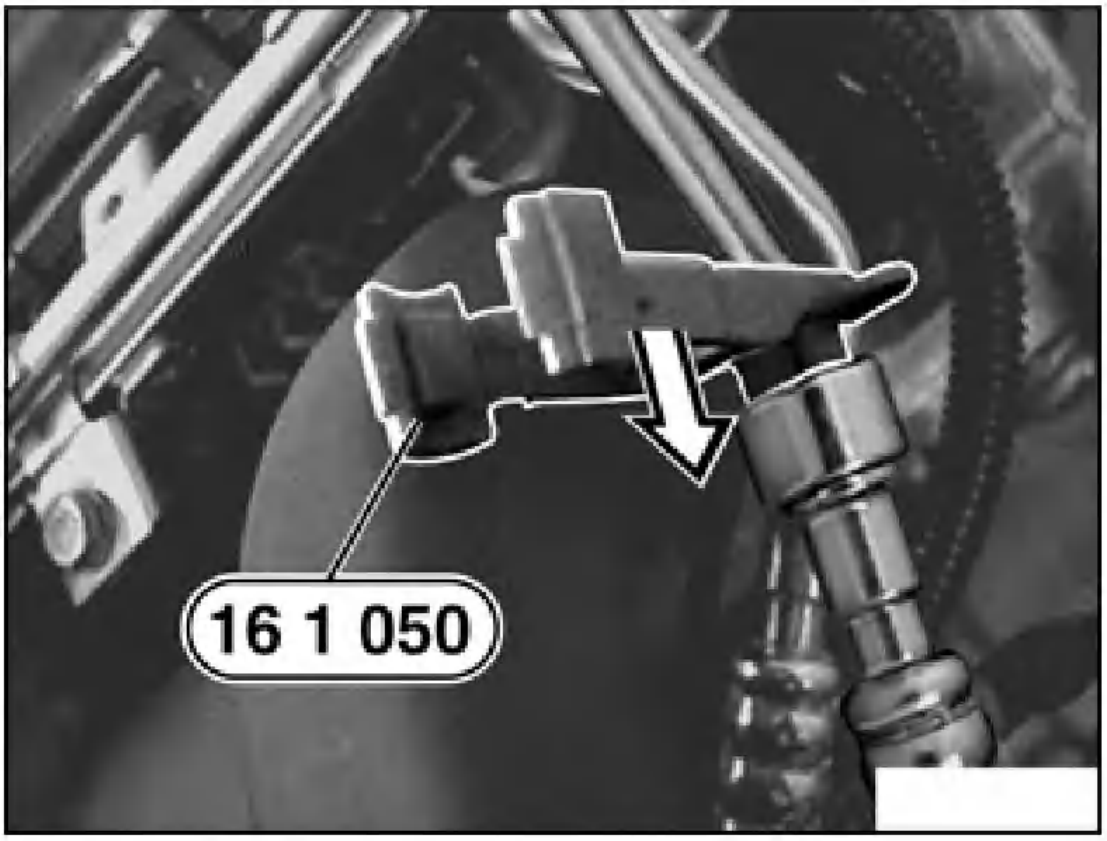



Fig. 20: Unlockin Fuel Hoses With Special Tool 16 1 050
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check O-ring in fuel hose and sealing surfaces on fuel lines for damage; replace components if necessary.

Coat O-ring for assembly with anti-friction agent.

Version, Fuel Hoses With Integrated Unlocking Facility:

Press fuel hose (1) downwards and keep pressed.

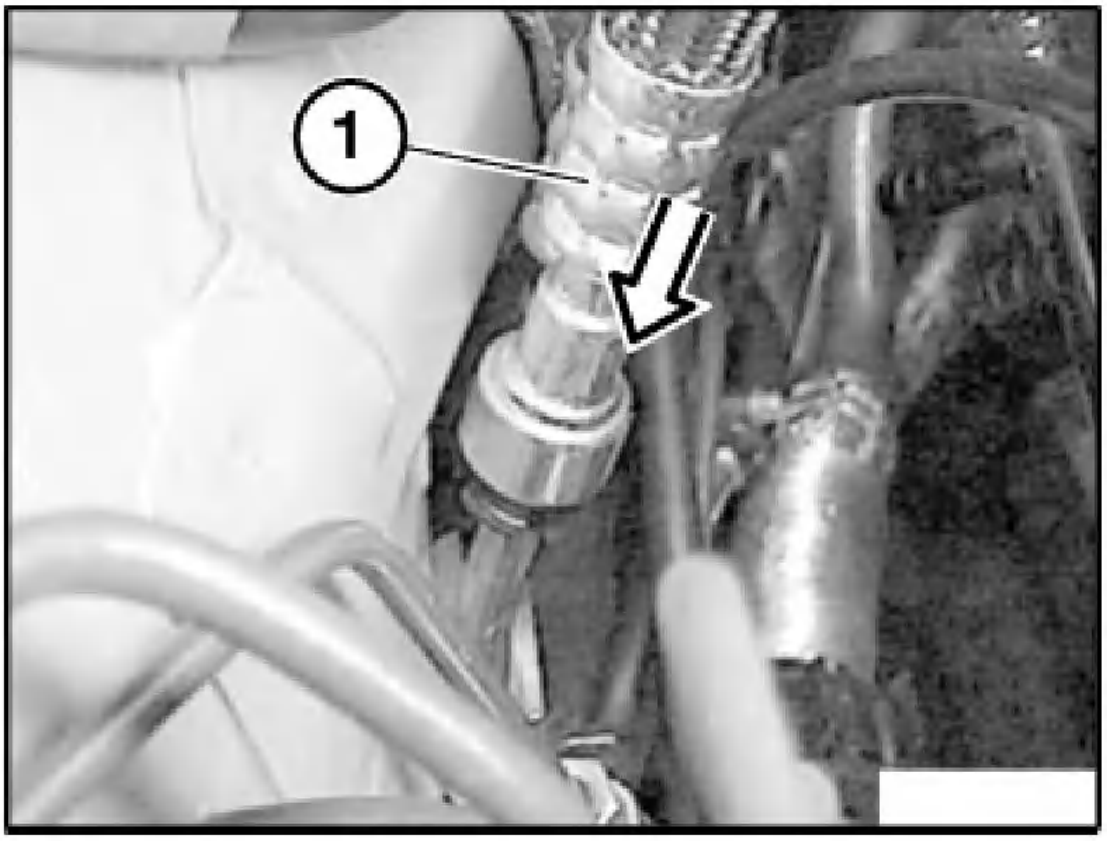



Fig. 21: Pressing Fuel Hose Downwards
Courtesy of BMW OF NORTH AMERICA, INC.

Press unlocking ring (2) upwards, keep pressed and detach fuel hose (1).

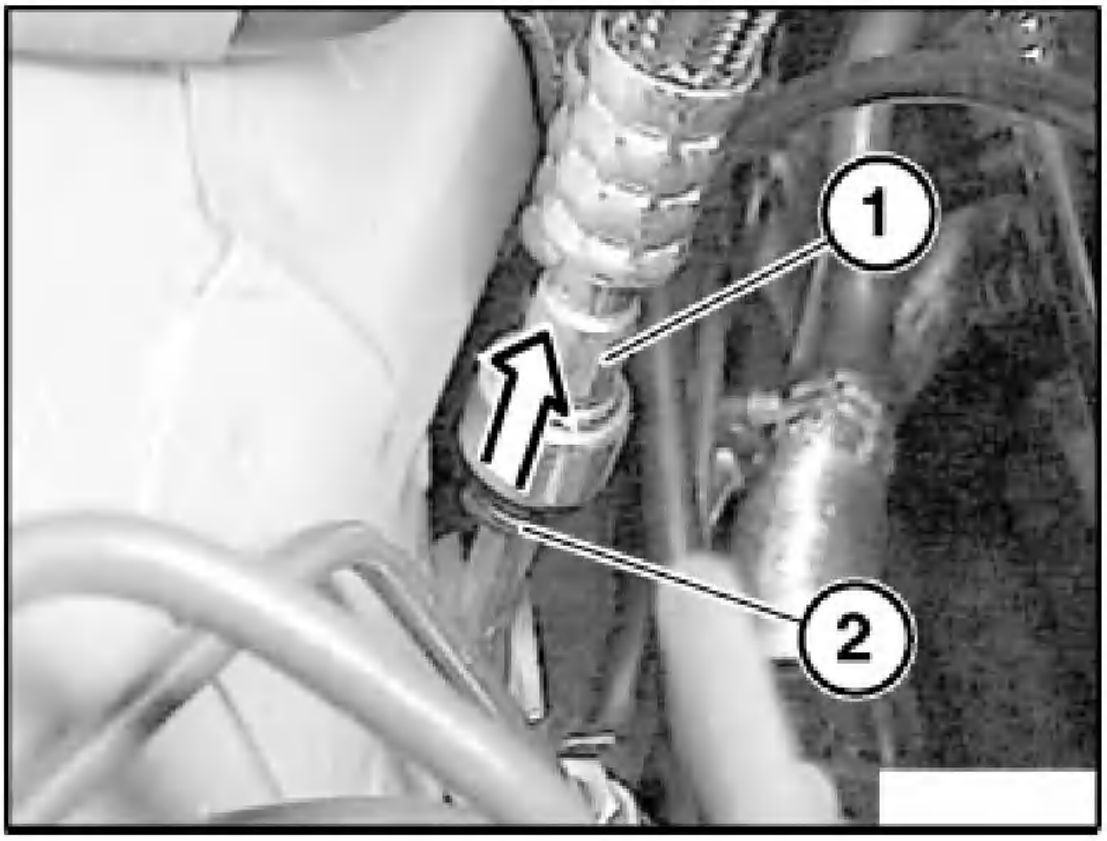



Fig. 22: Pressing Unlocking Ring Upwards
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check O-ring in fuel hose and sealing surfaces on fuel lines for damage; replace components if necessary.

Coat O-ring for assembly with anti-friction agent.

Seal Off Fuel Hoses:

Fuel hoses with hose clamps:

Seal hoses with special tool 13 3 010.

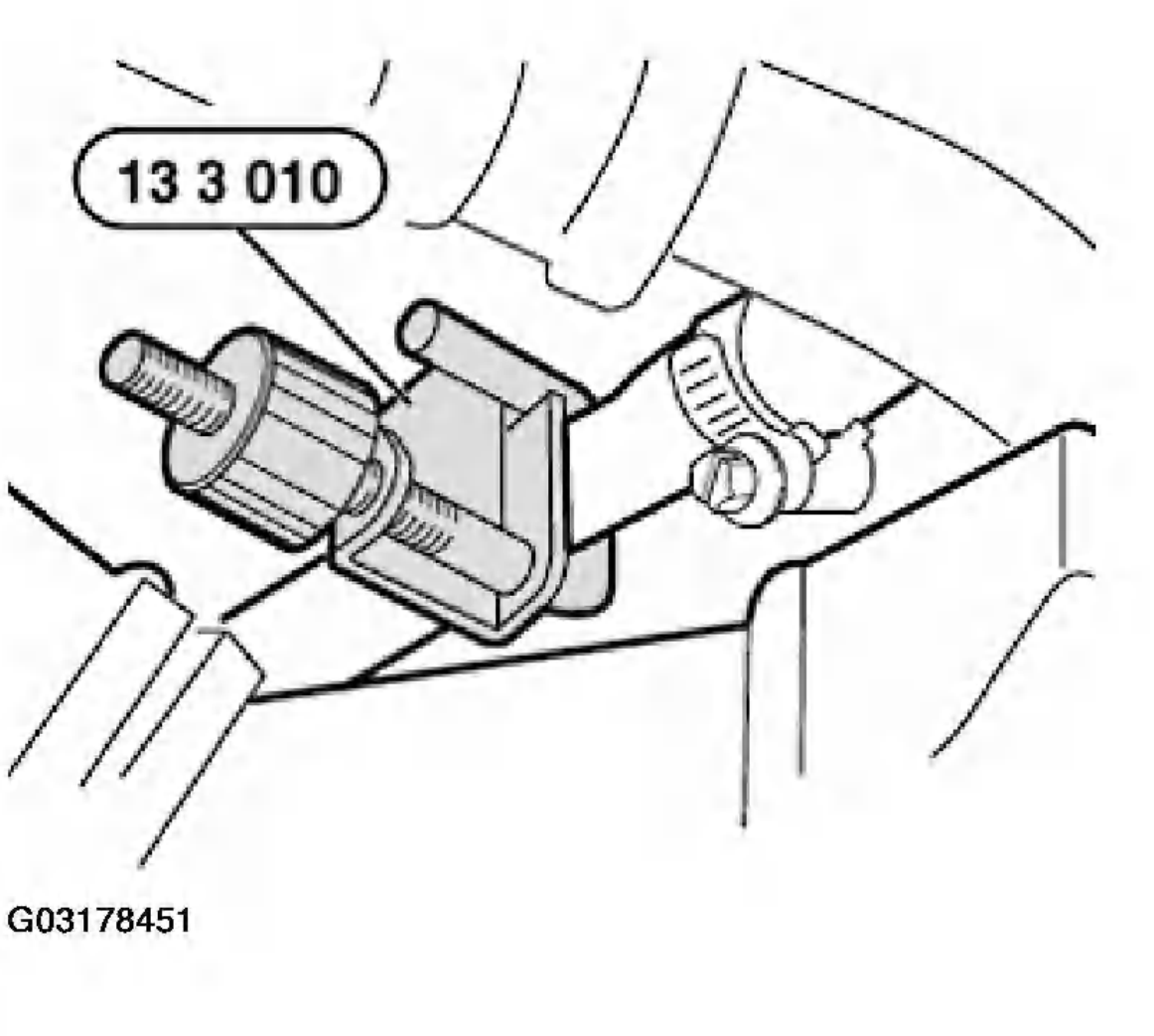



Fig. 23: Identifying Hose With Special Tool 13 3 010
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Fuel hoses and hose clamps must be replaced each time they are removed!

Fuel Hoses With Quick-Release Couplings:

Seal fuel hoses (1) with special tool 13 5 281.

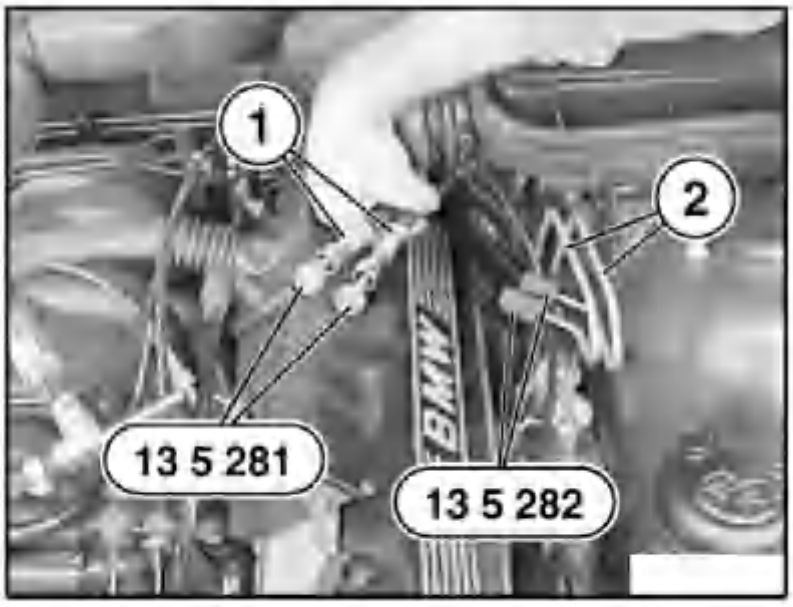



Fig. 24: Sealing Fuel Lines With Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

Seal fuel lines (2) with special tool 13 5 282.

Installation:

Check O-ring in fuel hose and sealing surfaces on fuel lines for damage; replace components if necessary.

Coat O-ring for assembly with anti-friction agent.

## THROTTLE AND OPERATION

### 13 54 030 REMOVING AND INSTALLING/SEALING THROTTLE ASSEMBLY (M54)

Turn off ignition.

Observe instructions for disconnecting and connecting battery. Refer to 12 00 ... DISCONNECTING AND CONNECTING BATTERY .

Disconnect battery negative lead from battery and lay to one side.

Remove intake filter housing. Refer to 13 71 000 REMOVING AND INSTALLING INTAKE FILTER HOUSING (M54) .

Remove intake hose completely (between intake filter housing and throttle assembly). Refer to 13 54 250 REPLACING INTAKE HOSE (BETWEEN AIR-MASS FLOW SENSOR AND CONNECTING PIECE) (M54) and 13 54 251 REPLACING INTAKE HOSE (BETWEEN CONNECTING PIECE AND THROTTLE ASSEMBLY) (M54) .

Disconnect following plug connections:

1. Resonance flap.
2. Idle-speed control valve.

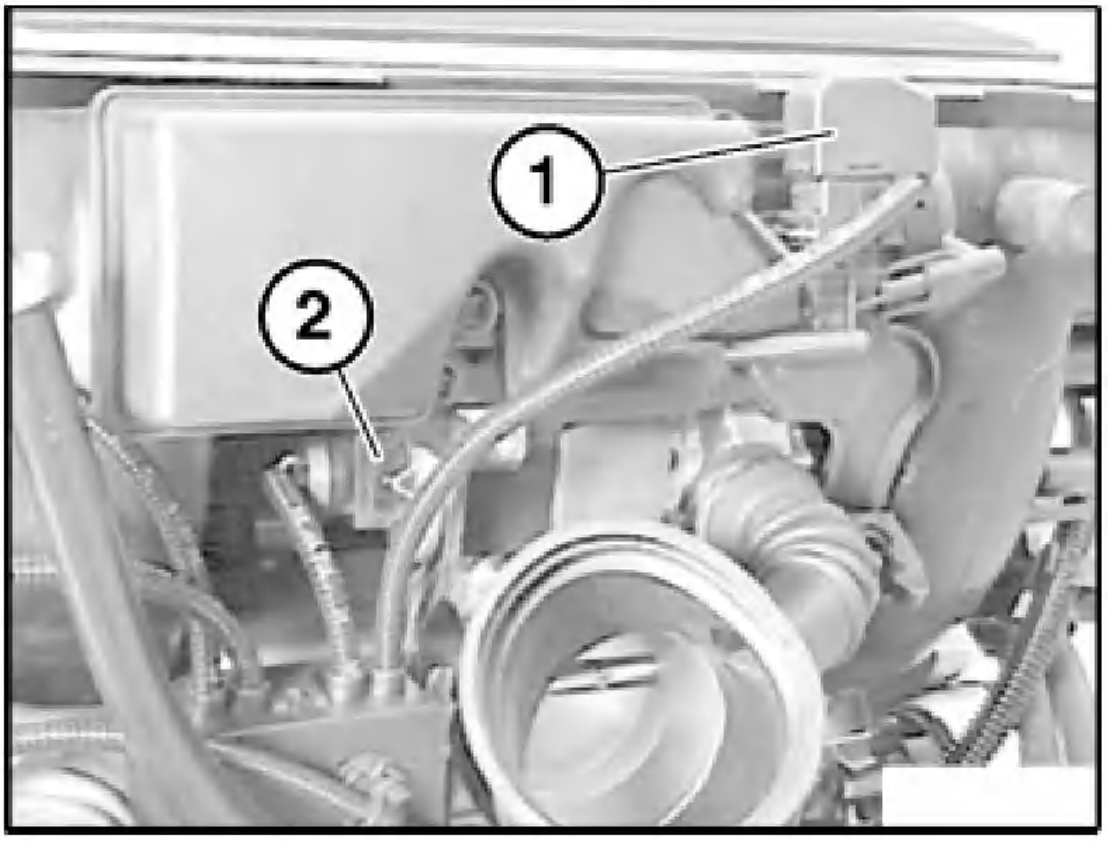



Fig. 25: Identifying Idle-Speed Control Valve And Resonance Flap
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect following plug connections:

1. Oil pressure switch.
2. Oil temperature switch.

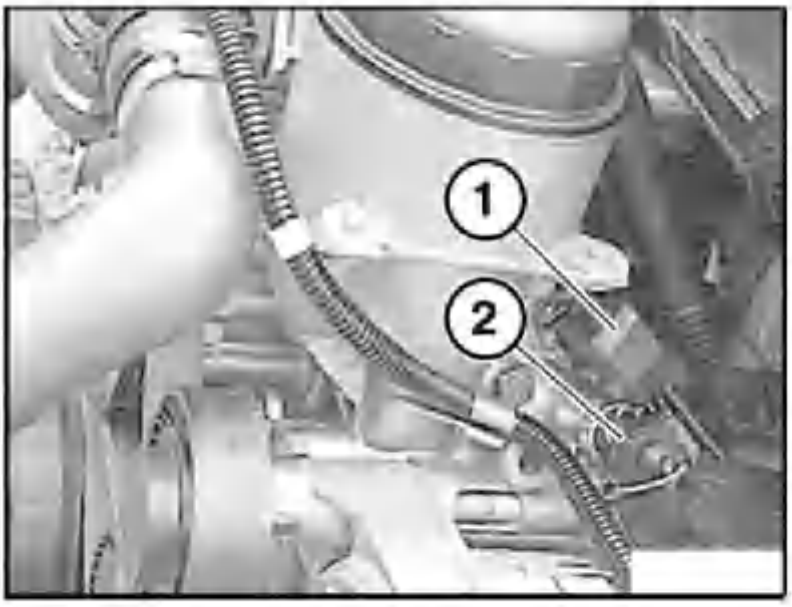



Fig. 26: Disconnecting Oil Pressure And Oil Temperature Switches
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: For purposes of clarity, the power steering pump supply tank is not shown.

Unlock plug (1) and detach from tank venting valve.

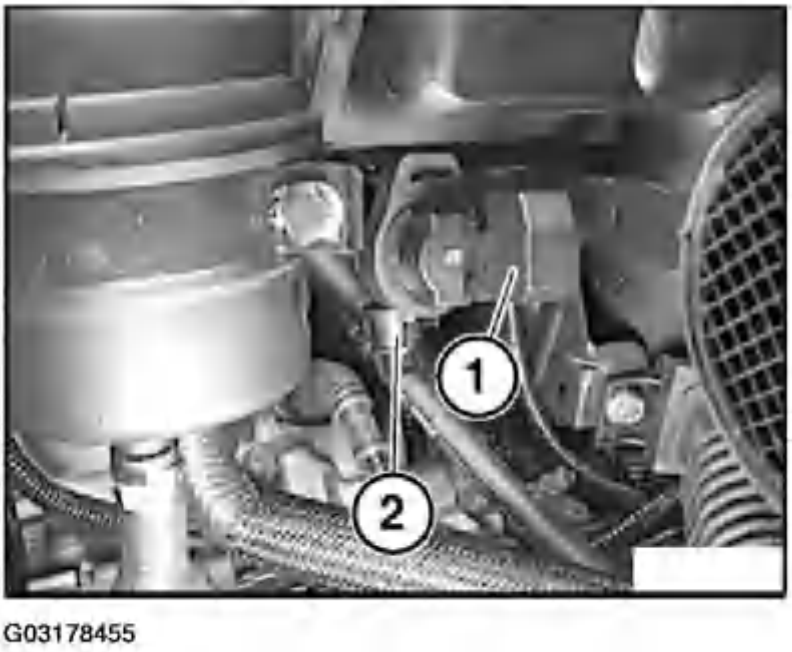



Fig. 27: Locating Plug On Tank Venting Valve
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) on cable duct mounting.

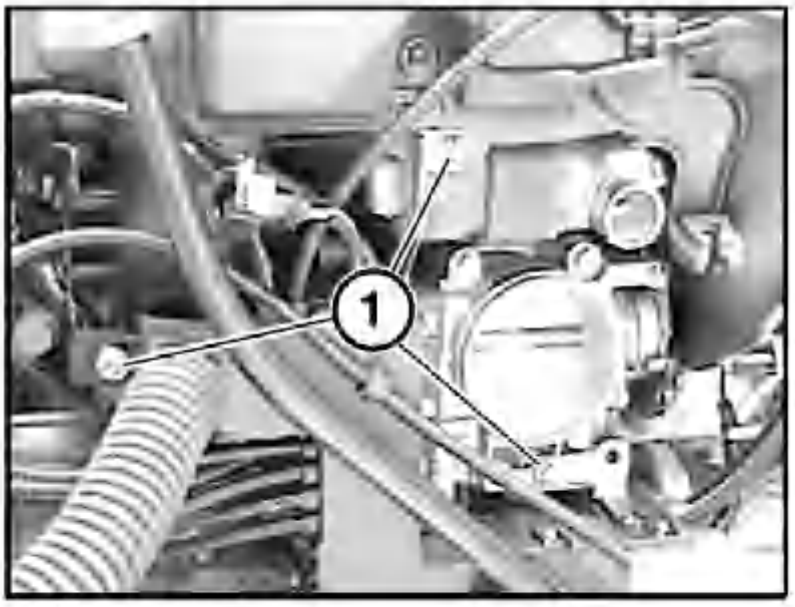



Fig. 28: Removing Screws On Cable Duct Mounting
Courtesy of BMW OF NORTH AMERICA, INC.

All Cars:

Unlock plug (1) and detach from throttle assembly (3).

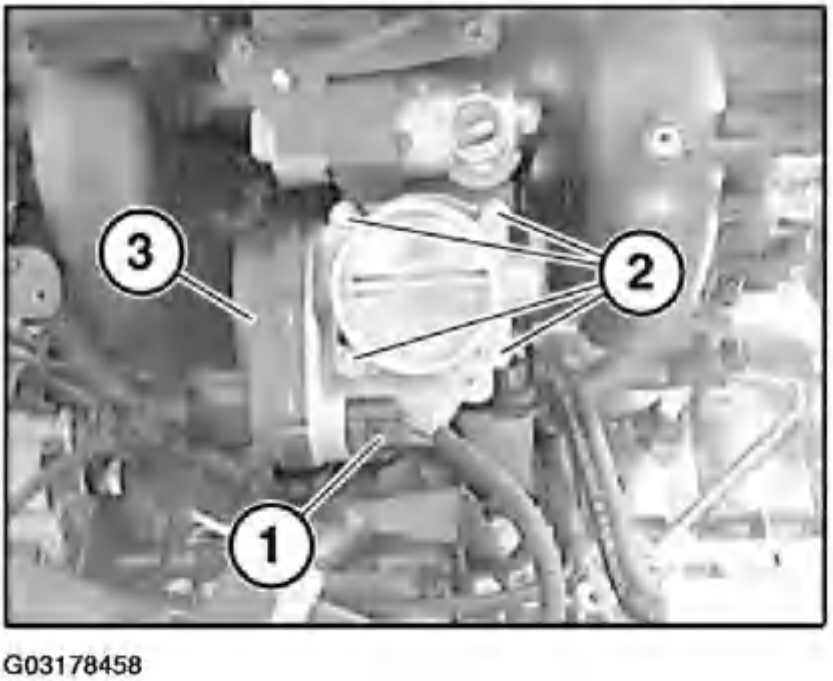



Fig. 29: Identifying Throttle Assembly Retaining Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (2) and remove throttle assembly (3).

Installation:

Replace sealing ring (1) between throttle assembly and intake manifold.

Fig. 30: Locating Sealing Ring On Throttle Assembly
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: A faulty throttle adjusts the adaptation values stored in the DME control unit. These adaptation values must be reset after the throttle assembly has been replaced.

Clearing Adaptation Values:

- Connect DIS Tester.
- Select vehicle type.
- Select "DME Motor Electronics MS43", carry out individual brief test.
- Continue with bottom right arrow.
- The "Fault pattern selection" window appears.

  Select "Function selection" (bottom left).

- The "Function and component selection" window appears:
  - Select "Service functions".
  - Select "Drive".
  - Select "Digital Motor Electronics".
  - Select "Reset adaptations".
  - Select "Test schedule" (bottom left).
- The "Test schedule" window appears.

  Select "Reset adaptations".

- Continue with bottom right arrow.

For subsequent procedure, follow DIS instructions.

The new adaptation values are stored in the DME control unit after the engine is started for the first time.

## 13 54 250 REPLACING INTAKE HOSE (BETWEEN AIR-MASS FLOW SENSOR AND CONNECTING PIECE) (M54)

Switch off ignition.

Unlock plug (1) and detach from air-mass flow sensor.

Detach vacuum line (2) from intake hose.

Release hose clamp (3).

Fig. 31: Locating Intake Hose And Vacuum Line
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check sealing ring (1) between air-mass flow sensor and intake filter housing for damage, replace if necessary.

Coat sealing ring (1) with acid-free grease.

If intake hose is replaced:

Insert air-mass flow sensor in new intake hose.

### 13 54 251 REPLACING INTAKE HOSE (BETWEEN CONNECTING PIECE AND THROTTLE ASSEMBLY) (M54)

Switch off ignition.

Z3, E39 And E53:

Release clips (1).

Pull intake hose (2) out of connecting piece.

Fig. 32: Pulling Intake Hose Out Of Connecting Piece
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw.

Remove suction jet pump (1) from intake air manifold.

Fig. 33: Locating Suction Jet Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Release hose clamps (1).

Fig. 34: Identifying Hose Clamps On Intake Hose
Courtesy of BMW OF NORTH AMERICA, INC.

Detach intake hose from throttle assembly and idle speed control valve.

## ELECTRONIC CONTROL UNIT

### 13 62 560 REMOVING AND INSTALLING/REPLACING AIR-MASS FLOW SENSOR (M54)

Turn off ignition.

Unlock retainers (1) on intake filter housing.

Unlock plug (2) and detach from air-mass flow sensor.

Release hose clip (3).

Detach intake hose (4) from air-mass flow sensor.

Fig. 35: Locating Air-Mass Flow Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Remove air-mass flow sensor.

Installation:

Check seal (1) between air-mass flow sensor and intake filter housing for damage; replace if damaged.

Fig. 36: Identifying Seal On Air-Mass Flow Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

To facilitate joint between air cleaner and throttle assembly, coat gasket with acid-free grease.

Installation:

Only reinstall mass air flow sensor with undamaged lattice frame.

Fig. 37: View Of Air-Mass Flow Sensor Lattice Frame
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Interrogate fault memory of DME control module. Check stored fault messages. Rectify faults. Then clear fault memory.

## SENSOR FOR CONTROL UNIT

### 13 62 511 REPLACING INTAKE AIR TEMPERATURE SENSOR (M52TU, M54)

Turn off ignition.

Remove cover from fuel injectors. Refer to FUEL RAIL & INJECTORS .

Disconnect plug connection (1) for temperature sensor.

Fig. 38: Identifying Plug Connection For Temperature Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Press catch and withdraw temperature sensor (1) from intake air manifold.

Fig. 39: View Of Temperature Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check sealing ring on temperature sensor for damage, replace if necessary.

Coat sealing ring with antiseize agent.

NOTE: Read out fault memory of DME control unit. Check stored fault messages. Rectify faults. Then clear fault memory.

### 13 62 531 REPLACING COOLANT TEMPERATURE SENSOR (M52TU, M54)

Turn off ignition.

Installation Location:

Coolant temperature sensor (1) is fitted below intake air manifold in cylinder head of cylinder 6.

Fig. 40: Identifying Coolant Temperature Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Remove intake air manifold. Refer to 11 61 050 REMOVING AND INSTALLING INTAKE AIR MANIFOLD (M54) .

Disconnect plug connection (1).

Fig. 41: Locating Plug Connection Of Temperature Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew temperature sensor.

Installation:

Tightening torque, refer to 13 62 2AZ in13 62 SENDERS FOR CONTROL UNIT .

Check coolant level, top up coolant if necessary.

NOTE: Read out fault memory of DME control unit. Check stored fault messages. Rectify faults. Then clear fault memory.

## 13 62 560 REMOVING AND INSTALLING/REPLACING AIR-MASS FLOW SENSOR (M54)

Turn off ignition.

Unlock retainers (1) on intake filter housing.

Unlock plug (2) and detach from air-mass flow sensor.

Release hose clip (3).

Detach intake hose (4) from air-mass flow sensor.

Fig. 42: Replacing Air-Mass Flow Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Remove air-mass flow sensor.

Installation:

Check seal (1) between air-mass flow sensor and intake filter housing for damage; replace if damaged.

Fig. 43: Locating Seal On Air-Mass Flow Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

To facilitate joint between air cleaner and throttle assembly, coat gasket with acid-free grease.

Fig. 44: View Of Air-Mass Flow Sensor Lattice Frame
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Only reinstall mass air flow sensor with undamaged lattice frame.

NOTE: Interrogate fault memory of DME control module. Check stored fault messages. Rectify faults. Then clear fault memory.

# THROTTLE POTENTIOMETER, FUEL PUMP RELAY

## 13 63 590 REPLACING FUEL PUMP RELAY (Z3 / M54)

Turn off ignition.

Fuel pump relay is located underneath panel in front left footwell.

NOTE: Interrogate fault memory of DME control unit. Check stored fault messages. Rectify faults. Then clear fault memory.

## START VALUES

### 13 64 541 REPLACING ALL FUEL INJECTORS

Necessary Preliminary Tasks:

- Switch off ignition.
- Remove complete injection pipe. Refer to 13 53 240 REPLACING COMPLETE INJECTION PIPE (M54) .

Detach retainer (1).

Detach fuel injector from injection pipe.

Fig. 45: Detaching Retainer From Injection Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check sealing rings, replace if necessary.

Insert fuel injector fully into injection pipe then pull out until groove is flush with edge of injection pipe.

Push on retainer.

Installation:

Coat sealing rings of fuel injectors with anti-seize agent to facilitate fitting of injection pipe.

### 13 64 582 CHECKING INJECTOR VALVES FOR LEAKS AND CLEANING

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 13 6 200
- 13 6 205
- 13 6 206
- 13 6 207

Injector valves removed.

Injector valves removed. Mark sequence of injector valves relative to cylinders on each injector valve.

CAUTION: Observe country specific safety regulations when handling fuels and cleaning agents.

Recycling: Note national regulations.

Check Injector Valves For Leaks:

Clip fuel injectors into special tool 13 6 205.

Fig. 46: Clipping Fuel Injectors Into Special Tool 13 6 205
Courtesy of BMW OF NORTH AMERICA, INC.

Connect special tool 13 6 206 to the injector valves.

Fig. 47: Connecting Special Tool 13 6 206 To The Injector Valves
Courtesy of BMW OF NORTH AMERICA, INC.

To catch remaining fuel, wrap fuel injectors in clean cleaning cloth. Connect special tool 13 6 206 to a 12 V car battery.

Connect special tool 13 6 205 to compressed air connection of max. 5 bar.

Fig. 48: Connecting Ultrasonic Cleaning System To Compressed Air
Courtesy of BMW OF NORTH AMERICA, INC.

Residual fuel is now blown out of the injector valves.

CAUTION: Carry out leak test only after remaining fuel has been blown out of injector valves.

Separate special tool 13 6 206 from the injector valves.

Separate special tool 13 6 206 from the injector valves. Install injector valves with special tool 13 6 205 in a container with hot water (60 ... 80Â°C).

Adjust air pressure at connection (1) on special tool 13 6 205 to max. 3 bar (motorsport models max. 5 bar).

Fig. 49: Locating Connection On Ultrasonic Cleaning System
Courtesy of BMW OF NORTH AMERICA, INC.

Note volume of air emerging.

Permitted volume of air emerging: 2 air bubbles per injector valve within a 15 second period.

Note injector valves with larger volumes of air emerging.

Injector valves with larger amounts of air emerging must be cleaned.

Remove fuel injectors from water and dry thoroughly with compressed air.

Clean Injector Valves:

Install injector valves in special tool 13 6 205.

Connect special tool 13 6 206 to injector valves and to a 12 V car battery.

Fig. 50: Installing Injector Valves To Ultrasonic Cleaning System
Courtesy of BMW OF NORTH AMERICA, INC.

Using ultrasonic cleaning unit 13 6 200 to clean injector valves.

Fig. 51: View Of Ultrasonic Cleaning Unit 13 6 200
Courtesy of BMW OF NORTH AMERICA, INC.

Read operating instructions before operating ultrasonic cleaning unit.

Attach injector valves to special tool 13 6 200 with special tool 13 6 205.

Fill special tool 13 6 200 with cleaning concentrate 13 6 207 as specified by manufacturer.

Fig. 52: View Of Ultrasonic Cleaning System
Courtesy of BMW OF NORTH AMERICA, INC.

Perform cleaning procedure as specified by manufacturer.

Repeat leak test on cleaned injector valves.

CAUTION: Do not carry out leak test in cleaning concentrate but rather in a water bath.

Only replace injector valves from which volume of air emerging exceeds the permitted limit of 2 bubbles within a 15 second period.

CAUTION: Install cleaned injector valves immediately in engine and run engine.

This flushes out any remaining cleaning concentrate thereby preventing injector valve corrosion.

Due to the risk of corrosion, cleaned injector valves can no longer be stored.

## INTAKE SILENCER

### 13 71 000 REMOVING AND INSTALLING INTAKE FILTER HOUSING (M54)

Turn off ignition.

Detach screw connection of intake filter housing on body.

Fig. 53: Identifying Plug On Air-Mass Flow Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock plug (1) and detach from air-mass flow sensor.

Unclip hose (2).

Release clips (3).

Remove intake filter housing. Refer to 13 71 000 REMOVING AND INSTALLING INTAKE FILTER HOUSING (M54) .

Installation:

Fit guide pin (2) on rubber mount (1).

Fig. 54: Fitting Guide Pin On Rubber Mount
Courtesy of BMW OF NORTH AMERICA, INC.

Insert intake pipe (3) in intake fitting (4).

# AIR CLEANER

## 13 72 001 REPLACING AIR CLEANER ELEMENT (M54)

Release lock of cassette (1) on intake filter housing.

Fig. 55: Releasing Lock Of Cassette On Intake Filter Housing
Courtesy of BMW OF NORTH AMERICA, INC.

Lift out cassette (1) with air cleaner.

Remove air cleaner element from cassette.

Fig. 56: Removing Air Cleaner Element From Cassette
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean intake filter housing from inside.

Install new air cleaner insert.

## 13 72 001 REPLACING AIR CLEANER ELEMENT (M54)

Unlock plug (1) and remove.

Unfasten hose clip (2).

Open locks (3).

Remove upper section of intake filter housing (4) towards top right.

Fig. 57: Removing Upper Section Of Intake Filter Housing
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Make sure lugs (1) are correctly locked in opening slots (2).

Fig. 58: Identifying Opening Slots
Courtesy of BMW OF NORTH AMERICA, INC.

Remove air cleaner element from intake filter housing.

Fig. 59: Removing Air Cleaner Element From Intake Filter Housing
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean intake filter housing from inside.

Install new air cleaner element.

# CARBON CANISTER VENT: 1

## 13 90 500 REPLACING TANK VENTING VALVE (M52TU, M54)

Turn off ignition.

Location:

Tank venting valve (2) is fitted at front below intake air manifold (1).

Fig. 60: Locating Tank Venting Valve
Courtesy of BMW OF NORTH AMERICA, INC.

Z3, E39 And E46:

Remove intake filter housing. Refer to 13 71 000 REMOVING AND INSTALLING INTAKE FILTER HOUSING (M54) .

E53/M54 Only:

Remove intake hose. Refer to 13 54 250 REPLACING INTAKE HOSE (BETWEEN AIR-MASS FLOW SENSOR AND CONNECTING PIECE) (M54) .

Z3, E39, E46 And E53:

Disconnect plug connection (1).

Fig. 61: Disconnecting Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Release vent hose (2). To do so, press locking bar and detach vent hose.

Detach hose (1) from tank venting valve (2).

Fig. 62: Detaching Hose From Tank Venting Valve
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Illustration shows removed supply tank for power steering.

NOTE: Interrogate fault memory of DME control module. Check stored fault messages. Rectify faults. Then clear fault memory.

## 16 12 010 REMOVING AND INSTALLING/REPLACING CARBON CANISTER (M ROADSTER, M COUPE AND Z3/USA)

Open hose clip (1) and pull off evaporation line.

Installation:

Replace hose clip.

Fig. 63: Identifying Evaporation Line And Hose Clip
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten plastic nut (1).

Unfasten hexagon bolt (2) and take off clamping strap (3).

Fig. 64: Locating Hexagon Bolt And Clamping Strap
Courtesy of BMW OF NORTH AMERICA, INC.

Carefully lower the activated carbon canister.

Actuate unlocking fixture (2) and pull off vent line (1).

Fig. 65: View Of Fixture And Vent Line
Courtesy of BMW OF NORTH AMERICA, INC.

Unclip the tank vent line (1) and the vent line (2) on the front side of the activated carbon canister.

Fig. 66: Unclipping Tank Vent Lines
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clip in lines in the proper position.

Press together ring (1) to release the detent. Pull off tank vent line (2).

Fig. 67: Identifying Ring On Detent
Courtesy of BMW OF NORTH AMERICA, INC.

Remove activated carbon canister.

16 12 010 REMOVING AND INSTALLING/REPLACING CARBON CANISTER (Z3)

Unlock and disconnect plug connection (1) of vent line to expansion tank.

Fig. 68: Disconnecting Plug Connection Of Vent Line To Expansion Tank
Courtesy of BMW OF NORTH AMERICA, INC.

Open hose clip (6) and pull off scavenging line (2). Detach evaporation line (3) from carbon canister (4).

Release screws (5). Lift carbon canister (4) out of metal bracket.

Installation:

Make sure plug connection (1) engages properly.

Replace hose clip (6).

Tightening torque, refer to 16 12 7AZ in FUEL TRANSFER SENSOR .

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Article GUID: A00202356

# ENGINE ELECTRICAL SYSTEM

## 12 1 080 REPAIR KIT

Minimum set: Mechanical tools

NOTE: For fitting spark plug connectors to ignition lead

Series: E36, E38

Storage location: K 103

SI number: 1 03 89 (037)

Order number: 12 1 080

Repair kit

Consisting of:

1 = 12 1 081 Pliers

3 = 12 1 083 Matrix set

NOTE: Cable 4 $mm^2$ /ignition cable

6=12 1 086 Mounting sleeve




Fig. 1: Identifying Special Tool - 12 1 080 Repair Kit
Courtesy of BMW OF NORTH AMERICA, INC.

12 1 120 LEVER

NOTE: Note: For unlocking edge connector on fuel injectors

Engine: S54

SI number: 1 15 00(609)

Order number: 12 1 120

Lever

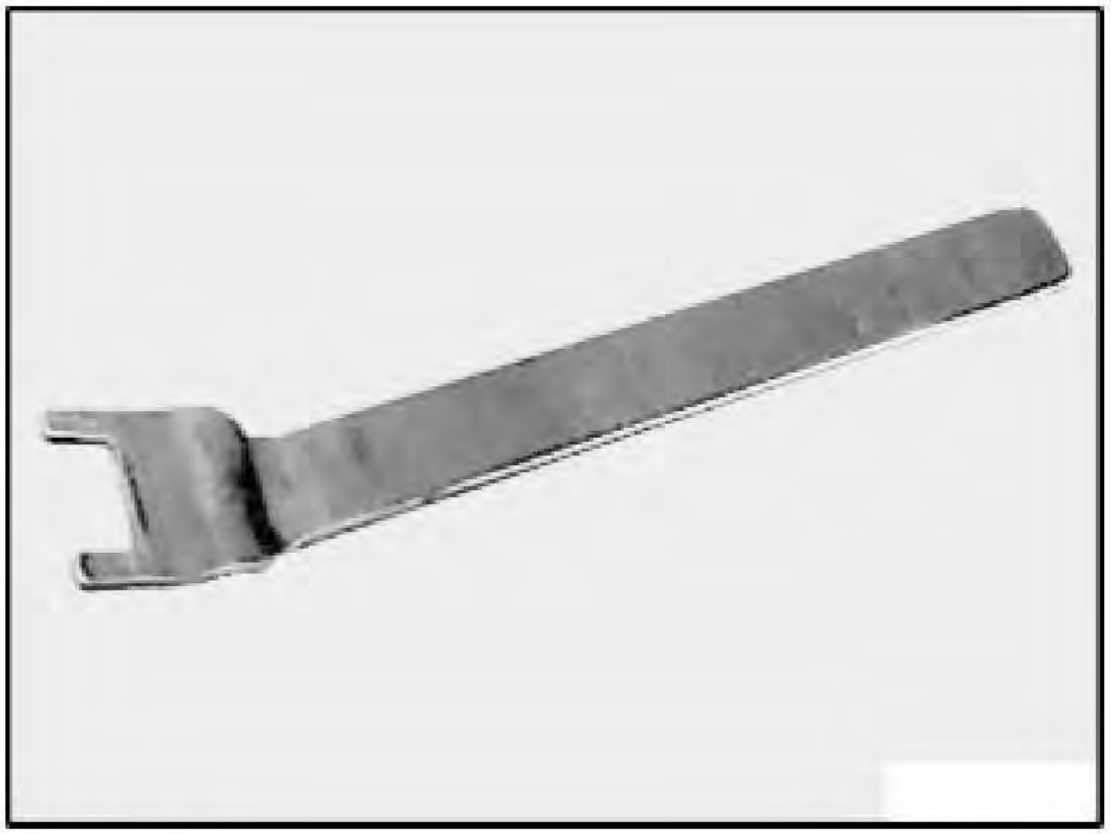



Fig. 2: Identifying Special Tool - 12 1 120 Lever
Courtesy of BMW OF NORTH AMERICA, INC.

## 12 1 305 ZERO-CODED COVER CAP FOR 52-PIN TEST BOX (12 1300/304)

NOTE: Note: New plugs in E61/E61/E63 and E64 on SGM control unit Cover cap 12 1 300/305 for diagnosis on wiring harness. From 08/2004 cover cap will be supplied with test box.

SI number: 2 07 04 (138)

Order number: 12 1 305

Zero-coded cover cap for 52-pin test box (12 1300/304)

## 12 6 050 SWITCHING UNIT

Minimum set: Measuring and testing equipment

In conjunction with:

12 6 411

Note: For activating solenoid valves in VANOS unit

Engine: S54, S62

Storage location: F 116

SI number: 1 01 99(416)

Order number: 12 6 050

Switching unit

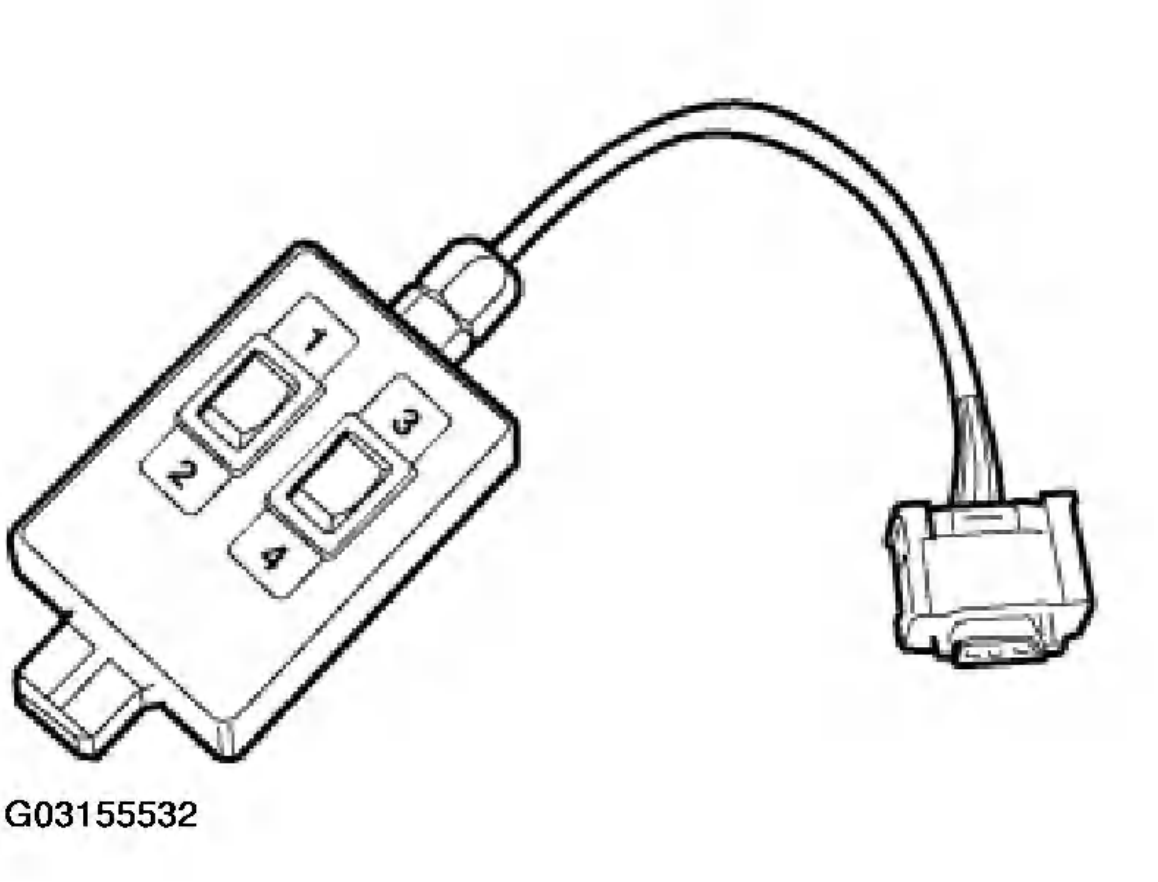



Fig. 3: Identifying Special Tool - Zero-Coded Cover Cap For 52-Pin Test Box (12 1300/304)
Courtesy of BMW OF NORTH AMERICA, INC.

## 12 6 410 ADAPTER LEAD AND SWITCHING UNIT

Minimum set: Measuring and testing equipment

NOTE: Note: For external operation of VANOS adjustment unit during assembly and for checking function of 4/2-way valve

Engine: M50, M52, S50B32, S54, S62

Storage location: F 111, F 115

SI number: 1 08 92(555)

Order number: 12 6 410

Adapter lead and switching unit

Consisting of:

12 6 411 Adapter lead with diode

NOTE: For non-interchangeable connection to a 12 volt power source, engine: M50, M52, S62, S54

12 6 412 Switching unit with cable connection

NOTE: Engine: S50B32

12 6 413 Polarity reversal protector

NOTE: Retrofit kit with polarity reversal protection diode for installation in adapter lead 12 6 411 for the purpose of adapting it to the power ratings of the switching unit 12 6 050.Identification: Red shrink-fit sleeve

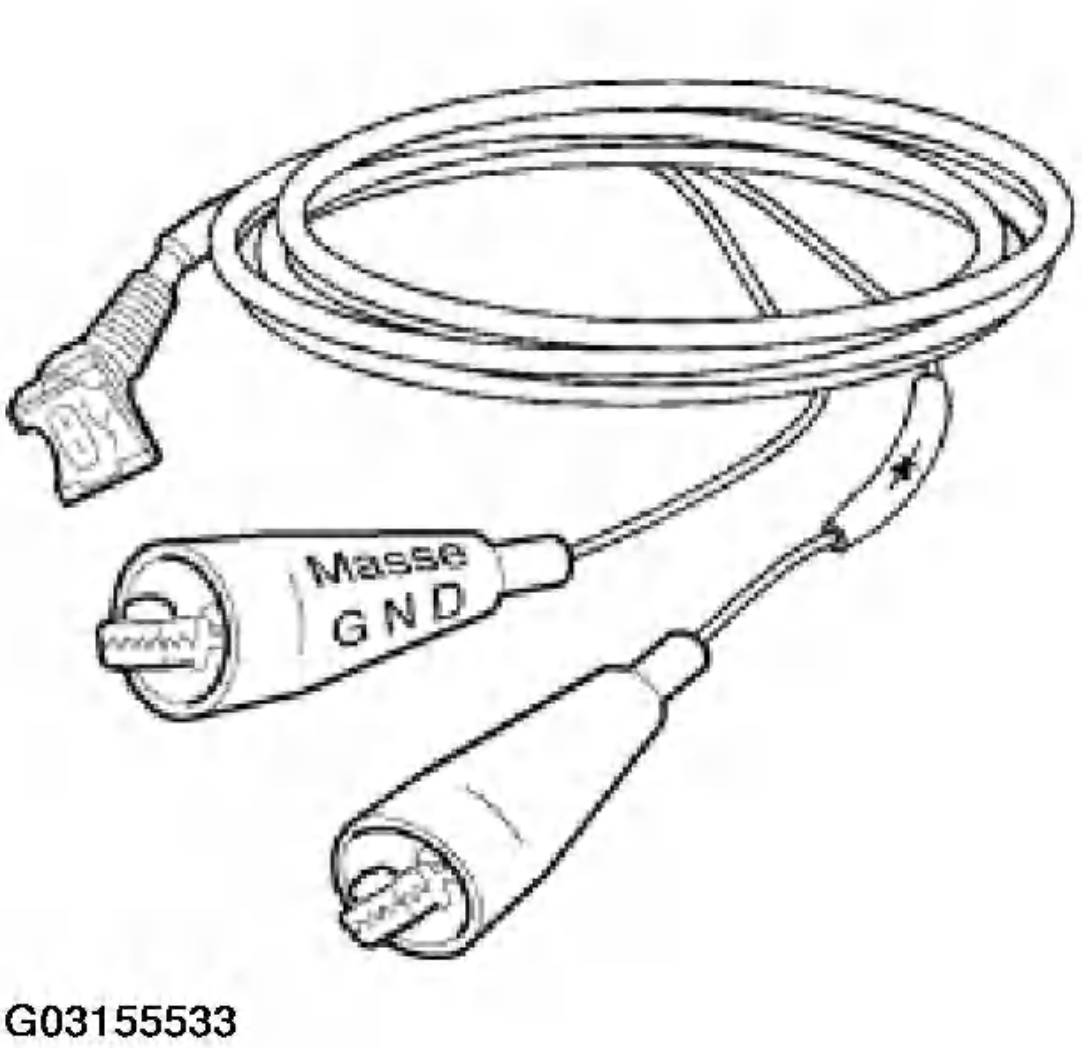



Fig. 4: Identifying Special Tool - Adapter Lead & Switching Unit
Courtesy of BMW OF NORTH AMERICA, INC.

12 7 050 ADAPTER LEAD

Minimum set: Measuring and testing equipment

NOTE: Note: For engines with rod-type ignition coils for measuring secondary voltage

Engine: M54, M56, N40, N42, N46, N62, N73, S54

Storage location: F 104

SI number: 2 01 01(671)

Order number: 12 7 050

Adapter lead

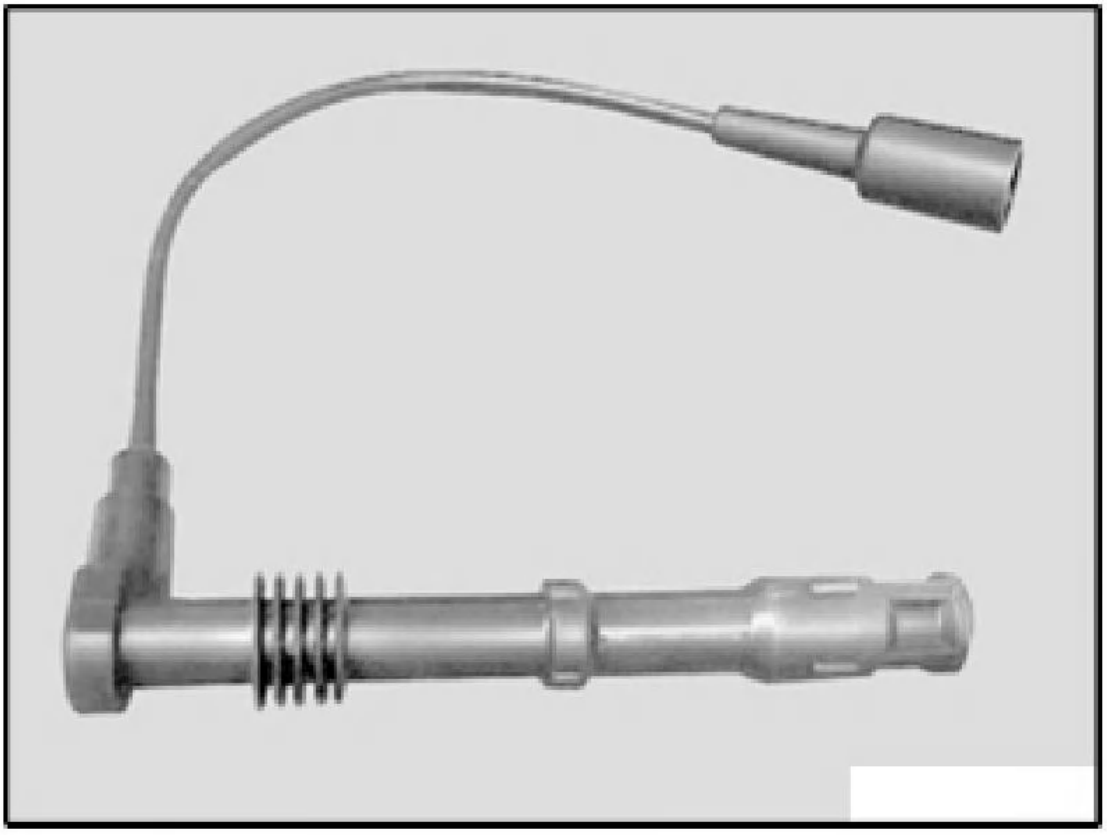



Fig. 5: Identifying Special Tool - Adapter Lead
Courtesy of BMW OF NORTH AMERICA, INC.

## 12 7 060 ANTI-STATIC MAT (ESD)

NOTE: Note: ESD (Electro Static Discharge) For protection against ESD during repairs to electronic components. (Replaces the sub-number 12 7 192 from EPROM tool kit 12 7 190)

Series: E36, E36/2, E36/3, E36/5, E36/7, E36/C, E36tou, E38, E38/3, E39, E39PL, E39tou, E46, E46/16, E46/2, E46/3, E46/5, E46/C, E52, E53, E60, E61, E63, E64, E65, E66, E67, E83, E85, E87, E90, R50, R52, R53, RR1

SI number: 2 06 04(128)

Order number: 12 7 060

Antistatic mat (ESD)

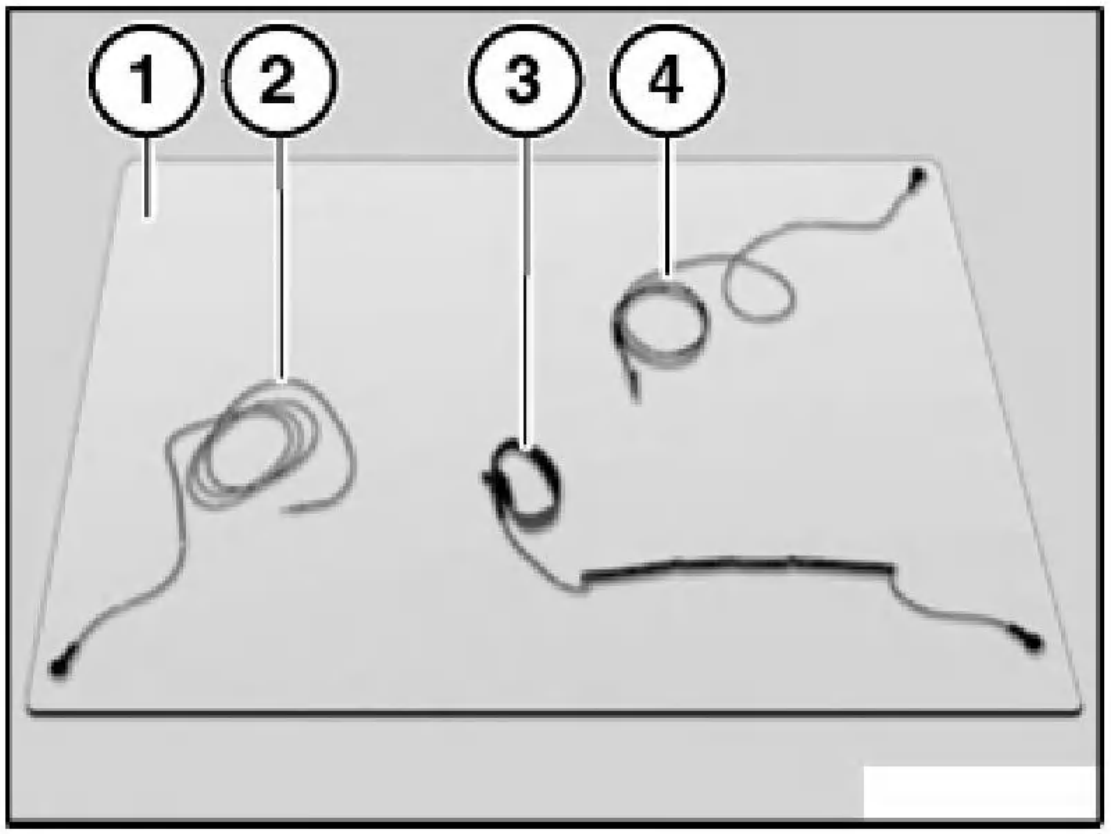



Fig. 6: Identifying Special Tool - Anti-Static Mat (ESD)
Courtesy of BMW OF NORTH AMERICA, INC.

## 12 7 121 COUNTERHOLDER WRENCH

COUNTERHOLDER WRENCH

| | |
|---|---|
| In conjunction with: | Socket |
| Note: | Alternator N42 engine |
| Order number: | 12 7 121 |
| Â | Counterholder wrench |

## 12 7 122 SOCKET

SOCKET

| | |
|---|---|
| In conjunction with: | Counterholder wrench |
| Note: | Hazet 8808 lg 10 |
| SI number: | 1 28 03(051) |
| Order number: | 12 7 122 |
| Â | Socket |

## 12 7 190 EPROM TOOLS/ID MARKING

EPROM TOOLS/ID MARKING

| | |
|---|---|
| Storage location: | J 101 |
| Order number: | 12 7 190 |

| | |
|---|---|
| Â | EPROM tools/ID marking |
| Consisting of: | |
| 1 = 12 7 191 | EPROM extractor pliers |
| 2 = 12 7 192 | Antistatic mat |
| NOTE:<br>incl. arm band | |

## 12 7 200 SET OF TOOLS

SET OF TOOLS

| | |
|---|---|
| Note: | For opening & closing control unit box |
| Storage location: | J 106 |
| Order number: | 12 7 200 |
| Â | Set of tools |
| Consisting of: | Â |
| 1 = 12 7 201 | Pliers |
| Â | NOTE:<br>For bending open tab washers |
| 2 = 12 7 202 | Lever |
| Â | NOTE:<br>For bending tab washers |
| 3 = 12 7 203 | Pliers |
| Â | NOTE:<br>For closing tab washers |
| 4 = 12 7 204 | Torx socket T20 |
| 5 = 12 7 205 | Torx socket T10 |
| 6 = 12 7 206 | Fine pen |
| Â | NOTE:<br>Black, waterproof |
| 8 = 12 7 208 | Slotted screwdriver 2 mm |
| 9 = 12 7 209 | Straightening tool |
| Â | NOTE:<br>For EPROM connections |

## 12 7 210 CONTROL UNIT SEAL

CONTROL UNIT SEAL

| | |
|---|---|
| Storage location: | J 106 |
| Order number: | 12 7 210 |
| Control unit seal | |
| Consisting of: | |
| 1 = 12 7 211 | Seal marks |
| 2 = 12 7 212 | Hole punch |
| NOTE: | |

For seal mark dating

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Article GUID: A00202800

# COOLING SYSTEM

## 17 0 000 TESTER

NOTE: Note: For checking cooling system for leaks and function of pressure relief valve in radiator cap. Replaced by 17 0 100

Storage location: A43, C17

Order number: 17 0 000

Tester

Consisting of:

1 = 17 0 001 Adapter

NOTE: For checking pressure relief valve in radiator cap/model series: all, except E28

2 = 17 0 002 Tester without adapter

NOTE: Pressure range 0...2.5 bar/model series: all, except E28

3 = 17 0 003 Screw neck

NOTE: For screw-on radiator caps (normal thread)/ model series: E28, E30, E31, E32 Engine: all, except M51.

4 = 17 0 004 Adapter

NOTE: For screw-on radiator caps (normal thread)/model series: E28, E30, E32/Engine: M51

5 = 17 0 005 Screw neck

NOTE: For screw-on radiator caps (buttress thread)/model series: E31, E32, E34, E36, E38, E39

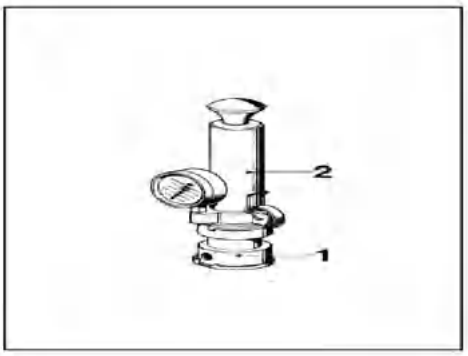
7 = 17 0 007 Adapter

NOTE: For checking expansion tank cap/model series: E31, E32, E34, E36, E38, E39

8 = 17 0 008 Pressure hose

9 = 17 0 009 Adapter for radiator expansion tank

NOTE: Model series: E36/Model: M3 US Engine W10




| | |
|---|---|
| Note: | For checking cooling system for leaks and function of pressure relief valve in radiator cap. Replaced by 17 0 100 |
| Storage location: | A43, C17 |
| Order number: | 17 0 000 |
| | Tester |
| Consisting of: | |
| 1 = 17 0 001 | Adapter |
| | Note: For checking pressure relief valve in radiator cap / model series: all, except E28 |
| 2 = 17 0 002 | Tester without adapter |
| | Note: Pressure range 0...2.5 bar / model series: all, except E28 |
| 3 = 17 0 003 | Screw neck |
| | Note: For screw-on radiator caps (normal thread)/ model series: E28, E30, E31, E32 Engine: all, except M51 |
| 4 = 17 0 004 | Adapter |
| | Note: For screw-on radiator caps (normal thread) / model series: E28, E30, E32 / Engine: M51 |
| 5 = 17 0 005 | Screw neck |
| | Note: For screw-on radiator caps (buttress thread) / model series: E31, E32, E34, E36, E38, E39 |
| 7 = 17 0 007 | Adapter |
| | Note: For checking expansion tank cap / model series: E31, E32, E34, E36, E38, E39 |
| 8 = 17 0 008 | Pressure hose |
| 9 = 17 0 009 | Adapter for radiator expansion tank |
| | Note: Model series: E36 / Model: M3 US Engine W10 |

G03155547

Fig. 1: Identifying Special Tool - 17 0 000 Tester
Courtesy of BMW OF NORTH AMERICA, INC.

## 17 0 010 REPAIR KIT FOR TESTER 17 0 002

Series: E12, E21, E23, E24, E28, E30, E31, E32, E34, E36, E38, E39

Order number: 17 0 010

Repair kit for tester 17 0 002

Consisting of:

1 = 17 0 011 Pressure gauge

2 = 17 0 012 Securing clip (2)

3 = 17 0 013 Mounting socket

4 = 17 0 014 Diaphragm

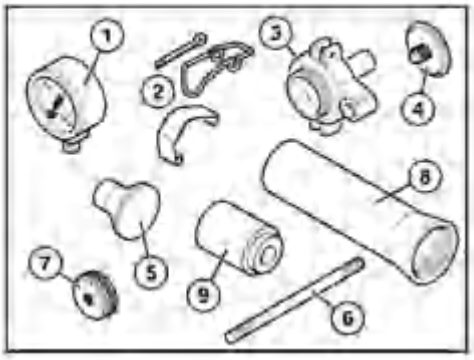
5 = 17 0 015 Handle

6 = 17 0 016 Threaded rod with 2 nuts and 2 washers

7 = 17 0 017 Leather sleeve

8 = 17 0 018 Cylinder

9 = 17 0 019 Rubber seal

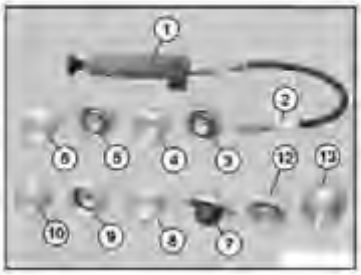


| | |
|---|---|
| Series: | E12, E21, E23, E24, E28, E30, E31, E32, E34, E36, E38, E39 |
| Order number: | 17 0 010 |
| | Repair kit for tester 17 0 002 |
| Consisting of: | |
| 1 = 17 0 011 | Pressure gauge |
| 2 = 17 0 012 | Securing clip (2) |
| 3 = 17 0 013 | Mounting socket |
| 4 = 17 0 014 | Diaphragm |
| 5 = 17 0 015 | Handle |
| 6 = 17 0 016 | Threaded rod with 2 nuts and 2 washers |
| 7 = 17 0 017 | Leather sleeve |
| 8 = 17 0 018 | Cylinder |
| 9 = 17 0 019 | Rubber seal |

Fig. 2: Identifying Special Tool - Repair Kit For Tester 17 0 002
Courtesy of BMW OF NORTH AMERICA, INC.

17 0 100 TESTER

Minimum set: Mechanical tools



| | |
|---|---|
| Note: | For checking engine cooling system for water leaks. For checking radiator cap. |
| Series: | E12, E21, E23, E24, E28, E30, E30/C, E30tou, E31, E32, E32/3, E34, E34tou, E36, E36/2, E36/3, E36/5, E36/7, E36/C, E36tou, E38, E38/3, E39, E39PL, E39tou, E46, E46/16, E46/2, E46/3, E46/5, E46/C, E52, E53, E60, E61, E63, E64, E65, E66, E67, E83, E85, E87, R50, R52, R53, RR1 |
| Engine: | M10, M20, M20B25, M20B27, M21, M30, M30B34, M30Tur, M40, M41, M42, M43, M43TU, M44, M47, M47TU, M50, M51, M52, M52TU, M54, M56, M57, M57D25, M57D30, M57TU, M60, M62, M62VAN, M67, M70, M73, M88, N40, N42, N45, N46, N52, N62, N73, S14, S38, S50B30, S50B32, S50US, S52US, S54, S62, W10, W11, W17 |
| SI number: | 01 07 02 (884) |
| Order number: | 17 0 100 |
| | Tester |
| Consisting of: | |
| 1 = 17 0 101 | Pump |
| 2 = 17 0 102 | Hose with quick-connect coupling |
| 3 = 17 0 103 | Adapter |
| | Note: For radiator cap (normal thread) |
| 4 = 17 0 104 | Adapter |
| | Note: For radiator cap (normal thread) |
| 5 = 17 0 105 | Adapter |
| | Note: For radiator cap (sawtooth thread) |
| 6 = 17 0 106 | Adapter |
| | Note: For radiator cap (sawtooth thread) |
| 7 = 17 0 107 | Adapter |
| | Note: For radiator cap R50 / W10 |
| 8 = 17 0 108 | Adapter |
| | Note: For radiator cap R50 / W10 |
| 9 = 17 0 109 | Adapter |
| | Note: For radiator connection R53/W11, R50/W17 Adapter corresponds to 17 0 051 |
| 10 = 17 0 111 | Adapter |
| | Note: For radiator cap R53/W11, R50/W17 Adapter corresponds to 17 0 052 |
| 11 = 17 0 112 | Case |
| 12 = 17 0 113 | Adapter |
| | Note: For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988) |
| 13 = 17 0 114 | Adapter |
| | Note: For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988) |

G00155549

Fig. 3: Identifying Special Tool - 17 0 100 Tester
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Note: For checking engine cooling system for water leaks. For checking radiator cap.

Series: E12, E21, E23, E24, E28, E30, E30/C, E30tou, E31, E32, E32/3, E34, E34tou, E36, E36/2, E36/3, E36/5, E36/7, E36/C, E36tou, E38, E38/3, E39, E39PL, E39tou, E46, E46/16, E46/2, E46/3, E46/5, E46/C, E52, E53, E60, E61, E63, E64, E65, E66, E67, E83, E85, E87, R50, R52, R53, RR1

Engine: M10, M20, M20B25, M20B27, M21, M30, M30B34, M30Tur, M40, M41, M42, M43, M43TU, M44, M47, M47TU, M50, M51, M52, M52TU, M54, M56, M57, M57D25, M57D30, M57TU, M60, M62,

M62VAN, M67, M70, M73, M88, N40, N42, N45, N46, N52, N62, N73, S14, S38, S50B30, S50B32, S50US, S52US, S54, S62, W10, W11, W17

SI number: 01 07 02 (884)

Order number: 17 0 100

Tester

Consisting of:

1 = 17 0 101 Pump

2 = 17 0 102 Hose with quick-connect coupling

3 = 17 0 103 Adapter

NOTE: For radiator cap (normal thread)

4 = 17 0 104 Adapter

NOTE: For radiator cap (normal thread)

5 = 17 0 105 Adapter

NOTE: For radiator cap (sawtooth thread)

6 = 17 0 106 Adapter

NOTE: For radiator cap (sawtooth thread)

7 = 17 0 107

Adapter

NOTE: For radiator cap R50/W10

8 = 17 0 108 Adapter

NOTE: For radiator cap R50/W10

9 = 17 0 109 Adapter

NOTE: For radiator connection R53/W11 R50/W17 Adapter corresponds to 17 0 051

10 = 17 0 111 Adapter

NOTE: For radiator cap R53/W11, R50/W17 Adapter corresponds to 17 0 052

11 = 17 0 112 Case

12 = 17 0 113

Adapter

NOTE: For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)

13 = 17 0 114 Adapter

NOTE: For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)

## 17 0 130 SET OF ADAPTERS

In conjunction with: 17 0 101, 17 0 102

NOTE: Note: For connecting adapters from 17 0 000 to pump 17 0 101 and hose 17 0 102.

SI number: 01 07 02 (884)

Order number: 17 0 130

Set of adapters

Consisting of:

1 = 17 0 131 Adapter

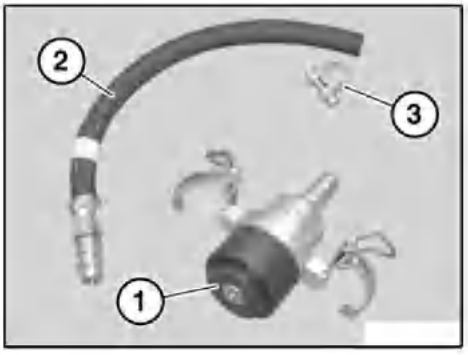
NOTE: For connecting pump 17 0 101 and hose 17 0 102 to adapter from 17 0 000

2 = 17 0 132 Hose with coupling connection

NOTE: For connecting pump 17 0 101 to adapter 17 0 007

3 = 17 0 133 Hose clamp

NOTE: For hose 17 0 132




| | |
|---|---|
| In conjunction with: | 17 0 101, 17 0 102 |
| Note: | For connecting adapters from 17 0 000 to pump 17 0 101 and hose 17 0 102. |
| SI number: | 01 07 02 (884) |
| Order number: | 17 0 130 |
| | Set of adapters |
| Consisting of: | |
| 1 = 17 0 131 | Adapter |
| | Note: For connecting pump 17 0 101 and hose 17 0 102 to adapter from 17 0 000 |
| 2 = 17 0 132 | Hose with coupling connection |
| | Note: For connecting pump 17 0 101 to adapter 17 0 007 |
| 3 = 17 0 133 | Hose clamp |
| | Note: For hose 17 0 132 |

Fig. 4: Identifying Special Tool - Set Of Adapters
Courtesy of BMW OF NORTH AMERICA, INC.

Article GUID: A00202803

# COOLANT CHECKING COOL

## 17 00 COOLANT

COOLANT - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Measure |
|---|---|---|
| 1AZ Coolant hoses 32 ... 48 mm dia. | All | 2.5 Nm |
| 2AZ Bleeder screw (8 mm wrench size) on thermostat housing | All, without E46 | 8 Nm |
| Plastic vent screws on coolant lines | E46 | 2 -0.5/+1 Nm |
| 3AZ Level switch (30 mm wrench size) to coolant expansion tank | All | 3 Nm |

# ENGINE RADIATOR WITH MOUNTING

## 17 11 RADIATOR AND MOUNTING PARTS

RADIATOR AND MOUNTING PARTS - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Measure |
|---|---|---|---|
| 1AZ Radiator to body | Â | Â | Â |
| self-tapping screw | All | B6.3 | 9 Nm |
| Â | All | M6 | 10 Nm |
| 2AZ Drain plug to radiator | All | Â | 2.5 Nm |
| 3AZ Temperature switch to radiator (91 Â°C / 99 Â°C) max. | All | Â | 15 Nm |
| 4AZ Expansion tank to body | All | Â | 9 Nm |
| Â | M57TU / E65 | Â | 4 Nm |
| 5AZ Radiator on module carrier | E46 | Â | 4 + 1 Nm |
| 6AZ Retaining plate, expansion tank, to radiator | E46 | Â | 4 + 1 Nm |
| 7AZ Fan cowl on radiator | E46 | Â | 4 + 1 Nm |
| 8AZ Plug in radiator (temperature switch omitted) | E36/7 / M54 | M14 x 1.5 | 15 Nm |
| 9AZ Mounting plate to radiator | M57TU / E65 | Â | 4.5 Nm |
| 10AZ Radiator bracket | All | Â | 2.5 Nm |

# OIL COOLER

## 17 21 ENGINE OIL COOLER

ENGINE OIL COOLER - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Measure |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1AZ Engine oil cooler to body | All | Â | 14 Nm |
| Oil cooler vapor extraction guide to trim panel | E36 / M3 | B4.8 | 4 Nm |

# OIL COOLER LINES

## 17 22 OIL COOLER PIPES

OIL COOLER PIPES - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Measure |
|---|---|---|---|
| 1AZ Pipes to engine oil cooler | All | Â | 28 Nm |
| 2AZ Pipes to oil filter head | E36 / M3 | Â | 25 Nm |
| 3AZ Holder on oil cooler pipes | All | Â | 6 Nm |
| 4AZ Holder for oil cooler pipes to alternator | E36 / M3 | M6 | 10 Nm |

## 17 22 OIL COOLER PIPES

OIL COOLER PIPES - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 5AZ Cap nut on transmission oil cooler (on radiator) and on transmission | All | M18 x 1.5 | Â | 20 Nm |
| Â | 5HP30 | M22 x 1.5 | Â | 28 Nm |
| 6AZ Oil lines on transmission | Â | Â | Â | Â |
| Hollow bolt | All | M16 x 1.5 | Â | 37 Nm |
| 7AZ Oil lines on transmission oil cooler | A 5 S 300 J | Â | Â | 28 Nm |
| Hollow bolt | All | M14 x 1.5 | Â | 27 Nm |
| 8AZ Screw-in fitting on transmission | All | M14x1.5/M16x1.5 | Â | 37 Nm |
| 9AZ Oil hose on oil pipe | E23 | Â | Â | 28 Nm |
| 10AZ Oil pipe bracket on radiator | E23 | Â | Â | 2 Nm |
| 11AZ Oil pipe bracket on body | E23 | Â | Â | 6.5 Nm |
| 12AZ Oil cooler on transmission | 5HP30 | Â | Â | 10 Nm |
| 13AZ Transmission oil cooler line to transmission | N42 | M8 | Â | 21 Nm |

# AUXILIARY ELECTRICAL

## 17 40 ADDITIONAL FAN (ELECTRIC)

ADDITIONAL FAN (ELECTRIC) - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Measure |
|---|---|---|
| 1AZ Electric auxiliary fan on fan cowl | E46 | 6 Nm |
| 2AZ Electronics for auxiliary fan on fan cowl | E46 | 6 Nm |

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Article GUID: A00202653

# ENGINE SUSPENSION

## 22 11 ENGINE SUSPENSION

ENGINE SUSPENSION - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Engine mount to front axle support | E52 / E85 | Â | Â | 42 Nm |
| Â | E60 / E61 / E63 / E64 / E65 / E66 / E67 | M8-8 | Â | 19 Nm |
| Â | E53 | M8-10.9 | Â | 30 Nm |
| Â | E83 | M8 | Â | 21 Nm |
| Â | E87 / E90 | M8 10.9 | Â | 28 Nm |
| 2AZ Engine mount to engine support arm | E60 / E61 / E63 / E64 / E65 / E66 / E67 / E53 / E83 / E87 / E90 | M10 10.9 | Â | 56 Nm |
| Â | E65 / E66 / E67 | M12 10.9 | Â | 100 Nm |
| Â | E85 / E52 | Â | Â | 42 Nm |
| 3AZ Engine support arm to engine | E60 / E61 / E63 / E64 / E65 / E66 / E67 / E87 / E90 | M10 8.8 | Â | 38 Nm |
| Â | E60/61 N52 / E63/64 N52 / E83/85 N52 / E87/ 90 N52 / E65 N52 | M12 | Aluminium screws marked blue must be replaced | Â |
| Â | Â | Â | Jointing torque | 34 Nm |
| Â | Â | Â | Torque angle | 90-110Â° |
| Â | E60 / E61 / E65 / E66 / E67 | M8 8.8 | Â | 19 Nm |
| Â | E85 / E83 | M8 8.8 | Â | 21 Nm |
| Â | E53 (N62/ M54) | Â | Â | 38 Nm |
| Â | E53 (M57) | Â | Â | 65 Nm |
| 4AZ Engine mount to mounting bracket | E65 / E60 / E61 / E63/E64 | M8 8.8 | Â | 19 Nm |
| 5AZ Mounting bracket to front axle carrier | E65 / E60 / E61 / E63 / E64 | M8-8 | Â | 19 Nm |

## 22 32 TRANSMISSION MOUNTS

TRANSMISSION MOUNTS - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Measure |
|---|---|---|---|
| 1AZ Bolt to transmission cross-member | E60 / E65 / E66 / E67 | Â | 30 Nm |
| 2AZ Transmission support block to transmission | E60 / E61 / E65 / E66 / E67 / E85 / E63 / E64 / E87 / E90 | Â | 38 Nm |

| | | | |
|---|---|---|---|
| 3AZ Transmission mount to transmission / transmission crossmember | E60 / E61 / E63 / E64 / E67 / E85 / E87 / E90 | M8 | 19 Nm |
| 4AZ Transmission cross-member to body | E85 / E46 / E83 | M8 8.8 | 21 Nm |
| Â | E60 / E61 / E63 / E64 / E67 / E87 / E90 | Â | 19 Nm |
| Â | E53 | M10 | 41 Nm |
| 5AZ Transmission cross member to rubber mounts | E46 / E53 / E83 | M12 | 74 Nm |

# TRANSMISSION SUSPENSION

## 22 32 TRANSMISSION MOUNTS

TRANSMISSION MOUNTS - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Measure |
|---|---|---|---|
| 1AZ Bolt to transmission cross-member | E60 / E65 / E66 / E67 | Â | 30 Nm |
| 2AZ Transmission support block to transmission | E60 / E61 / E65 / E66 / E67 / E85 / E63 / E64 / E87 / E90 | Â | 38 Nm |
| 3AZ Transmission mount to transmission / transmission crossmember | E60 / E61 / E63 / E64 / E67 / E85 / E87 / E90 | M8 | 19 Nm |
| 4AZ Transmission cross-member to body | E85 / E46 / E83 | M8 8.8 | 21 Nm |
| Â | E60 / E61 / E63 / E64 / E67 / E87 / E90 | Â | 19 Nm |
| Â | E53 | M10 | 41 Nm |
| 5AZ Transmission cross member to rubber mounts | E46 / E53 / E83 | M12 | 74 Nm |

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Article GUID: A00202655

# 11 0 000 ENGINE LIFTER FOR REMOVING AND INSTALLING ENGINES

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Engine: | M10, M47T2, M47TU, M52, M52TU, M54, M56, M60, M62, M67, M70, M73, N52, N62, N73, S14, S54, S62, W10, W11 |
| SI number: | 1 13 94 (888) |
| Order number: | 11 0 000 |
| | Engine lifter for removing and installing engines |
| Consisting of: | Â |
| 1 = 11 0 001 | Lifting beam |
| 2 = 11 0 002 | Chain, long |
| 3 = 11 0 003 | Chain, short |
| 4 = 11 0 009 | Shackle (2 x) |

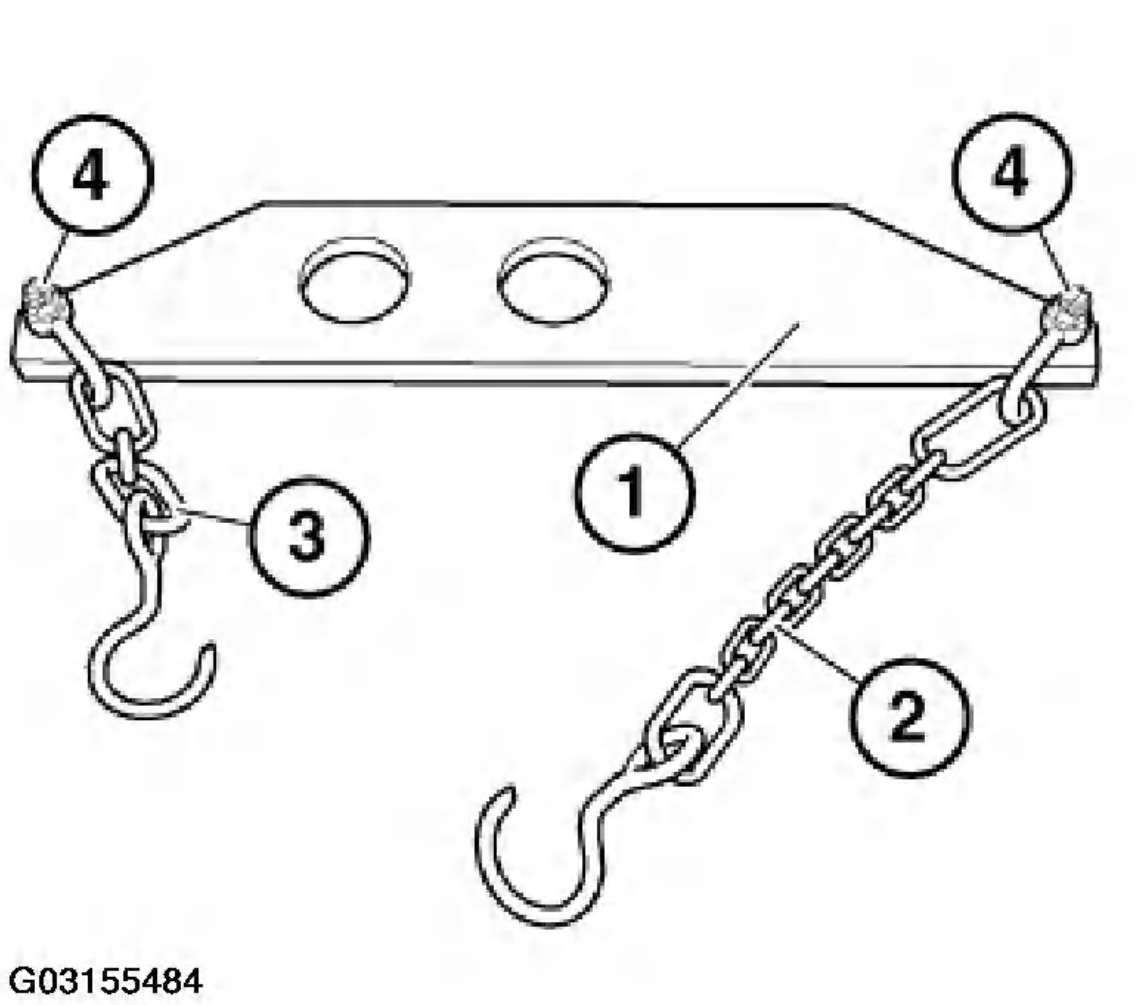



Fig. 1: Identifying Engine Lifter Components
Courtesy of BMW OF NORTH AMERICA, INC.

# 11 0 070 ENGINE HOIST

SPECIAL TOOL

| | |
|---|---|
| Note: | For removing and installing engines |
| Engine: | M10, M20, M20B25, M20B27, M21, M30, M30B34, M30Tur, M40, M41, M42, M43, M43TU, M44, M47, M47T2, M47TU, M50, M51, M52, M52TU, M54, M56, M57, M57D25, M57D30, M57T2, M57TU, M60, M62, M62VAN, M67, M67TU, M70, M73, M88, N40, N42, N45, N46, N52, N62, N73, S14, S38, S50B30, S50B32, S50US, S52US, S54, S62, S85, W10, W11, W17 |
| SI number: | 1 16 96 (107) |
| Order number: | 11 0 070 |
| Â | Engine hoist |
| Consisting of: | Â |
| 1 = 11 0 071 | Lifting beam |
| 2 = 11 0 072 | Carrying chain, long |
| 3 = 11 0 073 | Carrying chain, short |
| 4 = 11 0 079 | Shackle (2 x) |

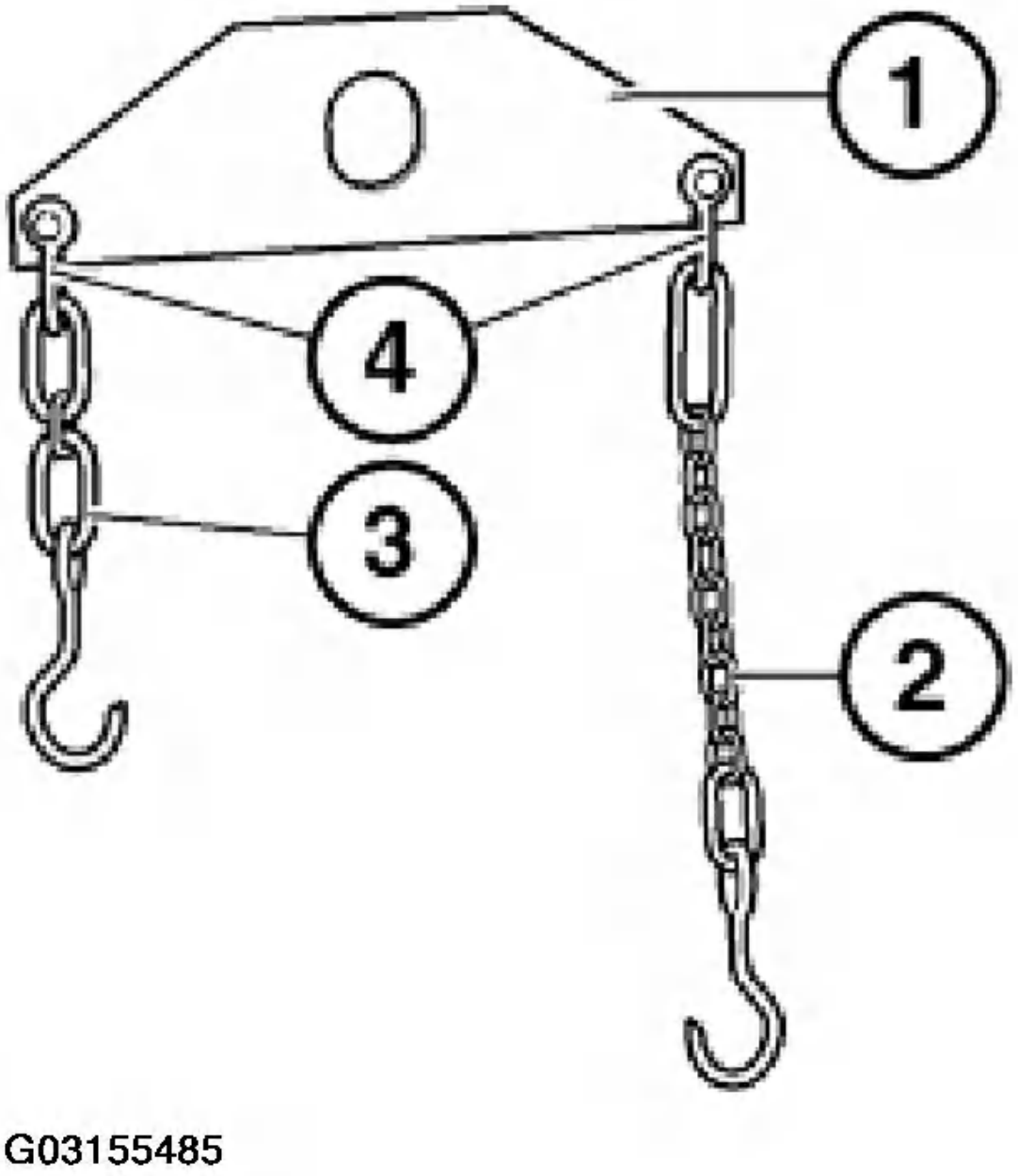



Fig. 2: Identifying Engine Hoist
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 0 190 ACCESSORIES

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 11 1 060, 11 1 065, 11 1 067, 11 3 131, 11 3 132 |
| Note: | For removing and installing valve springs |
| Engine: | M20, M21, M30, M40, M41, M42, M43, M44, M47, M47TU, M50, M51, M52, M57, M60, M62, M70, M73, S14, S38, S50B30, S50B32, S54, S62 |
| SI number: | 1 09 91(416) |
| Order number: | 11 0 190 |
| Â | Accessories |

| | |
|---|---|
| Consisting of: | Â |
| 2 = 11 0 192 | Guide tube |
| Â | NOTE:<br>Engine: all |
| 4 = 11 0 194 | Valve spring cage |
| Â | NOTE:<br>Engine: M41, M51, S50 |

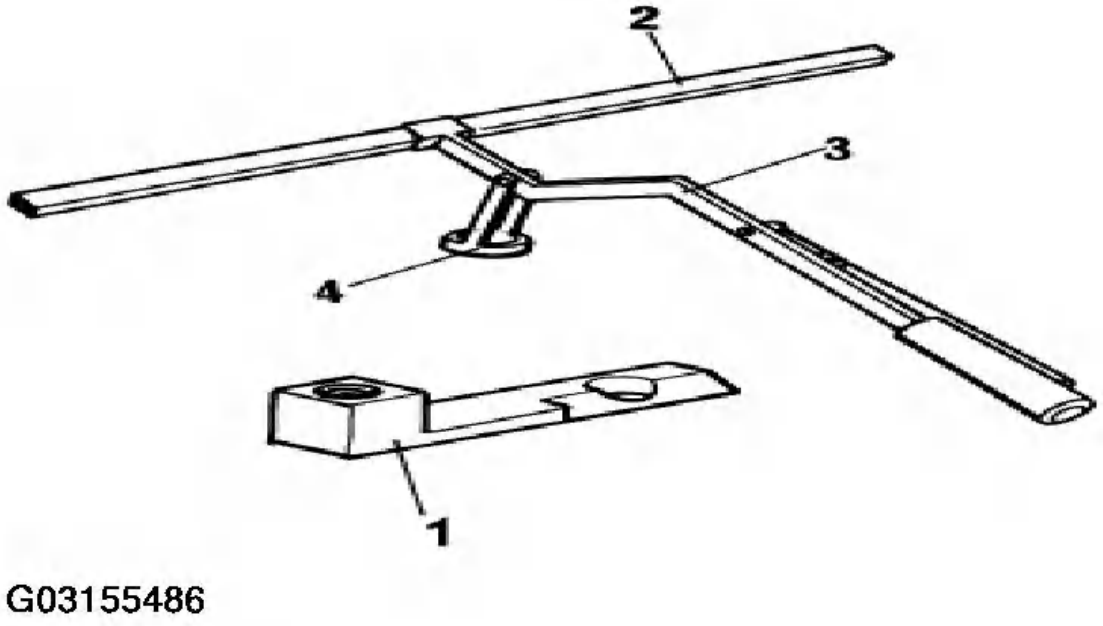



Fig. 3: Identifying Guide Tube
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 0 220 COMPRESSION TEST KIT

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For all petrol/gasoline and diesel engines. |
| Engine: | M10, M20, M20B25, M20B27, M21, M30, M30B34, M30Tur, M40, M41, M42, M43, M43TU, M44, M47, M47TU, M50,M51, M52, M52TU, M54, M56, M57, M57D25, M57D30, M57TU, M60, M62, M62VAN, M67, M67TU, M70, M73, M88, N40, N42, N62, N73, S14, S38, S50B30, S50B32, S50US, S52US, S54, S62, W10, W11, W17 |
| SI number: | 1 09 92 (558) |
| Order number: | 11 0 220 |
| Â | Compression test kit |

| | |
|---|---|
| Consisting of: | Â |
| 16= 11 0 239 | Adapter |
| Â | NOTE:<br>Engine M67, M67TU |
| 11 0 221 | Compression recorder for diesel engines |
| 11 0 222 | Test probe |
| Â | NOTE:<br>For compression recorder 11 0 221 and 11 0 160 / Engine: M21, M41, M47, M51, M57 |
| Â | In conjunction with: 11 0 240 |
| 11 0 223 | Test sheets (100 x) |
| Â | NOTE:<br>For compression recorder for 11 0 221 |
| 11 0 224 | Compression recorder for petrol/gasoline engines |
| 11 0 226 | Test probe |
| Â | NOTE:<br>For compression recorder 11 0 224 and 11 0 160 / engine: M10, M20, M30, M40, M42, M43, M44, M50, M52, M60, M62, M70, M73, S50US, S52US, S62 |
| Â | In conjunction with: 11 0 240 |
| 11 0 228 | Rubber taper with fitting |
| Â | NOTE:<br>For compression recorder 11 0 224 and 11 0 160 / engine: M10, M20, M30 |
| Â | In conjunction with: 11 0 240 |
| 11 0 229 | Test charts (100 x) |
| Â | NOTE:<br>For compression recorder 11 0 224 |
| 11 0 231 | Case |
| Â | NOTE:<br>With foam inlay for compression recorder |
| 11 0 233 | Non-return valve |
| 11 0 234 | Filter 3 x 3 mm |
| 11 0 235 | Test probe, screw-in |
| Â | NOTE:<br>For measuring "absolute compression" at all cylinders, engine: S14, S38, S50B30, S50B32, S50US, S52US, S54 |
| In conjunction with: | DIS and DIS pressure sensor |
| 11 0 236 | Test probe |
| Â | NOTE: |

| | |
|---|---|
| | For compression recorder 11 0 221 or DIS pressure sensor /engine: M47, M57, M57TU |
| 11 0 237 | Adapter |
| Â | NOTE:<br>For measuring "absolute compression" at all cylinders. Engine: W17 |
| Â | In conjunction with: 11 0 221, 11 0 235 or DIS pressure sensor, 11 0 235 |

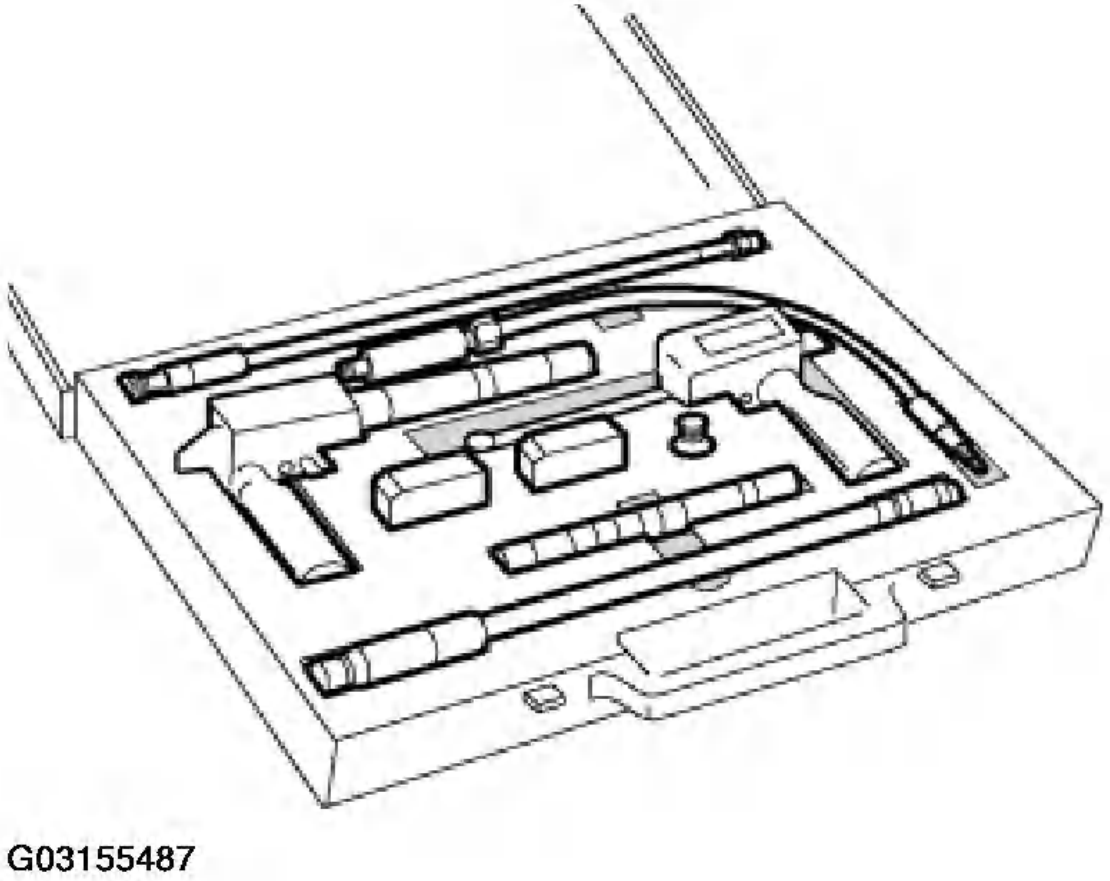



Fig. 4: Identifying Compression Test Kit
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 0 240 COUPLING

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 11 0 222, 11 0 226, 11 0 227, 11 0 225 |
| Note: | For adapting test probes to pressure gauge 11 0 162 |
| Engine: | All models |
| Order number: | 11 0 240 |
| Â | Coupling |

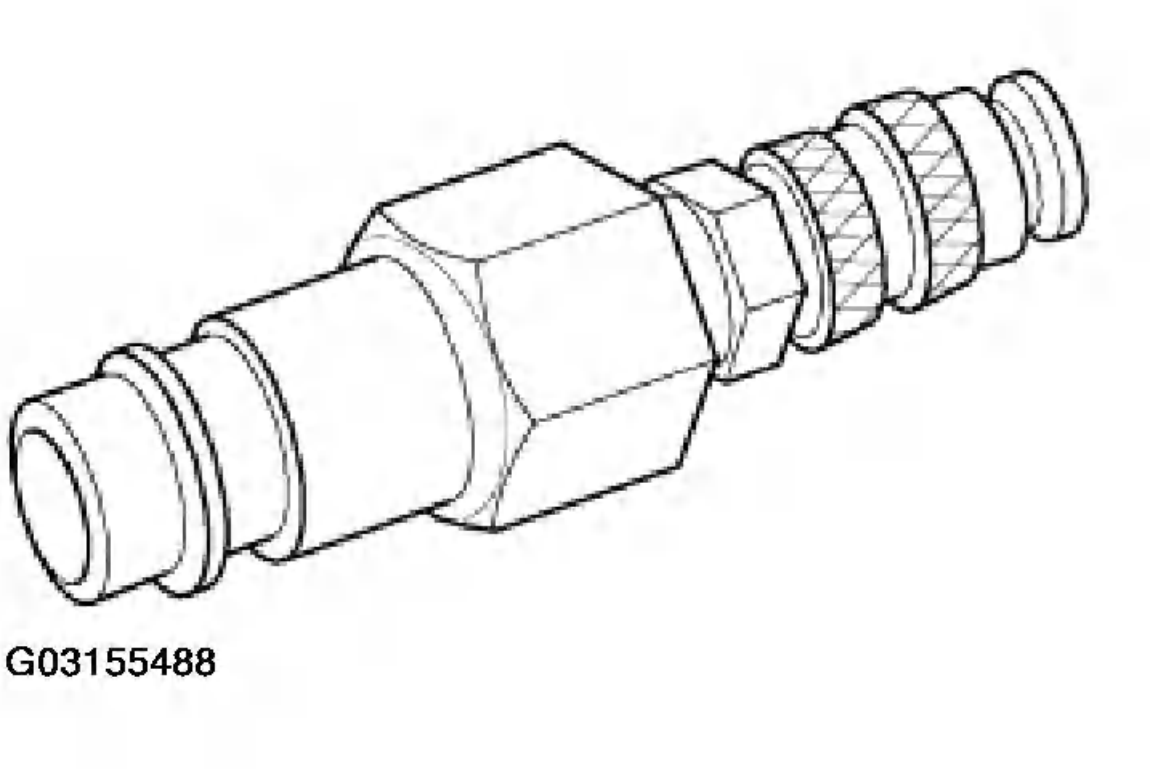


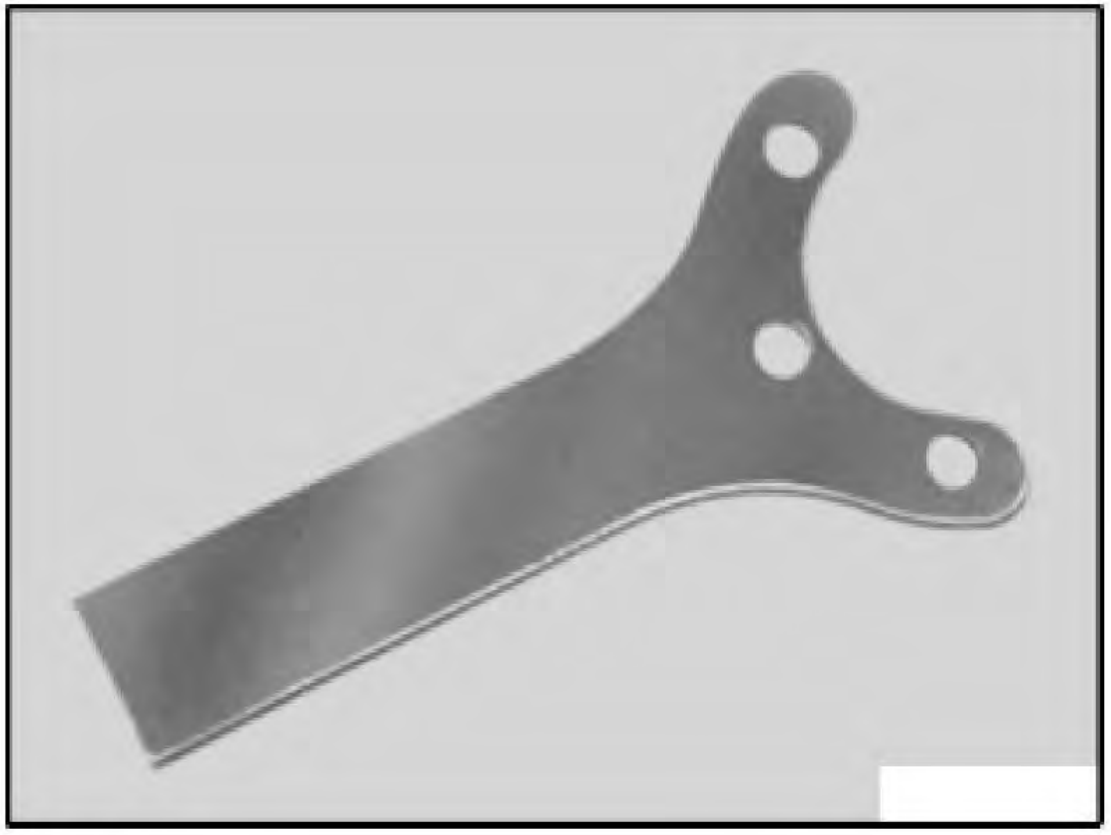

Fig. 5: Identifying Coupling
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 0 280 HOLDER

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For holding central bolts during loosening and tightening operations |
| Engine: | S54, S85 |
| SI number: | 1 15 00(609) |
| Order number: | 11 0 280 |
| Â | Holder |



G03155489

Fig. 6: Identifying Holder
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 0 340 ACCESSORIES

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 11 1 060 |
| Note: | For removing and installing valve springs Engine: M20, M21, M30, M40, M41, M42, M43, M44, M47, M47TU, M50, M51, M52, M57, M57D25, M57D30, M60, M62, M70, M73, N40, N42, N62, N73, S14, S38, S50B30, S50B32, S54, S62 |
| SI number: | 1 12 93(701) |
| Order number: | 11 0 340 |
| Â | Accessories |
| Consisting of: | Â |
| 1 = 11 0 341 | Valve spring cage |
| Â | NOTE:<br>Engine: M43, M73 |
| 2 = 11 0 342 | Pressure lever |
| Â | NOTE:<br>Engine: all, except M10 |

| | |
|---|---|
| 3 = 11 0 343 | Hook |
| Â | NOTE:<br>Length 220 mm - Engine: all, except M10 |
| 5 = 11 0 345 | Valve spring cage |
| Â | NOTE:<br>Engine: M44, M52, M62, S62, S54 |
| 6 = 11 0 346 | Valve spring cage |
| Â | NOTE:<br>Engine: M47, M47TU, M57, N40, N42 |

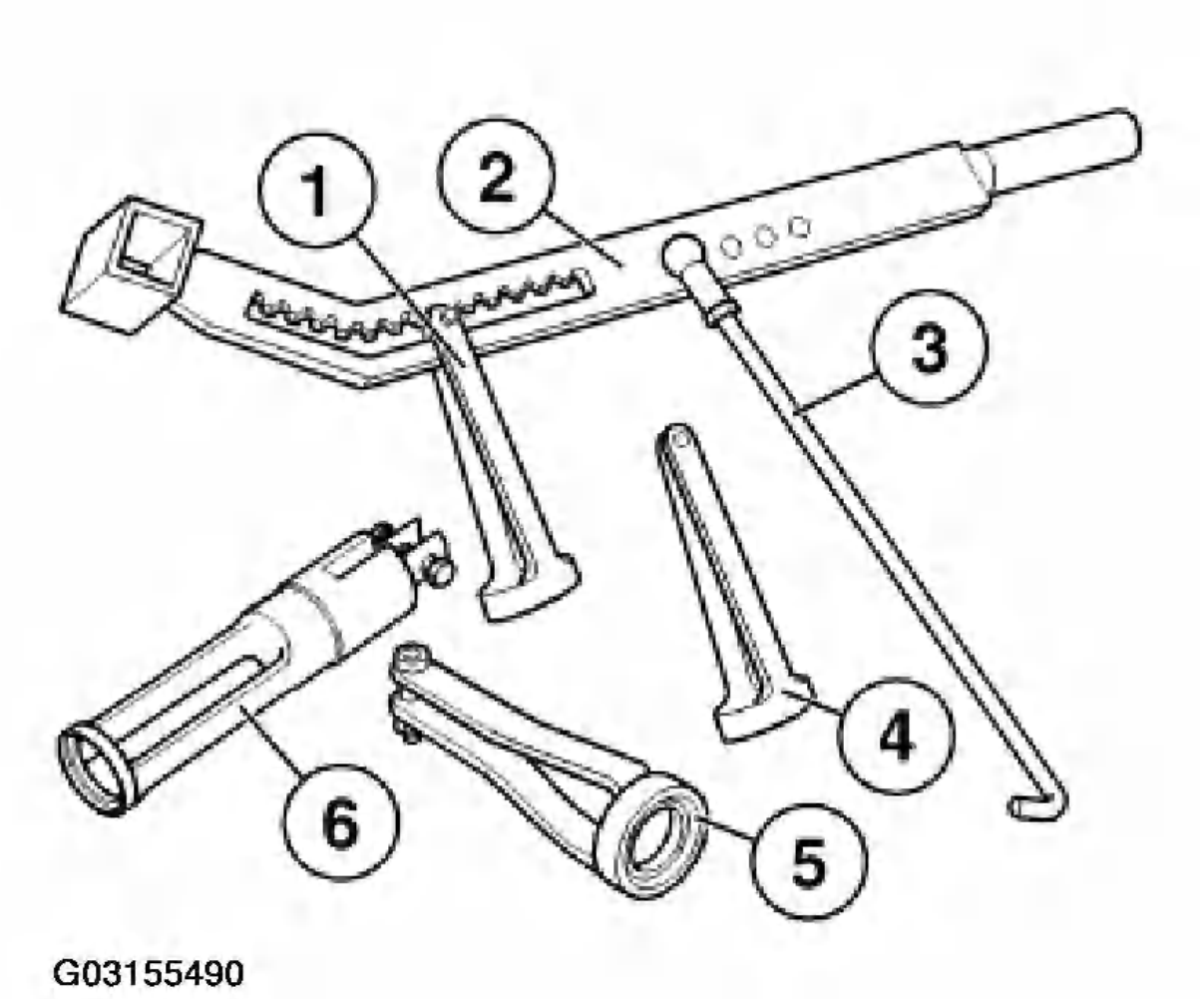



Fig. 7: Identifying Valve Spring Cage
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 1 200 DRIFT

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For fitting valve stem seals |
| Engine: | M20, M21, M40, M41, M42, M43, M44, M50, M51, M52, M52TU, M54, M56, M60, M62, M70, |

| | |
|---|---|
| | M73, S14, S38, S50B30, S50B32, S54, S62 |
| Storage location: | B14, C14 |
| Order number: | 11 1 200 |
| Â | Drift |

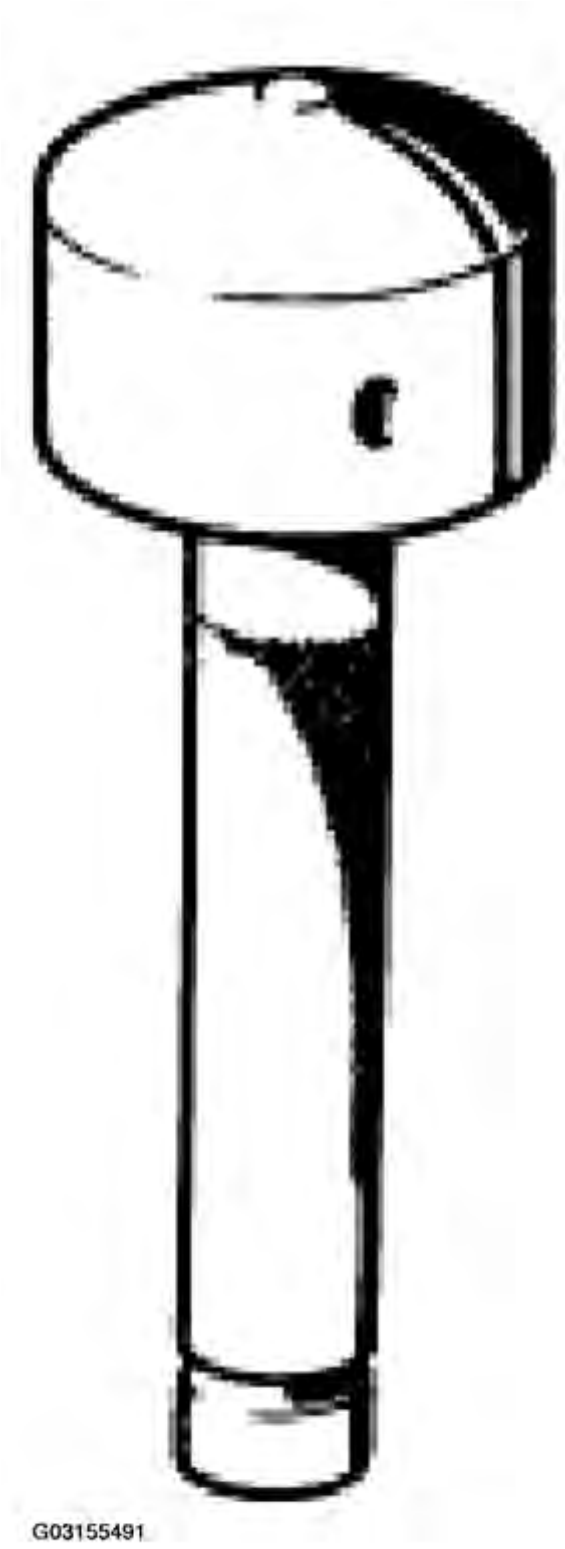



Fig. 8: Identifying Drift
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 1 220 INSTALLATION BUSHING

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For rotary shaft seal in timing case cover (crankshaft front) |
| Engine: | M60, M62, M70, S50B30, S50B32, S54, W10, W11 |
| Storage location: | C19 |
| SI number: | 1 02 87(721) |
| Order number: | 11 1 220 |
| Â | Installation bushing |

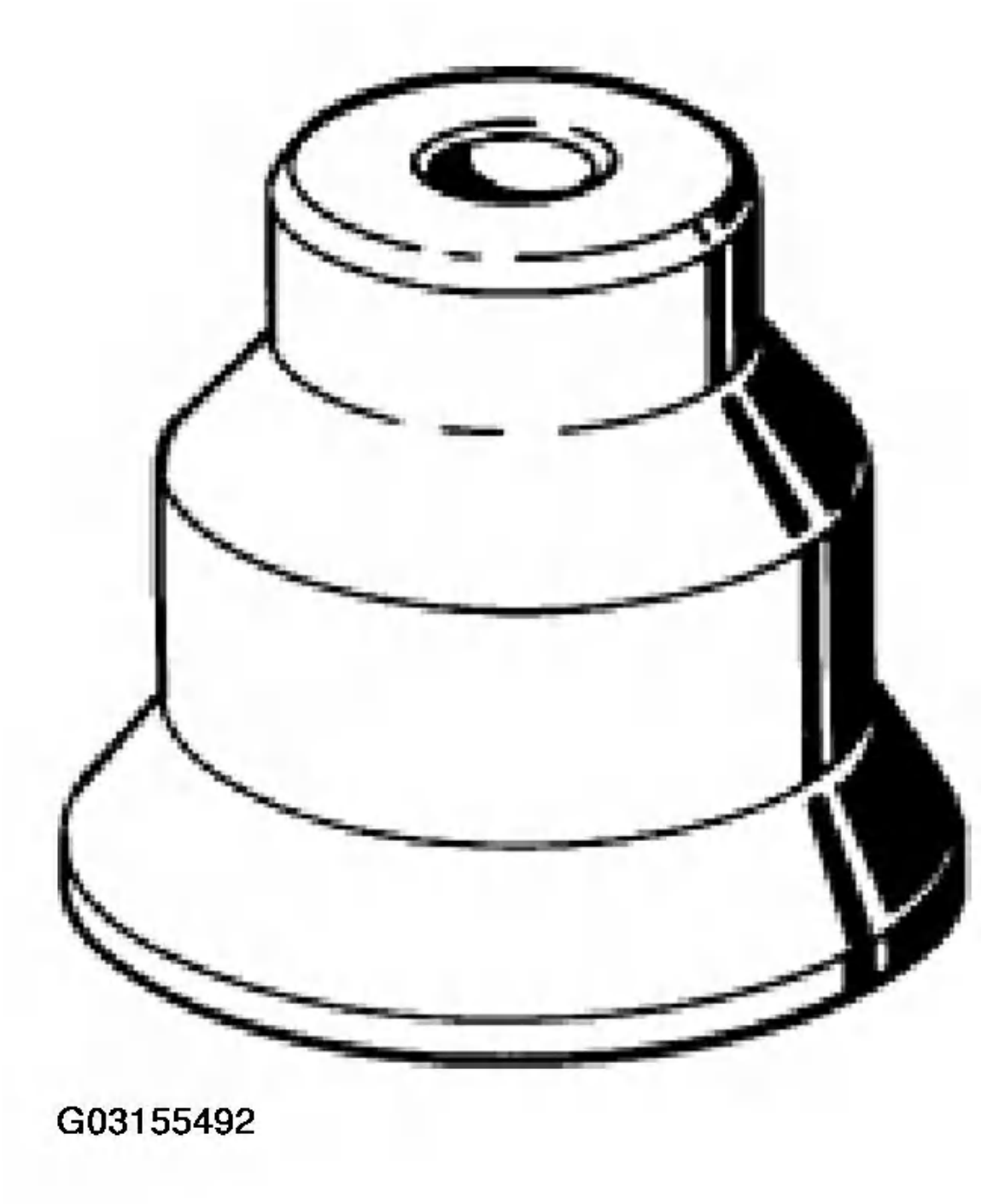



Fig. 9: Identifying Installation Bushing
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 1 260 IMPACT BUSH

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 00 5 500 |
| Note: | For fitting rotary shaft seal in rear crankshaft end cover |
| Engine: | M10, M20, M21, M30, M40, M41, M42, M43, M44, M47, M50, M51, M52, M57, M57D25, M57D30, S14, S38, S50B30, S50B32, S54 |
| Storage location: | C19 |
| SI number: | 1 03 95(900) |
| Order number: | 11 1 260 |
| Â | Impact bush |

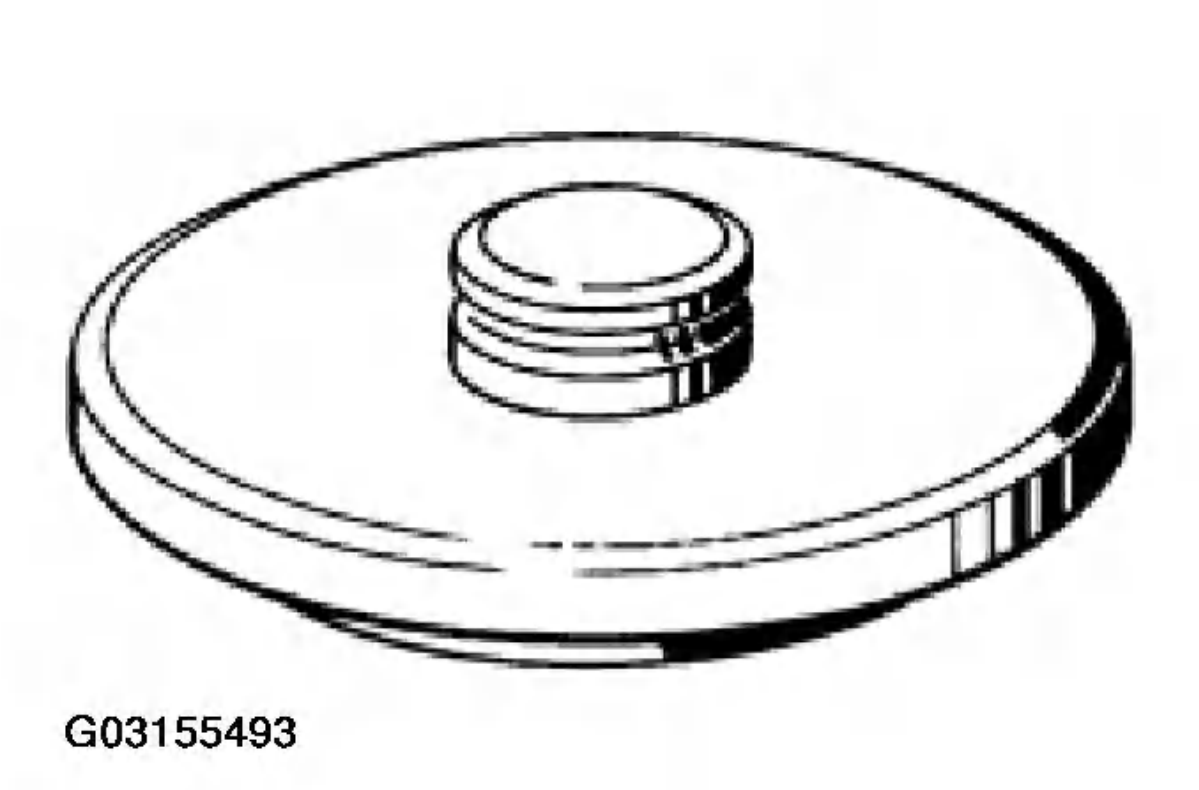



Fig. 10: Identifying Impact Bush
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 1 400 PRESSURE-TESTING FIXTURE

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 11 1 421, 11 1 422, 11 1 437 |
| Note: | For pressure testing cylinder head |
| Engine: | S50B30, S50B32, S54 |
| SI number: | 1 12 92(606) |
| Order number: | 11 1 400 |
| Â | Pressure-testing fixture |
| Consisting of: | Â |
| 1 = 11 1 401 | Cover plate |
| Â | NOTE: |

| | |
|---|---|
| | S50 only |
| 2 = 11 1 402 | Screws (13) |
| Â | NOTE:<br>Engine: M10, S54/S50 |
| 11 1 403 | End hose with clip |
| Â | NOTE:<br>24 mm diameter |
| Â | In conjunction with: 11 1 437 |
| 11 1 404 | Sealing plate |
| Â | NOTE:<br>For leak-testing of cylinder head engine: S54 |

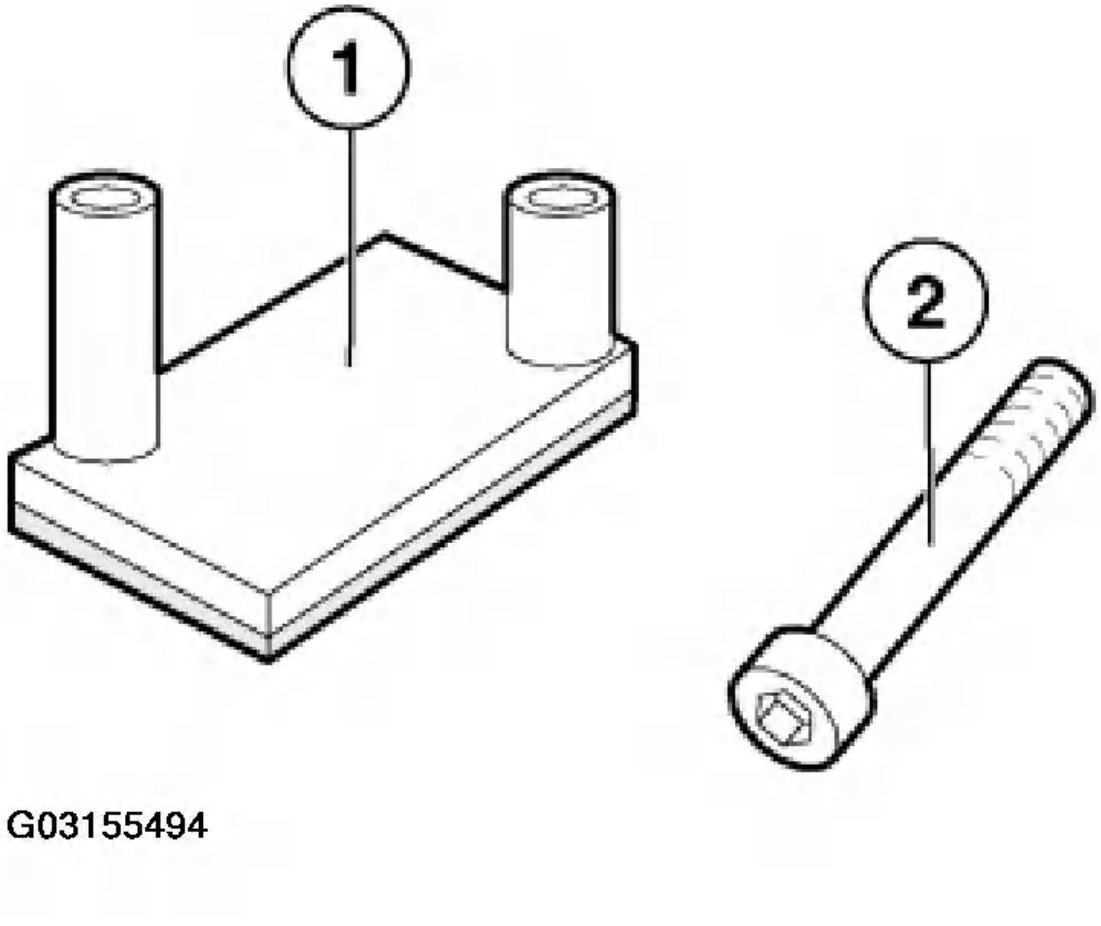



Fig. 11: Identifying Pressure-Testing Fixture
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 1 430 FIXTURE

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 11 0 316 (M42, M44), 11 1 450 (M50, M52, S50) |
| | |

| | |
|---|---|
| Note: | For pressure testing cylinder head |
| Engine: | M42, M44, M50, M52, S50B30, S50B32, S54 |
| SI number: | 1 05 89(099) |
| Order number: | 11 1 430 |
| Â | Fixture |
| Consisting of: | Â |
| 1 = 11 1 431 | Sealing strip |
| Â | NOTE:<br>With 5 pins and rubber seal Engine: M42, M44, M50, M52, S54 |
| 2 = 11 1 432 | Rubber seal |
| Â | NOTE:<br>For sealing strip 11 1 431 - Engine: M42, M44, M50, M52 |
| 3 = 11 1 433 | Sealing strip |
| Â | NOTE:<br>With 7 pins and rubber seal Engine: M42, M44, M50, M52, S54 |
| 4 = 11 1 434 | Rubber seal |
| Â | NOTE:<br>For sealing strip 11 1 433 - Engine: M42, M44, M50, M52 |
| 5 = 11 1 435 | Formed plate |
| Â | NOTE:<br>With rubber seal - Engine: M42, M44 |
| 6 = 11 1 436 | Bridge |
| Â | NOTE:<br>With rubber seal and 2 screws Engine: M42, M44 |
| 7 = 11 1 437 | Screw plug |
| Â | NOTE:<br>With valve and standard clip Engine: M42, M44, M50, M52, S50 |
| 8 = 11 1 438 | Screw plug and standard clip |
| Â | NOTE:<br>Engine: M42, M44, M50, M52 |
| 9 = 11 1 439 | Standard parts |
| Â | NOTE:<br>Engine: M42, M44, M50, M52 |

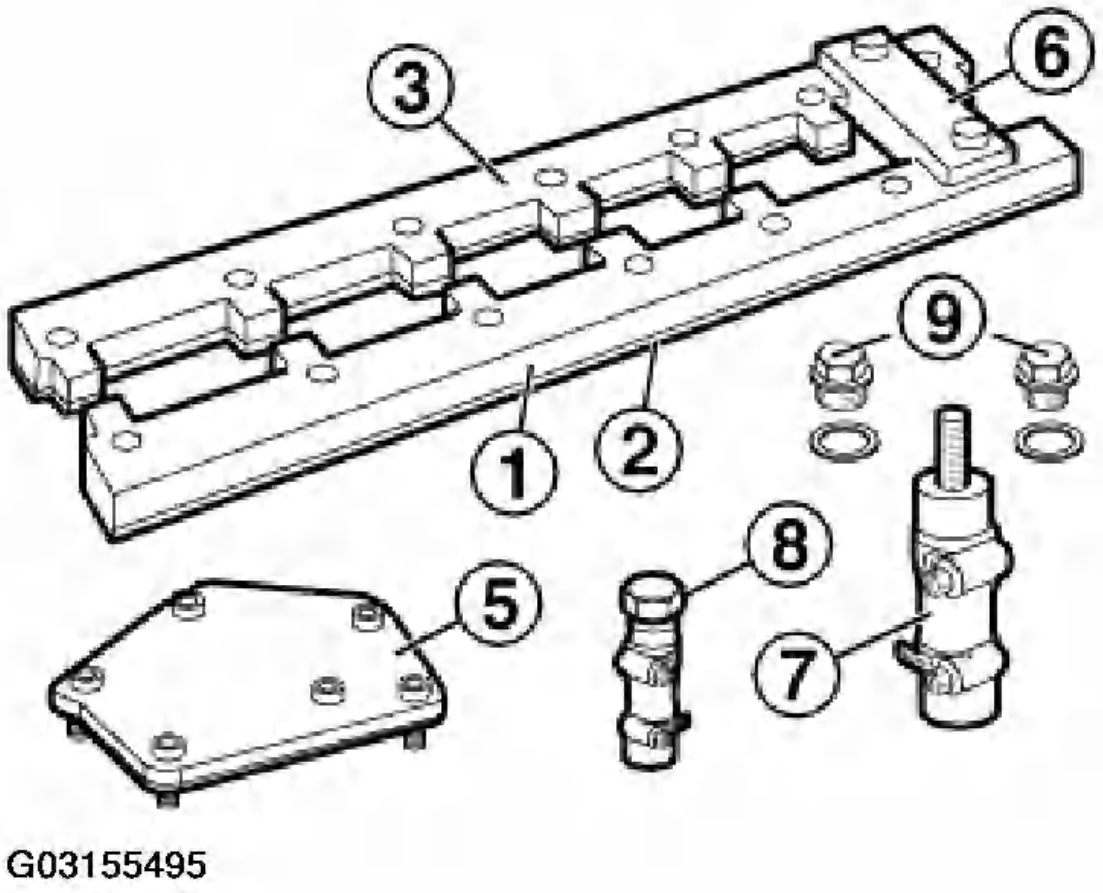



Fig. 12: Identifying Fixture
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 1 480 PLIERS

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For removing valve stem seal |
| Engine: | M40, M41, M42, M43, M44, M50, M51, M52, M52TU, M54, M56, M60, M62, M70, M73, N52, S38, S50B30, S50B32, S50US, S52US, S54, S62, W10, W11 |
| Storage location: | A10, B10 |
| SI number: | 1 01 93(621) |
| Order number: | 11 1 480 |
| Â | Pliers |

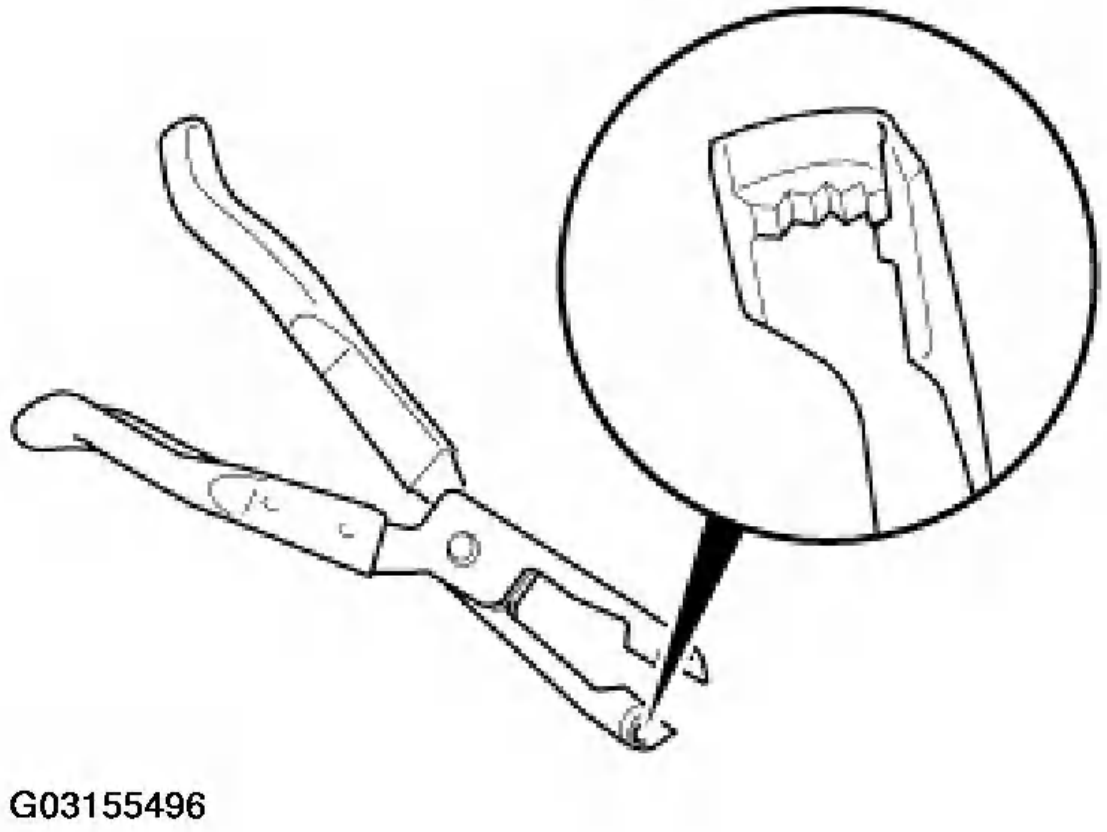



Fig. 13: Identifying Pliers
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 1 960 ASSEMBLY SLEEVES

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For fitting valve stem seals, 6 mm diameter |
| Â | Engine: M41, M42, M44, M47, M50, M51, M52, M52TU, M54, M56, M57, M57TU, M60, M62, S54, S62 |
| Order number: | 11 1 960 |
| Â | Assembly sleeves |

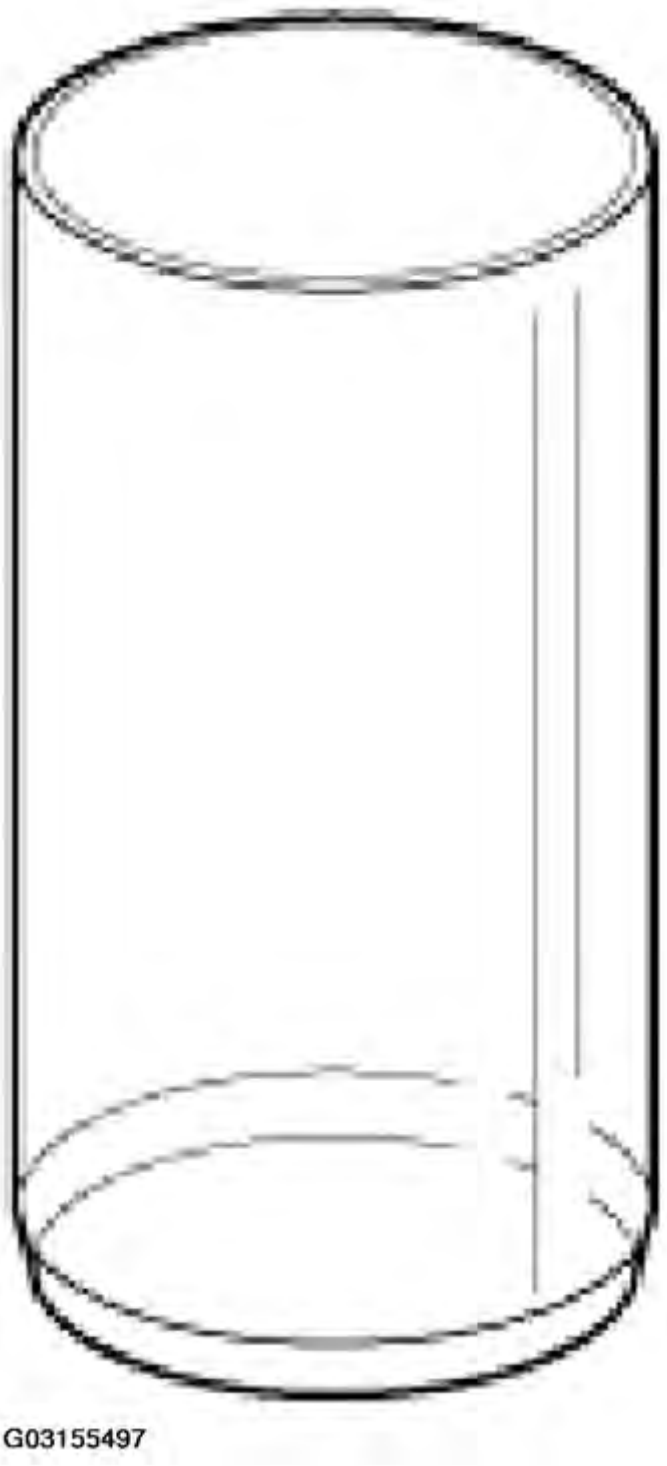



Fig. 14: Identifying Assembly Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 2 030 DRIFT

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 00 5 500 |
| Note: | For driving the guide bearing into the crankshaft (S14, S38, M10, M20, M21, M30, M40, M42, M50, M51 M52) and driving the centering support into |

| | |
|---|---|
| | the propeller shaft |
| Series: | E28, E30, E32, E34, E36, E38, E39, E46, E52, E65, E66, E85, E87, E90, RR1 |
| Storage location: | A28 |
| Order number: | 11 2 030 |
| Â | Drift |

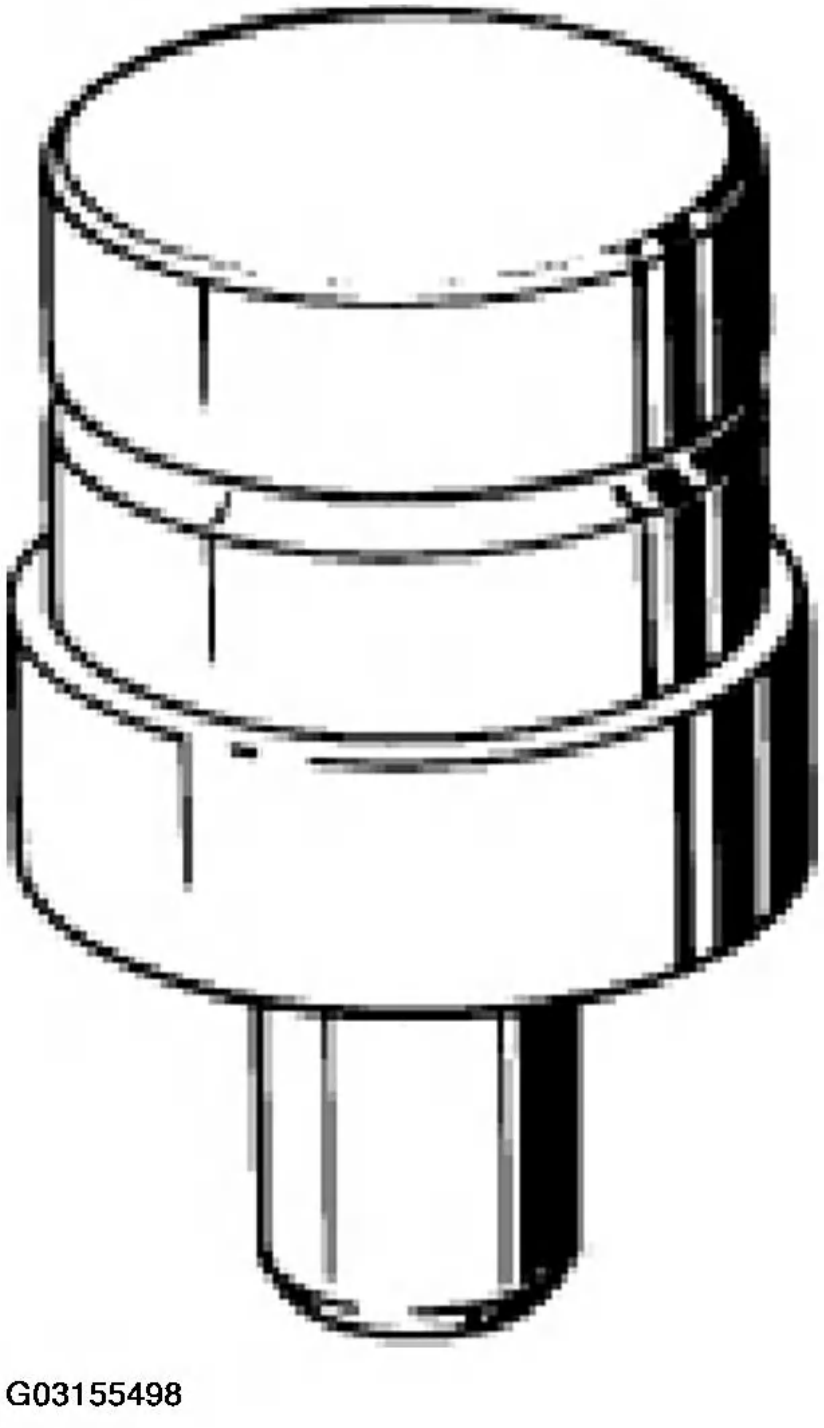



Fig. 15: Identifying Drift
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 2 050 GUIDE PINS

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For installing pistons for engines with M10x1.25 conrod bolts |
| Engine: | M21, M43, M43TU, M70, M73, N40, N42, N45, N46, S54 |
| Storage location: | A1, B1 |
| Order number: | 11 2 050 |
| Â | Guide pins |

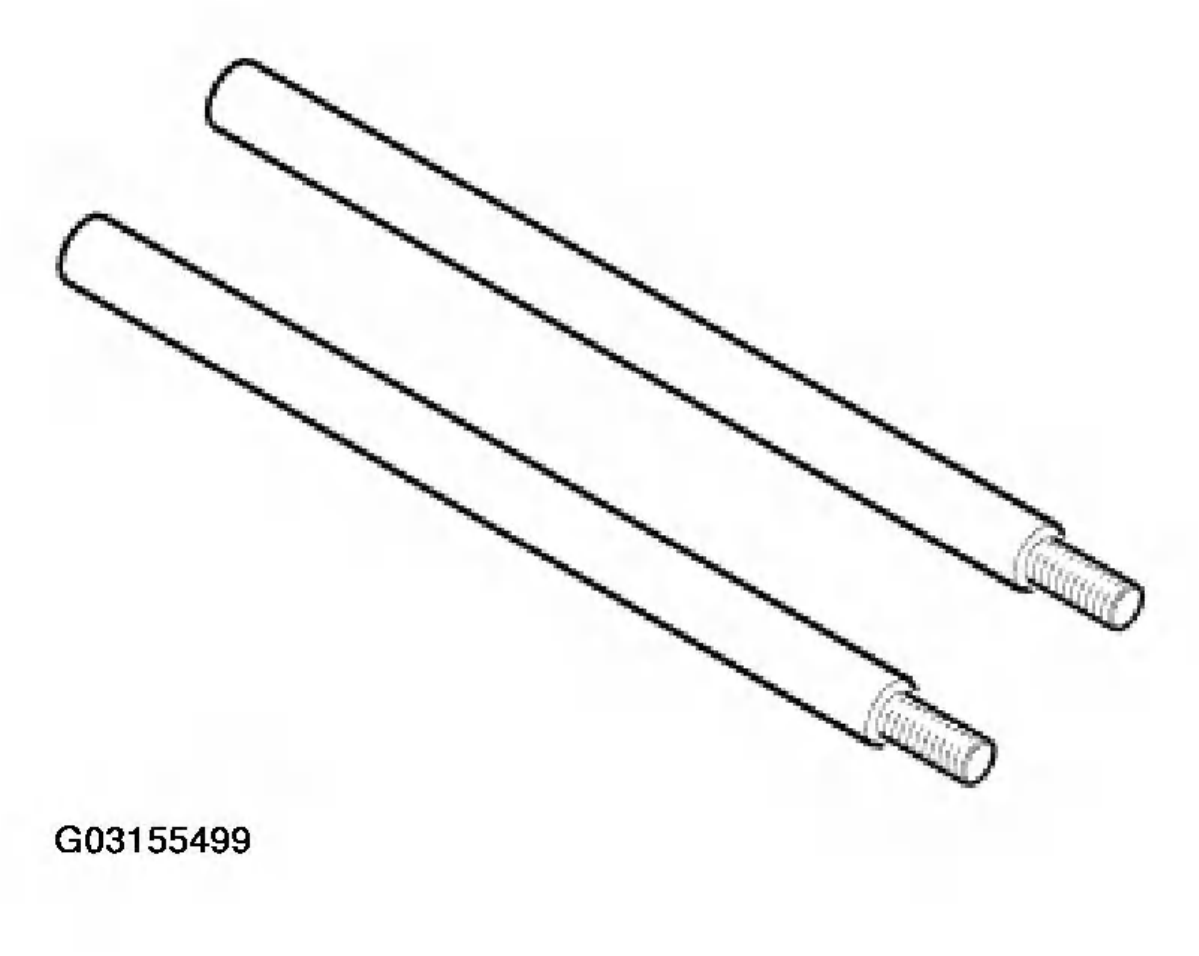



Fig. 16: Identifying Guide Pins
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 2 170 HOLDER

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For locking flywheel in position |
| Engine: | M20, M21, M40, M41, M42, M43, M44, M47, M47TU, M50, M51, M52, M52TU, M54, M56, M57, S50B30, S50B32, S54 |
| Storage location: | C4 |
| Order number: | 11 2 170 |
| Â | Holder |

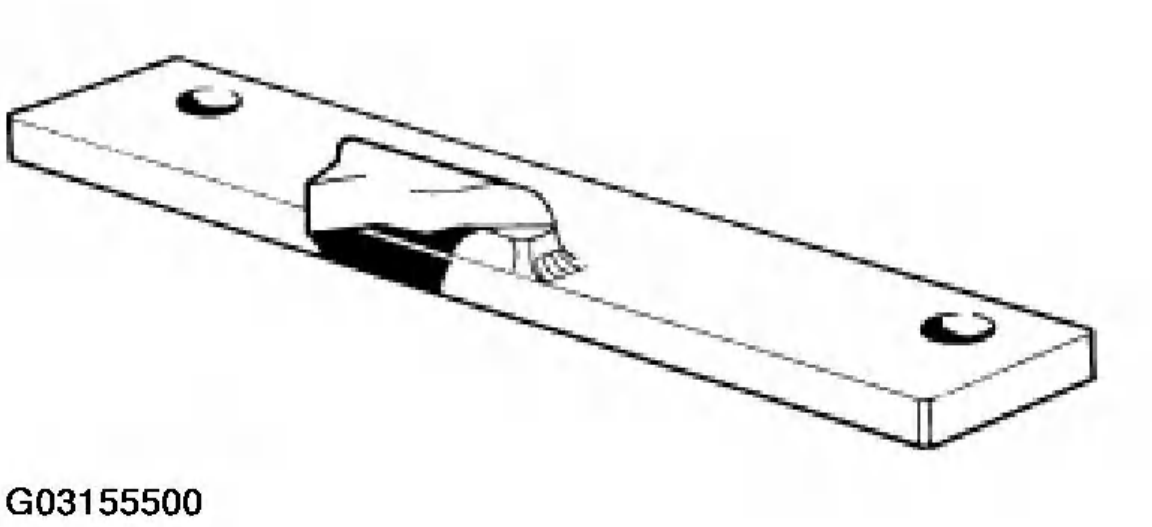



Fig. 17: Identifying Holder
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 2 300 PLUG MANDREL

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For locking crankshaft in ignition TDC position when adjusting timing |
| Engine: | M21, M40, M41, M42, M43, M43TU, M44, M47, M47TU, M50, M51, M52, M52TU, M54, M56, M57, M57TU, M60, M62, M70, M73, S50B30, S50B32, S54, S62 |
| Storage location: | C32 |
| Order number: | 11 2 300 |
| Â | Plug mandrel |




Fig. 18: Identifying Plug Mandrel
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 2 340 EXTRACTOR

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 11 2 016 (M60, M62) |
| Note: | For guide bearing in crankshaft, stem diameter 15 mm |
| Engine: | M41, M42, M43, M43TU, M44, M47, M47TU, |

| | |
|---|---|
| | M50, M51, M52, M52TU, M54, M56, M57, M57TU, M60, M62, M70, M73, N40, N42, N45, N46, S50B30, S50B32, S54, S62, S85 |
| Storage location: | C26 |
| SI number: | 1 05 90(207) |
| Order number: | 11 2 340 |
| Â | Extractor |
| Consisting of: | Â |
| 1 = 11 2 341 | Extractor claw with threaded bush |
| 2 = 11 2 342 | Extractor claw |
| 3 = 11 2 343 | Pressure spindle |
| 4 = 11 2 344 | Sleeve |

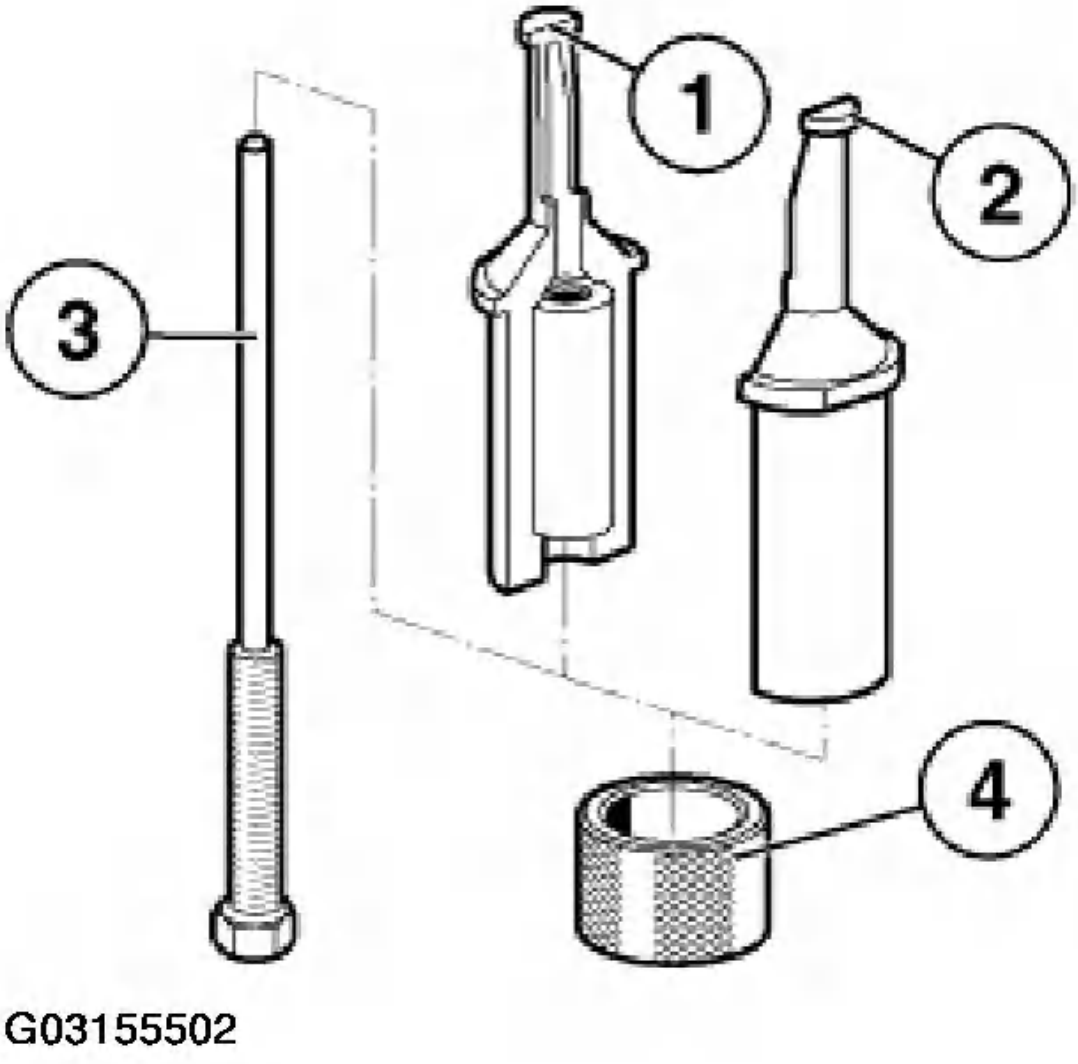



Fig. 19: Identifying Extractor
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 2 350 DRIFT

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For fitting guide bearing of crankshaft |
| Engine: | M41, M42, M43, M44, M47, M47TU, M50, M51, M52, M52TU, M54, M57, M57TU, M60, M62, M70, M73, N40, N42, N45, N46, S50B30, S50B32, S52US, S54, S62, S85 |
| Storage location: | A28 |
| SI number: | 1 05 90(207) |
| Order number: | 11 2 350 |
| Â | Drift |

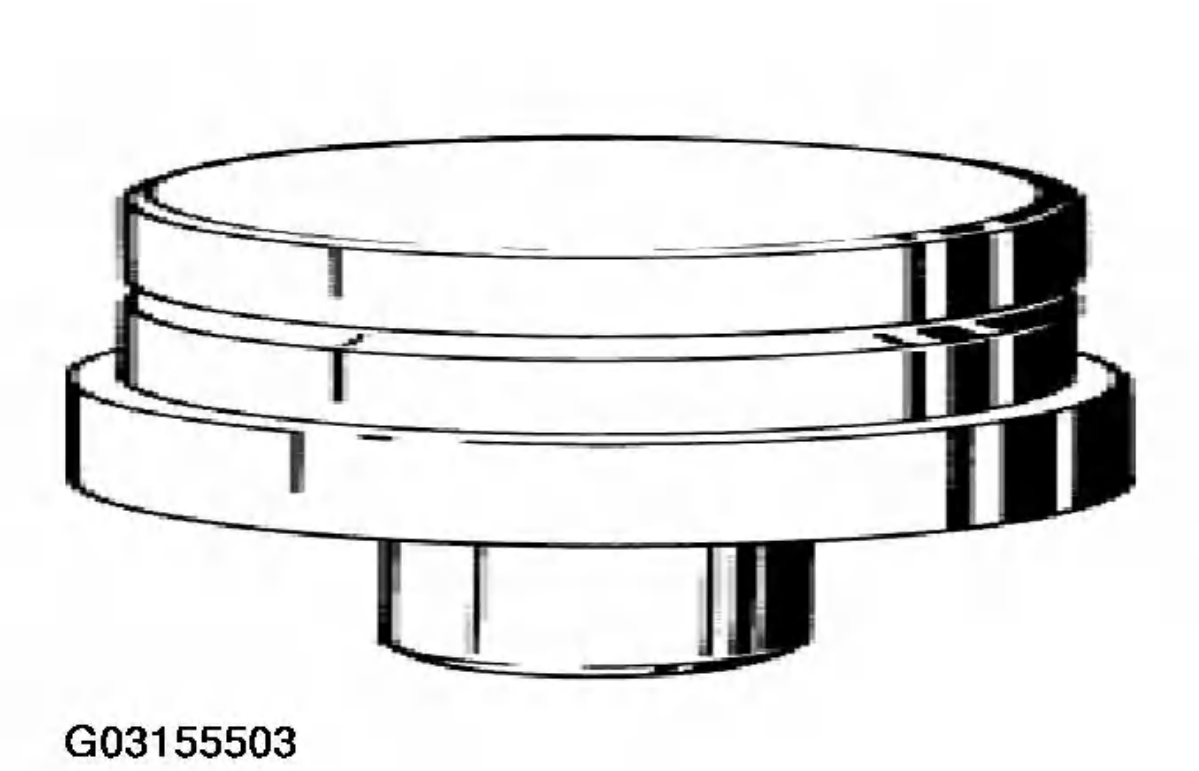



Fig. 20: Identifying Drift
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 2 380 PULLER

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For removing rotary shaft seal from timing case cover |
| Â | Engine: M41, M47, M50, M51, M52, M52TU, M54, M56, M60, M62, S50B30, S50B32, S54, S62, W10, W11 |
| Storage location: | A38, C25 |
| SI number: | 1 05 92(507) |
| Order number: | 11 2 380 |
| Â | Puller |
| Consisting of: | Â |
| 1 = 11 2 381 | Threaded bell housing |

| | |
|---|---|
| 2 = 11 2 382 | Spindle |
| 3 = 11 2 383 | Thrust piece |
| Â | NOTE:<br>Engine: M41, M47, M50, M51, M52, M60, M62, PENT |
| 11 2 384 | Thrust piece |
| Â | NOTE:<br>Engine: S50, S54 |
| 11 2 385 | Spacer bushing |
| Â | NOTE:<br>Engine: M41, M50, M51, M52 |
| 11 2 386 | Thrust piece |
| Â | NOTE:<br>Engine: S62 |

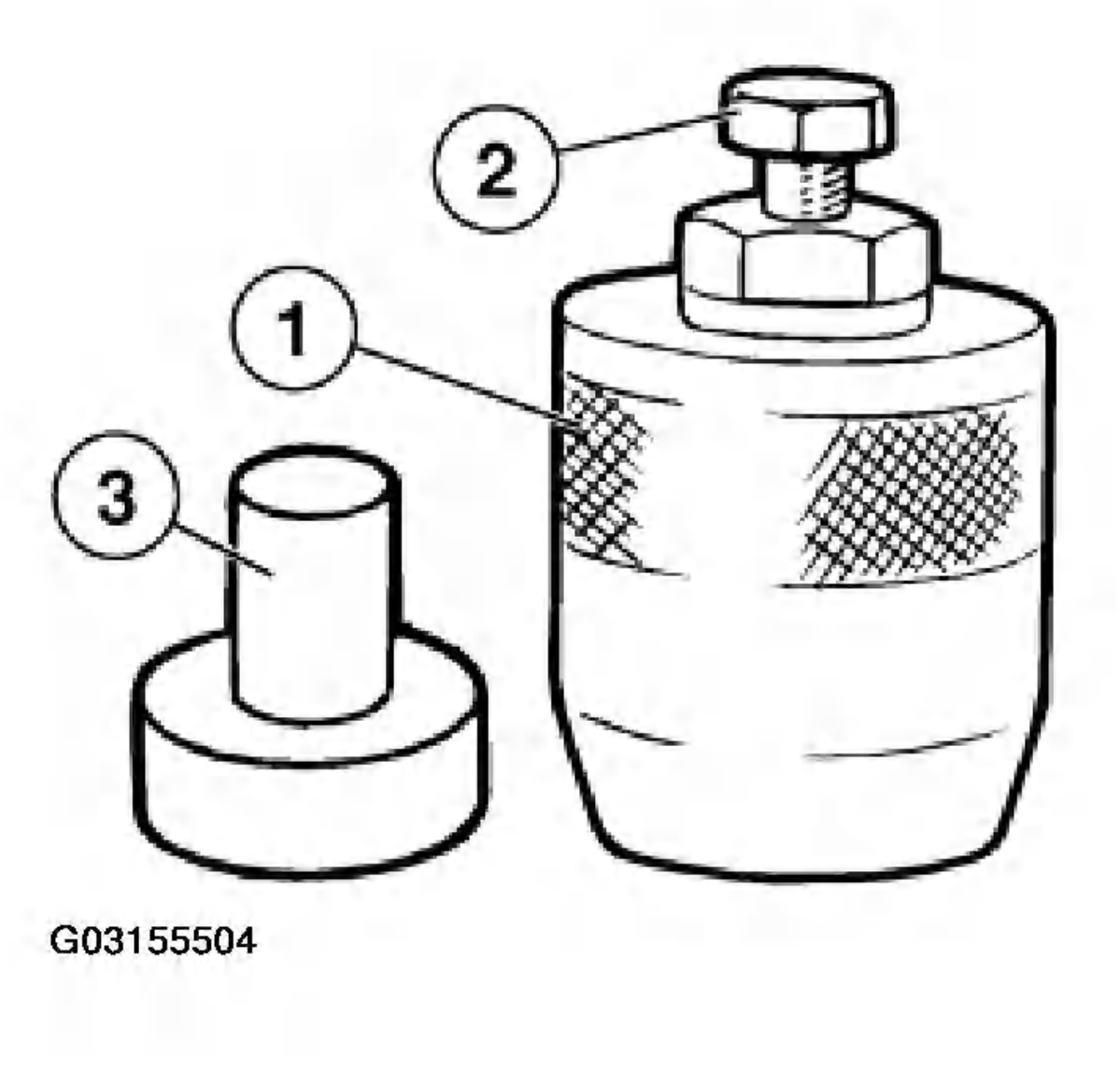



Fig. 21: Identifying Puller

Courtesy of BMW OF NORTH AMERICA, INC.

# 11 3 160 HOLDER WITH FEELER GAUGES

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For adjusting valves |
| Engine: | M88, S14, S38, S54 |
| Storage | location: B30, C30 |
| Order number: | 11 3 160 |
| Â | Holder with feeler gauges |
| Consisting of: | Â |
| 1 = 11 3 161 | Support bracket |
| 2 = 11 3 162 | Feeler gauges (5) |
| Â | NOTE:<br>0.25 / 0.30 / 0.35 / 0.40 / 0.45 mm |
| 3 = 11 3 163 | Feeler gauges (2) |
| Â | NOTE:<br>0.15 / 0.20 mm - engine: S54 |

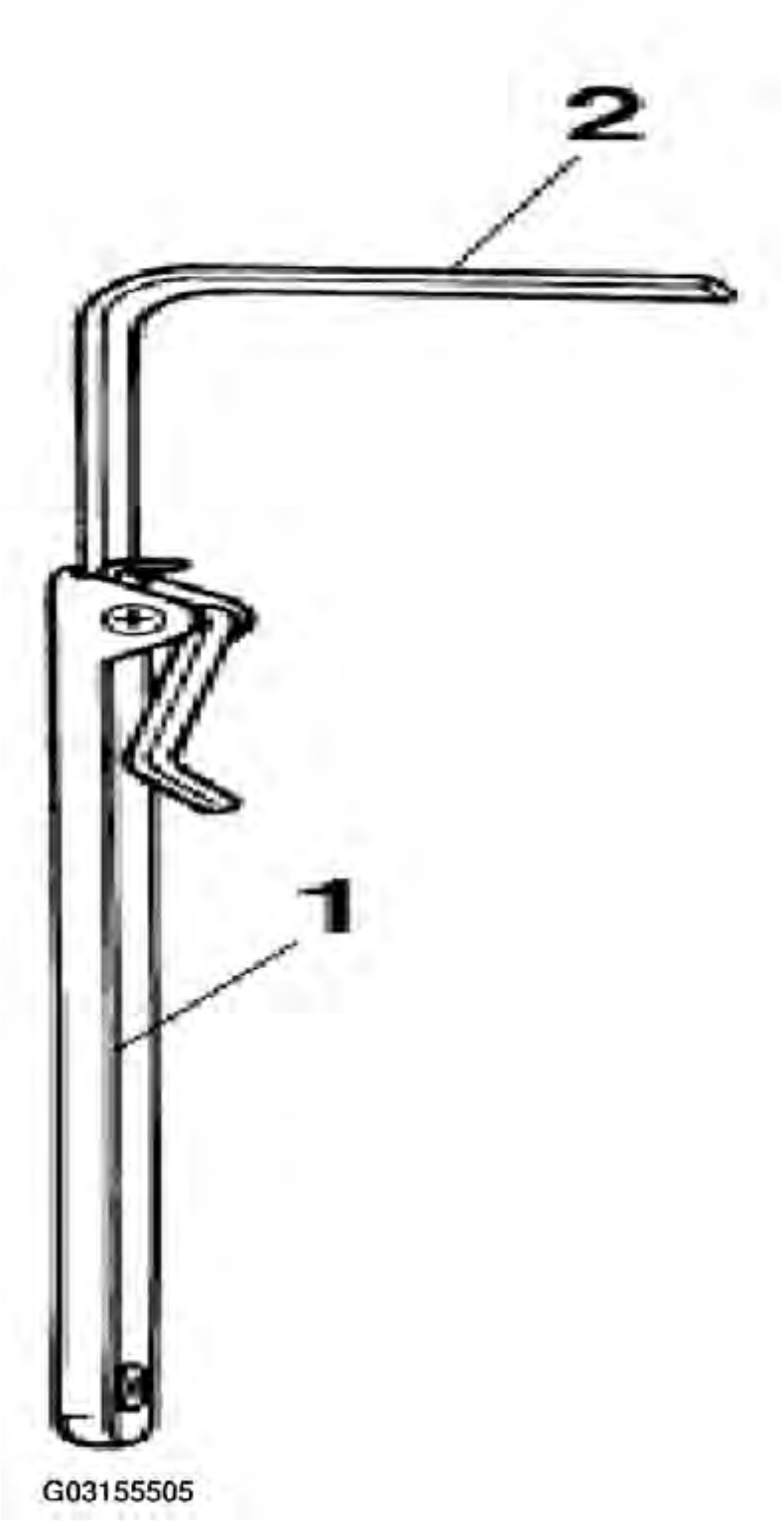



Fig. 22: Identifying Holder With Feeler Gauges
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 3 410 INSTALLATION ACCESSORY FOR VALVE SPRINGS

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 11 1 060 |
| Note: | For removing and installing valve springs |
| Engine: | S50B30, S50B32, S54 |
| SI number: | 1 12 92(606) |
| Order number: | 11 3 410 |
| | |

| | |
|---|---|
| Â | Installation accessory for valve springs |
| Consisting of: | Â |
| 1 = 11 3 411 | Placement board |
| 2 = 11 3 412 | Screws (2 x) |
| 3 = 11 3 413 | Hook |
| Â | NOTE:<br>Length 130 mm Engine: S50 |

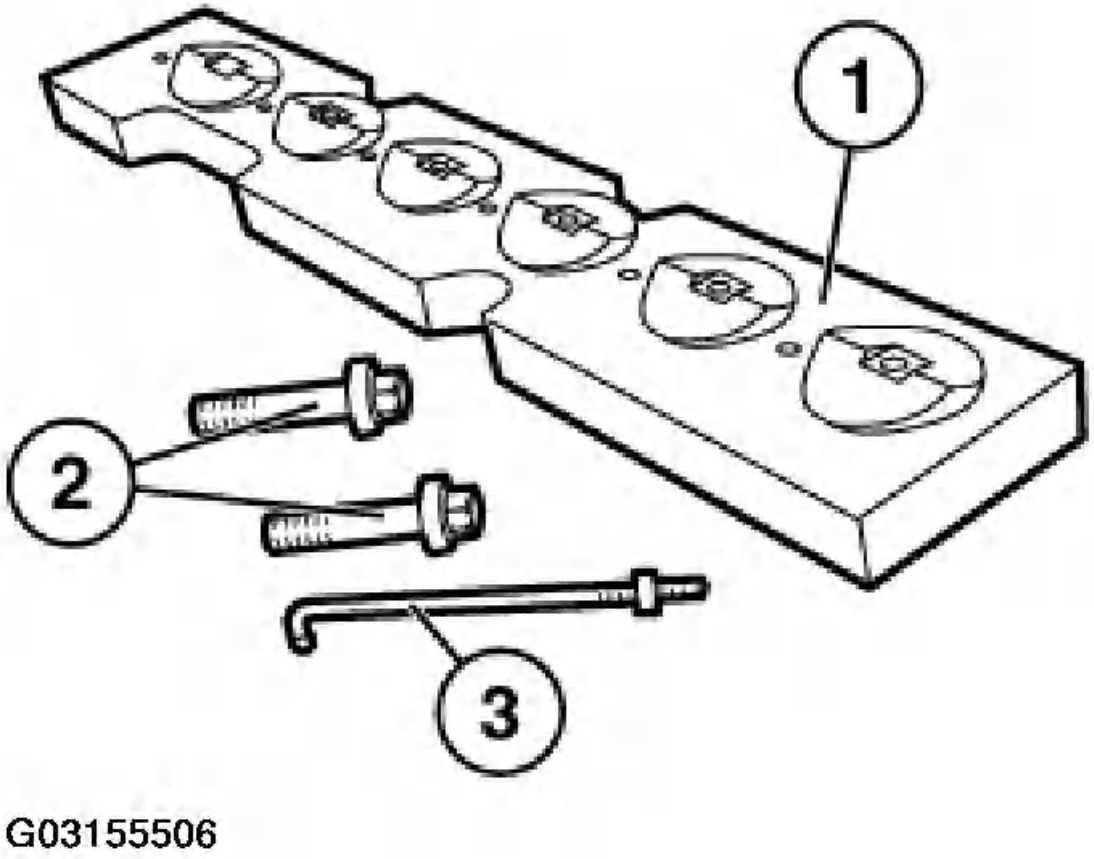



Fig. 23: Identifying Installation Accessory For Valve Springs
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 4 190 1/4" EXTENSION PIECE

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 11 3 390, 00 2 050 |
| Note: | M73 For removing and installing pedal travel sensor M60 Pretensioning timing chain E53 Mounting airbag control unit |
| Series: | All models |
| Storage location: | B6 |
| SI number: | 1 06 94(801) |
| | |

| | |
|---|---|
| Order number: | 11 4 190 |
| Â | 1/4" extension piece |

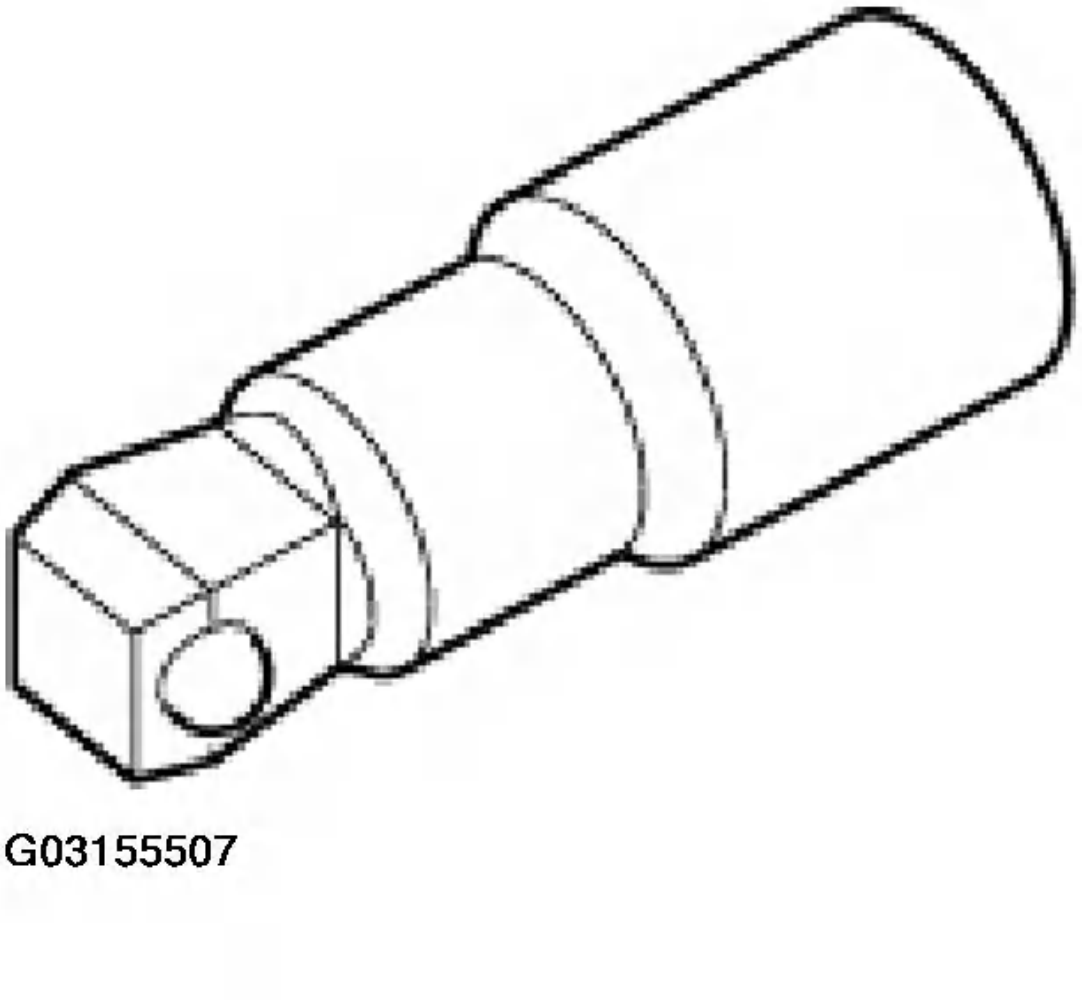



Fig. 24: Identifying 1/4" Extension Piece
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 4 380 PRESS-DOWN DEVICE

SPECIAL TOOL

| | |
|---|---|
| Note: | For pressing down camshaft |
| Engine: | S54 |
| SI number: | 1 15 00(609) |
| Order number: | 11 4 380 |
| Â | Press-down device |
| Consisting of: | Â |
| 1 = 11 4 381 | Device |
| 2 = 11 4 382 | Screws (2 x) |
| 3 = 11 4 383 | Screws (2 x) |

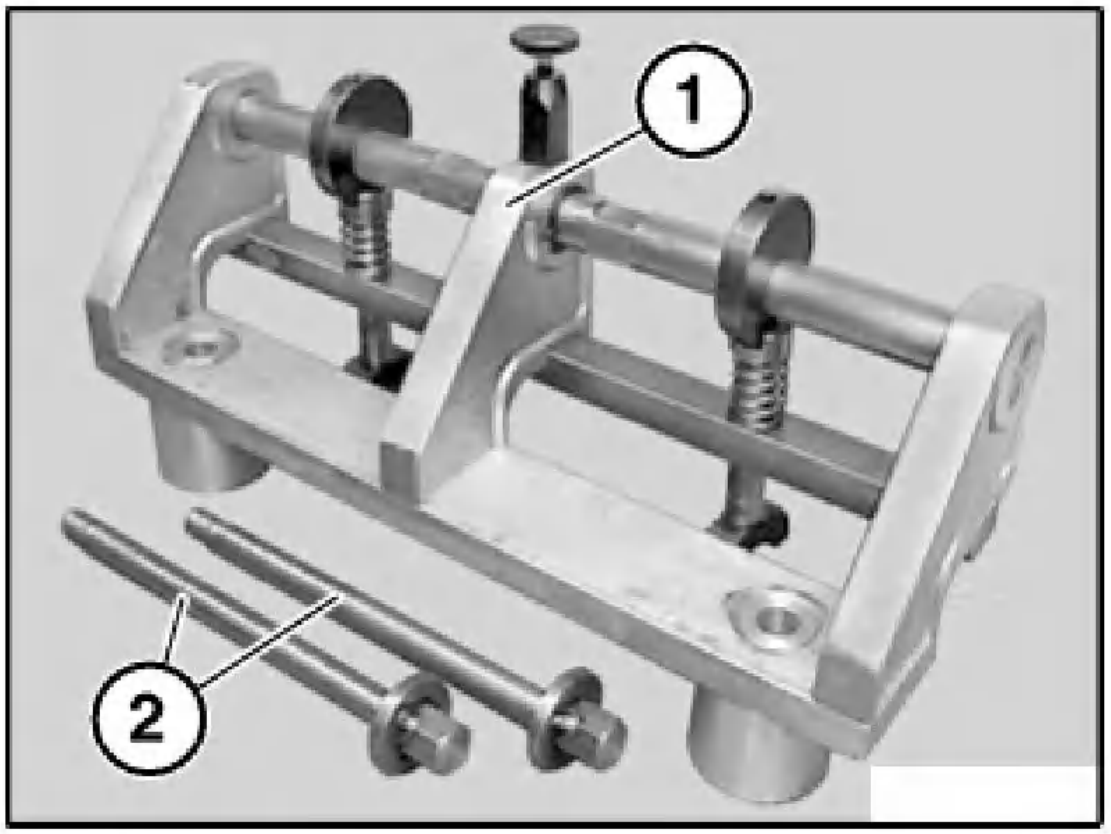



Fig. 25: Identifying Press-Down Device
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 4 390 ADAPTER SCREW

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 13 3 063 and 13 3 061 |
| Note: | For oil pressure testing |
| Engine: | S50B32, S54 |
| SI number: | 1 15 00(609) |
| Order number: | 11 4 390 |
| Â | Adapter screw |

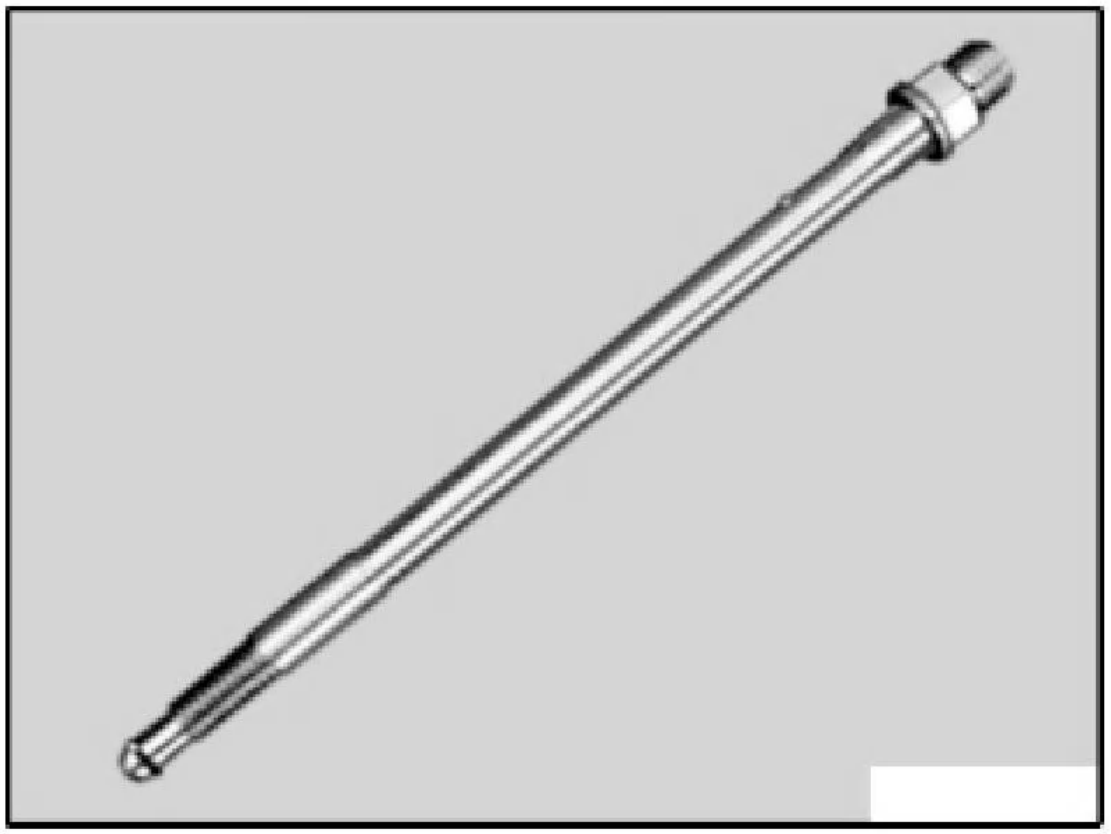
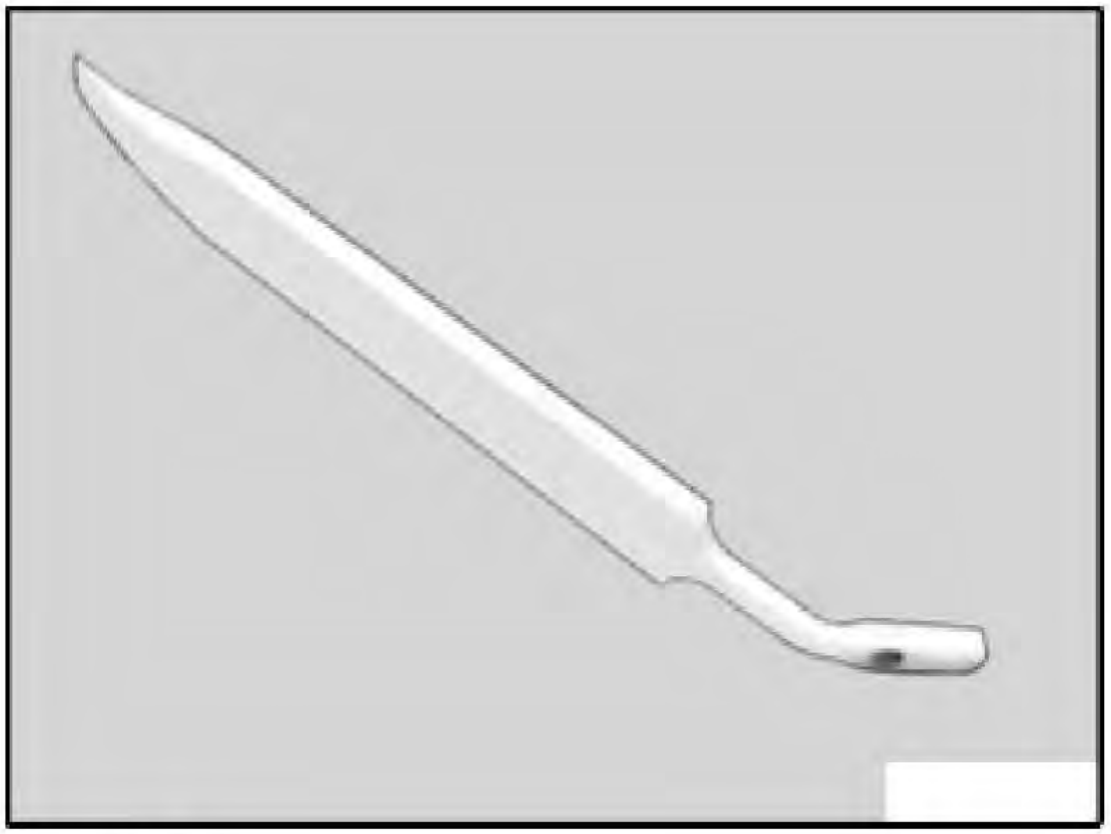



Fig. 26: Identifying Adapter Screw
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 4 400 HOLDER WITH MAGNET

SPECIAL TOOL

| | |
|---|---|
| Note: | For removing and installing valve adjustment plates |
| Engine: | S54 |
| SI number: | 1 15 00(609) |
| Order number: | 11 4 400 |
| Â | Holder with magnet |



G03155510

Fig. 27: Identifying Holder With Magnet
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 5 030 HOLDER

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For pulley on water pump when releasing and tightening fan / Model year: From 80 |
| Engine: | M10, M20, M21, M30, M50, M51, M52, M52TU, M54, M56, M70, M73, S14, S38, S50B30, S50B32, S54 |
| Storage location: | B3, C3 |
| Order number: | 11 5 030 |
| Â | Holder |




Fig. 28: Identifying Holder
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 5 040 OPEN-ENDED SPANNER WAF 32

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | Torque wrench 3/8" connection |
| Note: | For loosening and tightening fan wheel |
| Engine: | M10, M20, M21, M30, M40, M41, M42, M43, M44, M47, M47TU, M50, M51, M52, M52TU, |

| | |
|---|---|
| | M54, M56, M57, M60, M62, M70, M73, M88, N42, N62, S14, S38, S50B30, S50B32, S50US, S52US, S54, S62 |
| Storage location: | A11, B11 |
| SI number: | 1 01 87(670) |
| Order number: | 11 5 040 |
| Â | Open-ended spanner WAF 32 |

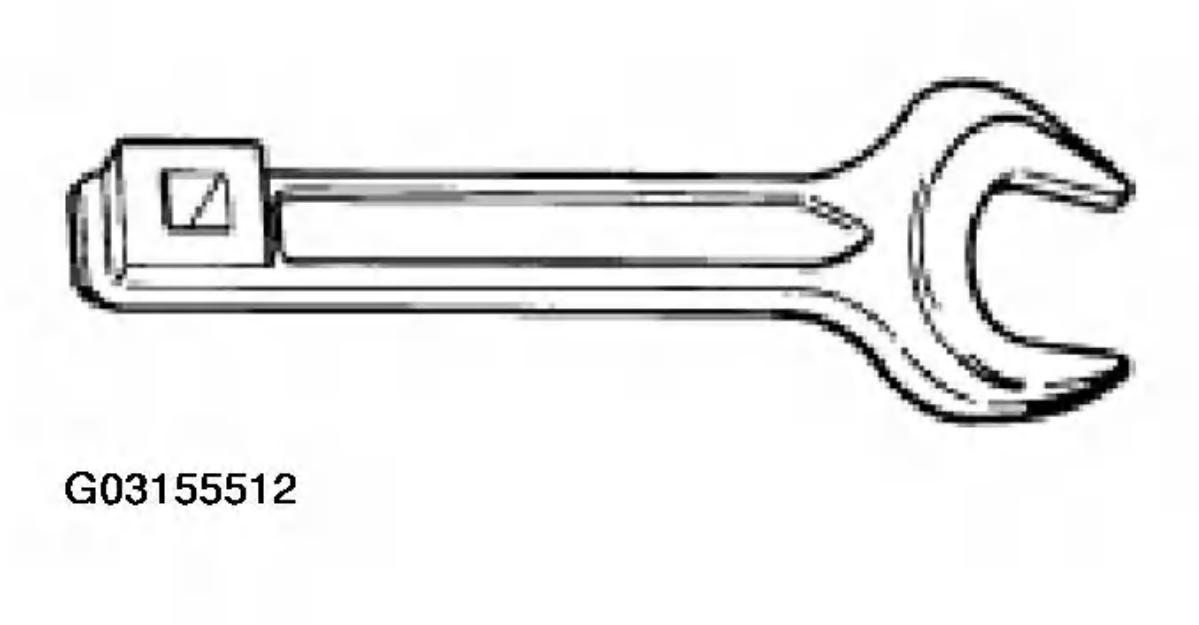



Fig. 29: Identifying Open-Ended Spanner WAF 32
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 5 090 FIXTURE

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 11 1 220 |
| Note: | For fitting rotary shaft seal on crankshaft in timing case cover |
| Engine: | S50B30, S50B32, S54 |
| Storage location: | A16 |
| SI number: | 1 12 92(606) |
| Order number: | 11 5 090 |
| Â | Fixture |

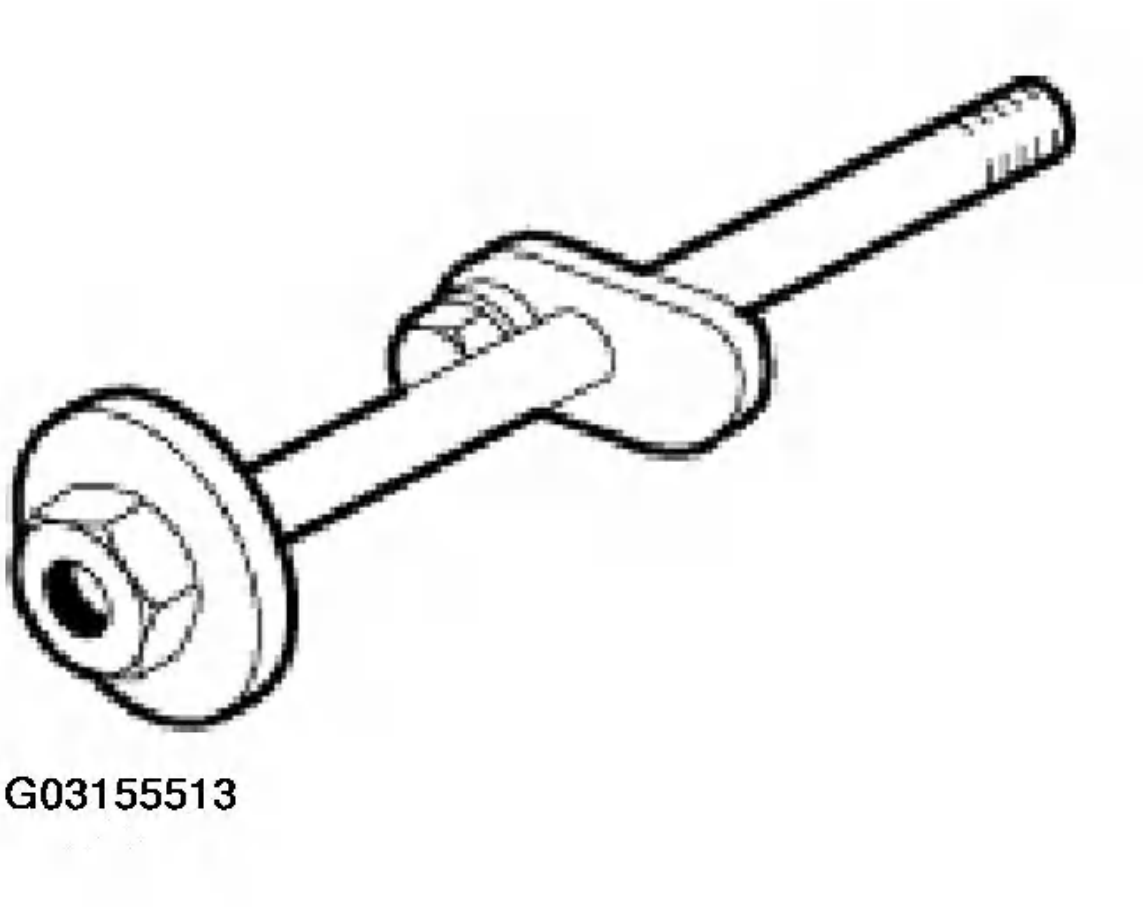



Fig. 30: Identifying Fixture
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 5 100 ADAPTER WITH SOCKET WRENCH

SPECIAL TOOL

| | |
|---|---|
| Note: | For turning over engine at crankshaft when adjusting valve timing |
| Engine: | S50B30, S50B32, S54 |
| Storage location: | A15 |
| SI number: | 1 12 92(606) |
| Order number: | 11 5 100 |
| Â | Adapter with socket wrench |

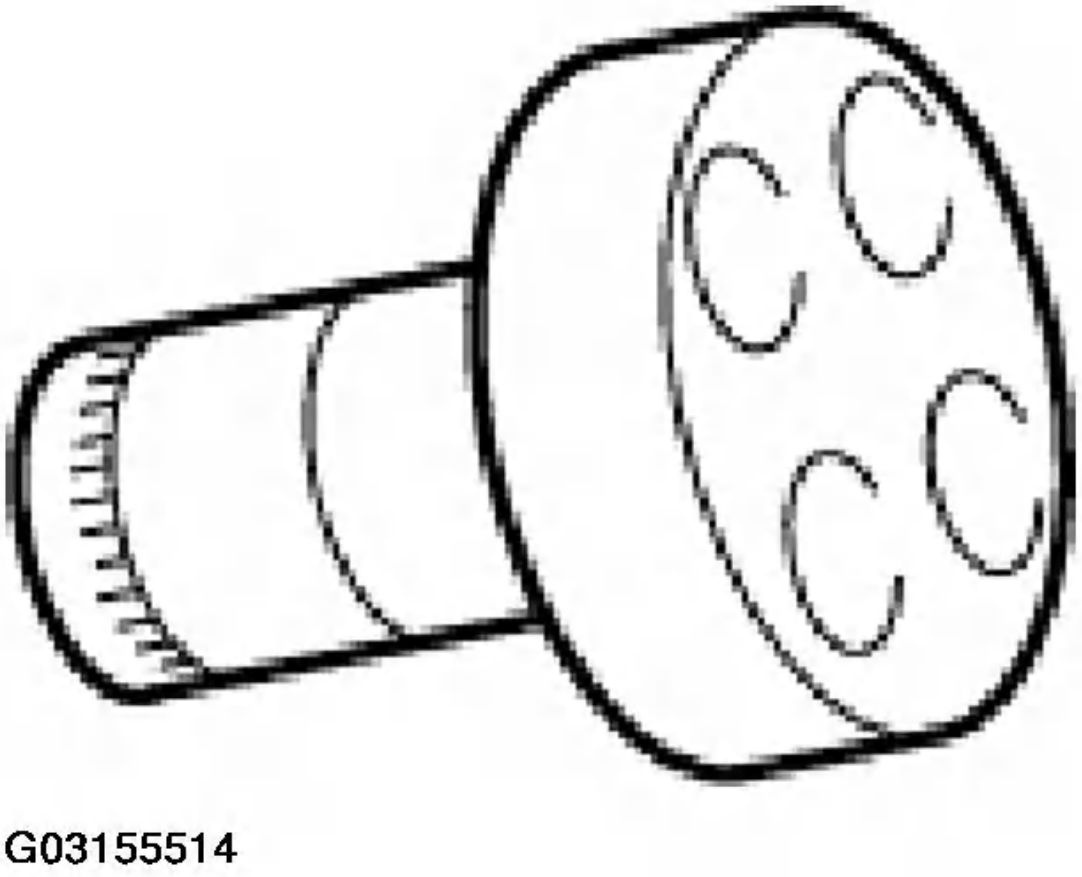



Fig. 31: Identifying Adapter With Socket Wrench
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 7 020 SOCKET WRENCH SOCKET WAF 22

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For loosening and tightening oxygen sensor |
| Engine: | M10, M20, M30, M40, M42, M50, M52TU, M54, M56, M57, M60, M70, M73, N42, N45, N46, S14, S38, S50B30, S50B32, S50US, S52US, S54 |
| Storage location: | C13 |
| Order number: | 11 7 020 |
| Â | Socket wrench socket WAF 22 |

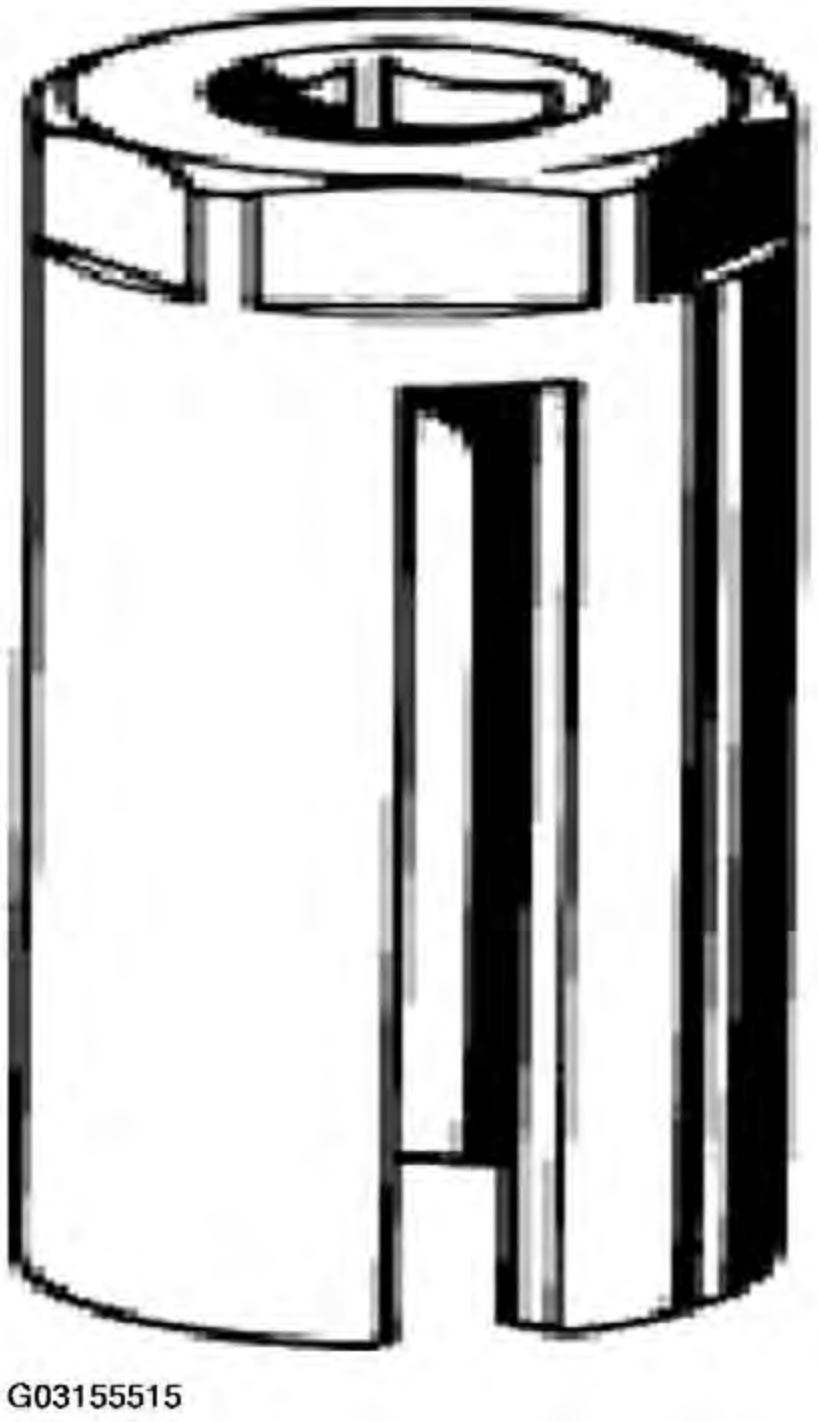



Fig. 32: Identifying Socket Wrench Socket WAF 22
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 7 030 SOCKET WRENCH SOCKET WAF 22

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| Note: | For loosening and tightening oxygen sensor |
| Engine: | M40, M43, M43TU, M44, M52, M52TU, M54, M56, M62, N40, N42, N45, N46, N62, N62TU, N73, S54, S62 |

| | |
|---|---|
| Storage location: | B15 |
| SI number: | 1 06 95(963) |
| Order number: | 11 7 030 |
| Â | Socket wrench socket WAF 22 |

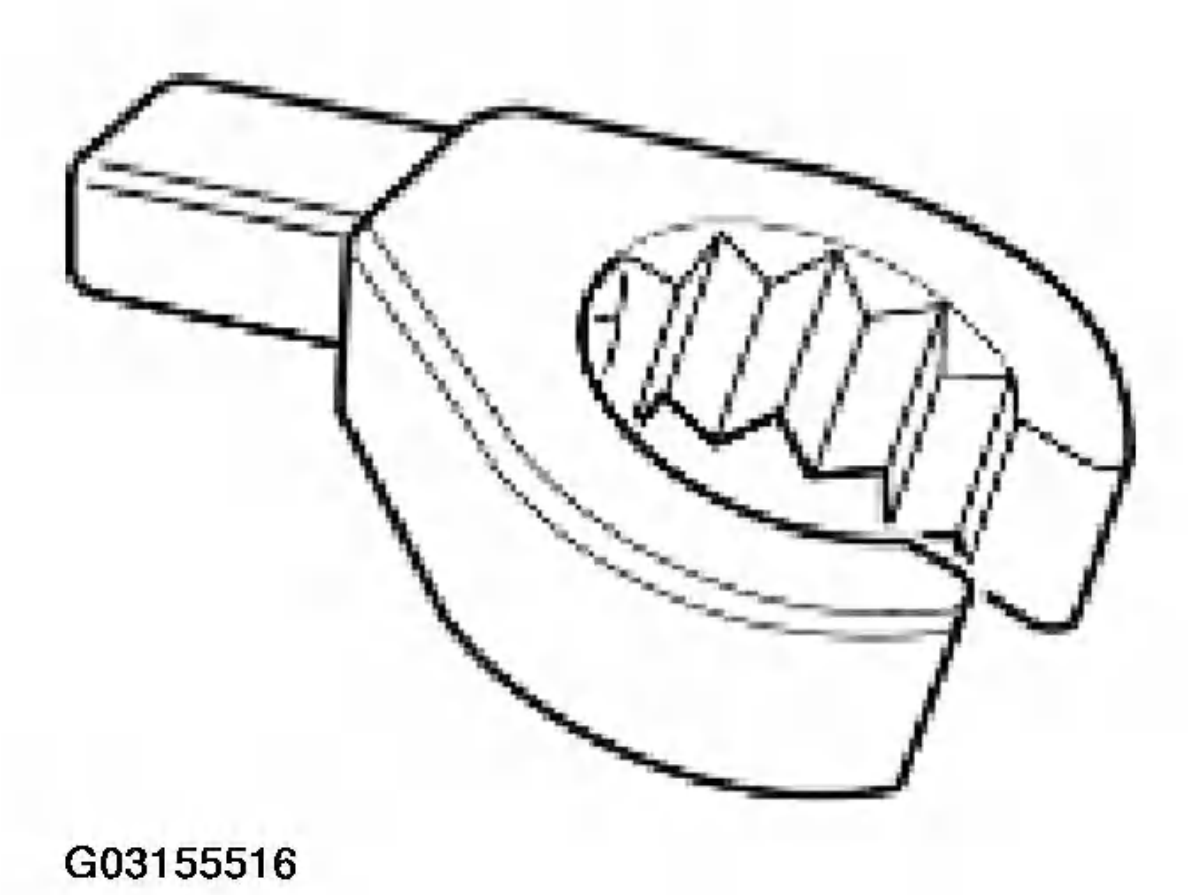



Fig. 33: Identifying Socket Wrench Socket WAF 22
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 7 130 CONNECTION PIECE

SPECIAL TOOL

| | |
|---|---|
| Note: | For compressed air hose for applying compressed air to VANOS unit during assembly |
| Engine: | S54, S62 |
| SI number: | 1 23 98(390) |
| Order number: | 11 7 130 |
| Â | Connection piece |

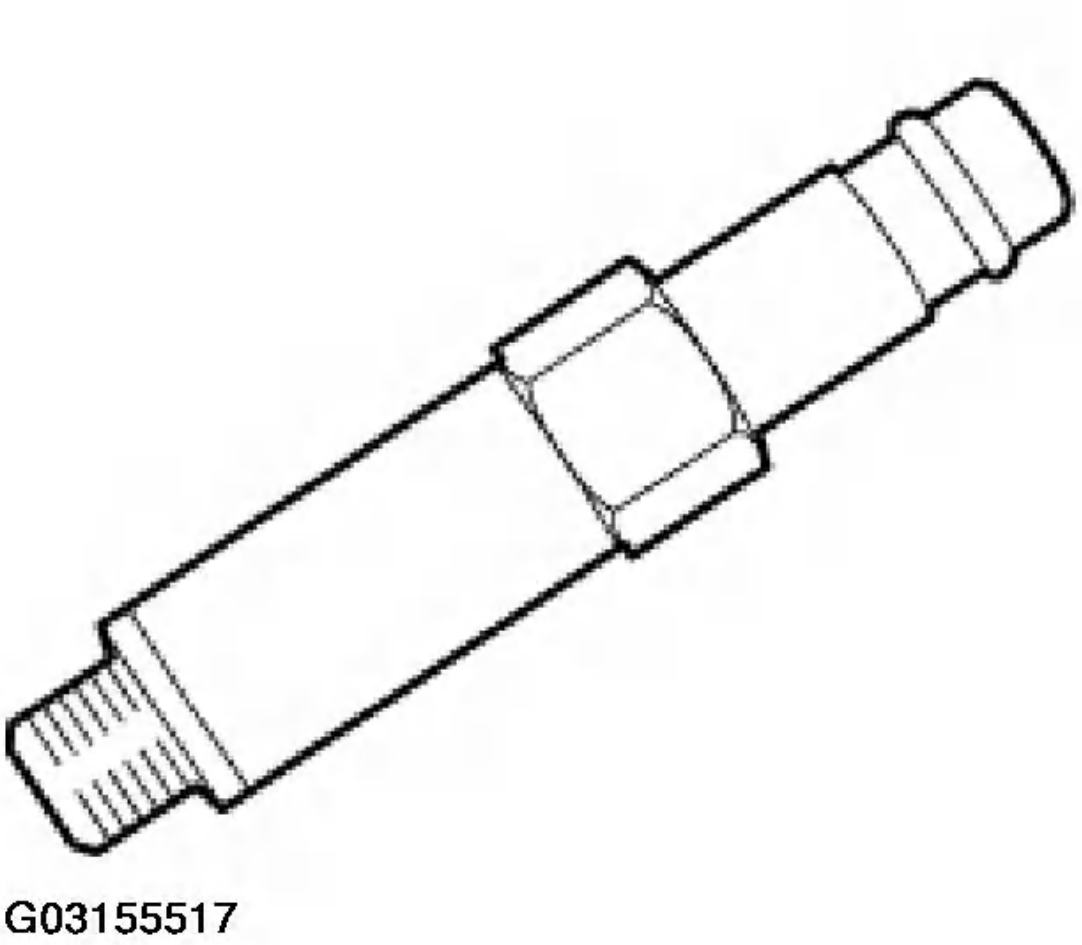



Fig. 34: Identifying Connection Piece
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 7 160 HOOK WRENCH

SPECIAL TOOL

| | |
|---|---|
| Note: | For adjusting spline hub on camshaft when fitting helical gearing of VANOS adjustment unit |
| Engine: | S54 |
| SI number: | 1 15 00(609) |
| Order number: | 11 7 160 |
| Â | Hook wrench |

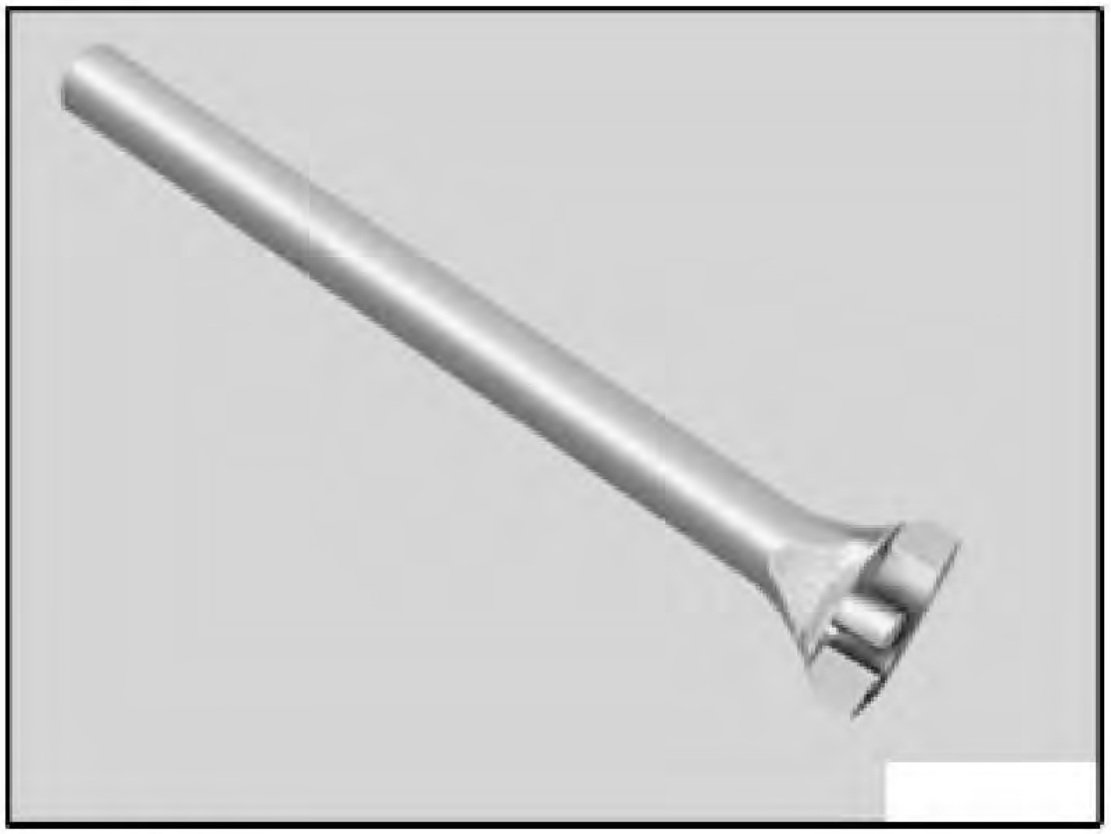



Fig. 35: Identifying Hook Wrench
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 7 200 PLUG-ON TOOL

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | Commercially available torque wrench |
| Note: | Open-ended spanner WAF 10 for tightening threaded connection of VANOS gear unit |
| Engine: | S54, S62 |
| SI number: | 1 23 98(390) |
| Order number: | 11 7 200 |
| Â | Plug-on tool |

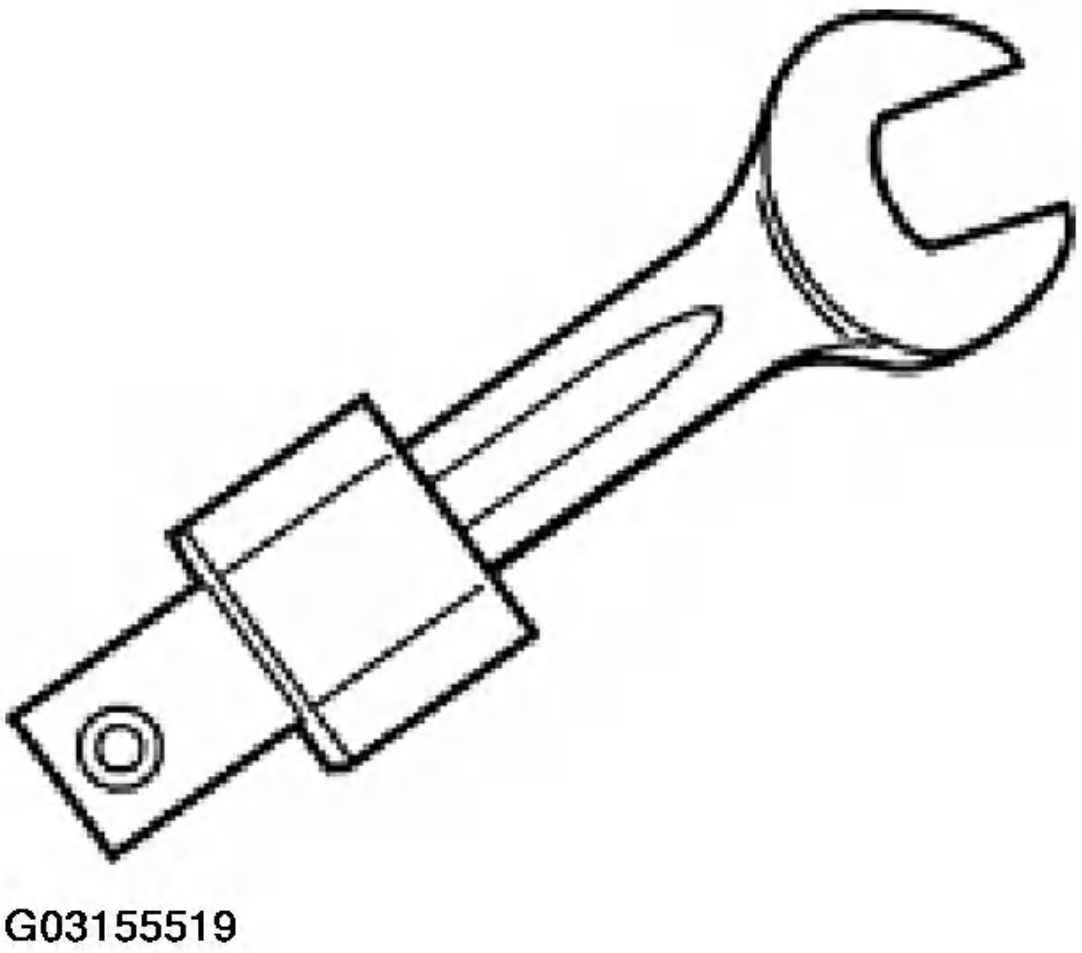



Fig. 36: Identifying Plug-On Tool
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 7 240 SLIP BUSH

SPECIAL TOOL

| | |
|---|---|
| Note: | For installing shaft seal in timing case cover |
| Engine: | S50B30, S50B32, S50US, S54 |
| Storage location: | B42 |
| SI number: | 1 15 00(609) |
| Order number: | 11 7 240 |
| Â | Slip bush |

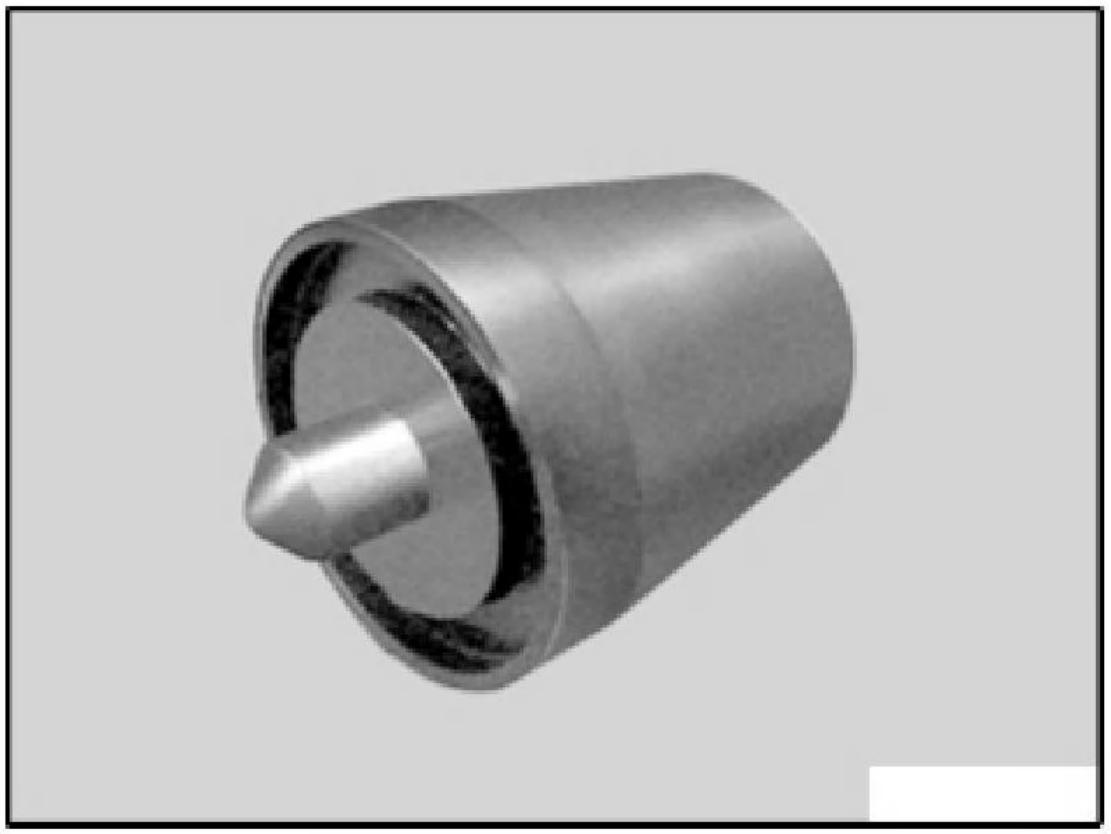



Fig. 37: Identifying Slip Bush
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 7 340 GAUGE (1.5Â°) WITH ALIGNMENT PIN

SPECIAL TOOL

| | |
|---|---|
| Note: | For setting camshaft lead angle (control diagram) when installing VANOS adjustment unit |
| Engine: | S50B32, S54 |
| Storage location: | B13 |
| SI number: | 1 07 95(964) |
| Order number: | 11 7 340 |
| Â | Gauge (1.5Â°) with alignment pin |
| Consisting of: | |
| 1 = 11 7 341 | Gauge 1.5Â° (basic body) |
| Â | NOTE:<br>Engine: S50 |
| 2 = 11 7 342 | Lock pin |
| Â | NOTE:<br>Engine: S50, S54 |

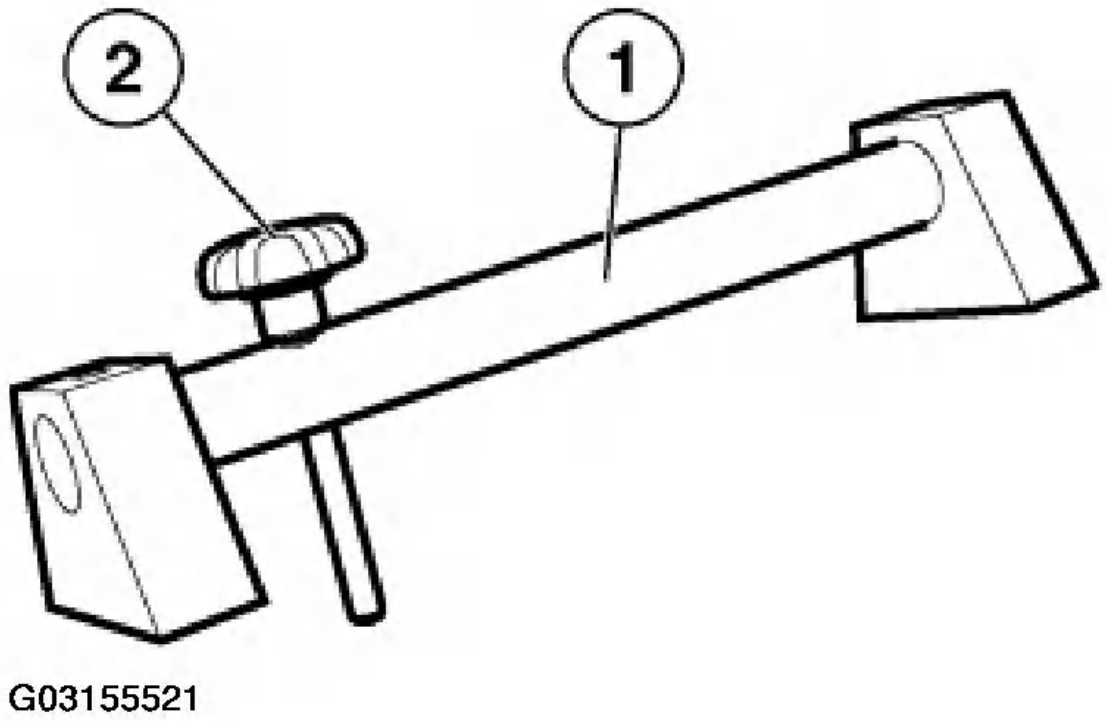



Fig. 38: Identifying Gauge (1.5Â°) With Alignment Pin
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 8 040 ENGINE SUPPORT PLATE

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 00 1 450 |
| Note: | For securing engine on assembly stand |
| Engine: | M41, M47, M47TU, M50, M51, M52, M52TU, M54, M56, M57, M57TU, S50B30, S50B32, S54 |
| SI number: | 1 09 94(839) |
| Order number: | 11 8 040 |
| Â | Engine support plate |

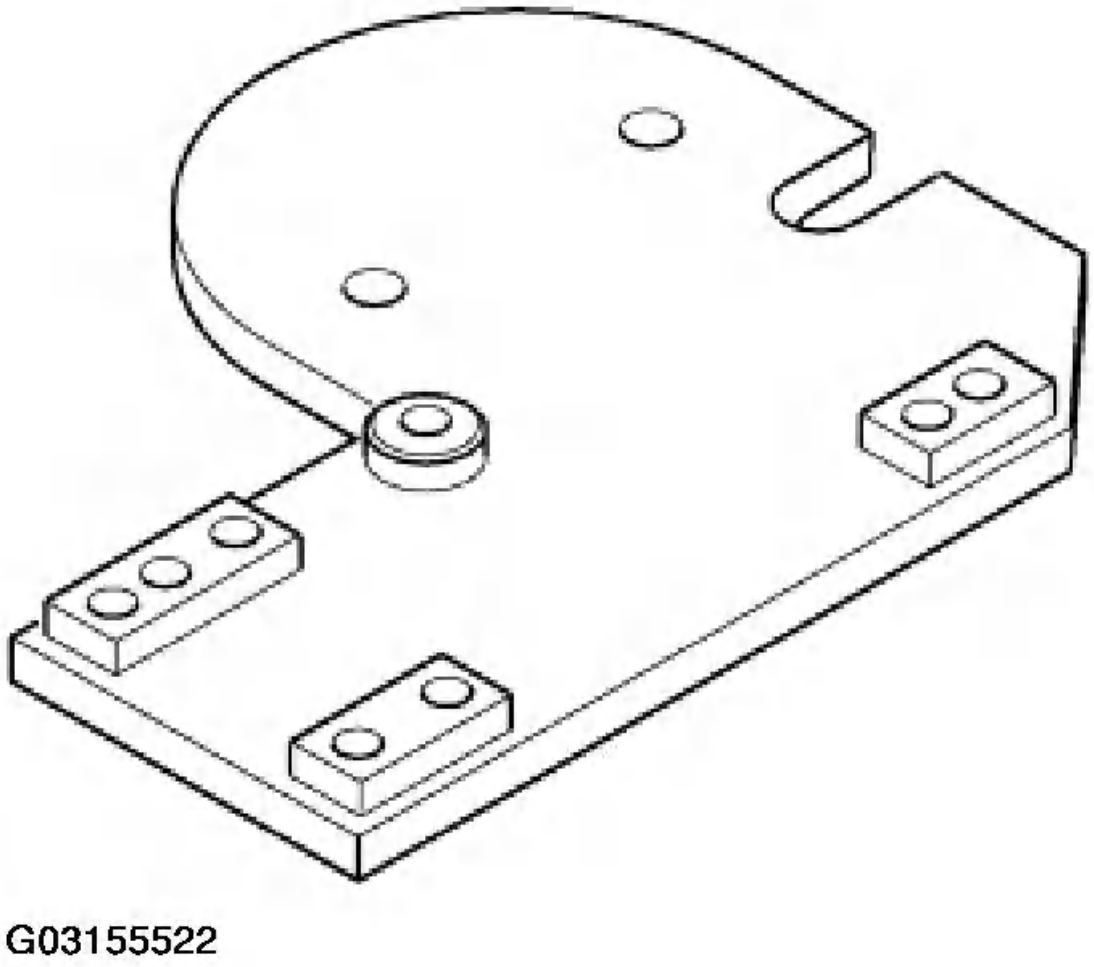



Fig. 39: Identifying Engine Support Plate
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 9 000 CYLINDER HEAD EXPANDER TOOL

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | Assembly stand 00 1 450 |
| Engine: | M10, M20, M20B25, M20B27, M21, M30, M30B34, M30Tur, M40, M41, M42, M43, M43TU, M44, M47, M47TU, M50, M51, M52, M52TU, M54, M56, M57, M57D25, M57D30, M57TU, M60, M62, M62VAN, M67, M70, M73, M88, N40, N42, N45, N46, N52, N62, N73, S14, S38, S50B30, S50B32, S50US, S52US, S54, S62, S85, W10, W11, W17 |
| Storage location: | Single |
| SI number: | 1 03 02 (833) |
| Order number: | 11 9 000 |
| Â | Cylinder head expander tool |
| Consisting of: | Â |
| | |

| | |
|---|---|
| 1 = 11 9 001 | Fixture |
| 2 = 11 9 002 | Rod |
| 3 = 11 9 003 | Sliding block with M10 thread |
| 4 = 11 9 004 | Tab |
| 5 = 11 9 005 | Quick tensioner |
| 6 = 11 9 006 | Aluminium profile insert |
| 7 = 11 9 007 | Slide |
| 8 = 11 9 008 | Profile plastic part |
| 9 = 11 9 009 | Lever |
| 10= 11 9 011 | Hook |
| 11= 11 9 012 | Valve spring cage |
| Â | NOTE:<br>Engine M41, M51, S50 |
| 12= 11 9 013 | Valve spring cage |
| Â | NOTE:<br>Engine M43, M73 |
| 13= 11 9 014 | Valve spring cage |
| Â | NOTE:<br>Engine M44, M52, M54, M56, M62, S52, S54, S62 |
| 14= 11 9 015 | Valve spring cage |
| Â | NOTE:<br>Engine M47, M47TU, M57, M57TU, N40, N42, N62, N73 |
| 15= 11 9 016 | Valve spring cage |
| Â | NOTE:<br>Engine M21, M40 |
| 16= 11 8 421 | Valve spring cage |
| Â | NOTE:<br>Engine: W10, W11, W17 |
| 18= 11 9 017 | Valve spring cage |
| Â | NOTE:<br>Engine N52 |

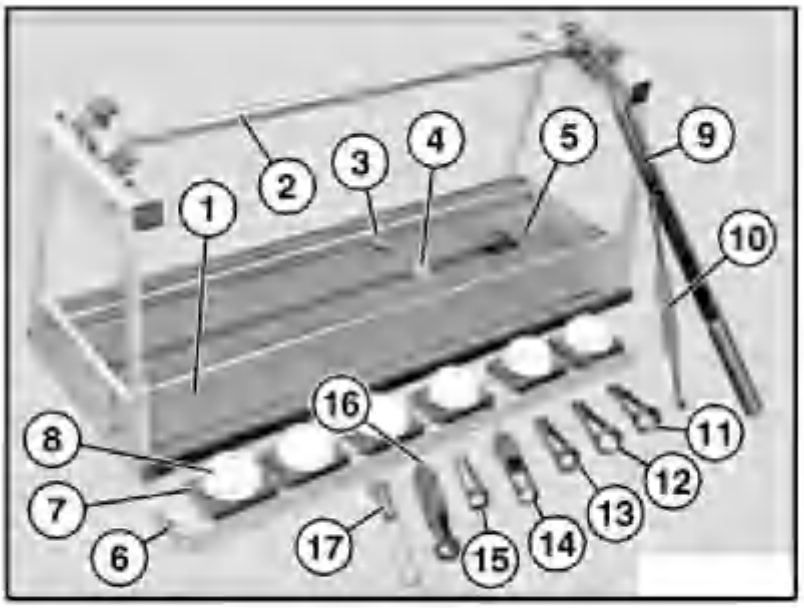



Fig. 40: Identifying Cylinder Head Expander Tool
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 9 120 PISTON PLIERS

SPECIAL TOOL

| | |
|---|---|
| Note: | For piston installation - new piston diameter 87.0 mm |
| Engine: | S54 |
| SI number: | 1 15 00(609) |
| Order number: | 11 9 120 |
| Â | Piston pliers |

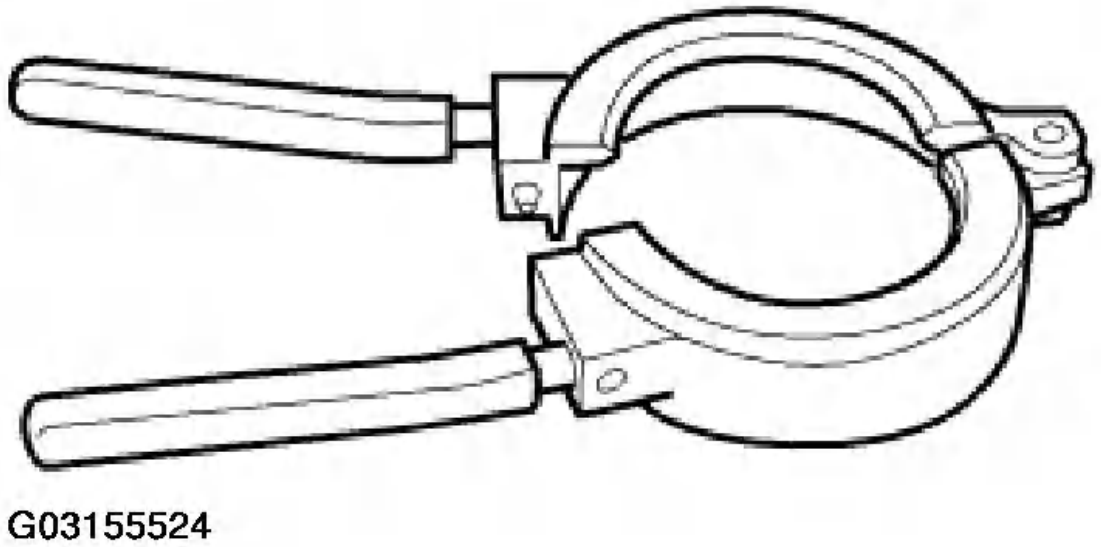


Fig. 41: Identifying Piston Pliers
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 9 130 SETTING GAUGE

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 11 7 342 |
| Note: | With correction angle for control diagram |
| Engine: | S54 |
| SI number: | 1 15 00(609) |
| Order number: | 11 9 130 |
| Â | Setting gauge |

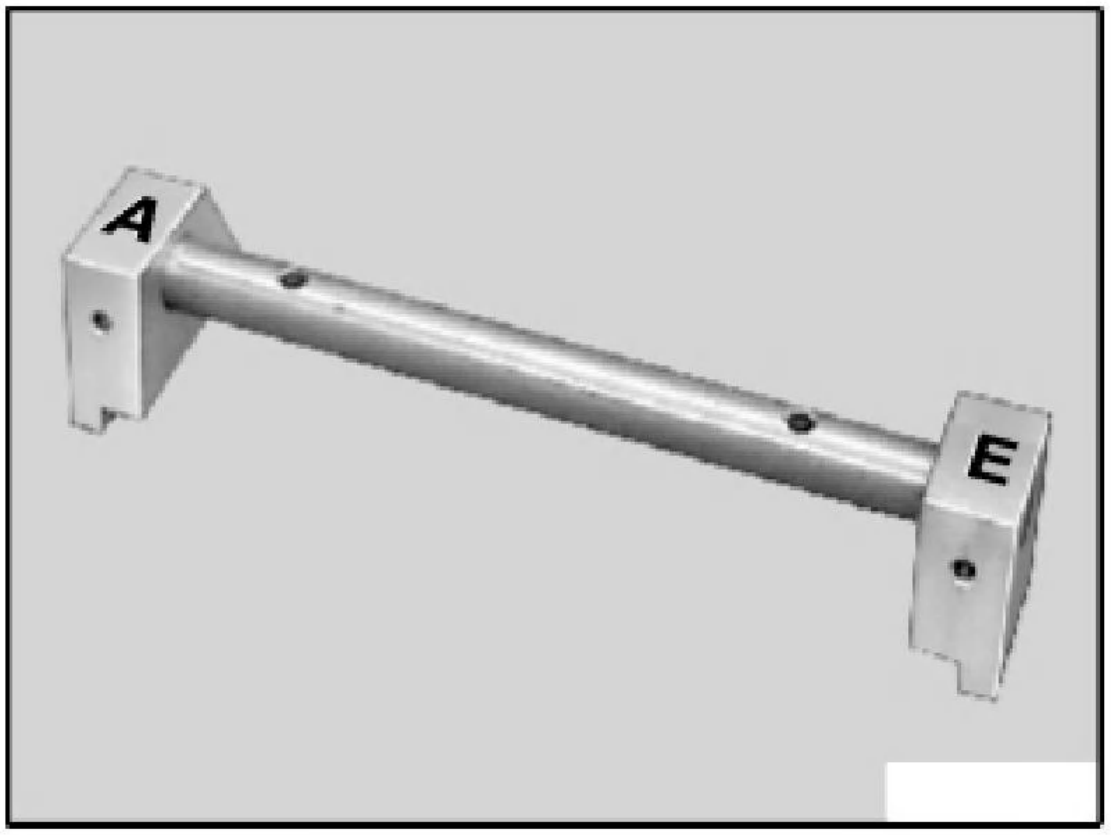



Fig. 42: Identifying Setting Gauge
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 9 140 GAUGE

SPECIAL TOOL

| | |
|---|---|
| Note: | For control diagram |
| Engine: | S54 |
| SI number: | 1 15 00(609) |
| Order number: | 11 9 140 |
| Â | Gauge |

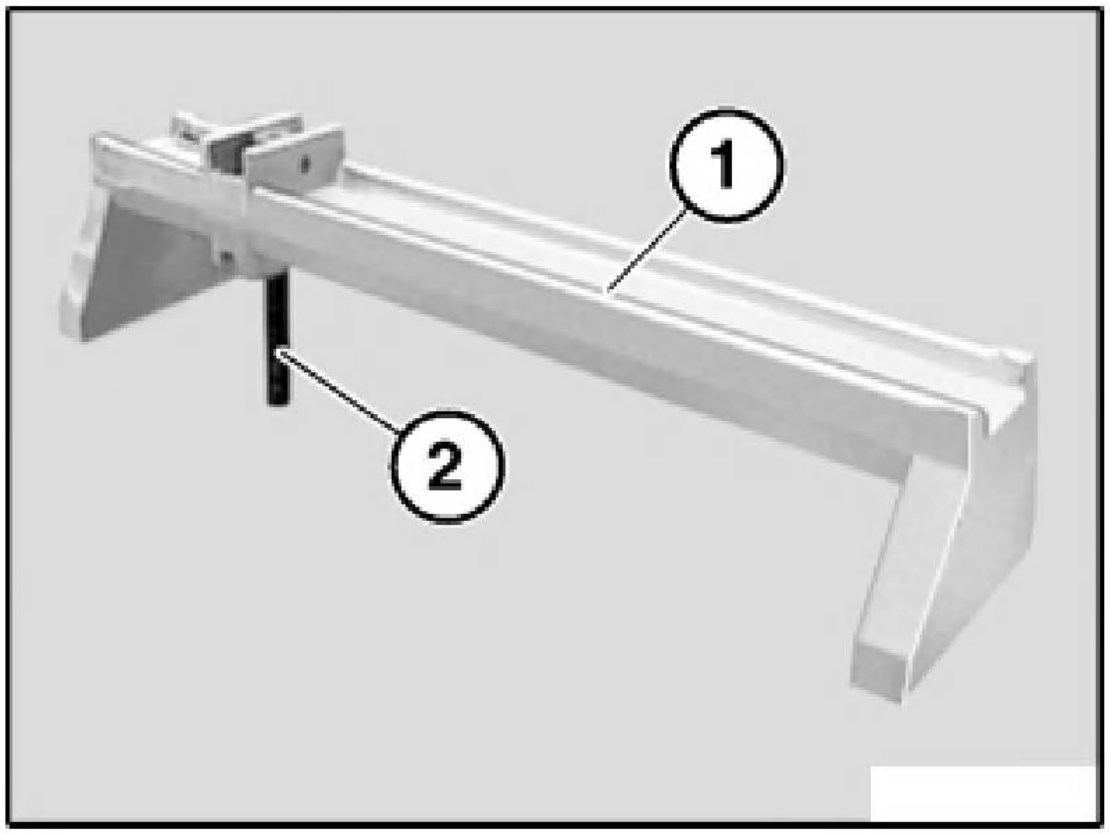



Fig. 43: Identifying Gauge
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 9 150 SPECIAL WRENCH

Minimum set: Mechanical tools

SPECIAL TOOL

| | |
|---|---|
| In conjunction with: | 11 7 030 |
| Note: | For releasing and tightening down oxygen sensors |
| Engine: | M54, M56, N42, N45, N46, N62, N62TU, N73, S54 |
| Storage location: | A42 |
| SI number: | 01 15 00 (609) |
| Order number: | 11 9 150 |
| Â | Special wrench |

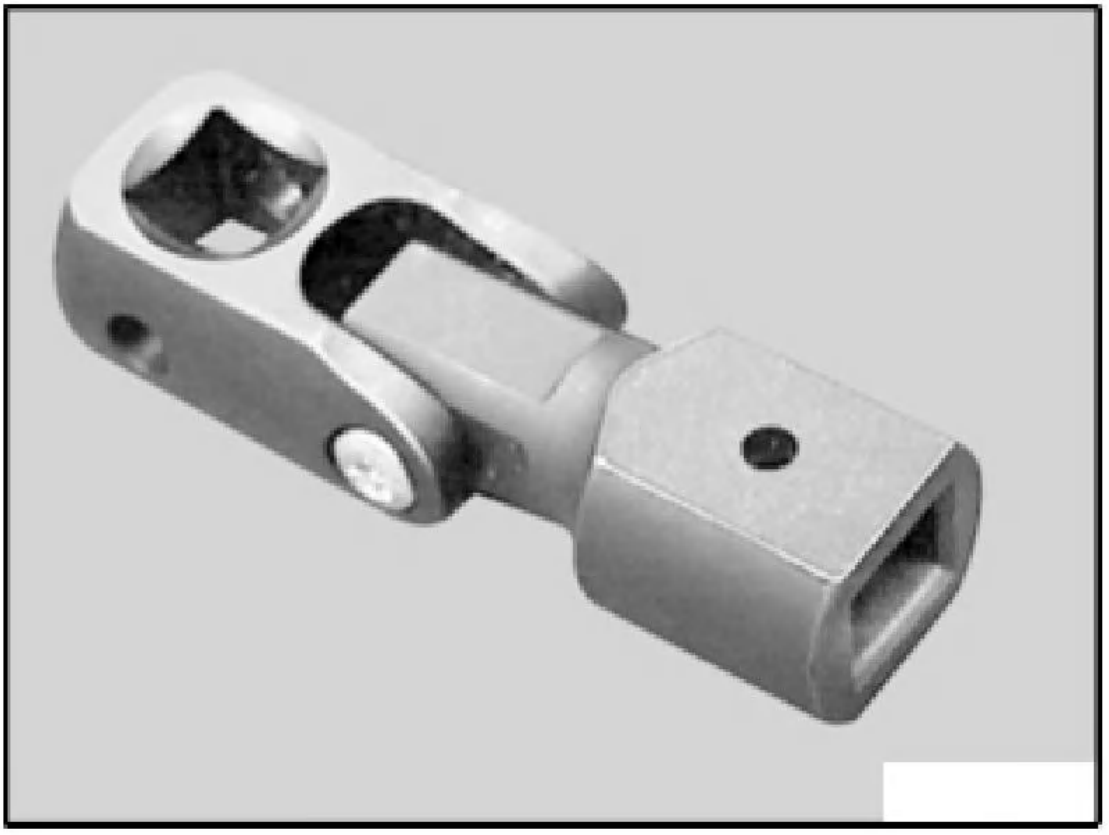



Fig. 44: Identifying Special Wrench
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 9 160 PLIERS

SPECIAL TOOL

| | |
|---|---|
| Note: | For opening and closing hose clips on intake manifold |
| Engine: | S54 |
| SI number: | 1 15 00 (609) |
| Order number: | 11 9 160 |
| Â | Pliers |

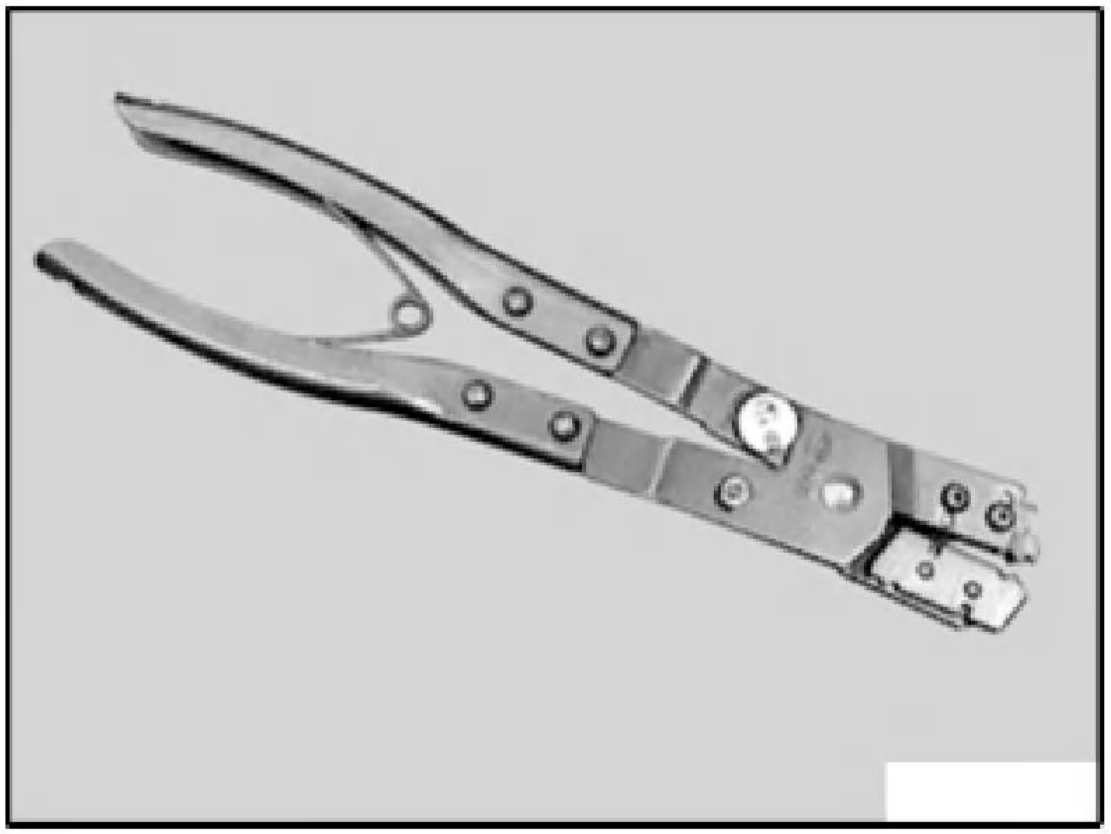



Fig. 45: Identifying Pliers
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 9 170 SPACER

SPECIAL TOOL

| | |
|---|---|
| Note: | For maintaining a prespecified distance during installation of VANOS adjustment unit |
| Engine: | S54 |
| SI number: | 1 15 00(609) |
| Order number: | 11 9 170 |
| Â | Spacer |

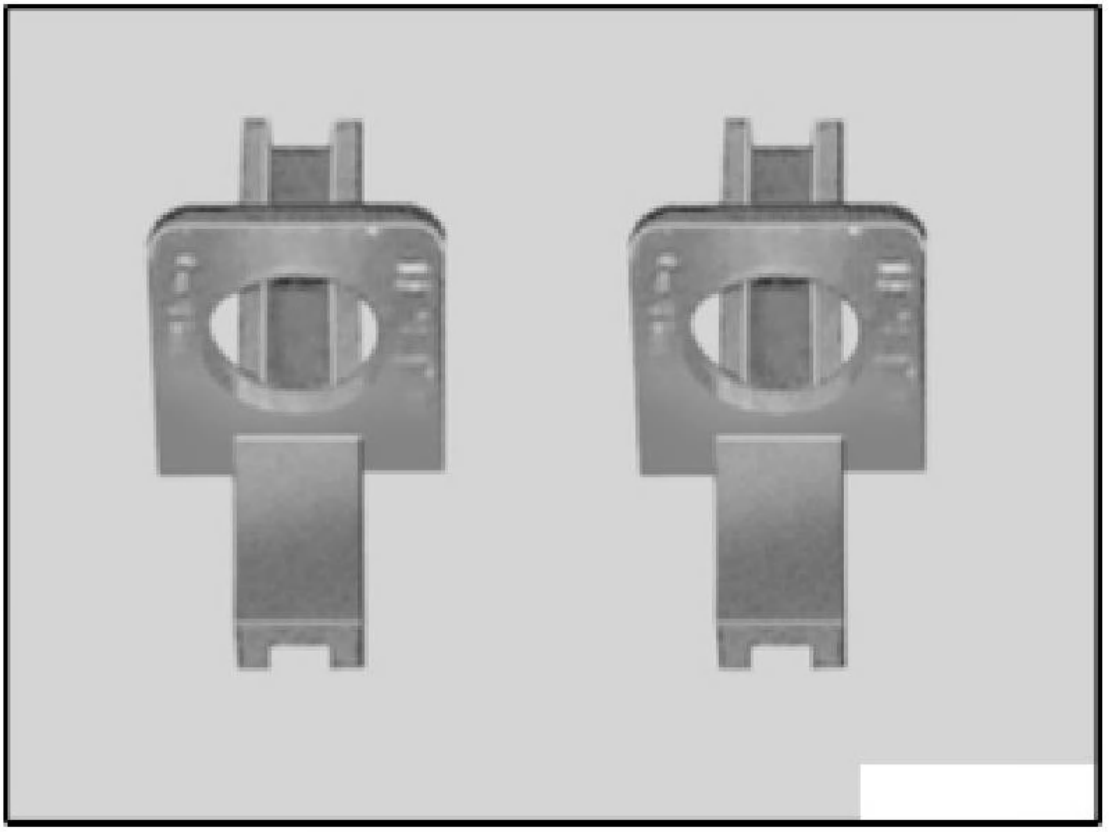



Fig. 46: Identifying Spacer
Courtesy of BMW OF NORTH AMERICA, INC.

Article GUID: A00202799

# ENGINE BLOCK

## 11 11 ENGINE BLOCK

### ENGINE BLOCK - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Main bearing screws | M10 / M20 / M30 | M10 | Replace, wash and oil screws | 60 Nm |
| Â | M21 | M10 | Replace, wash and oil screws | 65 Nm |
| Â | S38 / S14 / M40 / M42 / M43 / M43TU / M44 / M50 / M41 / M51 / S50 / S50 US | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 50 Â° |
| Â | M47 / M57 | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 70 Â° |
| Â | M47TU / M57TU | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 22 Nm |
| Â | Â | Â | Torque angle | 90 Â° |
| Â | M67 | M12 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 200 Â° |
| Â | S54 | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 25 Nm |
| Â | Â | Â | Torque angle | 50 Â° |
| 2AZ Main bearing screws | M70 / S70 / M73 | M10 | Replace screws Do not wash off screw coating | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 70 Â° |
| Â | M60 / M62 | M10/M11 | Replace screws Do not wash off screw coating | Â |
| Â | Â | M10/M11 | Jointing torque | 20 Nm |
| Â | Â | M10 | Torque angle | 70 Â° |
| Â | Â | M11 | Torque angle | 100 Â° |
| Â | M54 / M56 / M52TU / M52 / with aluminum engine block | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |

| | | | | |
|---|---|---|---|---|
| Â | Â | Â | Torque angle | 70 Â° |
| Â | S52 / M52 / with cast iron engine block | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque | 50 Â° |

## 11 11 ENGINE BLOCK

ENGINE BLOCK - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| Screws and spacer bolts | M60 / M62 / M70 / S70 / M73 / S62 | M8 | Replace screws | Â |
| 3AZ Taper screw mount on main bearing | Â | Â | Â | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 45 Â° |
| Â | N62 / N73 | M8 | Â | 34 Nm |
| Threaded support sleeves | M70 / M60 / M62 / S70 / M73 / S62 | Â | 10 Nm | Â |
| Â | N62 / N73 | Â | 6 Nm | Â |
| 4AZ Struts/bracing shell | M67 | M10.9 | 66 Nm | Â |
| Â | all others | M10 | 43 Nm | Â |
| Â | All | M8 | 22 Nm | Â |
| 5AZ Drain plug for coolant in engine block | All | M14 x 1.5 | 25 Nm | Â |
| 6AZ Main oil gallery seal plugs | All | M16 x 1.5 | 34 Nm | Â |
| Â | All | M18x1.5 | 40 Nm | Â |
| Â | N62 / N73 | M18x1.5 | Insert screw with Loctite | 25 Nm |
| N40 / N42 / N45 / N46 | M16x1.5 | 36 Nm | Â | Â |
| Main oil gallery, rear (seal plugs with control valve) | M62 / S62 | M18x1 | Â | 10 Nm |
| 7AZ Oil spray nozzle on engine block | All | M6 | Â | 10 Nm |
| Oil spray nozzle screwed into bearing seat (coat thread with Loctite 243) | M73 | M8x1 | Â | 5 Nm |
| Oil spray nozzle to engine block (banjo bolt) | all others | M8x1 | Â | 12 Nm |
| 8AZ Pressure holding valve to crankcase (1bar) | S54 / B32 | Â | Â | 20 Nm |

# CYLINDER HEAD WITH COVER

## 11 12 CYLINDER HEAD WITH COVER

CYLINDER HEAD WITH COVER - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 5AZ Cylinder head bolts | M51 / M41 | M11 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 80 Nm |
| Â | Â | Â | Loosen all bolts 1/2 turn | Â |
| Â | Â | Â | Jointing torque | 50 Nm |
| Â | Â | Â | Torque angle | 90 Â° |
| Â | Â | Â | Torque angle | 90 Â° |
| Â | Â | Â | Warm -running time | 25 min |
| Â | Â | Â | Torque angle | 90 Â° |
| 6AZ Cylinder head bolts | M40 / M42 / M43 / M43TU / M44 / M50 / S50 US / S52 / M52 / with cast iron engine block | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 30 Nm |
| Â | Â | Â | Torque angle | 90 Â° |
| Â | Â | Â | Torque angle | 90 Â° |
| Cylinder head bolts | M54 / M56 / M52TU / M52 / with aluminum engine block | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 40 Nm |
| Â | Â | Â | Torque angle | 90 Â° |
| Â | Â | Â | Torque angle | 90 Â° |
| Cylinder head bolts | N40 / N42 / N45 / N46 M8 / M10 | Tightening specifications for M8 and M10 screws are identical: Replace, wash and oil screws | Â | Â |
| Â | Â | Â | Jointing torque | 30 Nm |
| Â | Â | Â | Torque angle | 90 Â° |
| Â | Â | Â | Torque angle | 90 Â° |

## 11 12 CYLINDER HEAD WITH COVER

CYLINDER HEAD WITH COVER - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 11AZ Cylinder head cover | All | M6 | Â | 10 Nm |
| Â | All | M7 | Â | 15 Nm |
| Â | M21 | M8 | Â | 15 Nm |
| 12AZ Oil trap to cylinder head cover | M21 | M8 | Â | 17 Nm |
| 13AZ Timing case to cylinder head | All | M7 | Â | 15 Nm |
| Â | All | M8 | Â | 20 Nm |
| 14AZ Plug for oil channel (microencapsulated) | M47 / M57 | M12 x 1.5 | Â | 20 Nm |

| | | | | |
|---|---|---|---|---|
| 15AZ Vent plugs to cylinder head (coolant) | M67 | Â | Â | 2 Nm |

# OIL SUMP

## 11 13 OIL PAN

OIL PAN - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Oil drain plug | All | M12 x 1.5 | Â | 25 Nm |
| Â | All | M18 x 1.5 | Â | 35 Nm |
| Â | All | M22 x 1.5 | Â | 60 Nm |
| 2AZ Oil pan on engine block | All | M6 8.8 | Â | 10 Nm |
| Â | All | M6 10.9 | Â | 12 Nm |
| Â | N40 / N42 / N45 / N46 | M8 8.8 | Replace screws | 30 Nm |
| Â | All others | M8 8.8 | Â | 22 Nm |
| Oil sump, lower section to upper section | All | M6 8.8 | Â | 10 Nm |
| Â | All | M8 8.8 | Â | 22 Nm |
| Oil sump bottom section to top section with microencapsulated screws | All | M6 10.9 | Replace screws | 12 Nm |

# HOUSING COVER

## 11 14 CASE COVERS

CASE COVERS - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Timing case and timing case cover top and bottom | All | M6 | Â | 10 Nm |
| Â | All | M7 | Â | 15 Nm |
| Â | All | M8 | Â | 22 Nm |
| Â | All | M10 | Â | 47 Nm |
| 2AZ End cover, front/rear, to engine block | All | M6 | Â | 10 Nm |
| Â | All | M8 | Â | 22 Nm |
| 3AZ Bearing pin to timing case | M51 / M41 / M47 | M42x1.5 | Â | 65 Nm |
| 4AZ Screw plug or connection piece to timing case cover Screw plug to timing case cover | M51 / M41 / M47 | M20x1.5 | Â | 30 Nm |
| Screw plug to timing case cover | M57 / M47TU / M57TU | M30x1 | Â | 70 Nm |
| Screw plug to timing case cover | M57 / M47TU | M40x1.5 | Â | 30 Nm |

| | | | | |
|---|---|---|---|---|
| 5AZ End cover, top/rear (water jacket), to engine block | N73 | M6 | Â | 10 Nm |

# CRANKSHAFT WITH BEARING

## 11 11 ENGINE BLOCK

ENGINE BLOCK - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Main bearing screws | M10 / M20 / M30 | M10 | Replace, wash and oil screws | 60 Nm |
| Â | M21 | M10 | Replace, wash and oil screws | 65 Nm |
| Â | S38 / S14 / M40 / M42 / M43 / M43TU / M44 / M50 / M41 / M51 / S50 / S50 US | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 50 Â° |
| Â | M47 / M57 | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 70 Â° |
| Â | M47TU / M57TU | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 22 Nm |
| Â | Â | Â | Torque angle | 90 Â° |
| Â | M67 | M12 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 200 Â° |
| Â | S54 | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 25 Nm |
| Â | Â | Â | Torque angle | 50 Â° |
| 2AZ Main bearing screws | M70 / S70 / M73 | M10 | Replace screws Do not wash off screw coating | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 70 Â° |
| Â | M60 / M62 | M10/M11 | Replace screws Do not wash off screw coating | Â |
| Â | Â | M10/M11 | Jointing torque | 20 Nm |
| Â | Â | M10 | Torque angle | 70 Â° |
| Â | Â | M11 | Torque angle | 100 |
| Â | M54 / M56 / M52TU / M52 / with aluminum engine block | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |

| | | | | |
|---|---|---|---|---|
| Â | Â | Â | Torque angle | 70 Â° |
| Â | S52 / M52 / with cast iron engine block | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 50 Â° |

## 11 11 ENGINE BLOCK

### ENGINE BLOCK - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 3AZ Taper screw mount on main bearing | Â | Â | Â | Â |
| Screws and spacer bolts | M60 / M62 / M70 / S70 / M73 / S62 | M8 | Replace screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 45 Â° |
| Â | N62 / N73 | M8 | Â | 34 Nm |
| Threaded support sleeves | M70 / M60 / M62 / S70 / M73 / S62 | Â | Â | 10 Nm |
| Â | N62 / N73 | Â | Â | 6 Nm |
| 4AZ Struts/bracing shell | M67 | M10.9 | Â | 66 Nm |
| Â | all others | M10 | Â | 43 Nm |
| Â | All | M8 | Â | 22 Nm |
| 5AZ Drain plug for coolant in engine block | All | M14 x 1.5 | Â | 25 Nm |
| 6AZ Main oil gallery seal plugs | All | M16 x 1.5 | Â | 34 Nm |
| Â | All | M18x1.5 | Â | 40 Nm |
| Â | N62 / N73 | M18x1.5 | Insert screw with Loctite | 25 Nm |
| Â | N40 / N42 / N45 / N46 | M16x1.5 | Â | 36 Nm |
| Main oil gallery, rear (seal plugs with control valve) | M62 / S62 | M18x1 | Â | 10 Nm |
| 7AZ Oil spray nozzle on engine block | All | M6 | Â | 10 Nm |
| Oil spray nozzle screwed into bearing seat (coat thread with Loctite 243) | M73 | M8x1 | Â | 5 Nm |
| Oil spray nozzle to engine block (banjo bolt) | all others | M8x1 | Â | 12 Nm |
| 8AZ Pressure holding valve to crankcase (1bar) | S54 / B32 | Â | Â | 20 Nm |

## 11 24 CONNECTING RODS AND BEARINGS

### CONNECTING RODS AND BEARINGS - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Connecting rod bolts | M10 / M30 | Â | Replace, wash and oil screws | 55 Nm |
| Â | M20 / M21 / M40 / M41 / M42 / M43 / M43TU / M44 / M47 / M47TU / M50 / M51 / M52 / M52TU / M54 / M56 / M57 / M57TU / S52 / S50 US / M70 / S70 / M73 / N40 / N42 / N45 / N46 / N62 / N73 / N62S | Â | Replace, wash and oil screws | Â |
| Â | Â | Â | Application torque | 5 Nm |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 70 Â° |
| Â | M60 / M62 | Â | Replace, wash and oil screws | Â |
| Â | Â | Â | Application torque | 5 Nm |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 80 Â° |
| Â | M67 | Â | Â | Replace screws, do not wash off screw coating |
| Â | Â | Â | Application torque | 5 Nm |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 85 Â° |

## 11 21 CRANKSHAFT AND BEARINGS

CRANKSHAFT AND BEARINGS - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Increment wheel on crankshaft | S54 | M5 10.9 | Replace screws | Â |
| Â | Â | Â | Jointing torque | 5.0 Nm |
| Â | Â | Â | Torque angle | 45 Â° |
| Increment wheel on crankshaft | All others | M5 10.9 | Replace screws | 13 Nm |
| Increment wheel on crankshaft | All others | M5 8.8 | Replace screws | 5.5 Nm |

# FLYWHEEL

## 11 22 FLYWHEEL

FLYWHEEL - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Flywheel to crankshaft | Â | Â | Â | Â |
| Manual transmission flywheel to crankshaft | S62 / M60/1 / M60/2 / M62 | Â | Do not install with screw retaining compound. Bolts are a component part of the flywheel. Screw threads oiled. | 105 Nm |
| Manual transmission flywheel to crankshaft | M40 / M42 / M43 / M43TU / M44 / M70 / S70 / M73 / M57TU | Â | Replace screws | 120 Nm |
| Â | All others | Â | Replace screws | 105 Nm |
| Automatic transmission flywheel to crankshaft | N62 / N73 | Â | Replace screws | 105 Nm |
| Â | All others | Â | Replace screws | 120 Nm |
| Manual transmission flywheel to crankshaft | N62 | Â | Do not install with screw retaining compound. Bolts are a component part of the flywheel. Screw threads oiled. | 120 Nm |

# VIBRATION DAMPER

## 11 23 VIBRATION DAMPER

### VIBRATION DAMPER - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Vee belt pulley on crankshaft | M10 | Â | Replace nut | 190 Nm |
| 2AZ Vibration damper / hub to crankshaft | M20 / M21 / M50 / M52 / M52TU / S50 US / S52 / M54 / M56 | M18x1.5 | Replace screws | 410 Nm |
| Â | M30 / S14 / S38 / B35 | M24 x 1.5 | Replace nut | 440 Nm |
| Â | M41 / M47 / M47TU / M51 / M60 / M62 | M18x1.5 | Replace screw | Â |
| Â | Â | Â | Jointing torque | 100 Nm |
| Â | Â | Â | Torque angle | 60 Â° |
| Â | Â | Â | Torque angle | 60 Â° |
| Â | Â | Â | Torque angle | 30 Â° |
| Â | N62 / N73 | M18x1.5 | Replace screw | Â |
| Â | Â | Â | Jointing torque | 100 Nm |
| Â | Â | Â | Torque angle | 60 Â° |
| Â | Â | Â | Torque angle | 60 Â° |
| Â | Â | Â | Torque angle | 60 Â° |
| Â | M70 / S70 / M73 | M18x1.5 | Replace screw | Â |
| Â | Â | Â | Jointing torque | 100 Nm |

| | | | | |
|---|---|---|---|---|
| Â | Â | Â | Torque angle | 60 Â° |
| Â | Â | Â | Torque angle | 60 Â° |
| Â | M57 / M57TU / M67 / M67TU | M10 | Replace screws | Â |
| Â | Â | Â | Jointing torque | 40 Nm |
| Â | Â | Â | Torque angle | 60 Â° |
| Â | Â | Â | Torque angle | 60 Â° |

## 11 23 VIBRATION DAMPER

VIBRATION DAMPER - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 3AZ Belt pulley / vibration damper to hub | S38 / B36 | M8 10.9 | Â | 34 Nm |
| N40 / N42 / N45 / N46 / S38 / B38 | M8 10.9 | Â | 34 Nm | Â |
| Â | All / others | M8 | Â | 22 Nm |
| 4AZ Belt pulley to vibration damper | S38 / B35 | M8 8.8 | Â | 22 Nm |
| Â | S50 | M8 8.8 | Â | 22 Nm |
| 5AZ Sprocket with hub or hub to crankshaft | M40 | M16 x 1.5 | Replace screw | 310 Nm |
| Â | M42 / M43 / M43TU / M44 | M16 x 1.5 | Replace screw | 330 Nm |
| 6AZ Hub to crankshaft | N40 / N42 / N45 / N46 | M16 x 1.5 | Replace screw | 300 Nm |

# CONNECTING RODS AND BEARING

## 11 11 ENGINE BLOCK

ENGINE BLOCK - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Main bearing screws | M10 / M20 / M30 | M10 | Replace, wash and oil screws | 60 Nm |
| M21 | M10 | Replace, wash and oil screws | 65 Nm | Â |
| Â | S38 / S14 / M40 / M42 / M43 / M43TU / M44 / M50 / M41 / M51 / S50 / S50 US | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 50 Â° |
| Â | M47 / M57 | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 70 Â° |

| | | | | |
|---|---|---|---|---|
| Â | M47TU / M57TU | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 22 Nm |
| Â | Â | Â | Torque angle | 90 Â° |
| Â | M67 | M12 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 200 Â° |
| Â | S54 | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 25 Nm |
| Â | Â | Â | Torque angle | 50 Â° |
| 2AZ Main bearing screws | M70 / S70 / M73 | M10 | Replace screws Do not wash off screw coating | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 70 Â° |
| Â | M60 / M62 | M10/M11 | Replace screws Do not wash off screw coating | Â |
| Â | Â | M10/M11 | Jointing torque | 20 Nm |
| Â | Â | M10 | Torque angle | 70 Â° |
| Â | Â | M11 | Torque angle | 100 Â° |
| Â | M54 / M56 / M52TU / M52 / with aluminum engine block | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 70 Â° |
| Â | S52 / M52 / with cast iron engine block | M10 | Replace, wash and oil screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 50 Â° |

## 11 11 ENGINE BLOCK

### ENGINE BLOCK - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 3AZ Taper screw mount on main bearing | Â | Â | Â | Â |
| Screws and spacer bolts | M60 / M62 / M70 / S70 / M73 / S62 | M8 | Replace screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 45 Â° |
| Â | N62 / N73 | M8 | Â | 34 Nm |
| Threaded support sleeves | M70 / M60 / M62 / S70 / M73 / S62 | Â | Â | 10 Nm |
| Â | N62 / N73 | Â | Â | 6 Nm |
| 4AZ Struts/bracing shell | M67 | M10.9 | Â | 66 Nm |
| Â | all others | M10 | Â | 43 Nm |
| Â | All | M8 | Â | 22 Nm |

| | | | | |
|---|---|---|---|---|
| 5AZ Drain plug for coolant in engine block | All | M14 x 1.5 | Â | 25 Nm |
| 6AZ Main oil gallery seal plugs | All | M16 x 1.5 | Â | 34 Nm |
| Â | All | M18x1.5 | Â | 40 Nm |
| Â | N62 / N73 | M18x1.5 | Insert screw with Loctite | 25 Nm |
| Â | N40 / N42 / N45 / N46 | M16x1.5 | Â | 36 Nm |
| Main oil gallery, rear (seal plugs with control valve) | M62 / S62 | M18x1 | Â | 10 Nm |
| 7AZ Oil spray nozzle on engine block | All | M6 | Â | 10 Nm |
| Oil spray nozzle screwed into bearing seat (coat thread with Loctite 243) | M73 | M8x1 | Â | 5 Nm |
| Oil spray nozzle to engine block (banjo bolt) | all others | M8x1 | Â | 12 Nm |
| 8AZ Pressure holding valve to crankcase (1bar) | S54 / B32 | Â | Â | 20 Nm |

## 11 24 CONNECTING RODS AND BEARINGS

CONNECTING RODS AND BEARINGS - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Connecting rod bolts | M10 / M30 | Â | Replace, wash and oil screws | 55 Nm |
| Â | M20 / M21 / M40 / M41 / M42 / M43 / M43TU / M44 / M47 / M47TU / M50 / M51 / M52 / M52TU / M54 / M56 / M57 / M57TU / S52 / S50 US / M70 / S70 / M73 / N40 / N42 / N45 / N46 / N62 / N73 / N62S | Â | Replace, wash and oil screws | Â |
| Â | Â | Â | Application torque | 5 Nm |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 70 Â° |
| Â | M60 / M62 | Replace, wash and oil screws | Â | Â |
| Â | Â | Â | Application torque | 5 Nm |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 80 Â° |
| Â | M67 | Â | Replace screws, do not | Â |

| | | | | |
|---|---|---|---|---|
| | | | wash off screw coating | |
| Â | Â | Â | Application torque | 5 Nm |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 85 Â° |

# CAMSHAFT

## 11 31 CAMSHAFT

CAMSHAFT - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Camshaft bearing cap | All | M6 | Â | 10 Nm |
| Â | All | M7 | Â | 14 Nm |
| Â | All | M8 | Â | 20 Nm |
| 2AZ Sprocket to camshaft | M20 / M21 / M40 | M10 | Â | 65 Nm |
| 3AZ Sprocket to camshaft flange | M60 / M62 | M6 | Â | 15 Nm |
| Â | All / others | M6 | Â | 10 Nm |
| Â | M50 / M52 / M52TU / M54 / M56 / S52 / S50 US / M50 / VANOS | M7 | Â | Â |
| Â | Â | Â | Application torque | 5 Nm |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | All / others | M7 | Â | 15 Nm |
| 4AZ Sprocket to camshaft | M51 / M41 / M47 / M57 | M12 x 1.5 | Replace screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 35 Â° |
| Â | M47TU / M57TU | M12 x 1.5 | Replace screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 50 Â° |
| Â | M67 | M12 x 1.5 | Replace screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 90 Â° |
| 5AZ Toothed shaft to inlet camshaft | M52 / S52 / S50 US / M50 / VANOS | M14 x 1.5 | Â | Â |
| Â | Â | Â | Jointing torque | 40 Nm |
| Â | Â | Â | Torque angle | 60 Â° |

## 11 31 CAMSHAFT

CAMSHAFT - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 6AZ Flange to camshaft | M30 | Â | Â | 145 Nm |
| | | | | |

| | | | | |
|---|---|---|---|---|
| 7AZ Screw plug for chain tensioner | M50 / S50 US / S62 | M22 x 1.5 | Â | 50 Nm |
| Â | All / others | M22 x 1.5 | Â | 40 Nm |
| 8AZ Cylinder for chain tensioner plunger | M67 | M22 x 1.5 | Â | 45 Nm |
| Â | N40 / N42 / N45 / N46 / N62 / N73 | M22 x 1.5 | Â | 65 Nm |
| Â | M50 / M52 / M52TU / M54 / M56 / S52 / S50 US | M26 x 1.5 | Â | 70 Nm |
| Â | All / others | M26 x 1.5 | Â | 50 Nm |
| 9AZ Bearing flange on engine block | M60 | M6 | Â | 13 Nm |
| 10AZ Reversing rail on engine block | M62 / S62 | M6 /M7 | Â | 14 Nm |
| 11AZ Screw-in pin on camshaft | All | M7 | Â | 20 Nm |
| Nut on screw-in pin | All | M6 | Â | 10 Nm |
| 12AZ Bearing pin for sliding and tensioning rails | M41 / M47 / M47TU / M51 / M57 / M57TU | M16 x 1.5 | Â | 20 Nm |
| Â | M67 | M16 x 1.5 | Â | 26 Nm |
| 13AZ Signal disk to camshaft | S62 / S54 | M16 x 1.5 | Â | 50 Nm |
| 14AZ Sensor gear to camshaft | N62 / N73 | M14 x 1.5 | Â | 30 Nm |

# VARIABLE CAMSHAFT TIMING

## 11 36 VARIABLE CAMSHAFT CONTROL

VARIABLE CAMSHAFT CONTROL - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ 4/2-way valve/solenoid valve to VANOS housing | M52 / M52TU / M54 / M56 / S52 / S50 US / M50 / VANOS | Â | Â | 30 Nm |
| 2AZ Banjo bolt to VANOS adjustment unit | M52 / M52TU / M54 / M56 / S52 / S50 US / M50 / VANOS | M14 x 1.5 | Â | 32 Nm |
| 3AZ Screw plug to VANOS adjustment unit | M52 / M52TU / M54 / M56 / S52 / S50 US / M50 / VANOS | M22 x 1.5 | Â | 50 Nm |
| 4AZ Left-hand thread: Set screw for hydraulic piston to toothed shaft | M52TU / M54 / M56 | M6 | Â | 10 Nm |
| 5AZ Hydraulic line for VANOS to oil filter equipment carrier | M52 / M52TU / M54 / M56 / S52 / S50 US / | Â | Â | 32 Nm |

| | | | | |
|---|---|---|---|---|
| | M50 / VANOS | | | |
| 6AZ Collar nut on spline shaft | S50 | M6 | Â | 9 Nm |
| 7AZ Cover to VANOS adjustment unit (hydraulic piston inlet side) | S50 | M5 | Â | 5 Nm |
| 8AZ Filter screw to VANOS adjustment unit | S50 | M10x1 | Â | 12 Nm |
| 9AZ Pressure line to VANOS adjustment unit | S62 / S54 | M10 x 1 | Â | 13 Nm |
| Pressure line to pressure accumulator and VANOS adjustment unit | S50 | M12 x 1 | Â | 20 Nm |
| 10AZ Cover for solenoid valve to VANOS adjustment unit | S50 / B30 | M5 8.8 | Â | 6 Nm |
| Â | S50 / B32 | M5 10.9 | Â | 8 Nm |
| Â | S62 | M7 10.9 | Â | 19 Nm |
| 11AZ Cover to VANOS adjustment unit (exhaust side) | S54 / S50 / B32 | M6 10.9 | Â | 13 Nm |
| 12AZ Solenoid valve on distributor | M62 / VANOS | M27x1.5 | Â | 25 Nm |
| 13AZ Left-hand thread: Exhaust chain wheel to exhaust camshaft | M62 / VANOS | M12 x 1.5 | Â | 125 Nm |
| 14AZ Left-hand thread: VANOS adjustment unit to inlet camshaft | M62 / VANOS | M12 x 1.5 | Â | 110 Nm |
| 15AZ Left-hand thread: Nut of sensor gear screw fitting | M62 / VANOS | M18x1.5 | Â | 40 Nm |
| 16AZ Adjustment unit to exhaust or inlet camshaft | N40 / N42 / N45 / N46 | M10x1 | Replace screws | Â |
| Â | Â | Â | Jointing torque | 20 Nm |
| Â | Â | Â | Torque angle | 90 Â° |
| Â | Â | Â | Torque angle | 90 Â° |
| Â | N62 / N73 | M10x1 | Replace screws | Â |

# OIL PUMP WITH FILTER

## 11 41 OIL PUMP WITH STRAINER AND DRIVE

### OIL PUMP WITH STRAINER AND DRIVE - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Screw plug for pressure relief valve | M10 / M30 | Â | Â | 40 Nm |
| Â | M20 | Â | Â | 30 Nm |
| 2AZ Oil pump to crankcase | N62 / N73 | M8 10.9 | Â | 34 Nm |
| Â | All others | M8 | Â | 23 Nm |
| | | | | |

| | | | | |
|---|---|---|---|---|
| 3AZ Oil pump cover | All | M6 | Â | 10 Nm |
| 4AZ Sprocket to oil pump | All | M6 | Â | 10 Nm |
| Â | N40 / N42 / N45 / N46 | M10 x 1 | Â | 30 Nm |
| Â | All others | M10 x 1 | Â | 25 Nm |
| Â | All | M10 | Â | 45 Nm |
| 5AZ Oil pump to balancing shaft housing | M47TU | M6 10.9 | Â | 14 Nm |
| Â | M47TU | M7 10.9 | Â | 25 Nm |

# OIL FILTER AND LINES

## 11 42 OIL FILTER AND PIPES

### OIL FILTER AND PIPES - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Oil filter (one-way cartridge) (tightening torque by hand as specified on easy-change filter) | All | Â | Â | Nm |
| 2AZ Full flow oil filter (cover) | All | M8 | Â | 22 Nm |
| Â | All | M10 | Â | 33 Nm |
| Â | All | M12 | Â | 33 Nm |
| Screwed-on cover | All | Â | Â | 25 Nm |
| 3AZ Oil filter housing and lines on crankcase | All | M8 | Â | 22 Nm |
| Â | All | M20 x 1.5 | Â | 40 Nm |

## 11 42 OIL FILTER AND PIPES

### OIL FILTER AND PIPES - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 4AZ Oil filter drain plug | M21 / S38 | Hollow bolt | Â | 20 Nm |
| Â | M21 | Full length screw in aluminum | Â | 10 Nm |
| Â | M21 | Full length screw in threaded insert | Â | 23 Nm |
| 5AZ Oil drain line to oil filter and upper oil sump section | M60/1 / M60/2 / M62 / M70 / S70 / M73 / S62 | Banjo bolt M14x1.5 | Â | 30 Nm |
| 6AZ Oil line to bearing points and camshaft lubrication | All | M6 | Â | 10 Nm |
| 7AZ Oil line for camshaft lubrication on cylinder head | All | Banjo bolt M8x1 | Â | 10 Nm |
| Â | N40 / N42 / N45 / N46 | Banjo bolt M7x1 | Â | 10 Nm |
| Â | All | M5 | Â | 5 Nm |

| | | | | |
|---|---|---|---|---|
| 8AZ Oil drain line from oil separator to upper oil sump section | E53 / M62 | Banjo bolt M12x1.5 | Â | 25 Nm |

### 11 42 OIL FILTER AND PIPES

OIL FILTER AND PIPES - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 8AZ Oil cooler oil pipes to oil filter housing | All | M8 | Â | 22 Nm |
| 9AZ Oil pipes to turbocharger | All | M8 | Â | 22 Nm |
| 10AZ Oil lines from turbocharger to engine block Hollow bolt | All | M16 x 1.5 | Â | 40 Nm |
| 11AZ Oil supply pipe to turbocharger | Â | Â | Â | Â |
| Hollow bolt | All | Â | Â | 25 Nm |
| Coupling nut | All | Â | Â | 30 Nm |
| Oil return line to turbocharger and cylinder crankcase (hose clamp) | M47TU / M57 / M57TU / M67 | Â | Â | 3 Nm |

## WATER PUMP AND DRIVE

### 11 51 WATER PUMP AND DRIVE

WATER PUMP AND DRIVE - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Water pump to crankcase | All | M6 | Â | 10 Nm |
| Â | All | M7 | Â | 15 Nm |
| Â | All | M8 | Â | 22 Nm |
| 2AZ Water pump to power steering pump | N40 / N42 / N45 / N46 | M8 10.9 | Â | 32 Nm |

## FAN

### 11 52 FAN

FAN - TIGHTENING TORQUE SPECIFICATIONS

| Type | Thread | Measurement |
|---|---|---|
| 1AZ Fan clutch on water pump Coupling nut (left-hand threads) | All | 40 Nm |
| M54 | | 45 Nm |
| 2AZ Fan to fan clutch | All | 10 Nm |

## THERMOSTAT AND CONNECTION

### 11 53 THERMOSTAT AND CONNECTIONS

THERMOSTAT AND CONNECTIONS - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Measure |
|---|---|---|---|
| 1AZ Thermostat housing | All | M6 | 10 Nm |
| 2AZ Bleeder screw | All | M8 | 8 Nm |

# INTAKE MANIFOLD

## 11 61 INTAKE MANIFOLD

INTAKE MANIFOLD - TIGHTENING TORQUE SPECIFICATIONS

| Type | Thread | Tightening Specification | Measure |
|---|---|---|---|
| 1AZ Intake manifold on cylinder head | All | M8 | 22 Nm |
| All | | M7 | 15 Nm |
| All | | M6 | 10 Nm |
| 2AZ Soundproofing hood to holder M60/1 / M60/2 / M62 | M6 | Â | 8 Nm |

# EXHAUST MANIFOLD

## 11 62 EXHAUST MANIFOLD

EXHAUST MANIFOLD - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Exhaust manifold to cylinder head Coat screw connections with CRC copper paste | All | M6 | Replace nuts | 10 Nm |
| Â | M50 / M52 / M52TU / M54 / M56 / S52 / S50 US | M7 | Replace nuts | 20 Nm |
| Â | All / others | M7 | Replace nuts | 15 Nm |
| Â | M10 | M8 | Upper row of staybolts installed with bolt cement | Â |
| Â | Â | Â | Â | 23 Nm |
| Â | M21 | M8 | Â | 12 Nm |
| Â | Â | Â | Replace nuts Retighten after 2000 km Slacken nuts by a 1/4 turn | Â |
| Â | Â | Â | Â | 12 Nm |
| Â | M41 / M47 / M47TU / M51 / M57 / M57TU | M8 | Replace nuts | 20 Nm |
| All / others | M8 | Replace nuts | Â | 23 Nm |

# EMISSIONS CONTROL OXYGEN

## 11 78 EMISSIONS-CONTROL, LAMBDA OXYGEN SENSOR

EMISSIONS-CONTROL, LAMBDA OXYGEN SENSOR - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Measure |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1AZ Oxygen control sensor; oxygen monitor sensor | All | M18 x 1.5 | 50 Nm |

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# IGNITION WIRES, SPARK

## 12 12 SPARK PLUGS

SPARK PLUGS - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Measure |
|---|---|---|---|
| 1AZ Spark plugs (ungreased) | All | M12x1.25 | 23 +/- 3 Nm |
| Â | All | M14x1.25 | 30 +/- 3 Nm |

# ELECTRONIC SWITCHING

## 12 14 ELECTRONIC SHIFT UNITS OR CONTROL UNITS

ELECTRONIC SHIFT UNITS OR CONTROL UNITS - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ TCI control unit | All | Â | Â | 2.5 Nm |
| 2AZ Knock sensor | E23 | Â | Â | 13 Nm |
| Â | All | Â | Â | 20 Nm |
| 3AZ Engine speed and reference mark sensor | All | M6 | Replace microencapsulated screw | 10 Nm |
| 4AZ Cover on control unit box | All | Â | Â | 4.4 Nm |

# ALTERNATOR WITH DRIVE

## 12 31 ALTERNATOR WITH DRIVE AND MOUNTING PARTS

ALTERNATOR WITH DRIVE AND MOUNTING PARTS - TIGHTENING TORQUE SPECIFICATIONS

| Tightening Torques | Type | Thread | Measure |
|---|---|---|---|
| 1AZ Wires to alternator | Â | Â | Â |
| Terminal D+ | M10 / M20 | Â | 5 Nm |
| Â | All / others | M6 | 7 Nm |
| Terminal B+ | S38 / B38 | Â | 8 Nm |
| Â | All / others | M8 | 13 Nm |
| 2AZ Pulley | All | Â | 45 Nm |
| 3AZ Pulley (ribbed drive belt) | Alternator with cooling jacket | Â | 80 Nm |
| Â | all others | Â | 70 Nm |
| Â | N42, N46 Valeo | Â | 75 Nm |
| Â | N42, N46 Bosch | Â | 65 Nm |
| 4AZ Rear holder | All | Â | 3.5 Nm |
| 5AZ Fillister head screw for wire holder | All | Â | 3.5 Nm |
| 6AZ Alternator on bearing block | M40/M42 / M43 / M44 | Â | 43 Nm |
| 7AZ Alternator to | N42, N46, N62 | M8 | 21 Nm |

| | | | |
|---|---|---|---|
| crankcase | | | |
| 8AZ Belt pulley (ribbed V-belt) with freewheel (Ina) fitted to Bosch and Valeo alternators | N42 | Â | 80 Nm |

# REGULATOR

## 12 32 GOVERNOR

GOVERNOR - TIGHTENING TORQUE SPECIFICATIONS

| Application Â | Type | thread | Value Â |
|---|---|---|---|
| 1AZ Regulator switch | All | M4 | 2 Nm |
| Â | All | M5 | 4 Nm |

# STARTER AND MOUNTING

## 12 41 STARTER AND MOUNTING PARTS

STARTER AND MOUNTING PARTS - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Measure |
|---|---|---|---|
| 1AZ Starter motor mounting to transmission bell housing | All | Â | 45 Nm |
| 2AZ Support to starter | All | M5 | 5 Nm |
| 3AZ Support to crankcase | All | Â | 47 Nm |
| 4AZ Electrical leads to starter | Â | Â | Â |
| Â | All | M5 | 5 Nm |
| Â | All | M6 | 7 Nm |
| All | | M8 | 13 Nm |
| 5AZ Bolt connection, pole tube | All | M6 | 6 Nm |
| 6AZ Heat shield to starter motor | Â | M6 | 6 Nm |

# STARTER LEAD

## 12 42 WIRES TO STARTER

WIRES TO STARTER - TIGHTENING TORQUE SPECIFICATIONS

| Applications | Type | Thread | Measure |
|---|---|---|---|
| 1AZ Battery positive connection point in/at distributor | E32 / E34 / E31 / E36 / E46 / E87 | M8 | 20 Nm |
| Â | E39 / M57 | M8 | 11 Nm z |
| Â | E38 / M67 | M8 Â | 11 Nm |
| Â | E46 / M47TU | M8 Â | 11 Nm |
| | | | |

| | | | |
|---|---|---|---|
| Â | E60 / N62 | M8 | 15 Nm |
| Â | E65 / N62 / N73 | M8 | 15 Nm |
| 2AZ Wiring harness on distributor | E36 / M41 | M8 | 10 Nm |

# ENGINE WIRING LOOM

## 12 51 ENGINE WIRING HARNESS

ENGINE WIRING HARNESS - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Wiring harness on electrical cutout device | M51 / M41 | M5 | Â | 2.5 Nm |
| 2AZ Wiring harness on distributor | E36 / M41 | M8 | Â | 10 Nm |
| 3AZ Battery positive terminal to intake manifold | M57 | M8 | Â | 7 Nm |
| 4AZ Battery positive terminal in engine compartment | M62 / S62 | M8 | Â | 10 Nm |
| Â | M57 / M67 | M8 | Â | 10 Nm |
| Â | M54 | M8 | Â | 21 Nm |
| 5AZ Wiring harness to ground holder | M67 | M6 | Â | 10 Nm |
| Â | M47TU | M6 | Â | 7 Nm |
| 6AZ DDE wiring harness pick-off to battery positive terminal | M47TU / M57TU / M67 | M6 | Â | 9 Nm |
| 7AZ Injector guide strip to cylinder head cover | M47TU / M57TU | Â | Â | 3.5 Nm |

# CONNECTORS PLUGS

## 12 52 PLUG CONNECTORS, TERMINALS

PLUG CONNECTORS, TERMINALS - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Holder for modules | E36 | M6 | Â | 9 Nm |
| 2AZ Ground connections Flange nut | E36 | Â | Â | 16 Nm |
| 3AZ Cover on heating splash wall | E36 | Â | Â | 1.1 Nm |
| 4AZ Battery positive cap to cylinder head cover | M67 | M5 | Â | 6 Nm |
| 5AZ Wiring harness (term.50) to starter motor | M57TU / M67 | M6 | Â | 8 Nm |

| | | | | |
|---|---|---|---|---|
| 6AZ Wiring harness (term.30H) to starter motor | M57TU / M67 | M5 | Â | 5 Nm |
| 7AZ Battery positive lead (term.30) to alternator (B+) | M57TU / M67 | M8 | Â | 15 Nm |
| 8AZ Cable duct to cylinder head. | M57TU | M6x12 | Â | 4 Nm |

# OIL PRESSURE, OIL TEMPERATURES

## 12 61 OIL PRESSURE, OIL TEMPERATURE, OIL LEVEL DISPLAY

OIL PRESSURE, OIL TEMPERATURE, OIL LEVEL DISPLAY - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Oil-pressure switch/oil-temperature switch | All | M12x1.5 | Â | 27 Nm |
| 2AZ Level switch for engine oil | N62 / N73 / M67TU | Â | Jointing torque 2 Nm | 8.5 Nm |

# COOLANT TEMPERATURE

## 12 62 COOLANT TEMPERATURE

COOLANT TEMPERATURE - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Temperature sensor to water flange (glow time/coolant temperature gauge) | M21 | Â | Â | 18 Nm |
| Â | M51 | Â | Â | 13 Nm |
| 2AZ Temperature switch (5.5 Â°C / 17 Â °C) to fuel filter/cylinder head | M21 | Â | Â | 18 Nm |
| 3AZ Coolant temperature sensor (2-pin plug-in connection) | S38 / S50 | Â | Â | 13 Nm |
| Â | All / others | Â | Â | 20 Nm |
| 4AZ Remote thermometer sensor (2-pin plug-in connection) | All | Â | Â | 20 Nm |
| Remote thermometer sensor (4-pin plug-in connection) | M62 | Â | Â | 16 Nm |
| Â | S62 | M12 x 1.5 | Â | 14 Nm |
| 5AZ Remote thermometer sensor on coolant flange | S50 | Â | Â | 18 Nm |
| 6AZ Temperature | S38 / S50 | Â | Â | 13 Nm |

| | | | | |
|---|---|---|---|---|
| sensor - air | | | | |
| 7AZ Temperature sensor - oil | S38 / S50 | Â | Â | 13 Nm |

# SENSOR FOR CONTROL UNIT

## 12 72 SENDERS FOR CONTROL UNIT

SENDERS FOR CONTROL UNIT - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Lever to pedal value sender | E32 / E34 / E31 / E36 | Â | Â | 9 Nm |
| 2AZ Pedal value sender to pedal console | E32 / E34 / E31 | Â | Â | 5 Nm |

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# EXHAUST SYSTEM COMPUTE

## 18 00 EXHAUST ASSEMBLY

EXHAUST ASSEMBLY - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Primary catalytic converter to turbocharger/or jacket pipe to catalytic converter | M57 / M57TU | M10 | Â | 42 Nm |
| Â | M67 | Â | Â | 15 Nm |
| Â | M30 / M70 | Â | Tighten down compression spring with nut uniformly to full extent, then slacken by 1.5 turns | 10 Nm |
| Â | M51 | Â | Â | Preload compression springs with nut to 27Â° 1 mm |
| Â | S50 | M10 | Â | 30 Nm |
| Â | S54 / ECE | M10 | Â | 27 Nm |
| S54 / US | M10 | Â | Â | 24 Nm |
| 2AZ Exhaust pipe to flow section | E23 | Â | Â | 25 Nm |
| 3AZ Clamp for final muffler | All | M8 | Â | 15 Nm |
| 4AZ Catalytic converter on silencer | E36 / M42 / M43 / M44 | Â | Â | Version with compression spring: Evenly preload compression springs with nuts to 30 mm |
| 5AZ Connection of positive and negative leads to E catalytic converter | M73 | Â | Â | 5 Nm |
| 6AZ Rear muffler to intermediate muffler | E53 | M8 | Â | 30 Nm |
| 7AZ Vacuum tank to retaining plate | E46 / M54 | M8 | Â | 10 Nm |
| 8AZ Exhaust system to exhaust manifold | Â | M40 / M42 / M43 / M44 | M10 | 45 Nm |
| 9AZ Primary cat. to exhaust system | M57TU / E65 | Â | Â | 55 Nm |

# FUEL SUPPLY SYSTEM

## 16 1 020 PIN WRENCH

Minimum set: Mechanical tools

NOTE: Note: For removing and installing fuel level sensor in fuel tank

Series: E31, E34, E34tou, E36, E36/2, E36/3, E36/5, E36/7, E36/C, E36tou, E38, E38/3, E39, E39PL, E39tou, E46, E46/16, E46/2, E46/3, E46/5, E46/C, E52, E53, E60, E61, E63, E64, E65, E66, E67, E83, E85, E87, E90, E91, R50, R52, R53, RR1

Storage location: C21

SI number: 1 04 99 (425)

Order number: 16 1 020

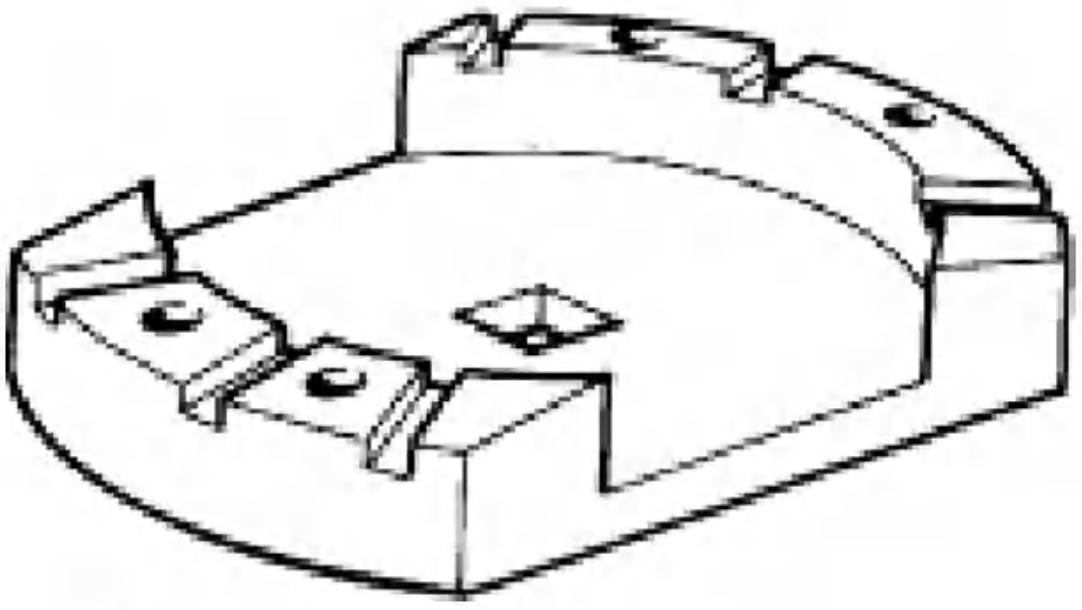
Pin wrench

Consisting of:

1 = 16 1 021 Basic wrench

2 = 16 1 022 Attachment (2 x)

NOTE: Model series: E46, E38, E39, R50, R53



G03155544

Fig. 1: Identifying Special Tool - Pin Wrench
Courtesy of BMW OF NORTH AMERICA, INC.

## 16 1 050 COMBINATION TOOL

Minimum set: Mechanical tools

NOTE: Note: For releasing line connections at carbon canister as well as for fuel lines on engine

Series: E36, E38, E39

Storage location: B16

SI number: 1 06 94 (801)

Order number: 16 1 050

Combination tool

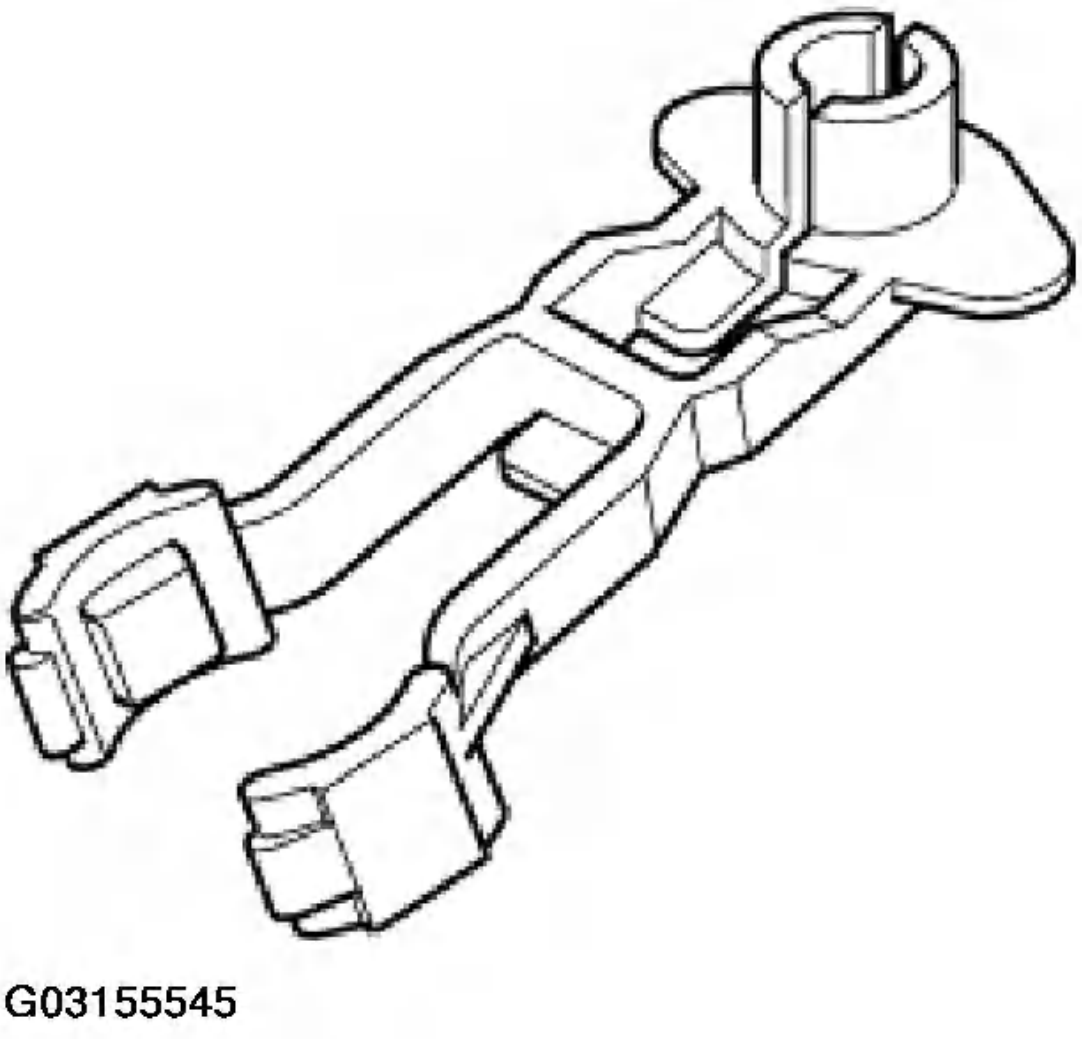



Fig. 2: Identifying Special Tool - Combination Tool
Courtesy of BMW OF NORTH AMERICA, INC.

16 1 160 SEALS

NOTE: Note: For leak-testing tank ventilation system with OBD II - sealing off of air filter and scavenging air line Miscellaneous: USA only

Series: E36, E36/2, E36/3, E36/5, E36/7, E36/C, E38, E38/3, E39, E39tou

SI number: 1 25 97 (263)

Order number: 16 1 160

Seals

Consisting of:

1 = 16 1 161 Seal

NOTE: For air filter of leak diagnosis pump - model series: E38, E39

2 = 16 1 162 Seal

NOTE: For scavenging air line of tank venting valve - model series: E36, E38, E39/model: Z3

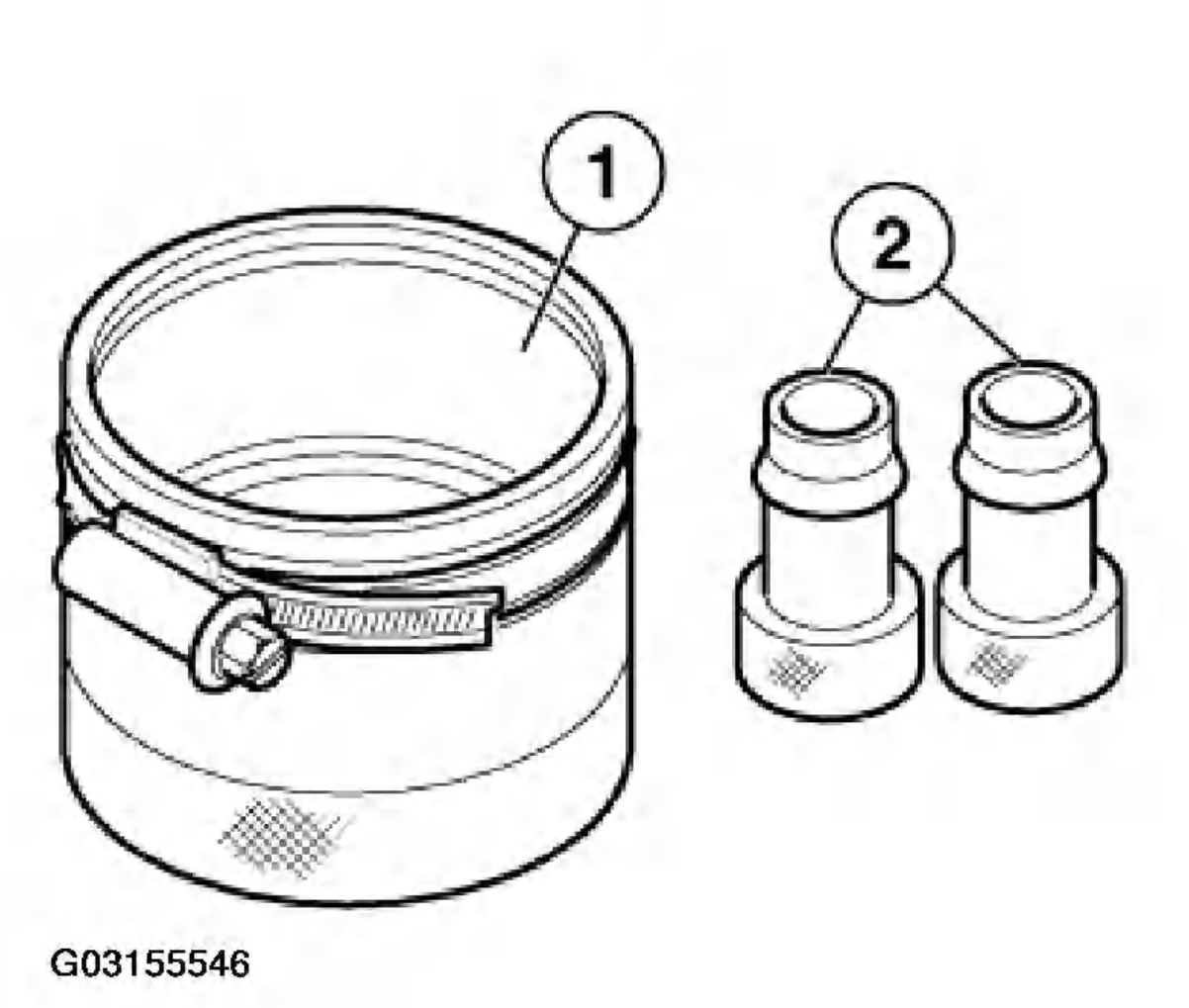



Fig. 3: Identifying Special Tool - Seals
Courtesy of BMW OF NORTH AMERICA, INC.

# FUEL SUPPLY SYSTEM

## 13 0 131 COMPRESSED AIR HOSE WITH FILTER

Order number: 13 0 131

Compressed air hose with filter

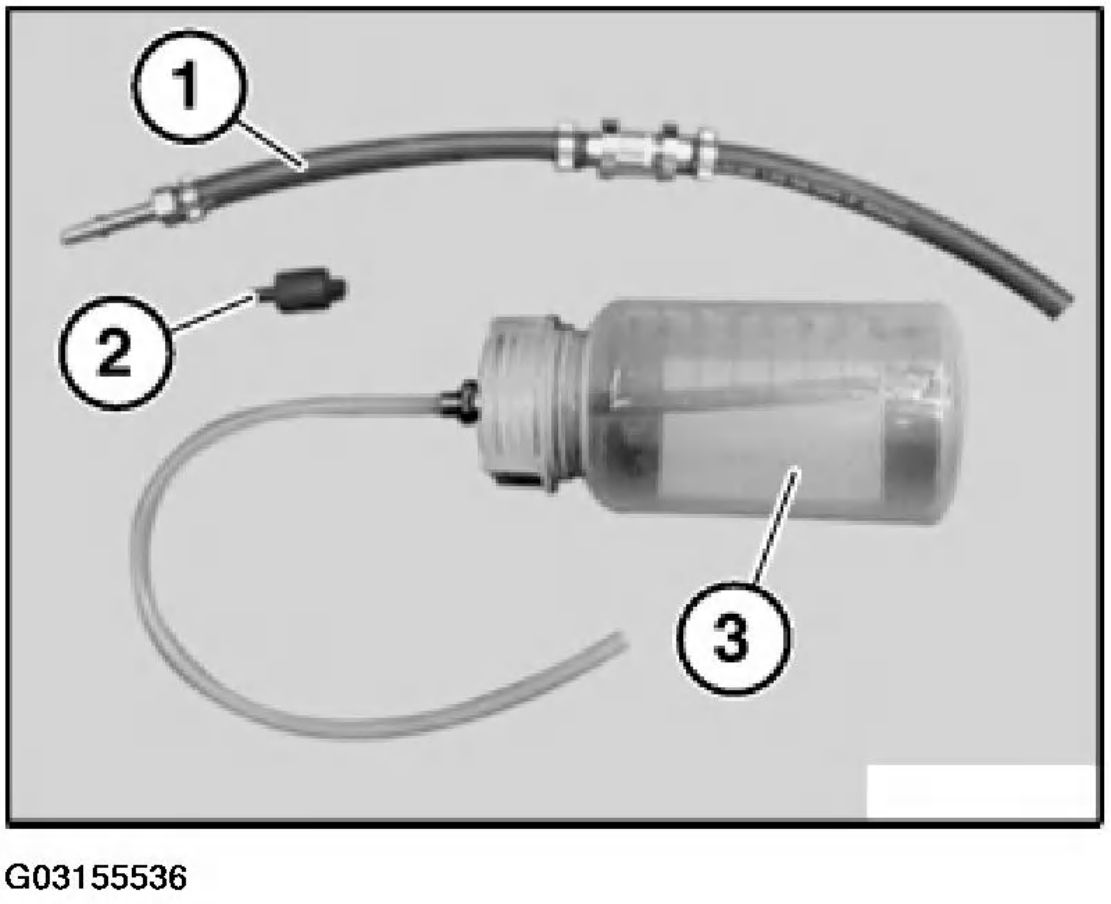



Fig. 1: Identifying Special Tool - Compressed Air Hose With Filter
Courtesy of BMW OF NORTH AMERICA, INC.

## 13 0 132 ADAPTER

Order number: 13 0 132

Adapter

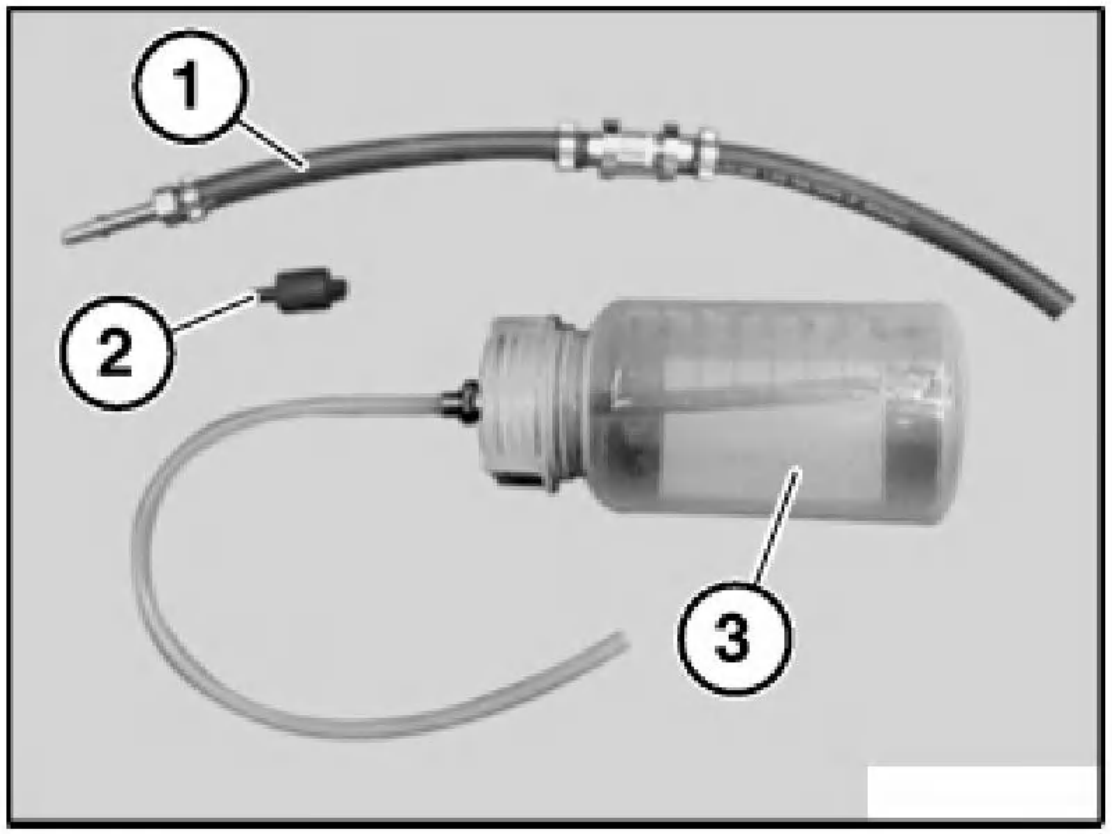



Fig. 2: Identifying Special Tool - 13 0 132 Adapter
Courtesy of BMW OF NORTH AMERICA, INC.

## 13 0 133 CONTAINER

Order number: 13 0 133

Container

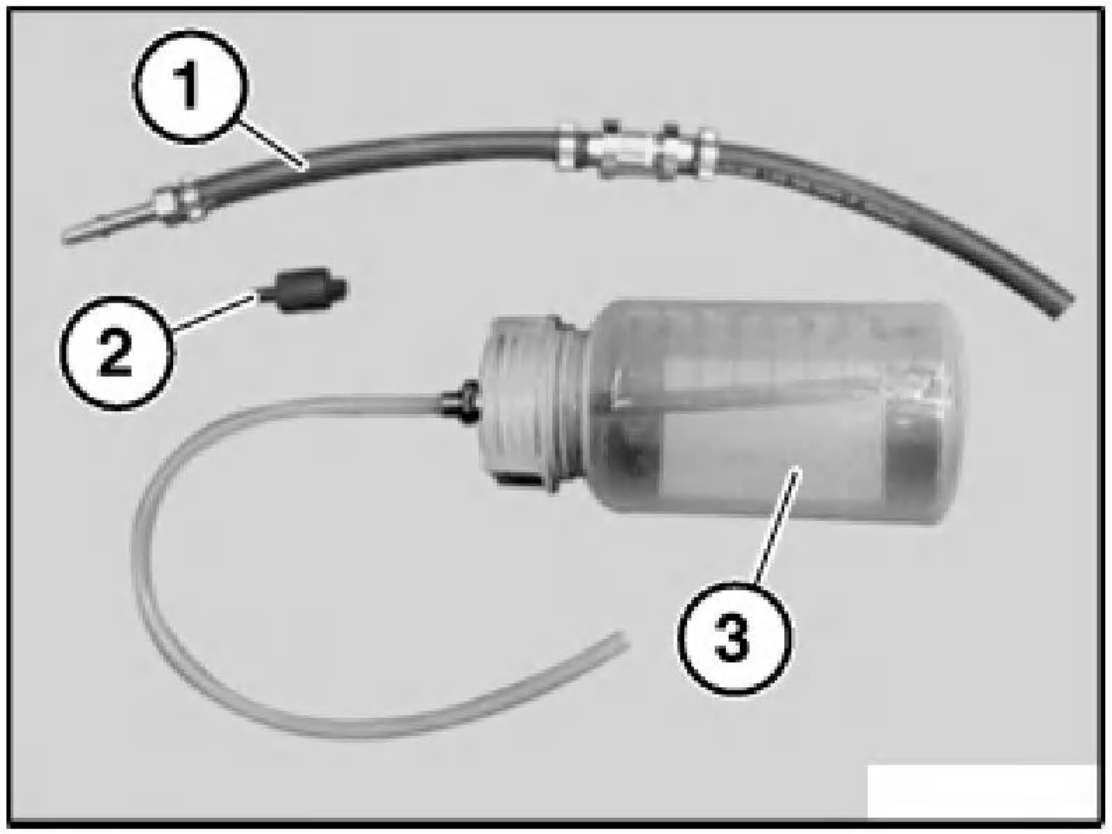



Fig. 3: Identifying Special Tool - 13 0 133 Container
Courtesy of BMW OF NORTH AMERICA, INC.

13 3 010 HOSE CLIP

Minimum set: Mechanical tools

NOTE: Note: For disconnecting a hose for repair work

Series: E12, E21, E23, E24, E28, E30, E30/C, E30tou, E31, E32, E32/3, E34, E34tou, E36, E36/2, E36/3, E36/5, E36/7, E36/C, E36tou, E38, E38/3, E39, E39PL, E39tou, E46, E46/16, E46/2, E46/3, E46/5, E46/C, E52, E53, E60, E61, E63, E64, E65, E66, E67, E83, E85, E87, E90, E91, R50, R52, R53, RR1

Storage location: A22

Order number: 13 3 010

Hose clip

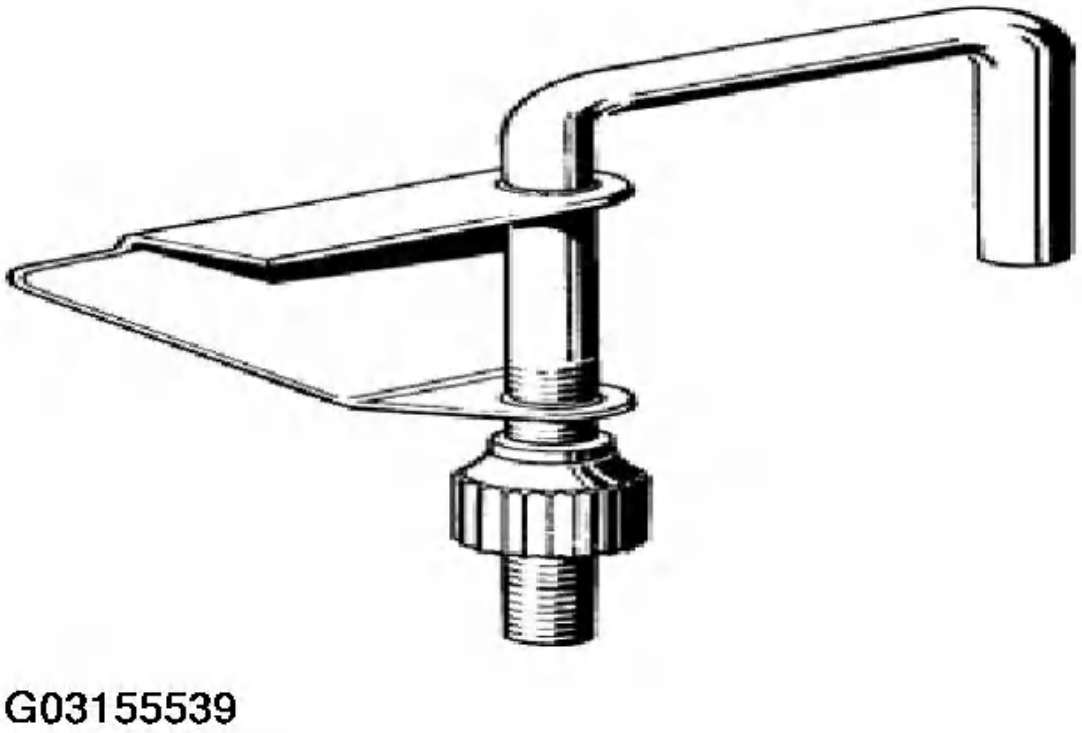



Fig. 4: Identifying Special Tool - 13 3 010 Hose Clip
Courtesy of BMW OF NORTH AMERICA, INC.

13 3 060 FIXTURE

NOTE: Note: For checking fuel pressure on K-Jetronic and L-Jetronic as well as oil pressure

Engine: M10, M20, M20B25, M20B27, M21, M30, M30B34, M30Tur, M40, M41, M42, M43, M43TU, M44, M47, M47T2, M47TU, M50, M51, M52, M52TU, M54, M56, M57, M57D25, M57D30, M57TU, M60, M62, M62VAN, M67, M70, M73, M88, N40, N42, N45, N46, N62, N73, S14, S38, S50B30, S50B32, S50US, S52US, S54, S62, W10, W11, W17

Order number: 13 3 060

Fixture

Consisting of:

1 = 13 3 061 Pressure gauge 0...25 bar

2 = 13 3 062 2-way cock

NOTE: Engine: All, except S50, S54, N73

3 = 13 3 063 Connecting lines (2 x)

NOTE: For fuel and oil pressure testing

4 = 13 3 064 Connecting line

NOTE: Mit T-piece for L-Jetronic All except N73

5 = 13 3 065 Connecting piece distributor

NOTE: All except N73

6 = 13 3 066 Connecting piece warm-up sensor

NOTE: All except N73

7 = 13 3 067 Connecting hose

NOTE: For checking fuel pump delivery All except N73

In conjunction with: 13 3 020

8 = 13 3 068 Connecting piece distributor

NOTE: All except N73

In conjunction with: BMW SERVICE TESTER

9 = 13 3 069 Connecting piece

NOTE: For warm-up sensor with hose all except N73

In conjunction with: BMW SERVICE TESTER

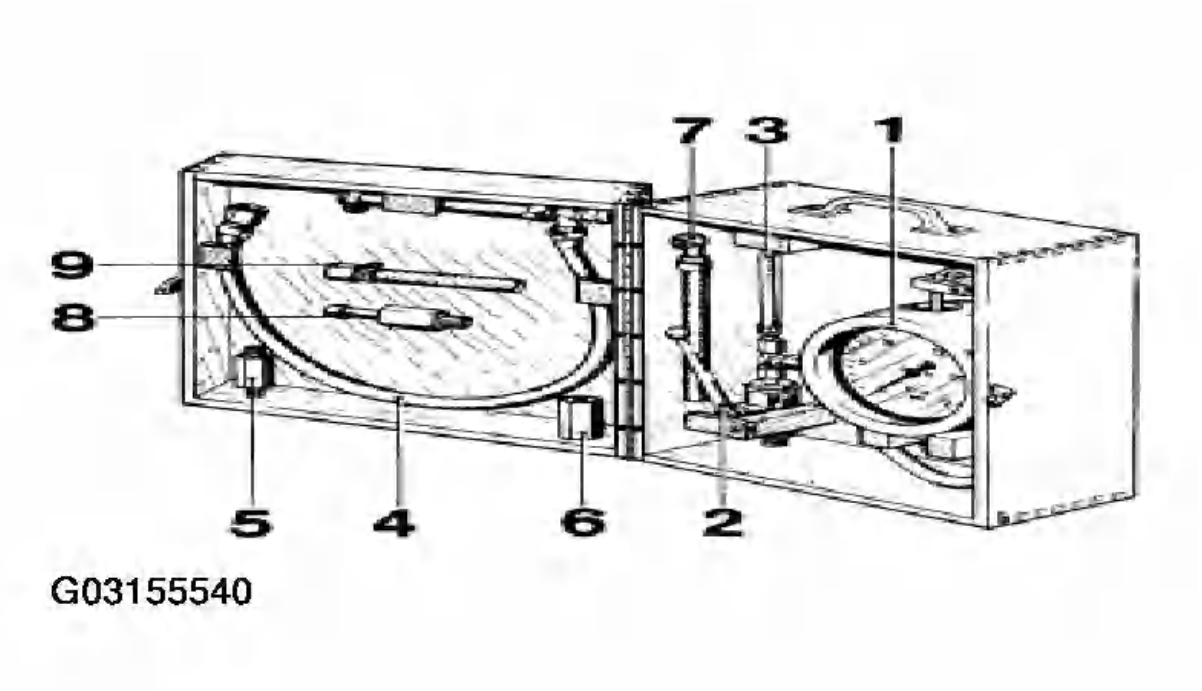



Fig. 5: Identifying Special Tool - 13 3 060 Fixture
Courtesy of BMW OF NORTH AMERICA, INC.

13 5 220 ADAPTER

Minimum set: Mechanical tools

In conjunction with: 13 3 063 or 13 6 051

NOTE: Note: For pressure gauge 13 3 061 or BMW DIS for measuring fuel pressure at injection rail

Engine: M10, M20, M20B25, M20B27, M21, M30, M30B34, M30Tur, M40, M41, M42, M43, M43TU, M44, M47, M47TU, M50, M51, M52, M52TU, M54, M56, M57, M57D25, M57D30, M57TU, M60, M62, M62VAN, M67, M70, M73, M88, N40, N42, N62, S14, S38, S50B30, S50B32, S50US, S52US, S54, S62, W10, W11, W17

Storage location: C16

SI number: 1 06 95 (963)

Order number: 13 5 220

Adapter

Consisting of: 1 = 13 5 221

Adapter

NOTE: Engine: M43, M44, M52, M62

2 = 13 5 222 Coupling connector

NOTE: For connecting DIS pressure sensor

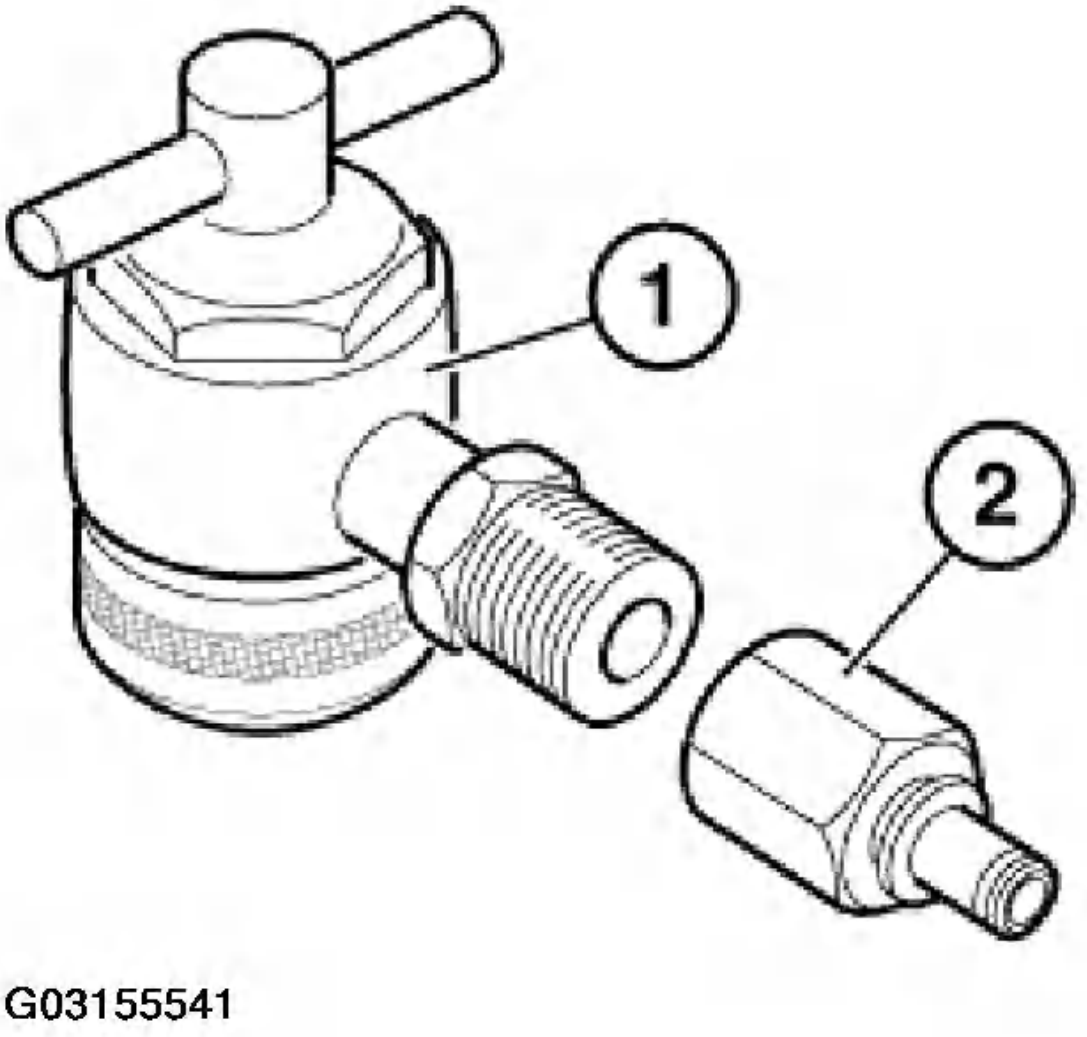



Fig. 6: Identifying Special Tool - 13 5 220 Adapter
Courtesy of BMW OF NORTH AMERICA, INC.

13 6 050 SET OF ADAPTERS FOR BMW DIS

Minimum set: Mechanical tools

NOTE: Note: For measuring oil and fuel pressures

Engine: M10, M20, M20B25, M20B27, M21, M30, M30B34, M30Tur, M40, M41, M42, M43, M43TU, M44, M47, M47T2, M47TU, M50, M51, M52, M52TU, M54, M56, M57, M57D25, M57D30, M57TU, M60, M62, M62VAN, M67, M70, M73, M88, N40, N42, N62, N73, S14, S38, S50B30, S50B32, S50US, S52US, S54, S62, W10, W11, W17

Storage location: A16, B16

SI number: 1 12 94 (859)

Order number 13 6 050

Set of adapters for BMW DIS

Consisting of:

1 = 13 6 051 Connecting hose

NOTE: For connecting reducers 13 6 052, 13 6 053, 13 6 55 and adapters 11 4 050, 11 4 160, 11 4 170, 13 5 131 to BMW DIS

2 = 13 6 052 Reducer

NOTE: For pipe elbows 24 0 023, 24 0 024, 24 0 140

In conjunction with: 13 6 051

3 = 13 6 053 Reducer for adapter 16 1 300

In conjunction with: 13 6 051

4 = 13 6 054 Pipe elbow

In conjunction with: 13 6 051, 11 4 050

5 = 13 6 055 Reducer for T-pieces 13 6 056 and 13 6 057

In conjunction with: 13 6 051

6 = 13 6 056 T-piece for 6 mm dia. line

7 = 13 6 057 T-piece for 8 mm dia. line

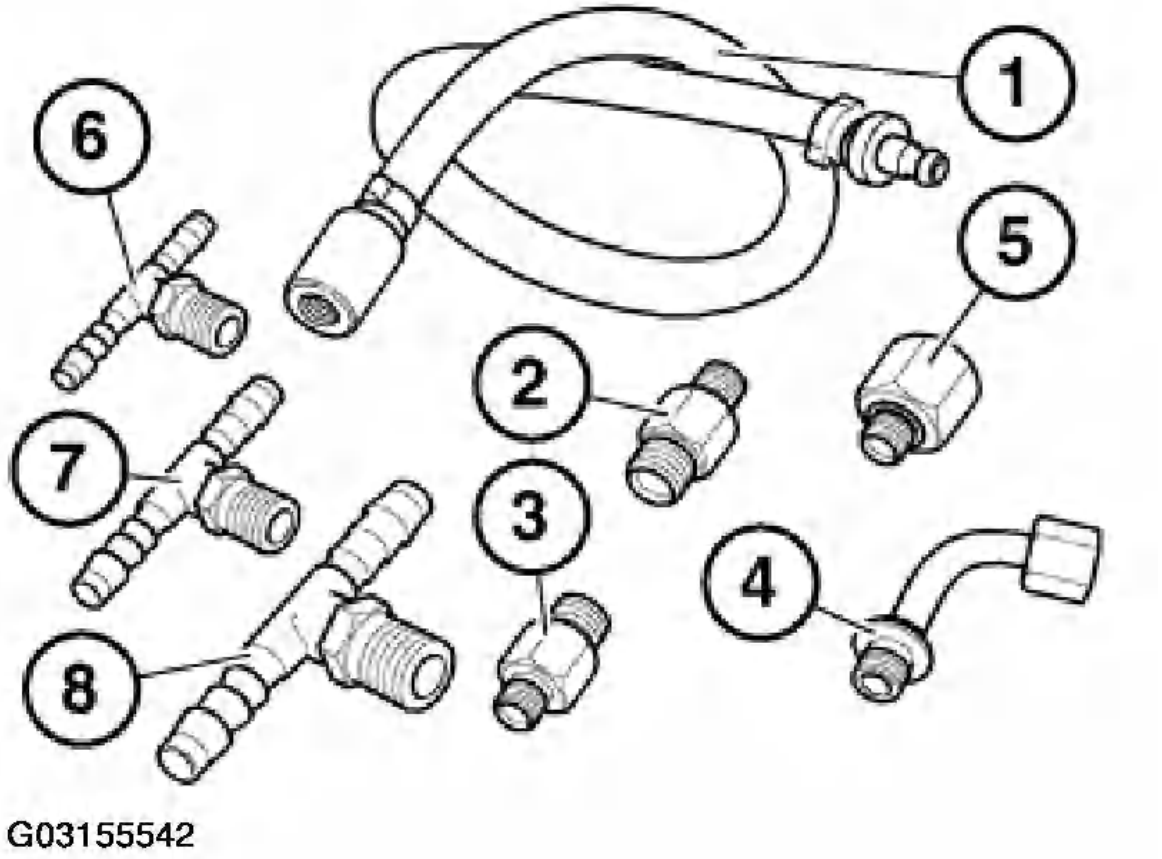


Fig. 7: Identifying Special Tool - Set Of Adapters For BMW DIS
Courtesy of BMW OF NORTH AMERICA, INC.

13 6 058 T-PIECE FOR 12 MM DIA. LINE

Order number: 13 6 058

T-piece for 12 mm dia. Line

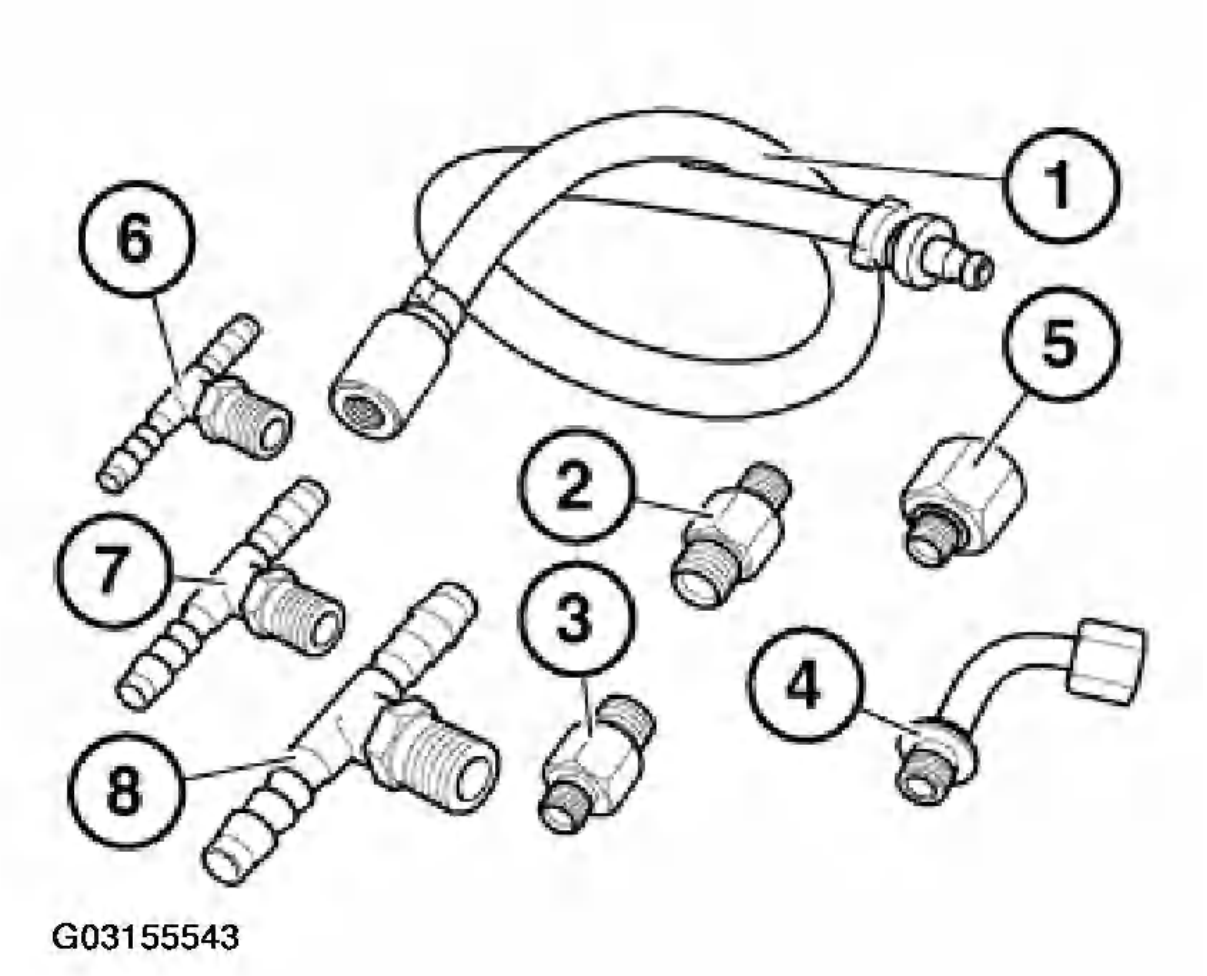



Fig. 8: Identifying Special Tool - T-Piece For 12 Mm Dia. Line
Courtesy of BMW OF NORTH AMERICA, INC.

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Article GUID: A00202801

# FUEL PUMP WITH DRIVE

## 13 31 FUEL PUMP WITH DRIVE AND PIPES

FUEL PUMP WITH DRIVE AND PIPES - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Measure |
|---|---|---|---|
| 1AZ Fuel pump to engine | All | Â | 12 Nm |
| 2AZ Fuel pipe coupling bolt | All / with K-Jetr. | M8 | 9 Nm |
| 3AZ Fuel pipe coupling bolt | All / with K-Jetr. | M12 | 20 Nm |
| 4AZ Fuel pipe to pressure regulator | All / with L-Jetr. | Â | 30 Nm |
| 5AZ Return pipe connector to pressure regulator | All / with L-Jetr. | Â | 27 Nm |

# FUEL FILTER

## 13 32 FUEL FILTER

FUEL FILTER - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Measure |
|---|---|---|---|
| 1AZ Fuel line to filter housing and injection pump | | | |
| Coupling nut | M21 / M51 / M41 | M14 x 1.5 | 14 Nm |
| Adapter | M21 / M51 / M41 | M12 x 1.5 | 9 Nm |
| Hollow bolt | M21 / M51 / M41 | M14 x 1.5 | 14 Nm |
| 2AZ Fuel filter to holder | M51 / M41 | M8 | 22 Nm |
| 3AZ Air duct to fuel cooler | M47 | Â | 5.7 Nm |
| Â | M57 | Â | 2 Nm |
| 4AZ Fuel filter cover | M47 | Â | 25 Nm |
| 5AZ Fuel filter with holder to body | N42 | Â | 8.8 Nm |

# INJECTION PUMP, REGULATOR

## 13 51 INJECTION PUMP, CONTROL RECEPTACLE

INJECTION PUMP, CONTROL RECEPTACLE - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Measure |
|---|---|---|
| 1AZ Plug for high pressure section of injection pump | M21 / M51 / M41 | 25 Nm |
| 2AZ Distributor injection pump to holder | M21 / M51 / M41 | 25 Nm |
| 3AZ Electric shutoff to injection pump | M21 / M51 / M41 | 20 +/- 5 Nm |
| 4AZ Electric cold start valve to injection pump | M21 | 20 Nm |
| 5AZ Coupling bolt (OUT) to injection pump (fuel return) | M21 / M51 / M41 | 25 Nm |
| 6AZ Pressure valve holder to injection pump | M21 / M51 | 45 Nm |
| 7AZ Expansion element housing (temperature dependent idling speed boost) to injection pump | M21 | 18 Nm |
| 8AZ Distributor injection pump to flange and | M21 / M51 / M41 | 22 Nm |

| | | |
|---|---|---|
| console | | |
| 9AZ Electr. line on fuel cutout device | M51 / M41 | 2.5 Nm |
| 10AZ Fuel feed line to injection pump (VP44) | M47 | 30 Nm |
| 11AZ Fuel return line to injection pump (VP44) | M47 | 25 Nm |
| 12AZ Plug for static basic adjustment (injection pump VP44) | M47 | 13 Nm |
| 13AZ Blocking screw for injection pump shaft without spacer plate (injection pump VP44) | M47 | 31 Nm |
| 14AZ Blocking screw for injection pump shaft with spacer plate (injection pump VP44) | M47 | 13 Nm |
| 15AZ Injection line (union nut) to injection pump (VP44) | M47 | 30 Nm |

# SENSOR FOR CONTROL UNIT

## 13 62 SENDERS FOR CONTROL UNIT

SENDERS FOR CONTROL UNIT - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Measure |
|---|---|---|
| 1AZ Temperature time switch | M21 / M51 | 18 Nm |
| 2AZ Coolant temperature sensor | M60/1 / M60/2 / M21 / M51 | 18 Nm |
| Â | All others | 13 Nm |
| 3AZ Temperature switch | All | 28 Nm |
| 4AZ Temperature sensor - air | All | 13 Nm |
| 5AZ Charge-air pressure sensor on holder | M51 / M41 | 4 Nm |
| Charge-air pressure sensor on intake manifold | M47 | 5 Nm |
| 6AZ Twin temperature sensor (4-pin plug-in connection) | M41 / M43 / M44 / S50 / S52 / M52 / M57 / M67 / M62 / M73 | 13 Nm |
| 7AZ Air-mass sensor on lower section of air filter housing | M51 | 3.5 Nm |
| Air-mass flow sensor to cylinder head cover | M47 / M47TU / M57 / M57TU | 4.5 Nm |
| 8AZ Pulse generator, camshaft to cylinder head cover | M57 | 4.5 Nm |
| Â | M47TU / M57TU | 3.5 Nm |
| 9AZ Intake neck on air-mass flow sensor | M47 | 9 Nm |

# START VALVES

## 13 64 FUEL INJECTORS

FUEL INJECTORS - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Measure |
|---|---|---|---|
| 1AZ Fuel injector to intake manifold | All | M6 | 10 Nm |
| 2AZ Coupling nut on fuel injector | All / with K-Jetr. | Â | 25 Nm |

Article GUID: A00202651

# COOLANT, CHECKING COOL

## 17 00 ...INSTRUCTIONS FOR WORKING ON COOLING SYSTEM.

WARNING: Danger of scalding! Work on the cooling system should only be carried out when the engine has cooled down.

CAUTION: When working on the oil, coolant or fuel circuit, you must protect the alternator against contamination. Cover alternator with suitable materials. Failure to comply with this procedure may result in an alternator malfunction.

CAUTION: Open cooling system only when it has cooled down. Opening the cooling system while hot can result in air entering the system. This can cause overheating with permanent damage to the engine.

### Recycling

Catch and dispose of drained coolant.

Observe country-specific waste-disposal regulations.

### Instructions for disassembly/assembly of coolant hose fast-release couplings

#### Disassembly of fast-release coupling

Withdraw lock (1/2), disconnect hose.

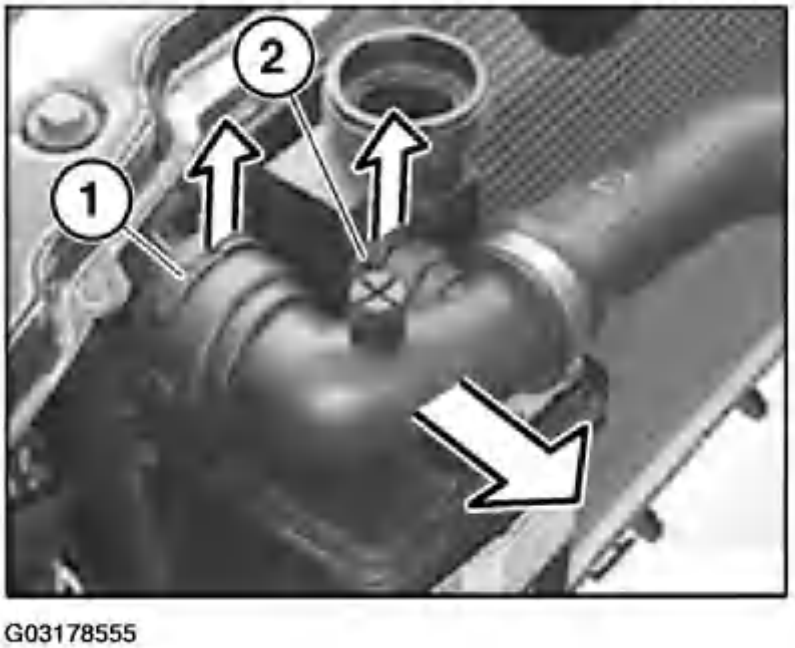



Fig. 1: Disconnecting Hose
Courtesy of BMW OF NORTH AMERICA, INC.

### Installation:

Check O-rings (1).

Do not coat O-rings (1) with antiseize agent.

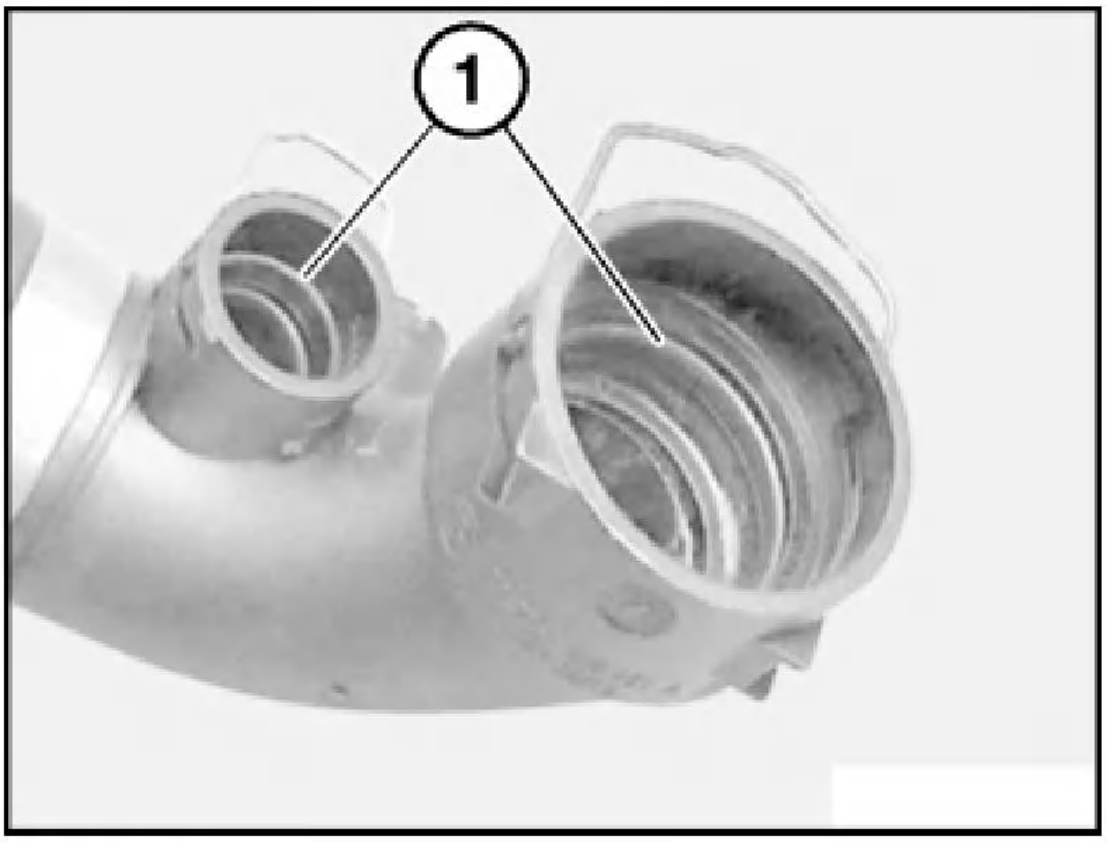



Fig. 2: Checking O-Rings
Courtesy of BMW OF NORTH AMERICA, INC.

### Assembly of fast-release coupling

Press in lock (1) before installing fast-release coupling.

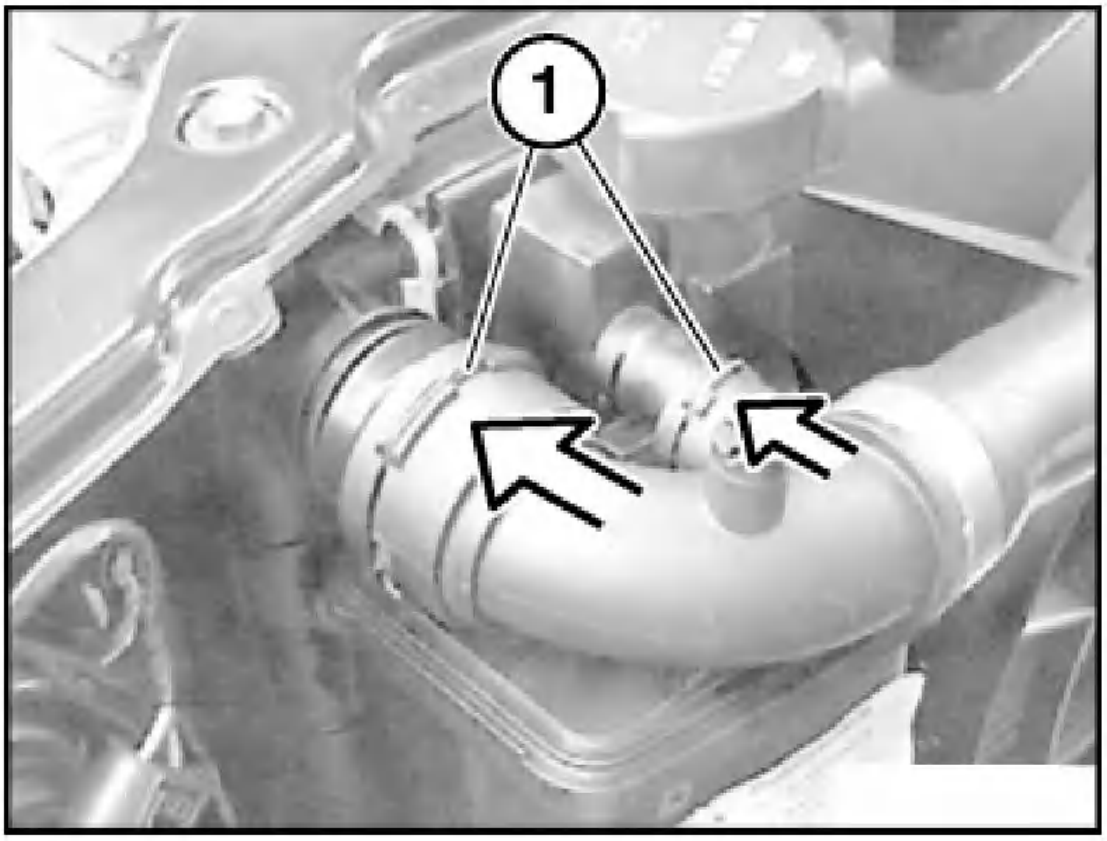



Fig. 3: Pressing In Lock
Courtesy of BMW OF NORTH AMERICA, INC.

Push on hose.

Fast-release coupling must audibly snap into place.

## 17 00 005 DRAINING AND TOPPING UP COOLANT

NOTE: After topping up the coolant, bleed the cooling system and check for water tightness, refer to 17 00 039 VENTING COOLING SYSTEM AND CHECKING FOR LEAKS (Z3 M54) .

### Drain coolant!

CAUTION: Danger of scalding! Safety information: Only perform this work after engine has cooled down.

### Separate expansion tank

Unfasten cap on expansion tank.

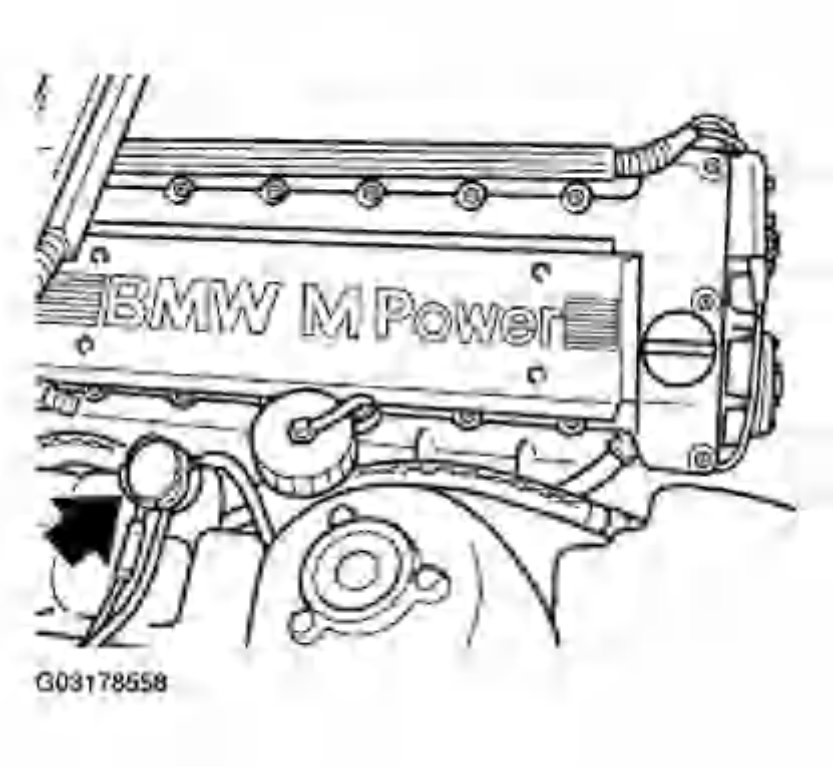



Fig. 4: Removing Cap On Expansion Tank (Separate Expansion Tank)
Courtesy of BMW OF NORTH AMERICA, INC.

### Integrated expansion tank

Unfasten cap on expansion tank.

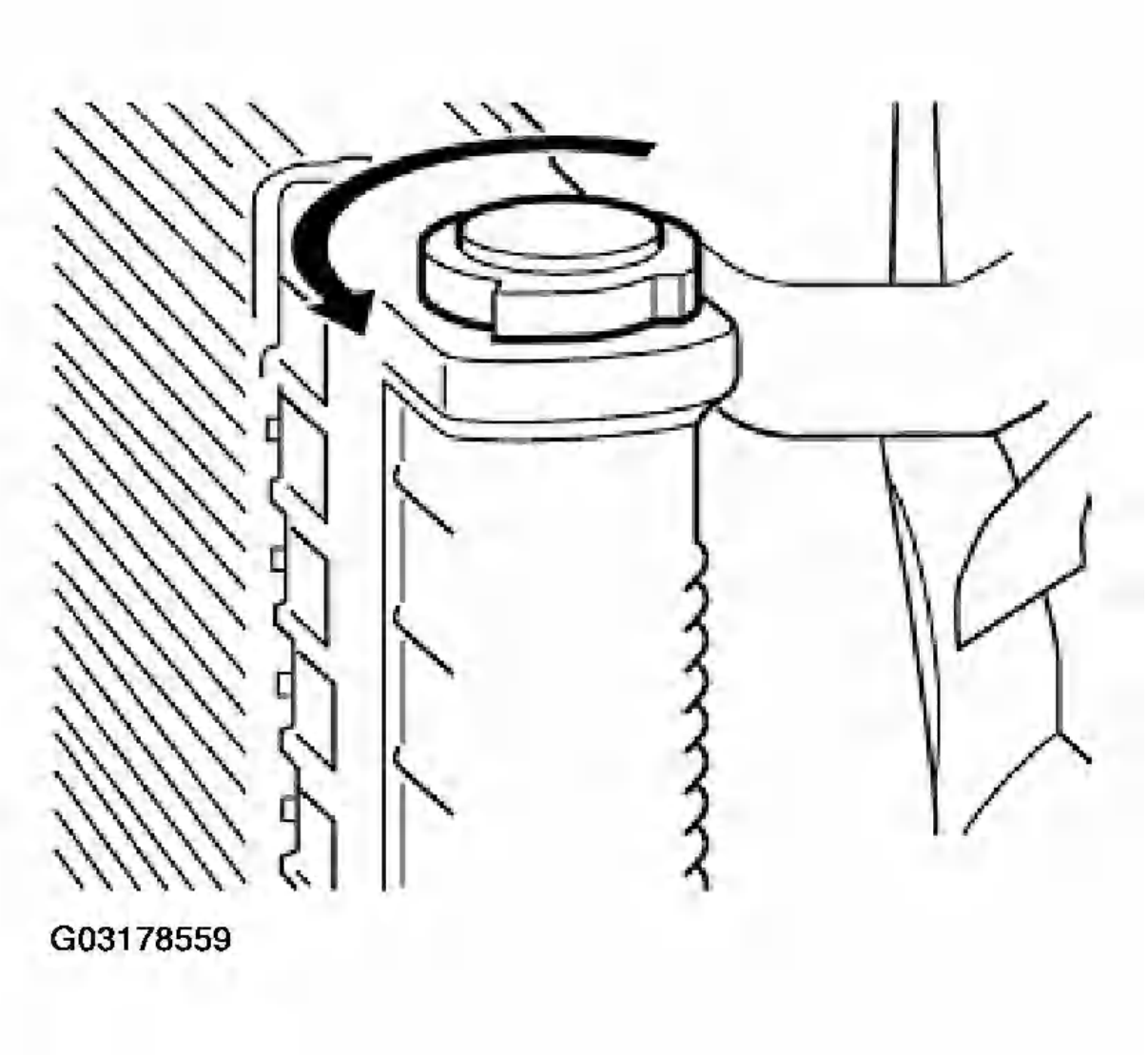



Fig. 5: Removing Cap On Expansion Tank (Integrated Expansion Tank)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove front underbody protection and unfasten drain plug at bottom of radiator if necessary.

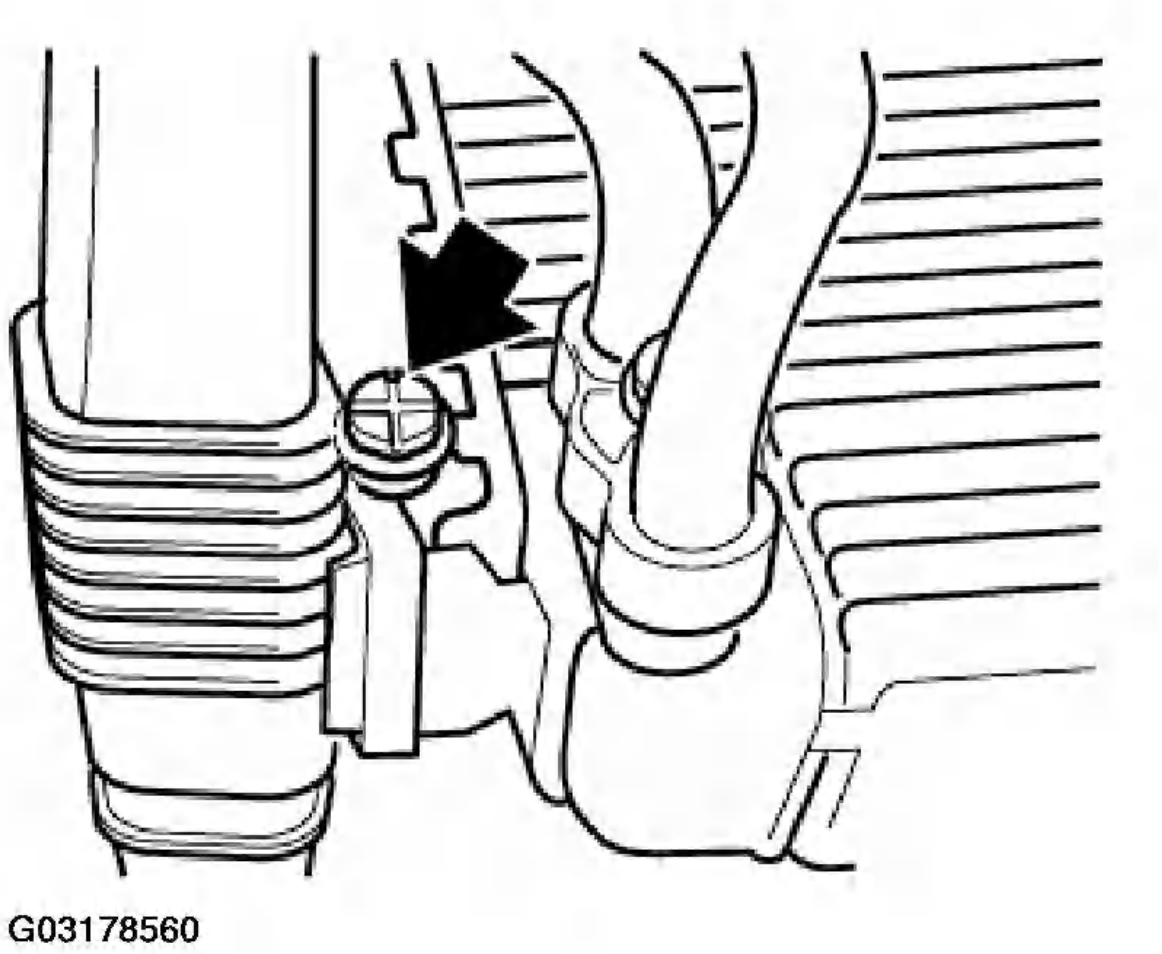



Fig. 6: Removing Drain Plug From Bottom Of Radiator
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace gasket.

Tightening Torque, refer to 17 11 2AZ 17 11 2AZ RADIATOR AND MOUNTING PARTS .

Drain, catch and dispose off coolant.

All 6-cylinder engines

Unfasten drain plug on engine block.

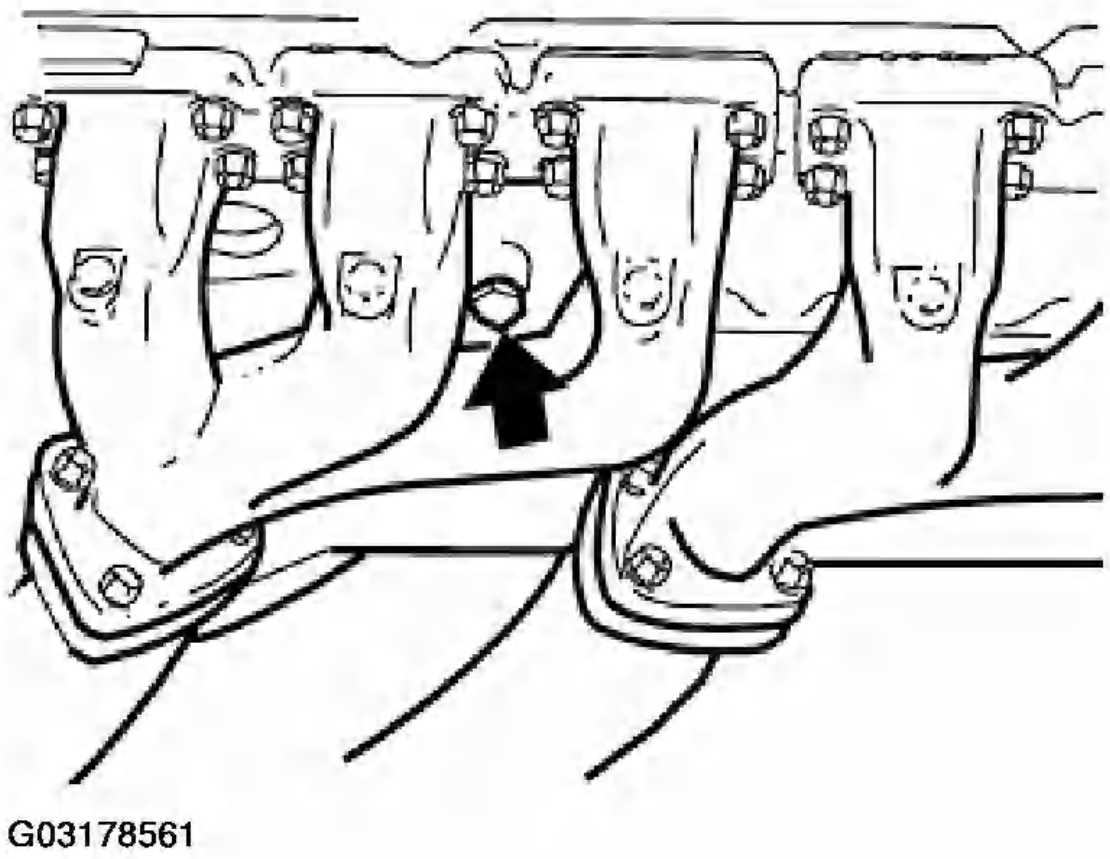



Fig. 7: Removing Drain Plug From Engine Block (6-Cylinder Engines)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace gasket.

Tightening Torque, refer to 11 11 5AZ 11 11 ENGINE BLOCK .

Drain, catch and dispose off coolant.

All 4-cylinder engines

Unfasten drain plug on engine block.

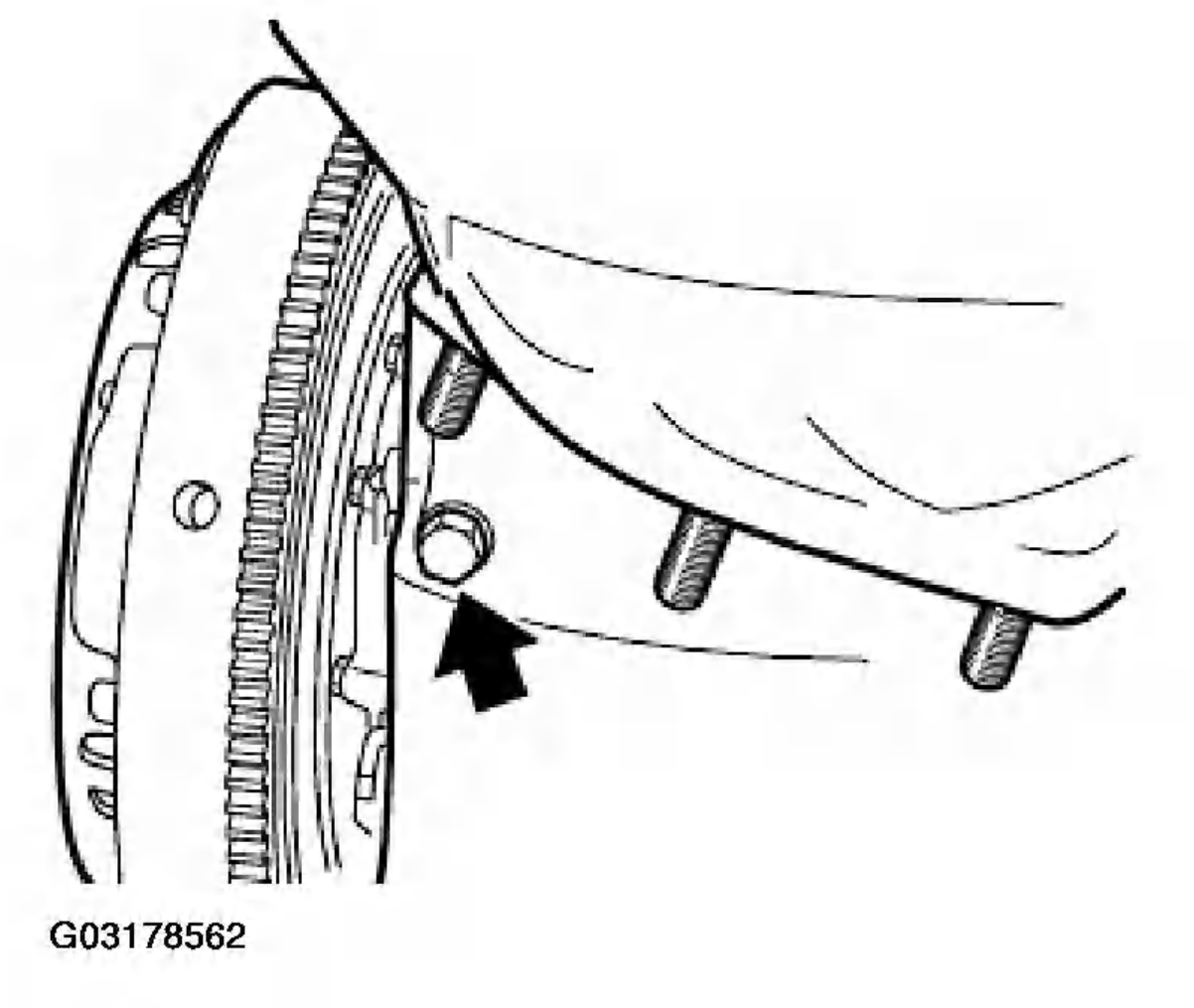



Fig. 8: Removing Drain Plug From Engine Block (4-Cylinder Engines)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace gasket.

Tightening Torque, refer to 11 11 5AZ 11 11 ENGINE BLOCK .

Drain, catch and dispose off coolant.

Top up coolant!

Separate expansion tank

No bleed screws on radiator and thermostat housing!

All bleeding occurs through the vent pipe which leads to the connection on the expansion tank.

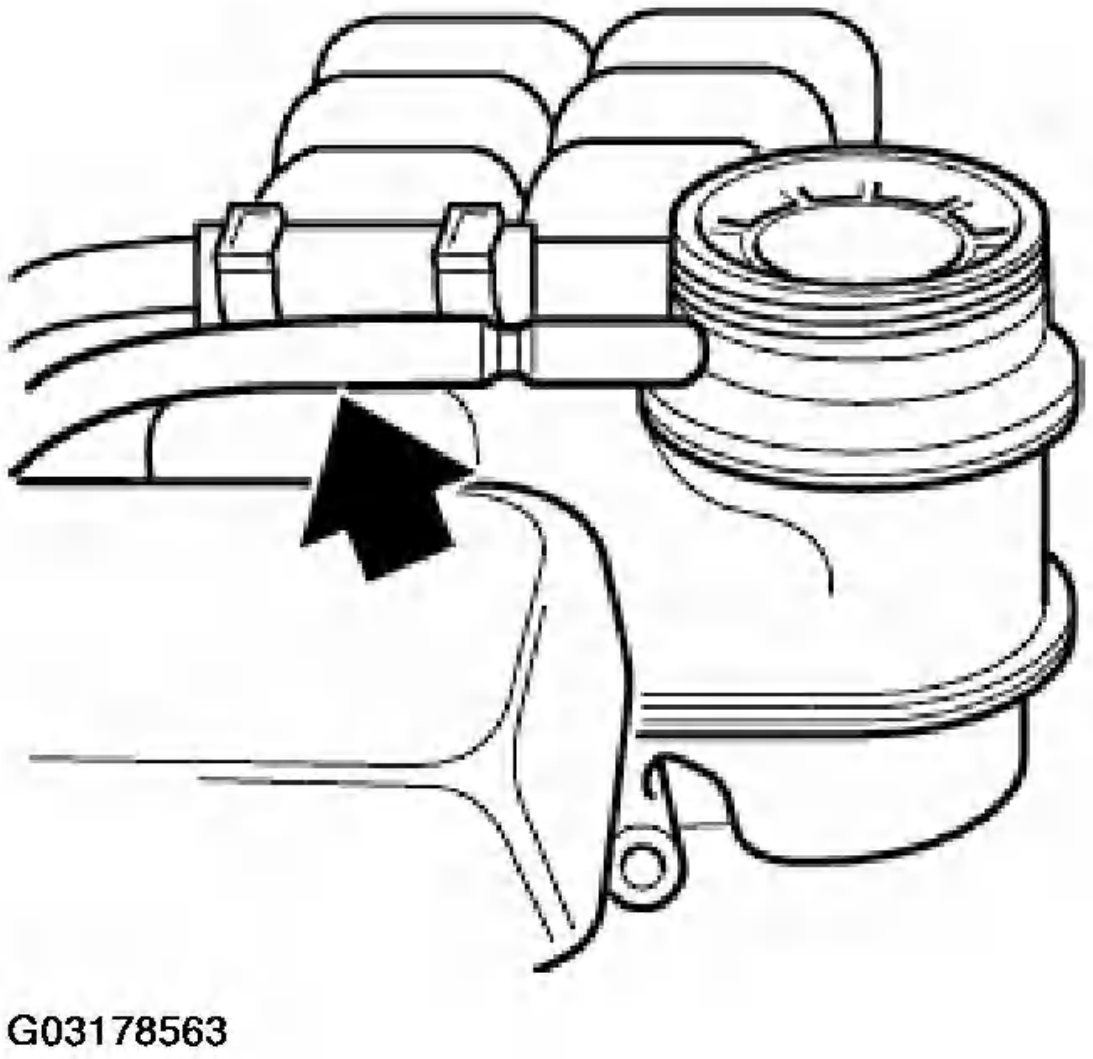



Fig. 9: Identifying Separate Expansion Tank
Courtesy of BMW OF NORTH AMERICA, INC.

Coolant system is vented during the filling procedure.

Integrated expansion tank

Unfasten vent screw on expansion tank.

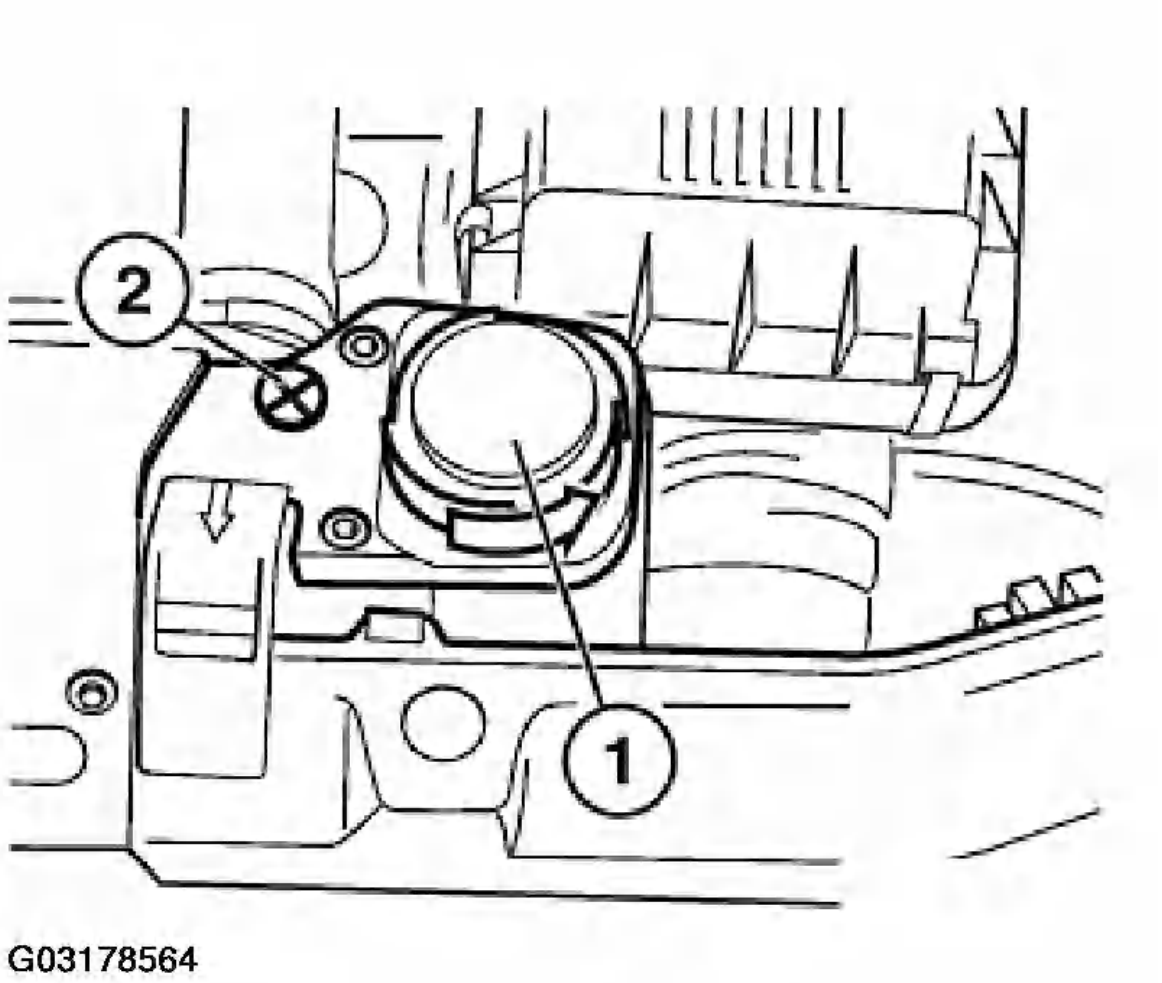



Fig. 10: Removing Vent Screw On Expansion Tank
Courtesy of BMW OF NORTH AMERICA, INC.

All bleeding occurs through vent plug on expansion tank.

Cooling system is vented after the filling procedure.

M52

On vehicles with M52 engines, also unfasten additional vent screw.

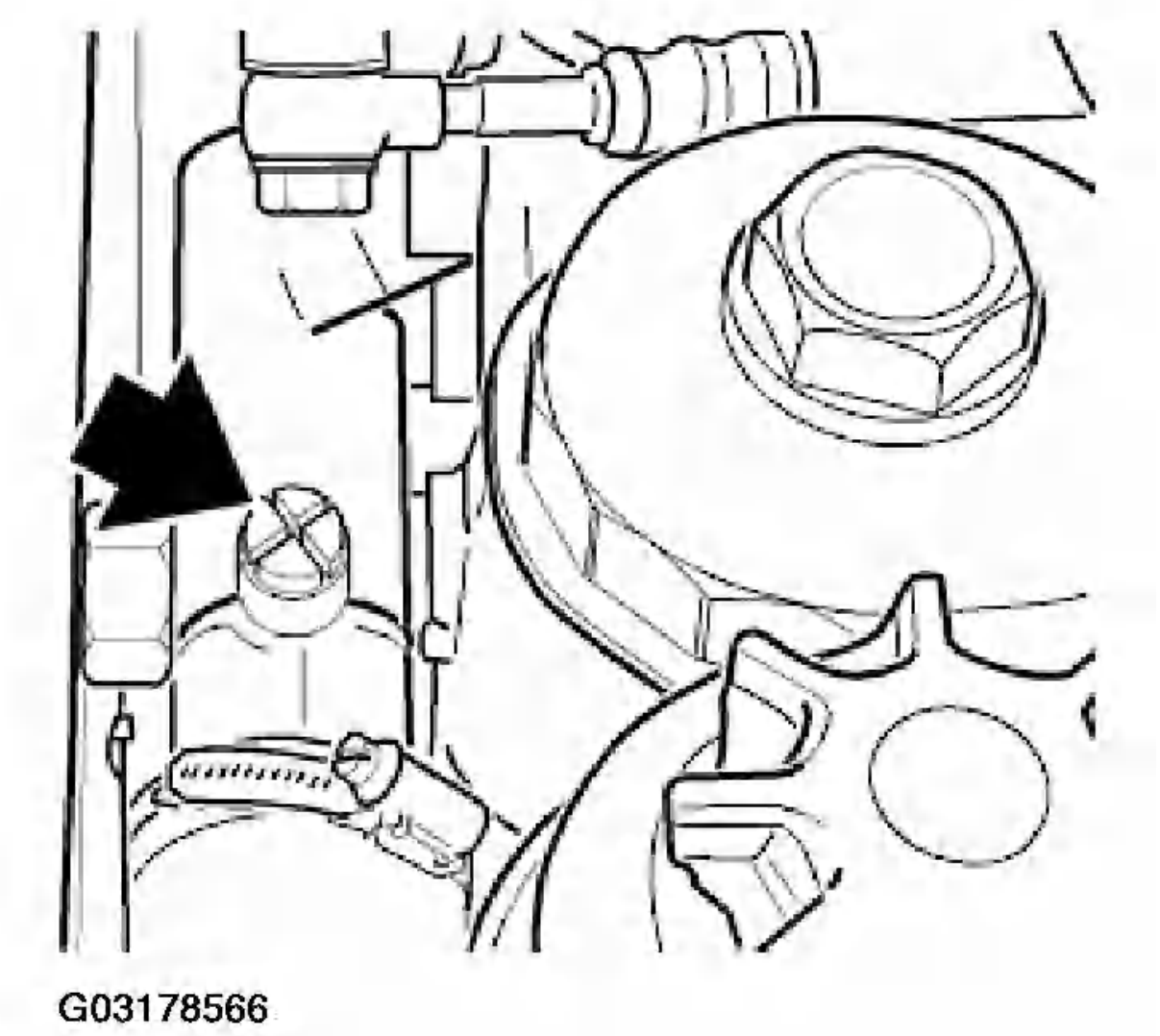



Fig. 11: Removing Additional Vent Screw On Thermostat Housing (M52)
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Before filling, switch on ignition, set heater control to maximum temperature and set fan to low speed. This opens heating valves and installed auxiliary water pump runs if necessary.

Perform filling operation slowly.

Fill expansion tank completely and wait until coolant emerges at vent point(s) without bubbles. Close bleed screw(s).

NOTE: Only use specified coolant.




Fig. 12: Locating Vent Point
Courtesy of BMW OF NORTH AMERICA, INC.

## 17 00 005 DRAINING AND TOPPING UP COOLANT (Z3 M54)

WARNING: Danger of scalding! Only perform these tasks on an engine that has cooled down.

### Recycling

Catch and dispose of drained coolant. Observe country-specific waste-disposal regulations.

Draining Coolant:

Open cap on coolant expansion tank.

Slacken vent screw (1) on coolant expansion tank.

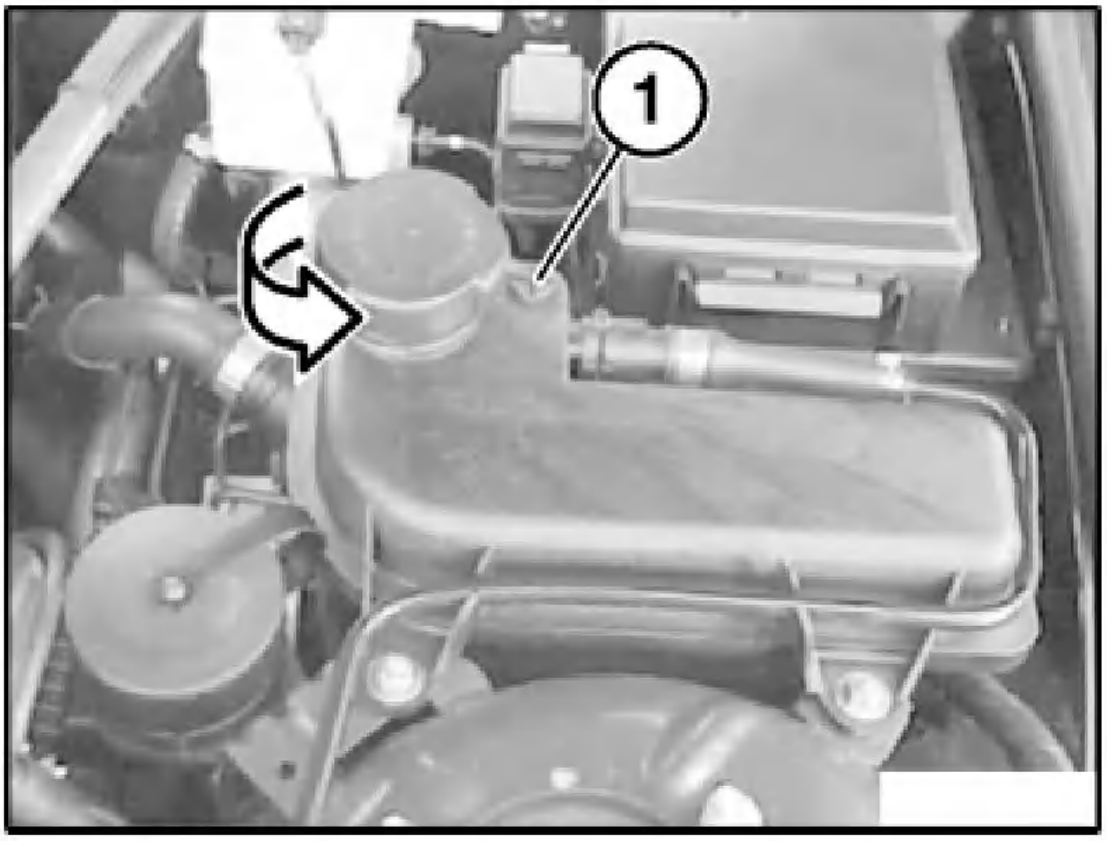



Fig. 13: Slackening Vent Screw On Coolant Expansion Tank
Courtesy of BMW OF NORTH AMERICA, INC.

Remove underbody protection.

Open drain plug at bottom of radiator.

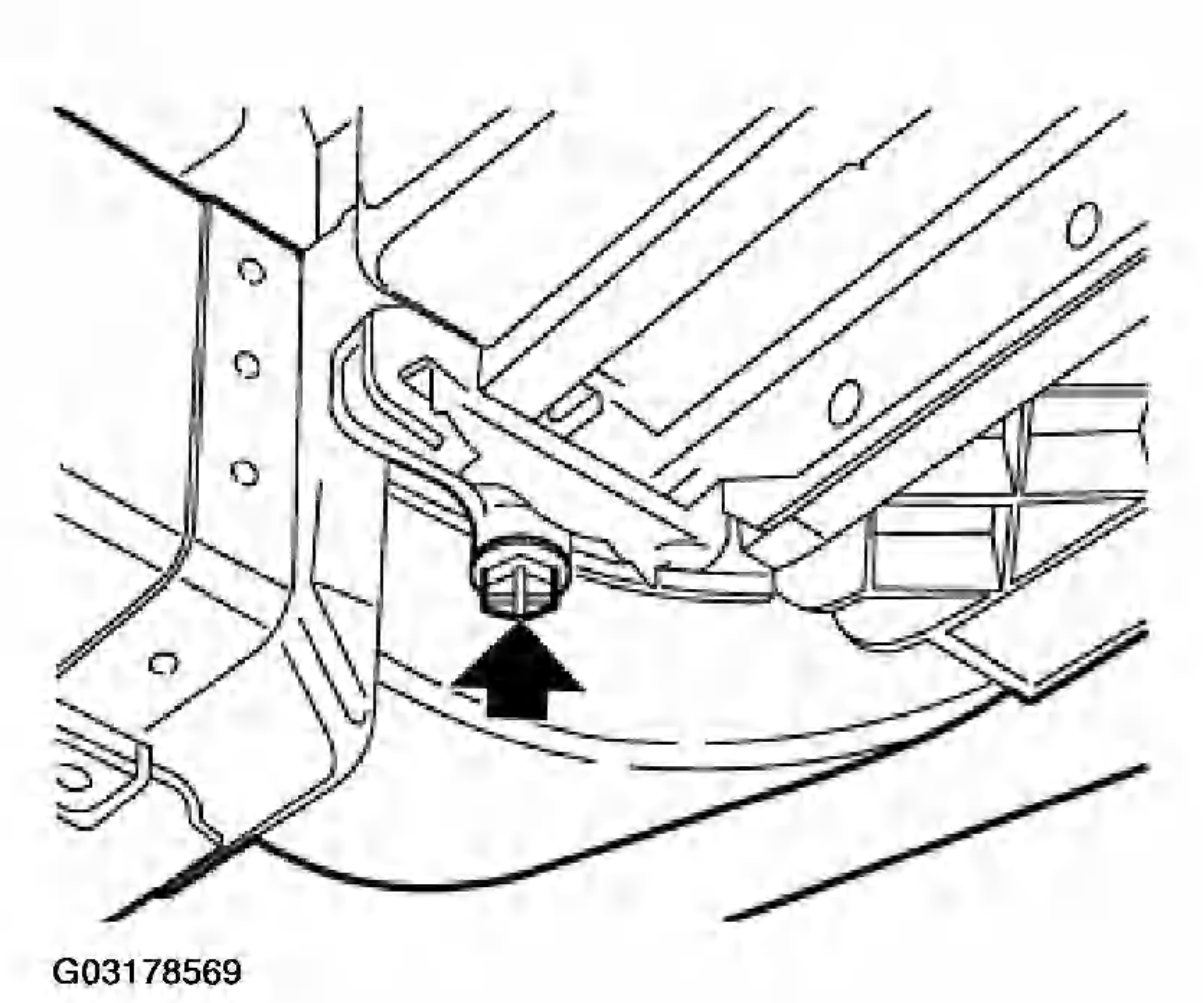



Fig. 14: Opening Drain Plug At Bottom Of Radiator
Courtesy of BMW OF NORTH AMERICA, INC.

Drain, catch and dispose of coolant.

Installation:

Replace seal.

Open drain plug on right of engine block.

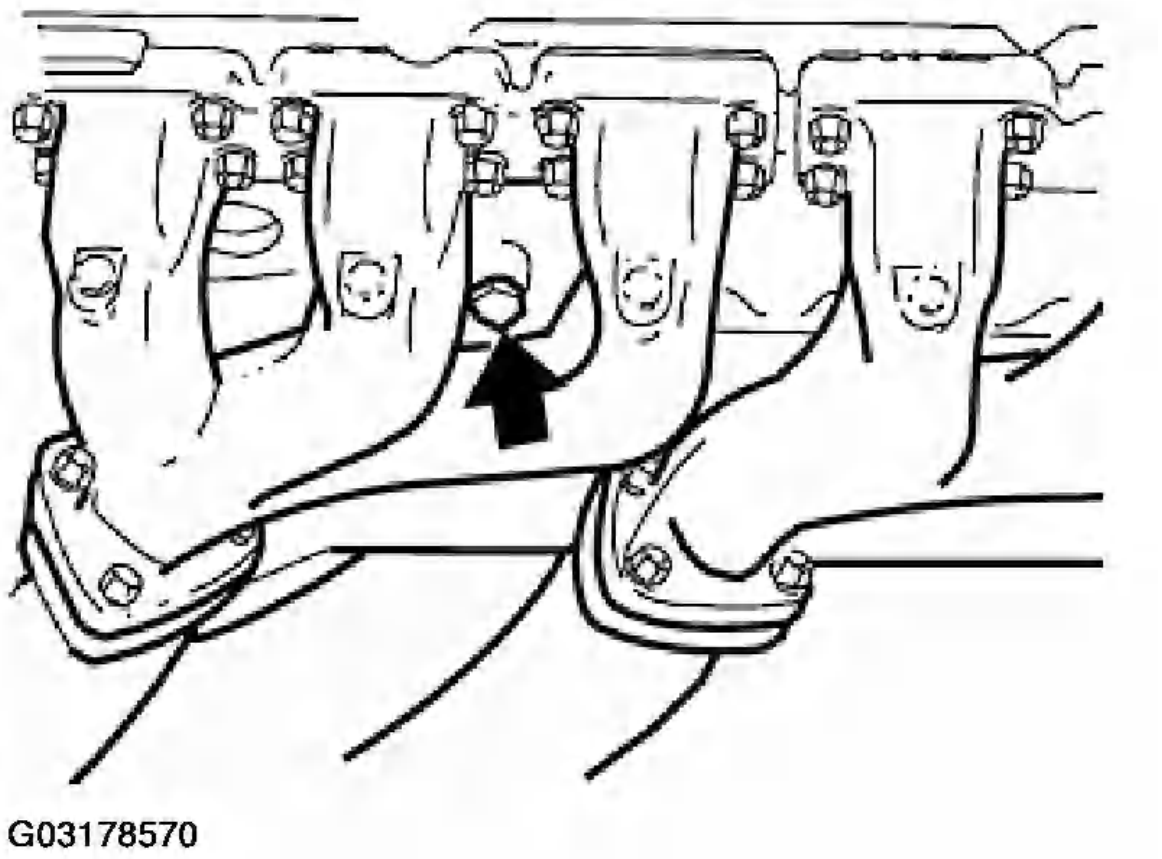



Fig. 15: Opening Drain Plug On Right Of Engine Block
Courtesy of BMW OF NORTH AMERICA, INC.

Drain, catch and dispose of coolant.

Installation:

Replace seal.

Tightening torque, refer to 11 11 5AZ 11 11 ENGINE BLOCK .

Adding Coolant:

NOTE: The tank mark indicates the fluid level at approx. 20Â°C. Use only recommended coolant.

1. Turn on ignition.
2. Set heating controller to maximum temperature.
3. Set fan to low setting. This opens the heating valves and starts the auxiliary water pump.
4. Perform filling operation slowly.
5. Top up coolant expansion tank up to max. cold fill level.
6. Close vent plug when bubble-free coolant emerges.
7. Close coolant expansion tank.

Vent cooling system and check for leaks.

17 00 009 CHECKING COOLING SYSTEM FOR WATER LEAKS

Special Tools required:

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

- 17 0 002
- 17 0 005
- 17 0 007
- 17 0 008

WARNING: Danger of scalding! Only perform this work after engine has cooled down.

Checking pressure drop in cooling system:

Remove cap on expansion tank. Attach special tool 17 0 002 /17 0 005.

Build up gauge pressure of 1.5 bar, wait approx. 2 minutes.

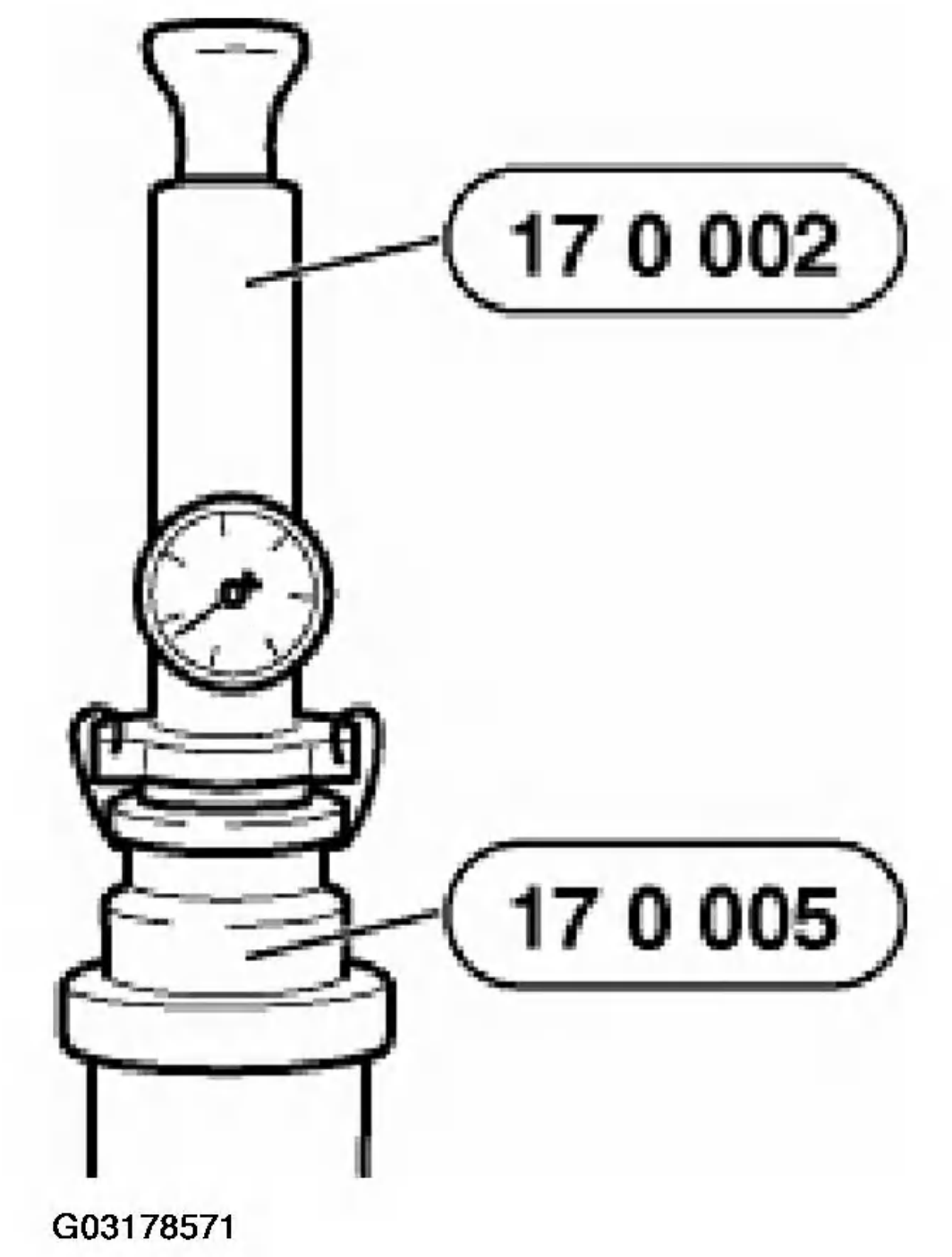



Fig. 16: Checking Pressure Drop In Cooling System
Courtesy of BMW OF NORTH AMERICA, INC.

Cooling system is impervious to leaks if pressure drop is max. 0.1 bar.

Checking pressure relief valve in cap:

Detach rubber (1) from hand pump.

Attach special tool 17 0 007 17 0 008.

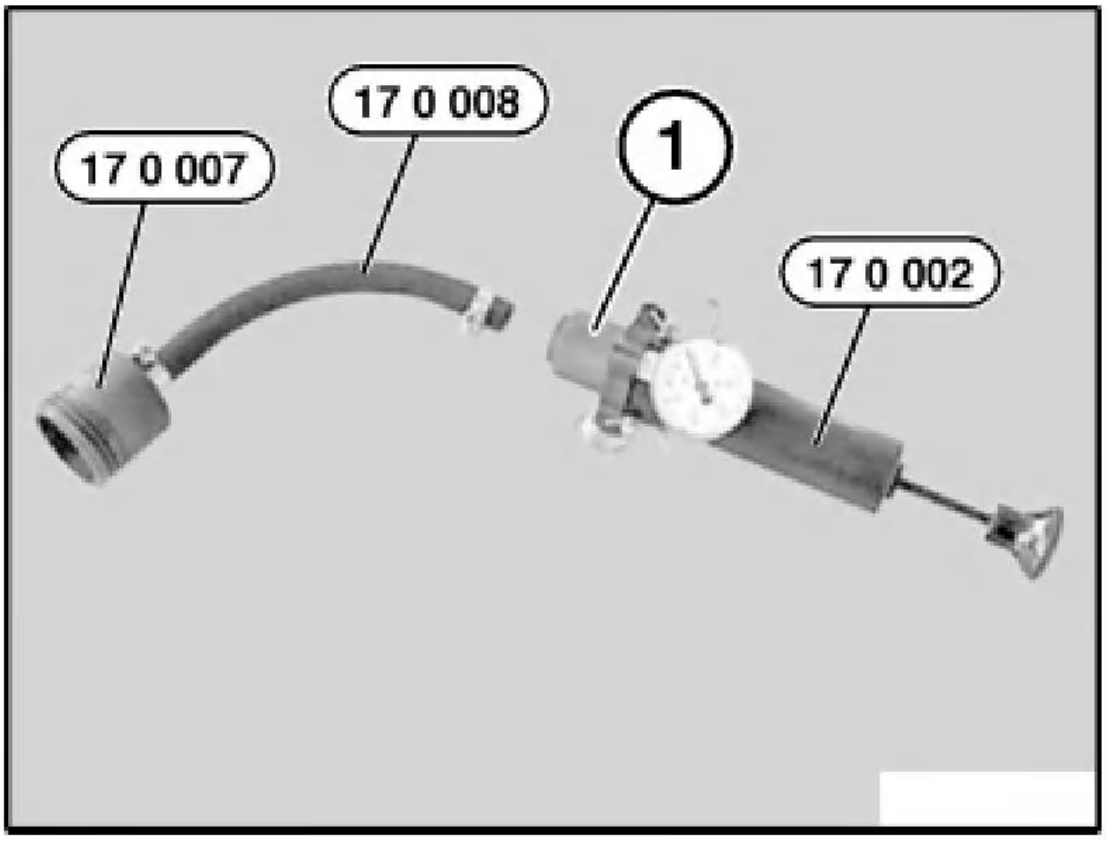



Fig. 17: Attaching Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Screw cap (1) onto special tool.

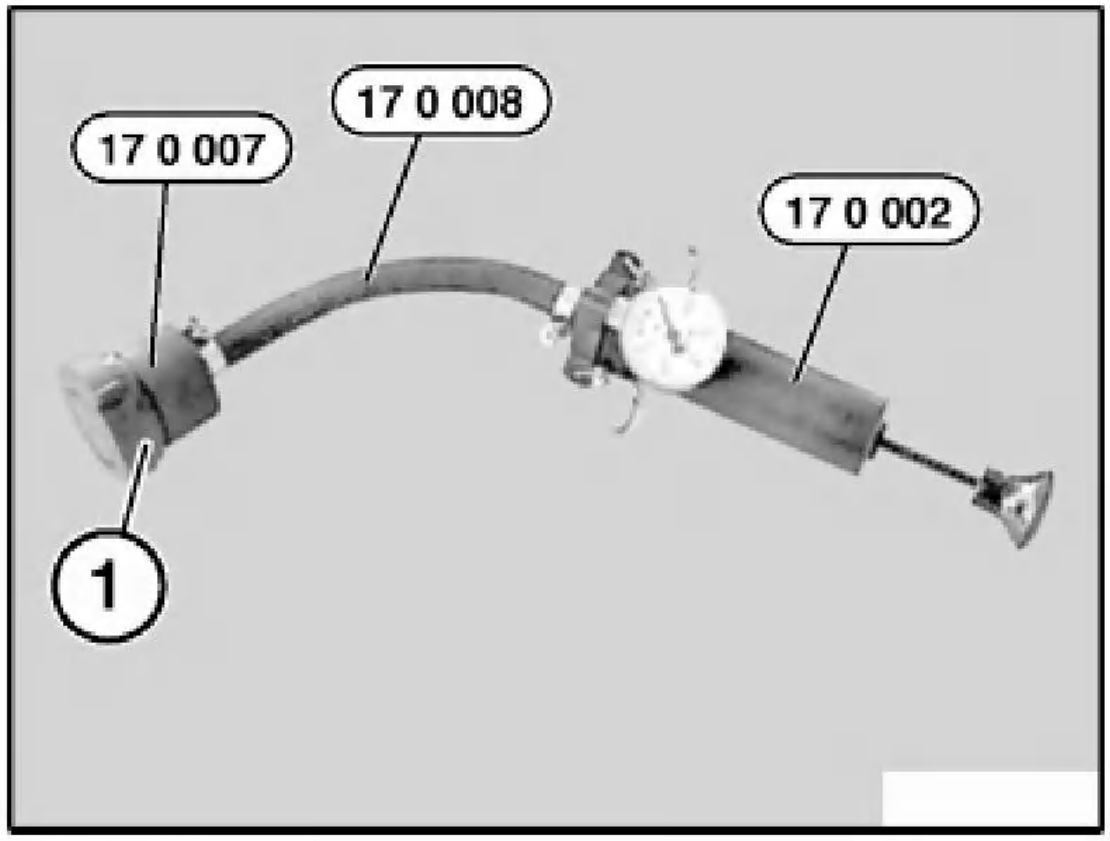



Fig. 18: Installing Screw Cap Onto Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Build up pressure with special tool (hand pump) 17 0 002; observe pressure gauge to ascertain when opening pressure is achieved.

Compare opening pressure of pressure relief valve. Refer to 17 11 RADIATOR AND MOUNTING PARTS M52TU / M54 or 17 11 RADIATOR AND MOUNTING PARTS E36 / M50 / M52 / M54 .

### Checking vacuum valve in cap

Screw cap (1) onto special tool 17 0 007 and connect to vacuum hose of vacuum pump.

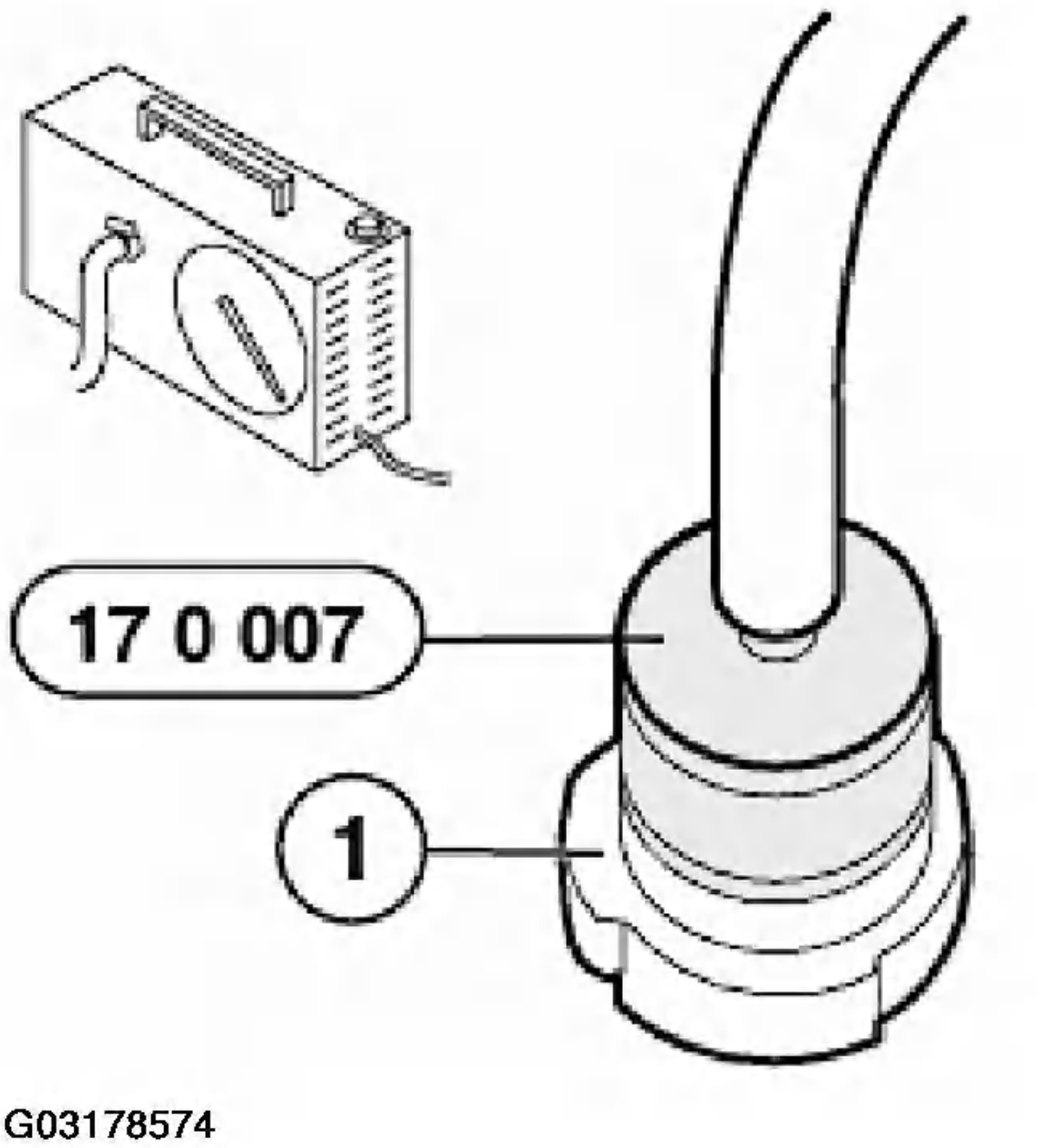



Fig. 19: Installing Cap Onto Special Tool And Connecting To Vacuum Hose Of Vacuum Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Sourcing reference: BMW Parts Service.

Feed vacuum pump with battery positive voltage.

Slowly apply partial vacuum to cap.

Compare opening pressure of vacuum valve. Refer to 17 11 RADIATOR AND MOUNTING PARTS M52TU / M54 or 17 11 RADIATOR AND MOUNTING PARTS E36 / M50 / M52 / M54 .

17 00 010 CHECKING FOR LEAKS BETWEEN COOLING SYSTEM AND COMBUSTION CHAMBER

Check for leaks with CO leak tester in accordance with Manufacturers Operating Manual.

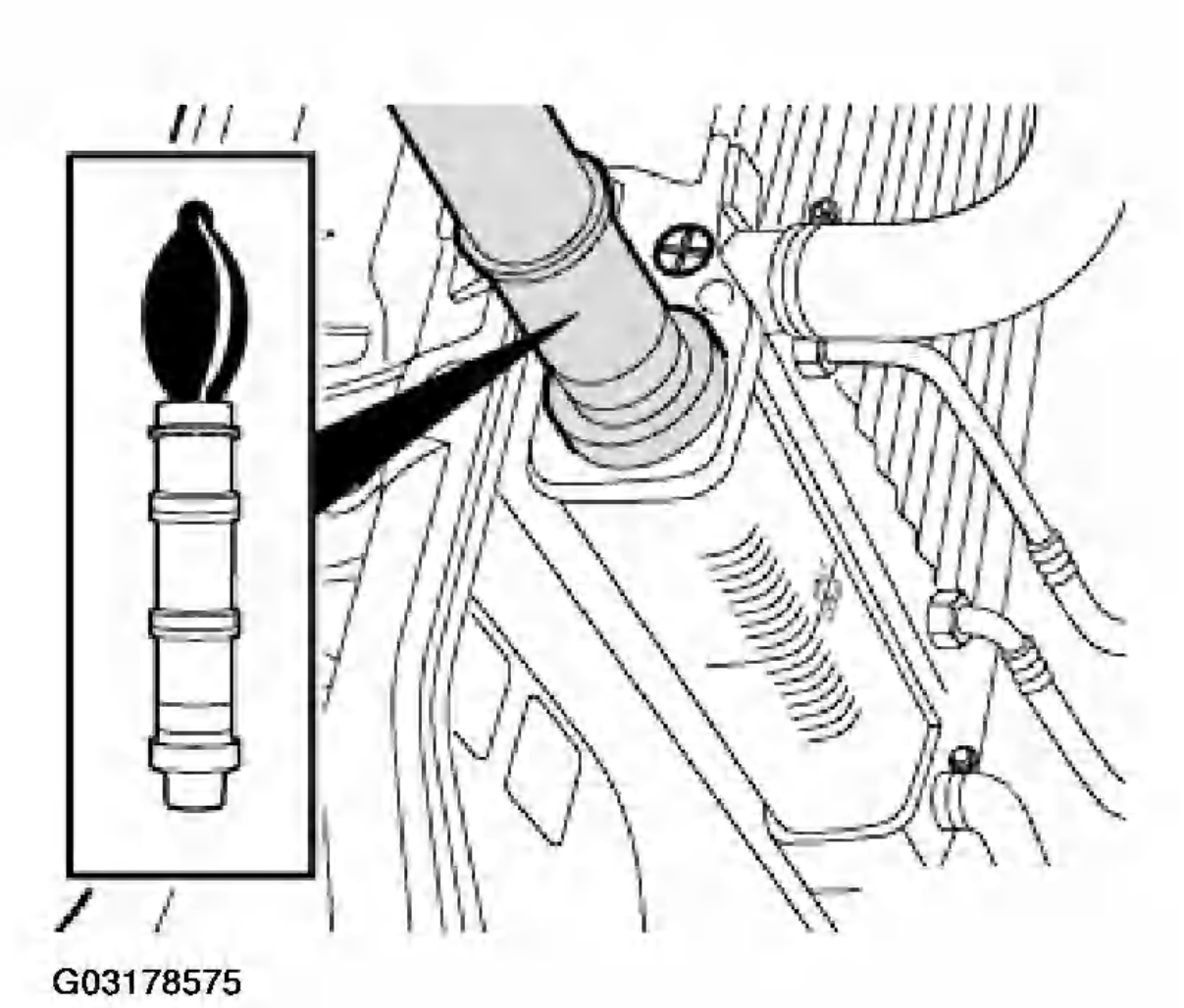



Fig. 20: Checking For Leaks With CO Leak Tester
Courtesy of BMW OF NORTH AMERICA, INC.

M43

CAUTION: Do not check for leaks while engine is running. Engine will overheat!

17 00 039 VENTING COOLING SYSTEM AND CHECKING FOR LEAKS (Z3 M54)

WARNING: Danger of scalding! Only perform these tasks on an engine that has cooled down.

Check cooling system for leaks. Refer to 17 00 009 CHECKING COOLING SYSTEM FOR WATER LEAKS . Top up coolant. Refer to 17 00 005 DRAINING AND TOPPING UP COOLANT .

To ensure the cooling system is properly vented, it is absolutely essential to follow the steps below:

1. Open cap on coolant expansion tank.
2. Turn on ignition.
3. Set heating controller to maximum temperature.
4. Set blower to low level. This opens the heating valves and starts the auxiliary water pump.
5. Carry out filling procedure slowly.

6. Close vent plug (1) when bubble-free coolant emerges.

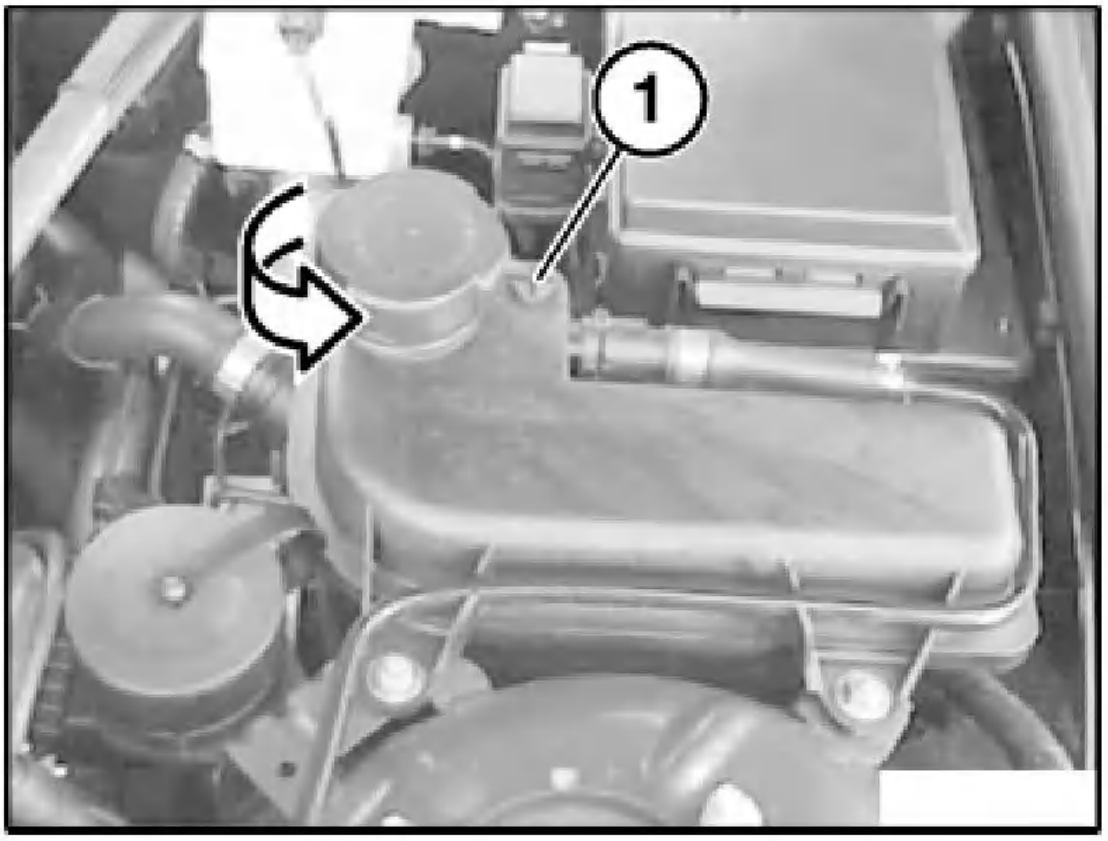



Fig. 21: Closing Vent Plug
Courtesy of BMW OF NORTH AMERICA, INC.

7. Pour coolant into coolant expansion tank up to max. cold fill level. Marking (2) is then level with upper edge of coolant expansion tank.
8. Close coolant expansion tank.
9. Allow engine to warm up until thermostat opens.

Allow engine to cool down before checking coolant level. Coolant temperature must not exceed 30Â°C. If ambient temperature exceeds 30Â°C, allow engine to cool down at least to ambient temperature.

Carefully open sealing cap and check fluid level. Fluid level is O.K. when top edge of coolant expansion tank is between both markings (1 and 2) on float needle.

- Minimum Cold Fill Level:

  Top edge of coolant expansion tank is level with marking (1).

- Maximum Cold Fill Level:

Top edge of coolant expansion tank is level with marking (2).

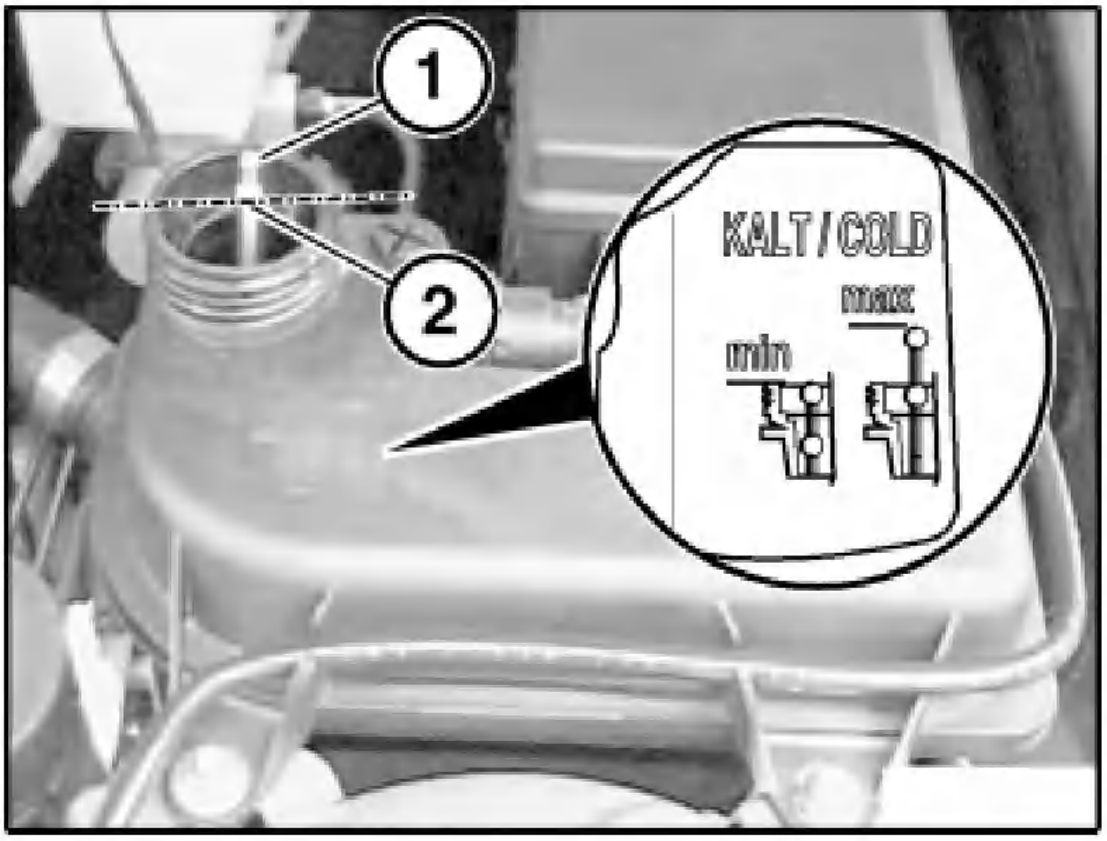



Fig. 22: Identifying Min And Max Markings On Coolant Expansion Tank
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, top up coolant.

NOTE: The tank mark indicates the fluid level at approx. 20Â°C.

Use only recommended coolant.

## RADIATOR, EXPANSION

### 17 00 009 CHECKING COOLING SYSTEM FOR WATER LEAKS

Special tools required:

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

- 17 0 002
- 17 0 005
- 17 0 007
- 17 0 008

WARNING: Danger of scalding! Only perform this work after engine has cooled down.

Checking pressure drop in cooling system:

Remove cap on expansion tank. Attach special tool 17 0 002 / 17 0 005.

Build up gauge pressure of 1.5 bar, wait approx. 2 minutes.

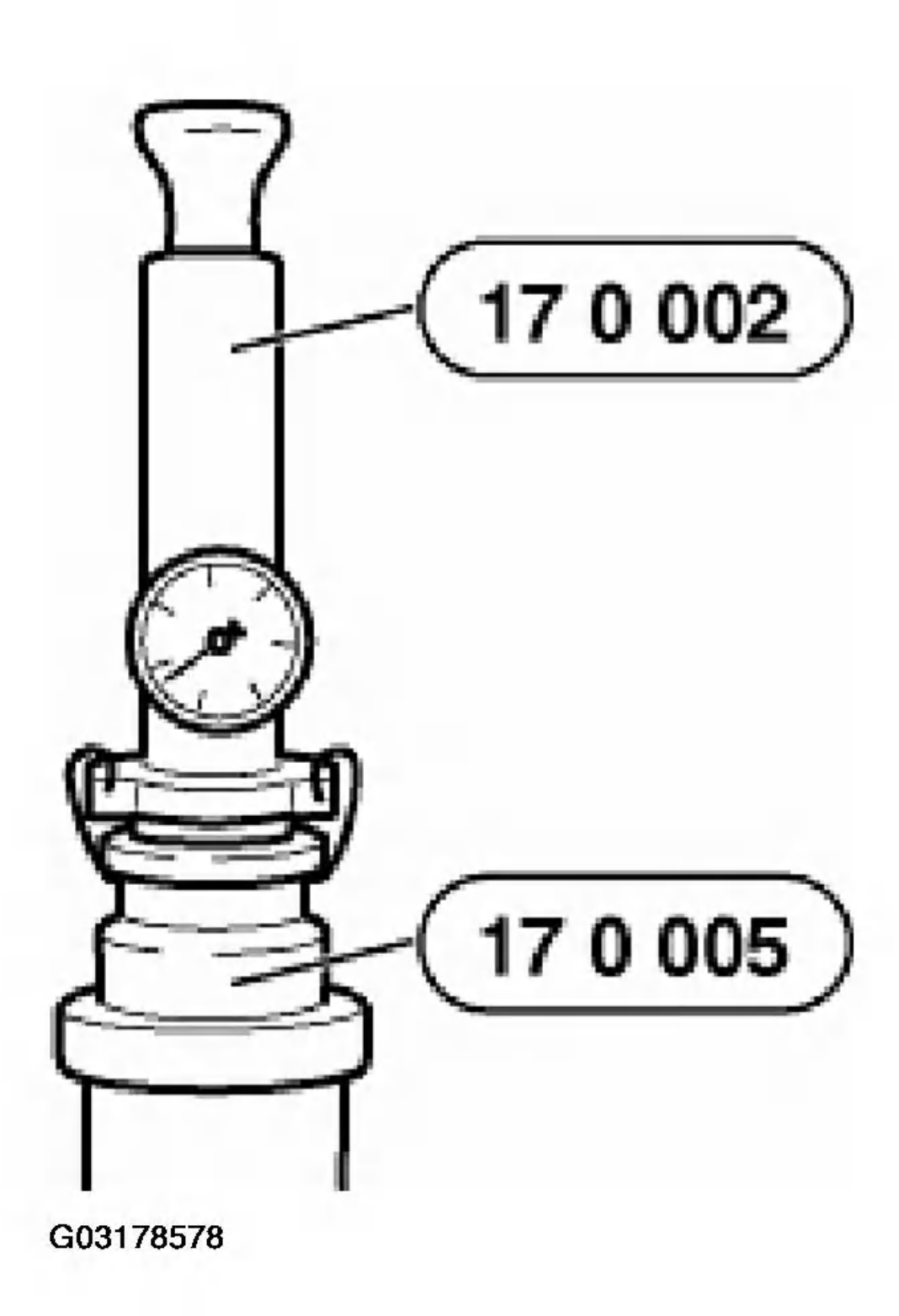



Fig. 23: Checking Pressure Drop In Cooling System
Courtesy of BMW OF NORTH AMERICA, INC.

Cooling system is impervious to leaks if pressure drop is max. 0.1 bar.

Checking pressure relief valve in cap:

Detach rubber (1) from hand pump.

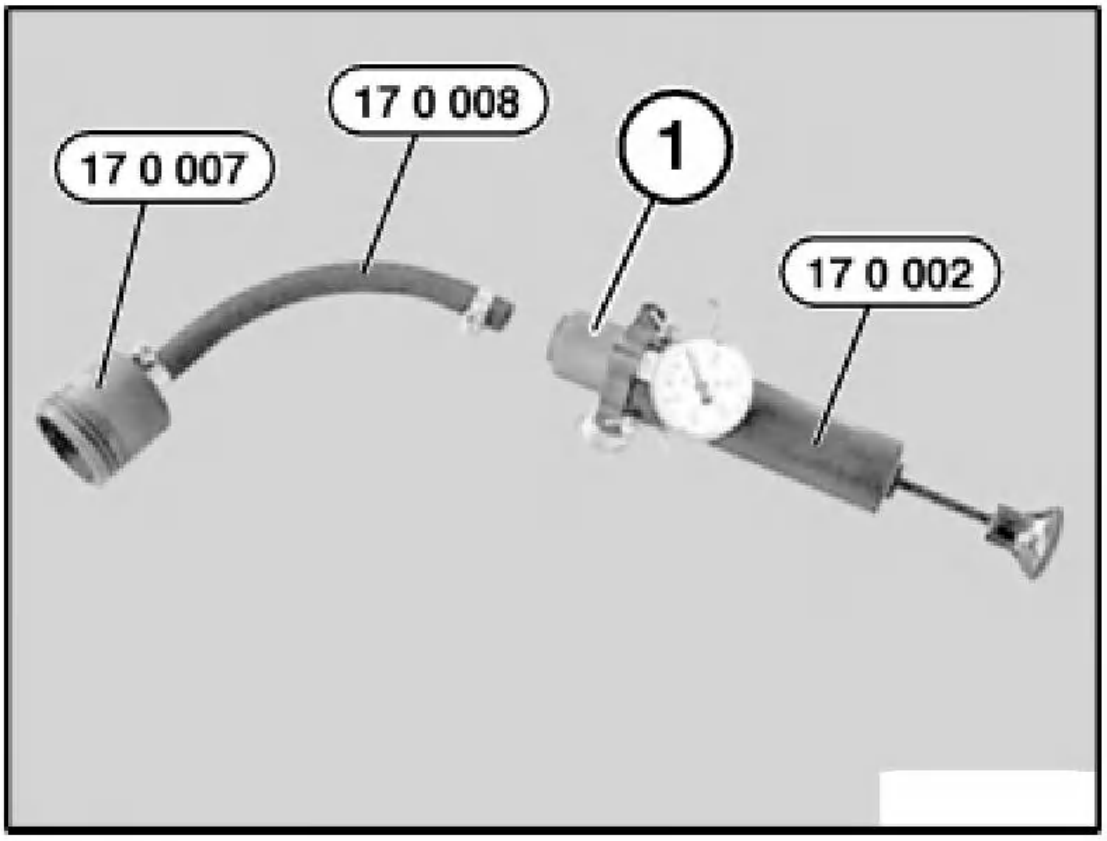



Fig. 24: Detaching Rubber From Hand Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 17 0 007 / 17 0 008.

Screw cap (1) onto special tool.

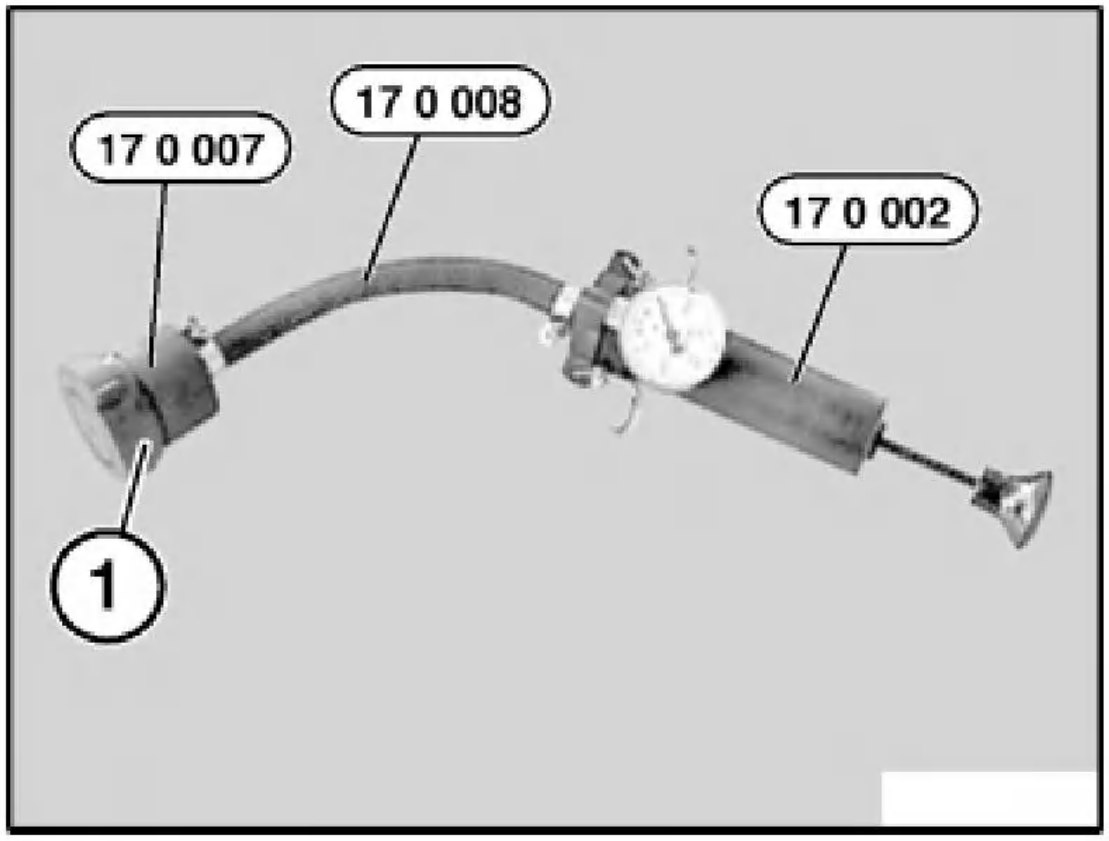



Fig. 25: Installing Cap Onto Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Build up pressure with special tool (hand pump) 17 0 002; observe pressure gauge to ascertain when opening pressure is achieved.

Compare opening pressure of pressure relief valve. Refer to 17 11 RADIATOR AND MOUNTING PARTS M52TU / M54 or 17 11 RADIATOR AND MOUNTING PARTS E36 / M50 / M52 / M54 .

### Checking vacuum valve in cap

Screw cap (1) onto special tool 17 0 007 and connect to vacuum hose of vacuum pump.

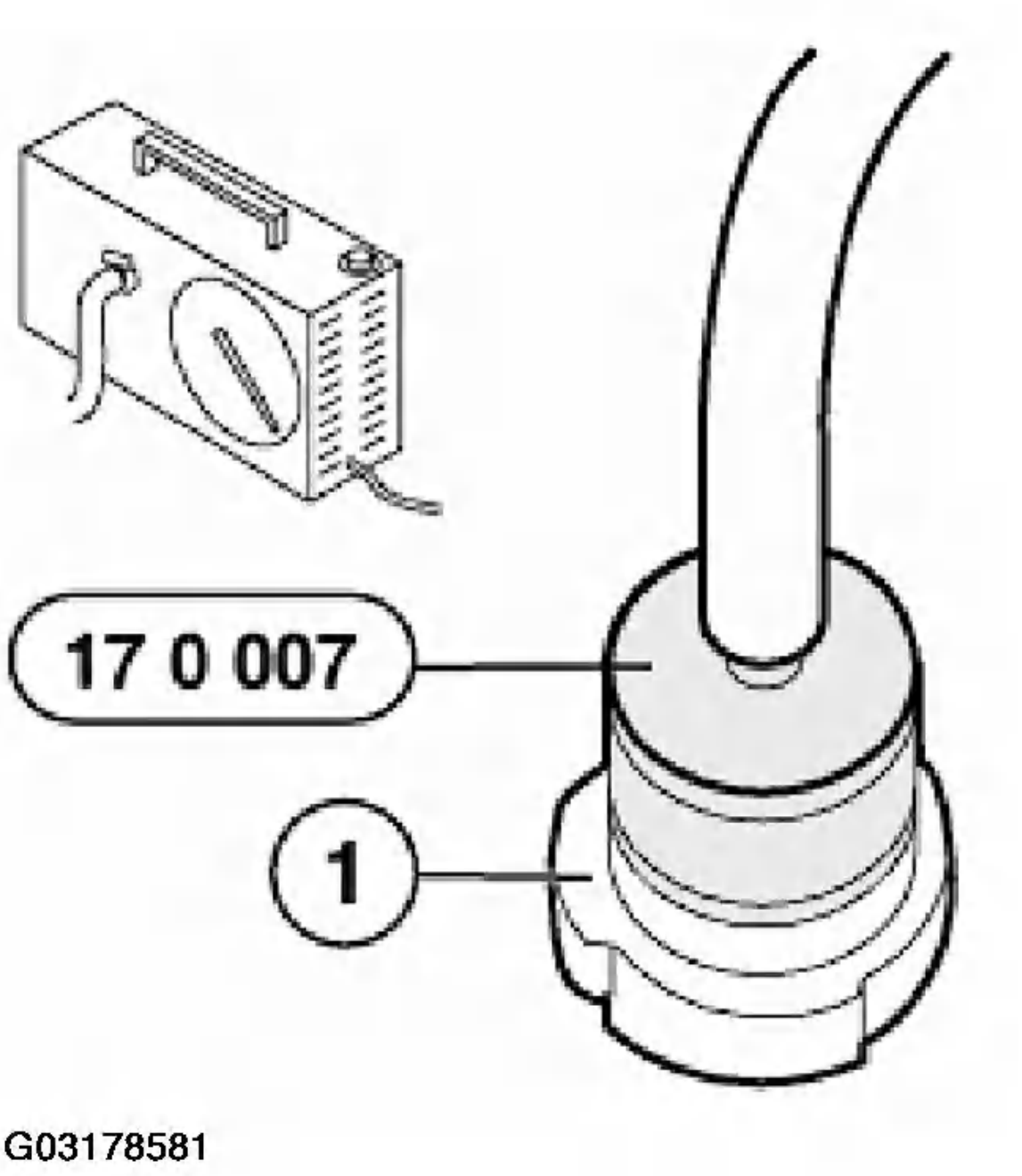



Fig. 26: Installing Cap Onto Special Tool And Connecting To Vacuum Hose Of Vacuum Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Sourcing reference: BMW Parts Service.

Feed vacuum pump with battery positive voltage.

Slowly apply partial vacuum to cap.

Compare opening pressure of vacuum valve.

## 17 00 010 CHECKING FOR LEAKS BETWEEN COOLING SYSTEM AND COMBUSTION CHAMBER

Check for leaks with CO leak tester in accordance with Manufacturers Operating Manual.

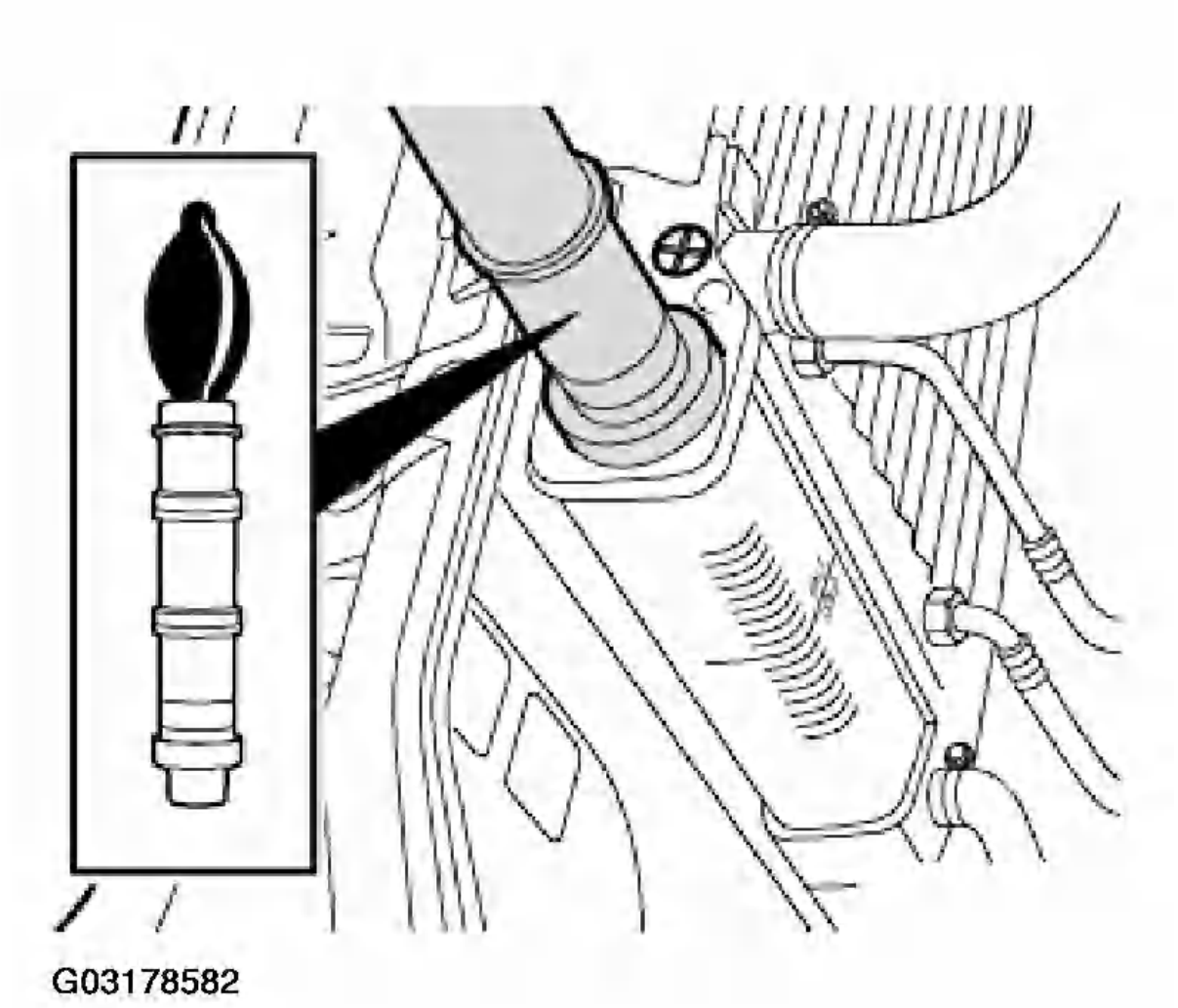



Fig. 27: Checking For Leaks With CO Leak Tester
Courtesy of BMW OF NORTH AMERICA, INC.

M43

CAUTION: Do not check for leaks while engine is running. Engine will overheat!

## ENGINE RADIATOR WITH

### 17 11 000 REMOVING AND INSTALLING RADIATOR (Z3/M54)

CAUTION: Danger of scalding! Open cap on expansion tank only after engine has cooled down.

Unlock plug and detach from temperature switch.

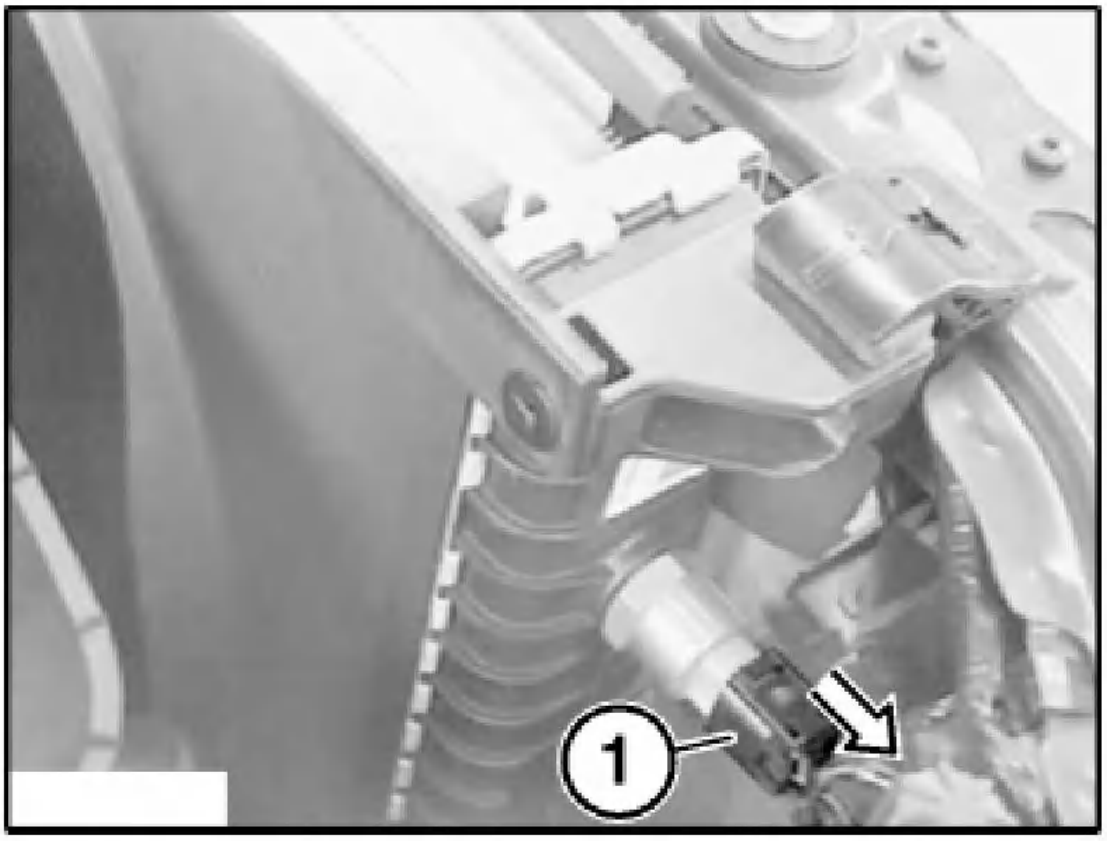



Fig. 28: Detaching Plug From Temperature Switch
Courtesy of BMW OF NORTH AMERICA, INC.

Drain off coolant. Refer to 17 00 005 DRAINING AND TOPPING UP COOLANT .

Remove fan cowl. Refer to 17 11 031 REPLACING FAN COWL (Z3 M54) .

Follow instructions for working on cooling system. Refer to 17 00 ...INSTRUCTIONS FOR WORKING ON COOLING SYSTEM. .

Release retaining clip (1) and detach vent hose (2).

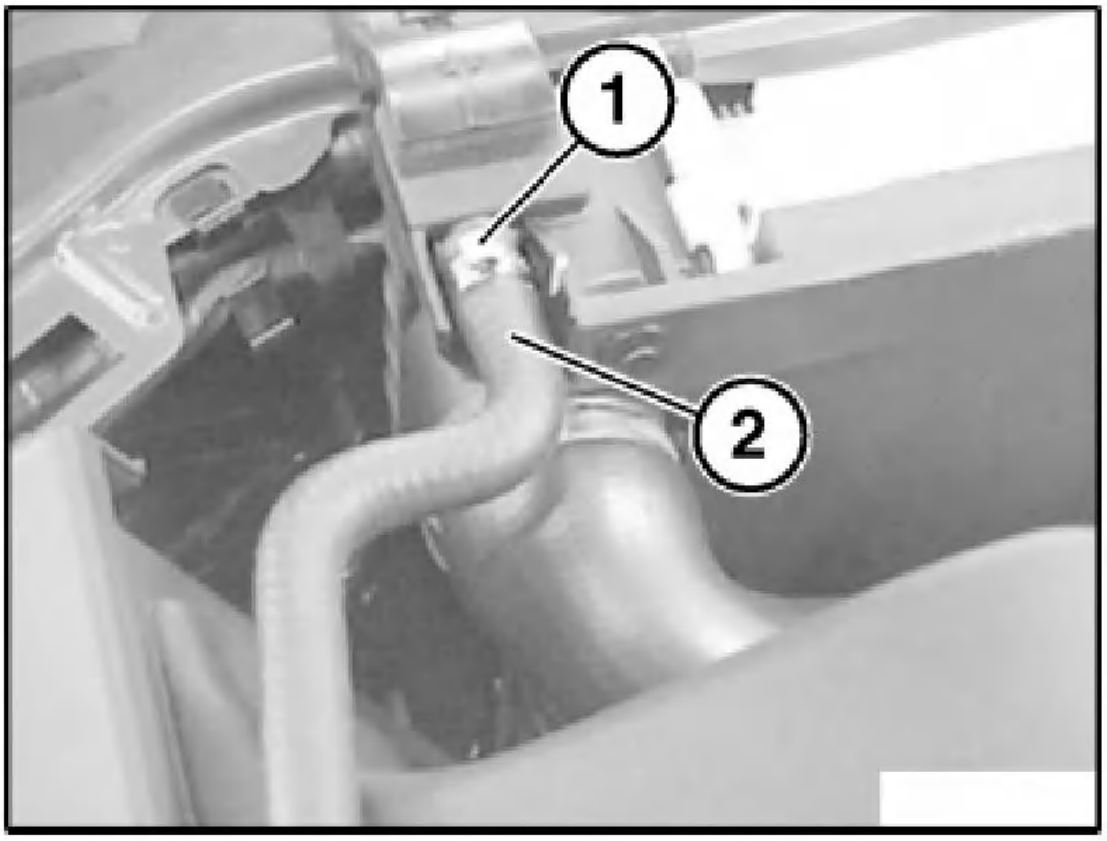



Fig. 29: Detaching Vent Hose
Courtesy of BMW OF NORTH AMERICA, INC.

Cut off hose connector (1).

Release clips on coolant hoses (2) and (3).

Detach top coolant hose (4) and bottom coolant hose (5).

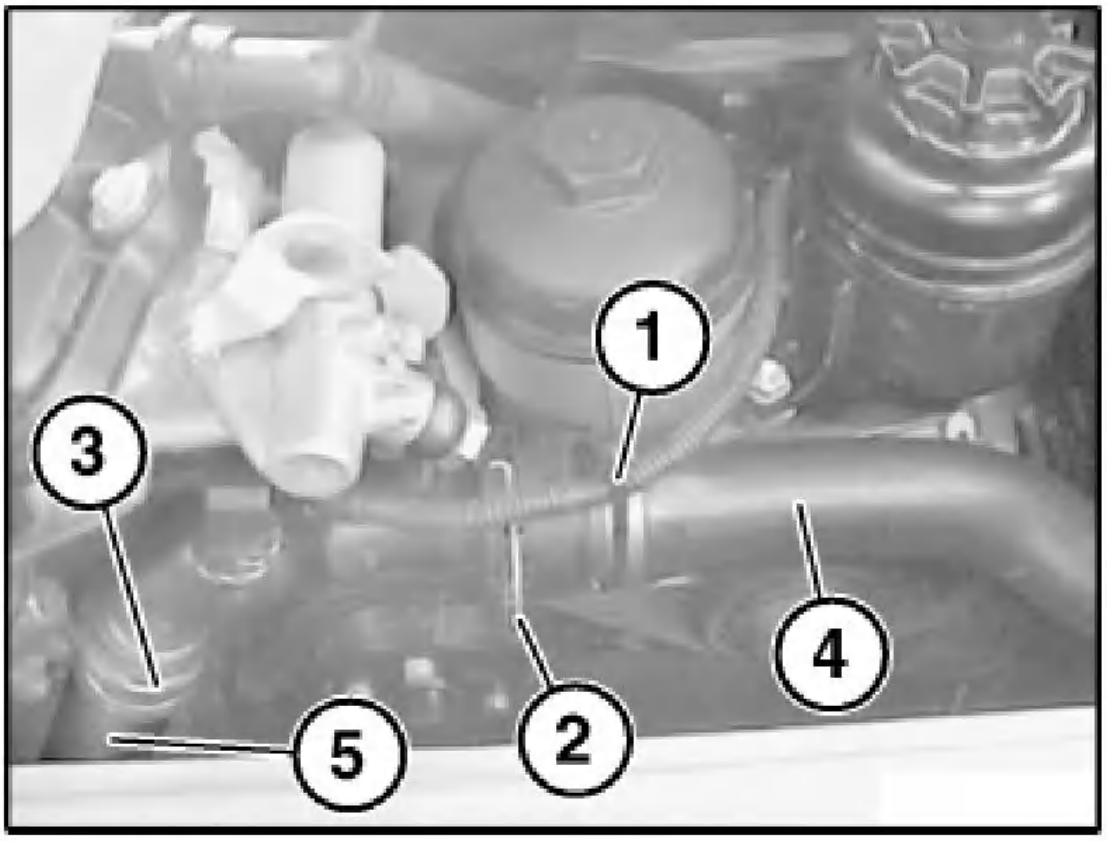



Fig. 30: Detaching Top Coolant Hose And Bottom Coolant Hose
Courtesy of BMW OF NORTH AMERICA, INC.

Release both retainers on radiator.

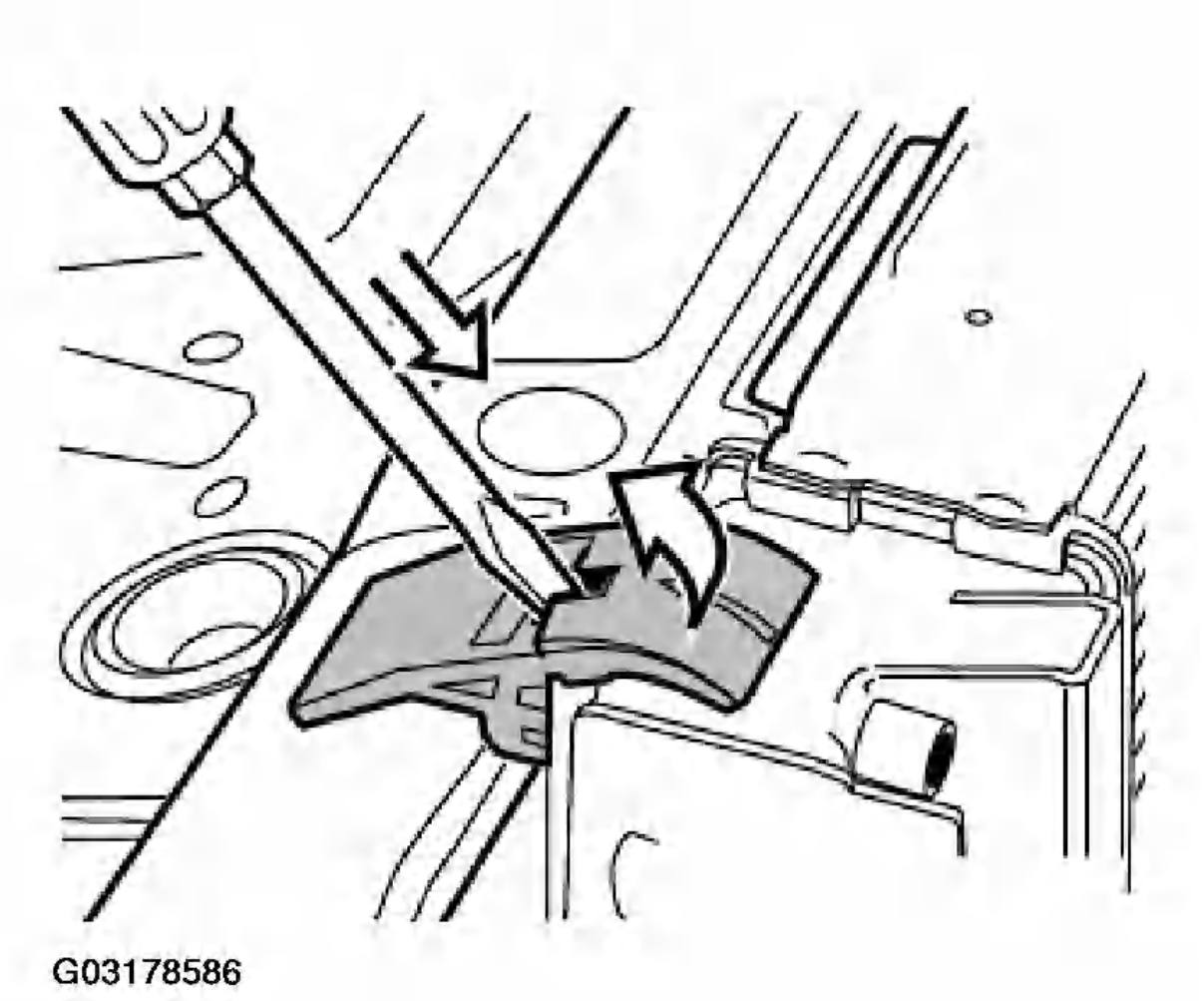



Fig. 31: Removing Retainers From Radiator
Courtesy of BMW OF NORTH AMERICA, INC.

On vehicles with Automatic Transmission .

Release retaining screws on radiator panel at bottom.

Remove cover.

NOTE: Illustration shows the left side only.

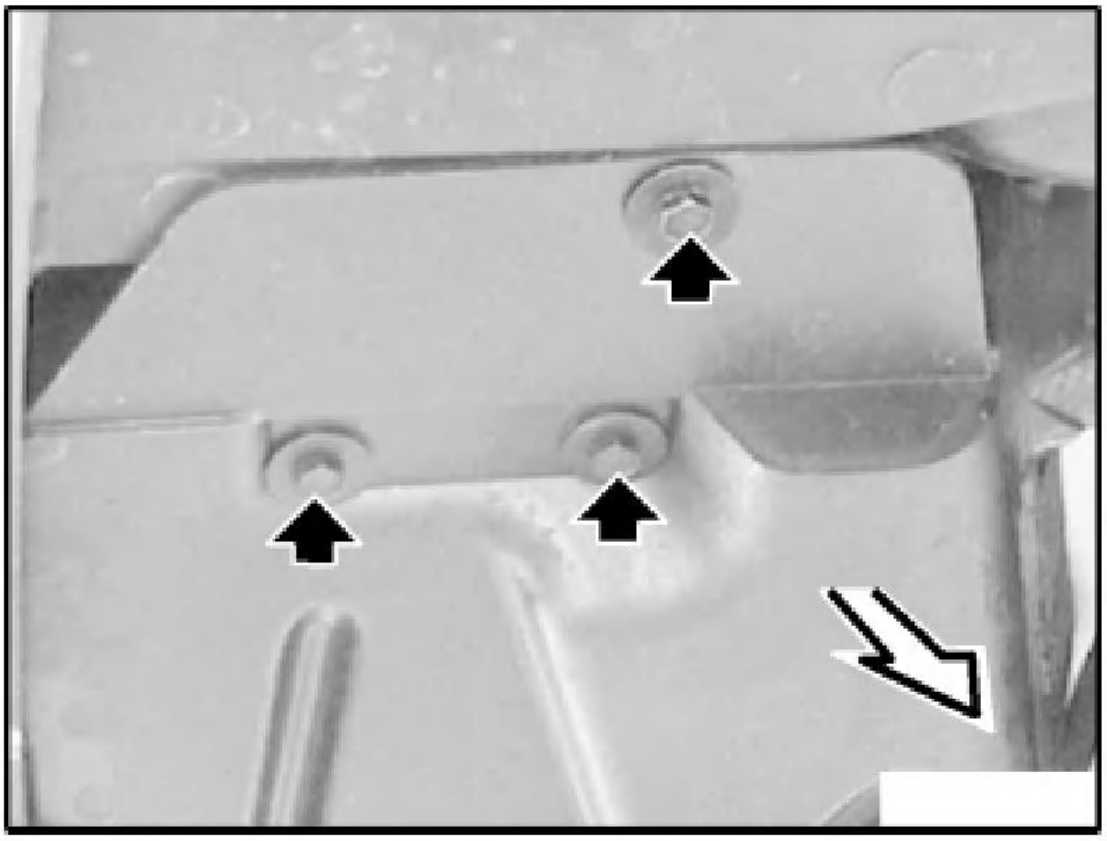



Fig. 32: Removing Retaining Screws On Radiator Panel At Bottom
Courtesy of BMW OF NORTH AMERICA, INC.

Slide radiator upwards and pull towards rear out of rests.

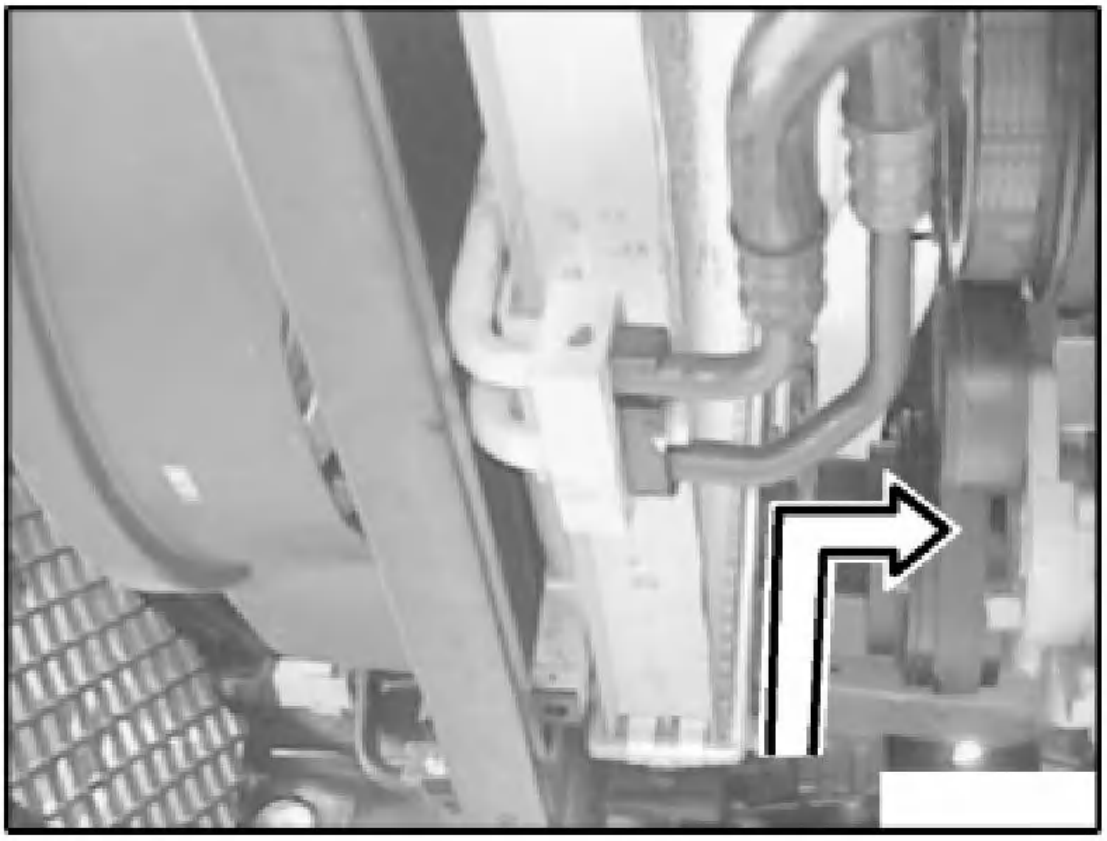



Fig. 33: Sliding Radiator
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws on oil cooler for automatic transmission at bottom.

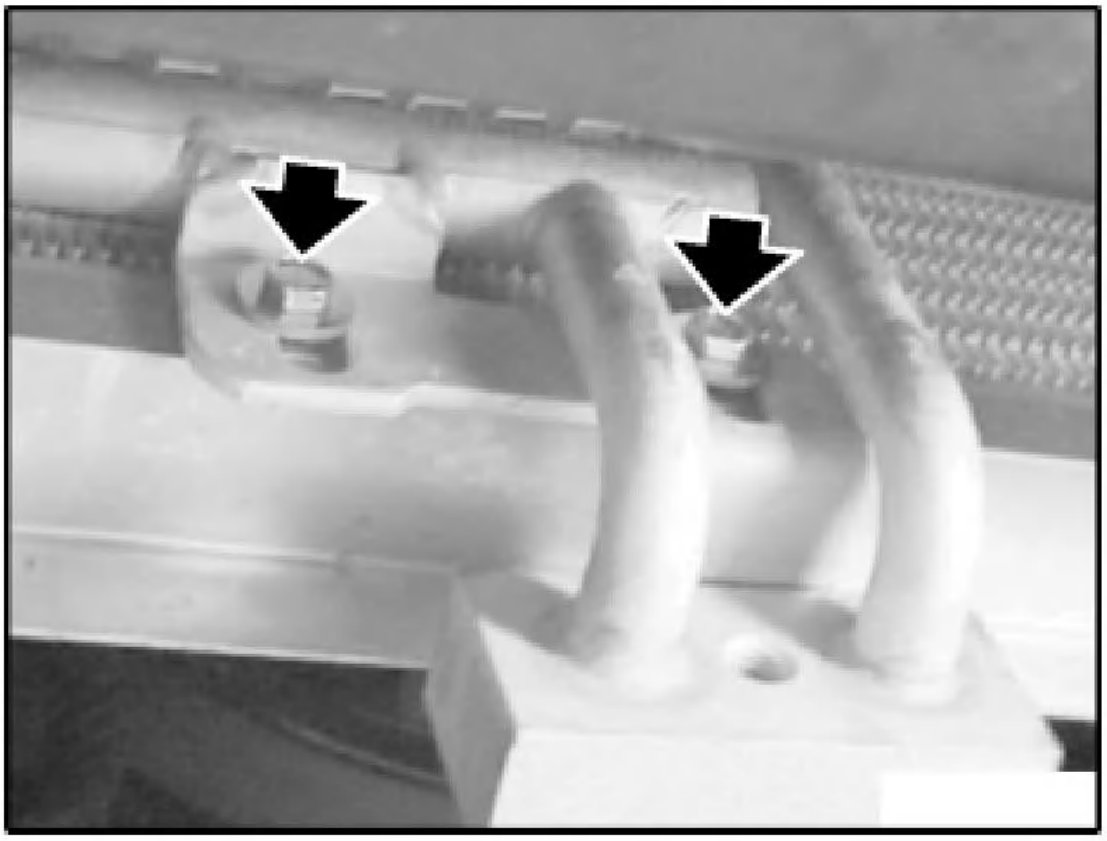



Fig. 34: Removing Screws On Oil Cooler For Automatic Transmission
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws on oil cooler for automatic transmission at top.

Remove oil cooler (1).

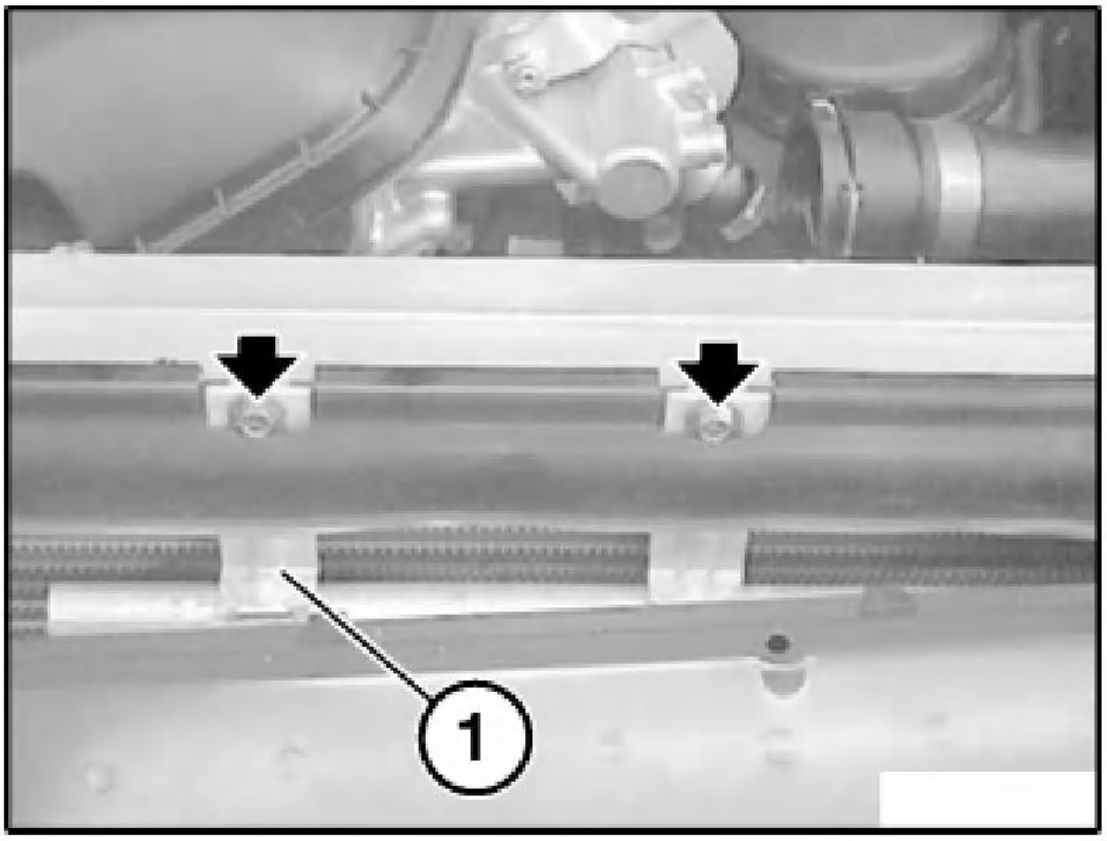



Fig. 35: Removing Oil Cooler
Courtesy of BMW OF NORTH AMERICA, INC.

Pull out radiator and remove.

Installation:

Attach retaining lugs to radiator on left and right and press forcefully downwards.

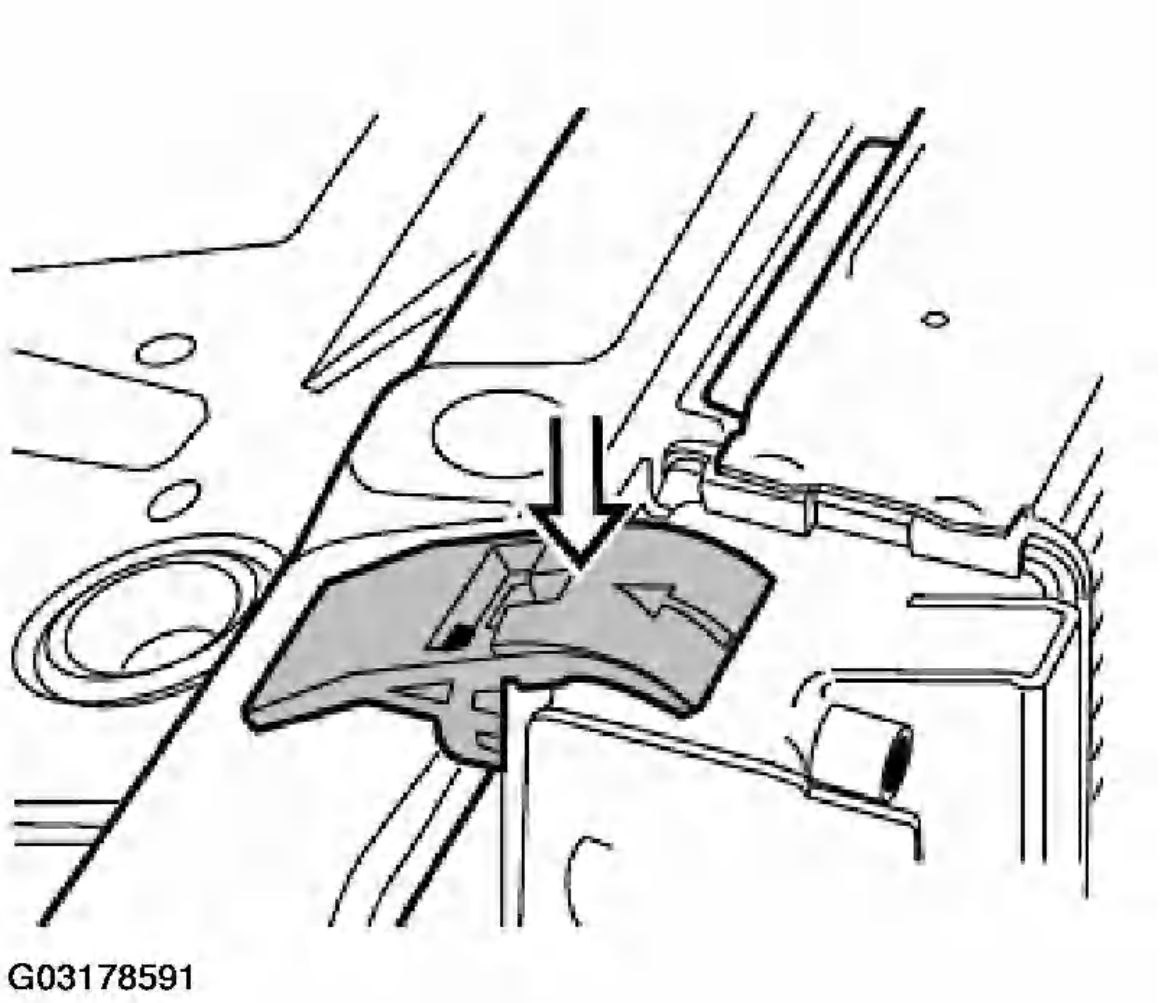



Fig. 36: Attaching Retaining Lugs To Radiator
Courtesy of BMW OF NORTH AMERICA, INC.

Catch must be heard to engage several times.

Installation:

Place a screwdriver underneath lug of retainers and retighten.

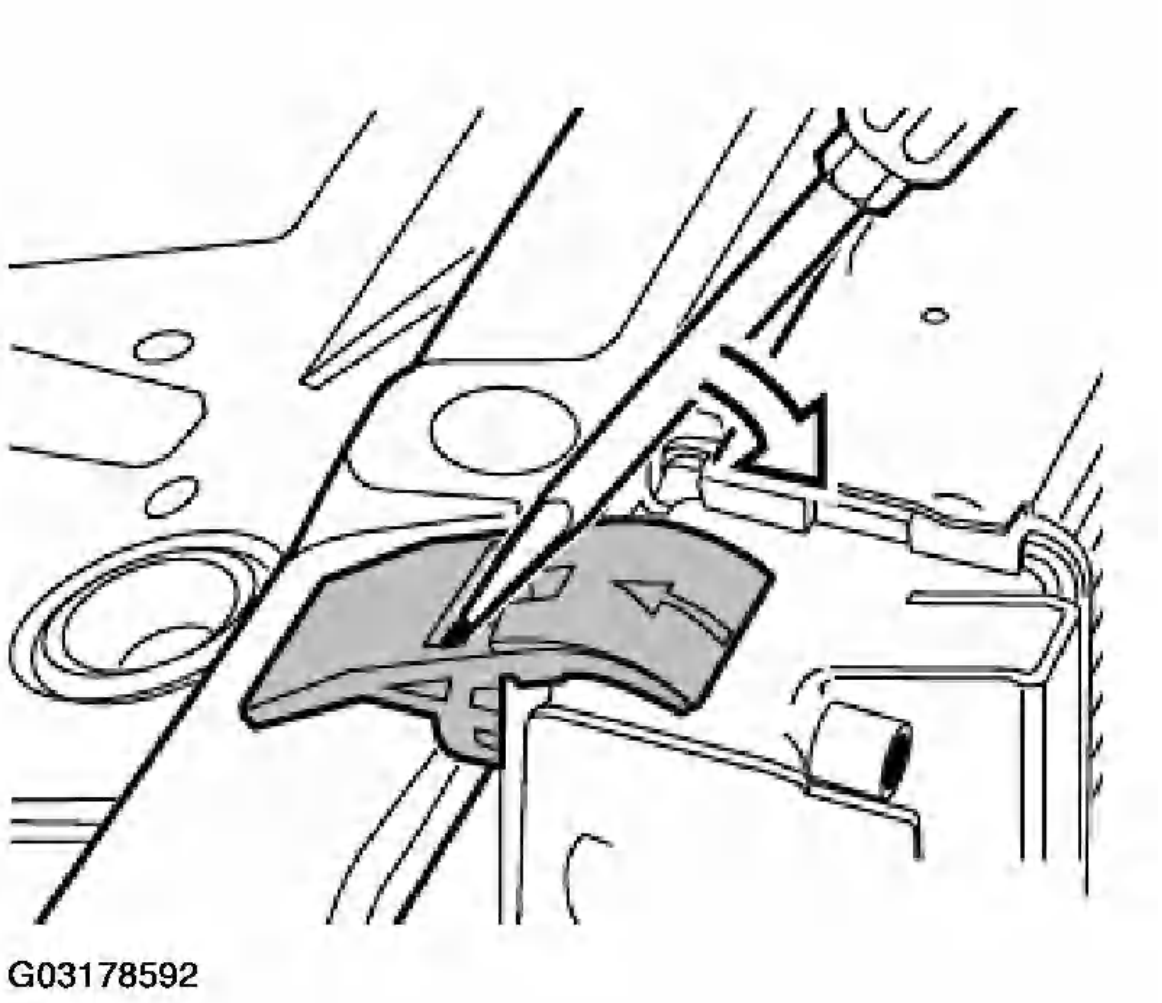



Fig. 37: Placing Screwdriver Underneath Lug Of Retainers
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Position radiator on supports (1).

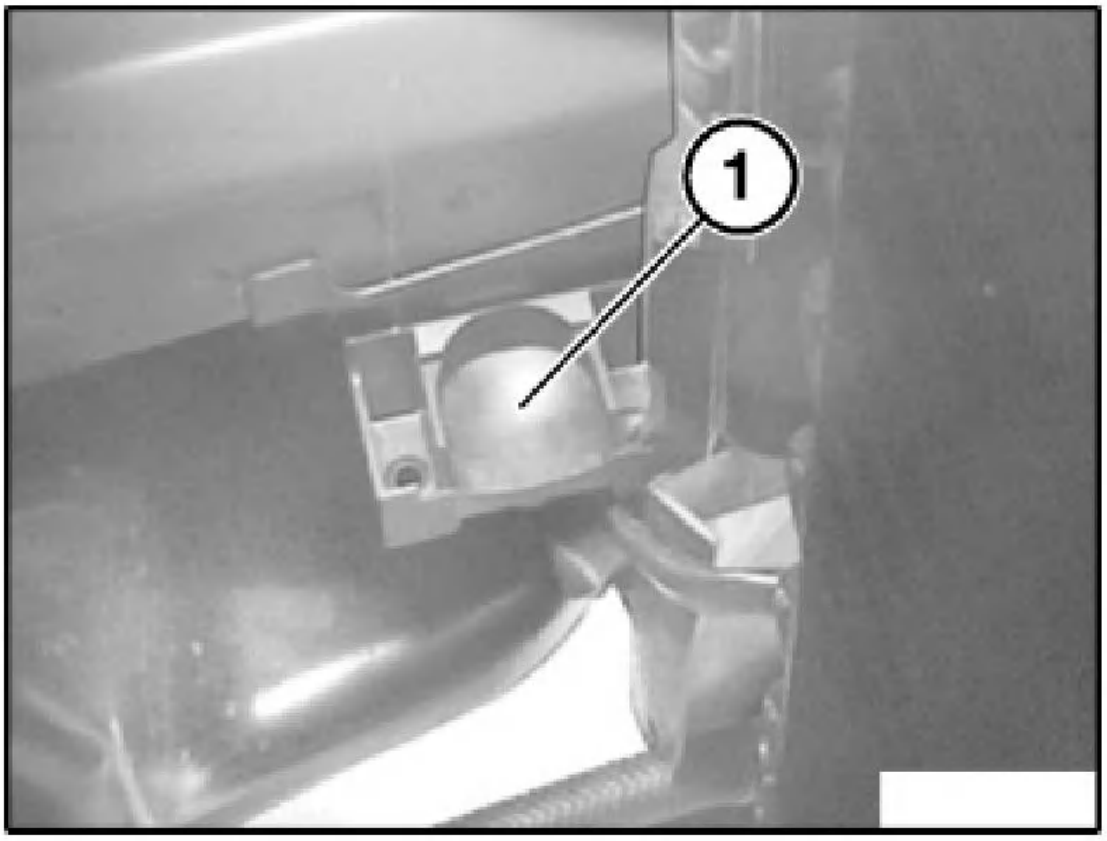



Fig. 38: Positioning Radiator On Supports
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Pay attention to rubber mounts (1) on left and right.

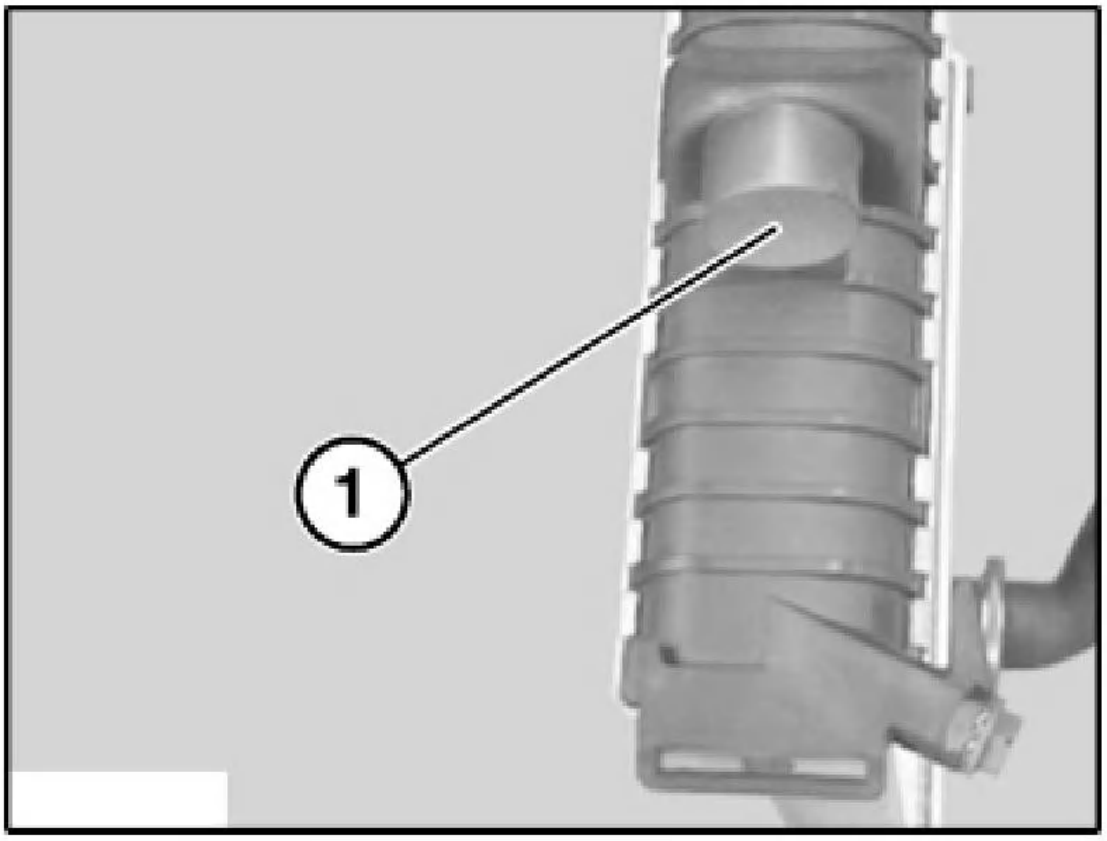



Fig. 39: Identifying Rubber Mounts
Courtesy of BMW OF NORTH AMERICA, INC.

## 17 11 031 REPLACING FAN COWL (Z3 M54)

Remove fan impeller with fan clutch from water pump. Refer to 11 52 020 FAN .

Lever out expansion rivets on left and right from fan cowl.

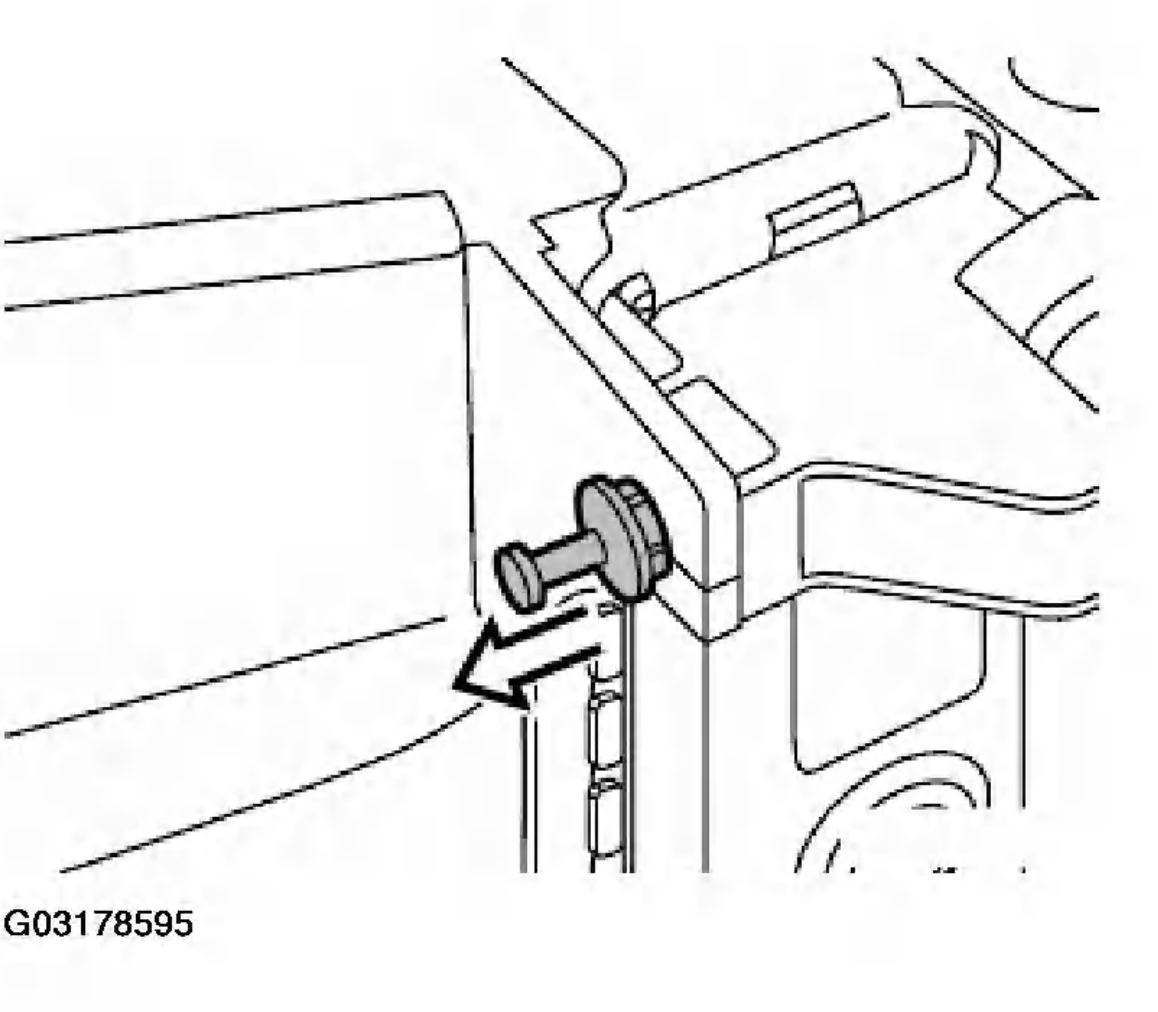



Fig. 40: Removing Expansion Rivets From Fan Cowl
Courtesy of BMW OF NORTH AMERICA, INC.

Lift out fan cowl and fan impeller together.

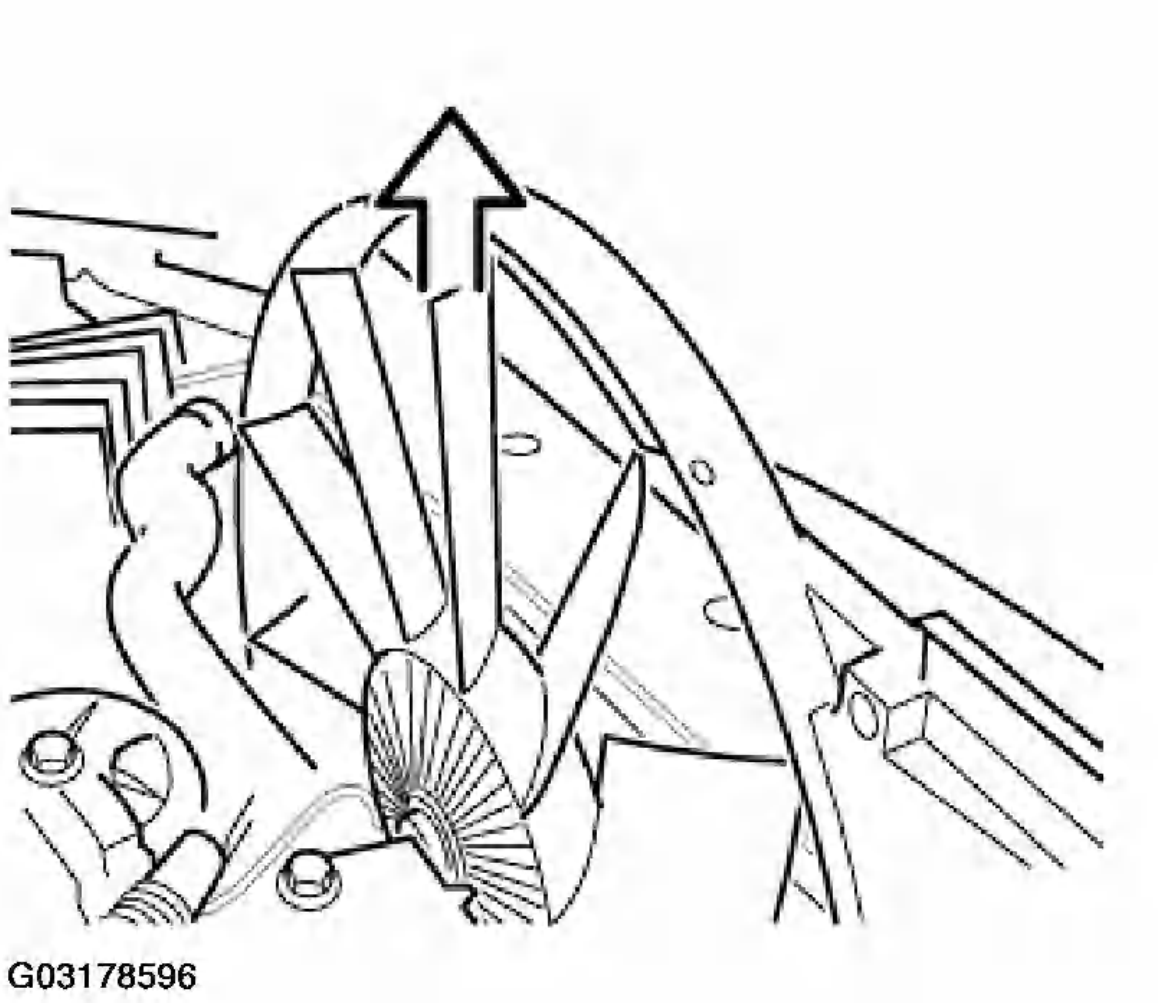



Fig. 41: Removing Fan Cowl And Fan Impeller
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Attach bracket (1) of fan cowl in retaining lugs at bottom and sides.

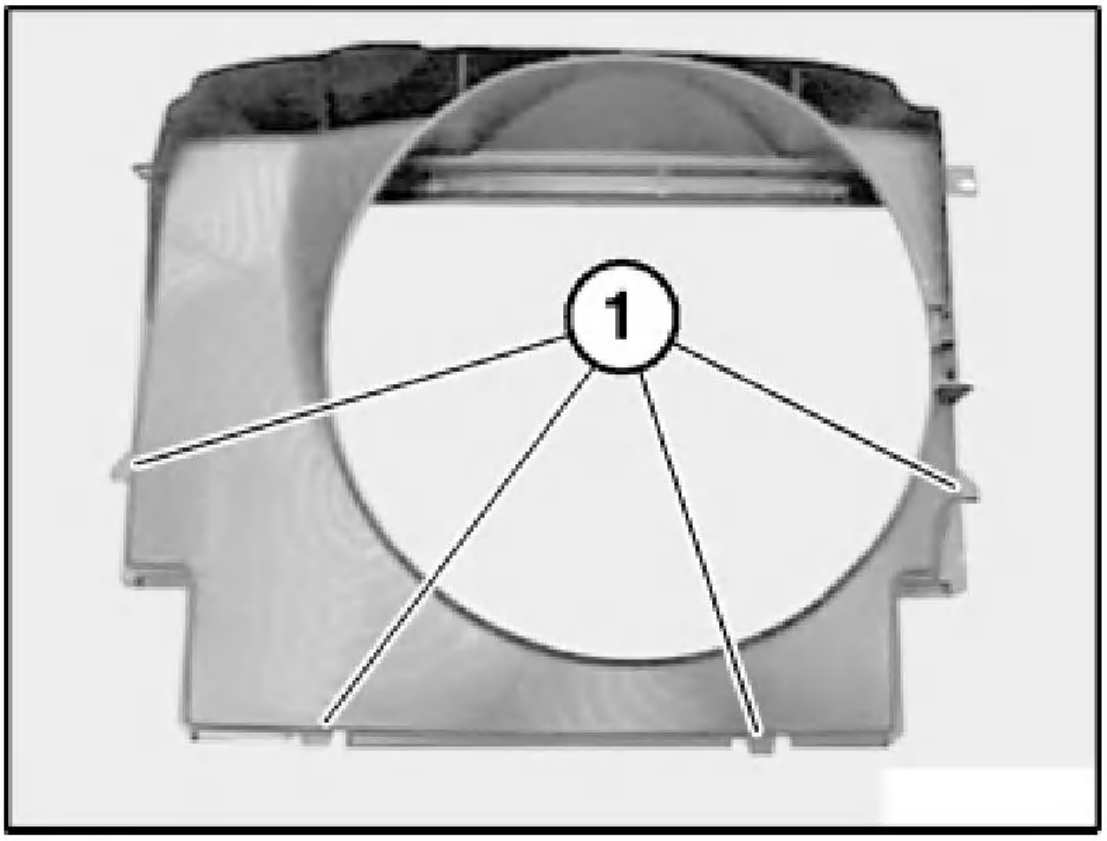



Fig. 42: Attaching Bracket Of Fan Cowl In Retaining Lugs
Courtesy of BMW OF NORTH AMERICA, INC.

## 17 11 100 REMOVING AND INSTALLING/REPLACING COOLANT EXPANSION TANK

CAUTION: Danger of scalding! Unscrew expansion tank cap only when engine is cold.

Only drain coolant as far as lower edge of expansion tank, refer to 17 00 005 DRAINING AND TOPPING UP COOLANT

### Separate expansion tank

Remove vent hose.

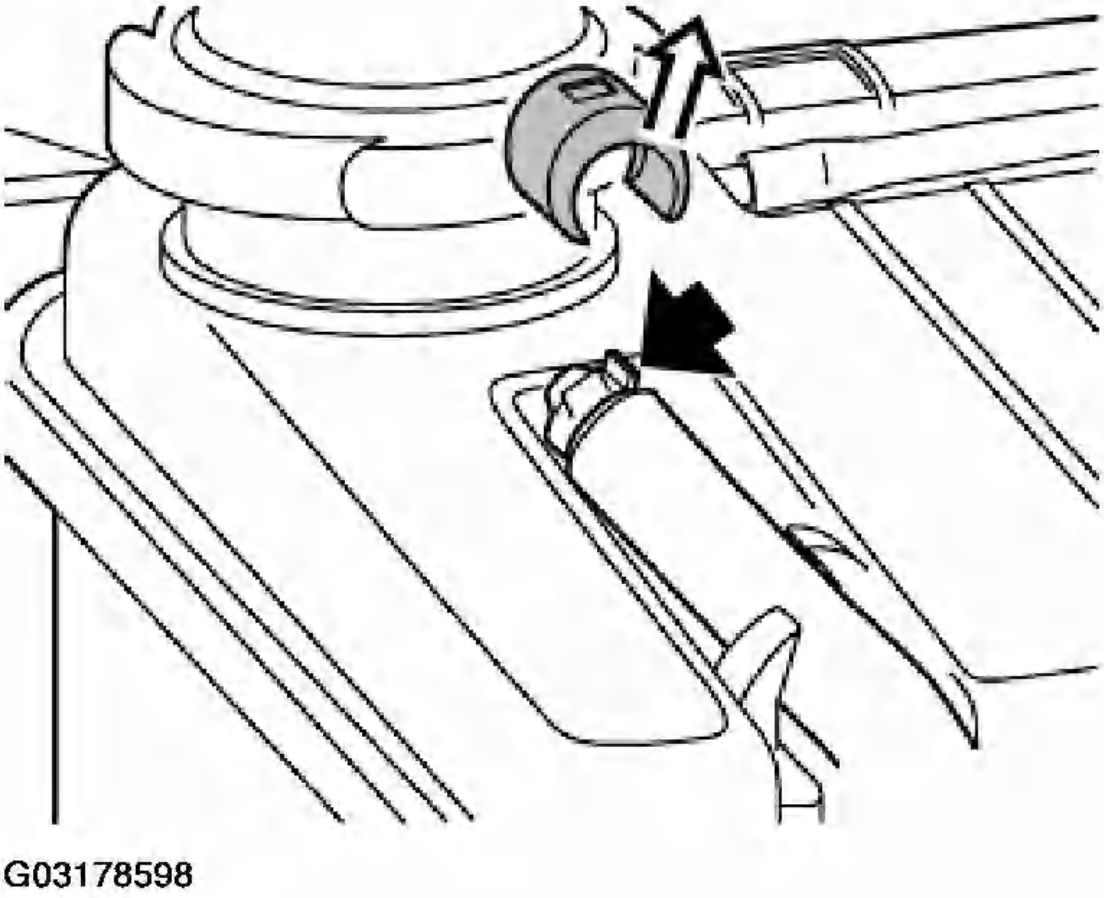



Fig. 43: Removing Vent Hose
Courtesy of BMW OF NORTH AMERICA, INC.

Separate expansion tank

Remove coolant hose.

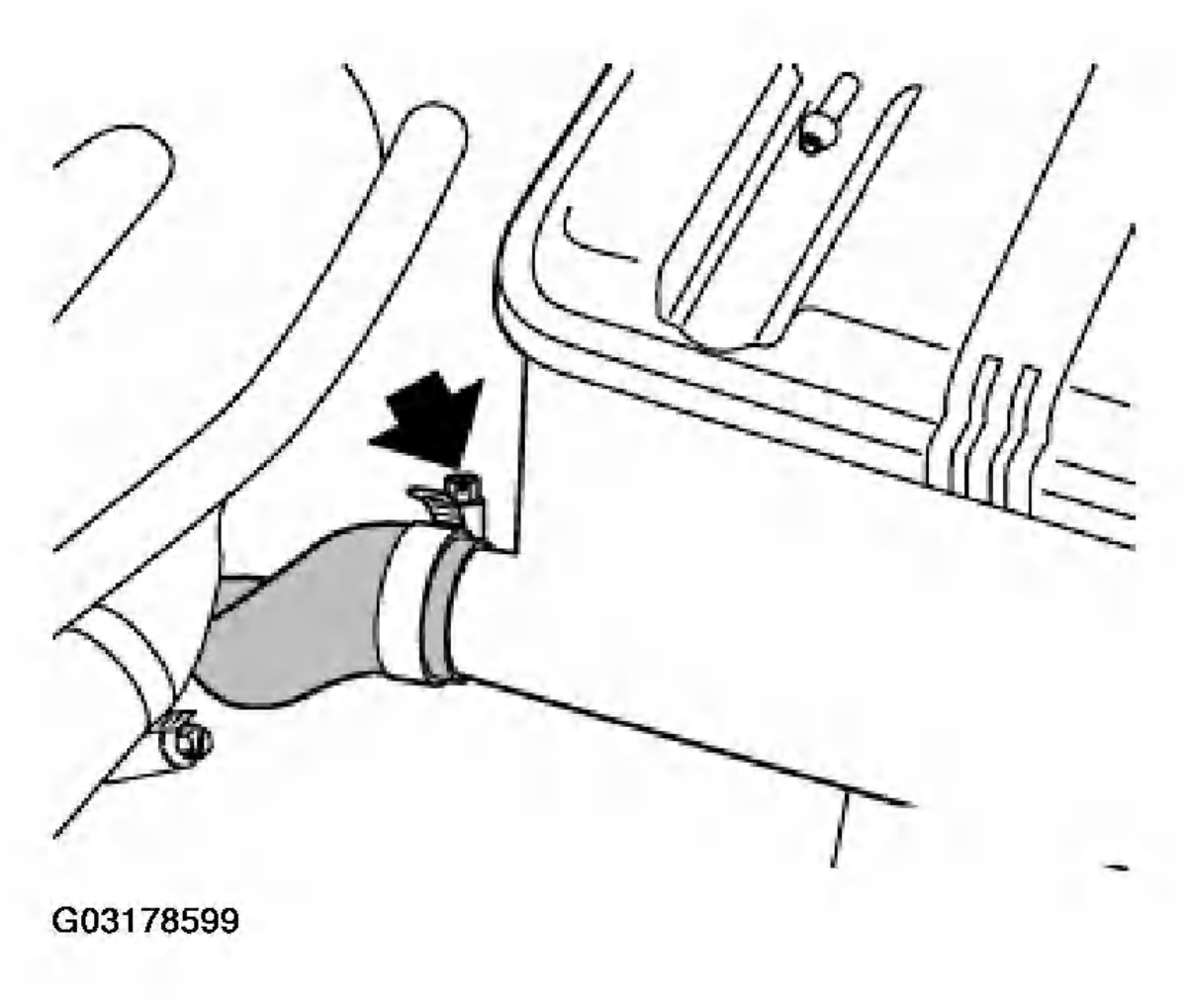



Fig. 44: Removing Coolant Hose
Courtesy of BMW OF NORTH AMERICA, INC.

Separate expansion tank

Unclip coolant expansion tank from retaining clips and pull upwards to remove from bracket.

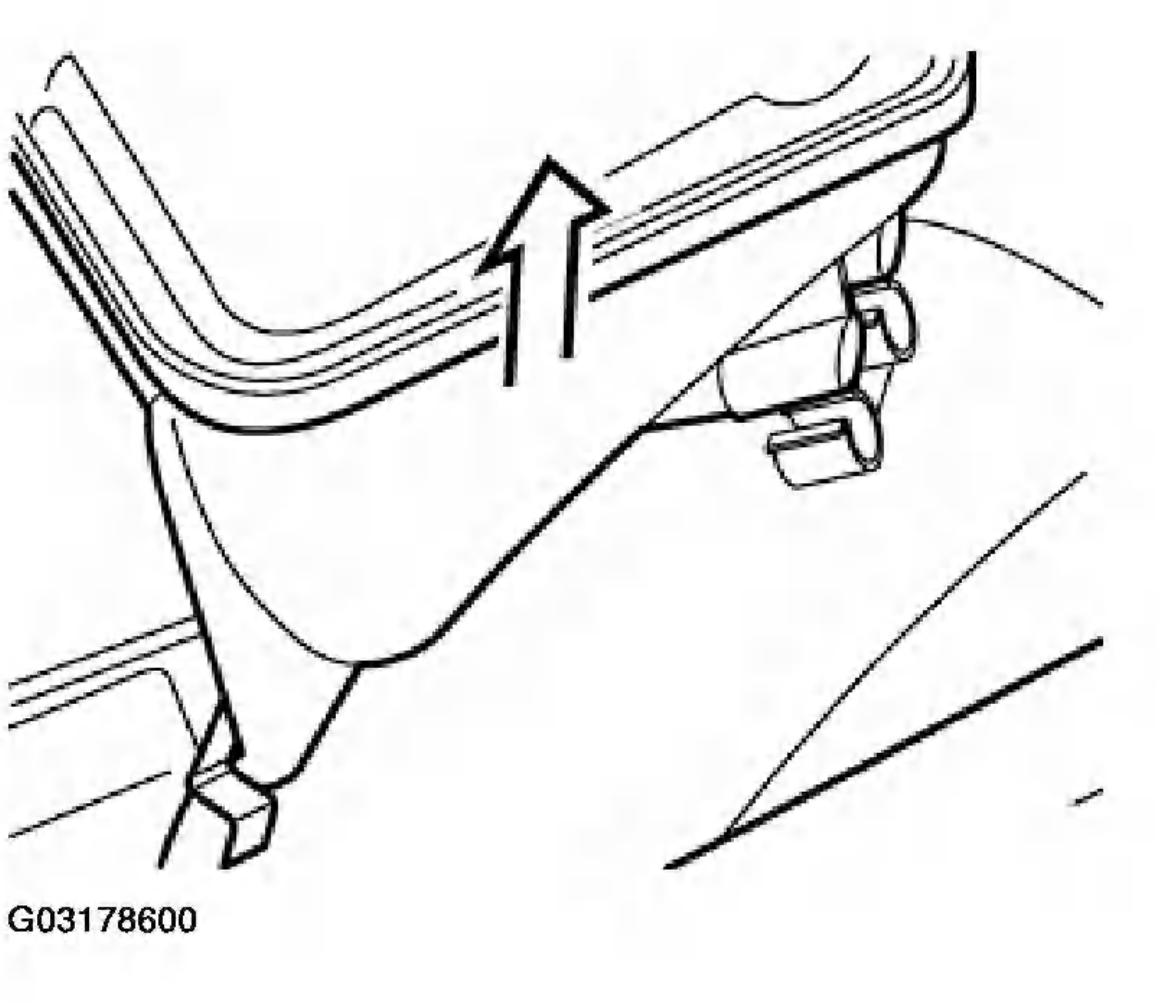



Fig. 45: Removing Coolant Expansion Tank From Bracket
Courtesy of BMW OF NORTH AMERICA, INC.

Integral expansion tank

Loosen bleeder screw (1).

Remove mounting screws (2) and take off upper section.

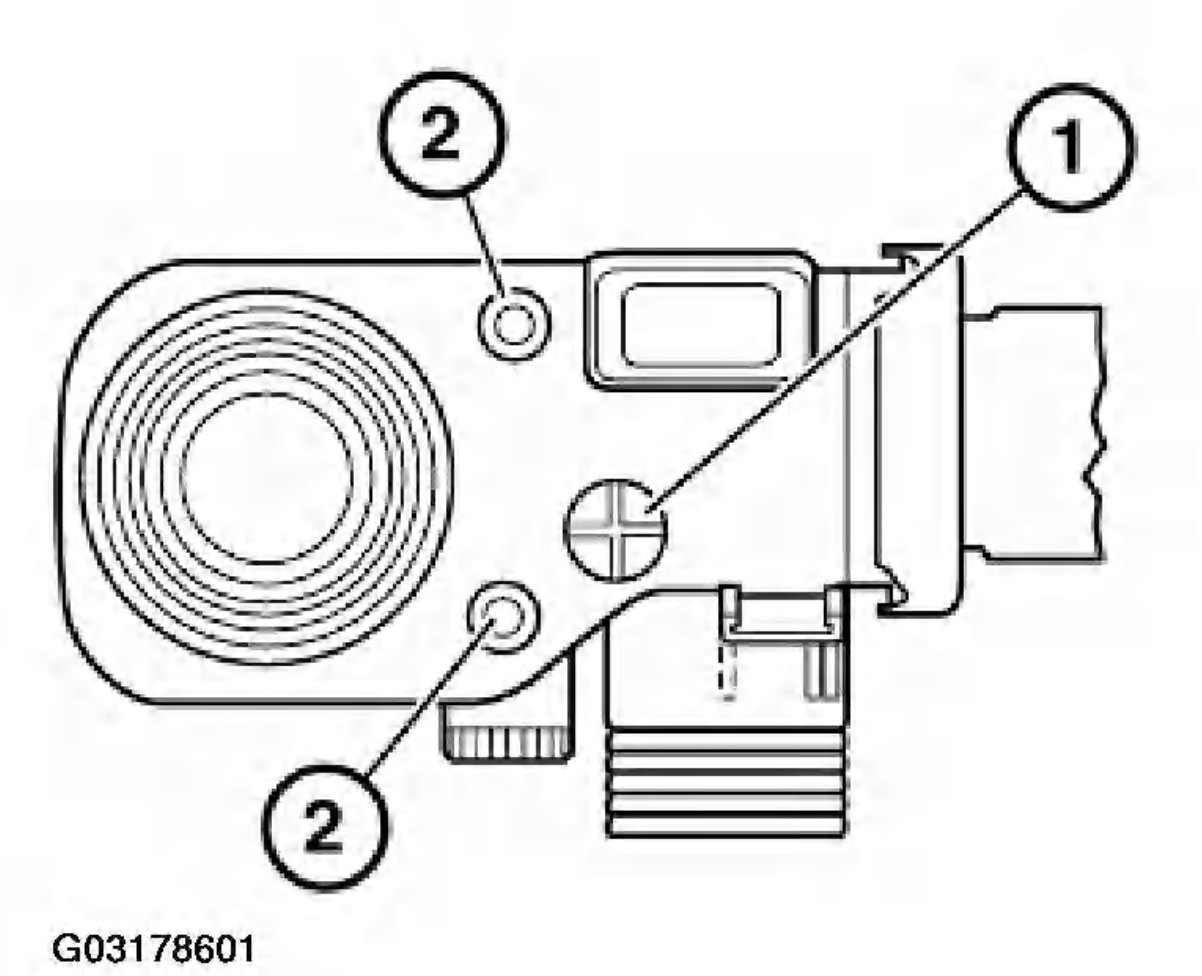



Fig. 46: Loosening Bleeder Screw
Courtesy of BMW OF NORTH AMERICA, INC.

### Integral expansion tank

Pull out expansion tank in upwards direction.

### Installation:

Replace sealing rings.

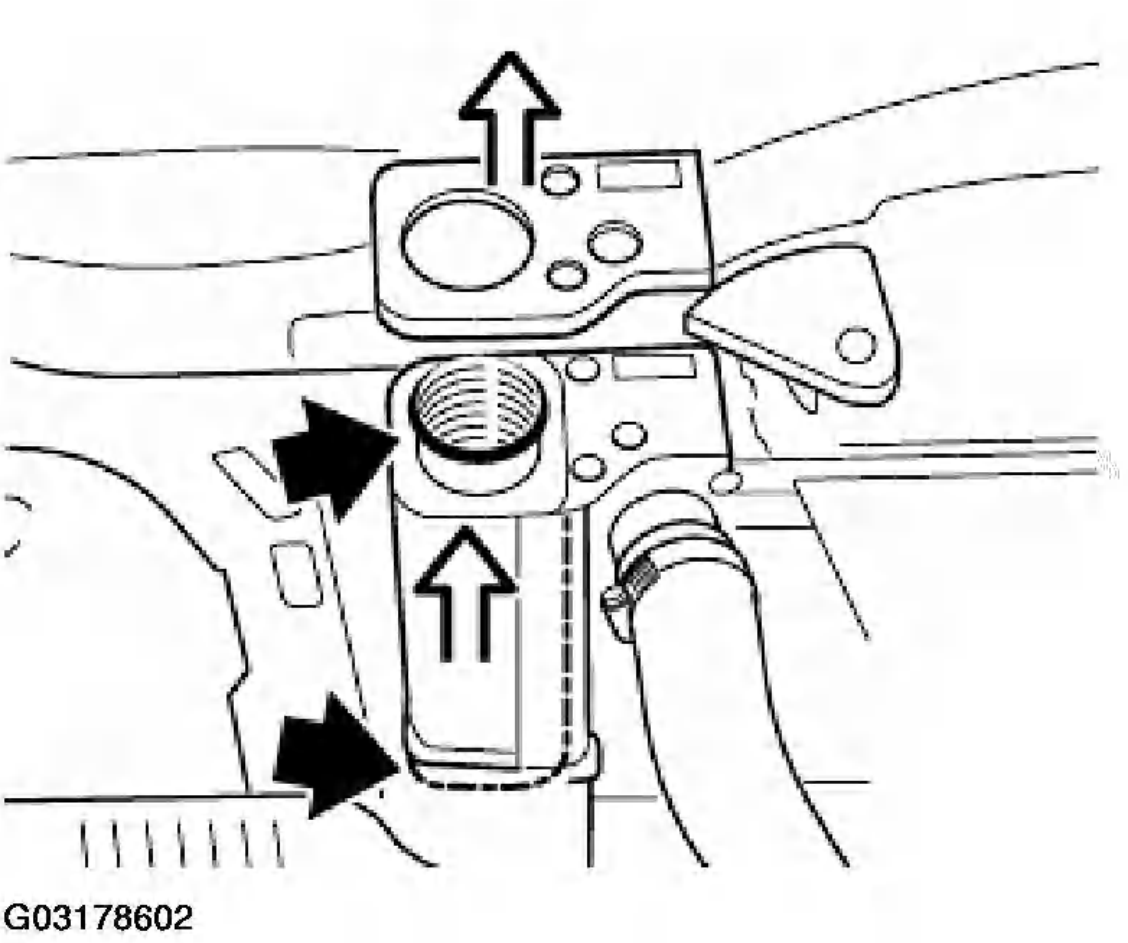



Fig. 47: Removing Expansion Tank
Courtesy of BMW OF NORTH AMERICA, INC.

## 17 11 100 REMOVING AND INSTALLING/REPLACING COOLANT EXPANSION TANK Z3/M54/S54

WARNING: Danger of scalding! Open cap on coolant expansion tank only after engine has cooled down.

NOTE: Follow instructions for working on cooling system. Refer to 17 00 ...INSTRUCTIONS FOR WORKING ON COOLING SYSTEM. .

Recycling

Catch and dispose of escaping coolant.

Observe country-specific waste-disposal regulations.

Drain off coolant only down to lower edge of coolant expansion tank, refer to 17 00 005 DRAINING AND TOPPING UP COOLANT .

Release clamp (1) and detach vent hose (2) from coolant expansion tank.

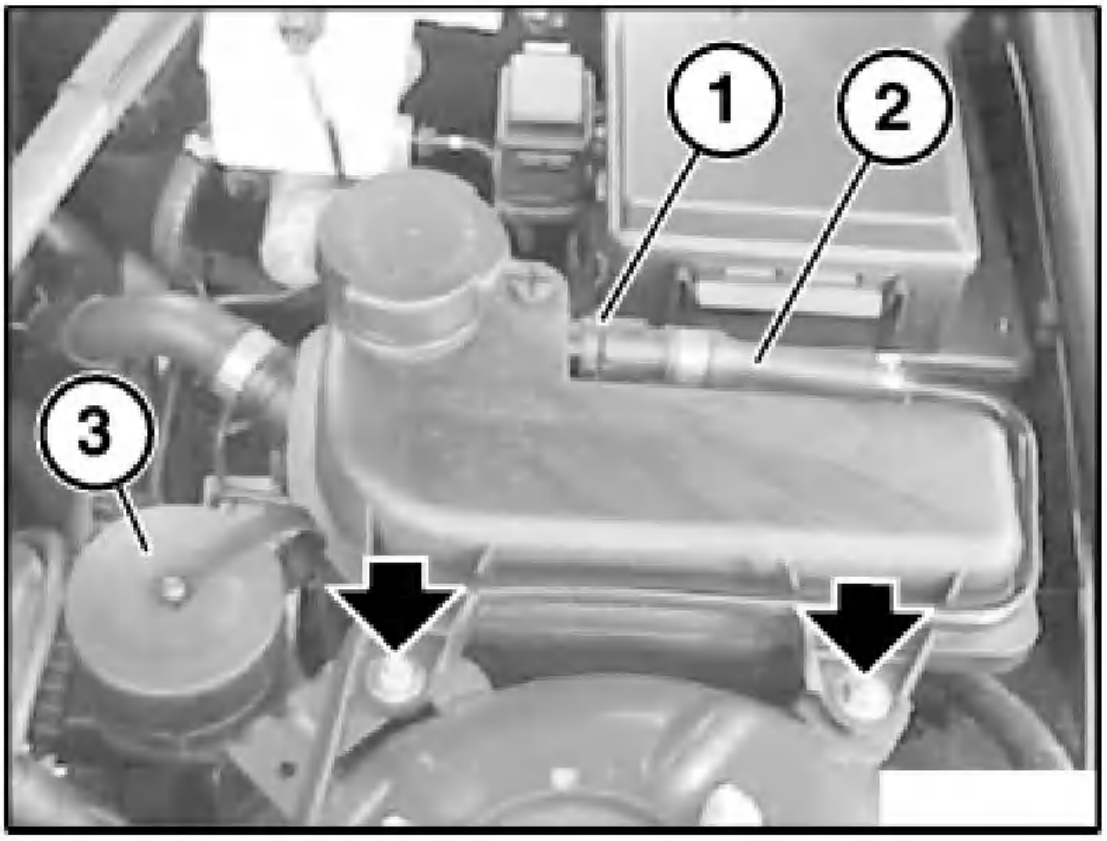



Fig. 48: Detaching Vent Hose From Coolant Expansion Tank
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws.

Release diagnosis socket (3) and place to one side.

Release clip (1) and detach water hose (2).

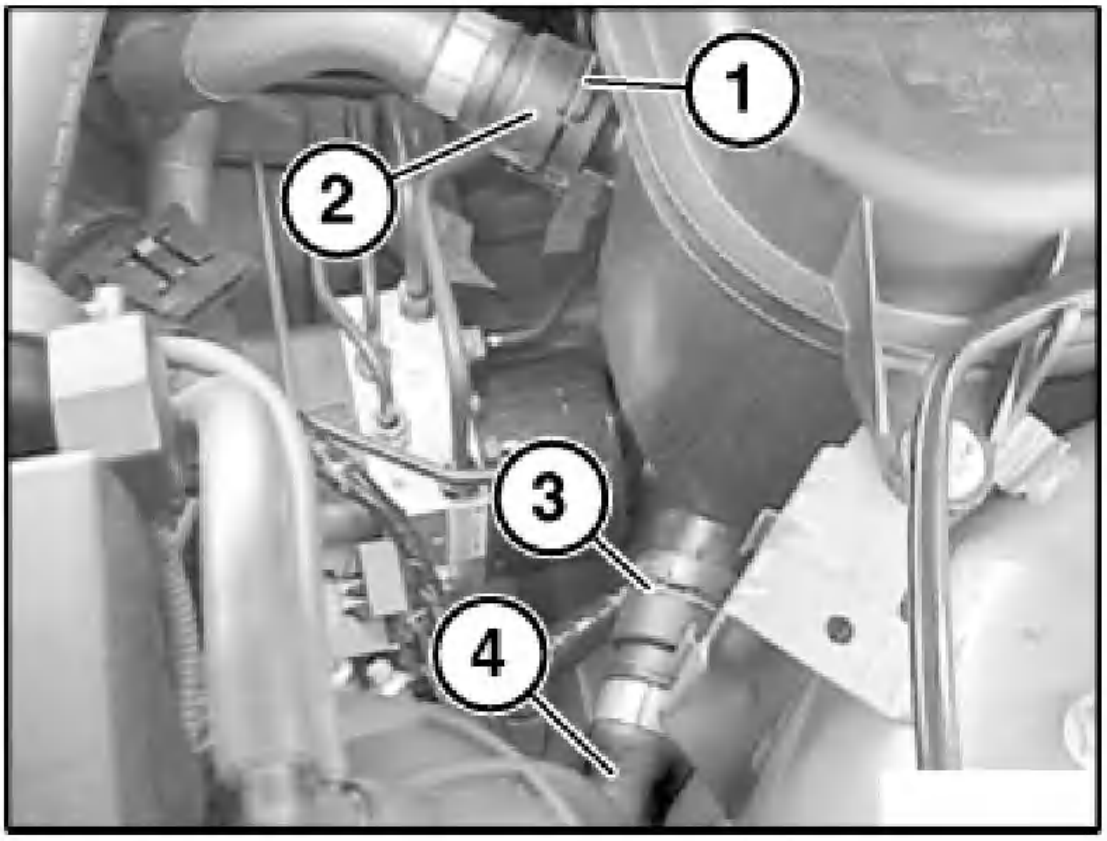



Fig. 49: Removing Clip And Detaching Water Hose
Courtesy of BMW OF NORTH AMERICA, INC.

Release clip (3) and detach water hose (4).

Remove coolant expansion tank.

Installation:

When installing coolant expansion tank:

Insert locating pin (1) into locating bore (2).

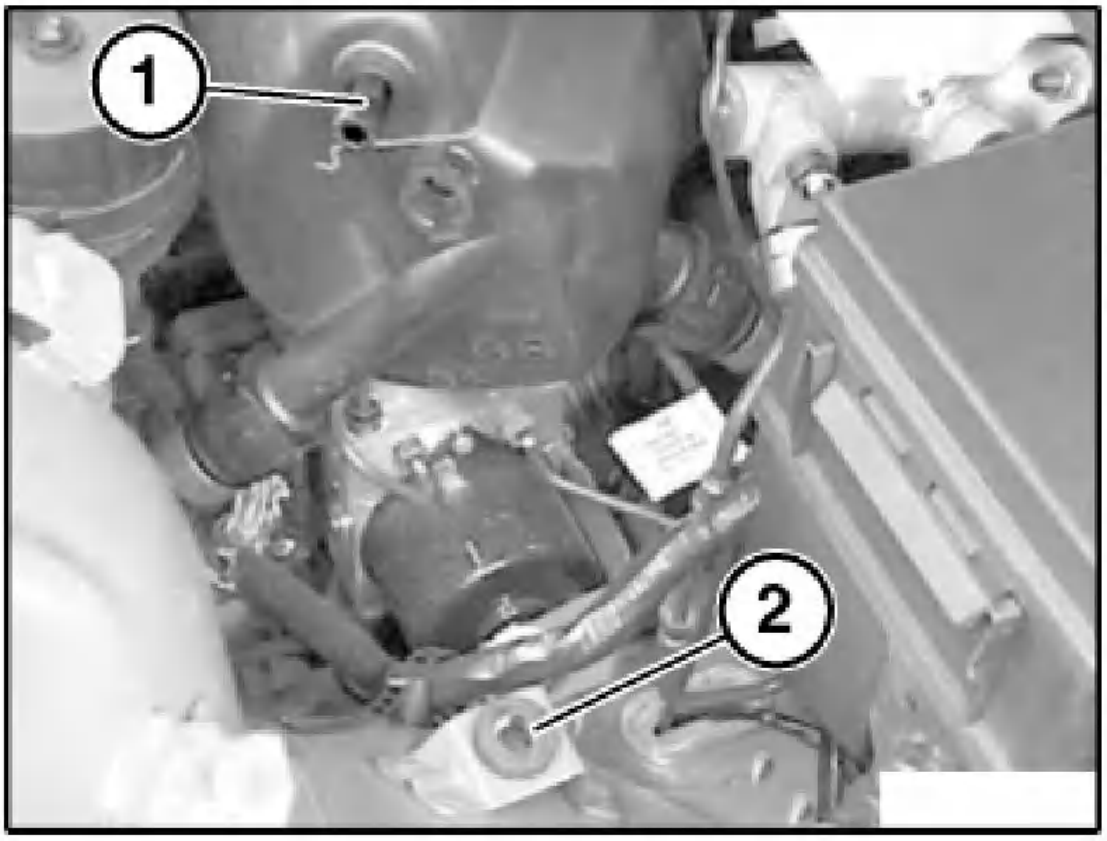



Fig. 50: Inserting Locating Pin Into Locating Bore
Courtesy of BMW OF NORTH AMERICA, INC.

To ensure the cooling system is properly vented, it is absolutely essential to follow the steps below:

1. Open cap on coolant expansion tank.
2. Turn on ignition.
3. Set heater control to maximum temperature.
4. Set blower to low level. This opens the heating valves and starts the auxiliary water pump.
5. Perform filling operation slowly.
6. Close vent plug (1) when bubble-free coolant emerges.

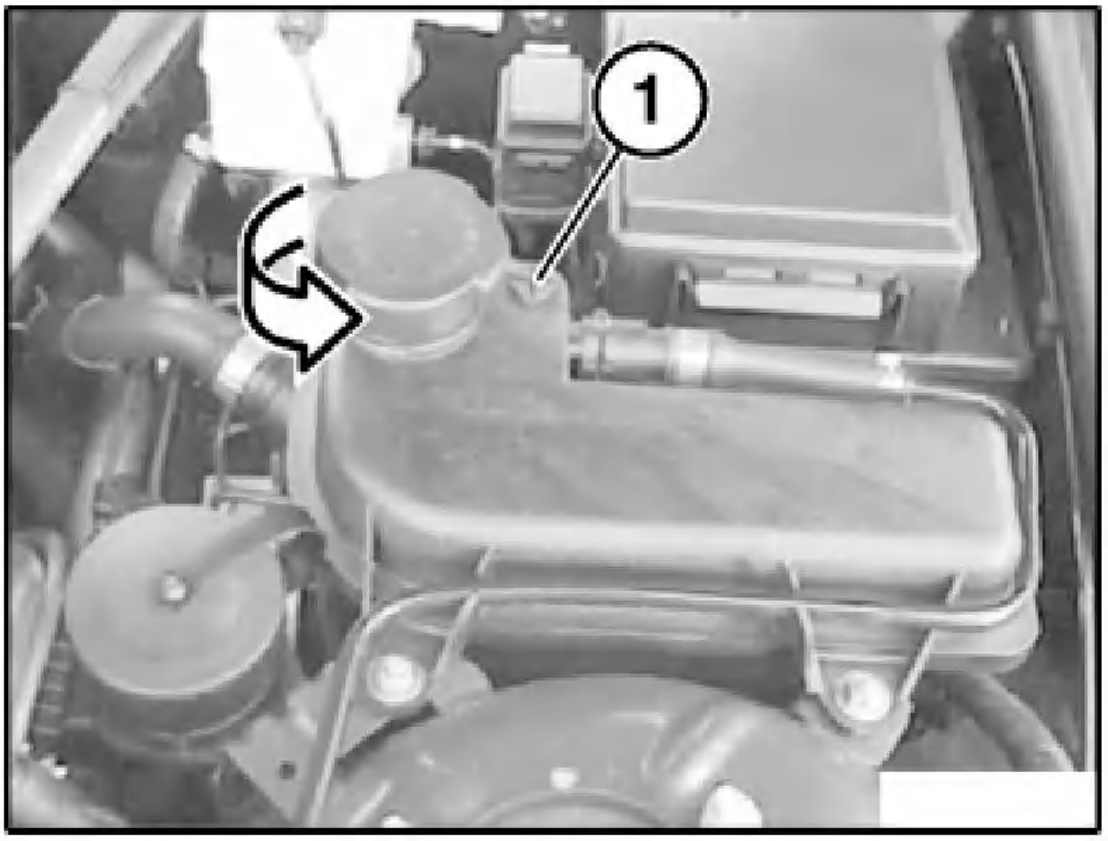



Fig. 51: Closing Vent Plug
Courtesy of BMW OF NORTH AMERICA, INC.

7. Pour coolant into coolant expansion tank up to max. cold fill level. Marking (2) is then level with upper edge of coolant expansion tank.
8. Close coolant expansion tank.
9. Allow engine to warm up until thermostat opens.

Allow engine to cool down before checking coolant level. Coolant temperature must not exceed 30Â°C. If ambient temperature exceeds 30Â°C, allow engine to cool down at least to ambient temperature.

Carefully open sealing cap and check fluid level. Fluid level is O.K. when top edge of coolant expansion tank lies between both markings (1 and 2) on float needle.

- Minimum Cold Fill Level:

  Top edge of coolant expansion tank is level with marking (1).

- Maximum Cold Fill Level:

Top edge of coolant expansion tank is level with marking (2).

If necessary, top up coolant.

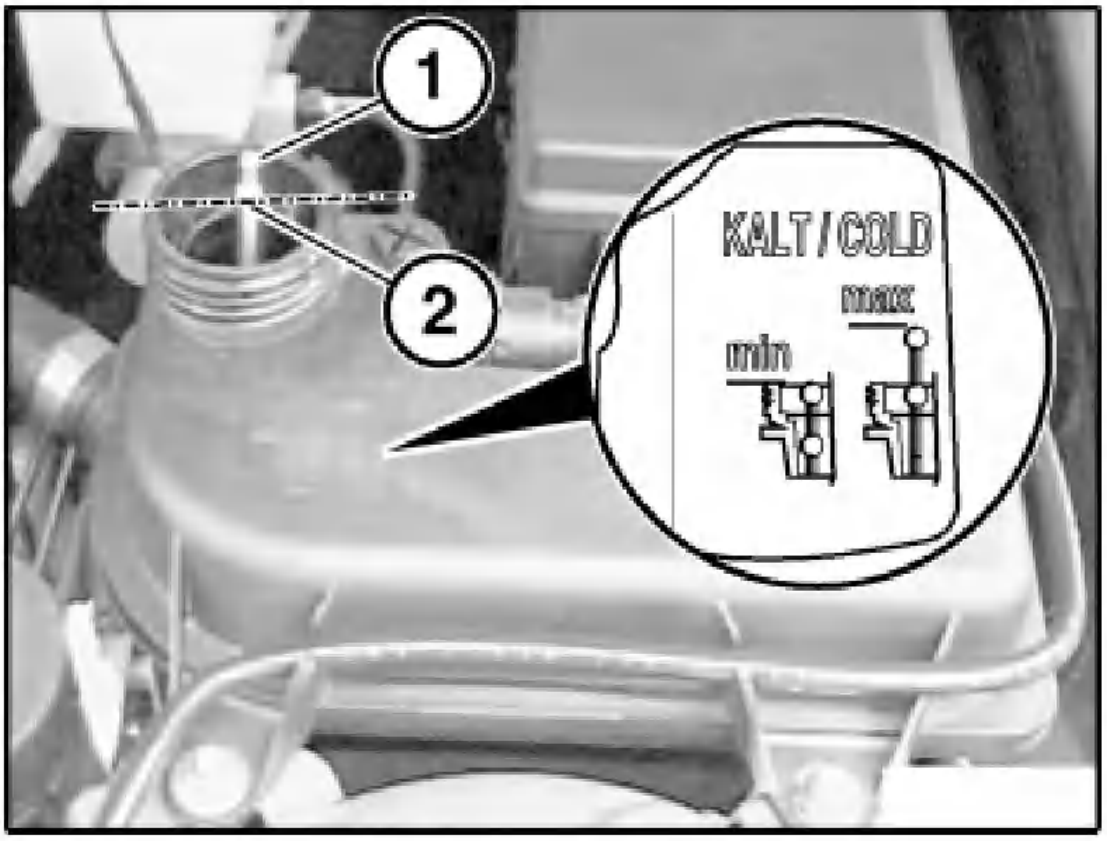



Fig. 52: Identifying Max And Min Markings Of Coolant Expansion Tank
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The tank mark indicates the fluid level at approx. 20Â°C. Use only recommended coolant.

## 17 11 509 FLUSHING RADIATOR

NOTE: If oil has penetrated the coolant circuit, you must flush the radiator and coolant expansion tank with cleaning agent.

CAUTION: When working on the oil, coolant or fuel circuit, protect the alternator against contamination (not applicable to alternators with coolant jackets). Cover alternator with suitable materials. Failure to comply with this procedure may result in an alternator malfunction.

### Separate coolant expansion tank

Remove radiator. Refer to 17 11 000 REMOVING AND INSTALLING RADIATOR (Z3/M54) .

Remove coolant expansion tank. Refer to 17 11 100 REMOVING AND INSTALLING/REPLACING COOLANT EXPANSION TANK .

### Integral coolant expansion tank

Remove radiator. Refer to 17 11 000 REMOVING AND INSTALLING RADIATOR (Z3/M54) .

1. Prepare approx. 2 liters of cleaning agent.
2. Fill radiator and coolant expansion tank and shake well. Wait a few minutes until oil has separated.
3. Drain radiator and coolant expansion tank.
4. Reinstall cleaned radiator and if necessary coolant expansion tank.
5. Fill entire cooling system (heating control to "warm") with hot water and thoroughly flush by changing water several times.
6. Check drained flushing fluid for traces of oil. If necessary, repeat Procedure 5.

After cleaning procedure, top up coolant. Refer to 17 00 005 DRAINING AND TOPPING UP COOLANT .

# OIL COOLER

## 17 21 500 FLUSHING OIL COOLER WITH LINES (AUTOMATIC TRANSMISSION)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 17 2 018
- 17 2 019

NOTE: Carry out the work steps listed when: Fitting a new or replacement transmission or flushing can only be carried out with the automatic transmission removed.

Procedure:

Automatic transmission removed.

Connect appropriate adapters to oil lines exiting from automatic transmission.

Connect the connecting line 17 2 019 from the oil collection unit with the quick-release coupling.

Connect drain line 17 2 018 using quick-release coupling.

Feed open end of drain line into a suitable collection container.

Using oil collection unit, flush approx. 1 liter of transmission fluid through oil lines and oil cooler.

Reposition quick-release couplings.

Flush oil lines/oil cooler in opposite direction with approx. 1 liter of transmission fluid.

Disconnect quick-release couplings, remove adapters.

NOTE: Dispose of flushing oil properly; do not under any circumstances reuse it.

Arrangement Of Flushing Device For Transmissions A5S 310Z, A5S 560Z, A5S 360R/390R, A4S 200R, A5S 325Z, GA6HP26Z

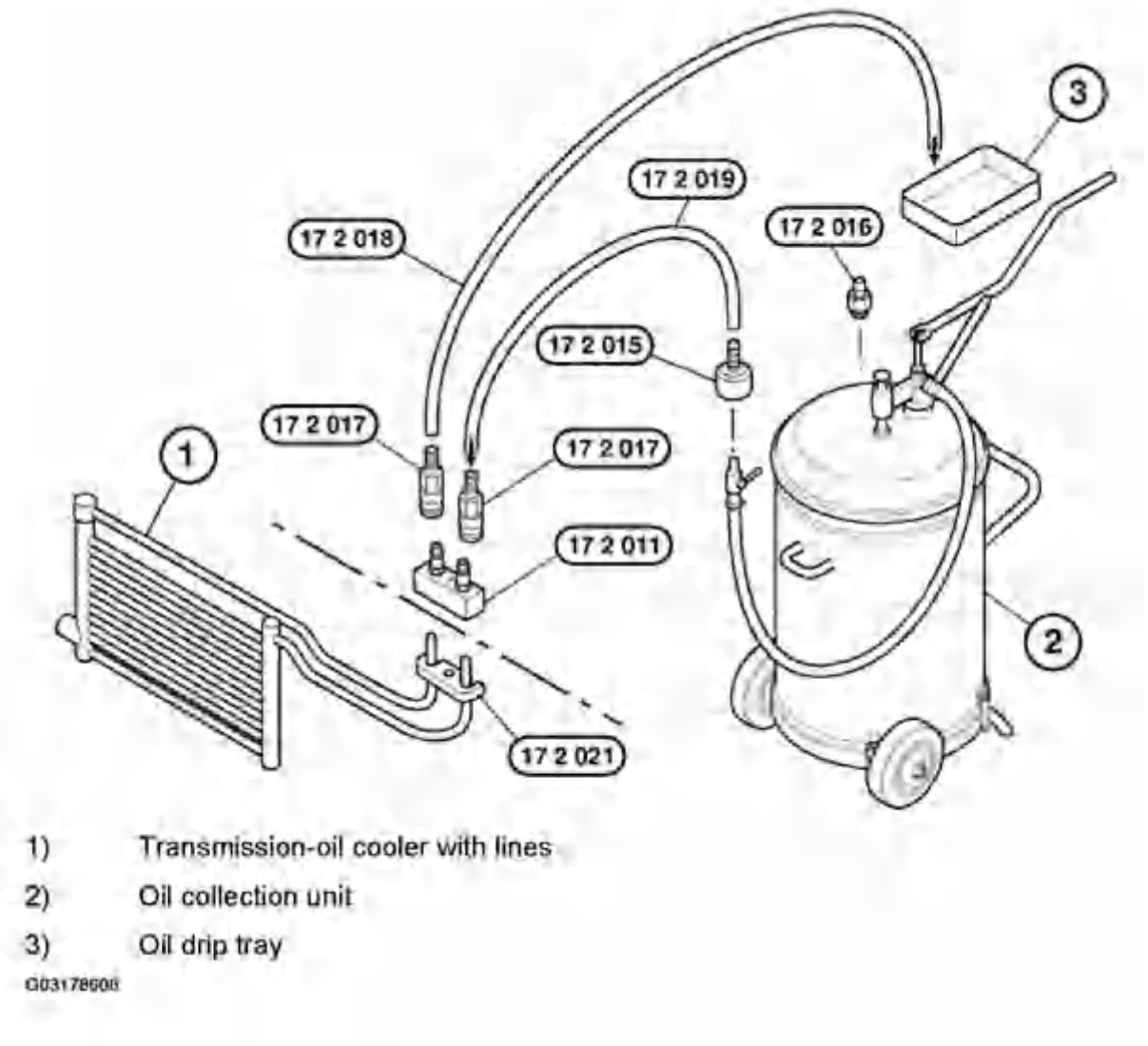



Fig. 53: Identifying Arrangement Of Flushing Device For Transmissions (A5S 310Z, A5S 560Z, A5S 360R/390R, A4S 200R, A5S 325Z, GA6HP26Z)
Courtesy of BMW OF NORTH AMERICA, INC.

17 2 011 Adapter for connecting transmission-side oil cooler lines (1).

17 2 015 Connection for oil collection unit (2), manufacturer: Deutsche Tecalemit or.

17 2 016 Connection for oil collection unit (2), manufacturer: Horn.

17 2 017 Quick-release coupling (2 pieces).

17 2 018 Hose to oil drip tray (3).

17 2 019 Hose to oil collection unit (2).

17 2 021 Mounting plate for adapter 17 2 011 for transmissions A5S 325Z, GA6HP26Z.

Arrangement Of Flushing Device For Transmission A4S 310R

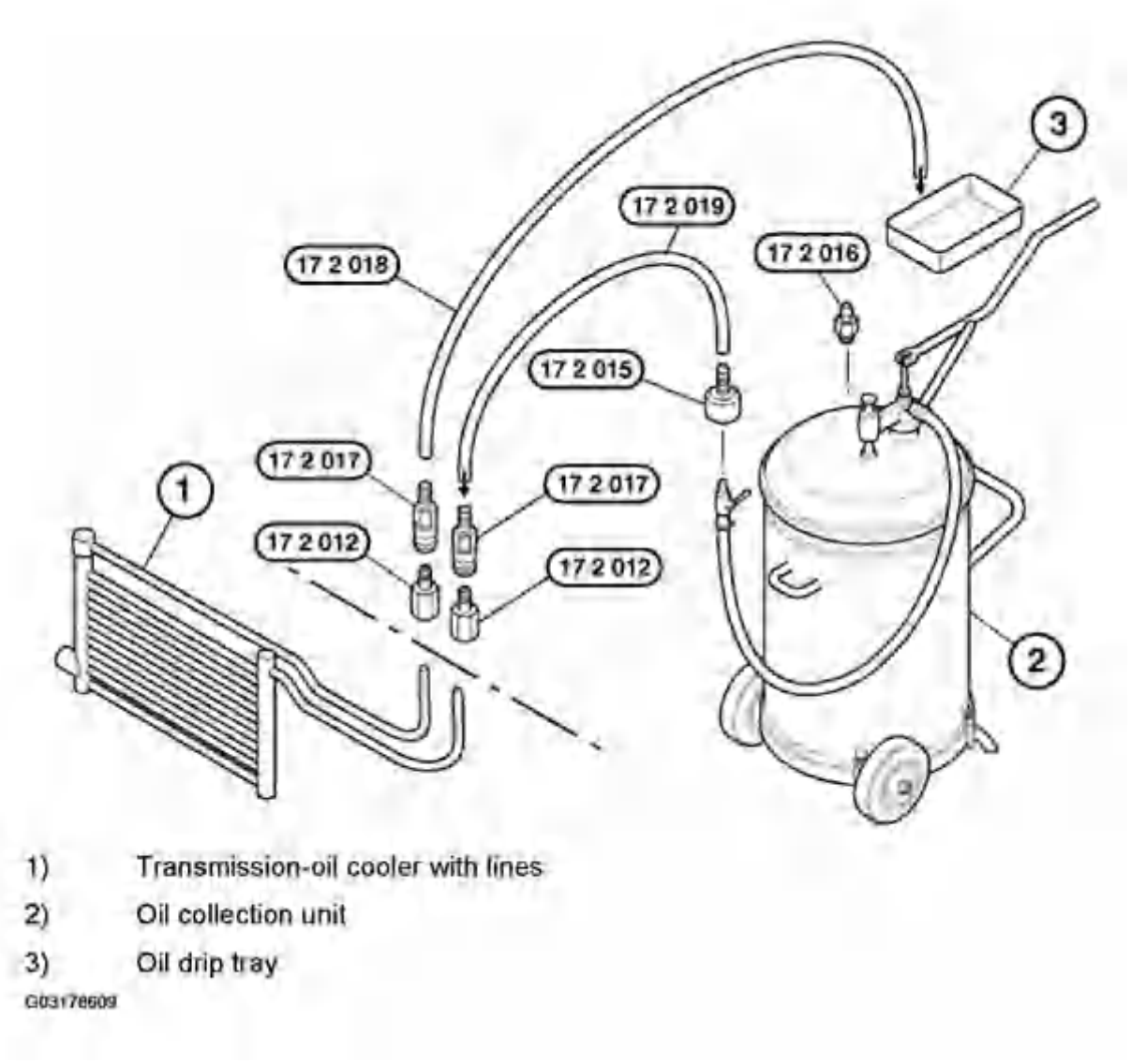



Fig. 54: Identifying Arrangement Of Flushing Device For Transmission (A4S 310R)
Courtesy of BMW OF NORTH AMERICA, INC.

17 2 012 Adapters (2 x) for connecting transmission-side oil cooler lines (1).

17 2 015 Connection for oil collection unit (2), manufacturer: Deutsche Tecalemit or.

17 2 016 Connection for oil collection unit (2), manufacturer: Horn.

17 2 017 Quick-release coupling (2 pieces).

17 2 018 Hose to oil drip tray (3).

17 2 019 Hose to oil collection unit (2).

Arrangement Of Flushing Device For Transmission A4S 300J

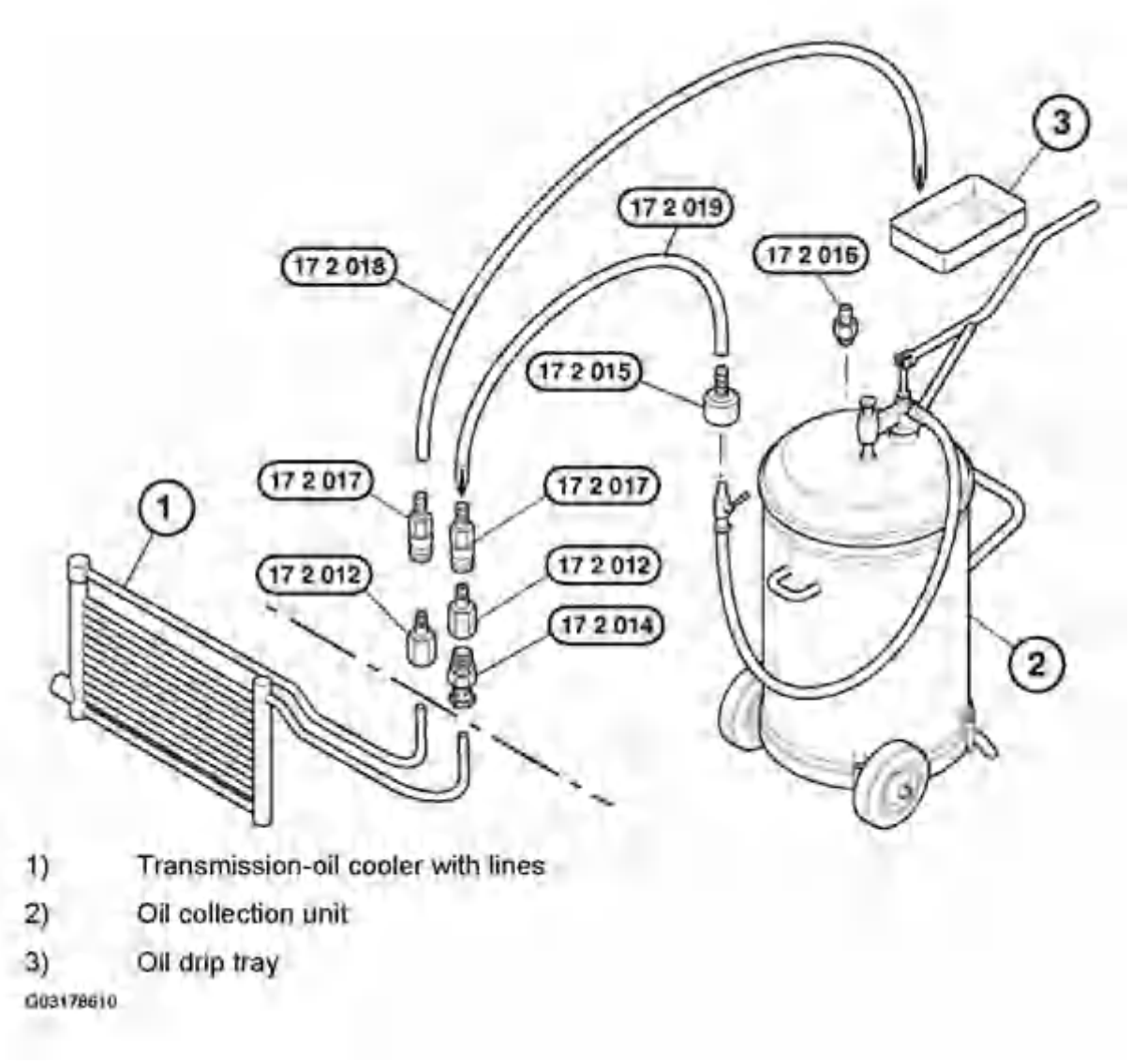



Fig. 55: Identifying Arrangement Of Flushing Device For Transmission (A4S 300J)
Courtesy of BMW OF NORTH AMERICA, INC.

17 2 012 Adapters (2 x) for connecting transmission-side oil cooler lines (1).

17 2 014 Banjo bolt for connecting transmission-side oil cooler lines (1).

17 2 015 Connection for oil collection unit (2), manufacturer: Deutsche Tecalemit or.

17 2 016 Connection for oil collection unit (2), manufacturer: Horn.

17 2 017 Quick-release coupling (2 pieces).

17 2 018 Hose to oil drip tray (3).

17 2 019 Hose to oil collection unit (2).

Arrangement Of Flushing Device For Transmission A5S 440Z

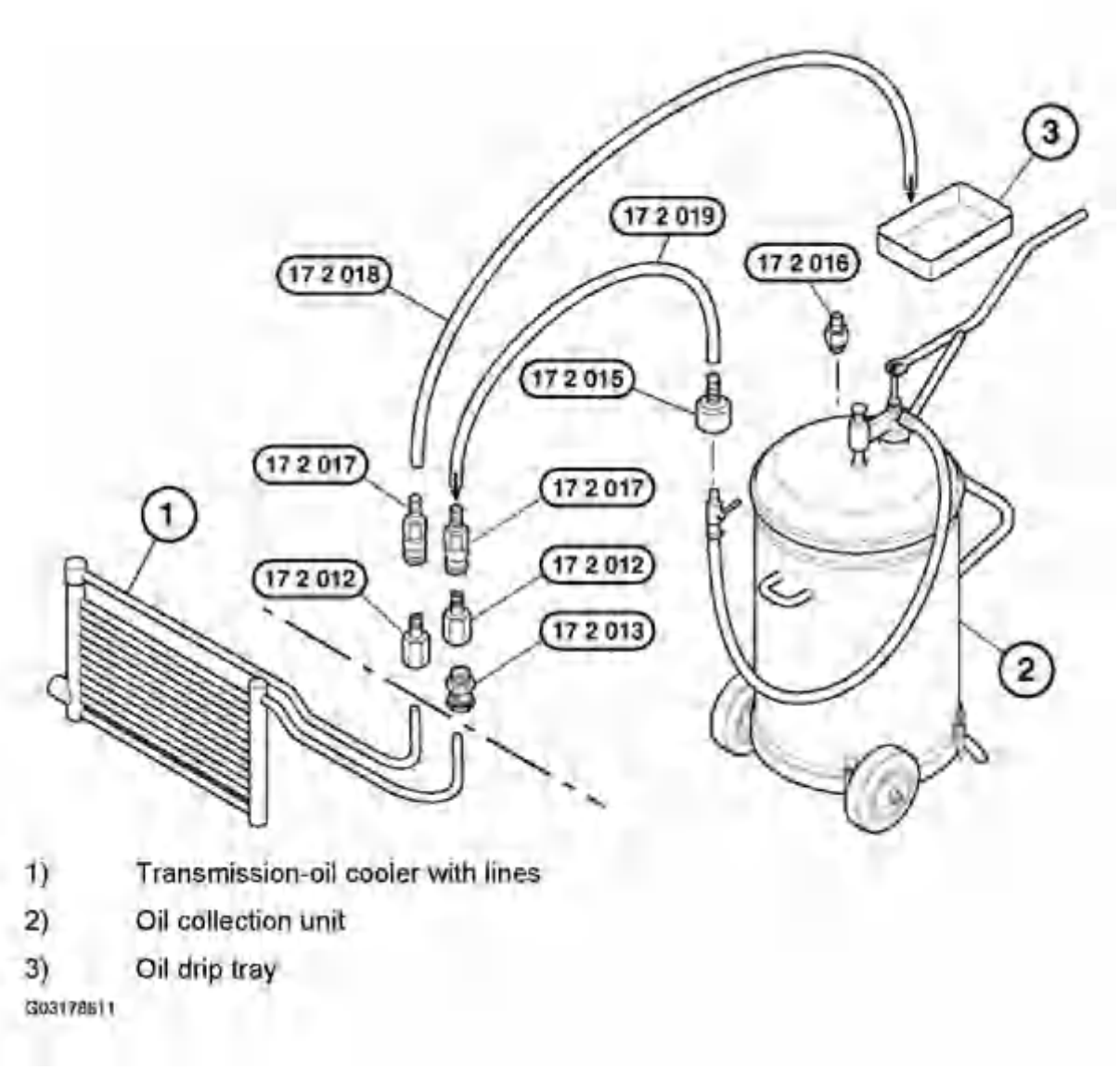



Fig. 56: Identifying Arrangement Of Flushing Device For Transmission (A5S 440Z)
Courtesy of BMW OF NORTH AMERICA, INC.

17 2 012 Adapters (2 x) for connecting transmission-side oil cooler lines (1).

17 2 013 Banjo bolt for connecting transmission-side oil cooler lines (1).

17 2 015 Connection for oil collection unit (2), manufacturer: Deutsche Tecalemit or.

17 2 016 Connection for oil collection unit (2), manufacturer: Horn.

17 2 017 Quick-release coupling (2 pieces).

17 2 018 Hose to oil drip tray (3).

17 2 019 Hose to oil collection unit (2).

## OIL COOLER LINES

### 17 21 500 FLUSHING OIL COOLER WITH LINES (AUTOMATIC TRANSMISSION)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 17 2 018
- 17 2 019

NOTE: Carry out the work steps listed when: Fitting a new or replacement transmission. Flushing can only be carried out with the automatic transmission removed.

Procedure:

Automatic transmission removed.

Connect appropriate adapters to oil lines exiting from automatic transmission.

Connect the connecting line 17 2 019 from the oil collection unit with the quick-release coupling.

Connect drain line 17 2 018 using quick-release coupling.

Feed open end of drain line into a suitable collection container.

Using oil collection unit, flush approx. 1 liter of transmission fluid through oil lines and oil cooler.

Reposition quick-release couplings.

Flush oil lines/oil cooler in opposite direction with approx. 1 liter of transmission fluid.

Disconnect quick-release couplings, remove adapters.

NOTE: Dispose of flushing oil properly; do not under any circumstances reuse it.

Arrangement Of Flushing Device For Transmissions A5S 310Z, A5S 560Z, A5S 360R/390R, A4S 200R, A5S 325Z, GA6HP26Z

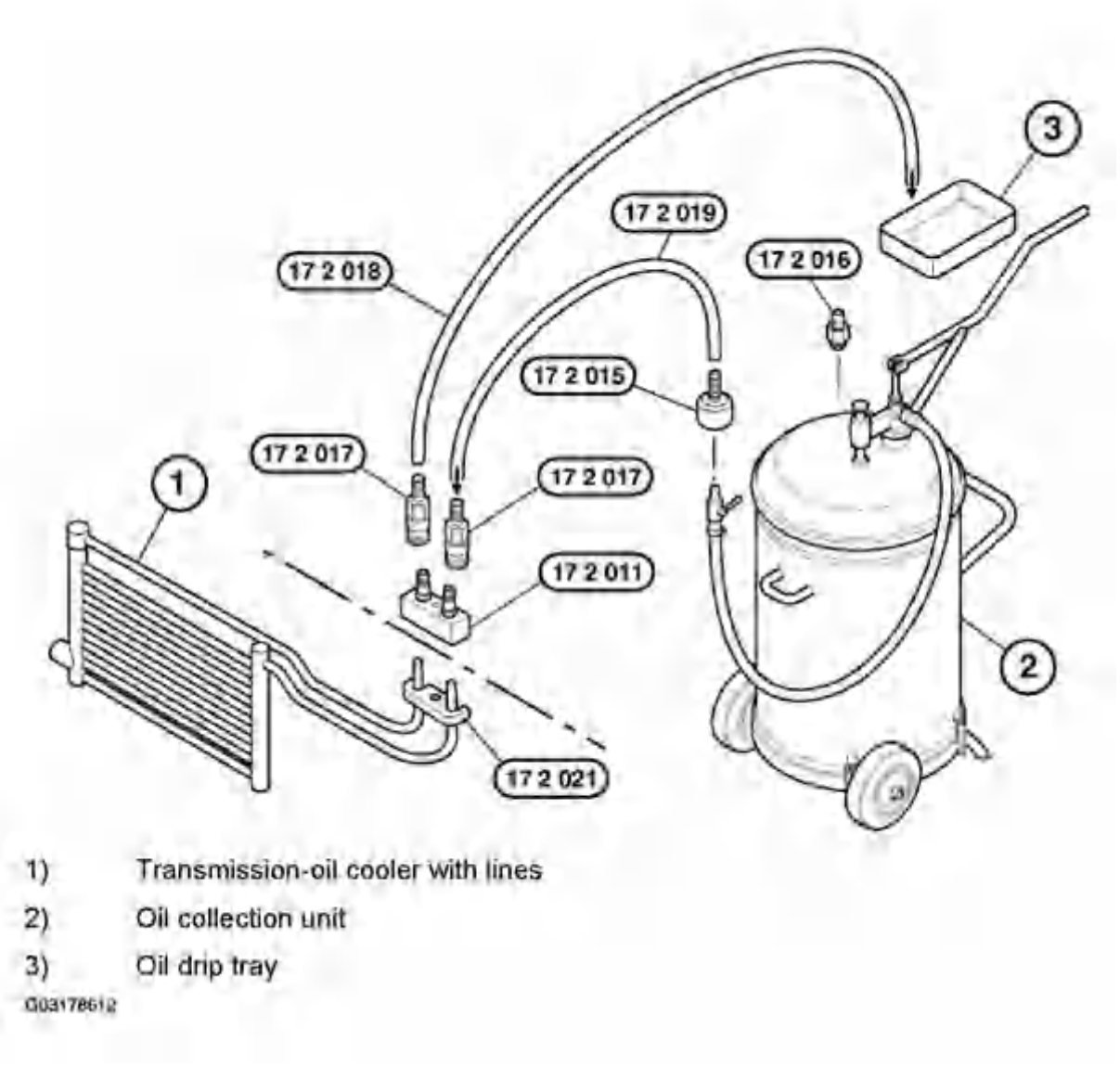



Fig. 57: Identifying Arrangement Of Flushing Device For Transmissions (A5S 310Z, A5S 560Z, A5S 360R/390R, A4S 200R, A5S 325Z, GA6HP26Z)
Courtesy of BMW OF NORTH AMERICA, INC.

17 2 011 Adapter for connecting transmission-side oil cooler lines (1).

17 2 015 Connection for oil collection unit (2), manufacturer: Deutsche Tecalemit or.

17 2 016 Connection for oil collection unit (2), manufacturer: Horn.

17 2 017 Quick-release coupling (2 pieces).

17 2 018 Hose to oil drip tray (3).

17 2 019 Hose to oil collection unit (2).

17 2 021 Mounting plate for adapter 17 2 011 for transmissions A5S 325Z, GA6HP26Z.

Arrangement Of Flushing Device For Transmission A4S 310R

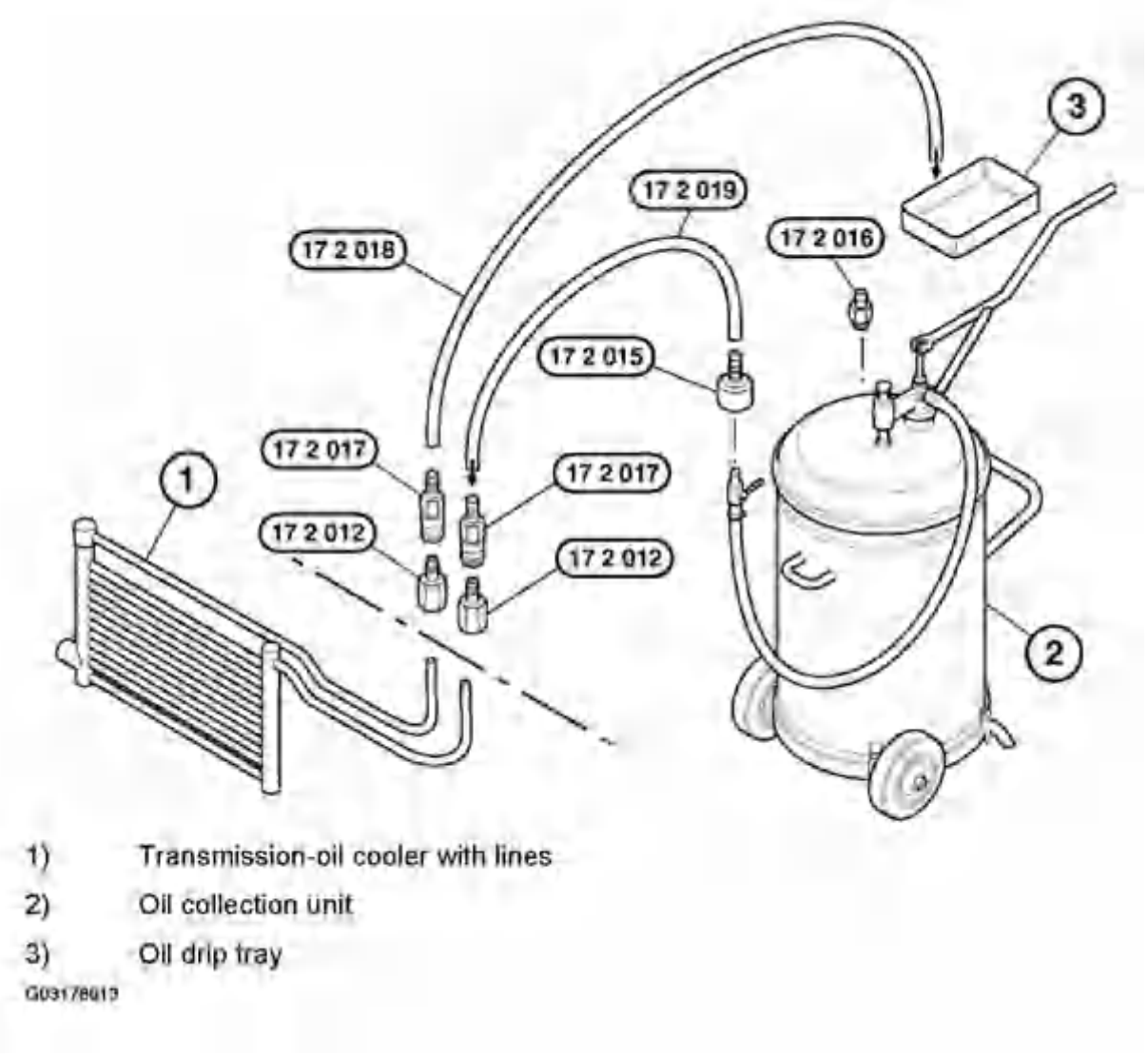



Fig. 58: Identifying Arrangement Of Flushing Device For Transmission (A4S 310R)
Courtesy of BMW OF NORTH AMERICA, INC.

17 2 012 Adapters (2 x) for connecting transmission-side oil cooler lines (1).

17 2 015 Connection for oil collection unit (2), manufacturer: Deutsche Tecalemit or.

17 2 016 Connection for oil collection unit (2), manufacturer: Horn.

17 2 017 Quick-release coupling (2 pieces).

17 2 018 Hose to oil drip tray (3).

17 2 019 Hose to oil collection unit (2).

Arrangement Of Flushing Device For Transmission A4S 300J

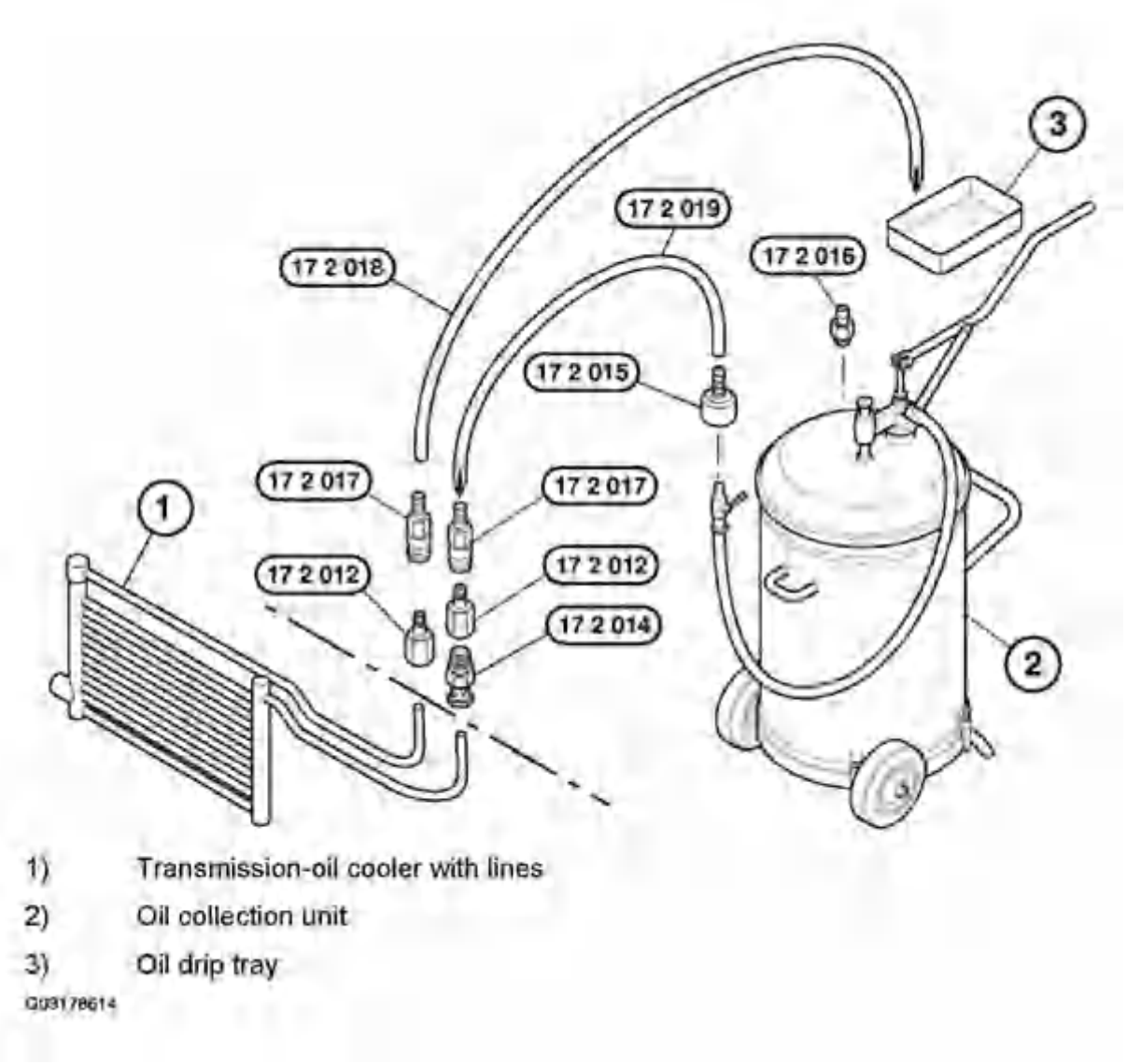



Fig. 59: Identifying Arrangement Of Flushing Device For Transmission (A4S 300J)
Courtesy of BMW OF NORTH AMERICA, INC.

17 2 012 Adapters (2 x) for connecting transmission-side oil cooler lines (1).

17 2 014 Banjo bolt for connecting transmission-side oil cooler lines (1).

17 2 015 Connection for oil collection unit (2), manufacturer: Deutsche Tecalemit or.

17 2 016 Connection for oil collection unit (2), manufacturer: Horn.

17 2 017 Quick-release coupling (2 pieces).

17 2 018 Hose to oil drip tray (3).

17 2 019 Hose to oil collection unit (2).

Arrangement Of Flushing Device For Transmission A5S 440Z

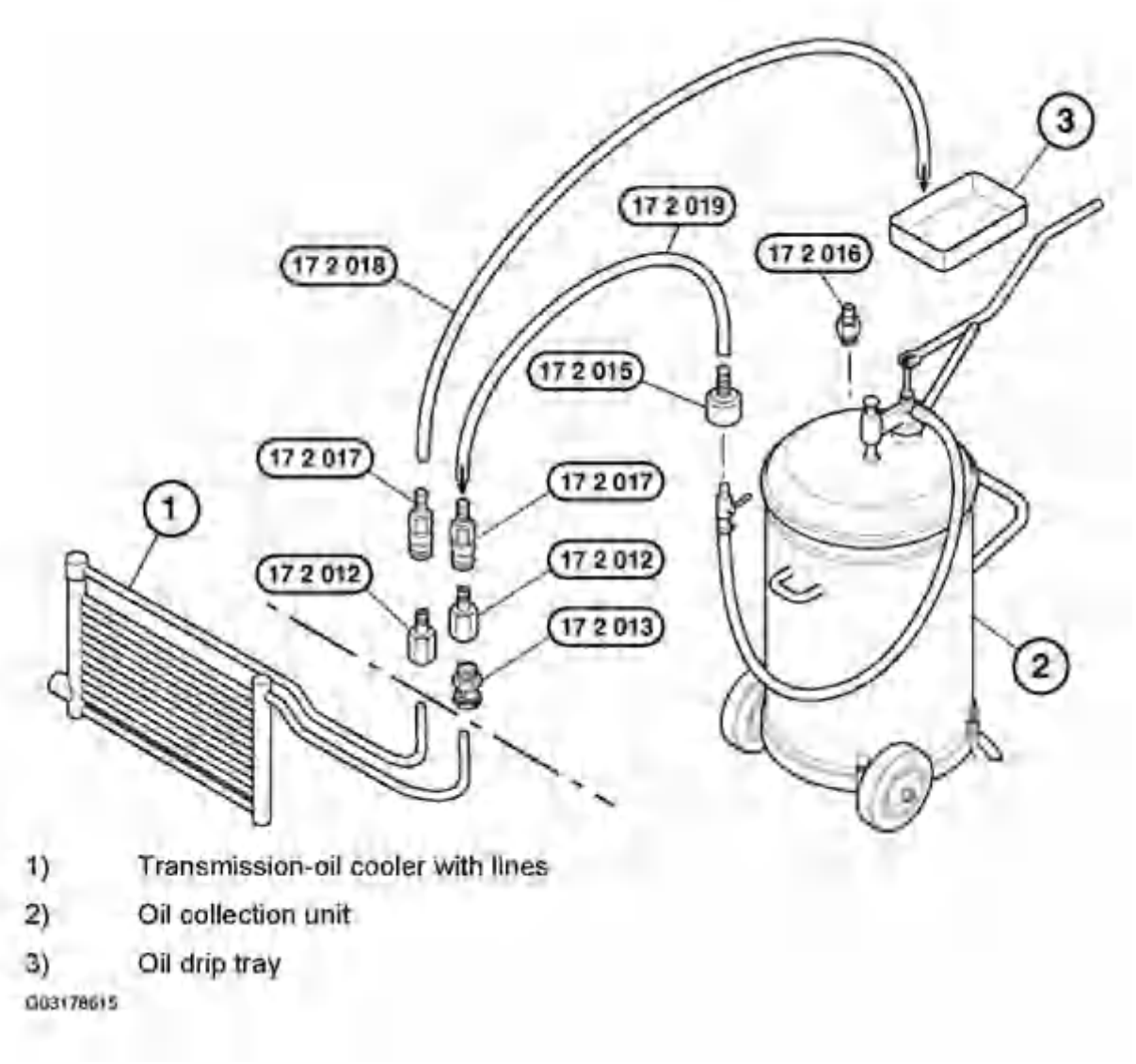



Fig. 60: Identifying Arrangement Of Flushing Device For Transmission (A5S 440Z)
Courtesy of BMW OF NORTH AMERICA, INC.

17 2 012 Adapters (2 x) for connecting transmission-side oil cooler lines (1).

17 2 013 Banjo bolt for connecting transmission-side oil cooler lines (1).

17 2 015 Connection for oil collection unit (2), manufacturer: Deutsche Tecalemit or.

17 2 016 Connection for oil collection unit (2), manufacturer: Horn.

17 2 017 Quick-release coupling (2 pieces).

17 2 018 Hose to oil drip tray (3).

17 2 019 Hose to oil collection unit (2).

## AUXILIARY ELECTRICAL

### 17 40 000 REMOVING AND INSTALLING/REPLACING COMPLETE AUXILIARY FAN

Remove cover from top of radiator.

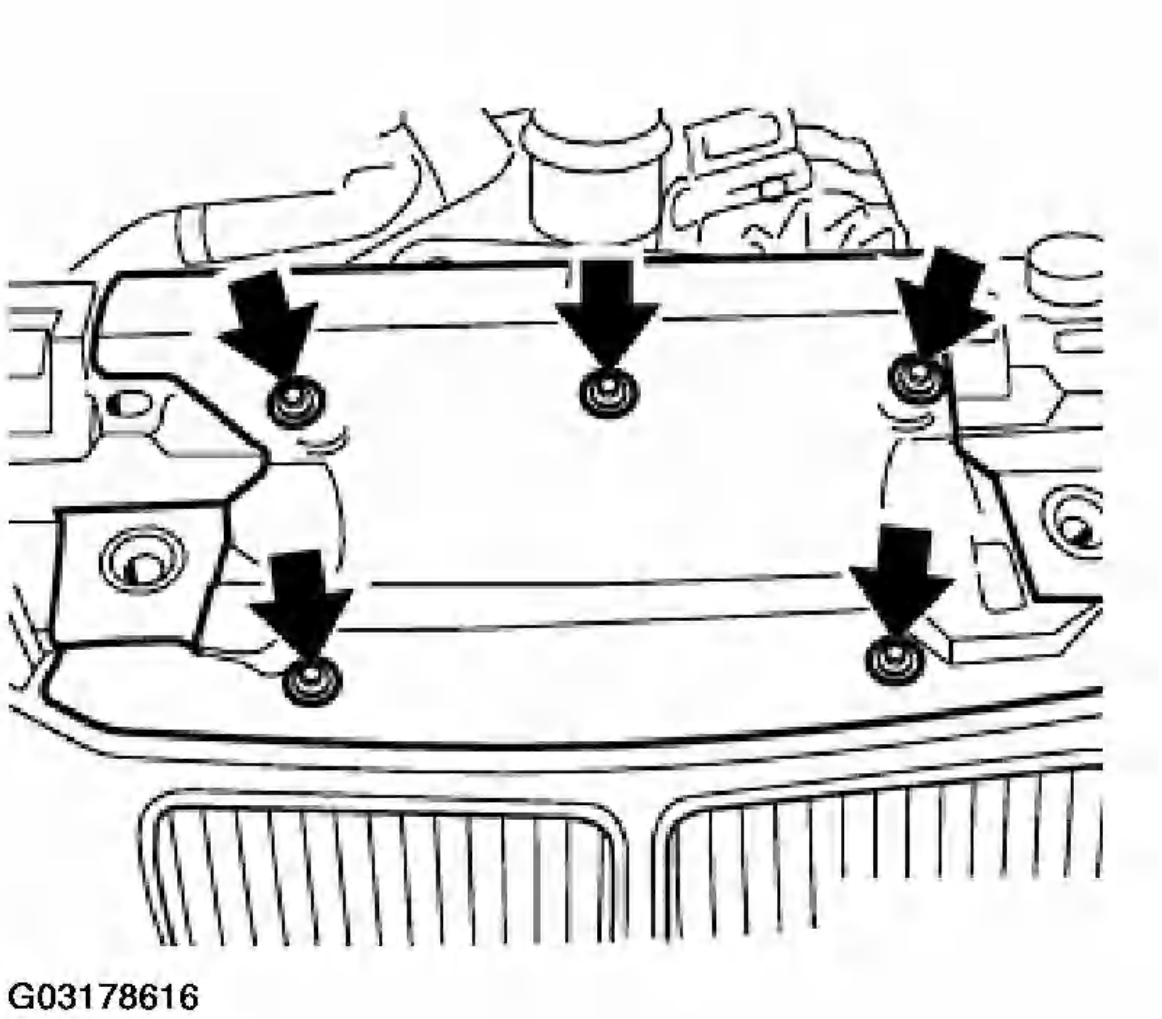



Fig. 61: Removing Cover From Top Of Radiator
Courtesy of BMW OF NORTH AMERICA, INC.

Version 1

Unfasten screws (1...3) from fan carrier.

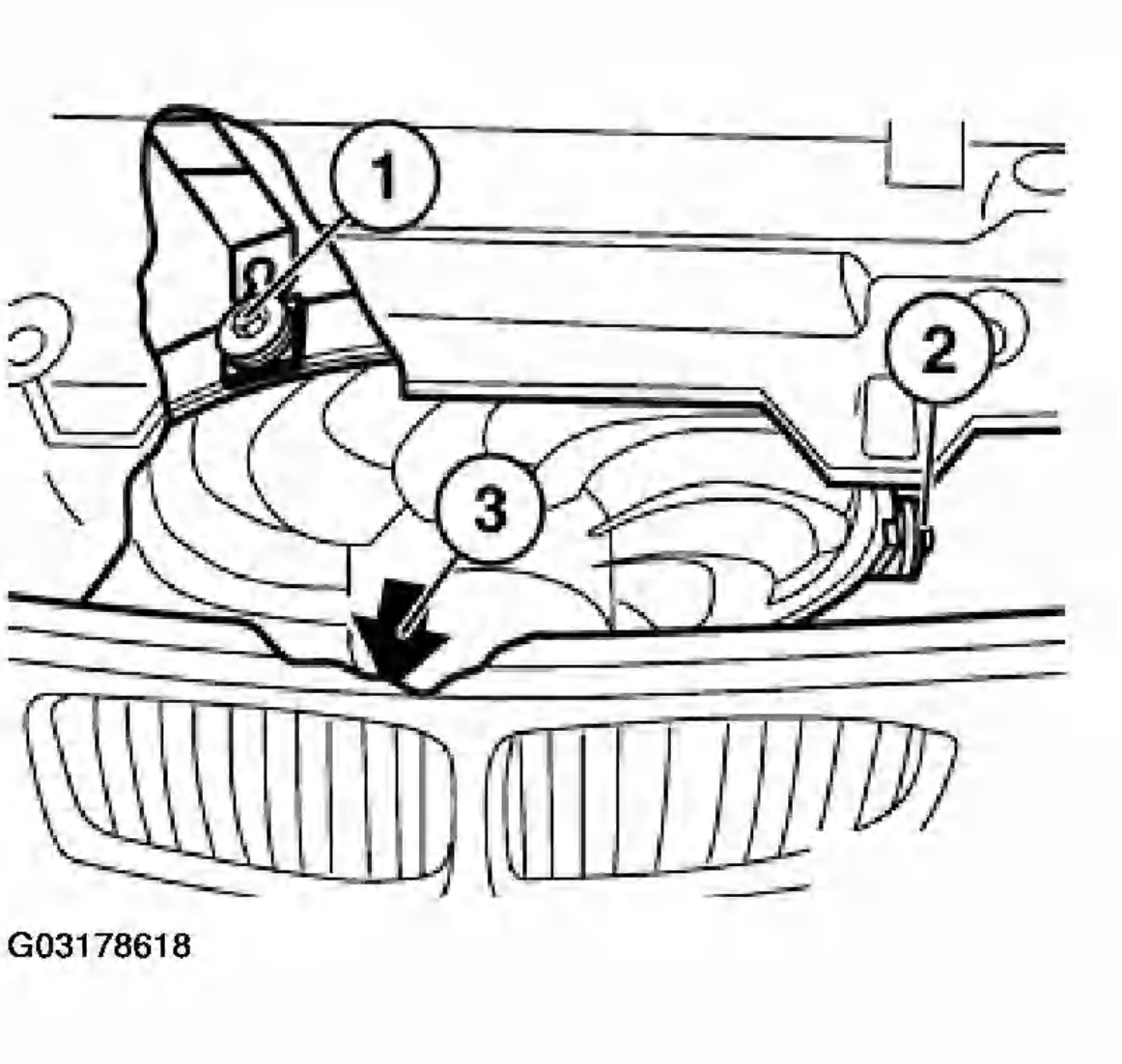



Fig. 62: Removing Screws From Fan Carrier
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect connector.

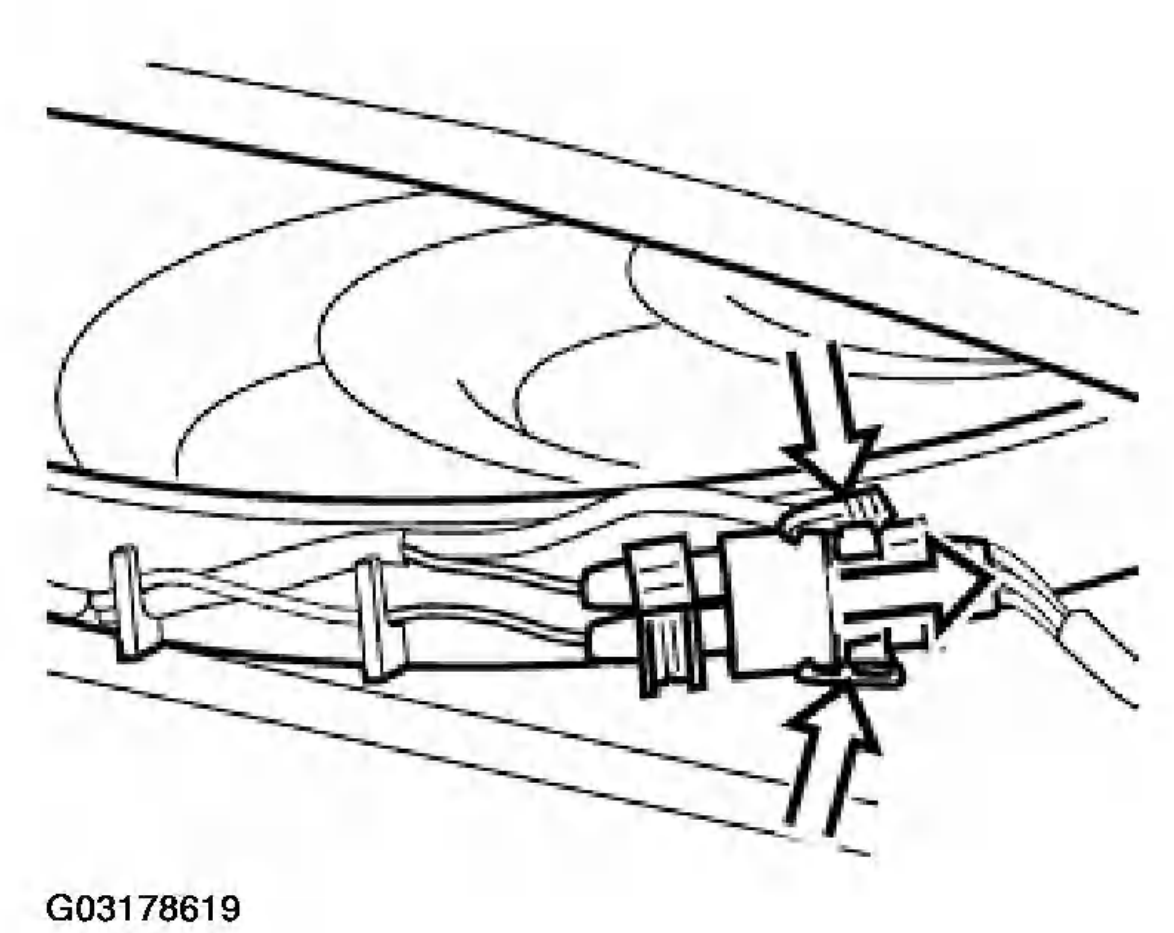



Fig. 63: Disconnecting Connector
Courtesy of BMW OF NORTH AMERICA, INC.

Remove fan bracket and fan from retaining shoe and lift out.

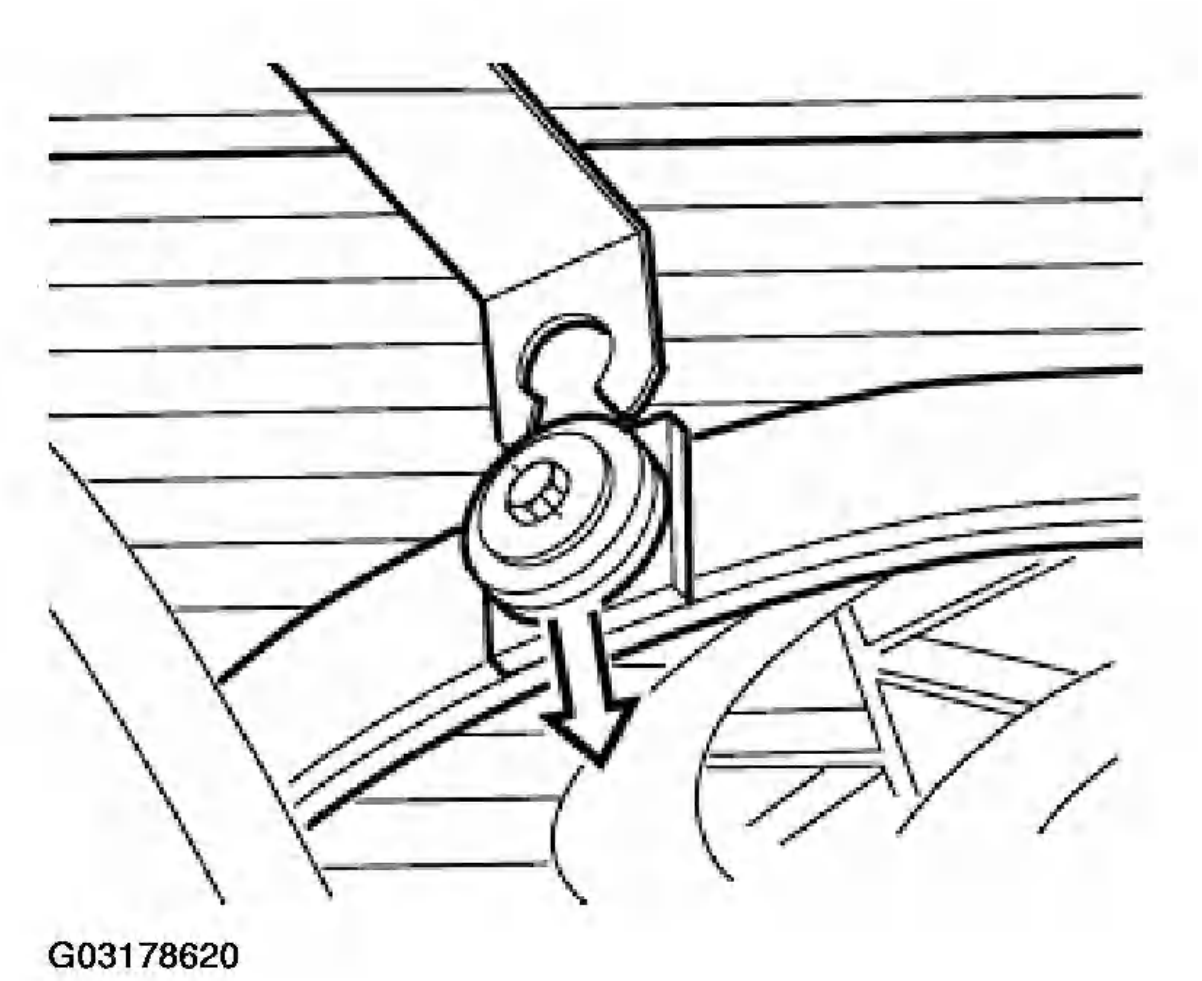



Fig. 64: Removing Fan Bracket And Fan From Retaining Shoe
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Remove complete front bumper, refer to 51 11 000 REMOVING AND INSTALLING COMPLETE FRONT BUMPER .

Disconnect connector.

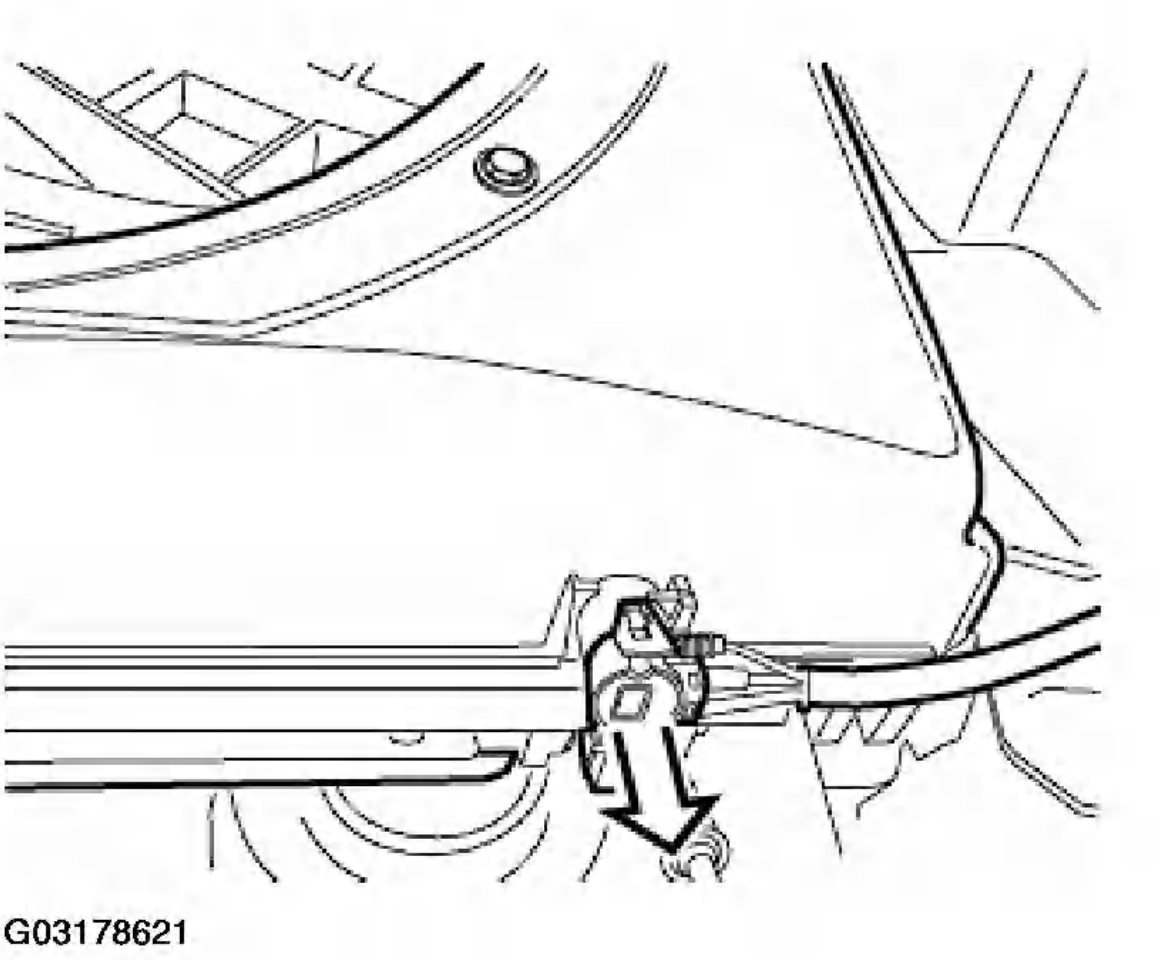



Fig. 65: Disconnecting Connector
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws from fan carrier.

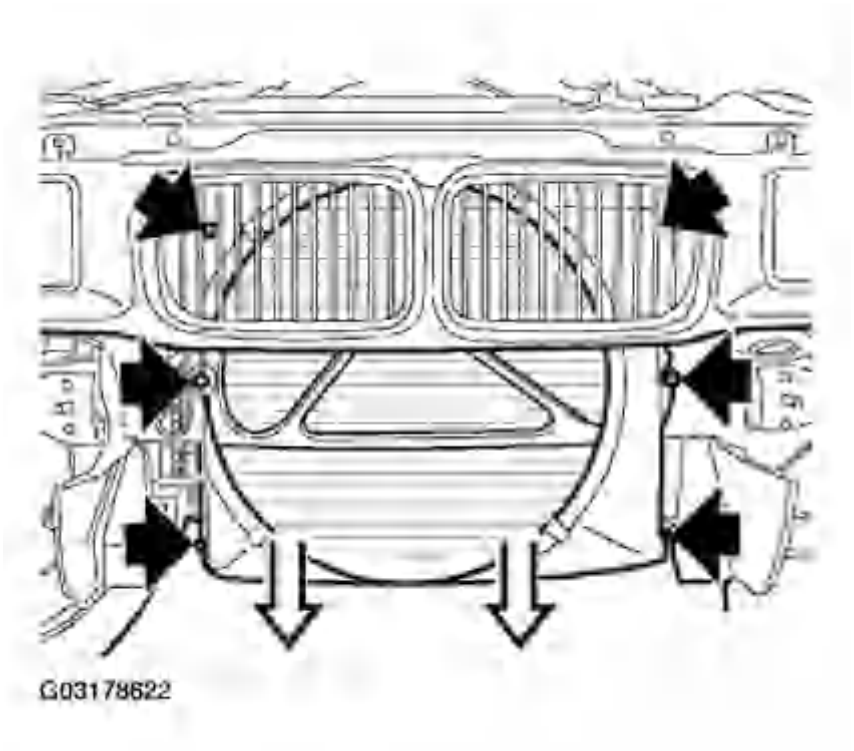


Fig. 66: Removing Screws From Fan Carrier
Courtesy of BMW OF NORTH AMERICA, INC.

Remove fan carrier from underside.

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Article GUID: A00202358

# COOLANT, CHECKING COOLING SYSTEM

## 17 11 RADIATOR AND MOUNTING PARTS M52TU / M54

RADIATOR AND MOUNTING PARTS M52TU/M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Cap for cooling system | ..... | ..... |
| Pressure relief valve opens at overpressure to ambient pressure | bar | $2^{+0.1}$ -0.2 |
| Vacuum valve must open at latest at partial vacuum to ambient pressure | bar | 0.1 |
| Test pressure, radiator (gauge pressure) | bar | 2.0 |

## 17 11 RADIATOR AND MOUNTING PARTS E36 / M50 / M52 / M54

RADIATOR AND MOUNTING PARTS E36/M50/M52/M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Cooling system cap | ..... | ..... |
| Pressure relief valve opens at overpressure to ambient pressure | bar | $2^{+0.1}$ -0.2 |
| Vacuum valve must open at latest at partial vacuum to ambient pressure | bar | 0.1 |
| Test pressure, radiator (gauge pressure) | bar | 1.5 |
| Transmission Oil Cooler<br>(integrated in radiator)<br>Models with automatic transmission | ..... | ..... |
| Operating pressure | bar | 8 |
| Testing pressure | bar | 12 |

# ENGINE RADIATOR WITH A...

## 17 11 RADIATOR AND MOUNTING PARTS M52TU / M54

RADIATOR AND MOUNTING PARTS M52TU/M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Cap for cooling system | ..... | ..... |
| Pressure relief valve opens at overpressure to ambient pressure | bar | $2^{+0.1}$ -0.2 |
| Vacuum valve must open at latest at partial vacuum to ambient pressure | bar | 0.1 |
| Test pressure, radiator (gauge pressure) | bar | 2.0 |

## 17 11 RADIATOR AND MOUNTING PARTS E36 / M50 / M52 / M54

RADIATOR AND MOUNTING PARTS E36/M50/M52/M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Cooling system cap | .... | ..... |
| Pressure relief valve opens at overpressure to ambient pressure | bar | $2^{+0.1}$ -0.2 |
| Vacuum valve must open at latest at partial vacuum to ambient pressure | bar | 0.1 |
| Test pressure, radiator<br>(gauge pressure) | bar | 1.5 |
| Transmission Oil Cooler<br>(integrated in radiator)<br>Models with automatic transmission | ..... | ..... |
| Operating pressure | bar | 8 |
| Testing pressure | bar | 12 |

# ENGINE, GENERAL

## 11 00 ENGINE IN GENERAL M54 B 30

ENGINE IN GENERAL M54 B 30 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Cylinder | ..... | 6 |
| Bore | mm | 84 |
| Stroke | mm | 89.6 |
| Effective displacement | $cm^3$ | 2979 |
| Compression ratio | :1 | 10.2 |
| Max. permissible engine speed | RPM | 6500 |
| Compression pressure (approx. equal value for all cylinders) | min. bar | 10...11 |

## 11 00 ENGINE IN GENERAL M54 B22

ENGINE IN GENERAL M54 B22 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Cylinder | ..... | 6 |
| Bore | mm | 80 |
| Stroke | mm | 72 |
| Effective displacement | $cm^3$ | 2171 |
| Compression ratio | :1 | 10.8 |
| Max. permissible engine speed | rpm | 6500 |
| Compression pressure (approx. equal value for all cylinders) | min. bar | 10...11 |

## 11 00 ENGINE IN GENERAL M54 B25

ENGINE IN GENERAL M54 B25 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Cylinder | ..... | 6 |
| Bore | mm | 84 |
| Stroke | mm | 75 |
| Effective displacement | $cm^3$ | 2494 |
| Compression ratio | :1 | 10.5 |
| Max. permissible engine speed | rpm | 6500 |
| Compression pressure (approx. equal value for all cylinders) | min. bar | 10...11 |

# ENGINE BLOCK

## 11 11 ENGINE BLOCK, CYLINDER CRANKCASE M54 B 30

ENGINE BLOCK, CYLINDER CRANKCASE M54 B 30 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Bore hole diameter a) | mm | $84.000^{+0.010}$ |
| 1. Interference a) (only permitted for aluminum engine block with cast iron liners) | mm | $84.250^{+0.010}$ |
| Permitted out-of-round of cylinder bore a) | mm | 0.005 |

| | | |
|---|---|---|
| Permitted conicity of cylinder bore a) | mm | 0.010 |
| Permissible total wear tolerance between piston and cylinder (engine operated) | mm | 0.15 |

a. new condition or rework

## 11 11 ENGINE BLOCK, CYLINDER CRANKCASE M54 B22

ENGINE BLOCK, CYLINDER CRANKCASE M54 B22 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Bore hole diameter a) | mm | 80.000 $^{+}$ 0.010 |
| 1. Interference a) (only permitted for aluminum engine block with cast iron liners) | mm | 80.250 $^{+0.010}$ |
| Permitted out-of-round of cylinder bore a) | mm | 0.005 |
| Permitted conicity of cylinder bore a) | mm | 0.010 |
| Permissible total wear tolerance between piston and cylinder (engine operated) | mm | 0.15 |

a. new condition or rework

## 11 11 ENGINE BLOCK, CYLINDER CRANKCASE M54 B25

ENGINE BLOCK, CYLINDER CRANKCASE M54 B25 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Bore hole diameter a) | mm | 84.000 $^{+0.010}$ |
| 1. Interference a) (only permitted for aluminum engine block with cast iron liners) | mm | 84.250 $^{+0.010}$ |
| Permitted out-of-round of cylinder bore a) | mm | 0.005 |
| Permitted conicity of cylinder bore a) | mm | 0.010 |
| Permissible total wear tolerance between piston and cylinder (engine operated) | mm | 0.15 |

a. new condition or rework

# CYLINDER HEAD WITH COVER

## 11 12 CYLINDER HEAD WITH COVER M54

CYLINDER HEAD WITH COVER M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Cylinder head height: Original dimension | mm | 140.0 |
| Machining limit refer to 11 12 719 RESURFACING CYLINDER HEAD SEALING SURFACE (M52/M52TU/M54/M56) . | mm | 139.7 |

| | | |
|---|---|---|
| Valve guides are not available as replacement parts. | ..... | ..... |
| Inside diameter of valve guide (installed) | ..... | ..... |
| Standard | mm | 6.0 H7 |
| Size 1 | mm | 6.1 H7 |
| Size 2 | mm | 6.2 H7 |
| Max. permissible tilt clearance (between valve and valve guide) | mm | 0.5 |
| Bearing of camshaft | ..... | ..... |
| Pilot bearing (1) width | mm | 20 d8 |

## 11 12 CYLINDER HEAD WITH VALVE SEAT COVER M54 B 30

### CYLINDER HEAD WITH VALVE SEAT COVER M54 B 30 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Valve seat angle | Â° | 45 |
| Correction angle: outer | Â° | 15 |
| Correction angle: inner | Â° | 60 |
| Valve seat width: Inlet | mm | 1.65 +/- 0.25 |
| Valve seat width: Exhaust | mm | 1.65 +/- 0.25 |
| Diameter Valve seat | ..... | ..... |
| Valve seat surface: Outside dia. inlet | mm | 32.4 |
| Valve seat surface: Outside dia. exhaust | mm | 30.0 |

## 11 12 CYLINDER HEAD WITH VALVE SEAT COVER M54 B22

### CYLINDER HEAD WITH VALVE SEAT COVER M54 B22 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Valve seat angle | Â° | 45 |
| Correction angle: outer | Â° | 15 |
| Correction angle: inner | Â° | 60 |
| Valve seat width: Inlet | mm | 1.65 +/- 0.25 |
| Valve seat width: Exhaust | mm | 1.65 +/- 0.25 |
| Ã˜ Valve seat | ..... | ..... |
| Valve seat surface: Outside dia. inlet | mm | 29.4 |
| Valve seat surface: Outside dia. exhaust | mm | 26.5 |

## 11 12 CYLINDER HEAD WITH VALVE SEAT COVER M54 B25

### CYLINDER HEAD WITH VALVE SEAT COVER M54 B25 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Valve seat angle | Â° | 45 |
| Correction angle: outer | Â° | 15 |
| Correction angle: inner | Â° | 60 |
| Valve seat width: | mm | 1.65 +/- 0.25 |

| | | |
|---|---|---|
| Inlet | | |
| Valve seat width:<br>Exhaust | mm | 1.65 +/- 0.25 |
| Diameter Valve seat | ..... | ..... |
| Valve seat surface:<br>Outside dia. inlet | mm | 32.4 |
| Valve seat surface:<br>Outside dia. exhaust | mm | 30.0 |

# CRANKSHAFT WITH BEARINGS

## 11 21 CRANKSHAFT AND BEARINGS M54

CRANKSHAFT AND BEARINGS M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Ground sizes of main bearing journals | ..... | ..... |
| Standard yellow | mm | 59.984 ... 59.990 |
| Standard green | mm | 59.977 ... 59.983 |
| Standard white | mm | 59.971 ... 59.976 |
| Undersize 1 (U 0.25) yellow | mm | 59.734 ... 59.740 |
| Undersize 1 (U 0.25) green | mm | 59.727 ... 59.733 |
| Undersize 1 (U 0.25) white | mm | 59.721 ... 59.726 |
| Undersize 2 (U 0.50) yellow | mm | 59.484 ... 59.490 |
| Undersize 2 (U 0.50) green | mm | 59.477 ... 59.483 |
| Undersize 2 (U 0.50) white | mm | 59.471 ... 59.476 |
| Crankshaft bearing clearance, radial | mm | 0.020 ... 0.058 |

## 11 21 CRANKSHAFT AND BEARINGS M54

CRANKSHAFT AND BEARINGS M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Grinding stages, crankshaft guide bearing | ..... | ..... |
| Standard | mm | 25.0 F8 |
| Size 1 | mm | 25.2 F8 |
| Size 2 | mm | 25.4 F8 |
| Crankshaft axial play | mm | 0.080 ... 0.163 |
| Ground sizes of conrod bearing journals | ..... | ..... |
| Standard | mm | $45.00\ ^{-0.009}_{-0.025}$ |
| Size 1 | mm | $44.75\ ^{-0.009}_{-0.025}$ |
| Size 2 | mm | $44.50\ ^{-0.009}_{-0.025}$ |
| Radial conrod bearing play | mm | 0.020 ... 0.055 |
| Max. permissible runout on center main bearing journal (crankshaft at outer bearing journal recorded) | mm | 0.20 |

# FLYWHEEL

## 11 22 FLYWHEEL M54

FLYWHEEL M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Max. axial runout measured at outside diameter | mm | 0.30 |
| Max. radial runout measured at outside diameter | mm | 0.20 |

# VIBRATION DAMPER

## 11 24 CONNECTING RODS AND BEARINGS M54

CONNECTING RODS AND BEARINGS M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Diameter Large connecting rod eye (without bearing) | mm | 48.000 ... 48.016 |
| Conrod bush bore diameter | mm | $22^{+0.010}_{+0.005}$ |
| Permitted weight deviation of conrods inside an engine (without bearing shells) | g | +/-4 |

## 11 23 VIBRATION DAMPER M54

VIBRATION DAMPER M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Max. radial runout | mm | 0.20 |
| Max. axial runout | mm | 0.40 |

# CONNECTING ROD WITH BEARINGS

## 11 24 CONNECTING RODS AND BEARINGS M54

CONNECTING RODS AND BEARINGS M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Diameter Large connecting rod eye (without bearing) | mm | 48.000 ... 48.016 |
| Conrod bush bore diameter | mm | $22^{+0.010}_{+0.005}$ |
| Permitted weight deviation of conrods inside an engine (without bearing shells) | g | +/-4 |

# PISTON WITH RINGS AND PINS

## 11 25 PISTONS WITH RINGS AND PINS M54 B 30

PISTONS WITH RINGS AND PINS M54 B 30 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Piston and piston pin are paired - replace together only. | ..... | ..... |
| Measuring point "A" (position) | mm | 8 |
| Piston diameter (measuring point "A") | ..... | ..... |
| Standard | mm | $83.995^{+/-\ 0.014}$ |
| 1. Oversize a) (only permitted for aluminum engine block with cast iron liners) | mm | $84.245\ +/-^{0.014}$ |
| Piston running clearance | mm | 0.01 ... 0.04 |
| Permissible total wear tolerance between piston and cylinder (engine operated) | mm | 0.15 |

## 11 25 PISTONS WITH RINGS AND PINS M54 B 30

PISTONS WITH RINGS AND PINS M54 B 30 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| 1st groove | ..... | ..... |
| End clearance | mm | 0.20 ... 0.40 |
| Axial play | mm | 0.020 ... 0.060 |
| 2nd groove | ..... | ..... |
| | | |

| | | |
|---|---|---|
| End clearance | mm | 0.20 ... 0.40 |
| Axial play | mm | 0.020 ... 0.060 |
| 3rd groove | ..... | ..... |
| End clearance | mm | 0.20 ... 0.45 |
| Axial play | mm | 0.015 ... 0.060 |

## 11 25 PISTONS WITH RINGS AND PINS M54 B22

PISTONS WITH RINGS AND PINS M54 B22 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Piston and piston pin are paired - replace together only. | ..... | ..... |
| Measuring point "A" (position) | mm | 10 |
| Piston diameter (measuring point "A") | ..... | ..... |
| Standard | mm | 79.980 +/- 0.013 |
| 1. Oversize a) (only permitted for aluminum engine block with cast iron liners) | mm | 80.230 +/- 0.013 |
| Piston running clearance | mm | 0.01 ... 0.04 |
| Permissible total wear tolerance between piston and cylinder (engine operated) | mm | 0.15 |

## 11 25 PISTONS WITH RINGS AND PINS M54 B22

PISTONS WITH RINGS AND PINS M54 B22 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| 1st groove | ..... | ..... |
| End clearance | mm | 0.10 ... 0.30 |
| Axial play | mm | 0.020 ... 0.060 |
| 2nd groove | ..... | ..... |
| End clearance | mm | 0.20 ... 0.40 |
| Axial play | mm | 0.020 ... 0.060 |
| 3rd groove | ..... | ..... |
| End clearance | mm | 0.25 ... 0.50 |
| Axial play | mm | 0.020 ... 0.060 |

## 11 25 PISTONS WITH RINGS AND PINS M54 B25

PISTONS WITH RINGS AND PINS M54 B25 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Piston and piston pin are paired - replace together only. | ..... | ..... |
| Measuring point "A" (position) | mm | 8 |
| Piston diameter (measuring point "A") | ..... | ..... |
| Standard | mm | 83.995 +/- 0.014 |
| 1. Oversize a) (only permitted for aluminum engine block with cast iron liners) | mm | 84.245 +/- 0.014 |
| Piston running clearance | mm | 0.01 ... 0.04 |
| Permissible total wear tolerance between piston and cylinder (engine operated) | mm | 0.15 |

## 11 25 PISTONS WITH RINGS AND PINS M54 B25

PISTONS WITH RINGS AND PINS M54 B25 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| 1st groove | ..... | ..... |
| End clearance | mm | 0.20 ... 0.40 |
| Axial play | mm | 0.020 ... 0.060 |
| 2nd groove | ..... | ..... |
| End clearance | mm | 0.20 ... 0.40 |
| Axial play | mm | 0.020 ... 0.060 |
| 3rd groove | ..... | ..... |
| End clearance | mm | 0.20 ... 0.45 |
| Axial play | mm | 0.015 ... 0.060 |

# CAMSHAFT

## 11 31 CAMSHAFT M54

CAMSHAFT M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Pilot bearing width: Inlet (bearing no. 1) | mm | 20 H8 |
| Pilot bearing width: Exhaust (bearing no. 1) | mm | 20 H9 |
| Running clearance: Radial | mm | 0.020 ... 0.054 |
| Running clearance: Axial | mm | 0.150 ... 0.330 |

# VALVES WITH SPRINGS

## 11 34 VALVES WITH SPRINGS M54

VALVES WITH SPRINGS M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| The following valve versions are available for repairs in addition to the standard valves: | | |
| Stem dia. inlet stage 1 | mm | $6.1\ ^{-0.025}_{-0.040}$ |
| Stem dia. exhaust stage 1 | mm | $6.1\ ^{-0.040}_{-0.055}$ |
| Overmeasure at valve plate | mm | 0.2 |
| Identification on stem | ..... | R1 |
| Stem dia. inlet stage 2 | mm | $6.2\ ^{-0.025}_{-0.040}$ |
| Stem dia. exhaust stage 2 | mm | $6.2\ ^{-0.040}_{-0.055}$ |
| Overmeasure at valve plate | mm | 0.4 |
| Identification on stem | ..... | R2 |

## 11 34 VALVES WITH SPRINGS M54 B 30

VALVES WITH SPRINGS M54 B 30 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Plate dia. | ..... | ..... |
| Inlet | mm | 33.0 |
| Exhaust | mm | 30.5 |
| Stem Ã˜ | ..... | ..... |
| Inlet | mm | $6.0\ ^{-0.025}_{-0.040}$ |
| Exhaust | mm | $6.0\ ^{-0.040}_{-0.055}$ |

### 11 34 VALVES WITH SPRINGS M54 B22

VALVES WITH SPRINGS M54 B22 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Plate dia. | ..... | ..... |
| Inlet | mm | 30.0 |
| Exhaust | mm | 27.0 |
| Stem Ã˜ | ..... | ..... |
| Inlet | mm | $6.0^{-0.025}_{-0.040}$ |
| Exhaust | mm | $6.0^{-0.040}_{-0.055}$ |

### 11 34 VALVES WITH SPRINGS M54 B25

VALVES WITH SPRINGS M54 B25 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Plate dia. | ..... | ..... |
| Inlet | mm | 33.0 |
| Exhaust | mm | 30.5 |
| Stem Diameter | ..... | ..... |
| Inlet | mm | $6.0^{-0.025}_{-0.040}$ |
| Exhaust | mm | $6.0^{-0.040}_{-0.055}$ |

## OIL SUPPLY

### 11 41 OIL PUMP WITH STRAINER AND DRIVE M54

OIL PUMP WITH STRAINER AND DRIVE M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Oil pressure at idle speed with engine at operating temperature | min bar | 0.5 |
| Regulated pressure | bar | 4.0 |

### 11 40 OIL SUPPLY E36/M54/Z3

OIL SUPPLY E36/M54/Z3 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Oil grade and oil consumption measurement, refer to BMW Service Operating Fluids | | |
| Oil change volume with oil filter | ltr. | 6.50 |

## OIL PUMP WITH FILTER & DRIVE

### 11 41 OIL PUMP WITH STRAINER AND DRIVE M54

OIL PUMP WITH STRAINER AND DRIVE M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Oil pressure at idle speed with engine at operating temperature | min bar | 0.5 |
| Regulated pressure | bar | 4.0 |

## FAN

### 11 52 FAN COUPLING M54

FAN COUPLING M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Fan clutch | ..... | ..... |
| Switch-on temperature | Â°C | 90 |
| Switch-off temperature | Â°C | 60 |
| Tilt play of bearing (with dia. 120 mm) | mm | +/-0.65 |

# THERMOSTAT AND CONNECTIONS

## 11 53 THERMOSTAT AND CONNECTIONS M54

THERMOSTAT AND CONNECTIONS M54 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Stamped in thermostat.<br>Electrically actuated map thermostat. | approx. Â°C | 97 |

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Article GUID: A00202371

# IGNITION WIRES, SPARK PLUGS

## 12 12 IGNITION HARNESS, SPARK PLUGS M54

IGNITION HARNESS, SPARK PLUGS M54 TECHNICAL SPECIFICATION

| | |
|---|---|
| Bosch FGR 7DQP | x |
| NGK BKR 6E QUP<br>(High Power) | x |

## 12 12 IGNITION HARNESS, SPARK PLUGS E36

IGNITION HARNESS, SPARK PLUGS E36 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Electrode gap on spark plugs | ..... | ..... |
| All models except "M" | mm | $0.7^{+0.1}$ |
| M models | mm | $0.6^{+0.1}$ |
| All models with dual mass<br>electrode<br>All models with three-mass and four-mass electrode cannot be adjusted! | mm | $0.9^{+0.1}$ |
| Cylinder identifying sensor | ..... | ..... |
| Coil resistance at 20Â°C | ..... | ..... |
| Pins 1 and 2 | Ω | < 1 |
| Firing sequence:<br>4 cylinders 1, 3, 4, 2<br>6 cylinders 1, 5, 3, 6, 2, 4<br>8 cylinders 1, 5, 4, 8, 6, 3, 7, 2<br>12 cylinders 1, 7, 5, 11, 3, 9, 6, 12, 2, 8, 4, 10 | ..... | ..... |

# IGNITION COIL

## 12 13 IGNITION COIL E36

IGNITION COIL E36 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Ignition coil for non-operating ignition distribution | ..... | ..... |
| Primary winding resistance | approx.Ω | 0.8 |
| Secondary winding resistance | ..... | not measurable |
| Resistance of Bosch spark plug connector | approx. kΩ | 1+/- 20% |
| Resistance of Bremi spark plug connector | approx. kΩ | 1.8 +/- 20% |

# ELECTRONIC SWITCHING OR CONTROL UNIT

## 12 14 ELECTRONIC SHIFT UNITS OR CONTROL UNITS E36

ELECTRONIC SHIFT UNITS OR CONTROL UNITS E36 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Pulse sender | ..... | ..... |
| Coil resistance at 20Â°C | ..... | ..... |
| All models | Ω | 540 +/- 10% |
| With breakerless ignition distribution | Ω | 1280 +/- 10% |
| Distance from inductive pulse sender/gear | mm | 1.0 +/- 0.3 |

# ALTERNATOR WITH DRIVE AND MOUNT

## 12 31 ALTERNATOR WITH DRIVE AND MOUNTING PARTS E36

ALTERNATOR WITH DRIVE AND MOUNTING PARTS E36 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Rated voltage | V | 14 |
| Rated voltage | A/W | 65/91070/98080/112090/1260105/1470115/1610140/1960150/2100 |
| Shielded capacitor | µF | 2.2 +/- 20% |

# REGULATOR

## 12 32 REGULATOR E36

REGULATOR E36 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Regulated voltage at 1500 rpm engine speed/no electrical devices on (at 30Â°C to 60Â°C at regulator) | V | 13.5... 14.2 |

# STARTER WITH MOUNTING

## 12 41 STARTER MOTOR WITH BRACKET, SOLENOID SWITCH E36

STARTER MOTOR WITH BRACKET, SOLENOID SWITCH E36 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Current consumption at term. 50 (with rated voltage) | ..... | ..... |
| With rated power of 1.4 KW | ..... | ..... |
| Pull-in winding | A | 54.5 |
| Hold-in winding | A | 10.5 |
| At rated power of 1.7 KW with intermediate transmission | ..... | ..... |
| Pull-in winding | A | 51 |
| Hold-in winding | A | 9.5 |
| With rated power of 1.8 KW | ..... | ..... |
| Pull-in winding | A | 50 |
| Hold-in winding | A | 12 |
| With rated power of 2.0 KW | ..... | ..... |
| Pull-in winding | A | 54.5 |
| Hold-in winding | A | 10.5 |

## 12 41 STARTER MOTOR WITH BRACKET, SOLENOID SWITCH E36

STARTER MOTOR WITH BRACKET, SOLENOID SWITCH E36 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Current consumption at term 50 (with rated voltage) | ..... | ..... |
| With rated power of 2.2 KW | ..... | ..... |
| Pull-in winding | A | 58 |
| Hold-in winding | A | 13 |
| At rated power of 2.2 KW with intermediate transmission | ..... | ..... |
| Pull-in winding | A | 60 |
| Hold-in winding | A | 10 |
| At rated power of 2.6 KW with intermediate transmission | ..... | ..... |
| Pull-in winding | A | 50 |
| Hold-in winding | A | 12 |

## 12 41 STARTER AND MOUNTING PARTS E36

STARTER AND MOUNTING PARTS E36 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Rated power | kW | ..... |
| M40, M42, M43, M43TU, M52, M52TU, S50 | kW | 1.4 |
| M41 | kW | 1.8 |
| M50, M52, S52 | kW | 1.7 |
| M51 | kW | 2.2 |
| M57 | kW | ..... |
| M67 | kW | ..... |
| S62 | kW | ..... |
| Axial armature play | mm | 0.1 ...0.2 |
| Carbon brush length | at least mm | 13 |
| Testing voltage | V | 12 +/- 0.3 |

# OIL PRESSURE/OIL TEMPERATURE GAUGE

## 12 61 OIL PRESSURE, OIL TEMPERATURE, OIL LEVEL DISPLAY E36

OIL PRESSURE, OIL TEMPERATURE, OIL LEVEL DISPLAY E36 SPECIFICATION

| | | |
|---|---|---|
| Switch-on pressure | bar | 0.2 ...0.5 |
| Oil level switch<br>Note:<br>Max. 200 mA testing load.<br>Measured against vehicle ground | ..... | ..... |
| Static at connection 1 | ..... | ..... |
| Level okay | kΩ | +/- 1% |
| Level too low | Ω | 0...0.2 |
| Dynamic at connection 2 | ..... | ..... |
| Level okay | Ω | 0...0.2 |
| Level too low | Ω | Ω |

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Article GUID: A00202372

# ENGINE GENERAL

## 00 00 250 BMW ENGINE OIL SERVICE INCL. SUPPLEMENTARY SERVICE (M54 / M56)

NOTE: Engine Oil Service including Supplementary Service comprises the engine oil and supplementary services. Only the engine oil service will be described in these repair instructions. For the supplementary service work steps, refer to the vehicle-specific inspection sheet.

Engine Oil Service:

Release and tighten down main flow oil filter cap with a socket only.

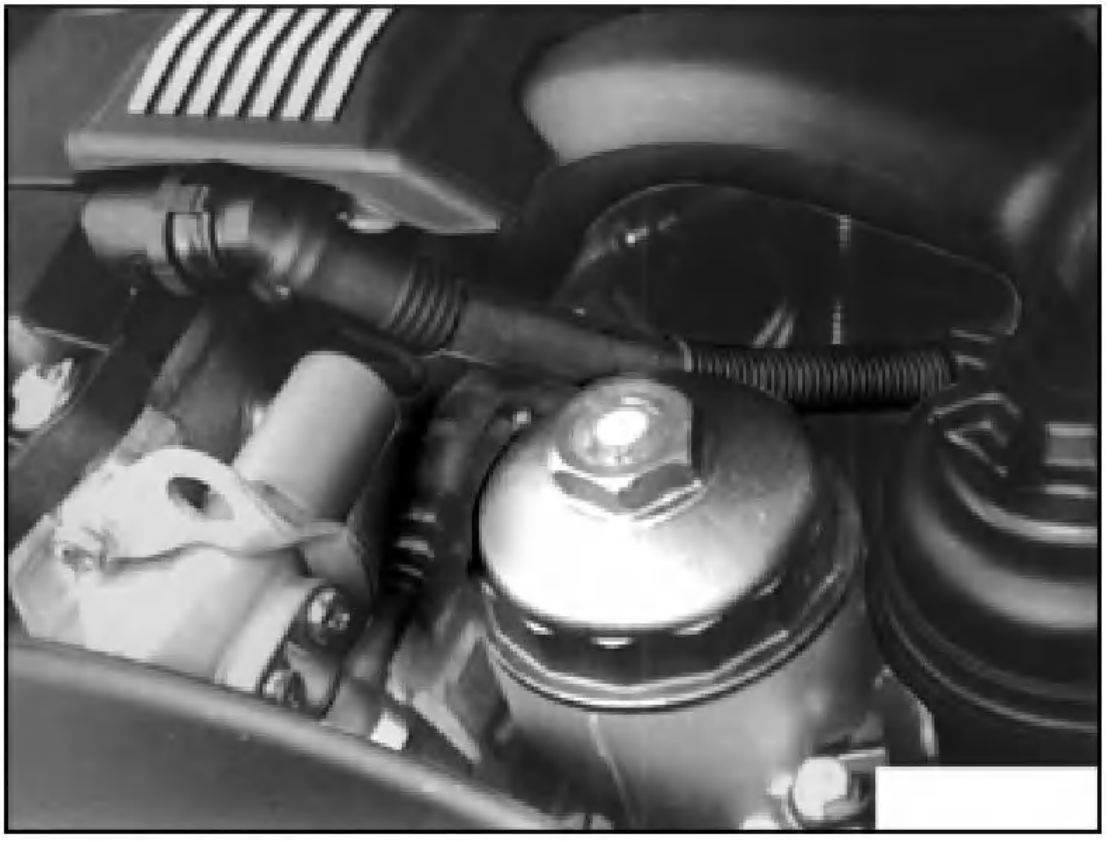



Fig. 1: Identifying Main Flow Oil Filter Cap
Courtesy of BMW OF NORTH AMERICA, INC.

When the main flow oil filter cap is opened, engine oil flows from the oil filter housing back into the oil sump.

Release main flow oil filter cap and remove towards top.

Installation:

Tightening torque 11 42 2AZ. Refer to 11 42 OIL FILTER AND PIPES .

Installation:

Replace and oil O-ring.

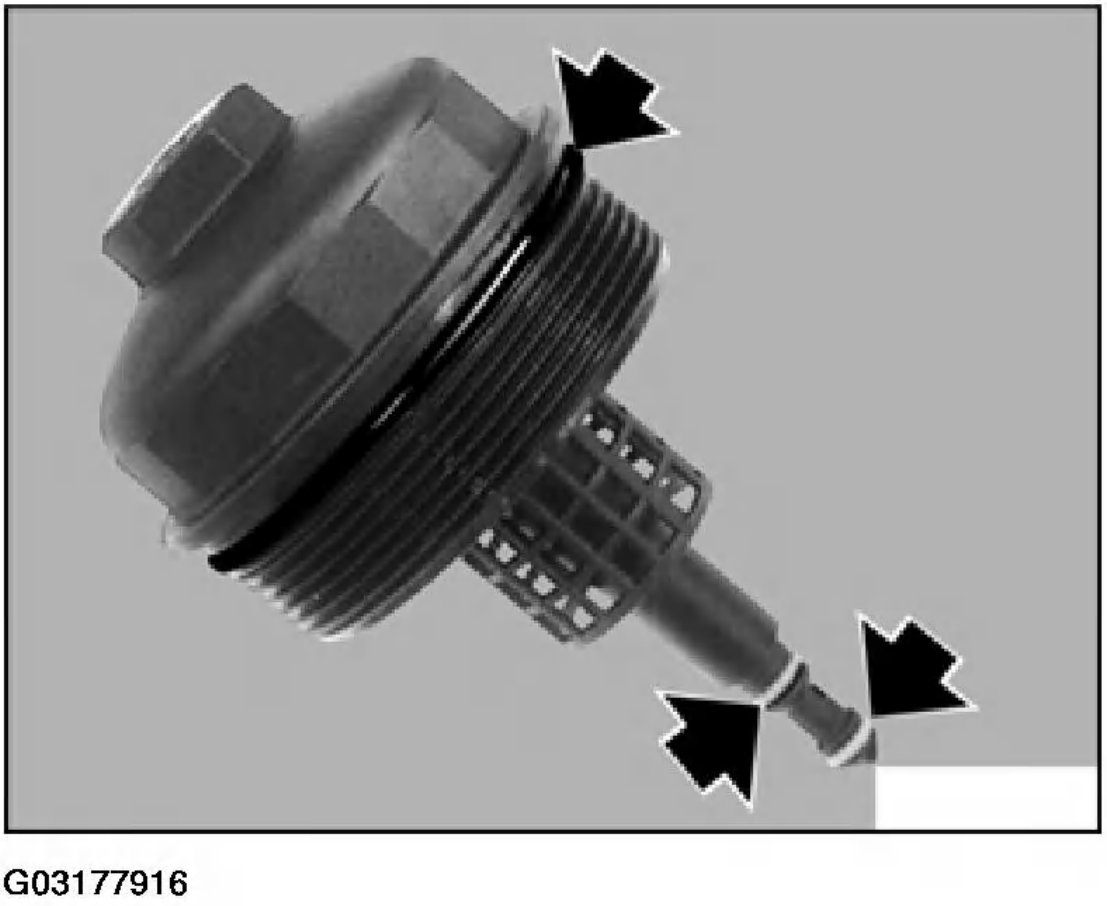



Fig. 2: Identifying Oil O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Drain or draw off engine oil.

When engine oil is drained, open cap in engine underguard.

Open oil drain plug and drain off engine oil.

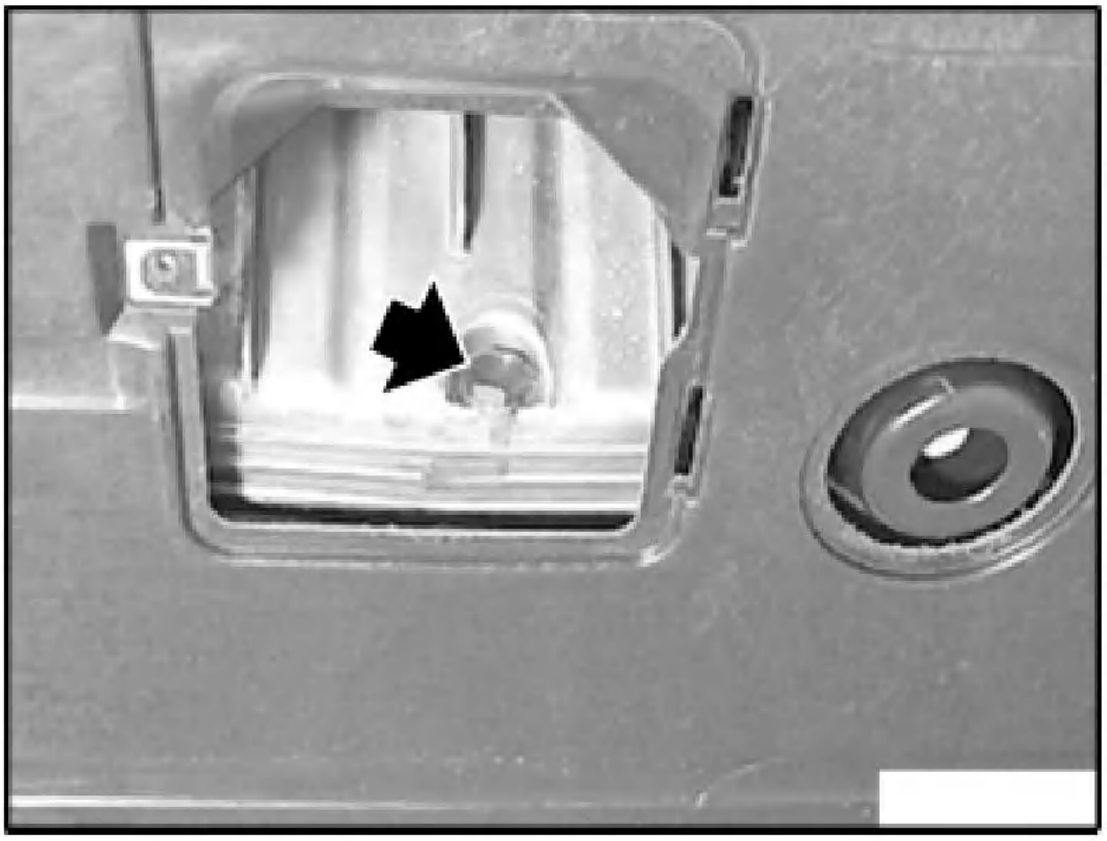



Fig. 3: Locating Drain Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace sealing ring.

Tightening torque 11 13 1AZ. Refer to 11 13 OIL PAN .

Complete vehicle and set in horizontal position.

Top up engine oil.

Start engine and run at idle until oil indicator lamp goes out.

Switch off engine, wait approx. 5 minutes and then check engine oil level.

Top up engine oil if necessary.

Supplementary Service:

Refer to vehicle-specific inspection sheet.

## 11 00 039 CHECKING COMPRESSION OF ALL CYLINDERS (M60 / M62 / M73 / S62 / M54)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 11 0 224
- 11 0 226

Important!

High tension - mortal danger!

Cut off power supply to ignition coils (disconnect plug connection at DME control unit).

Necessary Preliminary Tasks:

- Connect charger or a second battery.
- Read out fault memory of DME control unit
- Pull fuel pump relay or fuel pump fuse.
- Start engine and allow residual fuel to drain out (pressure reduction).
- Remove all spark plugs. Refer to 12 12 011 REPLACING ALL SPARK PLUGS .

Important!

Check Schrader valve on special tool 11 0 226 for tight fit.

Screw special tool 11 0 226 by hand into spark plug thread and connect special tool 11 0 224.

NOTE: Check that sealing ring is in perfect condition.

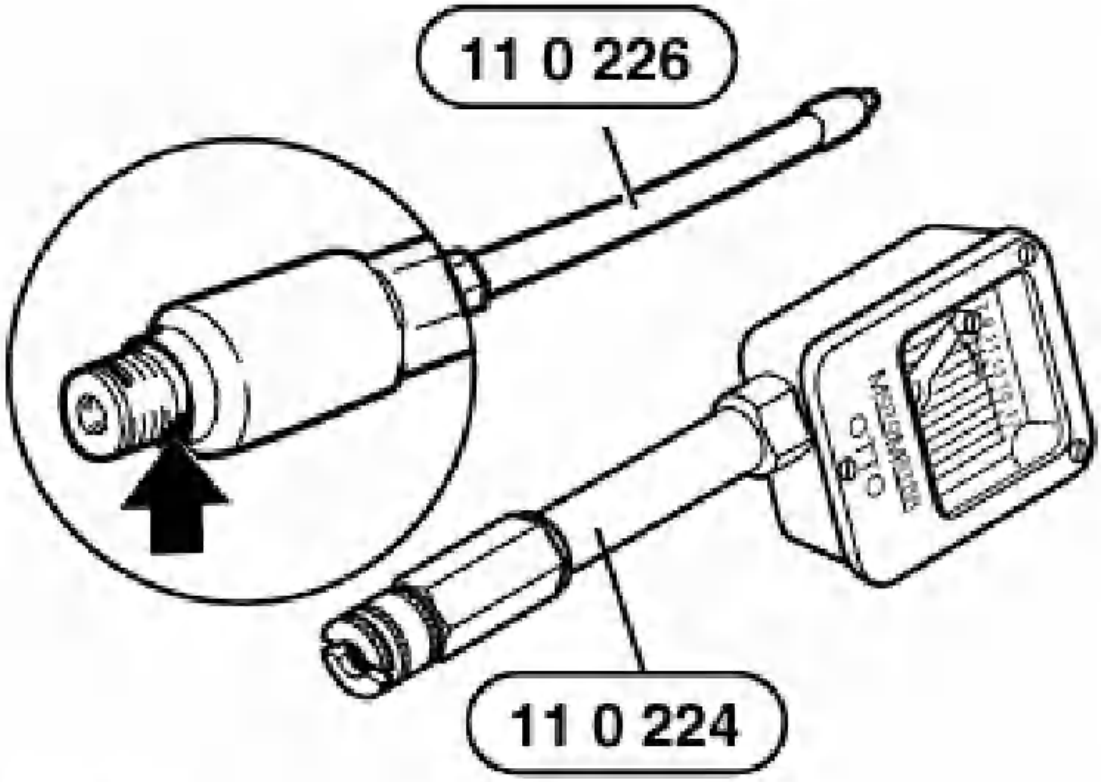


Fig. 4: Identifying Special Tool 11 0 226 Sealing Ring Location
Courtesy of BMW OF NORTH AMERICA, INC.

Depress accelerator and actuate starter until compression stops rising.

Compression pressure.

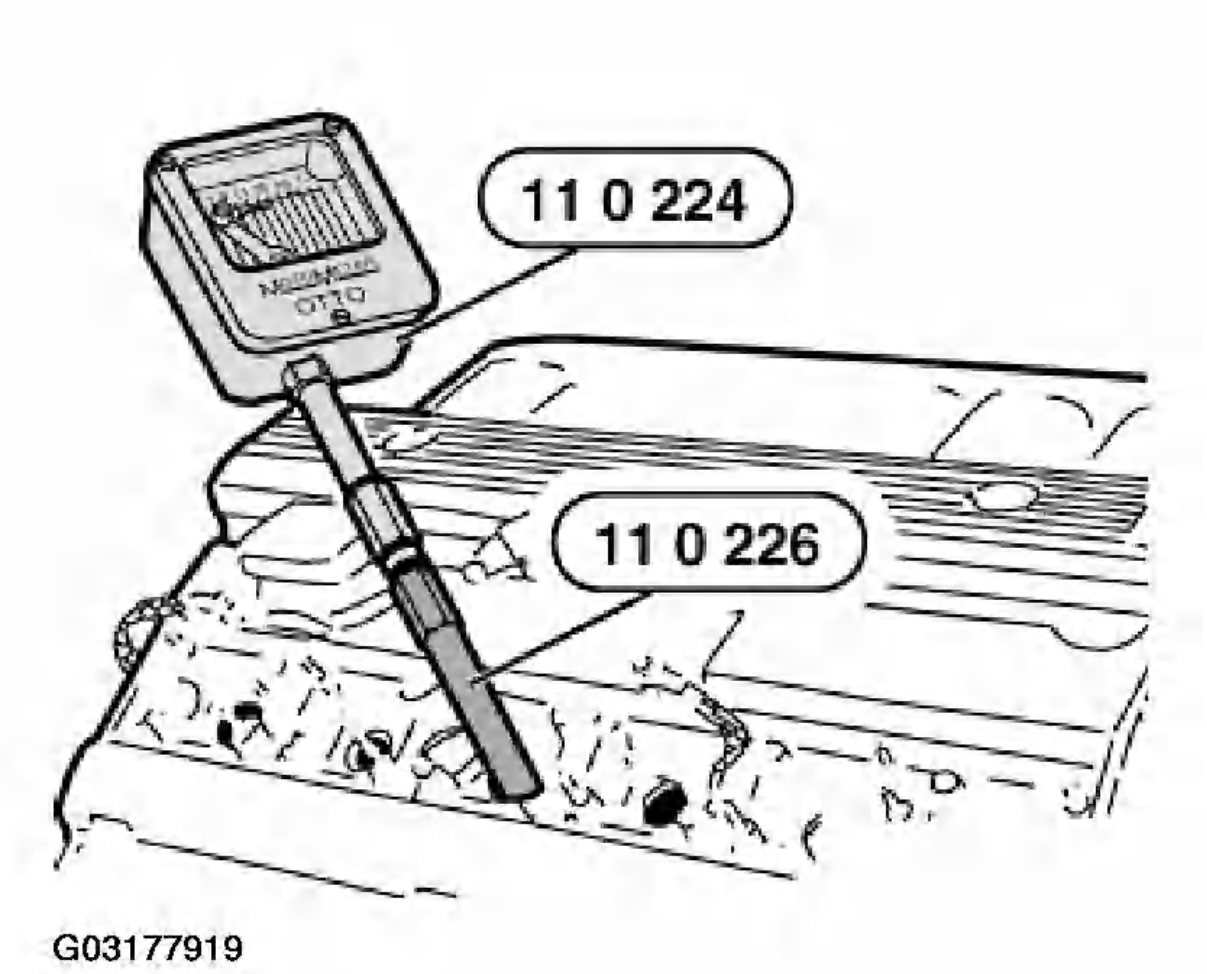



Fig. 5: Measuring Compression By Using Special Tool 11 0 226 And Special Tool 11 0 224
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

Now clear the fault memory.

## 11 00 045 CHECKING ABSOLUTE COMPRESSION OF ALL CYLINDERS

With BMW Diagnosis Information System (DIS).




Fig. 6: Identifying BMW Diagnosis Information System (DIS)
Courtesy of BMW OF NORTH AMERICA, INC.

- Connect DIS tester.
- BMW measuring technology.
- Preset measurements.
- Absolute compression.
    - The further procedure is described in:
    - Help.
    - Help on preset measurements.

- Adaptation of "Absolute compression".
- Clear fault memory.

## 11 00 050 REMOVING AND INSTALLING ENGINE (M52 / S52 / M52TU / M54)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 11 0 000

Instructions for disconnecting and connecting battery. Refer to 12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY .

Disconnect negative battery lead.

E36:

Move engine hood into assembly position and remove heater bulkhead (air collector). These work steps are described in Removing complete wiper bracket.

Z3:

Move engine hood to assembly position:

NOTE: The following work must be carried out with a second person assisting. Work instruction applies to left and right sides.

Hold engine bonnet/hood.

Unclip retainer (1).

Unhook damper and suspend in ball head (2).

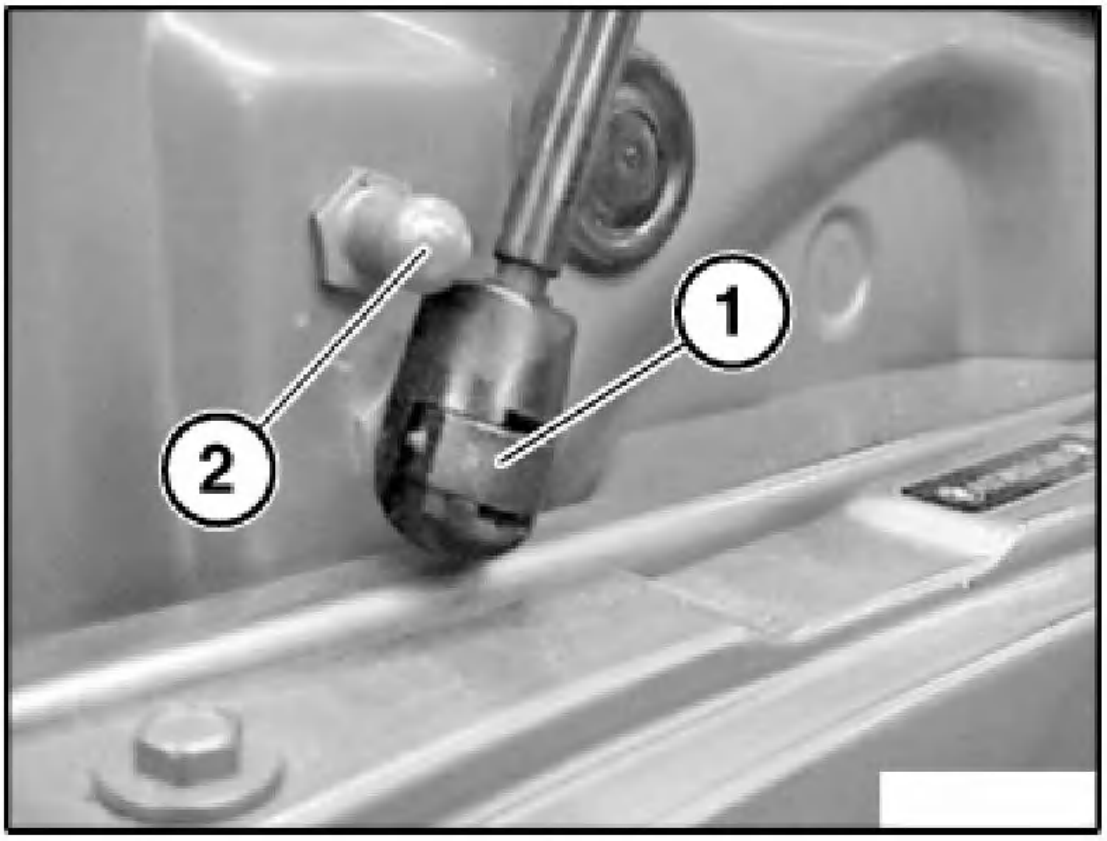



Fig. 7: Identifying Retainer And Damper
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew and remove splash guard.

Remove transmission, refer to REMOVAL & INSTALLATION or REMOVAL & INSTALLATION .

NOTE: M52TU / M54:
The water drain plug is located on the exhaust side on cylinder 2 in the engine block.

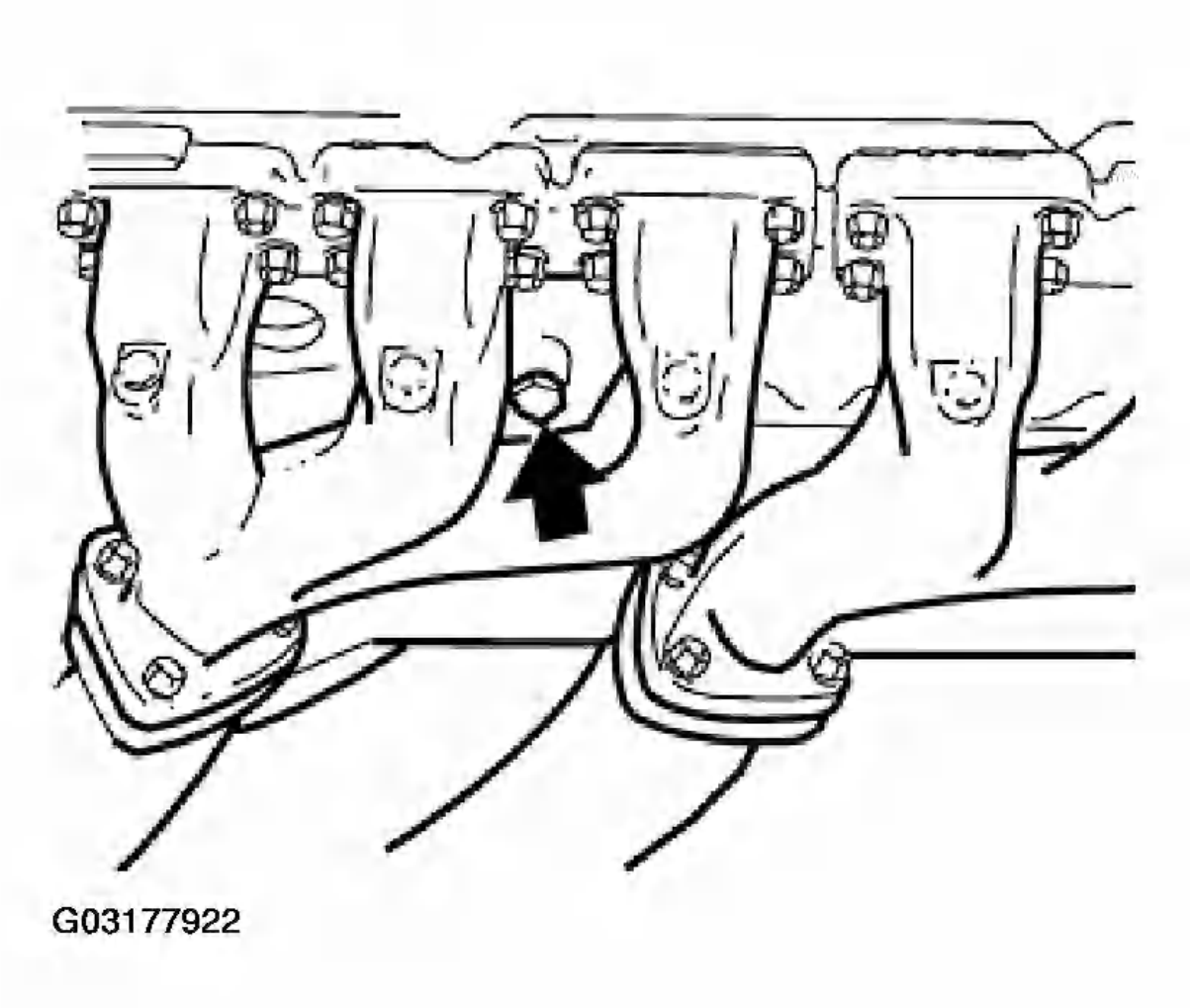



Fig. 8: Identifying Drain Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Drain off coolant and dispose of correctly.

Installation:

Replace seal.

Tightening torque, refer to 11 11 5AZ in 11 11 ENGINE BLOCK .

Remove radiator.

Take off cover.




Fig. 9: Taking Off Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Remove intake air manifold. Refer to 11 61 050 REMOVING AND INSTALLING INTAKE AIR MANIFOLD (M54).

Unfasten engine section of wiring harness and place to one side with cable duct.

Remove fan clutch with fan impeller. Refer to 11 52 020 REMOVING AND INSTALLING/REPLACING FAN CLUTCH (S52 / S54 / M52 / M52TU / M54 / M56).

Disconnect coolant hoses at heating valve and heater.

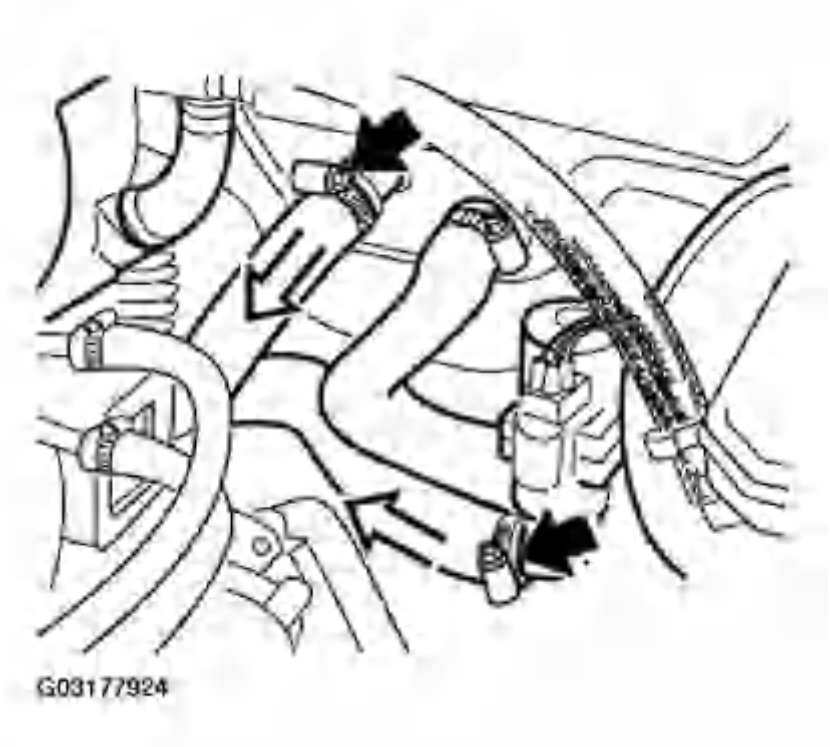


Fig. 10: Disconnecting Coolant Hoses At Heating Valve And Heater
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten reservoir for power steering unit and tie up to one side.

NOTE: Lines remain connected.

Remove vane pump from power steering unit.

NOTE: Lines remain connected.

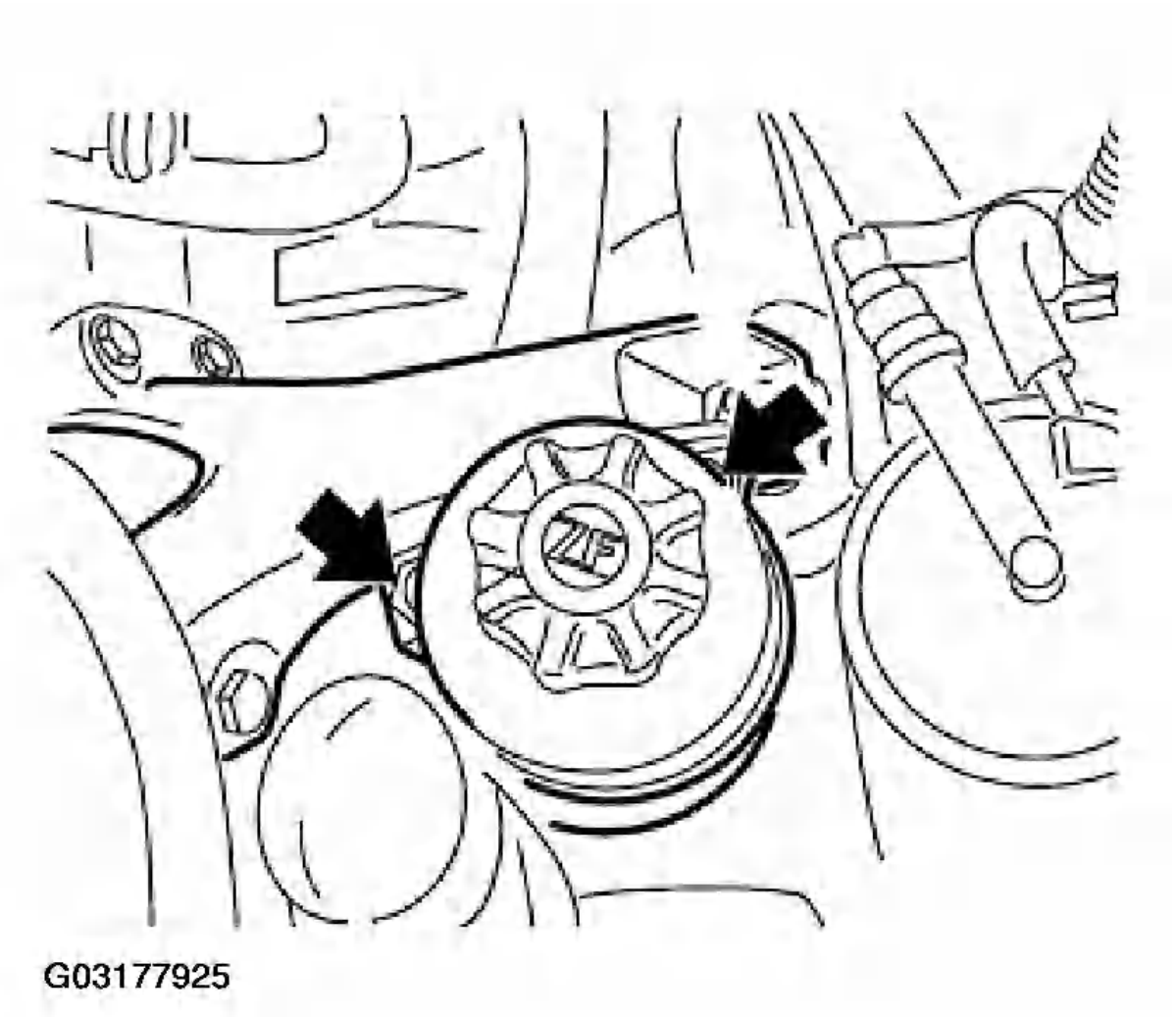



Fig. 11: Removing Reservoir For Power Steering Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Fit engine to special tool 11 00 000.

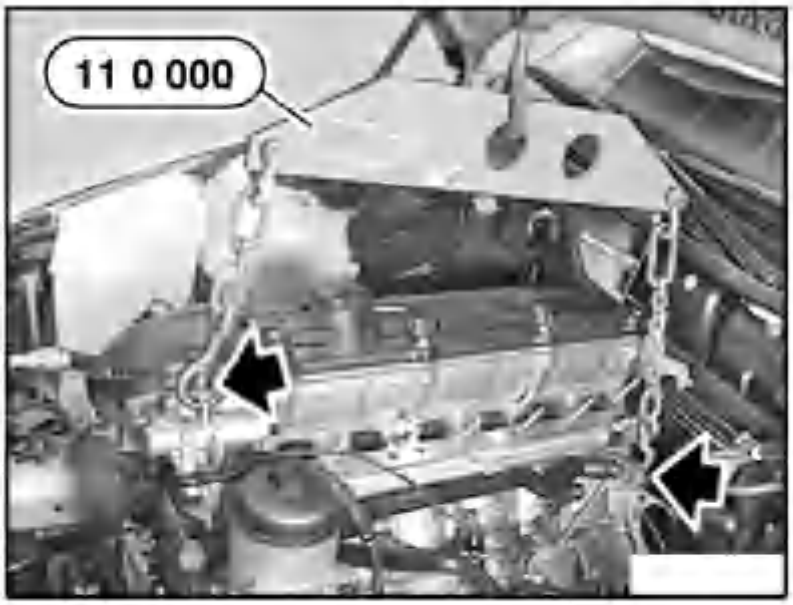



Fig. 12: Fitting Engine To Special Tool 11 00 000
Courtesy of BMW OF NORTH AMERICA, INC.

Front and rear suspension arrangement

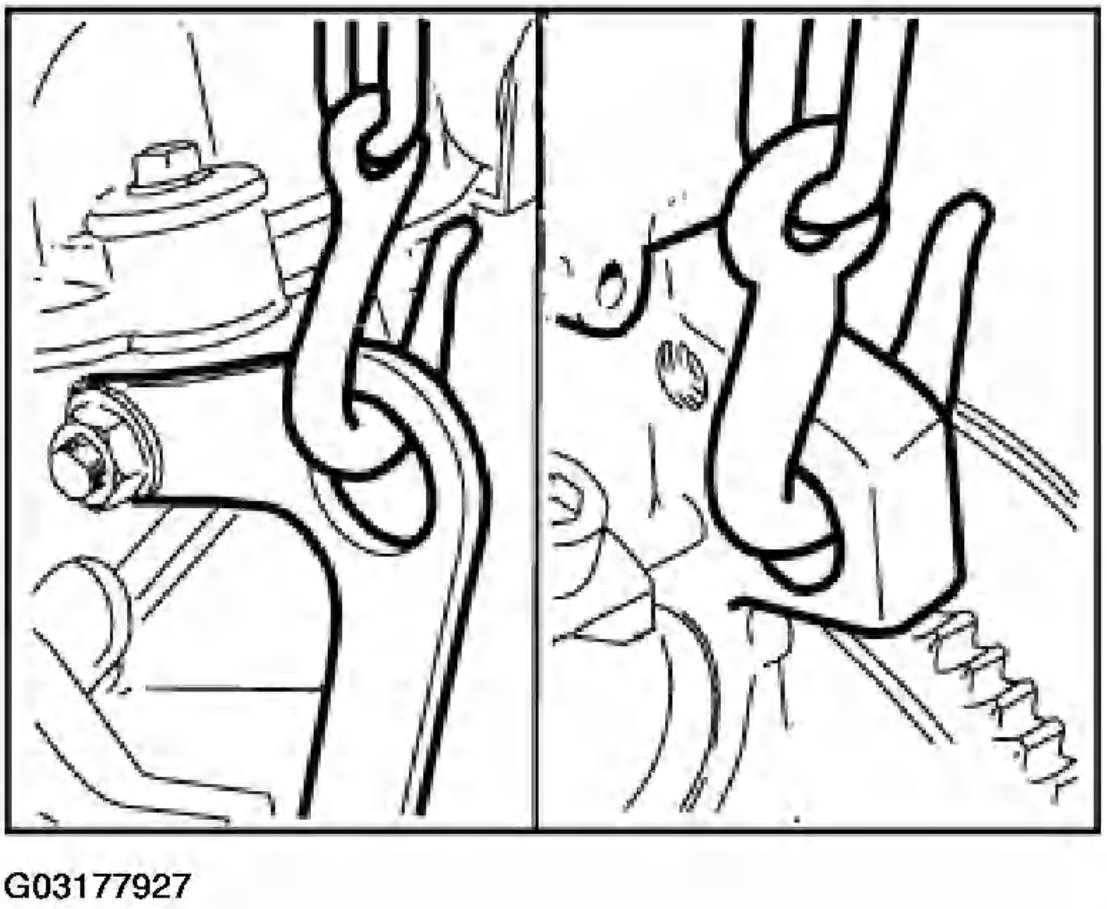



Fig. 13: Identifying Front And Rear Suspension Arrangement
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten right ground wire.

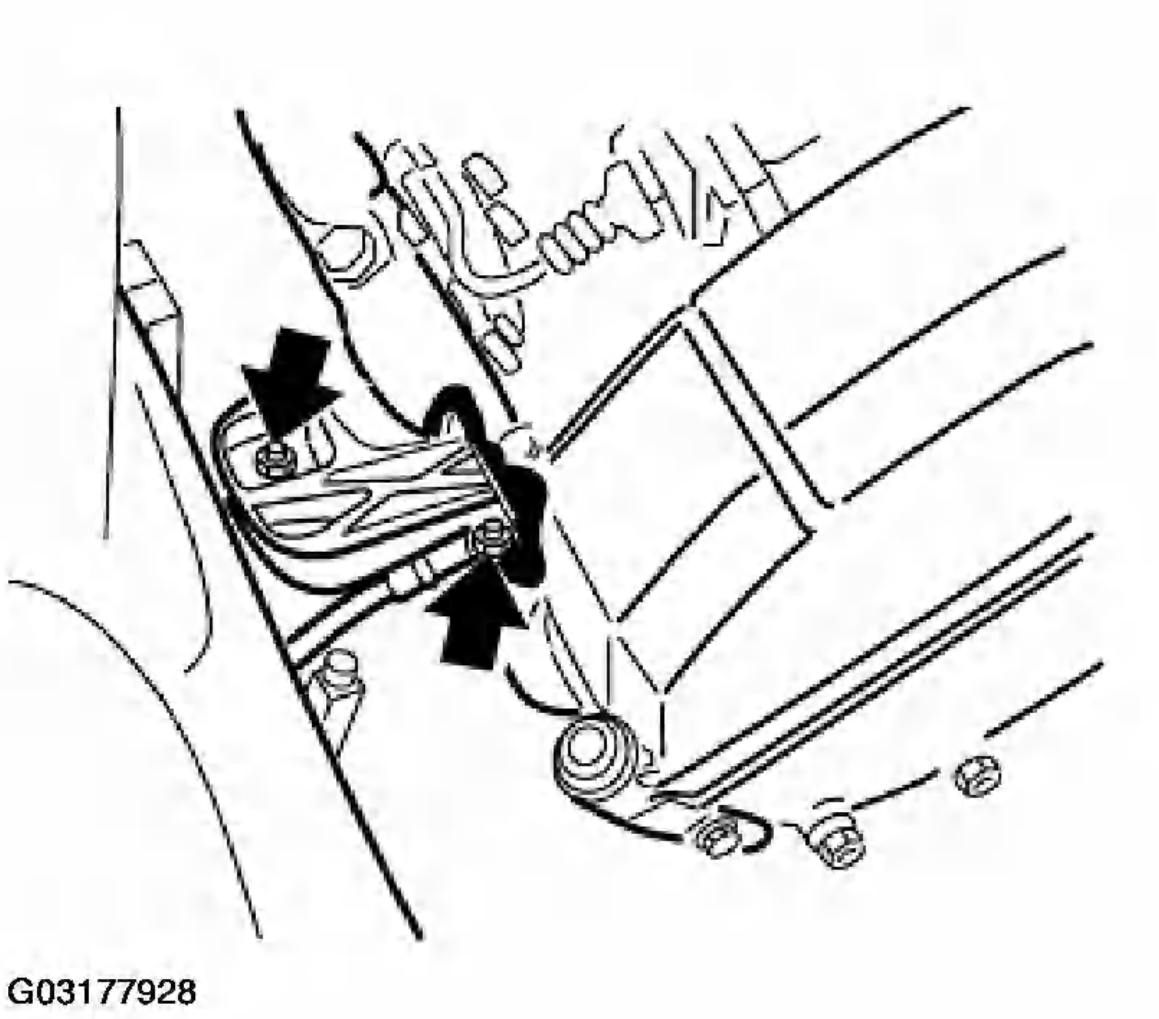



Fig. 14: Unfastening Right Ground Wire
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew left and right engine mounts.

Lift out engine.

## CYLINDER HEAD WITH COVER

### 11 12 000 REMOVING AND INSTALLING, SEALING CYLINDER HEAD COVER (M52TU / M54 / M56)

Remove engine cover.

Remove ignition coils. Refer to 12 13 511 REPLACING IGNITION COIL (M52, M52TU .

Remove wiring harness of ignition coils from cylinder head cover and place to one side.

NOTE: Illustration on M54 engine.

Press lock.

Pull off the hose for the engine breather.

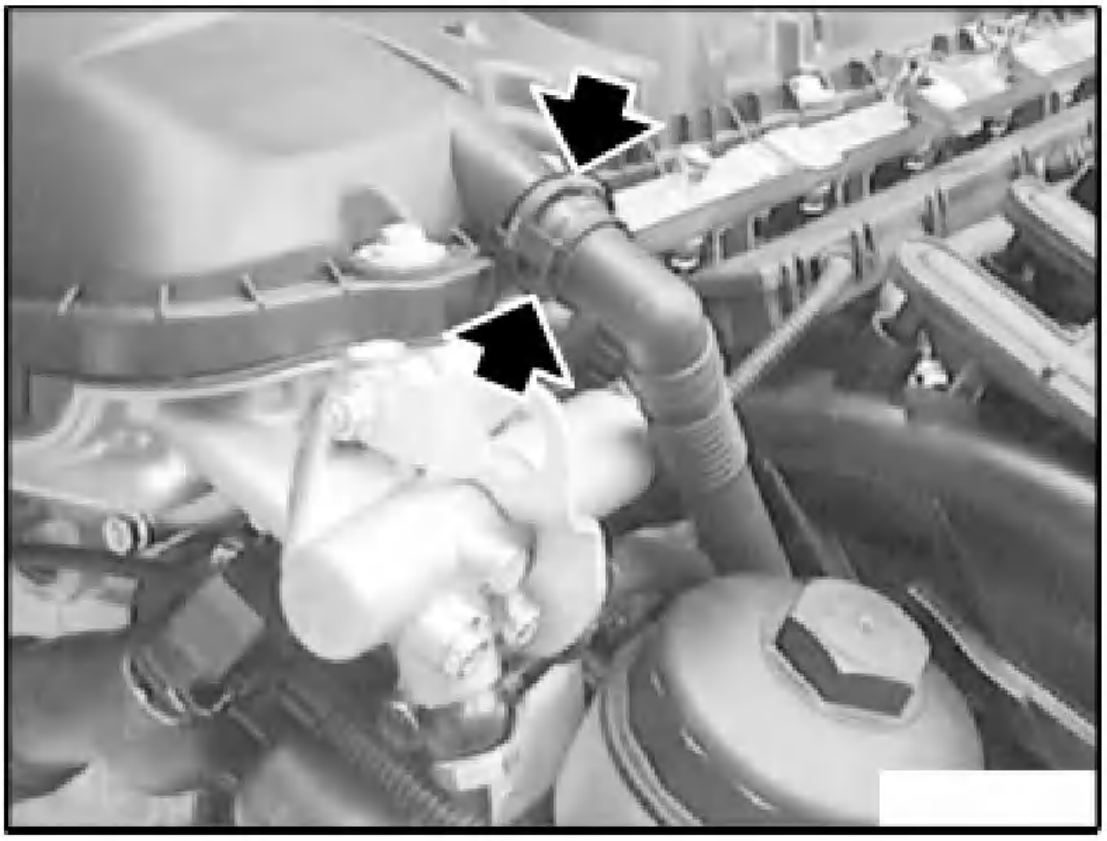



Fig. 15: Removing Hose For Engine Breather
Courtesy of BMW OF NORTH AMERICA, INC.

Remove grounding straps (1).

Remove cylinder head cover. Refer to 11 12 000 REMOVING AND INSTALLING, SEALING CYLINDER HEAD COVER (M52TU / M54 / M56).

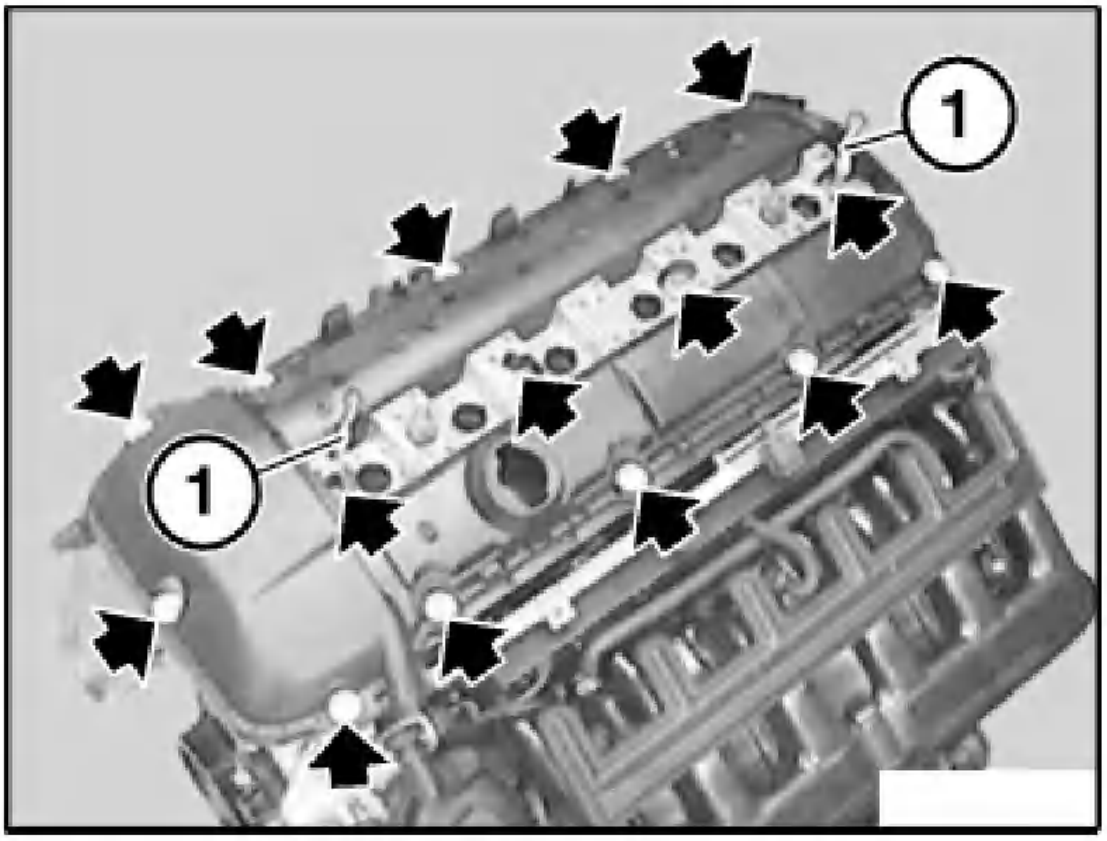



Fig. 16: Removing Cylinder Head Cover Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Remove sealing debris from sealing faces of cylinder head and cylinder head cover.

Apply a sealing bead of Drei Bond 1209 on left and right sides at transition between cylinder head and VANOS adjustment unit.

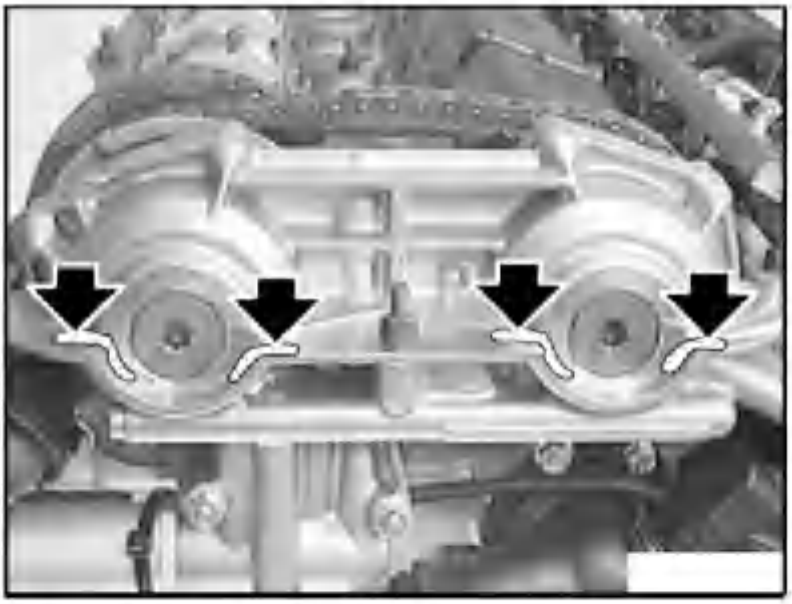


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Fig. 17: Applying Sealant Between Cylinder Head And VANOS Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Apply a thin and even sealing bead of Drei Bond 1209 at transition to half-moon sections at VANOS adjustment unit.



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Fig. 18: Applying Sealant To VANOS Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Illustration with engine removed.

Installation:

Apply a thin and even sealing bead of Drei Bond 1209 at transition to half-moon sections at rear of cylinder head.

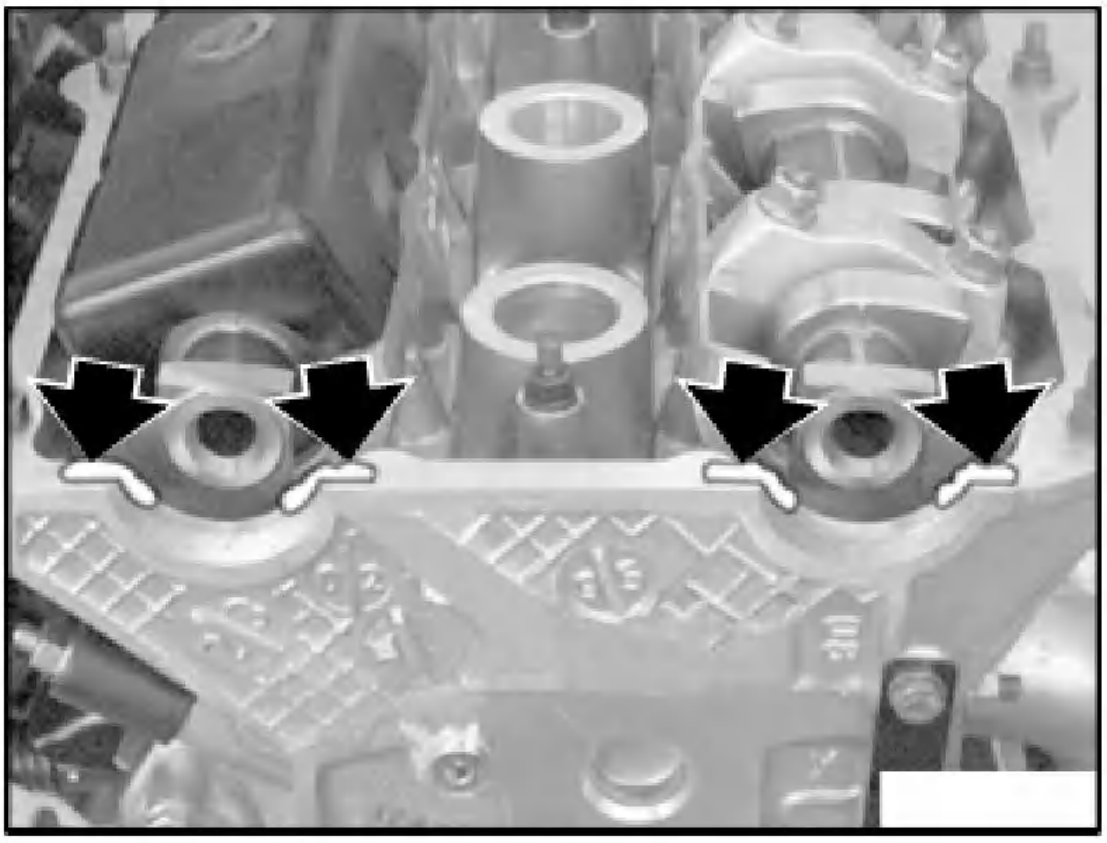



Fig. 19: Applying Sealant To Rear Of Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

Check seals and replace if necessary.

NOTE: Illustration with engine removed.

Installation:

Make sure gasket is correctly seated on rear and front ends of cylinder head.

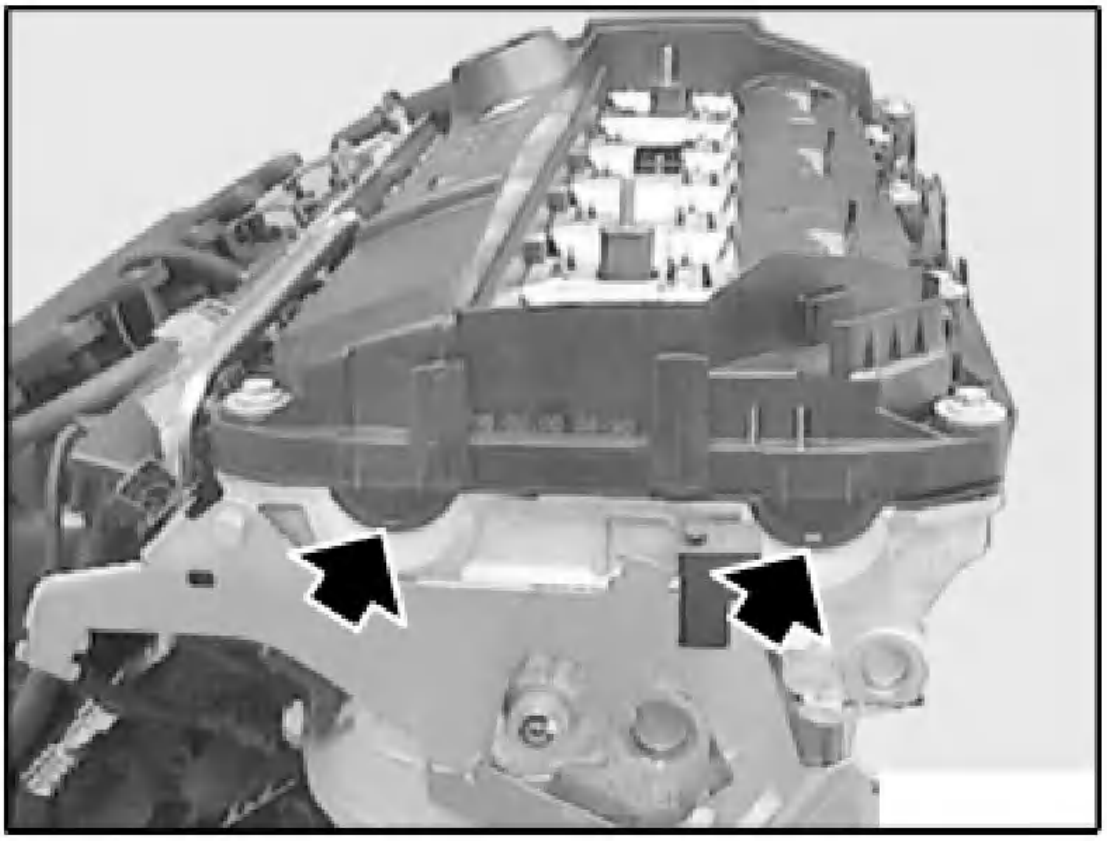



Fig. 20: Identifying Cylinder Head Gasket
Courtesy of BMW OF NORTH AMERICA, INC.

Install cover bolts and align cylinder head cover.

Hand-tighten all cover bolts without preload. Tighten cap nuts crosswise from inside to outside.

## 11 12 100 REMOVING AND INSTALLING/REPLACING CYLINDER HEAD (M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 00 0 200
- 00 9 120

Remove both exhaust manifolds. Refer to 11 62 140 REMOVING AND INSTALLING BOTH EXHAUST MANIFOLDS WITH CATALYTIC CONVERTER (M52TU / M54).

NOTE: After removing exhaust manifolds:

Reinstall engine support arm with engine mount and remove special tool 00 0 200.

Remove intake filter housing with air-mass flow sensor.

Remove cylinder head cover. Refer to 11 12 000 REMOVING AND INSTALLING, SEALING CYLINDER

HEAD COVER (M52TU / M54 / M56).

Remove all spark plugs. Refer to 12 12 011 REPLACING ALL SPARK PLUGS .

Remove intake air manifold. Refer to 11 61 050 REMOVING AND INSTALLING INTAKE AIR MANIFOLD (M54).

Remove coolant drain plug in engine block. Drain and dispose of coolant.

Installation:

Replace sealing ring on drain plug.

Tightening torque, refer to 11 11 5AZ in 1`11 11 ENGINE BLOCK .

Vent cooling system and check for leaks.

Remove coolant thermostat housing. Refer to 11 53 000 REMOVING AND INSTALLING/REPLACING COOLANT THERMOSTAT (M52TU / M54 / M56).

Remove coolant pipe.

NOTE: If the coolant pipe cannot be fed out:

Release banjo bolt (1) and disconnect oil pressure line for VANOS adjustment unit.

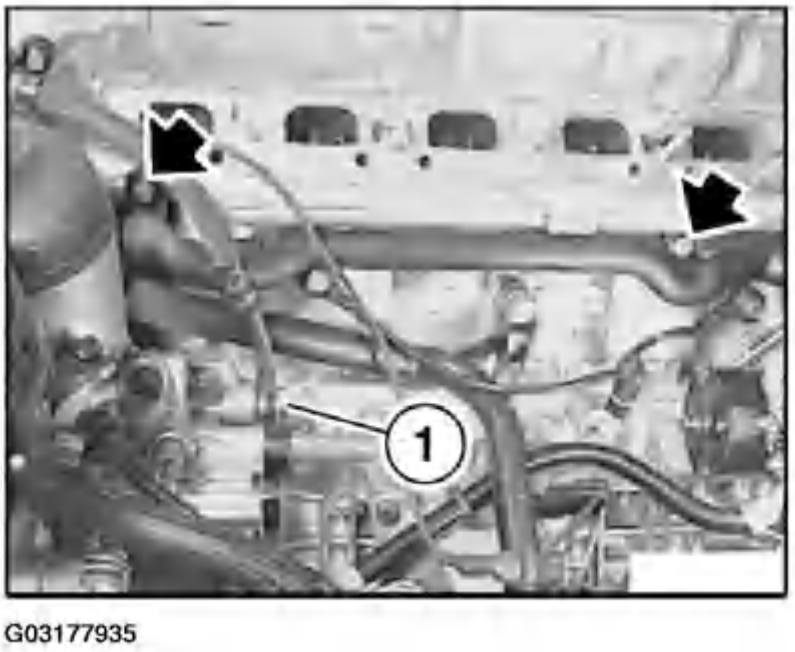



Fig. 21: Identifying Banjo Bolt On Oil Pressure Line
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace O-ring on coolant pipe.

If necessary, replace sealing rings on banjo bolt (1).

Tightening torque of banjo bolt (1) 11 36 2AZ. Refer to 11 36 VARIABLE CAMSHAFT CONTROL .

Removal

Removal of cylinder head is described separately from installation.

Remove double VANOS adjustment unit. Refer to 11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56).

Remove camshafts with bearing strips. Refer to 11 31 001 REPLACING CAMSHAFT (M52TU / M54 / M56).

Release screw connection between timing case cover and cylinder head.

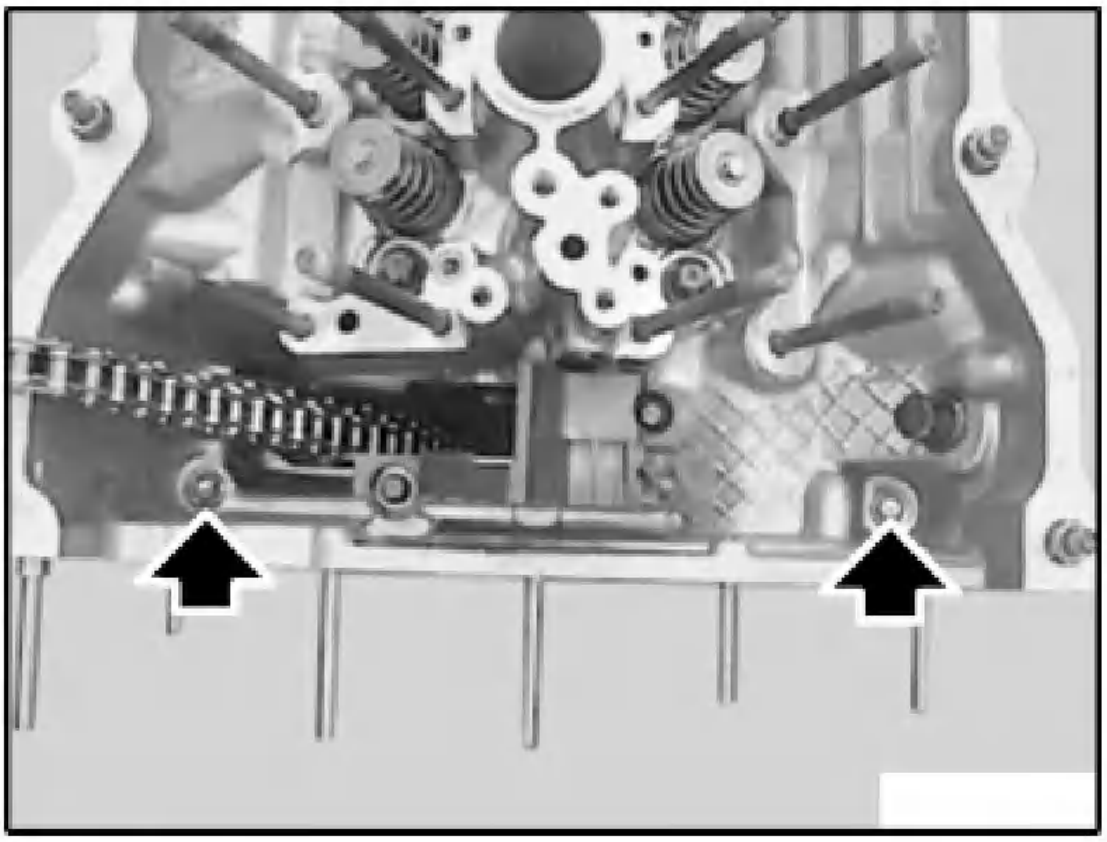



Fig. 22: Identifying Screw Connection Between Timing Case Cover And Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws, remove chain guide.

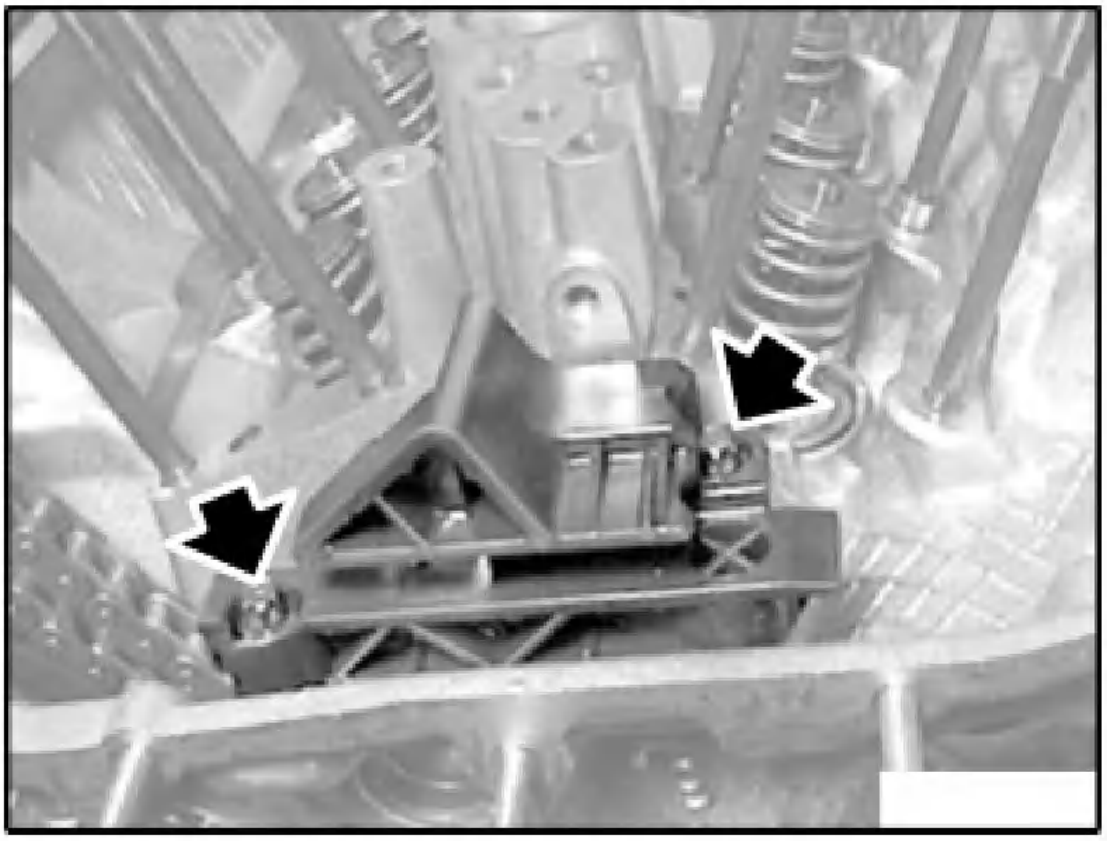



Fig. 23: Removing Chain Guide Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release cylinder head bolts from outside to inside in sequence 14 to 1.

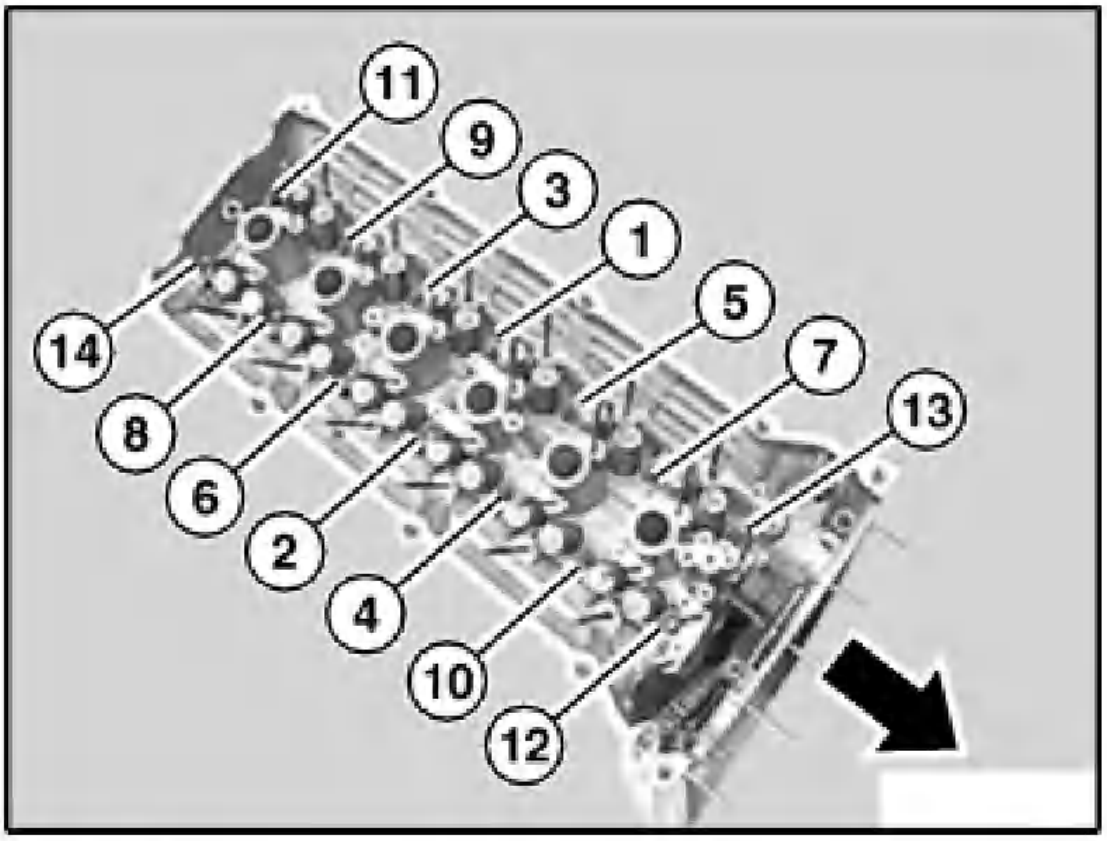



Fig. 24: Identifying Removal Sequence Of Cylinder Head Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Lift off cylinder head.

Installation

Installation of cylinder head is described separately from removal.

Clean sealing faces of cylinder head and engine block; if necessary, remove traces of gasket with hardwood spatula. Make sure no gasket remnants drop into oil and cooling channels.

Check adapter sleeves for damage and correct installation position.

Apply permanently elastic sealing compound Drei Bond 1209 to joints to timing case cover.

Replace cylinder head gasket.

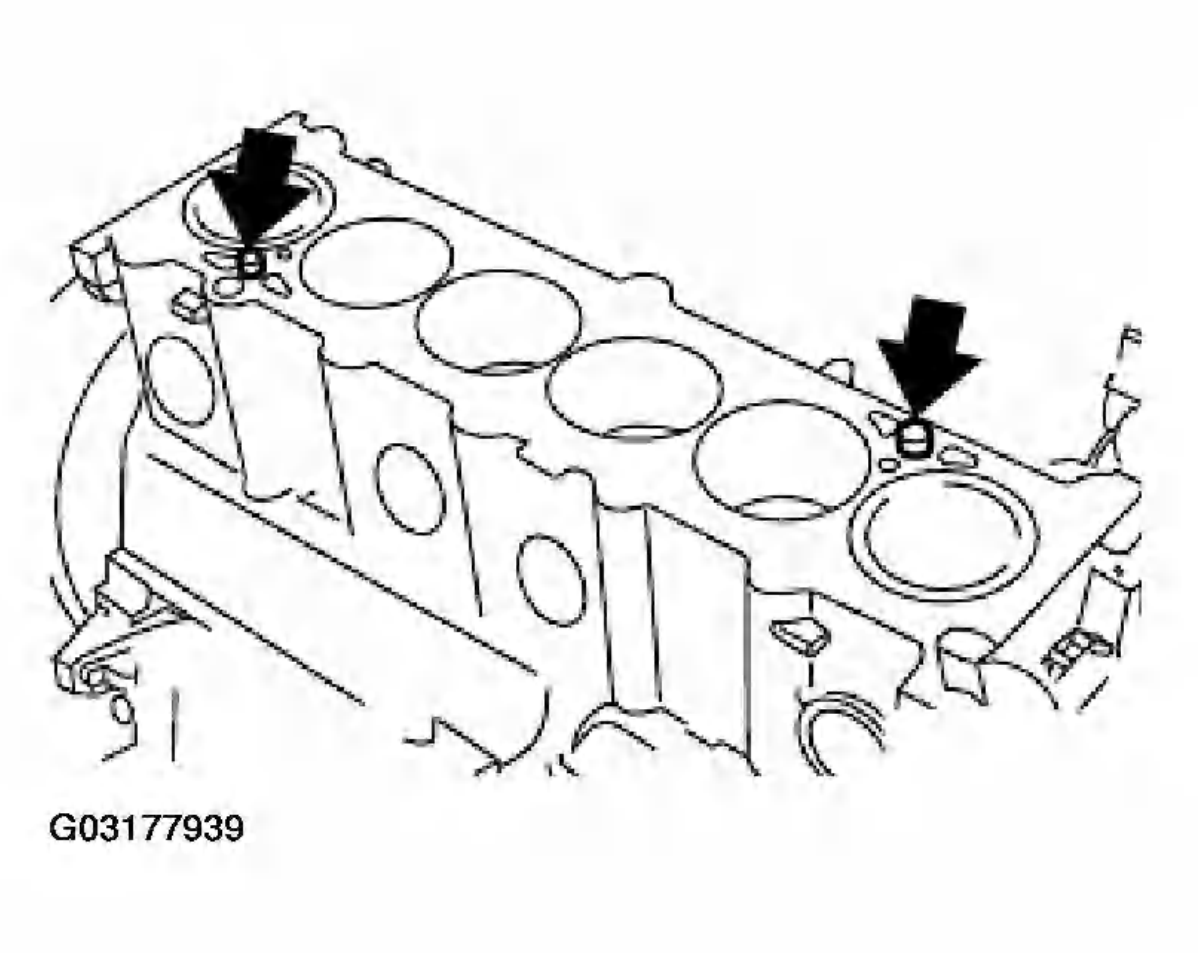



Fig. 25: Checking Adapter Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: A cylinder head seal 0.3 mm thicker than usual can be obtained for machined (milled) cylinder heads.

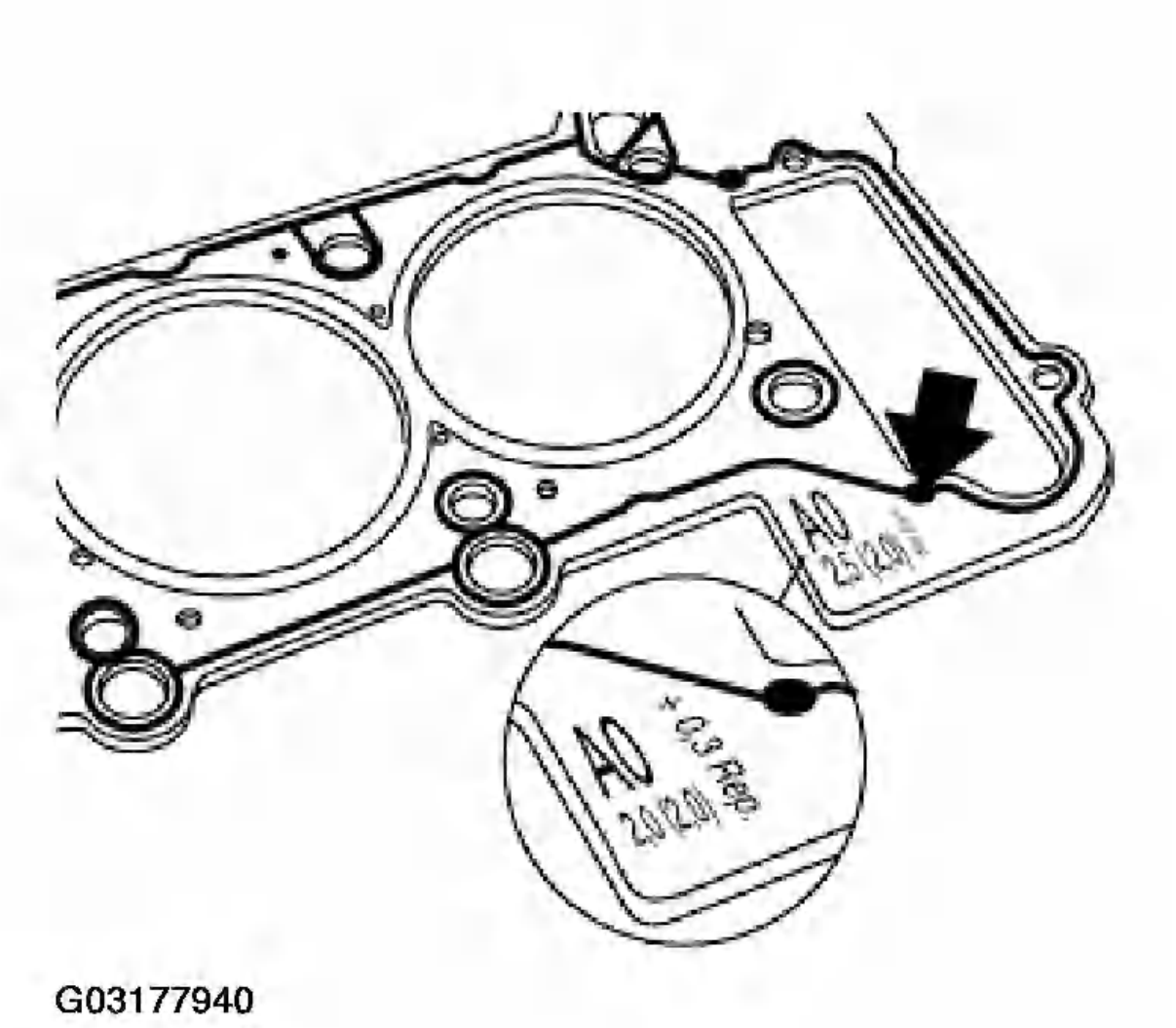



Fig. 26: Identifying Standard And Thicker Cylinder Head Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Use cylinder head bolts only once.

There must be no oil in the tapped holes of the engine block and the timing case cover.

Risk of cracking and distorted tightening values.

Put the cylinder head on.

Apply a light coat of oil to washer contact area and thread of new cylinder head bolts.

Tighten down cylinder head bolts in sequence 1 to 14.

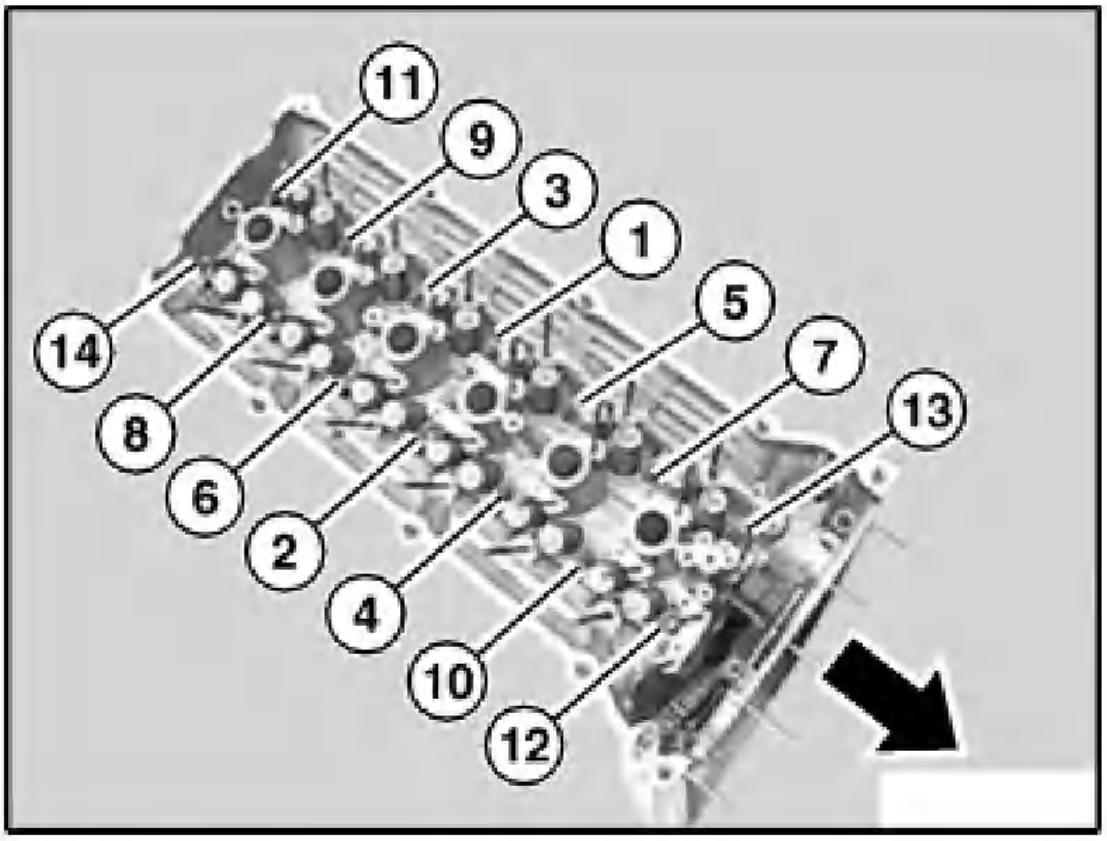



Fig. 27: Identifying Tightening Sequence Of Cylinder Head Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque 11 12 6AZ. Refer to 11 12 CYLINDER HEAD WITH COVER .

NOTE: Use special tool 00 9 120 for torsion angle tightening.

Install chain guide.

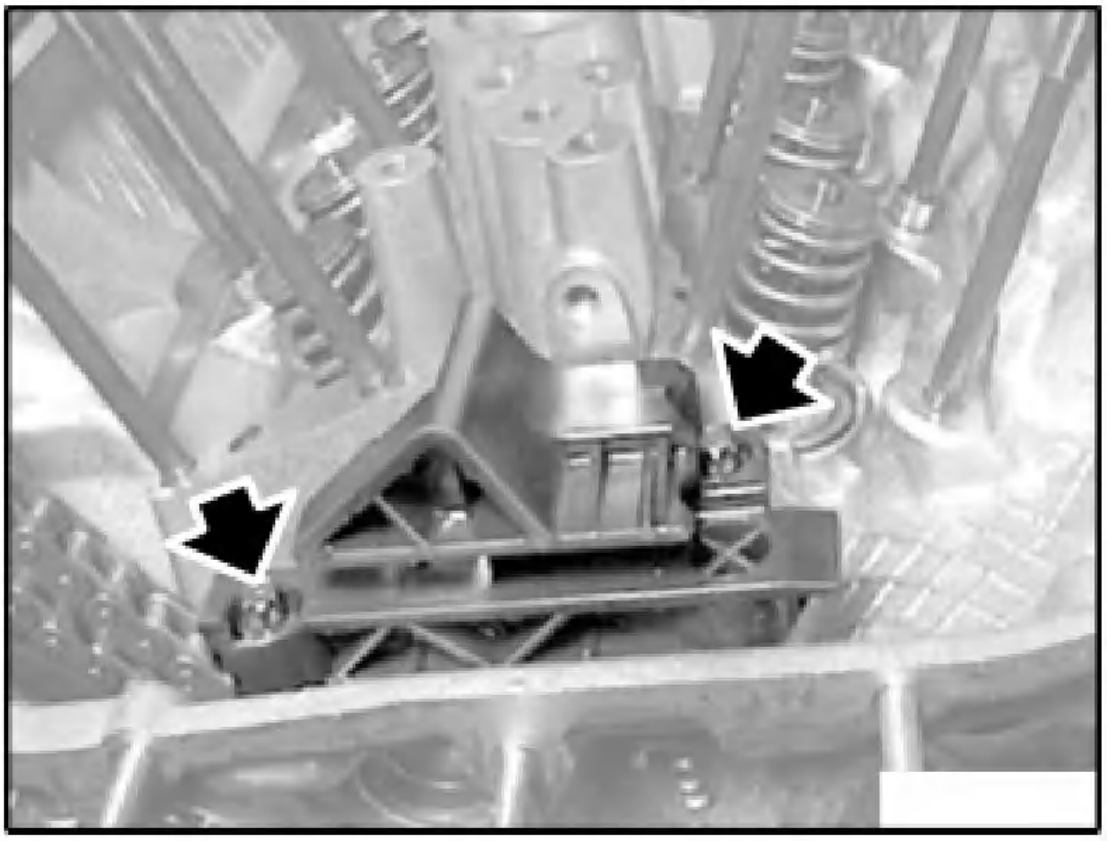



Fig. 28: Installing Chain Guide
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screws and tighten down screw connection between timing case cover and cylinder head.

Install camshafts. Refer to 11 31 001 REPLACING CAMSHAFT (M52TU / M54 / M56).

Install double VANOS adjustment unit. Refer to 11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56).

Assemble engine.

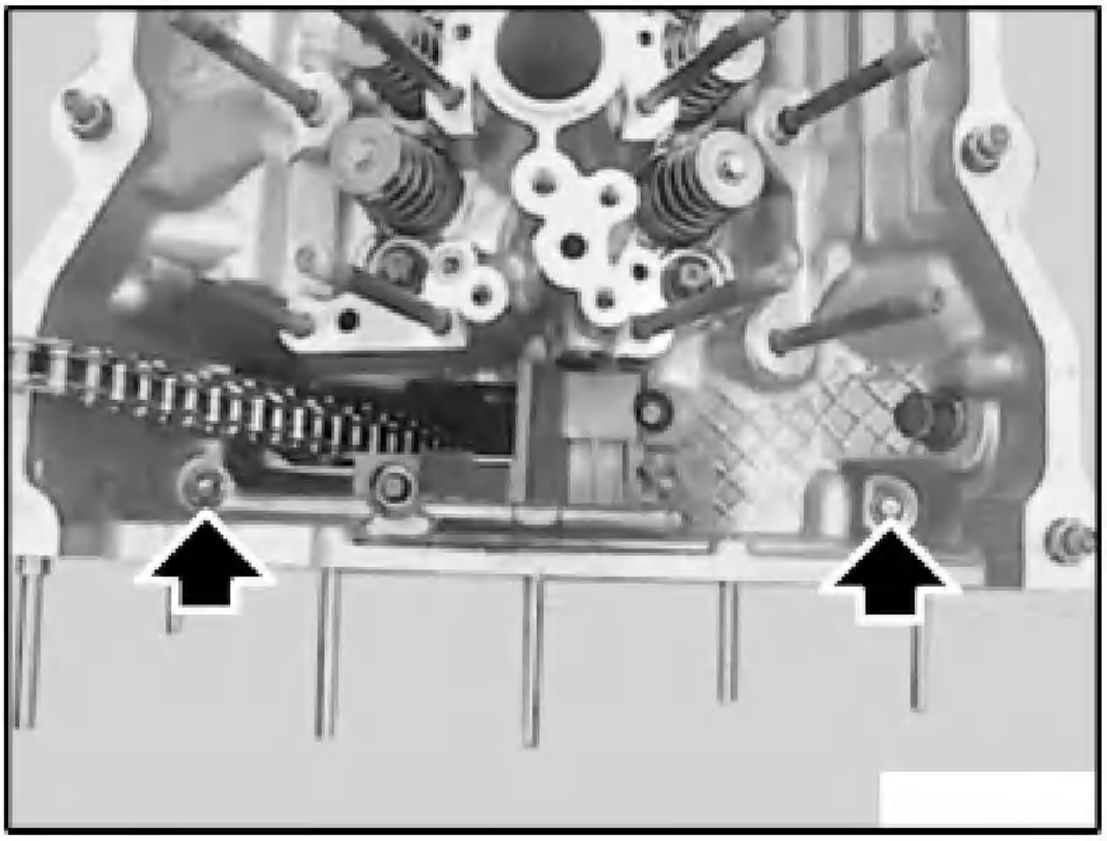



Fig. 29: Tightening Screw Connection Between Timing Case Cover And Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 12 101 REPLACING CYLINDER HEAD GASKET (M52 / S52 / M52TU / M54 / M56)

Tasks are identical to removing and installing cylinder head. Refer to 11 12 100 REMOVING AND INSTALLING/REPLACING CYLINDER HEAD (M52TU / M54 / M56).

## 11 12 503 DISASSEMBLING AND ASSEMBLING CYLINDER HEAD (M52 / S52 / M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 00 1 490
- 11 0 192
- 11 0 342
- 11 0 343
- 11 0 345
- 11 1 045
- 11 1 065
- 11 1 067
- 11 1 071

- 11 1 441
- 11 1 442

(Cylinder head removed)

If necessary, remove coolant thermostat. Refer to 11 53 000 REMOVING AND INSTALLING/REPLACING COOLANT THERMOSTAT (M52TU / M54 / M56).

Screw on special tool 11 1 442.

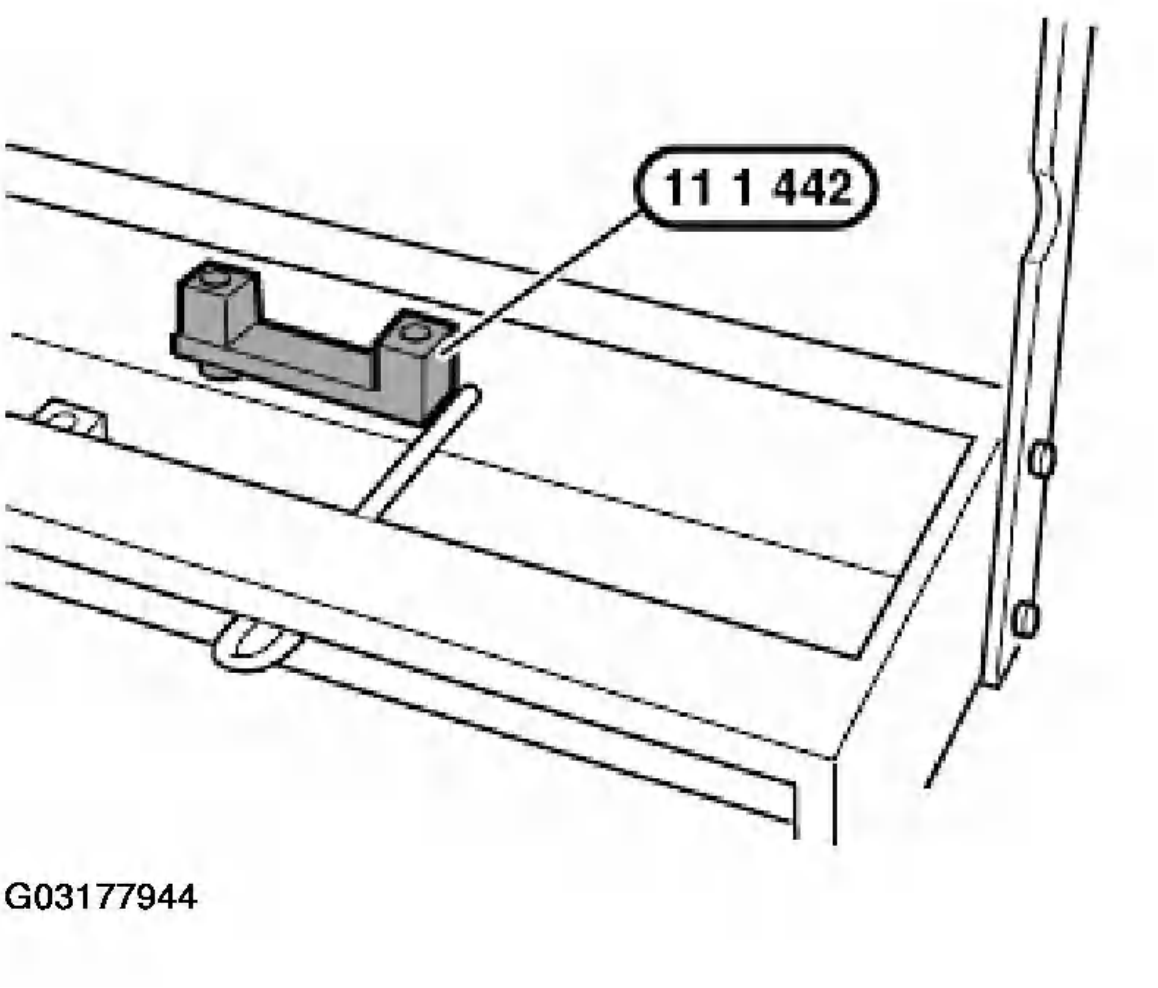



Fig. 30: Installing Special Tool 11 1 442
Courtesy of BMW OF NORTH AMERICA, INC.

Screw special tool 11 1 065 onto special tool 00 1 490.

Provide special tools for disassembling cylinder head:

- Special tool 11 1 071.
- Special tool 11 1 067.
- Special tool 11 0 192.

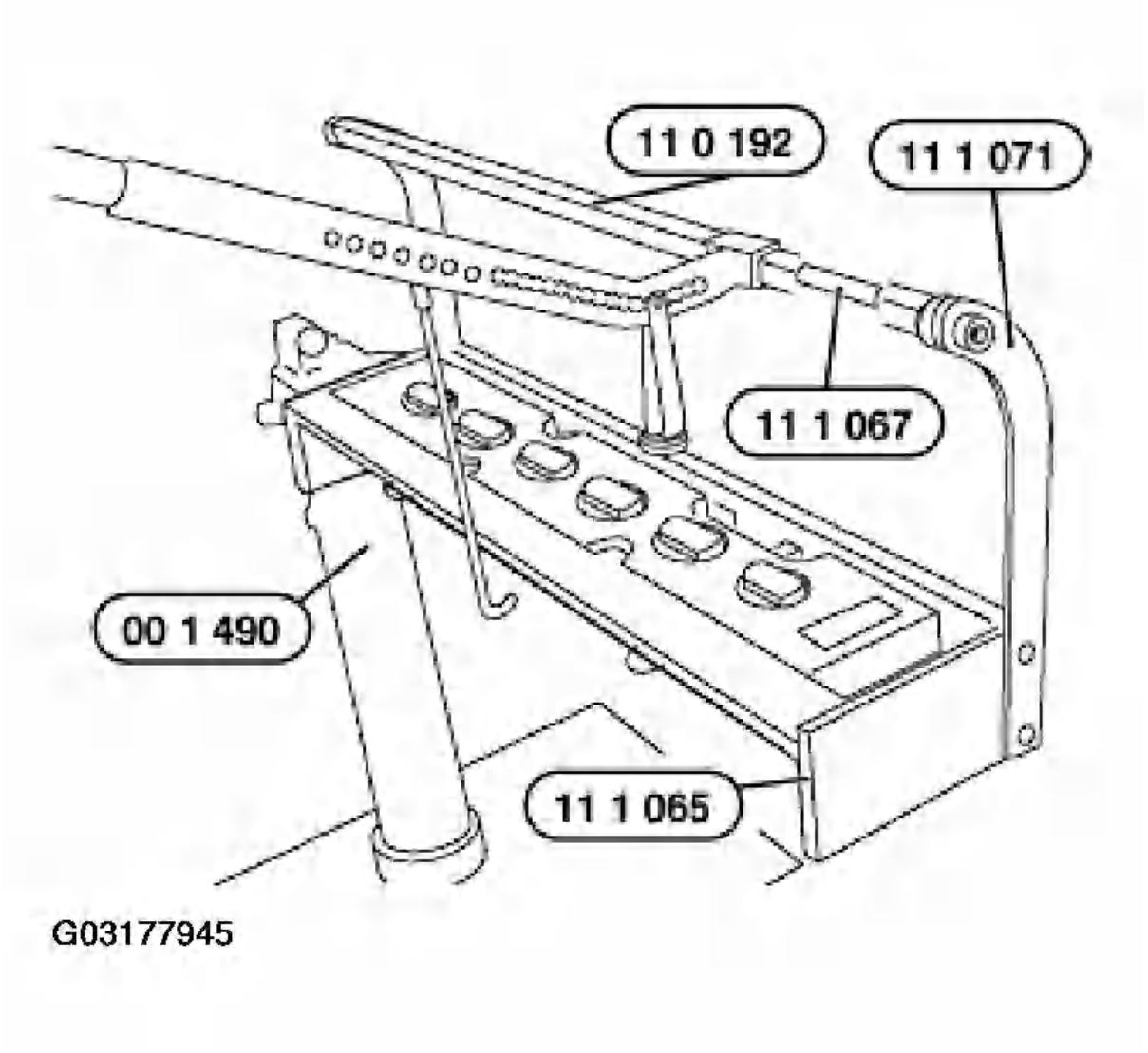



Fig. 31: Screwing Special Tool 11 1 065 Onto Special Tool 00 1 490
Courtesy of BMW OF NORTH AMERICA, INC.

- Special tool 11 1 045.
- Special tool 11 0 342.
- Special tool 11 0 343.
- Special tool 11 0 345.
- Special tool 11 1 441.

Assemble special tools.

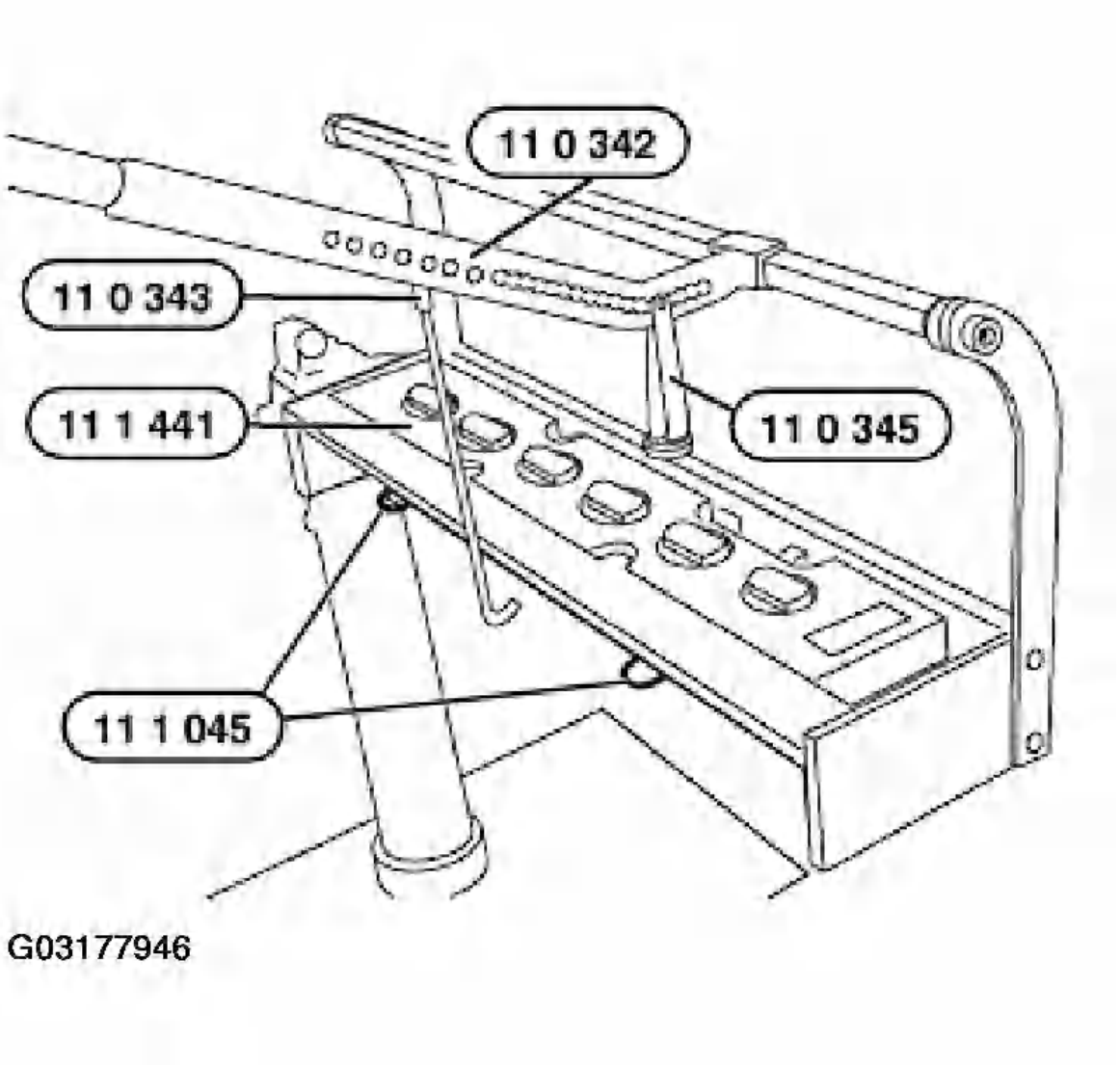



Fig. 32: Assembling Special Tools
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Do not install special tool 11 1 441 (locating board) in special tool 11 1 065 at this stage.

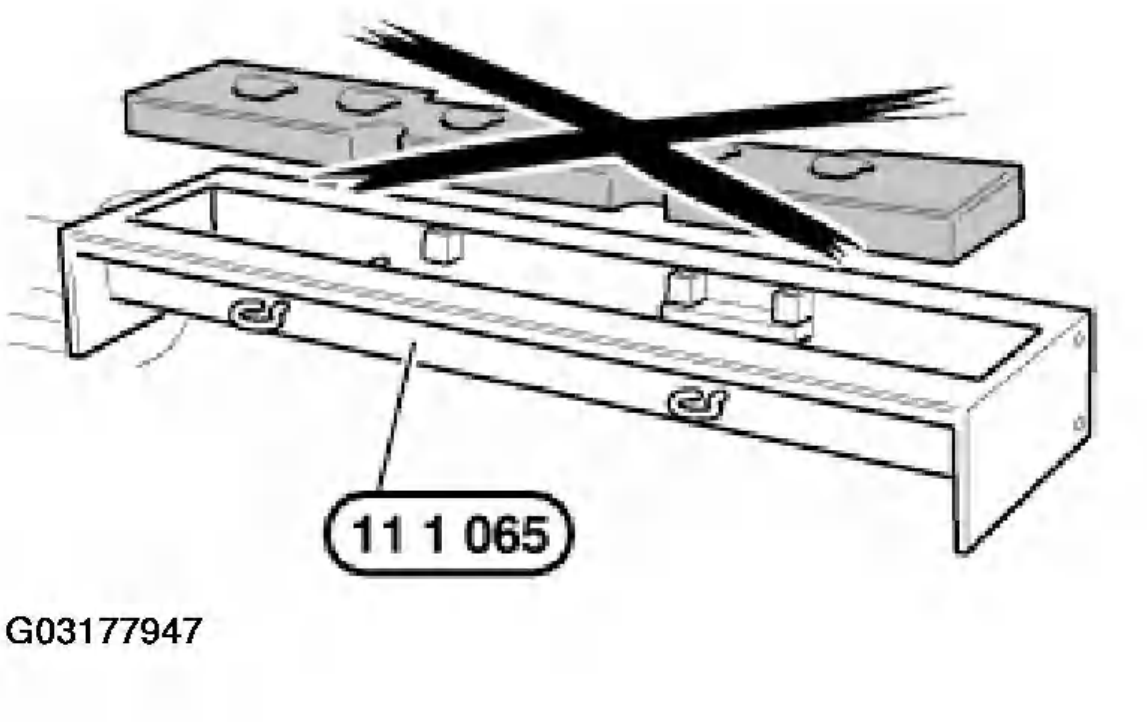



Fig. 33: Identifying Special Tool 11 1 065
Courtesy of BMW OF NORTH AMERICA, INC.

Place cylinder head on special tool 11 1 065 and screw on with two screws.

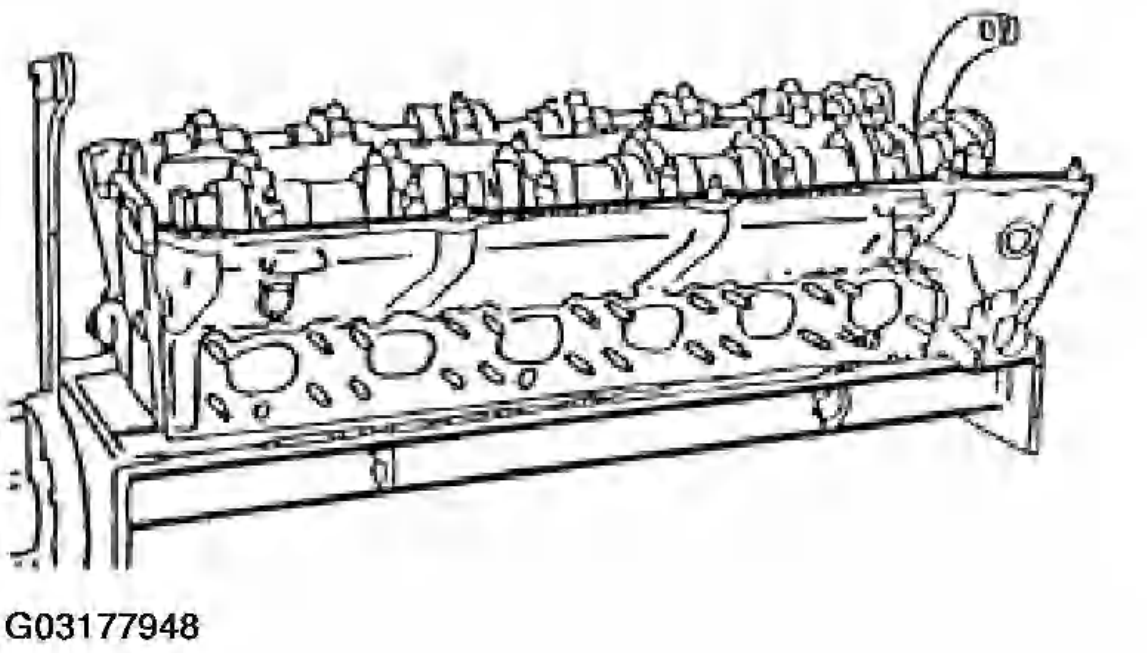



Fig. 34: View Of Cylinder Head On Special Tool 11 1 065
Courtesy of BMW OF NORTH AMERICA, INC.

Remove all valve springs. Refer to 11 34 715 REPLACING ALL VALVE SPRINGS (M52 / S52 / M52TU /

M54 / M56).

Remove all valve stem seals. Refer to 11 34 560 REPLACING ALL VALVE STEM SEALS (M52 / S52 / M52TU / M54 / M56).

Remove all valves. Refer to 11 34 552 REMOVING AND INSTALLING OR REPLACING ALL VALVES (M52 / S52 / M52TU / M54 / M56).

## 11 12 527 REMACHINING A VALVE SEAT (M52 / S52 / M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 00 3 520
- 00 3 580

(Cylinder head dismantled)

Machine valve seat surface with special tool 00 3 520 or with special tool 00 3 580 in accordance with manufacturer's instructions.

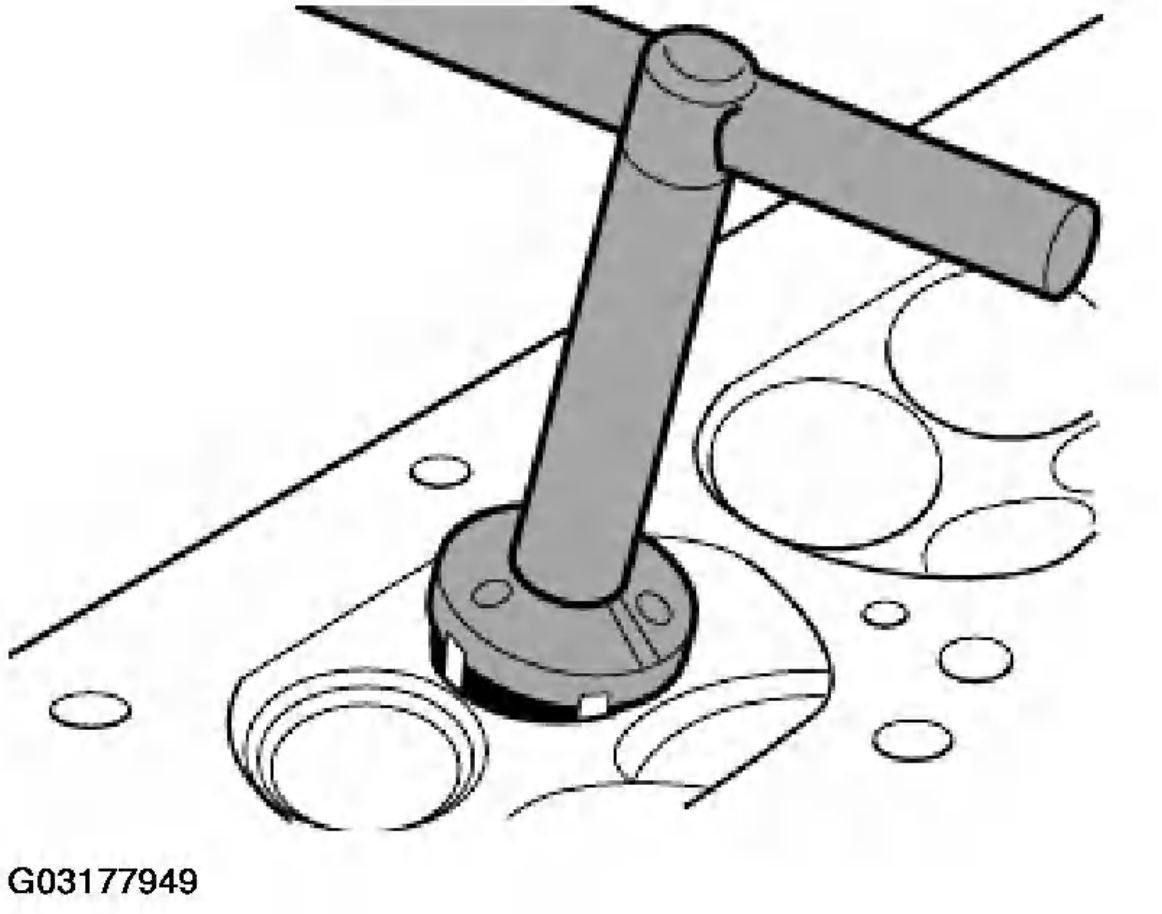



Fig. 35: Machining Valve Seat Surface
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: After machining the valve seat surface, remachine the outside and inside

diameters with a correction milling tool to the prespecified diameter to produce valve seat width (5).

1. Valve-seat angle.
2. Correction angle, outside.
3. Correction angle, inside.
4. Outside diameter seat face.
5. Valve-seat width.

Specified values (1 to 5). Refer to 11 12 CYLINDER HEAD WITH VALVE SEAT COVER M54 B 30 or 11 12 CYLINDER HEAD WITH VALVE SEAT COVER M54 B22 or 11 12 CYLINDER HEAD WITH VALVE SEAT COVER M54 B25

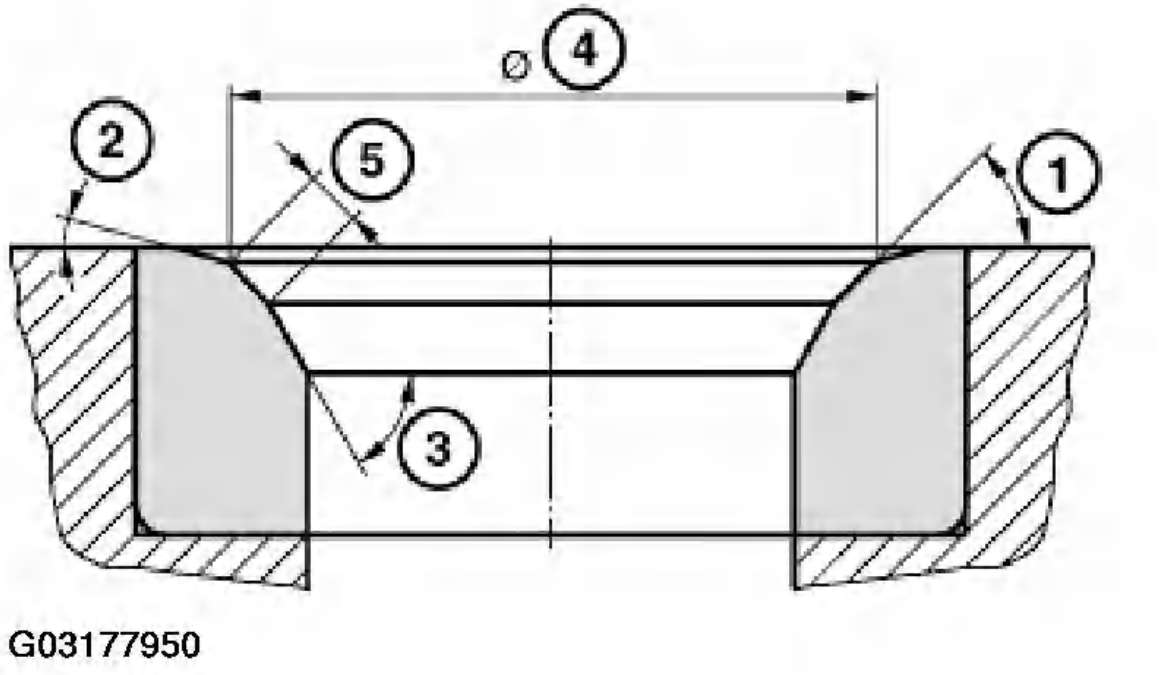



Fig. 36: Identifying Valve-Seat Dimensions
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 12 595 CHECKING A VALVE GUIDE FOR WEAR (M52 / S52 / M52TU / M54 / M56)

(Valve removed)

To measure tilt clearance, install a new valve so that end of valve stem is flush with valve guide.

Attach dial gauge and measure tilt clearance.

NOTE: Max, permissible tilt clearance. Refer to 11 12 CYLINDER HEAD WITH COVER M54 .

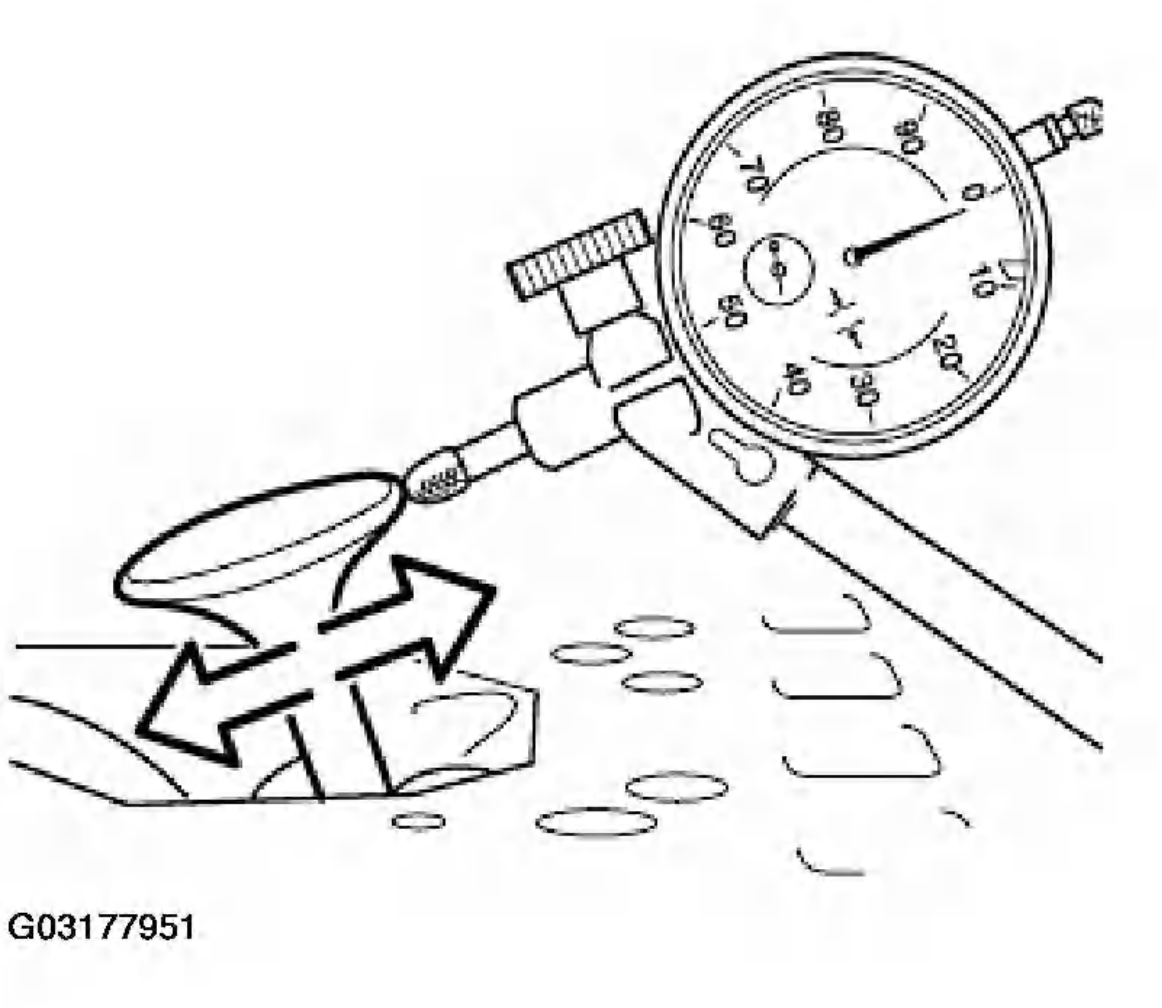



Fig. 37: Measuring Tilt Clearance Using Dial Gauge
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: If tilt clearance is excessive, valve guide is reamed out and a repair valve with a larger shaft diameter is installed.

If necessary, ream valve guide. Refer to 11 12 600 REAMING A VALVE GUIDE (M52 / S52 / M52TU / M54 / M56).

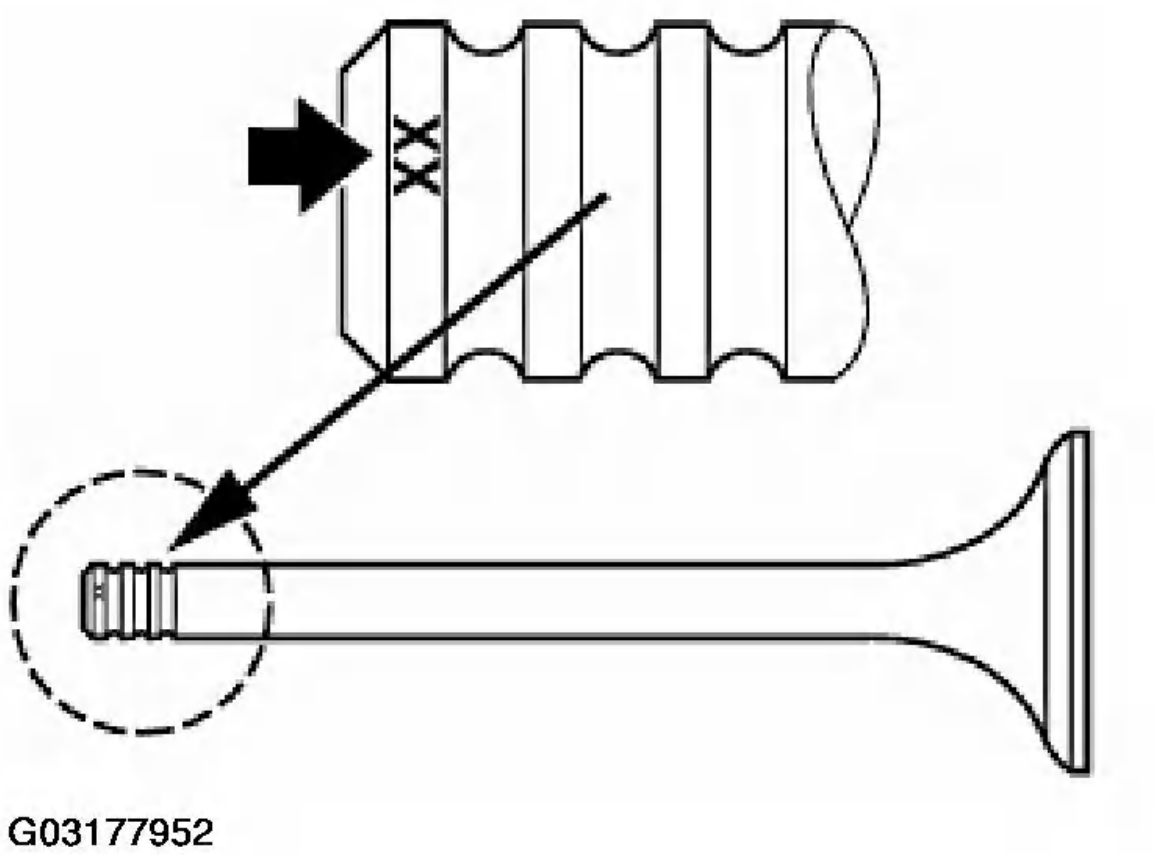



Fig. 38: Identifying Valve Guide
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 12 600 REAMING A VALVE GUIDE (M52 / S52 / M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 00 4 210

(Valve removed)

NOTE: In event of excessive clearance between valve stem and valve guide:

Valve guide is reamed and a repair valve with a larger stem diameter is installed.

Assemble reaming tool and guide taper (1) from special tool kit 00 4 210 depending on stem diameter. Press guide taper (1) onto valve seat. Starting from combustion chamber side, ream valve guide dry. Rotate reaming tool once in downwards direction.

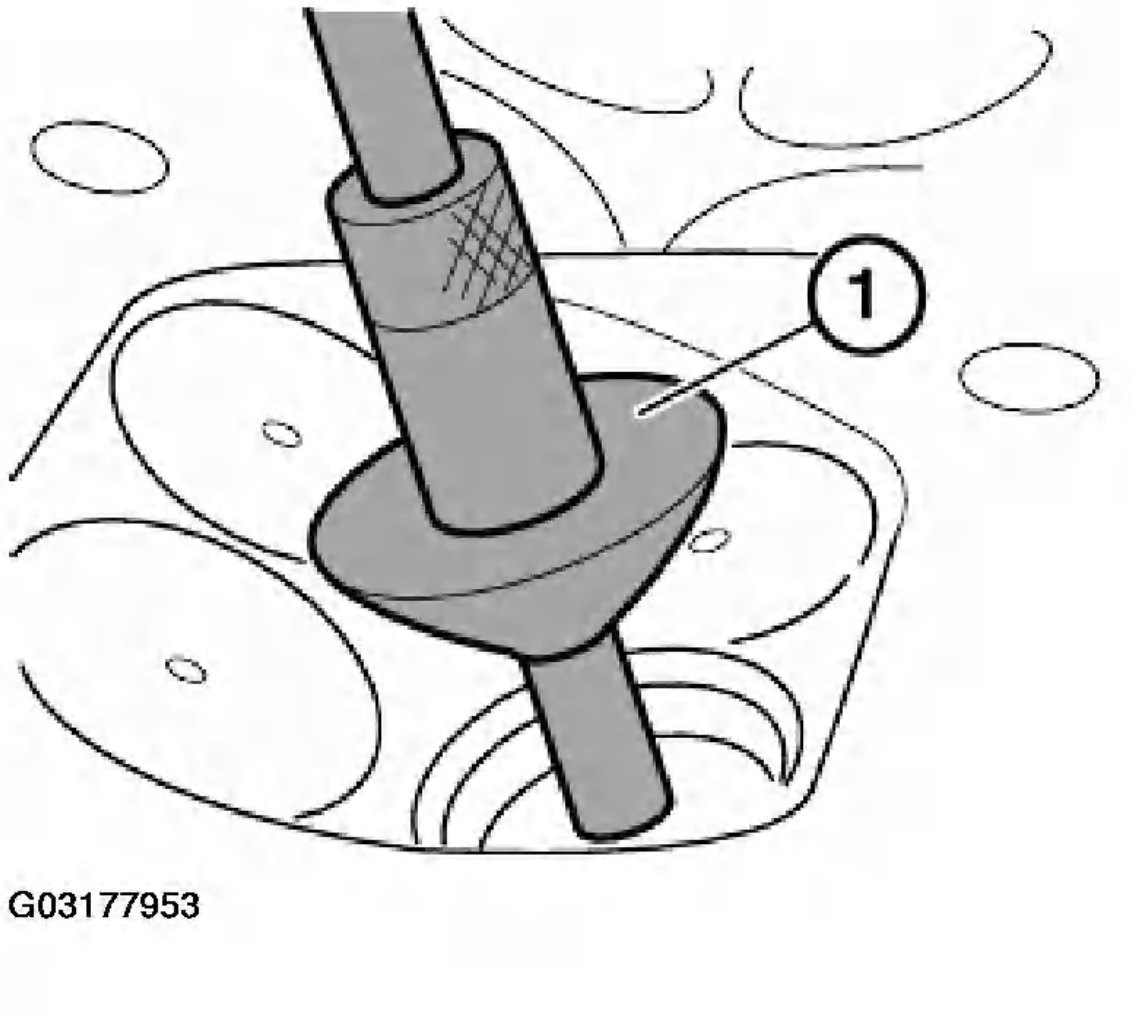



Fig. 39: Assembling Reaming Tool And Guide Taper
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Remachine valve seat after reaming. Refer to 11 12 527 REMACHINING A VALVE SEAT (M52 / S52 / M52TU / M54 / M56).

## 11 12 719 RESURFACING CYLINDER HEAD SEALING SURFACE (M52 / M52TU / M54 / M56)

(Cylinder head dismantled)

Check flatness of cylinder head sealing surface with a commercially available straightedge.

Deviation from flatness max. 0.05 mm.

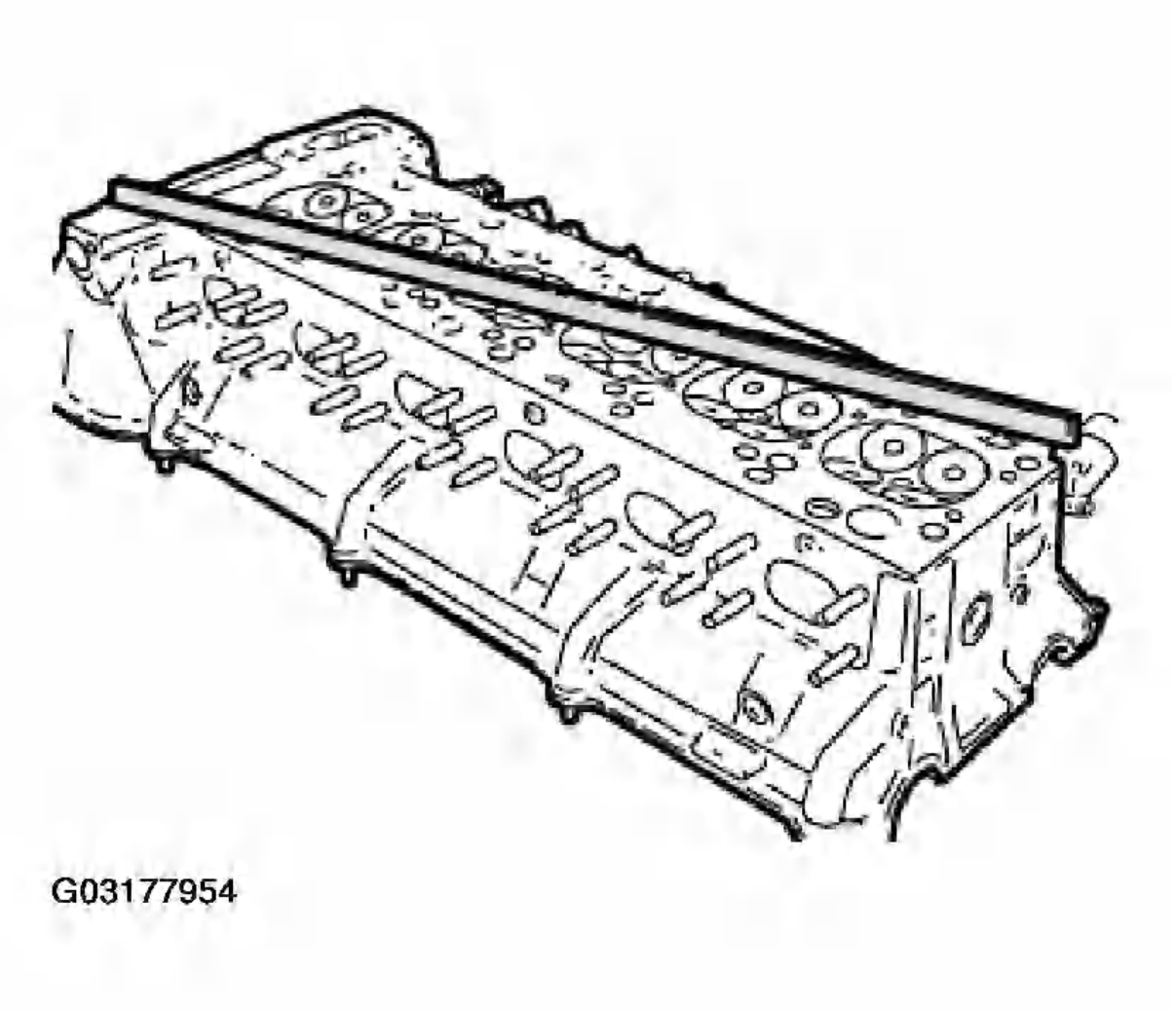



Fig. 40: Checking Flatness Of Cylinder Head With Straightedge
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Machining limit. Refer to 11 12 CYLINDER HEAD WITH COVER M54 .

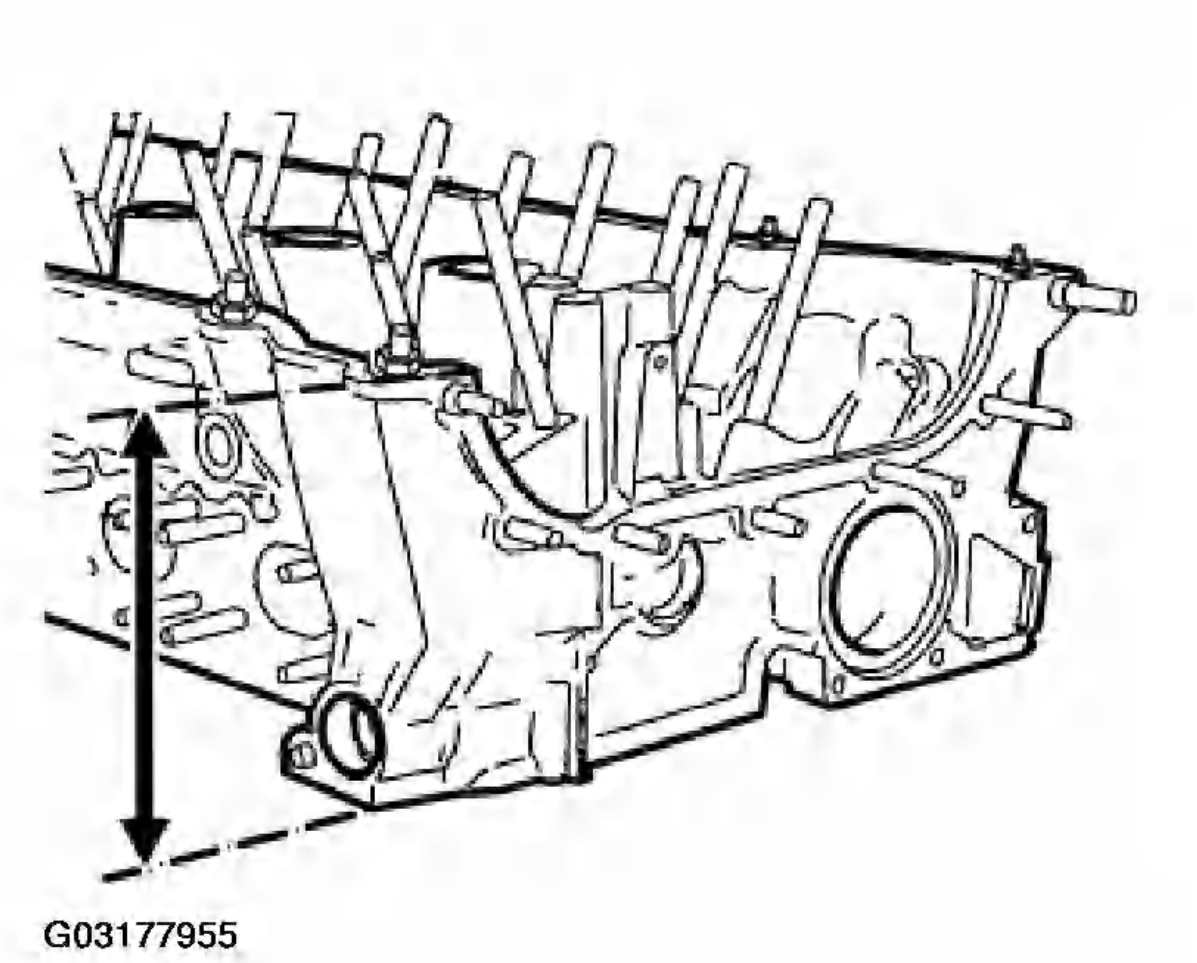



Fig. 41: Identifying Machining Limit
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: For compression comparison check, a repair cylinder head seal is provided.

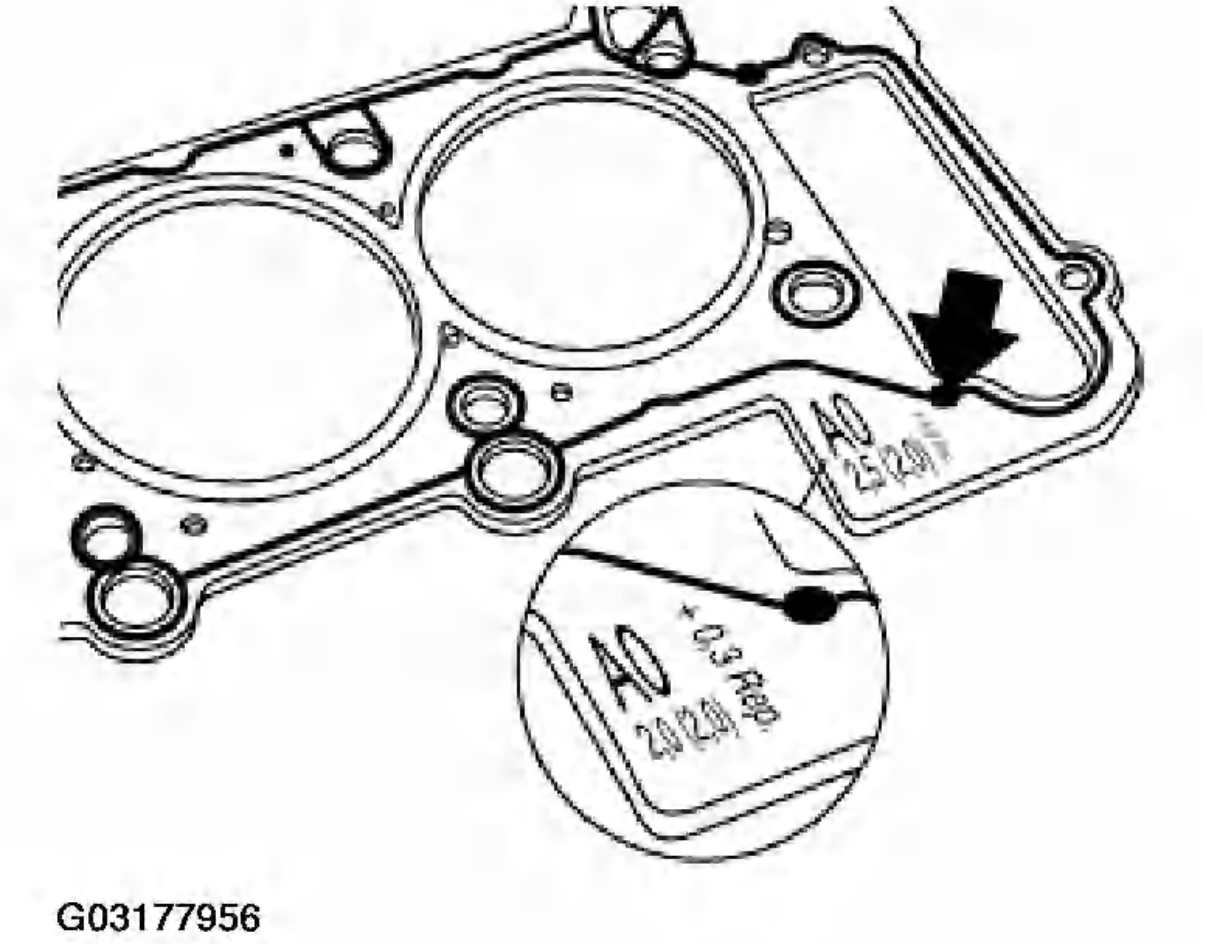



Fig. 42: Identifying Cylinder Head Seal
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 12 729 CHECKING CYLINDER HEAD FOR WATERTIGHTNESS (M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 11 7 390
- 11 7 391
- 11 7 392
- 11 7 393
- 11 7 394
- 11 7 395
- 11 7 396
- 11 7 397
- 11 7 398

(Cylinder head dismantled)

Prepare special tool kit 11 7 390.

NOTE: Special tool kit 11 7 390 consists of special tools 11 7 391 / 11 7 392 / 11 7 393 / 11 7 394 / 11 7 395 / 11 7 396 / 11 7 397 / 11 7 398.

Place special tools 11 7 391 / 11 7 392 on cylinder head sealing surface and screw down with cylinder head bolts.

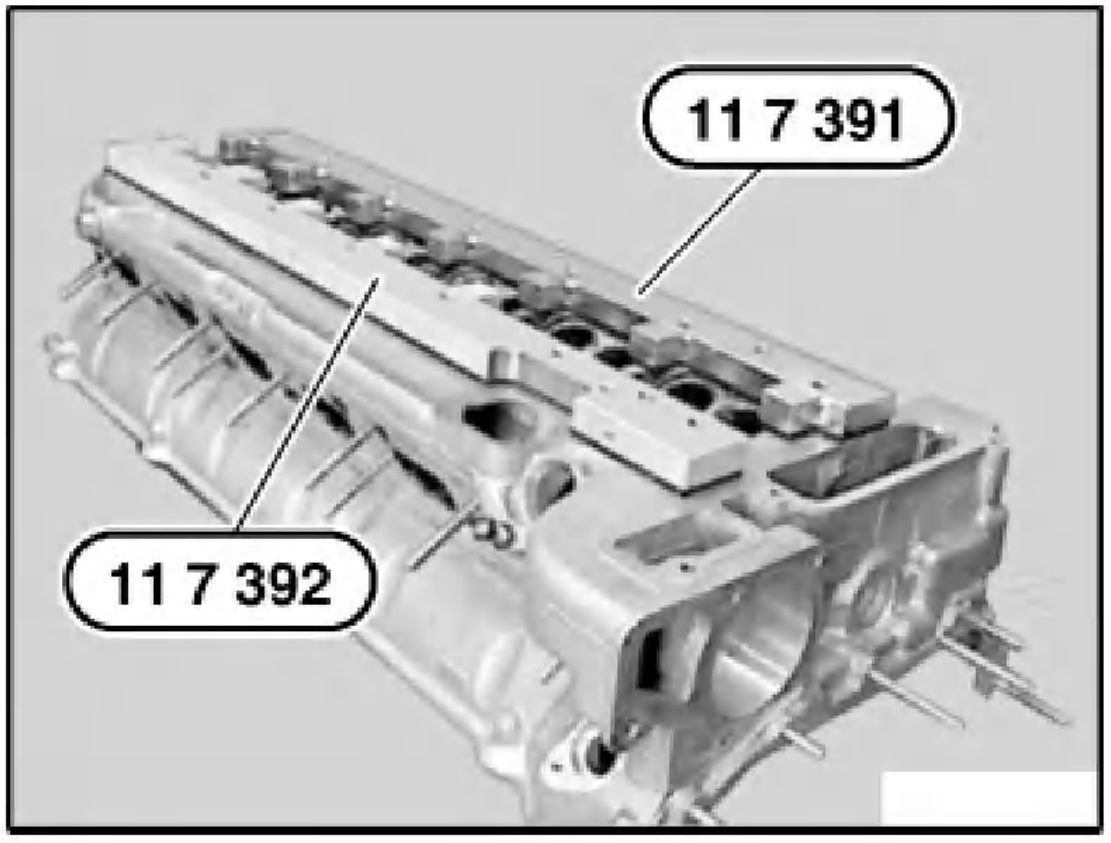



Fig. 43: Placing Pressure Testing Fixture On Cylinder Head Sealing Surface
Courtesy of BMW OF NORTH AMERICA, INC.

Turn back screw (1).

NOTE: Special tool 11 7 394 is secured with a pin (2).

Fit special tool 11 7 394.

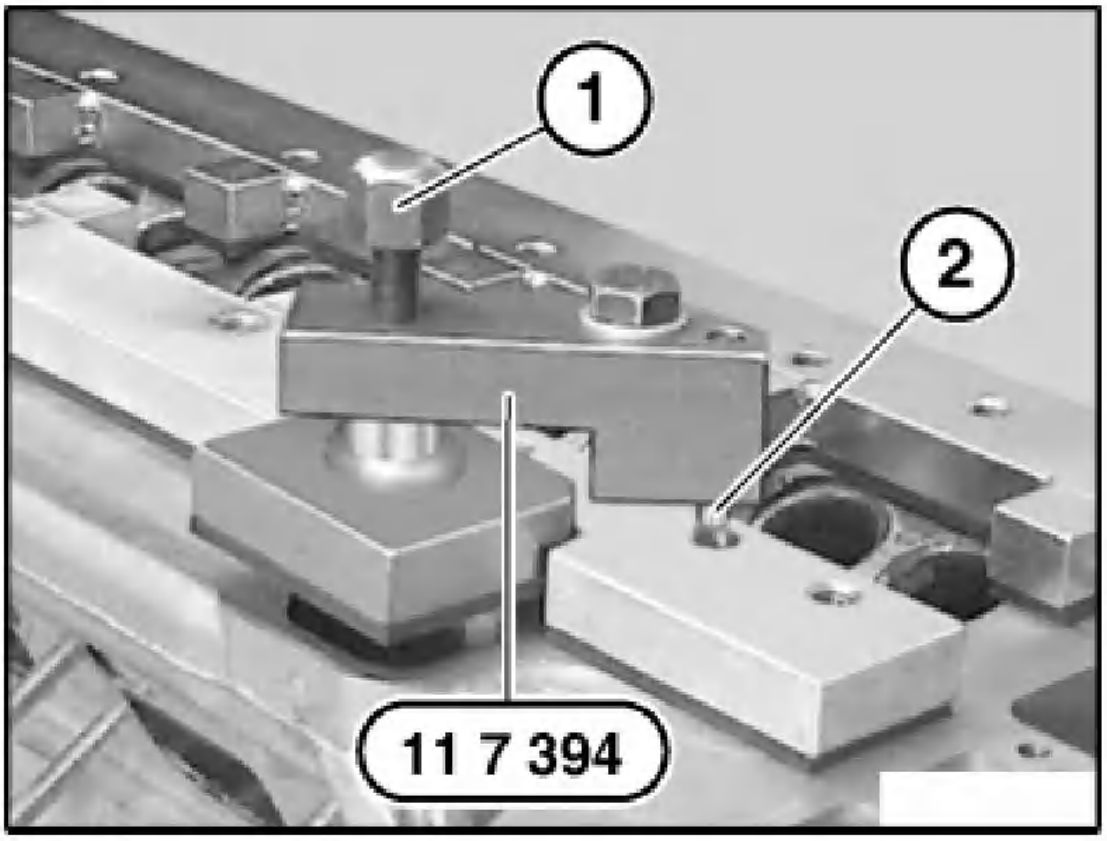



Fig. 44: Securing Pressure Testing Fixture With Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screw (1) by hand until special tool 11 7 393 rests on sealing surface.

Tighten down screw (1) by approx. a half to one turn.

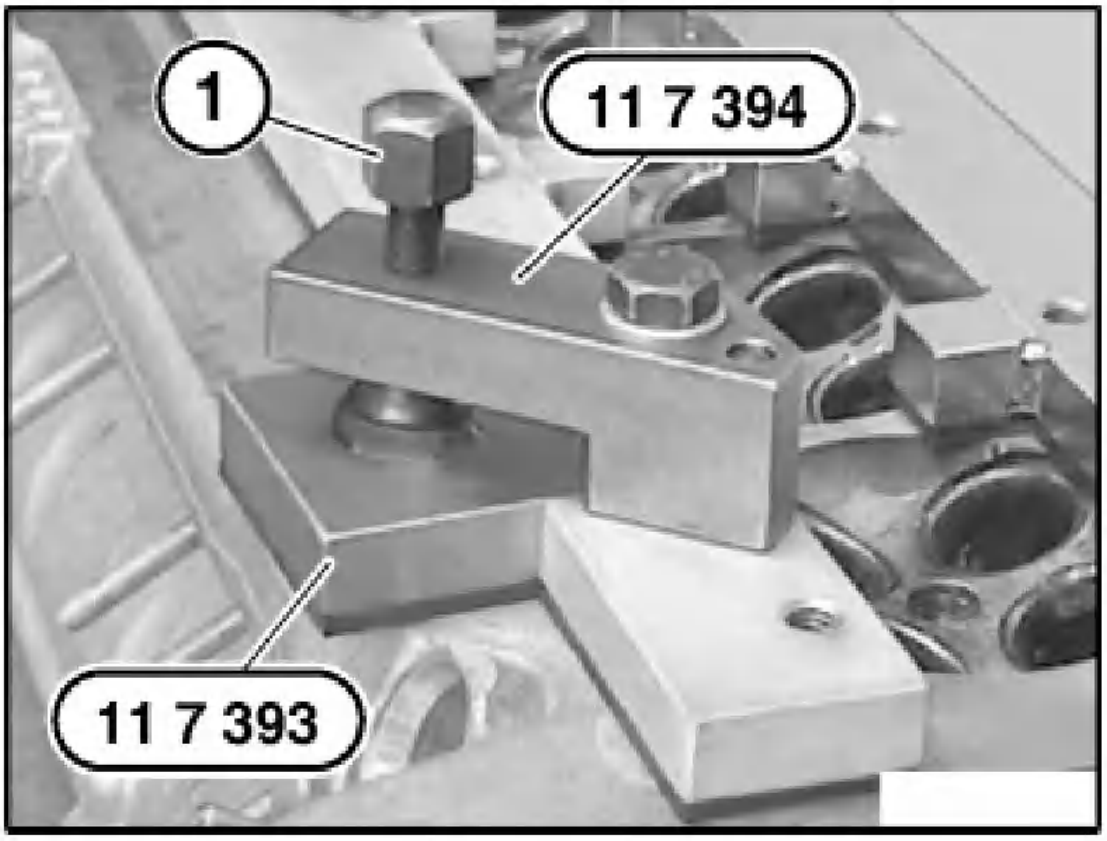



Fig. 45: Fastening Pressure Testing Fixture To Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

Check sealing rings (1) and coat with water as anti-friction coating. Insert special tool 11 7 395 and tighten down.

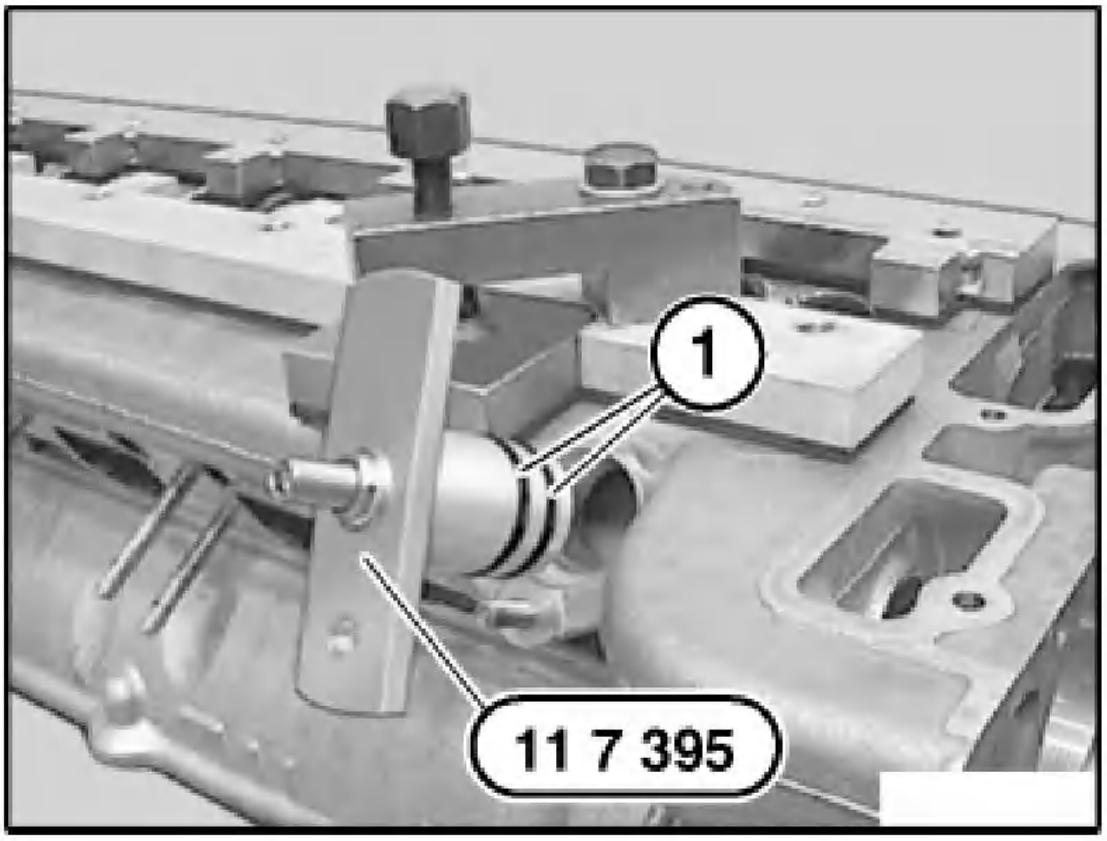



Fig. 46: Checking Sealing Rings
Courtesy of BMW OF NORTH AMERICA, INC.

Seal coolant apertures with special tool kit 11 7 390.

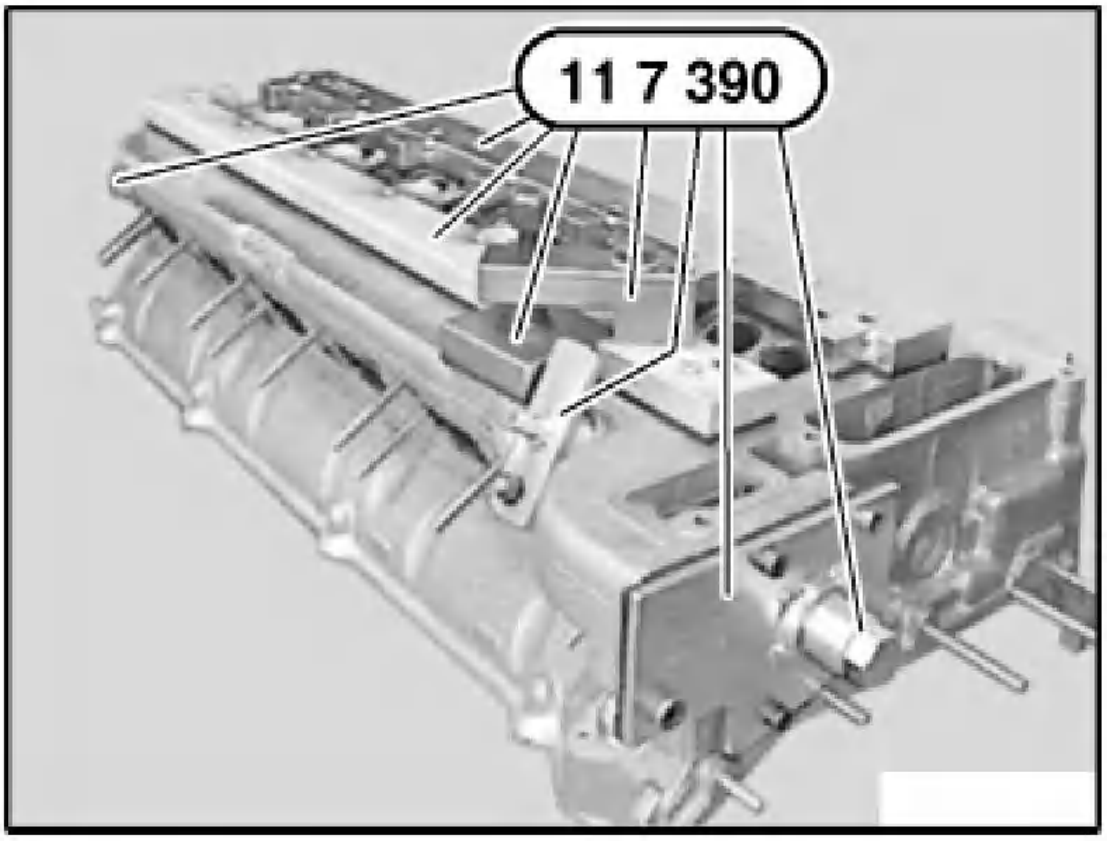



Fig. 47: Sealing Coolant Apertures With Pressure Testing Fixture
Courtesy of BMW OF NORTH AMERICA, INC.

Connect compressed air to special tool 11 7 395.

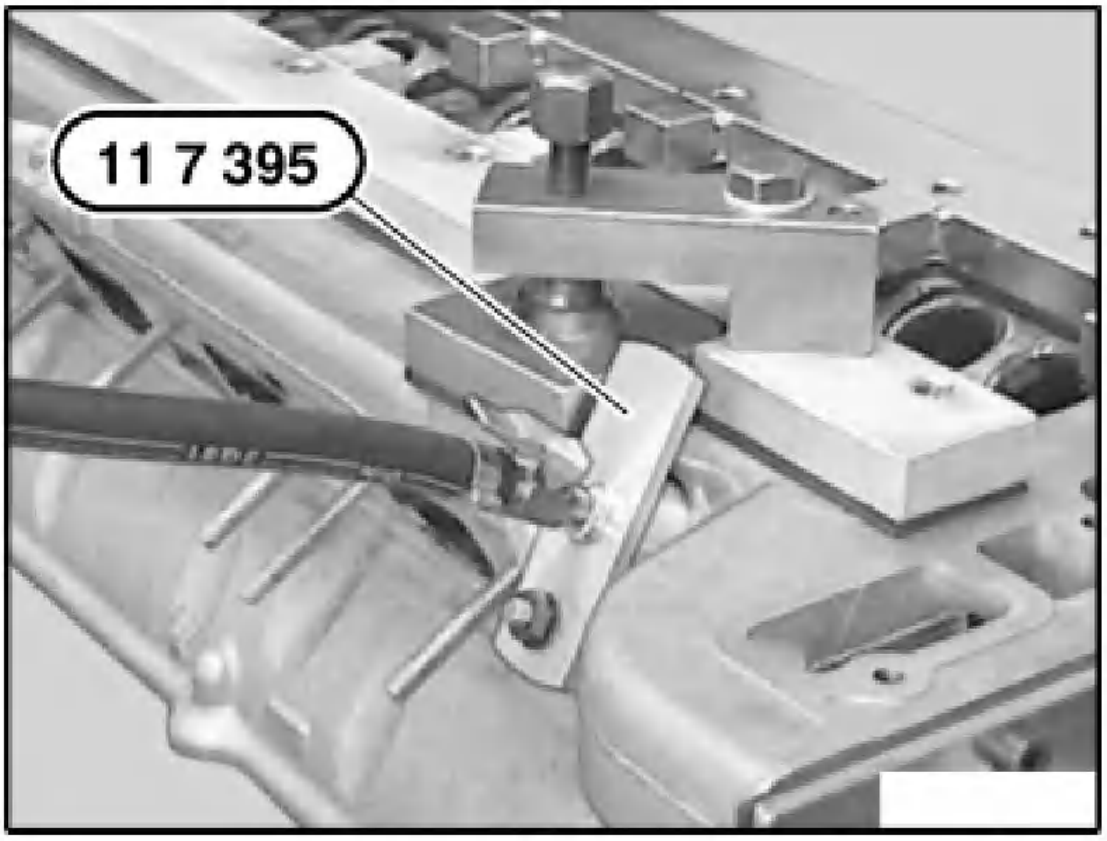



Fig. 48: Connecting Compressed Air To Pressure Testing Fixture
Courtesy of BMW OF NORTH AMERICA, INC.

Immerse cylinder head in a water bath. Inspection pressure 4.5 bar.

Check cylinder head for escaping air (cracks).

NOTE: If necessary, soften the bath water with a cleaning agent.

## OIL SUMP

### 11 13 000 REMOVING AND INSTALLING OIL SUMP (M52 / S52 / M52TU / M54)

NOTE: To remove the oil sump, you must lower the front axle support. There is no need to perform a front axle alignment check.

Remove intake filter housing with air-mass flow sensor.

Remove engine splash guard.

Drain engine oil. Refer to 00 00 250 BMW ENGINE OIL SERVICE INCL. SUPPLEMENTARY SERVICE (M54 / M56) .

Loosen guide tube for dipstick.

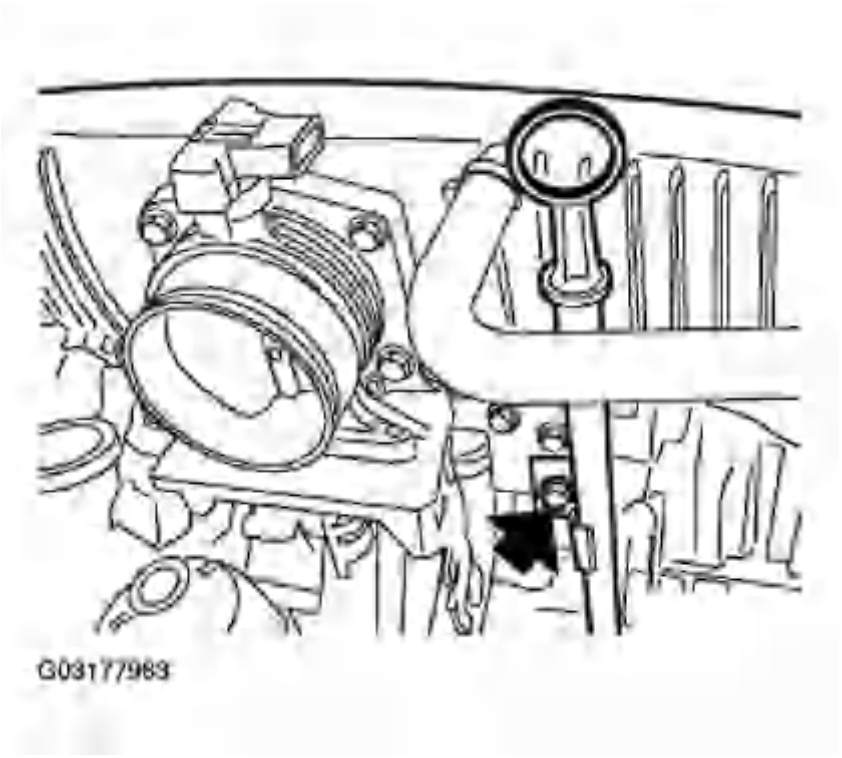



Fig. 49: Loosening Guide Tube For Dipstick
Courtesy of BMW OF NORTH AMERICA, INC.

Remove oil return hose from cyclone oil separator on guide tube for oil dipstick.

Pull out guide tube for oil dipstick.

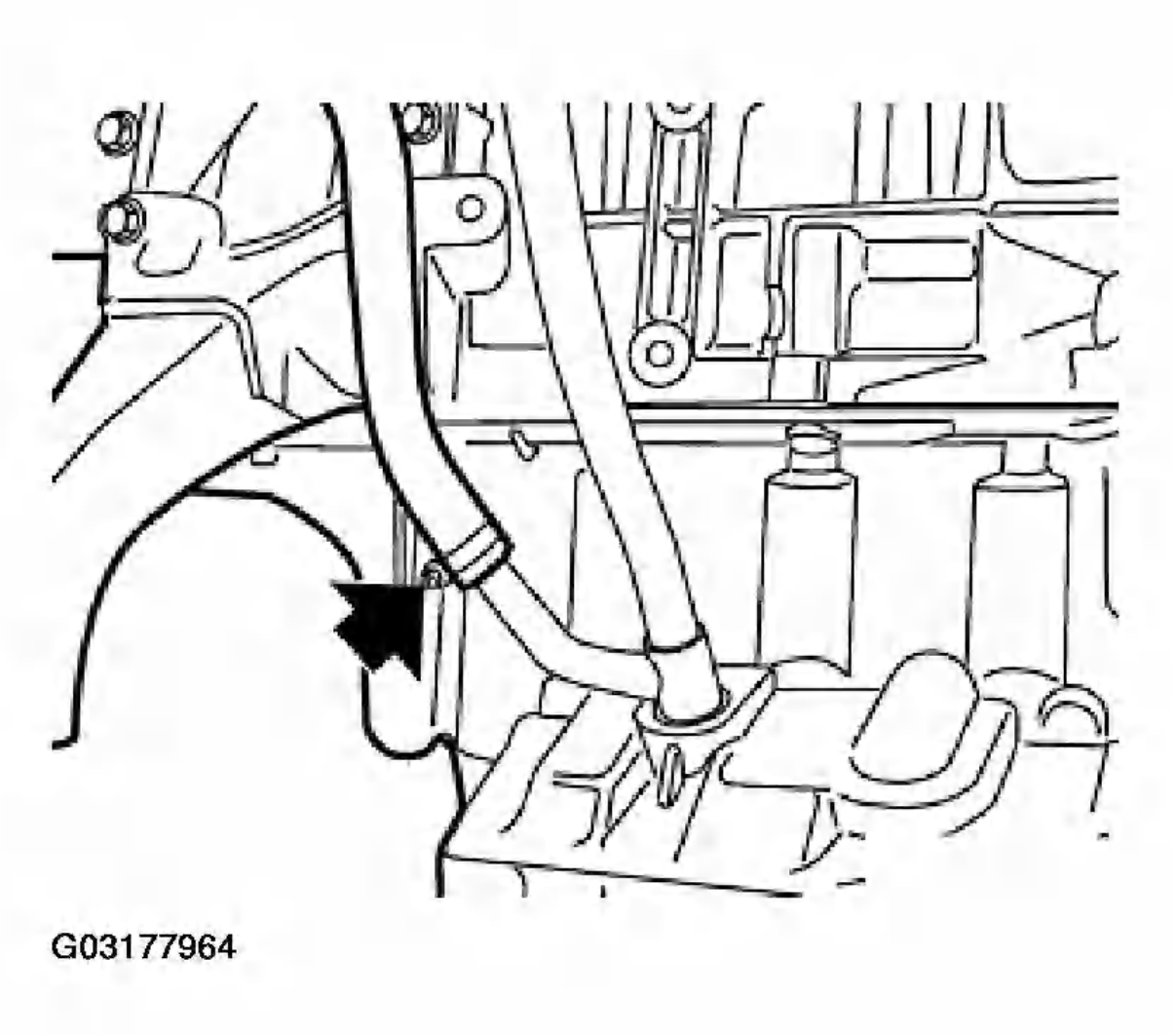



Fig. 50: Removing Oil Return Hose
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace O-ring.

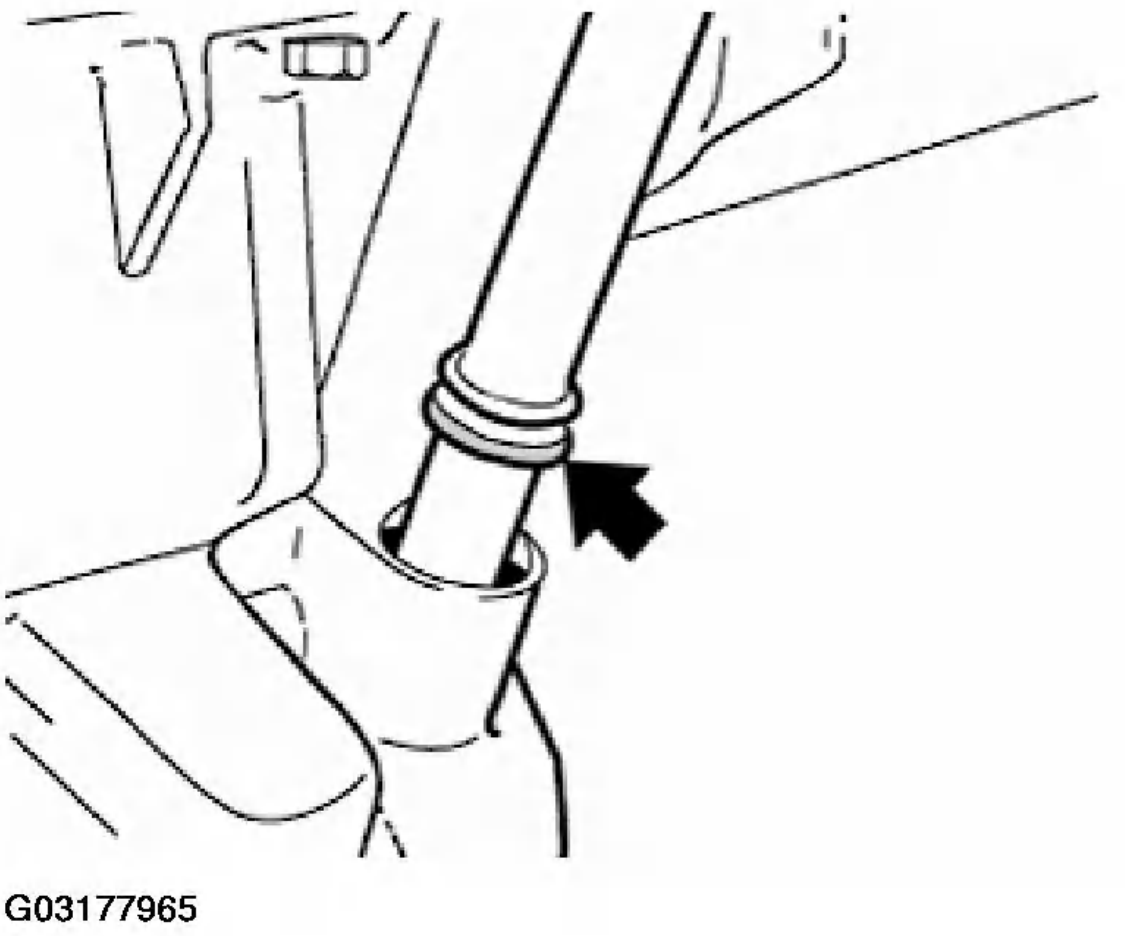



Fig. 51: Locating O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Prepare special tool 00 0 200, consisting of special tool 00 0 201/202/204/206.

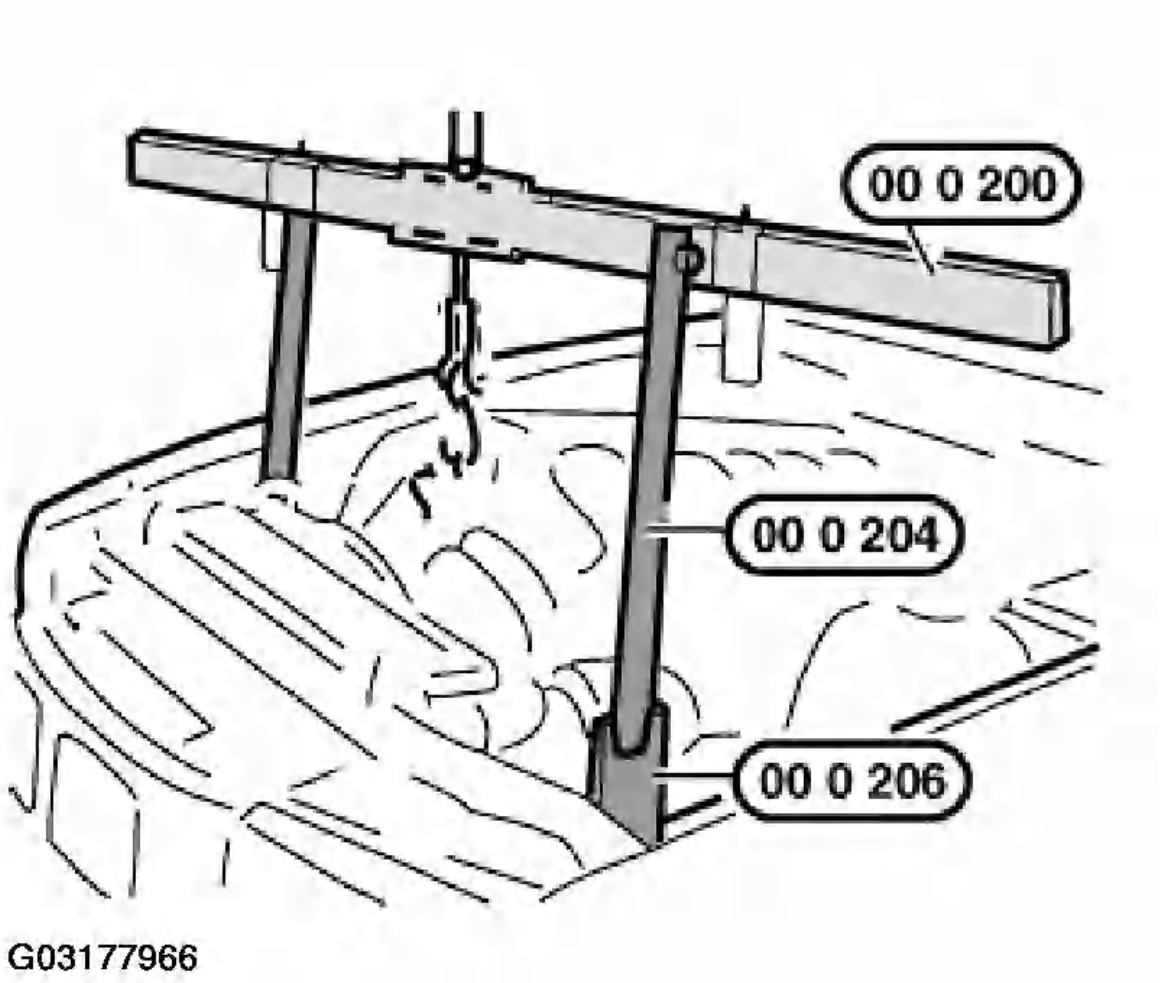



Fig. 52: Preparing Special Tool 00 0 200
Courtesy of BMW OF NORTH AMERICA, INC.

Unclip oil lines for power steering unit from bracket on engine support and place to one side.

Fit special tool 00 0 206 to engine mounting.

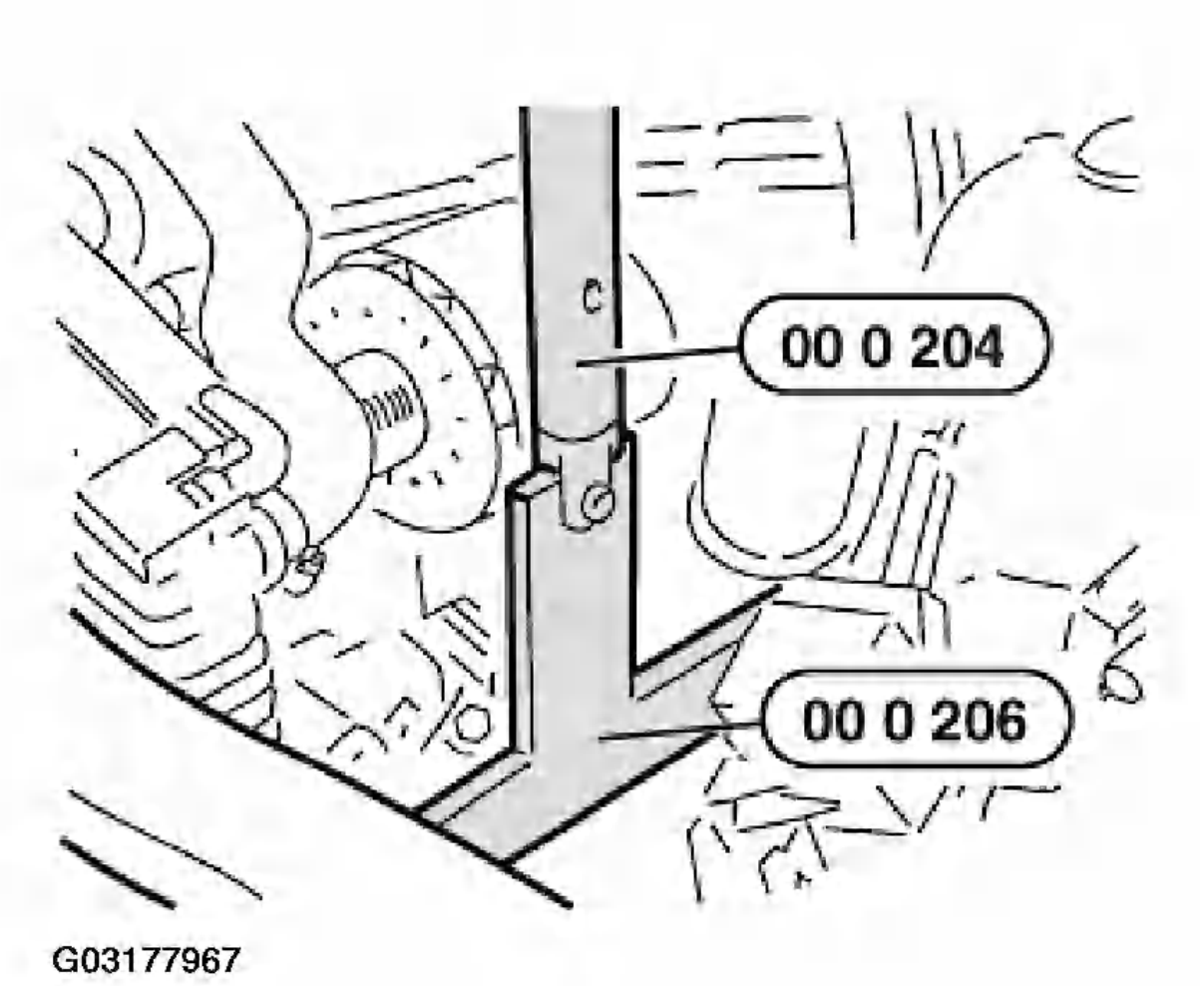



Fig. 53: Fitting Special Tool 00 0 206 To Engine Mounts
Courtesy of BMW OF NORTH AMERICA, INC.

Carefully lift engine approx. 5 mm.

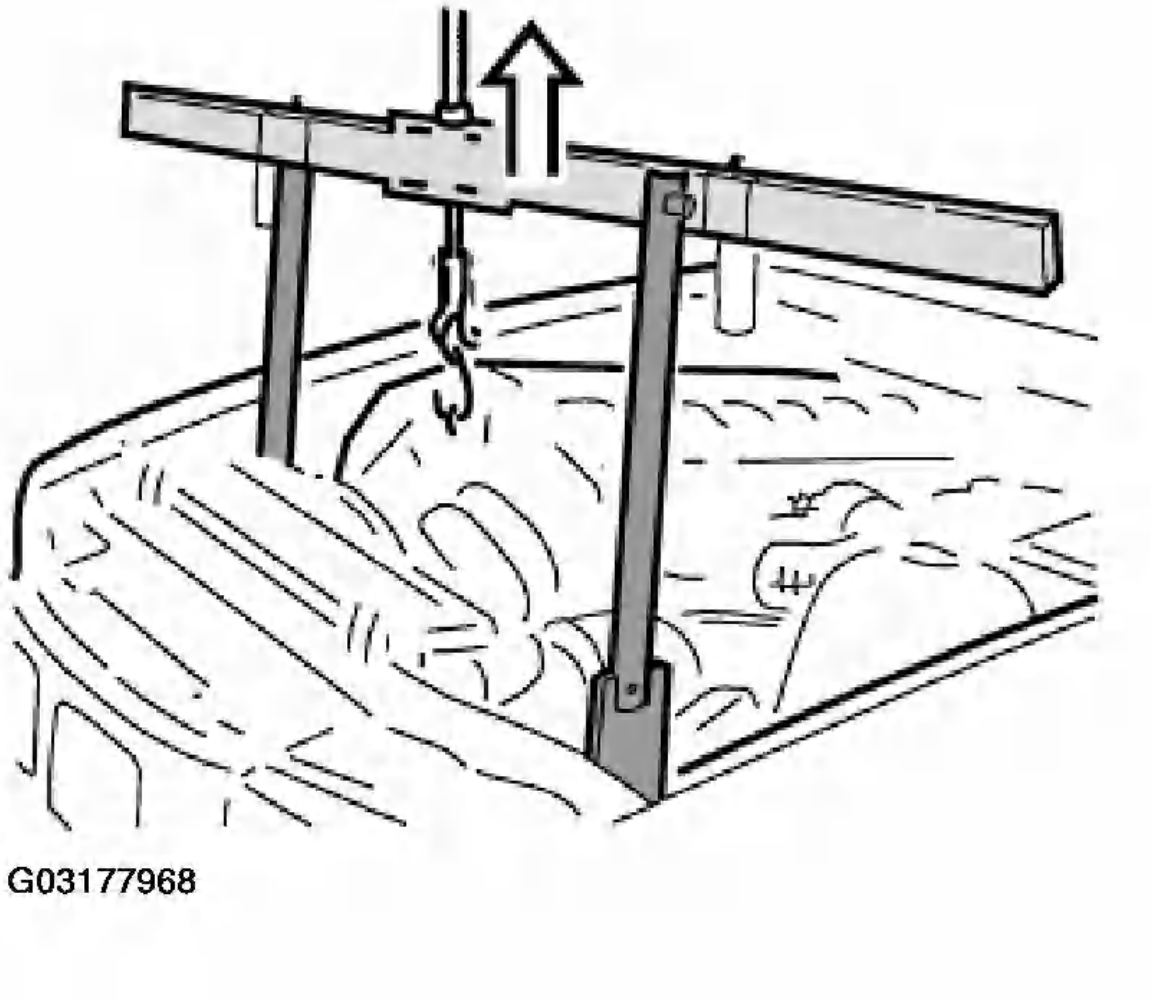



Fig. 54: Lifting Engine
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten steering spindle from steering gear. Refer to POWER STEERING GEAR .

Remove vane pump for power steering unit (lines remain connected).

Drain power steering supply tank and tie back to one side (lines remain connected).

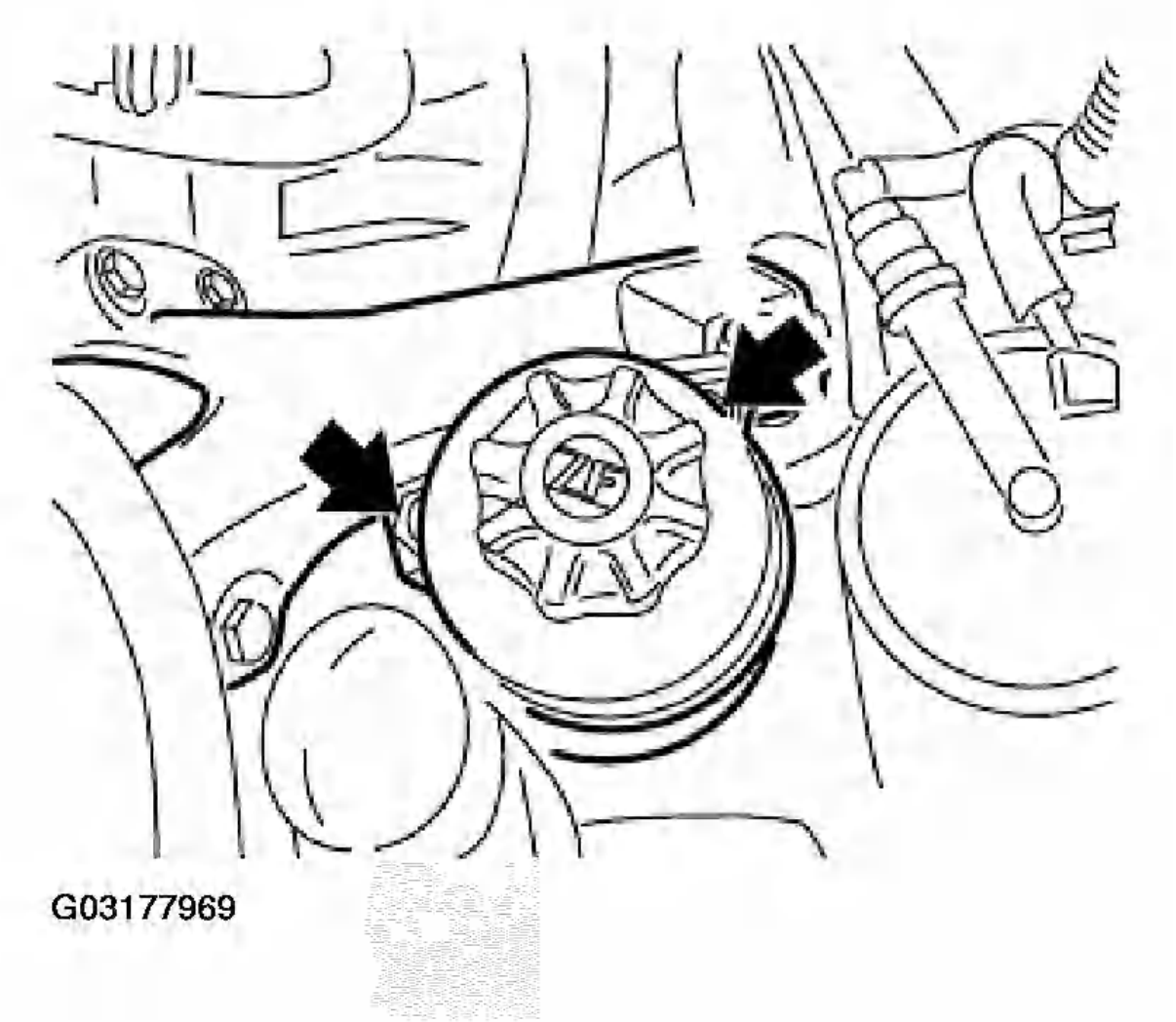



Fig. 55: Identifying Power Steering Supply Tank
Courtesy of BMW OF NORTH AMERICA, INC.

Loosen top and unfasten bottom of left and right engine mounts.

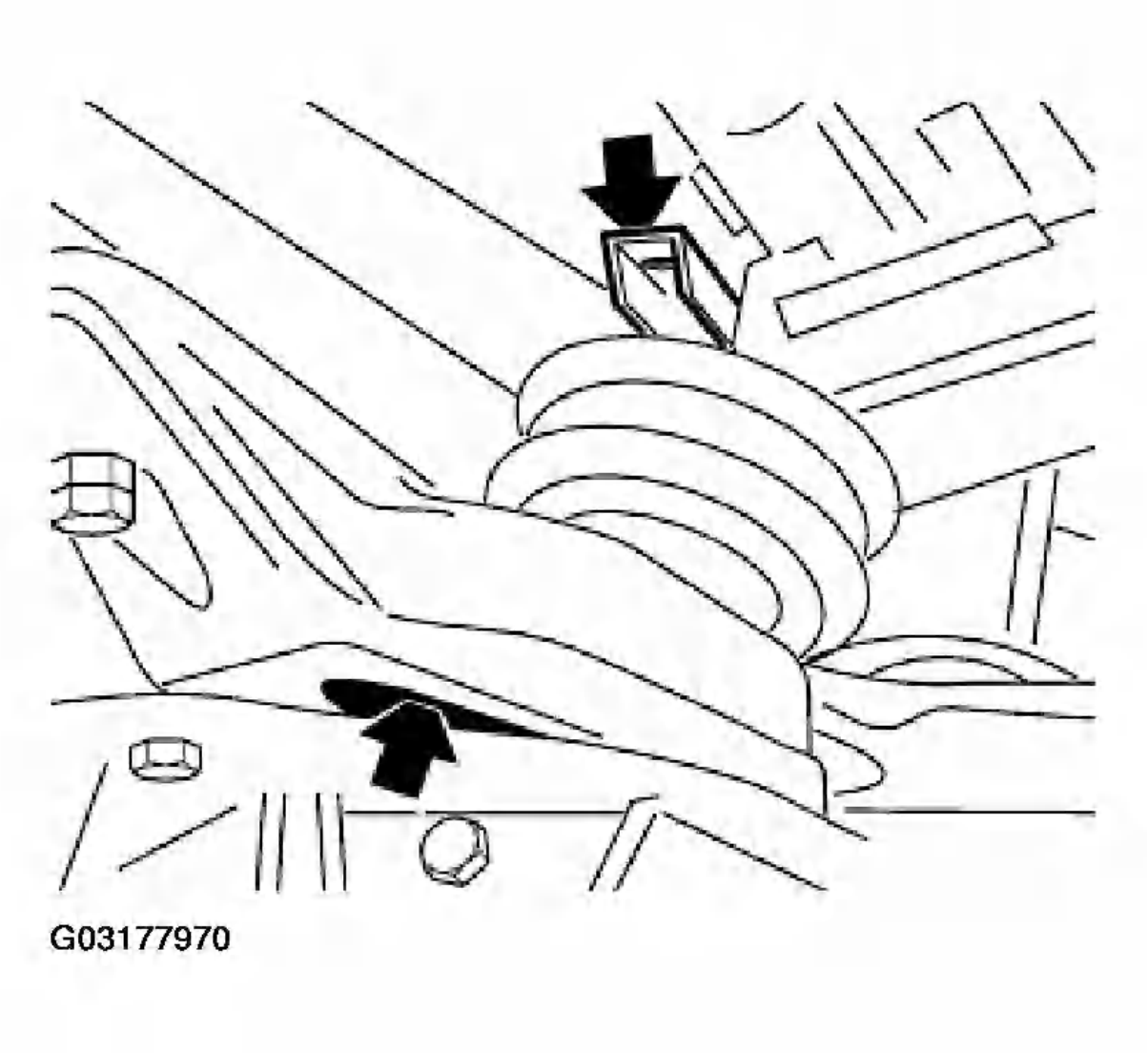



Fig. 56: Identifying Bottom Left And Right Engine Mounts
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten left and right control arm from engine carrier. Unfasten screw connection on front axle support and lower the front axle support. Refer to BALL JOINT .

NOTE: There is no need to detach the steering gear from the front axle support.

Automatic transmission:

Remove oil pipes from oil pan.

Unfasten oil pan screws at transmission and engine ends.

Lower oil pan and pull forwards to remove.

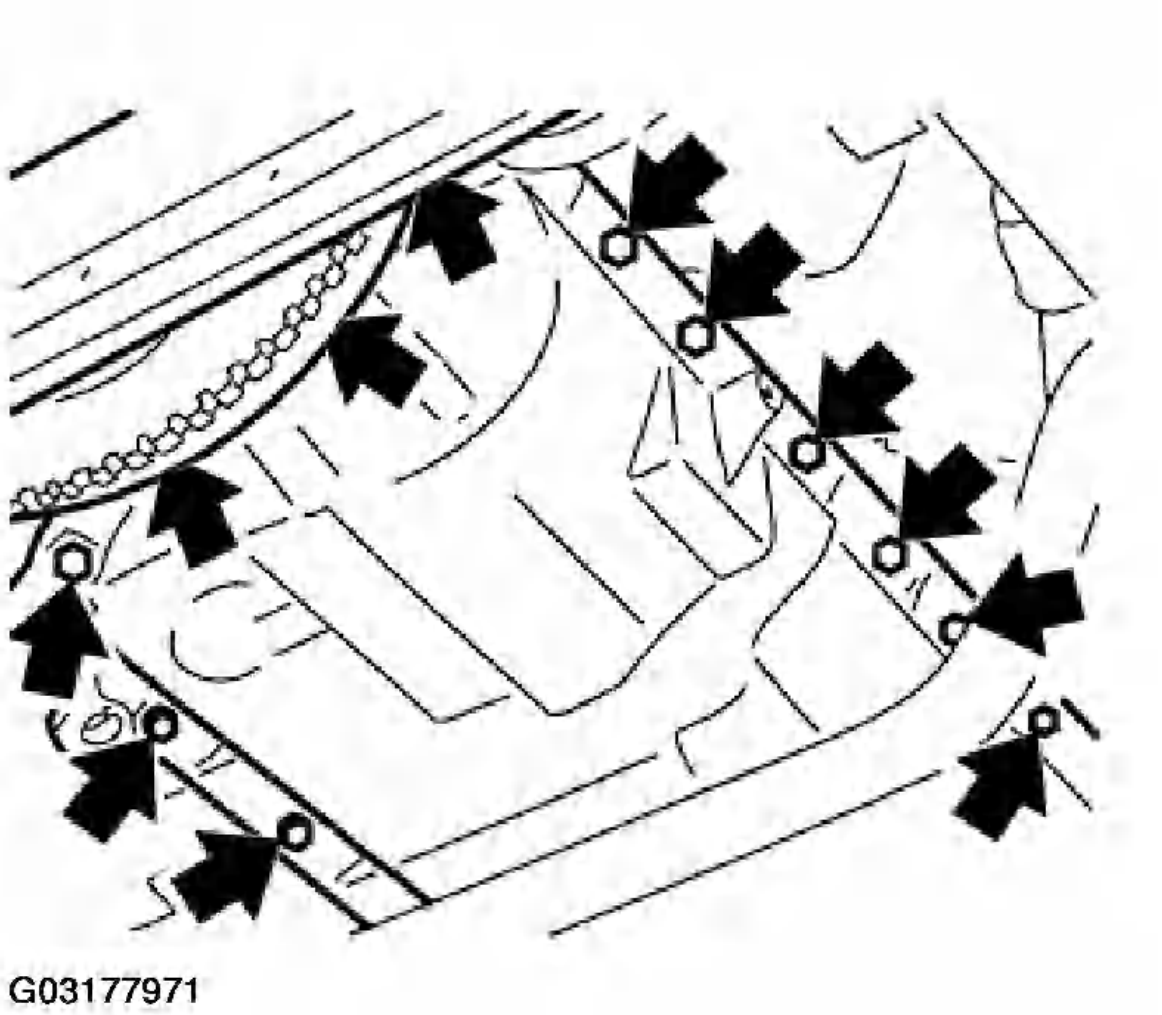



Fig. 57: Unfastening Oil Pan Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Sealing faces clean and free of seal debris.

Apply Drei Bond 1209 sealing compound to area around joint approx. 3 mm wide and 2 mm high.

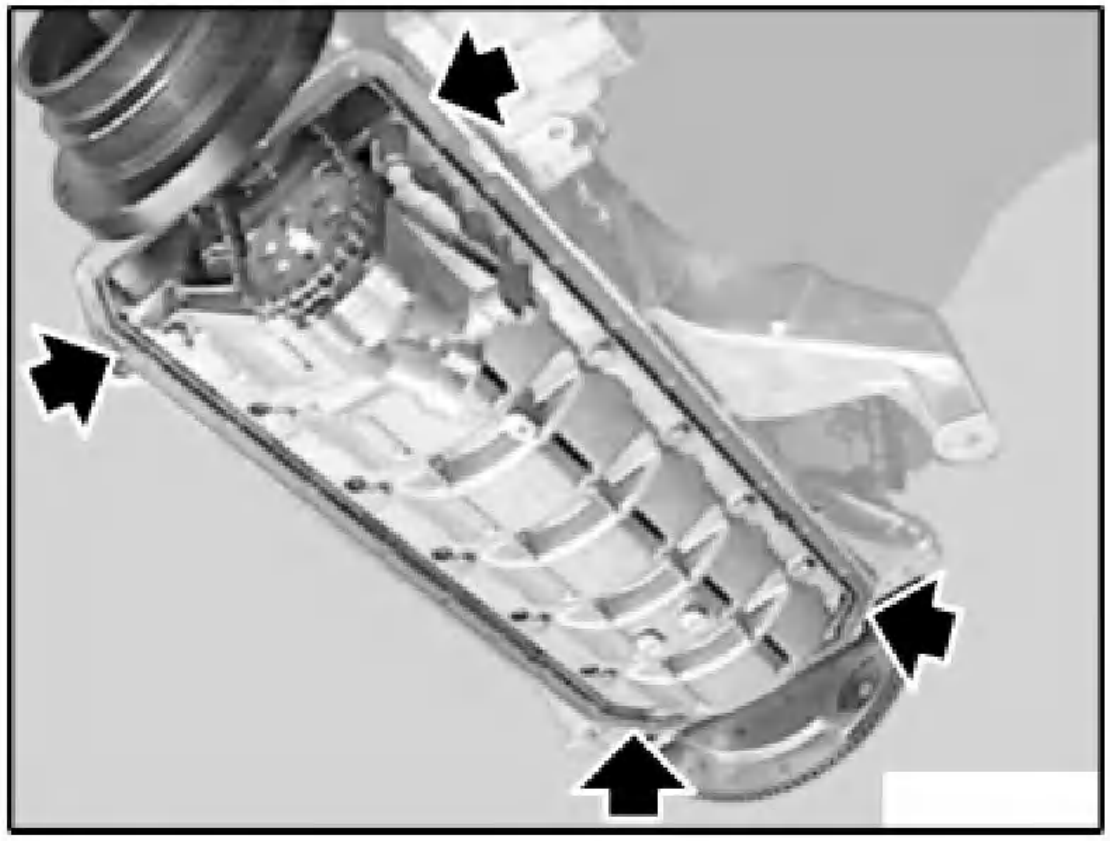



Fig. 58: Identifying Sealing Faces
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

1. Replace gasket.
2. Install oil sump. Refer to 11 13 000 REMOVING AND INSTALLING OIL SUMP (M52 / S52 / M52TU / M54) or 11 13 000 REMOVING AND INSTALLING, SEALING OR REPLACING OIL SUMP (M52TU / M54 / M56).
3. Insert all oil sump screws.
4. Insert screws in transmission end without preload at this stage.
5. Tighten down screws in engine end.
6. Tighten down screws in transmission end.

## 11 13 000 REMOVING AND INSTALLING, SEALING OR REPLACING OIL SUMP (M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 00 0 200
- 00 0 201
- 00 0 202

- 00 0 204
- 00 0 208

NOTE: To remove the oil sump, you must lower the front axle support.

There is no need to perform a front axle alignment check.

Assemble special tool 00 0 200 with special tools 00 0 201 / 00 0 202 / 00 0 204 / 00 0 208 and fit.

Secure special tool 00 0 200 to front suspension eye on engine.

NOTE: The supports (1) of special tool 00 0 208 must rest on the bolt connection of both side walls.

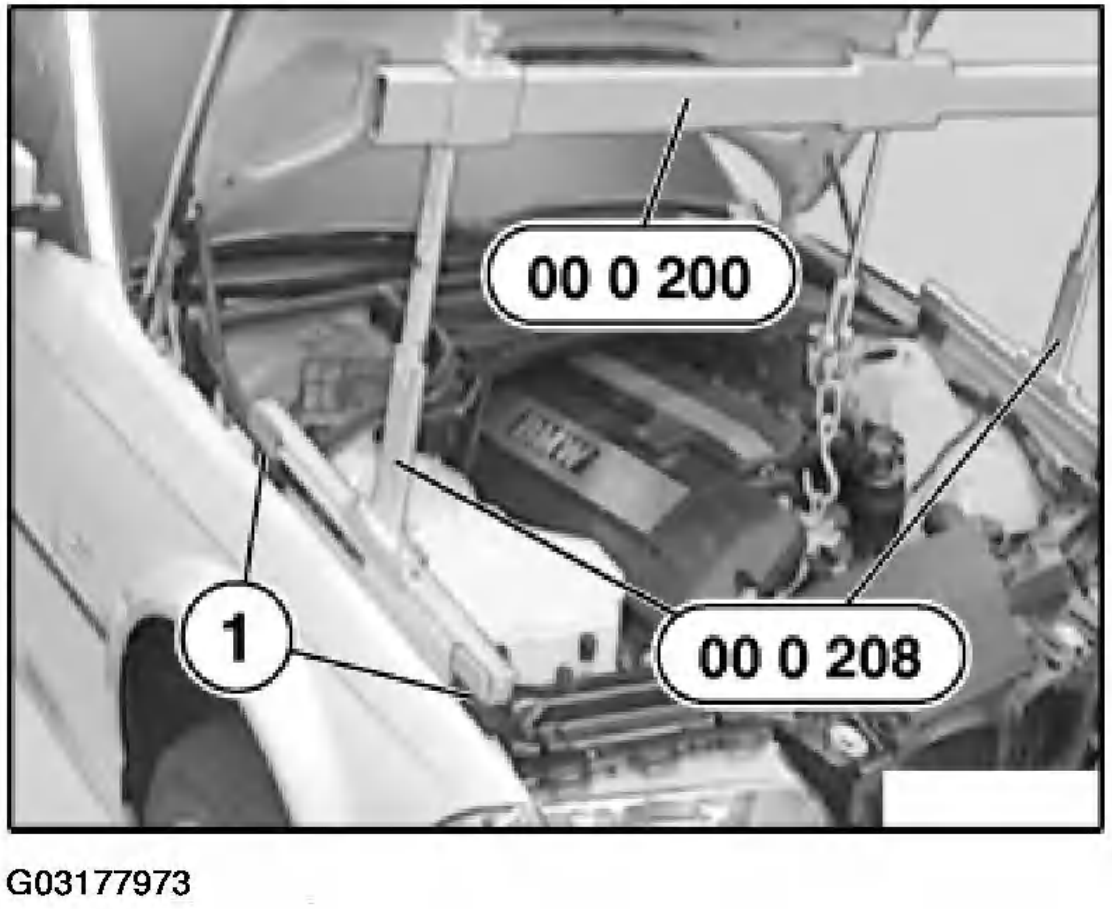



Fig. 59: Identifying Supports Of Cross Member
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten the screws (1 and 2).

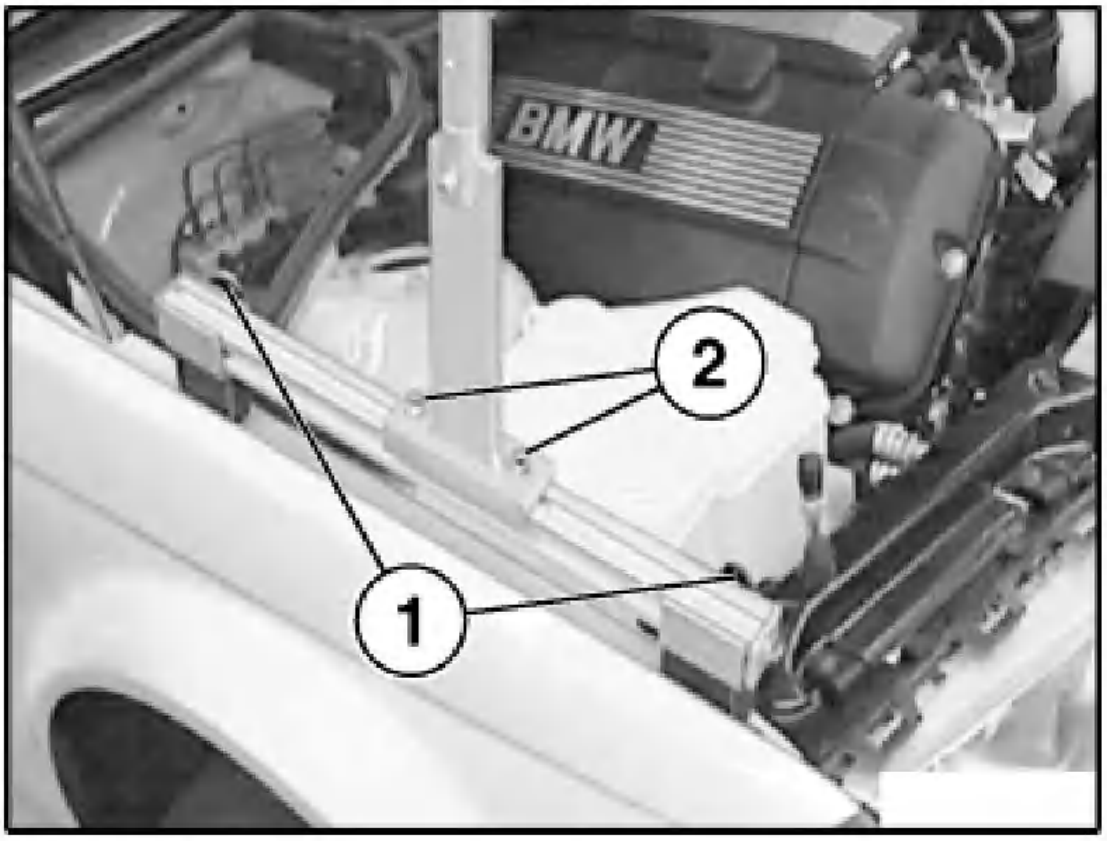



Fig. 60: Tightening Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Raise engine with special tool 00 0 200 approx. 5 mm.




Fig. 61: Raising Engine With Cross Member
Courtesy of BMW OF NORTH AMERICA, INC.

Remove suction filter housing.

Remove engine splash guard.

Drain engine oil. Refer to 00 00 250 BMW ENGINE OIL SERVICE INCL. SUPPLEMENTARY SERVICE (M54 / M56) .

On vehicles with automatic transmission:

Disconnect oil lines from automatic transmission and from oil pan.

Release guide tube for dipstick.

NOTE: M52 TU and M54 only.

Detach return hose from cyclone oil separator on oil dipstick guide tube.

Remove oil dipstick guide tube upwards.

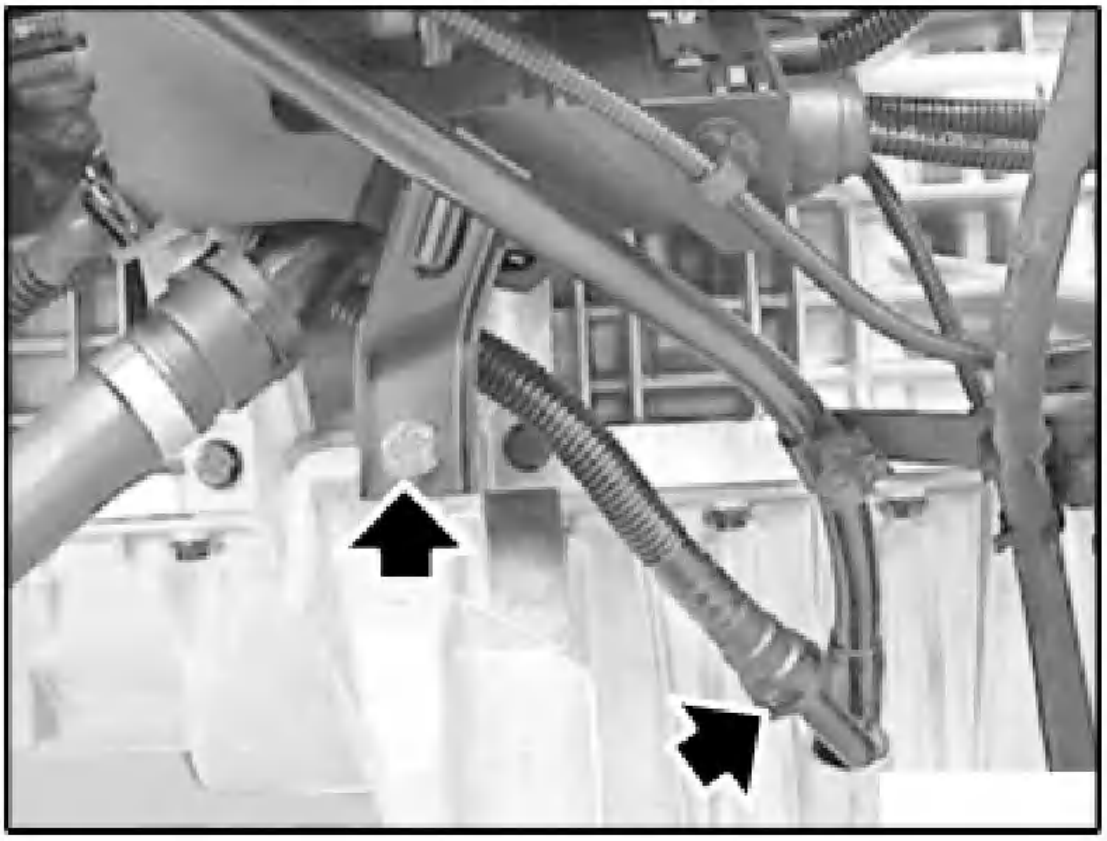



Fig. 62: Detaching Oil Return Hose
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace O-ring.

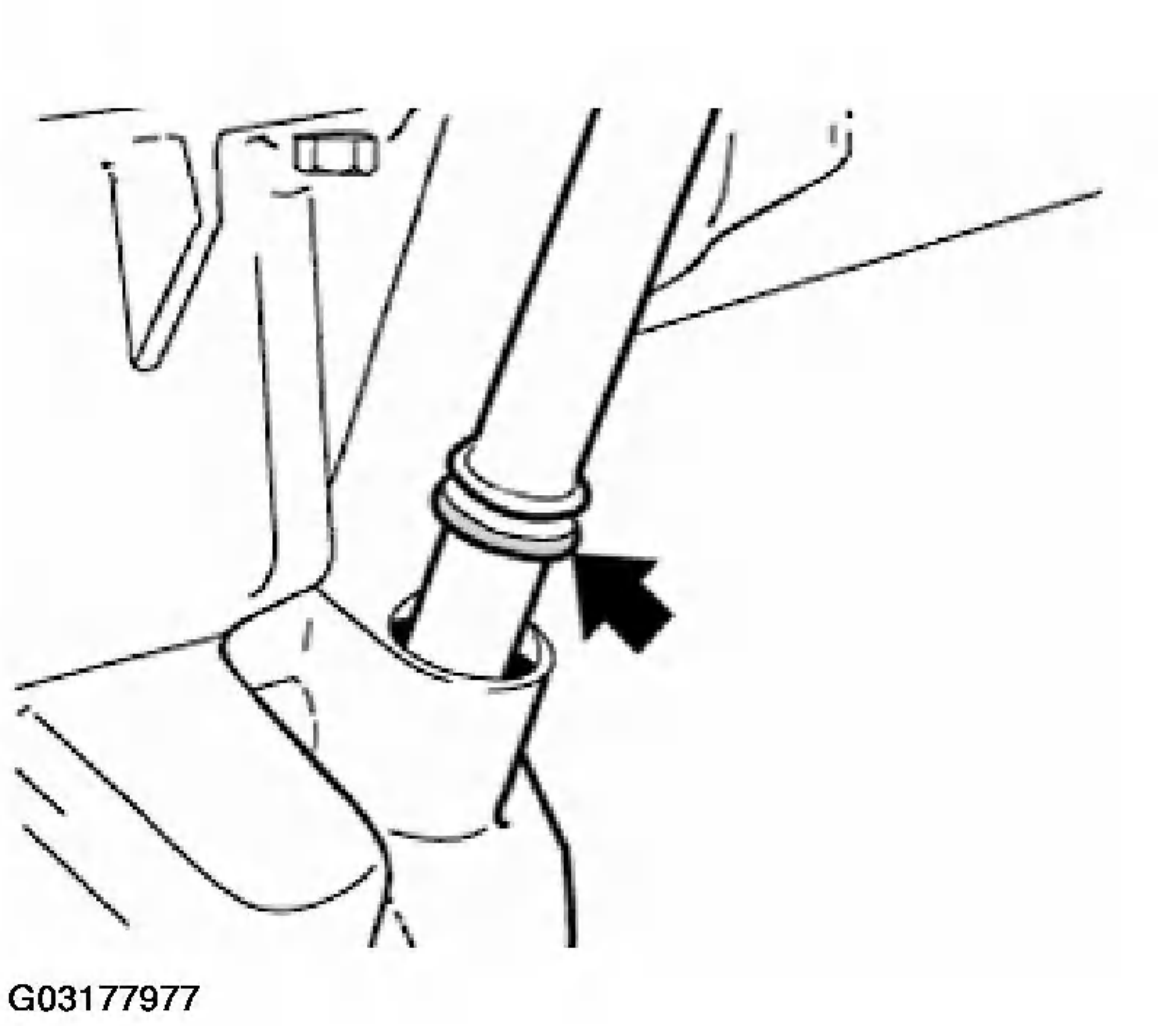



Fig. 63: Locating O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Remove front end reinforcement.

Detach steering spindle from steering gear. Refer to POWER STEERING GEAR .

Remove vane pump for power steering unit (lines remain connected).

Disconnect plug connection to oil level sensor.

Loosen top and unfasten bottom of left and right engine mounts.

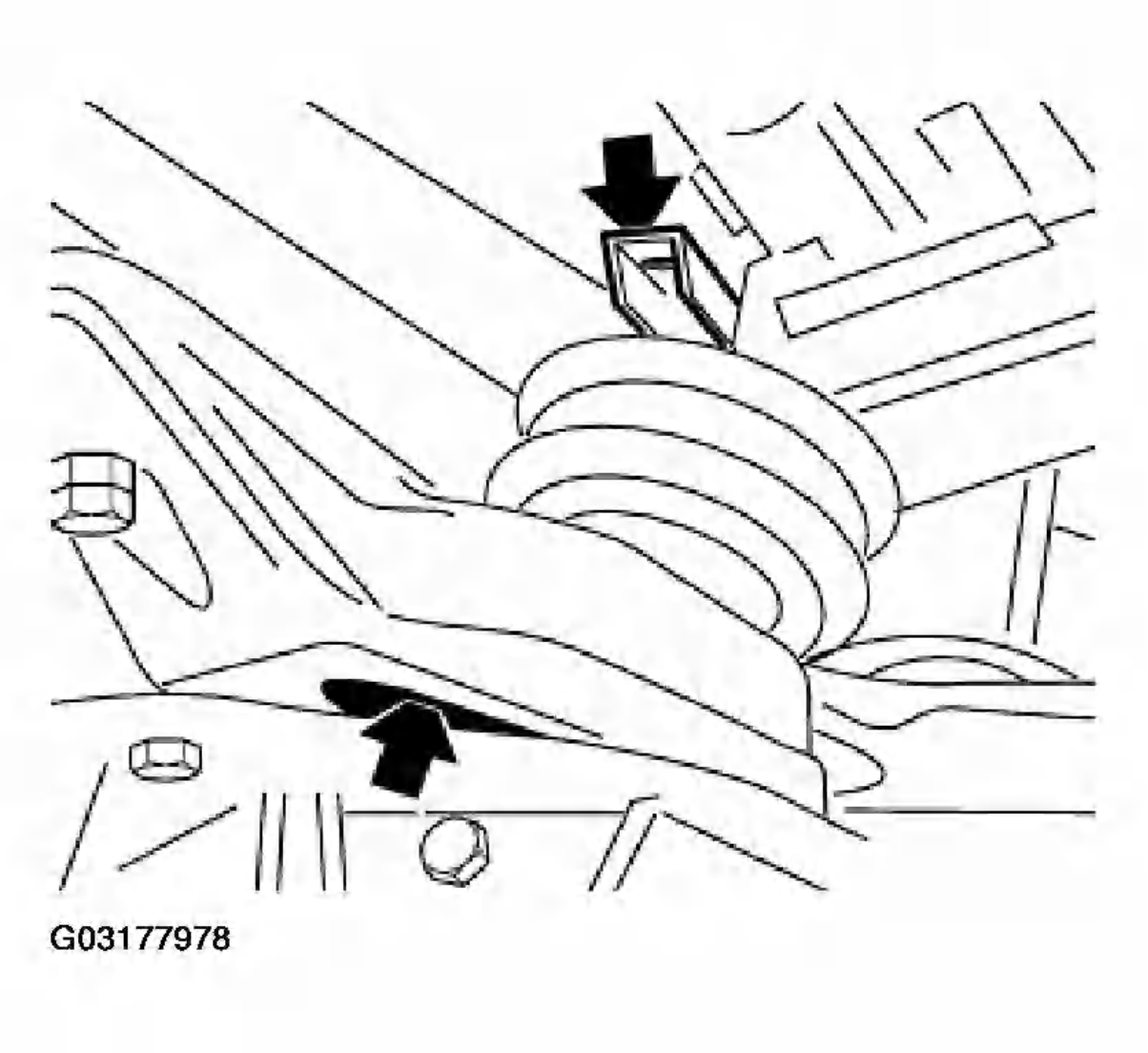



Fig. 64: Loosening Top And Unfastening Bottom Of Left And Right Engine Mounts
Courtesy of BMW OF NORTH AMERICA, INC.

Detach brackets for left and right control arms from engine carrier. Release retaining brackets for left and right stabilizer bars. Unfasten screw connection on front axle support and lower the front axle support.

These operations are described in the work step Replacing front axle support.

NOTE: There is no need to detach the steering gear from the front axle support.

Unfasten oil sump screws at transmission and engine ends.

Lower and remove oil sump.

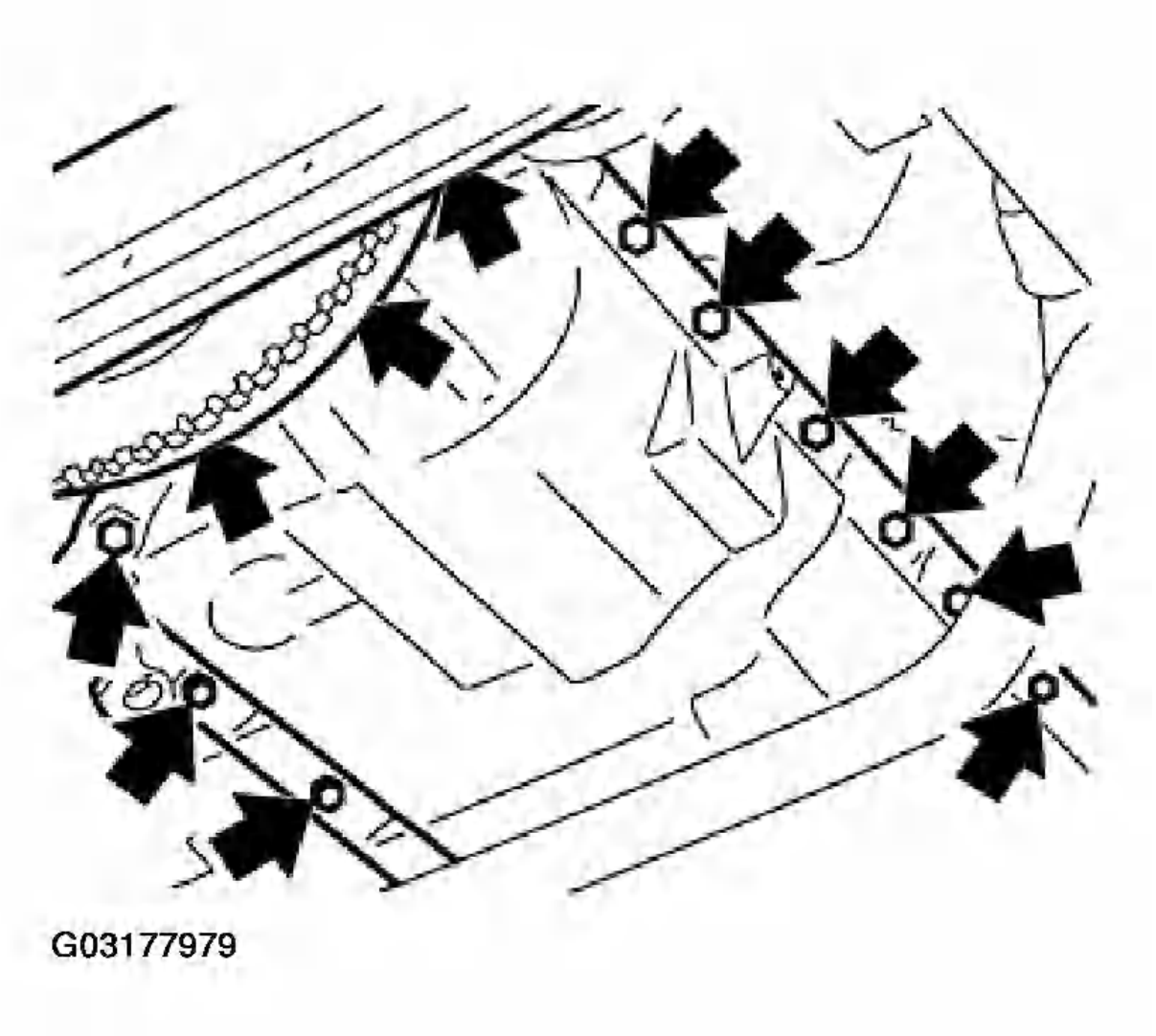



Fig. 65: Unfastening Oil Sump Screws At Transmission And Engine Ends
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Sealing faces clean and free of seal debris.

Apply approx. 3 mm wide, 2 mm high coat of Drei Bond 1209 sealing agent to the area around seams.

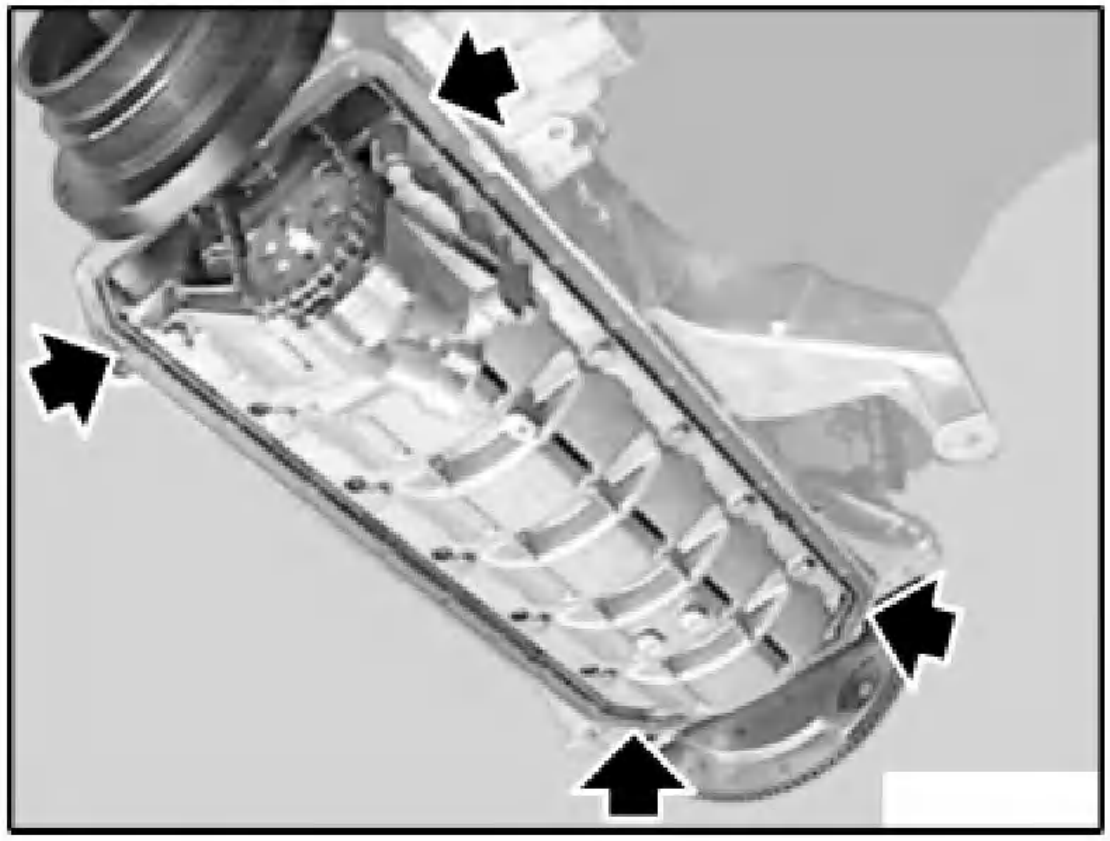



Fig. 66: Identifying Sealing Faces
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

1. Replace gasket
2. Install oil sump.
3. Insert all oil sump screws.
4. Insert screws in transmission end without preload at this stage.
5. Tighten down screws in engine end.
6. Tighten down screws in transmission end.

## HOUSING COVER

### 11 14 110 REMOVING AND INSTALLING LOWER TIMING CASE COVER (M52 / S52 / M52TU / M54)

Remove VANOS adjustment unit. Refer to 11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56).

Remove coolant thermostat. Refer to 11 53 000 REMOVING AND INSTALLING/REPLACING COOLANT THERMOSTAT (M52TU / M54 / M56).

Remove alternator drive belt and drive belt tensioner.

Brace pulley for water pump with drive belt and unfasten screws.

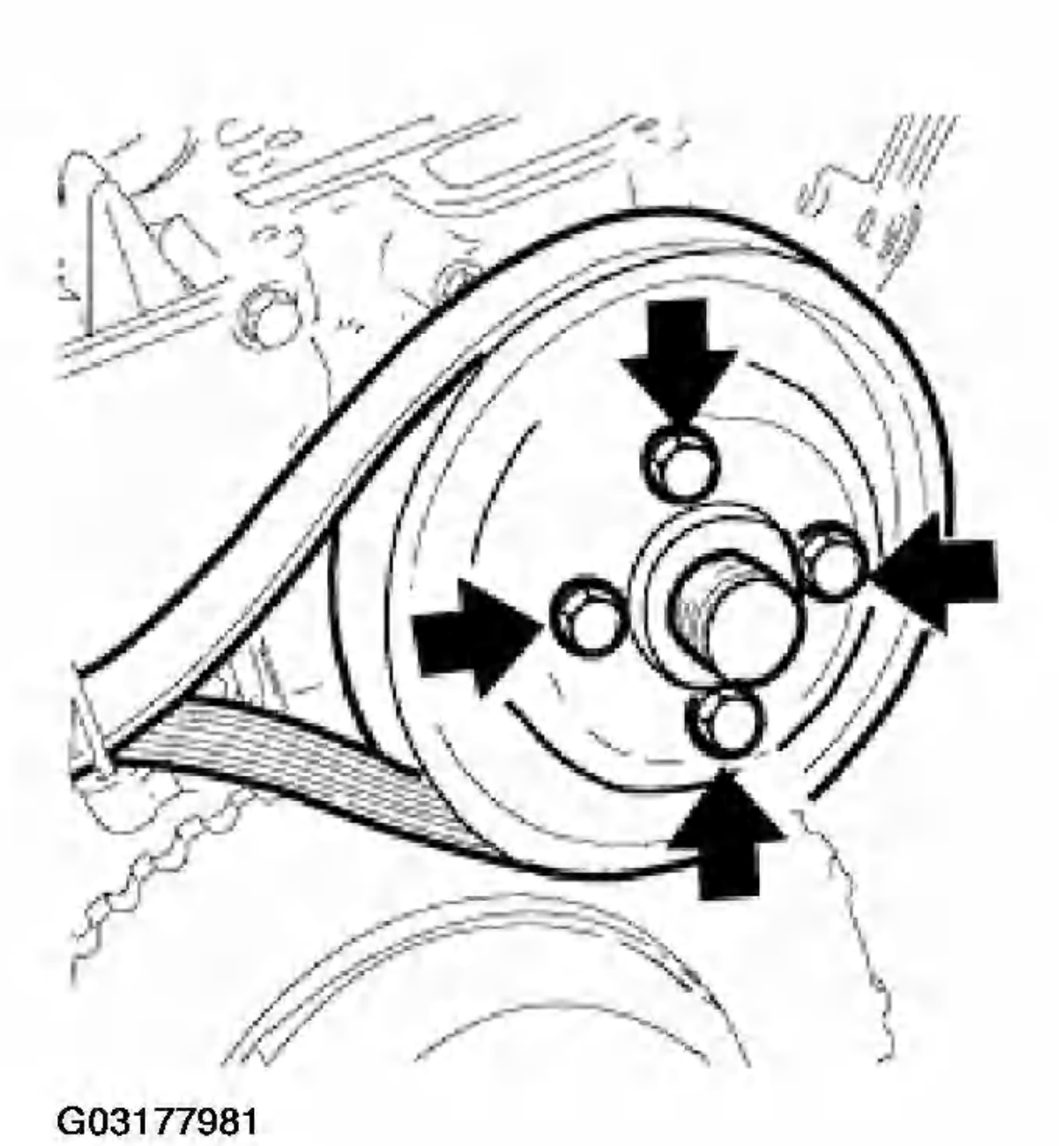



Fig. 67: Identifying Pulley Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Remove vibration damper. Refer to 11 23 010 REMOVING AND INSTALLING OR REPLACING VIBRATION DAMPER (M52TU / M54 / M56).

Version where vibration damper and hub are two parts: Remove hub for vibration damper.

Remove oil sump.11 13 000 REMOVING AND INSTALLING OIL SUMP (M52 / S52 / M52TU / M54) or 11 13 000 REMOVING AND INSTALLING, SEALING OR REPLACING OIL SUMP (M52TU / M54 / M56).

Drive out dowel pins from timing case cover towards rear.

(Mandrel diameter less than 5 mm)

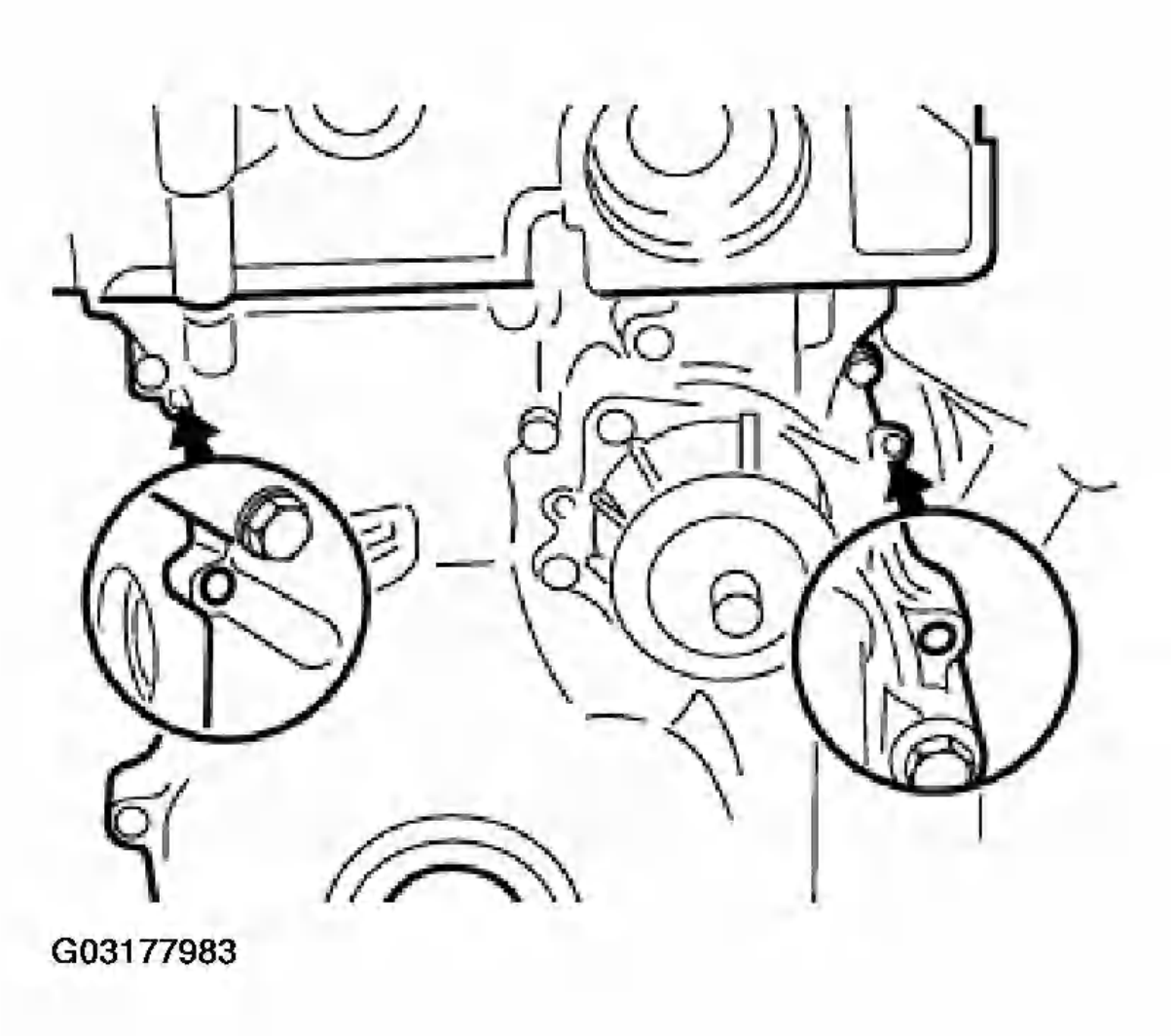



Fig. 68: Driving Out Dowel Pins From Timing Case Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew timing case cover to cylinder head bolts.

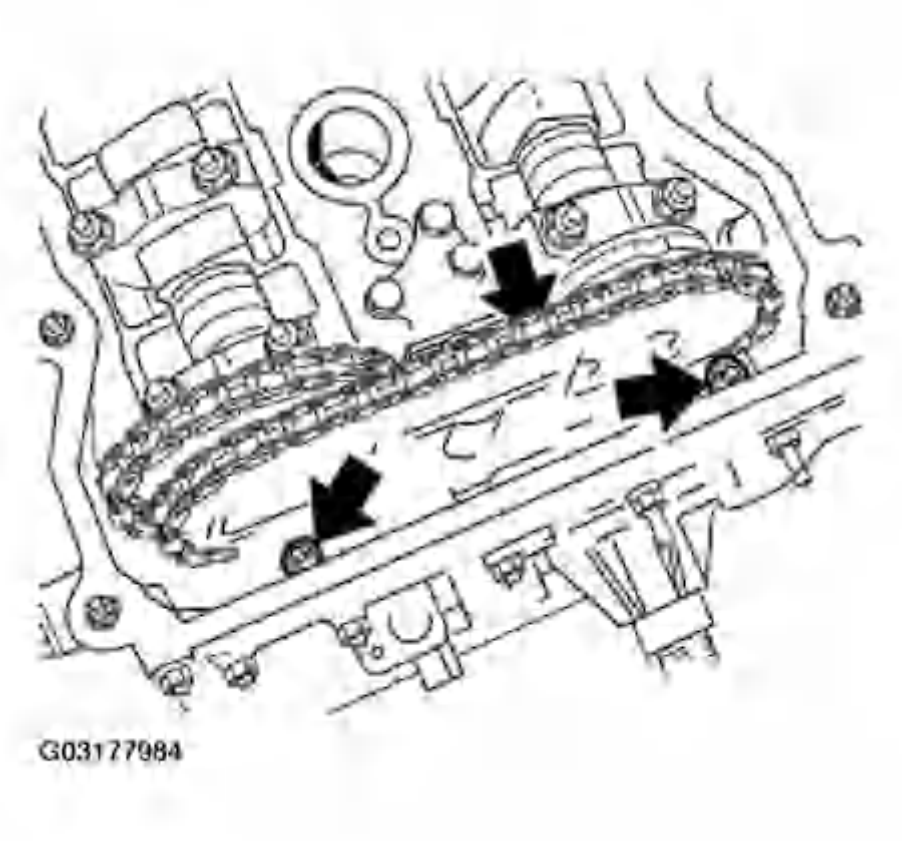



Fig. 69: Removing Timing Case Cover To Cylinder Head Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws and remove timing case cover.

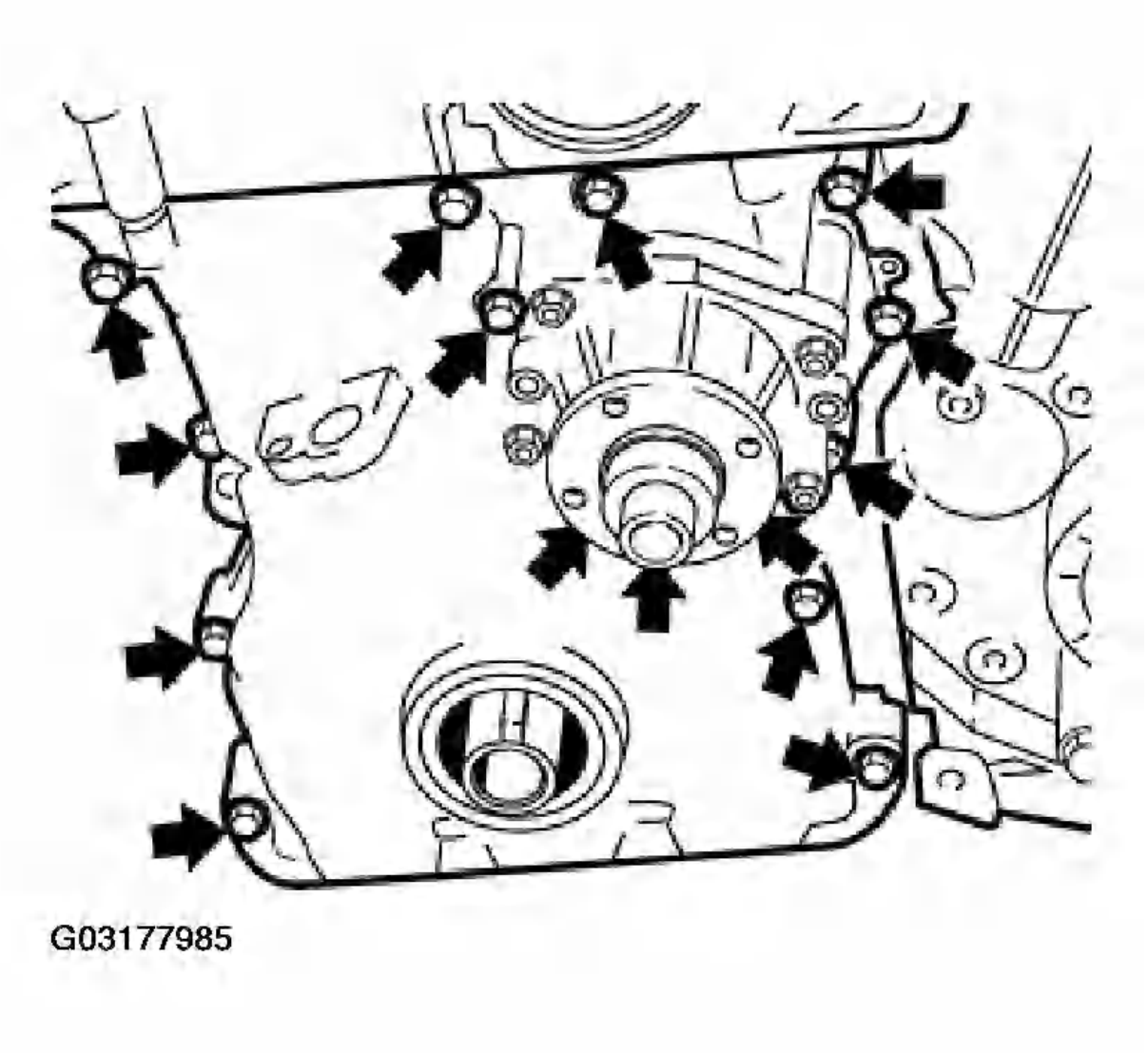



Fig. 70: Removing Timing Case Cover And Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Check cylinder head gasket for damage; if necessary, remove cylinder head and replace cylinder head gasket.

Installation:

Clean sealing surfaces.

Drive alignment pins into timing case cover until they protrude approx. 2 to 3 mm.

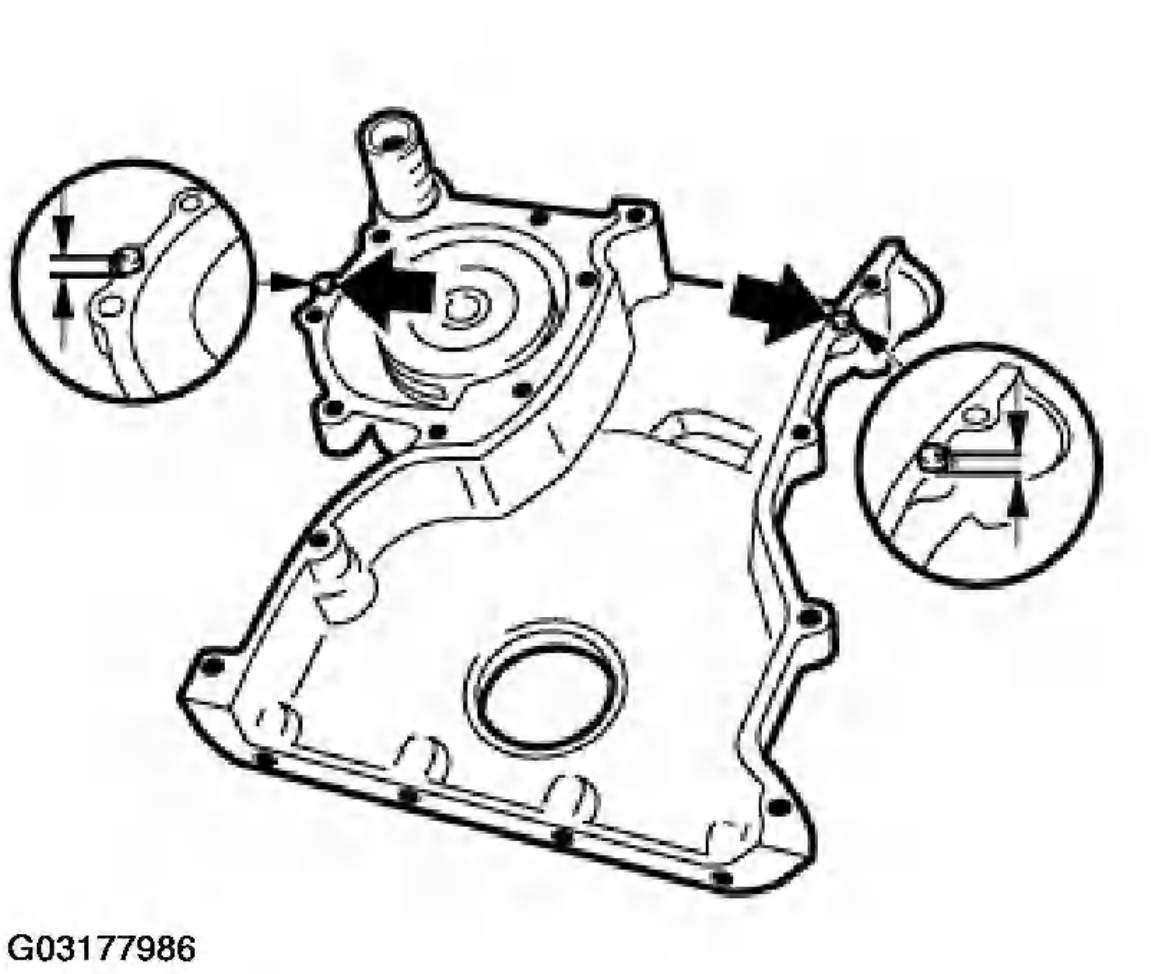



Fig. 71: Installing Alignment Pins Into Timing Case Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Secure new seals to timing case cover with a little grease.

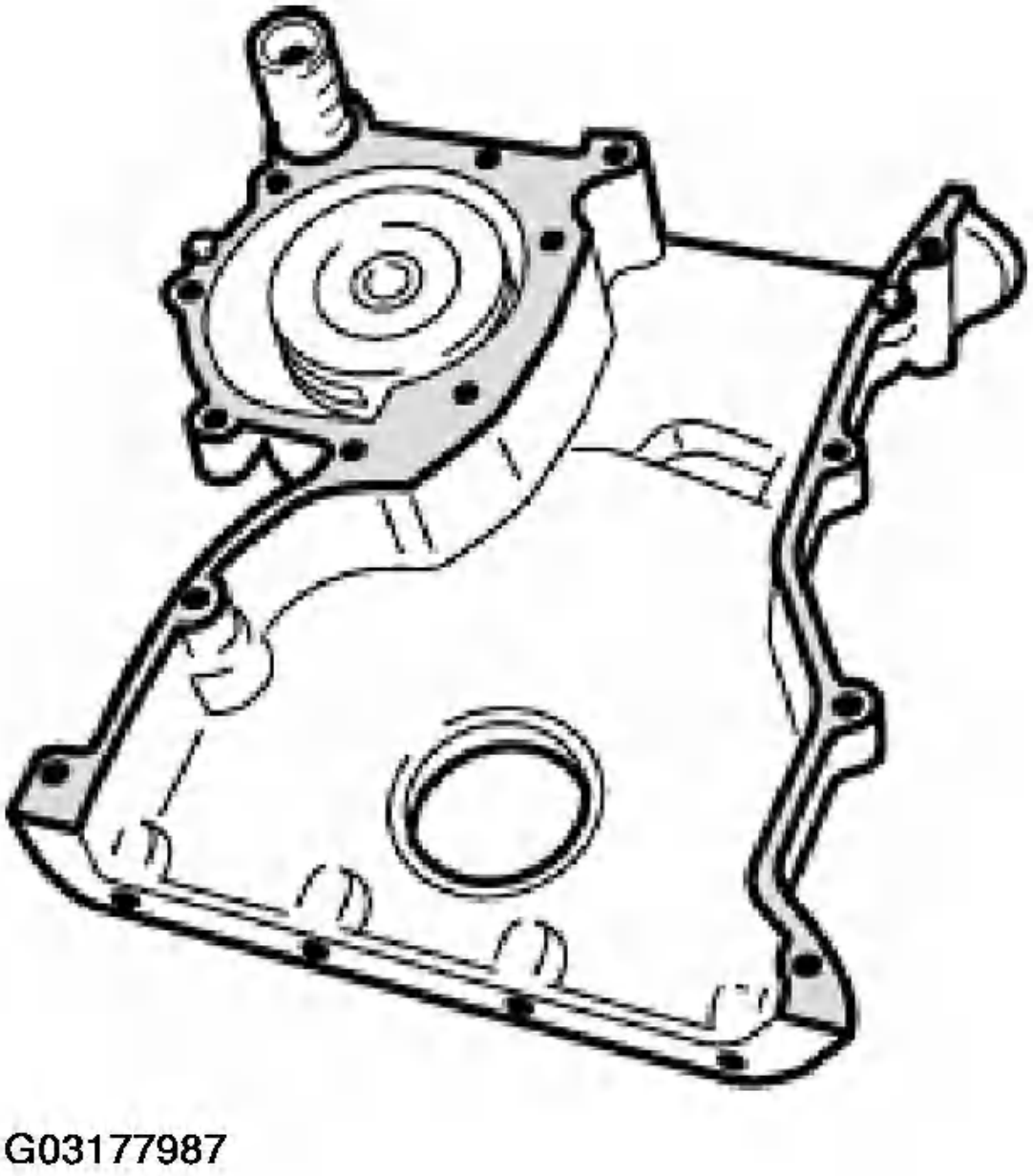



Fig. 72: Securing Seals To Timing Case Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Sealing faces clean and free of seal debris.

Apply Drei Bond 1209 sealing compound at following points:

- A bead at the transitions to the cylinder head gasket on the left and right.
- Thinly and evenly to the entire sealing face of the timing case cover to the cylinder head gasket.

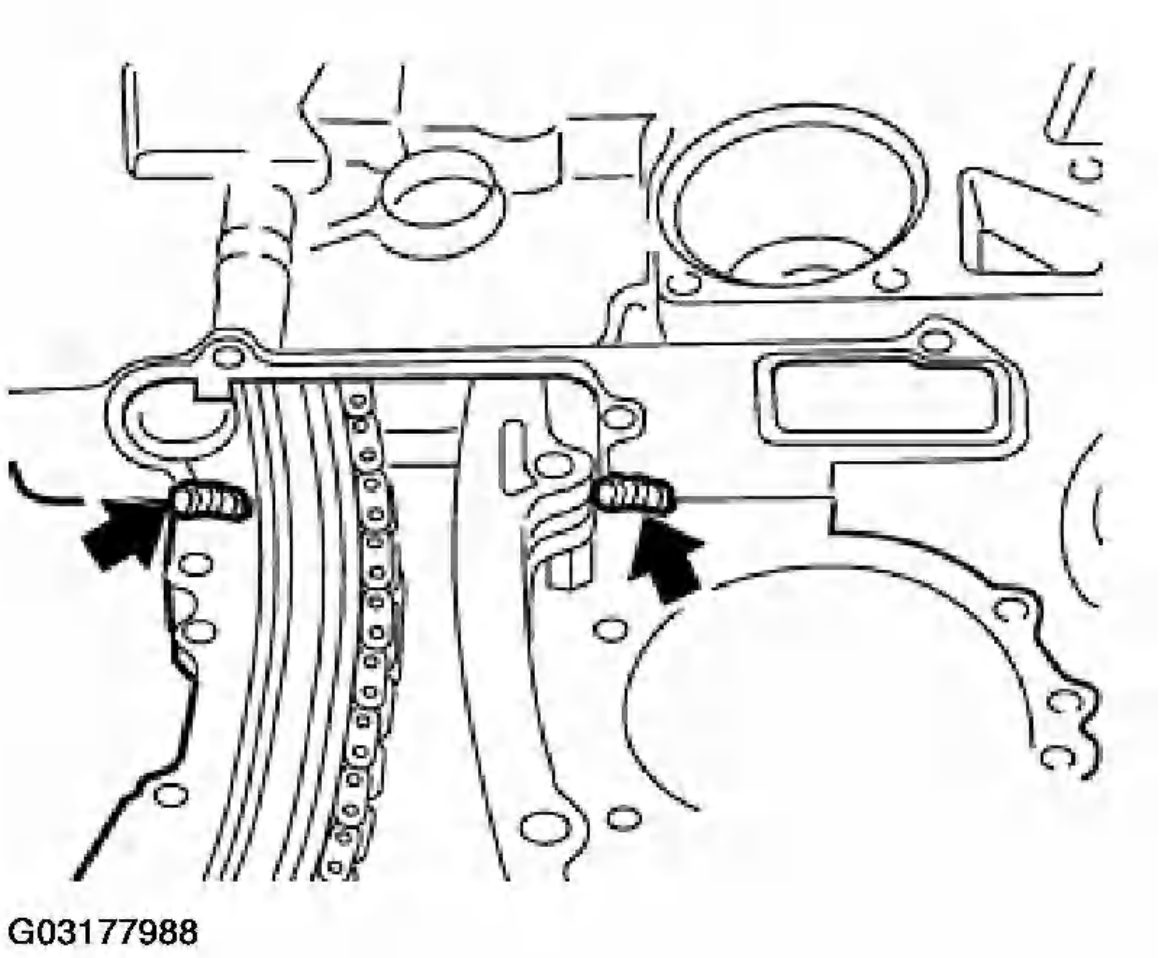



Fig. 73: Applying Sealant To Sides Of Cylinder Head Gasket
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Install timing case cover, insert all screws and initially tighten to approx. 5 Nm.

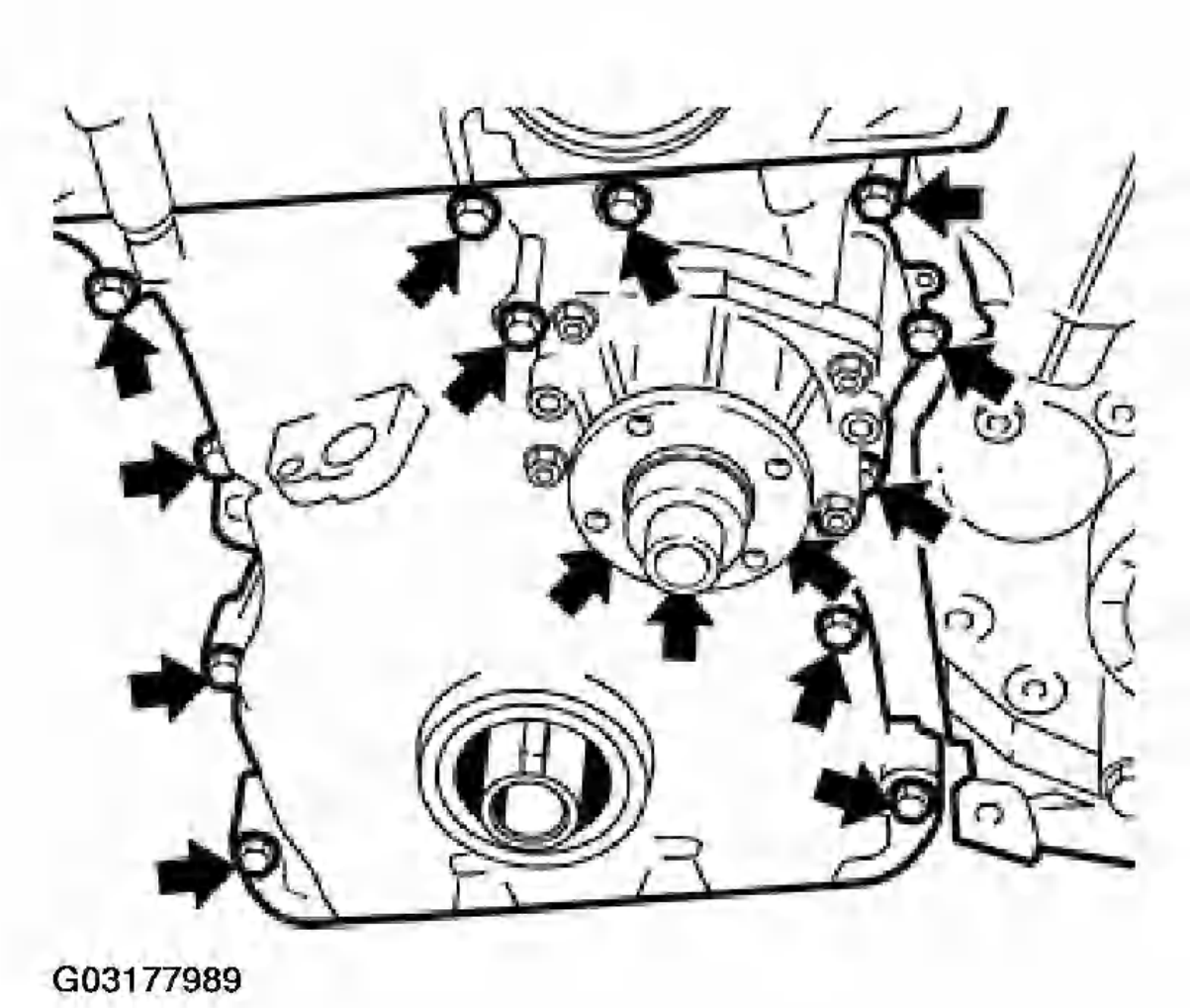



Fig. 74: Install Timing Case Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Drive in dowel pins from front until flush.

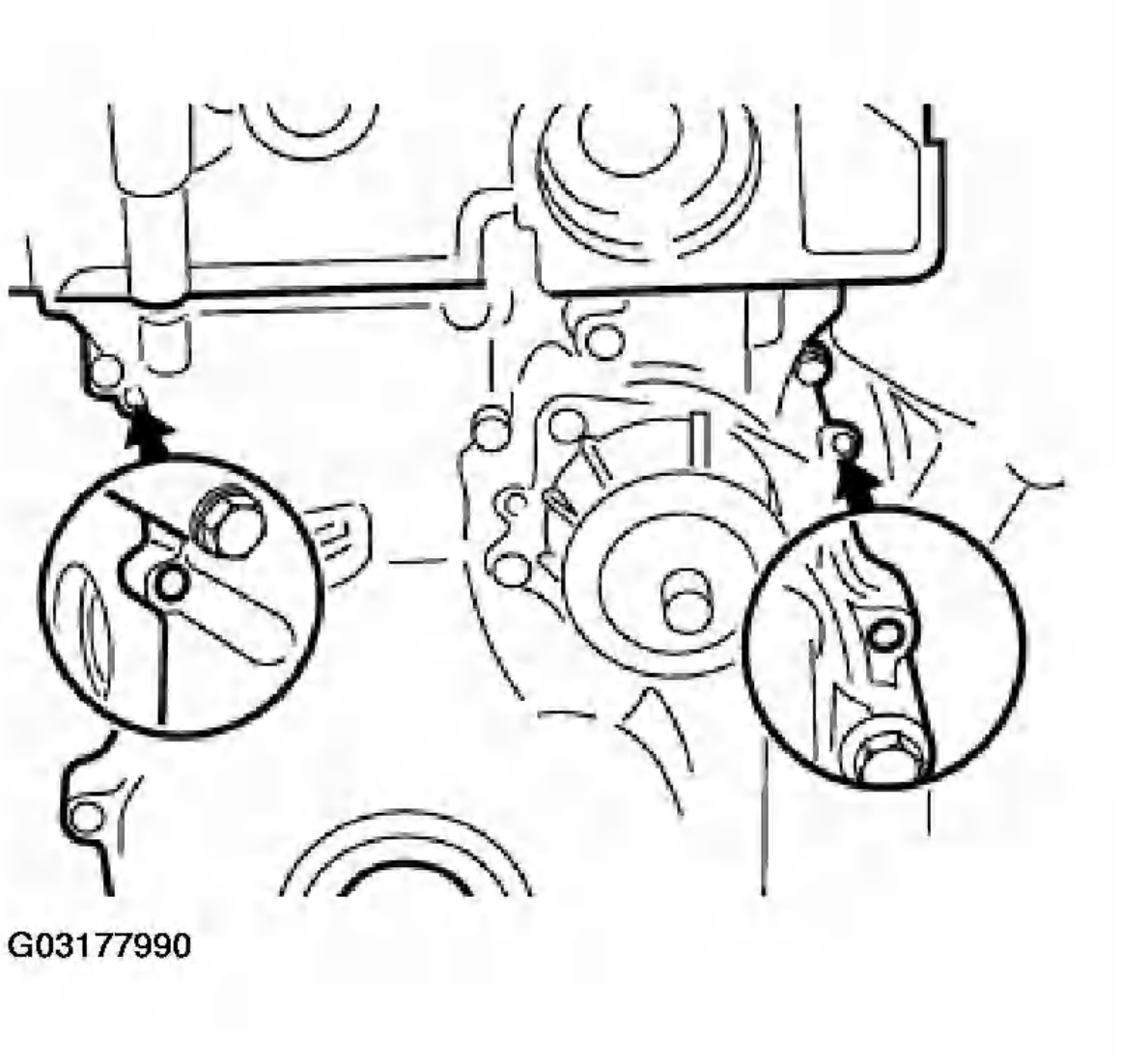



Fig. 75: Driving In Dowel Pins From Front Until Flush
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Fully tighten all screws in alternate sequence.

Tightening torque, refer to 11 14 1AZ in 11 14 CASE COVERS .

Important!

Once all screws have been tightened down, retighten them in a second operation.

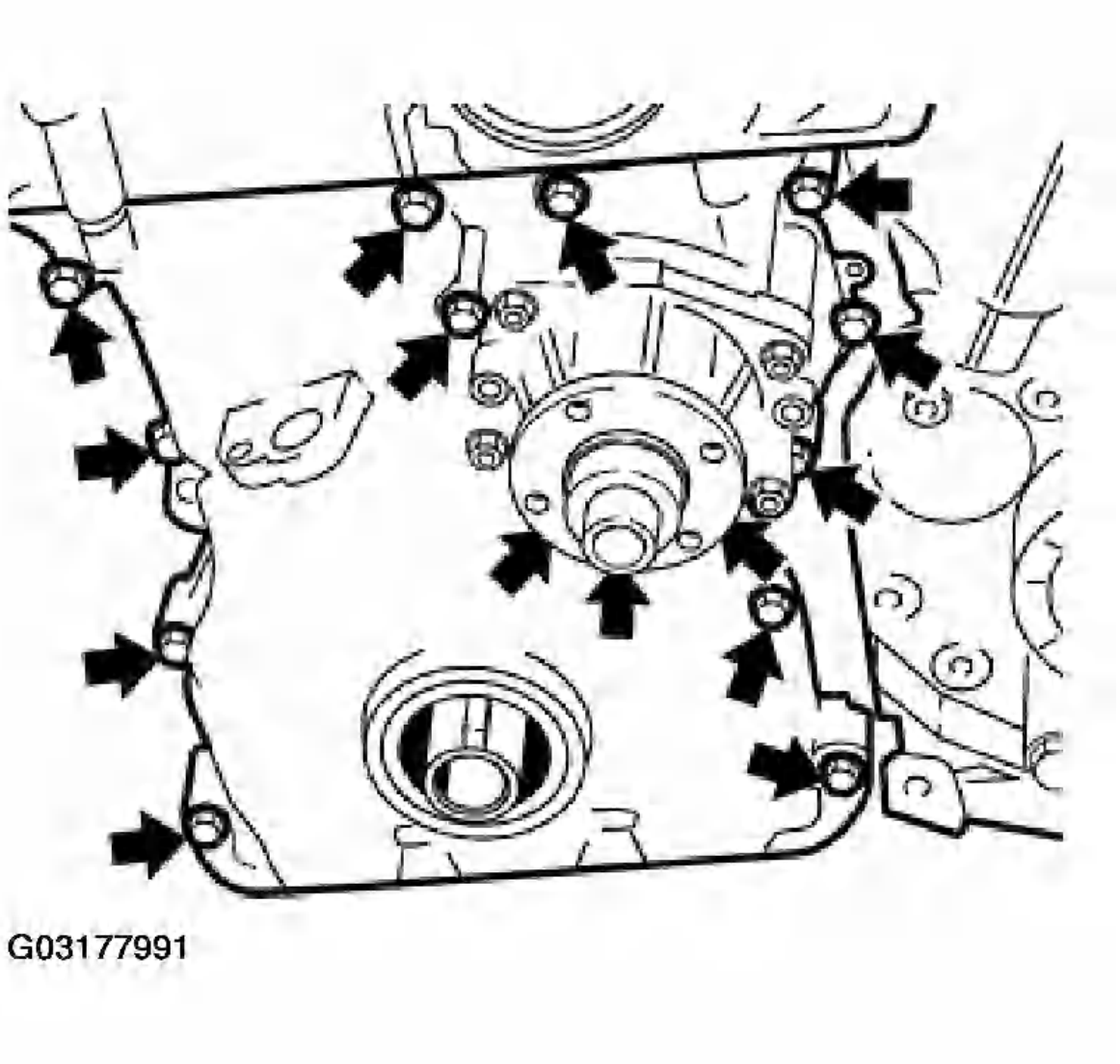



Fig. 76: Tightening Screws In Alternate Sequence
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screws, tighten screw connection for timing case cover to cylinder head.

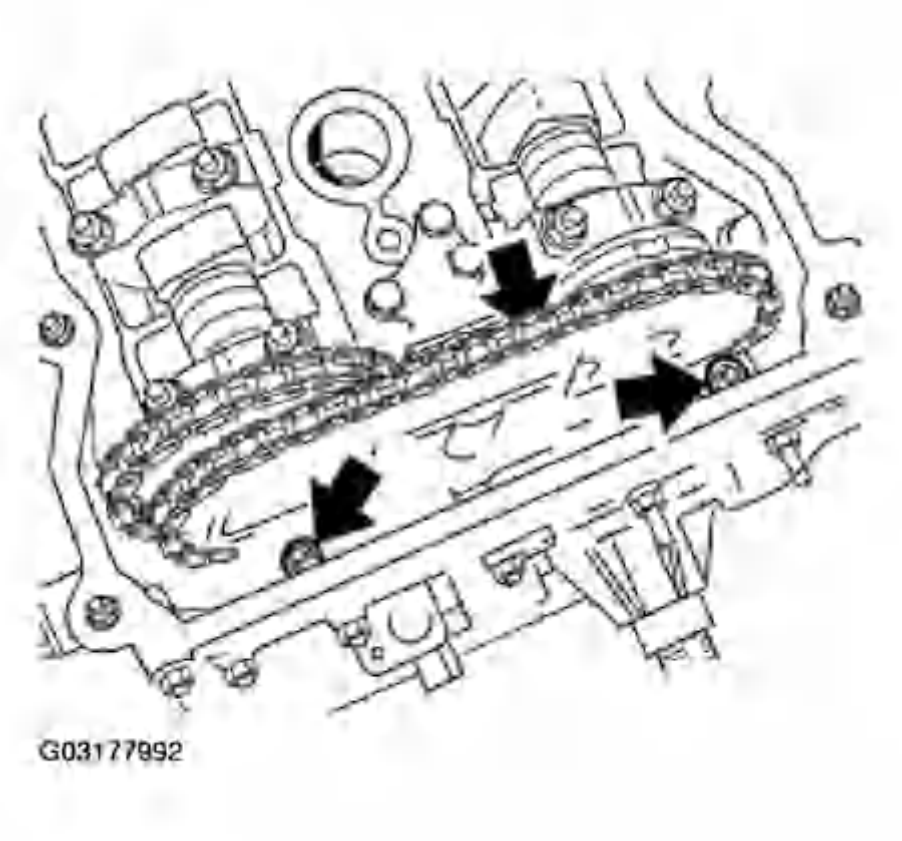



Fig. 77: Installing Screws For Timing Case Cover To Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

Replace radial seal in lower timing case cover. Refer to 11 14 141 REPLACING RADIAL SEAL IN LOWER TIMING CASE COVER.

Assemble engine.

## 11 14 141 REPLACING RADIAL SEAL IN LOWER TIMING CASE COVER

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 11 2 380
- 11 2 383
- 11 2 385
- 11 3 280

NOTE: This repair instruction is valid for the following engines:

- M50 / M52 / M52TU / M54 / M56

Remove vibration damper. Refer to 11 23 010 REMOVING AND INSTALLING OR REPLACING VIBRATION DAMPER (M52TU / M54 / M56).

NOTE: Version where vibration damper and hub are two parts:

Fit special tool 11 2 383 to crankshaft.

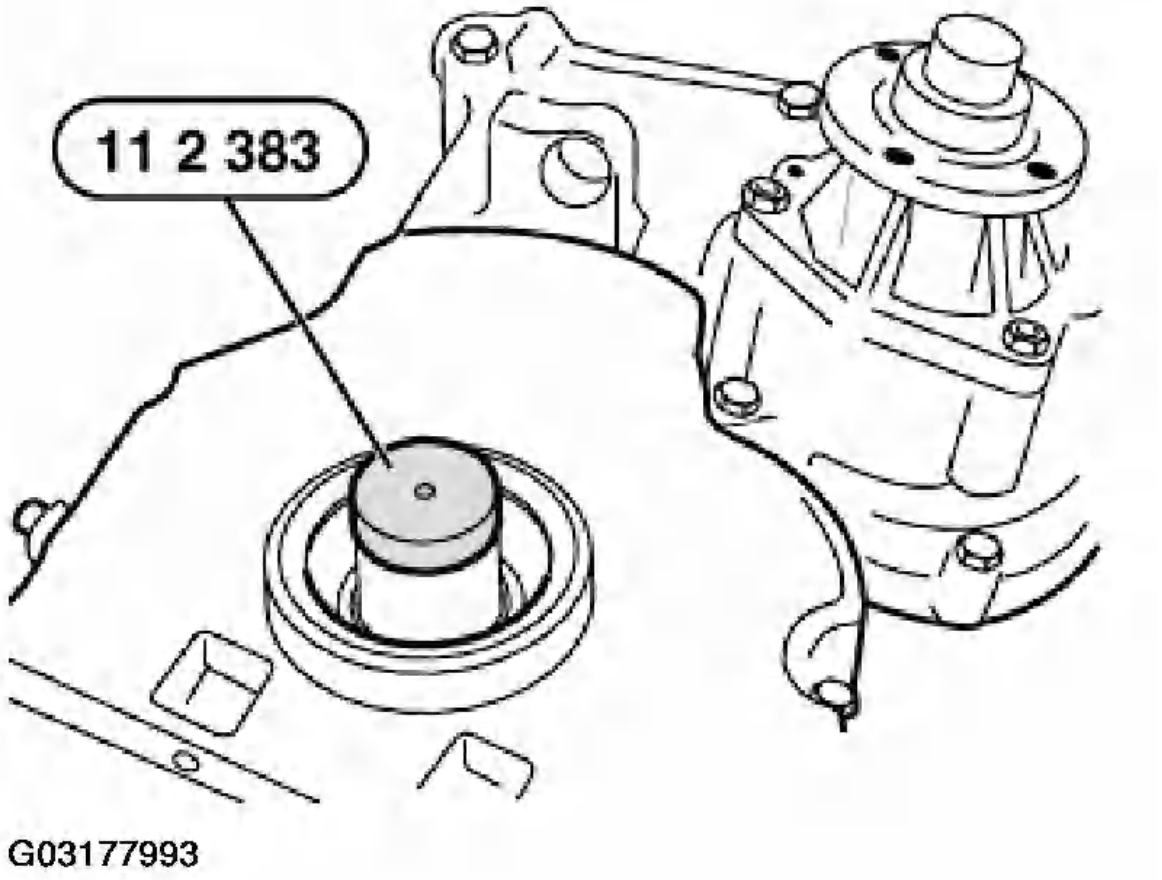



Fig. 78: Fitting Puller To Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 11 2 385 to crankshaft.

Align groove of special tool 11 2 385 to featherkey of crankshaft.

NOTE: Special tool 11 2 385 centers special tool 11 2 380.

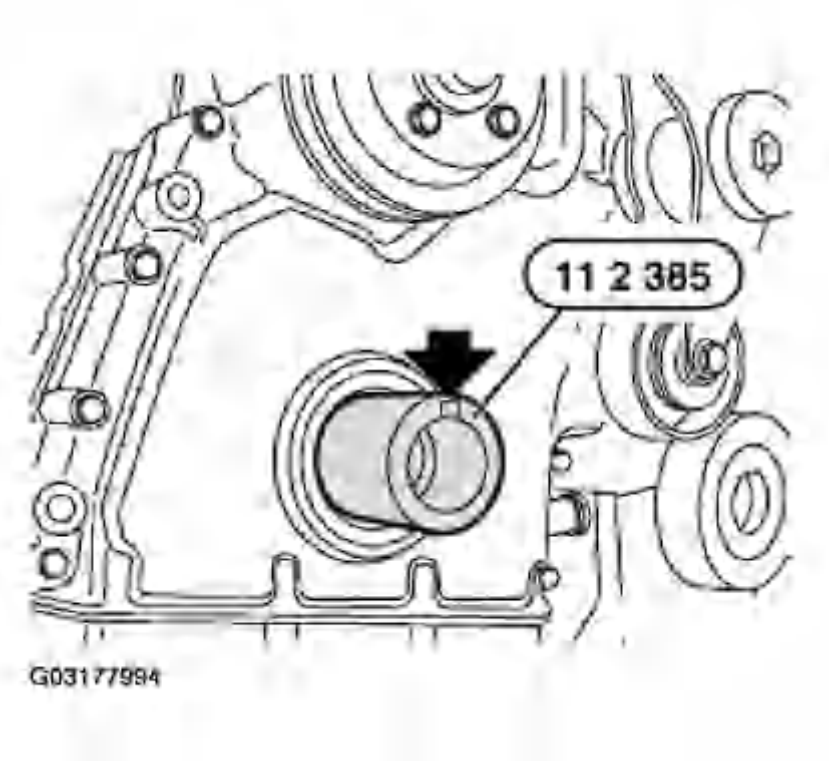



Fig. 79: Aligning Groove Of Puller To Featherkey Of Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Screw in special tool 11 2 380 until it has made firm contact with radial seal.

Remove radial seal by tightening screw on special tool.

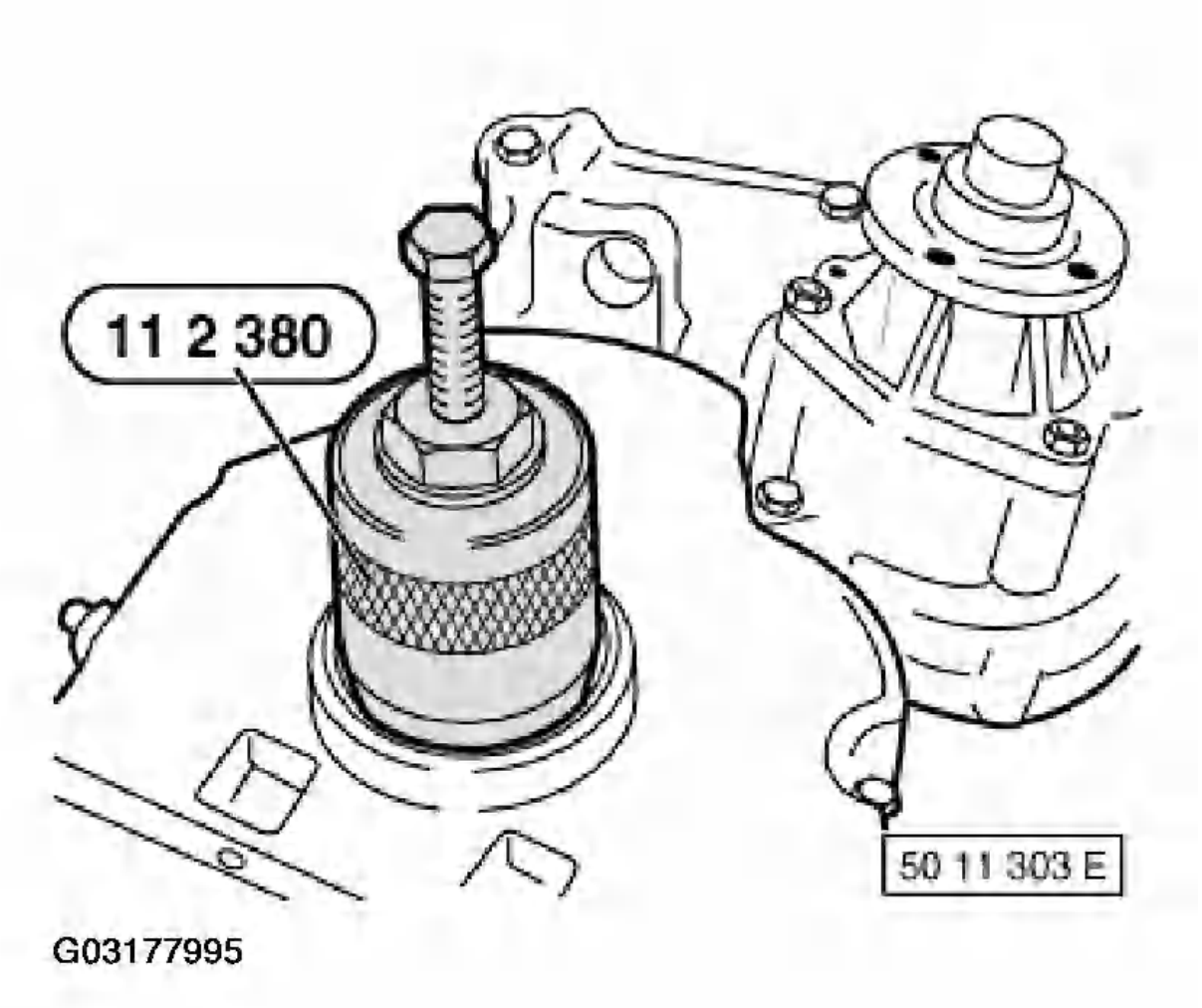



Fig. 80: Screwing In Special Tool 11 2 380
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Coat sealing lips of new radial sealing ring with oil.

Using special tool 11 3 280 and centering screw, install new radial seal flush with timing case cover.

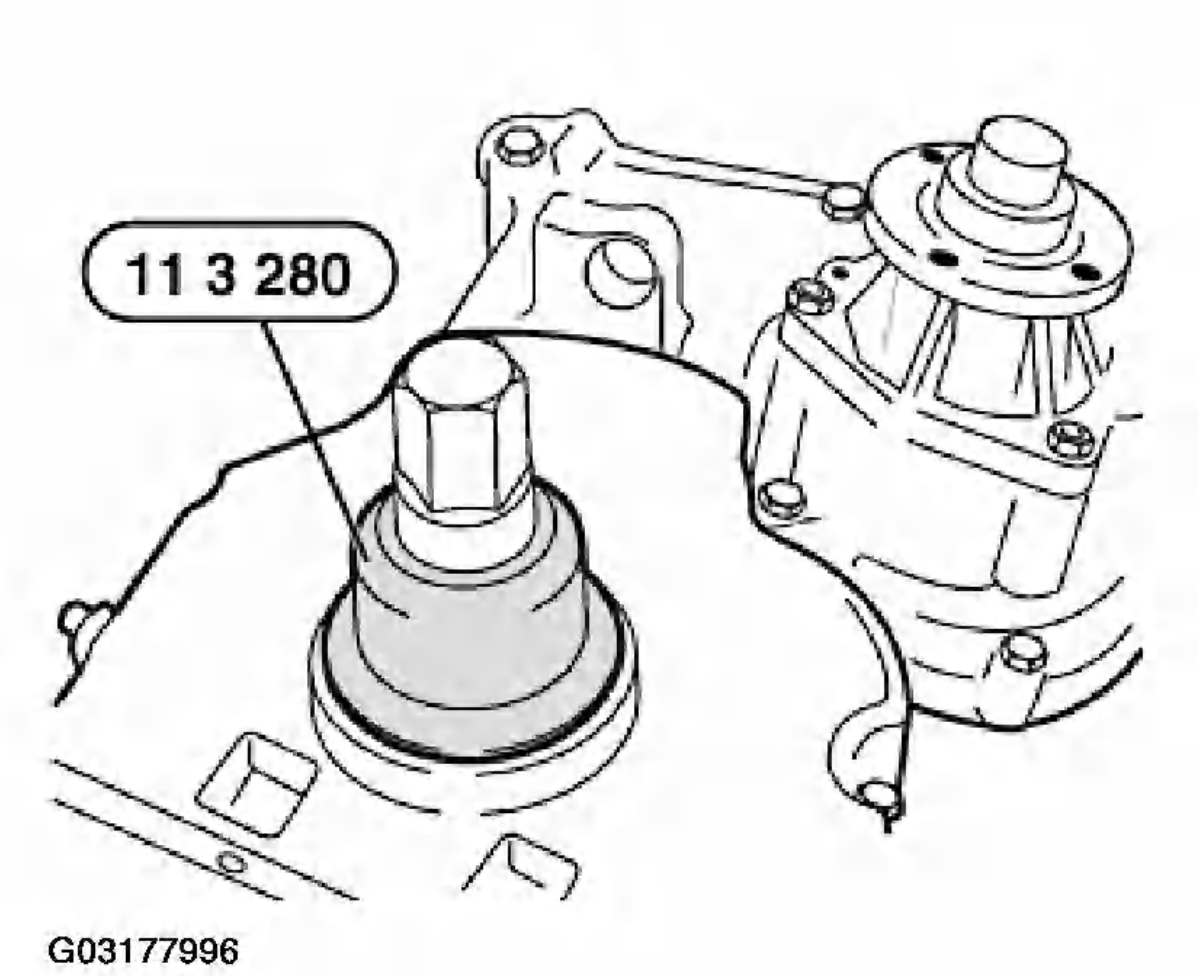



Fig. 81: Installing Radial Seal
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 14 151 REPLACING CRANKSHAFT RADIAL SEAL (TRANSMISSION SIDE)

NOTE: This repair instruction is valid for the following engines:

- M50 / M52 / M52TU / M54 / M56

Necessary Preliminary Tasks:

- Remove gearbox.
- Drain off engine oil.
- Remove flywheel.

Unfasten oil sump screws on transmission end.

Loosen oil pan.

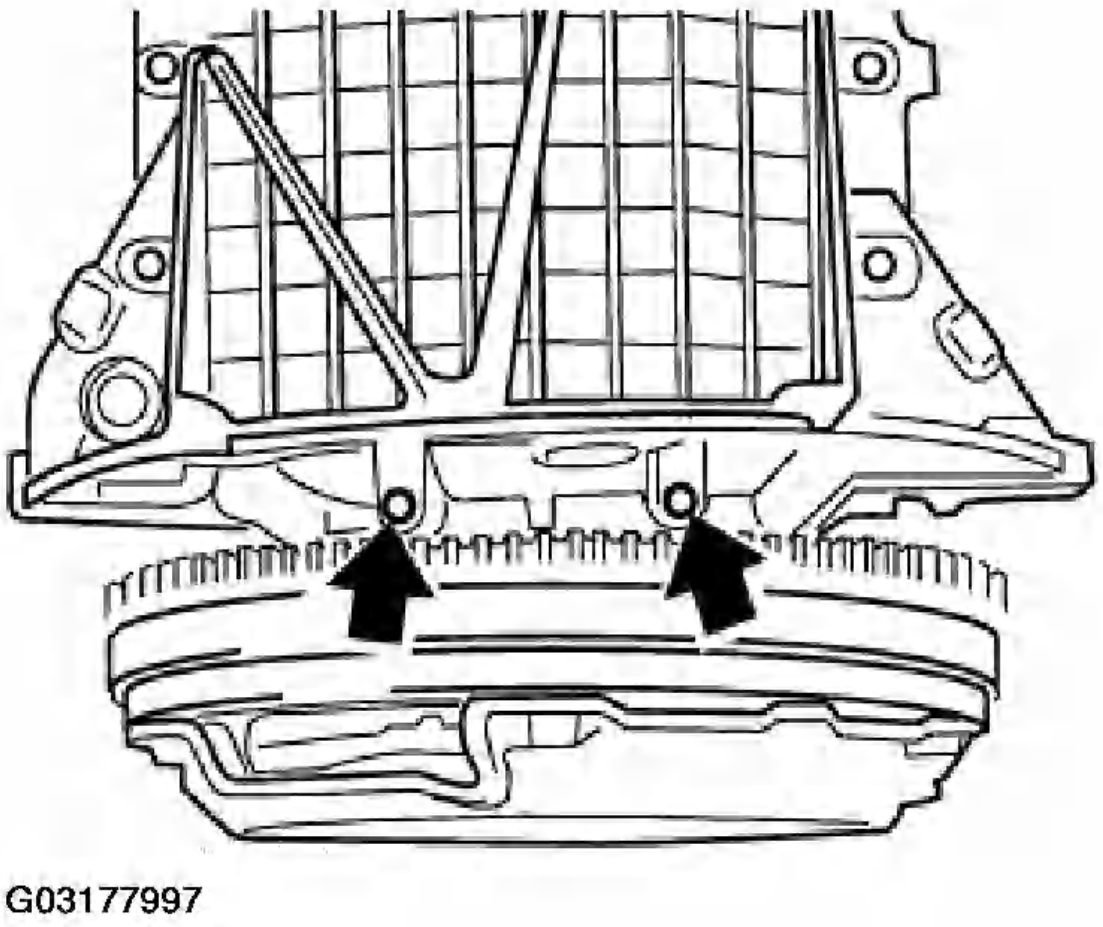



Fig. 82: Unfastening Oil Sump Screws On Transmission End
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws in end cover at rear.

Carefully detach oil sump gasket from end cover, remove end cover.

NOTE: After removing end cover: check oil sump gasket for damage. If necessary, remove oil sump and replace oil sump gasket.

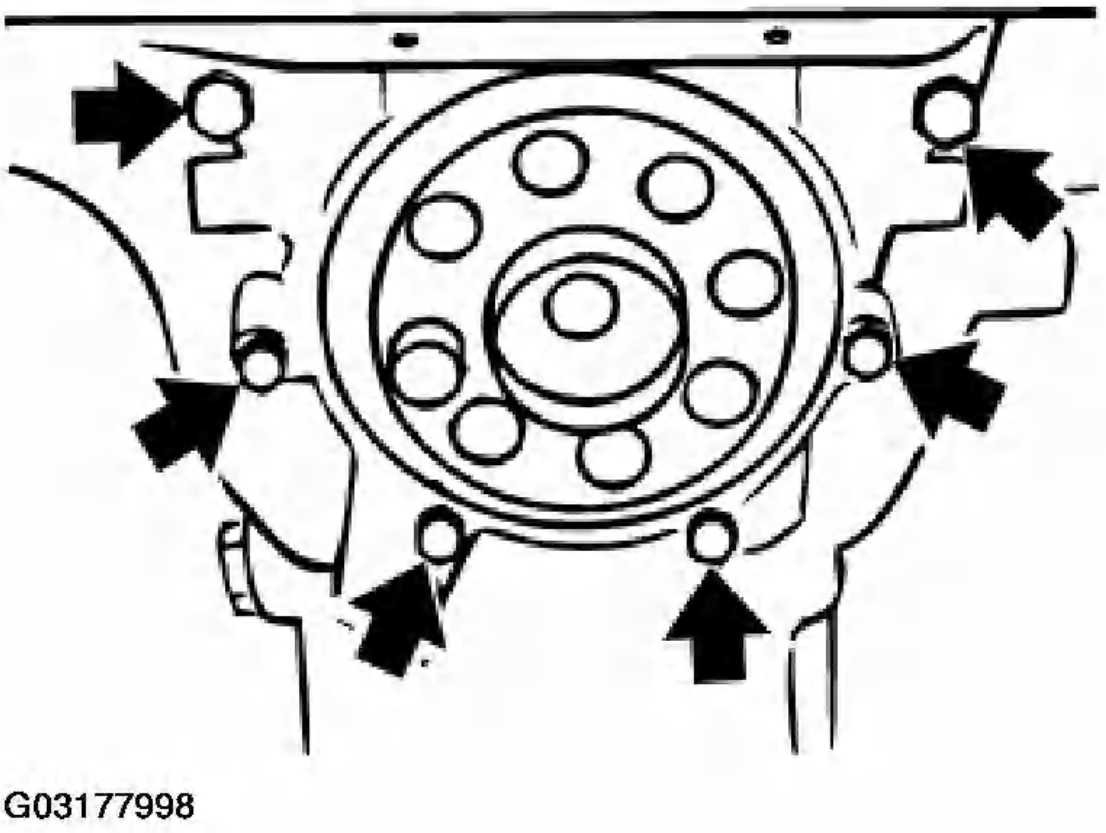



Fig. 83: Removing Screws In End Cover
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: As from 4/98, a new type of radial seal is used in the Series and as a replacement. This radial seal may only be supported with a "support bushing". If the radial seal is supported without the support bushing (1) for more than six months, operational reliability will no longer be assured and the radial seal must not be used any further.

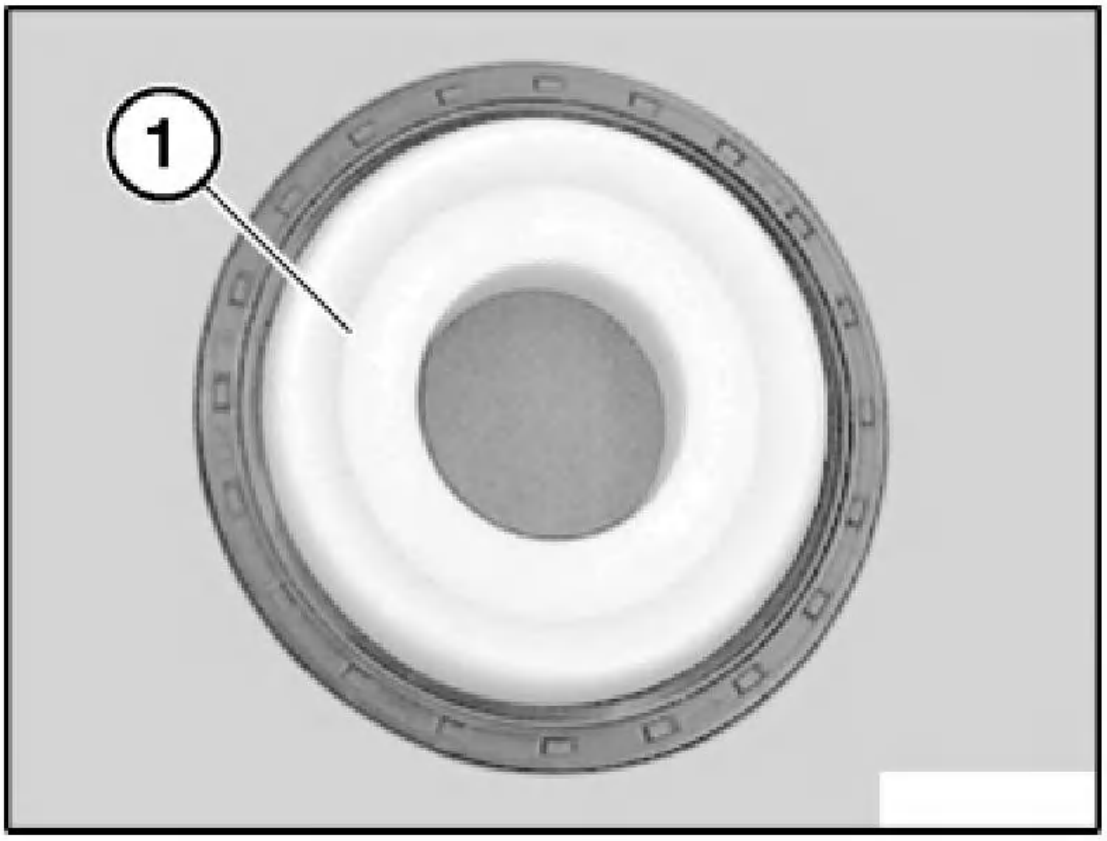



Fig. 84: Identifying Support Bushing
Courtesy of BMW OF NORTH AMERICA, INC.

Distinguishing feature:

- (1) New version "without hose spring".
- (2) Old version "with hose spring".

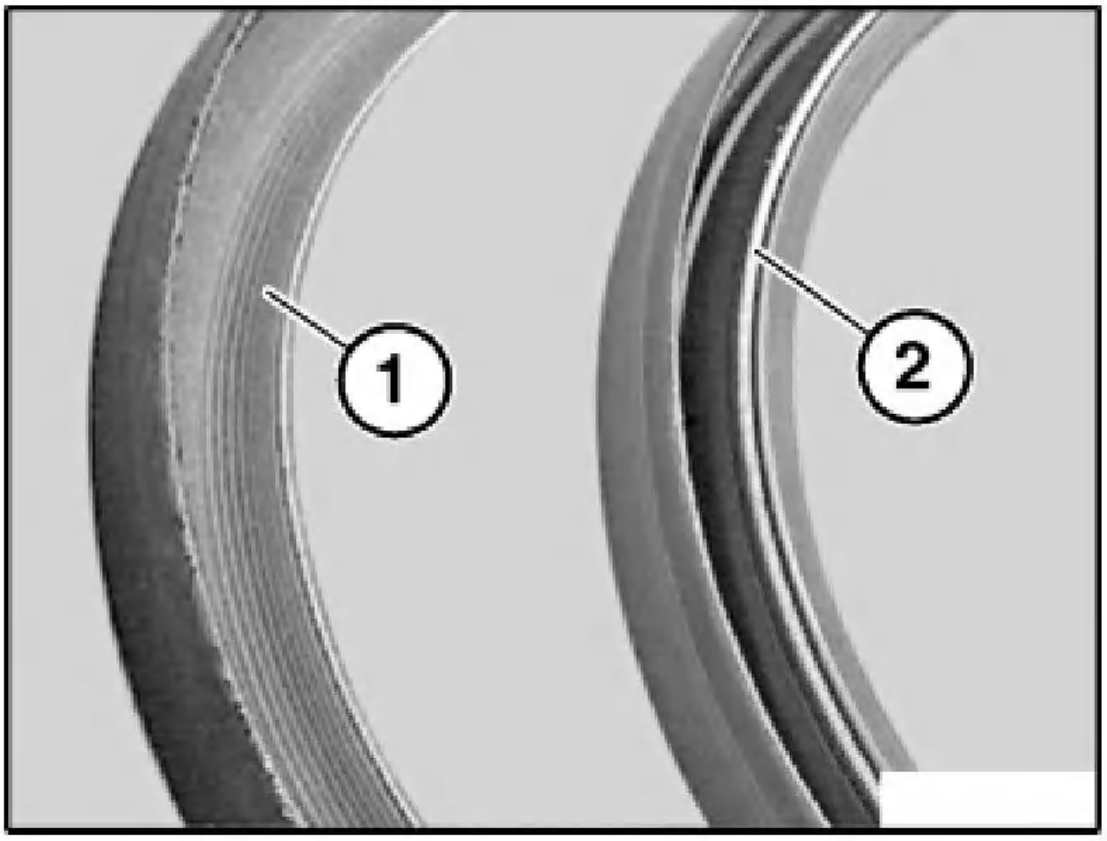



Fig. 85: Identifying New And Old Radial Seals
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

The sealing lip of the new version (1) is very sensitive and must not be kinked under any circumstances. Do not touch the sealing lip with your fingers.

NOTE: The end cover is offered in the kit with a radial seal. If necessary, lift out the radial sealing ring and drive in new sealing ring using special tool 11 1 260 in conjunction with special tool 00 5 500.

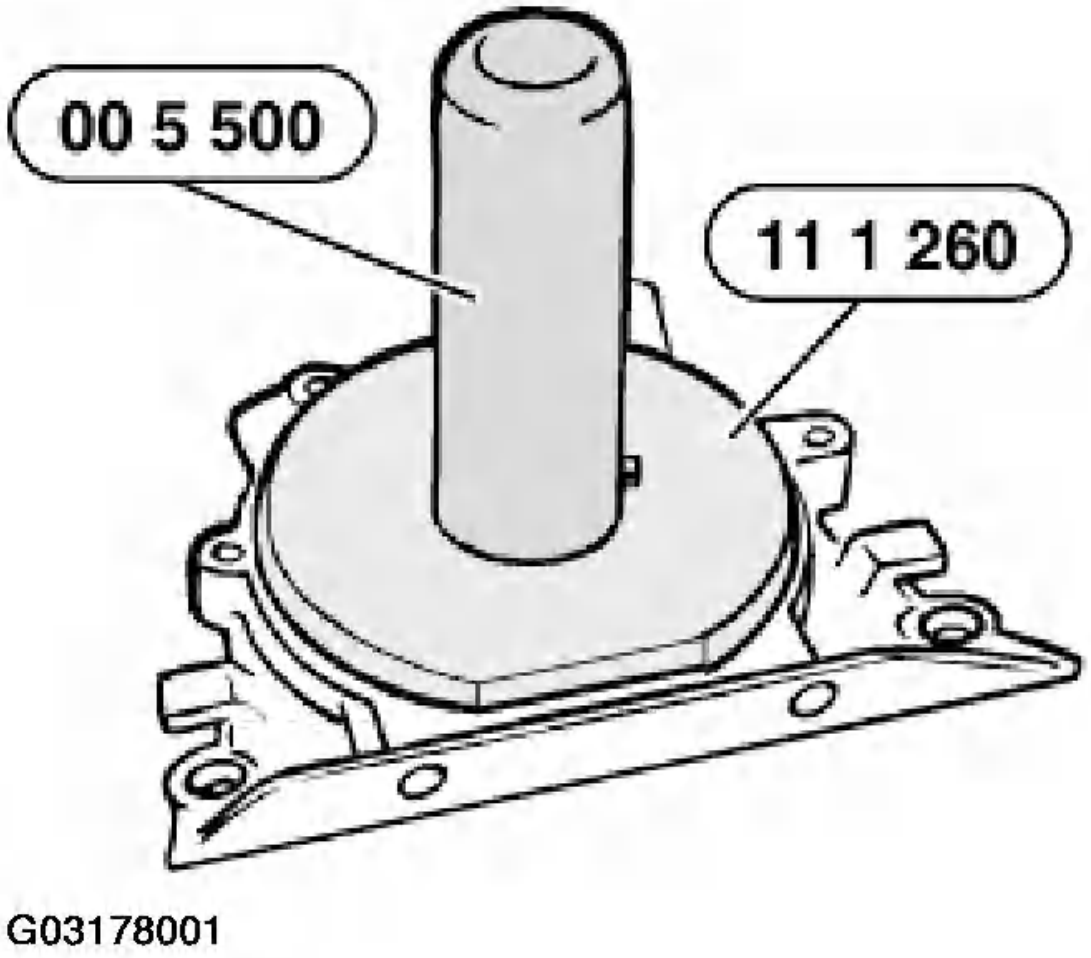



Fig. 86: Driving In Sealing Ring Using Special Tool 11 1 260
Courtesy of BMW OF NORTH AMERICA, INC.

Check dowel sleeves (1) for damage and correct installation position.

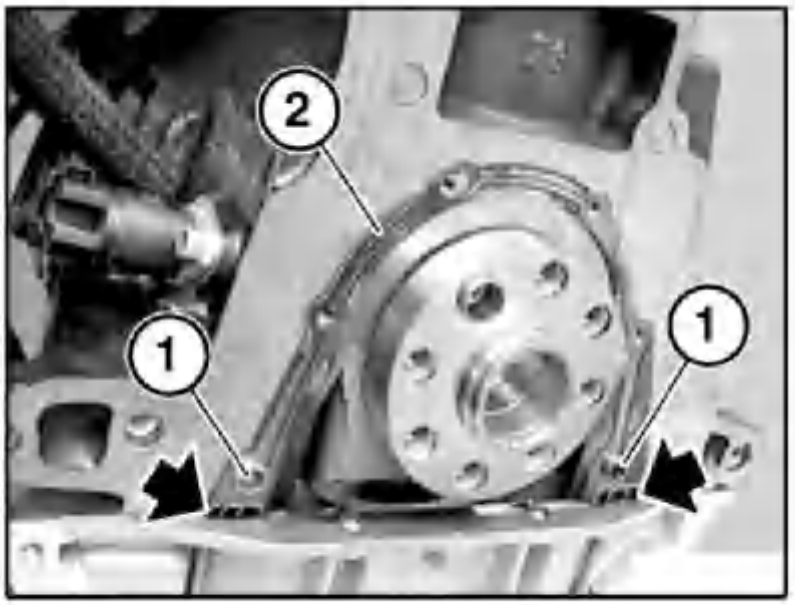



Fig. 87: Checking Dowel Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

Replace seal (2).

Apply thin, uniform coat of Drei Bond 1209 sealing compound to edges of joint on oil pan.

Important!

Do not use special tool 11 2 213 for the new radial seal version.

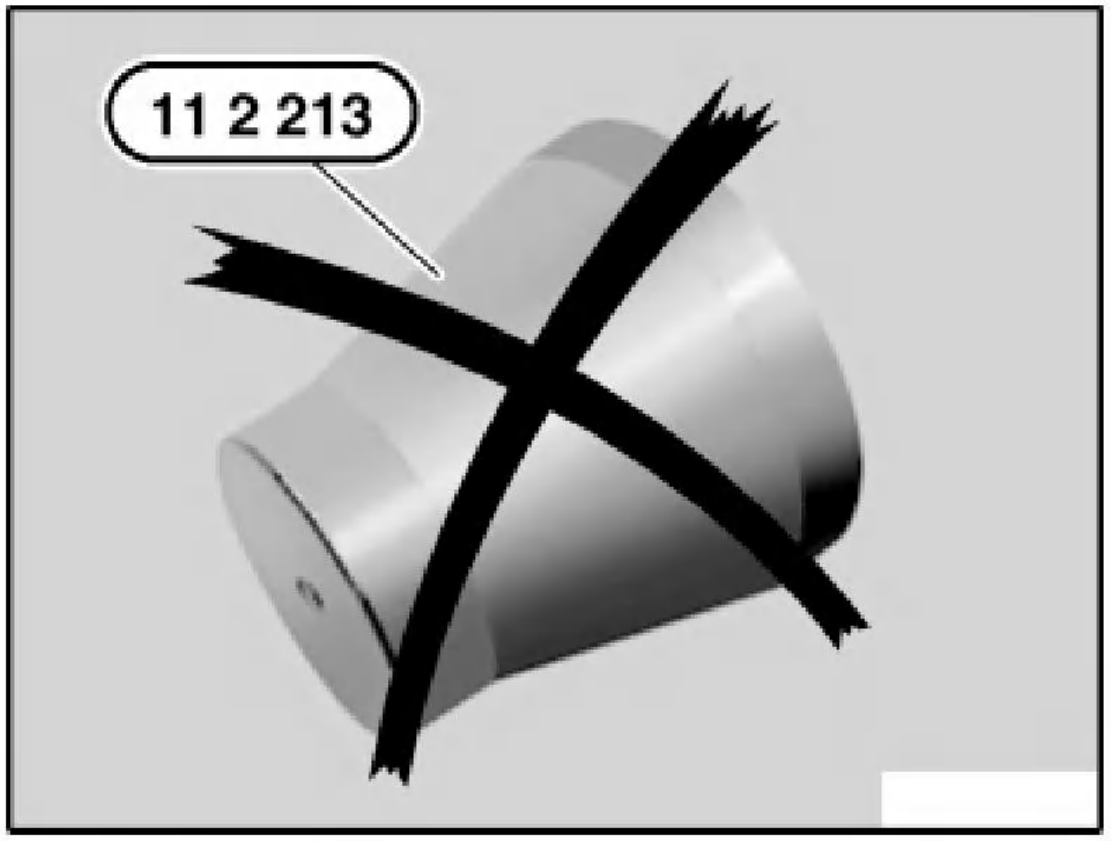



Fig. 88: Identifying Incorrect Special Tool For Radial Seal Installation
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: When fitting the end cover with radial seal on the crankshaft, it is only permitted to use the "support bushing (1)" as an installation tool.

Lubricate contact face of crankshaft.

Important!

Push on end cover with support bushing (1) straight and without tilting sideways.

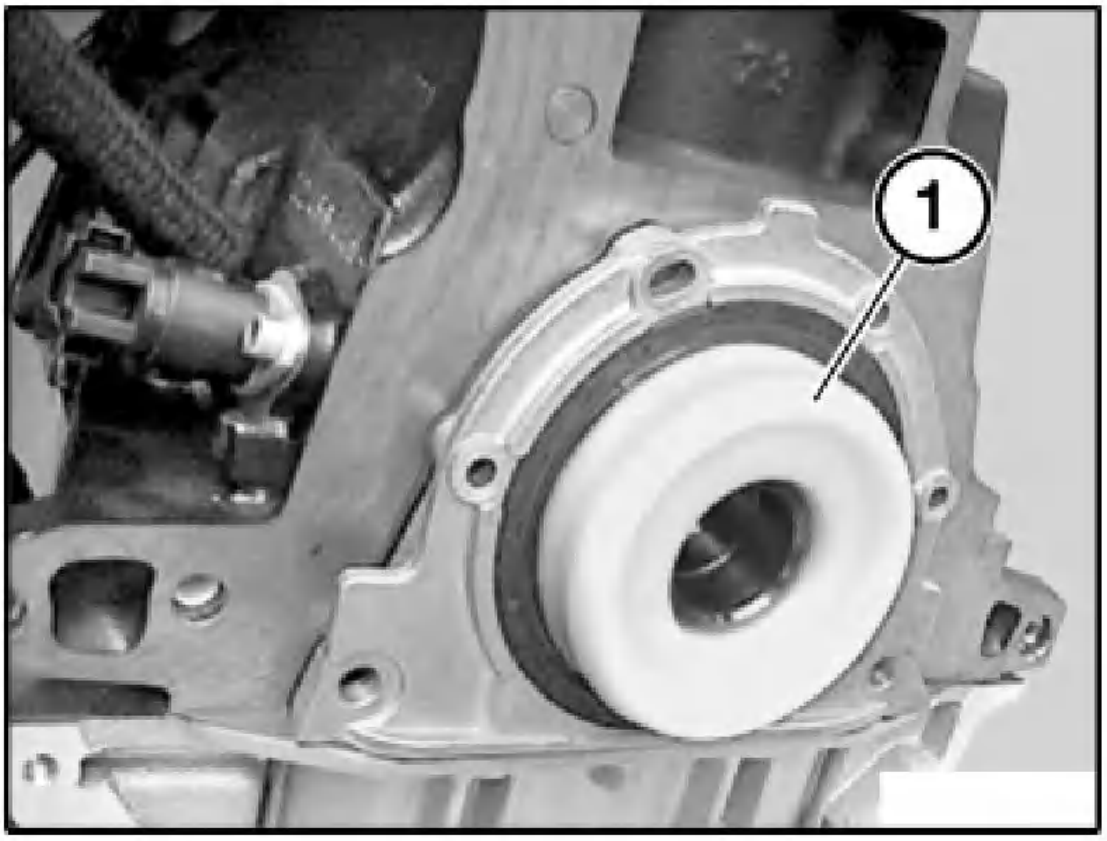



Fig. 89: Identifying Support Bushing
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Screw threads (1) are coated with sealing compound.

Replace screws (1).

Inserting screws of tighten down end cover.

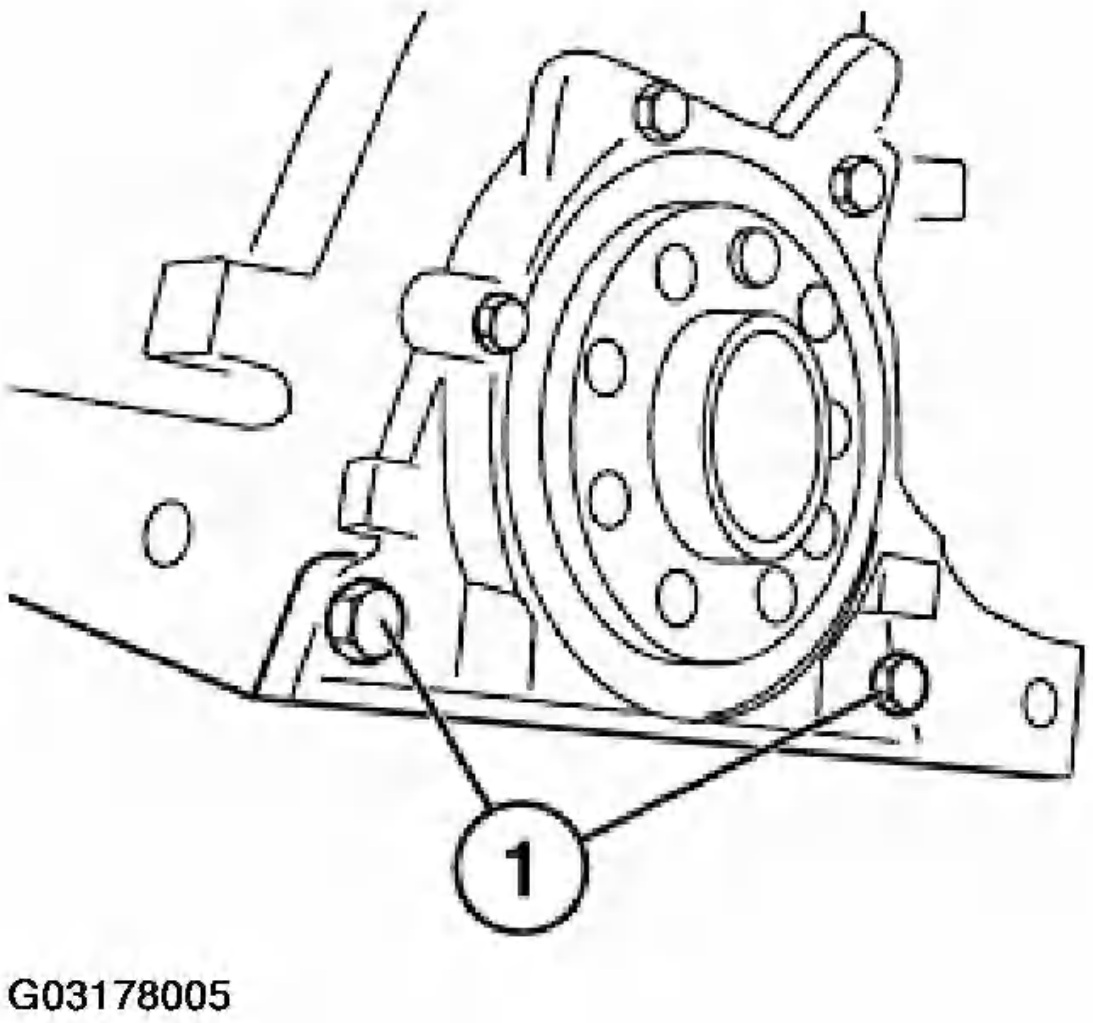



Fig. 90: Identifying End Cover Screws
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Keep the support bushing (1) of the new radial seal version as a "special tool", then render the special tool 11 2 213 unusable and dispose of it.

The old and new radial seal versions can be installed with the support bushing (1).

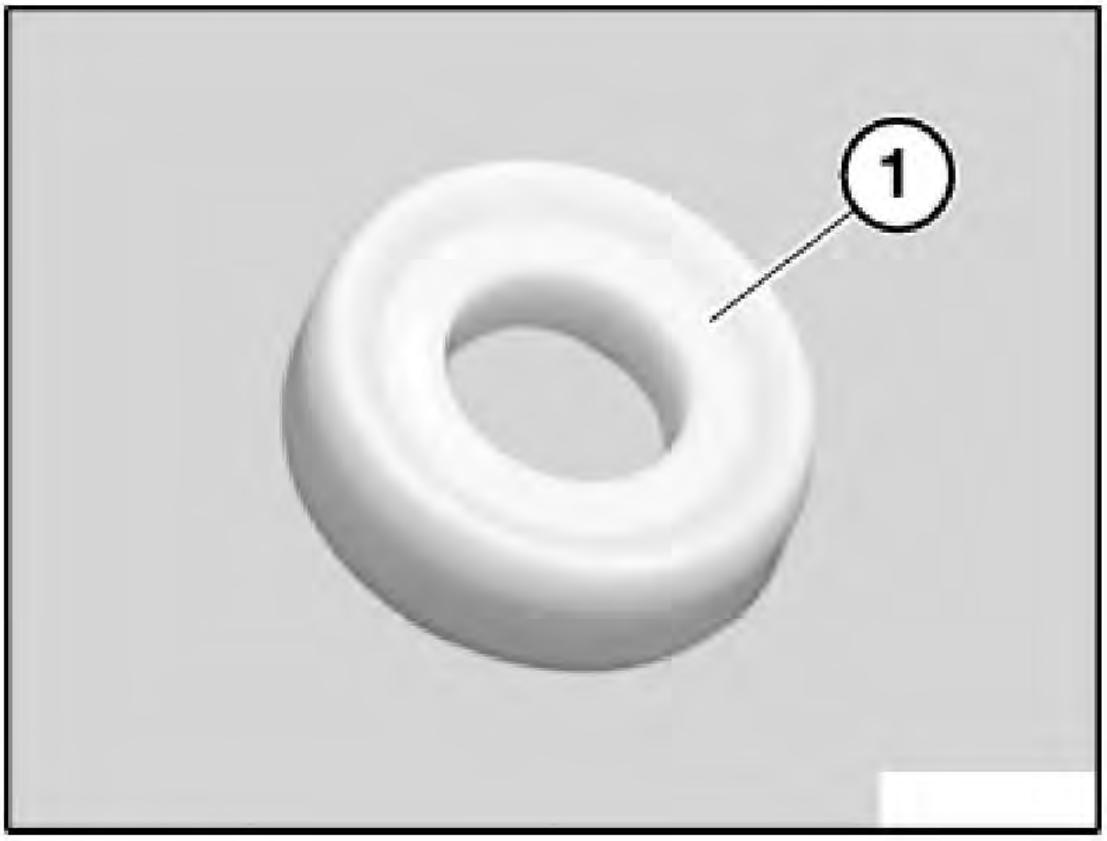



Fig. 91: Identifying Support Bushing
Courtesy of BMW OF NORTH AMERICA, INC.

## CRANKSHAFT WITH BEARINGS

### 11 21 500 REPLACING CRANKSHAFT (M52 / S52 / M52TU / M54 / M56)

(Engine removed)

Necessary Preliminary Tasks:

- Removing cylinder head.
- Removing lower timing case cover.
- Removing all pistons. Refer to 11 25 530 REMOVING AND INSTALLING OR REPLACING ALL PISTONS (M52 / S52 / M52TU / M54 / M56).
- Remove end cover. Refer to 11 14 151 REPLACING CRANKSHAFT RADIAL SEAL (TRANSMISSION SIDE).

Checking axial clearance:

If permitted end float is exceeded, check crankshaft, guide bearing shells and engine block, replacing if necessary, end float. Refer to CRANKSHAFT WITH BEARING .

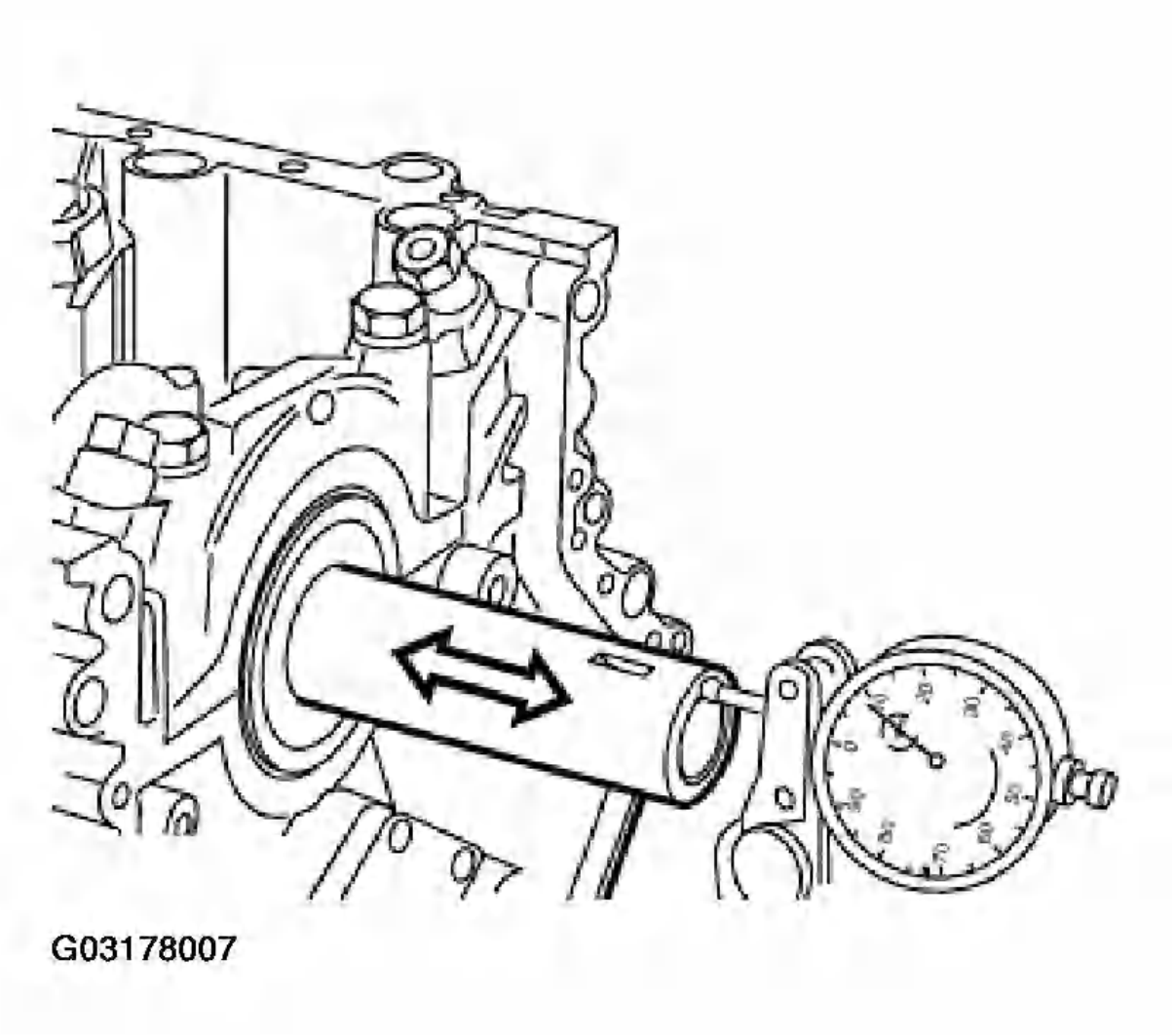



Fig. 92: Checking Axial Clearance
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screw connection on reinforcement plates.

NOTE: The reinforcement plates are not fitted on engines with gray cast iron engine blocks or on engines with oil pumps integrated in oil scrapers.

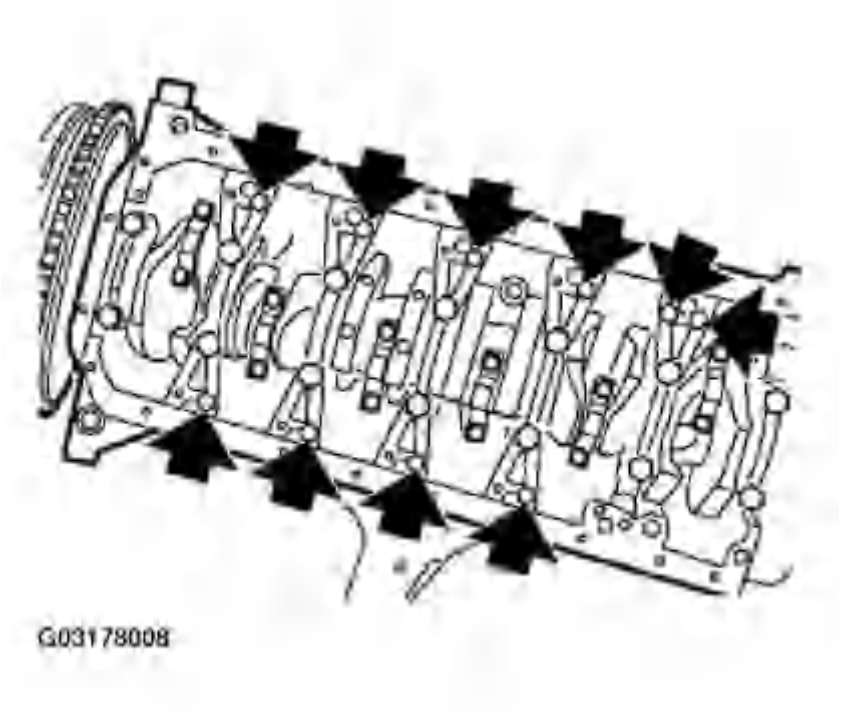



Fig. 93: Unfastening Reinforcement Plates Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screw connection on main bearing.

Remove main bearing caps (1 to 7).

Lever out crankshaft.

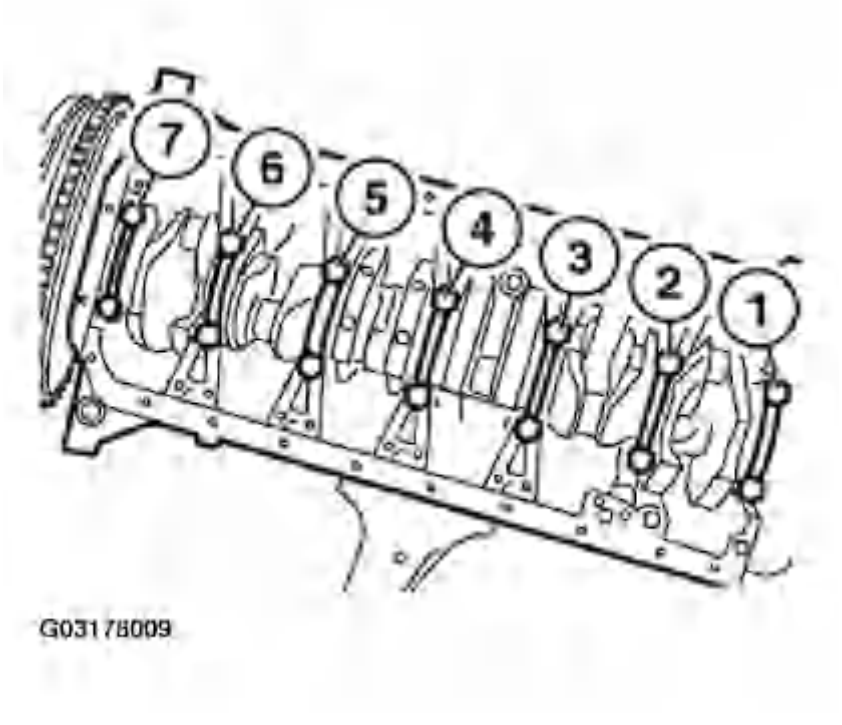



Fig. 94: Removing Main Bearing Caps
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, release incremental gear.

Installation:

Replace screws.

Install screws and tighten down in two passes.

Tightening torque, refer to 11 21 1AZ in 11 21 CRANKSHAFT AND BEARINGS .

Important!

Check grinding stage of crankshaft. Refer to CRANKSHAFT WITH BEARING .

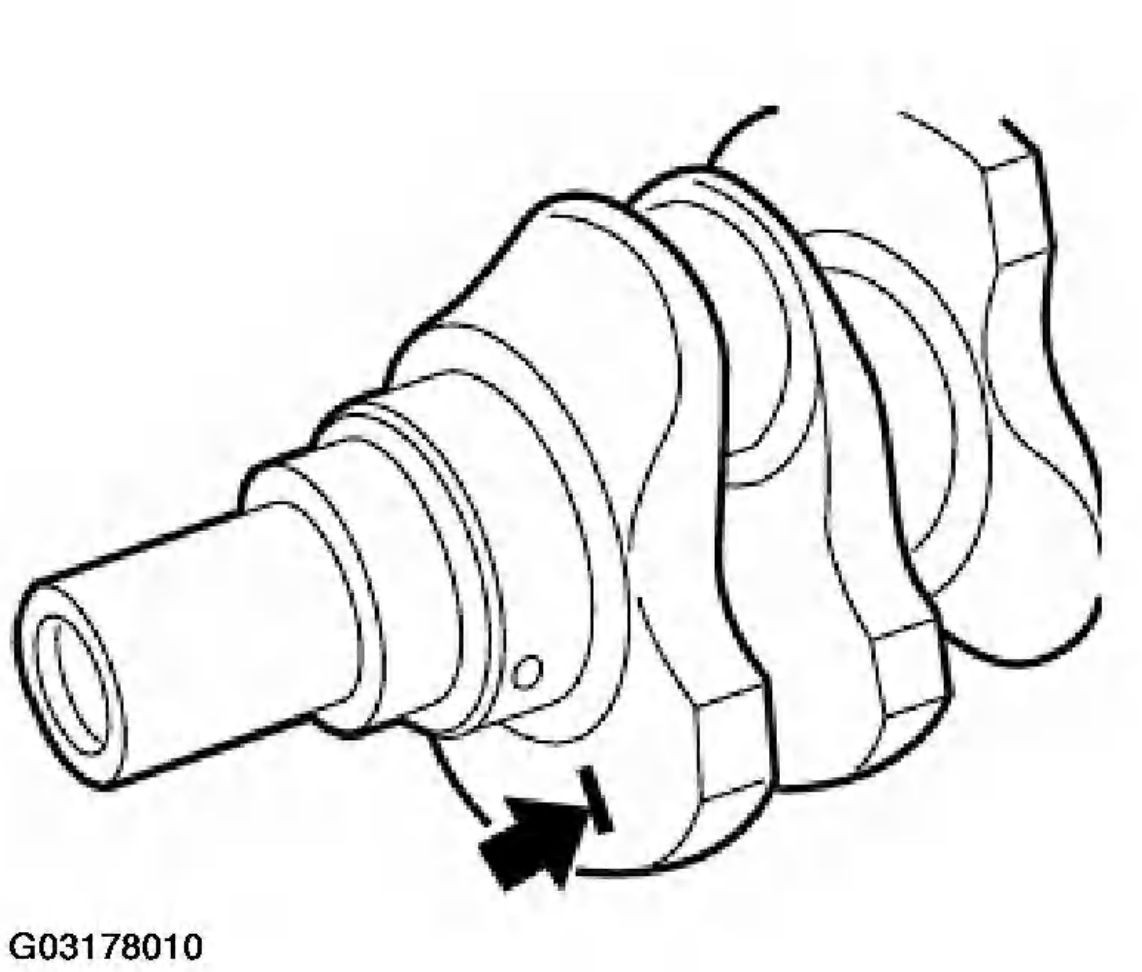



Fig. 95: Checking Grinding Stage Of Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Replace main crankshaft bearing shells. Refer to 11 21 531 REPLACING ALL MAIN CRANKSHAFT BEARING SHELLS (M52 / S52 / M52TU / M54 / M56).

Replace conrod bearing shells. Refer to 11 24 571 REPLACING ALL CONNECTING ROD BEARINGS (M52 / S52 / M52TU / M54 / M56).

Replace grooved ball bearings in crankshaft. Refer to 11 21 571 REPLACING GROOVED BALL BEARING IN CRANKSHAFT (M52 / S52 / M52TU / M54 / S50 / S54).

## 11 21 531 REPLACING ALL MAIN CRANKSHAFT BEARING SHELLS (M52 / S52 / M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 00 2 590
- 00 9 120
- 11 2 110

(Engine dismantled)

M52 B20 / M52TU/ B20/ M54/M22

NOTE: Injection nozzles for cooling the pistons are installed in the bores of bearing seats 2 to 7.

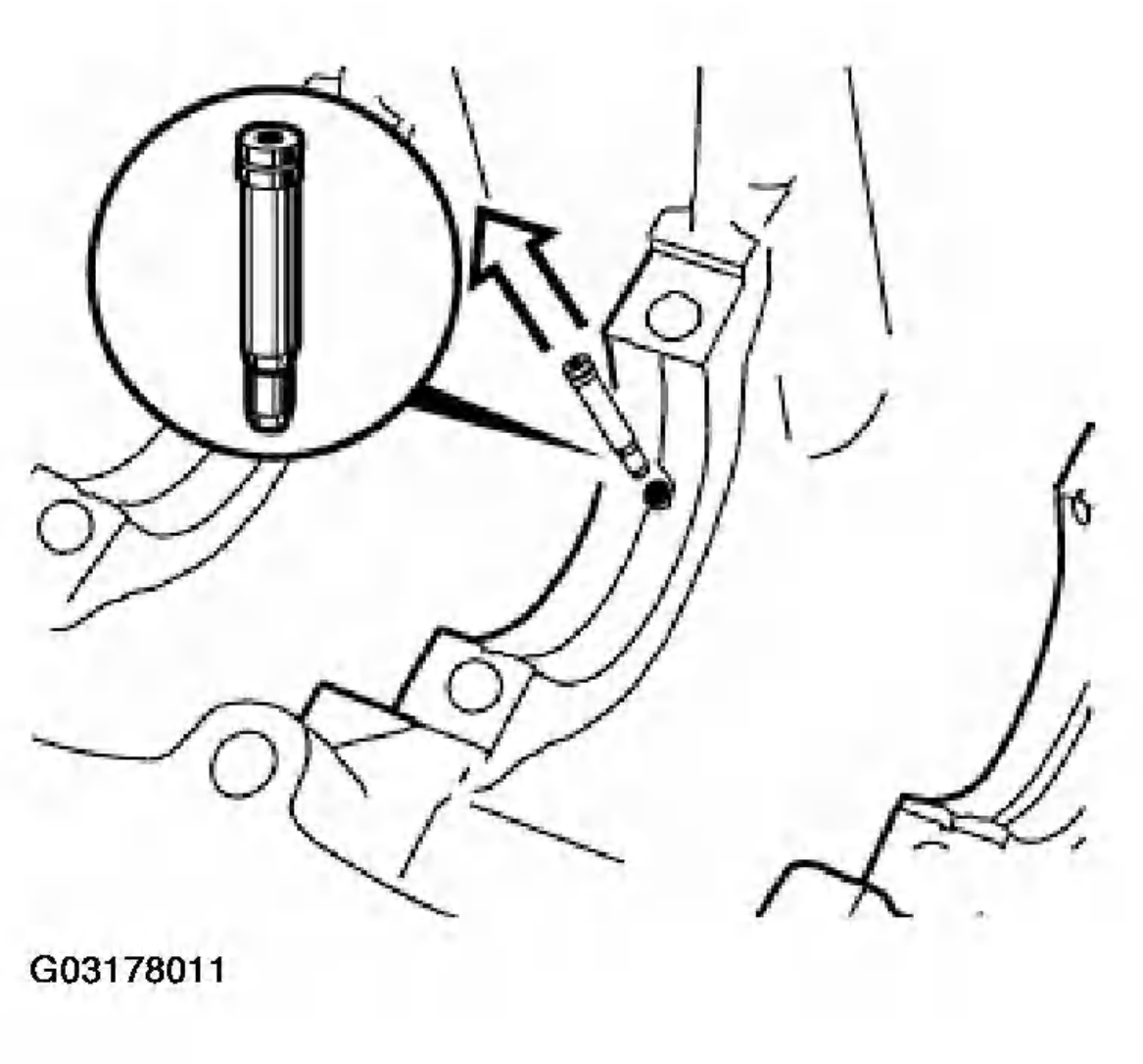



Fig. 96: Identifying Injection Nozzles For Cooling Pistons In Bores Of Bearing Seats
Courtesy of BMW OF NORTH AMERICA, INC.

M52 B25 / B28 S52 M52TU B25 / B28 M54 B25 / B30 M56

NOTE: Injection nozzles for cooling the pistons are installed on the underside of the cylinder between the bearing seats.

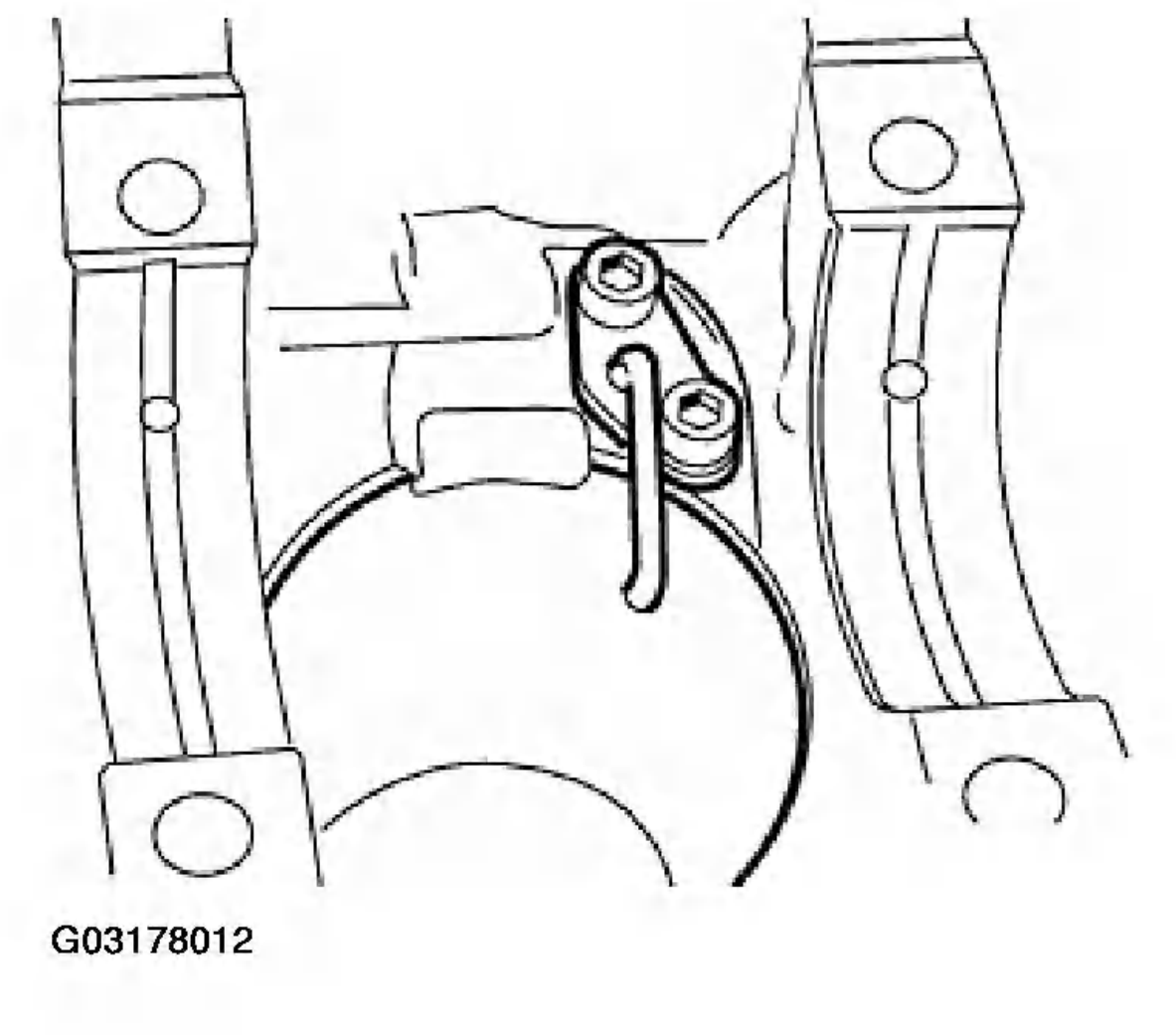



Fig. 97: Identifying Injection Nozzles For Cooling Pistons Between Bearing Seats
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Screw threads are coated with screw securing adhesive (Loctite).

Replace screws.

Important!

Observe grinding stage of crankshaft. Refer to CRANKSHAFT WITH BEARING .

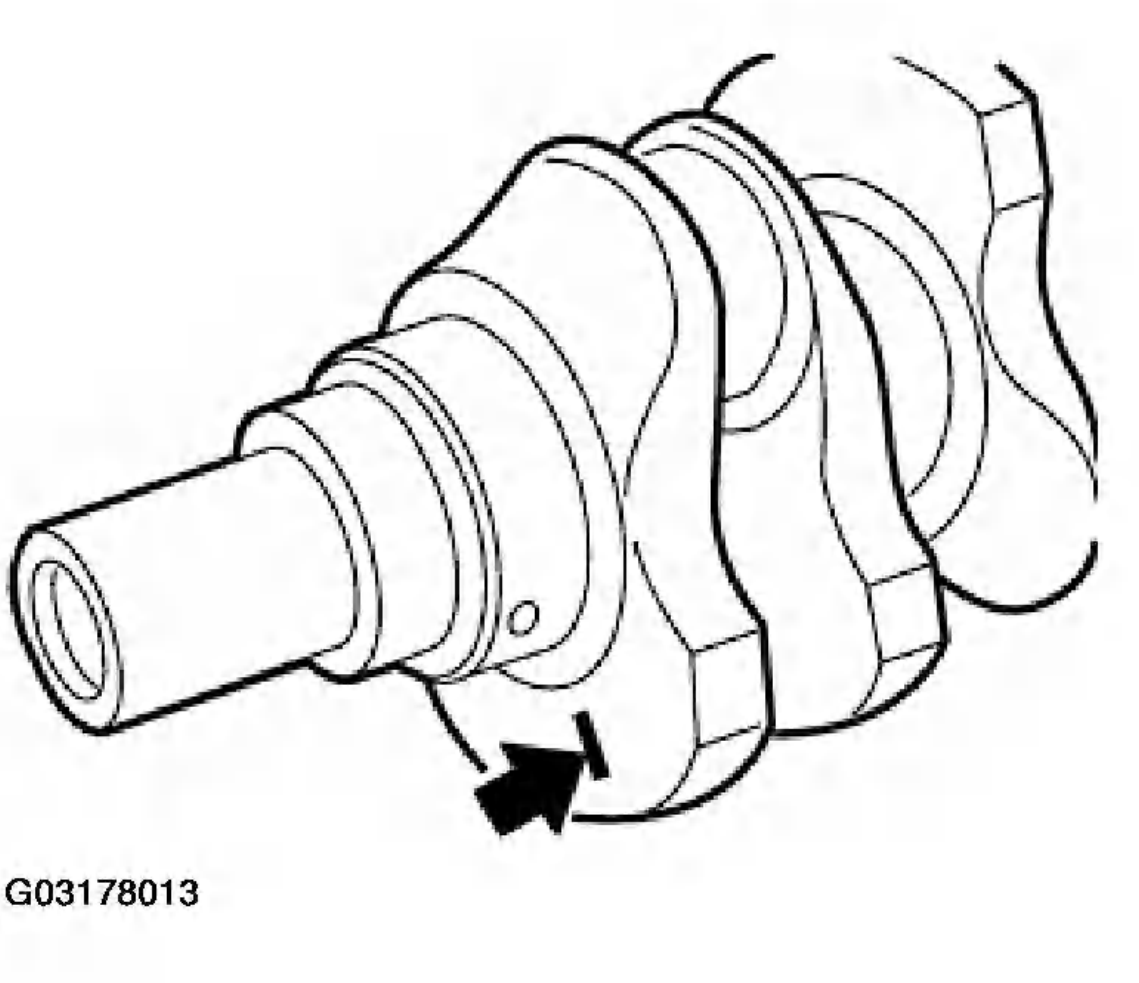



Fig. 98: Observing Grinding Stage Of Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

When replacing the bearing shells (also for replacement crankshaft), classification for bearing shell arrangement in engine block is waived.

Insert bearing shells with yellow color coding in engine block.

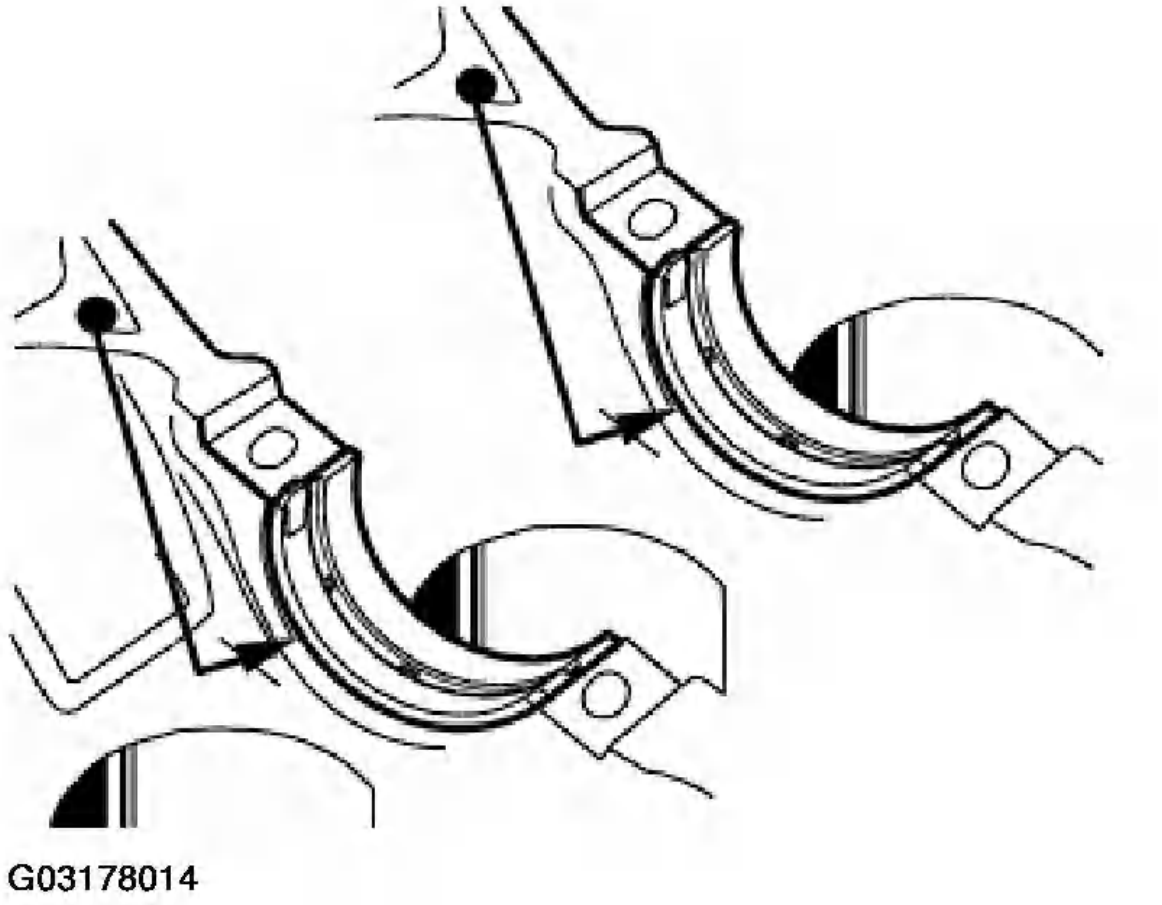



Fig. 99: Identifying Bearing Shells
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE:

1. Install bearing shells with continuous lubricant groove and one retaining lug in engine block.
2. Fit bearing shells without continuous lubricant groove and two retaining lugs in bearing cover.

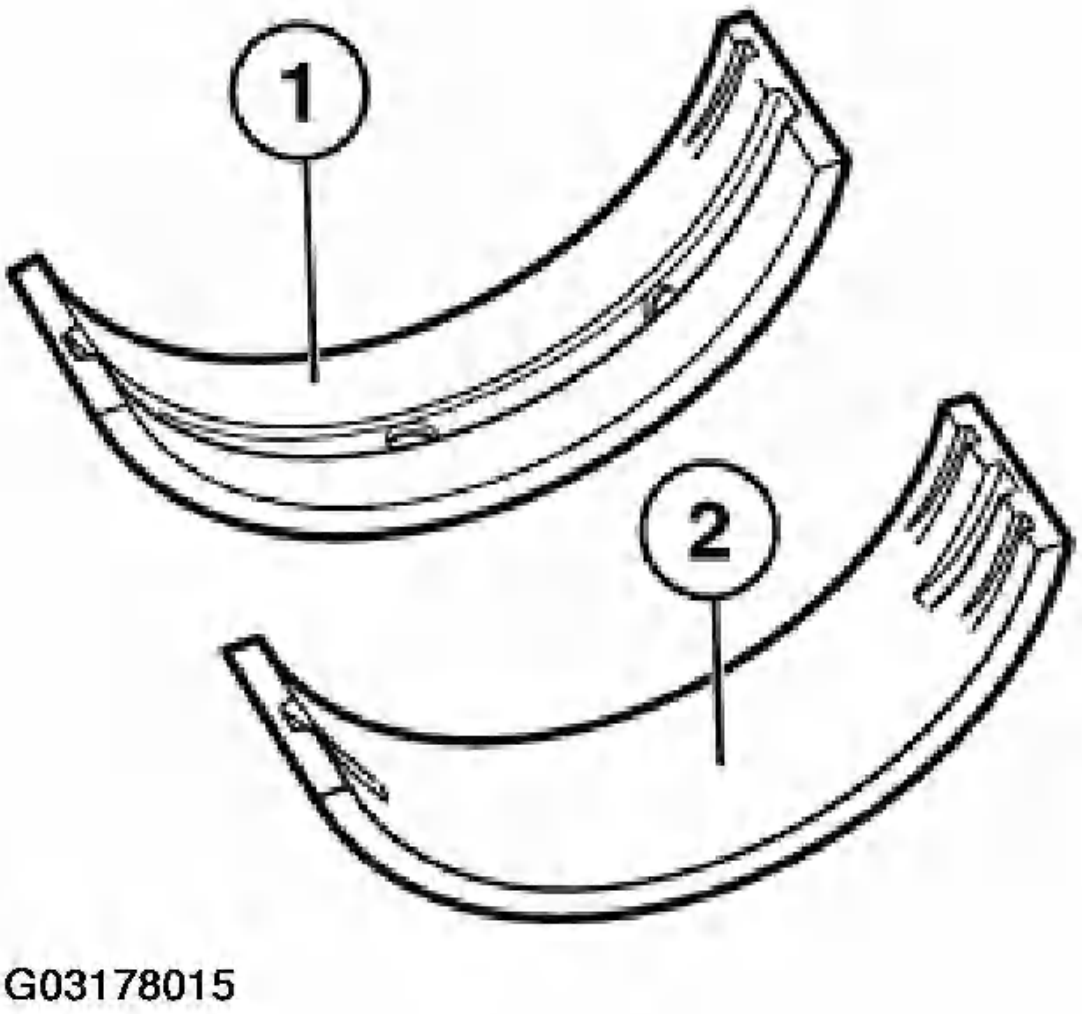



Fig. 100: Identifying Bearing Shells With And Without Continuous Lubricant Groove
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The axial guide on the crankshaft is fitted to bearing point 6. Insert pilot bearing shell in the engine block.

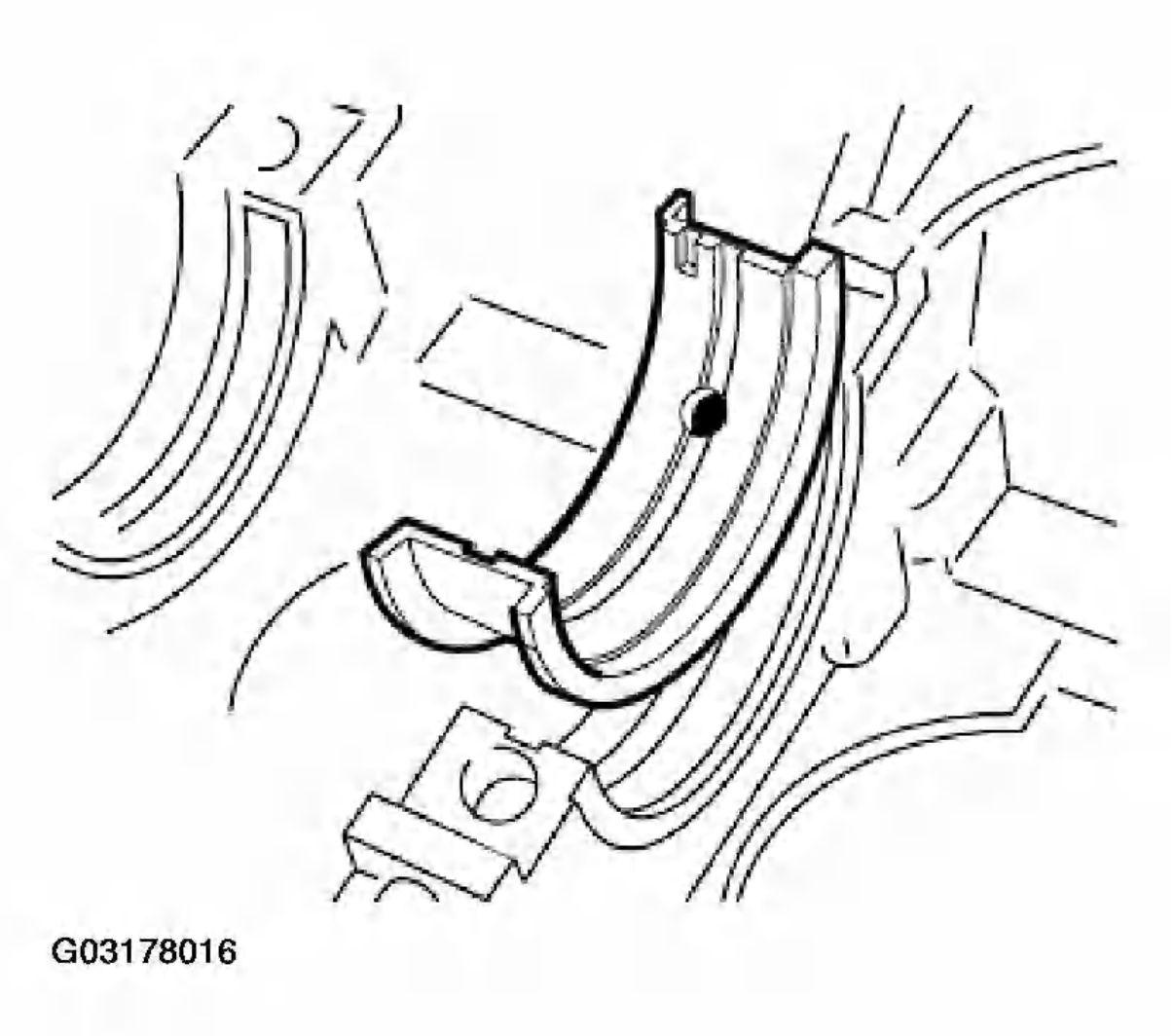



Fig. 101: Inserting Pilot Bearing Shell In Engine Block
Courtesy of BMW OF NORTH AMERICA, INC.

Install crankshaft.

NOTE: The crankshaft is marked with yellow, green or white paint according to the tolerance of the main journal.

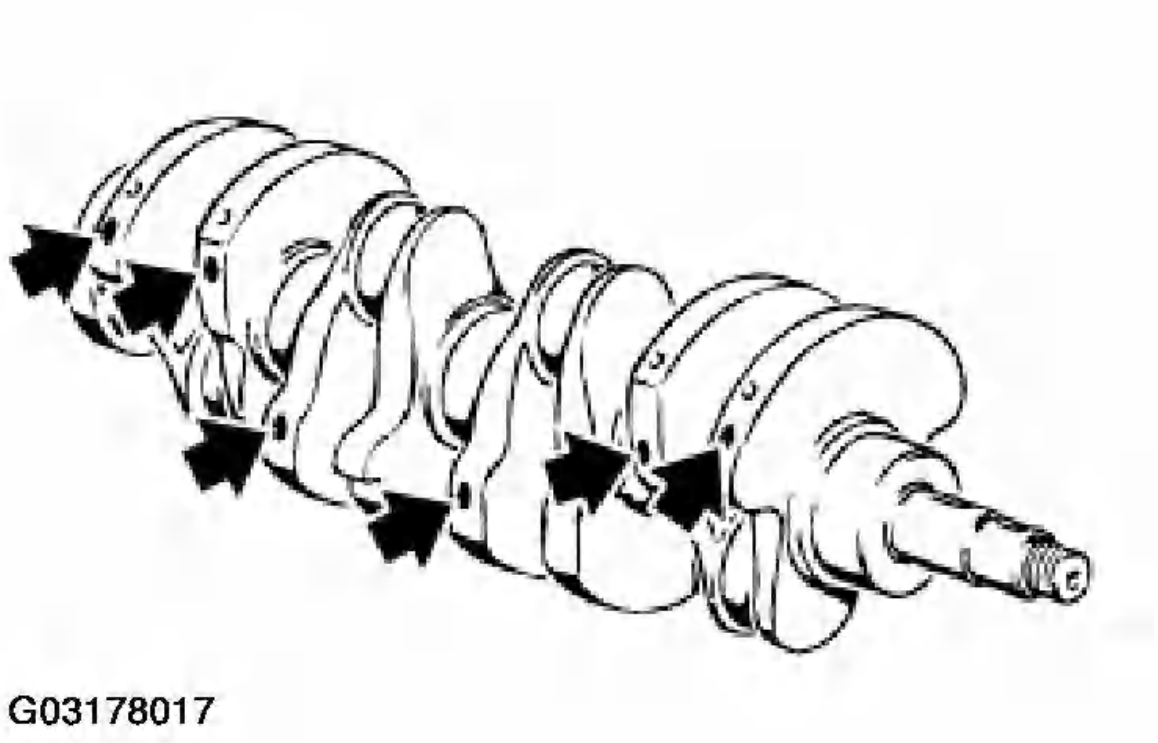



Fig. 102: Identifying Marks On Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

The bearing shell classification for the bearing cover is marked on the crankshaft in yellow, green or white paint.

Insert main bearing shells with same crankshaft color coding in main bearing caps.

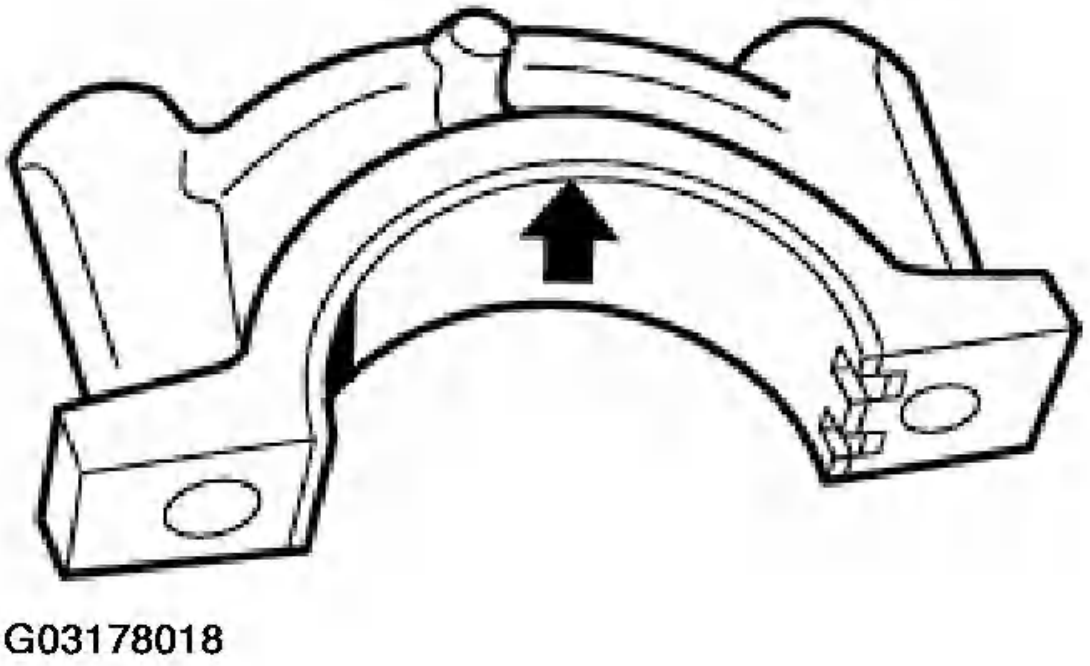



Fig. 103: Identifying Mark On Main Bearing Shells
Courtesy of BMW OF NORTH AMERICA, INC.

The bearing shells are marked with yellow, green or white paint.

1. Bearing shell.
2. Guide bearing.

Observe grinding stage of main bearing journals. Refer to CRANKSHAFT WITH BEARING .

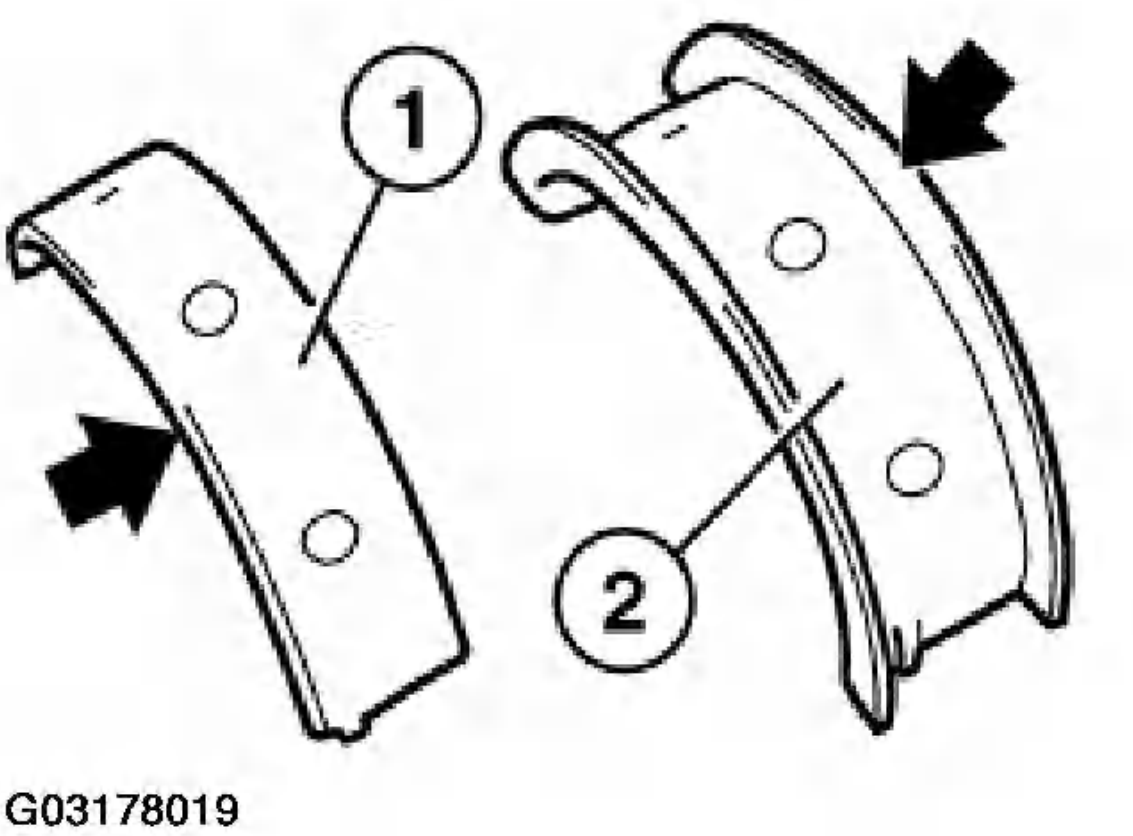



Fig. 104: Identifying Bearing Shell And Guide Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Bearing caps 1 to 5 are marked on exhaust side. Bearing caps 6 and 7 are not designated. Bearing cap 6 is a thrust bearing.

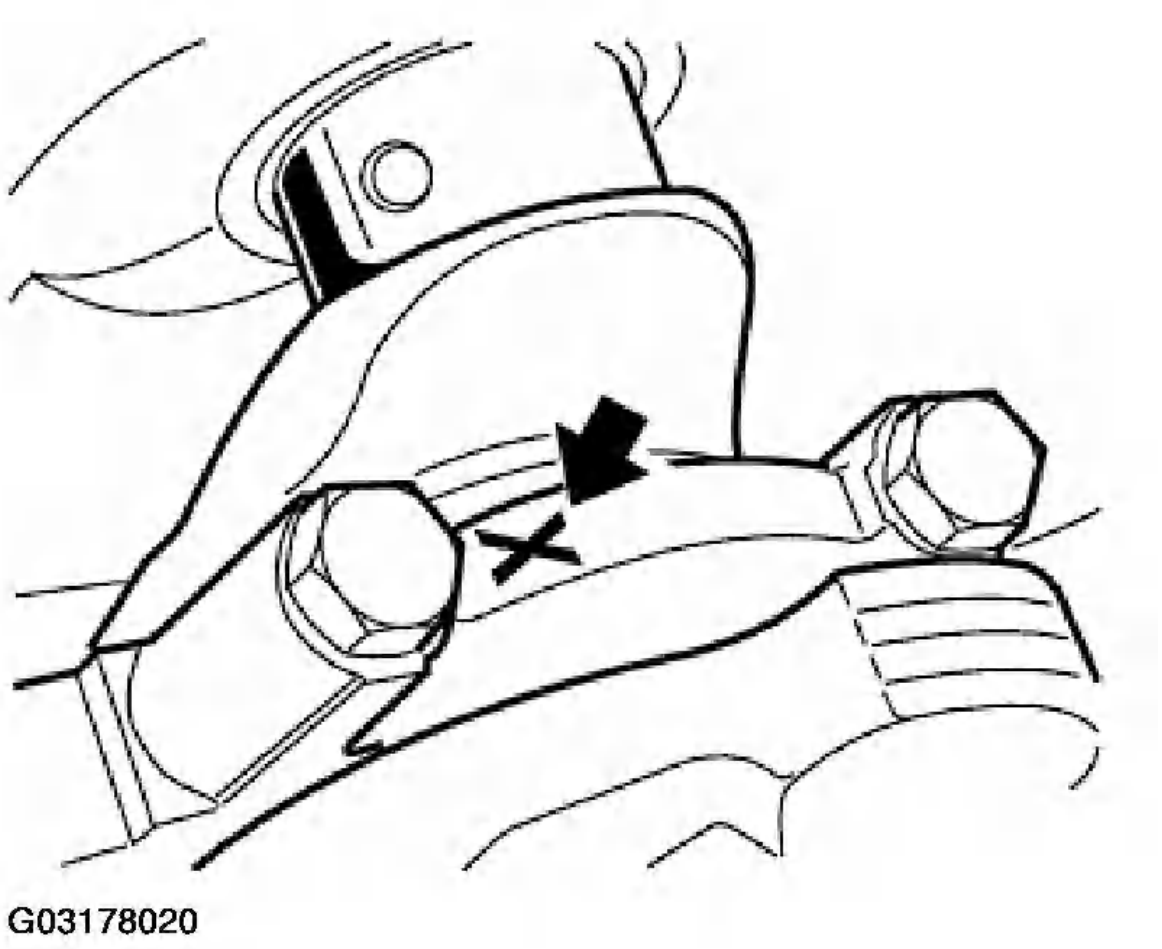



Fig. 105: Identifying Bearing Cap Mark
Courtesy of BMW OF NORTH AMERICA, INC.

Check clearance on main crankshaft bearing.

Install crankshaft and place special tool 00 2 590 (Plastigage Type PG1) on oil-free crankshaft.

Do not twist crankshaft.

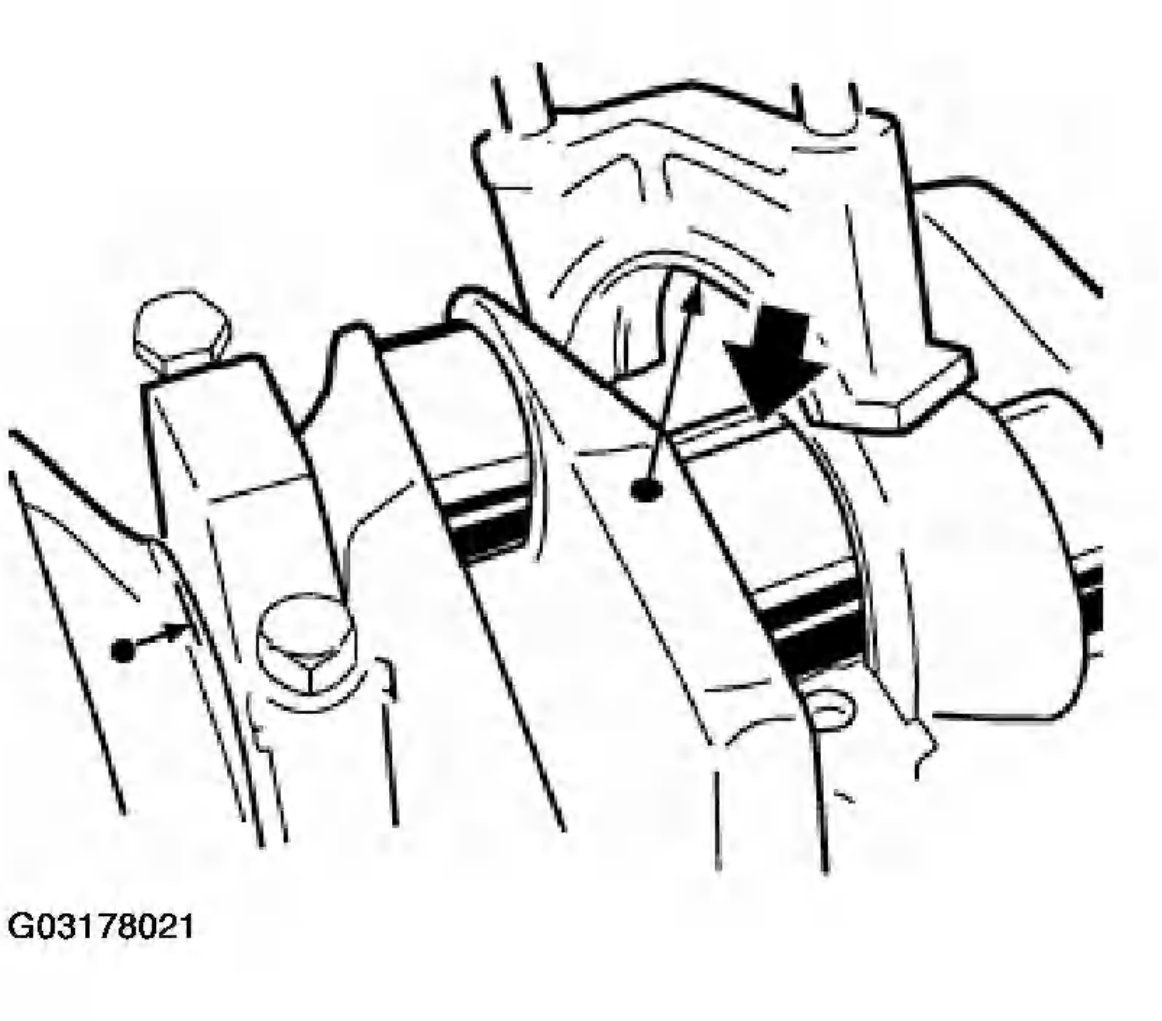



Fig. 106: Checking Clearance On Main Crankshaft Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

Install main bearing cap so that grooves in main bearing shell guide are one side.

Align main bearing cap flush with side of bearing seat.

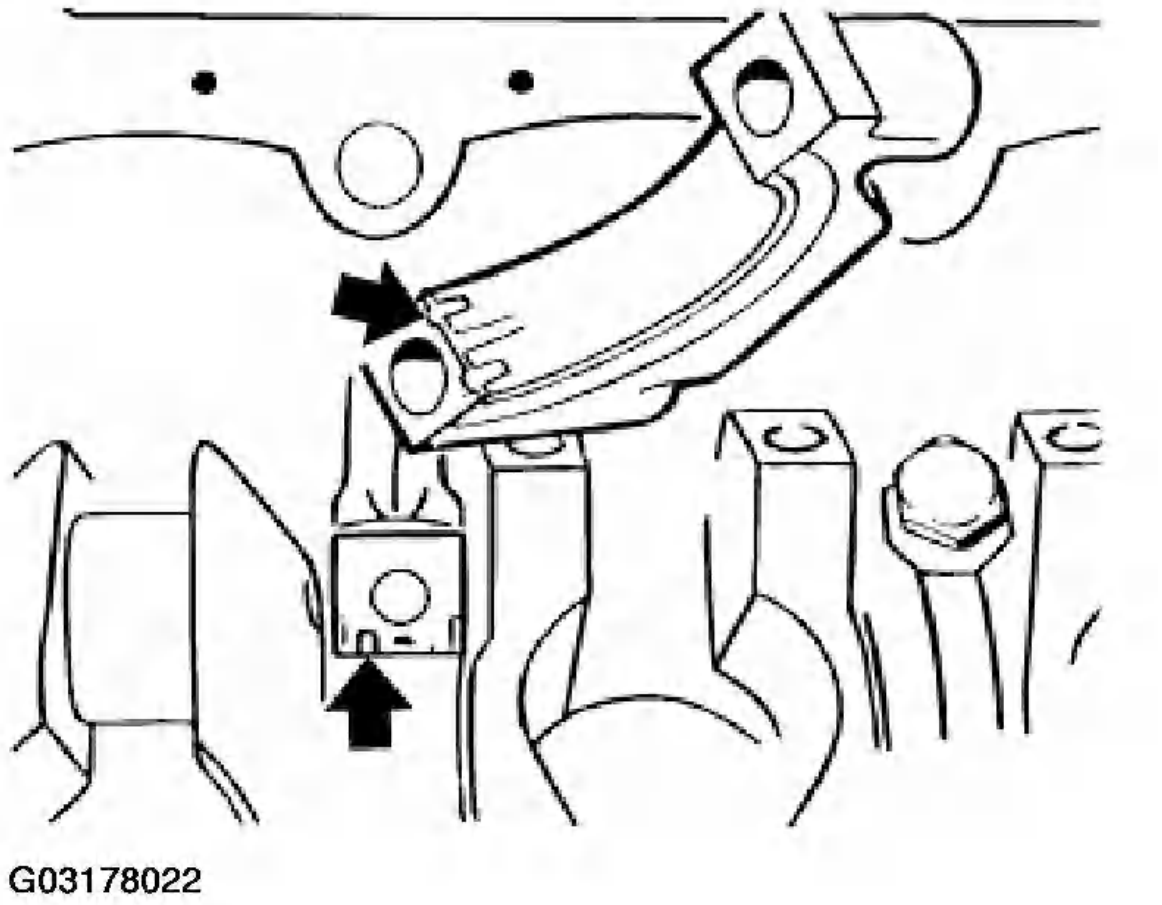



Fig. 107: Identifying Grooves In Main Bearing Shell Guide
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

To check main bearing clearance, use the old main bearing screws.

There must be no oil in the blind holes (risk of cracking).

1. Tighten down main bearing screws with jointing torque.
2. Tighten down main bearing bolts with special tool 00 9 120 to angle of rotation.

   Tightening torque, refer to 11 11 1AZ in ENGINE BLOCK .

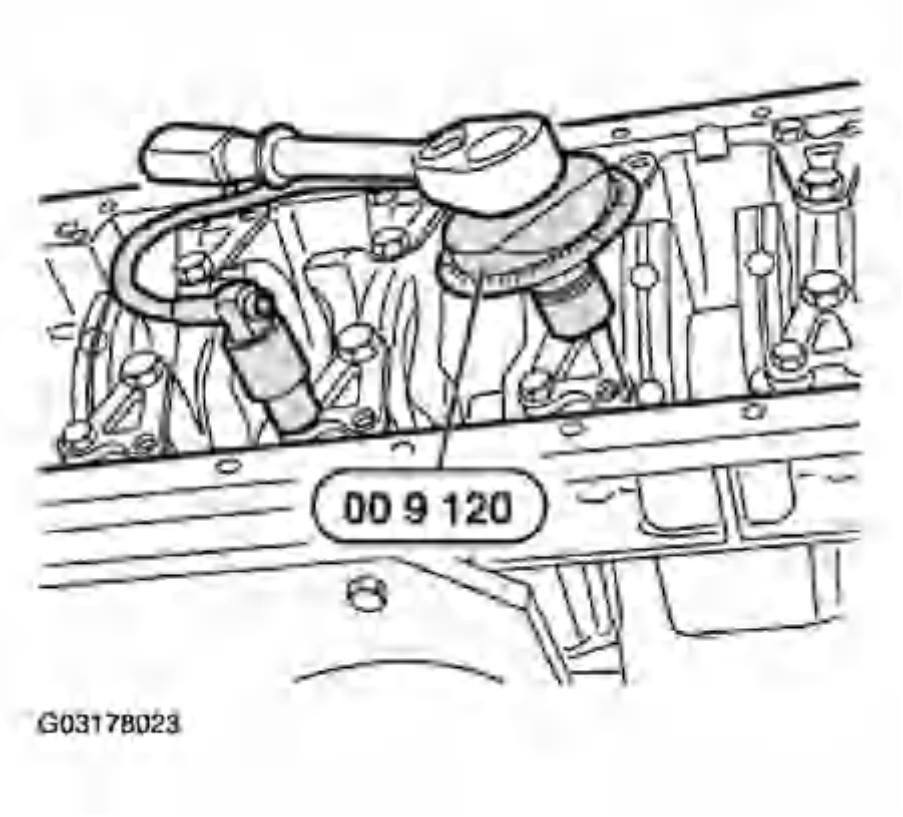



Fig. 108: Tightening Main Bearing Bolts With Special Tool 00 9 120
Courtesy of BMW OF NORTH AMERICA, INC.

Remove main bearing cap and read off bearing clearance at width of pinched plastic thread on measuring scale.

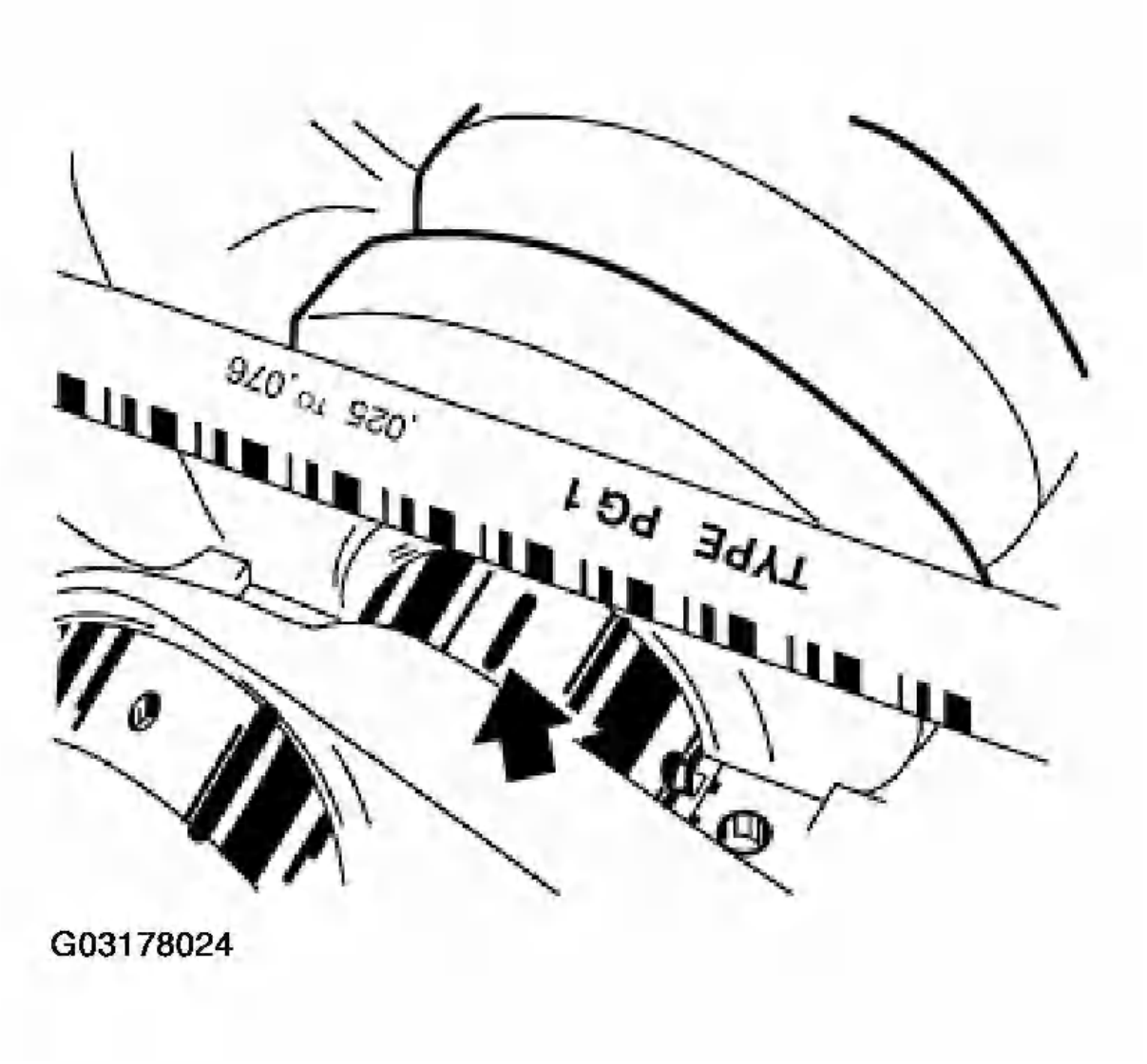



Fig. 109: Reading Bearing Clearance At Width Of Pinched Plastic Thread On Measuring Scale
Courtesy of BMW OF NORTH AMERICA, INC.

Radial crankshaft bearing clearance. Refer to CRANKSHAFT WITH BEARING .

If necessary, to correct bearing clearance, fit new bearing shells with a different color coding.

Remove plastic thread.

Coat main bearing shells and crankshaft with engine oil.

Install main bearing cap so that grooves in main bearing shell guide are one side.

Align main bearing cap flush with side of bearing seat.

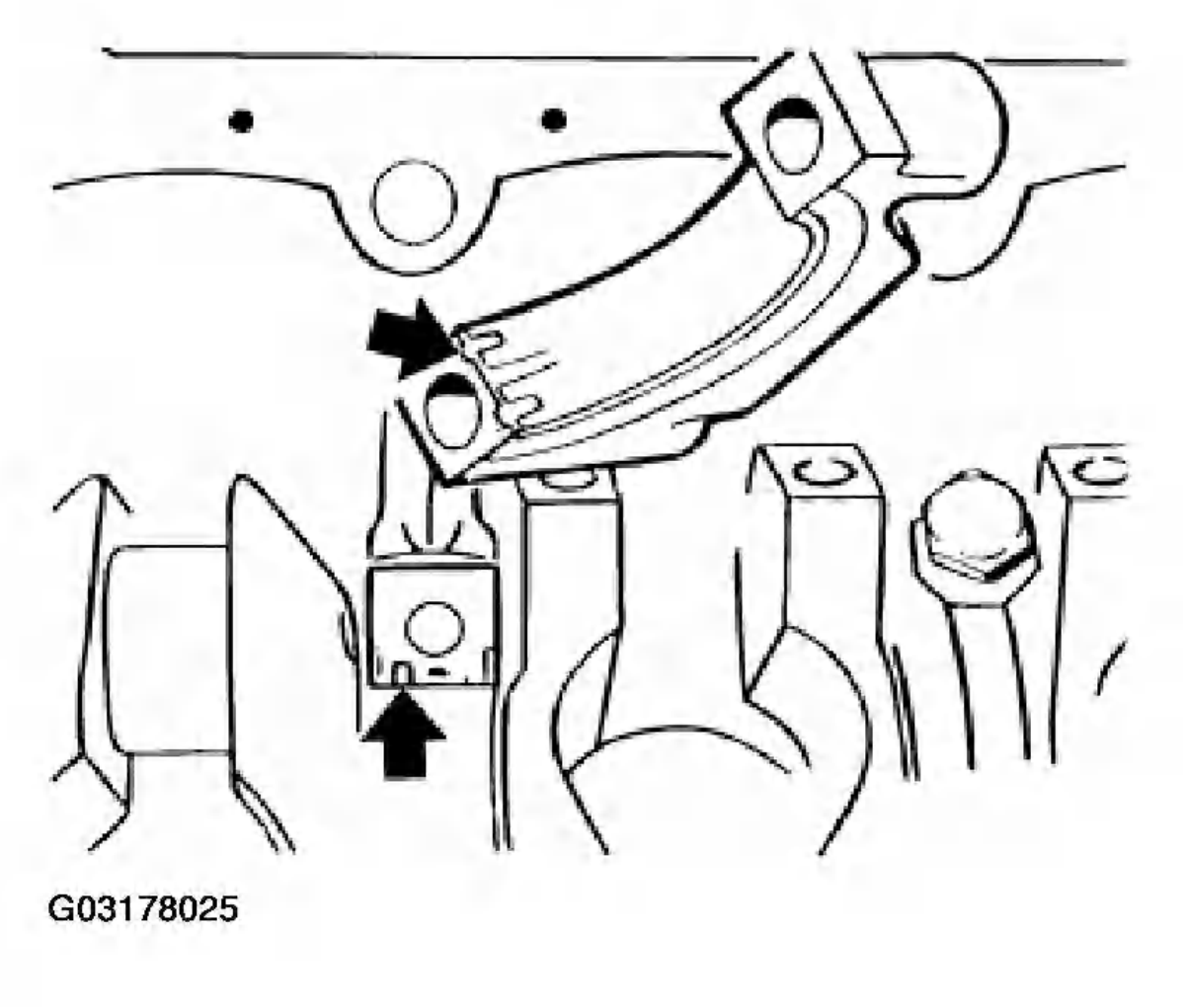



Fig. 110: Identifying Main Bearing Shells And Crankshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Always replace bolts of main bearing cap with new bolts.

There must be no oil in the blind holes (risk of cracking).

NOTE: The reinforcement plates are not fitted on engines with gray cast iron engine blocks or on engines with oil pumps integrated in oil scrapers.

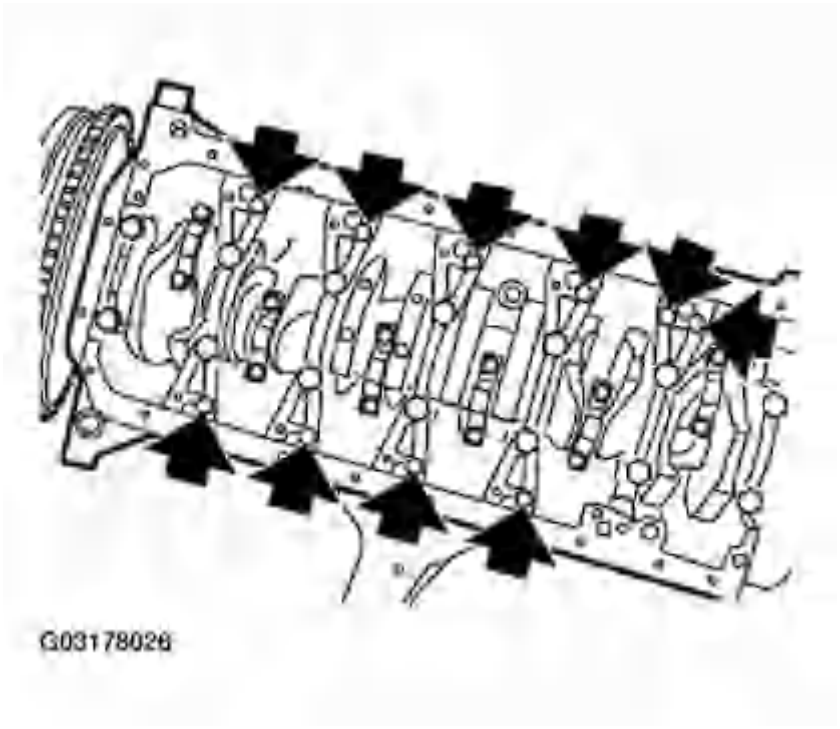



Fig. 111: Installing Reinforcement Plates
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Install reinforcement plates and fit screws with zero backlash.

Install main bearing shells and abut firmly.

Tighten down screw connection on reinforcement plates.

Tightening specifications for main bearing:

1. Tighten all screws on main bearing cover with jointing torque.
2. Unfasten screws on main bearing cover 6.
3. Strike back and front of crankshaft with plastic hammer to center thrust bearing (do not damage crankshaft).
4. Tighten screws of main bearing cover 6 with jointing torque.
5. Tighten down all screws of main bearing caps with special tool 11 2 110 or with special tool 00 9 120 to torsion angle.

Tightening torque, refer to 11 11 1AZ in ENGINE BLOCK .

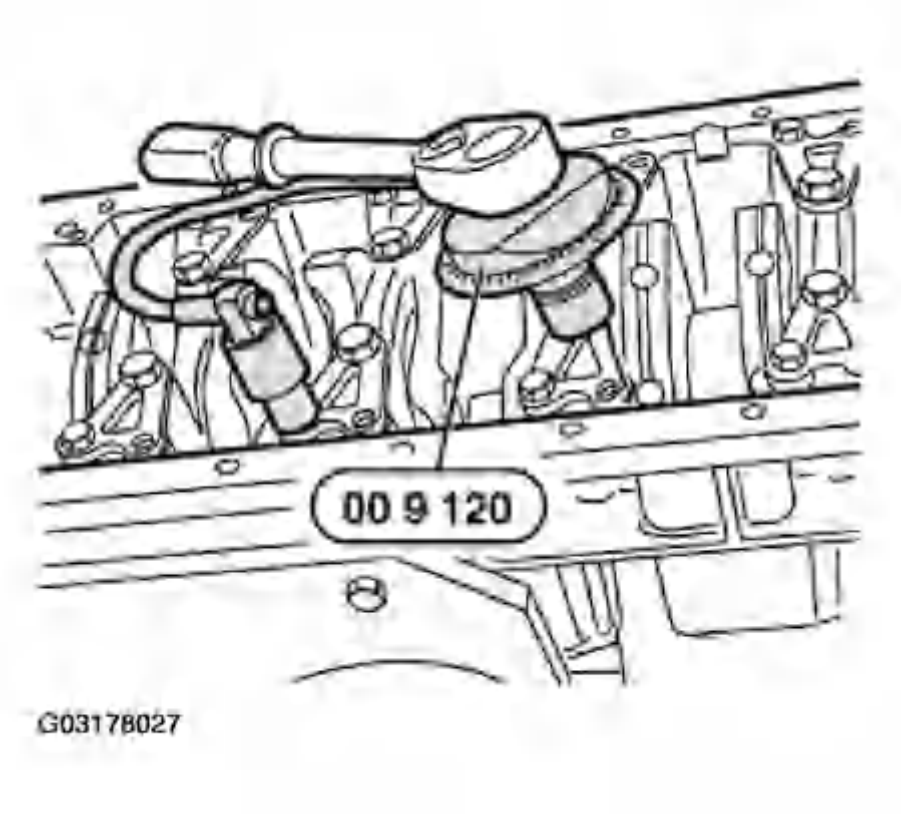



Fig. 112: Tightening Screw Of Main Bearing Caps With Torque Angle Measuring Dial
Courtesy of BMW OF NORTH AMERICA, INC.

Check axial play.

If permitted end float is exceeded, check crankshaft, guide bearing shells and engine block, replacing if necessary, end float. Refer to CRANKSHAFT WITH BEARING .

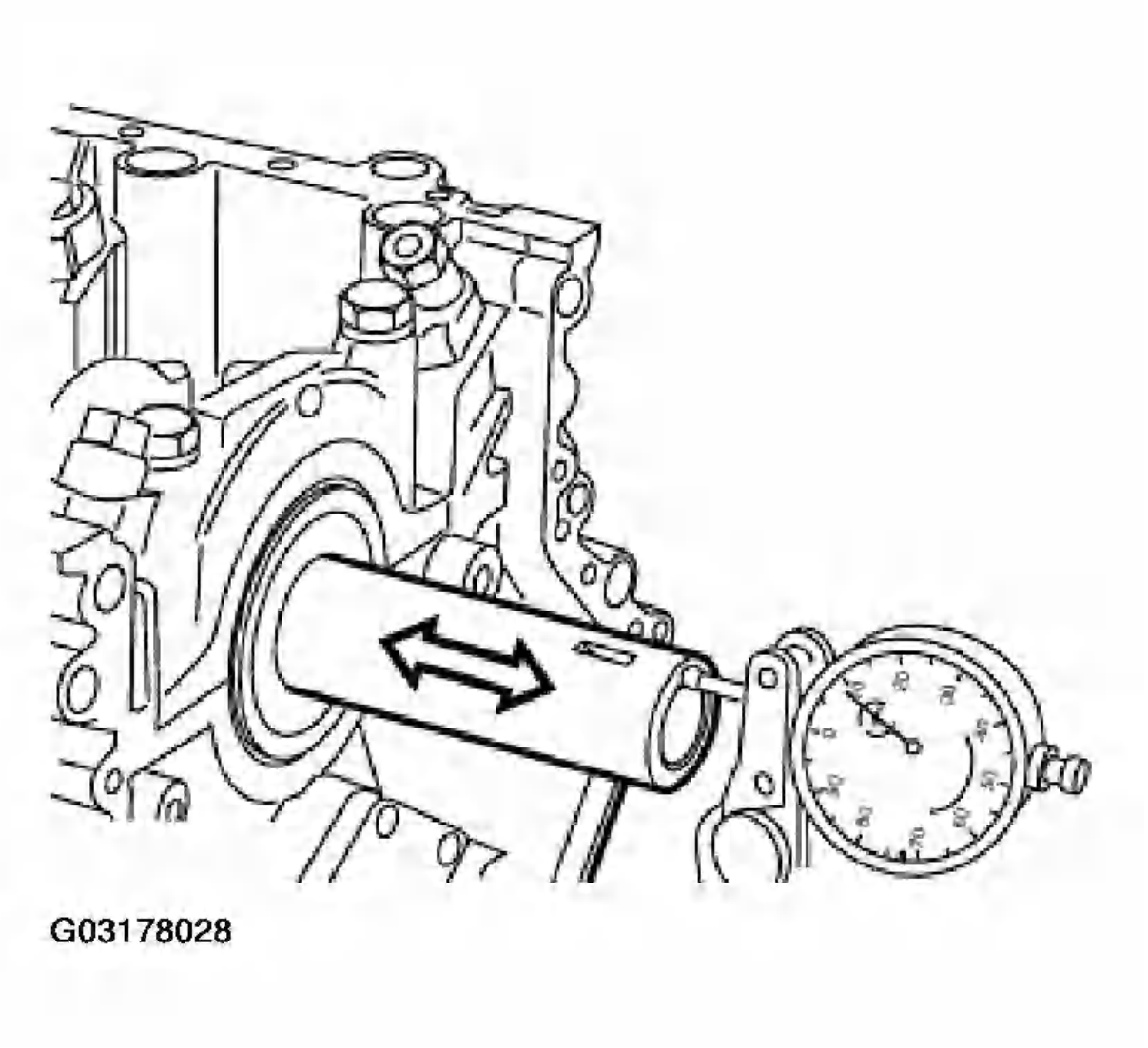



Fig. 113: Checking Axial Play
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 21 571 REPLACING GROOVED BALL BEARING IN CRANKSHAFT (M52 / S52 / M52TU / M54 / S50 / S54)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 00 5 500
- 11 2 340
- 11 2 350

(Clutch removed)

Important!

In version with needle bearing (1) in dual-mass flywheel (2), no grooved ball bearing may be fitted in the crankshaft.

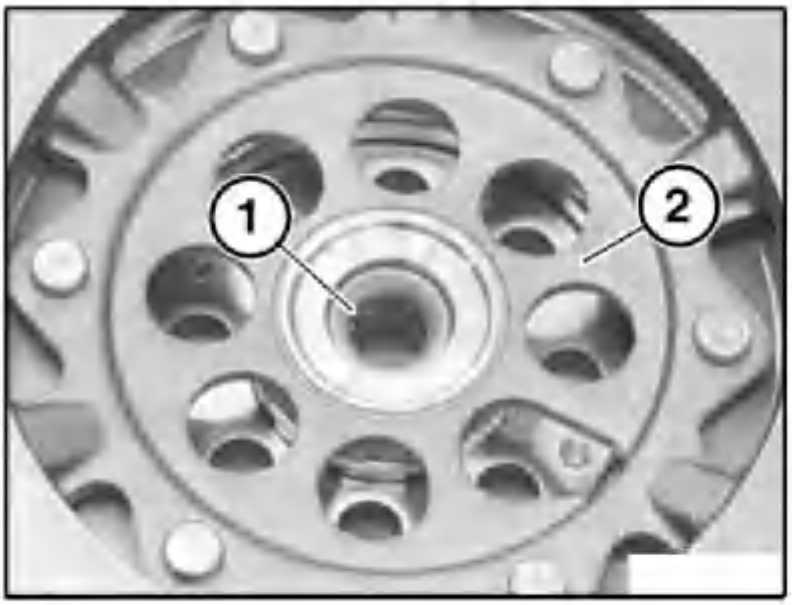



Fig. 114: Identifying Needle Bearing In Dual-Mass Flywheel
Courtesy of BMW OF NORTH AMERICA, INC.

Version With Grooved Ball Bearing:

Remove guide bearing with special tool 11 2 340.

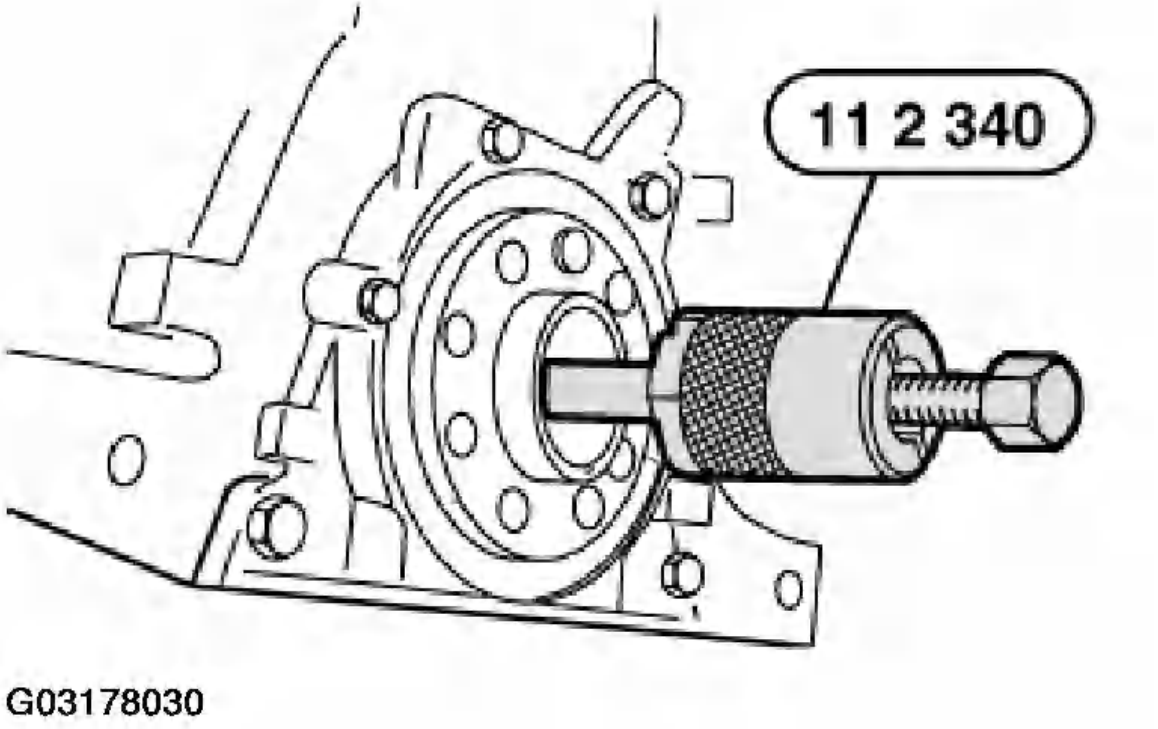



Fig. 115: Removing Guide Bearing With Special Tool 11 2 340

Courtesy of BMW OF NORTH AMERICA, INC.

Install new thrust bearing and drive firmly home with special tool 11 2 350 in conjunction with special tool 00 5 500.

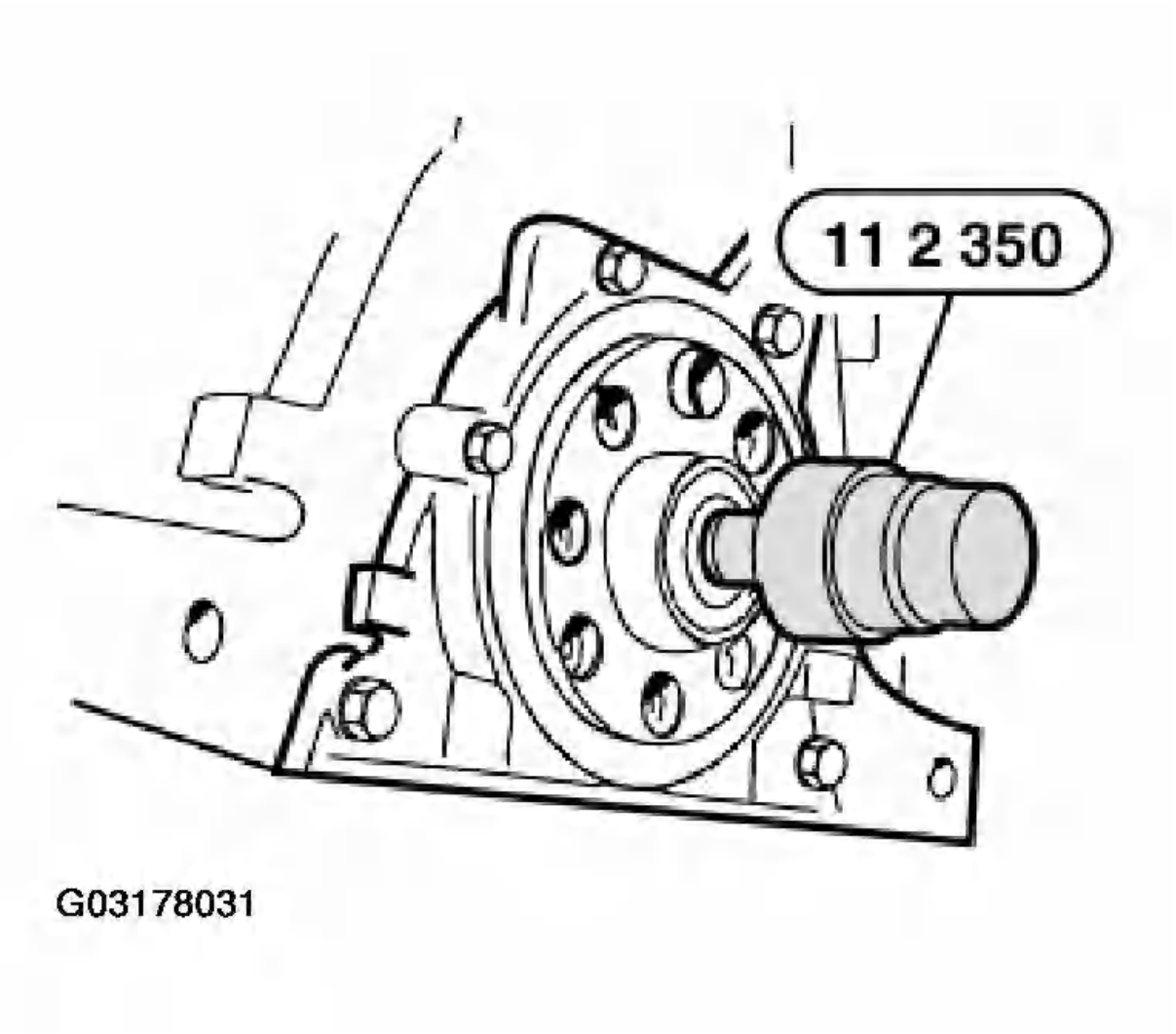



Fig. 116: Installing Thrust Bearing With Special Tool 11 2 350
Courtesy of BMW OF NORTH AMERICA, INC.

## FLYWHEEL

### 11 22 500 REMOVING AND INSTALLING OR REPLACING FLYWHEEL (M52 / S52 / M52TU / M54 / S54)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 11 2 170

(Clutch removed)

Lock flywheel with special tool 11 2 170.

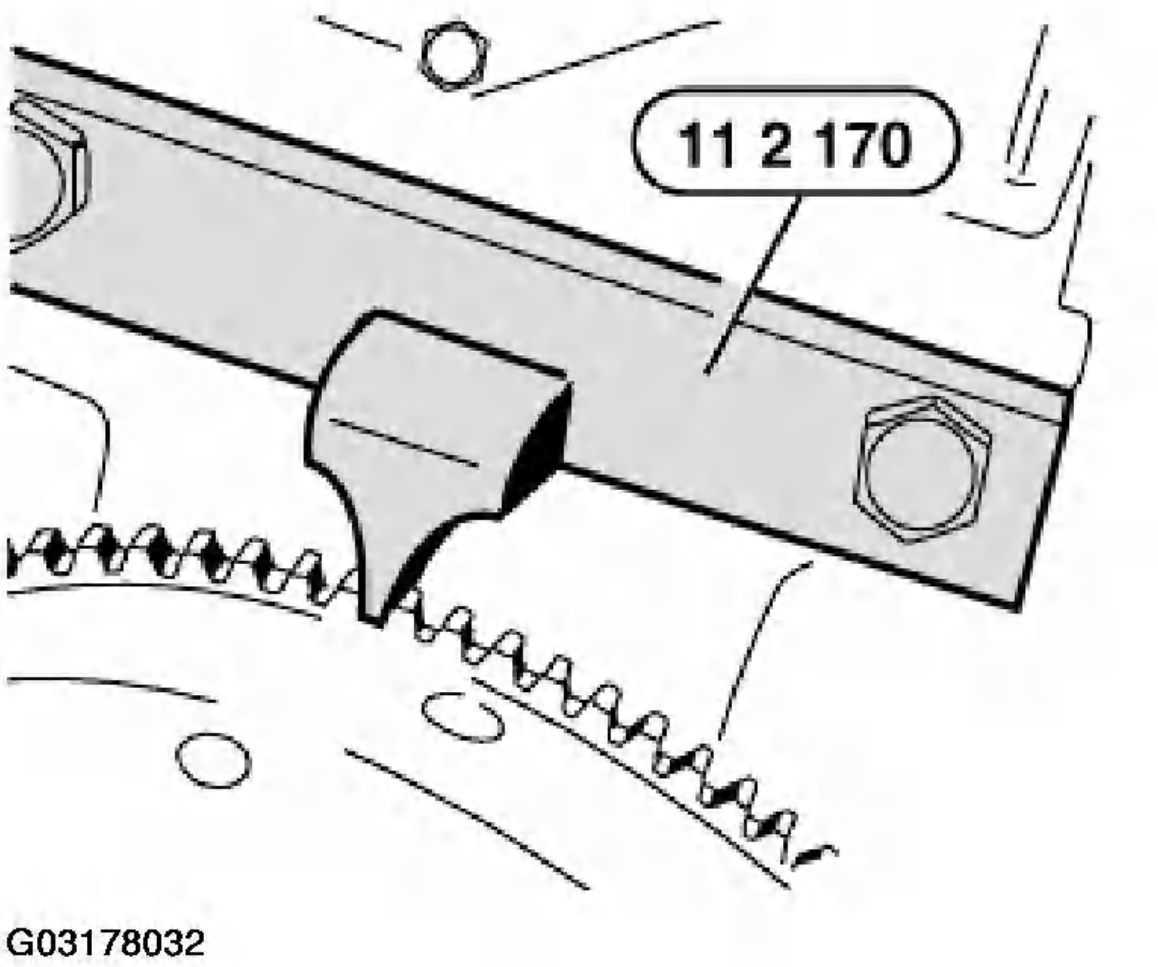



Fig. 117: Locking Flywheel With Special Tool 11 2 170
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws and remove flywheel.

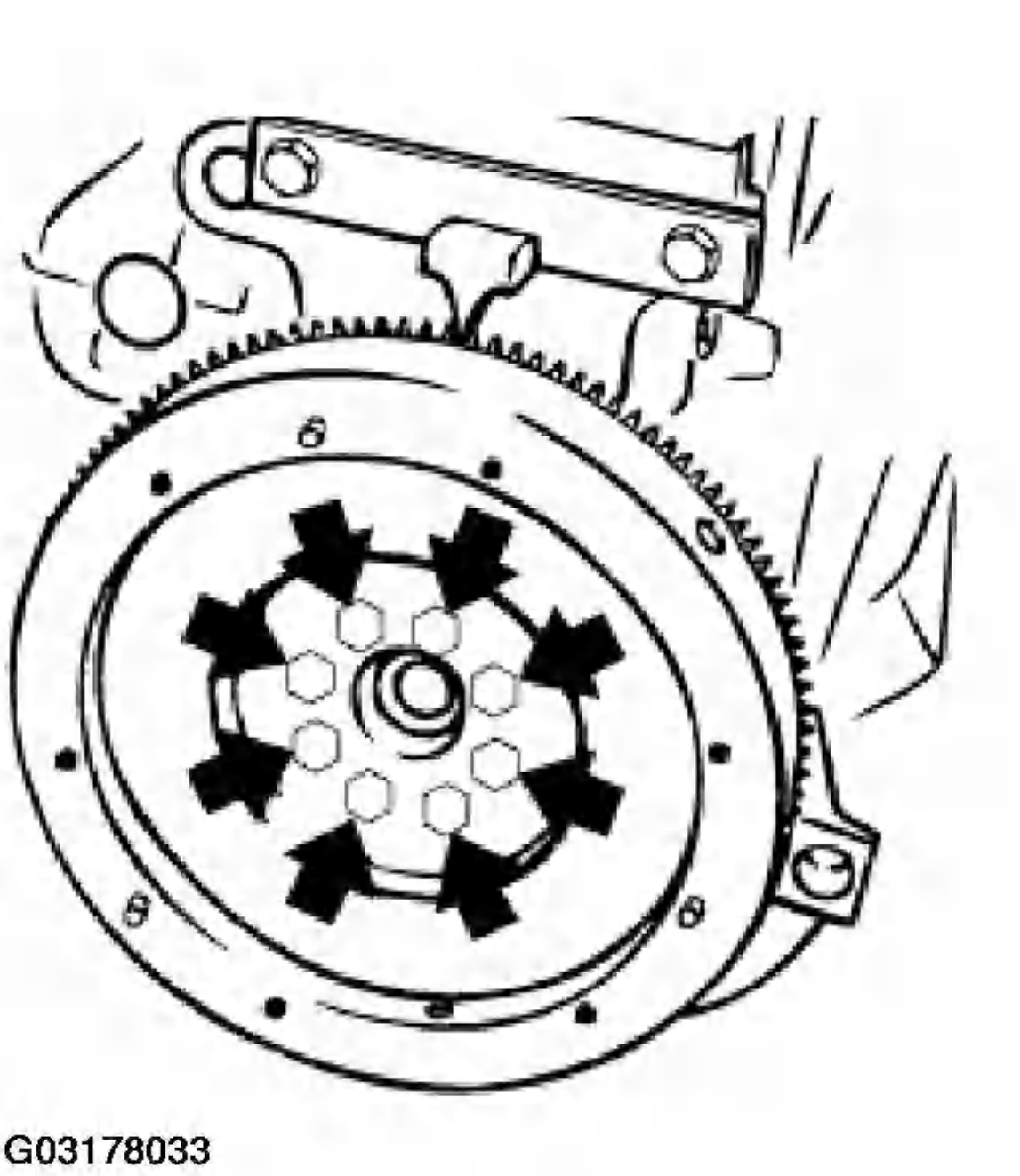



Fig. 118: Identifying Screws Of Flywheel
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check dowel sleeve for damage and correct installation position.

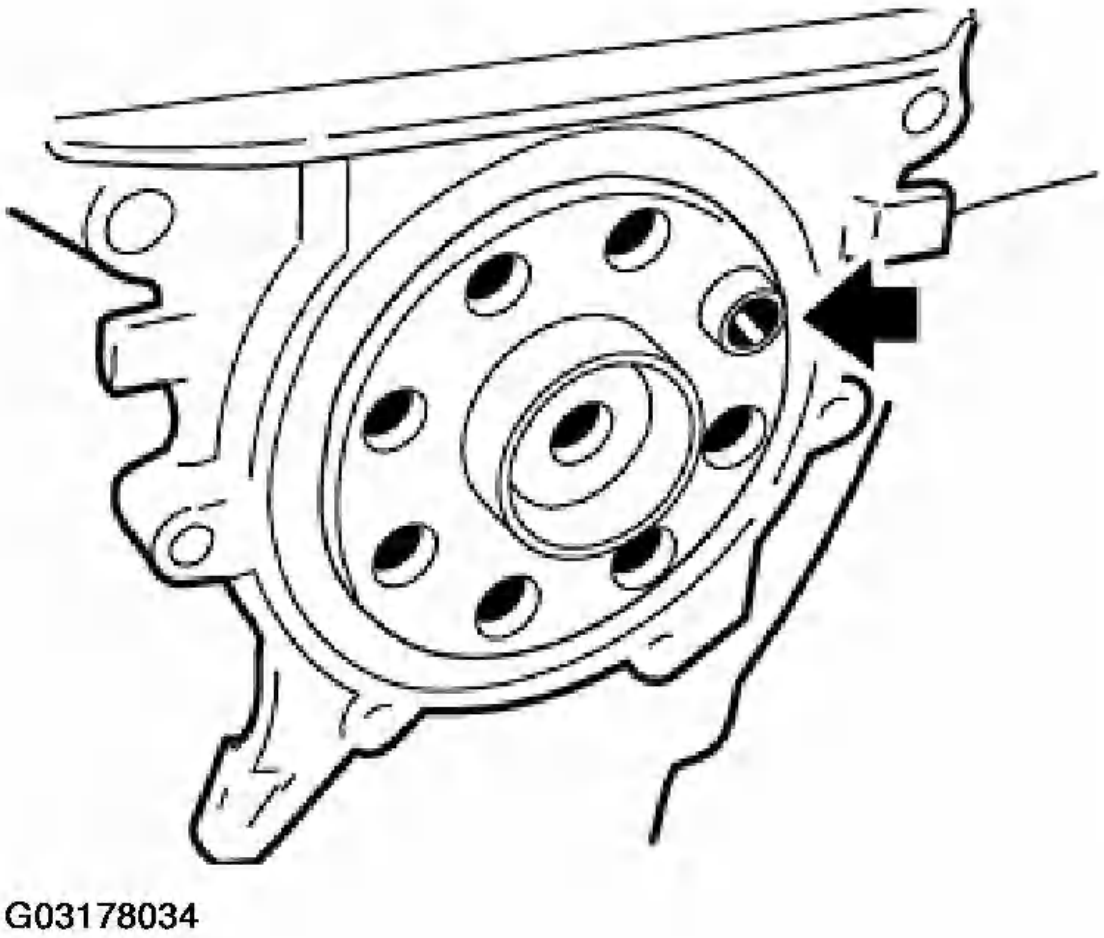



Fig. 119: Checking Dowel Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Position of dowel sleeve (1) in dual-mass flywheel is identified by two notches next to associated bolt hole.

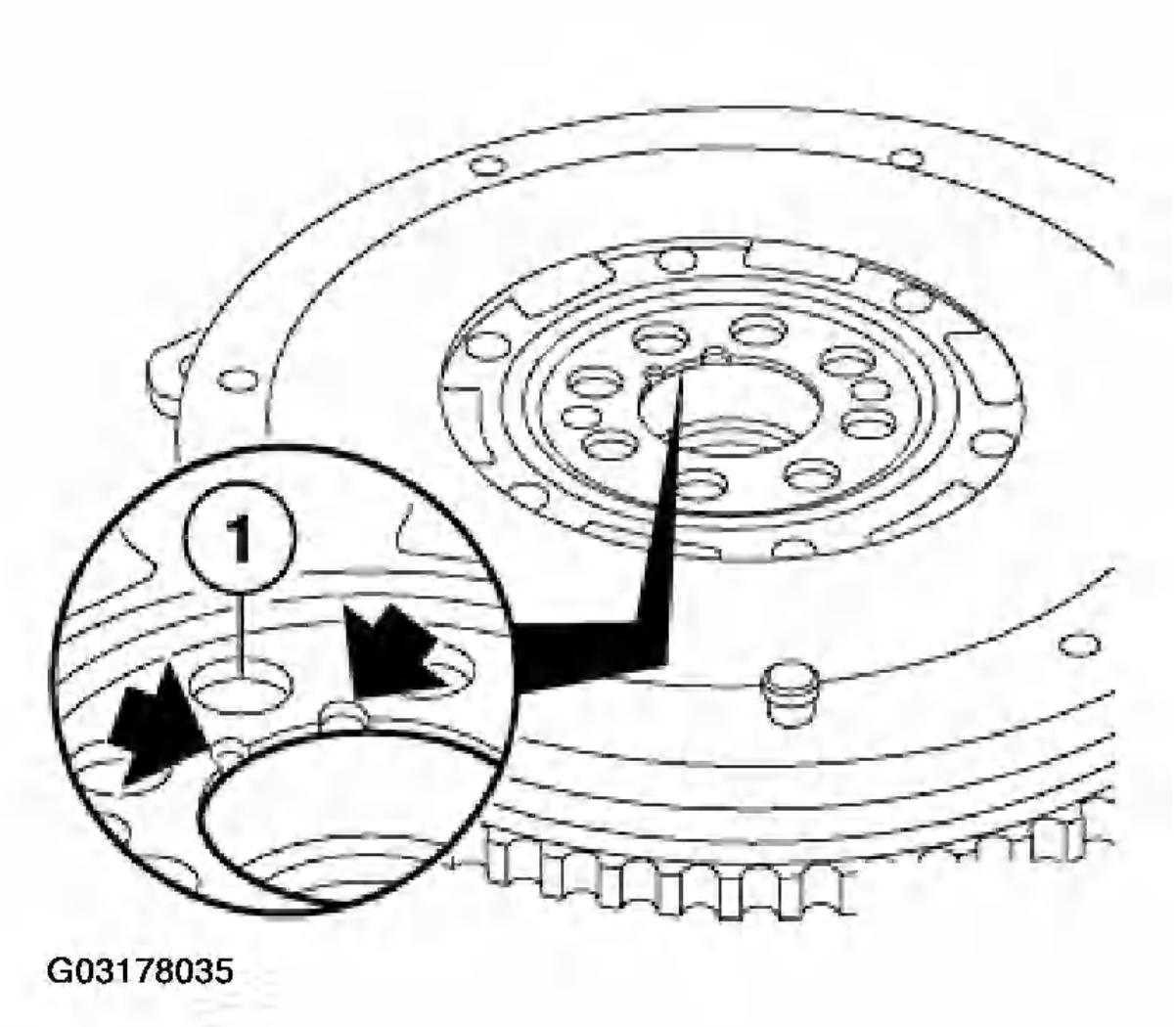



Fig. 120: Identifying Position Of Notches Next To Dowel Sleeve Bolt Hole
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean thread and install new micro-encapsulated screws.

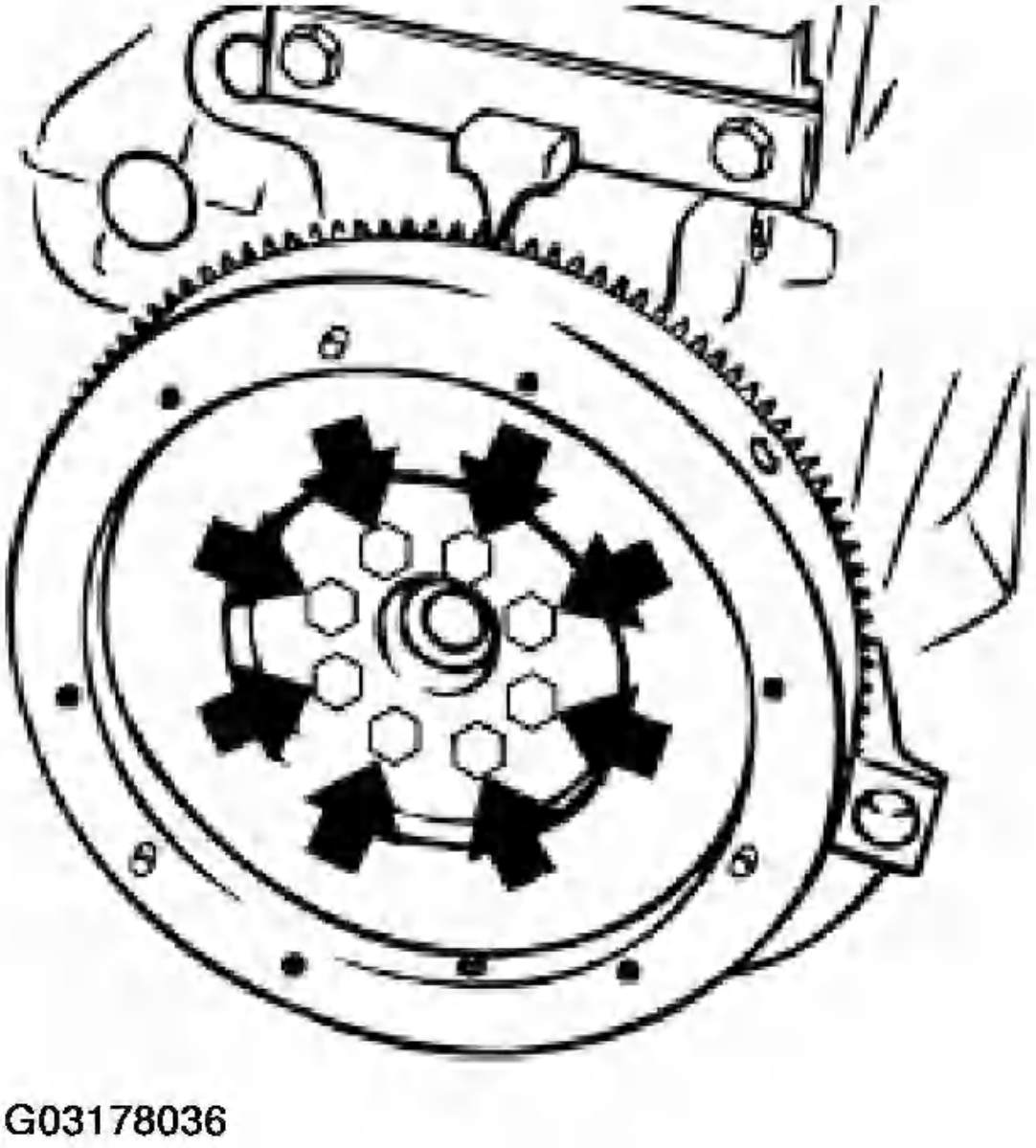



Fig. 121: Installing Micro-Encapsulated Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, refer to 11 22 1AZ in FLYWHEEL .

## VIBRATION DAMPER

### 11 23 010 REMOVING AND INSTALLING OR REPLACING VIBRATION DAMPER (M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 11 8 119
- 11 8 200

- 11 8 210

Necessary Preliminary Tasks:

- Unscrew and remove splash guard.
- Remove fan impeller with fan clutch and fan cowl. Refer to 11 52 020 REMOVING AND INSTALLING/REPLACING FAN CLUTCH (S52 / S54 / M52 / M52TU / M54 / M56).
- Remove A/C compressor drive belt. Refer to 11 28 050 REPLACING A/C COMPRESSOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56).
- Remove alternator drive belt. Refer to 11 28 010 REPLACING ALTERNATOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56)

Important!

Risk of damage.

Protect cooler against damage.

Version 1

Vibration damper and hub for vibration damper are two parts: Unscrew vibration damper bolts and take off vibration damper.

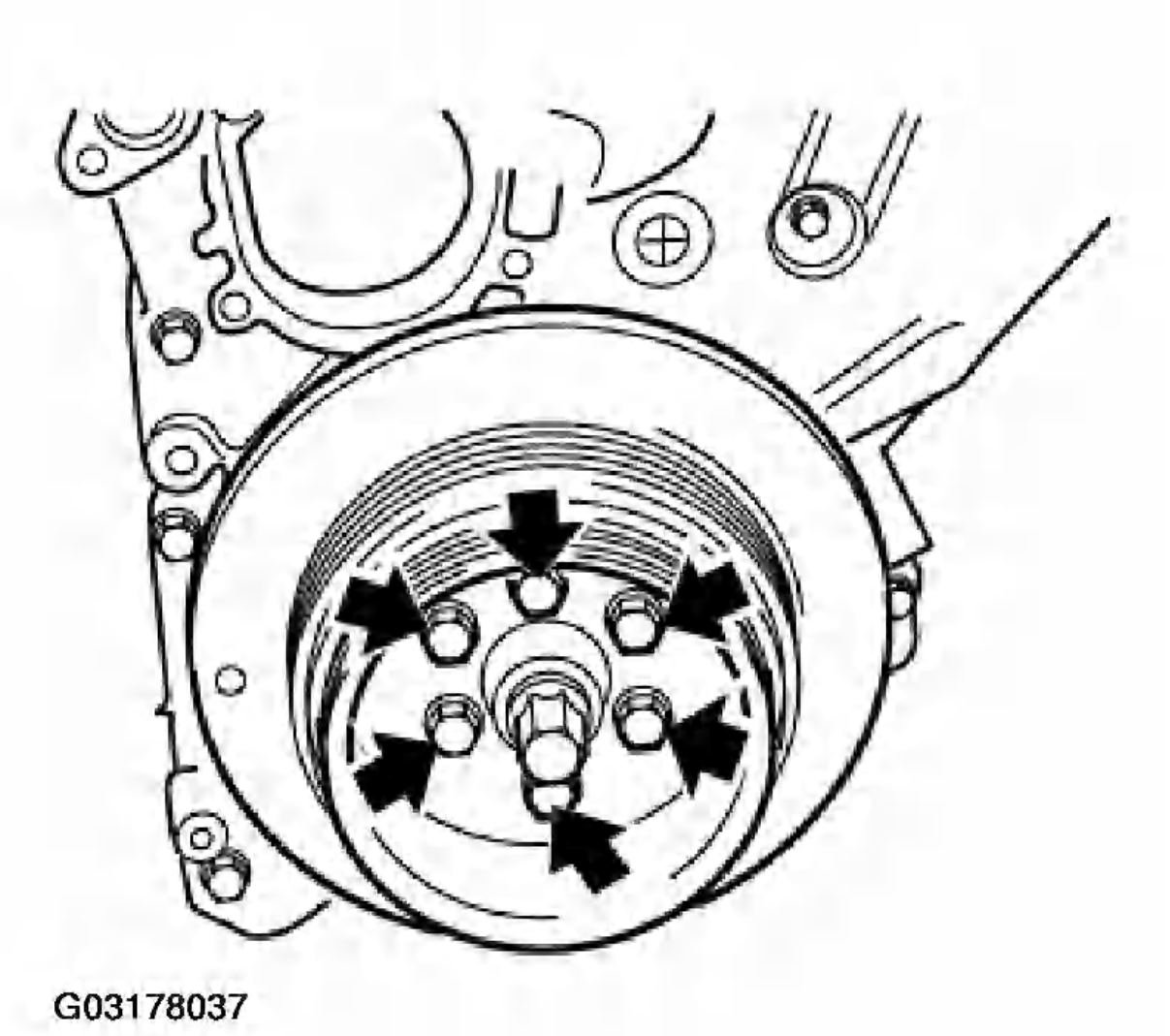



Fig. 122: Identifying Vibration Damper Bolts

Courtesy of BMW OF NORTH AMERICA, INC.

Version 1

Vibration damper and hub for vibration damper are two parts:

Installation:

Align locating bore in vibration damper to dowel pin.

Install and tighten down screws.

Tightening torque, refer to 11 22 3AZ in VIBRATION DAMPER .

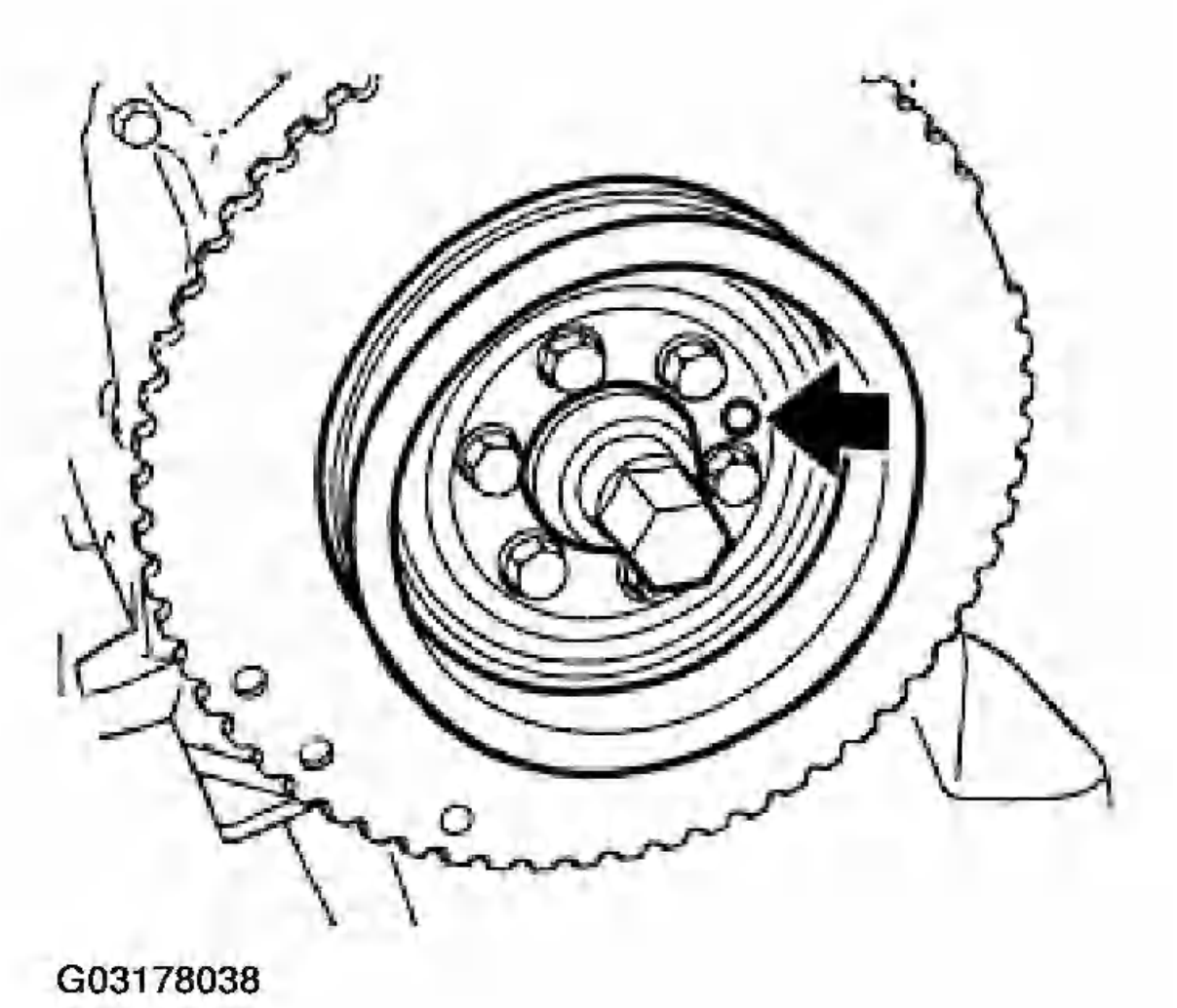



Fig. 123: Aligning Locating Bore In Vibration Damper To Dowel Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Vibration damper and hub for vibration damper are one part: Screw special tool 11 8 190 to special tool 11 8 200.

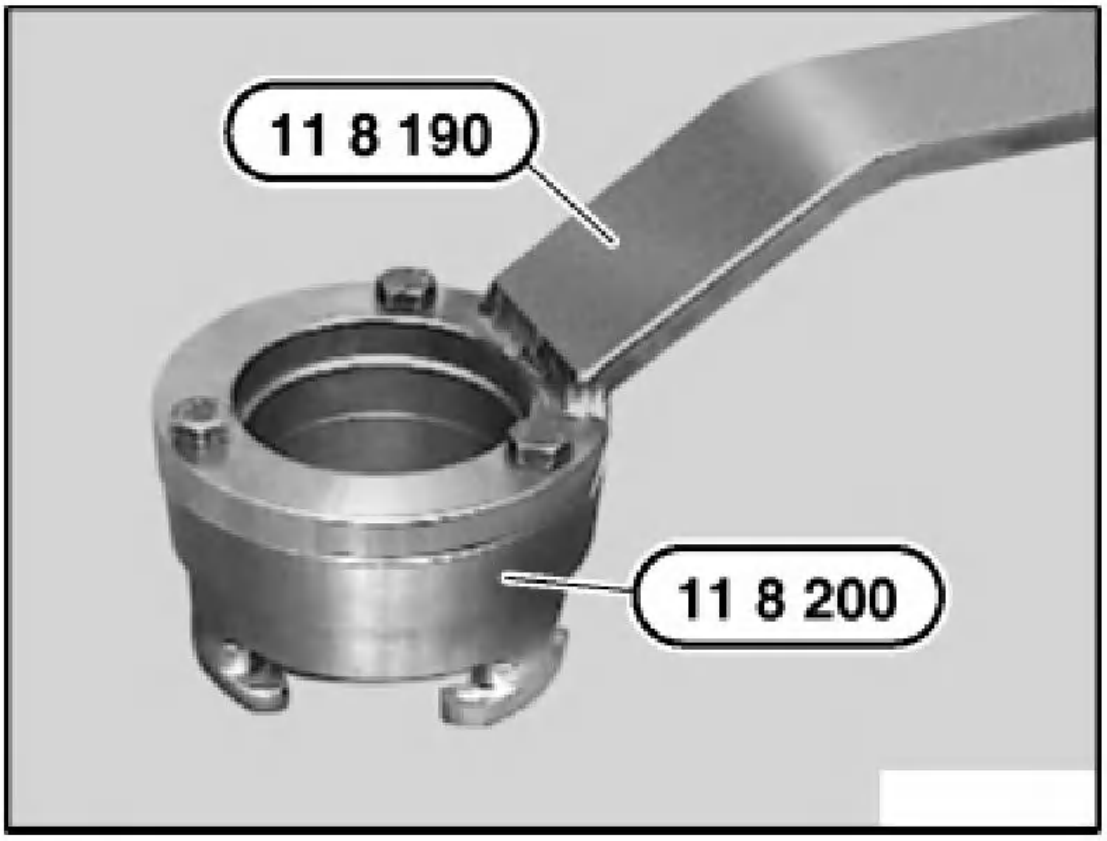



Fig. 124: Assembling Special Tool 11 8 190 To Special Tool 11 8 200
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

NOTE: Special tool 11 8 200 must snap into place in openings (1).

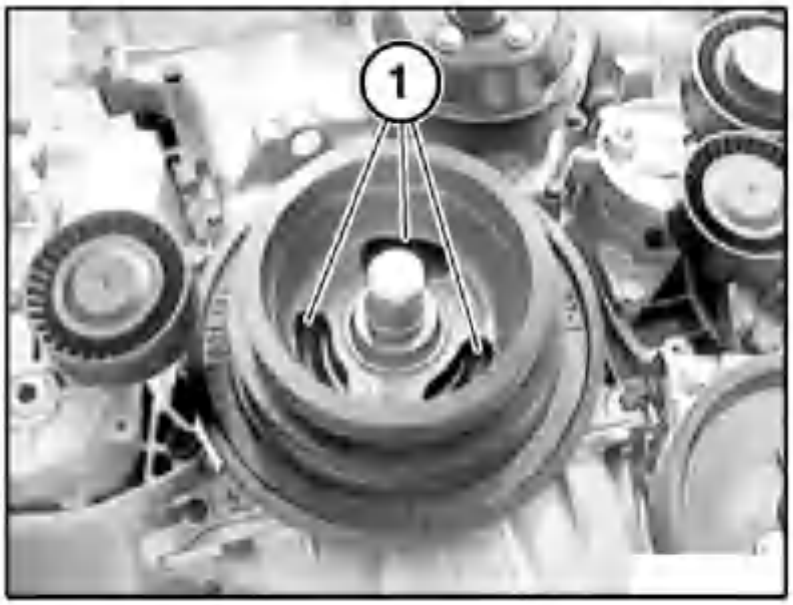



Fig. 125: Identifying Openings On Vibration Damper
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

When releasing and tightening down central bolt, grip special tool 11 8 190 with assistance of a second person.

Version 2

Insert special tool 11 3 200 in openings on vibration damper and turn counterclockwise so that counter-supports snap into place on vibration damper.

Release central screw (1).

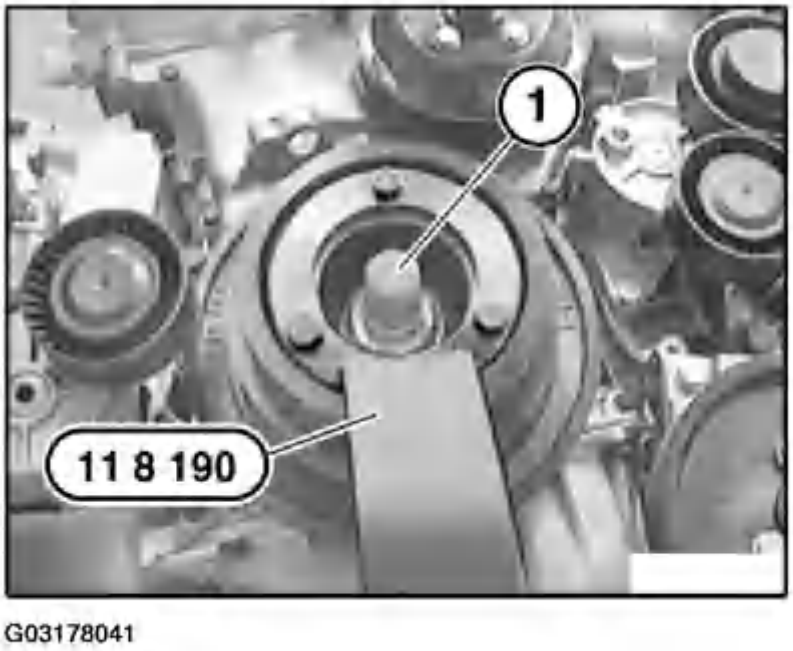


Fig. 126: Identifying Central Screw Of Vibration Damper
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Feed out special tools 11 8 190 / 11 8 200.

Remove central screw and washer.

Carefully detach vibration damper (1) by hand.

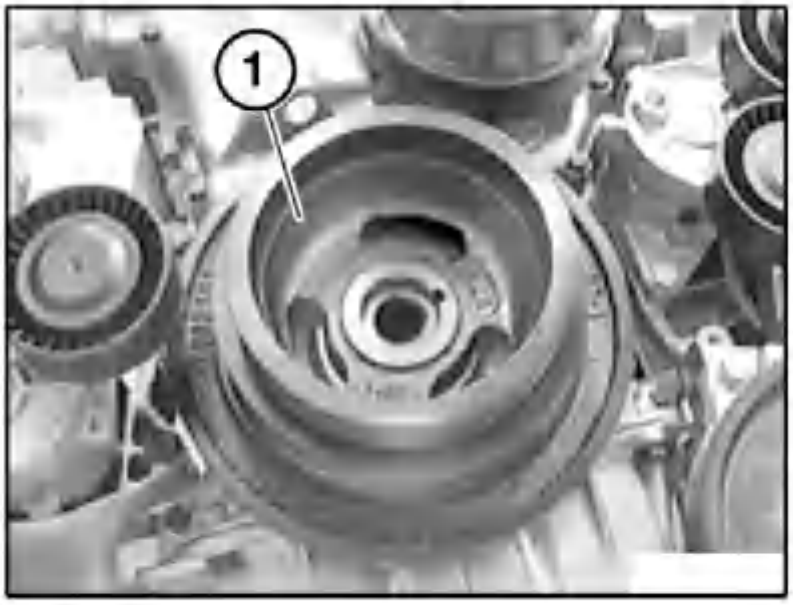



Fig. 127: Identifying Vibration Damper
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

NOTE: If vibration damper cannot be detached by hand:

Insert special tool 11 8 200 in openings on vibration damper and turn clockwise so that counter-supports snap into place on vibration damper.




Fig. 128: Inserting Special Tool 11 8 200 In Vibration Damper
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Screw out spindle (1) on special tool 11 3 210 as far as possible.

Z3 only:

Screw in spindle (1) on special tool 11 8 210 approx. 15 mm and screw out again only after installation between special tool 11 8 200 and cooler.

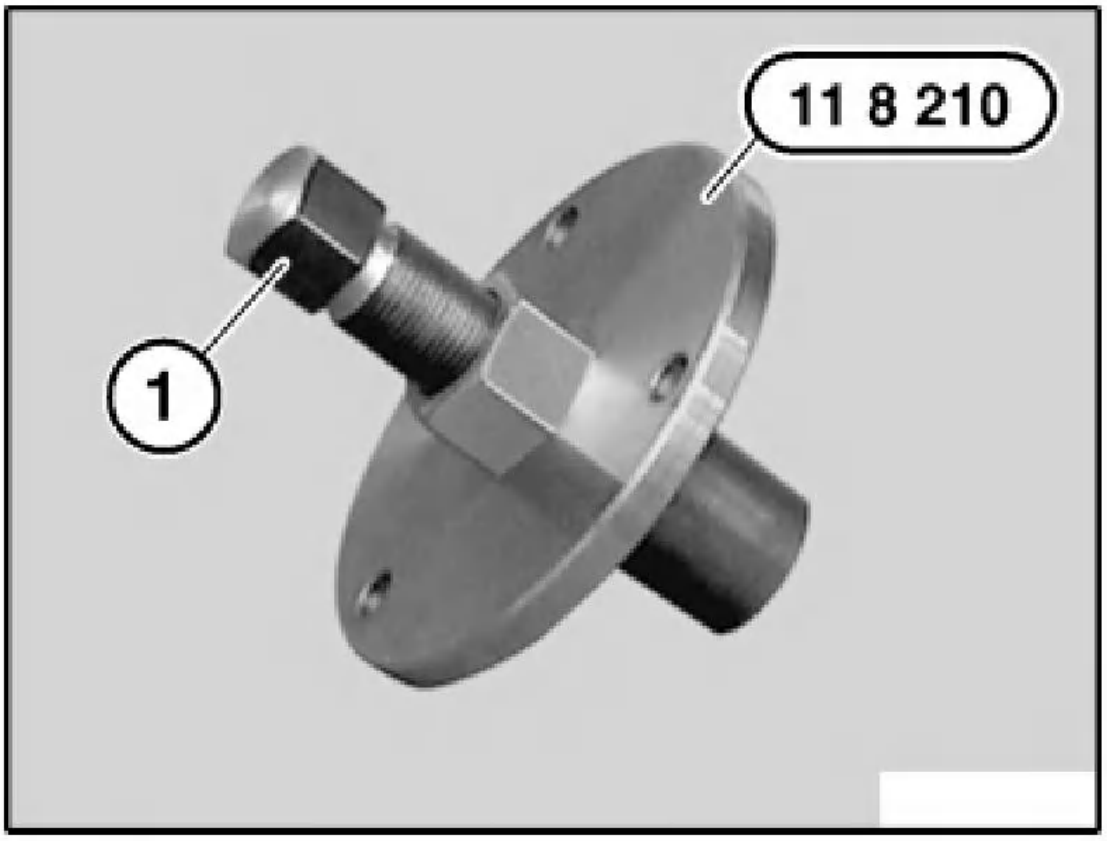



Fig. 129: Identifying Spindle On Special Tool 11 3 210
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Important!

Risk of damage.

Protect cooler against damage.

Carefully install special tool 11 8 210.

Screw special tool 11 8 210 to special tool 11 8 200.

Detach vibration damper by turning spindle (1) on special tool 11 8 210.

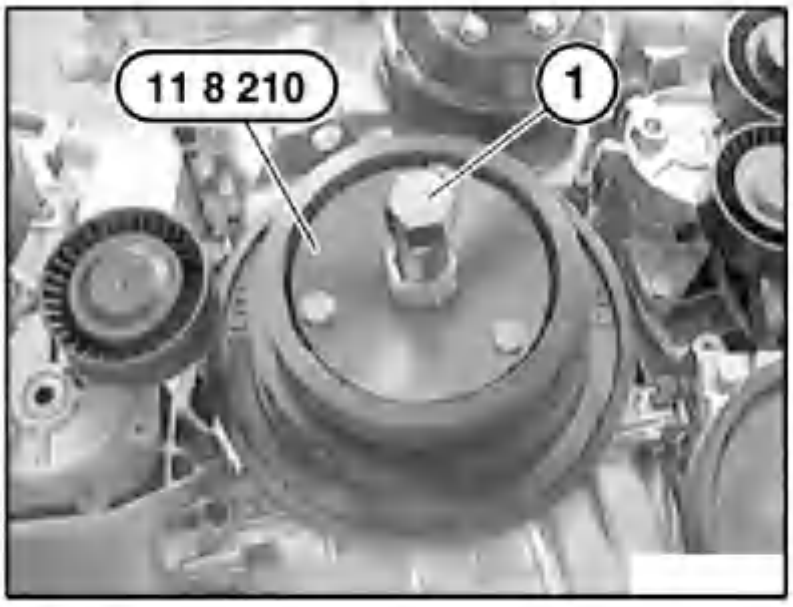



Fig. 130: Identifying Spindle On Special Tool 11 8 210
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Installation:

Check featherkey (1) for damage and correct installation position.

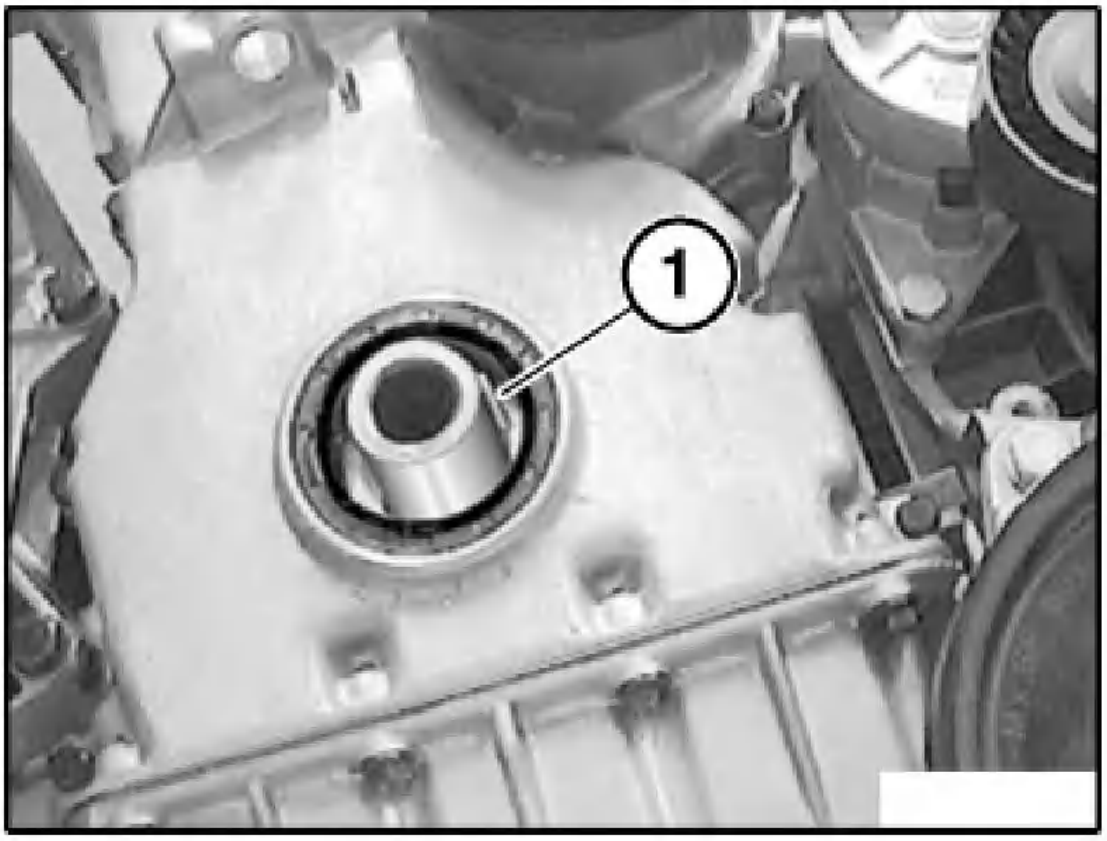



Fig. 131: Checking Featherkey For Damage
Courtesy of BMW OF NORTH AMERICA, INC.

Replace radial seal in lower timing case cover. Refer to 11 14 141 REPLACING RADIAL SEAL IN LOWER TIMING CASE COVER.

Version 2

Installation:

Align groove (1) in vibration damper to featherkey.

Fit vibration damper.

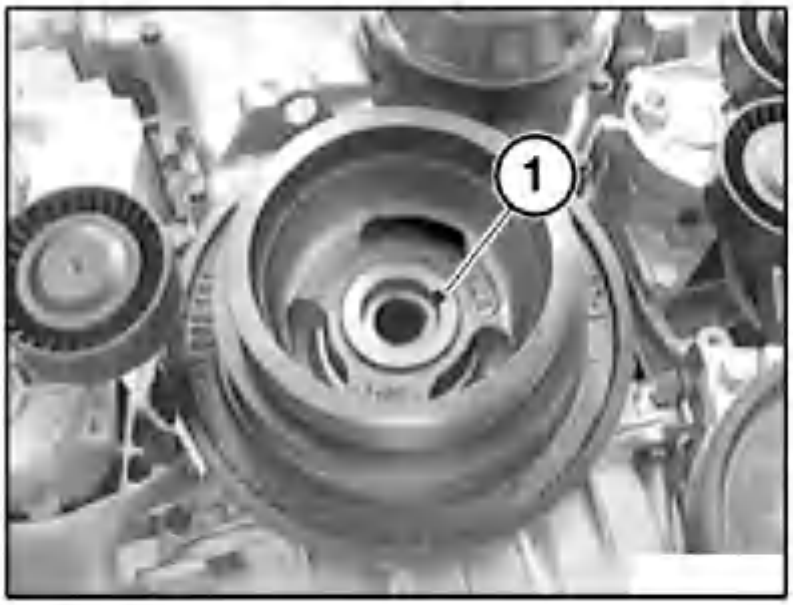



Fig. 132: Aligning Groove In Vibration Damper To Featherkey
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Installation:

Replace central screw (1).

Install central screw and washer.

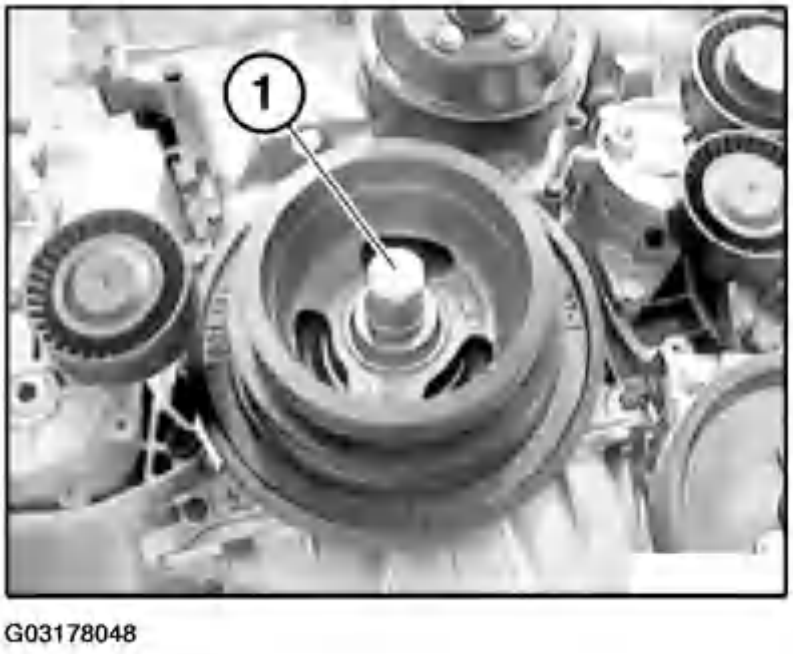



Fig. 133: Identifying Vibration Damper Central Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Installation:

Screw special tool 11 8 190 to special tool 11 8 200.

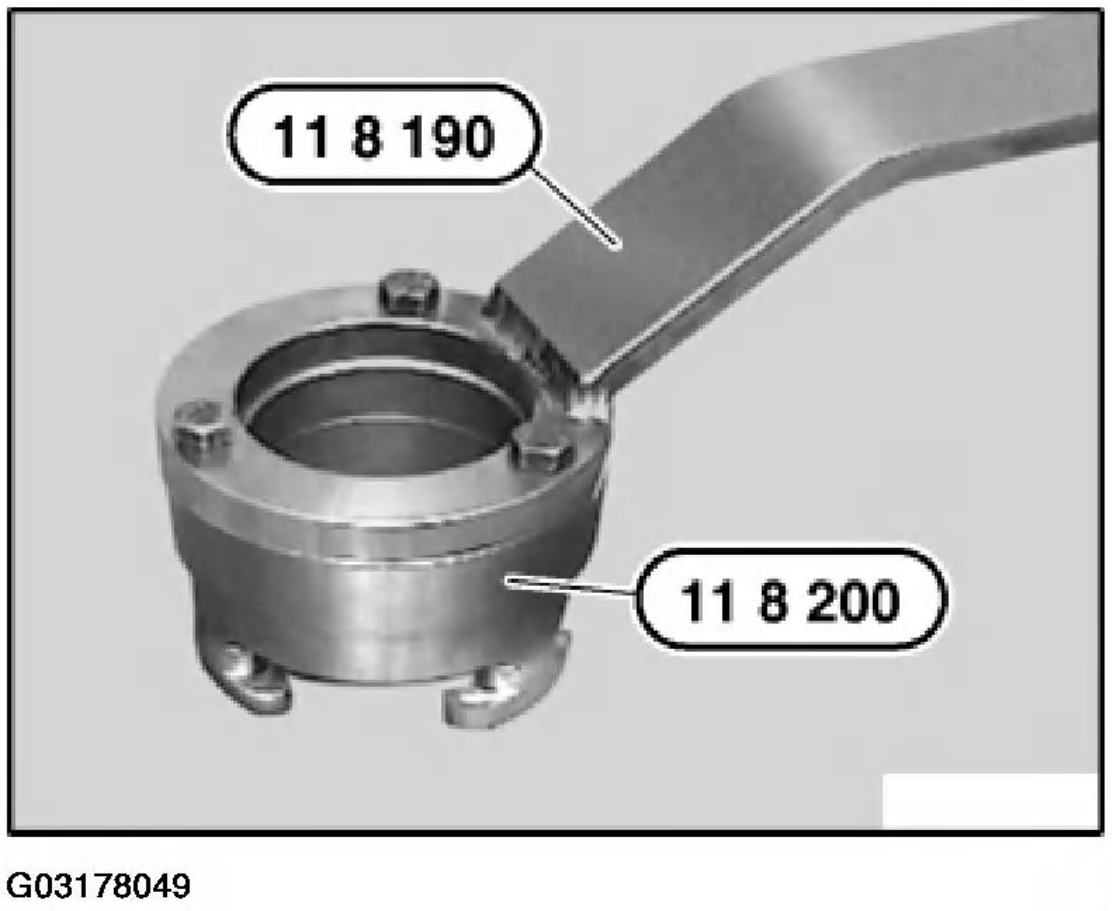



Fig. 134: Assembling Special Tool 11 8 190 To Special Tool 11 8 200
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Insert special tool 11 8 200 in openings on vibration damper and turn clockwise so that counter-supports snap into place on vibration damper.

Tighten down central screw (1).

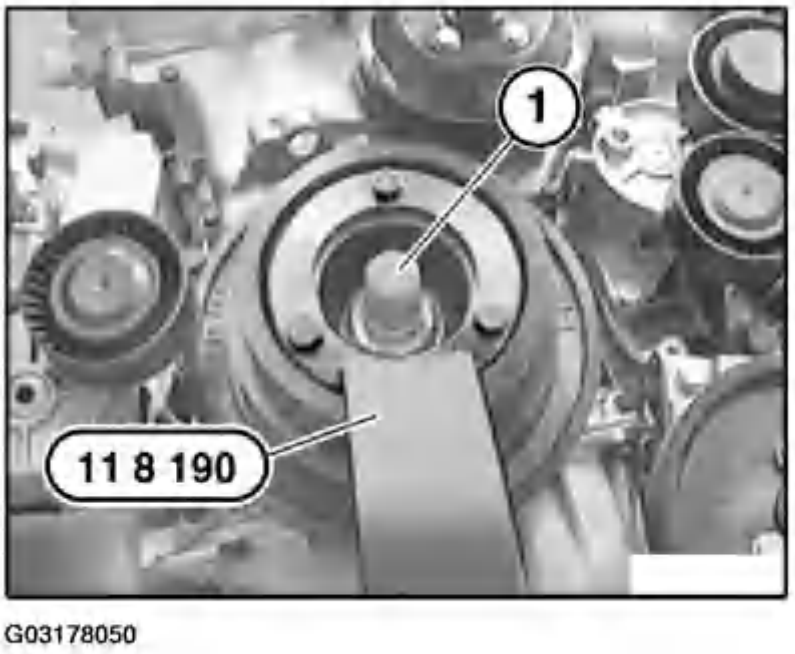



Fig. 135: Tightening Central Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, refer to 11 23 2AZ in VIBRATION DAMPER .

## CONNECTING ROD WITH BEARINGS

### 11 24 571 REPLACING ALL CONNECTING ROD BEARINGS (M52 / S52 / M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 00 2 590
- 00 9 120
- 11 2 110

(Piston removed)

Important!

Note grinding stages on crankshaft. Refer to CRANKSHAFT WITH BEARING .

Install new conrod bearing shells. Refer to 11 24 571 REPLACING ALL CONNECTING ROD BEARINGS (M52 / S52 / M52TU / M54 / M56).

Insert one blue (1) and one red (2) bearing shell (irrespective of the color coding on the conrod shaft).

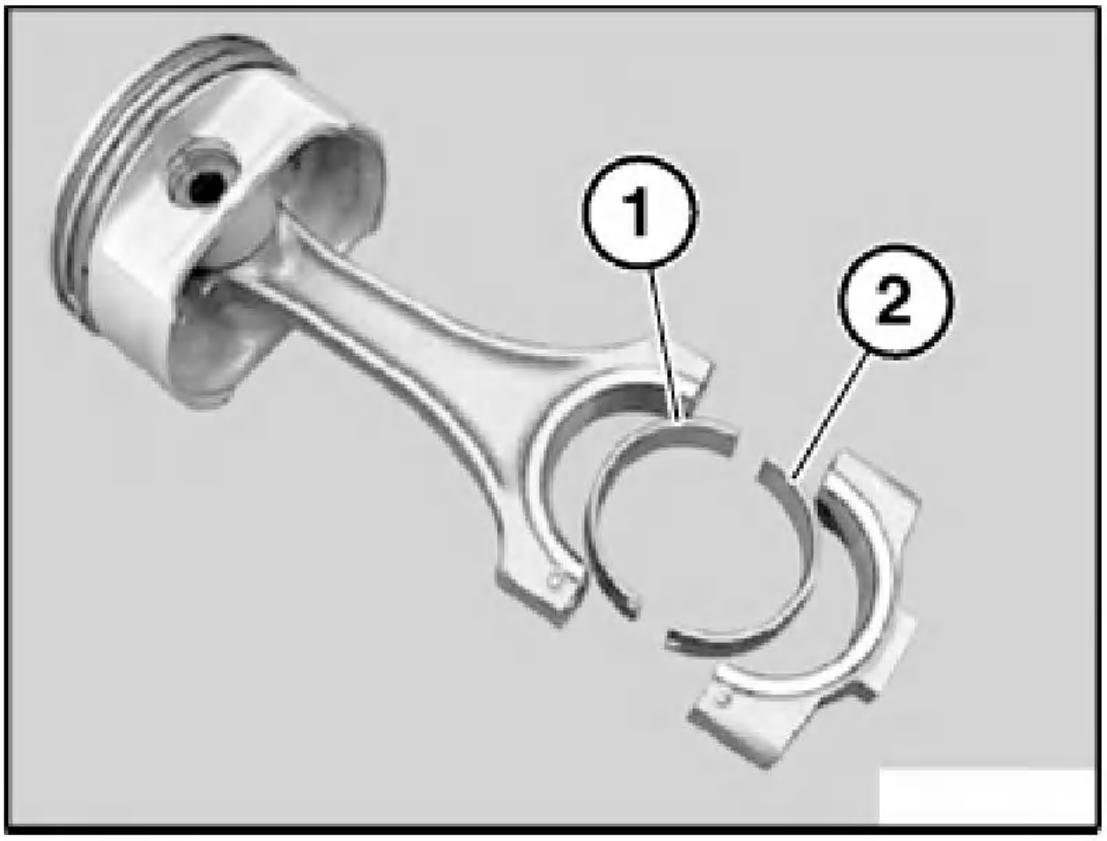



Fig. 136: Inserting One Blue And One Red Bearing Shell
Courtesy of BMW OF NORTH AMERICA, INC.

Install piston. Refer to 11 25 530 REMOVING AND INSTALLING OR REPLACING ALL PISTONS (M52 / S52 / M52TU / M54 / M56).

Check conrod bearing clearance.

Piston in BDC position.

Fit special tool 00 2 590 (Plastigage Type PG 1) to oil-free crankshaft.

Fit bearing caps so that pair numbers match up.

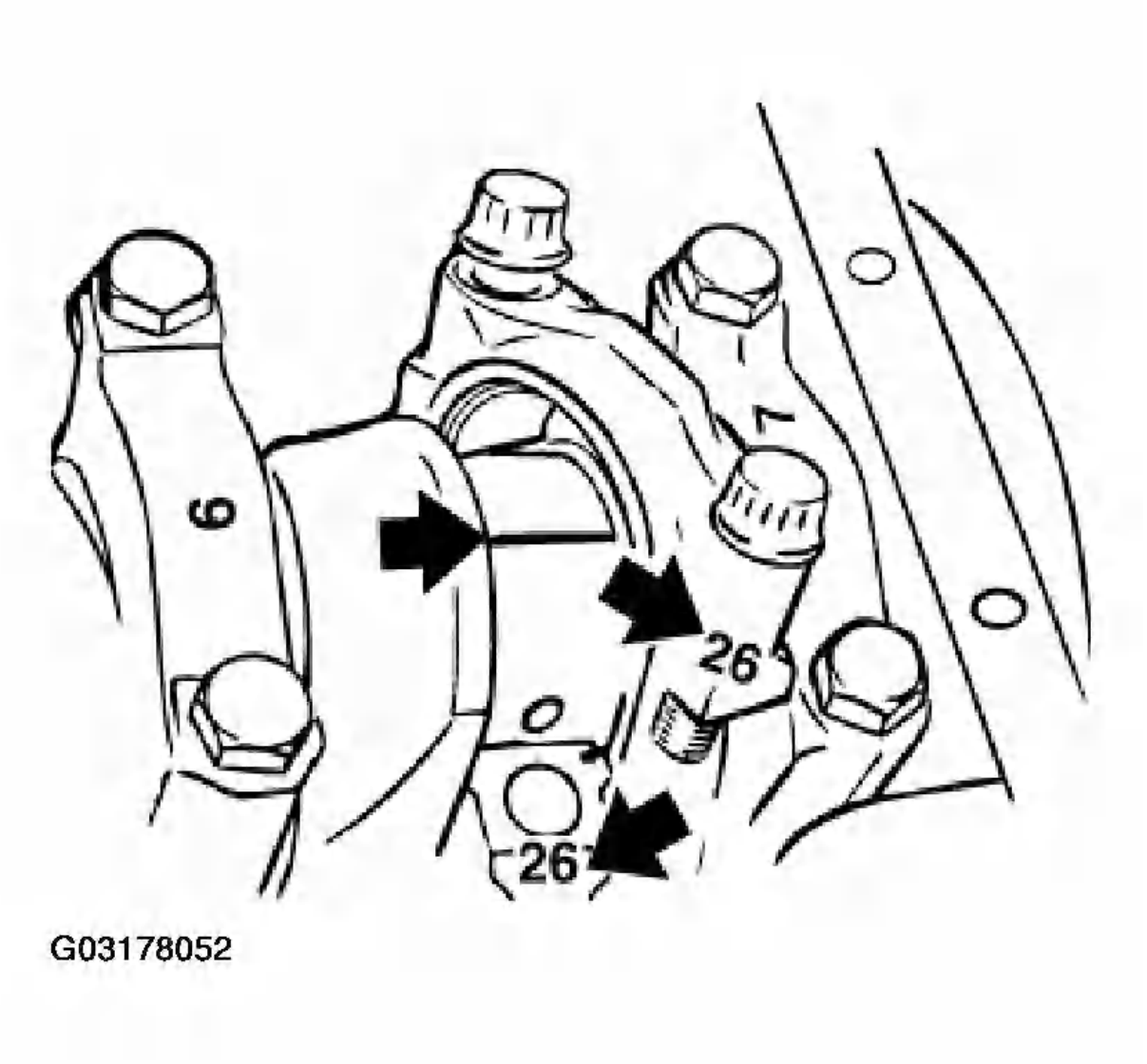



Fig. 137: Fitting Bearing Caps By Pair Numbers
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Do not distort conrods or crankshaft.

Use the old conrod bolts to check conrod clearance.

Tighten down conrod bolts with special tool 00 9 120 or with special tool 11 2 110.

Tightening torque, refer to 11 24 1AZ in CONNECTING RODS AND BEARING .

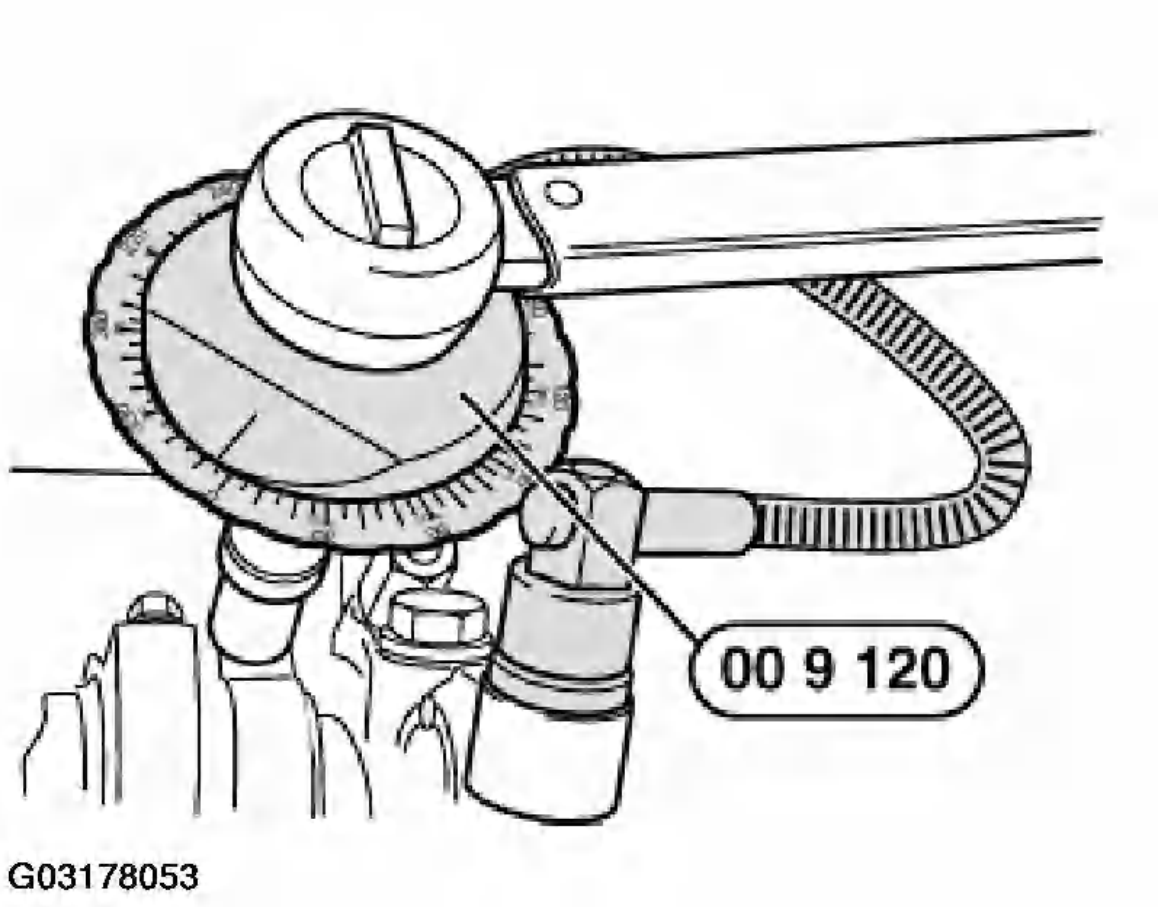



Fig. 138: Tightening Conrod Bolts With Special Tool 00 9 120
Courtesy of BMW OF NORTH AMERICA, INC.

Remove bearing cap and read off bearing play at width of flattened plastic thread with assistance of measurement scale.

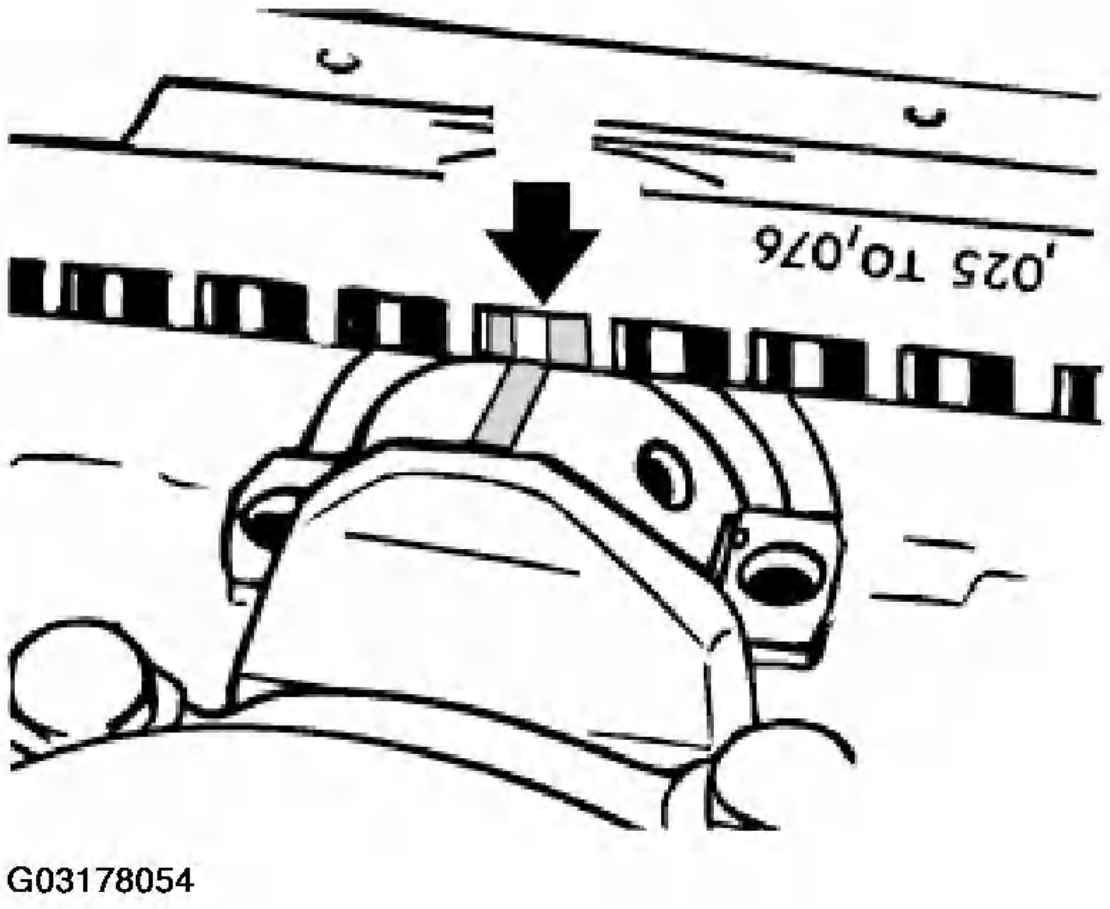



Fig. 139: Reading Bearing Play At Width Of Flattened Plastic Thread With Assistance Of Measurement Scale
Courtesy of BMW OF NORTH AMERICA, INC.

Conrod bearing clearance. Refer to CRANKSHAFT WITH BEARING .

- Remove plastic thread.
- Coat crankshaft and bearing shells with oil.
- Install new conrod bolts and tighten down.

Tightening torque, refer to 11 24 1AZ in CONNECTING RODS AND BEARING .

## PISTON WITH RINGS AND PIN

### 11 25 530 REMOVING AND INSTALLING OR REPLACING ALL PISTONS (M52 / S52 / M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 00 9 120
- 11 2 110
- 11 2 260
- 11 2 470

- 11 3 480
- 11 8 141

(Engine removed)

Remove cylinder head.

Removal:

Removal of pistons is described separately from installation.

Assembly sequence for removal and installation is different.

Important!

Re-install piston, connecting rod and bearing shells back in the same position and in the same installation location.

Connecting rods and bearing covers are designated with the same pair number: do not mix them.

Remove oil pump. Refer to 11 41 000 REMOVING AND INSTALLING/REPLACING OIL PUMP (M52TU / M54 / M56).

If oil pump and oil scraper are two parts:

Remove oil scraper.

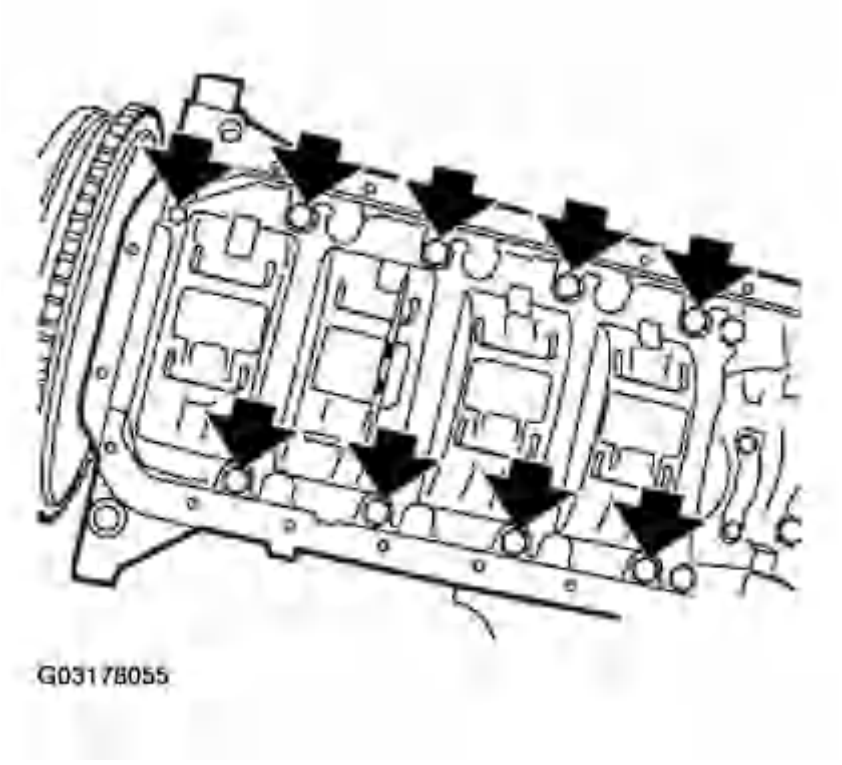



Fig. 140: Removing Oil Scraper Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Figure shows crankshaft removed.

On engines with spray nozzles for piston cooling on cylinder underside:

Important!

When removing and installing pistons, make sure the piston cooling spray nozzles are not damaged.

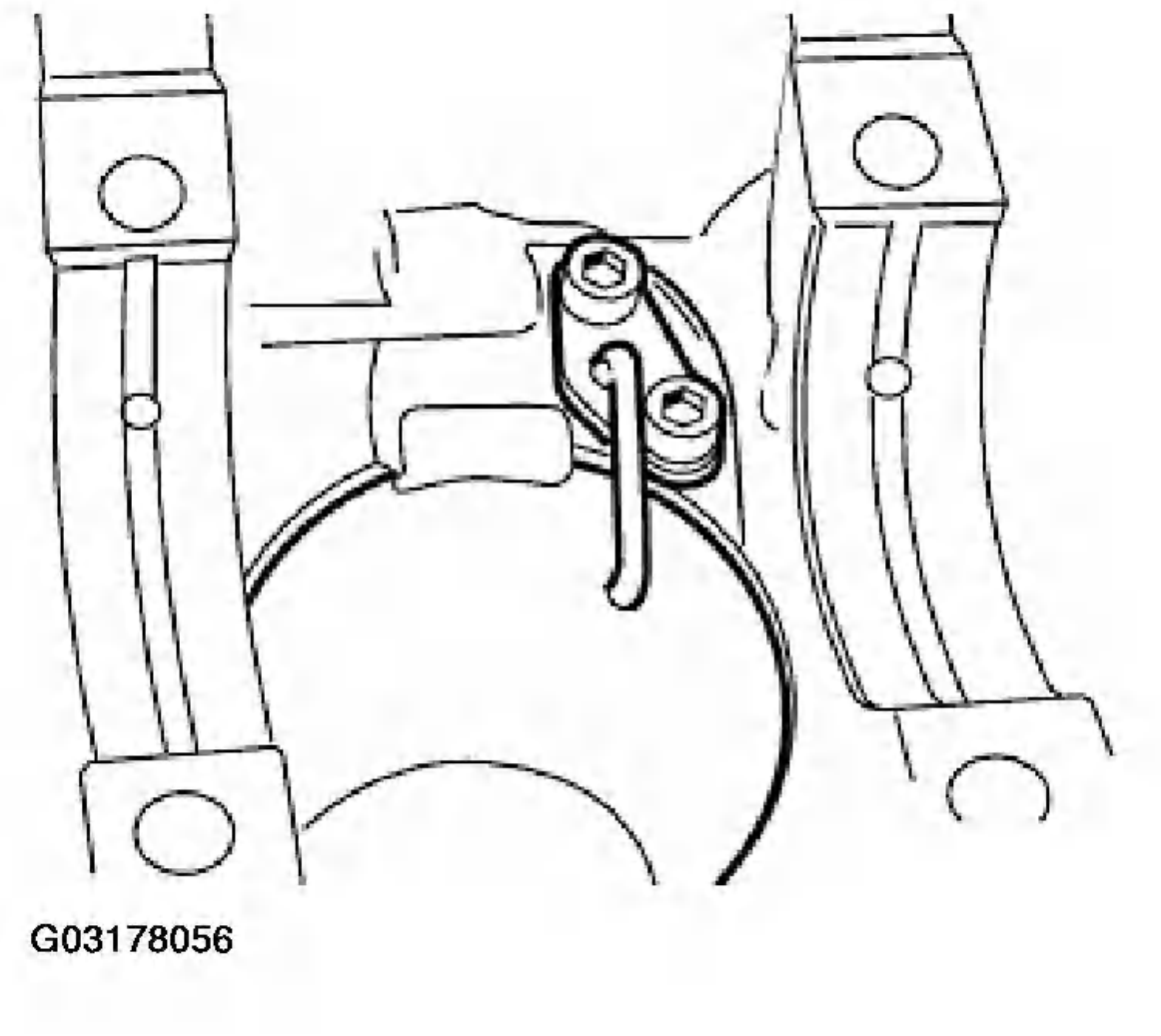



Fig. 141: Identifying Piston Cooling Spray Nozzles
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Screw threads are coated with screw securing adhesive (Loctite). Replace screws.

In event of heavy oil carbon residue:

Carefully remove oil carbon residue from cylinder wall.

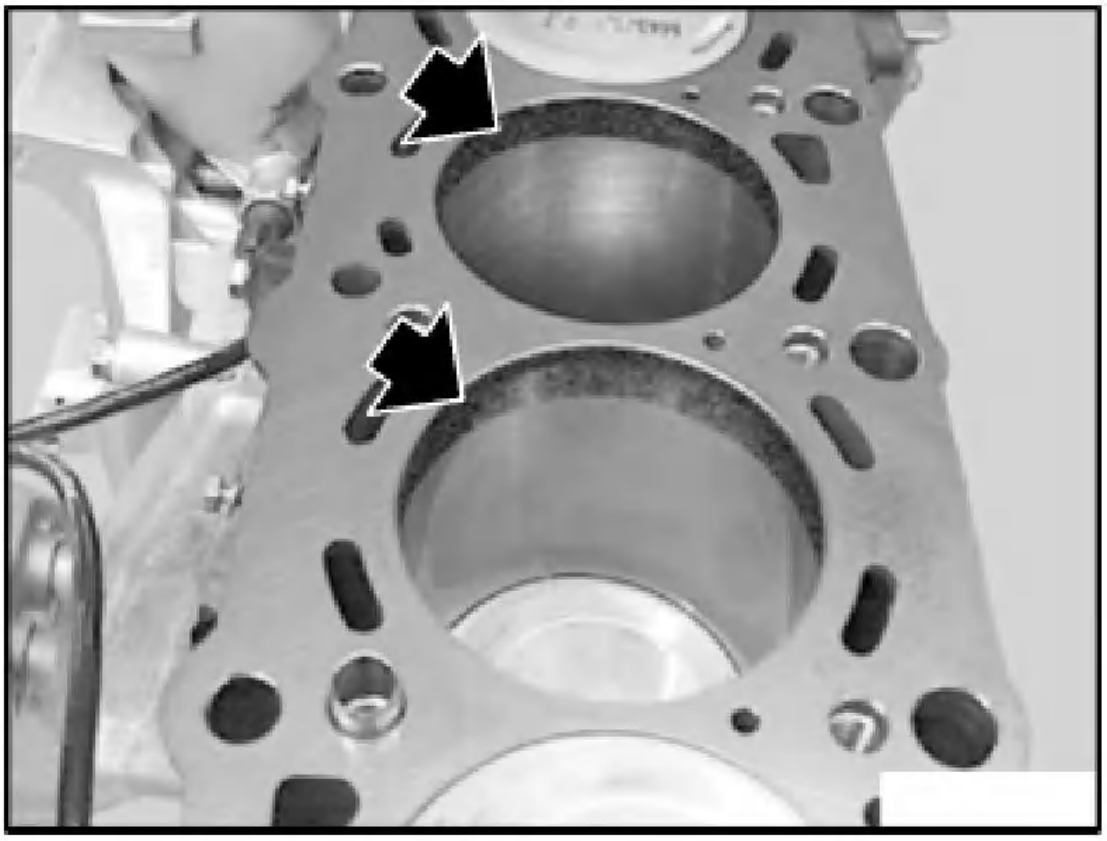



Fig. 142: Identifying Oil Carbon Residue On Cylinder Wall
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew conrod bearing cover.

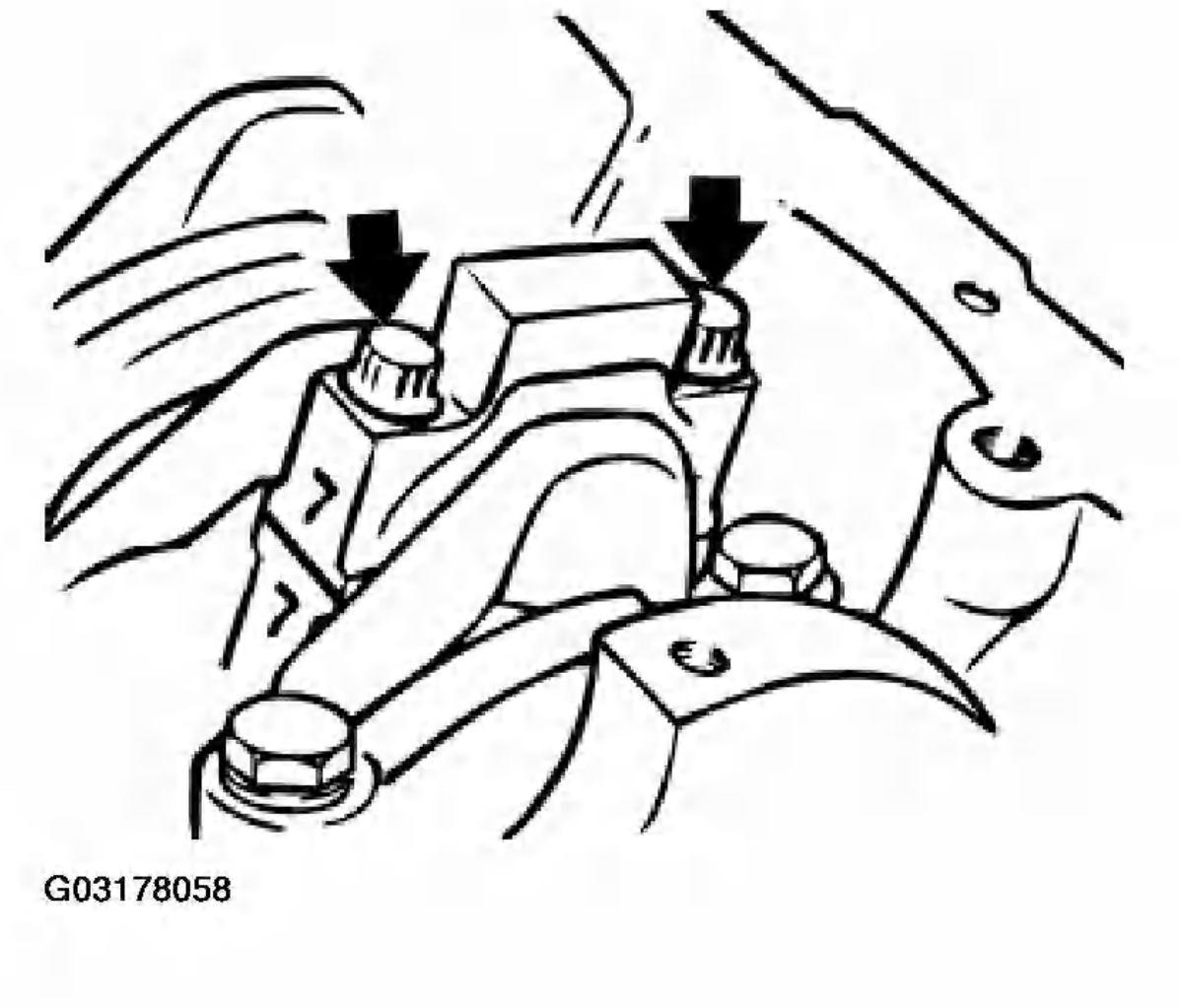



Fig. 143: Identifying Screw Of Conrod Bearing Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 11 3 430 in conrod.

Remove conrod with piston from cylinder head side.

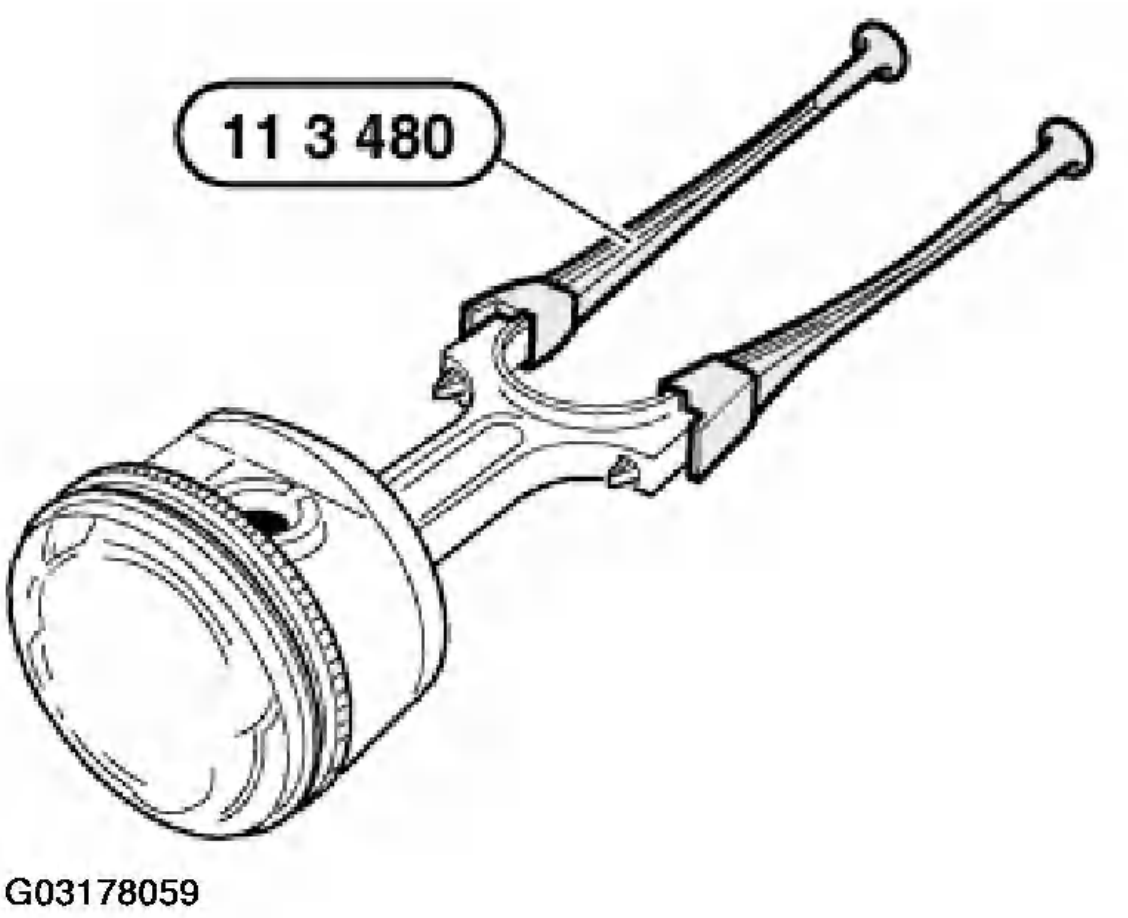



Fig. 144: Inserting Special Tool 11 3 430 In Conrod
Courtesy of BMW OF NORTH AMERICA, INC.

Lift out retaining ring and press out piston pin.

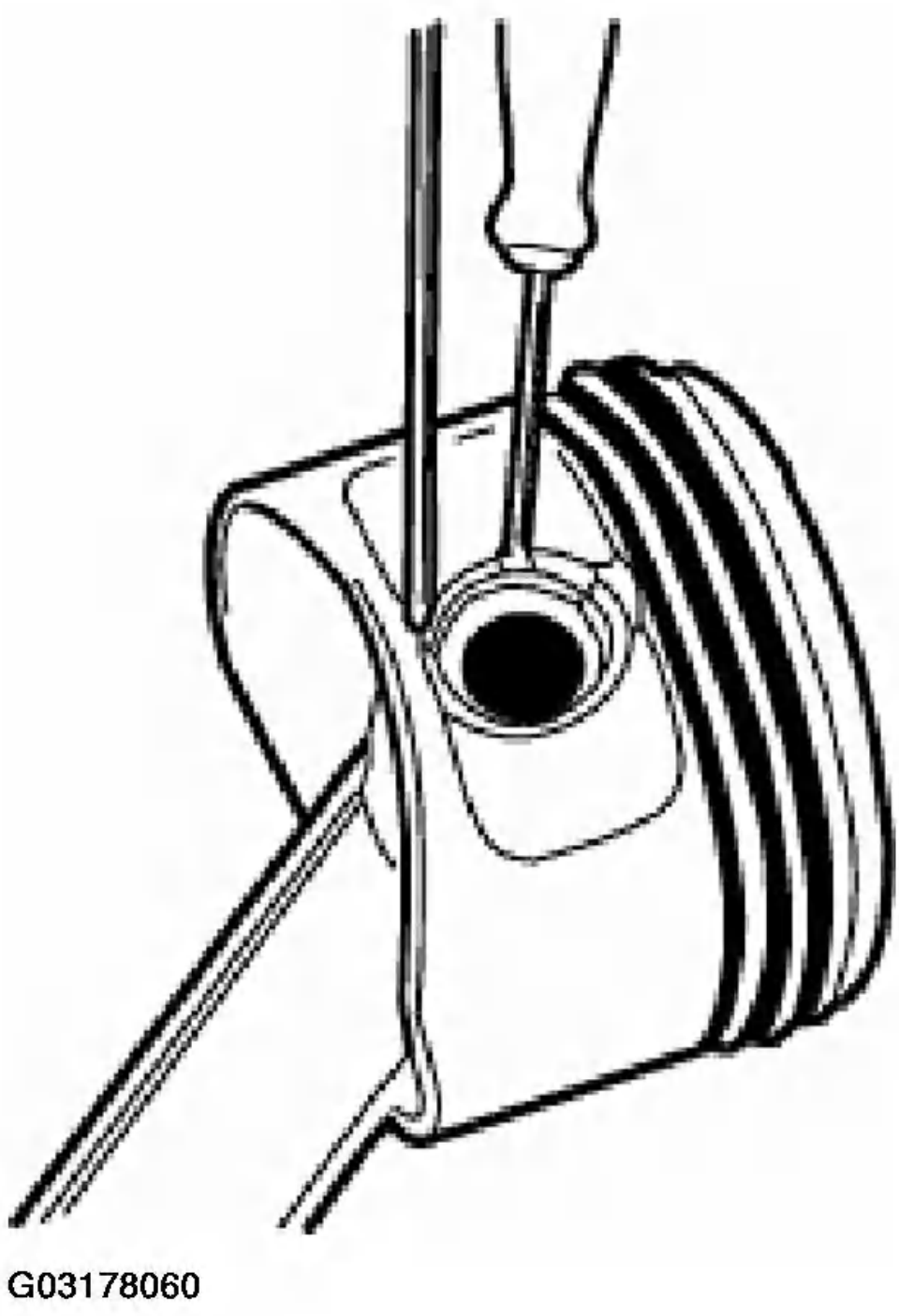



Fig. 145: Lifting Out Retaining Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Piston and piston pin are paired and must not be fitted individually.

Installation:

Installation of pistons is described separately from removal. The assembly sequence differs between removal and installation.

The piston pin must be able to be pressed through the liner by hand with little force and must not display any

significant play.

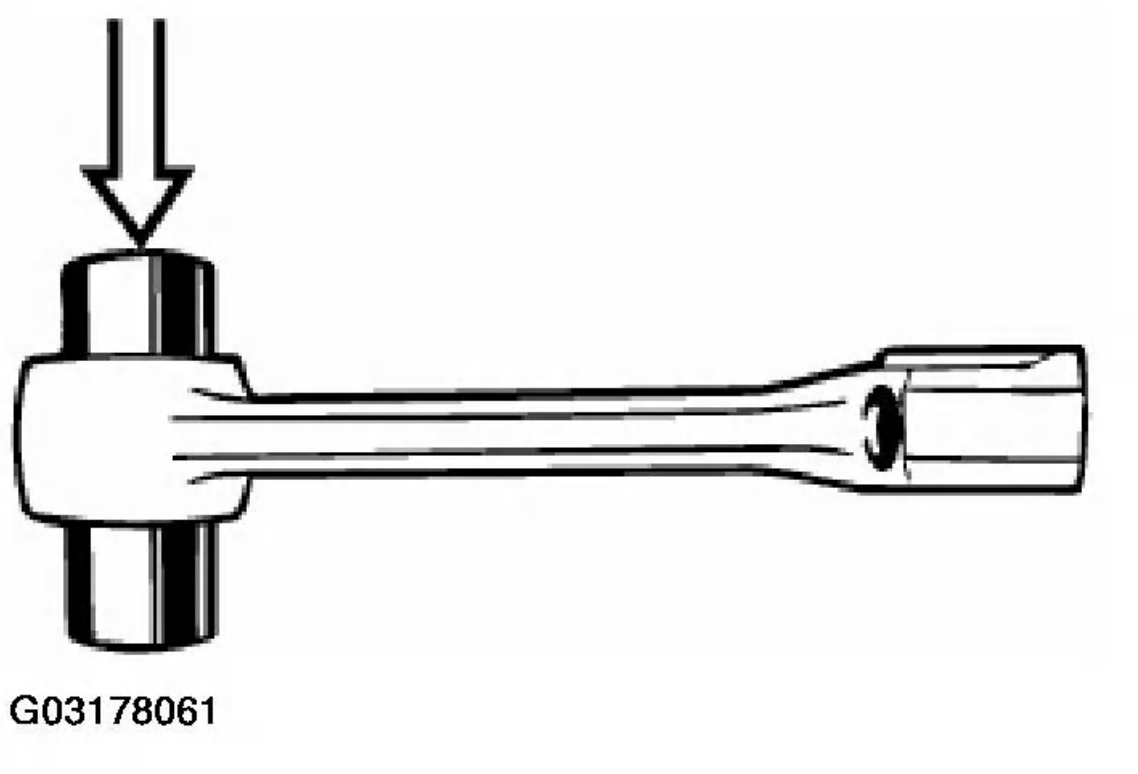



Fig. 146: Identifying Piston Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Measure piston installation clearance:

Measure piston diameter with micrometer at distance A from the underside of the piston and at offset angle of 90Â° to piston pin axis.

Measurement A, refer to PISTON WITH RINGS AND PINS .

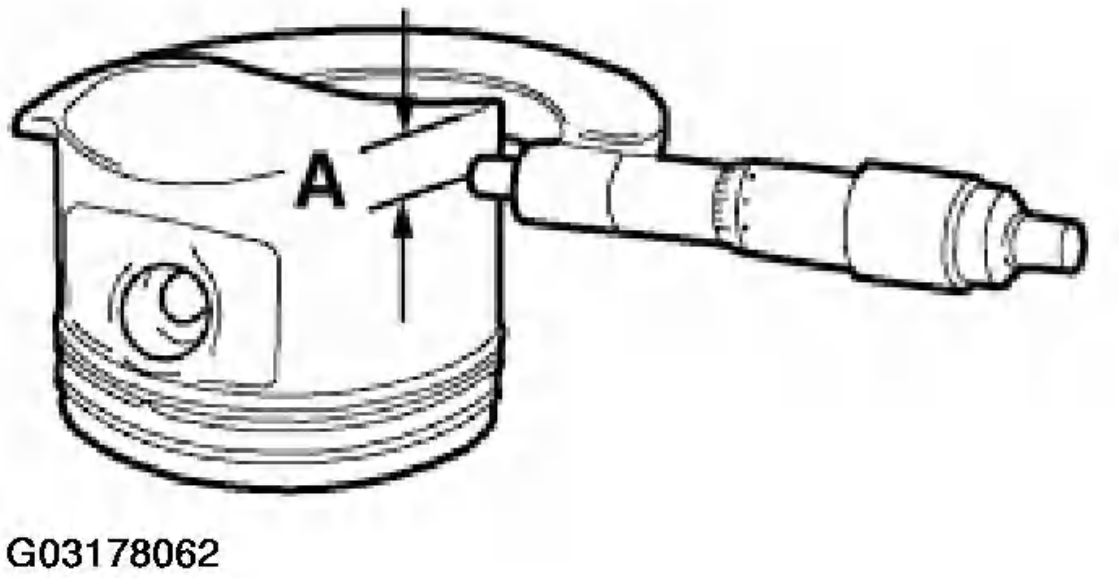



Fig. 147: Measuring Piston Diameter With Micrometer
Courtesy of BMW OF NORTH AMERICA, INC.

Adjust micrometer to cylinder bore of engine block, set internal caliper on micrometer to zero. Measure bottom, center and top of cylinder bore in direction of travel and direction of engine rotation.

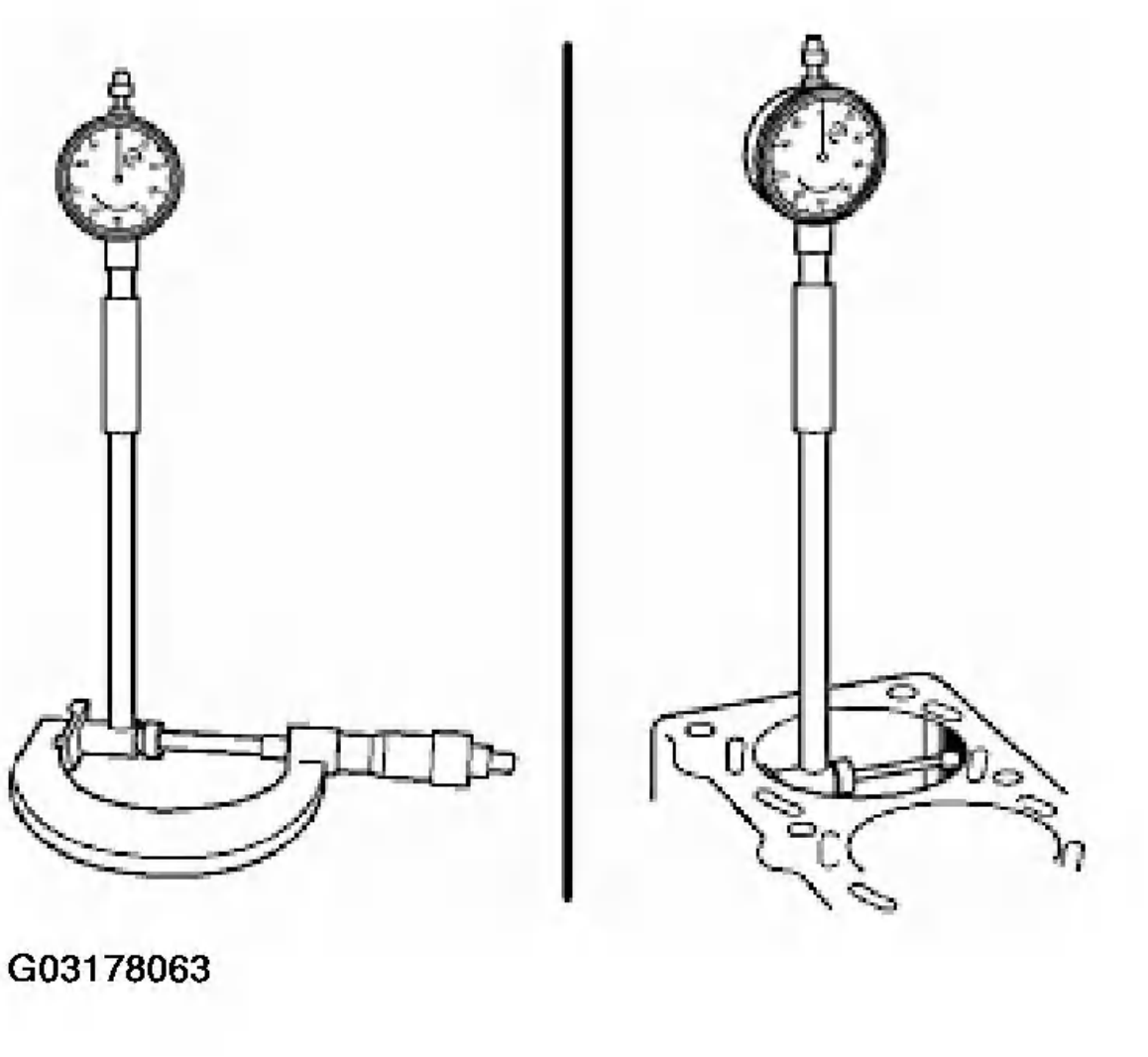



Fig. 148: Measuring Cylinder Bore Of Engine Block
Courtesy of BMW OF NORTH AMERICA, INC.

Diameter of cylinder bore, refer to ENGINE BLOCK .

Piston installation clearance, refer to PISTON WITH RINGS AND PINS .

Total permissible wear tolerance, refer to PISTON WITH RINGS AND PINS .

Replace conrod bearing shells. Refer to 11 24 571 REPLACING ALL CONNECTING ROD BEARINGS (M52 / S52 / M52TU / M54 / M56).

Important!

Piston and piston pin are paired and must not be fitted individually.

Fit conrod with piston pin to piston in such a way that both of the visible pair numbers on the installation direction arrow on the piston point to the right.




Fig. 149: Identifying Pair Numbers On Conrod
Courtesy of BMW OF NORTH AMERICA, INC.

Install snap ring so that opening is opposite recess.

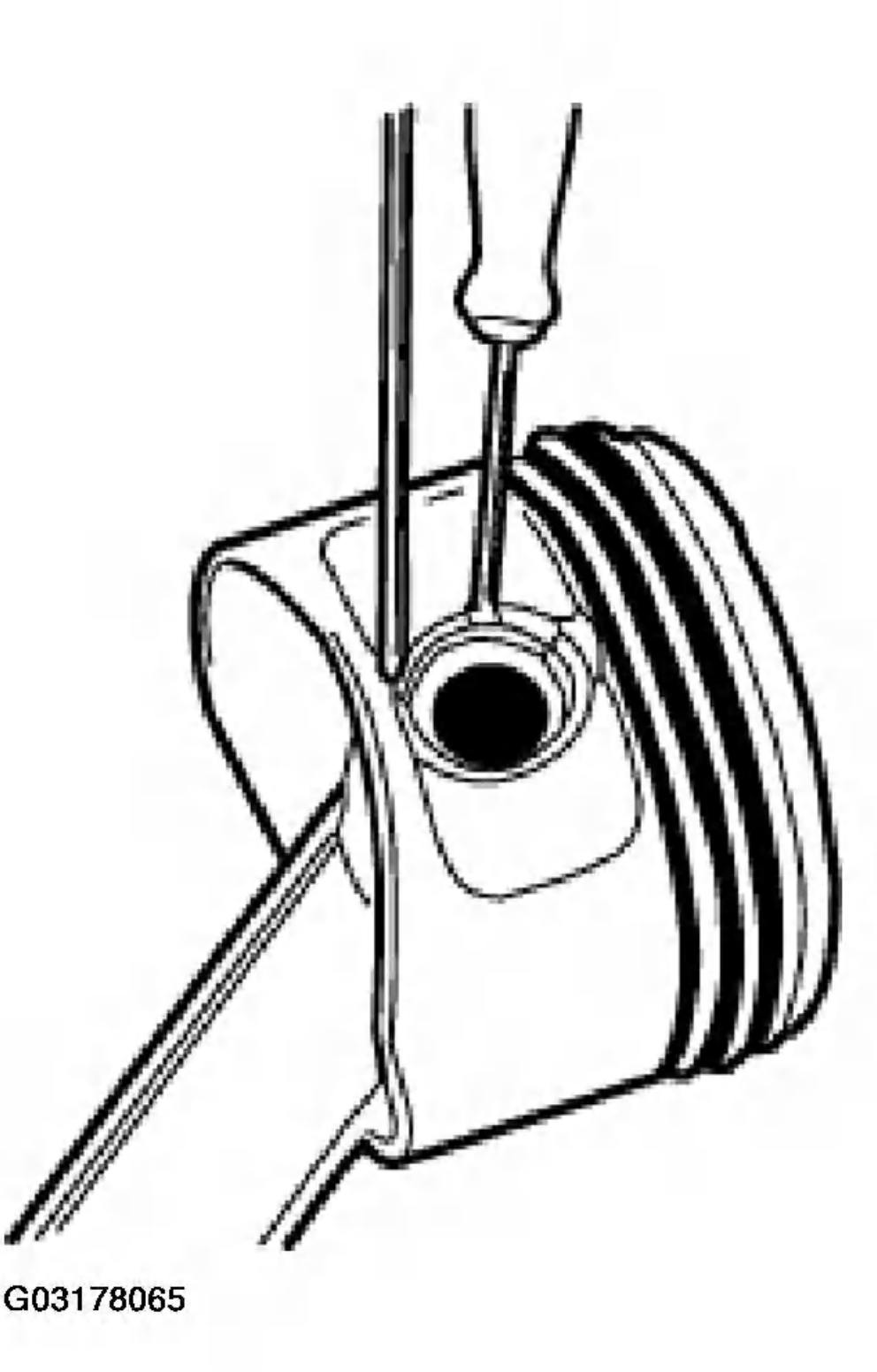



Fig. 150: Installing Snap Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 11 2 470 in conrod.

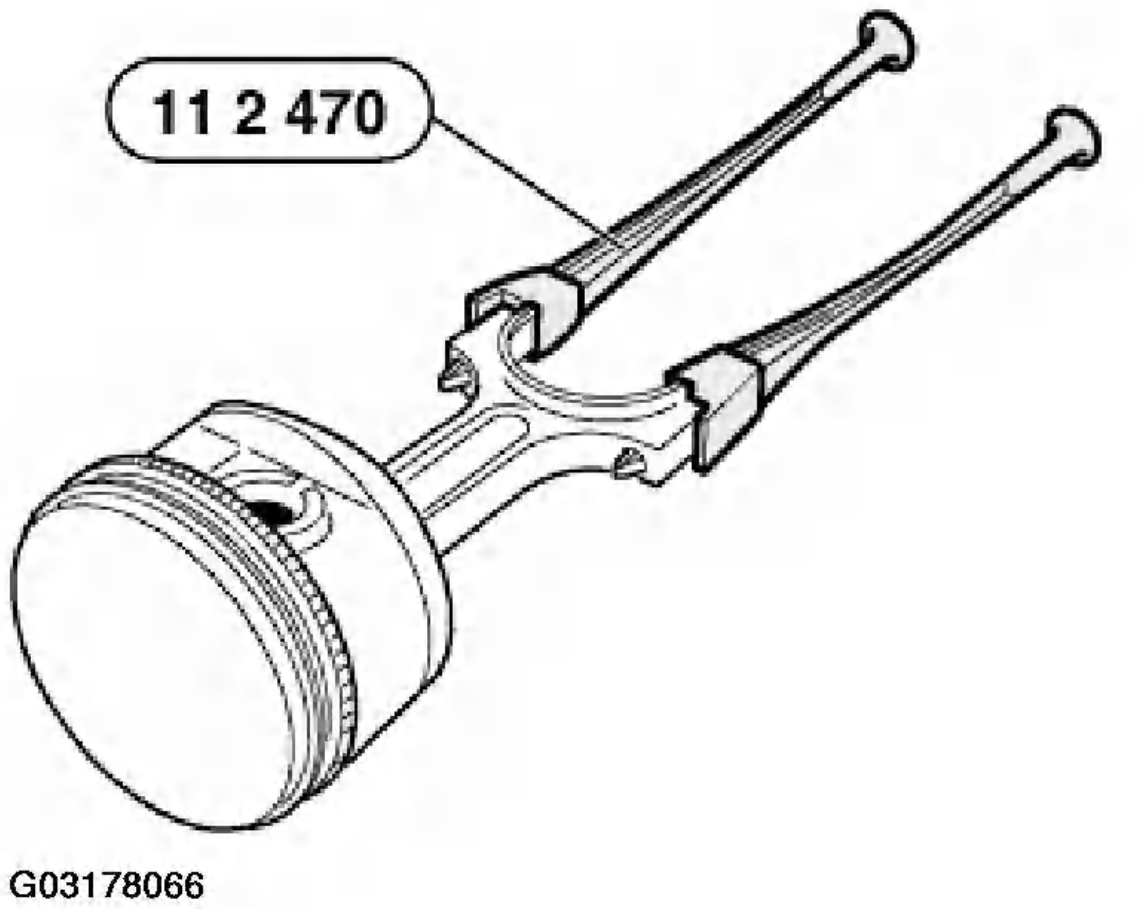



Fig. 151: Inserting Special Tool 11 2 470 In Conrod
Courtesy of BMW OF NORTH AMERICA, INC.

Lightly coat pistons and piston rings with oil.

Align contact points on piston rings (offset at approx. 120Â°, but do not arrange over piston pin lug).

NOTE: Piston diameter 84 mm: Use special tool 11 8 141. Piston diameter 80 mm: Press together piston rings with special tool 11 2 260.

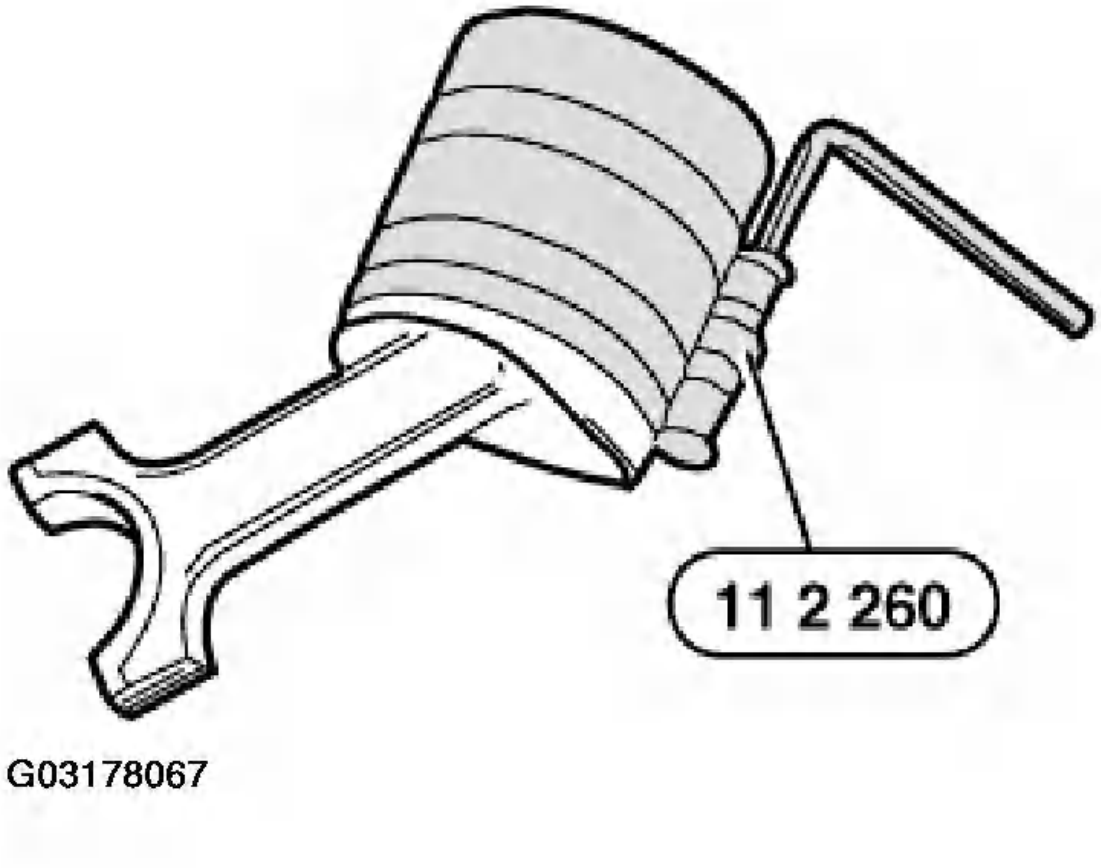



Fig. 152: Pressing Together Piston Rings With Special Tool 11 2 260
Courtesy of BMW OF NORTH AMERICA, INC.

Install piston so that arrow points to camshaft drive.

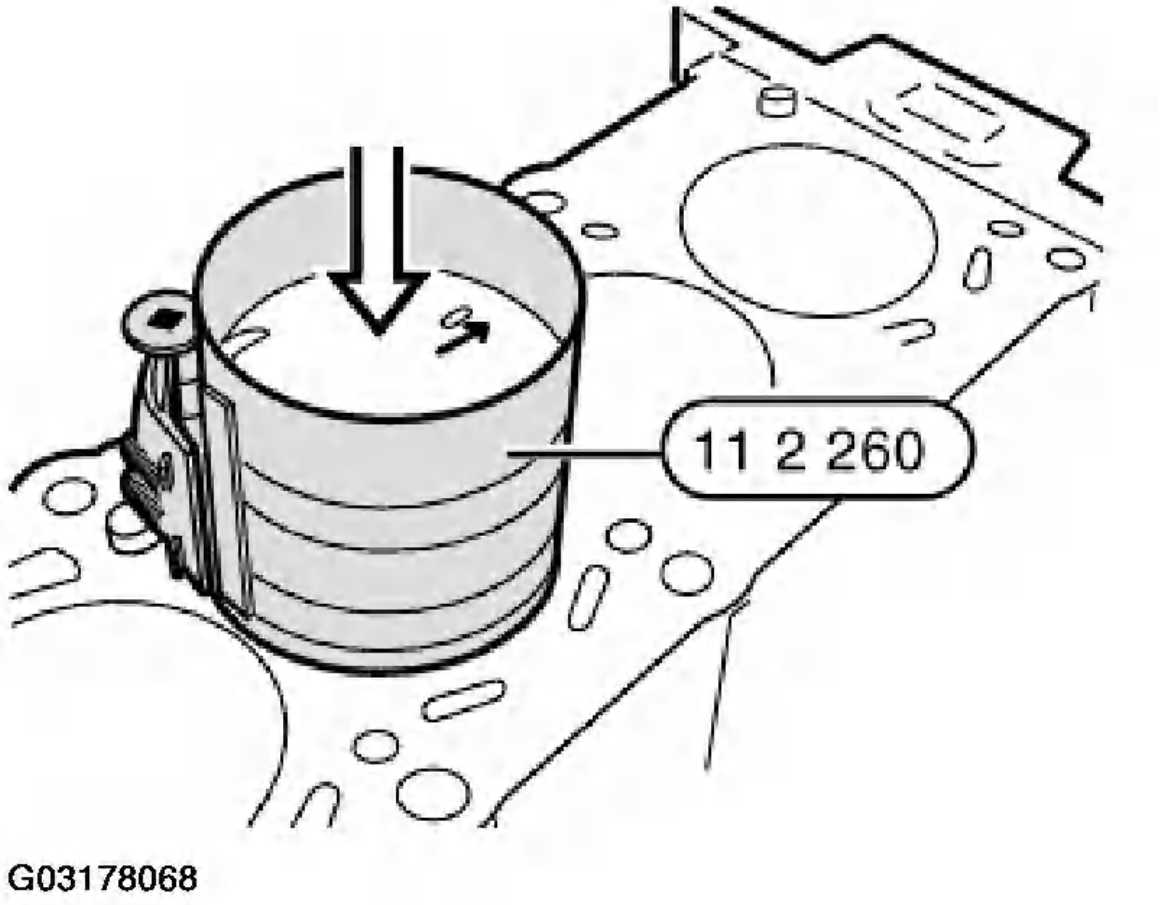



Fig. 153: Install Piston With Arrow Pointing Towards Camshaft Drive
Courtesy of BMW OF NORTH AMERICA, INC.

Entire circumference of tightening strap must rest firmly on engine block.

Important!

Danger of piston ring failure.

Press in piston only with finger force (do not knock in!).

Attach crankpin to connecting rod.

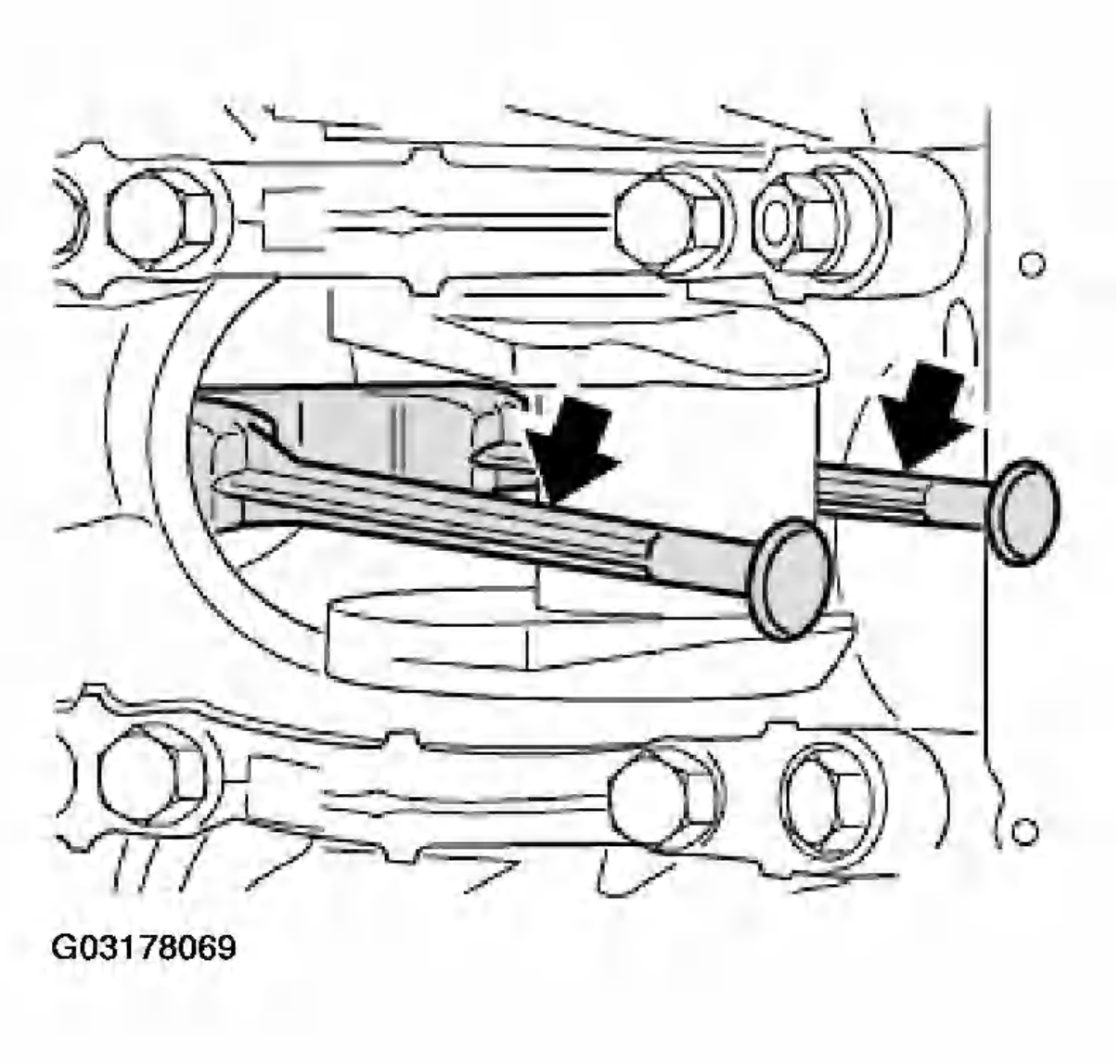



Fig. 154: Attaching Crankpin To Connecting Rod
Courtesy of BMW OF NORTH AMERICA, INC.

Apply light coat of oil to connecting-rod bearing shells.

Fit bearing caps so that pair numbers match up.

Install new conrod bolts.

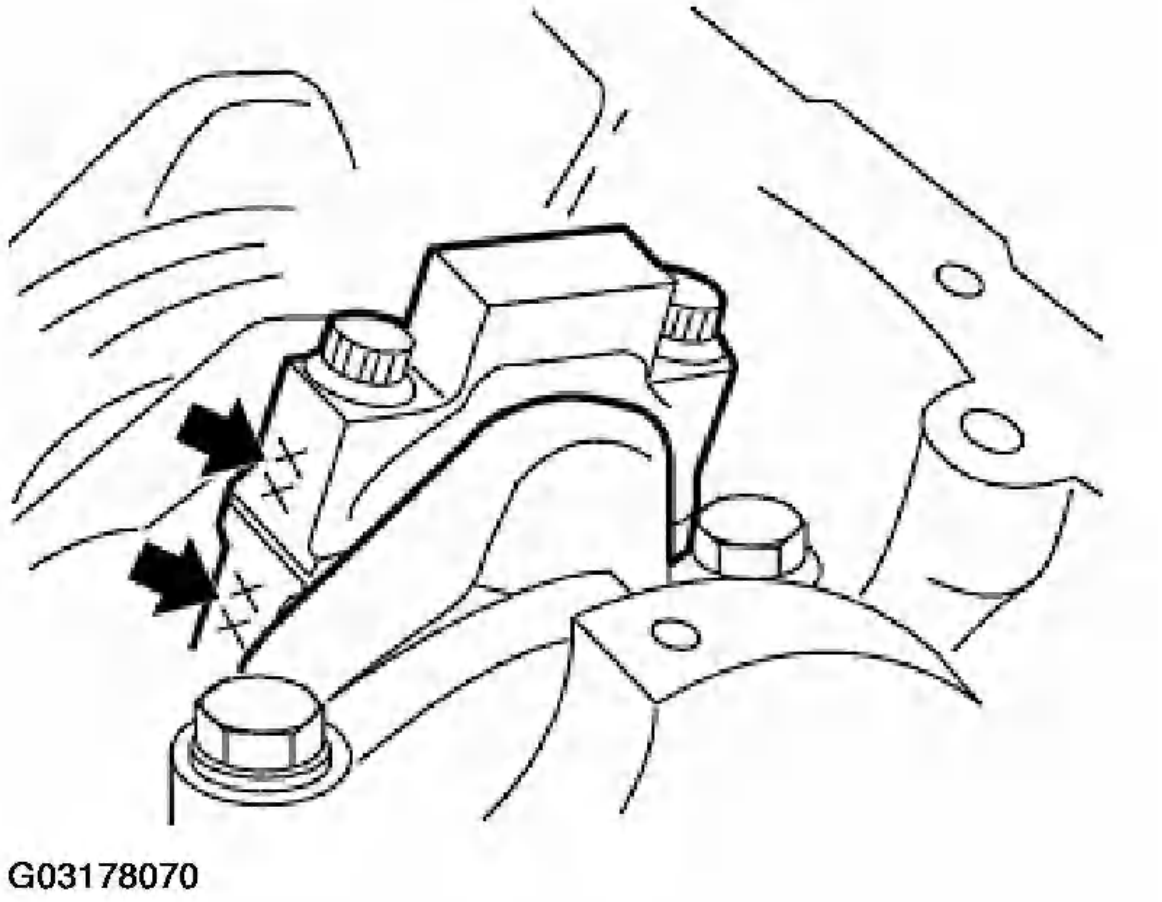



Fig. 155: Identifying Connecting-Rod Bearing Shells Marks
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down conrod bolts with special tool 00 9 120 or special tool 11 2 110.

Tightening torque, refer to 11 24 1AZ in CONNECTING RODS AND BEARING .

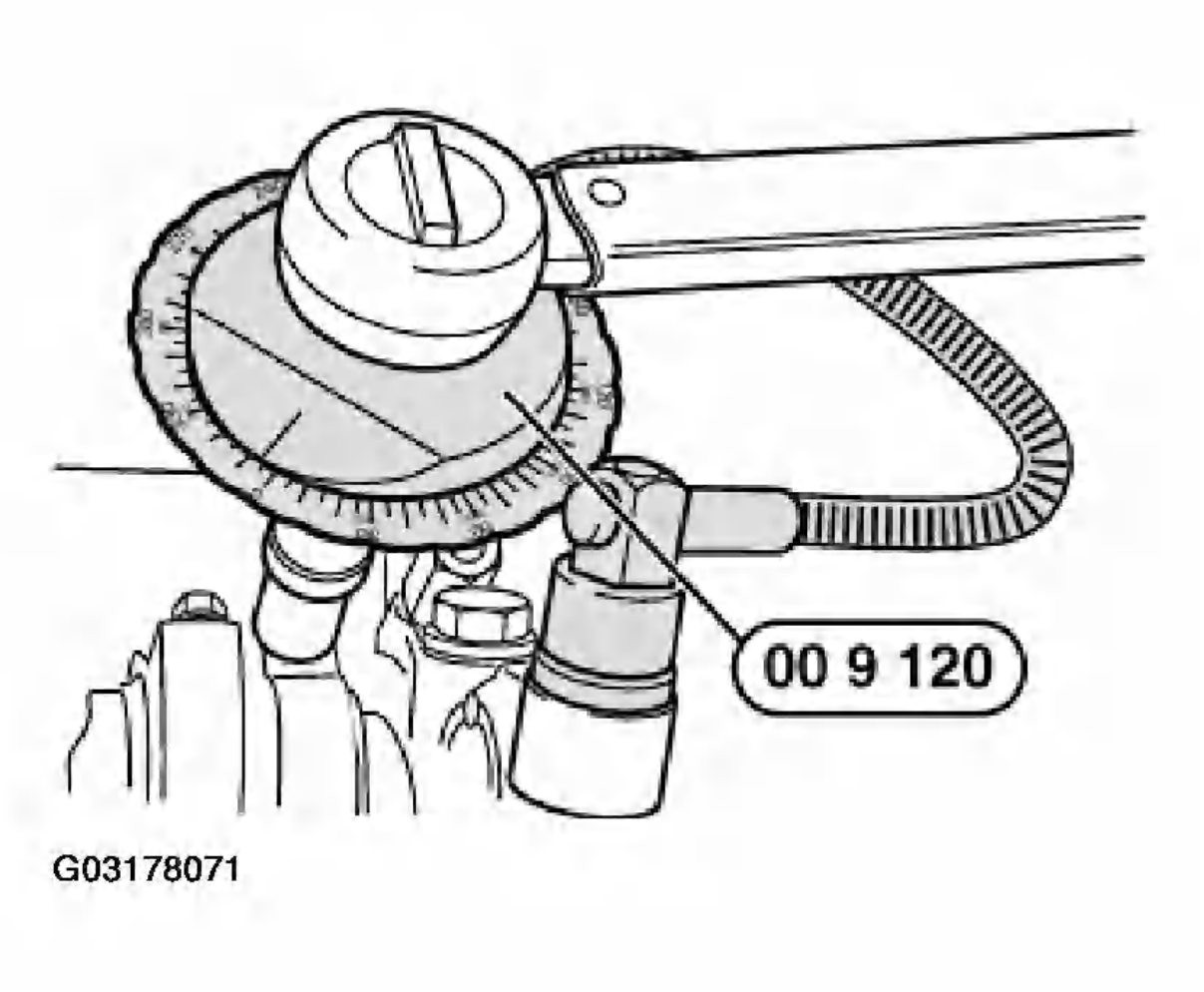



Fig. 156: Tightening Conrod Bolts With Special Tool 00 9 120
Courtesy of BMW OF NORTH AMERICA, INC.

Install oil pump. Refer to 11 41 000 REMOVING AND INSTALLING/REPLACING OIL PUMP (M52TU / M54 / M56).

If oil pump and oil scraper are two parts:

Fit oil scraper.

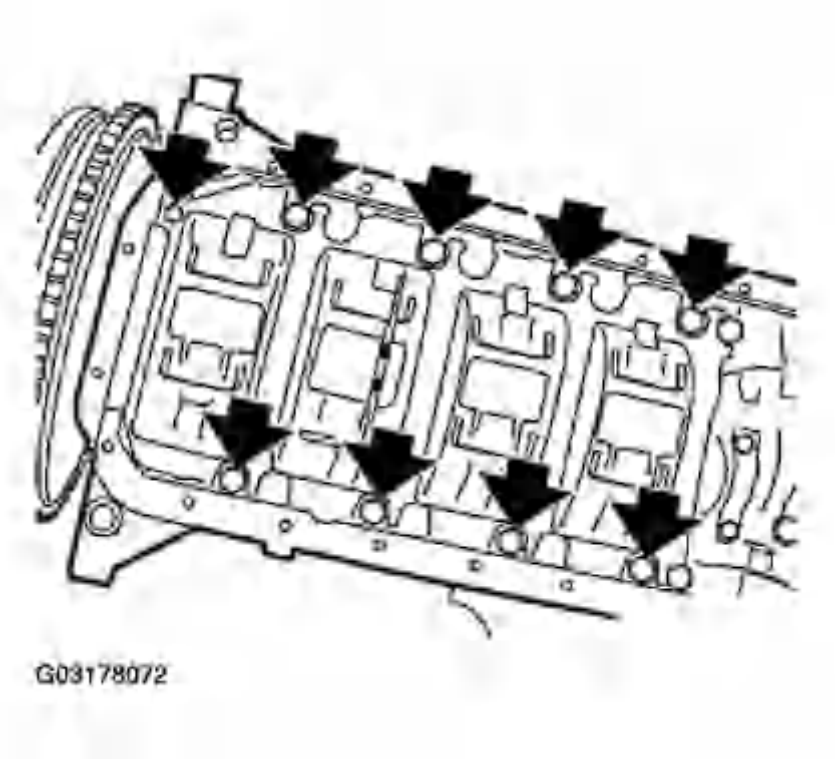



Fig. 157: Fitting Oil Scraper
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 25 671 REPLACING PISTON RINGS ON ALL PISTONS (M52 / S52 / M52TU / M54 / M56)

(Piston removed)

Remove piston rings with a piston-ring compressing pliers.

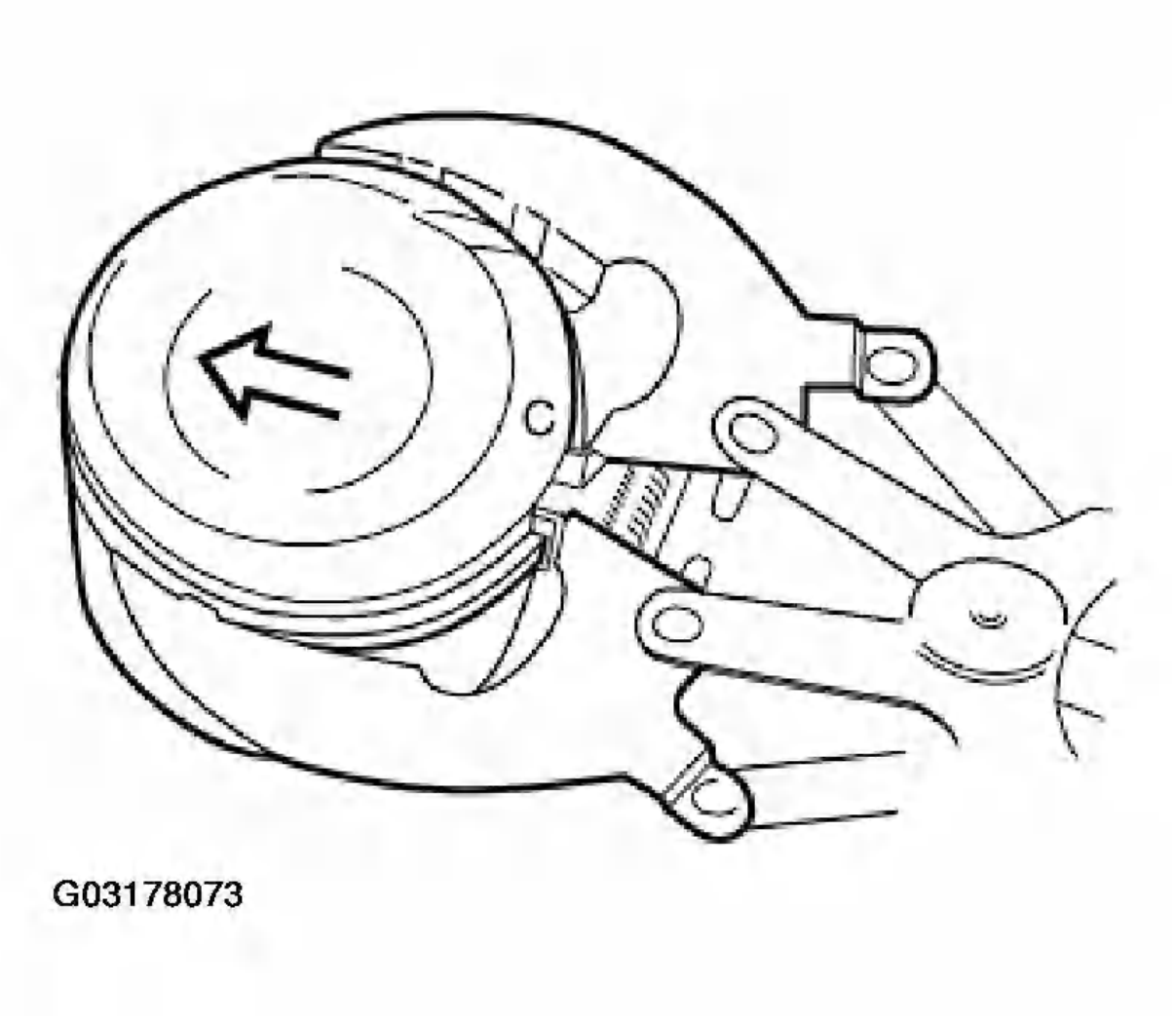



Fig. 158: Removing Piston Rings With Piston-Ring Compressing Pliers
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: It might not be possible to find the identification on used piston rings. Put aside piston rings in correct sequence and installation position. Only install new pistons in conjunction with new piston rings.

Installation:

Install piston rings with "TOP" to piston top.

1. Plain compression ring.
2. Stepped compression ring "Top".
3. Slotted oil ring with hose spring clip.

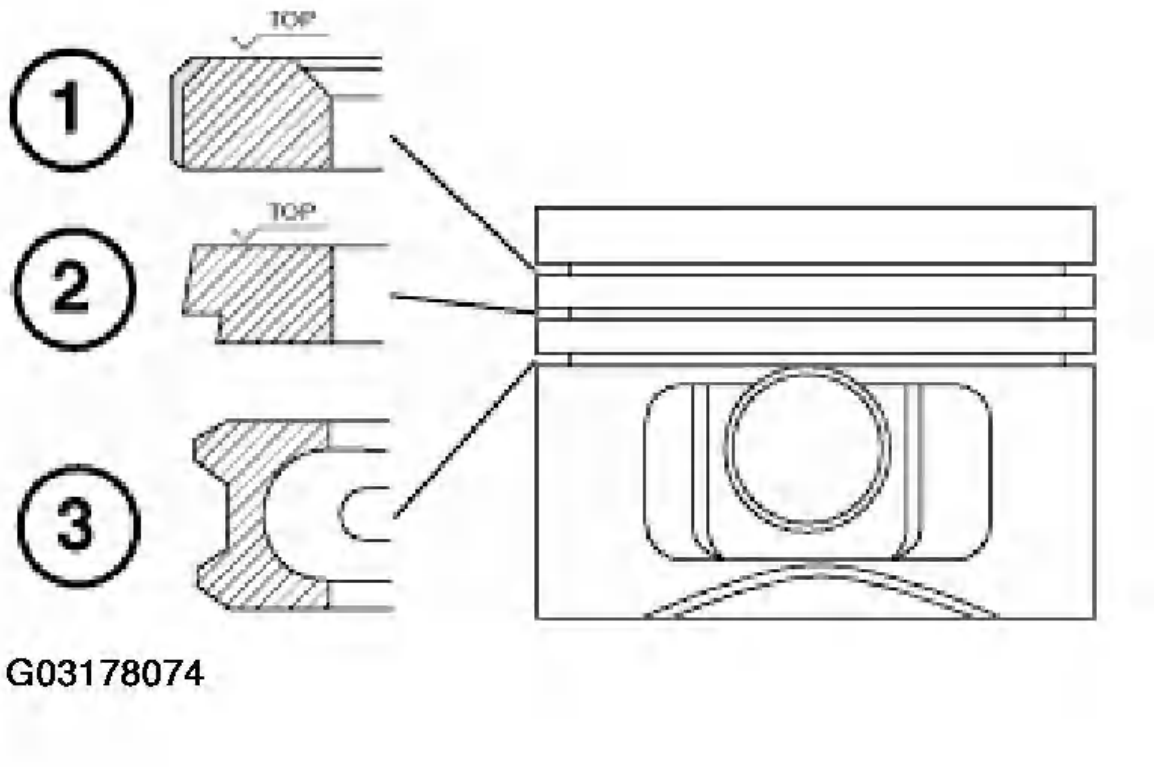



Fig. 159: Identifying Piston Rings
Courtesy of BMW OF NORTH AMERICA, INC.

Measure axial play. Refer to PISTON WITH RINGS AND PINS .

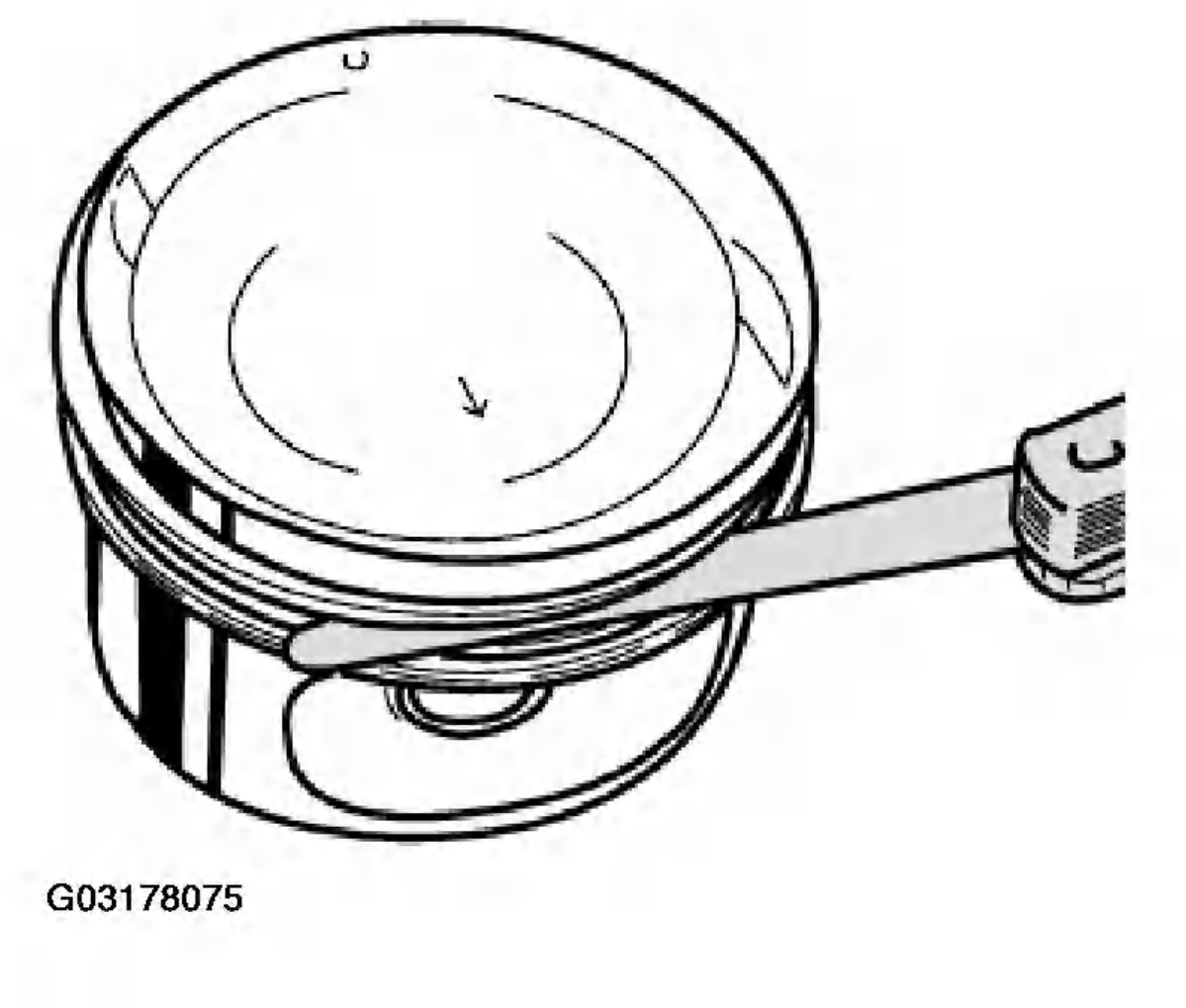



Fig. 160: Measuring Axial Play
Courtesy of BMW OF NORTH AMERICA, INC.

Measure end clearance. Refer to PISTON WITH RINGS AND PINS .

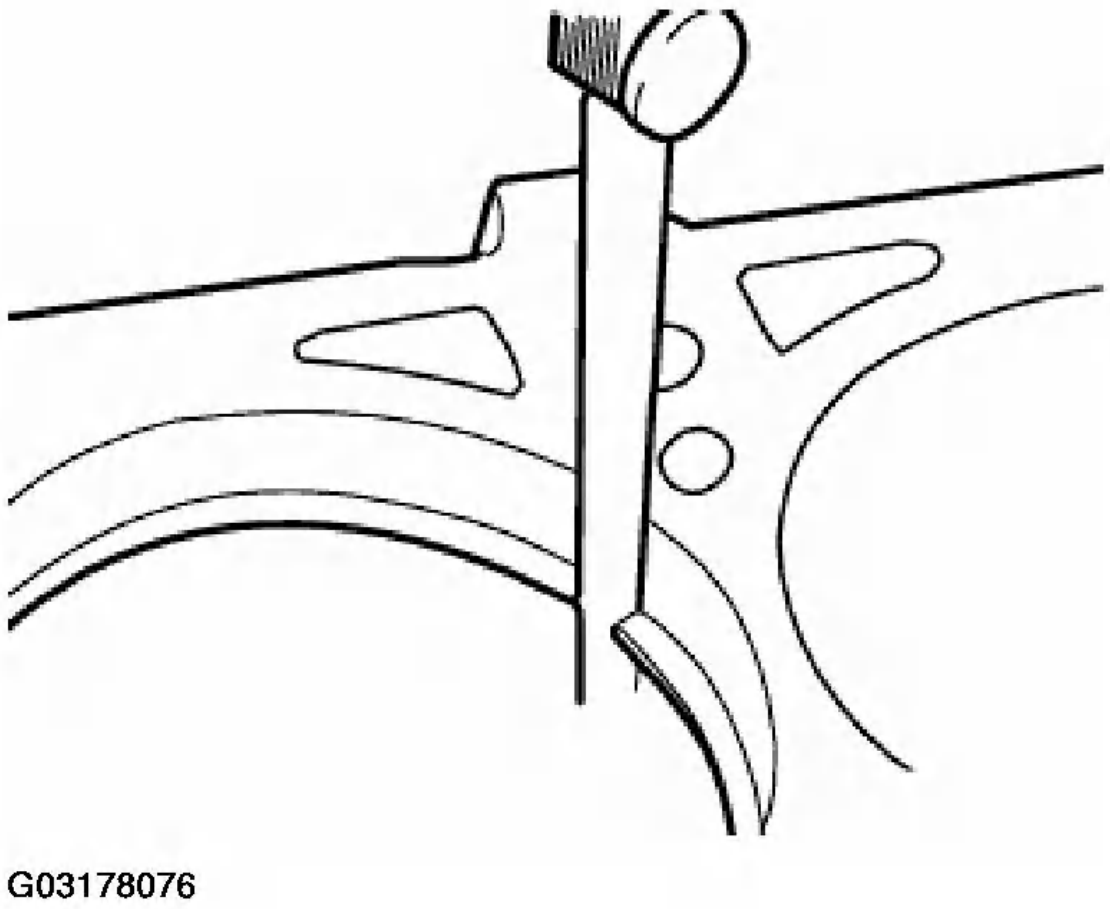



Fig. 161: Measuring End Clearance
Courtesy of BMW OF NORTH AMERICA, INC.

## V-RIBBED BELT W.TENSIONER & DEFLECT ELEMENT

### 11 28 010 REPLACING ALTERNATOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56)

NOTE: If the drive belt is to be subsequently reused: Mark direction of travel and reinstall drive belt in same direction of travel.

Necessary Preliminary Tasks:

- Remove fan clutch with fan impeller. Refer to 11 52 020 REMOVING AND INSTALLING/REPLACING FAN CLUTCH (S52 / S54 / M52 / M52TU / M54 / M56).
- Remove A/C compressor drive belt. Refer to 11 28 050 REPLACING A/C COMPRESSOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56).

Remove cap from tensioning roller.

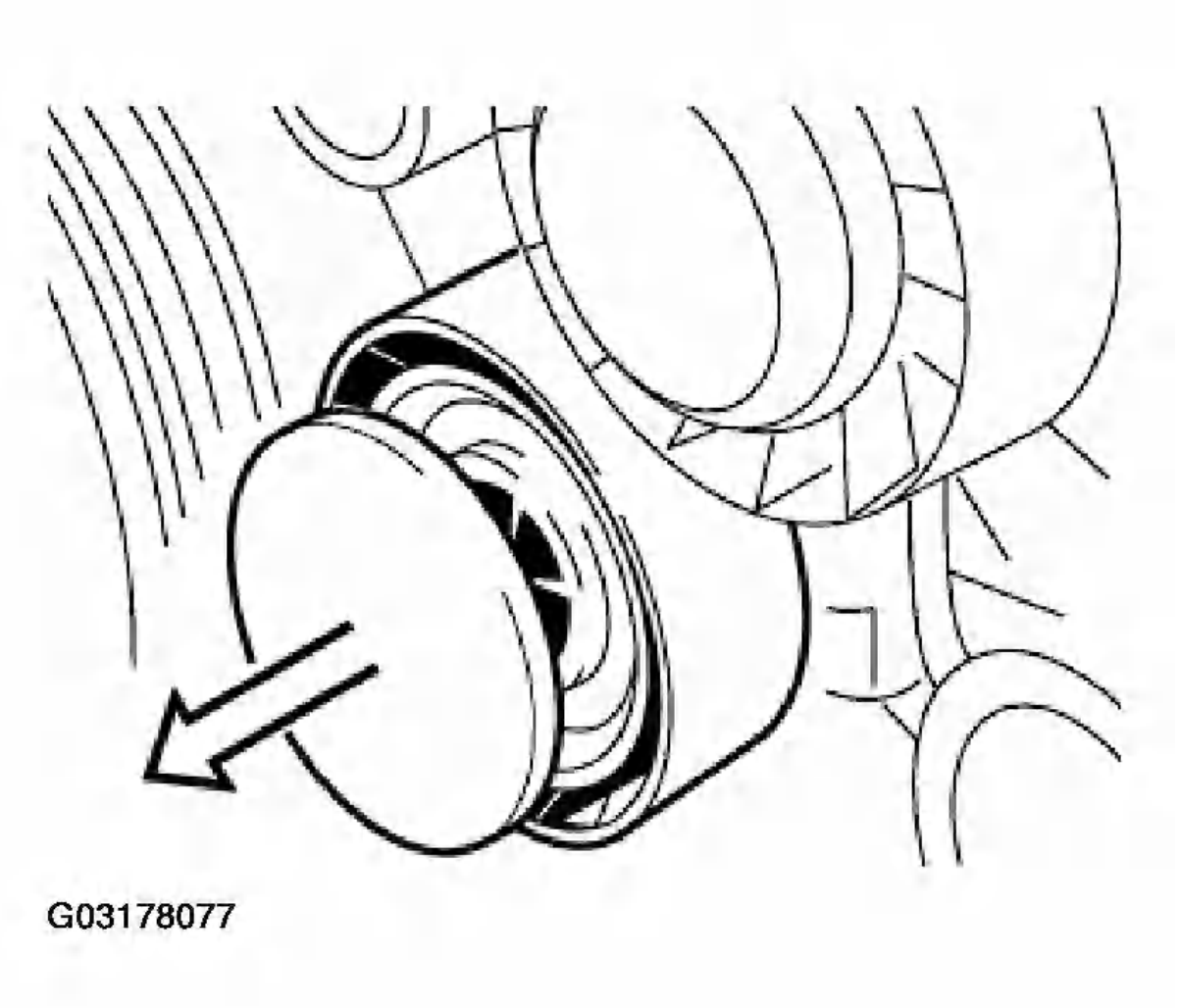



Fig. 162: Removing Cap From Tensioning Roller
Courtesy of BMW OF NORTH AMERICA, INC.

Relieve tension on belt drive.

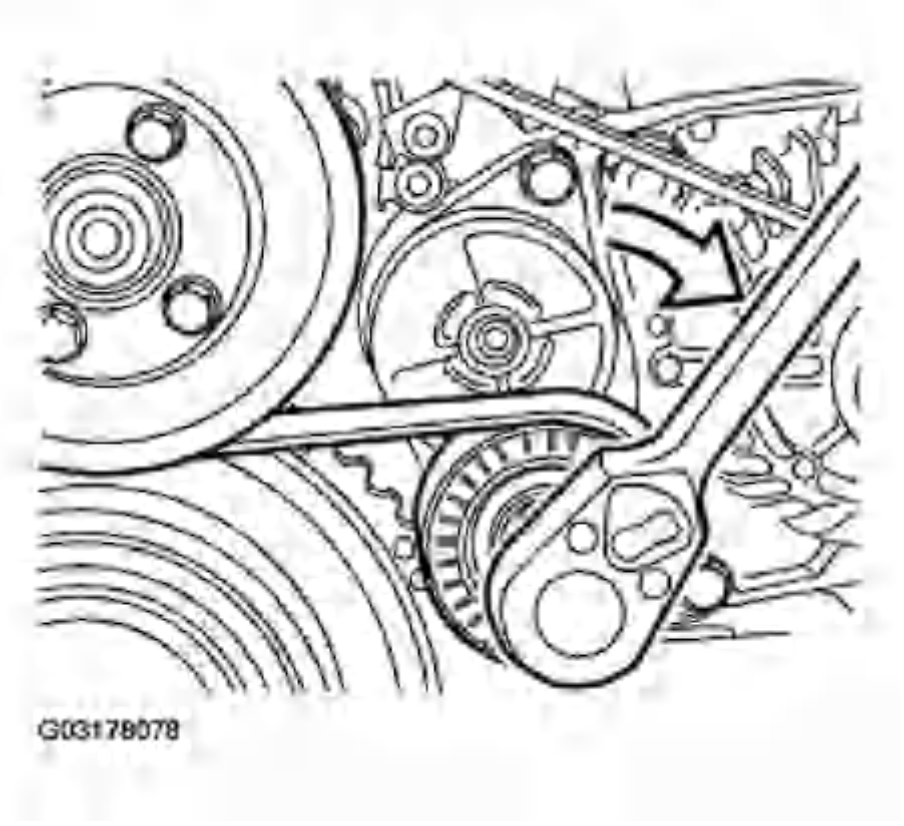


Fig. 163: Relieving Tension On Belt Drive
Courtesy of BMW OF NORTH AMERICA, INC.

Remove drive belt.

Important!

Drive belt must be replaced if fouled with hydraulic fluid.

Installation:

Check drive belt for coolant and oil residues, replace if necessary.

Installation:

Check that belt is correctly positioned on belt pulleys.

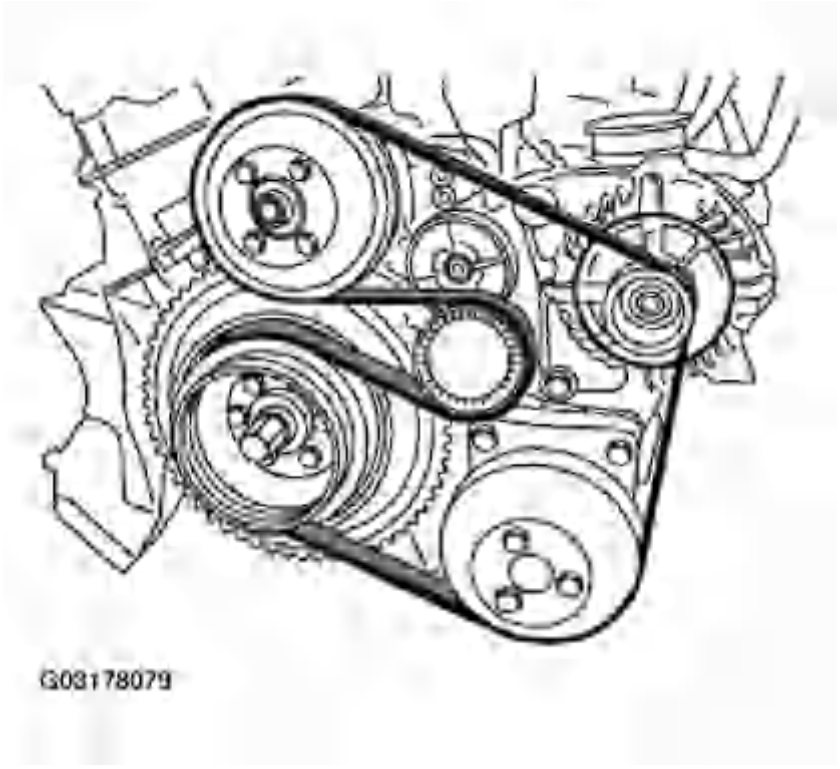



Fig. 164: Checking Belt Is Correctly Positioned On Belt Pulleys
Courtesy of BMW OF NORTH AMERICA, INC.

Version with auxiliary tensioning roller.

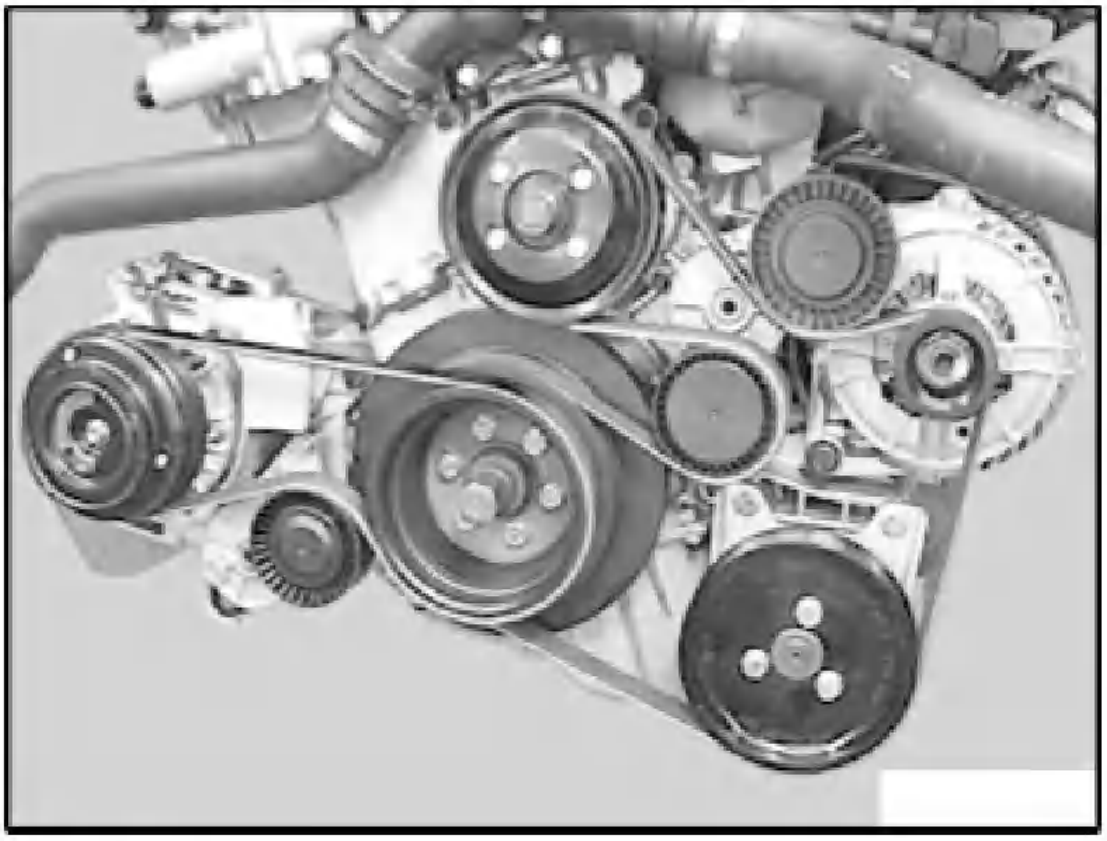



Fig. 165: Identifying Version With Auxiliary Tensioning Roller
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Locking device of auxiliary tensioning roller must snap into groove on alternator.




Fig. 166: Identifying Locking Device Of Auxiliary Tensioning Roller
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 28 050 REPLACING A/C COMPRESSOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56)

NOTE: If the drive belt is to be subsequently reused: Mark direction of travel and reinstall drive belt in same direction of travel.

Necessary Preliminary Tasks:

- If necessary, remove splash guard.

Model With Hydraulic Drive Belt And Tension Jack:

Remove the dust cab. Push back belt tensioner at bolt connection of guide pulley and remove drive belt.

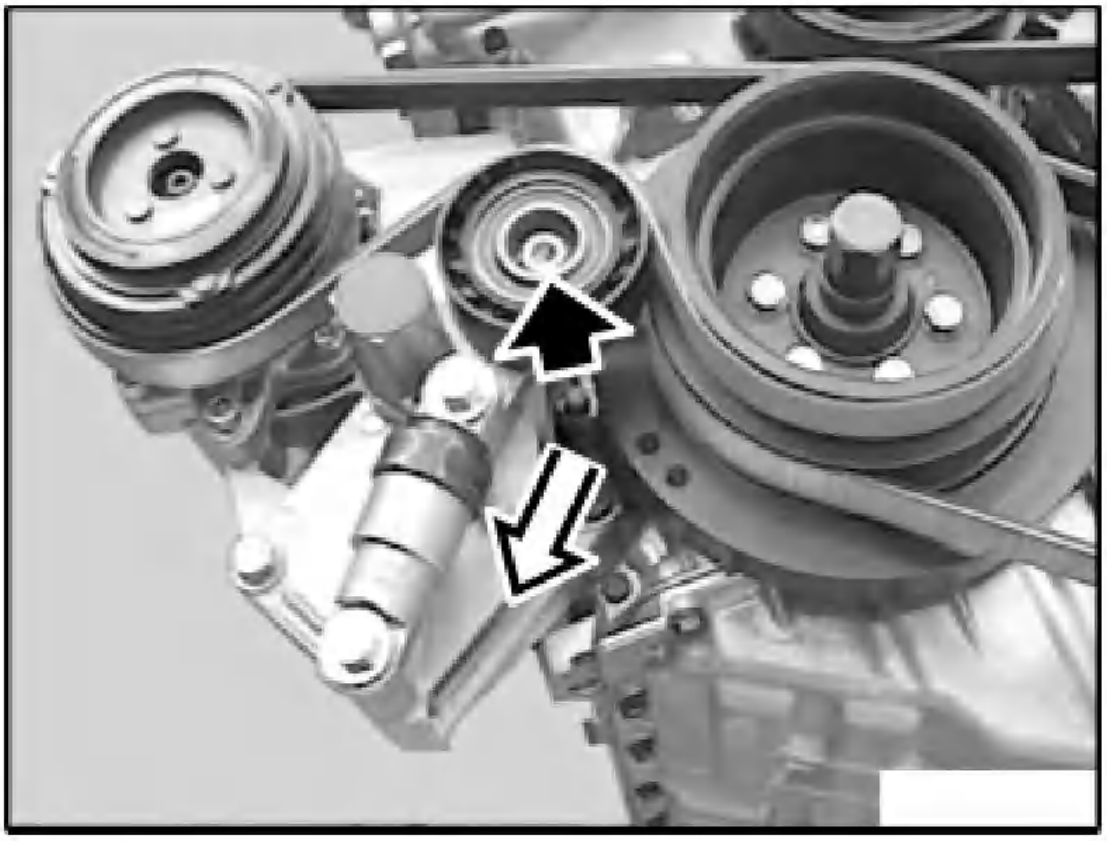



Fig. 167: Pushing Back Belt Tensioner At Bolt Connection Of Guide Pulley
Courtesy of BMW OF NORTH AMERICA, INC.

Model With Mechanical Drive Belt And Tension Jack:

Press back drive belt tensioner at hexagon head or Torx socket and remove drive belt.

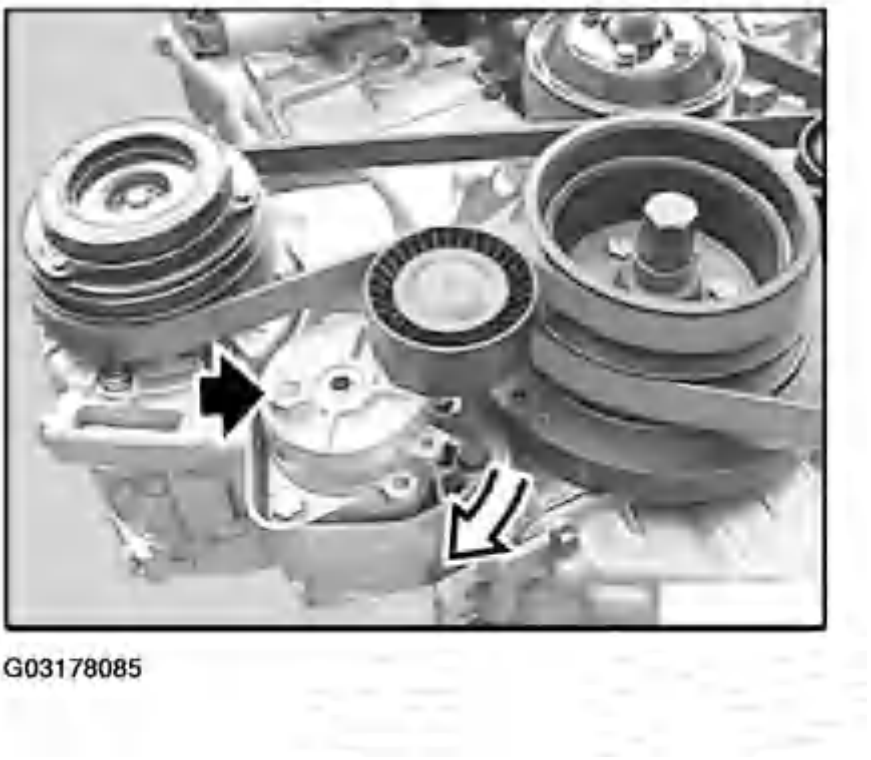



Fig. 168: Pressing Back Drive Belt Tensioner At Hexagon Head Or Torx Socket
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Drive belt must be replaced if fouled with hydraulic fluid.

Installation:

Check drive belt for coolant and oil residues, replace if necessary.

Install drive belt, make sure it is correctly positioned on belt pulleys.

## CAMSHAFT

### 11 31 001 REPLACING CAMSHAFT (M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 00 9 250
- 11 2 300
- 11 3 240
- 11 3 244
- 11 3 250
- 11 3 260
- 11 3 292
- 11 4 220
- 11 6 150
- 11 6 180

(If necessary inlet or exhaust side)

The inlet or exhaust camshaft can be replaced in the vehicle.

Important!

Incorrect assembly/removal without special tools exposes the camshaft to the risk of preliminary damage or breakage. The valves may also be bent by contact with the piston crown. Comply without fail with the job instructions, recommended special tools and work sequence.

Removal

Removal of camshafts is described separately from installation.

The assembly sequence for removal and installation is different.

Remove VANOS adjustment unit. Refer to 11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56).

Important!

Cylinder for chain tensioning piston is under spring pressure.

Unfasten cylinder for chain tensioning piston.

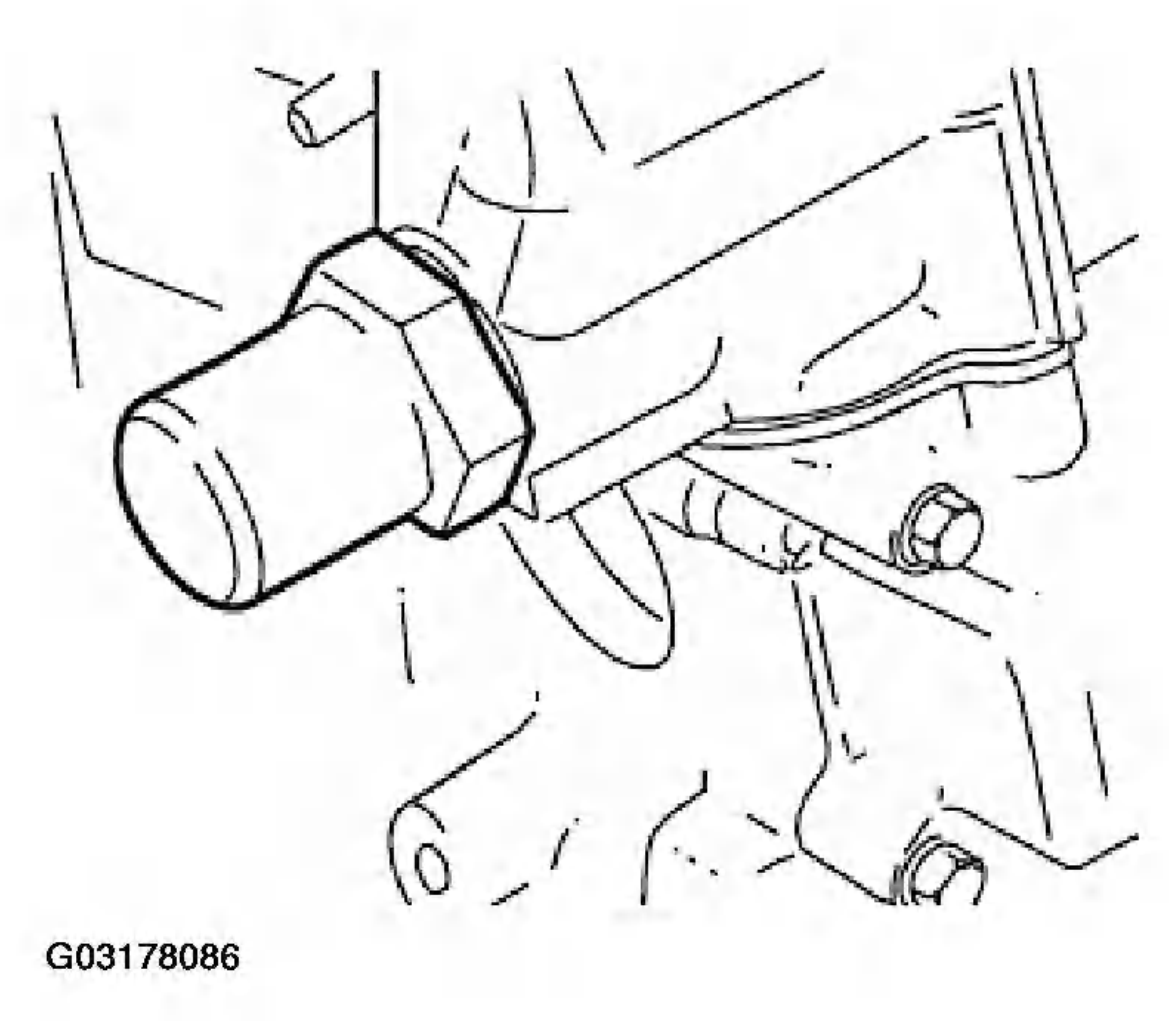



Fig. 169: Identifying Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Press down secondary chain tensioner at top and lock with special tool 11 3 292.

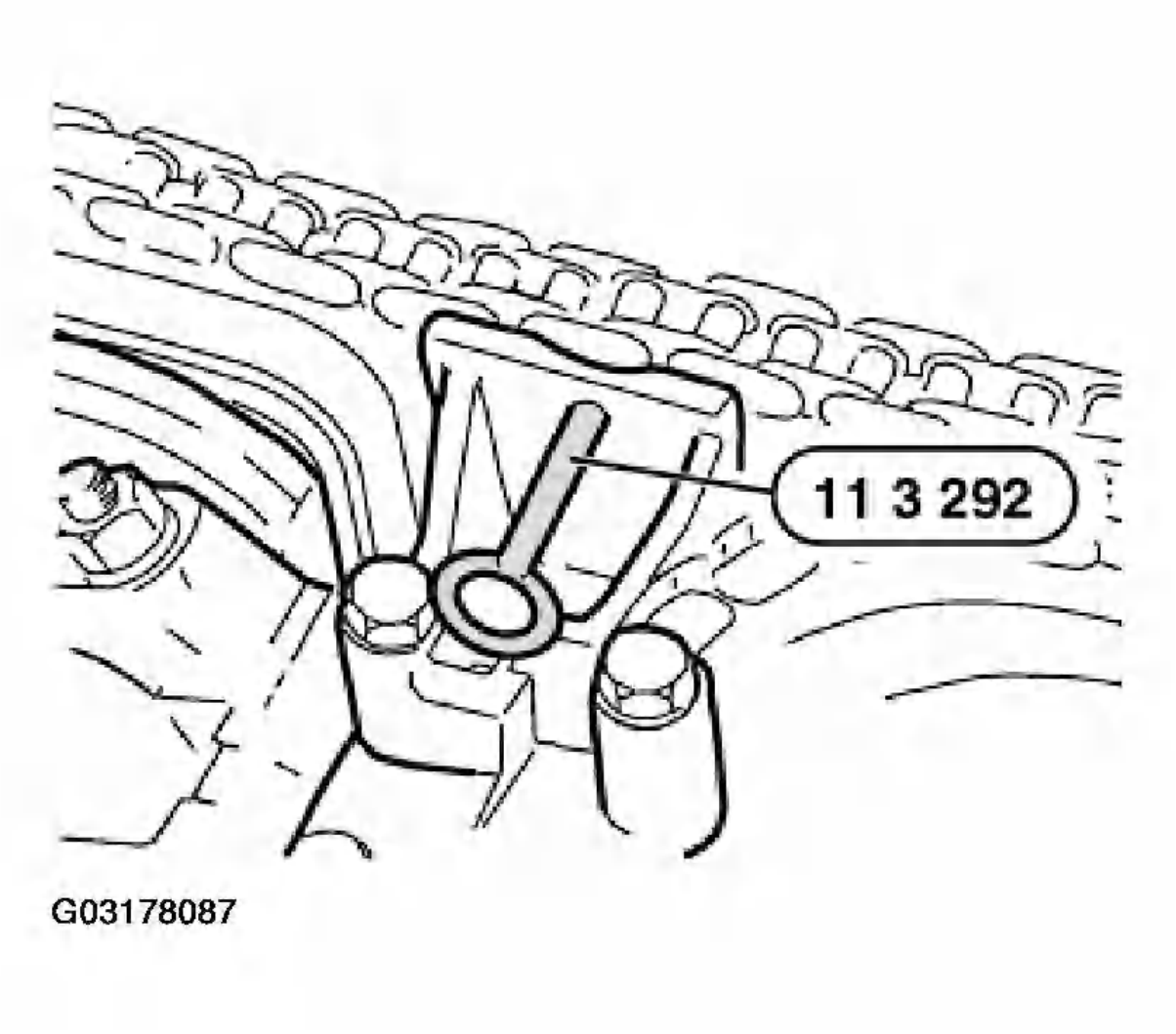



Fig. 170: Pressing Down And Locking Secondary Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts, remove sensor gear (1).

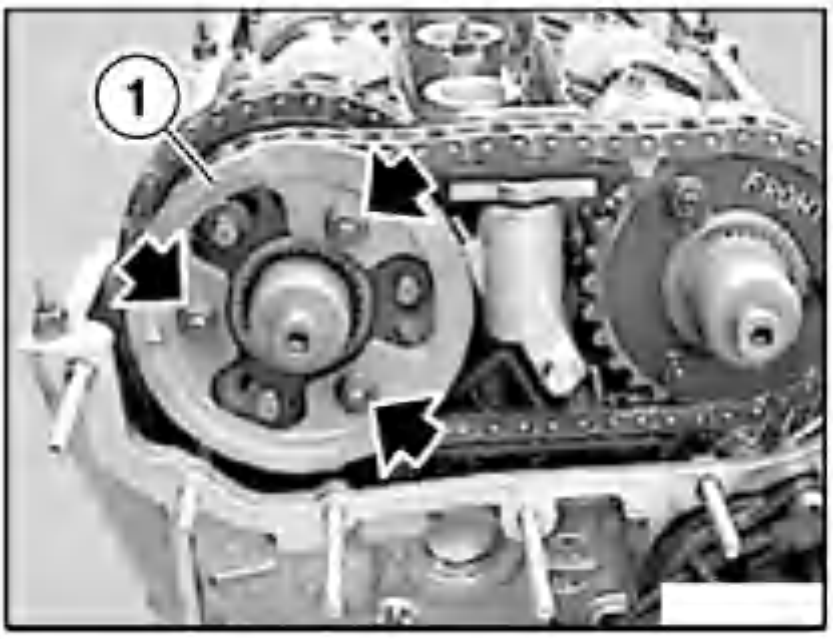
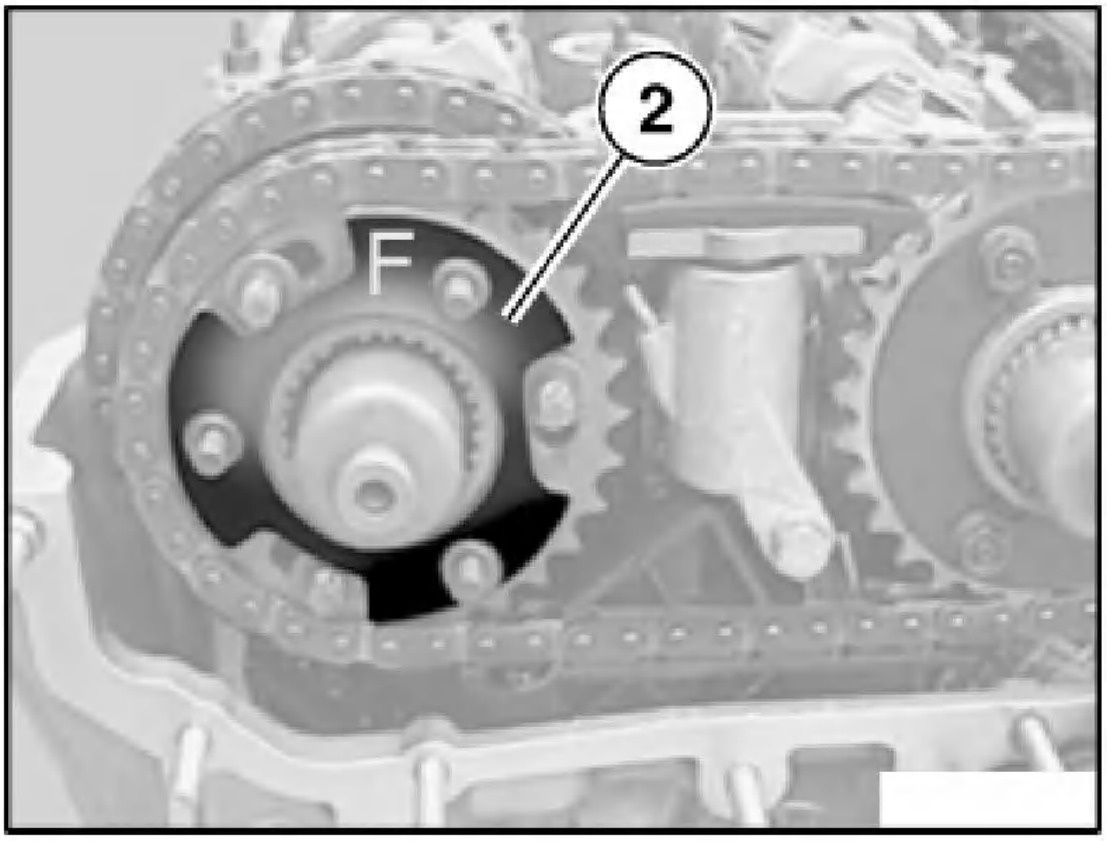



Fig. 171: Removing Nuts Of Sensor Gear
Courtesy of BMW OF NORTH AMERICA, INC.

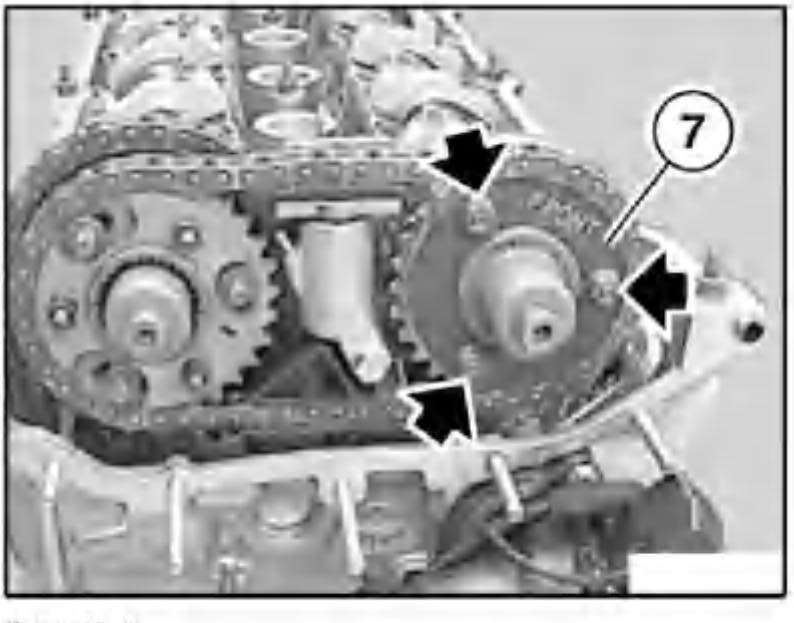
Remove plate spring (2).




G03178089

Fig. 172: Identifying Plate Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts on inlet side and remove corrugated washer (7).




G03178090

Fig. 173: Locating Nuts On Inlet Side
Courtesy of BMW OF NORTH AMERICA, INC.

Unfastening screws.

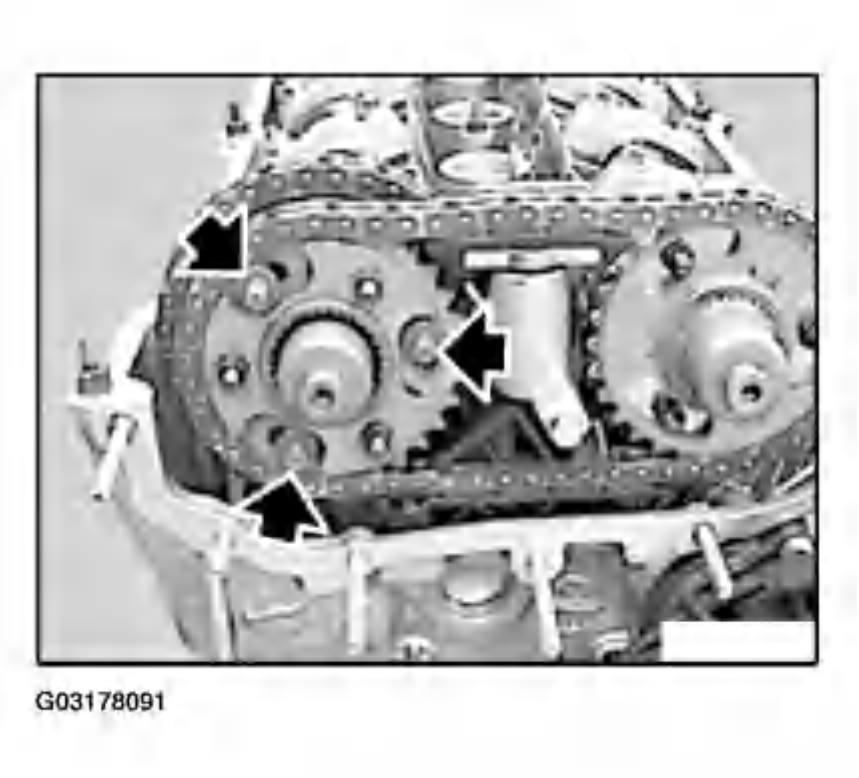



Fig. 174: Identifying Chain Wheel Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Lift off exhaust and inlet chain wheels together with chain, friction washer (3) and toothed shaft (4).

NOTE: Toothed shaft (4) is and identical part for exhaust and inlet sides. Store used toothed shafts in order and reinstall on the same side only.

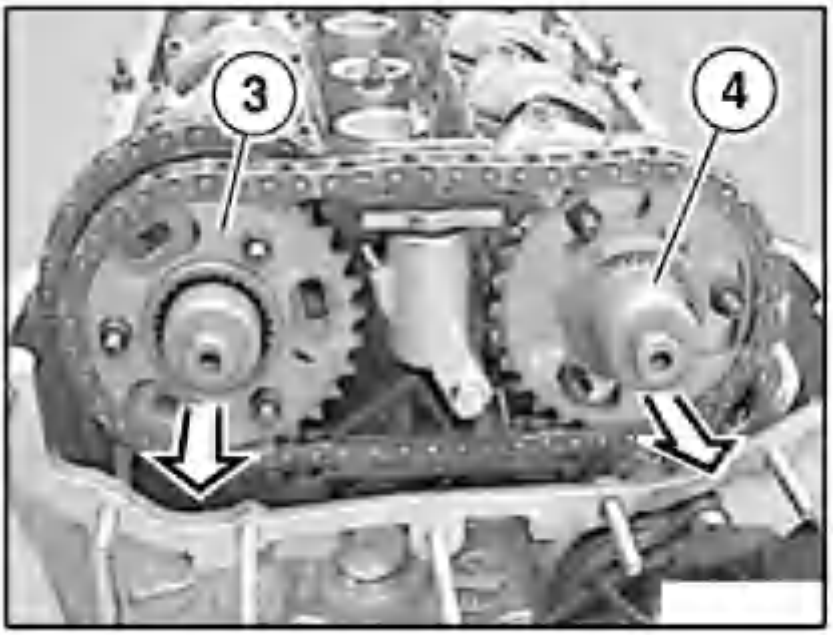



Fig. 175: Identifying Friction Washer And Toothed Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Remove toothed shaft (5) with toothed sleeve (6).

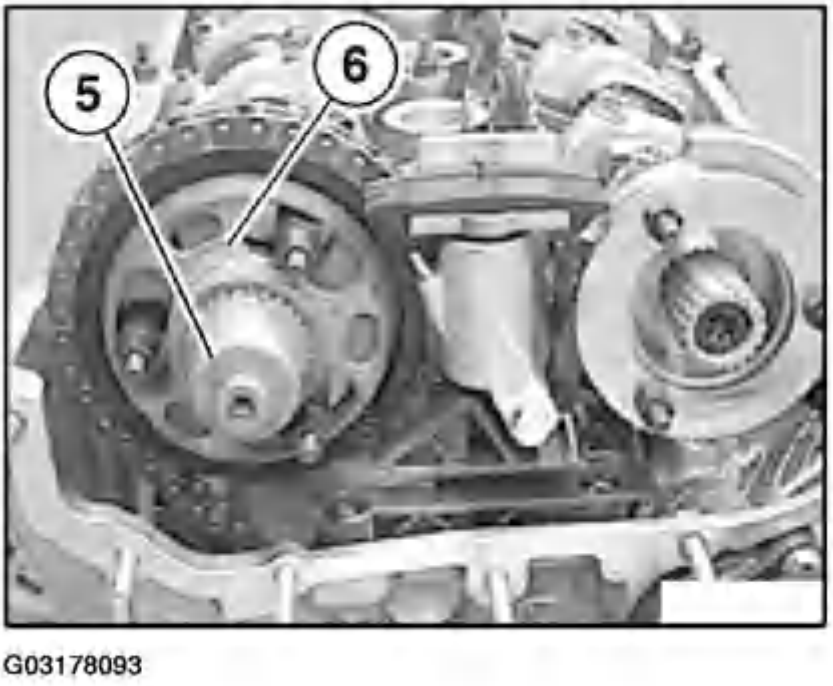



Fig. 176: Removing Toothed Shaft With Toothed Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws. Remove secondary chain tensioner.

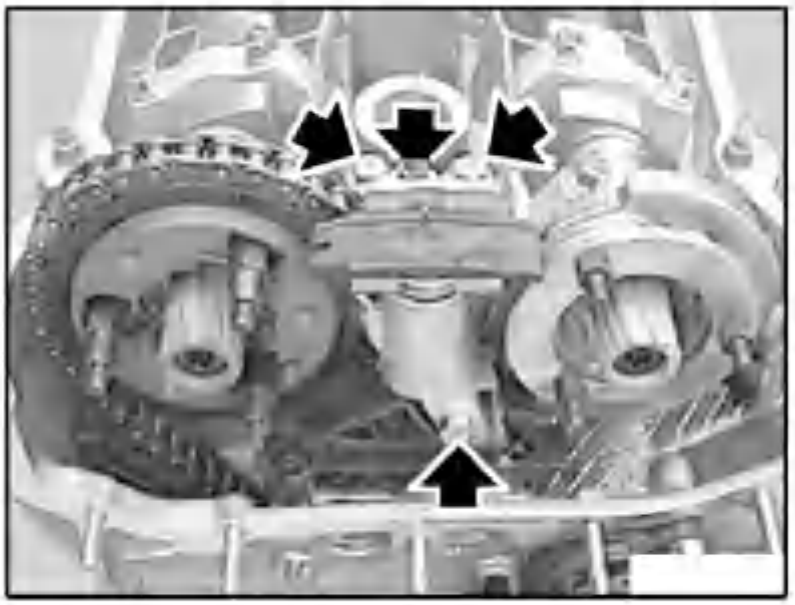



Fig. 177: Removing Secondary Chain Tensioner Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw-in pin.

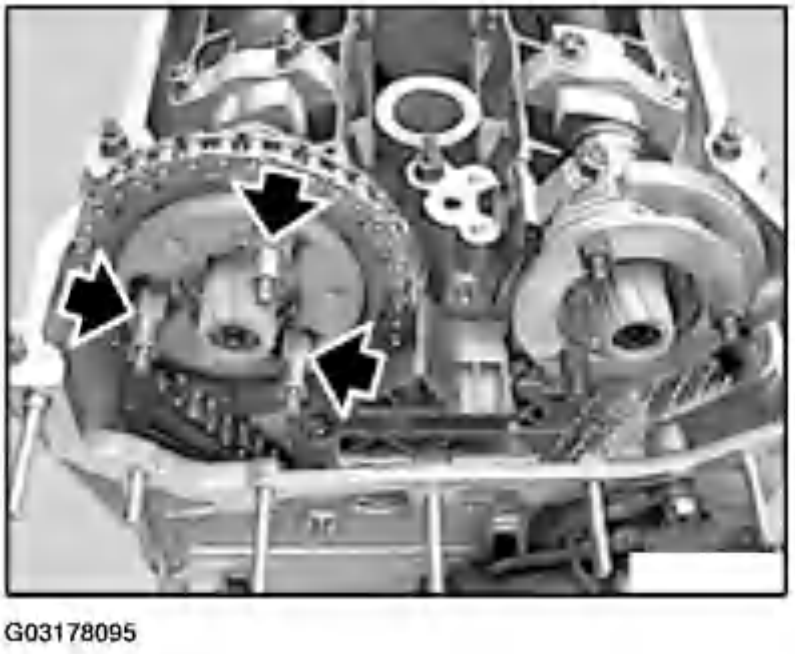



Fig. 178: Locating Screw-In Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Feed chain wheel (1) towards front out of timing chain (2).

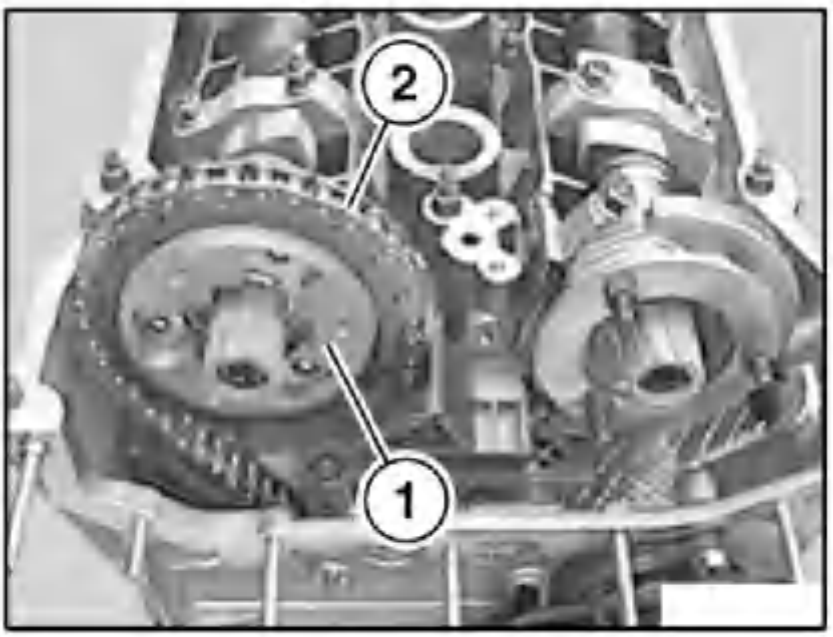



Fig. 179: Identifying Chain Wheel And Front Of Timing Chain
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Timing chain remains positioned over exhaust camshaft.

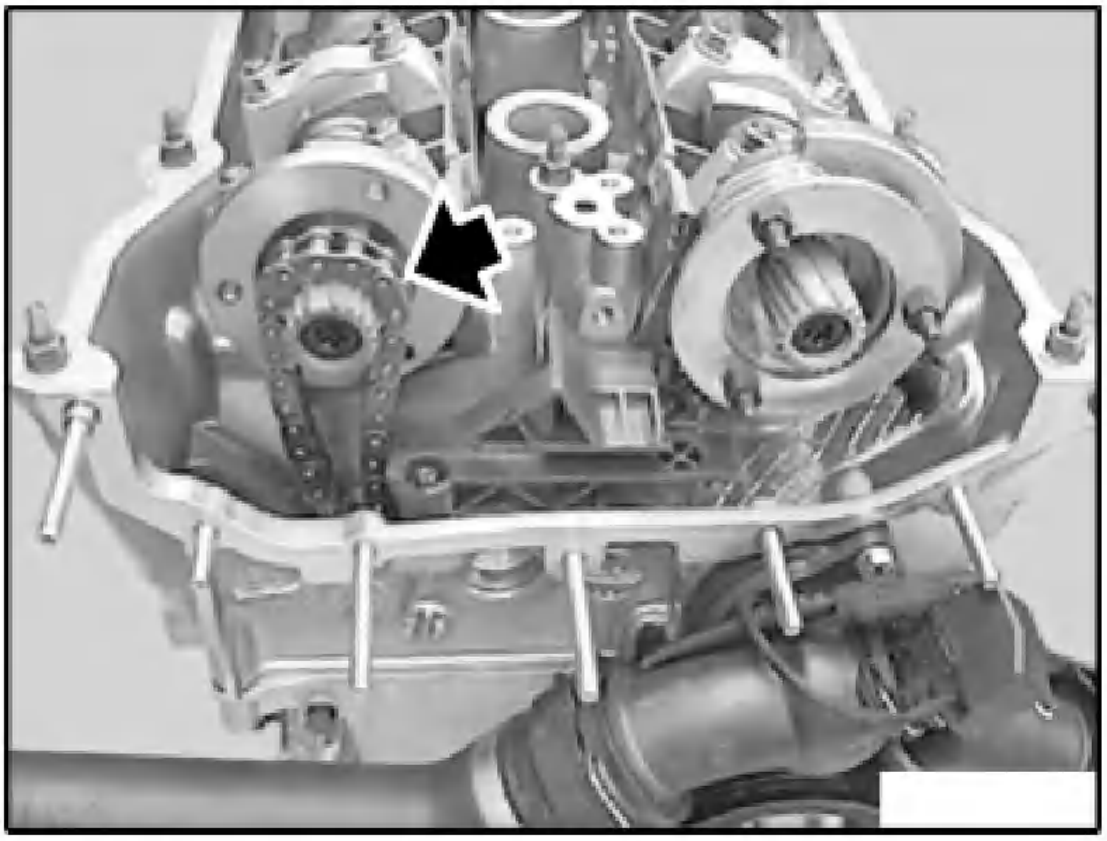



Fig. 180: Identifying Timing Chain Positioned Over Exhaust Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, release screw-in pin on inlet side.

Remove thrust washer.

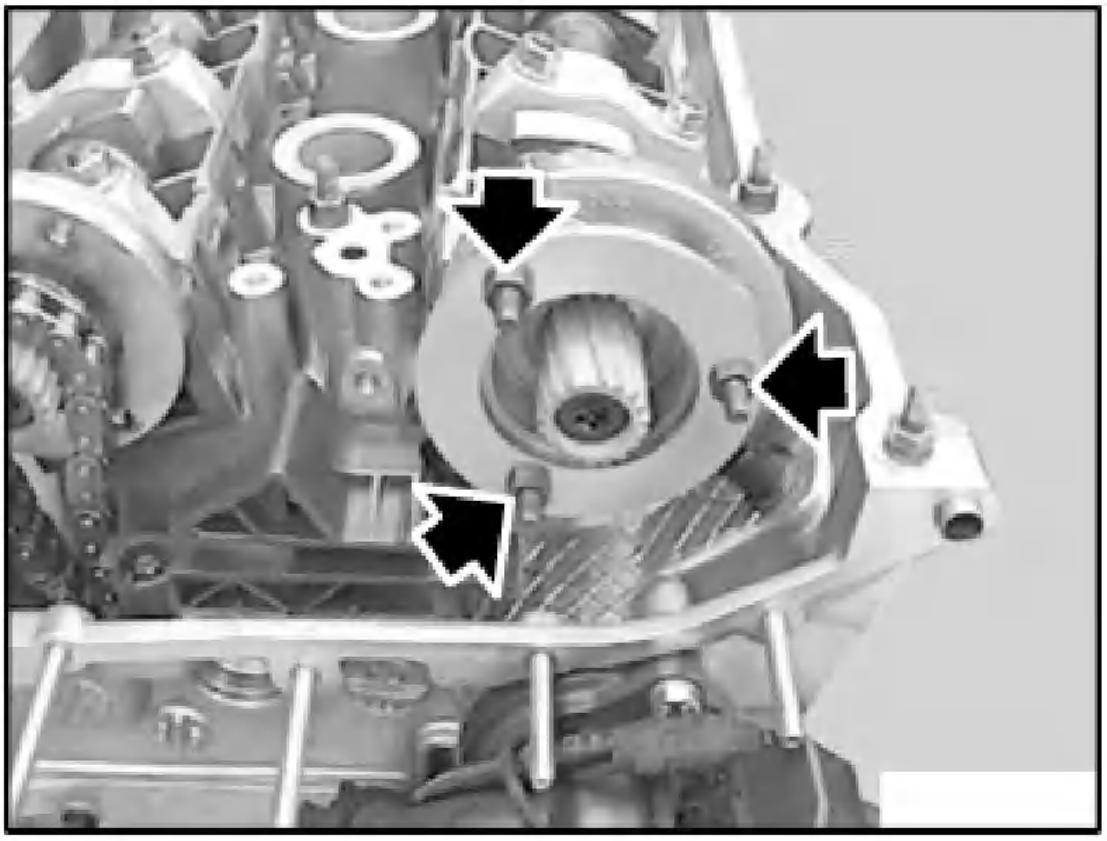



Fig. 181: Locating Screw-In Pin On Inlet Side
Courtesy of BMW OF NORTH AMERICA, INC.

Remove sensor gears.

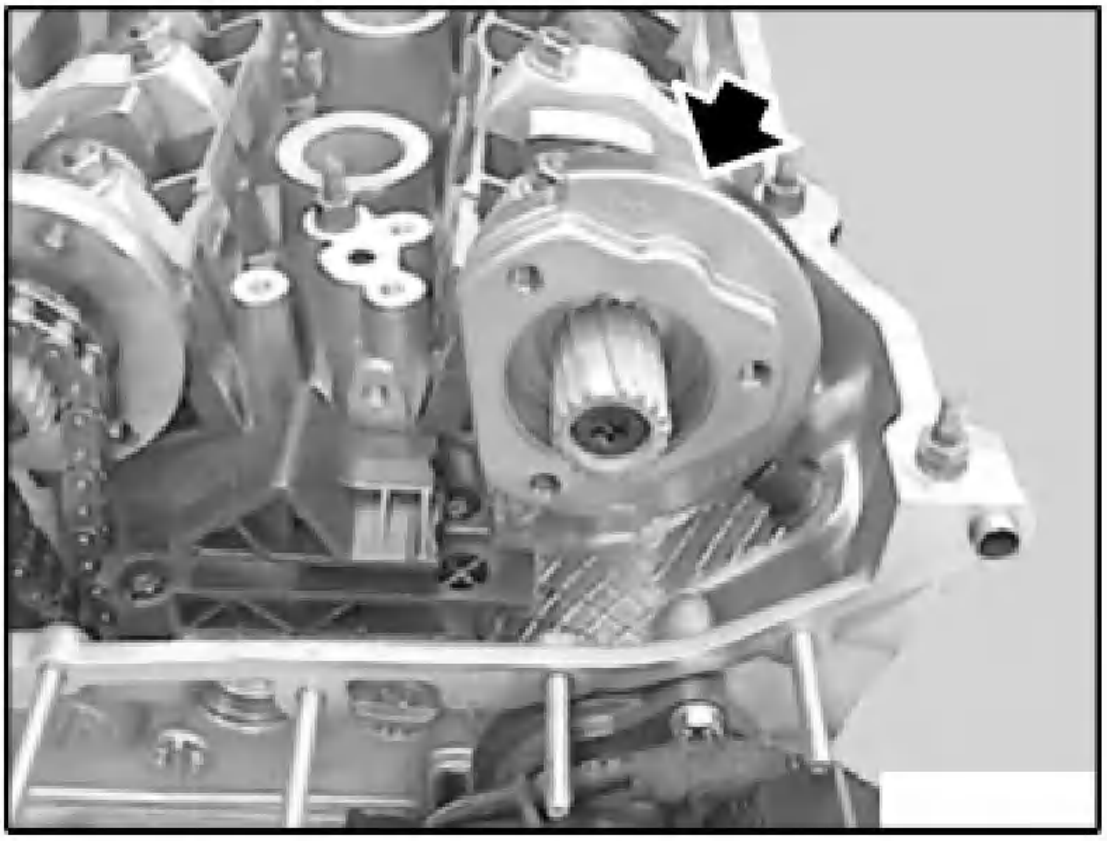



Fig. 182: View Of Sensor Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Do "not" release these screws.

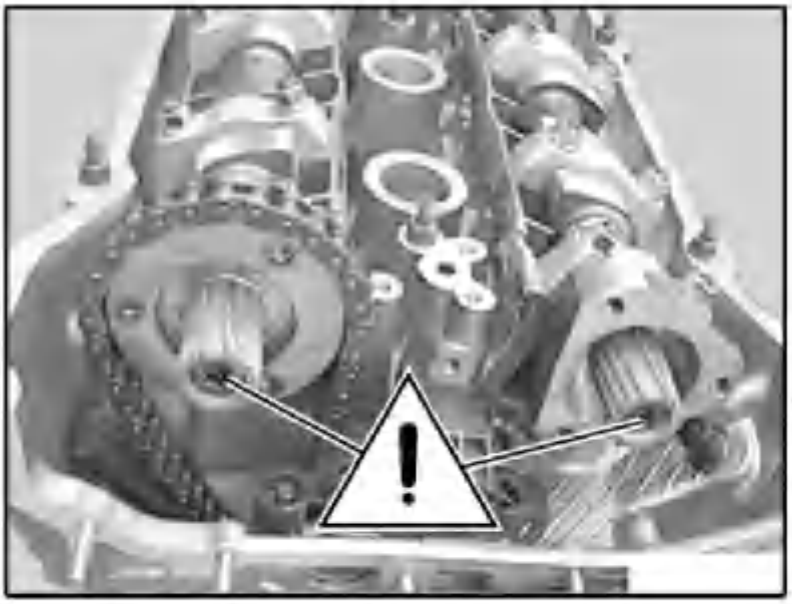



Fig. 183: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew studs.

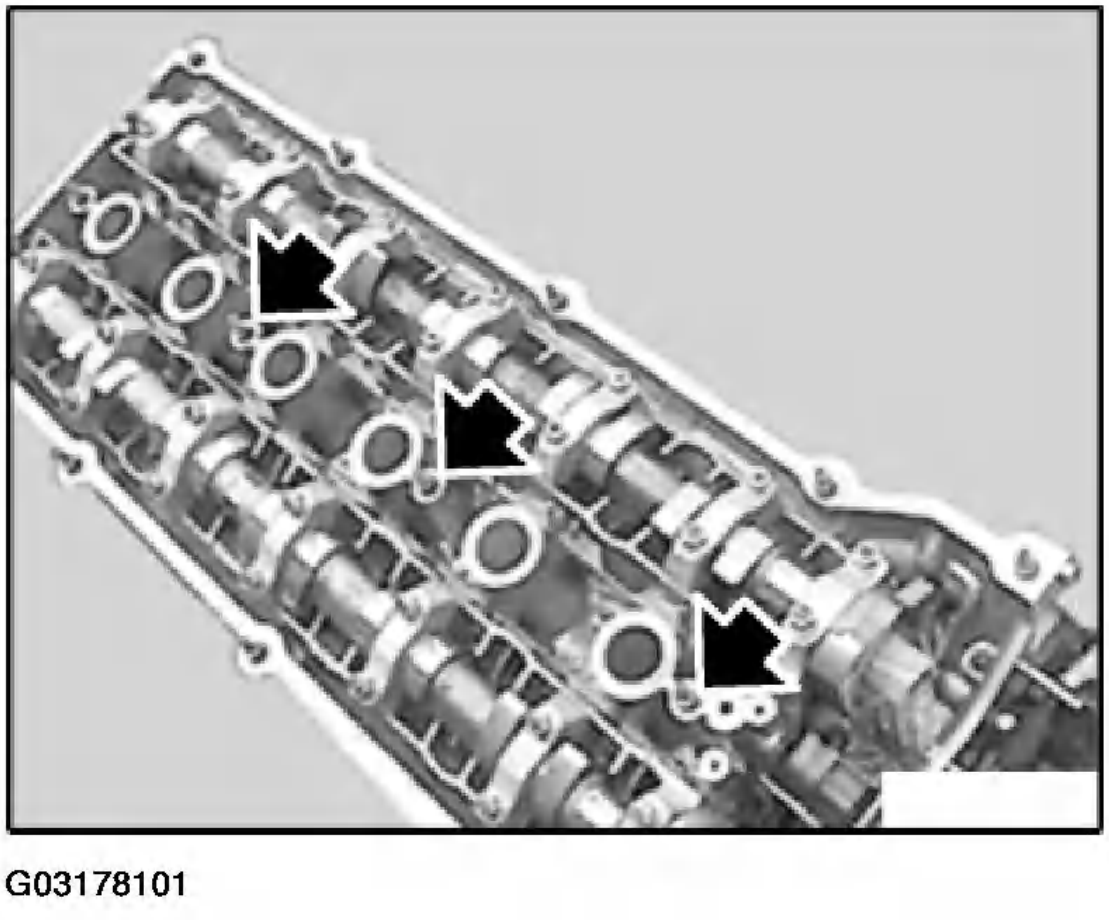


Fig. 184: Unscrewing Studs
Courtesy of BMW OF NORTH AMERICA, INC.

Pull special tool 11 2 300 back until flywheel is no longer secured in position.

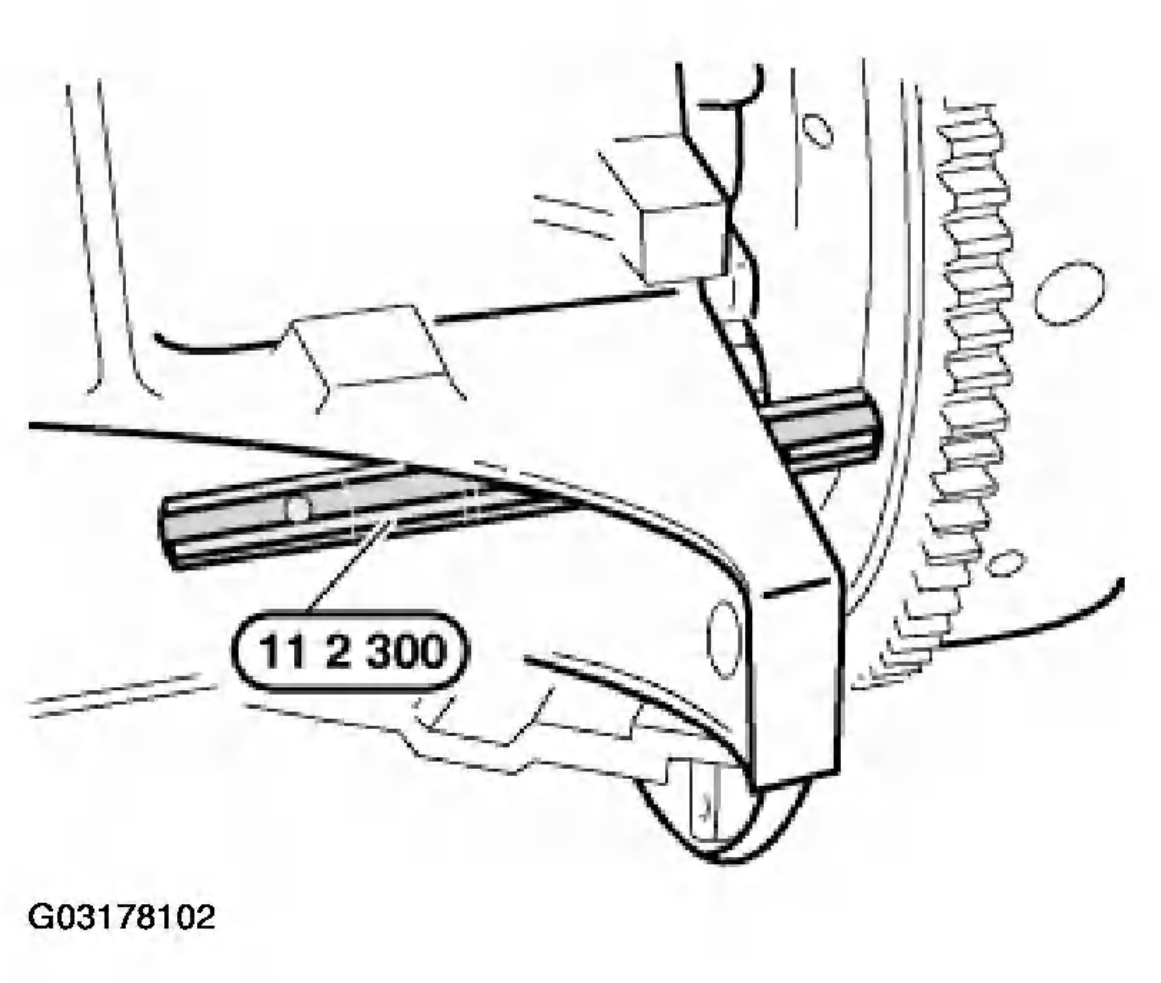



Fig. 185: Releasing Flywheel
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

To prevent damaging valves when fitting the camshafts, no pistons should be in TDC position.

Lift timing chain and hold under tension.

Rotate engine against direction of engine rotation approx. 30Â° using the central bolt.

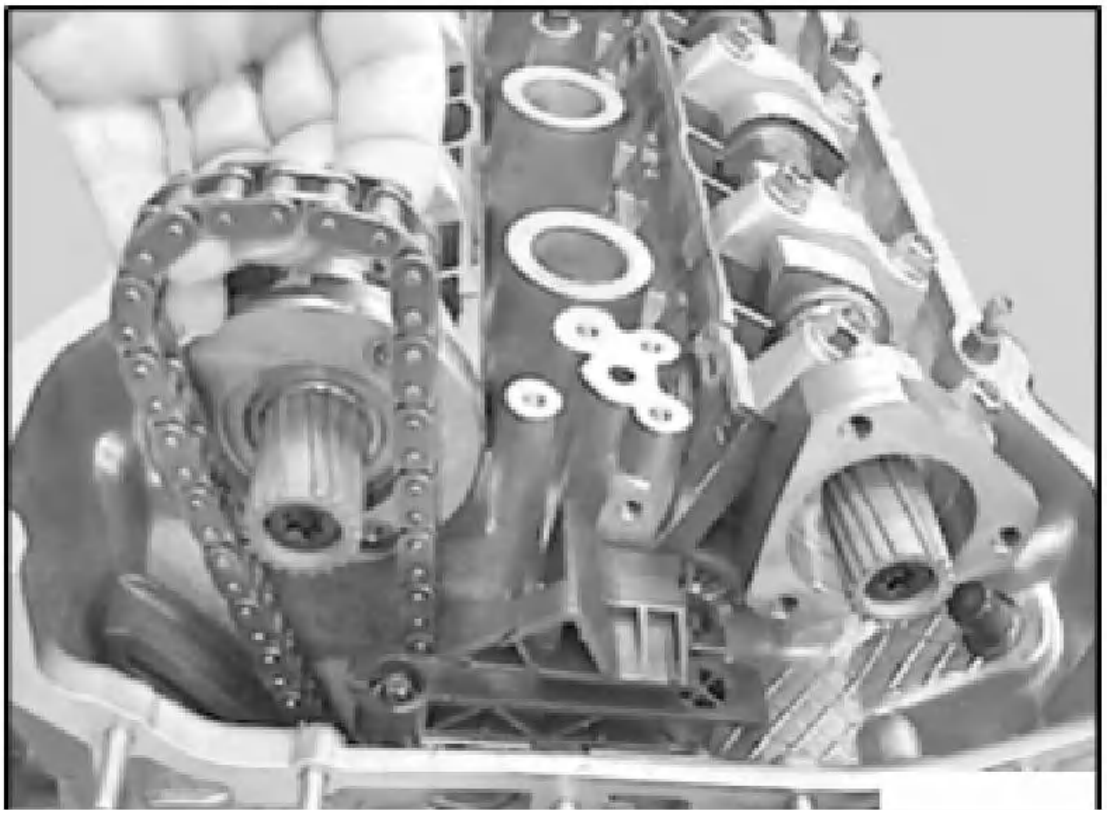


Fig. 186: Lifting Timing Chain
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Bearing cap 1 of inlet camshaft is centered with adapter sleeves.

To prevent inlet camshaft from tilting in bearing strip, release nuts and remove bearing cap 1.

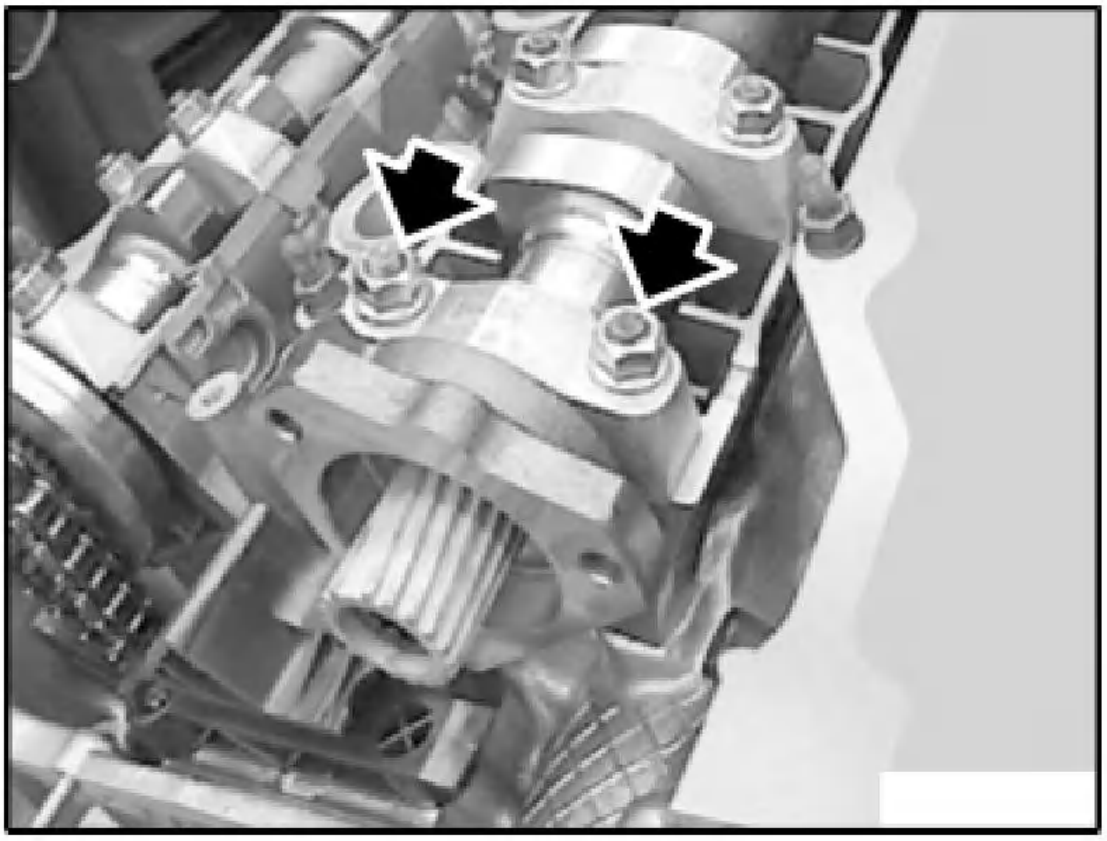



Fig. 187: Identifying Bearing Cap Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 11 3 260 to cylinder head and screw into spark plug threads in cylinders 1 and 4.

Fig. 188: Fitting Special Tool 11 3 260 Into Spark Plug Threads
Courtesy of BMW OF NORTH AMERICA, INC.

Turn the eccentric shaft to tension the bearing caps. Unfasten nuts on bearing cover.

Fig. 189: Locating Nuts On Bearing Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Relieve tension on eccentric shaft and remove special tool 11 3 260.

Remove bearing covers and place to one side in orderly fashion. Remove camshaft.

Fig. 190: Removing Bearing Covers
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: If the cylinder head is then to be removed, remove complete bearing strip with bucket tappets.

Locate bucket tappets in bearing strip with special tool 11 3 250.

Lift out complete bearing strip with bucket tappet.

NOTE: Only re-use used bucket tappets in the same tappet bore.

Fig. 191: Identifying Special Tool 11 3 250
Courtesy of BMW OF NORTH AMERICA, INC.

Check bearing points on bucket tappets for signs of wear (scoring).

Fig. 192: Checking Bearing Points On Bucket Tappets For Signs Of Wear (Scoring)
Courtesy of BMW OF NORTH AMERICA, INC.

Bearing strips are marked "A" for exhaust side and "E" for inlet side.

Fig. 193: Identifying Bearing Strips Marked "A" For Exhaust Side And "E" For Inlet Side
Courtesy of BMW OF NORTH AMERICA, INC.

Note centering dowels on retaining pins at bearing points 2 and 7.

Fig. 194: Locating Centering Dowels
Courtesy of BMW OF NORTH AMERICA, INC.

Install bearing strips.

Installation:

Installation of camshafts is described separately from removal.

The assembly sequence for removal and installation is different.

NOTE: Camshafts, bearings and bearing caps, friction washers, all splines on toothed shafts and spline hubs must be oiled before installation.

Important!

The bucket tappets expand when not subjected to load by the camshaft and therefore require some time before they can be pushed back down. During a rapid assembly sequence, the "closed" valves may still be open and be in contact with the piston.

Comply with following waiting periods after installing camshaft and before cranking engine back to TDC position.

- Room temperature (20Â°C) 4 mins.
- 10Â°C ... 20Â°C 11 mins.
- 0Â°C ... 10Â°C 30 mins.

Pull up timing chain and feed in exhaust camshaft.

Position timing chain on exhaust camshaft.

Fig. 195: Positioning Timing Chain On Exhaust Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Install camshafts so that cam tips on inlet and exhaust valves on 1st cylinder face one another. Refer to 11 31

001 REPLACING CAMSHAFT (M52TU / M54 / M56).

Fig. 196: Installing Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

Fit bearing cover.

NOTE: Bearing caps are marked from exhaust side:

A1 ... A7 for exhaust side.

E1 ... E7 for inlet side.

Fig. 197: Identifying Bearing Caps
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 11 3 260 to cylinder head and screw into spark plug threads in cylinders 1 and 4.

Fig. 198: Fitting Special Tool 11 3 260 Into Spark Plug Threads
Courtesy of BMW OF NORTH AMERICA, INC.

Turn the eccentric shaft to tension the bearing caps.

Tighten down bearing cover.

Tightening torque, refer to 11 31 1AZ in CAMSHAFT .

Fig. 199: Tightening Down Bearing Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 3 260.

Important!

Do not damage the cylinder head.

If necessary, machine open-end wrench accordingly.

Align camshafts with open-end wrench.

Fig. 200: Aligning Camshafts With Open-End Wrench
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 11 3 240 to camshafts on cylinder 6. Align camshafts so that special tool 11 3 240 rests without gaps on cylinder head.

Fig. 201: Fitting Special Tool 11 3 240 To Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 11 3 244 to special tool 11 3 240 and locate by way of spark plug thread.

Fig. 202: Attaching Special Tool 11 3 244 To Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

Lift timing chain and hold under tension.

Fig. 203: Lifting Timing Chain
Courtesy of BMW OF NORTH AMERICA, INC.

Turn engine from 30Â° before TDC position in direction of rotation as far as TDC position.

Secure crankshaft in firing TDC position with special tool 11 2 300.

Important!

Remove special tool 11 2 300 before starting engine.

Fig. 204: Securing Crankshaft In Firing TDC Position With Special Tool 11 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

Automatic Transmissions Only:

Illustration does not show automatic transmission.

Important!

On engines with automatic transmissions, there is shortly before the special tool bore (1) a large bore (2) which can be confused with the special tool bore.

Fig. 205: Identifying Special Tool Bore And Large Bore
Courtesy of BMW OF NORTH AMERICA, INC.

If special tool 11 2 300 is secured in the correct bore (1), the engine can no longer be cranked at the central bolt.

Position sensor gear on inlet camshaft.

Fig. 206: Positioning Sensor Gear On Inlet Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Fit thrust washer and tighten down with dowels.

Tightening torque, refer to 11 31 1AZ in CAMSHAFT .

Fig. 207: Tightening Thrust Washer Dowels
Courtesy of BMW OF NORTH AMERICA, INC.

Feed chain wheel onto timing chain so that arrow on chain wheel faces separating face of upper side of cylinder head.

Fig. 208: Aligning Arrow On Timing Chain
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 11 4 220 in cylinder head and bring adjustment screw into contact with tensioning rail, but do not pretension timing chain yet.

Check arrow on chain wheel to separating face of upper side of cylinder head, reposition chain wheel if necessary.

Fig. 209: Inserting Special Tool 11 4 220 In Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

Insert and tighten down screw-in pin.

Tightening torque, refer to 11 31 11AZ in CAMSHAFT .

Fig. 210: Installing Screw-In Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Install secondary chain tensioner.

Fig. 211: Installing Secondary Chain Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

Fit toothed sleeve (6) and align to toothed shaft in camshaft so that tooth gaps are opposed.

Fig. 212: Aligning Toothed Sleeve To Toothed Shaft In Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Secure toothed shaft (5).

Insert pin of toothed shaft (5) into tooth gaps of splines on camshaft and toothed sleeve (6).

Fig. 213: Inserting Pin Of Toothed Shaft Into Tooth Gaps Of Splines
Courtesy of BMW OF NORTH AMERICA, INC.

Push in toothed shaft (5) until the longitudinal holes in the toothed sleeve (6) are positioned centrally with respect to the thread.

Fig. 214: Aligning Toothed Shaft And Holes In Toothed Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

Place chain wheels in special tool 11 6 180, position tooth gap on inlet chain wheel as shown in illustration and feed on chain.

Fig. 215: Aligning Tooth Gap On Inlet Chain Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Do not alter position of chain wheels with respect to chain when removing from special tool 11 6 180.

Remove chain with sprocket wheels positioned from special tool 11 6 180 and so that tooth spaces oppose each other on inlet side.

Fig. 216: Positioning Tooth Spaces Opposite Each Other
Courtesy of BMW OF NORTH AMERICA, INC.

Align chain with sprocket wheels so that tooth spaces are positioned exactly over each other on inlet side.

Fig. 217: Aligning Tooth Spaces Opposite Each Other
Courtesy of BMW OF NORTH AMERICA, INC.

Secure toothed shaft (4).

Insert pin of toothed shaft (4) into tooth gaps of splines on camshaft and chain wheel.

Fig. 218: Inserting Pin Of Toothed Shaft Into Tooth Gaps Of Splines
Courtesy of BMW OF NORTH AMERICA, INC.

Push in toothed shaft (4) until approx. 1 mm of splines can still be seen.

Fig. 219: Pushing In Toothed Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Note installation direction of corrugated washer (7), "FRONT" lettering must be visible.

Fig. 220: View Of Lettering On Corrugated Washer
Courtesy of BMW OF NORTH AMERICA, INC.

Install corrugated washer, tighten nuts by hand but do not tighten down fully yet.

Insert screws on exhaust side, initially tighten to approx. 5 Nm and then slacken off again half a turn.

Fig. 221: Inserting Screws On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

Fit thrust washer (3).

Fig. 222: Fitting Thrust Washer
Courtesy of BMW OF NORTH AMERICA, INC.

Note installation direction of cup spring (2), "F" lettering must be visible.

NOTE: If "F" lettering is no longer visible on an engine that has been run:

Install cup spring (2) so that small locating diameter of spring (2) points to sensor gear.

Fit cup spring (2) in position.

Fig. 223: Installing Cup Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Position sensor gear (1) so that arrow on sensor gear faces separating face of upper side of cylinder head.

Install nuts and tighten by hand but do not tighten down fully yet.

Fig. 224: Positioning Sensor Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Withdraw toothed shaft (5) up to stop.

Fig. 225: Positioning Toothed Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Press down secondary chain tensioner at top and remove special tool 11 3 292.

Fig. 226: View Of Secondary Chain Tensioner And Special Tool 11 3 292
Courtesy of BMW OF NORTH AMERICA, INC.

Preload tensioning rail with special tool 11 4 220 by rotating adjusting screw with special tool 00 9 250 or standard torque wrench to 0.7 Nm.

Fig. 227: Identifying Special Tool 11 4 220 And Special Tool 00 9 250
Courtesy of BMW OF NORTH AMERICA, INC.

Preload cup spring slightly by pressing on sensor gear (1) and tighten nuts by hand.

Fig. 228: Locating Sensor Gear Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Do not tighten down nuts fully.

Remove gasket.

Check dowel sleeves (1) for damage and correct installation position.

Fig. 229: Checking Dowel Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

Keep sealing face clean and free of oil.

Important!

Fit special tool 11 6 150 "without gasket" only.

If gasket remains underneath special tool 11 6 150, camshaft timing will be "incorrectly" set.

Attach special tool 11 6 150 "without gasket", tighten nuts by hand and then tighten down uniformly until special tool 11 6 160 is in full contact with cylinder head.

Fig. 230: Locating Adjusting Plate Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screws (1) on exhaust side and initially tighten to approx. 5 Nm.

Fig. 231: Inserting Screws On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

Initially tighten nuts (2) on exhaust side and nuts (3) on inlet side to approx. 5 Nm.

Fig. 232: Tightening Nuts On Exhaust Side And Nuts On Inlet Side
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down screws (1) on exhaust side.

Tightening torque, refer to 11 31 3AZ in CAMSHAFT .

Fig. 233: Tightening Screws On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down nuts (2) on exhaust side and nuts (3) on inlet side.

Tightening torque, refer to 11 31 11AZ in CAMSHAFT .

Fig. 234: Tightening Nuts On Exhaust Side And Nuts On Inlet Side
Courtesy of BMW OF NORTH AMERICA, INC.

Pull special tool 11 2 300 back until flywheel is no longer secured in position.

Fig. 235: Aligning Plug Mandrel And Flywheel
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 3 244 and special tool 11 3 240.

Fig. 236: Removing Special Tool 11 3 244 And Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

Crank engine twice in direction of rotation until cam tips on inlet and exhaust camshafts on 1st cylinder face one another.

Fig. 237: Aligning Inlet And Exhaust Cam Tips
Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft in firing TDC position with special tool 11 2 300.

Important!

Do not turn the engine back.

Remove special tool 11 2 300 before switching on the engine.

Fig. 238: Removing Special Tool 11 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 11 3 240 to camshafts.

Fig. 239: Fitting Special Tool 11 3 240 To Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The timing is correctly set if the special tool 11 3 240 rests without a gap on the cylinder head or protrudes up to 1 mm to the inlet side. The timing must be reset if the special tool 11 3 240 protrudes to the exhaust side.

Fig. 240: Identifying Correct Fitting Of Special Tool 11 3 240 To Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 6 150.

Fig. 241: Removing Special Tool 11 6 150

Courtesy of BMW OF NORTH AMERICA, INC.

Install VANOS adjustment unit. Refer to Refer to 11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56).

Assemble engine.

## 11 31 005 CHECKING CAMSHAFT TIMING (M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 00 9 200
- 11 2 300
- 11 3 240
- 11 3 450
- 11 4 220

Necessary Preliminary Tasks:

- Remove fan impeller with fan clutch. Refer to Refer to 11 52 020 REMOVING AND INSTALLING/REPLACING FAN CLUTCH (S52 / S54 / M52 / M52TU / M54 / M56).
- Remove cylinder head cover. Refer to 11 12 000 REMOVING AND INSTALLING, SEALING CYLINDER HEAD COVER (M52TU / M54 / M56).
- Remove all spark plugs. Refer to 12 12 011 REPLACING ALL SPARK PLUGS .

Detach cover for inlet camshaft.

Fig. 242: Detaching Cover For Inlet Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Cylinder for chain tensioning piston is under spring pressure.

Remove cylinder for chain tensioning piston.

Fig. 243: Identifying Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Install special tool 11 4 220.

Fit adjusting screw to bow cover.

Fig. 244: Installing Special Tool 11 4 220
Courtesy of BMW OF NORTH AMERICA, INC.

Preload tensioning rail with special tool 11 4 220 by rotating adjusting screw with special tool 00 9 250 or standard torque wrench to 0.7 Nm.

Fig. 245: Preloading Tensioning Rail With Special Tool 11 4 220
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew oil pressure pipe.

Fig. 246: Locating Oil Pressure Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

Mount special tool 11 3 450 with banjo bolt of oil pressure line.

Fig. 247: Mounting Special Tool 11 3 450 With Banjo Bolt Of Oil Pressure Line
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Cover double VANOS adjustment unit; when the compressed air supply is connected, several drops of oil are sprayed out of the bore.

Fig. 248: Locating Double VANOS Adjustment Unit Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Connect compressed air (2 to 8 bar).

Fig. 249: Connecting Compressed Air To Special Tool 11 3 450
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: When the engine is switched off, it is possible that the camshafts are not in their initial positions. With the compressed air supply connected, rotate the engine to return the camshafts to their initial positions.

With compressed air supply connected, crank engine at least two revolutions in direction of rotation until cam tips on inlet and exhaust camshafts on 1st cylinder face each other.

Fig. 250: Identifying Position Of Cam Tips
Courtesy of BMW OF NORTH AMERICA, INC.

Pull dust guard out of the special tool bore.

Fig. 251: Pulling Dust Guard Out Of Special Tool Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft with special tool 11 2 300 in TDC firing position of 1st cylinder.

Important!

Do not turn the engine back.

Remove special tool 11 2 300 before starting engine.

Fig. 252: Securing Crankshaft With Special Tool 11 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

Automatic Transmissions Only:

Illustration does not show automatic transmission.

Important!

On engines with automatic transmissions, there is shortly before the special tool bore (1) a large bore (2) which can be confused with the special tool bore (1)

If special tool 11 2 300 is secured in the correct bore (1), the engine can no longer be cranked at the central bolt.

Fig. 253: Identifying Special Tool Bore And Large Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew studs.

Fig. 254: View Of Studs
Courtesy of BMW OF NORTH AMERICA, INC.

Place special tool 11 3 240 on camshafts.

Fig. 255: Installing Special Tool 11 3 240 On Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The timing is correctly set if the special tool 11 3 240 rests without a gap on the cylinder head or protrudes up to 1 mm to the inlet side. The timing must be reset if the special tool 11 3 240 protrudes to the exhaust side. If necessary, adjust camshaft timing. Refer to 11 31 505 ADJUSTING CAMSHAFT TIMING (M52TU / M54 / M56).

Fig. 256: Identifying Correct Setting Of Special Tool 11 3 240 On Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

Detach compressed air connection.

Remove special tool 11 3 450.

Fig. 257: View Of Special Tool 11 3 450
Courtesy of BMW OF NORTH AMERICA, INC.

Fit oil pressure line with new seals.

Fig. 258: Identifying Oil Pressure Line Fitting
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, refer to 11 36 2AZ in 11 36 VARIABLE CAMSHAFT CONTROL .

Remove special tool 11 3 240.

Fig. 259: Removing Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 2 300.

Install dust guard from inspection bore.

Fig. 260: Removing Special Tool 11 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten and remove special tool 11 4 220.

Fig. 261: Removing Special Tool 11 4 220
Courtesy of BMW OF NORTH AMERICA, INC.

Install cylinder for chain tensioning piston. Refer to 11 31 090 REMOVING AND INSTALLING/REPLACING CHAIN TENSIONING PISTON (M52 / M52TU / M54 / M56).

Fig. 262: Identifying Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

## 11 31 090 REMOVING AND INSTALLING/REPLACING CHAIN TENSIONING PISTON (M52 / M52TU / M54 / M56)

Important!

Spring pressure!

Unfasten cylinder for chain tensioning piston. Refer to 11 31 090 REMOVING AND INSTALLING/REPLACING CHAIN TENSIONING PISTON (M52 / M52TU / M54 / M56).

Fig. 263: Identifying Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace sealing ring.

Tightening torque, refer to 11 31 8AZ in CAMSHAFT .

Arrangement of components:

1. Cylinder for chain tensioning piston.
2. Sealing ring.
3. Spring.
4. Piston.

Fig. 264: Identifying Cylinder For Chain Tensioning Piston Components
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 31 505 ADJUSTING CAMSHAFT TIMING (M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 00 9 250
- 11 2 300
- 11 3 240

- 11 3 244
- 11 3 292
- 11 4 220
- 11 5 180
- 11 6 150

Before carrying out adjustment work:

Check camshaft timing. Refer to 11 31 005 CHECKING CAMSHAFT TIMING (M52TU / M54 / M56)

Crank engine in direction of rotation until cam tips on inlet and exhaust camshafts on 1st cylinder face one another.

Fig. 265: Identifying Cams Tip Position
Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft with special tool 11 2 300 in TDC position of 1st cylinder.

Important!

Do not turn the engine back.

Remove special tools 11 2 300 /11 5 180 before starting engine.

Fig. 266: Securing Crankshaft With Special Tool 11 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew studs.

Fig. 267: Unscrewing Studs
Courtesy of BMW OF NORTH AMERICA, INC.

Remove double VANOS adjustment unit. Refer to 11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56).

Press down top of chain tensioner and lock off with special tool 11 3 292.

Fig. 268: Locking Off Chain Tensioner With Special Tool 11 3 292
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Cylinder for chain tensioning piston is under spring pressure.

Remove cylinder for chain tensioning piston.

Fig. 269: Identifying Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Install special tool 11 4 220.

Fit adjusting screw to bow cover.

Fig. 270: Installing Special Tool 11 4 220
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) by half a turn.

Fig. 271: Locating Exhaust Side Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts (2) by two turns

Release nuts (3) by one turn.

Fig. 272: View Of Inlet Side Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Toothed shaft (4) slips very easily from splines.

Pull out toothed shaft (4) until approx. 1 mm of splines can be seen.

Fig. 273: Pulling Out Toothed Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Withdraw toothed shaft (5) up to stop.

Fig. 274: Withdrawing Toothed Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 11 3 240 to camshafts on cylinder 6. Align camshafts so that special tool 11 3 240 rests without gaps on cylinder head.

Fig. 275: Fitting Special Tool 11 3 240 To Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 11 3 244 to special tool 11 3 240 and locate by way of spark plug thread.

Fig. 276: Attaching Special Tool 11 3 244 To Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

Press down chain tensioner at top and remove special tool 11 3 292.

Fig. 277: Removing Special Tool 11 3 292
Courtesy of BMW OF NORTH AMERICA, INC.

Preload tensioning rail with special tool 11 4 220 by rotating adjusting screw with special tool 00 9 250 or standard torque wrench to 0.7 Nm.

Fig. 278: Preloading Tensioning Rail With Special Tool 11 4 220
Courtesy of BMW OF NORTH AMERICA, INC.

Preload cup spring slightly by pressing on sensor gear (1) and tighten nuts by hand.

Important!

Do not tighten down nuts fully.

Fig. 279: Tightening Sensor Gear Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Remove gasket.

Check dowel sleeves (1) for damage and correct installation position.

Fig. 280: Checking Dowel Sleeves For Damage
Courtesy of BMW OF NORTH AMERICA, INC.

Keep sealing face clean and free of oil.

Important!

Fit special tool 11 6 150 "without gasket" only.

If gasket remains underneath special tool 11 6 150, camshaft timing will be "incorrectly" set.

Attach special tool 11 6 150 "without gasket", tighten nuts by hand and then tighten down uniformly until special tool 11 6 150 is in full contact with cylinder head.

Fig. 281: Fitting Adjusting Plate On Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screws (1) on exhaust side and initially tighten to approx. 5 Nm.

Fig. 282: Inserting Screws On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

Initially tighten nuts (2) on exhaust side and nuts (3) on inlet side to approx. 5 Nm.

Fig. 283: Tightening Nuts On Exhaust Side And Nuts On Inlet Side
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down screws (1) on exhaust side.

Tightening torque, refer to 11 31 3AZ in CAMSHAFT .

Fig. 284: Tightening Screws On Exhaust Side
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down nuts (2) on exhaust side and nuts (3) on inlet side.

Tightening torque, refer to 11 31 11AZ in CAMSHAFT .

Fig. 285: Tightening Nuts On Exhaust Side And Nuts On Inlet Side
Courtesy of BMW OF NORTH AMERICA, INC.

Pull special tool 11 2 300/11 5 180 back until flywheel is no longer secured.

Fig. 286: Aligning Plug Mandrel To Flywheel
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 3 244 and special tool 11 3 240.

Fig. 287: Removing Special Tool 11 3 244 And Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

Crank engine twice in direction of rotation until cam tips on inlet and exhaust camshafts on 1st cylinder face one another.

Fig. 288: Identifying Position Of Cam Tips
Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft in firing TDC position with special tool 11 2 300.

Important!

Do not turn the engine back.

Remove special tools 11 2 300 / 11 5 180 before starting engine.

Fig. 289: Securing Crankshaft In Firing TDC Position With Plug Mandrel
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 11 3 240 to camshafts.

Fig. 290: Fitting Special Tool 11 3 240 To Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The timing is correctly set if the special tool 11 3 240 rests without a gap on the cylinder head or protrudes up to 1 mm to the inlet side. The timing must be reset if the special tool 11 3 240 protrudes to the exhaust side.

Fig. 291: Identifying Correct Fitting Special Tool 11 3 240 To Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten and remove special tool 11 4 220.

Fig. 292: Removing Special Tool 11 4 220
Courtesy of BMW OF NORTH AMERICA, INC.

Install cylinder for chain tensioning piston. Refer to 11 31 090 REMOVING AND INSTALLING/REPLACING CHAIN TENSIONING PISTON (M52 / M52TU / M54 / M56).

Fig. 293: Installing Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 2 300 / 11 5 180.

Fig. 294: Removing Special Tool 11 2 300 / 11 5 180
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 6 150.

Fig. 295: Removing Special Tool 11 6 150
Courtesy of BMW OF NORTH AMERICA, INC.

Install VANOS adjustment unit. Refer to 11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56).

Assemble engine.

## VALVES WITH SPRINGS

### 11 34 552 REMOVING AND INSTALLING OR REPLACING ALL VALVES (M52 / S52 / M52TU / M54 / M56)

(Cylinder head removed)

Preliminary tasks are described in disassembling and assembling cylinder head. Refer to 11 12 503 DISASSEMBLING AND ASSEMBLING CYLINDER HEAD (M52 / S52 / M52TU / M54 / M56).

Replace valve stem seals. Refer to 11 34 560 REPLACING ALL VALVE STEM SEALS (M52 / S52 / M52TU / M54 / M56).

Remove valves from cylinder head.

If necessary, check valve guide for wear. Refer to 11 12 595 CHECKING A VALVE GUIDE FOR WEAR (M52 / S52 / M52TU / M54 / M56).

If necessary, ream valve guide. Refer to 11 12 600 REAMING A VALVE GUIDE (M52 / S52 / M52TU / M54 / M56).

If necessary, remachine valve seat. Refer to 11 12 527 REMACHINING A VALVE SEAT (M52 / S52 / M52TU / M54 / M56).

Arrangement:

1. Valve.
2. Valve-stem seals.
3. Lower plate spring.
4. Valve spring.
5. Top plate spring.
6. Valve tapers.

Fig. 296: Identifying Valve Components
Courtesy of BMW OF NORTH AMERICA, INC.

### 11 34 560 REPLACING ALL VALVE STEM SEALS (M52 / S52 / M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 11 1 200
- 11 1 480
- 11 1 960

(Cylinder head removed)

Preliminary tasks are described in disassembling and assembling cylinder head. Refer to 11 12 503 DISASSEMBLING AND ASSEMBLING CYLINDER HEAD (M52 / S52 / M52TU / M54 / M56).

Remove all valve springs. Refer to 11 34 715 REPLACING ALL VALVE SPRINGS (M52 / S52 / M52TU / M54 / M56).

Remove valve stem seal with special tool 11 1 480.

Fig. 297: Removing Valve Stem Seal With Special Tool 11 1 480
Courtesy of BMW OF NORTH AMERICA, INC.

Lubricate valve stem with oil and insert valve. Fit special tool 11 1 960.

Coat new valve stem seal (1) with oil and install.

Fig. 298: Identifying Valve Stem Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Press valve stem seal firmly home by hand with special tool 11 1 200.

Fig. 299: Pressing Valve Stem Seal With Special Tool 11 1 200
Courtesy of BMW OF NORTH AMERICA, INC.

## 11 34 715 REPLACING ALL VALVE SPRINGS (M52 / S52 / M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 11 0 342
- 11 0 345
- 11 1 045
- 11 1 065
- 11 1 441
- 11 3 030
- 11 3 250

(Cylinder head removed)

Preliminary tasks are described in disassembling and assembling cylinder head. Refer to 11 12 503 DISASSEMBLING AND ASSEMBLING CYLINDER HEAD (M52 / S52 / M52TU / M54 / M56).

Brace bucket tappets with special tool 11 3 250.

Fig. 300: Identifying Special Tool 11 3 250
Courtesy of BMW OF NORTH AMERICA, INC.

Lift out bearing strip with bucket tappet.

Installation:

Only re-use used bucket tappets in the same tappet bore.

Arrange bucket tappets by cylinder and place on special tool 11 3 030 in correct order.

Fig. 301: Arranging Bucket Tappets By Cylinder And Placing On Special Tool 11 3 030
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 11 1 441 from below in special tool 11 1 065 and secure with special tool 11 1 045.

Fig. 302: Inserting Special Tool 11 1 441
Courtesy of BMW OF NORTH AMERICA, INC.

Align special tool 11 0 345 in direction of valve shaft and select appropriate groove in special tool 11 0 342.

Fig. 303: Aligning Special Tool 11 0 345 In Direction Of Valve Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Press down valve spring on spring cap, top, and remove valve keys.

Remove valve spring and plate spring.

Fig. 304: Removing Valve Keys
Courtesy of BMW OF NORTH AMERICA, INC.

Arrangement:

1. Valve.
2. Valve-stem seal.
3. Lower plate spring.
4. Valve spring.
5. Top plate spring.
6. Valve tapers.

Fig. 305: Identifying Valve Components
Courtesy of BMW OF NORTH AMERICA, INC.

## VARIABLE CAMSHAFT TIMING

### 11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 00 9 250
- 11 2 300
- 11 3 240
- 11 3 450
- 11 4 220
- 11 6 170

Necessary Preliminary Tasks:

- Remove intake filter housing with air-mass flow sensor
- Remove fan impeller with fan clutch and fan cowl. Refer to 11 52 020 REMOVING AND INSTALLING/REPLACING FAN CLUTCH (S52 / S54 / M52 / M52TU / M54 / M56).
- Remove cylinder head cover. Refer to 11 12 000 REMOVING AND INSTALLING, SEALING CYLINDER HEAD COVER (M52TU / M54 / M56).
- Remove spark plugs. Refer to 12 12 011 REPLACING ALL SPARK PLUGS .

Removal:

Removal of double VANOS adjustment unit is described separately from installation. Assembly sequence for removal and installation is different.

Detach plastic cover for inlet camshaft.

Fig. 306: Detaching Plastic Cover For Inlet Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew oil pressure pipe.

Fig. 307: Locating Oil Pressure Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

Mount special tool 11 3 450 with banjo bolt of oil pressure line.

Fig. 308: Mounting Special Tool 11 3 450 On Oil Pressure Line
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Cover double VANOS adjustment unit.

When the compressed air supply is connected, several drops of oil are sprayed out of the bore.

Fig. 309: View Of Double VANOS Adjustment Unit Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Connect compressed air (2 to 8 bar).

Fig. 310: Connecting Compressed Air To Oil Pressure Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: When the engine is switched off, it is possible that the camshafts are not in their initial positions. With the compressed air supply connected, rotate the engine to return the camshafts to their initial positions.

With compressed air supply connected, crank engine at least two revolutions in direction of rotation until cam tips on inlet and exhaust camshafts on 1st cylinder face each other.

Fig. 311: Identifying Position Of Cam Tips
Courtesy of BMW OF NORTH AMERICA, INC.

Pull dust guard out of the special tool bore.

Fig. 312: Pulling Dust Guard Out Of Special Tool Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft in firing TDC position with special tool 11 2 300.

Important!

Remove special tool 11 2 300 before switching on the engine.

Fig. 313: Securing Crankshaft In Firing TDC Position With Special Tool 11 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

Automatic Transmissions Only:

Illustration does not show automatic transmission.

Important!

On engines with automatic transmissions, there is shortly before the special tool bore (1) a large bore (2) which can be confused with the special tool bore.

If special tool 11 2 300 is secured in the correct bore (1), the engine can no longer be cranked at the central bolt.

Fig. 314: Identifying Special Tool Bore And Large Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew studs.

Fig. 315: Unscrewing Studs
Courtesy of BMW OF NORTH AMERICA, INC.

Secure camshafts with special tool 11 3 240.

Fig. 316: Securing Camshafts With Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

Detach compressed air connection.

NOTE: Special tool 11 3 450 still remains fitted.

Fig. 317: Detaching Compressed Air Connection From Oil Pressure Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Oil escapes after screw plugs have been removed. Have cleaning cloths and container ready.

Make sure no oil runs onto belt drive. Remove any remnants of oil immediately with cleaning cloth.

Remove screw plugs, catch escaping oil on inlet and exhaust sides.

Fig. 318: View Of Screw Plugs In Sealing Caps
Courtesy of BMW OF NORTH AMERICA, INC.

Remove sealing caps with special tool 11 6 170 or with commercially available short flat nose pliers.

Fig. 319: Removing Sealing Caps With Special Tool 11 6 170
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Left-hand threads.

Release fitting screws on inlet and exhaust sides.

Fig. 320: Releasing Fitting Screws On Inlet And Exhaust Sides
Courtesy of BMW OF NORTH AMERICA, INC.

Detach plug connections from camshaft sensor and solenoid valves on exhaust and inlet sides.

Fig. 321: Detaching Plug Connections From Camshaft Sensor And Solenoid Valves
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew suspension eye.

Fig. 322: Unscrewing Suspension Eye
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts and remove double VANOS adjustment unit. Refer to 11 36 010 REMOVING AND INSTALLING OR REPLACING DOUBLE VANOS ADJUSTMENT UNIT (M52TU / M54 / M56).

Fig. 323: Removing Double VANOS Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

With double VANOS adjustment unit removed:

Do not crank engine.

The toothed shaft on the inlet side may move and slip out of the spline teeth, the inlet camshaft is thus no longer non-positively connected and the valves could rest on the piston.

Installation:

Installation of double VANOS adjustment unit is described separately from removal. Assembly sequence for removal and installation is different.

Check dowel sleeves (1) for damage and correct installation position.

Fig. 324: Checking Dowel Sleeves For Damage
Courtesy of BMW OF NORTH AMERICA, INC.

Keep sealing faces clean and free of oil. Apply a thin and even coat of sealing compound Drei Bond 1209 to contact surface edges of separating face between cylinder head and double VANOS adjustment unit.

Replace seal.

Install and secure double VANOS adjustment unit.

Fig. 325: Securing Double VANOS Adjustment Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Attach plug connections of camshaft sensor and solenoid valves on exhaust and inlet sides.

Fig. 326: Attaching Plug Connections Of Camshaft Sensor And Solenoid Valves
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Left-hand threads.

Insert fitting screws for hydraulic piston on toothed shaft on inlet and exhaust sides and tighten down.

Tightening torque, refer to 11 36 4AZ in VARIABLE CAMSHAFT TIMING .

Fig. 327: Inserting Fitting Screws For Hydraulic Piston On Toothed Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Replace sealing caps and install with special tool 11 6 170 or with commercially available short flat nose pliers.

Fig. 328: Replacing Sealing Caps With Special Tool 11 6 170
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screw plugs with new sealing rings and tighten down.

Tightening torque, refer to 11 36 3AZ in VARIABLE CAMSHAFT TIMING .

Fig. 329: Inserting Screw Plugs With Sealing Rings
Courtesy of BMW OF NORTH AMERICA, INC.

Fit suspension lug.

Fig. 330: Fitting Suspension Lug
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: If the double VANOS adjustment unit has been replaced, you must check and, if necessary, adjust the camshaft timing. If work has been carried out which has "no" effect on the timing and it is assured that the timing adjustment is correct, the timing check described in the following does not"" have to be conducted.

Important!

Cylinder for chain tensioning piston is under spring pressure.

Remove cylinder for chain tensioning piston. Refer to 11 31 090 REMOVING AND INSTALLING/REPLACING CHAIN TENSIONING PISTON (M52 / M52TU / M54 / M56).

Fig. 331: Removing Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 11 4 220 in cylinder head and bring adjustment screw into contact with tensioning rail.

Fig. 332: Inserting Special Tool 11 4 220 In Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

Preload tensioning rail with special tool 11 4 220 by rotating adjusting screw with special tool 11 9 250 or standard torque wrench to 0.7 Nm.

Fig. 333: Preloading Tensioning Rail With Special Tool 11 4 220
Courtesy of BMW OF NORTH AMERICA, INC.

Pull special tool 11 2 300 back until flywheel is no longer secured in position.

Fig. 334: Pulling Special Tool 11 2 300 Back On Flywheel
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 3 240.

Fig. 335: Removing Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Cover double VANOS adjustment unit; when the compressed air supply is connected, several drops of oil are sprayed out of the bore.

Fig. 336: Covering Double VANOS Adjustment Unit Bore
Courtesy of BMW OF NORTH AMERICA, INC.

Connect compressed air (2 to 8 bar).

Fig. 337: Connecting Compressed Air To Oil Pressure Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

With compressed air supply connected, crank engine twice in direction of rotation until cam tips on inlet and exhaust camshafts on 1st cylinder face each other.

Fig. 338: Identifying Position Of Cam Tips
Courtesy of BMW OF NORTH AMERICA, INC.

Secure crankshaft with special tool 11 2 300 in TDC position of 1st cylinder.

Important!

Do not turn the engine back.

Remove special tool 11 2 300 before switching on the engine.

Fig. 339: Securing Crankshaft With Special Tool 11 2 300 In TDC Position
Courtesy of BMW OF NORTH AMERICA, INC.

Check camshaft setting:

Fit special tool 11 3 240 to camshafts.

Fig. 340: Fitting Special Tool 11 3 240 To Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The timing is correctly set if the special tool 11 3 240 rests without a gap on the cylinder head or protrudes up to 1 mm to the inlet side. The timing must be reset if the special tool 11 3 240 protrudes to the exhaust side.

If necessary, adjust camshaft timing. Refer to 11 31 505 ADJUSTING CAMSHAFT TIMING (M52TU / M54 / M56).

Fig. 341: Identifying Correct Fitting Of Special Tool 11 3 240 To Camshafts
Courtesy of BMW OF NORTH AMERICA, INC.

Detach compressed air connection.

Remove special tool 11 3 450.

Fig. 342: Removing Special Tool 11 3 450
Courtesy of BMW OF NORTH AMERICA, INC.

Fit oil pressure line with new seals.

Tightening torque, refer to 11 36 2AZ in 11 36 VARIABLE CAMSHAFT CONTROL .

Fig. 343: Identifying Oil Pressure Line Fitting
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten and remove special tool 11 4 220.

Fig. 344: Removing Special Tool 11 4 220
Courtesy of BMW OF NORTH AMERICA, INC.

Install cylinder for chain tensioning pistons. Refer to 11 31 090 REMOVING AND INSTALLING/REPLACING CHAIN TENSIONING PISTON (M52 / M52TU / M54 / M56).

Fig. 345: Installing Cylinder For Chain Tensioning Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 3 240.

Fig. 346: Removing Special Tool 11 3 240
Courtesy of BMW OF NORTH AMERICA, INC.

Remove special tool 11 2 300.

Fig. 347: Removing Special Tool 11 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

## 11 36 570 REPLACING SOLENOID VALVE FOR INLET SIDE ON VANOS ADJUSTMENT UNIT

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 32 2 110

Necessary Preliminary Tasks:

- Read out fault memory of DME control unit.
- Check stored fault messages.
- Switch off ignition.

Unlock hose (1) and detach.

Unlock plug (2) and remove.

Fig. 348: Identifying Hose And Plug
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Once it has been removed, oil drips from the solenoid valve. Have a cleaning cloth ready. Make sure no oil drips onto the belt drive. Remove any remnants of oil immediately with cleaning cloth. Do not damage oil line when releasing solenoid valve.

Installation:

Release solenoid valve with special tool 32 2 110.

Fig. 349: Releasing Solenoid Valve With Special Tool 32 2 110
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, refer to 11 36 1AZ in VARIABLE CAMSHAFT TIMING .

Now clear the fault memory.

## 11 36 575 REPLACING SOLENOID VALVE FOR EXHAUST SIDE ON VANOS ADJUSTMENT UNIT

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 11 6 420

Necessary Preliminary Tasks:

- Read out fault memory of DME control unit.
- Check stored fault messages.
- Switch off ignition.

Unlock plug (1) and remove.

Cut through cable tie (2).

Fig. 350: Identifying Plug And Cable Tie
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Once it has been removed, oil drips from the solenoid valve. Have a cleaning

cloth ready. Make sure no oil drips onto the belt drive. Remove any remnants of oil immediately with cleaning cloth.

Release solenoid valve with special tool 11 6 420.

Fig. 351: Releasing Solenoid Valve With Special Tool 11 6 420
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Tightening torque, refer to 11 36 1AZ in VARIABLE CAMSHAFT TIMING .

Now clear the fault memory.

# OIL SUPPLY

## 11 40 000 CHECKING ENGINE OIL PRESSURE

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 11 4 050
- 13 3 061
- 13 3 063
- 13 6 051
- 13 6 054

NOTE: For engine oil pressure to be checked, oil pressure switch must be removed and special tools must be installed and connected.

To avoid an excess discharge of oil when removing oil pressure switch:

Unscrew oil filter cap; the engine oil flows out of the oil filter housing into the oil sump.

Installation:

Replace sealing ring.

Tightening torque, refer to 11 42 2AZ in 11 42 OIL FILTER AND PIPES .

Remove oil pressure switch.

Installation:

Tightening torque, refer to 12 61 1AZ in OIL PRESSURE, OIL TEMPERATURES .

Install special tool 11 4 050 with sealing ring (1) in place of oil pressure switch.

Fig. 352: Installing Special Tool 11 4 050 With Sealing Ring In Place Of Oil Pressure Switch
Courtesy of BMW OF NORTH AMERICA, INC.

Checking Engine Oil Pressure With DIS Tester

Attach special tool 13 6 054 with sealing ring (1) and special tool 136051 and connect to DIS Tester.

Fig. 353: Attaching Special Tool 13 6 054 With Sealing Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Checking Engine Oil Pressure With Pressure Gauge

Install special tool 13 3 063 and special tool 13 3 061 (pressure gauge).

Start engine and check engine oil pressure.

Specified value, refer to OILS SUPPLY .

## OIL PUMP WITH FILTER & LINES

### 11 41 000 REMOVING AND INSTALLING/REPLACING OIL PUMP (M52TU / M54 / M56)

Remove oil sump. Refer to 11 13 000 REMOVING AND INSTALLING OIL SUMP (M52 / S52 / M52TU / M54) or 11 13 000 REMOVING AND INSTALLING, SEALING OR REPLACING OIL SUMP (M52TU / M54 / M56).

CAUTION: Left-hand threads. Unfasten nut.

Fig. 354: Locating Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Tightening torque, refer to 11 41 4AZ in OIL PUMP WITH FILTER .

Remove sprocket with chain.

Fig. 355: Removing Sprocket With Chain
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Align splines of chain wheel and oil pump shaft to each other.

Version 1

Oil pump integrated in oil scraper:

Release screws (1), remove oil pump with oil scraper. Refer to 11 41 000 REMOVING AND INSTALLING/REPLACING OIL PUMP (M52TU / M54 / M56).

Fig. 356: Removing Oil Pump With Oil Scraper
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Oil pump and oil scraper - two parts:

Release screws and remove oil pump intake pipe. Refer to 11 41 000 REMOVING AND INSTALLING/REPLACING OIL PUMP (M52TU / M54 / M56).

Fig. 357: Removing Screws Of Oil Pump Intake Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2

Oil pump and oil scraper - two parts:

Release screws and remove oil pump.

Fig. 358: Locating Screws Of Oil Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check dowel sleeves (1) for damage and correct installation position.

Fig. 359: Checking Dowel Sleeves For Damage
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace O-ring on intake pipe.

Fig. 360: View Of O-Ring On Intake Pipe
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, remove control piston.

Fig. 361: Locating Control Piston
Courtesy of BMW OF NORTH AMERICA, INC.

Press sleeve downwards with suitable drift.

CAUTION: The sleeve for the control plunger is under spring pressure.

Remove circlip.

Installation:

1. Control plunger.
2. Spring.
3. Sleeve.
4. O-ring (replace).
5. Circlip.

Fig. 362: Identifying Control Piston Components
Courtesy of BMW OF NORTH AMERICA, INC.

## OIL FILTER AND LINES

### 11 42 020 REMOVING AND INSTALLING COMPLETE FULL-FLOW OIL FILTER (M52 / S52 / M52TU / M54 / M56)

Remove intake air housing with air-mass flow sensor.

Unfasten oil filter cover to allow oil to flow out of main flow oil filter housing and back into oil pan.

This operation is described in the engine oil service instructions, refer to 00 00 250 BMW ENGINE OIL SERVICE INCL. SUPPLEMENTARY SERVICE (M54 / M56) .

Remove alternator. Refer to 12 31 020 REMOVING AND INSTALLING OR REPLACING ALTERNATOR (M52, M52TU, S50US, S52, M54, M56)

If necessary, empty supply tank for power steering.

If necessary, remove supply tank (lines remain connected).

If necessary, remove vane pump for power steering (lines remain connected).

If necessary, remove alternator drive belt tensioner. Refer to 11 28 010 REPLACING ALTERNATOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56).

Fig. 363: Locating Screws Of Full-Flow Oil Filter
Courtesy of BMW OF NORTH AMERICA, INC.

Remove connector for oil pressure switch.

If necessary, disconnect plug for oil temperature switch.

Disconnect oil pressure line for VANOS adjustment unit from oil filter housing.

Unfasten screws and remove complete full-flow oil filter.

Installation:

Check dowel sleeves for damage and correct installation position.

Fig. 364: Checking Dowel Sleeves For Damage
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace seal.

Fig. 365: Replacing Full-Flow Oil Filter Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Top up engine oil.

## WATER PUMP WITH DRIVE

### 11 51 000 REMOVING AND INSTALLING COMPLETE WATER PUMP (M52 / S52 / M52TU / M54 / M56)

Remove alternator drive belt. Refer to 11 28 010 REPLACING ALTERNATOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56).

Fig. 366: Identifying Water Drain Plug
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: M52TU / M54 / M56: Water drain plug is located on exhaust side on cylinder 2 in engine block.

Drain and dispose of coolant.

Installation:

Replace seal.

Tightening torque, refer to 11 11 5AZ in 11 11 ENGINE BLOCK .

Release belt pulley.

Fig. 367: View Of Belt Pulley Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Release water pump.

Fig. 368: Locating Water Pump Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten two screws (M 6) into thread of water pump and remove water pump out of timing case.

Fig. 369: Installing Screws (M 6) Into Threads Of Water Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace O-ring and coat with coolant as anti-friction agent.

Fig. 370: Identifying Water Pump O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

## FAN

### 11 52 020 REMOVING AND INSTALLING/REPLACING FAN CLUTCH (S52 / S54 / M52 / M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 11 5 030
- 11 5 040

If necessary, remove air duct.

Fig. 371: Gripping Pulley Using Special Tool 11 5 030
Courtesy of BMW OF NORTH AMERICA, INC.

Important!

Left-hand threads.

Using special tool 11 5 030. Grip pulley and unfasten cap nut from water pump using special tool 11 5 040.

Fig. 372: Identifying Special Tool 11 5 040

Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, unfasten fan cowl.

Take the fan wheel with fan coupling off the water pump and remove.

Installation:

Tighten down fan impeller using special tool 11 5 040.

Tightening torque, refer to 11 52 1AZ in FAN .

NOTE: When using special tool 11 5 040. 30 Nm on the torque wrench scale are equivalent to a tightening torque of 40 Nm.

Fig. 373: Locating Fan To Fan Coupling Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws and detach fan from fan coupling.

## THERMOSTAT AND CONNECTIONS

### 11 53 000 REMOVING AND INSTALLING/REPLACING COOLANT THERMOSTAT (M52TU / M54 / M56)

Remove fan clutch with fan impeller and fan cowl. Refer to 11 52 020 REMOVING AND INSTALLING/REPLACING FAN CLUTCH (S52 / S54 / M52 / M52TU / M54 / M56).

Drain and dispose of coolant.

NOTE: The water drain plug is located on the exhaust side on cylinder 2 in the engine block.

Installation:

Replacing sealing ring on water drain plug.

Tightening torque, refer to 11 11 5AZ in 11 11 ENGINE BLOCK .

Fig. 374: Disconnecting Water Hoses By Pulling Locks
Courtesy of BMW OF NORTH AMERICA, INC.

Pull locks and disconnect water hoses.

Installation:

Refer to 17 00 ...INSTRUCTIONS FOR WORKING ON COOLING SYSTEM for general instructions for working on cooling systems.

Loosen nut (1).

Fig. 375: Loosening Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws on thermostat housing, remove thermostat housing.

Installation:

Keep sealing faces clean and free of oil.

Fig. 376: Identifying Sealing Faces
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Coolant thermostat is integrated in coolant thermostat housing and can only be replaced as a single unit.

Installation:

Replace seal (1).

Fig. 377: Replacing Seal
Courtesy of BMW OF NORTH AMERICA, INC.

## INTAKE MANIFOLD

### 11 61 050 REMOVING AND INSTALLING INTAKE AIR MANIFOLD (M54)

Instructions for disconnecting and connecting battery. Refer to 12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY .

Disconnect negative battery lead.

Remove engine cover.

CAUTION: Do not mix up oxygen monitor sensors for cylinders 1 to 3 and 4 to 6 at plug connection to wiring harness. Mark plug connections.

Unclip plug connections (1) from holders.

Fig. 378: Unclipping Plug Connections From Holders
Courtesy of BMW OF NORTH AMERICA, INC.

Detach battery positive lead from intake air manifold.

Detach retainer (2) from battery positive lead.

Press lock and detach vent hose from cylinder head cover.

Pull off retainer (1).

Fig. 379: Disconnecting Plug Connection For Intake Air Temperature Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection (2) for intake air temperature sensor.

Detach terminal strip (3) from fuel injectors and place to one side.

Disconnect plug connection (1) on tank venting valve.

Fig. 380: Disconnecting Tank Venting Valve Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Remove tank venting valve from retainer (2) on manifold.

NOTE: For a better overview, this work step is shown on an engine that has been removed.

CAUTION: Catch and dispose of fuel as it escapes.

Instructions for removing and installing fuel hoses, refer to INJECTION NOZZLE AND L... .

Unclip fuel line (1) from holder (2).

Fig. 381: Unclipping Fuel Line From Holder
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock fuel line (1).

Loosen guide tube for dipstick.

Press lock and detach return line from guide tube for oil dipstick.

Remove throttle assembly. Refer to THROTTLE AND OPERATION .

Disconnect plug connections and lay cable duct to one side.

Unclip plug connection (1) for knock sensors from holder.

Fig. 382: Unclipping Knock Sensor Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Release nut (2) on manifold support.

Release nuts on manifold.

Fig. 383: Locating Nuts On Manifold
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Engines with air injection: Detach vacuum line on reverse side of intake air manifold.

Remove intake air manifold. Refer to 11 61 050 REMOVING AND INSTALLING INTAKE AIR MANIFOLD (M54).

Installation:

Check gaskets on all cylinders and replace if necessary.

Fig. 384: Checking Gaskets On Cylinders
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check rubber dampers and if necessary replace together with manifold support.

Fig. 385: Checking Rubber Dampers
Courtesy of BMW OF NORTH AMERICA, INC.

# EXHAUST MANIFOLD

## 11 62 140 REMOVING AND INSTALLING BOTH EXHAUST MANIFOLDS WITH CATALYTIC CONVERTER (M52TU / M54)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 00 0 200
- 00 0 201
- 00 0 202
- 00 0 204
- 00 0 206

Remove reservoir for windshield cleaning system.

Remove suction-filter housing.

Fig. 386: Preparing Cross Member
Courtesy of BMW OF NORTH AMERICA, INC.

Prepare special tool 00 0 200 comprising special tools 00 0 201/00 0 202/00 0 204/00 0 206.

Fig. 387: Placing Cross Member On Engine Carrier
Courtesy of BMW OF NORTH AMERICA, INC.

CAUTION: Risk of damage. Do not damage lines, cables or hoses.

Version with air conditioning:

A/C system lines remain connected. Detach drier bottle on mounting to body.

Place special tool 00 0 206 on engine carrier.

Fig. 388: Lifting Engine
Courtesy of BMW OF NORTH AMERICA, INC.

Carefully lift engine approx. 5 mm.

Fig. 389: Removing Cover From Injection Valves
Courtesy of BMW OF NORTH AMERICA, INC.

Remove cover from injection valves.

CAUTION: Do not mix up oxygen monitor sensors for cylinders 1 to 3 and 4 to 6 at plug connection to wiring harness.

Mark plug connections.

Unclip the cable from the retainer. Disconnect plug connection. Unclip cable on rear side of engine from cable guide.

Remove engine splash guard.

Remove exhaust system.

NOTE: The oxygen sensors are in danger of being damaged when the exhaust manifolds are removed and installed.

Remove oxygen monitor sensors. Refer to 11 78 613 REPLACING BOTH OXYGEN MONITOR SENSORS (M52TU / M54 / M56).

Remove oxygen control sensors. Refer to 11 78 510 REPLACING OXYGEN CONTROL SENSOR (M52TU / M54 / M56).

Remove right engine support arm from engine block.

Remove right engine mount from front axle support.

NOTE: Rear exhaust manifold with catalytic converter can only be removed after front exhaust manifold with catalytic converter has first been removed. Remove front exhaust manifold with catalytic converter. Remove rear exhaust manifold with catalytic converter.

Installation:

Clean sealing faces, replace gaskets.

Coat thread with copper paste -CRC-.

Replace nuts.

Tightening torque, refer to 11 62 1AZ in EXHAUST MANIFOLD .

## EMISSION CONTROL, OXYGEN SENSOR

### 11 78 510 REPLACING OXYGEN CONTROL SENSOR (M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 11 7 020

Check function of Digital Engine Electronics (DME). Refer to CHECKING - SETTING ENGINE .

Read out fault memory, clear if necessary.

Fig. 390: Releasing Oxygen Control Sensor With Special Tool 11 7 020
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The plug connection must be disconnected before the oxygen control sensor is removed.

If the plug connection separation point is below the cover for the fuel injectors:

If necessary, remove lower section of microfilter housing.

Remove cover from fuel injectors.

Unclip oxygen control sensor cable from retainer.

Disconnect plug connection for oxygen control sensor.

Release oxygen control sensor with special tool 11 7 020.

Installation:

The threads of new oxygen sensors are already coated with Never Seez Compound.

If an oxygen sensor is used again, apply a thin and even coat of Never Seez Compound to the thread only.

Part of oxygen control sensor which projects into exhaust system branch must not be cleaned or come into contact with lubricant.

Fig. 391: Securing Oxygen Control Sensor With Special Tool 11 7 020
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Secure oxygen control sensor with special tool 11 7 020.

Tightening torque, refer to 11 78 1AZ in EMISSIONS CONTROL OXYGEN .

Pay attention to cable routing of oxygen control sensor.

## 11 78 613 REPLACING BOTH OXYGEN MONITOR SENSORS (M52TU / M54 / M56)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 11 7 020
- 11 7 030

Check function of Digital Engine Electronics (DME). Refer to CHECKING - SETTING ENGINE .

Read out fault memory, clear if necessary.

Illustrations show M54.

Remove cover from fuel injectors.

Fig. 392: Removing Cover From Fuel Injectors
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Do not mix up oxygen monitor sensors for cylinders 1 to 3 and 4 to 6 at plug connection to wiring harness. Mark plug connections.

Unclip the cable from the retainer. Disconnect plug. Unclip cable on rear side of engine from cable guide.

NOTE: On vehicles with automatic transmission:

In event of unfavorable tolerances, accessibility to the oxygen monitor sensor from cylinders 4 to 6 is only possible after the exhaust system has been removed.

Release oxygen monitor sensor from cylinders 1 to 3 with special tool 11 7 030.

Fig. 393: Releasing Oxygen Monitor Sensor From Cylinders
Courtesy of BMW OF NORTH AMERICA, INC.

Release oxygen monitor sensor from cylinders 4 to 6 with special tool 11 7 020.

Installation:

The threads of new oxygen monitor sensors are already coated with Never Seez compound.

If an oxygen monitor sensor is reused, only apply a thin and uniform coat of Never Seez compound to thread.

Part of oxygen control sensor which projects into exhaust system branch must not be cleaned or come into contact with lubricant.

Installation:

Secure oxygen monitor sensor for cylinders 1 to 3 with special tool 11 7 030.

Fig. 394: Securing Oxygen Monitor Sensor With Special Tool 11 7 030
Courtesy of BMW OF NORTH AMERICA, INC.

Secure oxygen monitor sensor for cylinders 4 to 6 with special tool 11 7 020.

Tightening torque, refer to 11 78 1AZ in EMISSIONS CONTROL OXYGEN .

Cover oxygen monitor sensors when applying underseal.

Pay attention to cable routing of oxygen monitor sensors.

## POSITIVE CRANKCASE VENTILATION/OIL SEPARATOR

Fig. 395: Identifying Positive Crankcase Ventilation/Oil Separator Components
Courtesy of BMW OF NORTH AMERICA, INC.

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Article GUID: A00202354

# EXHAUST SYSTEM, COMPLETE

## 18 00 020 REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM (Z3 M54)

NOTE: For Special Tools, see SPECIAL TOOLS - Z3 .

- 31 2 220

WARNING: Scalding hazard!

Only perform this work after engine has cooled down.

Support exhaust system with jack and special tool 31 2 220 and secure against falling out.

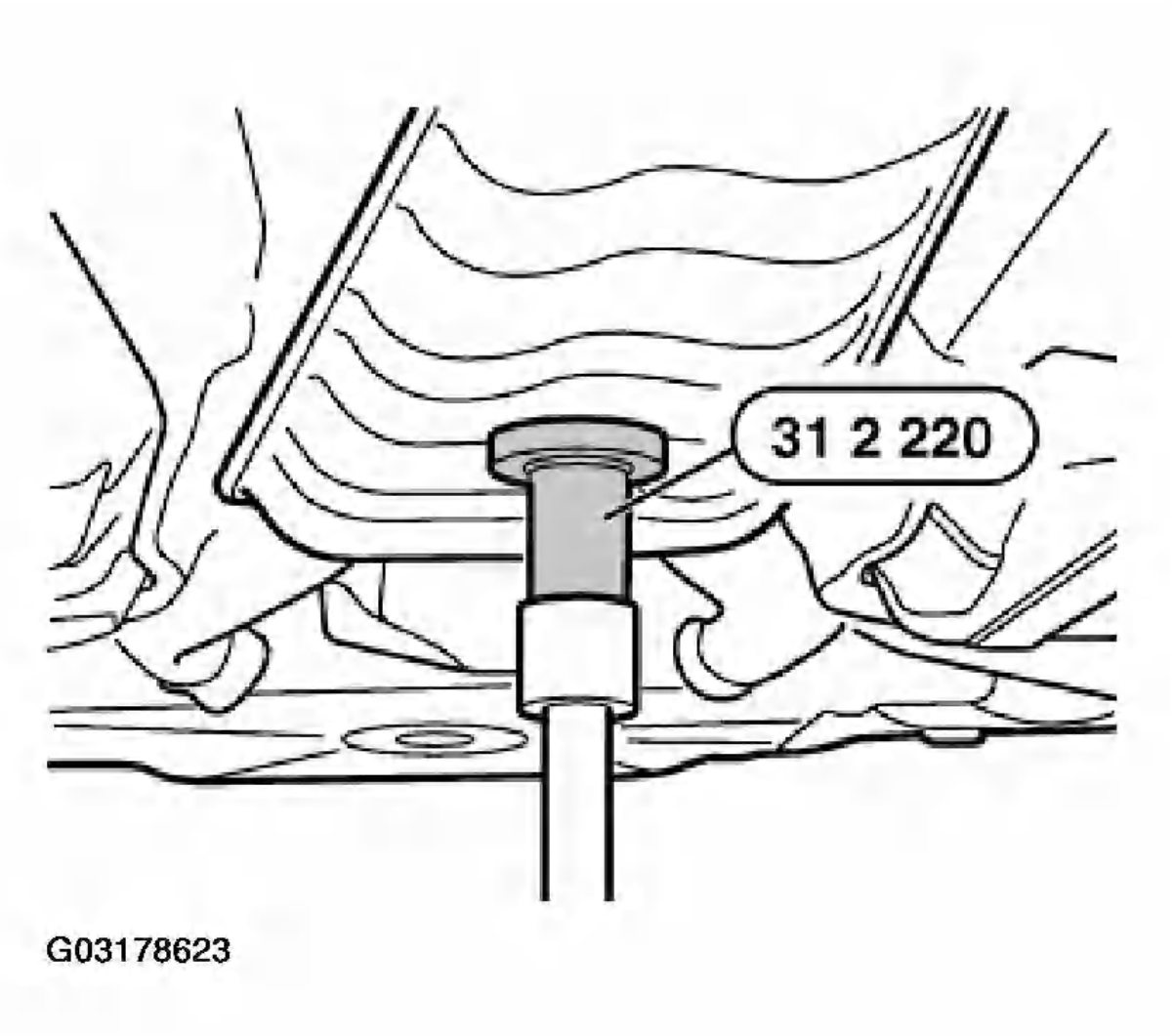



Fig. 1: Supporting Exhaust System With Jack And Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts (1) and remove connecting plate (2).

Installation:

Replace self-locking nuts.

Coat threads with copper paste, refer to BMW Parts Service.

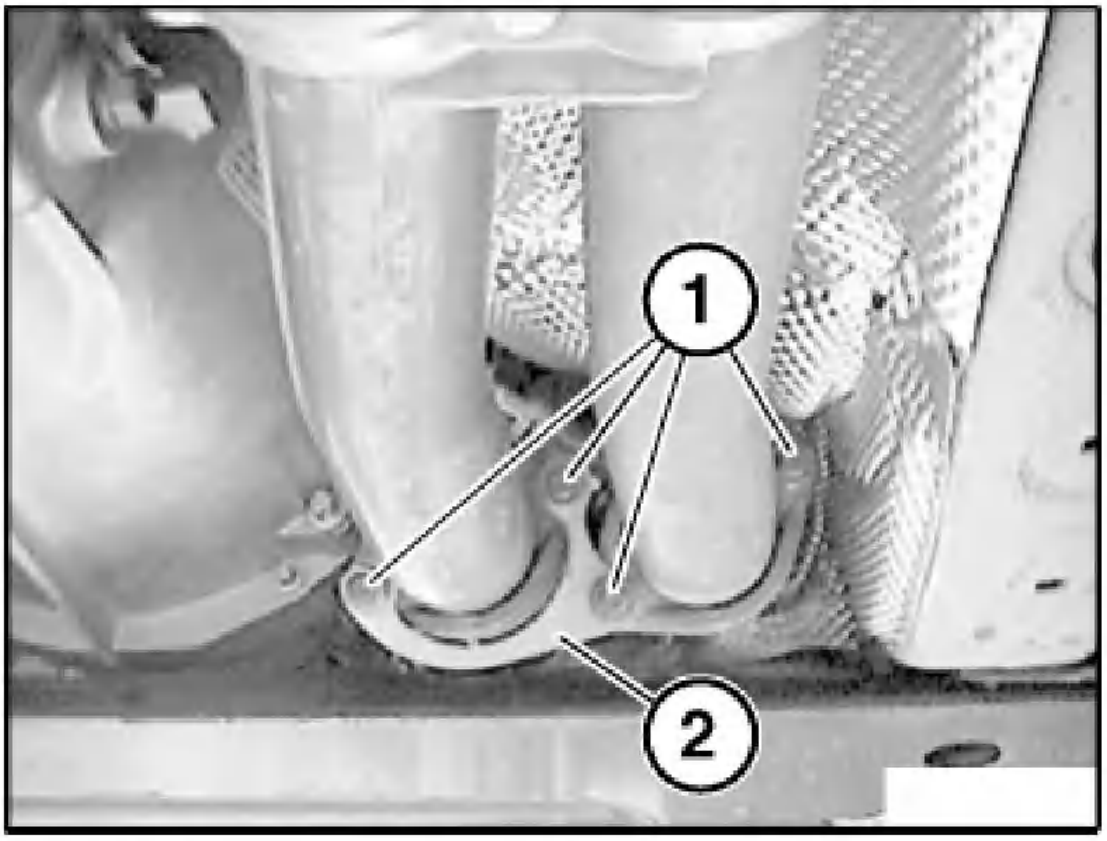



Fig. 2: Removing Connecting Plate
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check seals (1), replace if necessary.

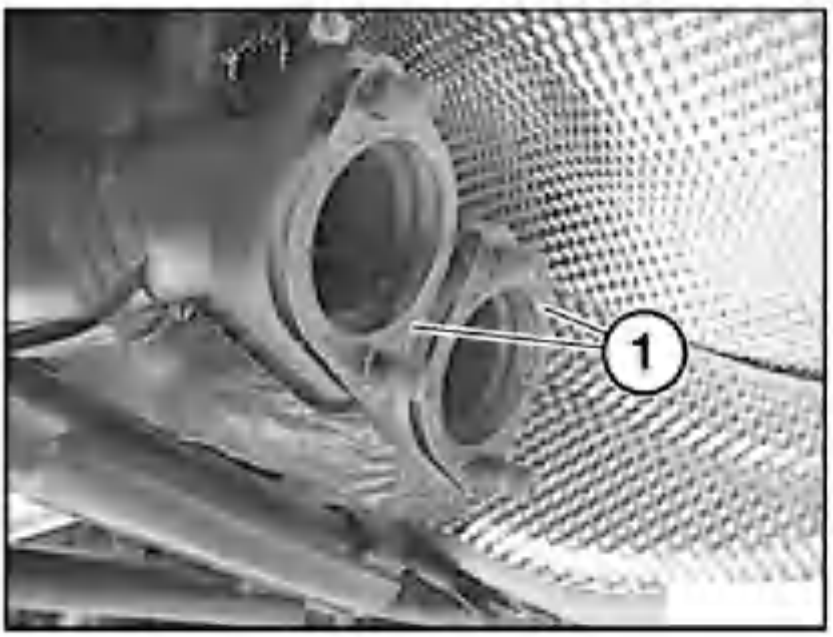



Fig. 3: Checking Seals
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw.

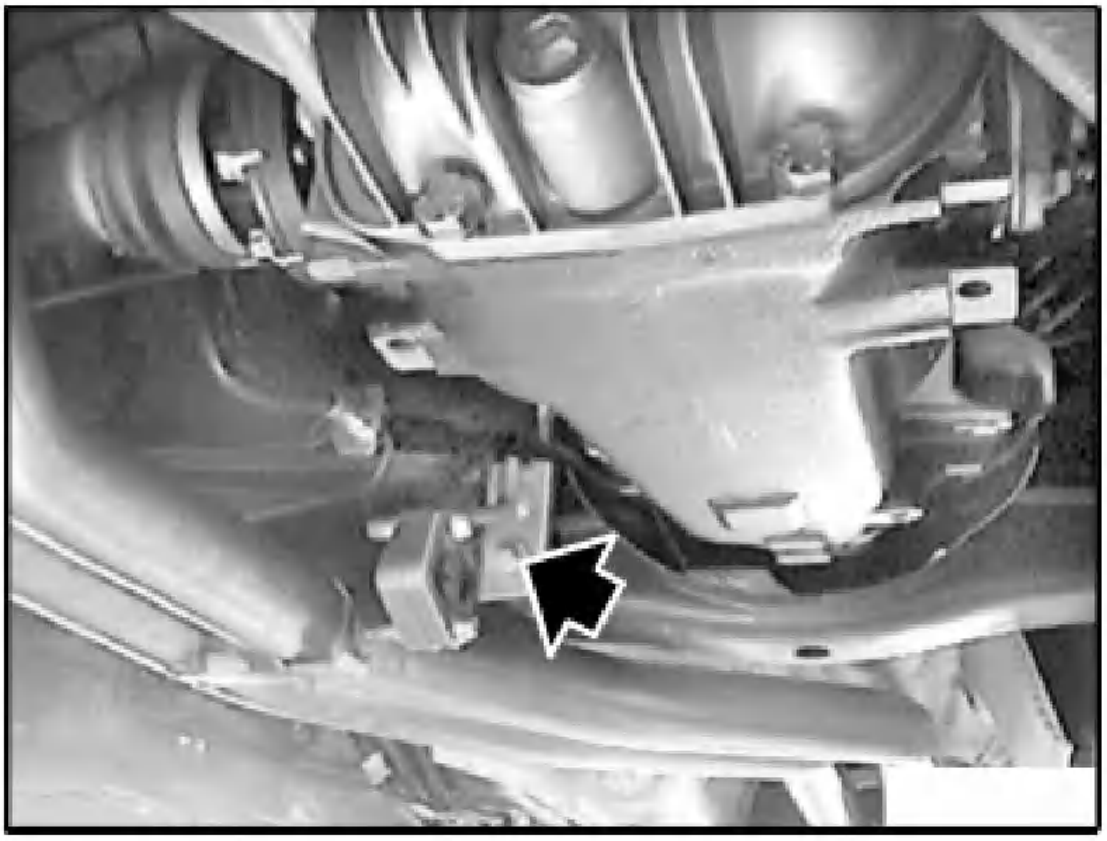



Fig. 4: Removing Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Removal of exhaust system must be carried out with assistance of a second person.

Detach rubber mounts (1) from bracket.

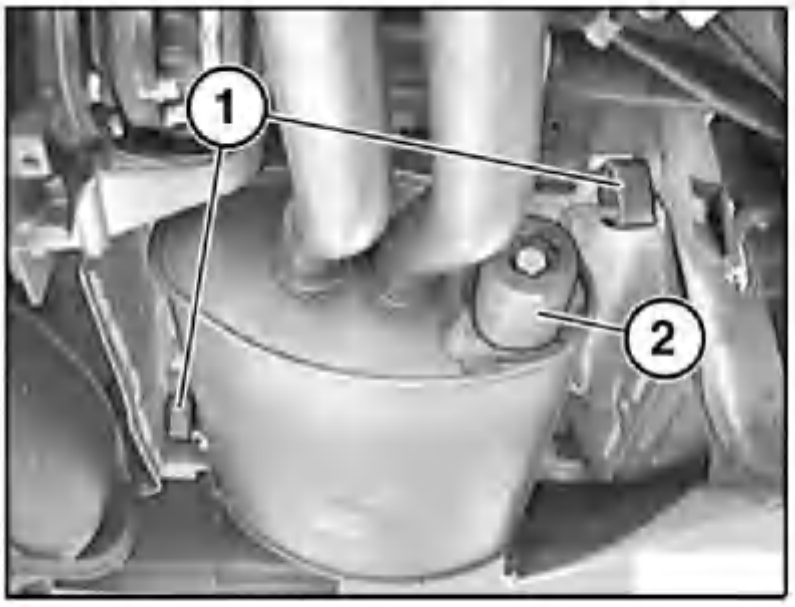



Fig. 5: Detaching Rubber Mounts From Bracket
Courtesy of BMW OF NORTH AMERICA, INC.

Lower exhaust system and remove.

If necessary, remove vibration damper (2) and install on new rear muffler.

## 18 12 061 REPLACING CENTER MUFFLER (Z3 M54)

WARNING: Scalding hazard!

Only perform these tasks after exhaust system has cooled down.

Remove complete exhaust system. Refer to 18 00 020 REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM (Z3 M54) .

NOTE: For the following work steps, some illustrations of the exhaust system of another BMW car are used.

Carry over length of new center muffler to old center muffler and mark cutting points.

Cut through exhaust pipes at marked points between center and rear mufflers and deburr.

Attach connecting plate from old center muffler to new center muffler.

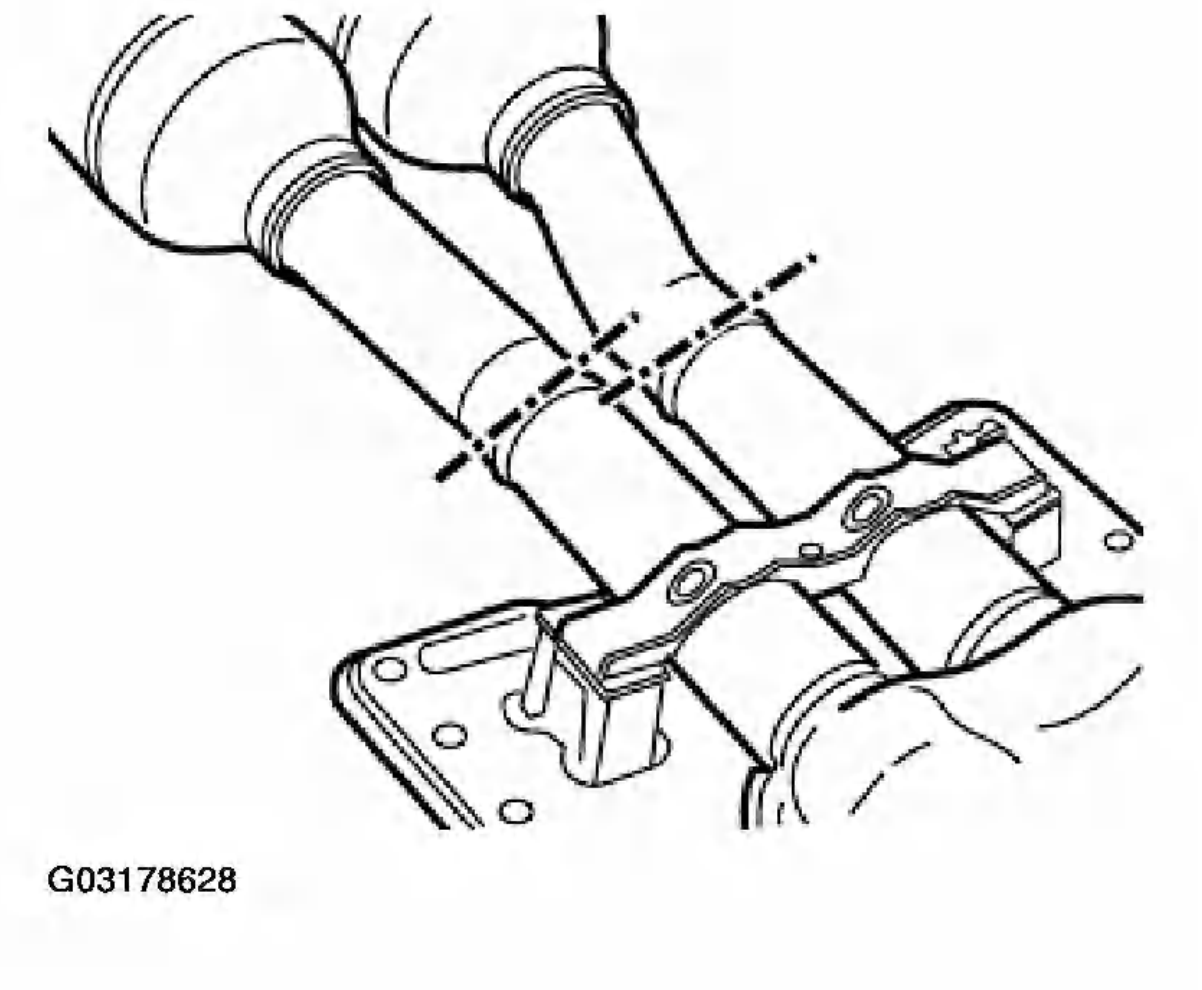



Fig. 6: Attaching Connecting Plate From Old Center Muffler To New Center Muffler
Courtesy of BMW OF NORTH AMERICA, INC.

Connect center muffler and rear muffler by means of clamping sleeves.

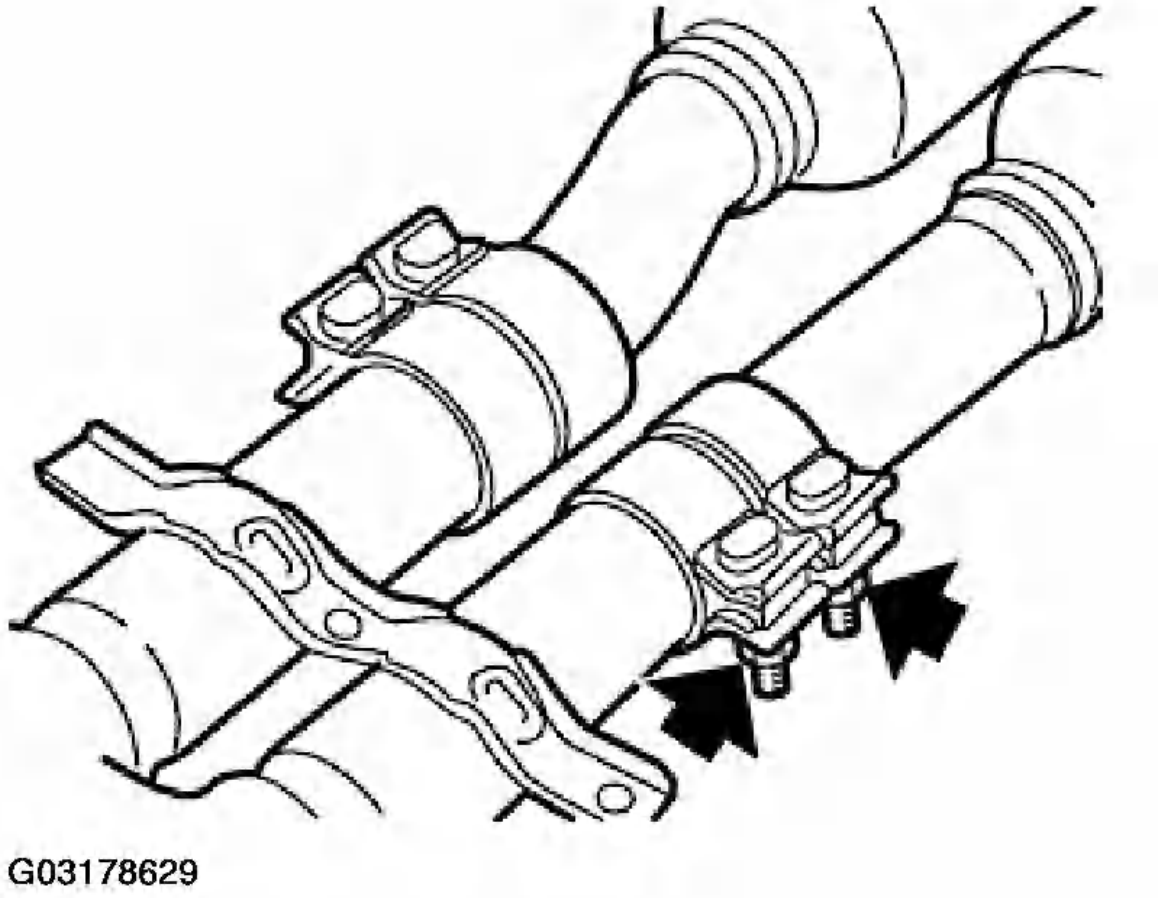



Fig. 7: Connecting Center Muffler And Rear Muffler By Clamping Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Nuts point downwards.

Align clamping sleeves so that:

- Cutting point is in middle of clamping sleeve, and.
- There is sufficient spacing to adjoining components.

## MUFFLER DIESEL

### 18 10 031 REPLACING FINAL MUFFLER

NOTE: For Special Tools, see SPECIAL TOOLS - Z3 .

- 00 2 210

WARNING: Scalding hazard!

These tasks should only be carried out on an exhaust system that has cooled down!

Determining Cutting Point:

Carry over length of new rear muffler to installed rear muffler.

Mark out cutting points.

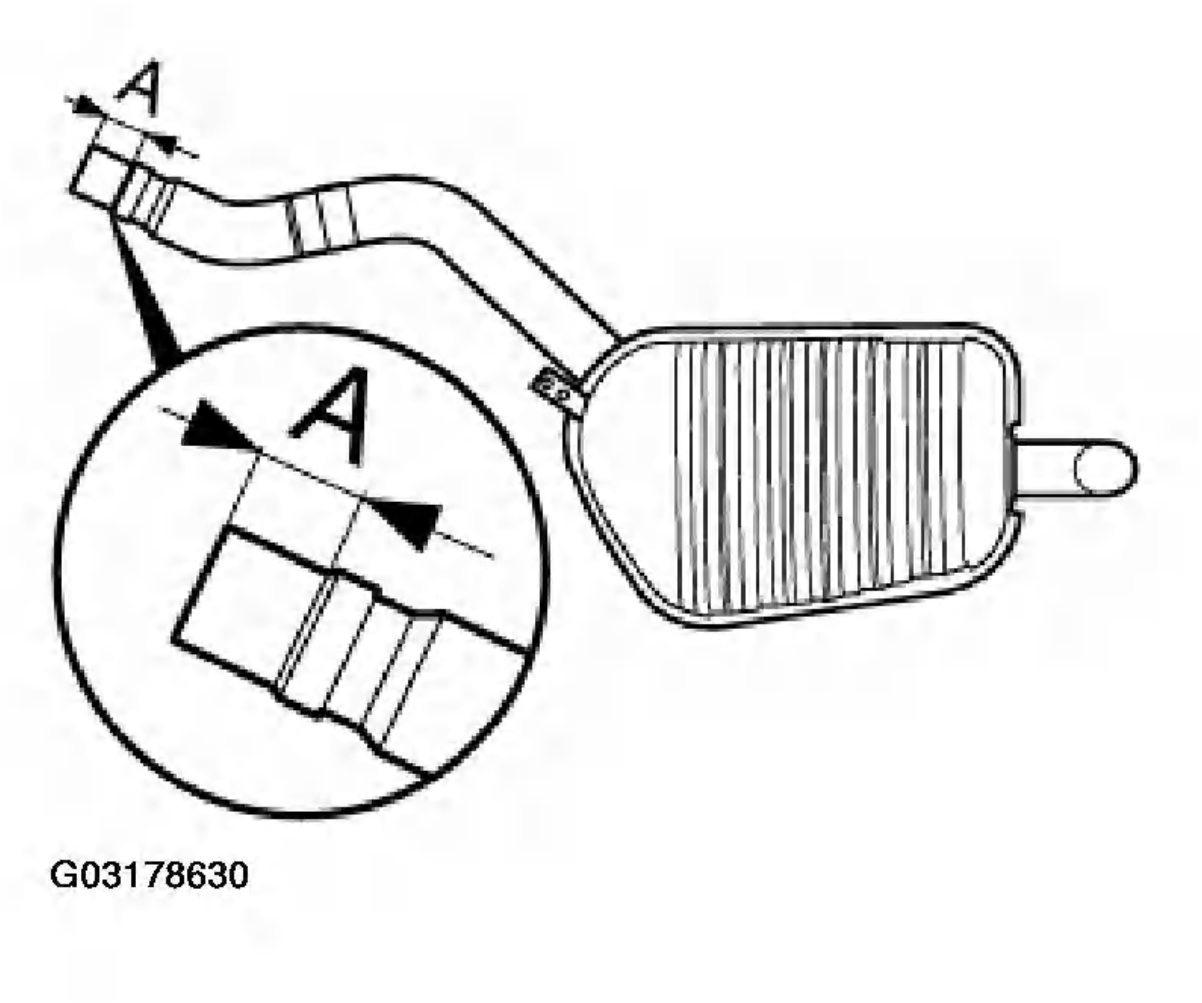



Fig. 8: Marking Cutting Points
Courtesy of BMW OF NORTH AMERICA, INC.

Cut exhaust pipes with special tool 00 2 210 at marked points and deburr.

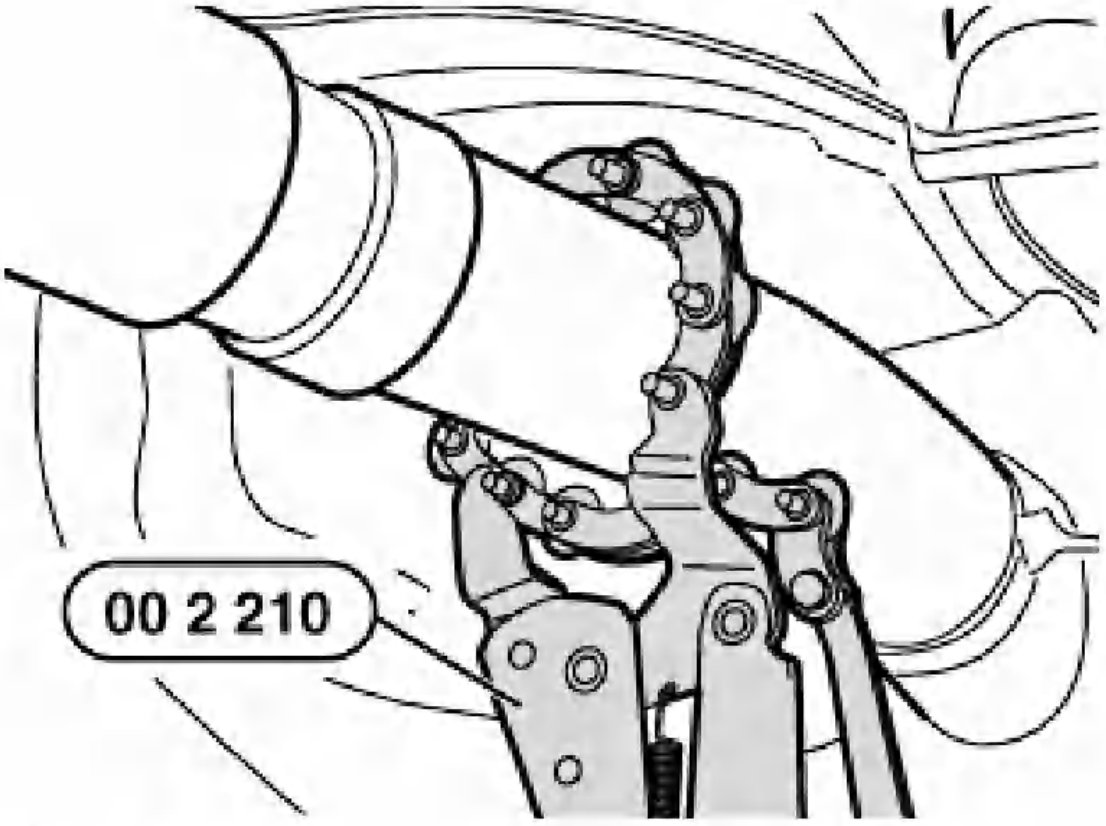



Fig. 9: Cutting Exhaust Pipes With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Detach rubber mounts (1) from bracket and remove rear muffler.

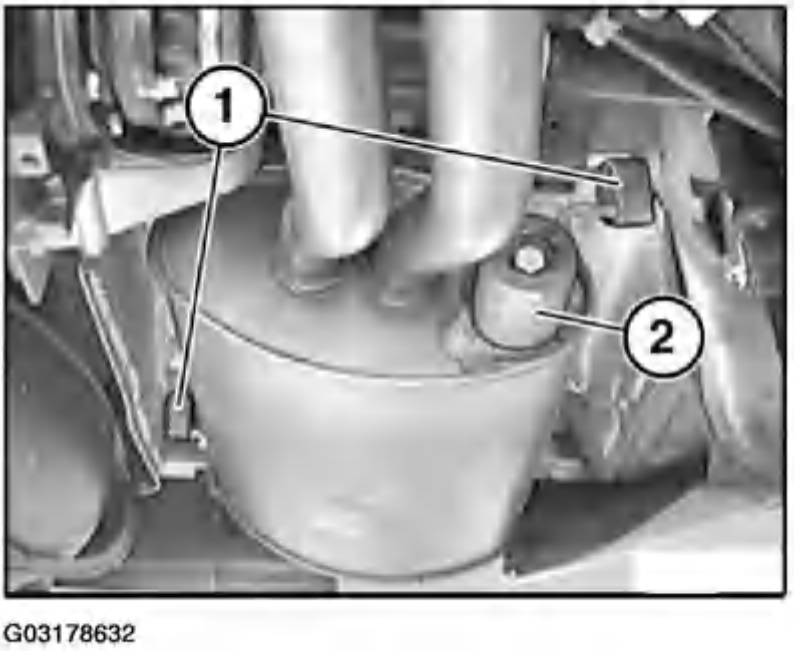


Fig. 10: Detaching Rubber Mounts From Bracket
Courtesy of BMW OF NORTH AMERICA, INC.

Remove vibration damper (2) and install on new rear muffler.

Install rubber mounts for suspension from body on new rear muffler.

Installation:

Connect new rear muffler and center muffler by means of clamping sleeve.

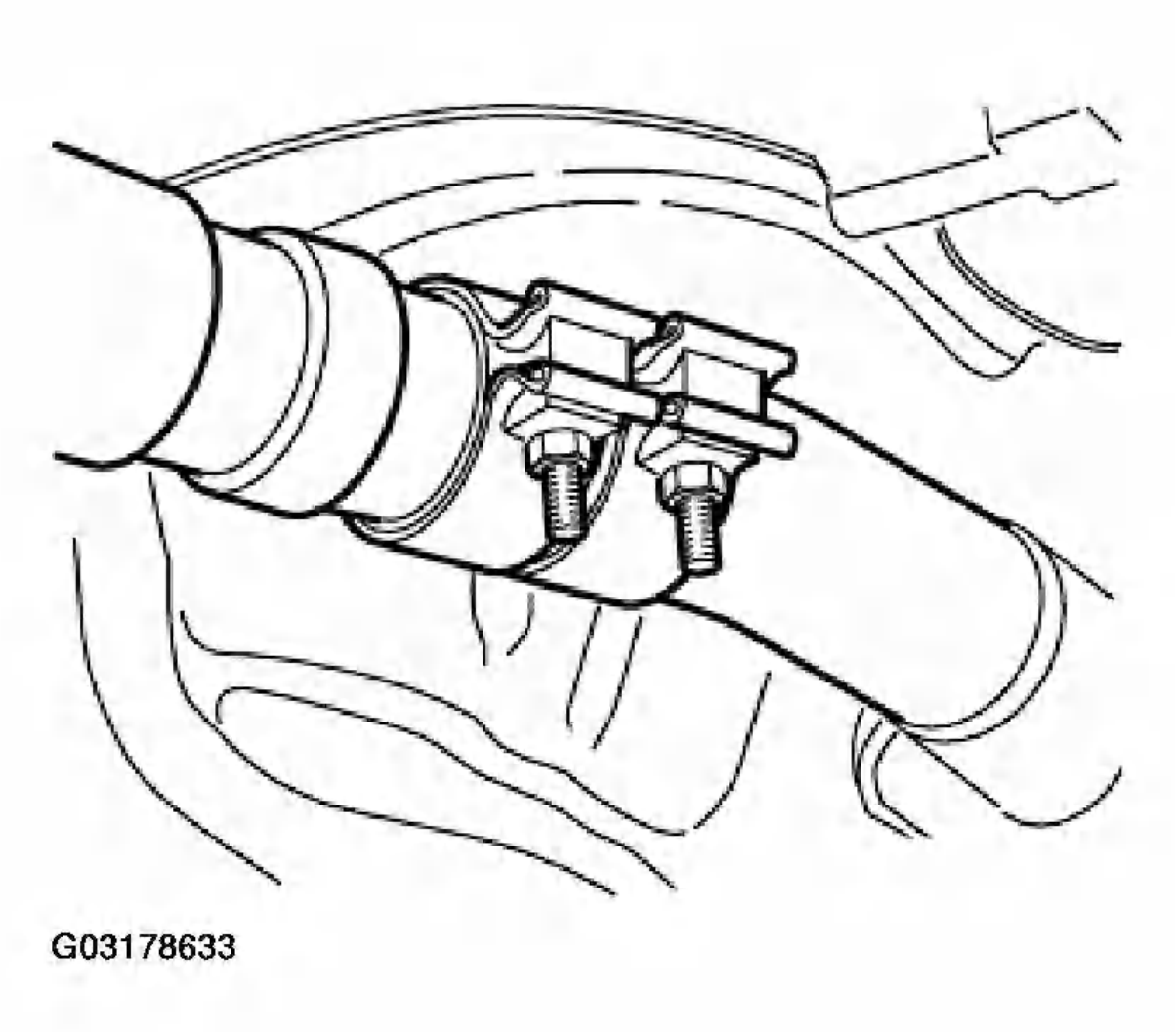



Fig. 11: Aligning Exhaust System And Clamping Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

Cutting point is in middle of clamping sleeve.

Align exhaust system and clamping sleeve in such a way that there is sufficient spacing to adjoining components.

## MUFFLER PATROL

### 18 12 061 REPLACING CENTER MUFFLER (Z3 M54)

WARNING: Scalding hazard!

Only perform these tasks after exhaust system has cooled down.

Remove complete exhaust system. Refer to 18 00 020 REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM (Z3 M54) .

NOTE: For the following work steps, some illustrations of the exhaust system of another BMW car are used.

Carry over length of new center muffler to old center muffler and mark cutting points.

Cut through exhaust pipes at marked points between center and rear mufflers and deburr.

Attach connecting plate from old center muffler to new center muffler.

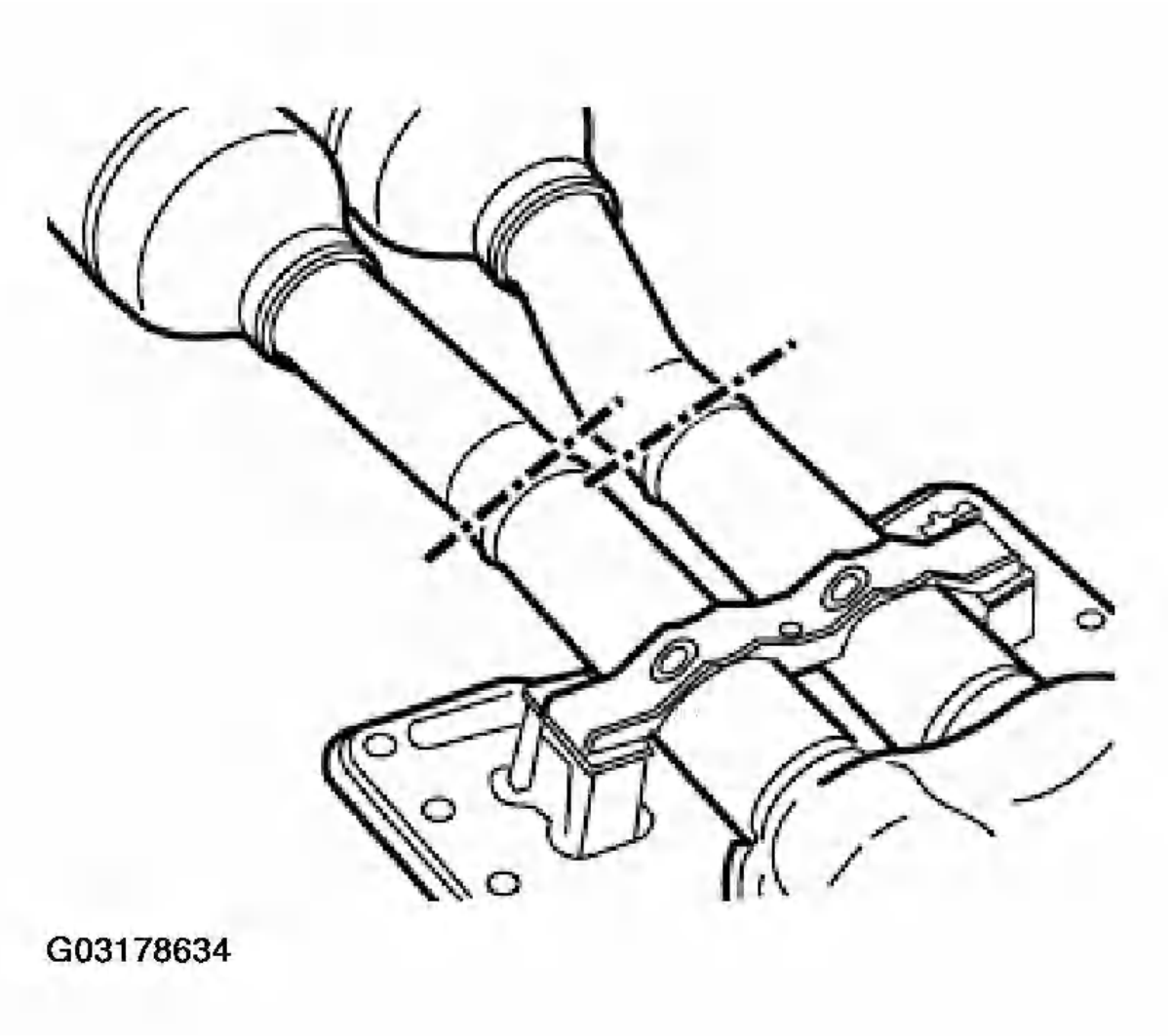



Fig. 12: Attaching Connecting Plate From Old Center Muffler To New Center Muffler
Courtesy of BMW OF NORTH AMERICA, INC.

Connect center muffler and rear muffler by means of clamping sleeves.

Installation:

Nuts point downwards.

Align clamping sleeves so that:

- Cutting point is in middle of clamping sleeve, and.
- There is sufficient spacing to adjoining components.

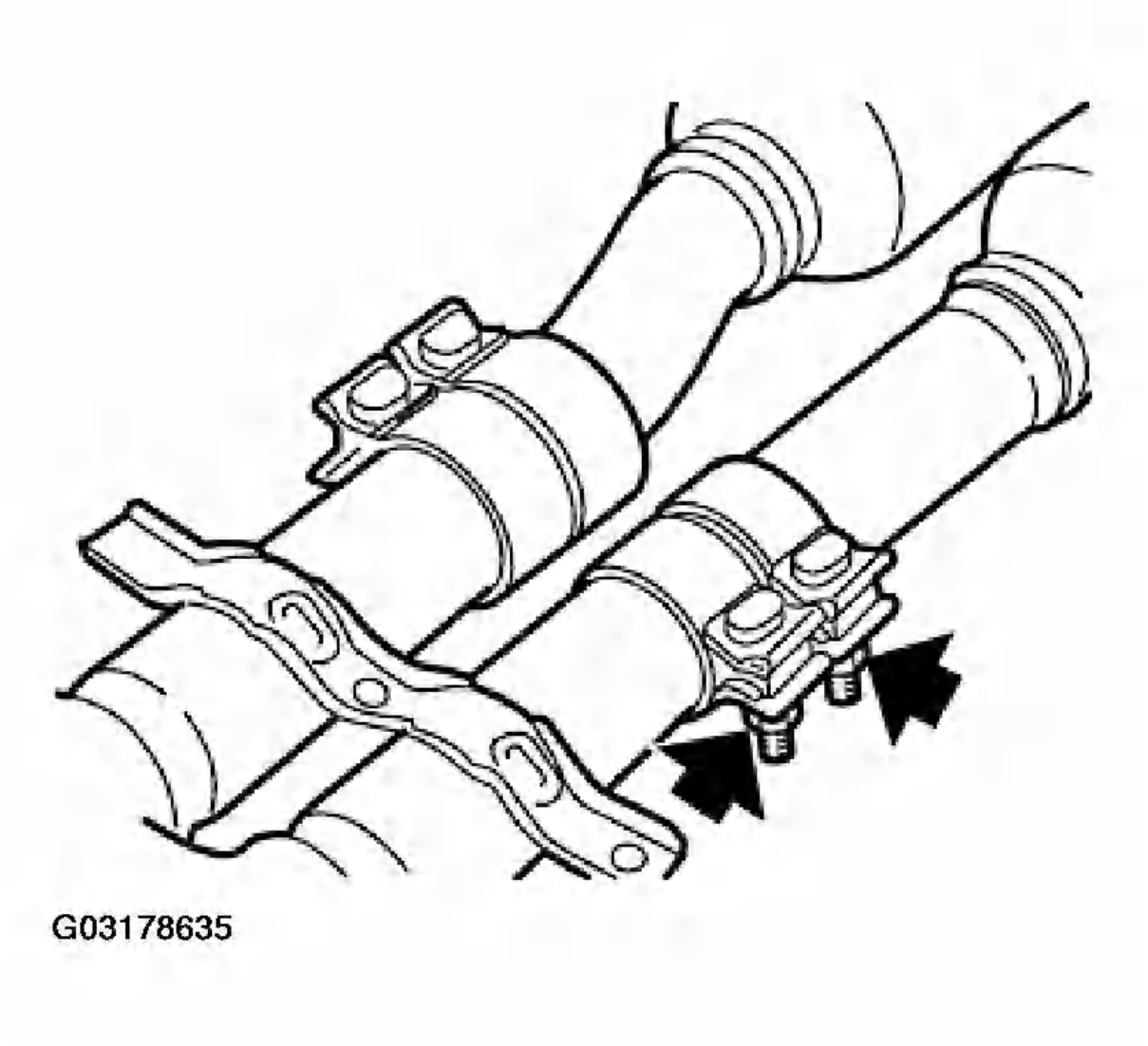



Fig. 13: Aligning Clamping Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

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Article GUID: A00202359

# FUEL TANK WITH MOUNTING

## 16 11 FUEL TANK AND MOUNTING PARTS E36 GASOLINE-DRIVEN CARS

FUEL TANK AND MOUNTING PARTS E36 GASOLINE-DRIVEN CARS TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Tank volume/reserve | ltr. | 65/8 |
| Venting: Gasoline-driven cars: Via rollover and venting valve, through carbon canister into intake system. | | |

# FUEL TRANSFER, SENSOR FOR GAUGE

## 16 12 FUEL SUPPLY, FUEL LEVEL SENDER E36

FUEL SUPPLY, FUEL LEVEL SENDER E36 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Resistance at connection | ..... | ..... |
| With empty tank: Left tank side | ohm | 10+/-2 |
| With empty tank: Right tank side | ohm | 10+/-2 |
| with empty tank | ohm | ..... |
| With full tank: Left tank side | ohm | E36 from 1/95: 231.3 +/- 5<br>E36/5 from 1/95: 239.5 +/- 4 |
| With full tank: Right tank side | ohm | E36 from 1/95: 268.7 +/- 5<br>E36/5 from 1/95: 260.6 +/- 5 |
| With full tank | ohm | ..... |
| Reserve warning contact | ltr. | 65/8 |

## 16 12 FUEL SUPPLY, FUEL LEVEL SENDER E36

FUEL SUPPLY, FUEL LEVEL SENDER E36 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Resistance at connection | ..... | ..... |
| With empty tank: Left tank side | ..... | 10+/-2 |
| With empty tank: Right tank side | ..... | 10+/-2 |
| with empty tank | ..... | ..... |
| With full tank: Left tank side | ..... | E36 from 1/95: 231.3 +/- 5<br>E36/5 from 1/95: 239.5 +/- 4 |
| With full tank: Right tank side | ..... | E36 from 1/95: 268.7 +/- 5<br>E36/5 from 1/95: 260.6 +/- 5 |
| With full tank | ..... | ..... |
| Reserve warning contact | ltr. | ..... |

## 16 12 FUEL SUPPLY, FUEL LEVEL SENDER E36/M COUPE/M ROADSTER/Z3/Z3 COUPE

FUEL SUPPLY, FUEL LEVEL SENDER E36 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Resistance at connection | ..... | ..... |
| With empty tank: Left tank side | ..... | ..... |
| With empty tank: Right tank side | ..... | ..... |
| with empty tank | ..... | 20+/-2 |
| With full tank: Left tank side | ..... | ..... |
| With full tank: Right tank side | ..... | ..... |

| | | |
|---|---|---|
| With full tank | ..... | 500+/-5 |
| Reserve warning contact | ltr. | ..... |

### 16 12 FUEL SUPPLY, FUEL LEVEL SENDER E36/M COUPE/M ROADSTER/Z3/Z3 COUPE

FUEL SUPPLY, FUEL LEVEL SENDER TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Resistance at connection | ..... | ..... |
| With empty tank: Left tank side | ohm | ..... |
| With empty tank: Right tank side | ohm | ..... |
| with empty tank | ohm | 20+/-2 |
| With full tank: Left tank side | ohm | ..... |
| With full tank: Right tank side | ohm | ..... |
| With full tank | ohm | 250+/-5 |
| Reserve warning contact | ltr. | Equal to or <6.5 |

## FUEL PUMP

### 16 14 FUEL PUMP E36 GASOLINE-DRIVEN CARS

FUEL PUMP E36 GASOLINE-DRIVEN CARS TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Operating pressure | Bar | 3.5 ...4 |
| Delivery rate at 12 V (pump removed, tested with testing fluid, approx. 20Â°C - counterpressure 3 bar -) | ltr./min. | Equal to or > 2.0 |
| Typical current consumption | A | Equal to or < 5.5 |

### 16 14 FUEL PUMP E36/M54/Z3 Z3 COUPE

FUEL PUMP E36/M54/Z3 Z3 Coupe TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Operating pressure | Bar | 3.5 |
| Typical current consumption | A | Equal to or <9 |

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Article GUID: A00202374

# FUEL TANK AND MOUNTING

## 16 11 FUEL TANK AND MOUNTING

FUEL TANK AND MOUNTING - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Fuel tank to body (hexagon nut) | E46, E83 | M8 | Replace self-locking nuts | 19 Nm |
| Â | E24 | M8 | Â | 45 Nm |
| Â | E30 | M8 | Â | 25 Nm |
| Tension strap to body (hexagon screw) | E53, E46, E85, E83 | M8 | Â | 19 Nm |
| Â | E24 | M8 | Â | 8 Nm |
| Â | E38, E65, E66, E67, E60, E61, E63, E64 | M8 | Â | 20 Nm |
| 2AZ Connecting pipe to fuel tank | E30 | Â | Â | 25 Nm |
| 3AZ Heat shield to fuel tank E30 | Â | Â | 8.5 Nm | Â |
| Â | E24 | Â | Â | 1.0 Nm |
| Â | E31 | Â | Â | 3 Nm |
| 4AZ Drain plug to fuel tank | All | Â | Â | 25 Nm |
| 5AZ Trunk separating wall/retaining bracket to trunk floor | E52 | M6 | Â | 7.8 Nm |
| 6AZ Wheel arch cover to body | E52 | M6 | Â | 3 Nm |

# FUEL TRANSFER SENSOR

## 16 12 FUEL DELIVERY

FUEL DELIVERY - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Measure |
|---|---|---|---|
| 1AZ Pump assembly to metal-bonded mount | All / with fuel injection | Â | 6.5 Nm |
| 2AZ Holder to fuel pump or fuel reservoir | All / with fuel injection | Â | 6.5 Nm |
| 3AZ Electric connections on fuel pump | All / with fuel injection | Â | 2 Nm |
| 4AZ Electric connections on fuel pump | All / with fuel injection | M4 | 1.2 Nm |
| 5AZ Electric connections on fuel pump | All / with fuel injection | M5 | 1.6 Nm |
| 6AZ Plastic nut on cover for fuel pipes | E30 | Â | 2 Nm |
| 7AZ Hose clamps 10 - 16 mm dia. | All | Â | 2 Nm |
| | | | |

| | | | |
|---|---|---|---|
| Â | E65 / E66 | Â | 1.5 Nm |
| 8AZ Hose clamps 18 mm dia. | All | Â | 3 Nm |
| 9AZ Hose clamps 37 - 43 mm dia. | All | Â | 4 Nm |
| Â | E52 | Â | 3 Nm |
| 10AZ Hose clamps 42 - 48 mm dia. | E65 / E66 | Â | 2 Nm |
| Â | E83 | Â | 4 Nm |
| 11AZ Fuel filler pipe to body | E46, E65, E66, E67, E83 | Â | 4 Nm |
| Â | E60, E61, E63, E64 | M6 | 9 Nm |
| Â | E85 | M6 8.8 | 7 Nm |
| 12AZ Feed line to fuel tank | E46 / M56 | M14 | 26 +/- 3 Nm |
| 13AZ Vent line from carbon canister to fuel tank | E46 / M56 | M24 | 26 +/- 3 Nm |
| 14AZ Fuel tank vent line to fuel filler pipe / purge air line to carbon canister | E46 / M56 | M14 | 26 +/- 3 Nm |
| 16AZ Grounding strap, fuel filler pipe to body | E85 | M6 8.8 | 9 Nm |
| Â | E83 | Â | 8 Nm |

# FUEL VENTILATION

## 16 13 TANK VENTILATION

TANK VENTILATION - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Fuel vapor venting tank to body | E24 | Â | Â | 3 Nm |
| Â | E30 | Â | Â | 4.5 Nm |
| Â | E39 | Â | Â | 4.0 Nm |
| Â | E38 | Â | Â | 5.5 Nm |
| Â | E53 | Â | Â | 3.5 Nm |
| Â | E65, E66, E67 | Â | Â | 9.0 Nm |
| 2AZ Carbon canister to body | E85 | M8 | Â | 9 Nm |
| Â | E46, E60, E61, E63, E64, E83 | M6 | Â | 9 Nm |
| 3AZ DMTL to holder / carbon canister E83, E85, E60, E46 / M56 | Â | Â | 1.8 Nm | Â |
| 4AZ Dust filter to holder / carbon canister | E46 / M56, E83, E60 | Â | Â | 1.8 Nm |
| Â | E85 | Â | Â | 2.1 +/- 0.2 Nm |

# FUEL PUMP

## 16 14 FUEL PUMP

FUEL PUMP - TIGHTENING TORQUE SPECIFICATIONS

| Application | Type | Thread | Tightening Specification | Measure |
|---|---|---|---|---|
| 1AZ Fuel level sender to fuel intake | All / with transfer pump in tank | Â | Â | 2 Nm |

| | | | | |
|---|---|---|---|---|
| Â | E32 | Â | Â | 8 Nm |
| 2AZ Sealing ring for fuel tank (service aperture, fuel level sensor, pump unit) | Â | Â | Â | Â |
| Plastic sealing ring 26.5 mm high | E34 / E31 | Â | Â | 40 Nm |
| Plastic sealing ring 31.5 mm high (new) | E36 / E34 / E31 | Â | First tighten sealing ring by hand 2 turns | 55 Nm |
| Locking ring (metal) | E39 / E52 / E53 | Â | Â | 35 Nm |
| Â | E60 / E61 / E63 / E64 / E65 / E66 / E67 | Â | Â | 45 +/- 5 Nm |
| Â | E85, | Â | Â | 50 +/- 10 Nm |
| Â | E83 | Â | Â | 55 +/- 5 Nm |
| 3AZ In-tank pump with fill level sensor to tank | E38 | M6 | Tighten nuts diagonally and evenly. | 6.5 Nm |
| 4AZ El. fuel pump control unit to body / holder | E60, E61 | M6 | Â | 8 Nm |

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Article GUID: A00202652

# FUEL PICK-UP, CLEANING

## 16 00 GENERAL FUNCTION DESCRIPTION FOR FUEL SUPPLY SYSTEMS

### Fuel supply systems, spark-ignition engines

Fuel System

The electric fuel pump in the fuel tank generates the pressure in the fuel system which is set by the pressure regulator to a specific level.

Tank Venting System

The tank venting system is an enclosed system which is vented via a carbon canister. The carbon is incorporated in the carbon canister as granulate. The large surface of the carbon stores the fuel vapors which occur in the fuel tank. The carbon canister must be regenerated on a regular basis so as to be able to continue storing fuel vapors. Regeneration is performed by way of purging with fresh air via the intake manifold. This process is controlled by the engine control unit.

### Fuel supply systems, diesel engines

Fuel System

The electric fuel pump in the fuel tank supplies the engine with fuel. Two types of high-pressure pump are used for cylinder injection.

1. The distributor injection pump supplies each cylinder directly with fuel via the corresponding injection nozzle.
2. The high-pressure pump for the common rail systems generates in the fuel rail the necessary pressure for all the injection nozzles.

In common rail systems, a further pump (inline pump, M57/gear pump, M67) is connected between the high-pressure pump and the electric fuel pump. This pump supports the fuel pump in the fuel tank in the event of a high fuel demand.

Tank Venting System

Diesel fuel is non-volatile and therefore a carbon canister is not required. The fuel tank is vented directly to atmosphere.

## 1600... FUEL TANK SURVEY

1. (left) Suction spray pump swing-arm fuel level sender.
2. (right) Fuel pump swing-arm fuel level sender sensor unit.

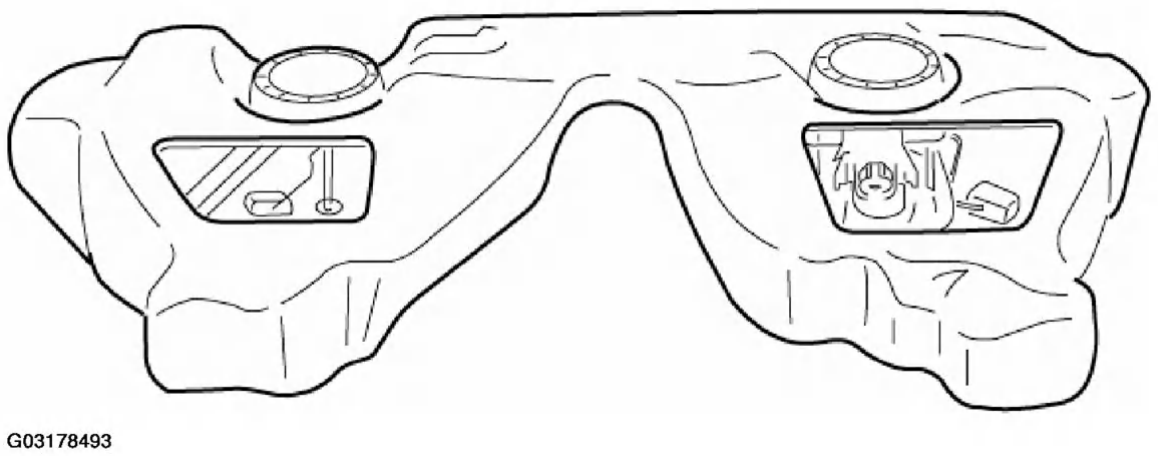



Fig. 1: Identifying Suction Spray Pump Swing-Arm Fuel Level Sender And Fuel Pump Swing-Arm Fuel Level Sender Sensor Unit
Courtesy of BMW OF NORTH AMERICA, INC.

1. Suction spray pump.
2. Swivel arm sensor.
3. Tank flange.
4. Floor support - centering.

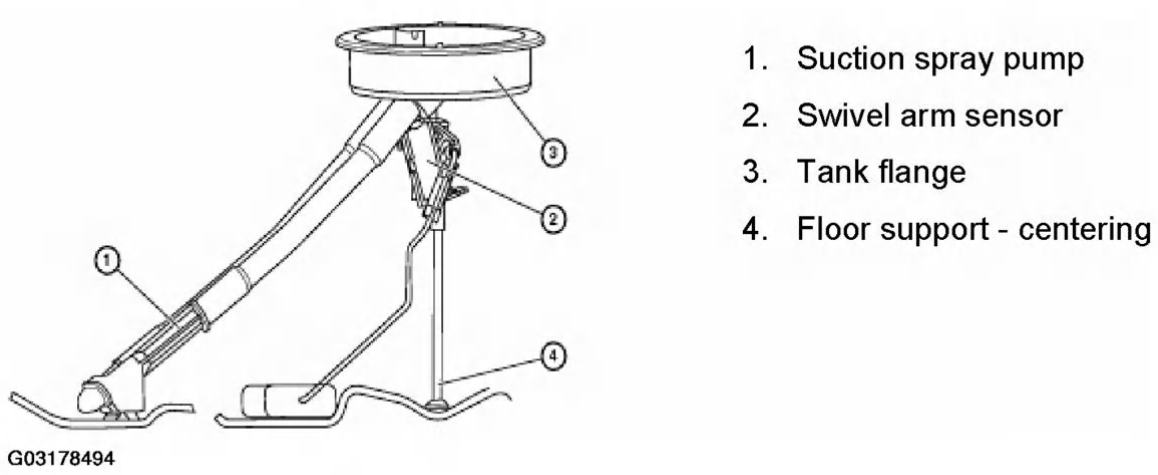



Fig. 2: Identifying Suction Spray Pump And Floor Support - Centering
Courtesy of BMW OF NORTH AMERICA, INC.

1. Pump carrier with fuel pump.
2. Swivel arm sensor.
3. Tank flange.
4. Floor support - centering.

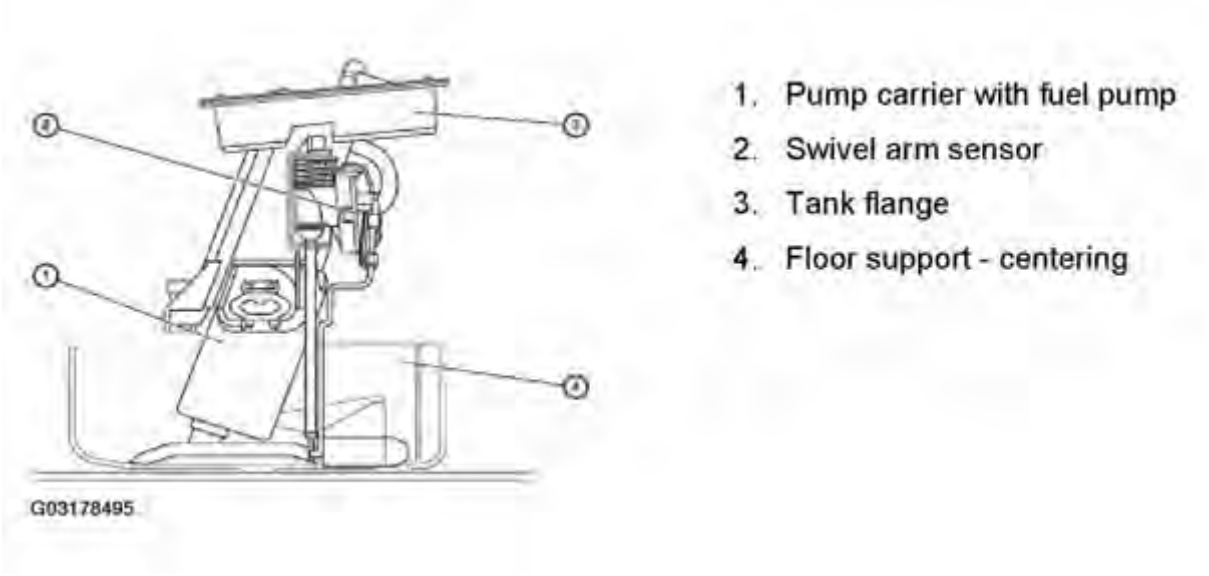



Fig. 3: Identifying Pump Carrier With Fuel Pump And Floor Support - Centering
Courtesy of BMW OF NORTH AMERICA, INC.

## 16 00 005 DRAINING AND FILLING FUEL TANK

CAUTION: Observe relevant country safety legislation and regulations! Ensure adequate ventilation in the place of work! Connect the exhaust and extraction systems to the exhaust tailpipe. The electric fuel pump must not operate without fuel! After servicing before the first engine start-up, fill the fuel tank via the fuel filling line with at least 5 l fuel.

### Drawing off through filler pipe

Switch on engine and run for 10 - 15 seconds to enable intake hose on air valve to fill with fuel. Fuel can be drawn out of left and right sides of tank through filler neck, leaving only a small residue. This residual quantity is drawn off after fuel level indicator sensor (right/left) has been removed.

Slide a suitable suction hose into filler neck about 130 cm, twisting slightly if necessary.

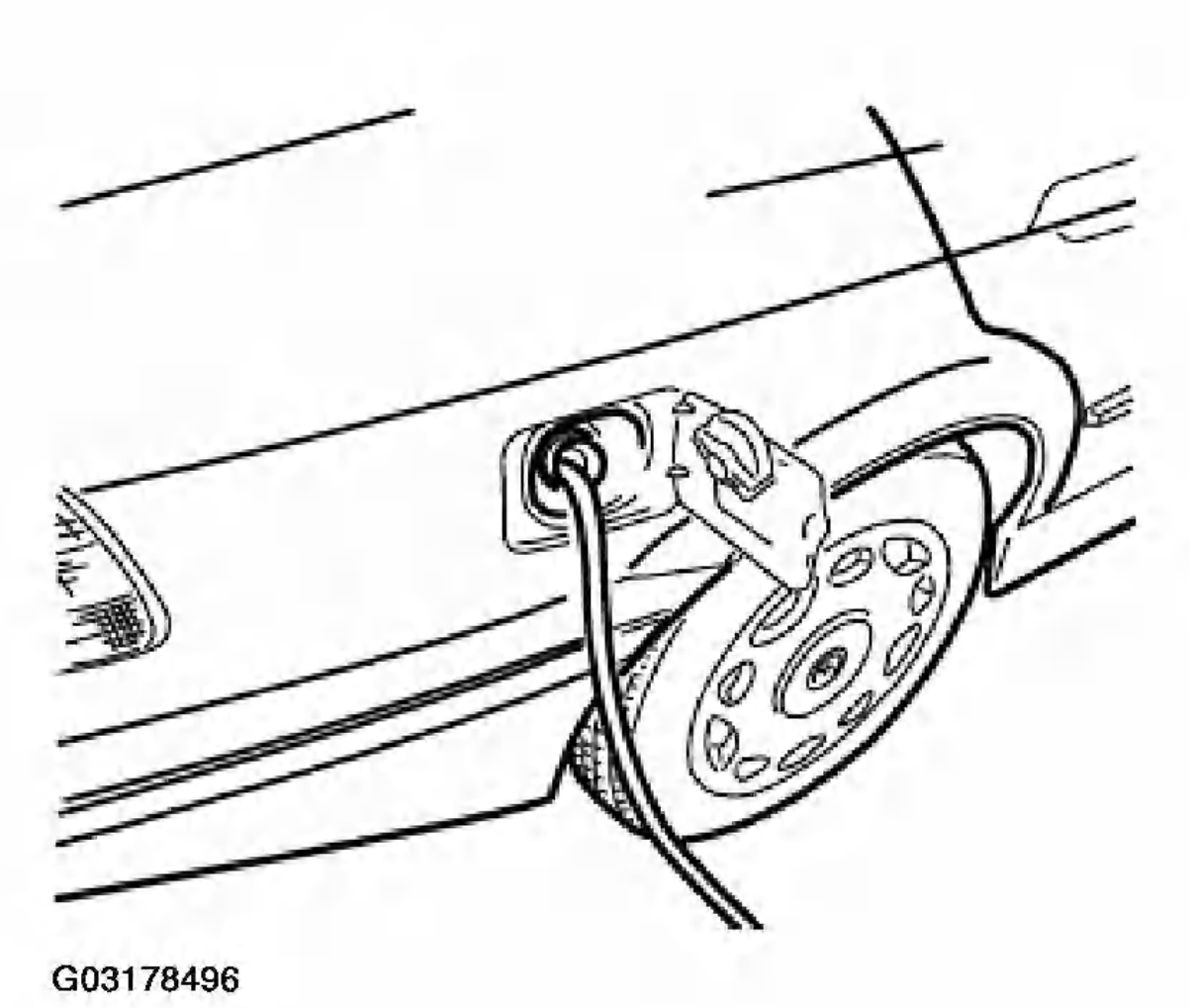



Fig. 4: Sliding Suitable Suction Hose Into Filler Neck
Courtesy of BMW OF NORTH AMERICA, INC.

Draw out fuel with suction unit as far as possible.

NOTE: When removing hose, avoid damaging the return baffle plate.

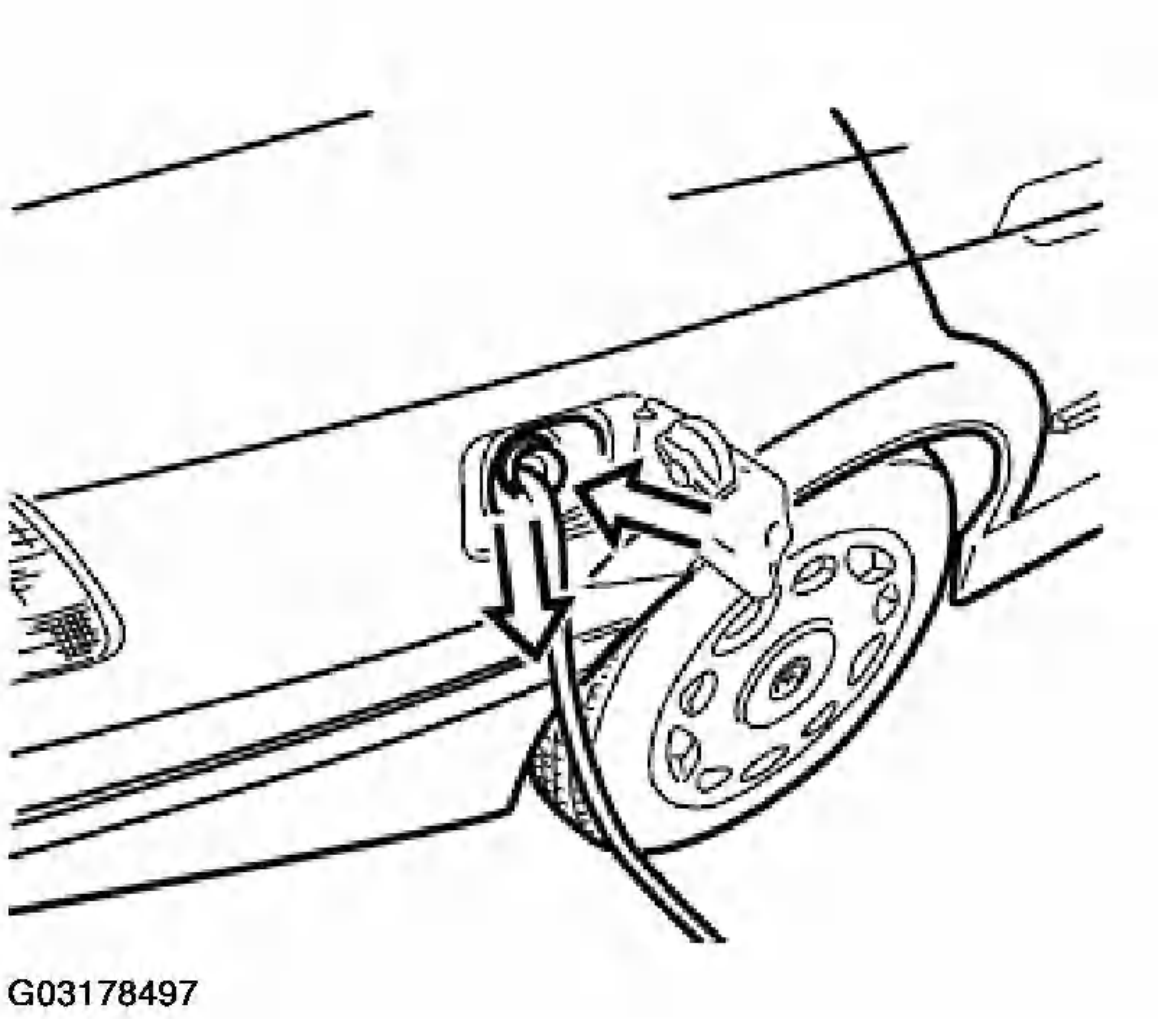



Fig. 5: Removing Hose
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Fill fuel into suction unit via filler aperture, inserting hose approx. 40 cm in length to do so.

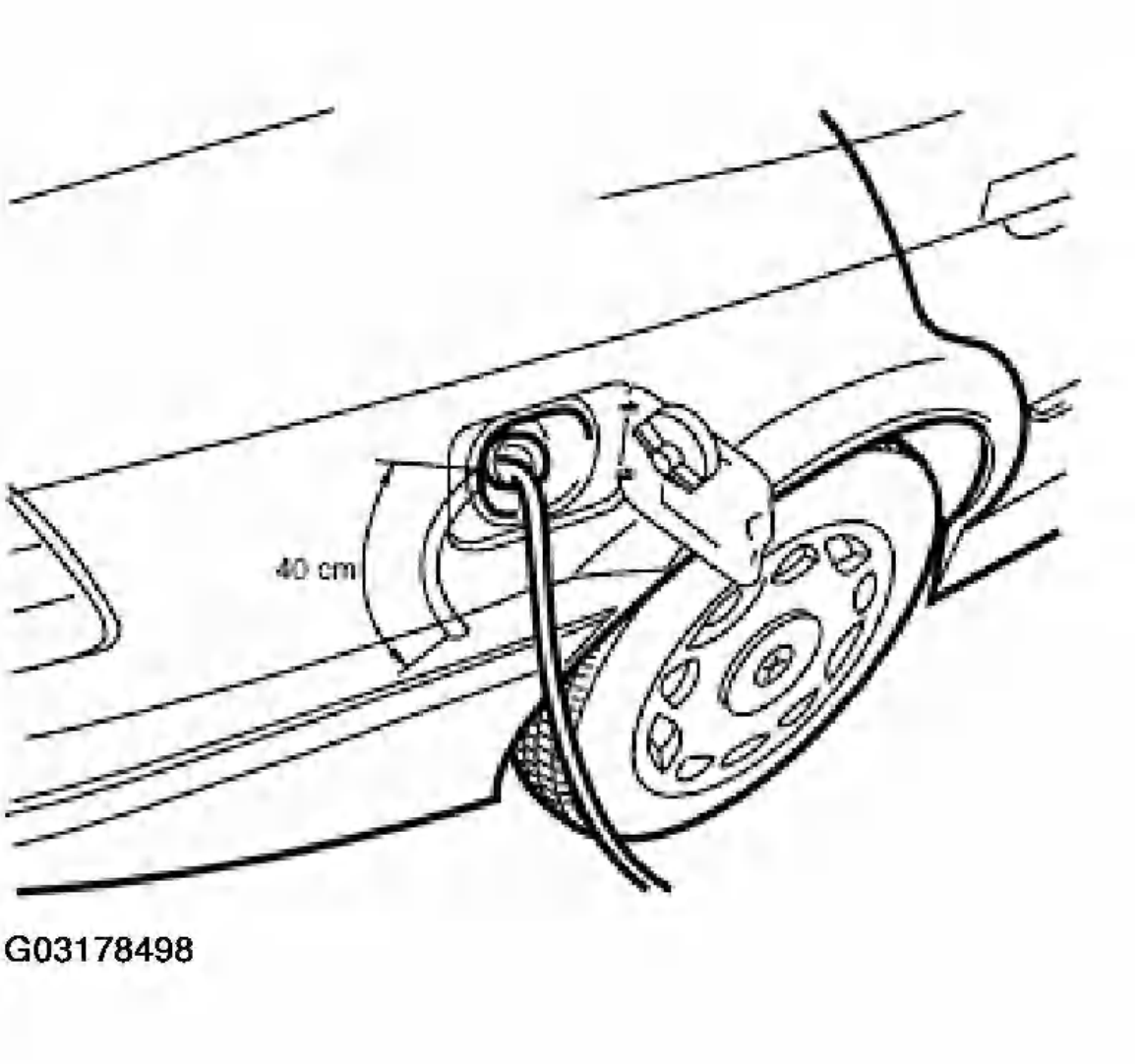



Fig. 6: Filling Fuel Into Suction Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Suction Check

Remove rear seat cushion. Unscrew covers on left and right sides.

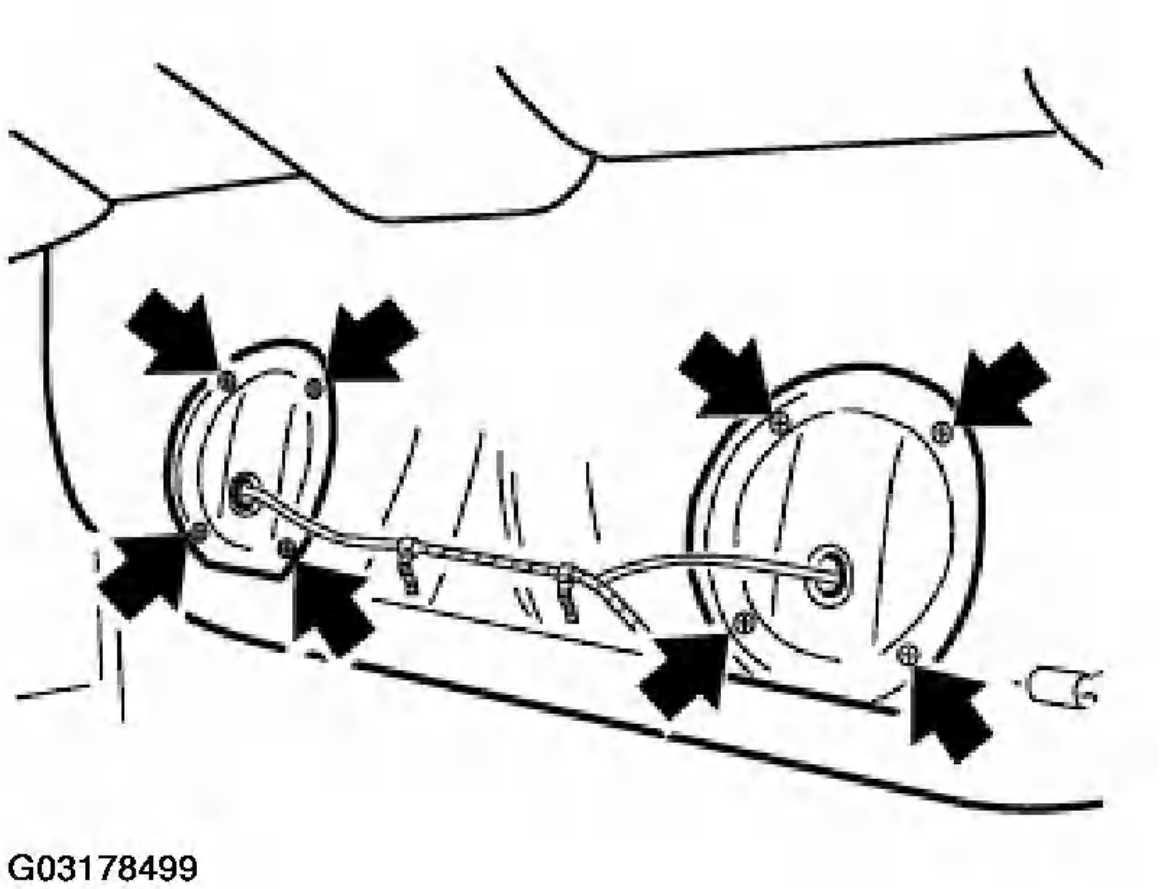



Fig. 7: Removing Covers Screws
Courtesy of BMW OF NORTH AMERICA, INC.

After disconnecting plug connections on fuel level sensors, reduction of fuel level in both halves of tank can be monitored with a multimeter.

Fuel level drops and resistance decreases.

Drawing off via right section of tank

Spark Ignition Engines Up To 12/94 And Diesel Engines

Remove rear seat cushion. Unscrew covers on left and right sides.

Remove tank compensating hose (2) from right tank flange.

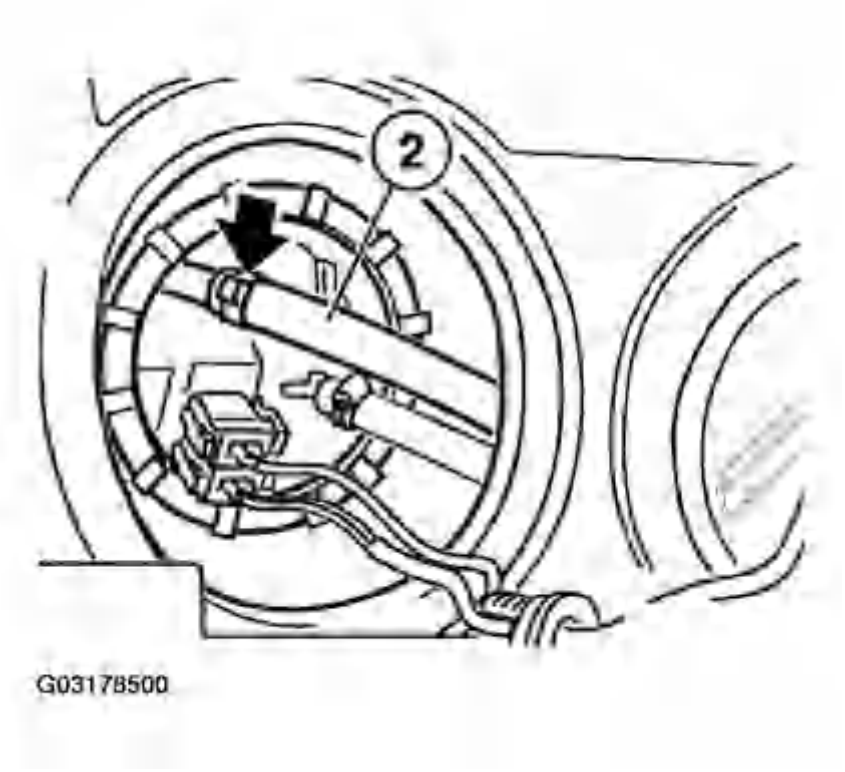



Fig. 8: Removing Tank Compensating Hose From Right Tank Flange
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace hose clips.

Connect suction unit on expansion hose using a hose and connector, and draw fuel out of left section of tank.

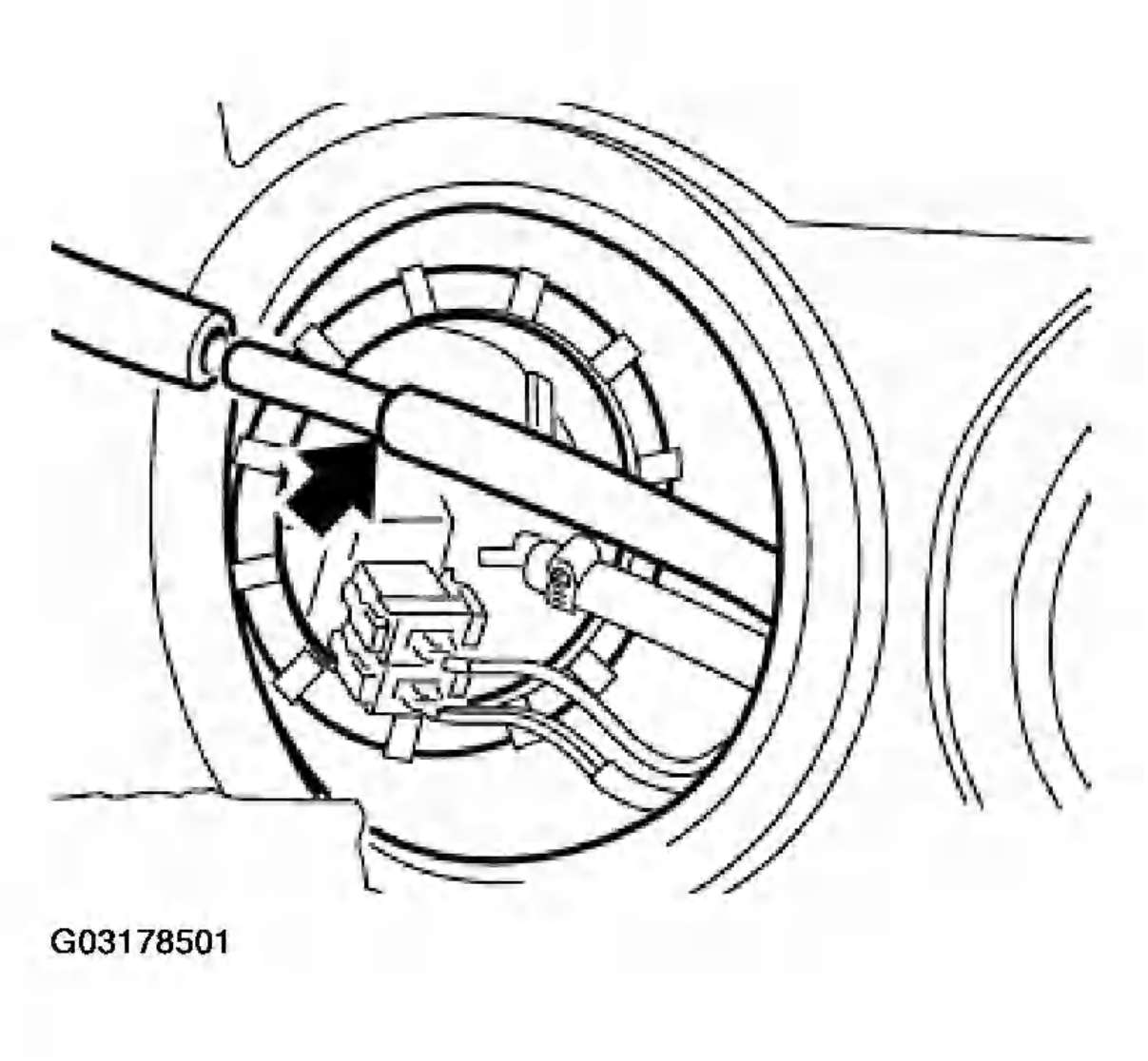



Fig. 9: Connecting Suction Unit On Expansion Hose Using Hose And Connector
Courtesy of BMW OF NORTH AMERICA, INC.

Spark ignition engines from 1/95

The tank compensating hose is fitted in the tank.

NOTE: If suction problems arise at the filler pipe, fuel level sensors (right/left) must be removed before suction can continue.

Drawing off after removal of fuel level sensors (left/right)

Remove fuel level sensors (right/left), refer to 16 12 000 REMOVING AND INSTALLING/REPLACING FUEL GAUGE SENSOR (Z3, UNIT, SENSOR-PUMP, COMPLETE) .

Fuel (even residual quantity) can be drawn off.

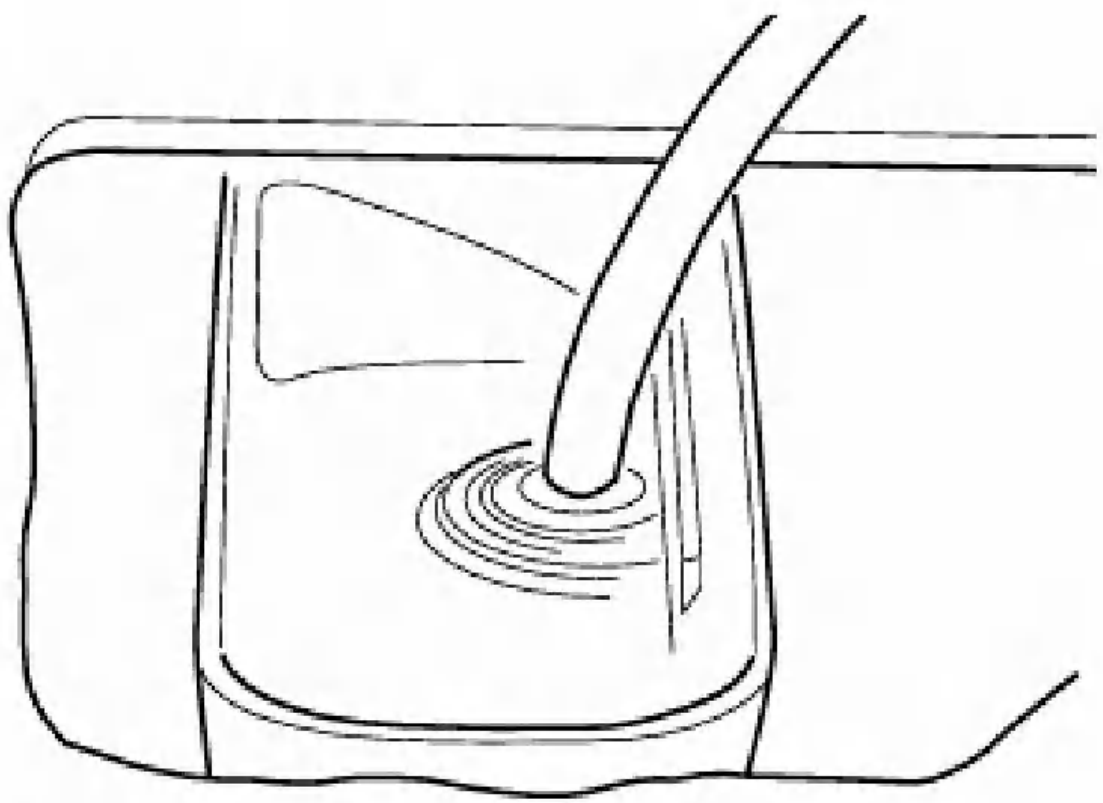



Fig. 10: Removing Fuel
Courtesy of BMW OF NORTH AMERICA, INC.

## 16 00 102 CHECKING FUEL TANK AND TANK VENTING SYSTEM FOR LEAKS WITH TANK LEAKAGE DIAGNOSIS MODULE (DM-TL)

NOTE: An OBD fault is indicated by the "Check Engine" indicator lamp in the instrument cluster lighting up. This may indicate a leak in the tank venting system. Information on this is provided by the fault memory of the DME control unit.

- Read out fault memory of DME control unit and carry out a diagnosis in accordance with faults stored.
- A leak test with the DM-TL module is then carried out if:

- The components of the DM-TL module are O.K.
- A error is stored in the DME fault memory (tank leak detected).

Adhere to following conditions in order to carry out a correct leak test:

- Content of fuel tank < 90%.
- Reserve indicator lamp "off".
- Leave car in workshop for at least 2 hours so that fuel temperature comes into line with workshop temperature (ideal fuel temperature approx. 10...20Â°C).
- Do not under any circumstances fill up car with fresh fuel (strong exhalation of fresh fuel).
- Check that tank cap is correctly seated.

WARNING: During the leak test, under no circumstance apply external pressurization through the tank filler neck as this may cause incorrect readings.

Clear DME fault memory.

In the Diagnosis and Information System (DIS), go to the "Function and component selection" page.

By selecting:

- Complete vehicle.
- Drive.
- Engine management.
- Tank system test.
- Diagnosis module tank leakage (DMTL).

adopt test module in test schedule.

Switch to the test schedule and implement the tank leakage diagnosis module. Leakage test is carried out.

If fault is recorded again in DME fault memory (tank leak detected), carry out leak test.

## 16 00 510 CONDUCTING LEAK TEST ON FUEL TANK AND TANK VENTILATION SYSTEM

NOTE: The following procedure is only applicable to vehicles with the tank leak diagnosis module (DM-TL).

CAUTION: On vehicles with tank leak diagnosis modules (DM-TL), do not work with external pressurization as the tank venting system will leak under this condition. On account of emerging fuel vapors, carry out all work in well ventilated rooms. Or use a suitable extractor system. Observe country-specific accident prevention and occupational safety regulations.

In the Diagnosis and Information System (DIS), go to the "Function and component selection" page.

By selecting:

- Service functions.
- Drive.
- Digital Motor Electronics.
- Activation DMTL pump.

adopt test module in test schedule.

Switch to the test schedule and implement the "Activation DMTL pump" test module.

Tank leak diagnosis pump pressurizes fuel tank and tank venting system.

Carry out leak test.

Terminate test module after completing leak test.

NOTE: Tank leak diagnosis pump is automatically shut down after approx. 15 minutes due to risk of overheating. Allow pump to cool down for at least 15 minutes. Then continue procedure. The leak test can be carried out with a leak detector. Follow manufacturer's operating instructions in doing so.




Fig. 11: Identifying Leak Detector
Courtesy of BMW OF NORTH AMERICA, INC.

Possible causes of leaks are:

- Tank cap leaking (check tank cap pressure relief valve). Refer to 16 11 130 CHECKING FILLER CAP PRESSURE RELIEF VALVE .
- Tank venting lines leaking (fuel tank - carbon canister - tank venting valve).
- Tank ventilation valve leaky (engine compartment).
- Fuel level sensor flange on tank leaking.

## 16 11 130 CHECKING FILLER CAP PRESSURE RELIEF VALVE

NOTE: For Special Tools identification, see SPECIAL TOOLS - Z3 .

CAUTION: Special Tools Required:

- 13 3 010
- 16 1 171
- 16 1 172
- 16 1 173

Set pressure regulator on special tool 16 1 171 fully in "-" direction.

Connect special tool 16 1 171 via compressed air line (1) to garage compressed air system (8...10 bar).

Connect pressure sensor (2) of Diagnosis and Information System with a measuring range of 0...3.5 bar.

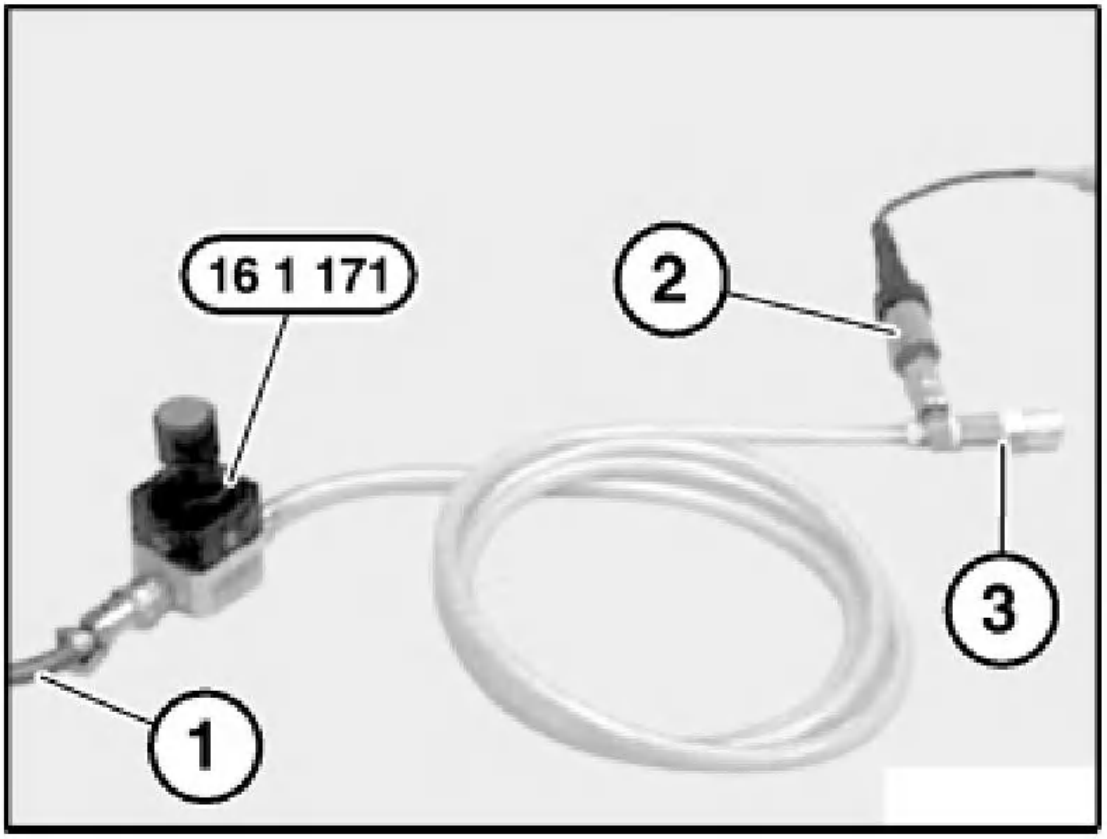



Fig. 12: Connecting Special Tool Via Compressed Air Line To Garage Compressed Air System
Courtesy of BMW OF NORTH AMERICA, INC.

Select special tool 16 1172 or 16 1 173 matching vehicle's filler cap and attach to quick release coupling of special tool 16 1 171.

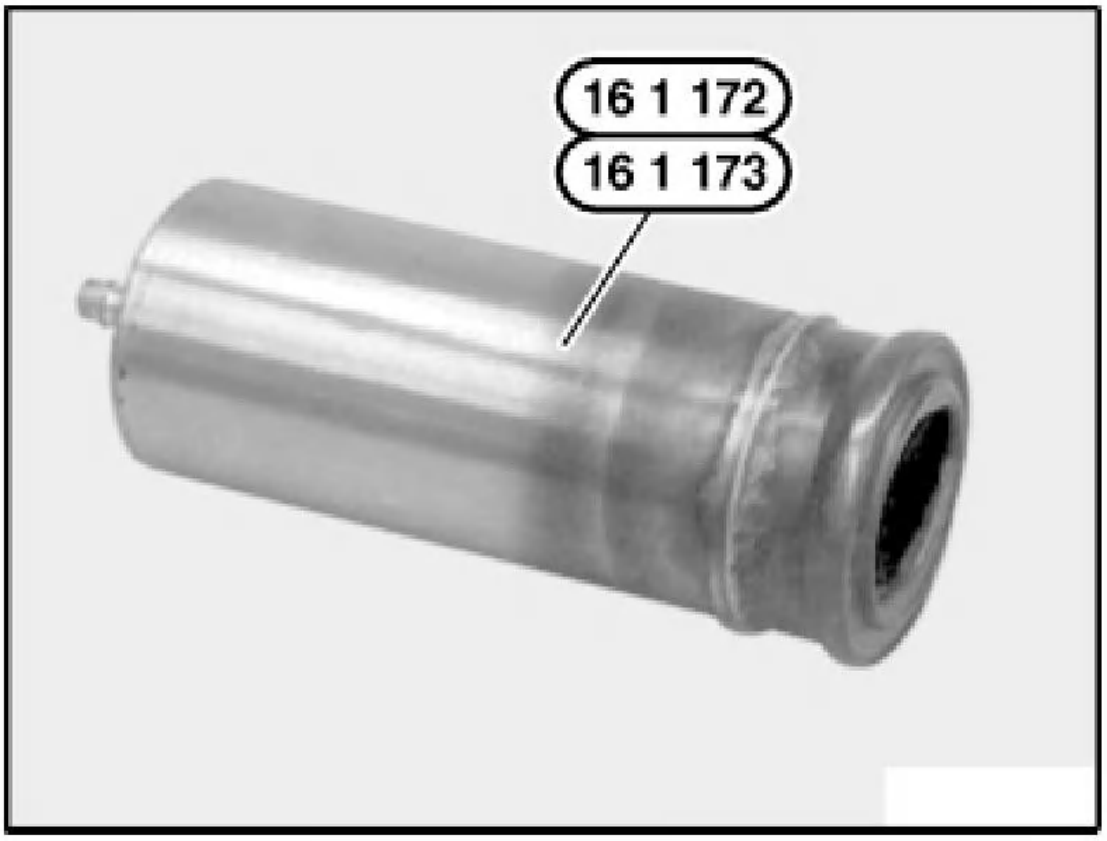



Fig. 13: Identifying Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Install filler cap on selected special tool (3).

NOTE: Only the absolute pressure is indicated in the display of the Diagnosis and Information System (DIS). The current ambient air pressure is already displayed without additional pressurization.

Check Testing Equipment For Leaks!

Select "Measurement" function on Diagnosis and Information System (DIS).

Set measuring range according to pressure sensor to 0-3.5 bar.

Increase pressure by 0.2 bar with pressure regulator on special tool 16 1 171.

Using special tool 133010, disconnect delivery line from special tool 16 1171 to tank filler neck.

Wait 60 secs.

Read off final pressure value and compare with starting pressure value.

Measurement evaluation:

MEASUREMENT EVALUATION

| | |
|---|---|
| Pressure drop > 0.012 bar | Testing equipment leaking. Check connection points for leaks. |

Check filler cap pressure relief!

Follow same test procedure as for "Checking testing equipment for leaks".

Increase pressure by 0.3 bar with pressure regulator on special tool 161 171.

Measurement evaluation:

MEASUREMENT EVALUATION

| | |
|---|---|
| Pressure drop > 0.012 bar | Filler cap pressure relief valve faulty. Replace filler cap. |

# FUEL TANK WITH MOUNTING

## 16 00... FUEL TANK SURVEY

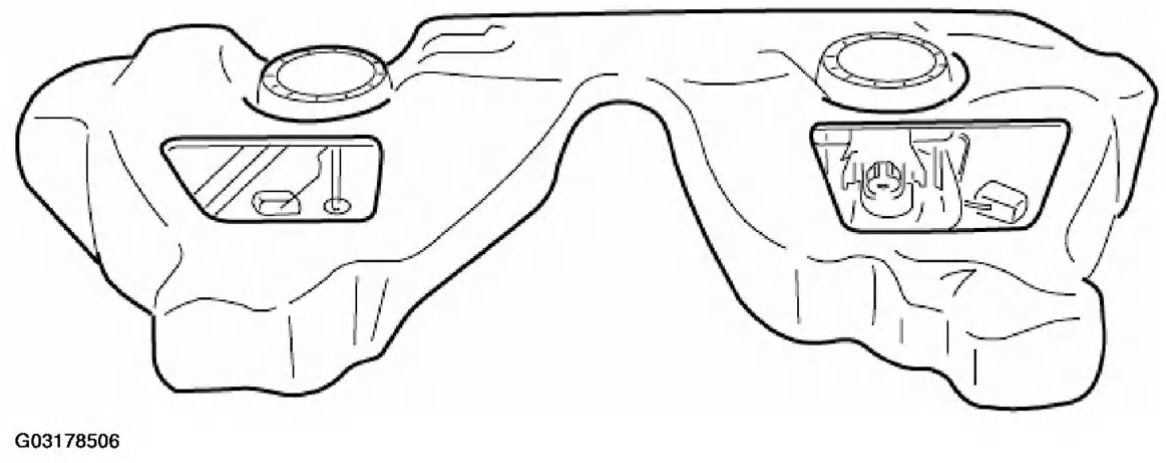



Fig. 14: Identifying Suction Spray Pump Swing-Arm Fuel Level Sender And Fuel Pump Swing-Arm Fuel Level Sender Sensor Unit
Courtesy of BMW OF NORTH AMERICA, INC.

1. (left) Suction spray pump swing-arm fuel level sender.
2. (right) Fuel pump swing-arm fuel level sender sensor unit.

1. Suction spray pump.
2. Swivel arm sensor.
3. Tank flange.
4. Floor support - centering.

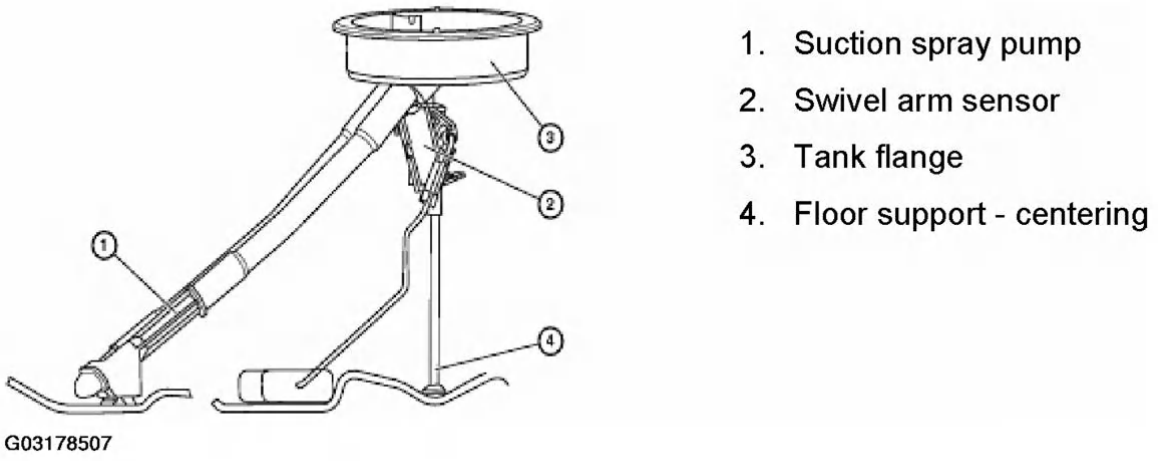



Fig. 15: Identifying Suction Spray Pump And Floor Support - Centering
Courtesy of BMW OF NORTH AMERICA, INC.

1. Pump carrier with fuel pump.
2. Swivel arm sensor.
3. Tank flange.
4. Floor support - centering.

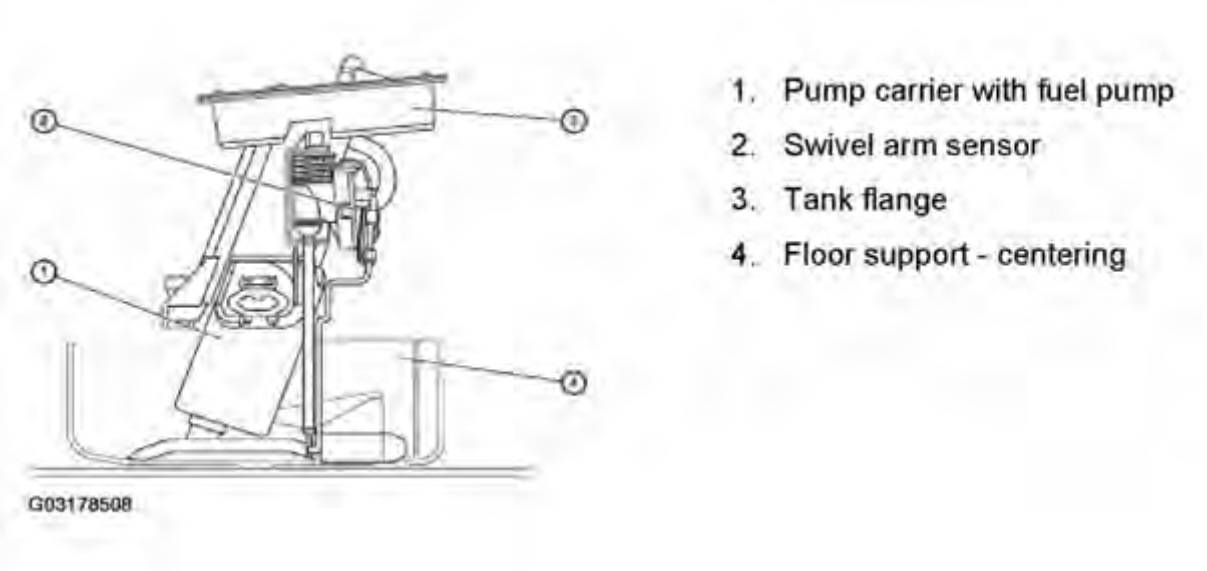



Fig. 16: Identifying Pump Carrier With Fuel Pump And Floor Support - Centering
Courtesy of BMW OF NORTH AMERICA, INC.

## 16 11 030 REMOVING AND INSTALLING FUEL TANK (Z3)

CAUTION: After the installation of the fuel tank/prior to the first engine start-up: Check electrical resistance between bayonet head (tank filler pipe) and body. Measured value: approx. 0.6 Â°. Fill fuel tank with at least 5 liters of fuel.

Draw off fuel from fuel tank, refer to 16 00 005 DRAINING AND FILLING FUEL TANK .

REMOVE COMPLETE REAR AXLE, refer to AXLE CARRIER ASSEMBLY .

ON M ROADSTER, REMOVE CARBON CANISTER , refer to 16 12 010 REMOVING AND INSTALLING/REPLACING CARBON CANISTER (M ROADSTER, M COUPE AND Z3/USA) .

Unfasten ground strap.

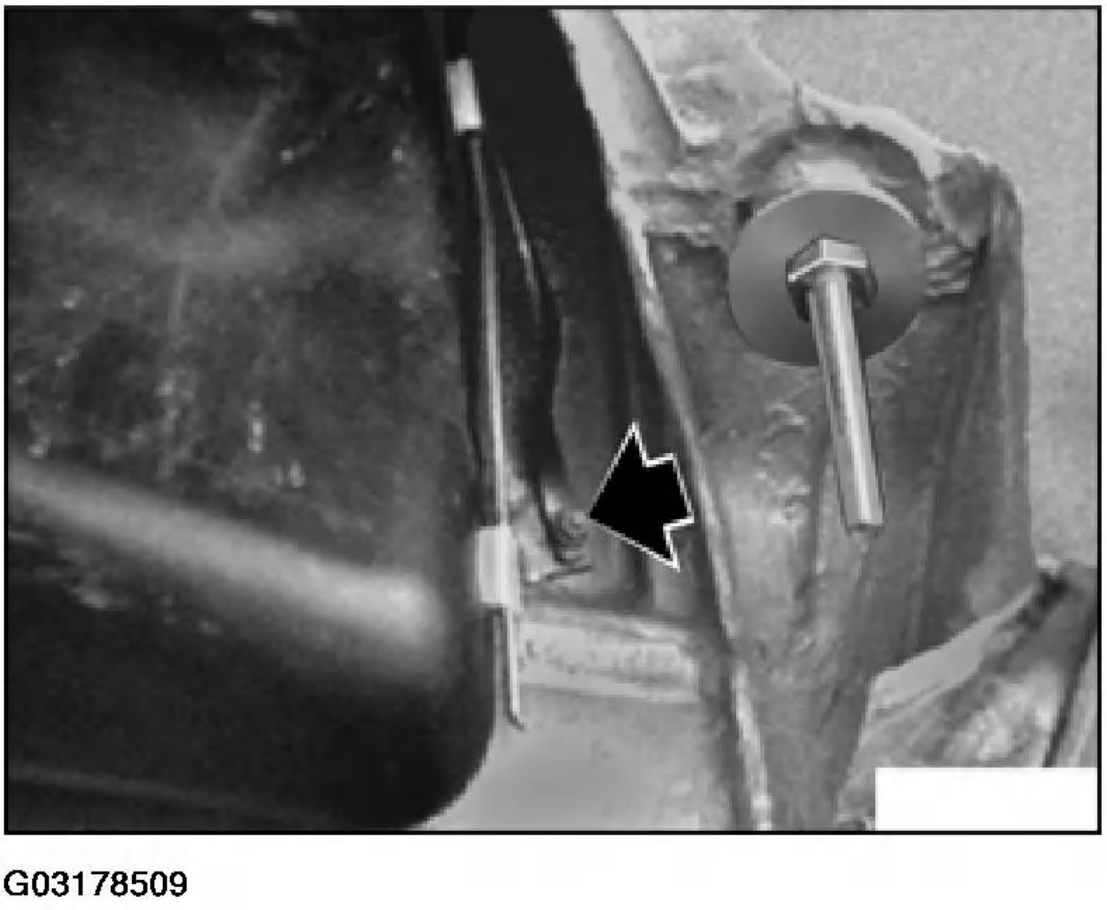



Fig. 17: Removing Ground Strap
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock and remove connecting nipple from tank ventilation line (1) with special tool 16 1 040.

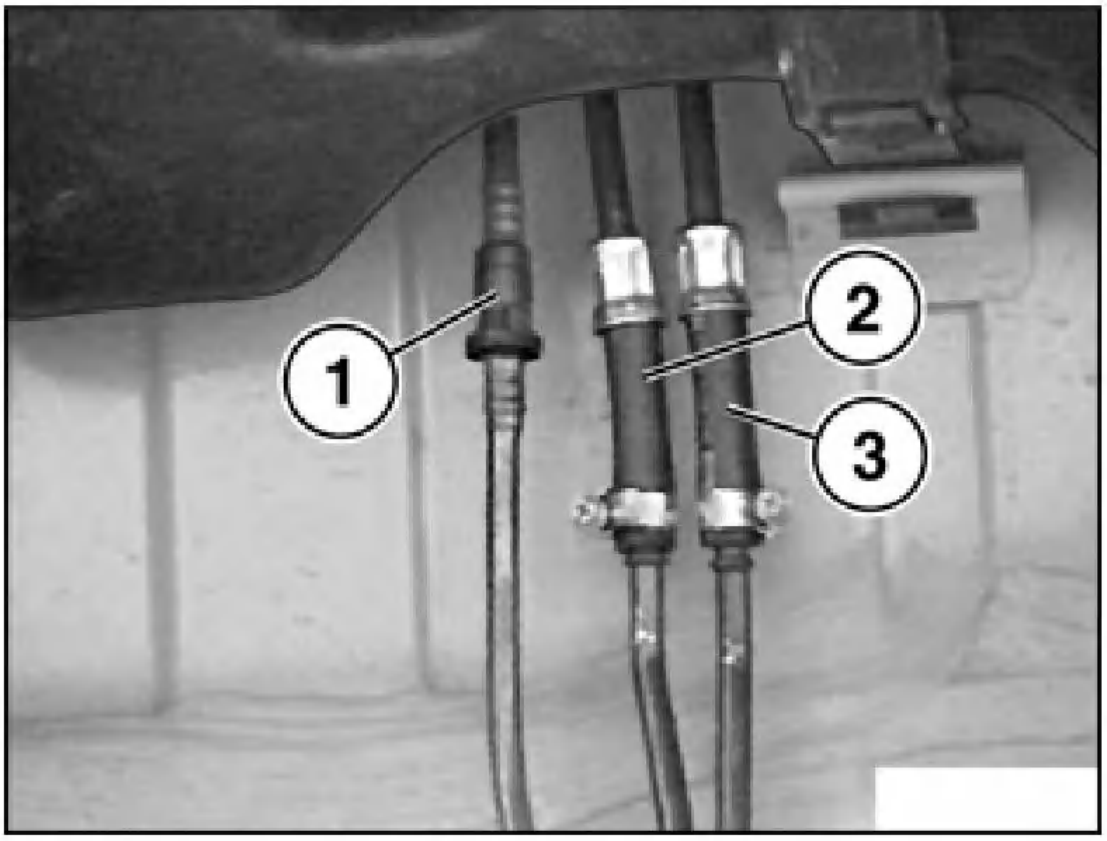



Fig. 18: Removing Connecting Nipple From Tank Ventilation Line With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Inlet line (2).

Return line (3).

Disconnect fuel hose with special tool 13 3 010 and remove supply line (5).

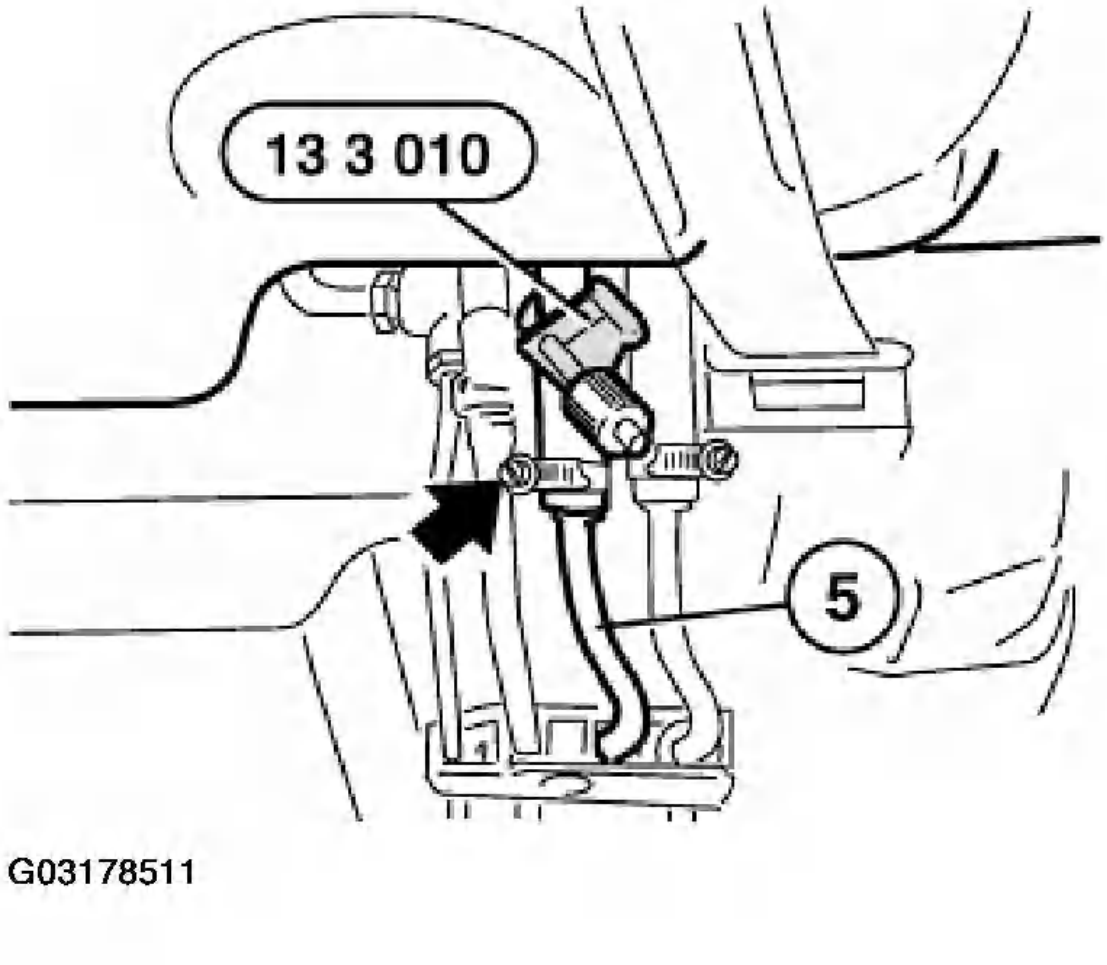



Fig. 19: Disconnecting Fuel Hose With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace hose clip.

Disconnect fuel hose with special tool 13 3 010 and remove return line (6).

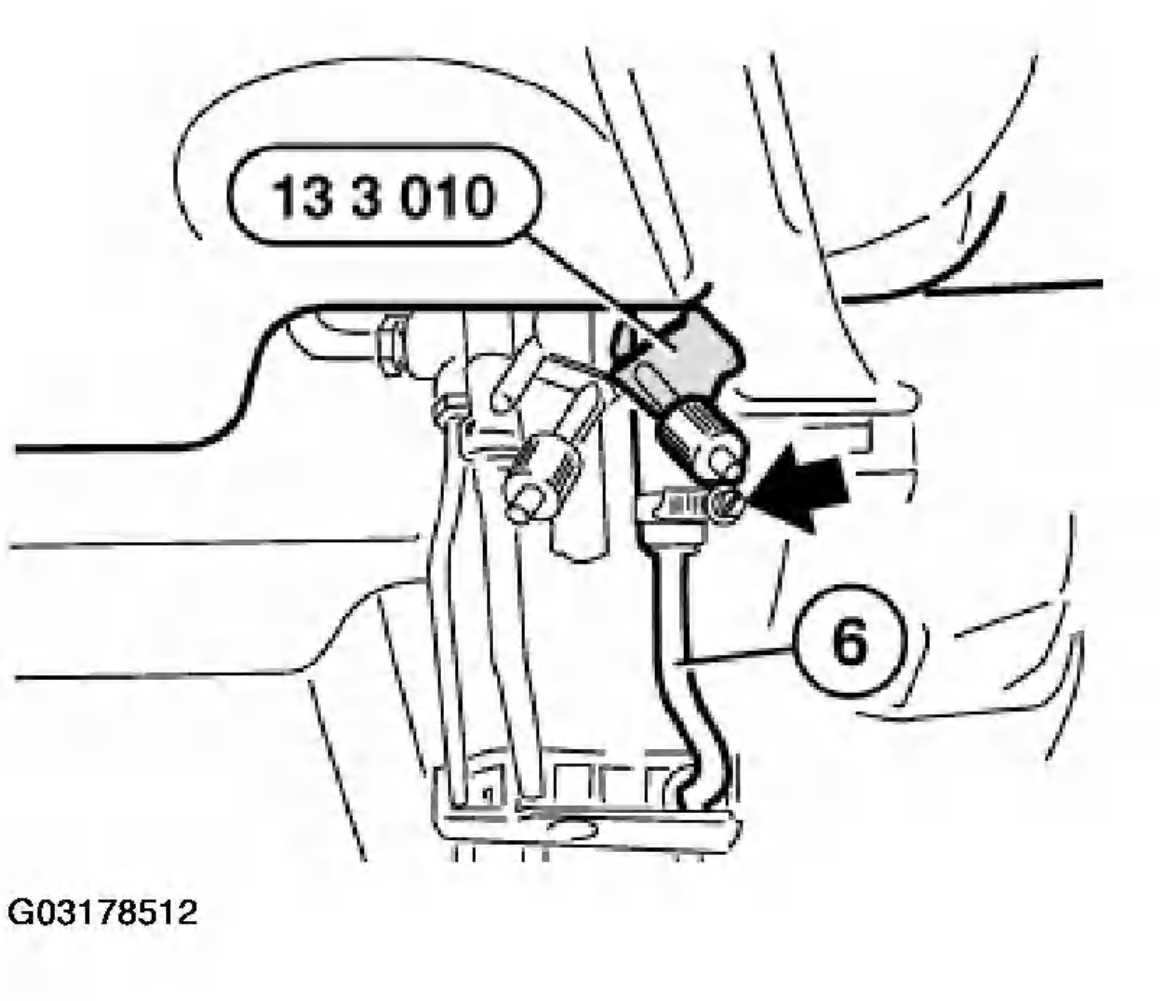



Fig. 20: Disconnecting Fuel Hose With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace hose clip.

Unfasten screws (1) on clamping tapes.

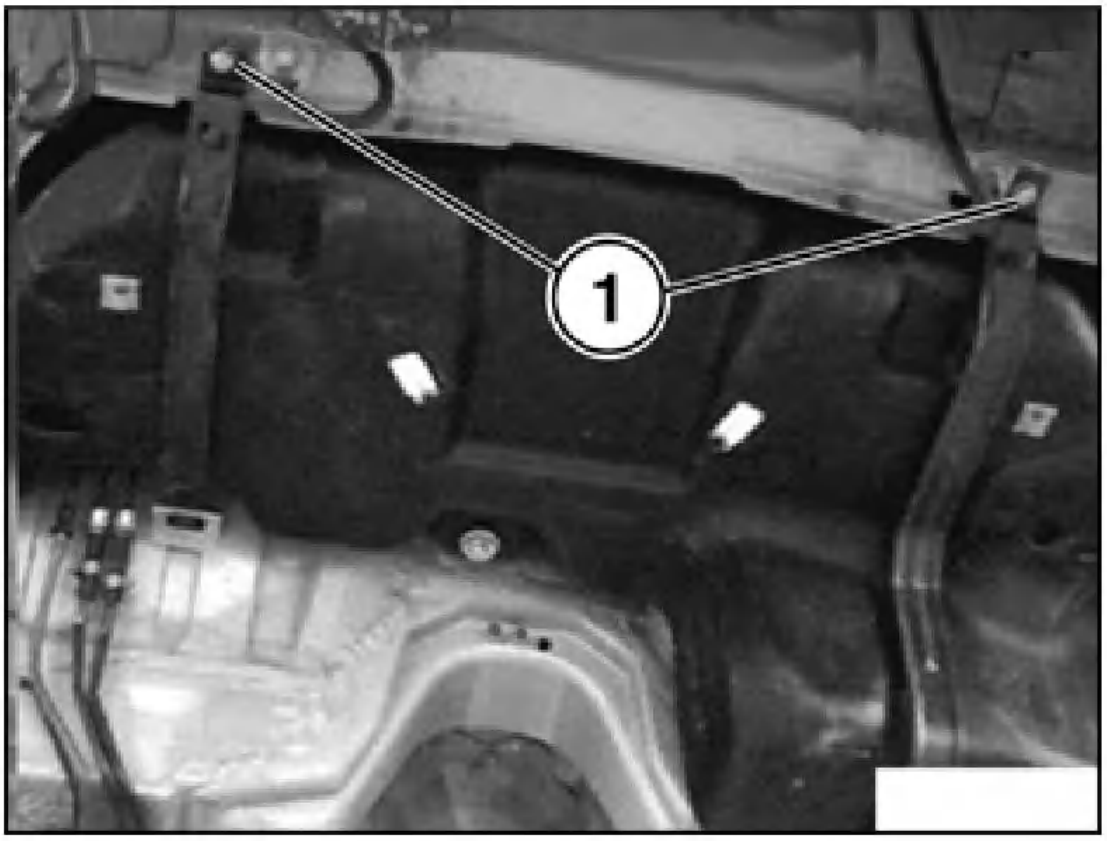



Fig. 21: Removing Screws From Clamping Tapes
Courtesy of BMW OF NORTH AMERICA, INC.

Support fuel tank with special tool 00 2 020.

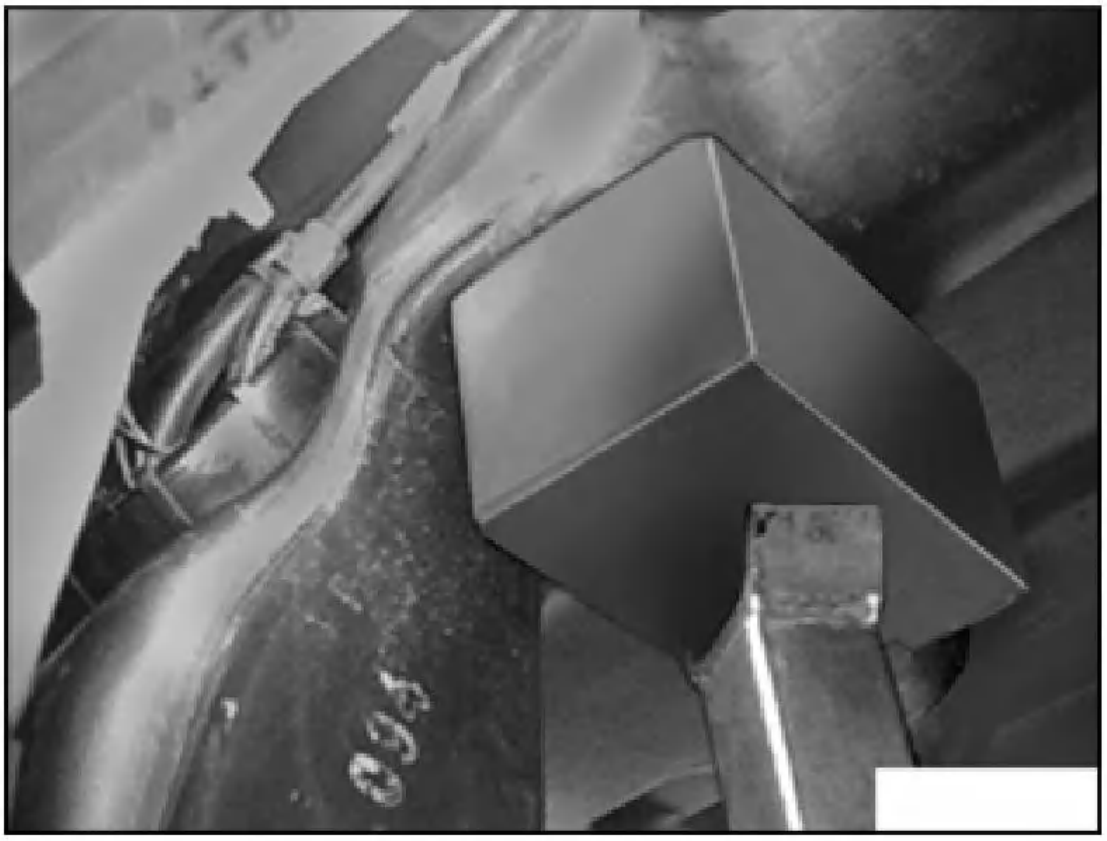



Fig. 22: Supporting Fuel Tank With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew screw.




Fig. 23: Removing Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Lower fuel tank approx. 5 ... 10 cm.

Unfasten plug connection.




Fig. 24: Disconnecting Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Pull fuel tank down to remove.

## 16 11 130 CHECKING FILLER CAP PRESSURE RELIEF VALVE

NOTE: For Special Tools identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 13 3 010
- 16 1 171
- 16 1 172
- 16 1 173

Set pressure regulator on special tool 16 1171 fully in "-" direction.

Connect special tool 16 1 171 via compressed air line (1) to garage compressed air system (8...10 bar).

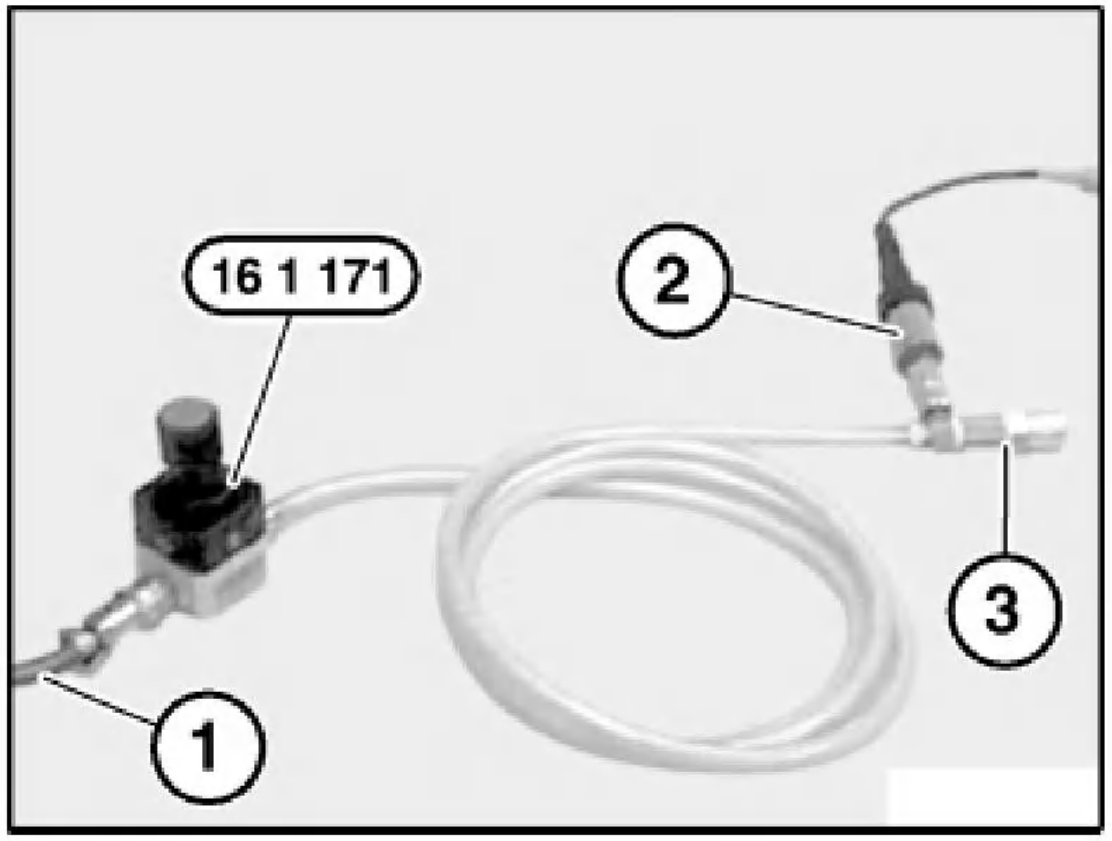



Fig. 25: Connecting Special Tool Via Compressed Air Line To Garage Compressed Air System
Courtesy of BMW OF NORTH AMERICA, INC.

Connect pressure sensor (2) of Diagnosis and Information System with a measuring range of 0...3.5 bar.

Select special tool 16 1172 or 16 1173 matching vehicle's filler cap and attach to quick release coupling of special tool 16 1 171.

Install filler cap on selected special tool (3).

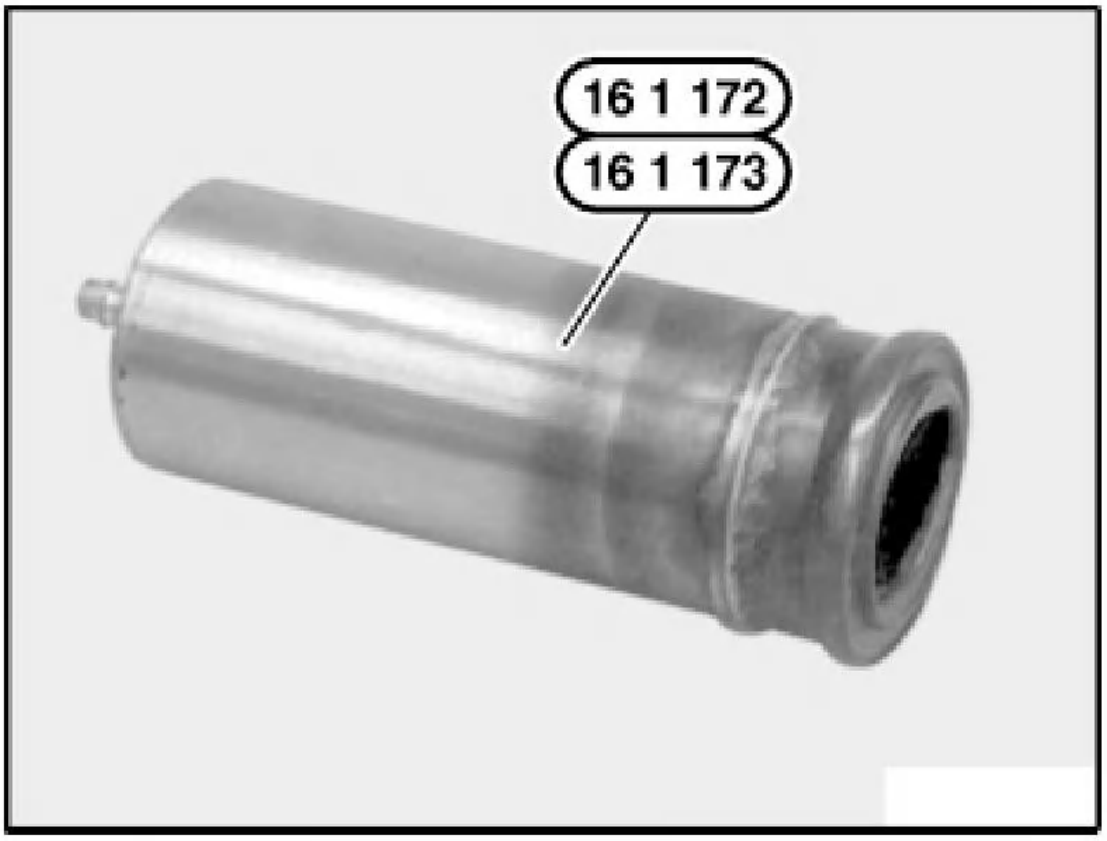



Fig. 26: Identifying Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Only the absolute pressure is indicated in the display of the Diagnosis and Information System (DIS). The current ambient air pressure is already displayed without additional pressurization.

Check Testing Equipment For Leaks!

Select "Measurement" function on Diagnosis and Information System (DIS).

Set measuring range according to pressure sensor to 0-3.5 bar.

Increase pressure by 0.2 bar with pressure regulator on special tool 161 171.

Using special tool 133010, disconnect delivery line from special tool 16 1171 to tank filler neck.

Wait 60 secs.

Read off final pressure value and compare with starting pressure value.

Measurement evaluation:

MEASUREMENT EVALUATION

| | |
|---|---|
| Pressure drop > 0.012 bar | Testing equipment leaking. Check connection points for leaks. |

Check filler cap pressure relief!

Follow same test procedure as for "Checking testing equipment for leaks".

Increase pressure by 0.3 bar with pressure regulator on special tool 16 1 171.

Measurement Evaluation:

MEASUREMENT EVALUATION

| | |
|---|---|
| Pressure drop > 0.012 bar | Filler cap pressure relief valve faulty. Replace filler cap. |

## FUEL TRANSFER, SENSOR

### 16 12 000 REMOVING AND INSTALLING/REPLACING FUEL GAUGE SENSOR (Z3, UNIT, SENSOR-PUMP, COMPLETE)

Draw off fuel from fuel tank, refer to 16 00 005 DRAINING AND FILLING FUEL TANK .

Remove passenger seat, refer to 52 10 000 REMOVING AND INSTALLING FRONT SEAT .

Cut carpet along perforation.

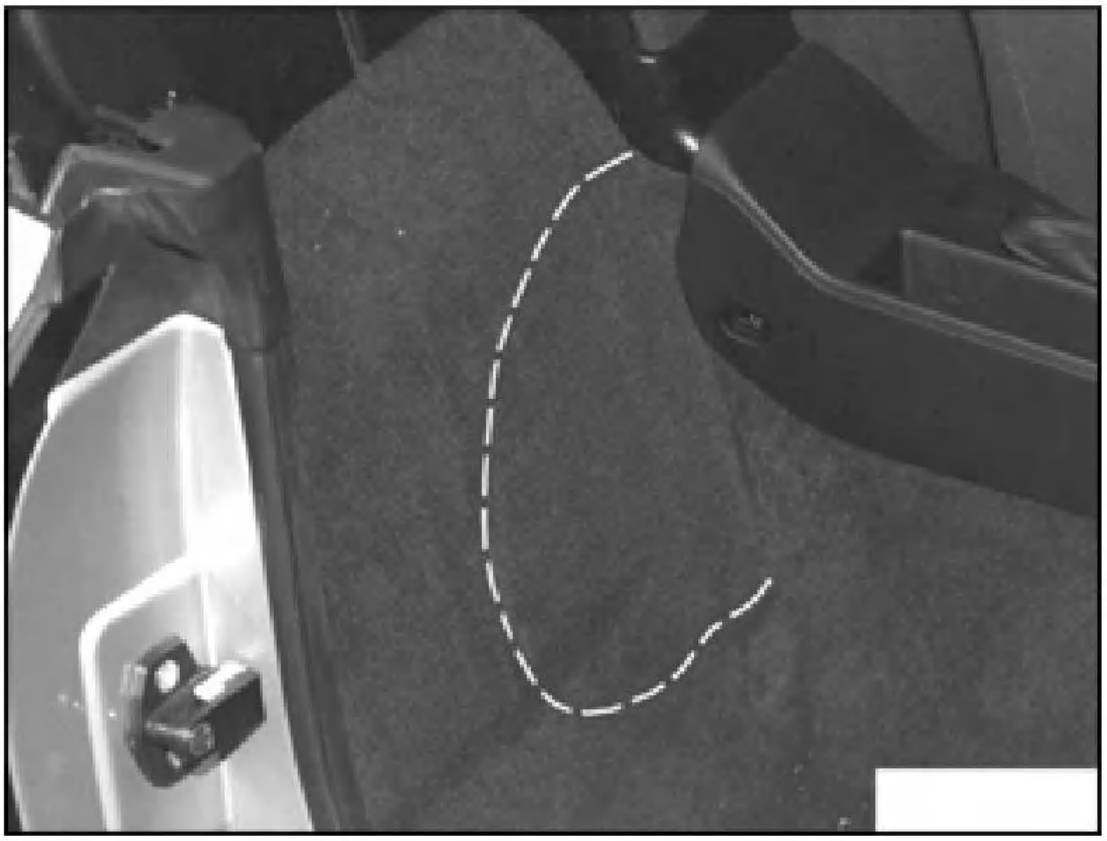



Fig. 27: Cutting Carpet Along Perforation
Courtesy of BMW OF NORTH AMERICA, INC.

Fold carpet (1) to one side. Unfasten screws (2) and remove cover.

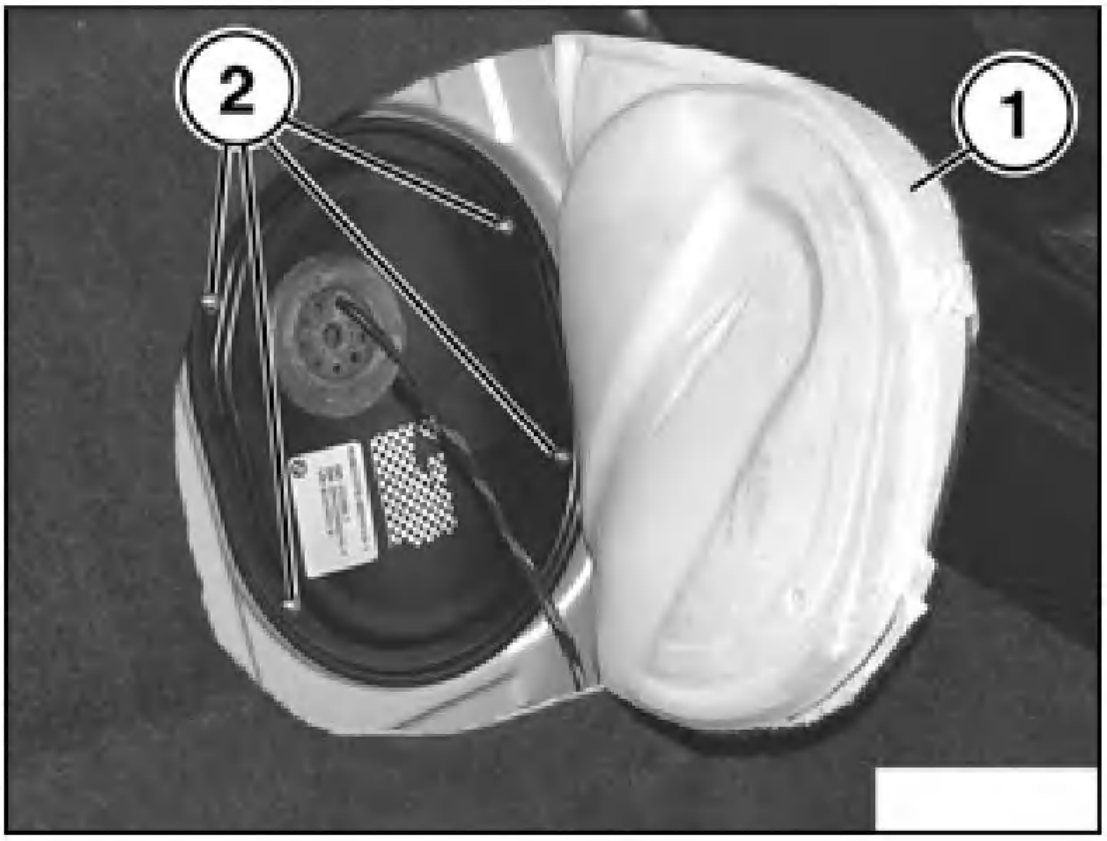



Fig. 28: Removing Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten hose clip (1/2) with special tool and remove hoses. Unlock connector (3) and remove.

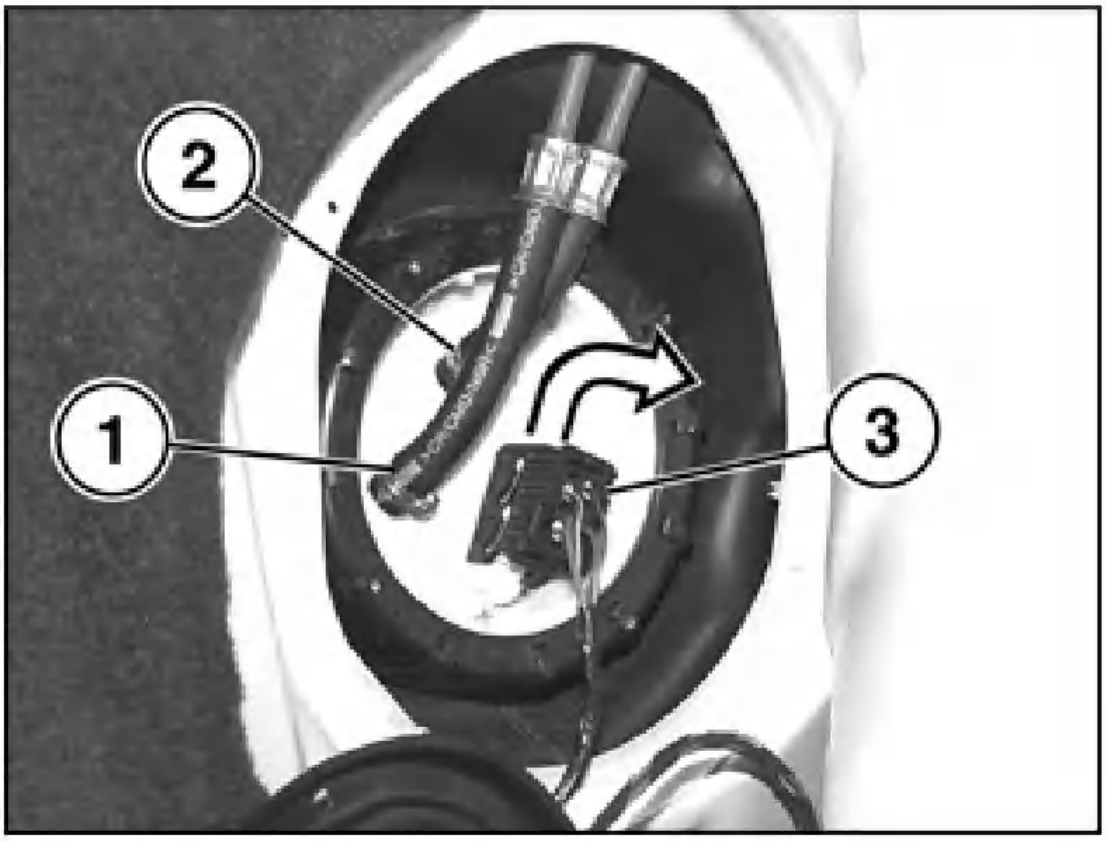



Fig. 29: Unlocking Connector
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: To open the reusable hose clip, fit special tool (32 3 020) with round side (1) as illustrated.

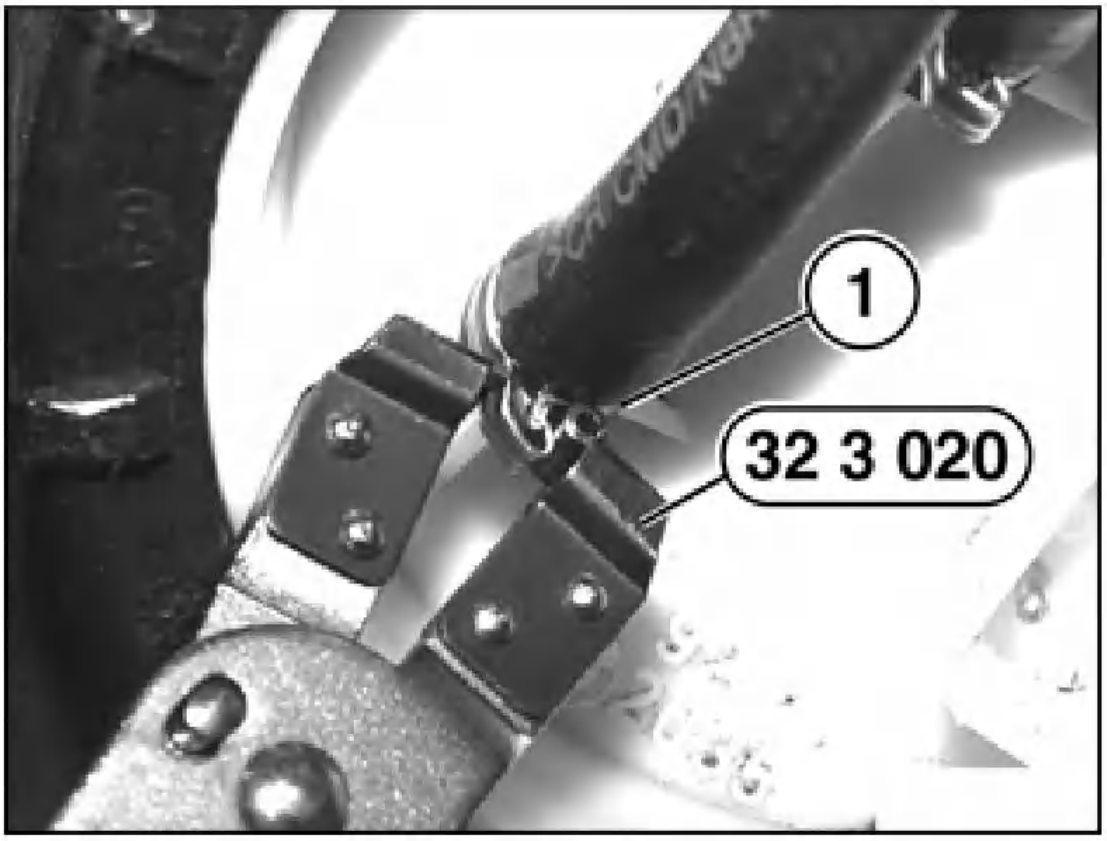



Fig. 30: Opening Reusable Hose Clip
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: To close the reusable hose clip, fit special tool (32 3 020) with the round side (1) as illustrated. Hose clip engages audibly when closing.

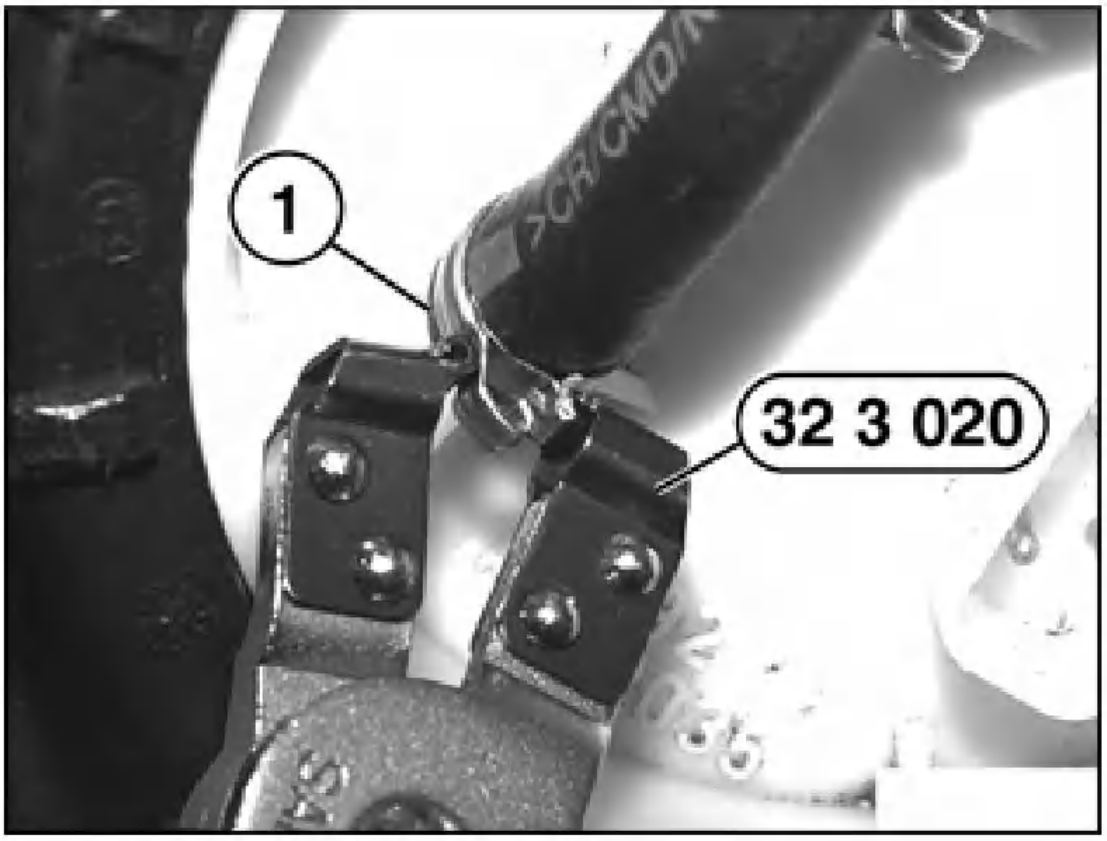



Fig. 31: Closing Reusable Hose Clip
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten rotary connection with special tool 16 1 020.

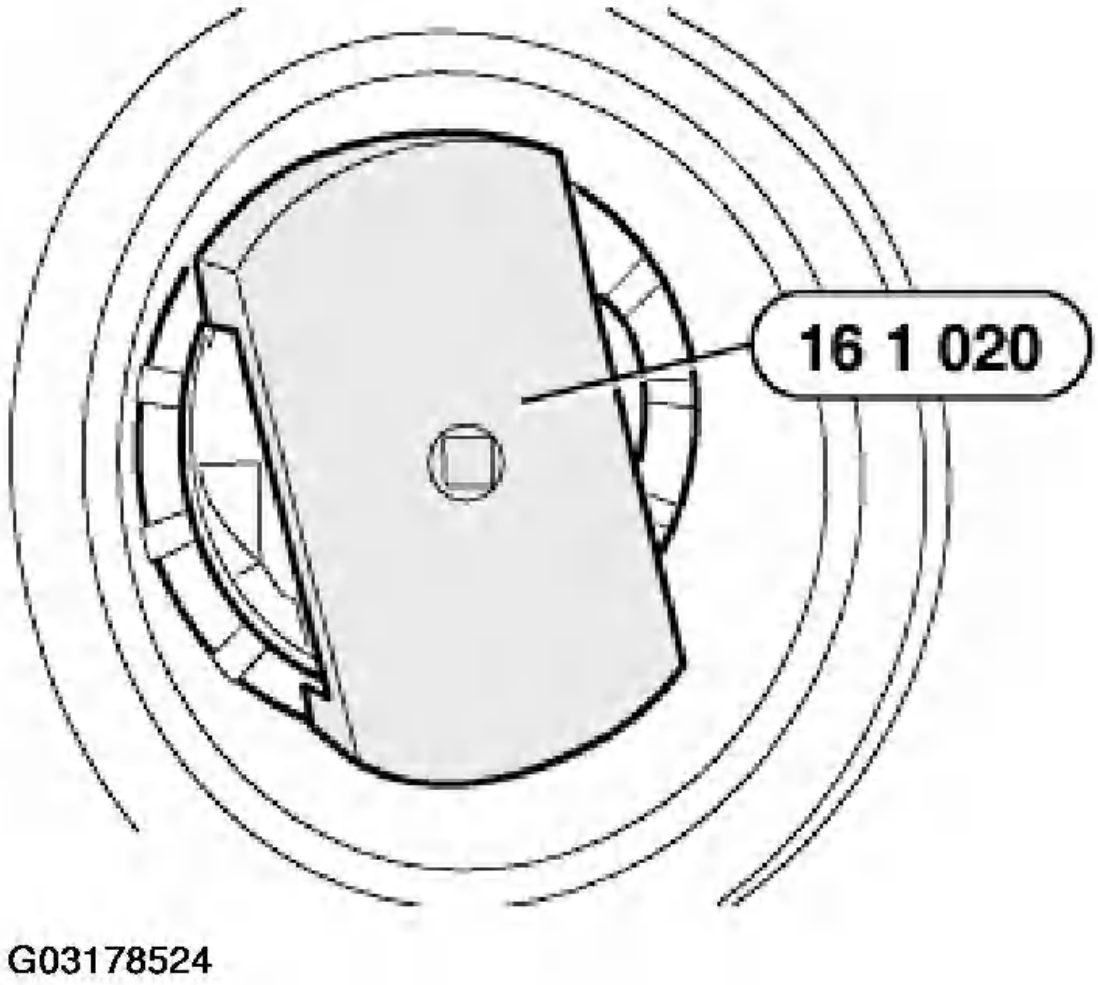



Fig. 32: Removing Rotary Connection With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace sealing ring. Check rotary connection for damage and replace if necessary. To ensure adequate preload on the seal, always fit new rotary connection on torsion bar.

Tighten rotary connection with torsion bar and check torque.

Tightening torque, refer to 16 14 2AZ FUEL PUMP .

Installation:

Replace sealing ring, first inserting sealing ring in the fuel tank.

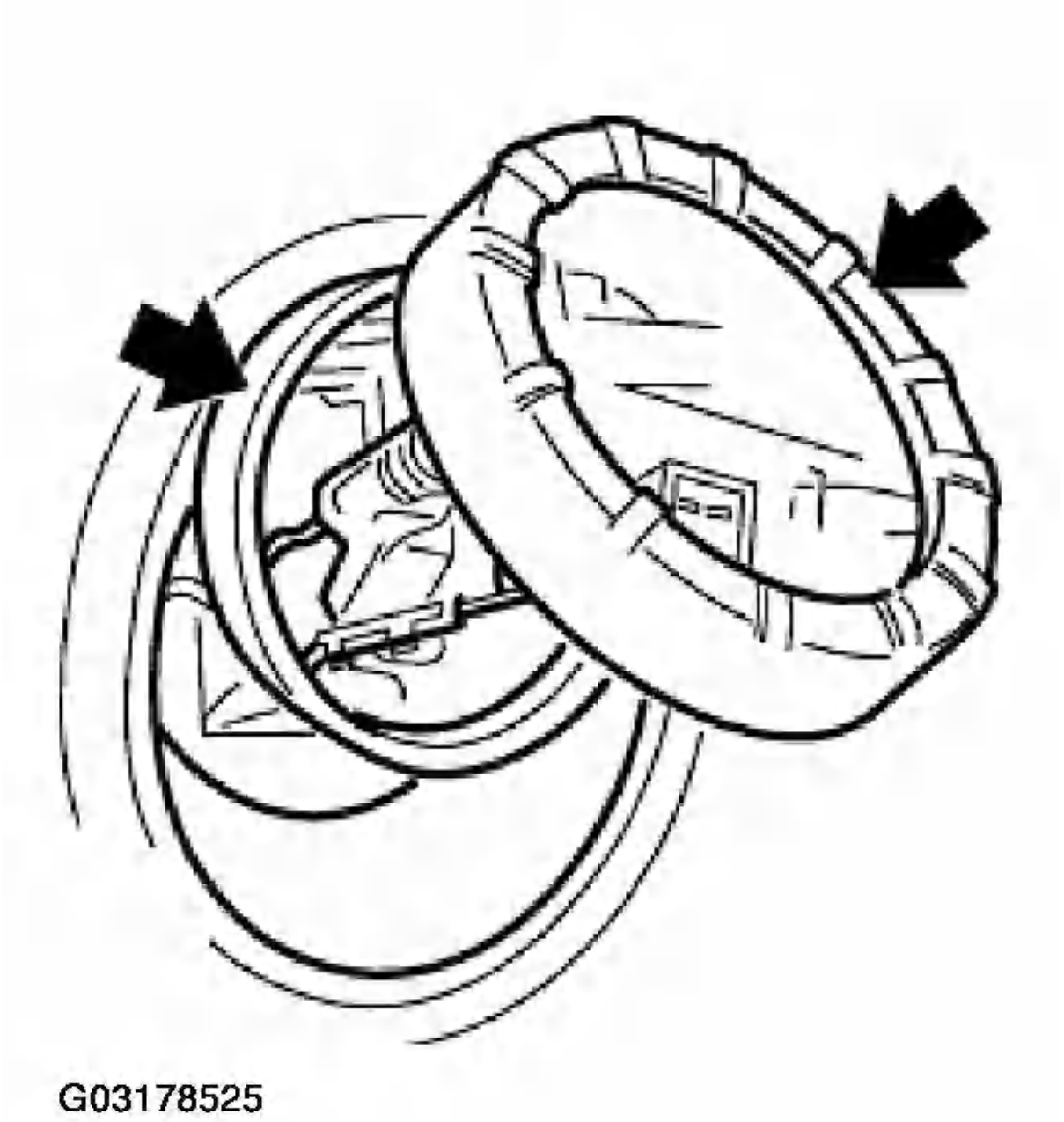



Fig. 33: Inserting Sealing Ring In Fuel Tank
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Ensure that the position marks on tank and supply unit are aligned opposite to one another.

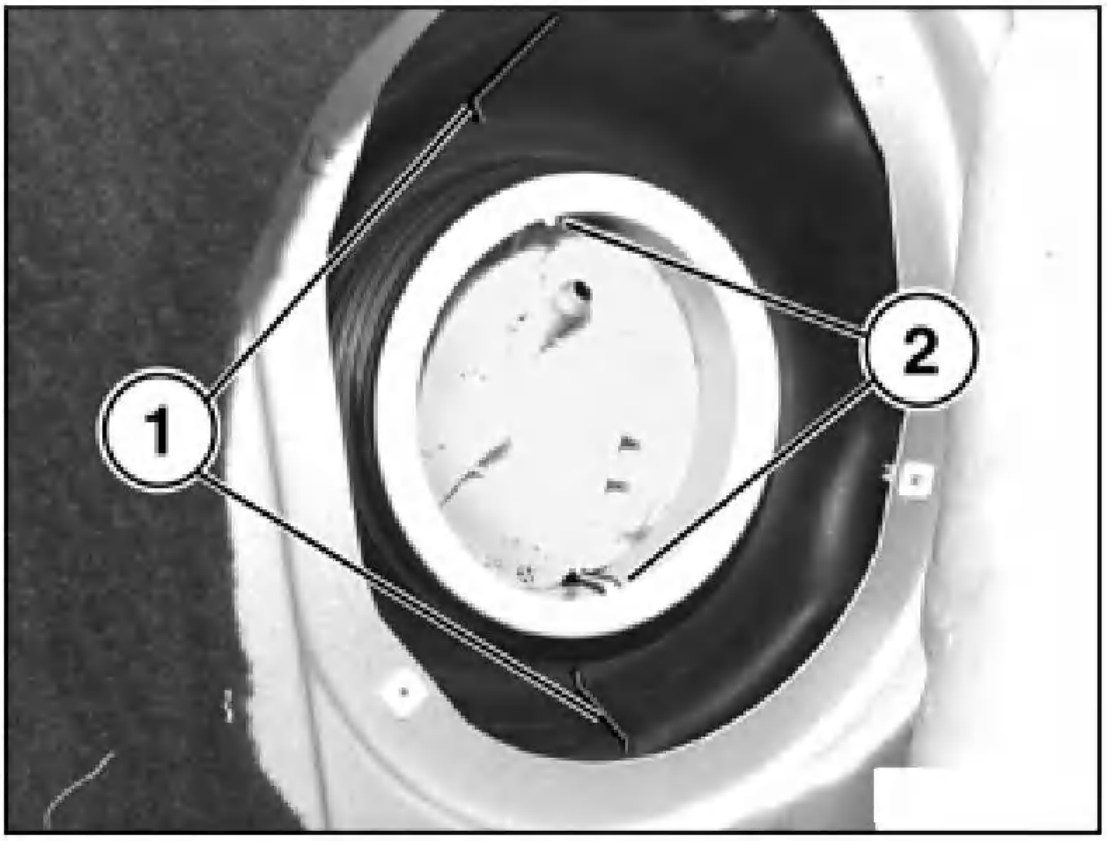



Fig. 34: Aligning Position Marks On Tank And Supply Unit
Courtesy of BMW OF NORTH AMERICA, INC.

## 16 12 010 REMOVING AND INSTALLING/REPLACING CARBON CANISTER (M ROADSTER, M COUPE AND Z3/USA)

Open hose clip (1) and pull off evaporation line.

Installation:

Replace hose clip.

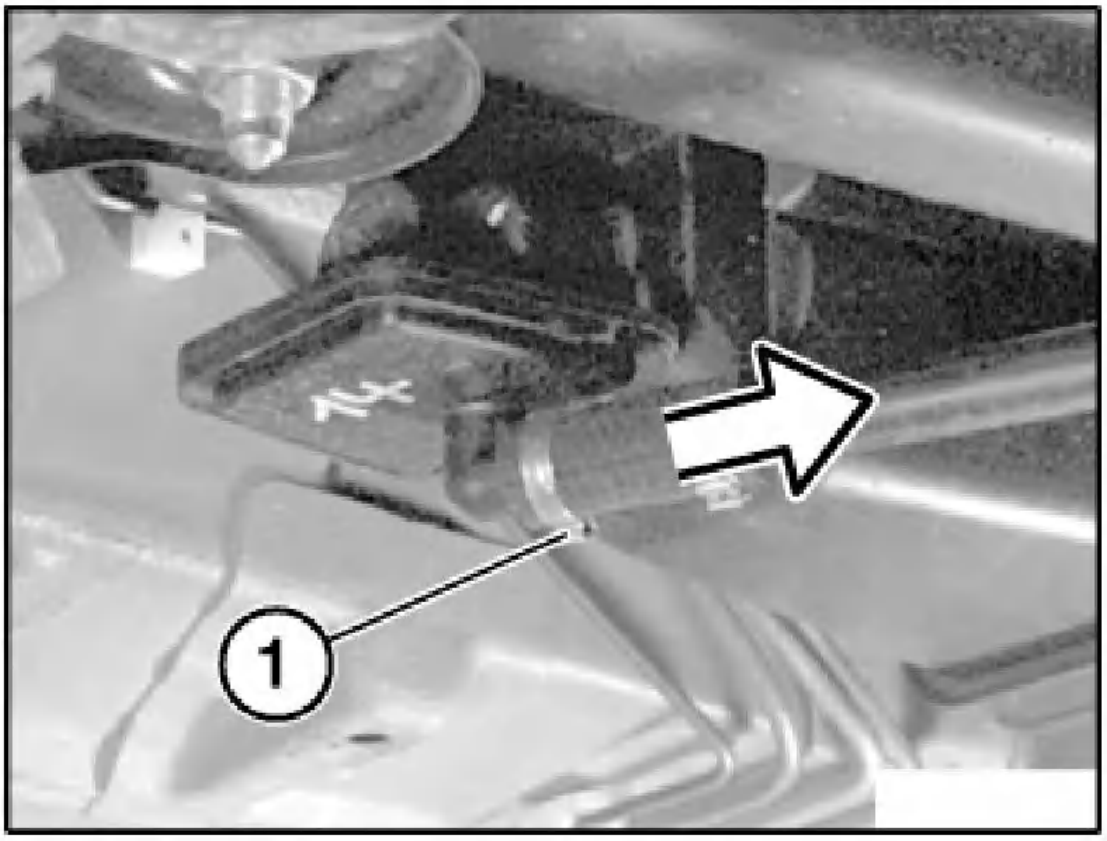



Fig. 35: Opening Hose Clip
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten plastic nut (1).

Unfasten hexagon bolt (2) and take off clamping strap (3). Carefully lower the activated carbon canister.

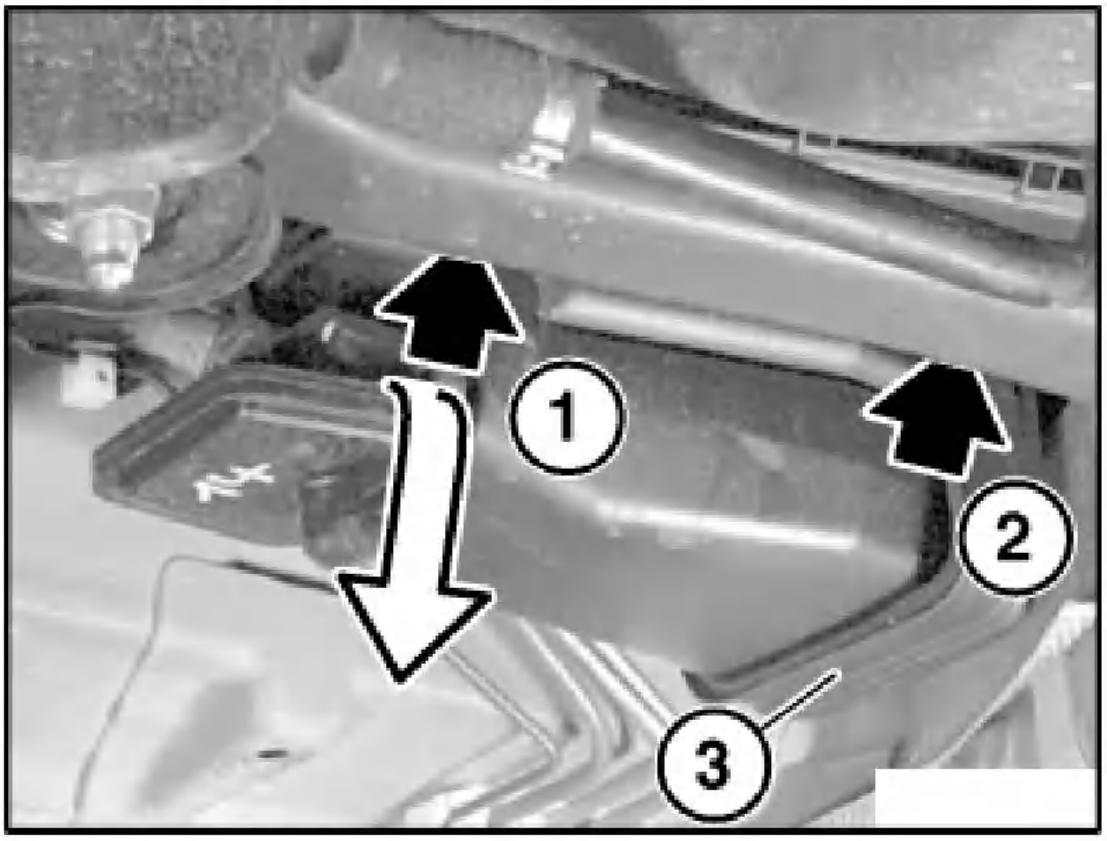



Fig. 36: Lowering Activated Carbon Canister
Courtesy of BMW OF NORTH AMERICA, INC.

Actuate unlocking fixture (2) and pull off vent line (1).

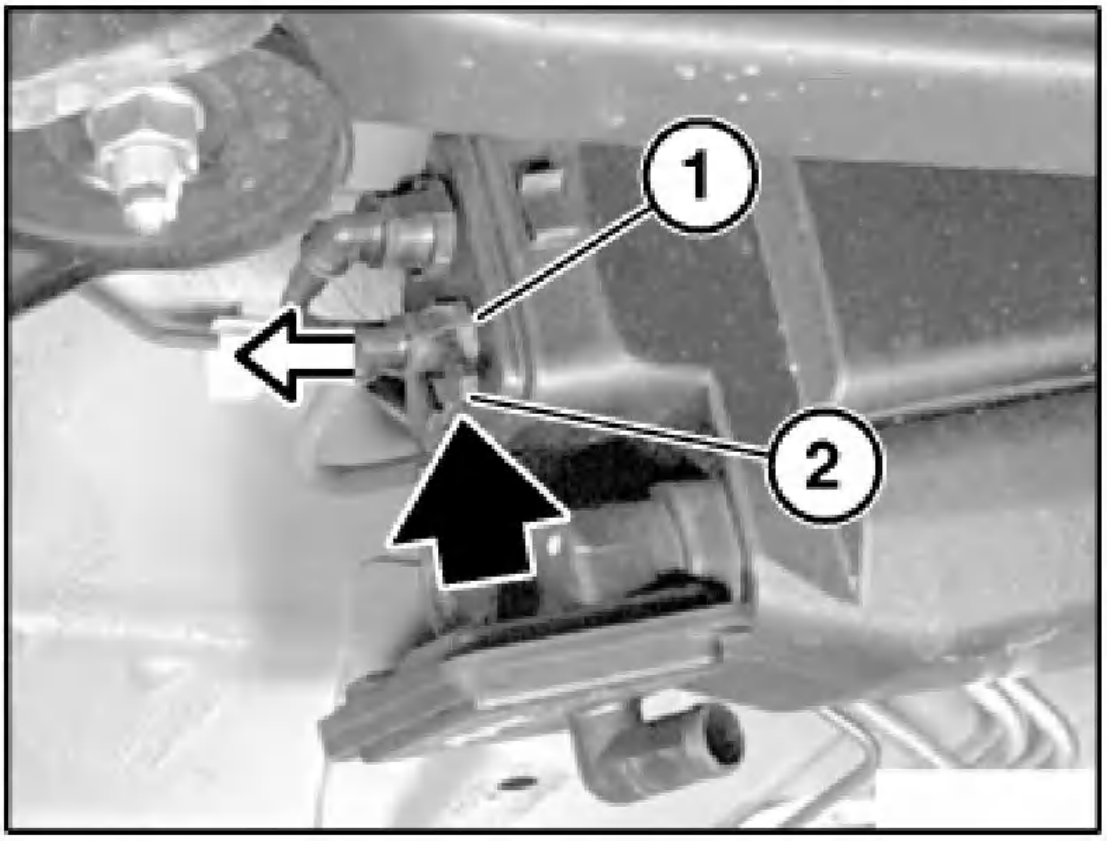



Fig. 37: Actuating Unlocking Fixture
Courtesy of BMW OF NORTH AMERICA, INC.

Unclip the tank vent line (1) and the vent line (2) on the front side of the activated carbon canister.

Installation:

Clip in lines in the proper position.

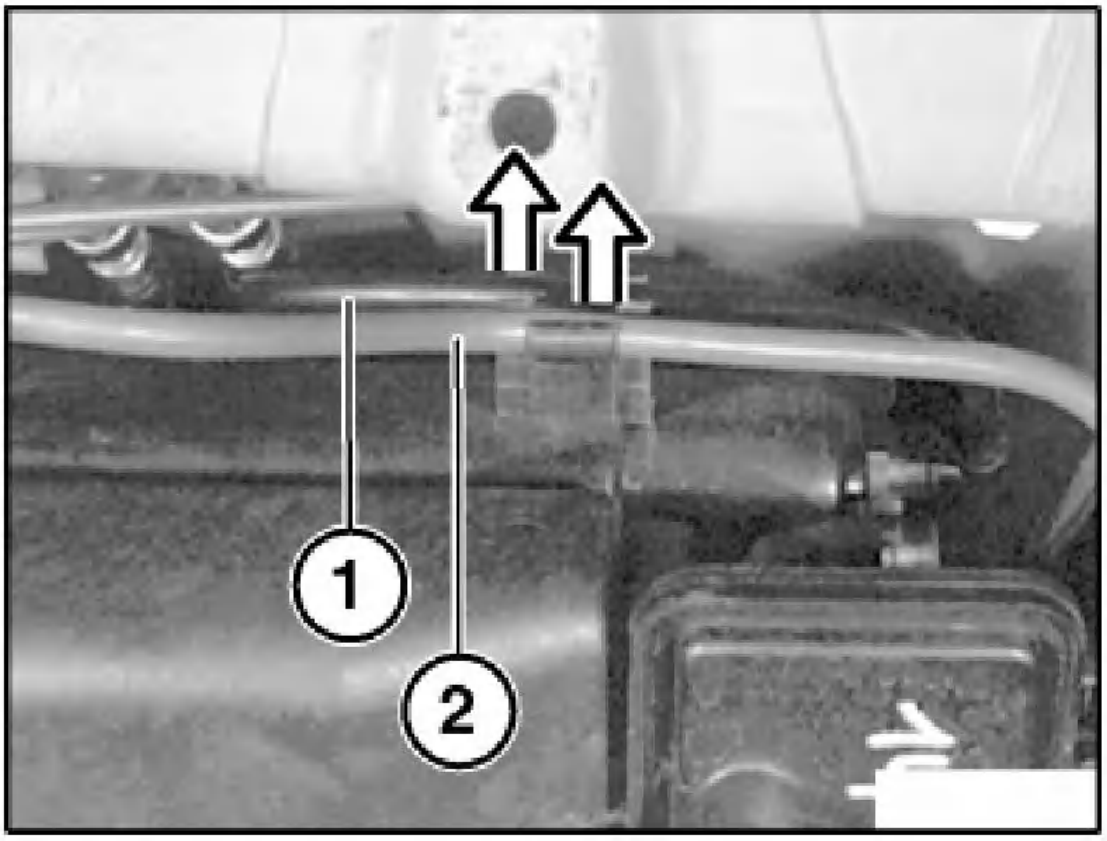



Fig. 38: Uncliping Tank Vent Line
Courtesy of BMW OF NORTH AMERICA, INC.

Press together ring (1) to release the detent. Pull off tank vent line (2).

Remove activated carbon canister.

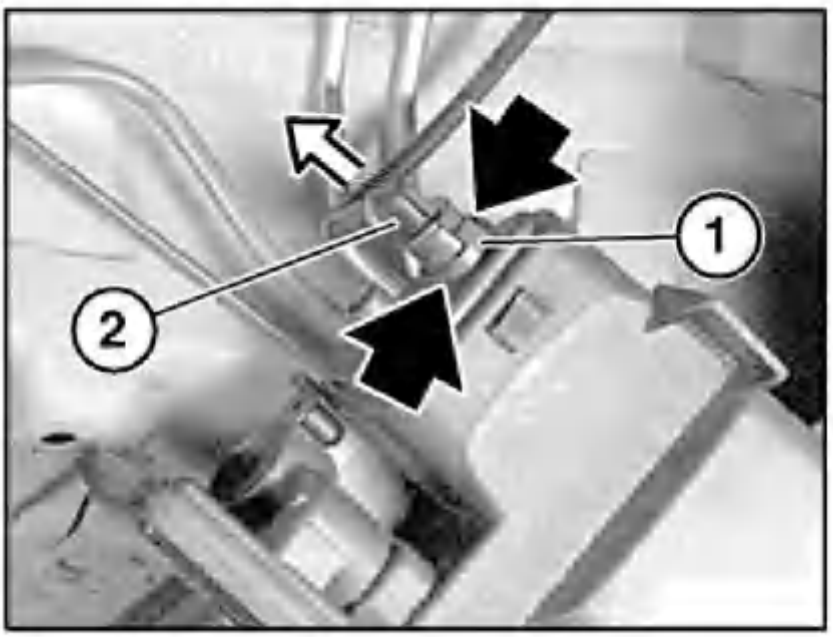



Fig. 39: Removing Activated Carbon Canister
Courtesy of BMW OF NORTH AMERICA, INC.

## 16 12 010 REMOVING AND INSTALLING/REPLACING CARBON CANISTER (Z3)

Unlock and disconnect plug connection (1) of vent line to expansion tank.

Open hose clip (6) and pull off scavenging line (2).

Detach evaporation line (3) from carbon canister (4).

Release screws (5). Lift carbon canister (4) out of metal bracket.

Installation:

Make sure plug connection (1) engages properly.

Replace hose clip (6).

Tightening torque,

refer to 16 12 7AZ FUEL TRANSFER SENSOR .

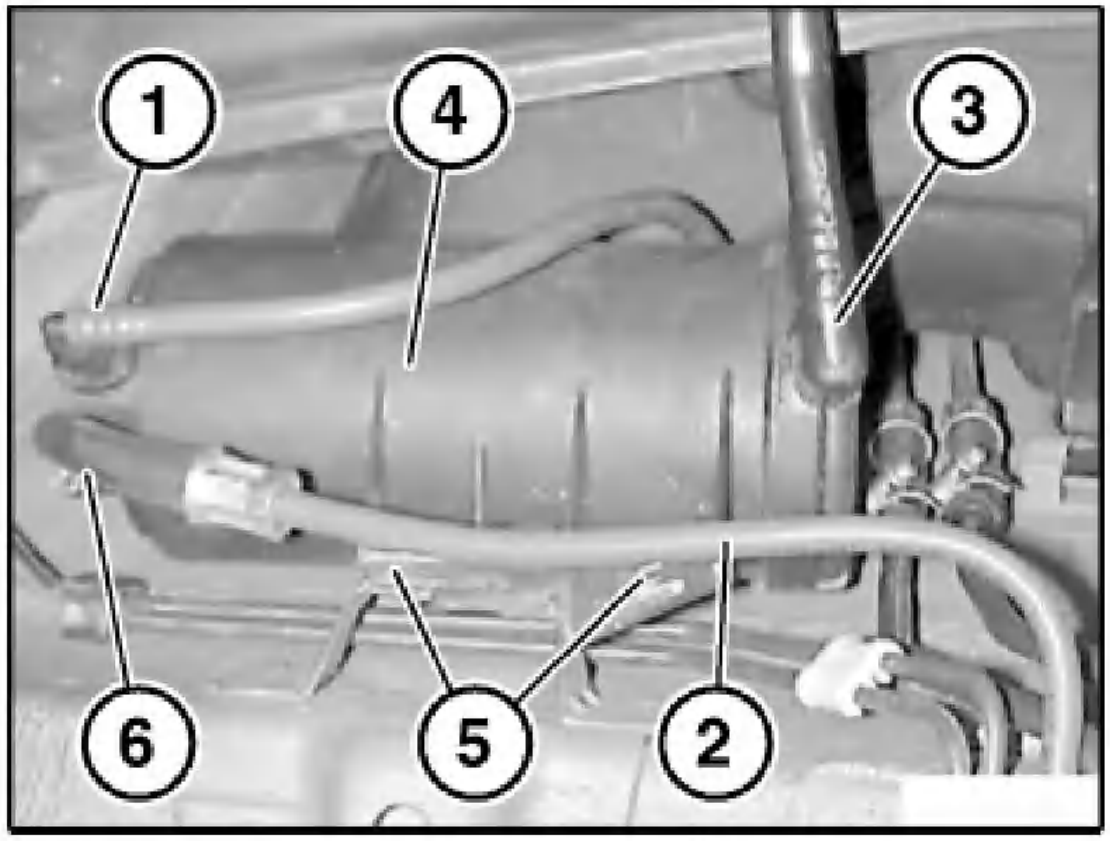



Fig. 40: Disconnecting Plug Connection Of Vent Line To Expansion Tank
Courtesy of BMW OF NORTH AMERICA, INC.

## FUEL VENTILLATION

### 16 12 010 REMOVING AND INSTALLING/REPLACING CARBON CANISTER (M ROADSTER, M COUPE AND Z3/USA)

Open hose clip (1) and pull off evaporation line.

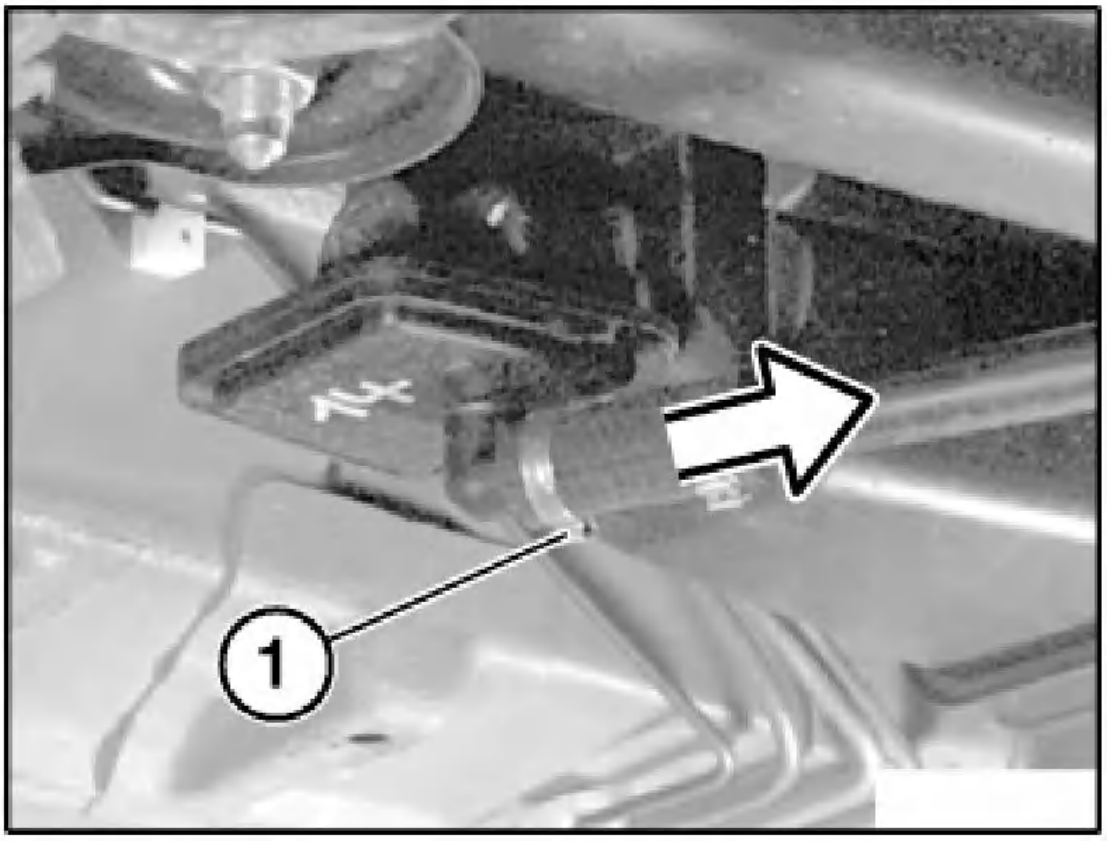



Fig. 41: Removing Evaporation Line
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace hose clip.

Unfasten plastic nut (1).

Unfasten hexagon bolt (2) and take off clamping strap (3).

Carefully lower the activated carbon canister.

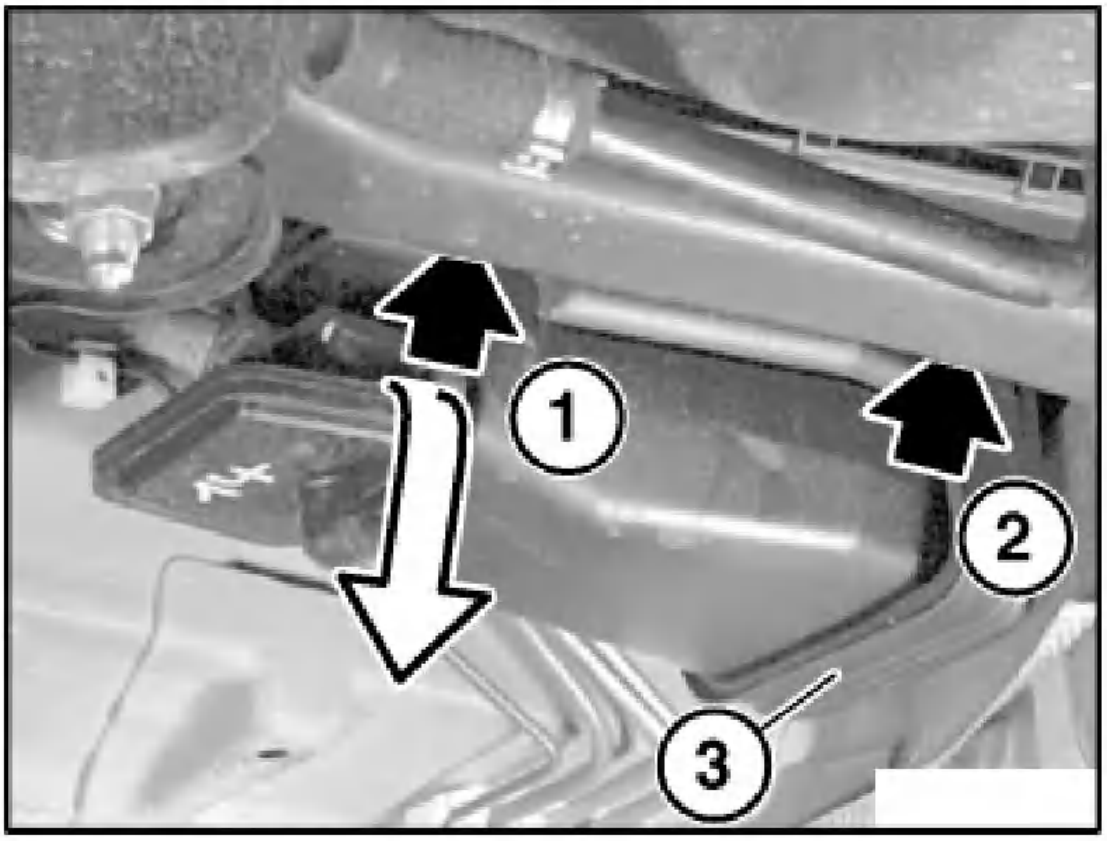



Fig. 42: Lowering Activated Carbon Canister
Courtesy of BMW OF NORTH AMERICA, INC.

Actuate unlocking fixture (2) and pull off vent line (1).

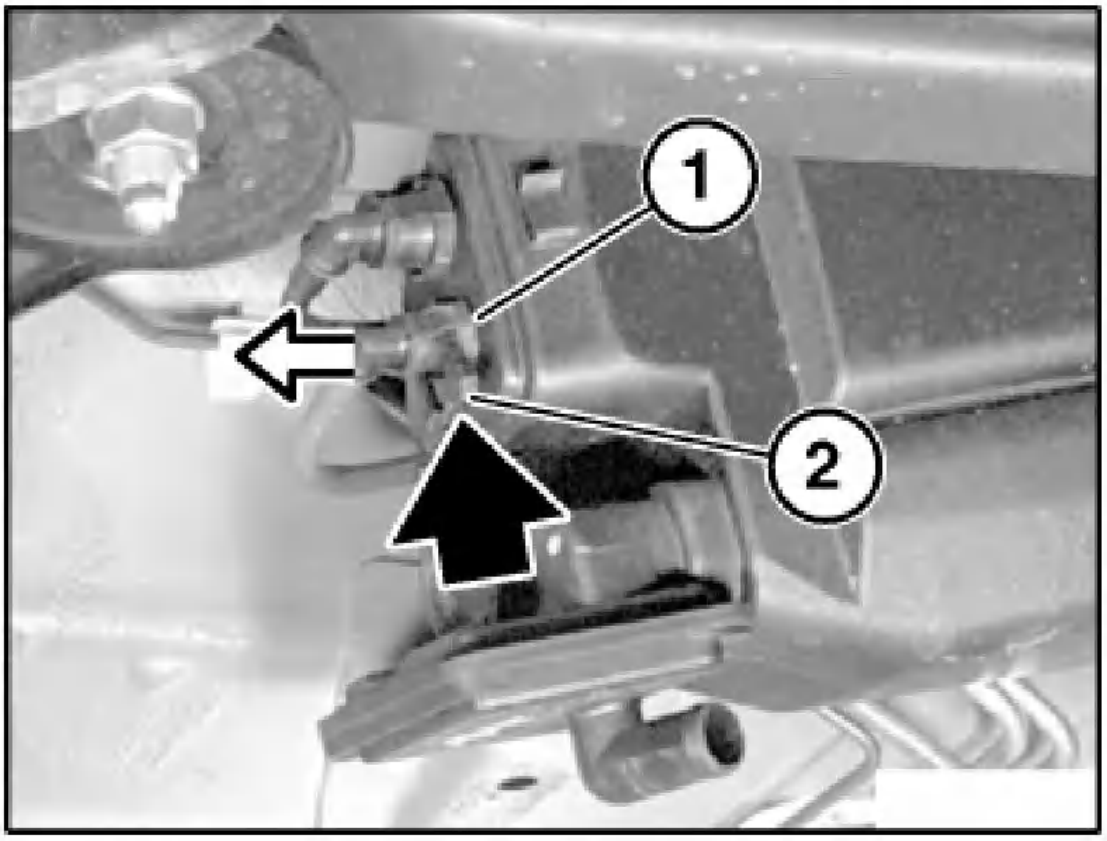



Fig. 43: Actuating Unlocking Fixture
Courtesy of BMW OF NORTH AMERICA, INC.

Unclip the tank vent line (1) and the vent line (2) on the front side of the activated carbon canister.

Installation:

Clip in lines in the proper position.

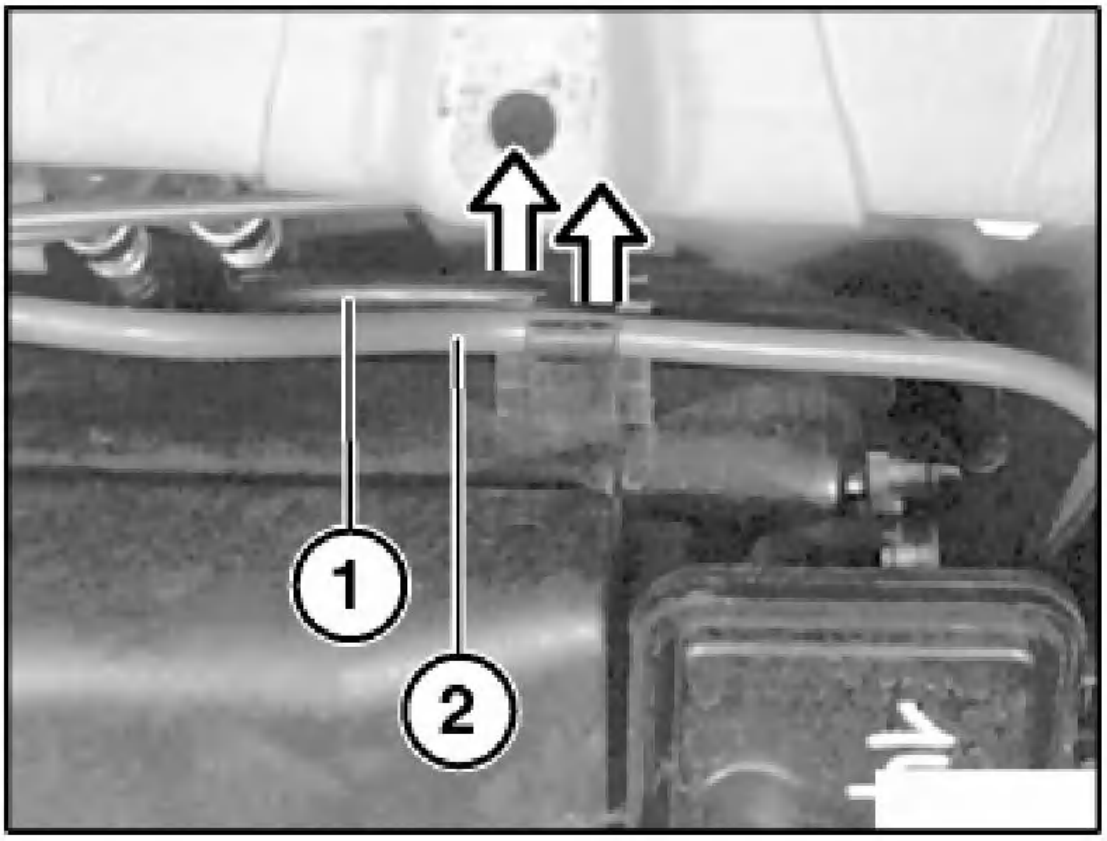



Fig. 44: Unclipping Tank Vent Line
Courtesy of BMW OF NORTH AMERICA, INC.

Press together ring (1) to release the detent. Pull off tank vent line (2).

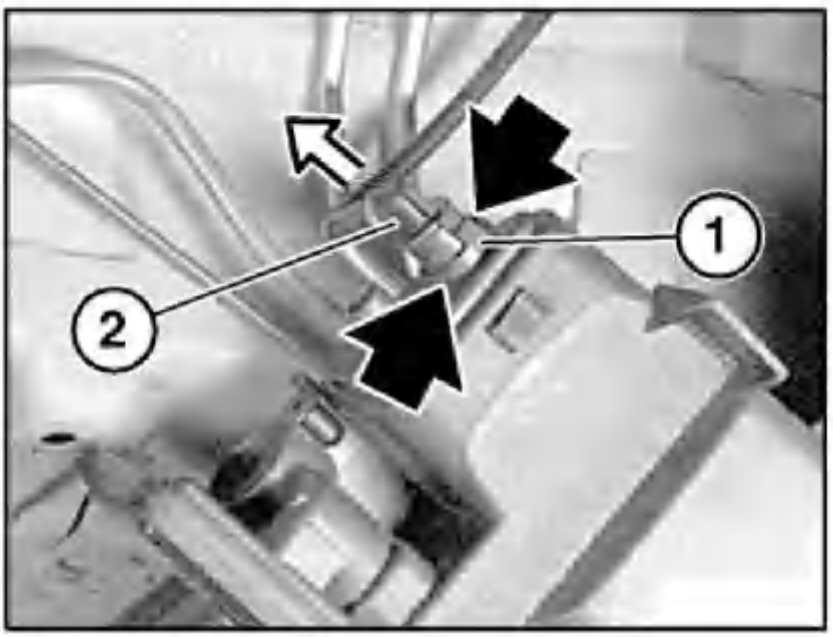



Fig. 45: Removing Tank Vent Line
Courtesy of BMW OF NORTH AMERICA, INC.

Remove activated carbon canister.

16 12 010 REMOVING AND INSTALLING/REPLACING CARBON CANISTER (Z3)

Unlock and disconnect plug connection (1) of vent line to expansion tank.

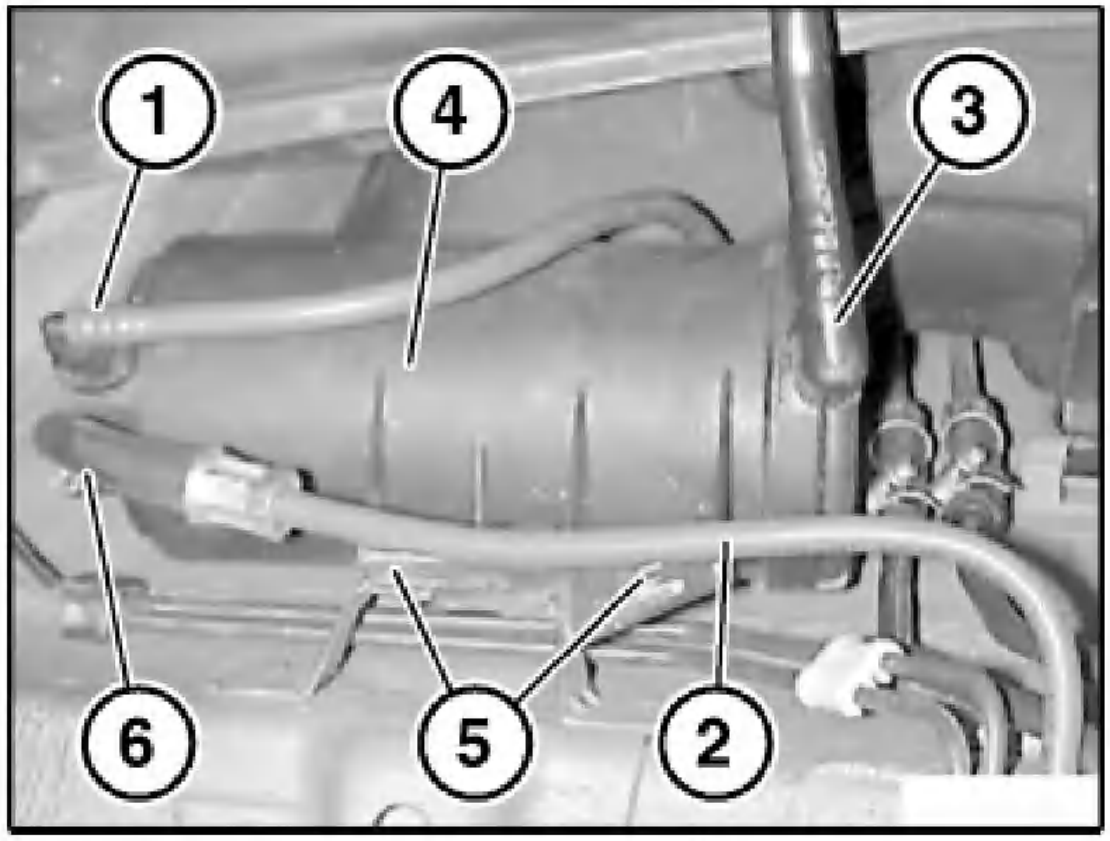



Fig. 46: Disconnecting Plug Connection Of Vent Line To Expansion Tank
Courtesy of BMW OF NORTH AMERICA, INC.

Open hose clip (6) and pull off scavenging line (2).

Detach evaporation line (3) from carbon canister (4).

Release screws (5). Lift carbon canister (4) out of metal bracket.

Installation:

Make sure plug connection (1) engages properly. Replace hose clip (6).

Tightening torque, refer to 16 12 7AZ in FUEL TRANSFER SENSOR .

## 16 13 015 REMOVING AND INSTALLING/REPLACING TANK LEAKAGE DIAGNOSIS MODULE (DM-TL)

Remove rear underbody protection from assemblies.

Remove cover at front left.

Unclip line (1) from line holders on fuel filter cover (2).

Release remaining screw connections and remove fuel filter cover (2).

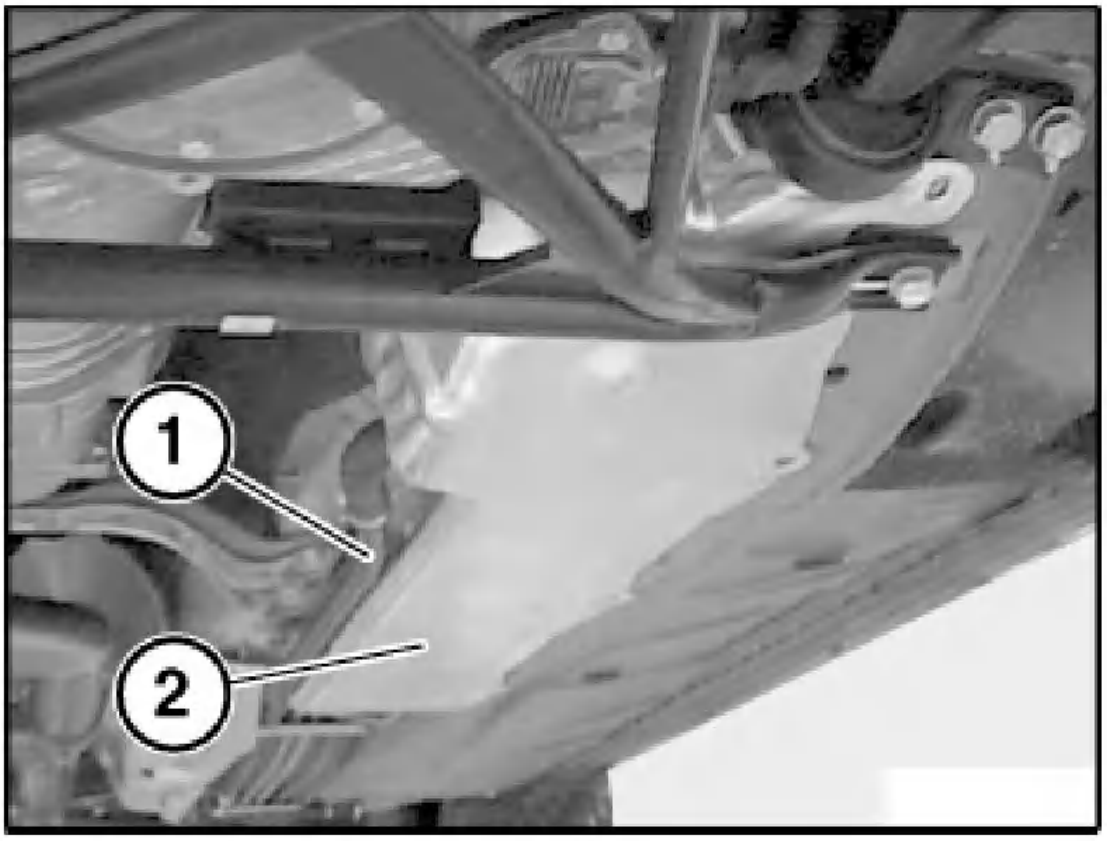



Fig. 47: Removing Fuel Filter Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock connector (1) and remove.

Press together lock (2) on plug (3).

Detach plug (3).

Release hose clip (4), detach line (5).

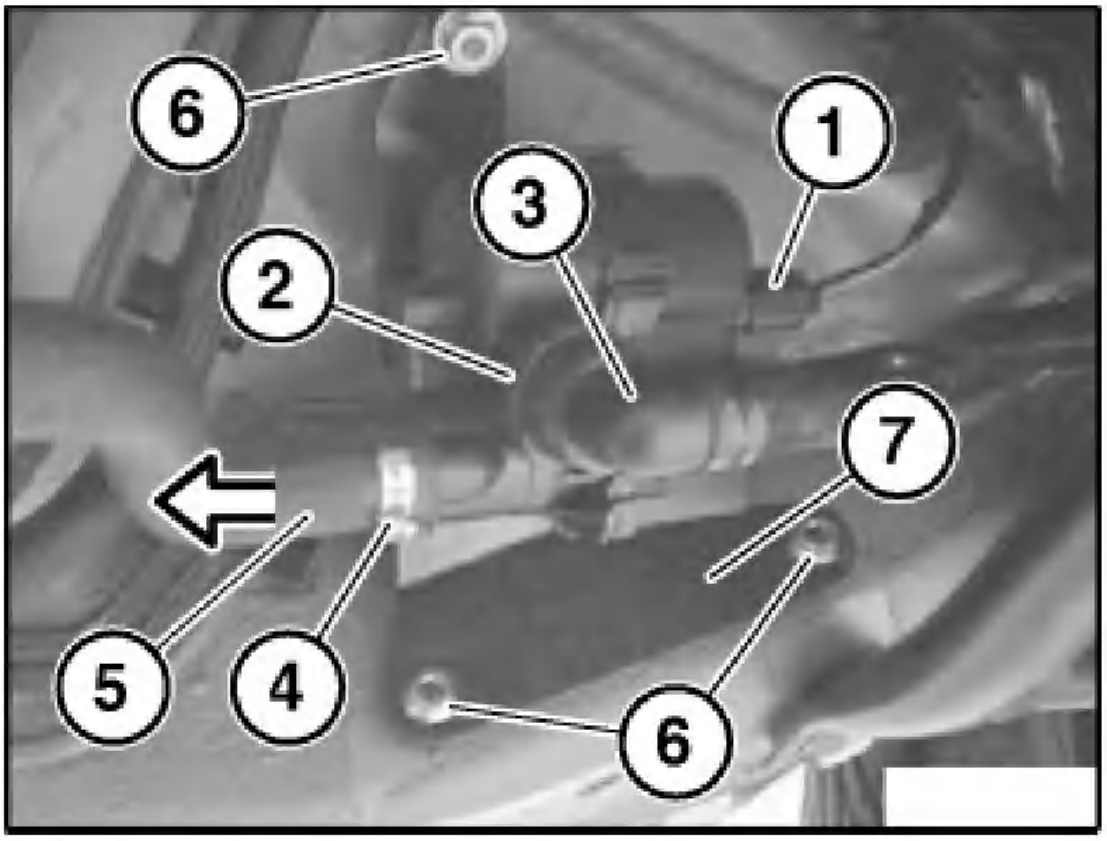



Fig. 48: Detaching line
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts (6).

Remove holder (7) with tank leakage diagnosis module.

Installation:

Replace hose clip (4).

Release screws (1) on rear side of holder (2).

Remove tank leakage diagnosis module (3) from holder (2).

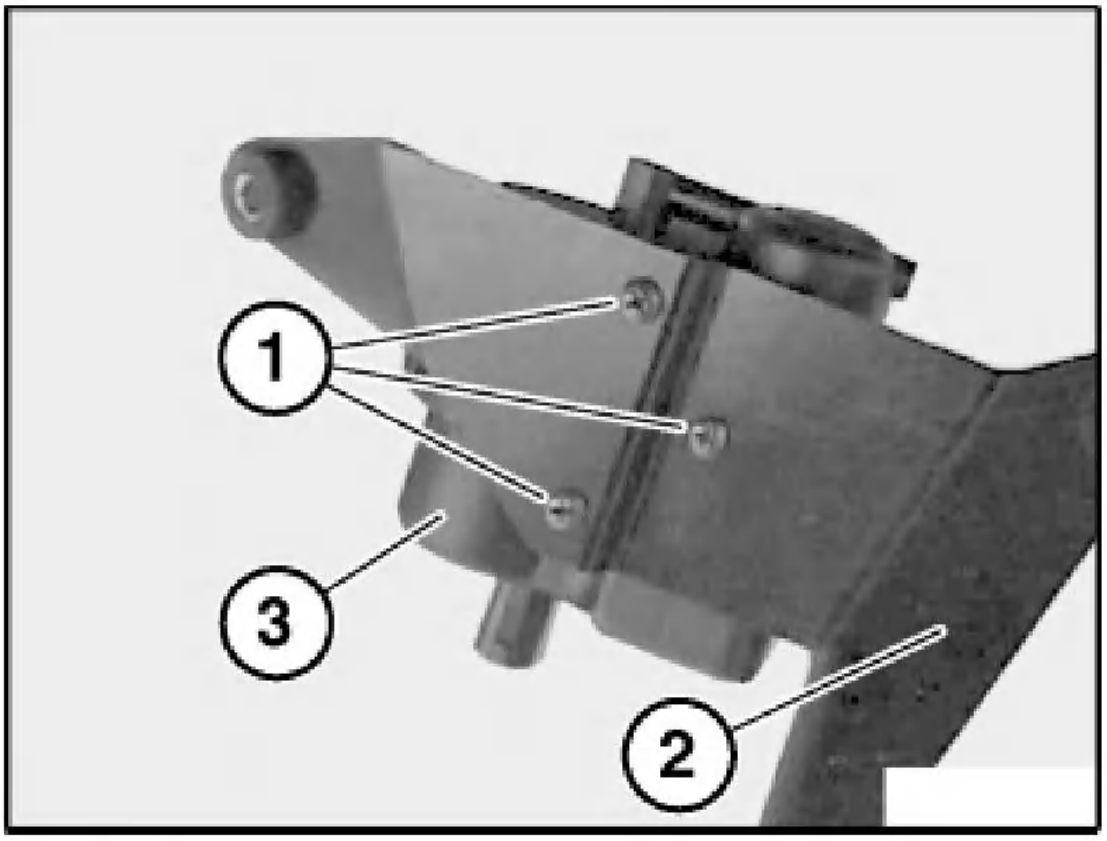



Fig. 49: Removing Tank Leakage Diagnosis Module From Holder
Courtesy of BMW OF NORTH AMERICA, INC.

## 16 14 600 REPLACING TANK PRESSURE SENSOR (Z3)

Remove fuel tank, refer to 16 11 030 REMOVING AND INSTALLING FUEL TANK (Z3) .

Release and disconnect plug connector (1), open hose clip (2) and pull off hose.

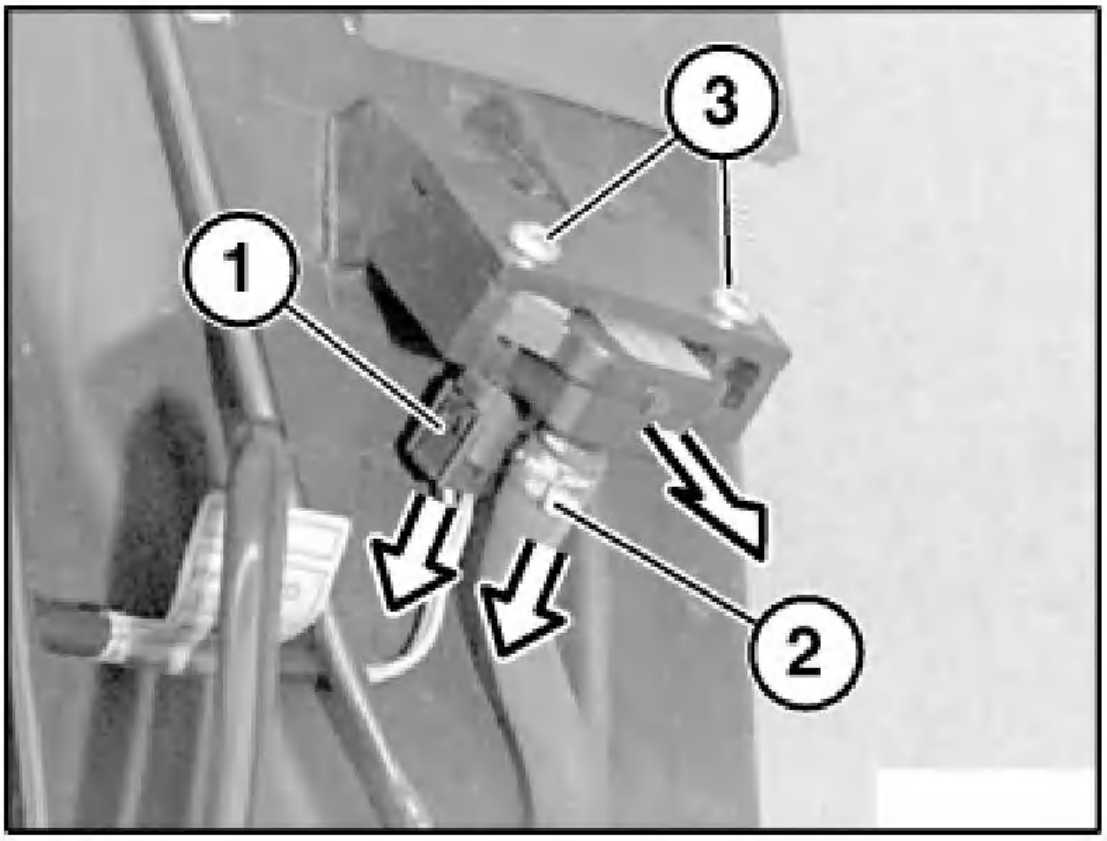



Fig. 50: Disconnecting Plug Connector
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws (3) and pull out tank pressure sensor.

Installation:

Ensure proper locking of plug connector. Replace hose clip.

## FUEL PUMP

### 16 12 000 REMOVING AND INSTALLING/REPLACING FUEL GAUGE SENSOR (Z3, UNIT, SENSOR-PUMP, COMPLETE)

Draw off fuel from fuel tank, refer to 16 00 005 DRAINING AND FILLING FUEL TANK .

Remove passenger seat, refer to 52 10 000 REMOVING AND INSTALLING FRONT SEAT .

Cut carpet along perforation.

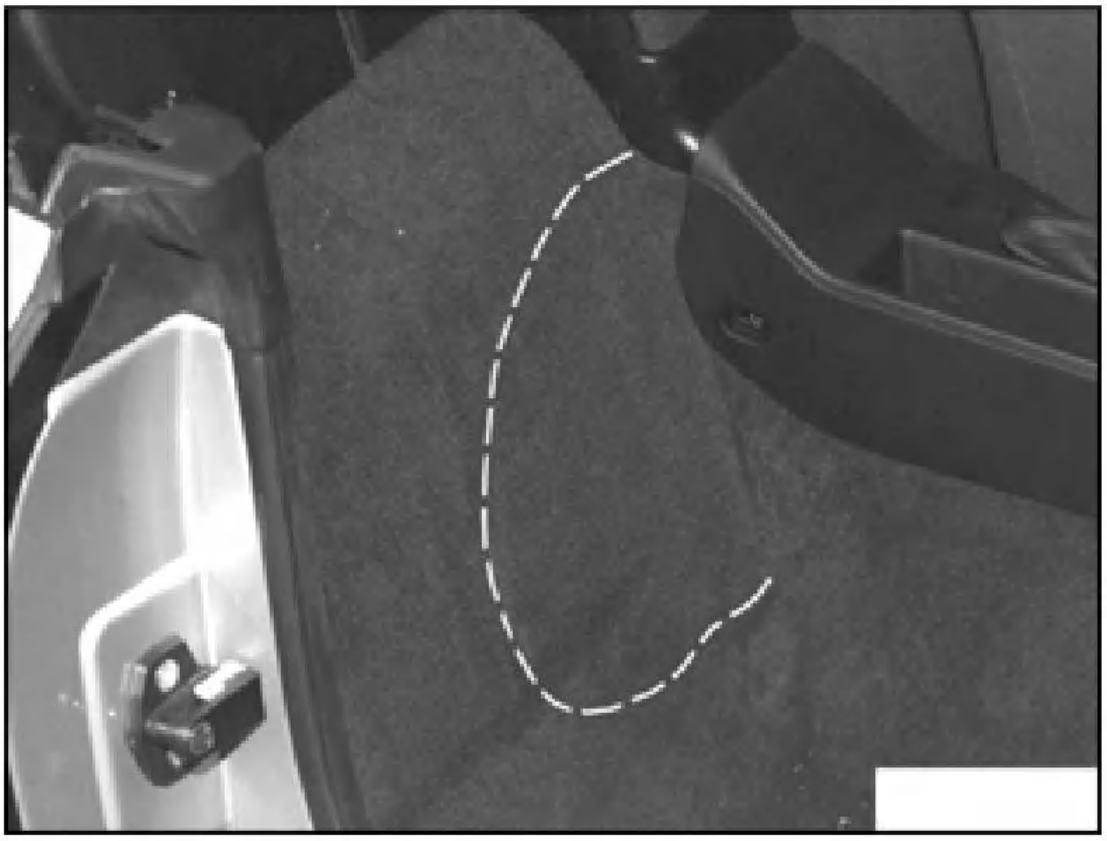



Fig. 51: Cutting Carpet Along Perforation
Courtesy of BMW OF NORTH AMERICA, INC.

Fold carpet (1) to one side. Unfasten screws (2) and remove cover.

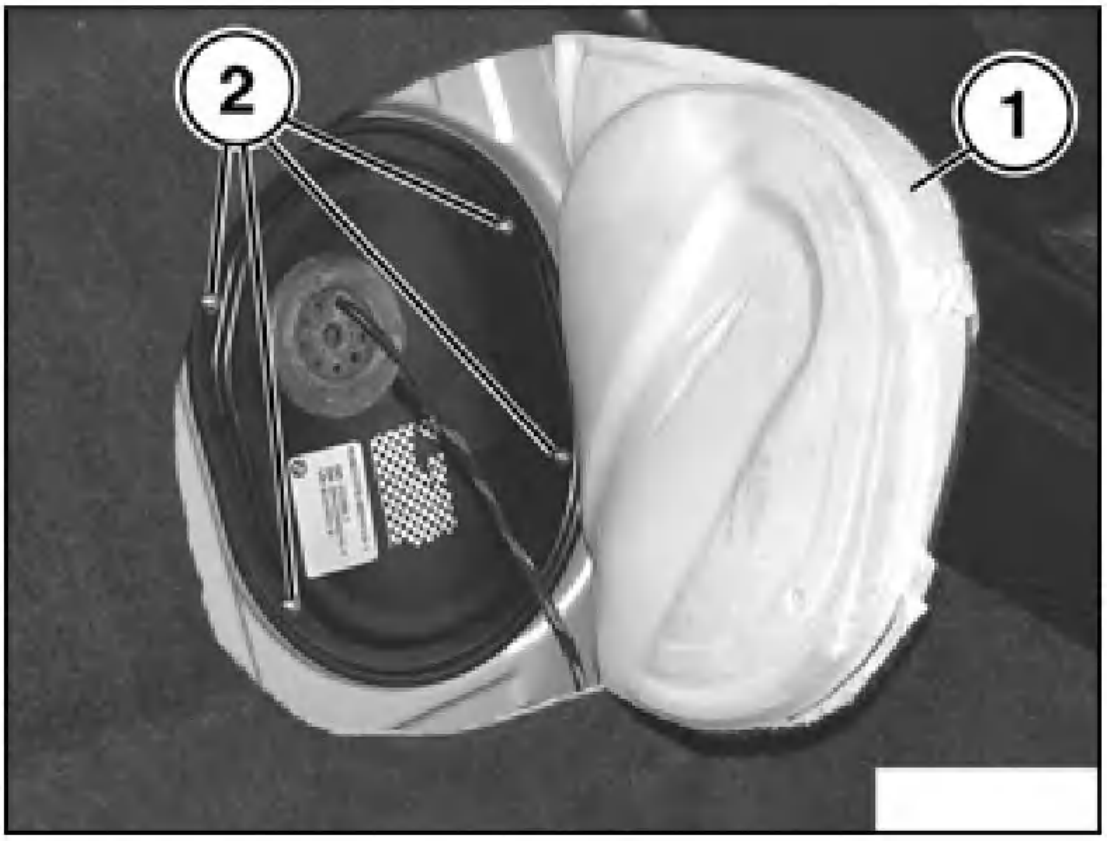



Fig. 52: Removing Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten hose clip (1/2) with special tool and remove hoses. Unlock connector (3) and remove.

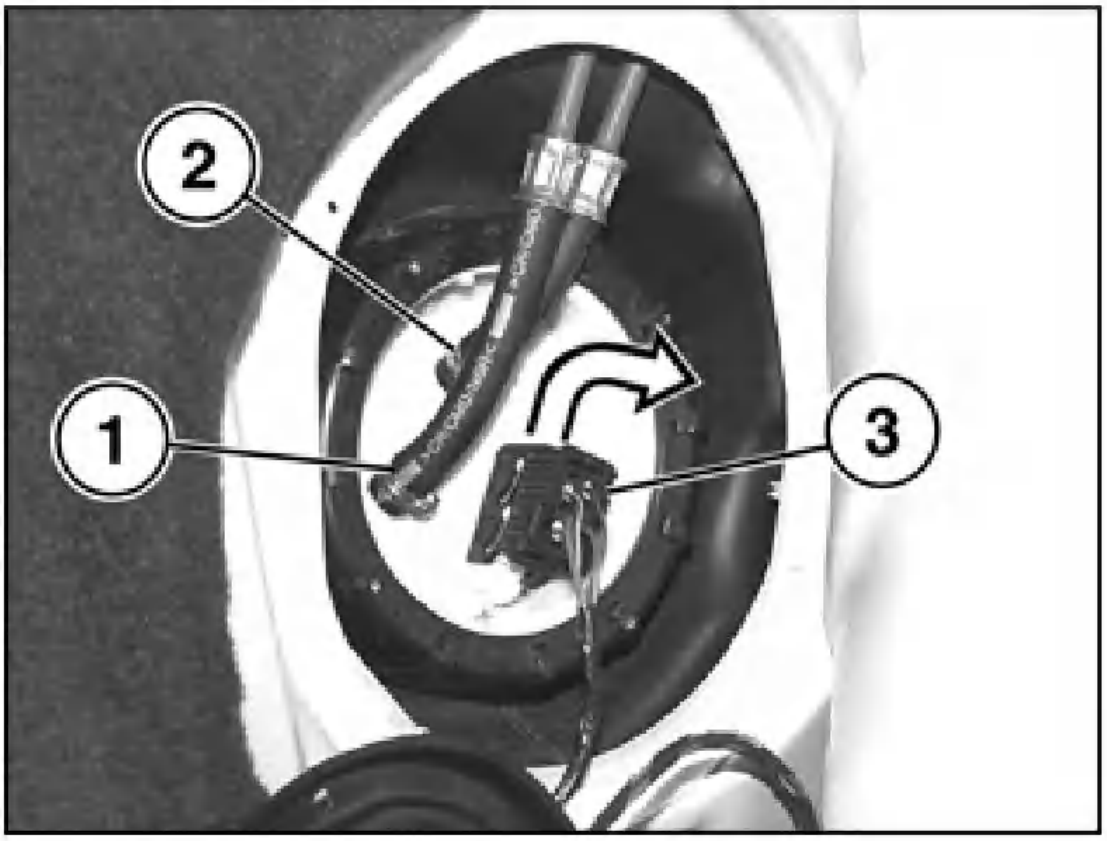



Fig. 53: Removing Connector
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: To open the reusable hose clip, fit special tool (32 3 020) with round side (1) as illustrated.

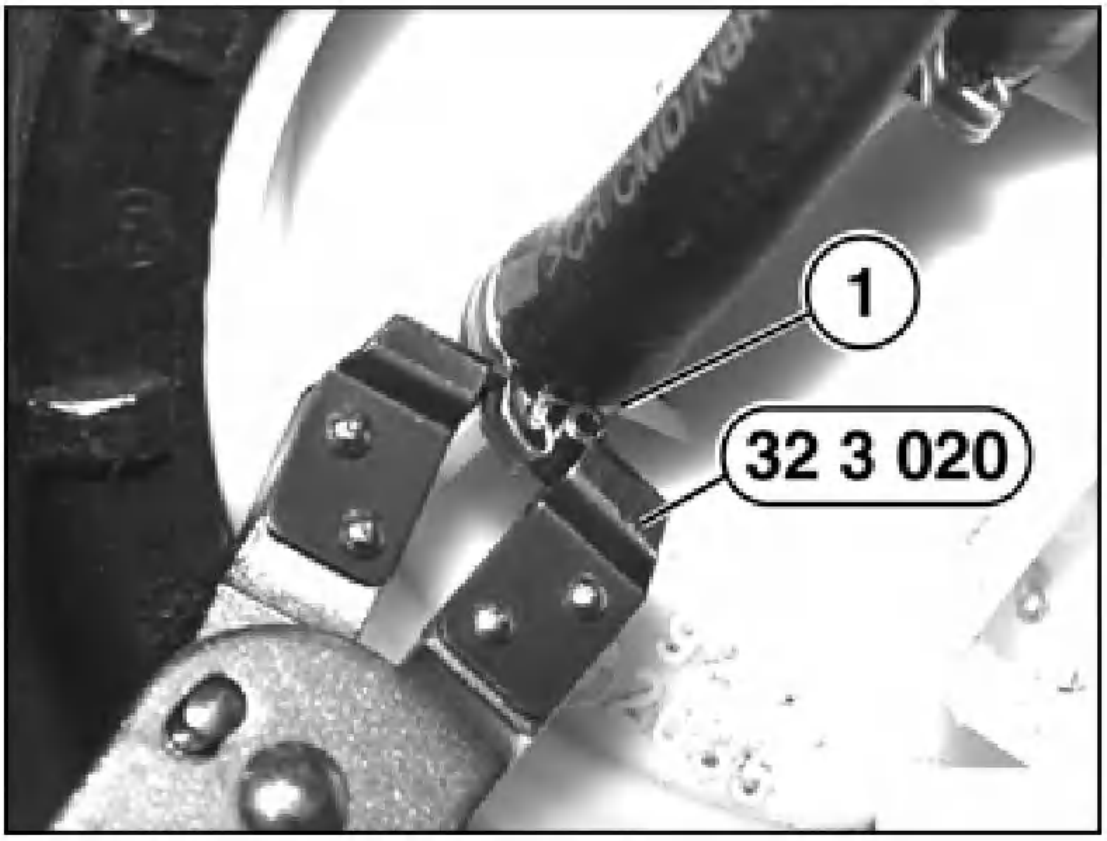



Fig. 54: Fitting Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: To close the reusable hose clip, fit special tool (32 3 020) with the round side (1) as illustrated. Hose clip engages audibly when closing.

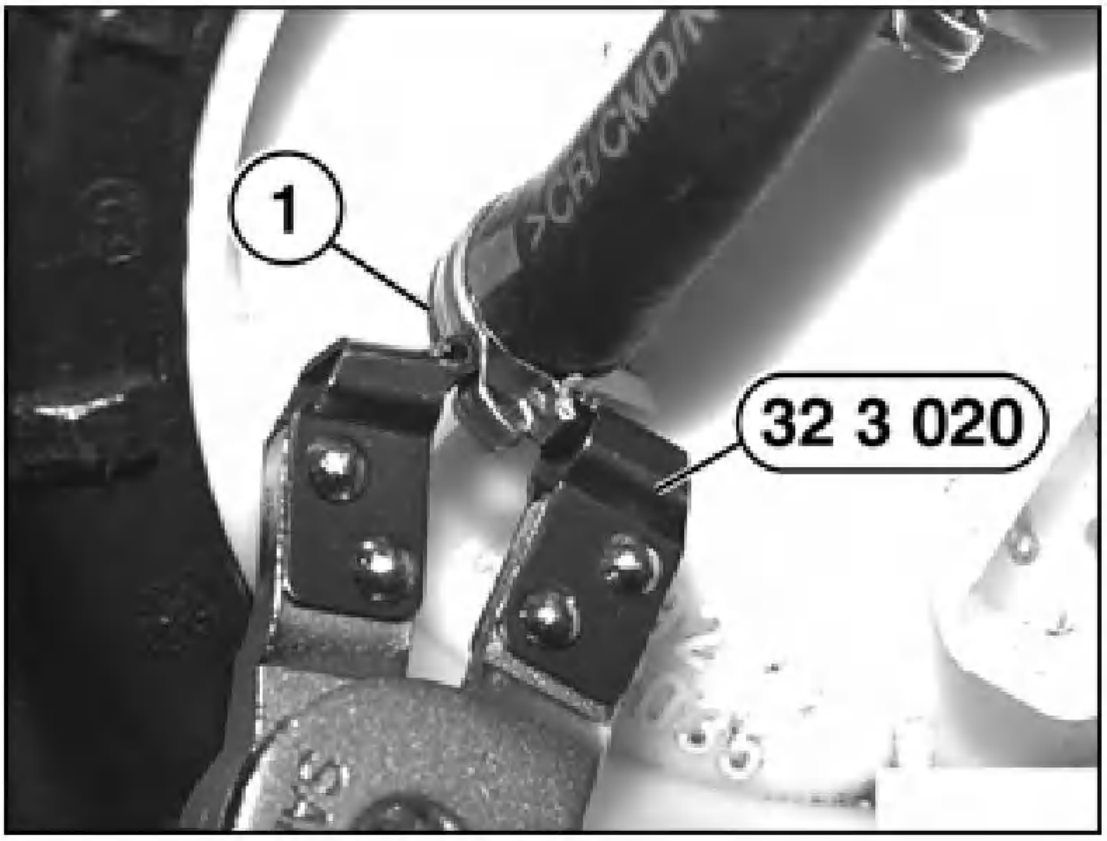



Fig. 55: Fitting Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten rotary connection with special tool 161 020.

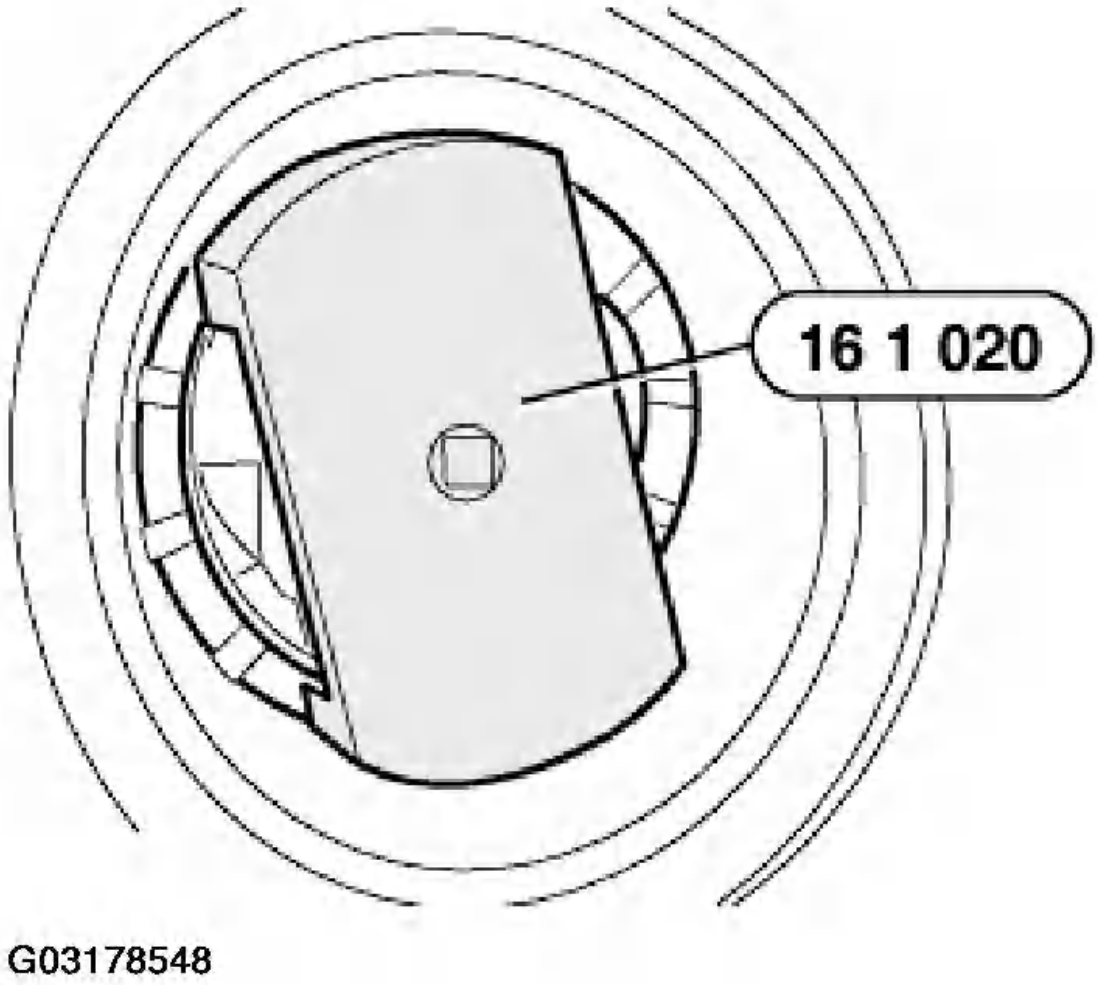



Fig. 56: Removing Rotary Connection With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace sealing ring. Check rotary connection for damage and replace if necessary. To ensure adequate preload on the seal, always fit new rotary connection on torsion bar.

Tighten rotary connection with torsion bar and check torque.

Tightening torque, refer to 16 14 2AZ FUEL PUMP .

Installation:

Replace sealing ring, first inserting sealing ring in the fuel tank.

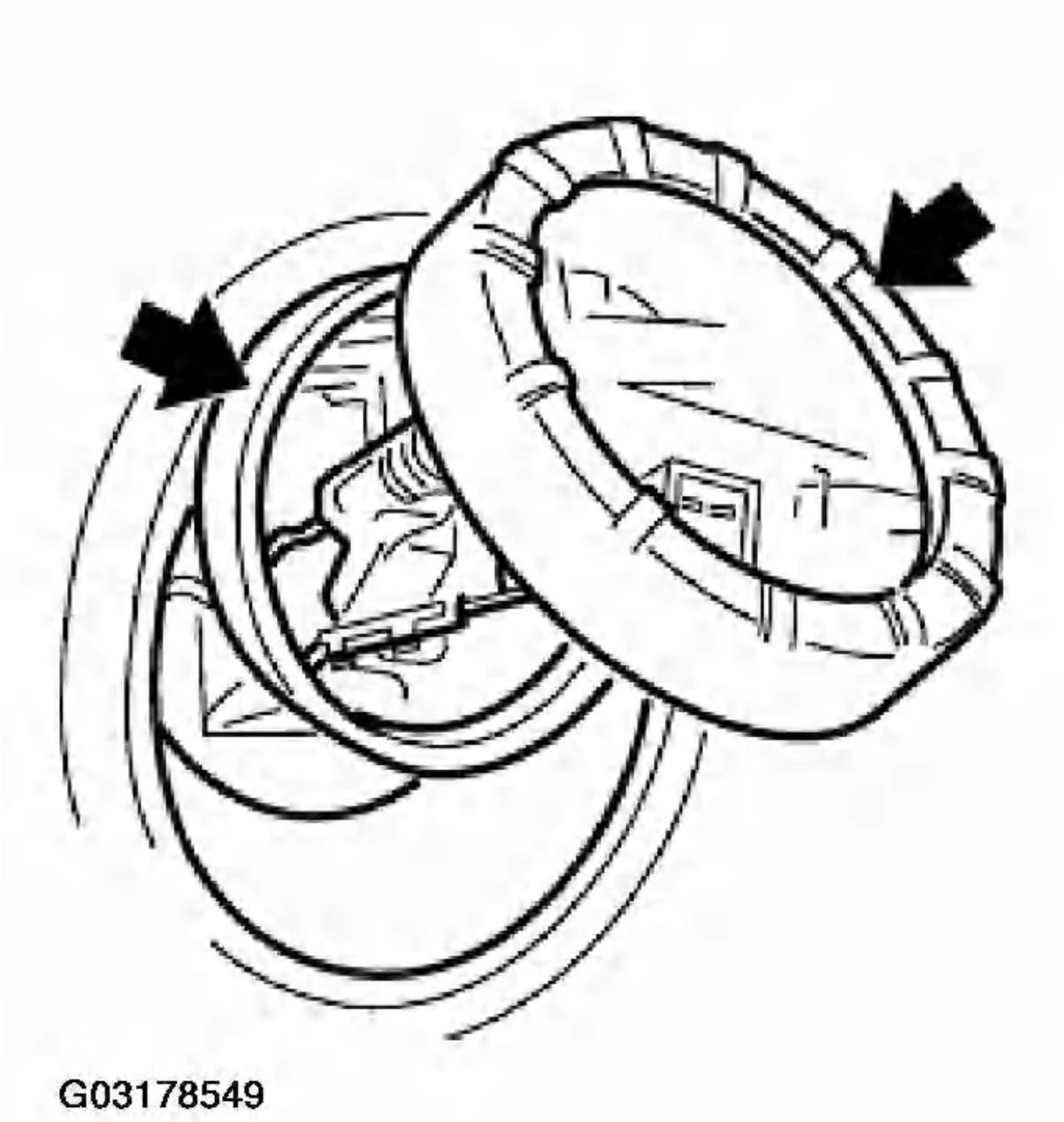



Fig. 57: Inserting Sealing Ring In Fuel Tank
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Ensure that the position marks on tank and supply unit are aligned opposite to one another.

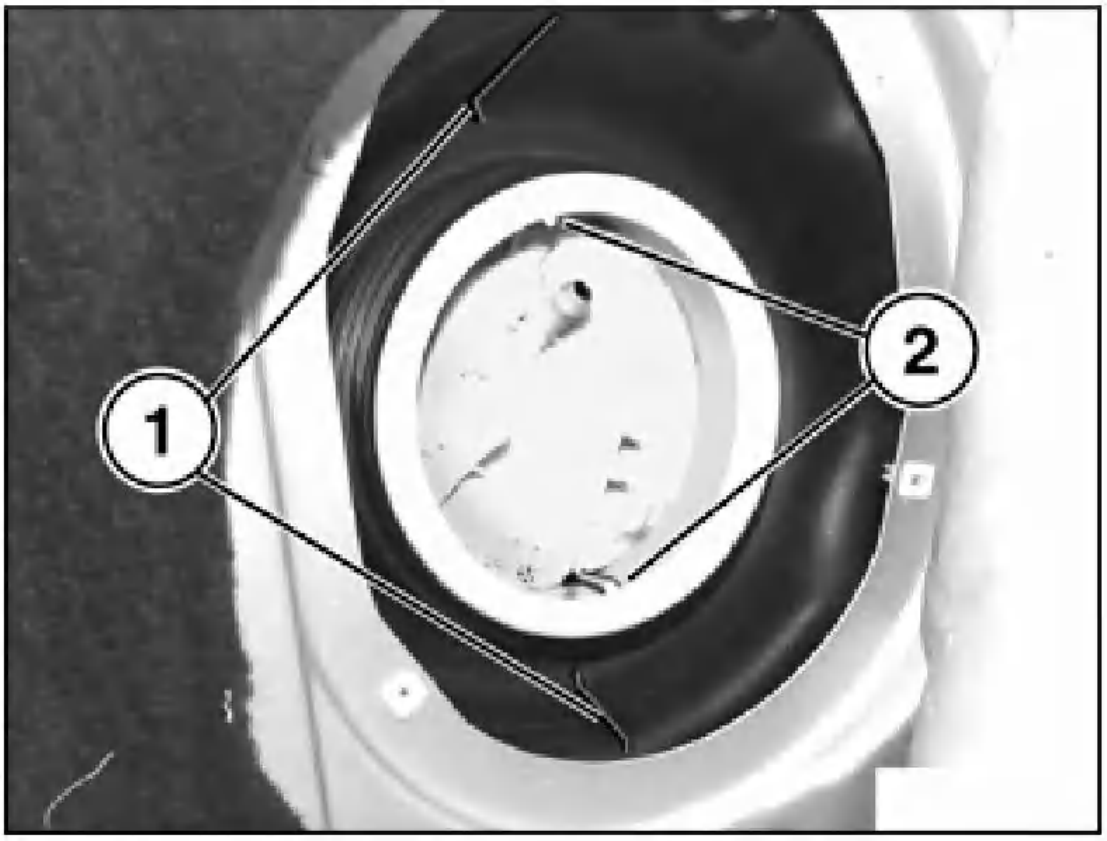



Fig. 58: Aligning Position Marks On Tank And Supply Unit
Courtesy of BMW OF NORTH AMERICA, INC.

## 16 14 010 REMOVING AND INSTALLING/REPLACING FUEL PUMP (Z3, UNIT, SENSOR-PUMP, COMPLETE)

NOTE: Work step is identical to Removing and installing/replacing fuel gauge sensor (unit, sensor-pump, complete), refer to 16 12 000 REMOVING AND INSTALLING/REPLACING FUEL GAUGE SENSOR (Z3, UNIT, SENSOR-PUMP, COMPLETE) .

## 16 14 530 REPLACING SUCKING JET PUMP (E36 PETROL ENGINES FROM 01/95)

Suck the fuel out of the fuel tank, refer to 16 00 005 DRAINING AND FILLING FUEL TANK .

Remove fuel level sensor (right), refer to 16 12 000 REMOVING AND INSTALLING/REPLACING FUEL GAUGE SENSOR (Z3, UNIT, SENSOR-PUMP, COMPLETE) .

Left Side:

Pull tank expansion line (1) on fuel baffle (2) out of locking fixture.

Installation:

Ensure that tank expansion line is perfectly connected in fuel baffle.

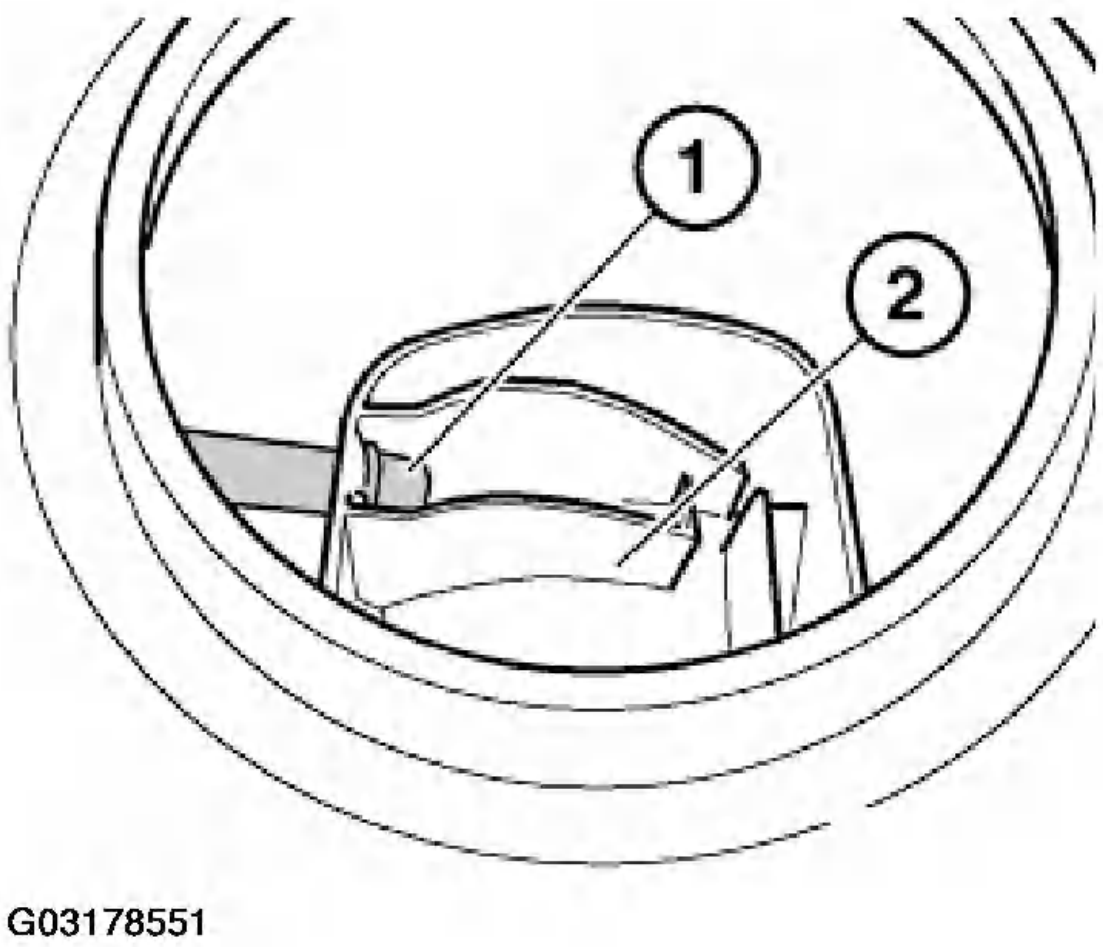



Fig. 59: Removing Tank Expansion Line (Left)
Courtesy of BMW OF NORTH AMERICA, INC.

Right Side:

Remove tank expansion line from fuel tank.

Installation:

Tank expansion line must not be bent when it is being removed.

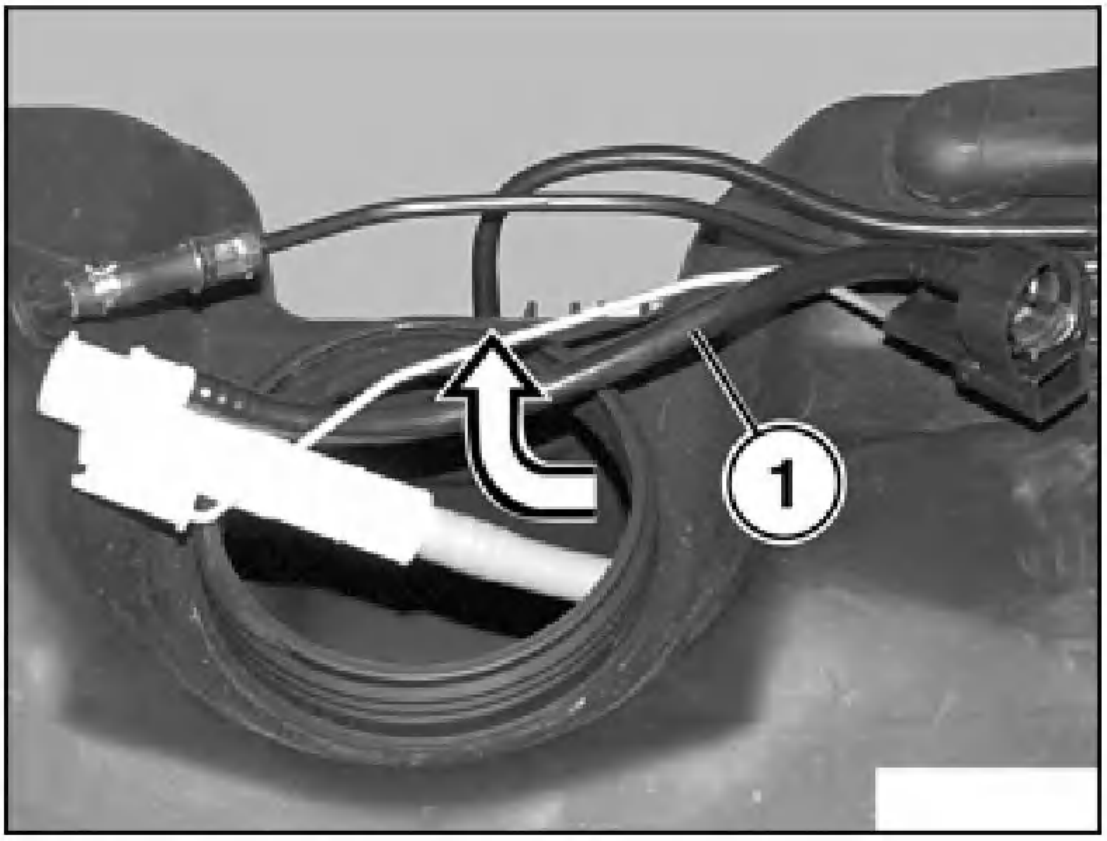



Fig. 60: Removing Tank Expansion Line (Right)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Ensure that non-return valve (1) is fitted in tank expansion line.

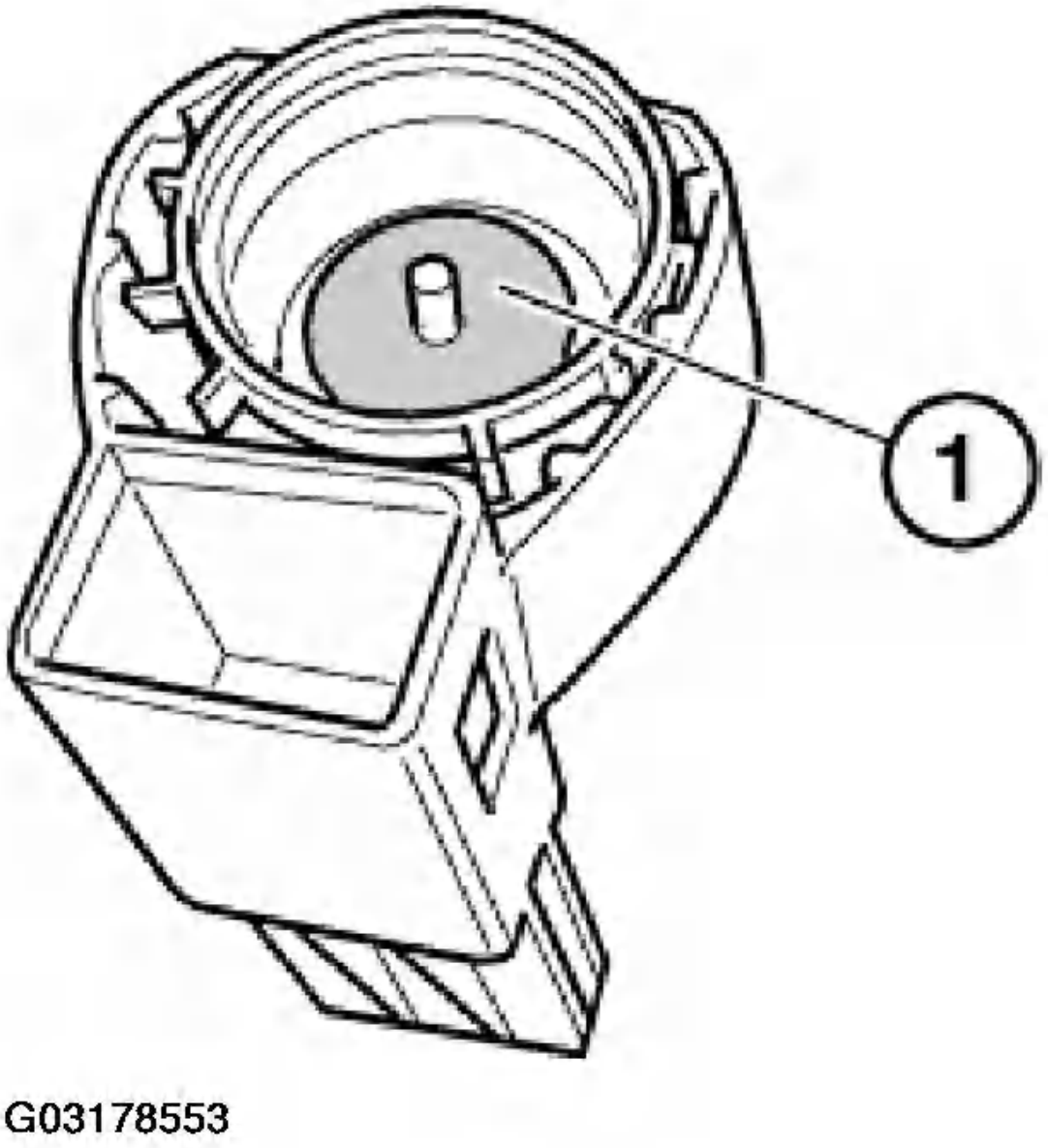



Fig. 61: Fitting Non-Return Valve In Tank Expansion Line
Courtesy of BMW OF NORTH AMERICA, INC.

## 16 14 600 REPLACING TANK PRESSURE SENSOR (Z3)

Remove fuel tank, refer to 16 11 030 REMOVING AND INSTALLING FUEL TANK (Z3) .

Release and disconnect plug connector (1), open hose clip (2) and pull off hose.

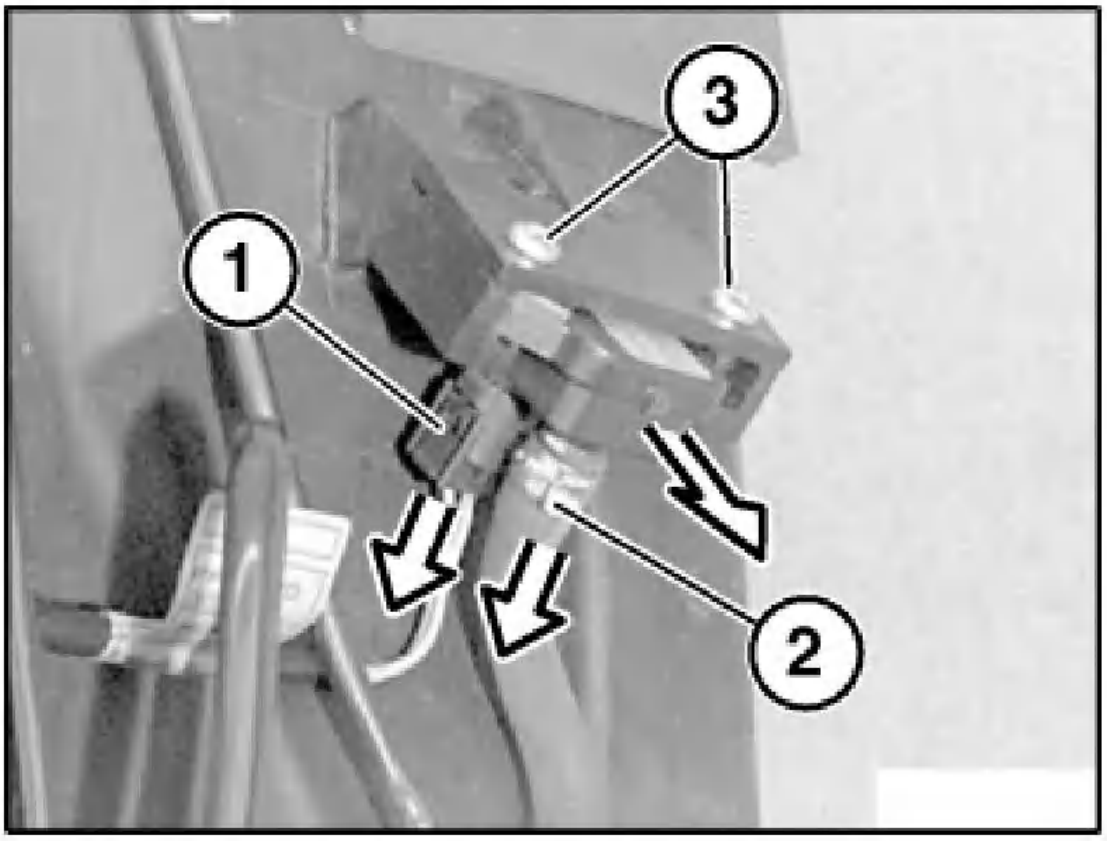



Fig. 62: Disconnecting Plug Connector
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws (3) and pull out tank pressure sensor.

Installation:

Ensure proper locking of plug connector. Replace hose clip.

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Article GUID: A00202357

# TROUBLESHOOTING

## 12 00 CONTENTS OF ENGINE ELECTRICAL SYSTEM GENERAL

General Information -->Working on ignition system. Refer to 12 00 ... WORKING INSTRUCTIONS FOR IGNITION SYSTEM, DME (DIGITAL MOTOR ELECTRONICS) AND ENGINE ELECTRICS .

-->Removing and installing electronic control units. Refer to 12 00 ... WORKING INSTRUCTIONS FOR REMOVING AND INSTALLING ELECTRONIC CONTROL UNIT .

-->Welding work (overload protection of control units). Refer to 12 00 ...WELDING WORK (OVERLOAD PROTECTION OF CONTROL UNITS) .

-->Disconnecting and connecting battery. Refer to 12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY .

-->Disconnecting and connecting test equipment. Refer to 12 00 ... DISCONNECTING AND CONNECTING TEST EQUIPMENT .

-->Component inspection! Refer to 12 00... COMPONENT INSPECTION: .

-->External jump-starting aid. Refer to 12 00 ... EXTERNAL JUMP-STARTING AID .

## 12 00 ... BREAKERLESS IGNITION DISTRIBUTION

1. Engine must never be started after disconnection of the secondary circuit, i.e. disconnection of connectors on spark plugs and earth connection (terminal 4a).
2. There is dangerous high tension in or on:

   1.1. Ignition leads.

   1.2. Spark-Plug connectors.

   1.3. Spark plugs.

   1.4. Ignition coil terminal 4.

   CAUTION: Approx. 40 kV high tension.

3. Terminal 1 wire from ignition coil to DME control unit.

   CAUTION: Approx. 350 V high tension at terminal 1.

4. Battery as well as wires on alternator and starter may not be disconnected on a running engine.

## 12 00... COMPONENT INSPECTION:

NOTE: On all inspections and operations on the engine electrics and electronics, comply with prevailing national safety legislation and accident prevention regulations.

Always disconnect connectors of control units or components before checking electric wires.

Testing Aids:

The relevant wiring diagrams are filed in the Electrical Troubleshooting Manual folder for the 3 Series E36.

Always use correctly produced inspection lines, adapters, terminals and test tips.

Test values for checking components are contained in the Electrical Troubleshooting Manual.

For further technical information, refer to ENGINE ELECTRICAL SYSTEM - TECHNICAL DATA .

## 12 00 ... DISCONNECTING AND CONNECTING BATTERY

Safety instructions for handling vehicle battery. Refer to 61 00 ... SAFETY INSTRUCTIONS FOR HANDLING VEHICLE BATTERY .

Disconnect Battery:

If the battery is not disconnected when working on components, cable connections etc., faults can occur in the fault memories of the relevant control units.

If the repair instructions contain an instruction to disconnect the battery before carrying out a specific repair job, for safety reasons, always follow this instruction.

CAUTION: Disconnecting the vehicle battery will cancel the fault memories of control units. For this reason, before disconnecting the battery, always interrogate the fault memories and print out the faults on the printer attached to the BMW Service-Tester. Investigate stored faults. Once the battery has been disconnected, the radio can only be restarted with the radio code; for this reason, ask the customer for his/her radio code card beforehand. Note stored stations and restore them after connecting the battery. Stored settings of the on-board computer and clock will also be lost. On door closing systems with infrared operation, all keys must be receded.

## 12 00 ... EXTERNAL JUMP-STARTING AID

Do not start the engine with help of starting sprays.

Preparation:.

Conform with the following when starting engine with starting cable.

Ensure that starting cable wires are to appropriate cross-section size.

Only use fuse-protected starting cables.

Check whether the current supplying battery has 12V voltage.

If engine is started from battery of another vehicle, ensure that there is no contact between the bodies of both vehicles.

CAUTION: Never touch ignition system components under current - dangerous high tension!

Operation:

Always conform with the procedures to avoid injury to persons or damage to parts.

Select range P in vehicles with an automatic transmission and apply the parking brake.

Move the shift lever of vehicles with manual transmission into neutral and apply the parking brake.

Ensure that the starting cables cannot get caught in rotating parts, e.g. fan.

First connect both positive poles of the batteries with one starting cable (red).

Use the positive connection point in the engine compartment for vehicles with the battery in the trunk.

Then connect the second starting cable (black) between the negative pole of the current supplying battery and engine or body earth of the vehicle to be started.

CAUTION: Never connect the second starting cable (black) on the negative pole of the battery in the vehicle to be started. Produced gas could be ignited by sparks.

Danger of explosion!

If the battery in the vehicle supplying power is weak, start the engine of this vehicle and let it run at idling speed.

After the engine of the vehicle to be started has started up, first disconnect the starting cable on the negative pole/earth connection. Then remove the starting cable from the positive poles.

## 12 00 ... EXTERNAL JUMP-STARTING AID AND CAR TELEPHONE!

Siemens C 2:

When starting the vehicle engine with outside help from another vehicle, remember that overvoltage could damage the Siemens C 2 telephone. For this reason, always disconnect the sender and receiver from the electric system before using outside starting aids.

Siemens C 3 And Motorola C 451:

Senders and receivers of Siemens C 3 and Motorola C 451 telephones are protected against overvoltage, but calls may not be made or received during outside starting.

Always pay attention to the operating instructions of different type and different make telephones. In case of doubt disconnect the sender and receiver from the vehicle electric system.

## 12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY

Observe safety instructions for handling vehicle battery. Refer to 61 00 ... SAFETY INSTRUCTIONS FOR HANDLING VEHICLE BATTERY .

Before Disconnecting Battery:

Switch off ignition.

NOTE: If the ignition is not turned off when the battery is disconnected, fault memories may be set in some control units.

Important!

- There is a danger of mixing up battery leads: If the battery positive and negative leads are the same color and you are in doubt, follow the polarity to the battery, then mark and cover the leads.
- On vehicles with radio code: After disconnecting the battery, the radio code must be re-entered. Therefore obtain the radio code card from the customer beforehand. Note stored stations and restore them after connecting the battery.
- Stored settings of the on-board computer and clock will also be lost.
- All available central keys must be receded for cars with first generation infrared transmitter locking systems.

General Notes On Disconnecting Battery:

- Do not disconnect battery leads and leads from alternator and starter motor while engine is running.
- Cars with IBS on battery negative terminal:
- Do not under any circumstances pull/lever off pole shoes by force.
- Do not under any circumstances release socket-head cap screw of IBS.
- When work is carried out on the electrical system, faults may be caused in the fault memories of some control units when the battery is connected.

After Connecting Battery:

Important!

After a power supply interruption some equipment is disabled and must be reactivated.

For further information and instructions on vehicle-specific activation, please refer to PROCEDURE FOR INITIALIZATION .

## 12 00 ... DISCONNECTING AND CONNECTING TEST EQUIPMENT

When connecting and disconnecting:

- Service Tester.
- Testing Devices.
- Test Leads.
- When Replacing Control Units.

It is essential to turn off the ignition.

Follow instructions for removing and installing electronic control units. See 12 00 ... WORKING INSTRUCTIONS FOR REMOVING AND INSTALLING ELECTRONIC CONTROL UNIT .

Follow operating instructions for testing devices.

Make sure that connected test leads cannot make contact with rotating parts (e.g.: fans, ribbed V-belts, etc.).

## 12 00 ...WELDING WORK (OVERLOAD PROTECTION OF CONTROL UNITS)

When performing welding work on installed control units, to avoid any defects in the electronic control units, observe the following steps:

- Observe instructions for disconnecting and connecting battery. See 12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY .
- Detach terminal of battery negative lead from car battery and second battery if fitted. Cover negative terminal posts.
- If welding is to be performed near the battery/batteries, first remove battery/batteries from vehicle (flying sparks - combustion of explosive gas).
- Fit return clamp on welding unit as close as possible to welding point (maximum distance approx. 1 mm).
- Never connect return clamp to ground pin on body which has ground wires attached!

## 12 00 ... WORKING INSTRUCTIONS FOR IGNITION SYSTEM, DME (DIGITAL MOTOR ELECTRONICS) AND ENGINE ELECTRICS

CAUTION:

1. Always switch off ignition before working on ignition system.

Never touch components under current with engine running!

Dangerous high tension!

2. Always remove DME master relay for the compression test to avoid activation of ignition coils by ignition final stages of the DME control unit.

   Dangerous high tension!

3. Always switch off ignition before connecting /disconnecting Service Tester, other testers and adapters or replacing components!
4. The secondary side (high voltage side) of ignition system must be under load of at least 4 kohm.
5. Never start engine after removing distributor cap or disconnecting wire (terminal 4) on ignition coil (terminal 4).
6. Never connect a shielded capacitor or test light on ignition coil terminal 1.
7. Never connect ignition coil terminal 1 wire earth or battery positive.

   For this reason, terminal 1 wire may not be used to interlock starting when service installing a burglar alarm system.

## 12 00 ... WORKING INSTRUCTIONS FOR REMOVING AND INSTALLING ELECTRONIC CONTROL UNIT

CAUTION: Disconnecting the vehicle battery will cancel the fault memories of control units.

For this reason, before disconnecting the battery, connect up BMW SERVICE TESTER or DIS. DIS: (select Expert mode) interrogate fault memory and print out fault messages stored in memory. BMW SERVICE TESTER: Interrogate fault memory and print out fault messages stored in memory. Investigate stored faults.

Ignition must always be switched off before disconnecting or connecting control-unit connectors.

Removal and installation of components, relays, fuse, etc. could cause the storage of faults in fault memories of control units capable of self-diagnosis. For this reason, fault memories must always be interrogated after working on the electrical system. Stored faults must be investigated and cancelled.

When Replacing Control Unit Of DME/DDE (Digital Motor Electronics/ Digital Diesel Electronics), Pleased Note The Following Points:

Each control unit is programmed with certain basic values, which serve as mean values. The control unit receives different input values, depending on engine condition, which are compared with the stored values. The adaptive system compares the input values with the stored map values. Appropriate correction commands are sent to the concerned drive elements.

If, for example, the DME control unit would be without current for a long time (more than an hour), its adaptive system would lose the stored values. After re-commissioning a cancelled unit or installing a new control unit, the input values of the relevant engine must be read in and stored for the adaptive system.

This procedure could lead to erratic idling and disturbed overrunning of the engine after starting. Depending on the engine it could require some time before all values are adapted to the engine condition.

For this reason, follow the procedure described below before replacing or reinstalling a DME/DDE control unit:

1. Run engine to operating temperature if possible before replacing the control unit.
2. Remove control unit, install new control unit and drive vehicle.

### 12 13 NOTES ON CHECKING IGNITION SYSTEM

Troubleshooting --> Fault in fuel injection system. Refer to 12 13 ... FAULT IN FUEL INJECTION SYSTEM .

Spark plug faults --> Refer to 12 13 ... SPARK-PLUG FAULTS .

Ignition coil faults --> Refer to 12 13 ... IGNITION COIL FAULTS .

Further fault patterns with evaluation --> Refer to 12 13 ... FURTHER FAULT PATTERNS WITH EVALUATION .

Additional fault notes for troubleshooting --> Refer to 12 13 ... ADDITIONAL FAULT NOTES FOR TROUBLESHOOTING .

Oscillograms Normal oscillogram --> Refer to 12 13 ... NORMAL OSCILLOGRAM (M, S, W ENGINES ONLY) .

Oscillograms of ignition coils from different manufacturers --> Refer to 12 13 ... OSCILLOGRAMS OF IGNITION COILS FROM DIFFERENT MANUFACTURERS .

Check Secondary signal for stationary ignition distribution --> Refer to 12 13 ... CHECKING SECONDARY SIGNAL FOR STATIONARY IGNITION DISTRIBUTION .

## IGNITION WIRES, SPARK

### 12 12 011 REPLACING ALL SPARK PLUGS

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 12 1 171
- 12 1 200

NOTE: This repair instruction is valid for the following engines:

- M52/M52TU/M54/M56

Necessary Preliminary Tasks:

- Remove ignition coils. Refer to 12 13 511 REPLACING IGNITION COIL (M52, M52TU, S52, S50US, M54) .

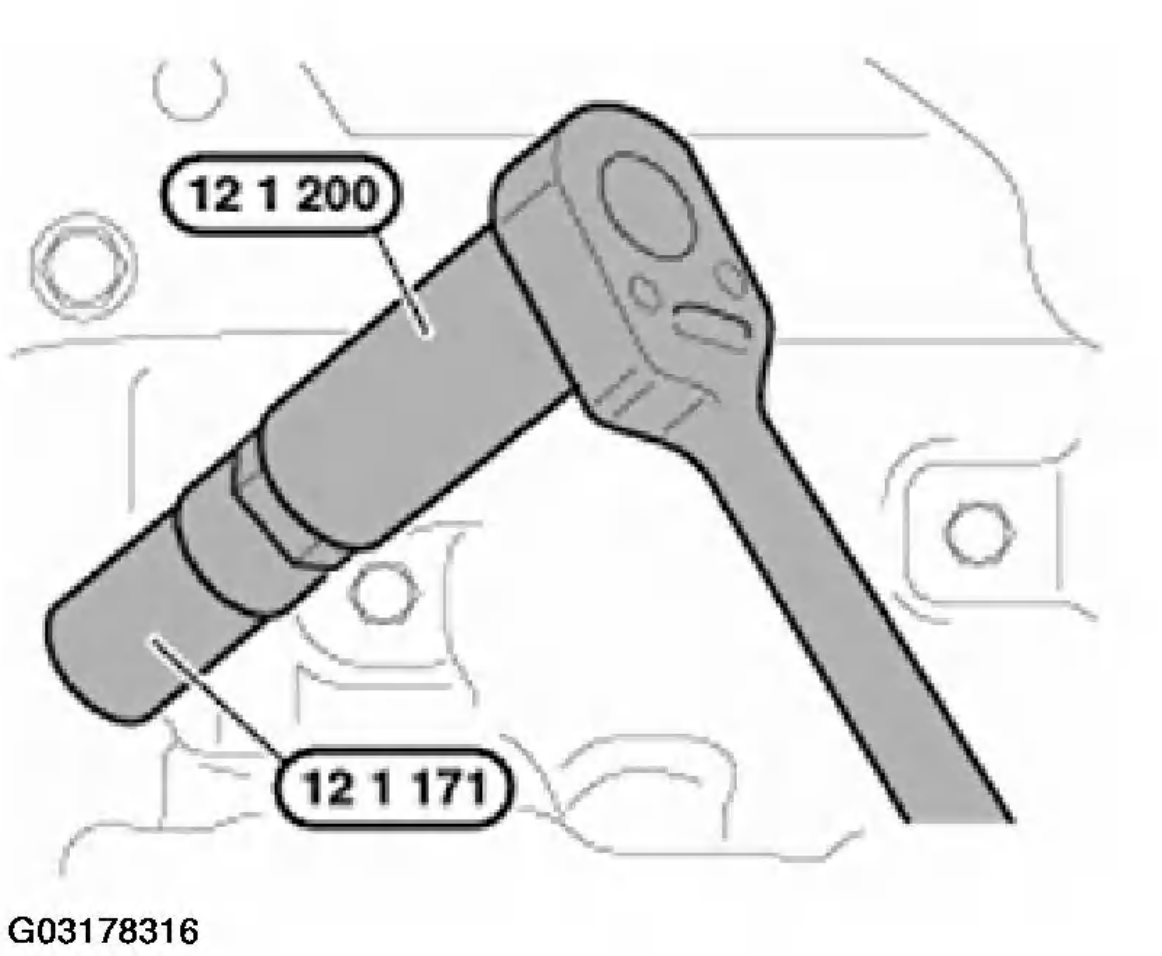



Fig. 1: Removing Spark Plugs With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew and remove spark plugs with special tool 12 1 171 in conjunction with special tool 12 1 200.

Installation:

If special tool 12 1 200 is not used, Tightening torque is 12 12 1AZ. Refer to 12 12 SPARK PLUGS .

## IGNITION COIL

### 12 13 NOTES ON CHECKING IGNITION SYSTEM

Refer to 12 13 NOTES ON CHECKING IGNITION SYSTEM .

### 12 13 ... CHECKING SECONDARY SIGNAL FOR STATIONARY IGNITION DISTRIBUTION

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 12 7 030

Engine Test Step 10:

Remove ignition coil. Clip Special Tool 12 7 030 on relevant ignition coil to be tested. Clip high tension clip around ignition lead.

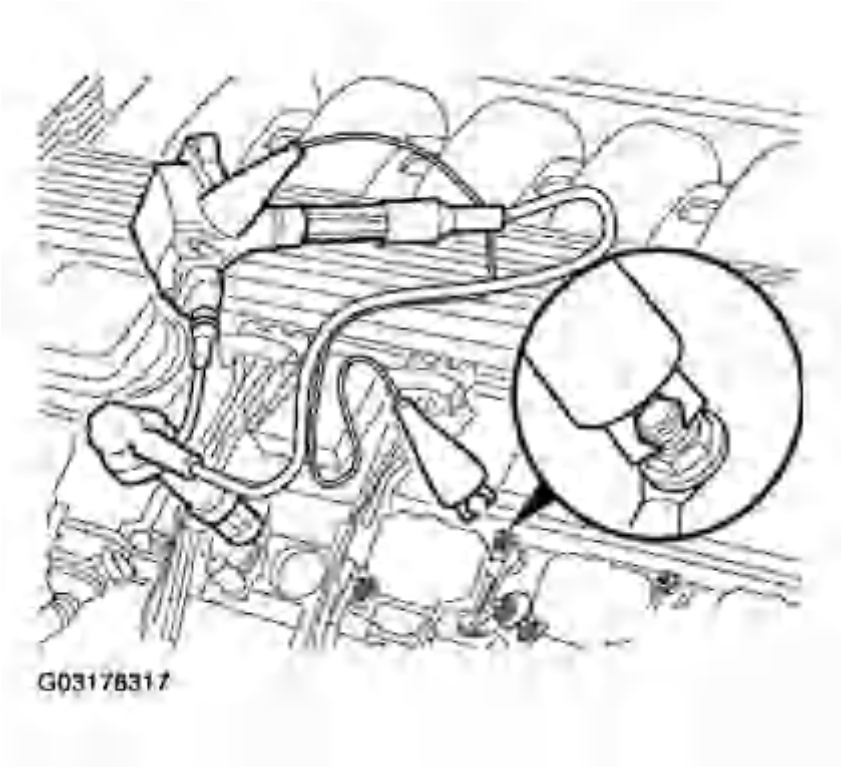



Fig. 2: Attaching High Tension Clip On Ignition Lead
Courtesy of BMW OF NORTH AMERICA, INC.

Connect earth lead of adapter to vehicle earth and ignition coil. Connect up diagnosis connector.

If trigger signal is not present (terminal 1), connect black clip of universal adapter cable to pin 1 of primary adapter cable.

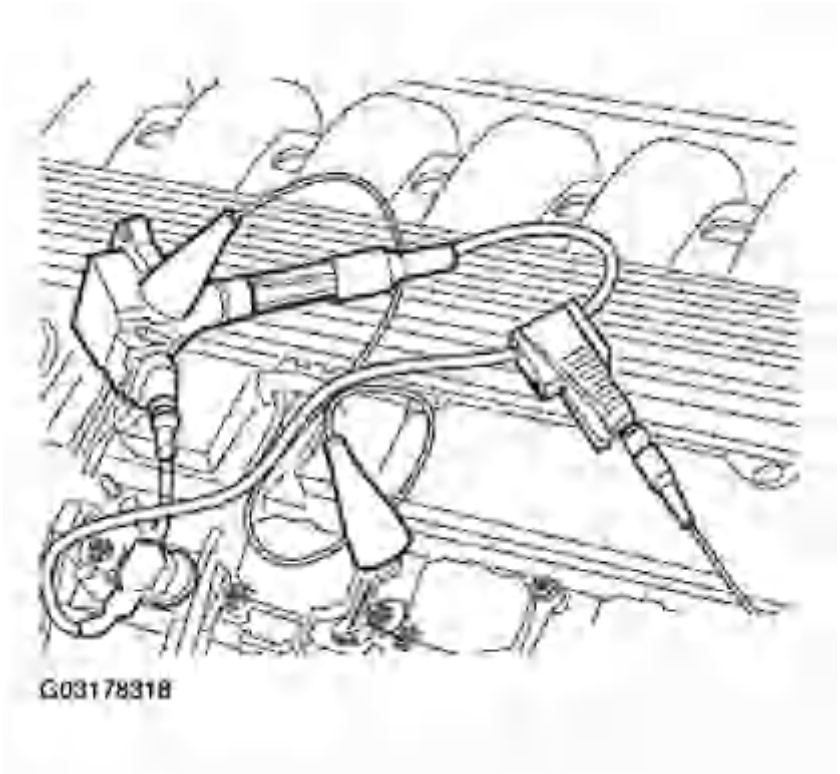



Fig. 3: Connecting Earth Lead Of Adapter To Vehicle Earth And Ignition Coil
Courtesy of BMW OF NORTH AMERICA, INC.

Produce a stationary signal by pressing key R on the tester.

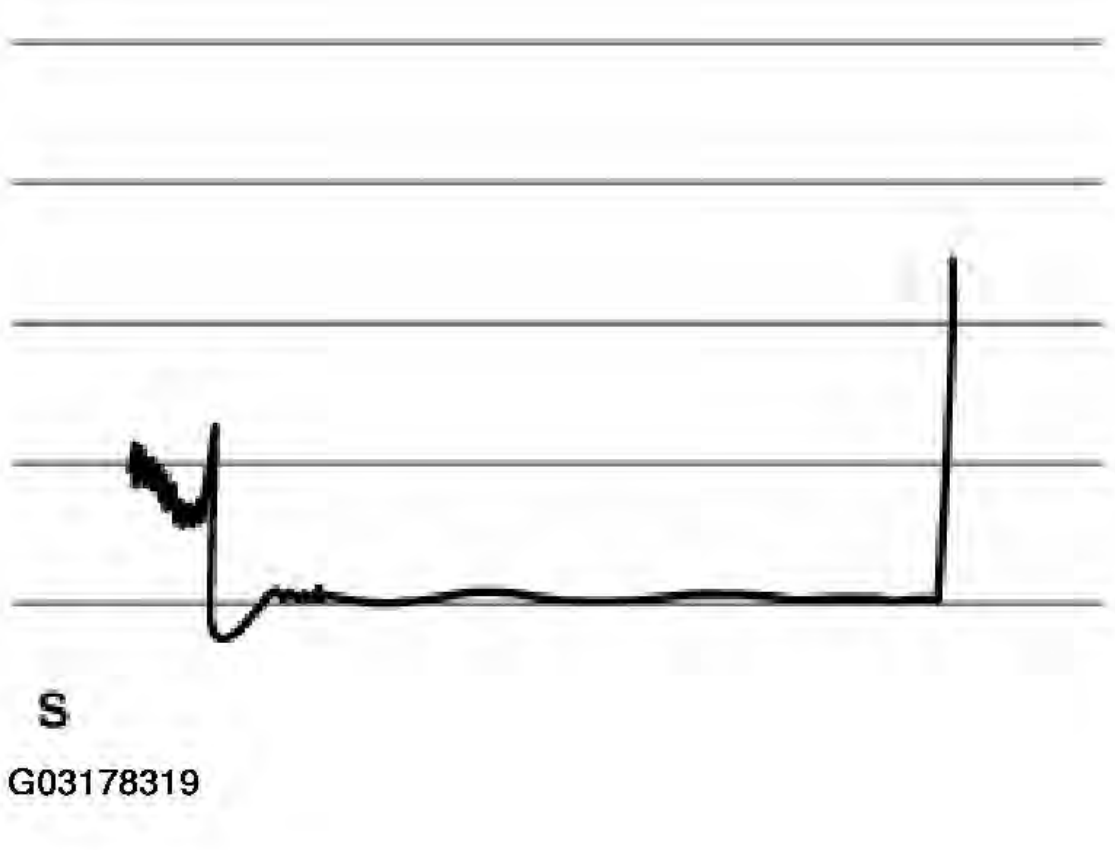



Fig. 4: Identifying Stationary Signal
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Neighboring ignition leads could produce interference on the screen of the oscilloscope.

Refer to the fault memories of engine control units for additional troubleshooting.

Interrogate fault memory and its fault reports.

12 13 ... NORMAL OSCILLOGRAM (M, S, W ENGINES ONLY)

1. Start of ignition voltage peak.
2. Level of ignition voltage.
3. Level of combustion voltage.
4. Period of combustion.
5. Combustion curve characteristics.
6. Start of decay process.
7. Termination oscillations.

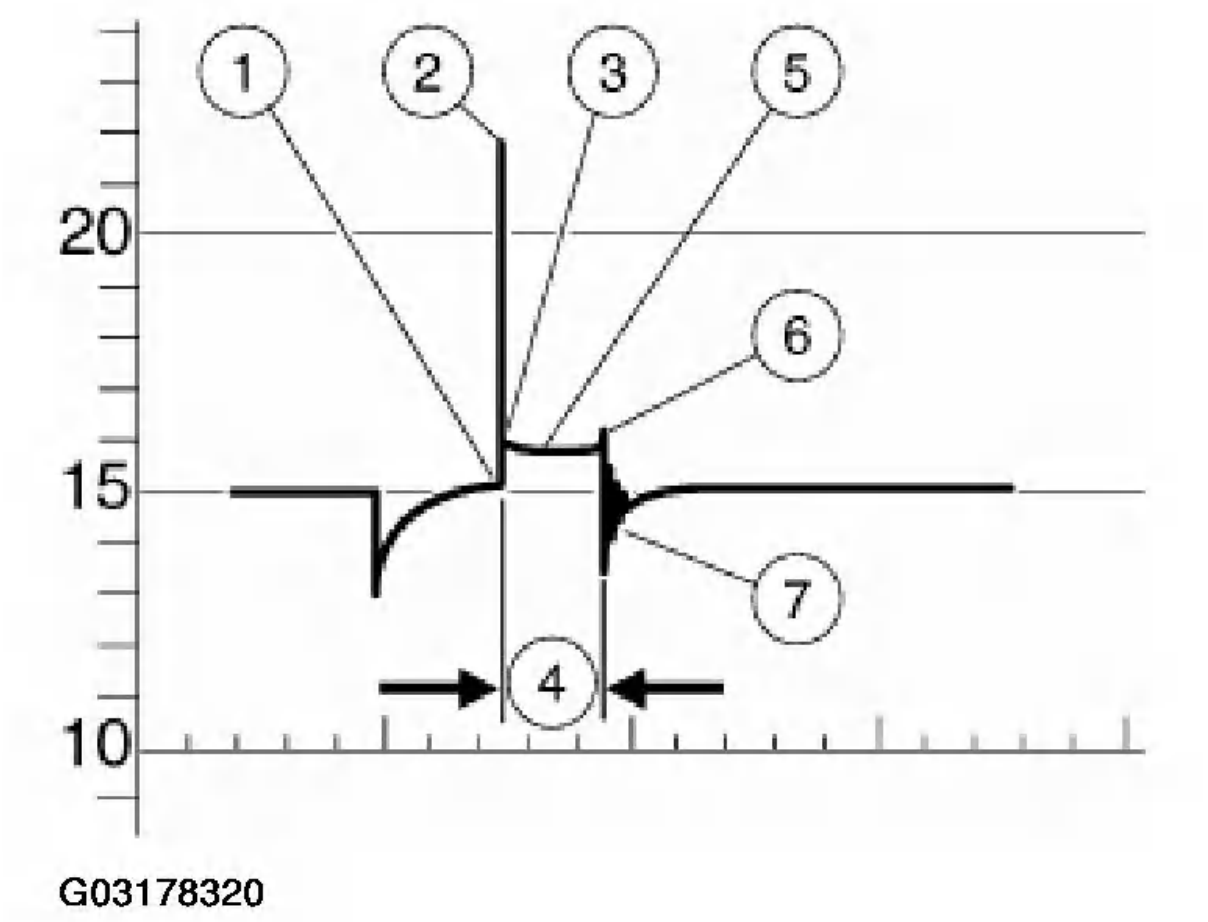



Fig. 5: Ignition Voltage Peak Oscillogram (M, S, W Engines Only) Graph
Courtesy of BMW OF NORTH AMERICA, INC.

Secondary voltage patterns, beside one another:

Evaluation of ignition voltage peaks at idle speed (this example shows an engine with 4 cylinders).

NOTE: The display of ignition voltage spikes is approx. 20-25% lower than the real value. The uniformity of all cylinders to each other is more important than the height of ignition voltage peaks. Differences of 3000 ... 4000 V are permitted. In event of greater differences, refer to 12 13 ... FURTHER FAULT PATTERNS WITH EVALUATION .

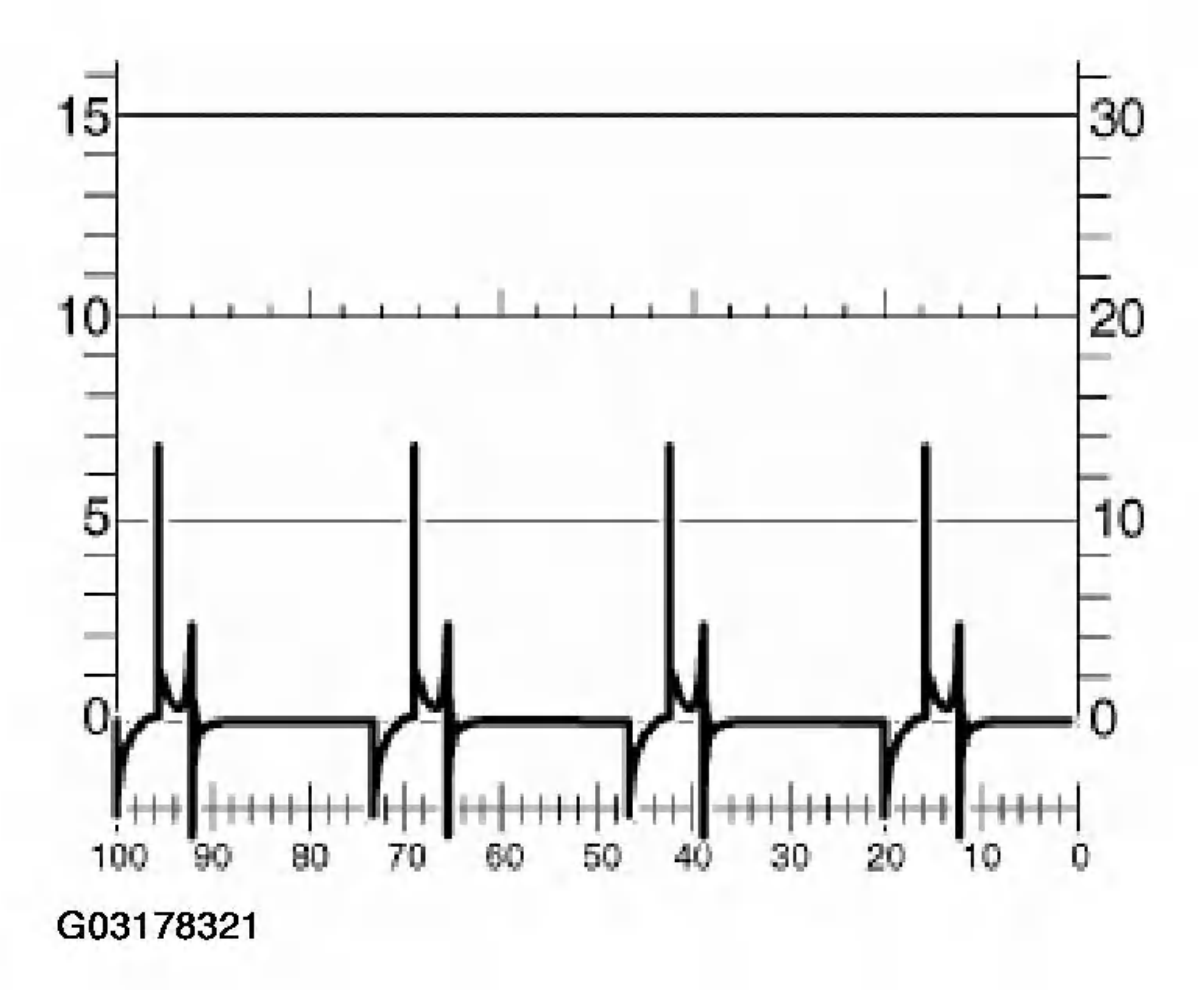



Fig. 6: Secondary Voltage Patterns Graph
Courtesy of BMW OF NORTH AMERICA, INC.

Evaluation of ignition voltage peaks at increased speed of approx. 2000 rpm (this example shows an engine with 4 cylinders).

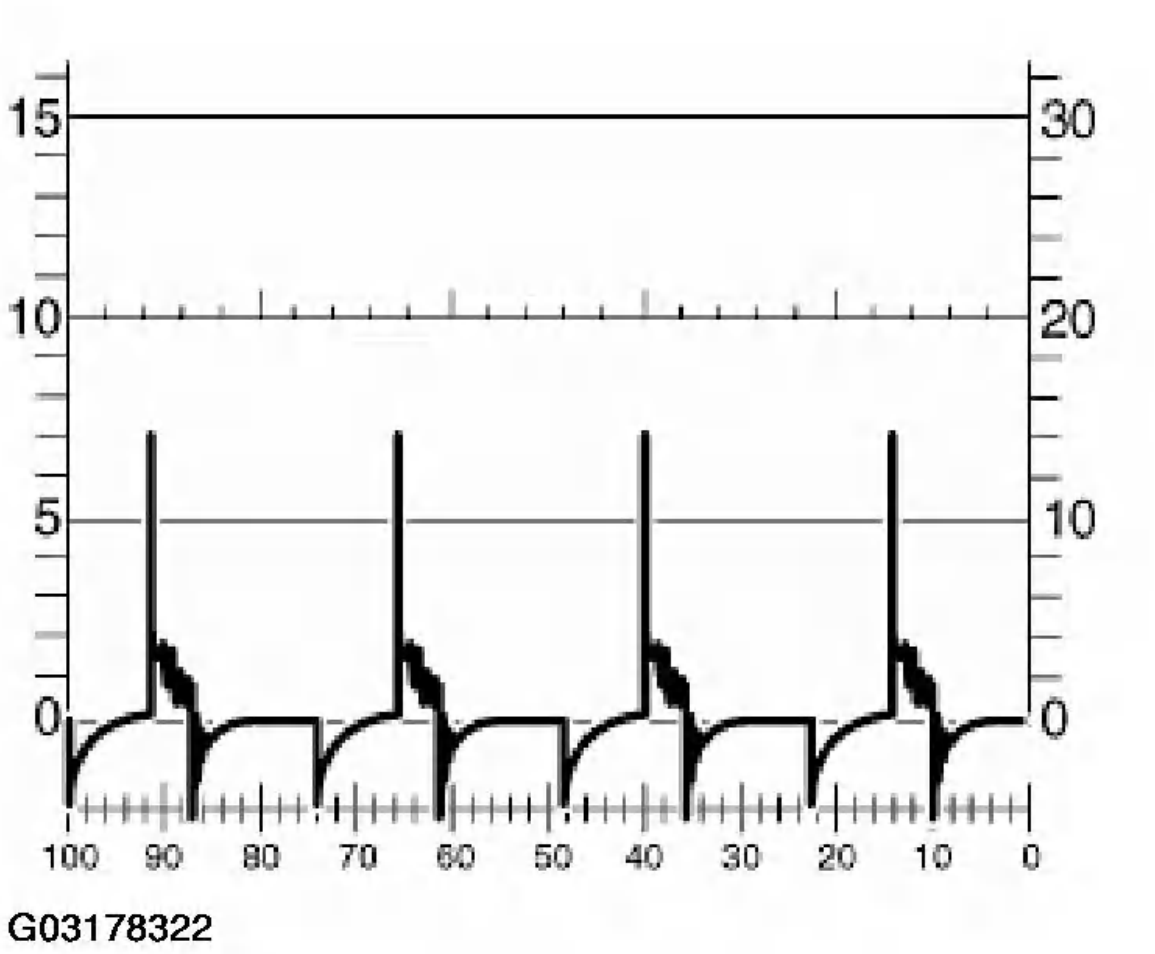



Fig. 7: Evaluation Of Ignition Voltage Peaks Graph
Courtesy of BMW OF NORTH AMERICA, INC.

Secondary voltage diagrams, superimposed:

Evaluation of combustion characteristics curve and decay characteristics at idle speed (this example shows a 4-cylinder engine).

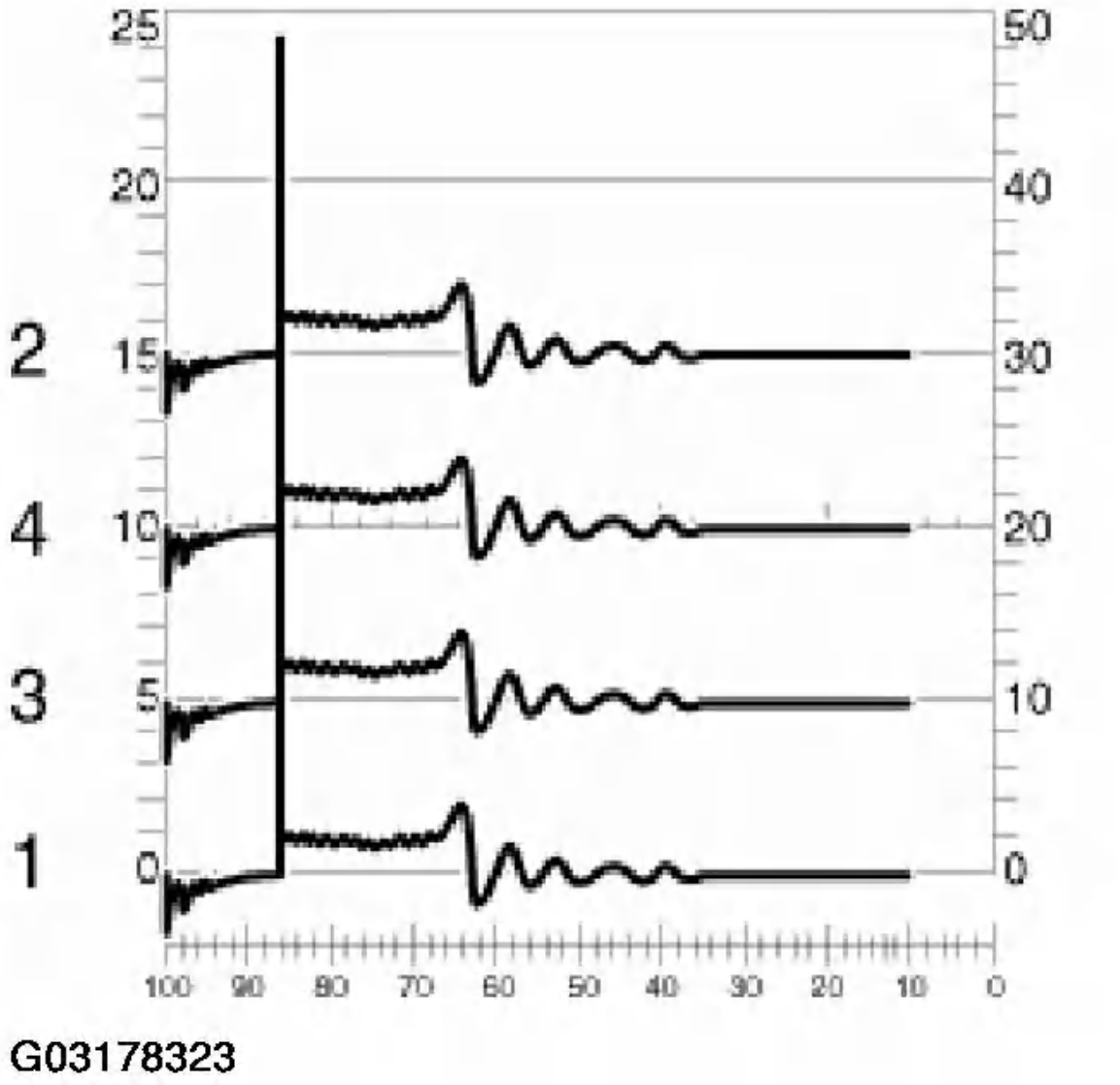



Fig. 8: Secondary Voltage Diagrams
Courtesy of BMW OF NORTH AMERICA, INC.

Secondary voltage diagrams, consecutive:

NOTE: Only the major differences in the ignition voltage patterns are revealed by this method of comparison.

The identified fault must be allocated to the relevant cylinder using the secondary voltage representation forms next to/on top of each other.

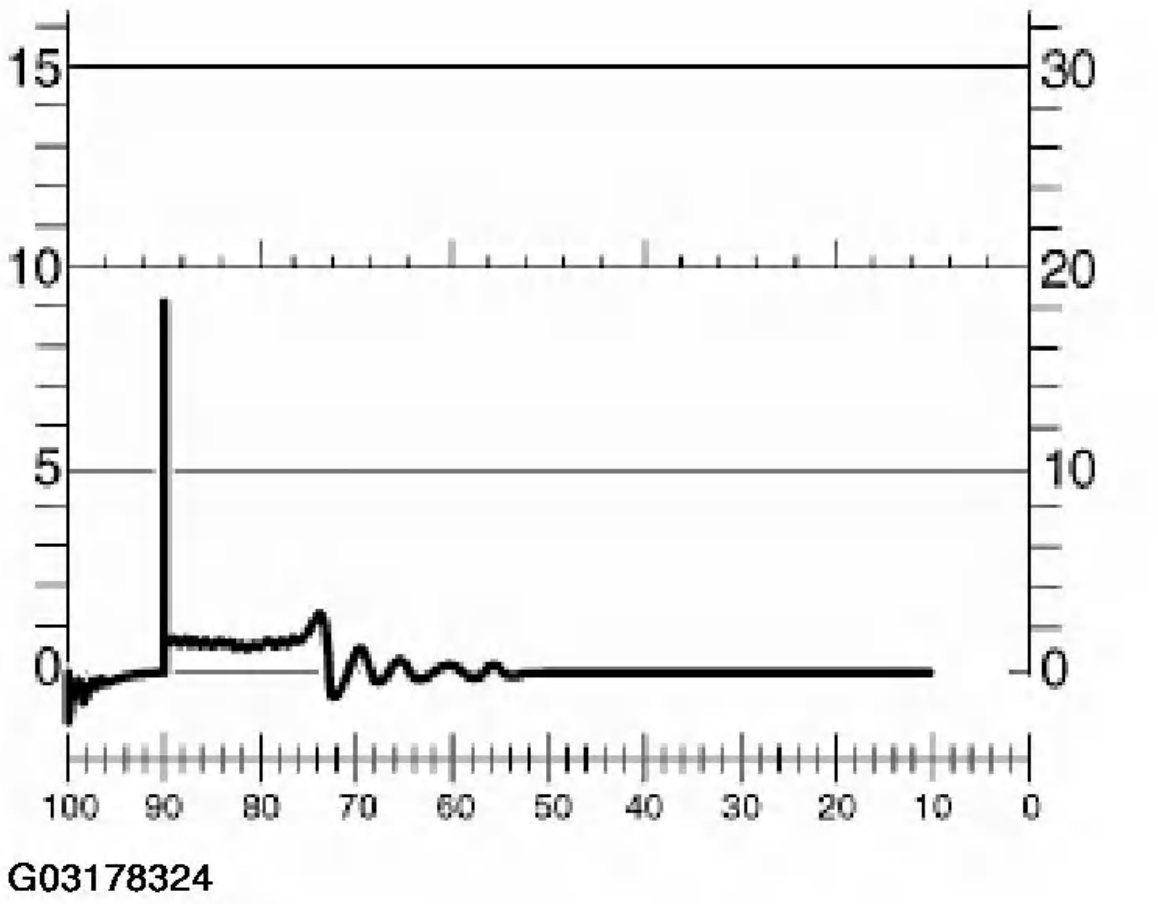



Fig. 9: Secondary Voltage Diagrams
Courtesy of BMW OF NORTH AMERICA, INC.

## 12 13 ... OSCILLOGRAMS OF IGNITION COILS FROM DIFFERENT MANUFACTURERS

Evaluation Of Ignition Voltage Peaks And Decay Characteristics At Idle Speed.

Make: Bremi

1. Normal ignition voltage spikes (6000-9000 V).
2. Normal start of attenuation processes.

Make: Beru

3. Normal ignition voltage peak.
4. High initial level of attenuation processes.

Make: May & Christe

5. Normal ignition voltage peak.
6. Low initial level of attenuation processes.

Make: Bosch

7. Low ignition voltage peak.
8. Normal start of attenuation processes.

Note: At high speeds, the ignition voltage peak falls very markedly relative to the peaks on units from other ignition coil manufacturers.

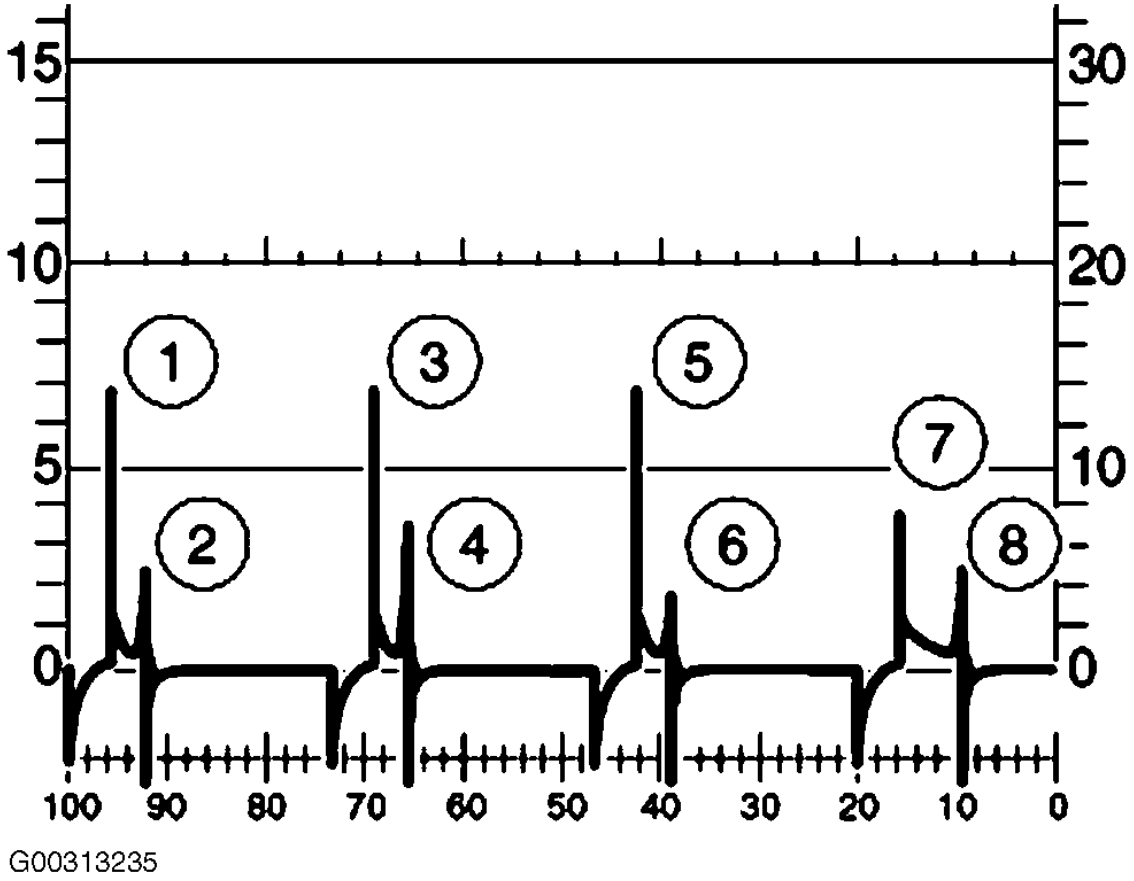



Fig. 10: Evaluation Of Different Ignition Coils (Idle Speed)
Courtesy of BMW OF NORTH AMERICA, INC.

Evaluation Of Combustion Voltage Characteristics At Raised Engine Speed Of Approx. 2500 RPM.

Make: Bremi

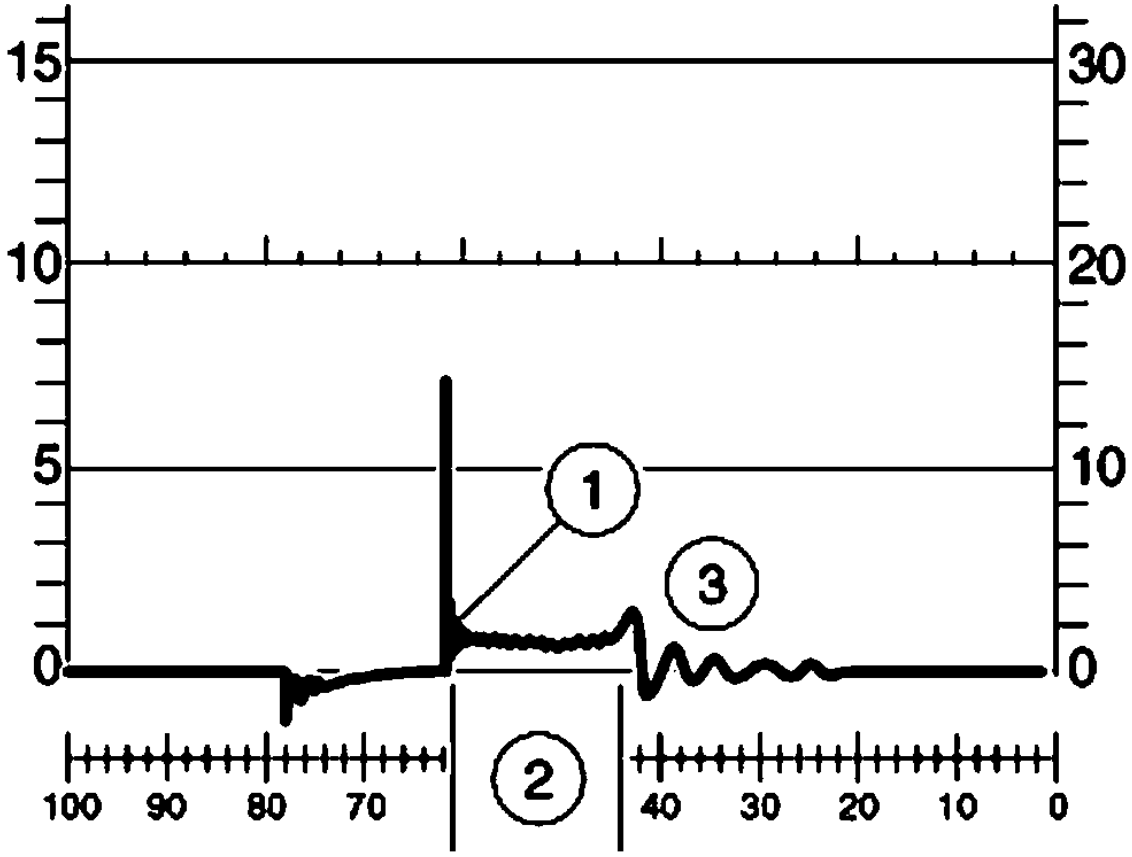



Fig. 11: Evaluation Of Different Ignition Coils At 2500 RPM (Bremi)
Courtesy of BMW OF NORTH AMERICA, INC.

1. Normal oscillation of the combustion voltage curve.
2. Normal combustion period.
3. 3 to 4 attenuations.

Make: Beru

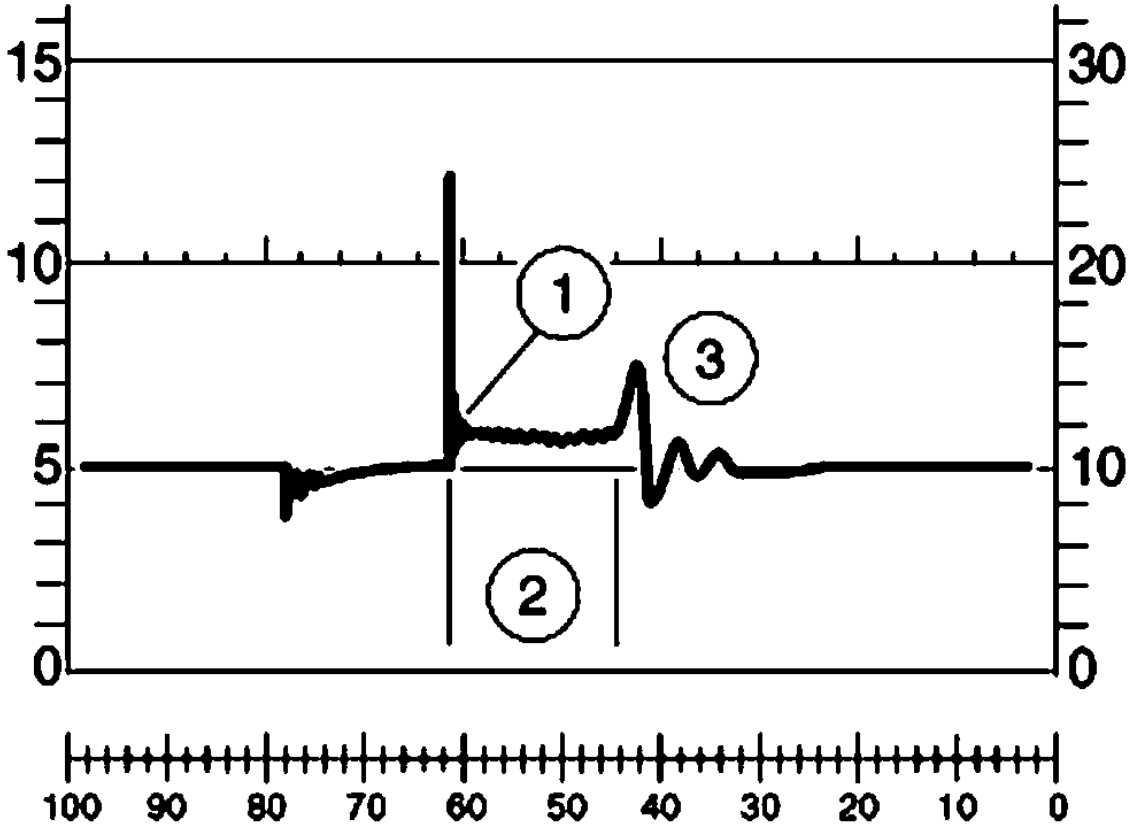



Fig. 12: Evaluation Of Different Ignition Coils At 2500 RPM (Beru)
Courtesy of BMW OF NORTH AMERICA, INC.

1. Normal oscillation of the combustion voltage curve.
2. Normal combustion period.
3. At least 3 decay oscillations.

Make: May & Christe

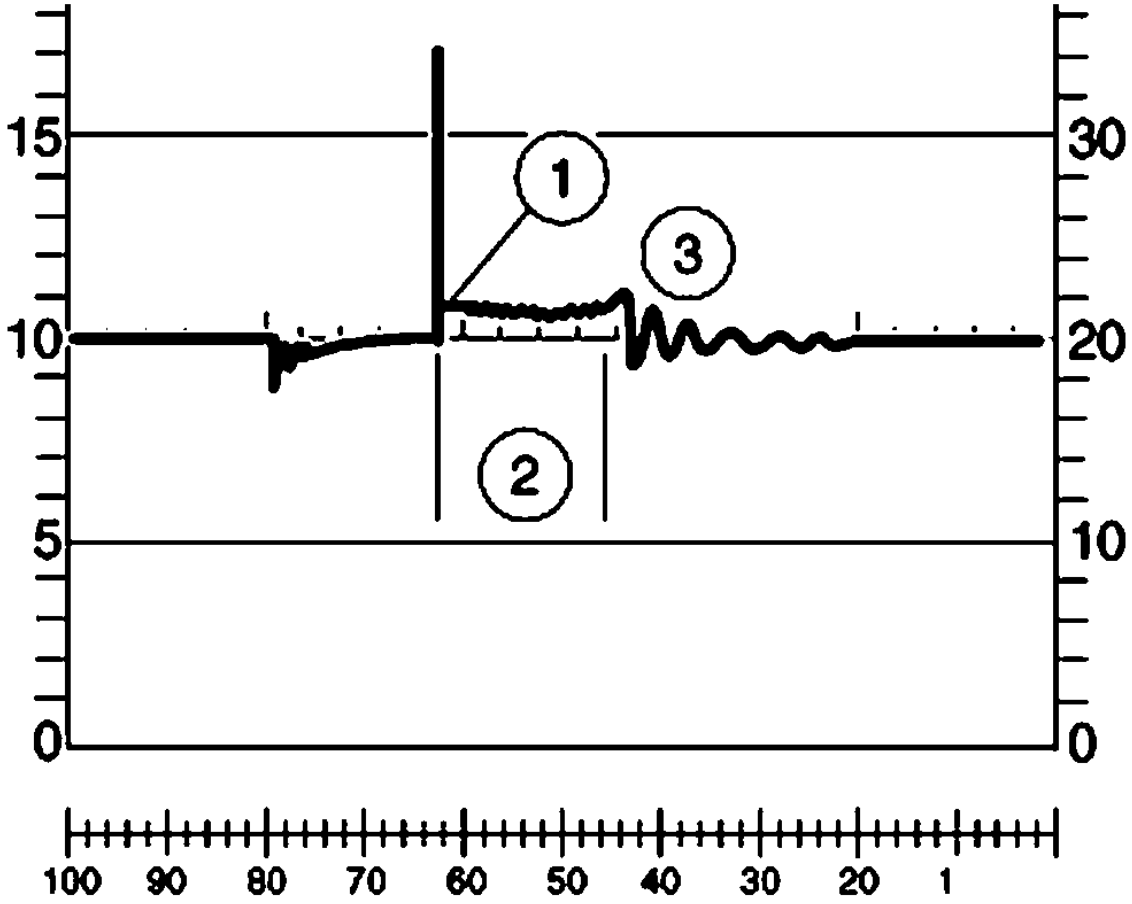



Fig. 13: Evaluation Of Different Ignition Coils At 2500 RPM (May & Cristie)
Courtesy of BMW OF NORTH AMERICA, INC.

1. No oscillation on combustion voltage curve.
2. Normal combustion period.
3. At least 5 decay oscillations.

Make: Bosch

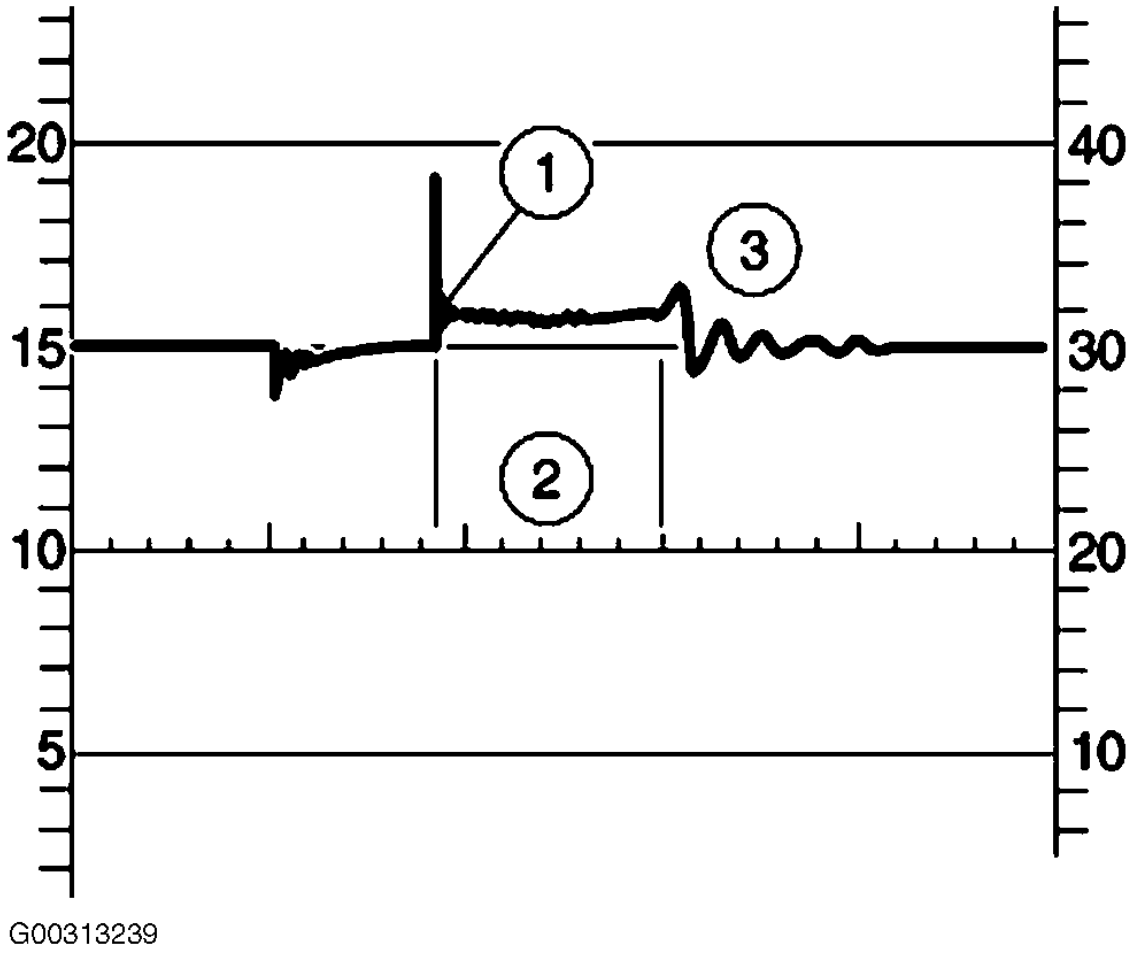



Fig. 14: Evaluation Of Different Ignition Coils At 2500 RPM (Bosch)
Courtesy of BMW OF NORTH AMERICA, INC.

1. Normal oscillation of the combustion voltage curve.
2. Long combustion period.
3. At least 3 decay oscillations.

## 12 13 ... FAULT IN FUEL INJECTION SYSTEM

Evaluation of ignition voltage peaks in response to sudden accelerator loads. See Fig. 15 .

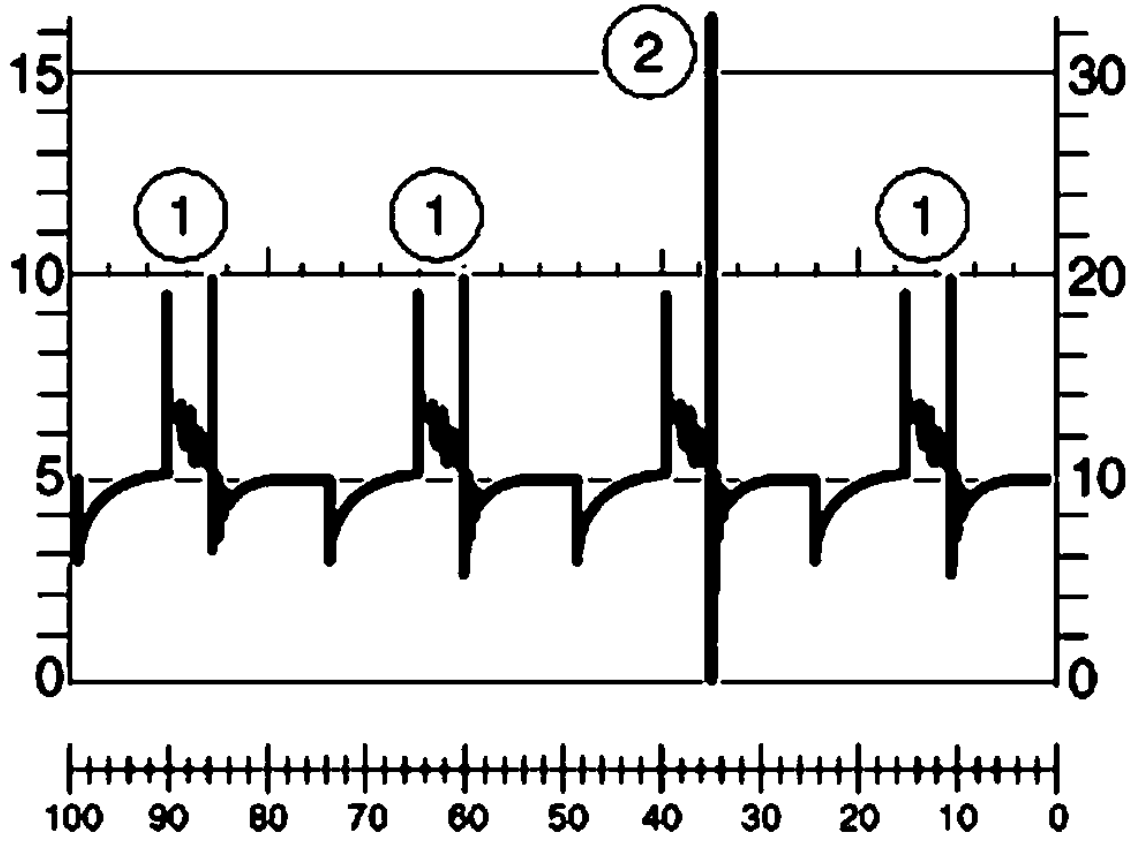



Fig. 15: Identifying Ignition System Faults With Oscilloscope
Courtesy of BMW OF NORTH AMERICA, INC.

1. Beginning of dying-out process is not much higher than ignition voltage peak. Ignition system is OK.
2. Beginning of dying-out process is considerably higher than ignition voltage peak.

   Fault in injection system:

   - Lean Mixture.
   - Defective Injection Valve.
   - Low Compressions.

## 12 13 ... SPARK-PLUG FAULTS

Evaluation of sparking period at idling speed.

1. Normal ignition voltage peak Spark plug is OK.
2. Low ignition voltage peak Small electrode gap.
3. High ignition voltage peak Large electrode gap.

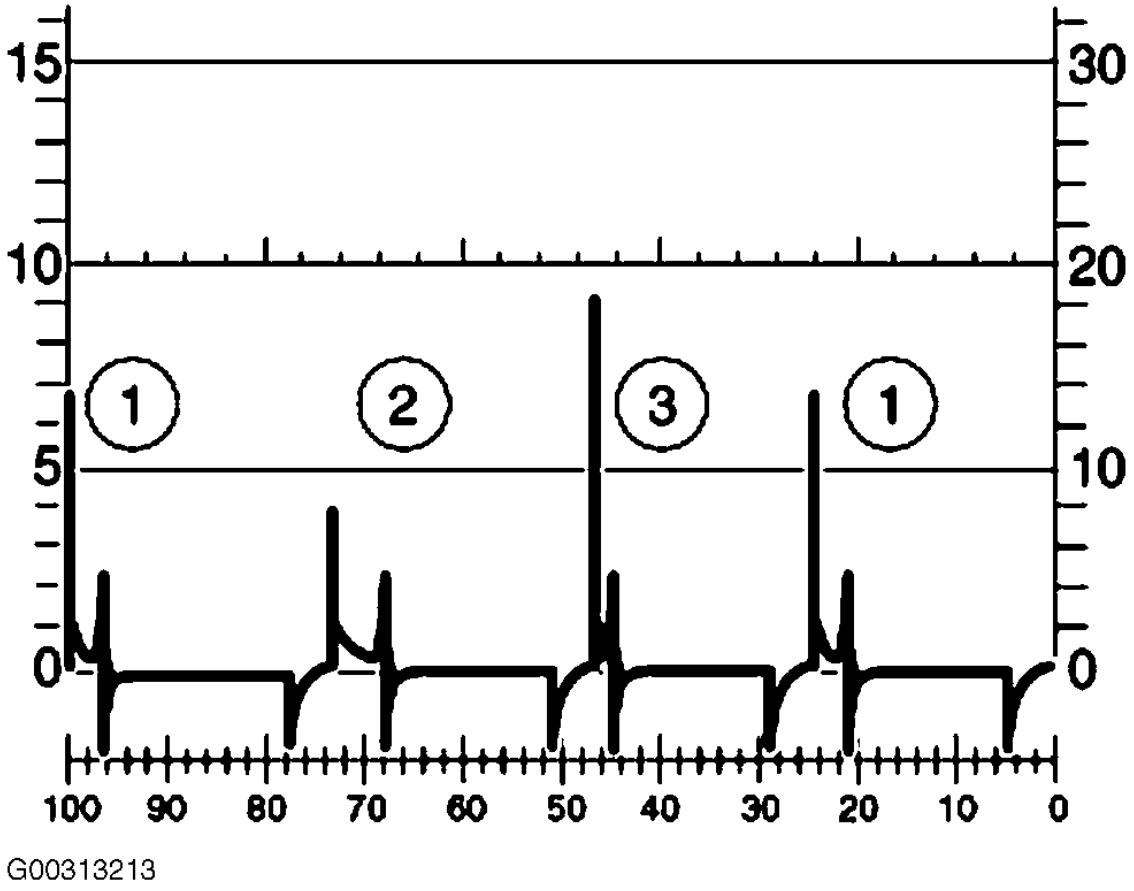



Fig. 16: Evaluation Of Sparking Period During Idling Period
Courtesy of BMW OF NORTH AMERICA, INC.

Evaluation of sparking period at idling speed:

Normal combustion period:

- Spark plug is OK

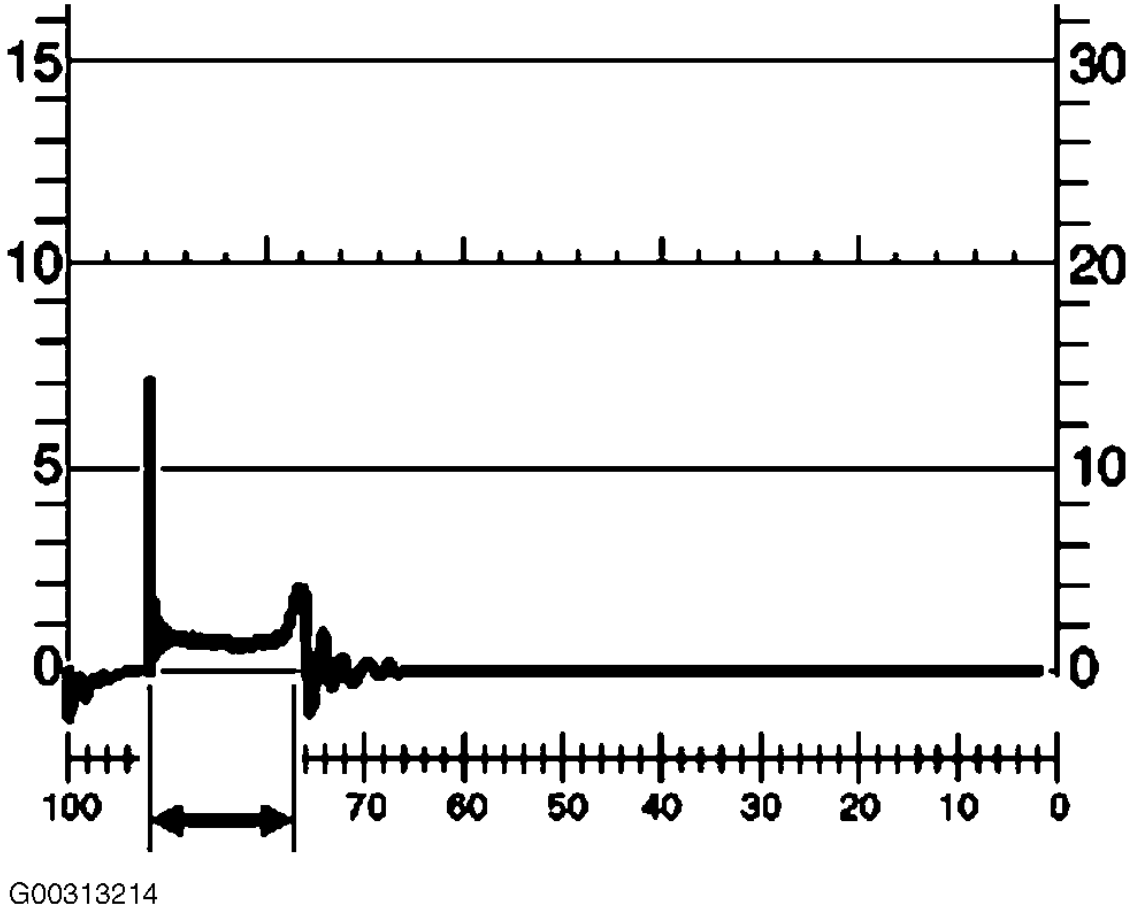



Fig. 17: Evaluation Of Sparking Period - Normal Combustion
Courtesy of BMW OF NORTH AMERICA, INC.

Long combustion period:

- Small electrode gap.

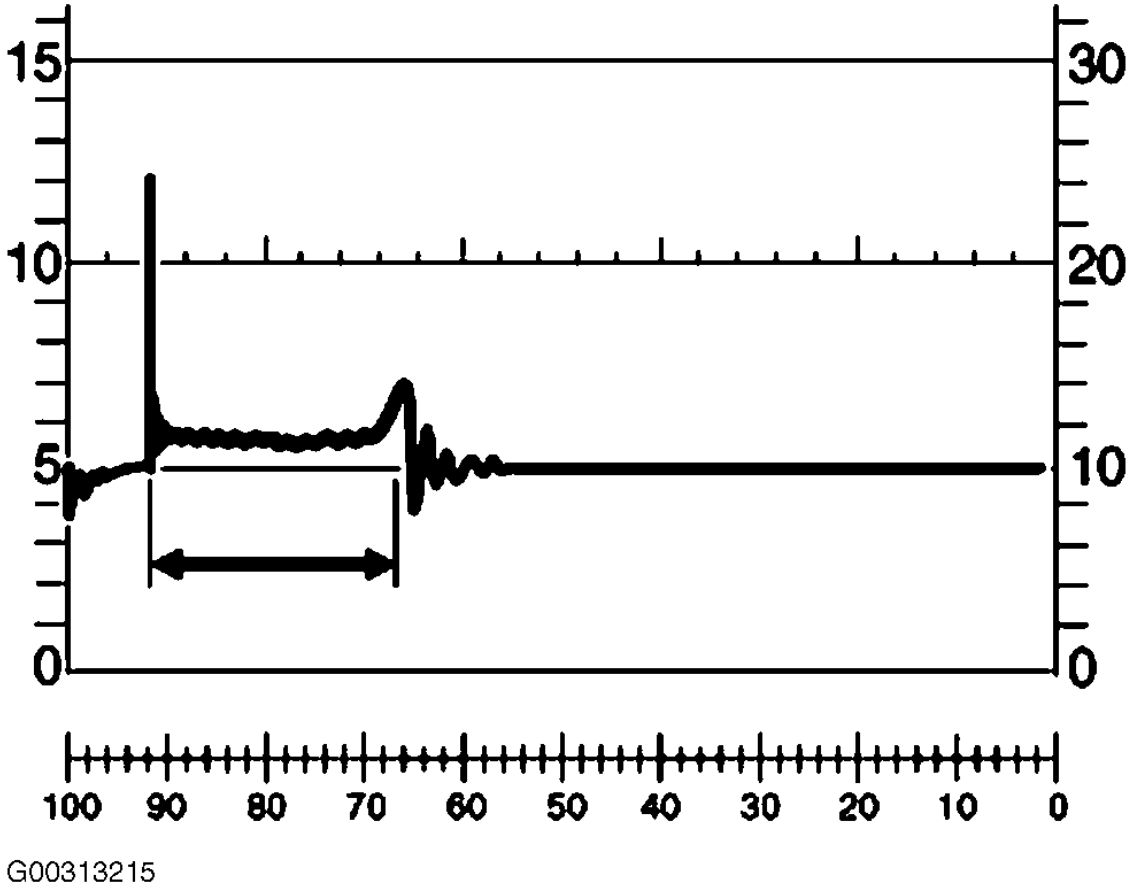



Fig. 18: Evaluation Of Sparking Period - Long Combustion Period
Courtesy of BMW OF NORTH AMERICA, INC.

Short sparking period:

- Large electrode gap.

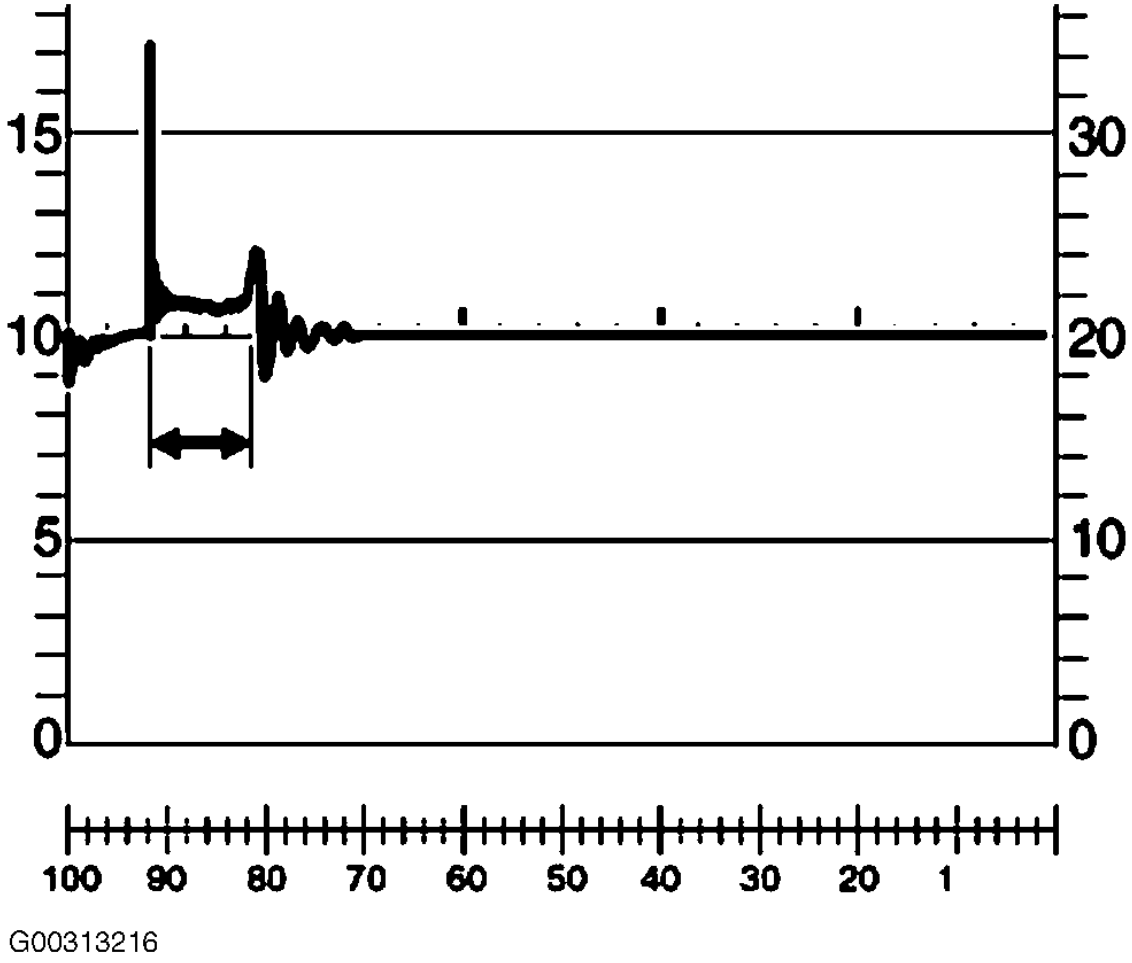



Fig. 19: Evaluation Of Sparking Period - Short Sparking Period
Courtesy of BMW OF NORTH AMERICA, INC.

## 12 13 ... IGNITION COIL FAULTS

Evaluation of ignition voltage peaks and attenuation process at idling speed:

1. Beginning of attenuation processes with normal peaks upwards and downwards.
2. Beginning of attenuation processes strongly shortened Ignition coil is defective.
3. Absence of initial downwards attenuation Ignition coil is defective.

NOTE: Higher ignition voltage peak is not always available.

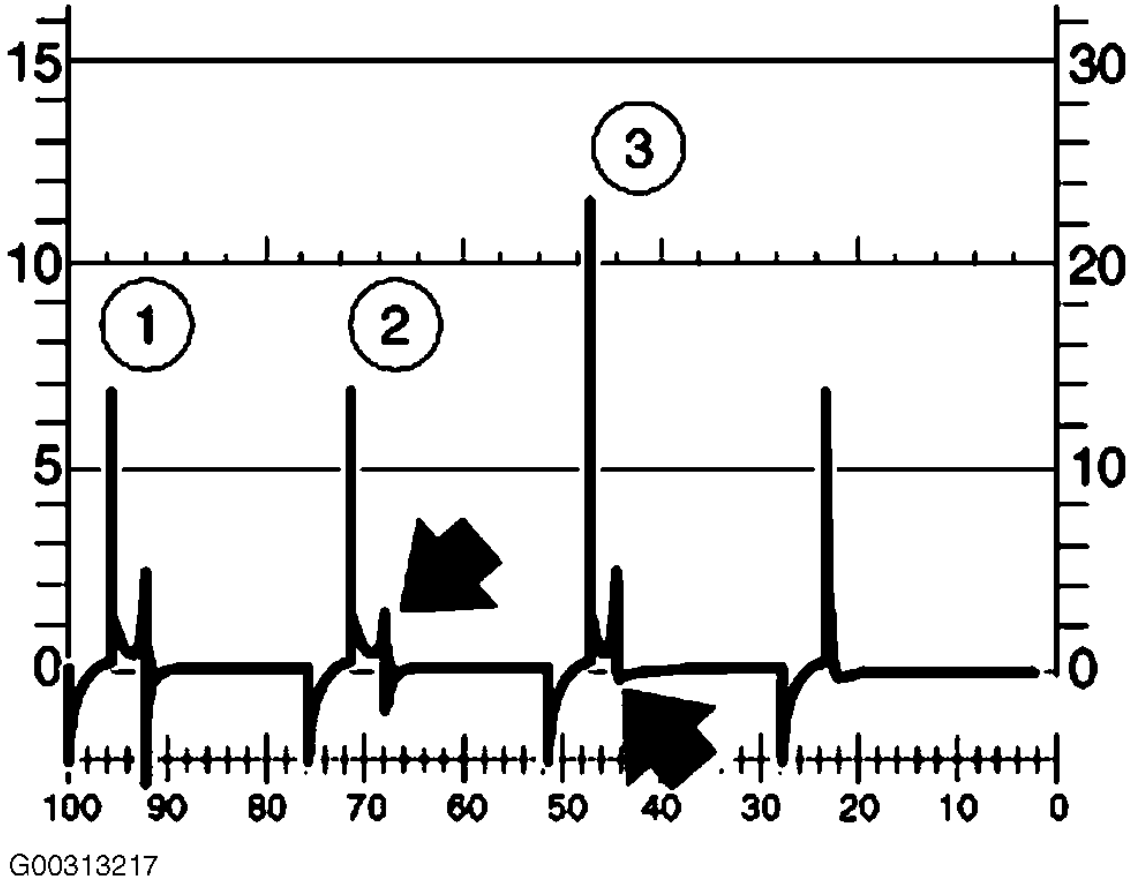



Fig. 20: Evaluation Of Ignition Voltage Peaks & Attenuation Process
Courtesy of BMW OF NORTH AMERICA, INC.

Evaluation of sparking voltage line at idling speed:

1. Normal combustion period.
2. Normal attenuations to sparking voltage line Ignition coil is OK.

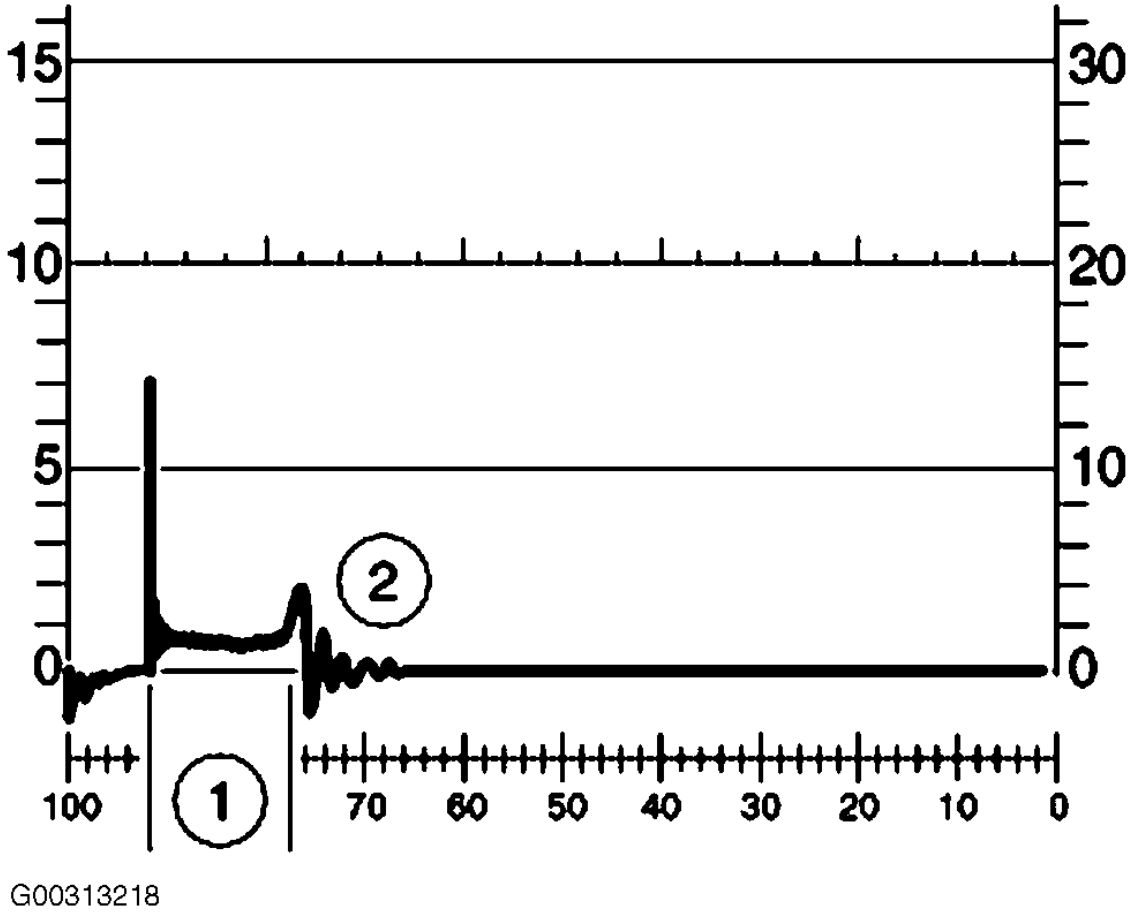



Fig. 21: Evaluation Of Sparking Voltage - Normal Combustion Period
Courtesy of BMW OF NORTH AMERICA, INC.

1. Shorter sparking period.
2. Attenuation to sparking voltage line is only slight. Ignition coil is defective.

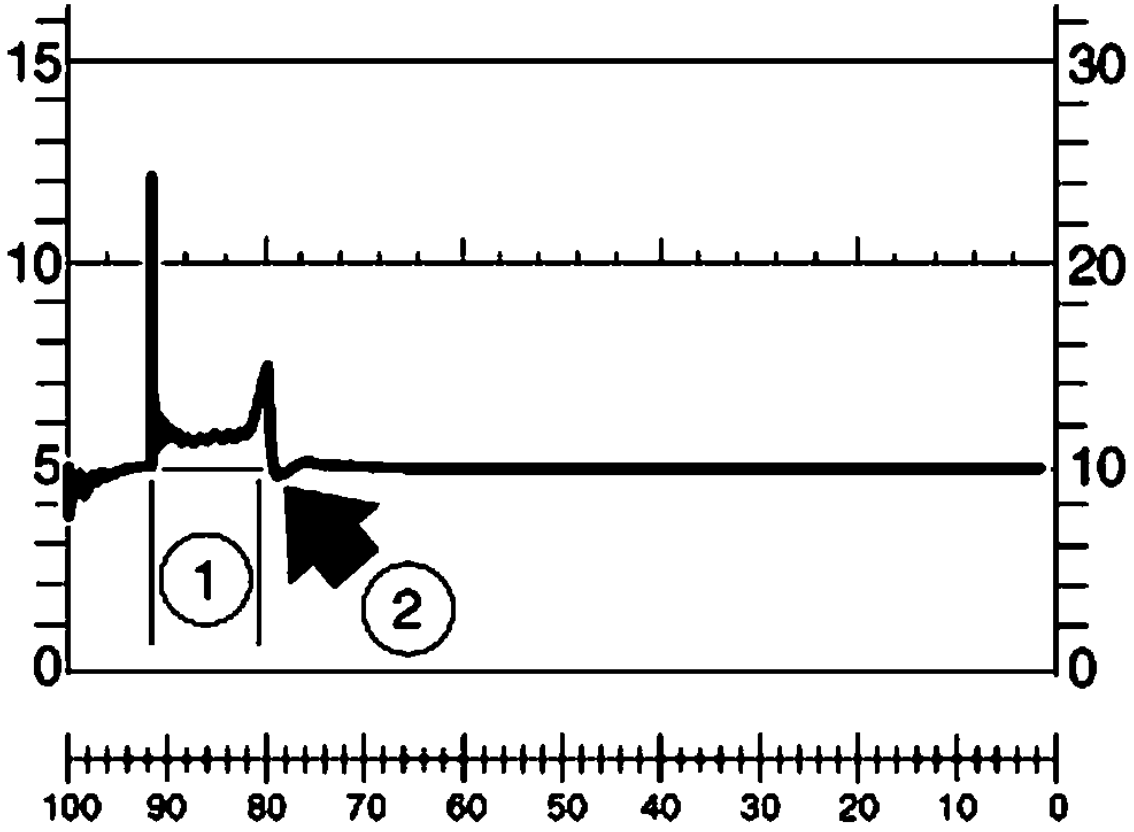



Fig. 22: Evaluation Of Sparking Voltage - Shorter Period
Courtesy of BMW OF NORTH AMERICA, INC.

1. Much shorter sparking period.
2. Attenuations to sparking voltage line absent. Ignition coil is defective.

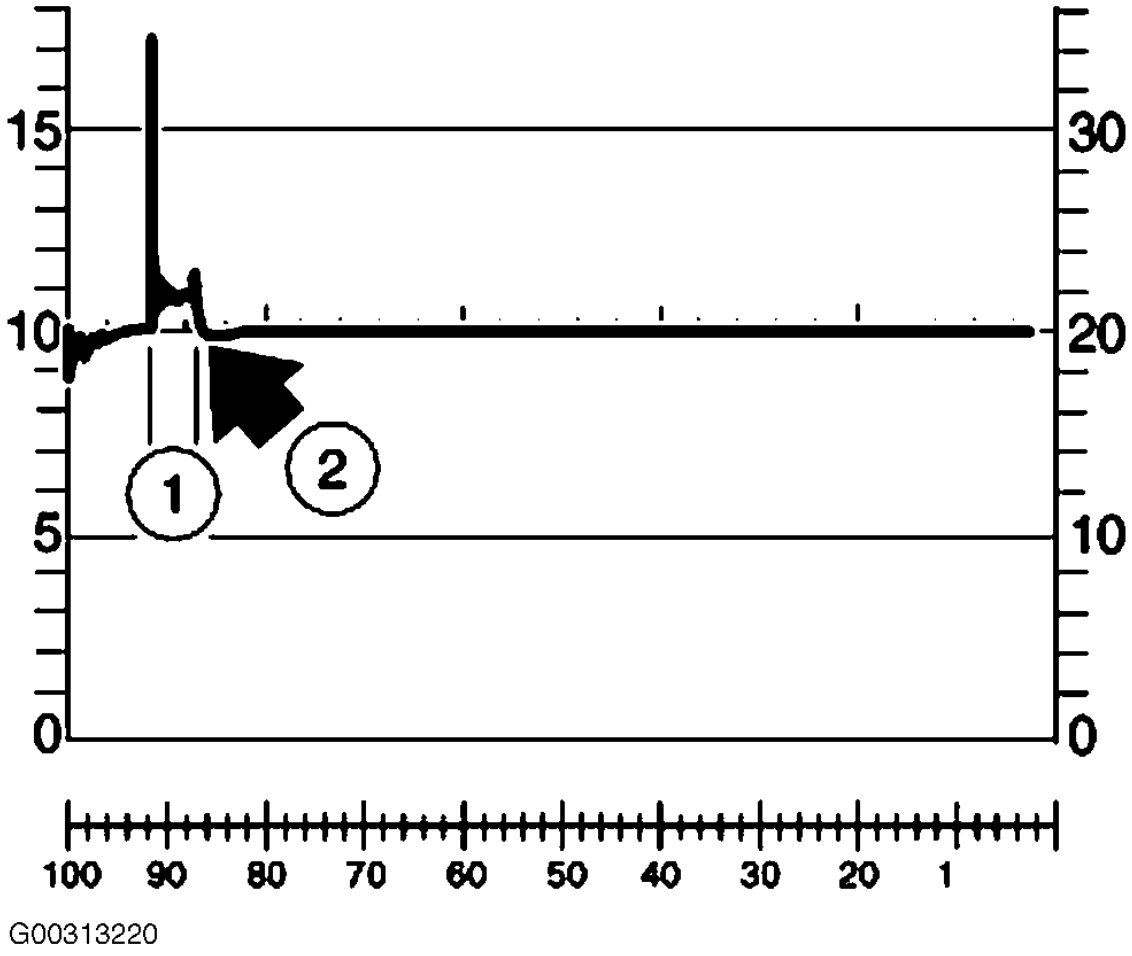



Fig. 23: Evaluation Of Sparking Voltage - Much Shorter Period
Courtesy of BMW OF NORTH AMERICA, INC.

No sparking voltage line. Ignition coil is defective.

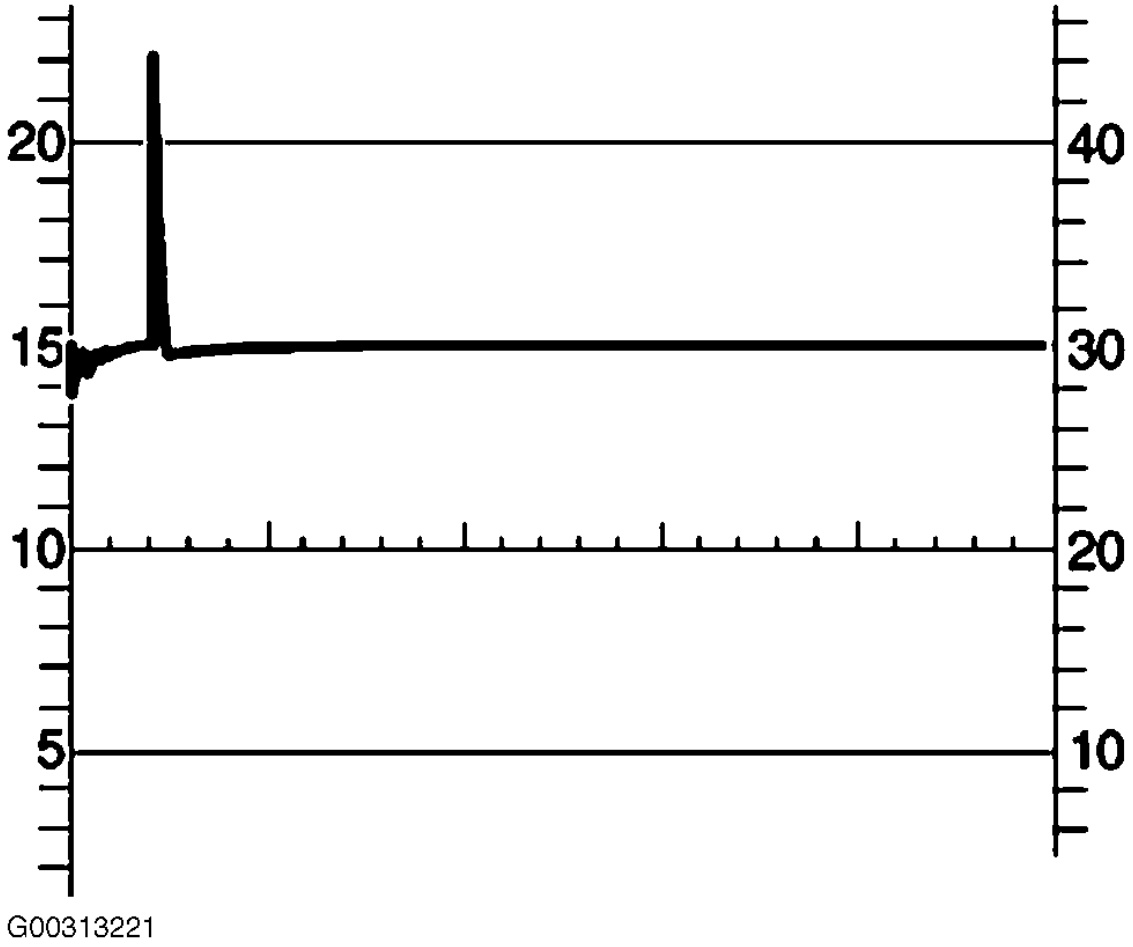



Fig. 24: Evaluation Of Sparking Voltage - No Sparking Voltage Line
Courtesy of BMW OF NORTH AMERICA, INC.

Evaluation of combustion voltage line at raised engine speeds approx. 1500 Min (1):

1. Normal combustion period.
2. Normal attenuations to sparking voltage line Ignition coil is OK.

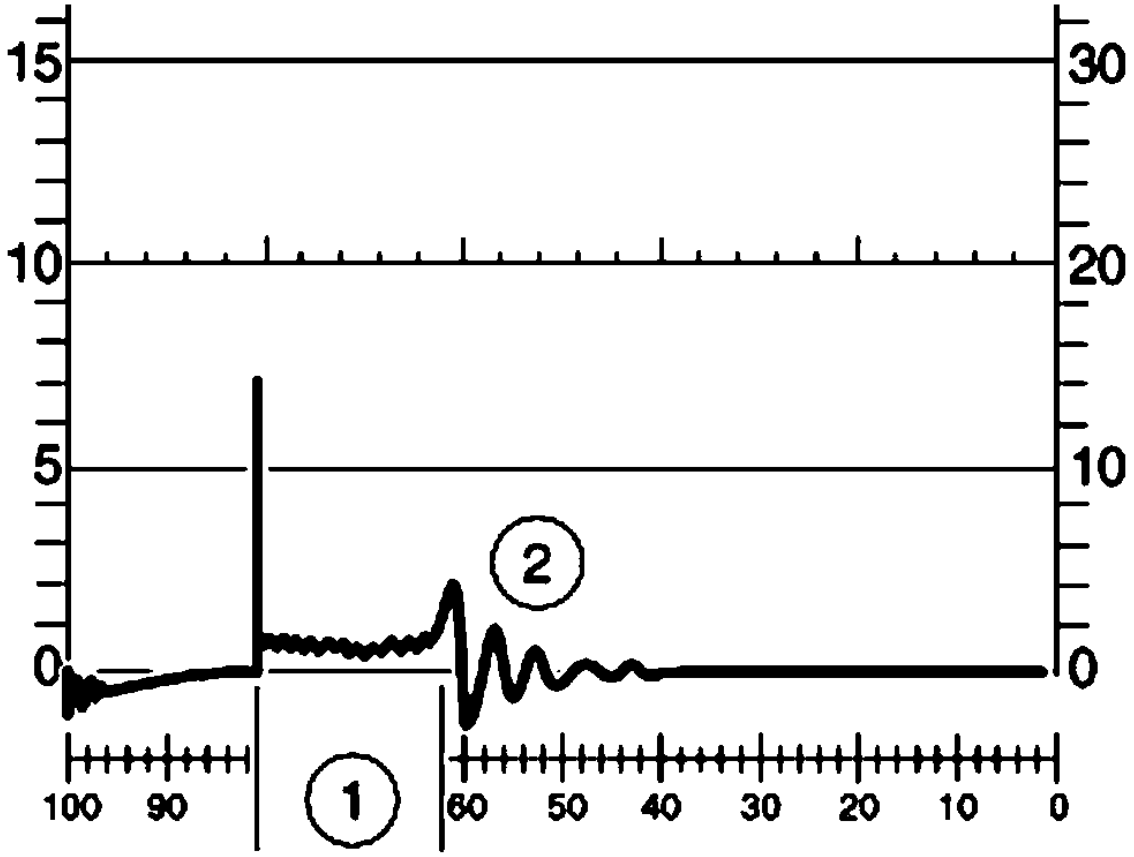



Fig. 25: Evaluation Of Combustion Voltage Line - Normal Combustion Period
Courtesy of BMW OF NORTH AMERICA, INC.

1. Shorter sparking period.
2. Attenuation to sparking voltage line is only slight. Ignition coil is defective.

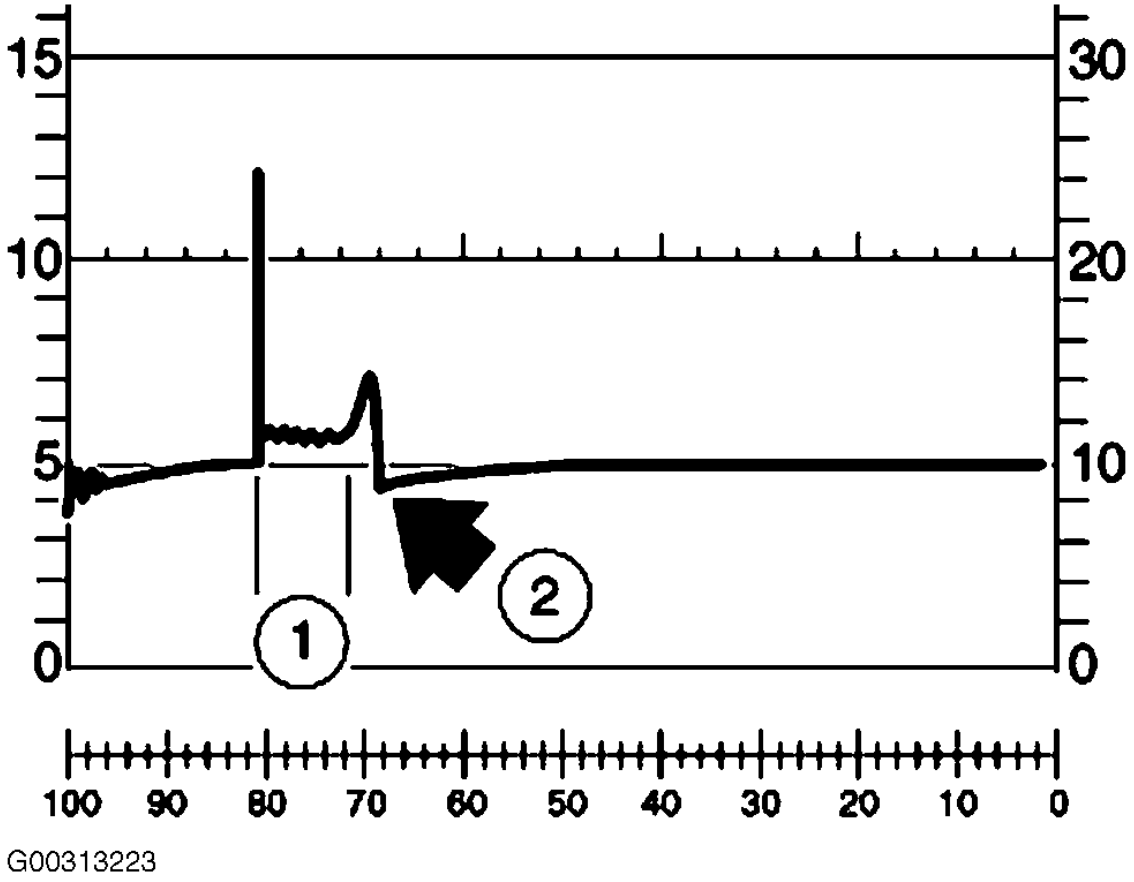



Fig. 26: Evaluation Of Combustion Voltage Line - Shorter Sparking Period
Courtesy of BMW OF NORTH AMERICA, INC.

1. Normal combustion period.
2. Attenuations to sparking voltage line absent. Ignition coil is defective.

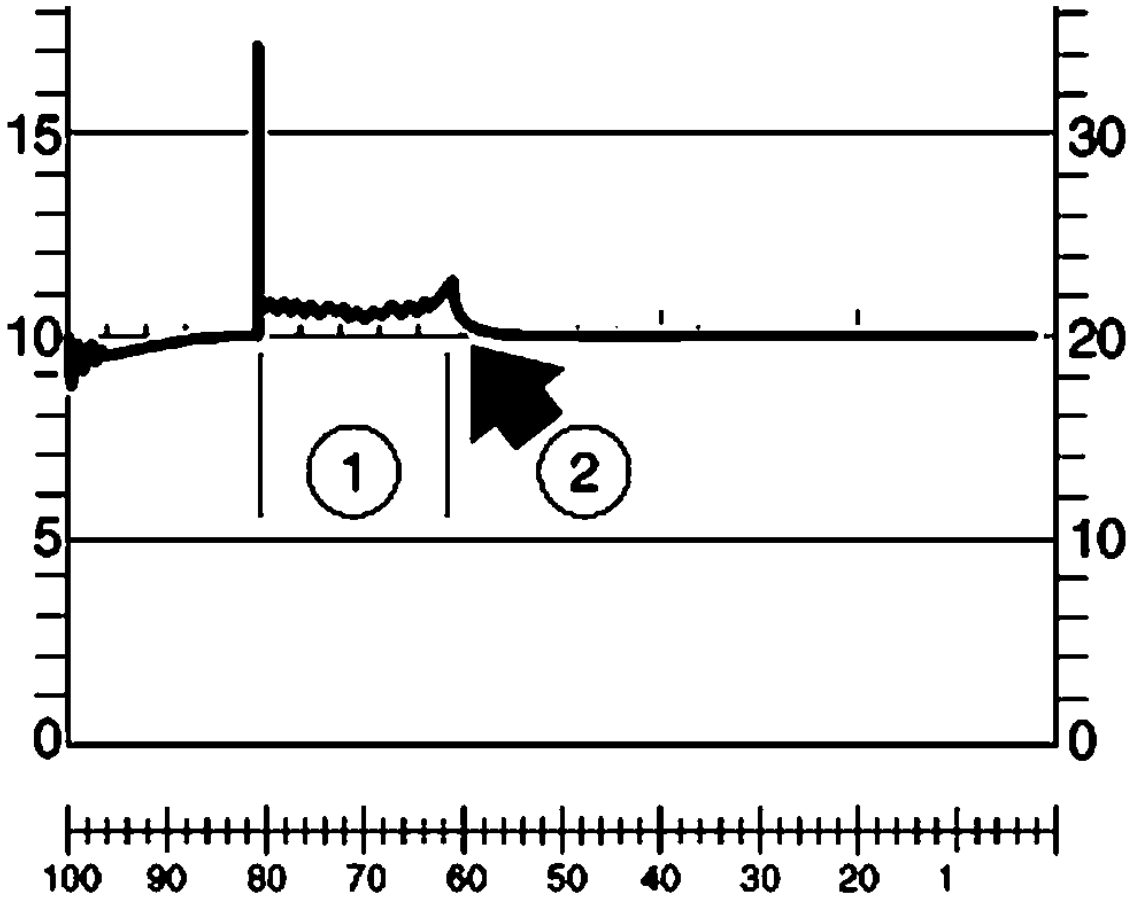



Fig. 27: Evaluation Of Combustion Voltage Line - Normal Combustion Period
Courtesy of BMW OF NORTH AMERICA, INC.

## 12 13 ... FURTHER FAULT PATTERNS WITH EVALUATION

Evaluation of sparking period and ignition voltage peaks at idling speed:

1. Normal combustion period.
2. Normal ignition voltage peak. Ignition system is OK.

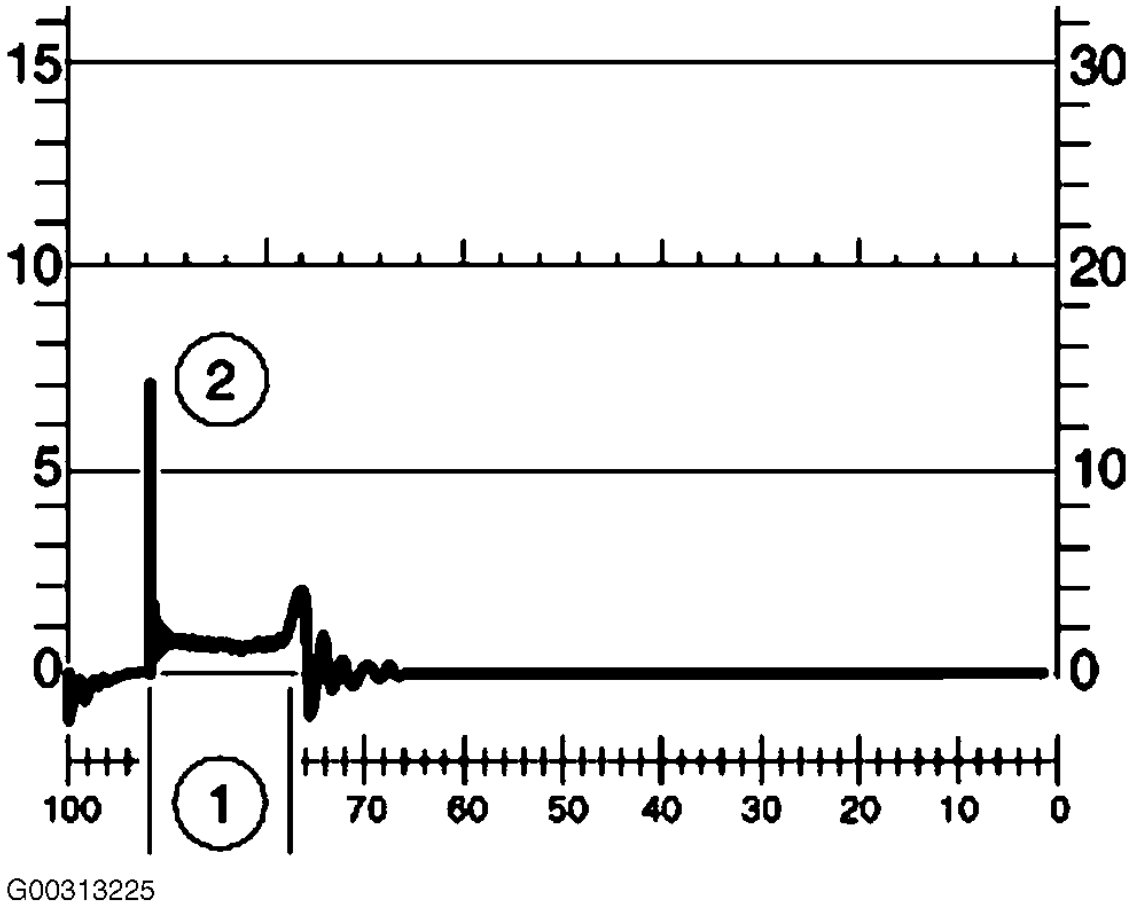



Fig. 28: Evaluation Of Sparking Period & Ignition Voltage Peaks At Idle Speed
Courtesy of BMW OF NORTH AMERICA, INC.

Long sparking period (1) with low ignition voltage peak (2). Indicates low compression.

Fluctuating sparking period: Indicates contamination on spark plug (shunt).

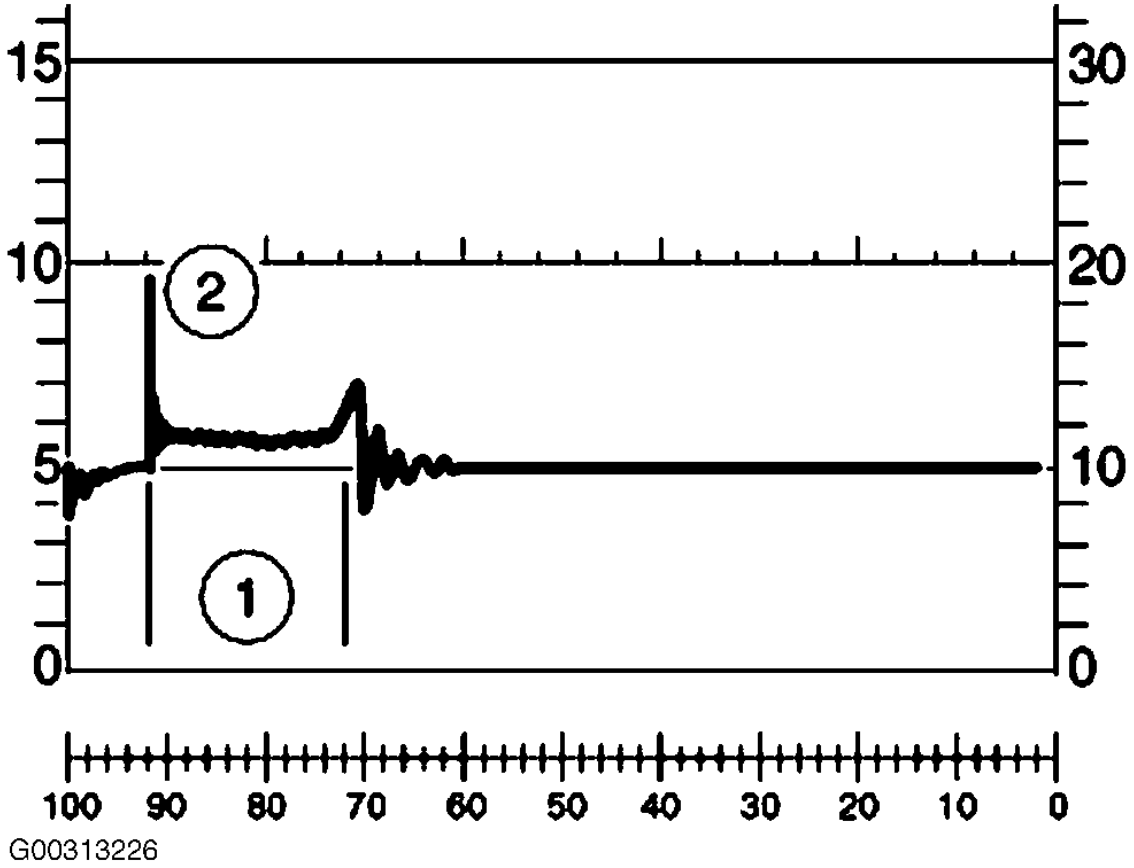



Fig. 29: Long Sparking Period With Low Ignition Voltage Peak
Courtesy of BMW OF NORTH AMERICA, INC.

Short sparking period (1) with high ignition voltage peak. Constant but short sparking period: Indicates defective ignition lead.

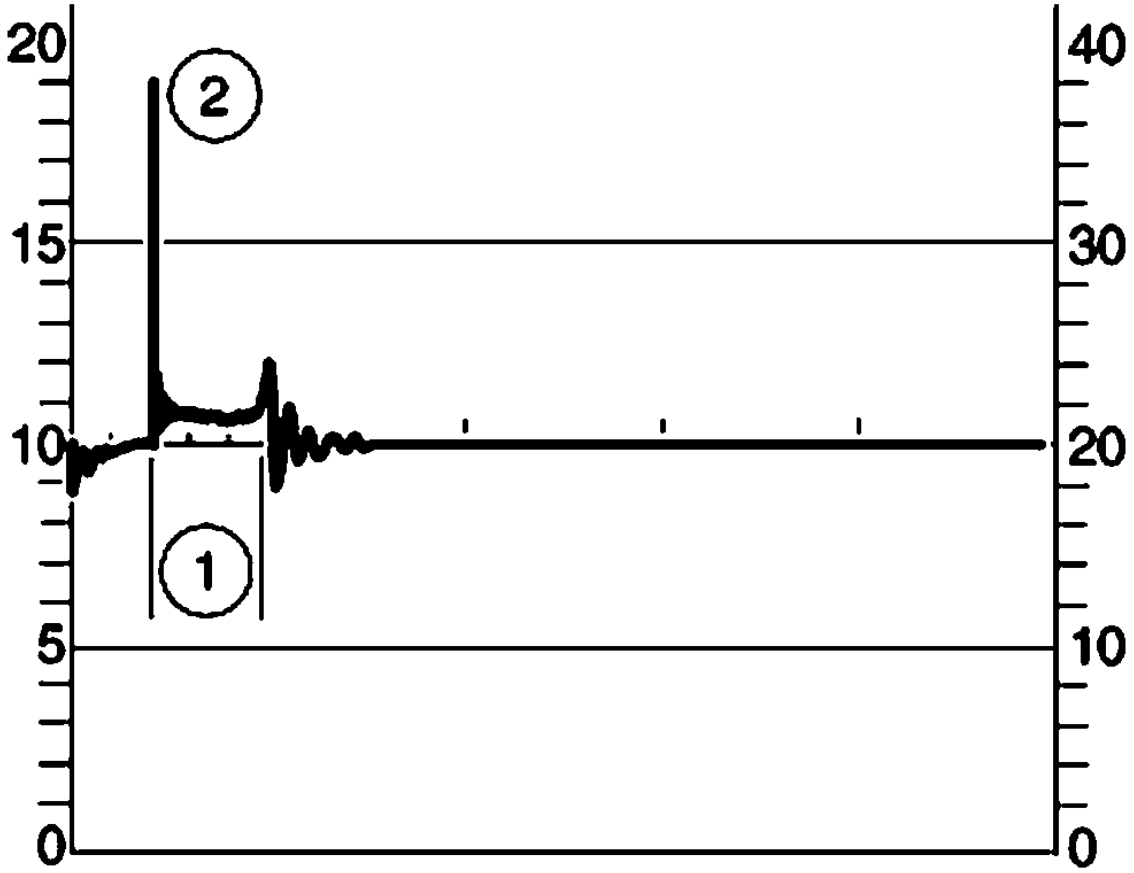



Fig. 30: Short Sparking Period With High Ignition Voltage Peak
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The sparking-voltage line could sometimes be missing completely and the ignition voltage peak could rise very high.

IGNITION VOLTAGE TOO HIGH

| | |
|---|---|
| Electrode Gap | Large |
| Compression | High |
| Fuel Air Mixture | Lean |
| Electrode Temperature | Low |
| Electrode Condition | Burnt |
| Ignition Lead | Interrupted |

IGNITION VOLTAGE TOO LOW

| | |
|---|---|
| Electrode Gap | Small |
| Compression | Low |
| Fuel Air Mixture | Correct |
| Electrode Temperature | High |
| Electrode Condition | New |

## 12 13 ... ADDITIONAL FAULT NOTES FOR TROUBLESHOOTING

Use the primary voltage test adapter, Special Tool 12 7 020 to troubleshoot the primary side of a separate ignition coil.

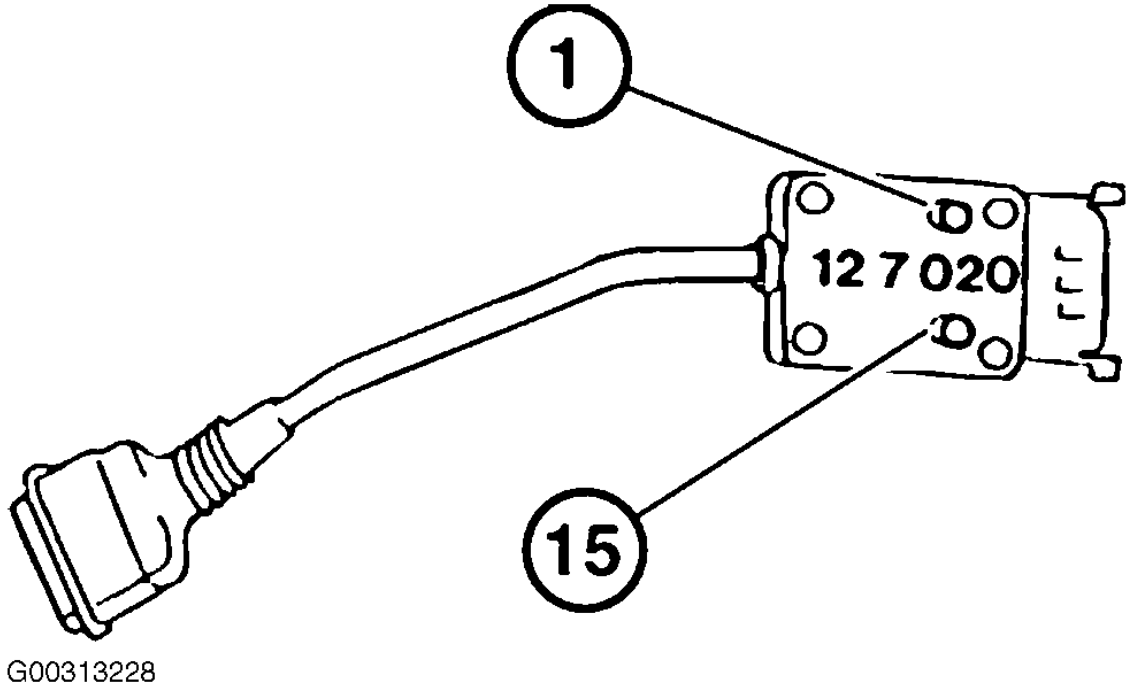



Fig. 31: Identifying Primary Voltage Tester
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: If terminal 1 signal is not present on pin 1 in the diagnosis connector, the external trigger signal for the BMW Service Tester can be prepared with the help of Special Tool 12 7 020.

Connect BMW SERVICE TESTER.

Select Engine Test Step 05.

Enter number of cylinders.

Connect universal adapter to tester.

Connect brown clip to vehicle earth.

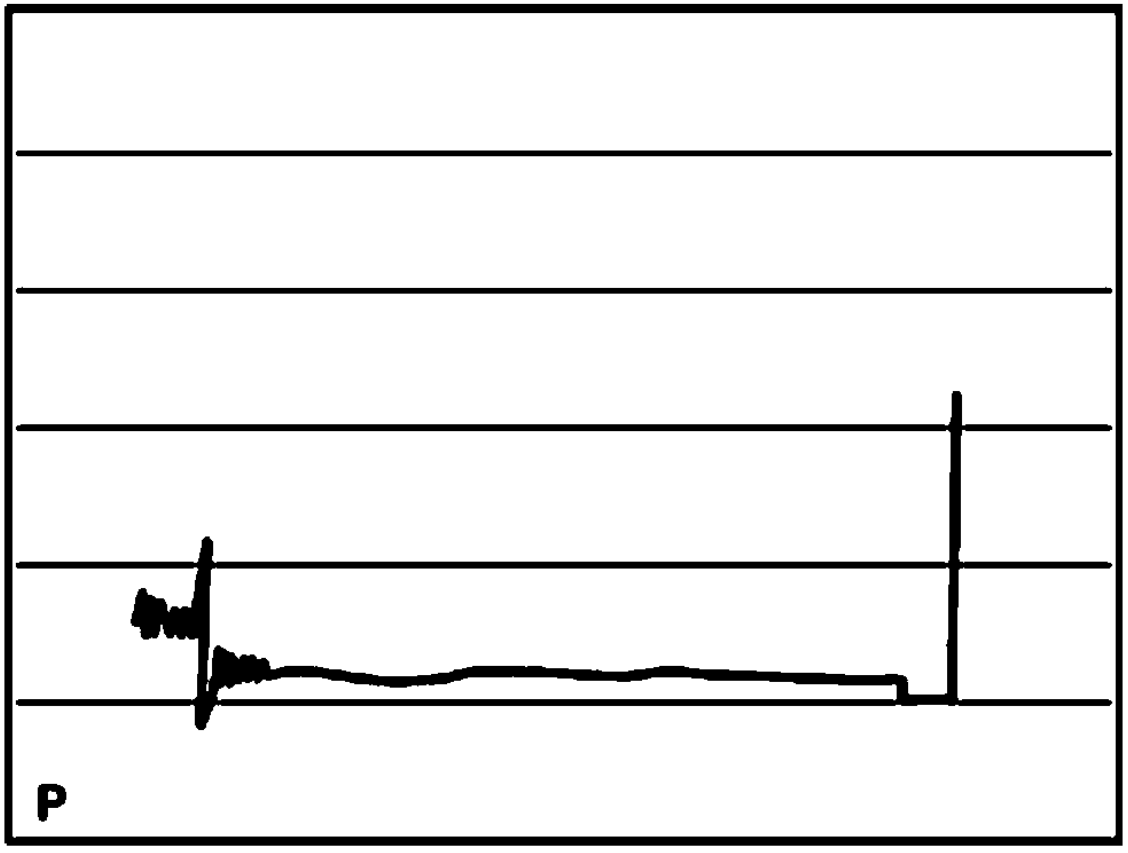
Connect black clip to terminal 1 of Special Tool 12 7 020.

NOTE: If trigger signal is missing from diagnosis box on 6-cylinder engine, preselect two cylinder settings on BMW SERVICE TESTER.

The red inductive clip is not used as only the cylinder is being tested. For this reason, the engine speed display will be too low by factor 4.

Connect Special Tool 12 7 020 to the ignition coil being tested and the vehicle wiring harness.

Produce a stationary signal on the oscilloscope by pressing key R.



G00313229

Fig. 32: Identifying Spark Line
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The sparking voltage line on the oscilloscope will be very nervous, as the fuel/air mixture swirl of a 4-valve engine will be greater than that of a 2-valve engine.

## 12 13 009 CHECKING ROD-TYPE IGNITION COILS (M54, M56, N40, N42, N45, N46, N52, N62, N73)

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 12 1 301
- 12 7 050

Necessary Preliminary Tasks:

- Read out fault memory in DME (Digital Motor Electronics)
- Remove M54/56 ignition coil cover.

Unlock plug fastener (1) of ignition coil.

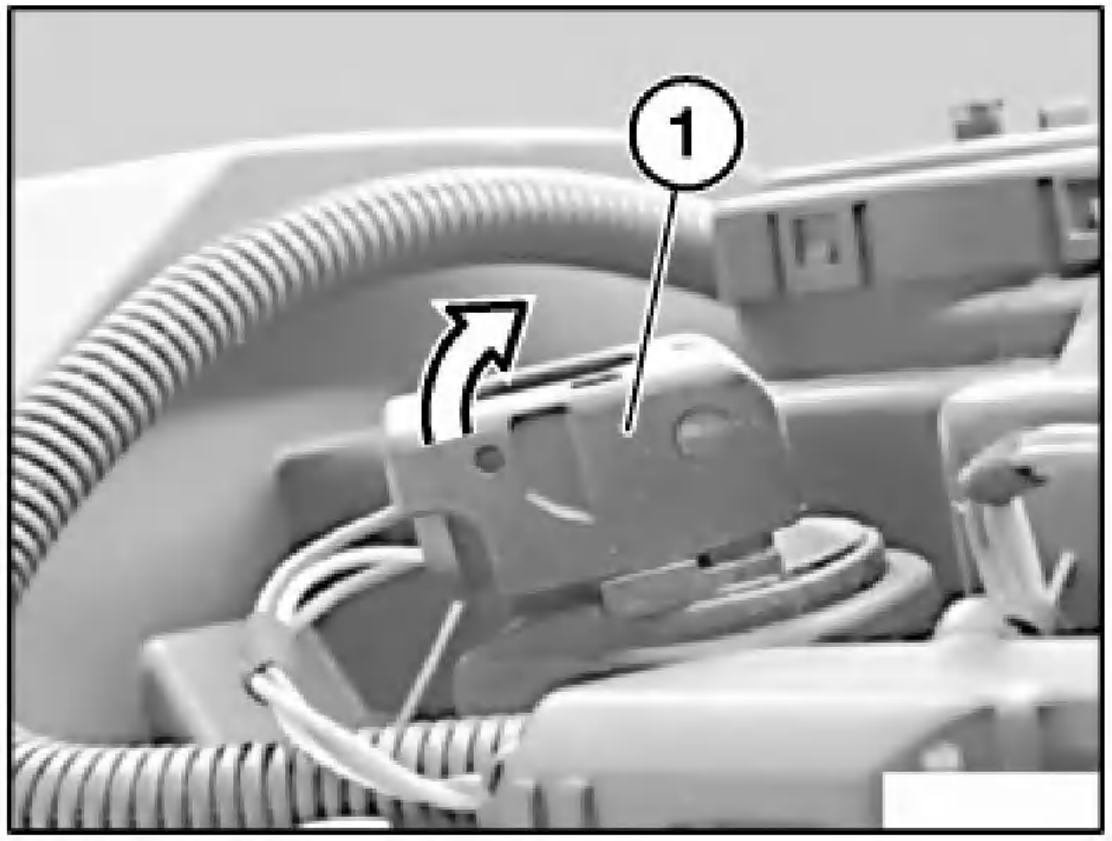



Fig. 33: Unlocking Plug Fastener Of Ignition Coil
Courtesy of BMW OF NORTH AMERICA, INC.

Detach plug (1) in direction of arrow.

Pull out ignition coil (2) towards top.

NOTE: Procedure applies to all rod-type ignition coils.

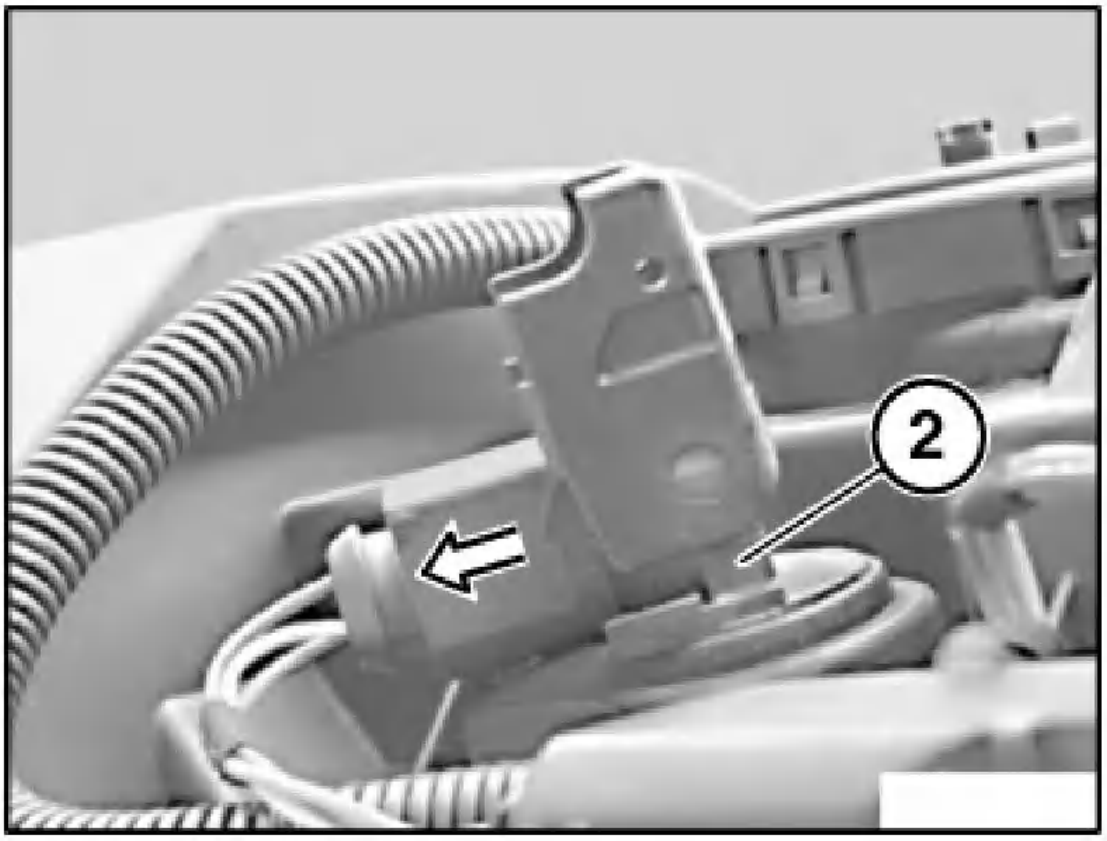



Fig. 34: Detaching Plug In Direction Of Arrow
Courtesy of BMW OF NORTH AMERICA, INC.

Install special tool 12 7 050.

Installation:

Special tool 12 7 050 is attached between spark plug and rod-type ignition coil.

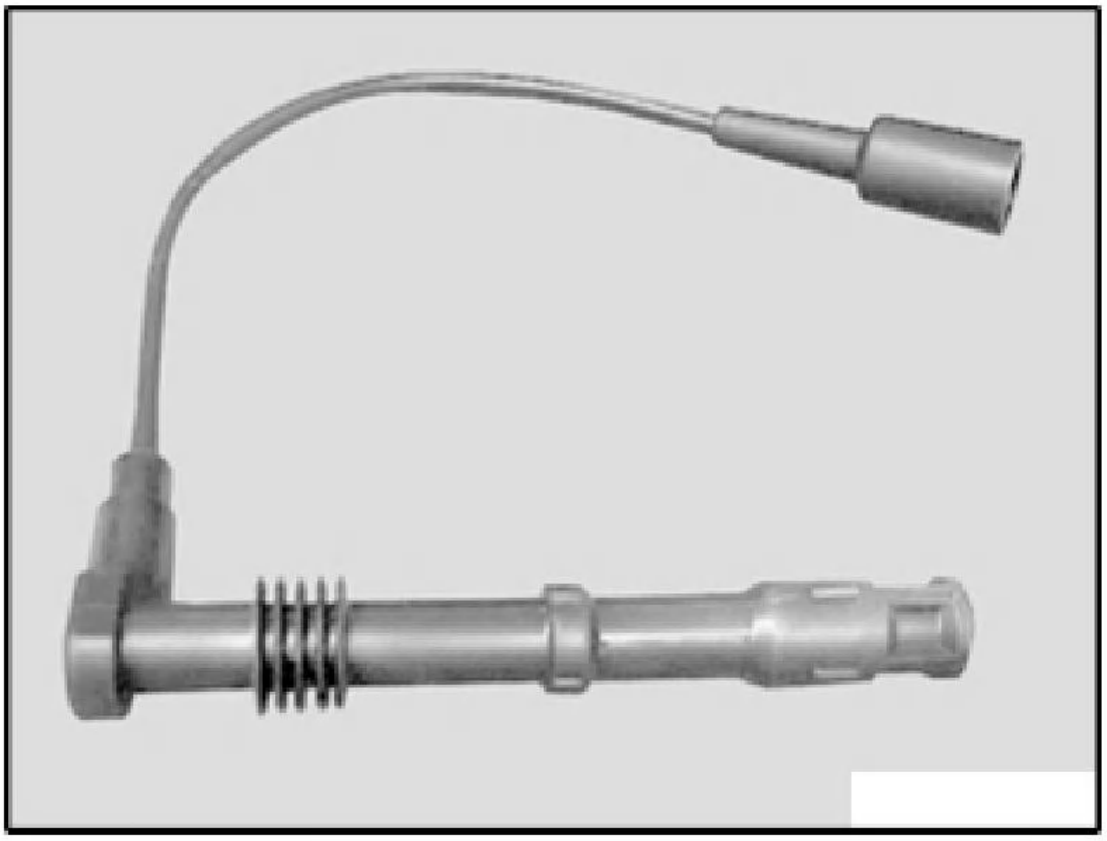



Fig. 35: Attaching Between Spark Plug And Rod-Type Ignition Coil
Courtesy of BMW OF NORTH AMERICA, INC.

Secondary Measurement:

Connect KV clip-on probe (1) of DIS Tester to special tool 12 7 050.

Procedure on DIS Tester:

- Select < Measurement>.
- Select < Preset measurements.
- Select < Secondary ignition signal>.
- Connect < TD cable to diagnostic head>.
- Select < static ignition distribution:".
- Select < Number of cylinders>.

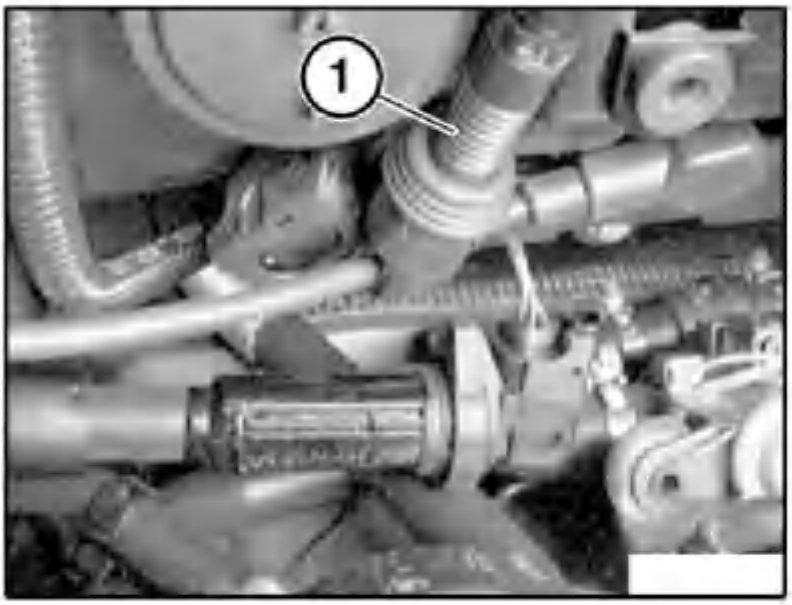



Fig. 36: Identifying Connecting KV Clip-On Probe
Courtesy of BMW OF NORTH AMERICA, INC.

For subsequent procedure, follow DIS instructions.

NOTE: Illustration shows: KV clip-on probe (1) US version.

Primary Measurement:

Connect 26-pin pin box with special tool 12 13 01 to connector (1) DME module 5.

Procedure on DIS Tester:

- Select < Measurement>.
- Select < Preset measurements>.
- Select < Ignition signal term. 1>.

For subsequent procedure, follow DIS instructions.

NOTE: Pin assignment ace. to connection scheme.

Illustration N42.

Important!

Ignition signal is a multiple spark ignition.

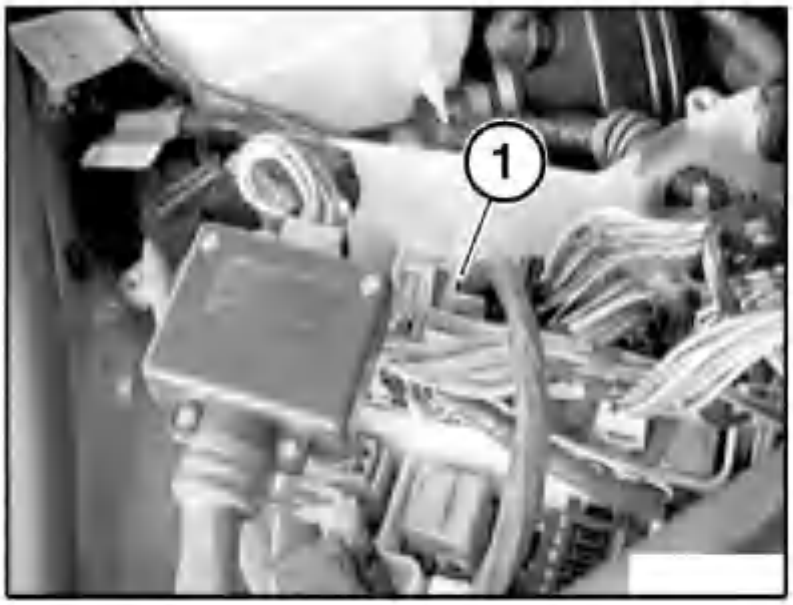



Fig. 37: Identifying Ignition Signal Is A Multiple Spark Ignition
Courtesy of BMW OF NORTH AMERICA, INC.

Illustration of multiple spark ignition:

1. Start of ignition peak.
2. Level of ignition voltage.
3. Level of sparking voltage.
4. Spark duration.
5. Sparking voltage curve.
6. Start of decay process.
7. Decay process.

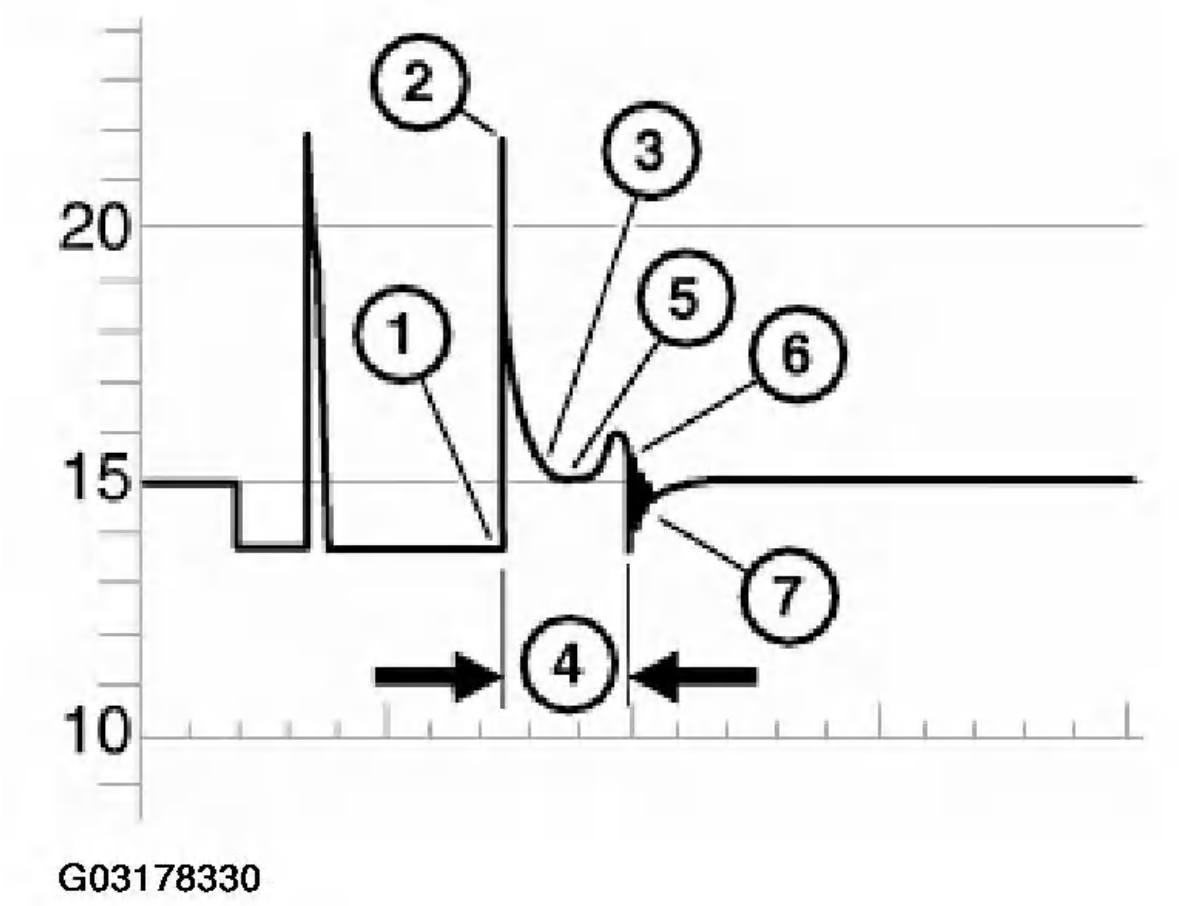



Fig. 38: Multiple Spark Ignition Graph
Courtesy of BMW OF NORTH AMERICA, INC.

M54 / M56 / N40 / N42 / N45 / N46 / N62 / N73:

The following ignition oscillogram applies to engines with multiple spark ignition from a production date of April 2001:

Depending on engine temperature (approx. -20Â° to 100Â°) and engine speed (< 2000 rpm.), some ignition voltage peaks (approx. 1-5 ignition peaks) can occur before the typical ignition voltage characteristic.

The additional ignition peaks play no role in diagnosis.

The last ignition peak (1) on the oscillogram is decisive.

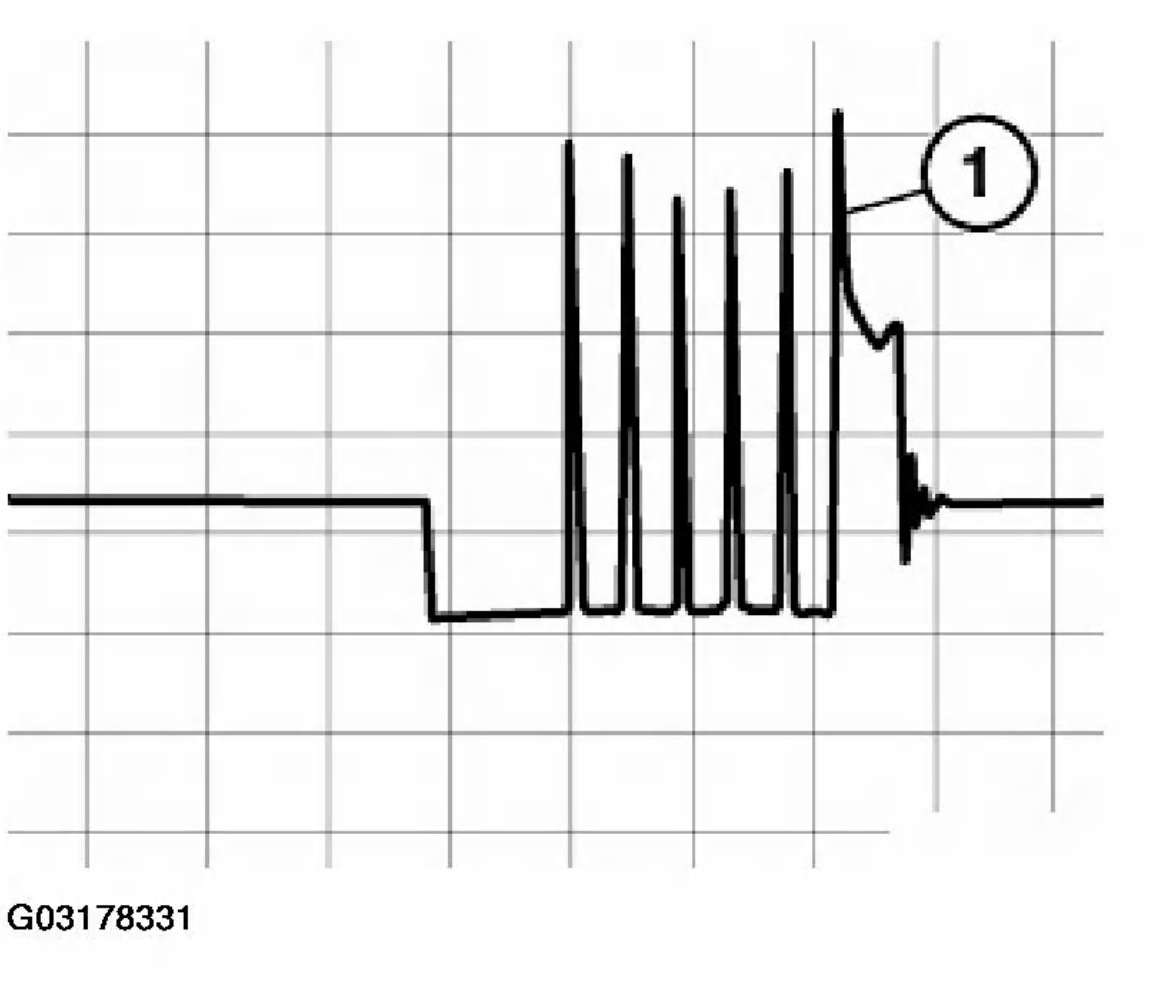



Fig. 39: Multiple Spark Ignition Oscillogram Graph
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The display of the ignition voltage peak is approx. 20-25 % lower than the real value. It is not the height of the ignition voltage peaks but rather the uniformity of all the cylinders that is important. Differences of 3000 to 4000 volts are permitted.

## 12 13 511 REPLACING IGNITION COIL (M52, M52TU, S52, S50US, M54)

Switch off ignition.

Remove cover for ignition coils.

Version With Single-Spark Ignition Coils:

Unlock connector of ignition coils.

Disconnect connector from ignition coils.

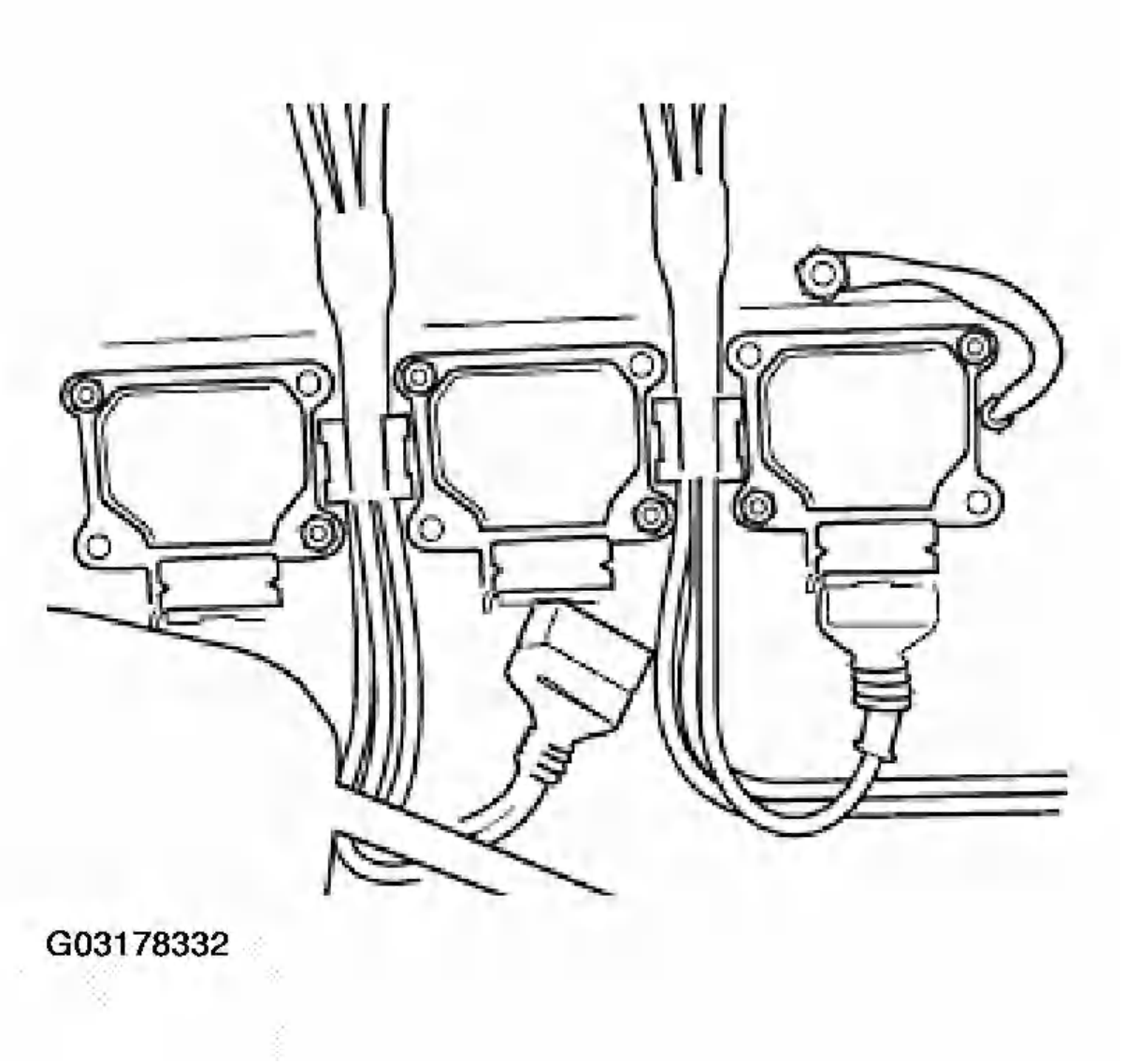



Fig. 40: Disconnecting Connector From Ignition Coils
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws on ignition coil.

Pull out ignition coil.

Installation:

Screw down grounding strap (1) to cylinder head cover mounting and to ignition coil for cylinders 1 and 6.

On metal covers:

Screw down grounding strap of cable duct to cylinder head cover mounting between cylinders 2 and 3.

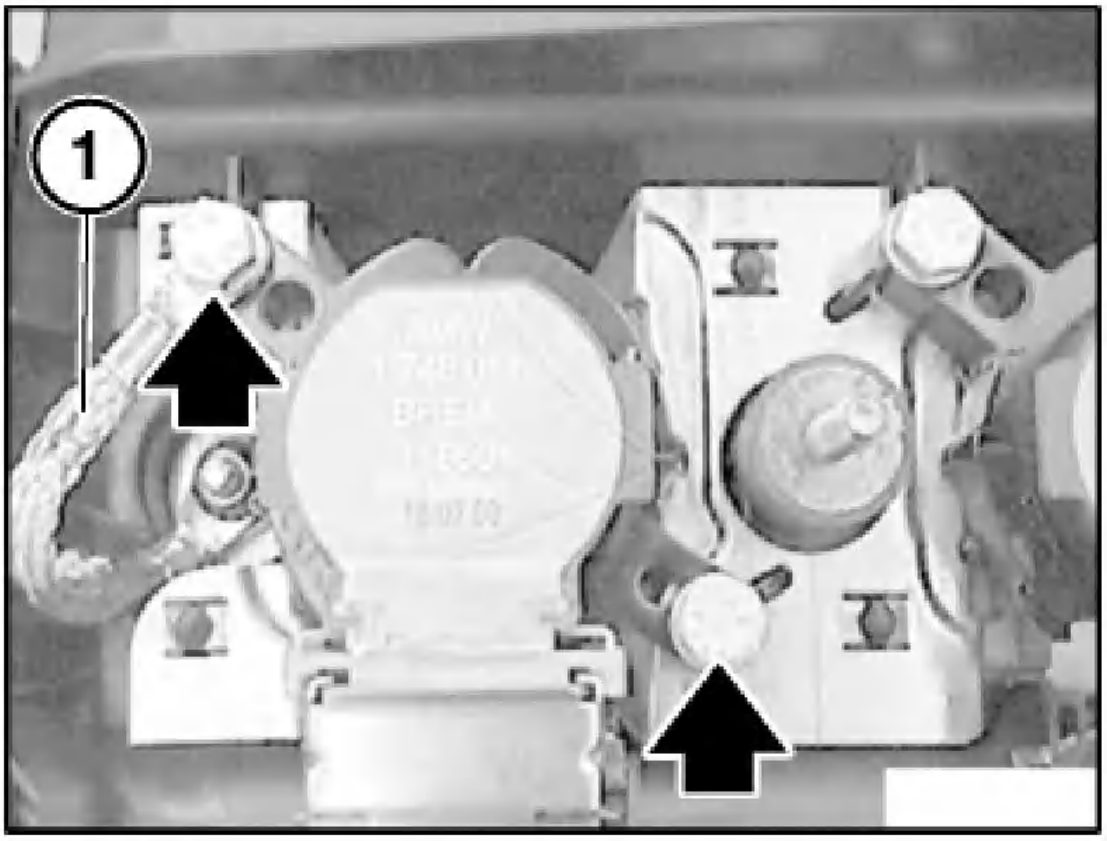



Fig. 41: Installing Down Grounding Strap To Cylinder Head Cover Mounting And To Ignition Coil
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Plastic cover M52TU, M54:

Screw down grounding strap (1) of connecting plate of ignition coils with retaining pin of ignition coil of cylinder 1.

Screw down grounding strap (2) of cable duct with connecting plate of ignition coils between cylinders 2 and 3.

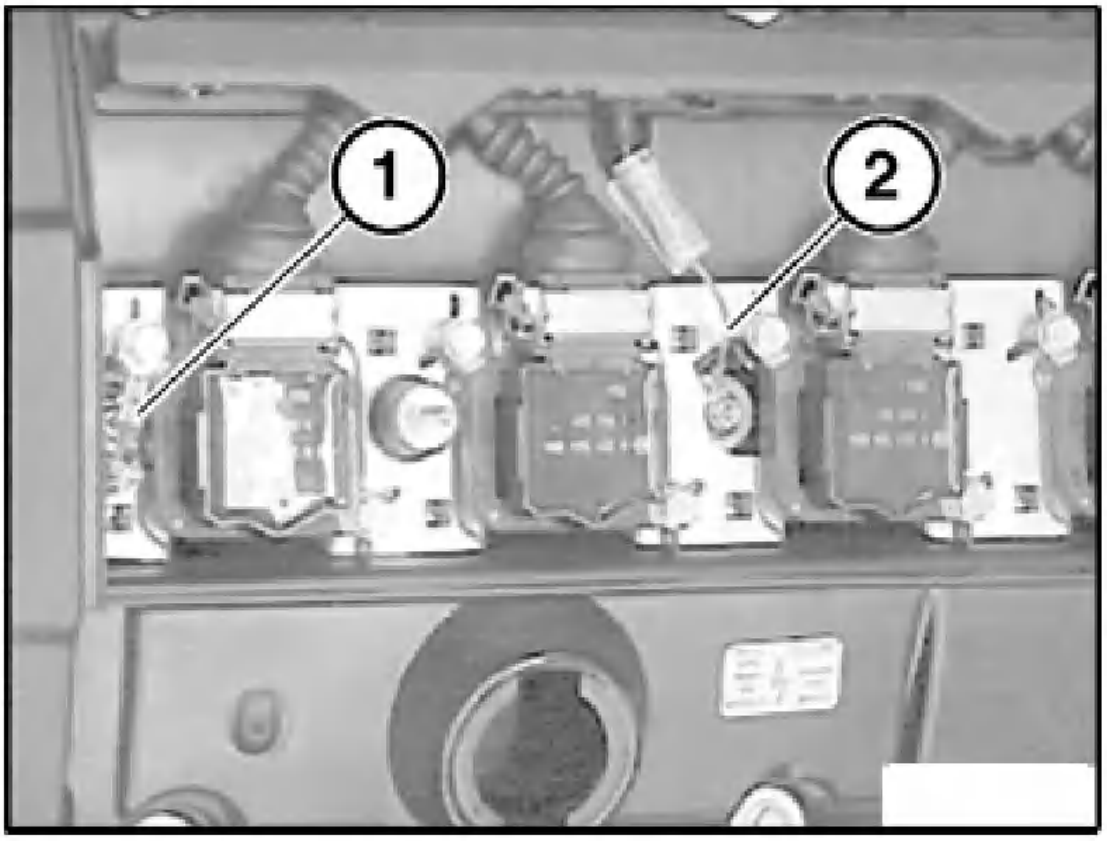



Fig. 42: Locating Grounding Straps And Connecting Plates
Courtesy of BMW OF NORTH AMERICA, INC.

Version With Rod-Type Ignition Coils:

Unlock plug retainer of ignition coil (1) and disconnect plug.

Pull ignition coil (1) up and out.

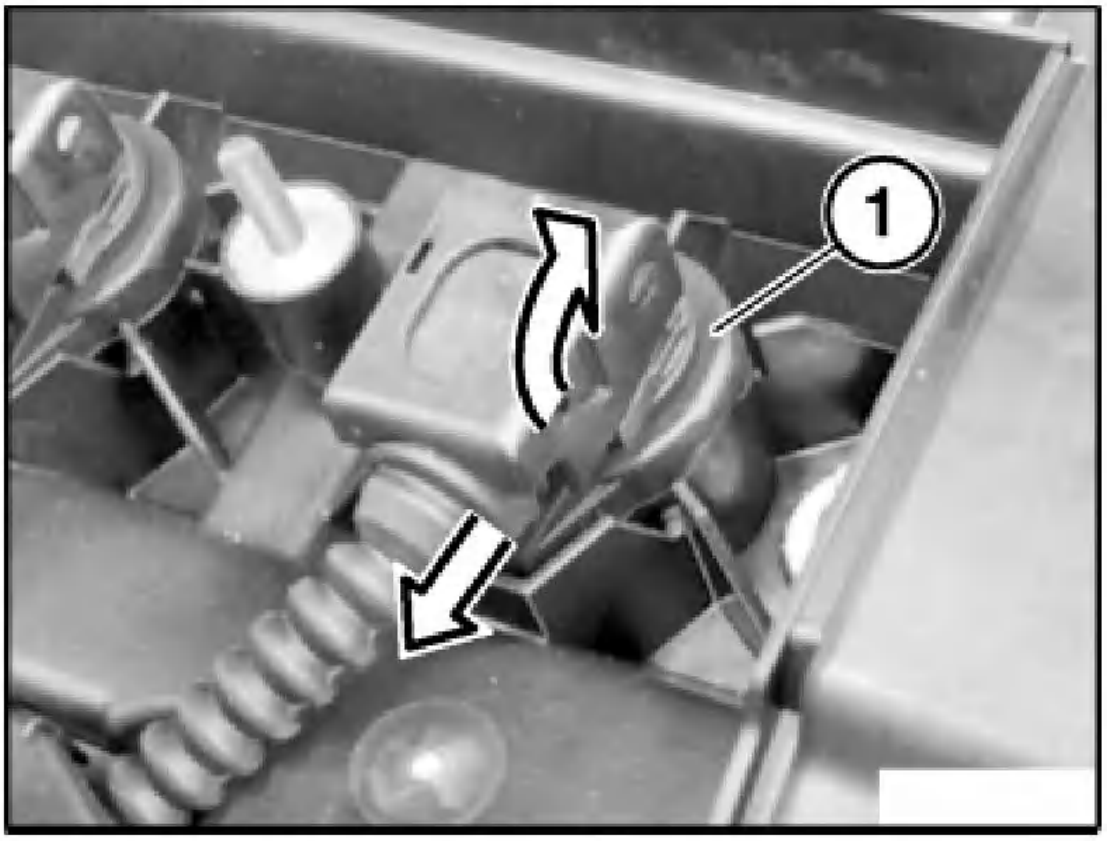



Fig. 43: Pulling Ignition Coil (1) Up And Out
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check that rubber seal of ignition coil (1) is correctly seated.

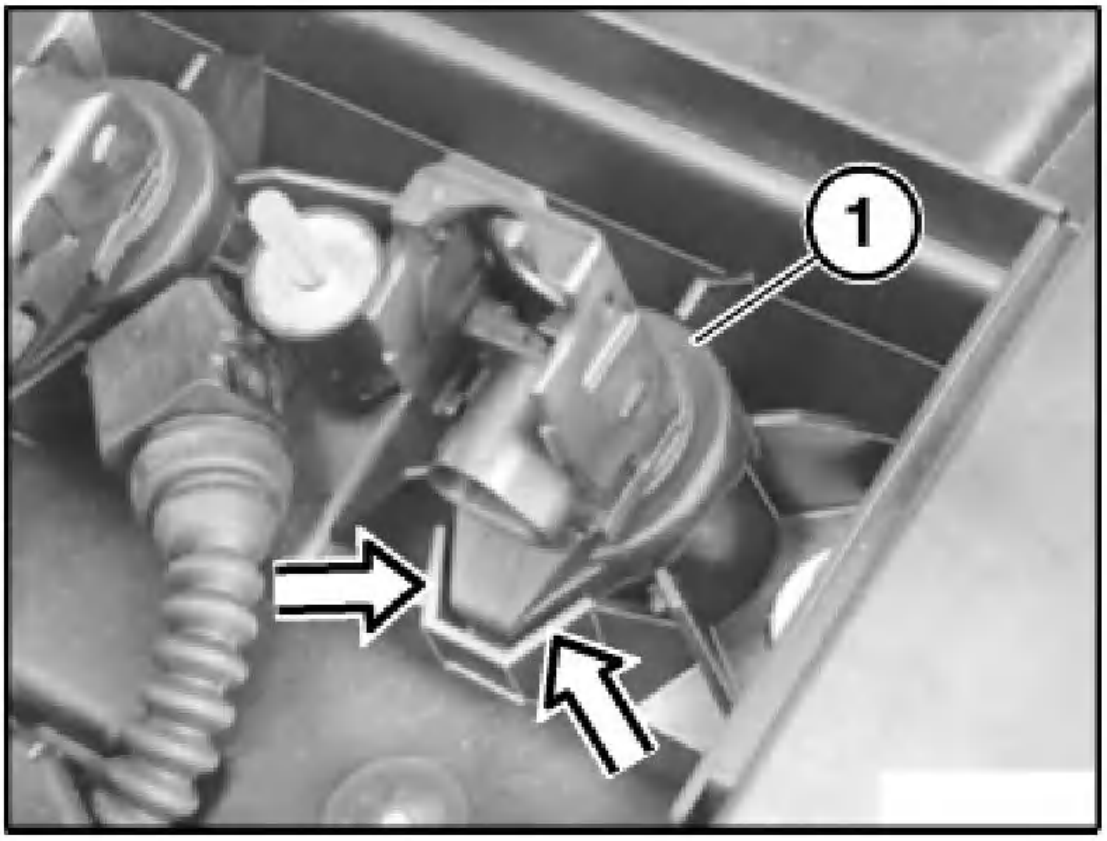



Fig. 44: Checking Rubber Seal Of Ignition Coil Is Correctly Seated
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Interrogate fault memory of DME control unit.

Check stored fault messages.

Now clear the fault memory.

12 13 520 REPLACING A SPARK PLUG CONNECTOR (M60, M62, M54)

Switch off ignition.

Remove ignition coils. Refer to 12 13 511 REPLACING IGNITION COIL (M52, M52TU, S52, S50US, M54) .

Detach ignition coil (1) from spark plug connector (2).

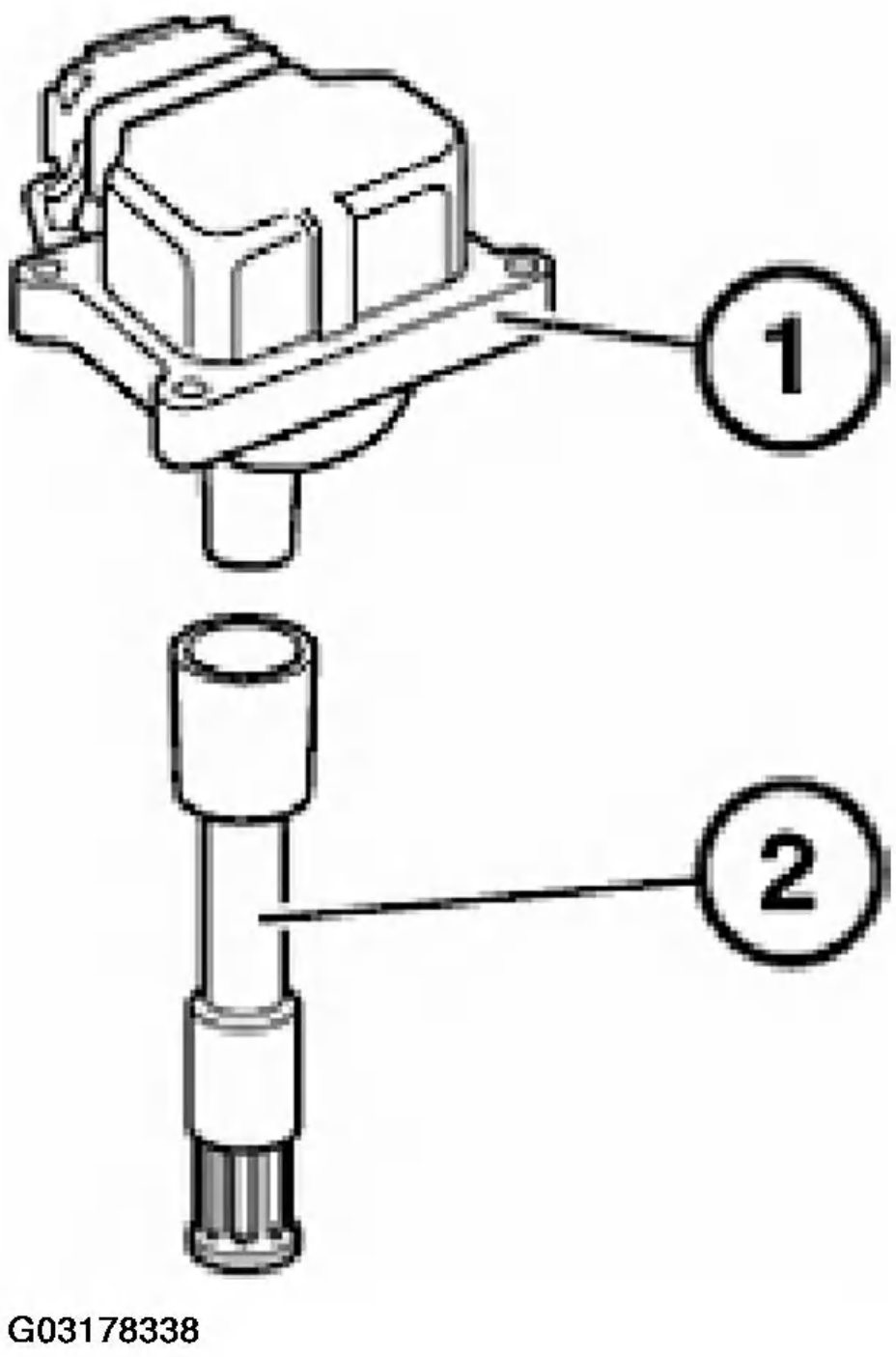



Fig. 45: Detaching Ignition Coil From Spark Plug Connector
Courtesy of BMW OF NORTH AMERICA, INC.

## ELECTRONIC SWITCHING

### 12 14 521 REPLACING PULSE GENERATOR ON CRANKSHAFT (M54/M56)

Necessary Preliminary Tasks:

- Read out fault memory of DME control unit
- Switch off ignition

All models:

NOTE: Installation location of pulse generator for crankshaft is underneath starter motor.

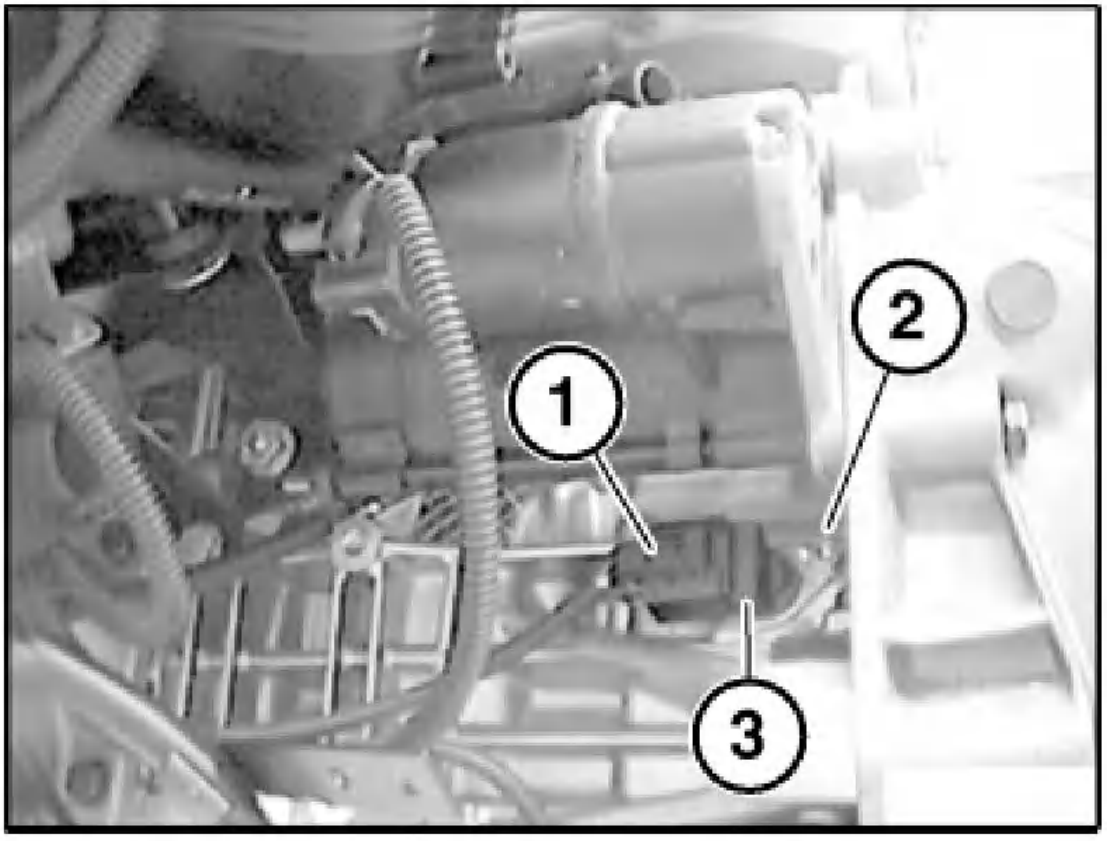
NOTE: For a better overview, this work step is shown on an engine that has been removed.

Unlock plug (1) and remove.

Unscrew bolt (2).

Remove pulse generator (3).

NOTE: Check stored fault messages.
Now clear the fault memory.



G03178339

Fig. 46: Removing Pulse Generator
Courtesy of BMW OF NORTH AMERICA, INC.

## 12 14 523 REPLACING PULSE GENERATOR ON INLET CAMSHAFT (M52TU / M54 / M56)

Necessary Preliminary Tasks:

- Check stored fault messages.
- Switch off ignition.

NOTE: Arrow shows installation position of pulse generator.

Remove solenoid valve (1) of VANOS adjustment unit for inlet camshaft.

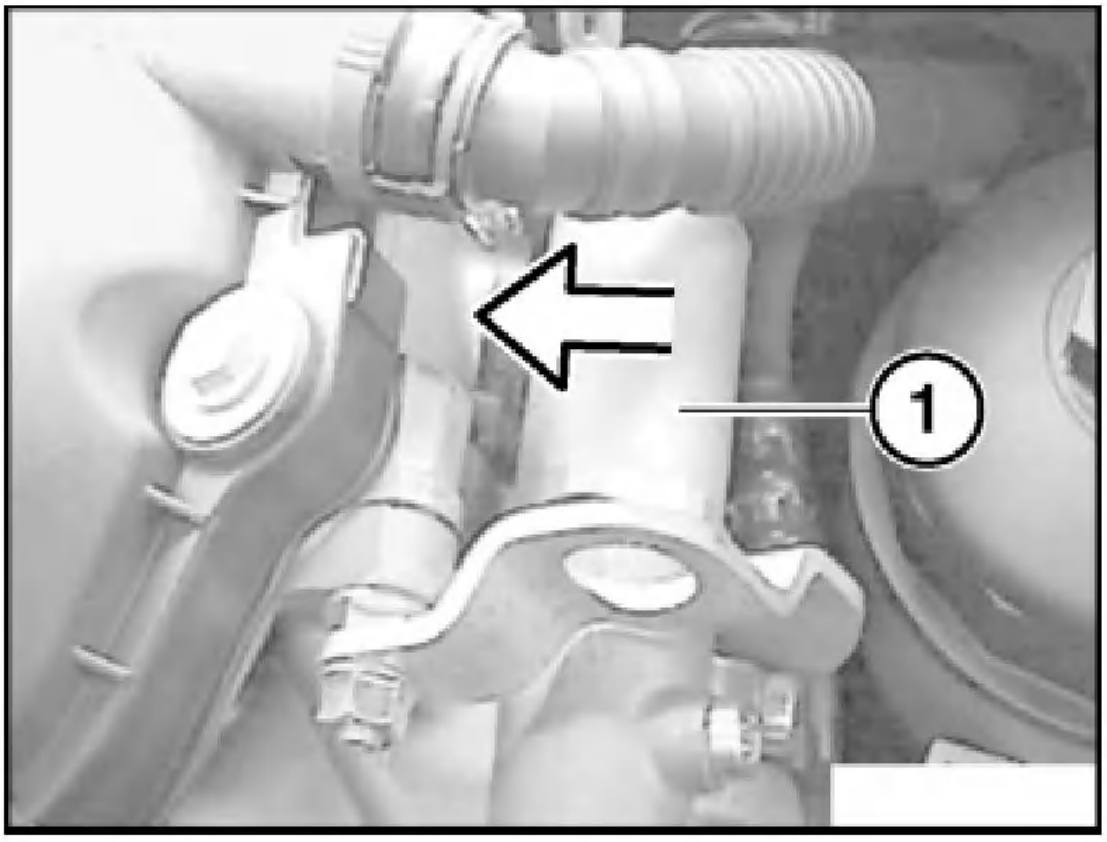



Fig. 47: Identifying Solenoid Valve Of VANOS Adjustment Unit For Inlet Camshaft
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace sealing ring. Tightening torque 11 36 IAZ. Refer to 11 36 VARIABLE CAMSHAFT CONTROL .

Disconnect plug connection (1) on cable duct (2).

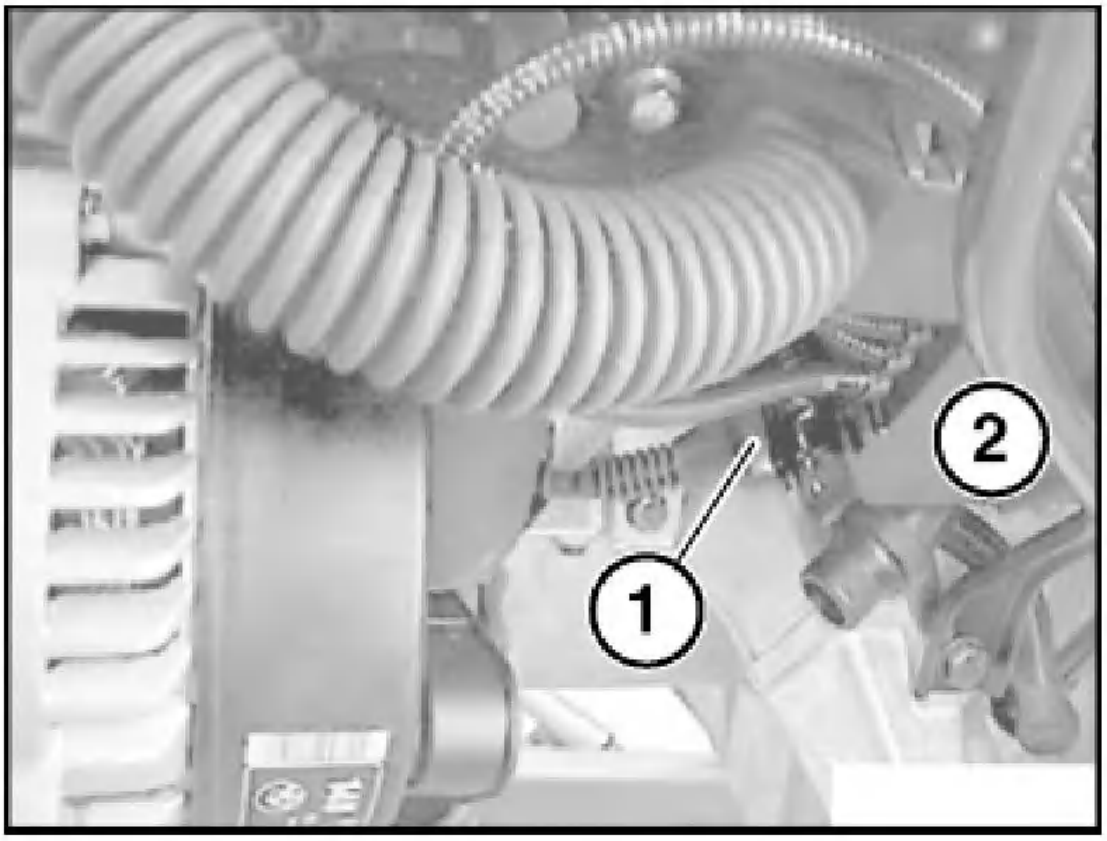



Fig. 48: Disconnecting Plug Connection On Cable Duct
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1) on pulse generator (2).

Remove pulse generator (2) from cylinder head.

NOTE: To facilitate installation of pulse generator lead: Secure an approx. 50 cm long auxiliary lead to plug connection of pulse generator.

Feed out end of pulse generator lead but only to such an extent that the auxiliary lead remains in the original routing in the intake system.

Remove pulse generator with lead.

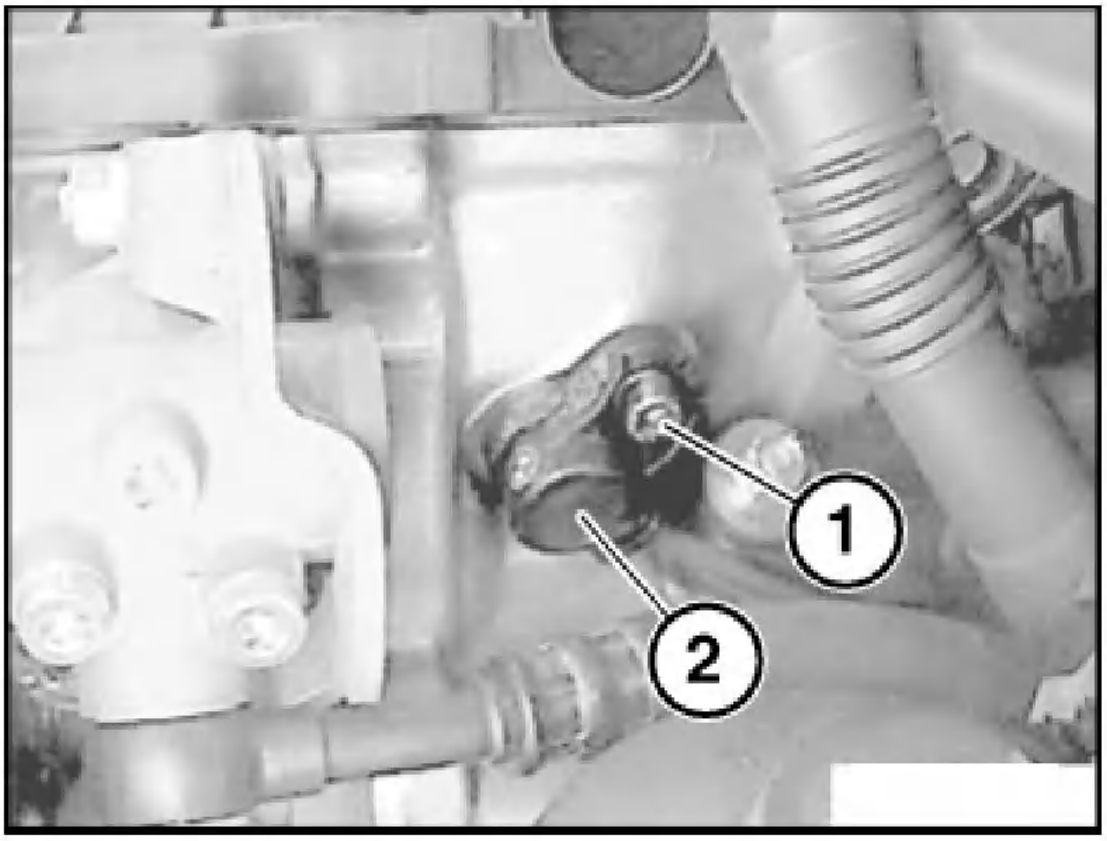



Fig. 49: Removing Pulse Generator With Lead
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect auxiliary lead from faulty pulse generator. Secure plug connection of new pulse generator to auxiliary lead.

Using auxiliary lead, feed new lead of pulse generator through to cable duct at bottom.

Installation:

Check sealing ring for possible damage, replace if necessary.

NOTE: Read out fault memory of DME control unit. Now clear the fault memory.

## 12 14 524 REPLACING PULSE GENERATOR ON EXHAUST CAMSHAFT (M52TU, M54, M56)

Necessary Preliminary Tasks:

- Check stored fault messages.
- Switch off ignition.

Location:

On cylinder head at front on exhaust side.

Unlock plug (1) and detach from pulse generator.

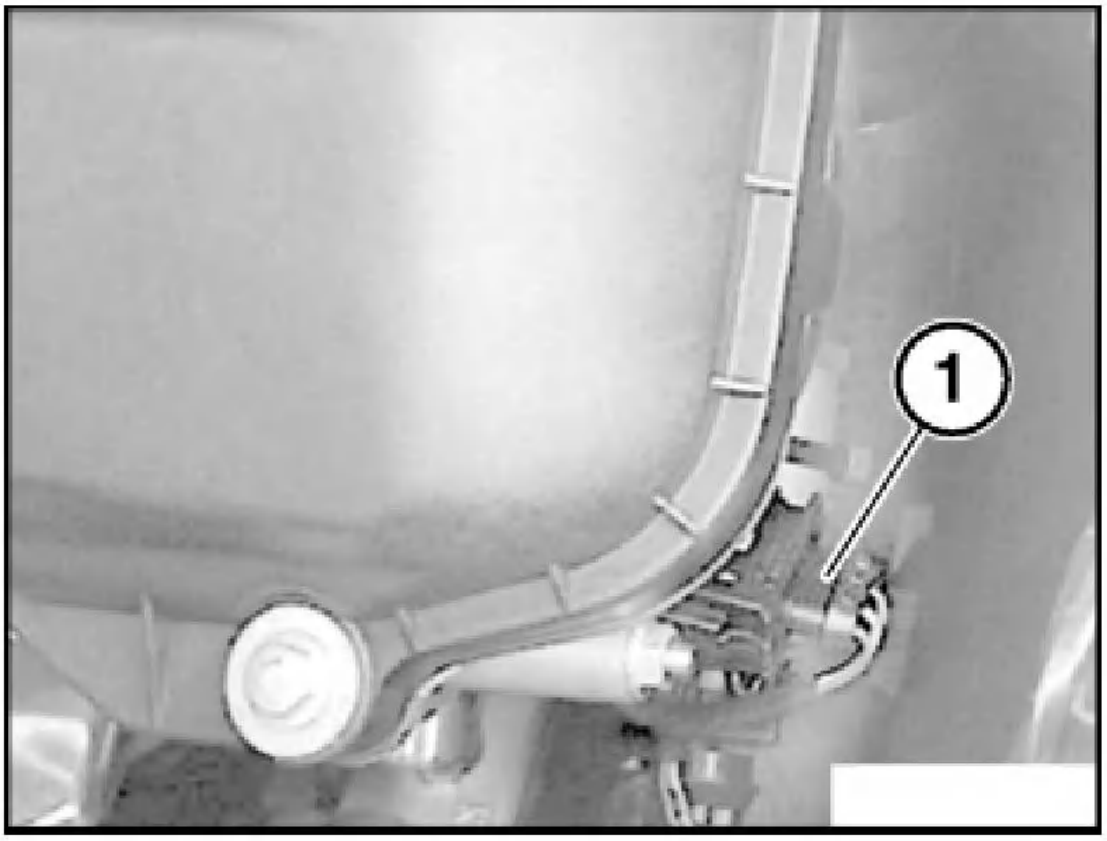



Fig. 50: Unlocking Plug And Detach From Pulse Generator
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1) on cylinder head.

Remove pulse generator.

Installation:

Check sealing ring for possible damage, replace if necessary.

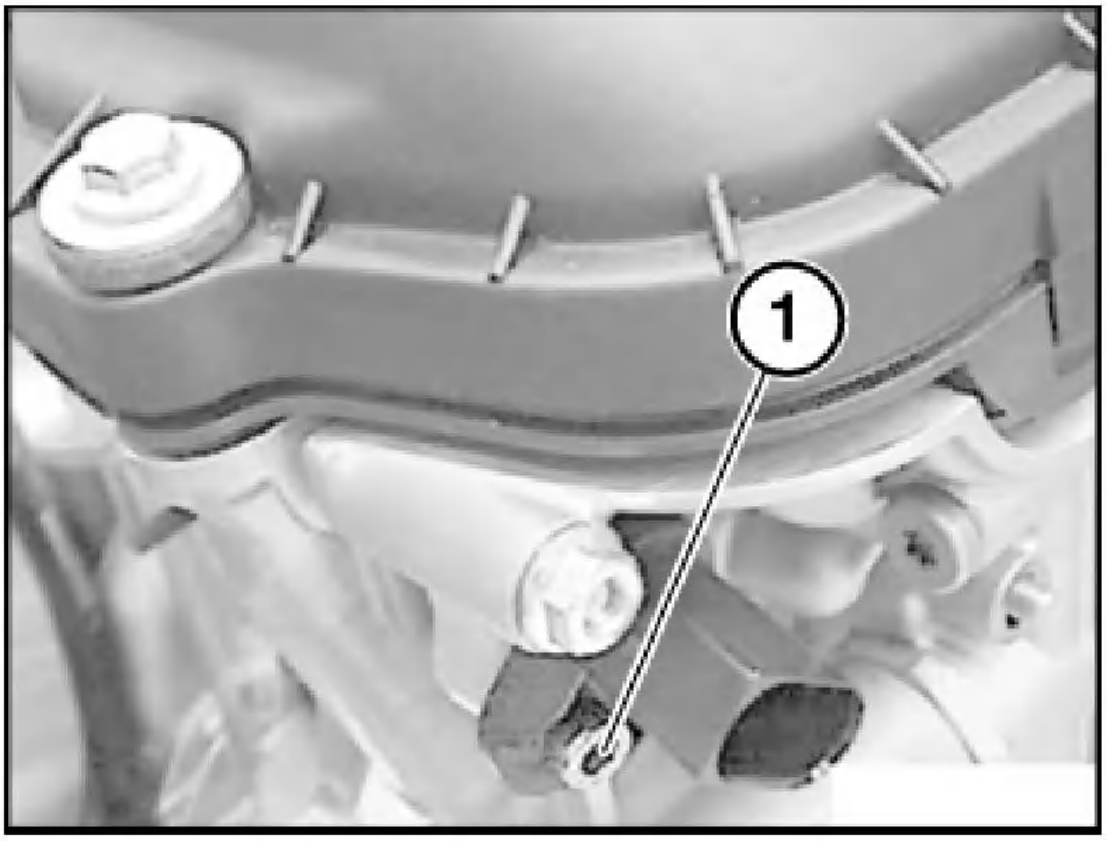



Fig. 51: Removing Pulse Generator
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Interrogate fault memory of DME control unit. Rectify faults. Now clear the fault memory.

## 12 14 550 REPLACING CONTROL UNIT (M54 / S54)

Follow instructions for removing and installing electronic control units. Refer to 12 00 ... WORKING INSTRUCTIONS FOR REMOVING AND INSTALLING ELECTRONIC CONTROL UNIT .

Read fault memory.

Turn off ignition.

Before replacing the control unit, you must comply with the following instructions:

- Code control unit. Refer to 12 14 700 CODING CONTROL MODULE (DME / DDE) .
- Program control unit. Refer to 12 14 705 PROGRAMMING CONTROL UNIT (DME / DDE) .

Release screw connection of electronics box (1).

Remove electronics box (1).

Installation:

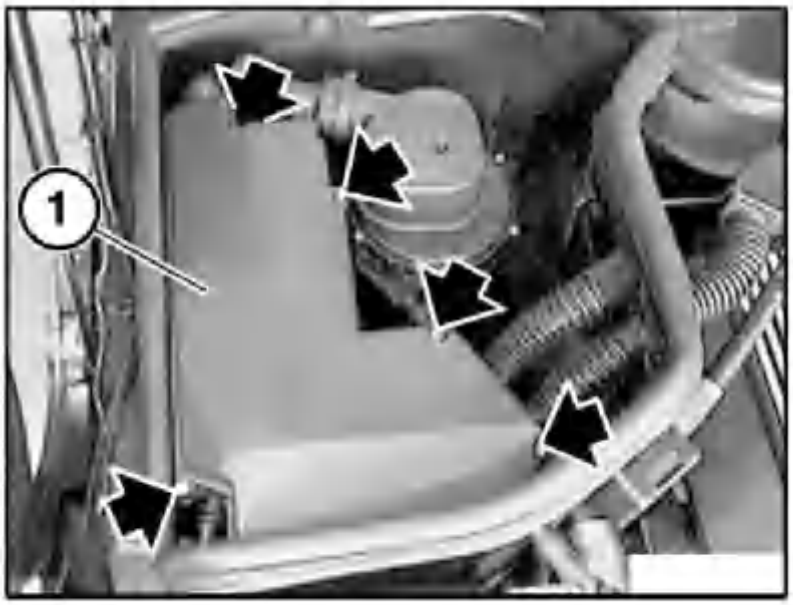



Fig. 52: Removing Electronics Box
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock plug (1) and detach from DME control unit.

Remove DME control unit.




Fig. 53: Removing DME Control Unit Plugs
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Interrogate fault memory of DME control unit. Check stored fault messages.

Rectify faults. Then clear fault memory.

## 12 14 600 REPLACING KNOCK SENSOR (M52TU, M54, M56)

Necessary Preliminary Tasks:

- Check stored fault messages.
- Switch off ignition.
- Remove intake air manifold. Refer to 11 61 050 REMOVING AND INSTALLING INTAKE AIR .

Unclip plug connection (1) from holder of cable duct (2) and disconnect.

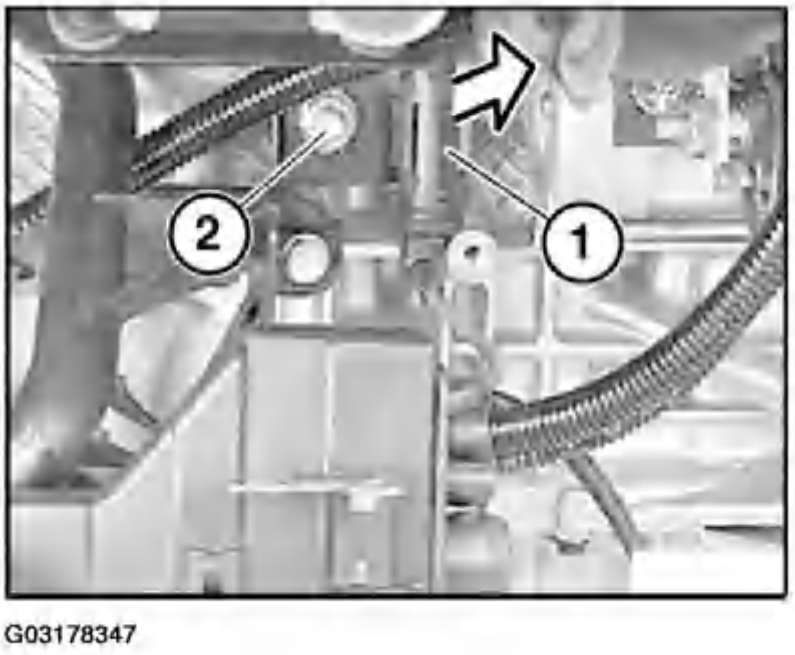



Fig. 54: Unclipping Plug Connection From Holder Of Cable Duct
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1) and remove knock sensor for cylinder bank 1-3.

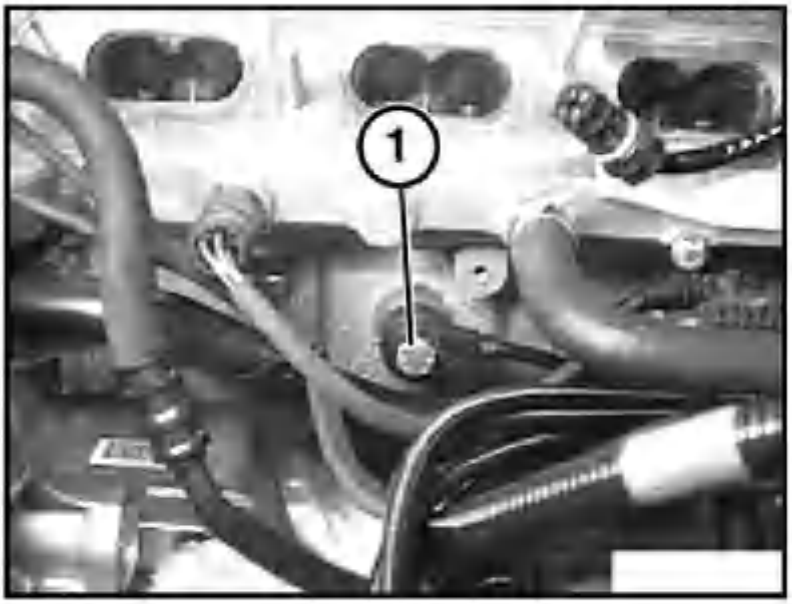



Fig. 55: Removing Knock Sensor Screw On Cylinder Bank 1-3
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (2) and remove knock sensor for cylinder bank 4-6.

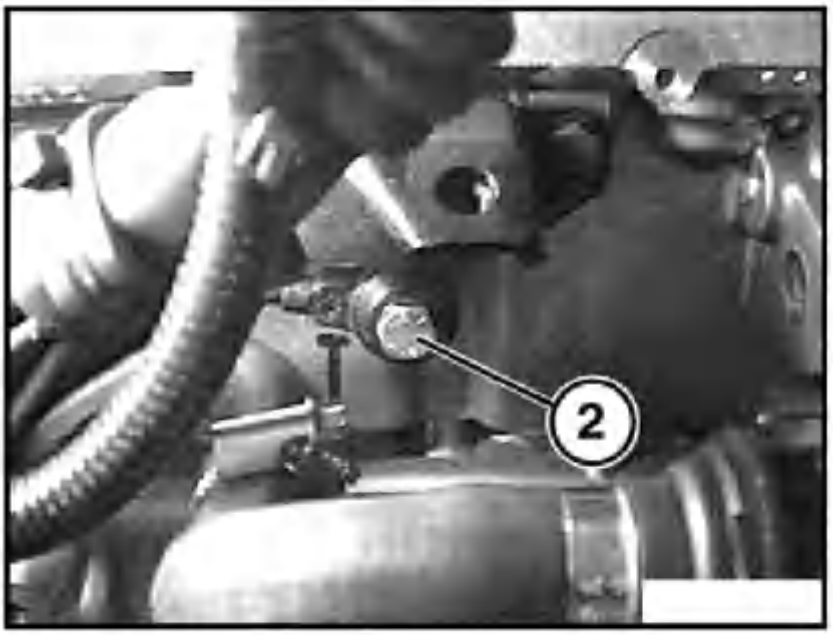



Fig. 56: Removing Knock Sensor Screw On Cylinder Bank 4-6
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean support face of knock sensors on engine block.

Tightening torque, 12 14 IAZ. Refer to 12 14 ELECTRONIC SHIFT UNITS OR CONTROL UNITS .

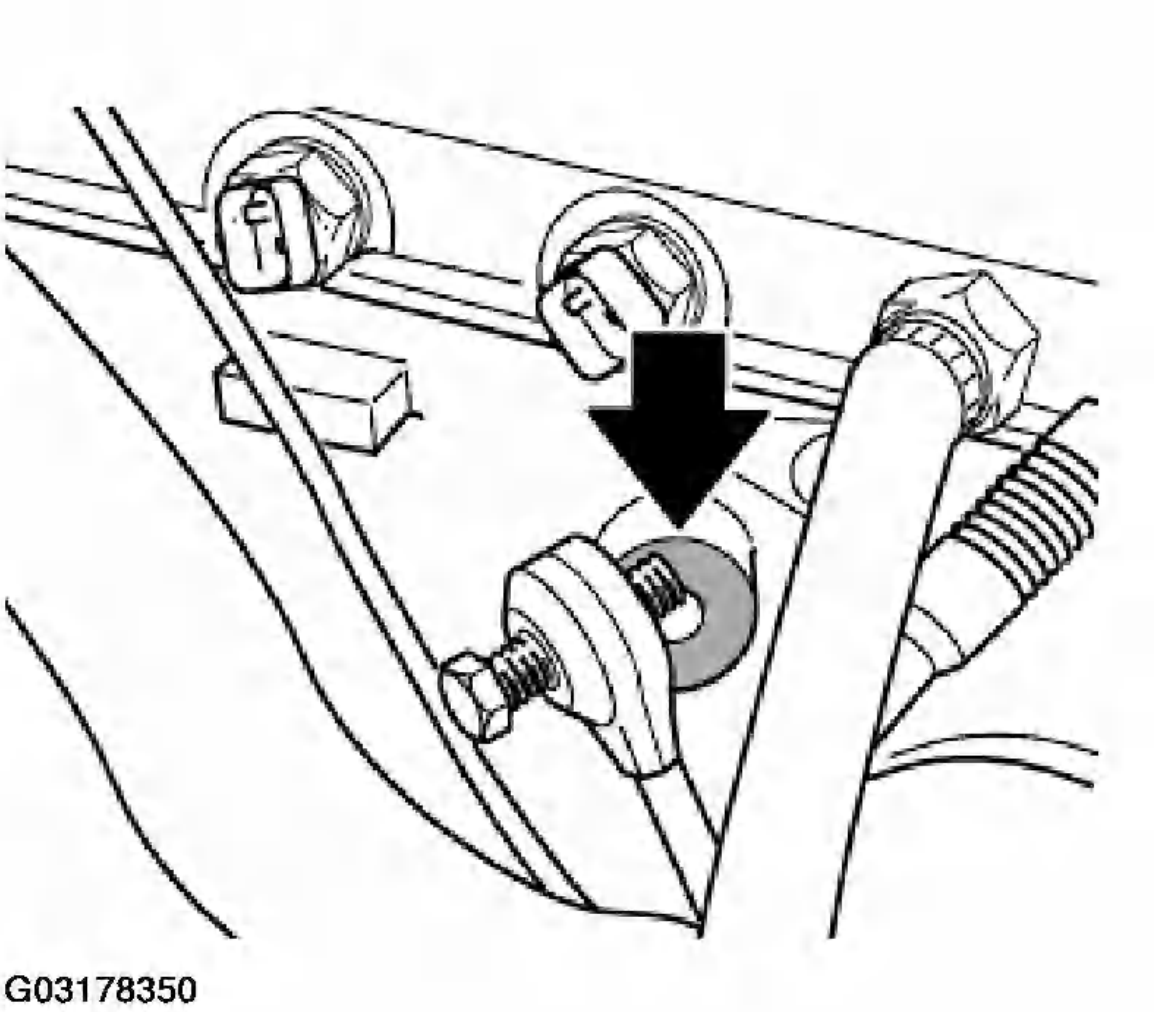



Fig. 57: Identifying Support Face Of Knock Sensors On Engine Block
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Read out fault memory of control unit of Digital Motor Electronics (DME).

Now clear the fault memory.

12 14 700 CODING CONTROL MODULE (DME / DDE)

Switch off ignition.

Connect MoDiC or DIS/GT1 Tester.

Switch on ignition.

Select "Coding" program.

For subsequent procedure, follow instructions in MoDiC or DIS/GT1 Tester.

Carry out adjustment of following control units:

- EWS (electronic immobilizer).
- DME (Digital Motor Electronics) or,

- DDE (Digital Diesel Electronics)

Refer to "Diagnosis and Coding" service information bulletins on subject of coding.

## 12 14 705 PROGRAMMING CONTROL UNIT (DME / DDE)

Switch off ignition.

Connect MoDiC or DIS/GT1 Tester.

Switch on ignition.

Select "Programming".

For subsequent procedure, follow instructions in MoDiC or DIS/GT1 Tester.

Carry out adjustment of following control units:

- EWS (electronic immobilizer).
- DME (Digital Motor Electronics) or,
- DDE (Digital Diesel Electronics).

Refer to "Diagnosis and Coding" service information bulletins on subject of programming.

## 12 63 520 REPLACING MAIN RELAY (M54 / S54)

Switch off ignition.

Connect DIS Tester.

Release screw connection of electronics box (1).

Remove electronics box (1).

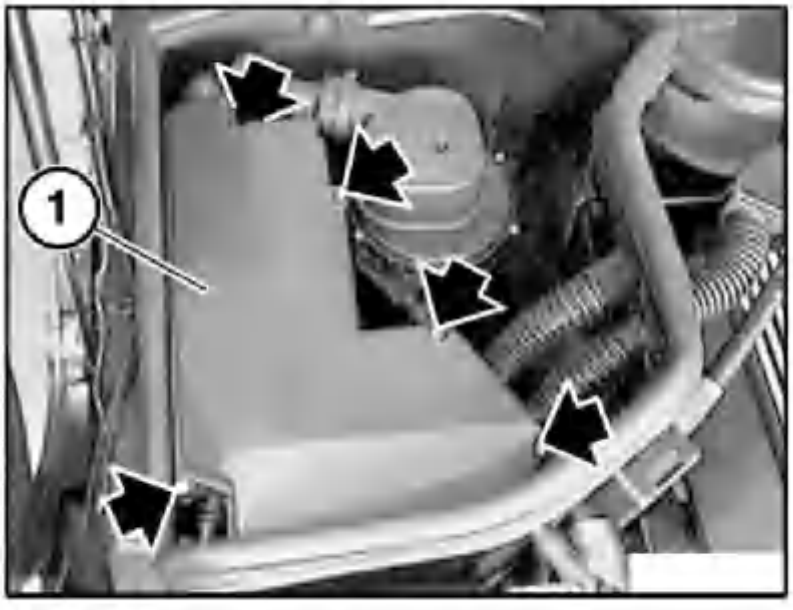



Fig. 58: Removing Electronics Box Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Arrangement:

1. Main relay of Digital Motor Electronics.
2. Engine fuses of Digital Motor Electronics.

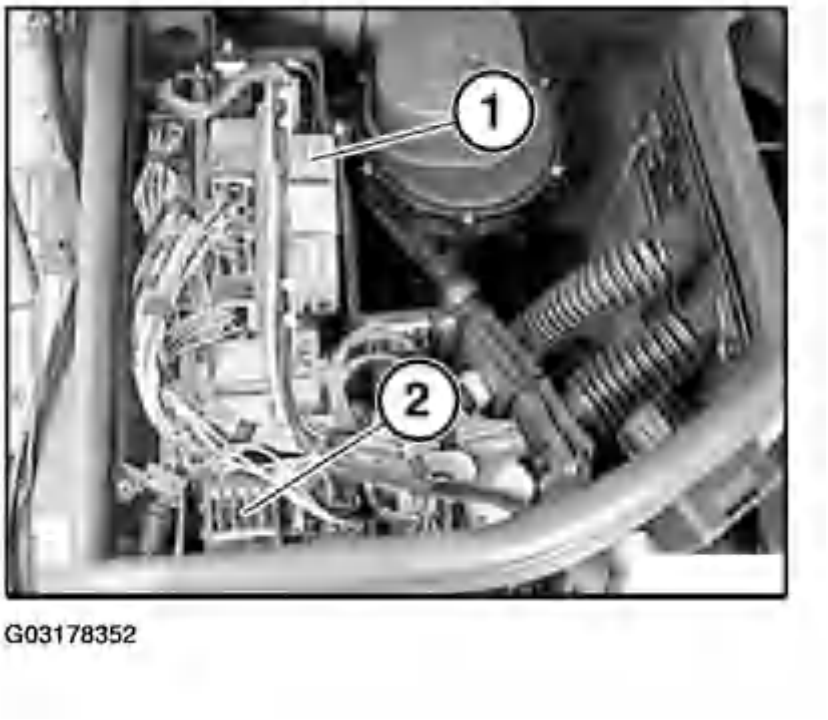



Fig. 59: Identifying Engine Fuses And Main Relay Of Digital Motor Electronics
Courtesy of BMW OF NORTH AMERICA, INC.

Notes On Troubleshooting:

If the starter motor cranks the engine during the starting sequence but the engine fails to fire, then:

1. Check engine fuses.
2. If fuses are blown, replace them completely with fuse holder.
3. Find out why fuses have blown.

   Continue troubleshooting as per DIS instructions.

## 61 35... NOTE ON REPLACING CODABLE/PROGRAMMABLE CONTROL UNITS

Replacement:

Carry out coding/programming.

Observe following IDC specifications:

- Programming.
- Coding.




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Fig. 60: Identifying Codable/Programmable Control Units
Courtesy of BMW OF NORTH AMERICA, INC.

## ALTERNATOR WITH DRIVE

### 12 31 ... REPLACING ALTERNATOR BELT PULLEY

NOTE: For Special Tool identification, see SPECIAL TOOLS - Z3 .

Special Tools Required:

- 12 7 110

Remove and install alternator drive belt.

Depending on alternator type, grip shaft with:

- Hexagon socket.
- Multi-Tooth socket or,
- Torx socket wrench.

Release nut with special tool 12 7 110.

Installation:

Tightening torque, 12 31 2AZ/12 31 3AZ. Refer to 12 31 ALTERNATOR WITH DRIVE AND

MOUNTING PART .

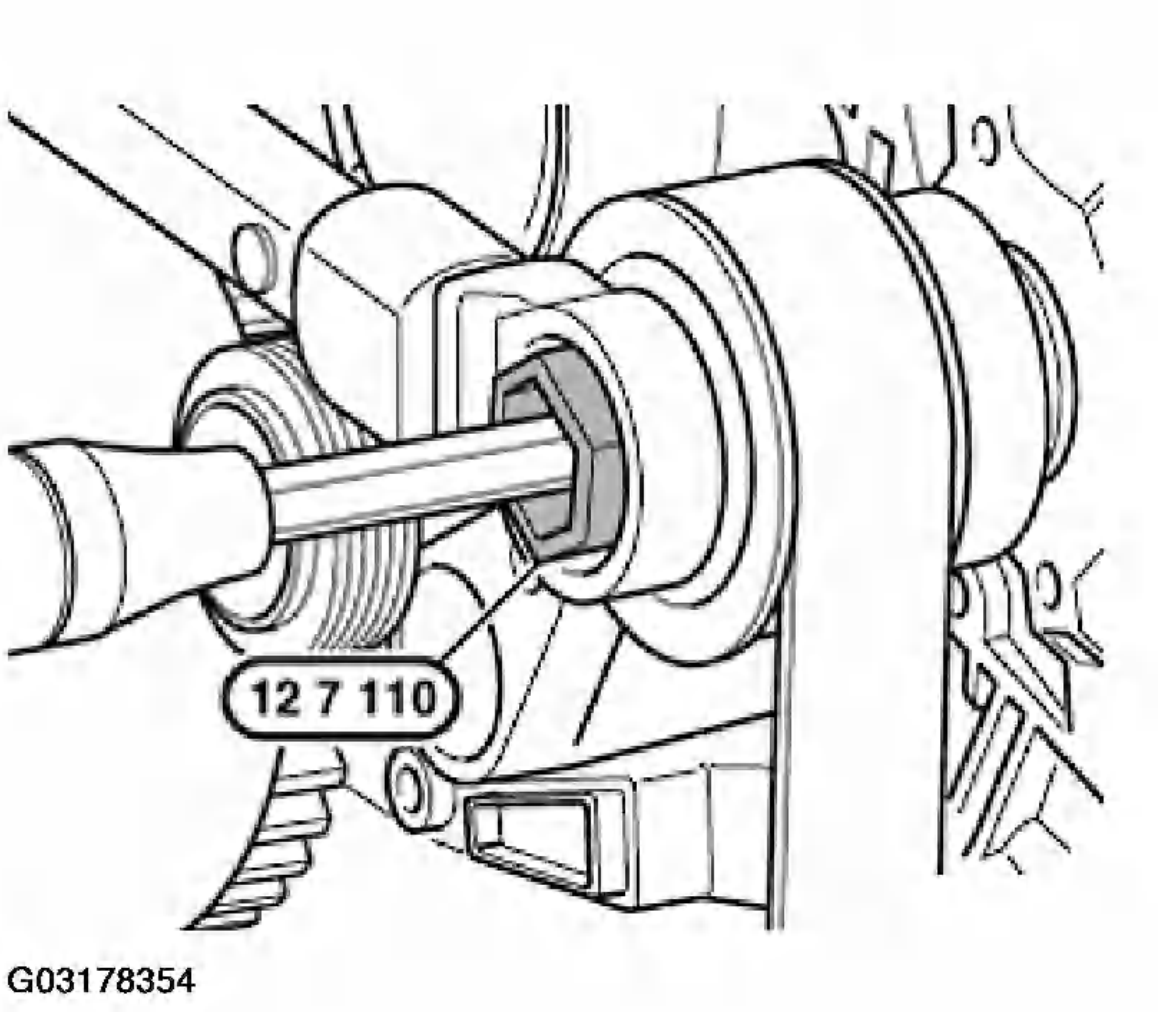



Fig. 61: Removing Pulley Nut
Courtesy of BMW OF NORTH AMERICA, INC.

## 12 31 009 CHECKING ALTERNATOR AND REGULATOR SWITCH

Test Requirements:

- Correct connections on charged battery.
- Correct connections on alternator and starter motor.
- Good ground connection between engine and body.
- Tightened drive belt.

Connect DIS Tester.

- Measurement.
- Checking alternator.

If charge indicator lamp is permanently lit:

Remove voltage regulator and check carbon brushes, replace if necessary.

Replace alternator regulator switch. Refer to 12 32 501 REPLACING VOLTAGE REGULATOR .

NOTE: Minimum length of carbon brushes "A" = 5 mm.

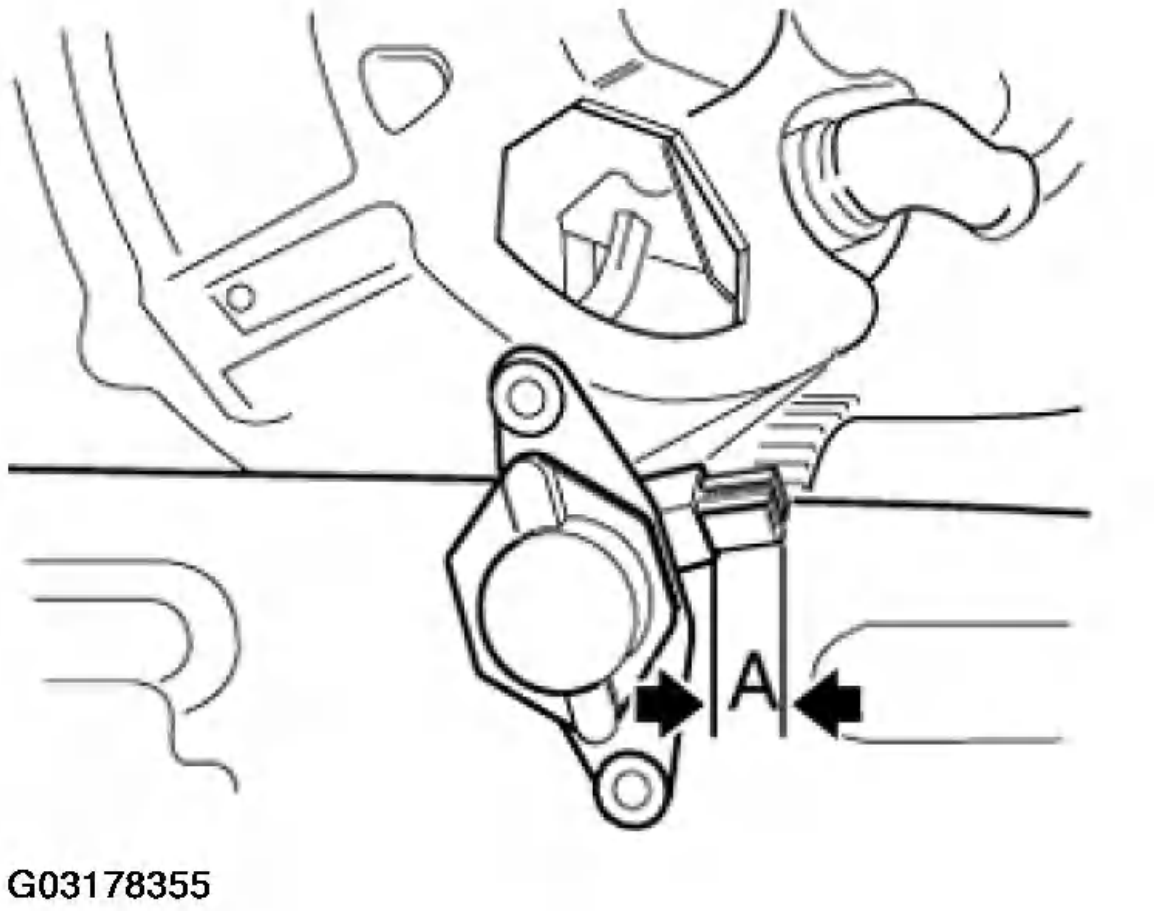



Fig. 62: Identifying Checking Carbon Brush Length
Courtesy of BMW OF NORTH AMERICA, INC.

If charge indicator lamp goes out while engine is running:

Check control voltage. Refer to 12 32 REGULATOR E36 .

Regulator switch must be replaced if control voltage is not achieved.

Replace alternator regulator switch. Refer to 12 32 501 REPLACING VOLTAGE REGULATOR .

Oscillogram For A Fault-Free Alternator:

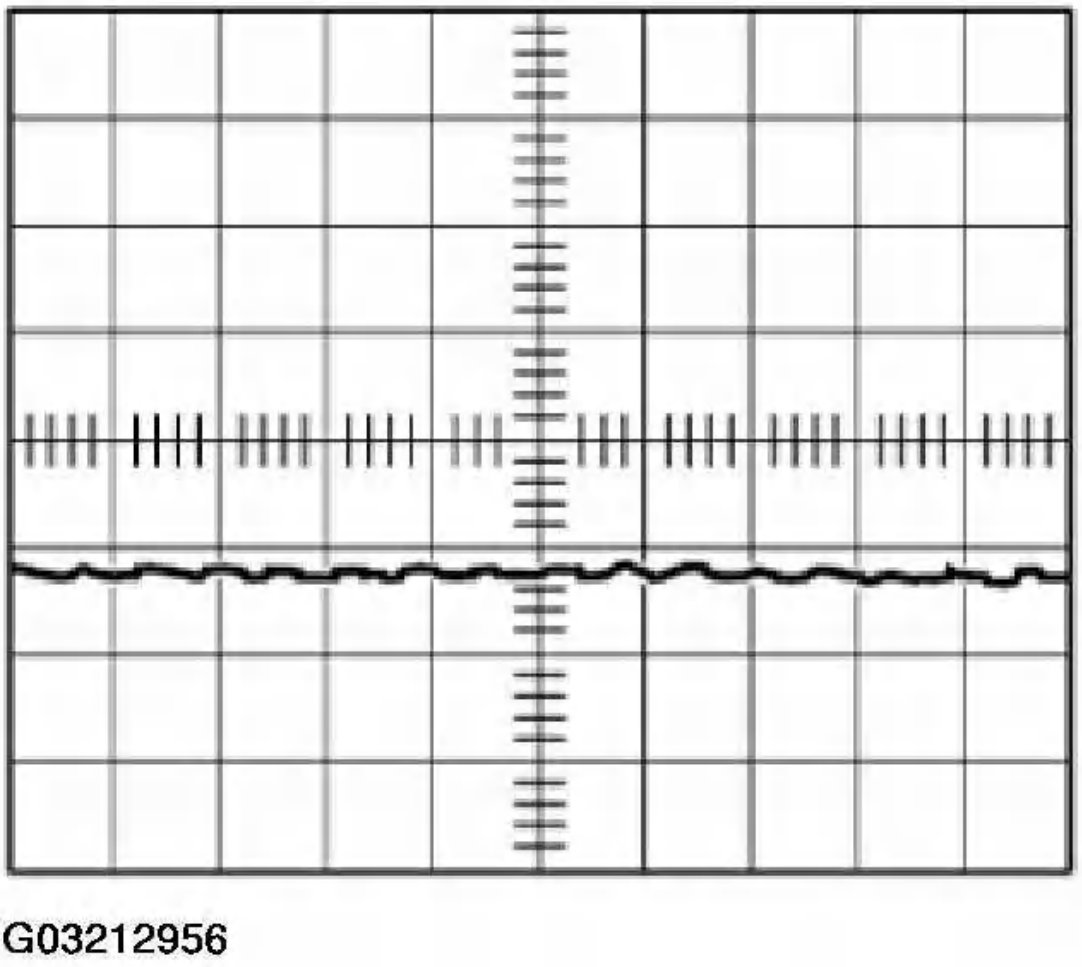



Fig. 63: Identifying Fault-Free Alternator Oscillogram
Courtesy of BMW OF NORTH AMERICA, INC.

Oscillogram For A Faulty Alternator:

One phase interrupted.

Repair/exchange alternator.

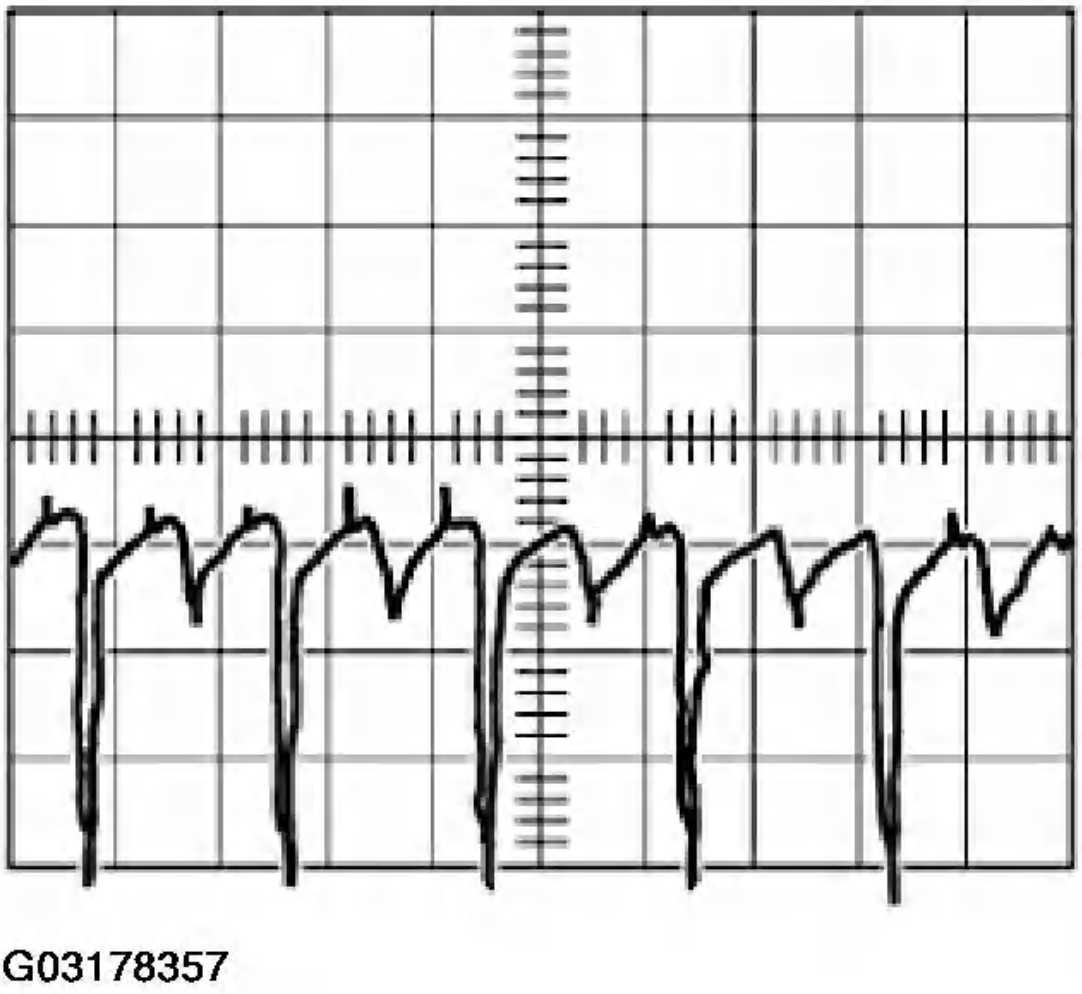



Fig. 64: Identifying Oscillogram One Phase Interrupted
Courtesy of BMW OF NORTH AMERICA, INC.

Interturn fault.

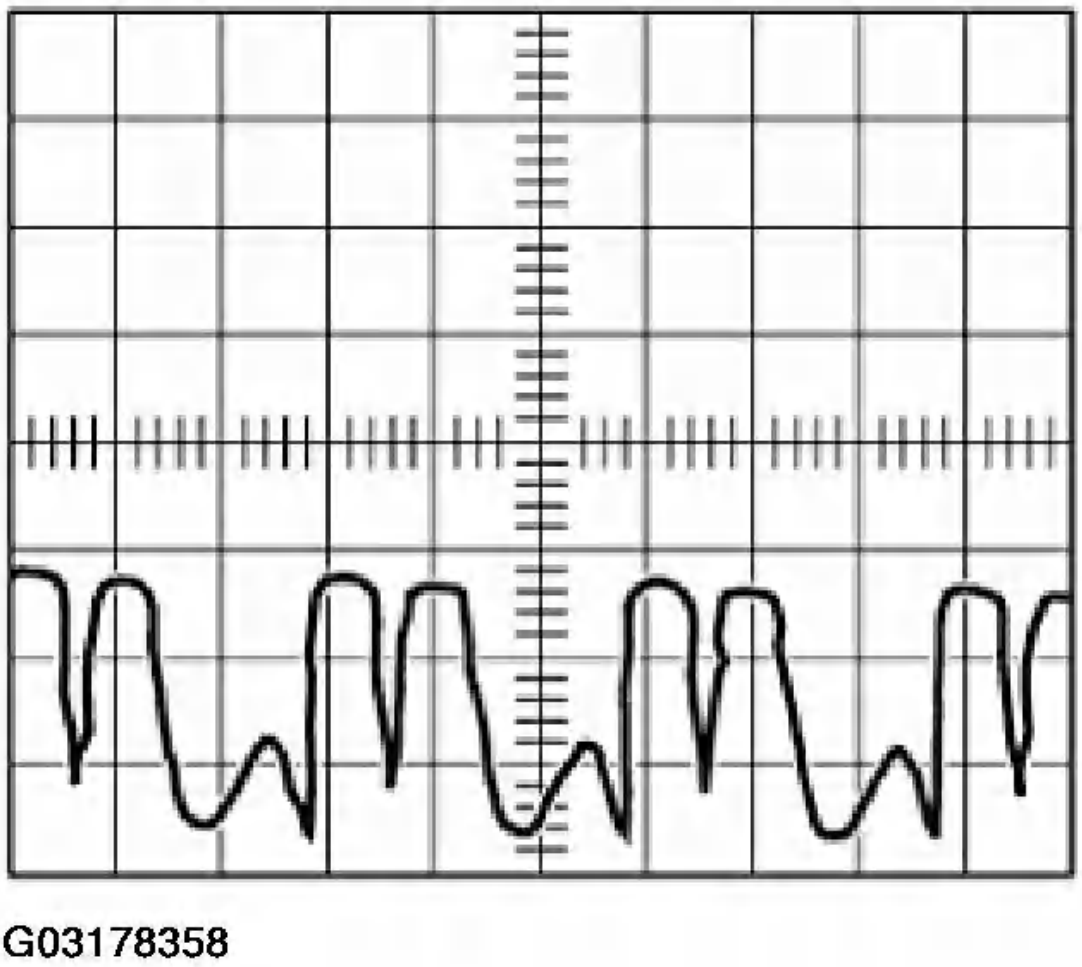



Fig. 65: Identifying Interturn Fault
Courtesy of BMW OF NORTH AMERICA, INC.

Repair/exchange alternator.

Open circuit in negative diode.

Repair/exchange alternator.

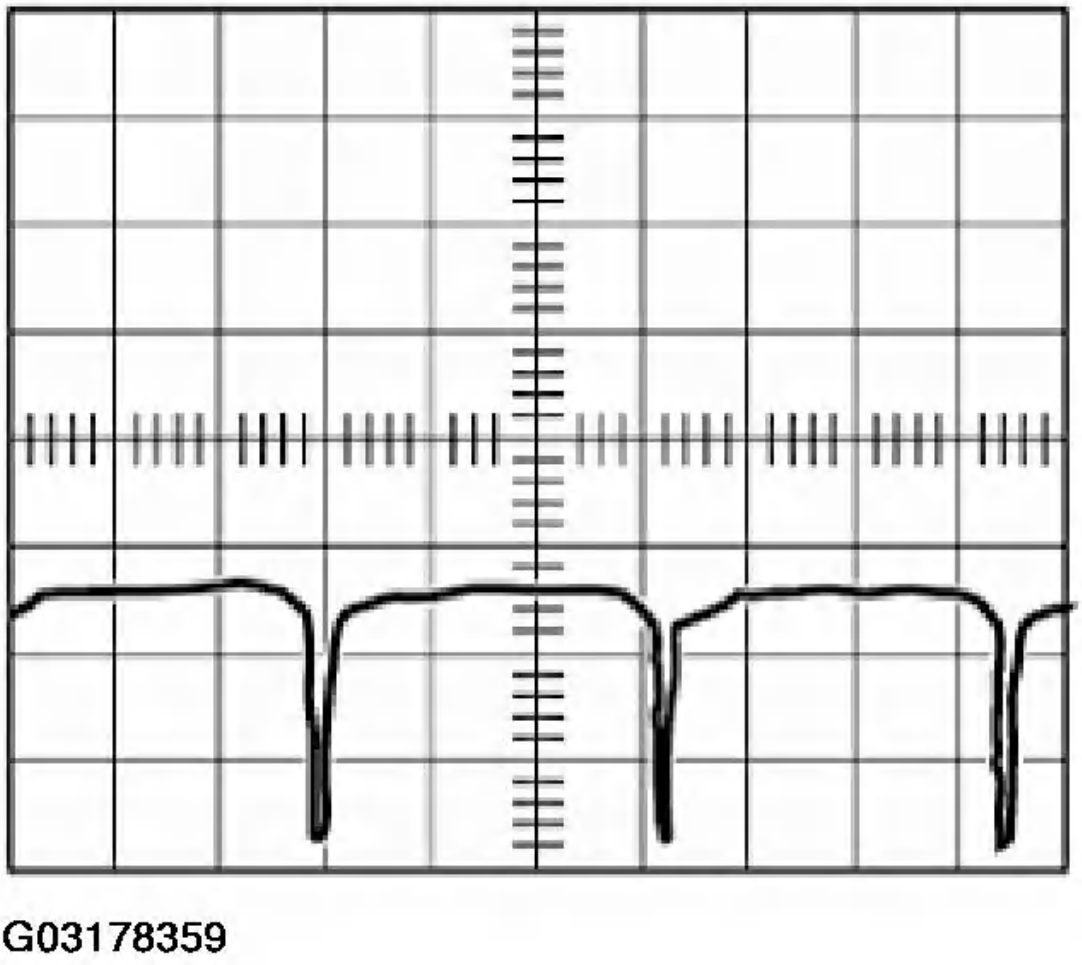



Fig. 66: Identifying Open Circuit In Negative Diode
Courtesy of BMW OF NORTH AMERICA, INC.

Short circuit in positive diode.

Repair/exchange alternator.

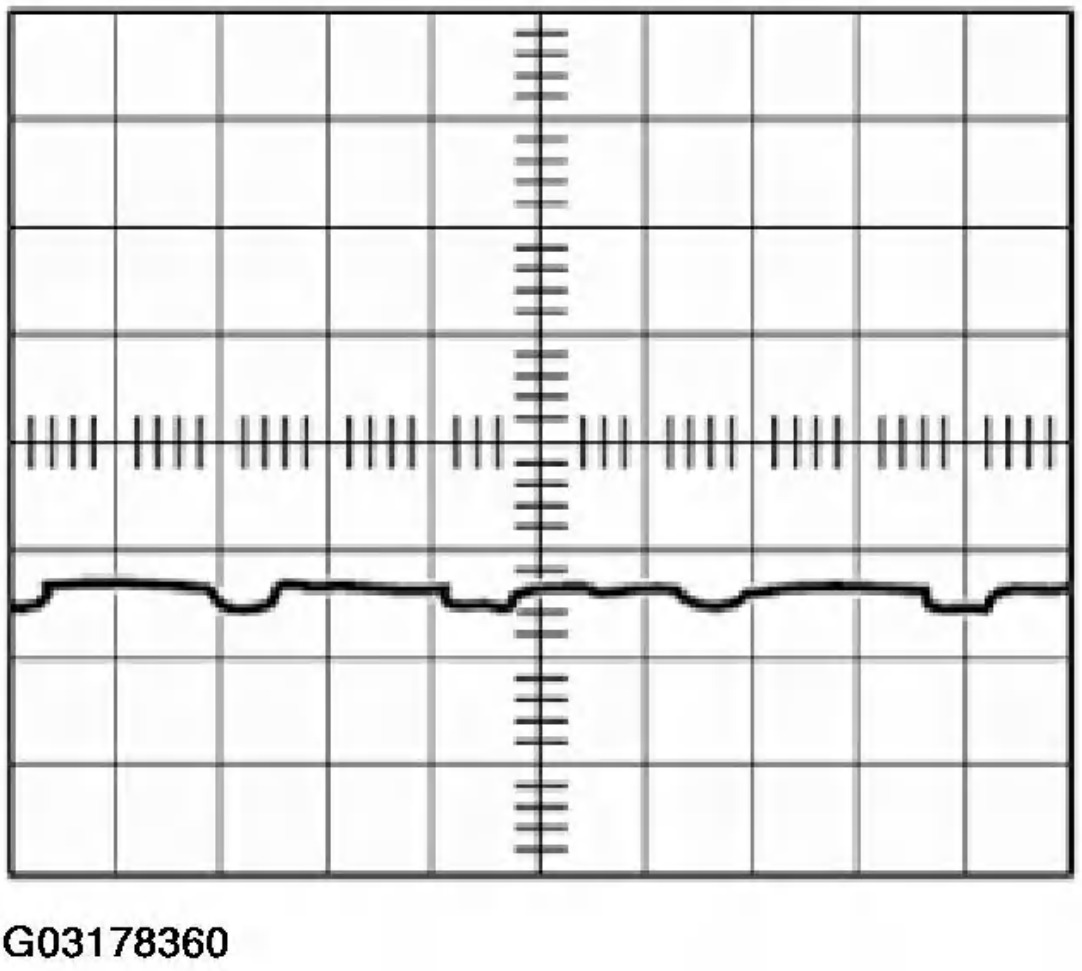



Fig. 67: Identifying Short Circuit In Positive Diode
Courtesy of BMW OF NORTH AMERICA, INC.

Open circuit in positive diode.

Repair/exchange alternator.

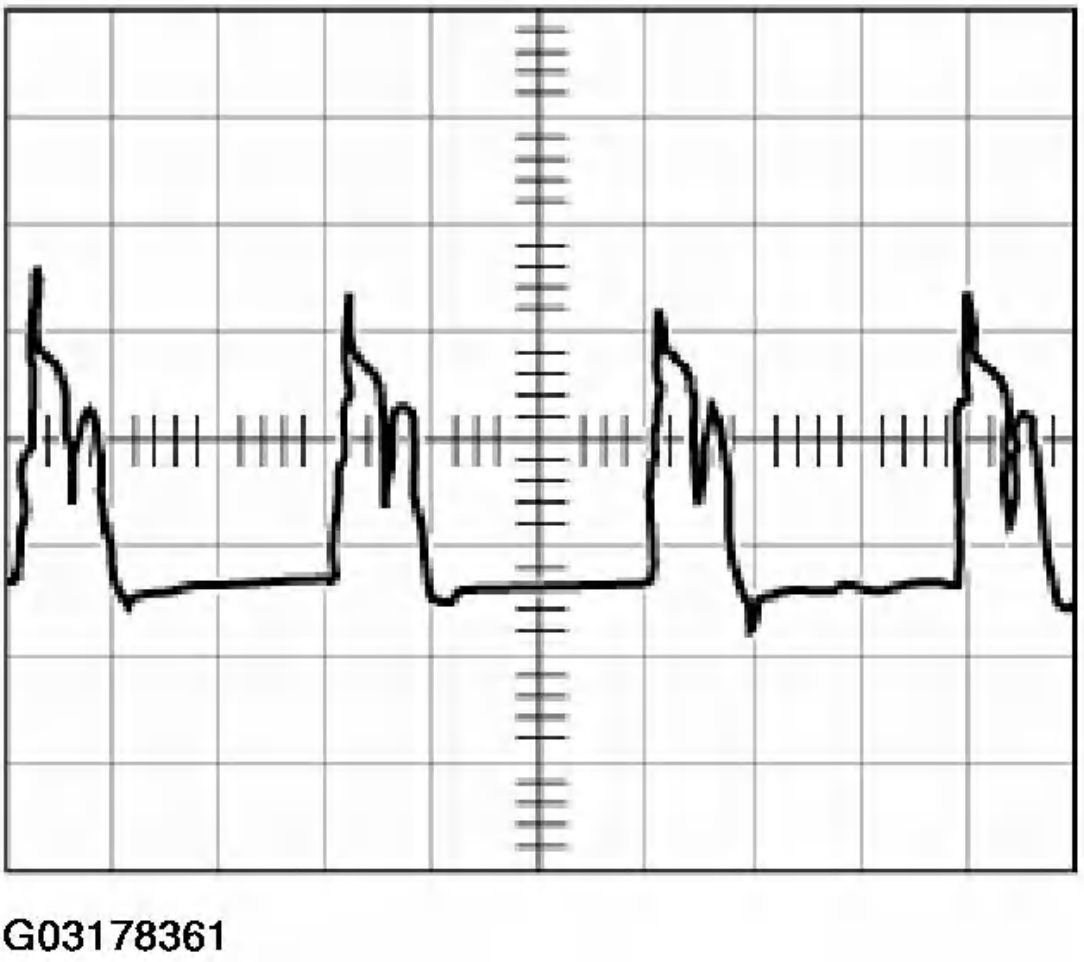



Fig. 68: Identifying Open Circuit In Positive Diode
Courtesy of BMW OF NORTH AMERICA, INC.

Open circuit in exciter diode.

Repair/exchange alternator.

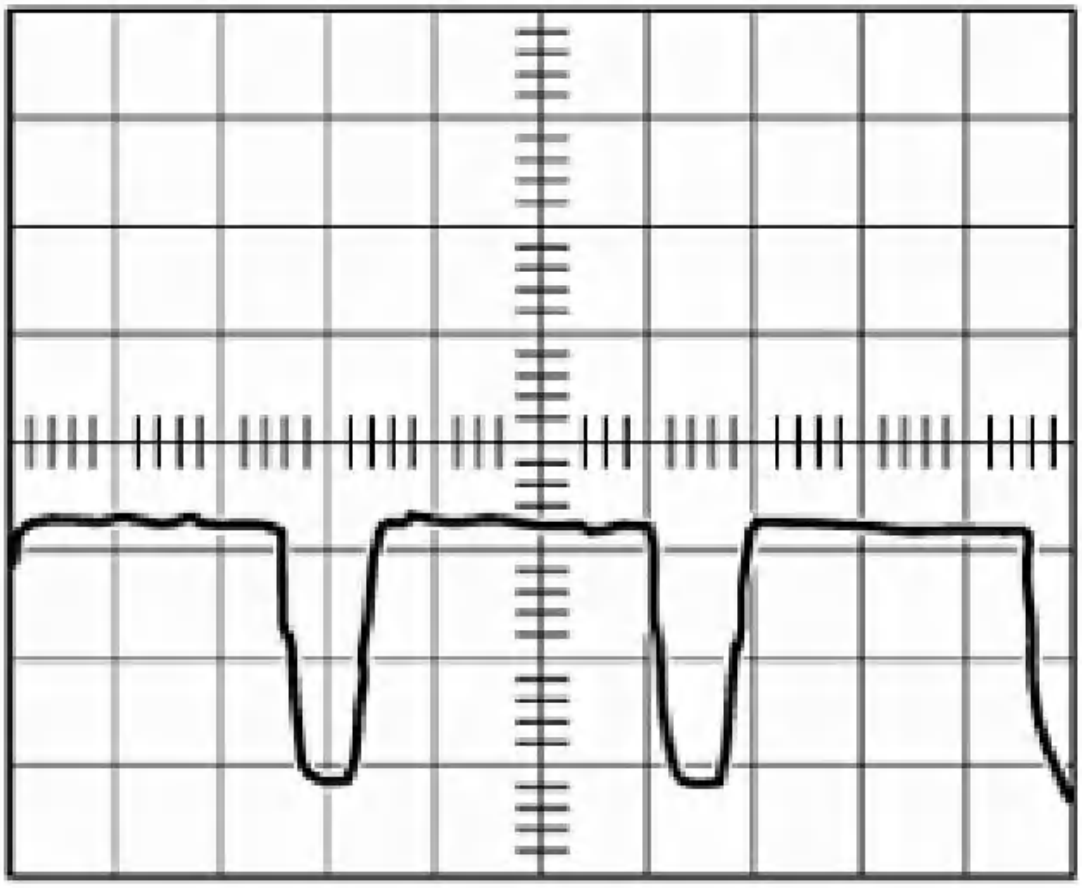



Fig. 69: Identifying Open Circuit In Exciter Diode
Courtesy of BMW OF NORTH AMERICA, INC.

## 12 31 020 REMOVING AND INSTALLING OR REPLACING ALTERNATOR (M52, M52TU, S50US, S52, M54, M56)

Necessary Preliminary Tasks:

- Read out stored fault messages.
- Switch off ignition.
- Follow instructions for disconnecting and connecting battery. Refer to 12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY .
- Disconnect and cover battery negative terminal.
- Remove suction filter housing. Refer to 13 71 000 REMOVING AND INSTALLING INTAKE FILTER HOUSING (M54) .
- Remove fan clutch. Refer to 11 52 020 REMOVING AND INSTALLING/REPLACING FAN CLUTCH (S52 / S54 / M52 / M52TU / M54 / M56) .
- Remove alternator drive belt. Refer to 11 28 010 REPLACING ALTERNATOR DRIVE BELT (M52 / S52 / M52TU / M54 / M56) .

If necessary, drain supply tank for power steering pump, remove with holder and place to one side.

NOTE: Lines on supply tank for power steering pump remain connected.

If fitted:

Remove air hose.

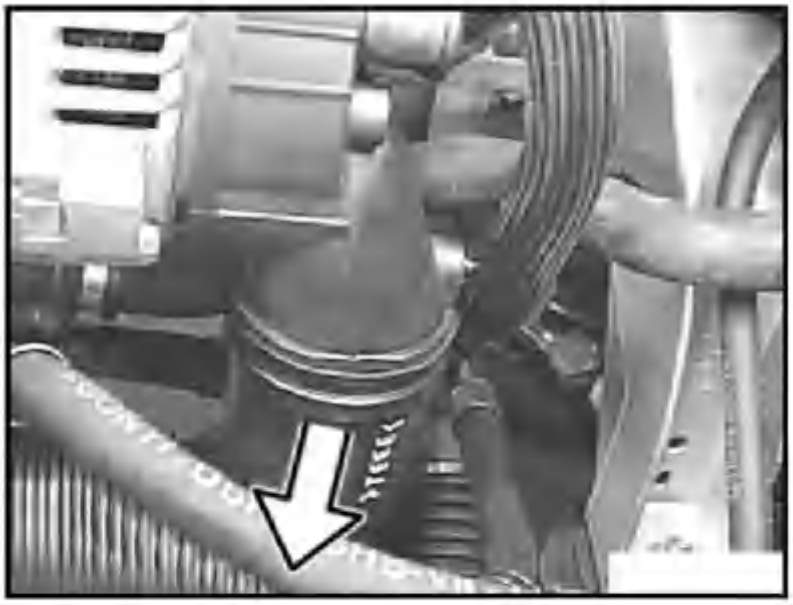



Fig. 70: Removing Air Hose
Courtesy of BMW OF NORTH AMERICA, INC.

Version 1

Take off cap on connections.

Disconnect plug connection (1).

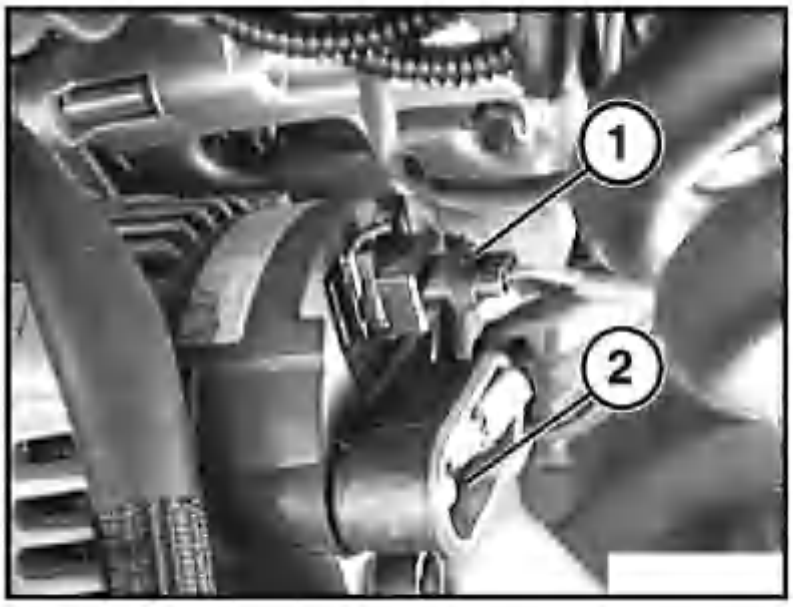



Fig. 71: Identifying Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Release nut (2) and disconnect battery positive lead.

Tightening torque, 12 31 1AZ. Refer to 12 31 ALTERNATOR WITH DRIVE AND MOUNTING PART .

Version 2

Unlock and detach plug connection (1).

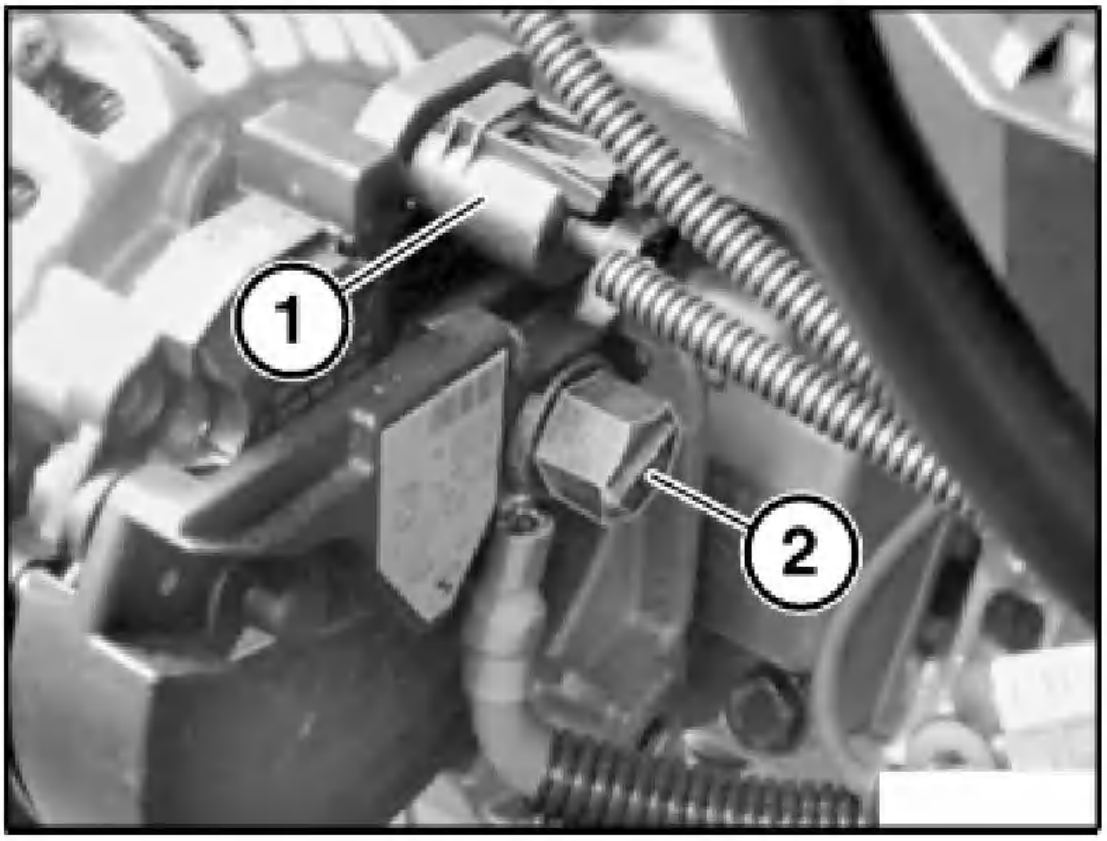



Fig. 72: Disconnecting Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Release nut (2) and disconnect battery positive lead.

Tightening torque, 12 31 1AZ. Refer to 12 31 ALTERNATOR WITH DRIVE AND MOUNTING PART .

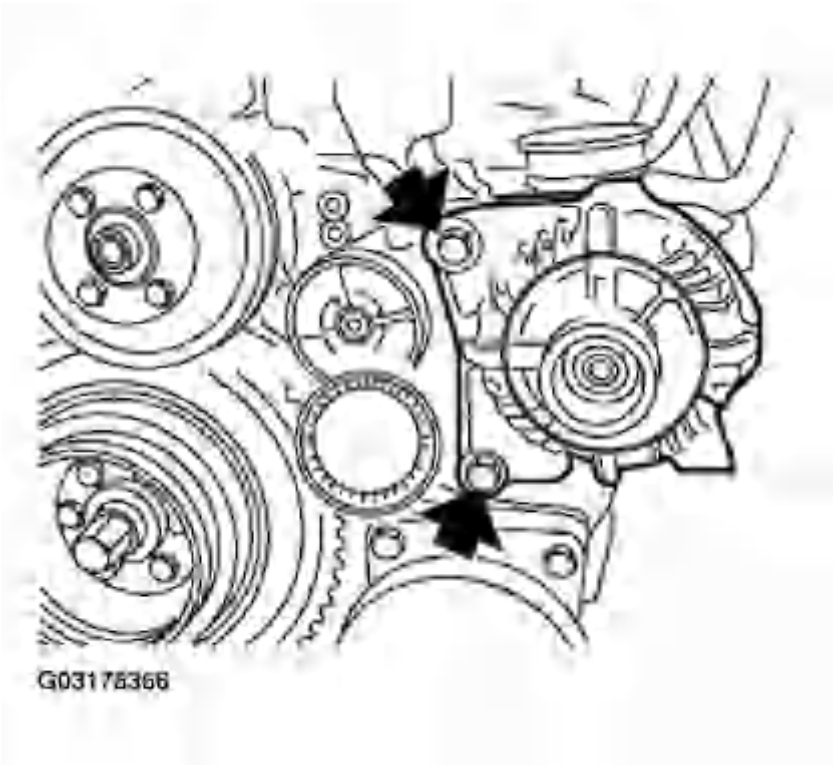



Fig. 73: Disconnecting Battery Positive Lead
Courtesy of BMW OF NORTH AMERICA, INC.

Version Without Idler Pulley:

Release alternator screws in succession while simultaneously gripping alternator firmly.

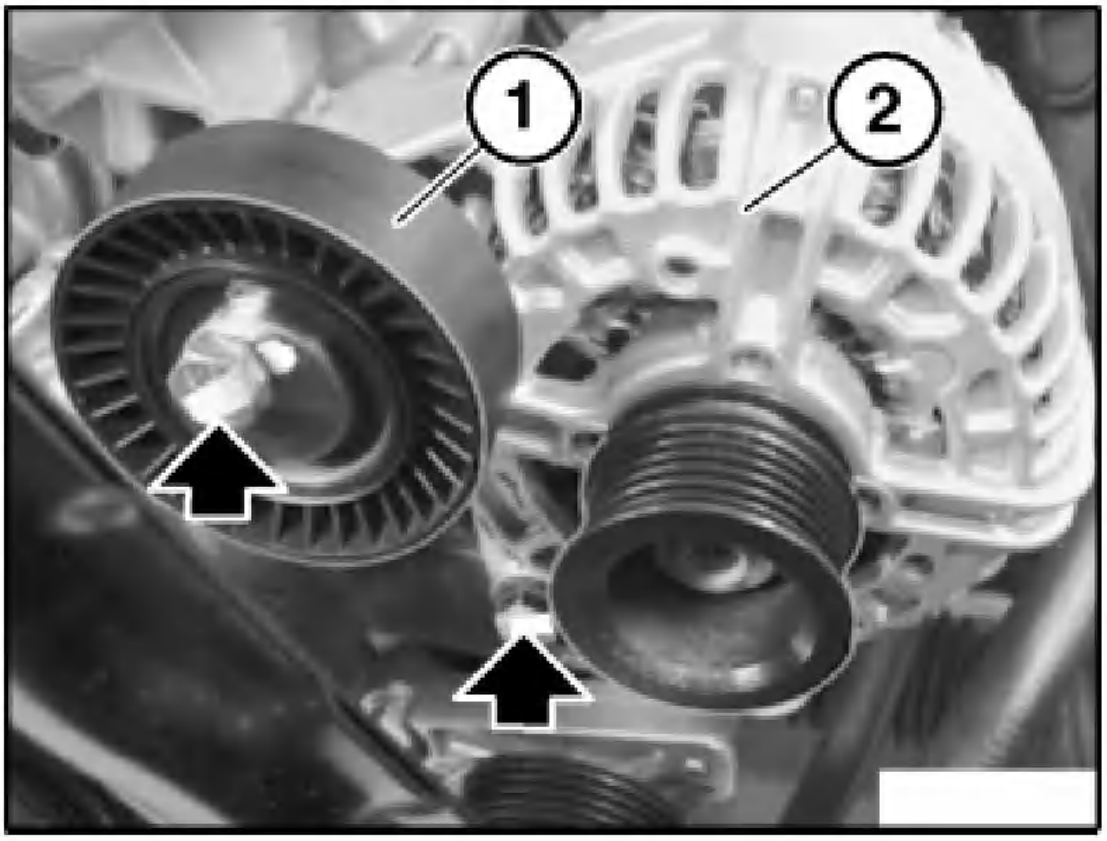



Fig. 74: Removing Alternator Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Remove alternator.

Version with idler pulley:

Remove cover from idler pulley (1).

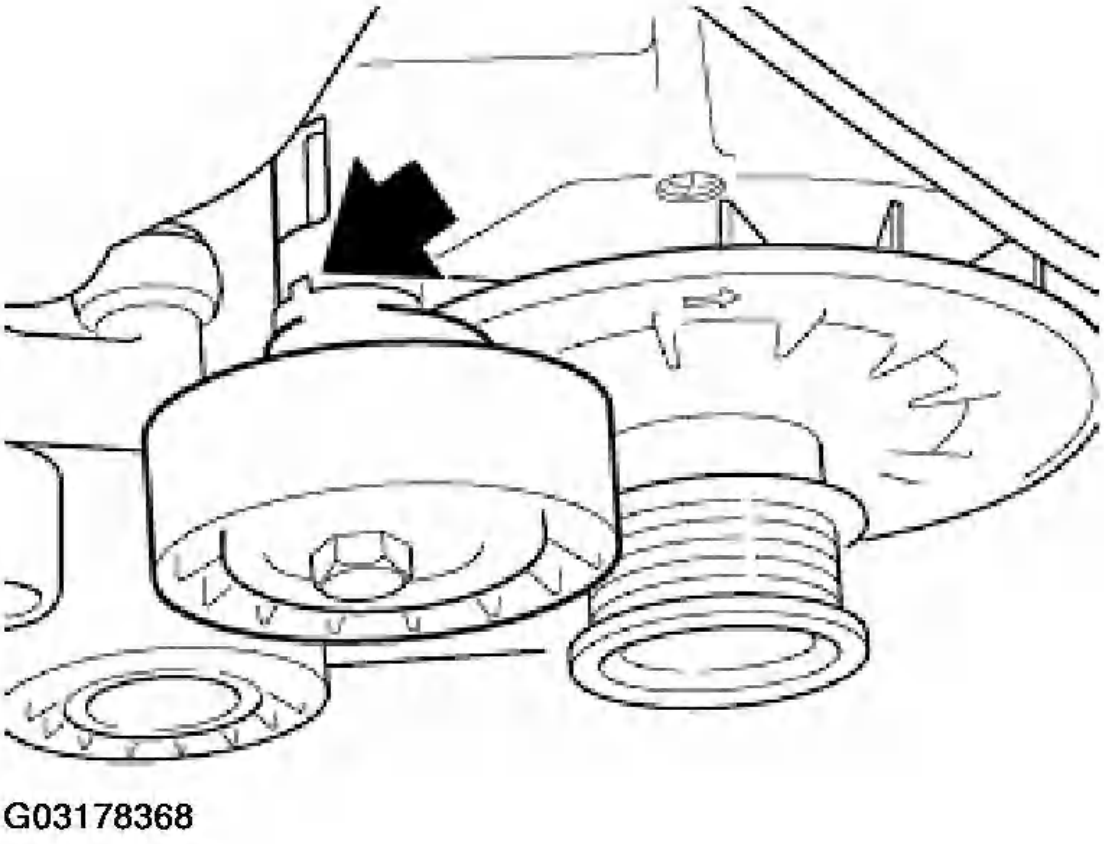



Fig. 75: Removing Idler Pulley Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw and remove idler pulley (1).

Release screw and remove alternator (2).

Version with idler pulley:

Installation:

Turning lock of tensioning roller must engage in alternator groove.

Interrogate fault memory of DME control unit.

Now clear the fault memory.

## 12 31 695 REPLACING DIODE PLATE (MOTOROLA ALTERNATOR)

NOTE: Alternator removed.

Unscrew capacitor and cover.

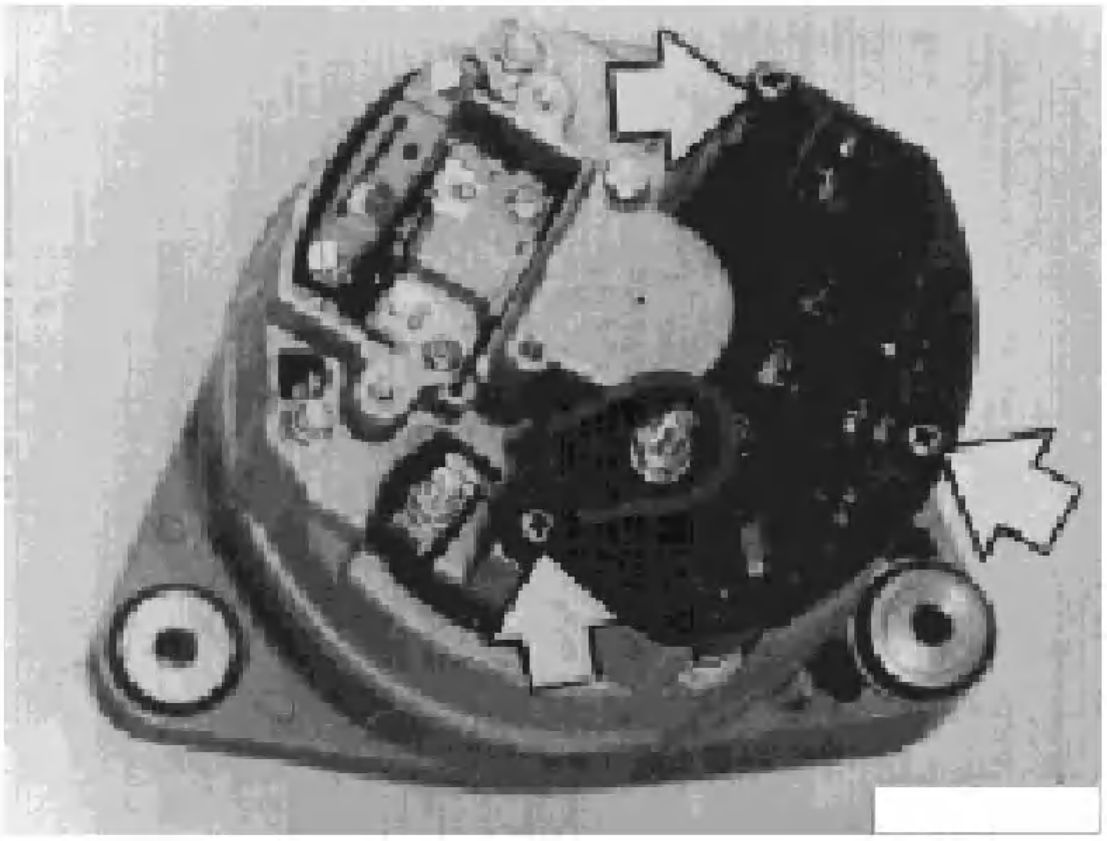



Fig. 76: Unscrewing Capacitor And Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Unsolder stator winding on diode plate.

CAUTION: Excessive heat from soldering iron would destroy diodes.

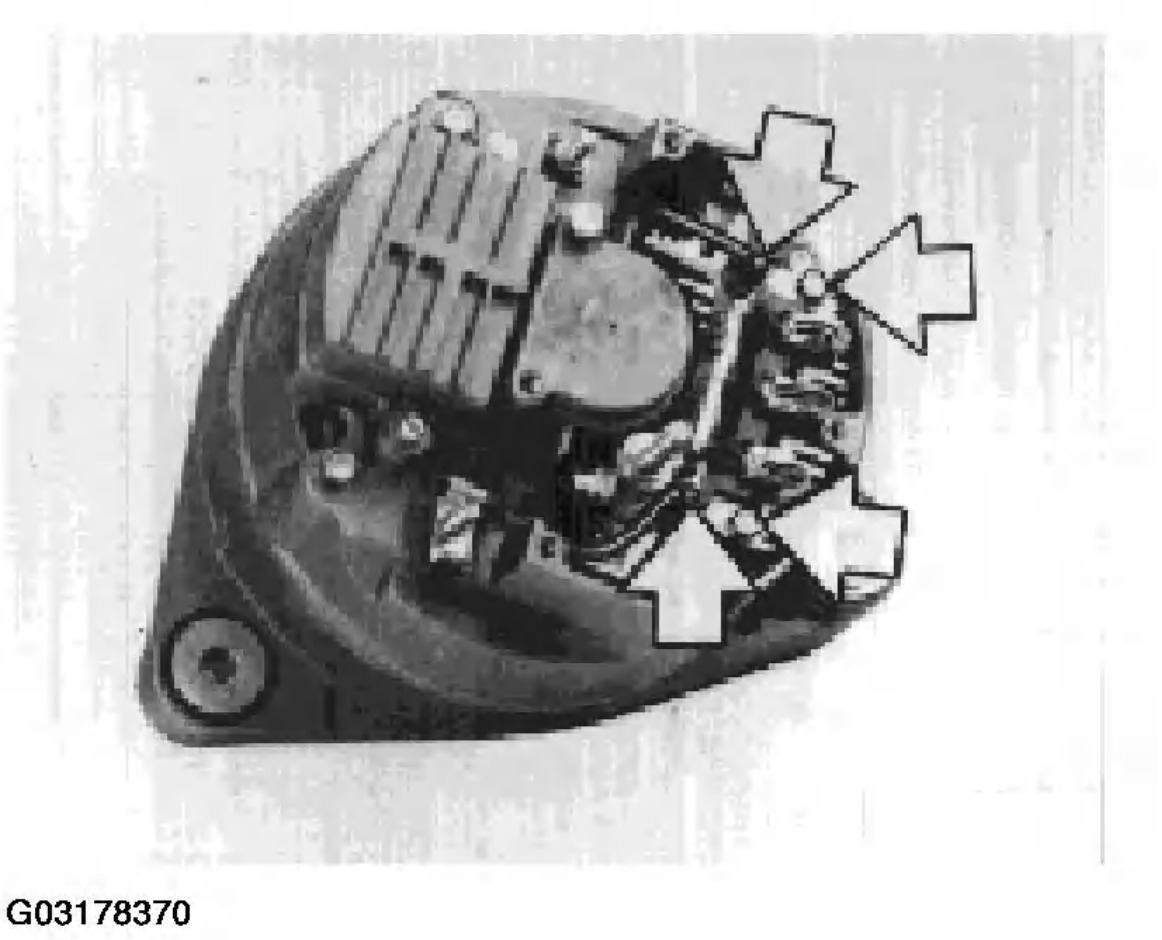



Fig. 77: Unsoldering Stator Winding On Diode Plate
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew screws and take off diode plate.

Installation:

Check that insulating sleeves are in satisfactory condition.

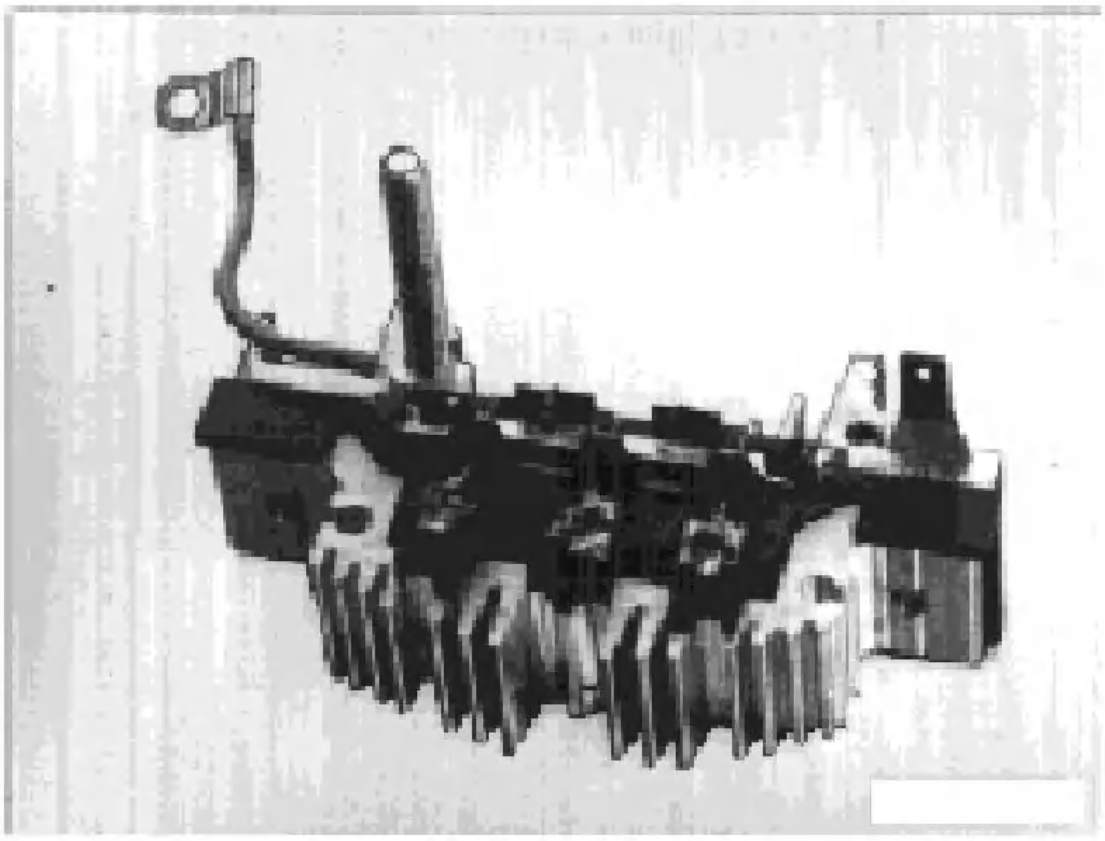



Fig. 78: Identifying Diode Plate
Courtesy of BMW OF NORTH AMERICA, INC.

## REGULATOR

### 12 32 501 REPLACING VOLTAGE REGULATOR

General Data, refer to Refer to 12 00 ... DISCONNECTING AND CONNECTING TEST EQUIPMENT and 12 00... COMPONENT INSPECTION: and 12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY .

Read fault memory.

Disconnect battery ground wire.

Remove alternator, refer to 12 31 020 REMOVING AND INSTALLING OR REPLACING ALTERNATOR (M52, M52TU, S50US, S52, M54, M56) .

Release screws and remove cover.

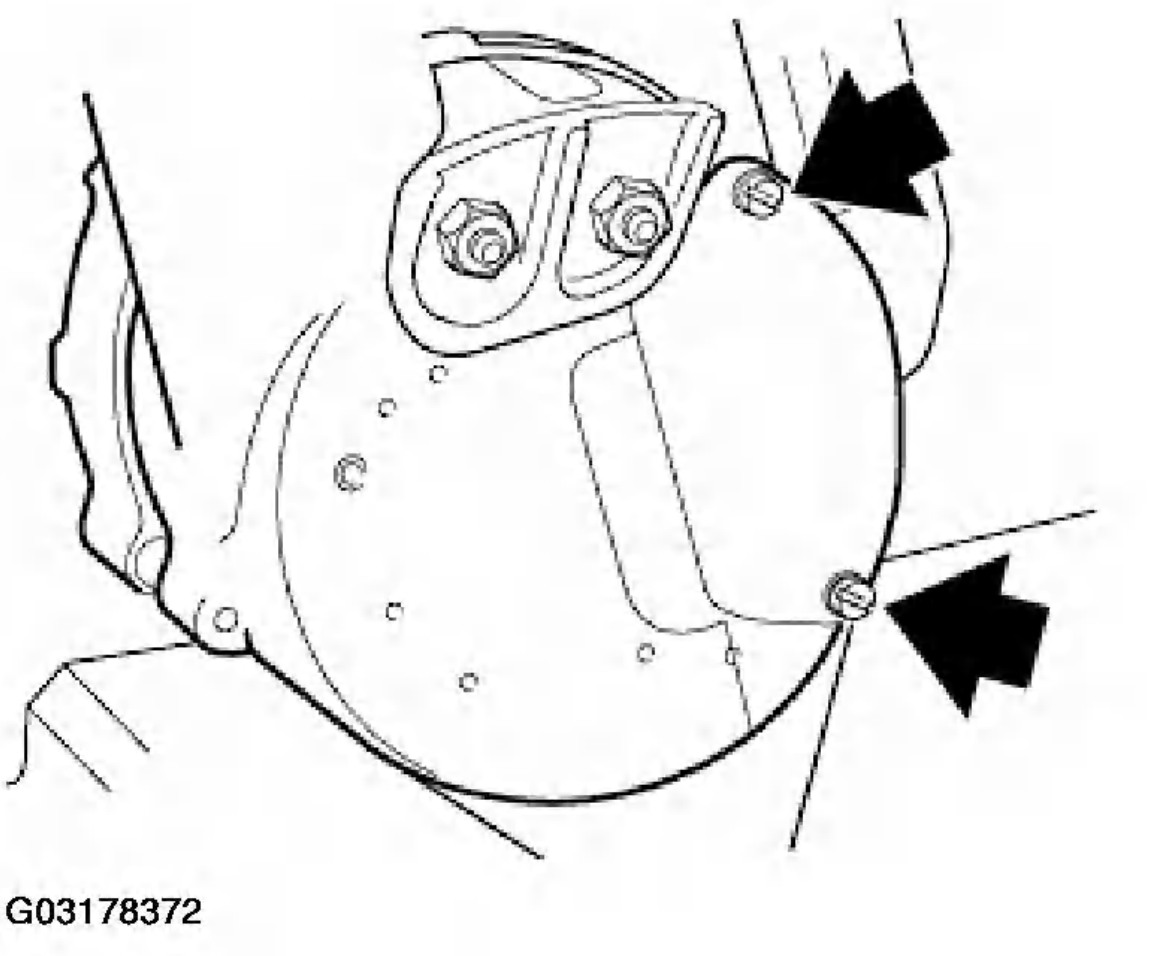



Fig. 79: Removing Voltage Regulator Cover Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Remove voltage regulator.

Check collector ring for wear and recondition if necessary.

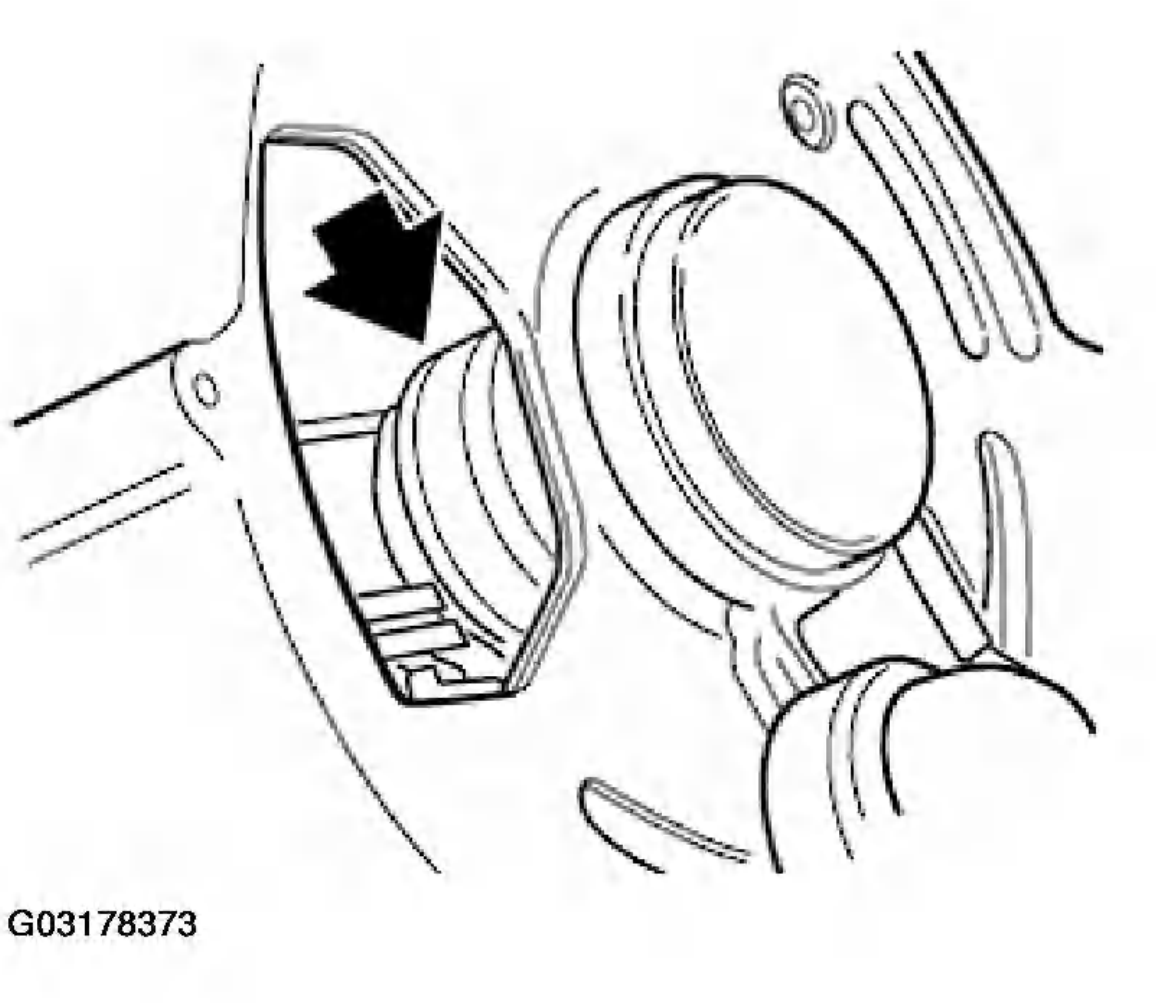



Fig. 80: Checking Collector Ring For Wear
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean contact surfaces and check contact-spring tension, bending to correct where indicated.

Distance A = at least 5 mm.

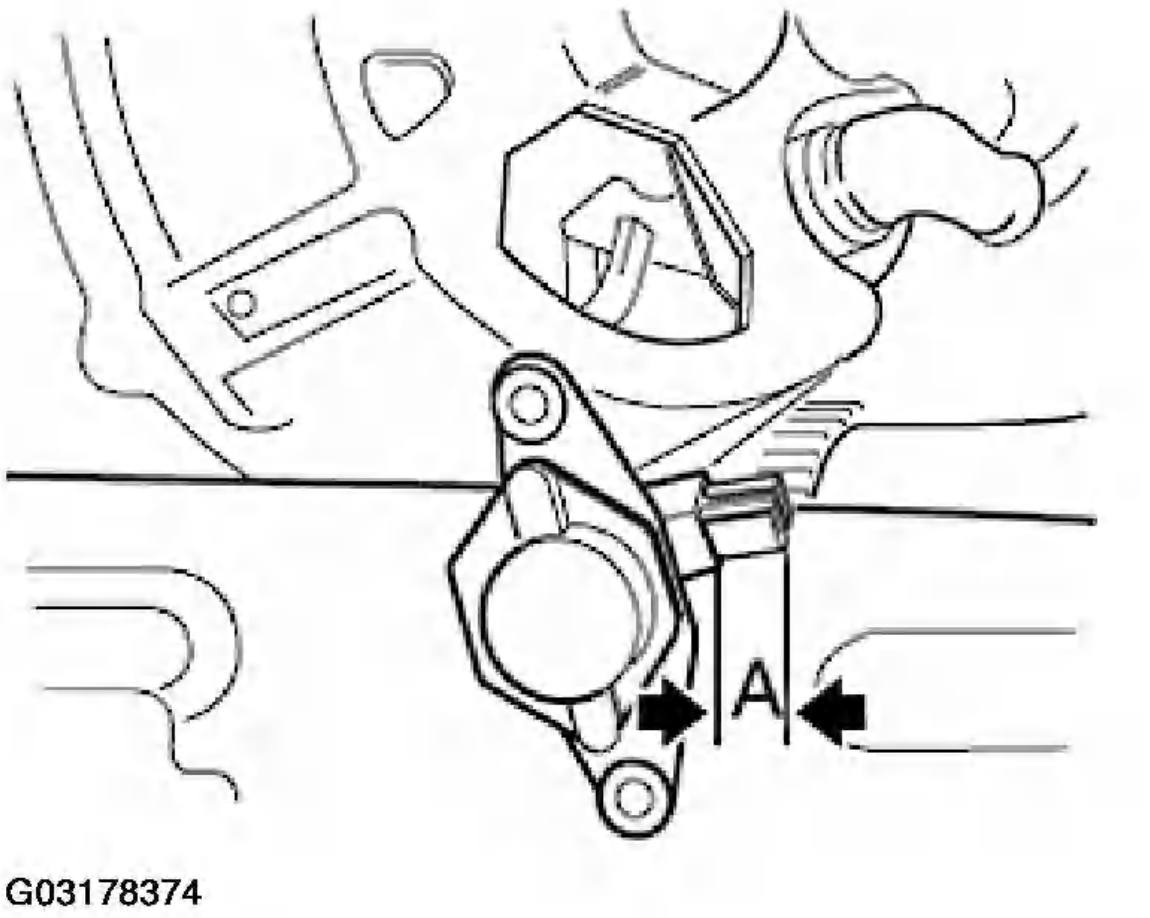



Fig. 81: Identifying Contact-Spring Tension
Courtesy of BMW OF NORTH AMERICA, INC.

## 12 32 501 REPLACING VOLTAGE REGULATOR (VALEO/BOSCH)

Read General Information in MG12. Refer to 12 00 ... DISCONNECTING AND CONNECTING TEST EQUIPMENT and 12 00... COMPONENT INSPECTION: .

Read fault memory.

Follow instructions for disconnecting and connecting battery. Refer to 12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY .

Disconnect battery ground wire.

Remove alternator. Refer to 12 31 020 REMOVING AND INSTALLING OR REPLACING ALTERNATOR (M52, M52TU, S50US, S52, M54, M56) .

Valeo alternator:

Release screws on cover.

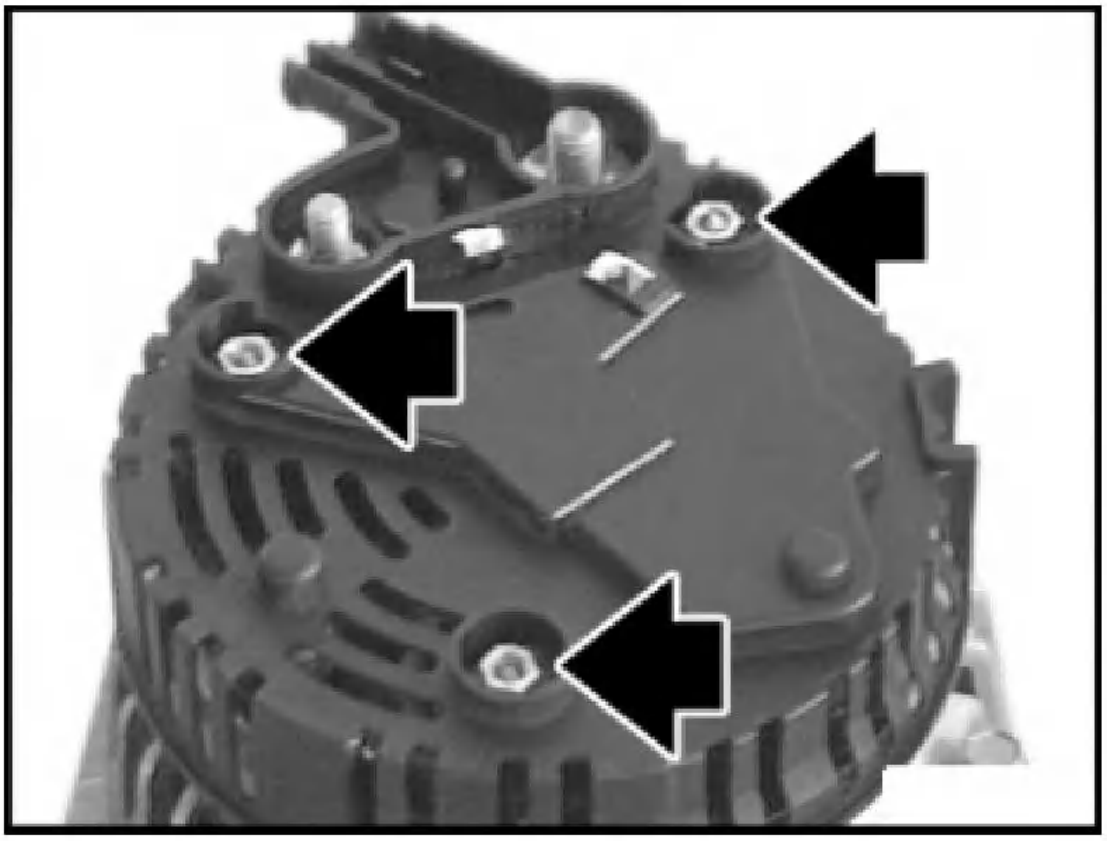



Fig. 82: Releasing Screws On Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws.

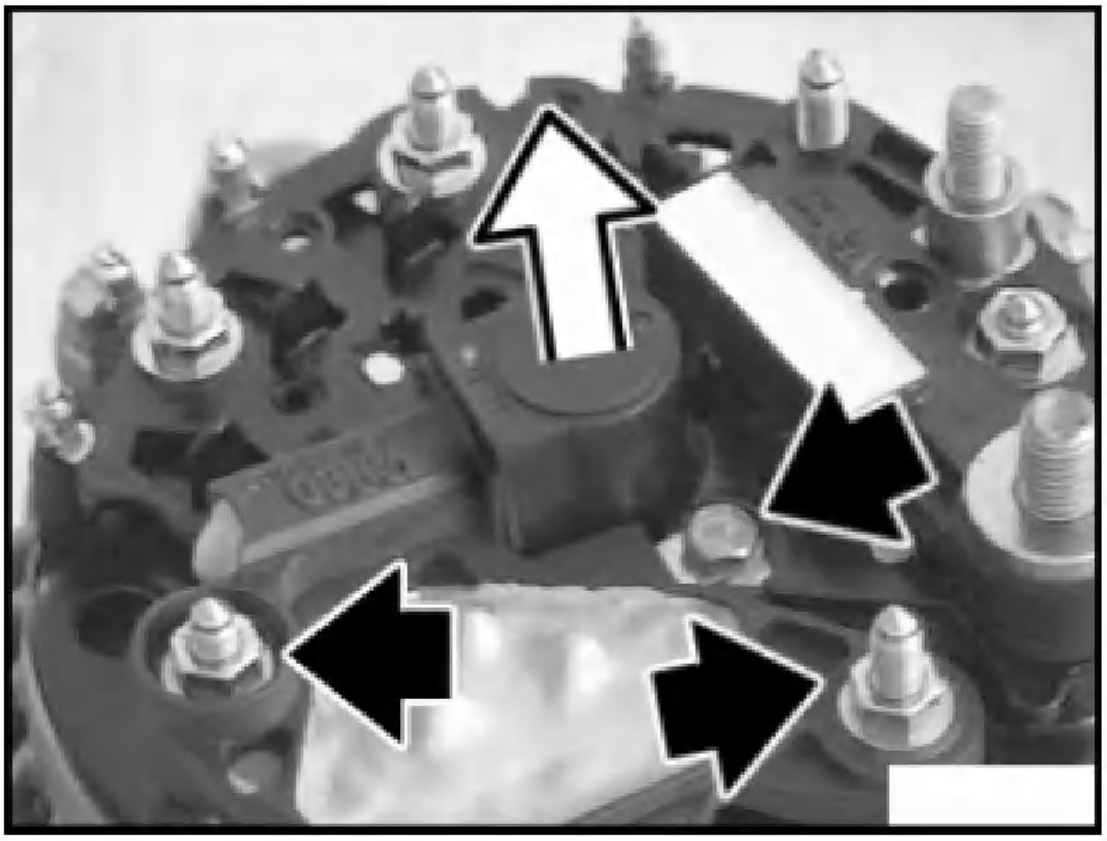



Fig. 83: Removing Regulator Switch Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Remove regulator switch.

Check contact surfaces of collector rings for wear and recondition if necessary.

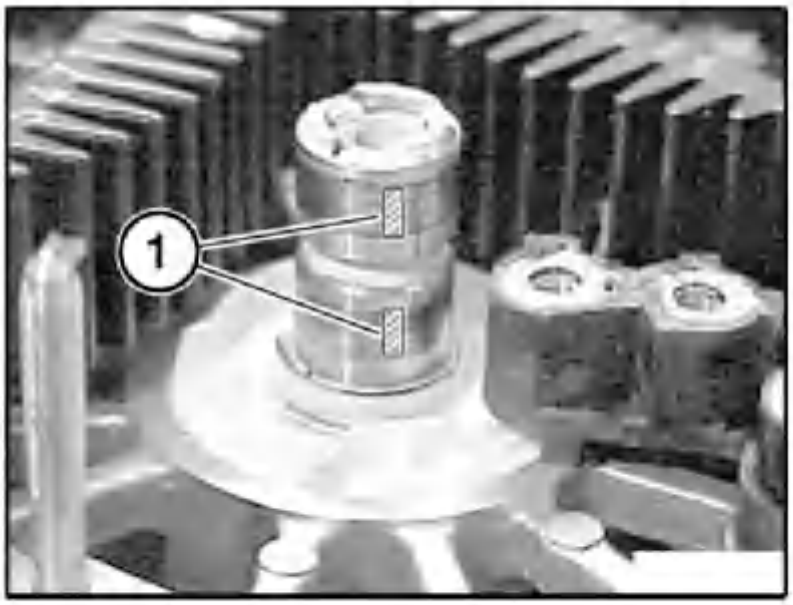



Fig. 84: Checking Contact Surfaces Of Collector Rings For Wear
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Install regulator switch with assembly cap.

Initially tighten nuts of regulator switch.

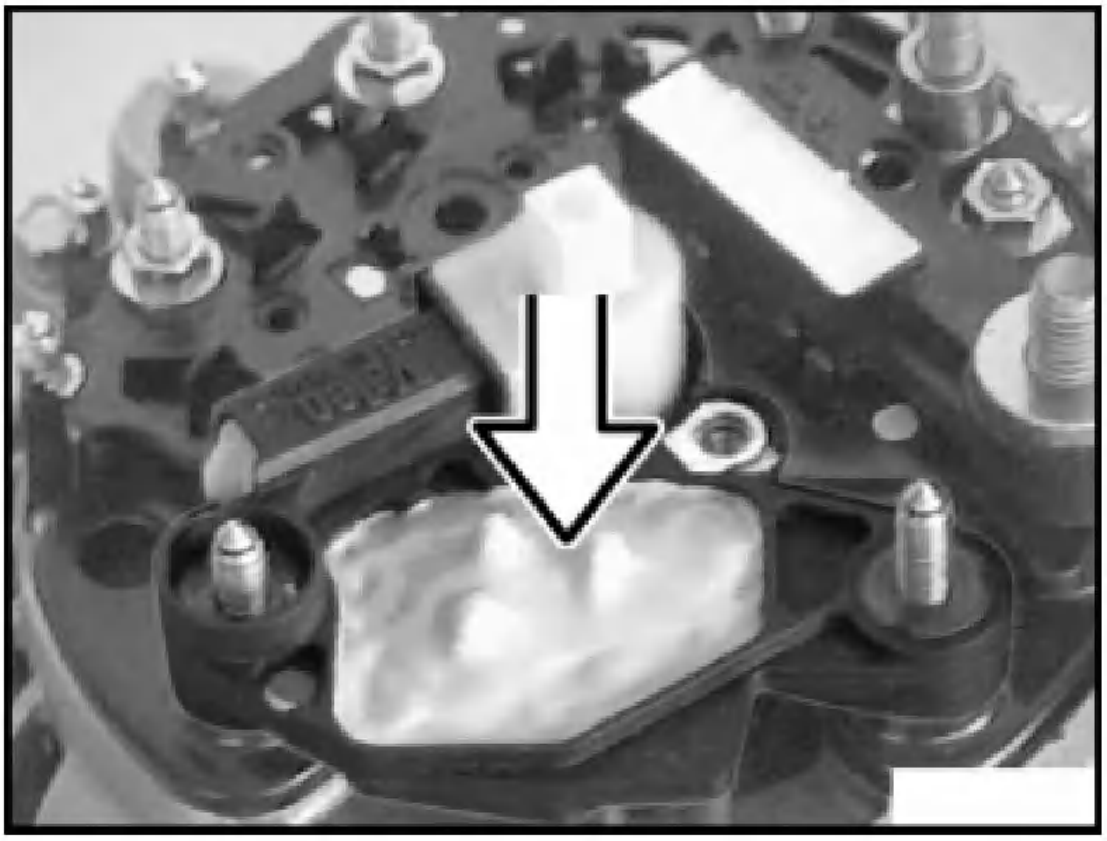



Fig. 85: Installing Regulator Switch With Assembly
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Remove assembly cap (1).

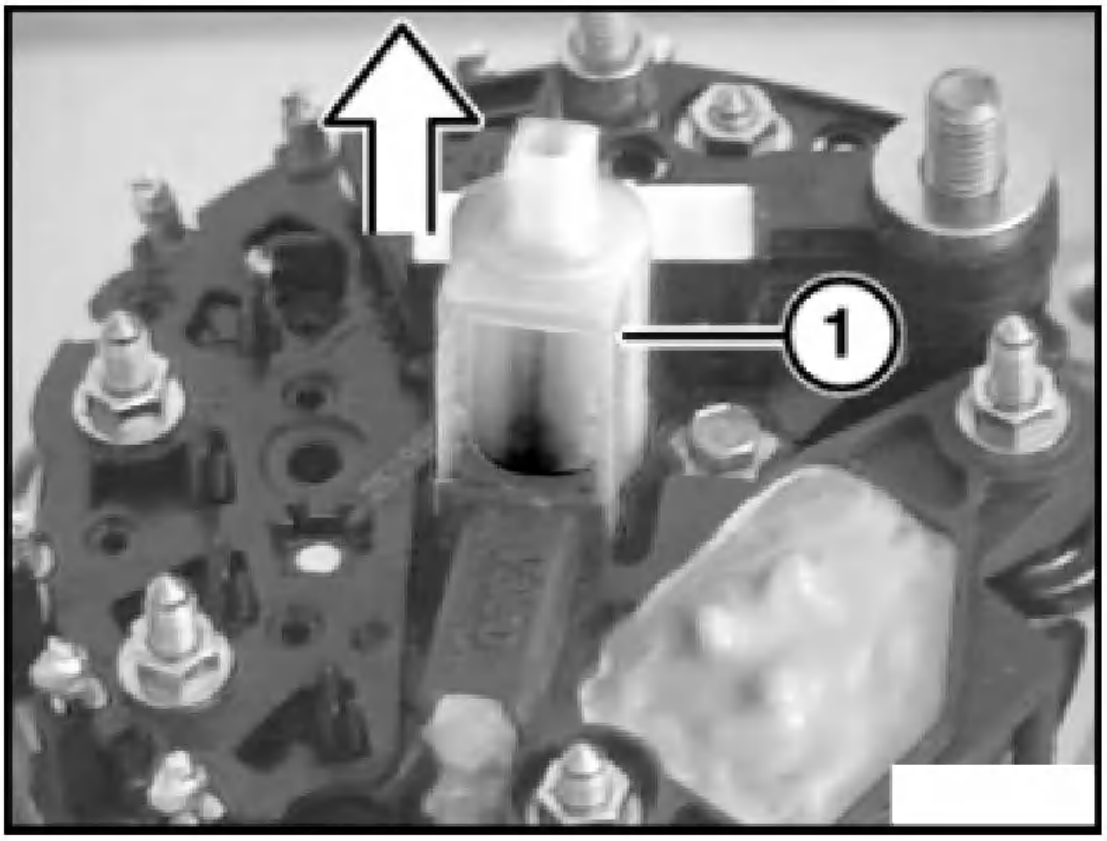



Fig. 86: Removing Assembly Cap
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Fit supplied cover cap (2).

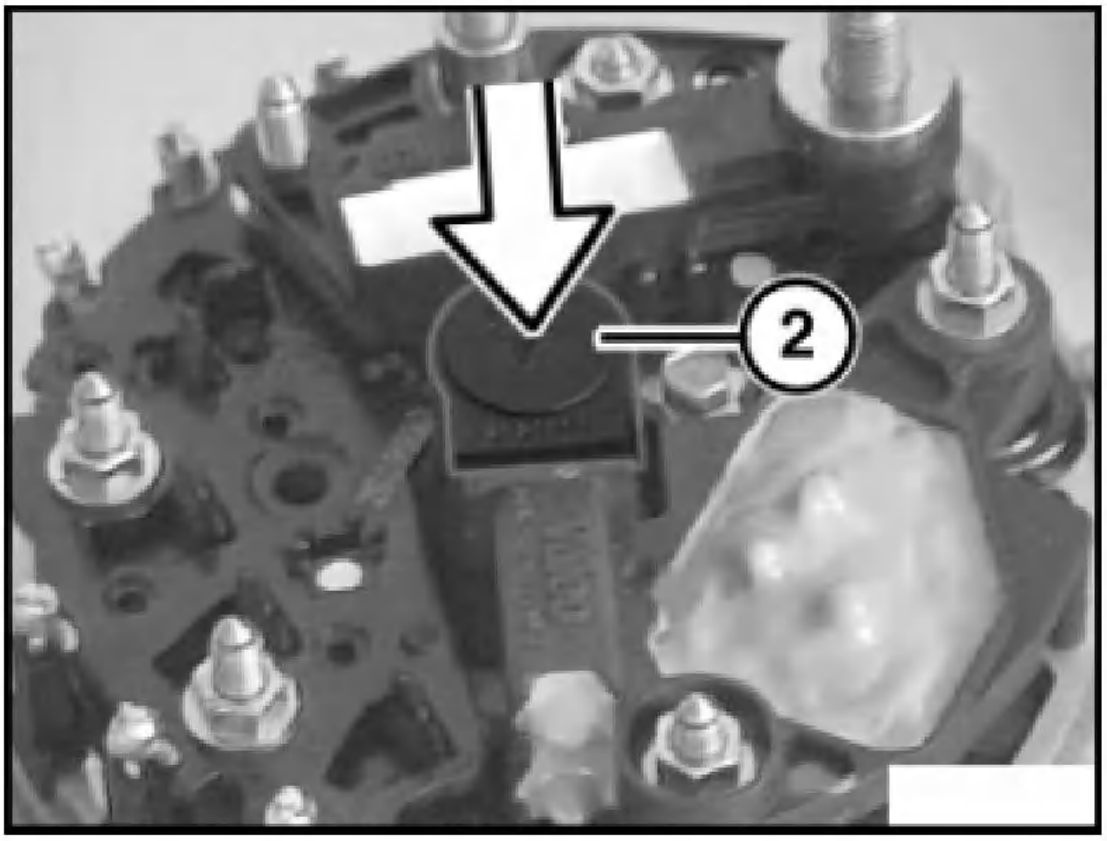



Fig. 87: Fitting Cover Cap
Courtesy of BMW OF NORTH AMERICA, INC.

Tighten down nuts and ground screw of regulator switch.

Tightening torque, 12 32 1AZ. Refer to 12 32 GOVERNOR .

Bosch Alternator:

Release screws on cover.

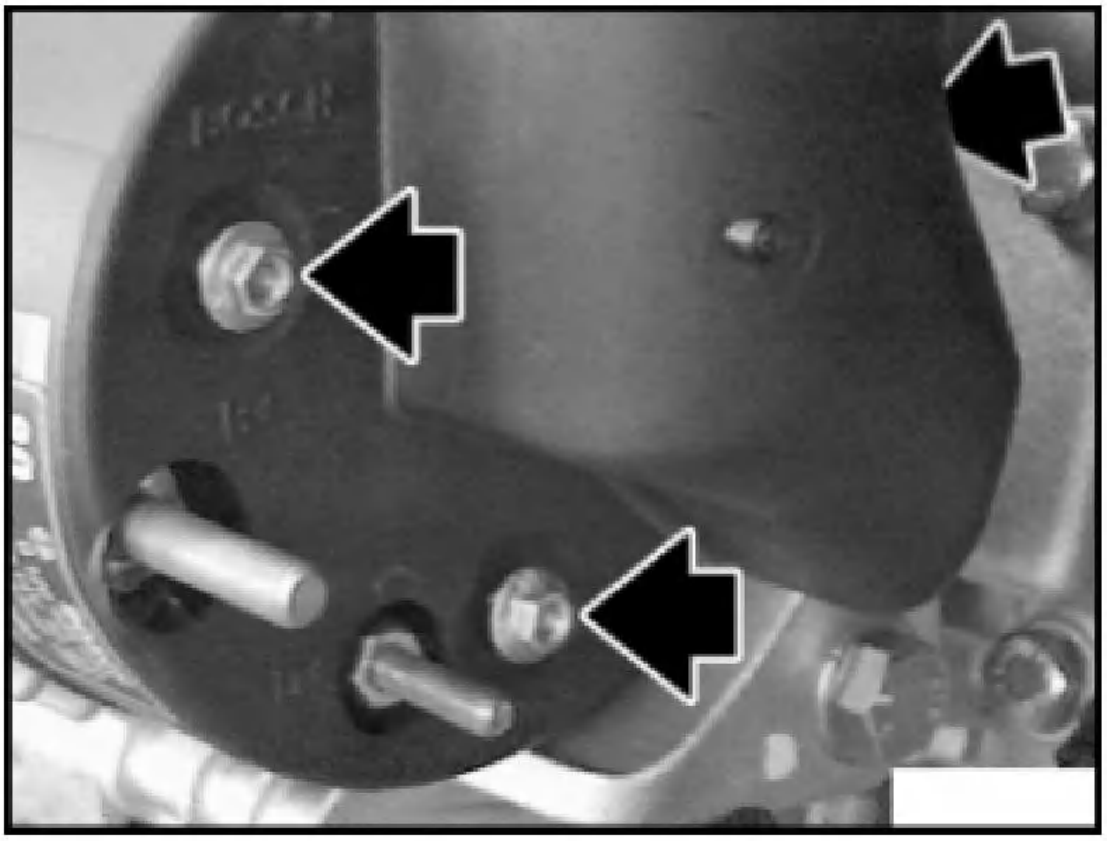



Fig. 88: Releasing Screws On Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws.

Remove regulator switch.

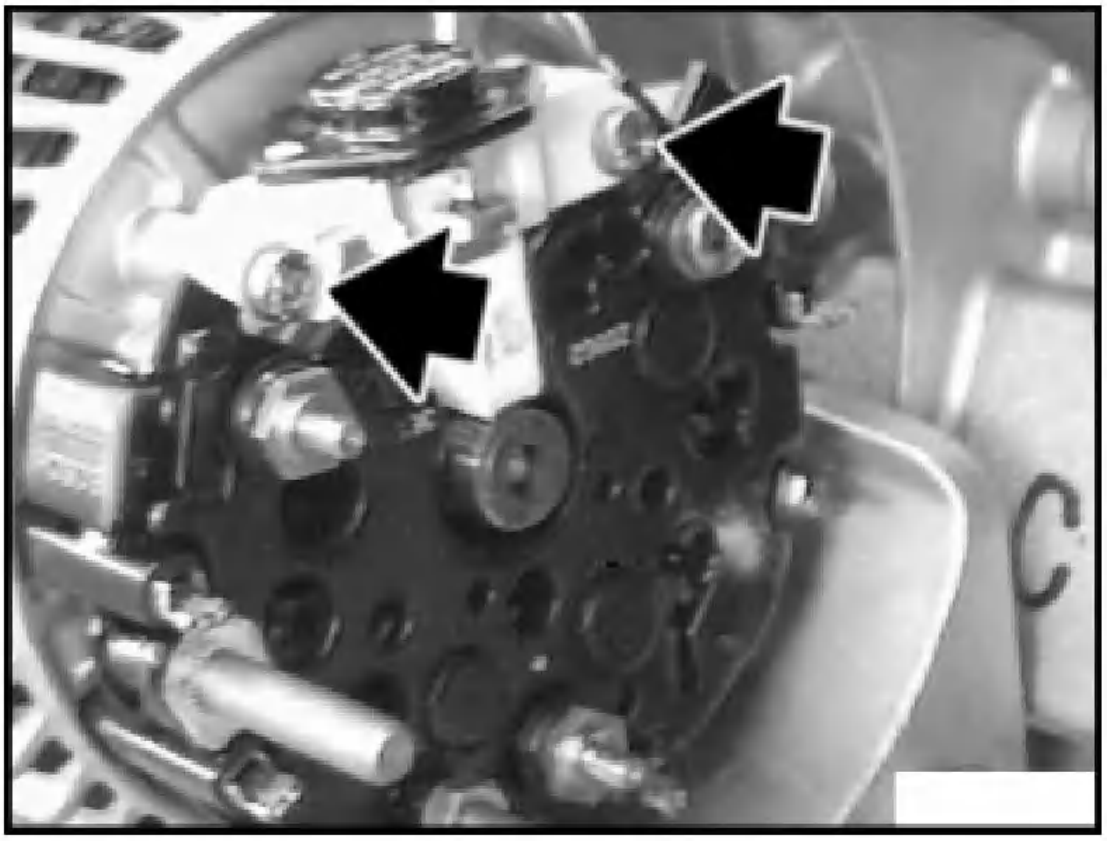



Fig. 89: Removing Regulator Switch
Courtesy of BMW OF NORTH AMERICA, INC.

Check contact surfaces of collector rings for wear and recondition if necessary.

## STARTER WITH MOUNTING

### 12 41 020 REMOVING AND INSTALLING/REPLACING STARTER MOTOR (Z3 / M54)

Observe instructions for disconnecting and connecting battery. Refer to 12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY .

Disconnect battery negative lead from battery.

Perform following tasks from above:

Release nuts (1) and disconnect battery positive leads from starter motor.

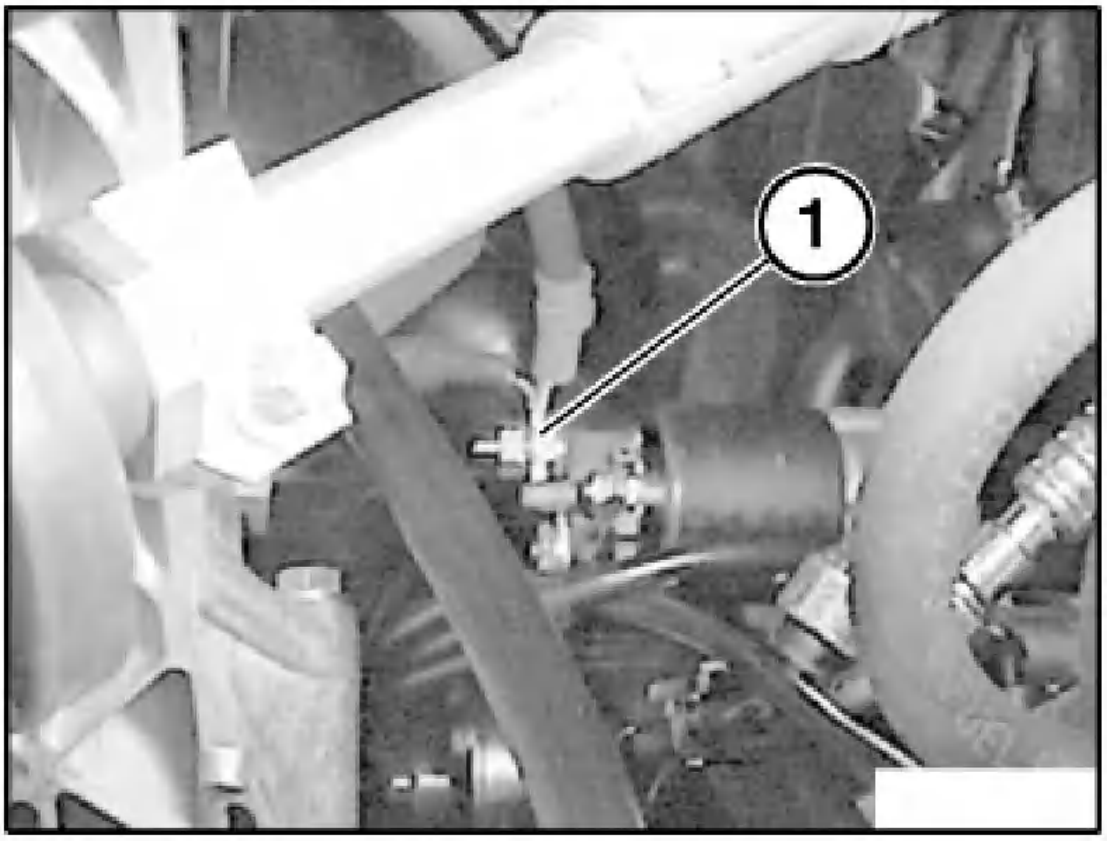



Fig. 90: Disconnecting Battery Positive Leads From Starter Motor
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Tightening torque, 12 41 4AZ. Refer to 12 41 STARTER AND MOUNTING PARTS .

Release nuts (1).

Installation:

Tightening torque, 12 41 4AZ. Refer to 12 41 STARTER AND MOUNTING PARTS .

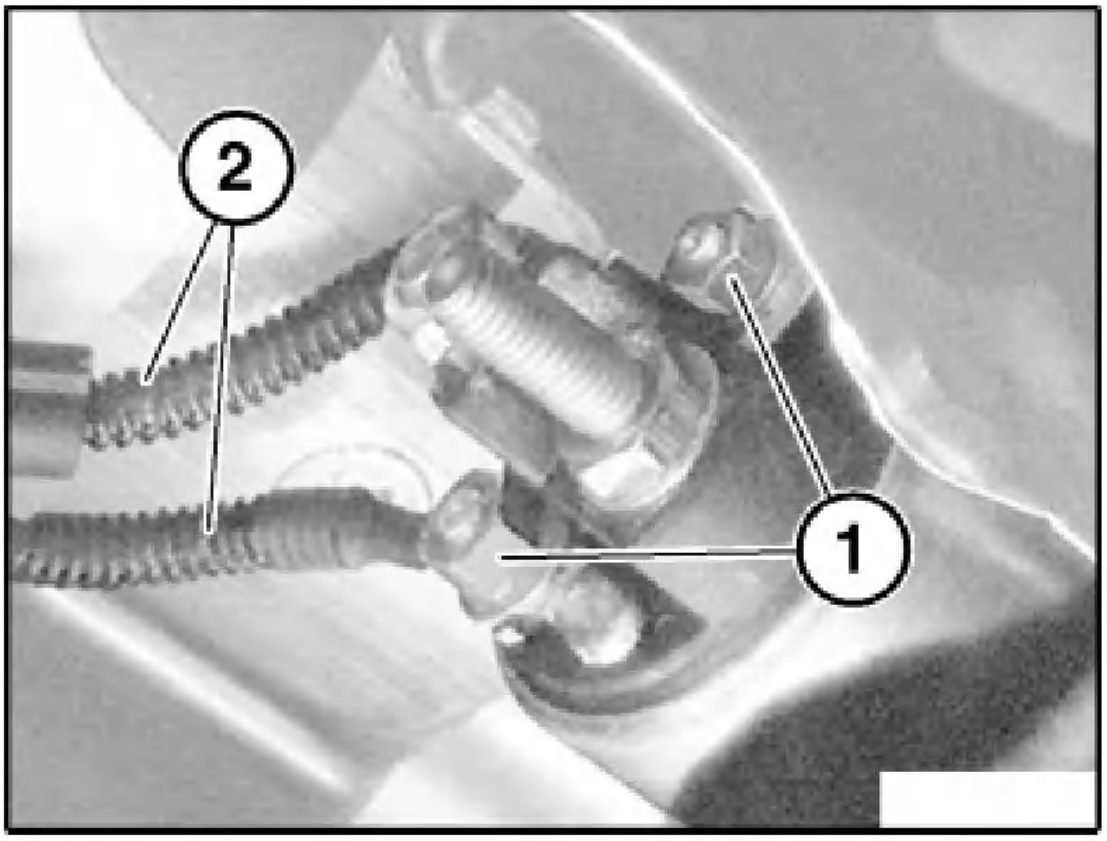



Fig. 91: Detaching Leads From Starter Motor
Courtesy of BMW OF NORTH AMERICA, INC.

Detach leads (2) from starter motor.

Detach cable duct (1) of B+ lead from firewall.

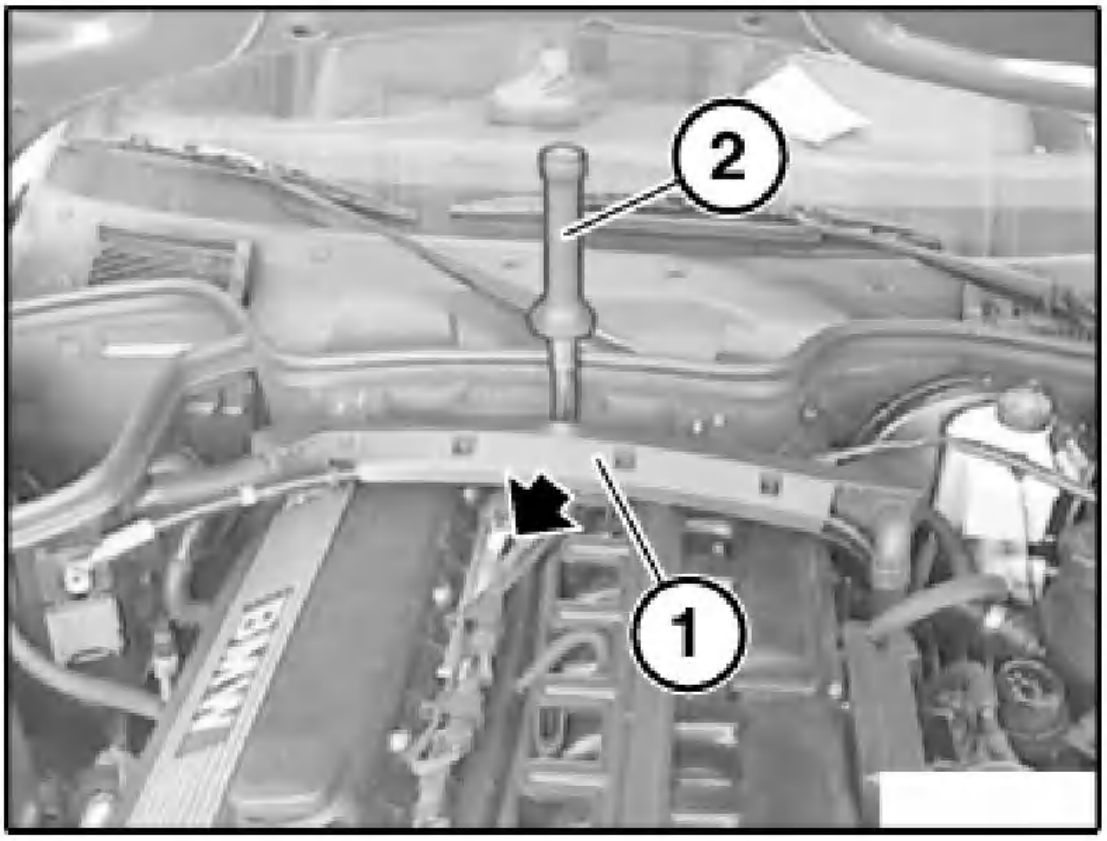



Fig. 92: Detaching Cable Duct Of B+ Lead From Firewall
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Detach heater valve from bracket in order to improve accessibility for torque tool (2).

Release starter motor screw (2) from upper vehicle side of transmission.

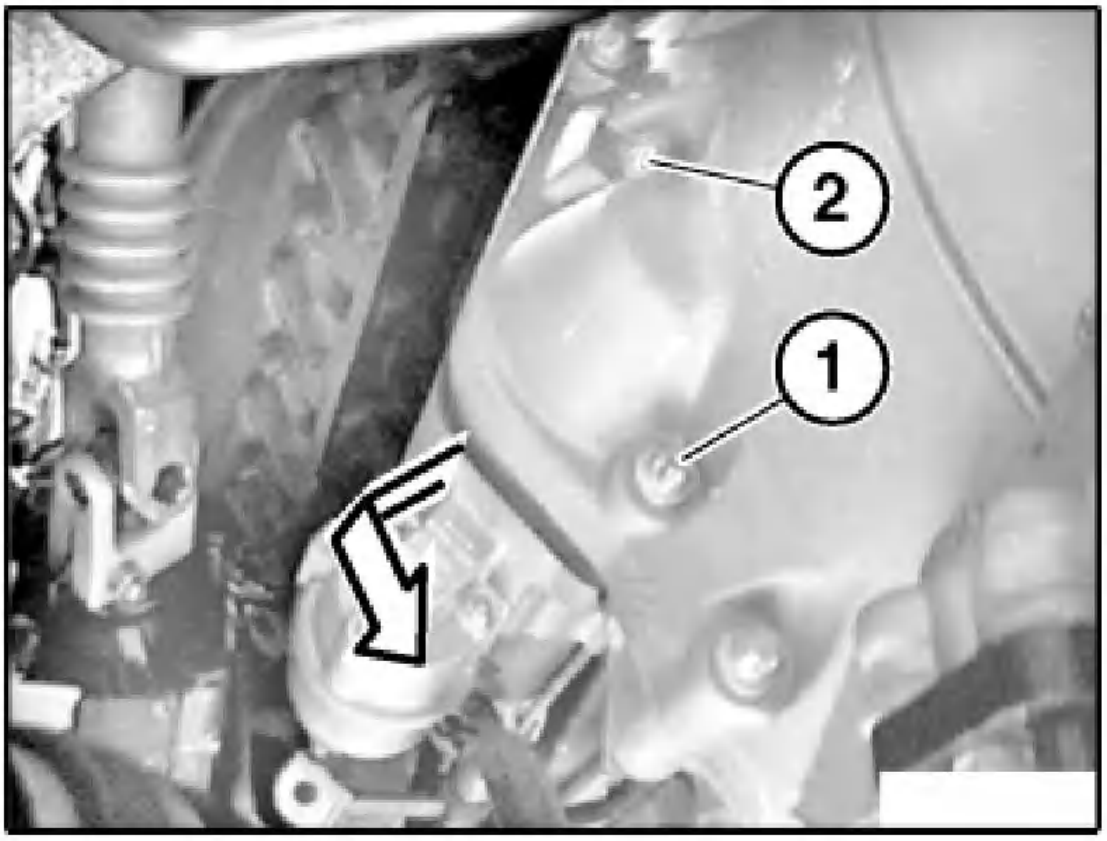



Fig. 93: Releasing Starter Motor Screw From Upper Vehicle Side Of Transmission
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque, 12 41 1AZ. Refer to 12 41 STARTER AND MOUNTING PARTS .

Starter motor screw (1) is accessible from lower vehicle side. Working from transmission output end, release starter motor screw (1) with a long extension and a universal joint.

Tightening torque, 12 41 1AZ. Refer to 12 41 STARTER AND MOUNTING PARTS .

Lift out starter motor.

Installation:

Check starter motor pinion and ring gear for damage.

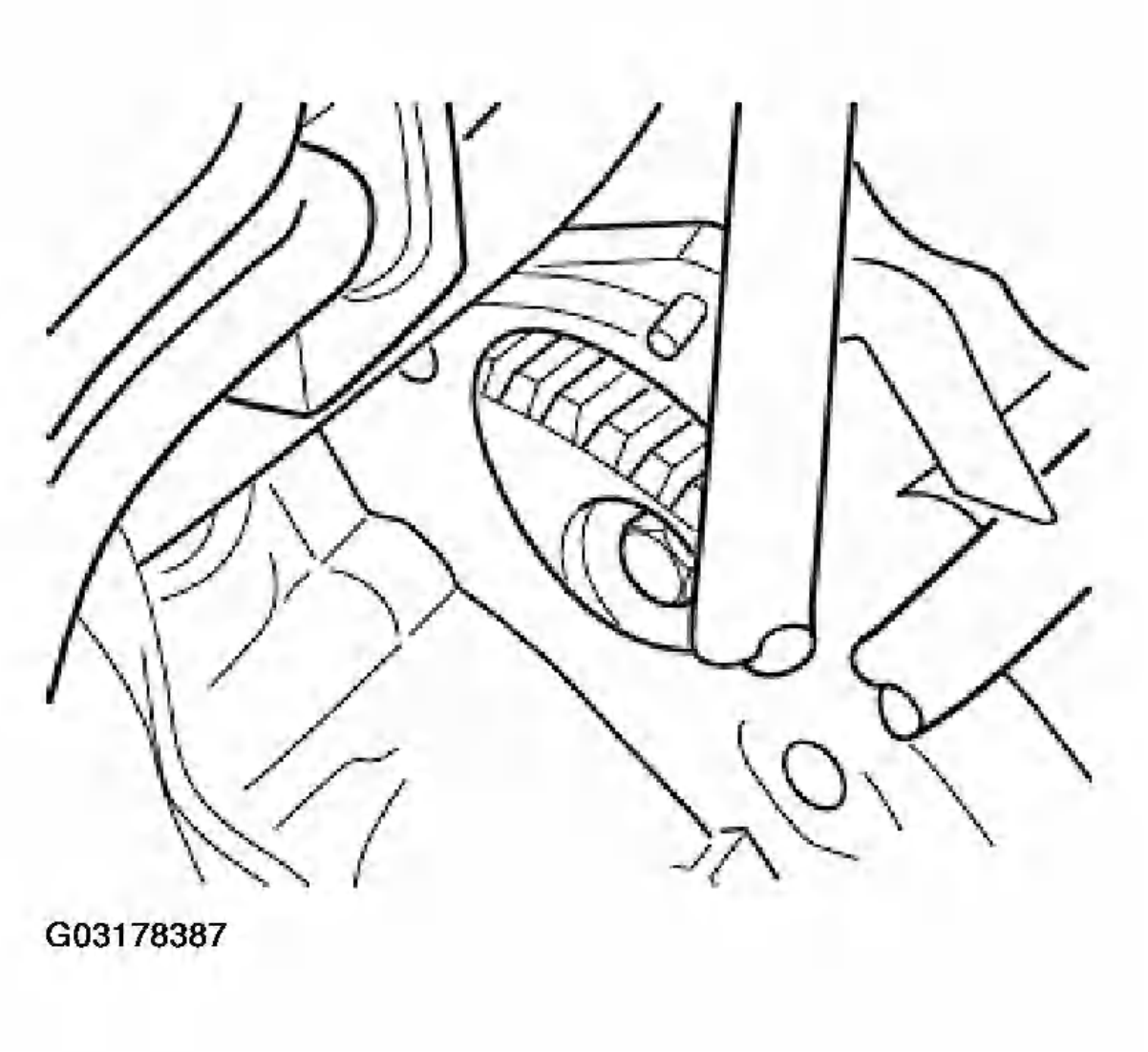



Fig. 94: Checking Starter Motor Pinion And Ring Gear For Damage
Courtesy of BMW OF NORTH AMERICA, INC.

## 12 41 041 REPLACING SOLENOID SWITCH

Turn off ignition.

Remove starter motor.

Release nut (1).

Remove cable lug (2).

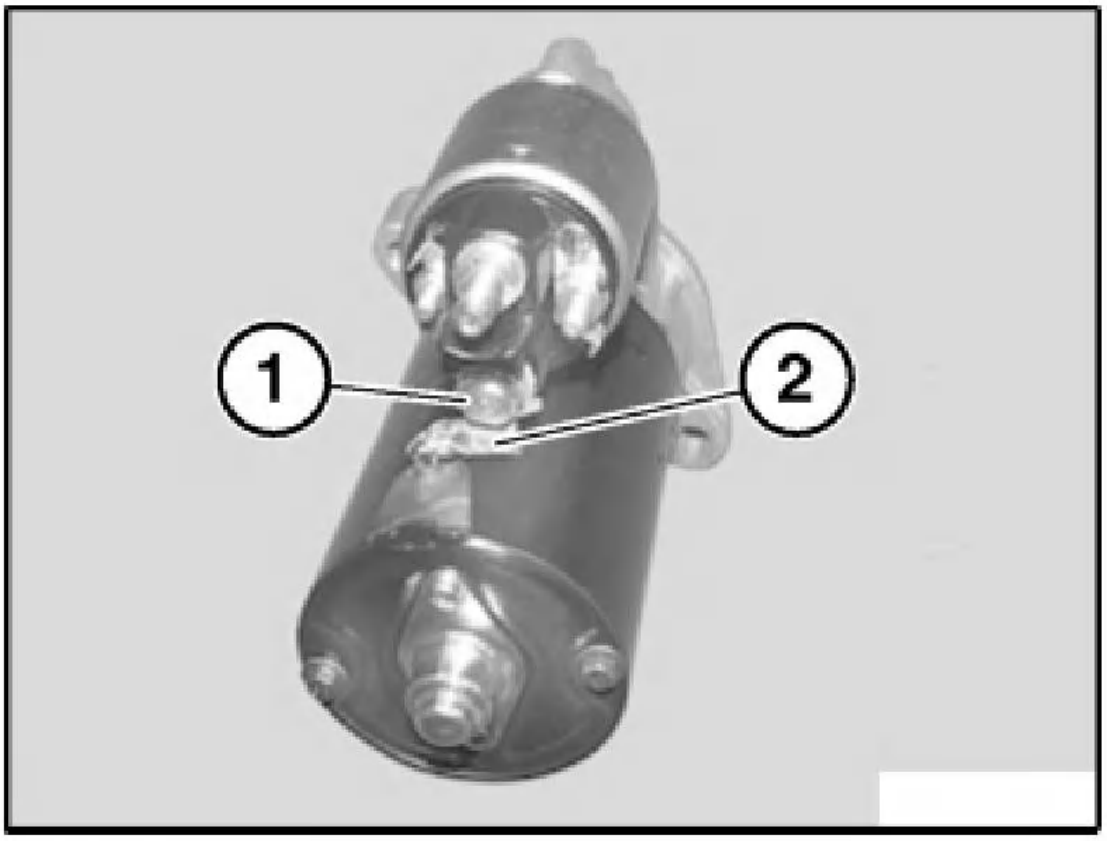



Fig. 95: Removing Cable Lug
Courtesy of BMW OF NORTH AMERICA, INC.

CAUTION: Do not turn cable lug (2) while tightening down - risk of short circuit to starter motor housing.Tightening torque, 12 41 4AZ. Refer to 12 41 STARTER AND MOUNTING PARTS .

Release screws (1).

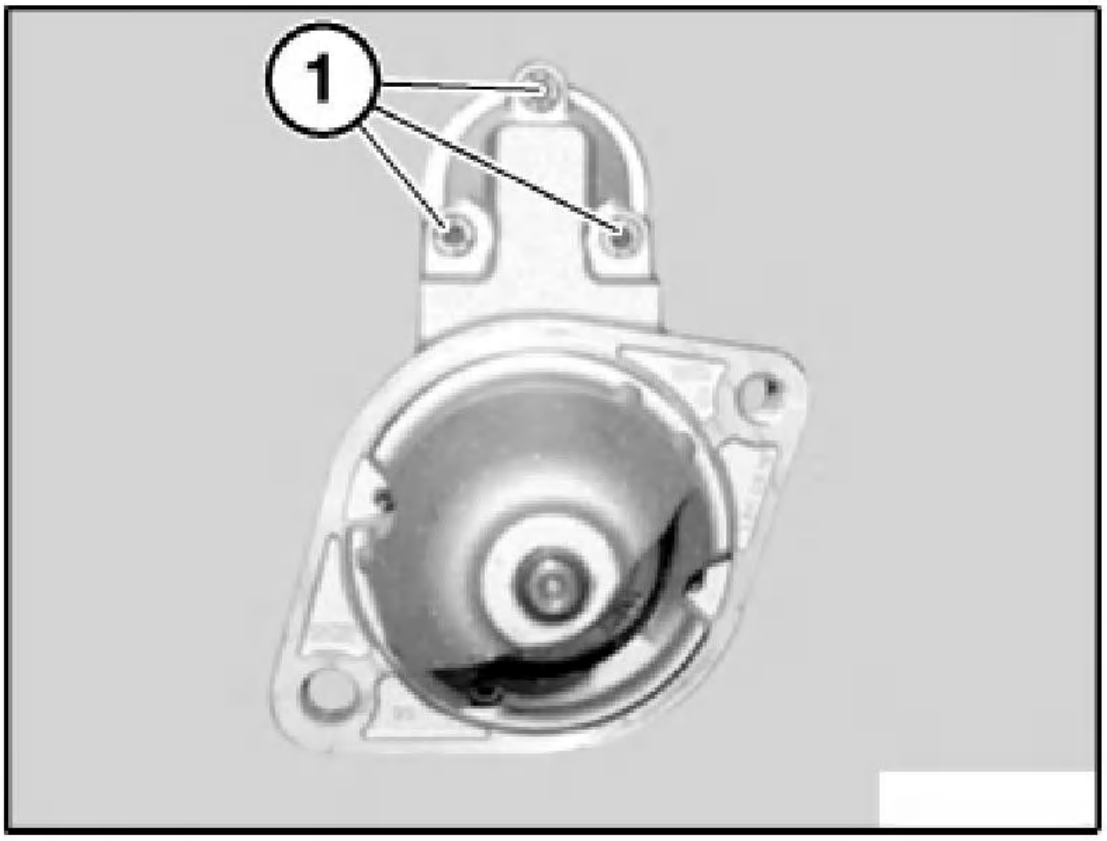



Fig. 96: Releasing Screws On Solenoid Switch
Courtesy of BMW OF NORTH AMERICA, INC.

Remove solenoid switch (1) and spring (2).

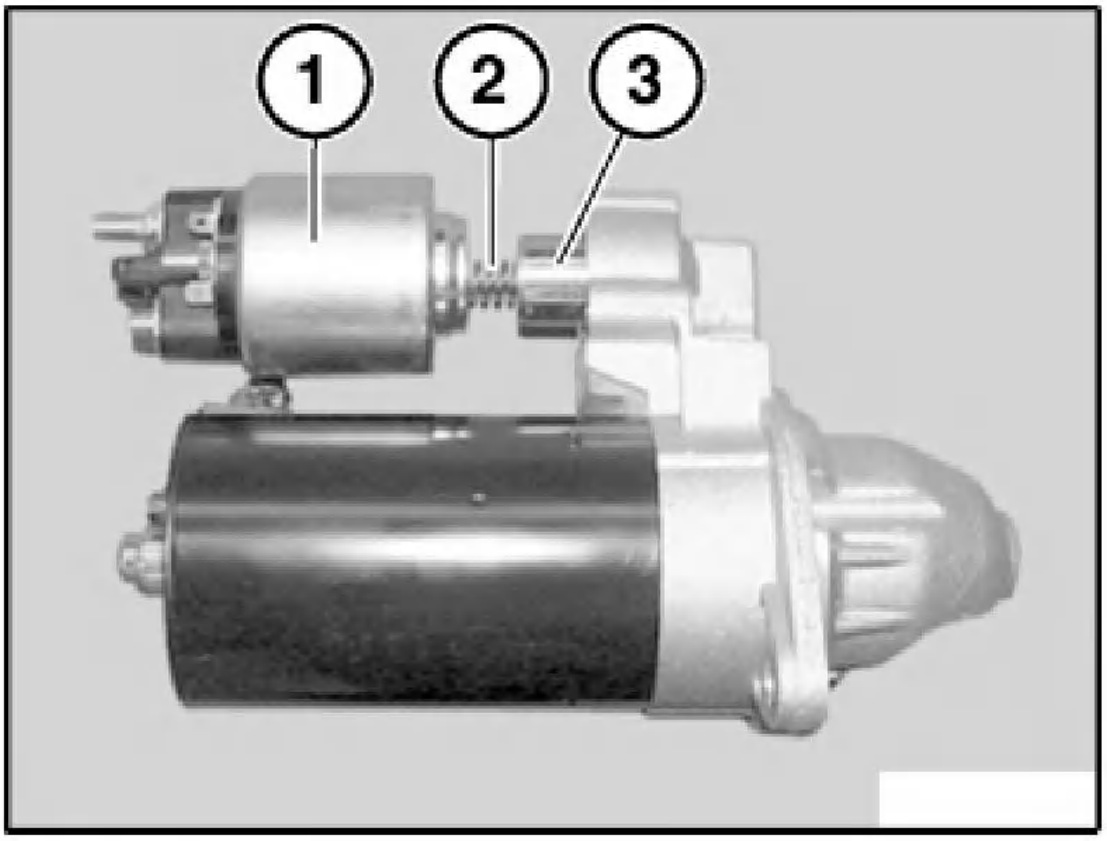



Fig. 97: Removing Solenoid Switch And Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Unhook pin (3).

Installation:

Check pin (3) for wear and apply grease.

## STARTER LEAD

### 12 42 510 REPLACING BATTERY POSITIVE LEAD Z3 M54 (BETWEEN STARTER MOTOR AND B+ SUPPORT POINT)

Read fault memory. Switch off ignition.

Observe safety instructions for handling vehicle battery. Refer to 61 00 ... SAFETY INSTRUCTIONS FOR HANDLING VEHICLE BATTERY .

Remove front underbody protection.

Observe instructions for disconnecting and connecting battery. Refer to 12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY .

Disconnect battery negative lead from battery and lay to one side.

Unclip battery positive lead by undoing clips.

Feed battery positive lead (1) out of cable duct.

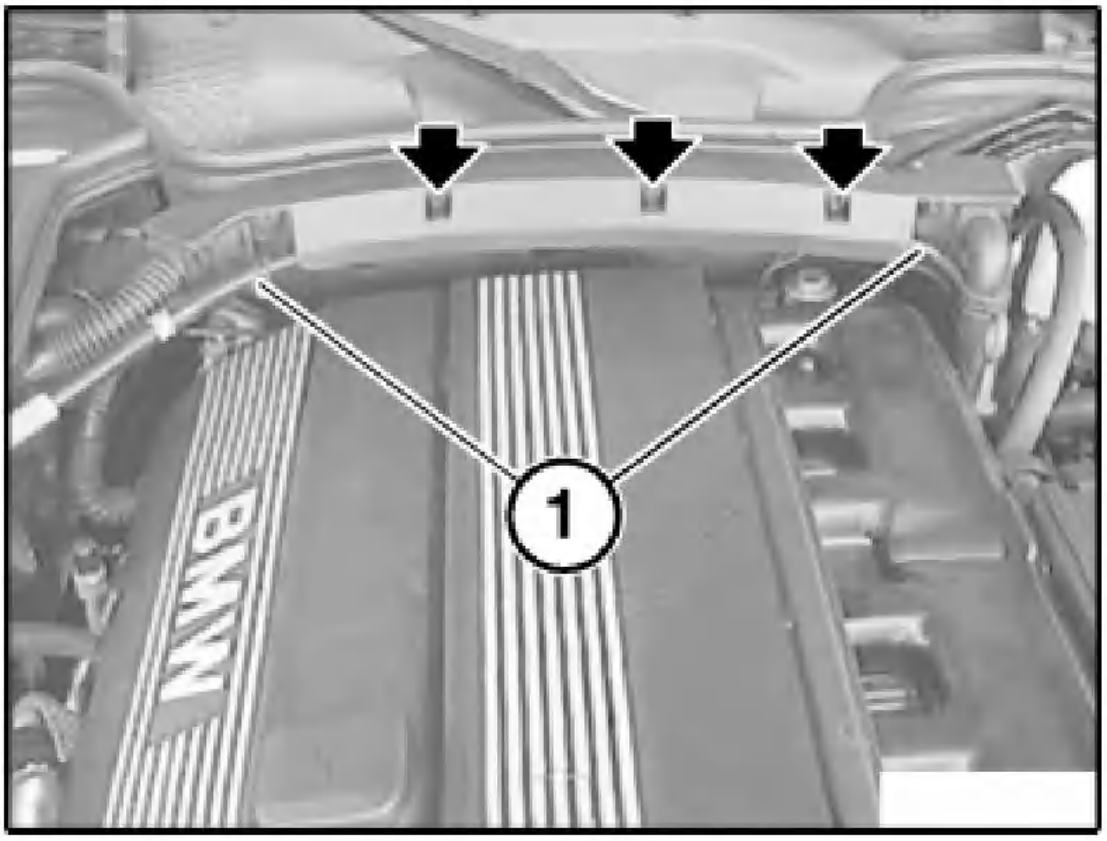



Fig. 98: Feeding Battery Positive Lead Out Of Cable Duct
Courtesy of BMW OF NORTH AMERICA, INC.

Fold cover cap (1) down.

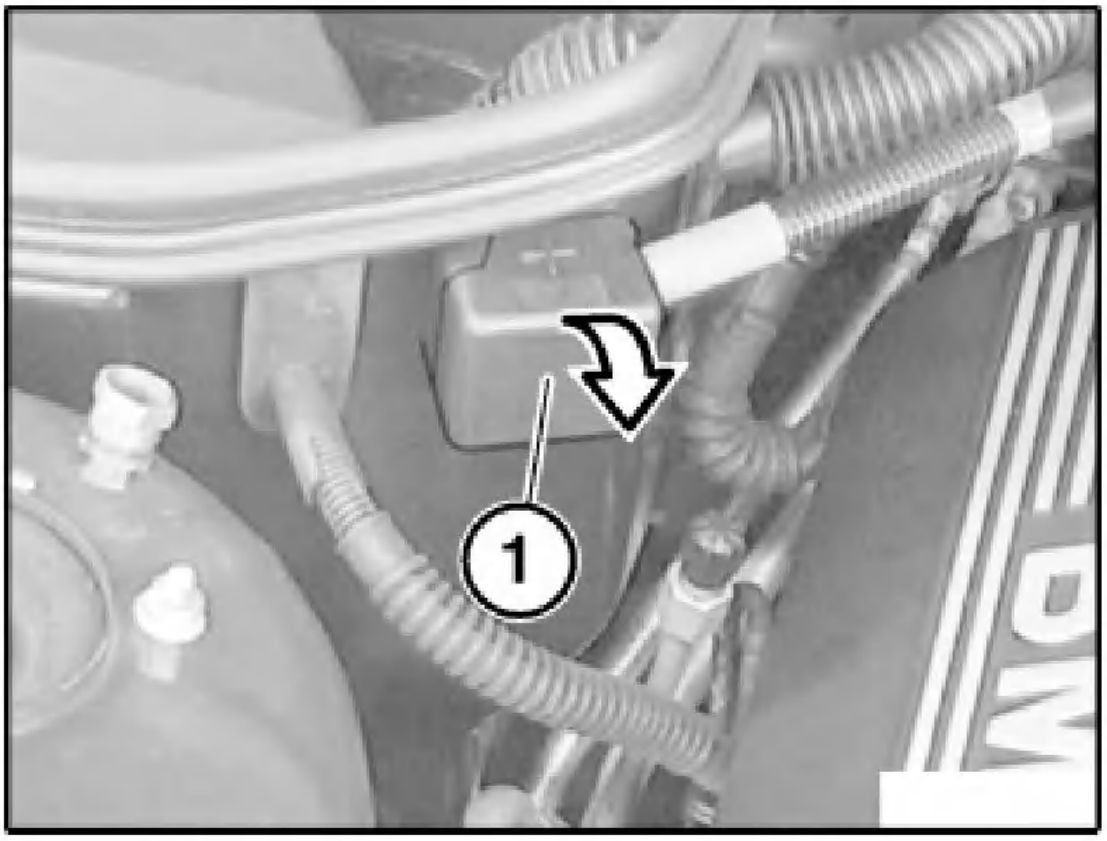



Fig. 99: Folding Cover Cap Down
Courtesy of BMW OF NORTH AMERICA, INC.

Release nut (2).

Installation:

Tightening torque, 12 51 4AZ. Refer to 12 51 ENGINE WIRING HARNESS .

Disconnect battery positive lead (3) from connection point.

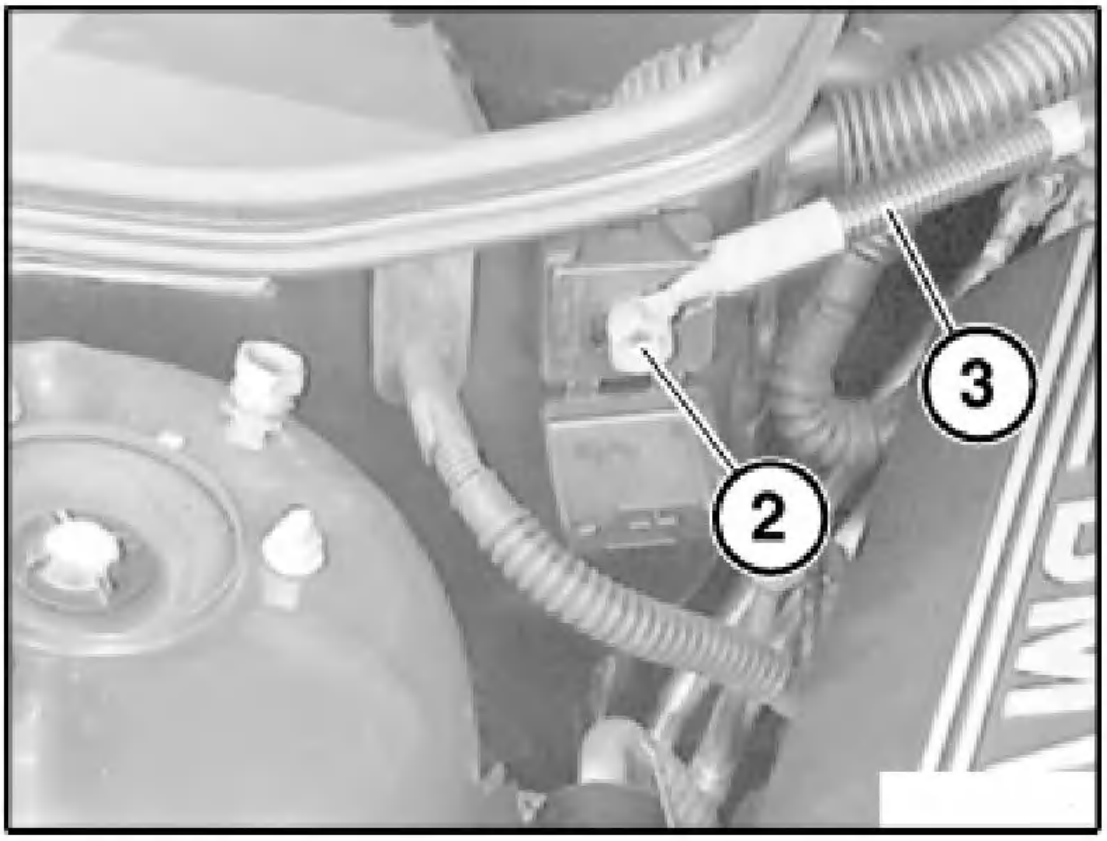



Fig. 100: Disconnecting Battery Positive Lead From Connection Point
Courtesy of BMW OF NORTH AMERICA, INC.

Release nut (1).

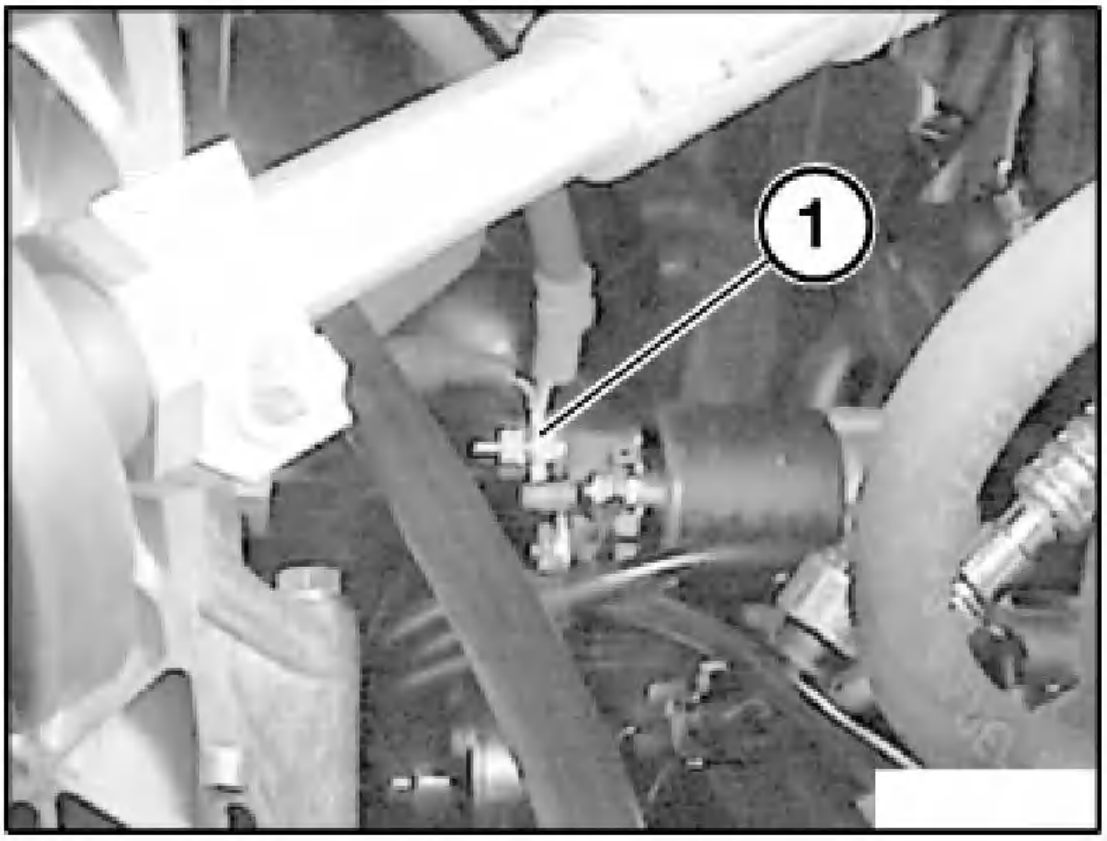



Fig. 101: Disconnecting Battery Positive Lead From Starter Motor
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Tightening torque, 12 41 4AZ. Refer to 12 41 STARTER AND MOUNTING PARTS .

Disconnect battery positive lead from starter motor.

NOTE: Interrogate fault memory of DME control unit.

Check stored fault messages.

Rectify faults.

Then clear fault memory.

## 12 42 540 REPLACING SAFETY BATTERY TERMINAL (SBK)

CAUTION: Observe safety regulations. Refer to AIR BAG SAFETY PRECAUTIONS for 2001 models, and AIR BAG SAFETY PRECAUTIONS for 2002 models. Investigate cause of triggering of safety battery terminal. To do so, read out fault memory of airbag control unit. Note fault messages stored in memory. Rectify faults. Then clear fault memory.

Use of safety battery terminal:

- From 4/99 in E36/Z3.
- In each of following new Series.

The different models have different installation locations:

Battery In Engine Compartment:

Safety battery terminal is replaced with cable up to battery positive support point.

Battery In Luggage Compartment Behind Side Trim Panel:

Remove side trim panel.

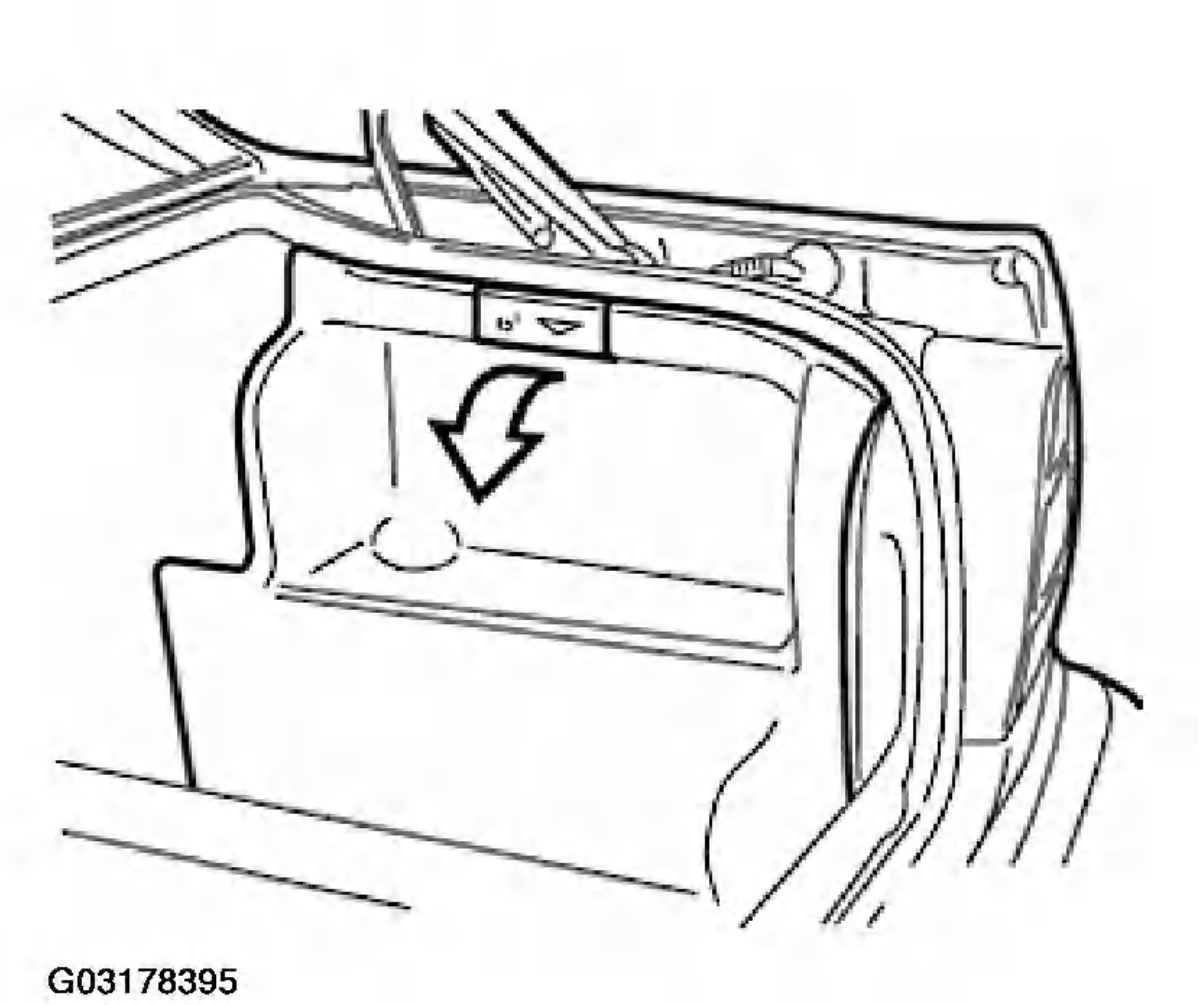



Fig. 102: Removing Side Trim Panel
Courtesy of BMW OF NORTH AMERICA, INC.

Follow instructions for disconnecting and connecting battery. Refer to 12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY .

Disconnect and cover battery negative lead.

Release front side trim panel partly and fold forward.

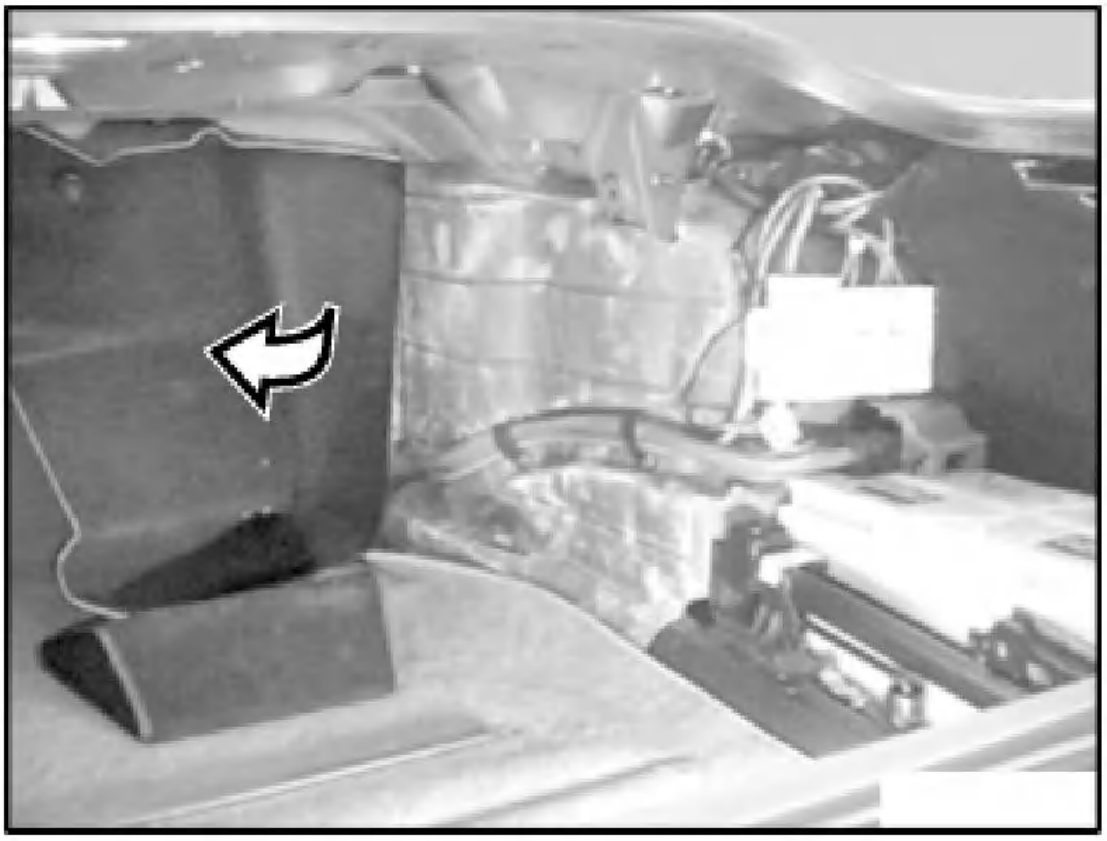



Fig. 103: Releasing Front Side Trim Panel
Courtesy of BMW OF NORTH AMERICA, INC.

Battery In Luggage Compartment Under Floor Trim Panel:

Follow instructions for disconnecting and connecting battery. Refer to 12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY .

Fold back floor trim panel (1).

Lift cover (2) on battery negative lead.

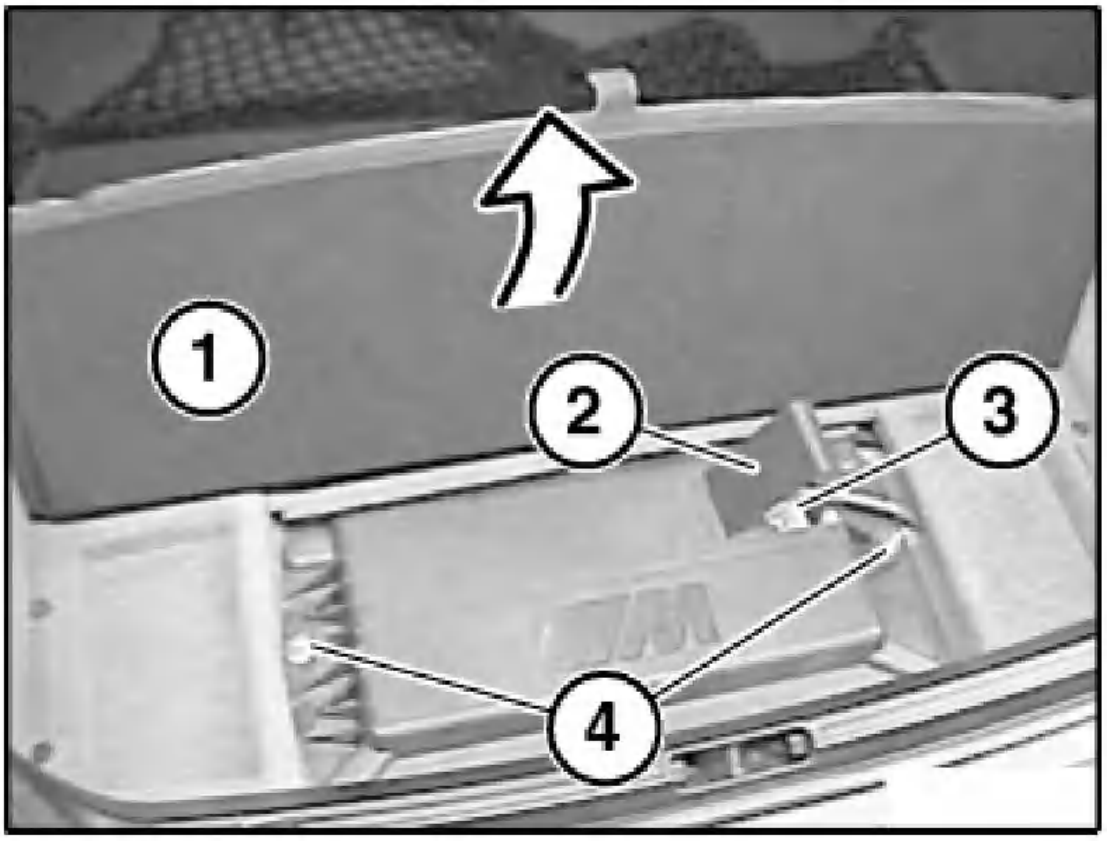



Fig. 104: Lifting Battery Negative Lead Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect and cover battery negative lead (3).

Release nuts (4).

Remove battery cover.

Battery In Luggage Compartment Under Spare Wheel:

Remove spare wheel.

Release screws.

CAUTION: Do not kink air pipes.

Set air supply system (1) to one side.

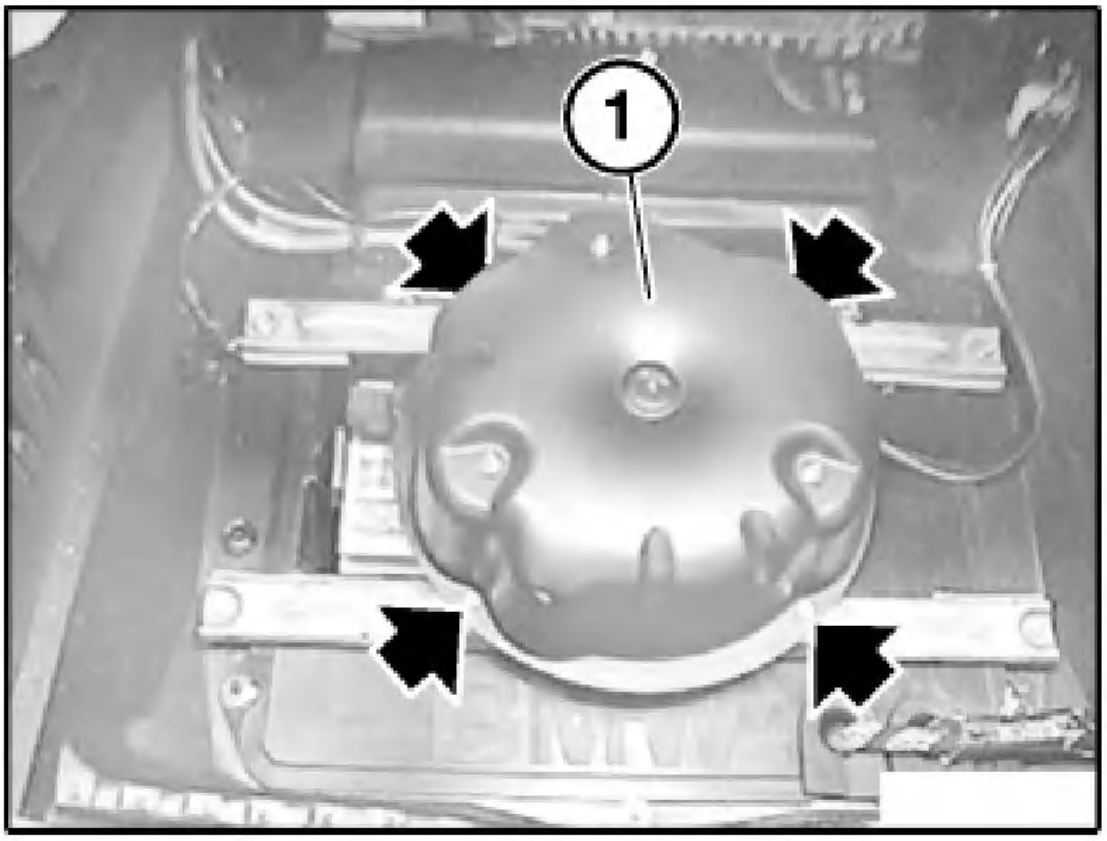



Fig. 105: View Of Air Supply System
Courtesy of BMW OF NORTH AMERICA, INC.

Follow instructions for disconnecting and connecting battery. Refer to 12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY .

Disconnect battery negative lead.

Disconnect supply cable (1) for vehicle electrical system.

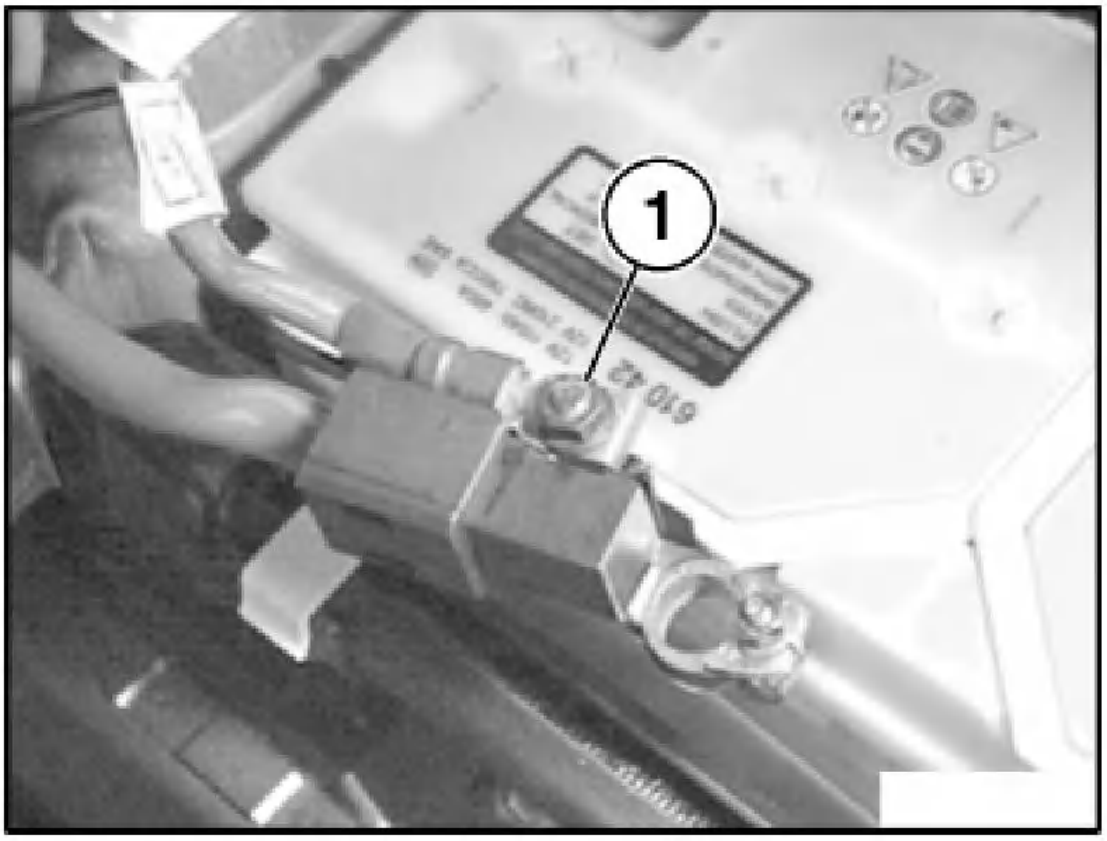



Fig. 106: Removing Supply Cable For Vehicle Electrical System
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Remove faulty fuses and carry out troubleshooting.

CAUTION: Pay attention to interface. The repair cable is always a standard length. The heavy-current connector of the repair cable has a larger diameter than the battery positive lead. In some Series (e.g. E46 touring), the heavy-current connector of the repair cable can lead to installation problems. This is the case when the interface is in the area of the close-fitting trim panels. Find matching interface (e.g. approx. 10 cm behind rear seat backrest in E46 touring

Lay repair cable parallel to battery positive lead.

Mark interface of battery positive lead at end of repair cable.

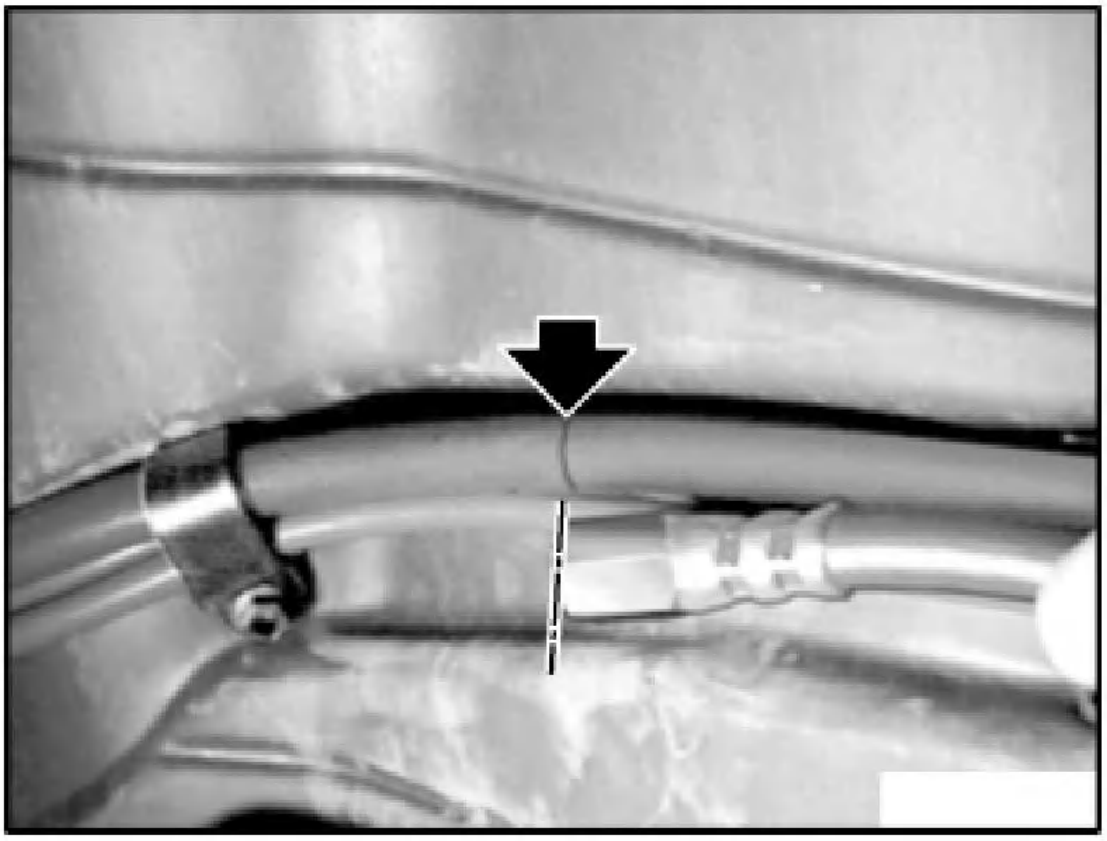



Fig. 107: Marking Interface of Repair Cable To Battery Positive Lead
Courtesy of BMW OF NORTH AMERICA, INC.

Release cable ties (1).

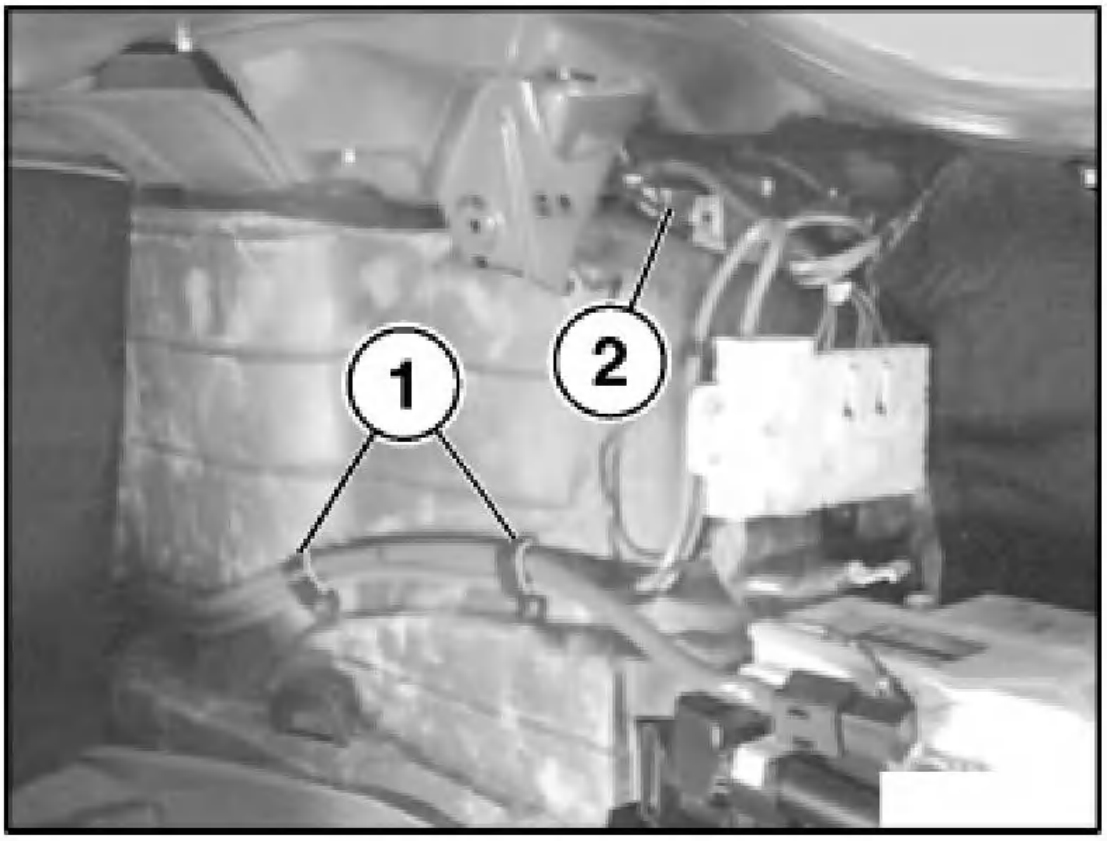



Fig. 108: Releasing Cable Ties
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection (2).

CAUTION: Do not use bolt cutters or similar tools to cut through the cable. A cable end that has been squashed flat will no longer fit into the clamping sleeve.

Saw through battery positive cable at marked point with an iron saw.

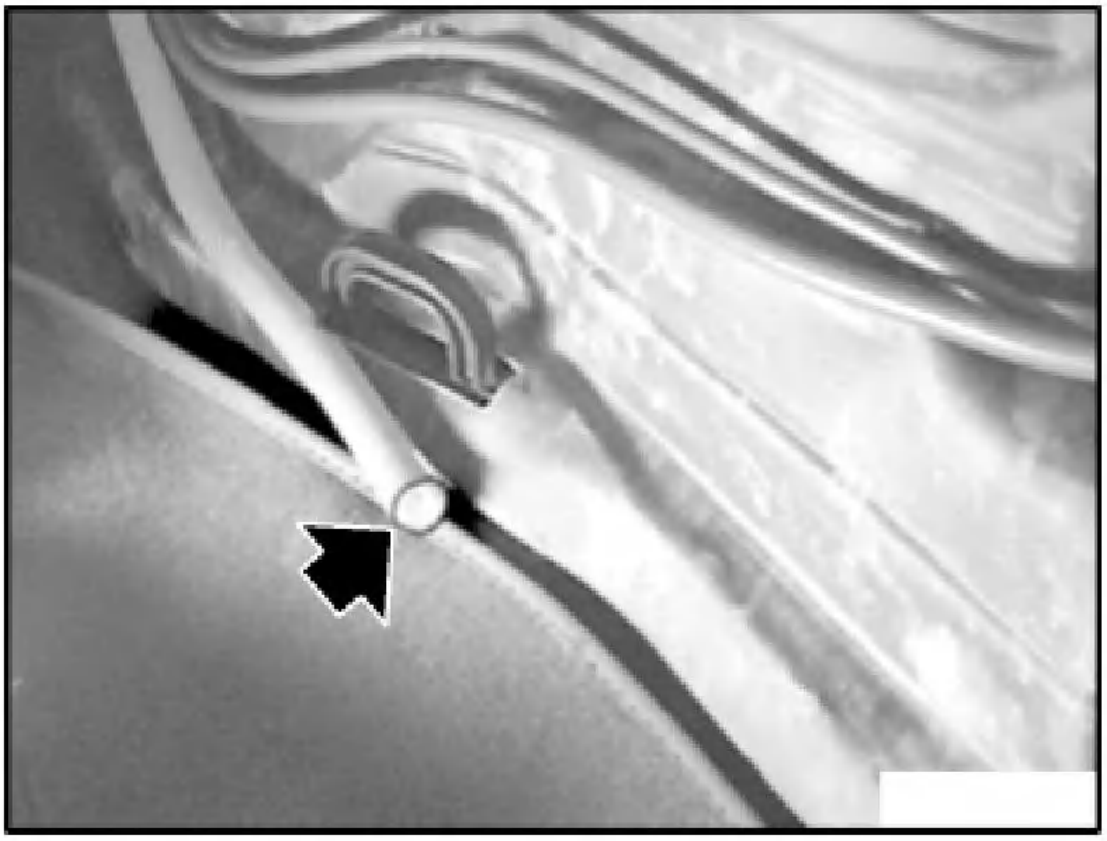



Fig. 109: Identifying Positive Battery Cable Cut At Marked Point
Courtesy of BMW OF NORTH AMERICA, INC.

Strip insulation - length (A) - from cable end.

Distance (A) = 15 mm.

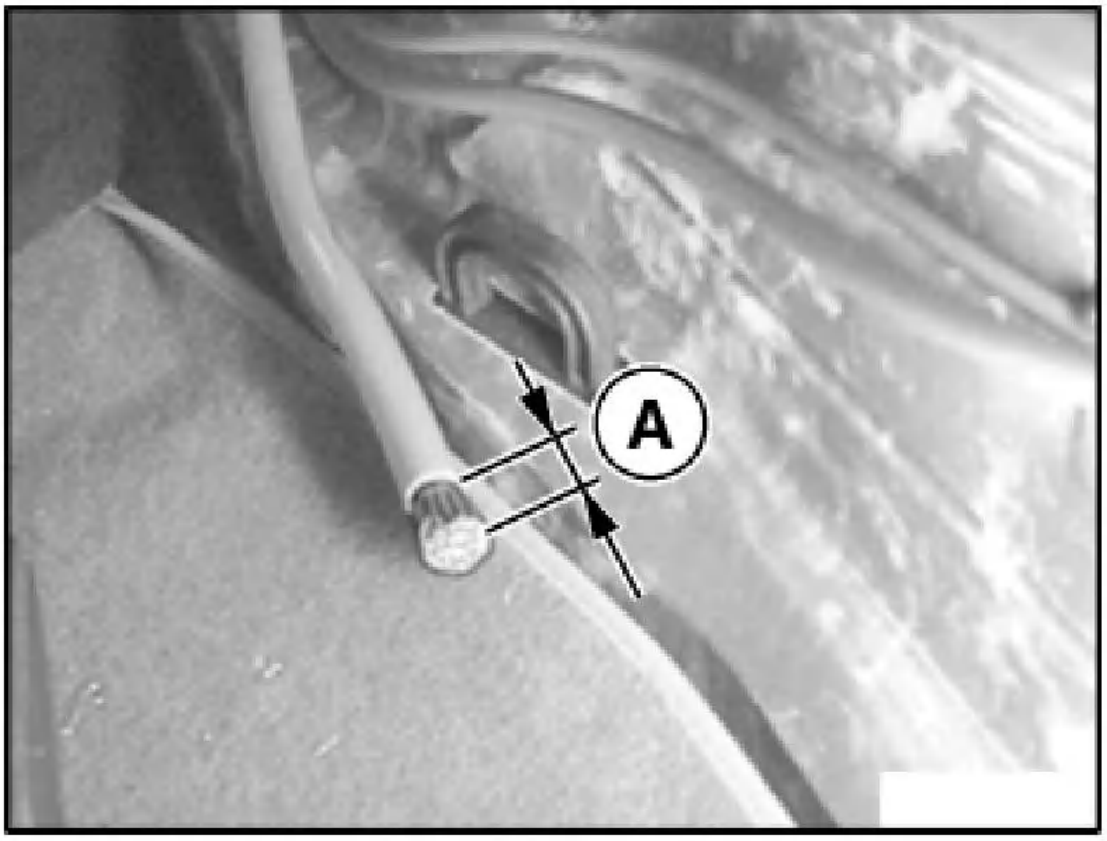



Fig. 110: Identifying Strip Insulation Length From Cable End
Courtesy of BMW OF NORTH AMERICA, INC.

Push heavy-current connector (1) over stripped cable end and screw into position.

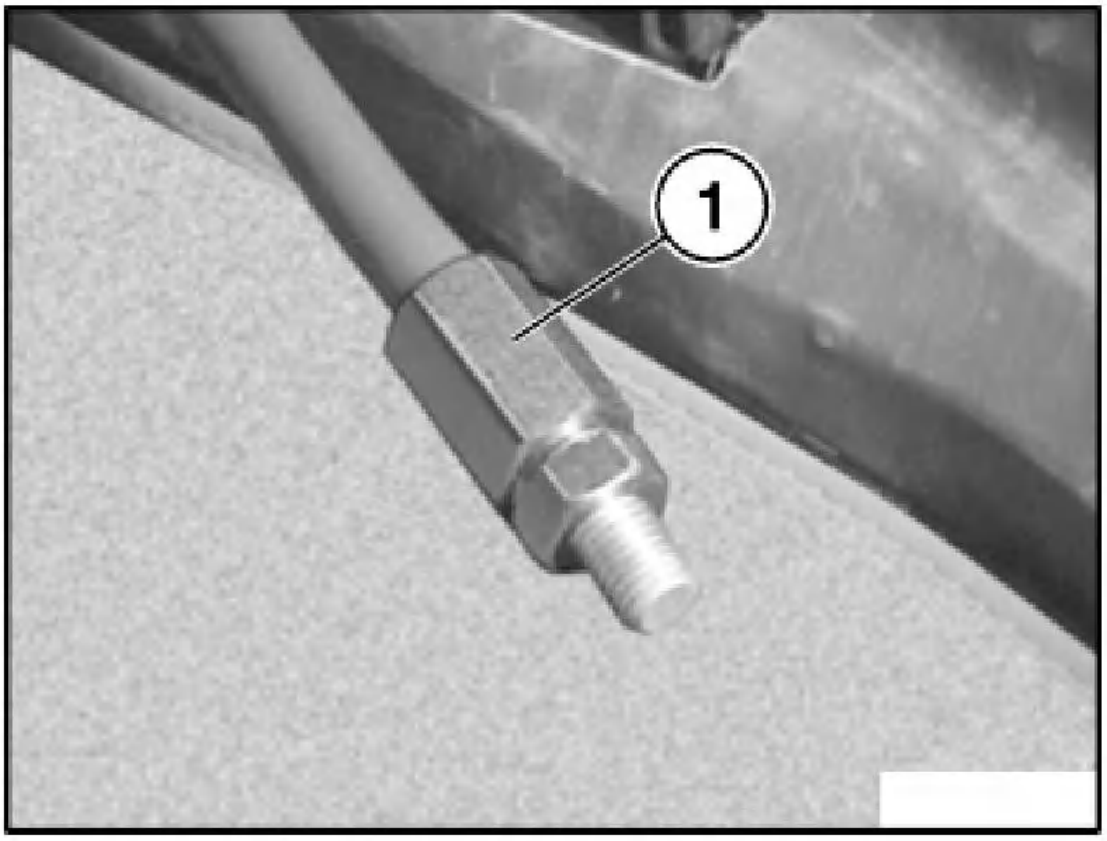



Fig. 111: Pushing Heavy-Current Connector (1) Over Stripped Cable
Courtesy of BMW OF NORTH AMERICA, INC.

Push shrink-fit hose (3) over repair cable.

Screw threaded sleeve (1) of repair cable (2) to heavy-current connector.

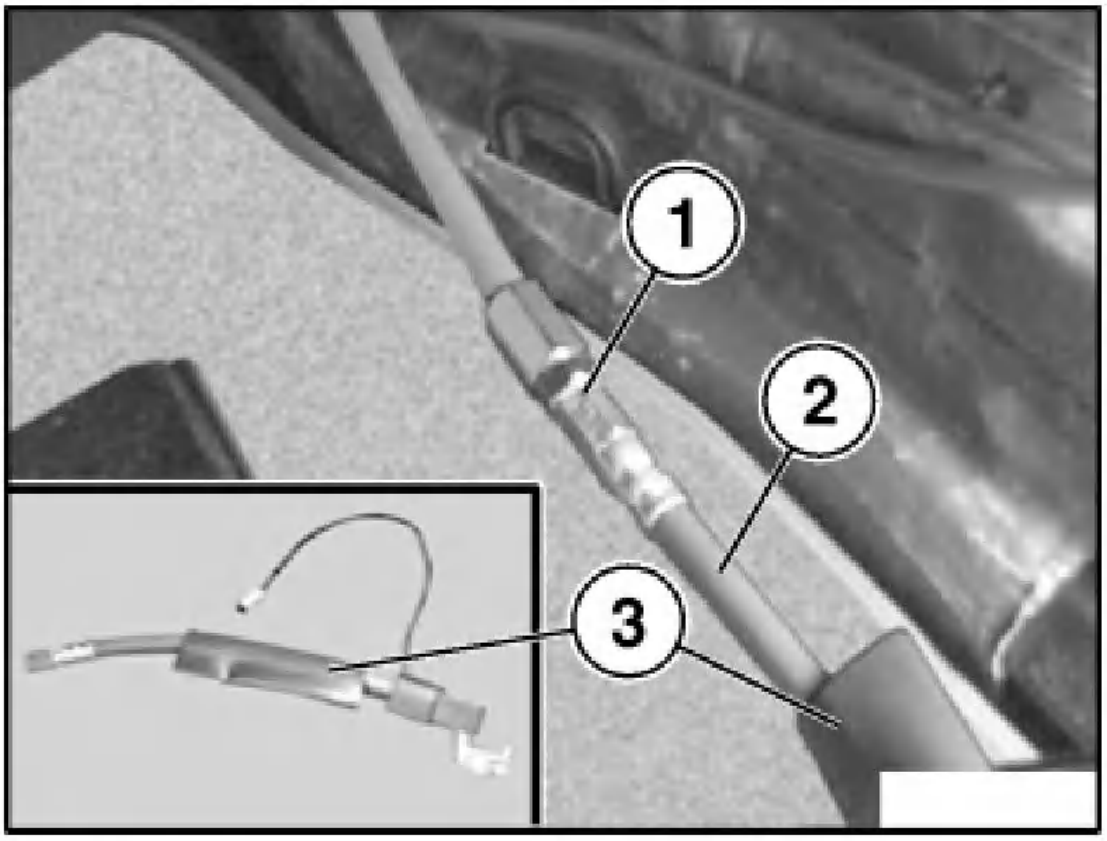



Fig. 112: Installing Threaded Sleeve Into Heavy-Current Connector
Courtesy of BMW OF NORTH AMERICA, INC.

Push shrink-fit hose (1) over connecting point and shrink on with a hot-air blower (2).

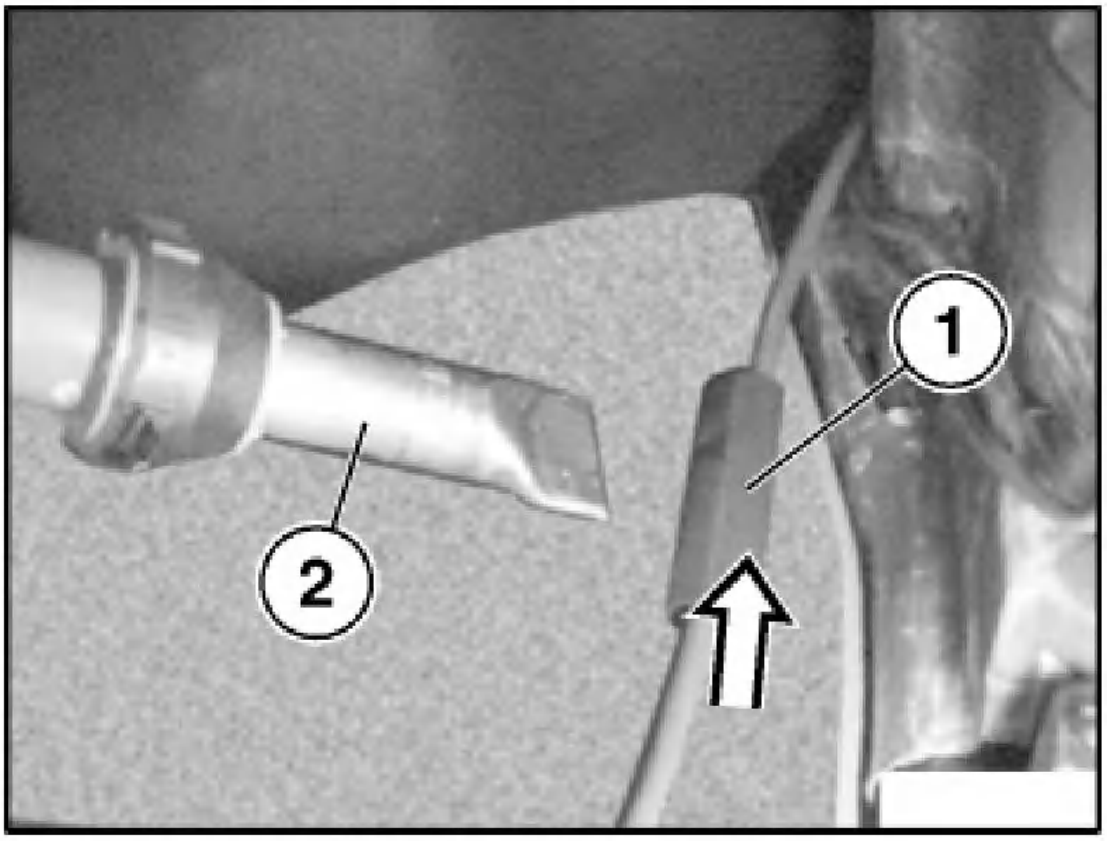



Fig. 113: Installing Shrink-Fit Hose Over Connecting Point
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Heat up shrink-fit hose until it has settled completely around the connection point.

When laying the repaired battery positive cable, observe the following:

- The shrink-fit hose must not be scuffed during any movement.
- The repair cable must not cause any disturbing noises during driving operation.

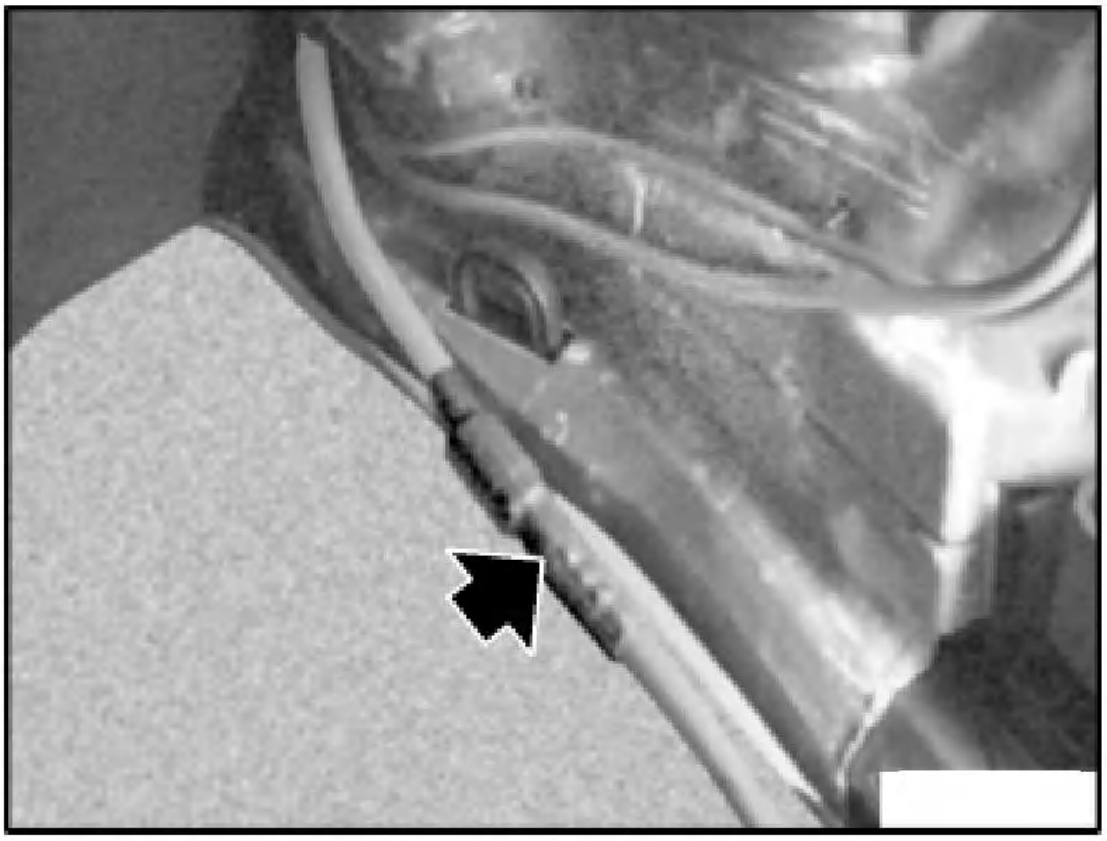



Fig. 114: Identifying Shrink-Fit Hose
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Offsetting cutting line by approx. 10 cm produces excess length of battery positive lead (1). Lay battery positive lead (1) without kinks or abrasions. (Shown on E46 touring.)

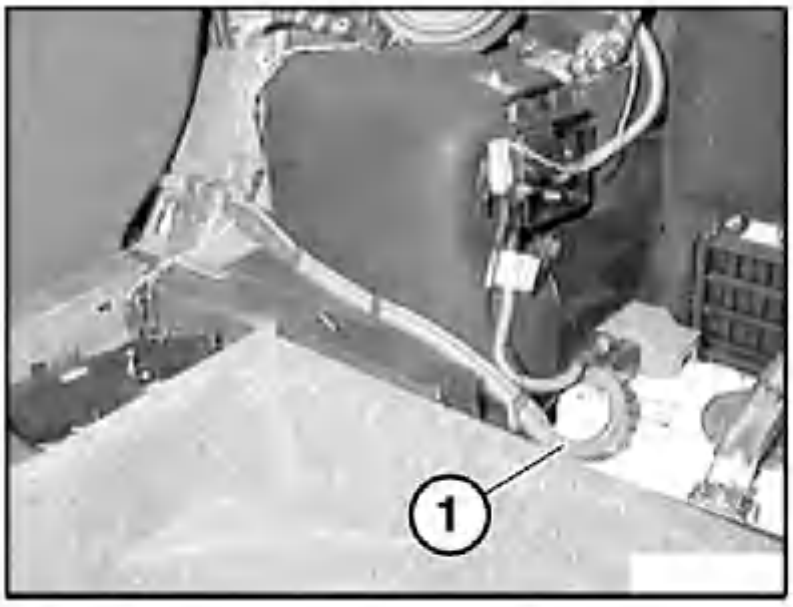



Fig. 115: Laying Battery Positive Lead Without Kinks Or Abrasions
Courtesy of BMW OF NORTH AMERICA, INC.

## ENGINE WIRING LOOM

### 12 51 100 REPLACING WIRING HARNESS SECTION FOR IGNITION COILS (M54)

Interrogate fault memory of DME control unit.

Switch off ignition.

Follow instructions for disconnecting and connecting battery. Refer to 12 00 ... INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY .

Disconnect battery negative lead from battery.

Z3, E39, E46, E53:

Remove cover for ignition coils.

Detach plug of wiring harness for ignition coils from DME control unit. Refer to 12 14 550 REPLACING CONTROL UNIT (M54 / S54) . Disconnect plug connection of wiring harness for ignition coils in electronics box.

NOTE: Do not remove DME control unit.

Detach grounding strap (2) of cable duct from connecting plate of ignition coils between cylinders 2 and 3.

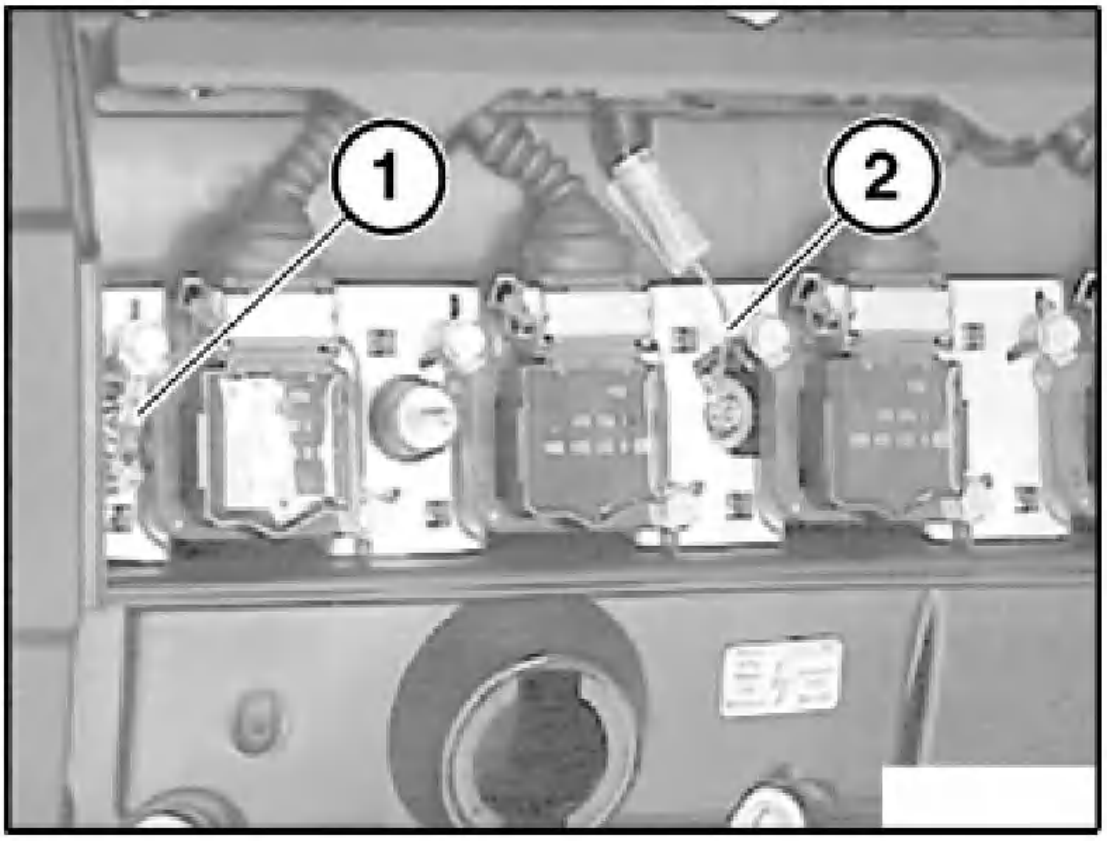



Fig. 116: Detaching Grounding Strap From Connecting Plate
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock plug (1) and detach from ignition coils.

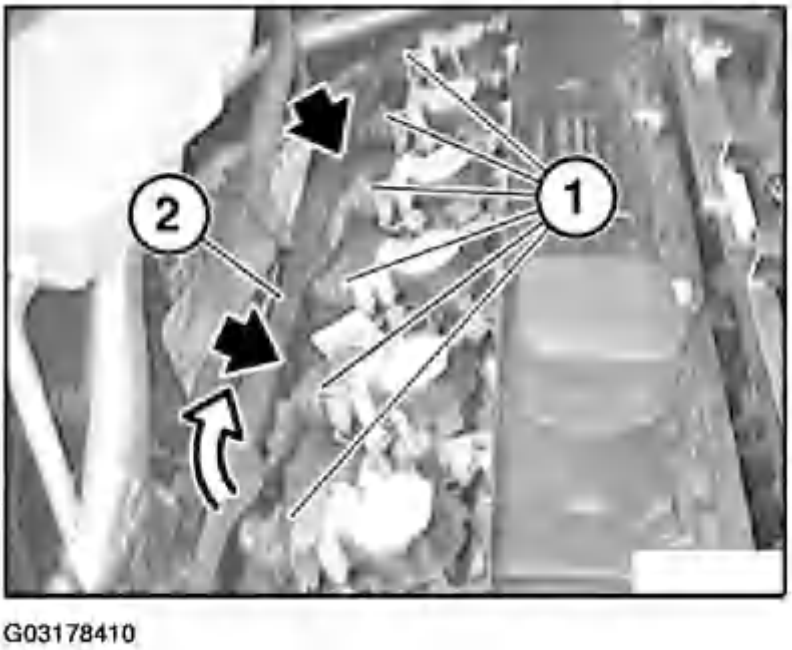


Fig. 117: Detaching Ignition Coils Plugs
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock cable strip (2) and remove towards top.

E46 and Z3 only:

NOTE: Shown on the E46. The same procedure applies to the Z3.

Pull off sealing strip (1).

Remove cable (3) together with profile seal (2) from partition wall towards top.

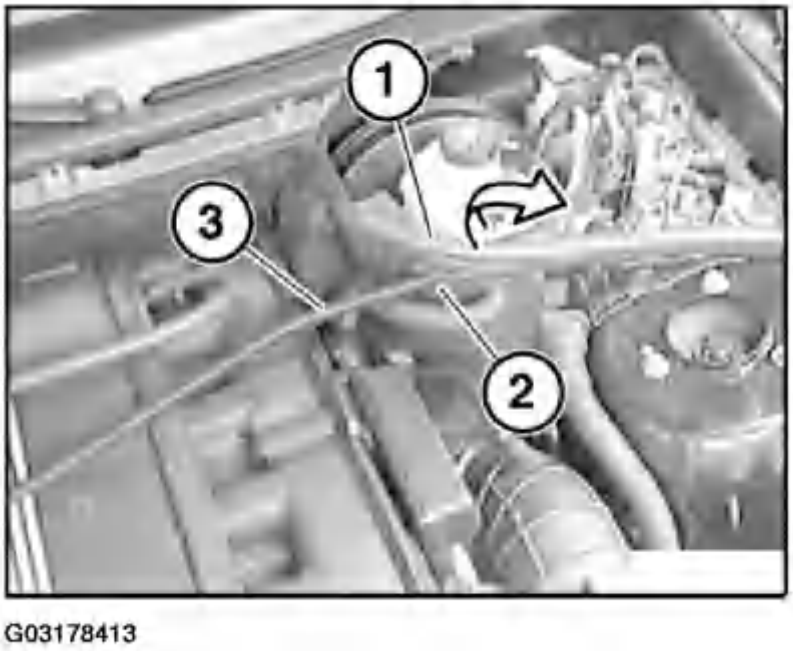



Fig. 118: Removing Cable With Profile Seal From Partition Wall
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

To prevent leaks, you must install profile seal (2) correctly.

Z3, E46, E53 and E39:

NOTE: Interrogate fault memory of DME control unit.

Check stored fault messages.

Rectify faults.

Then clear fault memory.

## OIL PRESSURE-OIL TEMPERATURE

### 12 61 250 REMOVING AND INSTALLING/REPLACING OIL TEMPERATURE SWITCH (M52TU, M54, M56)

Switch off ignition.

Remove suction filter housing. Refer to 13 71 000 REMOVING AND INSTALLING INTAKE FILTER HOUSING (M54) .

Unfasten oil filter cover to enable engine oil in filter to flow back into the oil sump.

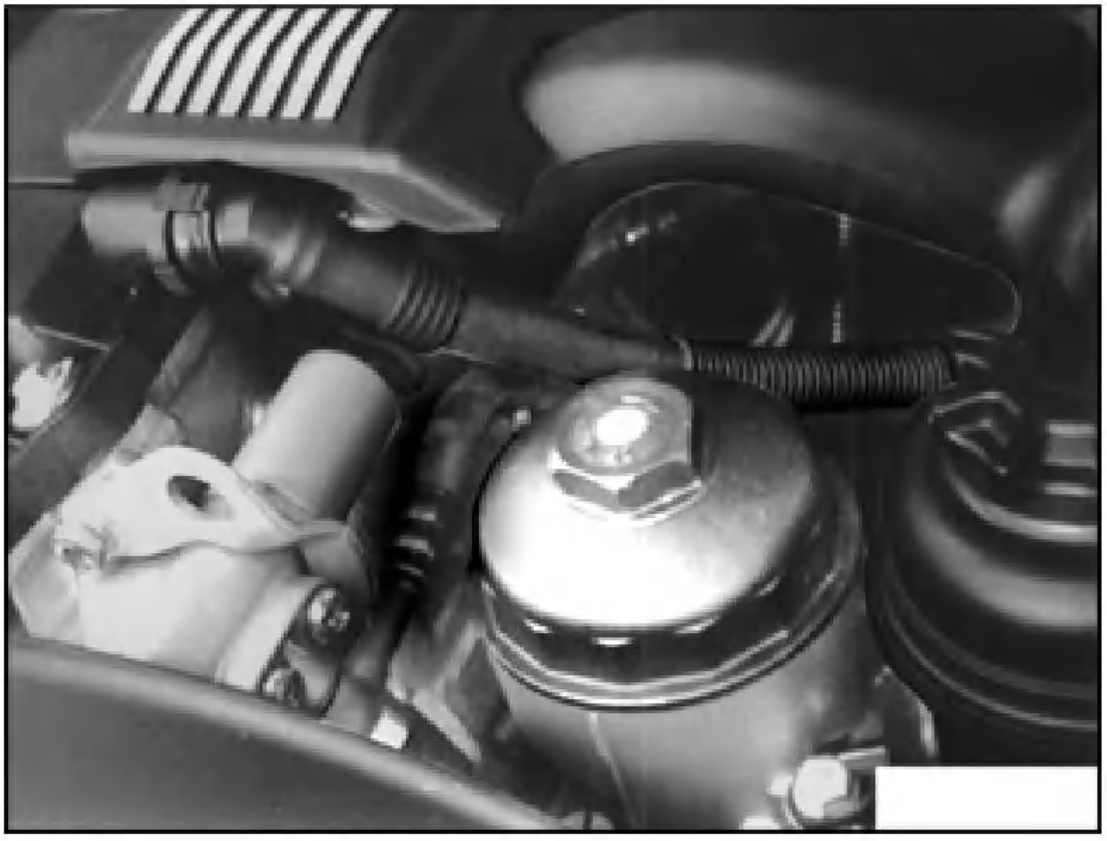



Fig. 119: Removing Oil Filter Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Refer to 00 00 250 BMW ENGINE OIL SERVICE INCL. SUPPLEMENTARY SERVICE (M54 / M56) .

Location: On base of oil-filter.

NOTE: Figure shows power steering pump supply tank removed.

Disconnect plug connection (1).

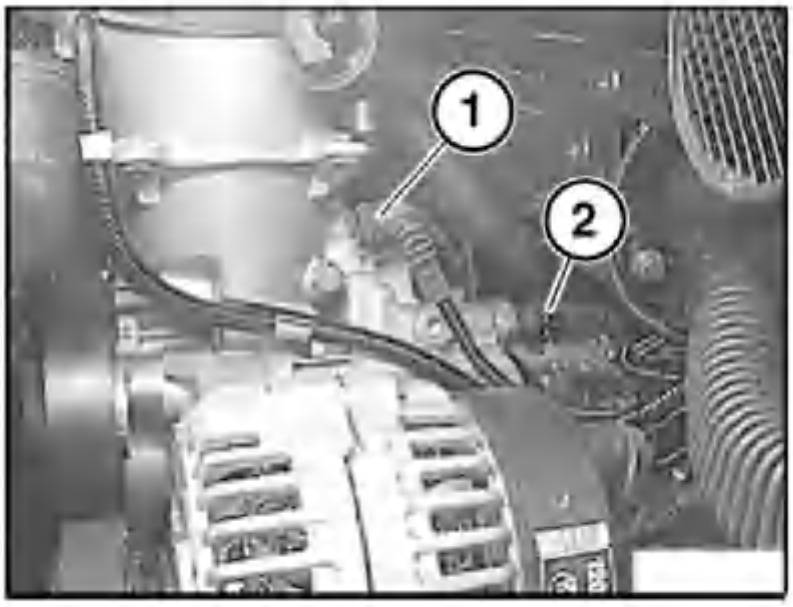



Fig. 120: Releasing Oil Temperature Switch Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

CAUTION: A few drops of oil escape when the oil temperature switch is released. Catch residual oil with cleaning cloth and dispose of oil.

Release oil temperature switch.

Installation:

Tightening torque, 12 61 1AZ. Refer to 12 61 OIL PRESSURE, OIL TEMPERATURE, OIL LEVEL .

12 61 280 REMOVING AND INSTALLING/REPLACING OIL PRESSURE SWITCH (M52TU, M54, M56)

Switch off ignition.

Remove suction filter housing. Refer to 13 71 000 REMOVING AND INSTALLING INTAKE FILTER HOUSING (M54) .

Unfasten oil filter cover to enable engine oil in filter to flow back into the oil sump.

Refer to 00 00 250 BMW ENGINE OIL SERVICE INCL. SUPPLEMENTARY SERVICE (M54 / M56) .

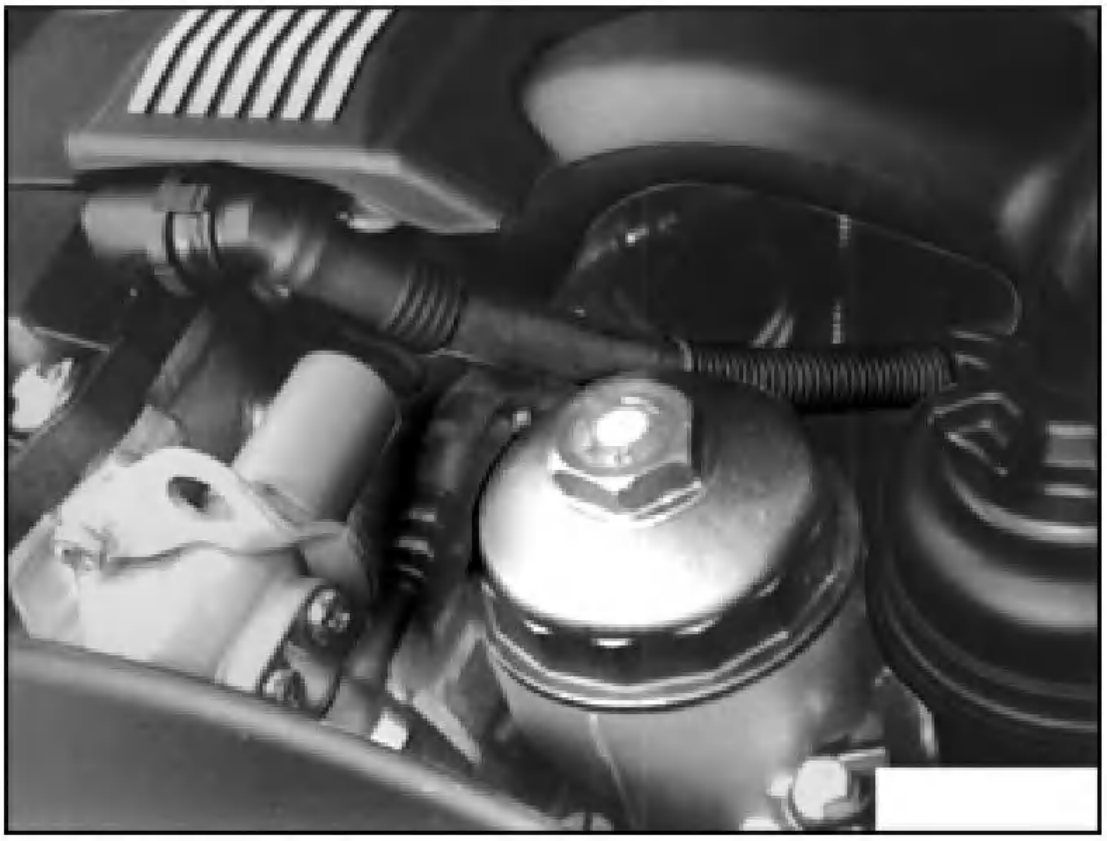



Fig. 121: Removing Oil Filter Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Location: On base of oil-filter.

NOTE: Figure shows power steering pump supply tank removed.

Disconnect plug connection (2).

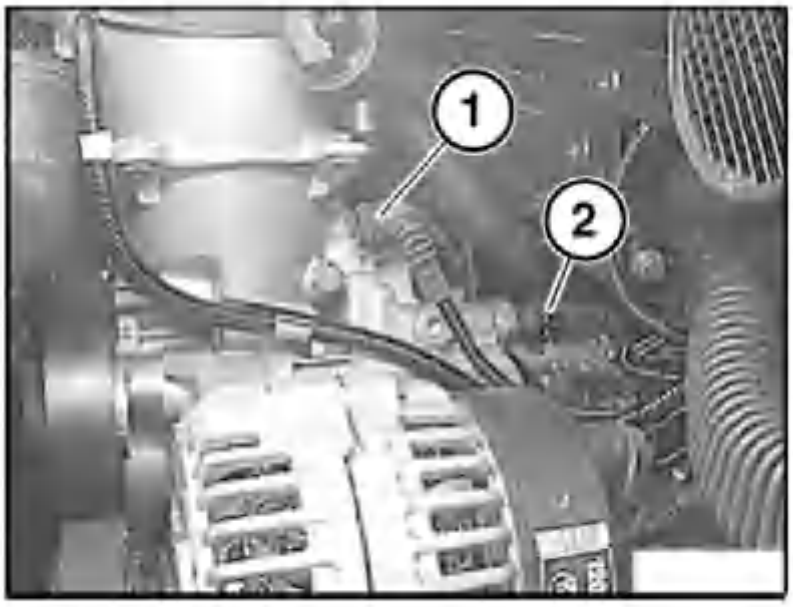



Fig. 122: Disconnecting Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

CAUTION: A few drops of oil escape when the oil pressure switch is released. Catch residual oil with cleaning cloth and dispose of oil.

Release oil pressure switch.

Installation:

Tightening torque, 12 61 1AZ. Refer to 12 61 OIL PRESSURE, OIL TEMPERATURE, OIL LEVEL .

12 61 285 REPLACING LEVEL SWITCH FOR ENGINE OIL (M62, M54, S54, M56)

Necessary Preliminary Tasks:

- Switch off ignition.
- Unfasten cover on full-flow oil filter to enable engine oil in filter to flow back into the oil sump.
- Drain engine oil.

Refer to 00 00 250 BMW ENGINE OIL SERVICE INCL. SUPPLEMENTARY SERVICE (M54 / M56) .

Remove reinforcement plate.

Disconnect plug connection (1).

Unscrew nuts (2).

Remove level switch (3).

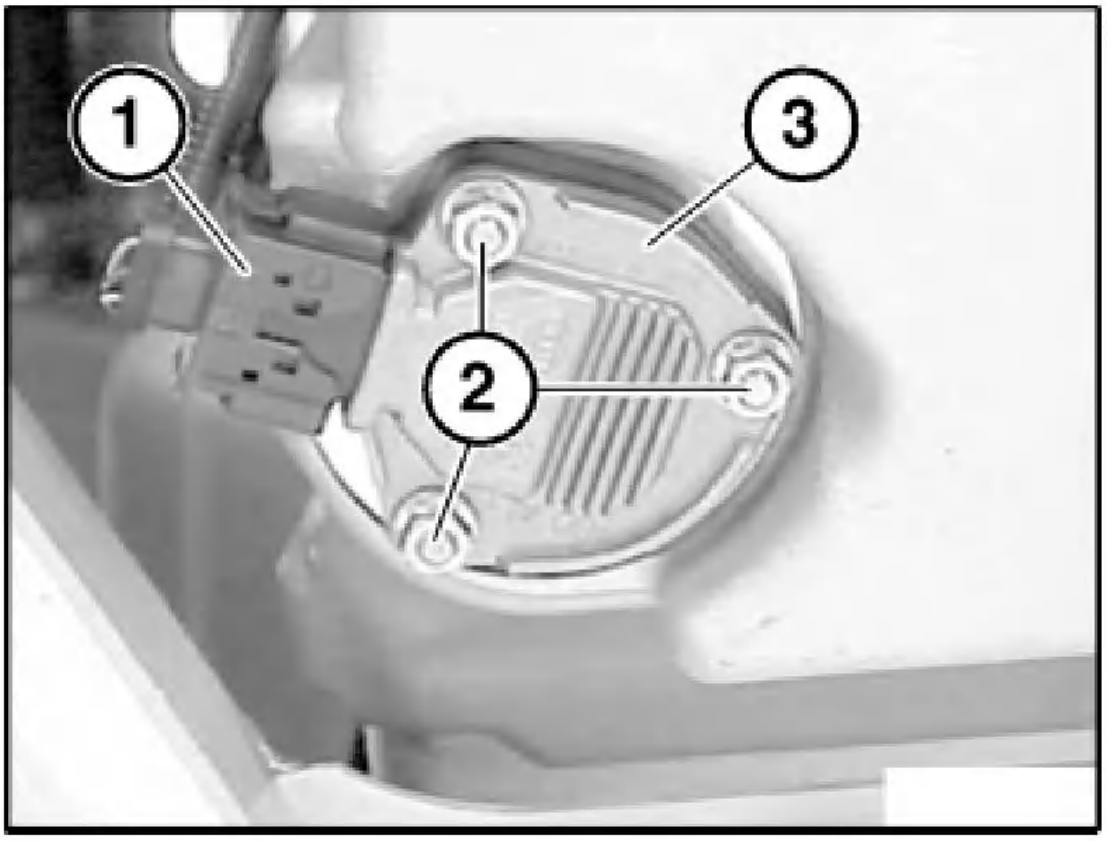



Fig. 123: Removing Level Switch
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean sealing surface on oil sump and replace seal of level switch.

Installation:

Screw on oil-filter cover tightly.

Tightening torque 11 42 2AZ. Refer to OIL FILTER AND LINES .

Top up engine oil. Refer to 00 00 250 BMW ENGINE OIL SERVICE INCL. SUPPLEMENTARY SERVICE (M54 / M56) .

## 12 61 285 REPLACING LEVEL SWITCH FOR ENGINE OIL (Z3 M54)

Turn off ignition.

Release oil filter cap so that engine oil from oil filter can flow back into oil pan.

Release screws.

Remove cruciform reinforcement (1).

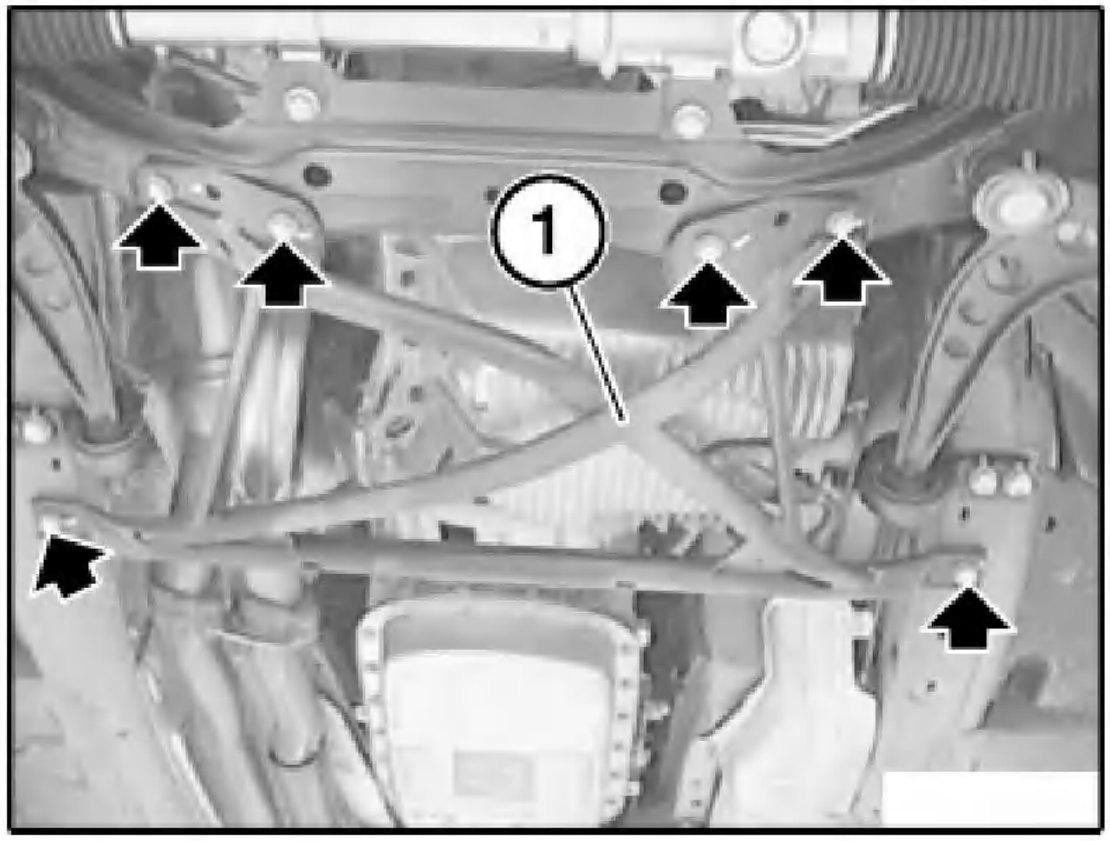



Fig. 124: Removing Cruciform Reinforcement
Courtesy of BMW OF NORTH AMERICA, INC.

Remove underbody paneling.

Drain engine oil.

Disconnect plug connection (1).

Release nuts (2).

Remove level switch (3).

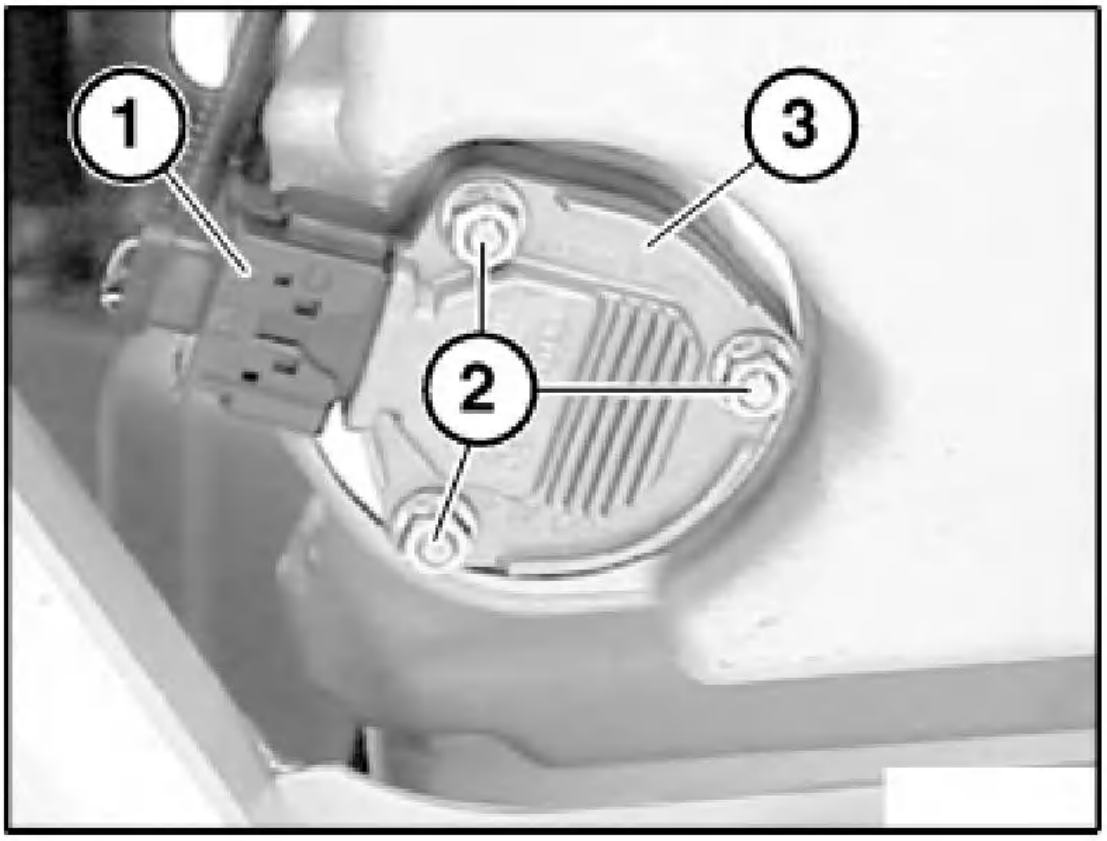



Fig. 125: Removing Level Switch
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean sealing surface on oil sump and replace level switch seal.

Installation:

Fill system with engine oil.

Resecure oil filter cap.

Tightening torque, 11 42 2AZ. Refer to OIL FILTER AND LINES .

## SWITCH AND RELAYS

### 12 63 520 REPLACING MAIN RELAY (M54 / S54)

Switch off ignition.

Connect DIS Tester.

Release screw connection of electronics box (1).

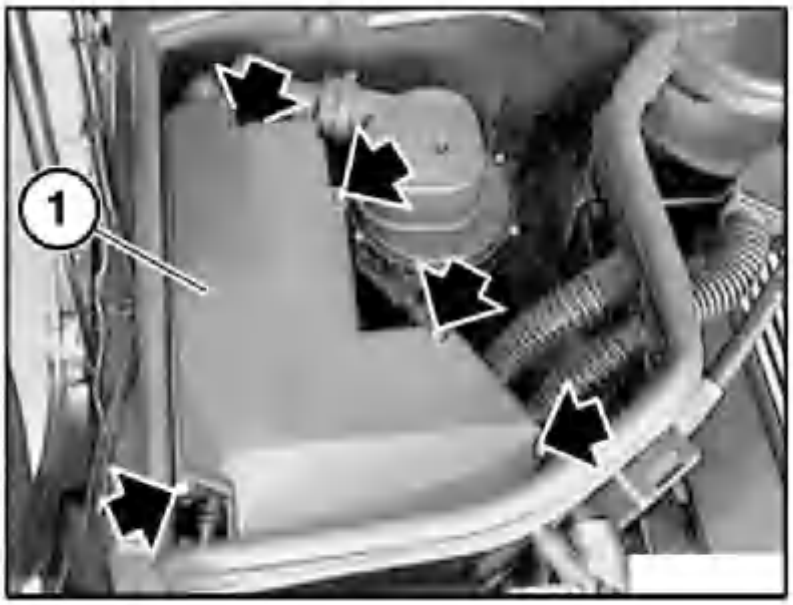



Fig. 126: Removing Electronics Box Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Remove electronics box (1).

Arrangement:

1. Main relay of Digital Motor Electronics.
2. Engine fuses of Digital Motor Electronics.

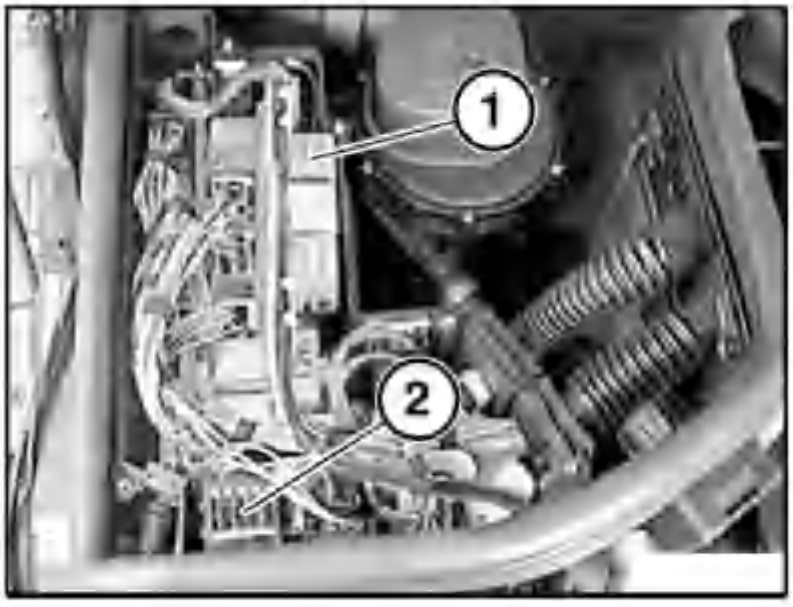



Fig. 127: Identifying Engine Fuses Of Digital Motor Electronics
Courtesy of BMW OF NORTH AMERICA, INC.

Notes On Troubleshooting:

If the starter motor cranks the engine during the starting sequence but the engine fails to fire, then:

1. Check engine fuses.
2. If fuses are blown, replace them completely with fuse holder.
3. Find out why fuses have blown.

Continue troubleshooting as per DIS instructions.

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Article GUID: A00202355

# INJECTION NOZZLE AND IJECTION LINES

## 13 53 INJECTORS AND LINES, FUEL PRESSURE REGULATOR M54 B30

INJECTORS AND LINES, FUEL PRESSURE REGULATOR M54 B30 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Test pressure/nominal value | bar +/- 0.2 | 3.5 |

# THROTTLE AND OPERATION

## 13 54 INJECTOR VALVES, START VALVES M54 B 30

INJECTOR VALVES, START VALVES M54 B 30 TECHNICAL SPECIFICATION

| | | |
|---|---|---|
| Testing pressure | bar +/- 0.2 | 3.5 |

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Article GUID: A00202373

# BASIC MEASURING TECHNIQUES

## BASIC ENGINE MEASUREMENTS

During the course of engine repairs some basic engine measurements are required to verify engine diagnosis as well as to complete proper repairs. These measurements are made by precision measuring tools such as micrometers, Vernier calipers, cylinder bore gauges and dial indicators.

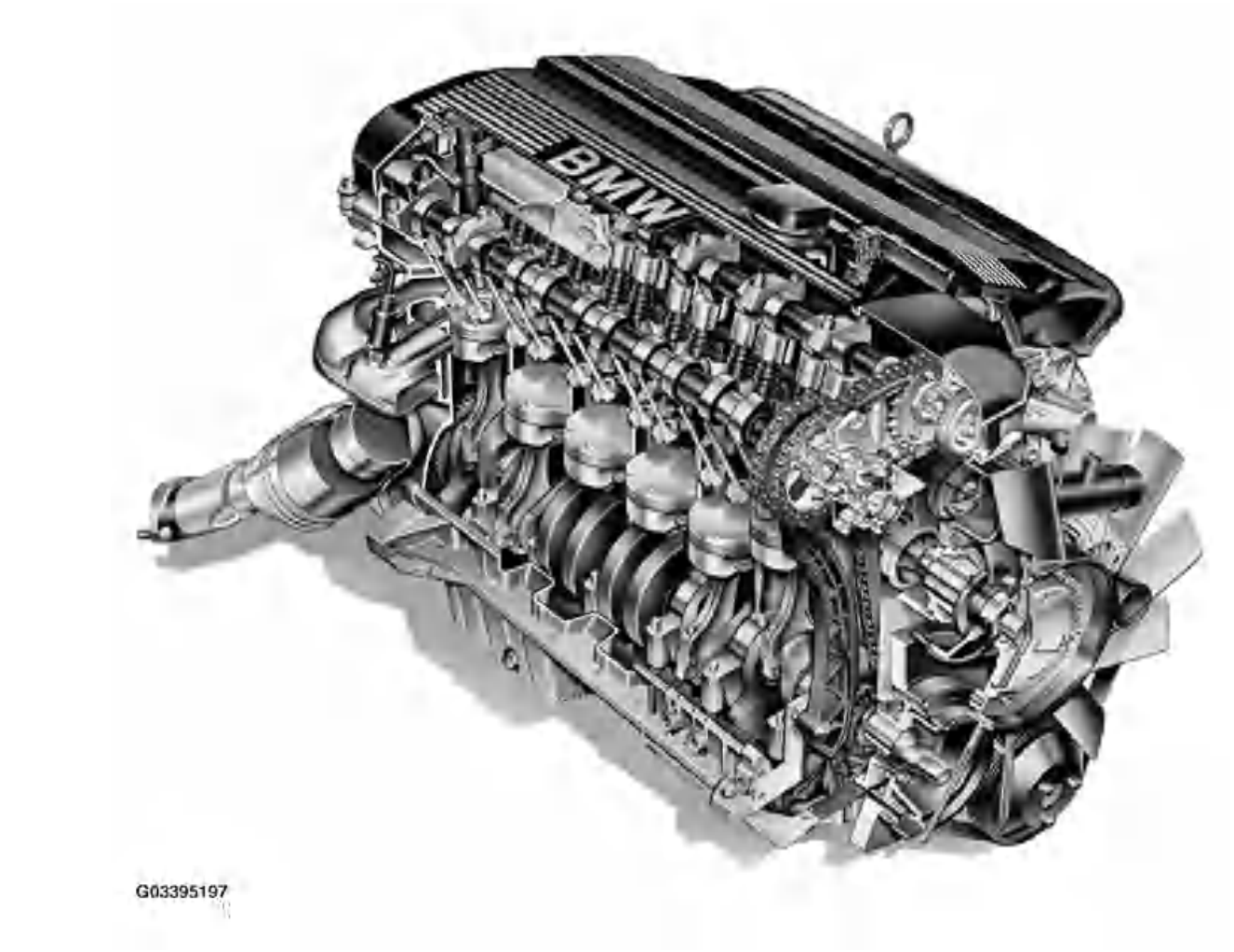



Fig. 1: Sectional View Of Engine
Courtesy of BMW OF NORTH AMERICA, INC.

Also, a working knowledge of the metric system is also a vital skill that is needed by the technician. All BMW engine measurements consist of metric specifications. Some of the routine engine measurements performed include:

- Valve Guide Wear (Tilt Angle K)
- Cylinder Bore Measurements (Taper and Out-of-Round)
- Cylinder Head Warpage and Thickness
- Axial and Radial Endplay Measurements (Crankshaft/Camshaft etc).

Among all of the skills possessed by a modern technician, basic measuring techniques are perhaps the most overlooked and least used. This is why it is important to review these skills from time to time as a refresher.

Also, it is necessary to access technical data to obtain the proper specifications for these measurements. This

course is designed to review measuring techniques to assist in engine diagnosis.

### Vernier Measurement

The Vernier scale is used on various measuring tools such as the Vernier caliper and the Depth Gauge. The Vernier scale can be used with Fractional (US) and Metric systems. For the purposes of this training module we will always refer to the Metric Vernier scale.

The Vernier scale consists of a fixed scale and a sliding scale. The fixed scale is divided with graduations in 1 millimeter increments. The sliding scale has 10 graduations in increments of .5.

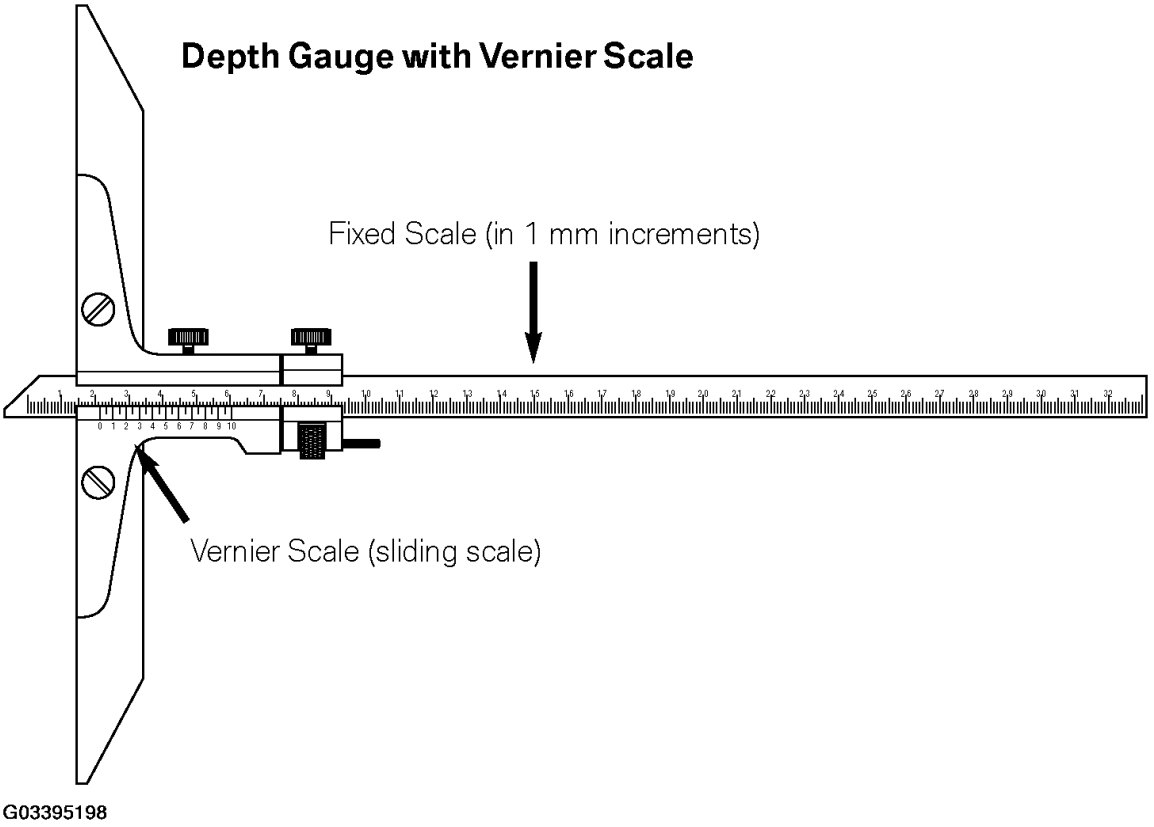



Fig. 2: Identifying Depth Gauge
Courtesy of BMW OF NORTH AMERICA, INC.

In order to read a measurement, use the zero mark on the left end of the vernier scale to use as a guide to read a measurement on the fixed scale.

In the example shown at the right, the zero mark is resting between 26 and 27 mm. Therefore the base measurement is 26 mm.

Next, the decimal measurement must be taken. For this, find a line on the Vernier that most closely matches any line on the fixed scale.

Using the example drawing, the "4" on the Vernier scale is lining up directly with a line on the fixed scale.

Combining the previous reading with this reading, the result would be 26.4 mm.

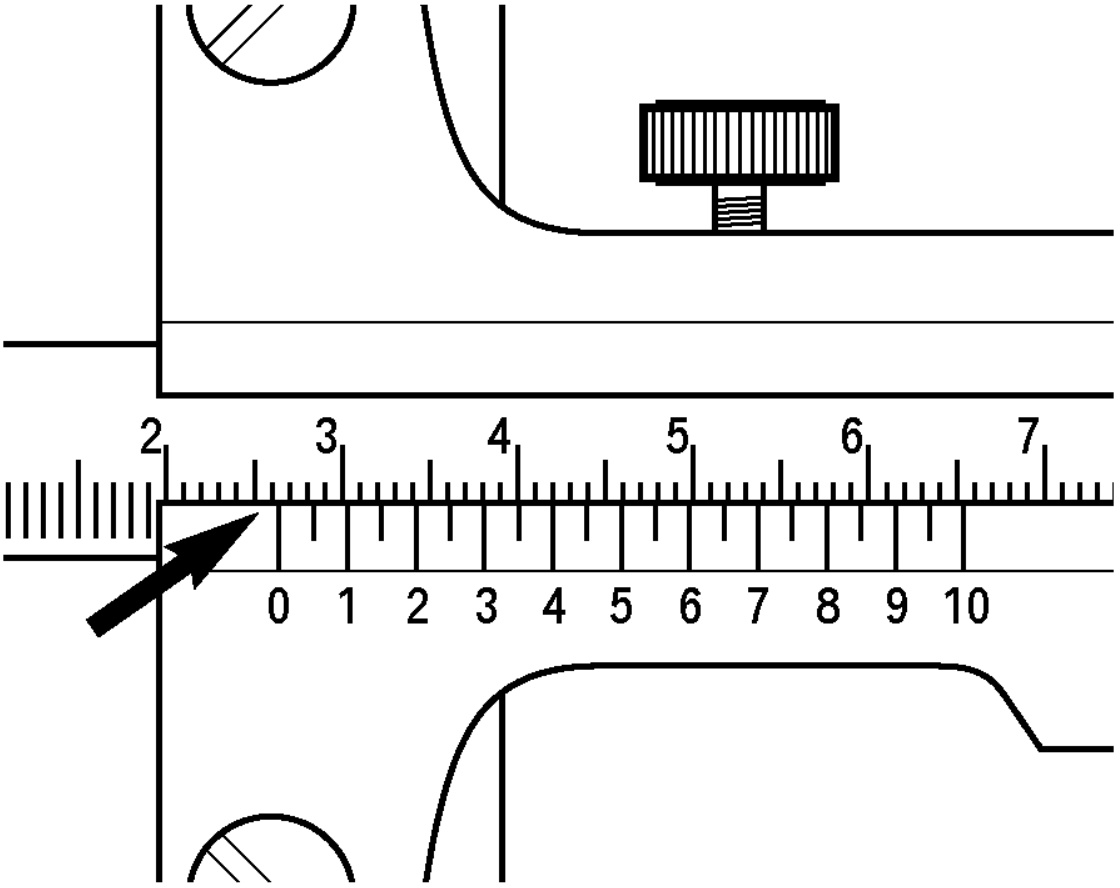



Fig. 3: Locating Vernier Scale Reading
Courtesy of BMW OF NORTH AMERICA, INC.

The designations on the Vernier scale are in increments of .5. For example, if a reading on the Vernier scale falls on the .5 (i.e. 2.5, 3.5 etc) designation this would indicate 5/100th's of a millimeter.

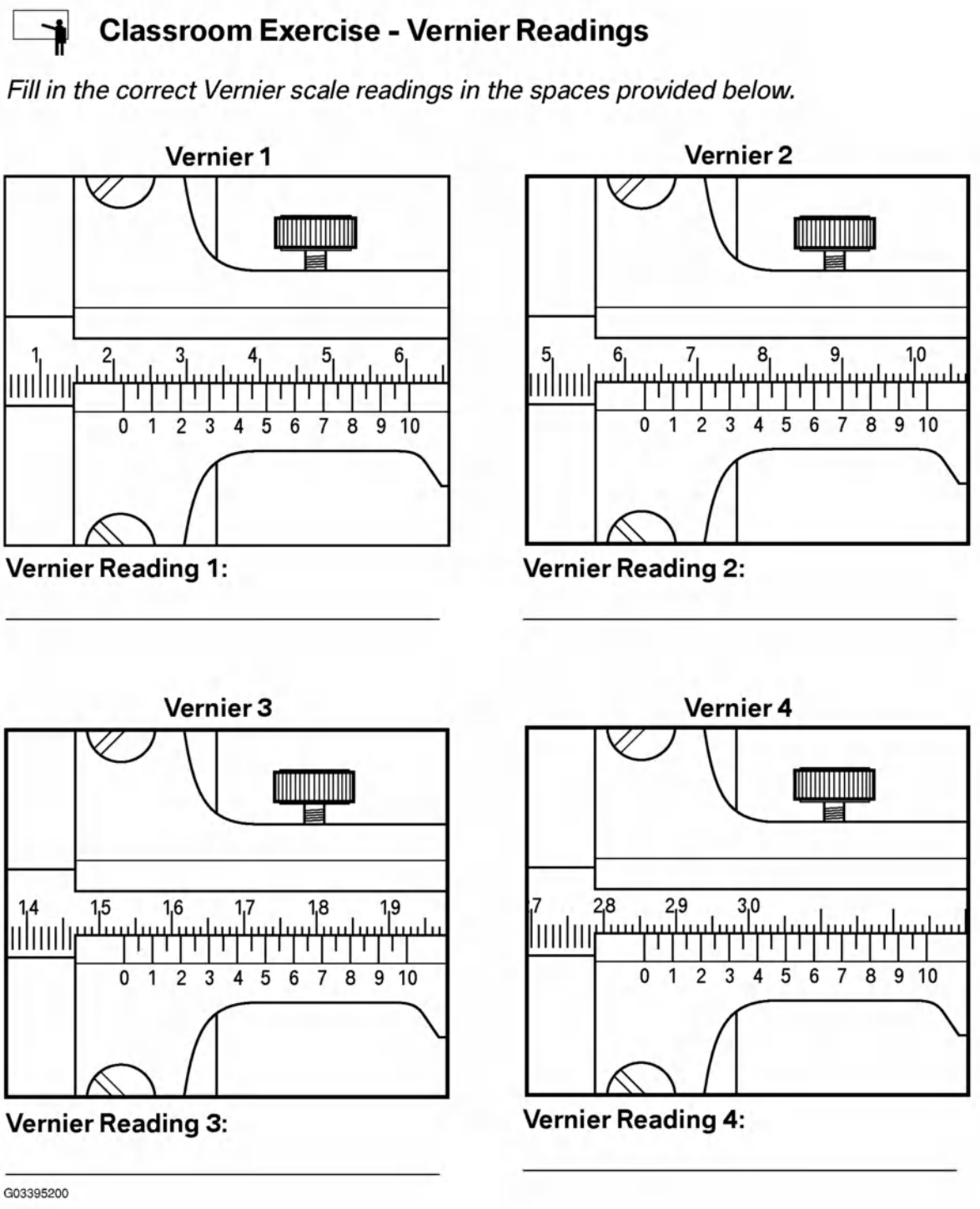



Fig. 4: Identifying Vernier Scale Reading
Courtesy of BMW OF NORTH AMERICA, INC.

### Micrometer Measurements

Another valuable measuring tool is the micrometer, which can be used for measurements such as bearing journal diameter, cylinder head thickness, valve shim thickness and brake rotor thickness etc. Micrometers also come in configurations for inside measurements as well.

The micrometer scale comes in both fractional and metric varieties. We will cover only the metric micrometer scale in this course.

First you must familiarize yourself with the construction of the micrometer in order to understand how measurements are made.

## Metric Micrometer Construction

The micrometer is constructed of a few basic parts. The actual item to be measured is placed between the anvil and the spindle. The micrometer can be adjusted to the approximate size using the thimble. The thimble should only be used for the coarse adjustment. In order to make the actual measurement, the micrometer should only be turned using the ratchet (a.k.a. the friction stop). Do not attempt to make a measurement using the thimble. This will give an inaccurate measurement and ultimately damage the micrometer.

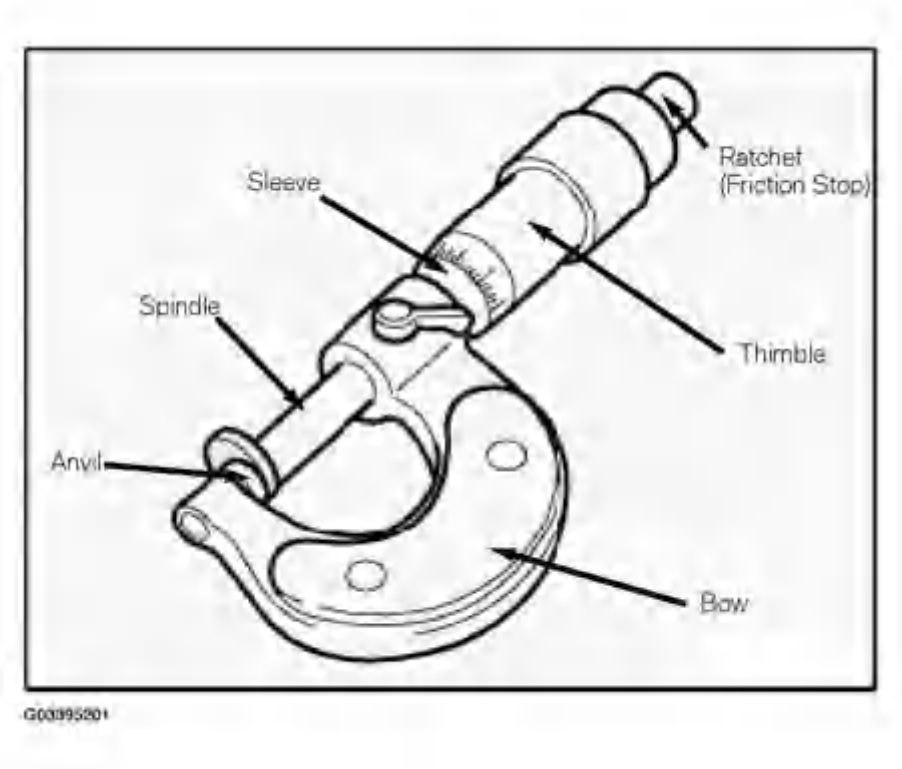



Fig. 5: Identifying Micrometer
Courtesy of BMW OF NORTH AMERICA, INC.

Micrometers are available in various sizes for outside as well as inside measurements. The more common variation is the outside micrometer. They are usually available in 25 millimeter increments such as 0-25 mm, 25-50 mm, 50-75 mm etc..

The metric micrometer can measure in increments of one hundredth of a millimeter (.01mm). One hundredth of a millimeter is equal to 0.0003937 inch which is less than one thousandth of an inch.

The measurement area of the micrometer consists of the sleeve scale and the thimble scale. The sleeve scale is used to read whole and half millimeters. The thimble scale (which rotates) reads in hundredths (.01) of a millimeter from zero to fifty. Two complete revolutions of the thimble equals one millimeter.

On the sleeve scale, each scale mark above the center line indicates whole millimeters. Below the center line, half of a millimeter (or .5mm) increments are indicated.

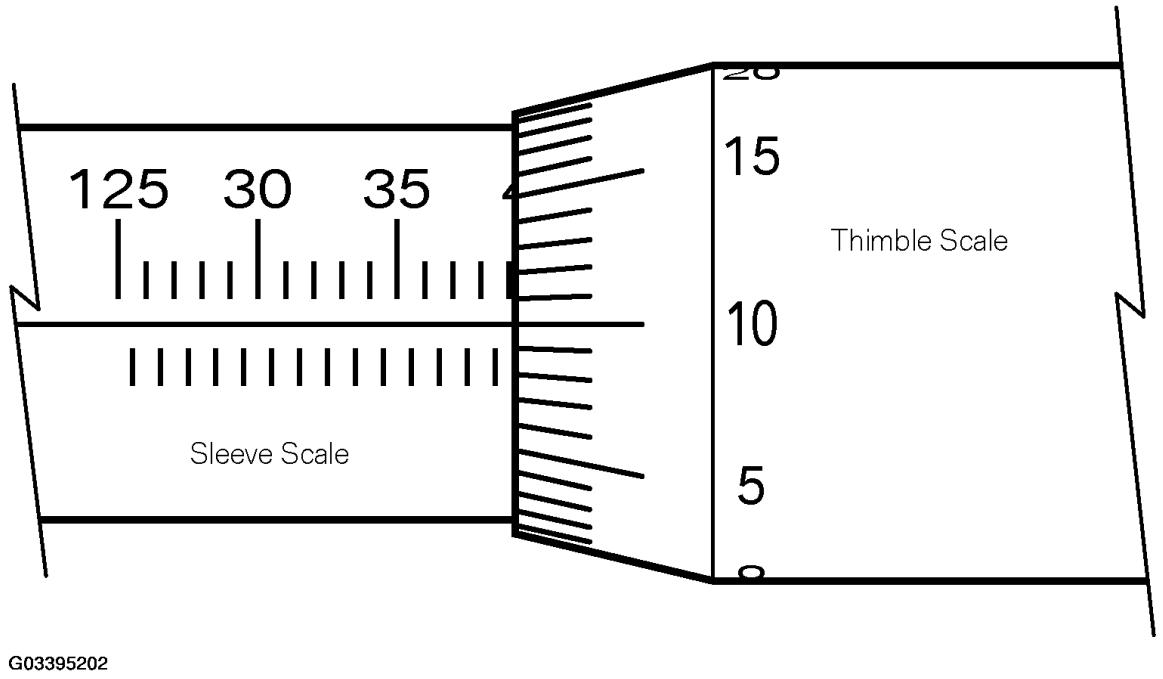



Fig. 6: Identifying Micrometer Reading
Courtesy of BMW OF NORTH AMERICA, INC.

Using the example shown above, the micrometer is a 125-150mm micrometer. To read this micrometer, first take the basic reading from the sleeve scale. The thimble is past the 139 mm mark. Therefore the reading is a least 139 mm. Next, look at the thimble scale and note the reading on the centerline. The "10" on the thimble scale is lined up with the centerline. This indicates a reading of .10 mm. If you add the two readings; 139 + .10 = 139.10 mm.

## Classroom Exercises - Micrometer Measurements

*Fill in the correct micrometer readings in the spaces provided below.*

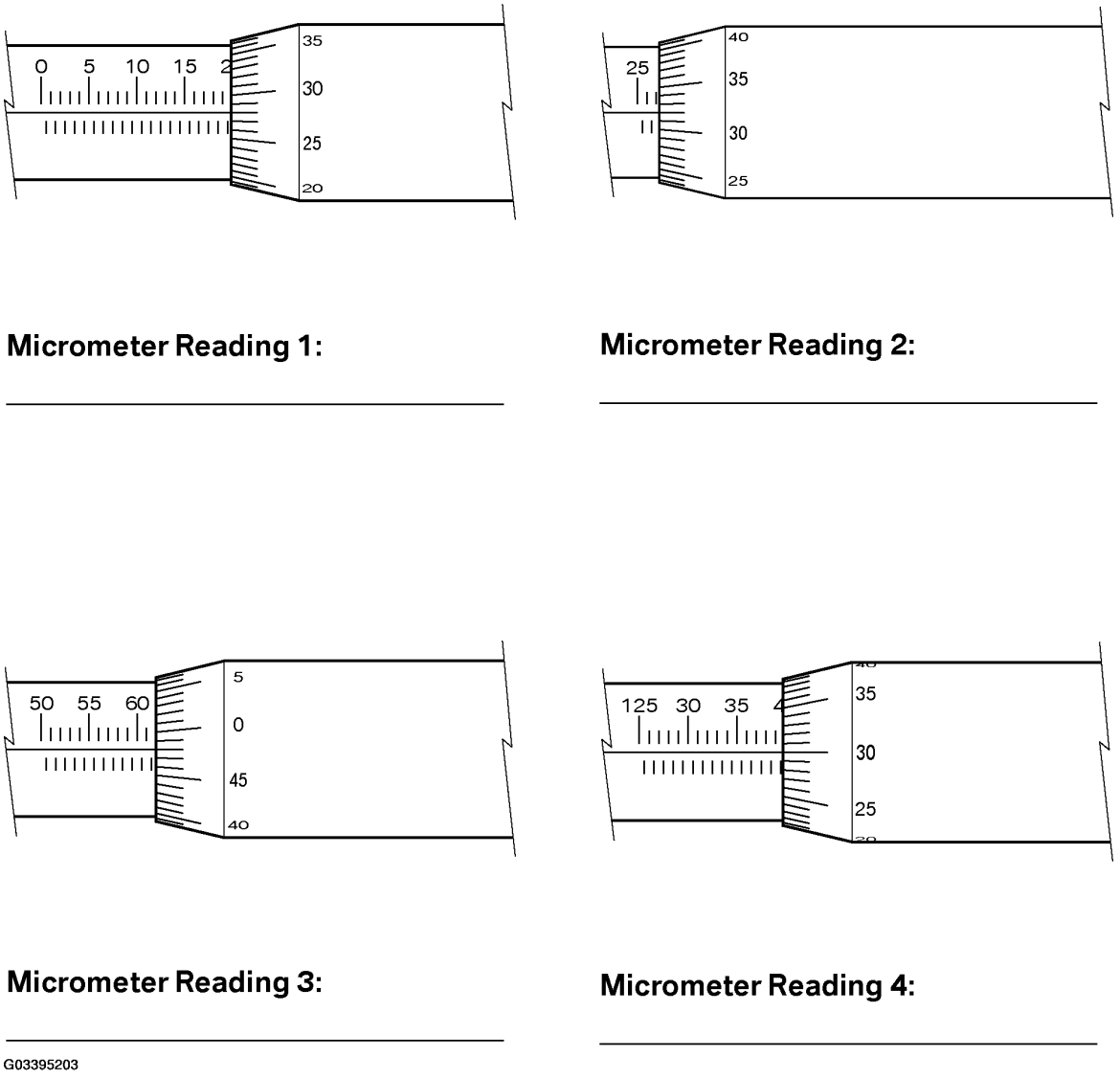



Fig. 7: Identifying Correct Micrometer Reading
Courtesy of BMW OF NORTH AMERICA, INC.

### Dial Indicator Measurements

The dial indicator is used to measure the travel or movement of a specific item. It can also be used to measure axial and radial runout. In engine measurement applications, the dial indicator can be used to measure valve guide wear, axial movement of the crankshaft (thrust), and runout of flywheels and harmonic balancers.

First, it is important to familiarize yourself with Dial Indicator construction. The face of the dial indicator consists of a moveable bezel which is also attached to the large measuring scale. This allows the tool to be brought to the "zero point" when needed.

The main measuring device is the contact point. The contact point (1) is placed against the object to be measured. Usually, the contact point is rounded or has a ball bearing. This allows for a more accurate measurement.

The measuring face of the dial indicator consists of 2 scales. The smaller scale is for the "coarse" measurement which is in graduations of 1 millimeter. One revolution of the small scale is 10 millimeters.

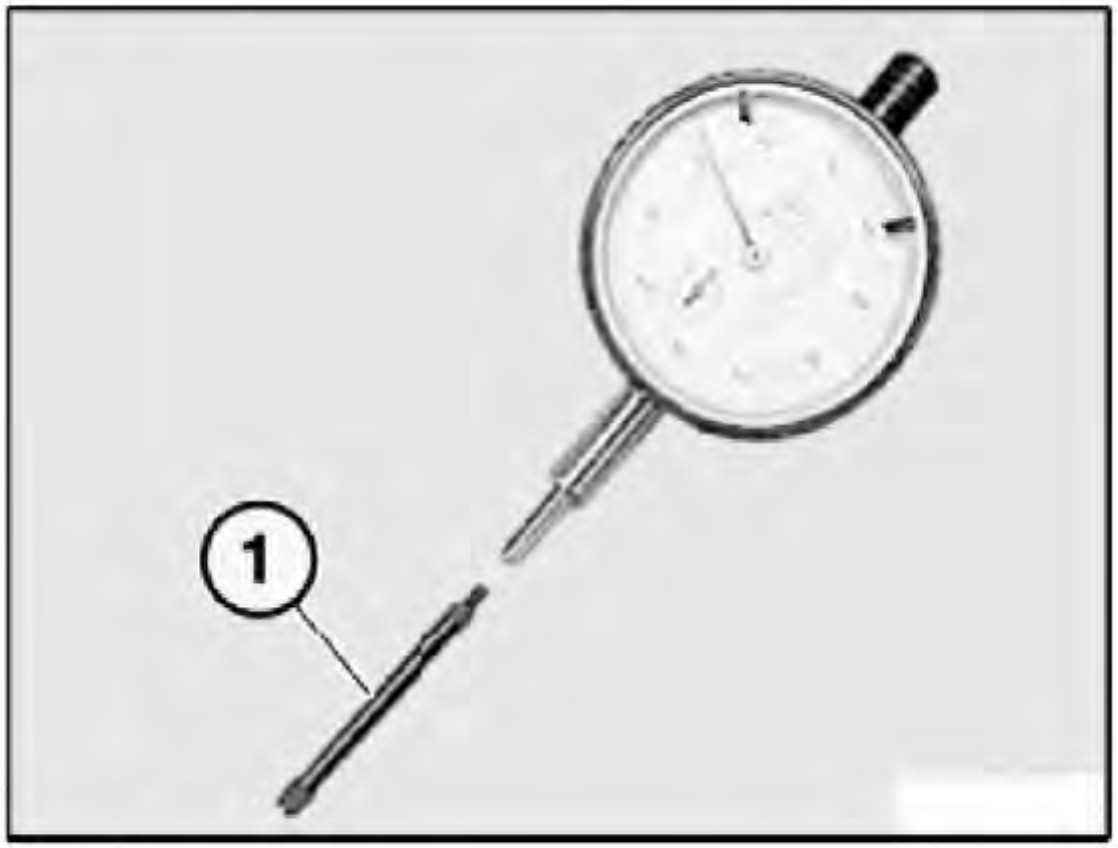



Fig. 8: Identifying Dial Indicator
Courtesy of BMW OF NORTH AMERICA, INC.

The large scale is in graduations of .01 millimeter and the scale goes from zero to one hundred. Therefore, one revolution of the large scale is one millimeter.

The dial indicator also needs to be held in place when taking a measurement. This requires a stand or base. Depending upon the application, these stands can be a clamp type, magnetic or a threaded base.

When taking a measurement, place the contact point on the object to be measured. The dial indicator must be pre-loaded slightly to prevent the measurement from bottoming out.

When reading the scale, be sure to "zero" the dial indicator first. If the readings to be taken are less than 1 millimeter, you do not need to use the small scale. If the readings are larger than 1 millimeter, be sure to factor the small scale into your measurement.




Fig. 9: Identifying Dial Indicator Reading
Courtesy of BMW OF NORTH AMERICA, INC.

Examples Of Dial Indicator Measurements

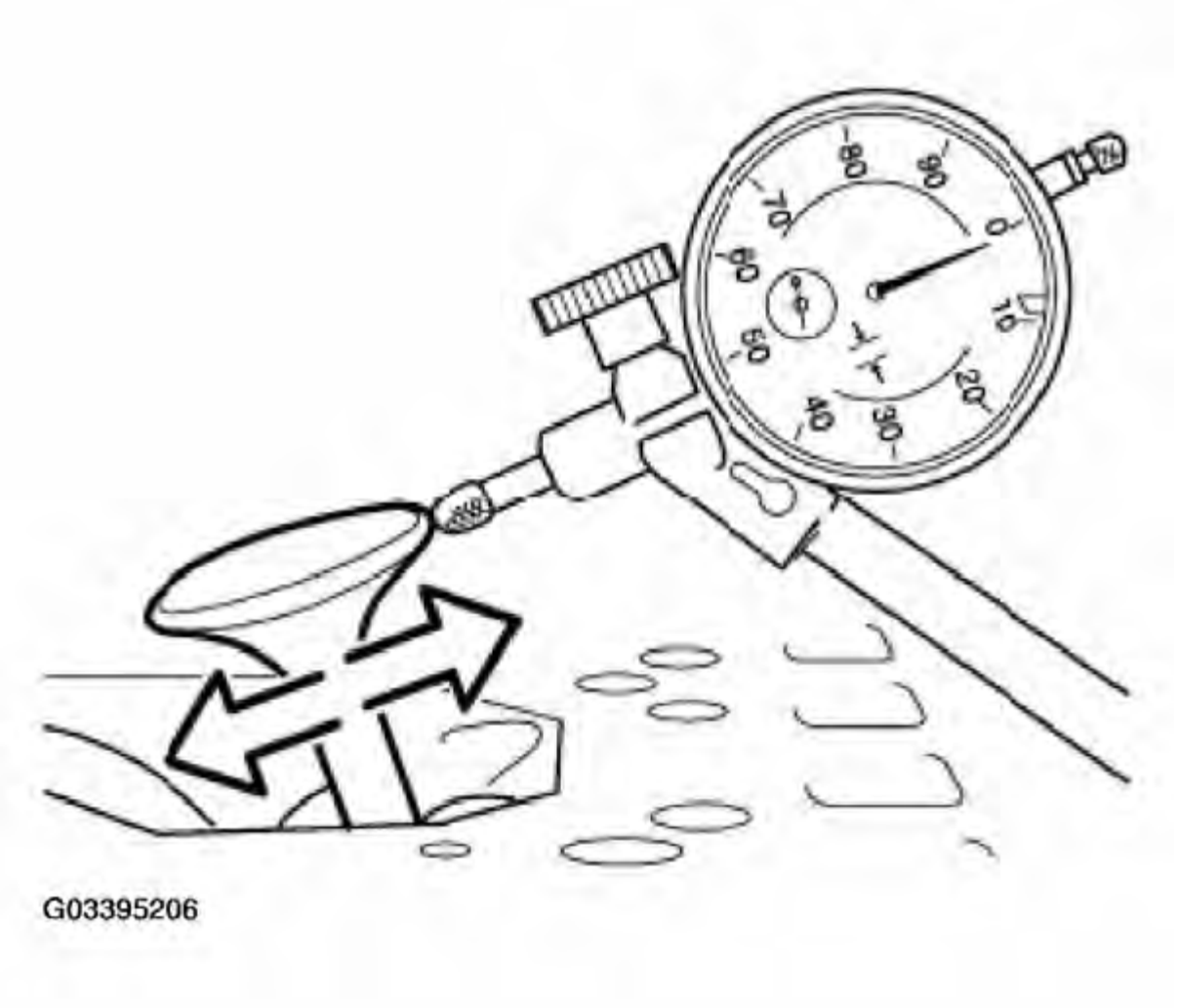



Fig. 10: Measuring Valve Guide Wear - Tilt Angle "K" Using Dial Indicator
Courtesy of BMW OF NORTH AMERICA, INC.

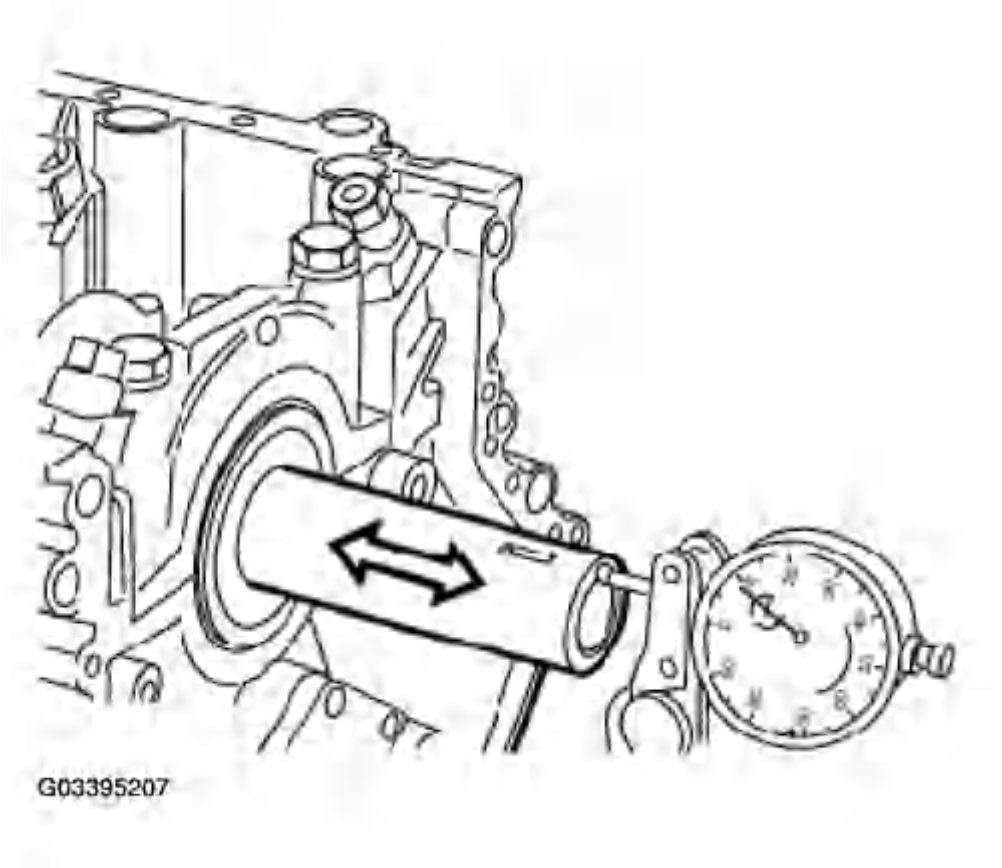


Fig. 11: Measuring Crankshaft Endplay - Axial Using Dial Indicator
Courtesy of BMW OF NORTH AMERICA, INC.




Fig. 12: Measuring S62 Engine - Basic Throttle Setting Using Dial Indicator
Courtesy of BMW OF NORTH AMERICA, INC.

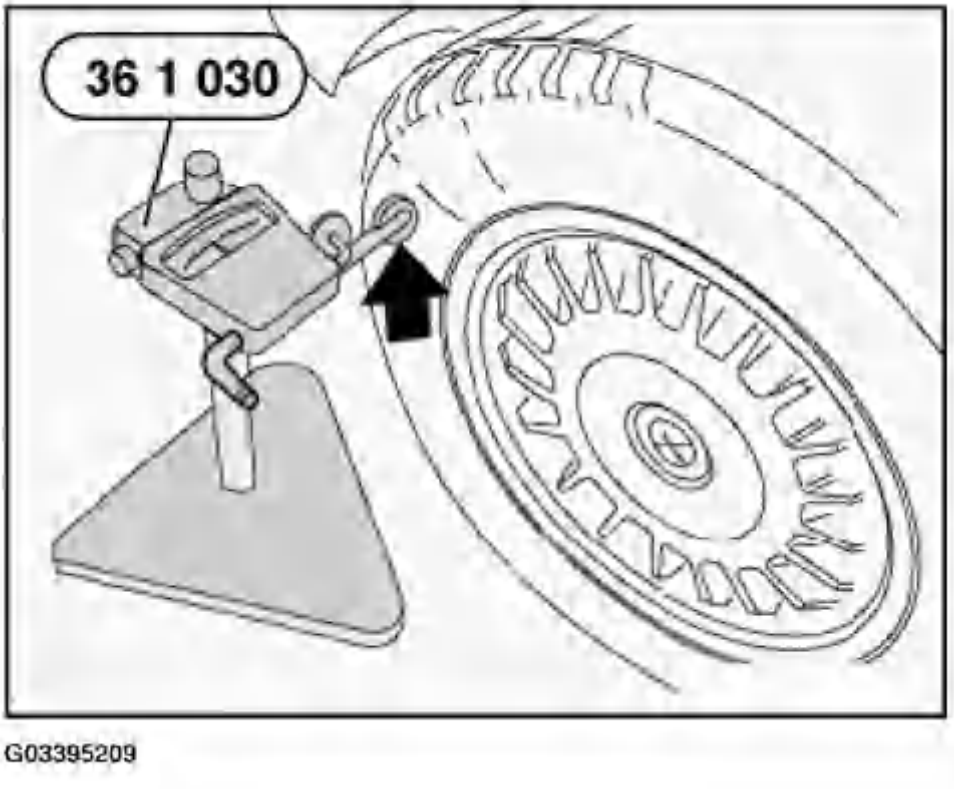



Fig. 13: Measuring Wheel Runout - Axial Using Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

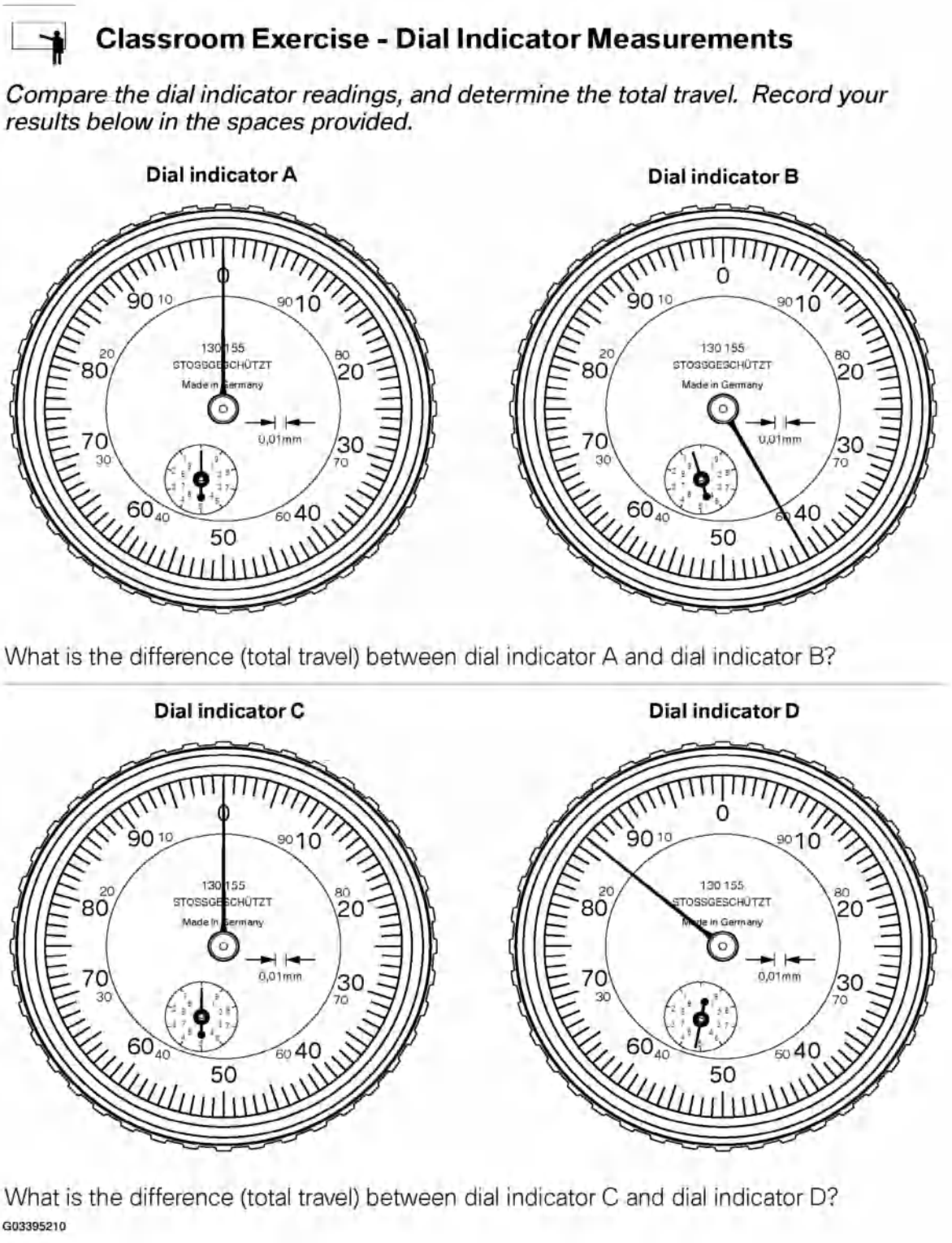



Fig. 14: Identifying Correct Dial Indicator Reading
Courtesy of BMW OF NORTH AMERICA, INC.

## ADDITIONAL ENGINE MEASUREMENTS

During engine repair procedures it is sometimes necessary to assess engine wear to make determinations on parts replacement. Also, some engine measurements are needed to verify a previous diagnosis.

For example, a cylinder leakdown test could indicate a cylinder sealing concern. Once the engine is disassembled, it would be necessary to verify this condition by checking the piston and piston ring condition. If OK, the next step would be to determine the condition of the cylinder bore. At this point, the cylinders should be checked for taper (conicity) and for out-of-round. The correct measurements could mean the difference between just replacing the rings and/or pistons or replacing the engine block. This is why it is necessary to

make accurate measurements when needed.

Some of the other routine engine measurements include:

- Cylinder head warpage
- Cylinder head thickness (on some applications)
- Piston rings - end gap and axial clearance
- Cylinder bore - including out-of-round and taper

### Cylinder Head Measurement

If a repair requires removal of the cylinder head, a few basic measurements can be performed to save time and unnecessary machine shop costs. If an engine has been overheated or has an internal or external fluid leakage (coolant/oil), it is a good idea to check the cylinder head for warpage.

This can be done by using a commercially available machinists straight edge and a feeler gauge. by sliding the feeler gauge under the straight edge in various locations, it can determine if there are any low spots or warpage. Usually, the specification is about .05 mm.

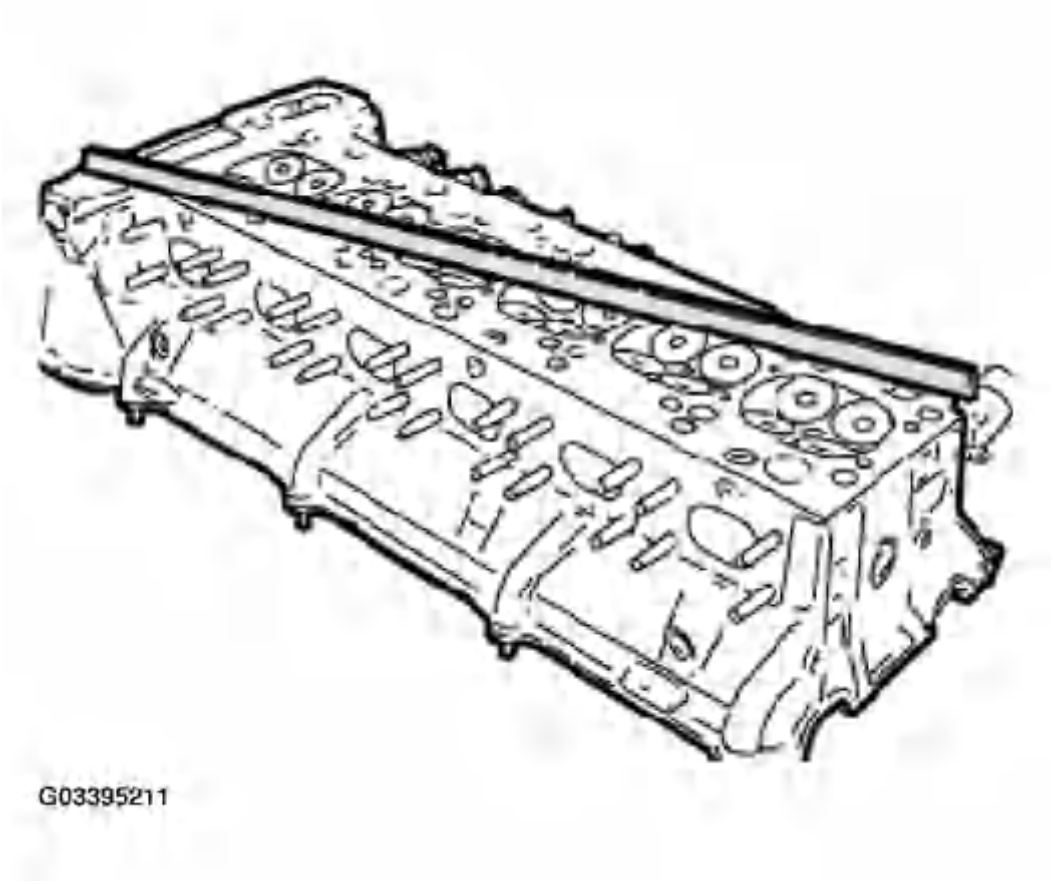



Fig. 15: Identifying Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

Also, check to see if the cylinder head has a specification for machining limit. If so, it may be possible to have the cylinder head re-surfaced. Depending on the amount of material removed during the machining process, it may be necessary to install a thicker head gasket. There are some "service" head gaskets available through the part s department.

The cylinder head can be checked for minimum thickness. This is done using a micrometer or a vernier caliper. This is not possible on all engines, the example shown is a 6-cylinder (M52TU/M54).

If the minimum thickness is not met, the head will need to be replaced.

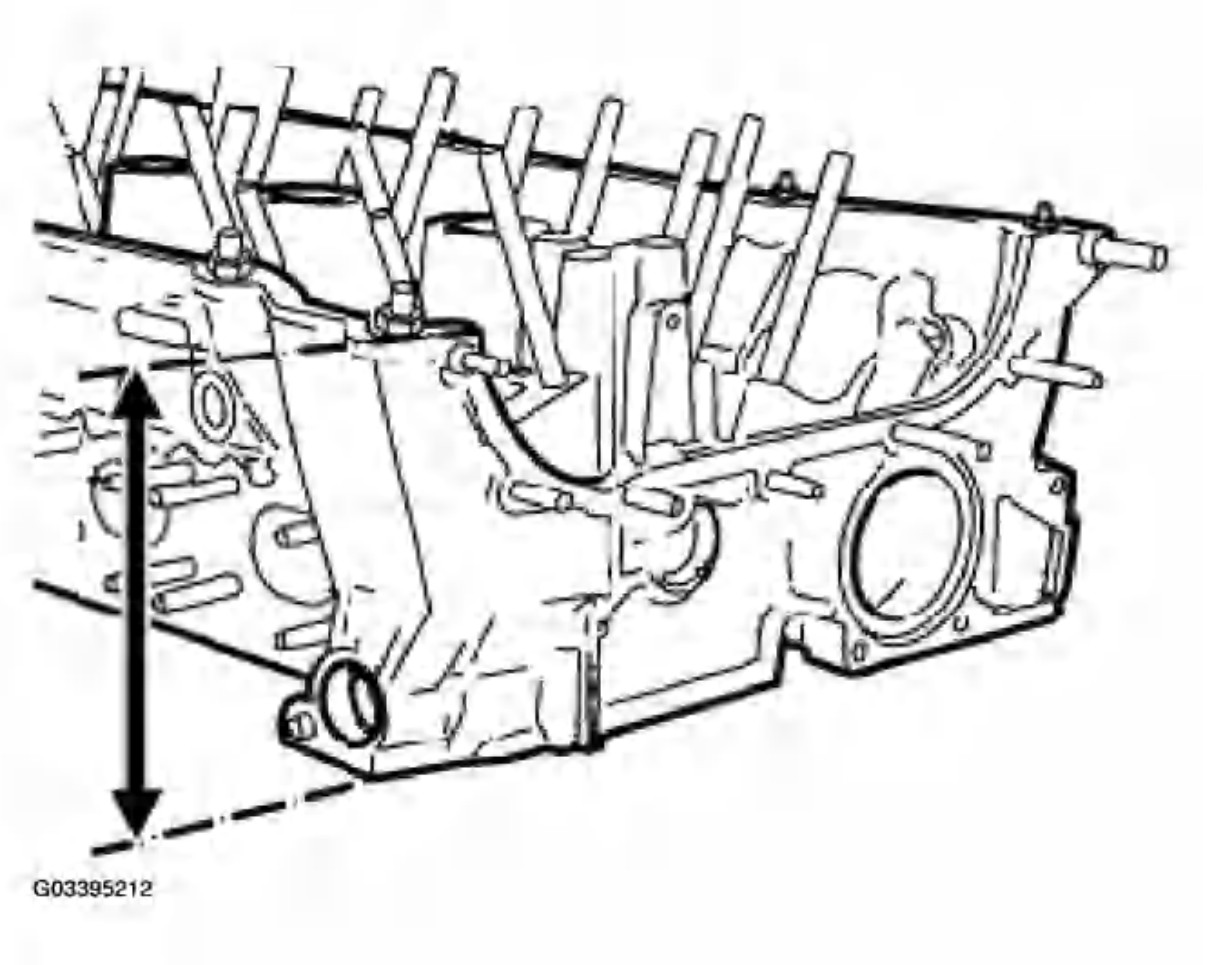



Fig. 16: Measuring Thickness Of Cylinder Head
Courtesy of BMW OF NORTH AMERICA, INC.

### Piston Measurements

When replacing pistons and/or piston rings, there are some basic measurements that need to be made. When fitting a piston to a cylinder bore, the piston diameter should be checked to ensure a proper fit.

The piston diameter is measured using a micrometer. The measurement is taken at a specified point (A) which is 90 degrees from the piston pin axis. Each engine has a specific location to measure piston diameter. For example, the illustration below shows measuring Point A. The specification for this engine (N62) is 18 mm. So the piston diameter is measured 18 mm from the bottom of the piston skirt.

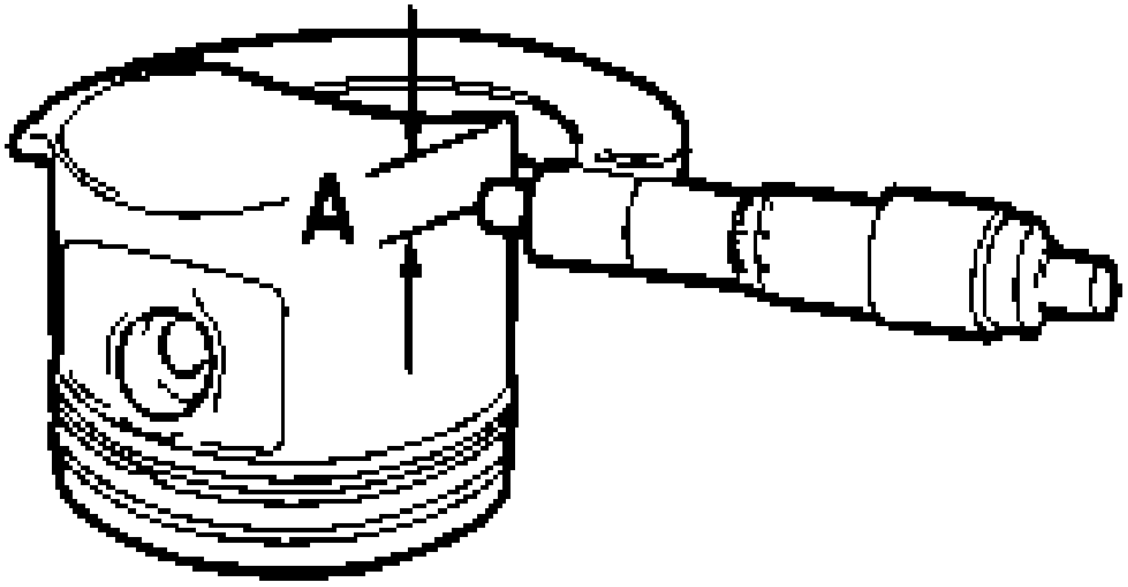



Fig. 17: Measuring Piston Diameter Using Micrometer
Courtesy of BMW OF NORTH AMERICA, INC.

The piston diameter, when subtracted from the cylinder bore equals the cylinder wall to piston clearance. If the clearance measurement obtained is not correct, re-check your readings.

### Piston Ring Measurements

There are some important specifications to check when installing piston rings. One of the measurements in axial clearance. Axial clearance is the distance between the piston ring and ring land. This prevents the rings from binding in the ring land at operating temperature. Axial clearance is measured using a feeler gauge.

Also the piston ring end gap has to be checked. This measurement is checked using a feeler gauge.

This clearance is critical in order to prevent the end gaps from contacting each other when the engine is at operating temp.

When installing the piston rings, always stagger the end gaps as per the repair instructions.

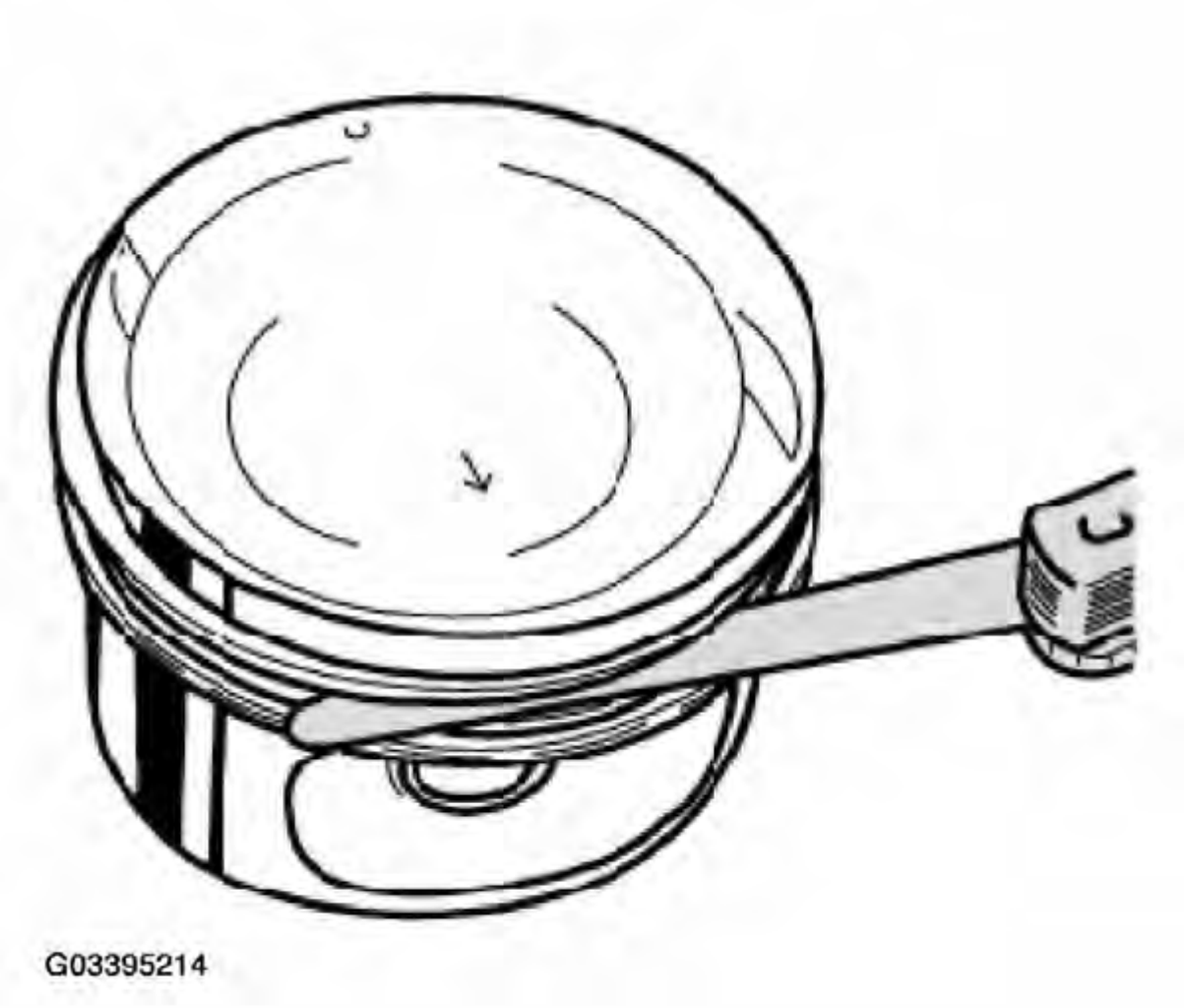



Fig. 18: Measuring Piston Ring Gap Using Feeler Gauge
Courtesy of BMW OF NORTH AMERICA, INC.

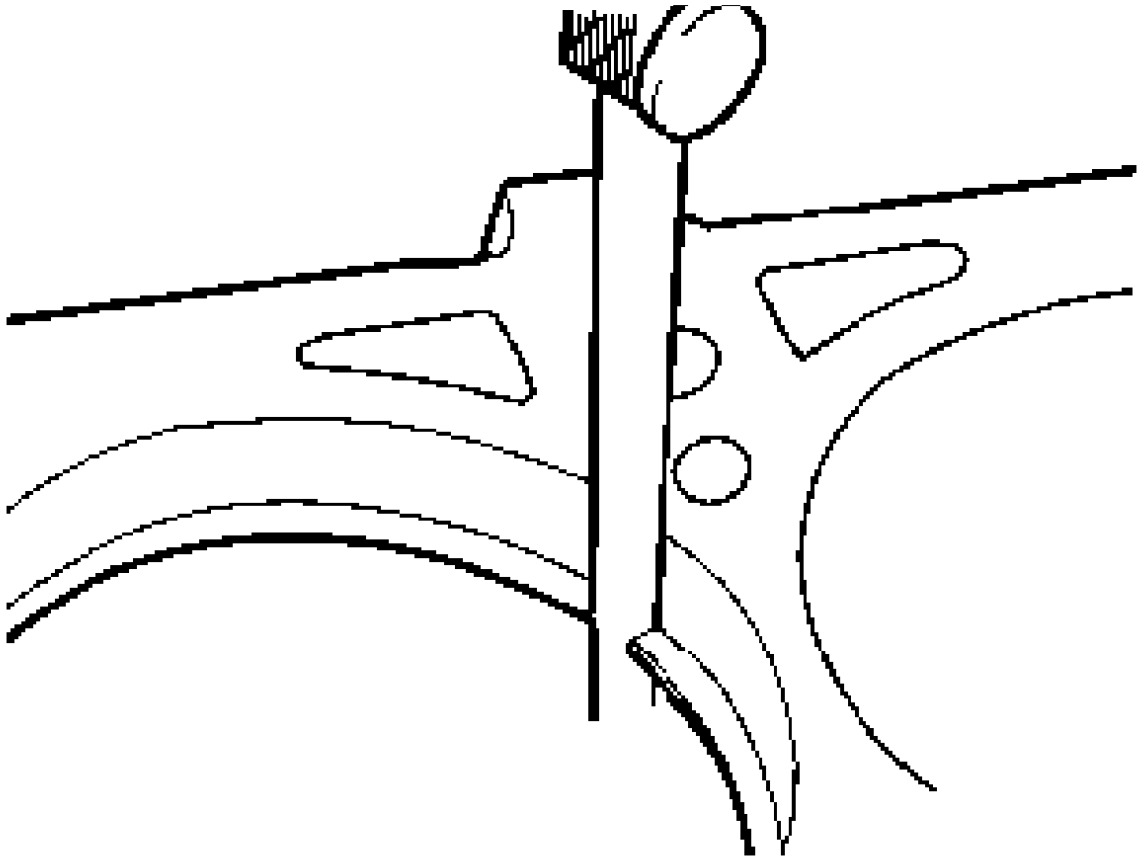



Fig. 19: Measuring Piston Ring End Gap Using Feeler Gauge
Courtesy of BMW OF NORTH AMERICA, INC.

### Cylinder Bore

In order for the cylinder bore to be considered acceptable, it must not be excessively tapered or out-of-round. Once the cylinder has been checked for obvious damage and the surface finish is OK, the integrity of the bores must be verified. If cylinder wear is suspected, it must be checked using the proper cylinder bore gauge.

Each cylinder must be checked at three position in the bore - top, middle and bottom. Also there must be two opposing dimensions that should be checked. The difference between the top and bottom measurements will indicate the taper of the bore. The opposing dimensions will indicate the out-of-round specification.

If these measurements are out of specification, the cylinder bore must be re-finished or overbored. New pistons and rings must be fitted as well.

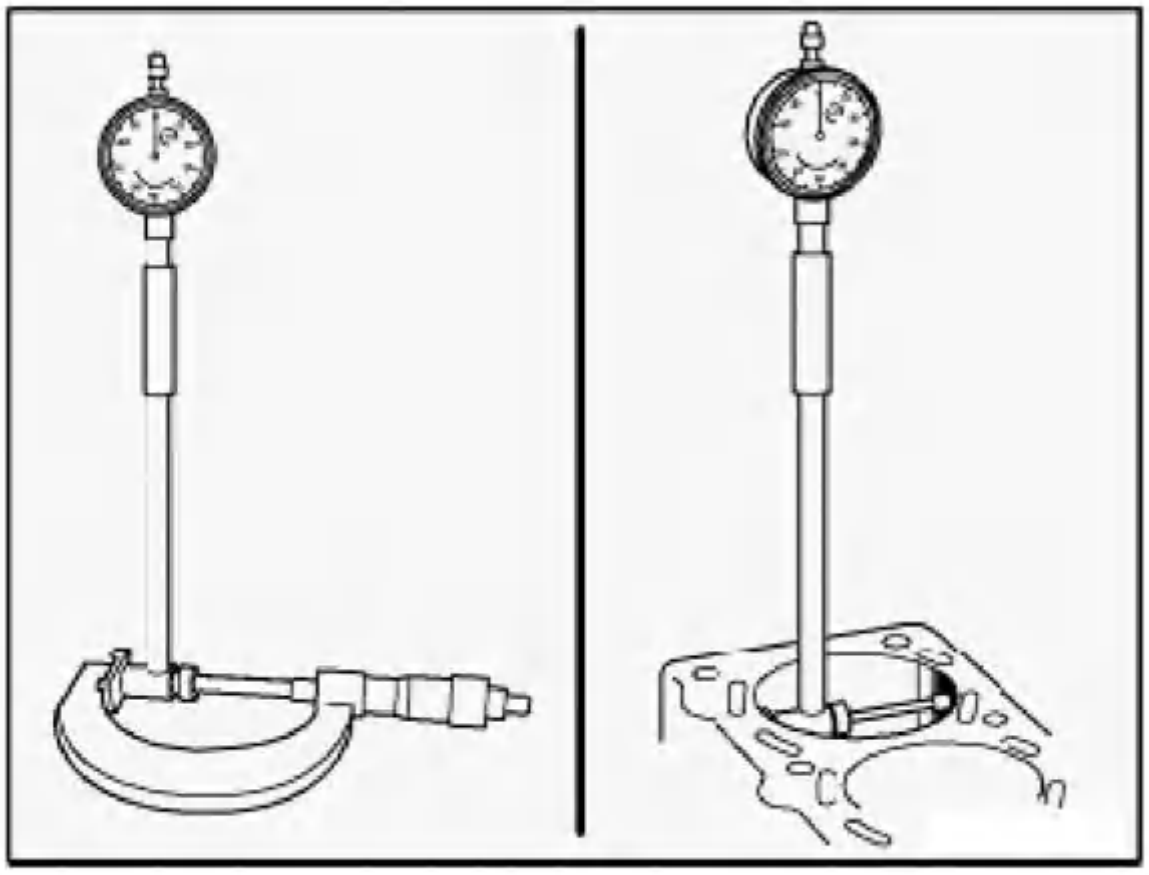



Fig. 20: Checking Cylinder Bore Using Cylinder Bore Gauge
Courtesy of BMW OF NORTH AMERICA, INC.

## METRIC SYSTEM

The unit of length, and the basis for all other metric units of measurement is the meter. The meter (1 meter), as a point of reference, is slightly longer that a yard (39.37 inches).

The divisions of a meter are hundredths and thousandths. One hundredth of a meter is called a centimeter, and is equal to .3937 inch or about half the diameter of a nickel.

One thousandth of a meter is called a millimeter. The small marks between the centimeter increments are each one millimeter, or one tenth of a centimeter. And as a point of reference, a standard paper clip is about one millimeter thick.

### Metric System Denominations

Throughout the metric system, common to all units of measurement, are prefixes which designate multiples or fractions of the unit.

For automotive applications, the most common prefixes are centi; designating one-hundredth; milli; for one thousandth and kilo- for one thousand.

There are letters uniformly used throughout the system to label the divisions or multiples of each unit of measurement. The letter "m" represents milli, "c' is for centi and "k" is for kilo. These are then combined with the letter representing the unit of measurement.

For example, mm is millimeter, cm is centimeter and km is kilometer. The same applies to liter which is the unit of volume and gram which is the unit of weight.

One kilogram is equal to one thousand grams which is equal to 2.2 pounds. All metric measurements are directly related. For example, one thousand cubic centimeters, or 10cm x 10cm x 10cm of water weighs one kilogram. The volume of those one thousand cc's is one liter.

## Metric Reference Chart

METRIC REFERENCE CHART

| | | | |
|---|---|---|---|
| Weight | | | |
| 1 kilogram | = 1 kg | = 1000 grams | = 1000 g |
| 1 hectogram | = 1 hg | = 100 grams | = 100 g |
| 1 dekagram | = 1 dag | = 10 grams | = 10 g |
| 1 gram | = 1g | Â | Â |
| 1 decigram | = 1dg | = .1 gram | = 0.1 g |
| 1 centigram | = 1 cg | = 0.01 gram | = 0.01 g |
| 1 milligram | = 1 mg | = 0.001 gram | = 0.001 g |
| Length | | | |
| 1 kilometer | = 1 km | = 1000 meters | = 1000 m |
| 1 hectometer | = 1 hm | = 100 meters | = 100 m |
| 1 dekameter | = 1 dam | = 10 meters | = 10 m |
| 1 meter | = 1m | Â | Â |
| 1 decimeter | = 1dm | = .1 meter | = .1 m |
| 1 centimeter | = 1 cm | = 0.01 meter | = 0.01 m |
| 1 millimeter | = 1 mm | = 0.001 meter | = 0.001 m |
| Volume | | | |
| 1 kiloliter | = 1 kl | = 1000 liters | = 1000 l |
| 1 hectoliter | = 1 hl | = 100 liters | = 100 l |
| 1 dekaliter | = 1 dal | = 10 liters | = 10 l |
| 1 liter | = 1l | Â | Â |
| 1 deciliter | = 1dl | = .1 liter | = .1 l |
| 1 centiliter | = 1 cl | = 0.01 liter | = 0.01 l |
| 1 milliliter | = 1 ml | = 0.001 liter | = 0.001 l |

## Metric System Conversion Charts

METRIC SYSTEM CONVERSION CHARTS

| Linear Measure to Metric | Linear Measure (Metric) to English |
|---|---|
| 1 inch = 2.54 cm | 1 mm = 0.03937 inch |
| 12 inches = 1 foot = 30.48 cm | 1 cm = 0.39 inch |
| 3 feet = 1 yard = 0.91 m | 1 m = 39.37 inch |
| 5.5 yards = 1 rod = 5.03 m | 1 km = 0.62 miles |
| 5280 feet = 1 mile = 1.61 km | - |
| Square Measure to Metric | Square Measure (Metric) to English |
| 1 $in^2$ = 6.45 $cm^2$ | 1 $mm^2$ = 0.002 $in^2$ |
| 144 $in^2$ = 1 ft 2 = 0.09 $m^2$ | 1 $cm^2$ = 0.16 $in^2$ |
| 9 $ft^2$ = 1 $yd^2$ = 0.84 $m^2$ | 1 $m^2$ = 1549 $in^2$ |
| 640 acres = 1$mi^2$ = 2.59 $km^2$ | 1 $km^2$ = 0.39 $mi^2$ = 247.10 acres |
| Cubic Measure to Metric | Cubic Measure (Metric) to English |
| 1 $in^3$ = 16.39 $cm^3$ | 1 $mm^3$ = 0.000061 $in^3$ |
| 1728 $in^3$ = 1 $yd^3$ = 0.76 $m^3$ | 1 $cm^3$ = 0.061 $in^3$ |
| 27$ft^3$ = 1 $yd^3$ = 0.76 $m^3$ | 1 $m^3$ = 35.32 $ft^3$ |

| | |
|---|---|
| Â | 1 $km^3$ = 0.24 $mi^3$ |
| Liquid Measure to Metric | Liquid Measure (Metric) to English |
| 1.81 $in^3$ = 1 fluid oz. = 30 ml | 1 ml = 0.03 fluid oz = 0.061 $in^3$ |
| 1 pint = 0.47 | 1 1000 $cm^3$ = 1 l = 61.02 $in^3$ = 1.06 qt |
| 57.75 $in^3$ = 1 quart = 0.95 l | 1 $ft^3$ water = 62.5 lb |
| 231 $in^3$ = 1 gal = 3.79 l = 0.0038 $m^3$ | Â |
| 1 $ft^3$ = 7.48 gal = 28.35 l | Â |
| Weights to Metric | Weight (Metric) to English |
| 1 0z = 28.35 g | 1 g = 0.035 oz |
| 1 lb = 453.59 g | 1 kg = 2.20 lb |
| 1 lb = 0.45 kg | 1 metric ton = 1000 kg = 1.102 tons = 2205 lb |
| 1 ton = .91 metric ton | Â |
| Temperature to Metric | Temperature to Fahrenheit |
| F = 9/5C +32 | C = 5/9 (F-32) |

Pressure Conversion Chart

PRESSURE CONVERSION CHART

| Bar | kPa | psi | in.Hg. |
|---|---|---|---|
| 6.0 | 600 | 87.0 | Â |
| 5.9 | 590 | 85.5 | Â |
| 5.8 | 580 | 84.0 | Â |
| 5.7 | 570 | 82.5 | Â |
| 5.6 | 560 | 81.0 | Â |
| 5.5 | 550 | 79.0 | Â |
| 5.4 | 540 | 78.5 | Â |
| 5.3 | 530 | 77.0 | Â |
| 5.2 | 520 | 75.5 | Â |
| 5.1 | 510 | 73.5 | Â |
| 5.0 | 500 | 72.5 | Â |
| 4.9 | 490 | 71.0 | Â |
| 4.8 | 480 | 69.5 | Â |
| 4.7 | 470 | 68.0 | Â |
| 4.6 | 460 | 66.5 | Â |
| 4.5 | 450 | 65.5 | Â |
| 4.4 | 440 | 64.0 | Â |
| 4.3 | 430 | 62.5 | Â |
| 4.2 | 420 | 61.0 | Â |
| 4.1 | 410 | 59.5 | Â |
| 4.0 | 400 | 58.0 | Â |
| 3.9 | 390 | 56.5 | Â |
| 3.8 | 380 | 55.0 | Â |
| 3.7 | 370 | 53.5 | Â |
| 3.6 | 360 | 52.0 | Â |
| 3.5 | 350 | 51.0 | Â |
| 3.4 | 340 | 49.5 | Â |
| 3.3 | 330 | 48.0 | Â |
| 3.2 | 320 | 46.5 | Â |
| 3.1 | 310 | 45.0 | Â |

| | | | |
|---|---|---|---|
| 3.0 | 300 | 43.5 | Â |
| 2.9 | 290 | 42.0 | Â |
| 2.8 | 280 | 40.5 | Â |
| 2.7 | 270 | 39.0 | Â |
| 2.6 | 260 | 37.5 | Â |
| 2.5 | 250 | 36.5 | Â |
| 2.4 | 240 | 35.0 | Â |
| 2.3 | 230 | 33.5 | Â |
| 2.2 | 220 | 32.0 | Â |
| 2.1 | 210 | 30.5 | Â |
| 2.0 | 200 | 29.0 | Â |
| 1.9 | 190 | 27.5 | Â |
| 1.8 | 180 | 26.0 | Â |
| 1.7 | 170 | 24.5 | Â |
| 1.6 | 160 | 23.0 | Â |
| 1.5 | 150 | 22.0 | Â |
| 1.4 | 140 | 20.5 | Â |
| 1.3 | 130 | 19.0 | Â |
| 1.2 | 120 | 17.5 | 35.90 |
| 1.1 | 110 | 16.0 | 32.91 |
| 1.0 | 100 | 14.5 | 29.92 |
| 0.9 | 90 | 13.0 | 26.93 |
| 0.8 | 80 | 11.5 | 23.94 |
| 0.7 | 70 | 10.0 | 20.94 |
| 0.6 | 60 | 9.0 | 17.95 |
| 0.5 | 50 | 7.5 | 14.96 |
| 0.4 | 40 | 6.0 | 11.97 |
| 0.3 | 30 | 4.5 | 8.98 |
| 0.2 | 20 | 3.0 | 5.98 |
| 0.1 | 10 | 1.5 | 2.99 |
| 0.0 | 0 | 0.0 | 0.0 |

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Article GUID: A00234319

# ENGINE DIAGNOSIS

## ENGINE DIAGNOSIS

When attempting to diagnose driveability complaints, always consider the basics. Regardless of the level of technology employed on an engine, it still needs a few basic things to occur in order to run properly. Whether the engine is very basic or uses so-called "New Generation" technology always refer to the basic principles first.

Any engine using four-cycle spark-ignition principles must meet the same fundamental conditions to run properly. Most engine related driveability problems fall into a few basic categories:

- No Start/No Crank
- Extending cranking before engine start
- Rough Running Cold Idle
- Rough Running Warm Idle
- Rough Running Under Load
- Lack of Power
- Check Engine Light (MIL)




Fig. 1: Sectional View Of Engine
Courtesy of BMW OF NORTH AMERICA, INC.

When referring to engine basics, all engines need fuel, air and spark to run. However, in order for a spark-ignition engine to run properly, a few things must be taken into consideration. The fuel, air, spark principle can be broken down further into the following categories:

- Sufficient engine compression with a leak-free combustion chamber.
- Sufficient amount of ignition voltage (spark) at the correct time.
- Proper fuel pressure and volume.
- Properly functioning fuel injection system (Engine management).
- Properly functioning air management system (Electronic throttle systems).
- Correct valve timing (VVT and VANOS).

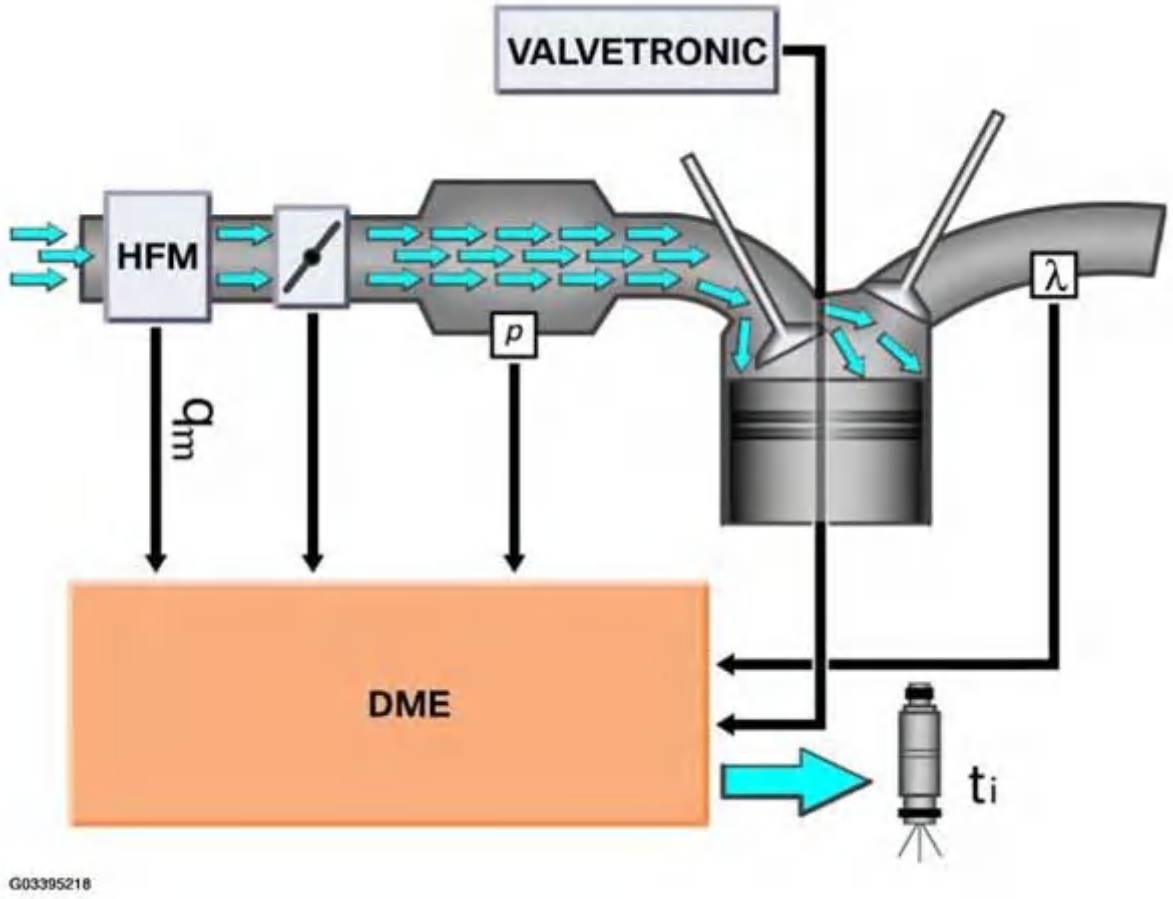



Fig. 2: Operation Of Valvetronic
Courtesy of BMW OF NORTH AMERICA, INC.

## Compression Testing

In order for an engine to run smoothly and efficiently, the combustion chamber must be free of leakage. An engine with low compression in one or more cylinders is inefficient and will run rough or lack in performance. Low compression may or may not cause the MIL to illuminate.

Low compression can be caused by the following:

- Leaking valves caused by burned valves or seats. The valve guide can also be worn causing the valve not to seat properly. Valves can also be bent from piston contact (from over-rev).
- Piston Rings which can be worn from high mileage or poor maintenance. Also, the rings can be damaged from foreign material or improper installation.
- Cracks in cylinder head or engine block. Cracks can be caused by overheating resulting in misfires or rough running.
- Defective cylinder head gasket. The cylinder head gasket can fail due to overheating which can cause cylinder leakage resulting in misfire, low compression and rough running.
- Bent connecting rod. A connecting rod can be bent from a defective fuel injector or water ingress into the combustion chamber causing hydrostatic lock.

Compression testing can be performed using a conventional compression gauge. There are some preliminary tasks and safety precautions that must be carried out before starting the compression test:

- Remove the fuel pump fuse and or relay, start the vehicle and allow vehicle to stall out on residual fuel
- Disable ignition by unplugging all ignition coils and remove ALL sparkplugs.
- Connect battery charger to vehicle

- Ensure that the throttle is wide open during cranking
- Crank engine until compression gauge stops increasing. Be sure to crank engine equally between cylinders.
- Continue compression test on ALL cylinders so comparisons can be done. Record readings.
- If necessary, re-check cylinders with suspect readings.
- If some cylinder readings come up low, add a few drops of oil and re-check. This can differentiate between valves/rings.

### Cylinder Leakage Testing

Once a problem cylinder is detected via a compression test or by other means, a cylinder leakage test is used to pinpoint the problem area.

The leakage test uses a gauge and compressed air to indicate the percentage of air loss. By listening and observing at key points, the problem can be narrowed down before the engine needs to be disassembled.

The piston (one or more) should be brought to TDC, compressed air should be introduced into the cylinder using the cylinder leakage tester. Be sure the engine does NOT rotate, if the engine rotates, the engine was not at true TDC.

Check the gauge on the tester, it should read in percentage of leakage. Check the engine specification for permissible leakdown. A general rule of thumb is 15 % or less for a good cylinder. However, some engine have a tighter tolerance. Most BMW engines should be at 8 % or less.

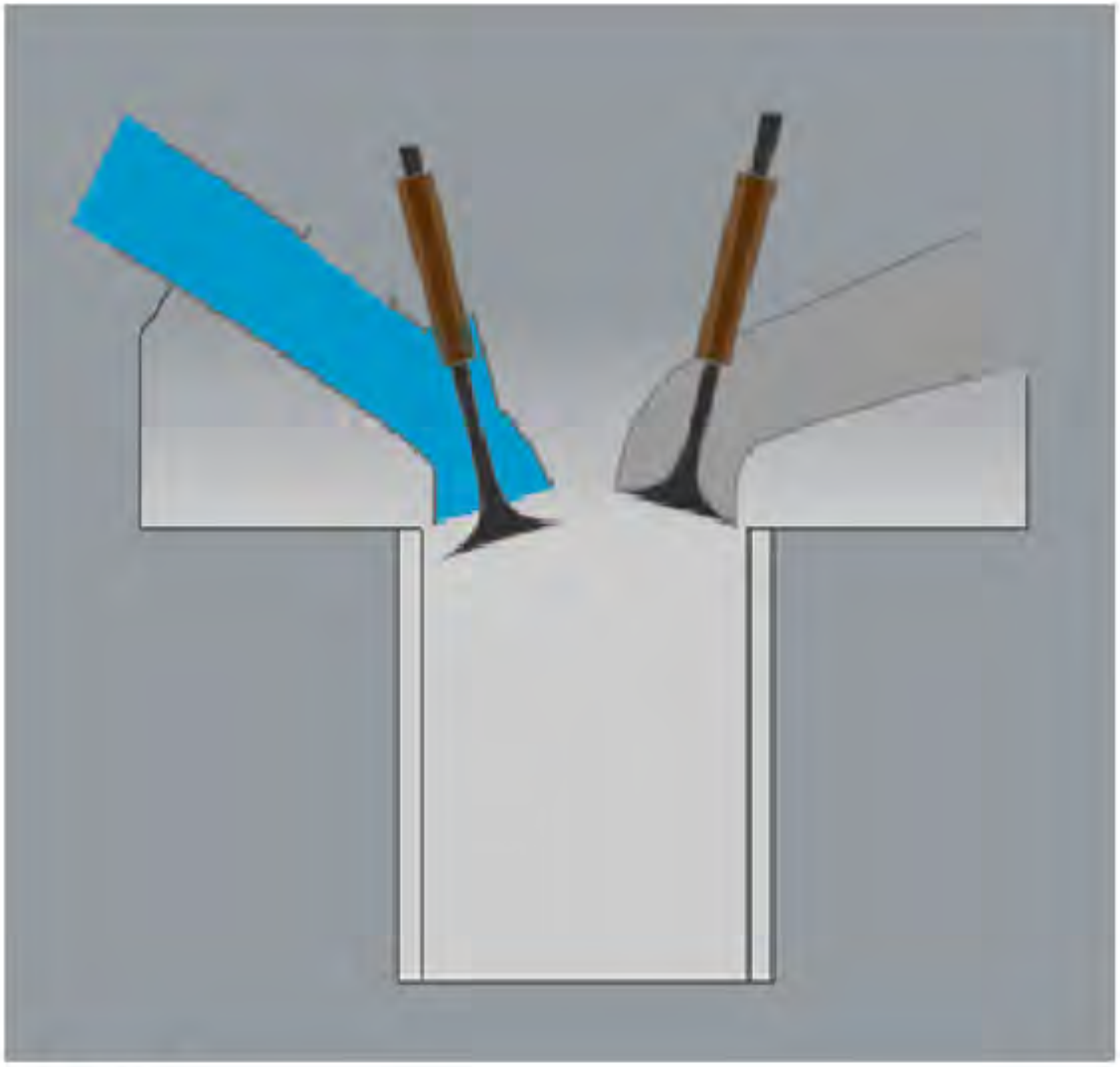



Fig. 3: Testing Cylinder Leakage
Courtesy of BMW OF NORTH AMERICA, INC.

If any cylinder shows excessive leakdown, check for leakage by listening or observing the following points:

- Listen for air (hissing) at the tailpipe. This would indicate leakage at the exhaust valves on that cylinder.
- Listen for air (hissing) at the throttle. This would indicate leakage at the intake valves on that cylinder. (Be sure throttle is wide open and listen at throttle opening)
- Open the oil cap and listen for air. This would indicate air leakage into the crankcase. This would be piston rings or cylinder bore concerns.
- Observe the coolant reservoir and or remove the radiator cap. Bubbles in the coolant would most likely indicate head gasket leakage or cracked block/head.

### Workshop Hints on Cylinder Leakage Testing

When performing cylinder leakage tests, the following tips might be helpful:

Remove all spark plugs to allow easier rotation of the engine. (If this test is done after a compression test, the plugs should already be out).

- Perform the leakage test on all cylinders, not just the problem cylinder. This would indicate any other

problems which can be rectified. This eliminates any repeat repairs and wasted diagnostic time.

- Perform the leakage test in cylinder firing order starting with cylinder #1. It takes two revolutions of the engine to complete the leakage test. Start at cylinder #1 and rotate the engine to the next cylinder in the firing order. Divide the number of cylinders into 720, the result is the number of degrees that each cylinder fires. For example, if you divide a 6 cylinder into 720, this equals 120 degrees. If you start at cylinder 1 and rotate the engine 120 degrees in the direction of rotation, you can check the next cylinder in the firing order. This process eliminates the need to rotate the engine an excessive amount.

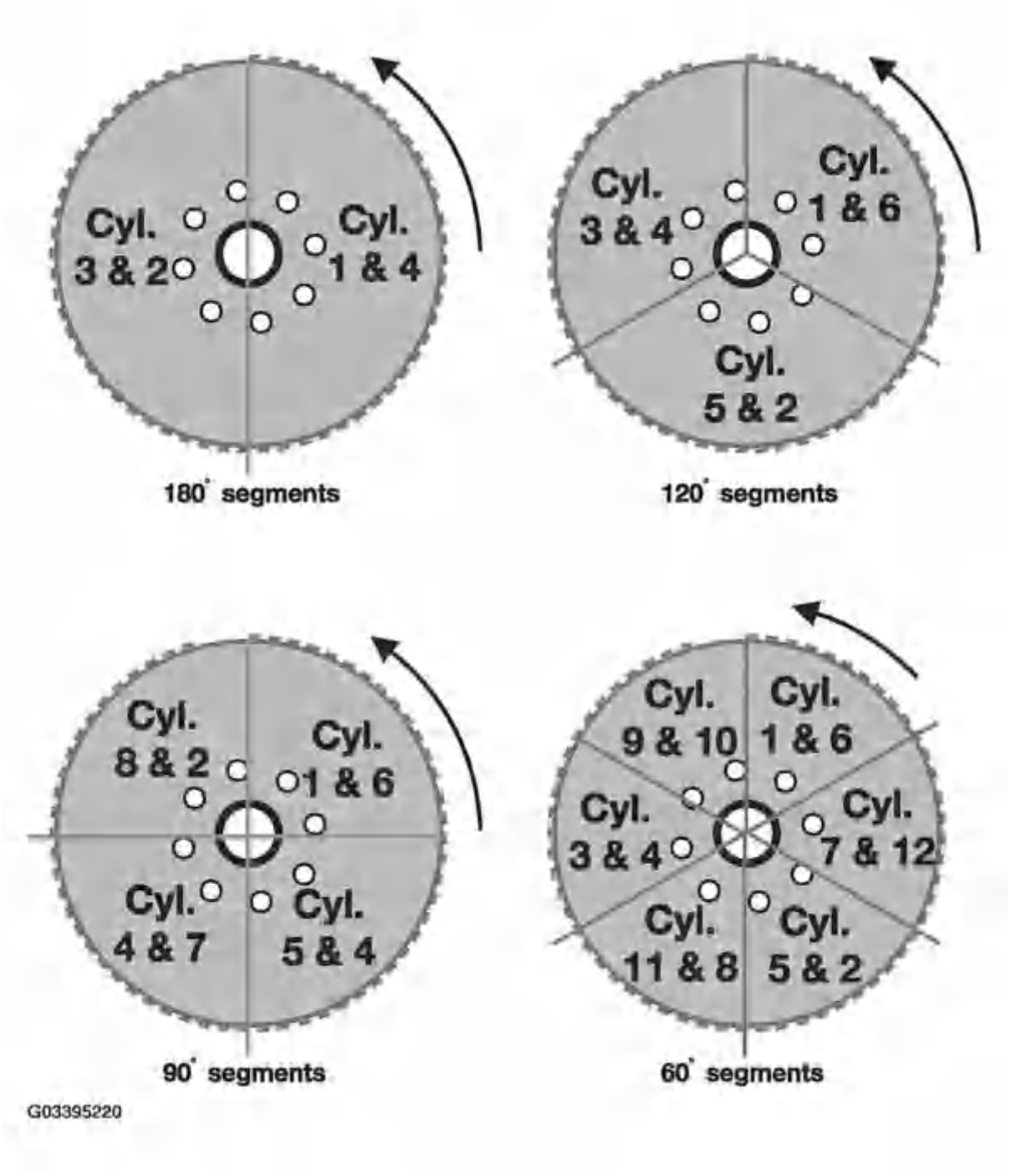



Fig. 4: Cylinder Leakage Testing Tips
Courtesy of BMW OF NORTH AMERICA, INC.

## Cylinder Arrangement And Firing Order

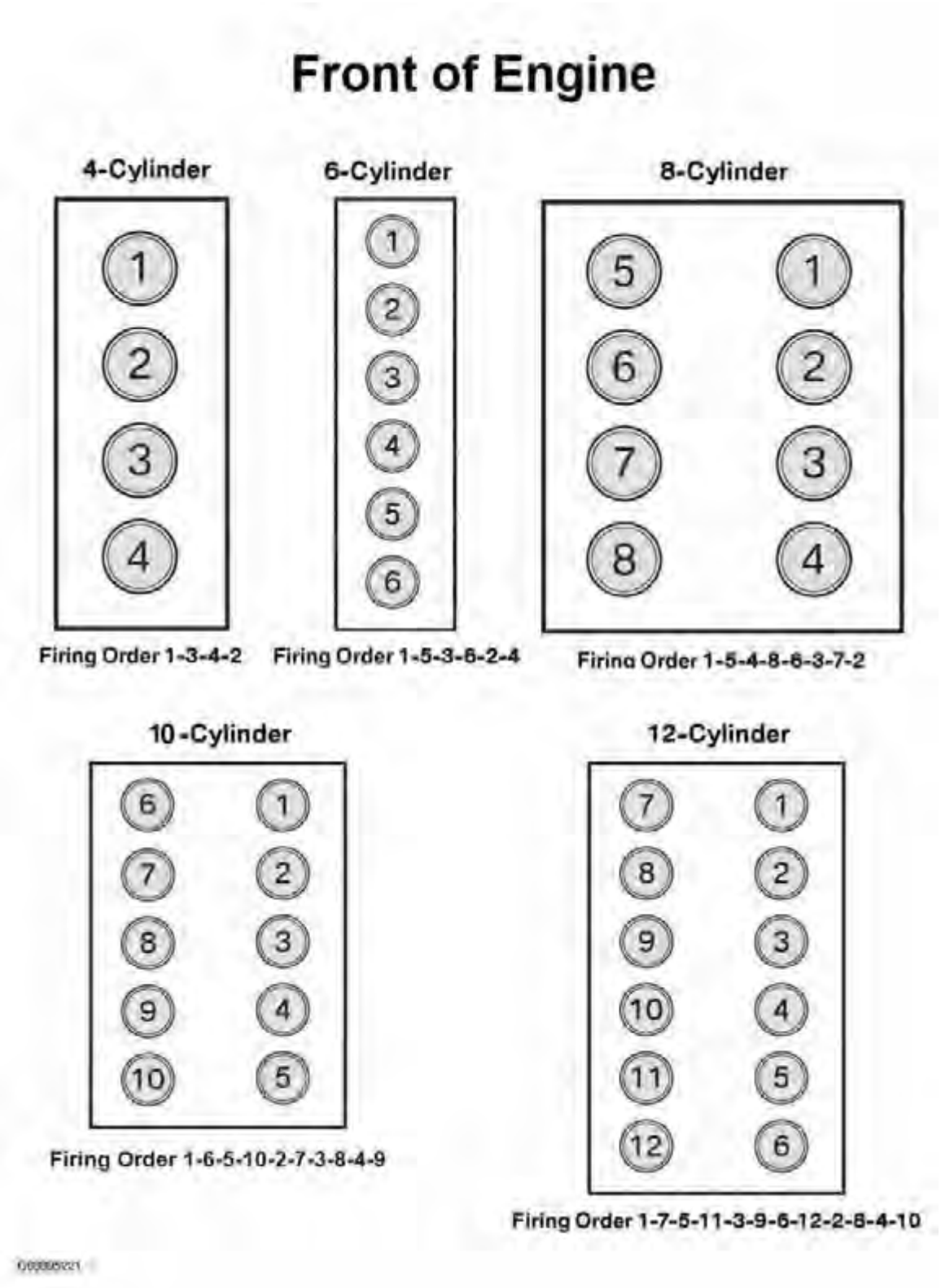



Fig. 5: Identifying Firing Order
Courtesy of BMW OF NORTH AMERICA, INC.

### Ignition System Diagnosis

The ignition system on modern BMW engines consist of one ignition coil per cylinder. This arrangement is known as RZV, or Direct Stationary Ignition. The ignition coil receives fused power usually from the DME main relay or IVM (N62).

The ignition coil primary circuit is controlled (triggered) by the engine control module (ECM). The ECM controls dwell and ignition timing on all cylinders individually. Electrical circuit faults on the primary circuit are recorded in the ECM and can be read out using the DISplus or GT-1.

Most new engines use the "pencil" type coil. This design houses the coil windings for the primary and secondary circuit as well as the spark plug boot which includes the secondary circuit resistance.



Fig. 6: Identifying Pencil Coil
Courtesy of BMW OF NORTH AMERICA, INC.

Due to the compact design of the ignition coil, much of the diagnosis is simplified. Misfire faults and/or ignition related faults can be easily diagnosed by swapping the coils between cylinders. If the fault moves with the coil, then it is obvious that the coil is at fault. If the fault stays in the cylinder, then the spark plug can be moved etc.

This greatly simplifies engine diagnosis. However sometimes, the diagnosis is not always as simple as swapping parts.

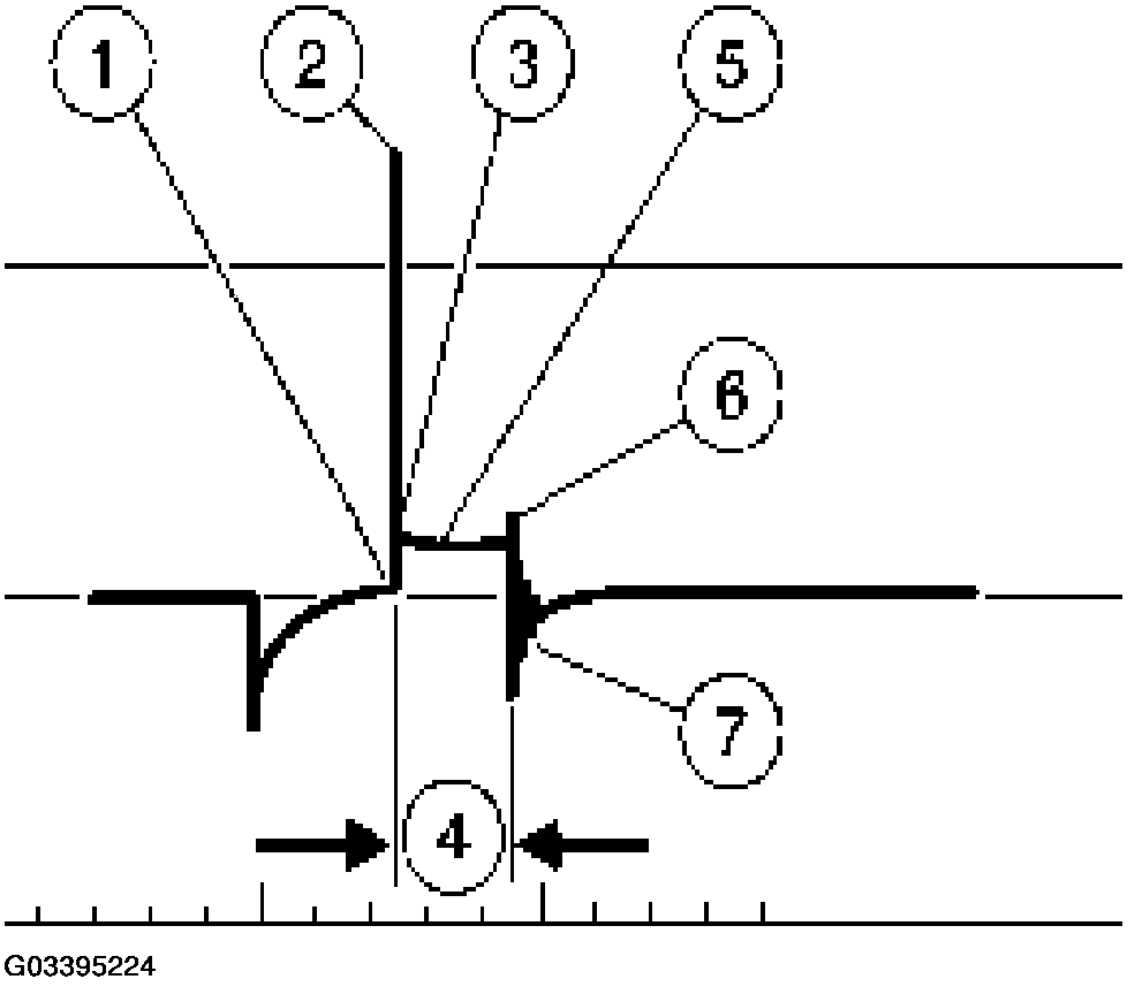



Fig. 7: Ignition Diagnosis Cyclic Diagram
Courtesy of BMW OF NORTH AMERICA, INC.

This is where the oscilloscope function of the DISplus/GT-1 can aid in diagnosis. A good knowledge of fundamental ignition diagnosis can be helpful. The illustration above is broken down as follows.

1. This point represent the start of the ignition process, also known as "transistor off". The ECM turns off the primary circuit causing the magnetic field to collapse. This begins the production of the secondary voltage needed to fire the spark plug.
2. The is called the firing line as it represents the voltage needed to overcome the secondary resistance and cross the spark plug electrode gap. This voltage level will increase as secondary circuit resistance increases. Also lean mixture will cause this line to increase as well. On RZV ignition systems, this line should be around 3-5kV.
3. This line indicates the start of the combustion process. This is also referred to as the spark line. The line should start relatively level and should be about 1/3 to 1/2 of the height of the firing line. Also, there should be no rapid upward or downward slope.
4. This period of time represented here is the combustion period. This area indicates the integrity of the combustion event. Problems such as low compression, lean or rich mixture problem would be indicated here.
5. This line represent the voltage present during the combustion period. This line should be mostly level. Upward or downward sloping can indicate mixture or engine compression problems.
6. This point represents the end of the combustion process. Combustion has ended and the remaining voltage available is the coil will start to dissipate.
7. This is known as the coil or decay oscillation period. Any excess voltage not used in the combustion process will "decay" and dissipate. The number and pattern of the oscillations is dependent on the coil type. Different types of coils and different coil manufacturers will be a factor on this pattern. Anywhere from 2 to 6 oscillations may be seen here. If no oscillations are present, this would indicate ignition coil internal problems.

Most newer engine use a "multiple spark" discharge when the ignition coil is triggered. This is to aid in startup. When diagnosing these ignition systems, the additional peaks do not need to be factored into your diagnosis.

Referring to the illustration below, the relevant portion of the scope pattern is at point 1.

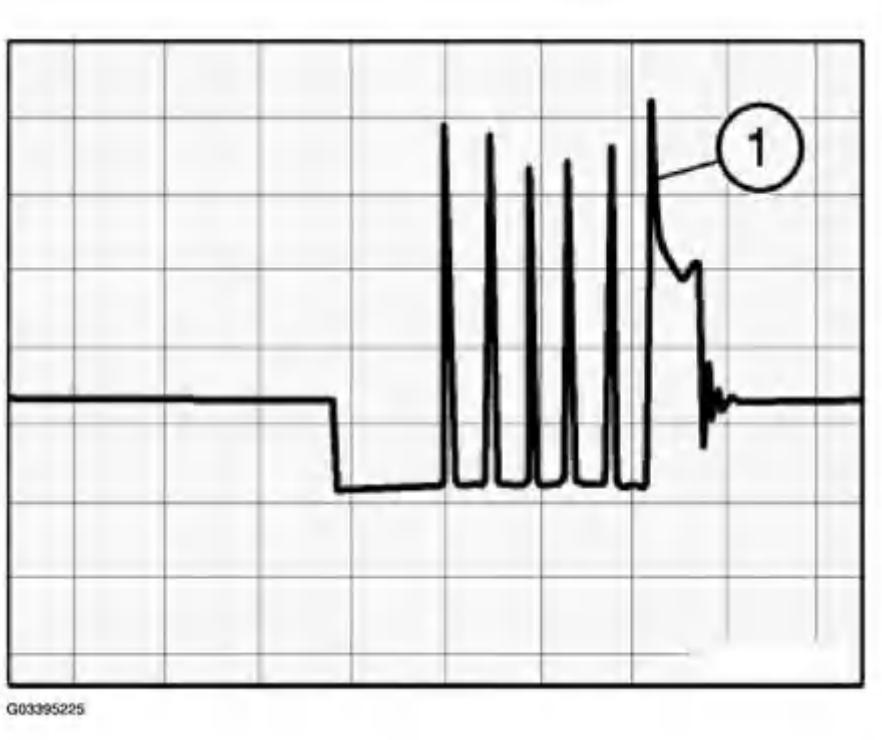



Fig. 8: Identifying Scope Pattern
Courtesy of BMW OF NORTH AMERICA, INC.

Fuel systems need to be checked for proper fuel pressure as well as sufficient volume. When diagnosing fuel system complaints, you must take into account the type of fuel system and how the fuel is delivered to the engine.

Malfunctions in the fuel system can cause driveability complaints which include:

- No start condition
- Hard start/extended cranking time
- Lack of power
- Check Engine (MIL) Light along with mixture related faults
- Excessive exhaust emissions (High CO and/or HC)

When a no start condition is experienced, it is important to start with the basics. Does the vehicle have any fuel in the tank? Don't assume that there is fuel, the fuel gauge or sender circuit may be faulty. Also, the siphon jet system may be defective. Check the fuel level using the instrument cluster test steps if necessary. Check to be sure that there is fuel available on the right side of the fuel tank.

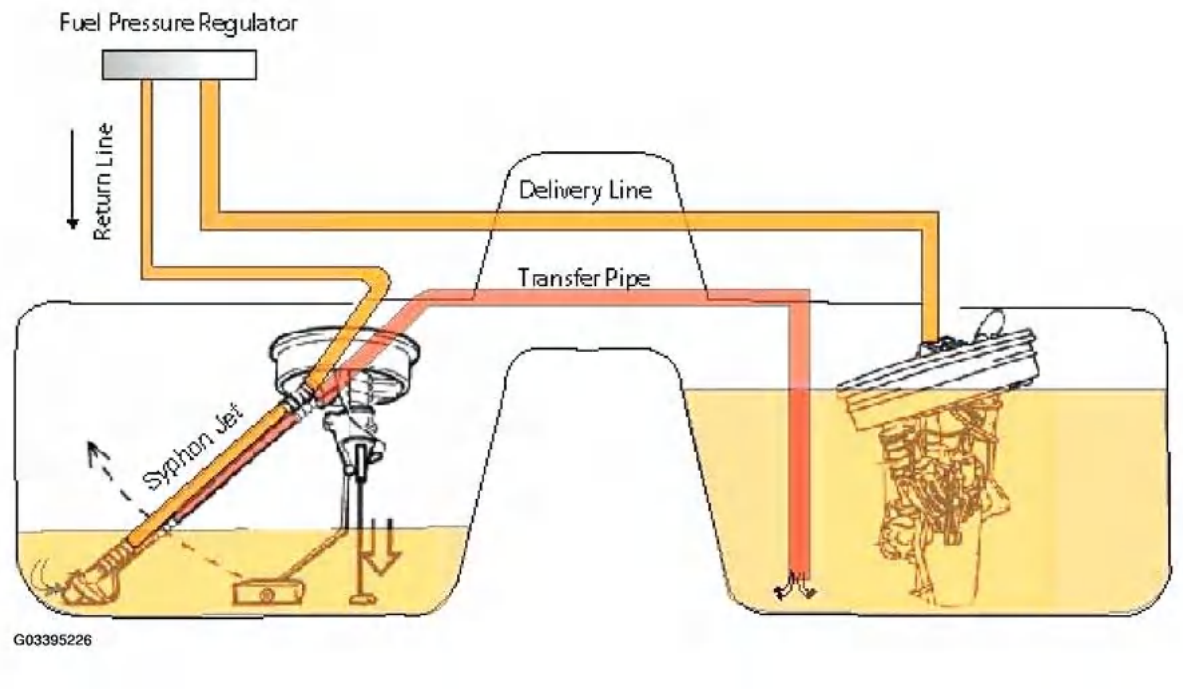



Fig. 9: Checking Fuel System
Courtesy of BMW OF NORTH AMERICA, INC.

Once is has been determined the there is fuel in the tank. The fuel system can be tested for proper pressure. Fuel pressure specifications vary between vehicles. Until recently, most fuel systems used a pressure of 3.5 bar. Some of the new systems use up to 5 or 6 bar. Direct injection systems use 6 bar for the fuel supply system and up to 120 bar pressure to the fuel injectors.

The fuel supply system should be tested using the appropriate fuel pressure gauge. Depending upon the vehicle, the testing methods and connections for the fuel pressure testing equipment differ.

Some vehicles have testing ports with a Schrader valve for easy hookup. Earlier vehicles did not have a test port. Testing fuel pressure required the use of a "T" connector to connect into the fuel system.

Most recently, M56 equipped (SULEV) vehicles have a sealed fuel system which require the use of a special tool.

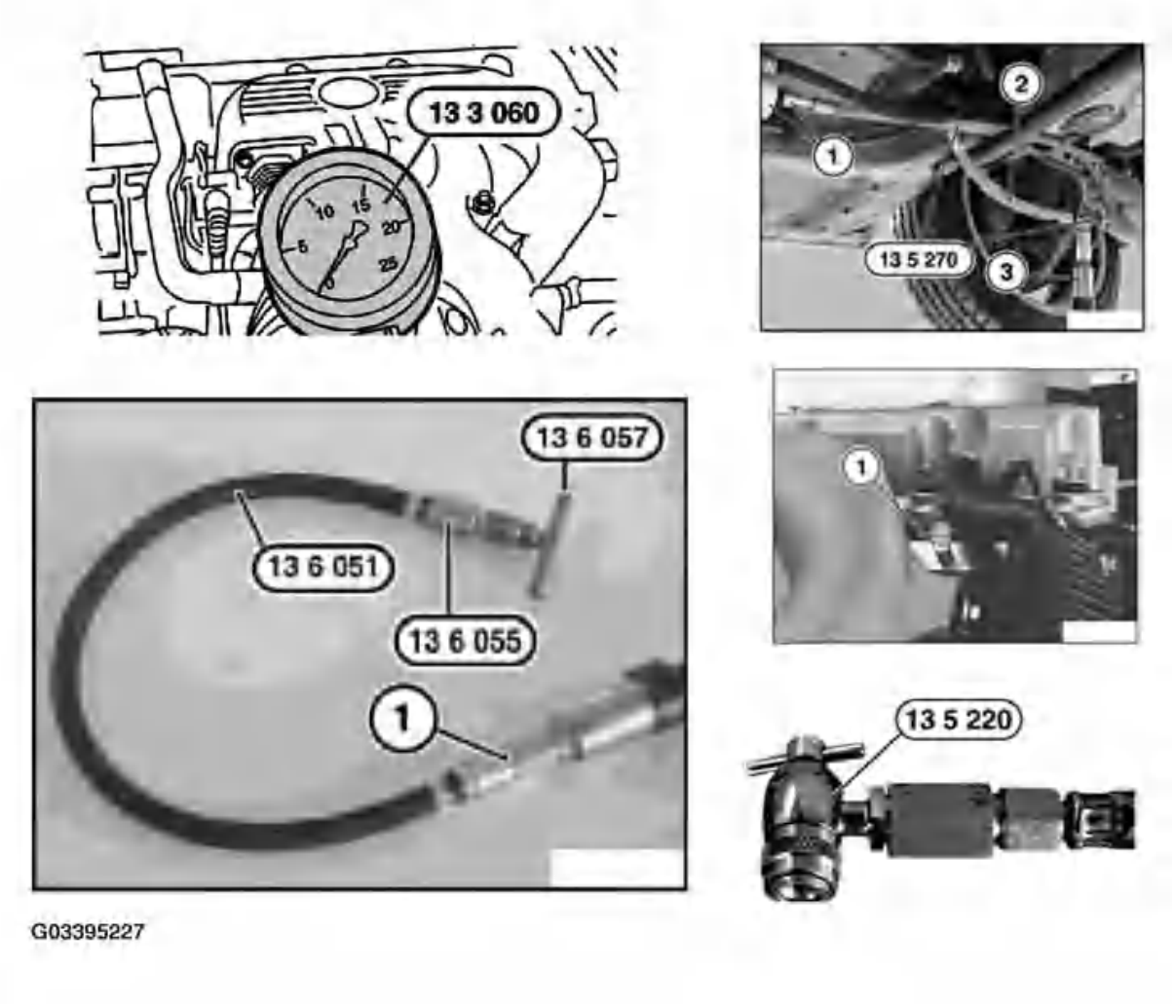



Fig. 10: Identifying "T" Connector
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Always observe all safety regulations when working on fuel systems. Obey all local and state fire safety laws regarding fuel handling. Always have the proper fire extinguisher on hand when performing testing and/or repair to the fuel system.

Once it has been determined that what the fuel pressure is, compare your reading to the proper specification. If the fuel pressure is low or zero, the fuel circuit must be checked over.

See if the fuel pump is energized. Check the voltage supply and ground to the fuel pump using proper electrical testing procedures (i.e voltage drop etc.). Make sure that you analyze the fuel pump circuit. Check the fuses, connections and appropriate relays.

Also, understand the operation of the fuel pump circuit. Older vehicles were somewhat straightforward, on the other hand, the newer vehicles are using more elaborate circuits for fuel pump operation.

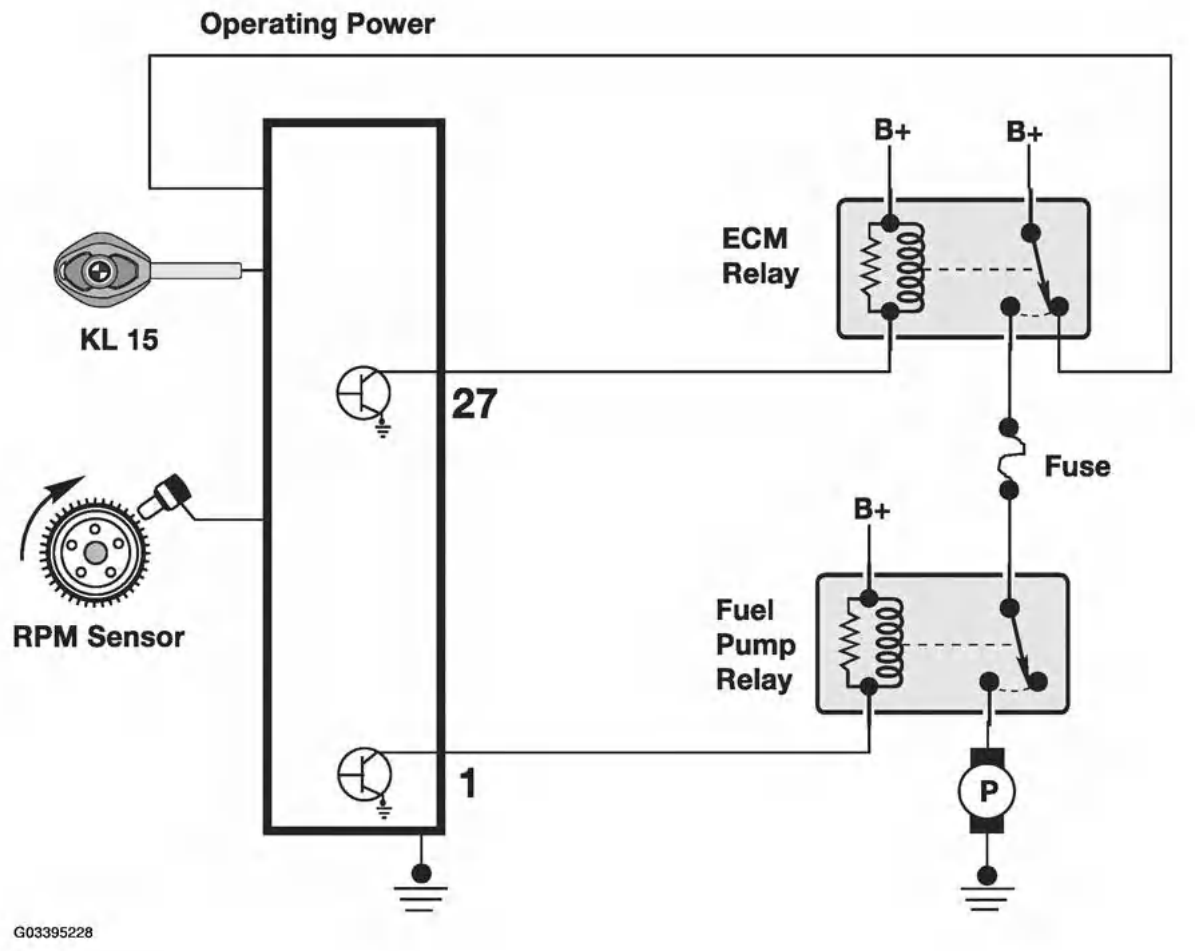



Fig. 11: Operating Power Circuit Diagram
Courtesy of BMW OF NORTH AMERICA, INC.

Some vehicles, now use a control module to control the speed and flow rate of the fuel pump. The M3, M5 and vehicles equipped with the M56 engine use a fuel pump control module. The E65/E66 uses the SBSR to control the fuel pump. Take this into consideration when performing diagnosis on these vehicles.

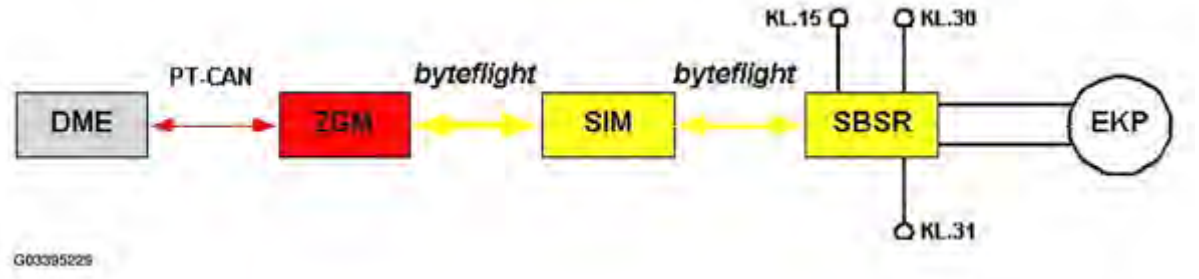



Fig. 12: Fuel Pump Control Module Diagram
Courtesy of BMW OF NORTH AMERICA, INC.

Always use available resources such as wiring diagrams, SI Bulletins and training material to better understand circuit operation.

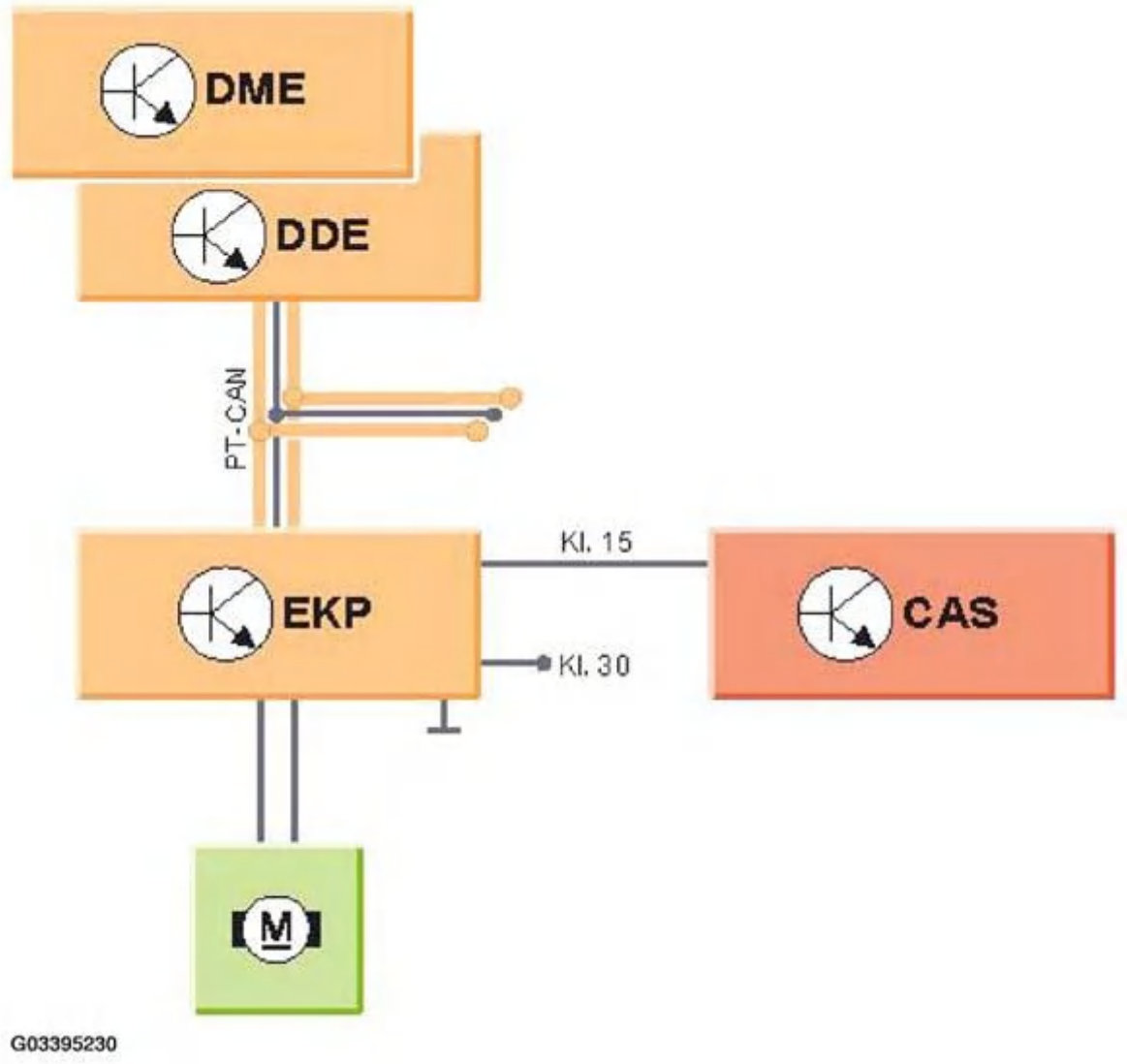



Fig. 13: Fuel System Circuit Diagram
Courtesy of BMW OF NORTH AMERICA, INC.

### Fuel Volume Testing

Some driveability concerns are related to incorrect fuel volume. Vehicles with lack of power complaints and mixture related fault codes may have insufficient fuel volume supplied to the fuel injection system. These vehicles may actually pass a fuel pressure test.

Fuel volume issues can be caused by faulty fuel pumps, fuel pressure regulators, clogged or restricted fuel filters and/or fuel lines.

If these driveability concerns are present, then a fuel volume test should be performed. A fuel volume test measures the amount of fuel delivered in a specific time frame.

The fuel pump is activated during this test using the proper test leads to ensure no arcing sparks are present. The fuel feed line is directed to a non-breakable (fuel-proof plastic) measuring can that has graduations for measurement.

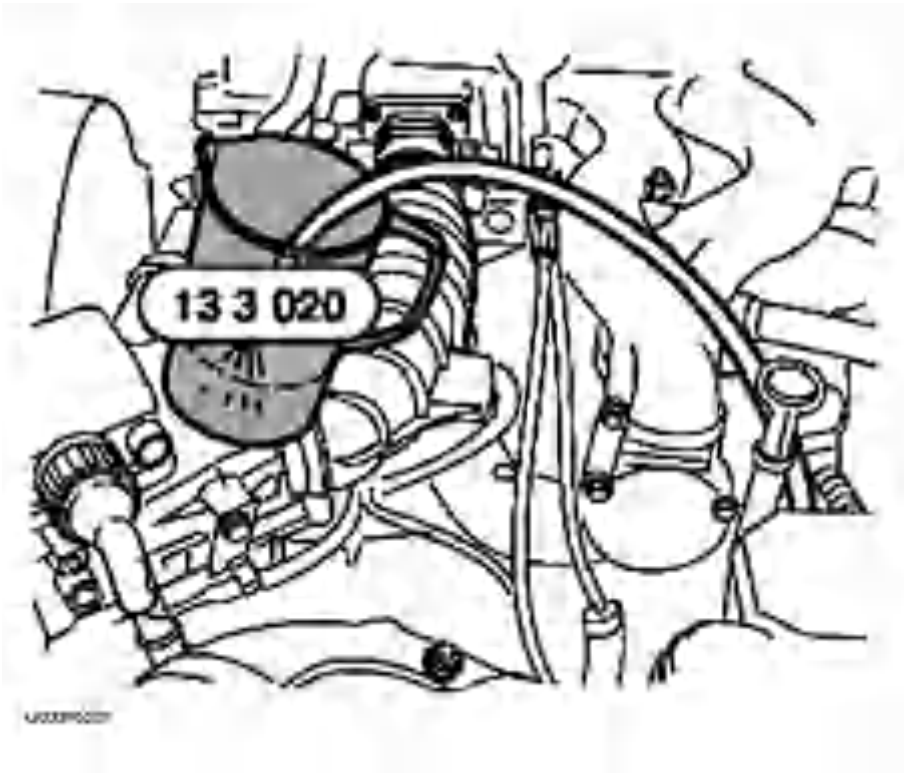



Fig. 14: Checking Fuel Volume Using Measuring Can
Courtesy of BMW OF NORTH AMERICA, INC.

A general specification for fuel volume would be approximately one liter in 30 seconds.

### Residual Pressure

Fuel injection systems require a residual pressure to present after the engine is switched off. This allows the engine to start immediately after the vehicle has been parked.

If the residual fuel pressure diminishes after the vehicle has been shut off. Upon restart, there will be an extended cranking period before engine start. This is due to the fuel pump attempting to supply enough fuel for startup.

When the fuel system is at rest, there a three components which allow the fuel system to retain sufficient residual pressure. These items are, the fuel pump check valve, the fuel pressure regulator and the fuel injectors.

### Fuel System - E32 with M60

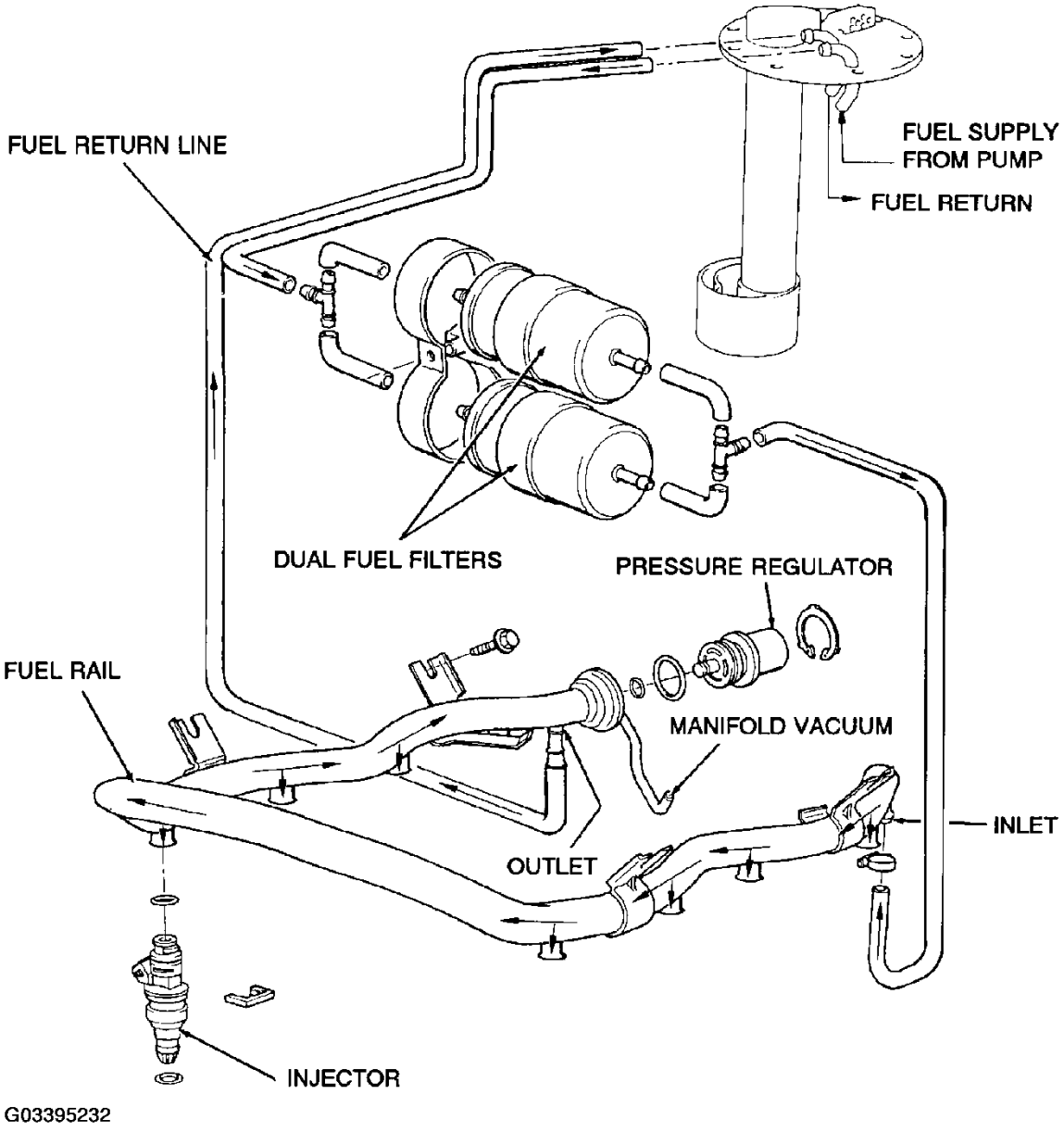



Fig. 15: Identifying Fuel System - E32 With M60 Components
Courtesy of BMW OF NORTH AMERICA, INC.

If any of these items are leaking and fail to hold pressure in the fuel rail, the vehicle will be difficult to start. The cranking time will be excessive and possibly not start at all. For example, If the fuel injectors are leaking, the vehicle will exhibit black smoke on startup.

Diagnosis of these concerns requires a fuel pressure gauge. The residual pressure is monitored on the fuel pressure gauge when the engine is shutoff. Diagnosis is determined by watching the drop in fuel pressure over time. The fuel pressure should not drop more than .5 bar in 30 minutes. If the pressure drops more than .5 bar, the concern should be investigated.

Fuel System - E39/E46 with M54

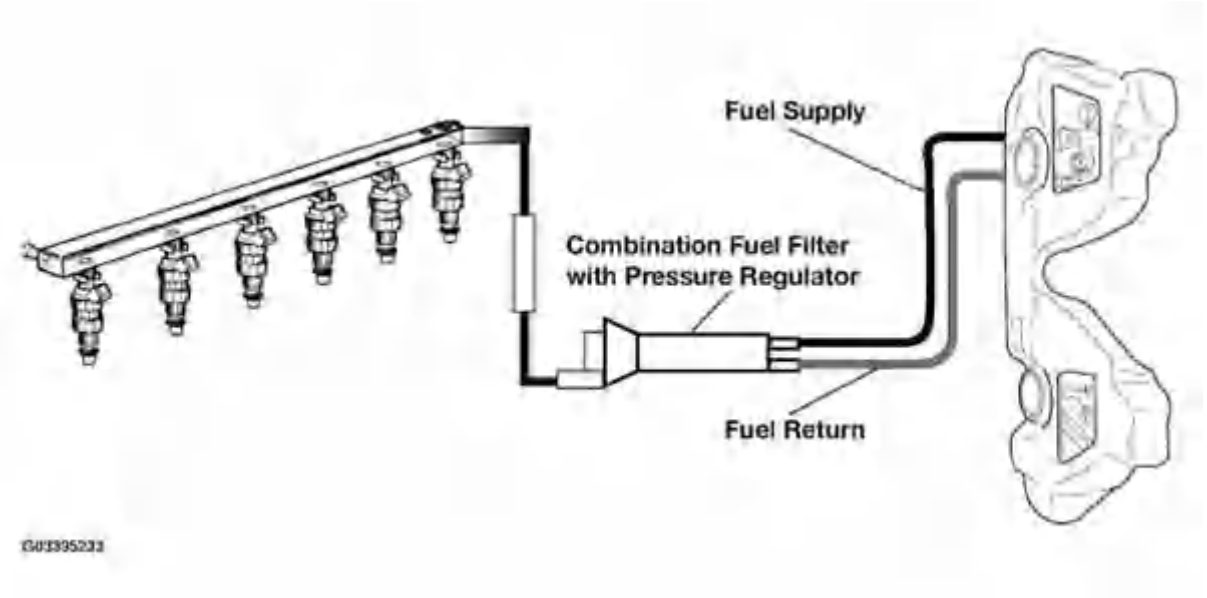
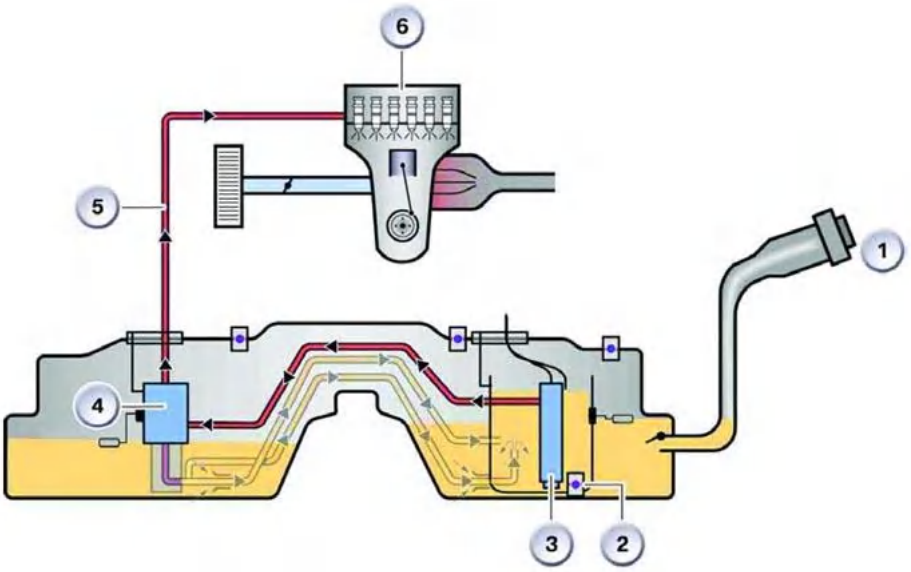



Fig. 16: Identifying Fuel System - E39/E46 With M54 System Diagram
Courtesy of BMW OF NORTH AMERICA, INC.

Depending on the type of fuel system used, diagnosis will vary. On older fuel systems, diagnosis is simplified due to the ability to clamp off certain components to determine, the origin of the leakdown.

Fuel System - E60




| Index | Explanation | Index | Explanation |
|---|---|---|---|
| 1 | Fuel Filler Pipe | 4 | Fuel Filter |
| 2 | Outlet Protection Valve | 5 | Feed Line |
| 3 | Electric Fuel Pump | 6 | Fuel Injectors/Fuel Rail |

G03395234

Fig. 17: Identifying Fuel System - E60 Components
Courtesy of BMW OF NORTH AMERICA, INC.

Newer fuel system use a non-return type fuel system with some components mounted externally. Most recently, many of the new vehicle have most of the fuel system components mounted in the fuel tank. This includes the

fuel pump, fuel filter and fuel pressure regulator. The only fuel system component outside the fuel tank is the fuel feed line, fuel rail and fuel injectors.

This makes the diagnosis of residual pressure concerns more difficult. Diagnosis of this type of system sometimes requires process of elimination.

If one or more of the fuel injectors is suspected as the cause of the loss in residual fuel pressure. They can be tested using a special tool to "bubble test" the injectors.

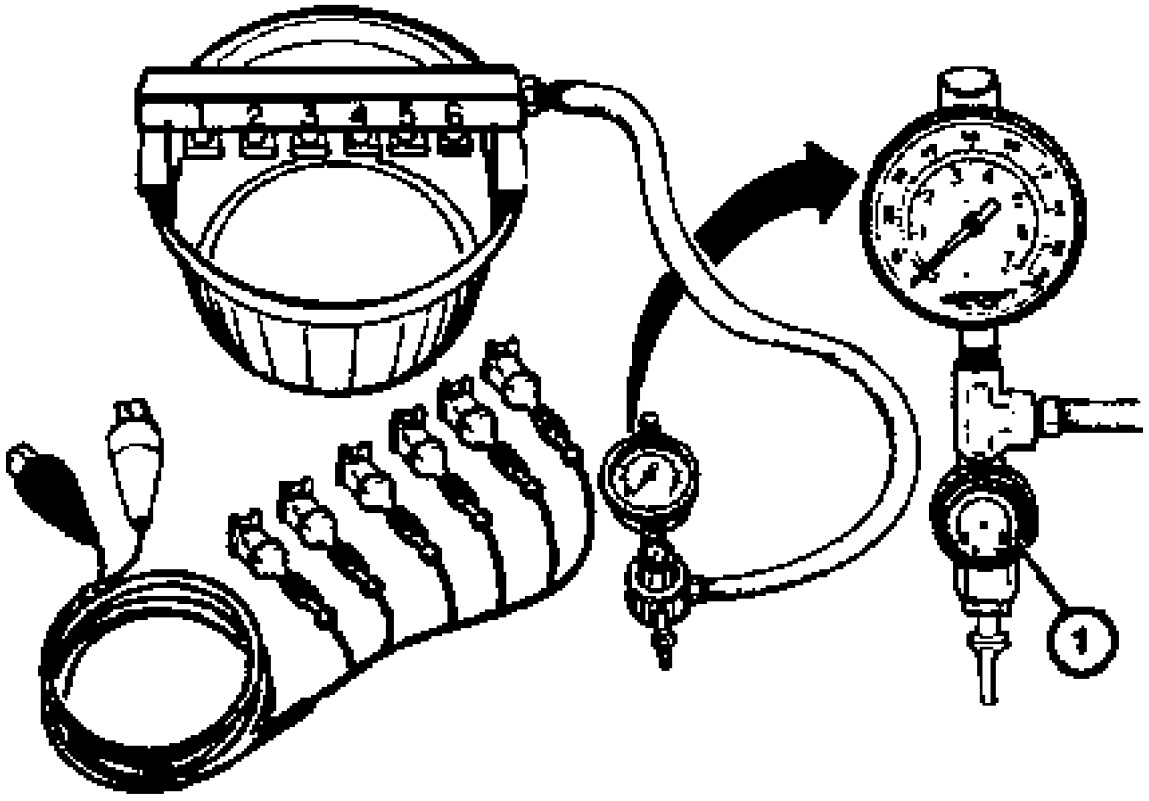



Fig. 18: Testing Bubbles In Injectors Using Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

First the injectors are connected to the test fuel rail supplied with the tool. Then, the fuel injectors are subjected to compressed air. The injectors are then triggered by the test harness to "blow out" any residual fuel.

The test harness is disconnected and the tips of the injectors are immersed in water. The injector tips are observed for any bubbles over time. Any excessive bubbles indicate a defective injector.

### Engine Adaptation Values

Engine adaptation values can be broken down into two categories:

- Additive Mixture Adaptation - additive adaptation refers to "long term fuel trim". These adaptation are made by the ECM (DME) at idle during "closed loop" fuel control. These values are measured in milliseconds and are expressed in negative and positive values.
- Multiplicative Mixture Adaptation - multiplicative adaptation occurs during part load conditions and are performed by the ECM during "closed loop" fuel control. These values are measured in percent and are also expressed as negative and positive values. This is also referred to as "short term fuel trim".

Additive mixture adaptation corrects for variations in idle mixture. The ECM monitors the oxygen sensor signals to evaluate the exhaust mixture. When a lean (or rich) mixture is detected, the ECM increases (or

decreases) the injector "on-time" to correct accordingly.

As long as the fuel trim correction is not excessive, the ECM will not register a fault code. The ECM will correct in increments of +/- .1 ms. When the fuel trim correction exceeds a predetermined threshold value, the check engine light (MIL) will illuminate and store appropriate fault codes for additive mixture adaptation.

Additive values which are excessively positive, would indicate a lean condition. This can be caused by:

- Un-metered air leaks - such as broken vacuum lines or a leaky intake manifold or gasket.
- Faulty crankcase ventilation system - crankcase vent valve stuck open.
- Low fuel pressure - Faulty fuel pressure regulator or fuel pump.
- Faulty HFM - can be sending erroneous load signal information which would cause the ECM to falsely enrich the mixture.

Additive values which are excessively negative, would indicate a rich condition. This can be caused by:

- An air restriction - any restriction to airflow such as a clogged air filter would create a rich fuel mixture. (this may also be indicated by negative multiplication values)
- Faulty crankcase ventilation system - crankcase vent valve stuck closed.
- High fuel pressure - Possible faulty fuel pressure regulator or restricted return line
- Faulty HFM - can be sending erroneous load signal information which would cause the ECM to falsely lean out the mixture.

NOTE: Some newer engine management systems use the term mg/stroke or milligrams per stroke. Treat these values as you would millisecond values.

Multiplicative mixture adaptation corrects for variations in fuel mixture under part load conditions. The ECM monitors the oxygen sensor signals to evaluate the exhaust gas mixture. When a lean (or rich) mixture is detected the ECM adjusts the injector "on-time" accordingly over a "short term" period to adapt for the existing situation.

Multiplicative values are expressed in percent and can be negative or positive. Negative values indicate a rich mixture and positive values indicate a lean mixture. When the Multiplicative values exceed a predetermined threshold value, the check engine light (MIL) will illuminate and store relevant fault codes for Multiplicative adaptation.

When multiplicative values are excessively positive, a lean condition exists. The ECM is attempting to add fuel to maintain the proper fuel mixture (close to lambda value 1). This situation can be caused by a faulty HFM, low fuel volume, restricted fuel filter or faulty fuel pressure regulator.

When the values are negative, the ECM is attempting to lean out (remove fuel) the fuel mixture to compensate for a rich condition. This can be caused by:

- Excessive fuel pressure - from a faulty fuel pressure regulator or restriction in the return line.
- A faulty HFM - the HFM can be sending erroneous load signal information which would cause the ECM to falsely enrich the mixture.
- An Air restriction - any restriction to airflow such as a clogged air filter would create a rich fuel mixture.
- Any system failure which would cause the mixture to be falsely enriched. This could be caused by erroneous signal information from sensors such as the engine coolant temperature sensor or intake air temperature sensor.

### Engine Misfire Diagnosis

Engines which have been produced since 1996 are OBDII complaint. The CARB/OBD regulations require the ECM to be capable of detecting misfires. Also, the ECM must be able to determine if the misfires increase engine emissions and/or are catalyst damaging.

The ECM detects engine misfires by monitoring crankshaft speed. The ECM receives the input from the crankshaft sensor and determines if there is a misfire present by comparing crankshaft speed variations between combustion events on each cylinder.

The crankshaft must rotate 720 degrees (2 rotations) to fire all of the cylinders in an engine regardless of the number of cylinders. Therefore each firing event is spaced apart and occurs at a specific time. By monitoring the crankshaft signal the ECM can determine which cylinder is misfiring and also the severity of the misfire.

Misfires are classified in 2 levels of severity:

- Misfires which increase emission levels - These misfires occur within an interval of 1000 crankshaft revolutions. The ECM counts and adds the detected misfire events for each cylinder. If the sum of all cylinder misfire incidents exceeds the predetermined value, a fault code will be stored and the "MIL" will be illuminated.

  If more than one cylinder is misfiring, all misfiring cylinders will be specified and the individual fault codes will be stored. The "MIL will be illuminated".

- Misfires which are catalyst damaging - These misfires are determined when the sum of the misfiring events occurs within 200 crankshaft revolutions. These misfires are considered catalyst damaging and the "MIL" will be illuminated.

The ECM will take the following measures - the oxygen sensor control will be switched to "open loop", a cylinder selective fault code will be stored for one or more cylinders and the relevant fuel injector(s) will be deactivated.

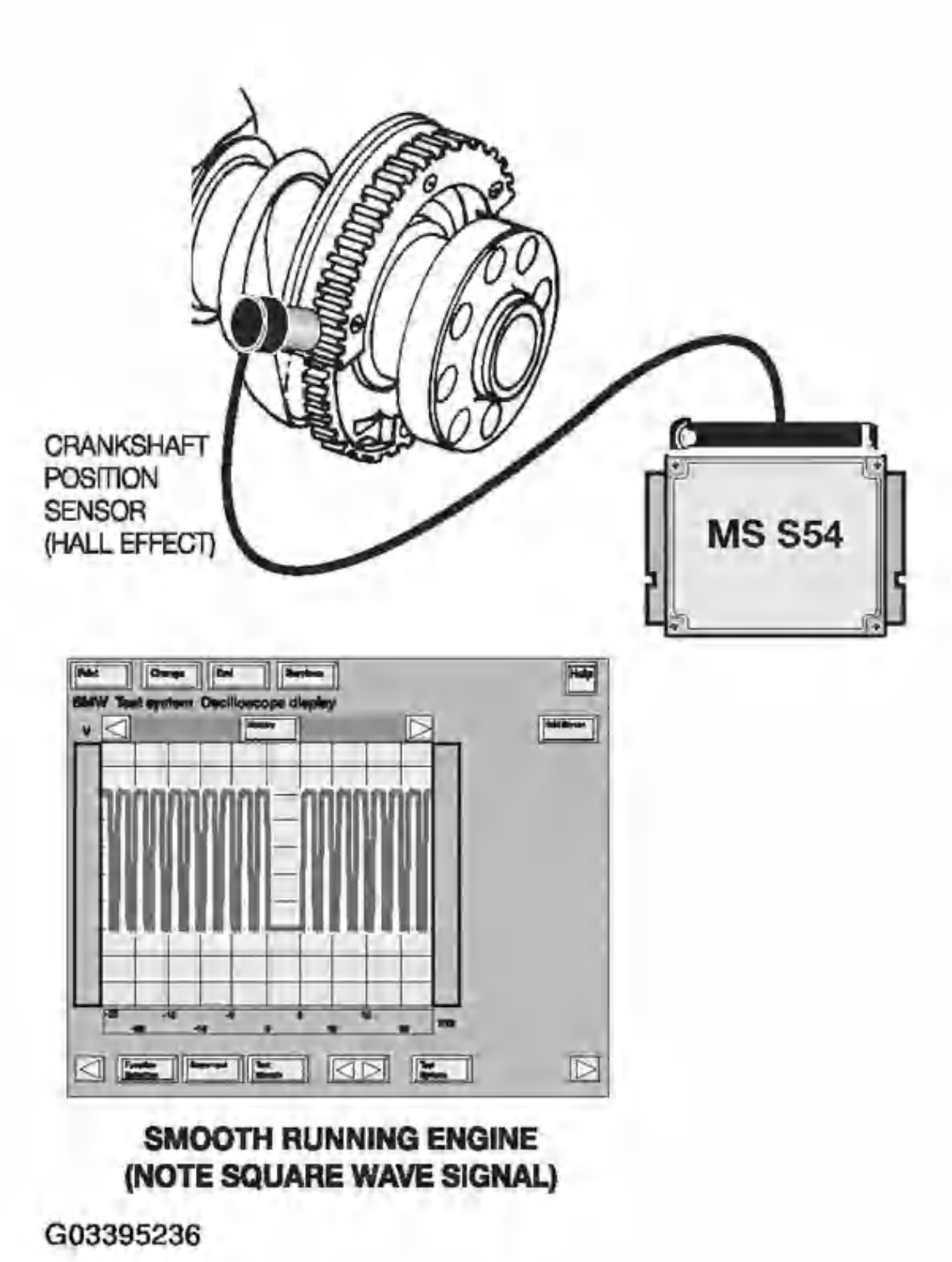



Fig. 19: Identifying Crankshaft Positioning Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

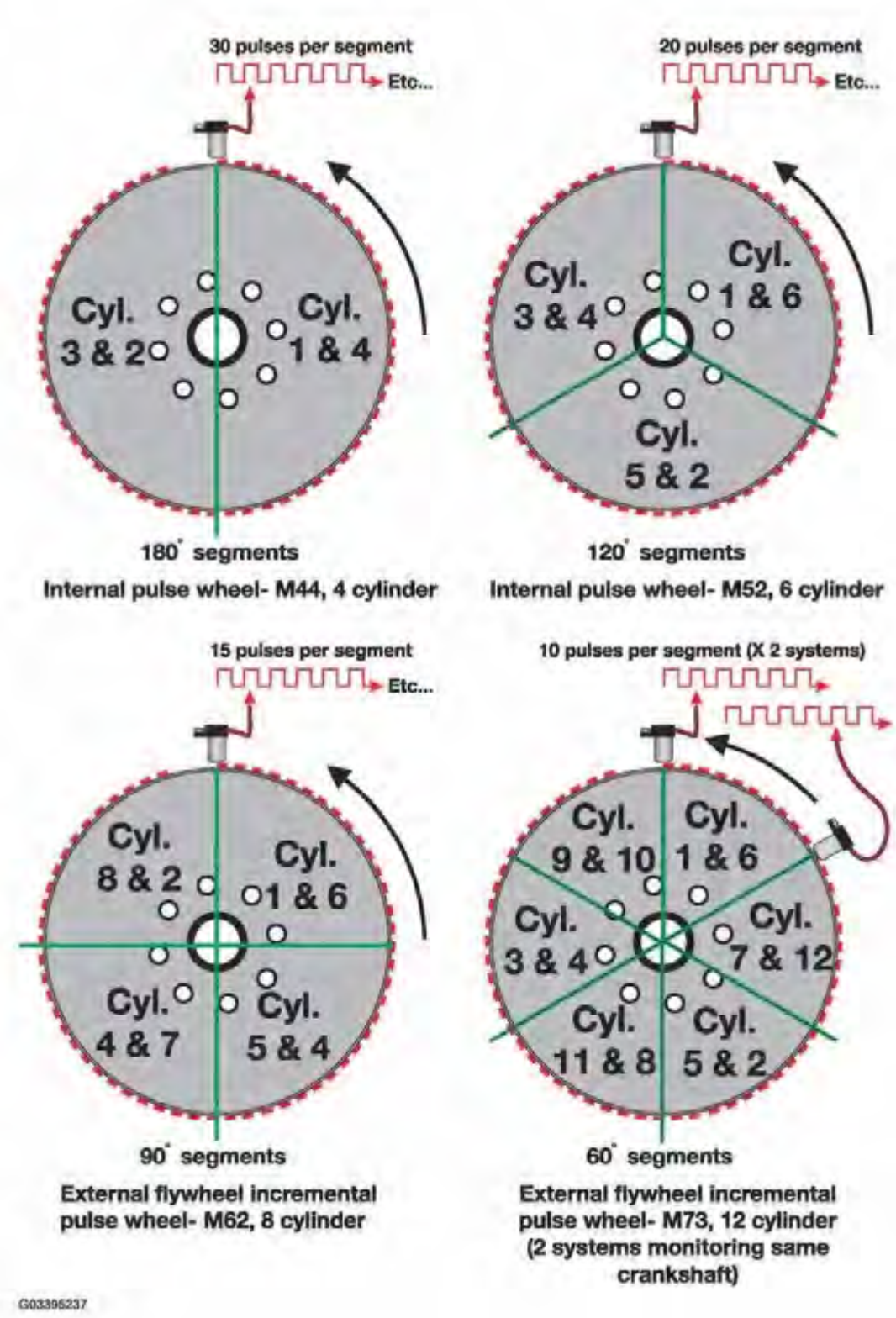



Fig. 20: Displaying Smooth Running Engine Waves
Courtesy of BMW OF NORTH AMERICA, INC.

The causes of engine misfires include:

- Ignition System - spark plugs, ignition coils, secondary circuit components and primary/secondary circuit wiring.
- Engine Mechanical - piston, piston rings, valves, camshaft and any valvetrain related components including Valvetronic. Valvetronic components include eccentric shaft, intermediate levers etc.

  The crankcase ventilation system should also be considered. This includes the crankcase ventilation valve and if applicable, the hose connections as well.

- Fuel System - fuel injectors, fuel pump, fuel filter and pressure regulator etc. This includes fuel quality as well. Other fuel system components include fuel tank vent valve (purge) as well as running losses components such as the 3/2 valve etc.
- Engine Electronics - any implausible input from a sensor such as the crankshaft sensor and camshaft sensor. Also any sensor which affects fuel mixture including HFM, coolant/intake air temperature sensors etc.
- Other items include the catalyst which could be restricted and/or the muffler.

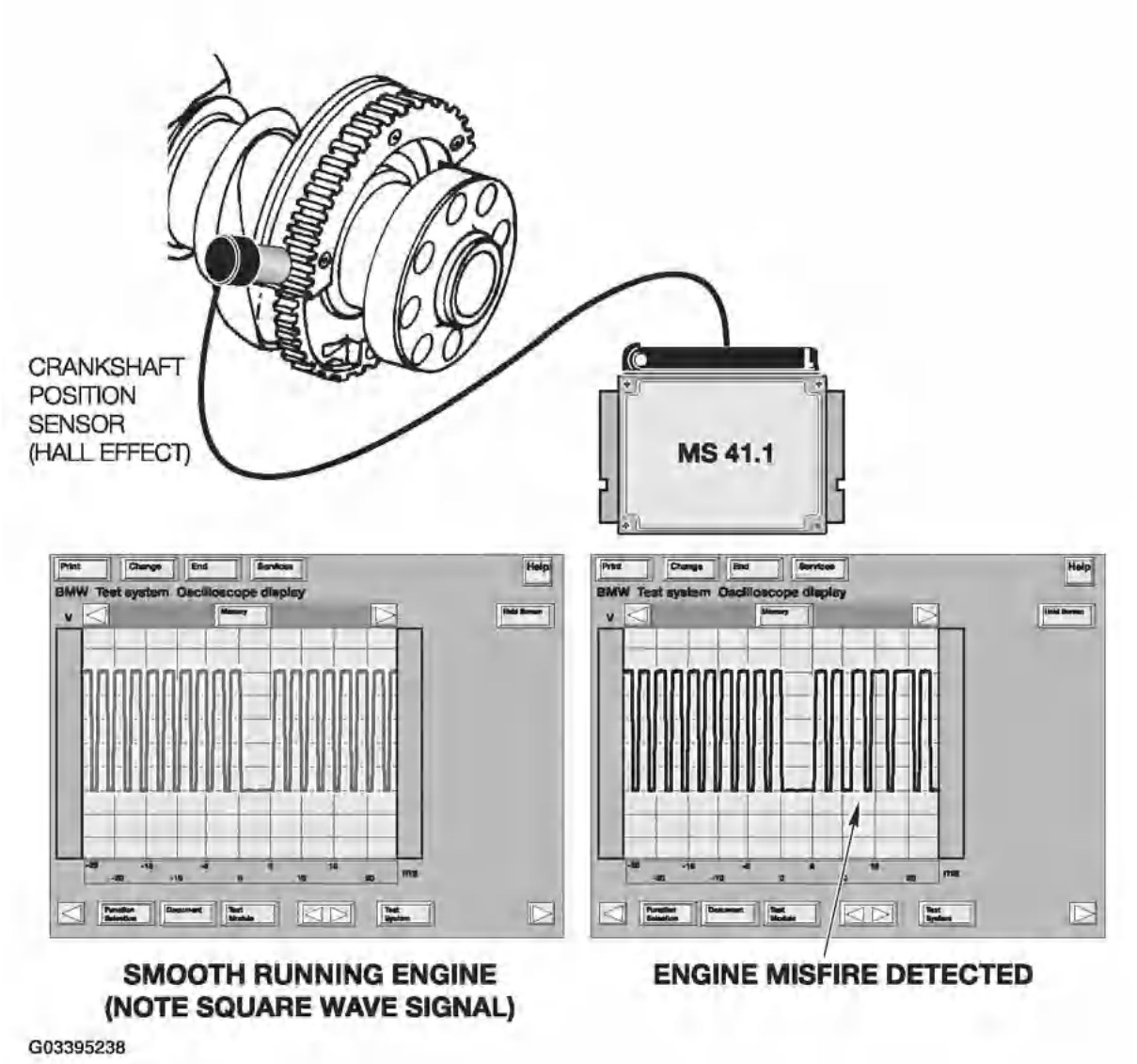



Fig. 21: Displaying Engine Misfire Waves
Courtesy of BMW OF NORTH AMERICA, INC.

### Smooth Running Measurement

The DISplus/GT-1 are helpful in pinpointing the cause of an engine misfire. Once the short test is completed, the fault memory of the ECM can be read out to determine which cylinder or cylinders have set misfire faults. There may or may not be any faults present. The engine could be running rough, however no misfire thresholds may have been exceeded.

Engine smoothness can be further evaluated by looking at the smooth running values. In the "Control Unit Functions" screen under "Diagnosis Requests" there is a value indicated for each cylinder which can be compared for each cylinder. This value is an indication of crankshaft speed variations in each cylinder.

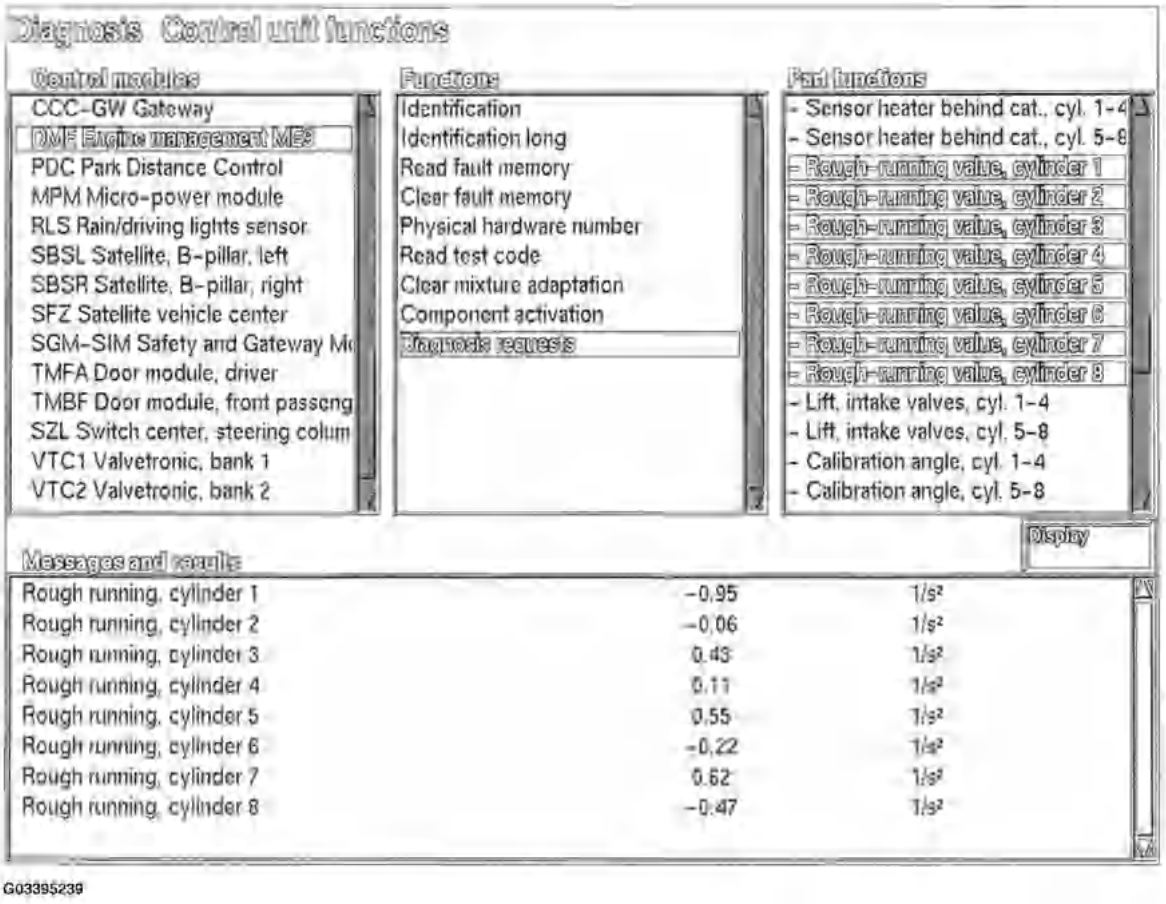



Fig. 22: Displaying Smooth Running Measurement
Courtesy of BMW OF NORTH AMERICA, INC.

### Valvetronic N62

In addition to the usual valvetrain diagnosis, the Valvetronic system has some additional components which need to be taken into consideration during diagnosis. The tolerances on the eccentric shaft and intermediate levers are critical in maintaining proper cylinder filling especially at idle. Any deviations in tolerances of these components will contribute to rough running complaints.

The intermediate levers are available in 5 classifications, the classification numbers are marked on the levers. On the N62, each cylinder head must use intermediate levers with the same classification. It is not necessary to have the same classification between cylinder heads.

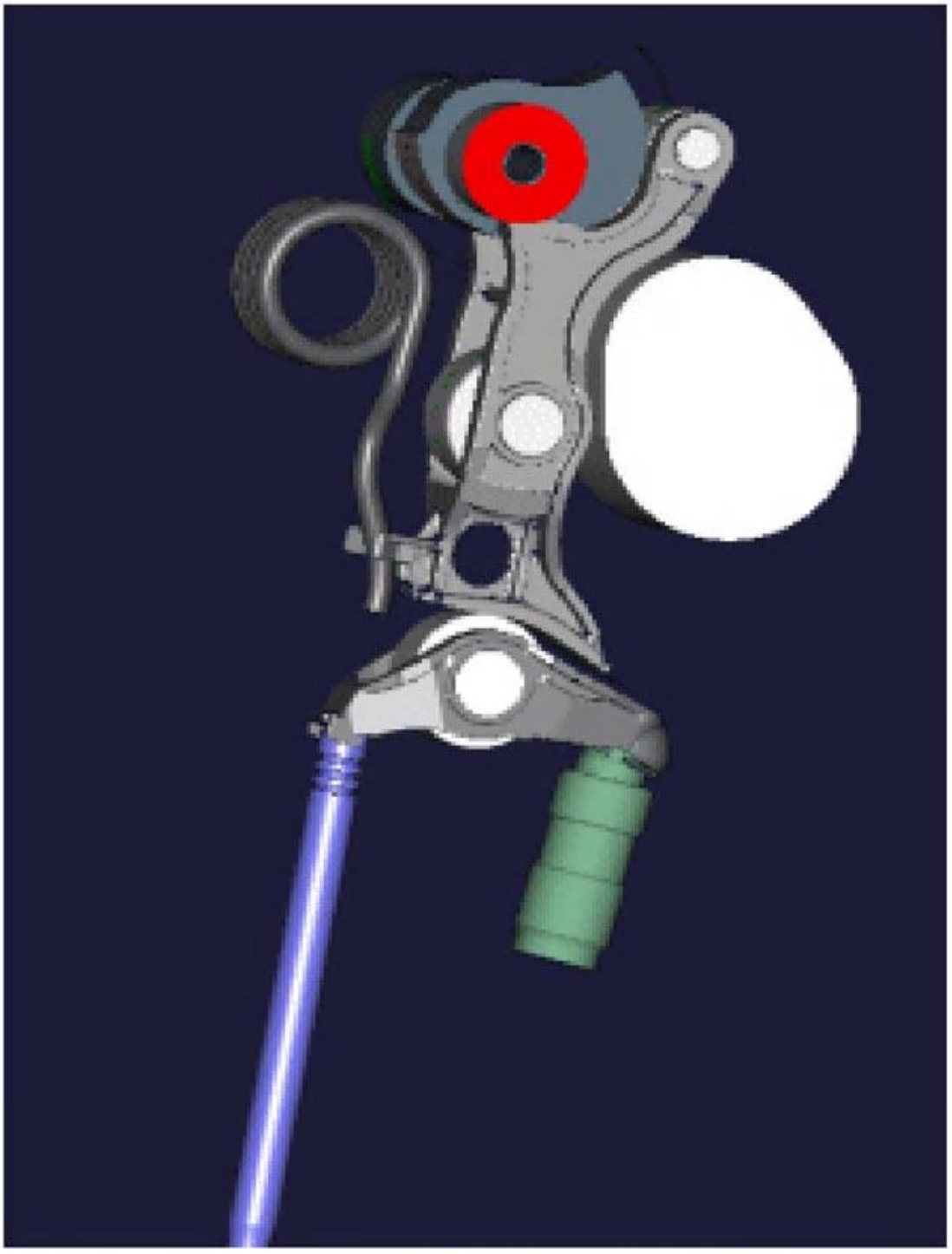



Fig. 23: Identifying Valvetronic N62
Courtesy of BMW OF NORTH AMERICA, INC.

Depending on the engine/vehicle, the minimum valve lift can be set from .3 to .8 mm. At these low valve lifts, any variation in tolerance will affect idle quality. When a diagnosis determines that there is a problem in the Valvetronic system, the components need to be inspected. The intermediate levers or eccentric shaft can be worn. The intermediate levers could be of the wrong classification.

The illustration below shows a worn eccentric shaft. The areas shown should be inspected for any wear. Grooves and scoring indicate a worn eccentric shaft which should be replaced.




Fig. 24: Identifying Camshaft Grooves
Courtesy of BMW OF NORTH AMERICA, INC.

The following pages contain testing information which will assist in the diagnosis of idle quality concerns on the N62.

### N62 Engine Testing

The N62 engine features Valvetronic which requires some specialized diagnostic procedures. Due the variable valve lift feature, there are some additional steps regarding engine and compression testing.

### MKA Adapter

The Multi-Channel Adapter (MKA) tool is used in conjunction with the DISplus to diagnose ignition and injection system concerns on the N62 engine. The MKA adapter is installed (in series) between the ECM and the engine harness at connectors 1, 3 and 5. In addition the four cables of MFK 2 are plugged into the MKA as well.




Fig. 25: Identifying MKA Adapter
Courtesy of BMW OF NORTH AMERICA, INC.

The MKA test module is found under the path > Service Functions > Drive > Engine Management ME9 > Test Runs > Ignition and Injection diagnosis N62.

The MKA engine test checks the integrity of the ignition system by looking at the primary ignition voltage on each cylinder.

The injection system is also checked by examining the voltage pattern of the injection circuit.

### Compression Test N62

The compression can be tested on the N62 using the DISplus. The DISplus can perform a relative compression test and provide a comprehensive engine analysis report.

The compression test can be done at minimum valve lift as well as at maximum valve lift. This difference between these reading can assist in determining the root cause such as wear in Valvetronic components.




Fig. 26: Identifying DIS
Courtesy of BMW OF NORTH AMERICA, INC.

When performing this test the following connections/cables are needed:

- Diagnostic head (can be hardwired or wireless)
- TD Cable connection to diagnostic head
- 25 Bar Pressure transducer connected to pressure connection #2.
- Compression adapter (quick disconnect)
- 1000 Amp clamp

The test module will prompt you to warm up the engine to 90Â°C. Once warmed up, you will be directed to run the engine at idle to set the minimum valve lift. Follow the on screen prompts. Once the minimum valve lift has been obtained (0.2 to 0.4 mm), disconnect both VVT motors to lock in the minimum adjustment.

Once this step in completed, shut the engine off and remove the #1 spark plug. Install the compression adapter into the spark plug hole. (Note: any cylinder can be used as long as the DISplus is set to the cylinder in use). Follow prompts until test is completed.




Fig. 27: Identifying Compression Adapter
Courtesy of BMW OF NORTH AMERICA, INC.




Fig. 28: Identifying TD Cable
Courtesy of BMW OF NORTH AMERICA, INC.

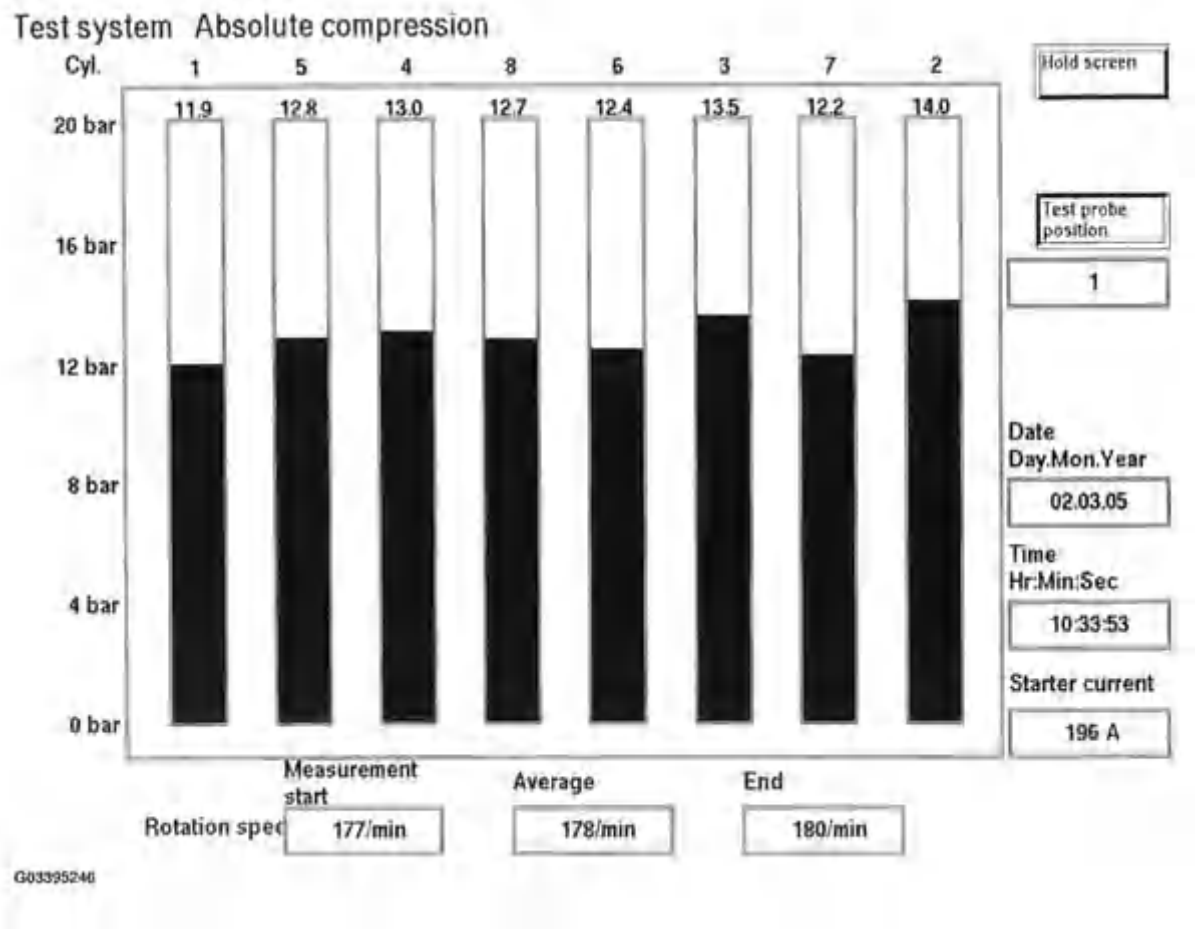



Fig. 29: Absolute Compression Bar Graph
Courtesy of BMW OF NORTH AMERICA, INC.

Once the test is completed, perform the same steps for the maximum valve lift. Compare the results, the results from the test at maximum valve lift should be slightly higher. Any cylinders that show low results on the minimum valve lift test which show improvements when the maximum valve lift test is performed should be checked for Valvetronic wear concerns.

During the final analysis potion of this test module, there may be on screen recommendations of repairs involving eccentric shaft or intermediate lever replacement. There may be a recommendation of changes to the classification of intermediate levers as well.

### Manual Compression Test (N62)

Manual compression testing can also be done on the N62. However, the DISplus must still be used to set the minimum/maximum valve lift. To access the test module for manual compression testing, go to path > Service Functions > Drive > Engine Management ME9 > Test Runs > Compression Test.

### Rough Running Diagnosis (N62)

Due to the design of the Valvetronic system, there are special diagnostic considerations when diagnosing rough running concerns on vehicles equipped with the N62 engine.

The following diagnostic flow chart should be used as a diagnostic aid when attempting to rectify idle quality complaints when the engine is at operating temperature.

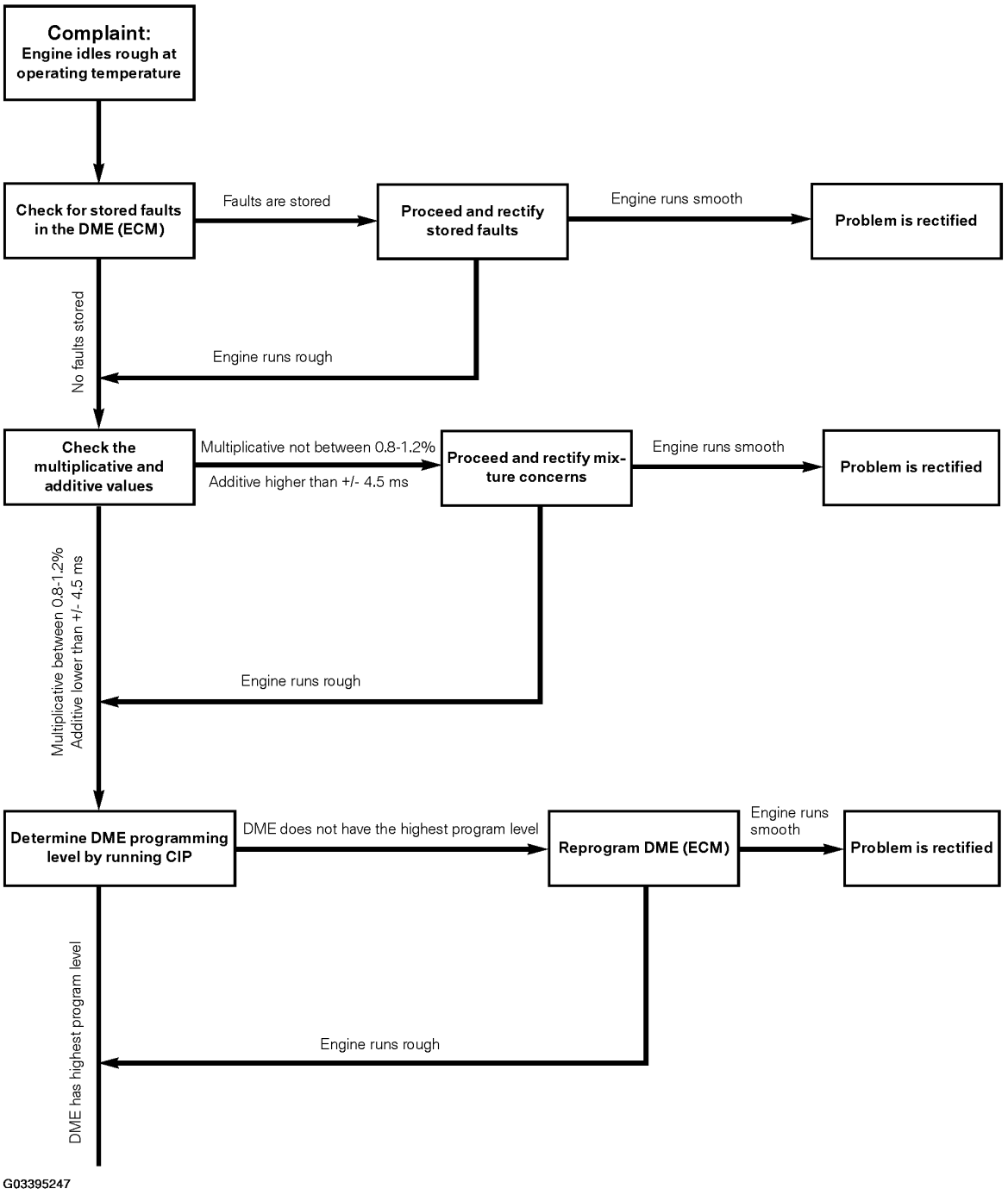



Fig. 30: Rough Running Diagnosis (N62) Diagnostic Flow Chart (1 Of 3)
Courtesy of BMW OF NORTH AMERICA, INC.

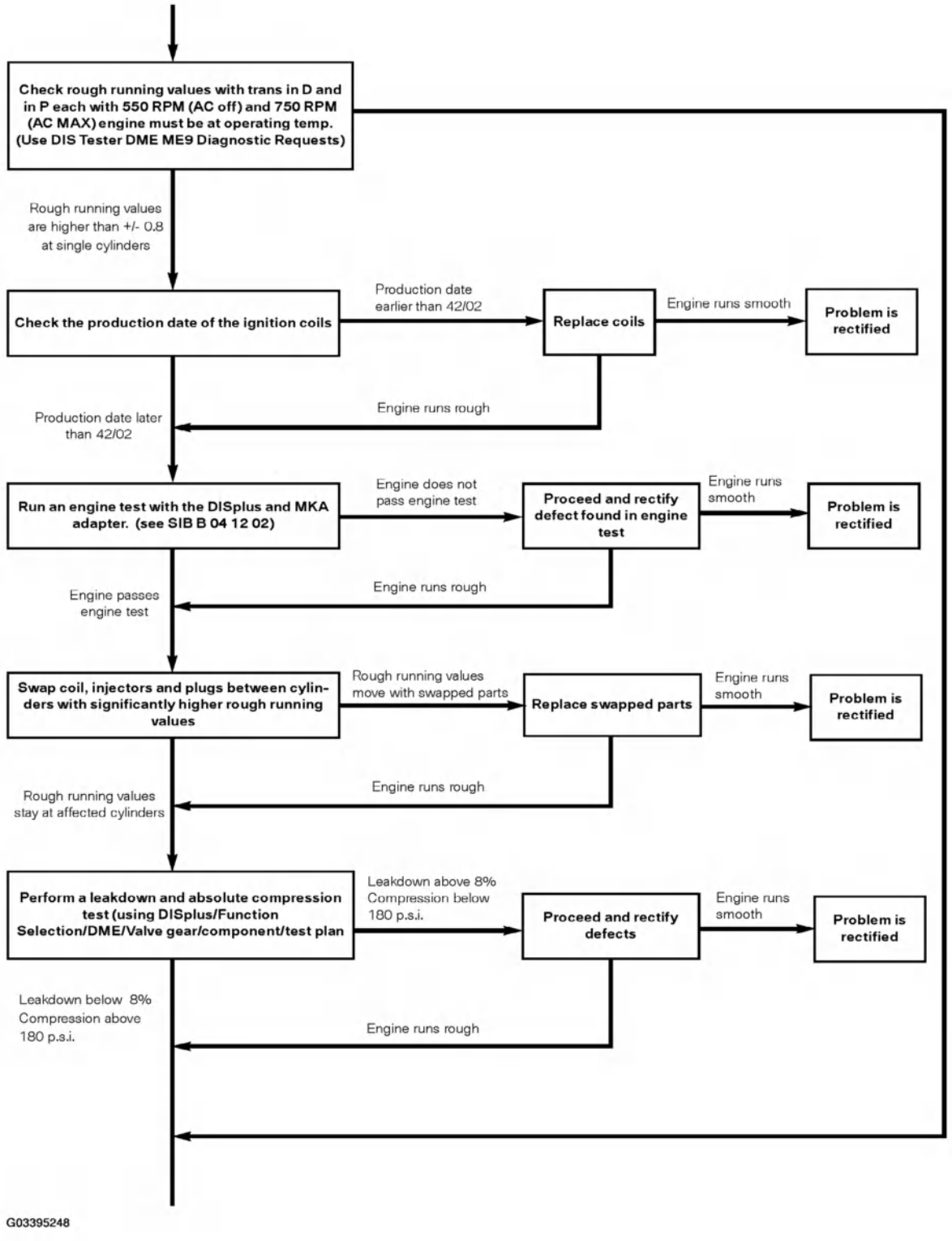



Fig. 31: Rough Running Diagnosis (N62) Diagnostic Flow Chart (2 Of 3)
Courtesy of BMW OF NORTH AMERICA, INC.

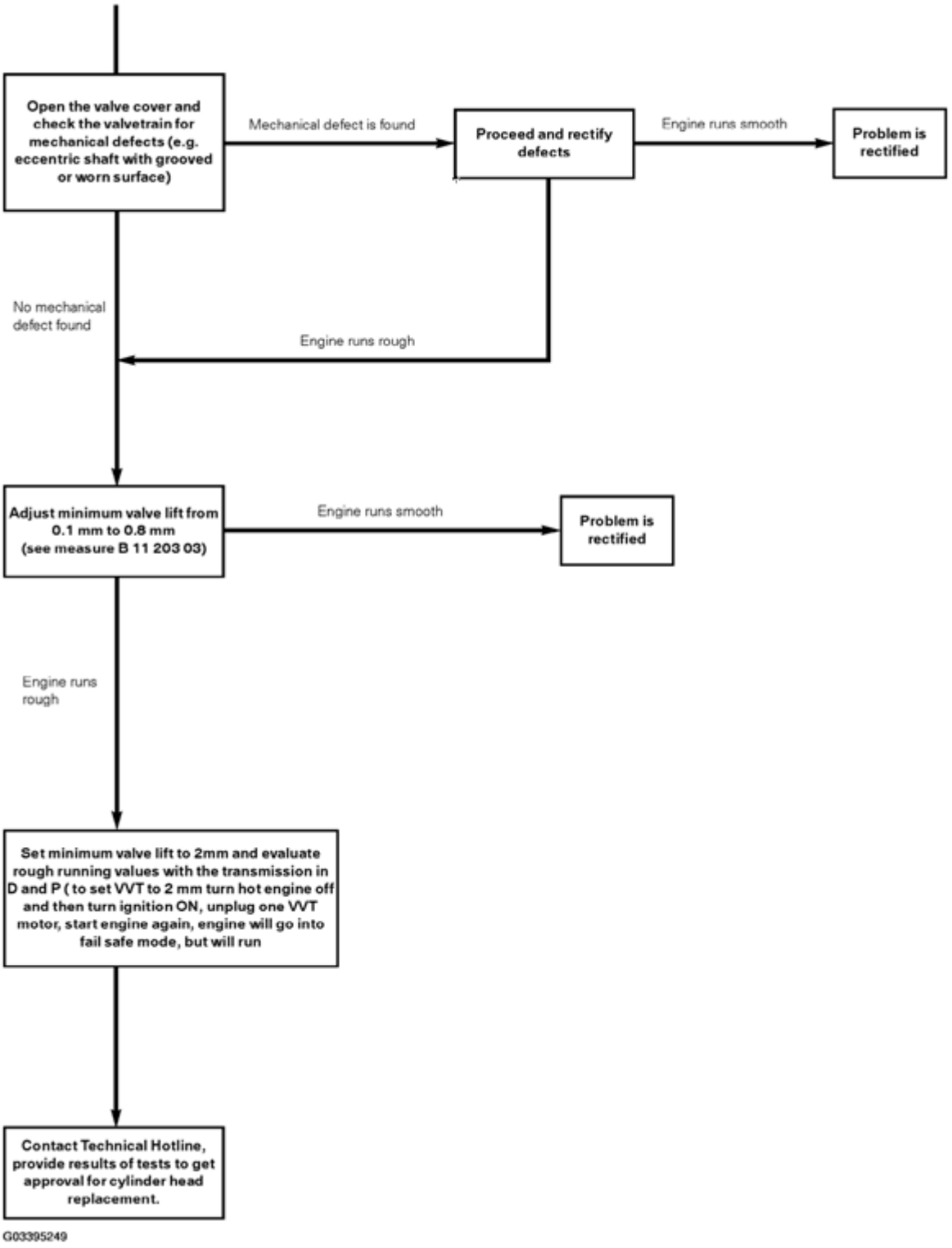



Fig. 32: Rough Running Diagnosis (N62) Diagnostic Flow Chart (3 Of 3)
Courtesy of BMW OF NORTH AMERICA, INC.

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Article GUID: A00234320

# STARTING SYSTEMS

Model: All

Production Date: All

## PURPOSE OF STARTING SYSTEM

The purpose of the starting system is to convert chemical energy stored in the battery into electrical energy, then into mechanical energy in the starter motor. This mechanical energy is then transferred through gears and drives from the starter motor to the engine flywheel.

After the transfer and conversion of all this energy the engine flywheel begins to rotate.

The rotation must be of sufficient speed to allow the engine to form the combustible air-fuel mixture required for starting. It must be maintained during initial combustion long enough until the engine can sustain operation.

To accomplish this a starter or cranking motor is used.

The starting system consists of the following components:

- Battery.
- Ignition Switch.
- Starter Motor Assembly.
- EWS (if equipped).
- Starter Safety Switch.
- Cables and Wiring Harness.

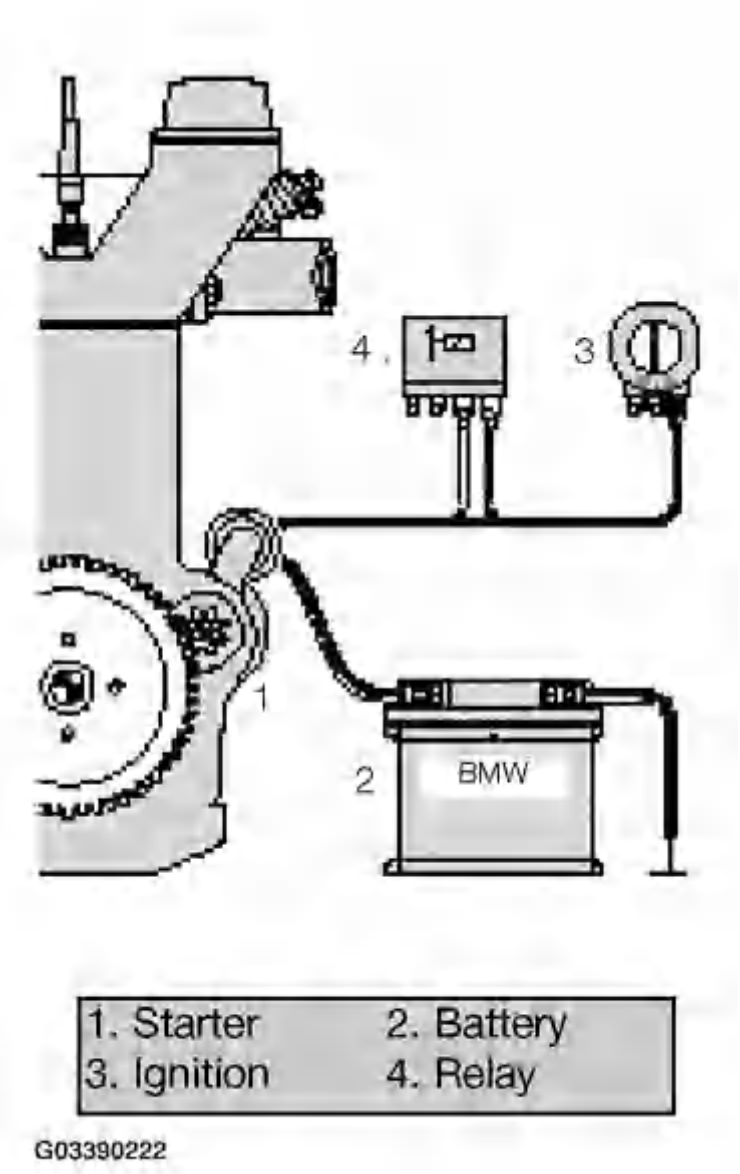



Fig. 1: Identifying Starting System
Courtesy of BMW OF NORTH AMERICA, INC.

## SYSTEM COMPONENTS

### Battery

The Battery is the primary EMF source in the automobile. The automotive battery is an electromechanical device that provides the potential difference (voltage). The battery does not store electrical energy. It stores chemical energy that is converted to electrical energy as it discharges.

All energy for starting the car is drawn from the battery. State-of-charge, and capacity of the battery are important factors in the ability of the engine to start, especially in cold and harsh conditions.

### Ignition Switch

The Ignition Switch provides a request to the starting system to engage the starter motor. This request is handled differently depending on the year of the vehicle and particular systems the vehicle is fitted with.

In non EWS systems the ignition switch provided power directly to the starter solenoid or a starter relay. Beginning with EWS I the start request (KL50) is passed to an Immobilizer control module or an EWS module (EWS II/III).

On vehicles with one touch starting the KL50 signal is passed to the DME.

## Starter Motor Assembly

The Starter Motor Assembly is a DC motor which uses the interaction of magnetic fields to convert electrical energy into mechanical energy.

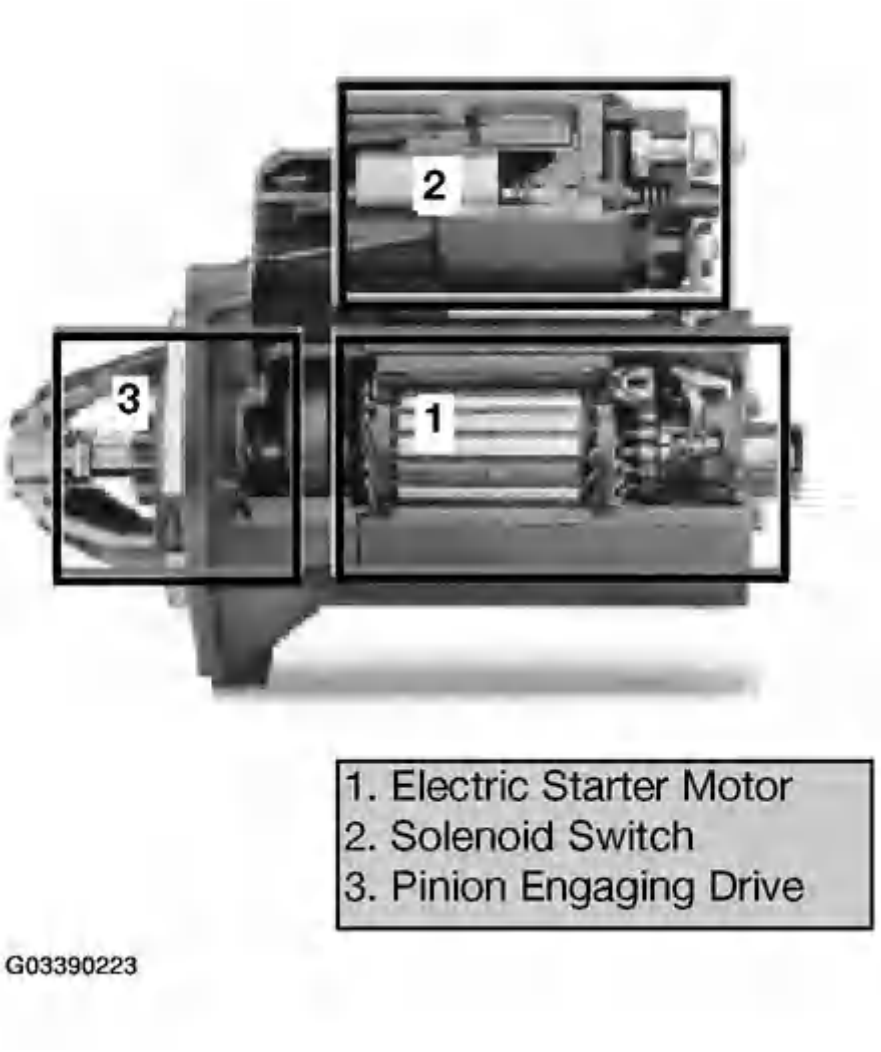



Fig. 2: Identifying Starter Motor Assembly
Courtesy of BMW OF NORTH AMERICA, INC.

## Electric Starter Motor

The Starter Motor provides the mechanical energy to rotate the engine through a direct or a gear reduction drive.

- Armature Shaft (1)
- Armature Stack (3)
- Poles Shoes (5)
- Carbon Brushes (7)
- Armature Winding (2)
- Commutator (4)
- Field Coil (6)
- Brush Holder (8)

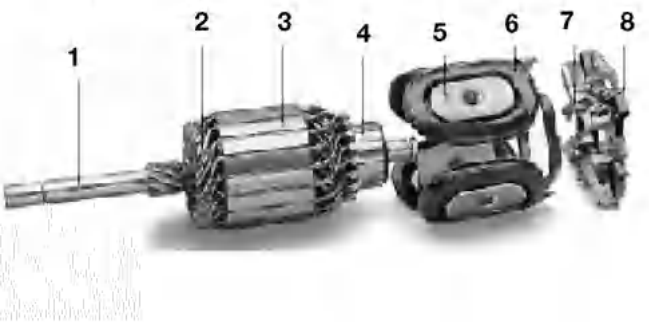


Fig. 3: Identifying Major Components Of Starter Motor
Courtesy of BMW OF NORTH AMERICA, INC.

### Armature

The Armature assembly is comprised of the armature shaft, armature winding, armature stack and commutator. Thin iron stampings are laminated together to form the stack or core. The slots on the outside of the laminations hold the armature windings. The windings loop around the core and are connected to the commutator. Each commutator segment is insulated from the adjacent segments. The commutator may have up to 30 segments. A steel shaft is insert in the center hole of the laminations with the commutator insulated from the shaft.

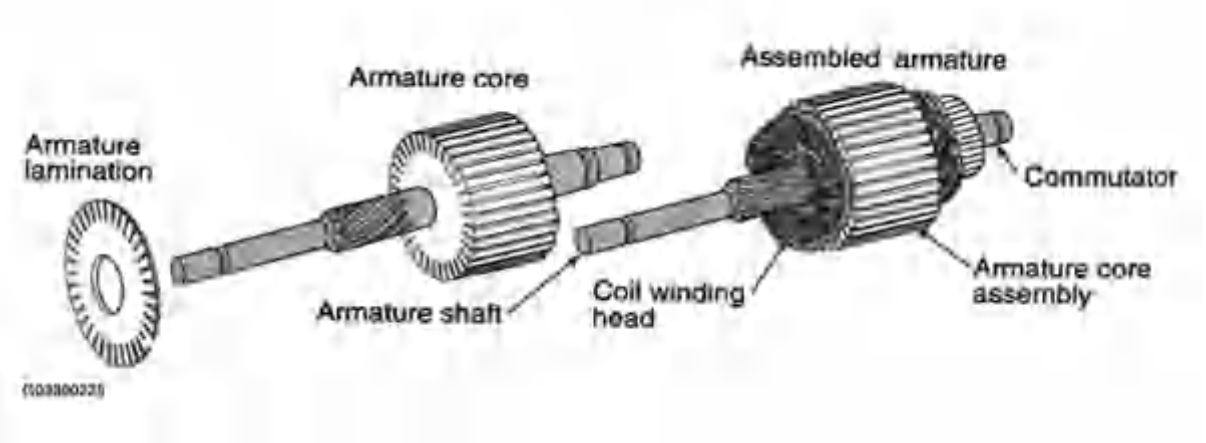



Fig. 4: Expanded View Of Armature Assembly
Courtesy of BMW OF NORTH AMERICA, INC.

### Field Coils

There are two types of field coils:

- Electromagnetic.
- Permanent magnet.

### Electromagnetic

Wire ribbons or coils wrapped around a pole shoe, attached to the inside of the starter housing. The iron pole shoes and the iron starter housing work together to increase and concentrate the strength of the field coils. When current flows thought the field coils strong electromagnetic fields with North and South poles are created.

### Permanent

Multiple permanent magnets manufactured from an alloy of boron, neodymium and iron are positioned in the starter housing. Use of permanent magnets allow for the elimination of the field circuit and windings and realize a 50% weight savings.

### Brushes

Brushes are electrically conductive sliding contacts, usually made of copper and carbon. The brushes make contact with the commutator and as the starter begins to rotate the brushes reverse the flow of current to the armature. Starter brushes carry the full flow of current through the motor.

### Solenoid

The Solenoid assembly is an integral part of the starter and is actually a combined relay and engagement solenoid.

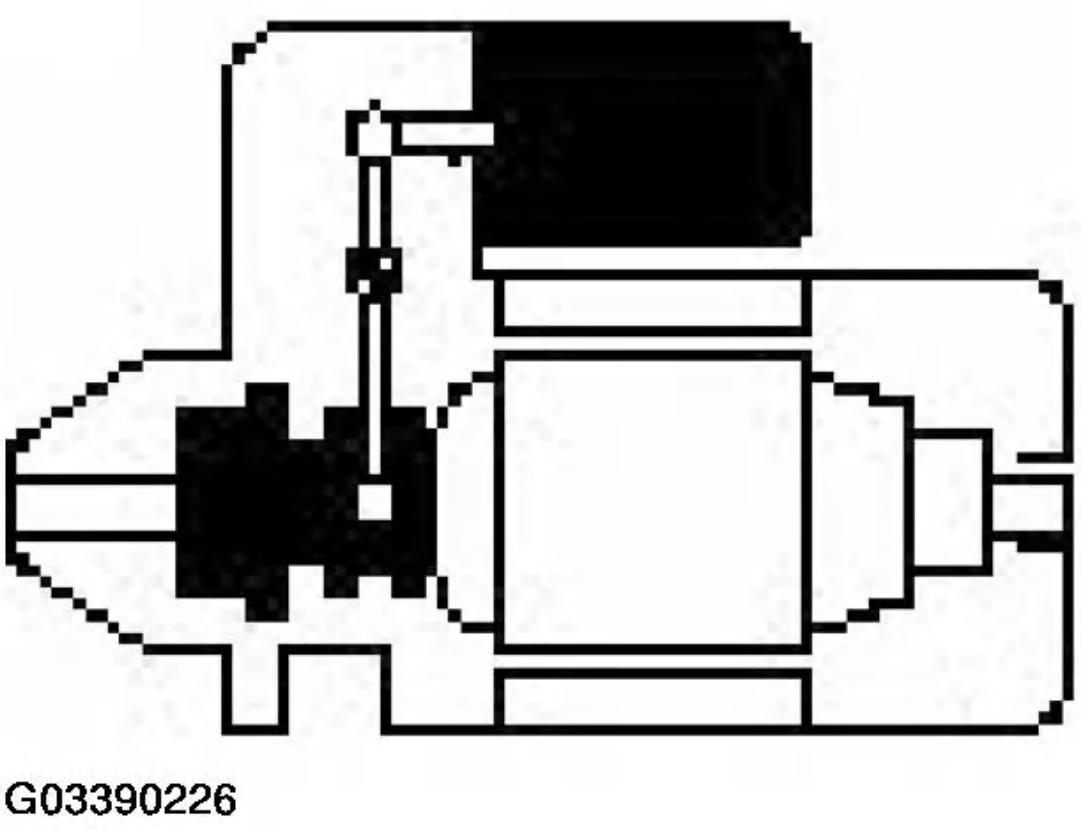



Fig. 5: Identifying Solenoid Switch And Pinion Engaging Drive
Courtesy of BMW OF NORTH AMERICA, INC.

Solenoid switch and pinion engaging drive.

The solenoid has two functions:

- Pushing the pinion forward so that it engages in the ring gear of the engine.
- Closing the moving contact, providing the main current path for the starter.

  The solenoid has two windings.

- Pull-in winding.
- Holding-in winding.

Both windings are used to draw in the plunger and engage the pinon, only the hold-in winding is used to hold the plunger in position.

### Pinion Engaging Drive

The starter's end shield assembly contains the Pinion Engaging Drive with pinion, overrunning clutch, engagement lever and spring. The drive mechanism is responsible for coordinating the thrust motion of the solenoid switch and the rotary motion of the electric starter motor and transferring them to the pinion.

The starter engages the ring gear on the flywheel by means of the pinion. A high conversion ratio of pinion teeth to flywheel teeth (between 10:1 and 15:1) make it possible to overcome the high cranking resistance of the engine using a relatively small but high speed starter motor.

As soon as the engine starts and accelerates past cranking speed, the pinion must automatically demesh in order to protect the starter. For this reason, the starter incorporates an overrunning clutch.

## STARTER DRIVES

### Conventional Drive

In a Conventional Drive starter the pinion gear is located directly on the armature shaft.

The pinion and overrunning clutch form the driver assembly.

The driver assembly rides on a helical spline on the armature shaft so that when the driver is thrust by the solenoid, a combined axial and rotary motion occurs which greatly facilitates the meshing of the pinion.

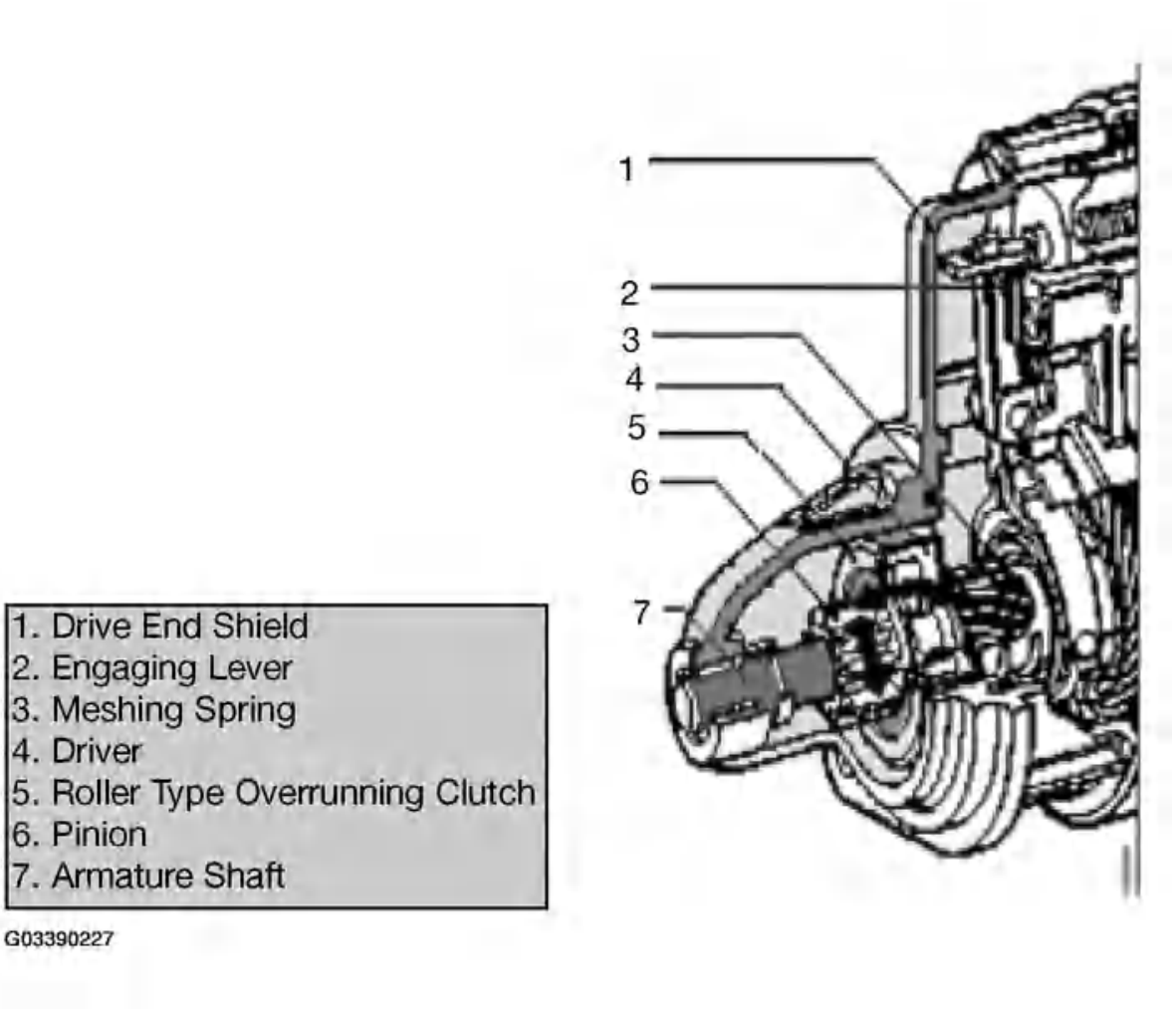



Fig. 6: Identifying Conventional Drive Starter Pinion Gear
Courtesy of BMW OF NORTH AMERICA, INC.

### Gear Reduction Drive

In their design and function, Gear Reduction Drives are much the same as conventional drive starters. The main difference in the gear reduction drive starter is a planetary gear set added between the field frame and the drive end shield. This design allows for the use of smaller and lighter starters.

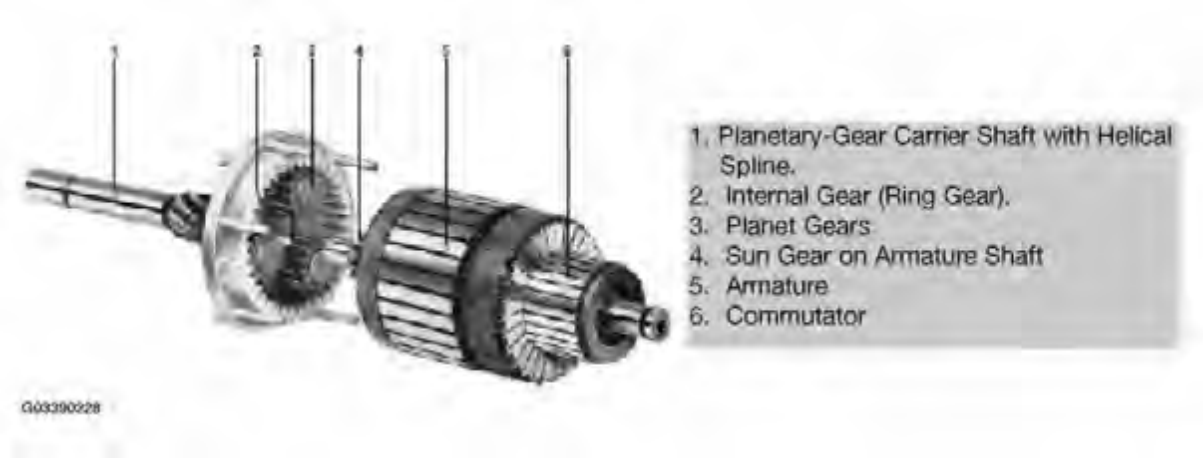



Fig. 7: Identifying Gear Reduction Drive
Courtesy of BMW OF NORTH AMERICA, INC.

## OVERRUNNING CLUTCH

In all starter designs the rotary motion is transmitted via an Overrunning Clutch. The overrunning clutch allows the pinion to be driven by the armature shaft (or planetary gear set), however it breaks the connection between the pinion and the armature shaft as soon as the accelerating engine spins the pinion faster than the starter.

The overrunning clutch is located between the starter motor and the pinion and prevents the starter motor armature from being accelerated to an excessive speed when the engine starts.

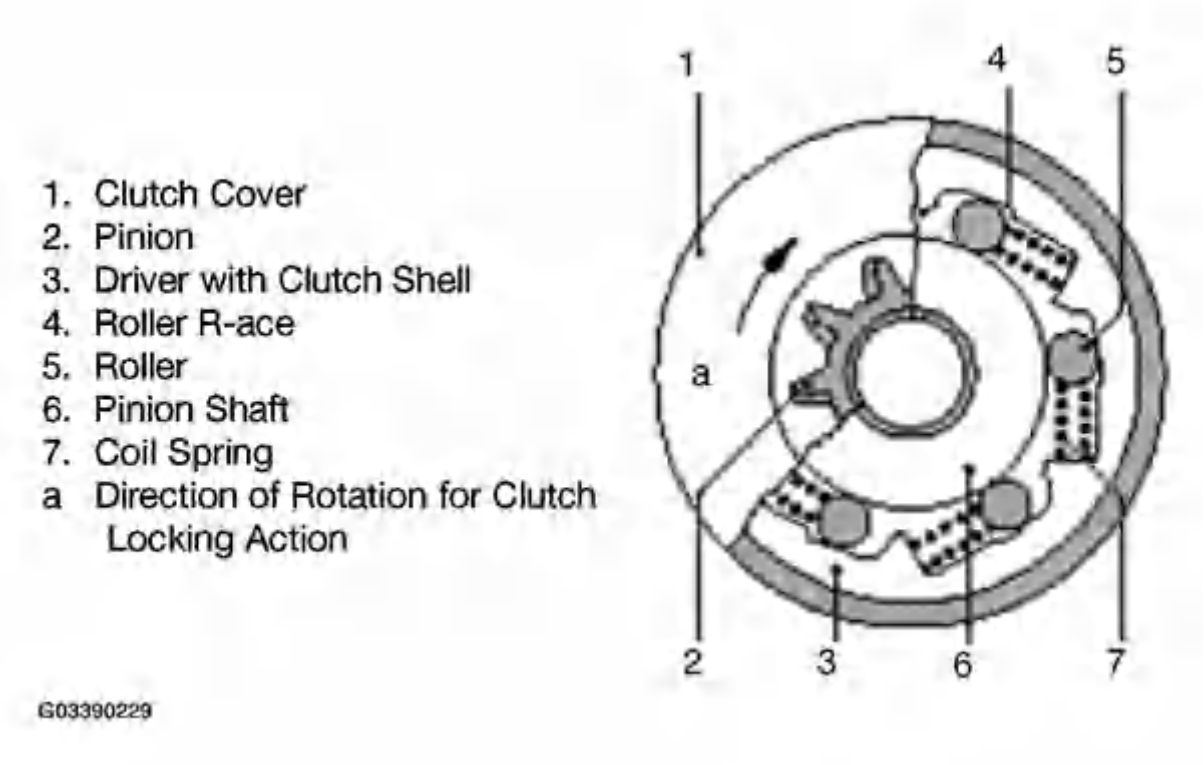



Fig. 8: Identifying Overrunning Clutch Components
Courtesy of BMW OF NORTH AMERICA, INC.

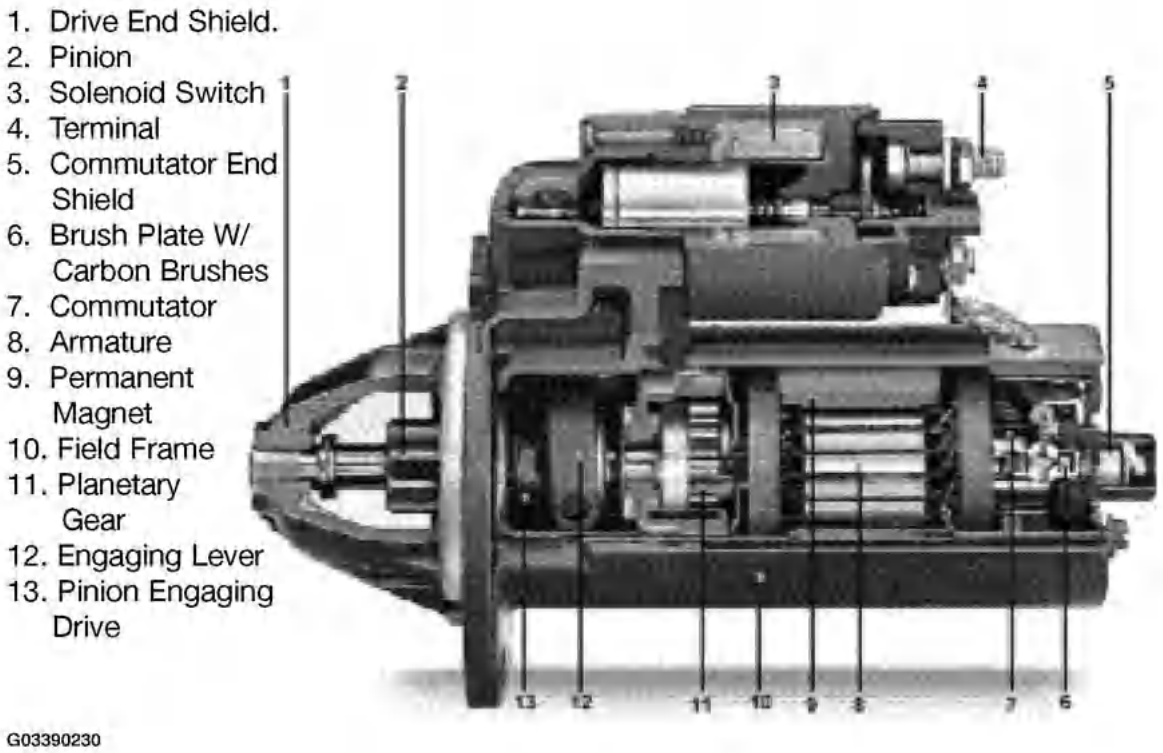



Fig. 9: Cross Sectional View Of Starter Motor
Courtesy of BMW OF NORTH AMERICA, INC.

Fully assembled permanent magnet gear reduction starter.

### EWS

The EWS system(s) is designed to provide electronic anti-theft protection for the vehicle through the use of coded keys and coded data communication between the EWS and the engine control module. The starter and engine control module are locked out until a properly coded key is recognized and the proper code is established between the EWS and the engine control modules.

### Starter Safety Switch

The Starter Safety Switch is part of the transmission range switch on automatic transmission vehicles and a clutch switch on manual transmission vehicles (beginning MY 1997). The purpose of the switch is to prevent engine start-up with the vehicle in gear or the clutch not depressed. On vehicles with EWS, this signal is sent directly to the EWS module for processing.

### Cable and Wiring Harness

Cables to the starter from the battery must carry large amounts of current. The wiring harness from the ignition switch and/or EWS carry little current as they are control signals to a relay or starter solenoid. Minimum voltage drop in starter cables is necessary to ensure sufficient starter speed and torque.

## PRINCIPLE OF OPERATION

### Electric Starter Motor

The Electric Starter Motor converts electrical current into rotary motion. In doing so it converts electrical energy into mechanical energy. The interaction of two magnetic fields produce this rotational force.

The field coils (either electromagnetic or permanent) located in the housing produce magnetic flux lines. Within the stationary field coils is the armature, a loop of wire (a conductor) with one end connected to B+, the other to B-. When current is applied to the armature flux lines circle the loop in one direction on one side and in the

opposite direction on the other side. The interaction of the flux lines on the armature and the flux lines from the field coil cause the armature to rotate.

The armature will only rotate to the point where the magnetic force is equal on both sides. (Armature 90Â° to magnetic flux lines of field) For the armature to continue to rotate, the polarity or direction of current flow must be reversed.

Through the brushes and the commutator, the current flow is reversed as the magnetic forces become equal, causing the armature to continue to rotate.

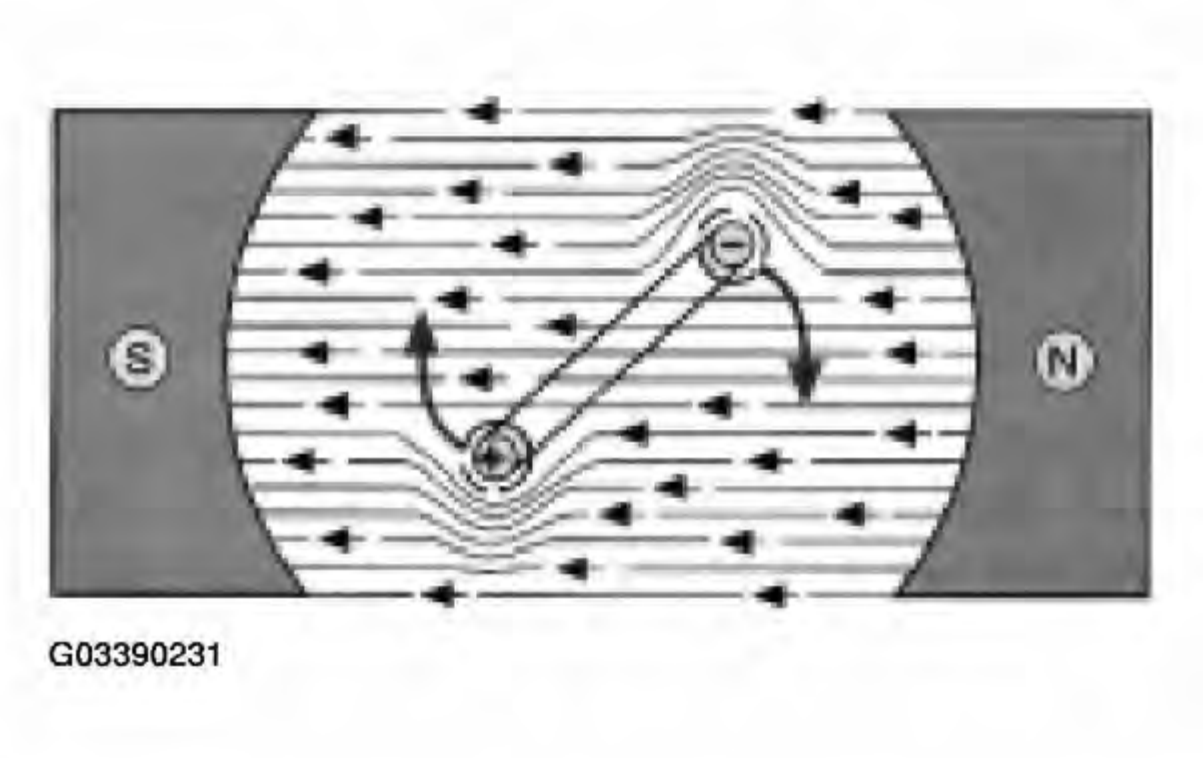



Fig. 10: Identifying Magnetic Flux Lines
Courtesy of BMW OF NORTH AMERICA, INC.

This constant reversal of current flow in the armature provides continual rotation.

Direction of rotation is determined using Flemings Left Hand Rule.

- Point your First finger in the direction of the magnetic Field (from N to S).
- Rotate your hand about that finger until your second finger points in the direction of the Current (conventional current, from + to -).

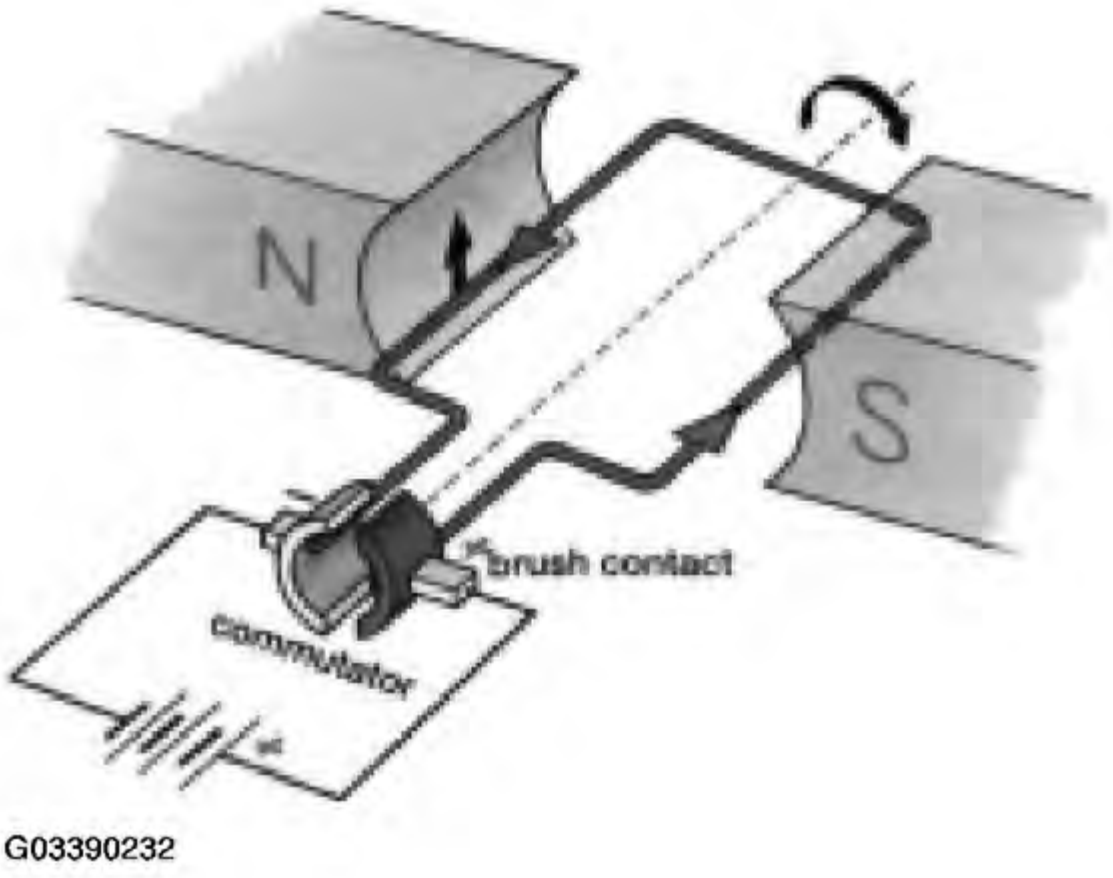



Fig. 11: Identifying Magnetic Field
Courtesy of BMW OF NORTH AMERICA, INC.

Loop symbolizes force out of magnetic field.

- Then your thumb points in the direction of the Movement of the wire.

To increase the force on the wire (armature) do one of the following:

- Use a larger current.
- Use a stronger magnetic field.
- Use a greater length of wire in the field.

To increase torque and speed in the starter motor, more windings in the armature are added, and the field has more pairs of magnets (either permanent or electromagnetic).

Flemings left hand rule:

The basic law of motors, the direction of force on a wire that is carrying current when it is in a magnetic field.

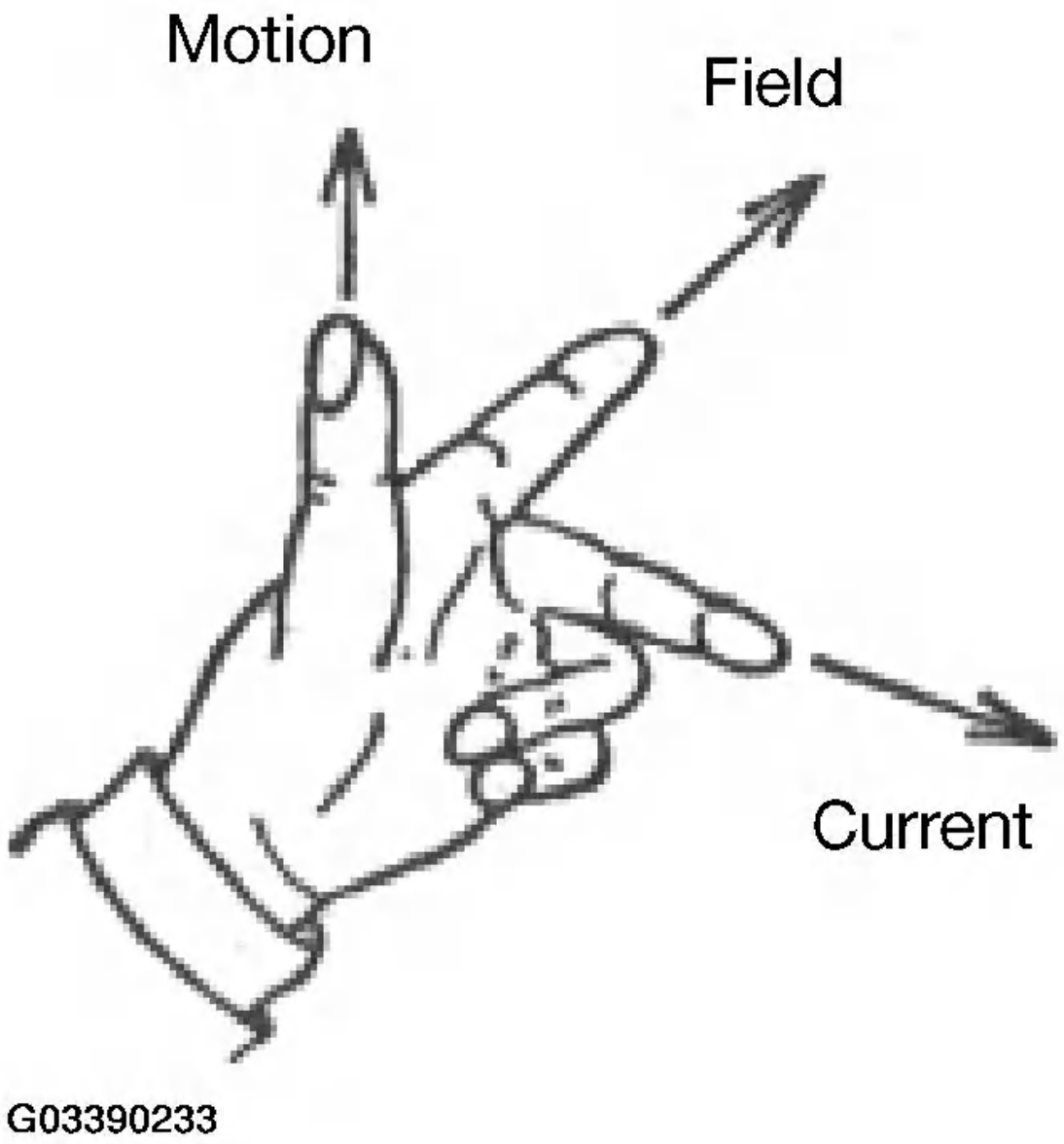



Fig. 12: Illustrating Flemings Left Hand Rule
Courtesy of BMW OF NORTH AMERICA, INC.

## MOTOR WINDINGS

Torque and speed of the starter motor is dependent on the wiring of the field coils (electromagnetic coils).

There are three types of Motor Windings:

- Shunt Wound.
- Series Wound.
- Compound.

### Shunt Wound Motors

In Shunt Wound Motors, the field coil is connected in parallel with the armature. The shunt motor does not decrease its torque as speed increases. Shunt motors do not produce high torque.

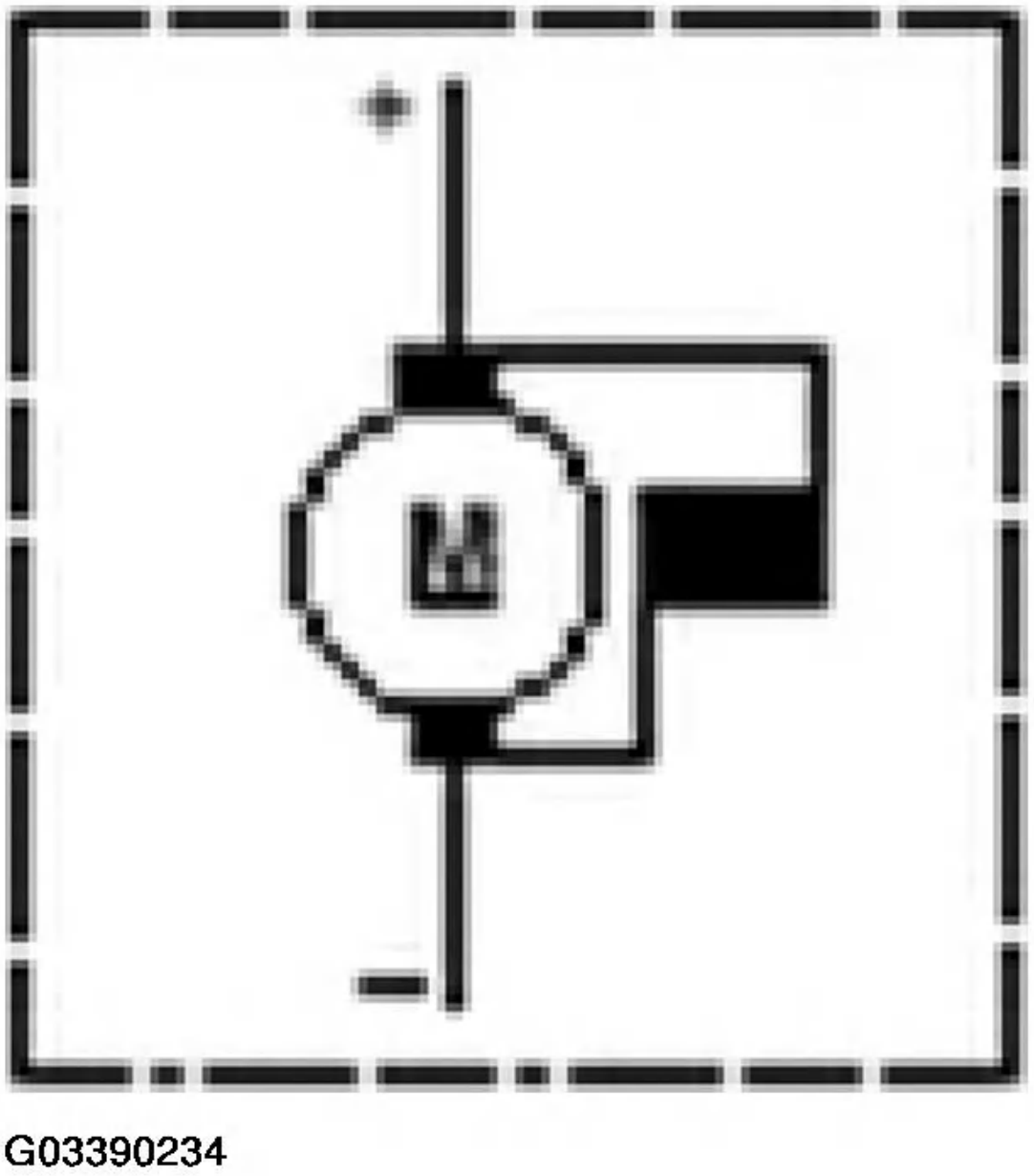



Fig. 13: Identifying Shunt Wound Motors
Courtesy of BMW OF NORTH AMERICA, INC.

### Series Wound Motors

In Series Wound Motors, the field coil is in series with the armature.

The current flows to the field windings, then to the brushes, commutator, and armature back again to the ground side brush. A series wound motor will develop maximum torque output at the time of initial start, then as motor speed increases, torque falls off rapidly due to the CEMF.

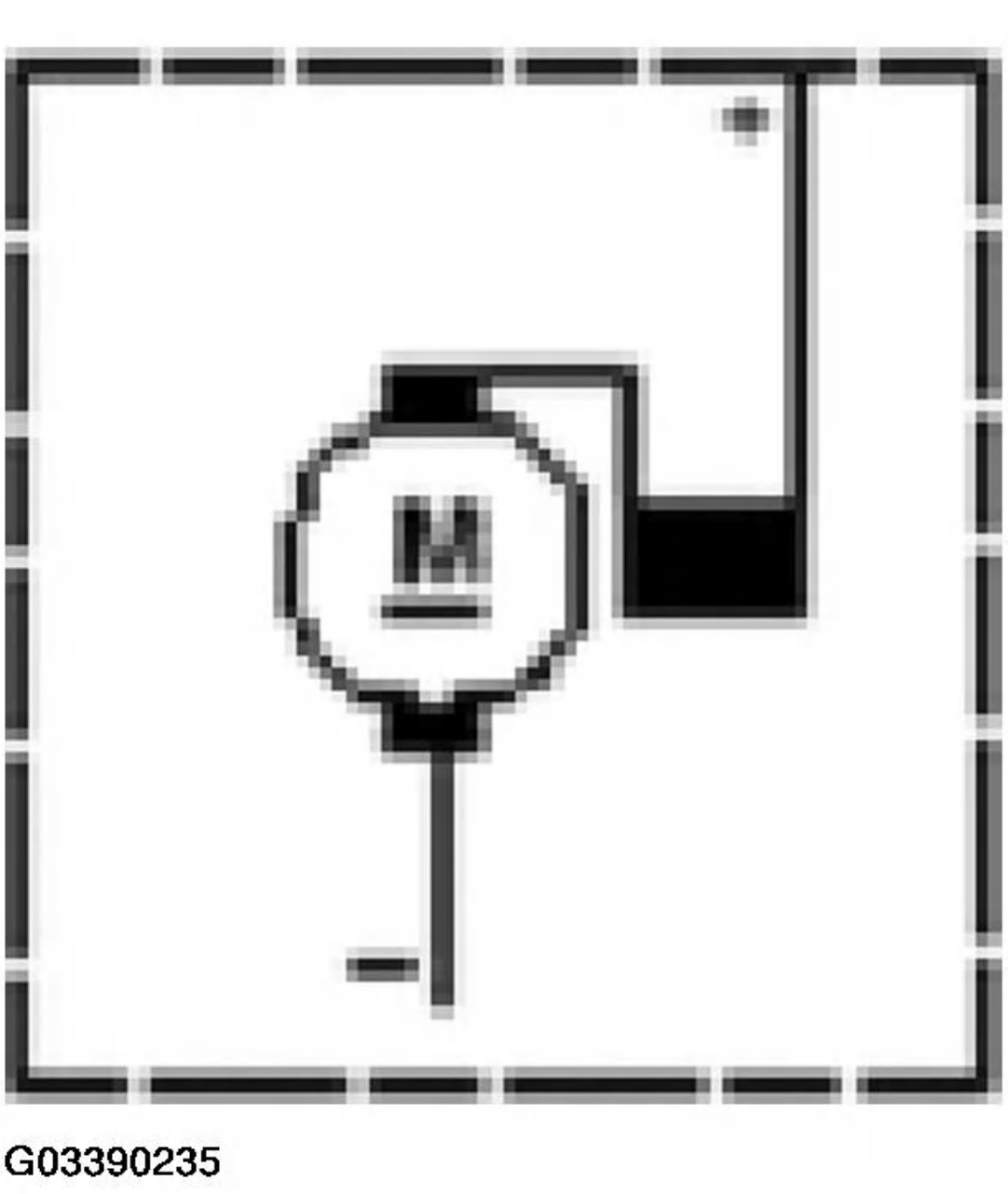



Fig. 14: Identifying Series Wound Motors
Courtesy of BMW OF NORTH AMERICA, INC.

### Compound Wound Motors

Compound Wound Motors have some of the field coils wired in series to the armature and some in parallel. This configuration allows the compound motor to develop good starting torque and constant operating speed.

CEMF:

Counter Electromotive Force.

The voltage produced in the starter motor itself through electromagnetic induction.

This voltage acts against the supply voltage from the battery.

Motors must be designed to control the CEMF for optimum operation.

## Permanent Magnet Motors

Permanent Magnet Motors eliminate all wiring to the field coils. The magnetic field is generated by the permanent magnet without the need for winding and pole shoes. The magnets use flux-concentrating pieces to direct the magnetic field.

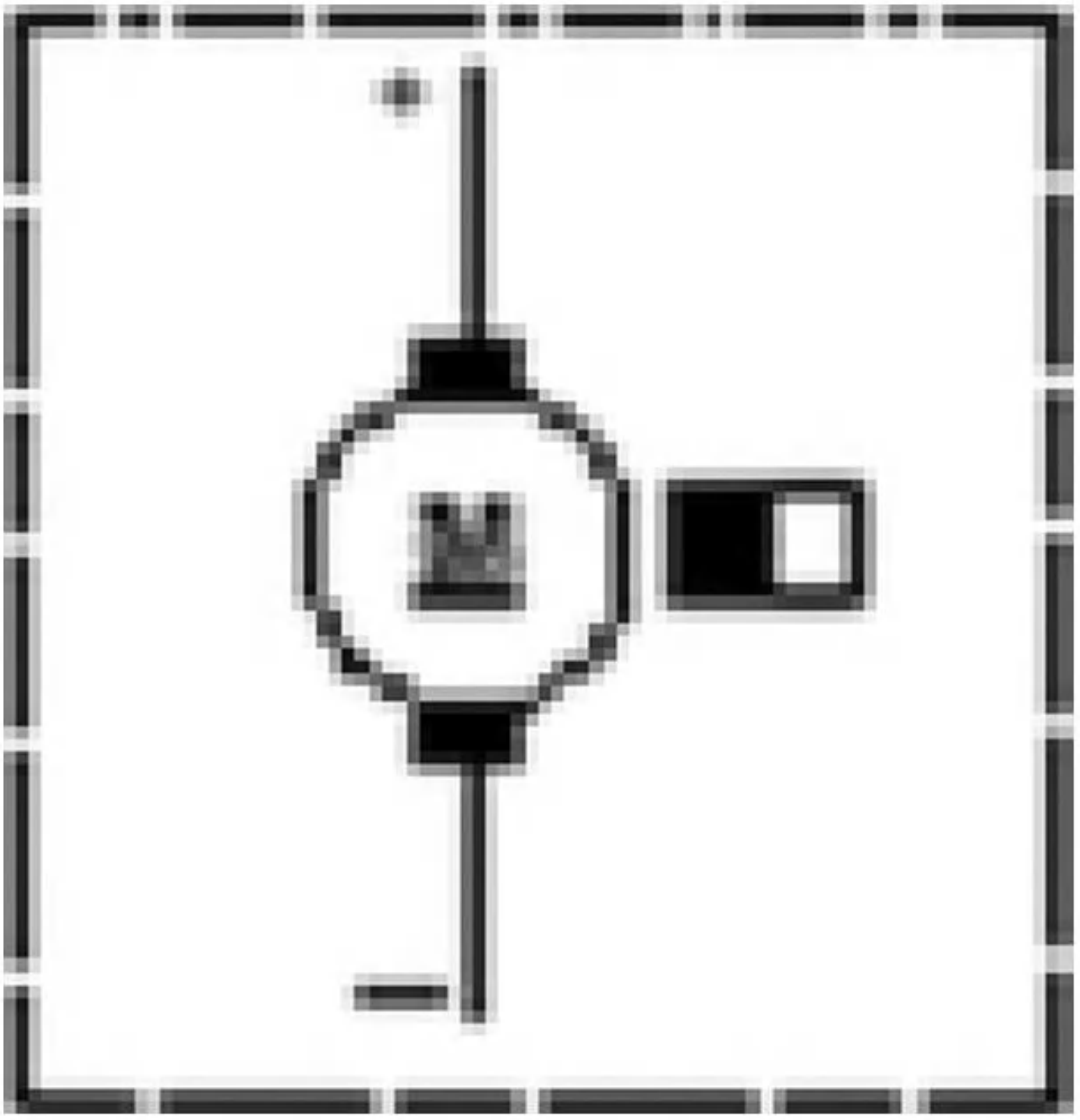



Fig. 15: Identifying Permanent Magnet Motors
Courtesy of BMW OF NORTH AMERICA, INC.

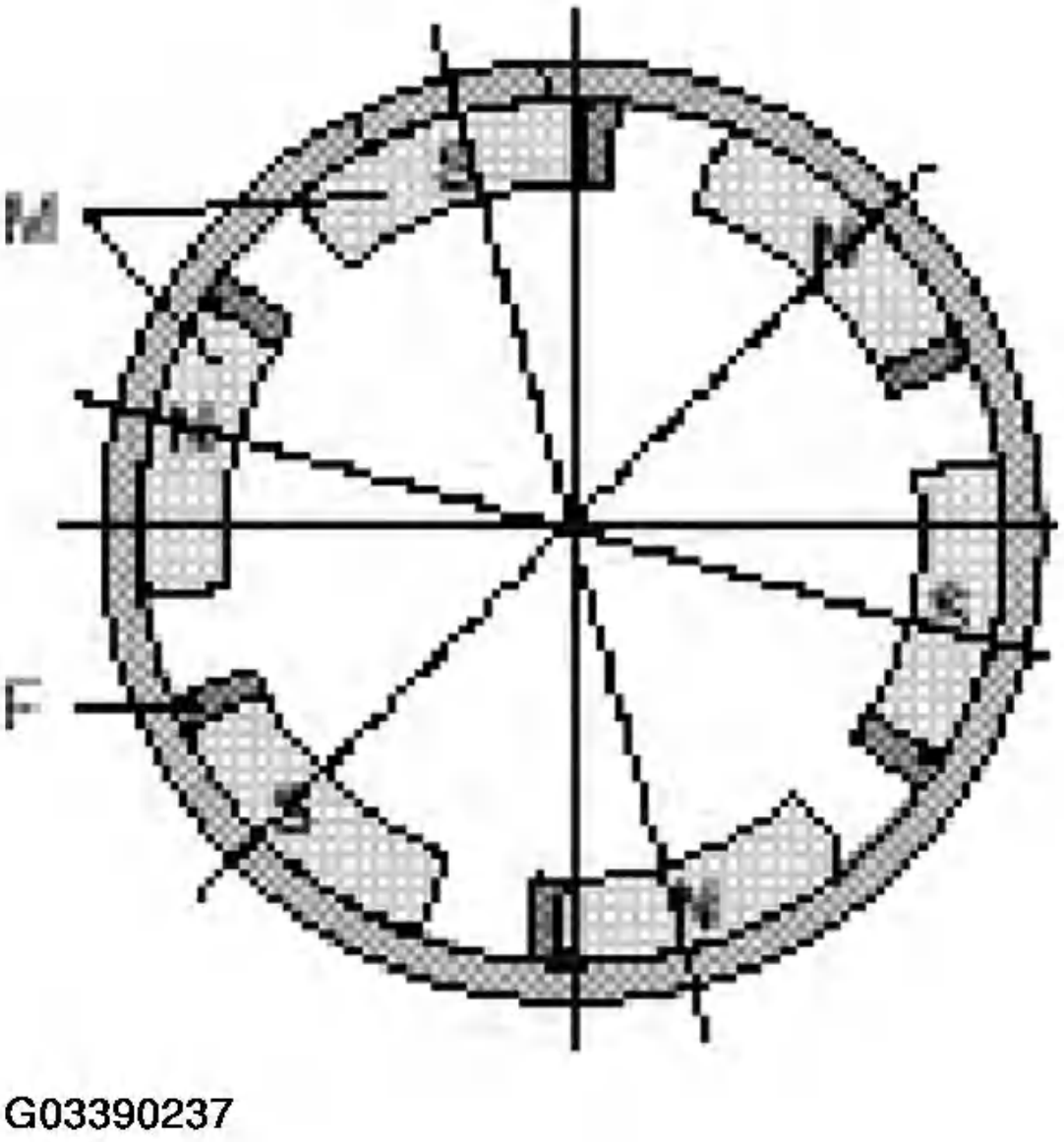



Fig. 16: Identifying Permanent Magnets With Flux Concentrating Pieces
Courtesy of BMW OF NORTH AMERICA, INC.

Arrangement of permanent magnets (M) with flux concentrating pieces (F).

## SOLENOID

The Solenoid performs the following functions:

- Pull the pinion to engage the flywheel.
- Hold the pinion engaged with the flywheel during starting rotation.
- Complete the electrical circuit from the battery to the brushes of the starter.
- Cause the pinion to retract from the flywheel.

Two windings are used to pull and hold the pinion engaged to the flywheel.

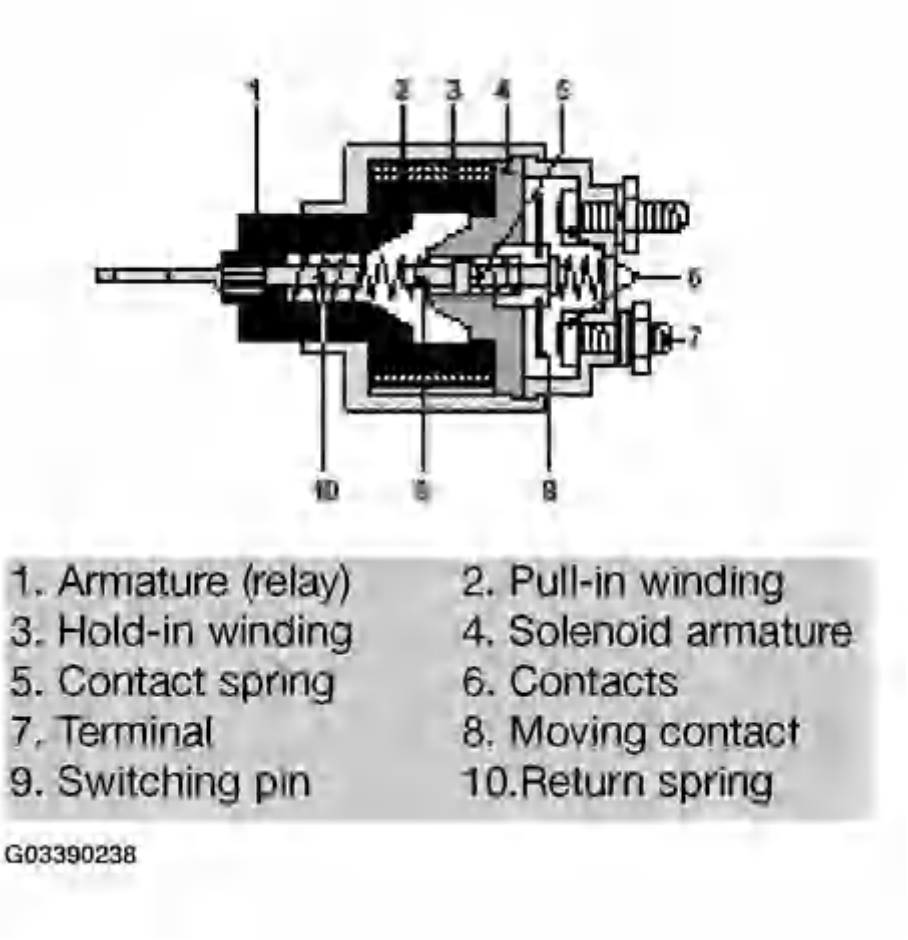



Fig. 17: Identifying Solenoid Components
Courtesy of BMW OF NORTH AMERICA, INC.

Pull-In Winding- The stronger of the two windings, used to pull the pinion into engagement. This winding is released when the starter circuit is completed.

Hold-In Winding- Used to help the pull-in winding move the pinion initially, then holds the pinion engaged to the flywheel.

Signal 50 is received at the solenoid, energizing both windings. The windings cause the armature to be drawn into the coils, pressing on a spring, causing the moving contacts to close. The pull-in winding is released, the starter begins to turn. When signal 50 is released, the power is lost to the hold-in winding, spring pressure forces the armature out of the coil, the moving contacts are opened and the pinion returns to the rest position.

Workshop Hint:

The starter motor does not begin to spin until after the pinion is engaged in the flywheel.

This aids in the meshing of the pinion and flywheel

Workshop Hint:

Battery voltage is critical.

The combination of the pull-in winding and the hold-in winding may have sufficient power to engage the pinion. When the moving contacts are completed and the increased load of the starter motor is added to the system, low voltage will cause the hold-in winding to release the pinion. If signal 50 is still present the pull-in winding will again assist in pulling the pinion into engagement and the cycle starts over again. This gives the "clicking" noise from the starter.

## Pinion Drive

The Pinion Drive gear is attached to the roller-type overrunning clutch which is splined via a helical shaft to the starter armature. At rest the spring pressure in the overrunning clutch wedge rollers between the pinion shaft and the clutch hub race. This locks the pinion to the clutch. During start-up the clutch and pinion rotate as one.

As the engine speed exceeds starter speed, the pinion pushes the rollers, against the spring pressure, into a wider area. This movement of the rollers allow the pinion to turn independently of the starter armature, not causing the armature to overspeed.

When the solenoid windings are released the clutch assembly is pulled away from the flywheel through spring pressure.

### Phases of Starter Operation

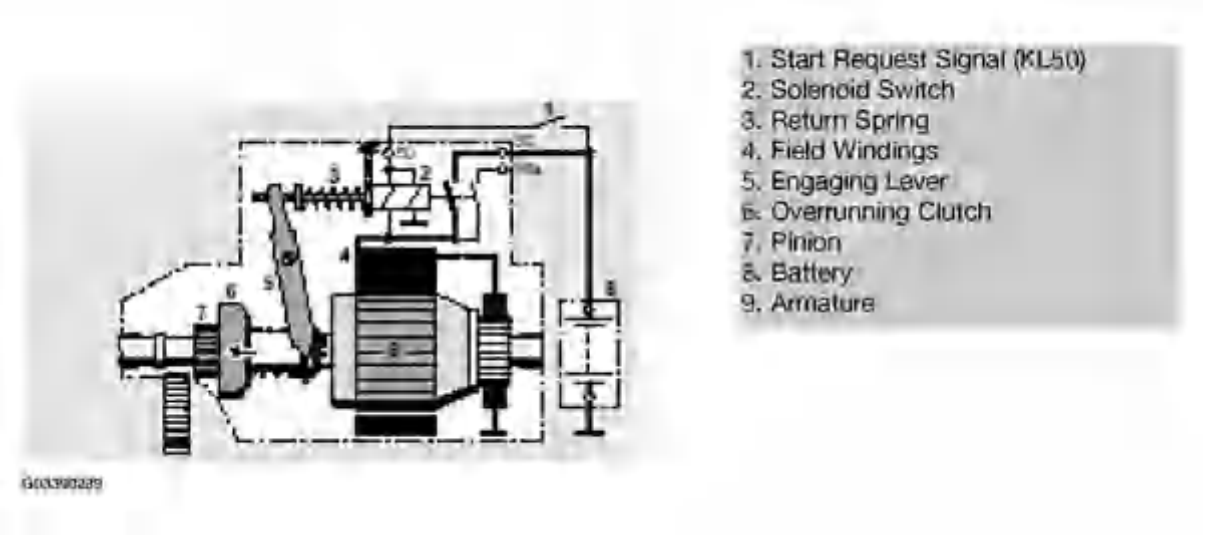



Fig. 18: View Of Starter At Rest
Courtesy of BMW OF NORTH AMERICA, INC.

Starter at rest, no current supplied.

Pull-in and hold-in winding energized.

Pinion tooth meets gap in ring gear and meshes.

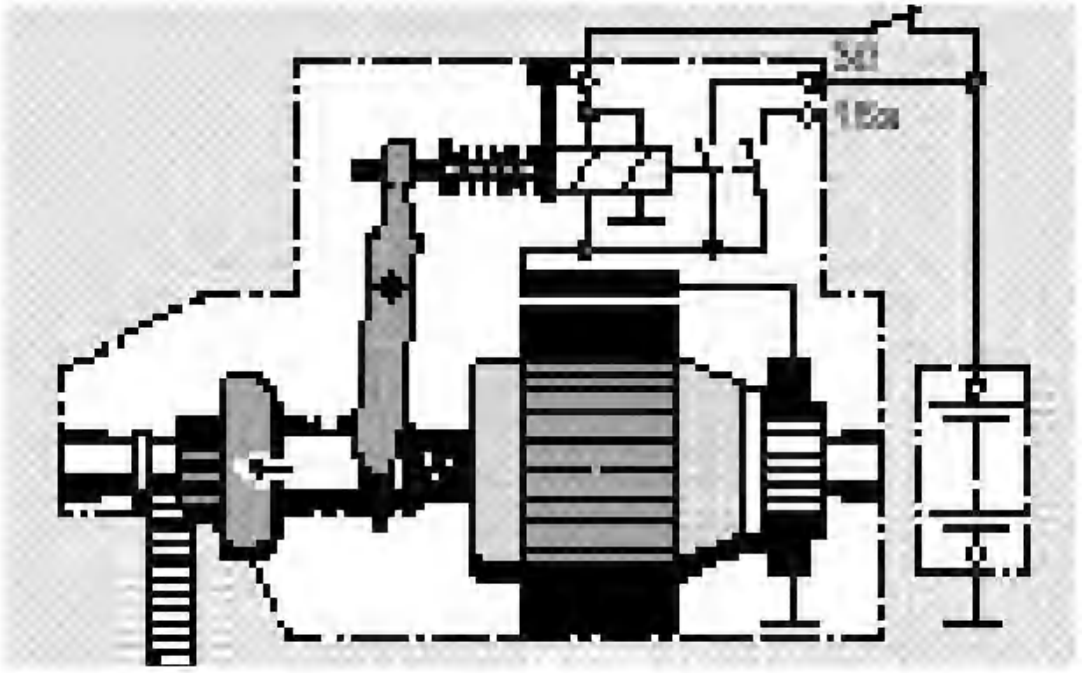



Fig. 19: Identifying First Phase Of Starter Operation
Courtesy of BMW OF NORTH AMERICA, INC.

Starter position just before Main current is switched on.

Engaging lever in end position.

Pull-in winding released.

Pinion meshed.

Main current flows.

Engine is rotated.

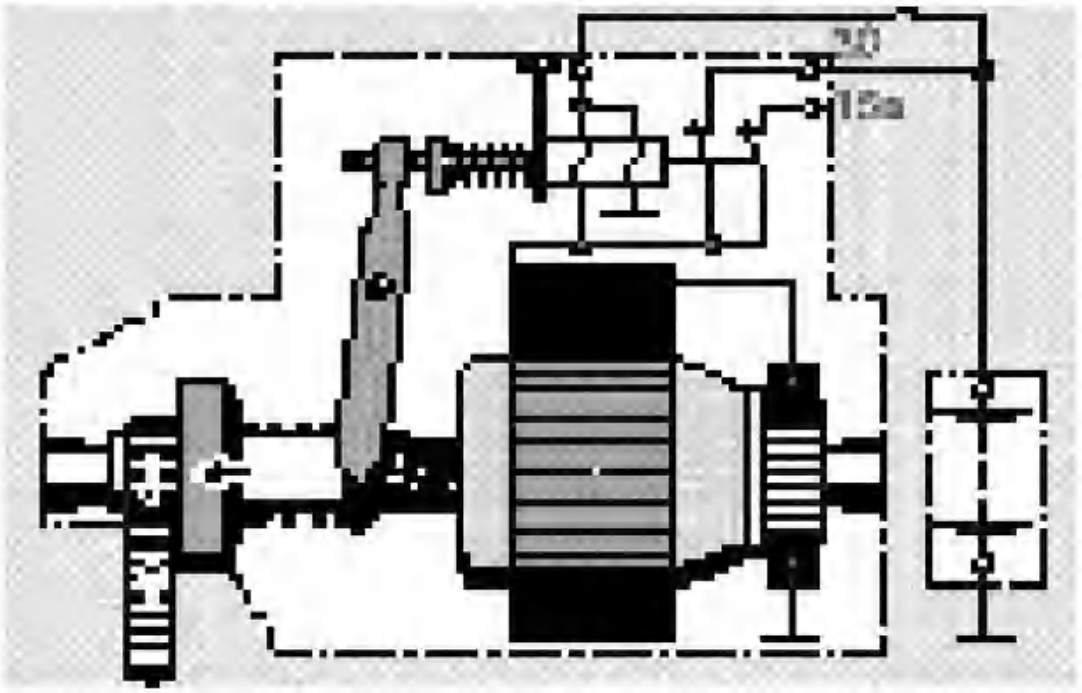



Fig. 20: View Of Starter Operation
Courtesy of BMW OF NORTH AMERICA, INC.

Engine is cranked.

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Article GUID: A00232603

# OPERATING FLUIDS

## Operating Fluids - Engine - All Models

## 1.0 GENERAL INFORMATION

The specified engine oil is extremely important for the operation and service life of an engine.

Engine oil requirements will depend on the engine design, operating conditions, oil change intervals and, in the case of diesel engines, the fuel grade.

A modern engine oil provides more than just a lubrication function. The following qualities are required:

### GOOD WEAR PROTECTION AND FRICTION REDUCTION

Frictional losses will lead to a reduction of engine power and efficiency. An approved engine oil will minimize frictional losses. Excessive wear will lead to a reduction in service life (e.g. wear of bearings, piston rings, cam lobes) or to mechanical failure.

### LIMITED TENDENCY TO PRODUCE COMBUSTION RESIDUE

During engine operation, a limited amount of oil enters the combustion chamber, where it is burned. Combustion residues or deposits, which build up in the combustion chamber, lead to unwanted increases in compression and promote surface ignition (" pinging"). Any approved engine oil will help prevent such a condition.

### FAVORABLE VISCOSITY TEMPERATURE BEHAVIOR

Viscosity is the tendency of oil to resist flowing. Engine oil, when cold, should be thin enough so that the engine can be cranked over. Hot oil should be thick enough to maintain proper lubrication.

### ANTI-FOAMING

The oil is forcefully mixed with air during engine operation. Heavy foaming will lead to impaired lubrication and reduction in oil flow rate. To prevent foaming, antifoaming additives are mixed with the oil.

### GOOD CORROSION INHIBITION

The engine oil must prevent corrosion on engine components under all circumstances. Corrosion and rust inhibitors are added to displace water and acids from metal surfaces so that oil coats them.

### MIXING ABILITY/COMPATIBILITY

It must be possible to mix all engine oils with each other, even synthetic with mineral oils, without causing any incompatibility problems. A further requirement is the compatibility with all materials contacted by oil, in particular oil seals, hoses and paint.

### GOOD THERMAL CONDUCTIVITY/GOOD COOLING PROPERTY

Engine oil makes an important contribution to the cooling of an engine. It must transfer heat from friction surfaces, and combustion heat away from affected areas. The oil absorbed heat is carried back to the oil pan where it is transferred to the surrounding air.

### GOOD DISPERSANT/DETERGENT QUALITIES

To limit or slow down the formation of combustion deposits and acidic components, together with abrasive particles and dirt from the intake air, good engine oils contain a detergent additive. Deposits of carbon and dirt are loosened and suspended in the oil, being drained away at the next oil change.

### OXIDATION INHIBITORS AND AGING STABILITY

Oxidation can be described as the oxygen absorption of hydrocarbons formed in the oil. The results of oxidation have a negative impact on viscosity causing corrosion on certain metals and the formation of sludge. Inhibitors are added to prevent oxidation from occurring. A good engine oil must maintain its stability during the required oil change intervals.

Good Lubricating Oil Must:

1. Lubricate moving parts to minimize wear.
2. Lubricate moving parts to minimize loss from friction.
3. Remove heat from engine parts by acting as a cooling agent.
4. Absorb shocks between bearings and other engine parts, reducing engine noise and extending engine life.
5. Form a good seal between piston rings and cylinder walls.
6. Act as a cleaning agent.

## 2.0 GRADING OF OILS

### VISCOSITY NUMBER

A method of classifying an oil by number, based on its resistance to flow at a high temperature.

These numbers are usually prefixed by SAE which is the abbreviation for the Society of Automotive Engineers.

A lower SAE Number (i.e. SAE 5W) indicates a thinner oil with a higher flow rate, for use at lower temperatures.

A higher SAE Number (i.e. SAE 30) indicates a thicker oil with a slower flow rate, for use at higher temperatures.

### MULTIGRADE OILS

A multigrade, or multiviscosity oil has the qualities of a lower number oil at low temperatures and those of a higher number oil at high temperatures. Multigrade oils have numbers such as SAE 5W- 30 and SAE 10W-40. For reliable engine performance in all temperature ranges mineral based engine oil viscosity must be matched to the temperature range at which the vehicle will be operated.

### SINGLE GRADE OILS

A single grade viscosity oil has a limited temperature/viscosity range compared with multigrade oils. Due to the limited temperature/viscosity range of these oils they are no longer used in BMW engines and thus no longer listed in the BMW Engine Oil Temperature/Viscosity Table.

### OIL CLASSIFICATIONS

A method of classifying oil was jointly developed by the SAE, API (American Petroleum Institute), and ASTM (American Society for Testing and Materials). Engine oils are rated according to two engine use categories:

C = Compression Ignition (i.e. CC)

Compression Ignition (C) oils are those that are used for diesel engines. The current service ratings for diesel-engine lubricating oils are: CA, CB, CC, CD, CE, CF and CG. The oils differ in their properties and in the additives they contain.

S = Spark Ignition (i.e. SE)

Spark Ignition (S) oils are those that are used for gasoline engines. The current service ratings for gasoline-engine lubricating oils are: SA, SB, SC, SD, SE, SF, SG, SH and SJ. These oils differ in their properties and in

the additives they contain.

Another method of classifying minimum performance standards for gasoline-fueled engine oils has been developed through ILSAC (International Lubrication Standardization Approval Committee). Oils that meet ILSAC GF-1 performance standards must have a " starburst" certification mark displayed on the print of the oil product packaging.

## 3.0 ENGINE OIL REQUIREMENTS AND SPECIFICATIONS

### APPROVED ENGINE OILS

-For BMW gasoline engines with two valves per cylinder, all reputable multiple grade engine oils* which meet or exceed the API classification of SH. (Combination with diesel oil specifications CD or CE quality classifications are also permitted, e.g. SH/CE etc.)

For BMW gasoline engines with four valves per cylinder, only reputable multiple grade engine oils* which meet or exceed the API classification of SH. (Combination with diesel oil specifications CD or CE quality classifications are also permitted, e.g. SH/CE etc.)

-For BMW turbocharged diesel engines, all reputable multiple grade engine oils* which meet or exceed the API classification CD/CE.

*: Engine oil may be mineral or synthetic based.

Special Oils category has been replaced by BMW High Performance Synthetic Engine Oil (5W-30). It eliminates the need for seasonal oil changes since it covers all ambient temperature ranges.

BMW of North America has introduced a line of exclusively formulated High Performance Engine Oils which exceed existing international quality specifications (SAE/CCMC) for motor oils. BMW part numbers are:

ENGINE OIL SPECIFICATIONS

| | | |
|---|---|---|
| SAE 5W-30 (SJ/CF)<br>BMW High Performance Synthetic Oil | 1 quart | Part No. 07 51 0 017 866 |
| SAE 15W-40 (SJ/CF)<br>BMW High Performance Mineral Oil | 1 quart | Part No. 07 51 0 017 868 |

Motorsport Engines

E46 M3/S54E36 M roadster, M coupe/S54 from start of production

E39 M5/S62 Up to 3/2000

E52 Z8/S62 Up to 3/2000

E60 M5/S85 From start of production

BMW High Performance Synthetic Oil Castrol RS SAE 10W-60 also called Castrol TWS Motorsport SAE 10W-60

Synthetic Oil Part No. 07 51 0 009 420 (1quart)

E39 M5/S62 From 3/2000

E52 Z8/S62 From 3/2000

BMW High Performance Synthetic Oil SAE 5W-30 Part No. 07 51 0 017 866 Or BMW High Performance Synthetic Oil Castrol RS SAE 10W-60 also called Castrol TWS Motorsport SAE 10W-60 Synthetic Oil Part No. 07 51 0 009 420 (1quart)

BMW High Performance Synthetic Oil 5W-30 and 10W-60 offer several benefits over conventional mineral based oils.

Superior Thermal Stability

The synthetic based oil resists thickening at very low ambient temperatures providing improved flow, lubrication and less internal engine resistance during cold starts.

Under high heat conditions, the oil resists thermal breakdown/shearing which causes a loss of lubrication quality compared with conventional oils.

Superior Lubrication Throughout The Life Of The Oil

Compared to conventional engine oils, BMW High Performance Synthetic Oil is better able to keep engine combustion contaminants in suspension and is less susceptible to the harmful effects of oxidation.

The oil resists sludge buildup thus allowing extended oil change intervals. Synthetic based oils also have a lower volatility which makes them less susceptible to evaporation thereby reducing oil consumption.

This oil has been durability tested on BMW engines and supplies superior lubrication under all operating conditions and over the extended BMW oil change intervals.

## 4.0 ENGINE OIL CHANGE INTERVALS

With the introduction of the 1999 Model Year vehicles BMW has introduced an extended oil change interval of approximately 15,000 miles (depending on engine operating conditions) on most models.

To coincide with the increased oil change interval, BMW has also introduced "BMW High Performance Synthetic Oil" which must be used on all 1999 Model Year vehicles (except E36 318ti, 323is/iC, 328is/iC, M3, M Roadster and M Coupe models) whenever a service is necessary to avoid engine damage.

NOTE: Only if it is necessary to top up the engine oil between oil changes is it permissible to use synthetic low viscosity engine oils which conform to the API classification SJ or higher.

A label in the engine compartment states the oil specifications and refers to the BMW website (www.bmwusa.com) and toll free number (1-800-831-1117) for additional information.




Fig. 1: Identifying Oil Specification Label
Courtesy of BMW OF NORTH AMERICA, INC.

BMW High Performance Synthetic Engine Oil may also be used on Model Year 1999 E36 (3-Series and M models) as well has Model Year 1998 and earlier BMW models.

The oil change intervals should not be extended due to the greater durability of a fully synthetic engine oil. The engine oil and filter should always be changed as per the vehicle's Service Interval Indicator when the "Oil

Service" or the "Inspection" display appears regardless of the type of oil being used.

BMW mineral-based High Performance engine oil is also offered for model year 1998 and earlier BMW models. However, for reliable engine performance in all temperature ranges mineral-based engine oil viscosity must be matched to the temperature range at which the vehicle will be operated. See Fig. 2 below.

BMW Engine Oil Temperature/Viscosity Table

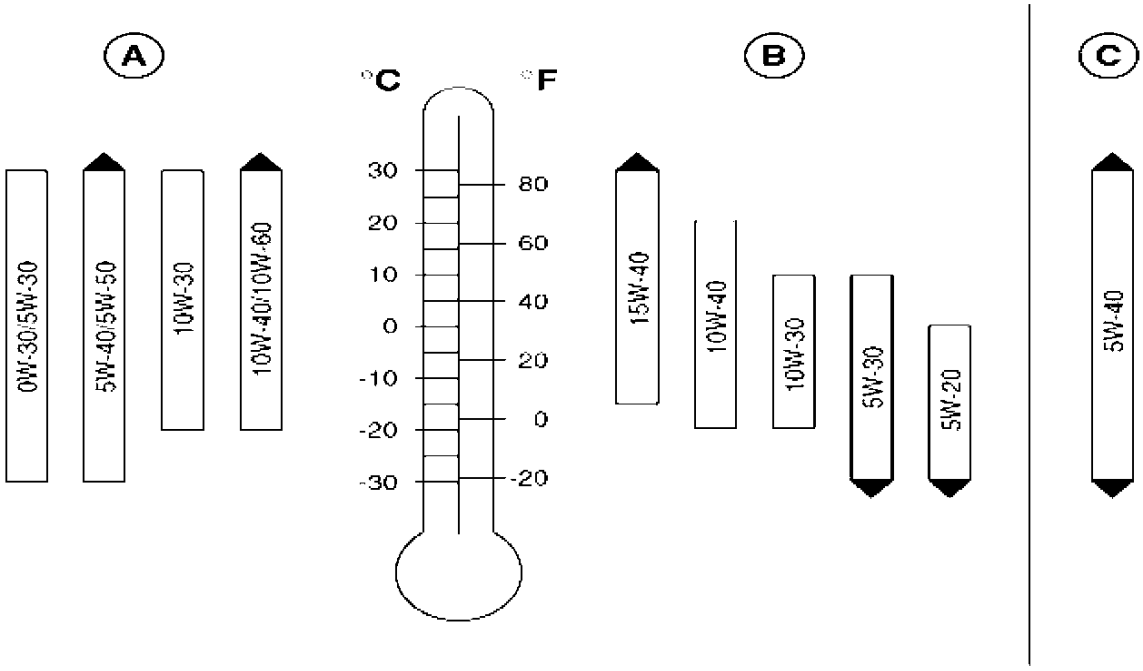



Fig. 2: Identifying BMW Engine Oil Temperature And Viscosity Chart
Courtesy of BMW OF NORTH AMERICA, INC.

A/B: Brand name oils approved per API or ACEA (CCMC)

A = Diesel engines
B = Spark-ignition engines

C: BMW High Performance Oil

C = Valid for spark-ignition and diesel engines

Other Oil Changes For Cars Without Service Indicator:

OIL CHANGES FOR CARS WITHOUT SERVICE INDICATOR

| Model Year(s) | Mileage |
|---|---|
| 1980 and later | 7,500 |
| 1975 thru 1979 | 6,500 |
| 1974 or earlier | 4,000 |

Including oil filter. However, at least twice annually, preferably before and after the winter season.

Under severe driving conditions it is recommended to increase the number of oil services.

## 5.0 CONDITION BASED SERVICE

Models: E90, E60, E61, E63, E64 E65, E66

Condition Based Service measures, monitors, and determines the required maintenance of several service items independent from each other. This technology prompts the customer to bring the vehicle for service whenever one of the CBS items requires maintenance or replacement. CBS strikes a compromise between too frequent maintenance and too rigid service intervals that call for the replacement of service items which may still have substantial remaining useful life. CBS also details the recommended, due, and overdue required maintenance during and after the BMW Vehicle Maintenance Program Agreement. Thus, CBS allows BMW customers to experience a technology that makes service more convenient, transparent and structured.

For E90 please refer to S.I. Bulletin B00 01 05 New Vehicle Preparation and Maintenance Requirements.

For E60, E61, E63, E64 E65, E66 please refer to S.I. Bulletin B00 07 02 Condition Based Service (CBS).

## 6.0 ENGINE OIL ADDITIVES

The use of engine oil additives is not recommended and not necessary on BMW engines. Instead, it is mandatory to use BMW High Performance Synthetic Oil in 1999 model year and later BMW models and recommended to use either BMW High Performance Synthetic Oil, BMW High Performance Mineral Oil or one of today's highly advanced brand name lubricating oils conforming to API classification SH or higher in 1998 and earlier BMW models.

## 7.0 BREAK-IN INSTRUCTIONS

During the break-in period of a new engine or parts of a reconditioned engine (new bearings, crankshaft, pistons, etc.)

BMW engines do not require special break-in oils.

All of the multiple grade engine oils can be used, as long as they conform with BMW specifications.

## 8.0 ENGINE OIL APPLIED TO ENGINE EXHAUST STUDS

Refer to S.I. Bulletin B 11 02 91 (3219).

## 9.0 LUBRICANT FOR OXYGEN SENSOR

Apply Bostik NEVER-SEEZÂ® (Part No. NSBT-16) to threads of oxygen sensor.

## 10.0 OIL CONSUMPTION

All engines normally consume a certain amount of oil. This is necessary in order to properly lubricate the cylinder walls, pistons, piston rings etc. In addition, engines with less than 6,000 miles will generally consume additional oil because the components are not fully seated. Therefore, oil consumption complaints received prior to 6,000 miles cannot be considered.

Once a new or rebuilt engine has accumulated 6,000 miles this procedure should be used if there is a drastic change in the oil consumption rate (i.e. the oil consumption rate triples) under similar driving conditions or if the oil consumption rate exceeds 1 qt. per 750 miles at any time. refer to S.I. Bulletin B 11 05 84 (888).

All Motorsport Engines:

Due to their increased output and maximum engine speeds, these engines are allowed a maximum consumption of 2.5 quarts per 1,000 miles.

## 11.0 REFERENCES

See S.I. Bulletin B 11 04 00 for Engine Oil Level Check.

See S.I. Bulletin B 11 08 98 for BMW Engine Oils.

See S.I. Bulletin B 11 11 90 for BMW Engine Oil Capacities.

## 12.0 OPERATING FLUIDS TABLE AND ALTERNATE SUPPLIERS

OPERATING FLUIDS AND ALTERNATE SUPPLIERS

| BMW Part Number | Description/Application | 3M | Wurth | Loctite | CRC |
|---|---|---|---|---|---|
| 11 12 1 262 571 (1) | Silicone Sealant | 8661 | Â | 80050/PX66BR | |
| 81 12 9 400 086 (1) | Hylogrip/Loctite 270 Thread Sealant (2) | Â | 8932700 | 21438 | Â |
| 81 22 9 400 243 (1) | Sealer (3) | Â | Â | Permatex 3D Aviation Form a Gasket 80017 | Â |
| 81 22 9 400 339 | Hylomar SQ32M Sealant (4) | Â | Â | Â | Â |
| 81 22 9 407 394 (1) | Loctite 380 Epoxy Cement (5) | 8155 | 8934103 | 38050 | Â |
| 81 22 9 400 794 (1) | Copper Paste (6) | 8945 | Â | Â | 3046010 |
| 81 22 9 407 439 (1) 07 58 9 062 376 (1) | Silicone Sealer (7) | 8670 8661 | Â | 81157/PX16B 80050/PX66BR | Â |
| 81 22 9 407 760 (1) | Engine Cleaner Spray (8) | 8899 | 890923 | 80043 | 14045 |
| N/A | Lubro Moly Lecksucher (9) | Â | Â | Â | Â |
| N/A | J-B Weld (10) | Â | Â | Â | Â |
| N/A | Bostik Never-Seez (11) | Â | Â | Â | Â |

(1) These items are no longer available through BMW NA Parts Department.

(2) Secures and seals bolts, studs, nuts, threaded inserts, screw plugs against impact and vibration. Fastens ball, roller and sliding bearings onto shafts or in housings, with play up to 0.25mm. Quick setting. Oil filter flange bolt-See S.I. Bulletin B 11 02 87.

(3) Low viscosity, non-hardening, removable. For sealing off against mineral oils, grease, gases, air and many chemicals. Application: from -40Â°C to approx. 200 Â°C. Tacking cylinder gasket - See S.I. Bulletin B 11 02 88.

(4) Universal sealing compound, applicable by brush. For sealing interfaces between surfaces that require excellent temperature resistance and sealing elasticity. Material: Polyester-urethane mixture.

(5) Black cyanacrylate adhesive for joining metals, rubber, PVC. See S.I. Bulletin B 11 06 89.

(6) Multi-purpose grease for all detachable joints at high temperatures and corrosive conditions, also after long operating periods. Able to withstand high pressures, protection against undesired weld contact, seizure and corrosion, active adhesion properties, effective as lubricant and separator up to 1100 Â°C. Applications: parts subject to high temperatures, such as bolts and flanges on exhaust system, engine, disk brakes, etc.

(7) A black colored silicone-based sealant for large areas. Resists temperatures up to 250 Â°C. For engine or gearbox; particularly suitable for sealing the timing case on M70 engine, and eliminating oil seepage from E36 M42 cylinder head. See S.I. Bulletins B 11 07 90, B 11 02 88, B 11 09 93.

(8) Fast acting cleaner for dirty engines and engine parts. Does not attack painted, rubber, or plastic parts.

(9) Intake and vacuum system leak detector. See S.I. Bulletin B 11 03 92.

(10) Repairs pitting in cylinder head sealing surfaces. See S.I. Bulletin B 11 10 93.

(11) Thread lubricant for oxygen sensors.

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# OPERATING FLUIDS

## Operating Fluids - Exhaust System - All Models

## 1.0 GENERAL INFORMATION

Detachable joints such as exhaust manifold bolts and exhaust system flange connections can be treated with a grease able to withstand high temperatures and corrosive conditions.

Use Copper Paste (former BMW Part No. 81 22 9 400 794).

EXHAUST SYSTEM FLUID SPECIFICATION

| | |
|---|---|
| 3M | Part No. 8945 |
| CRC | Part No. 3046010 |

See S.I. Bulletin B 18 03 89 (1954).

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