TRANSMISSION

Automatic Transmission - Operating Fluids

1.0 GENERAL INFORMATION ON AUTOMATIC TRANSMISSION FLUIDS

Automatic Transmission Fluid was developed especially for automatic transmissions. It requires additives which are carefully matched with each other, a high viscosity index and a solidification point below-40°F/-40° C.

Friction behavior of Automatic Transmission Fluid in plate-type clutches under very different operating conditions is extremely important. Other important factors are:

- Wear protection
- Oil film shear resistance
- Adhesive property
- Oxidation resistance
- Corrosion inhibition
- Sludge prevention
- Temperature-dependent viscosity changes
- Compatibility with sealing materials.

2.0 OIL ADDITIVES

Automatic transmissions are designed so that oil additives are not necessary. BMW disapproves the use of any oil additives and cannot accept the liability for any consequential damage which results from using oil additives.

3.0 APPROVED AUTOMATIC TRANSMISSION FLUIDS FOR INITIAL FILLINGS AND CORRECTING FLUID LEVELS

3.1 GM TRANSMISSIONS

USE OF ANY OTHER OIL WILL CAUSE A NON WARRANTABLE TRANSMISSION FAILURE

***Transmission identification plate can be utilized to determine proper transmission fitted in vehicle**

A4S 270R (THM-R1W)

E36

318i/is/iC/ti from 1996 to 1999 production

323i/is/iC from 1998 to 1999 production

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328i/is/iC from 1996 to 1998 production

Z3 1.9 from 1996 to 1999 production

Z3 2.3/2.8 from 1997 to 2000 production

All reputable brand name Automatic Transmission Fluids of the Dexron® III formulation.

E39

528i/iT from1997-1999 production

All reputable brand name Automatic Transmission Fluids of the Dexron® III formulation.

A4S 310R (THM-R1)

E34

525i from 1990 to 1995 production

All reputable brand name Automatic Transmission Fluids of the Dexron® III formulation.

E36

318i/is/iC/ti from 1992 to 1995 production

325i/is/iC from 1992 to 1995 production

All reputable brand name Automatic Transmission Fluids of the Dexron® III formulation.

A5S 360R (GM5)

E46

323i/Ci/Cic from 6/98 to 3/00 production

323iT from 1//00 to 3/01 to production

328i/Ci/Cic from 6/98 to 3/01 production

The transmission oil pan will be labeled with either Texaco ETL - 7045 or Dexron® III, please fill or top off with the proper fluid only. Do not mix Texaco ETL - 7045 and Dexron® III fluids.

A5S 390R (GM 5)

E46

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330xi from 6/00 production to present

325xiT from 9/00 production to present

E53

X5 3.0 from 8/03 production to present

E83

X3 2.5, 3.0 from 8/03 production to present

The transmission oil pan will be labeled with either Texaco ETL - 7045 or Dexron® III, please fill or top off with the proper fluid only. Do not mix Texaco ETL - 7045 and Dexron® III fluids.

E85

Z4 3.0 from 9/02 production to present

Z4 2.5 from 9/02 production to present

No subsequent transmission fluid changes are necessary. Never mix any other oil with this transmission fluid when doing repairs or topping up.

ESSO LT 71141, BMW Part No. 83 22 9 407 807.

GA6L45R (GM6)

DEXRON-VI Automatic Transmission Fluid

E83

X3 LCI from 9/06 production to present

E82, E88

128i, 135is from 12/07 production to present

E90

328Xi from 9/06 production to present

E91

328Xi from 9/06 production to present

The fluid can be sourced locally until a BMW PN is available.

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3.2 ZF TRANSMISSIONS

USE OF ANY OTHER OIL WILL CAUSE A NON WARRANTABLE TRANSMISSION FAILURE

***Transmission identification plate can be utilized to determine proper transmission fitted in vehicle**

ZF 3HP22, 4HP22, 4HP24

Utilizes Castrol TQ or Texaco Havoline Automatic Transmission Fluids of the Dexron® III formulation. Never mix any other oil with this transmission fluid when doing repairs or topping up.

A5S 310Z (5HP18)

E36

M3 from 1995 to 1999 production

Utilizes a lifetime filling of synthetic transmission fluid, ESSO LT 71141, no subsequent transmission fluid changes are necessary. Never mix any other oil with this transmission fluid when doing repairs or topping up.

ESSO LT 71141, BMW Part No. 83 22 9 407 807.

E34

530i/iT from 1993 through 1995 production

Utilizes Castrol TQ or Texaco Havoline Automatic Transmission Fluids of the Dexron® III formulation. Never mix any other oil with this transmission fluid when doing repairs or topping up.

A5S325Z (5HP19)

E46

323i/Ci/Cic from 3/00 to 8/00 production

325iT from 4/01production to present

330i/Ci/Cic from 6/00 production to present

325i/Ci/Cic from 9/00 production to present

No subsequent transmission fluid changes are necessary. Never mix any other oil with this transmission fluid when doing repairs or topping up.

ESSO LT 71141, BMW Part No. 83 22 9 407 807.

E39

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525i/iT from 3/01 production to present

530i from 3/01 production to present

No subsequent transmission fluid changes are necessary. Never mix any other oil with this transmission fluid when doing repairs or topping up.

ESSO LT 71141, BMW Part No. 83 22 9 407 807.

A5S 440Z (5HP24)

E31

840Ci from 9/96 to the present

No subsequent transmission fluid changes are necessary. Never mix any other oil with this transmission fluid when doing repairs or topping up.

ESSO LT 71141, BMW Part No. 83 22 9 407 807.

E38

740i/iL from 1/97 production to present

No subsequent transmission fluid changes are necessary. Never mix any other oil with this transmission fluid when doing repairs or topping up.

ESSO LT 71141, BMW Part No. 83 22 9 407 807.

E39

540i/iT from 1/97 production to present

No subsequent transmission fluid changes are necessary. Never mix any other oil with this transmission fluid when doing repairs or topping up.

ESSO LT 711 41, BMW Part No. 83 22 9 407 807.

E53

X5 4.4i from 9/99 production to present

X5 4.6i from 9/01 production to present

No subsequent transmission fluid changes are necessary. Never mix any other oil with this transmission fluid when doing repairs or topping up.

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ESSO LT 711 41, BMW Part No. 83 22 9 407 807.

A5S 560Z (5HP30)

E31

840Ci equipped with M60 engine

Utilizes a lifetime fill of transmission fluid, no subsequent oil changes are necessary on this transmission. If transmission fluid is required for repair purposes, use only the oil approved for this transmission. It is not permitted to mix this oil with other grades of transmission fluid.

Shell LA 2634, BMW Part No. 83 22 9 407 765.

E31

840Ci equipped with M62 engine

850Ci equipped with M73 Engine

Utilizes lifetime fill of transmission fluid, no subsequent transmission fluid changes are necessary.

Never mix any other oil with this transmission fluid when doing repairs or topping up.

ESSO LT 711 41, BMW Part No. 83 22 9 407 807.

E32

740i/iL from 1993 through 1994 production

Utilizes a lifetime fill of transmission fluid, no subsequent oil changes are necessary on this transmission. If transmission fluid is required for repair purposes, use only the oil approved for this transmission. It is not permitted to mix this oil with other grades of transmission fluid.

Shell LA 2634, BMW Part No. 83 22 9 407 765.

E34

540i/iT from 1993 through 1995 production

Utilizes a lifetime fill of transmission fluid, no subsequent oil changes are necessary on this transmission. If transmission fluid is required for repair purposes, use only the oil approved for this transmission. It is not permitted to mix this oil with other grades of transmission fluid.

Shell LA 2634, BMW Part No. 83 22 9 407 765.

Effective with model year 1995 and later:

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E31

850Ci from 10/94 to 6/97 production

840Ci from 12/95 to 8/96 production

Utilizes lifetime fill of transmission fluid, no subsequent transmission fluid changes are necessary.

Never mix any other oil with this transmission fluid when doing repairs or topping up.

ESSO LT 711 41, BMW Part No. 83 22 9 407 807.

E38

750iL from 1/95 production to present

740i/iL from 7/94 to 12/96 production

Utilizes lifetime fill of transmission fluid, no subsequent transmission fluid changes are necessary.

Never mix any other oil with this transmission fluid when doing repairs or topping up.

ESSO LT 711 41, BMW Part No. 83 22 9 407 807.

E39

540i/iT from 3/96 to 12/96 production

Utilizes lifetime fill of transmission fluid, no subsequent transmission fluid changes are necessary.

Never mix any other oil with this transmission fluid when doing repairs or topping up.

ESSO LT 711 41, BMW Part No. 83 22 9 407 807.

GA6HP19Z

E82/E88, E90/91/92

325i, 328i, 330i, 335i, All

The transmission fluid has a Condition Based Service interval of approximately 100,000 miles. Never mix any other oil with this transmission fluid when doing repairs or topping up.

Shell M-1375.4, BMW Part No. 83 22 0 142 516.

E60/61

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525i, 530i from 8/03 production to present

The transmission fluid has a Condition Based Service interval of approximately 100,000 miles. Never mix any other oil with this transmission fluid when doing repairs or topping up.

Shell M-1375.4, BMW Part No. 83 22 0 142 516.

GA6HP19ZTU

E70 3.0i from start production to present

The transmission fluid has a Condition Based Service interval of approximately 100,000 miles. Never mix any other oil with this transmission fluid when doing repairs or topping up.

Shell M-1375.4, BMW Part No. 83 22 0 142 516.

GA6HP26Z

E60

545i from 8/03 production to present

550i All

The transmission fluid has a Condition Based Service interval of approximately 100,000 miles. Never mix any other oil with this transmission fluid when doing repairs or topping up.

Shell M-1375.4, BMW Part No. 83 22 0 142 516.

E63, E64

645Ci, 645CiC from start of production to present

650Ci, 650CiC All

The transmission fluid has a Condition Based Service interval of approximately 100,000 miles. Never mix any other oil with this transmission fluid when doing repairs or topping up.

Shell M-1375.4, BMW Part No. 83 22 0 142 516.

E65

745i from 11/2001 production to present

750i All

The transmission fluid has a Condition Based Service interval of approximately 100,000 miles. Never mix any

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other oil with this transmission fluid when doing repairs or topping up.

Shell M-1375.4, BMW Part No. 83 22 0 142 516.

E66

745Li from 3/2002 production to present

750Li All

760Li from 9/2002 production to present

The transmission fluid has a Condition Based Service interval of approximately 100,000 miles. Never mix any other oil with this transmission fluid when doing repairs or topping up.

Shell M-1375.4, BMW Part No. 83 22 0 142 516.

GA6HP26ZTU

E70

X5 4.8i from start production to present

The transmission fluid has a Condition Based Service interval of approximately 100,000 miles. Never mix any other oil with this transmission fluid when doing repairs or topping up.

Shell M-1375.4, BMW Part No. 83 22 0 142 516.

4.0 CHECKING TRANSMISSION FLUID LEVEL

Due to the substantial expansion of transmission fluid when heated it is only possible to measure the oil level correctly at specified oil temperatures (after driving a distance of about 12 mi./20 km). All transmissions should be checked between a

ZF 3HP and 4HP

Due to the substantial expansion of transmission fluid when heated it is only possible to measure the oil level correctly at specified oil temperatures (after driving a distance of about 12 mi./20 km).

A5S 560Z, A5S440Z, GA6HP19Z, GA6HP26Z, GA6HP26Z, A5S325Z, A5S 310Z

All 5 and 6 speed transmissions require the fluid to be checked when fluid temperature is between 30-50° Celsius using DIS Plus or GT1. Do not check fluid level after temperature has exceeded 50° Celsius.

A4S 270R, A4S 310R and A5S 360R

See appropriate AUTOMATIC TRANSMISSION article for fluid level check procedure. These transmissions

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generally do not have a dipstick and fluid level check (if necessary) must be performed through the oil fill hole.

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TRANSMISSION

Automatic Transmission - Repair Instructions - X3

00 TRANSMISSION ASSEMBLY

00 DANGER OF POISONING IF OIL IS INGESTED/ABSORBED THROUGH THE SKIN

Danger of poisoning!

Ingesting oil or absorbing through the skin may cause poisoning!

Possible symptoms are:

- Headaches
- Dizziness
- Stomach aches
- Vomiting
- Diarrhoea
- Cramps/fits
- Unconsciousness

Protective measures/rules of conduct:

- Pour oil only into appropriately marked containers
- Do not pour oil into drinking vessels (drinks bottles, glasses, cups or mugs)
- Observe country-specific safety regulations

First aid measures:

- Do not induce vomiting.

  If the person affected is still conscious, he/she must rinse out their mouth with water, drink plenty of water and consult a doctor immediately.

  If the person affected is unconscious, do not administer anything by mouth, place the person in the recovery position and seek immediate medical attention.

00 RISK OF INJURY IF OIL COMES INTO CONTACT WITH EYES AND SKIN

Danger of injury!

Contact with eyes or skin may result in injury!

Possible symptoms are:

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- Impaired sight
- Irritation of the eyes
- Reddening of the skin
- Rough and cracked skin

Protective measures/rules of conduct:

- Wear protective goggles
- Wear oil-resistant protective gloves
- Observe country-specific safety regulations

First aid measures:

- Eye contact: Rinse eyes immediately with plenty of water for at least 15 minutes; if available, use an eye-rinsing bottle. If irritation of the eyes persists, consult a doctor.
- Skin contact: Wash off with soap and water immediately. If irritation persists, consult a doctor.

NOTE: Do not use solvents/thinners.

00 SAFETY INSTRUCTIONS FOR HANDLING OIL

**WARNING: Danger of poisoning if oil is ingested/absorbed through the skin!
Risk of injury if oil comes into contact with eyes and skin!**

Recycling:

Observe country-specific waste-disposal regulations.

Measures if oil is unintentionally released:

- Personal precautionary measures: Danger of slipping! Keep non-involved persons away from the work area. Wear personal protective clothing/equipment.
- Environmental protection measures: Prevent oil from draining into drain channels, sewerage systems, pits, cellars, water and the ground.
- Limiting spread: Use oil blocks to prevent the surface spread of oil.
- Cleaning procedure: Bind and dispose of escaped oil with nonflammable absorbents.

NOTE: Do not flush oil away with water or aqueous cleaning agents.

00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R)

**IMPORTANT: Use only the approved transmission fluid.
Failure to comply with this requirement will result in serious damage to the**

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automatic transmission!

Remove exhaust system bracket (1).

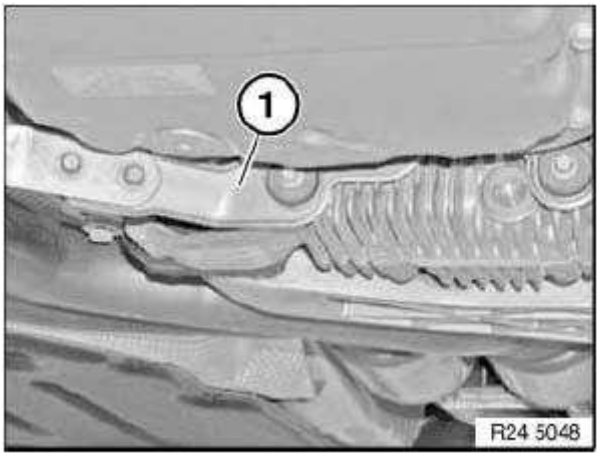


Fig. 1: Exhaust System Bracket
Courtesy of BMW OF NORTH AMERICA, INC.

Topping up transmission fluid after a repair:

Stand vehicle on a level surface and secure against rolling off.

Undo filler plug (1).

Installation:

Replace sealing ring.

Top up transmission fluid until it emerges from filling orifice.

Start engine.

Replenish transmission fluid until it emerges from filling orifice.

Screw in filler plug (1).

Tightening torque: 24 11 7AZ, see **24 11 TRANSMISSION HOUSING, TRANSMISSION OIL SUMP** .

Press brake pedal to floor and shift through all gears several times at idle speed. Then shift to "P" position (Park).

Then check fluid level.

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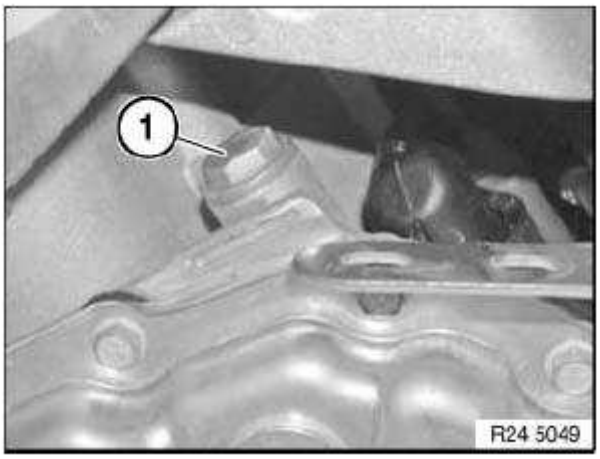


Fig. 2: Filler Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Checking fluid level:

- Connect BMW Diagnosis and Information System (DIS) to vehicle.
- Call up Service functions (drive).
- Carry out fluid level check in accordance with instructions.

23 TRANSMISSION DESIGNATIONS

BREAKDOWN OF BMW DESIGNATION

A5S 300J (old designation)		
A	Transmission type	○ S = Manual transmission ○ A = Automatic transmission
5	Number of forward gears	
S	Type of top gear	○ D = Direct gear ○ S = Overdrive gear
300	Max. input torque (Nm)	
J	Code letter of transmission manufacturer	○ G = Getrag ○ J = Jatco ○ R = GMPT (General Motors Powertrain) ○ Z = ZF (Zahnradfabrik Friedrichshafen)
SMG	Notes	SMG = Sequential M gearbox/transmission
GS6-37BZ (new designation according to BMW Group Standard GS 90007)		
G	Transmission	
S	Transmission type	○ S = Manual transmission ○ A = Automatic transmission
6	Number of forward gears	

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-		o - = Standard with manual gearshift o HP = Hydraulic planetary gear
37	Transmission type	o 26 = D-transmission o 31 = C-transmission o 39 = F-transmission o 37 = H-transmission o 53 = G-transmission o 17 = I-transmission o 47 = J-transmission
B	Gear set	o B = Petrol/gasoline gear ratio o D = Diesel gear ratio
Z	Code letter of transmission manufacturer	o G = Getrag o Z = ZF (Zahnradfabrik Friedrichshafen)

MANUAL TRANSMISSION

BMW designation	Manufacturer	Manufacturer designation	Remark
S5D 200G	Getrag	B transmission (220/5)	
S5D 200G	Getrag	B transmission (221/5)	for M41 engine only
S5D 250G	Getrag	B transmission (220/5)	Reinforced design
S5D 260Z	ZF	C-transmission (S5-31 D)	for M51 engine only
S5D 280Z	ZF	C-transmission (S5-31)	
S5D 310Z	ZF	C-transmission (S5-31)	up to 9.95
S5D 320Z	ZF	C-transmission (S5-31)	from 9.95 (reinforced design)
GS5S31BZ (SMG)	ZF	C transmission	SMG
GS5-39DZ	ZF	F transmission	
S6S 420G	Getrag	D-transmission (226/6)	
S6S 420G (SMG)	Getrag	D transmission	SMG
S6S 560G	Getrag	E-transmission (286/6)	
GS6-37BZ	ZF	H-transmission	
GS6S37BZ (SMG)	ZF	H-transmission	
GS6-37DZ	ZF	H-transmission	
GS6-37BG	Getrag	H-transmission	
GS6-53BZ	ZF	G-transmission	

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GS6-53DZ	ZF	G-transmission	
GS6-17BG	Getrag	I-transmission	
GS7S47BG (SMG)	Getrag	J-transmission (247)	SMG 7-speed

AUTOMATIC TRANSMISSION

BMW designation	Manufacturer	Manufacturer designation	Remark
A4S 200R	GMPT	GM4	
A4S 270R	GMPT	THM-R1w	Transmission widestepped
A4S 310R	GMPT	THM-R1	
A5S 300J	Jatco	Jatco	
A5S 310Z	ZF	5HP-18	
A5S 325Z	ZF	5HP-19	
A5S 440Z	ZF	5HP-24	
A5S 560Z	ZF	5HP-30	
A5S 360R / 390R	GM	GM5	
GA6HP19Z	ZF	6HP19	
GA6HP26Z	ZF	6HP26	
GA6HP32Z	ZF	6HP32	
GA6L45R	GM	GM6	

23 .. UNIVERSAL TRANSMISSION BRACKET

Special tools required:

- 00 2 030
- 23 0 132 , see **23 MANUAL TRANSMISSION**
- 23 4 050 , see **23 MANUAL TRANSMISSION**

NOTE:

- **The universal transmission bracket is introduced for the E60 AWD**
- **Suitable for manual and automatic transmissions**

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IMPORTANT: Front and rear supports (1) can be laterally adjusted by means of screws (2). Carrier (3) of rear supports (1) can be longitudinally adjusted by means of screw.
Supports must be adapted in length and width to the transmission.

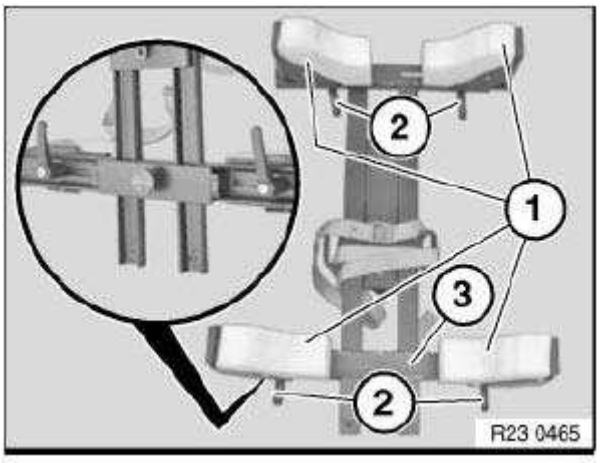


Fig. 3: Rear Supports, Screws And Carrier
Courtesy of BMW OF NORTH AMERICA, INC.

Supporting transmission:

Support transmission with special tools 23 4 050, 23 0 132 , 00 2 030 .

IMPORTANT: Transmission must be secured with tensioning strap (1).

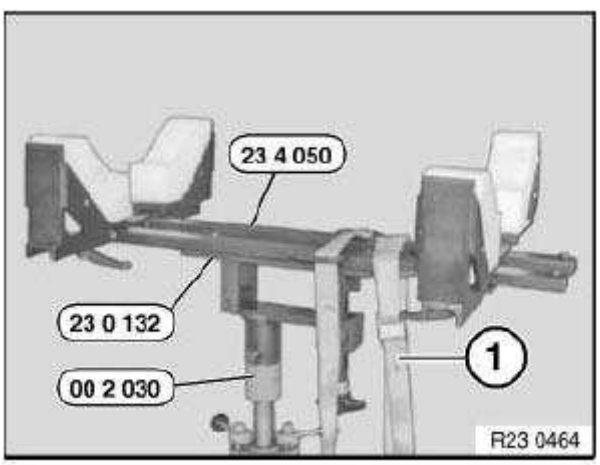


Fig. 4: Special Tools (23 4 050), (23 0 132) And (00 2 030)
Courtesy of BMW OF NORTH AMERICA, INC.

23 .. ... UNIVERSAL TRANSMISSION RETAINING BRIDGE

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Special tools required:

- 00 1 450
- **24 0 200 SUPPORT**

NOTE:
- **The transmission retaining bridge 24 0 200 is suitable for both manual and automatic transmissions**

**IMPORTANT: Adapters and spindles must be adapted for positive locking to the transmission.
(Risk of injury)**

Adapt adapters (1) and spindle with thrust piece (3) to transmission.

Adapt length with slide (2).

Screw in spindle (4).

IMPORTANT: Before mounting on assembly stand 00 1 450 , check retaining bridge for secure seating.

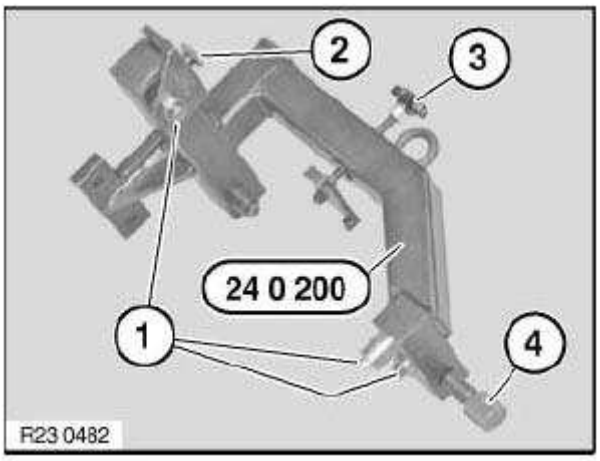


Fig. 5: Adapters, Thrust Piece Spindle And Special Tool (24 0 200)
Courtesy of BMW OF NORTH AMERICA, INC.

24 00 018 ADJUSTING SELECTOR LEVER (A5S 360R / 390R, A4S 200R, 6HP26Z/19Z)

**NOTE: Check cable for ease of movement.
Move selector lever to "P" position.**

Grip clamping sleeve (1).

Slacken nut (2).

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Press selector lever (3) forwards into park position. Press cable (4) in direction of arrow and release again.

Grip clamping sleeve (1).

Tighten down nut (2).

Tightening torque 25 16 2AZ , see **25 16 SHIFT CONSOLE - AUTOMATIC TRANSMISSION** .

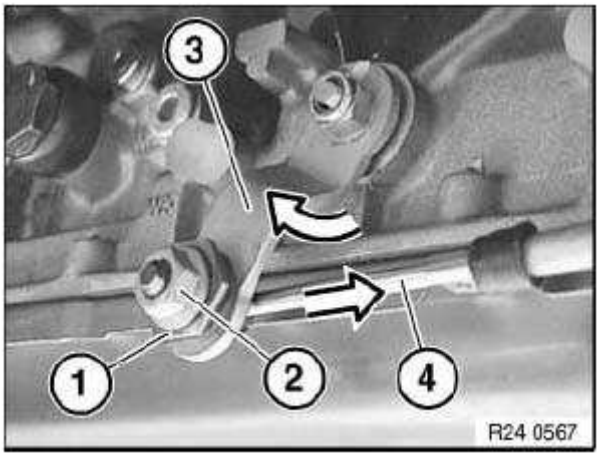


Fig. 6: Clamping Sleeve, Nut And Selector Lever
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Move selector lever to "P" position.

Check whether parking gear is engaged by turning propeller shaft.

24 00 018 ADJUSTING SELECTOR LEVER (GA6L45R) AWD

NOTE: Check cable for ease of movement.
Move selector lever to "P" position.

Grip clamping sleeve (1).

Loosen nut (2).

Press selector lever (3) forward into park position. Press cable (4) in direction of arrow, then release again.

Grip clamping sleeve (1).

Tighten nut (2).

Tightening torque, 25 16 2AZ. , see **25 16 SHIFT CONSOLE - AUTOMATIC TRANSMISSION**

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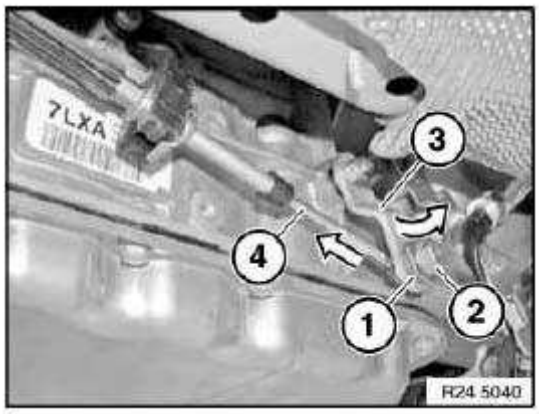


Fig. 7: Clamping Sleeve, Nut, Selector Lever And Cable
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Move selector lever to "P" position.

Check whether parking gear is engaged by turning propeller shaft.

24 00 018 ADJUSTING SELECTOR LEVER (GA6L45R)

NOTE: Check cable for ease of movement. Move selector lever to "P" position.

Grip clamping sleeve (1). Slacken nut (2). Press selector lever (3) forwards into park position. Press cable (4) in direction of arrow and release again. Grip clamping sleeve (1). Tighten down nut (2). Tightening torque, see 25 16 2AZ in **25 16 SHIFT CONSOLE - AUTOMATIC TRANSMISSION** .

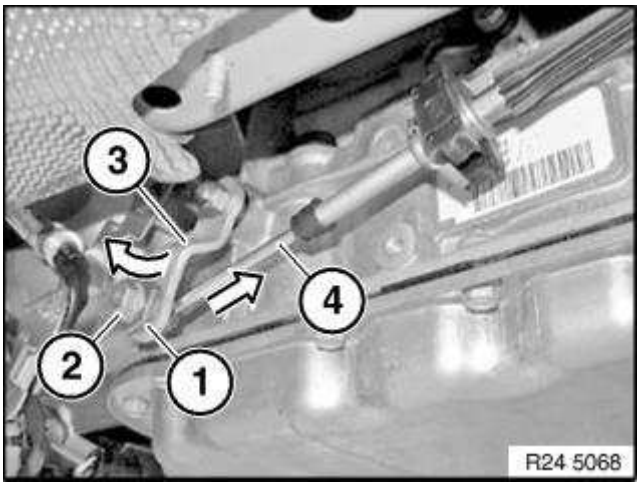


Fig. 8: Press Cable (4) In Direction Of Arrow And Release Again
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

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Move selector lever to "P" position. Check whether parking gear is engaged by turning propeller shaft.

24 00 032 REMOVING AND INSTALLING AUTOMATIC TRANSMISSION (GA6L45R)

Special tools required:

See **MAINTENANCE AND GENERAL INFORMATION - SPECIAL TOOLS** , **23 MANUAL TRANSMISSION** , **24 AUTOMATIC TRANSMISSION**

- 00 2 030
- 00 9 010
- 00 9 120
- 00 9 130
- 23 0 132
- 23 4 050
- 24 1 110
- 24 2 390
- 24 4 160
- 24 4 161
- 24 4 166

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) .
Use only the approved transmission fluid .
Failure to comply with this requirement will result in serious damage to the automatic transmission!

IMPORTANT: Aluminium-magnesium materials.
No steel screws/bolts may be used due to the threat of electrochemical corrosion.
A magnesium crankcase requires aluminium screws/bolts exclusively.
Aluminium screws/bolts must be replaced each time they are released .
The end faces of these screws/bolts are painted blue for the purposes of reliable identification.
Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Disconnect battery negative lead, see **THE BATTERY** .
- Remove underbody protection with bracket at front and rear.
- Remove reinforcement plate

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- Remove complete exhaust system
- Remove heat shields
- Remove front propeller shaft at transfer box and tie to one side
- Support engine with lifter when removing transmission

Release bolts (1).

Remove bracket and heat shield.

Unclip lines (2).

Remove bracket (3).

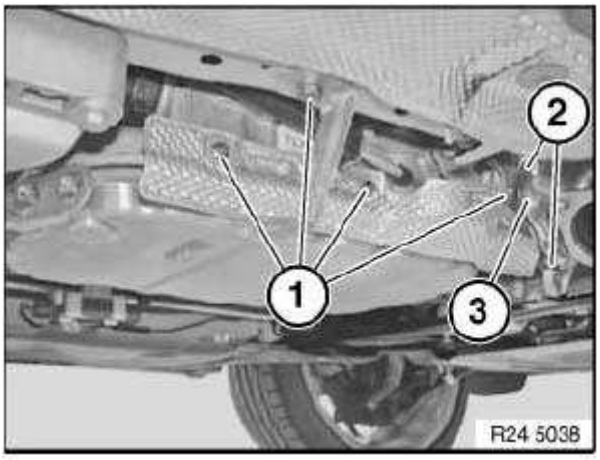


Fig. 9: Bolts, Lines And Bracket
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connector (1).

Release screws (2).

Remove retaining plate (3).

Tightening torque: 24 00 2AZ, see **24 00 TRANSMISSION IN GENERAL** .

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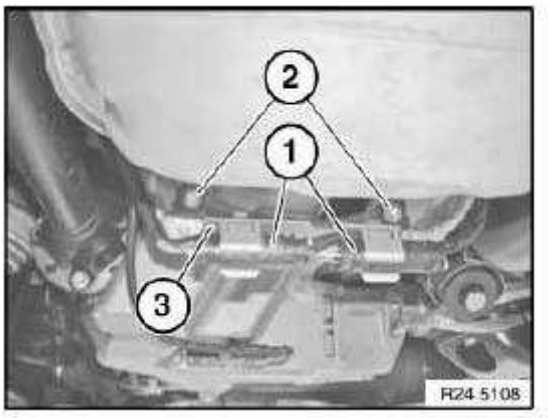


Fig. 10: Plug Connector, Screws And Retaining Plate
Courtesy of BMW OF NORTH AMERICA, INC.

Release aluminium screws on right next to cable retaining plate with special tool 00 9 010 .

Blue aluminium screws/bolts must be replaced.

Tightening torque: 24 00 2AZ, see **24 00 TRANSMISSION IN GENERAL** .

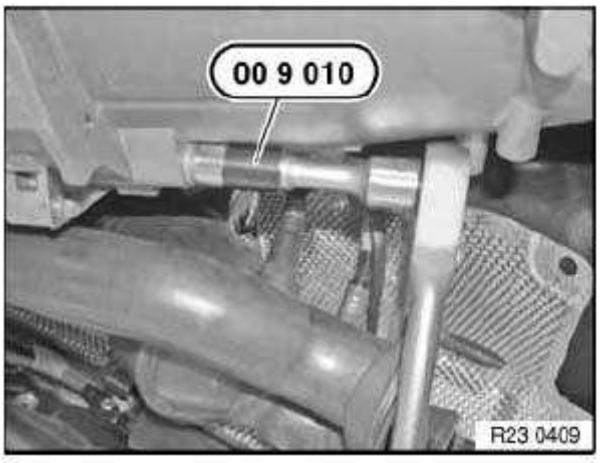


Fig. 11: Special Tool (00 9 010)
Courtesy of BMW OF NORTH AMERICA, INC.

Grip clamping sleeve (1).

Loosen nut (2).

Release screws (3).

Remove cable (4).

Tightening torque: 25 16 1AZ, see **25 16 SHIFT CONSOLE - AUTOMATIC TRANSMISSION** .

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Installation:

Adjust selector lever, see **24 00 018 Adjusting selector lever (A5S 360R / 390R, A4S 200R, 6HP26Z/19Z)**.

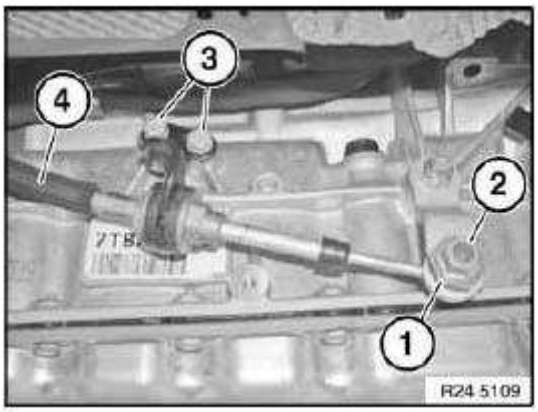


Fig. 12: Clamping Sleeve, Nut, Screws And Cable
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1).

Disconnect hydraulic lines (2) to transmission fluid cooler.

Installation:

Replace sealing rings.

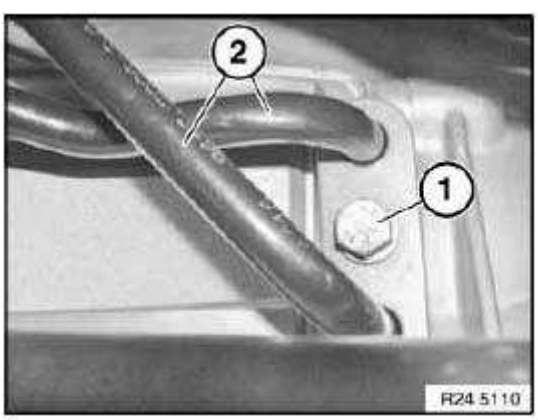


Fig. 13: Screws And Hydraulic Lines
Courtesy of BMW OF NORTH AMERICA, INC.

Release nut (1) and bracket from transmission oil lines on oil sump.

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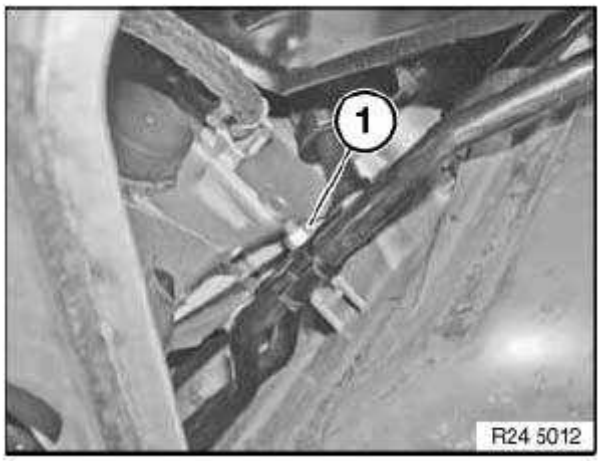


Fig. 14: Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Detach plugs (1) and (2) from servomotor.

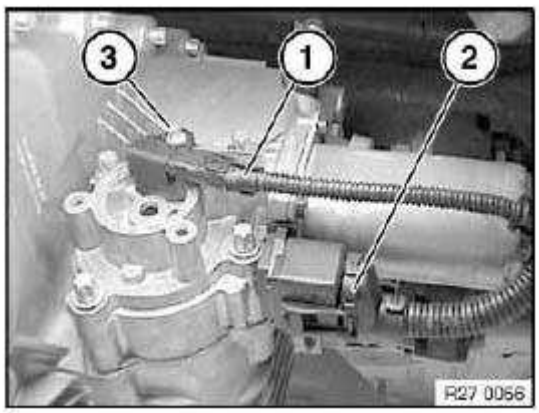


Fig. 15: Plugs And Servomotor
Courtesy of BMW OF NORTH AMERICA, INC.

Supporting transmission:

Support transmission with special tools 23 4 050, 23 0 132 and 00 2 030 .

Secure transmission with tensioning strap (1).

Tasks are described in Transmission bracket, see **23 .. UNIVERSAL TRANSMISSION BRACKET** .

After completion of work, check transmission oil level.

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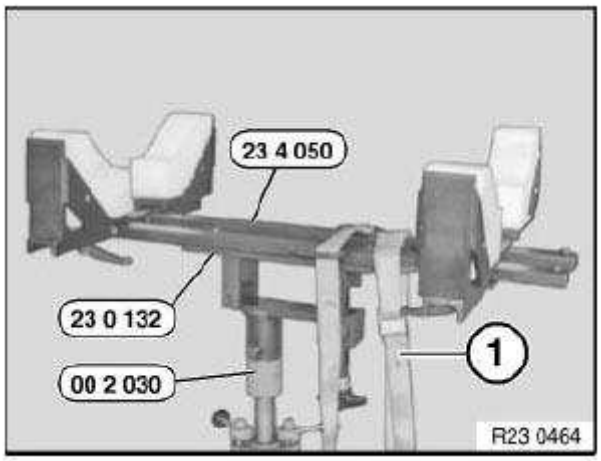


Fig. 16: Special Tools (23 4 050), (23 0 132) And (00 2 030)
Courtesy of BMW OF NORTH AMERICA, INC.

- Remove propeller shaft from transmission.
- Release center bearing.
- Tie propeller shaft to one side.

Tasks are described in Removing propeller shaft, see **26 11 000 REMOVING AND INSTALLING PROPELLER SHAFT (CARDAN UNIVERSAL JOINT) COMPLETELY** .

IMPORTANT: Do not allow propeller shaft to hang from fixed ball joint (risk of damage) .

Unfasten screws and remove transmission cross-member.

Tightening torque: 24 71 1AZ, see **24 71 TRANSMISSION MOUNTS** .

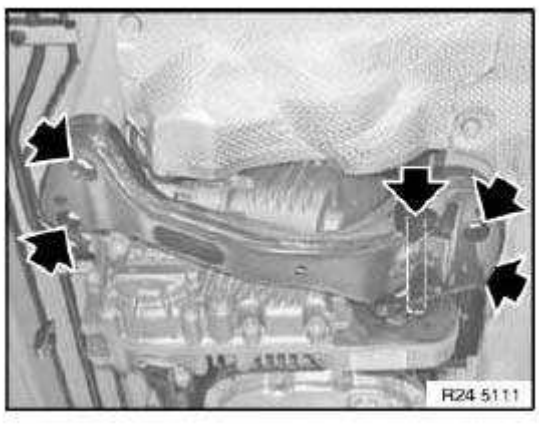


Fig. 17: Locating Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Crank engine at vibration damper in direction of rotation until screw (1) is visible in opening.

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Release all screws of torque converter with special tool 24 1 110 .

Crank engine further and release remaining 5 bolts.

Tightening torque: 24 40 1AZ, see **24 40 TORQUE CONVERTER** .

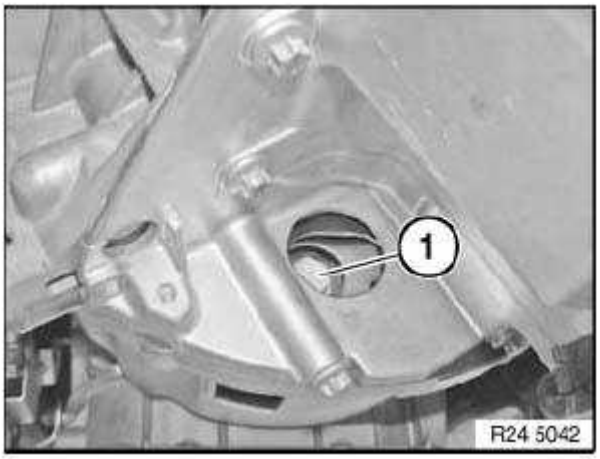


Fig. 18: Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Prepare special tool (1) 24 4 161 with shaped piece (2) 24 4 166.

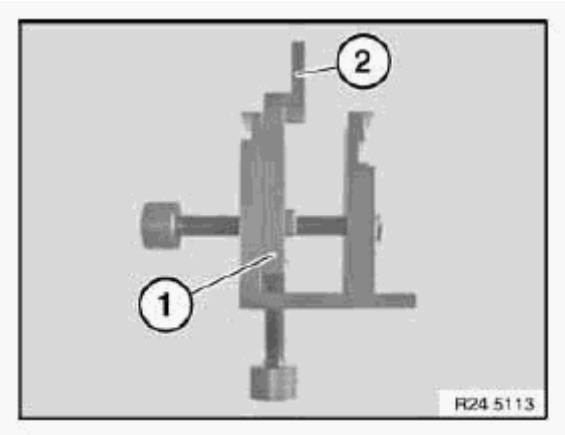


Fig. 19: Special Tool (24 4 161) And Shaped Piece
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 24 4 160 into opening of transmission housing and tensions slightly with screw (1).

Raise by turning screw (2) and clamp down.

Then tighten down screw (1).

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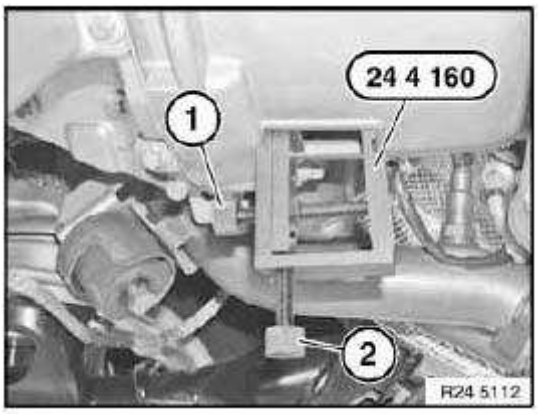


Fig. 20: Screws And Special Tool (24 4 161)
Courtesy of BMW OF NORTH AMERICA, INC.

- Unlock and disconnect plug (1) by turning.
- Do not touch pins.
- Release cable from retainers.
- Insert special tool 24 2 390 in sealing sleeve.

Operations are described in

Notes on mechatronics, see **24 34 561 Notes on mechatronics (GA6L45R)**.

IMPORTANT: Read and comply with important note.

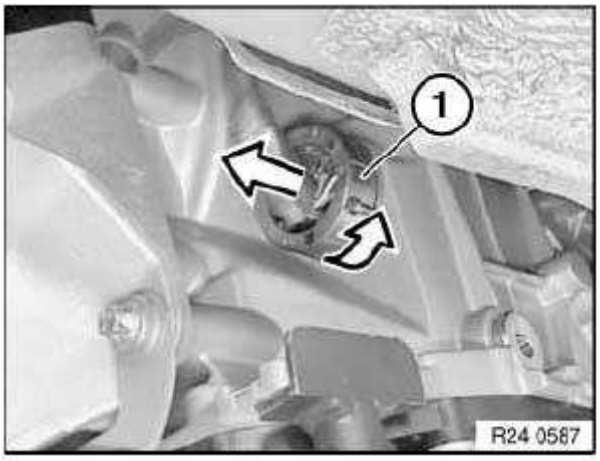


Fig. 21: Disconnecting Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws.

Installation:

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Observe **screw fastening sequence** without fail.

Tightening torque: 24 00 1AZ, see **24 00 TRANSMISSION IN GENERAL** .

Aluminium screws **must** be replaced.

Tightening torque: 24 00 2AZ, see **24 00 TRANSMISSION IN GENERAL** .

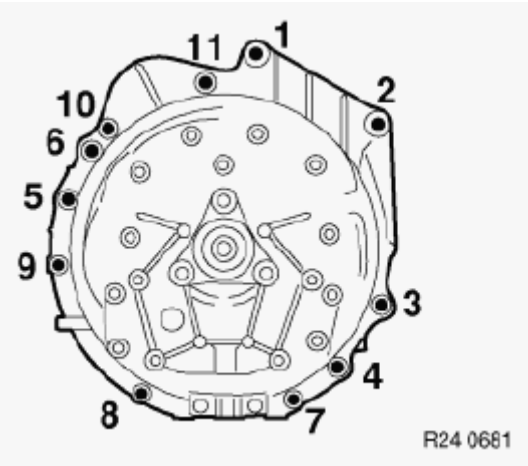


Fig. 22: Screw Fastening Sequence
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Tighten down screws/bolts to specified torque.

Secure special angle of rotation tool 00 9 120 with magnet 00 9 130 to underbody and screw down blue aluminium screws/bolts in accordance with angle of rotation.

Tightening torque: 24 00 2AZ, see **24 00 TRANSMISSION IN GENERAL** .

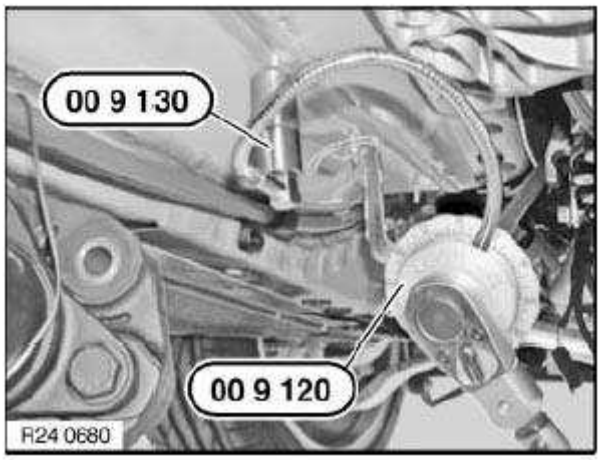


Fig. 23: Special Tools (00 9 120) And (00 9 130)

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Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Bore (1) in driving disk must be accessible from opening on engine oil pan.

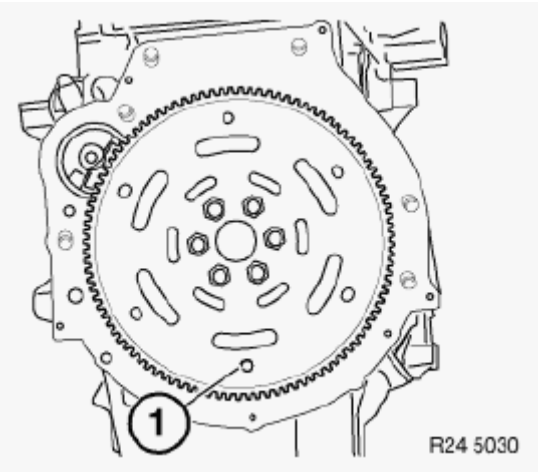


Fig. 24: Bore In Driving Disk
Courtesy of BMW OF NORTH AMERICA, INC.

Check that dowel sleeves are correctly seated.

Replace damaged dowel sleeves.

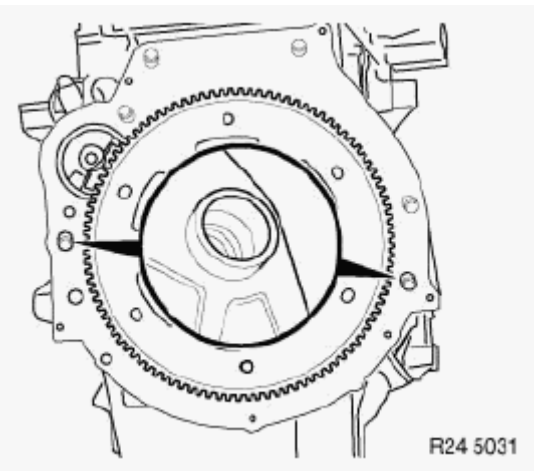


Fig. 25: Dowel Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Rotate torque converter until bore in torque converter is flush with bore in driving disk.

Flange automatic transmission to engine.

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24 00 050 INSTALLING REPLACEMENT TRANSMISSION (GA6L45R)

Drain automatic transmission fluid at oil drain plug.

Tightening torque: 24 11 6AZ, see **24 11 TRANSMISSION HOUSING, TRANSMISSION OIL SUMP** .

Recycling:

Catch and dispose of escaping transmission fluid.

Observe country-specific waste-disposal regulations

IMPORTANT:

- **Before installing replacement transmission, always flush transmission fluid cooler together with lines, see 17 21 500 FLUSHING OIL COOLER WITH LINES (AUTOMATIC TRANSMISSION) .**
- **After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) .**

Replacement transmission is supplied filled with transmission fluid.

Use only the approved transmission fluid .

Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks:

- Remove transfer case (AWD), see **27 10 010 REMOVING AND INSTALLING TRANSFER CASE (ATC 400 X-DRIVE)** .
- Remove automatic transmission, see **24 00 032 Removing and installing automatic transmission (GA6L45R)**.

Remove transportation lock (1).

Convert all cable holders.

Convert all seal plugs.

Remove protective cap on output shaft.

IMPORTANT: After removing transportation lock, secure torque converter against slipping out.

Transmission identification:

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- on type plate

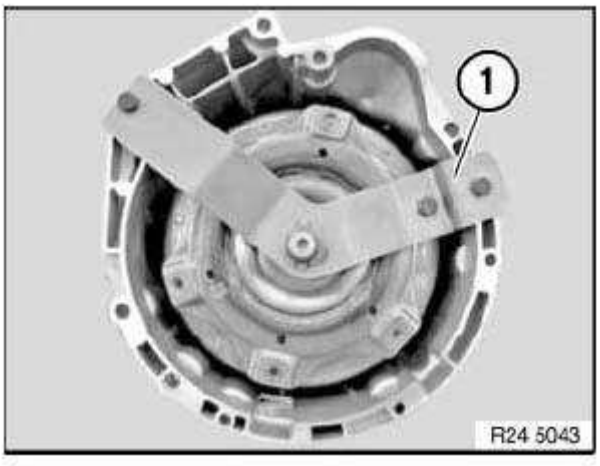


Fig. 26: Transportation Lock
Courtesy of BMW OF NORTH AMERICA, INC.

11 TRANSMISSION CASE, OIL SUMP

24 11 007 REPLACING SEALING PLUG (GA6L45R)

Special tools required:

- 24 4 340 (Lever)

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Use only approved transmission oil, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks: Remove rear underbody protection.

Remove holder (2).

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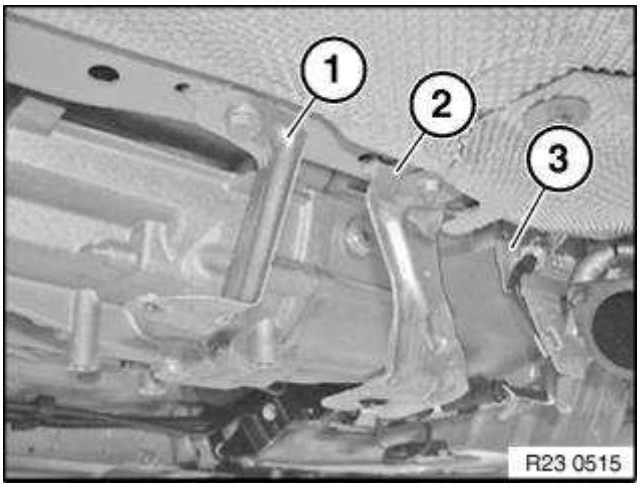


Fig. 27: Remove Holder (2)
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock sealing plug with special tool 24 4 340 in direction of arrow and remove.

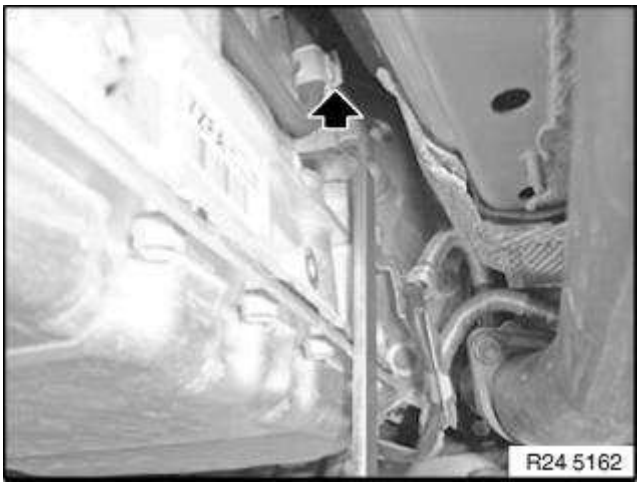


Fig. 28: Unlock Sealing Plug With Special Tool 24 4 340
Courtesy of BMW OF NORTH AMERICA, INC.

24 11 011 REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION SUMP (GA6L45R)

IMPORTANT: Remove transmission sump only after it has cooled down.
After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) .
Use only the approved transmission fluid. See AUTOMATIC TRANSMISSION - OPERATING FLUIDS . .
Failure to comply with this requirement will result in serious damage to the automatic transmission!

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Recycling:

Catch and dispose of escaping transmission fluid.

Observe country-specific waste-disposal regulations.

Necessary preliminary tasks:

Remove rear underbody protection.

Remove exhaust system bracket from transmission.

Remove oil drain plug (1).

Tightening torque: 24 11 6AZ, see **24 11 TRANSMISSION HOUSING, TRANSMISSION OIL SUMP** .

Drain automatic transmission fluid.

Installation:

Replace oil drain plug.

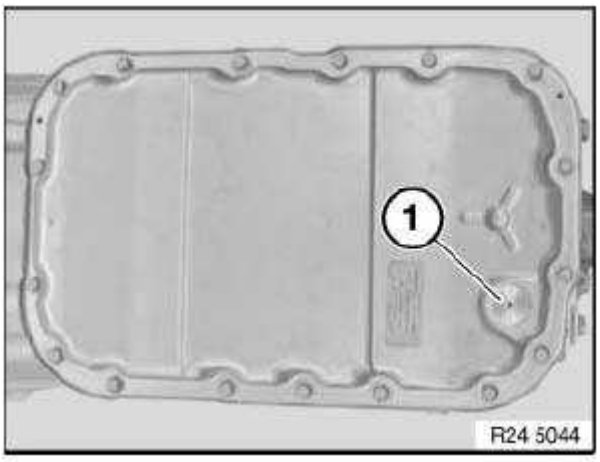


Fig. 29: Oil Drain Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew all bolts.

Remove transmission sump (1).

Installation:

Screw in bolts (1 to 17) in specified order until bolt heads make contact.

Tightening torque: 24 11 5AZ, see **24 11 TRANSMISSION HOUSING, TRANSMISSION OIL SUMP** .

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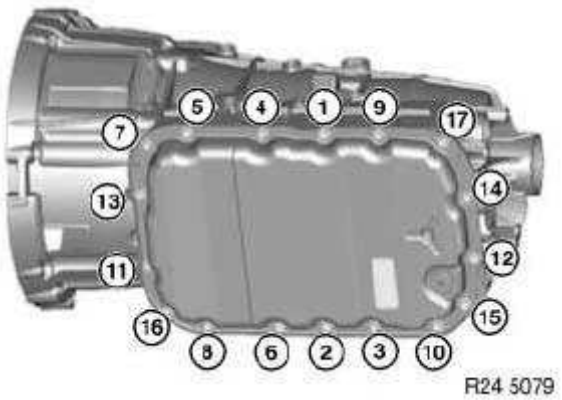


Fig. 30: Tightening Sequence Of Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Clean sump magnet (1) and check for metal filings/borings.

Remove gasket (2) from transmission sump.

Clean sealing faces and groove with a cloth.

Insert new gasket in transmission sump groove.

IMPORTANT: Do not degrease transmission sump with cleaning agent.

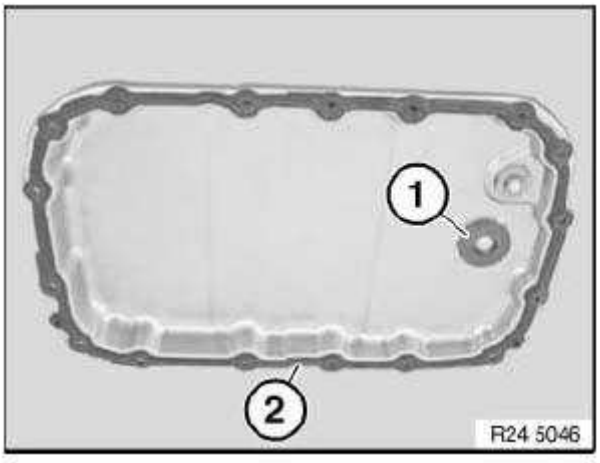


Fig. 31: Sump Magnet And Gasket
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

The gasket is correctly installed when it is engaged in the locating openings of the transmission sump.

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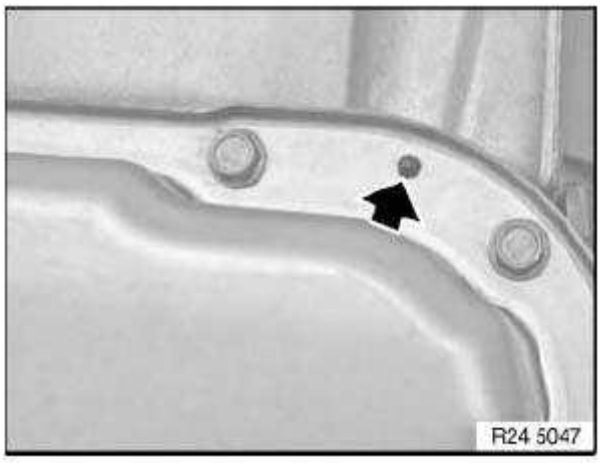


Fig. 32: Locating Openings Of Transmission Sump
Courtesy of BMW OF NORTH AMERICA, INC.

24 11 665 REMOVING AND INSTALLING/REPLACING TRANSMISSION OIL FILTER (GA6L45R)

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Use only approved transmission oil, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks:

- Remove **transmission fluid sump**.

Remove transmission oil filter (1) with a suitable tool (2). Installation: Replace **oil filter gasket**.

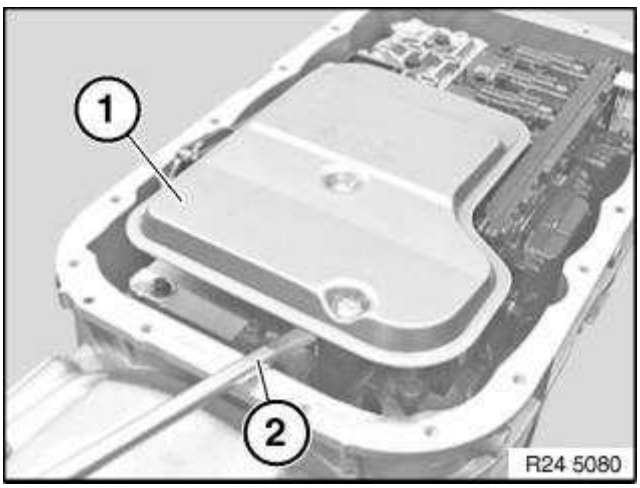


Fig. 33: Remove Transmission Oil Filter (1) With A Suitable Tool (2)
Courtesy of BMW OF NORTH AMERICA, INC.

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24 11 666 REMOVING AND INSTALLING/REPLACING TRANSMISSION OIL FILTER GASKET (GA6L45R)

Special tools required:

- 13 5 250
- 24 4 390
- 24 4 400

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Use only approved transmission oil, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks: Remove **transmission oil filter**.

Pull transmission oil filter gasket out of housing with special tools 24 4 390 and 13 5 250.

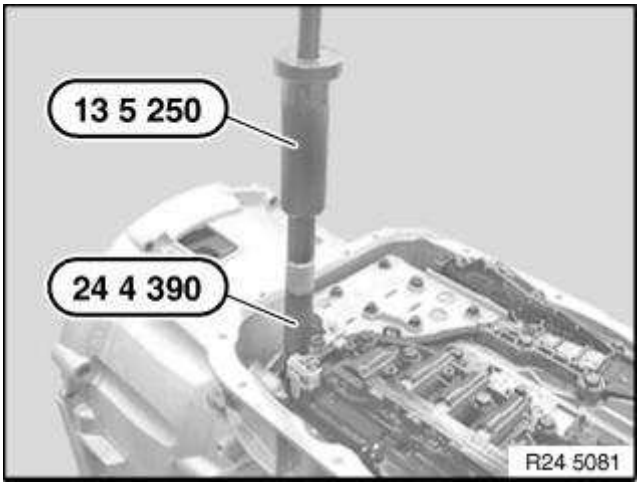


Fig. 34: Pull Transmission Oil Filter Gasket Out Of Housing With Special Tools 24 4 390 And 13 5 250
Courtesy of BMW OF NORTH AMERICA, INC.

Drive transmission filter gasket into housing with special tool 24 4 400.

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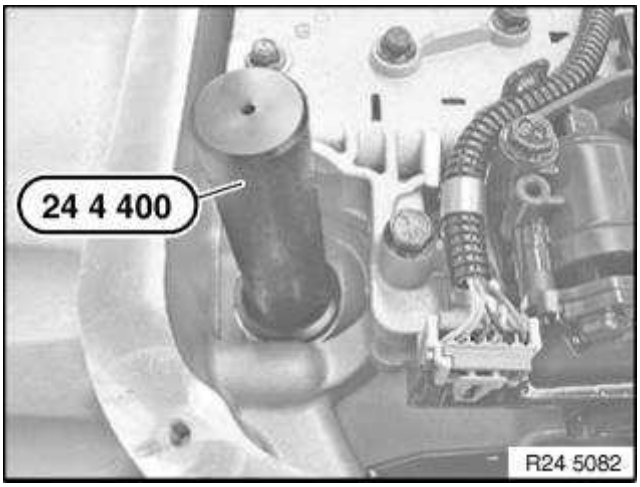


Fig. 35: Drive Transmission Filter Gasket Into Housing With Special Tool 24 4 400
Courtesy of BMW OF NORTH AMERICA, INC.

13 EXTENSION HOUSING, BEARINGS, SEAL

24 13 014 REPLACING OUTPUT FLANGE RADIAL SHAFT SEAL (GA6L45R) AWD

Special tools required:

- 24 4 320
- 24 4 330

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Use only approved transmission oil, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks:

- Remove rear underbody protection.
- Remove exhaust system.
- Remove heat shields.
- Support **transmission**.
- Remove transmission cross-member. See **22 32 050 REPLACING CROSS-MEMBER FOR TRANSMISSION MOUNTING** .
- Remove transfer box. See **27 10 010 REMOVING AND INSTALLING TRANSFER CASE (ATC 400 X-DRIVE)** .

Mount special tool 24 4 320 and secure with hook wrench (1). Screw in spindle (2) until radial shaft seal is released.

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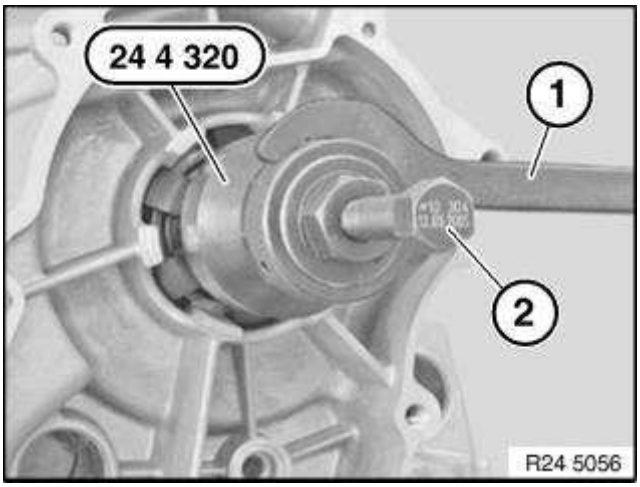


Fig. 36: Mount Special Tool 24 4 320 And Secure With Hook Wrench (1)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: Coat sealing lips of new radial shaft seal with clean transmission oil. Drive in radial shaft seal with special tool 24 4 330 until it stops.

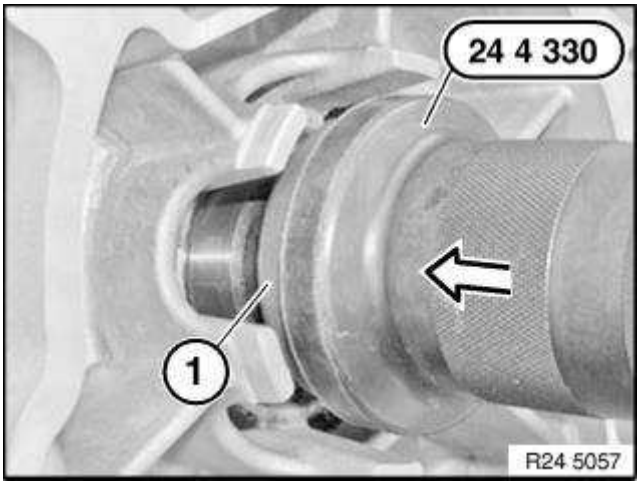


Fig. 37: Drive In Radial Shaft Seal With Special Tool 24 4 330
Courtesy of BMW OF NORTH AMERICA, INC.

24 13 014 REPLACING OUTPUT FLANGE SHAFT SEAL (GA6L45R)

Special tools required:

- 23 0 020
- 23 1 210
- 24 4 360
- 24 4 370

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237

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CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Use only approved transmission oil, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks:

- Remove underbody protection.
- Remove heat shields.
- Remove complete exhaust system
- Remove front muffler (N45T/N46T)
- Remove transmission cross-member

Remove propeller shaft from transmission. Release centre bearing. Tie propeller shaft to one side. Tasks are described in .**26 11 000 REMOVING AND INSTALLING PROPELLER SHAFT (CARDAN UNIVERSAL JOINT) COMPLETELY** .

NOTE: To rotate propeller shaft, unlock parking gear.

Release screws. Remove transmission bearing block (1). Tightening torque, see 24 71 6AZ in **24 13 TRANSMISSION EXTENSION, BEARINGS, SEALS** .

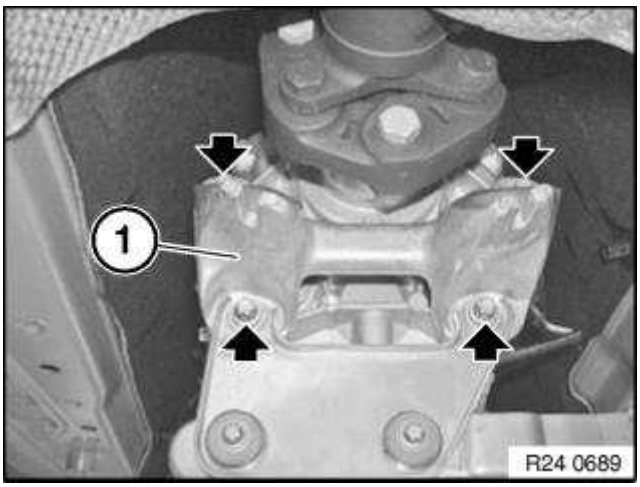


Fig. 38: Remove Transmission Bearing Block (1)
Courtesy of BMW OF NORTH AMERICA, INC.

Grip output flange (1) with special tool 23 0 020. Release nut with special tool 23 1 210. Tightening torque, see 24 13 3AZ in **24 13 TRANSMISSION EXTENSION, BEARINGS, SEALS** . Installation: Apply a streak of Loctite 277 over complete thread width. Replace nut and secure with a mandrel (8 mm) by caulking.

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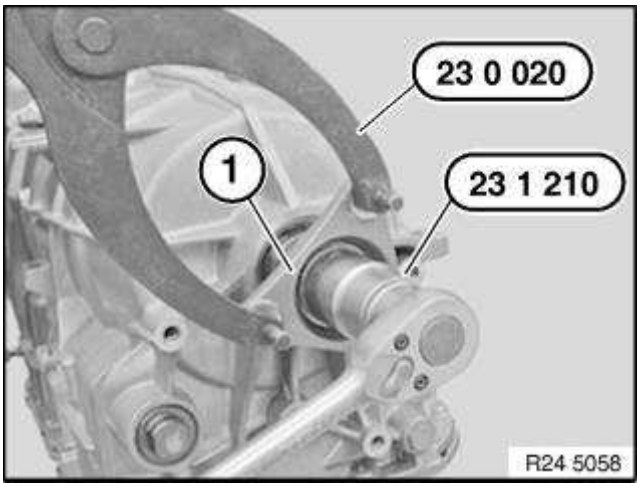


Fig. 39: Grip Output Flange (1) With Special Tool 23 0 020
Courtesy of BMW OF NORTH AMERICA, INC.

Detach output flange from output shaft. Remove spacer.

Push special tool 24 4 360 onto output shaft (1). Locking hooks (2) must enter completely.

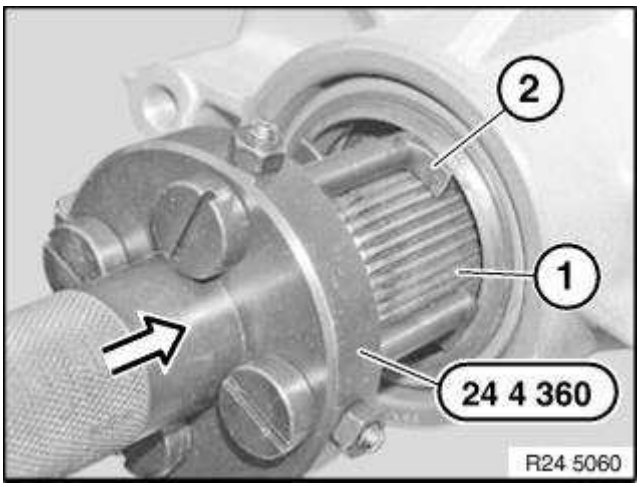


Fig. 40: Locking Hooks (2) Must Enter Completely
Courtesy of BMW OF NORTH AMERICA, INC.

Turn locks (1) counterclockwise. Screw in bolt (2) until radial shaft seal is released.

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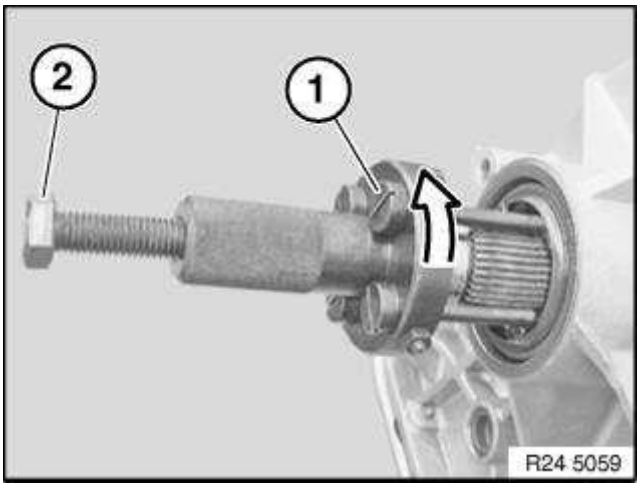


Fig. 41: Screw In Bolt (2) Until Radial Shaft Seal Is Released
Courtesy of BMW OF NORTH AMERICA, INC.

Oil sealing lip on radial shaft seal (1). Drive radial shaft seal (1) firmly home with special tool 24 4 370.

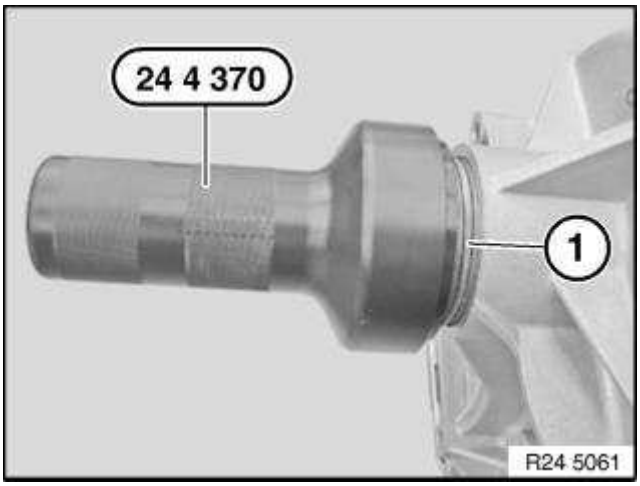


Fig. 42: Oil Sealing Lip On Radial Shaft Seal (1)
Courtesy of BMW OF NORTH AMERICA, INC.

14 MECHANICAL ATTACHMENTS

24 14 005 REPLACING SEALING CAP FOR SELECTOR SHAFT (GA6L45R)

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Use only approved transmission oil, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks:

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- Remove rear underbody protection. See **51 47 491 REMOVING AND INSTALLING/REPLACING REAR UNDERBODY PROTECTION** .
- Remove front propeller shaft from transfer case and tie to one side. Tasks are described in **REMOVING AND INSTALLING PROPELLER SHAFT (CARDAN UNIVERSAL JOINT) COMPLETELY**

Screw special tool 23 0 490 into sealing cap. Drive out sealing cap with impact weight (1).

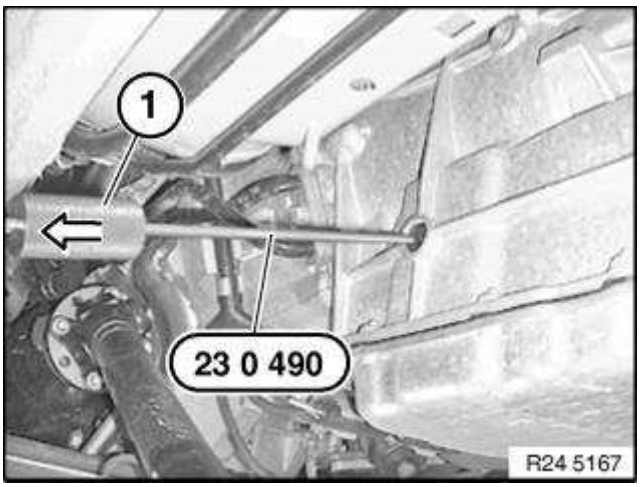


Fig. 43: Drive Out Sealing Cap With Impact Weight (1)
Courtesy of BMW OF NORTH AMERICA, INC.

Place new sealing cap (1) on drift (2).

NOTE: Drift (2) for driving in sealing cap is contained in repair kit.

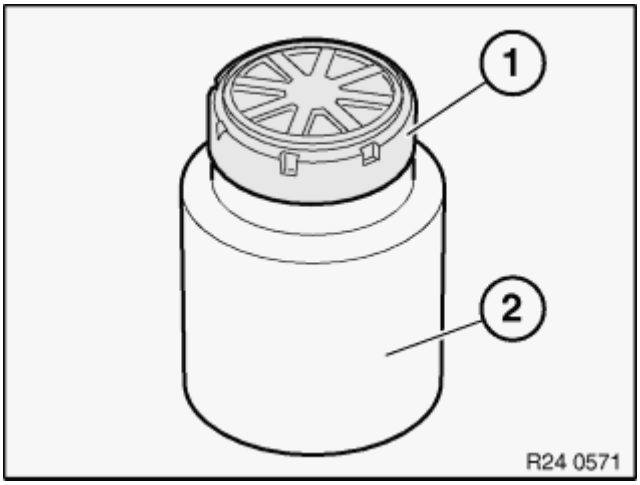


Fig. 44: Place New Sealing Cap (1) On Drift (2)
Courtesy of BMW OF NORTH AMERICA, INC.

Drive in new sealing cap (1) with drift (2) as far as it will go.

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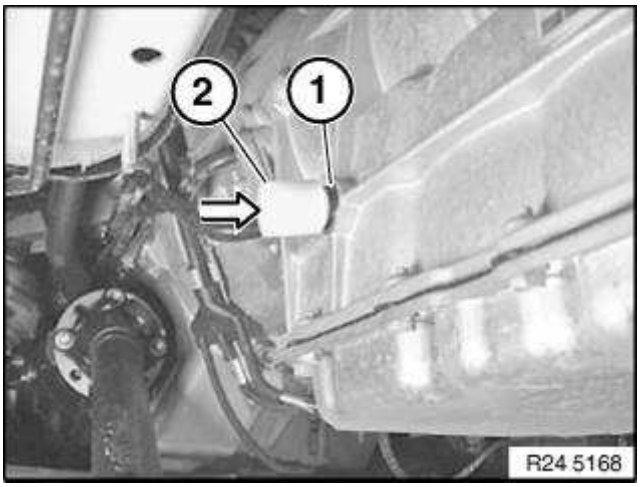


Fig. 45: Drive In New Sealing Cap (1) With Drift (2)
Courtesy of BMW OF NORTH AMERICA, INC.

24 14 003 REPLACING SELECTOR SHAFT SEAL (GA6L45R)

Special tools required:

- 24 4 381
- 24 4 382
- 24 5 361
- 24 5 362

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Use only approved transmission oil, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks: Remove heat shields.

Slacken nut (1). Take off holder (2). Tightening torque 24 51 1AZ. After completing work: Adjust shift lever.

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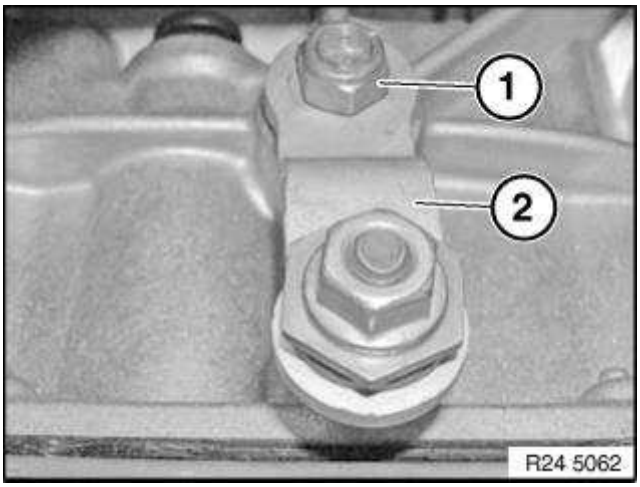


Fig. 46: Slacken Nut (1) And Take Off Holder (2)
Courtesy of BMW OF NORTH AMERICA, INC.

Screw in special tool 24 5 361 until it is firmly connected with shaft seal.

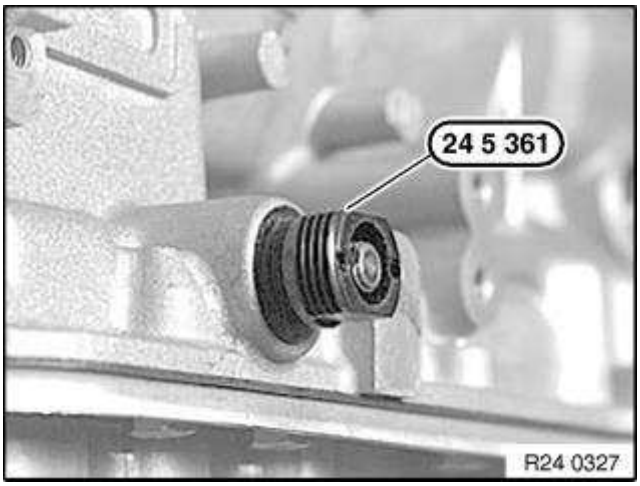


Fig. 47: Screw In Special Tool 24 5 361
Courtesy of BMW OF NORTH AMERICA, INC.

Screw special tool 24 5 362 onto special tool 24 5 361 and tighten down. This pulls the shaft seal out of the transmission housing.

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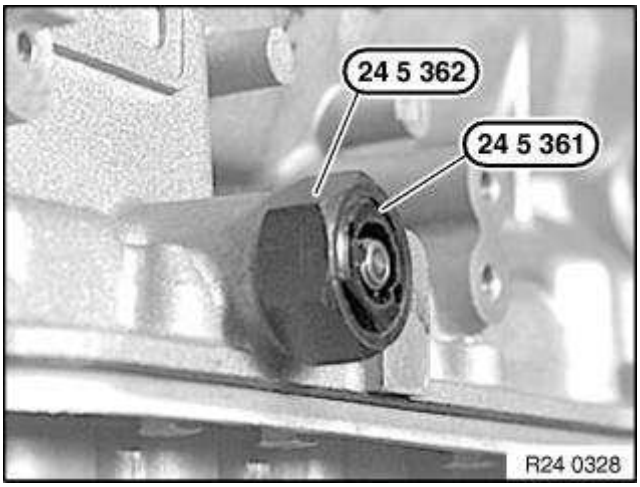


Fig. 48: Screw Special Tool 24 5 362 Onto Special Tool 24 5 361
Courtesy of BMW OF NORTH AMERICA, INC.

Oil sealing lip on shaft seal. Screw in shaft seal with special tools 24 4 381 and 24 4 382 as far as it will go.

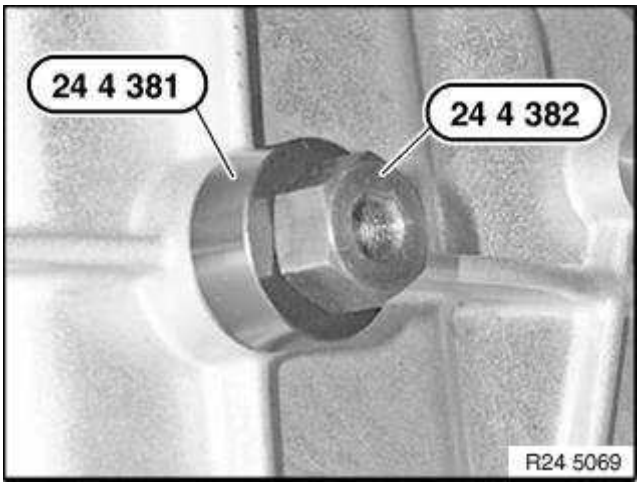


Fig. 49: Screw In Shaft Seal With Special Tools 24 4 381 And 24 4 382
Courtesy of BMW OF NORTH AMERICA, INC.

31 OIL PUMP

24 31 575 REPLACING OIL PUMP O-RINGS (GA6HP26/19Z)

Special tools required:

- 24 1 180
- 24 1 184

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Use only approved transmission oil, see 00 11 237

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CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks:

- Remove automatic transmission
- Secure transmission with transmission holding bridge on assembly stand. See **23 .. ... UNIVERSAL TRANSMISSION RETAINING BRIDGE** .
- Remove **torque converter**
- Remove **mechatronics**

Remove adapter (1). Installation: Note installation position.

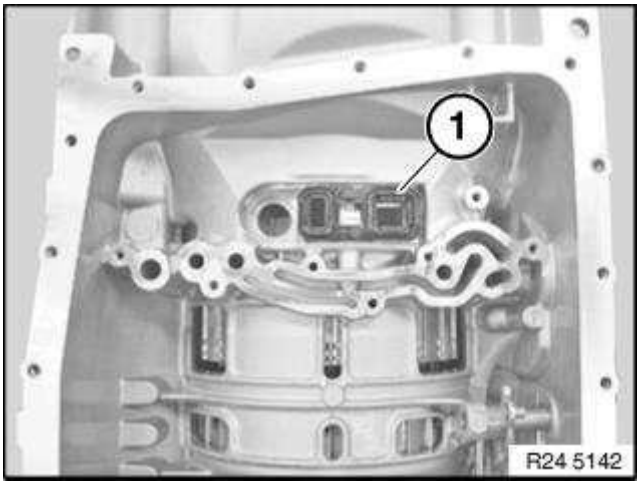
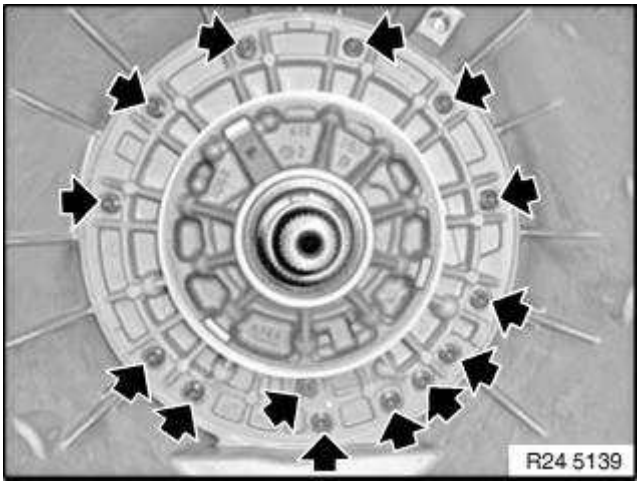


Fig. 50: Remove Adapter (1)
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws. Tightening torque, see 24 31 3AZ in .



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

Slide special tool 24 1 184 completely into puller 24 1 180.

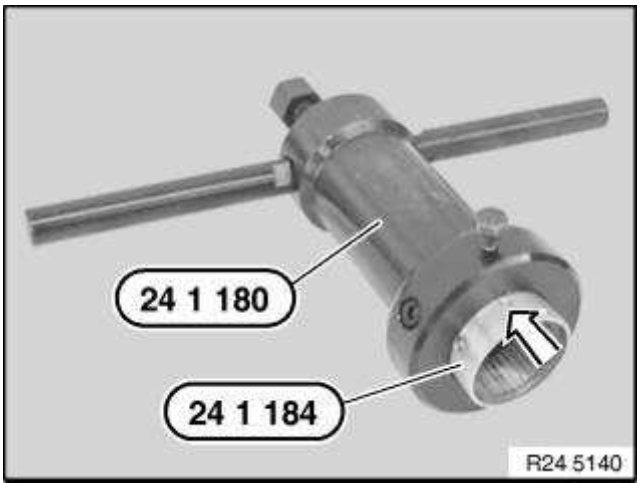


Fig. 52: Slide Special Tool 24 1 184 Completely Into Puller 24 1 180
Courtesy of BMW OF NORTH AMERICA, INC.

Attach special tool 24 1 180 and secure with screw (1). Insert screw (2) and release oil supply unit from transmission housing.

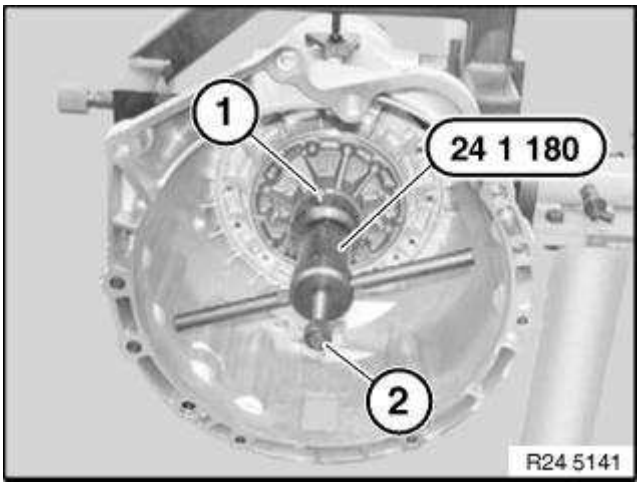


Fig. 53: Insert Screw (2) And Release Oil Supply Unit From Transmission Housing
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws. Tightening torque 24 31 1AZ.

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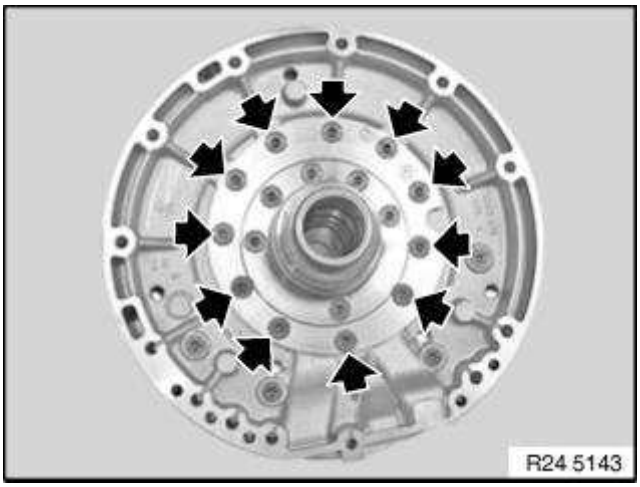


Fig. 54: Identifying Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Detach cover (1) from pump body (2). Replace O-rings (3 + 4). Installation: Pay attention to installation position of gears during disassembly.

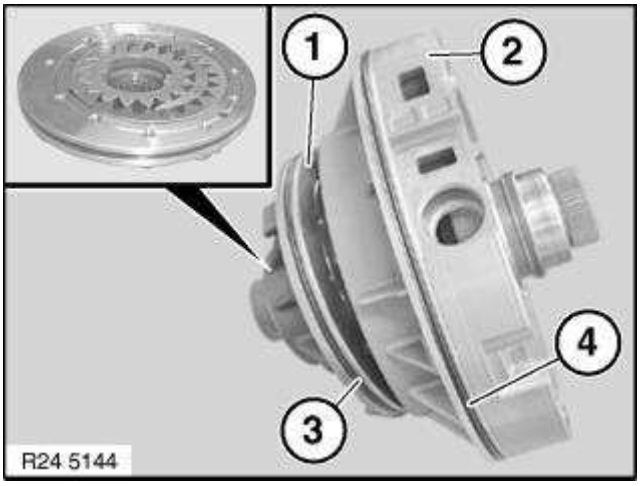


Fig. 55: Detach Cover (1) From Pump Body (2)
Courtesy of BMW OF NORTH AMERICA, INC.

24 31 012 REPLACING TORQUE CONVERTER RADIAL SHAFT SEAL (GA6L45R)

Special tools required:

- 00 1 450 .
- 24 0 200 .
- 24 2 351 .
- 24 2 352 .
- 24 2 354 .
- 24 2 360 .

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Necessary preliminary tasks:

- Remove **automatic transmission**

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Use only approved transmission oil, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Failure to comply with this instruction will result in serious damage to the transmission.

Secure transmission with special tool 24 0 200 on assembly stand 00 1 450 . Remove **torque converter** .

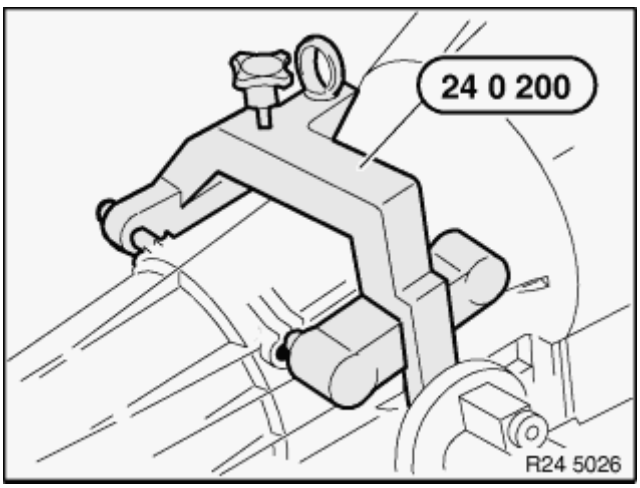


Fig. 56: Secure Transmission With Special Tool 24 0 200
Courtesy of BMW OF NORTH AMERICA, INC.

Remove retaining ring (1) with a suitable tool (2).

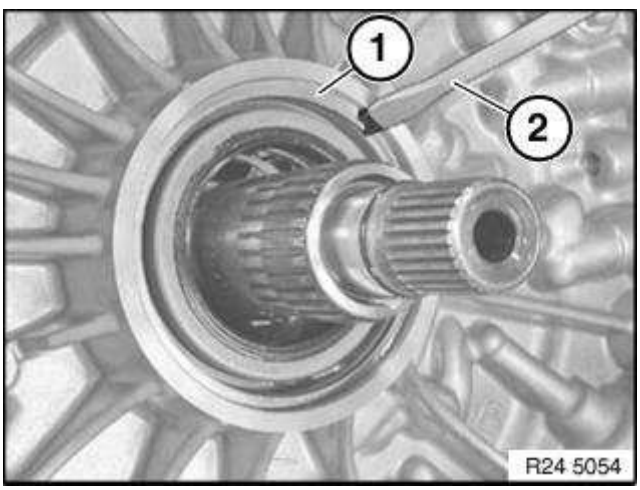


Fig. 57: Remove Retaining Ring (1) With A Suitable Tool (2)
Courtesy of BMW OF NORTH AMERICA, INC.

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Attach special tool 24 2 354 to input shaft (1).

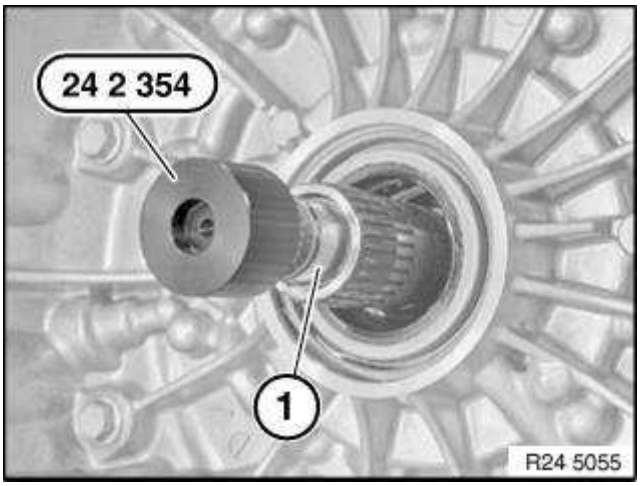


Fig. 58: Attach Special Tool 24 2 354 To Input Shaft (1)
Courtesy of BMW OF NORTH AMERICA, INC.

Screw in special tool 24 2 351 until it is firmly connected with radial shaft seal. Screw in special tool 24 2 352 to remove radial shaft seal.

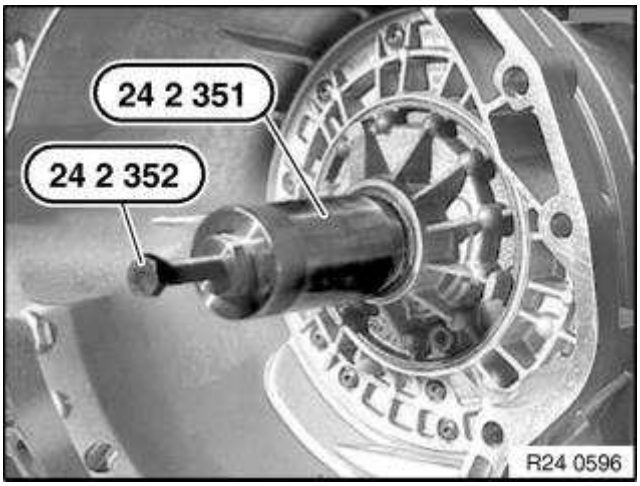


Fig. 59: Screw In Special Tool 24 2 352 To Remove Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Oil sealing lip on radial shaft seal. Drive in radial shaft seal (1) with special tool 24 2 360 as far as it will go.

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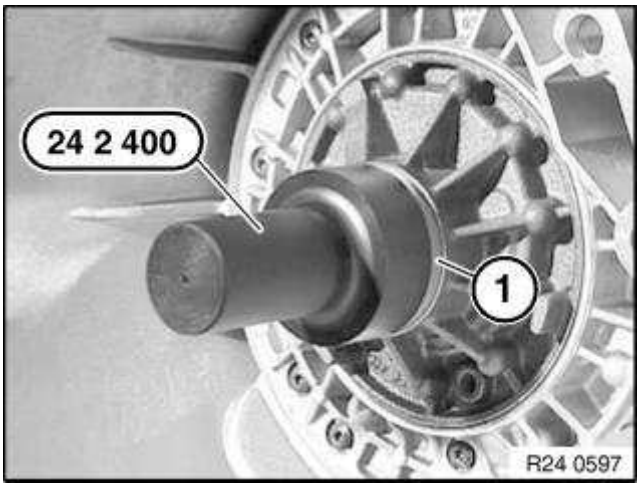


Fig. 60: Drive In Radial Shaft Seal (1) With Special Tool 24 2 360
Courtesy of BMW OF NORTH AMERICA, INC.

33 GEAR SELECTOR VALVE

24 33 530 REPLACING GEAR SELECTOR VALVE (GA6L45R)

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Use only approved transmission oil, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks:

- Remove **mechatronics**.

Release screw (1). Place gear position switch (2) to one side. Tightening torque 24 30 1AZ, see **24 30 HYDRAULIC / ELECTRIC CONTROL PARTS AND CONTROLLING ELEMENTS** .

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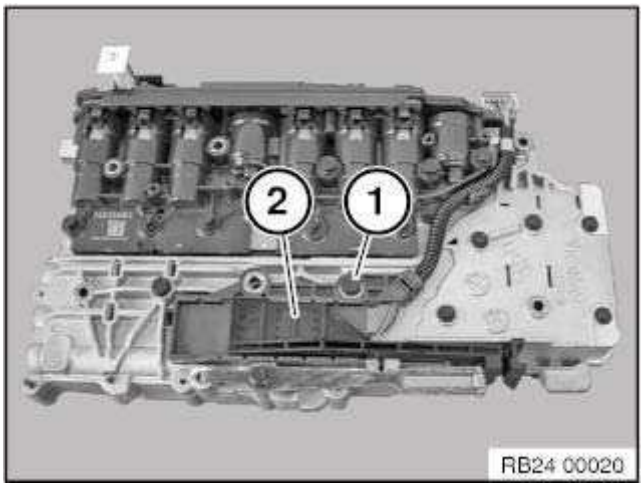


Fig. 61: Place Gear Position Switch (2) To One Side
Courtesy of BMW OF NORTH AMERICA, INC.

Slightly press bracket (1) upwards. Using suitable tool (2) push gear selector valve (3) out of the mechatronics system.

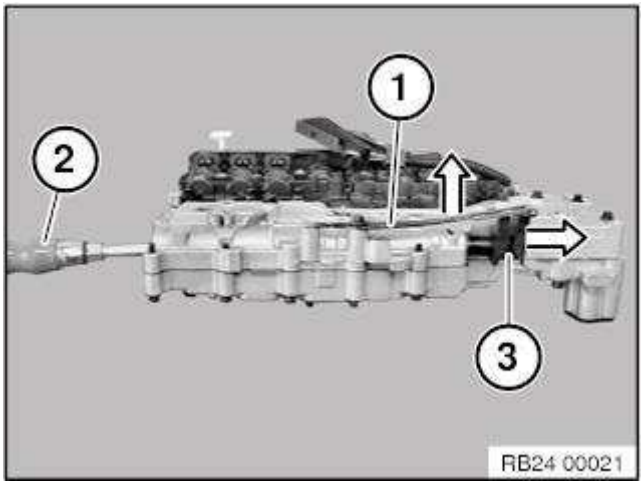


Fig. 62: Slightly Press Bracket (1) Upward
Courtesy of BMW OF NORTH AMERICA, INC.

34 SHIFT VALVES, PARKING

24 34 561 NOTES ON MECHATRONICS (GA6L45R)

Special tools required:

- 24 2 390 , see **24 AUTOMATIC TRANSMISSION** .

IMPORTANT: After completing work:

- **Load specific data version with DIS**

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- **After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) .**

  Use only approved transmission fluid .

  Failure to comply with this requirement will result in serious damage to the automatic transmission!

IMPORTANT: Read and comply with 61 35 ... NOTES ON ESD PROTECTION (ELECTRO STATIC DISCHARGE) .

Unscrew plug (1) and disconnect.

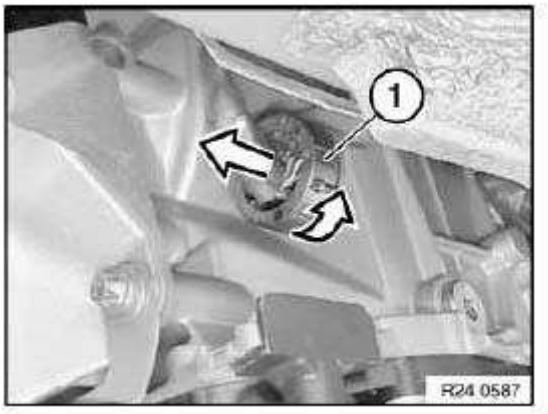


Fig. 63: Disconnecting Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 24 2 390 in sealing sleeve (1).

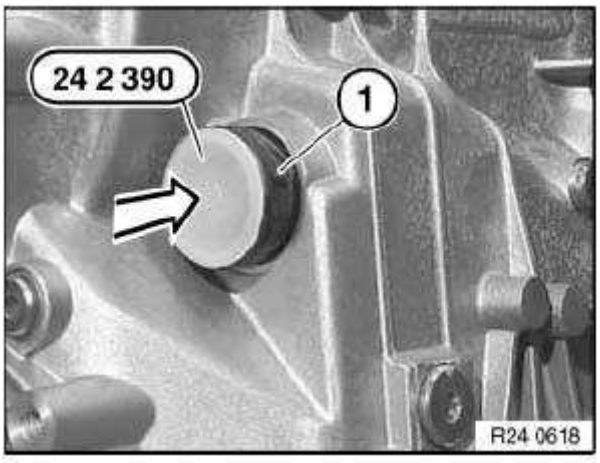


Fig. 64: Inserting Special Tool (24 2 390) In Sealing Sleeve

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Courtesy of BMW OF NORTH AMERICA, INC.

24 34 562 REPLACING MECHATRONICS (GA6L45R)

Special tools required:

- 24 2 390
- 24 4 350

NOTE: After completing work:

- **Load specific data version with DIS.**

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) .
Use only approved transmission fluid .
Failure to comply with this requirement will result in serious damage to the automatic transmission!

IMPORTANT: Read and comply with 61 35 ... NOTES ON ESD PROTECTION (ELECTRO STATIC DISCHARGE) .

Necessary preliminary tasks:

- Remove heat shields.
- Support automatic transmission with hydraulic lifter.
- Remove transmission cross-member.

Grip clamping sleeve (1).

Loosen nut (2).

Detach retainer (3) towards bottom using a screwdriver.

Pull cable (4) out of holder.

Installation:

Adjust selector lever.

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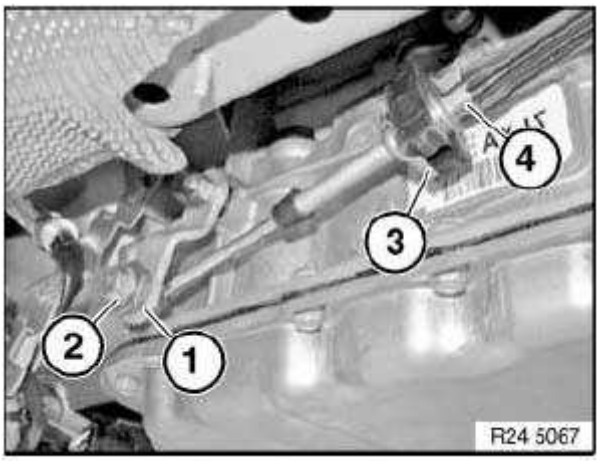


Fig. 65: Clamping Sleeve, Nut, Retainer And Cable
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Mechatronics can be destroyed by static discharges. Therefore the contacts inside the plug must not be touched. Insert special tool immediately after work step.

Unscrew plug (1) and disconnect.

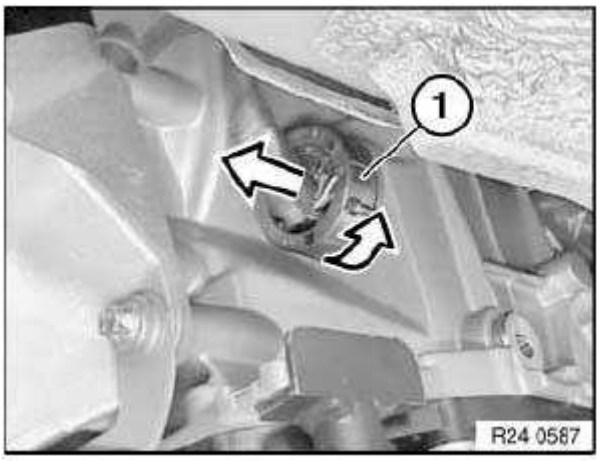


Fig. 66: Disconnecting Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 24 2 390 in sealing sleeve (1).

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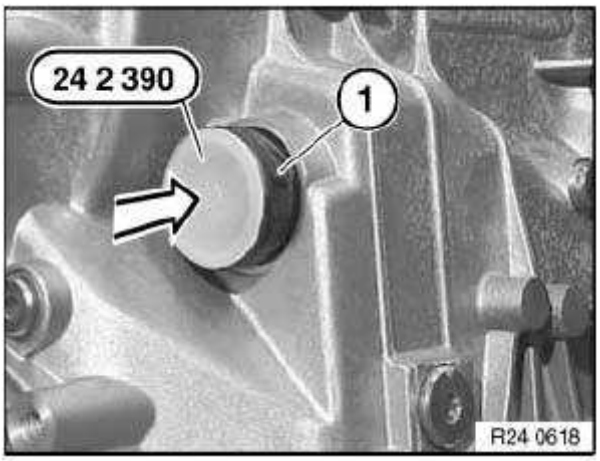


Fig. 67: Inserting Special Tool (24 2 390) In Sealing Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

Remove transmission oil sump.

Unlock sealing sleeve with slide (1).

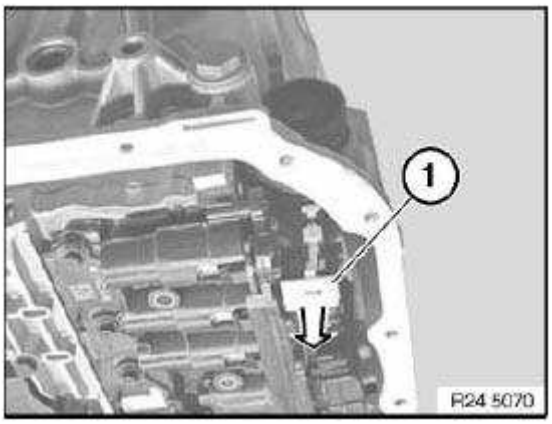


Fig. 68: Unlocking Sealing Sleeve With Slide
Courtesy of BMW OF NORTH AMERICA, INC.

Note position of sealing sleeve.

Pull out sealing sleeve (1).

Installation:

Screw in sealing sleeve partially (lug in upper area). Turn until lug engages in groove of transmission. Slide in sealing sleeve.

Lug on sealing sleeve must not be damaged!

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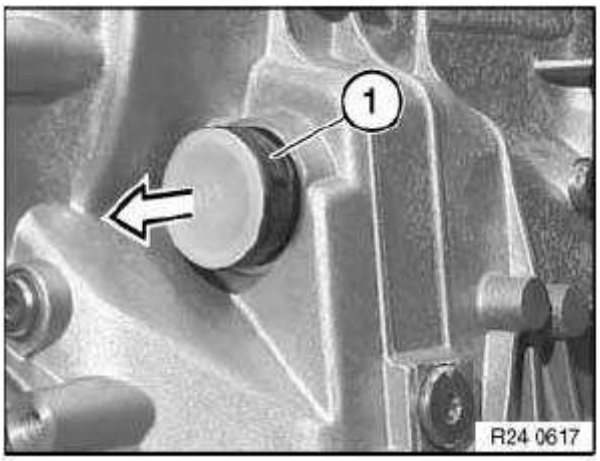


Fig. 69: Pulling Out Sealing Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

Release all bolts (1) with special tool 24 4 350.

Remove mechatronics.

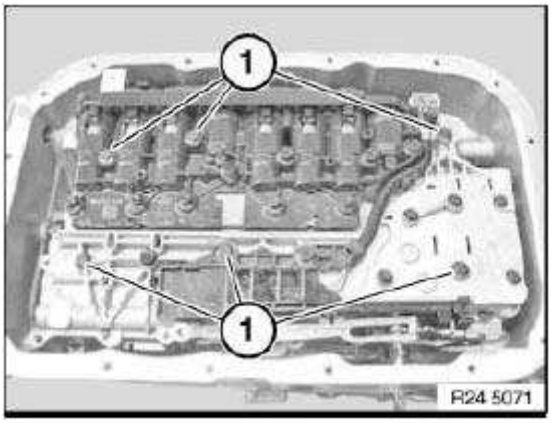


Fig. 70: Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace gasket (1).

Coat new seals with automatic transmission fluid and install.

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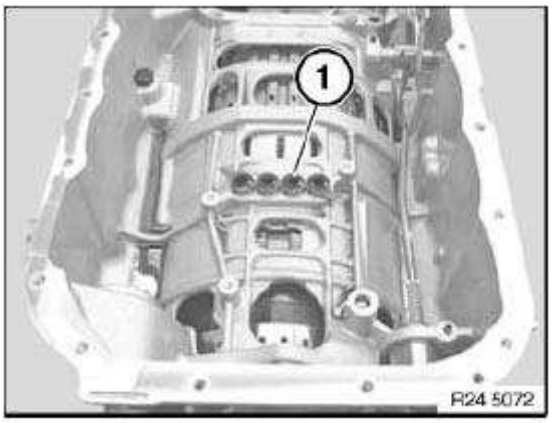


Fig. 71: Gasket
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace gaskets (1).

Coat new seals with automatic transmission fluid and install.

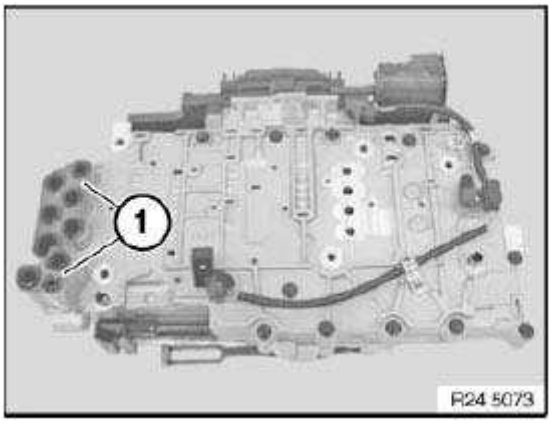


Fig. 72: Gasket
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Tighten down bolts in sequence (1 to 6).
Failure to comply with this requirement will result in serious damage to the automatic transmission!
Tightening torque: 24 30 1AZ, see 24 30 HYDRAULIC / ELECTRIC CONTROL PARTS AND CONTROLLING ELEMENTS .

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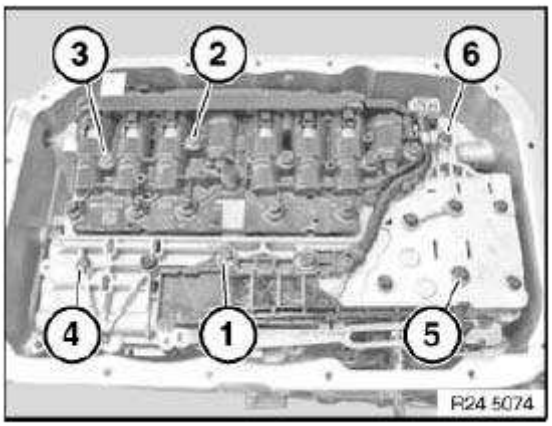


Fig. 73: Tightening Sequence Of Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

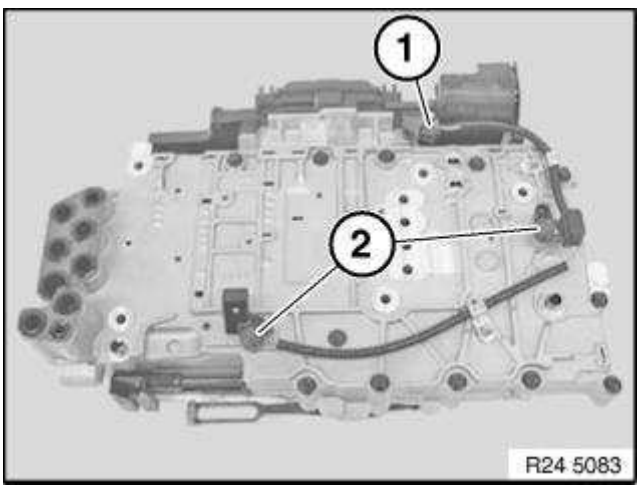
35 WIRING HARNESS, SHIFT ELEMENTS AND SENSORS

24 35 700 REMOVING AND INSTALLING/REPLACING INPUT AND OUTPUT SPEED SENSOR (GA6L45R)

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Use only approved transmission oil, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks: Remove **mechatronics**.

Unlock and disconnect plug (1). Release screws (2). Detach input and output speed sensor from mechatronics. Tightening torque, see 24 30 4AZ in **24 30 HYDRAULIC / ELECTRIC CONTROL PARTS AND CONTROLLING ELEMENTS** .



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Fig. 74: Unlock And Disconnect Plug (1), Release Screws (2)
Courtesy of BMW OF NORTH AMERICA, INC.

24 35 610 REMOVING AND INSTALLING/REPLACING TRANSMISSION POSITION SWITCH (GA6L45R)

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Use only approved transmission oil, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) . Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks: Remove **transmission oil filter**.

Unlock and disconnect plug (1). Release screws (2). Remove transmission position switch (3). Tightening torque, see 24 30 1AZ in **24 30 HYDRAULIC / ELECTRIC CONTROL PARTS AND CONTROLLING ELEMENTS** .

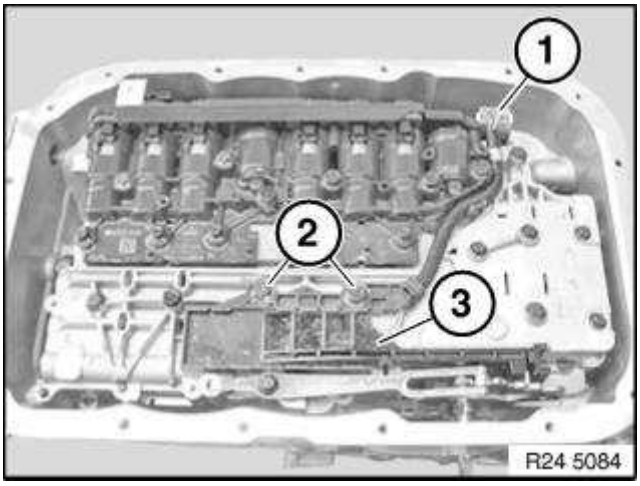


Fig. 75: Remove Transmission Position Switch (3)
Courtesy of BMW OF NORTH AMERICA, INC.

40 TORQUE CONVERTER

24 40 011 REMOVING AND INSTALLING/REPLACING TORQUE CONVERTER (GA6L45R)

Special tools required:

- 00 2 550
- 24 4 000

IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION

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(GA6L45R) .
Use only approved transmission oil .
Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks:

- Remove automatic transmission, see **24 00 032 Removing and installing automatic transmission (GA6L45R)**.

Screw special tool 24 4 000 into torque converter.

Remove torque converter.

NOTE: When torque converter is removed, transmission oil flows out.

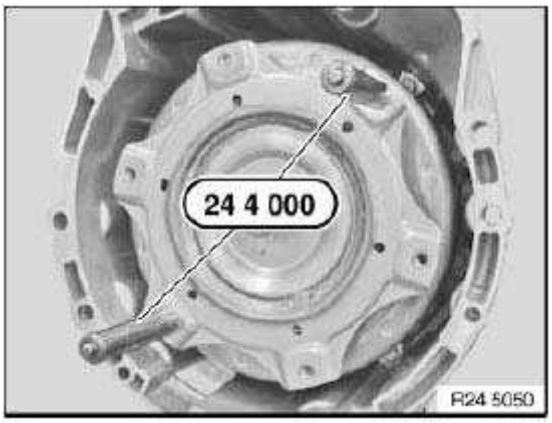


Fig. 76: Special Tool (24 4 000)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

When installing, do not damage shaft seal and bearing.

If the torque converter is not correctly installed, the driver of the pump impeller may be damaged when the transmission is flanged to the engine.

Remove torque converter and set down vertically.

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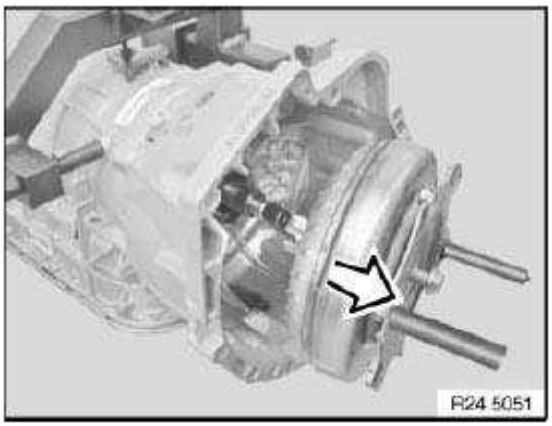


Fig. 77: Removing Torque Converter
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Push torque converter through shaft seal onto transmission shaft as far as it will go.

Press torque converter by hand into converter housing and turn in the process. Converter hub opening must snap into place in driver of pump impeller. Torque converter must be felt to slip inwards.

Determine distance between contact surface and surface (1) of tapped hole in torque converter with special tool 00 2 550 .

NOTE: Measured value must be greater than 25 mm.

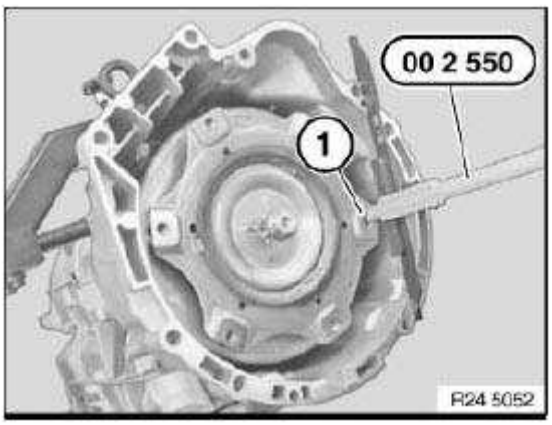


Fig. 78: Special Tool (00 2 550)
Courtesy of BMW OF NORTH AMERICA, INC.

50 SHIFT FUNCTION

24 50 030 REPLACING SELECTOR SHAFT (GA6L45R)

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IMPORTANT: After completion of work, check transmission fluid level, see 00 11 237 CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (GA6L45R) .
Use only approved transmission oil .
Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks:

- Remove **mechatronics**
- Remove **selector shaft seal**
- Remove **transmission** (AWD only)

Drive a metal pin (1) - dia. approx. 3 mm - into clamping pin (2) (to prevent clamping pin from being compressed). Grip clamping pin (2) with side nippers.

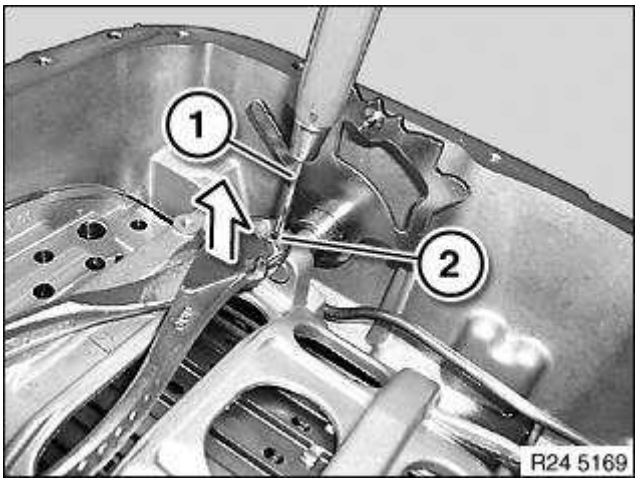


Fig. 79: Grip Clamping Pin (2) With Side Nippers
Courtesy of BMW OF NORTH AMERICA, INC.

Drive clamping pin (2) with a suitable tool out of selector shaft. Remove selector shaft.

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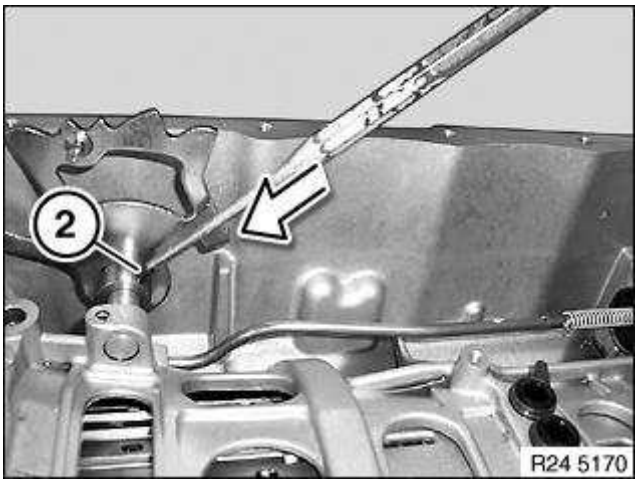


Fig. 80: Drive Clamping Pin (2) With A Suitable Tool Out Of Selector Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

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TRANSMISSION

Automatic Transmission - SI Techniques - X3

24 AUTOMATIC TRANSMISSION

VS-42 je Baugruppe/Group: 24 weltweit Datum/Date: 09/2003 Update: 24 01 03 (040) 05/2007

6-SPEED AUTOMATIC TRANSMISSION

E53, E60, E61, E63, E64, E65, E66, E70, E81, E83, E85, E86, E87, E90, E91, E92, E93

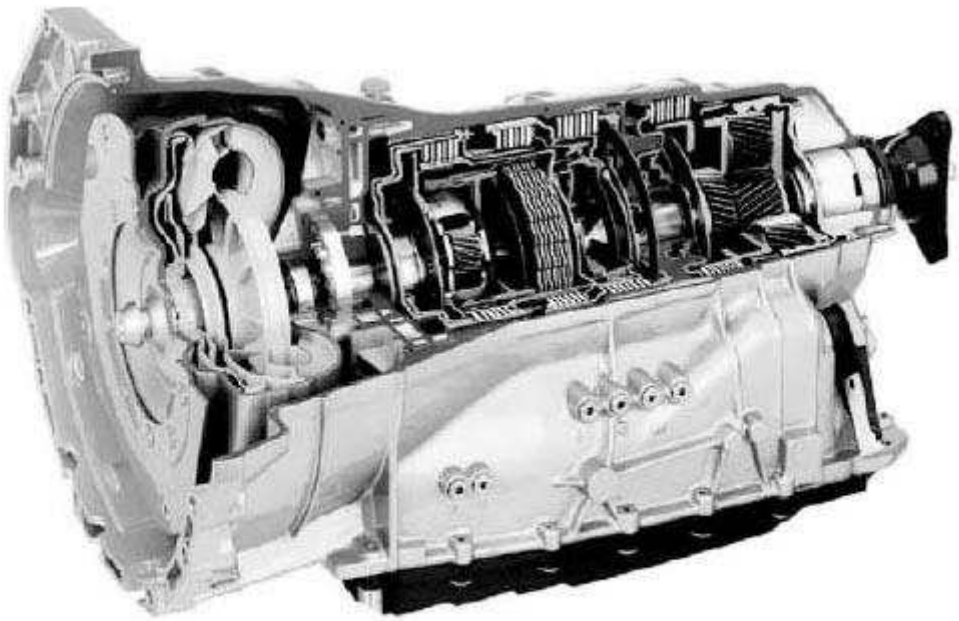


Fig. 1: 6-Speed Automatic Transmission
Courtesy of BMW OF NORTH AMERICA, INC.

INTRODUCTION

The 6-speed automatic transmissions were jointly developed by BMW and ZF (Zahnradfabrik Friedrichshafen).

- > E53, E83, E85, E86
- > E60, E61, E63, E64 before 09/2005
- > E60, E61 from 09/2005 until 03/2007 and E63, E64 from 09/2005 until 09/2007
- > E60, E61 from 03/2007
- > E60, E61 from 06/2007 with sport automatic transmission and E63, E64 from 09/2007 with sport automatic transmission

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- > E65, E66
- > E70
- > E81, E87, E90, E91, E92, E93

Depending on the model concerned, the automatic transmission is either standard or special equipment (option 205).

- > E60, E61 from 06/2007

  From 06/2007, besides option 205 "Automatic transmission", option 2TB "Sport automatic transmission" is also available.

  The special equipment "Sport automatic transmission" includes, amongst other features, gearshift paddles and a SPORT button.

- E63, E64 from 09/2007 Option 205 "Automatic transmission" is discontinued.

  On E63, E64 vehicles, only option 2TB "Sport automatic transmission" is available. Depending on the model concerned, the "sport automatic transmission" is either standard or special equipment.

The sport automatic transmission differs from the automatic transmission as follows:

- Gearshift paddles on steering wheel
- SPORT button in the selector lever trim
- Sport program also possible in selector lever position "D"
- Separate gear selector switch (GWS)

So as to be compatible with the engines with higher torques, the automatic transmissions are designed with different strengths. The automatic transmissions thus differ, e.g. through different torque converters.

Depending on the engine fitted, the following 6-speed automatic transmissions are fitted:

- GA6HP19Z (designed for maximum torque of 400 Nm)
- GA6HP19Z TU (designed for maximum torque of 400 Nm)
- GA6HP26Z (designed for maximum torque of 600 Nm)
- GA6HP26Z TU (designed for maximum torque of 650 Nm)
- GA6HP32Z (designed for maximum torque of 750 Nm)

(technical updates, e.g. of transmissions, are indicated with the letters "TU".)

The automatic transmission requires 5 multi-plate clutches to shift between the 6 gears: 3 input clutches and 2 brake clutches.

Electric steering lock discontinued:

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On vehicles with automatic transmission, the electric steering lock is discontinued as follows:

- E90, E91, E92, E93 from 12/2006 (US version only)
- E60, E61 from 03/2007
- E63, E64 from 09/2007
- E70 from start of series production

BRIEF DESCRIPTION OF COMPONENTS

The automatic transmission consists of the following components:

- **Mechatronics module**

  The automatic transmission is controlled by the mechatronics module. The mechatronics module is a combination of hydraulic unit and electronics module.

  The hydraulic control unit is the hydraulic part of the transmission control system.

  The electronics module contains the EGS control unit, the sensors and the electrical connections within the transmission. (EGS is the abbreviation for electronic transmission control)

- **Selector lever, selector lever position display**
  - > E53, E81, E83, E85, E86, E87, E90, E91, E92, E93
  - > E60, E61 until 03/2007
  - > E63, E64 until 09/2007

  The selector lever has the following positions:

  P for Park

  R for Reverse

  N for Neutral

  D for Drive (= automatic mode)

  M/S M for manual mode = Steptronic, S for sport program = automatic mode with sporty map

  The selector lever position display is located in the selector lever trim.

  - > E65, E66

  The selector lever is located on the steering column.

  The selector lever has the following positions:

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p for Park

R for Reverse

N for Neutral

D for Drive (= automatic mode)

The selector lever position display is located in the instrument cluster.

- **GWS: Gear selector switch**
  - > E60, E61 from 03/2007
  - > E63 from 09/2007
  - > E70

The gear selector switch is configured as a control unit in its own right. With the gear selector switch, the transmission is no longer actuated mechanically, but rather electronically.

- **SPORT button for Dynamic Driving Control**
  - > E60, E61, E63, E64 with sport automatic transmission

Dynamic Driving Control (FDC) is activated with the SPORT button: Gearshift times are shortened and the shift characteristics are made more sporty. The engine responds more spontaneously to movements of the accelerator pedal. The steering and holding forces of the steering tuned for a sportier feel - for Servotronic or active front steering (AFS). AFS includes Servotronic.

  - > E70

On the E70 with the option "Adaptive Drive", only the damping characteristics are changed (normal or sport).

- **Steering wheel with buttons for sport program and manual mode**
  - > E65, E66

The steering wheel has a button for selecting the program. The following drive programs can be selected in a predefined sequence: Sport program, manual mode or automatic mode.

The steering wheel also houses the buttons for changing up and down in manual mode.

Program selection and control in manual mode are described in the Owner's Handbook.

- **Gearshift paddles**

Vehicles with gearshift paddles:

In addition to the sequential gear selection with the selector lever, the gears can also be selected using the

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2 gearshift paddles on the steering wheel.

The shift pulse is transmitted electrically to the EGS control unit. With this gearshift method ("shift-by-wire") there is no mechanical linkage between the gearshift paddles and the transmission.

Pull one of the gearshift paddles briefly to change up a gear.

Press one of the gearshift paddles briefly to change down a gear.

- **Instrument cluster display**

  The drive ranges and drive program are displayed in the instrument cluster, the signal required for this is sent from the electronic transmission control.

- **CID: Central Information Display**
  - > E60, E61, E63, E64, E70, E81, E85, E86, E87, E90, E91, E92, E93

  The CID displays detailed information about the Check-Control messages in the instrument cluster.

  The instrument cluster controls these messages on the K-CAN (body CAN).

  In addition to the visual display, the Check Control also alerts the driver with acoustic signals. Depending on the importance of the associated message, a single or double gong with varying volume and tone will sound. The instrument cluster controls these warnings by means of the K-CAN. Acoustic warnings are emitted by the M-ASK (multi-audio system controller) or CCC (Car Communication Computer).

- **CD: Control display**
  - > E65, E66

  The control display is the central display for the information and communication system.

  The control display is used as an interface between the MOST and K-CAN data buses. (MOST = "Media Oriented System Transport"; K-CAN = body controller area network".)

  Amongst other things, detailed information about the Check-Control messages in the instrument cluster are displayed on the control display.

  The instrument cluster controls these messages on the K-CAN (body CAN).

The electronic transmission control requires signals from the following components (in alphabetical order):

- **Brake light switch**

  The signal from the brake light switch is needed for the function of the selector lever lock and the adaptive transmission control.

- **DME or DDE: Digital engine electronics or digital diesel electronics**

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The DME or DDE sends messages about the current operating status of the engine to the EGS (e.g. engine speed or torque).

The EGS reports the current operating status of the transmission back to the DME or DDE.

- **DSC: Dynamic Stability Control**

The DSC optimizes both driving stability when pulling away or accelerating and traction. Within the limitations of the laws of physics, DSC compensates for driving conditions such as over/understeering. As part of this process, dynamic driving signals (e.g. wheel rotation speed, lateral acceleration) are sent to the DSC control unit. DSC transmits the processed signals regarding cornering, acceleration and winter detection to the EGS control unit.

- **Accelerator pedal module**

The signal from the accelerator pedal module is needed for the adaptive transmission control.

- **JBE: Junction box electronics**
  - > E70, E81, E87, E90, E91, E92, E93

The JBE is the data interface (= gateway) between the K-CAN and the PT-CAN. Signals from the F-CAN are simply looped through. (K-CAN = body CAN; PT-CAN = powertrain CAN; F-CAN = chassis CAN.)

The junction box consists of the JBE and the power distributor.

The power distributor provides power, amongst other things, for the gate pattern diagram and the EGS control unit.

- **KGM: Body gateway module**
  - > E60, E61, E63, E64 from 09/2005

From 09/2005, the vehicle electrical system has been modified. The body gateway module (KGM) supersedes the SGM.

The KGM is the data interface (= gateway) between the K-CAN and the PT-CAN. (K-CAN = body CAN; PT-CAN = powertrain CAN.) The diagnosis wire is connected to the KGM.

- **SGM: Safety and gateway module**
  - > E60, E61, E63, E64 up to 09/2005
  - > E65, E66

The SGM is the data interface (= gateway) between the K-CAN, **byteflight** and the PT-CAN. (K-CAN = body CAN; PT-CAN = powertrain CAN.) The diagnosis wire is connected to the SGM.

SYSTEM FUNCTIONS

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The automatic transmission has the following system functions:

- Adaptive transmission control
- Overlap control
- Starter inhibitor
- Parking lock
- Warming-up program
- Engine intervention
- Downshift inhibitor
- Reverse gear inhibitor
- Selector lever lock (shiftlock)
- Standstill decoupling
- Interlock
- Emergency program

Adaptive transmission control

As with earlier automatic transmissions, the 6-speed automatic transmissions offer the choice between a comfort program and a sport program.

The adaptive transmission control (component of electronic transmission control) adapts the shift characteristics of the comfort program and sport program to the driver's wish and the driving situation.

In both programs, the adaptive transmission control changes from a basic map to a performance - orientated map, as required:

- Comfort program in selector lever position "D"

  The comfort program is based on 2 maps: The XE map (extreme economy) and the E map (economy). The EGS control unit normally selects the economical XE map (= basic map). In case of particular demands (e.g. load requirements), the system will change to the performance - orientated E map. If the input signals change in favor of a more gentle driving style, the system will change back to the more economical XE map.

- Sport program in selector lever position "M/S"

  The sport program effects dynamic, sporty shift characteristics. In the sport program, there is the basic S map (sport) and the performance-orientated XS map (extreme sport). If an extremely dynamic driving style is called for, the system will change from the S map to the performance - orientated XS map.

The adaptive transmission control takes the following demands into account:

- Adaptation to driver type
- Driving uphill or trailer towing

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- Driving downhill
- Braking deceleration and automatic upshift
- Winter program

Adaptation to driver type

The adaptation to different driver types is done using the following values:

- Kick-fast

  If the accelerator pedal is depressed rapidly, the shift program is changed accordingly. This is achieved by the detected accelerator-pedal value being compared with threshold values in the EGS control unit. The result of this comparison is the proposal of one of the two possible programs (XE or E in comfort program, S or XS in sport program).

- Cornering detection

  Cornering detection reacts to the vehicle's lateral acceleration with an indirect adaptation to the driver type.

  Lateral acceleration is considered an indirect statement of the preferred driving dynamics and does not cause an immediate gearshift response (shifts when cornering could adversely affect driving stability).

  Lateral acceleration is calculated from the signals from the wheel-speed sensors, from the yaw rate and road speed.

- Brake evaluation

  The braking action is evaluated in a similar way to "kick-fast".

  The braking deceleration is measured and compared with threshold values in the EGS control unit. The result of this comparison is the proposal of one of the two possible programs (XE or E in comfort program, S or XS in sport program).

The driver-type adaptation is restarted each time the vehicle pulls away from a standstill.

Driving uphill or trailer towing

These functions are based on a comparison of actual car acceleration with a nominal value. From the current engine operating situation, the acceleration with normal load on a level surface is calculated. If the actual acceleration is significantly below the theoretical value, the "Driving uphill or trailer towing" function is activated.

The design of the corresponding shift characteristics allows a high-speed driving style. Undesirable upshifts and frequent up/downshifts are eliminated or greatly reduced.

Driving downhill

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If the EGS control unit detects downhill driving, it will automatically shift down a gear if the vehicle's speed picks up. This enhances the engine's braking effect. A downshift is only effected if the engine speed is below the maximum speed of the lower gear.

The EGS control unit detects downhill driving on the basis of signals from the throttle valve potentiometer (load), wheel speed sensor (road speed) and brake light switch (brake activation).

Braking deceleration and automatic upshift

To decelerate the vehicle, the foot is taken off the gas and the brake depressed as necessary. The gearshift map triggers an upshift when the throttle is closed. These gearshifts are not necessary in conjunction with brake applications as they prevent the engine's braking effect from being exploited.

The intention to apply the brakes can often be anticipated from the accelerator pedal being rapidly released to the zero position. If such an action is detected, the upshift is suppressed for as long as the accelerator pedal is in the zero position and the vehicle is in overrun mode.

Winter program (only with selector lever in position "D")

The winter program is automatically activated if the drive wheels start to spin even at a low rate of acceleration. The winter program ensures better traction by not using 1st gear. Early upshifts reduced the reactions caused by load changes. The winter program is deactivated if the wheels do **not** spin for several seconds despite high drive torque.

Overlap control

Overlap control provides gentle shift characteristics as follows: With overlap control, several multi-plate clutches are in use at the same time. Here, pressure is reduced in the active multi-plate clutch and at the same time built up in the clutch that is about to be activated. The reduction and build-up of pressure is maintained until a synchronized speed is reached. At this point, the hydraulic pressure for the multi-plate clutch to be activated can be built up completely. Overlap control is active for all gearshifts from 1st to 6th gear and from 6th to 1st gear.

Starter inhibitor

It is only possible to start the engine when the selector lever is in position "P" or "N".

- > E53, E83, E85, E86

The EWS (electronic immobilizer) evaluates the following signal from the EGS (electronic transmission control) for the start:

- Selector lever position "P" or "N" as signal via the direct wire
- > E60, E61, E63, E64, E65, E66, E70, E81, E87, E90, E91, E92, E93

The CAS (Car Access System) evaluates the following signals from the EGS (electronic transmission control) for the start:

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- Selector lever position "P" or "N" as CAN message via the powertrain CAN
- Selector lever position "P" or "N" as signal via the direct wire

In principle, the CAN message is used. If the message is incorrect or invalid, it switches to the signal from the direct wire.

Parking lock

The parking lock locks the transmission output shaft. The vehicle is prevented from rolling unexpectedly. The parking lock is designed to provide a reliable brake on gradients up to 32 %.

- > E53, E81, E83, E85, E86, E87, E90, E91, E92, E93
- > E60, E61 until 03/2007
- > E63, E64 until 09/2007

When the vehicle is stationary, the parking lock is engaged purely mechanically via the selector lever (Bowden cable from selector lever to mechatronics module).

- > E65, E66, E70
- > E60, E61 from 03/2007
- > E63, E64 from 09/2007

With the electric version of the parking lock, the parking lock is applied and electrically secured via a mechanical spring system in the transmission.

The parking lock is activated under the following conditions:

- Pressure on the button on the selector lever and roadspeed signal less than 2 km/h.
- Remote control removed from the insert compartment and roadspeed signal 0 km/h.
- Engine ON

  and

  Transmission position "D", "N" or "R"

  and

  Driver's door open

  and

  Driver's seat not occupied

  (roadspeed signal less than 2 km/h).

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The parking lock is only released when the engine is ON. Reason: Only when the engine is ON is there enough hydraulic pressure to open the parking lock (mechanical emergency release possible).

- > E65, E66, E70

If the parking brake (EMF = "electromechanical parking brake") fails, the parking lock can still be applied.

Example: A fault in the system prevents the parking brake from being moved from "Hold" to "Park". In this event, the EGS control unit will apply the parking lock after performing a plausibility check.

The locking conditions are as follows:

- Selector lever in position "N"
- Speed 0 km/h
- Engine OFF and ignition OFF

Warming-up program

The warming-up program is activated after each engine start with the engine temperature lower than approx. 60 °C. In the warming-up program, the automatic transmission remains in the performance-orientated map E or XS up to a certain temperature. Gearshift are only executed at higher speeds. This enables the engine and the catalytic converter to reach their operating temperatures more quickly.

Up to a transmission oil temperature of approximately 35 °C, the converter lockup clutch is neither controlled nor closed.

Engine intervention

During the gearshift, the EGS control unit emits signals to influence the digital engine electronics (DME) or digital diesel electronics (DDE).

The DME then retards the ignition timing for a few milliseconds.

The DDE reduces the fuel quantity for a few milliseconds by reducing the injection period.

This action briefly reduces the torque, improves shift quality, reduces the load on the transmission and shortens the shifting time.

Downshift inhibitor

A downshift inhibitor prevents the transmission shifting to a lower gear until the engine speed is below the maximum speed for the next gear down. The engine speed signal is transmitted by the DME/DDE to the EGS control unit.

The downshift inhibitor prevents damage to the engine and transmission.

Reverse gear inhibitor

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The reverse gear inhibitor electronically prevents reverse gear from being engaged when the vehicle is moving forwards at speeds above 5 km/h (3 mph). When this road speed is exceeded, the corresponding solenoid valves are no longer actuated. This prevents multi-plate clutches B and D (for reverse gear) from being charged.

Selector lever lock (shiftlock)

- > E53, E60, E61, E63, E64, E81, E83, E85, E86, E87, E90, E91, E92, E93

The selector lever is locked in positions "P" and "N" by an electromagnet. The electromagnet is actuated by the EGS control unit. The selector lever lock is engaged when selector lever position "P" or "N" is detected and the ignition (terminal 15) is ON.

- Position change from selector lever position "P" or "N":

  A position change is only possible at road speeds of less than 5 km/h and if the brake is applied at an engine speed of less than 2500 rpm.

Standstill decoupling (depends on national version)

The standstill decoupling of the torque converter decouples the torque converter from the drive when the vehicle is at a standstill. Thus only a minimum load remains, and fuel consumption is reduced. Decoupling is effected by a clutch regulation system (clutch A) within the transmission (depending on the load signal and output speed).

Interlock

- > E53, E83, E85, E86 and

  E60, E61, E63, E64 up to 09/2005:

  The ignition lock is mechanically linked to the selector lever by a Bowden cable (as on the E38). The interlock only allows the ignition key to be removed when the selector lever is in position P.

  Conversely, the selector lever can only be moved from position "P" when the ignition key is in the ignition lock and turned at least to ignition ON.

- > E60, E61 from 03/2007 and

  E63, E64 from 09/2007 and

  E65, E66 and

  E70

  The remote control can only be removed when the CAS registers a roadspeed signal of less than 1 km/h. If the remote control is removed from the insert compartment after the engine has been switched OFF, the parking lock will automatically be applied.

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- > E81, E87, E90, E91, E92, E93 and E60, E61 from 09/2005 until 03/2007 and E63, E64 from 09/2005 until 09/2007

  The selector lever is locked in position P by an electromagnet when terminal 15 is OFF. When the remote control is not in the insert compartment, the selector lever is locked in position "P". When terminal 15 is activated, the EGS control unit applies current to the electromagnet and the selector lever is released. A microswitch registers the locking or unlocking of the selector lever. The microswitch transmits a signal to the CAS (Car Access System) to enable the remote control.

  - Interlock **without** convenience access

    If the selector lever is not engaged in position "P", the remote control cannot be removed from the insert compartment. The selector lever is locked when the selector lever is in position P and the ignition is OFF. The remote control can be removed.

  - Interlock **with** convenience access

    The engine and terminal 15 (ignition) can only be switched off when the selector lever is in position "P".

Emergency program

The emergency program is activated if the transmission management should fail or detect a malfunction that could lead to critical driving conditions. In the emergency program, the vehicle remains operational, albeit with limitations.

If the electronic transmission control fails (without current), the following forward gears can be engaged:

Failure in 1st-3rd gear -> emergency 3rd gear

Failure in 4th-6th gear -> emergency 5th gear

A restart will be performed in 3rd gear.

SPECIAL SITUATIONS (FUNCTIONS IN EGS)

- > E60, E61 from 03/2007
- > E63, E64 from 09/2007
- > E70

DIRECTION CHANGE MEMORY FUNCTION

The driver wishes to change from selector lever position "D" to selector lever position "R" or from selector lever position "R" to selector lever position "D".

- At v ± 5 km/h, the driver's wish is carried out by the electronic transmission control (EGS).

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- At 5 ± v ± 10 km/h, selector lever position "N" is engaged by the electronic transmission control, the display of the currently engaged gear range changes to the driver's desired selector lever position "D" or selector lever position "R".

  The driver's wish is stored. If the vehicle's speed drops below 5 km/h within 1 second, the driver's wish for selector lever position "D" or selector lever position "R" is carried out by the electronic transmission control. If the speed stays above this threshold, selector lever position "N" remains and the display changes to selector lever position "N".

- If v > 10 km/h, selector lever position "N" is engaged by the electronic transmission control

PARKING LOCK MEMORY FUNCTION

The driver wishes to engage selector lever position "P" (parking lock)

- At v ± 2 km/h, selector lever position "P" is engaged by the electronic transmission control (EGS).
- At 2 ± v ± 5 km/h, the current selector lever position remains, the driver's wish is stored. If the vehicle's speed drops below 2 km/h within a second, selector lever position "P" is engaged by the electronic transmission control
- At v > 5 km/h, the driver's wish is not accepted. The current selector lever position remains and the Check-Control message "Transmission position P only at standstill" is displayed

POSITION "N" HOLD TIME

If v ± 2 km/h, the engine is OFF, selector lever position "N" is engaged and the ID transmitter is inserted, the selector lever position "N" hold time starts for 30 minutes.

During this time, information is transmitted by the electronic transmission control (EGS), the function display remains on and selector lever position "N" lights up in the gate pattern diagram. At the end of selector lever position "N" hold time, the display flashes and the electronic transmission control (EGS) engages selector lever position "P" after 10 seconds.

If the selector lever is moved during position "N" hold time, the 30 minutes selector lever position "N" hold time start afresh.

OPERATION

The different automatic transmission drive positions are selected with the selector lever.

When driving, there are the following possibilities:

- **D = Automatic mode**

  When the selector lever is in position "D", gears are selected by the adaptive transmission control.

  - **Gearshift using gearshift paddles**

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If the selector lever is in position "D" and a gearshift is initiated using the gearshift paddles, the automatic transmission will automatically change to manual mode.

If no gearshift is made and the vehicle does not accelerate significantly within 6 seconds, the automatic transmission will change back to automatic mode.

- **SD = Automatic mode, sport program**

When the selector lever is moved to the right from position "D" into the shift gate "M/S", the automatic transmission's sport-shift program is activated. The display in the instrument cluster changes from "D" to "SD".

- **M1 to M6 = Steptronic**

If the selector lever is in shift gate "M/S" and is briefly moved to "-" or "+", the electronic circuitry changes to Steptronic. Permanent manual mode is activated with the selector lever or gearshift paddles. The display in the instrument cluster changes from "SD" to "M1" to"M6".

In manual mode (Steptronic), upshifts and downshifts are only executed by the transmission control if road speed and engine speed are suitable. Gearshifts that would result in an excessively high or low engine speed are suppressed.

- **Sport program via SPORT button**

When the SPORT button is pressed, the electronics will change to the sport program regardless of the drive range engaged or the current selector lever position.

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TRANSMISSION

Automatic Transmission - Special Tools - X3

24 AUTOMATIC TRANSMISSION

24 0 010 FIXTURE

In conjunction with: 00 2 510

Note: For checking axial play of drive shaft

Transmission: 4 HP 22, 4 HP 24, A5S 310Z, A5S 560Z

Storage location: B23

Order number: 24 0 010

Fixture

Consisting of:

1 = 24 0 011 Dial gauge holder

2 = 24 0 012 Clamping piece

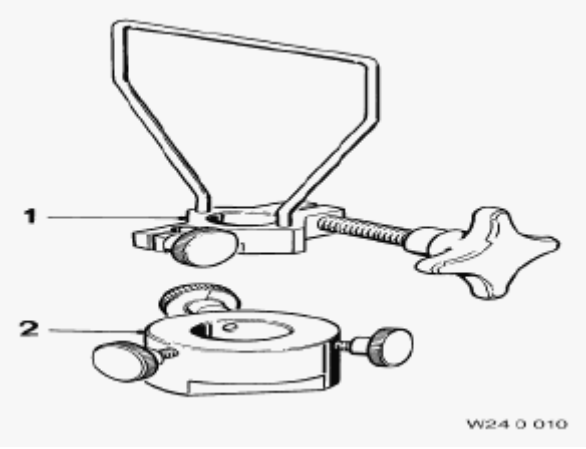


Fig. 1: Fixture (24 0 010)
Courtesy of BMW OF NORTH AMERICA, INC.

24 0 020 OIL PRESSURE TEST ACCESSORIES

Minimum set: Mechanical tools

In conjunction with: 13 3 061 and BMW DIS

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Note: For pressure gauge 13 3 061 or BMW DIS for checking oil pressure

Transmission: 3 HP 12, 3 HP 20, 3 HP 22, 4 HP 22, 4 HP 24, A4S 270R, A4S 310R, A5S 300J, A5S 310Z, A5S 440Z, A5S 560Z

Storage location: B23, B24, single

Order number: 24 0 020

Oil pressure test accessories

Consisting of:

1 = 24 0 021 Pressure hose with connection

Note: Pressure hose 1.7 m, connection M12x1.5 - M14x1.5 external thread/for checking the various converter pressures / Transmission: A4S 310R, A4S 270R

2 = 24 0 022 Reducer

Note: For checking main pressure (3 HP 22, A5S 310Z) and clutch A (ZF transmissions) / transmission: 3 HP 22, A5S 310Z, A5S 560Z and all ZF transmissions

In conjunction with: 24 0 140

3 = 24 0 023 Pipe bend, 145 mm

Note: Extended length 145 mm / Transmission: 4 HP 22, 4 HP 24

In conjunction with: 13 6 052

4 = 24 0 024 Pipe bend, 90 mm

Note: Extended length 90 mm

In conjunction with: 13 6 052

5 = 24 0 025 Banjo bolt

Note: M20x1.5 - M18x1.5 / For checking converter pressure / Transmission: 3 HP 12

In conjunction with: 24 0 024

6 = 24 0 026 Reducer

Note: M24x1.5 - 20x1.5 / For checking main pressure / Transmission: 3 HP 20

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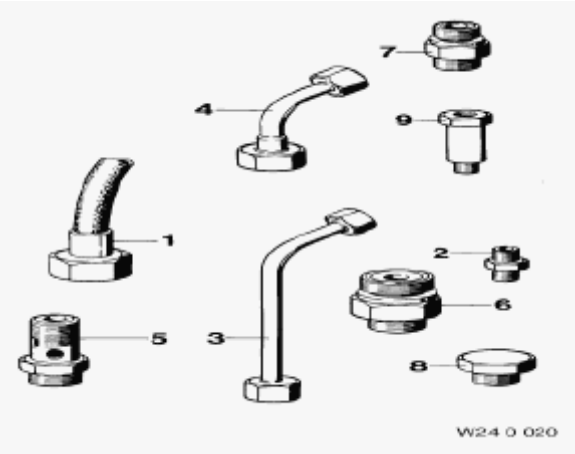


Fig. 2: Oil Pressure Test Accessories (24 0 020)
Courtesy of BMW OF NORTH AMERICA, INC.

In conjunction with: 24 0 024

7 = 24 0 027 Reducer

Note: M20x1.5 - M18x1.5 / For checking main pressure (3 HP 12) and converter pressure (3 HP 20) / Transmission: 3 HP 12, 3 HP 20

In conjunction with: 24 0 024

8 = 24 0 028 Screw plug

Note: M18x1.5 / For closing off oil supply lines while checking converter pressure / Transmission: 3 HP 20

9 = 24 0 029 Adapter

Note: For closing off supply and return lines while checking main pressure / Transmission: 3 HP 22

24 0 030 ADAPTER

In conjunction with: 13 3 061, 24 0 021, 24 0 023

Note: For pressure gauge 13 3 061 / For checking converter pressure

Transmission: 4 HP 22

Storage location: B23

Order number: 24 0 030

Adapter

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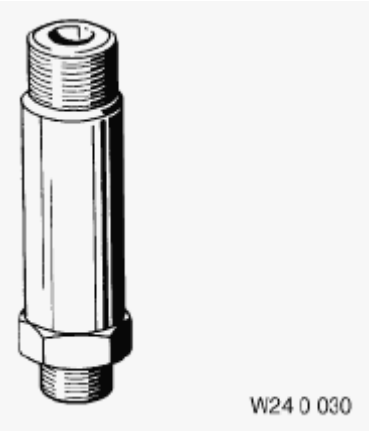


Fig. 3: Adapter (24 0 030)
Courtesy of BMW OF NORTH AMERICA, INC.

24 0 040 RETAINING FIXTURE

Note: For removing and installing disc pack

Transmission: 3 HP 20, 3 HP 22, 4 HP 22, 4 HP 24

Storage location: C27

Order number: 24 0 040

Retaining fixture

Consisting of:

1 = 24 0 041 Disc

2 = 24 0 042 Ring

3 = 24 0 043 Half shells

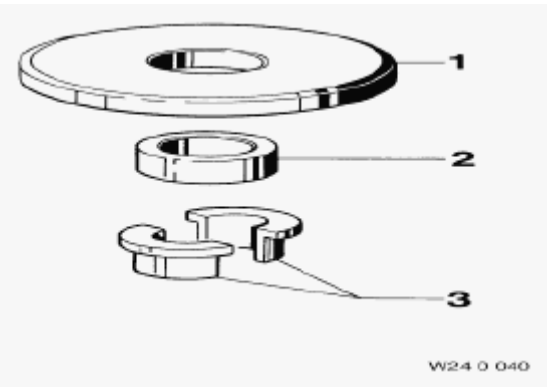


Fig. 4: Retaining Fixture (24 0 040)

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Courtesy of BMW OF NORTH AMERICA, INC.

24 0 050 EXTRACTOR GRIP

Note: For sealing plug in bottom section of transmission casing

Transmission: 3 HP 12, 3 HP 20, 3 HP 22, 4 HP 22, 4 HP 24

Storage location: A24

Order number: 24 0 050

Extractor grip

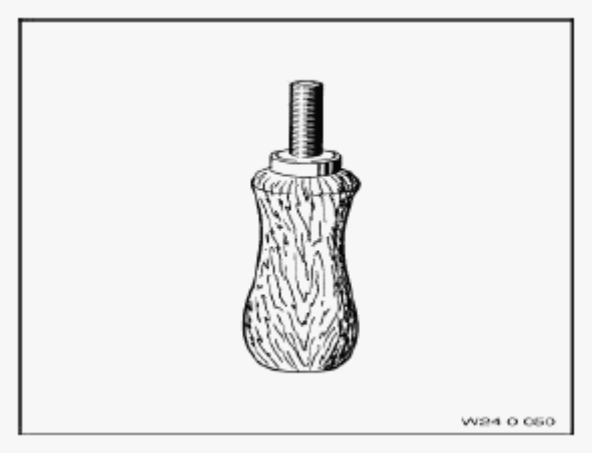


Fig. 5: Extractor Grip (24 0 050)
Courtesy of BMW OF NORTH AMERICA, INC.

24 0 070 ADAPTER

In conjunction with: 13 3 061 (pressure gauge), 24 0 021, 24 0 023

Note: For checking pump pressure

Transmission: 4 HP 22, 4 HP 24

Storage location: B23

Order number: 24 0 070

Adapter

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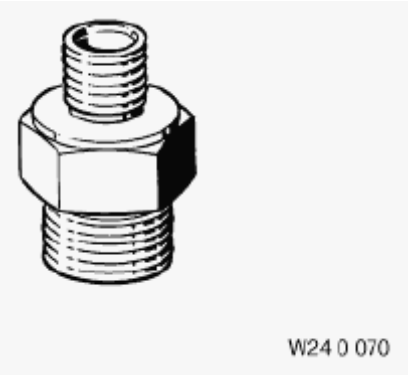


Fig. 6: Adapter (24 0 070)
Courtesy of BMW OF NORTH AMERICA, INC.

24 0 080 FUNNEL

Minimum set: Mechanical tools

Note: For filling transmission fluid in transmission

Transmission: 240/5, 242/4, 245/5, 245/5Sport, 260/5, 262/4, 265/5, 265/5Sport, 280/5Sport, 3 HP 12, 3 HP 20, 3 HP 22, 4 HP 22, 4 HP 24, A4S 270R, A4S 310R, A5S 300J, A5S 310Z, A5S 440Z, A5S 560Z, BW 65, S5D 200G, S5D 250G, S5D 260Z, S5D 310Z, S6S 420G, S6S 560G, ZF S5-16

Order number: 24 0 080

Funnel



Fig. 7: Funnel (24 0 080)
Courtesy of BMW OF NORTH AMERICA, INC.

24 0 090 DRIFT

Note: For driving in radial seal in transmission case front section / Replaced by 24 0 110, November 96

Transmission: 4 HP 22, 4 HP 24

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Order number: 24 0 090

Drift

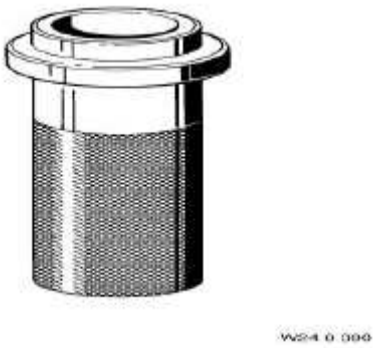


Fig. 8: Drift (24 0 090)
Courtesy of BMW OF NORTH AMERICA, INC.

24 0 120 ATTACHMENT FOR TROLLEY

Note: For removing and installing transmission / Replaced by 24 0 130, March 87

Transmission: 4 HP 22

Order number: 24 0 120

Attachment for trolley

24 0 130 TAKE-UP SUPPORT FOR TRANSMISSION

In conjunction with: 00 2 030 (not included in minimum kit)

Note: For removal and installation

Transmission: 4 HP 22, 4 HP 24

SI number: 1 02 87(721)

Order number: 24 0 130

Take-up support for transmission

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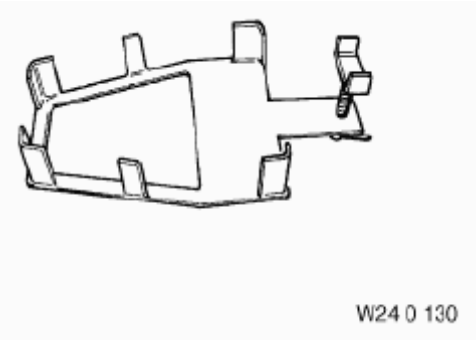


Fig. 9: Take-Up Support For Transmission (24 0 130)
Courtesy of BMW OF NORTH AMERICA, INC.

24 0 140 PIPE MANIFOLD

Minimum set: Mechanical tools

In conjunction with: 13 3 061, 24 0 021, 24 0 022, 13 6 051, 13 6 052, 24 5 190

Note: For pressure gauge 13 3 061 and BMW DIS for measuring oil pressure in transmission

Transmission: A4S 270R, A4S 310R, A5S 310Z, A5S 560Z

Storage location: C3

SI number: 1 01 92(469)

Order number: 24 0 140

Pipe manifold

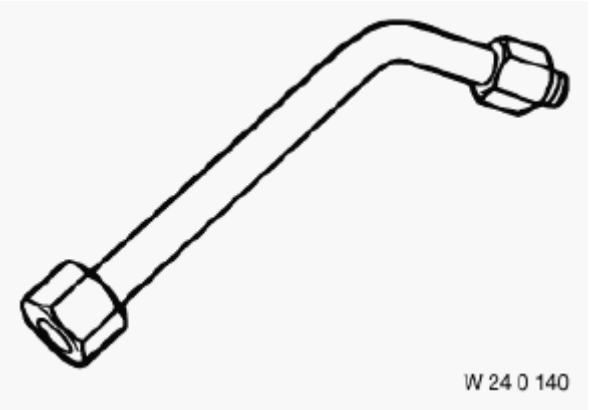


Fig. 10: Pipe Manifold (24 0 140)
Courtesy of BMW OF NORTH AMERICA, INC.

24 0 150 MOUNTING BRACKET

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In conjunction with: 00 1 450

Note: For mounting transmission on assembly stand

Transmission: 3 HP 12, 3 HP 20, 3 HP 22, 4 HP 22, A4S 270R, A4S 310R, A5S 310Z

Order number: 24 0 150

Mounting bracket

Consisting of:

2 = 24 0 152 Baseframe

3 = 24 0 153 Spindle with rotary handle

6 = 24 0 156 Spindle

Note: With thrust piece, transmission: all

In conjunction with: 00 1 450

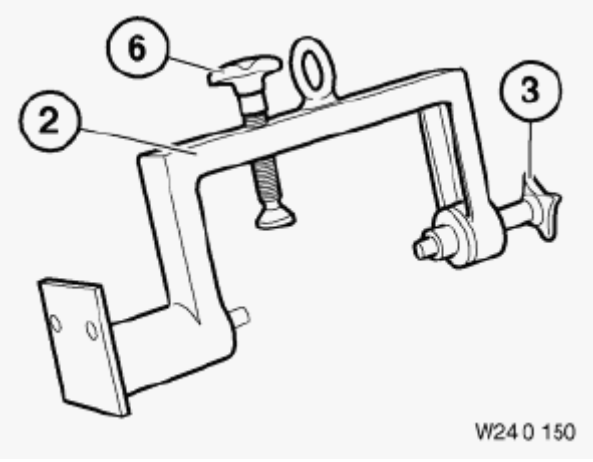


Fig. 11: Mounting Bracket (24 0 150)
Courtesy of BMW OF NORTH AMERICA, INC.

24 0 170 SUPPORT

In conjunction with: 00 2 030 (not included in minimum kit)

Note: For removing and installing transmission

Transmission: A5S 560Z

SI number: 1 06 92(509)

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Order number: 24 0 170

Support

Consisting of:

24 0 171 Adjusting screw

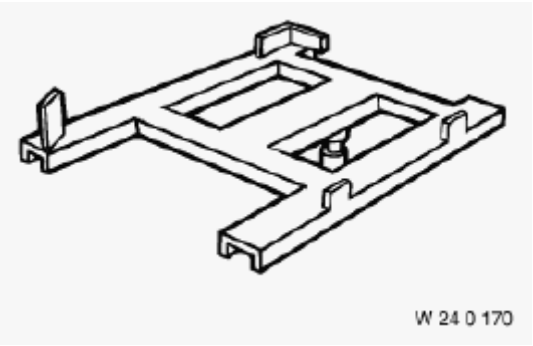


Fig. 12: Support (24 0 170)
Courtesy of BMW OF NORTH AMERICA, INC.

24 0 180 SUPPORT

In conjunction with: 00 1 450

Note: For mounting transmission on assembly stand.

Transmission: A5S 310Z, A5S 325Z, A5S 360R, A5S 440Z, A5S 560Z, GA6 HP19Z, GA6 HP26Z

SI number: 1 06 92 (509)

Order number: 24 0 180

Support

Consisting of:

1 = 24 0 181 Baseframe

2 = 24 0 182 Pressure spindle with star handle

4 = 24 0 184 Spindle, long (2 x)

5 = 24 0 185 Adapter

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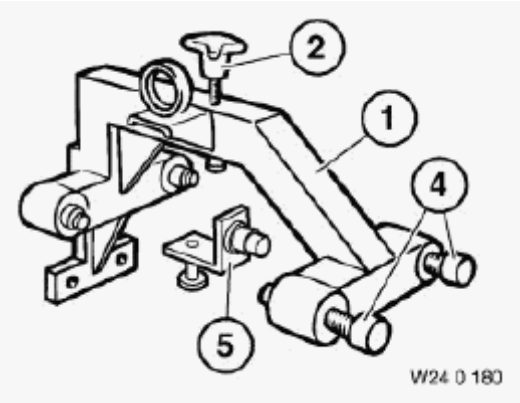


Fig. 13: Support (24 0 180)
Courtesy of BMW OF NORTH AMERICA, INC.

24 0 190 HOLDING FIXTURE

Minimum set: Mechanical tools

Note: For output flange of propeller shaft while releasing and tightening slotted nut

Transmission: A5S 310Z, A5S 325Z, A5S 360R, A5S 560Z

SI number: 1 06 92(509)

Order number: 24 0 190

Holding fixture

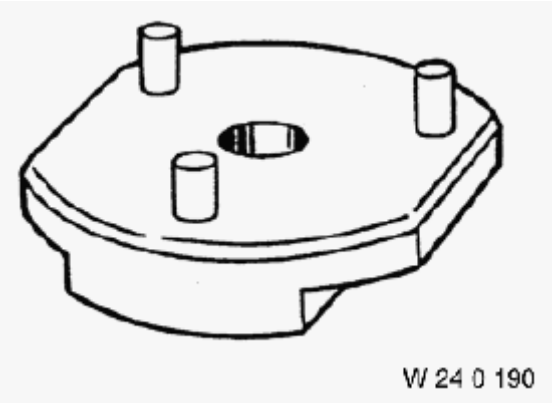


Fig. 14: Holding Fixture (24 0 190)
Courtesy of BMW OF NORTH AMERICA, INC.

24 0 200 SUPPORT

In conjunction with: 00 1 450

Note: For mounting transmission on assembly stand.

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Transmission: A5S 440Z, A5S 560Z, GA6 HP19Z, GA6 HP26Z, GA6 HP32Z

SI number: 1 27 06 (328)

Order number: 24 0 200

Support

Consisting of:

1 = 24 0 201 Basic body

2 = 24 0 202 Spindle with thrust member

3 = 24 0 203 Spindle with screw

4 = 24 0 204 Sliding piece

5 = 24 0 205 Adapter (long)

6 = 24 0 206 Adapter (medium)

7 = 24 0 207 Adapter (short)

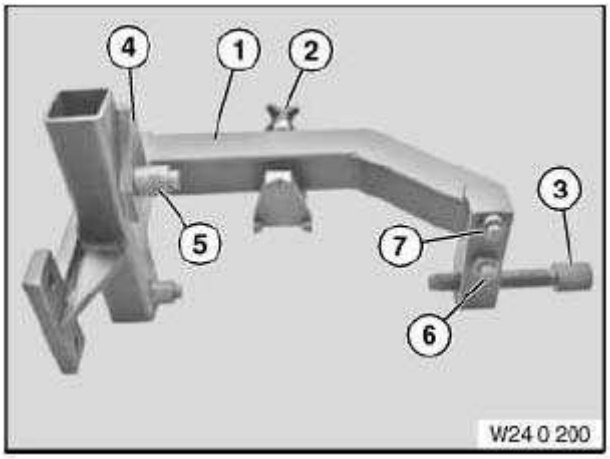


Fig. 15: Support (24 0 200)
Courtesy of BMW OF NORTH AMERICA, INC.

24 0 250 TAKE-UP SUPPORT FOR TRANSMISSION

In conjunction with: 24 5 301 and 00 2 030 (not included in minimum tool kit)

Note: For removing and installing transmission.

Transmission: A5S 440Z

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SI number: 1 08 96(080)

Order number: 24 0 250

Take-up support for transmission

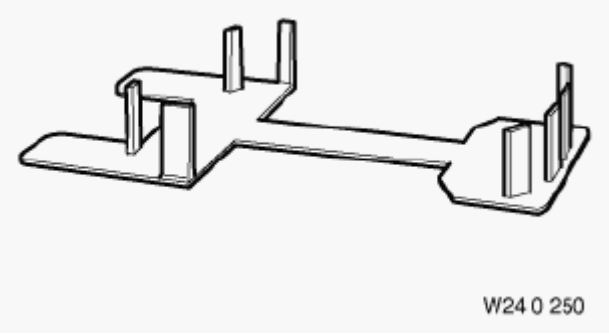


Fig. 16: Take-Up Support For Transmission (24 0 250)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 010 INSTALLATION SLEEVE

Note: For removing disc pack (4th gear) as well as fitting needle bearing in oil pump housing (A5S 560Z)

Transmission: 4 HP 22, 4 HP 24, A5S 560Z

Storage location: A18

Order number: 24 1 010

Installation sleeve

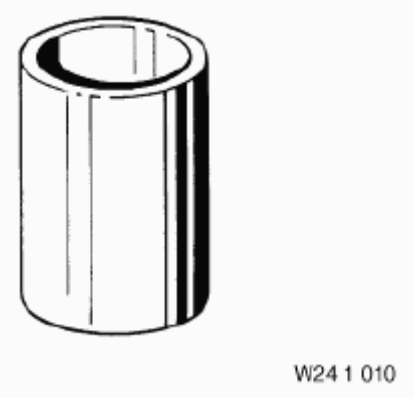


Fig. 17: Installation Sleeve (24 1 010)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 050 IMPACT BUSH

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Note: For fitting rotary shaft seal for torque converter in oil pump housing

Transmission: 3 HP 20, 3 HP 22

Storage location: C29

Order number: 24 1 050

Impact bush

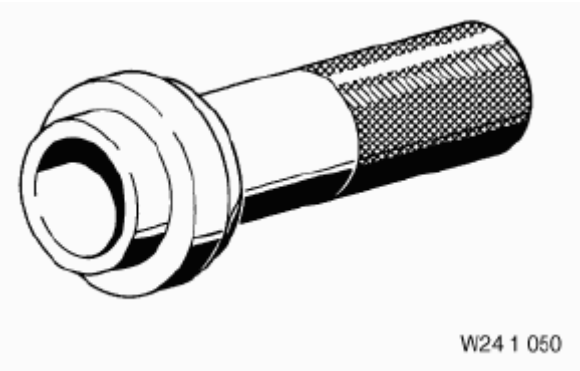


Fig. 18: Impact Bush (24 1 050)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 060 IMPACT BUSH

Note: For fitting rotary shaft seal for torque converter in oil pump housing and on output flange

Transmission: 3 HP 20, 3 HP 22, A5S 300J, BW 65

Storage location: B29, C29

Order number: 24 1 060

Impact bush

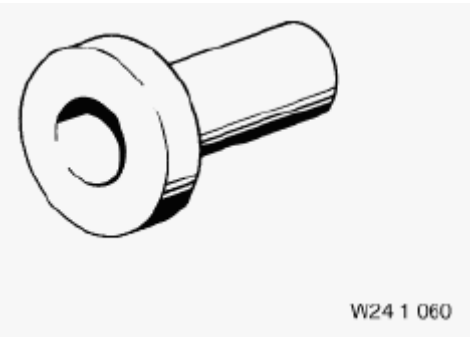


Fig. 19: Impact Bush (24 1 060)
Courtesy of BMW OF NORTH AMERICA, INC.

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24 1 070 IMPACT BUSH

Minimum set: Mechanical tools

Note: For fitting rotary shaft seal in oil pump housing

Transmission: A5S 325Z

Storage location: B36

SI number: 1 03 98(303)

Order number: 24 1 070

Impact bush

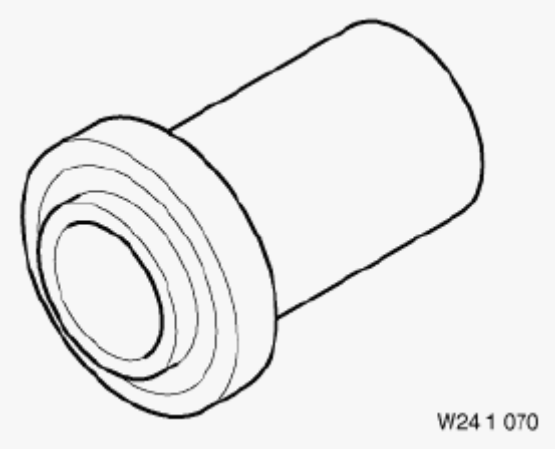


Fig. 20: Impact Bush (24 1 070)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 080 BUSH (ALUMINIUM)

Minimum set: Mechanical tools

In conjunction with: 00 5 010

Note: For fitting on input shaft while removing rotary shaft seal from oil pump housing

Transmission: A5S 325Z

Storage location: A36

SI number: 1 03 98(303)

Order number: 24 1 080

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Bush (aluminium)

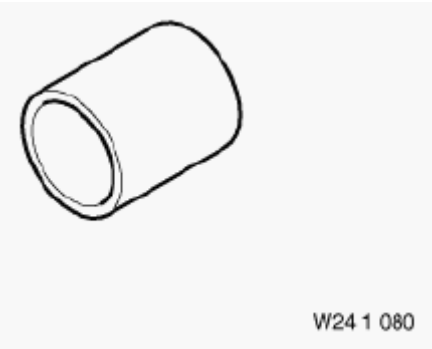


Fig. 21: Bush (24 1 080)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 090 IMPACT BUSH

Note: For installing rotary shaft seal on output flange

Transmission: A5S 390G

SI number: 1 08 98(333)

Order number: 24 1 090

Impact bush

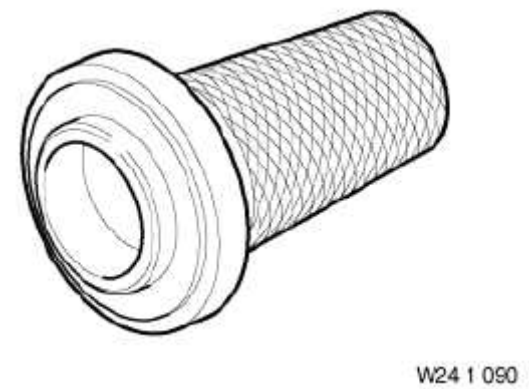


Fig. 22: Impact Bush (24 1 090)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 100 IMPACT BUSH

Note: For fitting rotary shaft seal for output flange in transmission extension

Transmission: 3 HP 12, 3 HP 20, 3 HP 22

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Order number: 24 1 100

Impact bush

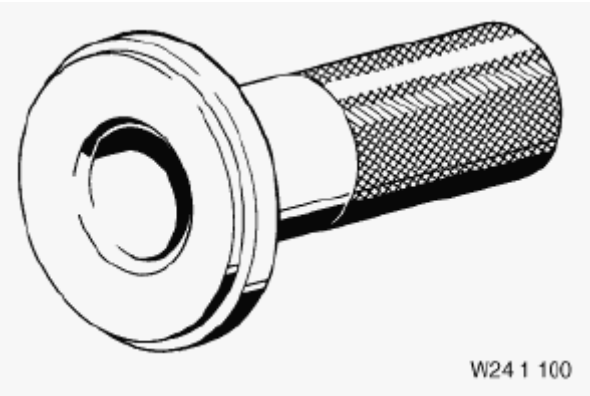


Fig. 23: Impact Bush (24 1 100)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 110 SOCKET WITH MAGNET

Minimum set: Mechanical tools

Note: For loosening and tightening converter mounting

Transmission: 3 HP 12, 3 HP 20, 3 HP 22, 4 HP 22, 4 HP 24, A4S 200R, A4S 270R, A4S 310R, A5S 300J, A5S 310Z, A5S 325Z, A5S 360R, A5S 390G, A5S 390R, A5S 440Z, A5S 560Z, GA6 HP19Z, GA6 HP26Z, GA6 HP32Z

Storage location: B19

SI number: 1 04 86 (566)

Order number: 24 1 110

Socket with magnet

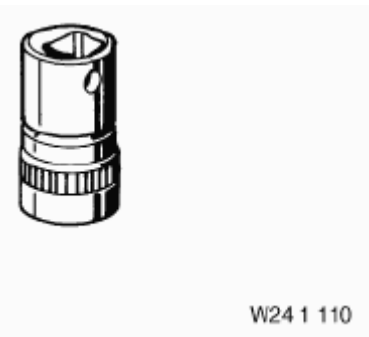


Fig. 24: Socket With Magnet (24 1 110)
Courtesy of BMW OF NORTH AMERICA, INC.

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24 1 120 GAUGE

Note: For adjusting position switch in "P" position during assembly / Model year: As from 03/96

Transmission: A4S 270R

SI number: 1 07 96(068)

Order number: 24 1 120

Gauge



Fig. 25: Gauge (24 1 120)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 170 PIN WRENCH

Minimum set: Mechanical tools

Note: For releasing and tightening slotted nut on output flange

Transmission: A5S 310Z

Storage location: A35

SI number: 1 09 90(282)

Order number: 24 1 170

Pin wrench

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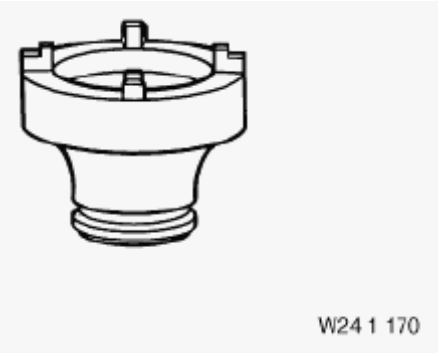


Fig. 26: Pin Wrench (24 1 170)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 180 FIXTURE

In conjunction with: 24 1 080 (A5S 325Z)

Note: For removing and installing oil pump

Transmission: A5S 310Z, A5S 560Z

Storage location: B18

SI number: 1 09 90(282)

Order number: 24 1 180

Fixture

Consisting of:

1 = 24 1 181 Retaining tube

2 = 24 1 182 Thread spindle

3 = 24 1 183 Retaining ring, inner

Note: (not shown)

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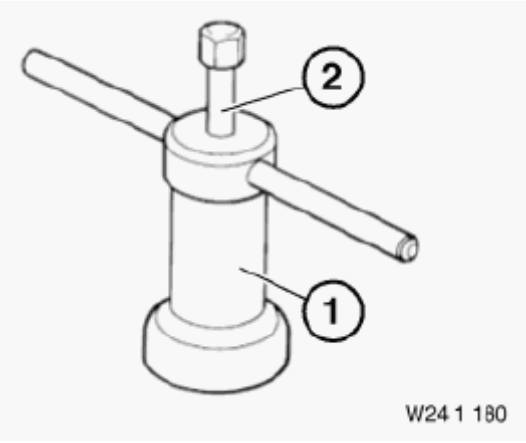


Fig. 27: Fixture (24 1 180)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 190 DRIFT

Minimum set: Mechanical tools

In conjunction with: 00 5 500

Note: For fitting rotary shaft seal in front section of transmission casing

Transmission: A5S 310Z

Storage location: B28

SI number: 1 09 90(282)

Order number: 24 1 190

Drift

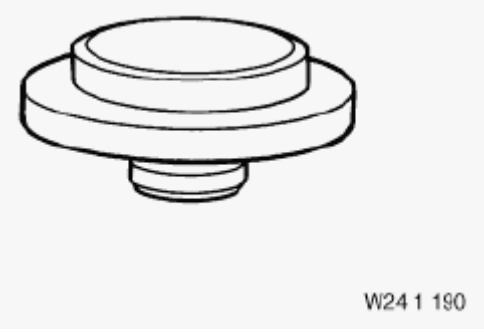


Fig. 28: Drift (24 1 190)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 200 INSTALLATION SLEEVE

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Minimum set: Mechanical tools

Note: For preventing damage to rotary shaft seal while fitting on gearshift shaft

Transmission: A5S 310Z

Storage location: B18

SI number: 1 09 90(282)

Order number: 24 1 200

Installation sleeve



Fig. 29: Installation Sleeve (24 1 200)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 210 RETAINING PLATE FOR DISC PACKAGE

Note: Not required as from transmission No. 11 2 300

Transmission: A5S 310Z

Storage location: B22

SI number: 1 09 90(282)

Order number: 24 1 210

Retaining plate for disc package

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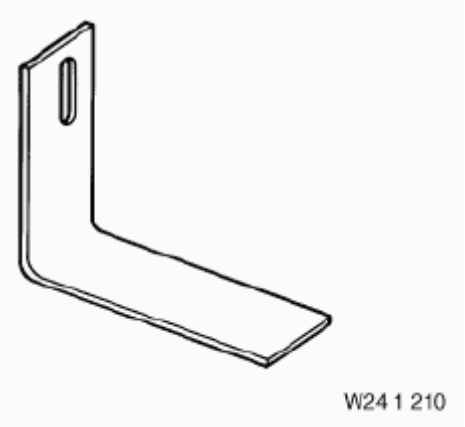


Fig. 30: Retaining Plate For Disc Package (24 1 210)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 220 TAKE-UP SUPPORT FOR DRIVE FLANGE

In conjunction with: 24 1 170 (A5S 310Z), 24 4 110 (A5S 440Z)

Note: When loosening slotted nut

Transmission: A5S 310Z, A5S 440Z

SI number: 1 09 90(282)

Order number: 24 1 220

Take-up support for drive flange

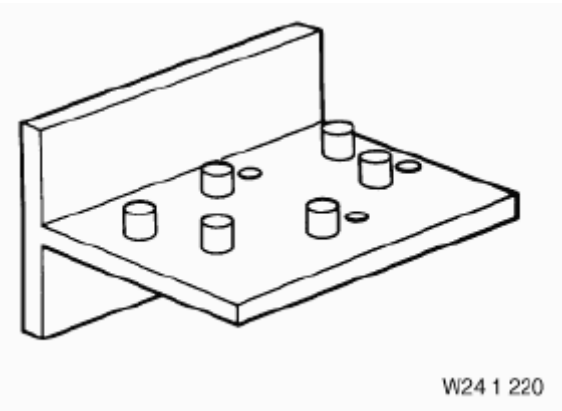


Fig. 31: Take-Up Support For Drive Flange (24 1 220)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 230 PRESSING TOOL

Note: For removing and installing piston (cover) on brake Ct

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Transmission: A5S 310Z

Storage location: B20

SI number: 1 14 93(718)

Order number: 24 1 230

Pressing tool

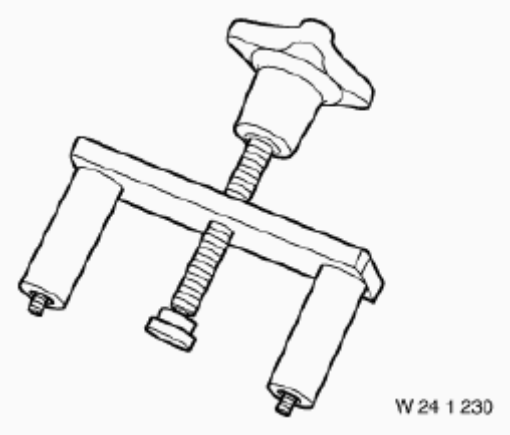


Fig. 32: Pressing Tool (24 1 230)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 240 MEASURING DEVICE

Note: For determining spacers on brake C

Transmission: A5S 310Z

Storage location: B20

SI number: 1 14 93(718)

Order number: 24 1 240

Measuring device

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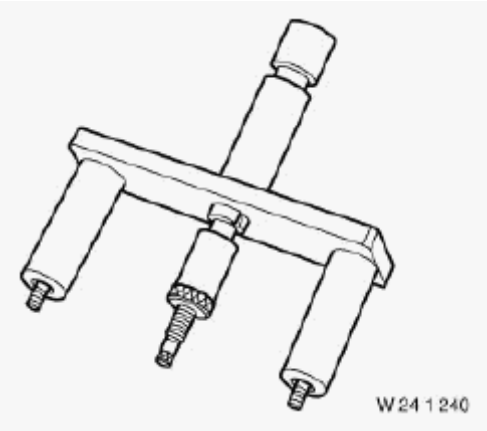


Fig. 33: Measuring Device (24 1 240)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 250 LIFTING GEAR

Note: For removing and installing brake clutch unit D/G incl. sprag wheel

Transmission: A5S 310Z

Storage location: B11, C11

SI number: 1 14 93(718)

Order number: 24 1 250

Lifting gear

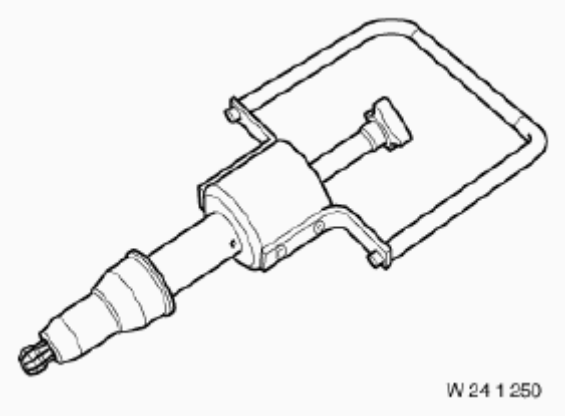


Fig. 34: Lifting Gear (24 1 250)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 260 REMOVAL AND MOUNTING FIXTURE

Note: For removing and installing cylinder D/E with planetary gear train

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Transmission: A5S 560Z

Storage location: C1, C2

SI number: 1 01 95(892)

Order number: 24 1 260

Removal and mounting fixture

Consisting of:

1 = 24 1 261 Handle

2 = 24 1 262 Spindle with knurled nut

3 = 24 1 263 Centering bush

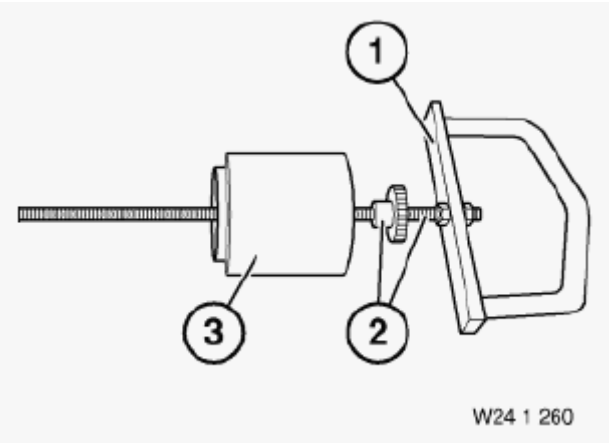


Fig. 35: Removal And Mounting Fixture (24 1 260)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 270 REMOVAL AND MOUNTING FIXTURE

Note: For removing and installing clutch A/B/C

Transmission: A5S 560Z

Storage location: B14, B15, B3

SI number: 1 01 95(892)

Order number: 24 1 270

Removal and mounting fixture

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Consisting of:

1 = 24 1 271 Lifting tube with eye bolt

2 = 24 1 272 Lock pin

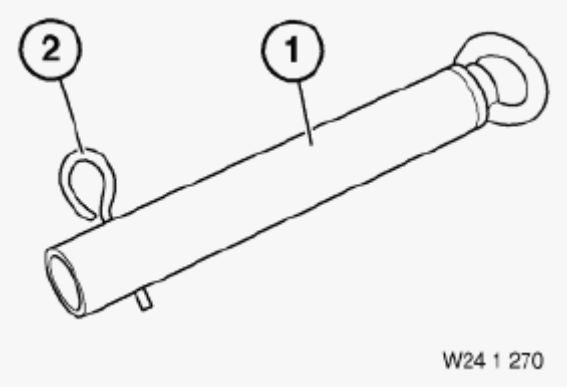


Fig. 36: Removal And Mounting Fixture (24 1 270)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 280 REMOVAL AND MOUNTING FIXTURE

Note: For removing and installing brake clutch F

Transmission: A5S 560Z

Storage location: C20

SI number: 1 01 95(892)

Order number: 24 1 280

Removal and mounting fixture

Consisting of:

1 = 24 1 281 Handle with spindle

2 = 24 1 282 Knurled nut

3 = 24 1 283 Centering handle

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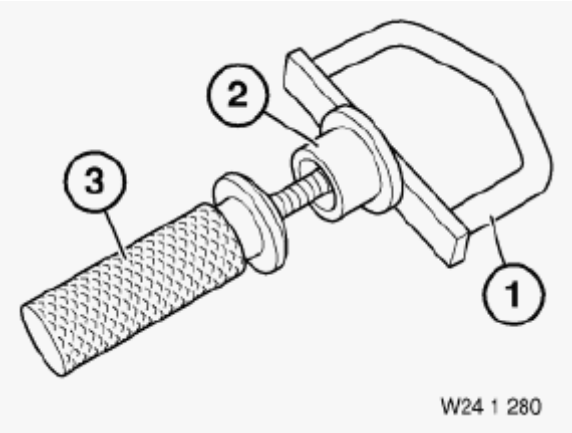


Fig. 37: Removal And Mounting Fixture (24 1 280)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 290 WEDGES

Note: For fixing disc pack C in position while securing retainer tabs

Transmission: A5S 560Z

Storage location: C17

SI number: 1 01 95(892)

Order number: 24 1 290

Wedges

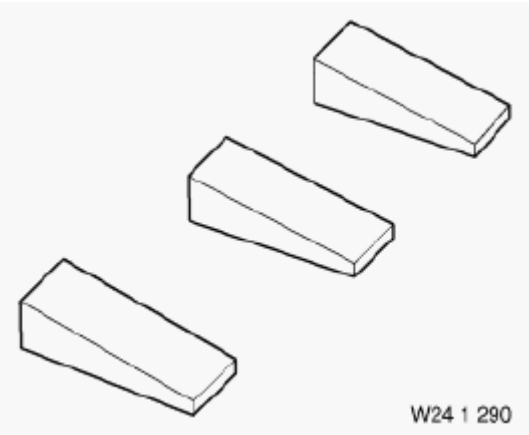


Fig. 38: Wedges (24 1 290)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 300 IMPACT TOOL

Note: For securing retainer tabs on disc pack C

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Transmission: A5S 560Z

Storage location: C17

SI number: 1 01 95(892)

Order number: 24 1 300

Impact tool

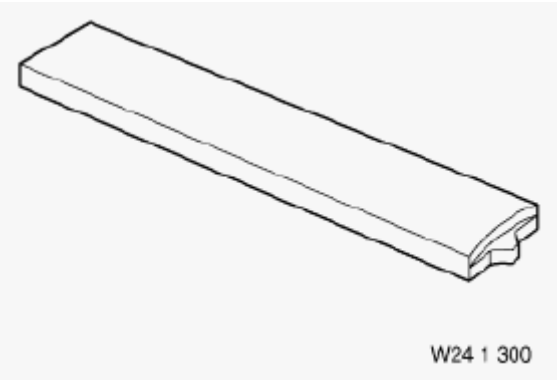


Fig. 39: Impact Tool (24 1 300)
Courtesy of BMW OF NORTH AMERICA, INC.

24 1 310 RELEASING TOOL

Note: For releasing retainer tabs on disc pack C

Transmission: A5S 560Z

Storage location: C2

SI number: 1 01 95(892)

Order number: 24 1 310

Releasing tool

Consisting of:

1 = 24 1 311 Profile section (slide)

2 = 24 1 312 Basic body

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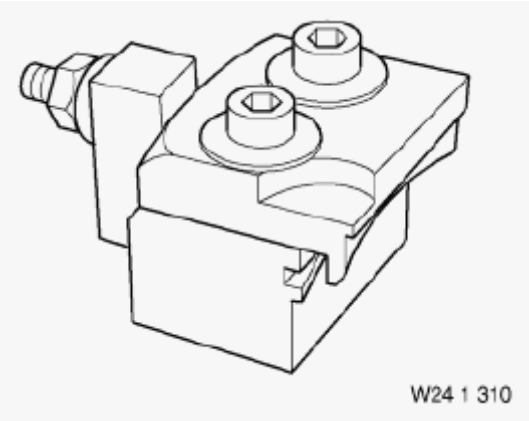


Fig. 40: Releasing Tool (24 1 310)
Courtesy of BMW OF NORTH AMERICA, INC.

24 2 020 TOOL

Note: For compressing disc spring

Transmission: 4 HP 22, 4 HP 24

Storage location: C32

Order number: 24 2 020

Tool

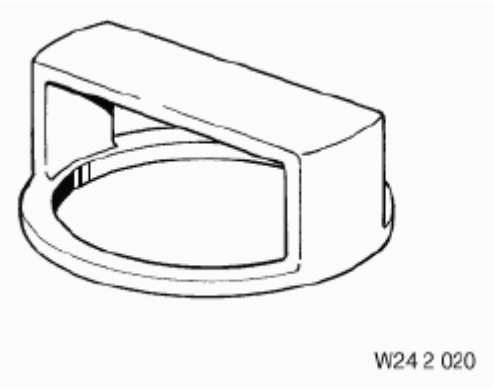


Fig. 41: Tool (24 2 020)
Courtesy of BMW OF NORTH AMERICA, INC.

24 2 030 TOOL

Note: For compressing disc spring

Transmission: 3 HP 20, 3 HP 22, 4 HP 22, 4 HP 24

Storage location: C32

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Order number: 24 2 030

Tool

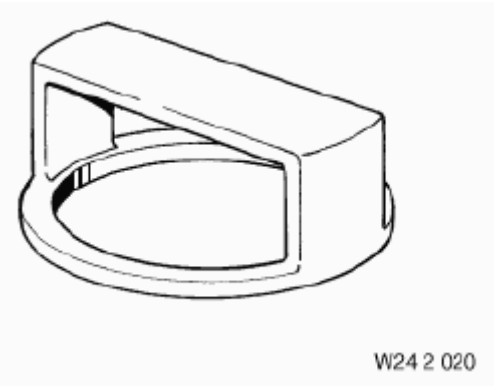


Fig. 42: Tool (24 2 020)
Courtesy of BMW OF NORTH AMERICA, INC.

24 2 040 TOOL

Note: For compressing disc spring

Transmission: 3 HP 12, 3 HP 20, 3 HP 22, 4 HP 22, 4 HP 24

Storage location: C32

Order number: 24 2 040

Tool

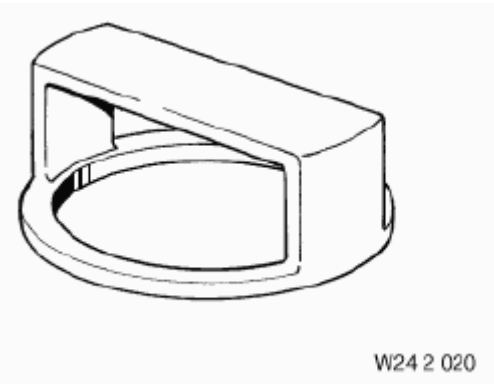


Fig. 43: Tool (24 2 020)
Courtesy of BMW OF NORTH AMERICA, INC.

24 2 050 EXTRACTOR GRIP

Note: For sealing plugs in transmission case lower section / Replaced by 24 0 050

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Order number: 24 2 050

Extractor grip

24 2 140 TENSIONING TOOL

Note: For removing and installing snap ring in front of centering plate of ZF transmissions

Transmission: 3 HP 12, 3 HP 20, 3 HP 22

Order number: 24 2 140

Tensioning tool

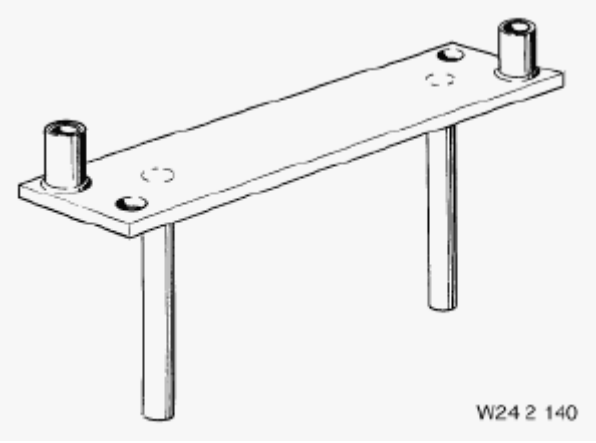


Fig. 44: Tensioning Tool (24 2 140)
Courtesy of BMW OF NORTH AMERICA, INC.

24 2 310 TOOL KIT FOR REMOVING AND INSTALLING REVERSE GEAR PISTON

Note: For disassembling and assembling transmission for "Sealing intermediate plate" job

Transmission: A4S 270R, A4S 310R

SI number: 1 22 97(239)

Order number: 24 2 310

Tool kit for removing and installing reverse gear piston

Consisting of:

1 = 24 2 311 Pressure plate

Note: For removing and installing spring retainer

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2 = 24 2 312 Spindle with pressure plate

Note: Spindle M14x1.5, nut M14, pressure plate and washer / For removing and installing spring retainer

3 = 24 2 313 Guide pin (2)

Note: For fixing gaskets and intermediate plates on intermediate housing

4 = 24 2 314 Slip bush

Note: For removing piston in cylinder of intermediate plate

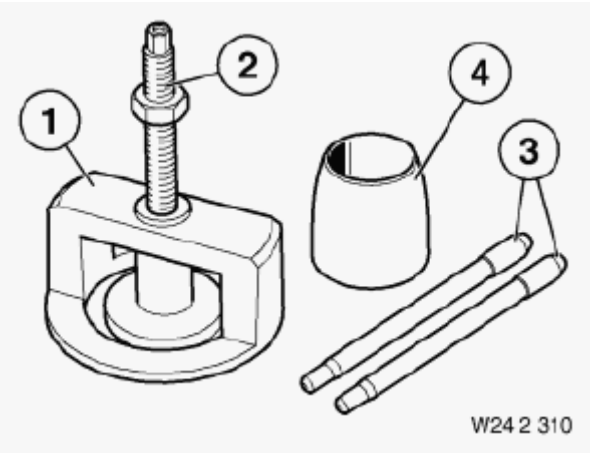


Fig. 45: Tool Kit For Removing And Installing Reverse Gear Piston (24 2 310)
Courtesy of BMW OF NORTH AMERICA, INC.

24 2 320 BOX SPANNER

In conjunction with: 24 2 330

Note: For 3/16" socket head cap screw with 1/4" socket for adjusting brake band

Transmission: A4S 270R, A4S 310R

SI number: 1 24 97(257)

Order number: 24 2 320

Box spanner

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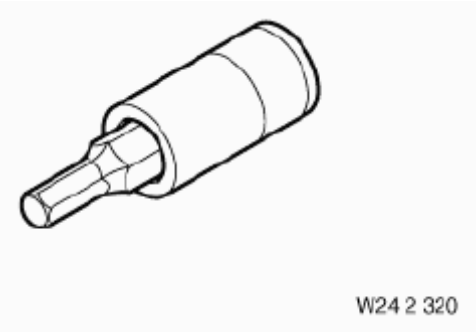


Fig. 46: Box Spanner (24 2 320)
Courtesy of BMW OF NORTH AMERICA, INC.

24 2 330 1/2" OPEN-ENDED SPANNER

In conjunction with: 24 2 320

Note: For adjusting brake band

Transmission: A4S 270R, A4S 310R

SI number: 1 24 97(257)

Order number: 24 2 330

1/2" open-ended spanner

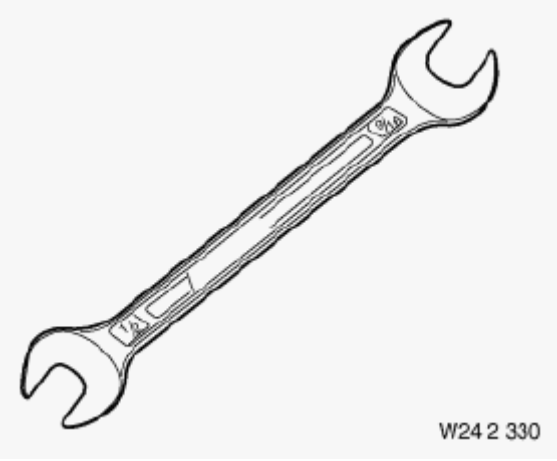


Fig. 47: 1/2" Open-Ended Spanner (24 2 330)
Courtesy of BMW OF NORTH AMERICA, INC.

24 3 040 GAUGE

Note: For adjusting restrictor piston when installing gearshift unit

Transmission: 3 HP 12, 3 HP 20, 3 HP 22

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Order number: 24 3 040

Gauge

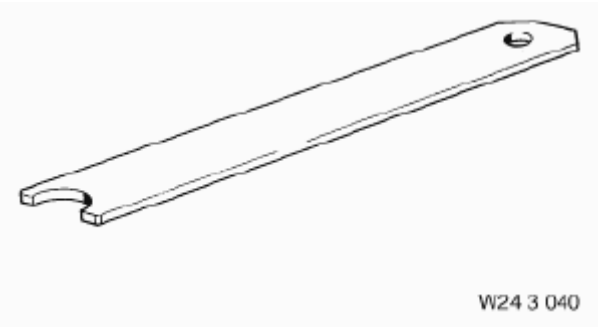


Fig. 48: Gauge (24 3 040)
Courtesy of BMW OF NORTH AMERICA, INC.

24 3 050 GAUGE

Note: For aligning hydraulic gearshift unit in transmission

Transmission: 3 HP 20, 3 HP 22, 4 HP 22, 4 HP 24

Order number: 24 3 050

Gauge

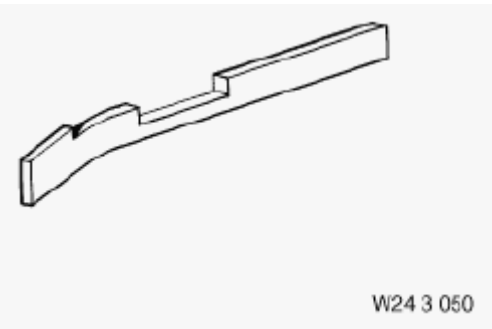


Fig. 49: Gauge (24 3 050)
Courtesy of BMW OF NORTH AMERICA, INC.

24 3 140 DRIVE BUSH

Note: For checking smooth movement of oil pump

Transmission: 3 HP 12, 3 HP 20, 3 HP 22, 4 HP 22, 4 HP 24, A5S 560Z

Storage location: A20

Order number: 24 3 140

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Drive bush

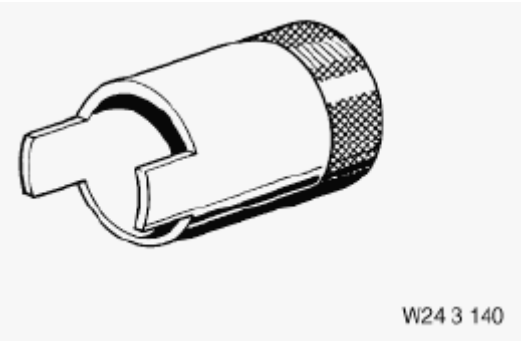


Fig. 50: Drive Bush (24 3 140)
Courtesy of BMW OF NORTH AMERICA, INC.

24 3 150 DRIVE BUSH

Note: For checking smooth movement of oil pump

Transmission: 3 HP 20, 3 HP 22

Storage location: A20

Order number: 24 3 150

Drive bush

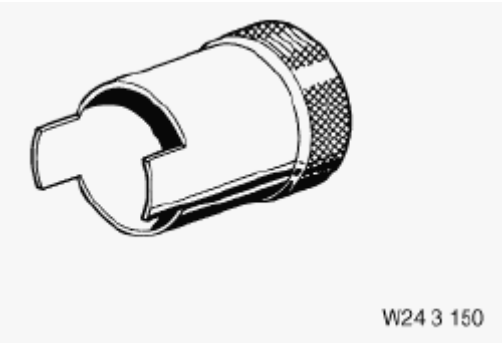


Fig. 51: Drive Bush (24 3 150)
Courtesy of BMW OF NORTH AMERICA, INC.

24 4 000 ASSEMBLY GRIP (2)

Minimum set: Mechanical tools

Note: For removing and installing torque converter

Transmission: A4S 200R, A4S 270R, A4S 310R, A5S 300J, A5S 310Z, A5S 325Z, A5S 360R, A5S 390G, A5S 390R, A5S 440Z, A5S 560Z, GA6 HP19Z, GA6 HP26Z, GA6 HP32Z

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Storage location: C18

Order number: 24 4 000

Assembly grip (2)

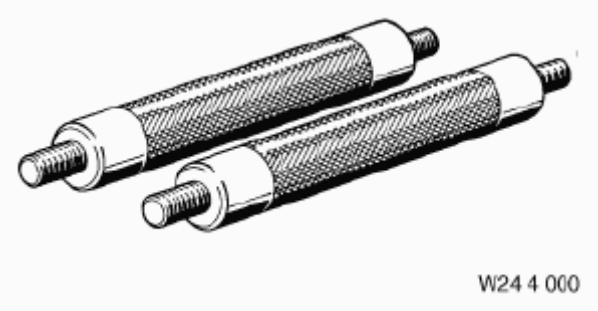


Fig. 52: Assembly Grip (24 4 000)
Courtesy of BMW OF NORTH AMERICA, INC.

24 4 070 FIXTURE

Note: For checking torque converter for leaks

Transmission: 3 HP 20, 3 HP 22, 4 HP 22

Order number: 24 4 070

Fixture

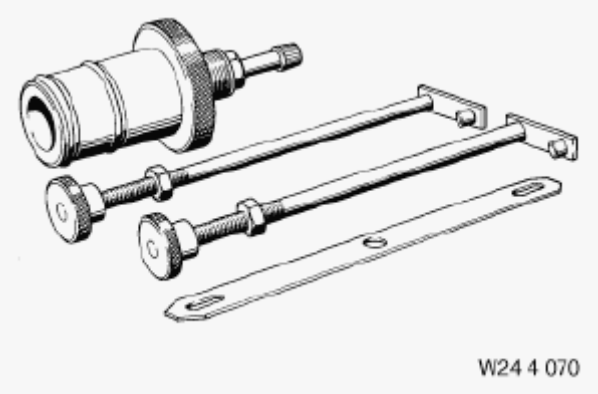


Fig. 53: Fixture (24 4 070)
Courtesy of BMW OF NORTH AMERICA, INC.

24 4 080 FIXTURE

Note: For firmly holding torque converter in position while removing and installing transmission

Transmission: 4 HP 22, 4 HP 24

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Storage location: Single

Order number: 24 4 080

Fixture

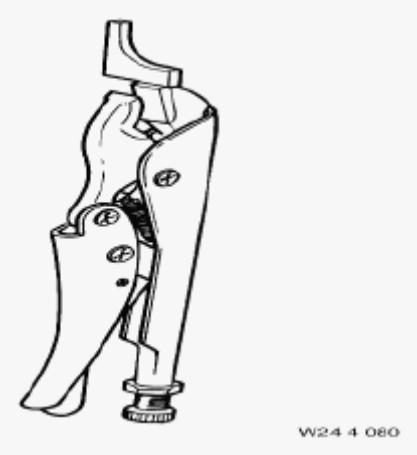


Fig. 54: Fixture (24 4 080)
Courtesy of BMW OF NORTH AMERICA, INC.

24 4 090 DRIFT

Minimum set: Mechanical tools

In conjunction with: 00 5 500

Note: For fitting rotary shaft seal on output end

Transmission: A5S 440Z, A5S 560Z

Storage location: B28

SI number: 1 06 92(509)

Order number: 24 4 090

Drift

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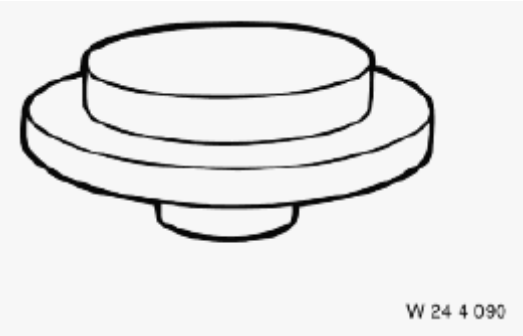


Fig. 55: Drift (24 4 090)
Courtesy of BMW OF NORTH AMERICA, INC.

24 4 100 DRIFT

Minimum set: Mechanical tools

Note: For fitting rotary shaft seal on drive side (behind converter)

Transmission: A5S 440Z, A5S 560Z

Storage location: C29

SI number: 1 06 92(509)

Order number: 24 4 100

Drift

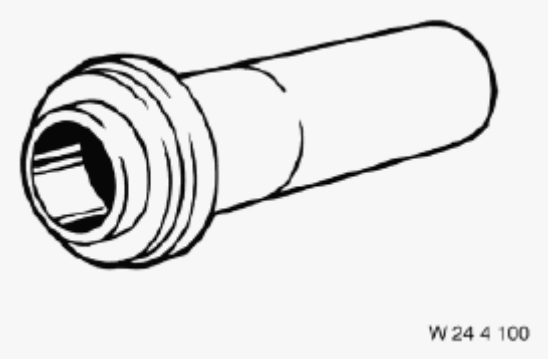


Fig. 56: Drift (24 4 100)
Courtesy of BMW OF NORTH AMERICA, INC.

24 4 110 SPANNER

Minimum set: Mechanical tools

Note: For releasing and tightening slotted nut on output flange

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Transmission: A5S 440Z, A5S 560Z

Storage location: A23

SI number: 1 06 92(509)

Order number: 24 4 110

Spanner

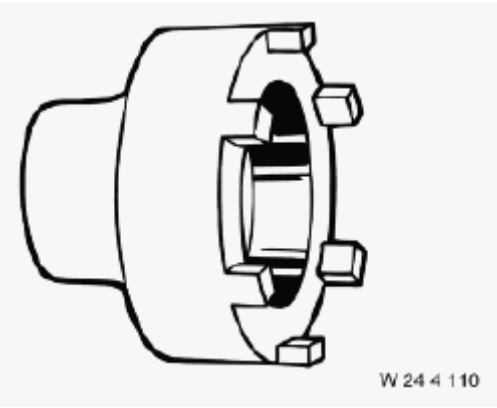


Fig. 57: Spanner (24 4 110)
Courtesy of BMW OF NORTH AMERICA, INC.

24 4 120 FIXTURE

Note: For firmly holding torque converter in position while removing and installing transmission.

Replaced by 24 4 130.

Order number: 24 4 120

Fixture

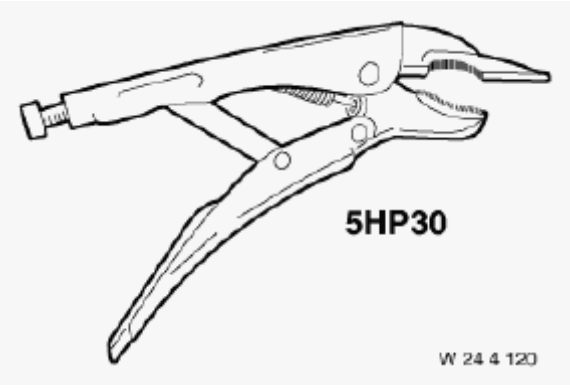


Fig. 58: Fixture (24 4 120)
Courtesy of BMW OF NORTH AMERICA, INC.

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24 4 130 LOCATING TOOL

Minimum set: Mechanical tools

Note: For firmly holding torque converter in position while removing and installing transmission

Transmission: A4S 310R, A5S 300J, A5S 310Z, A5S 325Z, A5S 360R, A5S 390G, A5S 440Z, A5S 560Z, GA6 HP26Z

Storage location: A33

SI number: 1 05 97 (181)

Order number: 24 4 130

Locating tool

Consisting of:

1 = 24 4 131 Base unit

2 = 24 4 132 Blade

Note: Transmission: A5S 440Z, GA6HP26Z (N62)

3 = 24 4 133 Blade

Note: Transmission: A4S 310R and A5S 390G

4 = 24 4 134 Blade

Note: Transmission: A5S 310Z, A5S 560Z, A5S 300J and A5S 325Z

5 = 24 4 135 Blade

Note: Transmission: A5S 560Z, GA6 HP26Z (M67), GA6 HP32Z (N73)

6 = 24 4 136 Counter plate

7 = 24 4 137 Blade

Note: Transmission: A5S 360R

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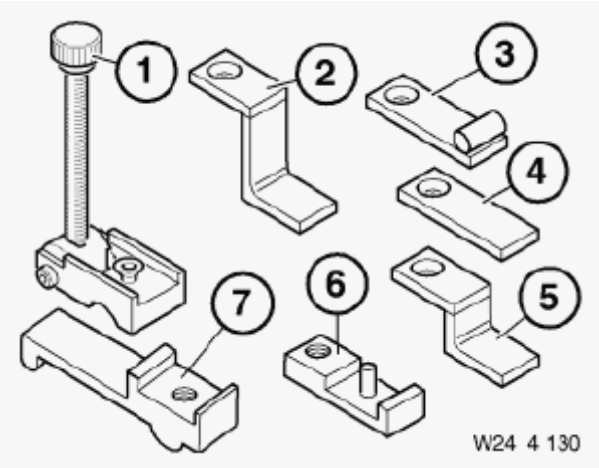


Fig. 59: Locating Tool (24 4 130)
Courtesy of BMW OF NORTH AMERICA, INC.

24 4 160 SUPPORT BRACKET

Minimum set: Mechanical tools

Note: For securing converter during removal and installation of transmission

Series: E53, E60, E61, E63, E64, E65, E66, E67, E70, E83, E85, E87, E90, E92, RR1

Transmission: GA6 HP19Z, GA6 HP26Z, GA6 HP32Z

Storage location: A47, C46

SI number: 1 11 02 (908)

Order number: 24 4 160

Support bracket

Consisting of:

1 = 24 4 161 Basic body

2 = 24 4 162 Shaped section

Note: For converter variant N73

3 = 24 4 163 Shaped section

Note: For converter variant M57TU

4 = 24 4 164 Shaped section

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Note: For converter variant M54

5 = 24 4 165 Shaped section

Note: Transmission: GA6 HP19 in E87, E90

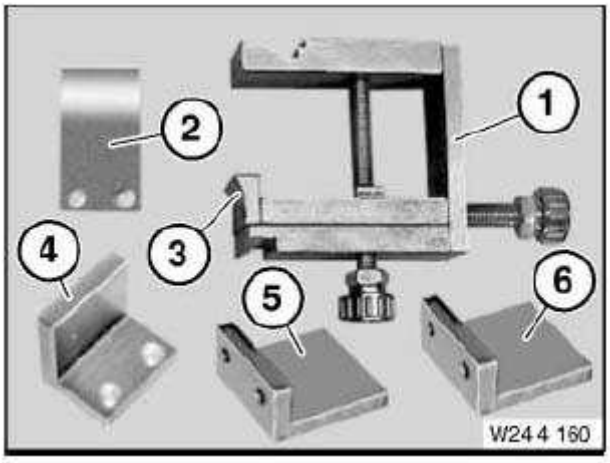


Fig. 60: Support Bracket (24 4 160)
Courtesy of BMW OF NORTH AMERICA, INC.

24 4 200 DRIFT AND SLIP BUSH

Minimum set: Mechanical tools

Note: For driving in shaft seal on drive shaft.

Transmission: GACVT16Z

Order number: 24 4 200

Drift and slip bush

Consisting of:

1 = 24 4 201 Drift

2 = 24 4 202 Slip bush

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Fig. 61: Drift And Slip Bush (24 4 200)
Courtesy of BMW OF NORTH AMERICA, INC.

24 4 210 SOCKET WAF 46

Note: For releasing and tightening down output shaft screw/bolt (bearing side).

Transmission: GACVT16Z

SI number: 1 09 05 (188)

Order number: 24 4 210

Socket WAF 46



Fig. 62: Socket WAF 46 (24 4 210)
Courtesy of BMW OF NORTH AMERICA, INC.

24 4 220 EXTRACTOR

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Note: For removing primary bearing on drive shaft.

Transmission: GACVT16Z

SI number: 1 09 05 (188)

Order number: 24 4 220

Extractor

Consisting of:

1 = 24 4 221 Basic body

2 = 24 4 222 Claws (2 x)

3 = 24 4 223 Thrust piece

4 = 24 4 224 Ring

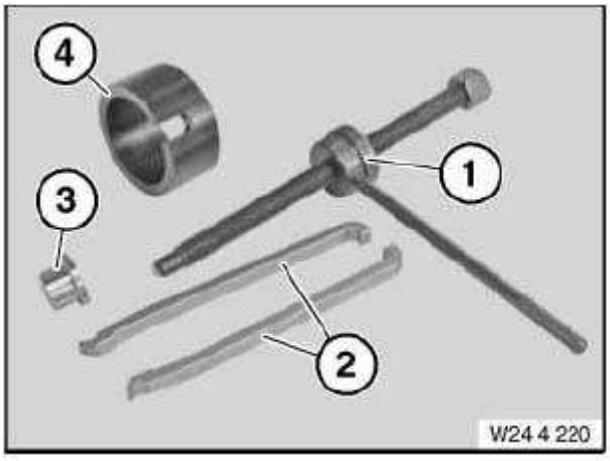


Fig. 63: Extractor (24 4 220)
Courtesy of BMW OF NORTH AMERICA, INC.

24 4 230 DRIFT

Note: For driving in primary bearing on drive shaft.

Transmission: GACVT16Z

SI number: 1 09 05 (188)

Order number: 24 4 230

Drift

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Fig. 64: Drift (24 4 230)
Courtesy of BMW OF NORTH AMERICA, INC.

24 5 120 TOOL

Note: For centering converter bell housing with respect to oil pump during assembly

Transmission: A4S 270R, A4S 310R

Storage location: B2

SI number: 1 04 95(906)

Order number: 24 5 120

Tool

Consisting of:

1 = 24 5 121 Centering bush

2 = 24 5 122 Centering pin (3)

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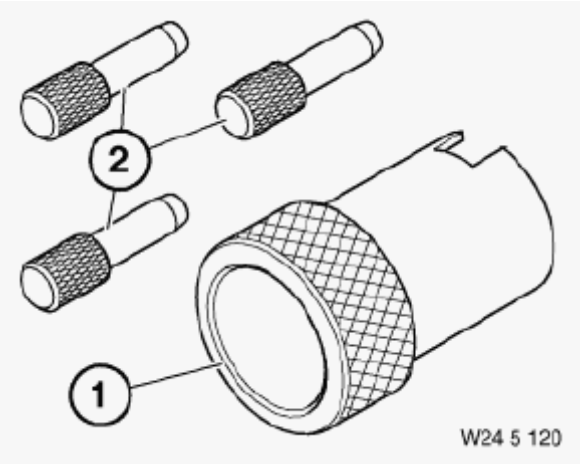


Fig. 65: Tool (24 5 120)
Courtesy of BMW OF NORTH AMERICA, INC.

24 5 140 CENTERING PIN

Note: For transfer plate and gasket to shift unit (2 x)

Transmission: A4S 310R

Order number: 24 5 140

Centering pin

24 5 150 CENTERING PIN WITH THREAD (2)

Note: For centering gearshift unit in transmission during assembly

Transmission: A4S 270R, A4S 310R

Storage location: A2

SI number: 1 03 90(184)

Order number: 24 5 150

Centering pin with thread (2)

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Fig. 66: Centering Pin With Thread (24 5 150)
Courtesy of BMW OF NORTH AMERICA, INC.

24 5 160 CENTERING PINS

Note: For centering main housing with respect to intermediate and converter housing (2)

Transmission: A4S 270R, A4S 310R

Storage location: A2, B2

SI number: 1 03 93(663)

Order number: 24 5 160

Centering pins

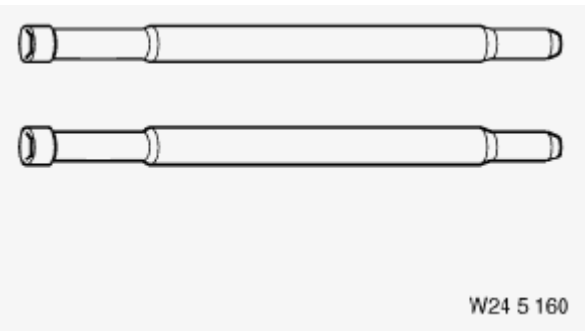


Fig. 67: Centering Pins (24 5 160)
Courtesy of BMW OF NORTH AMERICA, INC.

24 5 190 ADAPTER

In conjunction with: 13 3 061, 13 3 067, 24 0 021, 24 0 023, 24 0 140

Note: For pressure gauge 13 3 061 for checking oil pressure in transmission

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Transmission: A4S 270R, A4S 310R

Storage location: C20

SI number: 1 03 90(184)

Order number: 24 5 190

Adapter

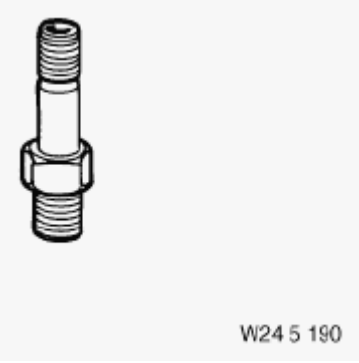


Fig. 68: Adapter (24 5 190)
Courtesy of BMW OF NORTH AMERICA, INC.

24 5 200 IMPACT BUSH

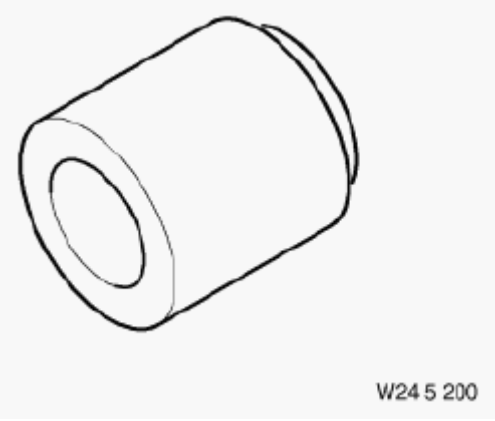
Note: For driving in radial seal of selector lever shaft / Replaced by 24 5 360

Transmission: A4S 270R, A4S 310R

SI number: 1 03 90 (184)

Order number: 24 5 200

Impact bush



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Fig. 69: Impact Bush (24 5 200)
Courtesy of BMW OF NORTH AMERICA, INC.

24 5 210 HOLDER

Note: For loosening and tightening gearshift cable

Transmission: 4 HP 22, 4 HP 24, A4S 270R, A4S 310R, A5S 310Z

Storage location: B19

SI number: 1 04 91(372)

Order number: 24 5 210

Holder

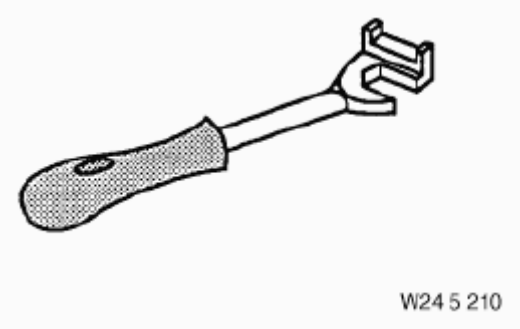


Fig. 70: Holder (24 5 210)
Courtesy of BMW OF NORTH AMERICA, INC.

24 5 220 HOLDER

Note: For loosening and tightening gearshift cable

Transmission: A5S 300J, A5S 310Z

Storage location: B19

SI number: 1 04 91(372)

Order number: 24 5 220

Holder

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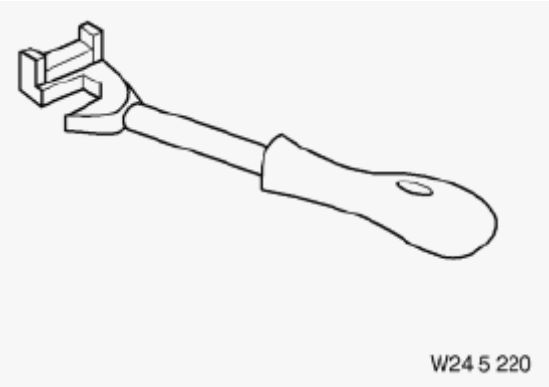


Fig. 71: Holder (24 5 220)
Courtesy of BMW OF NORTH AMERICA, INC.

24 5 230 ASSEMBLY RING

Minimum set: Mechanical tools

Note: For fitting rotary shaft seal on gearshift shaft

Transmission: 4 HP 22, 4 HP 24, A5S 310Z

Storage location: B19

SI number: 1 04 91(372)

Order number: 24 5 230

Assembly ring

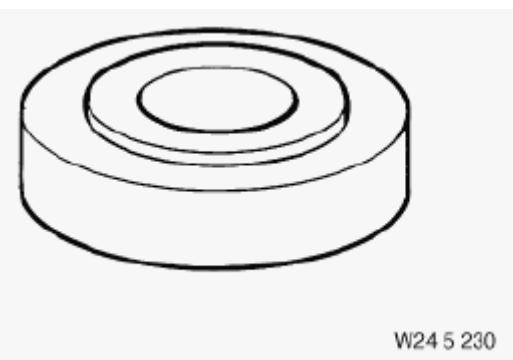


Fig. 72: Assembly Ring (24 5 230)
Courtesy of BMW OF NORTH AMERICA, INC.

24 5 240 HOLDER

Note: For releasing and tightening gearshift cable / transmission with position switch

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Transmission: A5S 310Z, A5S 560Z

Storage location: B19

SI number: 1 06 92(509)

Order number: 24 5 240

Holder

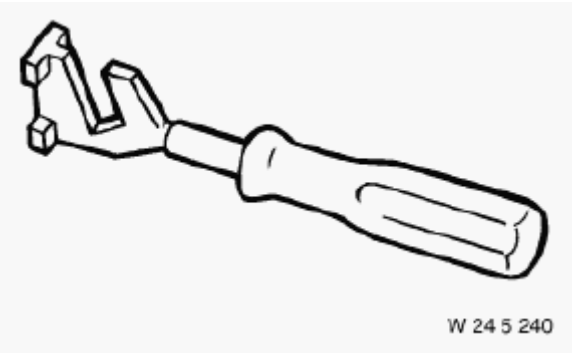


Fig. 73: Holder (24 5 240)
Courtesy of BMW OF NORTH AMERICA, INC.

24 5 250 BUSH

Minimum set: Mechanical tools

In conjunction with: 24 5 490

Note: For fitting rotary shaft seal on selector shaft

Transmission: A5S 310Z, A5S 560Z

Storage location: B19

SI number: 1 02 95(896)

Order number: 24 5 250

Bush

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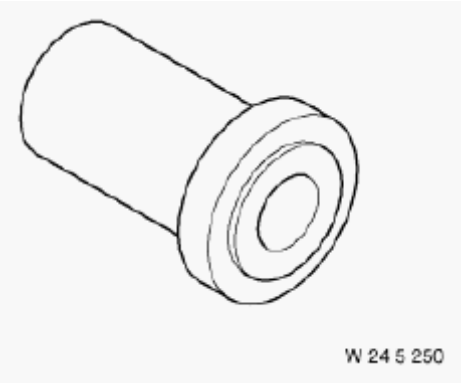


Fig. 74: Bush (24 5 250)
Courtesy of BMW OF NORTH AMERICA, INC.

24 5 260 EXTRACTOR TOOL

Minimum set: Mechanical tools

Note: For removing rotary shaft seal of selector shaft / transmission with position switch

Transmission: A5S 310Z, A5S 440Z, A5S 560Z

Storage location: B19

SI number: 1 02 95 (896)

Order number: 24 5 260

Extractor tool

Consisting of:

1 = 24 5 261 Insert

2 = 24 5 262 Bushing

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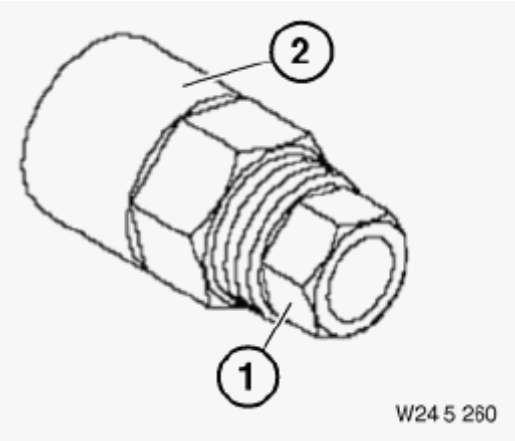


Fig. 75: Extractor Tool (24 5 260)
Courtesy of BMW OF NORTH AMERICA, INC.

24 5 270 BUSH

Minimum set: Mechanical tools

In conjunction with: 24 5 490

Note: For fitting rotary shaft seal on selector shaft

Transmission: A5S 440Z

Storage location: B18

SI number: 1 08 96(080)

Order number: 24 5 270

Bush

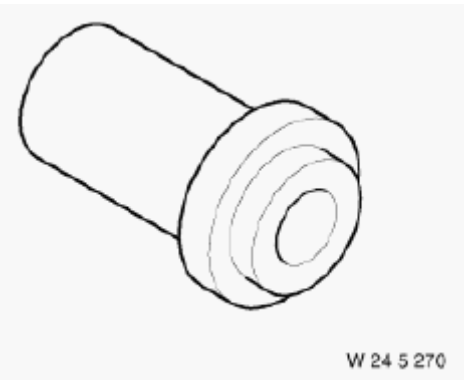


Fig. 76: Bush (24 5 270)
Courtesy of BMW OF NORTH AMERICA, INC.

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24 5 350 TAKE-UP SUPPORT FOR AUTOMATIC TRANSMISSION

Note: Miscellaneous: Japan and South Africa only

Transmission: A5S 300J

Order number: 24 5 350

Take-up support for automatic transmission

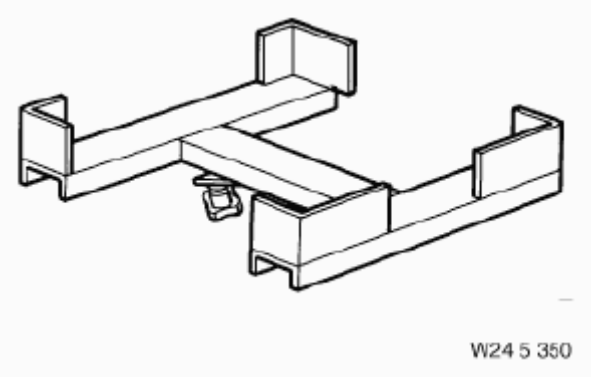


Fig. 77: Take-Up Support For Automatic Transmission (24 5 350)
Courtesy of BMW OF NORTH AMERICA, INC.

24 5 400 DRIFT

In conjunction with: 00 5 500

Note: For drive shaft seal.

Transmission: GACVT16Z

Order number: 24 5 400

Drift

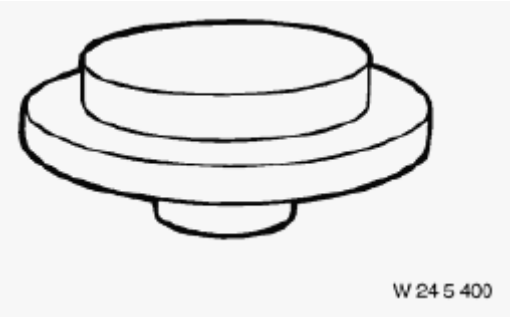


Fig. 78: Drift (24 5 400)
Courtesy of BMW OF NORTH AMERICA, INC.

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24 5 490 SLIP SLEEVE (5)

Minimum set: Mechanical tools

Note: For preventing damage to rotary shaft seal while fitting on gearshift shaft

Transmission: A5S 310Z, A5S 440Z, A5S 560Z

SI number: 1 02 95 (896)

Order number: 24 5 490

Slip sleeve (5)

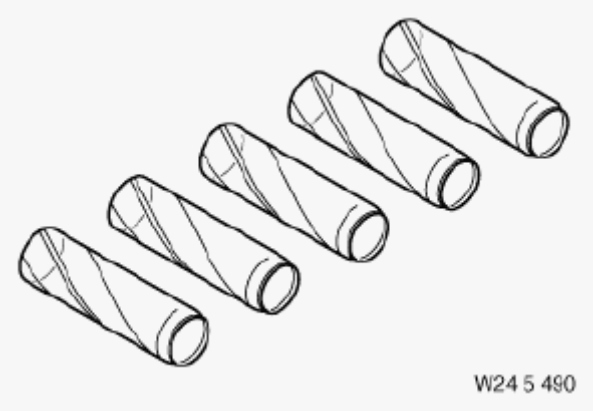


Fig. 79: Slip Sleeve (5) (24 5 490)
Courtesy of BMW OF NORTH AMERICA, INC.

24 6 000 TEST CABLE, 8-PIN

In conjunction with: Test box 88 -pin 614410

Note: For automatic transmission (EH transmission)

Transmission: 4 HP 22, 4 HP 24

Storage location: A 101

SI number: 2 03 91 (313)

Order number: 24 6 000

Test cable, 8-pin

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Fig. 80: Test Cable, 8-Pin (24 6 000)
Courtesy of BMW OF NORTH AMERICA, INC.

24 6 010 TEST CABLE, 9-PIN

In conjunction with: Test box 88 -pin 614410

Note: For automatic transmission (EH transmission)

Transmission: A4S 270R, A4S 310R

Storage location: A 102

SI number: 2 03 91 (313)

Order number: 24 6 010

Test cable, 9-pin

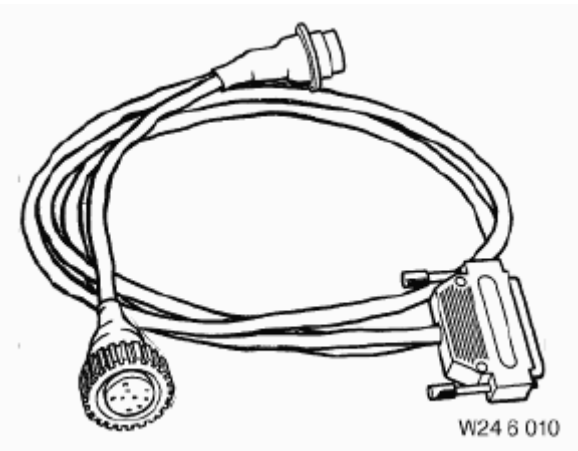


Fig. 81: Test Cable, 9-Pin (24 6 010)
Courtesy of BMW OF NORTH AMERICA, INC.

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24 6 020 TEST CABLE, 14-PIN

In conjunction with: Test box 88 -pin 614410

Note: For automatic transmission (EH transmission)

Transmission: A5S 310Z

Storage location: A 103

SI number: 0 02 99 (399)

Order number: 24 6 020

Test cable, 14-pin

Consisting of:

24 6 029 Operating instructions



Fig. 82: Test Cable, 14-Pin (24 6 020)
Courtesy of BMW OF NORTH AMERICA, INC.

24 6 060 TEST CABLE, 16-PIN

Note: For automatic transmission (EH transmission)

Transmission: A5S 310Z, A5S 560Z

Storage location: A 106

SI number: 2 02 93 (650)

Order number: 24 6 060

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Test cable, 16-pin

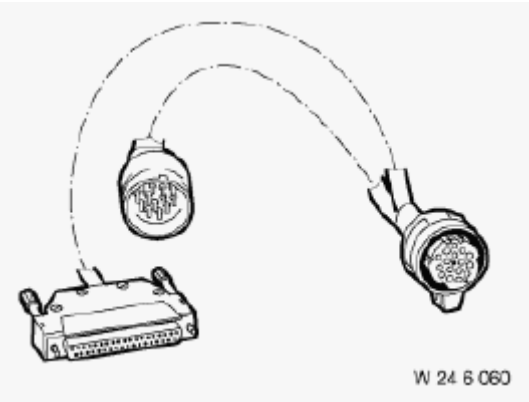


Fig. 83: Test Cable, 16-Pin (24 6 060)
Courtesy of BMW OF NORTH AMERICA, INC.

24 6 070 TEST CABLE, 20-PIN

Minimum set: Measuring and testing equipment

In conjunction with: 61 1 459

Note: For automatic transmission GM5

Transmission: A5S 360R

Storage location: A 107

SI number: 2 01 99 (468)

Order number: 24 6 070

Test cable, 20-pin

24 6 080 TEST LEAD, 16-PIN

Minimum set: Measuring and testing equipment

In conjunction with: 61 1 459

Transmission: GA6 HP26Z

Storage location: L204

SI number: 2 06 01 (763)

Order number: 24 6 080

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Test lead, 16-pin

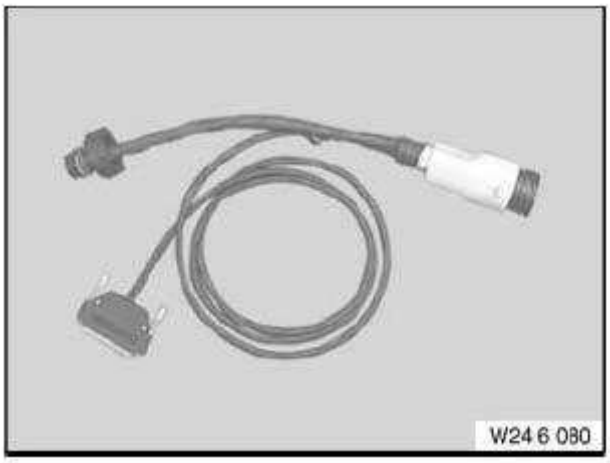


Fig. 84: Test Lead, 16-Pin (24 6 080)
Courtesy of BMW OF NORTH AMERICA, INC.

24 8 100 ADAPTER

Minimum set: Mechanical tools

Note: For filling automatic transmission

Transmission: GACVT16Z

SI number: 1 05 01 (718)

Order number: 24 8 100

Adapter

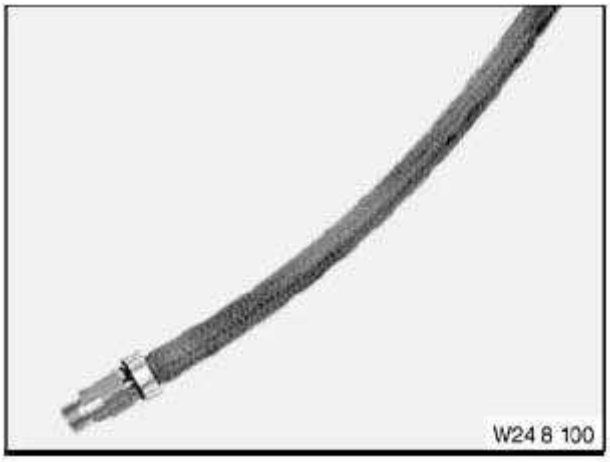


Fig. 85: Adapter (24 8 100)

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Courtesy of BMW OF NORTH AMERICA, INC.

24 8 110 DRIFT

Minimum set: Mechanical tools

In conjunction with: 00 5 500

Note: For driving shaft seal onto drive flange

Transmission: GACVT16Z

SI number: 1 02 02 (823)

Order number: 24 8 110

Drift



Fig. 86: Drift (24 8 110)
Courtesy of BMW OF NORTH AMERICA, INC.

24 8 120 RUBBER PROFILE

Minimum set: Mechanical tools

Note: For protecting shaft seal in transmission when installing output shafts.

Transmission: GACVT16Z, GS5-65BH, GS6-85BG, GS6-85DG

SI number: 1 02 02 (823)

Order number: 24 8 120

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Rubber profile

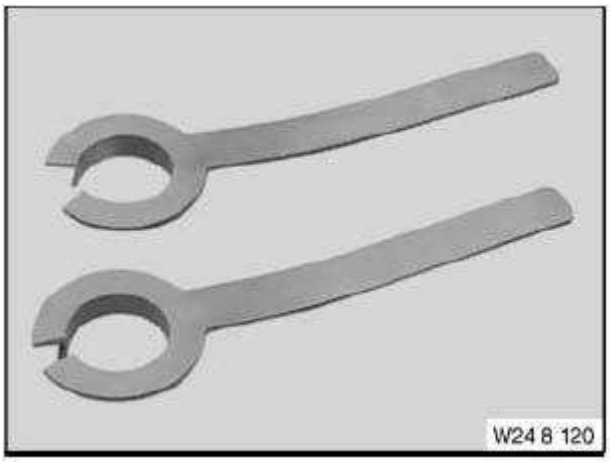


Fig. 87: Rubber Profile (24 8 120)
Courtesy of BMW OF NORTH AMERICA, INC.

24 8 130 DRIFT

In conjunction with: 00 5 550

Note: For driving in shaft seal on input shaft. Transmission: CVT automatic transmission Replaced by 24 4 200

Transmission: GACVT16Z

SI number: 1 02 02 (823)

Order number: 24 8 130

Drift



Fig. 88: Drift (24 8 130)

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Courtesy of BMW OF NORTH AMERICA, INC.

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TRANSMISSION

Automatic Transmission - Technical Data - X3

00 TRANSMISSION ASSEMBLY

24 00 TRANSMISSION IN GENERAL E83 GA5R390R

TECHNICAL DATA - TRANSMISSION GENERAL E83 GA5R390R

Manual shift		
1st gear		3.24
2nd gear		2.22
3rd gear		1.60
4th gear		1.00
5th gear		0.75
6th gear		
Reverse gear		3.03
Total oil volume (transmission and torque converter drained)	approx. ltr.	9.0

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TRANSMISSION

Automatic Transmission - Tightening Torques - X3

00 TRANSMISSION ASSEMBLY

24 00 TRANSMISSION IN GENERAL

TRANSMISSION IN GENERAL - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Transmission to engine				
Hex screws	A4S 200R / A4S 270R / A4S 310R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 360R/A5S 390R / GA6HP19Z / GA6HP26Z / GA6HP32Z	M8		24 Nm
Hex screws	A4S 200R / A4S 270R / A4S 310R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 360R/A5S 390R / GA6HP19Z / GA6HP26Z / GA6HP32Z	M10		45 Nm
Hex screws	A4S 200R / A4S 270R / A4S 310R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 360R/A5S 390R /	M12		82 Nm

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	GA6HP19Z / GA6HP26Z / GA6HP32Z			
Torx bolts	A4S 200R / A4S 270R / A4S 310R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 360R/A5S 390R	M8		21 Nm
Torx bolts	A4S 200R / A4S 270R / A4S 310R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 360R/A5S 390R	M10		42 Nm
Torx bolts	A4S 200R / A4S 70R / A4S 310R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 360R/A5S 390R	M12		72 Nm
Torx bolts	GA6HP19Z / GA6HP26Z	M6		9 Nm
Torx bolts	GA6HP19Z / GA6HP26Z	M8		22 Nm
Torx screws N62TU	GA6HP26Z	M8		19 Nm
Torx screws N62TU	GA6HP26Z	M10		38 Nm
Torx bolts	GA6HP19Z / GA6HP26Z	M12		73 Nm
Torx screws, steel N51/N52/N54/N47/N53/N43/N45K	GA6HP19Z / GA6L45R	M8		19 Nm
Torx screws, steel N51/N52/N54/N43/N47/N53/N52K	GA6HP19Z / GA6L45R	M12		66 Nm
2AZ Transmission to engine N51/N52/N54/N53/N52K Aluminium screws are marked blue	GA6HP19Z / GA6L45R		Replace screws Jointing torque and angle of rotation must be observed without fail	

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	GA6HP19Z / GA6L45R	M10x30	Jointing torque	20 Nm
			Torque angle	90-110°
	GA6HP19Z	M10x85	Jointing torque	20 Nm
			Torque angle	180-200°
	GA6HP19Z	M12	Jointing torque	34 Nm
			Torque angle	90-110°
	GA6HP19Z / GA6L45R	M12x76	Jointing torque	25 Nm
			Torque angle	130°
3AZ Reinforcement shell to transmission/extension	A4S 200R / A4S 270R / A4S 310R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 60Z / A5S 360R/A5S 390R / GA6HP19Z / GA6HP26Z / GA6HP32Z	M8		23 Nm
4AZ Cover plate for transmission	GA6HP19Z	M6		9 Nm

11 TRANSMISSION CASE, OIL SUMP

24 11 TRANSMISSION CASE, OIL SUMP

TRANSMISSION CASE, OIL SUMP - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
8AZ Oil filler pipe	3HP-22			105 Nm
	4HP-22/4HP-24/ A5S310Z			98 Nm
9AZ Plug	A4S 200R / A4S 270R / A4S 310R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 360R/A5S 390R / GA6HP19Z /	M18		43 Nm

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	GA6HP26Z / GA6HP32Z			
10AZ Oil duct screw plugs	A5S 300J			8 Nm
	A5S310Z / A5S 560Z			15 Nm
11AZ Damper cover on transmission case	A5S 300J	M6		10 Nm
12AZ Radial shaft seal to converter housing	A4S 270R / A4S 310R / A5S 360R/A4S 360R	M4		3 Nm
13AZ Intermediate plate on intermediate housing	A4S 270R / A4S 310R	5/16 inch		25 Nm

24 11 TRANSMISSION HOUSING, TRANSMISSION OIL SUMP

TRANSMISSION HOUSING, TRANSMISSION OIL SUMP - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Transmission extension	A4s 200R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 390R / GA6HP19Z / GA6HP26Z / GA6HP32Z	M8		25 Nm
	A4S 270R / A4S 310R	5/16 inch		32 Nm
	A5S 360R / A4S 360R	M8		22 Nm
2AZ Guard	A4s 200R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 390R / GA6HP19Z / GA6HP26Z / GA6HP32Z	M6		9 Nm
3AZ Converter housing	A4s 200R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 390R / GA6HP19Z / GA6HP26Z / GA6HP32Z	M8		25 Nm
	4HP-22/4HP-24	M10		46 Nm

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	A4S 270R / A4S310R	1/2"		42 Nm
4AZ Screw plug to intermediate plate	A4s 200R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 390R / GA6HP19Z / GA6HP26Z / GA6HP32Z	M10		16 Nm
	4HP-22 / 4HP-24	M14		40 Nm
	4HP-22 / 4HP-24	M20		50 Nm
	A5S 440Z	M12		23 Nm

24 11 TRANSMISSION HOUSING, TRANSMISSION OIL SUMP

TRANSMISSION HOUSING, TRANSMISSION OIL SUMP - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
5AZ Transmission oil sump	4HP-22 / 4HP-24 / A5S310Z / A5S 325Z	M6		6 Nm
	A5S 560Z / A5S 440Z	M6		10 Nm
	A4S 270R / A4S310R	M6		12 Nm
	A5S 360R / A4S 360R	M6		10 Nm
	A5S 300J			9 Nm
	GA6HP26Z / GA6HP19Z / GA6L45R / GA6HP32Z	M6		10 Nm
6AZ Oil drain plug	A4S 200R / A5S 310Z /	M10		16 Nm
	A5S 325Z			35 Nm
	A5S 440Z	M16x1.5		30 Nm
	A5S 560Z			50 Nm
	A5S 360R / A5S 390R	M14		18 Nm
	A4S 270R / A4S310R			25 Nm
	A5S 300J			35 Nm
	GA6L45R	M12x1.75		14 Nm
	GA6HP19Z / GA6HP26Z / GA6HP32Z	M10x1	Metal oil sump	12 Nm
	GA6HP19Z / GA6HP26Z / GA6HP32Z	M16x1.5 M24x1	Plastic oil sump	8 Nm
7AZ Oil filler plug	A5S 325Z			30 Nm
	A5S310Z / A5S 560Z			100 Nm
	A5S 440Z	M18x1.5		35 Nm
	A4S 270R / A4S310R			33 Nm
	A5S 360R / A4S 360R	M14		18 Nm

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	A5S 300J			40 Nm
	GA6HP26Z / GA6HP32Z	M30x1.5		80 Nm
	GA6HP19Z / GA6HP26Z / GA6HP32Z	M18x1.5		35 Nm
	GA6L45R	M18x1.5		19 Nm

13 EXTENSION HOUSING, BEARING, SEAL

24 13 TRANSMISSION EXTENSION, BEARINGS, SEALS

TRANSMISSION EXTENSION, BEARINGS, SEALS - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Slotted nut/output flange	A5S310Z / A5S 440Z / A5S 560Z / A5S 325Z			120 Nm
2AZ Double hexagon nut/output flange	GA6HP26Z / GA6HP19Z			80 Nm
3AZ Output shaft nut to output flange	GA6L45R	22x1.5		100 Nm

15 ELECTRICAL ATTACHMENTS

24 15 ELECTRICAL FITTINGS

ELECTRICAL FITTINGS - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Position switch on transmission	A4S 200R / A4S 270R / A4S 310R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 360R / A5S 390R / GA6HP19Z / GA6HP26Z / GA6HP32Z	M6		10 Nm

21 DRIVE/INTERMEDIATE OUTPUT SHAFTS

24 21 INPUT, INTERMEDIATE AND OUTPUT SHAFTS

INPUT, INTERMEDIATE AND OUTPUT SHAFTS - TIGHTENING TORQUES

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	Type	Thread	Tightening specification	Measure
1AZ Flange nut, output flange	A5S 300J			225 Nm
Flange nut, output flange without spring washer	A5S 360R			30 Nm
Flange nut, output flange, with spring washer	A5S360R / A5S 390R / A4S 200R			60 Nm
	A4S 270R / A4S310R			100 Nm

22 PLANETARY DRIVE

24 22 PLANETARY GEAR DRIVE

PLANETARY GEAR DRIVE - TIGHTENING TORQUES

	Type	thread	tightening specification	Measure
1AZ Brake coupling D/G on gear box housing	A5S 310Z / A5S 560Z	M10		
			Insert all screws until contact is made with screw head in each case	
			center bolt	30 Nm
			both outer screws	15 Nm
			center bolt	63 Nm
			both outer screws	30 Nm
			both outer screws	63 Nm

23 RELEASE CLUTCHES

24 23 SHIFT CLUTCHES

SHIFT CLUTCHES - TIGHTENING TORQUES

	Type	thread	tightening specification	Measure
1AZ Torx screws for F clutch on transmission case	4HP-22/4HP-24	M6		10 Nm
	/ A5S 560Z	M8		23 Nm
2AZ Brake band adjusting screw	A 4 S 270 R / A 4 S 310 R	5/16"		5 Nm
3AZ Lock nut of brake band adjusting screw	A 4 S 270 R / A 4S 310 R	5/16"		21 Nm

30 HYDR/EL CONTROL COMPONENTS/ELEMENTS

24 30 HYDRAULIC / ELECTRIC CONTROL PARTS AND CONTROLLING ELEMENTS

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HYDRAULIC / ELECTRIC CONTROL PARTS AND CONTROLLING ELEMENTS - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Valve body to transmission	3HP-22	M6		11 Nm
	4HP-22/4HP-24/ A5S310Z / A5S 440Z / A5S 300J / A5S 325Z / GA6HP19Z / GA6HP26Z / GA6HP32Z	M6		8 Nm
	A4S 270R / A4S310R	5/16 inch		20 Nm
	A5S360R / A4S 360R	M6		11 Nm
	A5S 560Z	M6x12		6 Nm
	A5S 560Z	M6x55		8 Nm
	GA6L45R	M5Torx		8 Nm
2AZ Valve housing to valve body	A4S 200R / A4S 270R / A4S 310R / A5S 300J / A5S 310Z / A5S 310Z / A5S 440Z / A5S 560Z / A5S 360R/A5S 390R / GA6HP19Z / GA6HP26Z / GA6HP32Z	M6		5 Nm
3AZ Adapter plate on shift unit	A4S 270R / A4S310R			13 Nm
4AZ Input and output speed sensors to mechatronics		M6		12 Nm

31 OIL PUMP

24 31 PRIMARY PUMP

PRIMARY PUMP - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Oil pump to case				
	A4S 270R / A4S310R	5/16 inch		
			1st pass	10 Nm
			2nd pass	20 Nm
	A5S 560Z	M6		10 Nm

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	A5S 560Z	M5		5 Nm
	A5S 300J / A5S 440Z / A5S 310Z / A5S325Z	M6		11 Nm
2AZ Oil strainer	A5S 440Z / A5S 560Z			5 Nm
	A5S310Z			6 Nm
	A5S 325Z	M6		6 Nm
	A4S 270R / A4S310R	5/16 inch		20 Nm
	A5S 300J			8 Nm
3AZ Oil pump body	A4S 270R / A4S310R	5/16 inch		20 Nm
	A5S310Z / A5S 560Z	M6		10 Nm
4AZ Oil cooler pipe adapter to transmission	A5S 300J / A4S 270R / A4S 310R			28 Nm
Hollow bolt	A5S 440Z	M18x1.5		25 Nm
Cap screw	A5S 440Z	M18x1.5		20 Nm

32 REGULATOR

24 32 GOVERNOR

GOVERNOR - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Governor flange to transmission	A4S 200R / A4S 270R / A4S 310R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 360R/A5S 390R / GA6HP19Z / GA6HP26Z / GA6HP32Z	M8		16 Nm
2AZ Threaded pin to centrifugal governor	A4S 200R / A4S 270R / A4S 310R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 360R/A5S 390R / GA6HP19Z /	M6		3 Nm

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	GA6HP26Z / GA6HP32Z			
3AZ Hexagon nut to threaded pin	A4S 200R / A4S 270R / A4S 310R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 360R/A5S 390R / GA6HP19Z / GA6HP26Z / GA6HP32Z			10 Nm
4AZ Hexagon head screw on centrifugal governor	A4S 200R / A4S 270R / A4S 310R / A5S 300J / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 360R/A5S 390R / GA6HP19Z / GA6HP26Z / GA6HP32Z	M6		11 Nm
5AZ Governor housing to hub	4HP-22H	M6		11 Nm

34 SHIFT VALVES PARKING

24 34 SHIFT VALVES, PARKING LOCK

SHIFT VALVES, PARKING LOCK - TIGHTENING TORQUES

	Type	thread	tightening specification	Measure
7AZ Pulse generator, output speed	A5S 325Z			6 Nm
8AZ Pulse generator, turbine speed	A5S 325Z			8 Nm
9AZ Plug	A5S 325Z			20 Nm

24 34 SHIFT TRAVEL VALVES, PARKING LOCK

SHIFT TRAVEL VALVES, PARKING LOCK - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Pressure regulator to valve housing	4HP-22EH / 4HP-24EH / A5S310Z	M6		5 Nm
	A4S 270R / A4S310R			10 Nm
2AZ Solenoid valve to valve housing	4HP-22EH / 4HP-24EH / A5S310Z	M6		5 Nm

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	A4S 270R / A4S310R			10 Nm
	A5S 560Z			6 Nm
	A5S 300J	M5		3 Nm
	A5S 300J	M6		8 Nm
3AZ Guide Plate / Parking Lock Mechanism	A5S310Z			10 Nm
	A5S 325Z			10 Nm
	A5S 560Z			23 Nm
	A5S360R / A4S 360R	M6		21 Nm
	A5S 440Z	M6		10 Nm
4AZ Pulse sender	A5S310Z / A5S 440Z	M5		5 Nm
	A5S 560Z	M5		6 Nm
		M8		23 Nm
	A5S360R / A4S 360R	M6		11 Nm
	A5S 300J	M5		6 Nm
5AZ Cover for servo piston on shift unit	A4S 270R / A4S310R	5/16 inch		25 Nm
6AZ Retaining plate for solenoid valves and pressure regulator on shift unit	A5S 440Z	M5		5 Nm
	A5S 325Z			6 Nm
7AZ Retaining plate for solenoid valves and EDS valves to hydraulic unit	GA6HP19Z / GA6HP26Z			5 Nm
8AZ Electronic module to hydraulic unit	GA6HP19Z / GA6HP26Z			8 Nm

35 WIRING HARNESS SHIFT ELEMENTS & SENSOR

24 35 WIRE HARNESS, SHIFT ELEMENTS AND SENSOR

WIRE HARNESS, SHIFT ELEMENTS AND SENSOR - TIGHTENING TORQUES

	Type	thread	tightening specification	Measure
1AZ Transmission socket to case	4HP-22EH/4 HP-24EH / A5S310Z	M26		12 Nm
	A4S 270R / A4S310R	M26		14 Nm

40 TORQUE CONVERTER

24 40 TORQUE CONVERTER

TORQUE CONVERTER - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure

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1AZ Torque converter to flywheel		M8		26 Nm
	A4S 270R / A4S 310R / A5S 310Z / A5S 300J / A5S 440Z / A5S 560Z / A5S 325Z / A4S 200R / GA6HP26Z / GA6HP19Z	M10 8.8		45 Nm
	A5S360/390R	M10		45 Nm
	A5S360/390R / GA6HP19Z / GA6HP26Z / GA6HP32Z / GA6L45R	M10 10.9		56 Nm

51 EXTERNAL GEARSHIFT

24 51 EXTERNAL SHIFT LINKAGE

EXTERNAL SHIFT LINKAGE - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Selector lever on transmission	A4S 200R / A4S 270R / A4S 310R / A5S 310Z / A5S 325Z / A5S 440Z / A5S 560Z / A5S 360R / A5S 390R / GA6HP19Z / GA6HP26Z / GA6HP32Z / GA6L45R	M8x1		10 Nm
	A5S 300J	M8		15 Nm

52 INTERNAL GEARSHIFT

24 52 INTERIOR SHIFT ELEMENTS

INTERIOR SHIFT ELEMENTS - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Shift segment to shaft	A4S 270R / A4S310R			22 Nm
	A5S 300J	M14x1.5		35 Nm
2AZ Detent spring on shift unit	A4S 270R / A4S310R	5/16"		25 Nm

71 TRANSMISSION MOUNTING

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24 71 TRANSMISSION MOUNTS

TRANSMISSION MOUNTS - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Cross member to body	E36 / E38 / E39 / E46 / E53			21 Nm
	E60 / E85 / E61 / E63 / E64 / E66 / E67 / E68 / E65 / E83 / E81 / E87 / E92 / E91 / E90 / E86	M8		19 Nm
2AZ Rubber mounts to cross member or transmission	E36 / E38 / E39 / E46 / E53			21 Nm
	E81 / E60 / E61 / E63 / E64 / E65 / E66 / E87 / E92 / E91 / E90 / E87 / E86 / E85 / E83 / E68 / E67			19 Nm
3AZ Support tube to engine subframe	E36			42 Nm
4AZ Rubber mounts to carrier pipe	E36			21 Nm
5AZ Carrier plate	E36			21 Nm
6AZ Transmission support block to transmission	E60 / E61 / E63 / E64 / E87 / E85 / E86 / E87 / E90 / E91 / E92 / E81		ASA screw	38 Nm
	E60 / E61 / E63 / E64 / E87 / E85 / E86 / E87 / E90 / E91 / E92 / E81	M10	M10 ISA pan-head screw	48 Nm
7AZ Transmission mount to transmission support bracket/transmission cross-member	E60 / E61 / E63 / E64 / E87 / E90 / E91 / E92 / E81			19 Nm

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TRANSMISSION

Clutch - Operating Fluids

1.0 GENERAL INFORMATION

Brake fluid is used as an operating fluid for hydraulic clutch operation.

2.0 SMG: SEQUENTIAL MANUAL GEAR BOX

All models SMG Hydraulic Unit require the use of Pentosin CHF 11S fluid.

3.0 OTHER OPERATING FLUIDS

CLUTCH COMPONENT GREASE

Use UNIREX S2 (replaces Klueber Microlube GL 261) for the lubrication of splines on the transmission input shaft, lubricating groove of the clutch release bearing, piston rod sleeve, clutch master cylinder and front push rod of the clutch slave cylinder.

UNIREX S2 Grease BMW Part No. 83 23 9 416 138

As of 11/93 the clutch release bearings are available as a replacement part which have plastic sliding sleeves instead of aluminum. Such updated bearings should not be lubricated at all. This applies to all models with manual transmission except for 8 Series models.

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TRANSMISSION

Clutch - Repair Instructions - X3

00 MAINTENANCE AND INSPECTION

21 00 006 BLEEDING CLUTCH HYDRAULIC SYSTEM

Special tools required:

- 21 5 030

Necessary preliminary tasks:

- Remove transmission underbody protection if necessary.
- Remove microfilter housing is necessary.

IMPORTANT: From 08.06 a plastic clutch slave cylinder is installed in the E8X, E9X.

Important notes on installation are described in this work step.

Unfasten nuts and remove clutch slave cylinder (pressure line remains connected).

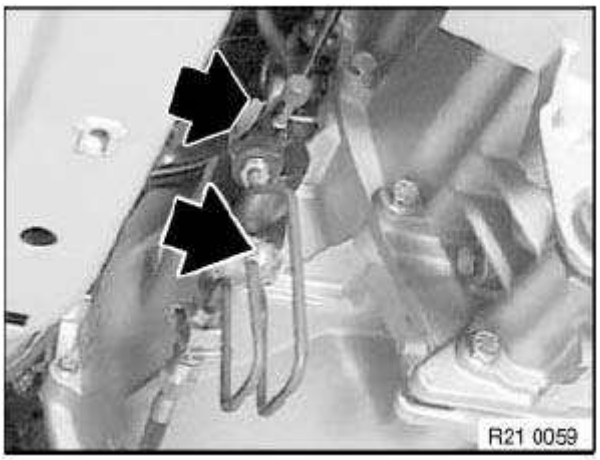


Fig. 1: Clutch Slave Cylinder Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 21 5 030 on clutch slave cylinder (1).

Press piston rod (2) with aid of spindle completely into clutch slave cylinder.

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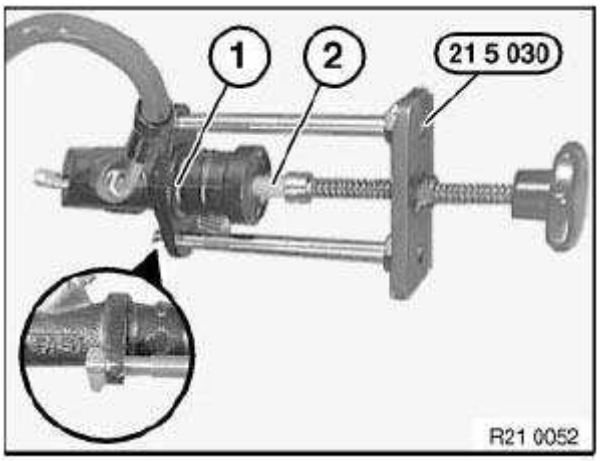


Fig. 2: Special Tool 21 5 030, Clutch Slave Cylinder And Piston Rod
Courtesy of BMW OF NORTH AMERICA, INC.

Connect bleeder unit to brake fluid expansion tank.

IMPORTANT: Check relevant Operating Instructions for each device.

Charging pressure should not exceed 2 bar.

Connect bleeder hose to bleed valve (1).

Hold clutch slave cylinder in illustrated position (refer to figure) with special tool 21 5 030 .

Open bleeder valve (1).

If bubble-free brake fluid emerges, retract piston rod (2) of clutch slave cylinder with aid of spindle a little and press in again.

If no air bubbles escape, close bleeder valve (1), otherwise repeat procedure.

IMPORTANT: Do not under any circumstances remove special tool 21 5 030 from clutch slave cylinder when brake system is pressurized.

Piston with push rod can jump out of clutch slave cylinder.

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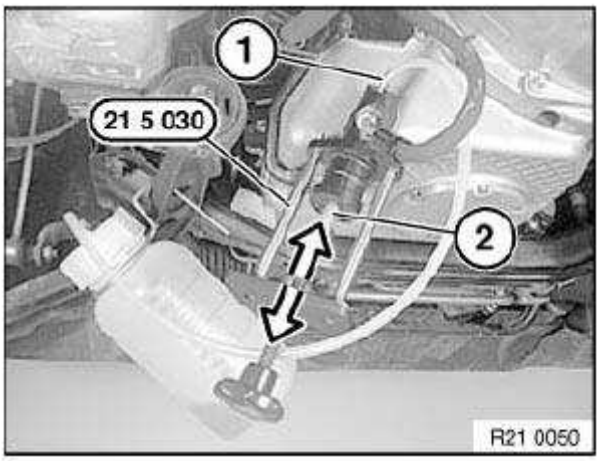


Fig. 3: Retracting Piston Rod Of Clutch Slave Cylinder
Courtesy of BMW OF NORTH AMERICA, INC.

Switch off bleeder unit or remove from brake fluid expansion tank.

Slowly retract piston rod (2) of clutch slave cylinder (1) with special tool 21 5 030 .

Remove special tool 21 5 030 from clutch slave cylinder (1).

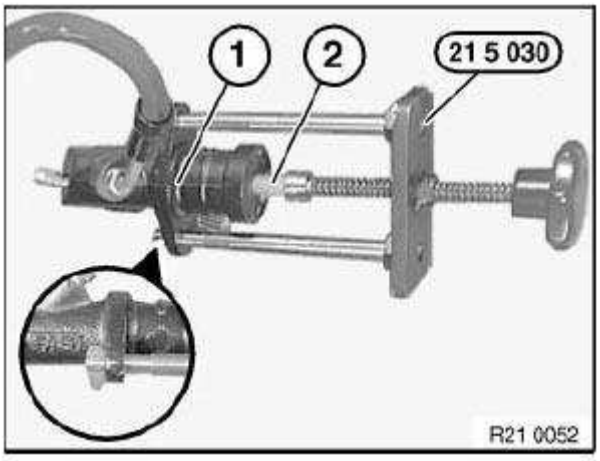


Fig. 4: Special Tool 21 5 030, Clutch Slave Cylinder And Piston Rod
Courtesy of BMW OF NORTH AMERICA, INC.

Fit clutch slave cylinder to transmission.

Installation:

Replace self-locking nuts.

Tightening torque: 5AZ, see **21 52 CLUTCH OPERATION (HYDRAULIC)** .

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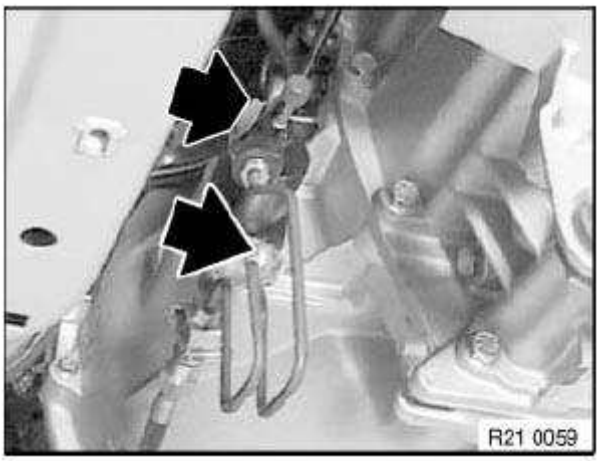


Fig. 5: Clutch Slave Cylinder Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Correct brake fluid level in expansion tank.

21 CLUTCH WITH DRIVING DISC

11 22 513 REPLACING ROLLER BEARING FOR DUAL-MASS FLYWHEEL

Special tools required:

- 21 2 051
- 21 2 052

NOTE: Flywheel removed!

Using hydraulic press (1) and special tool 21 2 051 , press out dual-mass flywheel downwards on engine side.

IMPORTANT: Risk of damage:
Roller bearing must not be driven out.

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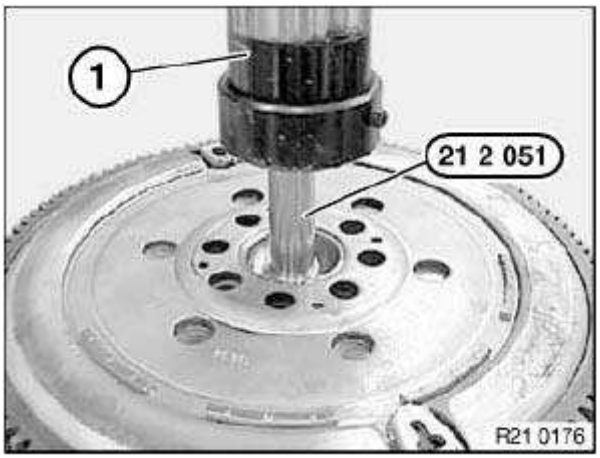


Fig. 6: Hydraulic Press And Special Tool 21 2 051
Courtesy of BMW OF NORTH AMERICA, INC.

Push roller bearing (2) onto special tool 21 2 052 .

Using hydraulic press (1), press roller bearing into dual-mass flywheel as far as it will go on clutch side.

IMPORTANT: Risk of damage:

Observe press-in instruction:

- Roller bearing must not be driven in.
- Roller bearing mounting force/travel monitored:

Min. 2000N 1 mm before end of pressing in.

Max. 15000N during entire press-in procedure.

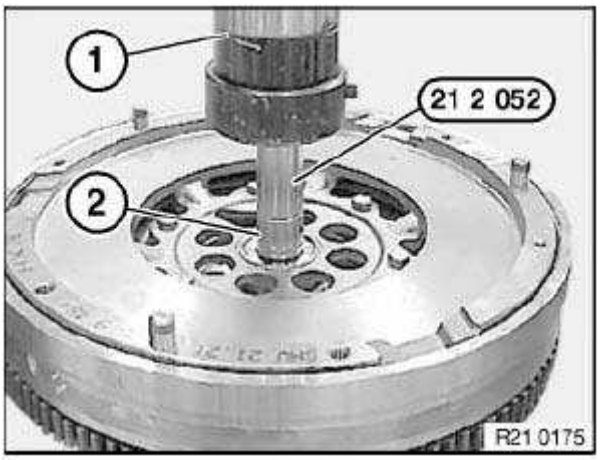


Fig. 7: Roller Bearing, Hydraulic Press And Special Tool 21 2 052

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Courtesy of BMW OF NORTH AMERICA, INC.

11 22 513 REPLACING ROLLER BEARING FOR DUAL-MASS FLYWHEEL

Special tools required:

- 00 5 500
- 11 2 010
- 11 2 343
- 11 2 350

NOTE: Flywheel removed!

Position special tool 11 2 010 in roller bearing.

Twist out roller bearing with special tool 11 2 343 .

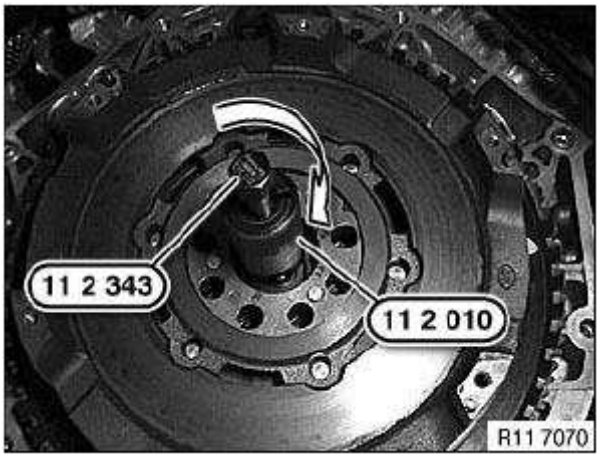


Fig. 8: Twisting Out Roller Bearing With Special Tool 11 2 343
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble special tools 11 2 350 and 00 5 500 .

Drive in roller bearing with special tools 11 2 350 and 00 5 500 in direction of arrow as far as it will go.

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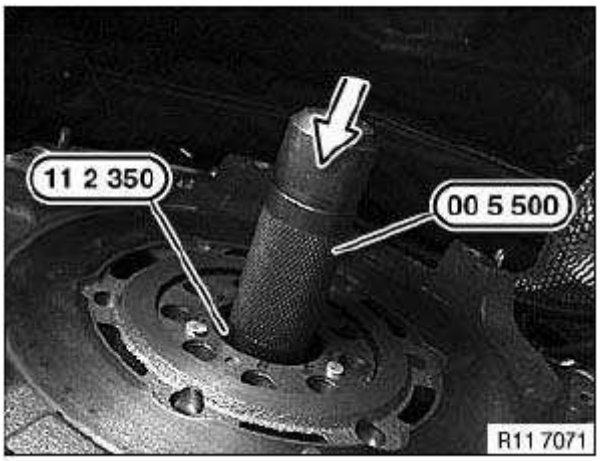


Fig. 9: Roller Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

Assemble engine.

11 22 513 REPLACING ROLLER BEARING FOR DUAL-MASS FLYWHEEL (N47)

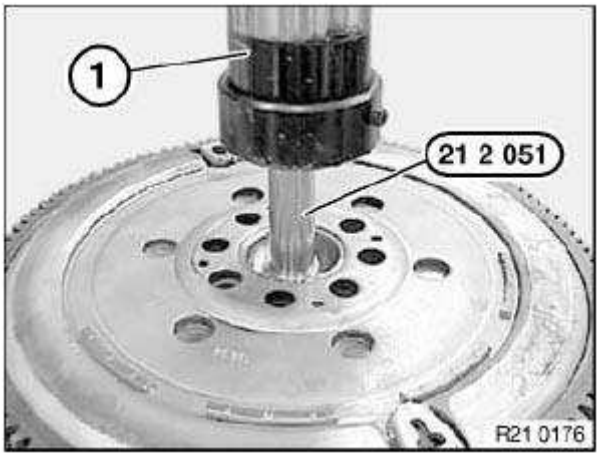
Special tools required:

- 21 2 051
- 21 2 052

NOTE: Flywheel removed!

Using hydraulic press (1) and special tool 21 2 051 , press out dual-mass flywheel downwards on engine side.

IMPORTANT: Risk of damage:
Roller bearing must not be driven out.



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Fig. 10: Hydraulic Press And Special Tool 21 2 051
Courtesy of BMW OF NORTH AMERICA, INC.

Push roller bearing (2) onto special tool 21 2 052 .

Using hydraulic press (1), press roller bearing into dual-mass flywheel as far as it will go on clutch side.

IMPORTANT: Risk of damage:
Observe press-in instruction:

- Roller bearing must not be driven in.
- Roller bearing mounting force/travel monitored:

Min. 2000N 1 mm before end of pressing in.

Max. 15000N during entire press-in procedure.

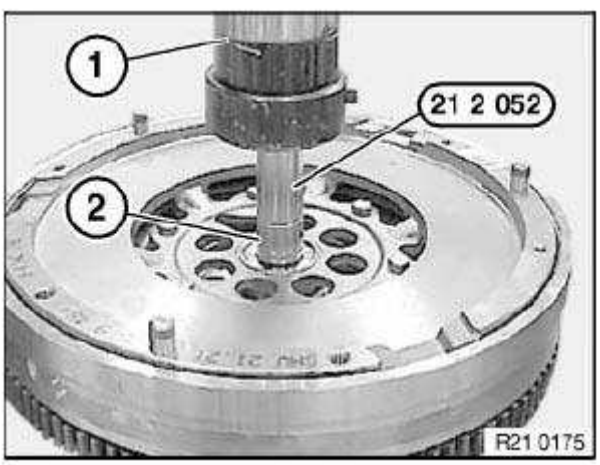


Fig. 11: Roller Bearing, Hydraulic Press And Special Tool 21 2 052
Courtesy of BMW OF NORTH AMERICA, INC.

21 21 500 REMOVING AND INSTALLING/REPLACING CLUTCH (SAC)

Special tools required:

- 11 9 260
- 11 9 263
- 11 9 264
- 11 9 265
- 21 2 141
- 21 2 170
- 21 2 180

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- 21 2 201
- 21 2 230
- 21 2 250

Necessary preliminary tasks:

Remove transmission, see **23 00 019 REMOVING AND INSTALLING TRANSMISSION (GS6-37BZ N52K)** .

Installation:

N52/N53

Screws must be replaced.

Jointing torque and angle of rotation must be observed without fail.

M54/M57/N52/N53/S54 only:

Block flywheel with special tools 11 9 260 and 11 9 265 .

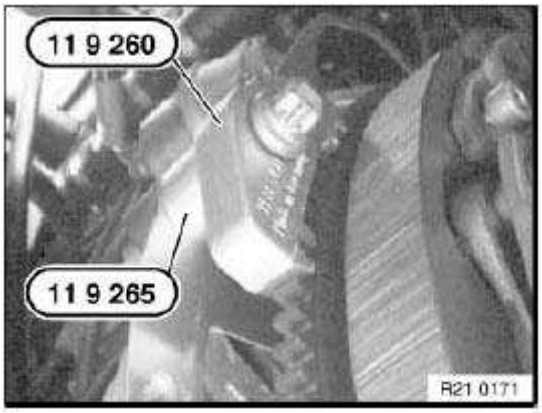


Fig. 12: Special Tools 11 9 260 And 11 9 265
Courtesy of BMW OF NORTH AMERICA, INC.

N62 only:

Block flywheel with special tools 11 9 260 , 11 9 263 and 11 9 264 .

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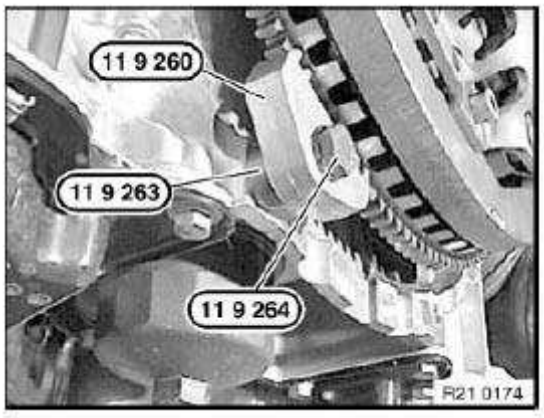


Fig. 13: Special Tools 11 9 260, 11 9 263 And 11 9 264
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws and remove clutch from flywheel.

Installation:

Clean flywheel and check for wear and damage.

Replace damaged flywheel.

IMPORTANT: Always replace clutch plates fouled e.g. by oil, cleaning agent.

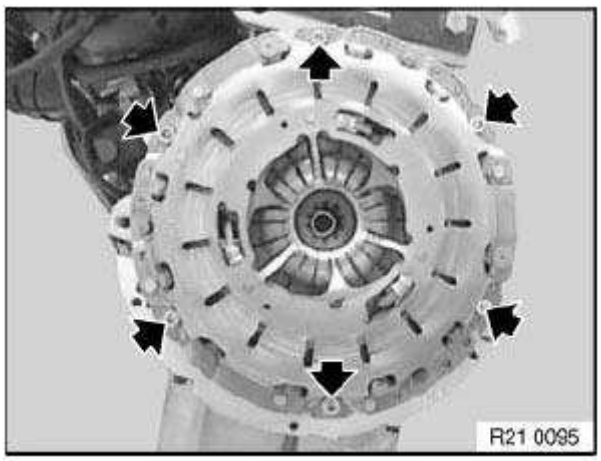


Fig. 14: Locating Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Observe the following procedure when installing the removed clutch and clutch plate.

Installation:

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Screws must be replaced.

Jointing torque and angle of rotation must be observed without fail.

Insert special tool 21 2 180 in clutch.

Press special tool 21 2 180 together at handles (1) as far as it will go and tighten down knurled screws (2).

Adjustment ring of clutch is now secured in its original position (wear position).

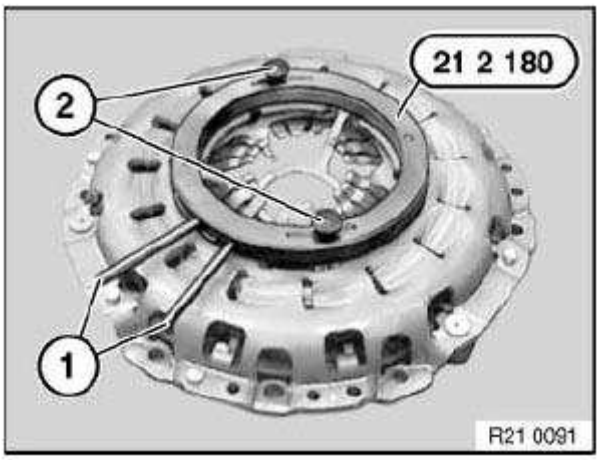


Fig. 15: Special Tool 21 2 180 And Handles
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Locking hooks (1) of special tool 21 2 180 must engage in openings of pressure spring.

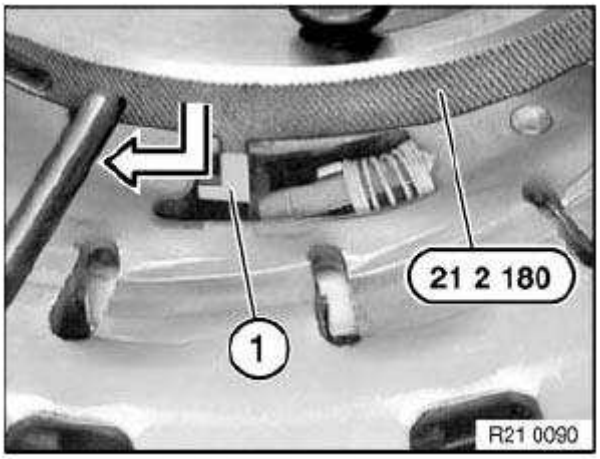


Fig. 16: Locking Hooks Of Special Tool 21 2 180
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 21 2 170 and tighten down at knurled screw (1).

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Screw in spindle (2) until diaphragm spring (3) is tensioned on stop.

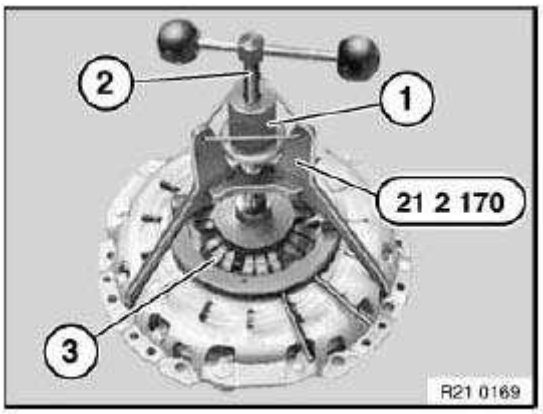


Fig. 17: Special Tool 21 2 170, Spindle And Diaphragm Spring
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Insert special tool 21 2 170 only in area of bores for dowel pins.

Centre clutch plate (1) with special tool in dual-mass flywheel.

IMPORTANT: Install clutch plate in correct position.
Note designation for "engine side" / "transmission side".
Handle clutch plate with care. Do not touch surfaces of friction linings.

Special tool Transmission

21 2 201 GS6-37BZ

21 2 230 GS6-53DZ/BZ

21 2 141 S5D 390Z

21 2 250 GS6-17BG

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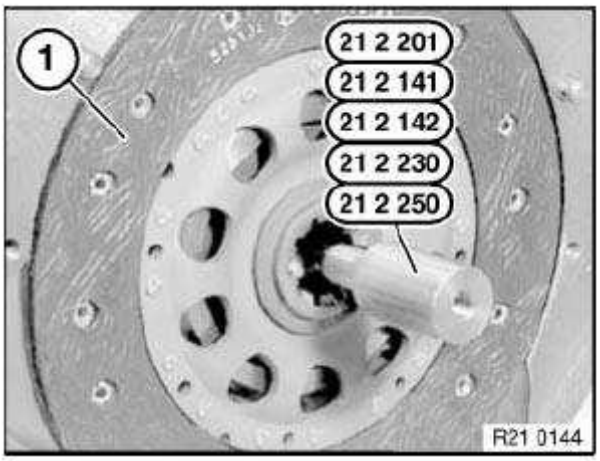


Fig. 18: Clutch Plate And Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Fit clutch (1) to flywheel.

Tightening torque: 1AZ, see **21 21 CLUTCH DISC AND DRIVE PLATE** .

NOTE: Clutch (1) must be secured by way of dowel pins (2).

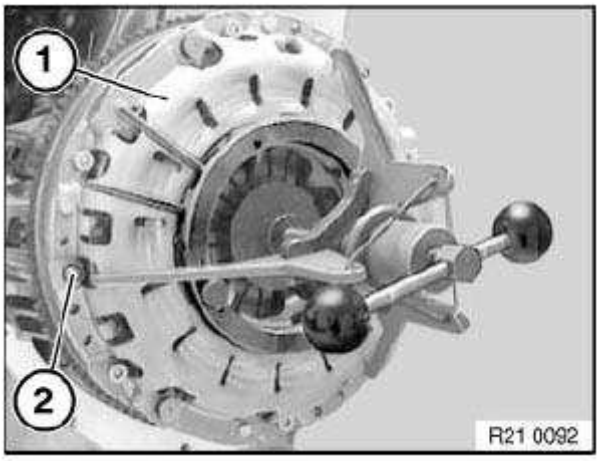


Fig. 19: Clutch And Dowel Pins
Courtesy of BMW OF NORTH AMERICA, INC.

Release spindle (1) until load is fully removed from diaphragm spring. Remove special tools 21 2 170 and 21 2 180 .

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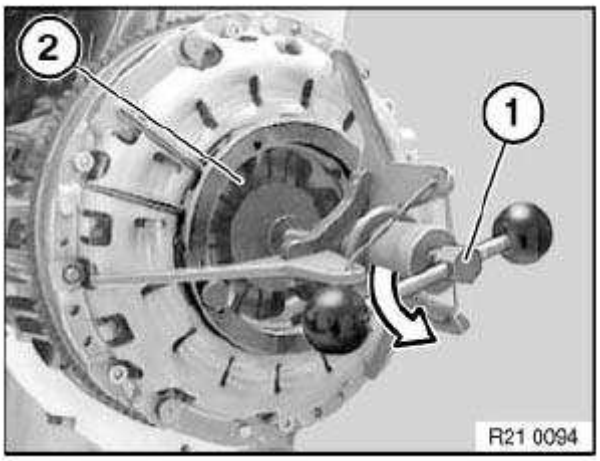


Fig. 20: Releasing Spindle
Courtesy of BMW OF NORTH AMERICA, INC.

Withdraw special tool from clutch plate with aid of accompanying screw (1).

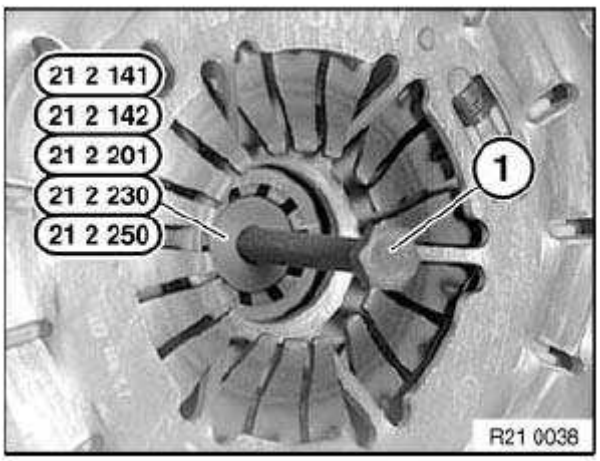


Fig. 21: Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Installing removed clutch with new clutch plate:

Installation:

N52

Screws must be replaced.

Jointing torque and angle of rotation must be observed without fail.

IMPORTANT: Before installing a used clutch with a new clutch plate, always reset adjustment ring in new position.

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Set clutch down on a clean surface.

Insert special tool 21 2 180 in clutch (1).

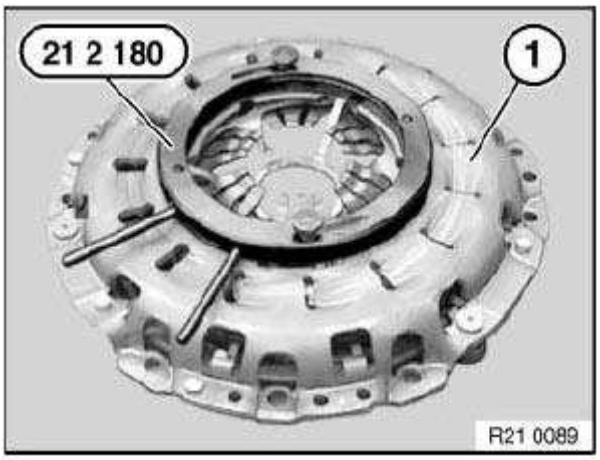


Fig. 22: Special Tool 21 2 180 And Clutch
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Locking hooks (1) of special tool 21 2 180 must engage in openings in clutch.

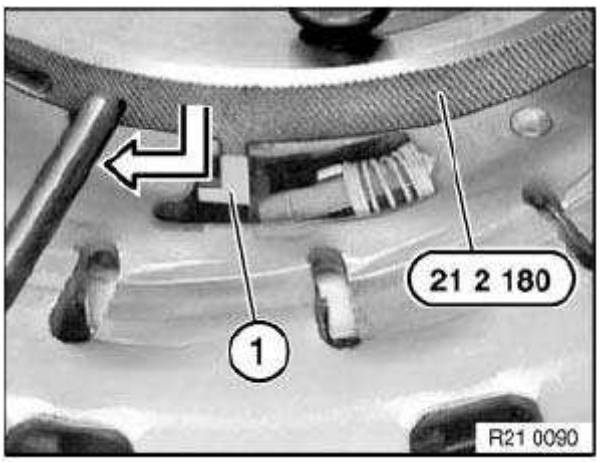


Fig. 23: Locking Hooks Of Special Tool 21 2 180
Courtesy of BMW OF NORTH AMERICA, INC.

Fit special tool 21 2 170 and tighten down at knurled screw (1).

NOTE: Insert special tool 21 2 170 only in area of bores for dowel pins.

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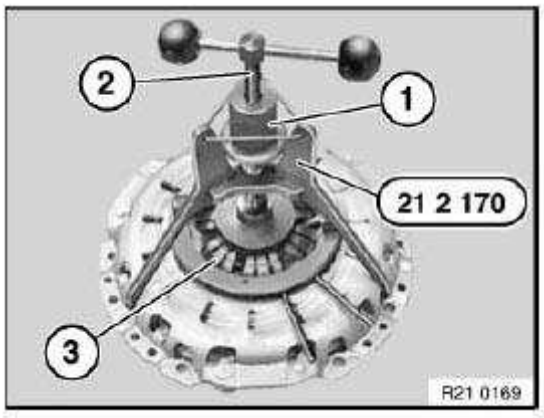


Fig. 24: Special Tool 21 2 170, Spindle And Diaphragm Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Screw in spindle (1) until adjustment ring of clutch (2) can be turned with special tool 21 2 180 at handles (3).

Press special tool 21 2 180 together at handles (3) as far as it will go and grip firmly.

At same time tighten down knurled screws (2).

Adjustment ring of clutch is now secured in new position.

Screw in spindle (1) until diaphragm spring is tensioned on stop.

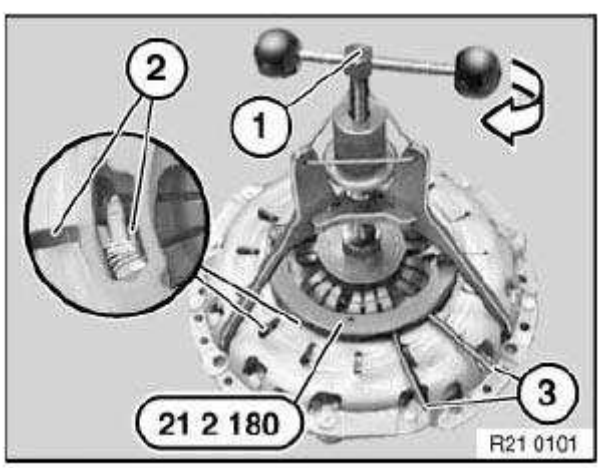


Fig. 25: Screwing In Spindle
Courtesy of BMW OF NORTH AMERICA, INC.

Centre clutch plate (1) with special tool.

IMPORTANT: Install clutch plate in correct position.
Note designation for "engine side" / "transmission side".

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Handle clutch plate with care. Do not touch surfaces of friction linings.

Special tool Transmission

21 2 201 GS6-37BZ

21 2 230 GS6-53DZ/BZ

21 2 141 S5D 390Z

21 2 250 GS6-17BG

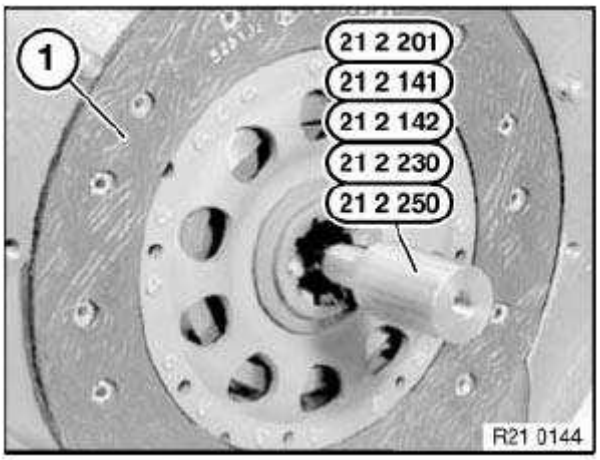


Fig. 26: Clutch Plate And Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Fit clutch (1) to flywheel.

Tightening torque: 1AZ, see **21 21 CLUTCH DISC AND DRIVE PLATE** .

IMPORTANT: Clutch (1) must be secured by way of dowel pins (2).

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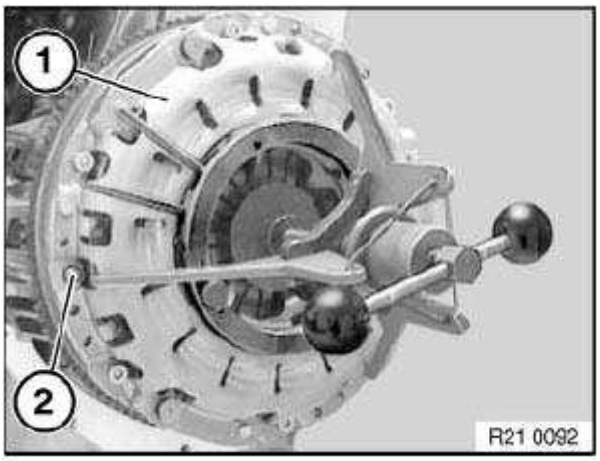


Fig. 27: Clutch And Dowel Pins
Courtesy of BMW OF NORTH AMERICA, INC.

Release spindle (1) until load is fully removed from diaphragm spring (2)

Remove special tools 21 2 170 and 21 2 180 .

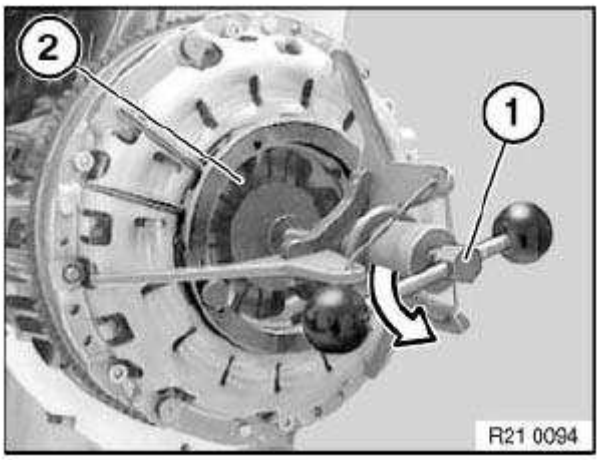


Fig. 28: Releasing Spindle
Courtesy of BMW OF NORTH AMERICA, INC.

Withdraw special tool from clutch plate with aid of accompanying screw (1).

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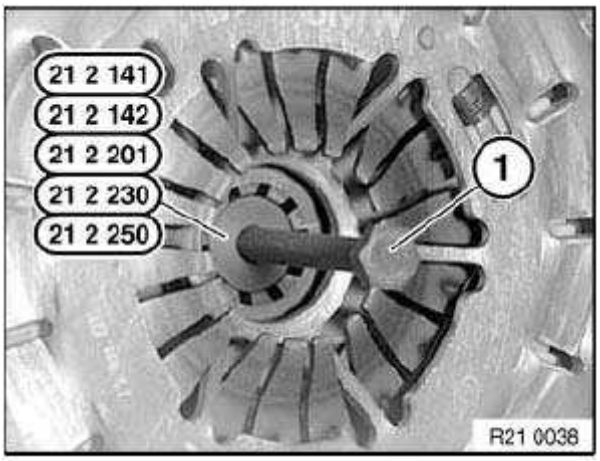


Fig. 29: Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Installing new clutch

IMPORTANT: Locking piece may only be removed clutch is screwed down!

Installation:

N52

Screws must be replaced.

Jointing torque and angle of rotation must be observed without fail.

Centre clutch plate (1) with special tool.

IMPORTANT: Install clutch plate in correct position.
Note designation for "engine side" / "transmission side".
Handle clutch plate with care. Do not touch surfaces of friction linings.

Special tool Transmission

21 2 201 GS6-37BZ; GS 6-17BG

21 2 230 GS6-53DZ/BZ

21 2 141 S5D 390Z

21 2 250 GS6-17BG

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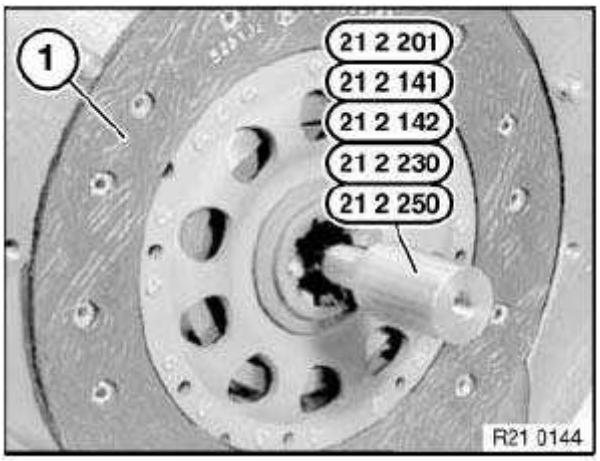


Fig. 30: Clutch Plate And Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Fit clutch to flywheel.

Tightening torque: 1AZ, see **21 21 CLUTCH DISC AND DRIVE PLATE** .

IMPORTANT: Clutch must be secured by way of dowel pins (1).

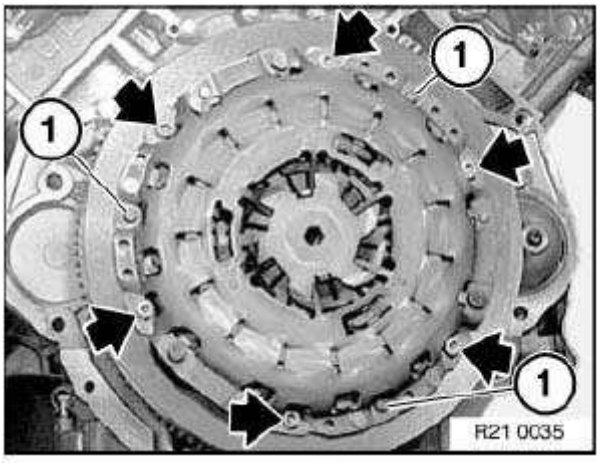


Fig. 31: Dowel Pins
Courtesy of BMW OF NORTH AMERICA, INC.

Carefully unscrew locking piece (1) clockwise or counterclockwise with a 14 mm WAF hexagon socket wrench (2).

NOTE: A slight snapping of the plate spring while unscrewing the lock is possible.

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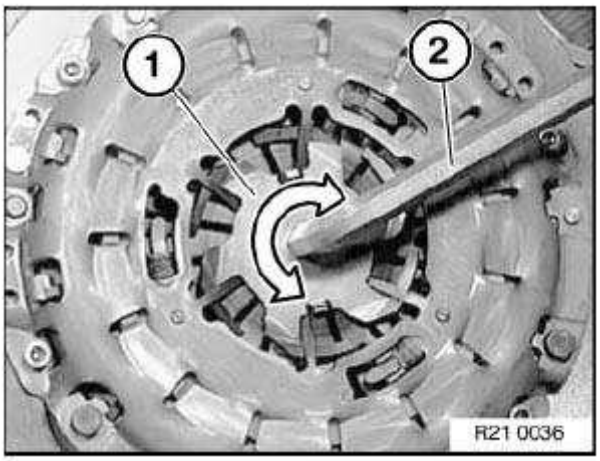


Fig. 32: Unscrewing Locking Piece Clockwise Or Counterclockwise
Courtesy of BMW OF NORTH AMERICA, INC.

Withdraw special tool from clutch plate with aid of accompanying screw (1).

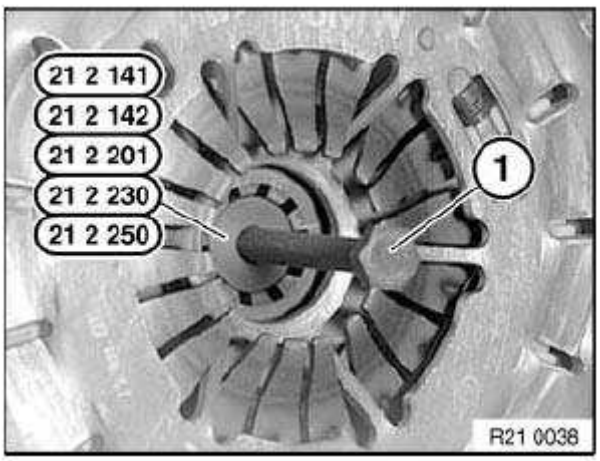


Fig. 33: Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

51 CLUTCH RELEASE CONTROL WITH LEVER

21 51 500 REMOVING AND INSTALLING OR REPLACING CLUTCH RELEASE BEARING/LEVER

NOTE: (transmission removed)

Detach release bearing (1).

Installation:

Clean all sliding surfaces on clutch release bearing, check for damage and replace if necessary.

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Do **not** grease clutch release bearing.

Sliding surfaces (2) of clutch release bearing must rest on sliding surfaces (3) of release lever.

Apply a thin coating of grease to sliding surfaces (2) of release bearing.

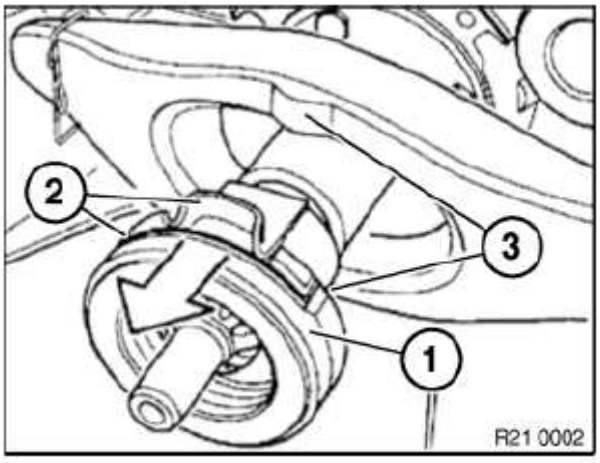


Fig. 34: Detaching Release Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

CAUTION: New clutch release bearing fitted!

See following graphic.

IMPORTANT: On E60/E61/E63/E64/M5 and M6 - apply a light coating of grease to bearing guide.

New clutch release bearing:

Clutch release bearing with moving thrust plate (1).

Swivel motion of thrust plate (1) possible.

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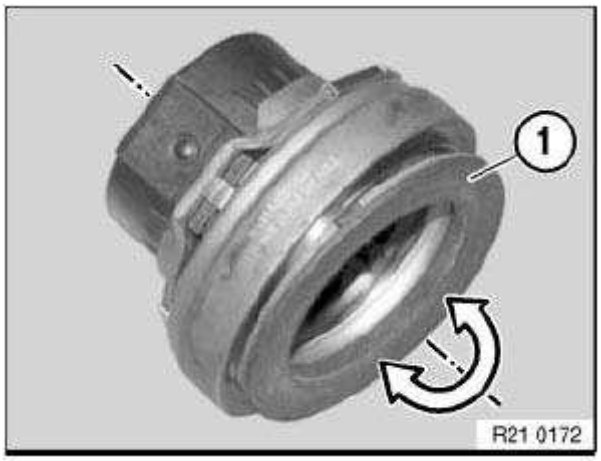


Fig. 35: Swivel Motion Of Thrust Plate
Courtesy of BMW OF NORTH AMERICA, INC.

Previous clutch release bearing:

Clutch release bearing with rigidly positioned thrust plate (1).

Swivel motion of thrust plate (1) not possible.

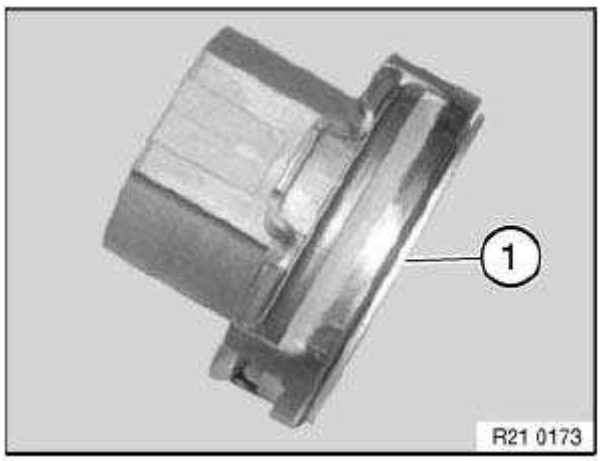


Fig. 36: Thrust Plate
Courtesy of BMW OF NORTH AMERICA, INC.

Withdraw release lever (4) from spring wire clip (5) and remove.

Installation:

Clean release lever.

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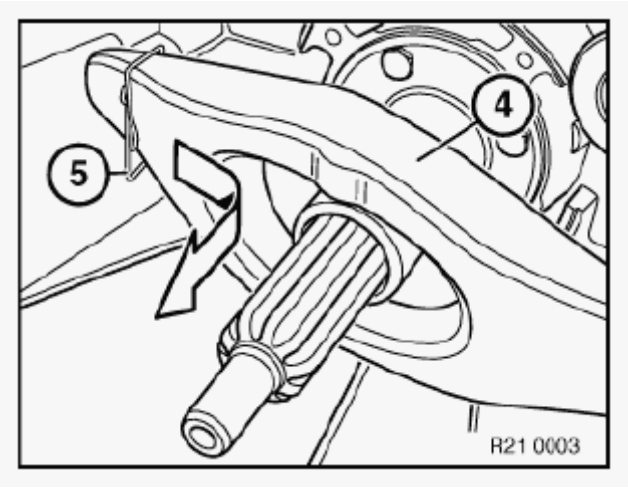


Fig. 37: Release Lever From Spring Wire Clip
Courtesy of BMW OF NORTH AMERICA, INC.

Apply a thin coating of grease to release lever at sliding surfaces (1 and 2) only.

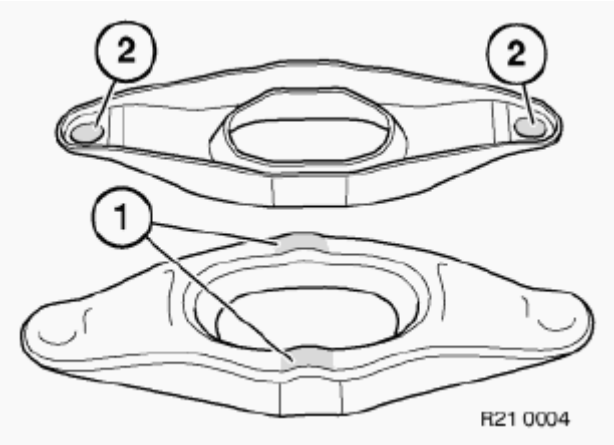


Fig. 38: Sliding Surfaces Of Release Lever
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check spring wire clip (5) and ball pin (6) for damage and replace if necessary.

Apply a thin coating of grease to ball pin (6).

NOTE: The spring wire clip and ball pin must always be replaced on the S6S 420G transmission.

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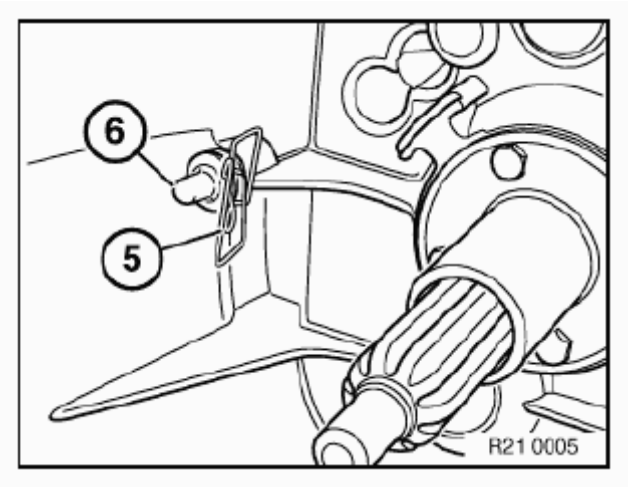


Fig. 39: Spring Wire Clip And Ball Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Note on installation: (except for E60/E61/E63/E64/M5 and M6)

Do **not** grease guide sleeve.

If guide sleeve is greased, the release lever can stick on the guide sleeve.

Clean guide sleeve (7).

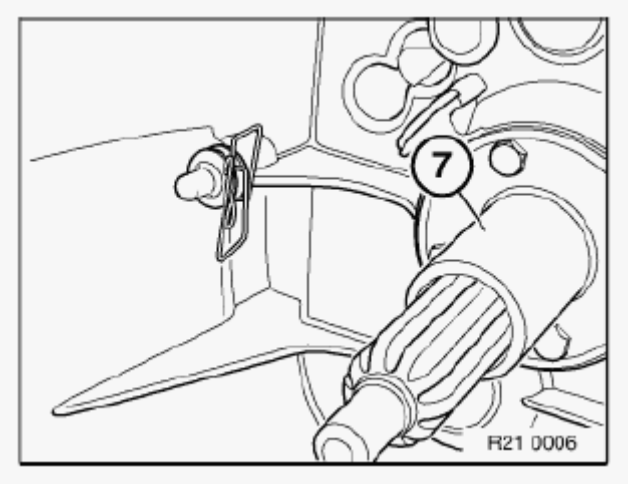


Fig. 40: Guide Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

52 CLUTCH OPERATION (HYDRAULIC)

21 52 500 REMOVING AND INSTALLING/REPLACING CLUTCH MASTER CYLINDER

NOTE: After completing work, bleed clutch hydraulic system .

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Necessary preliminary tasks:

- Remove trim panel for pedal assembly, see **21 00 006 Bleeding clutch hydraulic system**.

Draw off brake fluid up to supply hose of clutch hydraulic system (1). For this purpose, use only a vacuum pipe that is exclusively used for removing brake fluid.

Detach supply hose (1) from expansion tank.

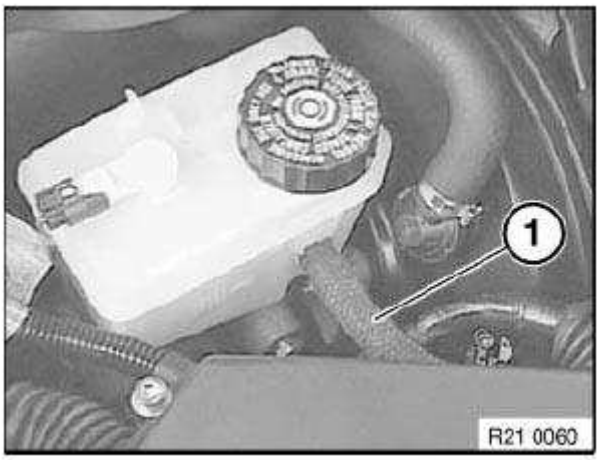


Fig. 41: Supply Hose Of Clutch Hydraulic System
Courtesy of BMW OF NORTH AMERICA, INC.

Press pin (1) out of clutch pedal with a short screwdriver.

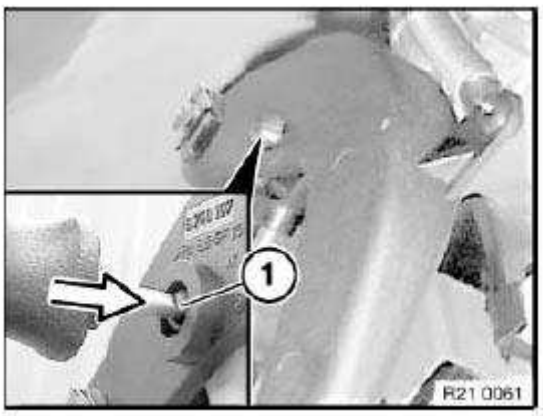


Fig. 42: Pressing Pin Out Of Clutch Pedal
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

The pin is coded by a straight surface (1).

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The coding points upwards.

Screw pin with coding upwards. Turn slightly until coding snaps into place. Press in pin until engaged (2).

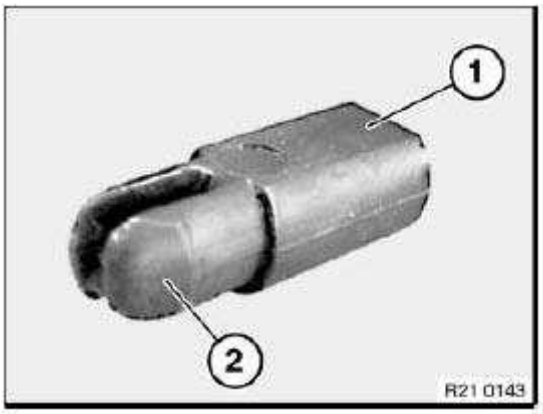


Fig. 43: Straight Surface Of Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws.

Tightening torque: 2AZ, see **21 52 CLUTCH OPERATION (HYDRAULIC)** .

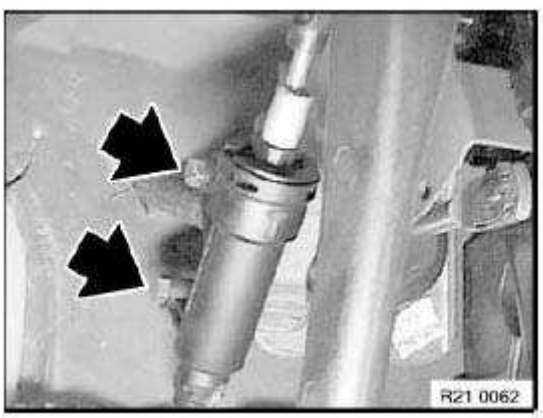


Fig. 44: Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Detach retainer (1) with a screwdriver (2).

NOTE: Do not foul carpet with brake fluid.

Detach hydraulic line from clutch master cylinder.

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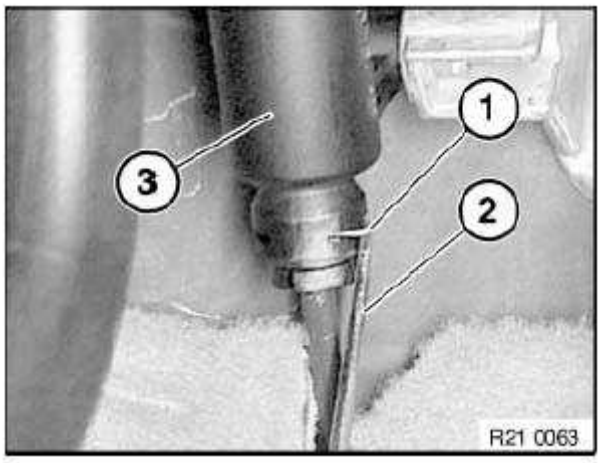


Fig. 45: Retainer
Courtesy of BMW OF NORTH AMERICA, INC.

Detach supply hose (1) from clutch master cylinder and remove clutch master cylinder.

IMPORTANT: Do not pull supply hose completely into interior.

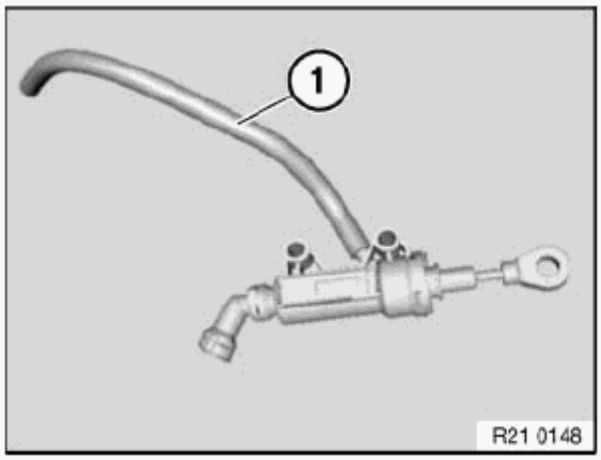


Fig. 46: Supply Hose
Courtesy of BMW OF NORTH AMERICA, INC.

Lever out shift element (1) from clutch master cylinder (2) with screwdriver.

Release plug connection (3) and disconnect plug (4) from shift element (1).

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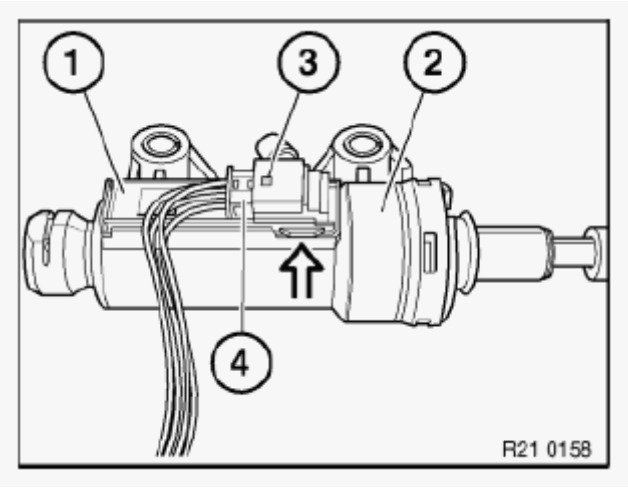


Fig. 47: Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Shift element is secured against incorrect installation.

Shift element must snap audibly into place.

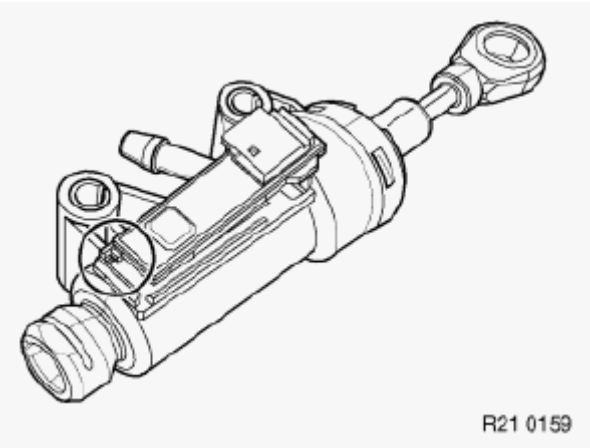


Fig. 48: Shift Element
Courtesy of BMW OF NORTH AMERICA, INC.

21 52 510 REMOVING AND INSTALLING OR REPLACING CLUTCH SLAVE CYLINDER

Special tools required:

- 13 3 010

NOTE: **After completing work bleed clutch hydraulic system, see 21 00 006 Bleeding clutch hydraulic system.**

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IMPORTANT: From 08.06 a plastic clutch slave cylinder is installed in the E8X, E9X. Important notes on installation are described in this work step.

Seal supply hose to clutch master cylinder with special tool 13 3 010 .

NOTE: Illustration shows E46.

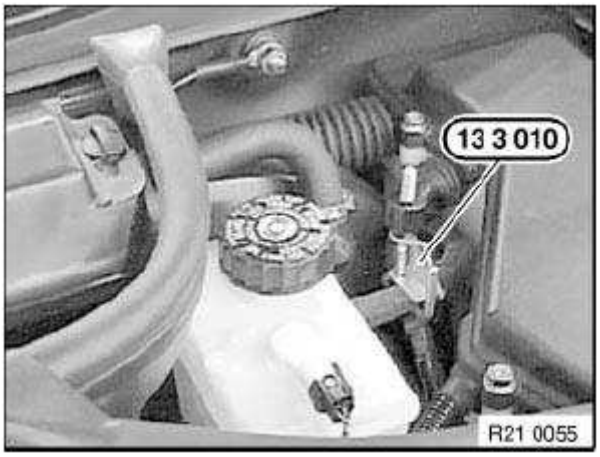


Fig. 49: Special Tool 13 3 010
Courtesy of BMW OF NORTH AMERICA, INC.

Remove transmission underbody protection if necessary.

Release union screw (1) on hydraulic line.

Release nut (2) and remove hydraulic line (3) with bracket.

Installation:

Tightening torque: 1AZ, see **21 52 CLUTCH OPERATION (HYDRAULIC)** .

NOTE: Illustration similar.

Version with throttle valve, tightening torque: 12AZ, see **21 52 CLUTCH OPERATION (HYDRAULIC)** .

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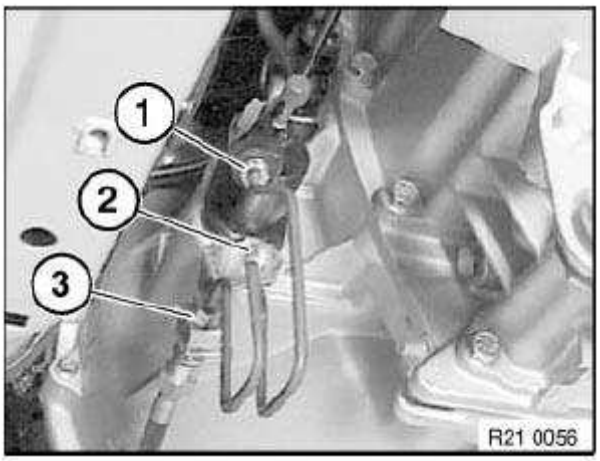


Fig. 50: Hydraulic Line
Courtesy of BMW OF NORTH AMERICA, INC.

Release nut and remove clutch slave cylinder.

Installation:

Tightening torque: 5AZ, see **21 52 CLUTCH OPERATION (HYDRAULIC)** .

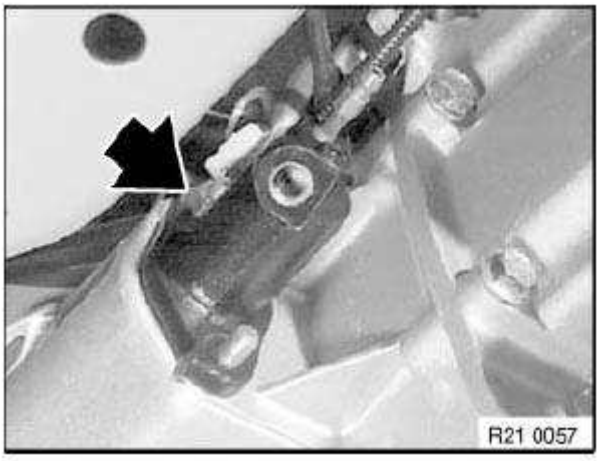


Fig. 51: Locating Clutch Slave Cylinder Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean thrust member (1) and contact face on release lever (2).

Lightly grease thrust member (1) on contact face (3).

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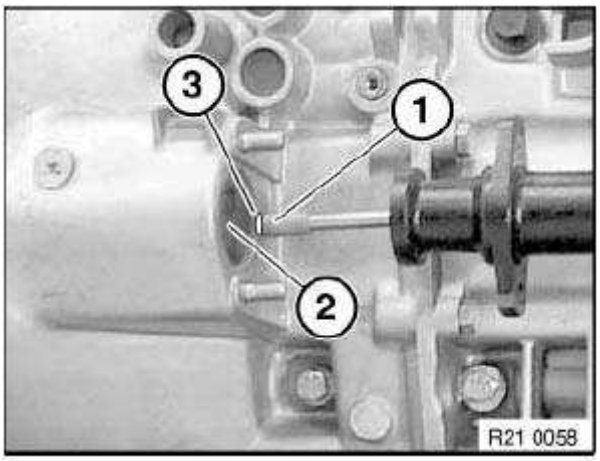


Fig. 52: Thrust Member And Release Lever
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Spacer between fuel line and pressure hose of clutch slave cylinder must be correctly fitted.

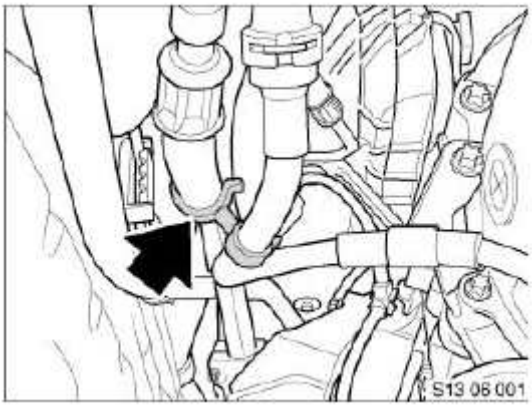


Fig. 53: Spacer Between Fuel Line And Pressure Hose Of Clutch Slave Cylinder
Courtesy of BMW OF NORTH AMERICA, INC.

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TRANSMISSION

Clutch - Special Tools - X3

21 CLUTCH

21 2 070 GAUGE

Note: For checking lining thickness on clutch drive plate. Replaced in 8/95 by 21 2 080.

Transmission: S5D 200G, S5D 250G, S5D 260Z, S5D 310Z, S6S 420G, S6S 560G

Order number: 21 2 070

Gauge

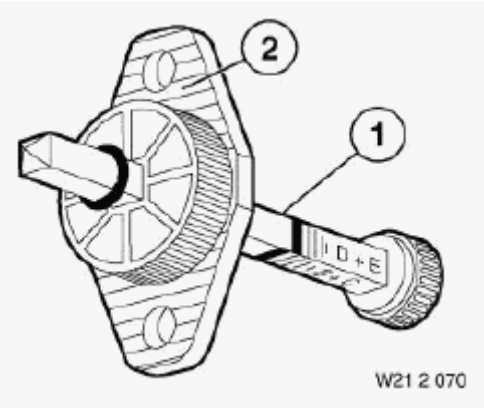


Fig. 1: Gauge (21 2 070)
Courtesy of BMW OF NORTH AMERICA, INC.

21 2 100 DRIFT

Note: For centering clutch disc while installing clutch

Transmission: 240/5, 260/5, 265/5, 265/5 Sport, 280/5 Sport

Storage location: C22

Order number: 21 2 100

Drift

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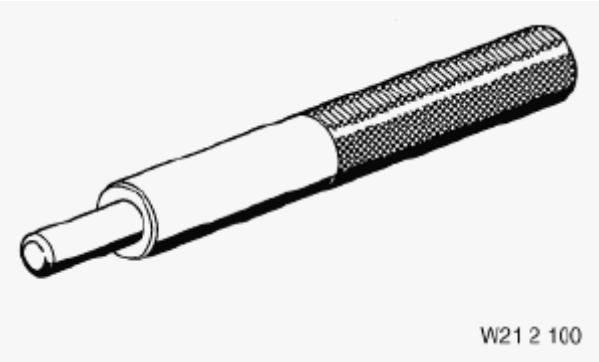


Fig. 2: Drift (21 2 100)
Courtesy of BMW OF NORTH AMERICA, INC.

21 2 120 DRIFT

Minimum set: Mechanical tools

Note: For centering clutch disc while installing clutch

Transmission: S6S 420G, S6S 560G

Storage location: C22

SI number: 1 05 90(207)

Order number: 21 2 120

Drift

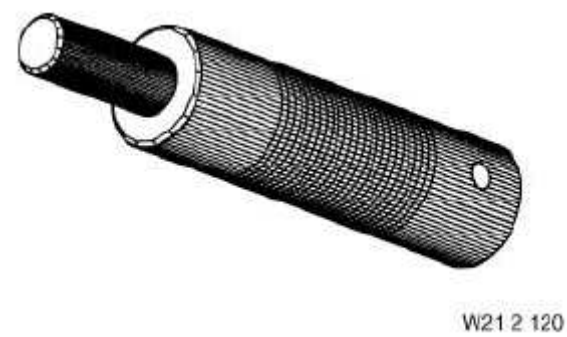


Fig. 3: Drift (21 2 120)
Courtesy of BMW OF NORTH AMERICA, INC.

21 2 130 DRIFT

Minimum set: Mechanical tools

Note: For centering clutch disc while installing clutch

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Transmission: S5D 200G, S5D 250G, S5D 260Z, S5D 310Z

Storage location: C22

SI number: 1 01 91(312)

Order number: 21 2 130

Drift

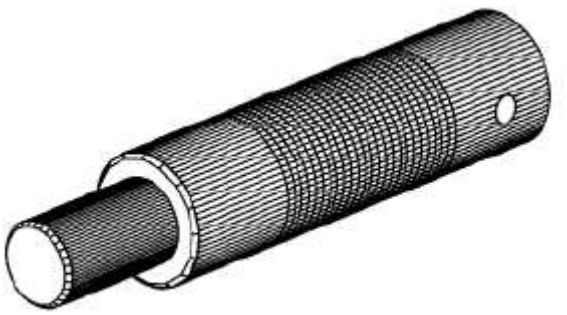


Fig. 4: Drift (21 2 130)
Courtesy of BMW OF NORTH AMERICA, INC.

21 2 140 CLUTCH CENTERING MANDREL (2 X)

Minimum set: Mechanical tools

Note: For centering clutch disc on flywheel while installing self-adjusting clutch (SAC) - Phase-in of SAC in E46, 09/97

Transmission: S5D 200G, S5D 250G, S5D 260Z, S5D 310Z, S6S 420G, S6S 560G

Storage location: C5

SI number: 1 13 96 (104)

Order number: 21 2 140

Clutch centering mandrel (2 x)

Consisting of:

1 = 21 2 141 Clutch centering tool

Note: With M10 screw - Transmission: S6S 420G, S6S 560G

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2 = 21 2 142 Clutch centering tool

Note: With M10 screw - Transmission: S5D 200G, S5D 250G, S5D 260Z, S5D 310Z

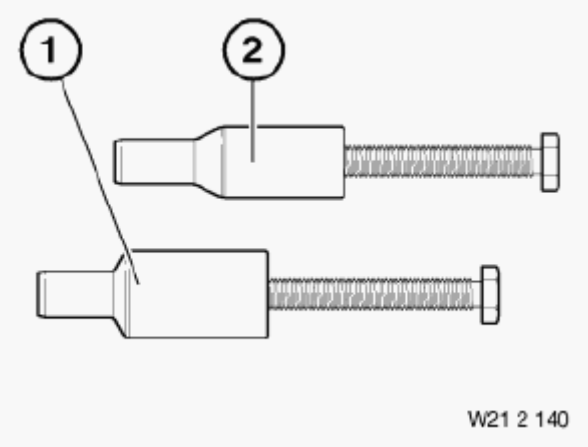


Fig. 5: Clutch Centering Mandrel (2 X) (21 2 140)
Courtesy of BMW OF NORTH AMERICA, INC.

21 2 170 TENSIONING TOOL

Minimum set: Mechanical tools

In conjunction with: 21 2 180, 21 2 190, 21 2 141, 21 2 142

Note: For resetting adjustment ring and installing self adjusting clutch (SAC) on flywheel without tension.

Series: E34, E36, E38, E39, E46, E52, E53, E60, E61, E83, E85, E86, E87, E90, E91

SI number: 1 16 00 (622)

Order number: 21 2 170

Tensioning tool

Consisting of:

1 = 21 2 171 Star with adjusting spindle

2 = 21 2 172 Clamping claw (1 x)

3 = 21 2 173 Pressure spindle with disk

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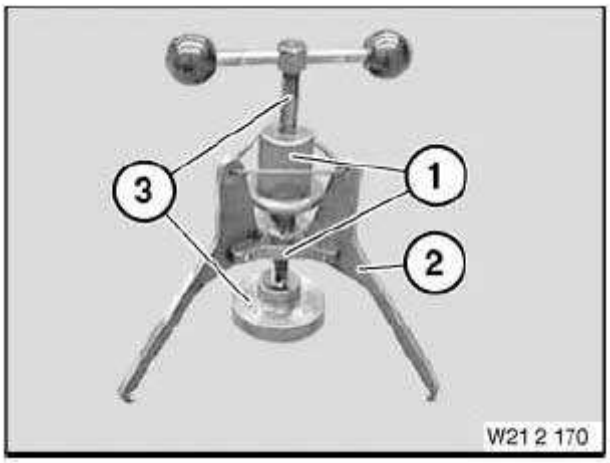


Fig. 6: Tensioning Tool (21 2 170)
Courtesy of BMW OF NORTH AMERICA, INC.

21 2 180 LOCATING RING

Minimum set: Mechanical tools

In conjunction with: 21 2 170

Note: For locating and resetting adjustment ring of SAC clutch on all 6 - and 8-cylinder engines.

Series: E34, E36, E38, E39, E46, E52, E53, E60, E61, E83, E85, E86, E90, E91

Storage location: A44

SI number: 1 16 00 (622)

Order number: 21 2 180

Locating ring

Consisting of:

1 = 21 2 181 Outer ring

2 = 21 2 182 Inner ring

3 = 21 2 183 Pin set

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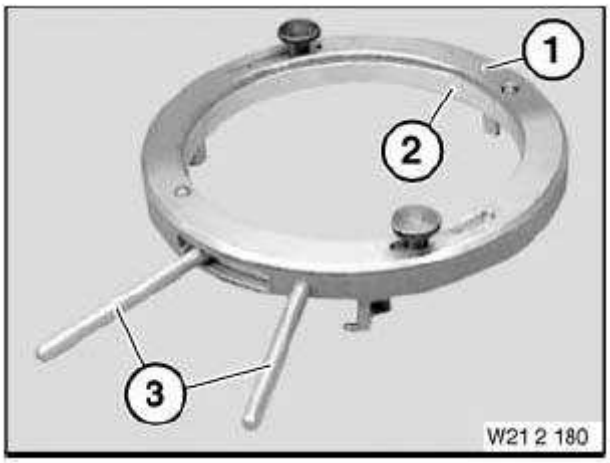


Fig. 7: Locating Ring (21 2 180)
Courtesy of BMW OF NORTH AMERICA, INC.

21 2 190 LOCATING RING

Minimum set: Mechanical tools

In conjunction with: 21 2 170

Note: For locating and resetting adjustment ring of SAC clutch on all 4 -cylinder engines.

Series: E34, E36, E38, E39, E46, E52, E53, E83, E87

Storage location: A44

SI number: 1 16 00 (622)

Order number: 21 2 190

Locating ring

Consisting of:

1 = 21 2 191 Outer ring

2 = 21 2 192 Inner ring

3 = 21 2 193 Driver (1 x)

4 = 21 2 194 Pin set

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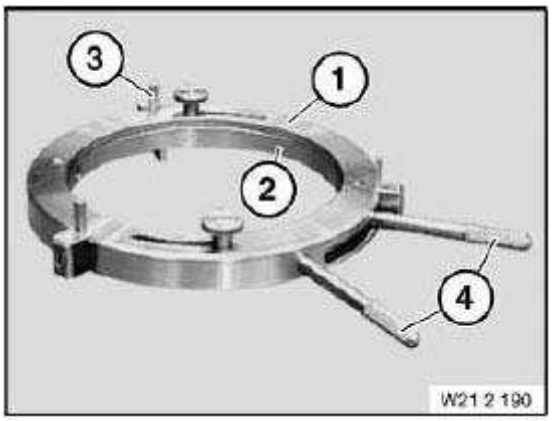


Fig. 8: Locating Ring (21 2 190)
Courtesy of BMW OF NORTH AMERICA, INC.

21 2 200 CLUTCH CENTERING TOOL

Minimum set: Mechanical tools

Note: For centering clutch plate during installation. H-transmission

Transmission: GS6-37BZ, GS6-37DZ

Storage location: B44, C44

SI number: 01 10 02 (907)

Order number: 21 2 200

Clutch centering tool

Consisting of:

1 = 21 2 201 Clutch centering tool

Note: With M10 screw Transmission: GS6-37BZ / DZ (H-transmission)

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Fig. 9: Clutch Centering Tool (21 2 200)
Courtesy of BMW OF NORTH AMERICA, INC.

21 2 220 GREASE SCRAPER RING

Minimum set: Mechanical tools

Note: Scraping grease off splines of transmission drive shaft

Series: E53, E60, E63, E64, E83, E85, E86, E87, E90, E91, E92

Transmission: GS6-17BG, GS6-37BZ, GS6-37DZ

SI number: 01 10 02 (907)

Order number: 21 2 220

Grease scraper ring

Consisting of:

1 = 21 2 221 Grease scraper ring

Note: Transmission: GS6-37BZ / DZ (H - transmission), GS6-17BG (i-transmission)

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Fig. 10: Grease Scraper Ring (21 2 220)
Courtesy of BMW OF NORTH AMERICA, INC.

21 2 230 CLUTCH CENTERING TOOL

Minimum set: Mechanical tools

Note: With M10 screw (G-transmission)

Transmission: GS6-53BZ, GS6-53DZ

Storage location: A47

SI number: 1 03 03 (960)

Order number: 21 2 230

Clutch centering tool



Fig. 11: Clutch Centering Tool (21 2 230)

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Courtesy of BMW OF NORTH AMERICA, INC.

21 2 240 GREASE SCRAPER RING

Minimum set: Mechanical tools

Note: For scraping grease on spline shaft teeth of transmission input shaft (G-transmission)

Transmission: GS6-53BZ, GS6-53DZ

Storage location: A47

SI number: 1 03 03 (960)

Order number: 21 2 240

Grease scraper ring



Fig. 12: Grease Scraper Ring (21 2 220)
Courtesy of BMW OF NORTH AMERICA, INC.

21 2 250 CLUTCH CENTERING TOOL

Minimum set: Mechanical tools

Note: For centering drive plate during installation. Clutch plate with modified toothing.

Transmission: S5D 250G (B transmission)

Series: E46, E46/16, E46/2, E46/3, E46/5, E46/C, E83, E87

Transmission: S5D 250G

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Storage location: A50

SI number: 1 20 04 (135)

Order number: 21 2 250

Clutch centering tool



Fig. 13: Clutch Centering Tool (21 2 250)
Courtesy of BMW OF NORTH AMERICA, INC.

21 2 270 CLUTCH CENTERING SLEEVE

Minimum set: Mechanical tools

Note: For centering drive plate to driven plate when installing clutch on engine. Transmission: GS6-53DG with M57T2, GS6-53BZ with N54 in E92, E60.

Transmission: GS6-53BZ, GS6-53DZ

SI number: 1 20 05 (218)

Order number: 21 2 270

Clutch centering sleeve

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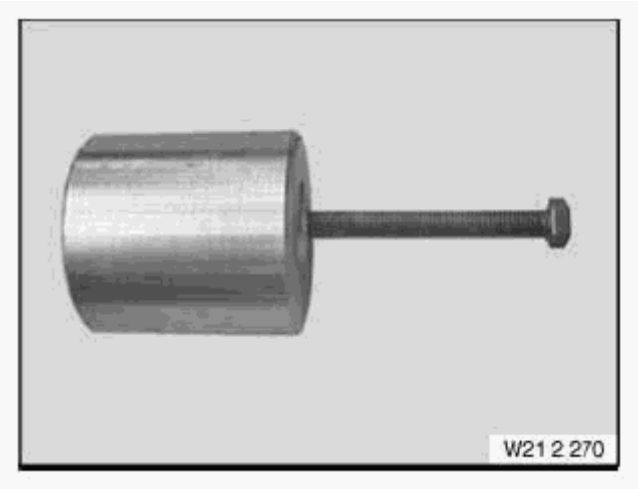


Fig. 14: Clutch Centering Sleeve (21 2 270)
Courtesy of BMW OF NORTH AMERICA, INC.

21 5 010 ADAPTER

In conjunction with: 17 0 002

Note: For expansion tank when bleeding hydraulic clutch system on automatic transmission

Transmission: S6S 420G

Storage location: C17

SI number: 1 06 97 (186)

Order number: 21 5 010

Adapter

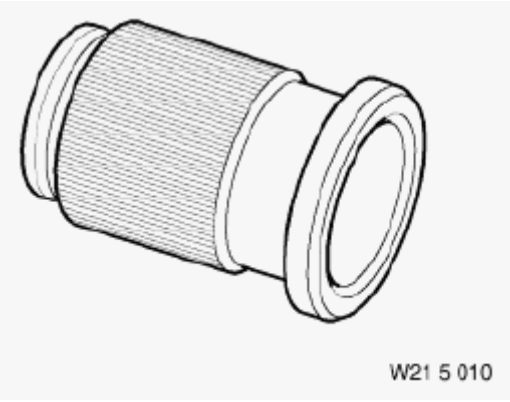


Fig. 15: Adapter (21 5 010)
Courtesy of BMW OF NORTH AMERICA, INC.

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21 5 020 BLEEDER FLASK

In conjunction with: 21 5 030

Note: For hydraulic fluid (Pentosin) - for bleeding hydraulic clutch system on sequential M - transmission.

Transmission: S6S 420G

SI number: 1 15 97 (211)

Order number: 21 5 020

Bleeder flask



Fig. 16: Bleeder Flask (21 5 020)
Courtesy of BMW OF NORTH AMERICA, INC.

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TRANSMISSION

Clutch - Technical Data - X3

21 CLUTCH WITH DRIVING DISC

21 21 CLUTCH WITH DRIVE PLATE MECH

TECHNICAL DATA - CLUTCH WITH DRIVE PLATE MECH

Lateral runout deviation of diaphragm springs to pressure plate	mm	0.6
Minimum lining thickness of clutch disk: Lining surface up to rivet closing head	mm	1.0

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TRANSMISSION

Clutch - Tightening Torques - X3

11 CLUTCH HOUSING

21 11 BELL HOUSING

BELL HOUSING - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Clutch housing to crankcase	E36 / E38 / E39 / E46 / E52 / E53 / E60 / E61 / E63 / E64 / E83 / E85 / E87 / E90 / E91	M8		28 Nm
	E36 / E38 / E39 / E46 / E52 / E53 / E60 / E61 / E63 / E64 / E83 / E85 / E87 / E90 / E91	M10		56 Nm
	E36 / E38 / E39 / E46 / E52 / E53 / E60 / E61 / E63 / E64 / E83 / E85 / E87 / E90 / E91	M12		98 Nm

21 CLUTCH WITH DRIVING DISC

21 21 CLUTCH DISC AND DRIVE PLATE

CLUTCH DISC AND DRIVE PLATE - TIGHTENING TORQUES

	Type	Thread	Work instruction	Measure
1AZ Clutch to flywheel	E36 / E38 / E39 / E46 / E52 / E53 / E60 / E61 / E63 / E64 / E83 / E85 / E86 / E87 / E90 / E91	M8 8.8	Replace screws	25 Nm
	E36 / E38 / E39 / E46 / E52 / E53 / E60 / E61 / E63 / E64 / E83 / E85 / E86 / E87 / E90 / E91	M8 10.9	Replace screws	34 Nm
Clutch to flywheel With ZNS bolts			Replace ZNS bolts Jointing torque and angle of rotation must be observed without fail	
	E60 S85		Jointing torque	15 Nm
			Torque angle	25°
	E60 N52 M47T2, E61 N52 M47T2, E63 N52, E64 N52, E65 N52, E83 N52 M47T2, E85 N52, E86 N52, E90 N52 N54 N46T M47T2, E91 N52 N54 N46T M47T2, E92 N54 N46T, E93 N46T, E81 N47, E87, N47, E81, N43, E87, N43, E87, N45K, E60, N53, E61, N53	M8 10.9	Jointing torque	15 Nm
			Torque angle	90° ± 5°

52 CLUTCH OPERATION (HYDRAULIC)

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21 52 CLUTCH OPERATION (HYDRAULIC)

CLUTCH OPERATION (HYDRAULIC) - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Hydraulic line to clutch slave cylinder or throttle.	E36 / E38 / E39 / E52 / E53 / E63 / E64 / E83 / E85 / E86 / E87 / E90 / E91 / E92			14.5 Nm
	E46			20 + 5 Nm
	E60 / E61			14 Nm
2AZ Clutch master cylinder to bearing block	E36 / E38 / E39 / E46 / E52 / E53 / E60 / E61 / E63 / E64 / E85 / E86 / E87 / E90 / E91 / E92 / E93 / E81			22 Nm
	E83			8 Nm
3AZ Fitting screw, clutch master cylinder	E36 / E38 / E39 / E46 / E52 / E53 / E60 / E61 / E63 / E64 / E83 / E85 / E86 / E87 / E90 / E91 / E92 / E93 / E81			22 Nm
4AZ Clutch master cylinder to pedal assembly	E36 / E38 / E39 / E46 / E52 / E53 / E60 / E61 / E63 / E64 / E83 / E85 / E86 / E87 / E90 / E91 / E92 / E93 / E81			9 Nm
5AZ Clutch slave cylinder to clutch housing / transmission case	E36 / E38 / E39 / E46 / E52 / E53 / E60 / E61 / E63 / E64 / E83 / E85 / E86 / E87 / E90 / E91 / E92 / E93 / E81			22 Nm
	E60 / E63	7-speed SMG		25 Nm
6AZ Pressure accumulator to hydraulic unit	E36 / M3			35 Nm
7AZ Coupling bolts for hydraulic pipes	E46 / M3 / E87 / E81			14 Nm
8AZ Pressure accumulator for hydraulic unit	E46 / M3			40 Nm
9AZ Clutch position sensor to clutch slave cylinder	E46 / E60 / E61 / E63 / E64 / E85	6-speed SMG		2.5 Nm
	E60 / E63	7-speed SMG		3.5 Nm
10AZ Banjo bolt, pipe, actuator / pump block	E60 / E63	7-speed SMG		18 Nm
11AZ Filler plug, expansion tank, pump block	E60 / E63	7-speed SMG		2.1 Nm
12AZ Throttle valve to clutch slave cylinder	E60, E61			17 Nm

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AUTOMATIC TRANSMISSION

Diagnostic Trouble Codes - 6-Speed ZF Transmission

DIAGNOSTIC TROUBLE CODES

A/T DIAGNOSTIC TROUBLE CODES

DTC (Diagnostic Trouble Code)	DTC Description
P0748	Pressure Control Solenoid 'A' Electrical
P0963	Pressure Control Solenoid 'A' Control Circuit High
P0962	Pressure Control Solenoid 'A' Control Circuit Low
P170A	Pressure Control Solenoid 'A' Shunt Monitoring
P0745	Pressure Control Solenoid 'A'
P0778	Pressure Control Solenoid 'B' Electrical
P0967	Pressure Control Solenoid 'B' Control Circuit High
P0966	Pressure Control Solenoid 'B' Control Circuit Low
P170B	Pressure Control Solenoid 'B' Shunt Monitoring
P0775	Pressure Control Solenoid 'B'
P0798	Pressure Control Solenoid 'C' Electrical
P0971	Pressure Control Solenoid 'C' Control Circuit High
P0970	Pressure Control Solenoid 'C' Control Circuit Low
P170C	Pressure Control Solenoid 'C' Shunt Monitoring
P0795	Pressure Control Solenoid 'C'
P2716	Pressure Control Solenoid 'D' Electrical
P2721	Pressure Control Solenoid 'D' Control Circuit High
P2720	Pressure Control Solenoid 'D' Control Circuit Low
P170D	Pressure Control Solenoid 'D' Shunt Monitoring
P2713	Pressure Control Solenoid 'D'
P2725	Pressure Control Solenoid 'E' Electrical
P2730	Pressure Control Solenoid 'E' Control Circuit High
P2729	Pressure Control Solenoid 'E' Control Circuit Low
P170E	Pressure Control Solenoid 'E' Shunt Monitoring
P2759	Torque Converter Clutch Pressure Control Solenoid Control Circuit Electrical
P2763	Torque Converter Clutch Pressure Control Solenoid Control Circuit High
P2764	Torque Converter Clutch Pressure Control Solenoid Control Circuit Low
P170F	Pressure Control Solenoid 'F' Shunt Monitoring
P1830	Pressure Control Solenoid Current Error in P/R/N
P0977	Shift Solenoid 'B' Control Circuit High
P0976	Shift Solenoid 'B' Control Circuit Low
P0755	Shift Solenoid 'B'
P0979	Shift Solenoid 'C' Control Circuit Low

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P0982	Shift Solenoid 'D' Control Circuit Low
P1806	Shift Solenoid 'A' or 'B' Mechanically Stuck
P2815	Pressure Control Solenoid 'G' Control Circuit High
P2814	Pressure Control Solenoid 'G' Control Circuit Low
P173C	Pressure Control Solenoid 'G' Shunt Monitoring
P0715	Input/Turbine Speed Sensor 'A' Circuit
P1811	Input/Turbine Speed Sensor Circuit Low
P0716	Input/Turbine Speed Sensor 'A' Circuit Range/Performance
P1812	Output Speed Sensor Circuit High Input
P1813	Output Speed Sensor Circuit Low Input
P0720	Output Speed Sensor Circuit
P0721	Output Speed Sensor Circuit Range/Performance
P1814	Output Speed Sensor Gradient Too High
P0710	Transmission Fluid Temperature Sensor 'A' Circuit
P1704	Transmission Fluid Temperature Sensor 'A' Circuit Shorted
P1718	Transmission Fluid Temperature Sensor 'A' Unpermitted Temperature Increase
P0711	Transmission Fluid Temperature Sensor 'A' Circuit Range/Performance
P0669	PCM/ECM/TCM Internal Temperature Sensor Circuit High
P0668	PCM/ECM/TCM Internal Temperature Sensor Circuit Low
P0666	PCM/ECM/TCM Internal Temperature Sensor Circuit
P0218	Transmission Fluid Over Temperature Condition
P171F	Internal Transmission Control Module Component CG122 Error
P0741	Torque Converter Clutch Circuit Performance or Stuck Off
P173D	CAN Message Monitoring Transmission Intake Torque
P1729	Engine High Rotational Irregularity
P1728	Engine Overspeed Condition
P1760	Engine Torque Request Plausibility
P17E1	Ratio Monitoring Clutch A
P17E2	Ratio Monitoring Clutch B
P17E3	Ratio Monitoring Clutch C
P17E4	Ratio Monitoring Clutch D
P17E5	Ratio Monitoring Clutch E
P17E6	Ratio Monitoring Shift 1-2
P17E7	Ratio Monitoring Shift 2-3
P17E8	Ratio Monitoring Shift 3-4
P17E9	Ratio Monitoring Shift 4-5
P17EA	Ratio Monitoring Shift 5-6
P17EB	Ratio Monitoring Shift 6-5
P17EC	Ratio Monitoring Shift 5-4
P17ED	Ratio Monitoring Shift 4-3
P17EE	Ratio Monitoring Shift 3-2
P17EF	

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	Ratio Monitoring Shift 2-1
P17F0	Ratio Monitoring Clutch A and D
P17F1	Ratio Monitoring Clutch A and C
P17F2	Ratio Monitoring Clutch A and B
P17F3	Ratio Monitoring Clutch A and E
P17F4	Ratio Monitoring Clutch B and E
P17F5	Ratio Monitoring Clutch C and E
P17F6	Ratio Monitoring Clutch B and D
P17F7	Ratio Monitoring Shift 6-4
P17F8	Ratio Monitoring Shift 5-3
P17F9	Ratio Monitoring Shift 4-2
P17FA	Ratio Monitoring Shift 3-1
P1790	Internal Transmission Control Module Memory Check Sum/EPROM Error
P1791	Internal Transmission Control Module Memory Check Sum/EEPROM Error
P171A	Internal Transmission Control Module Watchdog General Error
P171B	Internal Transmission Control Module Watchdog Run Time Error
P171C	Internal Transmission Control Module Watchdog Initialization Error
P171D	Internal Transmission Control Module Watchdog Electrical Error
P171E	Internal Transmission Control Module Watchdog Plausibility Error
P175A	TCM Internal Error Shifting to D without Driver Command
P177A	TCM Internal Error no Shifting despite of Driver Command
P175C	Gear Shift Position 2/4 Circuit Wrong Frequency
P1798	Internal Transmission Control Module Writing Error EEPROM
P1798	Internal Transmission Control Module Monitoring Level 2 Error, Engine Torque Up Request
P1712	Internal Transmission Control Module Monitoring Level 2 Error, Engine Torque Up Request
P1713	Internal Transmission Control Module Monitoring Level 2 Error, Calculation Engine Torque Up Request
P1723	Internal Transmission Control Module Severe QADC Error
P1722	Internal Transmission Control Module Minor QADC Error
P1724	Internal Transmission Control Module TPU AliveCounter Error
P1725	Internal Transmission Control Module TPU RAM Error Internal Transmission Control Module Level 2 Error,
P172E	Interference Counter above Threshold General Error Internal Transmission Control Module Level 2 Error,
P172A	Interference Counter 1 above Threshold
	Internal Transmission Control Module Level 2 Error,
P172B	Interference Counter 2 above Threshold
	Internal Transmission Control Module Level 2 Error,
P172C	Interference Counter 3 above Threshold
	Internal Transmission Control Module Level 2 Error,

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P172D	Interference Counter 4 above Threshold
	Internal Transmission Control Module Level 2 Error,
P1754	Interference Counter below Threshold General Error Internal Transmission Control Module Level 2 Error,
P172F	Interference Counter 1 below Threshold
	Internal Transmission Control Module Level 2 Error,
P1733	Interference Counter 2 below Threshold
	Internal Transmission Control Module Level 2 Error,
P1735	Interference Counter 3 below Threshold
	Internal Transmission Control Module Level 2 Error,
P1737	Interference Counter 4 below Threshold
P1891	System Voltage High Input
P1892	System Voltage Low Input
P1890	System Voltage
P1893	Supply Voltage Pressure Control Solenoid/Shift Solenoid Circuit High
P1894	Supply Voltage Pressure Control Solenoid/Shift Solenoid Circuit Low
P1895	Supply Voltage Pressure Control Solenoid/Shift Solenoid No Signal
P1896	Supply Voltage Pressure Control Solenoid/Shift Solenoid
P1897	Supply Voltage Sensors High Input
P1898	Supply Voltage Sensors Low Input
P0705	Transmission Range Sensor 'A' Circuit (PRNDL Input)
P0706	Transmission Range Sensor 'A' Circuit Range/Performance
P1701	Double Error Position Information CAN / Serial Line
P1730	Pressure Control Solenoid Unpermitted Activation
P1702	Combination Substitute Function
P1727	CAN Engine Speed
P1771	CAN Torque Interface Plausibility
U0001	High Speed CAN Communication Bus
U114A	Message Monitoring Engine Control Torque 1 Alive Check
U114B	Lost Communication With Engine Control Torque 1
U114D	Message Monitoring Engine Control Torque 2 Alive Check
U1163	Message Monitoring Engine Control Alive Check
U0100	Lost Communication With ECM/PCM 'A'
U1164	Message Monitoring Engine Control Check Sum Error
U1125	Message Monitoring DSC Status Alive Check
U1126	Lost Communication With DSC Status
U1127	Message Monitoring DSC Status Check Sum Error
U1149	Message Monitoring CAS Alive Check
U1131	Lost Communication With CAS
U1150	Message Monitoring CAS Check Sum Error
U112A	Message Monitoring Instrument Pack Status Alive Check

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U112B	Lost Communication With Instrument Pack Status
U112F	Message Monitoring Instrument Pack Status Check Sum Error

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GENERAL INFORMATION

Electronic Transmission Control - Overview

ELECTRONIC TRANSMISSION CONTROL

PURPOSE OF THE SYSTEM

Electronically controlled transmissions were introduced on BMW products in 1986 on 5 and 7 series vehicles. Currently EH (Electro-hydraulic) transmissions are offered on almost every production model (Except E46 M3 and E39 M5). EH transmissions offer the following benefits the to driver:

- Increased driving safety by reducing fatigue. All shifts are automatic as opposed to manual transmissions which require more driver interaction.
- Increased fuel economy through use of lock up torque converter.
- Increased fuel economy through optimized shift points.
- Improved shift comfort by use of "Overlap Shift" technology (ZF).
- More available features through the use of CAN bus technology.

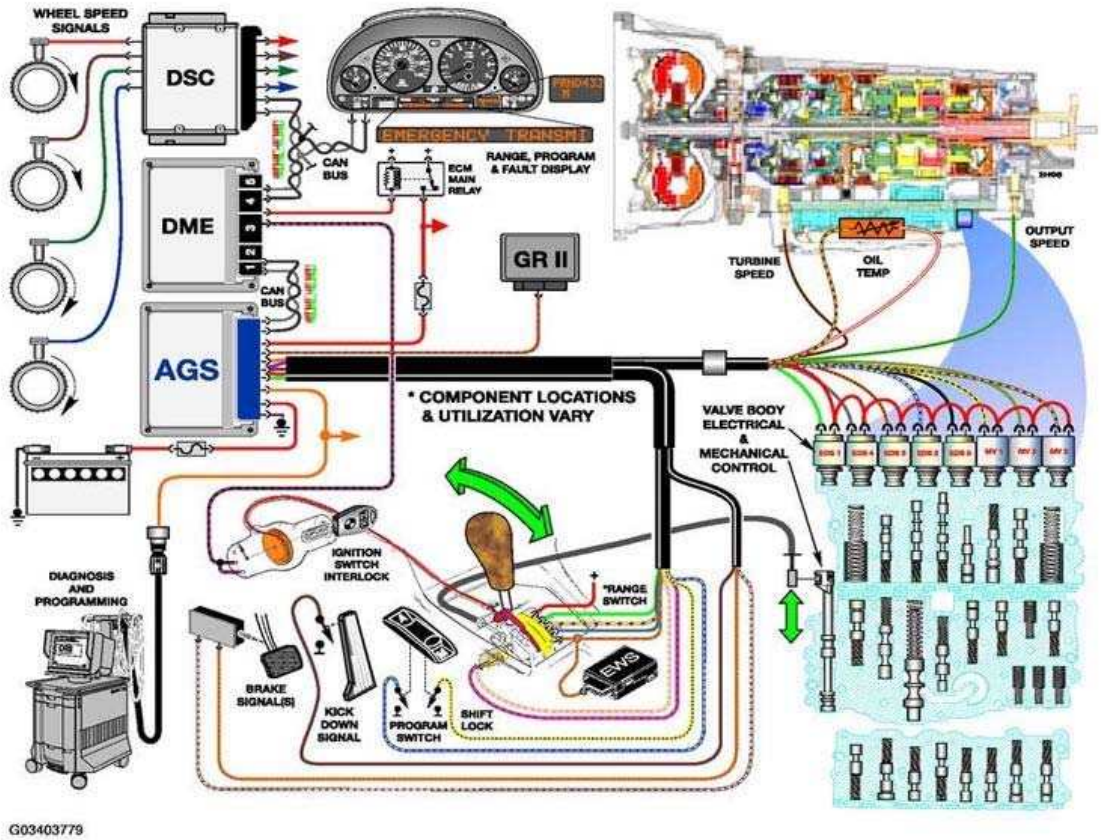


Fig. 1: Identifying Electro-Hydraulic Transmission Inputs/Outputs
Courtesy of BMW OF NORTH AMERICA, INC.

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The EH Control System is designed to work in conjunction with the engine electronics for precise shift control. The TCM receives information on engine RPM, load and throttle position to provide optimum shift points to maximize fuel economy and driver comfort.

The function of an EGS System is to:

- Monitor all operating conditions through input signals
- Continually assess operating conditions by processing input data and select the appropriate operating program for current conditions.
- Activate transmission system components and to communicate with other drivetrain control systems.
- Respond to driver selected driving program (Economy, Sport or Manual).

In addition to providing shift control, the TCM also adapts to changing conditions within the transmission by monitoring slip ratios and modifying line pressure. This increases the life of the transmission and reduces maintenance and adjustments. The TCM controls the operation of the Lock-Up Torque Converter which further increases economy.

On current models, the TCM also has the capability of adapting to driver habits and responds to changing environmental conditions. Items such as rate of throttle input and kickdown requests are monitored to select the most appropriate shift program.

The EGS system is also required to maintain occupant safety, safeguard drivetrain damage, improve vehicle emissions and operate in fail-safe mode when a malfunction occurs.

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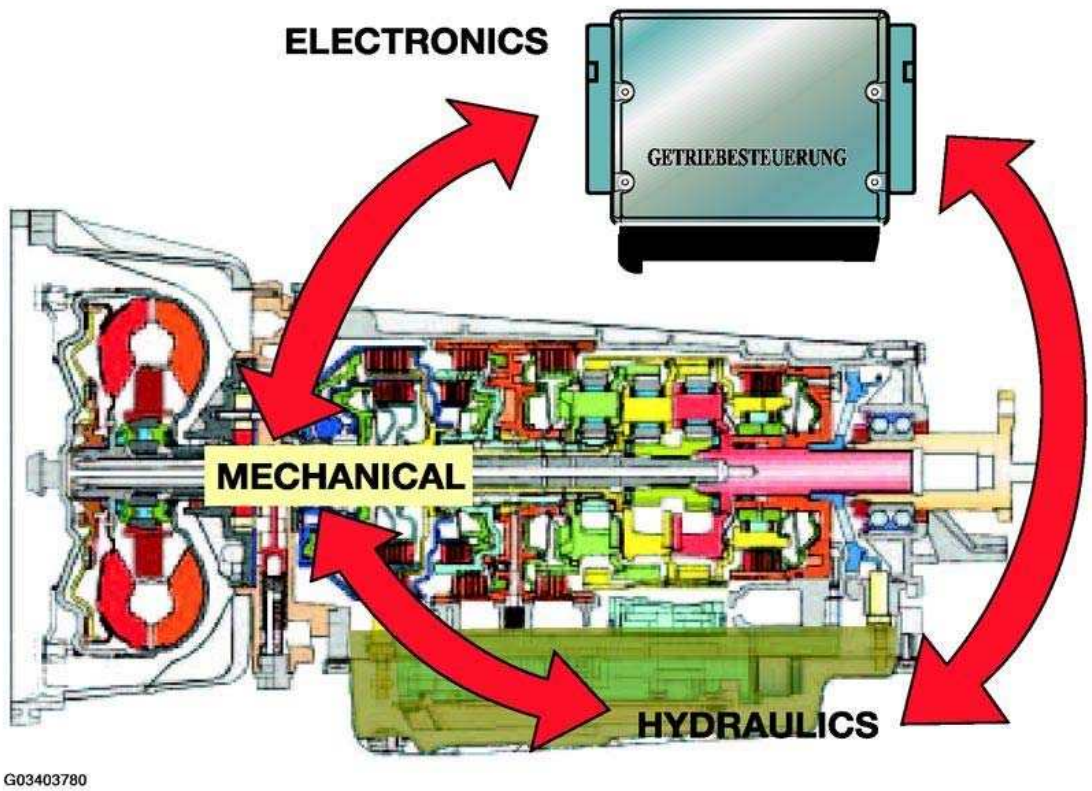


Fig. 2: Identifying EGS System
Courtesy of BMW OF NORTH AMERICA, INC.

TRANSMISSION VERSION AND CONTROL SYSTEMS

Each BMW Electro-hydraulic transmission has a corresponding control system. They are designated "GS" which stands for Transmission Control. This acronym is from the German words **G** etriebe **S** teurung. Each transmission can have more than one control system, this depends upon application (model year, series etc.). Below is a listing of ZF control systems used on BMW vehicles, Hydramatic control systems are shown on the opposing page.

ZF Control Systems

ZF CONTROL SYSTEMS SPECIFICATIONS

Transmission BMW ID #	Manufacturer ID	Model/Year	Control System	Engine
4HP22 (EH)	4HP22 (EH)	86 535i 86 635i 86 735i	GS 1.2X GS 1.2X GS 1.2X	M30 M30 M30
4HP24 (EH)	4HP24 (EH)	88-9/91 750iL (E32) 92-94 750iL (E32) 90-94 850i/Ci (E31)	GS 1.27 GS 1.29 GS 1.29	M70 M70 M70
A5S310Z	5HP18	93 530i/iT (E34)	GS 7.3	M60

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		94 530i/iT (E34) 95 M3 (E36) 96-99 M3 (E36)	GS 7.32 GS 7.11 GS 8.32	M60 S50 (US) S52
A5S325Z	5HP19	00 323i/Ci/CiC (3/00-8/00) 01 323iT (from 4/01) 01-02 325i/Ci/CiC from 9/00 00-01 330i/Ci/CiC from 6/00 01- 525 from 3/01 01- 530 from 3/01 03 Z4 (E85) 2.5i and 3.0i	GS 8.60 GS 8.60 GS 8.60.4 GS 8.60.4 GS 8.60.4 GS 8.60.4 GS 8.60.4	M52 TU M52 TU M54 M54 M54 M54 M54
A5S440Z	5HP24	97 840Ci (E31) from 9/96 97 540i (E39) 1/97-8/97 97 740i/iL (1/97 - 4/97) 97 740i/iL (5/97-8/97) 98-03 540i 98-01 740i/iL 00- X5 4.4i	GS 8.55 (CAN index 50) GS 8.55 (CAN index 50) GS 8.55 (CAN index 50) GS 8.55 (CAN index 60) GS 8.60.2 (CAN index 60) GS 8.60.2 (CAN index 60) GS 8.60.2	M62 M62 M62 M62 M62, M62 TU 99-02 M62, M62 TU 99-01 M62TU
A5S560Z	5HP30	93-94 740i/iL (E32) 93 540i (E34) 94-95 540i (E34) 94-95 840Ci (E31) 95 740i/iL (E38) 95-01 750iL (E38) 96-97 740i/iL (-1/97) 96 840Ci (E31) 95-97 850Ci	GS 9.2 GS 9.2 GS 9.22 GS 9.22 GS 9.22 GS 9.22.1 GS 9.22.1 GS 9.22.1 GS 9.22.1	M60 M60 M60 M60 M60 M73/M73TU M62 M62 M73
GA6HP26Z	GA6HP26Z GA6HP26Z	02- 745Li (E65/E66) 03- 760Li (E66)	GS 19 GS 19	N62 N73

Hydramatic Control Systems

HYDRAMATIC CONTROL SYSTEMS SPECIFICATIONS

Transmission BMW ID #	Manufacturer ID #	Model/Year	Control System	Engine

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A4S310R (THM-R1)	4L30-E(A4S310R) >>>	90-92 525i (E34) 93-95 525i (E34) 92 325i, is, ic (E36) 93-95325i, is, ic (E36) 92-95 318ti (E36)	GS 4.14 GS 4.16 GS 4.14 GS 4.16 GS 4.14 & GS 4.16	M50 M50 TU M50 M50 TU M42
A4S270R	4L30-E(A4S270R) >>>	96-98 328i (is, ic - 97) 96-98 318i (is, ic-97) 96-98 318ti (E36/5) 96-98 Z3 1.9 (E36/7) 96-98 Z3 2.8 97-98 528i (E39)	GS 8.34 GS 8.34 GS 8.34 GS 8.34 GS 8.34 GS 8.34	M52 M44 M44 M44 M52 M52
A5S360R (GMS)	5L40-E (A5S360R) >>	99-00 323i/Ci (7/98-3/00) 99-00 328i/Ci (6/98-5/00) 99-00 528i (E39) 9/99-8/00 99-00 Z3 (E36/7) 2.3/2.8	GS 20 GS 20 GS 20 GS 20	M52 TU M52 TU M52 TU M52 TU
A5S390R (GM5)	5L40-E (A5S390R) >>	00-03 X5 3.0i (4/00 -) 01 325iT (8/00-3/01) 01-03 325xi/xiT & 330Xi (-8/00) 01 525i/iT (9/00-3/01) 01 530i (9/00-3/01) 01-02 Z3 2.5/3.0 (6/00-)	GS 20 GS 20 GS 20 GS 20 GS 20 GS 20	M54 M54 M54 M54 M54 M54

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Fig. 3: Hydramatic Control Systems - GS 20 TCM (Siemens)
Courtesy of BMW OF NORTH AMERICA, INC.

TRANSMISSION IDENTIFICATION

BMW automatic transmission are manufactured by two suppliers for the US market:

- **Zahnradfabrik Friedrichshafen:** Commonly referred to as ZF. ZF manufactures both manual as well as automatic transmissions.
- **GM Powertrain - Hydramatic:** Hydramatic is a manufacturing division of General Motors located in Strasbourg, France. Hydramatic supplies automatic transmissions to BMW for four and six-cylinder vehicles.

BMW has developed an internal numbering system for their transmissions for ordering parts, information research and identification. Also, each transmission manufacturer uses an internal identification system. Here is a breakdown of these identification codes:

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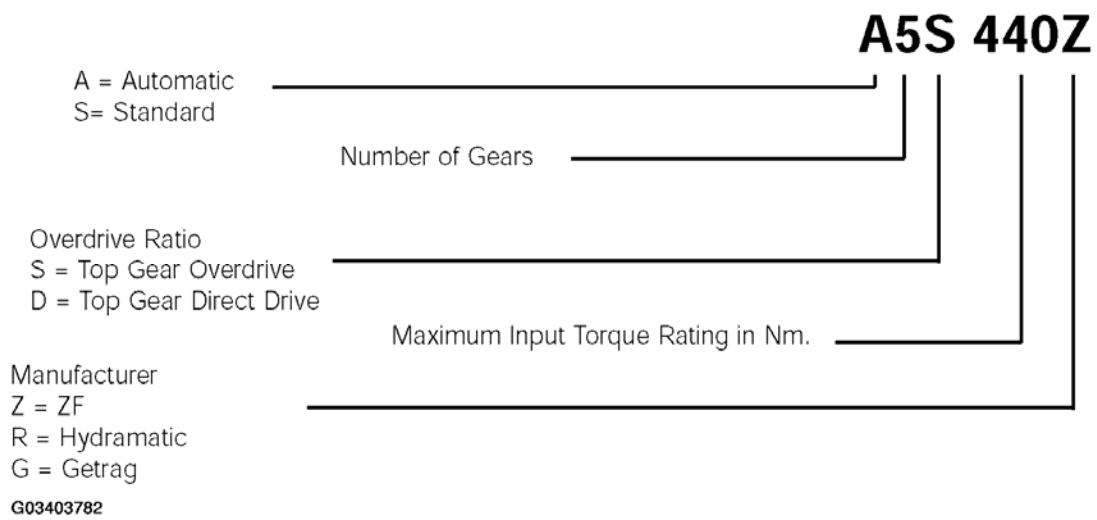


Fig. 4: Identifying BMW Identification Code Breakdown
Courtesy of BMW OF NORTH AMERICA, INC.

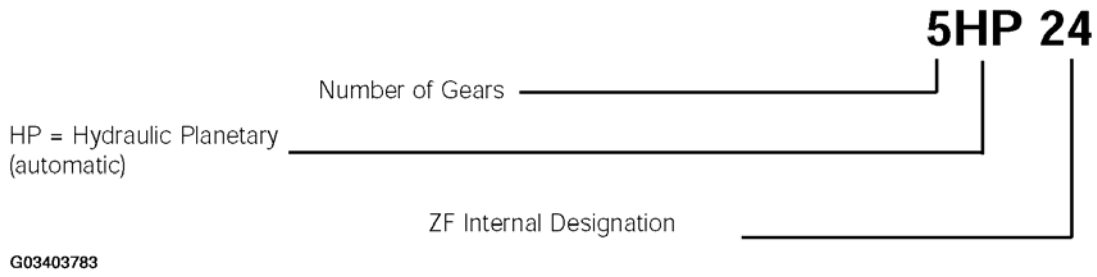


Fig. 5: Identifying ZF Identification Code Breakdown
Courtesy of BMW OF NORTH AMERICA, INC.

Hydramatic Transmissions have internal designations, however they are not used often. The internal code for the A4S310/270R is 4L30-E and the A5S360/390R is 5L40-E.

Transmission ID Tag Location

In order to identify BMW transmissions there are identification tags located externally on the transmission case. The tag contains information such as Manufacturer, Serial number, transmission type etc. This information is needed when ordering parts, referencing bulletins and calling for technical assistance.

- **ZF - Tag is Located on -**
  1. Right hand side (passenger side) of transmission case. (5HP30 and 5HP18)
  2. Left hand side (drivers side) of transmission case. (6HP26Z, 5HP24 and all 4HP)
  3. Rear under output shaft. (5HP19)

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Fig. 6: Identifying ID Tag Location 5HP19
Courtesy of BMW OF NORTH AMERICA, INC.

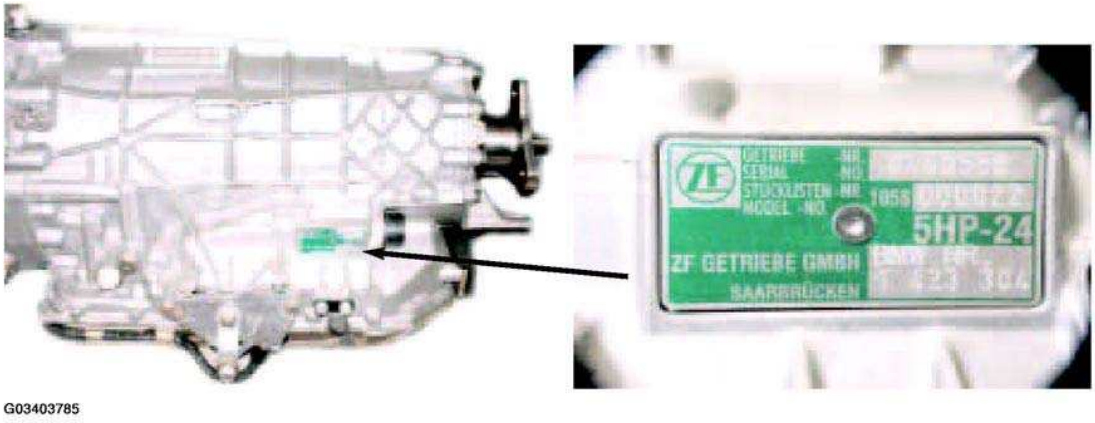


Fig. 7: Identifying Typical ZF Tag
Courtesy of BMW OF NORTH AMERICA, INC.

- **GM** - Located on left hand side (drivers side) of transmission case.

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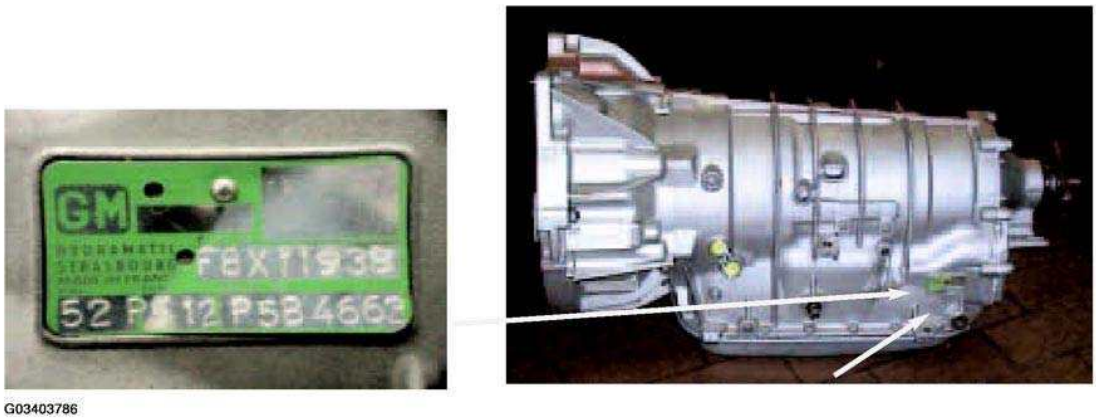


Fig. 8: Identifying GM ID Tag (GM 5)
Courtesy of BMW OF NORTH AMERICA, INC.

SYSTEM COMPONENTS (ELECTRICAL)

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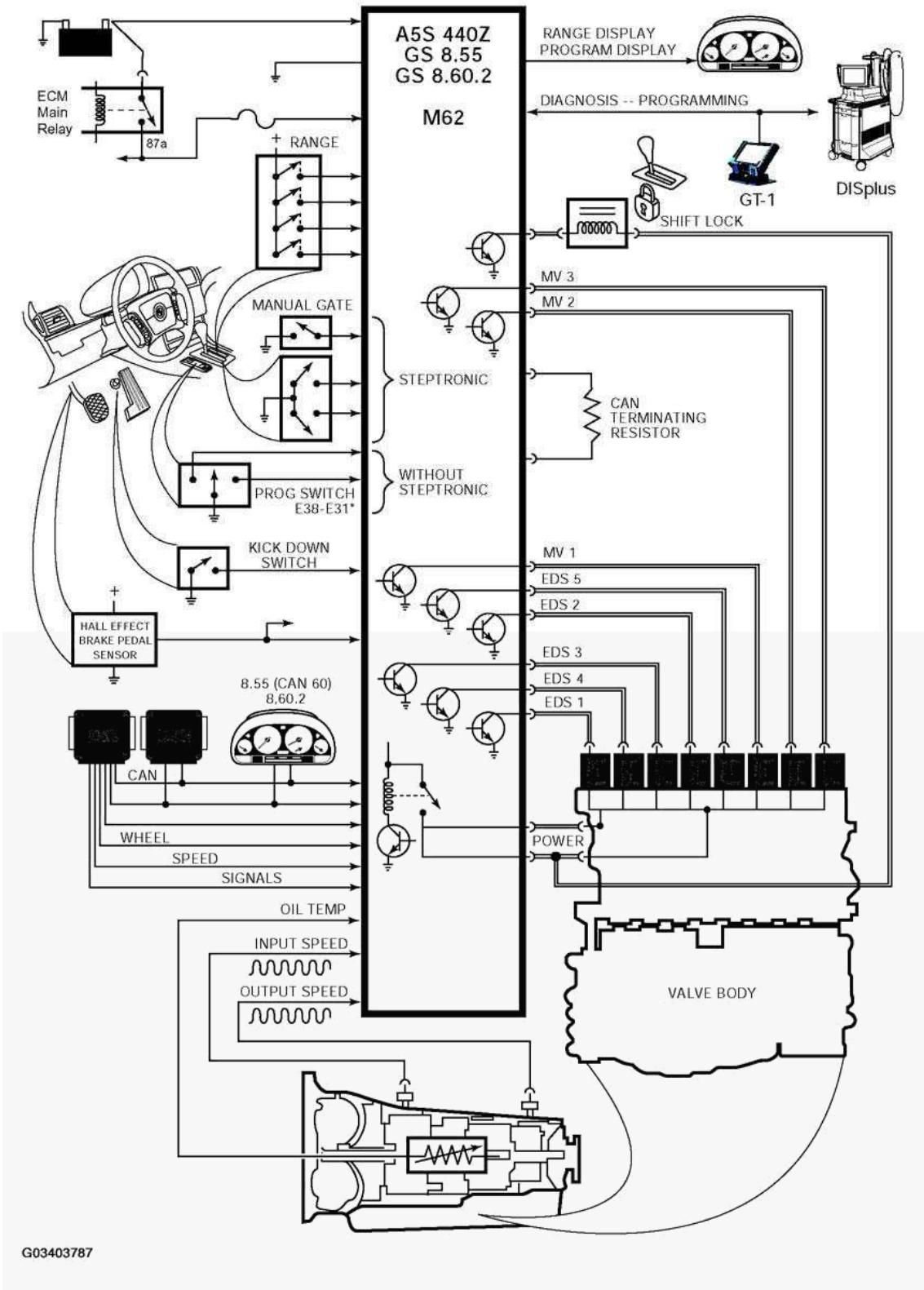


Fig. 9: Identifying System Components (Electrical)
Courtesy of BMW OF NORTH AMERICA, INC.

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Transmission Control Module

The TCM receives inputs, processes information and actuates the output elements to provide optimal shift points. The TCM is programmed for maximum shift comfort and fuel economy. The TCM on most BMW vehicles is located in the E-Box next to the ECM (DME).

There are several types of TCM housings:

- 35 Pin TCM (TCU) - used on the 4HP transmissions
- 55 Pin TCM - used on the A4S310R (THM-R1)
- 88 Pin TCM - used on all others up to 98
- 134 Pin TCM - used on all BMW transmission from the 99 model year. (Note- the 134 pin TCM was introduced on the 98 Models equipped with the A5S440Z).

The 134 Pin TCM is also referred to as SKE (Standard Shell Construction). The SKE housing uses 5 separate connectors. On transmission applications only three connectors 1, 3 and 4) are used. Connectors 2 and 5 are blank and are **NOT** used. The connectors are blue in color to avoid confusion with the ECM (DME) connectors which are black.

!34 Pin control modules are supplied by Bosch for ZF transmissions and Siemens for Hydramatic transmissions. Bosch and Siemens control modules are NOT interchangeable.

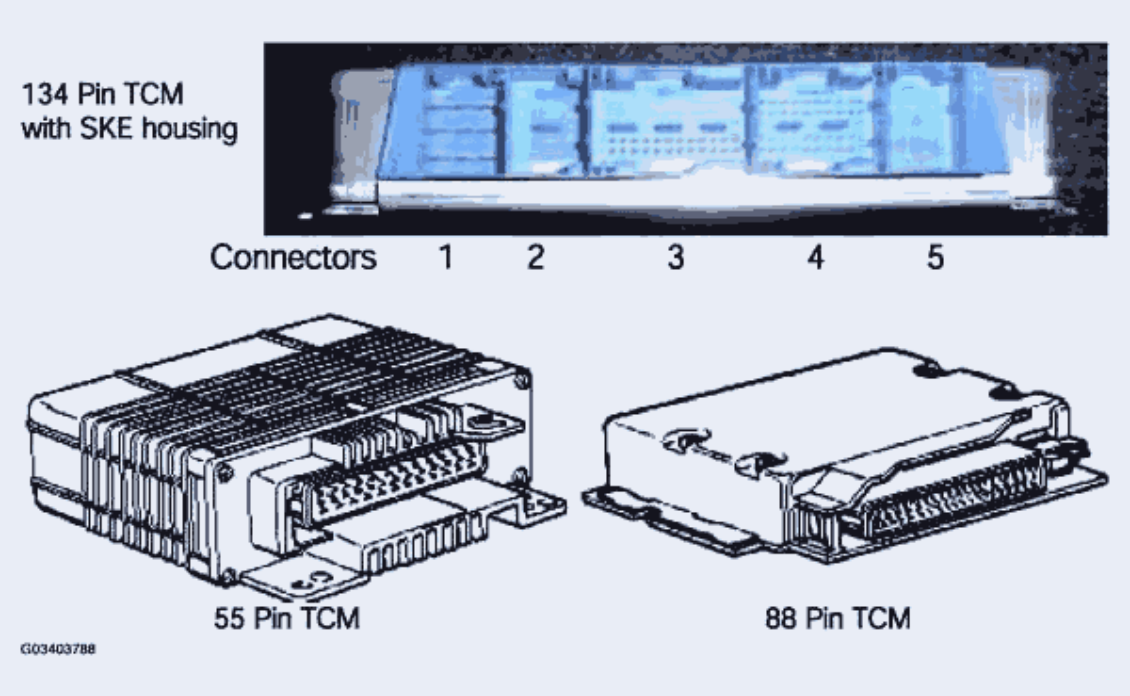


Fig. 10: Identifying Transmission Control Module
Courtesy of BMW OF NORTH AMERICA, INC.

Turbine Speed Sensor

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The Turbine Speed Sensor is used to provide input (turbine) shaft speed information to the TCM (EGS). The input shaft speed signal is used in conjunction with the output shaft speed signal to determine gear range and slip time information for processing in the TCM. Not all BMW transmissions use a turbine speed sensor. Some TCM's use the TD (engine speed) signal to determine input shaft speed. All transmissions with the exception of the A5S325Z use an inductive type sensor which generates an AC analog signal. The A5S325Z currently uses a Hall Effect Turbine Speed Sensor which will send a digital square wave signal to the TCM.

4HP22/24 (EH), A4S310/270R: These transmissions do not use a Turbine Speed Sensor. The TD signal is used to determine input shaft speed. The TD signal is an output signal of the DME control unit.

A5S310Z, A5S325Z, A5S440Z, A5S560Z, A5S360/390R: These transmission use a turbine speed sensor. The TD signal is also used with the turbine speed signal to allow the TCM to monitor Torque Converter Clutch operation. The TCM can control torque converter clutch slippage and also monitor for faults.

Output Shaft Speed Sensor

The Output Shaft Speed Sensor is used to provide output shaft speed information to the TCM. The output shaft speed signal is used in conjunction with the turbine speed signal to provide the TCM with information on gear ranges and slip times.

All BMW electronic transmissions have an output shaft speed sensor. The output shaft speed sensor is an inductive type which will generate an AC analog signal to the TCM. The frequency and amplitude of the signal will increase as output shaft speed increases. The exact location of the output shaft speed sensor varies by transmission model.

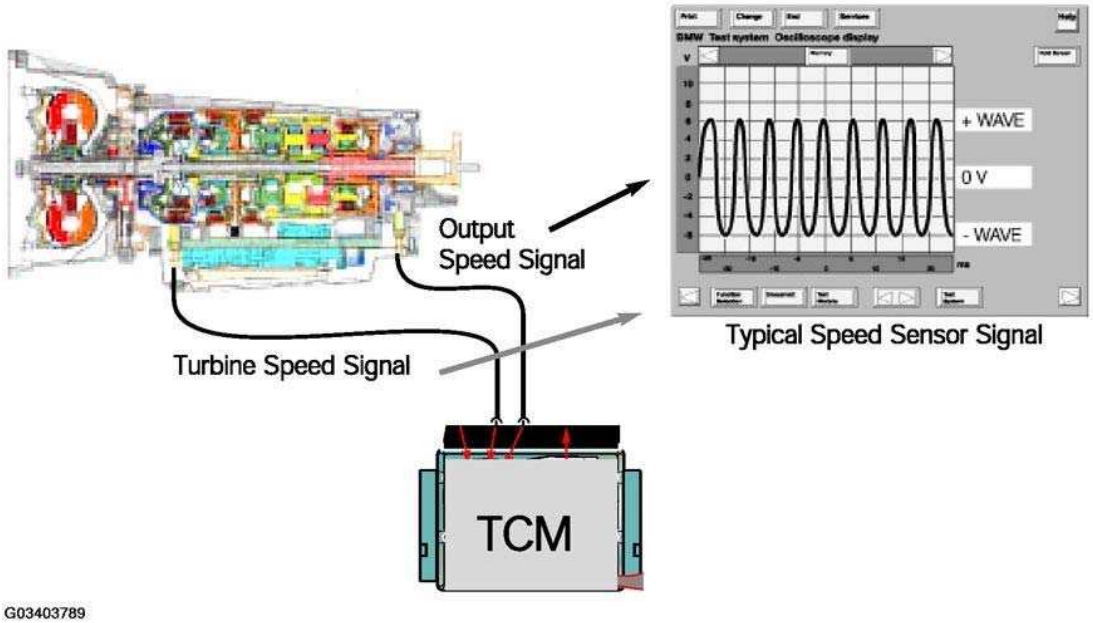


Fig. 11: Identifying Output Shaft Speed Sensor Graph
Courtesy of BMW OF NORTH AMERICA, INC.

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Transmission Oil Temp Sensor

The TCM is provided with transmission oil temperature information via a temperature sensor. On most BMW transmissions, the sensor is an NTC element which is part of the transmission internal wiring harness.

4HP22/24 (EH): These transmissions do not use a transmission oil temperature sensor. There are no transmission oil temperature influenced features on the 4HP transmissions.

All Except A5S360/390R, GA6HP26Z: The transmission fluid temp sensor is part of the transmission internal wiring harness. On these transmissions, the sensor cannot be replaced separately. The harness must be replaced.

A5S360/390R transmission: the sensor is a separate, replaceable sensor that can be unplugged from the harness.

GA6HP26Z: the sensor is located in the Mechatronics Module, which is located inside of the transmission.

NOTE: The Mechatronics Module is not currently serviceable at this time. Contact the BMW Technical Hotline in the event of a failure. Do not attempt any repair or replacement of the Mechatronics Module.

The transmission oil temperature information is used to:

- Initiate the Warm Up Program
- To inhibit TCC operation until a specified temperature has been reached.
- For determining fluid level when used with diagnostic equipment.

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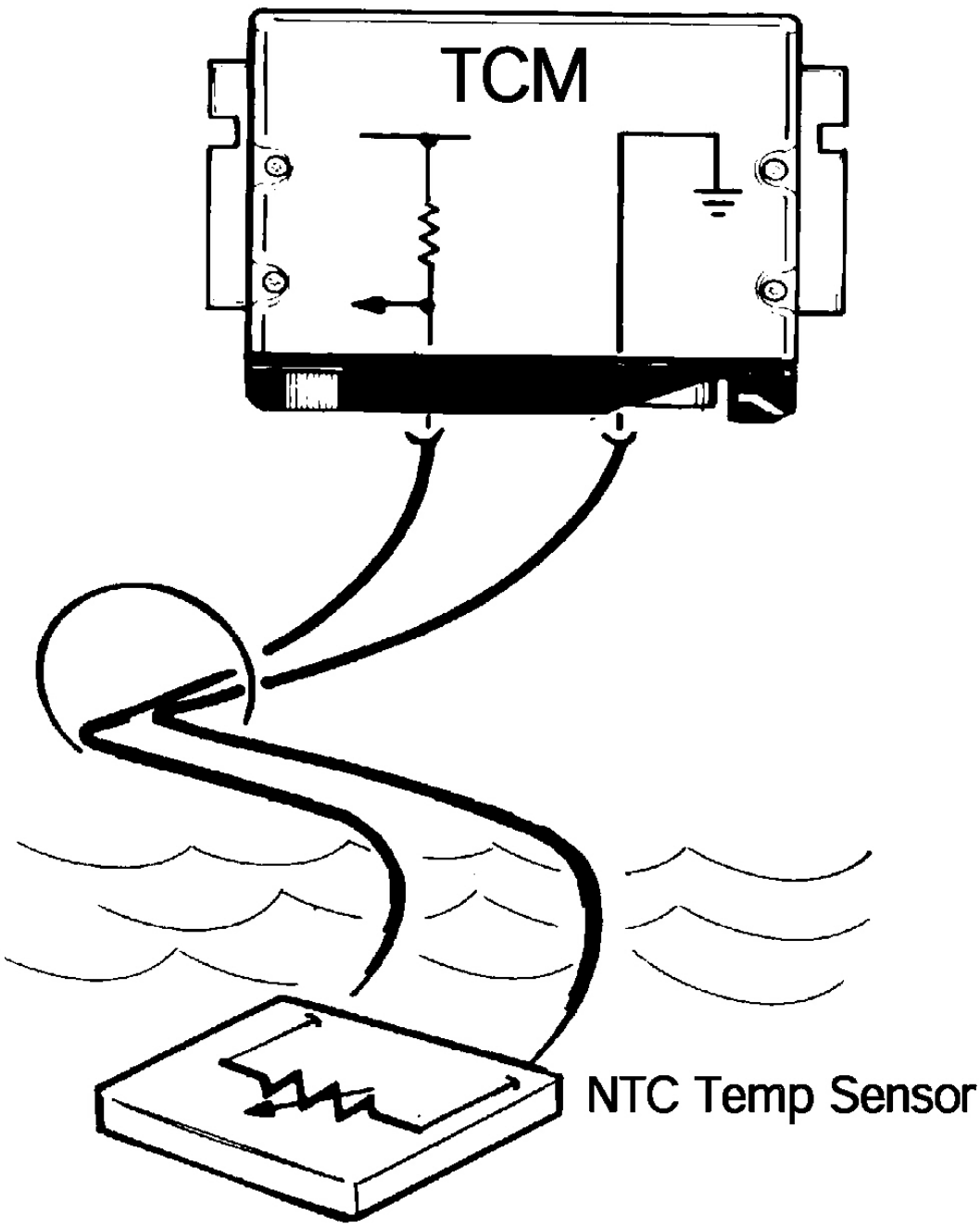


Fig. 12: Transmission Oil Temperature Sensor Is Connected To TCM
Courtesy of BMW OF NORTH AMERICA, INC.

The transmission oil temperature sensor is connected to the TCM via a 5 Volt reference and a circuit ground. As transmission oil temperature increases, the circuit resistance and voltage decrease proportionately.

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Kickdown Switch

The TCM receives a kickdown request via one of two possible methods:

- The kickdown signal is a direct ground input to the TCM. The kickdown input is provided by a kickdown switch located under the accelerator pedal. This method is used on most BMW vehicles without electronic throttle control systems (except M52TU with MDK).

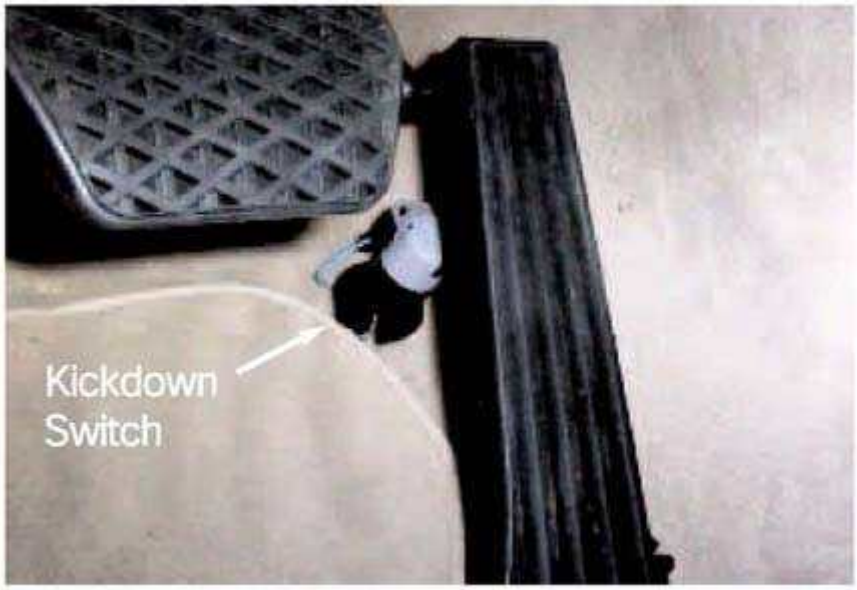


Fig. 13: Identifying Kickdown Switch
Courtesy of BMW OF NORTH AMERICA, INC.

- The kickdown request is provided by the ECM (DME) via the CAN bus. The kick down request originates from the PWG. There is no separate switch in the PWG. When the PWG voltage reaches approximately 4.5 volts, the ECM will process a kickdown request to the TCM via CAN. The PWG contains a kickdown detent to simulate the feel of a kickdown switch.

  This method is used on the M62TU, M54, M73, M73TU, N73 and N62 engines.

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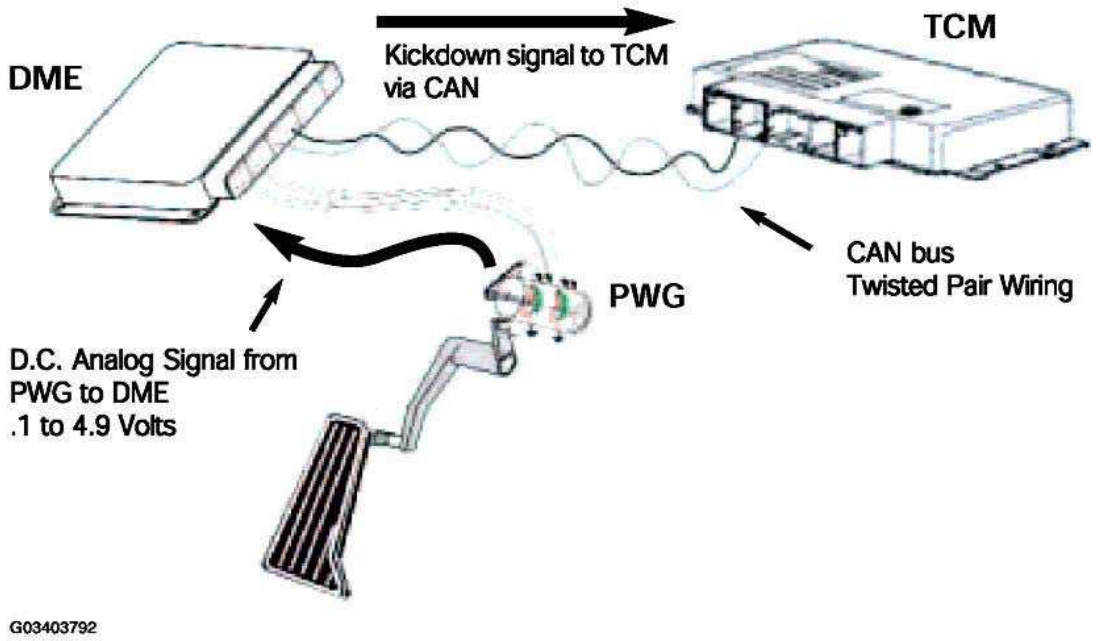


Fig. 14: Identifying Kickdown Signal Is A Direct Ground Input To
Courtesy of BMW OF NORTH AMERICA, INC.

Brake Switch

The brake switch is located on the brake pedal linkage. The brake switch signal is an input to the TCM which is used for:

- De-activation of the shift lock solenoid. When the ignition key is turned to KL15 the shift lock is active. The shift lock solenoid is de-activated when the brakes are applied.
- De-activate the Torque Converter. The TCC is deactivated whenever the brake is applied. (only on Hydramatic Transmissions).

There are two types of brake switches used on BMW vehicles:

- On early vehicles such as E32, E34, E36, E24, E28 and E31 the brake switch is a double-contact mechanical switch. There is a brake light circuit and a brake test circuit. The brake test circuit is used for a plausibility check to indicate faults within the brake light circuit.
- On the E38, E39, E46, E65/66, E85 and E53 the brake switch is a hall effect type switch. The electronic switch is also monitored for faults and plausibility.

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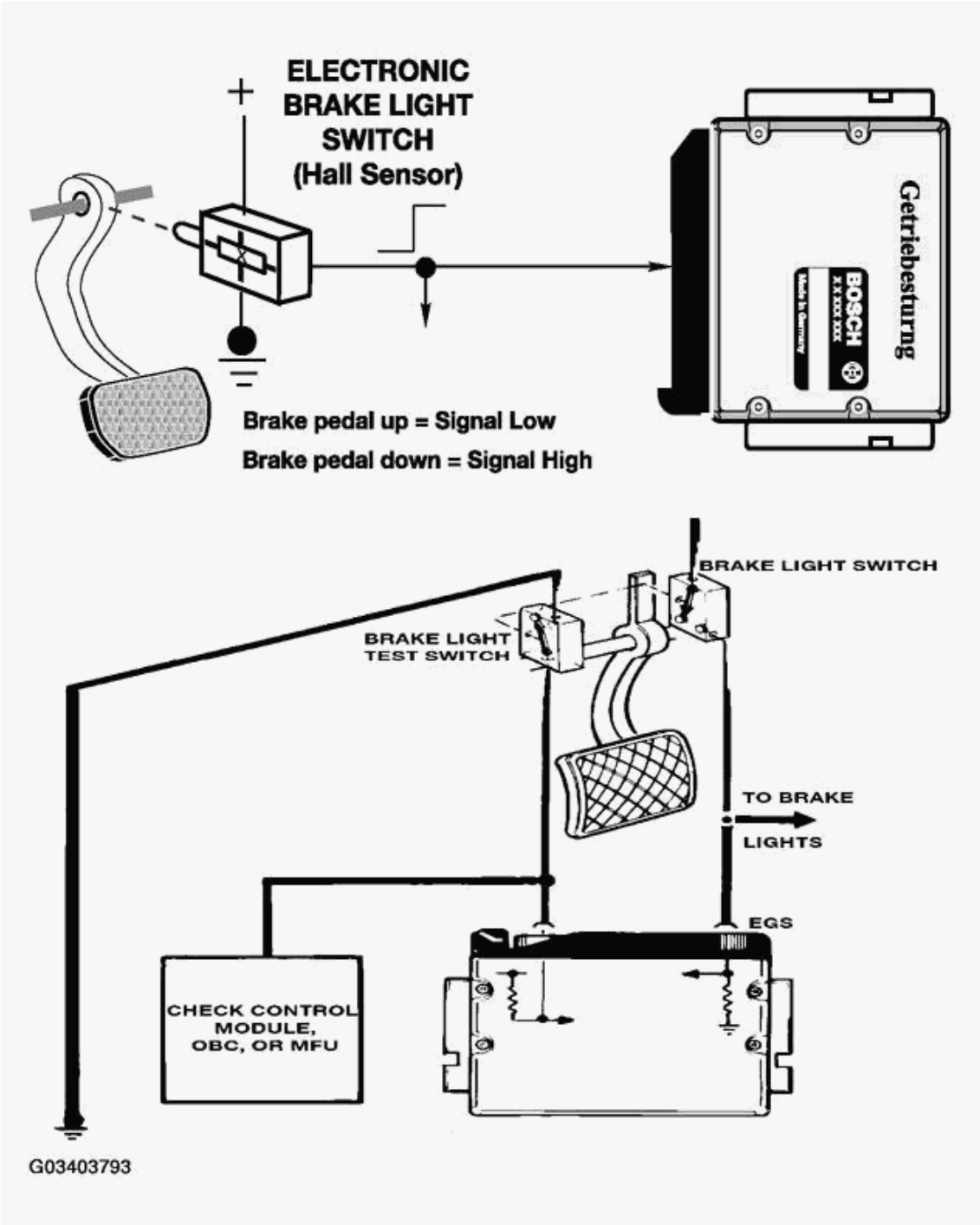


Fig. 15: Identifying Brake Switch Signal Is An Input To TCM
Courtesy of BMW OF NORTH AMERICA, INC.

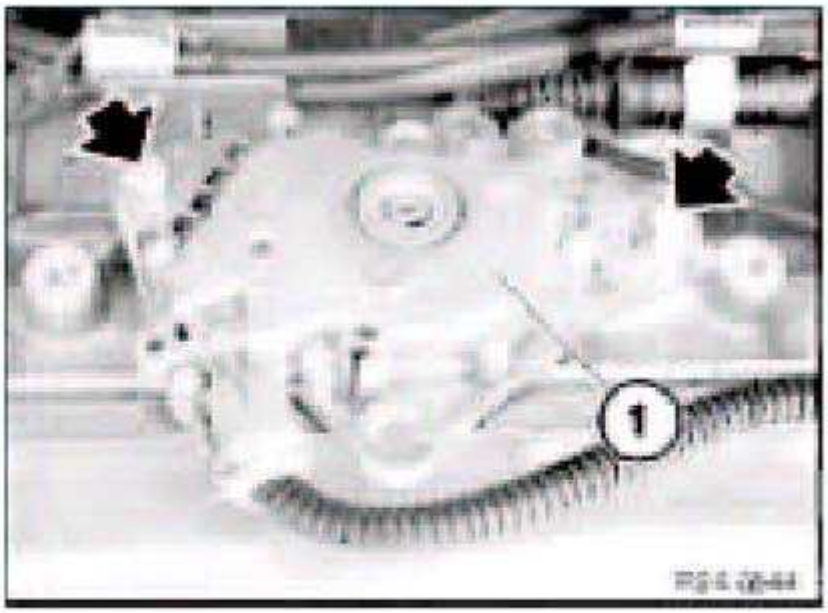
Transmission Range Selector Switch

The range selector switch is an input to the TCM. The input is used by the TCM to determine the position of the manual valve. The range switch uses the familiar "coded input" signal to determine selector lever position. On all transmissions except the A5S360/390R, the range switch uses a 4 wire configuration to determine 7 range

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selector positions. The A5S360/390R uses a five wire arrangement.

Most range switches are located on the transmission case with some exceptions. The E36 with the A4S270/310R the range switch is located is the center console on the selector lever assembly. The E39 with A4S270R the range switch is located on the transmission case and is adjustable. The range selector switch on the A5S360/390R is located inside the transmission housing. GA6HP26Z is part of the Mechatronics Module.



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Fig. 16: Identifying Transmission Range Selector Switch
Courtesy of BMW OF NORTH AMERICA, INC.

The range switch can be checked by using "Status Requests" in the DISplus or GT-1.

A multimeter or an oscilloscope can also be used to check the range switch. If the reading on "Status Requests" does not match the actual selector lever position, there will be various transmission malfunctions.

Use the switch logic chart to diagnose faults in the switch.

In the example below, the range switch is in neutral. Using the logic chart, switches L1, L2 and L3 are closed providing B+ voltage to the corresponding pins of the TCM. Switch L4 is open and no voltage is sent to the TCM. Malfunctions in the range switch or wiring can cause various shifting complaints and possible No-Start complaints.

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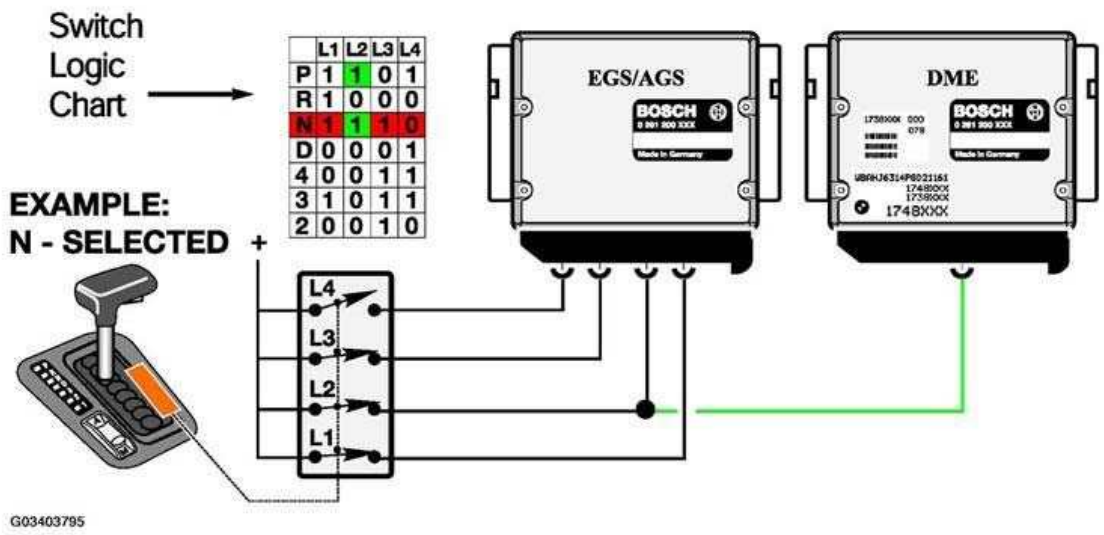


Fig. 17: Identifying Transmission Range Selector Switch Logic Chart
Courtesy of BMW OF NORTH AMERICA, INC.

Transmission Program Switch

The transmission program switch is used to switch between various operating modes of the transmission. The normal default mode of the TCM is Economy which is indicated in the program display as "E". Economy mode allows the transmission to operate in the most efficient mode. Shift priorities are for maximum economy and shift comfort. On some vehicles the program switch is designated "A" for economy mode. Program switches come in 2 or 3 position configurations. Early vehicles with the 4HP (Early E7) used a rotary program switch.

The TCM can also be switched to "Manual Mode" which on some vehicles is designated "Winter Mode". Manual mode is used to start the vehicle off in a higher gear when encountering slippery conditions. The program display will indicate "M" (manual) or an asterisk symbol for "Winter Mode".

Sport Mode is the third operating mode that is available. Sport mode allows for a slightly delayed and more aggressive shift. Sport mode is obtained a number of ways. On vehicles with 2 position program switches, moving the selector lever out of drive to 4, 3, or 2 with the program switch in Economy will allow Sport mode. On vehicles with 3 position program switches, Sport mode can be obtained by switching to "S".

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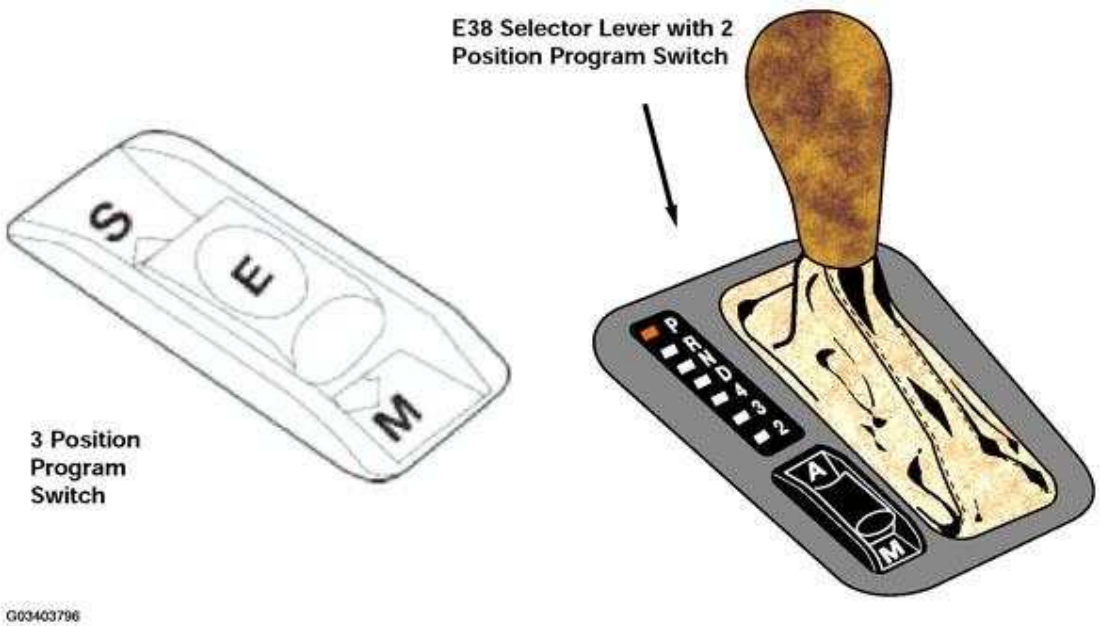


Fig. 18: Identifying Transmission Program Switch
Courtesy of BMW OF NORTH AMERICA, INC.

Steptronic Components

The Steptronic system uses additional components not found on a conventional system. These components consist of a manual switch and an Up/Down microswitch. Otherwise, the Steptronic system uses the same transmission and TCM.

The TCM monitors the Steptronic shifter position from P through D via the conventional range selector switch located on the transmission. The Range Selector Switch provides positions P through D to the TCM because the automatic gate of the shifter only travels through these positions.

When the Steptronic Shifter is moved to the left 15 degrees into the manual gate, the TCM receives a ground input from the manual gate switch. The ground signal is provided to the TCM through the Transmission Position Indicator. The transmission position indicator also provides range position signaling to the range position indicator in the shift console.

Steptronic was introduced on the E31 850Ci (10/94) and the 840Ci (1/96). Steptronic was subsequently introduced into the E38, E39, E46, E36/7 and the E53.

The Steptronic system can be diagnosed through "Status Requests" with the DISplus or GT-1.

From 2002 model year the Steptronic shifter has changed slightly. Downshifts are now achieved by moving the selector lever forward and upshifts are now rearward.

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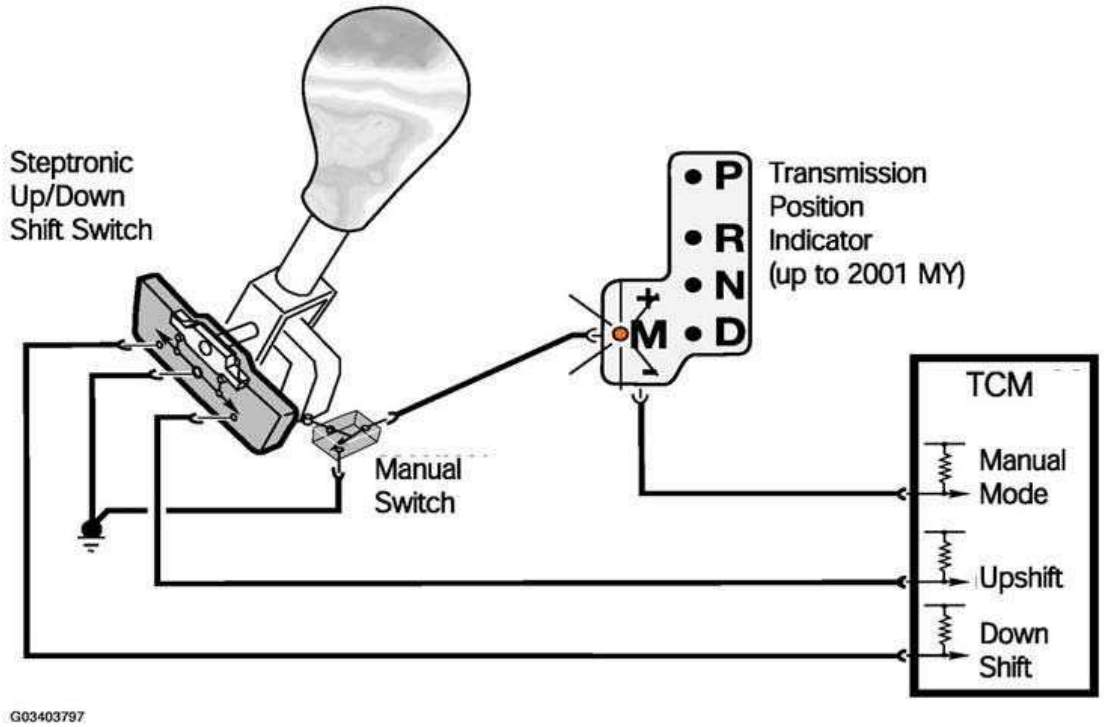


Fig. 19: Identifying Steptronic Components
Courtesy of BMW OF NORTH AMERICA, INC.

Magnetic Valves

Magnetic Valves (MV) are used to electronically control hydraulic fluid flow to the various shift elements within the transmission. Magnetic valves are located on the valvebody and replaceable as separate components. In ZF transmissions, MV valves are designated MV1, MV2, MV3 etc. In Hydramatic transmissions, they are designated Shift Valve A, Shift Valve B, Shift Valve C etc.

The magnetic valves are controlled by the TCM. They are supplied power by an internal TCM relay and are ground controlled. The TCM switches one or more of the MV's on or off in various combinations to achieve various shifts. Most transmission have 2 or 3 MV's to control shifting.

In addition to controlling shifts within the transmission, magnetic valves are also used for overlap shifting and pressure regulation on some transmission applications. For example MV4 and MV5 are used for overlap shifting in the A5S310Z. MV5 is used for pressure regulation on the 4HP22/24EH transmissions. When used for pressure regulation, the magnetic valves are pulse width modulated by the TCM.

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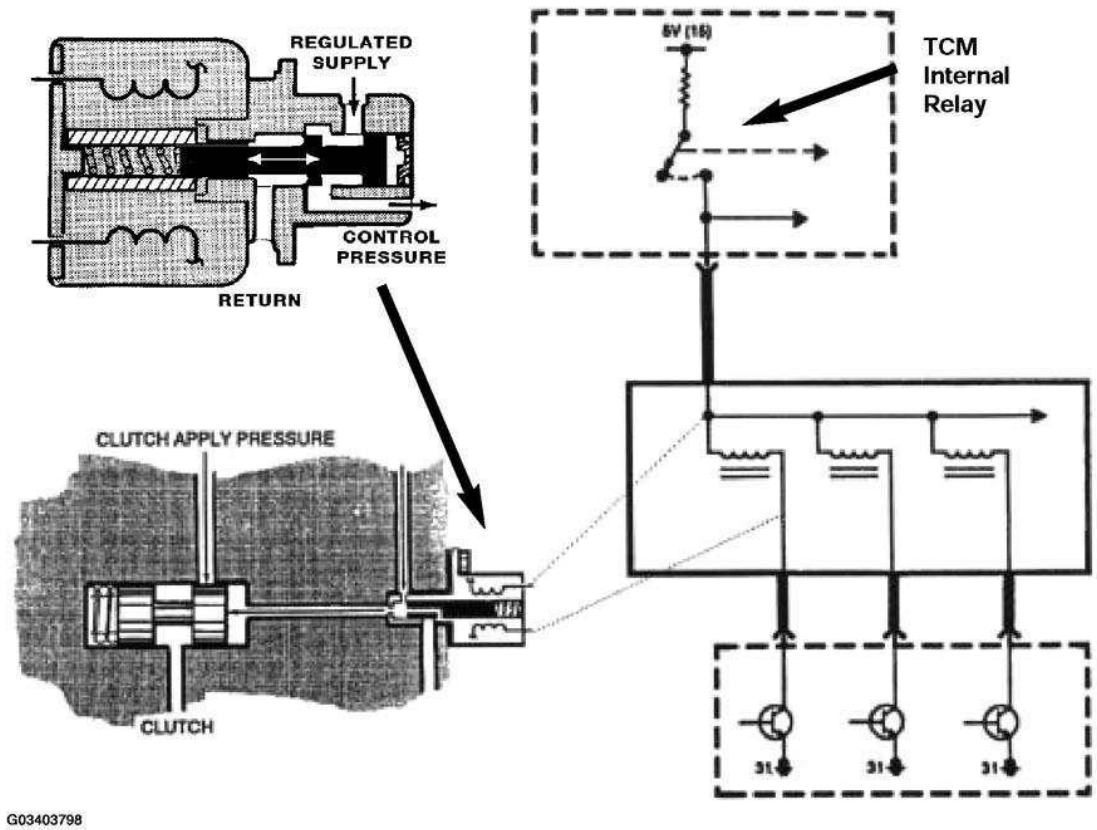


Fig. 20: Identifying Magnetic Valves Are Pulse Width Modulated By TCM
Courtesy of BMW OF NORTH AMERICA, INC.

Pressure Regulating Solenoids

Pressure Regulating Solenoids are used to modify line pressure for use in the transmission. There are numerous terms for these solenoids depending upon transmission type and manufacturer. ZF transmissions use the term EDS, while Hydramatic Transmissions use the term DR solenoid, Force Motor Solenoid and Variable Bleed Solenoid (VBS).

EDS valves are used for main line pressure regulation, TCC application and Overlap Shift Pressure Control on the A5S440Z and A5S560Z. All pressure regulating solenoid are controlled by Pulse Width Modulation.

Using the example in the picture below, this is a section of the A5S440Z/560Z valve body. The EDS valves are used for the following:

- EDS 1 is used for main line pressure regulation
- EDS 2, 3 and 5 are used Overlap Shift Pressure Control
- EDS 4 is used for TCC application. (GWK) Gradually applied TCC.

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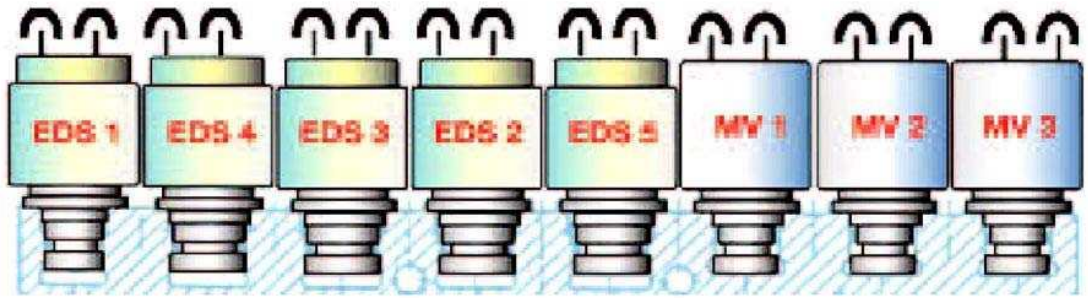


Fig. 21: Identifying Pressure Regulating Solenoids
Courtesy of BMW OF NORTH AMERICA, INC.

Hydramatic Pressure Regulator

The valve body shown at the right is from the A5S360/390R. Note the location of the main pressure regulator. Depending upon the reference text, the pressure regulator is also known as the Force Motor Solenoid, Variable Bleed Solenoid or PC Solenoid.

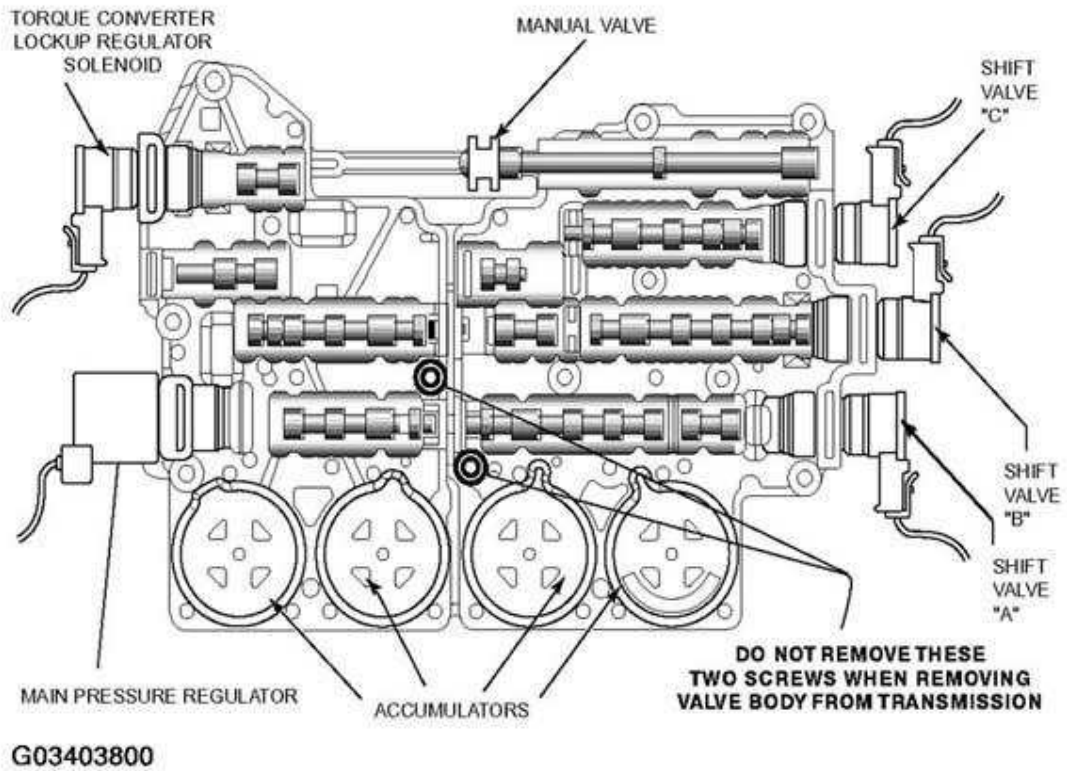
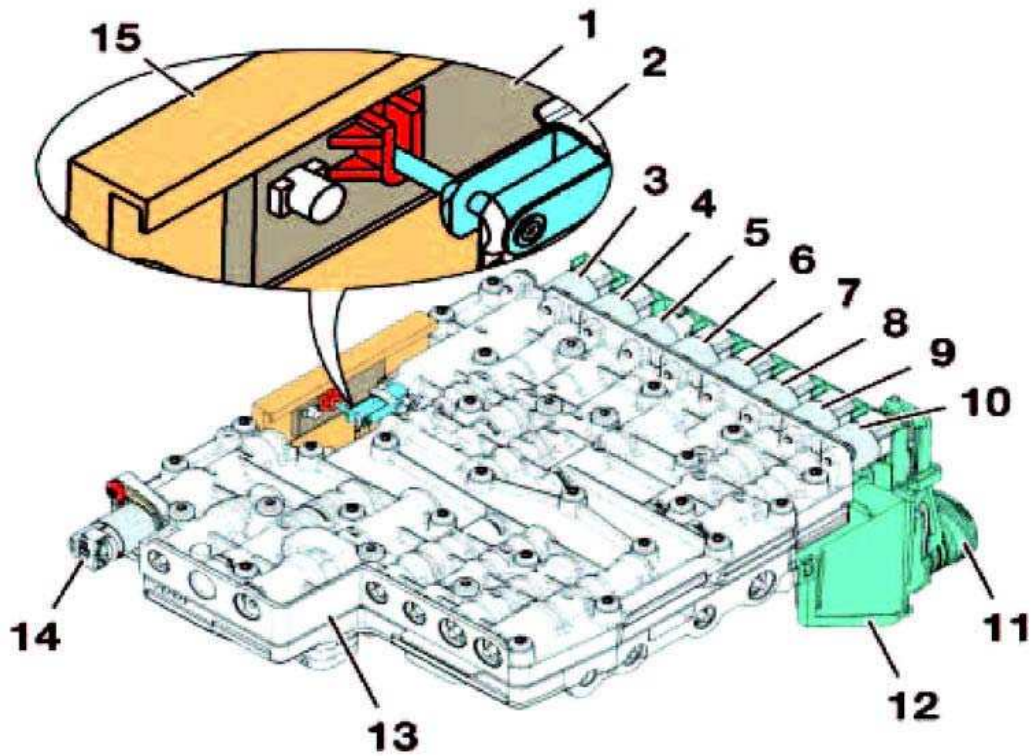


Fig. 22: Identifying Hydramatic Pressure Regulator
Courtesy of BMW OF NORTH AMERICA, INC.

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Mechatronics Module GA 6HP26Z



1	Position Slide Switch	9	EDS 2
2	Parking Lock Cylinder Piston	10	EDS 1
3	Solenoid Valve 3, parking lock Cylinder	11	Electronic Plug Connector
4	EDS	12	Electronic Module
5	Solenoid Valve 1	13	Hydraulic Module (Valve body)
6	EDS 4	14	Solenoid Valve 2
7	EDS 5	15	Position Switch
8	EDS 3		

G03403801

Fig. 23: Identifying Mechatronics Module GA 6HP26Z
Courtesy of BMW OF NORTH AMERICA, INC.

Instrument Cluster

The cluster is used to report information to the driver regarding transmission status. There are three items of information needed by the driver:

- **Transmission Range** - this indicates the position of the range selector lever. The driver needs to know whether the transmission is in P, R, N, D, 4, 3, or 2.
- **Transmission Program** - this indicates the mode of operation. There are 3 modes, Economy, Manual and

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Sport.

- **Transmission Fault Information** - the driver needs to know of there is a malfunction in the transmission. Depending upon application, transmission faults can be indicated by an icon or by a "Transmission Program" message in the instrument cluster display matrix.



Fig. 24: Identifying Instrument Cluster
Courtesy of BMW OF NORTH AMERICA, INC.

Depending upon vehicle model and transmission, these pieces of information arrive at the cluster through different methods.

- The most current method for this information to arrive at the cluster is through the CAN bus. The cluster processes this information from the TCM via CAN.
- On early E38 and E39 vehicles these is a "One Way Data Signal" from the TCM to the cluster. There is a one way serial data line that transfers this information to the cluster. On later vehicles, the cluster was introduced to the CAN bus and this method was no longer used. This was used on the E38 vehicles to 5/97 and E39 vehicles to 8/97 production.
- Early vehicles such as E32, E34, E36 etc. used a various combination of methods to transfer this data. Some clusters use the "Coded Input" method for the program indicator. Fault indication is done by a ground circuit through the TCM. Transmission range indication is achieved by a direct connection between the range switch and cluster or by a coded input to cluster.

There will be a FC6 in the Kombi when the TCM goes into fail-safe mode.

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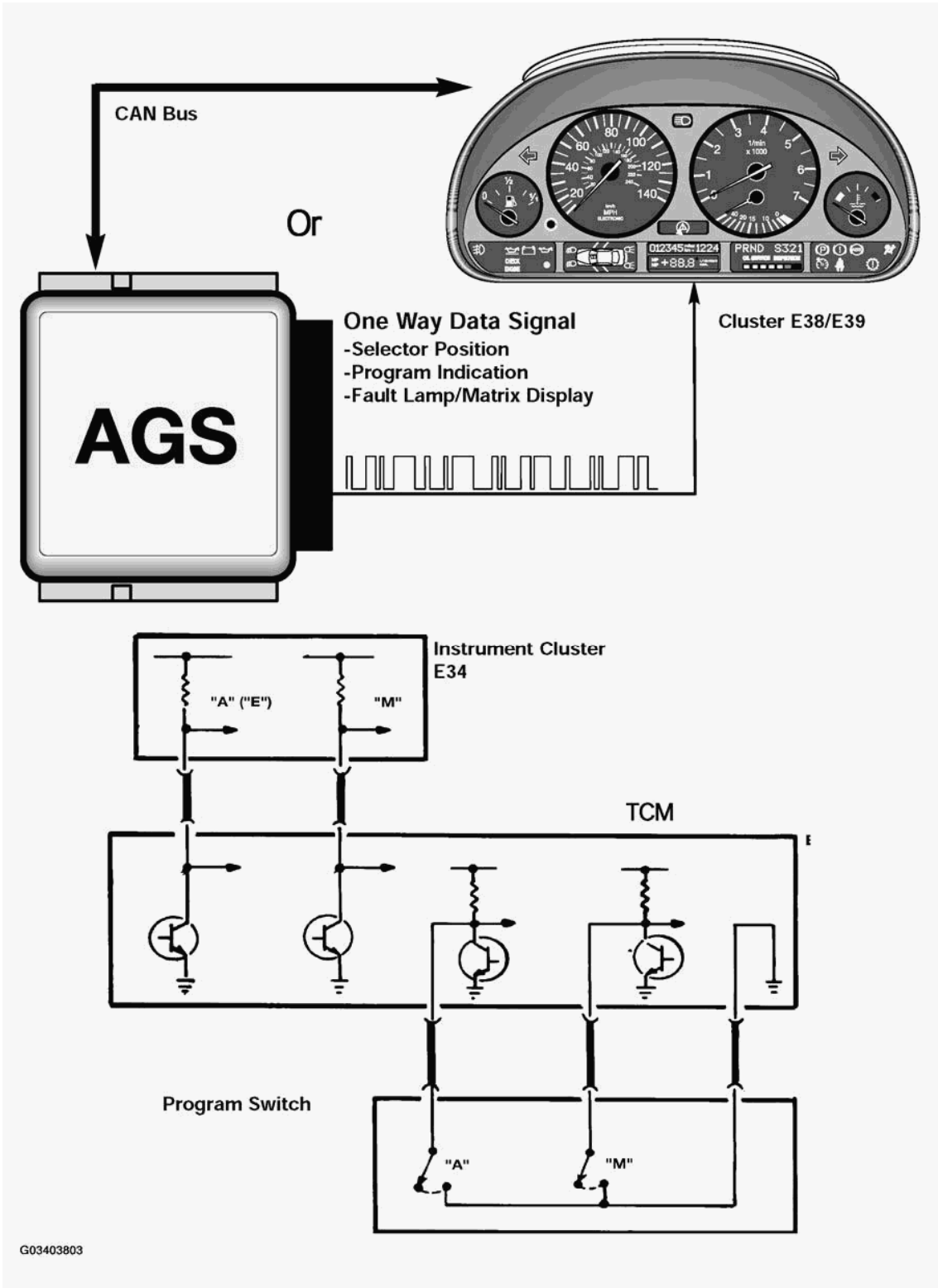


Fig. 25: Identifying Instrument Cluster Circuit
Courtesy of BMW OF NORTH AMERICA, INC.

TRANSMISSION FEATURES AND PRINCIPLES OF OPERATION

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Adaptive Hydraulic Pressure Control

Pressure adaptation has been a feature of ZF automatic transmissions since the 4HP22EH. The TCM will maximize shift quality by adapting to transmission wear over time. The TCM will adjust transmission shift pressures to compensate for wear in the multi-plate clutches. This is accomplished by monitoring the input and output speeds of the transmission. When the transmission shifts, the TCM monitors the time that it takes to accomplish the shift. The time change in gear ratio is monitored and compared to an internal time value in the TCM. If the ratio change takes more time than the stored value, the TCM will compensate by adjusting the transmission shift pressures via the EDS valve solenoids. The adaptation value is stored in the TCM. This adaptation values can only be cleared by the diagnostic tester (DIS plus or GT-1).

NOTE: DO NOT clear adaptation values unless directed to do so by technical assistance. Clearing pressure adaptations should not be done to resolve a customer complaint. The only time that you would need to do so is after a transmission or valve body replacement or software change.
Also it is important not to confuse pressure adaptation with AGS features. AGS features will be discussed later in this chapter. AGS features are not stored on a long term basis and will not be cleared when the pressure adaptations are cleared. Driving style is NOT stored.

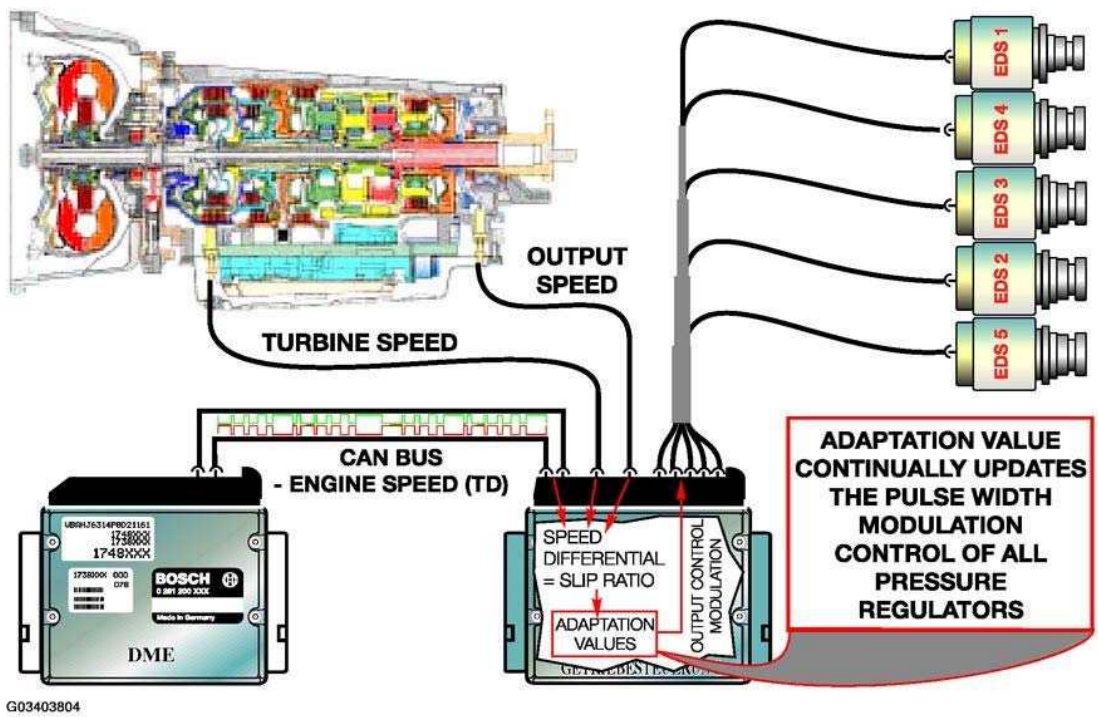


Fig. 26: Identifying Adaptive Hydraulic Pressure Control
Courtesy of BMW OF NORTH AMERICA, INC.

Downshift Protection

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Downshift protection is a feature that prevents unwanted or improper downshifting. If the range selector were moved to a lower gear at a high road speed, engine damage could occur from an unintended over-rev. This feature will prevent engine over-rev by delaying or preventing the unwanted downshift until the proper road speed is achieved. The result is increased safety by preventing unwanted deceleration slip.

Reverse Lockout

The TCM will lockout reverse above 3 MPH to prevent drivetrain damage. The range selector lever will go into the reverse detent, but reverse will not engage. This is achieved by the TCM through hydraulic intervention. The transmission will appear to be in neutral.

NOTE: Reverse Lockout is not operative when in fail-safe.

Engine Warm Up Cycle

The transmission shift points are modified after cold start to raise engine RPM during shifting. This allows for a faster engine warm up and reduction of catalyst warm up time. The TCM uses the transmission oil temperature information to determine the implementation of this function.

The warm up phase program will be terminated if any of the following conditions exist:

- The vehicle exceeds 25 MPH or
- Transmission oil temperature exceeds 60 Degrees Celsius or
- A Maximum of three minutes is exceeded.

ASC/DSC Shift Intervention

During ASC/DSC regulation upshifts are inhibited to enhance the effectiveness of tractional control. Depending upon vehicle model, this action can take place via the CAN bus or a dedicated shift intervention signal wire. On later model vehicles where the ASC/DSC module is connected to the CAN bus, the shift intervention signal is sent to the TCM via CAN.

Torque Reduction

In order to allow a smoother shift and reduce load on the transmission, engine torque is reduced during shifting. This is accomplished by a signal that is sent from the TCM (EGS) to the ECM (DME) during shifting. The ECM will retard timing momentarily during the shift for a few milliseconds. This timing change is transparent to the driver. Depending upon application, the torque reduction signal is sent over a dedicated wire or a signal over the CAN bus.

Emergency Program

When a malfunction occurs within the transmission, the Emergency program (fail-safe mode) will be initiated. The Emergency Program will prevent unintended gear engagement and ensure driver safety. The following will occur during Fail-safe Operation:

- All shift solenoids are de-energized via TCM internal relay.

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- The pressure regulation solenoid is de-energized resulting in maximum line pressure.
- The Torque Converter Clutch is de-activated.
- The Reverse Lockout function is cancelled.
- Shift lock solenoid is de-energized.
- Fault indicators are active.

The fault indicator varies depending upon model, year and cluster type etc. High version instrument cluster will display a message in the matrix display. Vehicles with low version clusters will display a fault symbol in the cluster.

During fail-safe mode the transmission will be shifted into a higher gear to allow the vehicle to be driven to a service location. Depending upon application, the transmission will shift into 3rd or 4th gear (on a 4spd) and 4th or 5th gear (on a 5 spd). For example the A5S360R transmission will go into 5th gear when there is a malfunction and 4th when there is a power failure to the TCM. Since pressure regulation ceases, the shift to fail-safe mode will be abrupt or harsh, unless the transmission is already in the fail-safe gear.

On newer OBD II compliant vehicles, the MIL light will also be illuminated by the ECM (DME).

NOTE: When diagnosing transmission related complaints, it is possible to have an erroneous fault indicator warning. Faults in the cluster can cause a false indication or "Trans Program" message. One indication of this scenario would be a transmission fault message in the cluster with no transmission faults stored in the TCM.

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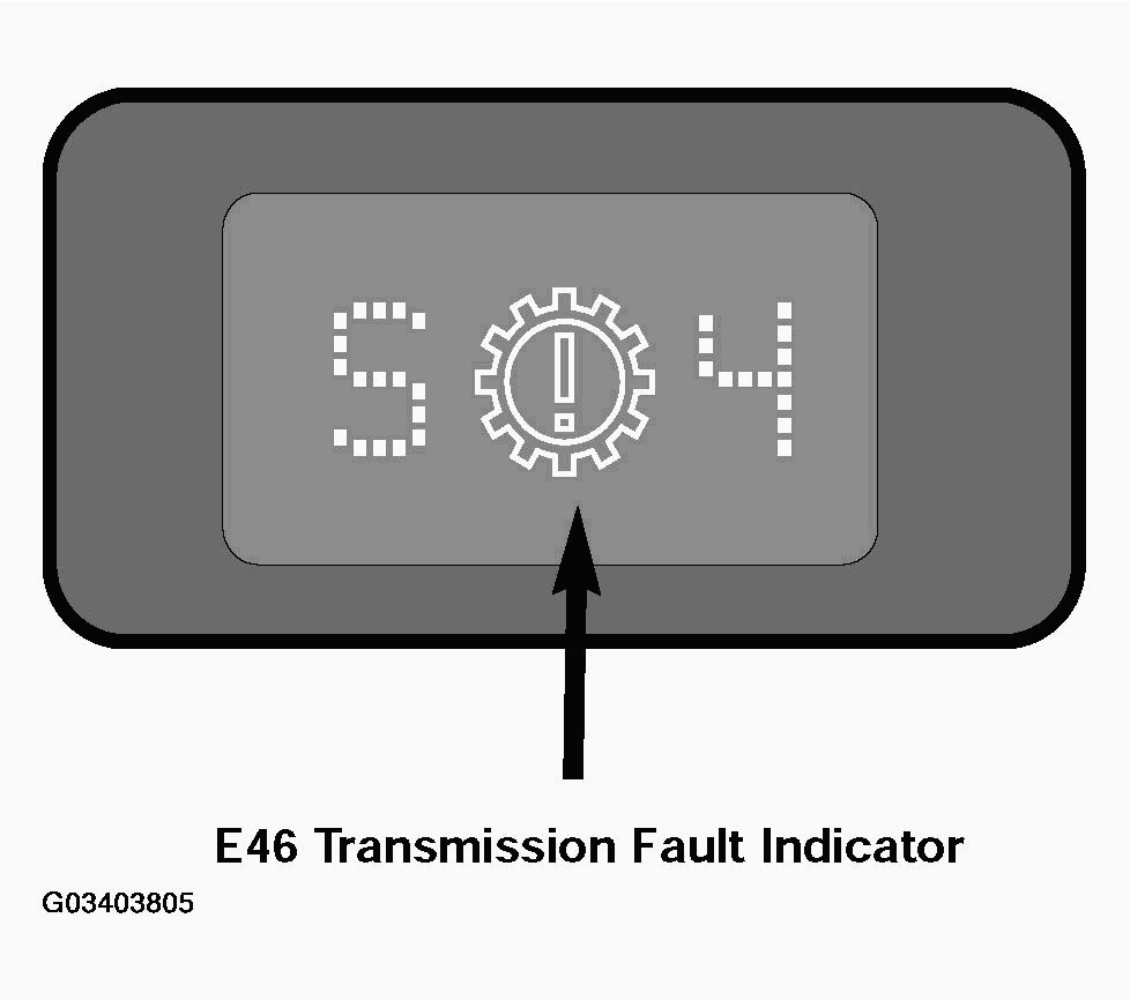


Fig. 27: Identifying E46 Transmission Fault Indicator
Courtesy of BMW OF NORTH AMERICA, INC.

AC Compressor Load Sensing (Hydramatic Transmissions)

When the AC Compressor is switched on, additional load is placed on the engine. To compensate for the additional load, the TCM modifies line pressure and shift points. On the THMR-1, the TCM receives these signals via a direct connection to the AC compressor control circuit.

On vehicles equipped with CAN bus technology, the "AC on" signal is sent to the TCM from the DME as a CAN bus message.

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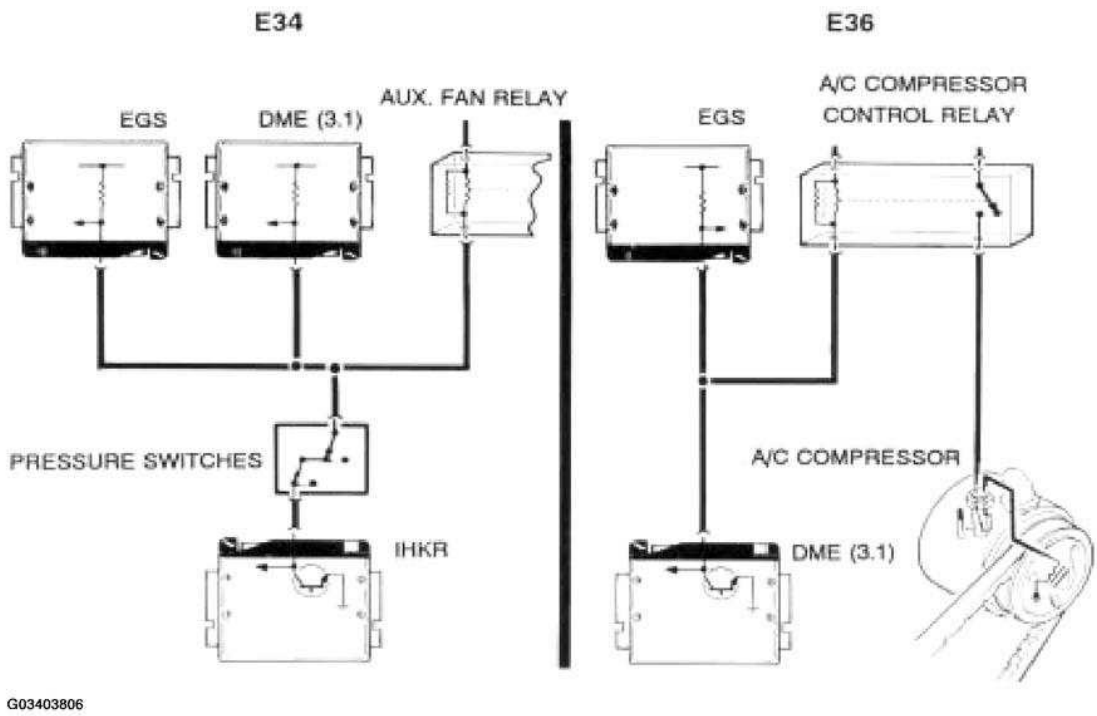


Fig. 28: Identifying AC Compressor Load Sensing (Hydramatic Transmissions)
Courtesy of BMW OF NORTH AMERICA, INC.

Shift Lock

The shift lock solenoid is mounted on the selector lever assembly and locks the selector lever in Park or Neutral when the ignition is ON. This prevent the selection of a gear unless the brake pedal is depressed. The solenoid is activated by a switched ground from the TCM. Power is supplied by the TCM internal relay. During fail-safe operation, the shift lock is disabled. On later models, the shift lock will also be active when the TD signal is present and the shifter will remain locked above an engine speed of 2500 RPM regardless of brake application.

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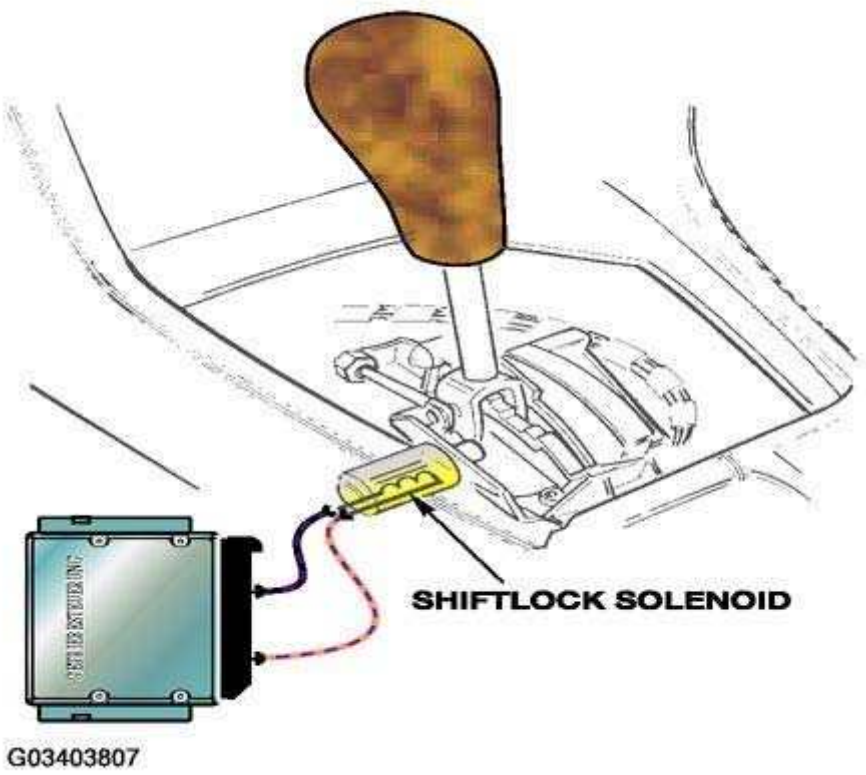


Fig. 29: Identifying Shift Lock Solenoid
Courtesy of BMW OF NORTH AMERICA, INC.

Torque Converter Clutch

Since the efficiency of the torque converter at coupling speed is approximately 1.1 to 1, fuel economy is compromised. To offset this a torque converter clutch was added on EH controlled transmissions. The torque converter clutch locks the turbine to the converter housing. This creates a mechanical coupling with a ratio of 1:1. This can only be achieved at higher engine speeds, the torque converter clutch must be disengaged at low engine speeds to prevent stalling.

There are two methods for controlling the torque converter clutch on BMW transmissions:

- **A4S310/270R, 4HP22/24 EH, A5S310Z** - These transmissions use an on/off control method to lock and unlock the torque converter. The Torque Converter Clutch is either completely engaged or disengaged. This method of engagement provides an abrupt sensation when the TCC is locking and unlocking. This abrupt sensation can be undesirable to some drivers.
- **A5S560Z, A5S440Z, A5S325Z, GA6HP26Z, A5S360/390R** - These transmissions use a gradual approach to TCC control. The TCC is gradually applied and released, this method reduces the abrupt feel of the on/off type TCC. The TCC solenoid is controlled by pulse width modulation. This allows fluid to be gradually introduced and released to the TCC.

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The TCC is spring loaded to the engaged position. Pressurized fluid releases the TCC, when the pressurized fluid is released, the TCC is engaged. Depending on transmission application, the TCC can be engaged in 3rd, 4th or 5th gear. The TCC must be disengaged at low speeds to prevent stalling.

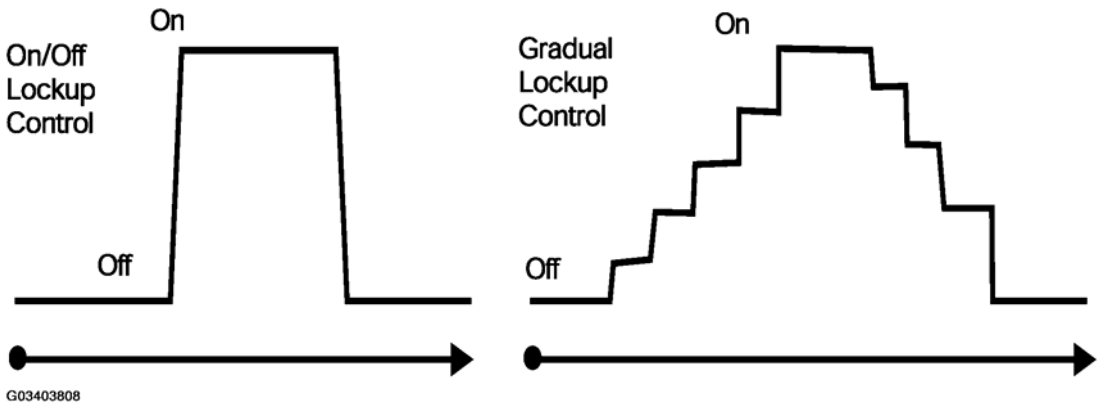


Fig. 30: Identifying Two Methods For Controlling Torque Converter Clutch On BMW Transmissions
Courtesy of BMW OF NORTH AMERICA, INC.

Lock-Up Torque Converter

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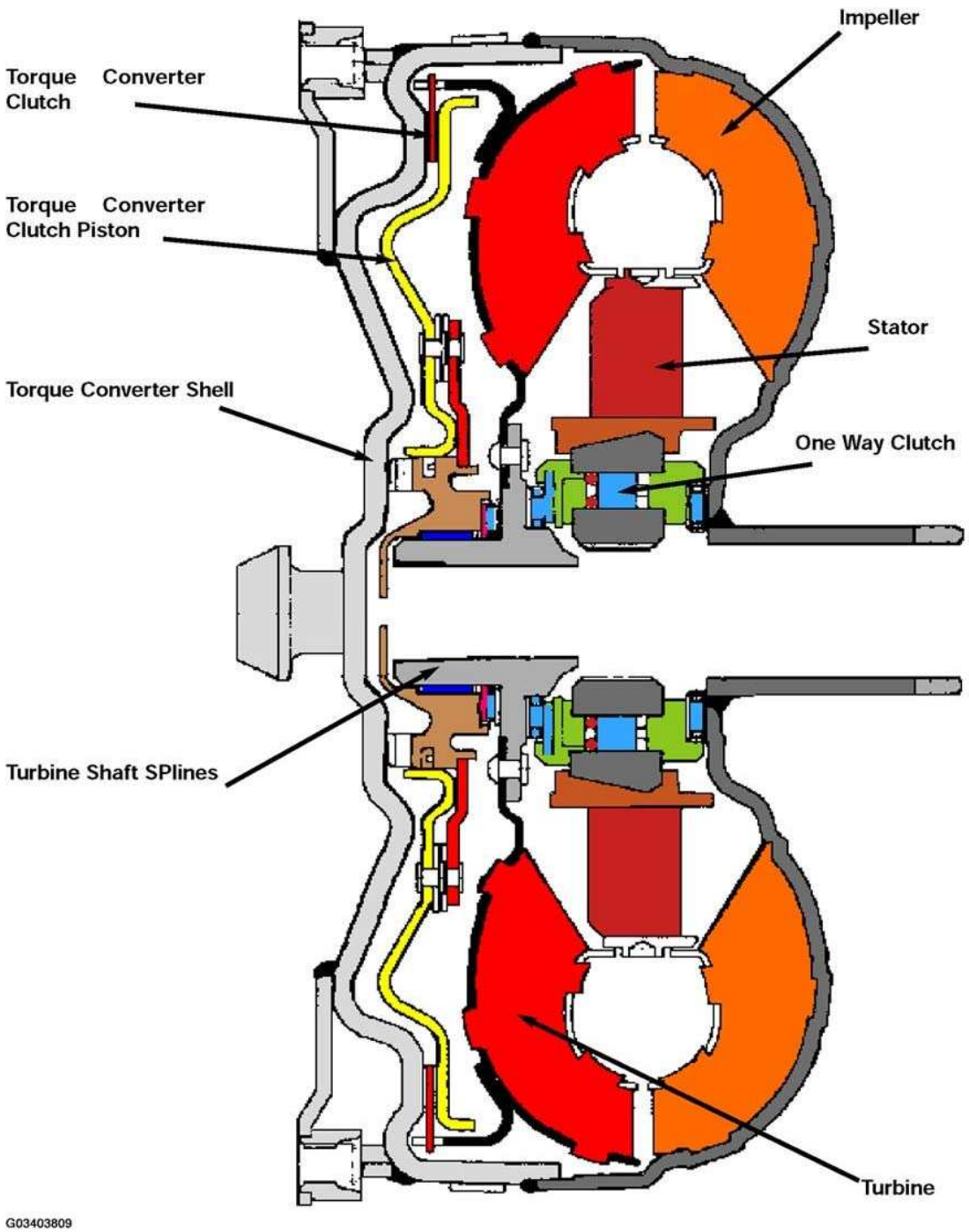


Fig. 31: Identifying Cross Section View Of Lock-Up Torque Converter
Courtesy of BMW OF NORTH AMERICA, INC.

Shift Solenoid Control

Magnetic valves are used to direct the flow of transmission fluid to control shift elements in the transmission. Another Term for "Magnetic Valve" is "Shift Valve". Magnetic valves (MV) are solenoids controlled by the

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TCM. They can be switched by B+ or B-.

On ZF transmissions, magnetic valves are designated MV1, MV2, MV3 etc. On GM transmissions they are designated Shift Valve A, Shift Valve B, Shift Valve C etc.

Either valve can be checked for proper resistance using a multi-meter, DISplus or GT-1. Also, the "Activate Components" function can be used to check the Magnetic valves. Most all magnetic valves are switched on/off instead of Pulse Width Modulation (PWM).

All magnetic valves (except THM R-1 to 12/95) are supplied power from an internal relay located in the TCM. The magnetic valves are switched on and off by final stage transistors in the TCM. During fail-safe operation, power to all MV's is switched off by the internal relay.

Magnetic valves are located on the valve body. They can be replaced individually.

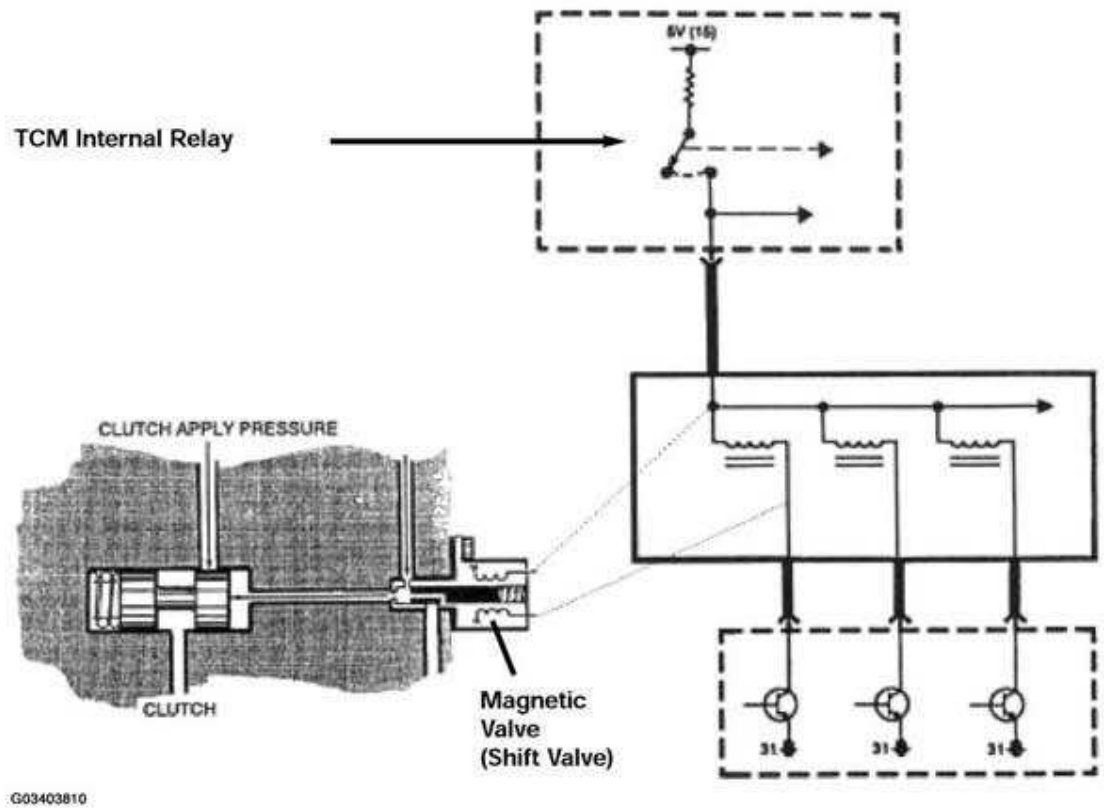


Fig. 32: Identifying Shift Solenoid Control Circuit Diagram
Courtesy of BMW OF NORTH AMERICA, INC.

Pressure Regulation

Pressure regulating solenoids modify line pressure for hydraulic operation. Solenoids for pressure regulation are referred to as EDS valves in ZF transmissions. GM transmissions have a few terms such as Force Motor Solenoid, Variable Bleed Solenoid, and DR solenoid. Regardless of the name used, they are all used to control

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main line pressure based on throttle position and engine load.

On ZF transmissions, EDS valves are also used to control "Overlap Shifting". This allows for improved shift comfort by controlling pressures during shifting.

Depending upon transmission application, pressure regulating solenoids can be controlled using Pulse Width Modulation on B+ or B-.

The TCM will increase line pressure by regulating current flow to the pressure regulator. Current flow is controlled by pulse width modulation. When the duty cycle is low, the current flow to the solenoid is low. This allows spring pressure to close the valve. Therefore maximum line pressure is achieved. As the duty cycle increases, the current flow also increases. The valve opening increases, which allows pressure to be released through the pressure discharge which in turn decreases line pressure.

Main line pressure is also increased during fail-safe operation and when needed during "Adaptive Hydraulic Pressure Control" functions. Mainline pressure will also default to maximum pressure when power to the TCM is switched off.

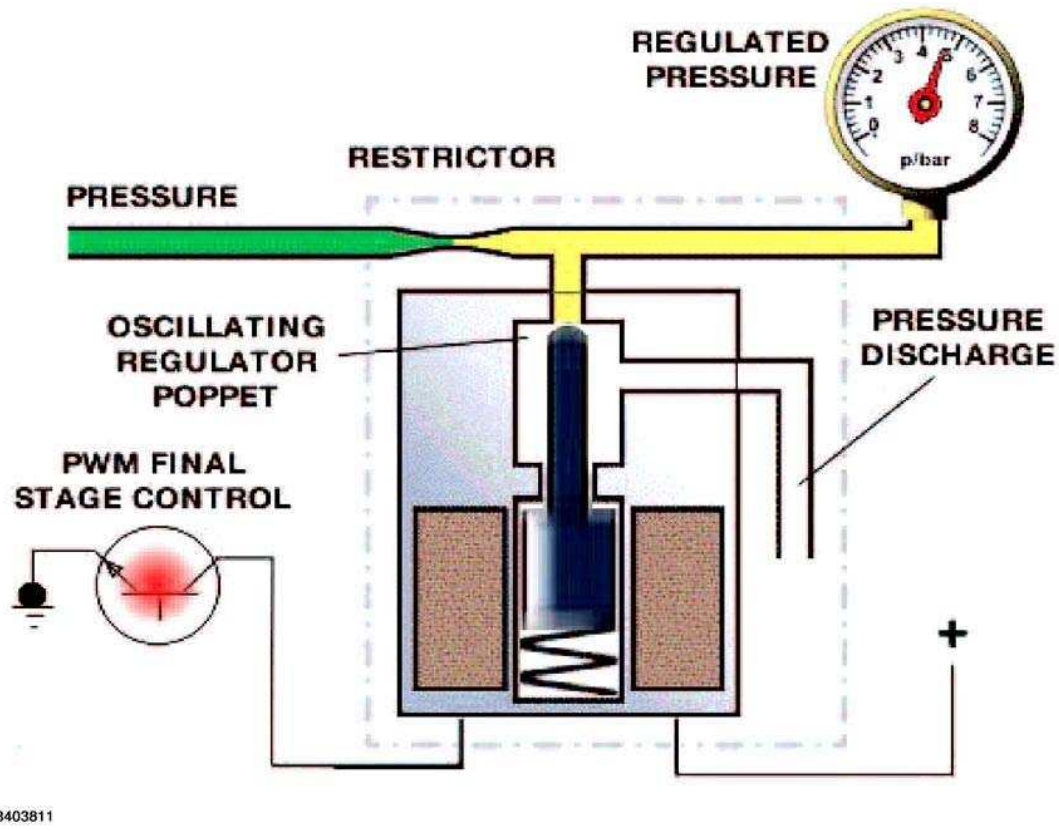


Fig. 33: Identifying Pressure Regulation
Courtesy of BMW OF NORTH AMERICA, INC.

Shift Programs

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BMW EH transmissions have selectable shift programs (or modes) to suit driver needs and operating conditions. There are 3 basic shift programs available:

- **Economy Program** - The economy program is the default program which is adopted every time the vehicle is started. When in economy mode, the operating priority is for maximum economy and shift comfort. Shifts will take place at low engine RPM and road speed. The economy mode is indicated by an **"A"** on the program switch. The cluster will display an **"E"** to indicate economy mode.
- **Manual Mode (Winter Mode)** - Manual mode is used to start out the vehicle in a higher gear on slippery surfaces when more traction is needed. A higher gear will reduce torque to the rear wheels. Manual mode can also be used to select a lower gear when needed such as when climbing a hill. Depending upon vehicle application an **"M"** will appear in the cluster when in Manual Mode or an asterisk (*) symbol will appear in the instrument cluster to indicate Winter Mode.
- **Sport Mode** - Sport Mode provides raised shift points and a more aggressive shift program for the "Enthusiastic" BMW driver. The cluster will display an "S" when in sport mode.

Regardless of vehicle application, the program switch provides a momentary ground to the TCM to switch between modes. There have been numerous designs of the program switch since it's introduction. The program switch configurations are as follows:

- **2 Position Slide Switch** - This switch has the "A" and the "M" selection. Sport mode is achieved by moving the selector lever from "D" to 4, 3 or 2 when in the Economy Mode. The 2 Position slide switch is used on most models. These vehicles usually have a range and program display located in the instrument cluster.
- **2 Position Rocker Switch** - This switch operates the same as the slide switch, but it is used exclusively on the E36. The E36 does not have a program indicator in the cluster. The rocker switch will illuminate, indicating the current program.
- **3 Position Slide Switch** - This switch has the added position for sport mode. The shifter does not have to be moved out of drive (D) to be in sport mode. This switch is used on the E36 M3 and the 4HP22/24 EH (Version Late E-7).
- **3 Position Rotary Switch** - This switch is used only on the Early 4HP22 EH trans missions (Version Early E-7).
- **No Program Switch** - On some vehicles with AGS features, there is no program switch. Shift modes are obtained by moving the shift lever out of "D" range or automatically by adaptive shift functions. (Example E39)

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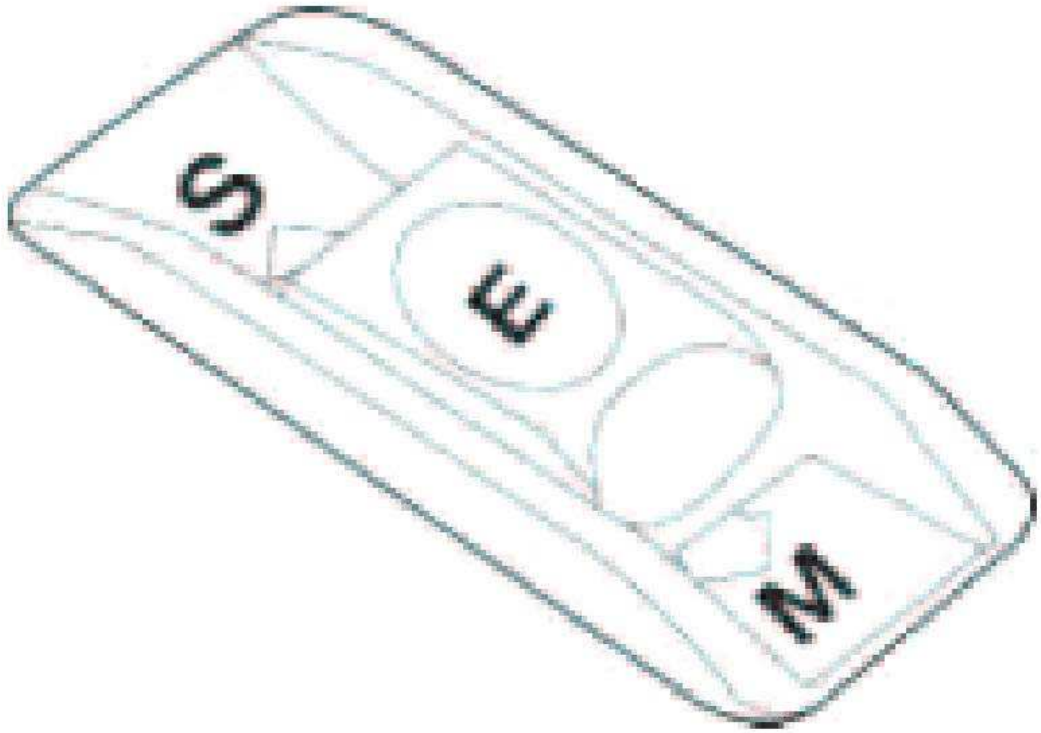


Fig. 34: Identifying 3 Position Program Switch
Courtesy of BMW OF NORTH AMERICA, INC.

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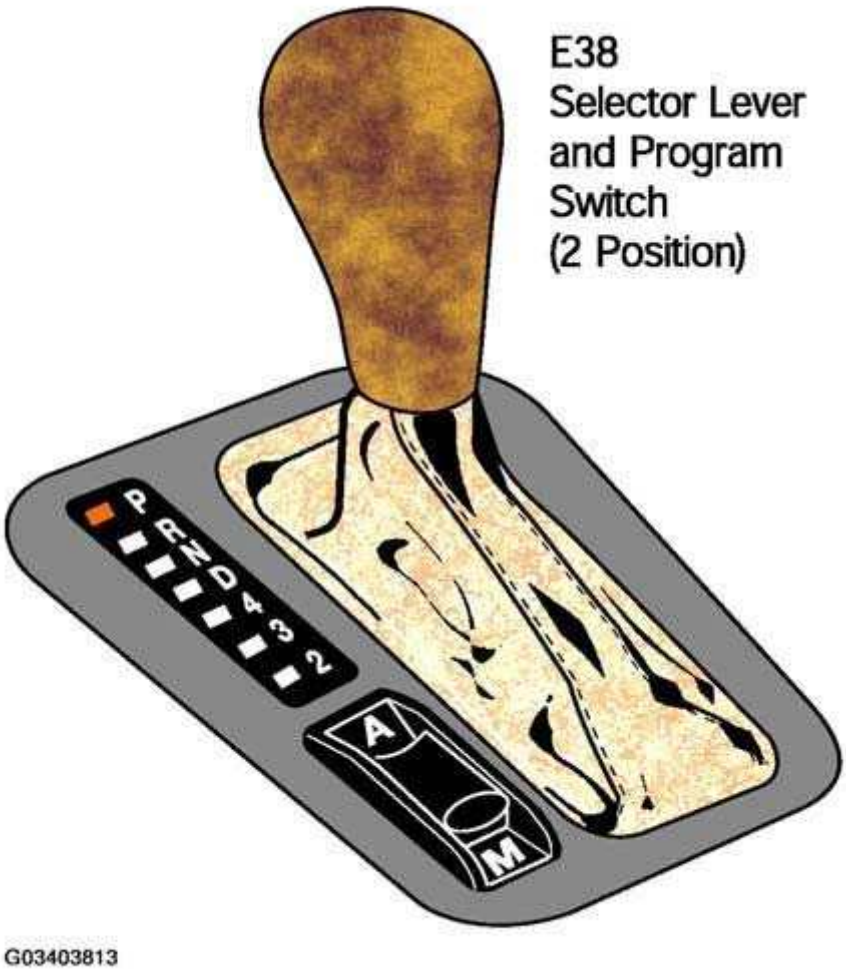


Fig. 35: Identifying E38 Selector Lever And Program Switch (2 Position)
Courtesy of BMW OF NORTH AMERICA, INC.

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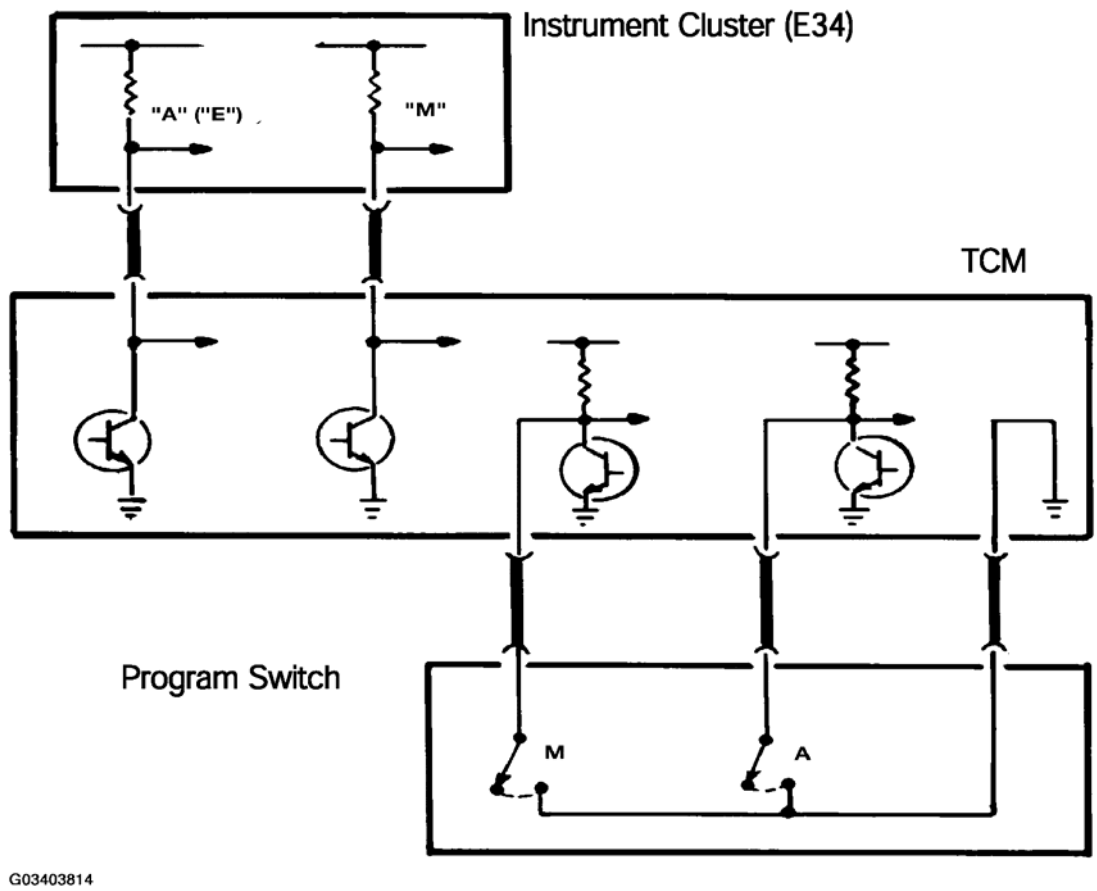


Fig. 36: Shift Programs Circuit
Courtesy of BMW OF NORTH AMERICA, INC.

Steptronic Shift Modes

The Steptronic shifting system was introduced to the BMW model line on the 95 E31 850Ci (from 10/94). Steptronic was subsequently added to other BMW models and is available on all BMW models with automatic transmissions. Other than a few additional components in the shifter mechanism, Steptronic equipped vehicles use the same transmission and TCM as non-Steptronic equipped vehicles.

Since the introduction of Steptronic, there have been several variations in Steptronic function. Regardless of version, the Steptronic system provides the driver with two modes of operation:

- To operate the transmission in fully automatic mode as with a non-Steptronic transmission.
- To operate the transmission in the manual shift mode by tilting the shift lever forward or backward when in the manual gate.

The Steptronic shift lever console contains and automatic and a manual shift gate. The automatic gate contains the gear lever positions P/R/N/D. When the lever is placed in "D" all of the shifting takes place based on the shift map programming in the TCM. To enter the manual gate the shift lever is moved 15 degrees to the left.

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Depending upon application, there are three possible configurations of the manual gate:

- On the E31 850Ci, the gate is marked as "M" only. There is a plus and minus sign for manual shifting. Upshifts are achieved by momentarily moving the shifter forward. Downshifts are achieved by moving the shifter rearward. When placing the shifter into the "M" gate, the transmission will adopt the current gear that is engaged. The transmission will stay in that gear until an upshift or down shift request is made.
- On all other vehicles until the 2002 model year, the gate is marked M/S. There is also a plus and minus sign for manual shifting. When placing the shifter into the M/S gate, the transmission will adopt Sport mode. All shifts will still be automatic. Full manual mode is achieved when an upshift or downshift request is made. Upshifts are achieved by moving the shifter forward momentarily and downshifts are achieved by moving the shifter rearward.
- On all models with Steptronic from 2002, the only change is to the manual shifting modes. In order to be consistent with SMG operation, the positions were reversed. Upshifts are now achieved by moving the shifter rearward and downshifts are now forward. Otherwise, Steptronic operation is identical to the previous models.

Automatic Functions In Manual Mode

When in manual mode there are certain functions which occur automatically to prevent drivetrain damage and improve driveability:

- **Engine Overspeed Prevention:** To prevent engine over-rev, the TCM will upshift automatically just prior to max engine cutoff.
- **Kickdown:** If plausible, the TCM will automatically shift down to the next lower when a kickdown request is received.
- **Decelerating:** If in 5th gear and coasting to a stop, the TCM will automatically down shift to 4th gear at approximately 31 mph and then 3rd gear at approximately 19 mph. The automatic downshift allows for an acceptable gear when re-accelerating. (6 cylinder models will shift to 2nd gear when stopping vehicle)
- **Implausible Gear Requests:** Certain shift requests are ignored by the TCM. For example, requesting a downshift at a high rate of speed would be ignored. Any shift request that would cause the engine to exceed the maximum RPM limit would not be allowed. Also starting out in a high gear is also not allowed. Only 1st, 2nd or third gear is allowed when accelerating from a stop.

E31 850Ci Shifter Console

1995 to 1997 Model Year.

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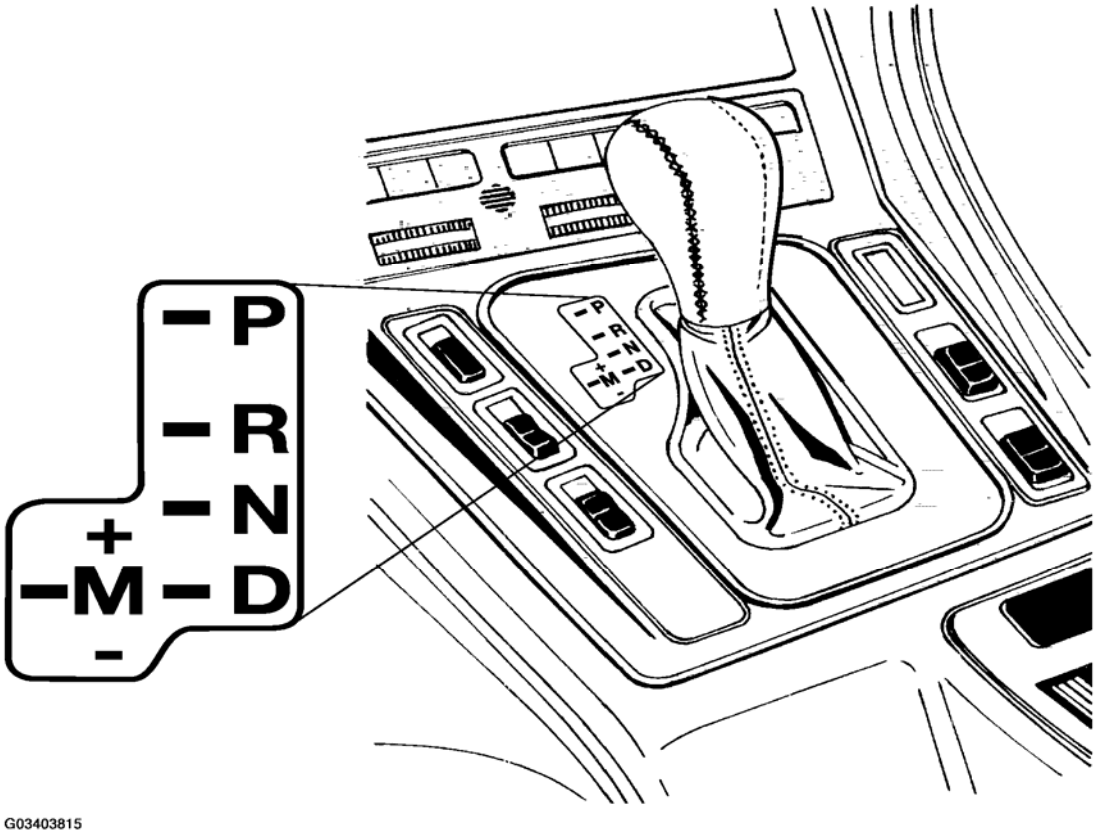


Fig. 37: Identifying E31 850Ci Shifter Console
Courtesy of BMW OF NORTH AMERICA, INC.

Steptronic Shifter Circuit

In order to achieve manual shifts with Steptronic, the selector lever is moved 15 degrees to the left. A pin on the selector lever engages the "up/down" microswitches which are a ground input to the TCM. The selector lever also triggers the "M" gate microswitch which is also a ground input to the TCM.

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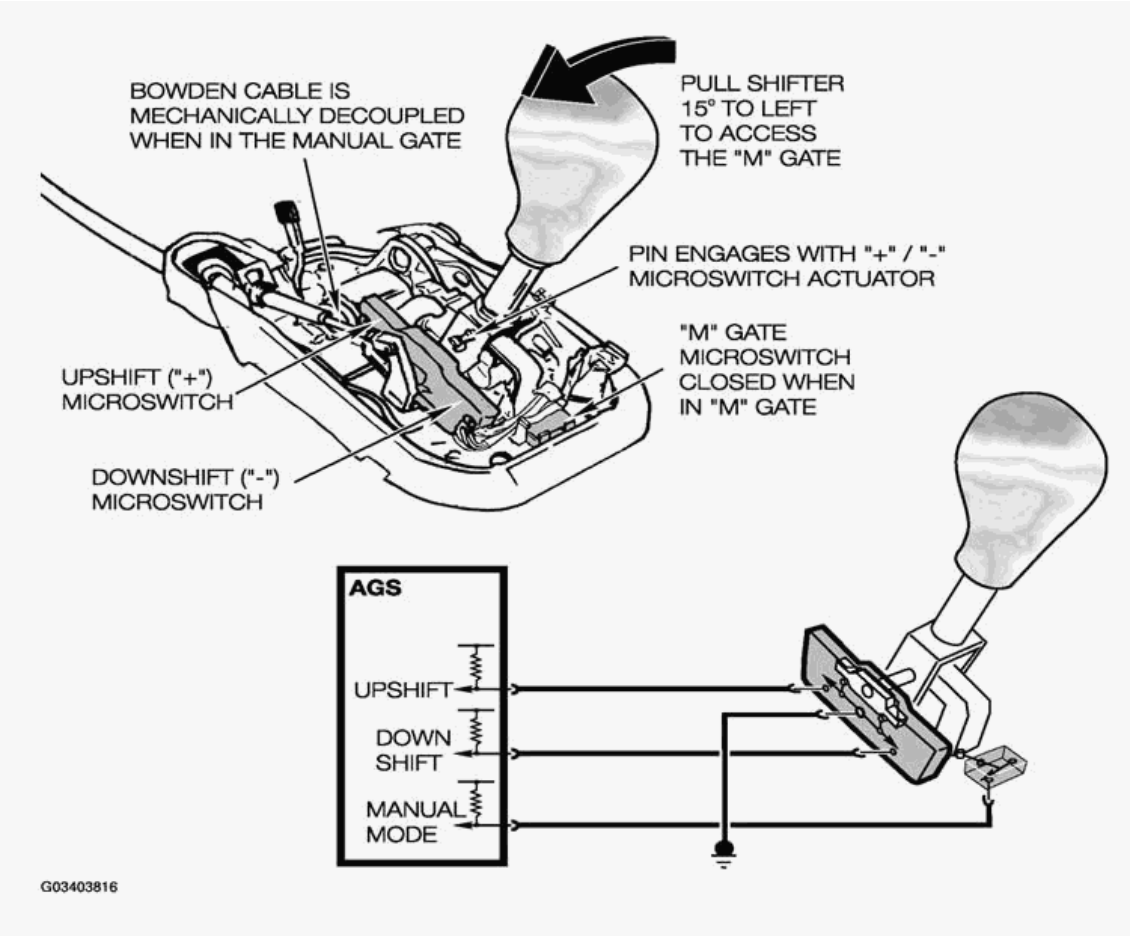


Fig. 38: Identifying Steptronic Shifter Circuit
Courtesy of BMW OF NORTH AMERICA, INC.

The example on the right shows a typical shift console for an E31. Note the shift pattern, upshifts are forward and downshifts are rearward. This shift pattern was used on vehicles up to the end of 2001 production. On vehicles from 2002 production, the shift pattern is reversed.

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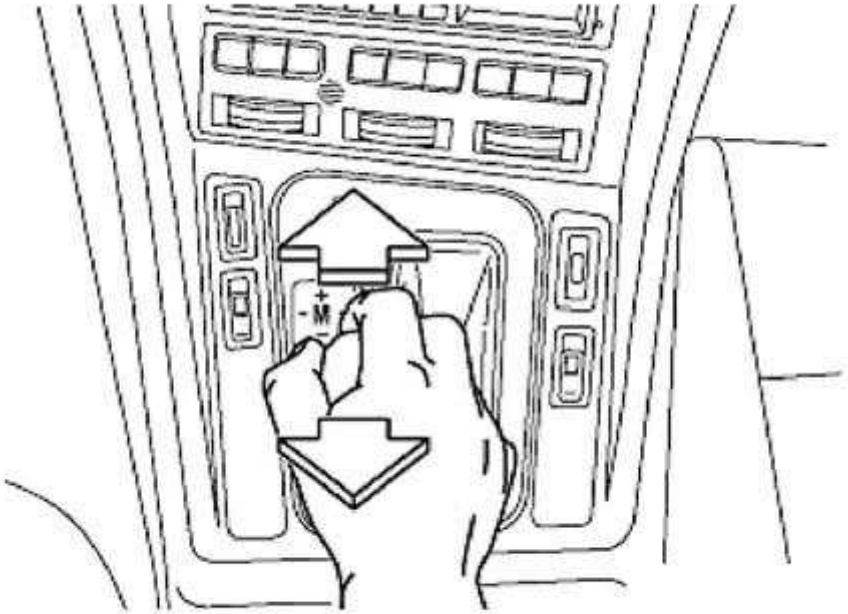


Fig. 39: Identifying Shift Pattern
Courtesy of BMW OF NORTH AMERICA, INC.

Steptronic System Comparison

STEPTRONIC SYSTEM COMPARISON

Detail	E31 850Ci 1995 to 1997	All model except E31 850Ci up to 2001 Model year with Steptronic.	All Models from 2002 model year with Steptronic
Shift Console Layout	"M" Gate	M/S Gate	M/S Gate
Selection of Manual Mode	Shift to "M" gate	Shift to "M/S" gate and move lever momentarily to "+" or to "-".	Shift to "M/S" gate and move lever momentarily to "+" or to "-".
Gear Range in Manual Mode.	2nd to 5th gear (1st gear only accepted for 2 minutes after cold start. If the throttle is pressed 100% a 2-1 shift will occur	1st to 5th gears	1st to 5th gears
Un-allowable gear requests.	4th and 5th gear after vehicle standstill. Downshifts that can cause engine over-rev. 1st gear after engine warm up.	4th and 5th gear after vehicle standstill. Downshifts that can cause engine over-rev.	4th and 5th gear after vehicle standstill. Downshifts that can cause engine over-rev.

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Upshifts/Downshifts	Upshifts - Forward Downshifts - Rear	Upshifts - Forward Downshifts - Rear	Upshifts - Rear Downshifts - Forward

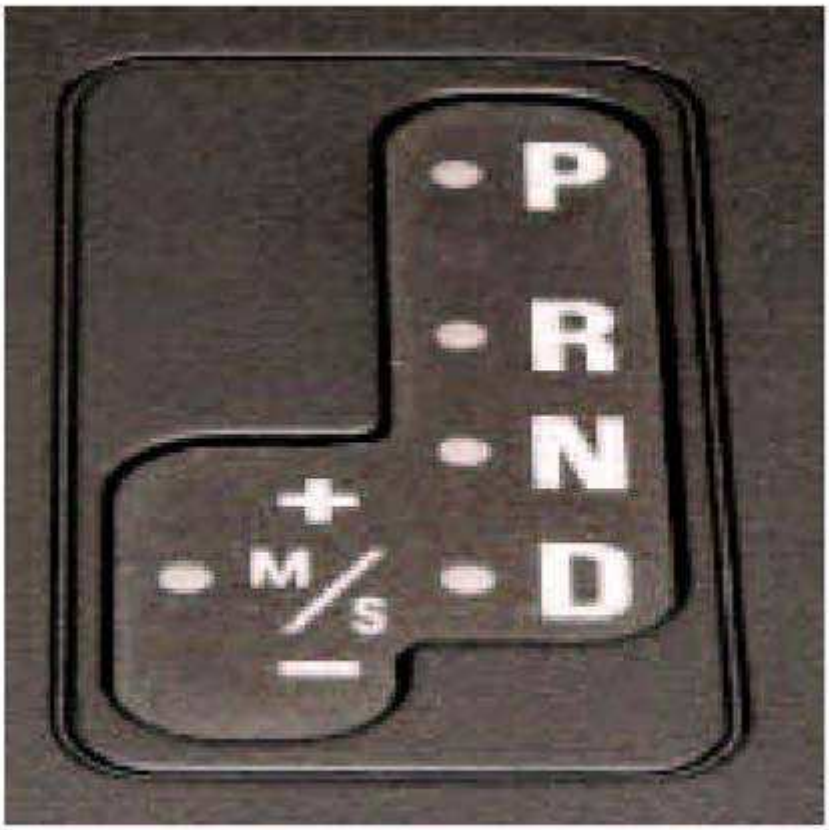


Fig. 40: Identifying Shift Pattern Up To 2001
Courtesy of BMW OF NORTH AMERICA, INC.

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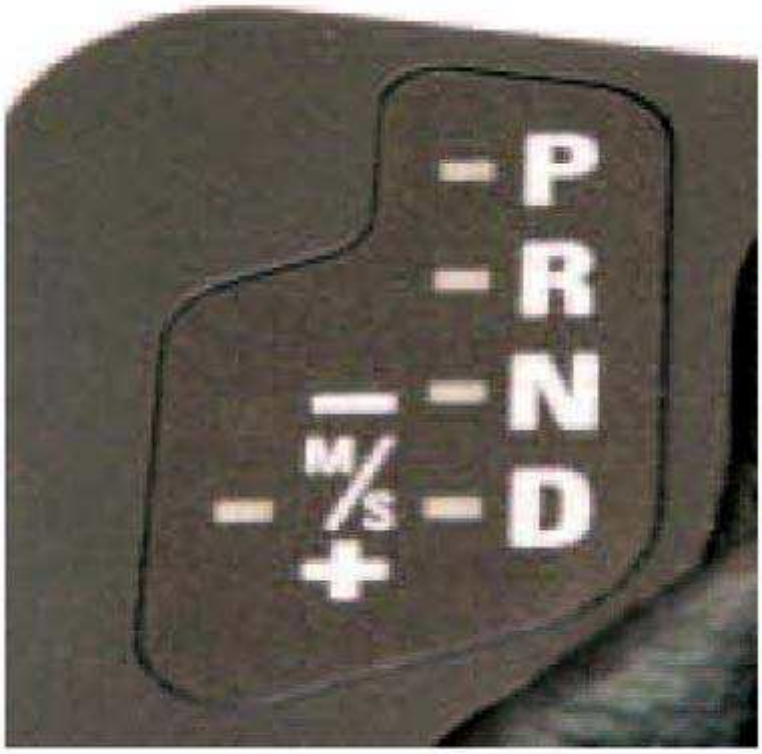


Fig. 41: Identifying Shift Pattern From 2002
Courtesy of BMW OF NORTH AMERICA, INC.

ADAPTIVE FEATURES (AGS)

AGS features were introduced in 1994 with the A5S560Z transmission. AGS control consists of adaptive features that will modify transmission operation according to various factors. AGS operation can be influenced by two major functional groups:

- Driver influenced features (influenced by throttle and kickdown input)
- Environmental influences (such as road conditions - icy, traffic etc.)

--EGS-- CONDITIONS THAT INFLUENCE SHIFT PROGRAM

--AGS-- ADDITIONAL CONDITIONS THAT INFLUENCE SHIFT PROGRAM

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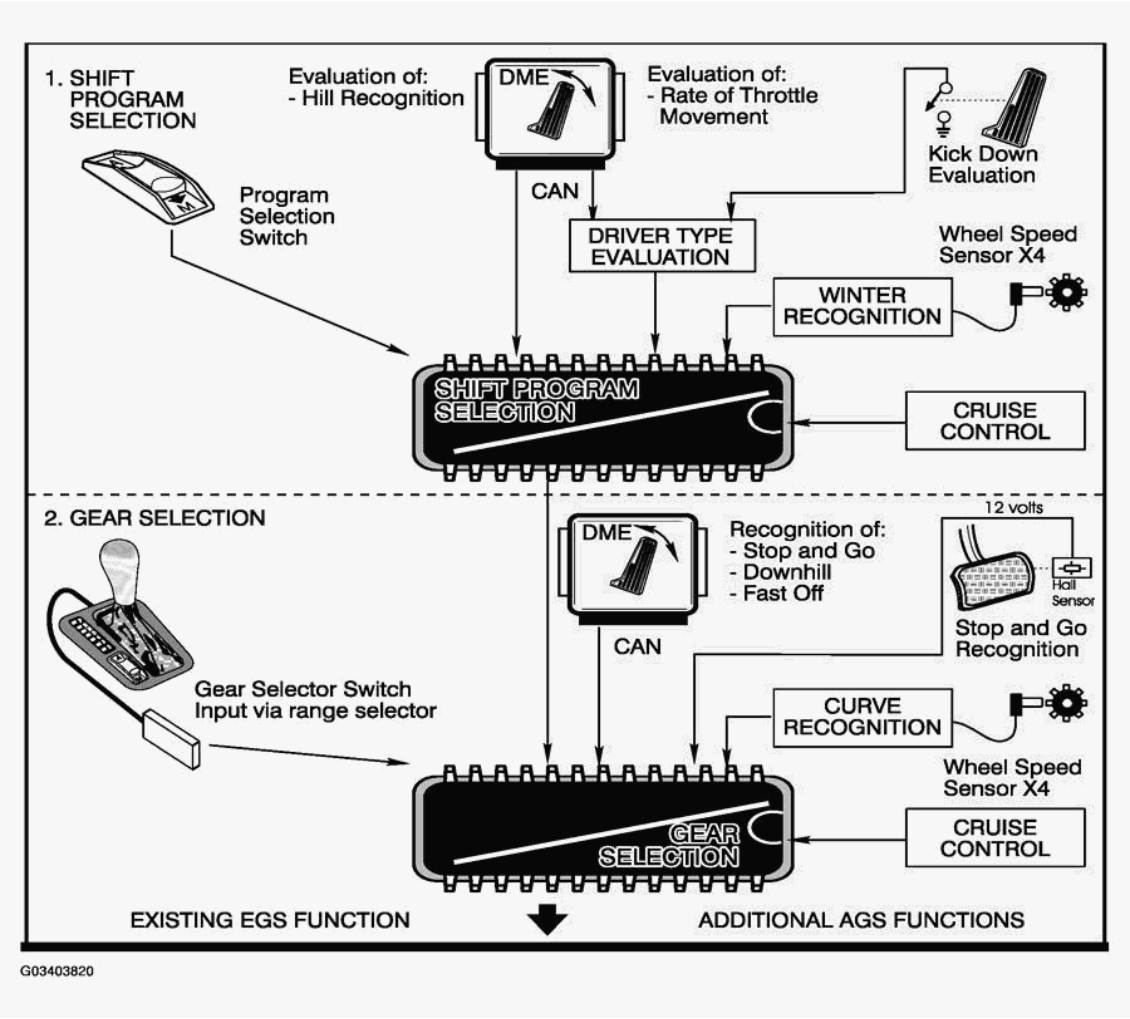


Fig. 42: Identifying Adaptive Features (AGS)
Courtesy of BMW OF NORTH AMERICA, INC.

The driving program selection is not adapted on a long term basis - nor is it stored in the control module memory when the ignition is switched off. It continually changes as the driver of the vehicle changes driving habits.

Driver Influenced Features Of AGS

The adaptive drive program is based primarily on throttle input. The throttle information comes from the ECM (DME) via the CAN bus. The TCM continuously monitors the throttle input for:

- The current throttle position
- The rate of change in pedal movement
- The number of acceleration requests
- The number of kickdown requests

Drive Away Evaluation

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The AGS system selects the appropriate shift program based on the amount of acceleration that occurs during takeoff. When driving away under full throttle the transmission will shift from XE to E.

Kick Fast Feature

Based on these inputs, the AGS will select one three different driving programs as follows:

- Extreme Economy - Shift points are a low speeds for maximum comfort and economy
- Economy - The shift points are raised for more performance with economy as priority
- Sport - The shift points are higher to take advantage of full engine performance.

  Under full throttle acceleration at high speed, single gear downshifts are possible. A two gear downshift is possible if the accelerator pedal is moved quickly to kick-down. The Extreme Sport program was eliminated as part of the kick-fast feature.

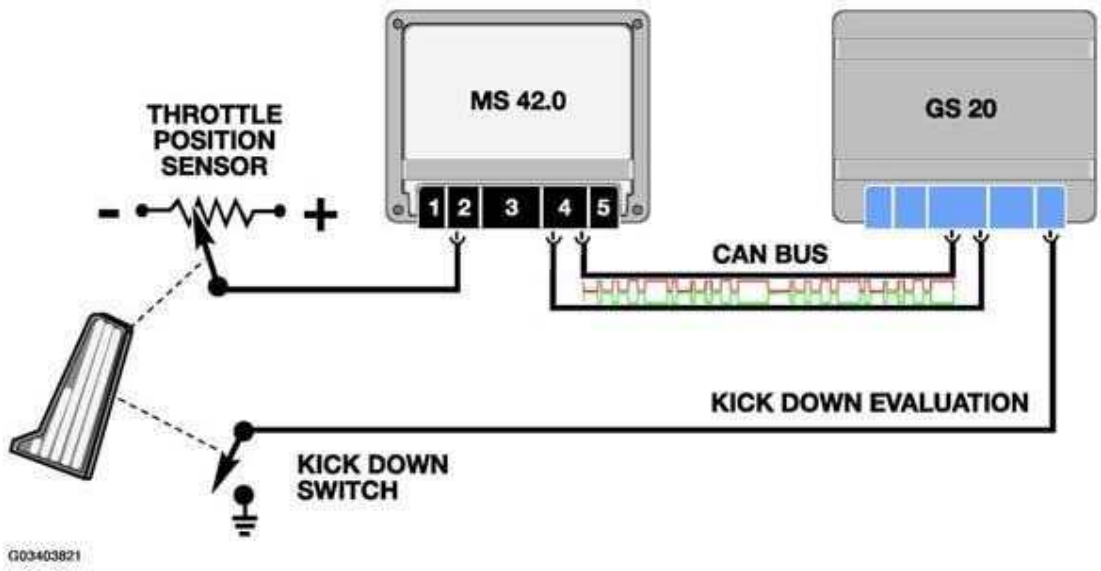


Fig. 43: Identifying Kick Fast Feature
Courtesy of BMW OF NORTH AMERICA, INC.

Environmentally Influenced AGS Features

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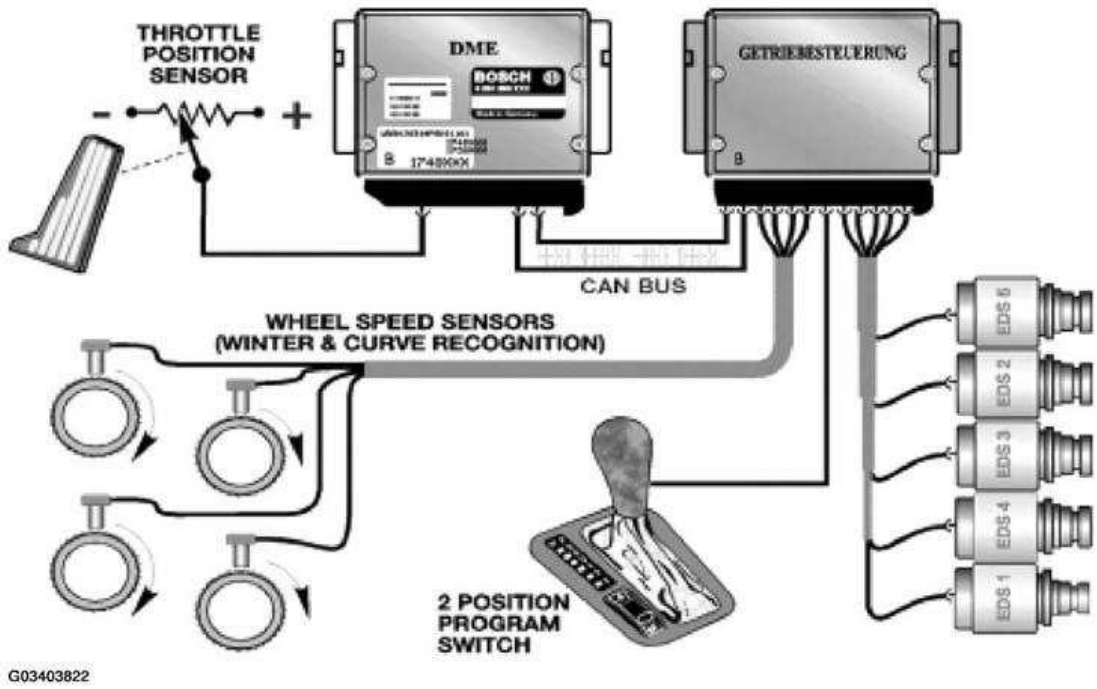


Fig. 44: Identifying Environmentally Influenced AGS Features
Courtesy of BMW OF NORTH AMERICA, INC.

STOP And GO

The feature is activated by defined sequence of shifts which are as follows:

- Upshift from first to second - followed by a downshift from second to first - followed by another upshift from first to second. This is then followed by the vehicle coming to a complete stop.

After this sequence occurs, the transmission will stay in second gear. The AGS control has recognized stop and go driving and this function will prevent excessive shifting during heavy conditions. The second gear start will be cancelled when:

- The vehicle speed exceeds 40 MPH
- The throttle pedal is pressed more than 90%
- The range selector is moved to Park, Neutral, Reverse or Sport (4, 3 or 2)
- The vehicle is in Sport Mode

Winter Drive Program

This feature is activated when the TCM detects slippage at the rear wheels by comparing front and rear wheel speed signals. When slippage is detected by the TCM, the transmission will start in second gear and the shift points will be lowered. This will reduce torque to the rear wheels allowing improved driveability and traction on slippery roads.

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Hill Recognition Program

There are two hill recognition programs, one for Uphill and one for Downhill. The TCM will activate this feature when it receives a high engine load signal at slower road speeds. The TCM will perceive this information as being consistent with climbing a hill. The shift points will be raised to prevent constant up and down shifting. This is referred to as the pendulum shift effect. When driving downhill, road speed will increase with minimal throttle input. The TCM will detect a downhill situation and hold the current gear to prevent an upshift when going downhill.

Curve Recognition

This feature will inhibit upshifts when the vehicle is in a curve. This is to improve stability when the vehicle is cornering at high speeds. The TCM will initiate this feature when it detects a difference between left and right (front) wheel speed signals. The difference in these signals will indicate that the vehicle is in a curve. Be aware that improper tire sizes, brands and inflation pressures can influence this feature. Always address these issues first when diagnosing delayed upshift complaints.

Cruise Control Drive program

A special cruise control shift map is selected by the TCM when cruise control is active. The TCM will prevent unwanted locking and unlocking of the torque converter clutch. Also, upshifting and downshifting will be minimized. Depending upon application, the cruise control interfaces with TCM via a single wire data link or as on vehicles with electronic throttle control, the TCM will interface with the ECM (DME).

Manually Selected "Extreme Sport" Program

This feature is activated by moving the shift lever to position 4, 3 or 2. This activates the "Extreme Sport Program" where the shift points are raised for maximum RPM and performance. On Steptronic equipped vehicles, the sport program is obtained by moving the shifter to the manual gate to initiate the "Sport Program".

Modifications To AGS Features

Since the introduction of AGS features in 1994, there have been some software changes to address customer concerns. Some AGS features have been perceived by the customer as malfunctions. To correct this, some of the AGS features were modified with updated software. The AGS features previously discussed in this text reflect the updated modifications.

CAN BUS COMMUNICATION

The CAN bus is a serial communications bus in which all connected control units can send as well as receive information. Data over the CAN bus operates at a rate of up to 1Mb/s (megabits per second).

The CAN protocol was developed by Intel and Bosch in 1988 for use in the automotive industry to provide a standardized, reliable and cost-effective communications bus to combat the increasing size of wiring harnesses.

The CAN bus was originally introduced on BMW automobiles in the 1993 E32 740i/IL as a data link between the TCM (EGS) and the ECM (DME).

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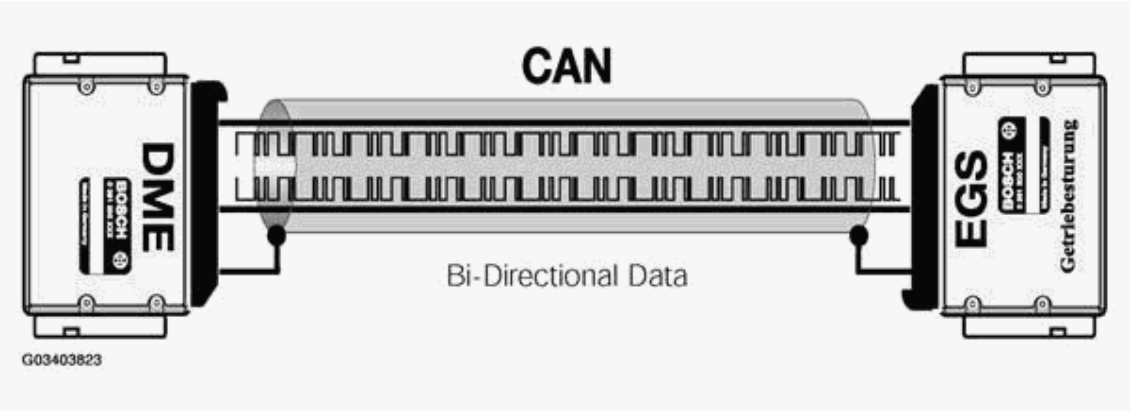


Fig. 45: Identifying CAN Bus
Courtesy of BMW OF NORTH AMERICA, INC.

On earlier EGS systems, various signals were transmitted on individual signal wires. This reduced reliability and increased the amount of wiring needed. The CAN bus allows faster signal transmission and increased versatility. For example, the signals listed in the chart below were previously transmitted on individual wires, now these signals are all on the CAN bus. This chart represents only some of the signals on the CAN bus, there are many more signals transmitted between the TCM and ECM.

EGS SYSTEMS SIGNALS

Sender	Information Item	Receiver	Signal Use
ECM	Engine Temperature	TCM	Shift Point Calculation
ECM	Engine Load (tL)	TCM	Shift Point Calculation
ECM	Engine RPM (TD)	TCM	TCC Slippage
ECM	Throttle Position (DKV)	TCM	Shift Point Calculation
ECM	A/C Compressor ON	TCM	Fine tune shift points to compensate for increased engine load.
TCM	Transmission Range	ECM	Engine Idle Speed Control
TCM	Torque Reduction Signal (ME)	ECM	Timing Retard during shifts.
TCM	TCC Lockup Status	ECM	Engine Timing Map adjustment.

CAN Bus Topology

The CAN bus consists of two twisted copper wires. Each wire contains an opposing signal with the exact same information (CAN-High, CAN-Low). The opposing signals transmitted through the twisted wire serve to suppress any electrical interference. Early CAN bus wiring included a grounded shield around the two wires, later vehicles discarded the shield in favor of the unshielded twisted pair wiring.

Due to the linear structure of the network, the CAN bus is available for other modules in the event of a disconnected or failed control unit. This is referred to as a "Tree" structure with each control unit occupying a branch.

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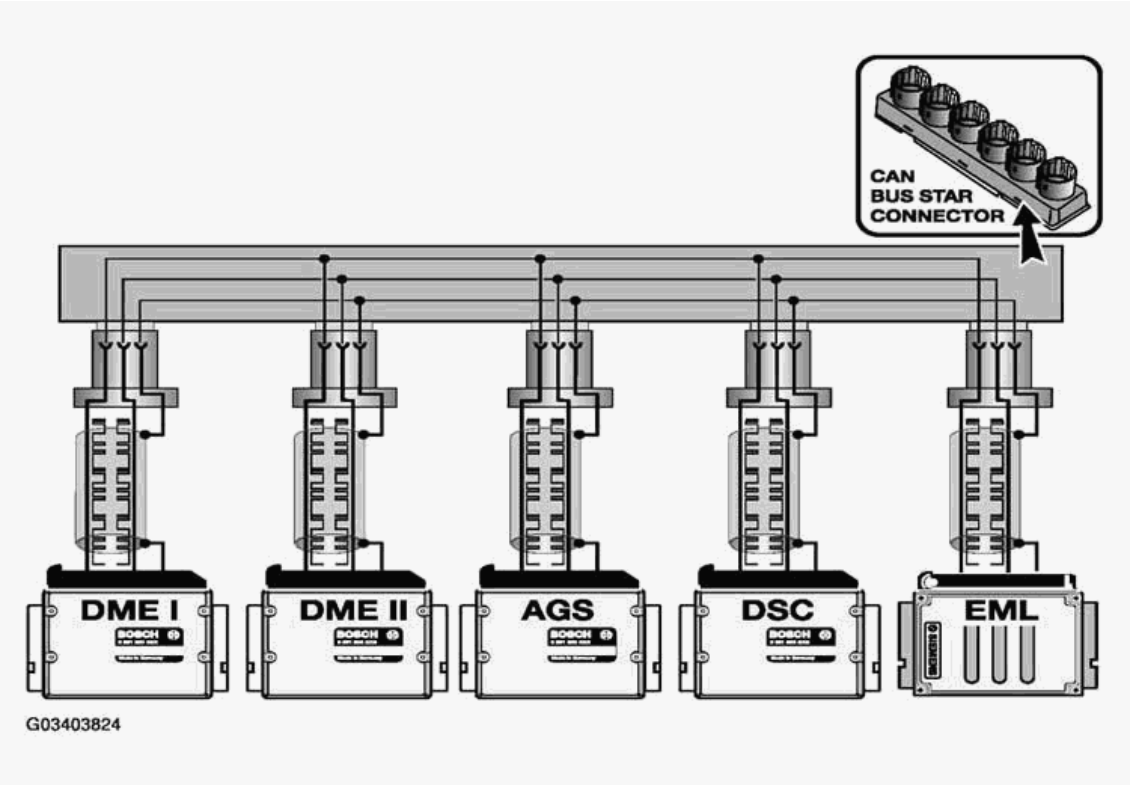


Fig. 46: Identifying CAN Bus Topology
Courtesy of BMW OF NORTH AMERICA, INC.

As previously mentioned, the CAN bus initially was used as a high speed communication link between the DME and AGS control units.

With the introduction of the E38 750iL (95 M.Y.), the CAN bus was expanded to include the EML and DSC control modules. The 750iL made exclusive use of the "star coupler" to link the individual CAN bus ends to a common connector.

The 1998 model year introduced new users of the CAN bus. The instrument cluster and the steering angle sensor were linked to expand the signal sharing capabilities of the vehicle.

The 1999 750iL was the last vehicle to use the shielded cable, after which the entire CAN bus went to twisted pair wiring.

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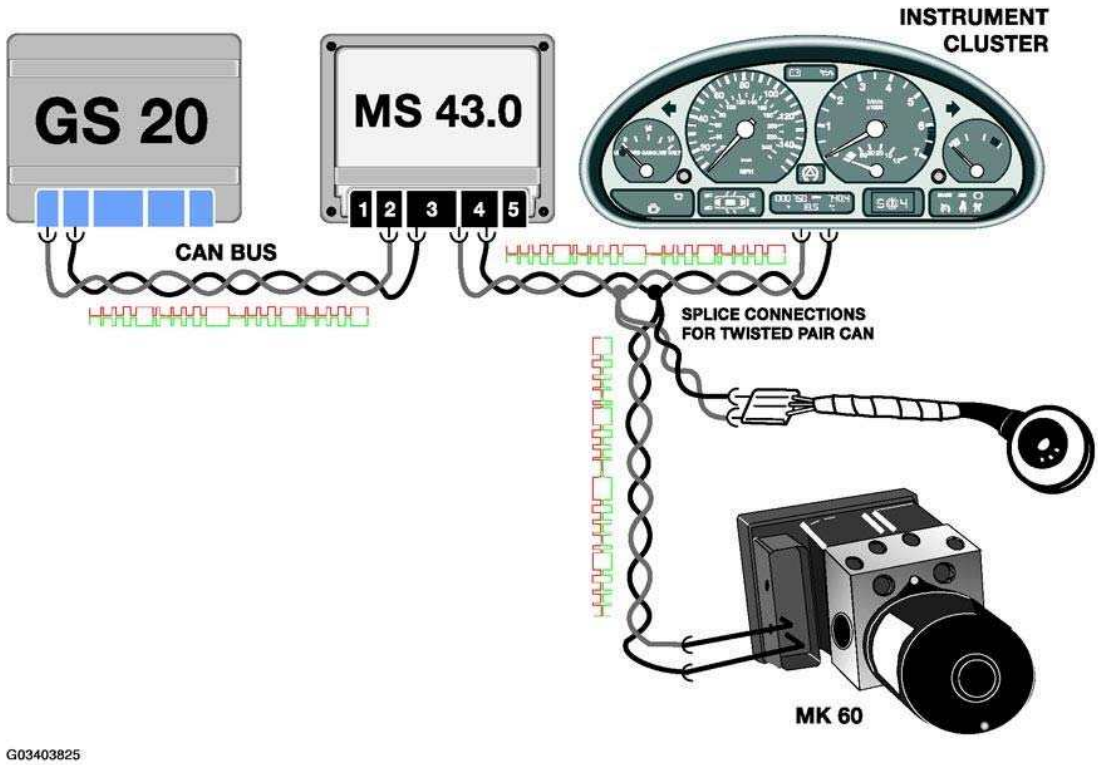


Fig. 47: Identifying CAN Bus Signal Sharing Capabilities
Courtesy of BMW OF NORTH AMERICA, INC.

On most current models the CAN bus provides data exchange between the following control modules:

- ECM (DME)
- EML (750iL E38)
- TCM (EGS)
- IKE/Kombi
- ASC/DSC
- LEW

On models that use twisted pair, the wire color of the CAN bus is uniform throughout the vehicle with: CAN-Low GE/BR and CAN-High GE/SW or GE/RT. Shielded wiring is easily identified by the black sheath surrounding the CAN bus.

Troubleshooting The CAN Bus

The failure of communication on the CAN bus can be caused by several sources:

- Failure of the CAN bus cables.
- Failure of one of the control units attached to the CAN.

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- Failure of the voltage supply or ground to individual modules.
- Interference in the CAN bus cables.

Failure of the CAN bus cables

The following faults can occur to the CAN bus wiring:

- CAN-H/L interrupted
- CAN-H/L shorted to battery voltage
- CAN-H/L shorted to ground
- CAN-H shorted to CAN-L
- Defective plug connections (damaged, corroded, or improperly crimped)

In each instance, the connected control units will store a fault due to the lack of information received over the CAN bus.

The voltage of the CAN bus is divided between the two data lines: CAN-High and CAN-Low for an average of 2.5V per line. The voltage measurement is taken from each data line to ground. Each module on the CAN contributes to this voltage.

The fact that 2.5V are present does not mean that the CAN bus is fault free, it just means that the voltage level is sufficient to support communication.

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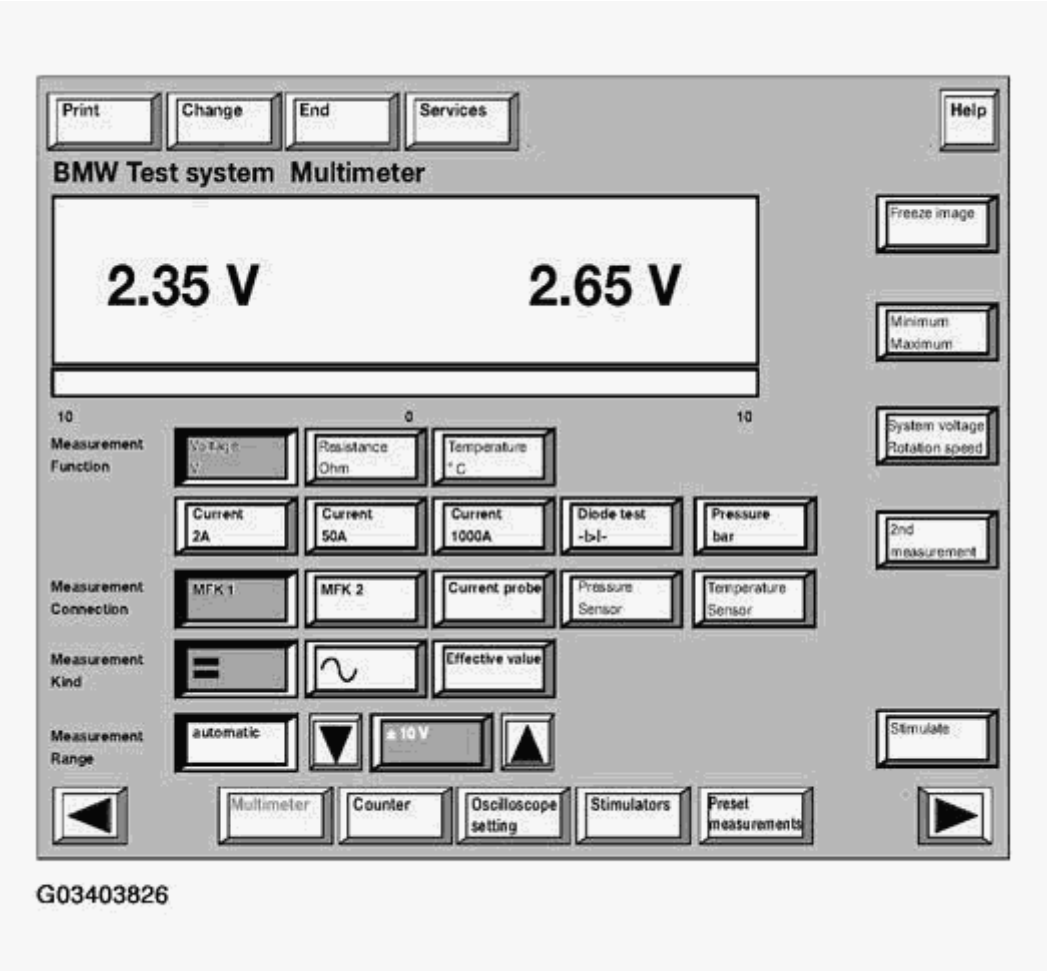


Fig. 48: Identifying BMW Test System Multimeter Display
Courtesy of BMW OF NORTH AMERICA, INC.

Terminal Resistors: are used in the CAN bus circuit to establish the correct impedance to ensure fault free communication. A 120 Ohm resistor is installed in two control units of the CAN between CAN-H and CAN-L. Because the CAN is a parallel circuit, the effective resistance of the complete circuit is 60 Ohms. On some vehicles there is a jumper wire that connects the two parallel branches together, others have an internal connection at the instrument cluster.

The resistance is measured by connecting the appropriate adapter to any of the modules on the CAN and measuring the resistance between CAN-L and CAN-H. The resistance should be 60 Ohms. The CAN bus is very stable and can continue to communicate if the resistance on the CAN bus is not completely correct; however, sporadic communication faults will occur.

The terminal resistors are located in the ASC/DSC control unit and either the instrument cluster or in the DME.

Early 750iL vehicles that used the star connector have a separate external resistor which connect CAN-H and CAN-L together.

Modules which do not have the terminal resistor can be checked by disconnecting the module and checking the

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resistance directly between the pins for CANH and CAN-L. The value at these control units should be between 10 kOhms and 50 kOhms.

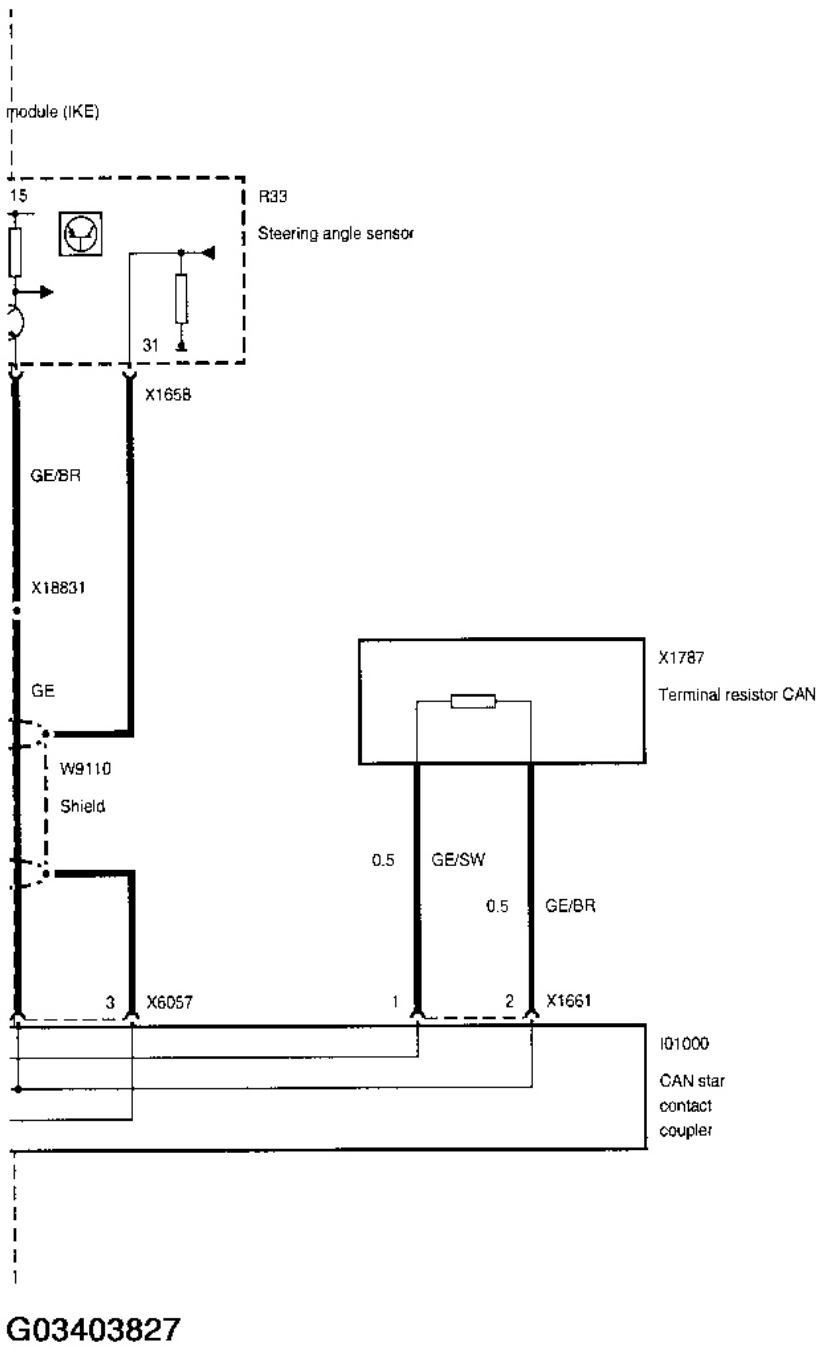


Fig. 49: Identifying Terminal Resistor Circuit
Courtesy of BMW OF NORTH AMERICA, INC.

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DIAGNOSIS AND TROUBLESHOOTING

Due to the cost and complexity of today's electronic transmissions, BMW recommends that the technical hotline be contacted before any repairs are performed. It is important that the technician perform some basic diagnostic procedures before contacting technical assistance. The following procedures should be followed:

- Always Verify customer complaint, make sure the complaint is not related to normal operation. (i.e. Warm Up Phase, AGS operation etc.)
- Survey Fault Memory - Perform **complete** quick test. There may be other systems that interface with EGS that could cause faults. (i.e DME, ASC/DSC, IKE/Kombi etc.)
- Print out all fault code with fault conditions. Also print out copy of Identification page and diagnostic report.
- CHECK TO SEE IF THERE ARE ANY SERVICE BULLETINS THAT APPLY TO YOUR SPECIFIC COMPLAINT. THIS INCLUDES THE SERVICE ROUND TABLE.
- Ensure that battery voltage is sufficient. Battery voltage must be greater than 12.5 with ignition switched off. Check battery connections for tightness and condition.
- Check ground connections. (chassis to engine, grounds to bulkhead and shock tower.)
- Check over vehicle to look for transmission leaks, physical damage, loose connections etc.
- If necessary, check fluid level and condition using DISplus or GT-1.
- Check to see if any aftermarket or performance components have been installed that could effect transmission operation. (DME or EGS software as well as any engine modifications).
- Check repair history to see if there were any recent repairs that could effect the proper operation of the transmission (i.e. Engine replacement with damaged dowel pin etc.).
- Check DCS for any open campaigns or recalls pertaining to drivetrain.
- Check and record chassis number, production date and transmission serial # before contacting technical assistance.

Establishing A Diagnostic Plan

Once all of the pre-diagnostic criteria has been satisfied, a logical diagnostic plan should be followed. A logical, well organized diagnostic plan will help avoid improper diagnosis, unnecessary parts replacement and lost diagnostic time. A technician's goal should be to satisfy the customer by "Fixing it the first time, on time, every time". The productivity of the technician can also be improved by following a logical, common-sense approach to problem solving. The following steps are recommended to form a diagnostic plan:

- **Verify the Customer Complaint** - This step is the most important, but also the most overlooked. The focus should always be on the exact customer concern. Make sure that the customer complaint is not a misunderstanding of proper vehicle operation. This step can avoid unnecessary diagnosis and lost time. If the customer concern is not exactly identified, any subsequent repairs can not be verified as being effective. This is the most common cause of "comeback" repairs. Communication between the customer to advisor and the advisor to technician must be clear. Vague or misunderstood customer complaints are often improperly diagnosed. Also make sure that the conditions under which the concern has occurred are duplicated. For example: If the customer is customer is complaining about a shifting concern after a cold start, then the vehicle should be road tested under those conditions.
- **Analyze the Problem** - Once the complaint has been verified, then all available resources should be used

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to find the "root cause" of the complaint. Start out by checking Service Information Bulletins, DCS messages, and Service Round table information. Use the DISplus or GT-1 to access the diagnostic program and per form Diagnostic Test Modules where applicable. Electrical Troubleshooting Manuals (ETM's) should also be used when needed.

- **Isolate the Problem** - Now, the problem can be narrowed down into the final steps of diagnosis. Using proper tools and procedures, the technician can "Isolate" by using the process of elimination and common sense. Having a working knowledge of BMW systems is helpful in this area. When applicable, use all available BMW special tools and equipment. Perform all necessary electrical checks such as Voltage Drop, resistance measurements etc.
- **Repair the Problem** - Once the concern has been correctly identified, perform all necessary repairs as per BMW guidelines. Make sure all repairs are properly documented to comply with warranty policies and procedures.
- **Verify the Repair** - Make sure the customer concern has been rectified. Road test the vehicle under the same conditions whenever possible. Failure to complete this step properly is almost a guaranteed comeback. Repeat repair attempts are costly to the BMW Center and the BMW Service Technician.

REMEMBER - Fix it the first time, On Time, Every time.

Fault Codes

When diagnosing transmission fault codes, always print out the fault code(s) and the fault conditions. When referring to the fault code itself, be aware that there are actually 3 formats for the fault code. The fault code breakdown is as follows:

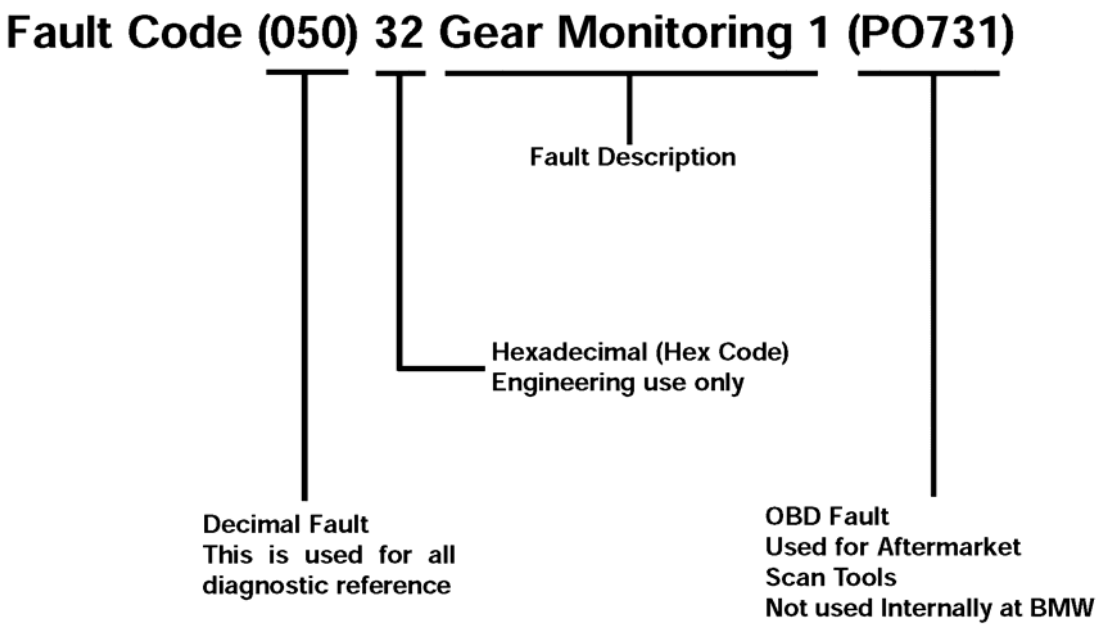


Fig. 50: Identifying Fault Codes
Courtesy of BMW OF NORTH AMERICA, INC.

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When referring to the "Fault Code" during diagnosis always use the fault that is in Decimal Format. The Decimal fault is referred to in all reference material such as Service Information Bulletins, Test Modules and DCS messages etc. In the example above, FC 050 would be the correct choice.

Fault Conditions

When a fault code is set, it is stored with a set of environmental conditions. The environmental conditions are used to aid in pinpointing the root cause of the fault. Some of the information found in the fault conditions contain information on transmission temperature, engine speed and road speed etc. This information is also helpful when trying to duplicate the customer complaint. For example, if a customer complains about a shifting complaint when cold, check the fault conditions to verify this complaint. Remember to always print out the fault codes with the fault conditions. This information is helpful to the technician as well as technical assistance.

Identification Page

The ID page is helpful to determine the Transmission and control system used as well as the chassis number and current software version. Always print out a copy of the ID page when performing any diagnosis or programming procedures.

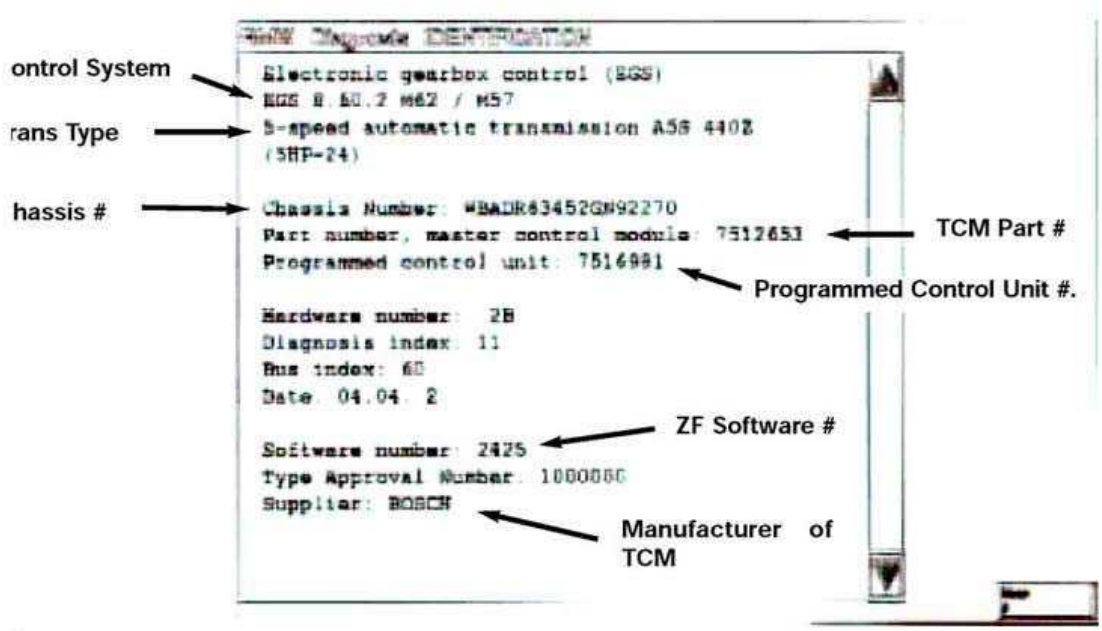


Fig. 51: Identifying Identification Page
Courtesy of BMW OF NORTH AMERICA, INC.

Diagnosis Program

There are two diagnostic formats (programs) used on current model BMW vehicles. The earlier diagnostic program was used on the E38 and E39. The latter diagnostic program was introduced as the "E46 Diagnostic Concept". This is used on the E46, E65 and the E52 (Z8). The E53 X5 uses a mixture of both diagnostic programs depending upon engine/transmission options. Below is an example of the earlier diagnostic program.

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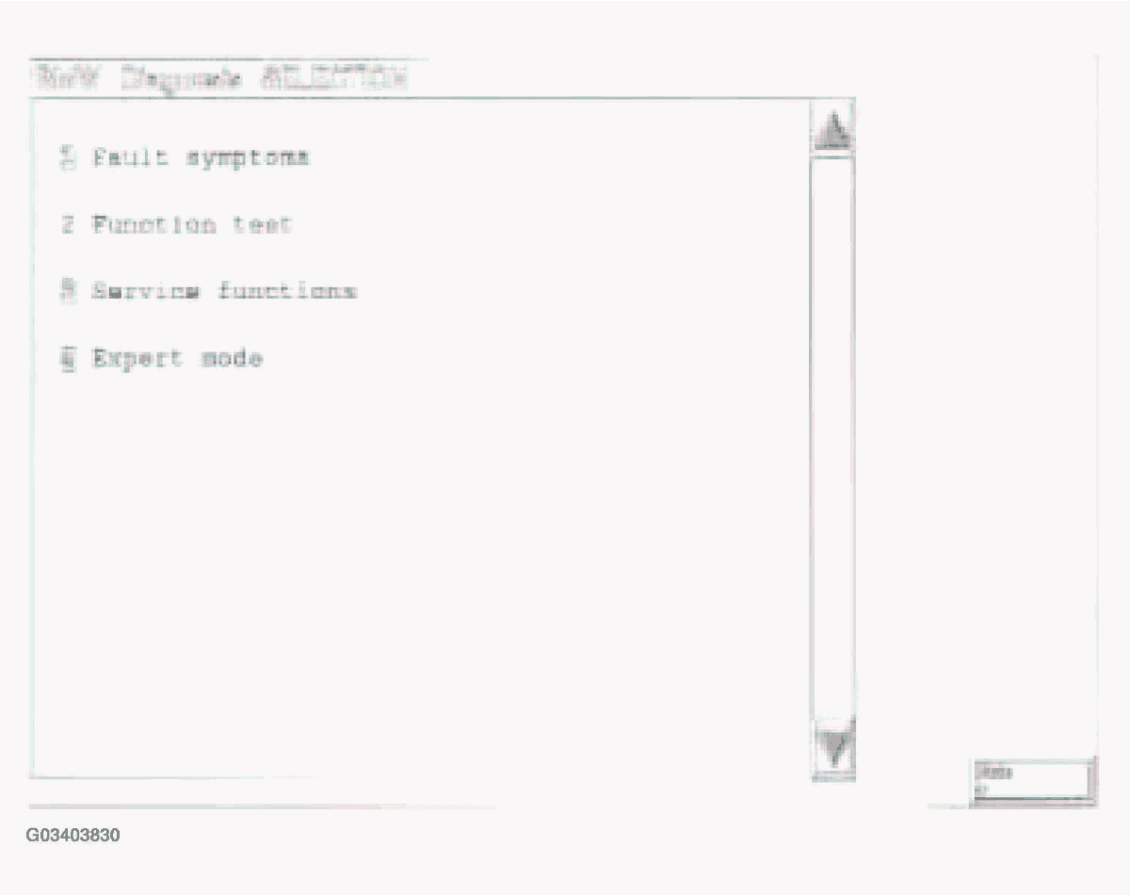


Fig. 52: Identifying Diagnosis Program
Courtesy of BMW OF NORTH AMERICA, INC.

The diagnostic program contains the following features:

- **Fault Symptoms** - This is a symptom driven program that will lead the technician into guided diagnostics. It contains several possible fault scenarios that are common to electronic transmissions. This path is helpful when the technician is not sure where to start in his diagnostic plan.
- **Function Test** - There are no function tests for electronic transmissions.
- **Service Functions** - This is where you will find the ATF level check function. Also Test Codes can be obtained and printed out for warranty purposes. The Adaptation values can be cleared as well as printed out.
- **Expert Mode** - Expert Mode should be used when the technician has a thorough working knowledge of the system. You will find several items in expert mode: Read/Clear fault memory, Diagnosis (Status) requests, Component Activation and Test Modules.

Test Modules

Test modules are found in the diagnosis program of the DISplus and GT-1. These allow the technician to take advantage of a guided diagnostic plan. The program will direct the technician through the various steps using a "trouble tree" format. When using test modules it is important to follow the instructions exactly. Due to the complex nature of some faults, the test modules are not always conclusive. The test module is only as effective

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as the information provided by the technician. The technician also needs to rely on his experience and some common sense. The test modules should be used to assist the technician, not as a replacement for good diagnostic skills.

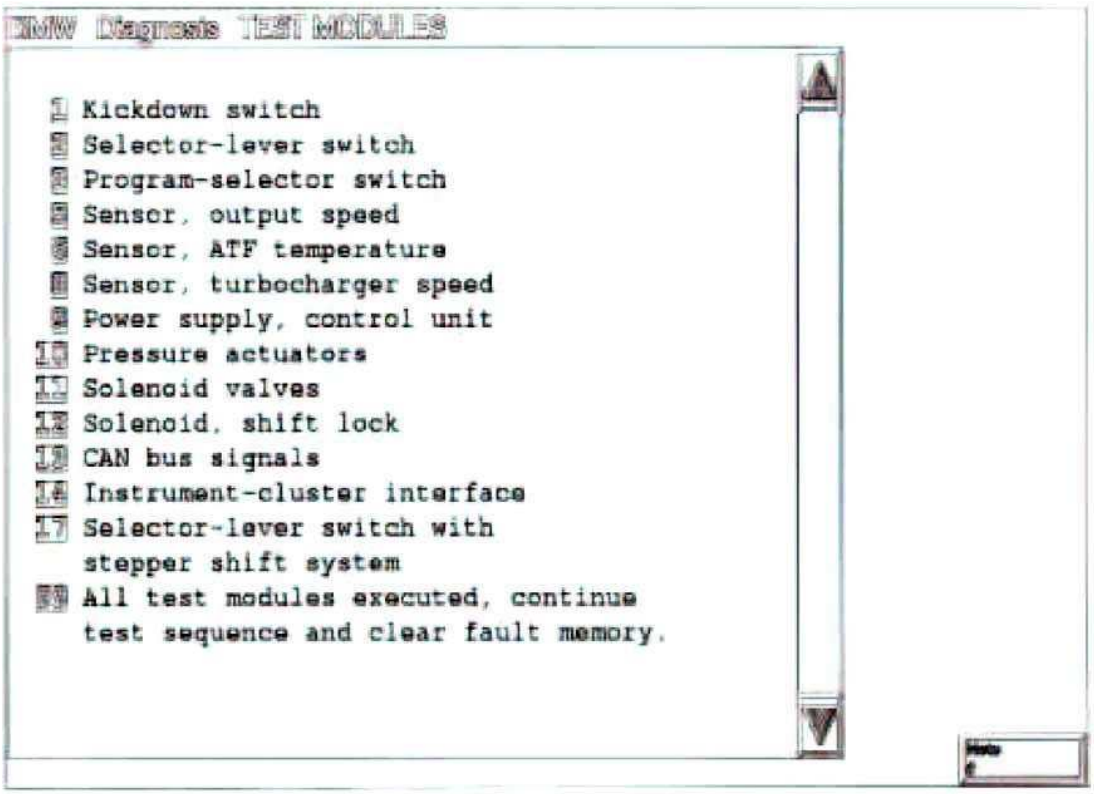


Fig. 53: Identifying Test Modules
Courtesy of BMW OF NORTH AMERICA, INC.

Test modules come in two formats. The one shown above is used on E38/E39 vehicles and the E53 with 4.4 and 4.6 engines. The E46, E65 and E53 (with 3.0 M54) uses the new "E46 Diagnostic Concept" which was introduced with the E46 in the 1999 model year. Regardless of the format used, the technician is still guided through a step by step procedure.

Diagnostic Tips

The following consists of some helpful hints to assist the BMW diagnostic technician. It is designed to assist the technician to form a logical path of diagnosis. These suggestions should be used in conjunction with other approved diagnostic routines. This does not exclude the technician from the responsibility to contact technical assistance. All major repairs and transmission replacement must be pre-approved by the BMW Technical Hotline. Transmission concerns can be broken down into several categories:

- **Shift Quality Complaints** - Shift Quality complaints consist of harsh up or down shifts, improper shift points and erratic shifting. These complaints could be related to electronic/software issues or hydraulic/mechanical problems. Perform quick test and check SIB's before proceeding. As with most

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concerns, check the transmission fluid level and condition as well.

Do not clear adaptation values unless instructed to do so by BMW Technical Hotline.

- **Delayed/No Upshifts** - Before proceeding on delayed upshift complaints, make sure you are aware of the conditions that this occurs. This could be normal operation, such as the "Warm-up Phase" program. Always check front tires for proper inflation pressures, correct size and type. Also check for uneven tire wear. Variations in front tire size from left to right can activate the AGS "Curve Recognition" feature. The TCM will interpret the difference in wheel speed signals as being a turn and suppress (or delay) upshifts.
- **Slipping** - This type of issue is usually associated with a fault code. Be sure to check the transmission fluid level and condition.
- **Noise, Vibration** - Noises and vibrations should be checked over by a good visual inspection. Look for loose transmission or engine mounts. Check the driveshaft, center bearing and flexible coupling (or constant velocity joints). Also check the lateral alignment of the driveshaft. There are several SIB's pertaining to noise and vibration.
- **No Forward or Reverse Gear** - Start by checking transmission fluid level and note the fluid condition. Inspect for leaks and external transmission damage.
- **Leaks** - When investigation transmission leaks, be sure to verify that the suspected leak is actually transmission fluid. Engine oil, hydraulic and brake fluid can be mistaken for a transmission leak. Check the transmission cooler lines, transmission cooler and transmission pan gasket. Try to locate the source of the leak. Do not make any major repairs until the technical hotline is contacted.
- **Fault Codes** - Perform COMPLETE short test (Quick test) on all vehicle systems. It is important to survey all systems in the event that a related system is causing the transmission fault. Always print out the ID Page, Fault codes and fault conditions.

Information Resources

When diagnosing transmission related concerns it is important to use all information resources available. The following information sources should be utilized at all times:

- Service Information Bulletins
- Technical Data
- ETM Electrical Troubleshooting Manual
- DCS (Dealer Communication System)
- Repair Instructions
- Tightening Torques
- Technical Training Manuals
- Special Tool Information

Technical Information System (TIS)

Most of the above information can be accessed by using the BMW TIS CD or by logging on the BMW TIS website through **www.bmwcenternet.com.** The BMW TIS website contains a wealth of helpful information for the technician. The information is updated on a regular basis.

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Service Round Table

In addition to the above sources of information, the technician should be up to date on the latest edition of the BMW Service Round table. The round table will cover the most recent topics and offer some hints that will assist the technician. The Service Round table is broadcast live on a monthly basis via the BMW Visionwerke Network. In addition to live broadcasts, the round table is rebroadcast on a regular schedule during the month.

TCM CODING AND PROGRAMMING

As with other control modules used on BMW systems, the TCM must be programmed and/or coded for the vehicle. Over the years, these methods have varied from system to system.

Coding

Coding will assign the control unit to a particular application. Information such as differential ratio, tire size, vehicle series, engine, engine control system, w/wo AC etc.are some of the possible variants that have to be considered. Transmission control units are coded using various methods.

- **Grounding pins in wiring harness connector** - On early models equipped with the 4HP22/24 EH transmissions, the TCM was coded to the vehicle by means of grounding pins in the wiring harness connector for the TCM. By selectively grounding specific pins in the harness, the TCM was assigned to that vehicle. For Example: The TCM could be installed in a 535, 635, or a 735. This only applies to the Early E- 7 Versions. (E23, E24, E28)
- **TCM ordered for Specific Application** - On some later models, the TCM was ordered for a specific vehicle application, coding was not necessary.
- **Coding performed during programming** - On systems that use a flash programmable TCM, the coding process is done during flash programming.

Programming

Programming refers to the instructions that the TCM is to follow. The TCM is programmed to apply certain shift maps according to operating conditions such as vehicle speed, engine speed, engine temperature, engine load and throttle position. This information can be entered into the TCM via an updated EPROM or through flash programming.

Flash programmable control units use a EEPROM which is Electronically Erasable. The EEPROM is also soldered into the TCM and cannot be removed or replaced. Flash programmable TCM's can be programmed up to 14 times (with a new TCM).

NOTE: Always clear adaptations after programming.

NOTE: Do not program a TCM to correct a complaint unless there is a specific SIB that covers the issue. Only program when installing a new TCM or when instructed to do so by BMW Technical Assistance. Always have the ID page available when calling for technical assistance.

TCM PROGRAMMING

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Control System	Transmission	Coding	Programming	TCM Type
GS 1.26 GS 1.27 GS 1.29	4HP22 EH (Early E-7) 4HP22/24 EH (Late E-7 and E-9)	Grounding pins in Harness. (Early E-7 Only) TCM ordered for specific application. Coding not needed.	Replaceable EPROM Replaceable EPROM	35 Pin 35 Pin
GS 7.3 GS 7.32 GS 7.11 GS 8.32	A5S310Z (5HP18)	TCM ordered for specific application. Coding not needed.	Replaceable EPROM	88 Pin
GS 8.60 GS 8.60.4	A5S325Z (5HP19)	Coding done when Programmed	Flash Programming (EEPROM)	134 Pin SKE
GS 8.55 GS 8.60.2	A5S440Z (5HP24)	Coding done when programmed	Flash Programming (EEPROM)	88 Pin up to 98 (E38 M62) 134 Pin SKE from 98 to present.
GS 9.2 GS 9.22 GS 9.22.1 GS 8.60.3	A5S560Z (5HP30) A5S560Z (5HP30) (E38 M73TU)	TCM ordered for specific application. Coding not needed. Coding done when programmed.	Replaceable EPROM Flash Programming (EEPROM)	88 Pin 134 Pin
GS 4.14 GS 4.16	A4S310R (THMR-1)	TCM ordered for specific application. Coding not needed.	Replaceable EPROM	55 Pin
GS 8.34	A4S270R (THMR-1)	TCM ordered for specific application. Coding not needed.	Replaceable EPROM	88 Pin
GS 20	A5S360R A5S390R	Coding done when programmed	Flash Programming (EEPROM)	134 Pin SKE

TRANSMISSION FLUID INFORMATION

Transmission Fluid (Oil)

The automatic transmission provides filtered, pressure regulated hydraulic fluid for all of the transmissions functional requirements. All BMW automatic transmissions are designed to operate with specific fluids. Use of non-approved oil will cause malfunctions and irreparable transmission damage which is not covered by BMW warranty.

The transmission fluid provides the following functions:

- Lubricates mechanical components (planetary gears, bearings etc.).
- Removes heat and transfers heat to transmission cooling system. (Heat Exchanger).
- Removes debris and contaminants to sump and filter when circulated.
- Provides a transfer of kinetic energy in the torque converter.

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- Allows hydraulic operation of mechanical components (clutches, brakes) via control of the valve body.

Also, transmission fluid has various properties to prevent oxidation and breakdown from heat and friction. Each type of transmission fluid has properties specific for each transmission application.

Fluid level is crucial in the proper operation of an automatic transmission. Improper fluid levels will cause improper operation and eventually irreparable transmission damage. Improper fluid level can cause:

- A low fluid level can cause an interruption in oil flow during fast acceleration or hard braking which can cause gear shift malfunctions and noises.
- An excessively high fluid level can cause the rotating mechanical components to paddle in the oil. This produces foam which introduces air into the hydraulic system.
- A low fluid level can also cause transmission overheating causing premature transmission failure.

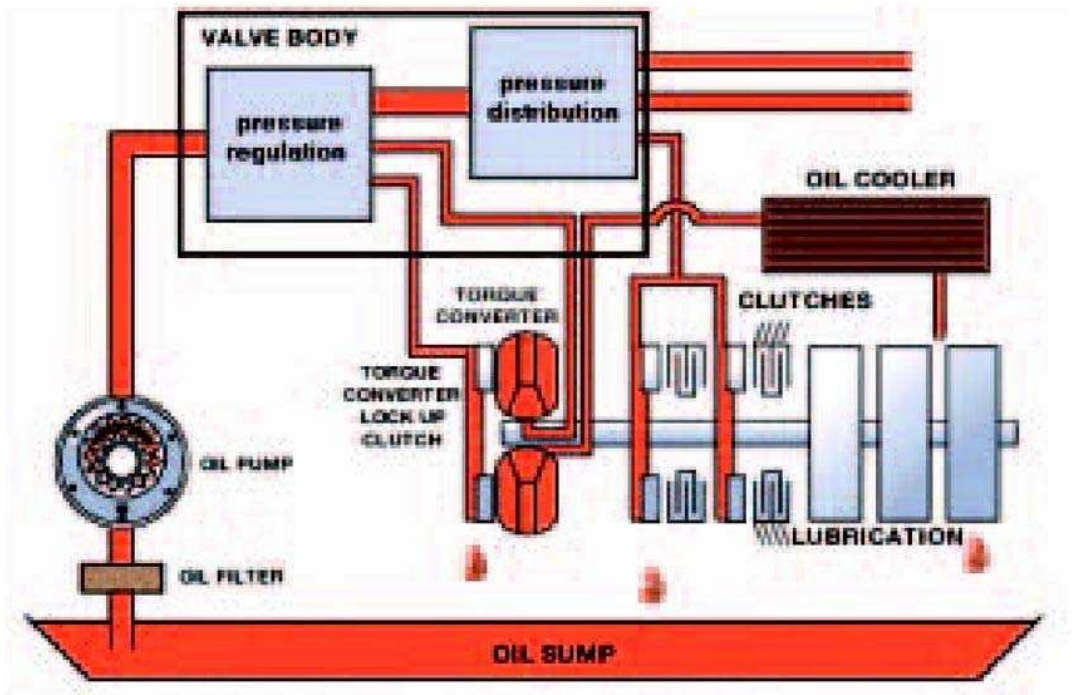


Fig. 54: Identifying Transmission Fluid Flow
Courtesy of BMW OF NORTH AMERICA, INC.

Transmission Fluid Checking Procedures

Transmission fluid checking is accomplished using the DISplus or GT-1. The DISplus or GT-1 is used to monitor transmission fluid temperature to insure the transmission is not over or under-filled. As with most other current ZF transmissions there is no dipstick, the fluid level is checked and filled at the fill plug. The location of the fill plug varies between transmissions.

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Transmission fluid should be checked between 30 and 50 degrees Celsius (unless otherwise specified). Use the DISplus and/or GT-1 to determine transmission temperature. The transmission temperature information can be found in the diagnosis section under Service Functions.

Proper procedures for checking and filling transmission fluid can be found in BMW Service Information Bulletin B 24 01 98.

When checking transmission fluid, observe the following items:



Fig. 55: Identifying Transmission Fluid Checking Procedures
Courtesy of BMW OF NORTH AMERICA, INC.

- Transmission in Park
- Parking brake applied
- Engine Running
- Vehicle level
- No engine load
- Trans Temp 30-50C
- Observe correct drain plug torque

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- Use correct fluid

  When replacing parts on transmissions that use lifetime fluid, drain fluid into a clean container and reuse.

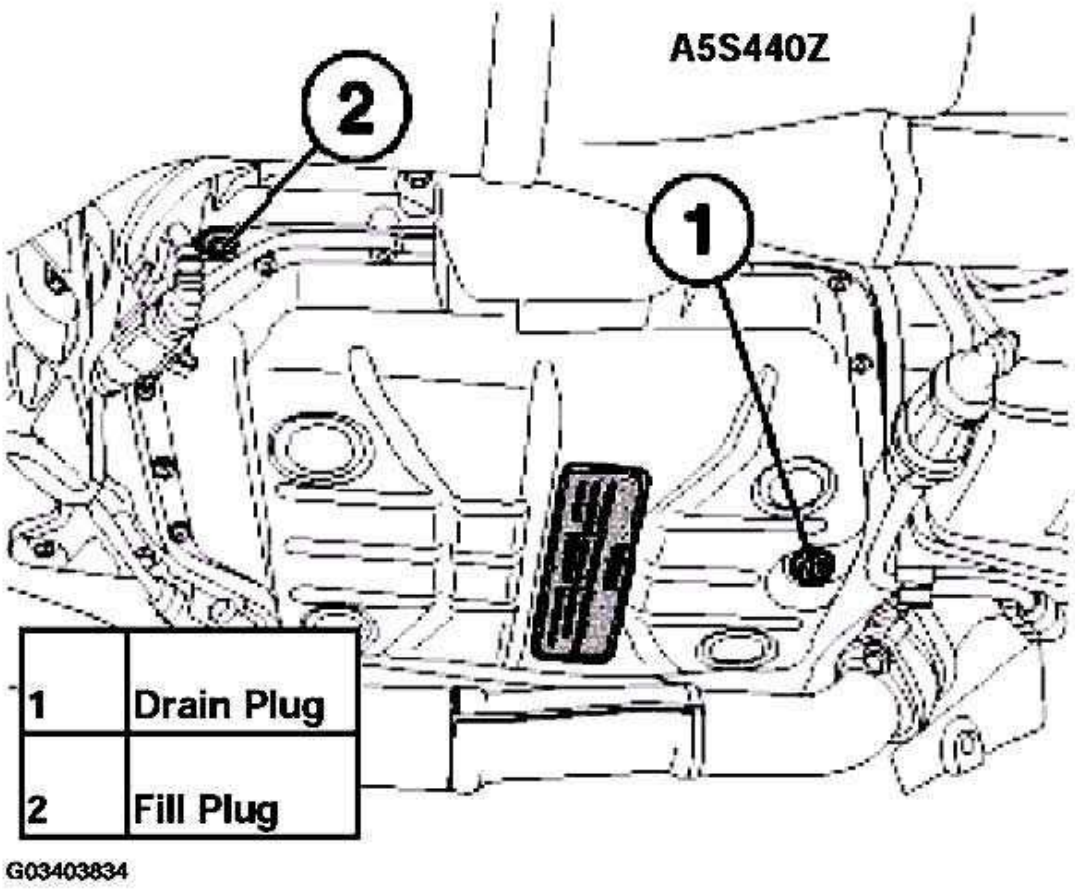


Fig. 56: Identifying Transmissions Drain Plug And Fill Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Transmission Fluid Application

There are numerous types of transmission fluid used in BMW transmissions. With the exception of the early transmissions (4HP22/24, A4S310/270R and the A5S310Z in the E34) all current BMW transmissions use "Lifetime Fill" transmission fluid. There is no maintenance required for these transmissions. It is important to use the correct fluid. Incorrect use of the transmission fluid can cause non-warrantable transmission damage.

When performing repairs on transmissions with lifetime fluid, it is important to drain the transmission fluid in to a clean container for re-use. New fluid should only be used for transmission replacement and for topping off after repairs.

Also, transmission fluid level is vital to the proper operation of the transmission.

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When servicing or repairing BMW automatic transmissions, refer to TIS for fluid capacities.

TRANSMISSION FLUID

Transmission	Fluid Type	BMW Part #	Container	SIB Ref.
4HP22 **4HP24**	Dexron III Mercon	Available Commercially (Castrol or Texaco)	N/A	
A5S310Z 530i/iT (E34)	Dexron III	Available Commercially (Castrol or Texaco)	N/A	
M3 (E36)	ESSO LT 71141	83 22 9 407 807	20 liter container	B 24 03 95
A5S325Z	ESSO LT 71141	83 22 9 407 807	20 liter container	
A5S440Z	ESSO LT 71141	83 22 9 407 807	20 liter container	
A5S560Z 740 (E32), 540 (E34) 840Ci (E31- 6/93-12/94) 740i/iL-750iL (E38)	Shell LA2634	83 22 9 407 765	5 liter container	B 24 11 92
540i (3/96-12/96) 850Ci (10/94-6/97)	ESSO LT 71141	83 22 9 407 807	20 liter container	B 24 02 94
A4S310R **A4S270R** **(THM-R1)**	Dexron III Mercon	Available Commercially (Castrol or Texaco)	N/A	
A5S360R **A5S390R**	Texaco ETL 7045E Texaco ETL 8072B	83 22 0 026 922 83 22 0 024 359	25 liter container 25 liter container	
GA6HP26Z **GA6HP32Z**	Shell M-1375.4	83 22 0 142 516	20 liter container	

TRANSMISSION SERVICE

Overview Of Allowable Repairs

Currently, service of transmissions covered under warranty is limited to level I. Level I service includes electrical, minor mechanical and hydraulic repairs as well as repair manual provided service adjustments.

Part availability is limited to include the repair of the following:

- **Oil Leaks** - Radial Seals and gaskets.
- **Mechanical/Hydraulic Faults** - Torque Converter, Valve Body, parking pawl, oil pan, output shaft bearing.
- **Electrical Faults** - Solenoid Valves, pressure regulator valves, wiring harness.
- **Signal Sensing** - Turbine and Output Speed Sensors, CAN bus, Temp Sensor.

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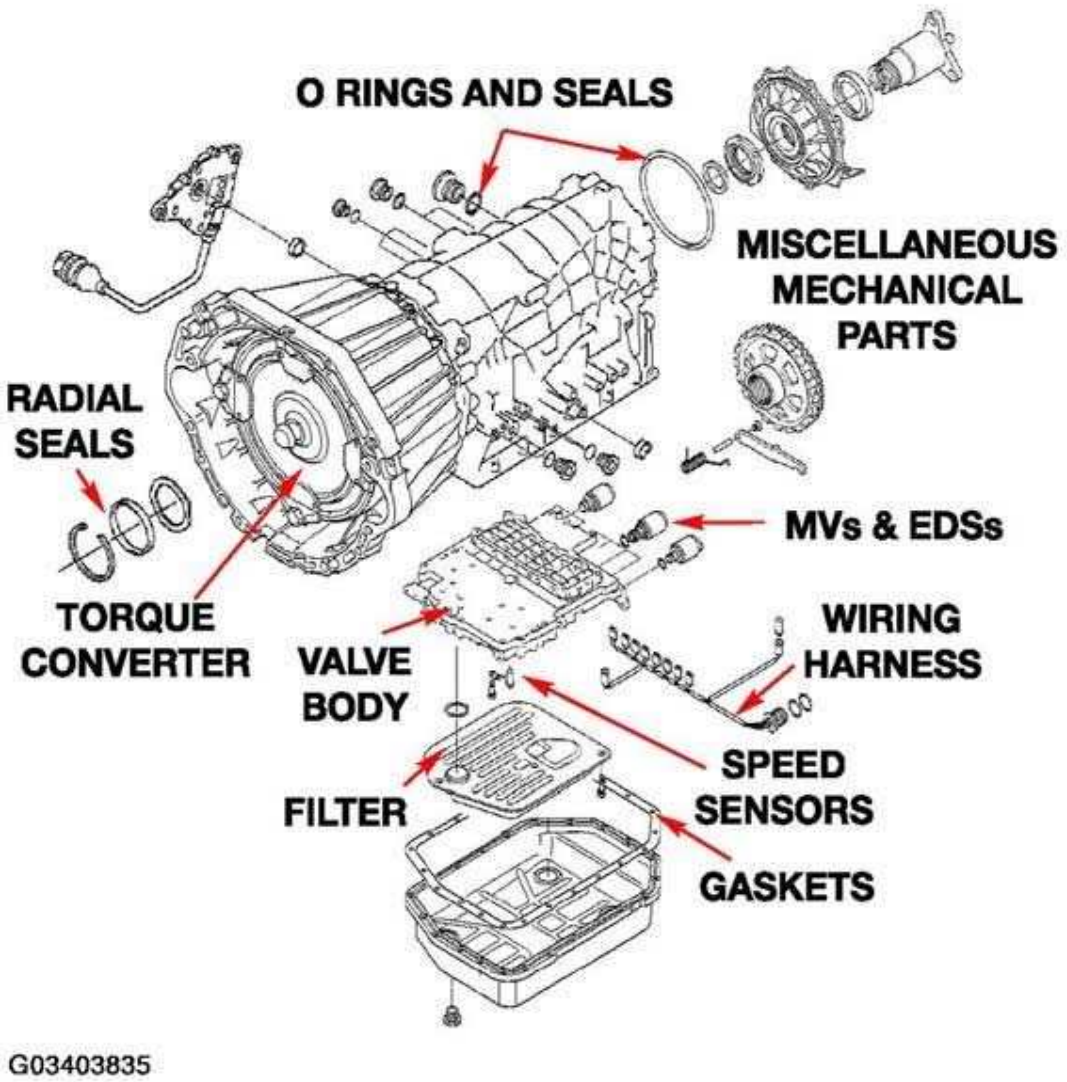


Fig. 57: Exploded View Of Transmission Parts
Courtesy of BMW OF NORTH AMERICA, INC.

BMW Technical Hotline

Before performing any majors repairs or transmission replacement, always contact the BMW Technical Hotline at 1-800-472-7222. When prompted to do so, select option 1 for the Drivetrain Group. Be prepared will all necessary information such as transmission serial number, ID page, fault codes etc. Failure to contact the technical hotline could result in the non payment of warranty claims.

BMW Value Line Program

The Value-Line replacement transmission program provides the availability of factory certified rebuilt units at a very competitive cost.

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BMW SPECIAL TOOLS (TRANSMISSION)

The following pages contain information about BMW special tools, this is not an all inclusive list. This is a list of tools that would be helpful in the diagnosis and service of BMW transmissions.

Transmission Removal And Installation

Tool # 24 1 110

This tool is used to remove the torque converter to flexplate bolts. It is a 17 mm socket with 3/8" drive. There is a magnet to help retain the bolt during installation and removal.

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Fig. 58: Identifying BMW Special Tools - Tool # 24 1 110
Courtesy of BMW OF NORTH AMERICA, INC.

Tool # 24 4 130

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During transmission installation and removal the oil pump must be protected from damage. This tool helps keep the torque converter in place, to prevent oil pump damage due to misalignment.

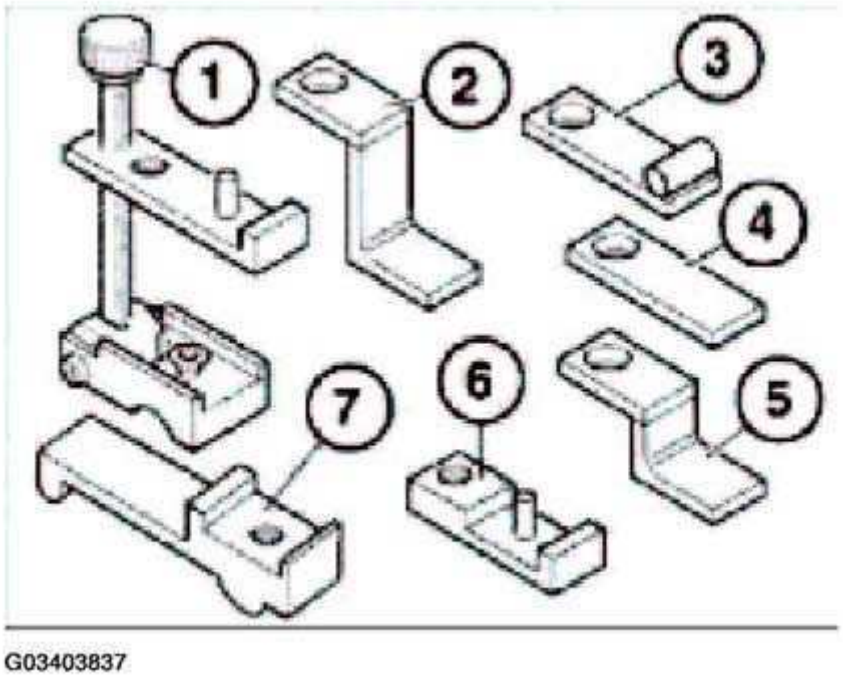


Fig. 59: Identifying BMW Special Tools - Tool # 24 4 130
Courtesy of BMW OF NORTH AMERICA, INC.

Tool # 24 2 300

Used to align torque converter with flexplate during installation. Use on all BMW automatic transmissions.



Fig. 60: Identifying BMW Special Tools - Tool # 24 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

Transmission Adjustments

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Tool # 24 2 320

3/16" socket head cap screw (hex) with 1/4" drive. Used to adjust brake band on the THMR-1.

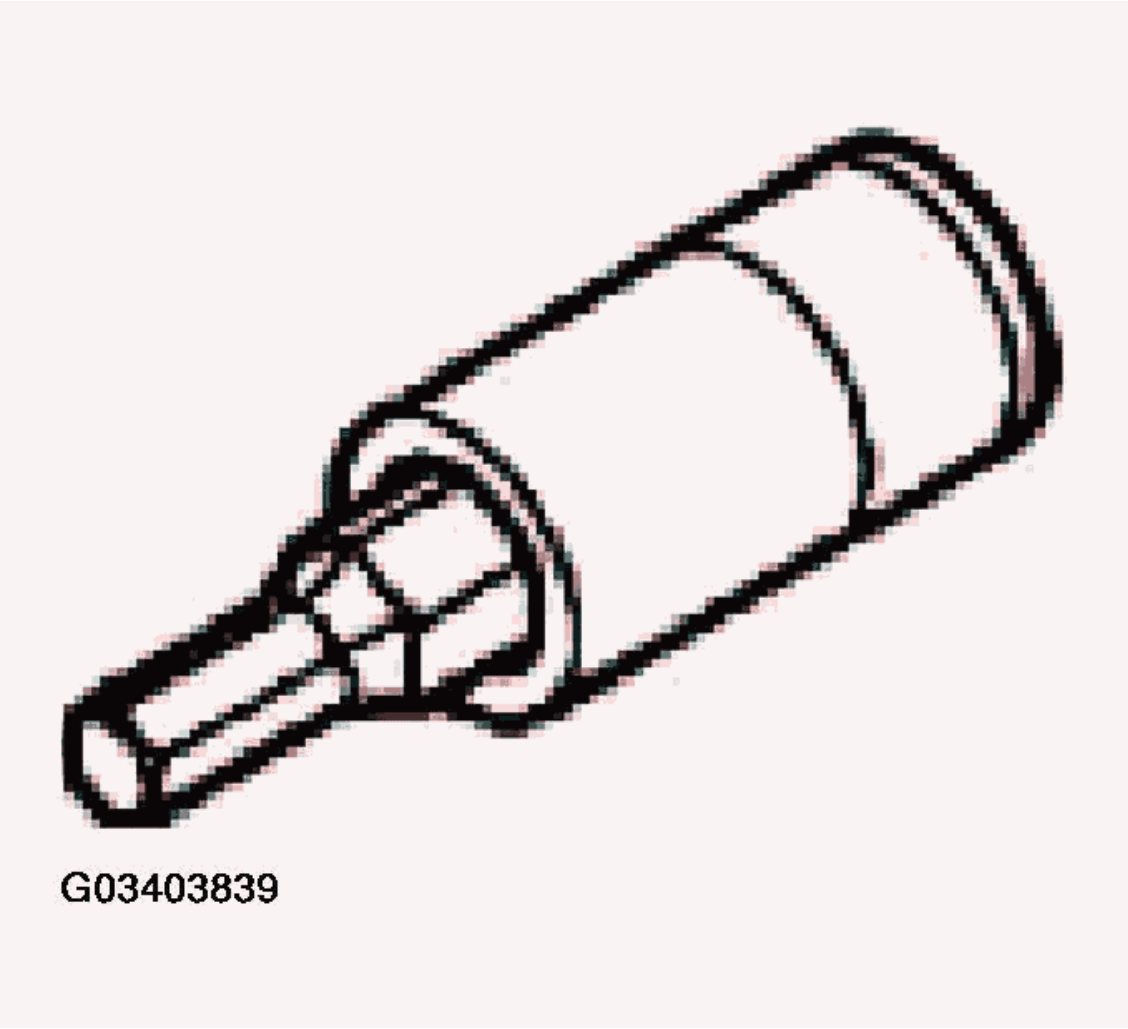


Fig. 61: Identifying BMW Special Tools - Tool # 24 2 320
Courtesy of BMW OF NORTH AMERICA, INC.

Tool # 24 2 330

1/2 open end wrench used to turn lock-nut on the brake band servo when adjusting the brake band. Used only on the THMR-1 transmissions.

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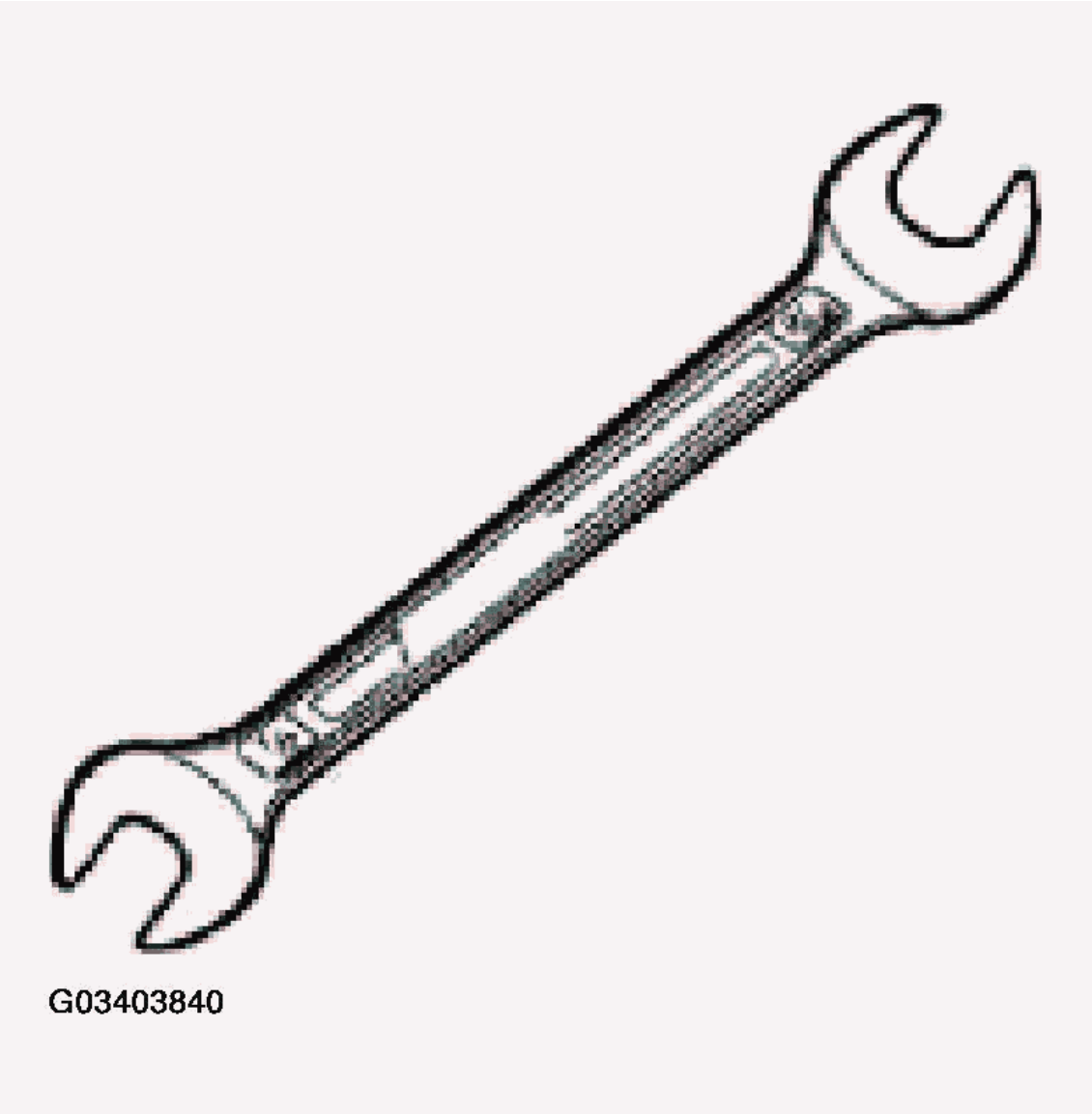


Fig. 62: Identifying BMW Special Tools - Tool # 24 2 330
Courtesy of BMW OF NORTH AMERICA, INC.

Tool # 24 1 120

Used as guide to lock the range selector switch in "P" when installing. It is used on the A4S270R transmission. Used only for applications which have the selector switch mounted on the transmission case.

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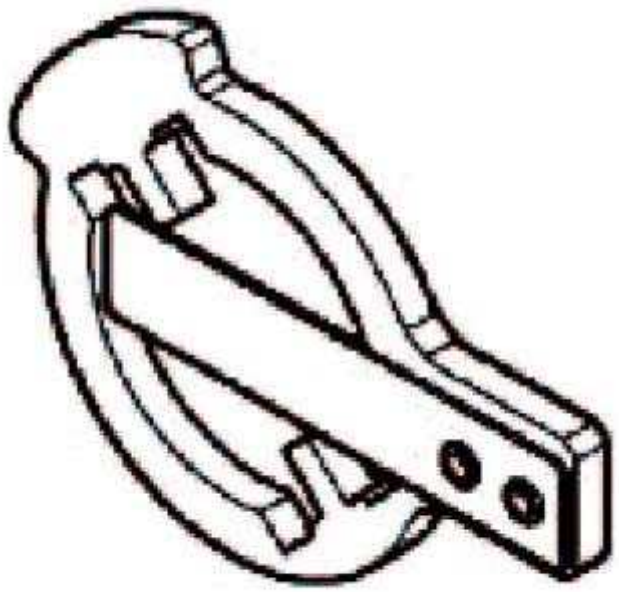


Fig. 63: Identifying BMW Special Tools - Tool # 24 1 120
Courtesy of BMW OF NORTH AMERICA, INC.

Transmission Diagnostic Tools

Tool # 24 6 000

8-pin test cable used to test the transmission at the "Cannon Plug" located on transmission case. This cable is used for the 4HP22/24 EH. Used in conjunction with 61 1 459.

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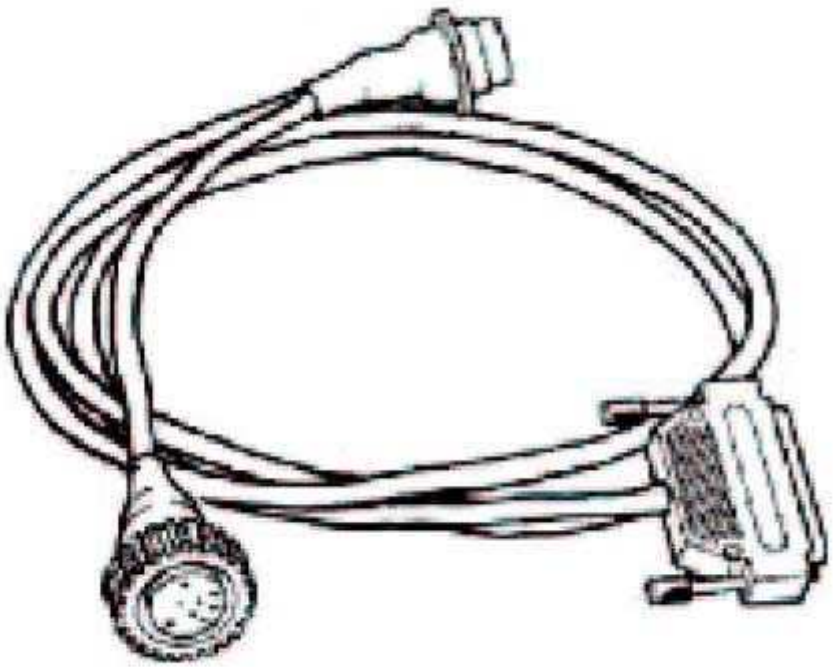


Fig. 64: Identifying Transmission Diagnostic Tools - Tool # 24 6 000
Courtesy of BMW OF NORTH AMERICA, INC.

Tool # 24 6 060

16 pin test cable used to test the transmission at the "Cannon Plug" located on the transmission case. This cable is used for the A5S310Z and A5S560Z. Used in conjunction with 61 1 459.

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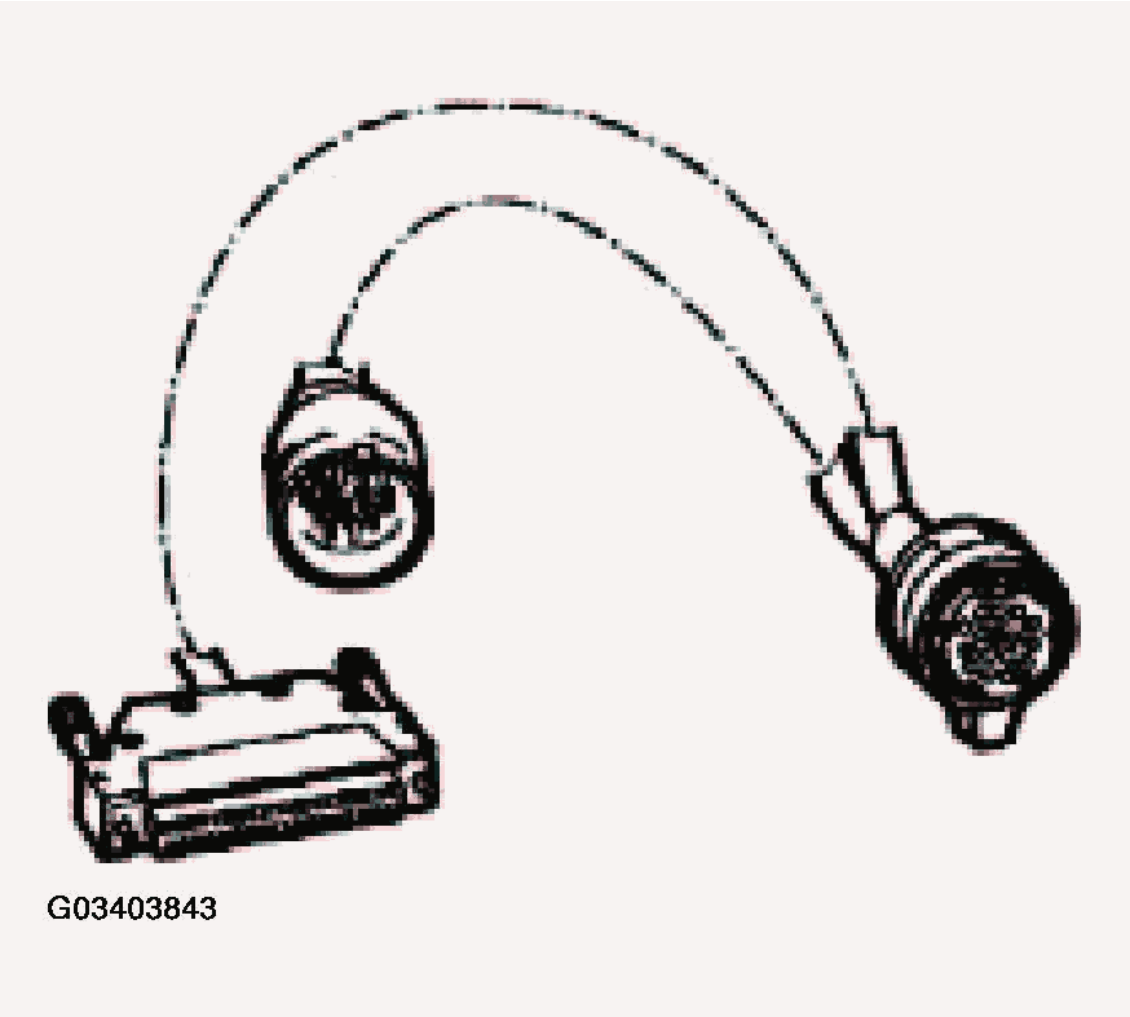


Fig. 65: Identifying Transmission Diagnostic Tools - Tool # 24 6 060
Courtesy of BMW OF NORTH AMERICA, INC.

Tool # 24 6 020

14 pin test cable used to test the transmission at the "Cannon Plug" located on the transmission case. This cable is used on the A5S310Z.

Used in conjunction with 61 1 459.

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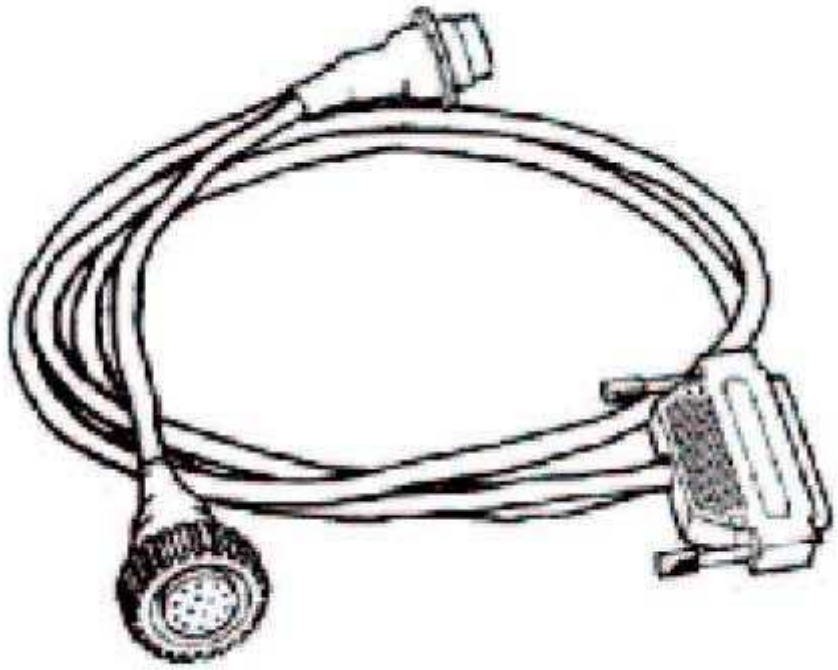


Fig. 66: Identifying Transmission Diagnostic Tools - Tool # 24 6 020
Courtesy of BMW OF NORTH AMERICA, INC.

Tool # 24 6 010

8-pin test cable used to test the transmission at the "Cannon Plug" located on transmission case. This cable is used for the A4S270/310R.

Used in conjunction with 61 1 459.

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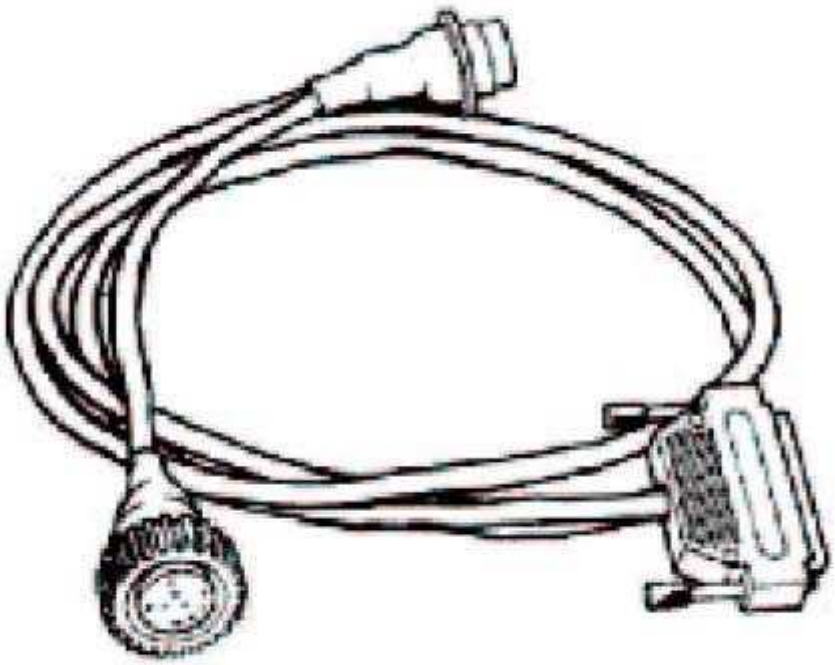


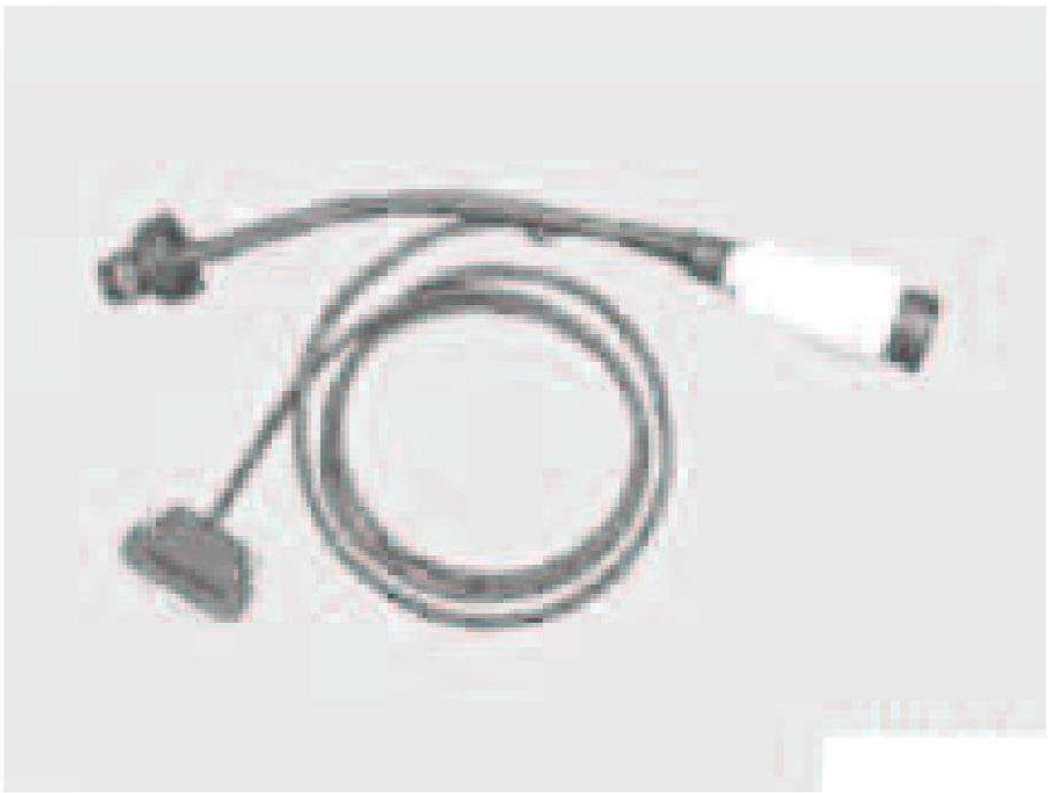
Fig. 67: Identifying Transmission Diagnostic Tools - Tool # 24 6 010
Courtesy of BMW OF NORTH AMERICA, INC.

Tool # 24 6 080

16-pin test cable used to test the transmission at the "Cannon Plug" located on transmission case. This cable is used for the 6HP26Z.

Used in conjunction with 61 1 459.

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Fig. 68: Identifying Transmission Diagnostic Tools - Tool # 24 6 080
Courtesy of BMW OF NORTH AMERICA, INC.

Tool # 24 6 070

20-pin test cable used to test the transmission at the "Cannon Plug" located on transmission case. This cable is used for the A5S360/390R.

Used in conjunction with 61 1 459.

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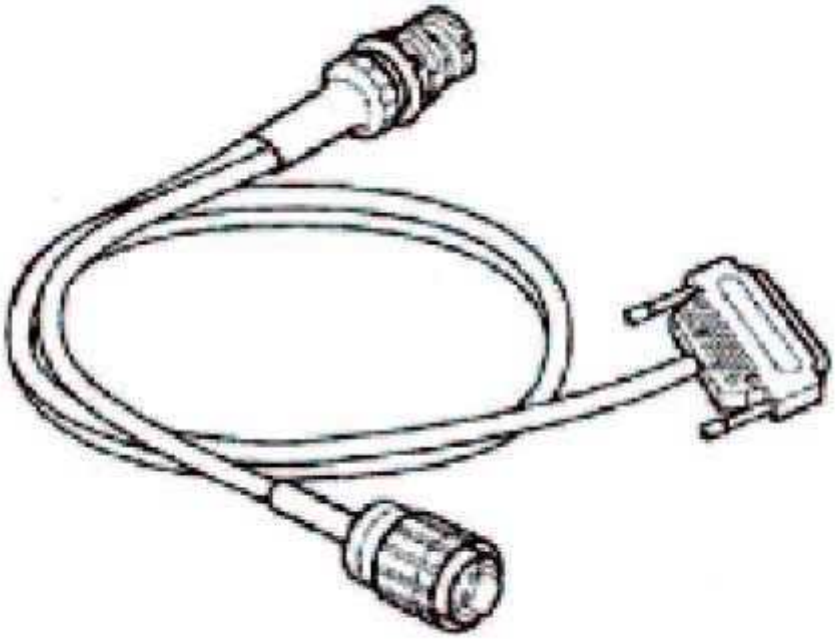


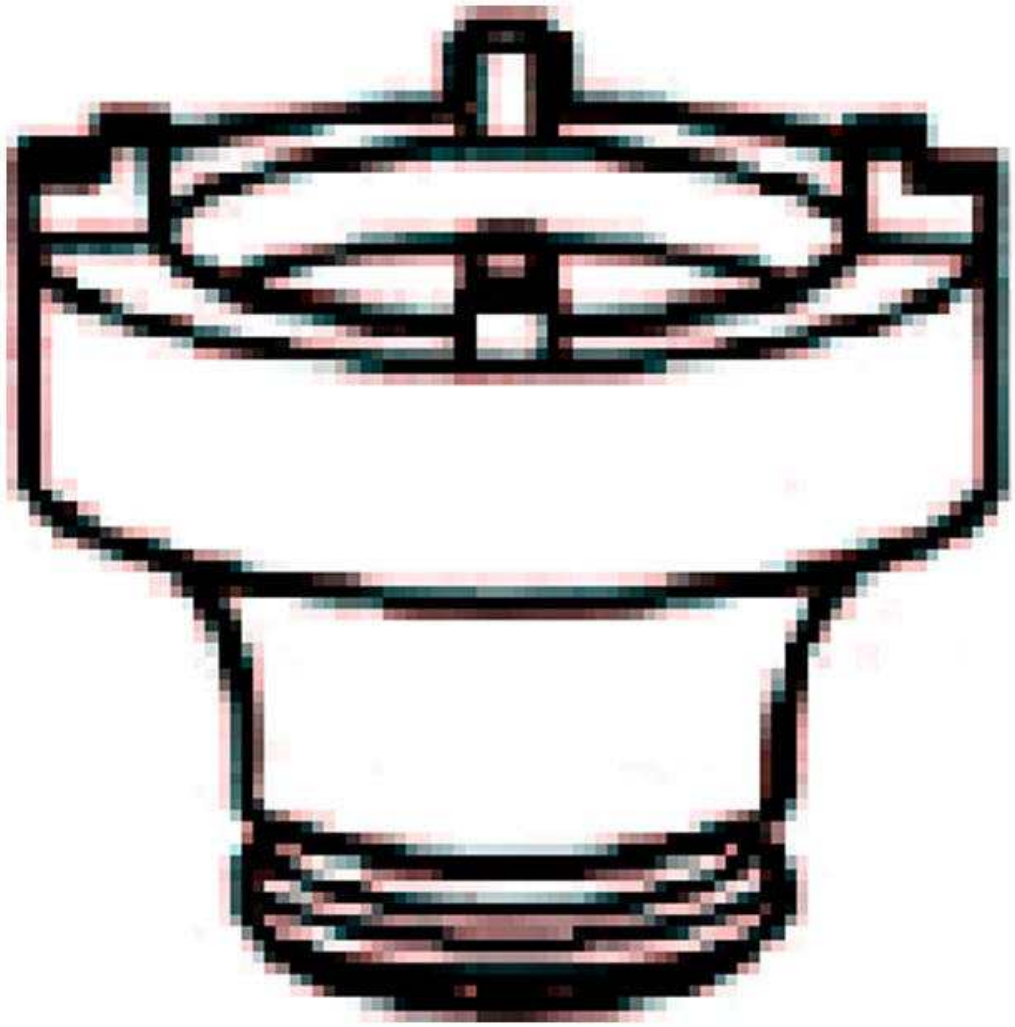
Fig. 69: Identifying Transmission Diagnostic Tools - Tool # 24 6 070
Courtesy of BMW OF NORTH AMERICA, INC.

Service and Repair Tools

Tool # 24 1 170

For loosening and tightening slotted nut on output drive flange. Used on 5HP18 (A5S310Z). Use in conjunction with tool #24 1 220.

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Fig. 70: Identifying Service And Repair Tools - Tool # 24 1 170
Courtesy of BMW OF NORTH AMERICA, INC.

Tool # 24 4 110

For loosening and tightening slotted nut on output drive flange. Used on 5HP24 and 5HP30. Use in conjunction with tool #24 1 220.

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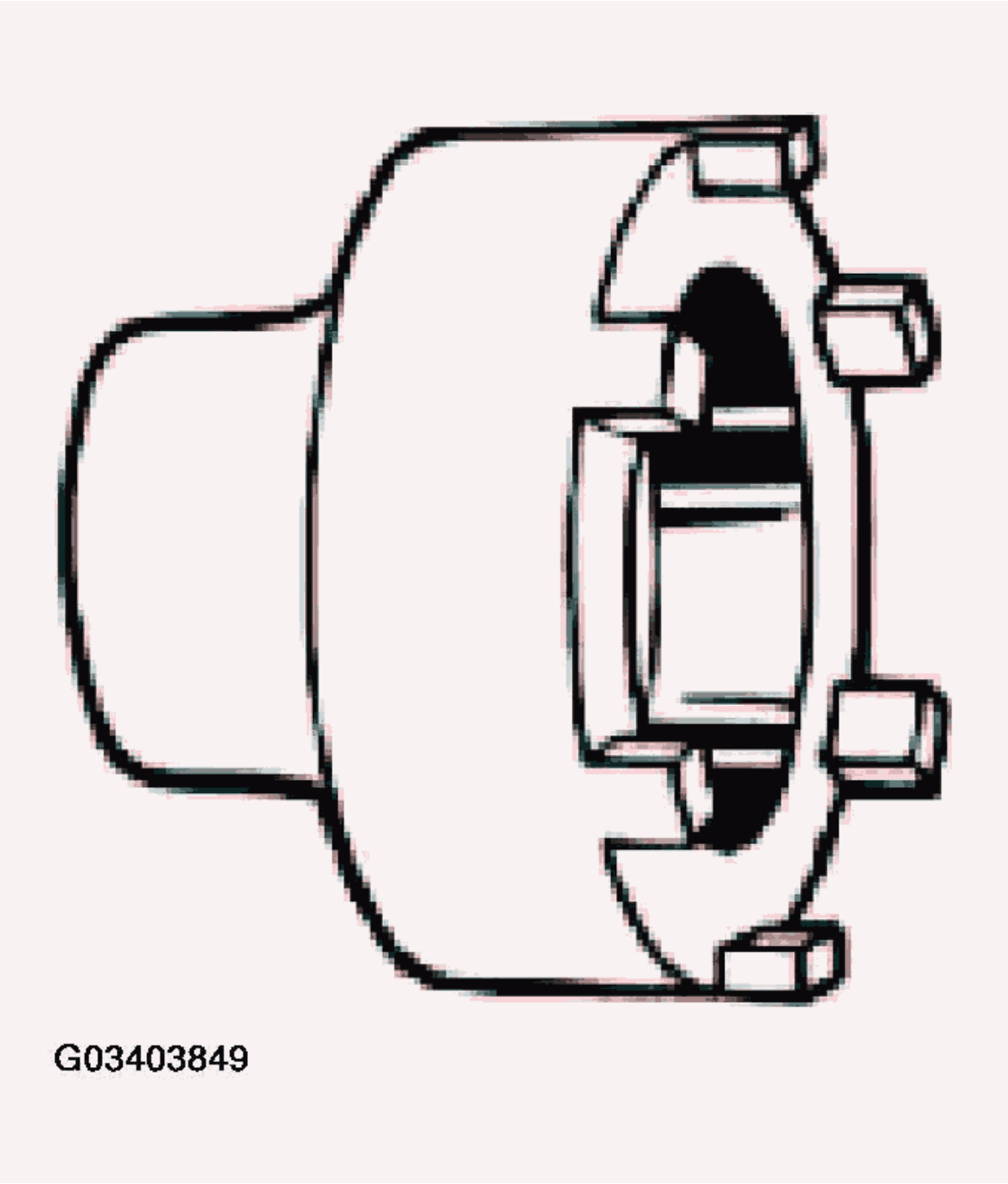


Fig. 71: Identifying Service And Repair Tools - Tool # 24 4 110
Courtesy of BMW OF NORTH AMERICA, INC.

Tool # 24 1 220

Take up support for drive flange. Used when tightening of loosening slotted nut on output drive flange. Used with tool numbers 24 4 170 and 24 4 110.

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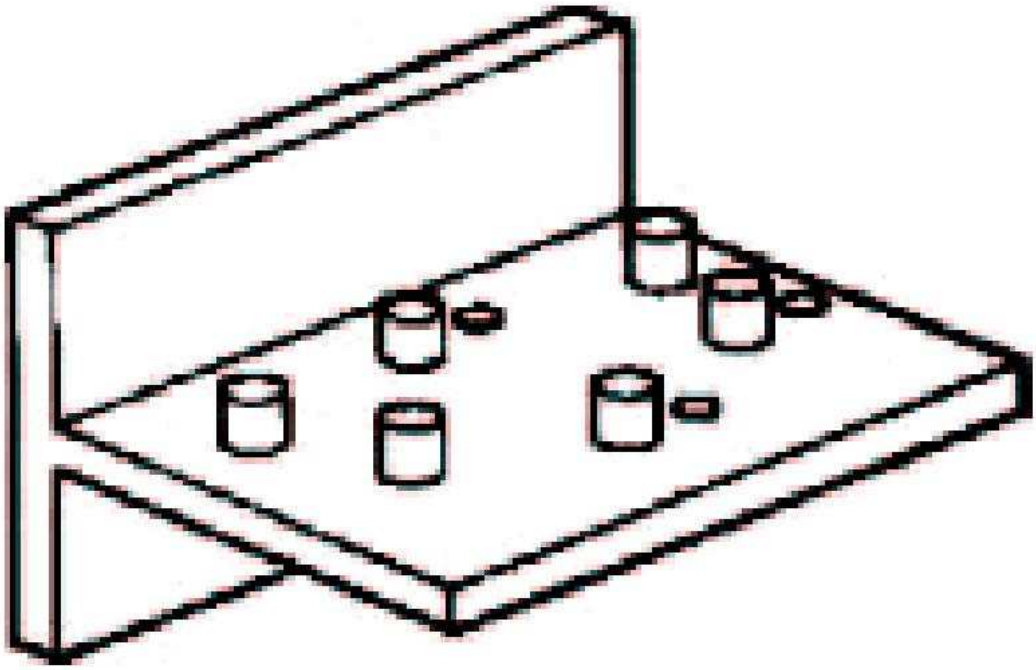


Fig. 72: Identifying Service And Repair Tools - Tool # 24 1 220
Courtesy of BMW OF NORTH AMERICA, INC.

Tool # 24 2 380

34 mm Socket used to tighten and loosen nut on output drive flange. Used with special tool 23 0 020. For GA6HP26Z transmission.

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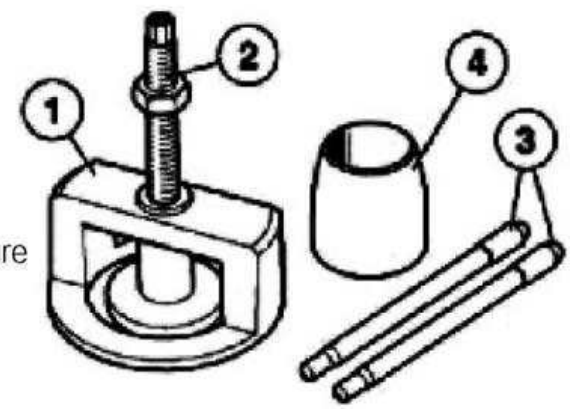


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Fig. 73: Identifying Service And Repair Tools - Tool # 24 2 380
Courtesy of BMW OF NORTH AMERICA, INC.

Tool # 24 2 310

Set of tools used to re-seal intermediate plate. Used on A4S310R and A4S270R. Tool Set Consists of:



1. 24 2 311 Pressure Plate
2. 24 2 312 Spindle with Pressure Plate
3. 24 2 313 Guide Pins (2)
4. 24 2 314 Slip Bushing

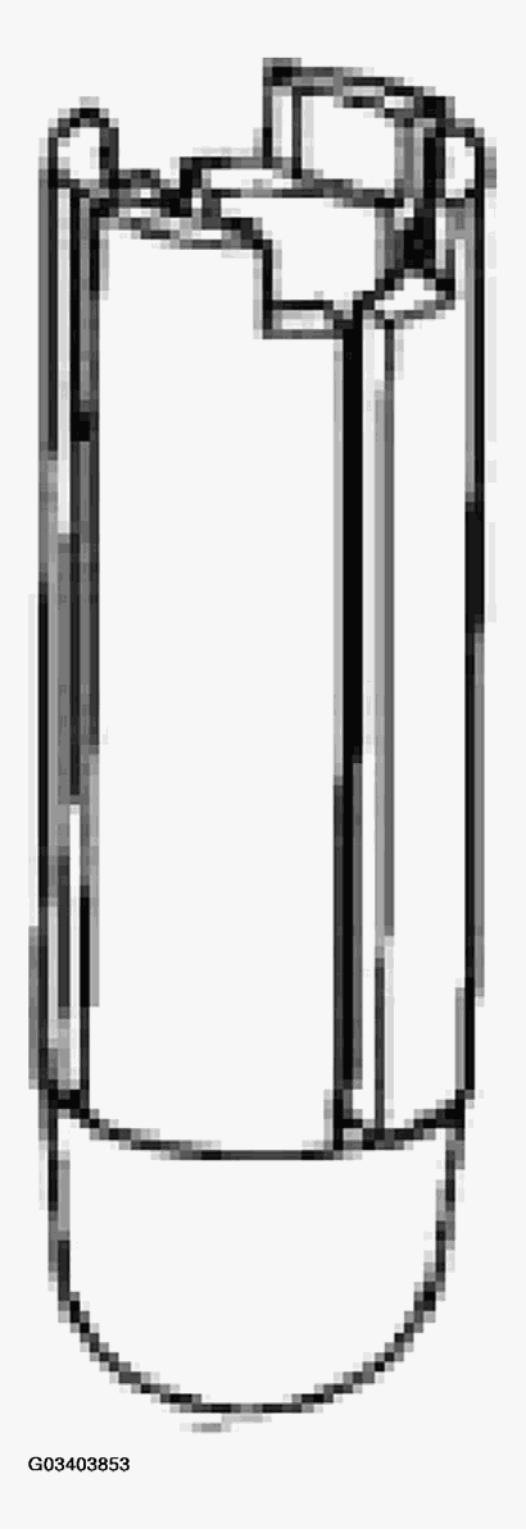
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Fig. 74: Identifying Service And Repair Tools - Tool # 24 2 310
Courtesy of BMW OF NORTH AMERICA, INC.

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Tool # 24 1 200

Used to prevent damage to rotary shift shaft seal when fitting new seal on shift shaft. Used on A5S310Z (5HP18).



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Fig. 75: Identifying Service And Repair Tools - Tool # 24 1 200
Courtesy of BMW OF NORTH AMERICA, INC.

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TRANSMISSION

Gear Shift - Repair Instructions - X3

11 CENTRE SHIFT MANUAL TRANSMISSION

25 11 000 REMOVING AND INSTALLING SHIFT LEVER

Special tools required:

- **25 1 120 PIN WRENCH**

Necessary preliminary tasks:

- Remove complete exhaust system, see **18 00 020 REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM** .
- Remove heat shield.
- Remove transmission cross-member, see **22 31 050 REPLACING CROSS-MEMBER FOR TRANSMISSION MOUNTING** .

Unfasten screws.

Tightening torque: 6AZ, see **26 11 PROPELLER SHAFT, COMPLETE** .

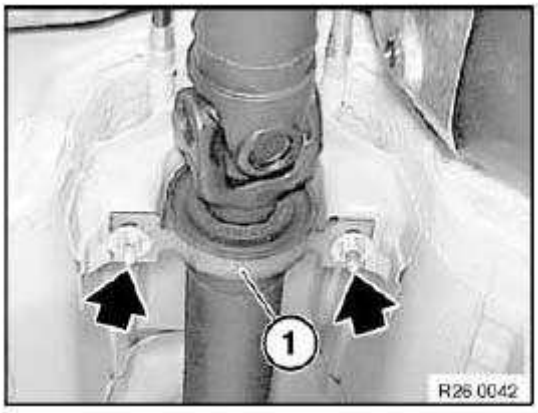


Fig. 1: Screws
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Lower transmission.

IMPORTANT: Risk of damage:
Engine must not rest against bulkhead.

Detach knob with a firm tug.

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NOTE: Do not turn knob when detaching as this will shear off the turning lock in the knob.

Installation:

Fit knob on selector lever, align and press on until it snaps noticeably into place.

NOTE: Illustration shows E46.

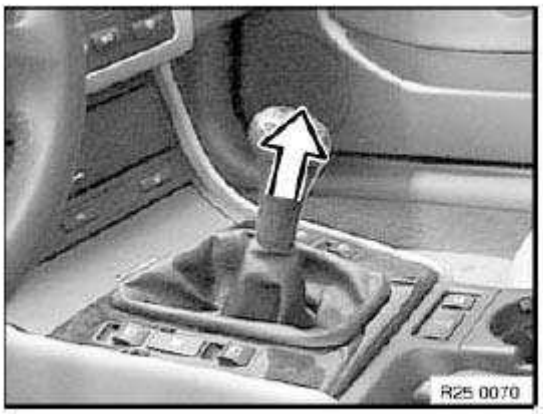


Fig. 2: Detaching Knob With Firm Tug
Courtesy of BMW OF NORTH AMERICA, INC.

Press installation frame of rubber gaiter (1) together a little and remove rubber gaiter (1) from center console.

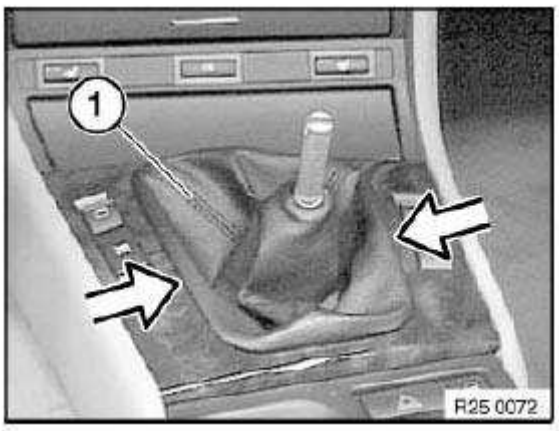


Fig. 3: Rubber Gaiter
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Feed rubber gaiter (1) downwards and fit on selector lever (2).

Pull rubber gaiter (1) over selector lever and insert in center console.

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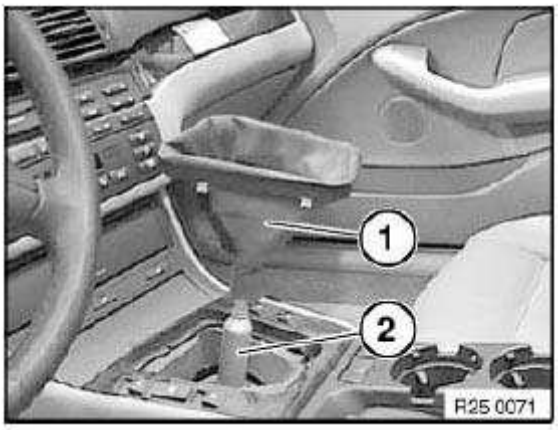


Fig. 4: Rubber Gaiter And Selector Lever
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Push rubber gaiter (1) down until groove (2) is fully exposed.

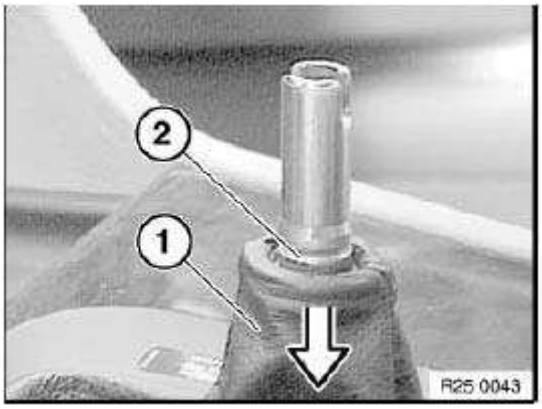


Fig. 5: Pushing Rubber Gaiter Down
Courtesy of BMW OF NORTH AMERICA, INC.

Remove soundproofing (1).

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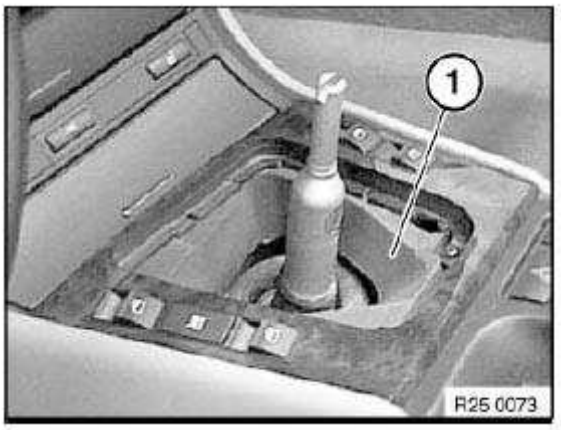


Fig. 6: Soundproofing
Courtesy of BMW OF NORTH AMERICA, INC.

Lever out fixture (1) in direction of arrow.

Remove shims (3).

Pull selector rod (2) in direction of arrow.

Installation:

Grease selector rod pin.

Make sure shims (3) are in correct position.

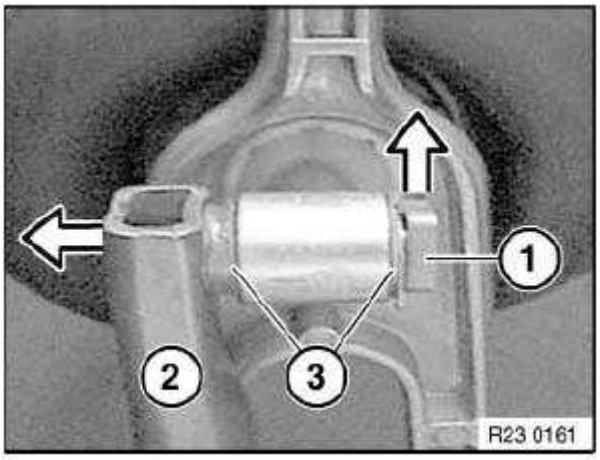


Fig. 7: Pulling Selector Rod
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 25 1 120 in mounting and turn 90° counterclockwise.

Press mount upwards out of selector arm.

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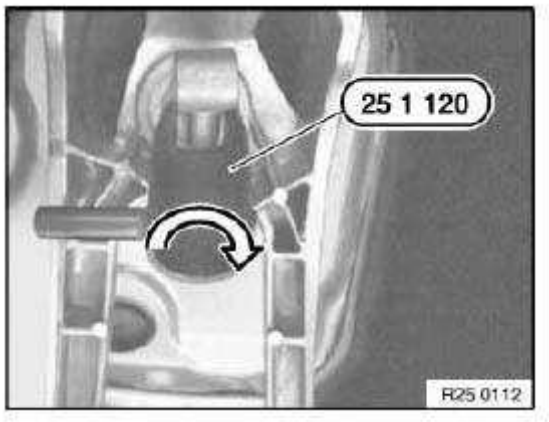


Fig. 8: Inserting Special Tool And Turning Counterclockwise
Courtesy of BMW OF NORTH AMERICA, INC.

Remove rubber gaiter from body cutout and lift out with selector lever.

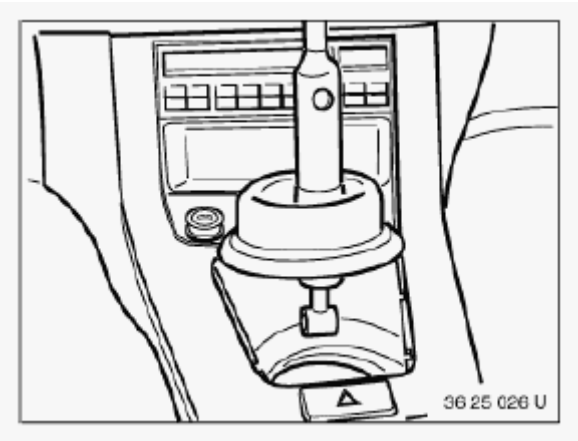


Fig. 9: Rubber Gaiter And Selector Lever
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Insert rubber gaiter with arrow in direction of travel towards front.

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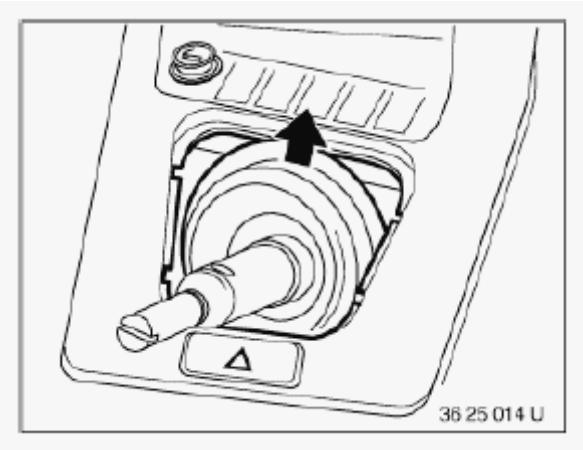


Fig. 10: Inserting Rubber Gaiter
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Grease selector lever ball.

Install selector lever in selector arm.

Align mount:

- Arrows on mount in longitudinal axis of vehicle.
- Retaining lugs of mount, transverse to direction of travel.

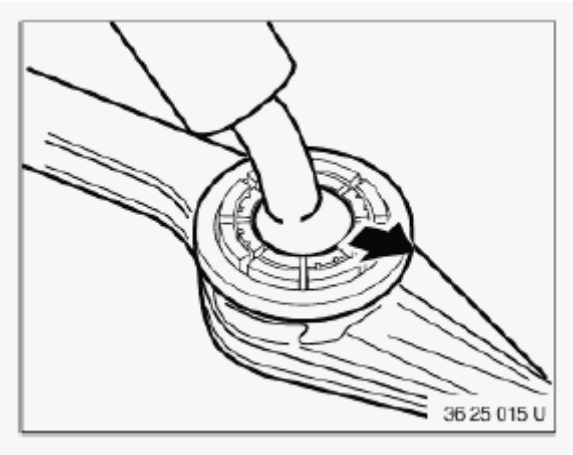


Fig. 11: Aligning Mount In Longitudinal Axis Of Vehicle
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Press mount in area of retaining lugs into selector arm until it audibly snaps into place.

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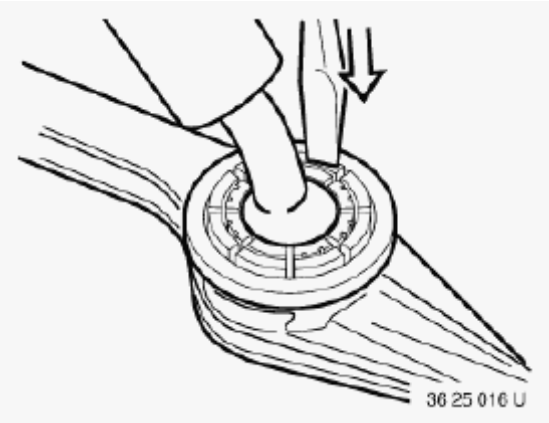


Fig. 12: Pressing Mount In Area Of Retaining Lugs Into Selector Arm
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Pull inner rubber gaiter over bowl on selector arm and press outer rubber gaiter into body cutout.

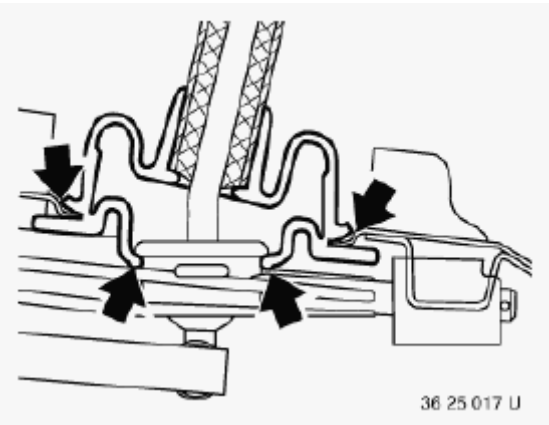


Fig. 13: Pulling Inner Rubber Gaiter Over Bowl On Selector Arm
Courtesy of BMW OF NORTH AMERICA, INC.

25 11 001 REPLACING COMPLETE SHIFT LEVER

Necessary preliminary tasks:

- Remove shift lever, see **25 11 000 Removing and installing shift lever**.
- Remove vibration damper (if fitted).

Detach mount from selector lever.

Installation:

Grease ball joint.

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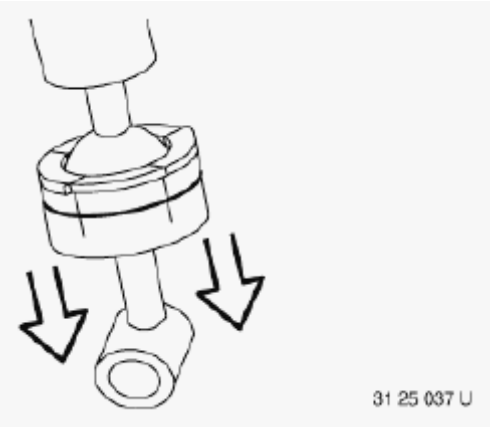


Fig. 14: Detaching Mount From Selector Lever
Courtesy of BMW OF NORTH AMERICA, INC.

Detach rubber gaiter from selector lever.

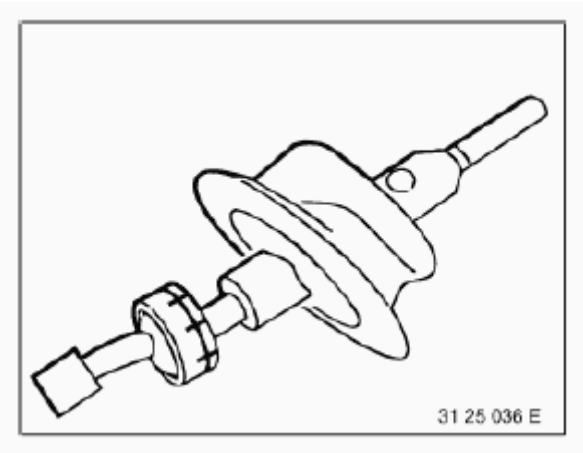


Fig. 15: Rubber Gaiter And Selector Lever
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Degrease selector lever (1).

Coat rubber bellows on inside of shaped section (2) with Circolight.

Pull rubber gaiter from above over selector lever and align.

Arrow (3) on rubber gaiter must point in direction of travel (A).

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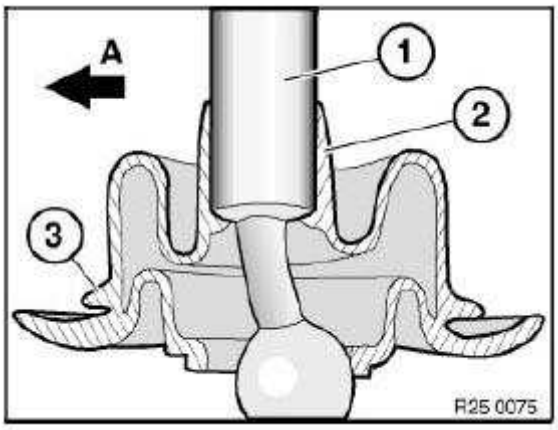


Fig. 16: Selector Lever And Shaped Section
Courtesy of BMW OF NORTH AMERICA, INC.

25 11 041 REPLACING BEARING SHELL FOR SHIFT LEVER

Necessary preliminary tasks:

- Remove shift lever, see **25 11 000 Removing and installing shift lever**.

Detach mount from selector lever.

Installation:

Grease ball joint.

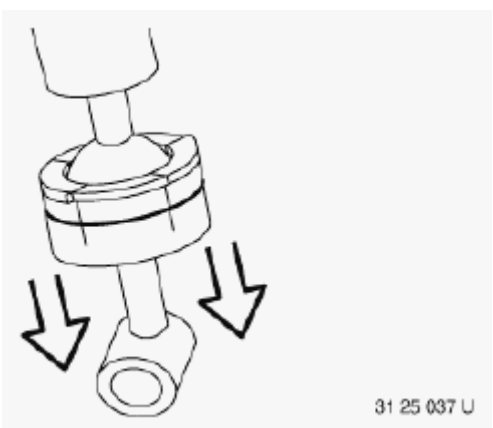


Fig. 17: Detaching Mount From Selector Lever
Courtesy of BMW OF NORTH AMERICA, INC.

25 11 071 REPLACING KNOB FOR SHIFT LEVER

NOTE: Do not twist knob during removal as this would cause the turning lock in the knob to shear off.

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Tug firmly to remove knob.

Installation:

Fit knob on selector lever, align and press on until it snaps noticeably into place.

NOTE: Illustration shows E46.



Fig. 18: Detaching Knob With Firm Tug
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Push rubber gaiter (1) down until groove (2) is fully exposed.

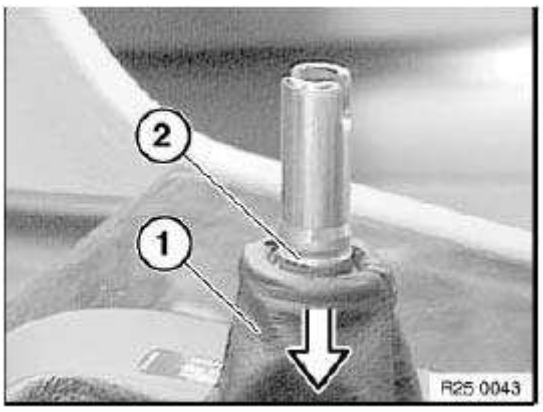


Fig. 19: Pushing Rubber Gaiter Down
Courtesy of BMW OF NORTH AMERICA, INC.

25 11 081 REPLACING GAITER (SHIFT LEVER COVER) FOR SHIFT LEVER

Necessary preliminary tasks:

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- Remove knob for shift lever, see **25 11 071 Replacing knob for shift lever**.

NOTE: The method for removing the gaiter is the same for manual and automatic transmissions.

Removing gaiter:

1. Carefully pull gaiter taut on leather.
2. Press frame inwards slightly until catch is released.
3. Lift out gaiter.

NOTE: Illustrations show E85.

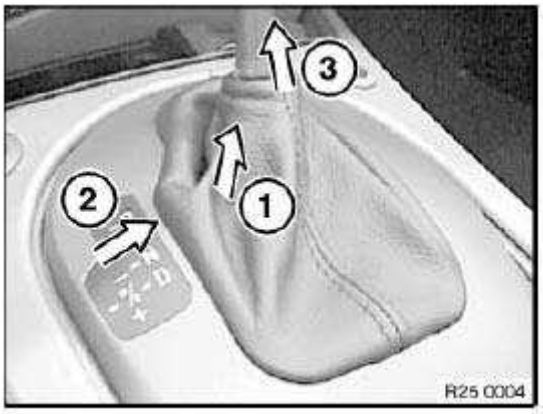


Fig. 20: Lifting Out Gaiter
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Retaining lugs must not be damaged.

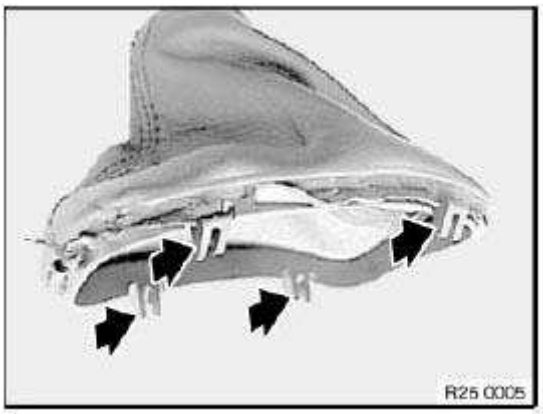


Fig. 21: Retaining Lugs

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Courtesy of BMW OF NORTH AMERICA, INC.

25 11 111 REPLACING SHIFT ROD JOINT

Necessary preliminary tasks:

- Remove complete exhaust system, see **18 00 020 REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM** .
- Remove heat shield.
- Remove transfer box, see **27 10 010 REMOVING AND INSTALLING TRANSFER CASE (ATC 400 X-DRIVE)** .

Lift off retainer (1).

Disconnect shift rod (2).

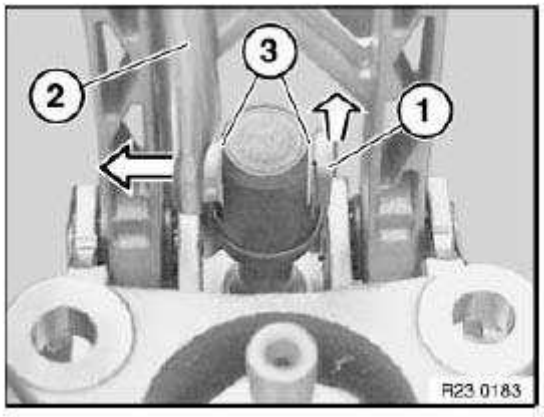


Fig. 22: Lifting Off Retainer
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Grease shift rod.

Make sure shims (3) are in correct position.

Lever spring washer (1) out of groove and push a little towards rear.

Press dowel pn (2) upwards/downwards out of shift rod joint and remove shift rod joint.

Installation:

Grease ball of selector shaft.

Replace spring washer (1).

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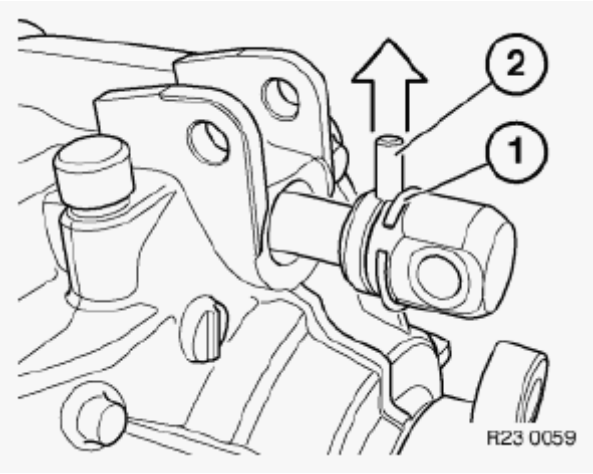


Fig. 23: Spring Washer And Dowel Pn
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check rubber ring (1) in shift rod joint (2) and replace if necessary.

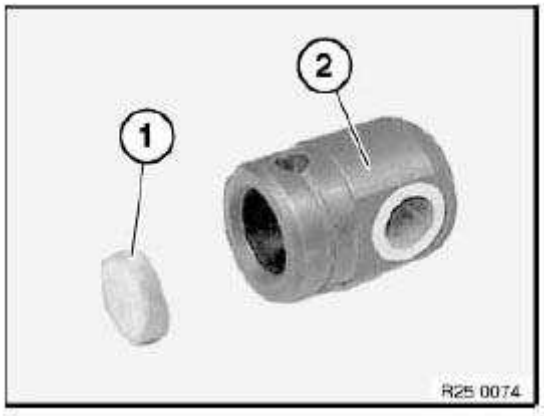


Fig. 24: Rubber Ring And Shift Rod Joint
Courtesy of BMW OF NORTH AMERICA, INC.

25 11 211 REPLACING SHIFT ARM FOR SHIFT-LEVER MOUNT

Necessary preliminary tasks:

- Remove shift lever, see **25 11 000 Removing and installing shift lever**.

Unlock bearing pin (1) in direction of arrow and remove.

Pull shift arm forwards out of rubber mount.

Installation:

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Grease bearing pin and bearing journal.

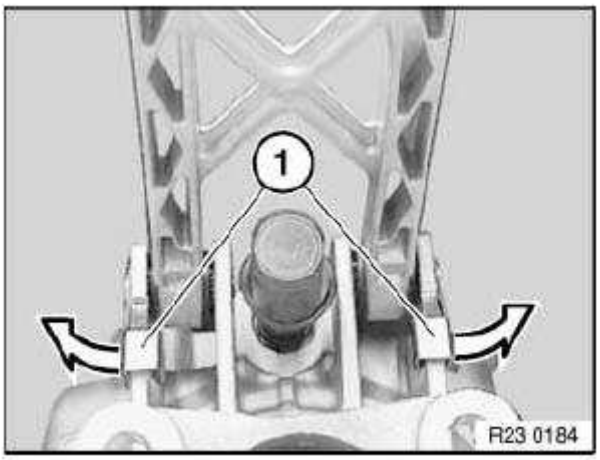


Fig. 25: Unlocking Bearing Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Replace bearing bush if damaged, see **25 11 235 Replacing bearing bushes for shift arm**.

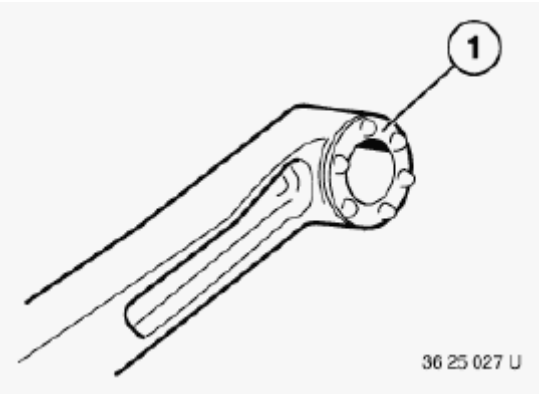


Fig. 26: Bearing Bush
Courtesy of BMW OF NORTH AMERICA, INC.

25 11 235 REPLACING BEARING BUSHES FOR SHIFT ARM

Necessary preliminary tasks:

- Remove shift arm, see **25 11 000 Removing and installing shift lever**.

Press out bearing bush (1).

Coat new bearing bush (1) with Circolight and then press into shift arm until side edges of bush protrude uniformly.

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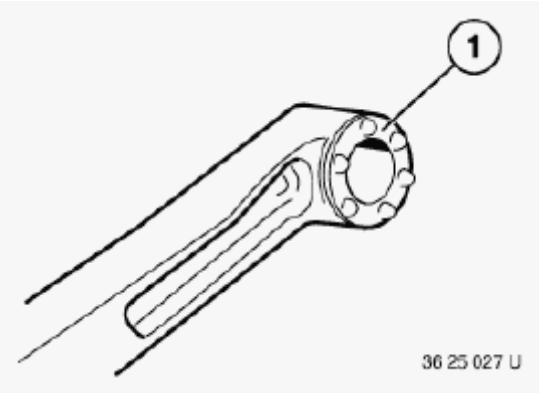


Fig. 27: Bearing Bush
Courtesy of BMW OF NORTH AMERICA, INC.

25 11 245 REPLACING SHIFT-ARM SUPPORT BEARING

Necessary preliminary tasks:

- Remove complete exhaust system, see **18 00 020 REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM** .
- Remove heat shield.

- Remove propeller shaft from transfer box at rear.
- Release center bearing.
- Tie propeller shaft to one side.

Tasks are described in **26 11 000 REMOVING AND INSTALLING PROPELLER SHAFT (CARDAN UNIVERSAL JOINT) COMPLETELY** .

Lever support bearing (1) with a short screwdriver out of mounting.

Pull support off shift arm.

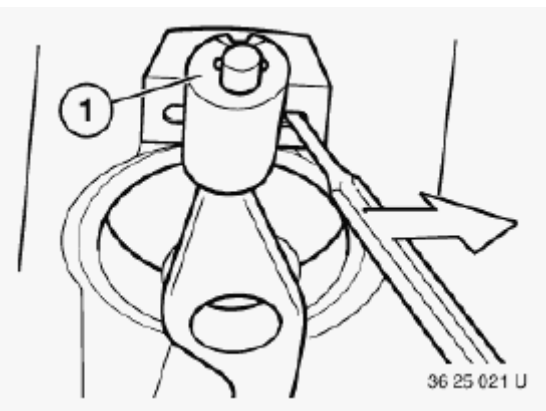


Fig. 28: Pulling Support Off Shift Arm
Courtesy of BMW OF NORTH AMERICA, INC.

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Installation:

Grease bearing pin of shift arm.

Fit support bearing (1) with opening (2) towards top rear onto mounting.

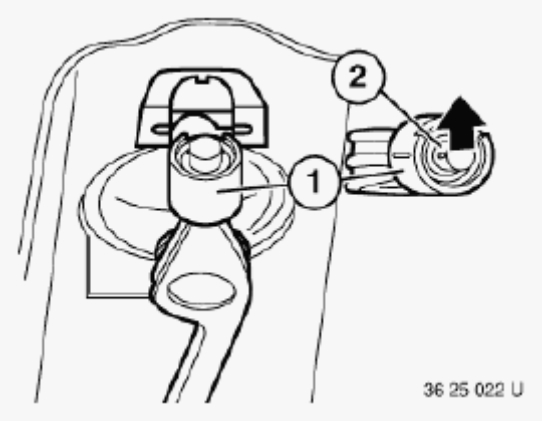


Fig. 29: Fitting Support Bearing With Opening
Courtesy of BMW OF NORTH AMERICA, INC.

16 CENTRE SHIFT AUTOMATIC TRANSMISSION

25 16 056 REMOVING AND INSTALLING / REPLACING SHIFT TOWER (STEPTRONIC)

Necessary preliminary tasks:

- Remove trim for instrument panel, see **51 45 030 REMOVING AND INSTALLING INSTRUMENT PANEL TRIM** .

Move selector lever to "P" position.

Grip clamping sleeve (1) and slacken nut (2).

Installation:

Adjust selector lever, see **24 00 018 ADJUSTING SELECTOR LEVER (A5S 360R / 390R, A4S 200R, 6HP26Z/19Z)** .

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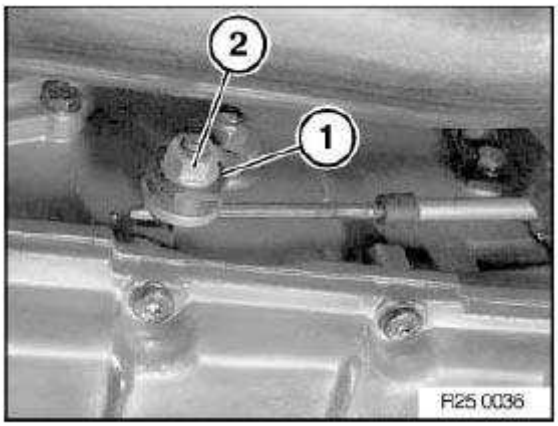


Fig. 30: Clamping Sleeve And Slacken Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Brace cable on hex head (1) and loosen nut (2).

Installation:

Tightening torque: 1AZ, see **25 16 SHIFT CONSOLE - AUTOMATIC TRANSMISSION** .

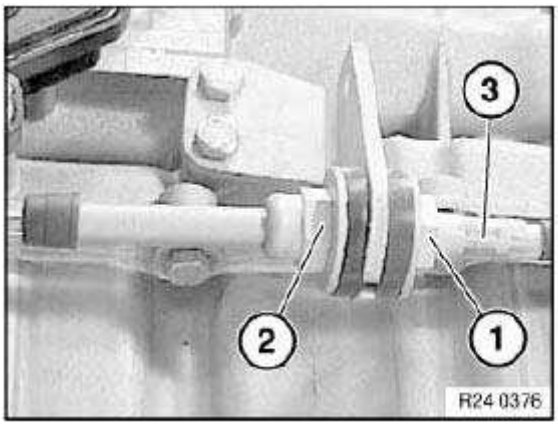


Fig. 31: Hex Head And Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Pull cable (2) out of holder.

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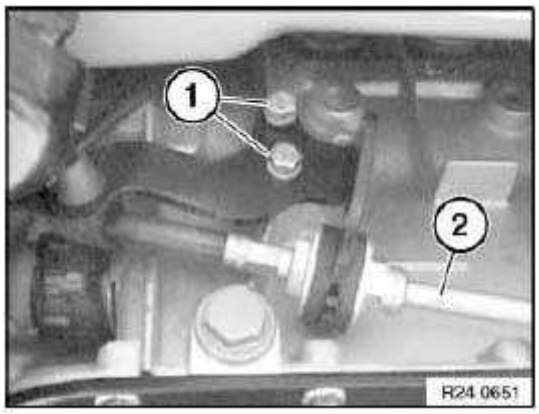


Fig. 32: Screws And Cable
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plugs (1 and 2).

Unscrew bolt (3).

Tightening torque: 5AZ, see **25 16 SHIFT CONSOLE - AUTOMATIC TRANSMISSION** .

Slide interlock cable (4) down using a screwdriver (5) from shaft of interlock locking pawl towards left.

Installation:

Adjust interlock cable and check interlock function, see **25 16 175 Adjusting interlock cable**.

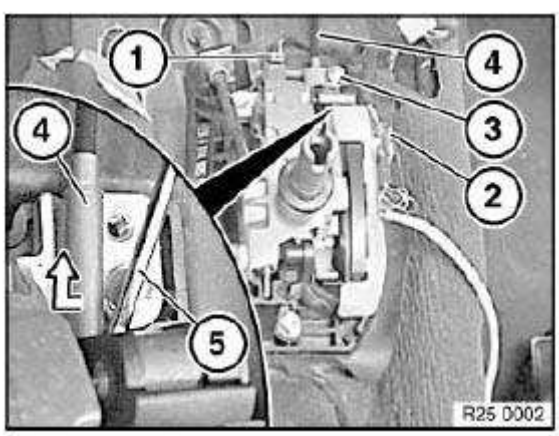


Fig. 33: Plugs, Bolt, Interlock Cable And Screwdriver
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Tightening torque: 3AZ, see **25 16 SHIFT CONSOLE - AUTOMATIC TRANSMISSION** .

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Feed sleeve (2) out of body and remove shift tower.

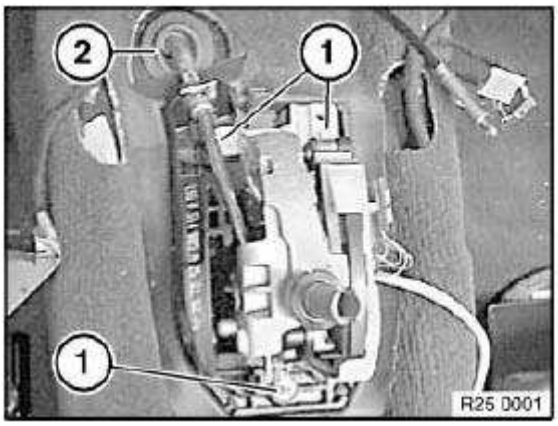


Fig. 34: Screws And Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Insert rubber seal (1) of shift cable (2) in transmission tunnel (3).

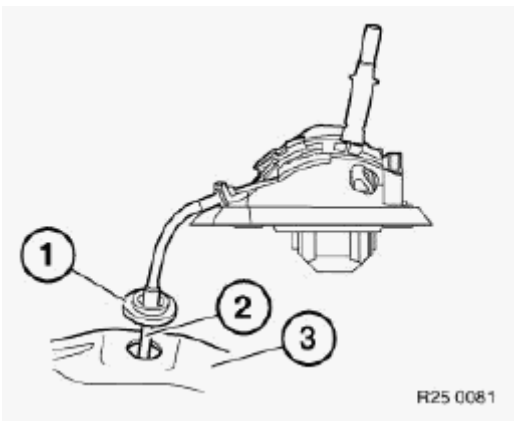


Fig. 35: Rubber Seal, Shift Cable And Transmission Tunnel
Courtesy of BMW OF NORTH AMERICA, INC.

25 16 061 REPLACING GRIP/KNOB FOR SHIFT LEVER

NOTE: The method for removing the grip/knob is identical for manual and automatic transmissions.

Do not twist grip/knob when removing as the turning lock in the knob will shear off.

Detach grip/knob in direction of arrow with a firm tug.

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NOTE: Illustrations show E85.



Fig. 36: Detach Grip/Knob
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Fit grip/knob on shift lever, align and press on until it can be felt to snap into place.

25 16 065 REPLACING GAITER (SELECTOR LEVER COVER) FOR SHIFT TOWER

Necessary preliminary tasks:

- Remove grip, see **25 16 061 Replacing grip/knob for shift lever**.

1. Carefully pull gaiter taut on leather
2. Gently press frame inwards until catch is released
3. Lift out gaiter

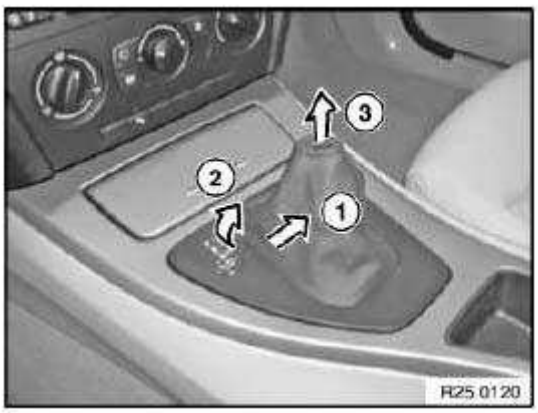


Fig. 37: Lifting Out Gaiter
Courtesy of BMW OF NORTH AMERICA, INC.

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IMPORTANT: Start removing at top left, otherwise the frame will be damaged.

Installation:

Retaining lugs must not be damaged.

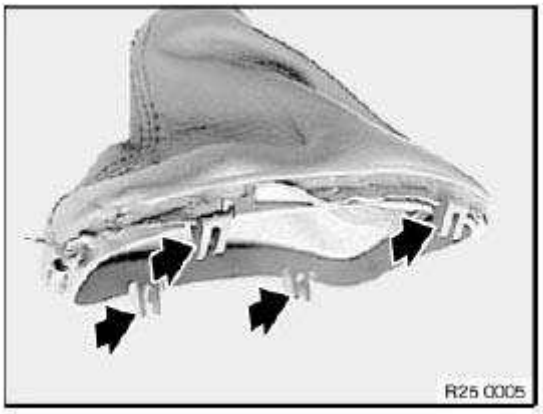


Fig. 38: Retaining Lugs
Courtesy of BMW OF NORTH AMERICA, INC.

25 16 175 ADJUSTING INTERLOCK CABLE

Necessary preliminary tasks:

- Remove function carrier, see **51 45 106 REMOVING AND INSTALLING/REPLACING FUNCTION CARRIER ON INSTRUMENT PANEL TRIM** .

Move selector lever (1) to "P" position (front stop of shifting gate).

Loosen screw (4).

Tightening torque: 5AZ, see **25 16 SHIFT CONSOLE - AUTOMATIC TRANSMISSION** .

It must be possible to move cable (2) slightly in holder (3).

Move ignition key to "zero" position and remove.

Press interlock locking pawl (5) downwards as far as it will go.

Tighten screw (4).

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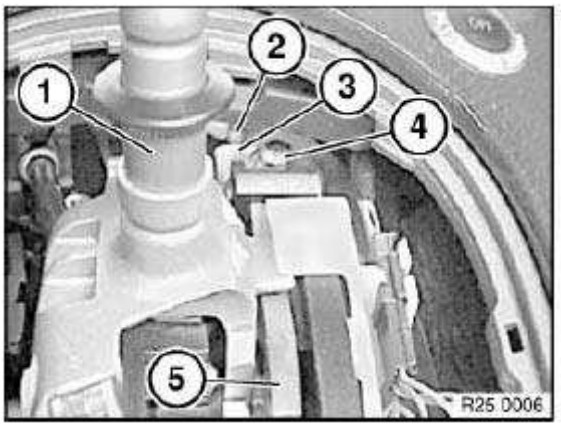


Fig. 39: Selector Lever, Cable, Holder, Screw And Locking Pawl
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Check adjustment of Interlock:

- **Turn ignition key to "ignition" position and then back to "zero" position.**
- **Interlock locking pawl (1) must rest (3) on contact face in shift tower (2).**
- **If necessary, adjust interlock cable again.**

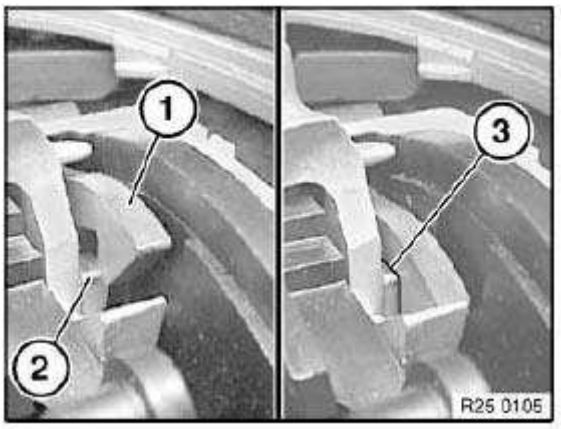


Fig. 40: Locking Pawl And Shift Tower
Courtesy of BMW OF NORTH AMERICA, INC.

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TRANSMISSION

Gear Shift Mechanism - Operating Fluids

1.0 GENERAL INFORMATION

Components of the gear shift mechanism located outside of the transmission housings, such as ball cups, bearing bushings, gearshift joints, etc. may be lubricated with Polylub GLY 801 (BMW Part No. 81 22 9 407 647).

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TRANSMISSION

Gear Shift Mechanism - Special Tools - X3

25 GEAR SHIFT MECHANISM

25 1 120 PIN WRENCH

Minimum set: Mechanical tools

Note: For removing gear lever (releasing gear lever bearing).

Series: E31, E36, E60, E61, E83, E85, E87, E90, E91, E92

SI number: 1 17 05 (212)

Order number: 25 1 120

Pin wrench



Fig. 1: Pin Wrench (25 1 120)
Courtesy of BMW OF NORTH AMERICA, INC.

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TRANSMISSION

Gear Shift Mechanism - Tightening Torques - X3

11 CENTER SHIFT MANUAL TRANSMISSION

25 11 SHIFT CONSOLE - MANUAL TRANSMISSION

SHIFT CONSOLE - MANUAL TRANSMISSION TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Front console to shift console	E36 / E38 / E39 / E46 / E53 / E60 / E61 / E63 / E64 / E83 / E85 / E86 / E87/E90/E91/ E92, with sheet metal console			25 Nm
2AZ Shift console to transmission	E36 / E38 / E39 / E46 / E53 / E60 / E61 / E63 / E64 / E83 / E85 / E86 / E87/E90/E91/ E92, with sheet metal console			23 Nm
3AZ Rear shift console to body	E36 / E38 / E39 / E46 / E53 / E60 / E61 / E63 / E64 / E83 / E85 / E86 / E87/E90/E91/ E92			11 Nm
4AZ Aluminium shift arm console to transmission	E30 / M3			21.5 Nm
5AZ Aluminium shift arm to console	E30 / M3			11 Nm
6AZ Shift arm console to body	E36 / E38 / E39 / E46 / E53 / E60 / E61 / E63 / E64 / E83 / E85 / E86 / E87/E90/E91/ E92			21 Nm
	E31			9 Nm
7AZ Adjustable shift rod (clamping sleeve)	E31			23 Nm
8AZ Support bearing to transmission tunnel	E53			21.5 Nm
10AZ Hose clamp, vibration damper	E60 / E61			6 Nm

16 CENTER SHIFT AUTOMATIC TRANSMISSION

25 16 SHIFT CONSOLE - AUTOMATIC TRANSMISSION

SHIFT CONSOLE - AUTOMATIC TRANSMISSION TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Bowden cable on shift	E36 / E38 / E39 / E46 / E53 / E60 / E61 / E63 /			15 Nm

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tower/transmission	E64 / E65 / E66 / E67 / E68 / E83 / E85 / E86 / E87 / E90 / E91 / E92 / E81			
2AZ Clamping screw on shift lever	E36 / E38 / E39 / E46 / E53 / E60 / E61 / E63 / E64 / E65 / E66 / E67 / E68 / E83 / E85 / E86 / E87 / E90 / E91 / E92 / E81			9 Nm
3AZ Shift console to tunnel	E36 / E38 / E39 / E46 / E53 / E60 / E61 / E63 / E64 / E65 / E66 / E67 / E68 / E83 / E85 / E86 / E87 / E90 / E91 / E92 / E81			7 Nm
4AZ Switch to shift console	E36 / E38 / E39 / E46 / E53 / E60 / E61 / E63 / E64 / E65 / E66 / E67 / E68 / E83 / E85 / E86 / E87 / E90 / E91 / E92			4.5 Nm
5AZ Interlock cable to shift tower	E36 / E38 / E39 / E46 / E53 / E60 / E61 / E63 / E64 / E65 / E66 / E67 / E68 / E83 / E85 / E86			7 Nm
6AZ Cable retaining tab to transmission	E91 / E92 AWD	M8x18		19 Nm
7AZ Oval-head screw for emergency release device	E60, E61			1.6 Nm
8AZ Screw for adjusting cable on transmission	E90 / E91 / E92/E81/E87/E60/E61		With ball head	13 Nm
9AZ Vulcanized support angle to transmission	E81 / E87	M6		9 Nm

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2007-10 TRANSMISSION

Manual Transmission - Operating Fluids

1.0 GENERAL INFORMATION ON GEAR LUBRICANTS

Gear lubricants for manual transmissions must conform to the following requirements due to the different transmission designs with considerable variation in loads, temperature and speeds.

The qualities of a recommended gear lubricant are:

A. Load carrying capacity, i.e. high-pressure resistance.
B. Noise reduction.
C. Non-corrosive to various metals.
D. Non-foaming.
E. Non-separation of additives at operating temperatures.
F. Non-sludge forming.
G. Prevention of swelling, hardening and shrinking of seals.

These properties are already provided in manual transmission oil by:

- High-pressure additives.
- Corrosion inhibitors.
- Oxidation inhibitors (inhibitors which limit or prevent chemical reactions).
- Anti-foaming agents.

2.0 OIL ADDITIVES

BMW manual transmissions are designed so that they do not require aftermarket oil additives.

BMW disapproves the use of any oil additives and cannot accept the liability for any consequential damage that results from using oil additives.

3.0 MANUAL TRANSMISSION OIL REQUIREMENTS AND SPECIFICATIONS

BMW

A. All reputable brand mineral-based transmission oils of viscosity class SAE 80 according to specifications MIL-L-2105 or API GL-4 (**no label** on transmission bell housing).
B. Synthetic transmission fluid, Mobil SHC 630 (325e/528e without dual mass flywheel, produced before mid-1986). Manual transmissions which are filled with Mobil SHC 630 synthetic gear lube have a **green label** with the words "Special Oil" located next to the oil filter plug.

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Fig. 1: Identifying Manual Transmission - Green Label
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Mobil SHC 630 is available in 5-gallon pails or 55-gallon drums from:

Filling BMW transmissions with unapproved synthetic gear lubes could cause the following damage:

- Premature synchromesh ring wear
- Reduced service life of bearings
- Tooth profile damage
- Faster wear of selector forks
- Damage to radial shaft oil seals

Transmission gear clashing will eventually result.

NOTE: Do not use synthetic fluid Mobil SHC 630 in other vehicles. The transmission synchronizers of cars other than listed above are not compatible with synthetic fluid and premature wear will result.

NOTE: To reduce the physical effort required to change gear at low ambient temperatures, the following oils can be used in the transmission during the winter:

- Single-grade HD mineral engine oils SAE40, SAE30, SAE20
- In countries where the ambient temperatures are particularly low, ATF oils can also be used.

This has the disadvantage that the transmission tends to rattle or knock while in neutral at higher temperatures.

CAUTION: These transmissions must never be filled with synthetic engine oils or multigrade engine oils, since these oils contain coefficient of friction-reducing agents that can adversely affect operation of the synchromesh mechanism.

C. Automatic Transmission Fluid (ATF) of Dexron® II or Dexron® III formulation on any of the following:
   - Dual mass flywheel
   - Direct drive fifth gear as of 9/90
   - Six-speeds

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Manual transmissions which are filled with ATF have 17mm external hex plugs in the filler and drain openings as well as an **orange label** on the transmission bell housing next to the filler plug.



Fig. 2: Identifying Manual Transmission - Orange Label
Courtesy of BMW OF NORTH AMERICA, INC.

D. From model year 1998 (9/97 production) all manual transmissions are filled with Esso/Exxon "MTF-LT-1" lifetime fluid. A **yellow label** with the letters "MTF-LT-1" is located next to the oil filler plug.

No oil change is required for the entire service life of these transmissions.

In the event of a repair, the transmission must only be filled with the lifetime oil.

Esso/Exxon MTF-LT-1

BMW P/N 83 22 9 408 942.

E. From model year 2004 some manual transmissions are filled with Castrol "MTF-LT-2" lifetime fluid. This fluid has the same properties as the "MTF-LT-1" fluid indicated above in section D. The "MTF-LT-1" fluid may be mixed and/or substituted for the "MTF-LT-2" manual transmission fluid.

2006 MY and later E60 M5 and E63/64 M6 equipped with and without SMG utilizes only MTF-LT-2 fluid.

2006 MY and later E85 M Roadster and Coupe require MTF-LT-2 fluid.

MTF-LT-2 Fluid

BMW P/N 83 22 0 309 031

F. From Model Year 2006 all vehicles equipped with a manual transmission and the N52 engine require the MTF-LT-3 lifetime fluid.

N52 equipped vehicles:

- E60 from 3/2005 production
- E85 from 9/2005 production
- E86 from 1/2006 production
- E90/91 from 3/2005 production
- E92 from 7/2006 production

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- E83 from 9/2006 production

MTF-LT-3

BMW P/N 83 22 0 409 878

No oil change is required for the entire service life of these transmissions.

MANUAL TRANSMISSION COLD SHIFT EFFORT

NOTE: The following information does not apply to transmissions filled with lifetime fluid.

Transmission cold shift effort is reduced by replacing the original oil (SAE 80 or Mobil SHC 630) with a reputable brand single-grade HD engine mineral oil of API-SE standards (SAE 20, SAE 30, or SAE 40). Thinner oils will run the risk of increased gear noise.

A further reduction in shift effort can be obtained by using ATF, but gear noise will be more noticeable compared to single-grade engine mineral oils.

For summer operation it is recommended that ATF or engine oil be drained and replaced by the original lubricant, either SAE 80 or Mobil SHC 630 (as specified) transmission fluid.

CAUTION: Never fill a manual transmission with synthetic engine oils or multigrade mineral-based engine oils, since they have friction-reducing components that could impair the function of the synchronizers.

4.0 TRANSMISSION OIL CHANGE INTERVAL

Starting with 1998 models all manual transmissions are filled with lifetime fluid and require no fluid changes for the life of the vehicle.

5.0 SMG: SEQUENTIAL MANUAL GEAR BOX

All models SMG Hydraulic Unit require the use of Pentosin CHF 11S fluid.

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TRANSMISSION

Manual Transmission - Repair Instructions - X3

00 COMPLETE TRANSMISSION

00 DANGER OF POISONING IF OIL IS INGESTED/ABSORBED THROUGH THE SKIN

Danger of poisoning!

Ingesting oil or absorbing through the skin may cause poisoning!

Possible symptoms are:

- Headaches
- Dizziness
- Stomach aches
- Vomiting
- Diarrhoea
- Cramps/fits
- Unconsciousness

Protective measures/rules of conduct:

- Pour oil only into appropriately marked containers
- Do not pour oil into drinking vessels (drinks bottles, glasses, cups or mugs)
- Observe country-specific safety regulations

First aid measures:

- Do not induce vomiting.

If the person affected is still conscious, he/she must rinse out their mouth with water, drink plenty of water and consult a doctor immediately.

If the person affected is unconscious, do not administer anything by mouth, place the person in the recovery position and seek immediate medical attention.

00 RISK OF INJURY IF OIL COMES INTO CONTACT WITH EYES AND SKIN

Danger of injury!

Contact with eyes or skin may result in injury!

Possible symptoms are:

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- Impaired sight
- Irritation of the eyes
- Reddening of the skin
- Rough and cracked skin

Protective measures/rules of conduct:

- Wear protective goggles
- Wear oil-resistant protective gloves
- Observe country-specific safety regulations

First aid measures:

- Eye contact: Rinse eyes immediately with plenty of water for at least 15 minutes; if available, use an eye-rinsing bottle. If irritation of the eyes persists, consult a doctor.
- Skin contact: Wash off with soap and water immediately. If irritation persists, consult a doctor.

NOTE: Do not use solvents/thinners.

00 SAFETY INSTRUCTIONS FOR HANDLING OIL

**WARNING: Danger of poisoning if oil is ingested/absorbed through the skin!
Risk of injury if oil comes into contact with eyes and skin!**

Recycling:

Observe country-specific waste-disposal regulations.

Measures if oil is unintentionally released:

- Personal precautionary measures: Danger of slipping! Keep non-involved persons away from the work area. Wear personal protective clothing/equipment.
- Environmental protection measures: Prevent oil from draining into drain channels, sewerage systems, pits, cellars, water and the ground.
- Limiting spread: Use oil blocks to prevent the surface spread of oil.
- Cleaning procedure: Bind and dispose of escaped oil with nonflammable absorbents.

NOTE: Do not flush oil away with water or aqueous cleaning agents.

00 11.. ... DRAINING/TOPPING UP GEAR OIL IN MANUAL TRANSMISSION

**NOTE: Gearbox must be at normal operating temperature.
Gear oil:**

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Filling capacities:

Draining gear oil:

- Release oil drain plug (1) and filler plug (2).
- Clean oil drain plug (1) and screw in.

Tightening torque: 23 00 4AZ, see **23 00 TRANSMISSION IN GENERAL** .

Fill transmission with ATF.

- Pour in gear oil until overflowing.
- Tighten in filler screw (2).

Tightening torque: 23 00 4AZ, see **23 00 TRANSMISSION IN GENERAL** .

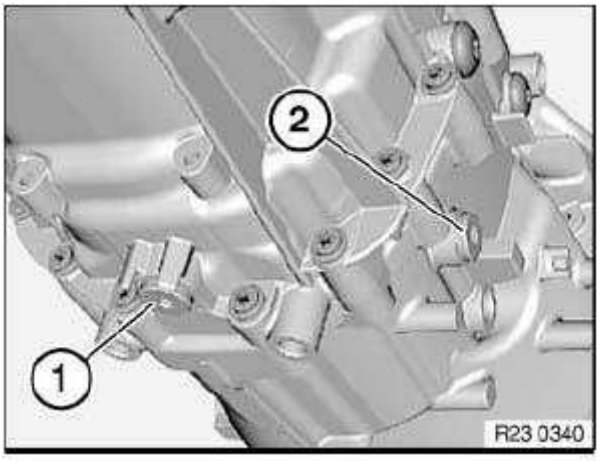


Fig. 1: Oil Drain Plug And Filler Plug
Courtesy of BMW OF NORTH AMERICA, INC.

23 TRANSMISSION DESIGNATIONS

BREAKDOWN OF BMW DESIGNATION

A5S 300J (old designation)		
A	Transmission type	○ S = Manual transmission ○ A = Automatic transmission
5	Number of forward gears	
S	Type of top gear	○ D = Direct gear ○ S = Overdrive gear
300	Max. input torque (Nm)	
		○ G = Getrag

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J	Code letter of transmission manufacturer	○ J = Jatco ○ R = GMPT (General Motors Powertrain) ○ Z = ZF (Zahnradfabrik Friedrichshafen)
SMG	Notes	SMG = Sequential M gearbox/transmission
GS6-37BZ (new designation according to BMW Group Standard GS 90007)		
G	Transmission	
S	Transmission type	○ S = Manual transmission ○ A = Automatic transmission
6	Number of forward gears	
-		○ - = Standard with manual gearshift ○ HP = Hydraulic planetary gear
37	Transmission type	○ 26 = D-transmission ○ 31 = C-transmission ○ 39 = F-transmission ○ 37 = H-transmission ○ 53 = G-transmission ○ 17 = I-transmission ○ 47 = J-transmission
B	Gear set	○ B = Petrol/gasoline gear ratio ○ D = Diesel gear ratio
Z	Code letter of transmission manufacturer	○ G = Getrag ○ Z = ZF (Zahnradfabrik Friedrichshafen)

BREAKDOWN OF BMW DESIGNATION (MANUAL TRANSMISSION)

BMW designation	Manufacturer	Manufacturer designation	Remark
S5D 200G	Getrag	B transmission (220/5)	
S5D 200G	Getrag	B transmission (221/5)	for M41 engine only
S5D 250G	Getrag	B transmission (220/5)	Reinforced design
S5D 260Z	ZF	C-transmission (S5-31 D)	for M51 engine only
S5D 280Z	ZF	C-transmission (S5-31)	
S5D 310Z	ZF	C-transmission (S5-31)	up to 9.95
S5D 320Z	ZF	C-transmission (S5-31)	from 9.95 (reinforced design)
GS5S31BZ (SMG)	ZF	C transmission	SMG
GS5-39DZ	ZF	F transmission	
S6S 420G	Getrag	D-transmission (226/6)	
S6S 420G (SMG)	Getrag	D transmission	SMG
S6S 560G	Getrag	E-transmission (286/6)	
GS6-37BZ	ZF	H-transmission	

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GS6S37BZ (SMG)	ZF	H-transmission	
GS6-37DZ	ZF	H-transmission	
GS6-37BG	Getrag	H-transmission	
GS6-53BZ	ZF	G-transmission	
GS6-53DZ	ZF	G-transmission	
GS6-17BG	Getrag	I-transmission	
GS7S47BG (SMG)	Getrag	J-transmission (247)	SMG 7-speed

BREAKDOWN OF BMW DESIGNATION (AUTOMATIC TRANSMISSION)

BMW designation	Manufacturer	Manufacturer designation	Remark
A4S 200R	GMPT	GM4	
A4S 270R	GMPT	THM-R1w	Transmission widestepped
A4S 310R	GMPT	THM-R1	
A5S 300J	Jatco	Jatco	
A5S 310Z	ZF	5HP-18	
A5S 325Z	ZF	5HP-19	
A5S 440Z	ZF	5HP-24	
A5S 560Z	ZF	5HP-30	
A5S 360R / 390R	GM	GM5	
GA6HP19Z	ZF	6HP19	
GA6HP26Z	ZF	6HP26	
GA6HP32Z	ZF	6HP32	
GA6L45R	GM	GM6	

23 .. UNIVERSAL TRANSMISSION BRACKET

Special tools required:

See **23 MANUAL TRANSMISSION** .

- 00 2 030
- 23 0 132
- 23 4 050

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NOTE:

- **The universal transmission bracket is introduced for the E60 AWD**
- **Suitable for manual and automatic transmissions**

IMPORTANT: Front and rear supports (1) can be laterally adjusted by means of screws (2). Carrier (3) of rear supports (1) can be longitudinally adjusted by means of screw.
Supports must be adapted in length and width to the transmission.

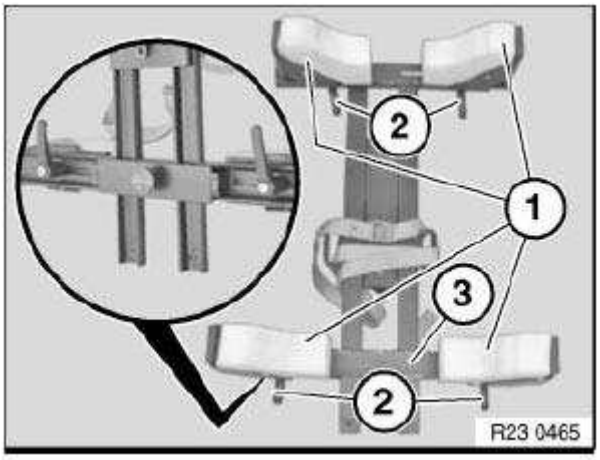


Fig. 2: Rear Supports And Rear Supports Carrier
Courtesy of BMW OF NORTH AMERICA, INC.

Supporting transmission:

Support transmission with special tools 23 4 050, 23 0 132 , 00 2 030 .

IMPORTANT: Transmission must be secured with tensioning strap (1).

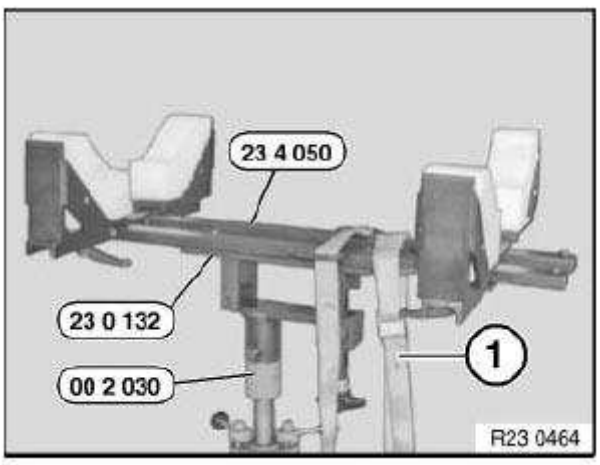


Fig. 3: Special Tools And Tensioning Strap
Courtesy of BMW OF NORTH AMERICA, INC.

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23 .. ... UNIVERSAL TRANSMISSION RETAINING BRIDGE

Special tools required:

See **24 AUTOMATIC TRANSMISSION**

- 00 1 450
- 24 0 200

NOTE:

- **The transmission retaining bridge 24 0 200 is suitable for both manual and automatic transmissions**

**IMPORTANT: Adapters and spindles must be adapted for positive locking to the transmission.
(Risk of injury)**

Adapt adapters (1) and spindle with thrust piece (3) to transmission.

Adapt length with slide (2).

Screw in spindle (4).

IMPORTANT: Before mounting on assembly stand 00 1 450 , check retaining bridge for secure seating.

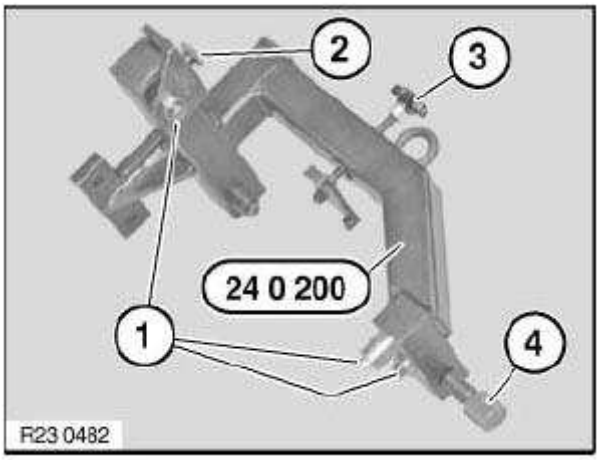


Fig. 4: Adapters, Spindle And Thrust Piece
Courtesy of BMW OF NORTH AMERICA, INC.

23 00 019 REMOVING AND INSTALLING TRANSMISSION (GS6-37BZ N52K)

Special tools required:

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- **00 2 030 UNIVERSAL HYDRO-LIFTER BASIC UNIT**
- **00 9 110 CIRCLIP PLIERS**
- **00 9 120 TORQUE ANGLE MEASURING DIAL**
- **00 9 130 MAGNET WITH 1/2" CONNECTION**
- 21 2 221, see **21 CLUTCH**
- 23 0 132, see **23 MANUAL TRANSMISSION**
- 23 4 050, see **23 MANUAL TRANSMISSION**

IMPORTANT: After completion of work, check transmission oil level, see 00 11.. ... DRAINING/TOPPING UP GEAR OIL IN MANUAL TRANSMISSION . Use only the approved gear oil .

Failure to comply with this requirement will result in serious damage to the manual transmission.

IMPORTANT: Aluminium-magnesium materials.
No steel screws/bolts may be used due to the threat of electrochemical corrosion.
A magnesium crankcase requires aluminium screws/bolts exclusively.
Aluminium screws/bolts must be replaced each time they are released .
The end faces of these screws/bolts are painted blue for the purposes of reliable identification.
Jointing torque and angle of rotation must be observed without fail (risk of damage) .

Necessary preliminary tasks:

- Disconnect battery
- Remove underbody protection with bracket at front and rear
- Remove reinforcement plate
- Remove complete exhaust system
- Remove heat shields
- Remove front propeller shaft at transfer box and tie to one side, see **REMOVAL & INSTALLATION** .
- Support engine with lifter when removing transmission

  - Remove propeller shaft from transmission.
  - Release center bearing.
  - Tie propeller shaft to one side.

Tasks are described in Removing propeller shaft, see **REMOVAL & INSTALLATION** .

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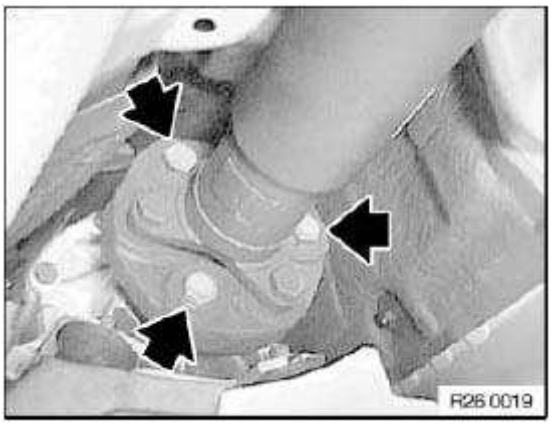


Fig. 5: Locating Propeller Shaft Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Detach plugs (1) and (2) from servomotor.

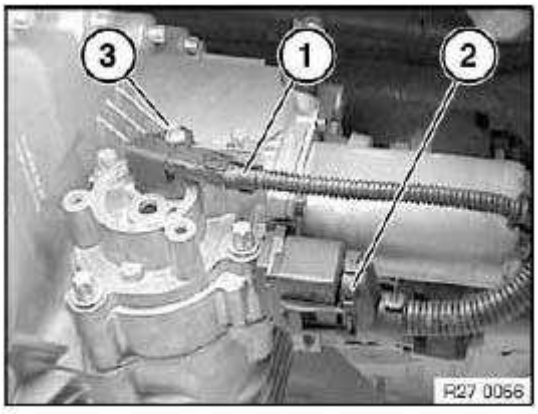


Fig. 6: Plugs
Courtesy of BMW OF NORTH AMERICA, INC.

Detach plug (1) from reversing light switch.

Release cable from mountings and tie to one side.

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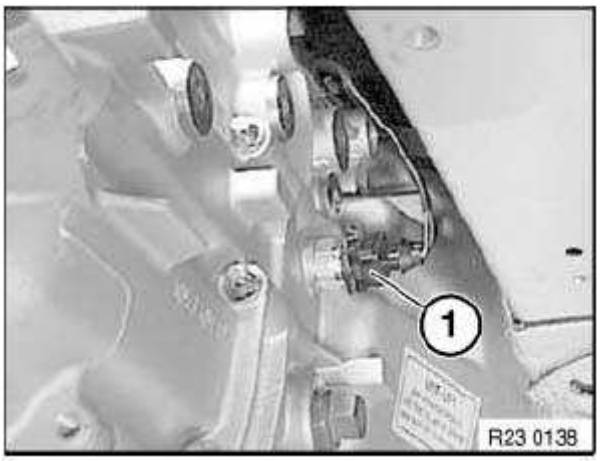


Fig. 7: Plug
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Pressure line of clutch slave cylinder remains connected.

IMPORTANT: Relieve tension on clutch slave cylinder slowly; otherwise air will be drawn in through sealing sleeve.

Release nuts and remove clutch slave cylinder.

Tightening torque: 21 52 5AZ, see **21 52 CLUTCH OPERATION (HYDRAULIC)** .

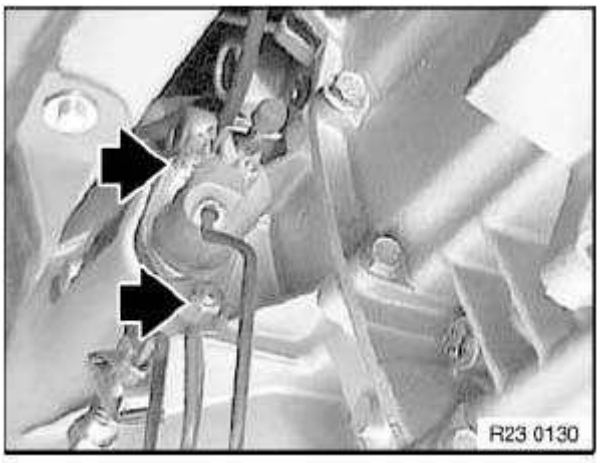


Fig. 8: Locating Clutch Slave Cylinder Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Release aluminium screw on right next to cable retaining plate with special tool 00 9 010 .

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Installation:

Aluminium screws must be replaced.

Tightening torque: 23 00 2AZ, see **23 00 TRANSMISSION IN GENERAL** .

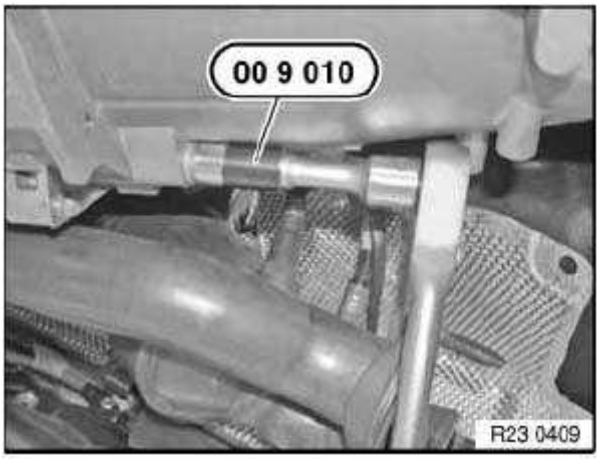


Fig. 9: Special Tool 00 9 010
Courtesy of BMW OF NORTH AMERICA, INC.

Supporting transmission:

Support transmission with special tools 23 4 050, 23 0 132 , 00 2 030 .

Secure transmission with tensioning strap (1).

Tasks are described in **23 .. UNIVERSAL TRANSMISSION BRACKET** .

After completion of work, check transmission oil level.

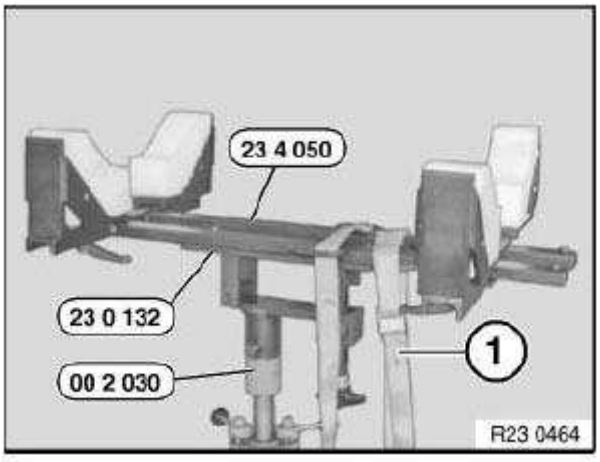


Fig. 10: Special Tools And Tensioning Strap

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Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws and remove transmission cross-member.

Tightening torque: 22 32 4AZ/5AZ, see **22 32 TRANSMISSION MOUNTS** .

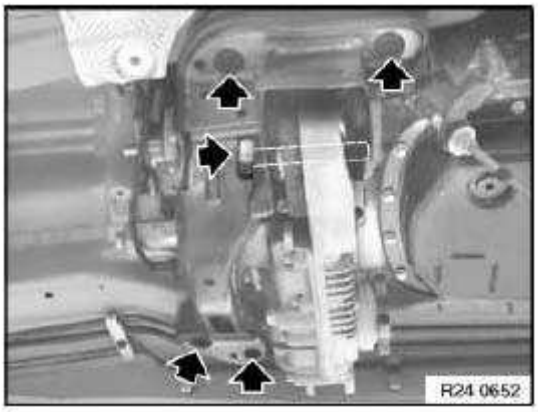


Fig. 11: Transmission Cross-Member Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock bearing pin (1) in direction of arrow and remove.

Lift out shift arm.

Installation:

Grease bearing pins (1).

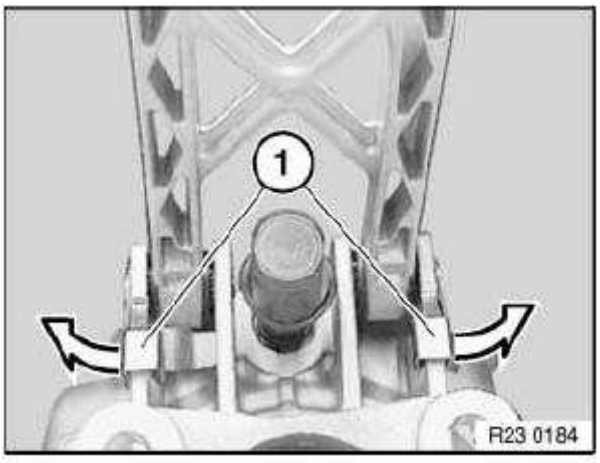


Fig. 12: Unlocking Bearing Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Lift off retainer (1).

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Disconnect shift rod (2).

Installation:

Grease shift rod.

Make sure shims (3) are in correct position.

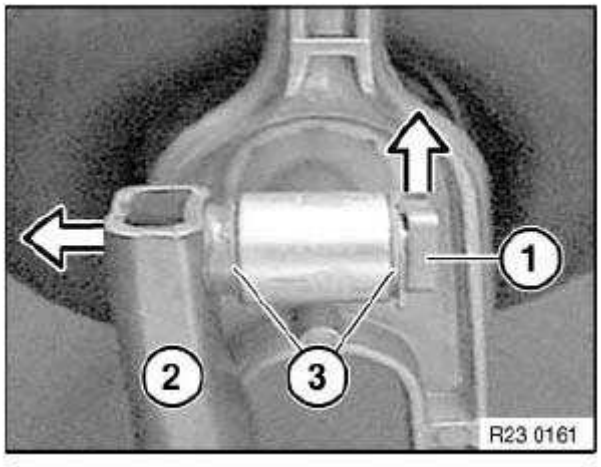


Fig. 13: Disconnecting Shift Rod
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws.

Installation:

Observe **screw fastening sequence** without fail.

Tightening torque, steel screws: 23 00 1AZ, see **23 00 TRANSMISSION IN GENERAL** .

Aluminium screws **must** be replaced.

Tightening torque and angle of rotation

Aluminium screws: 23 00 1AZ, see **23 00 TRANSMISSION IN GENERAL** .

IMPORTANT: Do not allow transmission to hang from the transmission input shaft when removing and installing, as the clutch disk will be deformed. Pull transmission downwards and remove.

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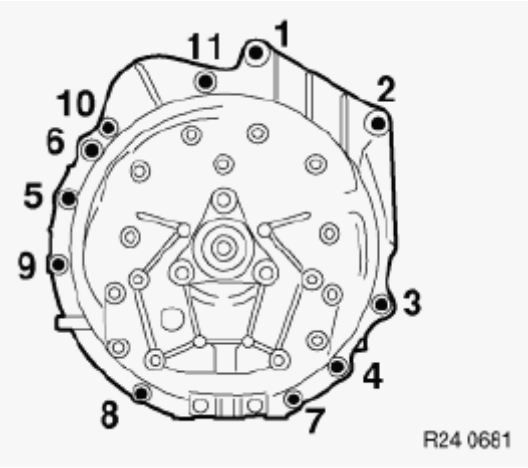


Fig. 14: Tightening Sequence Of Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Secure angle of rotation special tool 00 9 120 with magnet 00 9 130 to floor plate.

Screw down aluminium screws according to angle of rotation.

Angle of rotation: 23 00 2AZ, see **23 00 TRANSMISSION IN GENERAL** .

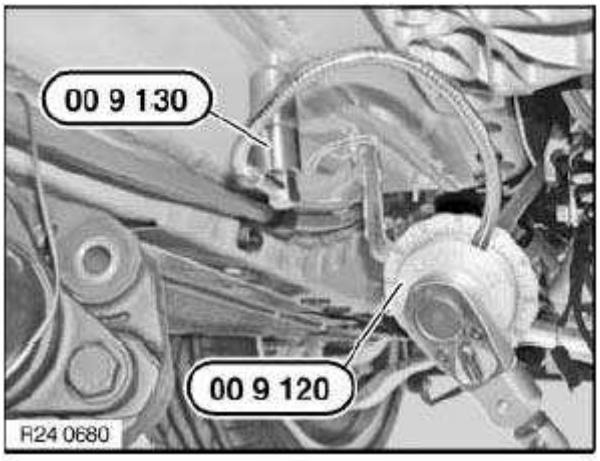


Fig. 15: Special Tool 00 9 120 And 00 9 130
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check that dowel sleeves are correctly seated.

Replace damaged dowel sleeves.

Ensure correct position of cover plate.

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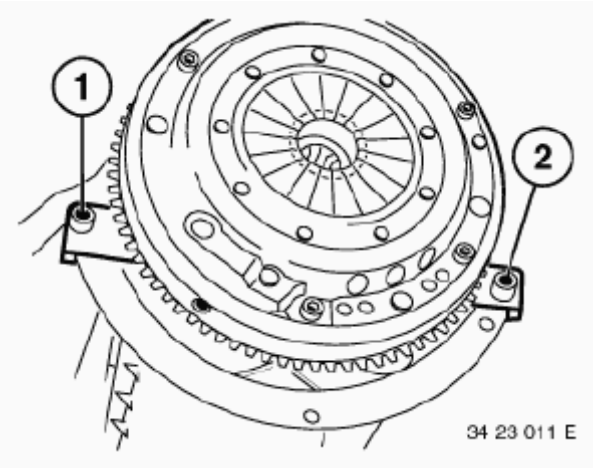


Fig. 16: Dowel Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Check lubrication of transmission input shaft for sticky consistency. If grease is sticky, clean input shaft and replace clutch plate, see **21 21 500 REMOVING AND INSTALLING/REPLACING CLUTCH (SAC)** .

Check clutch plate for friction rust in splines and replace if necessary.

Mechanically remove existing grease and lining abrasion from splines of clutch plate (with a cloth).

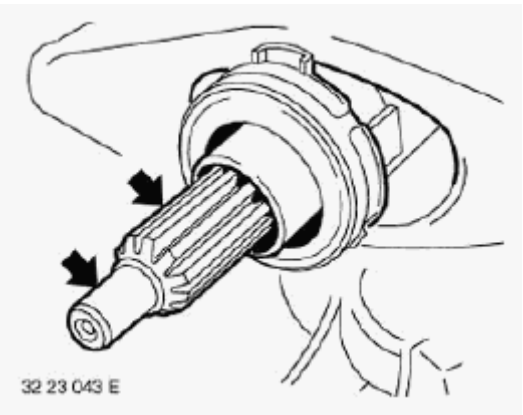


Fig. 17: Locating Input Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Greasing specification:

- Remove and clean release bearing and release lever, see **21 51 500 REMOVING AND INSTALLING OR REPLACING CLUTCH RELEASE BEARING/LEVER** .
- Push on grease scraper ring 21 2 221 as far as it will go.

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- Grease splines (1) of input shaft with a brush.
- Detach grease scraper ring.

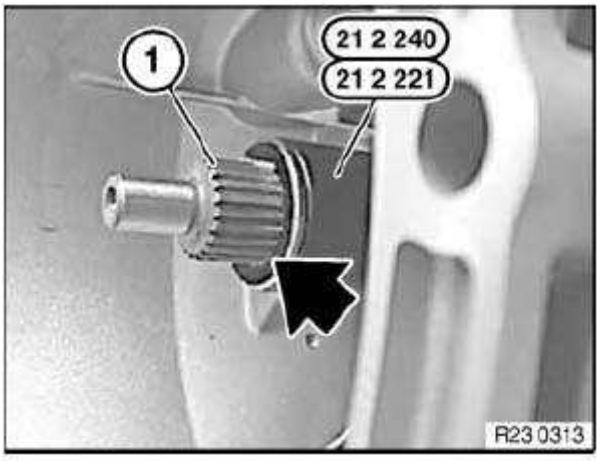


Fig. 18: Splines Of Input Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

23 00 036 INSTALLING REPLACEMENT TRANSMISSION (GS6-37BZ/DZ)

IMPORTANT: After completion of work, check transmission oil level, see 00 11.. ... DRAINING/TOPPING UP GEAR OIL IN MANUAL TRANSMISSION . Use only the approved transmission fluid .

Failure to comply with this instruction will result in serious damage to the transmission.

Recycling:

Catch and dispose of escaping transmission fluid.

Observe country-specific waste-disposal regulations

Necessary preliminary tasks:

- Drain gear oil at oil drain plug.

  Tightening torque: 23 00 4AZ, see **23 00 TRANSMISSION IN GENERAL** .

- Remove transfer box.
- Remove transmission, see **23 00 019 Removing and installing transmission (GS6-37BZ N52K)**.

Convert following parts from previous transmission to new transmission.

- Release bearing and release lever, see **21 51 500 REMOVING AND INSTALLING OR REPLACING**

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CLUTCH RELEASE BEARING/LEVER .

- Ball pin and spring wire clip.
- Studs for clutch slave cylinder.
- Reversing light switch tightening torque: 23 41 5AZ, see **23 41 EXTERNAL GEARSHIFT COMPONENTS** .

Convert shift rod joint.

Push back retaining ring (1) and drive out dowel pin (2).

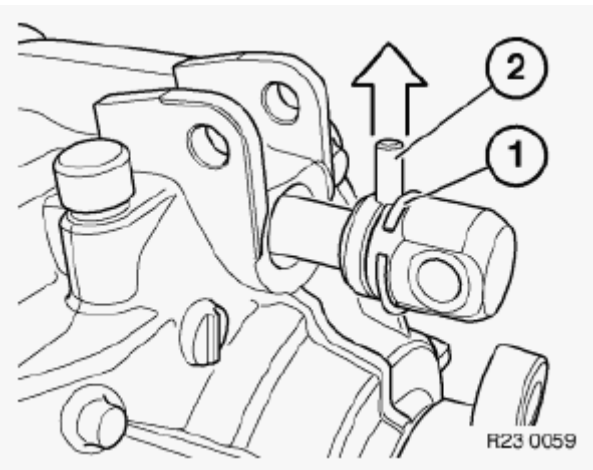


Fig. 19: Removing Dowel Pin
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Check damping disk (6) for damage and replace if necessary.

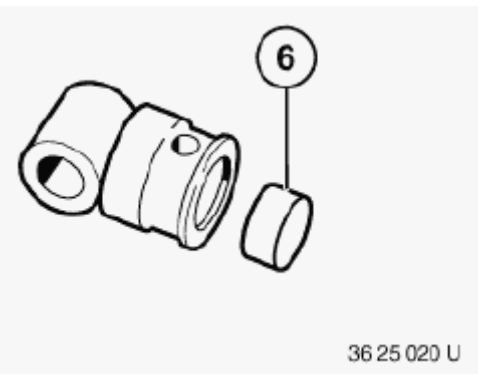


Fig. 20: Damping Disk
Courtesy of BMW OF NORTH AMERICA, INC.

Add final details to vehicle.

Check oil level.

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Installation:

Observe greasing specification .

23 00 036 INSTALLING REPLACEMENT TRANSMISSION (GS6-37BZ) AWD

IMPORTANT: After completion of work, check transmission fluid level. See DRAINING/TOPPING UP GEAR OIL IN MANUAL TRANSMISSION . Use only the approved transmission fluid. Failure to comply with this instruction will result in serious damage to the transmission.

NOTE: Recycling: Catch and dispose of escaping transmission fluid. Observe country-specific waste-disposal regulations.

Necessary preliminary tasks:

- Drain gear oil at oil drain plug. Tightening torque, see 23 00 4AZ in **00 COMPLETE TRANSMISSION** .
- Remove transfer case.
- Remove transmission.

Convert following parts from previous transmission to new transmission:

- Release bearing and release lever. See **51 CLUTCH RELEASE CONTROL WITH LEVER** .
- Knurled pin for clutch slave cylinder.
- Reversing light switch tightening torque, see 23 41 5AZ in **23 41 EXTERNAL GEARSHIFT COMPONENTS** .

Convert shift rod joint. Push back retaining ring (1) and drive out dowel pin (2).

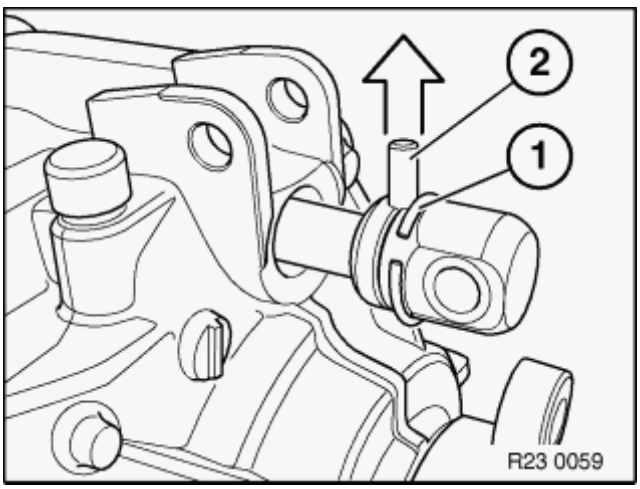


Fig. 21: Push Back Retaining Ring (1) And Drive Out Dowel Pin (2)
Courtesy of BMW OF NORTH AMERICA, INC.

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NOTE: Check damping disk (6) for damage and replace if necessary.

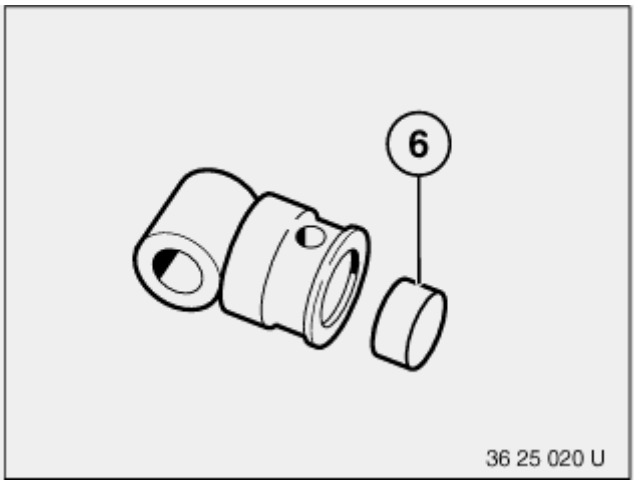


Fig. 22: Checking Damping Disk (6) For Damage
Courtesy of BMW OF NORTH AMERICA, INC.

Add final details to vehicle. Check oil level. Installation: Observe greasing specification.

11 HOUSING WITH COVER

23 11 614 REPLACING GUIDE TUBE FOR CLUTCH RELEASE UNIT (GS6-37BZ/DZ)

NOTE: (transmission removed)

Necessary preliminary tasks:

Remove clutch release bearing and release lever from guide tube, see **21 51 500 REMOVING AND INSTALLING OR REPLACING CLUTCH RELEASE BEARING/LEVER** .

Unfasten screws.

Remove guide tube (1).

Installation:

Clean thread.

Install screws with Loctite 243.

Tightening torque: 23 11 2AZ, see **23 11 CASE AND COVER** .

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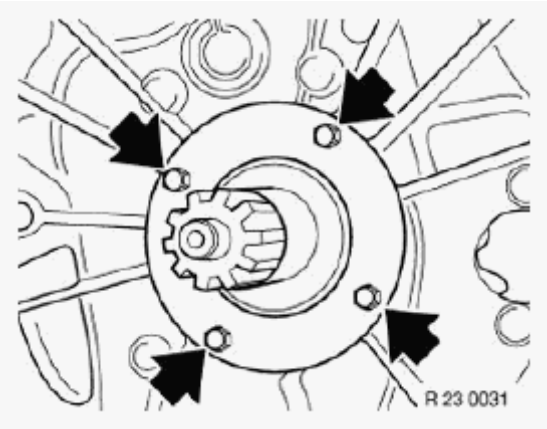


Fig. 23: Locating Screws
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Remove sticker (1) and adhesive with a suitable solvent.

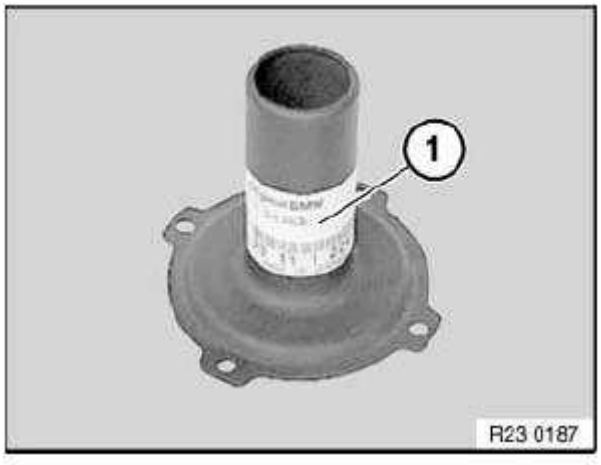


Fig. 24: Sticker
Courtesy of BMW OF NORTH AMERICA, INC.

12 BEARING IN HOUSING, SEALING RING

23 12 050 REPLACING RADIAL SHAFT SEAL FOR OUTPUT FLANGE (GS6-37BZ / DZ H-TRANSMISSION)

Special tools required:

See **23 MANUAL TRANSMISSION** .

- 23 0 020
- 23 2 320
- 23 3 161

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- 23 3 162
- 33 1 150

IMPORTANT: After completion of work, check transmission oil level, see 00 11.. ... DRAINING/TOPPING UP GEAR OIL IN MANUAL TRANSMISSION .
Use only approved transmission oil .
Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks:

- Remove exhaust system, see **18 00 020 REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM (M54)** .
- Support transmission, see **23 00 019 Removing and installing transmission (GS6-37BZ N52K)**.
- Remove transmission cross-member, see **23 00 019 Removing and installing transmission (GS6-37BZ N52K)**.
- Remove transmission bearing block, see **23 00 019 Removing and installing transmission (GS6-37BZ N52K)**.
- Unflange propeller shaft from transmission and tie up to one side

Brace output flange with special tool 23 0 020 .

Release collar nut with special tool 23 2 320 .

Installation:

Mark flange with thermo pin and heat to min. 100°C.

WARNING: Scalding hazard! Fit flange wearing suitable protective gloves only!

IMPORTANT: Do not drive on flange.

Secure collar nut with Loctite 243.

- Loctite 243: BMW Parts Service.

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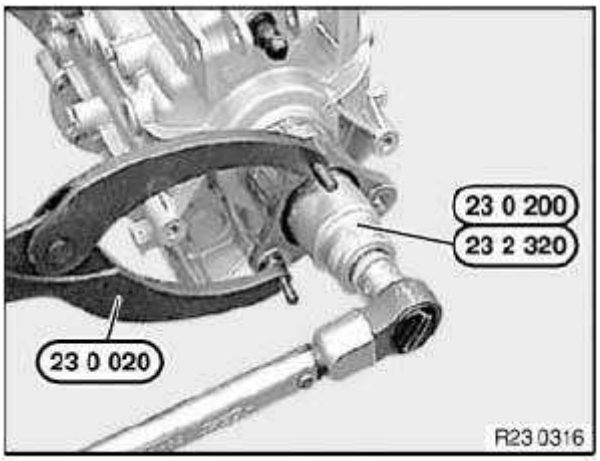


Fig. 25: Special Tool 23 0 020 And 23 2 320
Courtesy of BMW OF NORTH AMERICA, INC.

- Tightening torque: 23 21 1AZ, see **23 21 TRANSMISSION SHAFTS** .

Detach output flange with special tool 33 1 150 from output shaft.

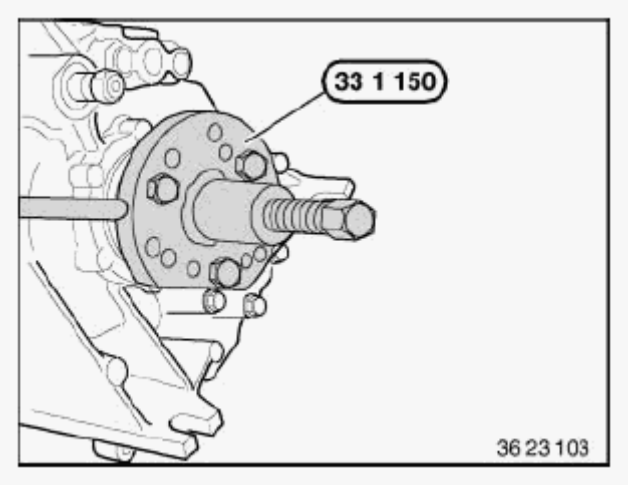


Fig. 26: Special Tool 33 1 150
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw on special tool 23 3 161 .

Push special tool over output shaft and screw firmly into sealing ring.

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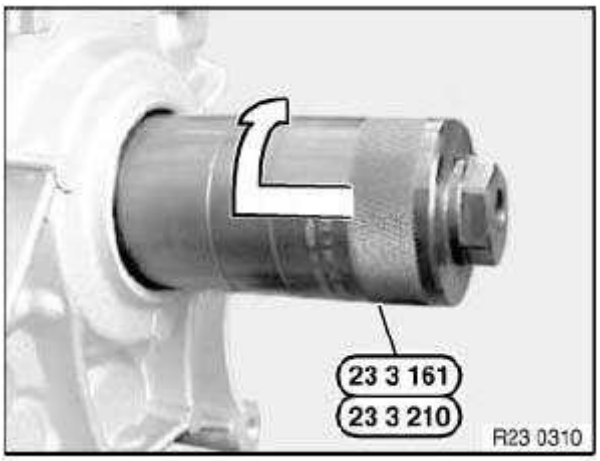


Fig. 27: Pushing Special Tool Over Output Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screw into special tool again and continue turning until sealing ring is pulled out of transmission housing.

If necessary, remove Woodruff key of sealing ring.

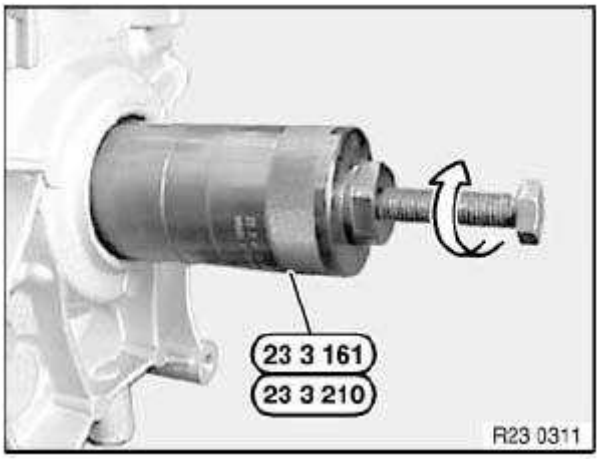


Fig. 28: Turning Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Coat sealing lips of new radial seal with gear oil.

Drive in radial seal as far as it will go with special tool 23 3 162 and plastic hammer.

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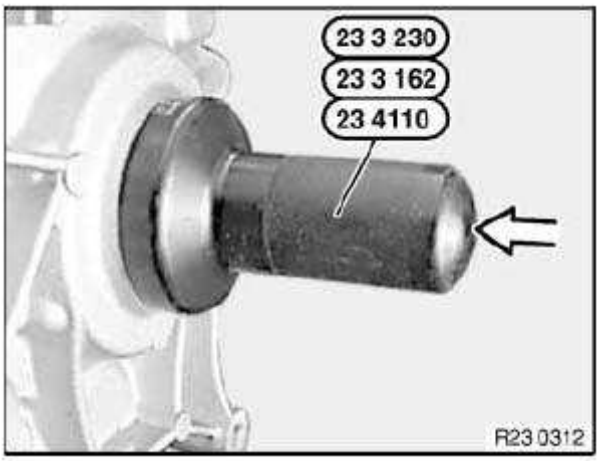


Fig. 29: Installing Radial Seal
Courtesy of BMW OF NORTH AMERICA, INC.

23 12 088 REPLACING RADIAL SEAL FOR SELECTOR SHAFT (GS6-37BZ)

Special tools required:

See **23 MANUAL TRANSMISSION**

- 23 0 210
- 23 0 220

IMPORTANT: After completion of work, check transmission oil level, see 00 11.. ... DRAINING/TOPPING UP GEAR OIL IN MANUAL TRANSMISSION .
Use only approved transmission oil .
Failure to comply with this instruction will result in serious damage to the transmission.

Necessary preliminary tasks:

- Remove transfer case, see **27 10 010 REMOVING AND INSTALLING TRANSFER CASE (ATC 400 X-DRIVE)** .
- Shift transmission into 2nd gear

Transmission extension N46

Release bolts and remove transmission extension (1).

Tightening torque: 23 2 5AZ, see **23 00 TRANSMISSION IN GENERAL** .

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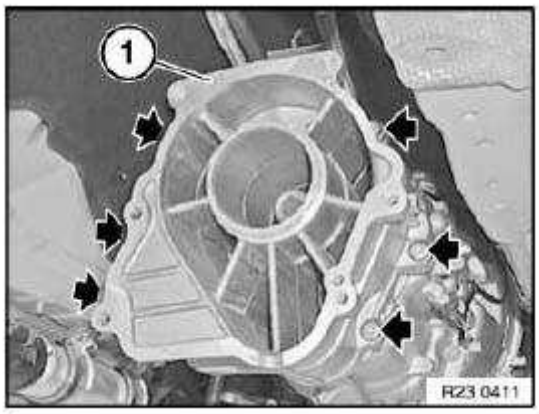


Fig. 30: Transmission Extension
Courtesy of BMW OF NORTH AMERICA, INC.

Lever retaining ring (1) out of groove with a small screwdriver.

Slide locking ring (1) towards rear.

Drive out cylinder pin (2).

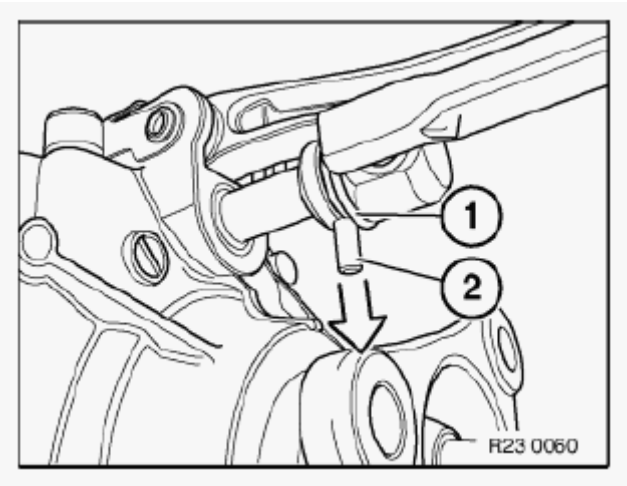


Fig. 31: Removing Cylinder Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Screw in special tool 23 0 210 until it is firmly connected with radial seal (1).

Pull out radial seal with special tool 23 0 210 .

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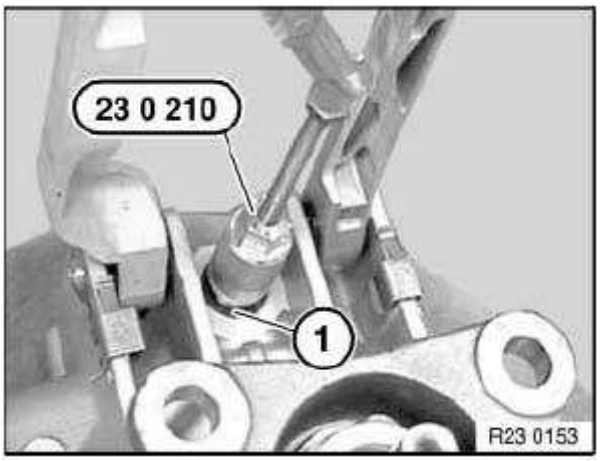


Fig. 32: Radial Seal And Special Tool 23 0 210
Courtesy of BMW OF NORTH AMERICA, INC.

Coat sealing lips of radial seal and selector shaft with transmission oil.

Drive in radial seal with special tool 23 0 220 .

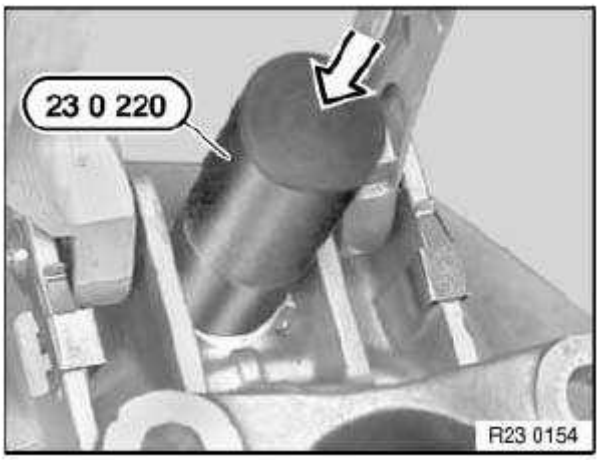


Fig. 33: Installing Radial Seal
Courtesy of BMW OF NORTH AMERICA, INC.

23 12 508 REPLACING RADIAL SHAFT SEAL FOR DRIVE SHAFT (GS6-37BZ/DZ)

Special tools required:

See **23 MANUAL TRANSMISSION**

- 23 3 151
- 23 3 152

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IMPORTANT: After completion of work, check transmission fluid level, see 00 11.. ... DRAINING/TOPPING UP GEAR OIL IN MANUAL TRANSMISSION .
Use only approved transmission oil .
Failure to comply with this requirement will result in serious damage to the automatic transmission!

Necessary preliminary tasks:

- Remove transmission, see **23 00 036 Installing replacement transmission (GS6-37BZ/DZ)**.
- Remove clutch release unit and release lever from guide tube, see **21 51 500 REMOVING AND INSTALLING OR REPLACING CLUTCH RELEASE BEARING/LEVER** .

Release screws.

Tightening torque: 23 11 2AZ, see **23 11 CASE AND COVER** .

Remove guide tube (1).

Installation:

Clean guide tube.

Do not grease guide tube.

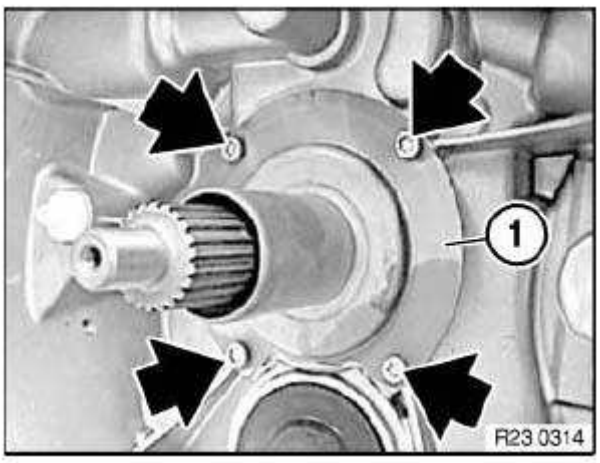


Fig. 34: Locating Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw on special tool 23 3 151 .

Push special tool onto drive shaft and screw into sealing ring.

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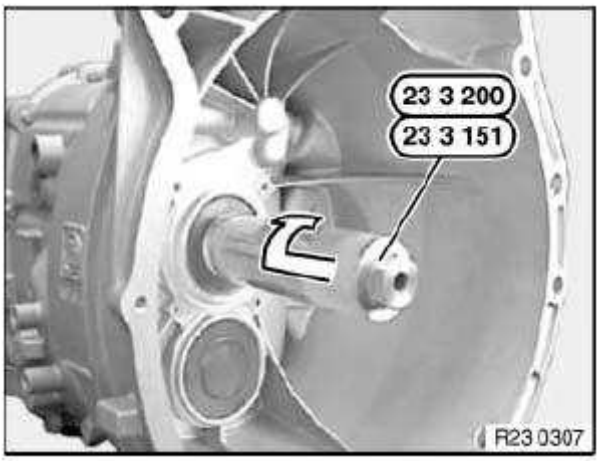


Fig. 35: Pushing Special Tool Onto Drive Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Insert screw into special tool 23 3 151 again and continue turning until sealing ring is pulled out of transmission housing.

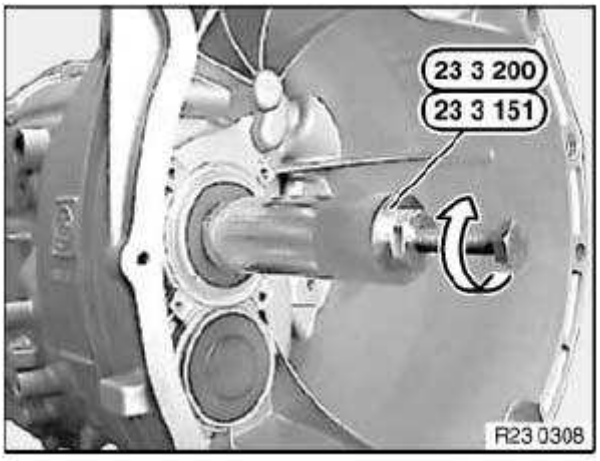


Fig. 36: Turning Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Coat sealing lips of radial seal with gear oil.

Push radial seal (1) onto drive shaft up to housing.

Drive in radial seal (1) as far as it will go with special tool 23 3 152 and plastic hammer.

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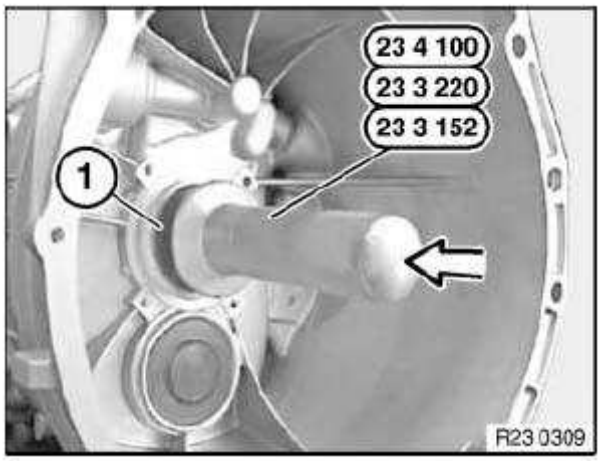


Fig. 37: Installing Radial Seal
Courtesy of BMW OF NORTH AMERICA, INC.

14 ELECTRICAL ADD-ON PARTS

23 14 ... REPLACING REVERSING LIGHT SWITCH

Necessary preliminary tasks:

- Remove rear underbody protection.

GS6-17DG/BG and GS6-37DG/BG transmissions only. Disconnect plug connection (1) on reverse gear switch.

Remove reverse gear switch. Tightening torque 23 14 1AZ.

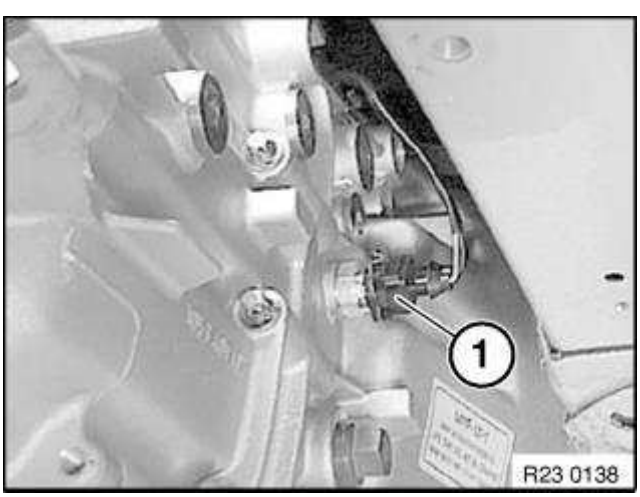


Fig. 38: Disconnect Plug Connection (1) On Reverse Gear Switch (GS6-17DG/BG and GS6-37DG/BG Transmission)
Courtesy of BMW OF NORTH AMERICA, INC.

GS6-53DG/BG transmission only Disconnect plug connection (1) on reverse gear switch. Remove reverse gear

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switch. Tightening torque 23 14 1AZ.

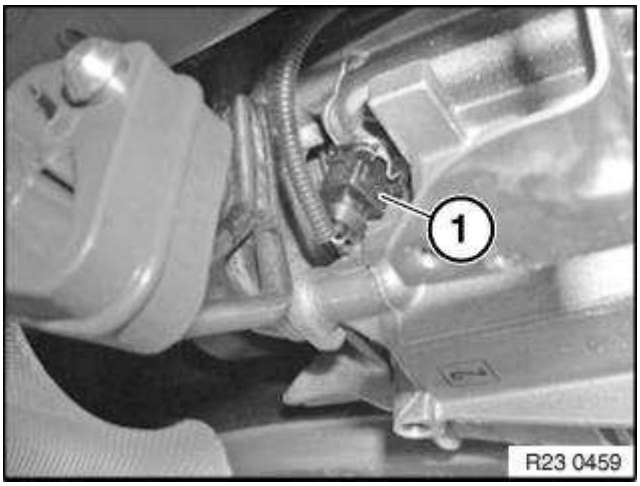


Fig. 39: Disconnect Plug Connection (1) On Reverse Gear Switch (GS6-53DG/BG Transmission)
Courtesy of BMW OF NORTH AMERICA, INC.

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TRANSMISSION

Manual Transmission - SI Techniques - X3

KINEMATIC DIAGNOSIS SYSTEM AND ENVIRONMENT

32 01 99 (503) all countries BMW KDS (Beissbarth)

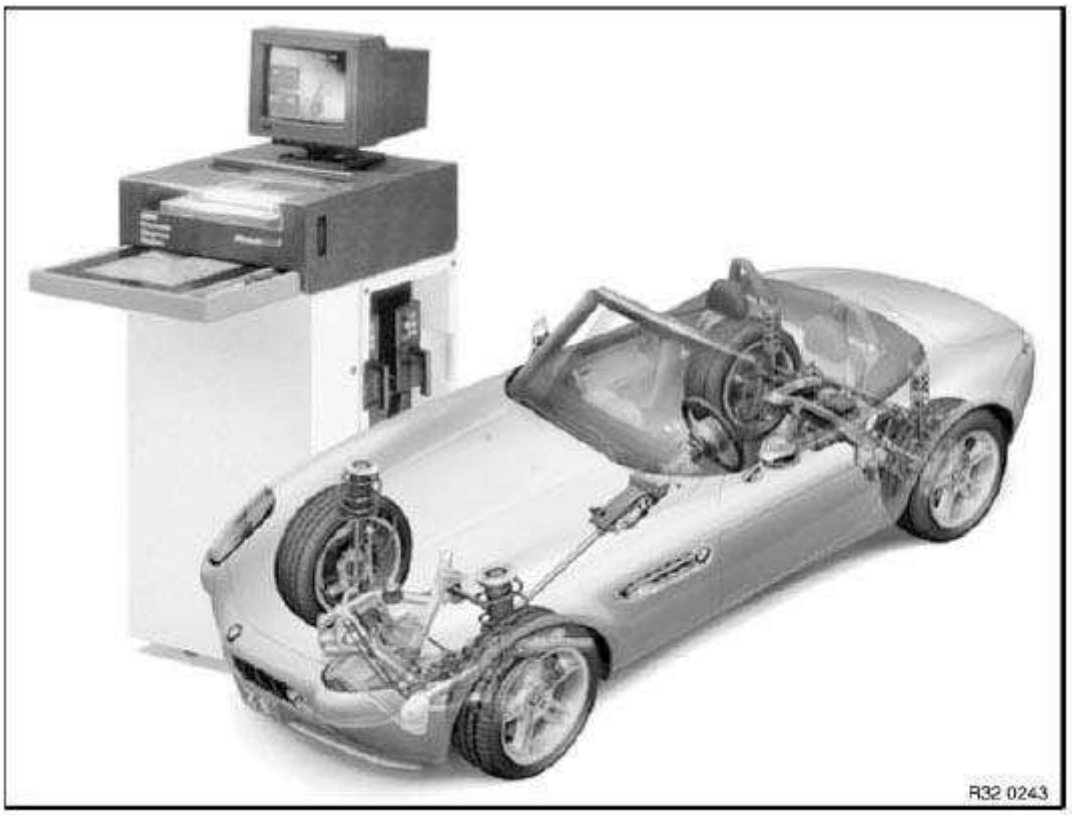


Fig. 1: Kinematic Diagnosis System
Courtesy of BMW OF NORTH AMERICA, INC.

1. FOREWORD

1.1 Objectives

Wheel alignment has become an increasingly complex subject. The aim of this BMW Service Technology bulletin, therefore, is to achieve several objectives:

- Creation of guidelines for working with the BMW Kinematic Diagnosis System (KDS).
- Familiarization with wheel alignment technology for current vehicles and clarifying any questions which arise in this connection.
- Transparency and clarification of different terms.
- Clarification of the causes of errors in the past, such that they can be avoided after reading this document.

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- Creation of conditions for dealing safely with the BMW KDS.

1.2 Further development of the BMW Kinematic Diagnosis System

- The BMW Kinematic Diagnosis System is an integrated part of automotive system concepts. It ensures that work is carried out in a particularly rational manner which is appropriate for BMW requirements, such that you can also be certain of being prepared for future technological developments. As far as precision and performance in wheel alignment and tuning is concerned, BMW, together with leading manufacturers, has made the best of what is technically feasible: the BMW Kinematic Diagnosis System.
- The BMW Kinematic Diagnosis System manufactured by Beissbarth is more than just the further development of conventional wheel alignment equipment. It sets new standards in precision, performance, speed and handling. It is a guarantor for the perfection which BMW service customers rely on.
- Ride comfort, road safety and tire wear depend to a large extent on the perfect interplay of the vehicle's kinematic functions. BMW is constantly launching new generations of chassis which are even better than their predecessors. This is why there are fewer kinematics system adjusting points and narrower tolerances when measuring and tuning the chassis.
- With the use of the multi-link rear suspension and the E36, the electronic wheel alignment devices are no longer suitable for BMW wheel alignment purposes. This applies to both the measuring procedure and measuring precision. The generation of equipment which was approved with the E36 series still fulfils all the requirements placed on a modern wheel alignment device, including the use of the latest computer technology.
- Only BMW Kinematic Diagnosis Systems manufactured by Beissarth and Bosch may be used for wheel alignment.

1.3 Technical Data



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Fig. 2: Display Kinematic Diagnosis Systems Technical Data
Courtesy of BMW OF NORTH AMERICA, INC.

KINEMATIC DIAGNOSIS SYSTEMS TECHNICAL DATA

1. Display	**17" graphic screen with high-resolution graphics (640x480 pixels with 256 colours)**
2. On-screen text	in the appropriate national language
3. Wheel dimensions	12"...20"
4. Vehicle memory locations	unlimited
5. Rotating plates	Loadbearing capacity 1000 kg, angle of rotation ± 360°, 450 x 450 x 50 mm (L x W x H), sliding range ±50 mm, weight 18 kg
6. Sliding plates	Loadbearing capacity 1000 kg, angle of rotation ± 10°, 450 x 450 x 50mm (L x W x H), sliding range ± 65 mm, weight 17 kg
7. Electrical connection	100...115 V / 220...240 V 50/60 Hz, 0.5 kW (other connections on request)

1.4 Scope of delivery

1 PC display device with graphic screen, graphical tablet, small or large equipment cabinet including automatic charging station, DIN A4 dot matrix printer

4 Measuring sensors with CCD camera technology and infrared data transmission with built-in power supply

1 Cable set (comprising 4 cables)

1 Brake clamping device

1 Steering lock device

2 Electronic precision rotating plates with integrated sensor without access ramps

2 Sliding plates without access ramps

4 BMW quick-clamping units, comprising a P8-68 locating bell and P267 01 quick-acting clamp including coated holding claws

1 Operating instructions for BMW KDS (8 languages)

1 BMW software and the BMW vehicle setpoint data with setting screens as well as text for the measurement preparations

1.5 Accessories required

2 Locating rods for positioning the vehicle

1 Set of sand bags for the prescribed loading

1.6 Accessories recommended

4 Quick-clamping units

2 Sets of access ramps

1 Remote control / display

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1 Trolley (for ballast bags, rotating and sliding plates and 4 quick-acting clamps)

2. MEASURING OPTIONS USING THE BMW KINEMATIC DIAGNOSIS SYSTEM

2.1 Front axle

- Toe-in (single and total toe-in in relation to the geometrical drive axis)
- Camber (with steering wheel pointing straight ahead)
- Wheel displacement (in relation to the left-hand front wheel)
- Castor, kingpin inclination and toe-differential angle

2.2 Rear axle

- Toe-in (single and total toe-in in relation to the longitudinal center plane of the vehicle --> previously called symmetrical axis)
- Geometrical drive axis
- Camber

2.3 Other measuring options

- Rear wheel displacement
- Wheelbase difference
- Lateral displacement on right
- Lateral displacement on left
- Track difference
- Axial displacement

3. SYSTEM DESCRIPTION

3.1 BMW Kinematic Diagnosis System 1, based on the Beissbarth ML4000

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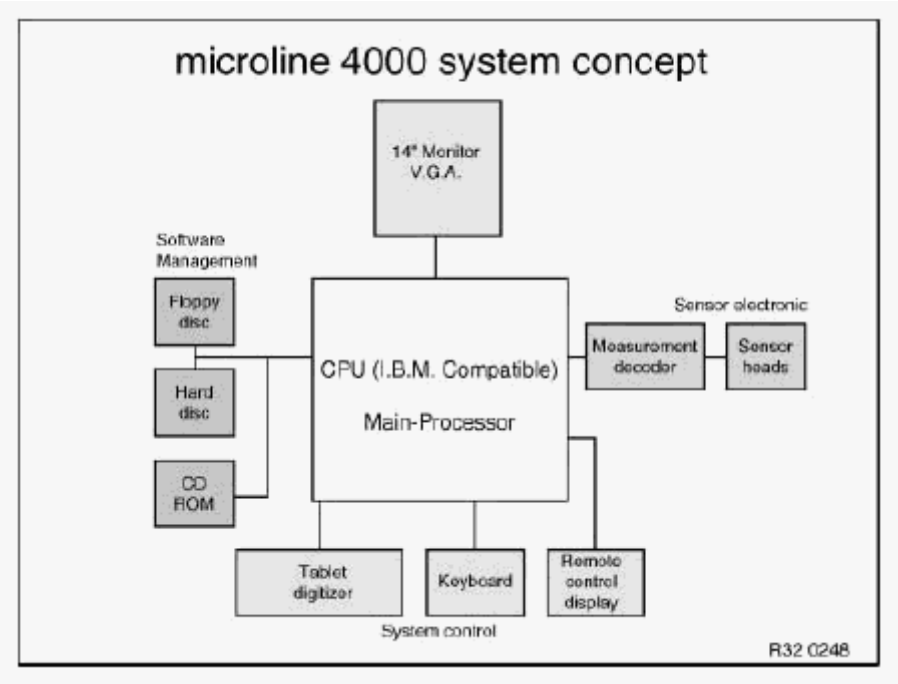


Fig. 3: BMW Kinematic Diagnosis System Diagram
Courtesy of BMW OF NORTH AMERICA, INC.

The KDS 1 is available in two different designs at no extra charge:

1. **Mobile workstation**



Fig. 4: Mobile Workstation
Courtesy of BMW OF NORTH AMERICA, INC.

2. **Mobile compact cabinet**

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Fig. 5: Mobile Compact Cabinet
Courtesy of BMW OF NORTH AMERICA, INC.

The larger workstation offers a small storage area for accessories, while the compact cabinet is mobile and ideal for restricted working areas. Both variants can be supplied as a cableless measuring system (infrared). From the point of view of measuring technology, there is only a difference in the handling and equipping of the system. For both designs, the four measuring sensors are stored in integrated inserts with rechargeable battery charging points. When automatically charged over night, the measuring sensor batteries provide enough power for 10 hours of continuous use.

3.2 Computer

- The KDS 1 system comprises tested and reliable industrial components. The computer is an IBM-compatible, 32-bit Intel processor with CD ROM drive to the industry standard.



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

3.3 Graphical tablet

- All functions are shown in graphical form on a "pictogram" panel. The panel is protected by a plexiglass cover. It can easily be replaced if more extensive design modifications are necessary. The operator interface has no membrane and is thus protected against damage. The main functions are activated by

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clicking the icon with the digital pen.

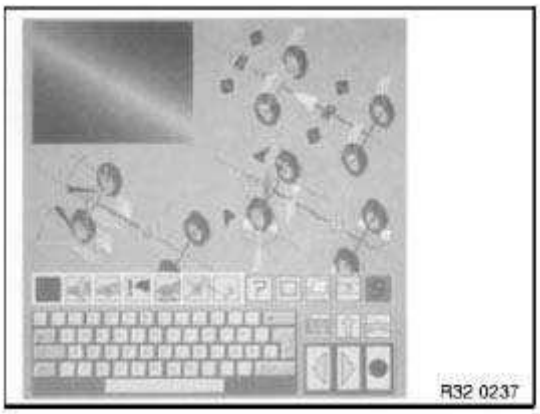


Fig. 7: Graphical Tablet
Courtesy of BMW OF NORTH AMERICA, INC.

3.4 Equipment cabinet

- The PC with graphic monitor and removable operating panel, supports for the measuring sensors, the remote control and the A4 printer are integrated into the workstation. The charging station is located in the cabinet and can also be connected to the measuring sensors and the remote control using the plug-in cables (operating while simultaneously charging the batteries).

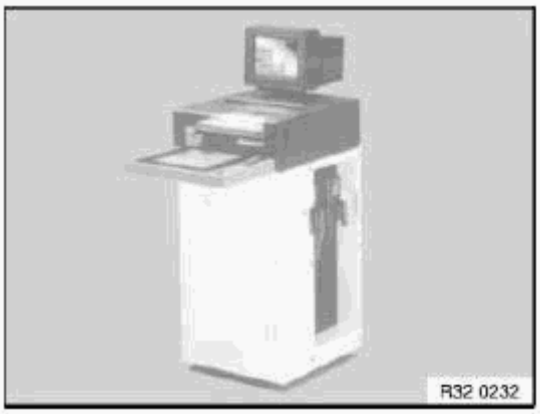


Fig. 8: Equipment Cabinet
Courtesy of BMW OF NORTH AMERICA, INC.

3.5 Remote display

A cableless remote display can be supplied on request. The remote control keys are only active during measuring and adjustment (not for customer data input, or if selecting a vehicle or editing the setpoint data etc.). The following displays are supported by the remote control:

- Measured value with setpoint / actual comparison and tolerance bar
- Steering graphics for steering routines

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- Live overview of the track / camber values with a setpoint / actual comparison
- Rim run-out compensation



Fig. 9: Remote Display
Courtesy of BMW OF NORTH AMERICA, INC.

3.6 Measuring sensors with CCD camera

The measuring sensors are each equipped for automatic measurement with two CCD cameras and their own processor for the cableless infrared transmission of data with integrated batteries. Benefits:

- No temperature deviation
- Very high measuring resolution (the track could theoretically be measured in angular seconds)
- Single track range of more than ± 9 degrees for the constant display of toe-in when changing the tie-rod ends
- Exact system accuracy, i.e. when carrying out measurements at the vehicle following rim run-out compensation, the toe-in and camber measurements are accurate to 2 angular minutes



Fig. 10: Measuring Sensors With CCD Camera
Courtesy of BMW OF NORTH AMERICA, INC.

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3.7 BMW Quick-acting clamp

- BMW quick-acting clamp for holding the measuring sensors precisely in position and measuring without rim run-out compensation.

NOTE: Any existing quick-acting clamps, e.g. from older F1600s or ML-3000s, must not be used on the BMW KDS.

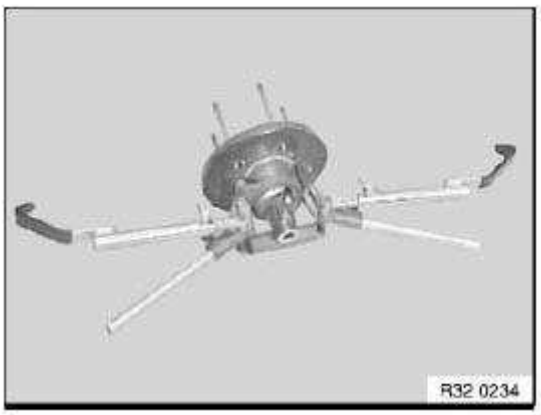


Fig. 11: BMW Quick-Acting Clamp
Courtesy of BMW OF NORTH AMERICA, INC.

3.8 Rotating / sliding plates

- Electronic precision rotating plates for the front wheels with integrated sensor (360 degree measuring range)
- Stable sliding plates for the rear wheels with a swivelling / rotating top plate
- Accessories: Cover hood for aluminium rotating plates

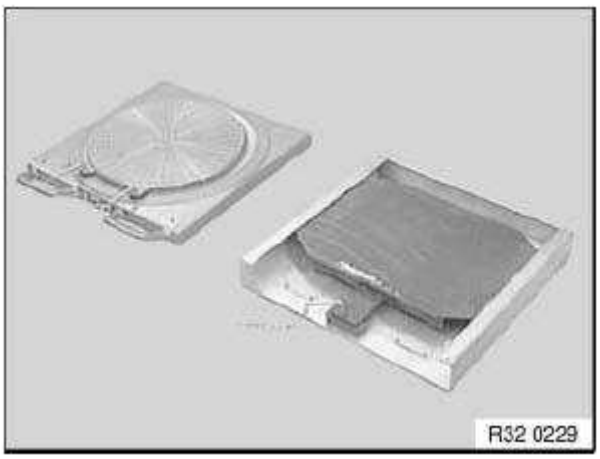


Fig. 12: Rotating/Sliding Plates
Courtesy of BMW OF NORTH AMERICA, INC.

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3.9 Sensor pins

- A new BMW light alloy wheel (styling no. 18) has been available as optional equipment from April 1993. When measurements are being made on vehicles with these wheels, new sensor pins are required for the quick-acting clamps of the recommended wheel alignment equipment.
- The new sensor pins are included in the scope of supply for new deliveries of KDS 1 (order number: BS 90 19 11).

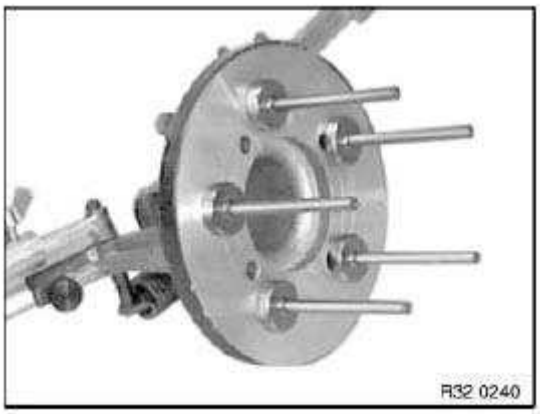


Fig. 13: Sensor Pins
Courtesy of BMW OF NORTH AMERICA, INC.

3.10 Spoiler adapter

- In the case of vehicles with very low spoilers, the sensor beam may be broken by the spoiler between the measuring sensors. This primarily occurs in front of the front axle.
- The spoiler adapter is used here as a connecting element between the measuring equipment clamp and the measuring sensor. Thanks to the adapter, the sensors are placed 50 mm lower, thus allowing the sensor beam to move freely below the spoiler.



Fig. 14: Spoiler Adapter
Courtesy of BMW OF NORTH AMERICA, INC.

3.11 Quick-clamping units

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- Quick-clamping units for wheel alignment on non-BMW vehicles with rim run-out compensation.
- Rims without sensors boreholes (rims for BMW vehicles from other manufacturers)

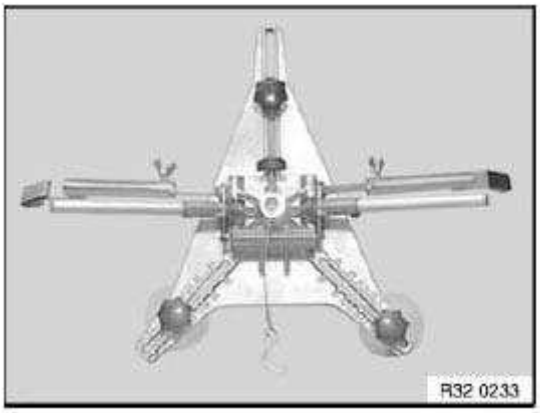


Fig. 15: Quick-Clamping Units
Courtesy of BMW OF NORTH AMERICA, INC.

3.12 Retainers

- The most varied clamping options for the measuring equipment are possible thanks to the versatile retainers and the rubber-coated thrust pieces, even on exotic light-alloy rims.

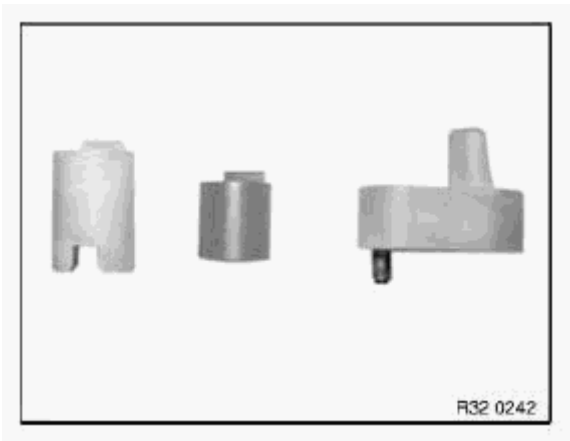


Fig. 16: Retainers
Courtesy of BMW OF NORTH AMERICA, INC.

4. WORKSTATION

4.1 Environment

DESCRIPTION AND REQUIREMENTS REFERENCE

Description:	Requirements:
	- Wheel alignment pits

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All lifting platforms currently recommended by BMW (see) for wheel alignment meet the requirements for the BMW KDS.	○ Pillar-type lifts with set-down device ○ 2 plunger-type lifting platforms with set-down device ○ Repair stands with set-down device
No particular requirements have to be met in respect of the location at which the BMW KDS is used. The measuring device can be installed over working pits or on lifting platforms.	○ One measuring area (approx. 4.5 m x 7.0 m). ○ The rotating plates must be pinned to the platform

The support surfaces for the rotating and sliding plates may only display the following maximum height difference:

- from left to right ± 0.5 mm
- from front to back ± 1.0 mm
- diagonally ± 1.0 mm.

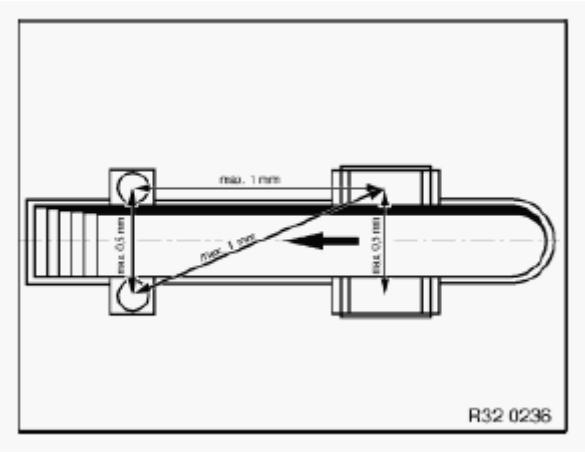


Fig. 17: Rotating And Sliding Plates Height Difference
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: A difference in the height of the rotary plates of ± 2 mm from left to right results in a measuring error of 4.8 ° in the camber.
As a comparison: The camber tolerance on the E36 is ± 10'. The tire tread difference or varying tire pressure cause measuring errors of the same magnitude.

4.2 Preconditions for alignment

When carrying out the wheel alignment, the front and rear wheels must be centered on the rotating and sliding plates in order that all wheel suspensions remain free of tension during the steering routine and adjustment

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work. As a result, the rotating and sliding plates for the relevant wheel bases and track widths of the vehicle to be aligned must be moved.

4.3 Measuring tolerance

All measuring tolerances are system tolerances. This means that the sum of all individual tolerances gives the value shown in the example. Example of camber: Quick-acting clamp + measuring sensor + computer = 1' at a measuring range of ± 3° (all BMW vehicles are within this measuring range).

4.4 Levelling the measuring station

The manufacturers of the BMW KDS (Beissbarth / Bosch) are able to measure the measuring area to the required accuracy using levelling devices. Any "normal" water level is not suitable for this. Lifting platforms must be levelled under load so that the uneven deflection in the travel rails is taken into account.

IMPORTANT: Adjustment work for the lifting platform concerned must be executed by a specialist (manufacturer's after - sales service).

5. CHASSIS-RELATED TERMS

5.1 Toe-differential angle

- The toe-differential angle (a) is the angular position of the internal wheel on the curve in relation to the external wheel on the curve when driving round bends. The steering is designed such that the angular position of the wheels in relation to each other changes as the steering angle increases.
- In ideal cases, the wheel axes meet at point D in any steering position (except for straight ahead).

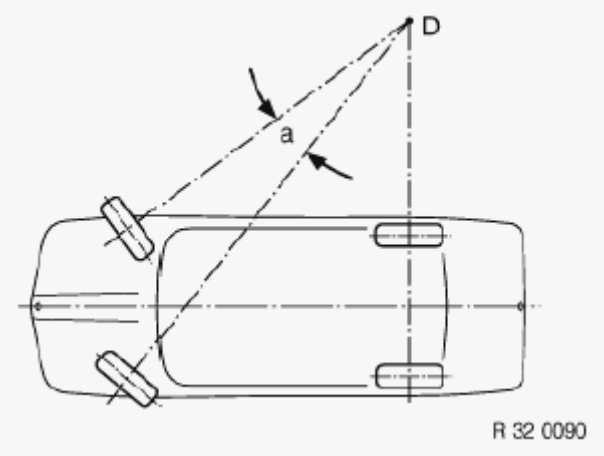


Fig. 18: Toe-Differential Angle
Courtesy of BMW OF NORTH AMERICA, INC.

5.2 Camber

- The camber is the angle of inclination of the wheel in relation to the vertical.

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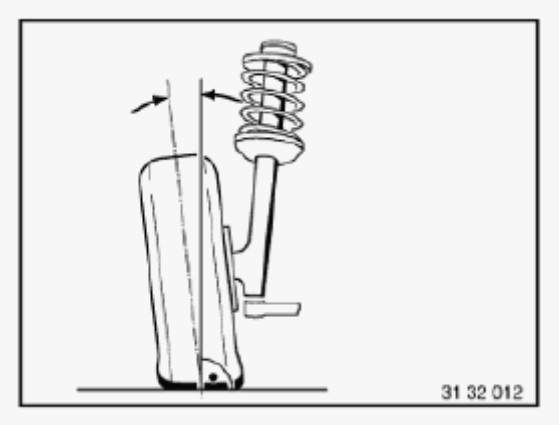


Fig. 19: Camber Angle
Courtesy of BMW OF NORTH AMERICA, INC.

5.3 Toe-in

- The toe-in is the reduction in the distance between the front of the wheels and the rear. The toe-in prevents the wheels from moving apart while driving (wobbling and grinding).

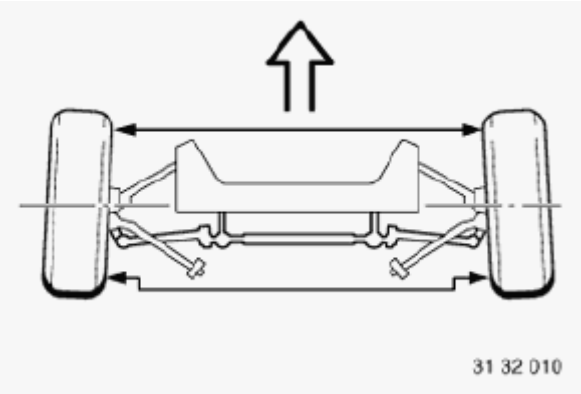


Fig. 20: Toe-In
Courtesy of BMW OF NORTH AMERICA, INC.

5.4 Castor

- The castor is the kingpin angle seen from the side in the opposite direction of travel. The line through the center of the spring strut mount and control arm ball joint corresponds to the kingpin.

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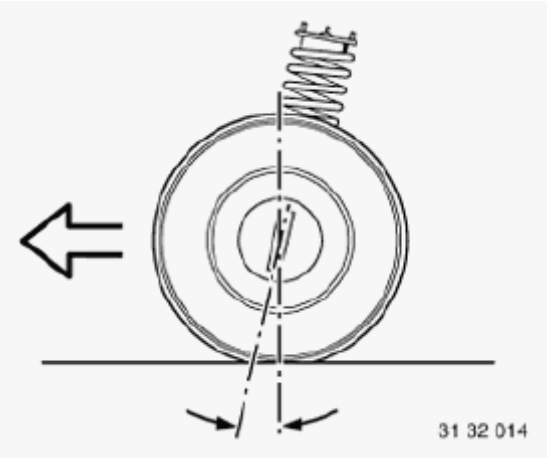


Fig. 21: Castor Angle
Courtesy of BMW OF NORTH AMERICA, INC.

5.5 Geometrical drive axis / symmetrical axis

- (1) The geometrical drive axis is the line bisecting the angle of the overall rear wheel toe. The measurements of the front wheels relate to this axis.
- (2) The symmetrical axis represents the center line through the front and rear axes.

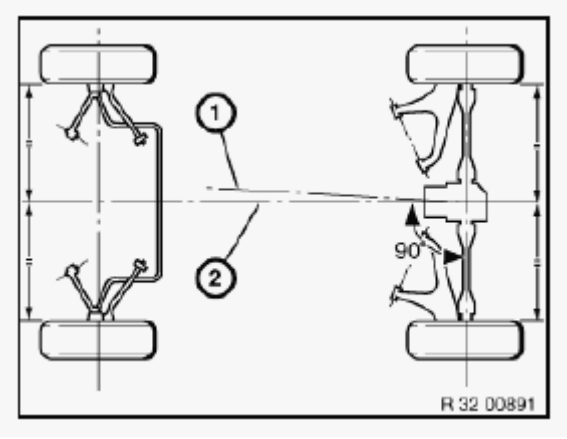


Fig. 22: Geometrical Drive Axis/Symmetrical Axis
Courtesy of BMW OF NORTH AMERICA, INC.

5.6 Wheel displacement angle

- The wheel displacement angle is the angular deviation of the connecting line of the wheel contact points in relation to a line running at 90° to the geometrical drive axis. The wheel displacement angle is positive if the right-hand wheel is displaced to the front, and is negative if it is displaced to the rear.

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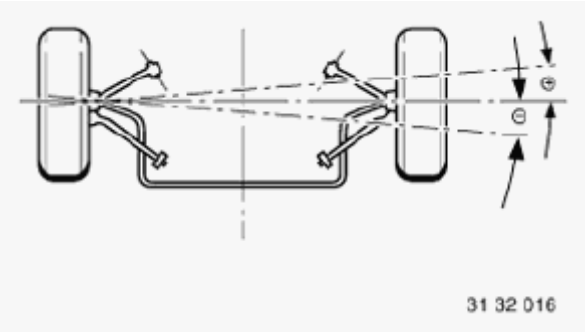


Fig. 23: Wheel Displacement Angle
Courtesy of BMW OF NORTH AMERICA, INC.

5.7 Kingpin offset

- The kingpin offset is the distance from the center of the wheel contact point to the contact point of the kingpin extrapolation.

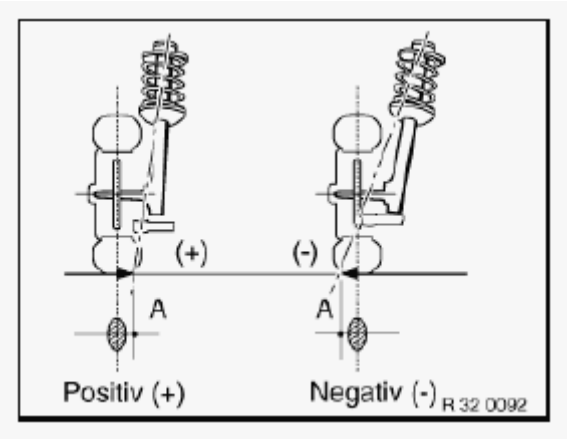


Fig. 24: Kingpin Offset
Courtesy of BMW OF NORTH AMERICA, INC.

6. WHEEL SUSPENSION

Those parts which connect the wheel to the mostly load-bearing floor elements of the bodywork and guide it in the required direction belong to the wheel suspension. They are connected by axles or other comparable structures and guided by the arms. The wheel suspension plays a decisive role in the handling characteristics of a vehicle. Two main groups have to be distinguished: 1. Rigid axle suspension and 2. Independent wheel suspension.

6.1 Rigid axle suspension

RIGID AXLE SUSPENSION ADVANTAGES AND DISADVANTAGES

Description	Advantages	Disadvantages
The rigid axle suspension has a rigid connection between both wheels or wheel pairs. Any change in one wheel is more or	In the event of deflection taking place, there are no changes to the camber or	Non-driven rear axles may also acquire negative camber

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less transferred to the other. It is now only fitted as a rear axle, if at all. However it is frequently used for lorries or busses.	wheel toe. This means: less tyre wear and good track stability.	as well as increasing tyre lateral guidance, thus increasing tyre wear.

6.2 Independent wheel suspension

INDEPENDENT WHEEL SUSPENSION ADVANTAGES AND DISADVANTAGES

Description	Advantages	Disadvantages
State-of-the-art individual wheel suspension is available on BMW vehicles on the front and rear axles. This development has its cause in mass inertia, as a reduction in the non-suspended mass improves wheel and ground contact, and the wheel stays better on the road. Control arms and trailing arms, which have to absorb high longitudinal and lateral forces to some extent, are required for guiding independently suspended wheels.	Wheels suspended independently from each other have no mutual influence on each other.	Depending on the type, changes may occur in the camber, wheel toe, track width, castor and wheelbase.

7. WHEEL ALIGNMENT / PROCEDURE

7.1 Measuring options

An overview of all measuring options and values (VA = front axle, HA = rear axle) is shown below.

WHEEL ALIGNMENT SPECIFICATION

Measuring options	Measuring accuracy	In measuring range	Total measuring range
Total wheel toe (VA + HA)	± 2'	± 2°	± 18°
Single wheel toe (VA + HA)	± 2'	± 2°	± 9°
Camber (VA + HA)	± 1	± 3°	± 10°
Wheel displacement (VA)	± 2'	± 2°	± 9°
Geometrical drive axis	± 2'	± 2°	± 9°
Castor	± 4'	± 18°	± 22°
Kingpin inclination	± 4'	± 18°	± 22°
Toe-differential angle	± 4'	± 20°	± 20°
Maximum steering angle (VA)	± 4'	± 60°	± 300°
Maximum steering angle (HA)	± 4'	± 9°	± 9°
Castor correction range	± 4'	± 7°	± 10°

NOTE: The measuring accuracy details only apply when using the precision rotating and sliding plates as well as the BMW quick-acting clamps.

7.2 Preparatory work

Before commencing the measurement, preparatory work must be carried out at the measuring area and on the vehicle. Preparatory work includes:

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- Easy-running rotating and sliding plates
- Aligning the rotating and sliding plates in relation to the track width and wheelbase
- Centering the vehicle on the plates
- Applying the parking brake
- Removing the lock pins on the plates to prevent tension in the chassis under loading
- Checking the rim and tire size, tread depth, tire pressure, steering wheel play, wheel bearings and condition of suspension and shock absorbers
- Fastening the measuring equipment to the wheels
- Loading the vehicle according to BMW KDS specifications
- Rock the vehicle firmly with the brakes released to ensure a stable center position
- Lock the service brake using the brake clamping device

7.3 Initial / final measurement

This measurement can be carried out as a program-guided measurement in the same way as any subsequent adjusting work and the final measurement. The sequence of the chassis measuring points to be called up is specified and controlled by the system software. The individual steps comprise:

- Driving straight ahead to correctly record the wheel toe and camber values for the rear axle
- Steering routine for recording the castor, kingpin inclination and toe-differential angle
- Recording the wheel toe and camber of the front axle (adjust the steering center point in advance)
- Steering routine for measuring the maximum steering angle on the left/right
- Checking the overview of measured values with the setpoint and actual comparison of all measured values

7.4 Printing out the data

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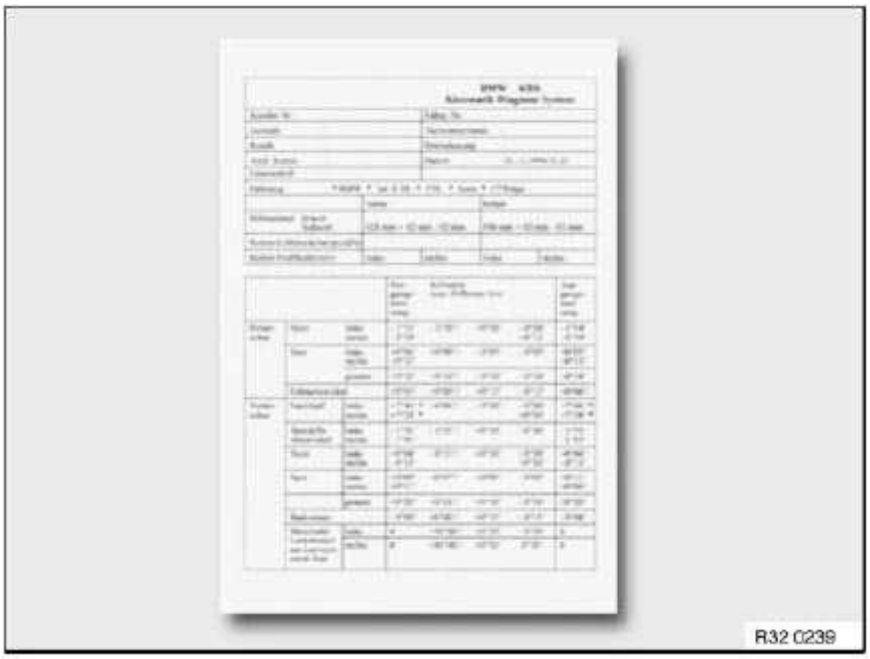


Fig. 25: Printing Layout Of Customer And Vehicle Identification Data
Courtesy of BMW OF NORTH AMERICA, INC.

The report printout from the integrated DIN A4 printer is subdivided into three sections:

- Header lines with customer and vehicle identification data --> the customer data entered before beginning the measurement as well as vehicle data are printed out here.
- Centre section with vehicle data --> this includes the make, type, model and vehicle model year defined when the setpoint data record was selected. The values previously measured for height level, tire pressure and tread depth are also printed in this section.
- The end section with all vehicle alignment values comprises the 3 columns initial measurement, setpoint values and output measurement. The measured values are recorded separately in these three columns.

8. SPECIAL FEATURES

8.1 Free wheel alignment

With free wheel alignment the selection and sequence of the measuring points is freely selectable. The following points must be observed for attaining the correct measurement results:

- Carry out all work in the same way as with the program-guided measurement.
- Before measuring the wheel toe and camber values for the rear axle, the steering must be in the "straight ahead" position to ensure that it is perfectly aligned in relation to the longitudinal center plane of the vehicle.
- Before measuring the single wheel toe values on the front axle, the center of steering must be established to ensure the correct position of the steering wheel.

8.2 System settings

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The following settings must only be entered or set once: language, display format, date/time, advertising text, remote control with display, rotating plate selection and printer settings. They remain stored.

9. BMW KINEMATIC DIAGNOSIS SYSTEM COMPARISON (BOSCH - BEISSBARTH)

BMW KINEMATIC DIAGNOSIS SYSTEM COMPARISON (BOSCH - BEISSBARTH)

	Bosch	**Beissbarth**
Measured value recording	Infrared	CCD camera
Data transmission	Cable	Infrared / cable
Measuring sensor power supply	Cable	Battery / cable
Remote control	Infrared	Infrared
Remote control with measured value display	Cable	Infrared
Setpoint data memory	Floppy disk	Hard disk
Measured value memory	Always the last vehicle measured	Unlimited vehicle memory
Operating system	---	MS-DOS
Languages	English and one language on request	EN, DE, NI, SV, IT, FR, SP (further languages can be called up)
Update	3.5" floppy disk	3.5" floppy disk using TIS/DIS
Monitor	20"	17"
Computer	---	Pentium
Disk drives	2 x floppy disk	1 x floppy, 1 x CD ROM

10. CONTROL MODIFICATION (MENU)

10.1 Remote control with display

The following steps show how the remote control with display is activated:

1. Call up the "**Service** " menu in special functions ("**S** " key)
2. Call up the "**Remote control** " sub-menu in the "**Service** " menu.
3. Select the "**Remote control with display** " item in the "**Remote control** " sub-menu-this configuration is retained.

IMPORTANT: In the case of equipment without remote control, this must be configured to " No remote control ".

10.2 Brief operating instructions

1. Activate the remote control with the "**ON** " button (it may also be switched on during alignment). The title page will appear on the LCD.
2. Select "**Straight ahead** " of the "**Initial measurement** ", "**Adjustment work** " or "**Final measurement** " at the measuring equipment cabinet. The steering graphics for " **Straight ahead** " will appear on the LCD.

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3. Use the "**Forward arrow** " to change to the next measurement image. Display blocks will appear on the LCD with the designation of the measured value and tolerance bar with the measured value. If the measured value is within the tolerance range, it is shown in dark figures against a light background. If the measured value is outside the tolerance range, it will be shown in inverse video (light figures against a dark background).
4. By pressing the "**F** " key shortly, you can move alternately between the designation of the measured value and the setpoint value with the tolerance inside the display blocks.
5. You can scroll through the measured values using the "**Forward arrow** ", "**Backward arrow** " and "**Cancel" (red dot)** keys. The function of these keys is identical to that of the keys on the graphics panel.
6. Even with "**Free alignment** ", it is possible to scroll through the measured values in the same way as with "**Program-guided alignment** ".
7. During measurement, the report print-out can be initiated using the "**Printer** " key. The remote control keys are only active during measurement and adjustment (not during customer data input, vehicle selection etc.).

10.3 Display support

- Measured values with a setpoint/actual comparison and tolerance bar (setpoint figures can be displayed with the "**F** " key)
- Steering graphics for steering routines
- Overview of measured values with current setpoint/actual comparison
- Rim run-out compensation
- With all other functions (e.g. customer input), the title illustration appears on the LCD display

NOTE: If the data transmission from the remote control to the computer is interrupted, the remote control icon in the bottom right-hand corner of the screen changes color from green to red and the illustration on the LCD display is shown inversely - black turns to white, white to black. This change does not take place in the title illustration. Once the line-of-sight connection has been re-established, the remote control continues to operate from the point of interruption in the program. A continuous visual connection during alignment is therefore not necessary.

- The "**Hour glass** " icon in the LCD display means: "**Please wait** ".
- The "**Battery** " icon in the top right-hand corner of the LCD display means that the battery reserve has been reached.
- To switch off the remote control: press the "**F** " key for 5 seconds, then return it to its charging unit or connect it to a charge cable. The title illustration will again appear as a charging check.
- If, during the measurement, the remote control has been placed back in the charging unit, it must be switched on again using the "**ON** " button.

11. UPDATING THE SOFTWARE / SETPOINT DATA

Floppy disks will no longer be sent to BMW partners who have acquired a "**BMW KDS** (Beissbarth / Bosch)".

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For cost-related reasons, you can create these disks yourself on the **"DIS-tester"** or on the "**TIS/EPC server** ". The data for this is regularly updated on the TIS CD.

11.1 Requirements

- BMW KDS (Beissbarth / Bosch)
- TIS CD program status (Beissbarth): from CD 12/95
- EPC program status: from 12/95
- TIS CD program status (Bosch): from CD 08/97
- DIS program status: from V6.0
- 3.5" diskettes, 1.44 MB (Beissbarth 5 diskettes / Bosch 1 diskette)

11.2 Procedure (Beissbarth)

1. Go to the "Administration" screen
2. Select the **KDS button**
3. Select **Beissbarth**
4. Insert "**Diskette 1** " on request and confirm with "**OK** " (program diskette 1 of 2 is created, label it)
5. Insert "**Diskette 2** " on request and confirm with "**OK** " (program diskette 2 of 2 is created, label it)
6. Insert "**Diskette 3** " on request and confirm with "**OK** " (setpoint data diskette 1 of 3 is created, label it)
7. Insert "**Diskette 4** " on request and confirm with "**OK** " (setpoint data diskette 2 of 3 is created, label it)
8. Insert "**Diskette 5** " on request and confirm with "**OK** " (setpoint data diskette 3 of 3 is created, label it)
9. Perform update and/or setpoint data on the KDS in the usual manner with the diskettes which have just been created.

11.3 Procedure (Bosch)

1. Go to the "Administration" screen
2. Select the **KDS button**
3. Select **Bosch**
4. Label "**Diskette 3.1** ", insert it into the drive on request and confirm with "**OK** " (2x) --> Setpoint data is copied to the diskettes.
5. Insert setpoint data diskette 3.1 into the 3.1 floppy disk drive, insert operating system diskette 3.0 into the 3.0 drive.
6. Switch on the machine in the usual manner.

IMPORTANT: When creating the KDS diskettes, all data on the diskettes used is overwritten.

NOTE: In the event of an error, a corresponding message is shown and the program is cancelled completely. The procedure must be run from the beginning again and all data on the diskette will be deleted. A new diskette may have to be used.

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12. CREATING, COPYING AND EDITING SETPOINT DATA

12.1 Copying

- Press the "**C** " button and select the vehicle to be copied.
- Select the "**Edit setpoint data** " menu item from the special functions. Create a new vehicle in the usual manner. The setpoint values for the last vehicle selected will appear in the data input screen. Enter the data and save the data record.

12.2 Creating

- Press the "**C** " button and select the "**Edit setpoint data** " menu item from the special functions. Create a new vehicle in the usual manner. An empty data input screen will appear. Enter the data and save the data record.

12.3 Editing

- Factory-programmed setpoint data can neither be deleted nor modified. If this data does need to be modified, a new vehicle with modified setpoint data must be created. New vehicles created by the user are identified by a "+ " in the selection menu. These vehicles can be deleted by the user using the "- " key or modified using the "< > " key. These keys only appear if vehicles have been entered by the user.

13. SPECIAL FUNCTIONS

13.1 Customer-specific printer report header

The sub-item "**Customer-specific text** " must be called up in the "**Special functions** " menu. An input screen will appear on the monitor. This input screen must be filled out with the name and address and stored with the "**S** " screen key. The text entered is inserted into the report header.

13.2 Adjusting options

- Call up the "**Service** " menu in the special functions ("**S** " key).
- Select the "**Wheel toe adjustment** " item or the "**Camber adjustment** " item from the "**Adjustment** " sub-menu. The toe and camber adjustment program will guide the user step by step through the adjustment using text and images. The measuring deviation for each measuring sensor will be shown on the screen when the adjustment has been completed.
- You can store the adjustment values in the measuring sensor using the "**Store** " key or you can quit the program with the "**Red dot key** " without saving them (check). The adjustment values can be printed out.

13.3 Rotating plate test

- Call up the "**Service** " menu in the special functions ("**S** " key).
- Call up the "**Rotating plate** " item in the "**Service** " menu. Turn the left-hand and right-hand rotating plate and check the display on the screen. Important: The measuring range is ± 306 degrees.

13.4 Viewing and deleting customer entries from database

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- Call up the menu item "**Delete** " in the "**Database** " menu in the special functions. The data input screen will appear. Fill in the search fields with the data to be deleted.
- Use the "- " button to delete this data record. A new data record can then be highlighted and deleted with the digital pen.
- You can scroll through the entire database with the "**Arrow up** " and "**Arrow down** " keys.
- You can quit the delete function by pressing the cancel key (red dot).

14. MODIFICATIONS WITHIN PROGRAM

Further modifications were carried out within the program which only slightly change the program sequence but which optimizes the alignment in respect of comfort and speed. This is described below:

- Optimization of the rim run-out compensation in respect of speed.
- Optimization of the steering routines: Highlighted values within the gate can still be corrected. The message "**Rotating plates not connected** " no longer causes the steering routine to be cancelled. Further measurements can be carried out after the rotating plates have been connected.
- Standardization of screen colors with the colors on the tablet.
- Addition of texts in several foreign languages.
- Elimination of program-related and cosmetic faults.
- Electronic water level.
- Omission of kingpin inclination measurement.

15. FAULTS

15.1 Tyre faults

TYRE FAULTS DESCRIPTION CHART

Fault	Effect
1 Wheel toe, camber, toe-differential angle and castor not correct	1 Severe tyre squeaking even at relatively low speeds
2 Excessive toe-in and excessive positive camber	2 Tyres are worn down on one outside edge in the longitudinal direction
3 Excessive negative camber	3 Tyre wear on inside edge
4 Worn front-axle suspension on front-wheel-drive vehicles	4 Increased noise / Vehicle pulls on one side when accelerating
5 Incorrect wheel alignment	5 Wheels scrubbing / Tyre surface shows feathering in the tread
6 Play in the suspension due to mechanical parts (suspension, steering)	6 Washout / Wobbling of front wheels
7 Tyre pressure too low	7 Outside tyre surface wear

15.2 Front axle faults

FRONT AXLE FAULTS DESCRIPTION CHART

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Fault	Cause	Remedy
1. Toe deviation	a) Vehicle not in normal position	a) Correct height level
	b) Tie rod(s) bent	b) Replace tie rod(s)
	c) Tie rod ball joints worn	c) Replace tie rod(s)
	d) Rubber mount in control arm defective	d) Replace control arm
2. Camber deviation: The camber is fixed during the design stage and cannot be adjusted.	a) Rubber mount in control arm defective	a) Replace control arm
	b) Control arm deformed	b) Replace control arm
	c) Spring strut deformed	c) Replace spring strut
	d) Traction strut worn	d) Replace control arm
	e) Spring deflection too great	e) Replace coil spring, height level
	f) Front axle carrier deformed	f) Replace front axle carrier
	g) Spring strut mount deformed	g) Repair forward structure
	h) Distortion in the floor assembly (engine bracket)	h) Repair body
3. Castor deviation: The castor is fixed during the design stage and cannot be adjusted.	a) Rubber mount for tension / traction strut defective	a) Replace rubber mount
	b) Tension / traction strut deformed	b) Replace tension / traction strut
	c) Control arm deformed	c) Replace control arm
	d) Spring strut deformed	d) Replace spring strut
	e) Wheelhouse deformed (spring strut mount)	e) Repair forward structure
	f) Distortion in the floor assembly (engine bracket)	f) Repair body
4. Toe-differential angle deviation	Requirement: camber and castor are correct	
	a) Tie rods unevenly adjusted	a) Set wheel toe on left and right to identical values
5. Wheel displacement deviation	Requirement: Front wheels have same single toe in relation to the geometrical axis	
	a) Front axle carrier deformed	a) Replace front axle carrier
	b) Engine bracket deformed	b) Repair body
	c) Control arm deformed	c) Replace control arm
	d) Tension / traction strut deformed	d) Replace tension /

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		traction strut

15.3 Rear axle faults

REAR AXLE FAULTS DESCRIPTION CHART

Fault	Cause	Remedy
1. Camber deviation	a) Vehicle not in normal position: spring deflection too great	a) Correct height level
	b) Rubber mount on rear axle carrier defective	b) Replace rubber mount
	c) Rear axle carrier deformed	c) Check rear axle carrier and replace, if necessary
	d) Control arm deformed	d) Check control arm and replace, if necessary
	e) Traction strut deformed	e) Check traction strut and replace, if necessary
	f) Distortion in the floor assembly	f) Repair body
	g) Swinging arm deformed	g) Replace swinging arm
2. Rear wheel position is not correct	a) Rear axle carrier has been shifted laterally	a) Check the rubber mounts on the rear axle carrier and replace, if necessary
	b) Distortion in the floor assembly	b) Repair body
3. Toe deviation	a)Vehicle not in normal position, i.e. spring deflection too great	a) Correct height level
	b) Rubber mount in rear axle carrier defective	b) Replace rubber mount
	c) Control arm deformed	c) Replace control arm
	d) Rubber mount and swinging arm defective	d) Replace swinging arm
	e) Rear axle carrier deformed	e) Check rear axle carrier and replace, if necessary
	f) Traction strut deformed	f) Check traction strut and replace, if necessary
4. Deviation from the geometrical drive axis	Requirement: Total wheel toe is correct	
	a) Distortion in the floor assembly	a) Repair body

Further details on the "Kinematic Diagnosis System" can be found in the operating instructions for the BMW KDS (Beissbarth / Bosch).

Functional and system descriptions are not subject to change. Parts availability and immediate ordering availability cannot be derived from this information. The specialist departments will be providing further details at the relevant time.

VS-23/Starringer Baugruppe/Group: 36 weltweit

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08/1999 360299(469) All countries

TIRES WITH EMERGENCY RUNNING CHARACTERISTICS AND TIRE PRESSURE WARNING SYSTEMS

All models

GENERAL INFORMATION

Warning systems

BMW AG offers two different systems to warn the driver of a drop in tire pressure.

WARNING SYSTEMS REFERENCE

System	Description	Measuring principle
RDC	Tyre pressure control	Tyre pressure/temperature
RDW	Tyre pressure warning	Comparison of wheel speeds

EMERGENCY RUNNING SYSTEMS

In addition to the warning systems, two emergency running systems are also employed to prevent a depressurized tire from caving in:

Components of emergency running system with self-supporting tires:

EMERGENCY RUNNING SYSTEMS REFERENCE

RDW (standard equipment)	Tyre pressure warning
RDC (available as option from 03/2000)	Tyre pressure control
SST	**S** elf **S** upporting **T** yre
EH2 disc wheel	Disc wheel with **E** xtended **H** ump **2**

Components of emergency running system with integrated support ring:

COMPONENTS OF EMERGENCY RUNNING SYSTEM WITH INTEGRATED SUPPORT RING

Support ring	**NOTE:** **In the future, only for heavy safety vehicles (E38/3)**
RDC (optional)	Tyre pressure control
H2 disc wheel	Standard disc wheel with **H** ump **2**

TYRE PRESSURE CONTROL (RDC)

RDC system description

RDC permanently monitors the tire pressure and the temperature in the tires, both while the vehicle is being driven and when it is stationary. Data is transmitted via data telegram by the wheel electronic units to the

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antennas installed in the wheel housing and on to the RDC control unit. There, the data received is compared with the stored limit values.

After correcting the air pressure with the engine off and the ignition on, press the Set button and hold (approx. 6 seconds) until the words "Set tire pressure" appear in the instrument cluster (instrument cluster high) or the yellow LED lights up (basic instrument cluster).

If the limit values are exceeded, the driver will be warned via the instrument cluster in two stages, as follows:

LOSS OF TYRE PRESSURE AND WARNING REFERENCE

Loss of tyre pressure	**Warning**
Drop in tyre pressure of 0.2 to 0.4 bar	Yellow LED on basic instrument cluster or Text: "Check tyre pressure" on instrument cluster high Gong: no
Drop in tyre pressure of more than 0.4 bar	Red LED on basic instrument cluster or Text: "Tyre failure" on instrument cluster high Gong: yes

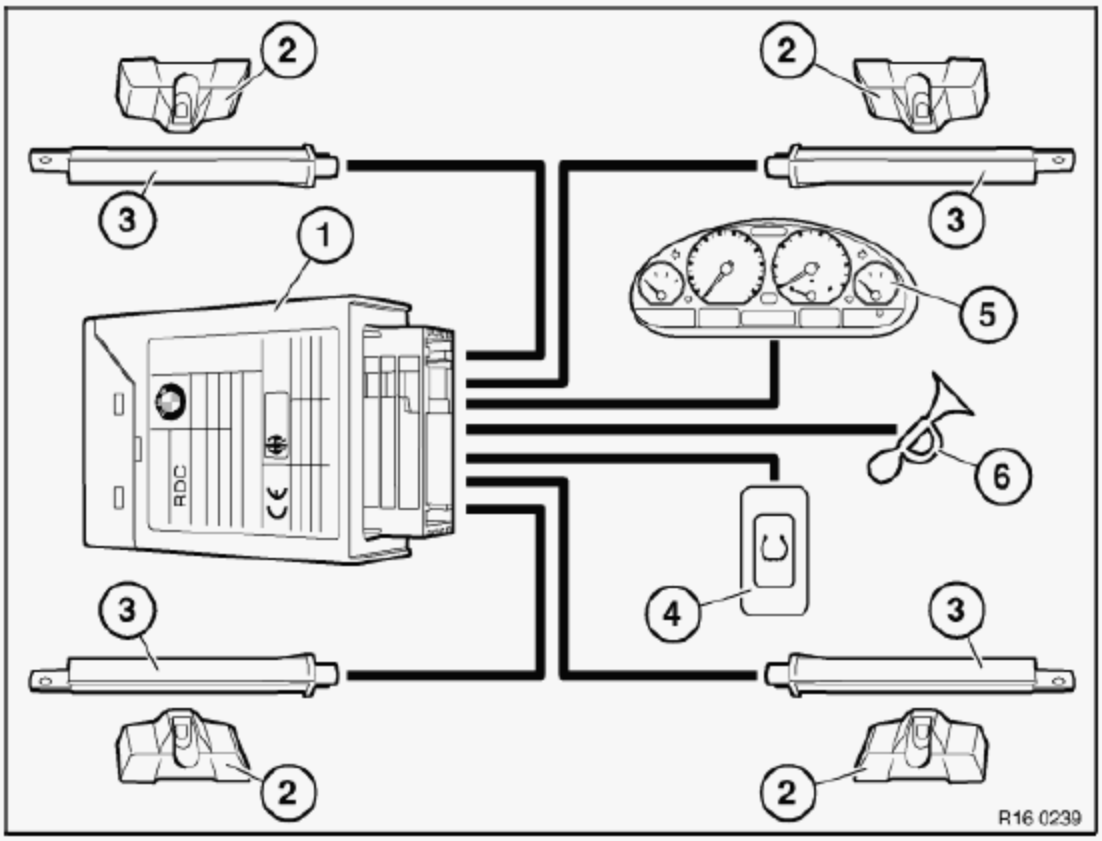
Advantages of RDC

ADVANTAGES OF RDC

1. Safety	○ early warning in the event of rapid loss of pressure ○ warning of loss of tyre pressure through normal diffusion
2. Comfort	○ unchanging ride comfort ○ instruction to check tyre pressure as necessary
3. Service life, economy	○ minimisation of tyre wear ○ minimisation of fuel consumption
4. New developments	○ allow tyres with emergency running characteristics to be fitted ○ no spare wheel if tyres with emergency running characteristics are fitted (saves weight)

RDC SYSTEM LAYOUT

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(1) RDC control unit
(2) Wheel electronic units (4 off)
Wheel electronic unit for spare wheel (optional)
(3) Receiving antennas (4 off)
(4) Set button
(5) Display element
(6) Anti-theft warning system
- Wiring harness

Fig. 26: RDC System Layout
Courtesy of BMW OF NORTH AMERICA, INC.

Component description

RDC control unit

Fully diagnosis-compatible

Task:

evaluates the following telegrams from the wheel electronic units:

- tire pressure
- tire air temperature
- identification number (ID) of wheel electronic unit

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- remaining service life of wheel electronic unit battery

If required, information or a warning is transmitted.

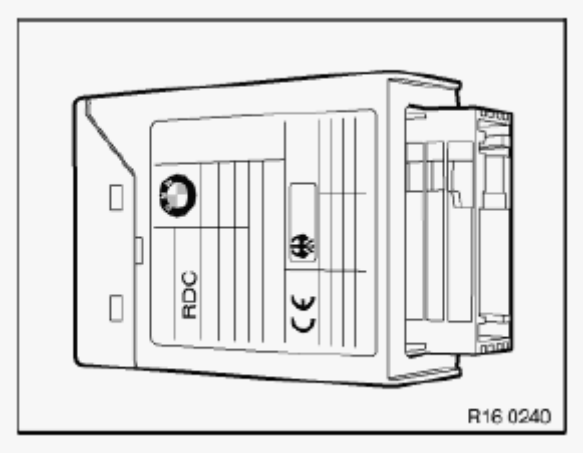


Fig. 27: RDC Control Unit
Courtesy of BMW OF NORTH AMERICA, INC.

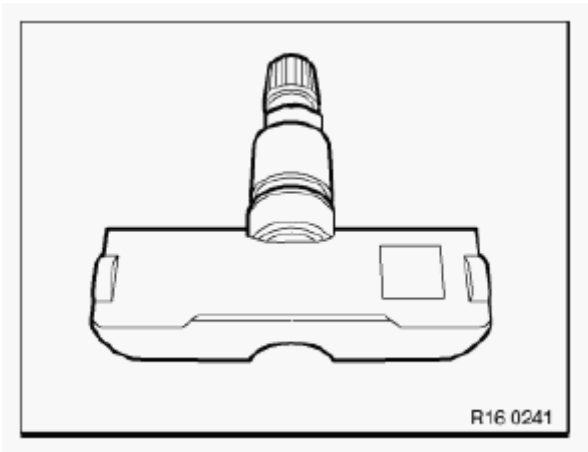
Wheel electronic unit with valve

Components:

- pressure sensor
- temperature sensor
- transmitter
  - frequencies according to country

power supply

  - service life: approx. 7 years
  - not exchangeable



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Fig. 28: Wheel Electronic Unit With Valve
Courtesy of BMW OF NORTH AMERICA, INC.

Installation location of wheel electronic unit in disc wheel

The wheel electronic unit (1) is screwed to the valve (2) on the disc wheel (3)

Identifying feature:

metal tire valves

NOTE: Different valves have to be used to allow for the different disc wheel sizes. The valves are color-coded. The correct coding can be taken from the spare parts catalogue.

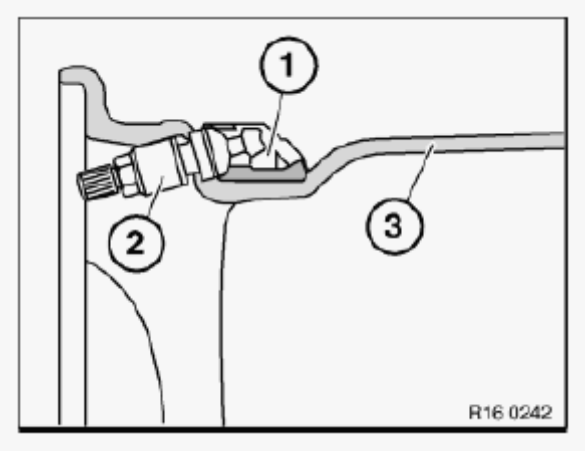


Fig. 29: Wheel Electronic Unit, Valve And Disc Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

Antenna

There is an antenna in each wheel housing.

Task:

receives telegrams and forwards these to the RDC control unit.

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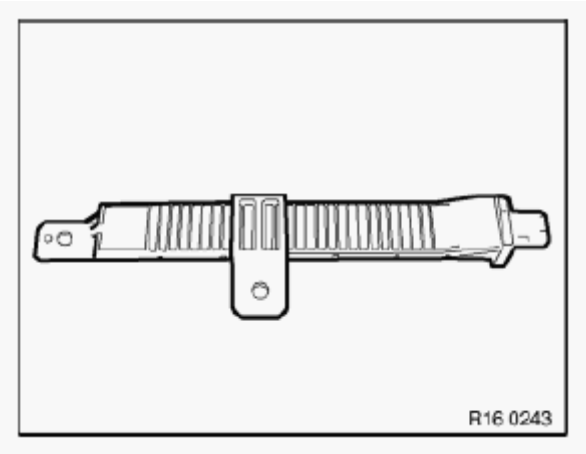


Fig. 30: Antenna
Courtesy of BMW OF NORTH AMERICA, INC.

COMPONENT DESCRIPTION

Set button

Installed in the instrument panel to the right of the steering wheel. (E46: in the center console)

Symbol: tire cross-section

Task:

initialization after resetting cold tire pressure or after changing tire or wheel location.

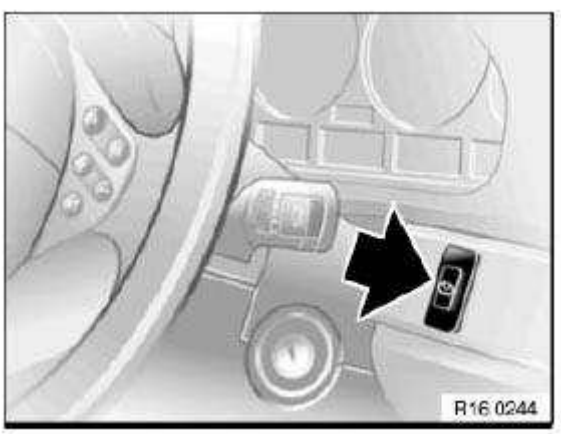


Fig. 31: Set Button
Courtesy of BMW OF NORTH AMERICA, INC.

Display element in instrument cluster

Indicator lamp lights up yellow:

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- drop in tire pressure of 0.2 to 0.4 bar Indicator lamp lights up red:
- drop in tire pressure greater than 0.4 bar

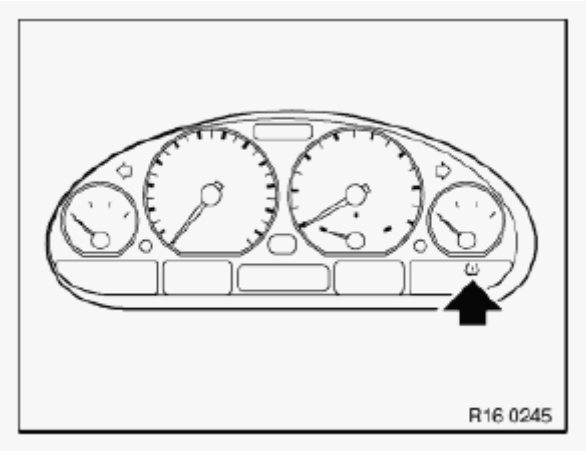


Fig. 32: Indicator Lamp
Courtesy of BMW OF NORTH AMERICA, INC.

TYRE PRESSURE WARNING RDW

RDW system description

RDW measures the wheel speeds on all four wheels, using the wheel speed sensors of the ABS/ASC or ABS/DSC system. It compares the wheel speeds of the diagonally opposite wheels and of the average speed.

In the event of a drop in tire pressure, the dynamic diameter of a wheel will change, leading to a changed wheel speed.

A drop in tire pressure of 30 ± 10 % can be detected on all wheels from about 15 km/h (10 mph) up to the vehicle's top speed.

If this value is exceeded, the driver will be warned via the instrument cluster as follows:

LOSS OF TYRE PRESSURE AND WARNING REFERENCE

Loss of tyre pressure	**Warning**
Loss of tyre pressure of 30 ± 10 %	Red LED Text: "Tyre failure" Gong: yes **The vehicle is not to be driven faster than 80 km/h (50 mph).** **NOTE:** **A cautious driving style with moderate forward and transverse acceleration will help to prolong the service life of the defective tyre.**

ADVANTAGES OF RDW

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With two exceptions, the advantages of RDC also apply to RDW.

Exceptions:

- no warning of loss of tire pressure through normal diffusion
- tire pressure still have to be checked regularly, every 14 days

RDW SYSTEM LAYOUT

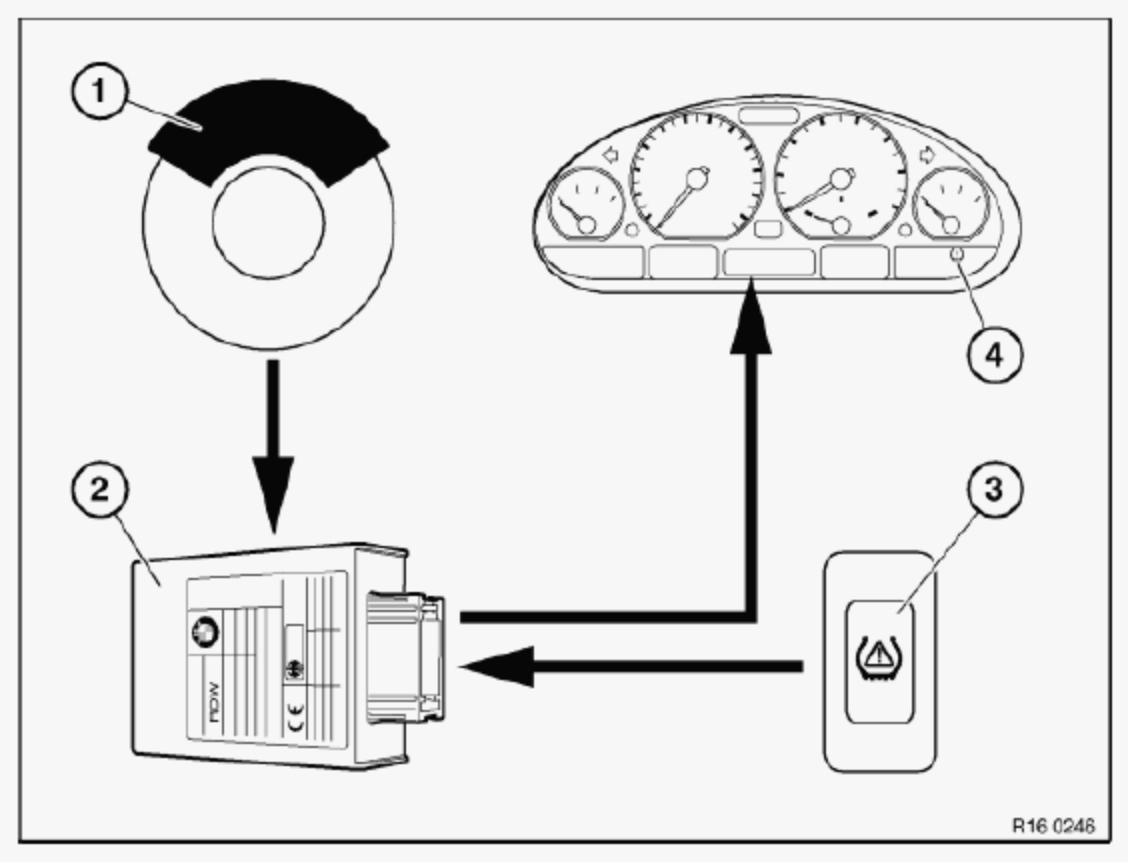


Fig. 33: RDW System Layout
Courtesy of BMW OF NORTH AMERICA, INC.

COMPONENT DESCRIPTION

RDW control unit

Fully diagnosis-compatible

Task:

- evaluates wheel speeds.
- a warning is transmitted as required.

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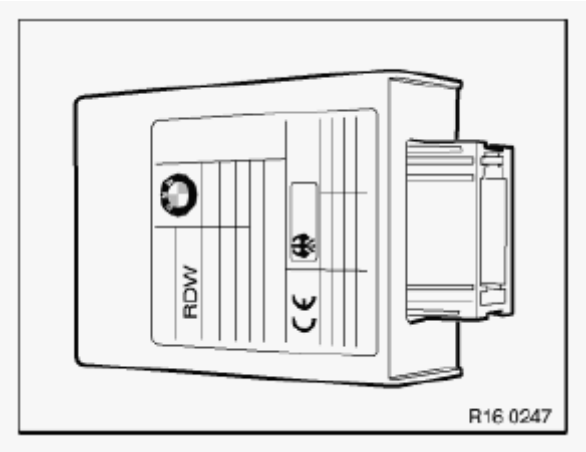


Fig. 34: RDW Control Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Set button

Installed in the dashboard to the right of the steering wheel. Symbol: tire cross-section with warning triangle

Task:

initialization after resetting cold tire pressure or after changing tire or wheel location.

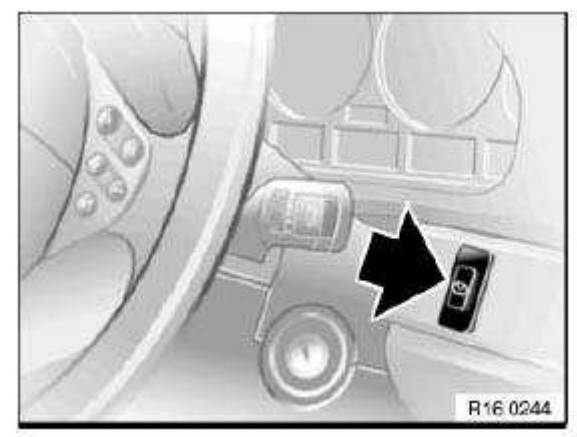


Fig. 35: Set Button
Courtesy of BMW OF NORTH AMERICA, INC.

Display element in instrument cluster

Indicator lamp lights up red:

- drop in tire pressure 30 ± 10 %

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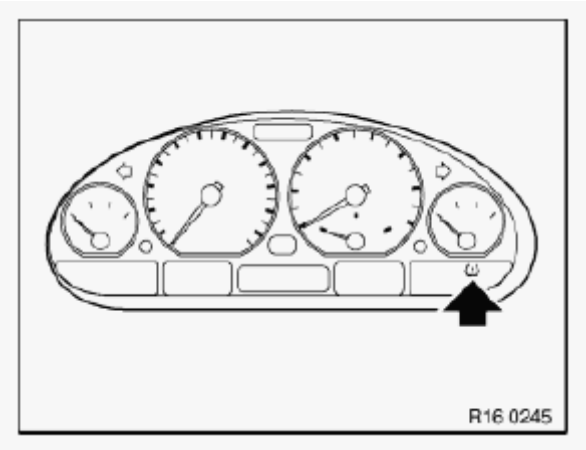


Fig. 36: Indicator Lamp
Courtesy of BMW OF NORTH AMERICA, INC.

EMERGENCY RUNNING SYSTEMS

Introduction

Tires with emergency running characteristics can still be used for a certain distance even if they suffer a complete loss of pressure. There are two different systems which meet these requirements:

- emergency running system with self-supporting tires
- emergency running system with integrated support ring

EMERGENCY RUNNING SYSTEMS SETUP

Emergency running system with self-supporting tires

The side walls of the self-supporting tire are reinforced. In conjunction with a special disc wheel, the tire can still be used for a certain distance even if it suffers a complete loss of pressure.

Mobility is retained for the following distances up to a speed of 80 km/h (50 mph) and with a cautious, suitably adapted driving style:

DISTANCES FOR RETAINED MOBILITY

Unloaded vehicle	max. 500 km (300 miles)
Unloaded roadster	less than 250 km (150 miles)
Fully loaded vehicle	max. 50 km (30 miles)

Self-supporting tires demand permanent monitoring of the tire pressure to ensure that the driver is given adequate warning if pressure is lost during a journey. For this reason, these tires are only available in conjunction with the warning system RDW and from 03/2000 also with RDC.

To prevent the self-supporting tires from becoming detached from the disc wheel in the event of a complete loss of tire pressure, they must be fitted to newly developed wheels with modified disc wheel humps, but with

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unchanged tire seating (= standard disc wheel).

However, the new wheels can also be used for standard tires of the same size.

COMPARISON STANDARD TIRES / SELF-SUPPORTING TIRES

Standard tires, unpressurized

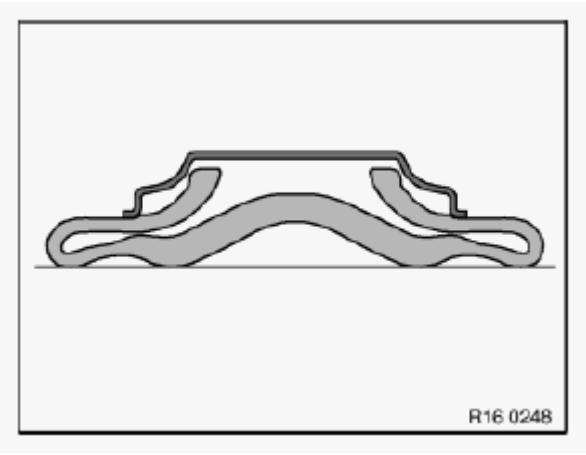


Fig. 37: Standard Tires, Unpressurized
Courtesy of BMW OF NORTH AMERICA, INC.

Self-supporting tires, unpressurized

Envulcanised reinforcement (1) made of a temperature-resistant rubber compound.

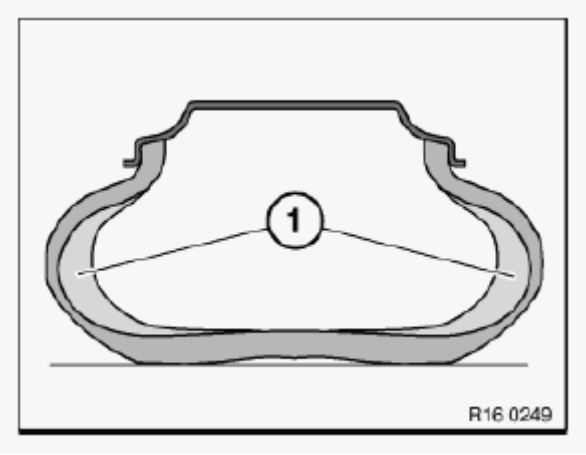


Fig. 38: Identifying Envulcanised Reinforcement
Courtesy of BMW OF NORTH AMERICA, INC.

DISC WHEELS

H2 disc wheel (standard disc wheel) for emergency running system with integrated support ring

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1. Hump 2 of standard disc wheel

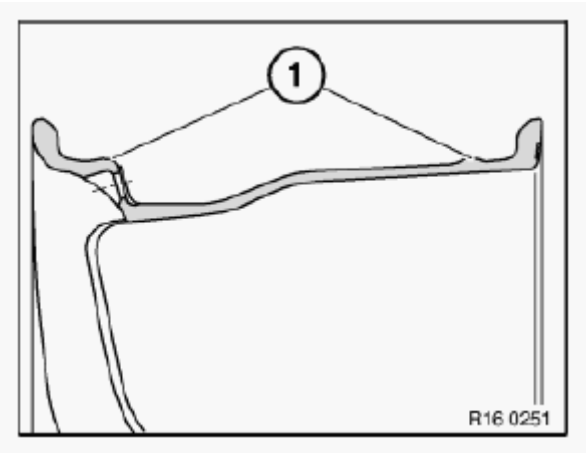


Fig. 39: Hump 2 Of Standard Disc Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

EH2 disc wheel for emergency running system with self-supporting tire

1. Extended Hump 2 of disc wheel
2. Drop center relocated a few millimeters to the center (precentring on outside)

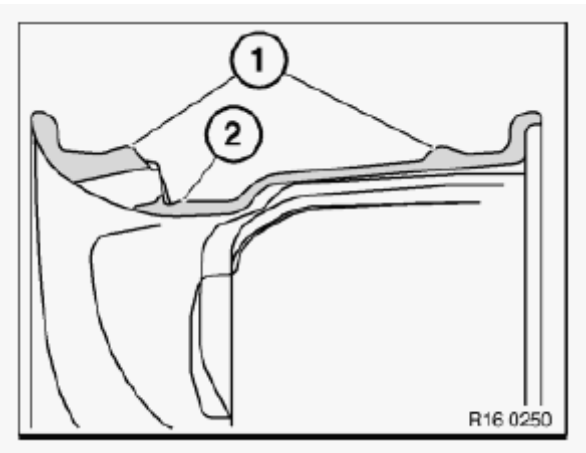


Fig. 40: Extended Hump 2 Of Disc Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The new EH2 disc wheels (extended Hump 2 inner and outer) will be used more frequently on BMW vehicles in the future as they can also help to delay standard tires from being lost in the event of a drop in tire pressure.

Example: from current 1.1 bar to 0.6 bar (X5 or Landrover disc wheel)

Emergency running system with integrated support ring

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(In the future, primarily on heavy safety vehicles)

The support ring is made of a high-strength resilient plastic and is fitted on the disc wheel inside the tire. The support ring can only be removed using special tools which have been specially approved by BMW. It can only be removed after destroying the tire.

Emergency running systems with integrated support ring are used in particular on heavy safety vehicles. They allow the vehicle to be driven away from a potential danger without dropping speed even if the tires have suffered a complete loss of pressure (flight situation).

It is possible as an option to have the tire pressure monitored by an RDC system. The RDC is installed by pressing the components into the support ring before it is fitted.

Wheel structure with integrated support ring

Emergency running system with integrated support ring

1. Tyre
2. Support ring

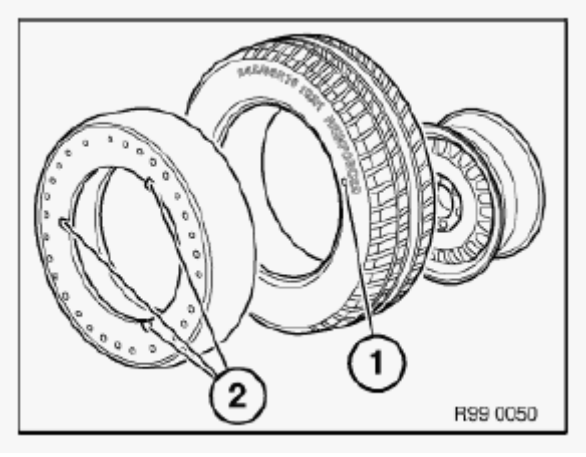


Fig. 41: Tyre And Support Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Installation location of RDC wheel electronic unit

1. Wheel electronic unit
2. Support ring

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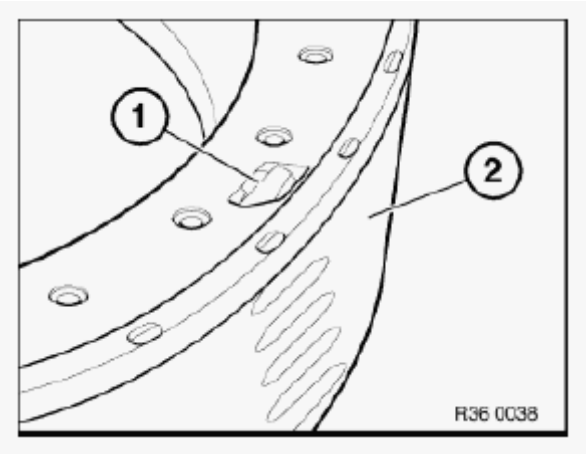


Fig. 42: Wheel Electronic Unit And Support Ring
Courtesy of BMW OF NORTH AMERICA, INC.

For further information on the subject of "Tyre pressure warning systems and tires with emergency running characteristics", please refer to the vehicle Owner's Handbook.

A Parts Information bulletin will be published with information on how to order parts.

Functional and system descriptions are not subject to change. Parts availability and immediate ordering availability cannot be derived from this information. The specialized departments will inform the markets with further details at the appropriate time.

VS-23/Hack Baugruppe/Group: 36 weltweit 11/1999

36 04 99 (502) all countries

STORING WHEELS AND TIRES

all models

WHEELS / TIRES - GENERAL NOTES

The service of storing a customer's wheels is one which is now almost taken for granted. For this reason, we have published this BMW Technical Service bulletin to provide a uniform storage concept, which will prevent damage being caused due to incorrect storage.

The tire's rubber will age under the influence of sunlight, heat, humidity, movements in the air and ozone, and will thus lose some of its stability and elasticity. For this reason, tires should never be stored in the open-air. If open-air storage cannot be avoided, the wheels / tires must be stored in a clean and dry condition and covered with waterproof material. It is essential that wheels / tires are protected against rain, snow and sunlight, but due to the risk of corrosion they must not be stored in tire sacks.

Wheels / tires with tire pressure control (RDC) must not be cleaned with high-pressure cleaning equipment.

Storage requirements

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The following requirements apply in general to storage in enclosed rooms:

STORAGE REQUIREMENTS

cool	**15...25 °C / sources of heat screened, or 1 m minimum distance from source of heat**
dry	Prevent water and condensation Avoid contact with mineral lubrication products
dark	Protect from direct sunlight and high-UV artificial light
moderate ventilation	Avoid a supply of oxygen and ozone

In short, the storage room should be cool and dry. It is not necessary to heat the room during the winter. In the summer, the doors and windows should be kept closed to ensure that no air can circulate. In addition, the windows can also be coated with sun protection paint.

The storage room should not contain any working electric machinery, welding equipment, distribution boxes etc. as electrical sparks generate ozone which can have a serious impact on the surface of the tire (ozone cracks).

Tires should not be allowed to come into contact with oil, petrol, or other mineral lubricants as these dissolve rubber, making the tire porous.

Preparing wheels / tires

1. Before removing a wheel, mark its position on the vehicle.
2. Whenever possible, keep the tire on its wheel (complete wheels).
3. Correct the inflation pressure and recheck every 2 months.
4. Ensure that tires are stored at a sufficient distance above the ground. Wheels / tires should never be stored on the ground.
5. Complete the storage forms. These should contain the following data:
   - Type and size of tire
   - Condition and tread depth
   - Customer's address
   - Date and signature of customer

Wheel / tire storage requirements

A. **Tyre fitted to wheel**

Do not store upright,...

NOTE: If storing the wheels upright cannot be avoided, the inflation pressure must be increased to 3.5 bar.

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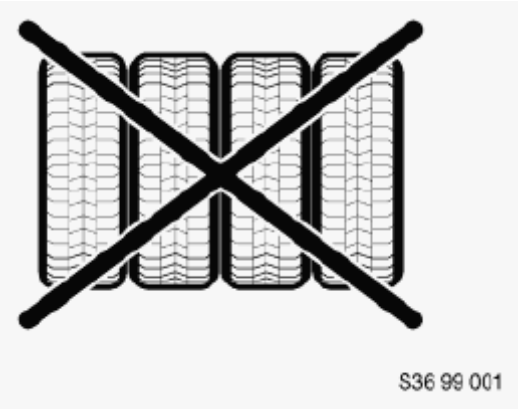


Fig. 43: Precaution For Storing Wheels And Tires - Do Not Store Upright
Courtesy of BMW OF NORTH AMERICA, INC.

... but rather hang ...

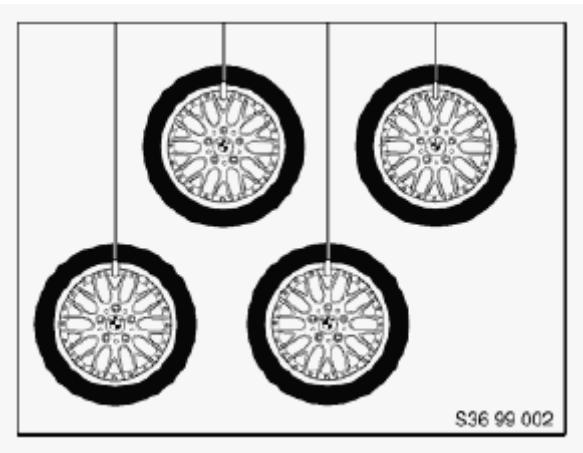


Fig. 44: Precaution For Storing Wheels And Tires - Rather Hang
Courtesy of BMW OF NORTH AMERICA, INC.

... or stack.

NOTE: Never store tires on the ground.
Use a wooden palette or similar.

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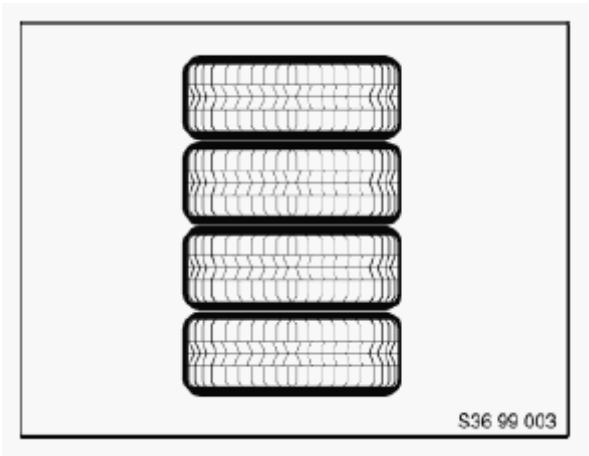


Fig. 45: Precaution For Storing Wheels And Tires - Stack
Courtesy of BMW OF NORTH AMERICA, INC.

B. **Tires not fitted**

Do not stack,...

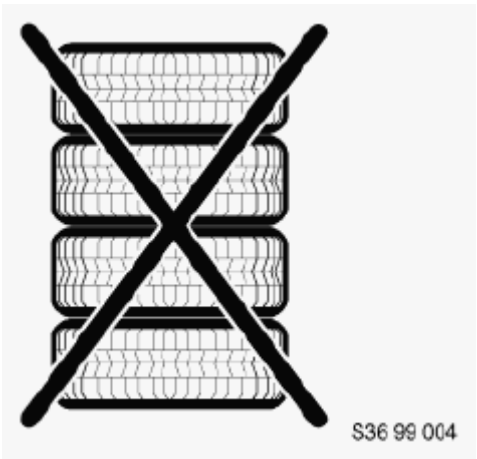


Fig. 46: Precaution For Storing Wheels And Tires - Do Not Stack
Courtesy of BMW OF NORTH AMERICA, INC.

... do not hang,...

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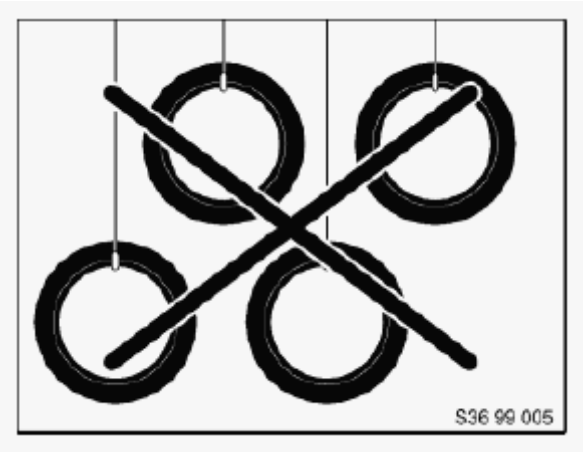


Fig. 47: Precaution For Storing Wheels And Tires - Do Not Hang
Courtesy of BMW OF NORTH AMERICA, INC.

... but rather store them upright and turn them every 4 weeks.

NOTE: Never store tires on the ground.
Use commercially available shelves.

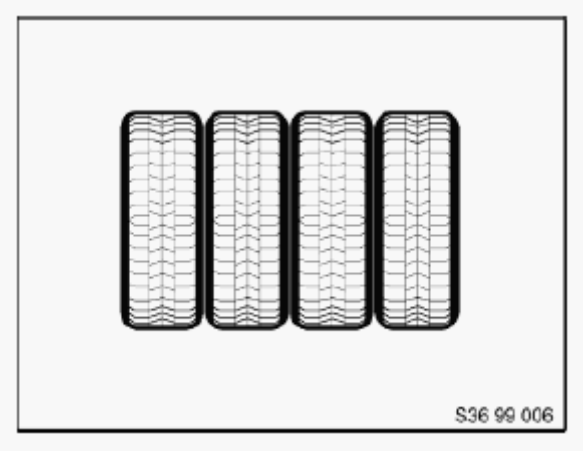


Fig. 48: Precaution For Storing Wheels And Tires - Store Upright
Courtesy of BMW OF NORTH AMERICA, INC.

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TRANSMISSION

Manual Transmission - Special Tools - X3

23 MANUAL TRANSMISSION

23 0 000 ATTACHMENT

Note: For car jack, for removing and installing manual and automatic transmissions

Order number: 23 0 000

Attachment

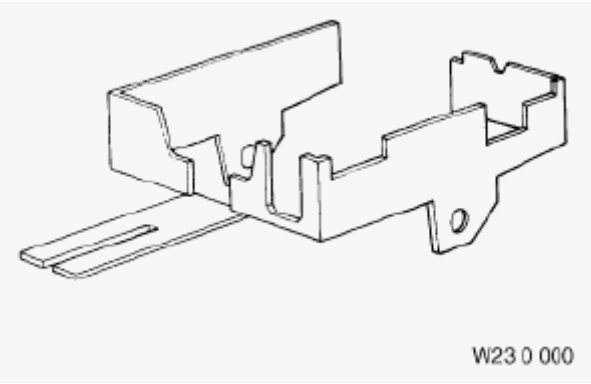


Fig. 1: Attachment (23 0 000)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 020 HOLDER

Minimum set: Mechanical tools

Note: For all three- and four-hole flanges during releasing and tightening down

Series: E38, E39, E46, E52, E53, E60, E61, E63, E64, E65, E66, E67, E70, E83, E85, E86, E87, E90, E91, E92

Transmission: A4S 200R, A5S 360R, A5S 390R, GA6 HP19Z, GS6-17BG, rear diff. type M, S5D 200G, S5D 250G

Storage location: A5, B5, C5

Order number: 23 0 020

Holder

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Fig. 2: Holder (23 0 020)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 030 SUPPORT

Note: For Getrag transmission

Transmission: 280/5 Sport

Order number: 23 0 030

Support

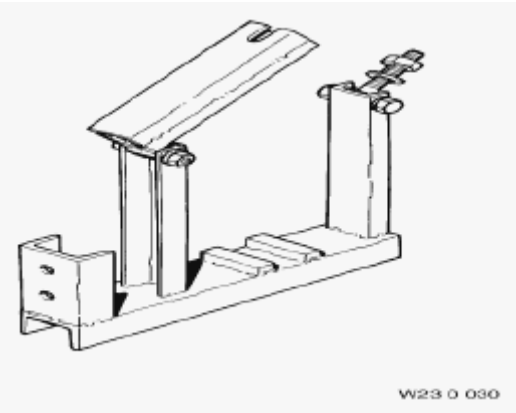


Fig. 3: Support (23 0 030)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 040 SUPPORT

In conjunction with: 00 2 030

Note: For transmissions for removal and installation. Replaced by 23 0 110.

Transmission: S6S 420G, S6S 560G

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SI number: 1 05 90(207)

Order number: 23 0 040

Support

Consisting of:

1 = 23 0 041 Locating cage

Note: Transmission: S6S 560G

2 = 23 0 042 Support bracket

Note: Transmission: S6S 420G

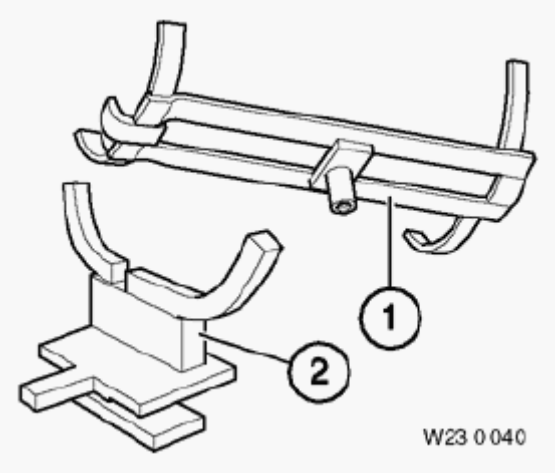


Fig. 4: Support (23 0 040)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 050 SUPPORT

In conjunction with: 00 1 450

Note: For all 4-speed and 5-speed transmissions

Transmission: 242/4

Order number: 23 0 050

Support

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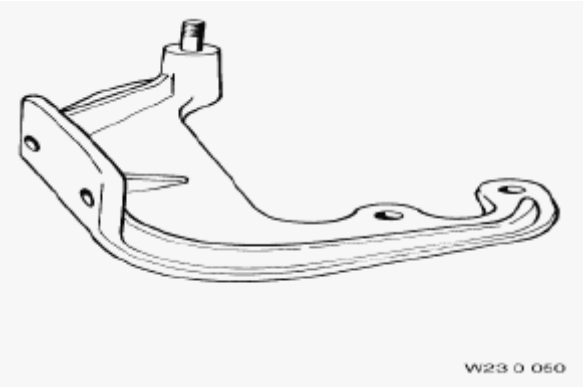


Fig. 5: Support (23 0 050)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 060 SUPPORT

In conjunction with: 00 1 450

Note: For Getrag transmission

Transmission: 245/5, 245/5 Sport

Order number: 23 0 060

Support

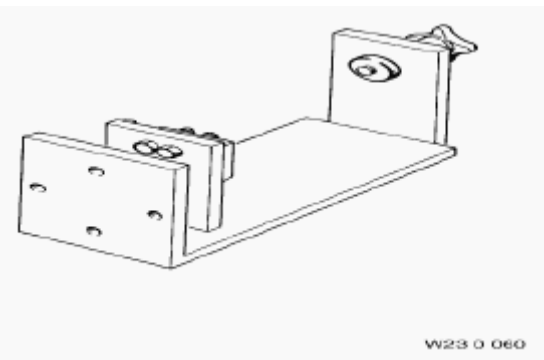


Fig. 6: Support (23 0 060)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 070 MOUNTING BRACKET

In conjunction with: 00 1 450

Note: For Getrag transmission

Transmission: 265/5, 265/5 Sport

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Order number: 23 0 070

Mounting bracket

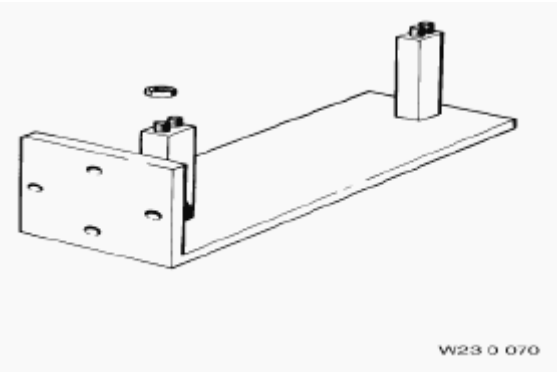


Fig. 7: Mounting Bracket (23 0 070)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 080 FIXTURE

Note: For removing 5th gear wheel

Transmission: 265/5, 265/5 Sport, 280/5 Sport

Order number: 23 0 080

Fixture

Consisting of:

23 0 081 Puller jaws (2)

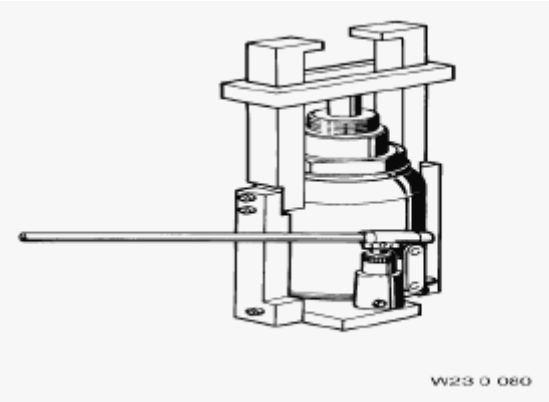


Fig. 8: Fixture (23 0 080)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 090 SUPPORT

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In conjunction with: 00 1 450

Note: For ZF and Getrag transmissions

Transmission: 240/5, 260/5, ZF S5-16

Order number: 23 0 090

Support

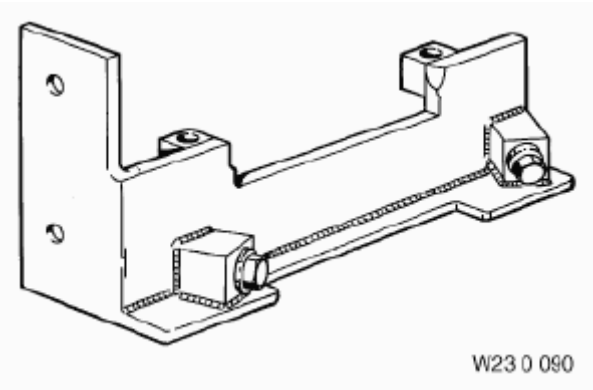


Fig. 9: Support (23 0 090)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 100 SUPPORT

In conjunction with: 00 1 450

Note: For mounting transmission on assembly stand

Transmission: S5D 200G, S5D 250G, S5D 260Z, S5D 310Z, S5D 320Z

SI number: 1 07 90 (244)

Order number: 23 0 100

Support

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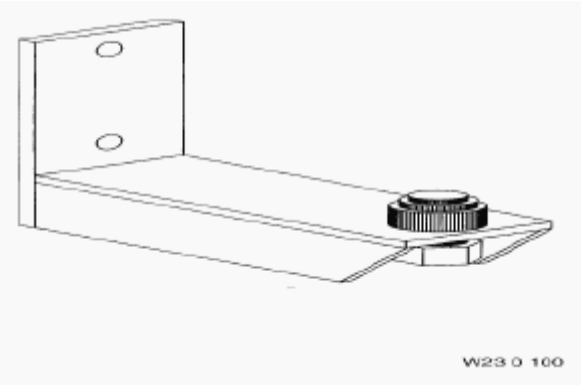


Fig. 10: Support (23 0 100)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 100 SUPPORT

In conjunction with: 00 2 030

Note: For removing and installing transmission.

Transmission: S6S 420G, S6S 560G

SI number: 1 02 00 (551)

Order number: 23 0 110

Support

Consisting of:

1 = 23 0 111 Take-up support

Note: Transmission: S6S 560G

2 = 23 0 112 Locating bracket (not shown)

Note: Transmission: S6S 420G

In conjunction with: 21 0 111 Take-up support

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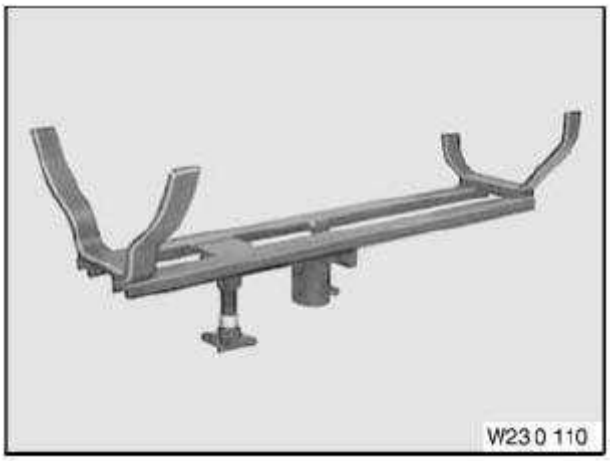


Fig. 11: Support (23 0 100)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 130 TAKE-UP SUPPORT FOR TRANSMISSION

In conjunction with: 00 2 030

Note: For accommodating transmission during removal and installation.

Series: E39, E46, E52, E53, E60, E61, E63, E64, E65, E66, E67, E70, E83, E85, E86, E87, E90, E91, E92, E93

Transmission: GS6-17BG, GS6-37BZ, GS6-37DZ, GS6-53BZ, GS6-53DZ, GS7S47BG, S5D 280Z, S5D 320Z

SI number: 1 06 00 (575)

Order number: 23 0 130

Take-up support for transmission

Consisting of:

1 = 23 0 131 Basic body

2 = 23 0 132 Adjusting unit

3 = 23 0 133 Take-up support

Note: Transmission: S5D 280Z in E53

4 = 23 0 134 Take-up support

Note: Transmission: GS6-37BZ (Htransmission), GS6-17BG (i-transmission)

5 = 23 0 135 Take-up support

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Note: Transmission: GS6-37BZ, GS6-53BZ SMG H-SMG

In conjunction with: 23 0 131 / 132, 23 0 134 (front take-up support)

6 = 23 0 136 Take-up support

Note: Transmission: GS6-53BZ, GS6-53DZ

7 = 23 0 137 Take-up support

Note: Transmission: GS6 37BZ, GS6 37DZ (H-transmission) in E87, E90.

In conjunction with: 23 0 131 / 132 / 134 / 136

23 0 138 Take-up support

Note: Transmission: GS6 37DZ (H-transmission) in E83/M47TU.

In conjunction with: 23 0 131 / 132 / 133

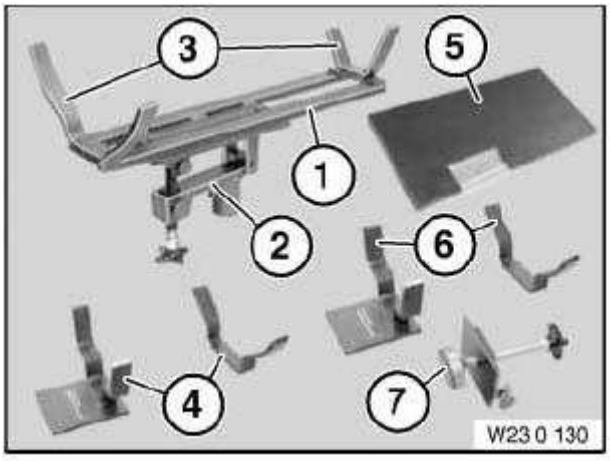


Fig. 12: Take-up Support For Transmission (23 0 130)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 139 Take-up support

Note: Transmission: GS7S47BG in E60/S85 (M5)

In conjunction with: 23 0 131 / 132 / 133

23 0 140 SUPPORT

In conjunction with: 00 2 030

Note: For accommodating transmission during removal and installation. Transmission: F-transmission

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Transmission: S5D 320Z, S5D 390Z

SI number: 1 20 98(378)

Order number: 23 0 140

Support

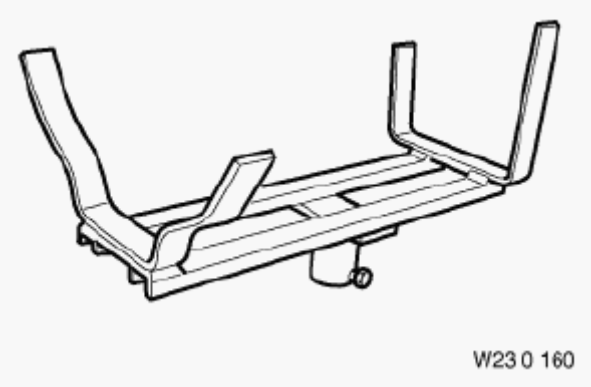


Fig. 13: Support (23 0 140)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 150 SUPPORT

In conjunction with: 00 1 450

Note: For accommodating transmission on assembly stand. For ZF transmission.

Transmission: ZF S5-16

Order number: 23 0 150

Support

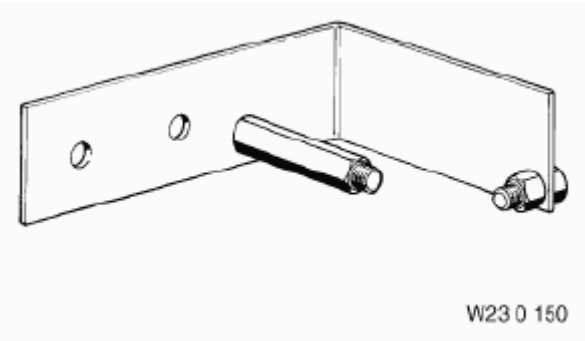


Fig. 14: Support (23 0 150)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 160 SUPPORT

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In conjunction with: 00 1 450

Note: For Getrag transmission

Transmission: 262/4

Order number: 23 0 160

Support

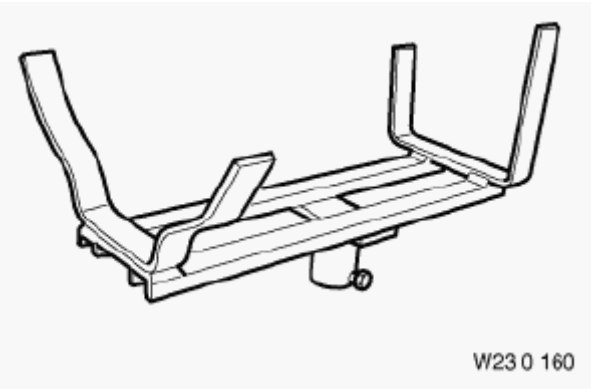


Fig. 15: Support (23 0 140)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 170 SUPPORT

In conjunction with: 00 1 450

Note: For mounting F-transmission on assembly stand

Transmission: S5D 390Z

SI number: 1 14 99(482)

Order number: 23 0 170

Support

Consisting of:

1 = 23 0 171 Basic body

2 = 23 0 172 Spindle (2)

Note: With handle

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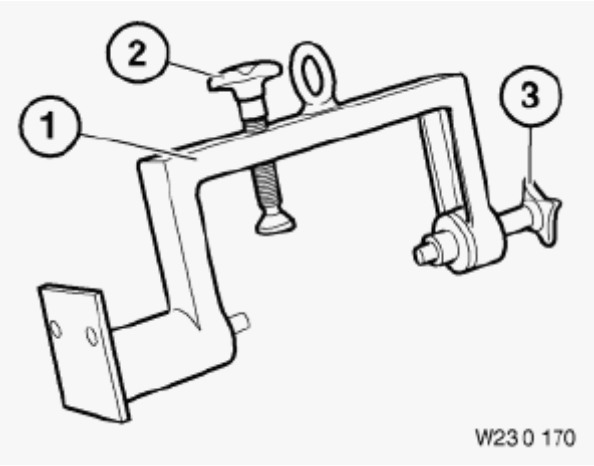


Fig. 16: Support (23 0 170)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 180 IMPACT RING WITH SLIP SLEEVE

Minimum set: Mechanical tools

In conjunction with: 23 2 491

Note: For driving in radial shaft seal on drive side - F transmission

Transmission: S5D 390Z

SI number: 1 14 99(482)

Order number: 23 0 180

Impact ring with slip sleeve

Consisting of:

1 = 23 0 181 Impact ring

2 = 23 0 182 Slip sleeve

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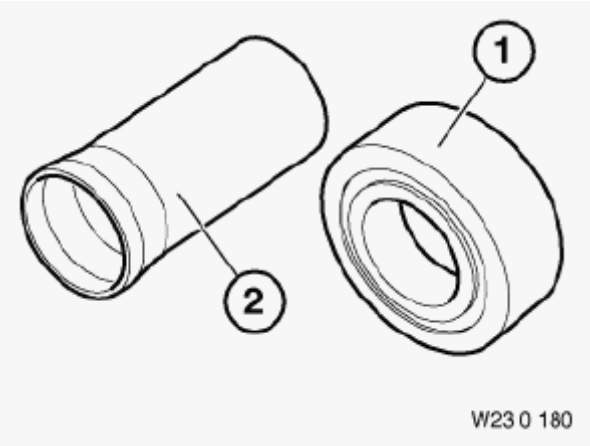


Fig. 17: Impact Ring With Slip Sleeve (23 0 180)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 190 IMPACT BUSH

Minimum set: Mechanical tools

Note: For driving in radial shaft seal on output side - F transmission

Transmission: S5D 280Z, S5D 320Z, S5D 390Z

Storage location: B39

SI number: 1 14 99(482)

Order number: 23 0 190

Impact bush

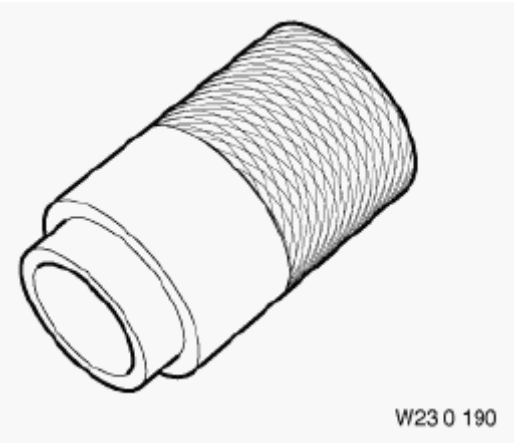


Fig. 18: Impact Bush (23 0 190)
Courtesy of BMW OF NORTH AMERICA, INC.

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23 0 200 SOCKET 41 A/F

Minimum set: Mechanical tools

Note: Long version for releasing and tightening down output flange - F-transmission

Transmission: S5D 390Z

SI number: 1 14 99(482)

Order number: 23 0 200

Socket 41 A/F

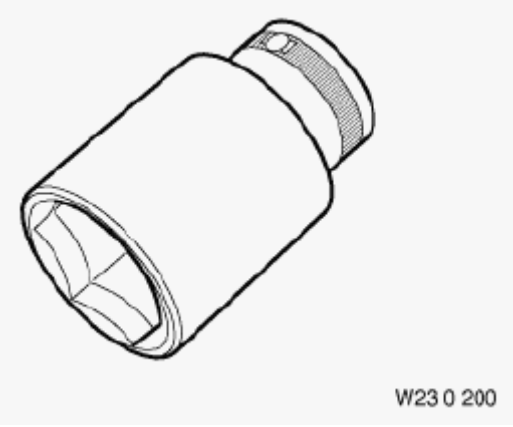


Fig. 19: Socket 41 A/F (23 0 200)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 250 HOLDER

Minimum set: Mechanical tools

Note: Assistance in releasing and tightening down output flange

Transmission: GS5-39DZ, S5D 280Z, S5D 320Z

Storage location: B41

SI number: 1 06 00(575)

Order number: 23 0 250

Holder

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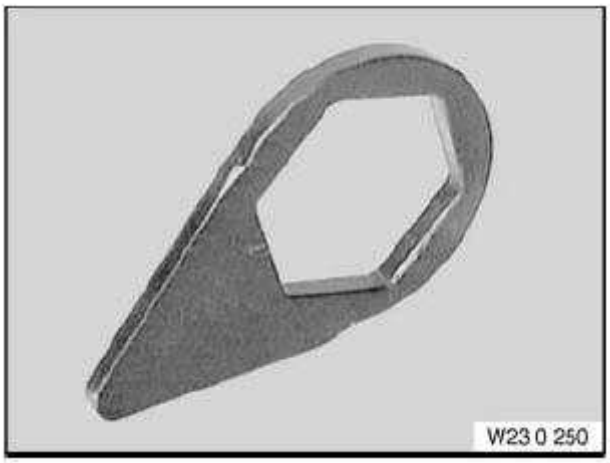


Fig. 20: Holder (23 0 250)
Courtesy of BMW OF NORTH AMERICA, INC.

23 0 370 DRIFT

Minimum set: Mechanical tools

Note: For driving in shaft seal on differential on left and right (output shaft).

Transmission: GS6-53BG, GS6-55BG

SI number: 01 23 06 (308)

Order number: 23 0 370

Drift



Fig. 21: Drift (23 0 370)
Courtesy of BMW OF NORTH AMERICA, INC.

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23 0 490 EXTRACTOR

Note: For removing shaft seal

Series: E34, E34tou, E36, E36/2, E36/3, E36/5, E36/7, E36/C, E36tou, E39, E39PL, E39tou, E46, E46/16, E46/2, E46/3, E46/5, E46/C, E53, E60, E61, E63, E64, E70, E83, E85, E87, E90, E91, E92, R50, R52

Transmission: GS5-39DZ, GS5-65BH, GS6-17BG, GS7S47BG, S5D 200G, S5D 250G, S5D 260Z, S5D 280Z, S5D 310Z, S5D 320Z, S5D 390Z, S6S 420G, S6S 560G

Storage location: B6, C6

SI number: 1 15 96 (106)

Order number: 23 0 490

Extractor

Consisting of:

1 = 23 0 491 Rod

Note: With self-tapping screw

2 = 23 0 492 Impact weight

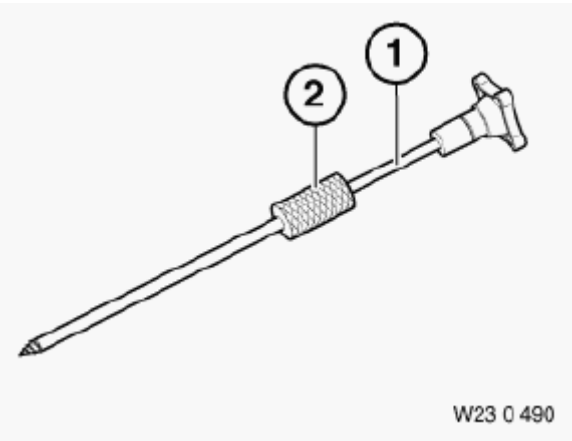


Fig. 22: Extractor (23 0 490)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 000 FIXTURE

Note: For pressing-on transmission casing and deep groove ball bearing on transmission input shaft and in transmission casing

Transmission: 240/5, 242/4, 245/5, 245/5Sport, 260/5, 262/4, 265/5, 265/5Sport, 280/5Sport, 3 HP 12, 3 HP 20,

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3 HP 22, 4 HP 22, 4 HP 24, A4S 270R, A4S 310R, A5S 300J, A5S 310Z, A5S 440Z, A5S 560Z, BW 65, S5D 260Z

Storage location: C15, C16

Order number: 23 1 000

Fixture

Consisting of:

1 = 23 1 001 Sleeve

2 = 23 1 002 Dowel pin (2 x)

3 = 23 1 003 Thrust piece, long

4 = 23 1 004 Thrust piece, short

5 = 23 1 005 Handle

7 = 23 1 007 Thrust piece for Getrag transmissions

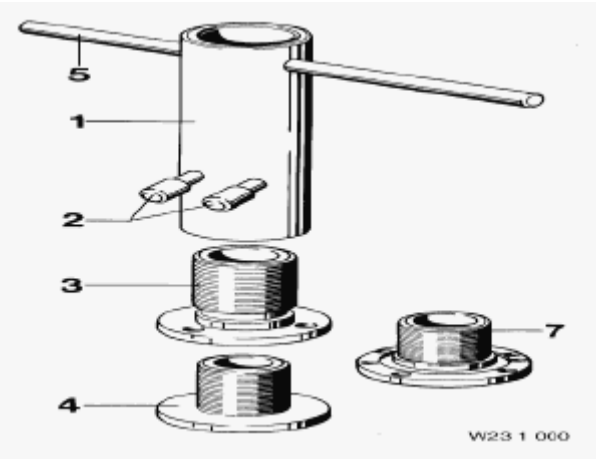


Fig. 23: Fixture (23 1 000)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 010 FITURE FOR REMOVING REAR SECTION OF TRANSMISSION CASING

Transmission: 280/5 Sport

Order number: 23 1 010

Fixture for removing rear section of transmission casing

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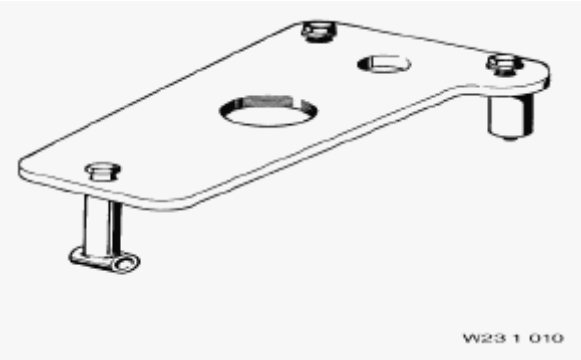


Fig. 24: Fiture For Removing Rear Section Of Transmission Casing (23 1 010)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 020 FIXTURE FOR REMOVING TRANSMISSION CASING (FRONT AND REAR SECTION)

In conjunction with: 33 1 301

Transmission: 245/5 Sport

Storage location: C32

Order number: 23 1 020

Fixture for removing transmission casing (front and rear section)



Fig. 25: Fixture For Removing Transmission Casing (23 1 020)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 030 DRIFT FOR FITTING INNER BEARING RACE ON COUNTERSHAFT

Transmission: 245/5, 265/5

Storage location: C22

Order number: 23 1 030

Drift for fitting inner bearing race on countershaft

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Fig. 26: Drift For Fitting Inner Bearing Race On Countershaft (23 1 030)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 040 DRIFT

Note: For mounting sliding section (5th gear) and driving water pipe out of crankcase Engine: N73

Transmission: 245/5Sport, S5D 200G, S5D 250G

Storage location: C23

Order number: 23 1 040

Drift



Fig. 27: Drift (23 1 040)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 050 PULLER (KUKKO)

Note: For 5th gear as well as reverse gear wheel

Transmission: 240/5, 245/5, 260/5, 265/5Sport, 280/5Sport, S5D 260Z, S5D 310Z, S5D 320Z, ZF S5 -16

Order number: 23 1 050

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Puller (Kukko)

Consisting of:

1 = 23 1 051 Claw

23 1 060 FIXTURE

In conjunction with: 33 1 301

Note: For removing inner bearing race - reverse gear wheel

Transmission: 245/5, 265/5 Sport

Storage location: B20

Order number: 23 1 060

Fixture

Consisting of:

1 = 23 1 061 Shells (2)

2 = 23 1 062 Threaded ring

3 = 23 1 063 Holding sleeve

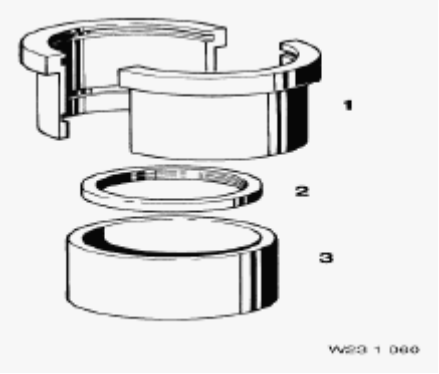


Fig. 28: Fixture (23 1 060)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 070 MEASURING RING

Note: For determining shim ring between outer bearing race and circlip of countershaft

Transmission: 245/5

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Storage location: B28

Order number: 23 1 070

Measuring ring



Fig. 29: Measuring Ring (23 1 070)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 080 DRIFT

In conjunction with: 00 5 500

Note: For removing and installing outer bearing race in front section of transmission casing/centre section of countershaft and of ball bearing in rear section of transmission casing, input shaft

Transmission: 245/5, 265/5

Storage location: A28

Order number: 23 1 080

Drift

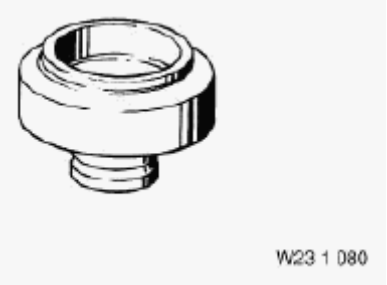


Fig. 30: Fixture (23 1 060)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 090 DRIFT

In conjunction with: 00 5 500

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Note: For removing and installing outer bearing race of input shaft in front section of transmission casing

Transmission: 245/5, 265/5, GS5-65BH

Storage location: A28

Order number: 23 1 090

Drift

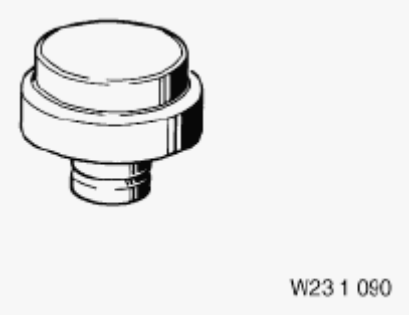


Fig. 31: Drift (23 1 090)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 100 PULLER CLAWS

In conjunction with: 00 7 500

Note: For speedometer gear

Transmission: 245/5, 265/5, 280/5Sport

Storage location: B29

Order number: 23 1 100

Puller claws

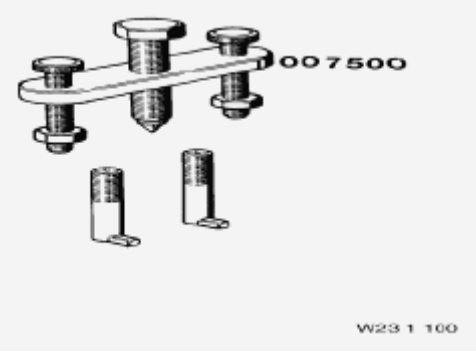


Fig. 32: Puller Claws (23 1 100)

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Courtesy of BMW OF NORTH AMERICA, INC.

23 1 110 DRIFT

In conjunction with: 00 5 500

Note: For installing bearing of output shaft in rear section of transmission casing

Transmission: 245/5

Storage location: A28

Order number: 23 1 110

Drift

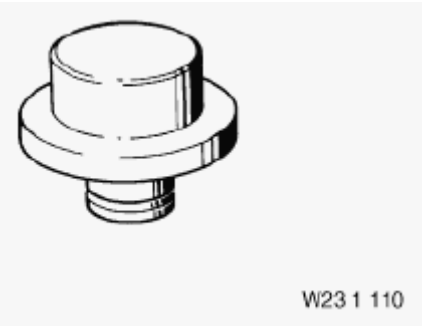


Fig. 33: Drift (23 1 110)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 120 DRIFT

In conjunction with: 00 5 500

Note: For removing outer bearing race of countershaft in centre section of transmission casing

Transmission: 240/5, 245/5, 260/5, 280/5Sport, ZF S5-16

Storage location: A29

Order number: 23 1 120

Drift

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Fig. 34: Drift (23 1 120)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 130 DRIFT

Note: For removing bearing of input shaft and roller bearing in centre section of transmission casing

Transmission: 245/5, 280/5Sport

Storage location: A29

Order number: 23 1 130

Drift

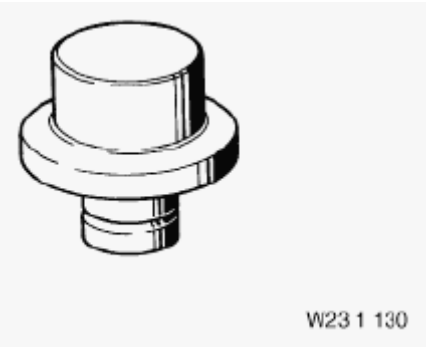


Fig. 35: Drift (23 1 130)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 170 FIXTURE

Note: For removing front section of transmission casing

Transmission: 265/5

Order number: 23 1 170

Fixture

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Consisting of:

1 = 23 1 171 Plate

2 = 23 1 172 Knurled screw (3)

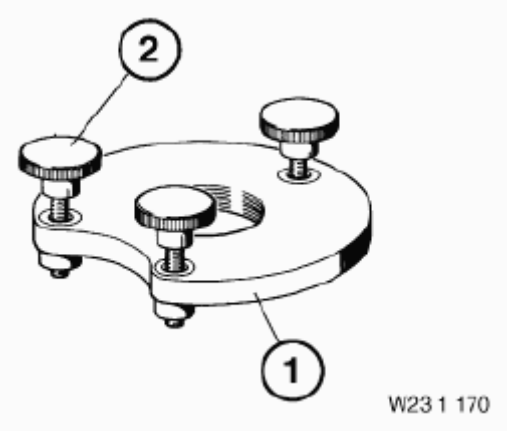


Fig. 36: Fixture (23 1 170)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 180 DRIFT

In conjunction with: 00 0 500

Note: For fitting rotary shaft seal in guide tube of clutch release mechanism

Transmission: 260/5, 265/5, 265/5Sport, 280/5Sport

Storage location: A29

Order number: 23 1 180

Drift

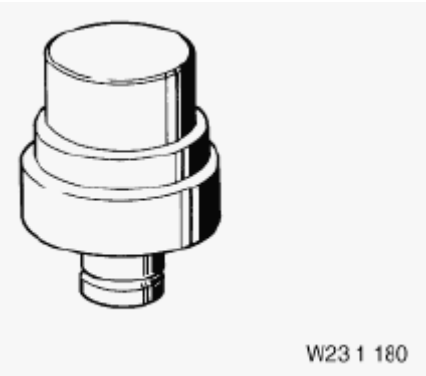


Fig. 37: Drift (23 1 180)

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Courtesy of BMW OF NORTH AMERICA, INC.

23 1 190 DRIFT

In conjunction with: 00 5 500

Note: For removing and installing ball bearing of input shaft in front section of transmission casing

Transmission: 265/5, 280/5 Sport

Order number: 23 1 190

Drift

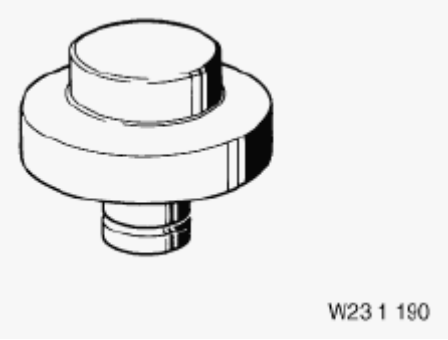


Fig. 38: Drift (23 1 190)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 200 GUIDE BUSH

In conjunction with: 23 1 210

Note: For centering wrench socket when releasing and tightening transmission output flange and input flange of rear axle differential

Transmission: 265/5

Storage location: B30

Order number: 23 1 200

Guide bush

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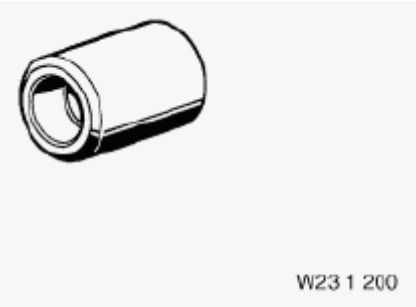


Fig. 39: Guide Bush (23 1 200)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 220 DRIFT

In conjunction with: 00 5 500

Note: For removing and installing roller bearing of countershaft shaft in front section of transmission casing

Transmission: 260/5, 265/5, A5S 310Z

Storage location: A29

Order number: 23 1 220

Drift

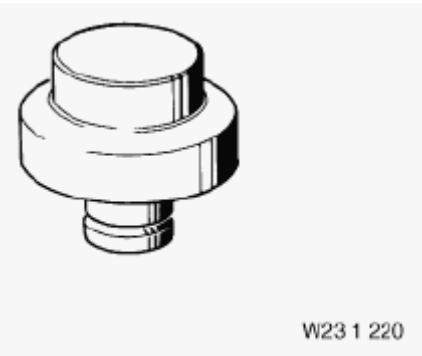


Fig. 40: Drift (23 1 220)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 230 SPINDLE (2)

In conjunction with: 00 7 500

Note: For removing inner bearing race from input shaft in front section of transmission casing

Transmission: 265/5

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Order number: 23 1 230

Spindle (2)

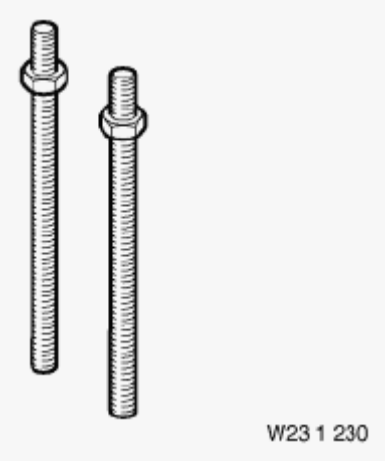


Fig. 41: Spindle (23 1 230)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 240 DRIFT

Minimum set: Mechanical tools

Note: For fitting rotary shaft seal on gearshift shaft

Transmission: 240/5, 242/4, 245/5, 245/5Sport, 260/5, 262/4, 265/5, 265/5Sport, 280/5Sport, 3 HP 12, 3 HP 20, 3 HP 22, 4 HP 22, 4 HP 24, A4S 270R, A4S 310R, A5S 300J, A5S 310Z, A5S 440Z, A5S 560Z, BW 65, S5D 200G, S5D 250G, S6S 420G, ZF S5-16

Storage location: A20

Order number: 23 1 240

Drift



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Fig. 42: Drift (23 1 240)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 270 DRIFT

In conjunction with: 00 5 500

Note: For removing outer bearing race on countershaft in front section of transmission casing as well as for removing seal and needle bearing from oil pump housing (A5S 560Z)

Transmission: 240/5, 260/5, A5S 560Z

Storage location: A29

Order number: 23 1 270

Drift



Fig. 43: Drift (23 1 270)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 300 FIXTURE

Minimum set: Mechanical tools

In conjunction with: 23 2 150

Note: For fitting output flange on all manual and automatic transmissions, for installing deep groove ball bearing on transmission output shafts and for fitting input flange on all rear axle differentials

Series: E36, E36/2, E36/3, E36/5, E36/7, E36/C, E38, E39, E46, E52, E53, E60, E61, E63, E64, E65, E66, E67, E83, E85, E86, E87, E90, E91, E92

Transmission: HAG 188kom, HAG 220kom, HAG 225kom, HAG Type G, HAG Type K, HAG Type M, S5D 200G, S5D 250G

Storage location: B15, B16

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Order number: 23 1 300

Fixture

Consisting of:

1 = 23 1 301 Adapter

2 = 23 1 302 Support disk

Note: For pressing drive flange onto rear differential

In conjunction with: 33 1 341, 23 1 300

3 = 23 1 303 Mandrel

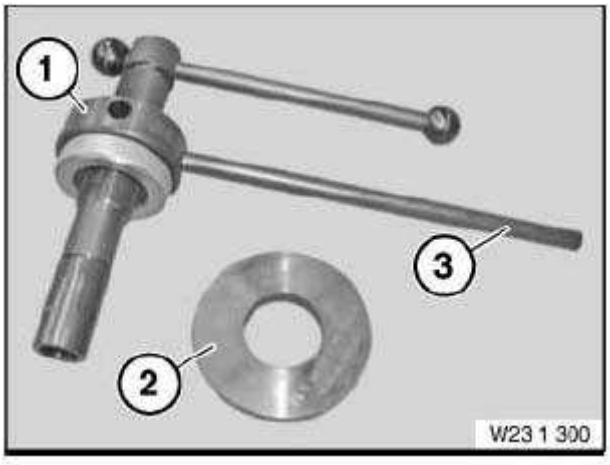


Fig. 44: Fixture (23 1 300)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 310 TOOL

Note: For fitting locking device on deflection lever

Transmission: 280/5 Sport

Order number: 23 1 310

Tool

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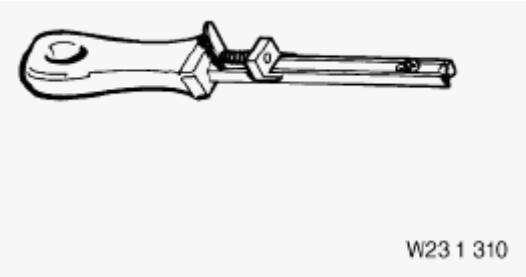


Fig. 45: Tool (23 1 310)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 350 PULLER FIXTURE

In conjunction with: 33 1 301

Note: For rear section of transmission casing

Transmission: 265/5

Order number: 23 1 350

Puller fixture

Consisting of:

1 = 23 1 351 Plate

2 = 23 1 352 Screw, short (2)

3 = 23 1 353 Screw, long (2)

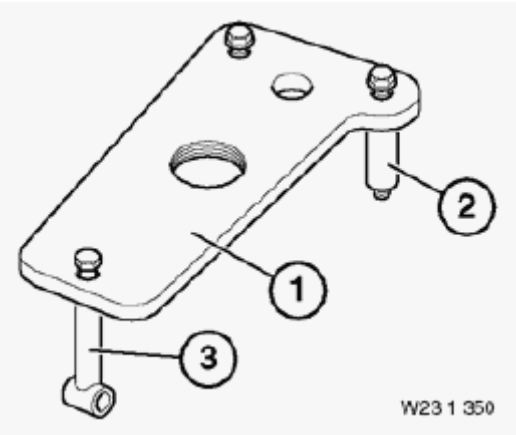


Fig. 46: Puller Fixture (23 1 350)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 360 DRIFT

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In conjunction with: 00 5 500

Note: For fitting rotary shaft seal on transmission input shaft

Transmission: 240/5, 245/5, 262/4, ZF S5-16

Storage location: A35

Order number: 23 1 360

Drift

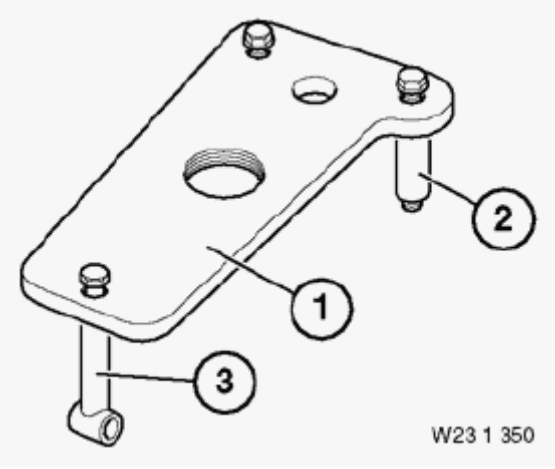


Fig. 47: Drift (23 1 360)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 370 DRIFT

Note: For fitting rotary shaft seals on transmission output flanges

Transmission: 242/4, 262/4, 265/5, 265/5Sport

Storage location: B28

Order number: 23 1 370

Drift

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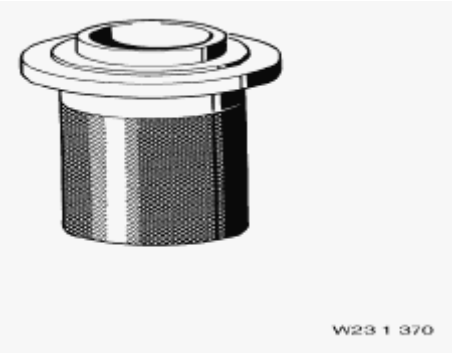


Fig. 48: Drift (23 1 370)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 380 DRIFT

In conjunction with: 00 0 500

Note: For installing roller bearing of countershaft shaft in rear section of transmission casing

Transmission: 240/5, 245/5, 260/5, 280/5Sport

Storage location: B30

Order number: 23 1 380

Drift

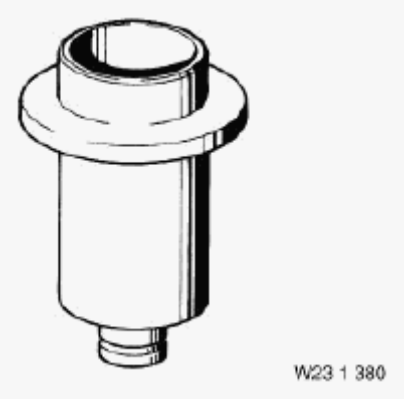


Fig. 49: Drift (23 1 380)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 390 DRIFT

In conjunction with: 00 5 500

Note: For installing roller bearing of countershaft shaft in rear section of transmission casing

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Transmission: 265/5, 280/5 Sport

Storage location: A29

Order number: 23 1 390

Drift

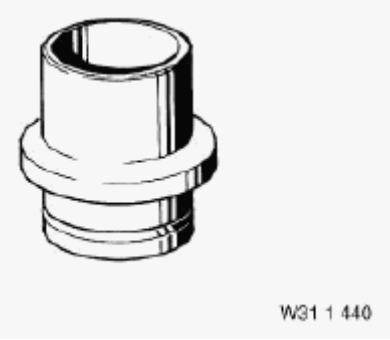


Fig. 50: Drift (23 1 390)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 400 FIXTURE

Note: For fitting rotary shaft seal in bush of speedometer pinion

Transmission: 242/4, 262/4

Order number: 23 1 400

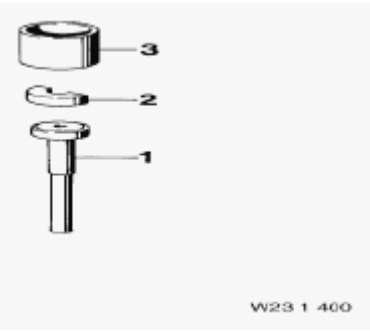
Fixture

Consisting of:

1 = 23 1 401 Fitting shaft

2 = 23 1 402 Radial plug

3 = 23 1 403 Union sleeve



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Fig. 51: Fixture (23 1 40)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 410 DRIFT

In conjunction with: 00 5 500

Note: For fitting ball bearing of output shaft in rear section of transmission casing and roller bearing of output shaft in centre section of transmission casing

Transmission: 260/5, 265/5

Storage location: A29

Order number: 23 1 410

Drift

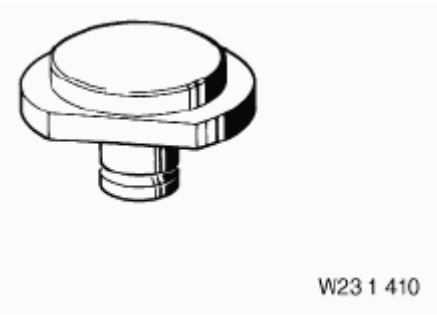


Fig. 52: Drift (23 1 410)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 420 FIXTURE

In conjunction with: 33 1 301

Note: For removing slide (5th gear)

Transmission: 265/5

Storage location: C31

Order number: 23 1 420

Fixture

Consisting of:

23 1 421 Clamping screw

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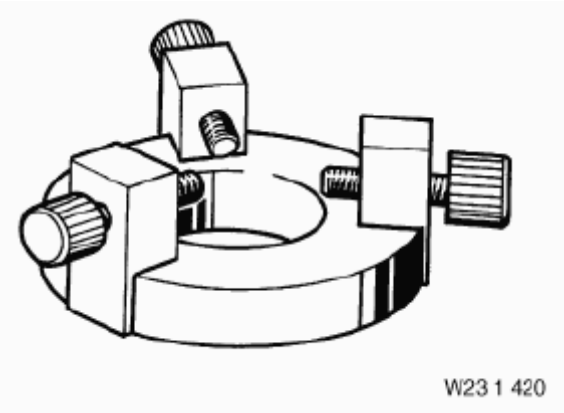


Fig. 53: Fixture (23 1 420)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 430 THRUST PIECE

Note: For fitting 5th gear wheel

Transmission: 265/5, 280/5 Sport

Storage location: A35

Order number: 23 1 430

Thrust piece

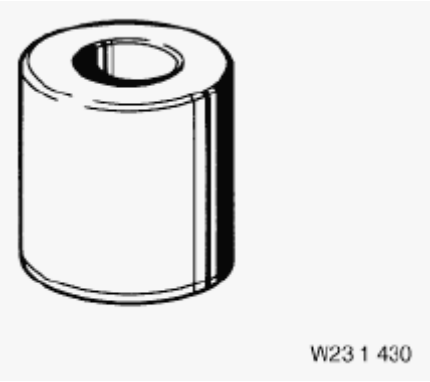


Fig. 54: Thrust Piece (23 1 430)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 440 HOLDING SLEEVE

Note: For fitting bearing bush and inner bearing race on output shaft as well as for removing bearing on output shaft (S5D 310Z)

Transmission: 265/5, 265/5Sport, 280/5Sport, S5D 310Z

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Storage location: C22, C23

Order number: 23 1 440

Holding sleeve

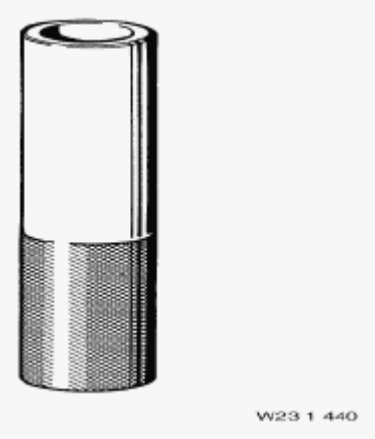


Fig. 55: Holding Sleeve (23 1 440)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 450 GUIDE PINS (2 X)

Note: For fitting bearing bush in locking device of guide sleeve

Transmission: 245/5, 265/5

Storage location: C3

Order number: 23 1 450

Guide pins (2 x)



Fig. 56: Guide Pins (2 X) (23 1 450)
Courtesy of BMW OF NORTH AMERICA, INC.

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23 1 460 PULLER PLATE

In conjunction with: 33 1 301

Note: For front section of transmission casing

Transmission: 260/5, 280/5Sport, ZF S5-16

Storage location: A27

Order number: 23 1 460

Puller plate

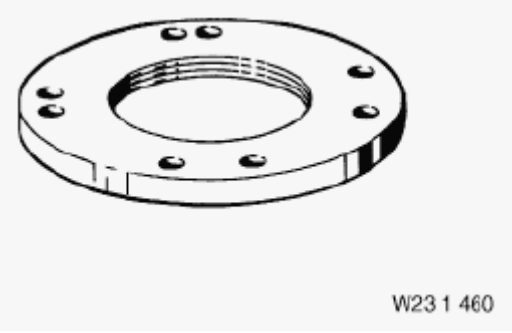


Fig. 57: Puller Plate (23 1 460)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 480 DRIFT

In conjunction with: 00 5 500

Note: For removing and installing deep groove ball bearing in front section of transmission casing

Transmission: 240/5, 242/4, 260/5, 280/5Sport

Storage location: A29

Order number: 23 1 480

Drift

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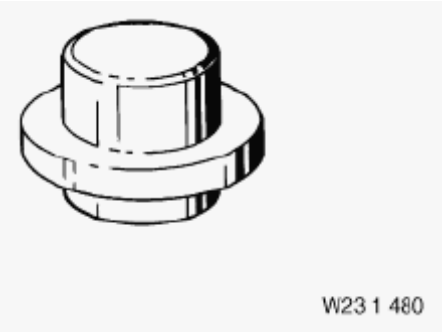


Fig. 58: Drift (23 1 480)
Courtesy of BMW OF NORTH AMERICA, INC.

23 1 490 FIXTURE

Note: For removing gear wheels

Transmission: 240/5, 260/5, 280/5Sport, S5D 200G, ZF S5-16

Order number: 23 1 490

Fixture

Consisting of:

23 1 491 Spacer

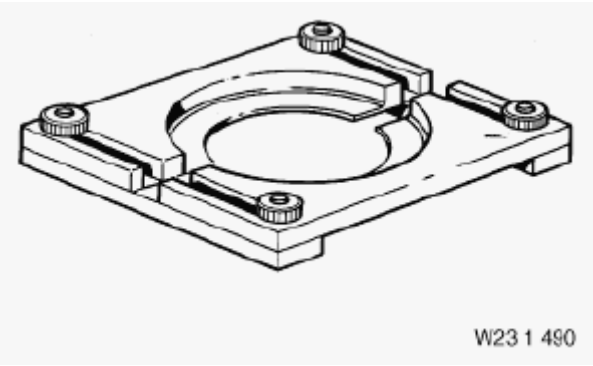


Fig. 59: Fixture (23 1 490)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 000 RILLEX BALL BEARING EXTRACTOR 6206

Note: 9 balls with steel cage - for removing deep groove ball bearing of transmission input shaft

Order number: 23 2 000

Rillex ball bearing extractor 6206

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Consisting of:

1 = 23 2 001 Claw for Rillex 6206 (9 x)

2 = 23 2 002 Union sleeve

3 = 23 2 003 Pressure spindle

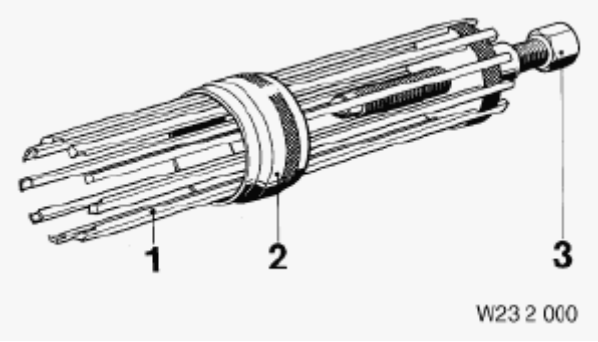


Fig. 60: Rillex Ball Bearing Extractor 6206 (23 2 000)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 010 RELLEX BALL BEARING EXTRACTOR 6206 E

Note: 8 balls with plastic cage - for removing deep groove ball bearing of transmission input shaft

Transmission: 242/4, 245/5Sport, 265/5

Order number: 23 2 010

Rillex ball bearing extractor 6206 E

Consisting of:

1 = 23 2 011 Claw for Rillex 6206 E (8)

2 = 23 2 012 Union sleeve

3 = 23 2 013 Pressure spindle

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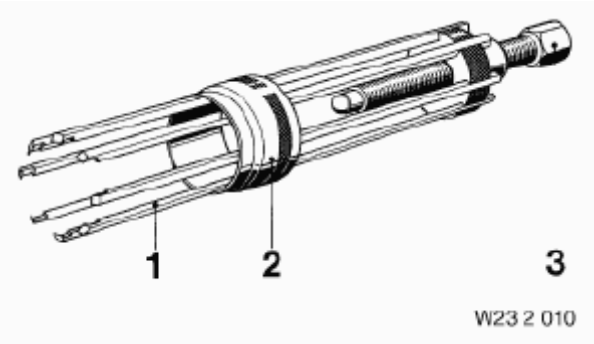


Fig. 61: Rellex Ball Bearing Extractor 6206 E (23 2 010)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 020 RILLEX BALL BEARING EXTRACTOR

Note: 7 balls - for removing deep groove ball bearing of transmission input shaft

Transmission: 245/5 Sport, 265/5 Sport

Order number: 23 2 020

Rillex ball bearing extractor

Consisting of:

1 = 23 2 021 Claw for Rillex (7)

2 = 23 2 022 Union sleeve

3 = 23 2 023 Pressure spindle

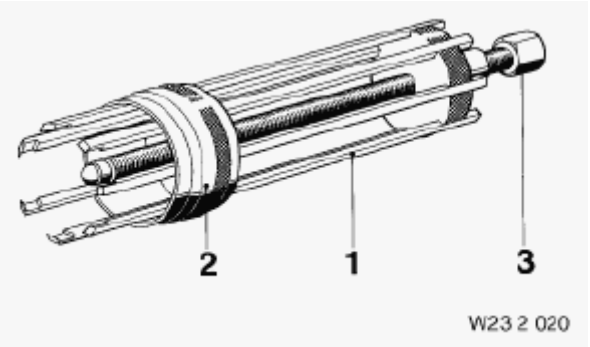


Fig. 62: Rillex Ball Bearing Extractor (23 2 020)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 050 RILLEX BALL BEARING EXTRACTOR 6205

Note: For removing deep groove ball bearing of transmission countershaft and transmission output shaft

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Transmission: 245/5 Sport, 262/4, 265/5 Sport

Order number: 23 2 050

Rillex ball bearing extractor 6205

Consisting of:

1 = 23 2 051 Claw for Rillex 6305 (8)

2 = 23 2 052 Union sleeve

3 = 23 2 053 Pressure spindle

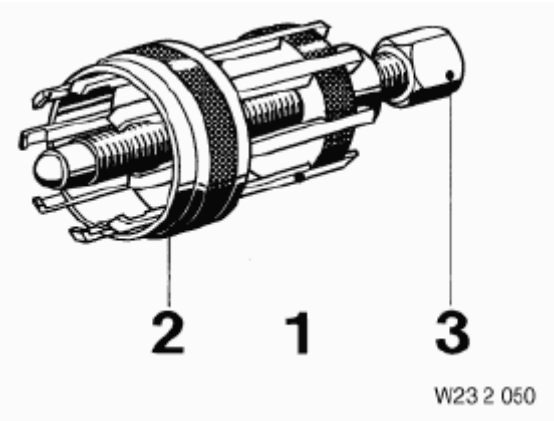


Fig. 63: Rillex Ball Bearing Extractor 6205 (23 2 050)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 060 RILLEX BALL BEARING EXTRACTOR 6306

Note: For removing deep groove ball bearing of input and output shaft

Transmission: 242/4, 262/4

Order number: 23 2 060

Rillex ball bearing extractor 6306

Consisting of:

1 = 23 2 061 Claw for Rillex 6306 (8)

2 = 23 2 062 Union sleeve

3 = 23 2 063 Pressure spindle

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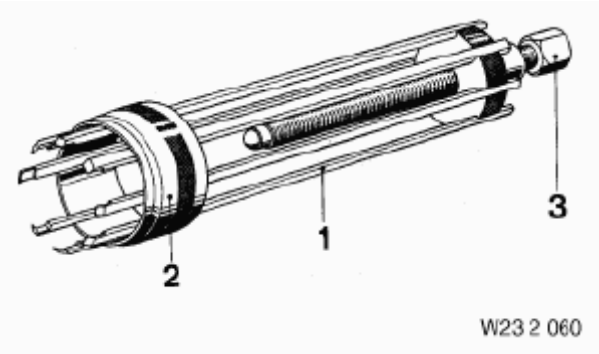


Fig. 64: Rillex Ball Bearing Extractor 6306 (23 2 060)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 080 ADAPTER

Note: For removing guide sleeve - 2nd/3rd gear

Transmission: 260/5

Storage location: C21

Order number: 23 2 080

Adapter

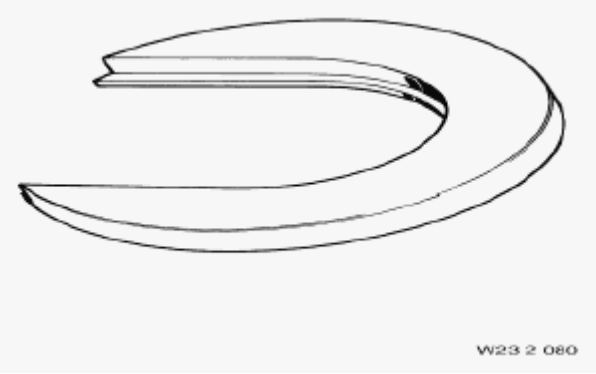


Fig. 65: Adapter (23 2 080)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 100 PLIERS

Note: For removing and installing circlip on transmission output shaft

Transmission: 240/5, 242/4, 245/5, 245/5Sport, 260/5, 262/4, 265/5, 265/5Sport, 280/5Sport, 3 HP 12, 3 HP 20, 3 HP 22, 4 HP 22, 4 HP 24, A4S 270R, A4S 310R, A5S 300J, A5S 310Z, A5S 440Z, A5S 560Z, BW 65, S5D 200G, S5D 250G, S5D 260Z, S5D 310Z, S6S 420G, S6S 560G, ZF S5-16

Order number: 23 2 100

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Pliers

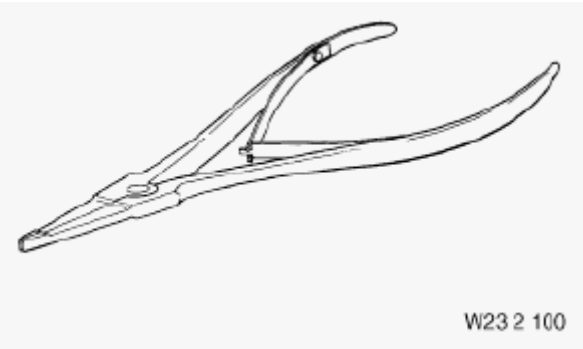


Fig. 66: Pliers (23 2 100)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 150 PRESSURE SLEEVE

In conjunction with: 23 1 300

Note: For fitting deep groove ball bearing of transmission output shaft (260/5, 245/5), for fitting front tapered roller bearing on drive pinion in all rear axle differentials as well as for mounting cover of countershaft (S5D 310Z)

Transmission: 245/5Sport, 260/5, S5D 260Z, S5D 310Z, S5D 320Z

Storage location: B29

Order number: 23 2 150

Pressure sleeve

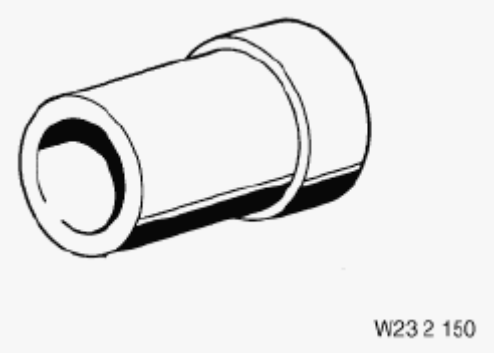


Fig. 67: Pressure Sleeve (23 2 150)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 160 IMPACT BUSH

Note: For rotary shaft seal in rear section of transmission housing - output shaft

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Transmission: 280/5Sport, ZF S5-16

Storage location: B28

Order number: 23 2 160

Impact bush



Fig. 68: Impact Bush (23 2 160)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 170 FIXTURE

Note: For tensioning transmission leaf spring

Transmission: ZF S5-16

Order number: 23 2 170

Fixture

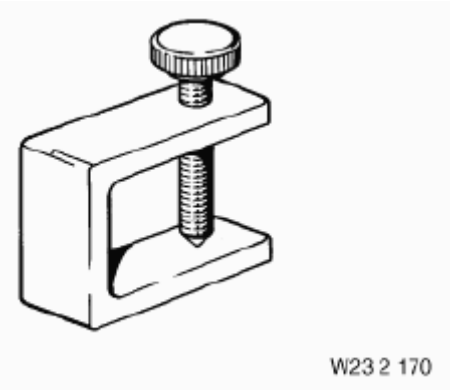


Fig. 69: Fixture (23 2 170)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 180 GUIDE BUSH

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Note: For mounting front section of transmission casing on selector shaft

Transmission: ZF S5-16

Order number: 23 2 180

Guide bush

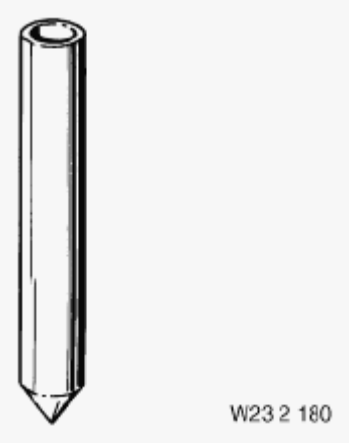


Fig. 70: Guide Bush (23 2 180)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 200 CIRCLIP PLIERS (STRAIGHT)

Note: For removing and installing external circlips on transmission shafts

Transmission: 240/5, 242/4, 245/5, 245/5Sport, 260/5, 262/4, 265/5, 265/5Sport, 280/5Sport, 3 HP 12, 3 HP 20, 3 HP 22, 4 HP 22, 4 HP 24, A4S 270R, A4S 310R, A5S 300J, A5S 310Z, A5S 440Z, A5S 560Z, BW 65, S5D 200G, S5D 250G, S5D 260Z, S5D 310Z, S6S 420G, S6S 560G, ZF S5-16

Order number: 23 2 200

Circlip pliers (straight)

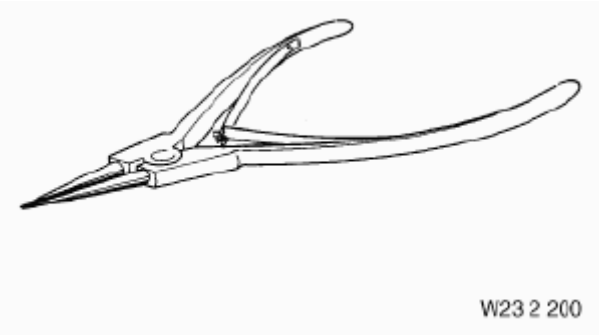


Fig. 71: Circlip Pliers (Straight) (23 2 200)
Courtesy of BMW OF NORTH AMERICA, INC.

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23 2 210 CIRCLIP PLIERS (STRAIGHT)

Note: For removing and installing internal circlips in transmission casings when replacing deep groove ball bearings

Transmission: 240/5, 242/4, 245/5, 245/5Sport, 260/5, 262/4, 265/5, 265/5Sport, 280/5Sport, 3 HP 12, 3 HP 20, 3 HP 22, 4 HP 22, 4 HP 24, A4S 270R, A4S 310R, A5S 300J, A5S 310Z, A5S 440Z, A5S 560Z, BW 65, S5D 200G, S5D 250G, S5D 260Z, S5D 310Z, S6S 420G, S6S 560G, ZF S5-16

Order number: 23 2 210

Circlip pliers (straight)

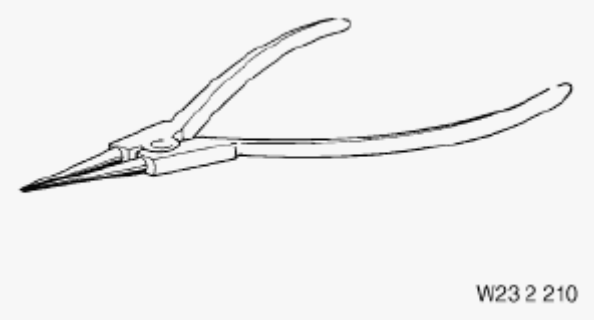


Fig. 72: Circlip Pliers (Straight) (23 2 210)
Courtesy of BMW OF NORTH AMERICA, INC.

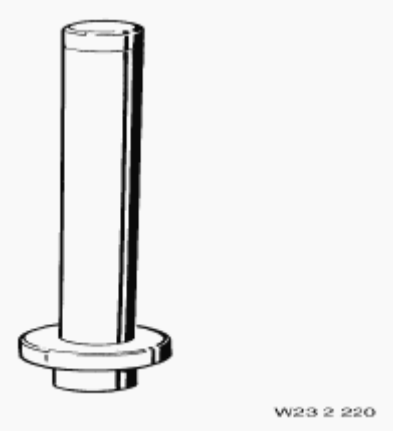
23 2 220 DRIFT

Note: For bearing of countershaft shaft in front and rear section of transmission casing

Transmission: ZF S5-16

Order number: 23 2 220

Drift



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Fig. 73: Drift (23 2 220)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 230 DISC

In conjunction with: 00 7 500

Note: For removing guide sleeve from gear wheel or output shaft with toothed lock washer

Transmission: 280/5 Sport

Order number: 23 2 230

Disc

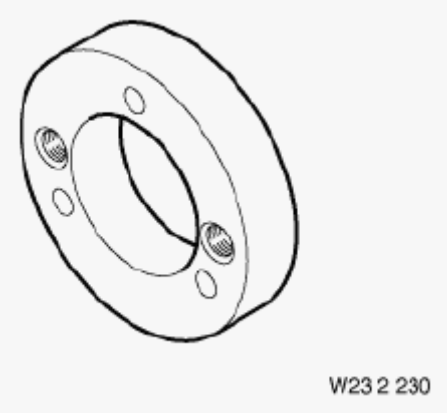


Fig. 74: Disc (23 2 230)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 250 BRACKET

Note: For tensioning main shaft to countershaft

Transmission: S5D 310Z

Storage location: C20, C24

SI number: 1 07 90(244)

Order number: 23 2 250

Bracket

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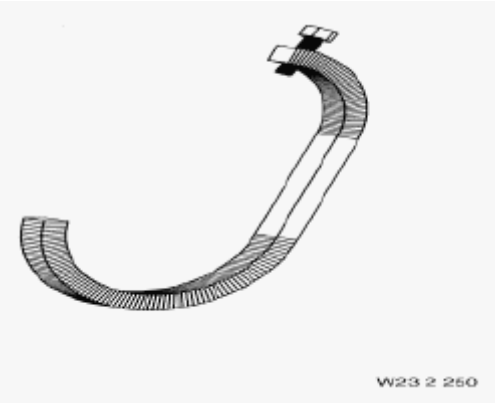


Fig. 75: Bracket (23 2 250)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 260 INSTALLATION DRIFT

Minimum set: Mechanical tools

Note: For fitting rotary shaft seal on selector shaft of rear section of transmission casing

Transmission: S5D 310Z

Storage location: A20

SI number: 1 07 90(244)

Order number: 23 2 260

Installation drift



Fig. 76: Installation Drift (23 2 260)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 270 FIXTURE

Note: For centering selector shaft while mounting front section of transmission casing

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Transmission: S5D 310Z

Storage location: C30

SI number: 1 07 90(244)

Order number: 23 2 270

Fixture

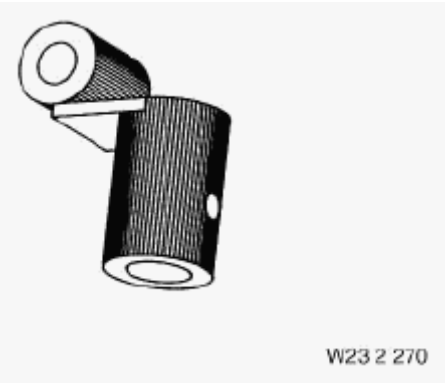


Fig. 77: Fixture (23 2 270)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 280 PULLER PLATE

In conjunction with: 33 1 301

Note: For front section of transmission casing

Transmission: S5D 310Z

Storage location: C31

SI number: 1 07 90(244)

Order number: 23 2 280

Puller plate

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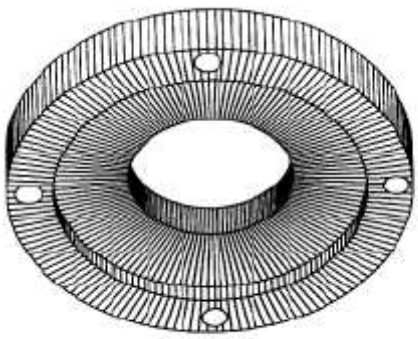


Fig. 78: Puller Plate (23 2 280)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 290 FIXTURE

Note: For mounting front section of transmission casing

Transmission: S5D 310Z

Storage location: C18

SI number: 1 07 90(244)

Order number: 23 2 290

Fixture

Consisting of:

1 = 23 2 291 Base frame

2 = 23 2 292 Support

3 = 23 2 293 Ring

4 = 23 2 294 Set of shells

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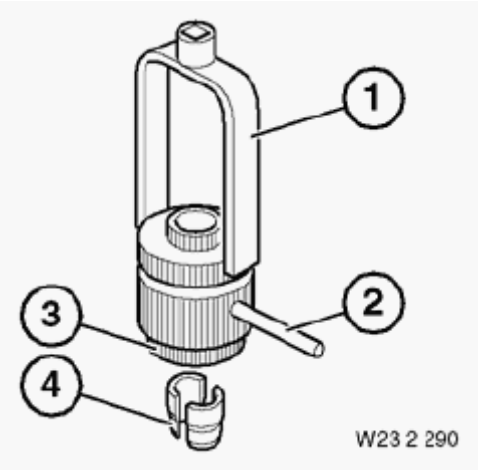


Fig. 79: Fixture (23 2 290)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 300 DRIFT

Minimum set: Mechanical tools

Note: For fitting rotary shaft seal of output shaft in rear section of transmission casing

Transmission: S5D 310Z

Storage location: B28

SI number: 1 07 90(244)

Order number: 23 2 300

Drift



Fig. 80: Drift (23 2 300)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 310 FIXTURE

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Note: For removing 3rd and 4th gear wheel from countershaft

Transmission: S5D 310Z

Storage location: C30

SI number: 1 07 90(244)

Order number: 23 2 310

Fixture

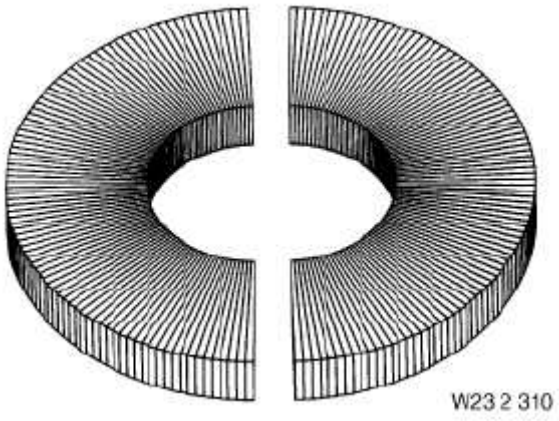


Fig. 81: Fixture (23 2 310)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 320 SOCKET FOR SOCKET WRENCH WAF 36

Minimum set: Mechanical tools

Note: For loosening and tightening flanged nut

Transmission: S5D 310Z, S6S 420G, S6S 560G

Storage location: B30

SI number: 1 07 90(244)

Order number: 23 2 320

Socket for socket wrench WAF 36

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Fig. 82: Socket For Socket Wrench WAF 36 (23 2 320)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 330 FIXTURE

Note: For installing complete gear train in rear section of transmission housing

Transmission: S5D 310Z

Storage location: C18

SI number: 1 07 90(244)

Order number: 23 2 330

Fixture



Fig. 83: Fixture (23 2 330)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 340 DRIFT

Minimum set: Mechanical tools

Note: For fitting rotary shaft seal in front section of transmission casing

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Transmission: S5D 310Z

Storage location: B29, C29

SI number: 1 07 90(244)

Order number: 23 2 340

Drift



Fig. 84: Drift (23 2 340)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 350 DRIFT

Note: For fitting sealing cover for notch pin of selector shaft

Transmission: S5D 310Z

Storage location: B14, C14

SI number: 1 07 90(244)

Order number: 23 2 350

Drift

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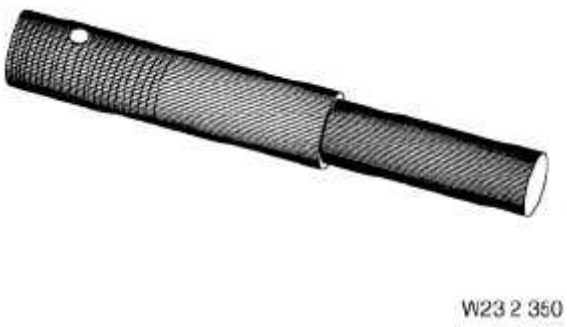


Fig. 85: Drift (23 2 350)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 360 DRIFT

Note: For fitting end cover for notch pin

Transmission: S5D 310Z

Storage location: B14, C14

SI number: 1 07 90(244)

Order number: 23 2 360

Drift



Fig. 86: Drift (23 2 360)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 370 FIXTURE

In conjunction with: 23 1 050

Note: For removing gear train

Transmission: S5D 310Z

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Storage location: C30

SI number: 1 02 91(330)

Order number: 23 2 370

Fixture

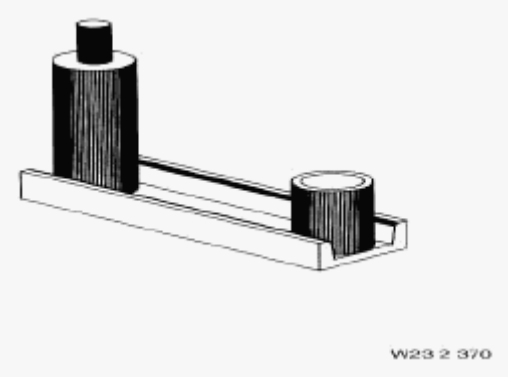


Fig. 87: Fixture (23 2 370)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 380 INSTALLATION SLEEVE

Note: For retaining ring on input shaft

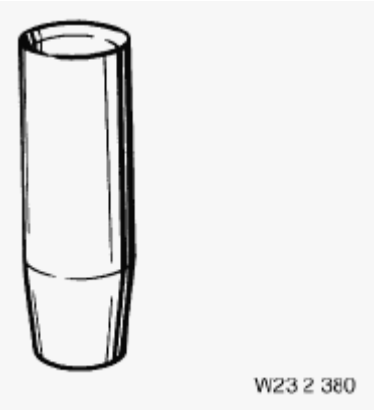
Transmission: S5D 310Z

Storage location: A5

SI number: 1 02 91(330)

Order number: 23 2 380

Installation sleeve



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Fig. 88: Installation Sleeve (23 2 380)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 460 INSTALLATION SLEEVE

Note: For retaining ring on input shaft

Transmission: S5D 200G, S5D 250G

Storage location: A6

SI number: 1 02 91(330)

Order number: 23 2 460

Installation sleeve

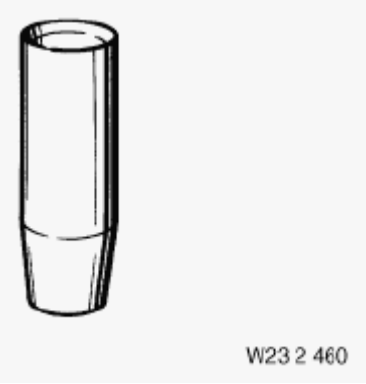


Fig. 89: Installation Sleeve (23 2 460)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 470 IMPACT BUSH

Note: For fitting tab washer of securing nut on output flange

Transmission: S6S 420G, S6S 560G

Storage location: A25

SI number: 1 10 93(689)

Order number: 23 2 470

Impact bush

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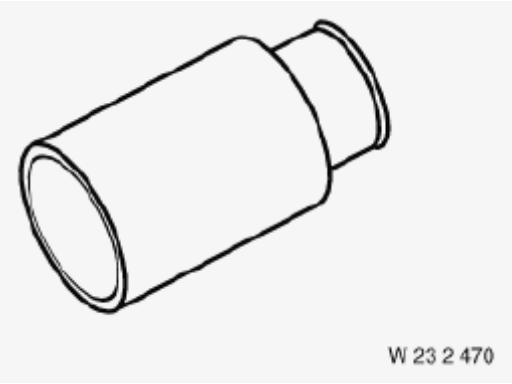


Fig. 90: Impact Bush (23 2 470)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 480 IMPACT BUSH

Note: For installing radial seal on output shaft

Transmission: S6S 420G, S6S 560G

Storage location: A19

SI number: 1 10 93(689)

Order number: 23 2 480

Impact bush

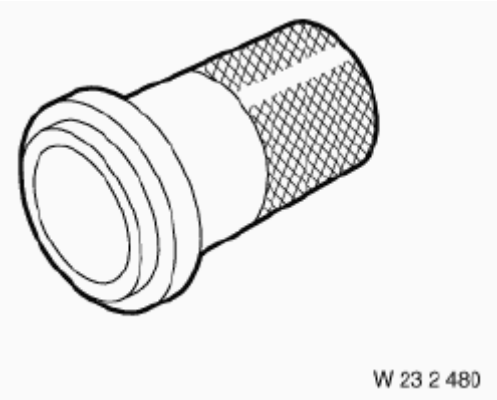


Fig. 91: Impact Bush (23 2 480)
Courtesy of BMW OF NORTH AMERICA, INC.

23 2 490 IMPACT BUSH AND SLIP SLEEVE

Minimum set: Mechanical tools

Note: For fitting rotary shaft seal on input shaft

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Transmission: GS5-65BH, S6S 420G, S6S 560G

Storage location: C29

SI number: 1 10 93(689)

Order number: 23 2 490

Impact bush and slip sleeve

Consisting of:

1 = 23 2 491 Impact bush

2 = 23 2 492 Slip sleeve (2-part)

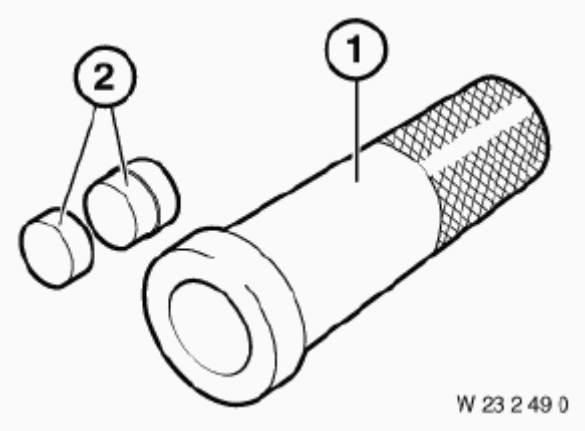


Fig. 92: Impact Bush And Slip Sleeve (23 2 490)
Courtesy of BMW OF NORTH AMERICA, INC.

23 3 010 FIXTURE

Note: For fitting output flange on output shaft

Transmission: S6S 420G, S6S 560G

Storage location: A26

SI number: 1 10 93(689)

Order number: 23 3 010

Fixture

Consisting of:

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1 = 23 3 011 Adapter spindle

2 = 23 3 012 Pressure sleeve

3 = 23 3 013 Pressure nut with bearing

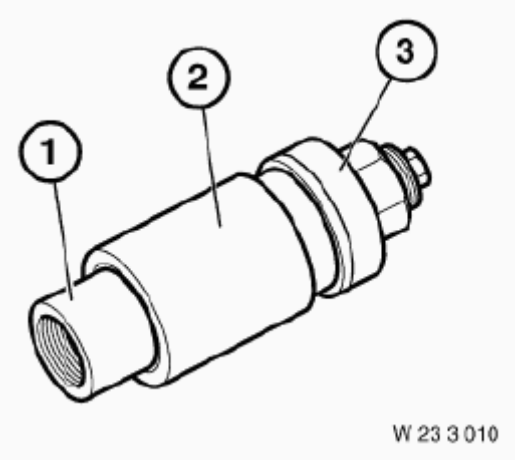


Fig. 93: Fixture (23 3 010)
Courtesy of BMW OF NORTH AMERICA, INC.

23 3 020 MOUNTING SLEEVE

Note: For installing gaiter of selector rod

Transmission: S6S 560G

Storage location: A14, B14

SI number: 1 10 93(689)

Order number: 23 3 020

Mounting sleeve

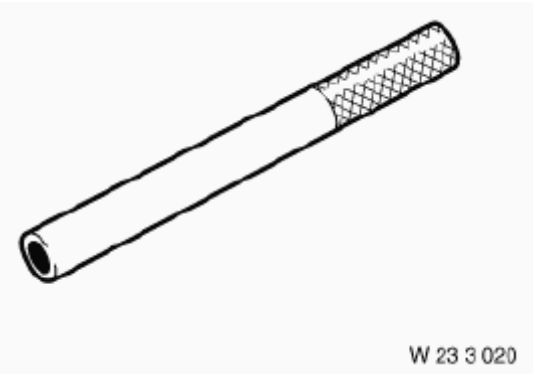


Fig. 94: Mounting Sleeve (23 3 020)

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Courtesy of BMW OF NORTH AMERICA, INC.

23 3 110 DRIFT

Note: For driving in guide bushings for catch pins on manual transmissions.

Transmission: GS5-39DZ, S5D 280Z, S5D 320Z, S5D 390Z

SI number: 1 12 02 (918)

Order number: 23 3 110

Drift

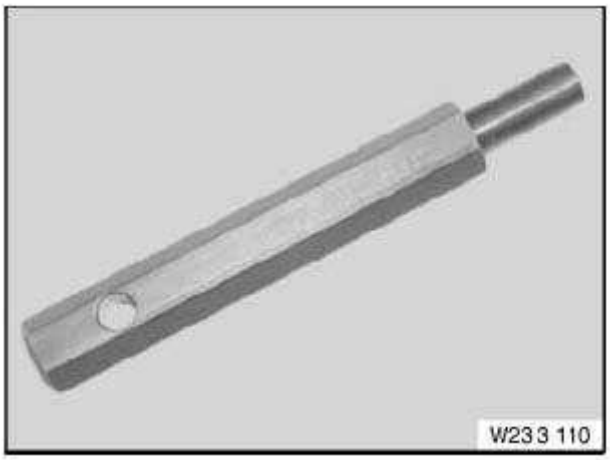


Fig. 95: Drift (23 3 110)
Courtesy of BMW OF NORTH AMERICA, INC.

23 3 160 SET OF TOOLS

Minimum set: Mechanical tools

Note: Removing and installing shaft seal on output shaft

Transmission: GS6-37BZ, GS6-51BZ

SI number: 01 10 02 (907)

Order number: 23 3 160

Set of tools

Consisting of:

1 = 23 3 161 Extractor

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2 = 23 3 162 Drift



Fig. 96: Set Of Tools (23 3 160)
Courtesy of BMW OF NORTH AMERICA, INC.

23 3 169 SET OF TOOLS

Minimum set: Mechanical tools

Note: Removing and installing shaft seals on output side

Transmission: GS6-37BZ

Order number: 23 3 169

Set of tools

23 3 200 EXTRACTOR

Minimum set: Mechanical tools

Note: For removing shaft seal on drive shaft

Transmission: GS6-53BZ, GS6-53DZ

Storage location: A49, A50

SI number: 1 11 04 (093)

Order number: 23 3 200

Extractor

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Fig. 97: Extractor (23 3 200)
Courtesy of BMW OF NORTH AMERICA, INC.

23 3 210 EXTRACTOR

Minimum set: Mechanical tools

Note: For removing shaft seal on output shaft

Transmission: GS6-53BZ, GS6-53DZ

Storage location: A50

SI number: 1 11 04 (093)

Order number: 23 3 210

Extractor



Fig. 98: Extractor (23 3 210)

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Courtesy of BMW OF NORTH AMERICA, INC.

23 3 220 DRIFT

Minimum set: Mechanical tools

Note: For driving in shaft seal on drive shaft (G - transmission)

Transmission: GS6-53BZ, GS6-53DZ

Storage location: A49

SI number: 1 11 04 (093)

Order number: 23 3 220

Drift



Fig. 99: Drift (23 3 220)
Courtesy of BMW OF NORTH AMERICA, INC.

23 3 230 DRIFT

Minimum set: Mechanical tools

Note: For driving in shaft seal on output shaft (G - transmission)

Transmission: GS6-53BZ, GS6-53DZ

Storage location: A49

SI number: 1 11 04 (093)

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Order number: 23 3 230

Drift



Fig. 100: Drift (23 3 230)
Courtesy of BMW OF NORTH AMERICA, INC.

23 4 000 DRIFT SET

Minimum set: Mechanical tools

In conjunction with: 00 5 500

Note: For driving shaft seal into transmission

Transmission: GS6-85BG

Storage location: A49, B84

SI number: 1 02 02(823)

Order number: 23 4 000

Drift set

Consisting of:

1 = 23 4 001 Drift dia. 67 mm

2 = 23 4 002 Drift dia. 53 mm

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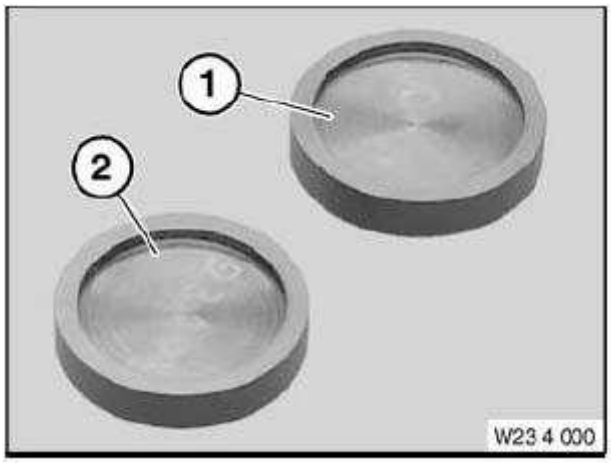


Fig. 101: Drift Set (23 4 000)
Courtesy of BMW OF NORTH AMERICA, INC.

23 4 010 REMOVAL TOOL

Minimum set: Mechanical tools

Note: For pressing connector out of transmission

Transmission: GS6-85BG

Storage location: B83

SI number: 1 02 02 (823)

Order number: 23 4 010

Removal tool

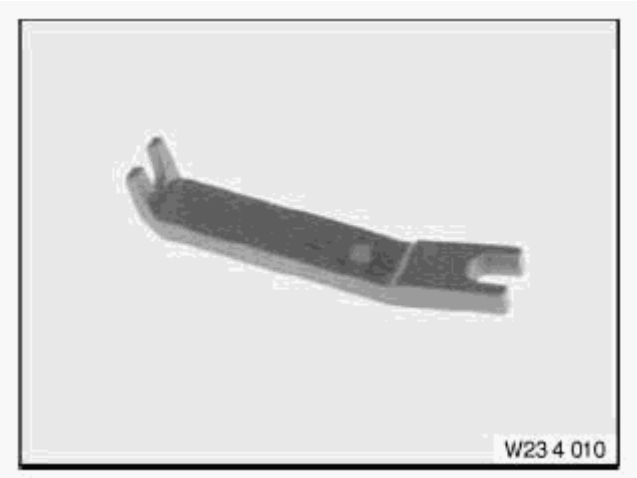


Fig. 102: Removal Tool (23 4 010)

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Courtesy of BMW OF NORTH AMERICA, INC.

23 4 030 FIXTURE

In conjunction with: 23 4 040 Grease gun

Note: For removing and installing guide bearing (pilot bearing) in transmission input shaft.

Transmission: GS6-53DZ

SI number: 01 05 06 (248)

Order number: 23 4 030

Fixture

Consisting of:

1 = 23 4 031 Bridge

2 = 23 4 032 M10x120 screws with nuts (2 x)

3 = 23 4 033 Grease cartridge

4 = 23 4 034 Brass adapter

5 = 23 4 035 Pressure spindle

6 = 23 4 036 Thrust member

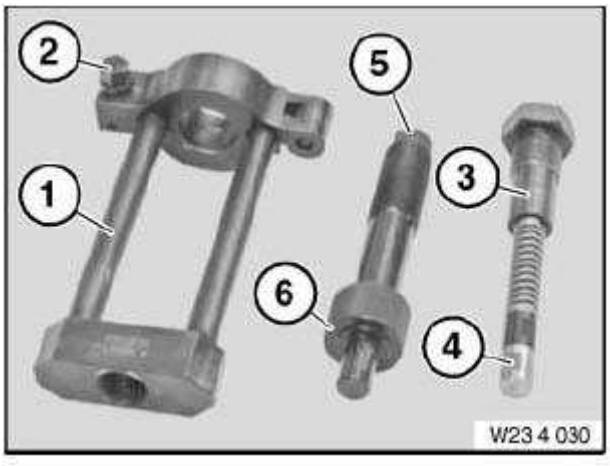


Fig. 103: Fixture (24 4 030)
Courtesy of BMW OF NORTH AMERICA, INC.

23 4 040 GREASE GUN

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In conjunction with: 23 4 030

Note: For actuating cartridge 23 4 033.

Transmission: GS6-53DZ

SI number: 01 05 06 (248)

Order number: 23 4 040

Grease gun

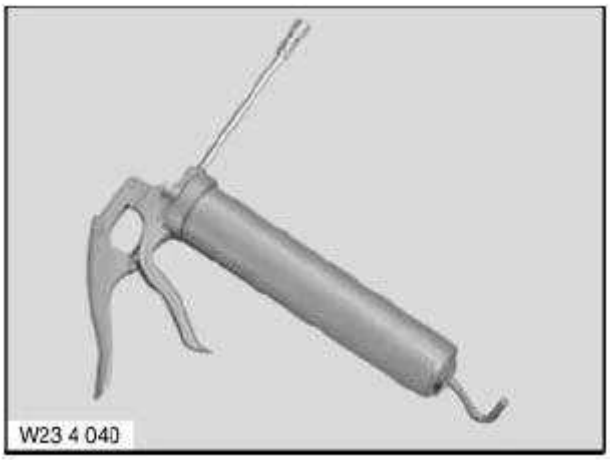


Fig. 104: Grease Gun (23 4 040)
Courtesy of BMW OF NORTH AMERICA, INC.

23 4 150 UNIVERSAL TRANSMISSION BRACKET

In conjunction with: 00 2 030

Note: Bracket for removing and installing manual and automatic transmissions.

Transmission: GA6F21WA, GS6-53BG, GS6-55BG

SI number: 01 23 06 (308)

Order number: 23 4 150

Universal transmission bracket

Consisting of:

1 = 23 4 151 Joint

2 = 23 4 152 Base frame

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3 = 23 4 153 Foam inserts (1 set = 4 pcs.)

4 = 23 4 154 Tensioning strap

5 = 23 4 155 Locator for foam material insert

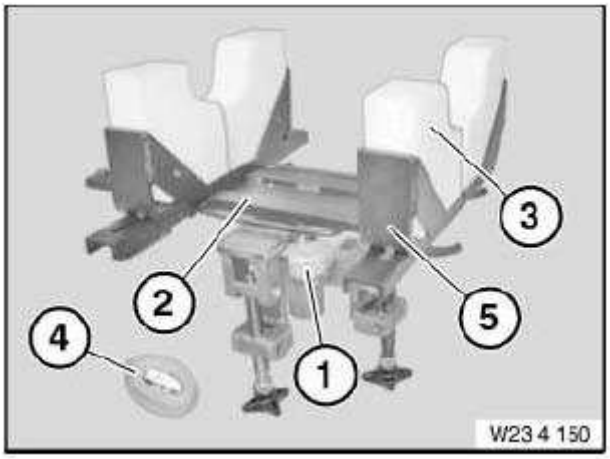


Fig. 105: Universal Transmission Bracket (23 4 150)
Courtesy of BMW OF NORTH AMERICA, INC.

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TRANSMISSION

Manual Transmission - Technical Data - X3

00 COMPLETE TRANSMISSION

23 00 TRANSMISSION IN GENERAL GS6-17BG

TECHNICAL DATA - TRANSMISSION GENERAL GS6-17BG

Oil grade refer to appropriate article.		
Oil fill quantity for oil change	Liters	1.3 + 0.1
Oil fill quantity for initial fill or replacement transmission	Liters	1.4 + 0.1

23 00 TRANSMISSION IN GENERAL S5D 200G

TECHNICAL DATA - TRANSMISSION GENERAL S5D 200G

Oil grade: refer to appropriate article.		
Oil volume	Liters	1.0
Oil fill quantity for initial fill or replacement transmission	Liters	1.1

23 00 TRANSMISSION IN GENERAL S5D 250G

TECHNICAL DATA - TRANSMISSION GENERAL S5D 250G

Oil grade: refer to appropriate article.		
Oil volume	Liters	1.0
Oil fill quantity for initial fill or replacement transmission	Liters	1.1

23 00 TRANSMISSION IN GENERAL S5D 280Z

TECHNICAL DATA - TRANSMISSION GENERAL S5D 280Z

Oil grade, refer to appropriate article.		
Oil fill quantity for oil change	Liters	-
Oil fill quantity for initial fill or replacement transmission	Liters	1.3

23 00 TRANSMISSION IN GENERAL S5D 310Z S5D 320Z

TECHNICAL DATA - TRANSMISSION GENERAL S5D 310Z S5D 320Z

Oil grade: refer to appropriate article.		
Oil volume	Liters	1.2
Oil fill quantity for initial fill or replacement transmission	Liters	1.3

23 00 TRANSMISSION IN GENERAL S5D 390Z

TECHNICAL DATA - TRANSMISSION GENERAL S5D 390Z

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Oil grade: refer to appropriate article.		
Oil volume	Liters	1.5
Oil fill quantity for initial fill or replacement transmission	Liters	1.55

23 00 TRANSMISSION IN GENERAL S6-37BZ/DZ

TECHNICAL DATA - TRANSMISSION GENERAL S6-37BZ/DZ

Oil grade, refer to appropriate article.		
Oil fill quantity for oil change	Liters	1.5
Oil fill quantity for initial fill or replacement transmission	Liters	1.6

23 00 TRANSMISSION IN GENERAL S6S 420G

TECHNICAL DATA - TRANSMISSION GENERAL S6S 420G

Oil grade: refer to appropriate article.		
Oil volume	Liters	1.7
Oil fill quantity for initial fill or replacement transmission	Liters	1.9

23 00 TRANSMISSION IN GENERAL S6S 560G

TECHNICAL DATA - TRANSMISSION GENERAL S6S 560G

Oil grade: refer to appropriate article.		
Oil volume	Liters	2.3
Oil fill quantity for initial fill or replacement transmission	Liters	2.5

23 00 TRANSMISSION IN GENERAL S7S 47BG

TECHNICAL DATA - TRANSMISSION GENERAL S7S 47BG

Oil grade, refer to appropriate article.		
Oil fill quantity for oil change	Liters	2.55
Oil fill quantity for initial fill or replacement transmission	Liters	2.75

23 00 TRANSMISSION IN GENERAL: 240/5 / MECH OVERDRIVE

TECHNICAL DATA - TRANSMISSION GENERAL 240/5 / MECH OVERDRIVE

Oil grade: refer to appropriate article.		
Oil volume	ltr.	1.05
Oil fill quantity for initial fill or replacement transmission	ltr.	1.15

23 00 TRANSMISSION IN GENERAL: 260/5 / MECH OVERDRIVE

TECHNICAL DATA - TRANSMISSION GENERAL 260/5 / MECH OVERDRIVE

Oil grade: refer to appropriate article.		

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Oil volume	ltr.	1.25
Oil fill quantity for initial fill or replacement transmission	ltr.	1.35

23 00 TRANSMISSION IN GENERAL: 260/5 / MECH SPORT

TECHNICAL DATA - TRANSMISSION GENERAL 260/5 / MECH SPORT

Oil grade: refer to appropriate article.		
Oil volume	ltr.	1.25
Oil fill quantity for initial fill or replacement transmission	ltr.	1.35

23 00 TRANSMISSION IN GENERAL: 260/6 / MECH OVERDRIVE

TECHNICAL DATA - TRANSMISSION GENERAL 260/6 / MECH OVERDRIVE

Oil grade: refer to appropriate article.		
Oil volume	ltr.	1.25
Oil fill quantity for initial fill or repair transmission	ltr.	1.35

23 00 TRANSMISSION IN GENERAL: 265/5 / MECH SPORT

TECHNICAL DATA - TRANSMISSION GENERAL 265/5 / MECH SPORT

Oil grade: refer to appropriate article.		
Oil volume	ltr.	1.5
Oil fill quantity for initial fill or repair transmission	ltr.	1.7

23 00 TRANSMISSION IN GENERAL: 265/6 / MECH OVERDRIVE

TECHNICAL DATA - TRANSMISSION GENERAL 265/6 / MECH OVERDRIVE

Oil grade: refer to appropriate article.		
Oil volume	ltr.	1.5
Oil fill quantity for initial fill or repair transmission	ltr.	1.7

23 00 TRANSMISSION IN GENERAL: 280/5 / MECH SPORT

TECHNICAL DATA - TRANSMISSION GENERAL 280/5 / MECH SPORT

Oil grade: refer to appropriate article.		
Oil volume	ltr.	1.25
Oil fill quantity for initial fill or repair transmission	ltr.	1.35

23 00 TRANSMISSION IN GENERAL: S6-53DZ / MECH

TECHNICAL DATA - TRANSMISSION GENERAL S6-53DZ / MECH

Oil grade: refer to appropriate article.		
Oil volume	ltr.	1.5

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Oil fill quantity for initial fill or replacement transmission	ltr.	1.6

23 00 TRANSMISSION IN GENERAL: ZF-S5-16 / MECH

TECHNICAL DATA - TRANSMISSION GENERAL ZF-S5-16 / MECH

Oil grade: refer to appropriate article.		
Oil volume	ltr.	1.05
Oil fill quantity for initial fill or replacement transmission	ltr.	1.15

23 00 TRANSMISSION, COMPLETE, TRANSMISSION CONFIGURATION B,C,D,E,F,G,H,I,J

TECHNICAL DATA - TRANSMISSION, COMPLETE, TRANSMISSION CONFIGURATION

A letter code is located on the transmission case o underside of transmission center o underside of clutch housing o sticker on left side of transmission extension With help of letter code and the appropriate BMW parts microfiche for the vehicle, the transmission model can be established.
Example: xxxxxxx = ser. transmission no. AKD = BMW code S 5 D 200 G = transmission variant

11 HOUSING WITH COVER

23 11 CASE AND COVER 240/5 / MECH OVERDRIVE

TECHNICAL DATA - CASE AND COVER 240/5 / MECH OVERDRIVE

Temperature for installation of bearings	°C	80

23 11 CASE AND COVER 260/5 / MECH OVERDRIVE

TECHNICAL DATA - CASE AND COVER 260/5 / MECH OVERDRIVE

Temperature for installation of bearings	°C	80

23 11 CASE AND COVER 260/5 / MECH SPORT

TECHNICAL DATA - CASE AND COVER 260/5 / MECH SPORT

Temperature for installation of bearings	°C	80

23 11 CASE AND COVER 260/6 / MECH OVERDRIVE

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TECHNICAL DATA - CASE AND COVER 260/6 / MECH OVERDRIVE

Temperature for installation of bearings	°C	80

23 11 CASE AND COVER 265/5 / MECH SPORT

TECHNICAL DATA - CASE AND COVER 265/5 / MECH SPORT

Temperature for installation of bearings	°C	80

23 11 CASE AND COVER 265/6 / MECH OVERDRIVE

TECHNICAL DATA - CASE AND COVER 265/6 / MECH OVERDRIVE

Temperature for installation of bearings	°C	80

23 11 CASE AND COVER 280/5 / MECH SPORT

TECHNICAL DATA - CASE AND COVER 280/5 / MECH SPORT

Temperature for installation of bearings	°C	80

23 11 CASE AND COVER S 5 D 200 G

TECHNICAL DATA - CASE AND COVER S 5 D 200 G

Temperature for installation of bearings	approx. °C	80

23 11 CASE AND COVER S 5 D 250 G

TECHNICAL DATA - CASE AND COVER S 5 D 250 G

Temperature for installation of bearings	approx. °C	80

23 11 CASE AND COVER S 5 D 310 Z

TECHNICAL DATA - CASE AND COVER S 5 D 310 Z

Temperature for installation of bearings	approx. °C	80

23 11 CASE AND COVER S 6 S 420 G

TECHNICAL DATA - CASE AND COVER S 6 S 420 G

Temperature for installation of bearings	approx. °C	80

23 11 CASE AND COVER S 6 S 560 G

TECHNICAL DATA - CASE AND COVER S 6 S 560 G

Temperature for installation of bearings	approx. °C	80

23 11 CASE AND COVER S 6-53BZ/DZ

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TECHNICAL DATA - CASE AND COVER S 6-53BZ/DZ

Temperature for installation of bearings	approx. °C	80

23 11 CASE AND COVER S6-37BZ/DZ / MECH

TECHNICAL DATA - CASE AND COVER S6-37BZ/DZ / MECH

Temperature for installation of bearings	°C	80

23 11 CASE AND COVER ZF-S5-16 / MECH

TECHNICAL DATA - CASE AND COVER ZF-S5-16 / MECH

Temperature for installation of bearings	°C	80

21 TRANSMISSION SHAFTS

23 21 TRANSMISSION SHAFTS 240/5 / MECH OVERDRIVE

TECHNICAL DATA - TRANSMISSION SHAFTS 240/5 / MECH OVERDRIVE

Axial play (axial bearing clearance) of:		
Output shaft	mm	0 ... 0.09
Input shaft	mm	0 ... 0.09
Layshaft	mm	0.1 ... 0.2
Output spigot		
Radial runout	max mm	0.07
Output flange		
Radial runout	max mm	0.07
Axial runout	max mm	0.1

23 21 TRANSMISSION SHAFTS 260/5 / MECH OVERDRIVE

TECHNICAL DATA - TRANSMISSION SHAFTS 260/5 / MECH OVERDRIVE

Axial play (axial bearing clearance) of:		
Output shaft	mm	0 ... 0.09
Input shaft	mm	0 ... 0.09
Layshaft	mm	0.1 ... 0.2
Output spigot		
Radial runout	max mm	0.07
Output flange		
Radial runout	max mm	0.07
Axial runout	max mm	0.1

23 21 TRANSMISSION SHAFTS 260/5 / MECH SPORT

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TECHNICAL DATA - TRANSMISSION SHAFTS 260/5 / MECH SPORT

Axial play (axial bearing clearance) of:		
Output shaft	mm	0 ... 0.09
Input shaft	mm	0 ... 0.09
Layshaft	mm	0.13 ... 0.23
Output spigot		
Radial runout	max mm	0.07
Output flange		
Radial runout	max mm	0.07
Axial runout	max mm	0.1

23 21 TRANSMISSION SHAFTS 260/6 / MECH OVERDRIVE

TECHNICAL DATA - TRANSMISSION SHAFTS 260/6 / MECH OVERDRIVE

Axial play (axial bearing clearance) of:		
Output shaft	mm	0 ... 0.09
Input shaft	mm	0 ... 0.09
Layshaft	mm	0.1 ... 0.2
Output spigot		
Radial runout	max mm	0.07
Output flange		
Radial runout	max mm	0.07
Axial runout	max mm	0.1

23 21 TRANSMISSION SHAFTS 265/5 / MECH SPORT

TECHNICAL DATA - TRANSMISSION SHAFTS 265/5 / MECH SPORT

Axial play (axial bearing clearance) of:		
Output shaft	mm	0 ... 0.09
Input shaft	mm	0 ... 0.09
Layshaft	mm	0.1 ... 0.2
Output spigot		
Radial runout	max mm	0.07
Output flange		
Radial runout	max mm	0.07
Axial runout	max mm	0.1

23 21 TRANSMISSION SHAFTS 265/6 / MECH OVERDRIVE

TECHNICAL DATA - TRANSMISSION SHAFTS 265/6 / MECH OVERDRIVE

Axial play (axial bearing clearance) of:		
Output shaft	mm	0 ... 0.09

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Input shaft	mm	0 ... 0.09
Layshaft	mm	0.1 ... 0.2
Output spigot		
Radial runout	max mm	0.07
Output flange		
Radial runout	max mm	0.07
Axial runout	max mm	0.1

23 21 TRANSMISSION SHAFTS 280/5 / MECH SPORT

TECHNICAL DATA - TRANSMISSION SHAFTS 280/5 / MECH SPORT

Axial play (axial bearing clearance) of:		
Output shaft	mm	0 ... 0.09
Input shaft	mm	0 ... 0.09
Output spigot		
Radial runout	max mm	0.07
Output flange		
Radial runout	max mm	0.07
Axial runout	max mm	0.1

23 21 TRANSMISSION SHAFTS GS6-37BZ/DZ

TECHNICAL DATA - TRANSMISSION SHAFTS GS6-37BZ/DZ

Axial play (axial bearing clearance) of:		
Output shaft	mm	0.15 ... 0.19
Output spigot		
Radial runout	Max. mm	0.07
Output flange		
Radial runout	Max. mm	0.07
Axial runout	Max. mm	0.1

23 21 TRANSMISSION SHAFTS GS6-53DZ / MECH

TECHNICAL DATA - TRANSMISSION SHAFTS GS6-53DZ / MECH

Axial play (axial bearing play) of:		
Output shaft	mm	
Input shaft	Max. mm	
Output journal:		
Radial runout	Max. mm	0.15
Output flange		
Radial runout	Max. mm	0.15
Axial runout	Max. mm	0.15

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23 21 TRANSMISSION SHAFTS S 5 D 200 G / MECH

TECHNICAL DATA - TRANSMISSION SHAFTS S 5 D 200 G / MECH

Axial play (axial bearing clearance) of:		
Output shaft	mm	0 ... 0.09
Input shaft	Max. mm	0.04
Output spigot		
Radial runout	Max. mm	0.07
Output flange		
Radial runout	Max. mm	0.07
Axial runout	Max. mm	0.1

23 21 TRANSMISSION SHAFTS S 5 D 250 G / MECH

TECHNICAL DATA - TRANSMISSION SHAFTS S 5 D 250 G / MECH

Axial play (axial bearing clearance) of:		
Output shaft	mm	0 ... 0.09
Input shaft	Max. mm	0.04
Output spigot		
Radial runout	Max. mm	0.07
Output flange		
Radial runout	Max. mm	0.07
Axial runout	Max. mm	0.1

23 21 TRANSMISSION SHAFTS S 5 D 310 Z / MECH

TECHNICAL DATA - TRANSMISSION SHAFTS S 5 D 310 Z / MECH

Axial play (axial bearing clearance) of:		
Output shaft	mm	0 ... 0.09
Output spigot		
Radial runout	Max. mm	0.07
Output flange		
Radial runout	Max. mm	0.07
Axial runout	Max. mm	0.1

23 21 TRANSMISSION SHAFTS S 6 S 420 G / MECH

TECHNICAL DATA - TRANSMISSION SHAFTS S 6 S 420 G / MECH

Axial play (axial bearing clearance) of:		
Output shaft	mm	0 ... 0.09
Output spigot		
Radial runout	Max. mm	0.07

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Output flange		
Radial runout	Max. mm	0.07
Axial runout	Max. mm	0.1

23 21 TRANSMISSION SHAFTS S 6 S 560 G / MECH

TECHNICAL DATA - TRANSMISSION SHAFTS S 6 S 560 G / MECH

Axial play (axial bearing clearance) of:		
Output shaft	mm	0 ... 0.09
Output spigot		
Radial runout	Max. mm	0.07
Output flange		
Radial runout	Max. mm	0.07
Axial runout	Max. mm	0.1

23 21 TRANSMISSION SHAFTS ZF-S5-16 / MECH

TECHNICAL DATA - TRANSMISSION SHAFTS ZF-S5-16 / MECH

Axial play (axial bearing clearance) of:		
Output shaft	mm	0 ... 0.09
Input shaft	mm	1.1 ... 1.3
Output spigot		
Radial runout	max mm	0.07
Output flange		
Radial runout	max mm	0.07
Axial runout	max mm	0.1

22 GEARS

23 22 GEARS (LAYSHAFT) 240/5 / MECH OVERDRIVE

TECHNICAL DATA - GEARS (LAYSHAFT) 240/5 / MECH OVERDRIVE

Pressing-off force at ambient temperature		
5th gear wheel	t	4.5 ... 5.5
Contact pressure force at warming temperature		
3rd gear wheel	t °C	- -
4th gear wheel	t °C	- -

23 22 GEARS (LAYSHAFT) 260/5 / MECH OVERDRIVE

TECHNICAL DATA - GEARS (LAYSHAFT) 260/5 / MECH OVERDRIVE

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Pressing-off force at ambient temperature		
5th gear wheel	t	5.5 ... 6.8
Contact pressure force at warming temperature		
3rd gear wheel	t °C	- -
4th gear wheel	t °C	- -
5th gear wheel	t °C	4.9 ... 6.8approx. 120

23 22 GEARS (LAYSHAFT) 260/5 / MECH SPORT

TECHNICAL DATA - GEARS (LAYSHAFT) 260/5 / MECH SPORT

Pressing-off force at ambient temperature		
5th gear wheel	t	5.5 ... 6.8
Contact pressure force at warming temperature		
3rd gear wheel	t °C	- -
4th gear wheel	t °C	- -
5th gear wheel	t °C	4.9 ... 6.8approx. 120

23 22 GEARS (LAYSHAFT) 260/6 / MECH OVERDRIVE

TECHNICAL DATA - GEARS (LAYSHAFT) 260/6 / MECH OVERDRIVE

Pressing-off force at ambient temperature		
5th gear wheel	t	5.5 ... 6.8
Contact pressure force at warming temperature		
3rd gear wheel	t °C	- -
4th gear wheel	t °C	- -
5th gear wheel	t approx. °C	4.9 ... 6.8 120

23 22 GEARS (LAYSHAFT) 260/6 / MECH OVERDRIVE

TECHNICAL DATA - GEARS (LAYSHAFT) 260/6 / MECH OVERDRIVE

Pressing-off force at ambient temperature		
5th gear wheel	t	5.5 ... 6.8
Contact pressure force at warming temperature		
3rd gear wheel	t °C	- -

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4th gear wheel	t °C	- -
5th gear wheel	t approx. °C	4.9 ... 6.8 120

23 22 GEARS (LAYSHAFT) 265/5 / MECH SPORT

TECHNICAL DATA - GEARS (LAYSHAFT) 265/5 / MECH SPORT

Pressing-off force at ambient temperature		
3rd gear wheel	t	5 ... 7
4th gear wheel	t	5 ... 7
5th gear wheel	t	9 ... 10
Contact pressure force at warming temperature		
3rd gear wheel	t °C	- -
4th gear wheel	t °C	- -
5th gear wheel	t approx. °C	5 ... 6150

23 22 GEARS (LAYSHAFT) 265/6 / MECH OVERDRIVE

TECHNICAL DATA - GEARS (LAYSHAFT) 265/6 / MECH OVERDRIVE

Pressing-off force at ambient temperature		
3rd gear wheel	t	5 ... 7
4th gear wheel	t	5 ... 7
5th gear wheel	t	9 ... 10
Contact pressure force at warming temperature		
3rd gear wheel	t °C	- -
4th gear wheel	t °C	- -
5th gear wheel	t approx. °C	5 ... 6150

23 22 GEARS (LAYSHAFT) 280/5 / MECH SPORT

TECHNICAL DATA - GEARS (LAYSHAFT) 280/5 / MECH SPORT

Pressing-off force at ambient temperature		
3rd gear wheel	t	5 ... 7
4th gear wheel	t	5 ... 7
5th gear wheel	t	9 ... 10
Contact pressure force at warming temperature		
3rd gear wheel	t °C	- -

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4th gear wheel	t °C	- -
5th gear wheel	t approx. °C	5 ... 6150

23 22 GEARS (LAYSHAFT) 280/5 / MECH SPORT

TECHNICAL DATA - GEARS (LAYSHAFT) 280/5 / MECH SPORT

Pressing-off force at ambient temperature		
3rd gear wheel	t	5 ... 7
4th gear wheel	t	5 ... 7
5th gear wheel	t	9 ... 10
Contact pressure force at warming temperature		
3rd gear wheel	t °C	- -
4th gear wheel	t °C	- -
5th gear wheel	t approx. °C	5 ... 6 150

23 22 GEARS (LAYSHAFT) GS6-53DZ / MECH

TECHNICAL DATA - GEARS (LAYSHAFT) GS6-53DZ / MECH

Press-off and press-on force		
5th gear wheel	kN	50
4th gear wheel	kN	50

23 22 GEARS (LAYSHAFT) S 5 D 200 G / MECH

TECHNICAL DATA - GEARS (LAYSHAFT) S 5 D 200 G / MECH

Press-off and press-on force		
5th gear wheel	kN	50 ... 70
4th gear wheel	kN	

23 22 GEARS (LAYSHAFT) S 5 D 250 G / MECH

TECHNICAL DATA - GEARS (LAYSHAFT) S 5 D 250 G / MECH

Press-off and press-on force		
5th gear wheel	kN	50 ... 70

23 22 GEARS (LAYSHAFT) ZF-S5-16 / MECH OVERDRIVE

TECHNICAL DATA - GEARS (LAYSHAFT) ZF-S5-16 / MECH OVERDRIVE

Pressing-off force at ambient temperature		
3rd gear wheel	t	7.5

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4th gear wheel	t	8.0
5th gear wheel	t	8.0
Contact pressure force at warming temperature		
3rd gear wheel	t °C	- -
4th gear wheel	t °C	- -
5th gear wheel	t °C	- -

23 SYNCHRONIZATION

23 23 SYNCHRONIZATION 240/5 / MECH OVERDRIVE

TECHNICAL DATA - SYNCHRONIZATION 240/5 / MECH OVERDRIVE

Distance between synchronizer ring and clutch body		
New condition	mm	1.0 ... 1.3
Max. wear limit size	mm	0.8
Reverse gear		
New condition	mm	0.5 ... 0.6
Max. wear limit size	mm	0.4

23 23 SYNCHRONIZATION 260/5 / MECH OVERDRIVE

TECHNICAL DATA - SYNCHRONIZATION 260/5 / MECH OVERDRIVE

Distance between synchronizer ring and clutch body		
New condition	mm	1.0 ... 1.3
Max. wear limit size	mm	0.8
Reverse gear		
New condition	mm	0.5 ... 0.6
Max. wear limit size	mm	0.4

23 23 SYNCHRONIZATION 260/5 / MECH SPORT

TECHNICAL DATA - SYNCHRONIZATION 260/5 / MECH SPORT

Distance between synchronizer ring and clutch body		
New condition	mm	1.0 ... 1.3
Max. wear limit size	mm	0.8
Reverse gear		
New condition	mm	0.5 ... 0.6
Max. wear limit size	mm	0.4

23 23 SYNCHRONIZATION 260/6 / MECH OVERDRIVE

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TECHNICAL DATA - SYNCHRONIZATION 260/6 / MECH OVERDRIVE

Distance between synchronizer ring and clutch body		
New condition	mm	1.0 ... 1.3
Max. wear limit size	mm	0.8
Reverse gear		
New condition	mm	0.5 ... 0.6
Max. wear limit size	mm	0.4

23 23 SYNCHRONIZATION 265/5 / MECH SPORT

TECHNICAL DATA - SYNCHRONIZATION 265/5 / MECH SPORT

Distance between synchronizer ring and clutch body		
New condition	mm	1.0 ... 1.3
Max. wear limit size	mm	0.8
Reverse gear		
New condition	mm	0.5 ... 0.6
Max. wear limit size	mm	0.4

23 23 SYNCHRONIZATION 265/6 / MECH OVERDRIVE

TECHNICAL DATA - SYNCHRONIZATION 265/6 / MECH OVERDRIVE

Distance between synchronizer ring and clutch body		
New condition	mm	1.0 ... 1.3
Max. wear limit size	mm	0.8
Reverse gear		
New condition	mm	0.5 ... 0.6
Max. wear limit size	mm	0.4

23 23 SYNCHRONIZATION 280/5 / MECH SPORT

TECHNICAL DATA - SYNCHRONIZATION 280/5 / MECH SPORT

Distance between synchronizer ring and clutch body		
New condition	mm	1.0 ... 1.3
Max. wear limit size	mm	0.8
Reverse gear		
New condition	mm	0.5 ... 0.6
Max. wear limit size	mm	0.4

23 23 SYNCHRONIZATION GS6-37BZ/DZ / MECH

TECHNICAL DATA - SYNCHRONIZATION GS6-37BZ/DZ / MECH

Distance between synchronizer ring and clutch body		
New condition		

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1st/2nd gear	mm	1.3 ... 2.05
Wear limit size	mm	1.0
3st/4nd gear	mm	0.8 ... 1.40
Wear limit size	mm	0.7
5/6st gear	mm	0.95 ... 1.5
Wear limit size	mm	0.75
Reverse gear		
New condition	mm	0.65 ... 1.25
Max. wear limit size	mm	0.5

23 23 SYNCHRONIZATION GUIDE SLEEVES 240/5 / MECH OVERDRIVE

TECHNICAL DATA - SYNCHRONIZATION GUIDE SLEEVES 240/5 / MECH OVERDRIVE

Pressing-off force		
1st/2nd and 5th/R gear	t max	3.0
3rd/4th gear	t max	2.7
Pressing-on force		
1st/2nd and 5th/R gear	t max	2.1
3rd/4th gear	t max	1.9
Bearing Sleeves	approx. °C	80

23 23 SYNCHRONIZATION GUIDE SLEEVES 260/5 / MECH OVERDRIVE

TECHNICAL DATA - SYNCHRONIZATION GUIDE SLEEVES 260/5 / MECH OVERDRIVE

Pressing-off force		
1st/2nd and 5th/R gear	t max	3.7
3rd/4th gear	t max	3.0
Pressing-on force		
1st/2nd and 5th/R gear	t max	2.5
3rd/4th gear	t max	2.1
Bearing Sleeves	approx. °C	80

23 23 SYNCHRONIZATION GUIDE SLEEVES 260/5 / MECH SPORT

TECHNICAL DATA - SYNCHRONIZATION GUIDE SLEEVES 260/5 / MECH SPORT

Pressing-off force		
1st/2nd and 5th/R gear	t max	3.7
3rd/4th gear	t max	3.0
Pressing-on force		
1st/2nd and 5th/R gear	t max	2.5
3rd/4th gear	t max	2.1
Bearing Sleeves	approx. °C	80

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23 23 SYNCHRONIZATION GUIDE SLEEVES 260/6 / MECH OVERDRIVE

TECHNICAL DATA - SYNCHRONIZATION GUIDE SLEEVES 260/6 / MECH OVERDRIVE

Pressing-off force		
1st/2nd and 5th/R gear	t max	3.7
3rd/4th gear	t max	3.0
Pressing-on force		
1st/2nd and 5th/R gear	t max	2.5
3rd/4th gear	t max	2.1
Bearing Sleeves	approx. °C	80

23 23 SYNCHRONIZATION GUIDE SLEEVES 260/6 / MECH OVERDRIVE

TECHNICAL DATA - SYNCHRONIZATION GUIDE SLEEVES 260/6 / MECH OVERDRIVE

Pressing-off force		
1st/2nd and 5th/R gear	t max	3.7
3rd/4th gear	t max	3.0
Pressing-on force		
1st/2nd and 5th/R gear	t max	2.5
3rd/4th gear	t max	2.1
Bearing Sleeves	approx. °C	80

23 23 SYNCHRONIZATION GUIDE SLEEVES 265/5 / MECH SPORT

TECHNICAL DATA - SYNCHRONIZATION GUIDE SLEEVES 265/5 / MECH SPORT

Pressing-off force		
Pressing-on force		
Bearing Sleeves	approx. °C	80

23 23 SYNCHRONIZATION GUIDE SLEEVES 265/6 / MECH OVERDRIVE

TECHNICAL DATA - SYNCHRONIZATION GUIDE SLEEVES 265/6 / MECH OVERDRIVE

Pressing-off force		
Pressing-on force		
Bearing Sleeves	approx. °C	80

23 23 SYNCHRONIZATION GUIDE SLEEVES 280/5 / MECH SPORT

TECHNICAL DATA - SYNCHRONIZATION GUIDE SLEEVES 280/5 / MECH SPORT

Pressing-off force		
Pressing-on force		
Bearing Sleeves	approx. °C	80

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23 23 SYNCHRONIZATION GUIDE SLEEVES 280/5 / MECH SPORT

TECHNICAL DATA - SYNCHRONIZATION GUIDE SLEEVES 280/5 / MECH SPORT

Pressing-off force		
Pressing-on force		
Bearing Sleeves	approx. °C	80

23 23 SYNCHRONIZATION GUIDE SLEEVES GS6-37BZ/DZ / MECH

TECHNICAL DATA - SYNCHRONIZATION GUIDE SLEEVES GS6-37BZ/DZ / MECH

1st / 2nd gear	kN	10 ... 36
3rd / 4th gear	kN	20 ... 58
5th / 6th gear	kN	19 ... 55

23 23 SYNCHRONIZATION GUIDE SLEEVES GS6-53DZ / MECH

TECHNICAL DATA - SYNCHRONIZATION GUIDE SLEEVES GS6-53DZ / MECH

Press-off and press-on force	kN	50 / 2

23 23 SYNCHRONIZATION GUIDE SLEEVES S 5 D 200 G / MECH

TECHNICAL DATA - SYNCHRONIZATION GUIDE SLEEVES S 5 D 200 G / MECH

Press-off and press-on force	kN	10 ... 20

23 23 SYNCHRONIZATION GUIDE SLEEVES S 5 D 250 G / MECH

TECHNICAL DATA - SYNCHRONIZATION GUIDE SLEEVES S 5 D 250 G / MECH

Press-off and press-on force	kN	10 ... 20

23 23 SYNCHRONIZATION GUIDE SLEEVES ZF-S5-16 / MECH OVERDRIVE

TECHNICAL DATA - SYNCHRONIZATION GUIDE SLEEVES ZF-S5-16 / MECH OVERDRIVE

Pressing-off force		
Pressing-on force		
1st/2nd and 5th/R gear	t max	0.08
Bearing Sleeves	approx. °C	80

23 23 SYNCHRONIZATION S 5 D 200 G / MECH

TECHNICAL DATA - SYNCHRONIZATION S 5 D 200 G / MECH

Distance between synchronizer ring and clutch body		
New condition		
1st/2nd gear	mm	1.3 ... 2.1
3rd gear	mm	1.1 ... 1.5

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4th/5th gear	mm	0.9 ... 1.5
Max. wear limit size	mm	0.8
Reverse gear		
New condition	mm	1.1 ... 1.7
Max. wear limit size	mm	0.5

23 23 SYNCHRONIZATION S 5 D 250 G / MECH

TECHNICAL DATA - SYNCHRONIZATION S 5 D 250 G / MECH

Distance between synchronizer ring and clutch body		
New condition		
1st/2nd gear	mm	1.3 ... 2.1
3rd gear	mm	1.1 ... 1.5
4th/5th gear	mm	0.9 ... 1.5
Max. wear limit size	mm	0.8
Reverse gear		
New condition	mm	1.1 ... 1.7
Max. wear limit size	mm	0.5

23 23 SYNCHRONIZATION S 5 D 310 Z / MECH

TECHNICAL DATA - SYNCHRONIZATION S 5 D 310 Z / MECH

Distance between synchronizer ring and clutch body		
New condition		
1st/2nd gear	mm	1.1 ... 1.6
3rd gear	mm	0.95 ... 1.35
4th/5th gear	mm	0.95 ... 1.35
Max. wear limit size	mm	0.8
Reverse gear		
New condition	mm	0.7 ... 1.15
Max. wear limit size	mm	0.5

23 23 SYNCHRONIZATION S 6 S 420 G / MECH

TECHNICAL DATA - SYNCHRONIZATION S 6 S 420 G / MECH

Distance between synchronizer ring and clutch body		
New condition		
Max. wear limit size	mm	0.8
Reverse gear		
Max. wear limit size	mm	0.5

23 23 SYNCHRONIZATION S 6 S 560 G / MECH

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TECHNICAL DATA - SYNCHRONIZATION S 6 S 560 G / MECH

Distance between synchronizer ring and clutch body		
New condition		
Max. wear limit size	mm	0.8
Reverse gear		
Max. wear limit size	mm	0.5

23 23 SYNCHRONIZATION ZF-S5-16 / MECH OVERDRIVE

TECHNICAL DATA - SYNCHRONIZATION ZF-S5-16 / MECH OVERDRIVE

Distance between synchronizer ring and clutch body		
New condition	mm	1.0 ... 1.3
Max. wear limit size	mm	0.8
Reverse gear		
New condition	mm	0.5 ... 0.6
Max. wear limit size	mm	0.4

31 INTERNAL GEARSHIFT COMPONENT

23 31 INTERNAL SHIFT COMPONENTS 240/5 / MECH OVERDRIVE

TECHNICAL DATA - INTERNAL SHIFT COMPONENTS 240/5 / MECH OVERDRIVE

Shift fork guide width		
1st ... 5th gear		
Wear limit	mm	4.8

23 31 INTERNAL SHIFT COMPONENTS 260/5 / MECH OVERDRIVE

TECHNICAL DATA - INTERNAL SHIFT COMPONENTS 260/5 / MECH OVERDRIVE

Shift fork guide width		
1st ... 5th gear		
Wear limit	mm	4.8

23 31 INTERNAL SHIFT COMPONENTS 260/5 / MECH SPORT

TECHNICAL DATA - INTERNAL SHIFT COMPONENTS 260/5 / MECH SPORT

Shift fork guide width		
1st ... 5th gear		
Wear limit	mm	4.8

23 31 INTERNAL SHIFT COMPONENTS 260/6 / MECH OVERDRIVE

TECHNICAL DATA - INTERNAL SHIFT COMPONENTS 260/6 / MECH OVERDRIVE

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Shift fork guide width		
1st ... 5th gear		
Wear limit	mm	4.8

23 31 INTERNAL SHIFT COMPONENTS 265/5 / MECH SPORT

TECHNICAL DATA - INTERNAL SHIFT COMPONENTS 265/5 / MECH SPORT

Shift fork guide width		
1st ... 5th gear		
Wear limit	mm	4.8

23 31 INTERNAL SHIFT COMPONENTS 265/6 / MECH OVERDRIVE

TECHNICAL DATA - INTERNAL SHIFT COMPONENTS 265/6 / MECH OVERDRIVE

Shift fork guide width		
1st ... 5th gear		
Wear limit	mm	4.8

23 31 INTERNAL SHIFT COMPONENTS 280/5 / MECH SPORT

TECHNICAL DATA - INTERNAL SHIFT COMPONENTS 280/5 / MECH SPORT

Shift fork guide width		
1st ... 5th gear		
Wear limit	mm	4.8

23 31 INTERNAL SHIFT COMPONENTS ZF-S5-16 / MECH OVERDRIVE

TECHNICAL DATA - INTERNAL SHIFT COMPONENTS ZF-S5-16 / MECH OVERDRIVE

Shift fork guide width		
1st ... 5th gear		
Wear limit	mm	4.8

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TRANSMISSION

Manual Transmission - Tightening Torques - X3

00 COMPLETE TRANSMISSION

23 00 TRANSMISSION IN GENERAL

TRANSMISSION IN GENERAL - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
2AZ Transmission to clutch housing	B/C/D/E/F/G/H/I/J-transmission	M12		76 Nm
3AZ Reinforcement plate to transmission	B/C/D/E/F/G/H/I/J-transmission	M8		23 Nm
4AZ Oil drain plug / filler plug	B/C-transmission			50 Nm
	D/E-transmission			52 Nm
	G/H-transmission	M18x1.5 hexagon socket		35 Nm
	H/I-transmission	M12x1.5		25 Nm
	J-transmission			40 Nm
5AZ Transmission extension	g/H transmission	M10		46 Nm

23 00 TRANSMISSION IN GENERAL

TRANSMISSION IN GENERAL - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
Hex screws	B/C/D/E/F/G/H/I/J-transmission	M6		9 Nm
	B/C/D/E/F/G/H/I/J-transmission	M8		25 Nm
	B/C/D/E/F/G/H/I/J-transmission	M10		49 Nm
	B/C/D/E/F/G/H/I/J-transmission	M12		74 Nm
Torx bolt	B/C/D/E/F/G/H/I/J-transmission	M6		9 Nm
	B/C/D/E/F/G/H/I/J-transmission	M8		22 Nm
	B/C/D/E/F/G/H/I/J-transmission	M10		43 Nm
	B/C/D/E/F/G/H/I/J-	M12		72 Nm

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	transmission			
	J-transmission	M10x55 8.8		43 Nm
	J-transmission	M10x42 8.8		42 Nm
	H/G-transmission	M12		73 Nm
Steel screws with Torx head N52/N54/N53	I/G/H-transmission	M8		19 Nm
Steel / N53/N46T screws with Torx head N52 / N54	I/G/H-transmission	M12		66 Nm
2AZ Transmission to N52/N52K/N53/N54 aluminium screws marked blue	I/G/H-transmission		Replace screws Jointing torque and angle of rotation must be observed without fail	
	I/G/H-transmission	M10x30	Jointing torque	20 Nm
			Torque angle	90-110°
	I/G/H-transmission	M10x85	Jointing torque	20 Nm
			Torque angle	180-200°
	G/I/H-transmission only with E9x	M12x91	Jointing torque	34 Nm
			Torque angle	90-110°
	1 / H / G-transmission	M12x91	Jointing torque	25 Nm
			Torque angle	130°
3AZ Cover plate, transmission	1 transmission	M6		6 Nm

11 HOUSING WITH COVER

23 11 CASE AND COVER

CASE AND COVER - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Transmission housing, rear section/front section	B/C/D/E/F/G/H/I/J-transmission			22 Nm
2AZ Cover with guide tube/transmission case	B/C/D/E/F/G/H/I/J-transmission	M8 x 22		18 Nm
	B/C/D/E/F/G/H/I/J-transmission	M8 x 30		25 Nm
	B/C/D/E/F/G/H/I/J-transmission	M6		10 Nm
3AZ Bearing cap/sealing flange	B/C/D/E/F/G/H/I/J-transmission			10.5 Nm
4AZ Reverse gear wheel axle to	B/C/D/E/F/G/H/I/J-			

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intermediate housing	transmission			49 Nm
5AZ Retaining plate for reverse gear wheel axle to intermediate housing	B/C/D/E/F/G/H/I/J-transmission			25 Nm
6AZ Transmission closing plate	B/C/D/E/F/G/H/I/J-transmission	M6		8 Nm

23 11 CASE AND COVER

CASE AND COVER - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
6AZ Reverse gear shaft to case	B/C/D/E/F/G/H/I/J-transmission	M8		25 Nm
	S5D 310Z/S5D 320Z	M8		20 Nm
	B/C/D/E/F/G/H/I/J-transmission	M10		45 Nm
7AZ Support for reverse gear shaft	B/C-transmission	M8		25 Nm
8AZ Bearing holder to rear housing section	B/C-transmission	M6		10 Nm
9AZ Retaining tabs for sealing cap	C-transmission	M6		10 Nm
10AZ Bearing on countershaft	B-transmission	M10		90 Nm
	C-transmission	M10		30 Nm
	C-transmission	M10		60 Nm

23 11 CASE AND COVER

CASE AND COVER - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
11AZ Screw plug to rear housing section	B/C/D/E/F/G/H/I/J-transmission	M20		60 Nm
	B-transmission	M16		40 Nm
	B/C-transmission	M22		60 Nm
12AZ Sealing caps to rear housing section	B/C-transmission	M6		10 Nm
13AZ Reversing bolt to reversing lever	ZFS-5-16/C-transmission			43 Nm
14AZ Clamping claw to rear housing section	ZFS-5-16/C-transmission			33 Nm
15AZ Screws on detent plate	ZFS-5-16/C-transmission			9 Nm

23 11 CASE AND COVER

CASE AND COVER - TIGHTENING TORQUES

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	Type	Thread	Tightening specification	Measure
16AZ Holder to transfer case	265 / Sport	M6		9 Nm
17AZ Retaining plates for bearings on housing	S5D 310Z/S5D 320Z / S5D 200G / S5D 250G	M6		10 Nm
18AZ Retaining plate to housing	S5D 320Z SMG	M6		5.5 Nm

21 TRANSMISSION SHAFTS

23 21 TRANSMISSION SHAFTS

TRANSMISSION SHAFTS - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Output flange	S5D 200G / S5D 250G/ S5D260Z / S5D 310Z/S6S 420G		Collar nut installed with bolt cement	
			Pretension	190 Nm
			Release	
			Tighten down	120 Nm
	S5D 280Z / S5D 320Z		Collar nut installed with bolt cement	
			Pretension	170 Nm
			Release	
			Tighten down	130 Nm
	S5D 390Z		Collar nut installed with bolt cement	
			Pretension	200 Nm
			Release	
			Tighten down	145 Nm
	GS6-37BZ / GS6-17BG		Collar nut installed with bolt cement	
			Pretension	170 Nm
			Release	
			Tighten down	120 Nm
	GS6-53DZ		Collar nut installed with bolt cement	
			Pretension	200 Nm
			Release	
			Tighten down	140 Nm
	GS7S47BG		Collar nut installed with bolt cement	200 Nm
2AZ Gear to countershaft	265 / Sport	M10		60 Nm

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31 INTERNAL GEARSHIFT COMPONENT

23 31 INTERIOR SHIFT COMPONENTS

INTERIOR SHIFT COMPONENTS - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Shift arms to transmission case	S5D310 Z			45 Nm
2AZ Sealing cap for locking sleeves of gearshift rods	S6S 420G	M6		10 Nm
3AZ Retaining screw, shift actuator / selector shaft	S5D 320Z / S6S37BZ/ S6S53BZ SMG	M6		10 Nm

41 EXTERNAL GEARSHIFT COMPONENT

23 41 EXTERNAL GEARSHIFT COMPONENTS

EXTERNAL GEARSHIFT COMPONENTS - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Servomotor / actuator to transmission housing Insert screws with screw securing adhesive	D/G/HSMG transmission	M6		10 Nm
2AZ Switch for gear recognition to servomotor	DSMG transmission	M5		6 Nm
3AZ Hydraulic lines to servomotor	DSMG transmission	M12x1		17 Nm
4AZ Actuator to transmission casing	DSMG transmission	M8		25 Nm
5AZ Reversing light switch	B/C/D/E/F/G/H/I/J-transmission	M12		16 Nm
6AZ Pressure accumulator to valve block	C/G/HSMG transmission			30 Nm
7AZ Protective plate Expansion tank Shift actuator Hydraulic pump Valve block to transmission housing Ground strap to transmission housing	C/G/HSMG transmission	M6		10 Nm
8AZ Protecting plate / valve block to transmission housing /	C/G/HSMG transmission	M8		20 Nm
9AZ Valves to valve block	C/G/HSMG transmission	M4		3.5 Nm
10AZ Pressure sensor to valve block	C/G/HSMG transmission			15 Nm
11AZ Shift/selector sensor to	C/G/HSMG	M4		2.8 Nm

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transmission housing	transmission			
12AZ Retaining screw for hydraulic line	C/G/HSMG transmission			18 Nm
13AZ Banjo bolt for hydraulic line	CSMG transmission			16 Nm
14AZ Heat shield to expansion tank/ pump bracket	H transmission			6 Nm
15AZ Clutch speed sensor	G/H-transmission			35 Nm
16AZ Transmission oil cooler to transmission	E60 / E63 / E64 / E61	7-speed SMG M6x35		10 Nm
17AZ Transmission oil screen in transmission oil cooler	E60 / E63 / E64 / E61	7-speed SMG M18		25 Nm
18AZ Banjo bolt to transmission oil cooler	E60 / E63 / E64 / E61	7-speed SMG M16x1.5		40 Nm
19AZ Union nut to screwed socket	E60 / E63 / E64 / E61	7-speed SMG		40 Nm
20AZ Oil cooler connection to transmission oil cooler	E60 / E63 / E64 / E61	7-speed SMG		40 Nm
21AZ Oil pump to transmission oil cooler	E60 / E63 / E64 / E61	7-speed SMG M6x20		10 Nm
22AZ Speed sensor to transmission	E60 / E63 / E64 / E61	7-speed SMG M6x16		10 Nm
23AZ Temperature and pressure sensor to hydraulic unit	E60 / E63 / E64 / E61	7-speed SMG		15 Nm
24AZ Clamp, pressure accumulator to transmission	E60 / E63 / E64 / E61	7-speed SMG		22 Nm
25AZ Pressure accumulator to pump block	E60 / E63 / E64 / E61	7-speed SMG		29 Nm
26AZ Pump block to transmission	E60 / E63 / E64 / E61	7-speed SMG		22 Nm
27AZ Banjo bolts, pressure lines clutch actuator and pump block	E60 / E63 / E64 / E61	7-speed SMG		25 Nm
28AZ Screws, actuator block	E60 / E63 / E64 / E61	7-speed SMG		25 Nm
29AZ Union nut, hydraulic line, actuator block	E60 / E63 / E64 / E61	7-speed SMG		11 Nm
30AZ Pump to electric motor	E60 / E63 / E64 / E61	7-speed SMG		5 Nm
31 AZ Electric motor to pump block	E60 / E63 / E64 / E61	7-speed SMG		5 Nm

71 TRANSMISSION SUSPENSION

23 71 TRANSMISSION MOUNTS

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TRANSMISSION MOUNTS - TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
1AZ Transmission mounts (rubber) to body	B/C/D/E/F/G/H/I/J-transmission	M10		42 Nm
2AZ Transmission cross-member to body	B/C/D/E/F/G/H/I/J-transmission	M10		42 Nm
	B/C/D/E/F/G/H/I/J-transmission	M8		21 Nm
3AZ Mount bracket to transmission	B/C/D/E/F/G/H/I/J-transmission	M8		21 Nm
4AZ Transmission support block to transmission	B/C/D/E/F/G/H/I/J-transmission	M10 ASA screw		38 Nm
	B/C/D/E/F/G/H/I/J-transmission	M10 ISA pan head		48 Nm
5AZ Transmission mount to transmission support bracket/transmission cross-member	B/C/D/E/F/G/H/I/J-transmission	M8		19 Nm

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AUTOMATIC TRANSMISSION

Overview - All Models

STANDARD/AUTOMATIC TRANSMISSION

In today's modern vehicles, the automatic transmission has become a vital part of the powertrain. Automatic transmissions provide overall better fuel economy and efficiency while adapting to changing road conditions and driving habits. Standard transmissions offer more driver interaction with the vehicle, however automatic transmissions reduce driver fatigue and increase safety by shifting automatically. Automatic transmissions also offer improved driveability in stop and go traffic. If there is a disadvantage to an automatic transmission, it would be complexity and cost of manufacturing. See **Fig. 1**.

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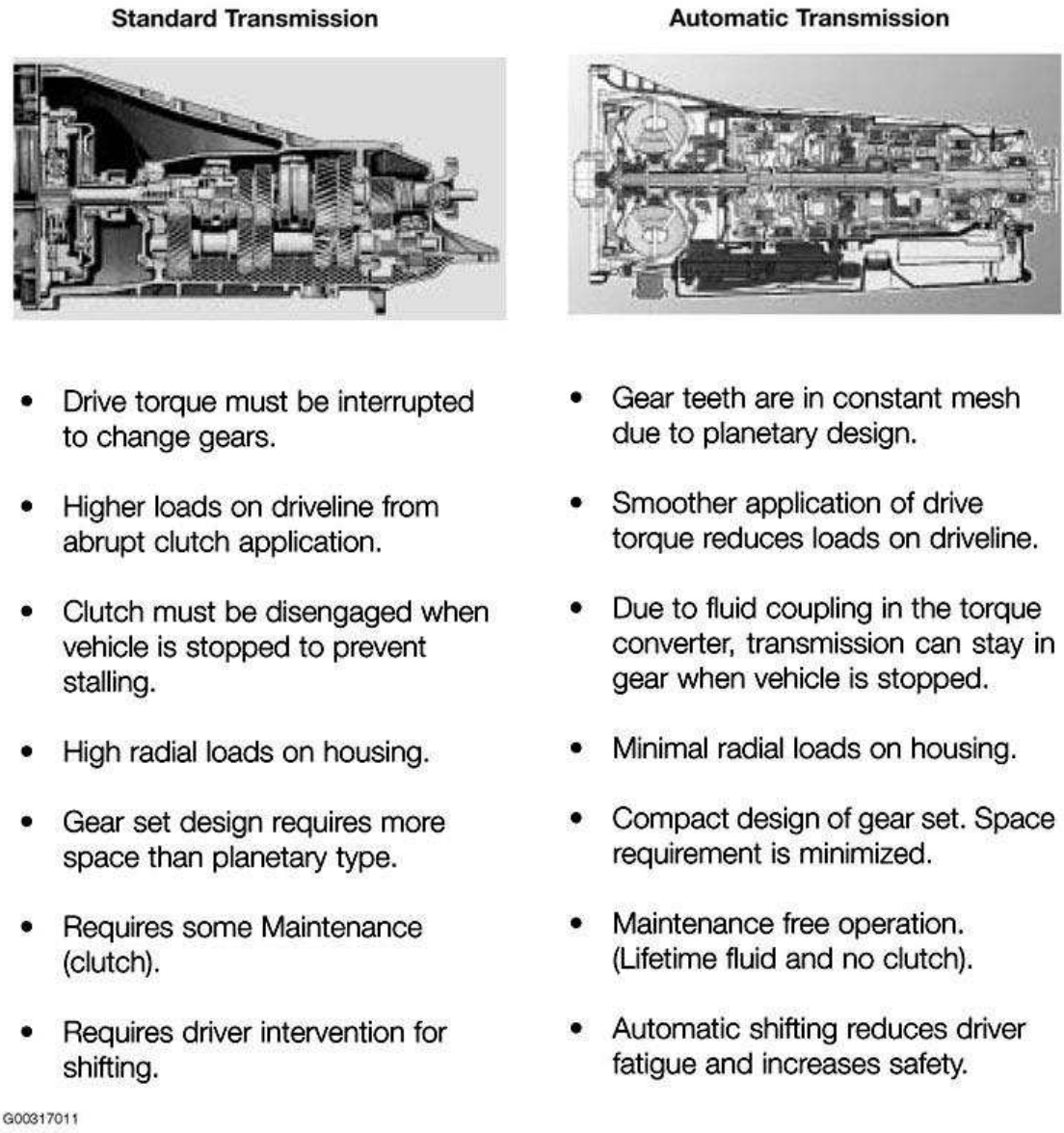


Fig. 1: Standard & Automatic Transmission Comparison
Courtesy of BMW OF NORTH AMERICA, INC.

HYDRAULIC TRANSMISSION VS. ELECTRO-HYDRAULIC TRANSMISSION

Since the introduction of the automatic transmission there have been numerous refinements to improve shift comfort as well as fuel economy. Early automatic transmissions used only hydraulic control, there was no electronic intervention. In 1986 BMW introduced their first EH (Electro-Hydraulic) transmission into production vehicles. The acronym EGS is used by BMW for its electronic transmission control system. EGS stands for "Electronic Transmission Control" which comes from the German words "Elektronisch Getriebe Steurung". In order to comply with SAE terminology we will refer to the EGS control module as the TCM "Transmission Control Module". EH controlled transmissions allow for optimized shift points by closely

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monitoring changing conditions. Engine speed, road speed and throttle angle are some of the inputs that are monitored by the TCM to determine optimal shift points. The TCM will then process this information and control shift point via electronic solenoids mounted on the valve body. With the introduction of Adaptive Transmission Control, shift comfort and fuel economy was further improved. The TCM now monitors throttle angle deviations, wheel speeds and CAN Bus information to fine tune shift points. See **Fig. 2**.

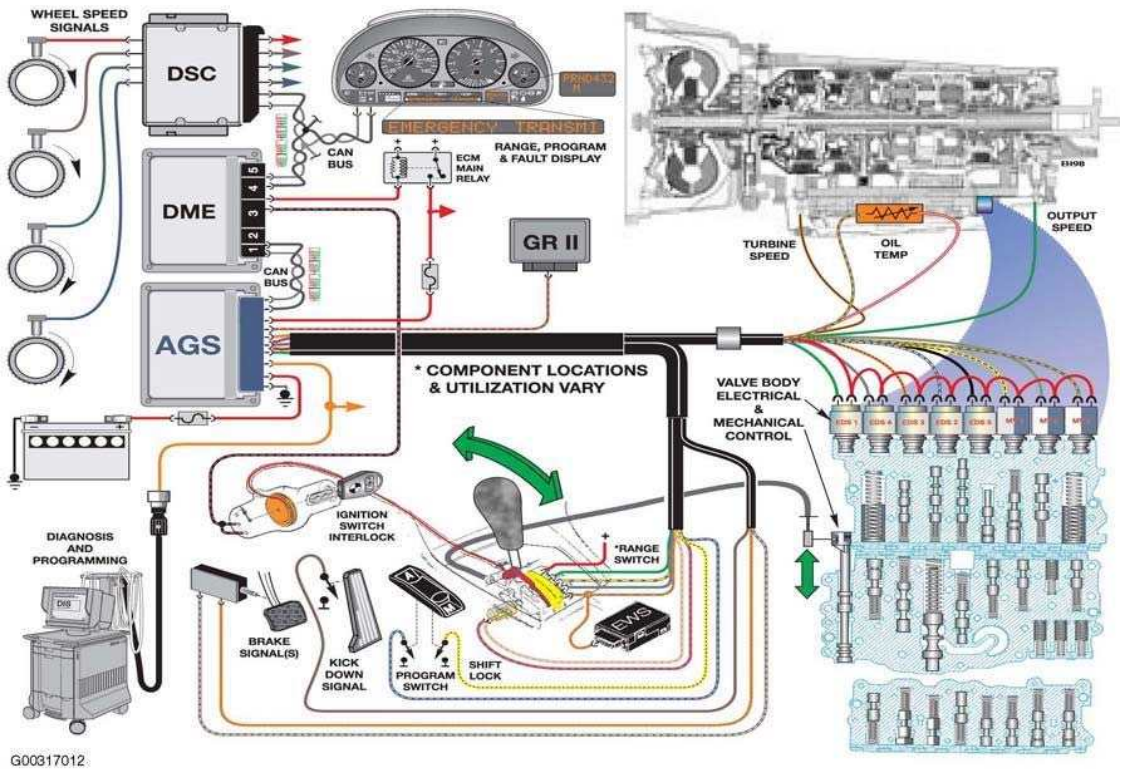


Fig. 2: Electronic Transmission Control System
Courtesy of BMW OF NORTH AMERICA, INC.

TRANSMISSION IDENTIFICATION

BMW automatic transmissions are manufactured by two suppliers for the US market:

- Zahnradfabrik Friedrichshafen: Commonly referred to as ZF. ZF manufactures both manual and automatic transmissions.
- GM Powertrain - Hydramatic: Hydramatic is a manufacturing division of General Motors located in Strasbourg France. Hydramatic supplies automatic transmissions to BMW for four and six-cylinder vehicles.

BMW has developed an internal numbering system for their transmissions for parts ordering, information research and identification. Also, each manufacturer uses their own internal identification system. Here is a breakdown of these identification codes. See **Fig. 3**.

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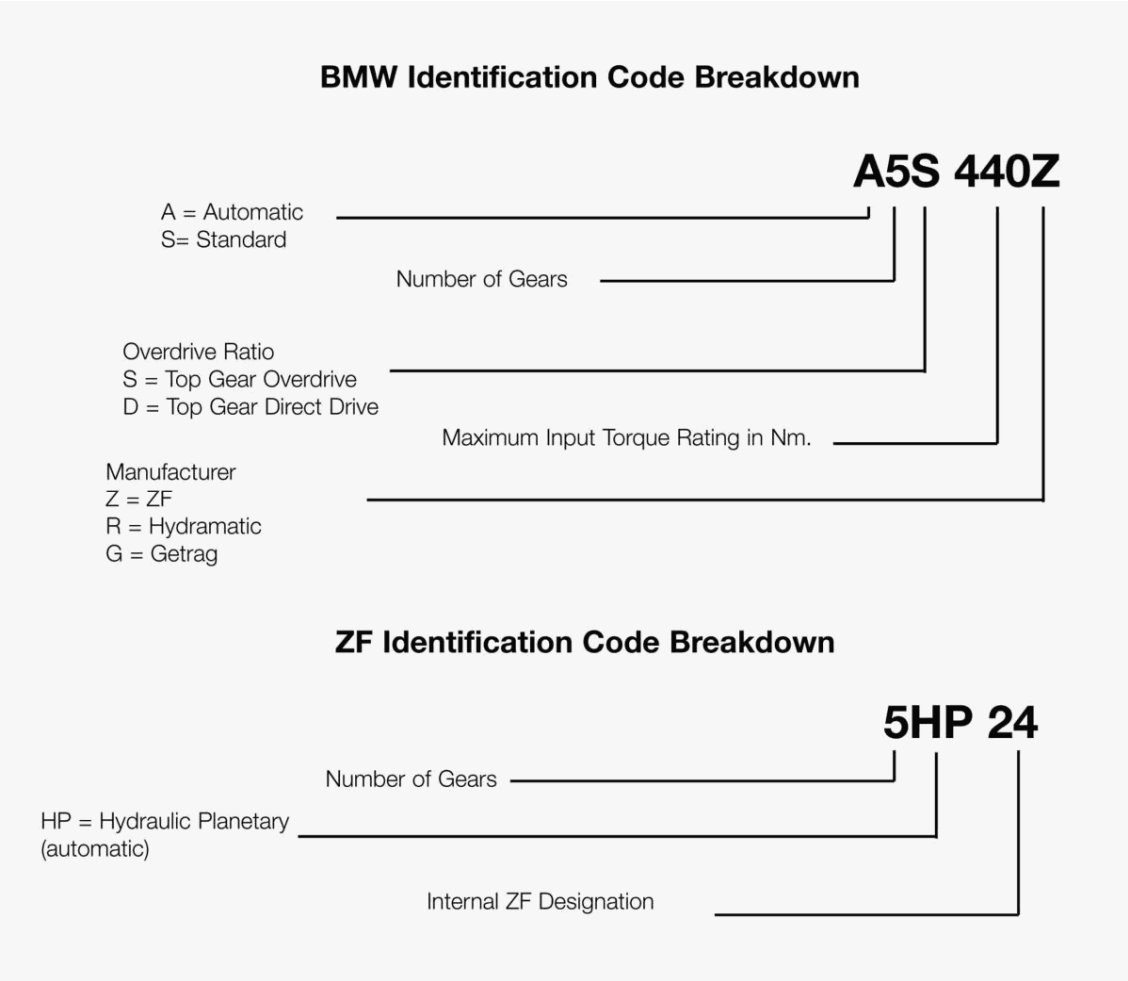


Fig. 3: Transmission Code Breakdown
Courtesy of BMW OF NORTH AMERICA, INC.

TRANSMISSION HYDRAULICS

TRANSMISSION FLUID (OIL)

The automatic transmission provides pressure regulated hydraulic fluid which is filtered for all of the transmissions functional requirements. See **Fig. 4**. All BMW automatic transmissions are designed to operate with specific fluids. Use of non-approved oil will cause malfunctions and irreparable transmission damage which is not covered by BMW warranty. The transmission fluid provides the following functions:

- Lubricates mechanical components (planetary gears, bearings etc.).
- Removes heat and transfers heat to transmission cooling system. (heat exchanger).
- Removes debris and contaminants to sump and filter when circulated.
- Provides a transfer of kinetic energy in the torque converter.
- Allows hydraulic operation of mechanical components (clutches, brakes) via control of the valve body.

Also, transmission fluid has various properties to prevent oxidation and breakdown from heat and friction. Each

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type of transmission fluid has properties specific for each transmission application. Fluid level is crucial in the proper operation of an automatic transmission. Improper fluid levels will cause improper operation and eventually irreparable transmission damage. Improper fluid level can cause:

- A low fluid level can cause an interruption in oil flow during fast acceleration or hard braking which can cause gear shift malfunctions.
- An excessively high fluid level can cause the rotating mechanical components to paddle in the oil. This produces foam which introduces air into the hydraulic system.
- A low fluid level can also cause transmission overheating causing premature transmission failure.

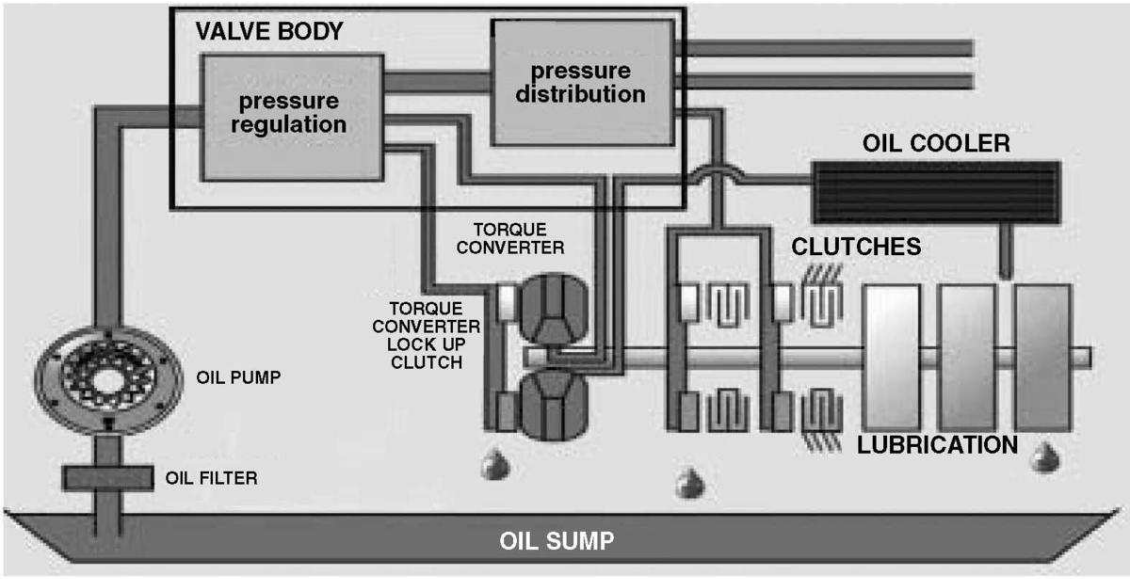


Fig. 4: Identifying Transmission Hydraulics
Courtesy of BMW OF NORTH AMERICA, INC.

TRANSMISSION FLUID APPLICATION

There are numerous types of transmission fluid used in BMW transmissions. With the exception of the early transmissions (4HP22/24, A4S310/270R and the A5S310Z) all current BMW transmissions use "Lifetime Fill" transmission fluid. There is no maintenance required for these transmissions. It is important to use the correct fluid. Incorrect use of the transmission fluid can cause non-warrantable transmission damage.

When performing repairs on transmissions with lifetime fluid, it is important to drain the transmission fluid in to a clean container for re-use. New fluid should only be used for transmission replacement and for topping off after repairs.

Also, transmission fluid level is vital to the proper operation of the transmission. See **Fig. 5**.

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Transmission	Fluid Type	BMW Part #	Container	SIB Ref.
4HP22 **4HP24**	Dexron III Mercon	Available Commercially (Castrol or Texaco)	N/A	
A5S310Z 530i/iT (E34)	Dexron III	Available Commercially (Castrol or Texaco)	N/A	
M3 (E36)	ESSO LT 71141	83 22 9 407 807	20 liter contalner	B 24 03 95
A5S325Z	ESSO LT 71141	83 22 9 407 807	20 liter contalner	
A5S440Z	ESSO LT 71141	83 22 9 407 807	20 liter container	
A5S560Z 740 (E32), 540 (E34) 840Ci (E31- 6/93-12/94) 740i/iL-750iL (E38)	Shell LA2634	83 22 9 407 765	5 liter container	B 24 11 92
540i (3/96-12/96) 850Ci (10/94-6/97)	ESSO LT 71141	83 22 9 407 807	20 liter container	B 24 02 94
A4S310R **A4S270R** **(THM-R1)**	Dexron III Mercon	Available Commercially (Castrol or Texaco)	N/A	
A5S360R **A5S390R**	Texaco ETL 7045E Texaco ETL 8072B	83 22 0 026 922 83 22 0 024 359	25 liter container 25 liter container	
GA6HP26Z	Shell M1375.4	83 22 0 142 516		

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Fig. 5: Transmission Fluid Application
Courtesy of BMW OF NORTH AMERICA, INC.

TORQUE CONVERTER

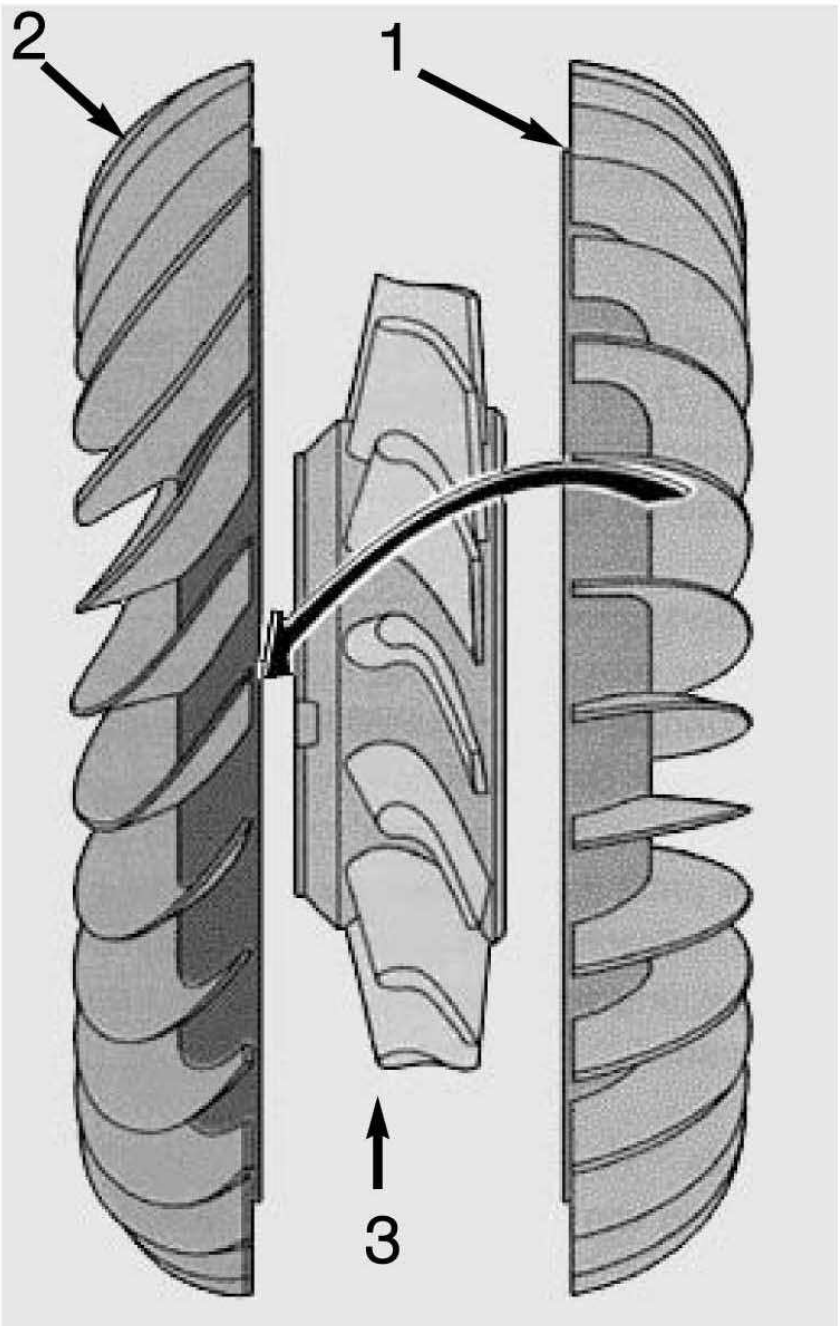
In standard transmissions the crankshaft is linked to the transmission input shaft via the clutch assembly. Power flows from the crankshaft through the flywheel. The pressure plate transfers power to the clutch disc which is splined to the transmission input shaft. The pressure plate is used to disconnect (or interrupt) power flow to the transmission input shaft. Because the engine is mechanically connected to the driveline, power flow must be interrupted when the vehicle is stationary. Otherwise the engine would stall. In automatic transmissions, there is a fluid coupling between the engine and transmission. This fluid coupling is more commonly referred to as the torque converter. In the torque converter there is no rigid connection between the engine and transmission (except for lock up clutch). In order to understand the operation of the torque converter, we must first start with the components. The breakdown of the components are as follows:

- The Impeller, which is rigidly connected to the torque converter housing.
- The Turbine, which is splined to the input shaft (turbine shaft) of the transmission.
- The Stator, which has a one-way clutch. The inner race of the one-way clutch is splined to a stationary

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shaft attached to the transmission. See **Fig. 6**.

The addition of the stator allows the fluid coupling to be referred to as a torque converter. The stator provides for a multiplication of torque at low speeds. Without the stator there would be no multiplication of torque.



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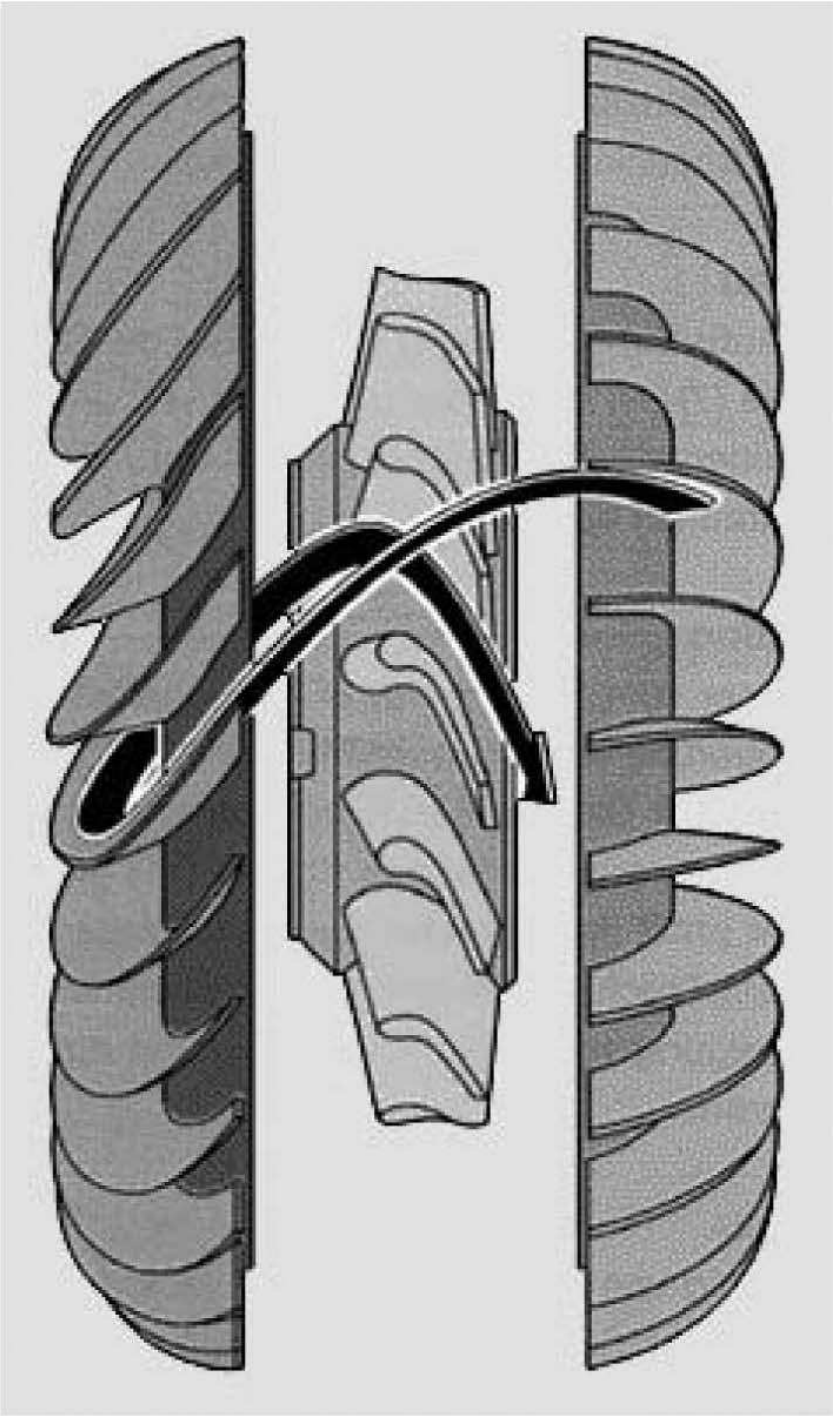
Fig. 6: Identifying Impeller, Turbine & Stator
Courtesy of BMW OF NORTH AMERICA, INC.

When the engine is running, the impeller which is directly connected to the converter housing, rotates at engine speed. Fluid is directed from the impeller blades to the turbine blades. The fluid drives the turbine which is splined to the input (turbine) shaft of the transmission. This functions the same way as a waterfall acting on a paddle wheel. The ratio of the impeller speed to turbine speed is approximately 1.1 to 1. This ratio is improved to 1:1 with the addition of the torque converter clutch which is discussed later.

Torque Converter Operation At Low Speeds

1. At low engine speeds there is a large difference in rotational speed between the impeller and the turbine
2. Fluid flow is directed from the impeller to the turbine. Fluid strikes the vanes of the turbine. The turbine is driven forward in the direction of engine rotation.
3. Fluid flow is then directed back towards the impeller.
4. Before the fluid reaches the impeller, the fluid strikes the vanes of the stator.
5. When the fluid strikes the stator, the one way clutch prevents the stator from rotating.
6. The fluid is then re-directed by the curved vanes of the stator. The fluid is now flowing in the same direction as the impeller.
7. The fluid that is acting on the impeller increases the force on the impeller which multiplies torque. See **Fig. 7**.

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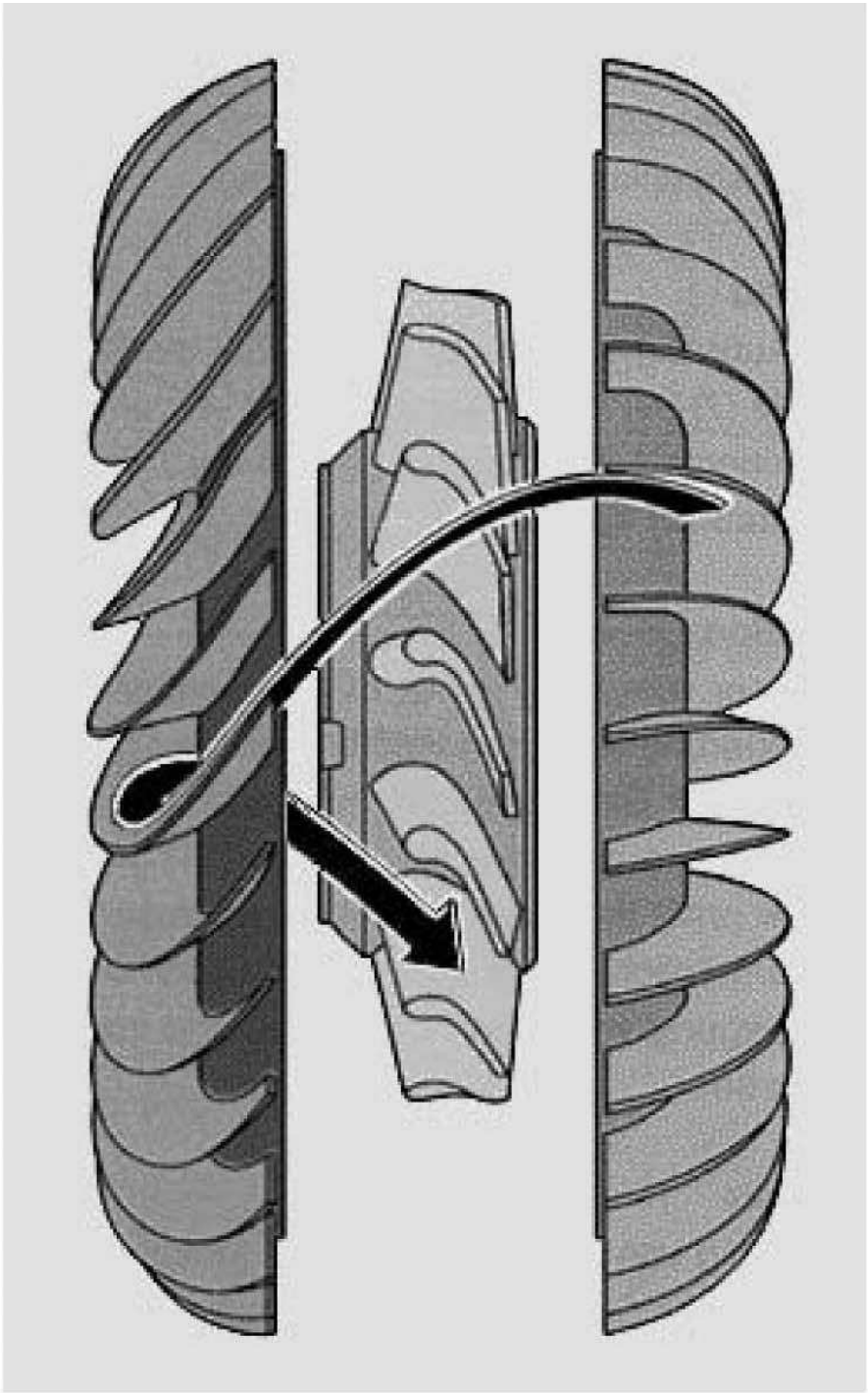
Fig. 7: Torque Converter Operation At Low Speed
Courtesy of BMW OF NORTH AMERICA, INC.

Torque Converter Operation at High Speed

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1. As engine speed increases, the turbine speed approaches the speed of the impeller.
2. The fluid flow is directed from the turbine to the back side of the impeller blades.
3. The one-way clutch in the stator unlocks and the stator blades turn in the direction of engine rotation.
4. Fluid is no longer re-directed and torque multiplication no longer takes place.
5. This is referred to as "Coupling Speed". The turbine never reaches the same speed as the impeller as fluid flow would come to a halt. Ratio is approximately 1.1 to 1. See **Fig. 8**.

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Fig. 8: Torque Converter Operation At High Speed
Courtesy of BMW OF NORTH AMERICA, INC.

Torque Converter Clutch

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Since the efficiency of the torque converter at coupling speed is approximately 1.1 to 1, fuel economy is compromised. To offset this a torque converter clutch was added on EH controlled transmissions. The torque converter clutch locks the turbine to the converter housing. This creates a mechanical coupling with a ratio of 1:1. This can only be achieved at higher engine speeds. The torque converter clutch must be disengaged at low engine speeds to prevent stalling. There are two methods for controlling the torque converter clutch on BMW transmissions:

- A4S310/270R, 4HP22/24 EH, A5S310Z - These transmission use an on/off control method to lock and unlock the torque converter. The TCC is either completely engaged or completely disengaged. This method of engagement provides an abrupt sensation when the TCC is locking and unlocking. This abrupt sensation can be unpleasant and undesirable to some drivers.
- A5S560Z, A5S440Z, A5S325Z, GA6HP26Z, A5S360/390R - These transmissions use a gradual approach to TCC control. The TCC is gradually applied and released, this method reduces the abrupt feel of the on/off type TCC. The TCC solenoid is controlled by pulse width modulation. This allows fluid to be gradually introduced and released to the TCC.

The TCC is spring loaded to the engaged position. Pressurized fluid releases the TCC, when the pressurized fluid is released, the TCC is engaged. Depending on transmission application, the TCC can be engaged in 3rd, 4th or 5th gear. The TCC must be disengaged at low speeds to prevent stalling. See **Fig. 9** and **Fig. 10** .

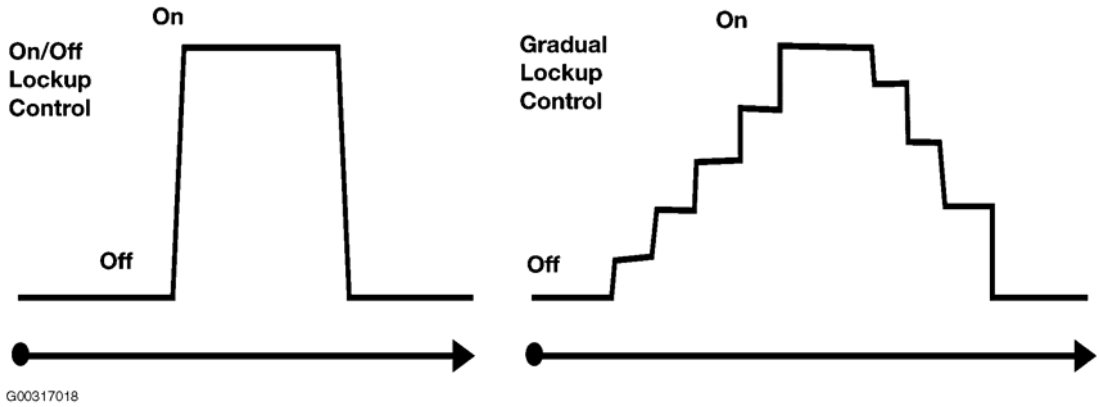


Fig. 9: Identifying TCC Operation
Courtesy of BMW OF NORTH AMERICA, INC.

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Example of TCC oil control circuit from the A5S440/560Z transmission.

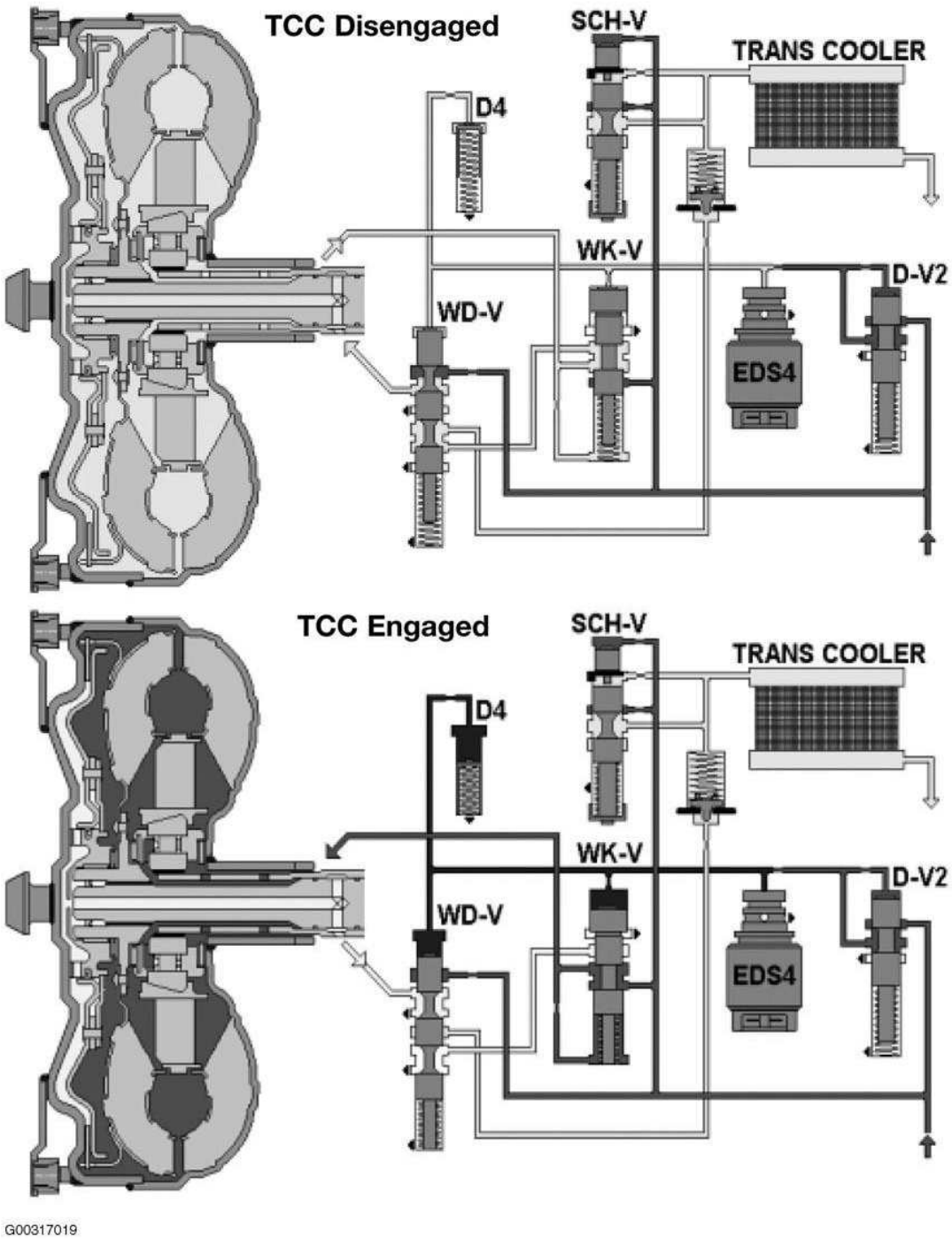


Fig. 10: TCC Oil Control Circuit
Courtesy of BMW OF NORTH AMERICA, INC.

OIL PUMP

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The transmission oil pump is used to circulate oil and provide pressure for hydraulic operation. The pump is driven by the torque converter shell and rotates with engine. Fluid is drawn from the sump through the filter and distributed to the various transmission hydraulic systems. The output pressure is regulated to an operating pressure of approximately 25 bar. Currently there are two types of oil pumps used in BMW transmissions: Crescent type and Vane type. See **Fig. 11**.

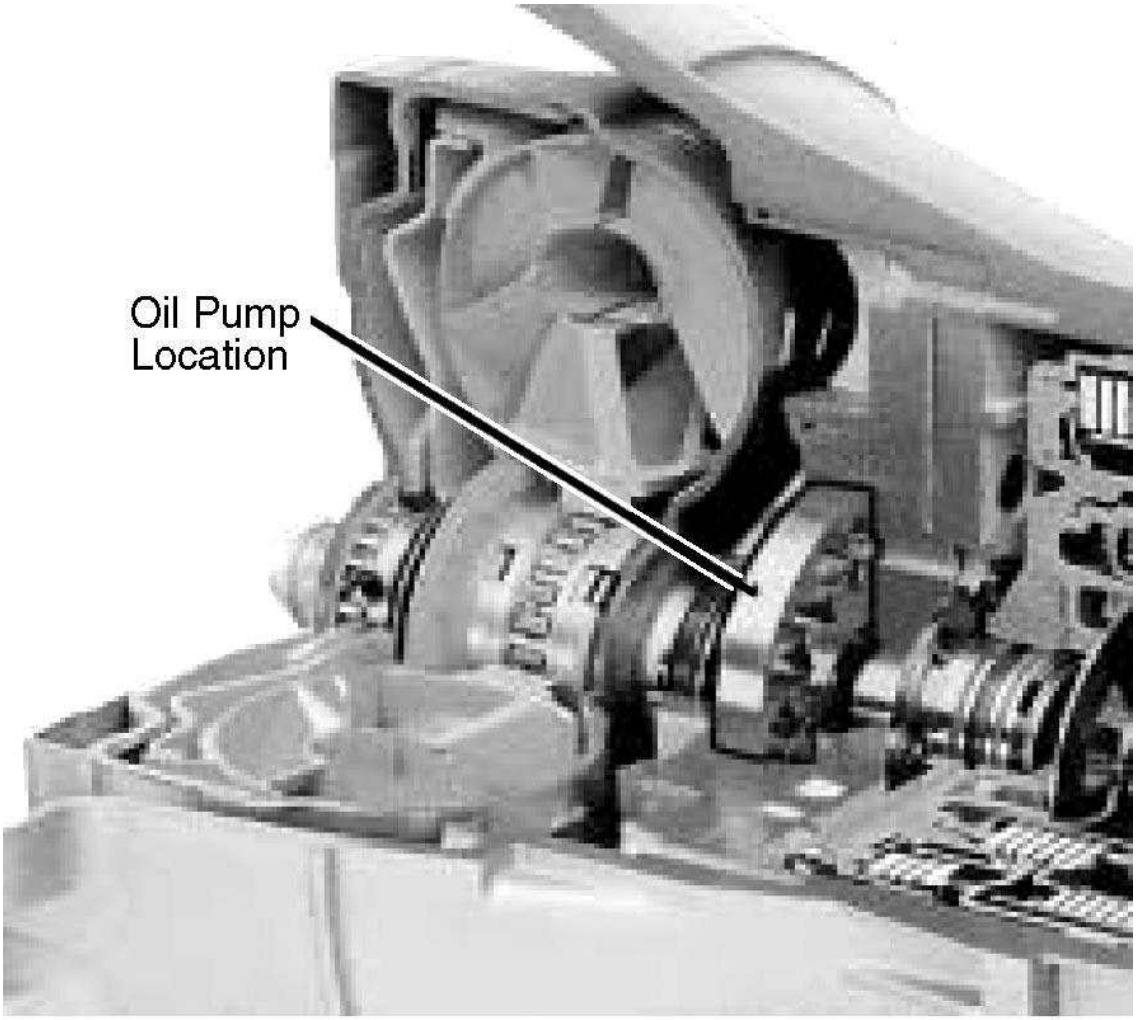


Fig. 11: Locating Oil Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Crescent Type Oil Pump (All except A5S360/390R)

The crescent type is an internal gear pump containing a drive gear and a driven gear. The inner gear is driven by the torque converter and acts as the impeller. The outer gear is driven by the inner gear. The gap between the teeth varies from the input, through the crescent and to the output of the pump. A low pressure area is created on the input side of the pump by the widening gap between the gear teeth. The oil is drawn to the crescent and transferred to the output side of the pump, where the pressure is increased by the narrowing gap between the

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gear teeth. The output pressure of the pump is controlled by spring loaded pressure regulator. See **Fig. 12**.

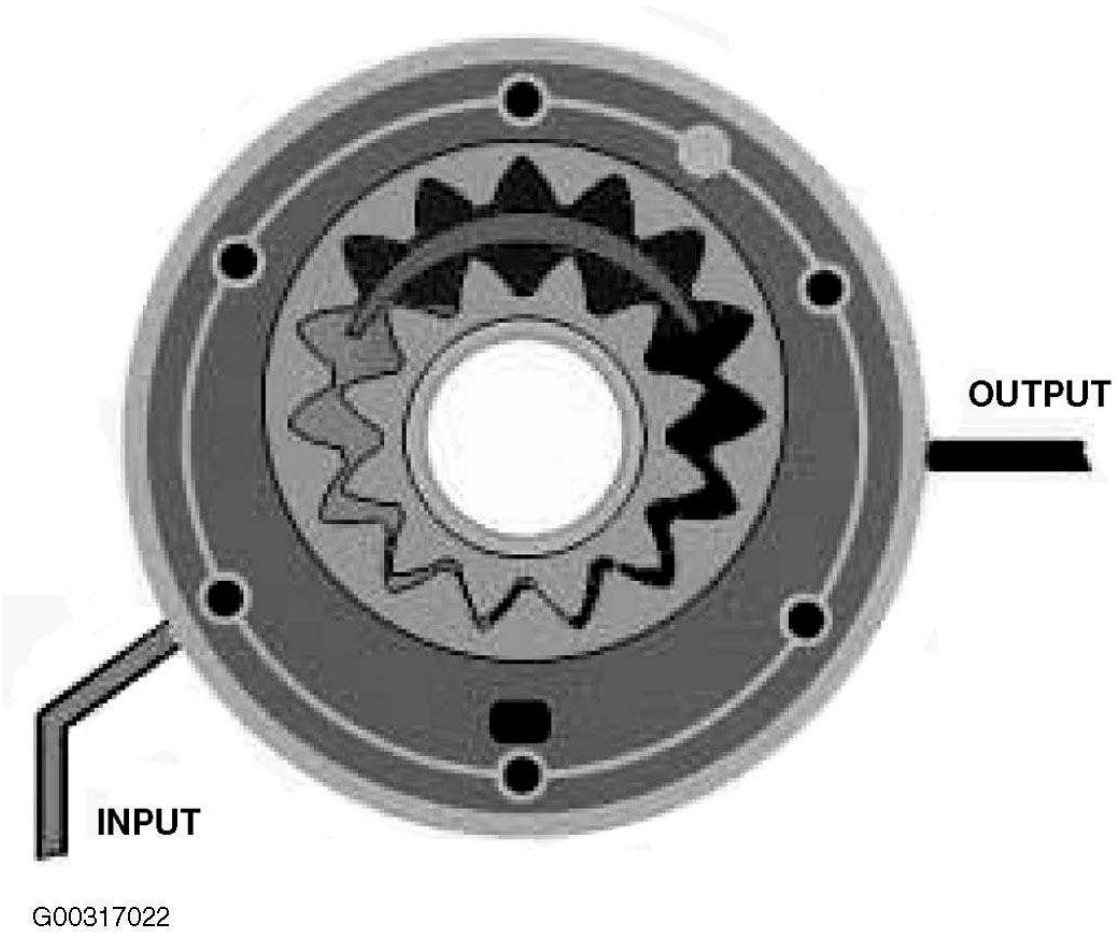


Fig. 12: Identifying Crescent Type Oil Pump
Courtesy of BMW OF NORTH AMERICA, INC.

Oil Volume Control

On the A5S440Z transmission, oil pump output volume is controlled based on engine RPM. High oil volume is initially required at start up to quickly fill the transmission requirements. As engine RPM increases, the volume is greater than is required. The Oil Volume Control Damper regulates the pump output volume based on engine RPM. This helps improve fuel economy by reducing the load on the engine at high RPM.

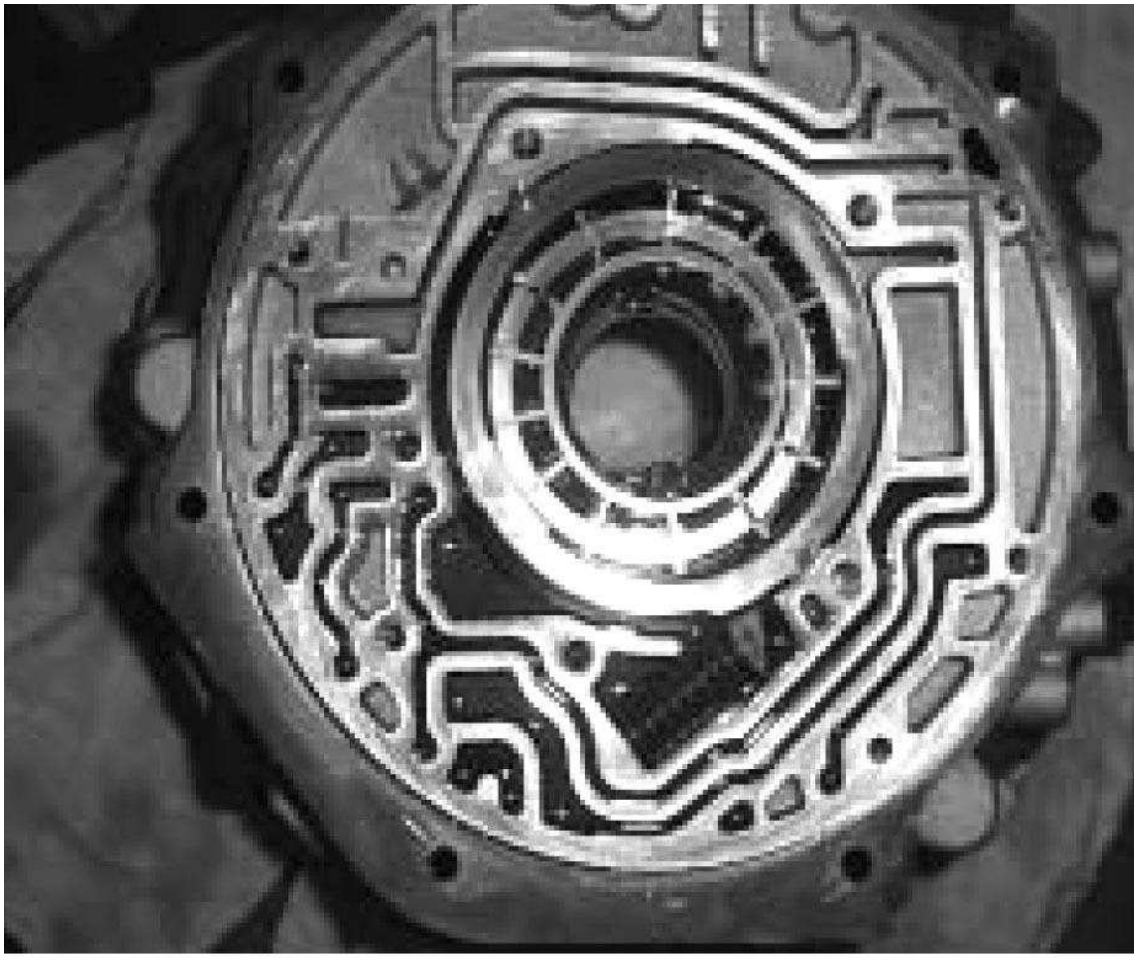
Vane Type Pump (A5S360/390R)

The new A5S360/390R (GM5) transmission uses a vane type pump. See **Fig. 13**. The torque converter drives the pump rotor and 13 vanes. The rotor and vanes are placed inside a slide mechanism. As the rotor spins, the vanes sweep oil from the pump intake to the output along the mating surface on the vane ends and the interior surface of the slide. The slide is mounted on a pivot pin. As it pivots, it changes the eccentricity of the rotor to slide mating surface. This in turn will alter the output oil volume. This provides the same function as the Oil

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Control Volume Damper on the A5S440Z. The slide's position is influenced by a calibrated spring and hydraulic control pressure from the main pressure regulator solenoid on the valve body. See **Fig. 14**. The benefit of changing the slide position is to optimize pump output volume to meet the following operating conditions:

- Provide maximum volume during engine start-up. This condition provides a fast priming action of the pump for immediate lubrication and for hydraulic pressure operation.
- Regulated output volume at higher engine speeds. Maximum pump volume is not required at all times.



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Fig. 13: Identifying Vane-Type Pump
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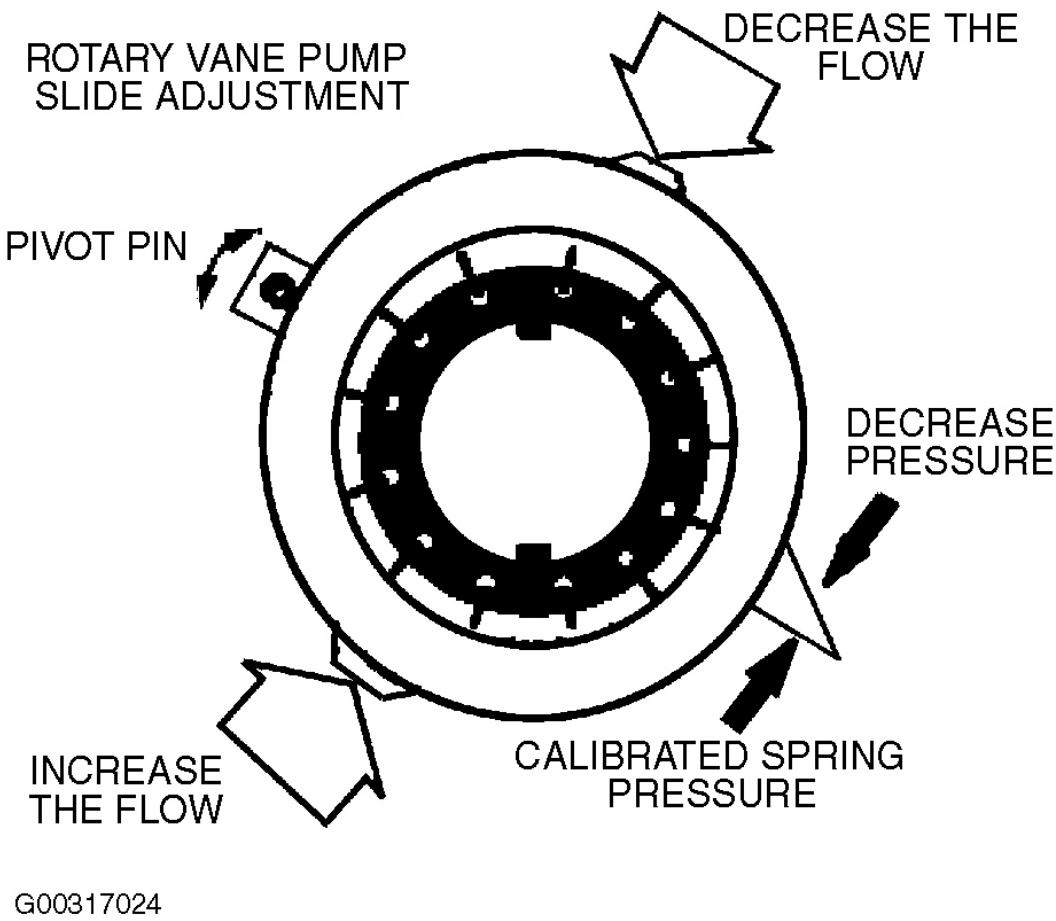


Fig. 14: Rotary Vane Pump Slide Adjustment
Courtesy of BMW OF NORTH AMERICA, INC.

HYDRAULIC CONTROL COMPONENTS

Electro/Hydraulic Valve Body

The valve body assembly is the main shift control element in the transmission. In non-EH transmissions the valve body was only hydraulically controlled. In the current EH (electrohydraulic) transmissions the valve body is similar in design, but now also housing a number of shift solenoids which are controlled by the TCM. The valve body consists of a number of sub-assemblies. Each sub-assembly contains a number of spool valves which are hydraulically controlled. Most spool valves are opposed by spring pressure. The spool valves are used to direct hydraulic fluid flow to the various shift elements in the transmission. There is also a manual valve which is connected to the shift assembly by a cable. The manual valve allows the drivers to select the basic operating mode (or ratio). See **Fig. 15**. The valve body is responsible for the following:

- Regulating main pressure.

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- Controlling fluid flow to shift elements for Upshifts and Downshifts.
- Providing for manual operation by driver via manual valve.
- Reverse Lockout.
- Failsafe Operation.
- Shift Comfort through: Overlap Shift Control (ZF) Pressure Accumulators (GM).
- Torque Converter Control.
- Distribution of lubrication.

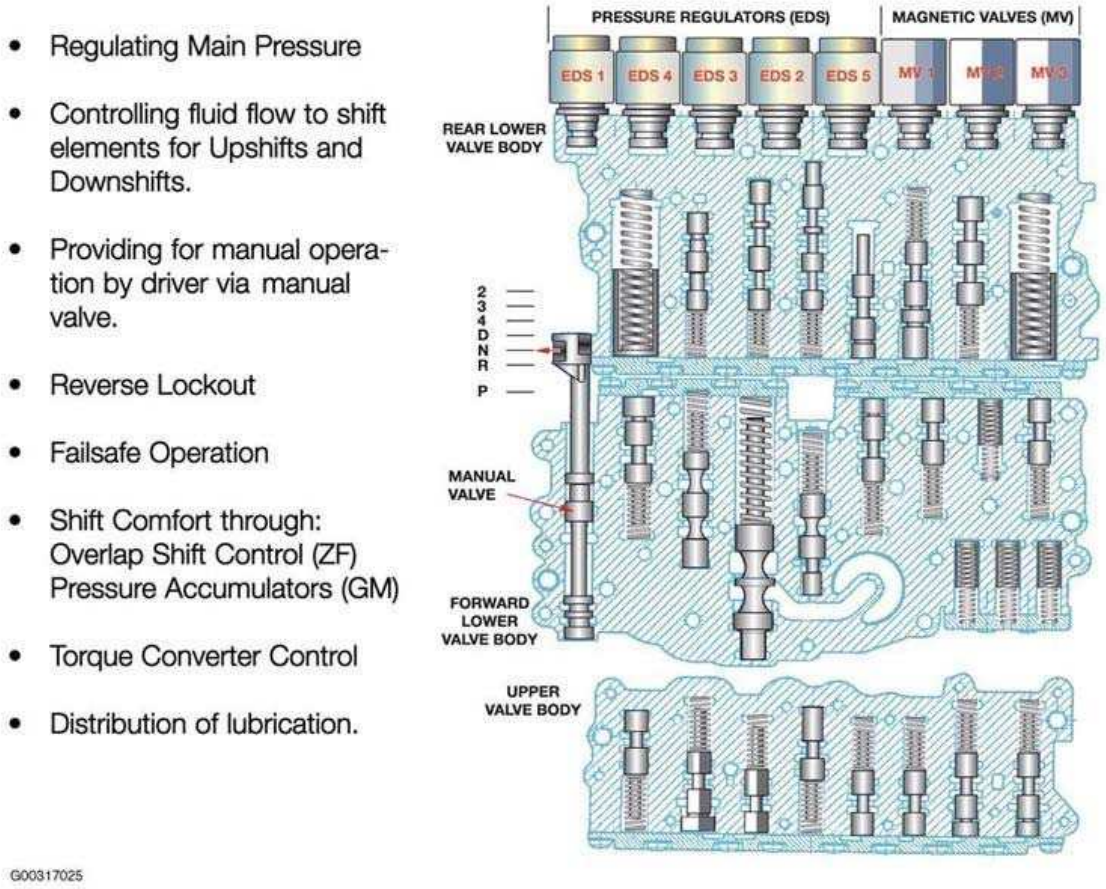


Fig. 15: Identifying Electro/Hydraulic Valve Body Components
Courtesy of BMW OF NORTH AMERICA, INC.

Shift Valves

Shift valves are used to direct application pressure to the various shift elements. Shift valves are regulated by spring pressure and control pressure for the shift solenoids. Shift valves come in various configurations depending upon application and transmission type. The most basic is the 3/2 shift valve. The 3/2 shift valve has 2 positions which are switched through one or two control pressures.

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With no control pressure from shift solenoid present, the shift valve is moved to its end travel (left) by spring pressure. Operating pressure is blocked to the shift component. Also in this position any application pressure is drained from the shift component. See **Fig. 16**.

Once the control pressure is applied to the 3/2 shift valve, the shift valve moves to the right. This allows operating pressure to reach the shift component. When the control pressure is again reduced, spring pressure returns the 3/2 shift valve to the rest position. This drains and operating pressure from the shift component. See **Fig. 17**.

Operating Pressure to Shift Component. The example shown is a 4/2 shift valve. The operation is similar to the 3/2 valve. The primary difference is that the 4/2 shift valve affects 2 shift components. See **Fig. 18**.

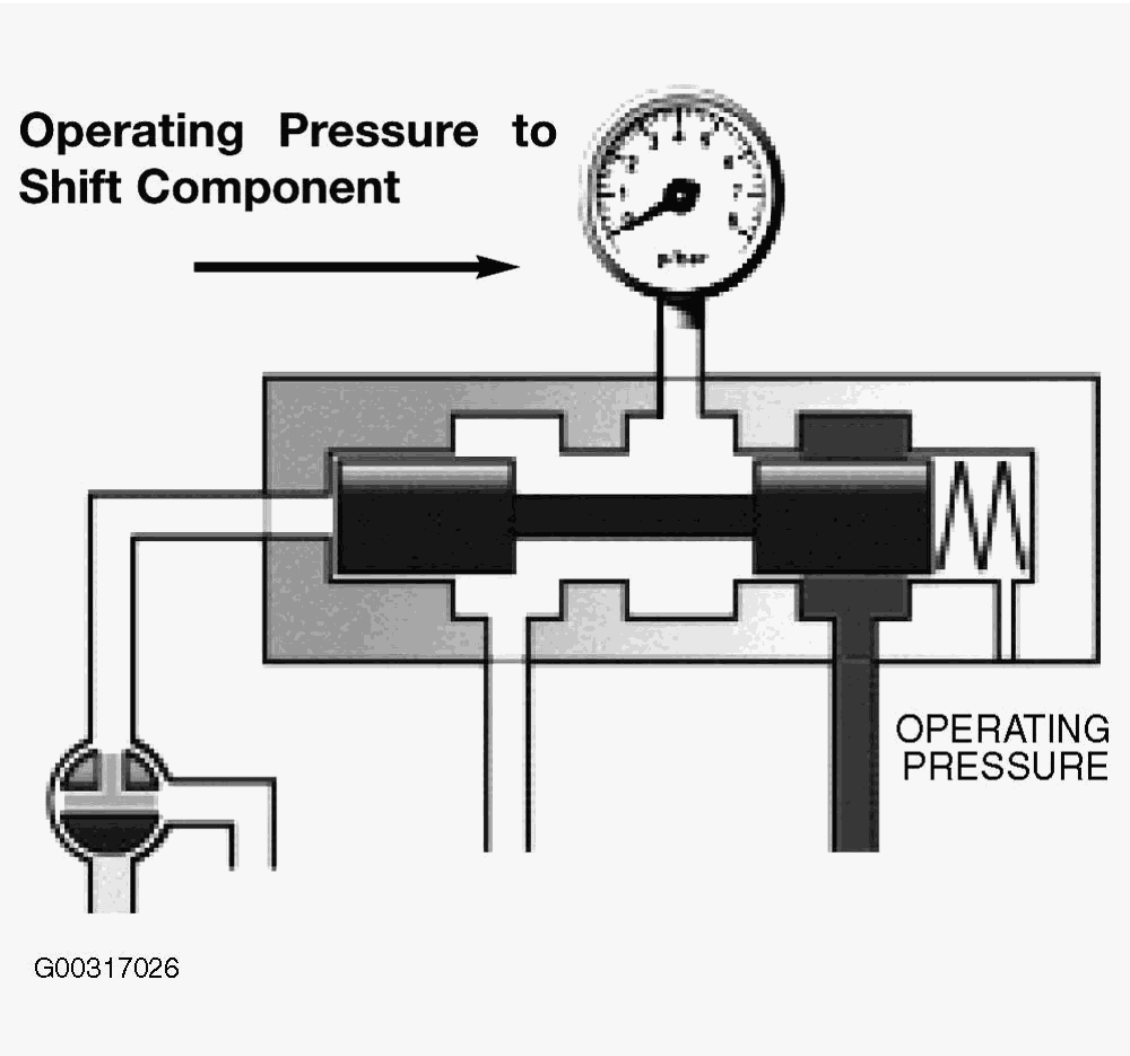


Fig. 16: Shift Valve Operation (1 Of 3)
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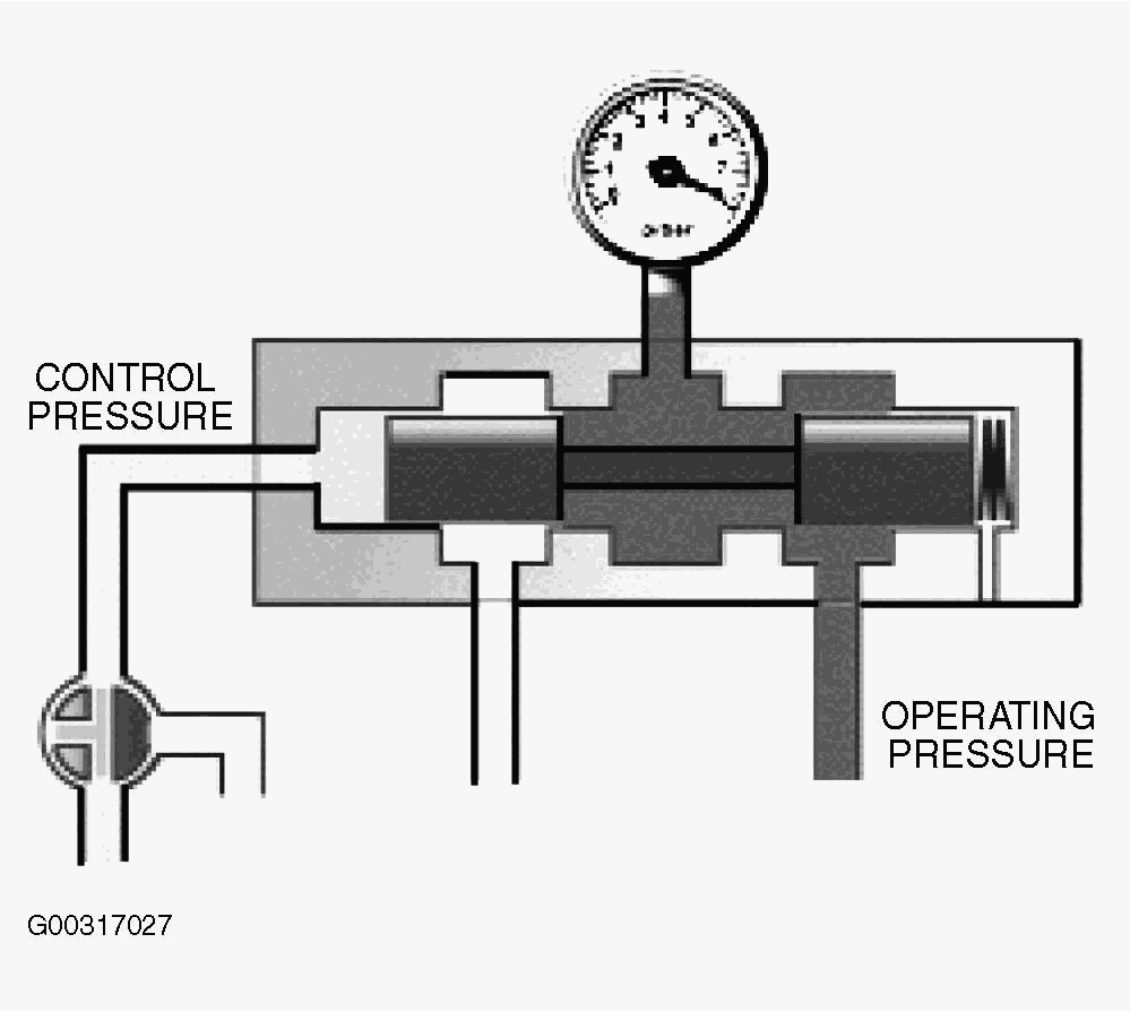


Fig. 17: Shift Valve Operation (2 Of 3)
Courtesy of BMW OF NORTH AMERICA, INC.

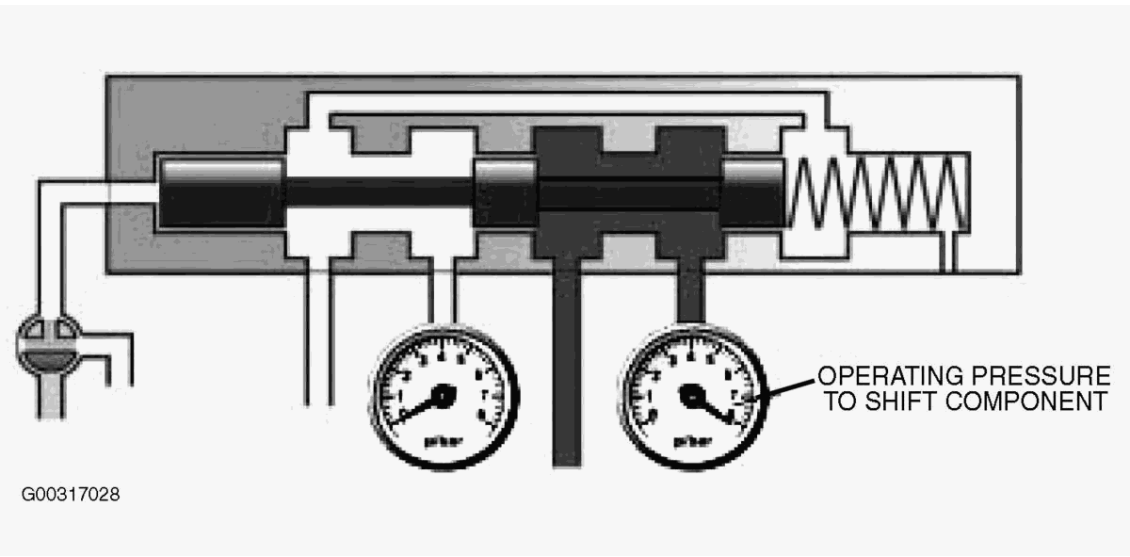


Fig. 18: Shift Valve Operation (3 Of 3)

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Pressure Regulation

Pressurized oil from the pump must be regulated for use within the transmission. Otherwise, the high pressure directly from the pump would influence shift quality. The shifts would be more abrupt and harsh. In order to "fine tune" the pressures within the transmission, there is a pressure regulating valve and a pressure regulating solenoid. The pressure regulating valve is located in the oil pump housing or the valve body dependent upon transmission type. The pressure regulating solenoid is a pulse width modulated (PWM) solenoid. Current is controlled by the TCM. The pressure regulating solenoid is normally closed, there is maximum line pressure available when minimum (or no) current is applied to the pressure regulating solenoid. Depending upon application, pressure regulating solenoid can be PWM with B- or B+ control. GM transmissions use B+ control with a constant ground supply. ZF transmissions uses B- control with a constant B+ supply.

There are also pressure regulators used in ZF transmissions that are used to control shift pressures. The A5S440Z and A5S560Z both use EDS solenoids for "Overlap Shift Control" this will be explained later in this text. There are a few different names for pressure regulating solenoids depending upon the transmission type and manufacturer:

- ZF transmissions use the following terms - EDS solenoid (valve), or MV (magnetic valve).
- Hydramatic (GM) transmissions use the following terms: DR solenoid, Force Motor Solenoid or Variable Bleed Solenoid.

Transmission operating pressures are regulated based on engine speed, throttle angle and engine load. The regulated pressure from the pressure regulating solenoid is referred to as throttle pressure. This pressure is fed to the main pressure regulating valve. See **Fig. 19**.

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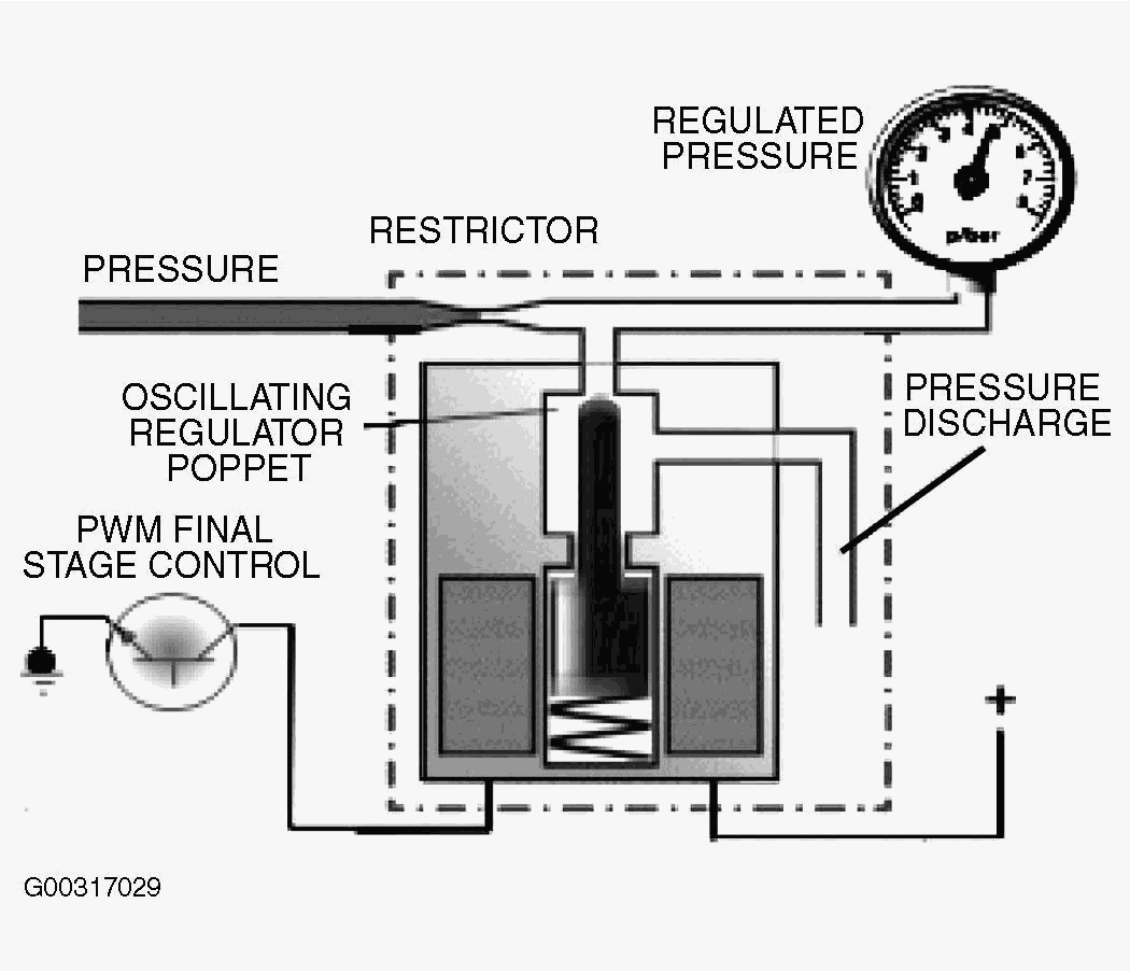


Fig. 19: Identifying Transmission Operating Pressure
Courtesy of BMW OF NORTH AMERICA, INC.

Pressure Regulation

As the diagram shows, regulating valve pressure is fed to the pressure regulating solenoid. See **Fig. 20**. This pressure is then regulated to create throttle pressure. Throttle pressure is modified based on throttle angle, engine speed and engine load. Throttle pressure is then fed to the pressure regulating valve. As throttle pressure increases, the regulating valve piston is moved to the left (with respect to the diagram). As the regulating valve piston is moved to the left, operating pressure is increased to the 4/2 shift valve. The operating pressure to the 4/2 shift valve will be fed to Shift Component A or Shift Component B depending the position on the 4/2 shift valve. The operating pressure to the shift components will be increased or decreased depending upon the throttle valve pressure. As engine speed and load are increased, the operating pressure will be increased to provide higher clamping forces on the shift components. When there is no electrical power present to the pressure regulator solenoid, throttle pressure will be a maximum. Therefore maximum operating pressure will be available at the 4/2 shift valve. This condition would exist if the transmission was operating in failsafe mode.

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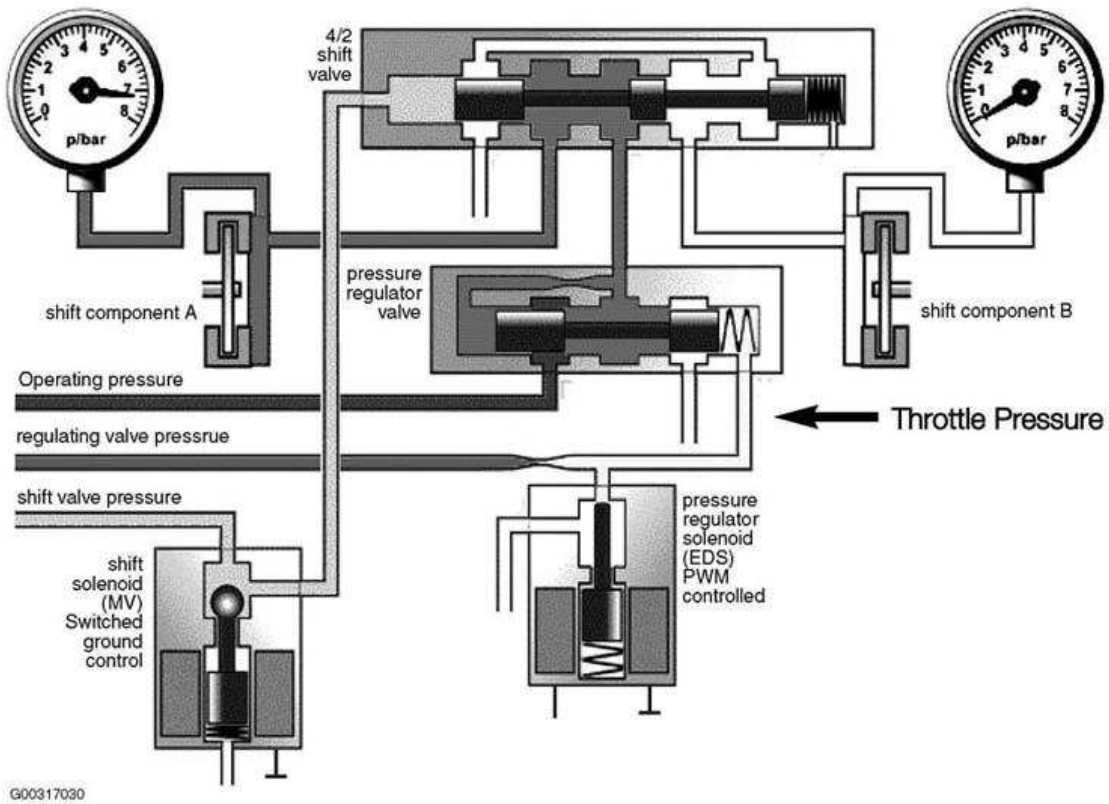


Fig. 20: Identifying Transmission Regulation Pressure
Courtesy of BMW OF NORTH AMERICA, INC.

APPLY COMPONENTS

Multi - Plate Clutches and Brakes

Multi Plate Clutches and Brakes are used to drive or hold members of the planetary gear set. See **Fig. 21**. As a general rule, Multi Plate Clutches connect one planetary member to another. Multi Plate Brakes connect a planetary member to the case to hold it stationary. The clutches and brakes consist of a number of friction discs and steel discs. The friction discs are coated with a friction material and have engaging lugs (splines) on the inner perimeter. The steel discs are steel on both sides and have engaging lugs located on the outer perimeter. The engaging lugs on the friction discs are usually engaged with a planetary member. The engaging lugs on the steel discs are usually engaged with the clutch piston housing. In addition to the friction and steel discs, there is also an apply piston, housing and return spring. Once hydraulic fluid is applied to the clutch assembly, the friction discs and steel discs will be locked together. Once hydraulic pressure is released, the return spring will cause the clutch piston to return to its rest position which will unlock the clutch assembly. See **Fig. 22**.

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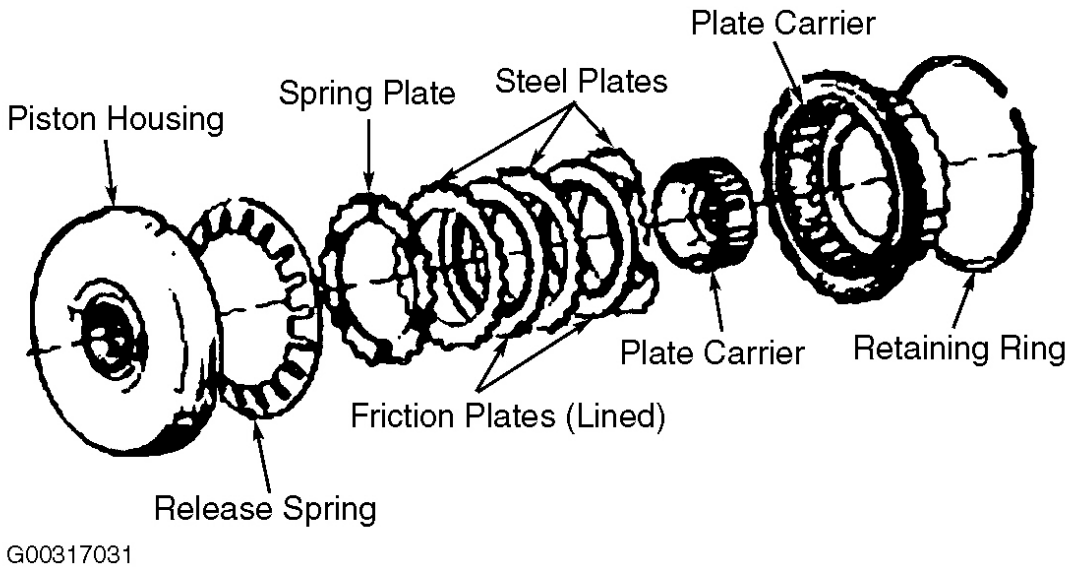


Fig. 21: Identifying Multi-Plate Clutches & Brakes
Courtesy of BMW OF NORTH AMERICA, INC.

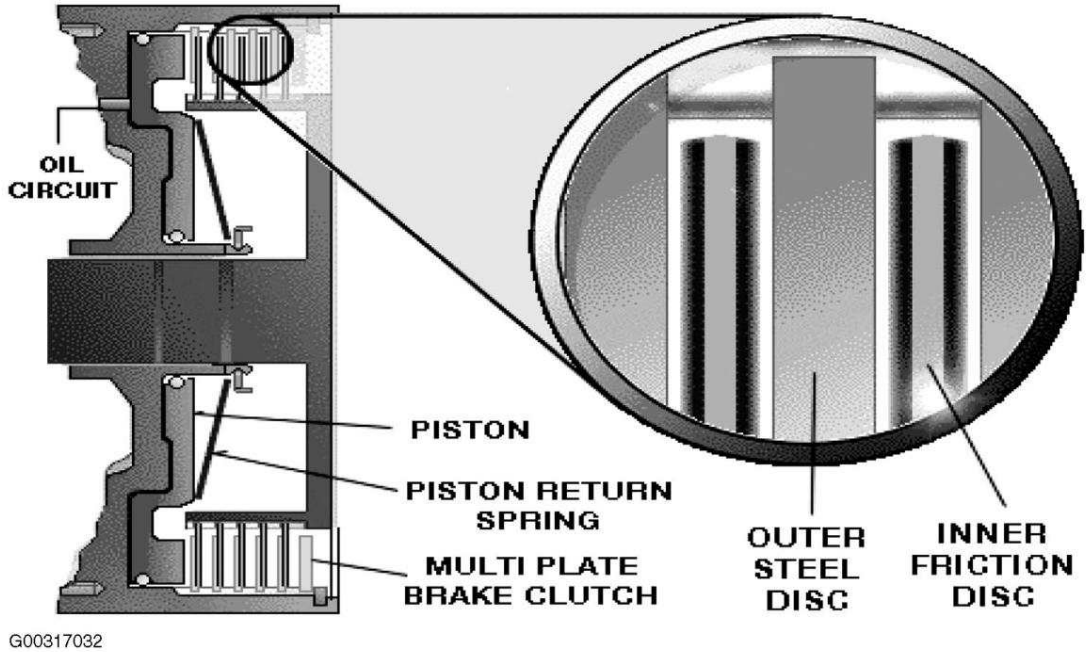


Fig. 22: Multi-Plate Clutch Identification
Courtesy of BMW OF NORTH AMERICA, INC.

Multi - Plate Clutch Operation

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In order to carry out a shift in ratio, fluid needs to be applied or released from the Multi - Plate Clutch (or Brake). As shown in the example at the right, the following sequence occurs:

1. Fluid from a shift valve in the valve body is applied to the clutch assembly.
2. Fluid pressure builds behind the apply piston and overcomes the resistance from the diaphragm spring.
3. The friction and steel discs are compressed together and become locked, preventing any slippage between them.
4. Two planetary members are now locked together.
5. When fluid pressure is released, the steel and friction discs are allowed to unlock.
6. The diaphragm spring pushes against the apply piston and returns the piston back to the rest position.
7. The check ball in the apply piston is unseated by centrifugal force which allows the clutch to drain completely. See **Fig. 23**.

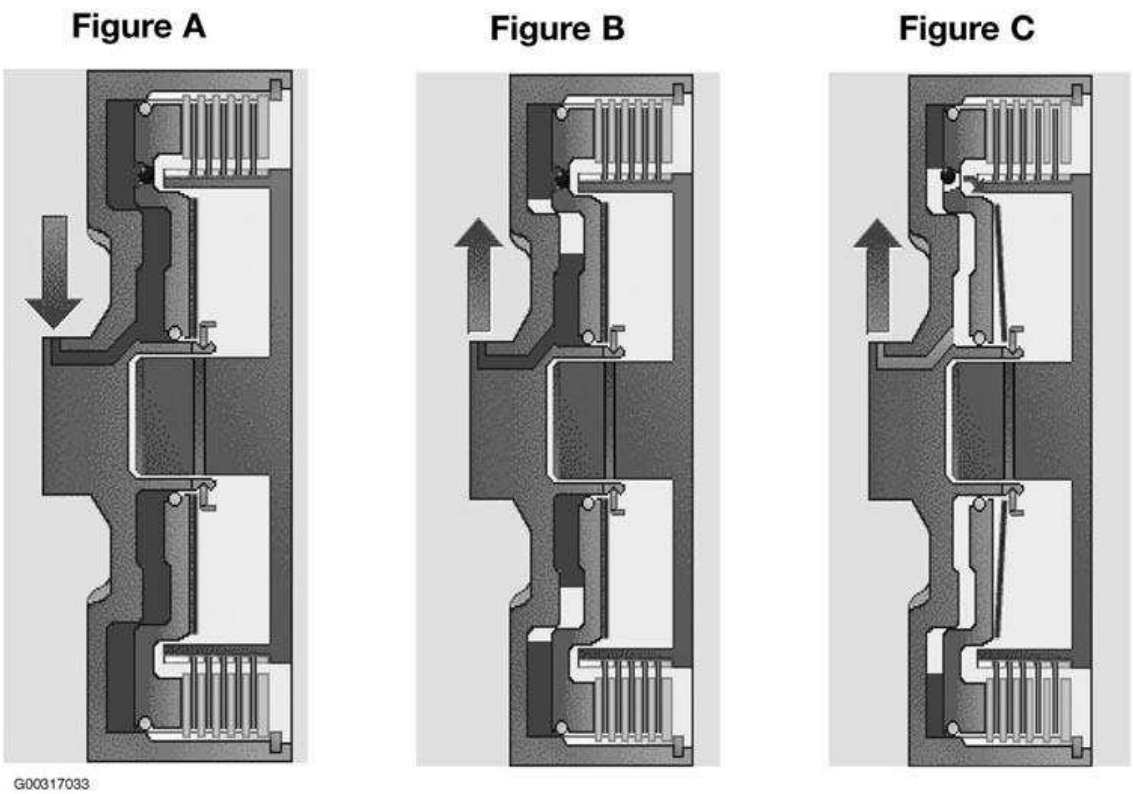


Fig. 23: Multi-Plate Clutch Operation
Courtesy of BMW OF NORTH AMERICA, INC.

BAND BRAKES

On some BMW transmissions there is a band type brake used for some applications. The A4S270/310R and the A5S310Z use a band type brake. The brake band is a circular band with friction material bonded to the inner surface. The band wraps around a particular planetary component (clutch drum) and locks that component to the transmission case. The brake band is applied and released by the clutch apply piston. The brake band is not

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adjustable on the A5S310Z, however there is some adjustment allowed when needed on the A4S270/310R. The brake band functions in the following manner on BMW transmissions:

- A4S270/310R - The brake band is active (applied) in first and second gear. The brake band holds the reaction sun drum stationary. The reaction sun drum is splined to the reaction sun gear.
- A5S310Z - The brake band is active (applied) in second, third and fifth gear. The brake band holds the forward sun gear to the case. See **Fig. 24**.

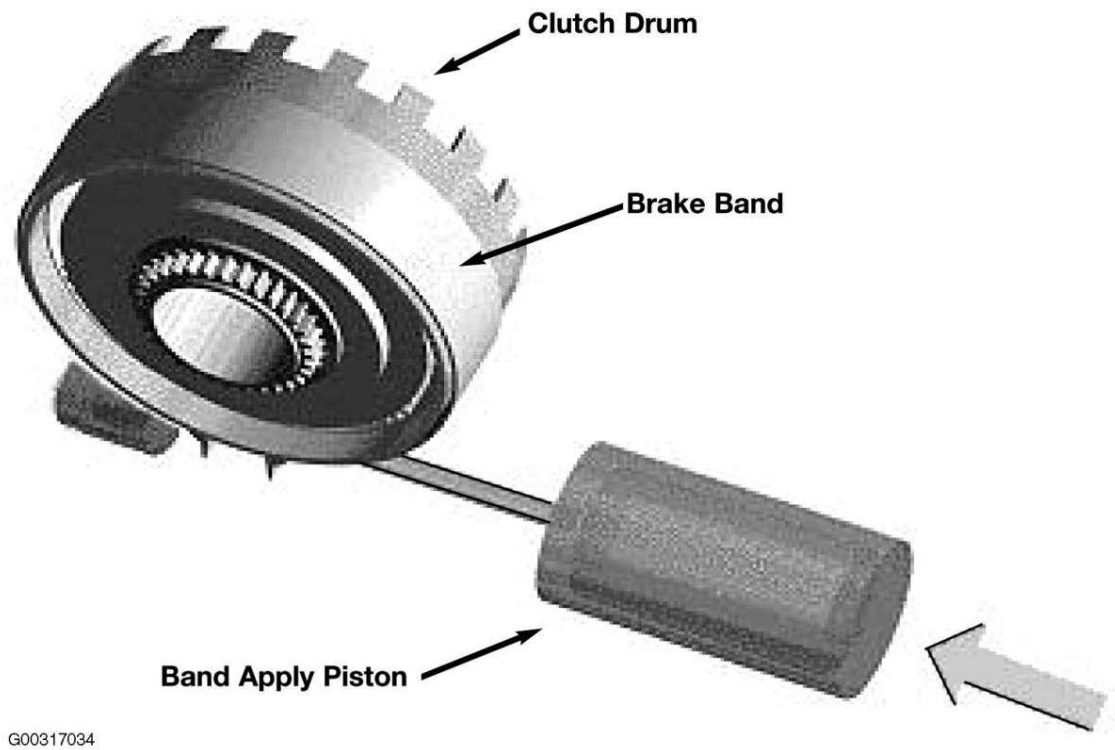


Fig. 24: Identifying Band Brake Operation
Courtesy of BMW OF NORTH AMERICA, INC.

ONE-WAY CLUTCHES (FREEWHEEL)

The one way clutch consists of an inner and outer ring with a locking device between the two. The one way clutch is designed to lock in one direction and to allow free rotation in the other direction. See **Fig. 25**. Currently there are two types of one way clutches used in BMW transmissions:

- Roller type which consists of spring loaded rollers between the inner and outer race of the one way clutch. (Roller type is also used without springs on some applications).
- Sprag type which consists of asymmetrical shaped wedges located between the inner and outer race of the one way clutch.

In both versions of the one way clutch (freewheel), rotation is only allowed in one direction. Using the diagrams above, imagine that the inner races were locked stationary. The outer race would only be allowed to turn

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counter clock wise. In the clock wise direction, the outer race of both versions would be locked. In the roller type, the helper springs would push the rollers up the ramp on the outer race. This would force the rollers in to the smaller area which would cause the outer race to lock, In the sprag type, the asymmetrical wedges would lock between the inner and outer race. The one way clutches are used in the transmission to prevent an interruption of drive torque during certain gear shifts and to allow engine braking during coasting. Also there is a one way clutch in the stator of the torque converter.

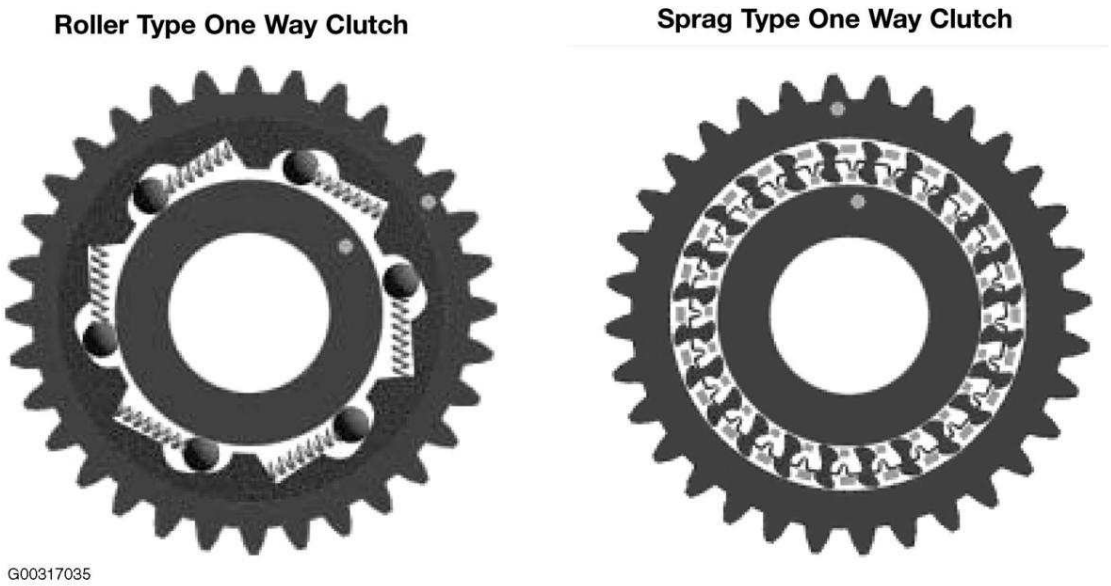


Fig. 25: Identifying One-Way Clutches
Courtesy of BMW OF NORTH AMERICA, INC.

PLANETARY GEAR SET

Planetary gear seats are compact gear units that receive input drive torque and provide the required output ratios for all forward gears and reverse gear. The planetary gear set consists of four main components:

1. Internal ring gear.
2. Planetary gears (pinions).
3. Sun gear.
4. Planetary gear carrier.

Various ratios are obtained by driving or holding different components in the planetary gear set. The example shown is a simple planetary gear set. See **Fig. 26**. Today's modern transmissions use a combination of multiple planetary gear sets referred to as a compound planetary gear set.

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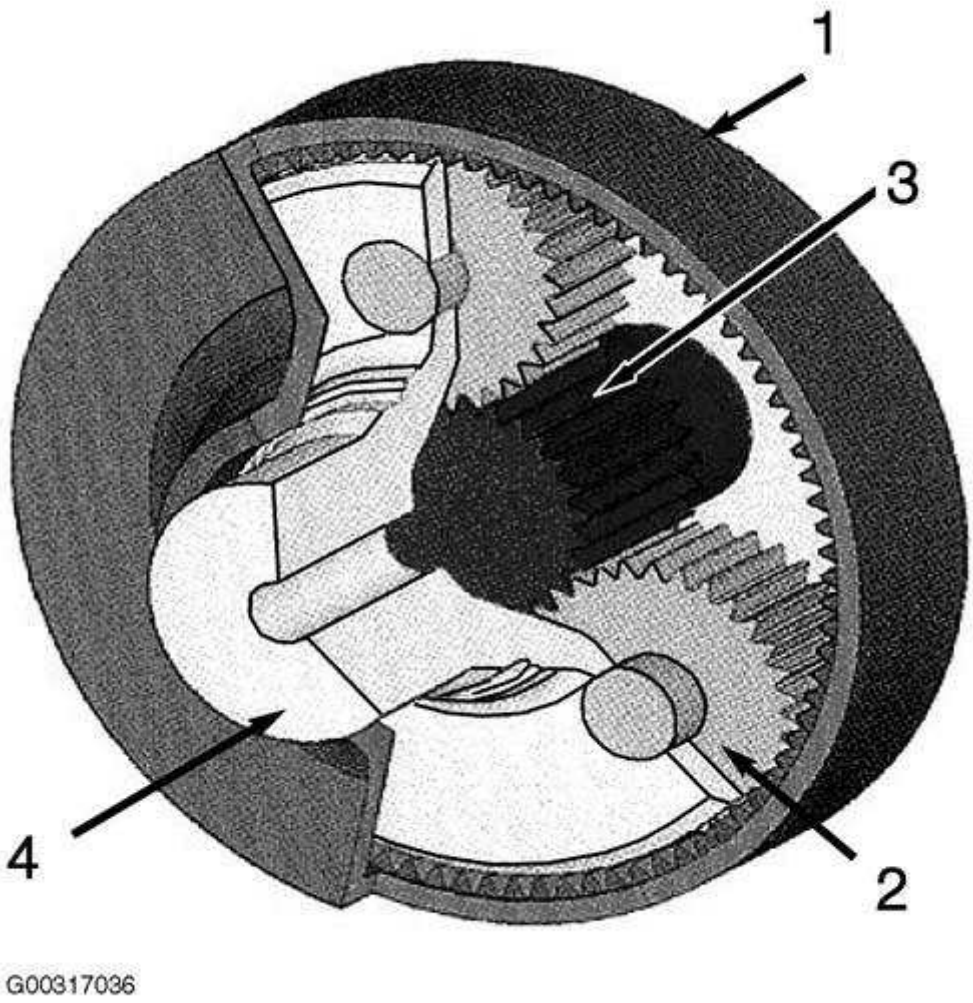


Fig. 26: Identifying Planetary Gear Set
Courtesy of BMW OF NORTH AMERICA, INC.

Advantages of Planetary Design

There are distinct advantages to the planetary gear set in comparison with a standard transmission gear set. Primarily, drive torque does not need to be interrupted to change gears. The planetary members are in constant mesh and there are more teeth engaged in any given ratio. This allows more torque to be transferred through the transmission.

Basic Power Flow Example

As an example of power flow in reverse gear, planetary gear carrier (4) is held stationary. The sun gear (3) is driven in a clockwise direction. The planetary pinions (2) are driven counterclockwise, which in turn drives the internal ring gear (1) counter clockwise as well. See **Fig. 27**.

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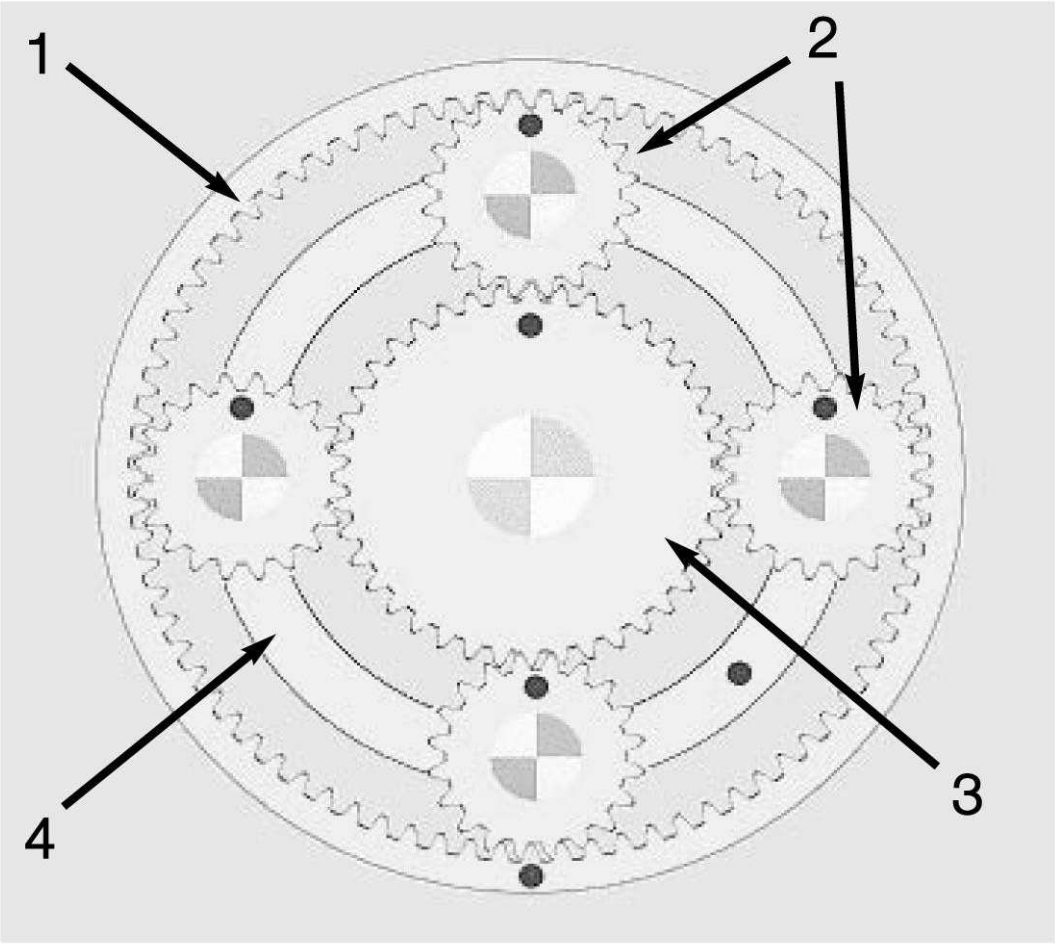


Fig. 27: Identifying Basic Power Flow
Courtesy of BMW OF NORTH AMERICA, INC.

Compound Planetary Gear Sets

Compound planetary gear sets use multiple planetary components which are a variation on the simple planetary gear set. Since the inception of the simple planetary gear set, there have been numerous compound gear sets introduced. BMW transmissions use the following gear sets:

- Simpson Gear Set - used on 4HP22 and 4HP24.
- Ravigneax Gear Set - used on A4S270R, A4S310R, A5S310Z, A5S325Z, A5S360R and A5S390R.
- Wilson Gear Set - used on A5S440Z and A5S560Z.
- Lepelletier Gear Set - used on the GA6HP26Z.

Simpson Gear Set

The Simpson Gear Set is one of the early variations on the simple set. It is capable of 3 forward gears and one

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reverse. On BMW transmissions, the Simpson Gear set is used in the 4HP transmission which is a four speed automatic. See **Fig. 28**. Fourth gear (overdrive) is obtained by the addition of an auxiliary gear set (simple). Characteristics of the Simpson Gear set are as follows:

- Two Internal Ring Gears, one rear input ring and one attached to the rear planetary carrier.
- Two Planetary carriers, each containing three planetary pinions.
- One common Sun gear, which meshes with both sets of planetary pinions.

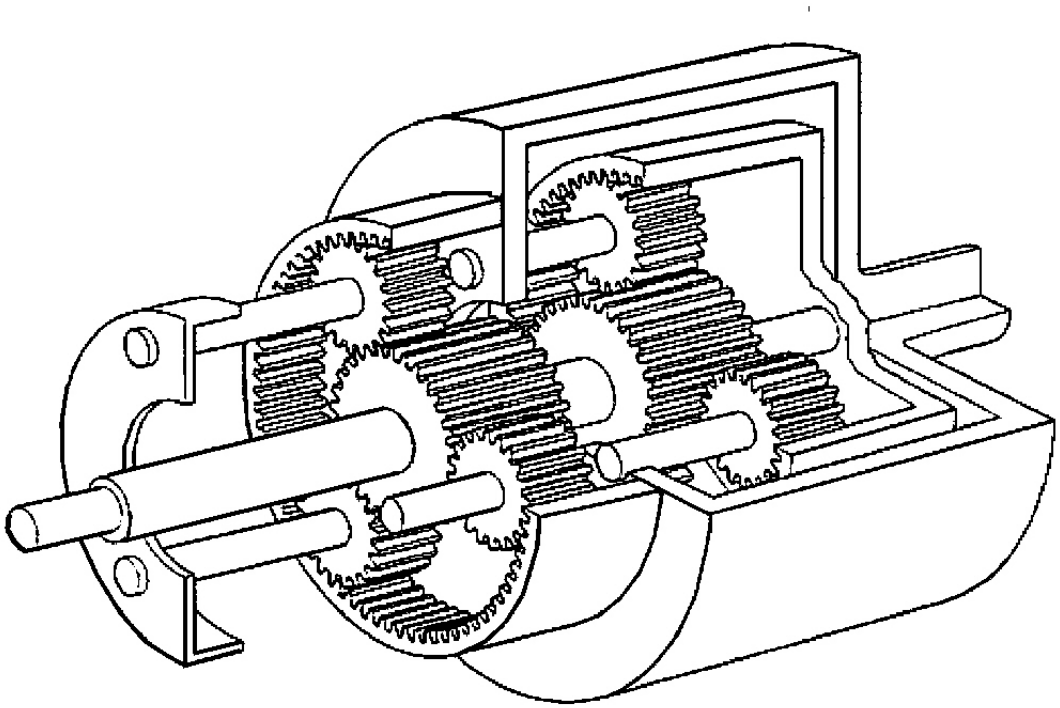


Fig. 28: Identifying Simpson Gear Set
Courtesy of BMW OF NORTH AMERICA, INC.

Ravigneaux Gear Set

A new version on the planetary design is the Ravigneaux gear set. See **Fig. 29**. This gear set is capable of 4 forward gears and one reverse. However, depending upon application it may be used with an auxiliary gear set. Here are some examples:

- The A4S310/270R uses the Ravigneax set for 3 forward gears and one reverse. Overdrive is obtained by the auxiliary gear set.
- The A5S310Z uses a combination of the Ravigneaux gear set and the auxiliary gear set to obtain 5 forward gear and one reverse. First, second and reverse gears are achieved by using a combination of both gear sets.

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- The A5S360/390R uses a modified version of the Ravigneaux set that provides five forward gears and one reverse. There is no auxiliary gear set used.

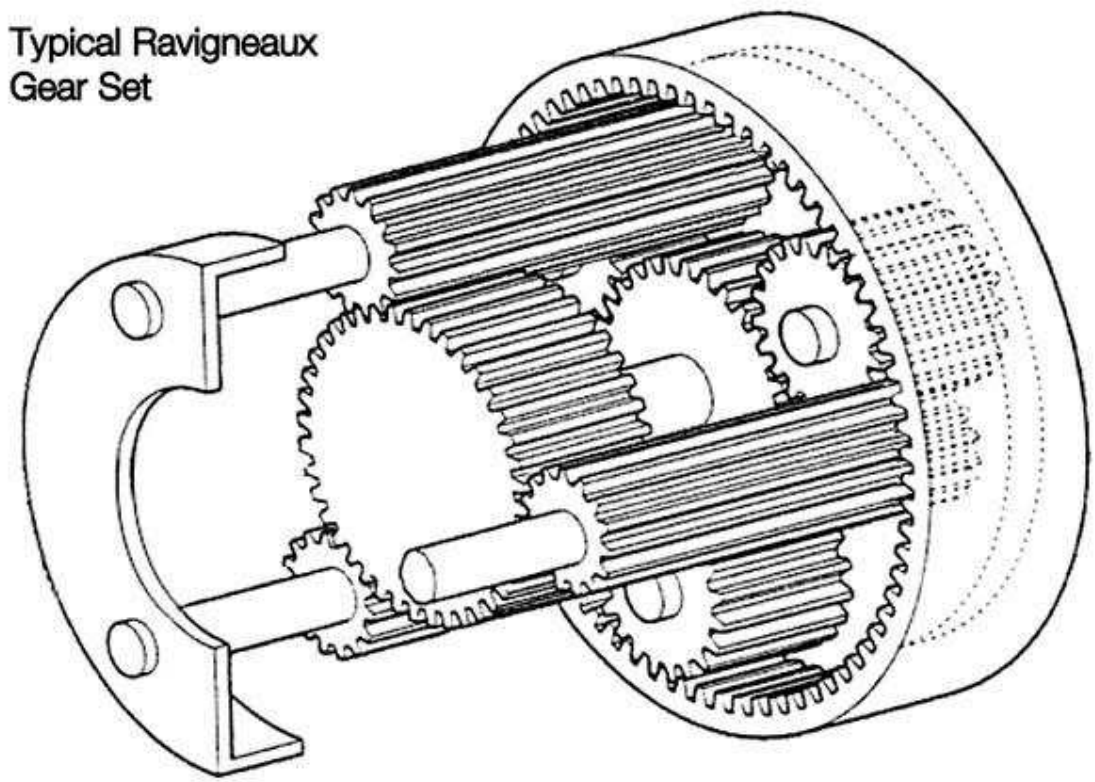


Fig. 29: Identifying Ravigneaux Gear Set
Courtesy of BMW OF NORTH AMERICA, INC.

Characteristics of the Ravigneaux Gear Set are:

- One planetary carrier which is common to both sets of planetary pinions.
- Two sets of planetary pinions, one long set with small diameter and one short set with large diameter.
- Two sun gears, one input sun gear and one reaction sun gear.
- One common ring gear.

NOTE: The Ravigneaux Gear Set shown in the figure is a typical representation. There are a few variations of this arrangement used on BMW transmissions.

Wilson Gear Set

On BMW transmissions, the Wilson gear set is only used on the A5S440Z and A5S560Z. See **Fig. 30**. The Wilson Gear Set consists of three planetary gear sets. The ring gear of the first gear set, the planetary carrier of the second gear set and the ring gear of the third planetary gear set and directly connected to the "Pot". The "Pot" is a cylindrical device that slides over all of the components to unitize the individual gear sets into an

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assembly. The characteristics of the Wilson Gear Set are:

- Three planetary carriers.
- Three ring gears, with ring gear 1 and 3 meshed to "Pot" assembly.
- Three sun gears, sun gear 2 and 3 are common (attached). Sun gears 2 and 3 are also referred to as the "Double Sun Gear".

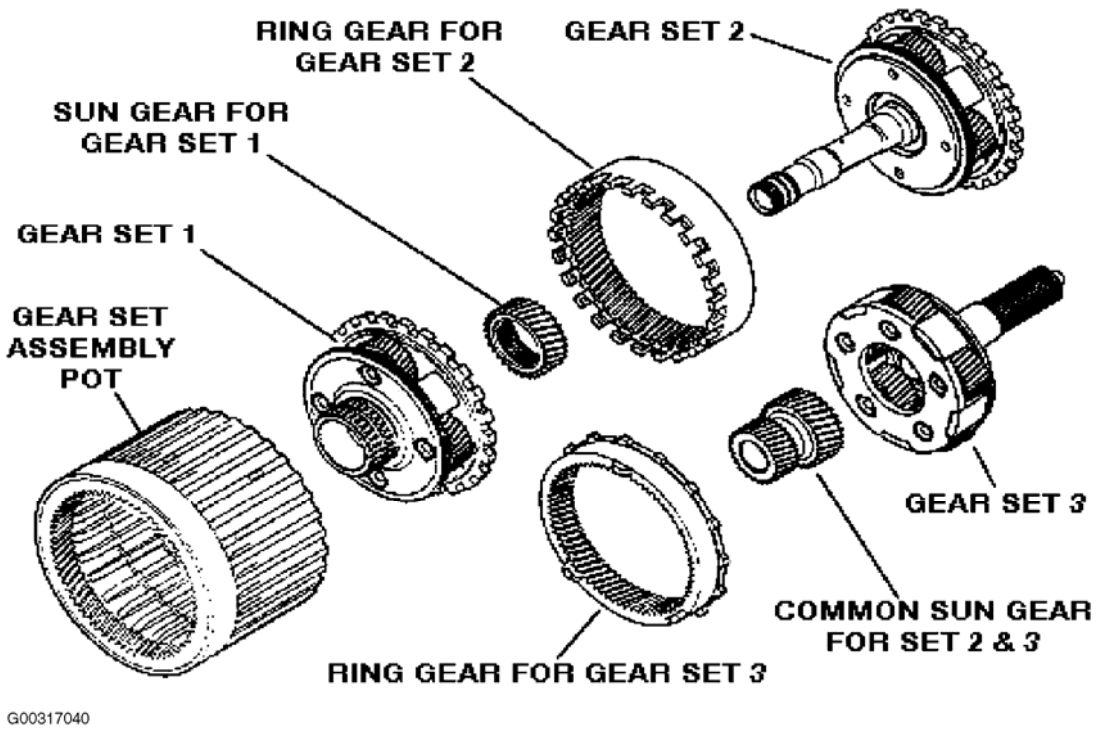


Fig. 30: Identifying Wilson Gear Set
Courtesy of BMW OF NORTH AMERICA, INC.

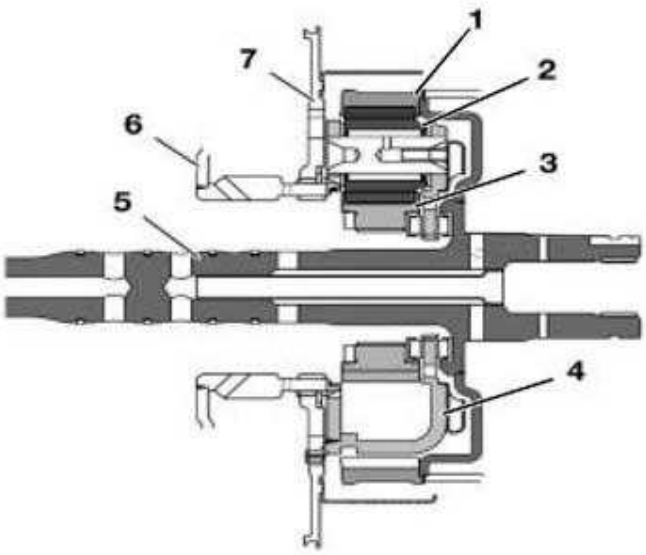
Lepelletier Gear Set

The Lepelletier Gear Set was introduced to BMW on the ZF GA6HP26Z. See **Fig. 31**. This gear set allows for 6 forward speeds and one reverse gear using a light weight design. The planetary gear train consists of a single carrier planetary gear train and a downstream double planetary gear train.

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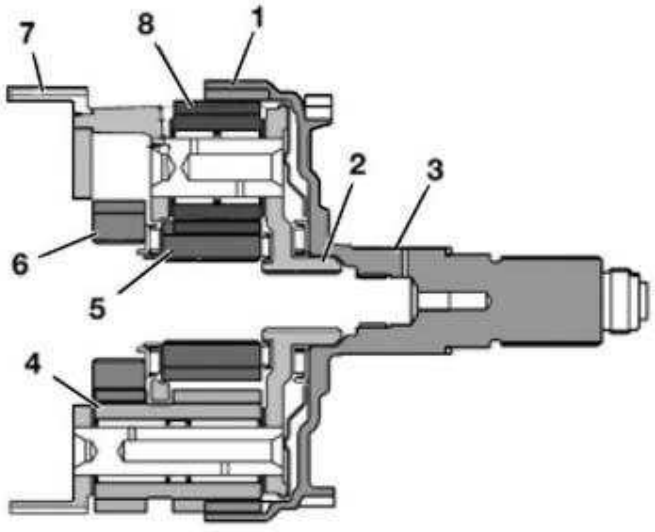
Lepelletier Gear Set

1. Internal Ring Gear 1
2. Planet Gear (pinion)
3. Planet Carrier
4. Planet Carrier
5. Turbine Shaft
6. Cylinder A
7. Pressure Plate A



Double Planetary Set

1. Internal Gear 2
2. Planet Carrier Clutch E
3. Output
4. Double Planet Gear Long
5. Sun Gear 3, Clutch E
6. Sun Gear 2, Clutch A
7. Planer carrier 1
8. Planet Gear (short)



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Fig. 31: Identifying Lepelletier Gear Set
Courtesy of BMW OF NORTH AMERICA, INC.

Planetary Gear Set Operation

In order to understand planetary gear set operation, it is important to understand some basic rules of operation:

- It is assumed that engine rotation is clockwise when referring to power flow charts and diagrams.
- Planetary pinions will always rotate in the same direction as the internal ring gear.
- When the sun gear is driven clockwise and the planetary carrier is held stationary the internal ring gear will rotate counter clockwise (reverse gear).

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- When two or more planetary members are locked together, the assembly will rotate together. The ratio from input to output is 1:1.
- When the sun gear is held stationary and the planetary carrier is driven clockwise, the ring gear will be driven clockwise in an overdrive ratio (.75:1)

When trying to understand power flow schematics, it is important to be able to draw a comparison between the actual planetary components and the schematic symbols. The diagram below outlines the relationship between these components and the power flow schematic. The schematic is a representation of a cross section of the transmission, but you only see the top half of the cross section. The transmission is shown as though it has been quartered lengthwise. See **Fig. 32**.

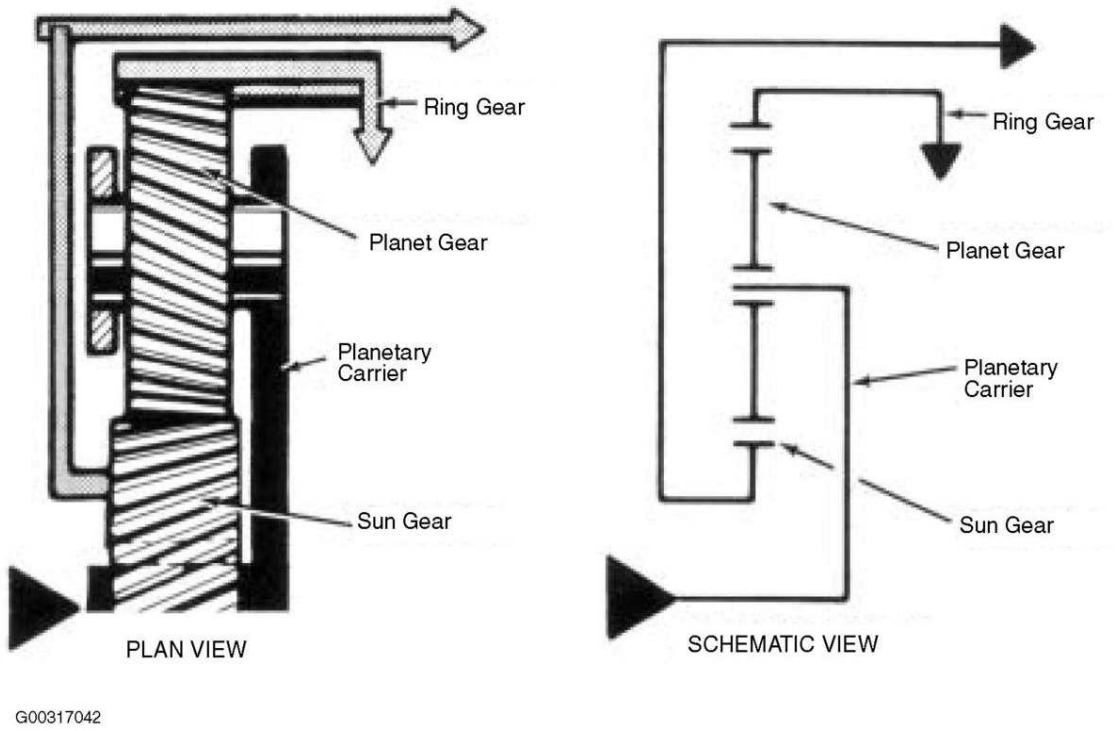


Fig. 32: Identifying Gear Set Operation
Courtesy of BMW OF NORTH AMERICA, INC.

POWER FLOW SCHEMATIC

In order to understand power flow schematics, a relationship must be drawn between the actual components and the schematic representation. This example uses the 4HP22/24 power flow schematic. The 4HP22/24 transmission uses a Simpson Planetary Gearset and an auxiliary gearset. The auxiliary gear set is a simple planetary gearset. See **Fig. 33**.

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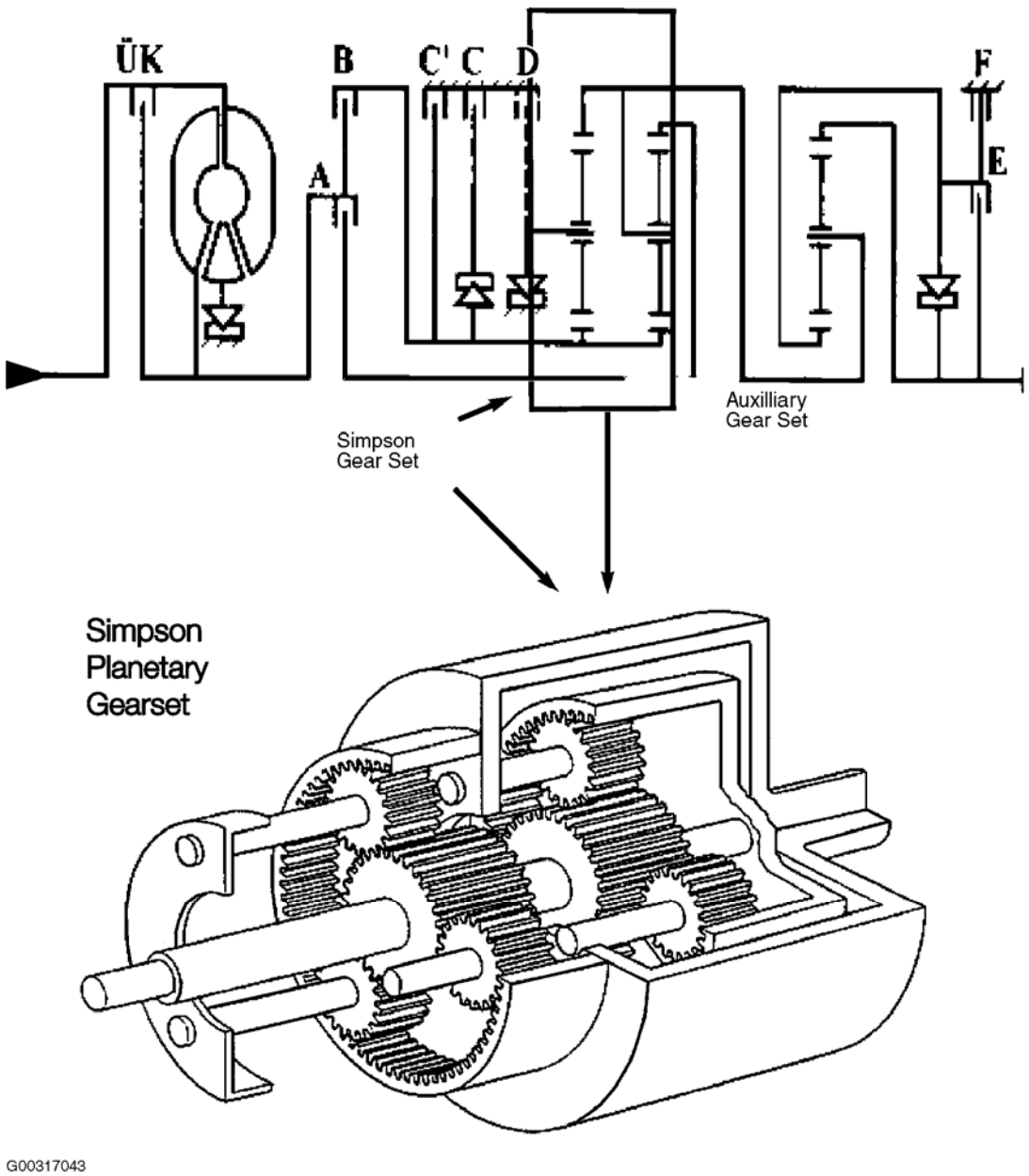


Fig. 33: Identifying Power Flow Schematic
Courtesy of BMW OF NORTH AMERICA, INC.

Power Flow In First Gear

Drive torque is applied to the torque converter impeller and transferred to the turbine. The turbine shaft rotates clockwise (CW). The "A" clutch locks the turbine shaft to the rear input ring gear. The rear input ring gear rotates CW driving the rear planet pinions CW. The planetary pinions drive the common sun gear CCW, which in turn drive the front planet pinions CW. The front planetary carrier is held from rotating CCW by one way clutch "J". The front planetary pinions which are rotating CW drive the front ring gear/rear carrier CW. The rear

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planetary carrier is rotating CW and is driving the planetary carrier from the auxiliary gear set. The "E" clutch in the auxiliary gear set is holding the Sun gear and the ring gear together. Therefore the auxiliary gear set is locked in a 1:1 ratio. See **Fig. 34**.

One Way Clutch "J" is locked to prevent the front planetary carrier from rotating CCW. One Way Clutch "H" is not used and One Way Clutch "K" is locked. One way clutch "K" is used to prevent an interruption in power flow before the "E" clutch is locked during the 4-3 shift. See **Fig. 35**.

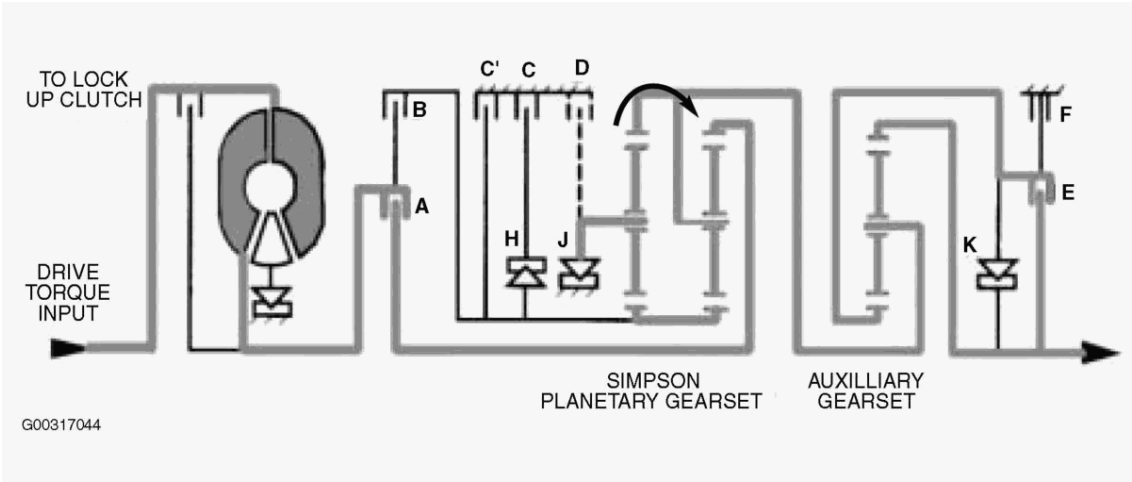


Fig. 34: Power Flow Schematic In First Gear
Courtesy of BMW OF NORTH AMERICA, INC.

ent an interruption in power flow before the "E" clutch is locked during the 4-

POSITION GEAR	D				3			2		1	R
	1	2	3	4	1	2	3	1	2	1	R
Clutch A	X	X	X	X	X	X	X	X	X	X	
Clutch B			X	X			X				X
Clutch C'		X				X			X		
Clutch C		X	X	X		X	X		X		
One Way Clutch H		X				X			X		
Clutch D										X	X
One Way Clutch J	X				X			X		X	
Clutch E	X	X	X		X	X	X	X	X	X	X
One Way Clutch K	X	X	X		X	X	X	X	X	X	X
Clutch F				X							

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Fig. 35: Power Flow In First Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Second Gear

Drive torque is applied to the torque converter impeller and transferred to the turbine. See **Fig. 36**. The turbine shaft rotates clockwise (CW). The "A" clutch locks the turbine shaft to the rear input ring gear. The rear input ring gear rotates CW driving the rear planet pinions CW. The sun gear is held stationary by the C' clutch. The rear planet pinions rotate around the fixed sun gear CW. The rear planetary carrier will rotate CW. The rear planetary carrier will drive the auxiliary gear set and will rotate as a complete unit. The auxiliary gear set is locked in a 1:1 ratio due to the "E" clutch locking the sun and ring gear together. The "C" clutch is locking the outer race of the "H" freewheel to the case. This is used for the 3/2 downshift. Freewheel "J" is not active and Freewheel "K" is locked.

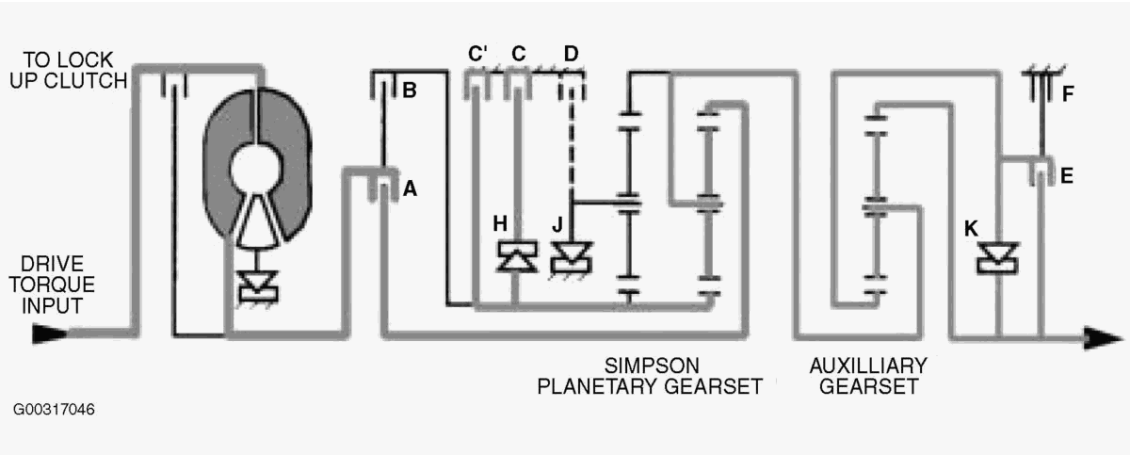


Fig. 36: Power Flow Schematic In Second Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Third Gear

Drive torque is applied to the torque converter impeller and transferred to the turbine. See **Fig. 37**. The turbine shaft rotates clockwise (CW). The "A" clutch and the "B" clutch are locked, this causes the rear input ring gear to be locked to the sun gear in the Simpson Gear set. The Simpson gear set is locked in a 1:1 ratio. The "E" clutch is locked which locks the ring gear to the sun gear in the Simpson gear set. The entire transmission planetary system is now locked in a 1:1 ratio. Freewheel "H" is overrun and freewheel "J" is not used. Freewheel "K" continues to be locked.

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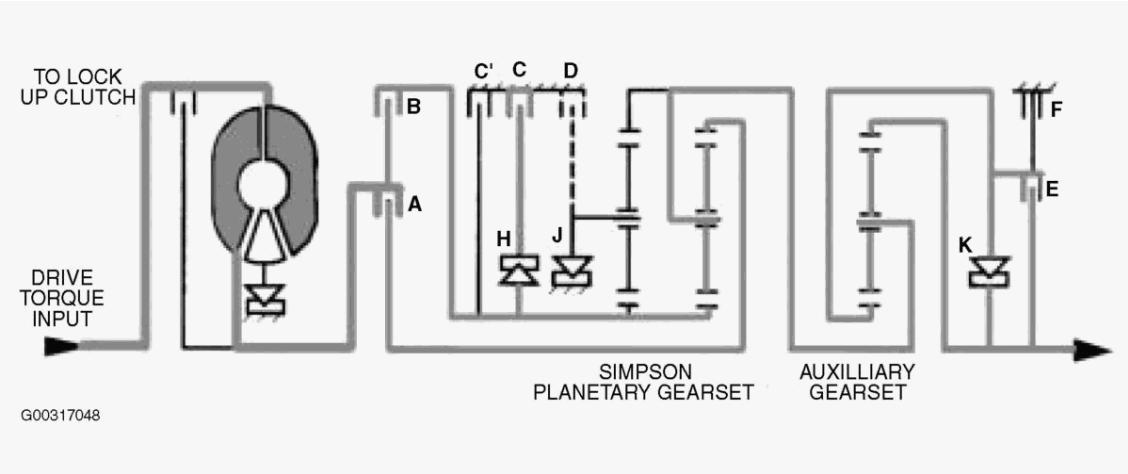


Fig. 37: Power Flow Schematic In Third Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Fourth Gear

Drive torque is applied to the torque converter impeller and transferred to the turbine. See **Fig. 38**. The turbine shaft rotates clockwise (CW). (The turbine shaft can also be driven by the lock up clutch when engaged). The "A" clutch and the "B" clutch are locked, this causes the rear input ring gear to be locked to the sun gear in the Simpson Gear set. The Simpson gear set is locked in a 1:1 ratio. The "F" clutch is locked which locks the sun gear in the auxiliary gear set to the case. The Simpson gear set drives the planetary carrier CW. The planet pinions walk around the fixed sun gear in a CW direction. This causes the ring gear to rotate CW as well. The ring gear, which is the output of the transmission is driven in an overdrive ratio. Freewheel "H" and "K" are overrun. Freewheel "J" is not used.

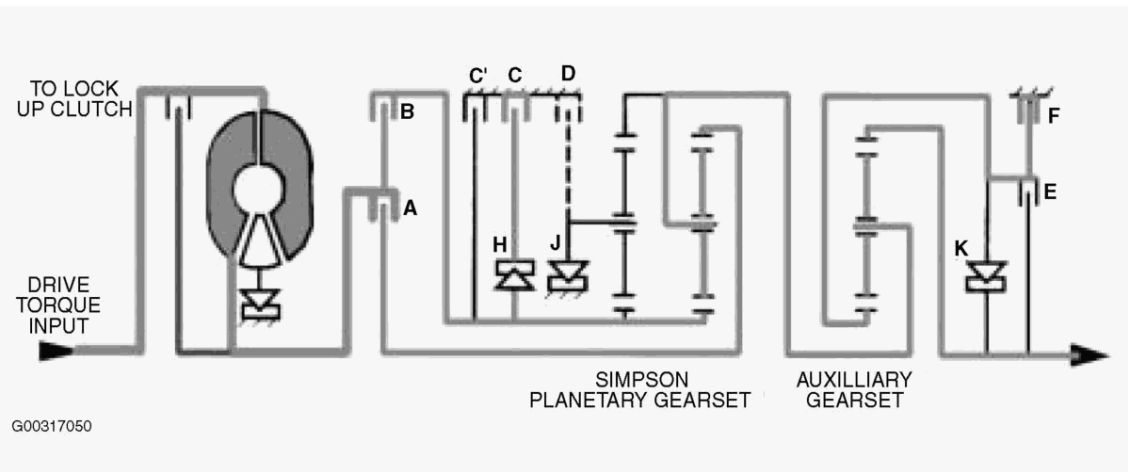


Fig. 38: Power Flow Schematic In Fourth Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Reverse Gear

Drive torque is applied to the torque converter impeller and transferred to the turbine. See **Fig. 39**. The turbine shaft rotates clockwise (CW). The "B" clutch is locked which drives the sun gear in the Simpson gear set CW.

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The sun gear drives the planet pinions CCW. The planetary carrier is held stationary by the "D" clutch. The planet pinions cause the front ring gear to rotate CCW. The front ring gear (and rear carrier) drive the auxiliary gear set CCW which rotates at a ratio of 1:1 due to the "E" clutch locking the sun and ring gear of the auxiliary gear set. Freewheel "H" and "J" are not used. Freewheel "K" is locked.

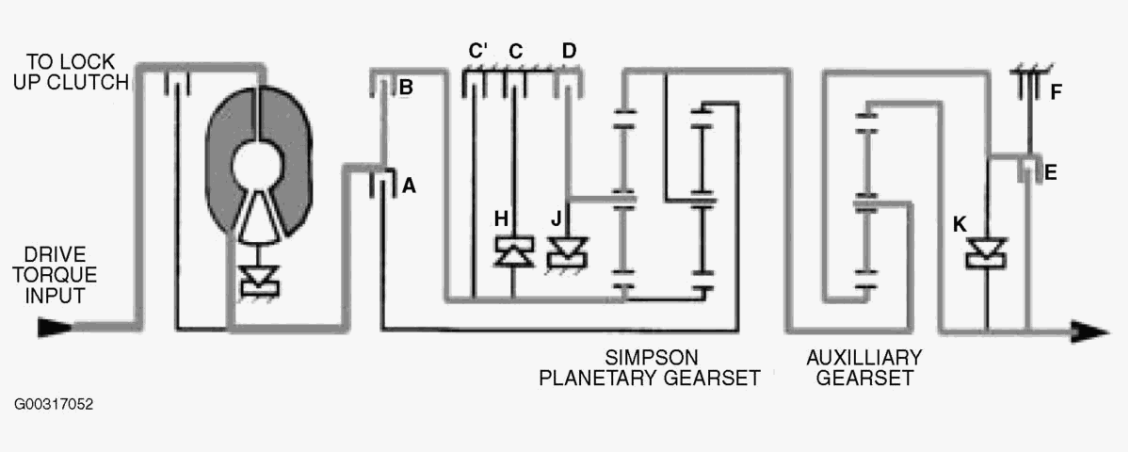


Fig. 39: Power Flow Schematic In Reverse Gear
Courtesy of BMW OF NORTH AMERICA, INC.

SHIFT CONTROL

Freewheel Shifting

In order to prevent an interruption in power flow, freewheel (One Way Clutches) are used to lock members of the planetary gear set. Certain transmissions such as the 4HP22/24, A4S270/310R and the A5S360R use freewheel shifting on all gear shifts. Transmissions such as A5S310Z, A5S440Z, A5S560Z and GA6HP26Z use freewheel shifting for only specific shifts. Other shifts in these transmissions use overlap shifting technology. To demonstrate how the freewheel is used, the freewheel "H" in the 4HP22/24 transmission will be examined.

In third gear, the sun gear is rotating clockwise. Freewheel "H" is overrun (unlocked) allowing the sun gear to rotate. Clutch "C" is active which locks the outer race of freewheel "H" to the case. During a 3/2 downshift, clutch "B" is released. The sun gear is held from rotating counter clockwise by freewheel "H" and the "C" clutch. Freewheel "H" is used to stop the counter clockwise rotation of the sun gear before the "C" clutch can engage. This prevents an interruption of power flow during the 3/2 downshift. If freewheel "H" fails to operate, there would be an increase in engine RPM from 3rd to 2nd gear. See **Fig. 40** and **Fig. 41** .

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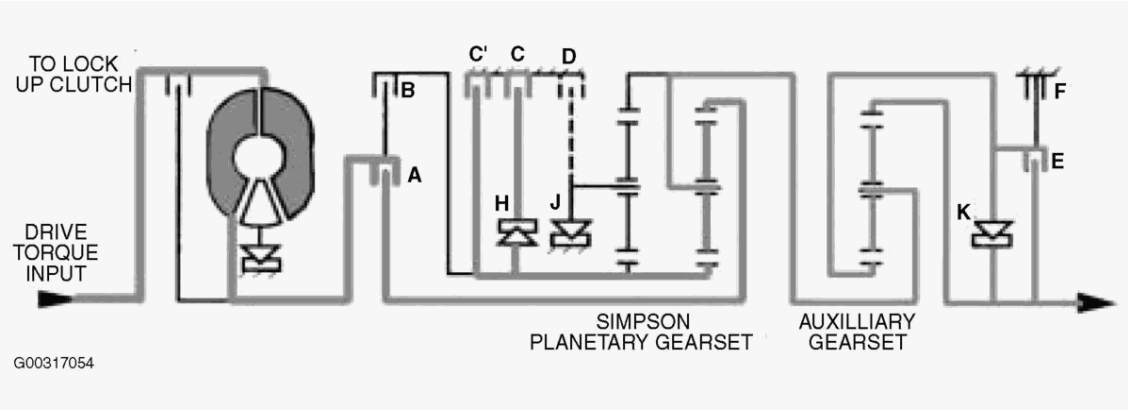


Fig. 40: Freewheel Shifting (Second Gear)
Courtesy of BMW OF NORTH AMERICA, INC.

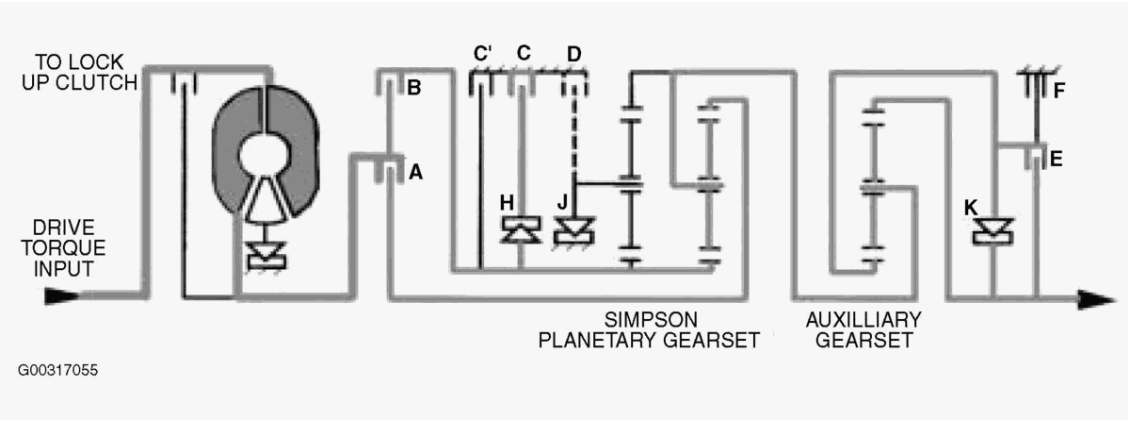


Fig. 41: Freewheel Shifting (Third Gear)
Courtesy of BMW OF NORTH AMERICA, INC.

Overlap Shift Control

Overlap shift technology is currently used on ZF transmissions. The A5S310Z, A5S440Z, A5S560Z and the GA6HP26Z use overlap shift technology on most gear changes. The advantages of this design allows for the reduction of the use of One Way Clutches (freewheel) and a significant improvement in shift quality. During an overlap shift, the releasing clutch pressure is reduced at the same rate that the engaging clutch pressure is increased. The result is a smooth transfer or torque between gear ratios.

As shown in the diagram, clutch 1 is fully engaged with maximum pressure. Clutch 2 is fully released. During overlap shifting, the TCM closely monitors the rotational speeds of the turbine (input) shaft and output shaft. The TCM then uses the EDS solenoids to control pressures during shifting to provide the optimum shift timing and overlap control. See **Fig. 42**.

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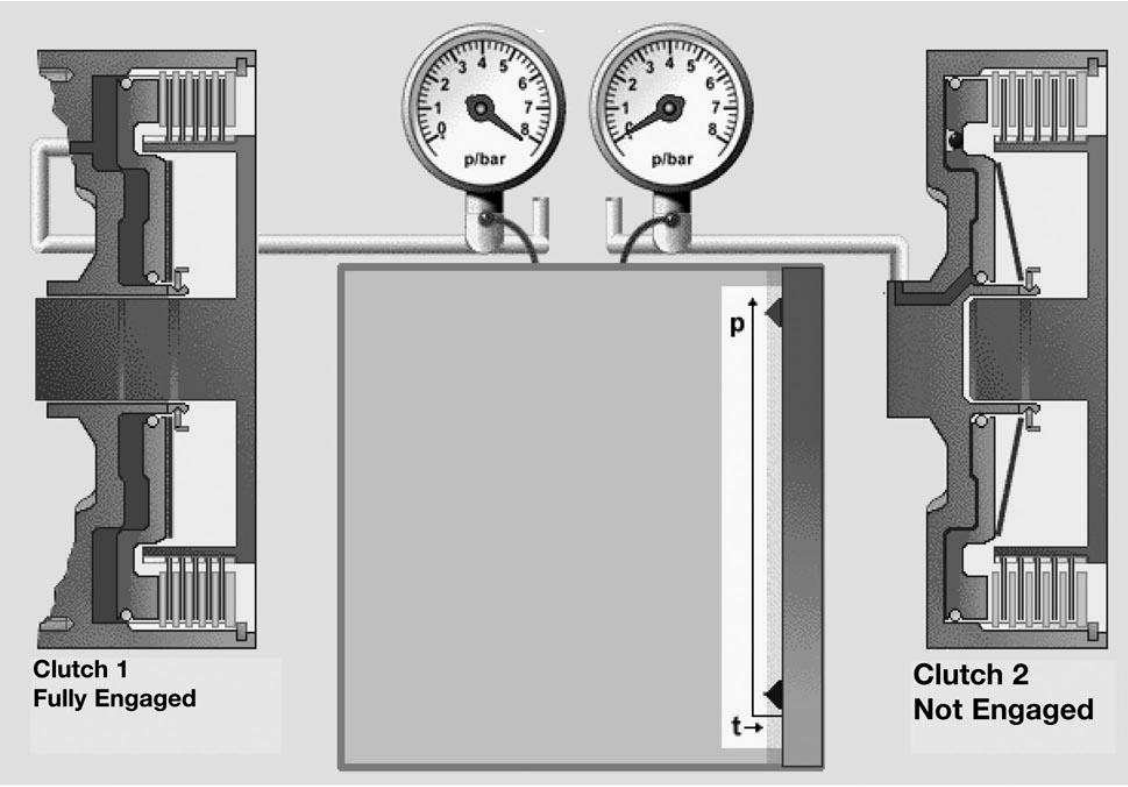
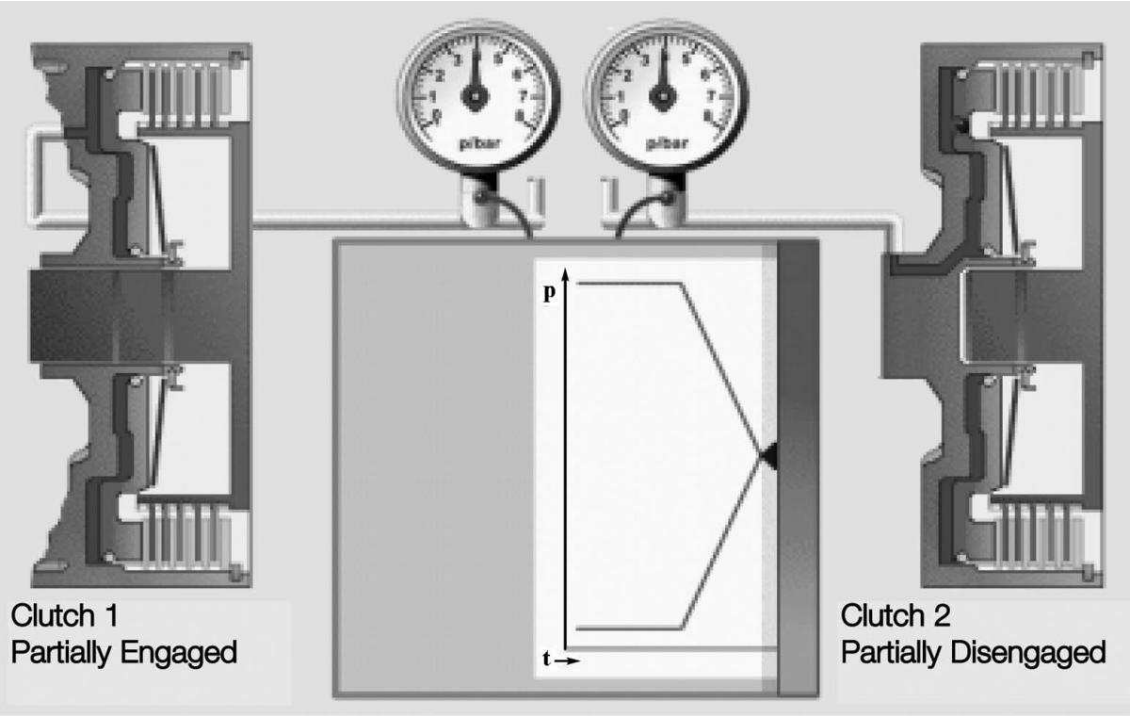


Fig. 42: Identifying Overlap Shift Control
Courtesy of BMW OF NORTH AMERICA, INC.

Overlap Shifting

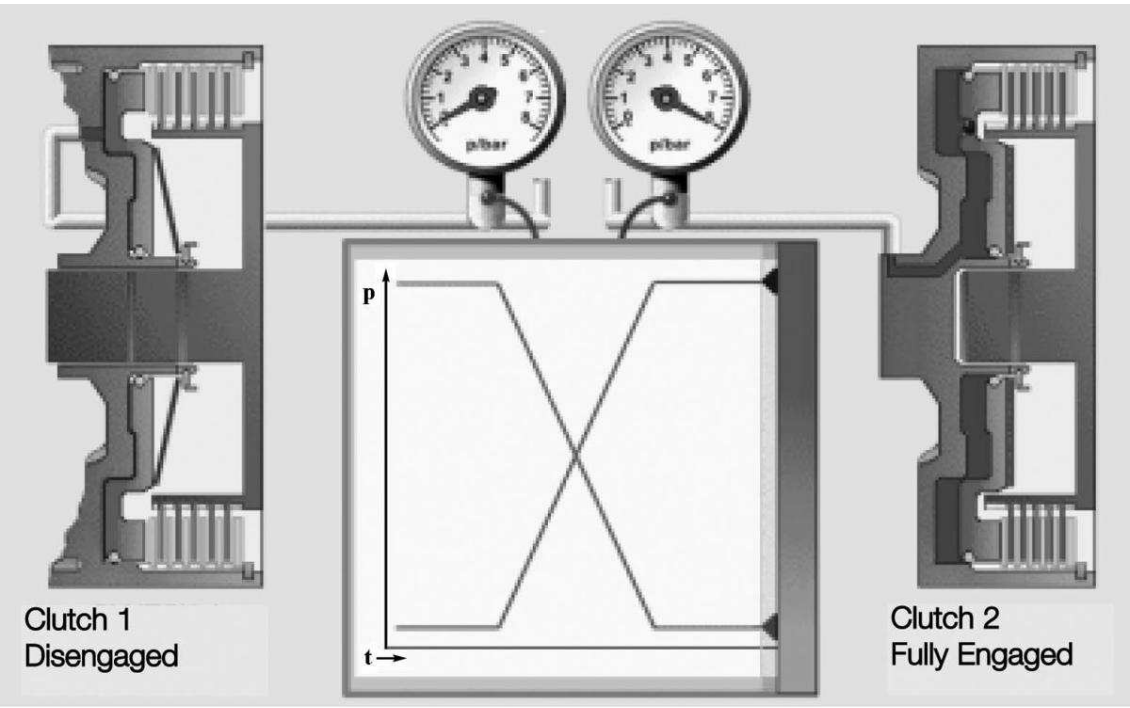
During the transition of overlap, the clutches run through a slip zone. The torque is gradually transferred from the clutch that is releasing to the clutch that is engaging. The new gear engages the moment the torque level exceeds that of the first clutch. This is described as overlap. If the overlap is correct, (zero overlap) the engaging clutch takes over as much torque as the disengaging clutch releases. The result is a seemingly unnoticed shift of the best quality. See **Fig. 43** and **Fig. 44** .

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Fig. 43: Identifying Overlap Shifting (Clutch 1 Engaged)
Courtesy of BMW OF NORTH AMERICA, INC.



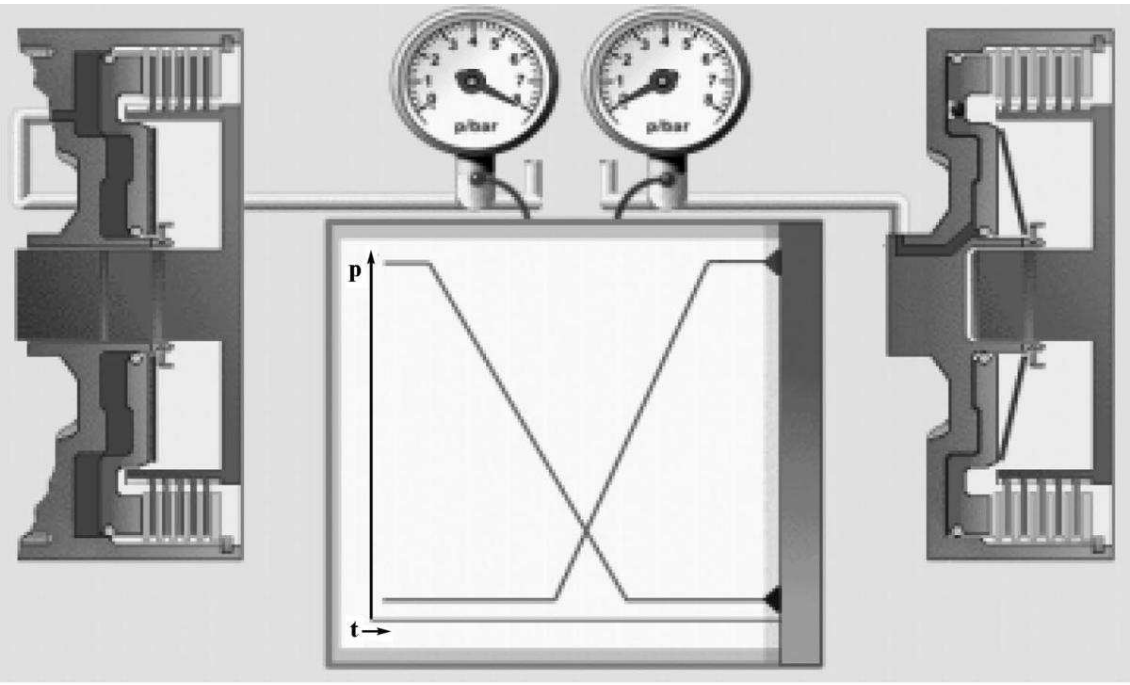
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Fig. 44: Identifying Overlap Shifting (Clutch 1 Disengaged)
Courtesy of BMW OF NORTH AMERICA, INC.

Negative Overlap

Negative overlap occurs when the engaging clutch takes over too late or the releasing clutch drops pressure too early. The result is that the drive torque is briefly interrupted. When the engine is operating under load, the engine speed increases due to the interruption. When coasting the engine speed drops. See **Fig. 45**.



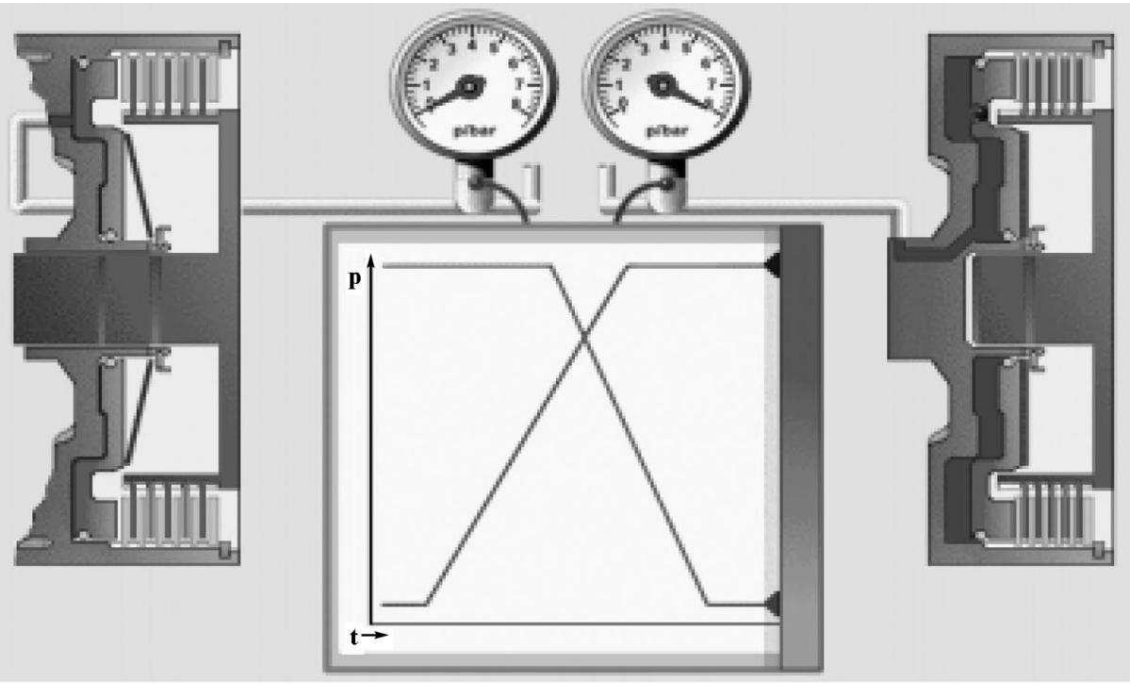
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Fig. 45: Identifying Negative Overlap
Courtesy of BMW OF NORTH AMERICA, INC.

Positive Overlap

If positive overlap occurs, the engaging clutch takes over too early or the releasing clutch pressure drops too late. The gear set would become momentarily blocked if this condition occurs during an upshift. When this occurs the ratio of the gear set becomes 1:1 momentarily. The result is a loss in drive torque during a gear shift. See **Fig. 46**.

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

TRANSMISSION CONTROL MODULE

The TCM receives inputs, processes information and actuates the output elements to provide optimal shift points. The TCM is programmed for maximum shift comfort and fuel economy. The TCM on most BMW vehicles is located in the E-Box next to the ECM (DME). There are several types of TCM housings:

- 35 Pin TCM (TCU) - used on the 4HP transmissions.
- 55 Pin TCM used on the A4S310R (THM-R1).
- 88 Pin TCM used on all others up to 98.
- 134 Pin TCM used on all BMW transmission from the 99 model year. (Note- the 134 pin TCM was introduced on the 98 Models equipped with the A5S440Z).

The 134 Pin TCM is also referred to as SKE (Standard Shell Construction). The SKE housing uses 5 separate connectors. On transmission applications only three connectors (1, 3 and 4) are used. Connectors 2 and 5 are blank and are NOT used. The connectors are Blue in color to avoid confusion with the ECM (DME) connectors which are Black. See **Fig. 47**.

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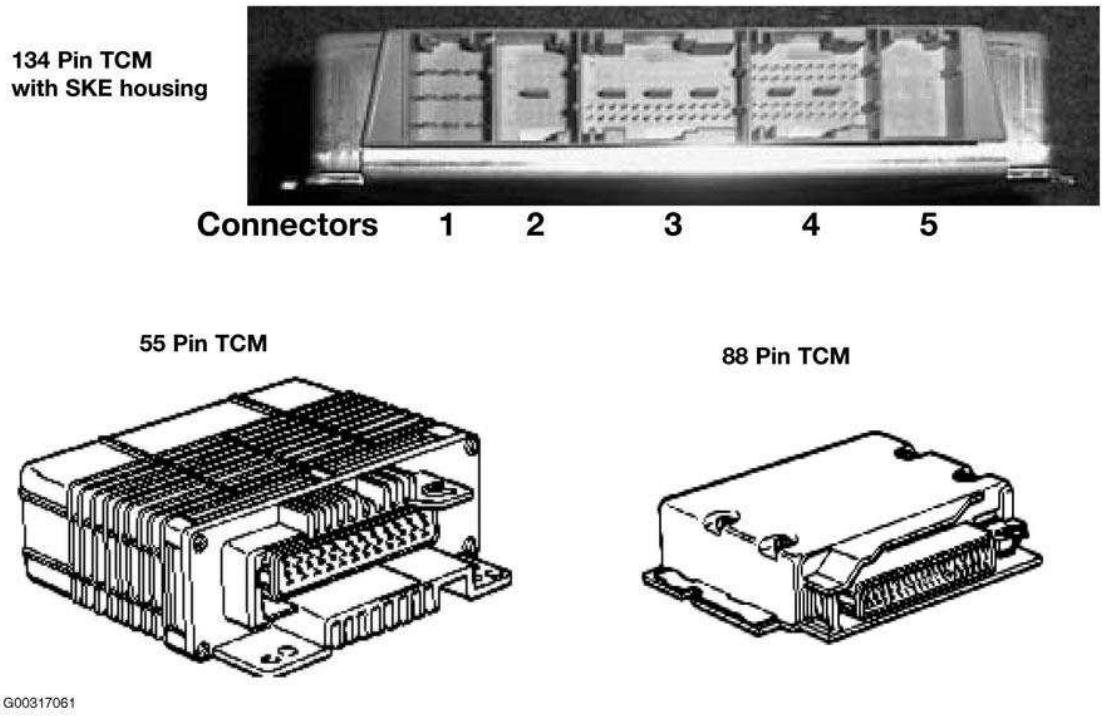


Fig. 47: Identifying Transmission Control Modules & Connectors
Courtesy of BMW OF NORTH AMERICA, INC.

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2003-05 TRANSFER CASES

Overview - xDrive

DESCRIPTION & OPERATION

XDRIVE

xDrive is a new four-wheel-drive system that delivers continuously variable input torques to the front and rear axles. xDrive comprises Dynamic Stability Control (DSC) and an electronically controlled multi-plate clutch in the transfer case. The DSC triggers the electronically controlled multi-plate clutch to supply continuously variable and power-oriented input torques to the front and rear axles. The rear axle is always powered. All of the input torque is applied to the rear axle when the multi-plate clutch is separated. xDrive communicates permanently with the DSC and receives from it, for instance, the following information:

- Whether the accelerator is pressed or released.
- Whether the engine torque is increasing or decreasing.
- Whether the car is driving straight ahead or in a curve.

xDrive continuously evaluates this information to detect whether the car can respond to the driver's requirements. xDrive intervenes to counter the threat of any tendency for wheelspin, oversteer or understeer. xDrive regulates input torque distribution between the two axles to meet driving demands. DSC only ever engages (by reducing engine power output and selective braking of individual wheels) should xDrive need assistance to keep the car on course. The input torque is delivered to the axle that has better traction when road conditions change, such as on snow, ice or a loose road surface.

TOPPING UP/CHANGING TRANSFER CASE OIL

NOTE: Use only the approved gear oil in the transfer box. See TRANSFER CASE APPROVED OIL . Failure to comply with this requirement will result in serious damage to the transfer box. Only change the oil when the transfer box is at normal operating temperature.

TRANSFER CASE APPROVED OIL

Oil Type	Part Number
Shell Gear Oil	83 220 306 816

CHECKING/CORRECTING TRANSFER CASE OIL LEVEL

NOTE: Numbers in text refer to numbers in figures.

Undo oil filler plug (1). Check transfer case oil level. If necessary, pour in gear oil up to lower edge of opening for oil filler plug (1). See **Fig. 1** . Replace sealing ring.

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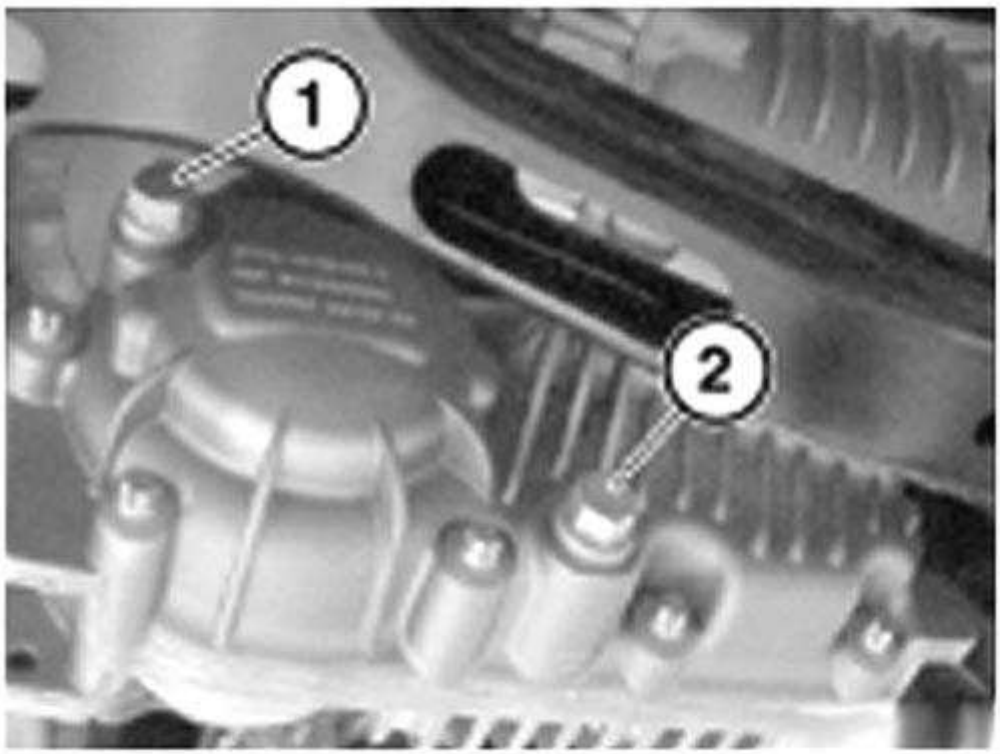


Fig. 1: Identifying Oil Filler Plug & Drain Plug
Courtesy of BMW OF NORTH AMERICA, INC.

CHANGING TRANSFER CASE OIL

NOTE: Numbers in text refer to numbers in figures.

Place oil collecting apparatus underneath. Remove oil drain plug (2). Drain and dispose of gear oil. Replace sealing ring, screw in oil drain plug (2) and tighten down. Undo oil filler plug (1). Pour in gear oil up to lower edge of opening for oil filler plug (1). See **Fig. 1** . Replace sealing ring.

PURPOSE OF SYSTEM

XDRIVE

The innovative xDrive four-wheel drive is a system that controls and regulates the distribution of driving torque to the front and rear axles. The measured variables of DSC are used by xDrive but are also influenced by modified handling performance. The multi-disc clutch is the heart of the xDrive. By using the controlled multi-disc clutch, it is possible to resolve the conflict between traction and handling performance. This is achieved through the fact that torque distribution is not determined by a fixed gear ratio in the xDrive as was the case in the previous systems. Instead, the distribution of driving torque is dependent on the locking torque of the controlled multi-disc clutch in the transfer case and on the transferable torque to the front and rear axles. See

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Fig. 2 .

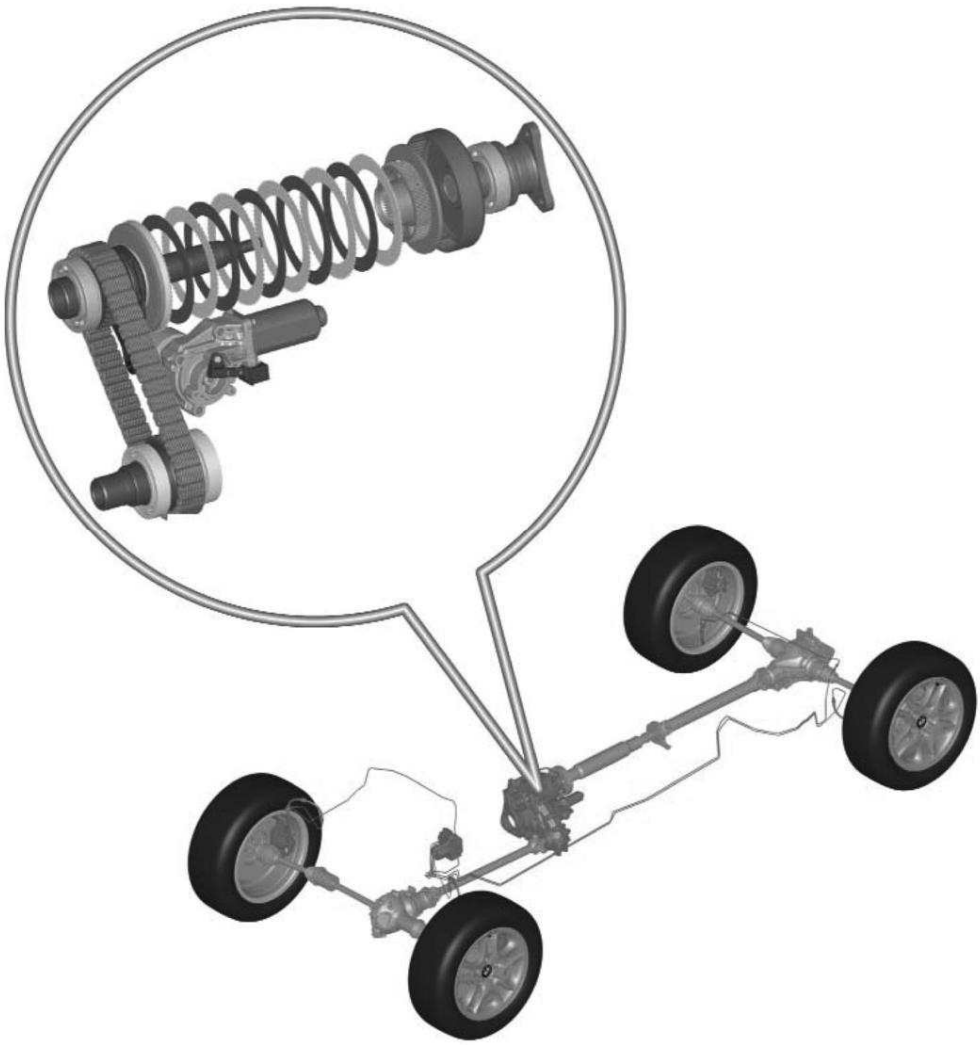


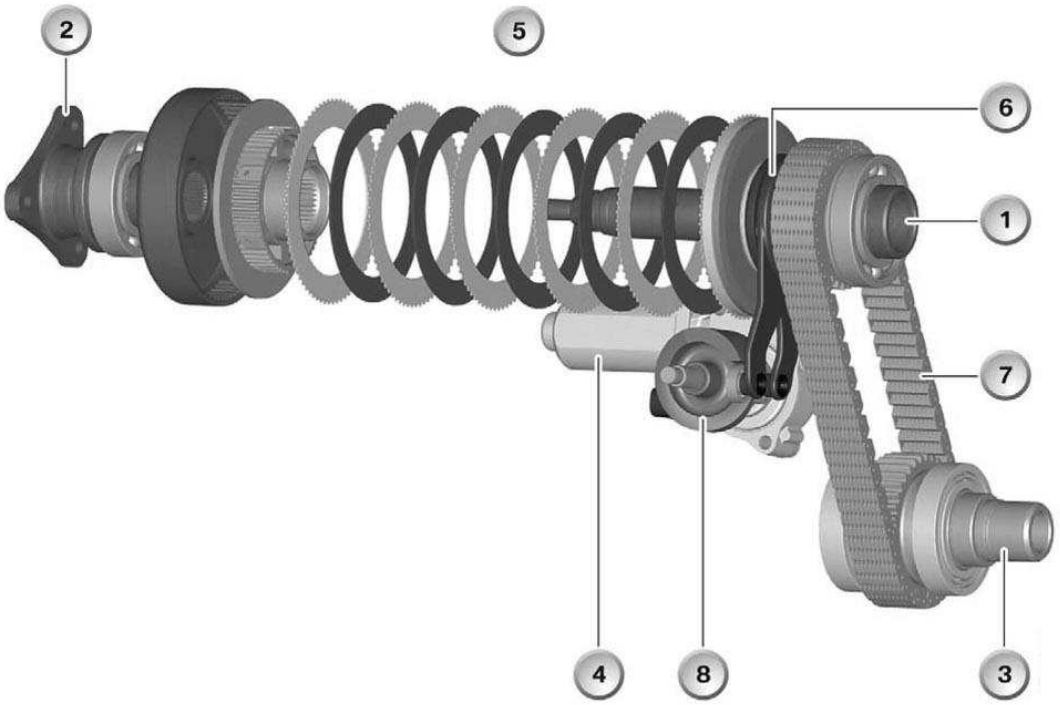
Fig. 2: Identifying xDrive System
Courtesy of BMW OF NORTH AMERICA, INC.

SYSTEM COMPONENTS

ATC 400/ATC 500 TRANSFER CASE

The ATC 400 is installed in the E83 and the ATC 500 in the E53 MU. They differ in that the ATC 500 is splined to the front propeller shaft and the ATC 400 uses a four bolt flange. In addition, there is one more disc in the multi-disc clutch of the ATC 500 and the distance between the input shaft and the output shaft to the front axle is 19 mm greater than in the ATC 400. See **Fig. 3** .

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1. Input from manual / automatic transmission
2. Output to rear axle prop. shaft
3. Output to front axle prop. shaft
4. Servomotor
5. Clutch discs
6. Adjusting levers with ball ramp
7. Chain
8. Disc cam

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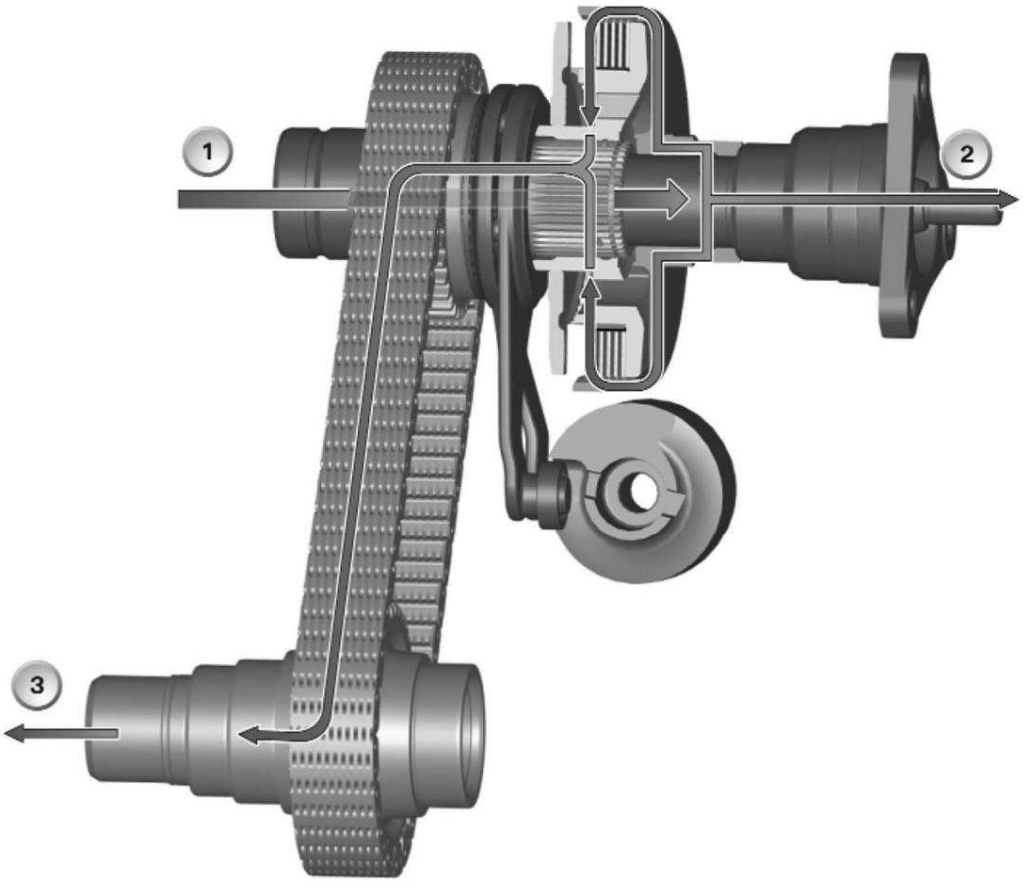
Fig. 3: Identifying xDrive Transfer Case Components
Courtesy of BMW OF NORTH AMERICA, INC.

POWER FLOW

When the multi-disc clutch in the transfer case is disengaged, no driving torque is transmitted to the front axle. All of the driving torque is then distributed to the rear axle. This is because the input shaft (1) is splined providing a permanent connection to the rear axle propeller shaft output flange (2). The multi-disc clutch couples the rear axle propeller shaft output flange to the front propeller shaft output (3). The driving torque on the front axle is increased or decreased by regulating the locking pressure of the multi-disc clutch, providing a stepless coupling of the front axle to the drivetrain. This depends on driving situations and road conditions. When the multi-disc clutch is fully engaged, the front and rear axles turn at the same speed. Driving torque distribution (front/rear) is based on available traction at each axle. For example, when traction is identical on the front and rear axles and a driver accelerates from a stop in first gear at full throttle, the rear axle is capable of sustaining greater driving torque as the vehicle weight shifts from the front to the rear. Another example is when the front axle is on a high traction surface and the rear axle is on ice. In this case, virtually all of the available driving torque is transmitted to the front axle. Based on available traction, virtually no driving torque can be supported by the rear axle . Obviously, when more driving torque is transmitted to the front axle, driving

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torque on the rear axle is proportionally reduced due to lack of traction. See **Fig. 4** .



1. Input from transmission
2. Rear propeller shaft output
3. Front propeller shaft output

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Fig. 4: Identifying xDrive Power Flow
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: On a vehicle equipped with an automatic transmission, when driving onto brake analyzers, move the selector lever to the "N" position . On a vehicle equipped with a manual transmission, do not press the accelerator pedal once on the brake analyzer. This keeps the transfer case clutch open and the vehicle cannot be pulled off the analyzer.

ADJUSTING LEVERS

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When the disc cam is rotated, it forces the adjusting levers apart. The ball ramps create a precision axial movement which compresses and increases pressure on the multi-disc clutch. This is completely variable up to a full lock. See **Fig. 5** .

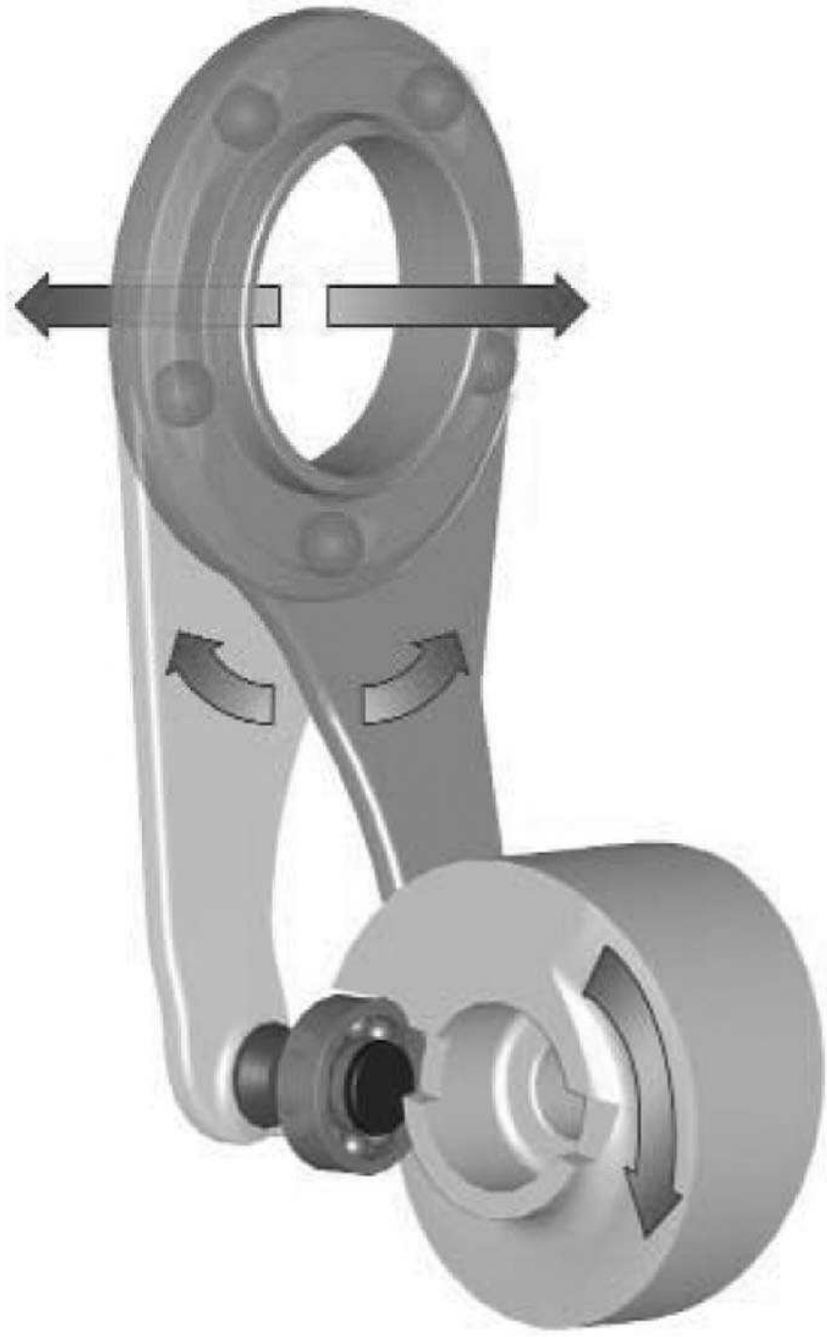


Fig. 5: Identifying Adjusting Levers
Courtesy of BMW OF NORTH AMERICA, INC.

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SERVOMOTOR WITH MOTOR POSITION SENSOR

The servomotor with worm gear are powered to rotate the disc cam. The servomotor is a permanent magnet (1) DC motor which contains a Hall sensor (2) to detect the position and the adjusting speed of the motor shaft. This is proportional to the degree of multi-disc clutch engagement. See **Fig. 6** .

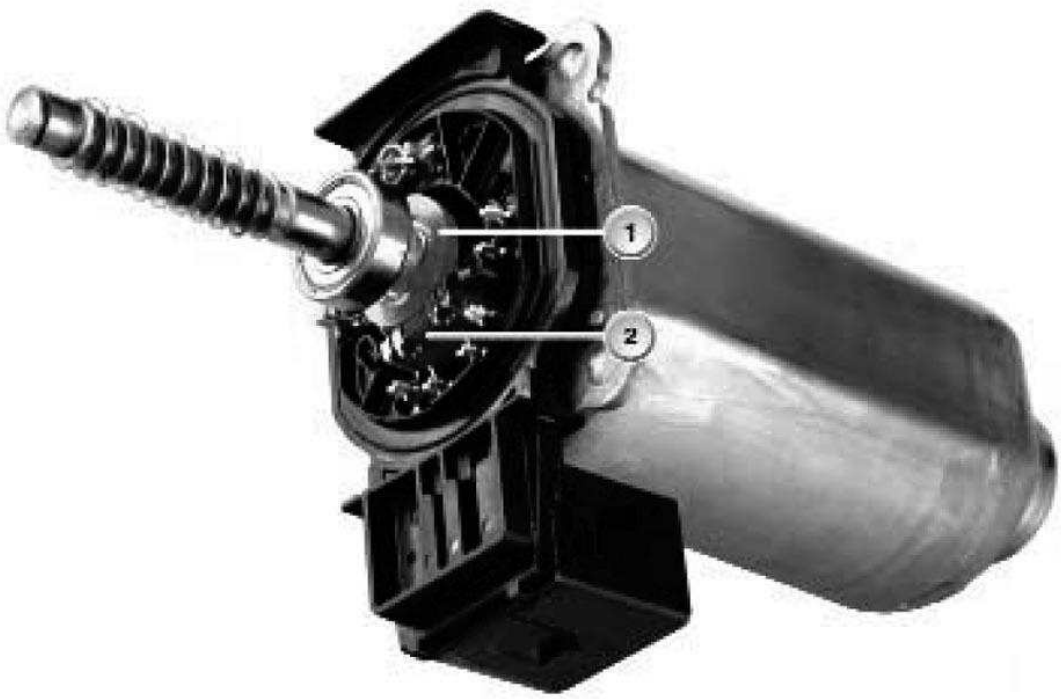
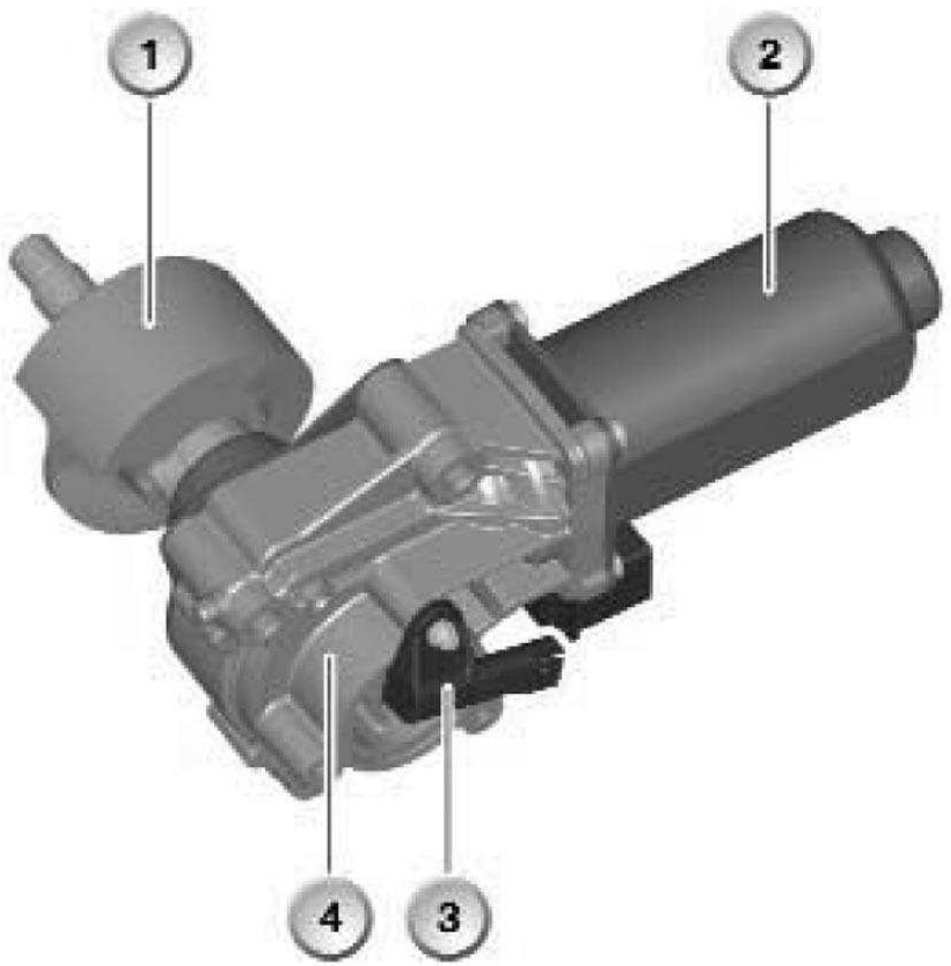


Fig. 6: Identifying Servomotor With Motor Position Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

CODING RESISTOR

Because of mechanical tolerances in production, the characteristic curve of the multi-disc clutch locking torque varies slightly. Once the actual locking torque has been measured on the clutch test bench, a resistor is attached to the servomotor; the resistor's value is a reference to the locking torque characteristic. Each time the engine is started, the transfer case control unit measures the resistance value once and the optimum program map for the transfer case fitted is selected. See **Fig. 7** .

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1. Disc cam
2. Electric motor
3. Coding resistor
4. Worm gear

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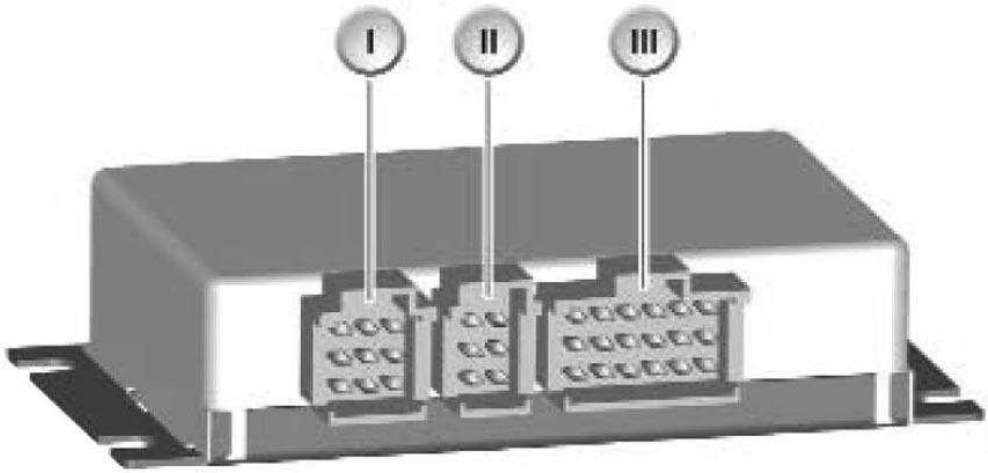
Fig. 7: Identifying Coding Resistor
Courtesy of BMW OF NORTH AMERICA, INC.

TRANSFER CASE ELECTRONIC CONTROL UNIT

The transfer case control unit (VGSG) is installed in the X3 on the rear floor panel under the luggage compartment trim. In X5, it is located underneath the rear bench seat on the left. See **Fig. 8** . The transfer case

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control unit (VGSG) is on the PT-CAN Bus. VGSG shares information with DSC for overall xDrive control and has diagnostic communication via the OBD connector. See **Fig. 9** and **Fig. 10** .



I. 9-pin ELO connector (not used)
II. 6-pin ELO connector
III. 18-pin ELO connector

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Fig. 8: Identifying Transfer Case Electronic Control Unit
Courtesy of BMW OF NORTH AMERICA, INC.

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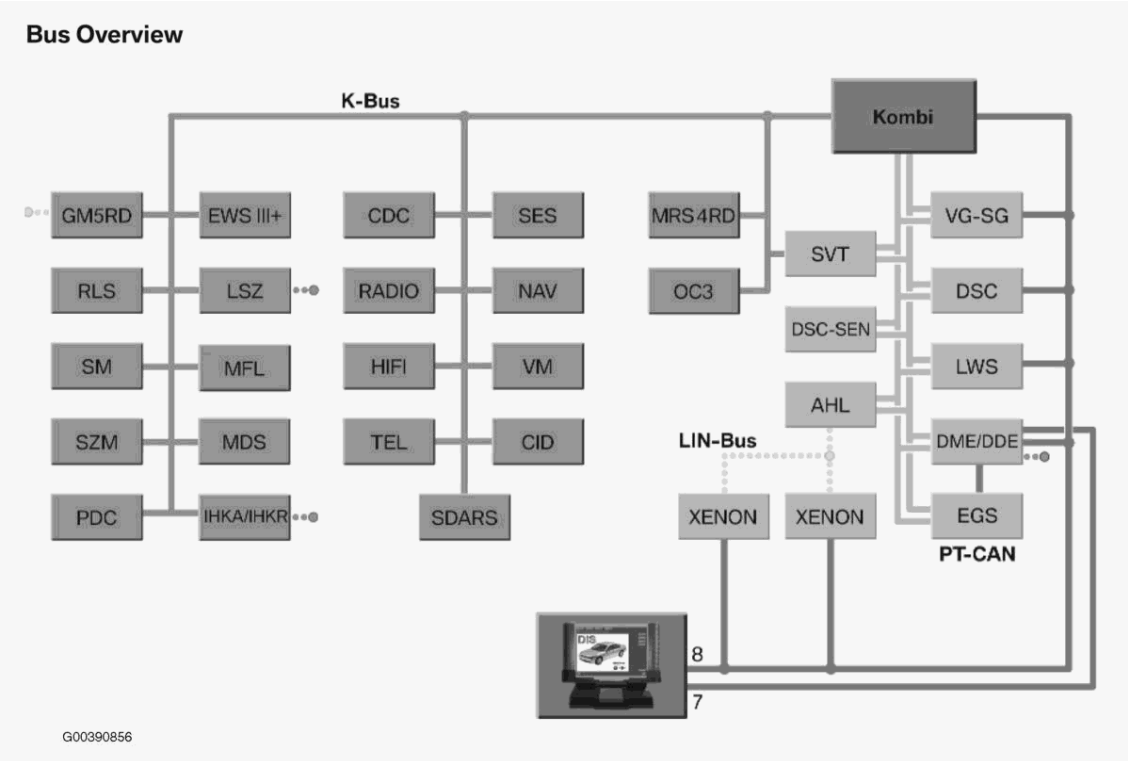
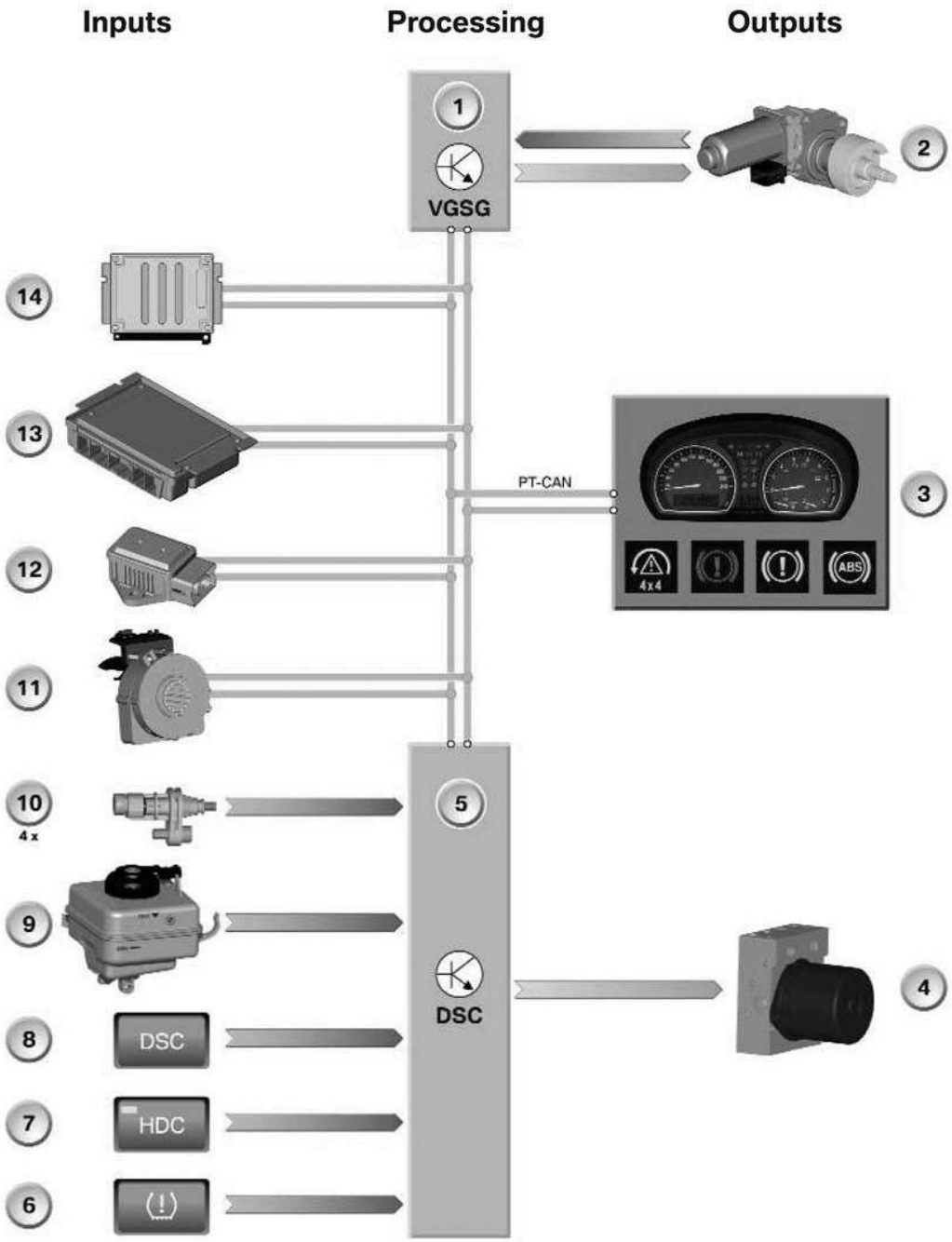


Fig. 9: Transfer Case Bus Overview
Courtesy of BMW OF NORTH AMERICA, INC.

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1. Transfer case control unit
2. Transfer case clutch servomotor
3. Instrument cluster
4. DSC hydraulic modulator
5. DSC control unit
6. RDW button
7. HDC button
8. DSC button
9. Brake fluid level
10. Wheel speed sensor
11. Steering angle sensor
12. Yaw/transverse acceleration sensors
13. EGS
14. ECM (DME)

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Fig. 10: Transfer Case Inputs, Processing & Outputs

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Courtesy of BMW OF NORTH AMERICA, INC.

PRINCIPLE OF OPERATION

XDRIVE

The transfer case control unit (VGSG) regulates the locking pressure of the multi-disc clutch in the transfer case. The transfer case control unit receives information on the required clutch locking pressure from the DSC control unit. The processing, control and electronics required for this are integrated in the transfer case control unit. This information is converted and output as a corresponding rotary motion of the servomotor. In order to position the servomotor and compensate for wear, a reference run is carried out each time the ignition is switched off. The servomotor position is determined by a Hall sensor integrated in the servomotor. During the reference run, the clutch is engaged and disengaged completely (once). While the clutch is actuated, the current consumption is measured for the servomotor position. This allows the VGSG to determine the beginning and end of the clutch actuating procedure. A clutch and oil wear calculation is also processed and stored in the VGSG. It increases the locking pressure as necessary in order to reduce friction. In the event of DSC failure, the VGSG incorporates a fallback level (strategy) for activating the transfer case clutch in order to maintain the four-wheel drive function.

TCC

Regulation of the transfer case clutch (TCC) locking pressure allows stepless coupling of the front axle to the drivetrain. The driving torque on the front axle can be increased or decreased depending on the driving situation and road conditions. Obviously, when more driving torque is transmitted to the front axle, driving torque on the rear axle is proportionally reduced due to lack of traction. The advantages of variable distribution of driving torque to the front and rear axles are:

- Optimum utilization of the cornering and longitudinal wheel forces on the front and rear axles.
- DSC brake interventions only become necessary at a significantly later stage, an increase in comfort refinement.
- Compared with an "open" differential transfer case and DSC, xDrive significantly improves driving torque distribution when traction on the front and rear axles is notably different. The DSC control unit influences control of the transfer case clutch. Even when DSC is deactivated, TCC remains active for the purpose of maximum traction and driving dynamics.

Permanent four-wheel drive is only completely deactivated in three control situations:

- During very tight cornering with low engine torque to allow speed compensation between the front and rear axles (e.g. parking).
- At speeds greater than 112 mph.
- When the vehicle dramatically understeers.

The transfer case clutch control logic is described in three main modules:

- Pre-control.
- Traction control/driving dynamics control.

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- Tire tolerance logic.

PRE-CONTROL

The pre-control logic (shared from DSC) reflects the driver's command and is calculated based on:

- Accelerator Pedal Value
- Engine Torque
- Engine RPM

In normal driving, the clutch is operated with minimum slip so that permanent four-wheel drive with a driving torque distribution of 40 percent on the front axle and 60 percent on the rear axle is available. Even when the traction for the front and rear axles is dramatically different, the pre-control ensures that the system responds very quickly.

In the case of the open transfer case, the brake is applied after slip is detected on the rear axle. This takes approximately one half of a second in reaction time. Sixty-two percent of the driving torque is supported on the two rear brake discs and only 38 percent of the driving torque can be transferred to the front axle. In other words, wheel slip must be sensed first before driving torque is transferred through the transfer case by applying the rear wheel brakes. In contrast to an "open" transfer case (differential), the xDrive does not require brake intervention on the rear axle because no slip can occur (permanent through connection). The transfer case clutch is engaging the front axle as the vehicle is accelerating. This takes significantly less time (approximately 1/10th of a second).

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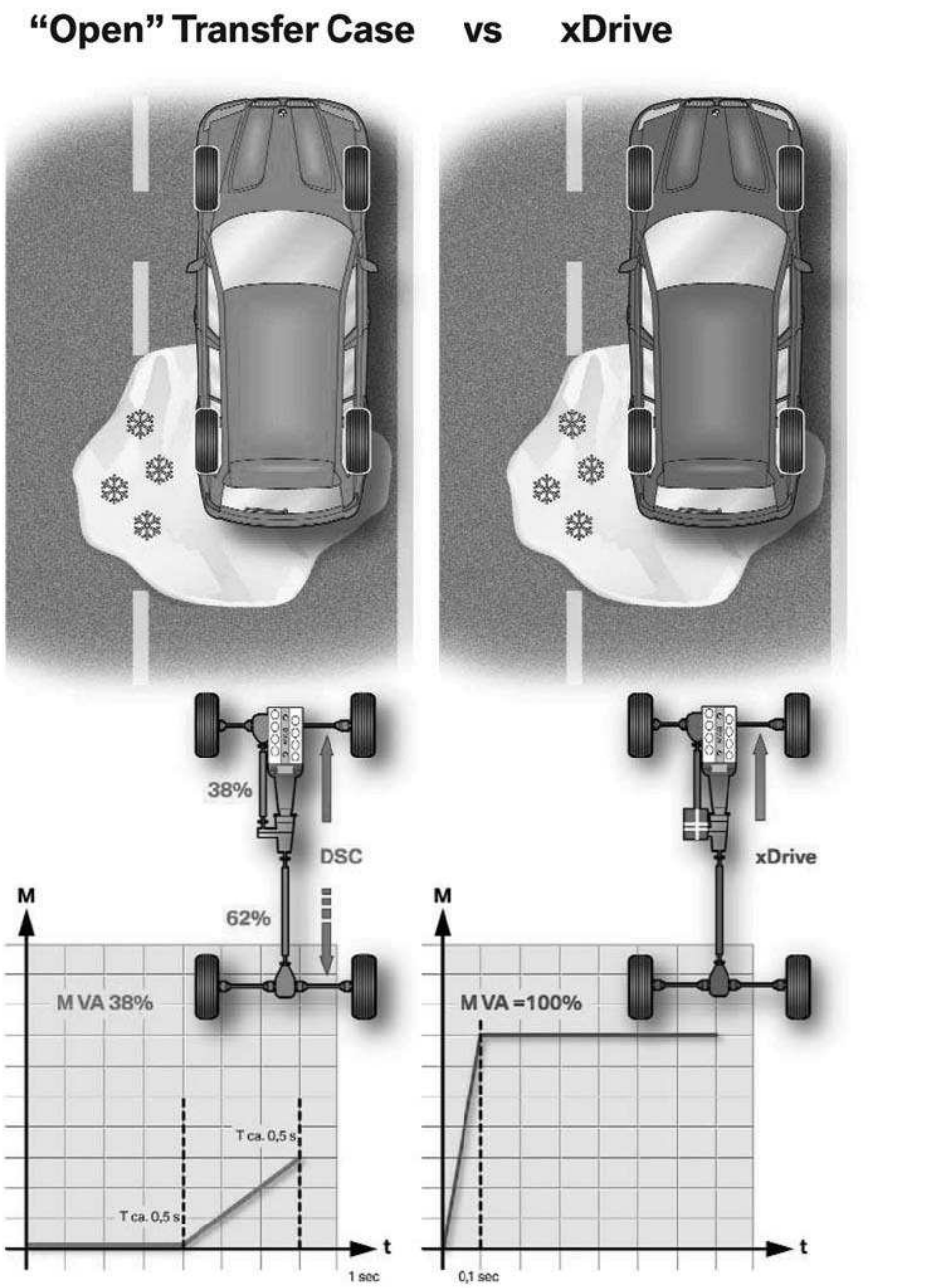


Fig. 11: Transfer Case & xDrive Usage
Courtesy of BMW OF NORTH AMERICA, INC.

TRACTION CONTROL/DRIVING DYNAMICS CONTROL

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Traction control monitors the slip conditions on the front and rear axles. The wheel speeds, yaw rate and transversal acceleration serve as the input signals. The function of traction control/driving dynamics control is to achieve optimum traction and to keep the vehicle stable. In the event of an oversteer tendency, the transfer case clutch is completely engaged and the maximum supportable driving torque on the front axle is transmitted. This helps to "pull' the front of the vehicle until stability is achieved. See **Fig. 12** .

In the event of an understeer tendency, the clutch can be fully disengaged if necessary. In this example, the front axle is separated from the drivetrain and the driving torque can only be transmitted to the rear axle. This helps to "push" the rear of the vehicle until stability is achieved. See **Fig. 13** .

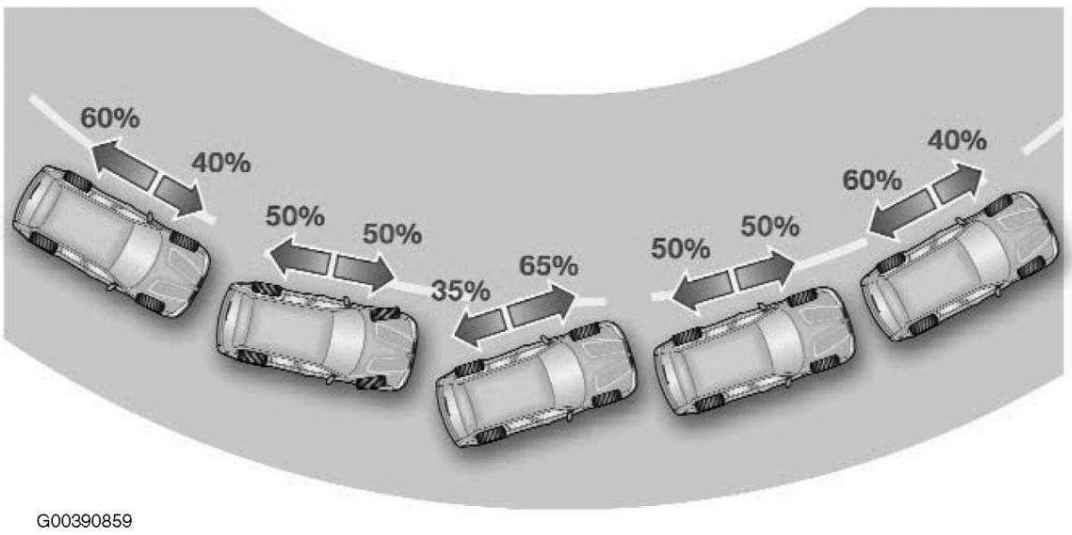


Fig. 12: xDrive Oversteer Compensation
Courtesy of BMW OF NORTH AMERICA, INC.

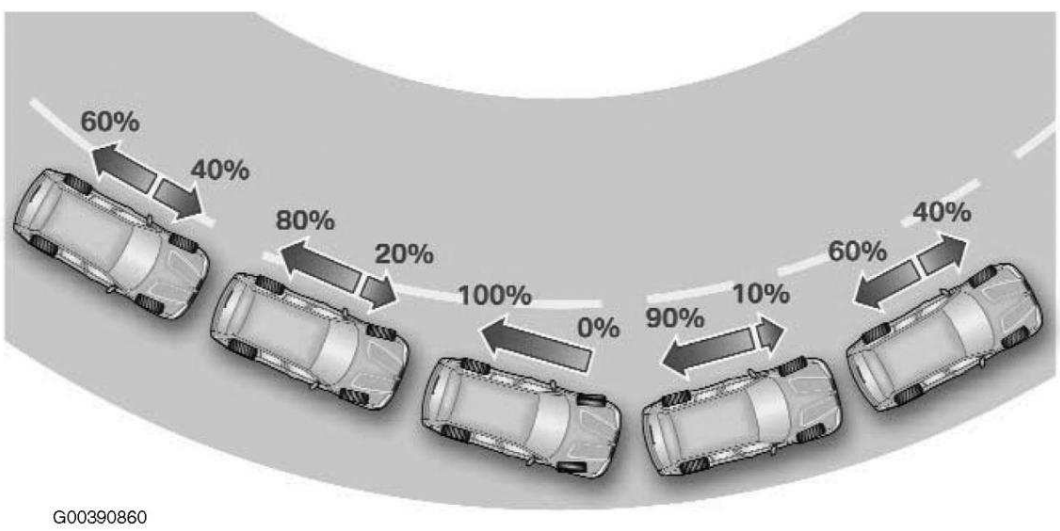


Fig. 13: xDrive Understeer Compensation

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Courtesy of BMW OF NORTH AMERICA, INC.

TIRE TOLERANCE LOGIC

The tire tolerance logic detects different tread circumferences on the front and rear axles. This occurs when:

- Mixed tires are used.
- Space saving spare tire is installed.
- Tires are used that have been worn down to different levels.

Normally, tire circumference deviations result in drivetrain torque bias (unwanted variations). The tire circumference can fluctuate up to 1 percent or more as a result of mixed tires or wear. The tire tolerance logic decides depending on the driver's command and driving situation whether the slip is to occur in the transfer case clutch or at the contact area between tire and road. If the slip is permitted in the transfer case clutch, the locking pressure set by the pre-control is reduced in order to keep the work loss low. In the driving dynamic control situation, the clutch is locked slightly more than normal, the four wheel drive is always guaranteed when required. For maximum xDrive performance, tires (and wheels) of the same diameter should be installed on the vehicle.

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2004-05 MANUAL TRANSMISSION

Removal & Installation - X3 (GS6-37BZ)

REMOVAL & INSTALLATION

MANUAL TRANSMISSION

CAUTION: Use only the approved gear oil in this manual transmission. Failure to comply with this requirement will result in serious damage to the transmission. For further information, see MANUAL TRANSMISSION - SERVICING article.

Removal

1. Disconnect battery. See INSTRUCTIONS FOR DISCONNECTING AND CONNECTING BATTERY.
2. Remove front underbody protection.
3. Remove complete exhaust system. See REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM (M54).
4. Remove heat shield. Remove front propeller shaft at transfer box and tie to one side. See **DRIVE SHAFTS & UNIVERSAL JOINTS** article.
5. Install Special Tool (11 0 250) between dome cross-brace and engine suspension eye and secure with dowel pin. See **Fig. 1** . Pretension special tool with adjusting screw (1) to measurement "A". Engine secured in installation position. Installation position, measurement "A" = approximately 36 cm.
6. Remove propeller shaft from transmission. Release center bearing. Tie propeller shaft to one side. See **DRIVE SHAFTS & UNIVERSAL JOINTS** article.
7. Unfasten screws and remove transmission cross-member. See **Fig. 2** .
8. Detach plug (1) from reversing light switch. See **Fig. 3** . Release cable from mountings and tie to one side.
9. Detach plugs (1) and (2) from servomotor. See **Fig. 4** .

NOTE: Pressure line of clutch slave cylinder remains connected. Relieve tension on clutch slave cylinder slowly; otherwise air will be drawn in through sealing sleeve.

10. Release nuts and remove clutch slave cylinder. See **Fig. 5** .

CAUTION: Risk of damage: When lowering the transmission, make sure the engine does not rest against the bulkhead.

11. Lower transmission: turn Special Tool (11 0 250) back with adjusting screw (1) to measurement "A". See **Fig. 1** . Transmission in removal position. Transmission removal position, measurement "A" = approximately 34 cm.

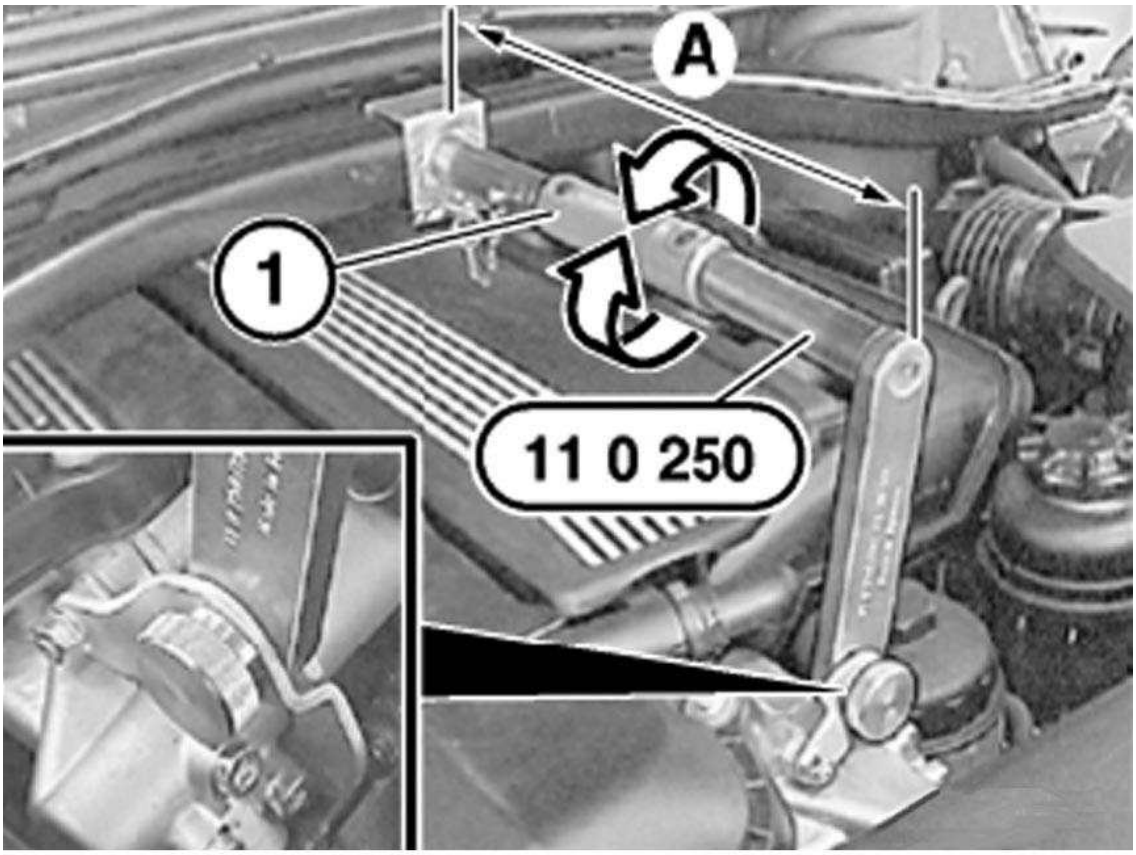
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NOTE: Illustrations show E60.

12. Unlock bearing pin (1) in direction of arrow and remove. See **Fig. 6** . Lift out shift arm.
13. Lift off retainer (1). See **Fig. 7** . Disconnect shift rod (2).
14. Unfasten screws. See **Fig. 8** .
15. Unscrew bolt (1). See **Fig. 9** .
16. Support transmission with Special Tools (23 0 134, 23 0 131, 23 0 132, 23 0 112) and (00 2 030). See **Fig. 10** .

CAUTION: Do not allow transmission to hang from the transmission input shaft when removing and installing, as the clutch disk will be deformed.

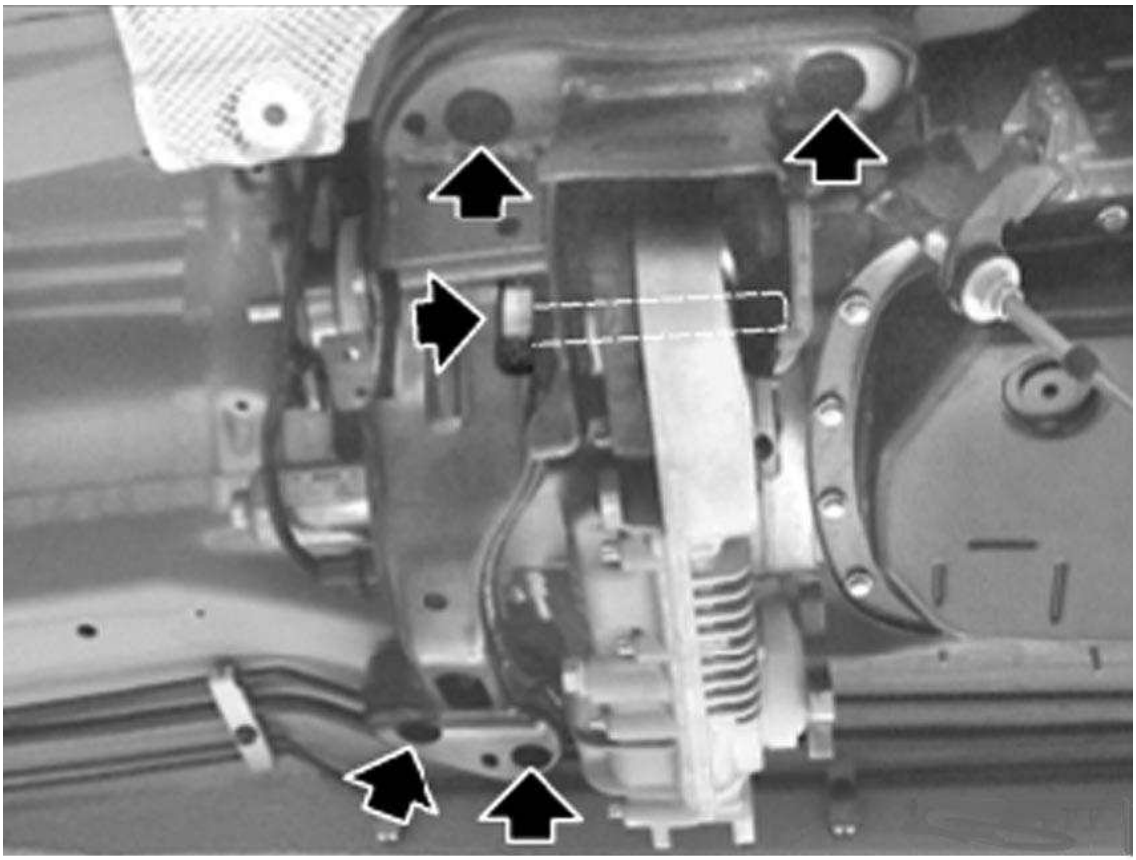
17. Unfasten screws. See **Fig. 11** . Pull transmission downwards and remove.



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Fig. 1: Supporting Engine & Transmission
Courtesy of BMW OF NORTH AMERICA, INC.

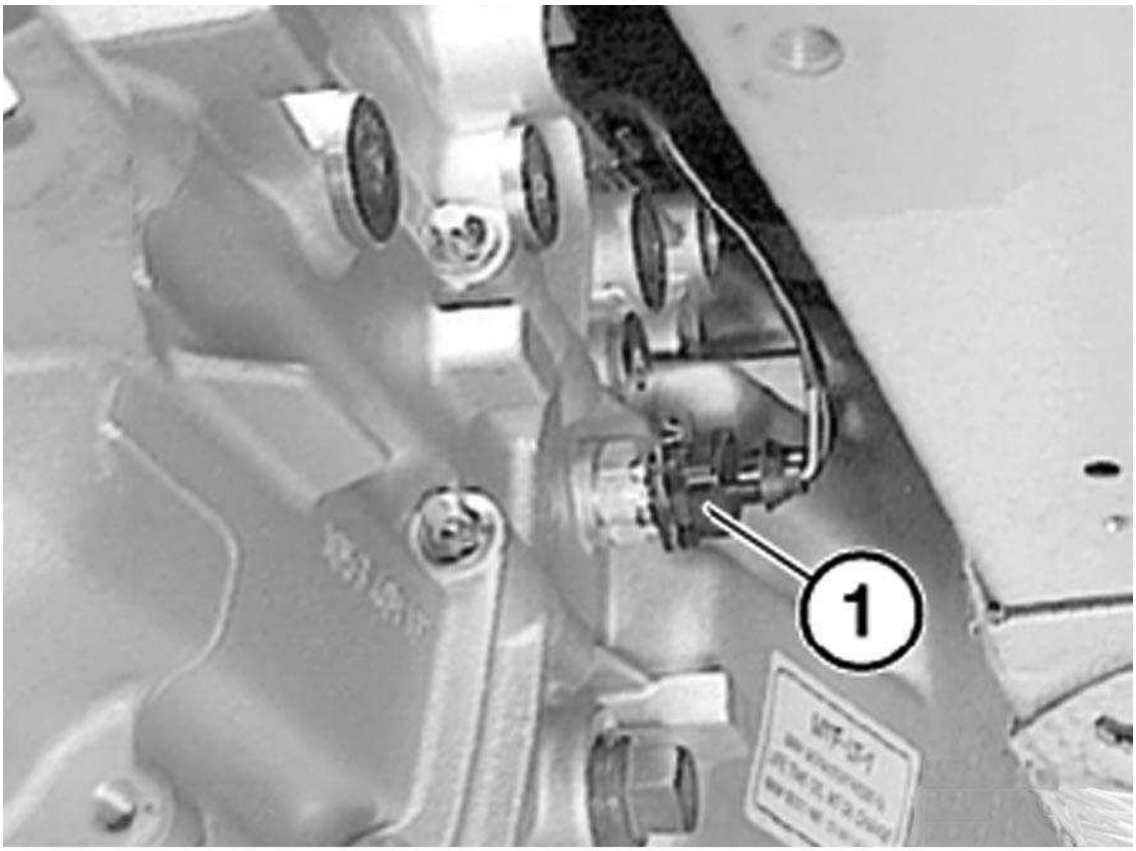
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Fig. 2: Removing Transmission Cross-Member
Courtesy of BMW OF NORTH AMERICA, INC.

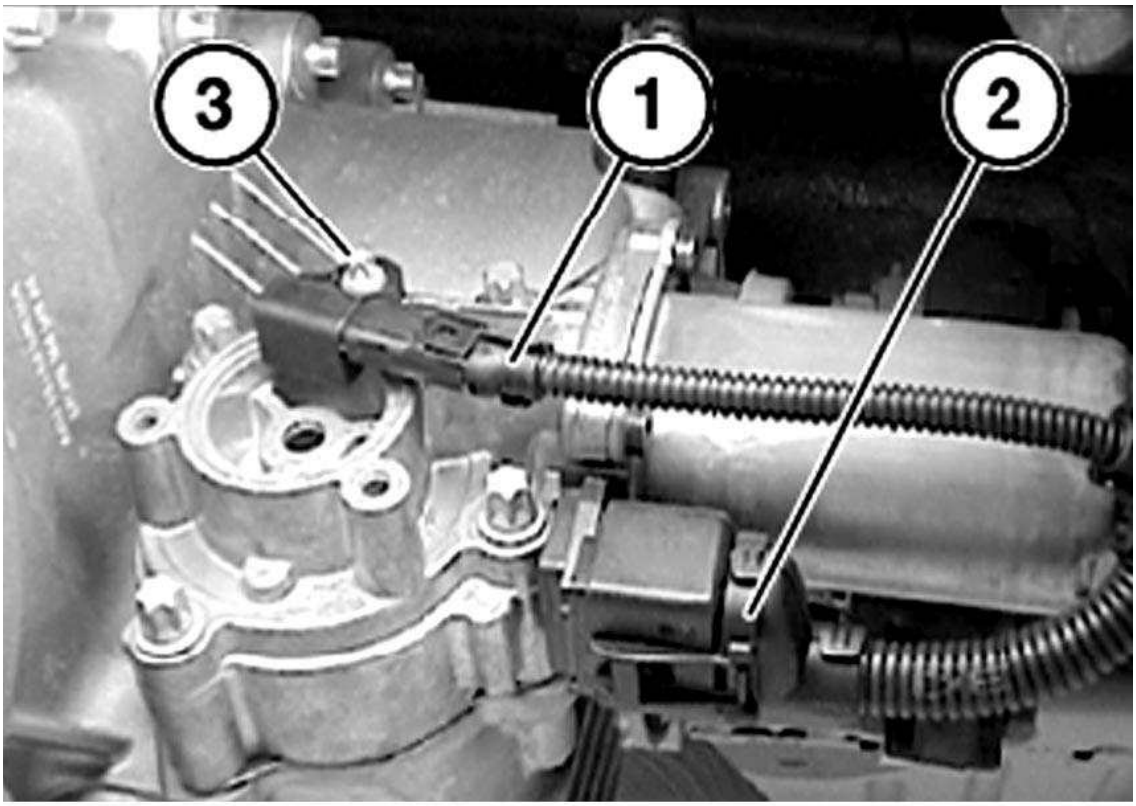
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Fig. 3: Detaching Cable Plug From Reverse Gear Switch
Courtesy of BMW OF NORTH AMERICA, INC.

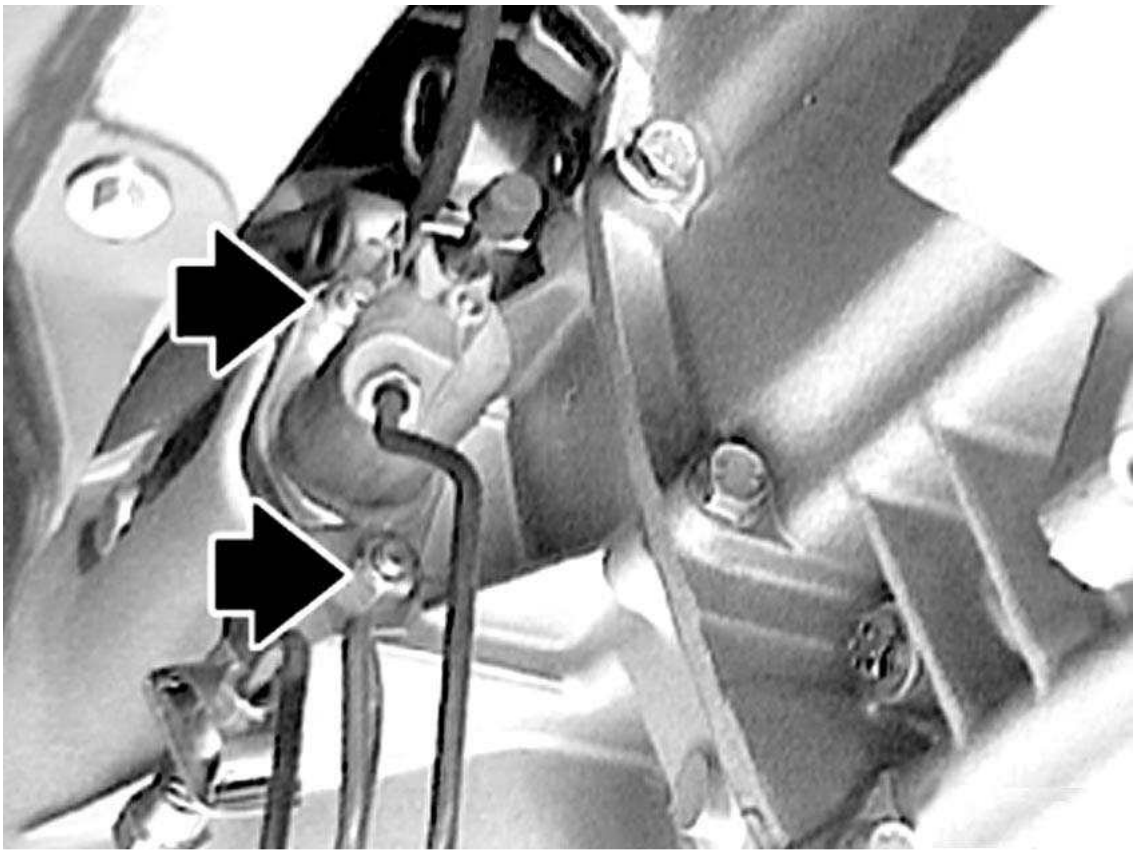
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Fig. 4: Detaching Plugs From Servomotor
Courtesy of BMW OF NORTH AMERICA, INC.

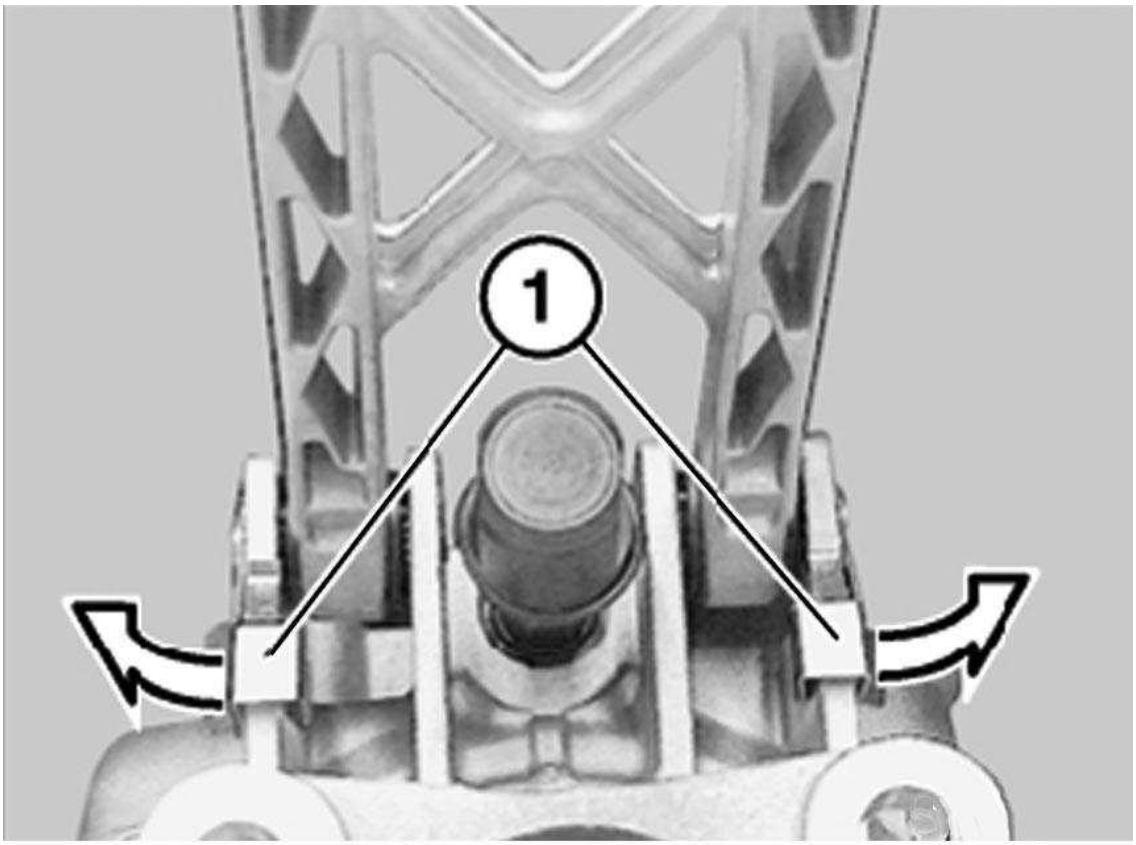
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Fig. 5: Removing Clutch Slave Cylinder
Courtesy of BMW OF NORTH AMERICA, INC.

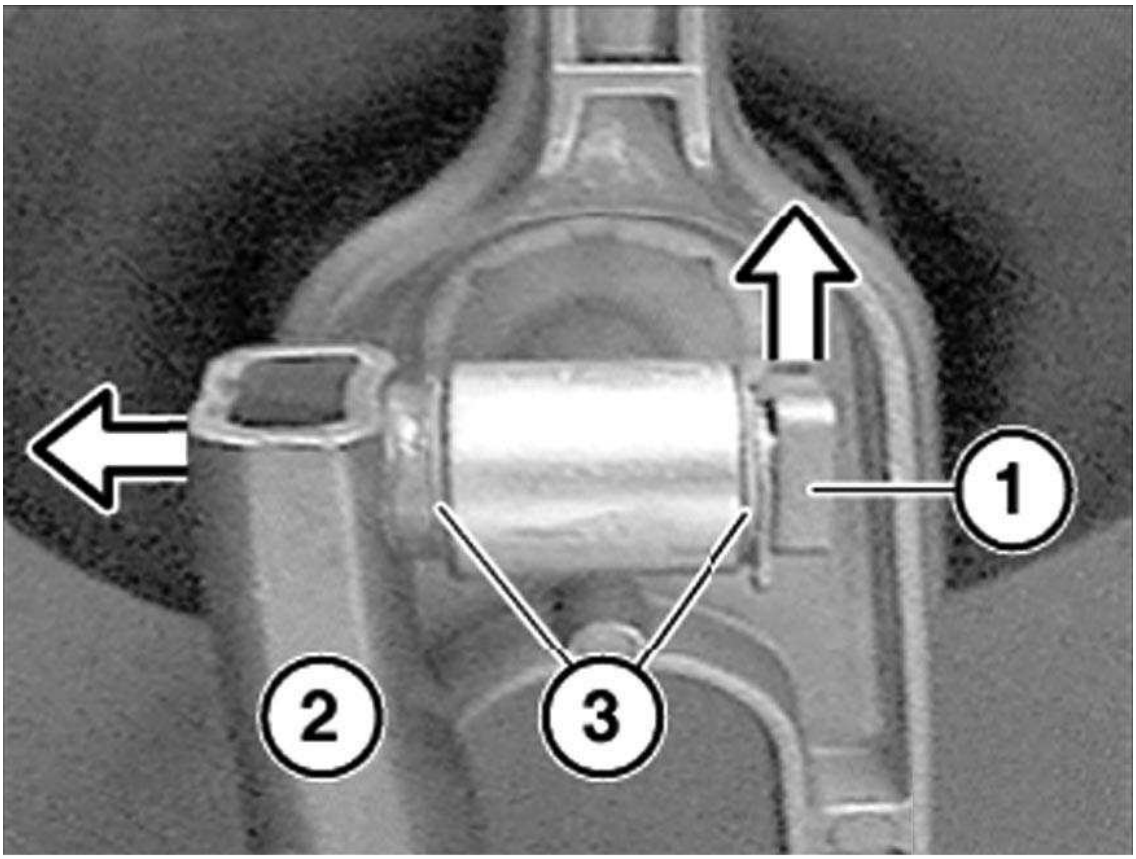
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Fig. 6: Removing Bearing Pin
Courtesy of BMW OF NORTH AMERICA, INC.

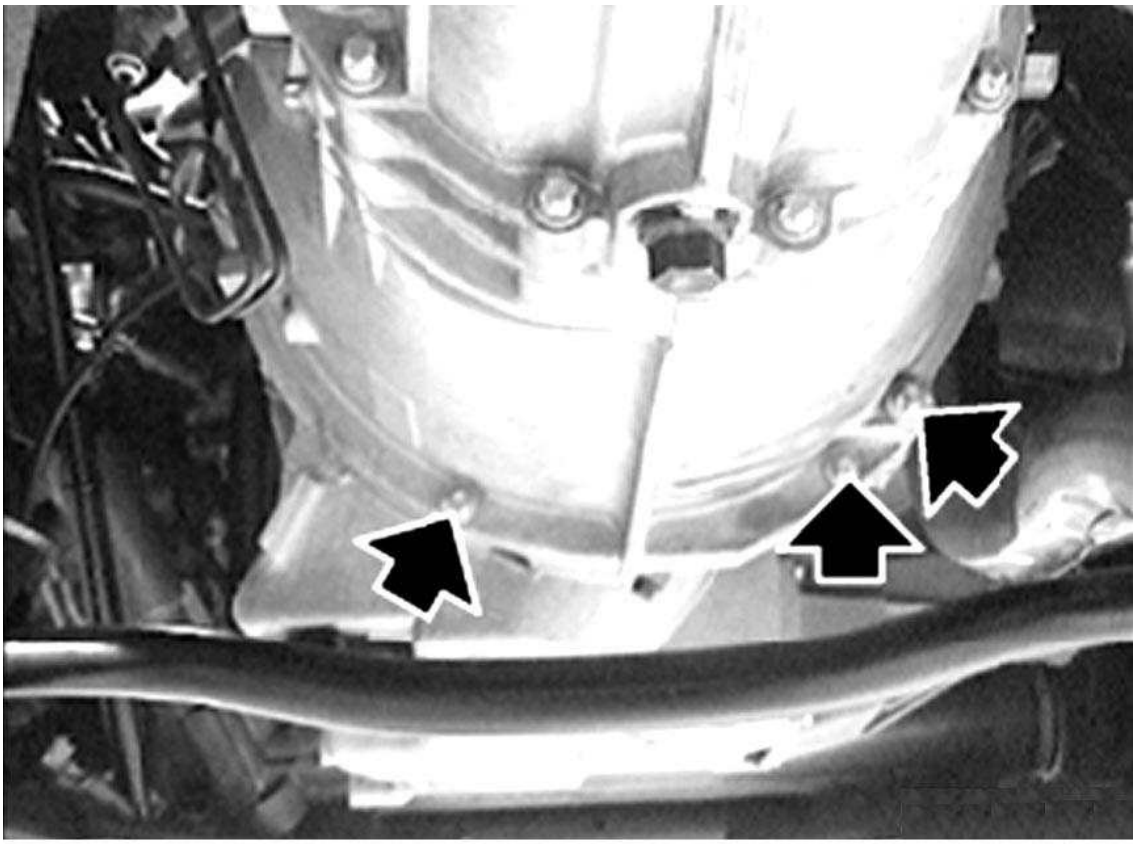
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Fig. 7: Disconnecting Shift Rod
Courtesy of BMW OF NORTH AMERICA, INC.

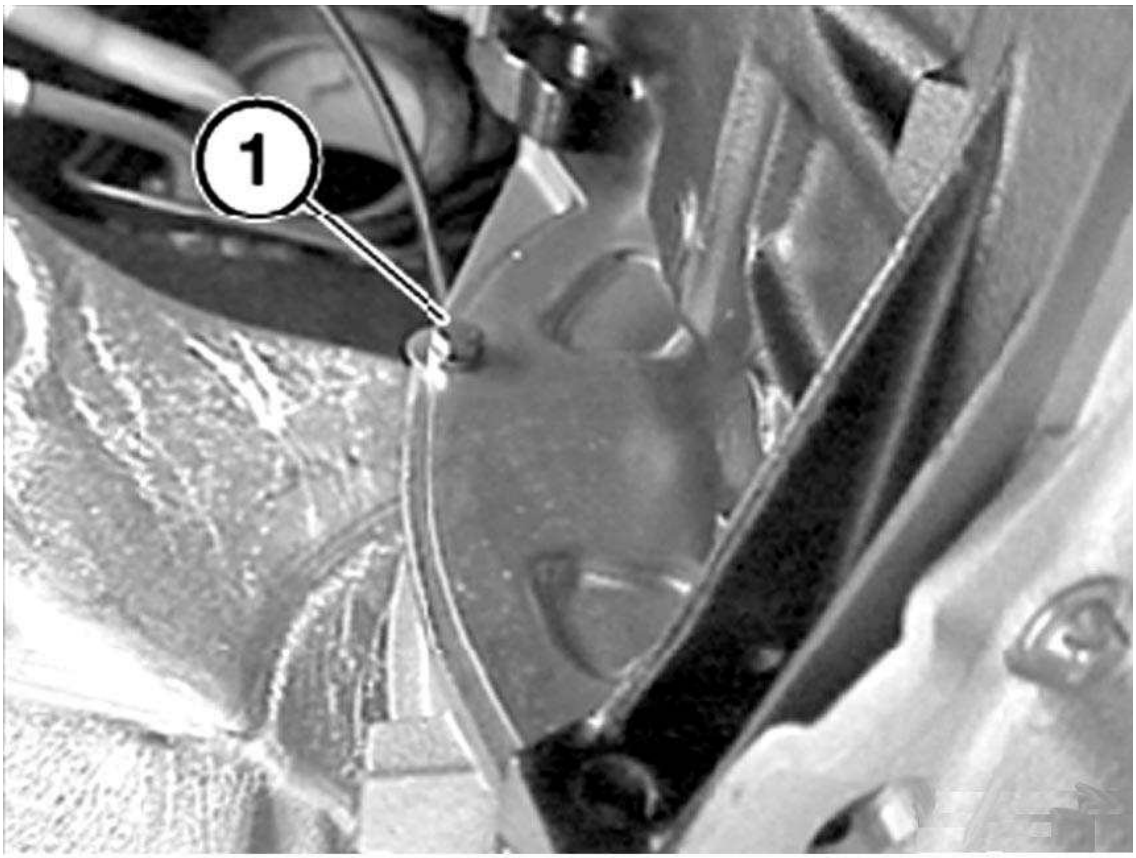
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Fig. 8: Locating Transmission To Engine Screws
Courtesy of BMW OF NORTH AMERICA, INC.

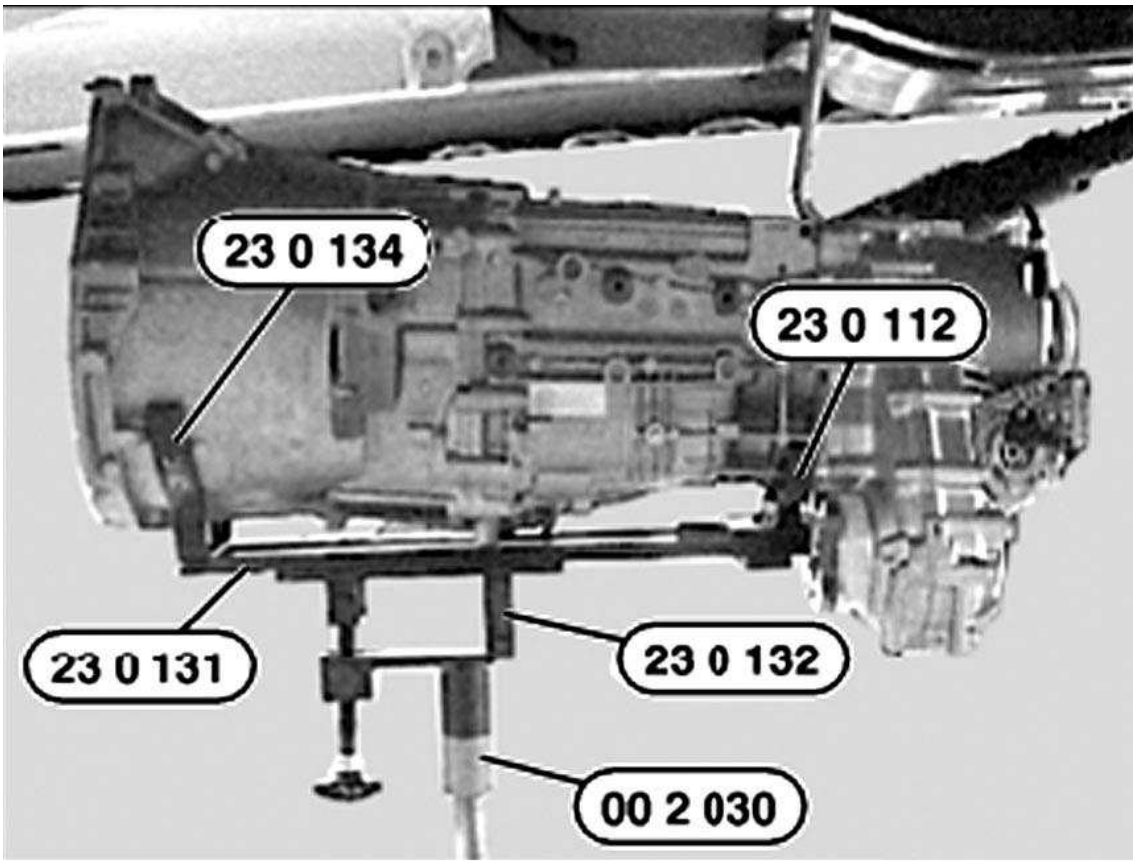
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Fig. 9: Locating Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

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Fig. 10: Supporting Transmission
Courtesy of BMW OF NORTH AMERICA, INC.

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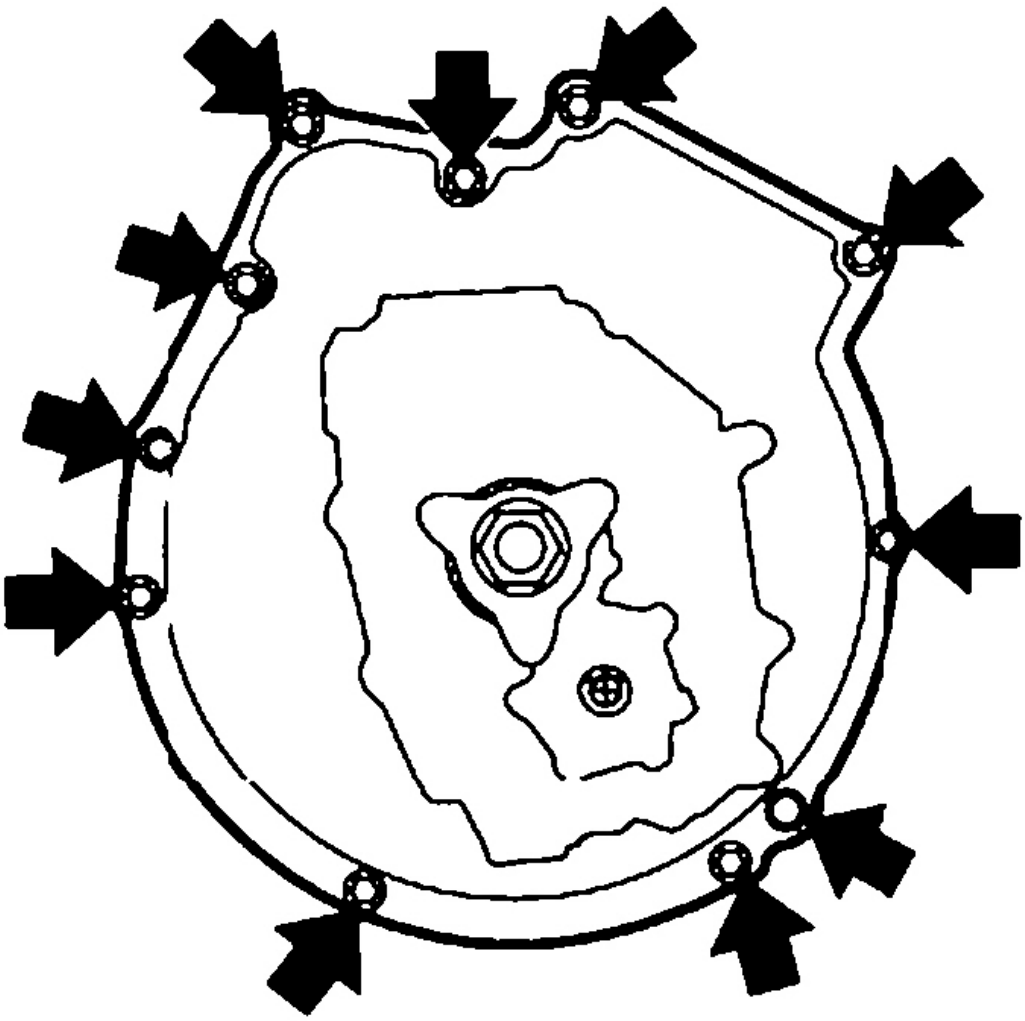


Fig. 11: Removing Transmission (Locating Transmission To Engine Mounting Bolts)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation

1. Check that dowel sleeves are correctly seated. See **Fig. 12** . Replace damaged dowel sleeves. Ensure correct position of cover plate.
2. Check lubrication of transmission input shaft for sticky consistency. See **Fig. 13** . If grease is sticky, clean input shaft and replace clutch plate. Check clutch plate for friction rust in splines and replace if necessary. Mechanically remove existing grease and lining abrasion from splines of clutch plate (with a cloth).
3. Remove and clean release bearing and release lever. Push on grease Scraper Ring (21 2 221) as far as it

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will go. See **Fig. 14** . Grease splines (1) of input shaft with a brush. Detach grease scraper ring.

4. To install, reverse removal procedure. Grease shift rod. Make sure shims (3) are in correct position. See **Fig. 7** . Grease bearing pins (1). See **Fig. 6** . Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** . Before installing transmission cross-member, turn Special Tool (11 0 250) back with adjusting screw (1) to measurement "A" (installation position). See **Fig. 1** . Installation position, measurement "A" = 36 cm.

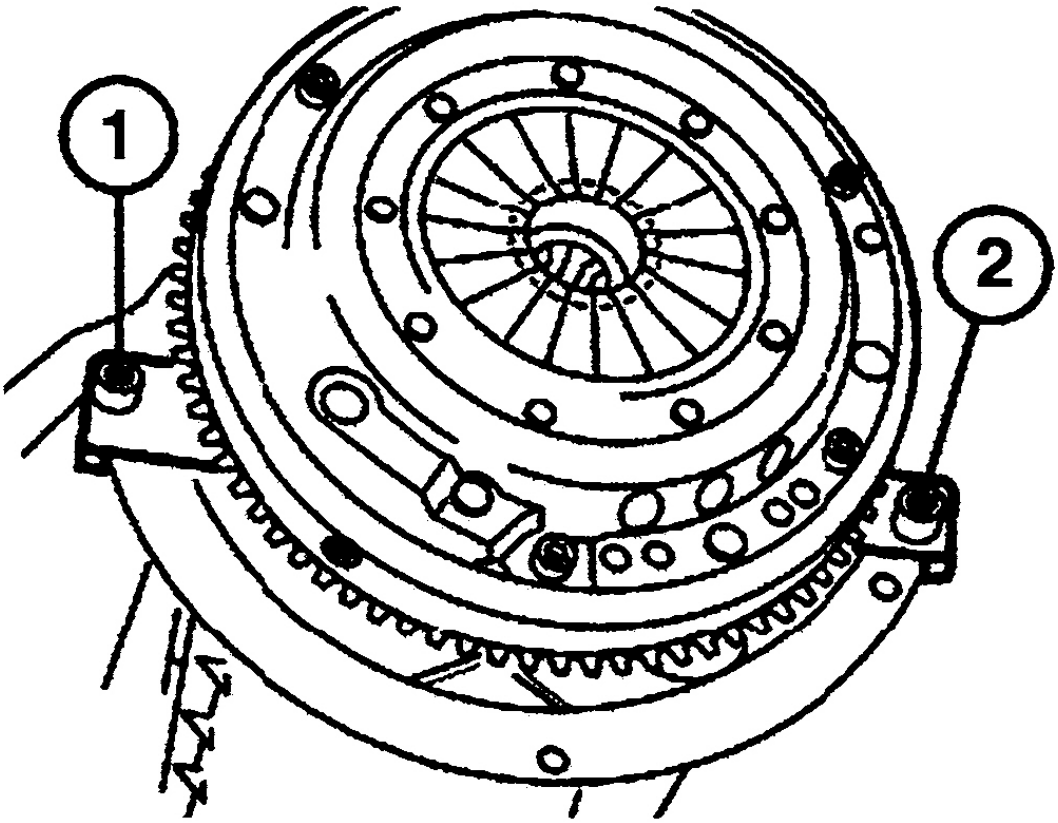


Fig. 12: Checking Dowel Sleeves
Courtesy of BMW OF NORTH AMERICA, INC.

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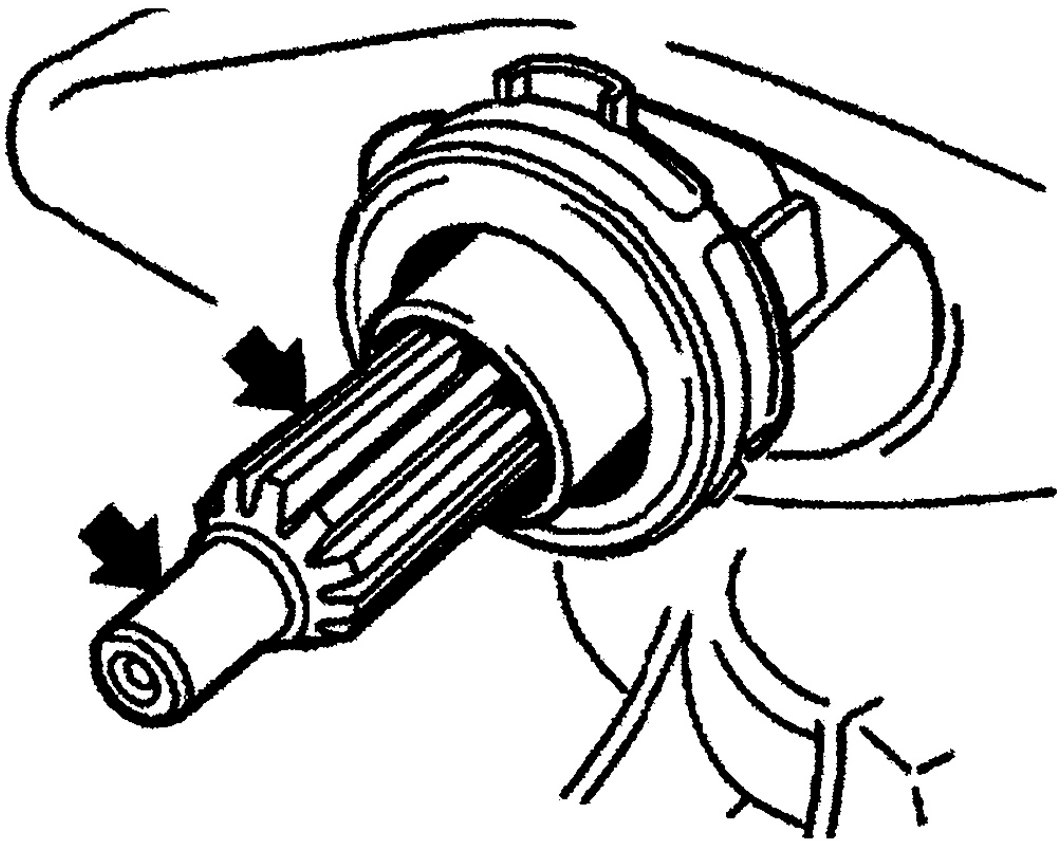
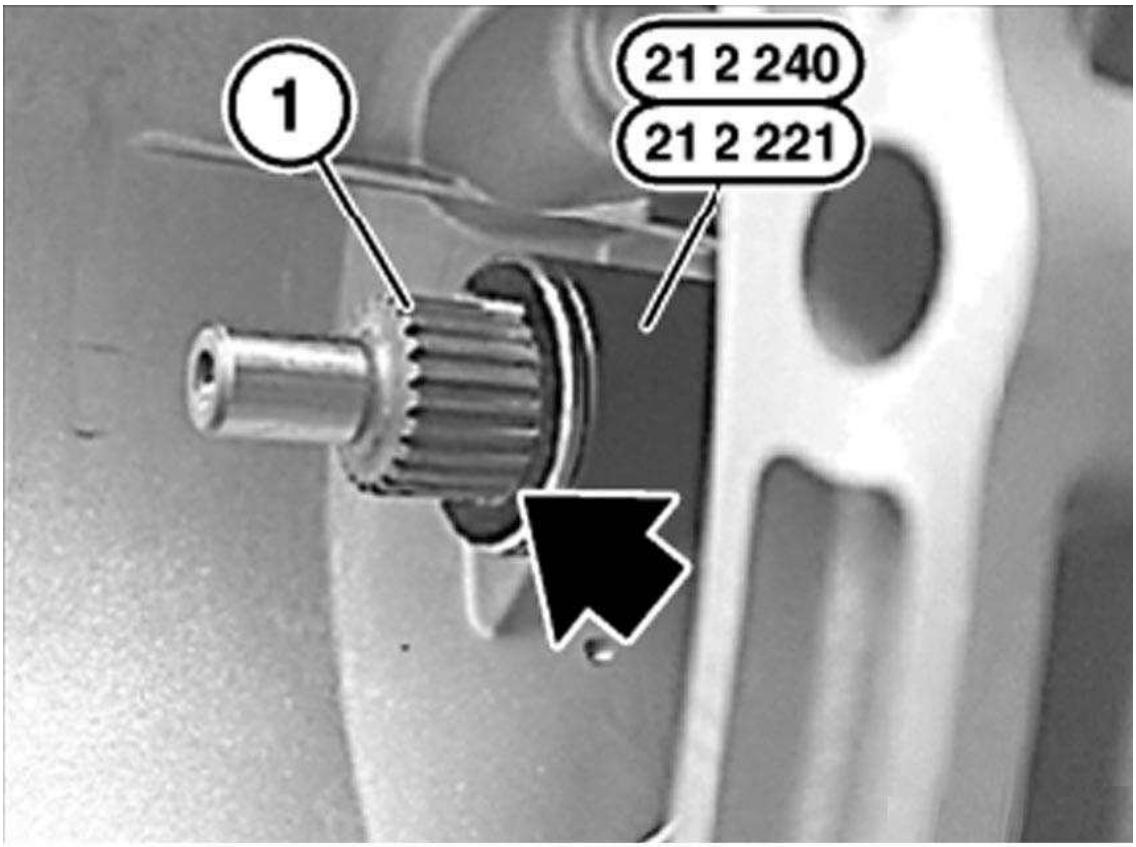


Fig. 13: Checking Lubrication Of Transmission Input Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

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Fig. 14: Locating Grease Scraper Ring
Courtesy of BMW OF NORTH AMERICA, INC.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Clutch Slave Cylinder-To-Clutch Housing/Transmission Case	16 (22)
Transmission Cross Member-To-Body	15 (21)
Transmission Cross Member-To-Rubber Mounts	55 (74)
Transmission-To-Engine	
Hex Screws	
M8	18 (25)
M10	36 (49)
M12	55 (74)
Screw With Torx Head	
M8	16 (22)
M10	32 (43)

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M12	53 (72)
H-Transmission/G Transmission	54 (73)
	INCH Lbs. (N.m)
Transmission-To-Engine M6 Thread	80 (9)

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1997-2005 AUTOMATIC TRANSMISSIONS

Servicing - A5S 325Z & A5S 360R/390R

APPLICATION

For transmission application, see **AUTOMATIC TRANSMISSION APPLICATION** table. For transmission application and oil recommendation, see **Fig. 1** -**Fig. 5** . Also see **LUBRICATION** .

AUTOMATIC TRANSMISSION APPLICATION

Application	Transmission Model
3-Series (E46)	A5S 325Z (5HP19), A5S 360R/390R (GM5)
525i (E39)	A5S 325Z (5HP19)
528i (E39)	A5S 360R/390R (GM5)
530i (E39)	A5S 325Z (5HP19)
X3 (E83)	A5S 360R/390R (GM5)
X5 3.0L (E53)	A5S 360R/390R (GM5)
Z4 (E85)	A5S 325Z (5HP19)

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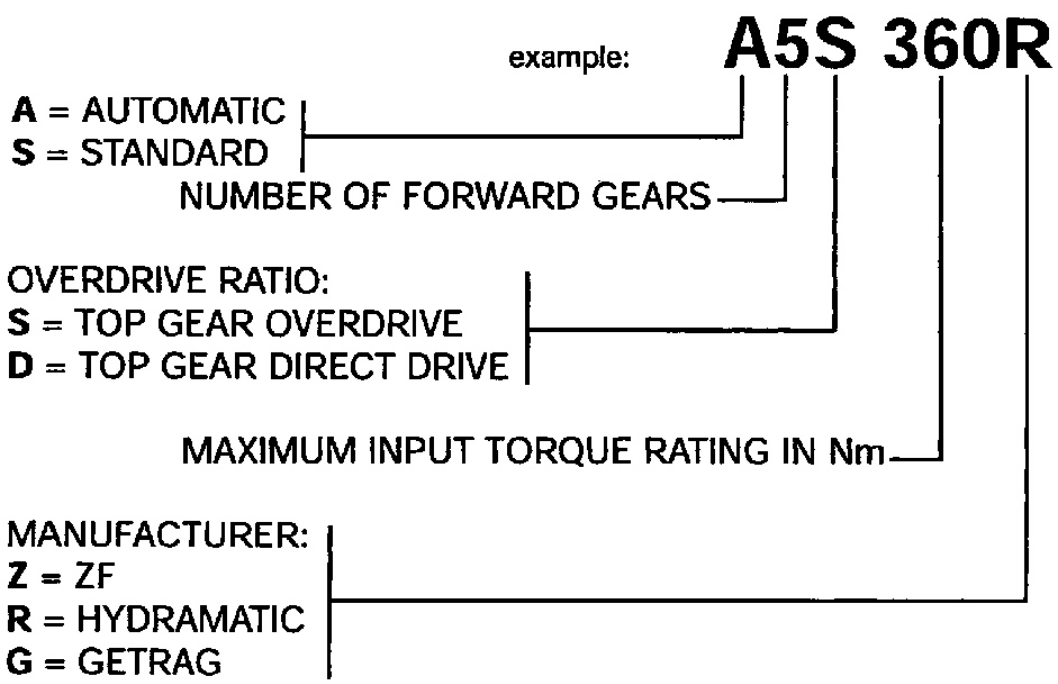


Fig. 1: BMW Transmission Identification Code (1 Of 2)
Courtesy of BMW OF NORTH AMERICA, INC.

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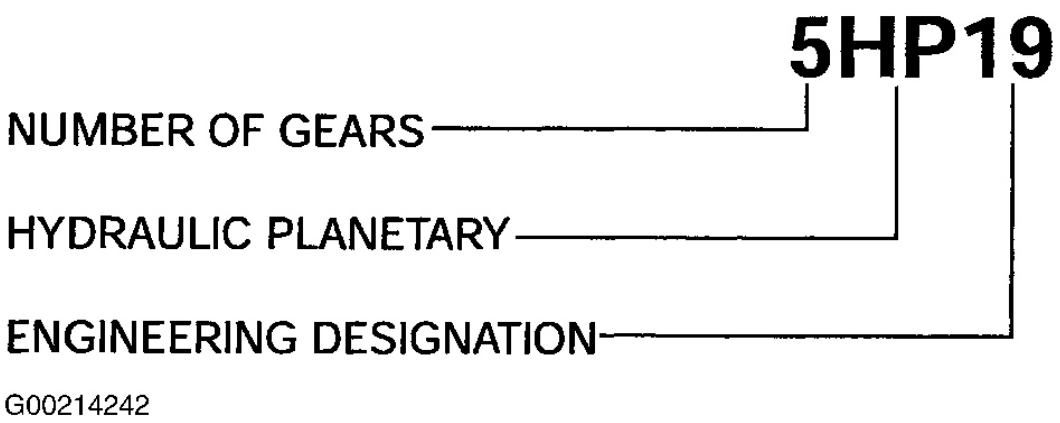


Fig. 2: BMW Transmission Identification Code (2 Of 2)
Courtesy of BMW OF NORTH AMERICA, INC.

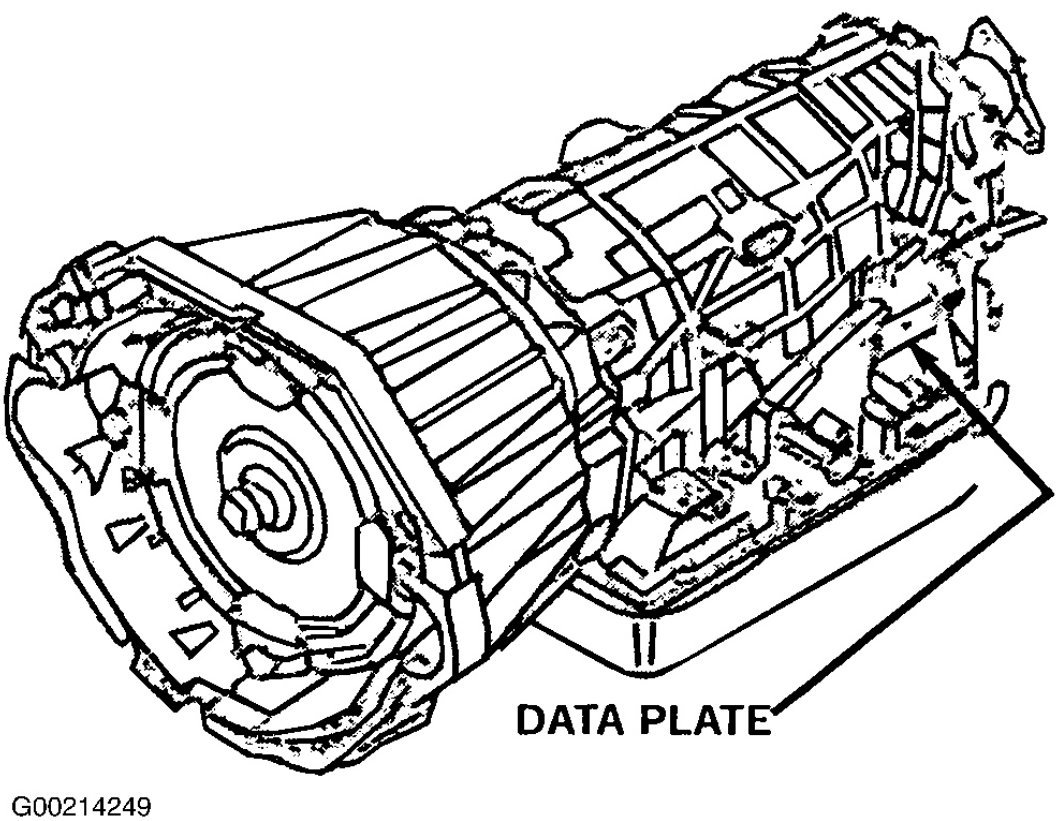


Fig. 3: BMW Transmission Specification Plate
Courtesy of BMW OF NORTH AMERICA, INC.

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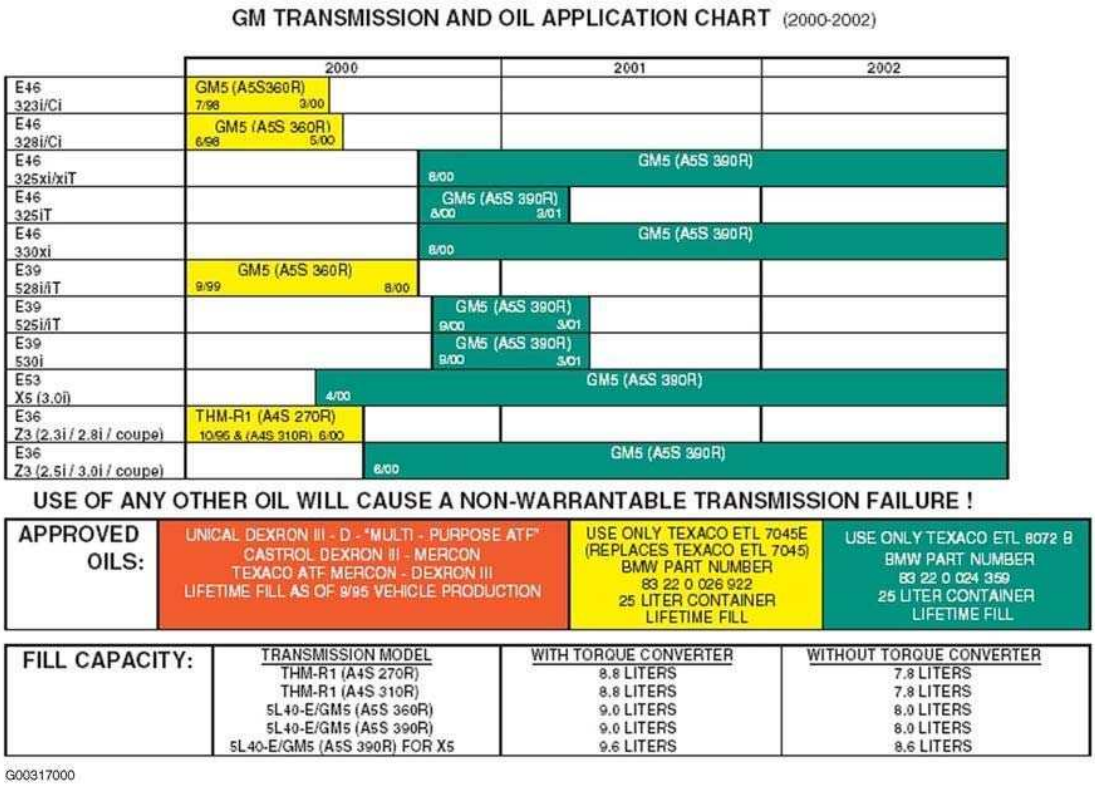


Fig. 4: BMW GM Transmission & Oil Application Chart (2000-02)
Courtesy of BMW OF NORTH AMERICA, INC.

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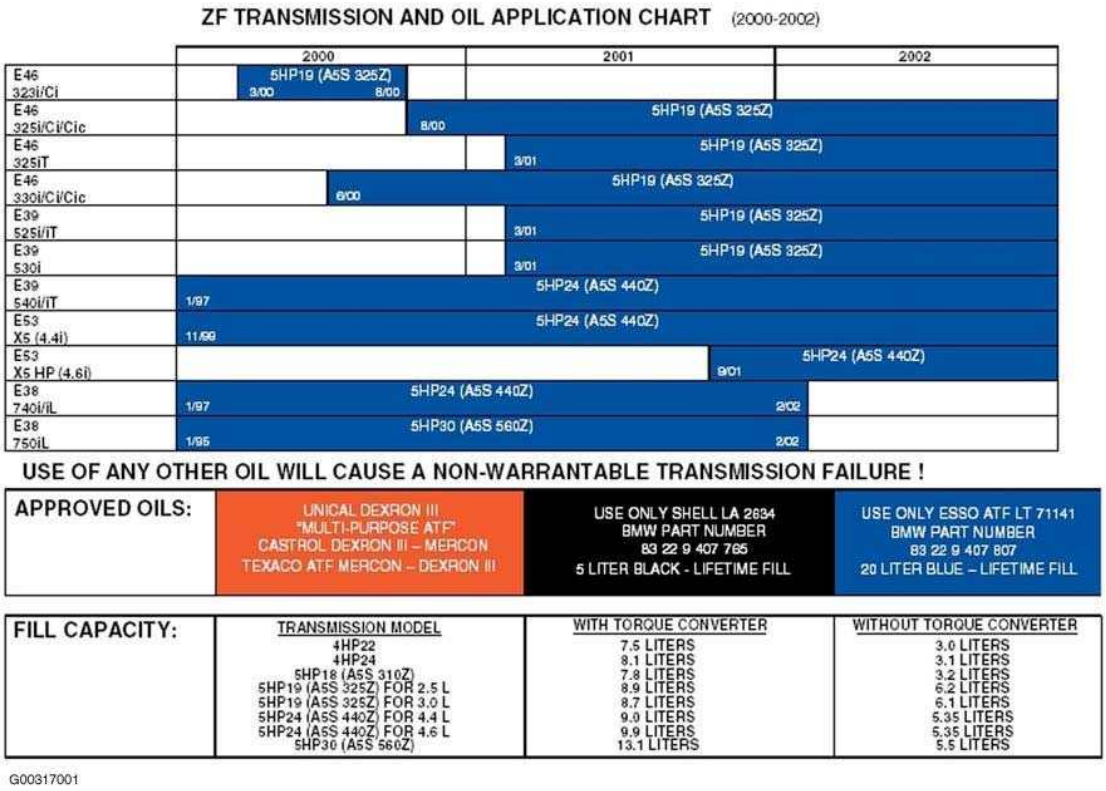


Fig. 5: BMW ZF Transmission & Oil Application Chart (2000-02)
Courtesy of BMW OF NORTH AMERICA, INC.

LUBRICATION

NOTE: Transmission is sealed at factory for life of transmission. If any leaks are found, factory recommends replacing transmission assembly.

SERVICE INTERVALS

Transmission fluid replacement is not necessary, except for some newer model vehicles with Condition Based Service. See **AUTOMATIC TRANSMISSION** overview article.

CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 325Z)

CAUTION: It is absolutely essential to use the approved automatic transmission fluid in this automatic transmission. Failure to comply with this requirement will result in serious damage to the automatic transmission. See RECOMMENDED FLUID .

NOTE: Before releasing filler plug (1), make sure temperature of automatic transmission fluid is at least 30 °C.

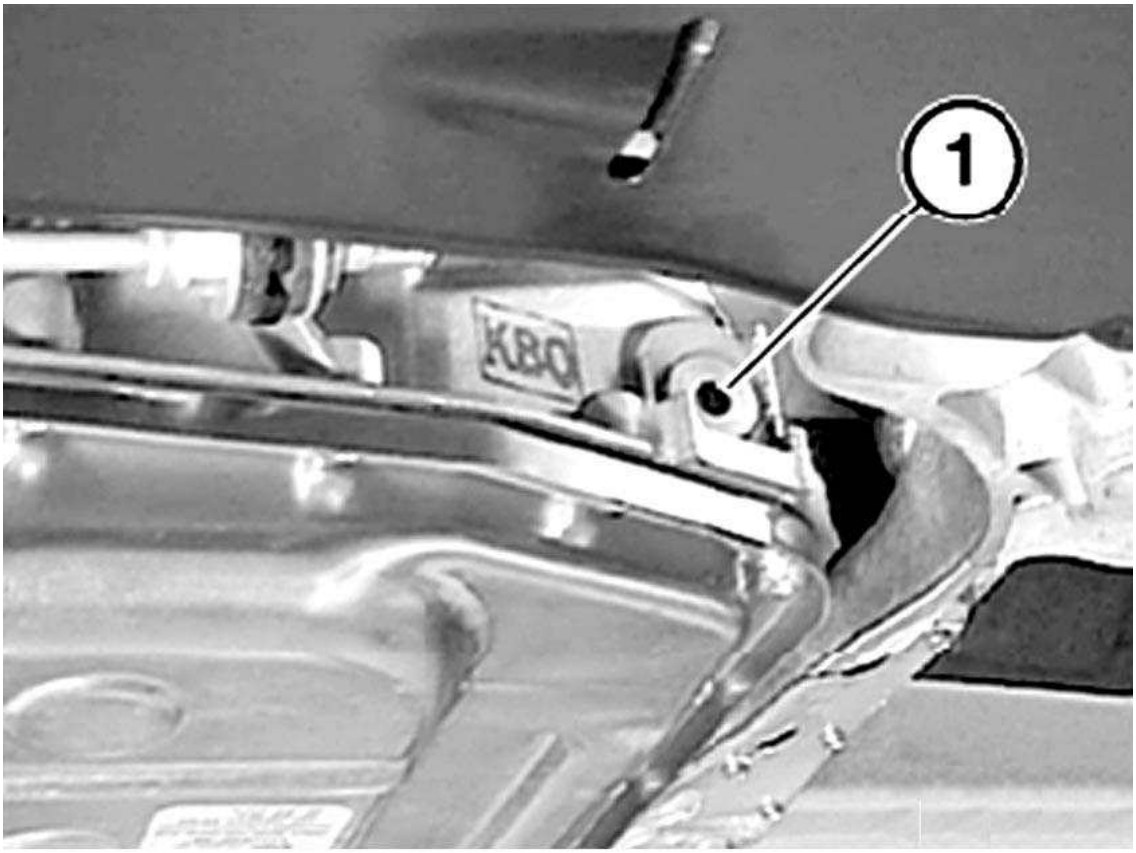
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NOTE: Numbers in text refer to numbers in figures.

Add ATF After Repairs

Selector lever to setting "P". The vehicle must be horizontal and should be secured to prevent it from rolling away. Connect BMW Diagnosis and Information System (DIS) or BMW MoDiC to car.

Release filler plug (1). See **Fig. 6** . Top up automatic transmission fluid until it flows over. Screw in filler plug (1) by hand. Start engine and run at idle speed. Operate brake and shift through all gears at idle speed several times (hold gears for 3 sec. in each case).



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Fig. 6: Locating Filler Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Release filler plug (1) again. Top up automatic transmission fluid until it flows over. Increase temperature of automatic transmission fluid to 40-50°C. Check temperature of automatic transmission fluid with MoDiC or DIS. Screw in filler plug (1).

Installation: replace filler plug (1). Tighten to specification. See **TORQUE SPECIFICATIONS** .

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Check Fluid Level

Connect BMW Diagnosis and Information System (DIS) and/or BMW MoDiC to vehicle and perform fluid level check in accordance with instructions.

CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 360R/390R, A4S 200R/310R)

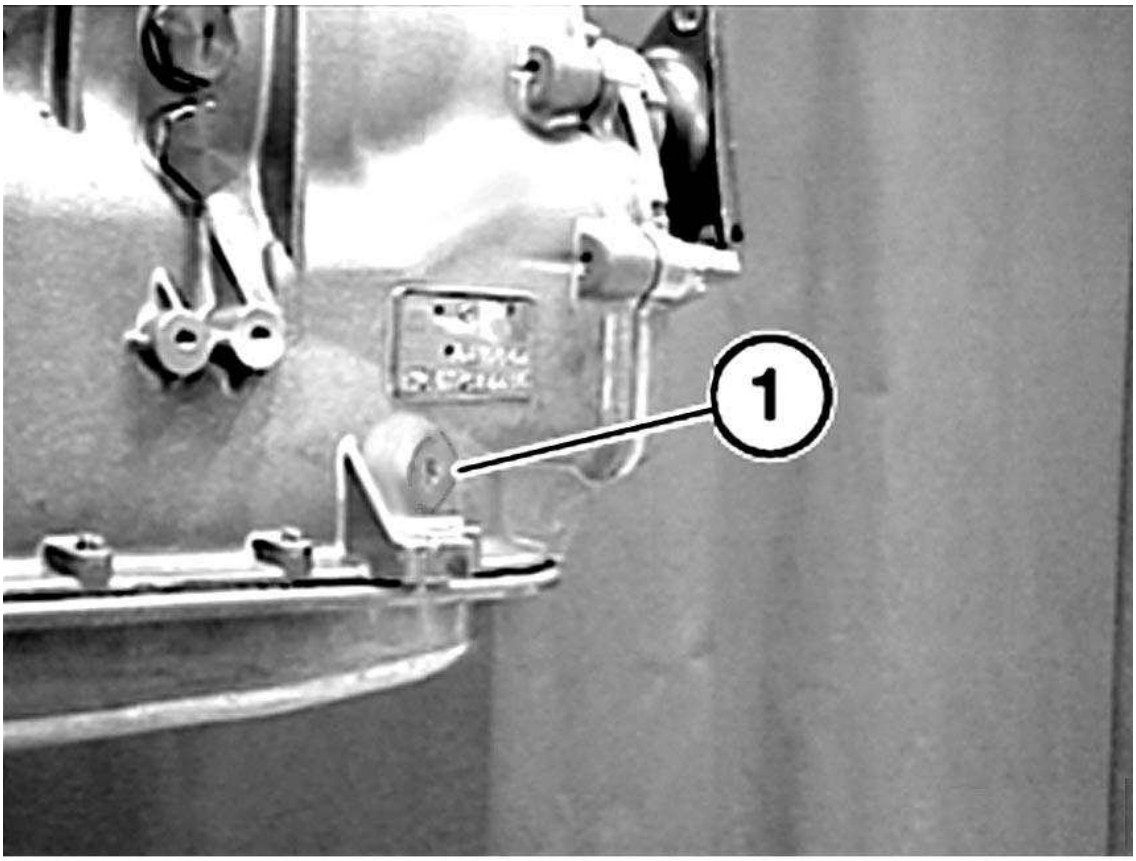
NOTE: Numbers in text refer to numbers in figures.

CAUTION: Use only the approved transmission fluid in this automatic transmission. See RECOMMENDED FLUID . Failure to comply with this requirement will result in serious damage to the automatic transmission. Refer also to adhesive label on transmission fluid sump.

Move selector lever to park position "P". The vehicle must be horizontal and secured against rolling off.

Connect BMW Diagnosis and Information System (DIS) or BMW MoDiC to vehicle. Release filler plug (1). See **Fig. 7** . Top up automatic transmission fluid until overflowing. Screw in filler plug (1) by hand. Start engine and run at idle speed. Actuate brake and shift through all gears at idle speed. Open filler plug (1) again. Increase temperature of transmission fluid to 30-50°C. Interrogate temperature of transmission fluid with MoDiC or DIS. Top up automatic transmission fluid until overflowing. Screw in filler plug (1).

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Fig. 7: Removing Filler Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: check sealing ring on filler plug (1) for damage and, if necessary, replace sealing ring and filler plug. Tighten to specification. See **TORQUE SPECIFICATIONS** .

RECOMMENDED FLUID

A5S 360R/390R (GM5)

330xi (6/00 To Present)

The transmission oil pan will be labeled with either Texaco ETL-7045 or Dexron III. Fill or top off with the proper fluid only. Do not mix Texaco ETL-7045 and Dexron fluids.

A5S 325Z (5HP19)

330i & 330Ci (6/00 To Present) & 325i & 325Ci (9/00 To Present)

No fluid changes are necessary. Never mix any other oil with this transmission when doing repair or when topping off. Use ESSO (LT 711441) BMW part No. (83 22 9 407 807).

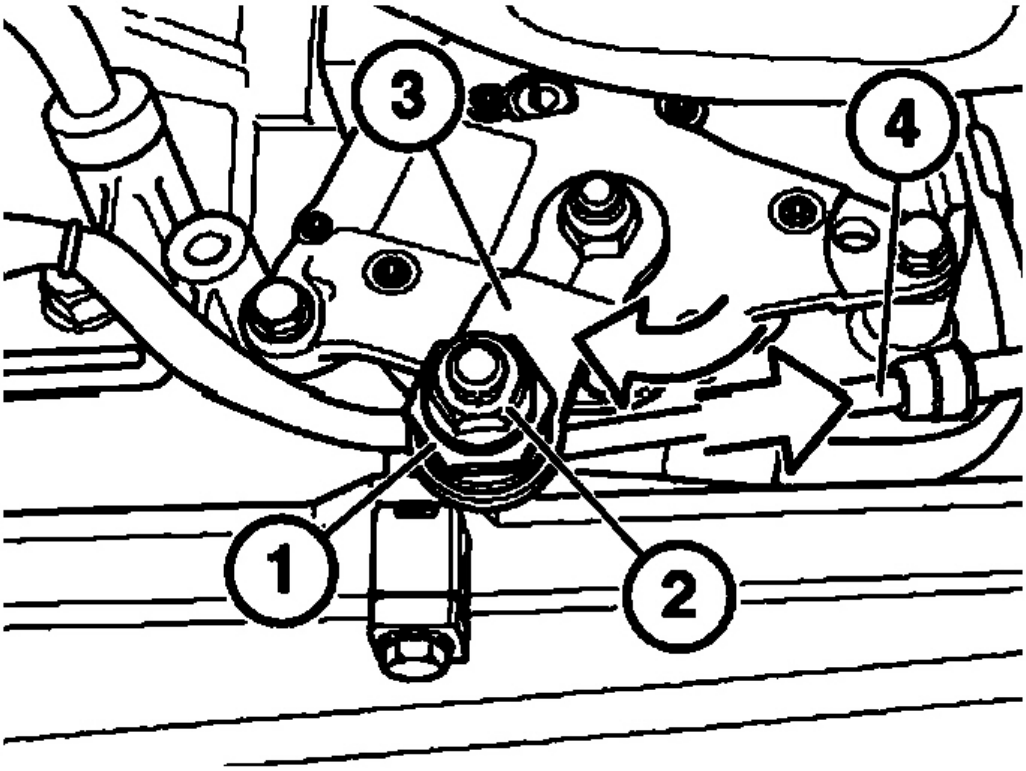
ADJUSTMENTS

GEARSHIFT SELECTOR LEVER CABLE (A5S 325Z)

NOTE: Numbers in text refer to numbers in figures.

Check cable for ease of movement. More selector lever to "P" setting. Grip clamp bushing (1). Loosen nut (2). Press selector lever (3) forward (park position). Press cable (4) in direction of arrow and release again. Grip clamping piece (1). Tighten nut (2) to 88 INCH lbs. (10 N.m). See **Fig. 8** . Move selector lever to "P" position. Check whether parking lock is engaged by rotating shaft or pushing car.

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1. Clamp Bushing
2. Nut
3. Selector Lever
4. Cable

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Fig. 8: Adjusting Selector Lever Cable (A5S 325Z)
Courtesy of BMW OF NORTH AMERICA, INC.

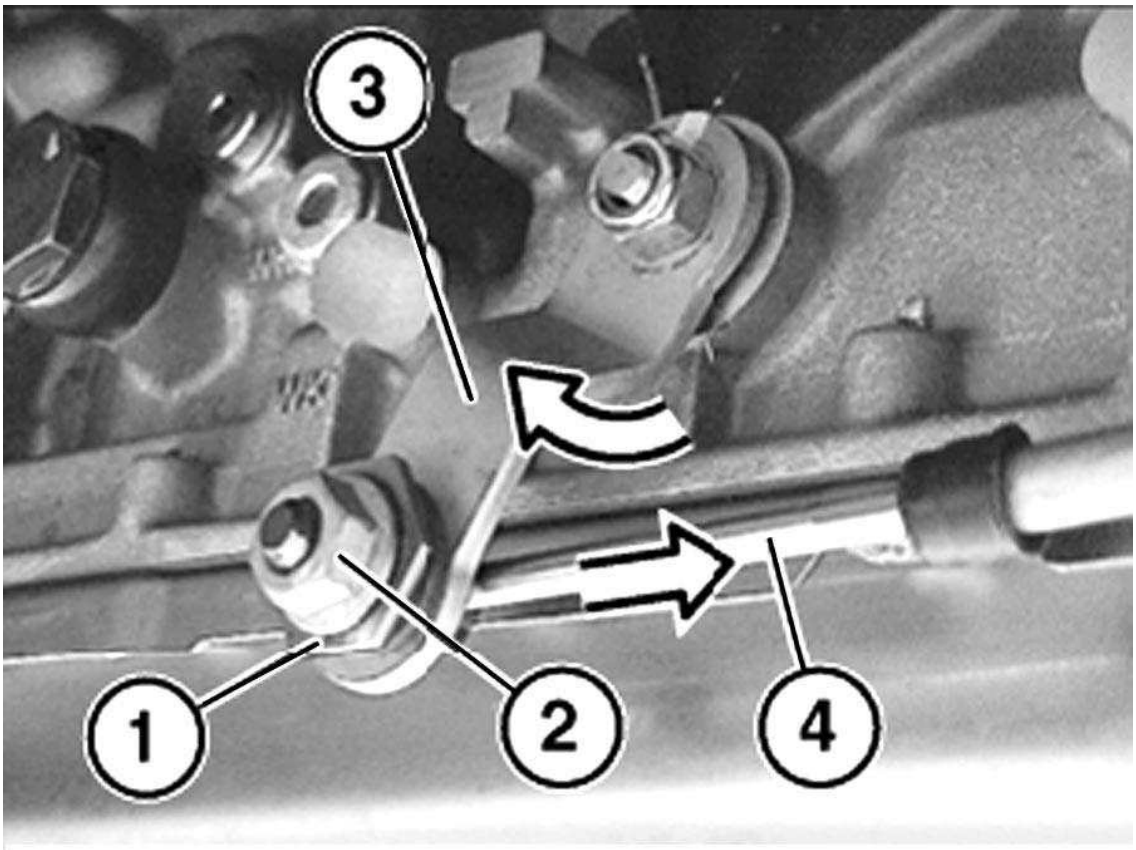
ADJUSTING SELECTOR LEVER (A5S 360R/390R, A4S 200R, 6HP26Z/19Z)

NOTE: Numbers in text refer to numbers in figures.

Check cable for ease of movement. Move selector lever to "P" position.

Grip clamping sleeve (1). See **Fig. 9** . Slacken nut (2). Press selector lever (3) forwards into park position. Press cable (4) in direction of arrow and release again. Grip clamping sleeve (1). Tighten down nut (2) to specification. See **TORQUE SPECIFICATIONS** .

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Fig. 9: Adjusting Selector Lever
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: move selector lever to "P" position. Check whether parking gear is engaged by turning propeller shaft.

PROGRAMMING

CONTROL UNIT

Turn off ignition. Connect MoDiC or DIS Tester. Turn on ignition. Select "Programming". For subsequent procedure, follow MoDiC or DIS instructions. Installation location of control unit, refer to DIS Tester.

REMOVAL & INSTALLATION

CAUTION: It is absolutely essential to use the approved automatic transmission fluid in this automatic transmission. Failure to comply with this requirement will result in serious damage to the automatic transmission.

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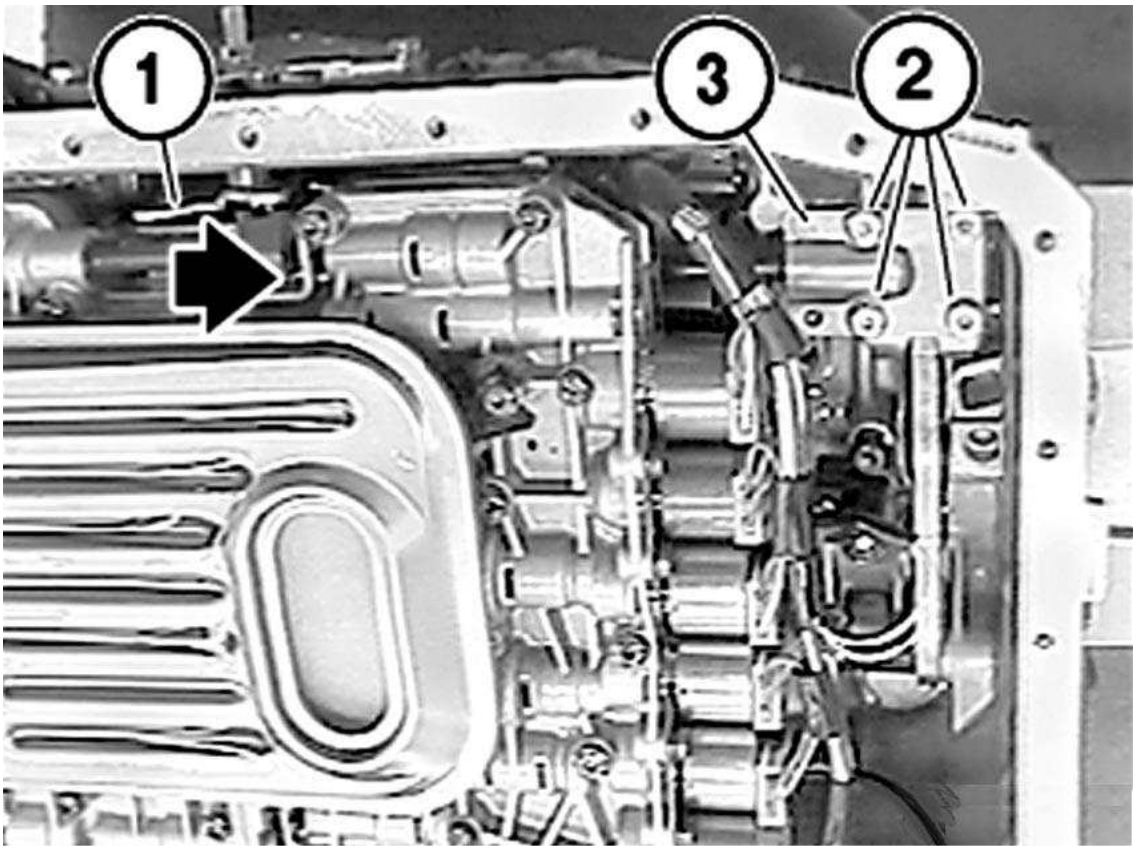
REMOVING AND INSTALLING OR REPLACING PARKING LOCK (A5S 325Z)

NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 325Z) .

Remove and install transmission oil sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION OIL SUMP (A5S 325Z)** .

Push in detent disk (1) in direction of arrow up to stop. See **Fig. 10** . Unfasten screws (2). Remove guide bracket (3). Upon installation, tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .



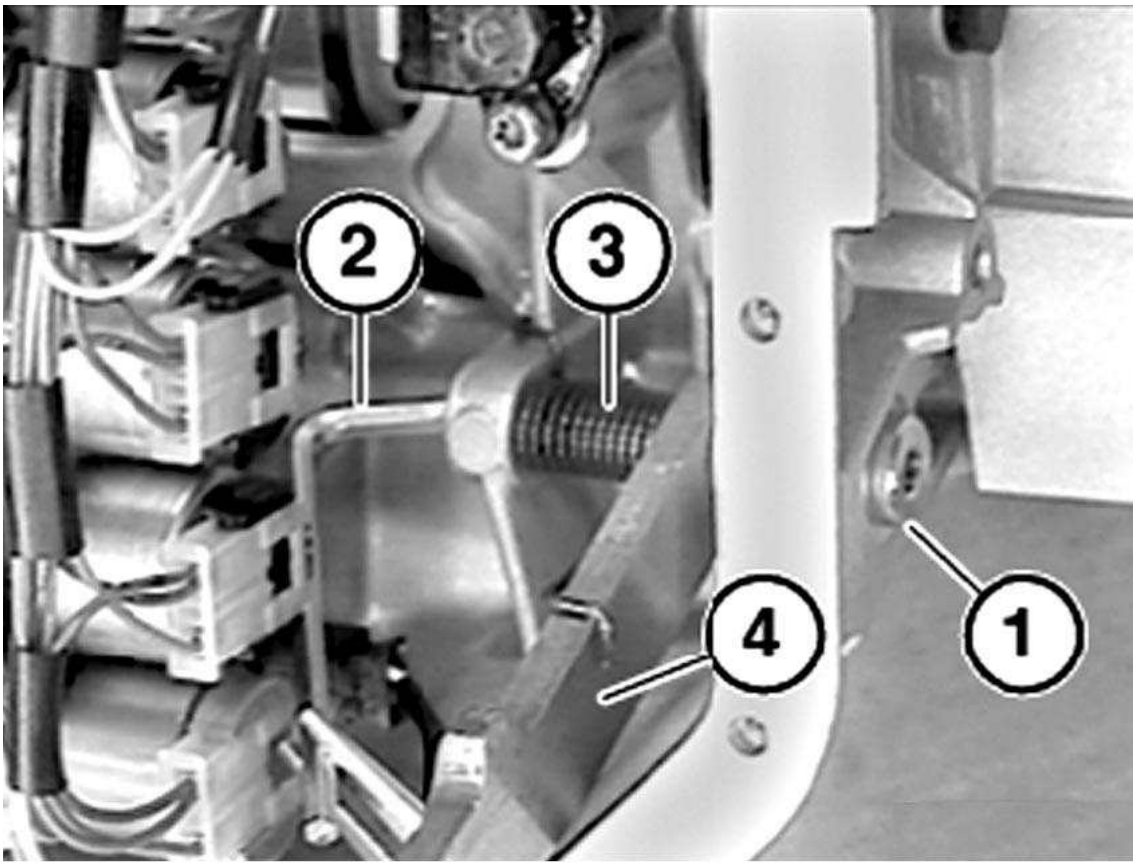
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Fig. 10: Removing Guide Bracket
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew bolt (1). See **Fig. 11** . With an offset tool (2) (e.g. hexagon socket screw key 5 A/F), push out guide pin of locking pawl (4). Remove spring (3) and locking pawl (4). Upon installation, tighten fasteners to

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specification. See **TORQUE SPECIFICATIONS** .



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Fig. 11: Removing Spring & Locking Pawl
Courtesy of BMW OF NORTH AMERICA, INC.

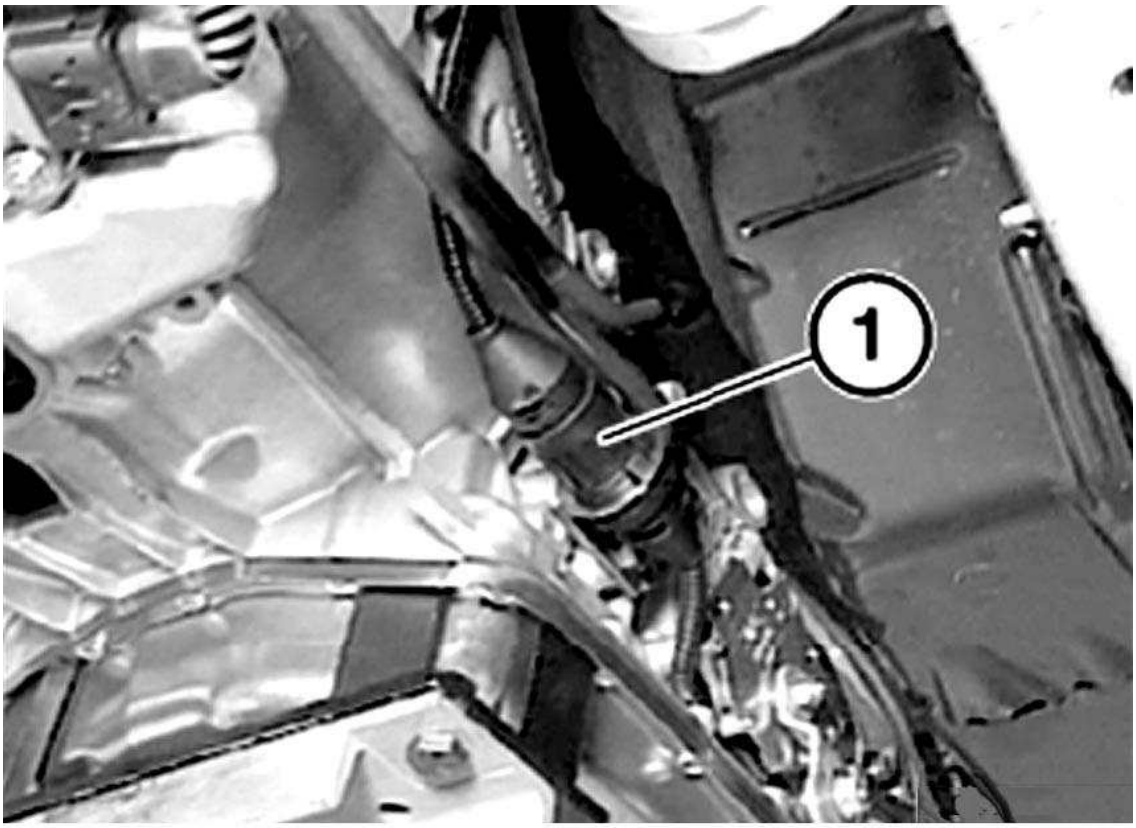
Installation: check function of parking lock. Move selector lever into "P" setting. Check whether parking lock is engaged by rotating Cardan shaft or by pushing car.

REMOVING AND INSTALLING/REPLACING POSITION SWITCH (A5S 325Z)

NOTE: Numbers in text refer to numbers in figures.

Move selector lever into "P" setting. Unlock cable plug (1) and disconnect. See **Fig. 12** .

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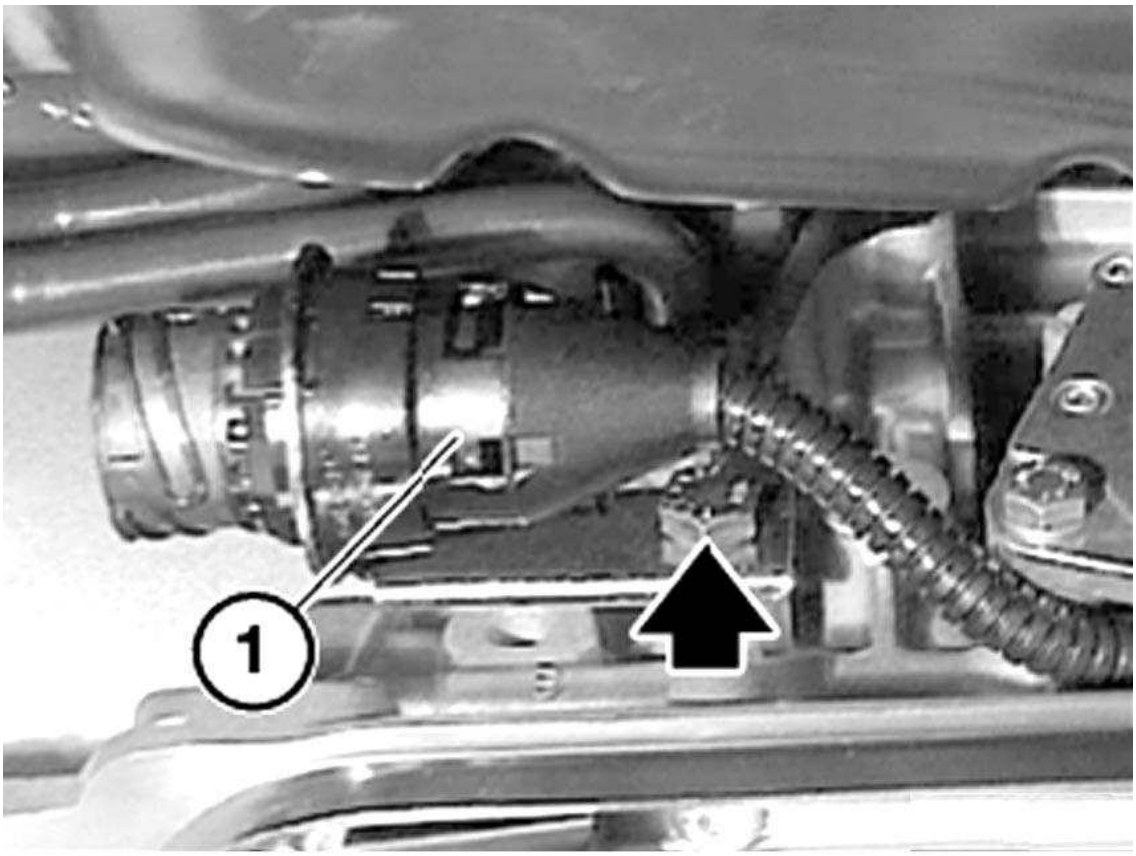


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Fig. 12: Locating Cable Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw. Remove cable plug (1) with retaining bracket. See **Fig. 13** .

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Fig. 13: Removing Cable Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Grip clamping sleeve (1). See **Fig. 14** . Loosen nut (2). Installation: adjust selector lever. See **GEARSHIFT SELECTOR LEVER CABLE** .

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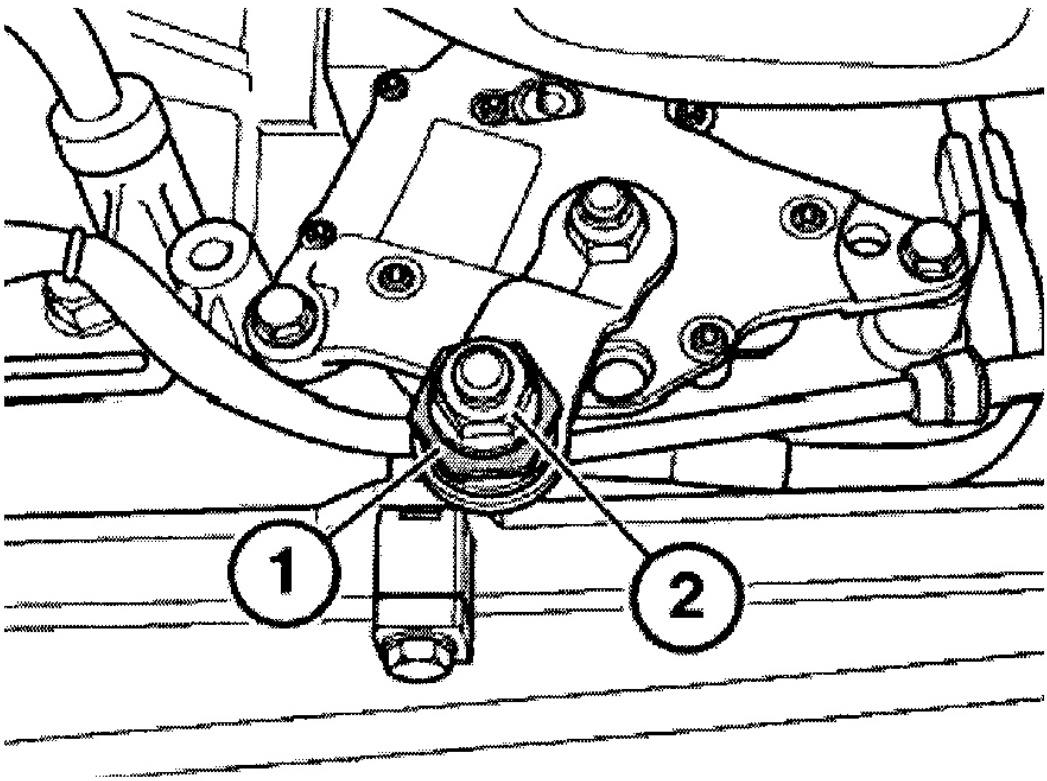
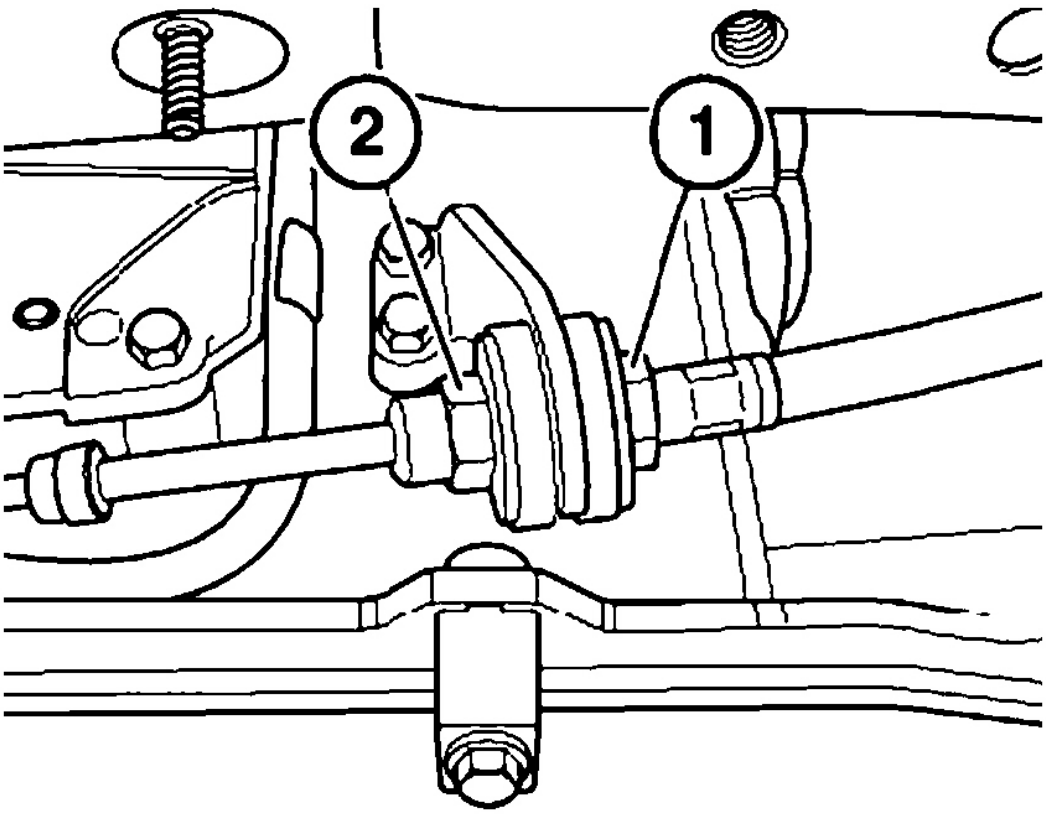


Fig. 14: Locating Shift Lever Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Grip cable at hexagon head (1). Unscrew nut (2). See **Fig. 15** . Remove cable from bracket. Upon installation, tighten to specification. See **TORQUE SPECIFICATIONS** .

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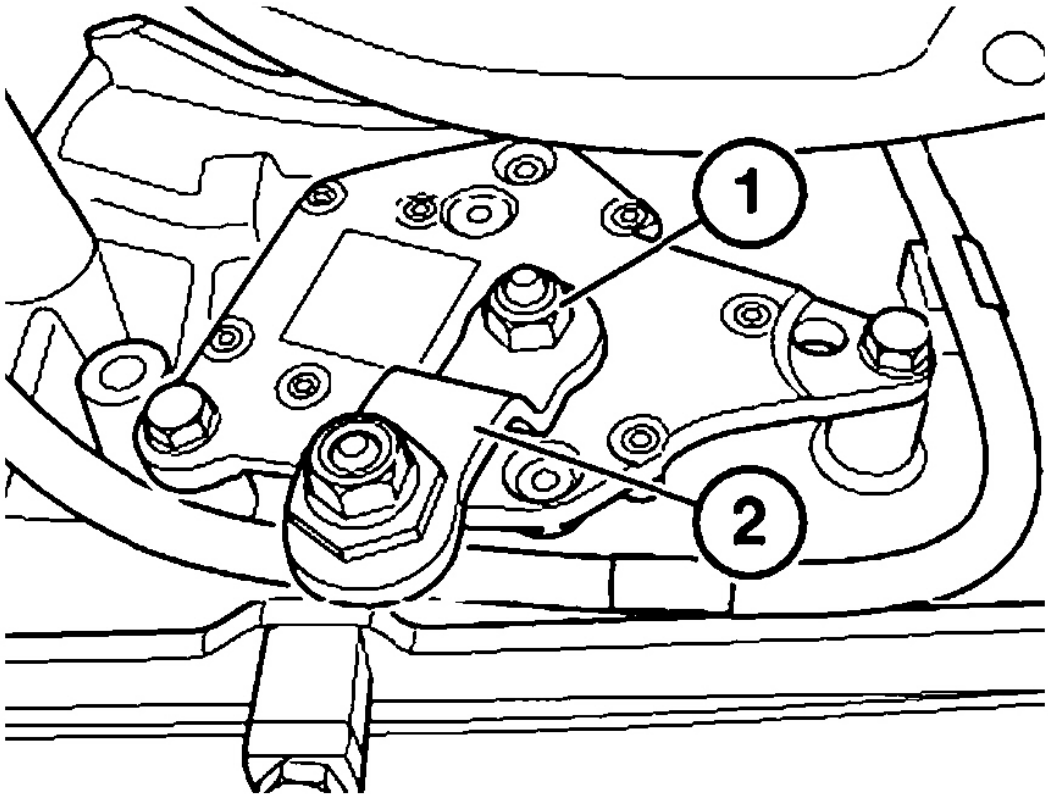


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Fig. 15: Removing Cable From Bracket
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew nut (1). See **Fig. 16** . Remove gearshift lever (2). Upon installation, tighten to specification. See **TORQUE SPECIFICATIONS** .

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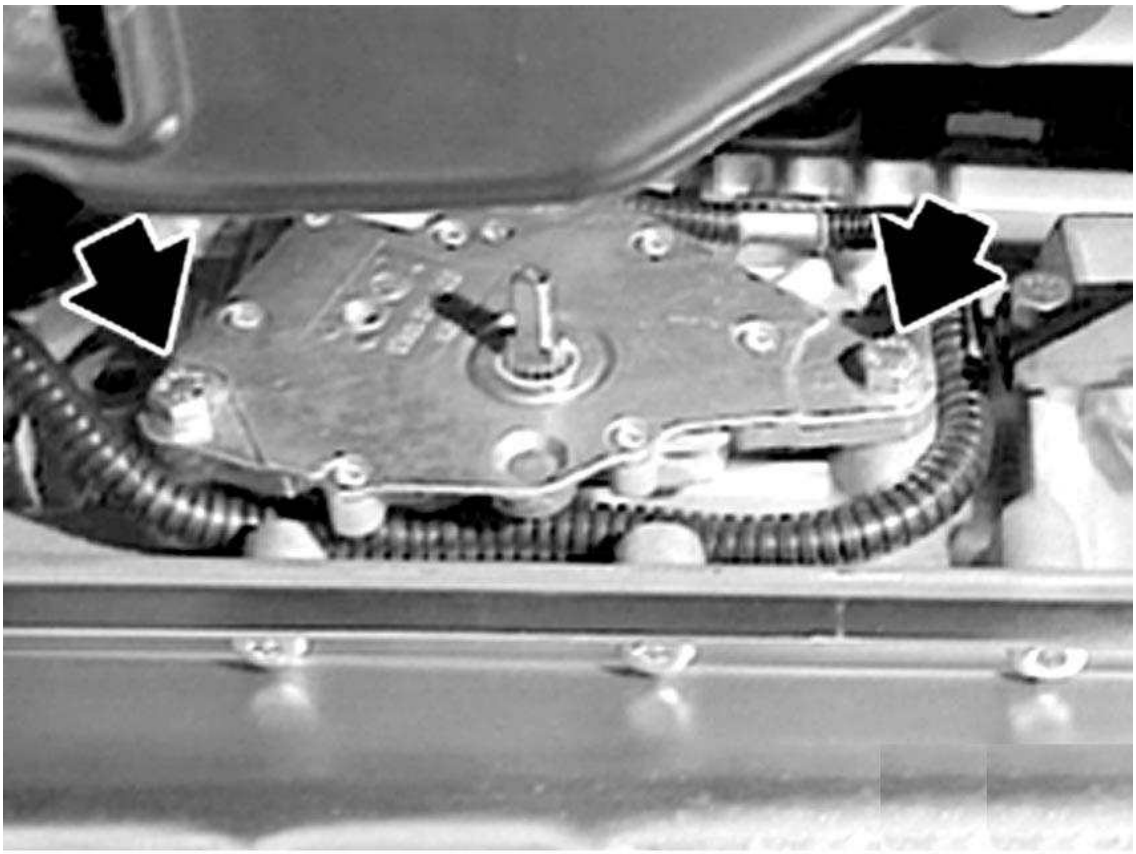


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Fig. 16: Removing Gearshift Lever
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws. Detach position switch from manual shift valve shaft. See **Fig. 17** . Upon installation, pay attention to locating pin and cable routing.

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Fig. 17: Detaching Position Switch
Courtesy of BMW OF NORTH AMERICA, INC.

To install, reverse removal procedure.

REMOVING AND INSTALLING/REPLACING SHIFT UNIT (A5S 325Z)

NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 325Z) .

Remove and install transmission sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION OIL SUMP (A5S 325Z)** .

Remove and install/replace transmission fluid screen. See **REMOVING AND INSTALLING/REPLACING TRANSMISSION OIL SCREEN (A5S 325Z)** .

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Remove retaining clip with screwdriver (2). See **Fig. 18** . Insert transmission plug (1) in transmission. Upon installation: to facilitate assembly, coat O-ring with Vaseline. See **Fig. 19** .

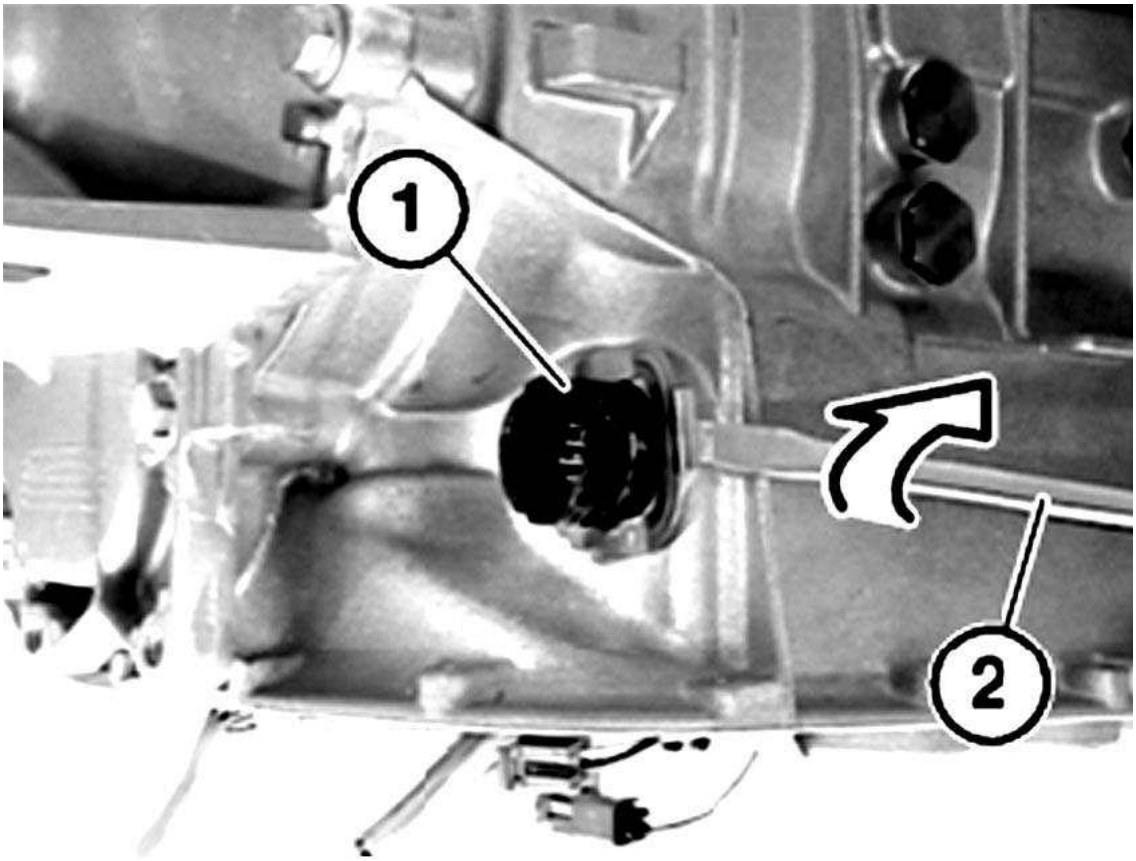


Fig. 18: Removing Retaining Clip
Courtesy of BMW OF NORTH AMERICA, INC.

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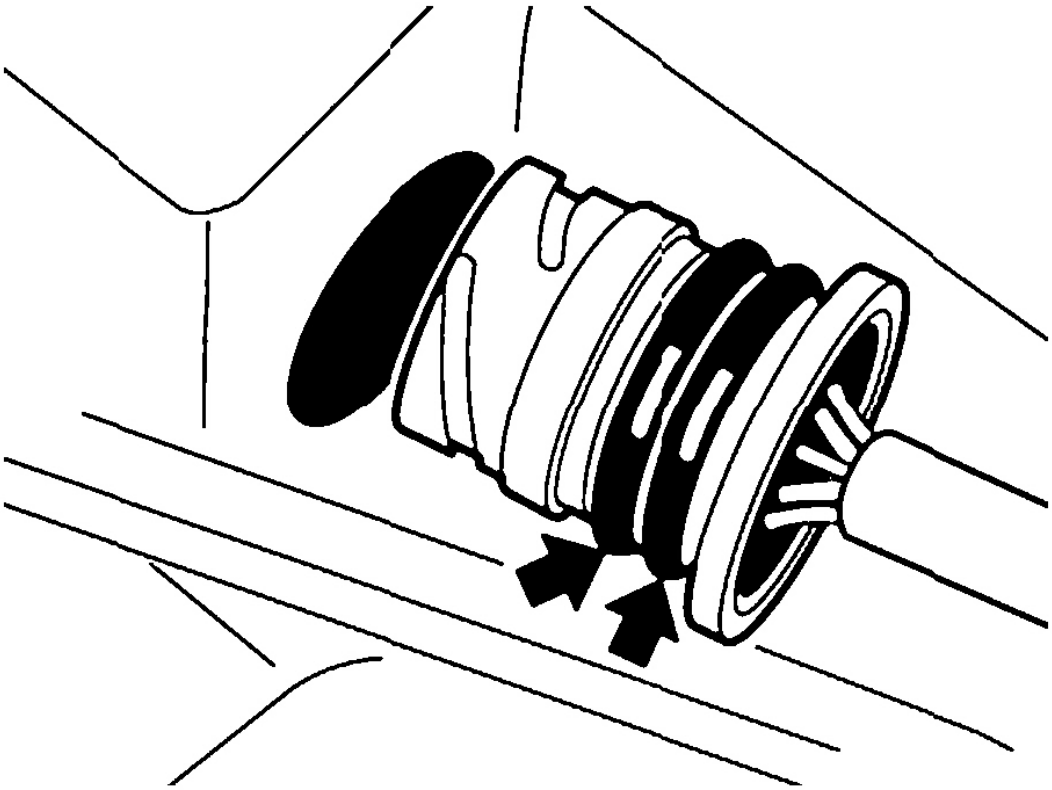
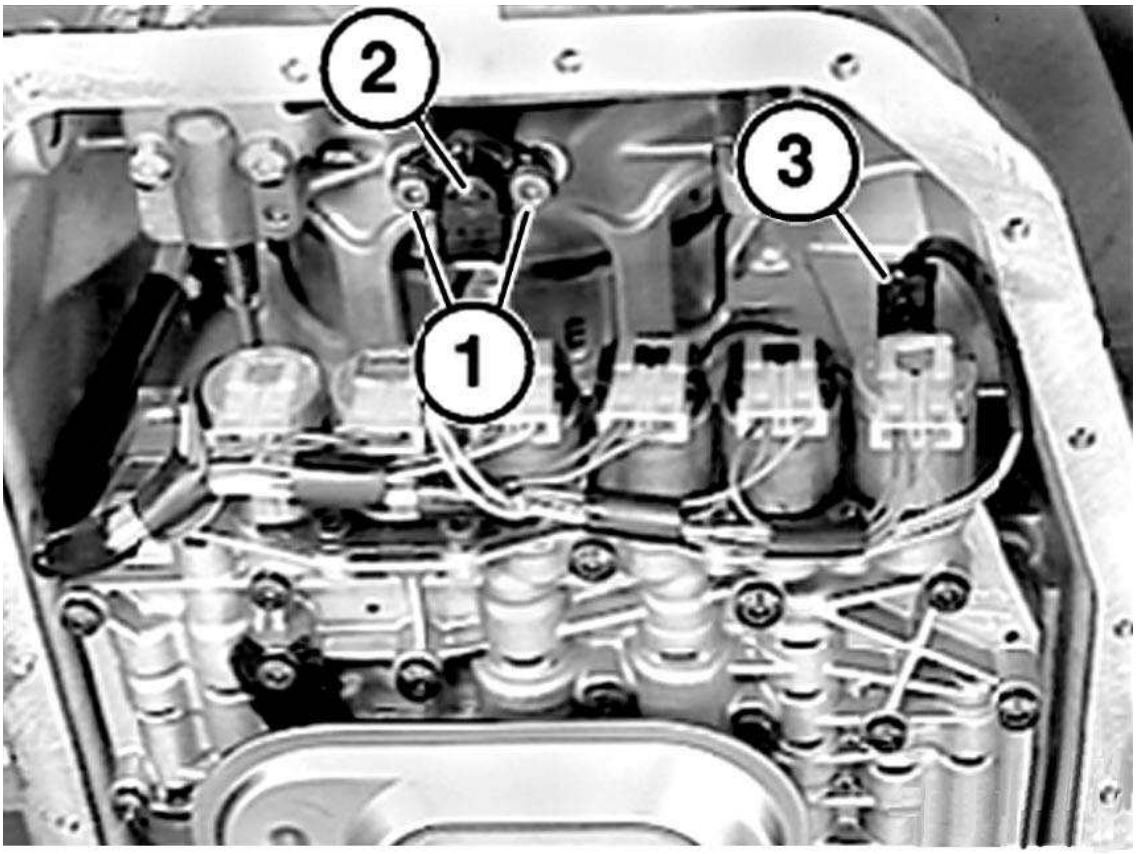


Fig. 19: Locating O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1). See **Fig. 20** . Remove pulse generator (2). Pull off connector (3).

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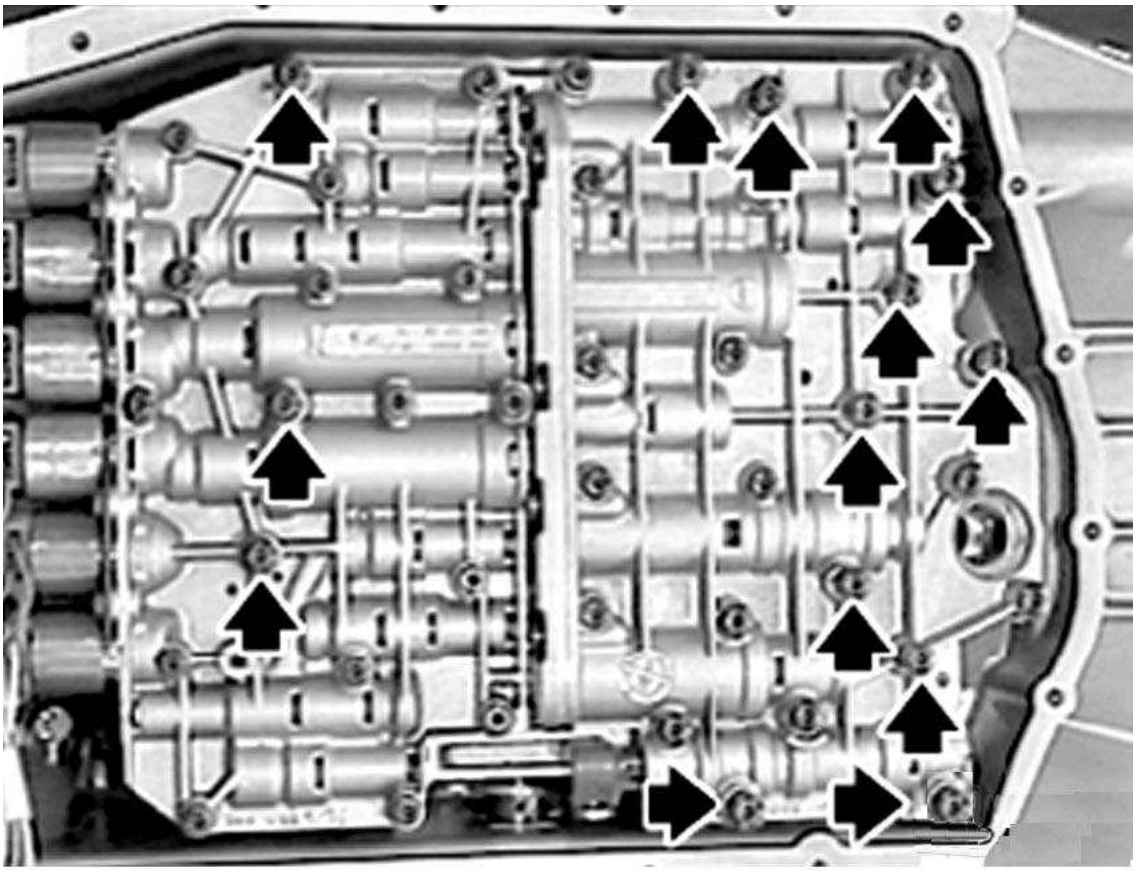


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Fig. 20: Removing Pulse Generator
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws. See **Fig. 21** . Take off valve body. Upon installation, tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .

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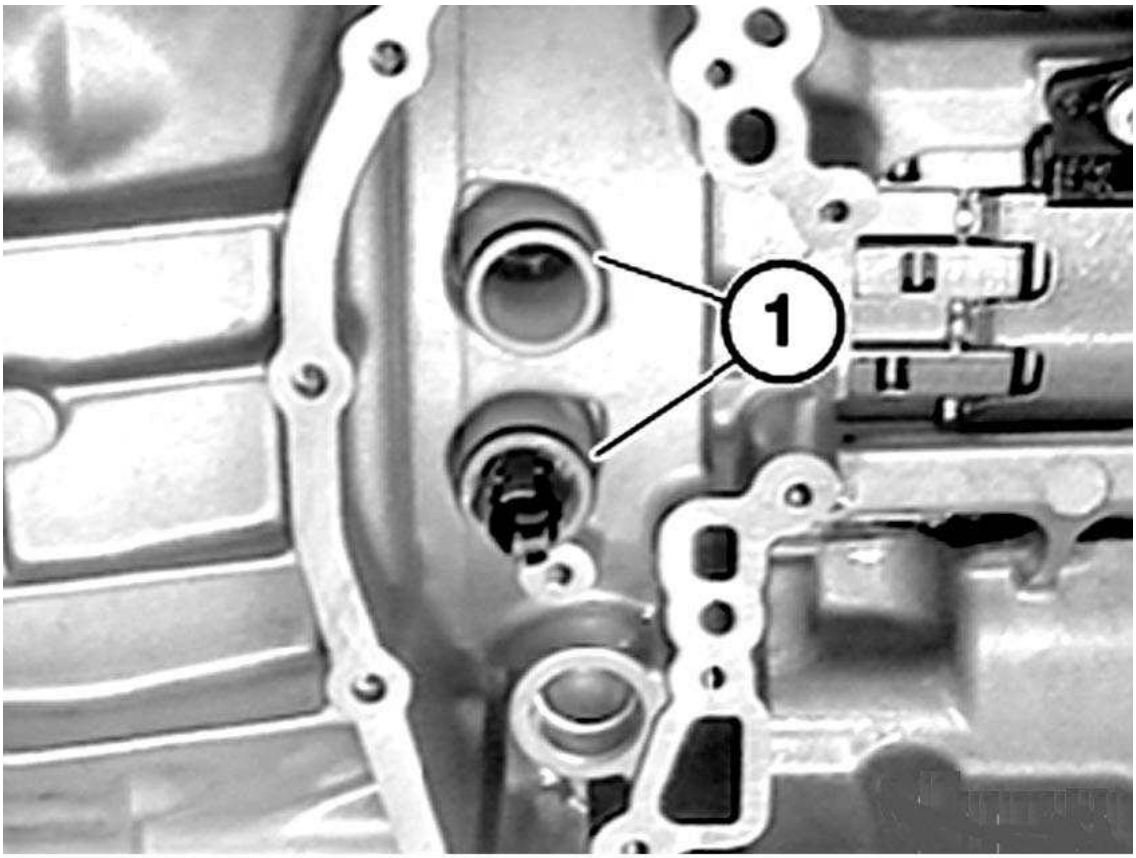
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Fig. 21: Removing Valve Body
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: coat O-rings (1) with automatic transmission fluid. See **Fig. 22** .

CAUTION: Journal (1) of detent disk must be located in groove (2) of slide valve. See Fig. 23 .

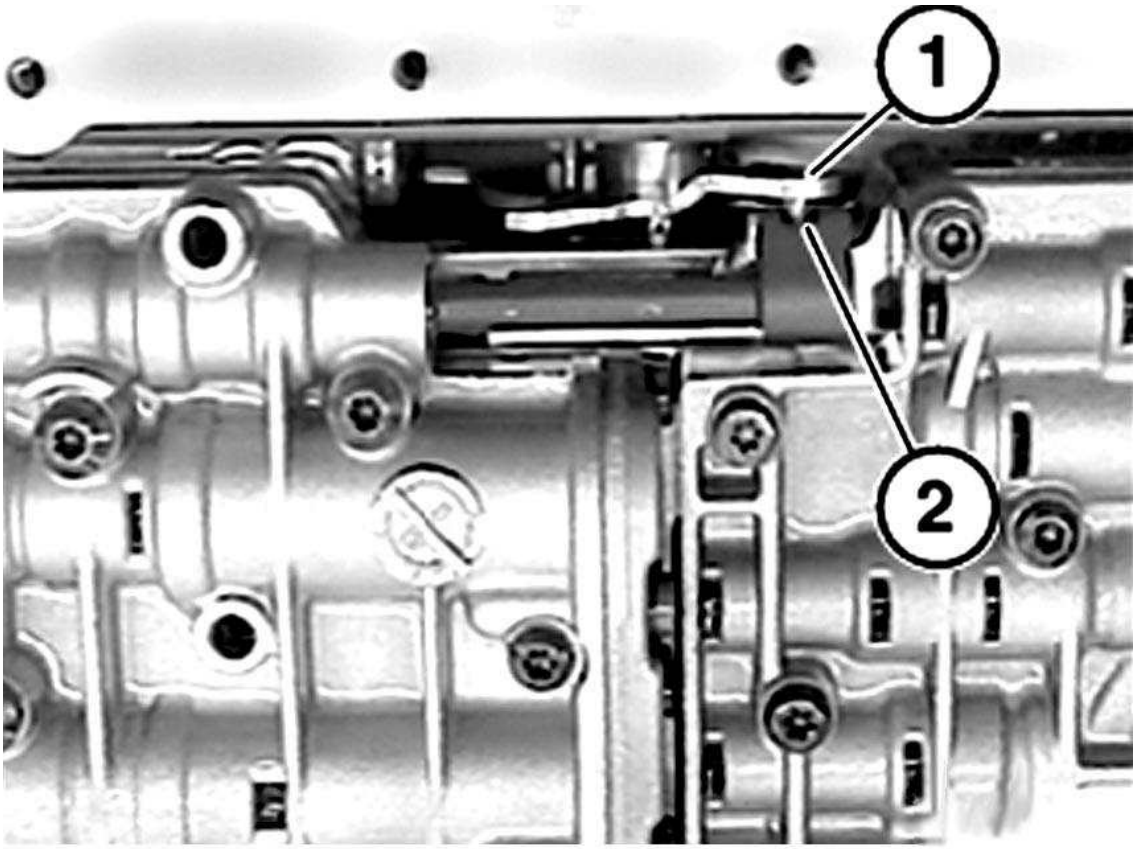
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Fig. 22: Locating O-Rings
Courtesy of BMW OF NORTH AMERICA, INC.

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Fig. 23: Locating Detent Disk
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING SOLENOID VALVE OR PRESSURE REGULATOR (A5S 325Z)

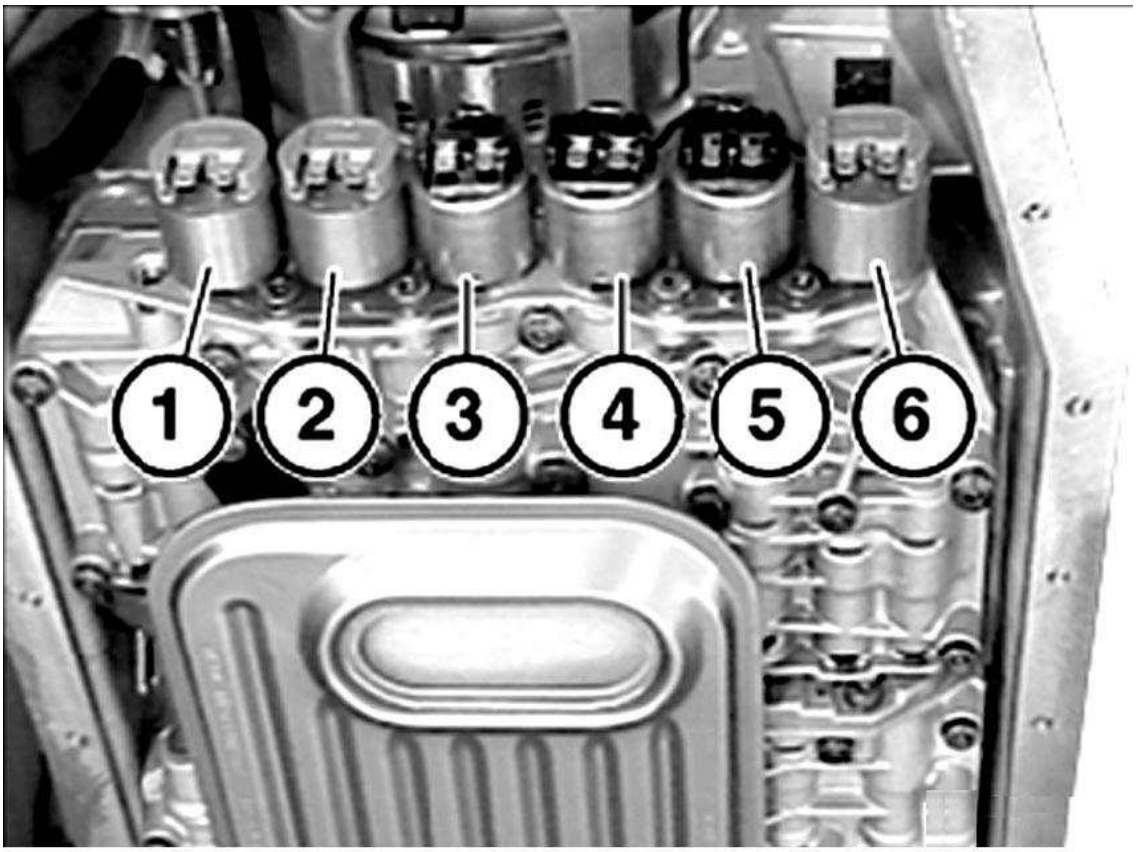
NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 325Z) .

Remove and install transmission oil sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION OIL SUMP (A5S 325Z)** .

To locate solenoid valve and pressure regulator components, see **Fig. 24** .

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Fig. 24: Locating Solenoid Valve & Pressure Regulator Valve Components
Courtesy of BMW OF NORTH AMERICA, INC.

Detach plug (1) from solenoid valve or pressure regulator. See **Fig. 25** .

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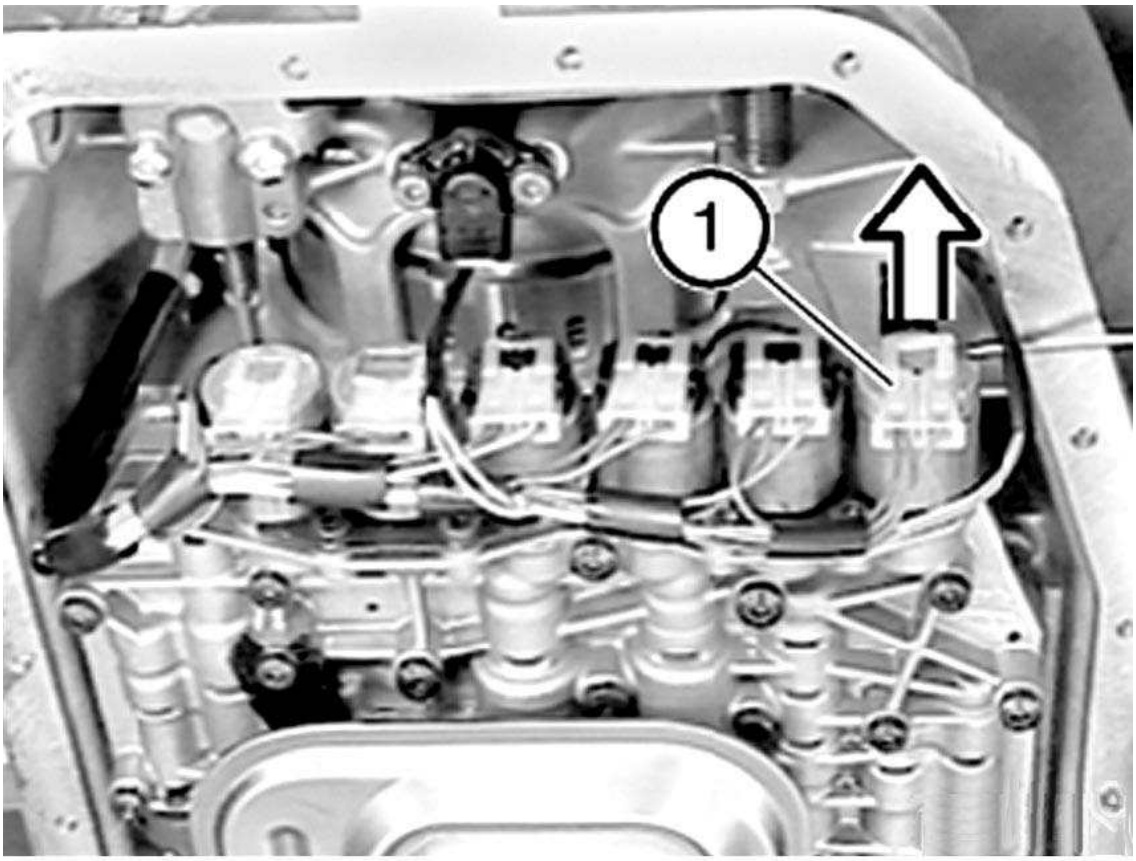
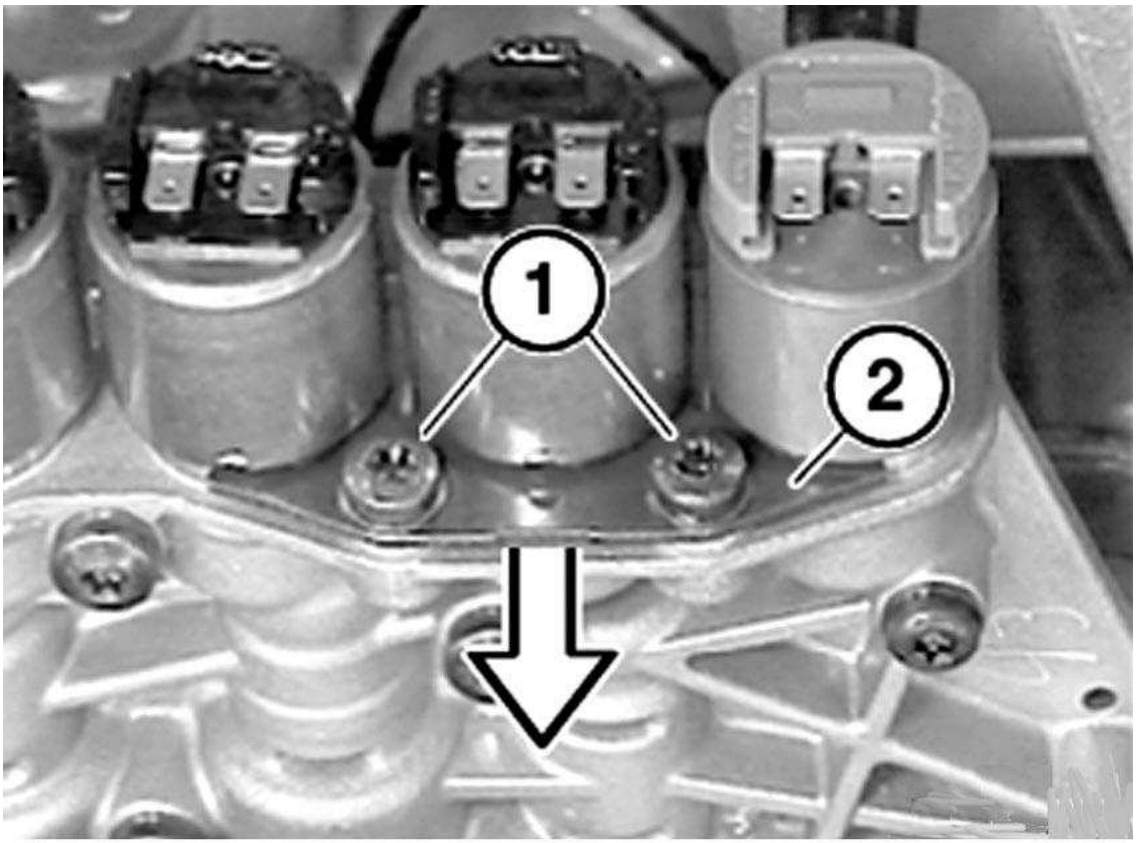


Fig. 25: Detaching Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1). See **Fig. 26** . Remove retaining plate (2). Withdraw solenoid valve (1, 2 or 3) or pressure regulator (2, 3 or 4). Upon installation: coat new solenoid valve with ATF.

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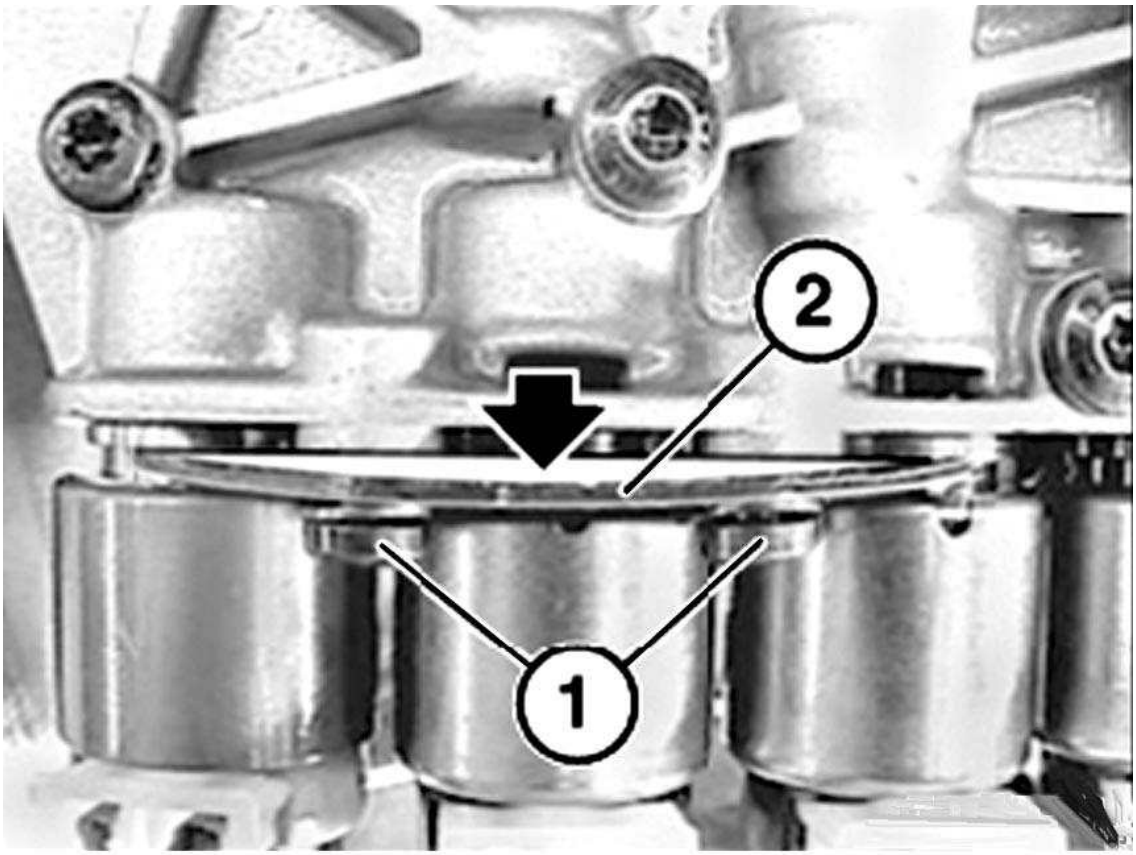


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Fig. 26: Removing Solenoid Valve Or Pressure Regulator
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: note installation position of retaining plate (2). See **Fig. 27** . Curved surface of retaining plate (2) must point to solenoid valve or pressure regulator. Install screws (1). Tighten to specification. See **TORQUE SPECIFICATIONS** .

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Fig. 27: Installing Retaining Plate
Courtesy of BMW OF NORTH AMERICA, INC.

REMOVING AND INSTALLING/REPLACING SELECTOR UNIT (A5S 360R/390R, A4S 200R)

NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 360R / 390R, A4S 200R / 310R) .

Remove and install transmission fluid sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION FLUID SUMP (A5S 360R / 390R, A4S 200R)** .

Remove and install/replace transmission fluid screen. See **REMOVING AND INSTALLING/REPLACING TRANSMISSION SCREEN (A5S 360R / 390R, A4S 200R)** .

NOTE: As of model year 2001 (04/2000), the temperature sensor is integrated in the

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wiring harness.

Disconnect all plug connections on shift unit. See **Fig. 28** . Unclip temperature sensor (1) from holder.

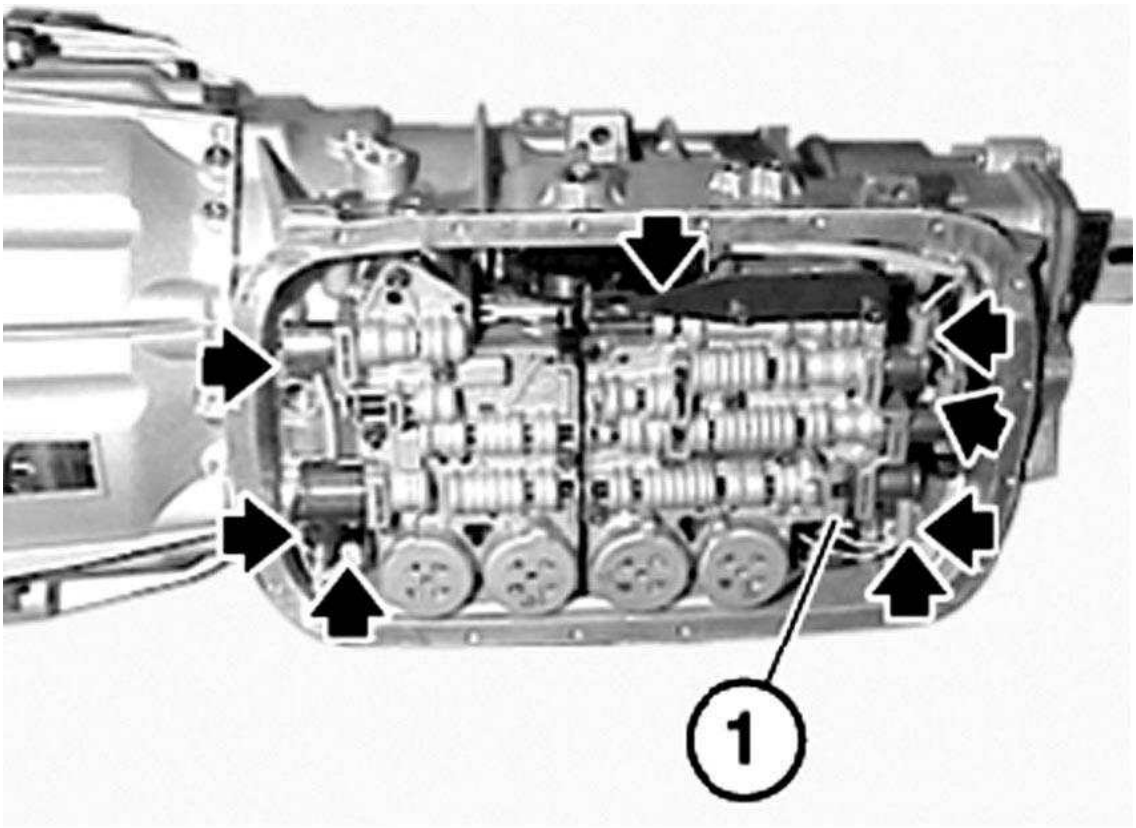


Fig. 28: Locating Plug Connections & Temperature Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE:

DO NOT release screws (1). See **Fig. 29** . Release all other screws, with outside Torx E8, on shift unit and remove shift unit.

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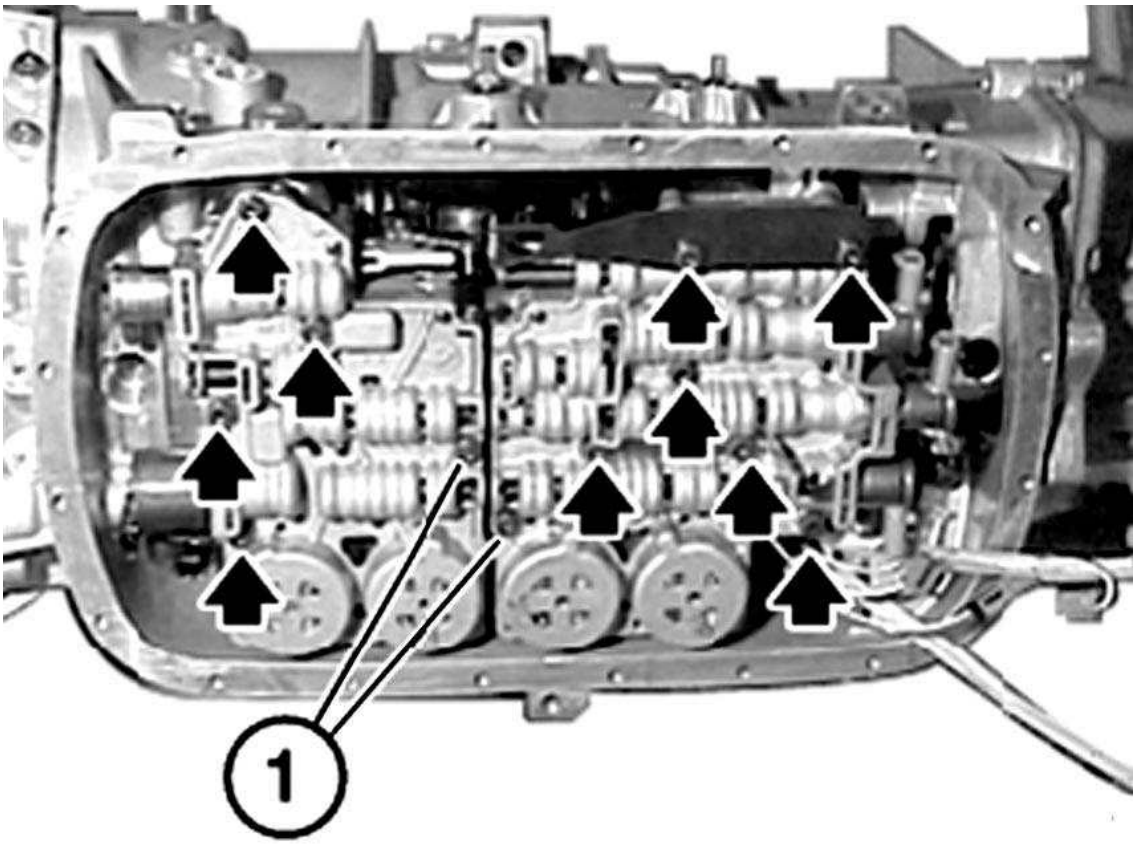
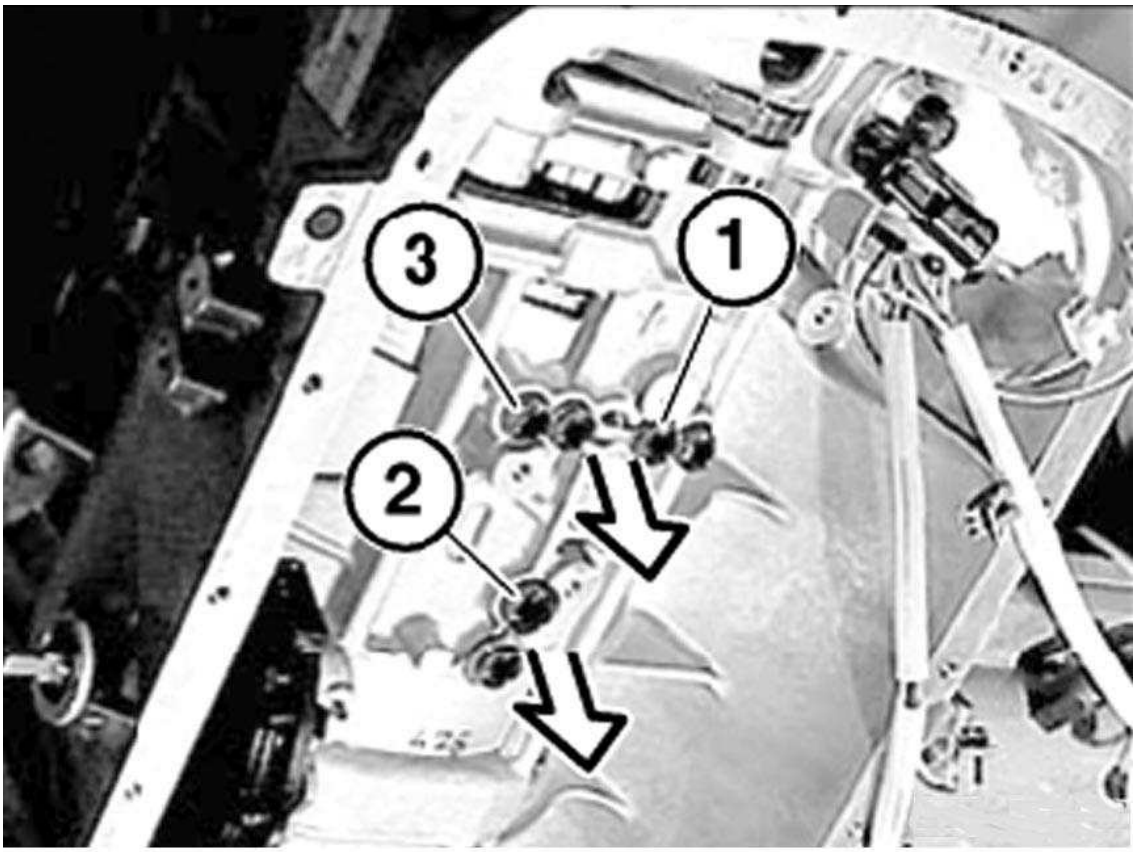


Fig. 29: Removing Shift Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Pull out seals (1), (2) and (3). See **Fig. 30** . Coat new seals with automatic transmission fluid and install.

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

Installation: blow out tapped holes with compressed air gun. Insert set screws (1) from seal set into tapped holes. See **Fig. 31** .

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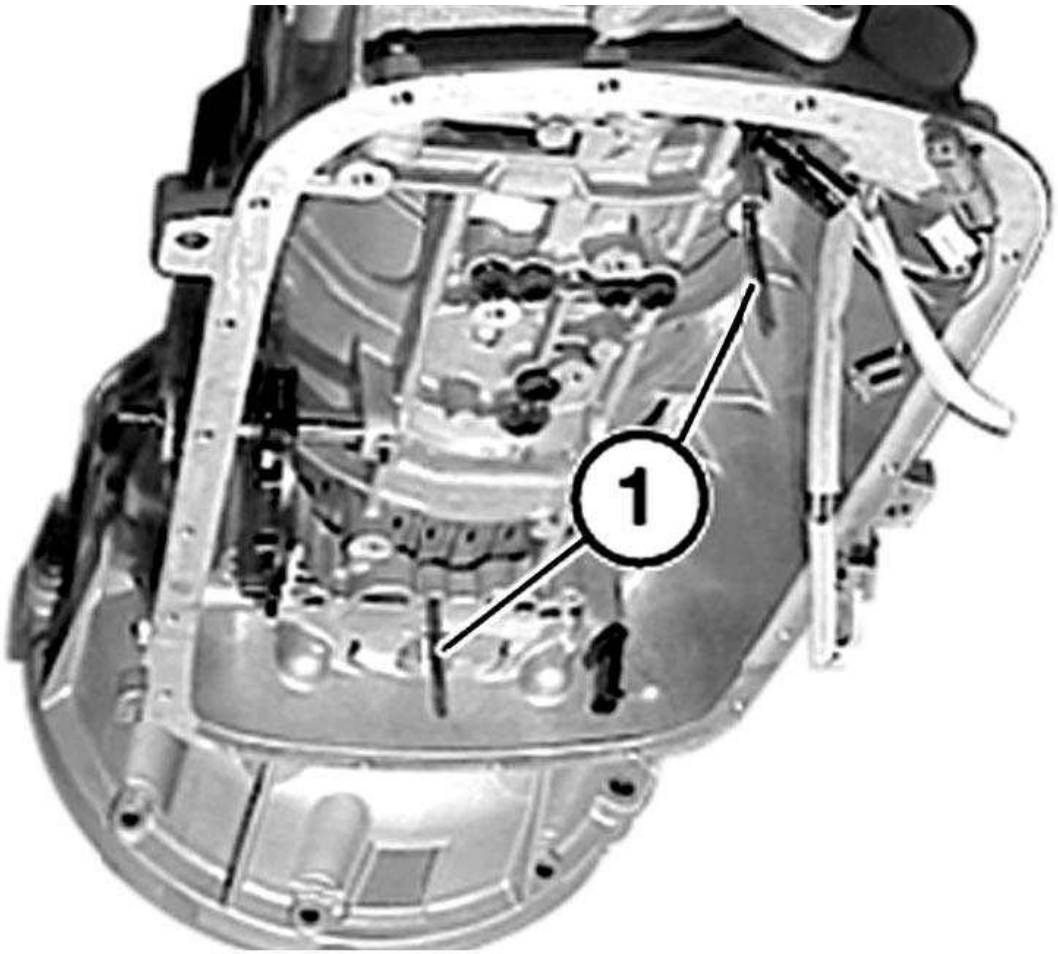
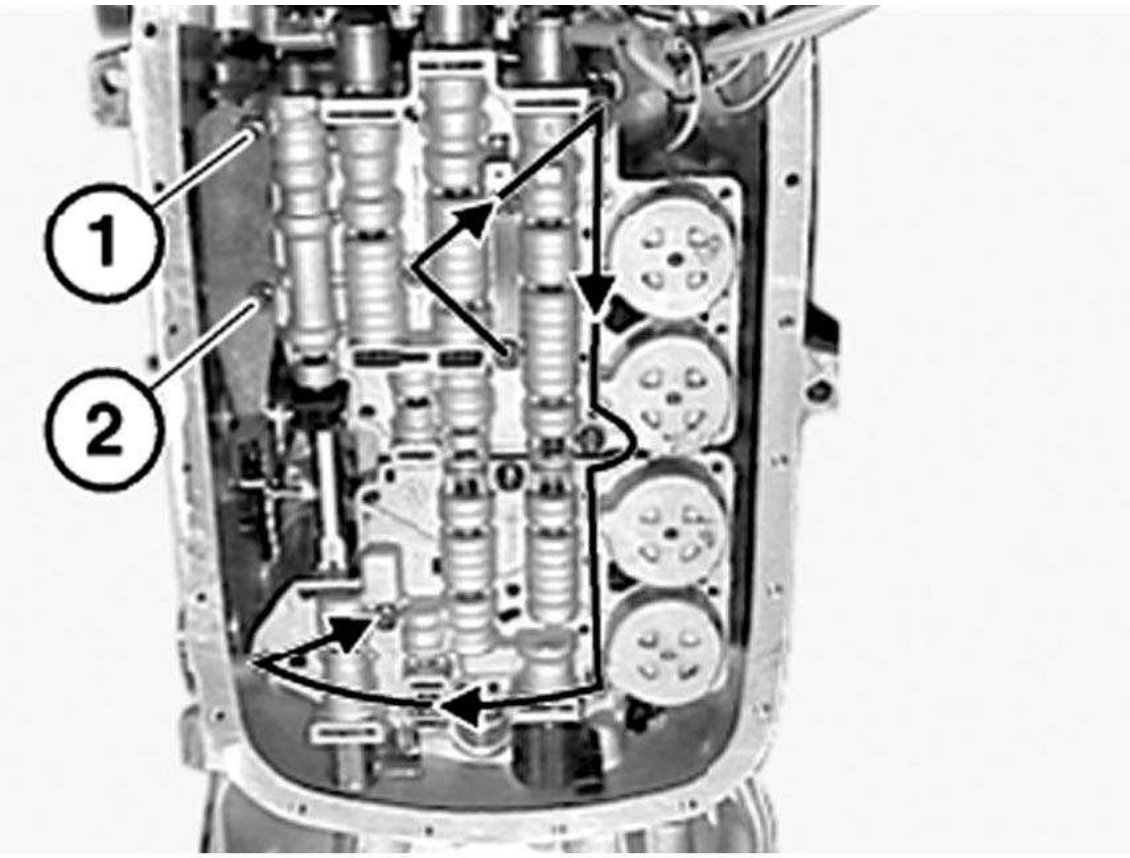


Fig. 31: Inserting Set Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Length of screws: (1) = (2) = 68 mm, all others = 58 mm. Install shift unit with aid of both set screws and secure in place with screws. See **Fig. 32** . Remove both set screws. Tighten all screws until hand-tight. When tightening screws: follow sequence without fail. Tighten to specification. See **TORQUE SPECIFICATIONS** . Do not tighten screws (1) and (2) yet.

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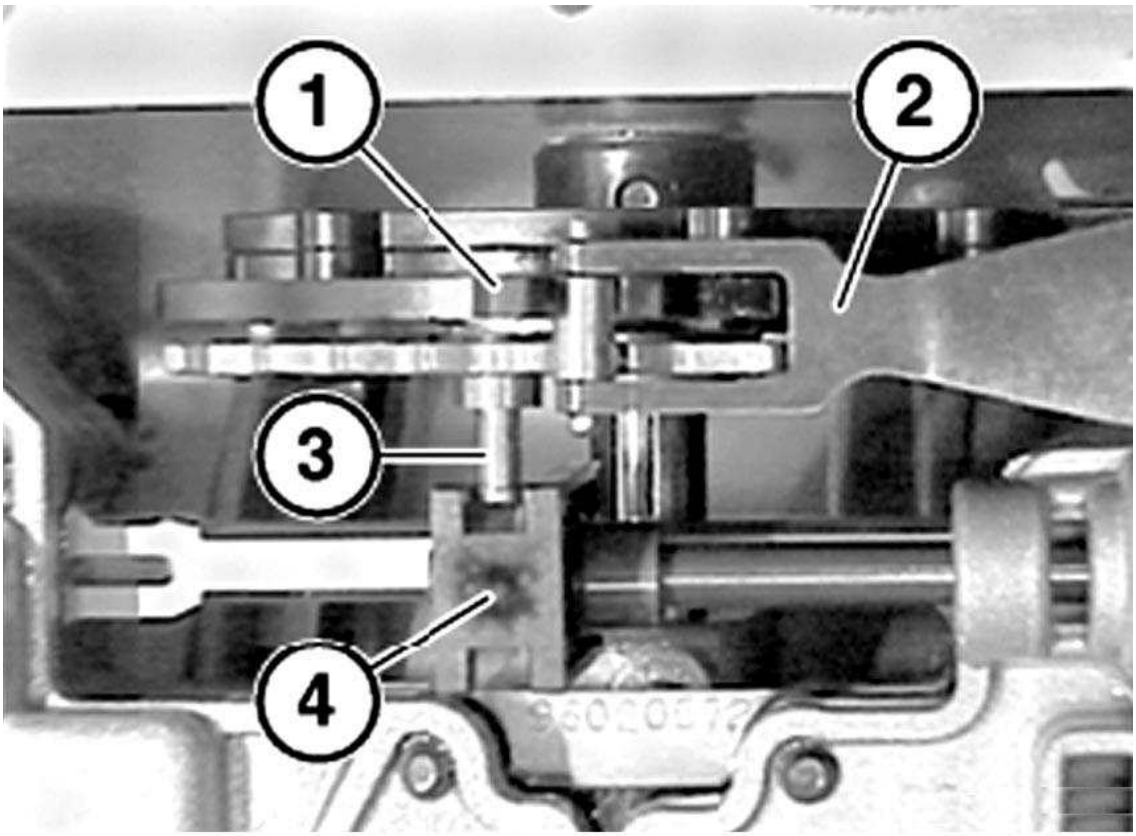


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Fig. 32: Locating Set Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Suspend guide (1) of transmission switch in detent spring (2). See **Fig. 33** . Journal (3) of detent disk must be located in groove (4) of slide valve.

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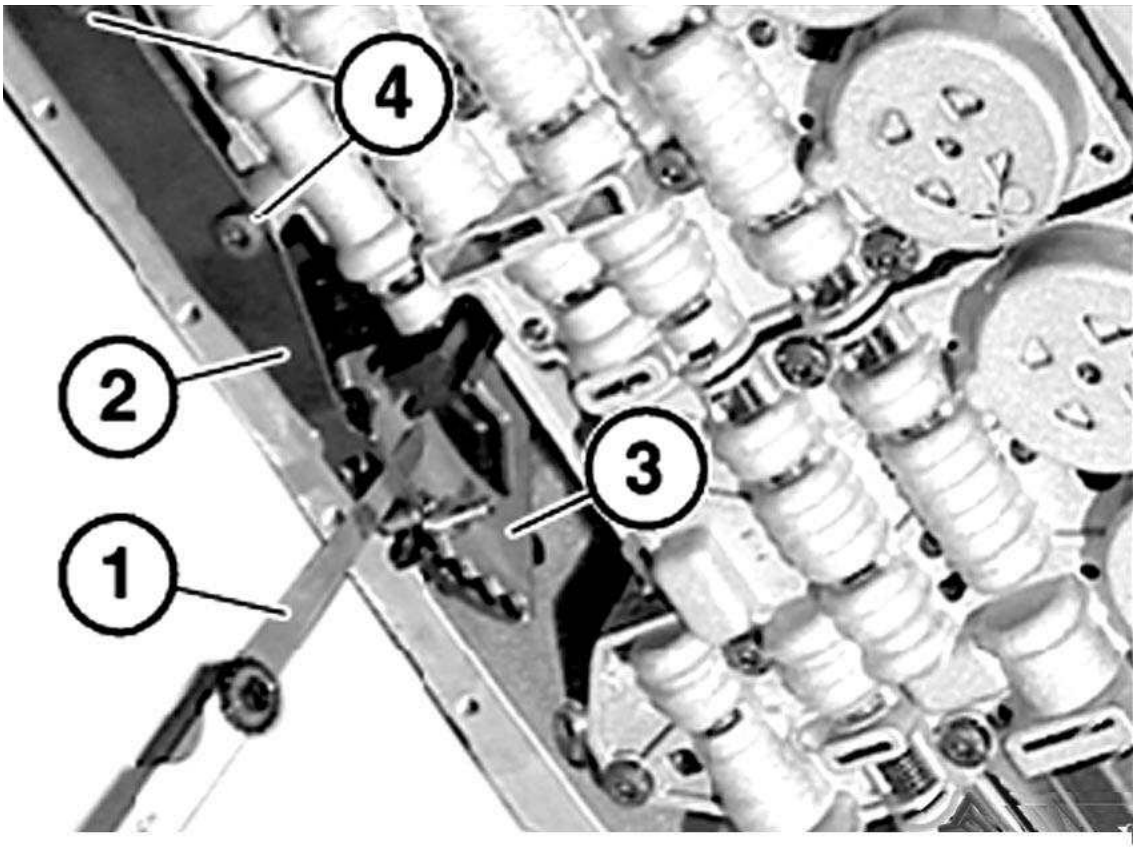


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Fig. 33: Suspending Guide Of Transmission Switch In Detent Spring
Courtesy of BMW OF NORTH AMERICA, INC.

Insert feeler gauge (1) between detent spring (2) and detent disk (3) and set gap of 0.80 mm by moving detent spring (2). See **Fig. 34** . Tighten down screws (4). See **TORQUE SPECIFICATIONS** .

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Fig. 34: Setting Gap Between Detent Spring & Detent Disk
Courtesy of BMW OF NORTH AMERICA, INC.

REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION FLUID SUMP (A5S 360R / 390R, A4S 200R)

NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 360R / 390R, A4S 200R / 310R) .

Open drain plug (1). See **Fig. 35** . Drain off automatic transmission fluid. Unscrew all bolts. Remove oil sump (2). Detach gasket from oil sump (2). Clean sealing faces. Upon installation, replace sealing ring on drain plug. Tighten drain plug to specification. See **TORQUE SPECIFICATIONS** .

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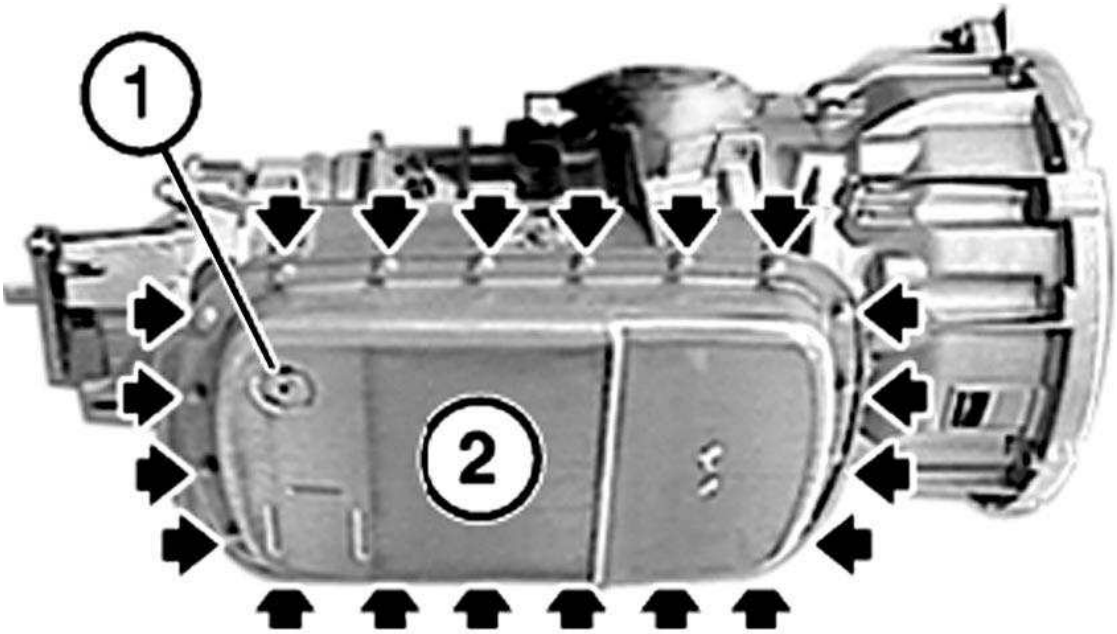


Fig. 35: Locating Drain Plug
Courtesy of BMW OF NORTH AMERICA, INC.

CAUTION: Tighten down screws, not in diagonal sequence but rather in order, one time to specified torque.

Fit new gasket on oil sump. Clean magnets (1) and reinstall in oil sump. See **Fig. 36** . Install oil sump. Insert all screws until contact is made with screw head in each case. Tighten to specification. See **TORQUE SPECIFICATIONS** .

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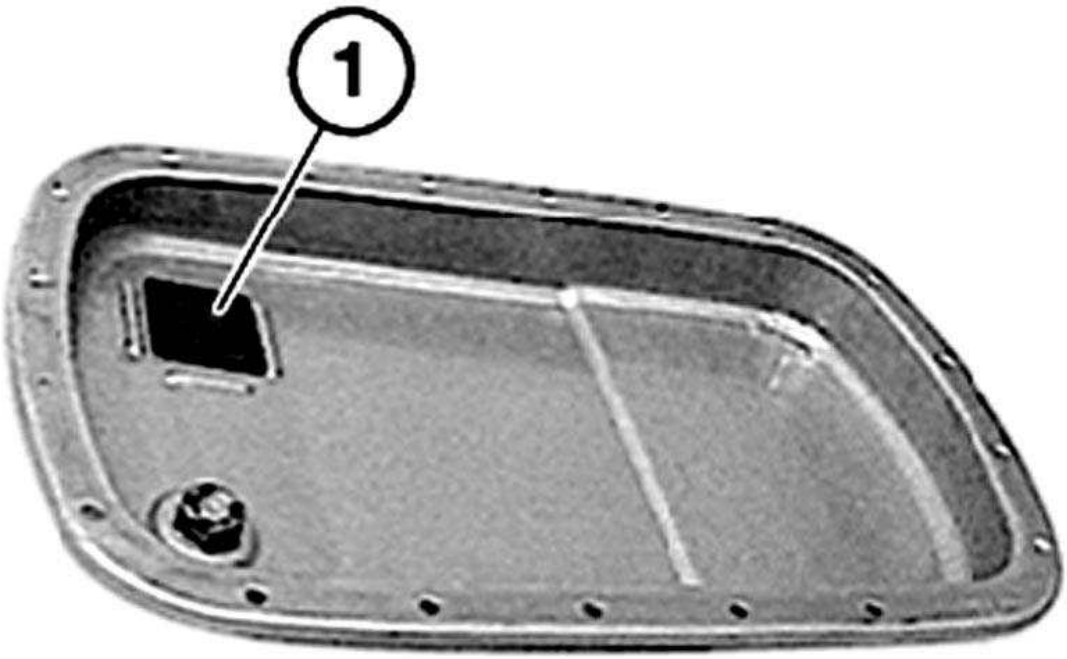


Fig. 36: Installing Oil Sump
Courtesy of BMW OF NORTH AMERICA, INC.

REMOVING AND INSTALLING/REPLACING TRANSMISSION OIL SCREEN (A5S 325Z)

NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 325Z) .

Remove and install transmission oil sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION OIL SUMP (A5S 325Z)** .

Release screws (1). See **Fig. 37** . Pull transmission oil screen (2) towards bottom and remove.

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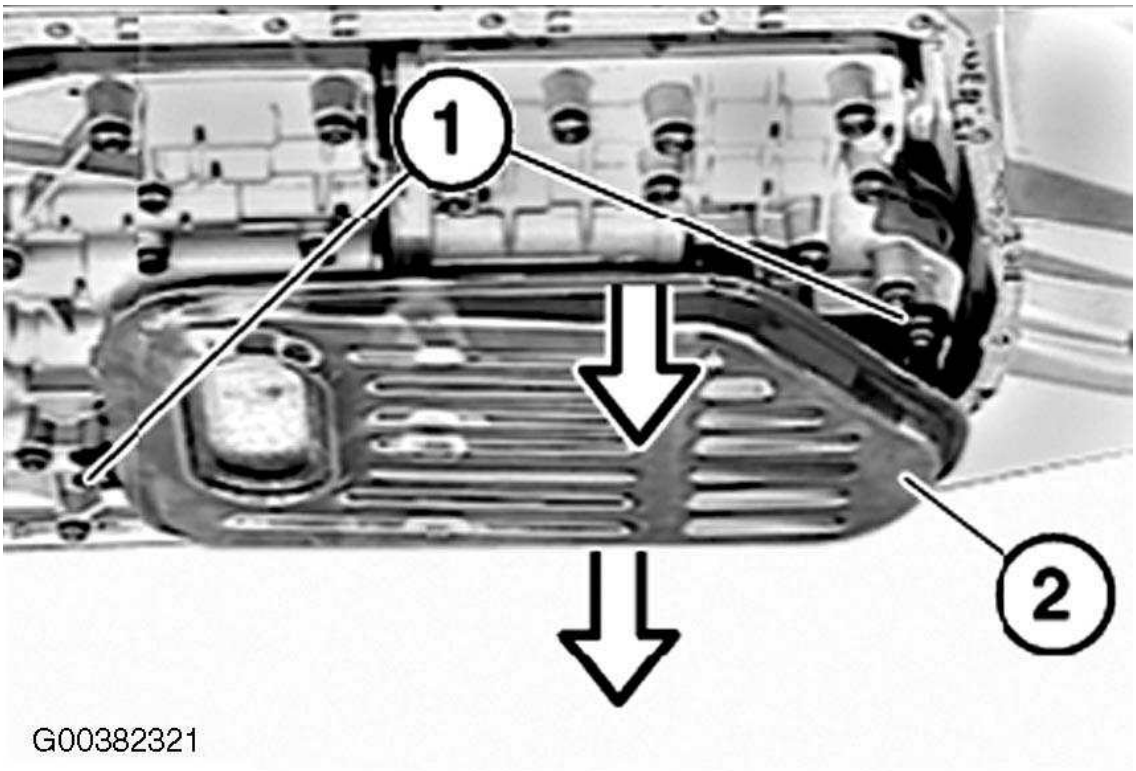


Fig. 37: Removing Transmission Oil Screen
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: coat sealing ring with ATF. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .

REMOVING AND INSTALLING/REPLACING TRANSMISSION SCREEN (A5S 360R / 390R, A4S 200R)

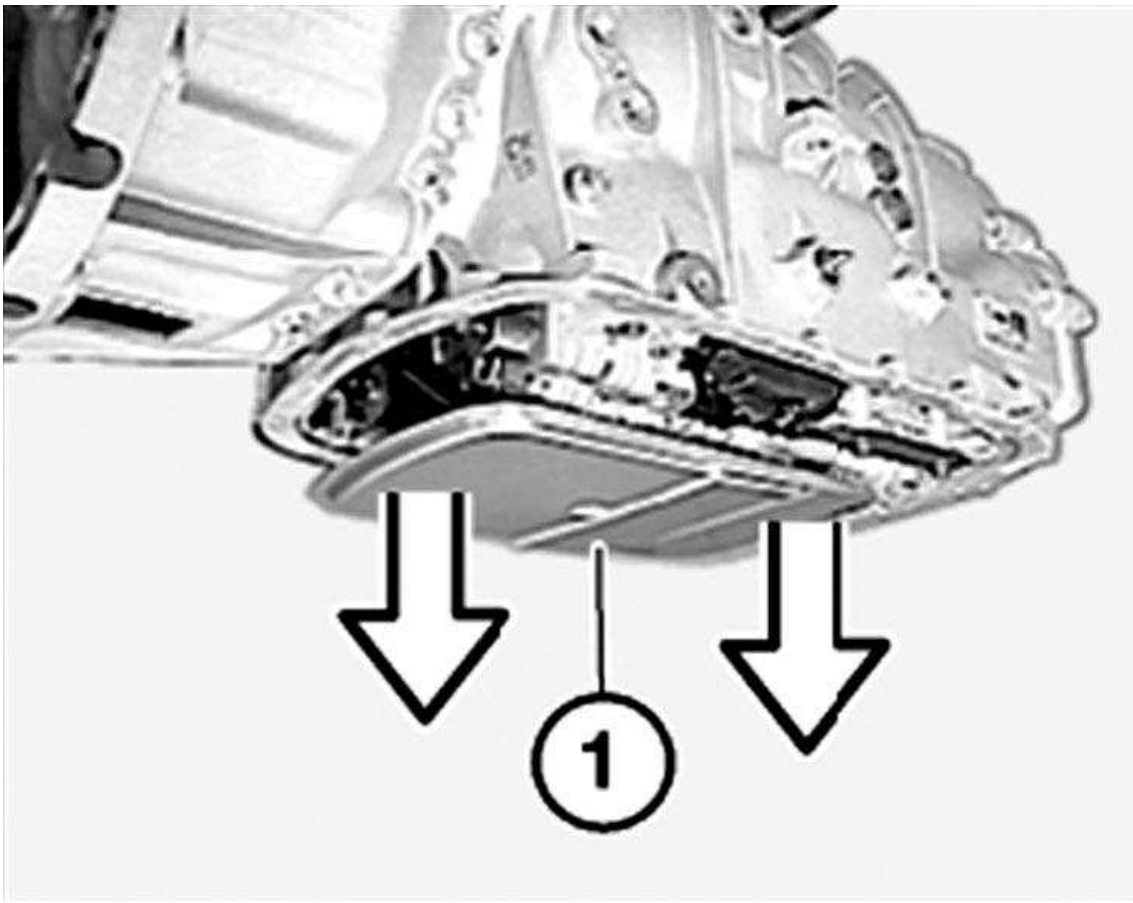
NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 360R / 390R, A4S 200R / 310R) .

Remove transmission oil sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION FLUID SUMP (A5S 360R / 390R, A4S 200R)** .

Pull off transmission fluid screen (1) towards bottom and remove. See **Fig. 38** .

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Fig. 38: Pulling Off Transmission Fluid Screen
Courtesy of BMW OF NORTH AMERICA, INC.

If the sealing ring (1) has remained in the pump housing, it must be removed and the transmission fluid screen replaced. See **Fig. 39** .

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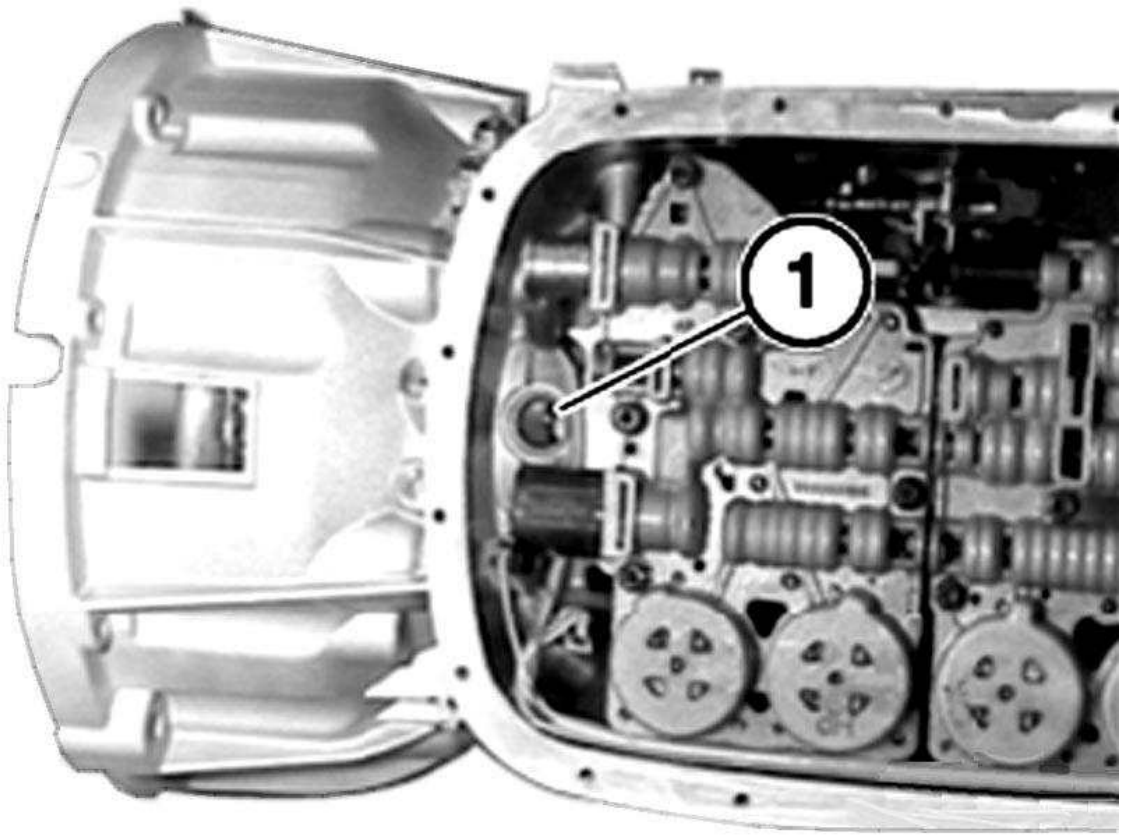


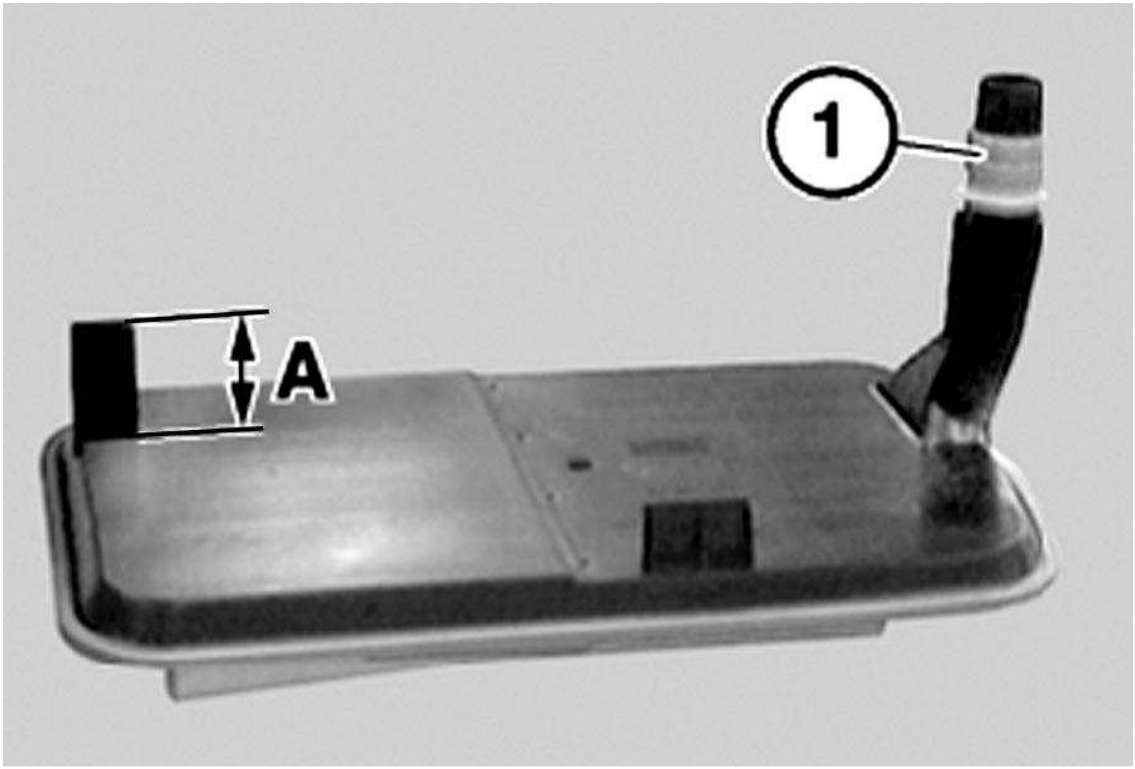
Fig. 39: Locating Sealing Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: different transmission fluid screens are used in petrol/gasoline and diesel engines. Therefore check specified measurement A prior to installation. See **Fig. 40** . Measurement A: Gasoline engine:

- M52TU = 38-40 mm
- M43TU = 29-31 mm

Diesel engine: M57 = 29-31 mm. Position (1): Two gaskets are fitted.

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Fig. 40: Identifying Transmission Screen
Courtesy of BMW OF NORTH AMERICA, INC.

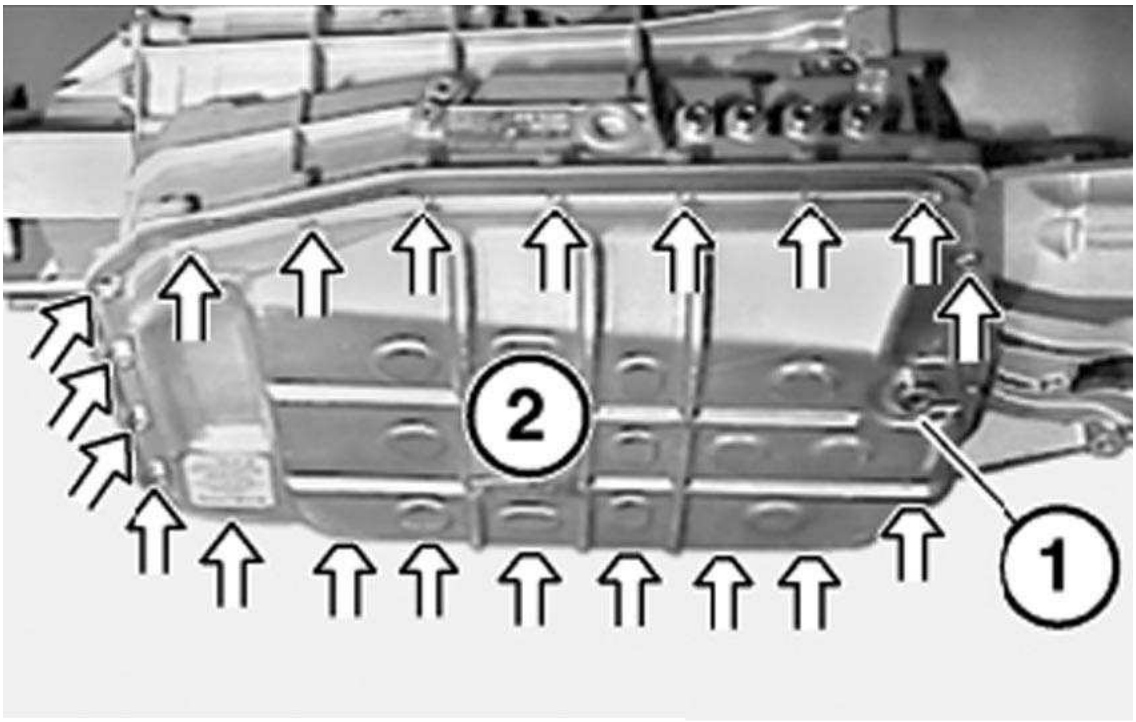
REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION OIL SUMP (A5S 325Z)

NOTE: Numbers in text refer to numbers in figures.

CAUTION: It is absolutely essential to use the approved automatic transmission fluid in this automatic transmission. Failure to comply with this requirement will result in serious damage to the automatic transmission.

Release drain plug (1). See **Fig. 41** . Drain automatic transmission fluid. Unscrew all bolts. Remove oil sump (2). Upon installation, tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .

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Fig. 41: Removing Oil Sump
Courtesy of BMW OF NORTH AMERICA, INC.

Remove gasket (1). See **Fig. 42** . Clean sealing surface (2). Upon installation, replace seal.

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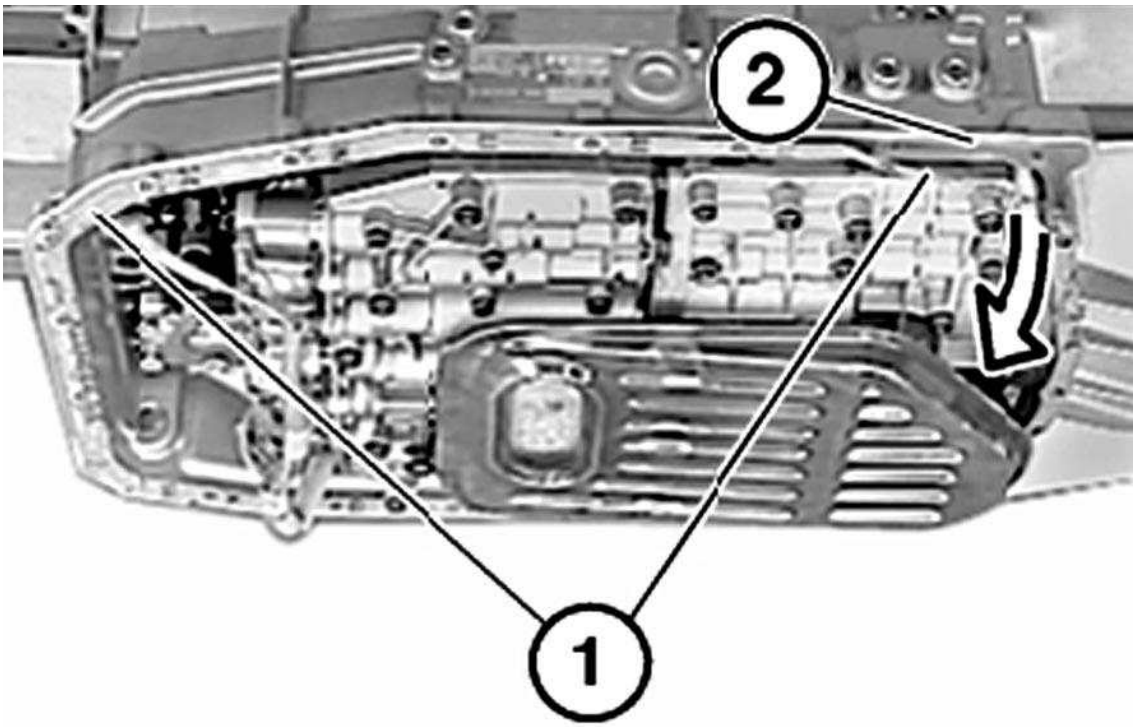


Fig. 42: Locating Gasket
Courtesy of BMW OF NORTH AMERICA, INC.

CAUTION: Using torque wrench, do not tighten screws diagonally but once one after the other. DO NOT tighten screws further.

Clean magnets (1) and insert in oil sump again (2). See **Fig. 43** . Install oil sump (2). Insert all screws until contact is made with screw head in each case. Tighten to specification. See **TORQUE SPECIFICATIONS** .

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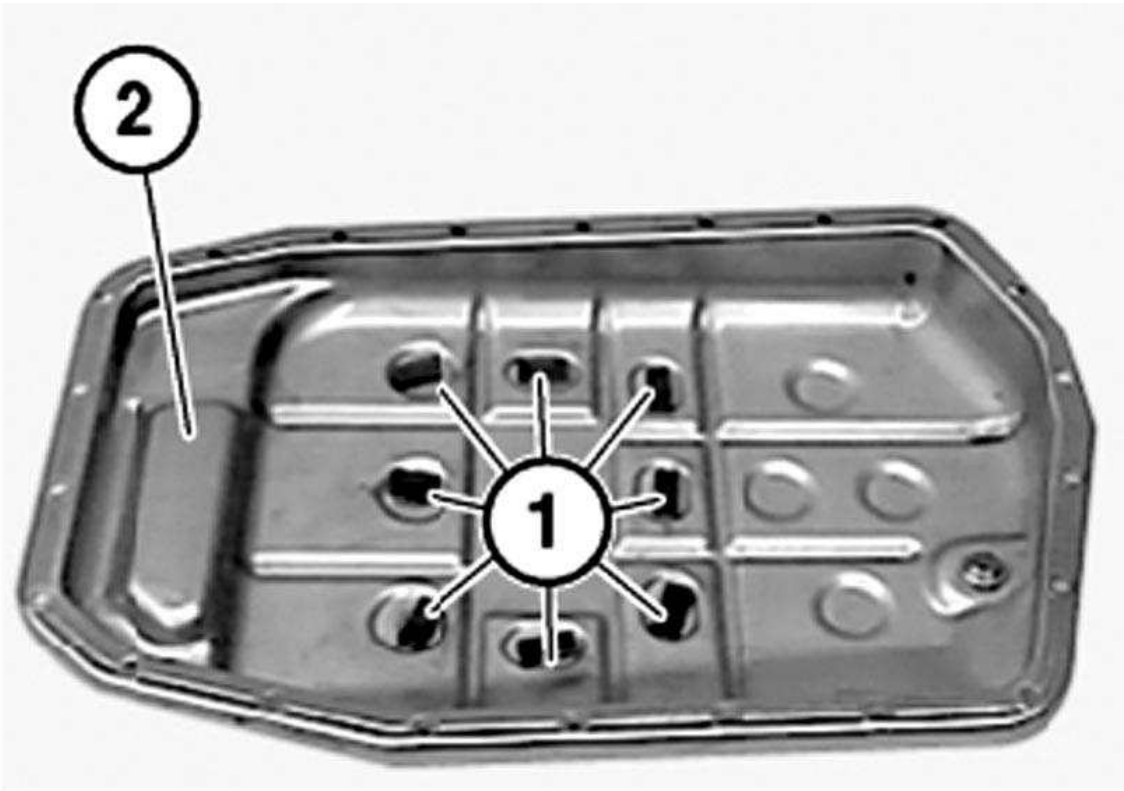


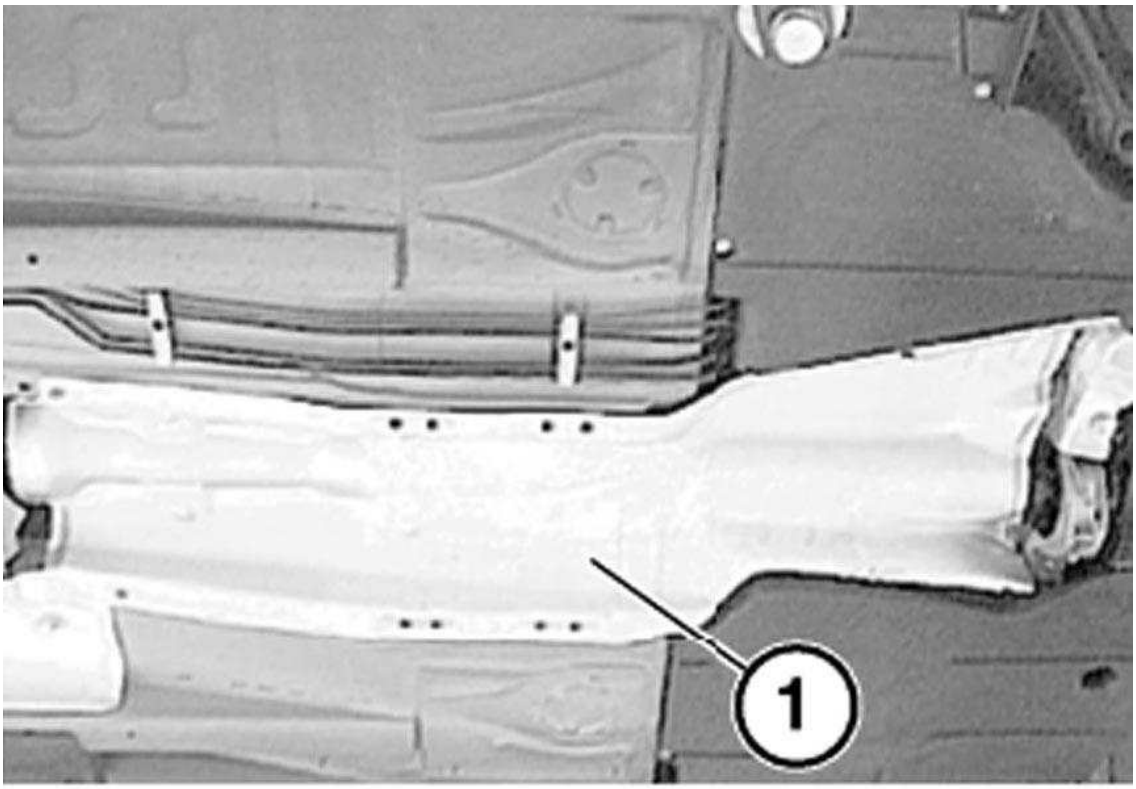
Fig. 43: Locating Magnets
Courtesy of BMW OF NORTH AMERICA, INC.

REMOVING & INSTALLING TRANSMISSION EXTENSION (A5S 325Z)

NOTE: Numbers in text refer to numbers in figures.

Remove heat shield (1). See **Fig. 44** .

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Fig. 44: Removing First Heat Shield
Courtesy of BMW OF NORTH AMERICA, INC.

Remove heat shield (1). See **Fig. 45** .

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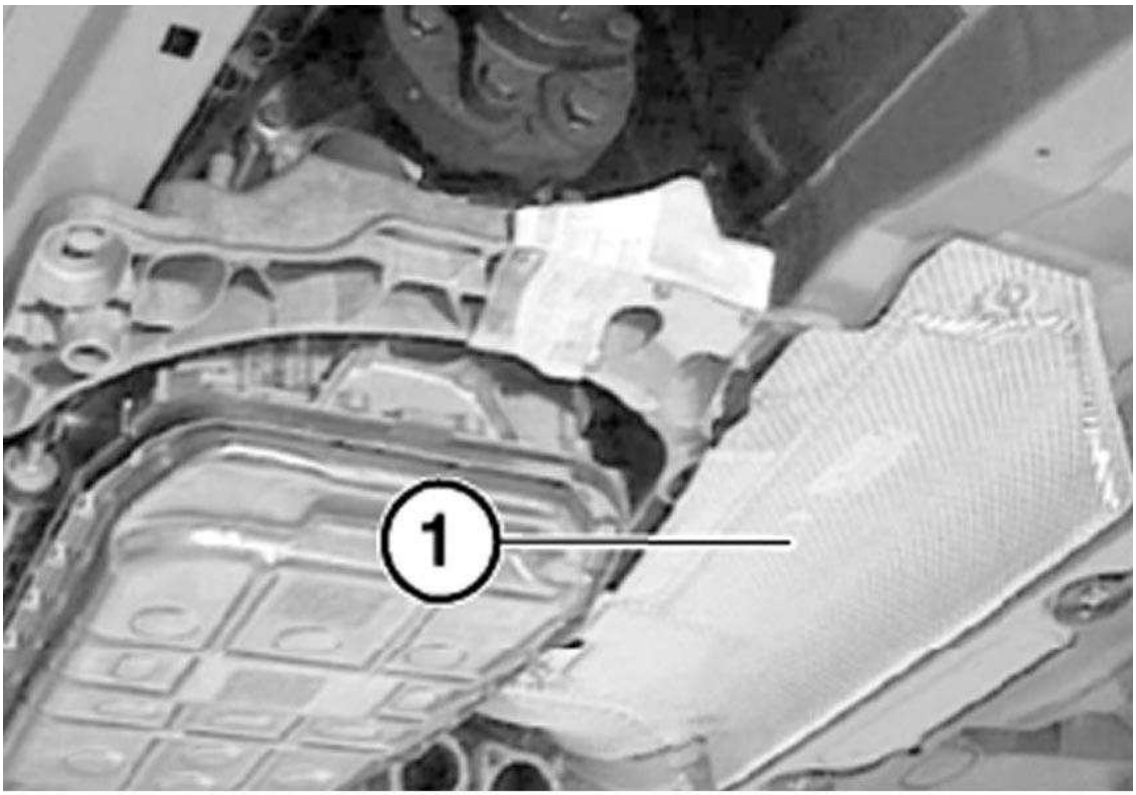
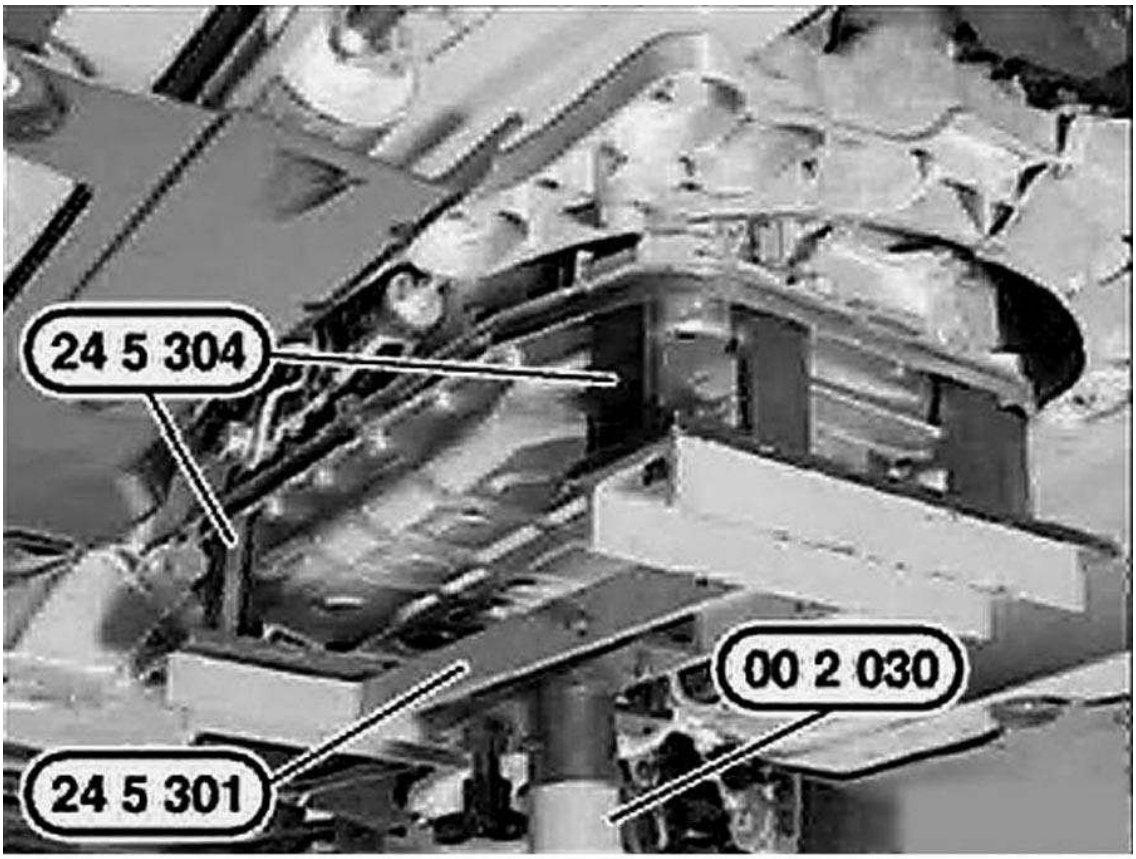


Fig. 45: Removing Second Heat Shield
Courtesy of BMW OF NORTH AMERICA, INC.

Support transmission with Special Tool (00 2 030 / 24 5 301 / 24 5 304). See **Fig. 46** .

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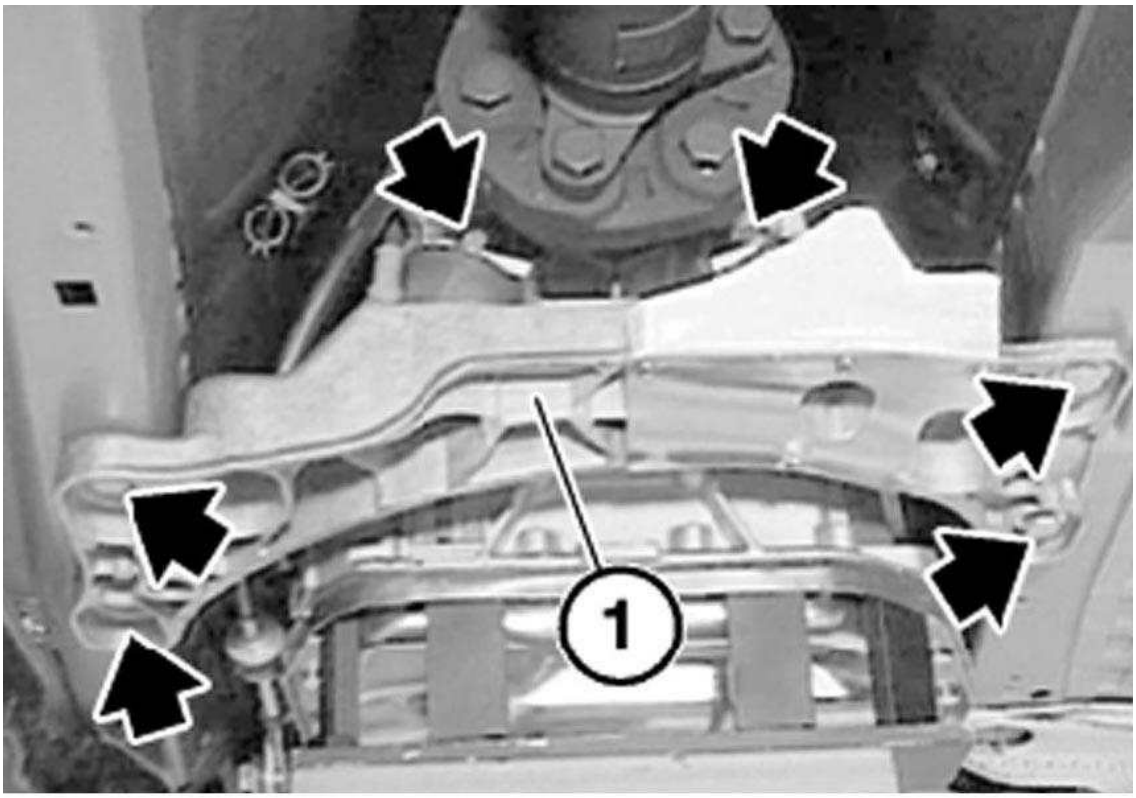


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Fig. 46: Supporting Transmission With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws and remove cross-member (1). See **Fig. 47** . Upon installation, tighten screws to specification. See **TORQUE SPECIFICATIONS** .

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Fig. 47: Removing Cross-Member
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws. See **Fig. 48** . Upon installation, replace self-locking nuts. Tighten to specification. See **TORQUE SPECIFICATIONS** .

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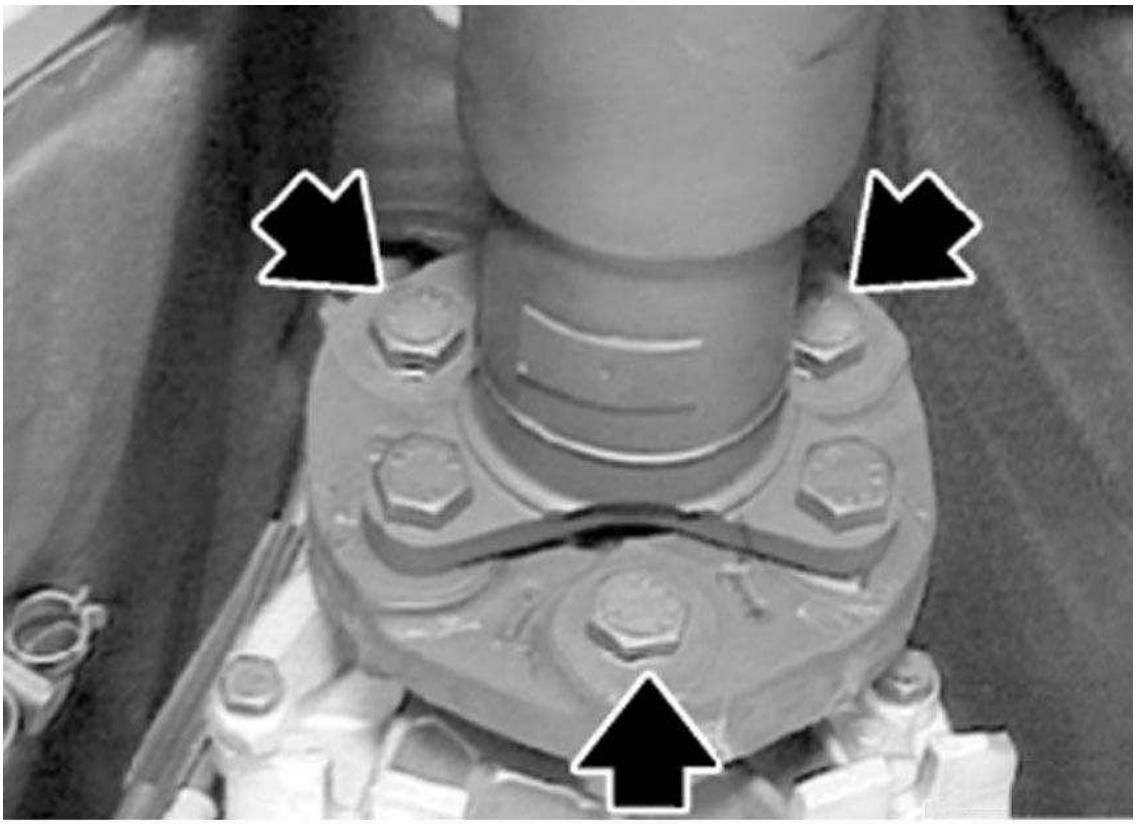
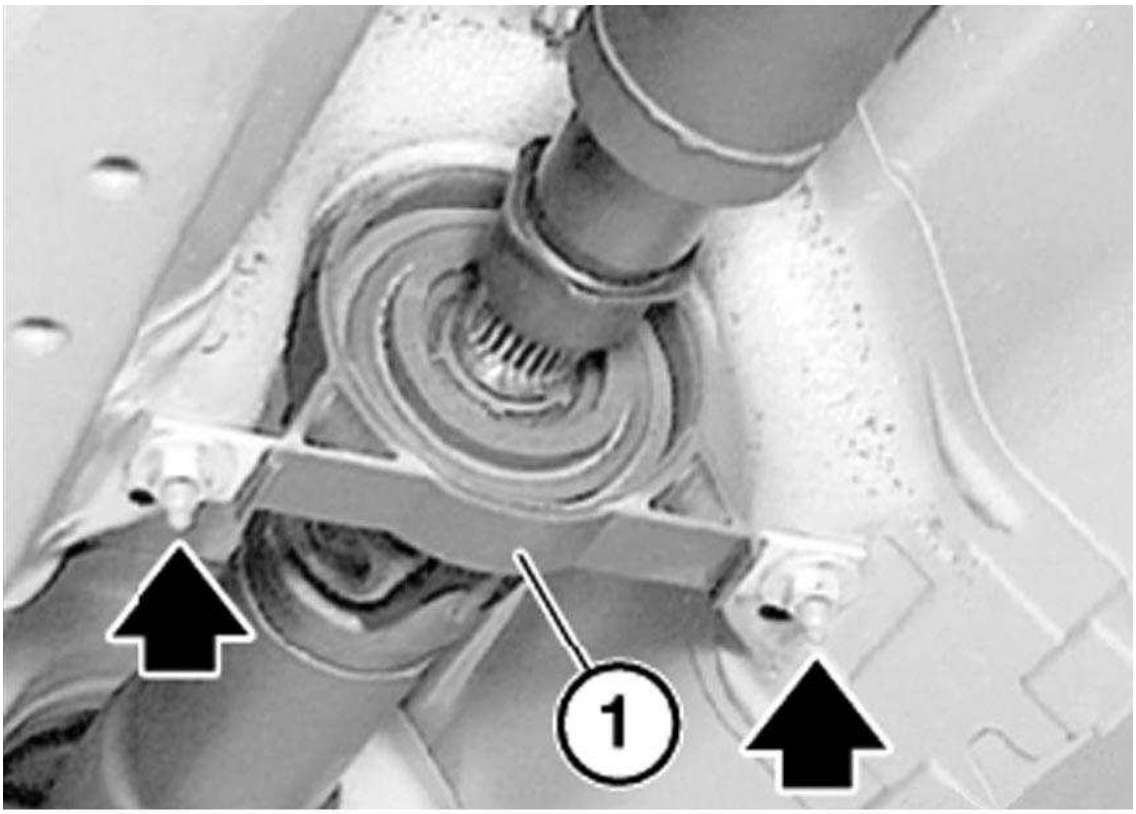


Fig. 48: Locating Flexible Disk To Propeller Shaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Grip propeller shaft and release nuts. See **Fig. 49** . Bend propeller shaft downwards at center mount (1), detach from transmission output flange and tie back to one side on underbody of vehicle. Upon installation, tighten screws to specification. See **TORQUE SPECIFICATIONS** .

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Fig. 49: Detaching Propeller Shaft From Transmission Output Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws. See **Fig. 50** . Upon installation, tighten screws to specification. See **TORQUE SPECIFICATIONS** .

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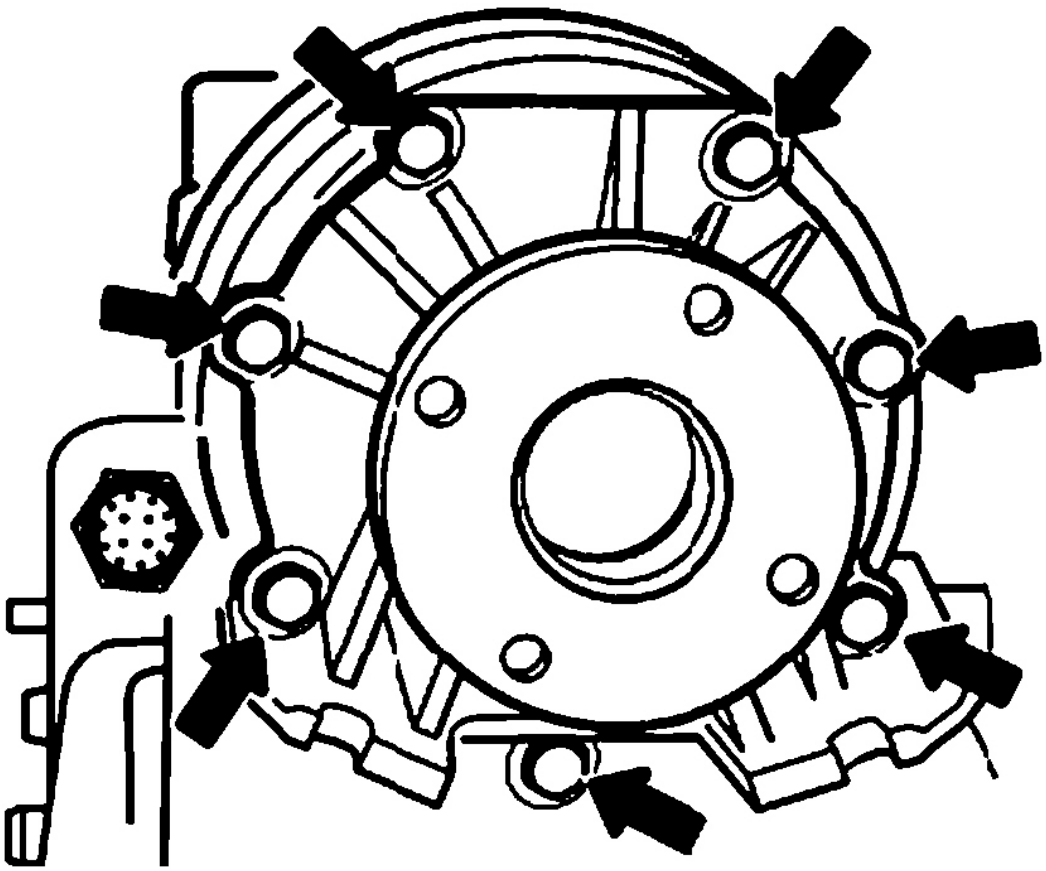


Fig. 50: Locating Transmission Extension Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Remove transmission extension. Upon installation, install shim (1). Replace O-ring (2). See **Fig. 51** .

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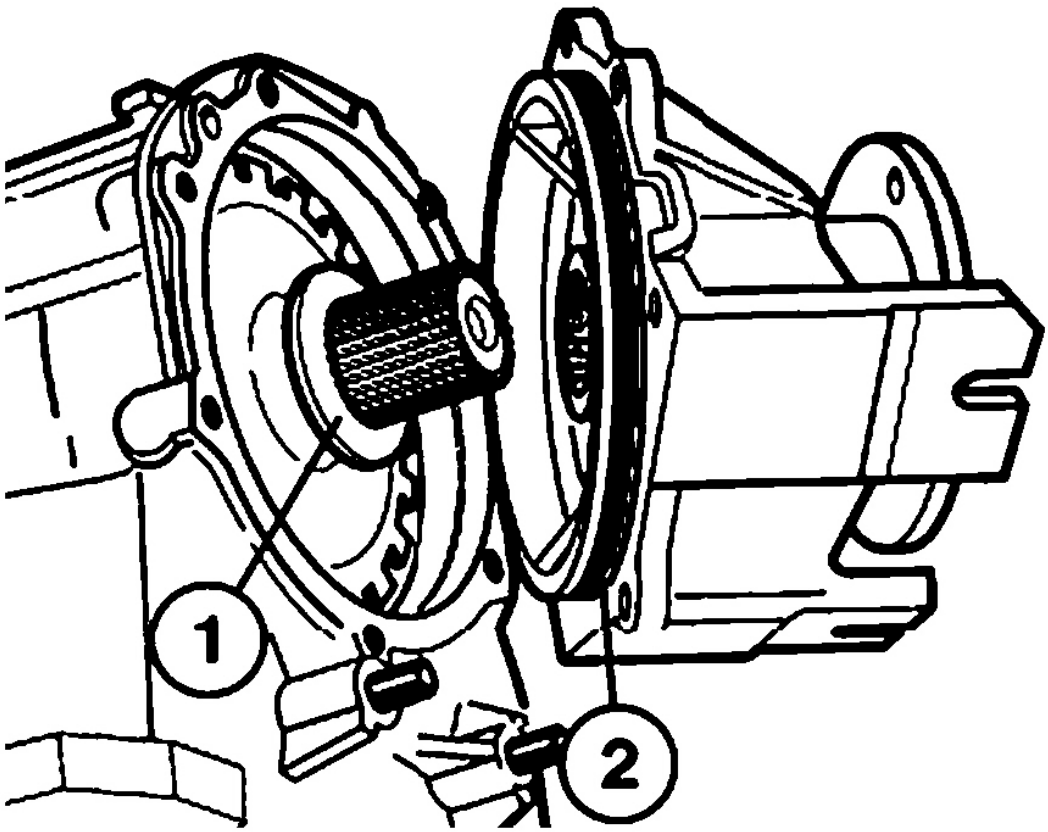


Fig. 51: Locating Shim & O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

To install, reverse removal procedure.

REMOVING AND INSTALLING OR REPLACING TRANSMISSION EXTENSION HOUSING (A5S 360R / 390R)

NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 360R / 390R, A4S 200R / 310R) .

Remove complete exhaust system.

Remove heat shields. See **Fig. 44** and **Fig. 45** .

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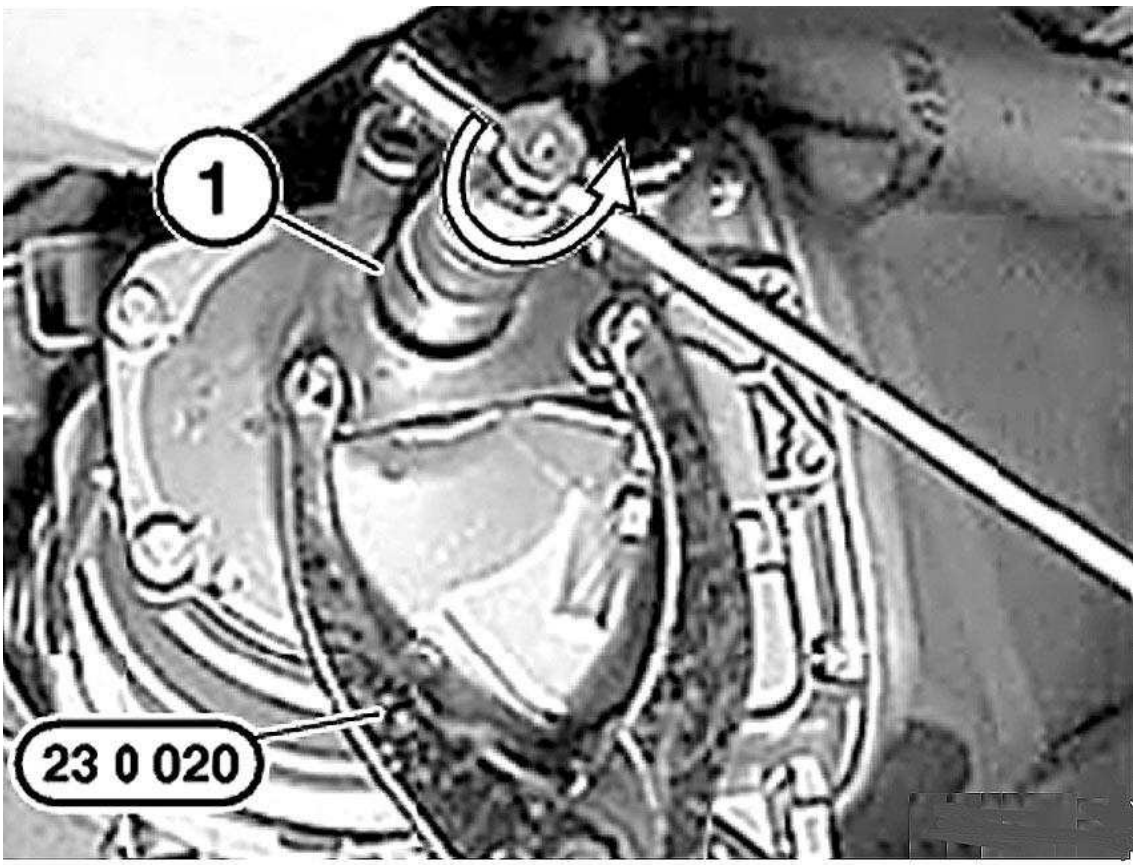
Support transmission with special tools 00 2 030 / 24 5 301 / 24 5 305. See **Fig. 46** .

Release screws. Remove cross-member (1). See **Fig. 47** . Upon installation, tighten screws to specification. See **TORQUE SPECIFICATIONS** .

Release screws. See **Fig. 48** . Upon installation, replace self-locking nuts. Tighten to specification. See **TORQUE SPECIFICATIONS** .

Grip propeller shaft and release nuts. See **Fig. 49** . Bend propeller shaft downwards at center bearing (1). Detach propeller shaft from transmission output flange and tie back to side on vehicle underbody. Upon installation, tighten nuts to specification. See **TORQUE SPECIFICATIONS** .

Version 1 without spring washer: grip output flange (1) with Special Tool (23 0 020). See **Fig. 52** . Release hexagon nut. Detach output flange (1). Upon installation, replace sealing ring in output flange (1). Install hexagon nut with screw retaining compound. Tighten to specification. See **TORQUE SPECIFICATIONS** .

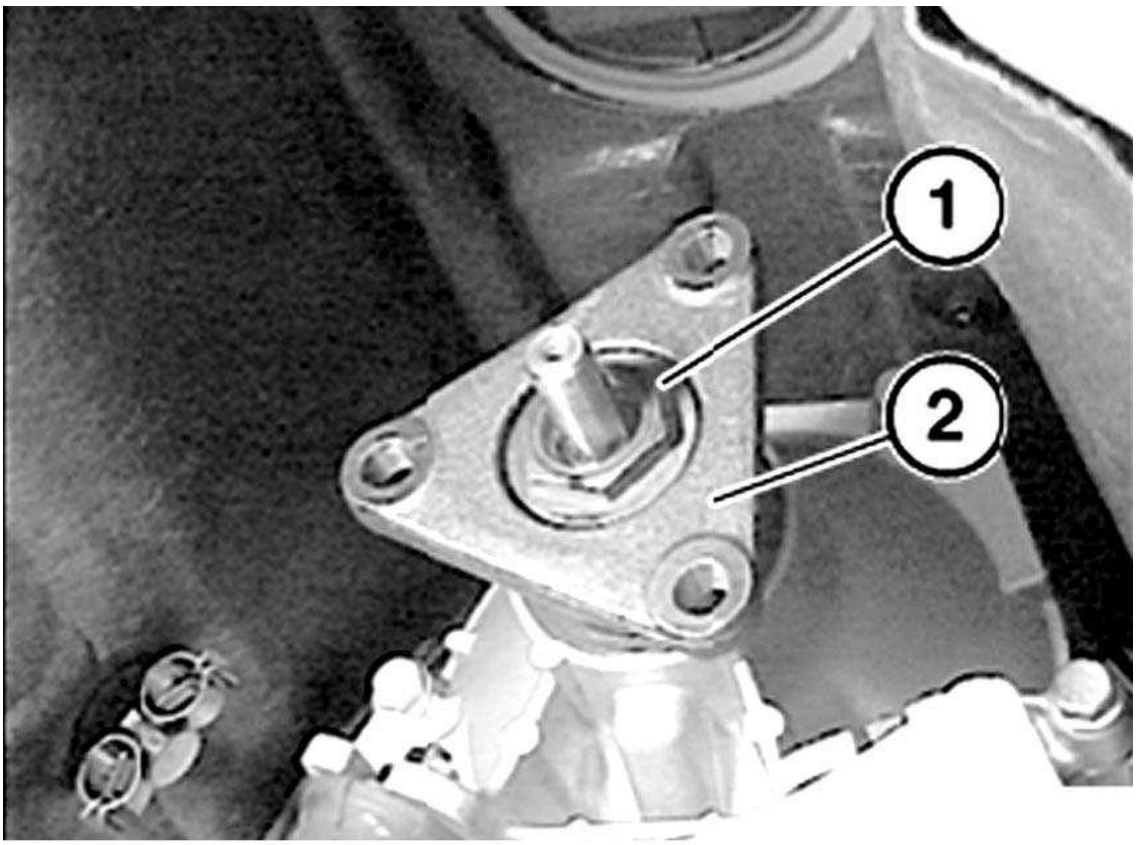


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Fig. 52: Detaching Output Flange (Version 1)
Courtesy of BMW OF NORTH AMERICA, INC.

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Version 2 with spring washer: release hexagon nut (1) on output flange (2). See **Fig. 53** . Upon installation, install hexagon nut with screw retaining compound and tighten to specification. See **TORQUE SPECIFICATIONS** .

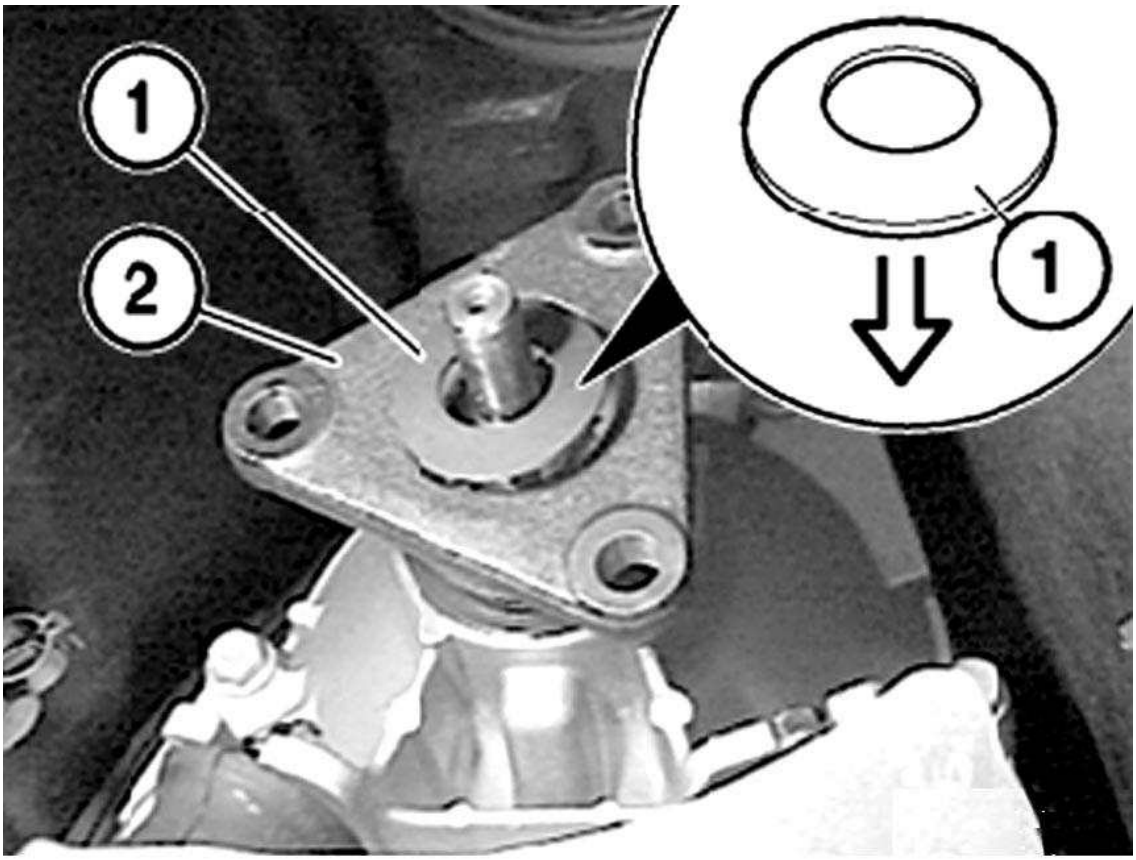


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Fig. 53: Releasing Hexagon Nut On Output Flange
Courtesy of BMW OF NORTH AMERICA, INC.

Version 2 with spring washer: remove spring washer (1). See **Fig. 54** . Remove output flange (2). Upon installation: note installation direction of spring washer (1). Replace sealing ring in output flange (2).

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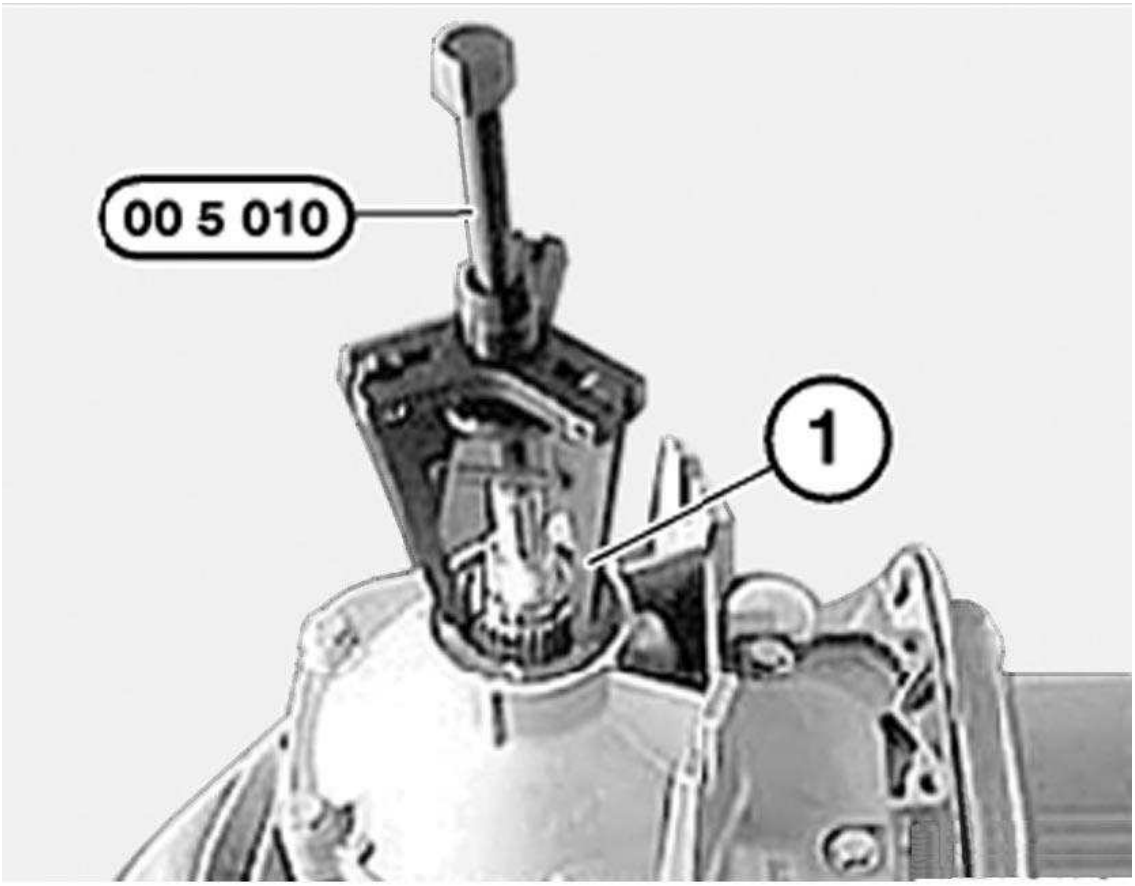


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Fig. 54: Removing Output Flange (Version 2)
Courtesy of BMW OF NORTH AMERICA, INC.

Withdraw radial seal (1) with Special Tool (00 5 010). See **Fig. 55** .

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Fig. 55: Removing Radial Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws on transmission extension housing (1). See **Fig. 56** . Carefully pull off transmission extension housing (1). Upon installation, tighten screws to specification. See **TORQUE SPECIFICATIONS** .

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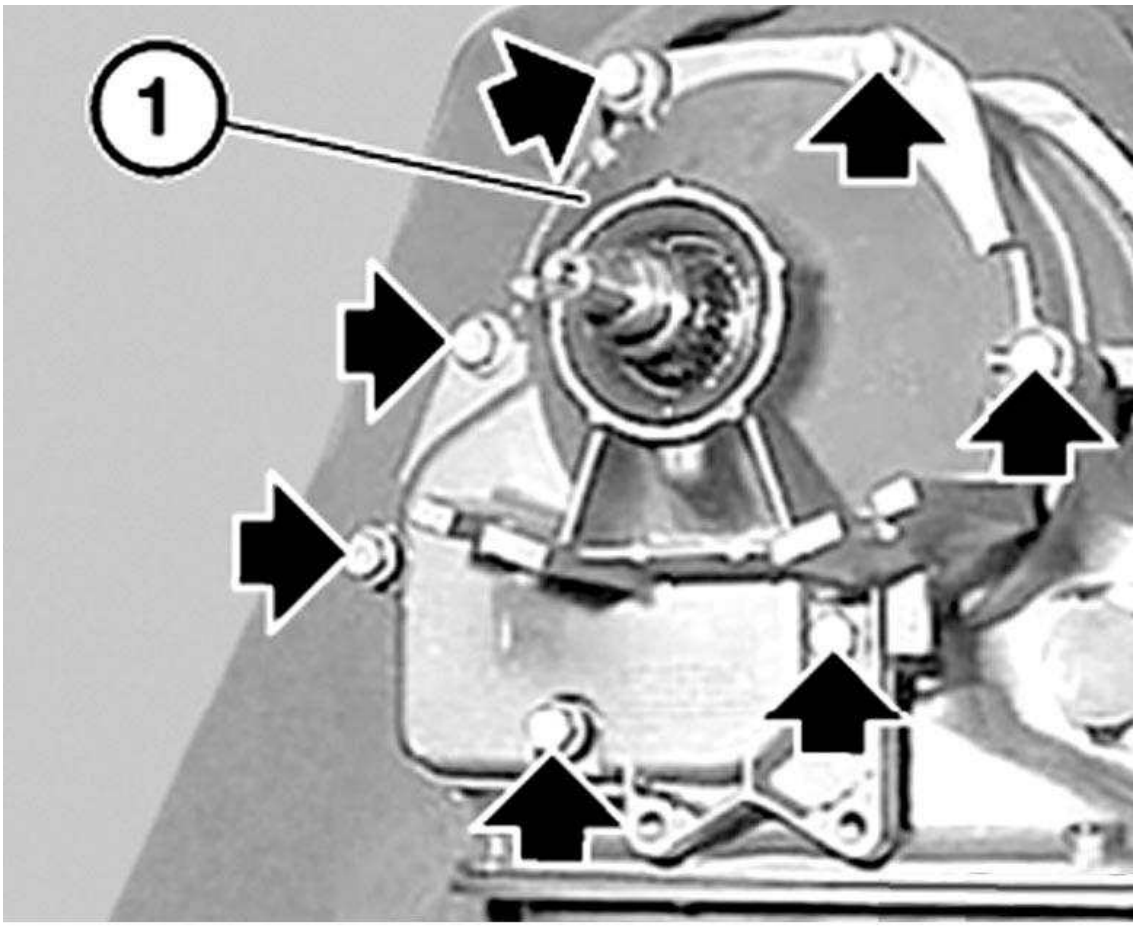
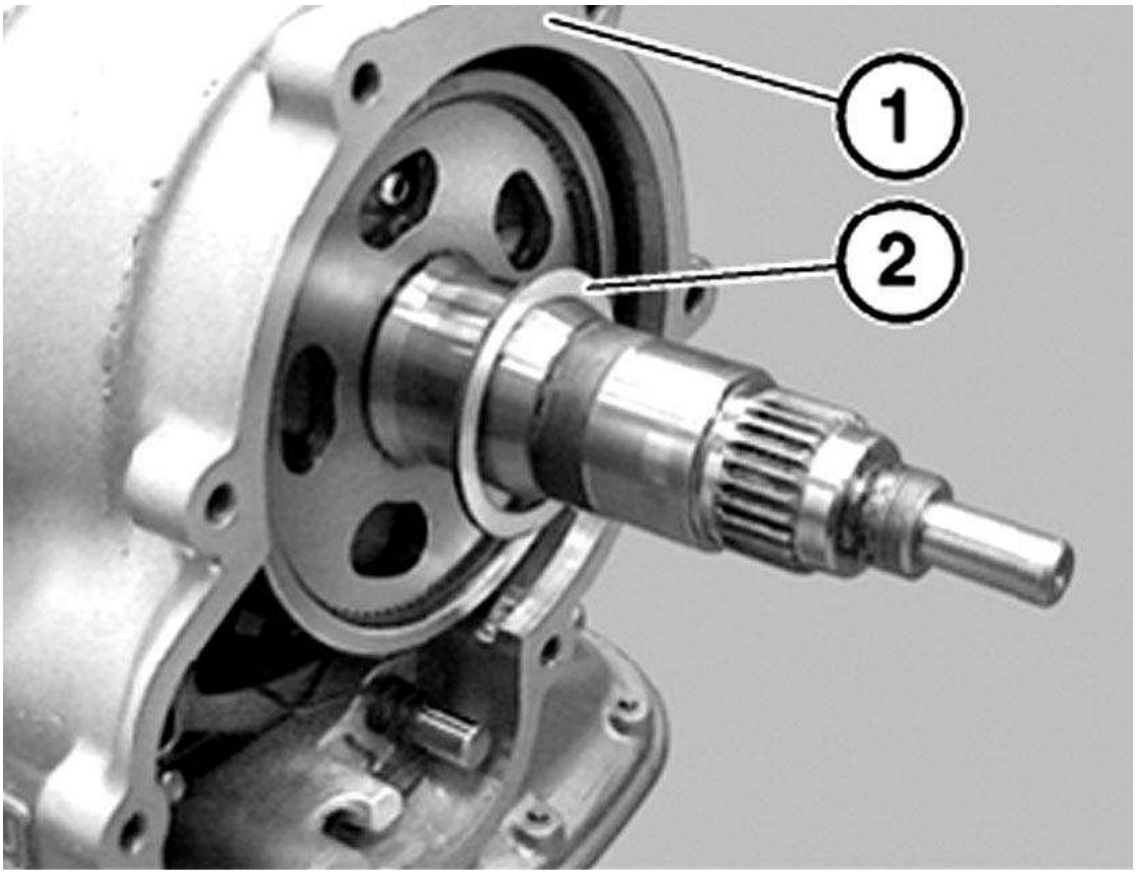


Fig. 56: Locating Screws On Transmission Extension Housing
Courtesy of BMW OF NORTH AMERICA, INC.

CAUTION: Existing shim (2) remains fitted and is not recalculated.

Replace gasket between transmission housing (1) and end cover. See **Fig. 57** .

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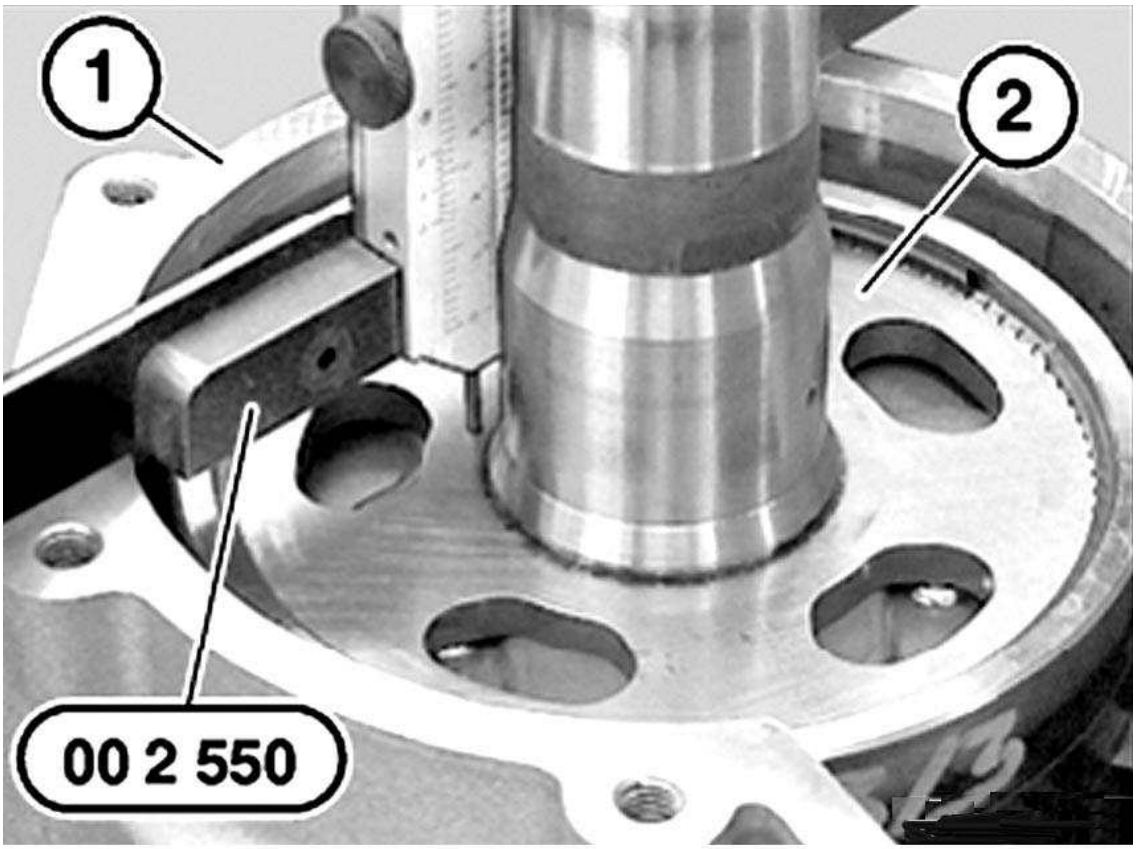
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Fig. 57: Replacing Gasket Between Transmission Housing & End Cover
Courtesy of BMW OF NORTH AMERICA, INC.

CAUTION: If shim is lost: Calculate new shim.

Calculate measurement between contact face (1) and parking gear (2) with Special Tool (00 2 550). See **Fig. 58** . Calculate the new shim with this measurement from the following figure. See **Fig. 59** .

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Fig. 58: Measuring Between Contact Face & Parking Gear
Courtesy of BMW OF NORTH AMERICA, INC.

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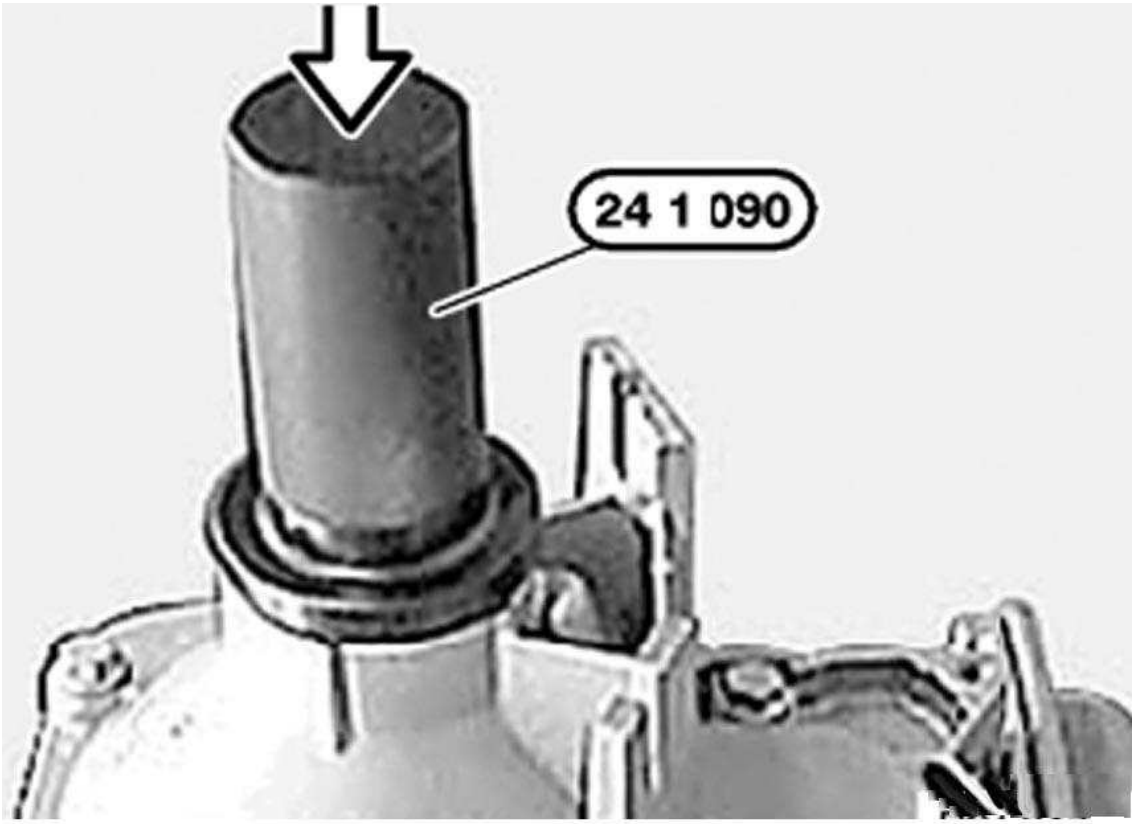
Calculated measurement in mm	Shim
15,99 - 16,27	0.95/1.05
16,27 - 16,47	1.15/1.25
16,47 - 16,67	1.35/1.45
16,67 - 16,87	1.55/1.65
16,87 - 17,07	1.75/1.85
17,07 - 17,27	1.95/2.05
17,27 - 17,47	2.15/2.25
17,47 - 17,67	2.35/2.45
17,67 - 17,87	2.55/2.65
17,87 - 18,07	2.75/2.85

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Fig. 59: Calculating Shim Measurement
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: coat sealing lips of new radial seal with automatic transmission fluid. Drive in radial seal with Special Tool (24 1 090) until flush. See **Fig. 60** .

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Fig. 60: Driving In Radial Seal
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING BEARING ON TRANSMISSION EXTENSION (A5S 325Z)

NOTE: Numbers in text refer to numbers in figures.

CAUTION: After completion of work, check transmission oil level. Use only approved transmission fluid. Failure to comply with this instruction will result in serious damage to the transmission. End play must be checked and, if necessary, adjusted. See REPLACING OUTPUT FLANGE (A5S 325Z) .

Remove output flange. See **REMOVING & INSTALLING TRANSMISSION EXTENSION (A5S 325Z)** .

Lift out circlip (1). See **Fig. 61** . Remove ball ring (2).

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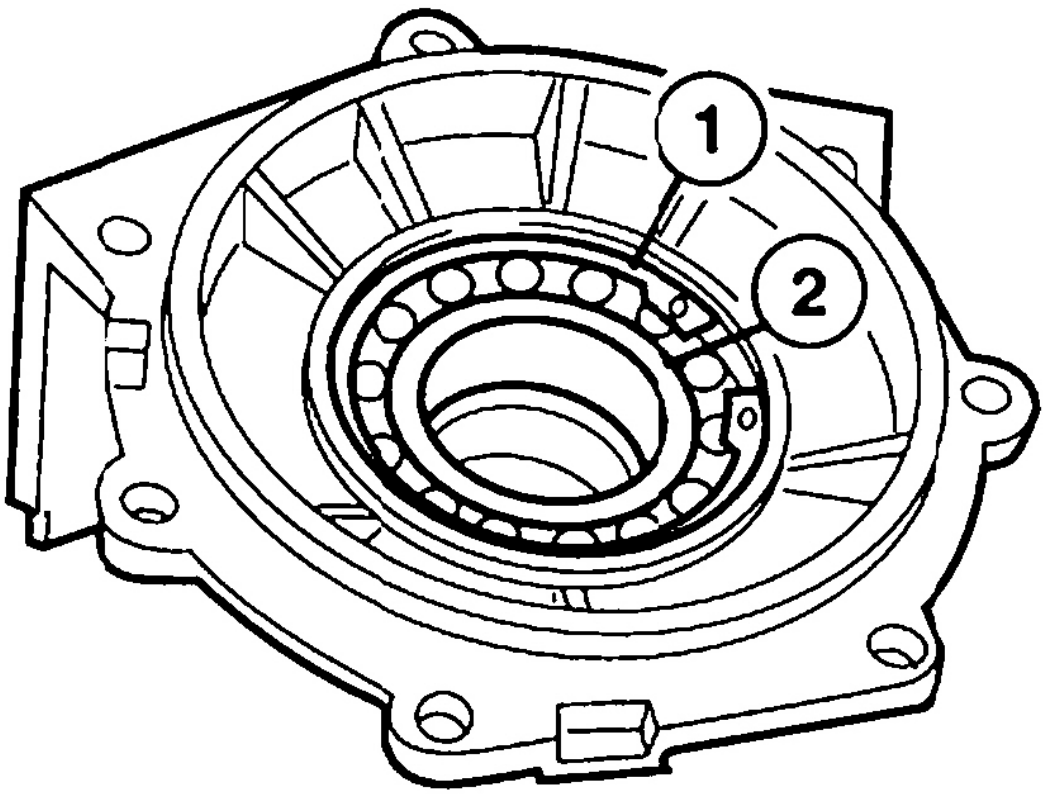


Fig. 61: Locating Circlip
Courtesy of BMW OF NORTH AMERICA, INC.

Heat transmission extension in area of bearing race to approx. 80°C (hot air blower). See **Fig. 62** . Remove bearing race (3). Installation: install first ball ring (4), then bearing race.

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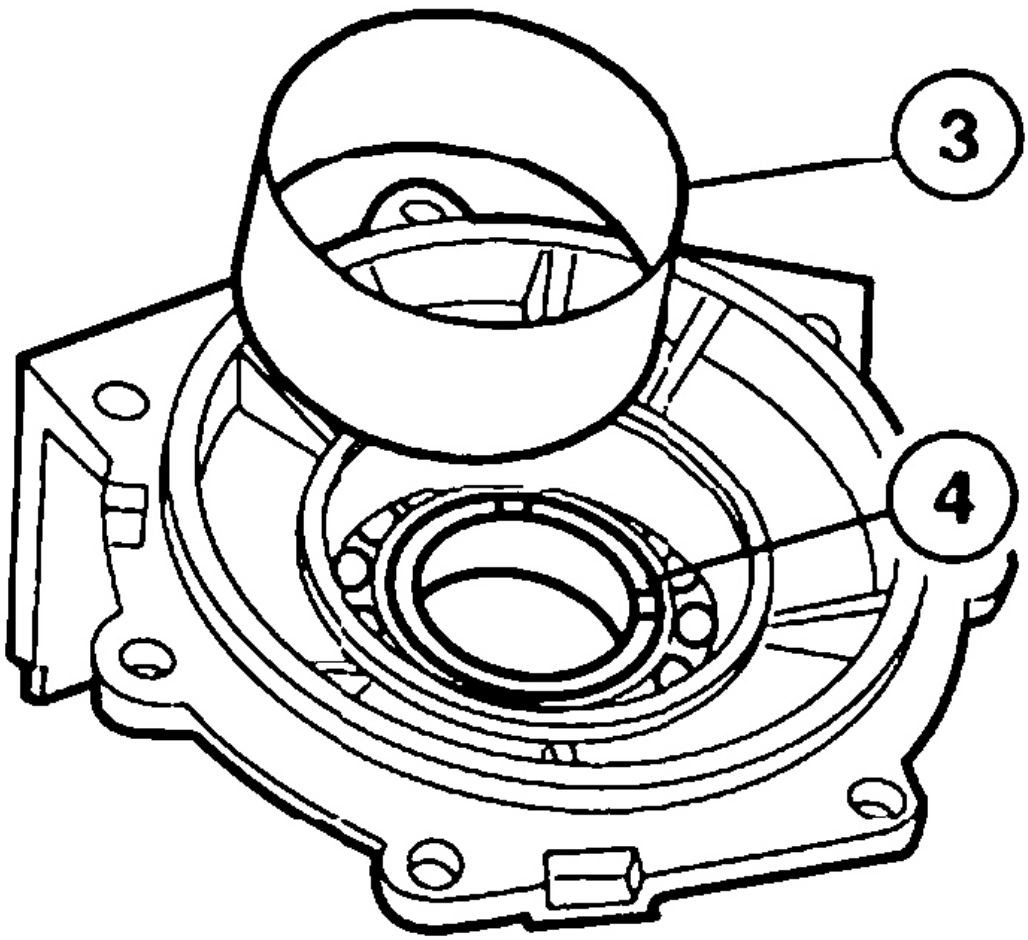


Fig. 62: Removing Bearing Race
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING OUTPUT FLANGE (A5S 325Z)

NOTE: Numbers in text refer to numbers in figures.

Remove output flange from mounting. See **REPLACING RADIAL SEAL FOR OUTPUT FLANGE (A5S 325Z)** . Installation: coat sealing lip of radial seal and sealing surface of output flange with ATF.

Installation: an end float of 0.15 - 0.35 mm is required between parking interlock gear and end face of output flange. End play is adjusted with shim (1). See **Fig. 92** . Replace sealing ring.

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NOTE: Output flange must be free.

Determining thickness of shim: clamp transmission extension in a vise. Press output flange in direction of arrow. See **Fig. 63** .

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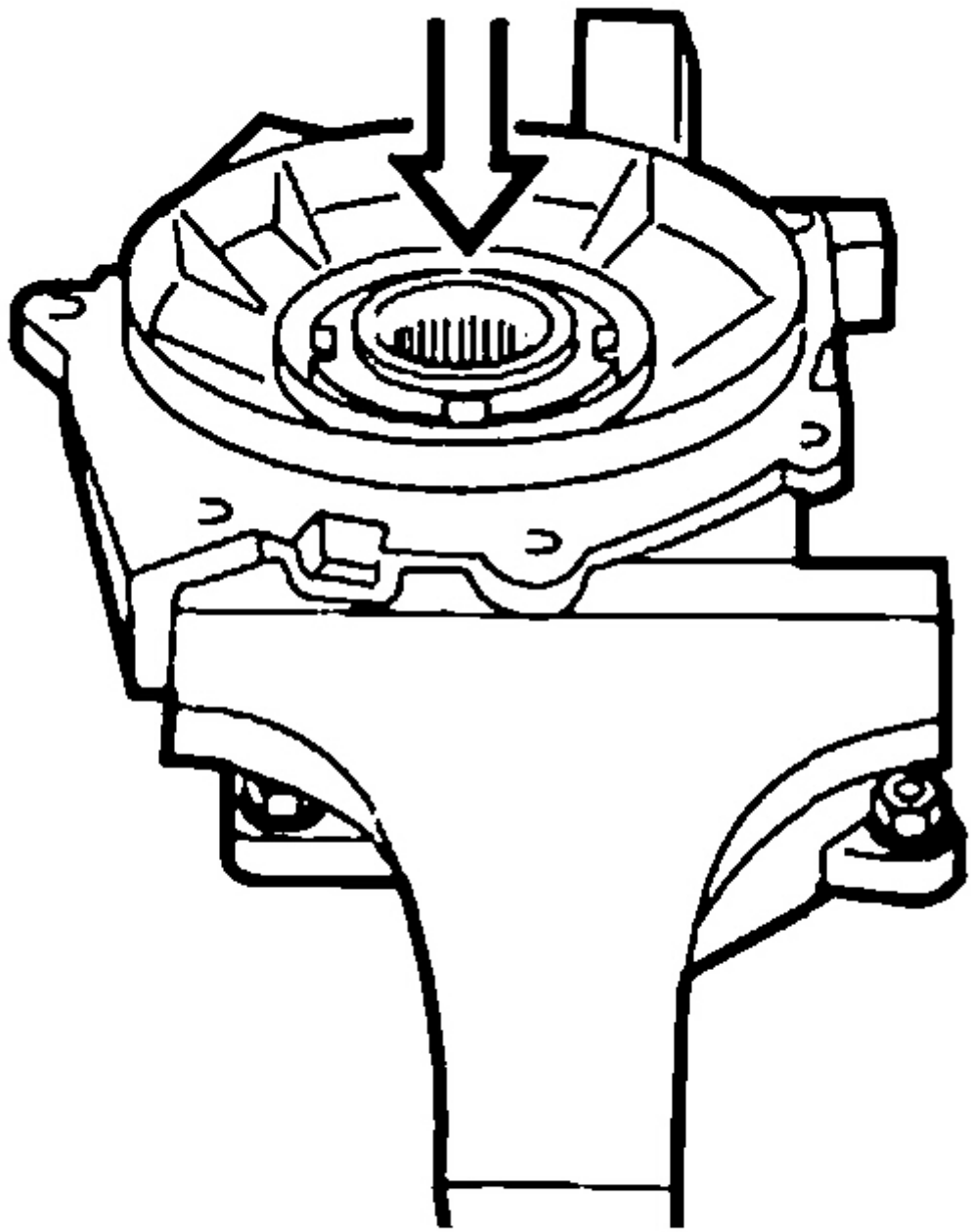


Fig. 63: Pressing Output Flange
Courtesy of BMW OF NORTH AMERICA, INC.

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Determine distance (A) from shoulder to sealing surface and distance (B) from shoulder to end face of output flange. See **Fig. 64** . Example:

- A = 10.00 mm
- B = 7.50 mm

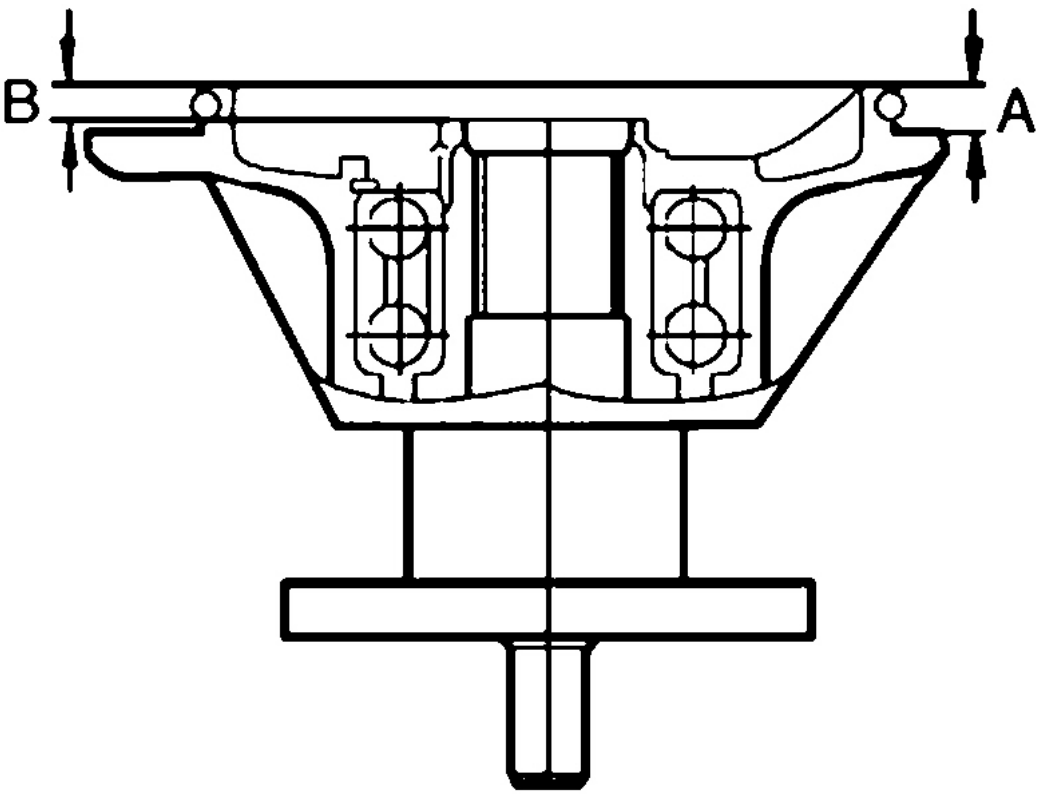


Fig. 64: Locating Distance A & B
Courtesy of BMW OF NORTH AMERICA, INC.

Remove shim from sprag wheel. Press sprag wheel inwards. Determine distance (E) from sealing surface on transmission housing to shoulder (1) on parking lock gear. See **Fig. 65** . Example: E = 4.00 mm.

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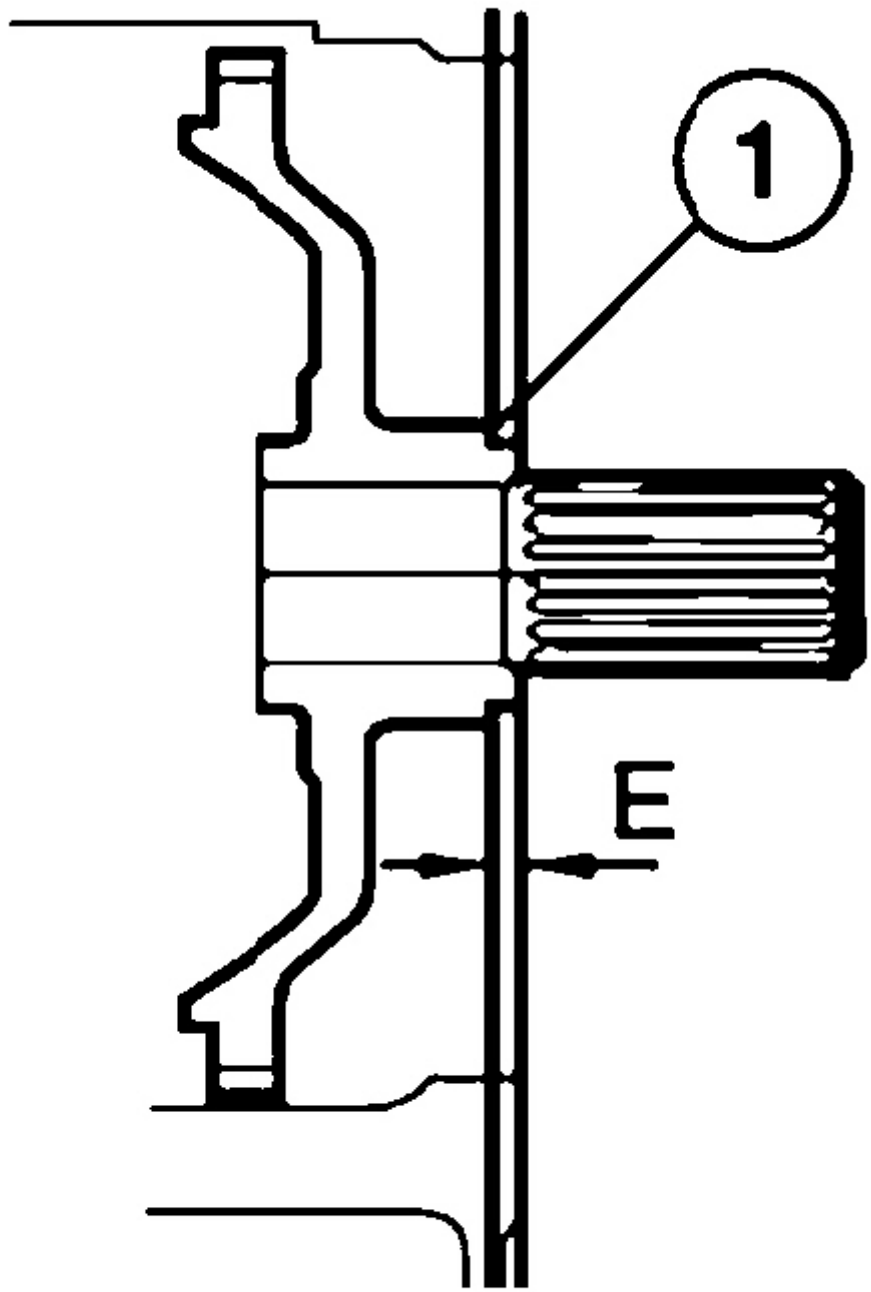


Fig. 65: Locating Distance E

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Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Shims are available in 0.2 mm increments from 0.8 to 2.8 mm.

Calculate shim thickness:

1. A - B = C
2. E - C - end play = shim thickness
3. If necessary: round distance to an amount divisible by 2. Pay attention to distance for end play (0.15 - 0.35 mm) in so doing. Example:
   - 10 - 7.5 = 2.5
   - 4 - 2.5 - 0.25 = 1.15 3. 1.2

Install shim (example: 1.20 mm).

REPLACING OUTPUT FLANGE (A5S 360R / 390R)

NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 360R / 390R, A4S 200R / 310R) .

Remove complete exhaust system.

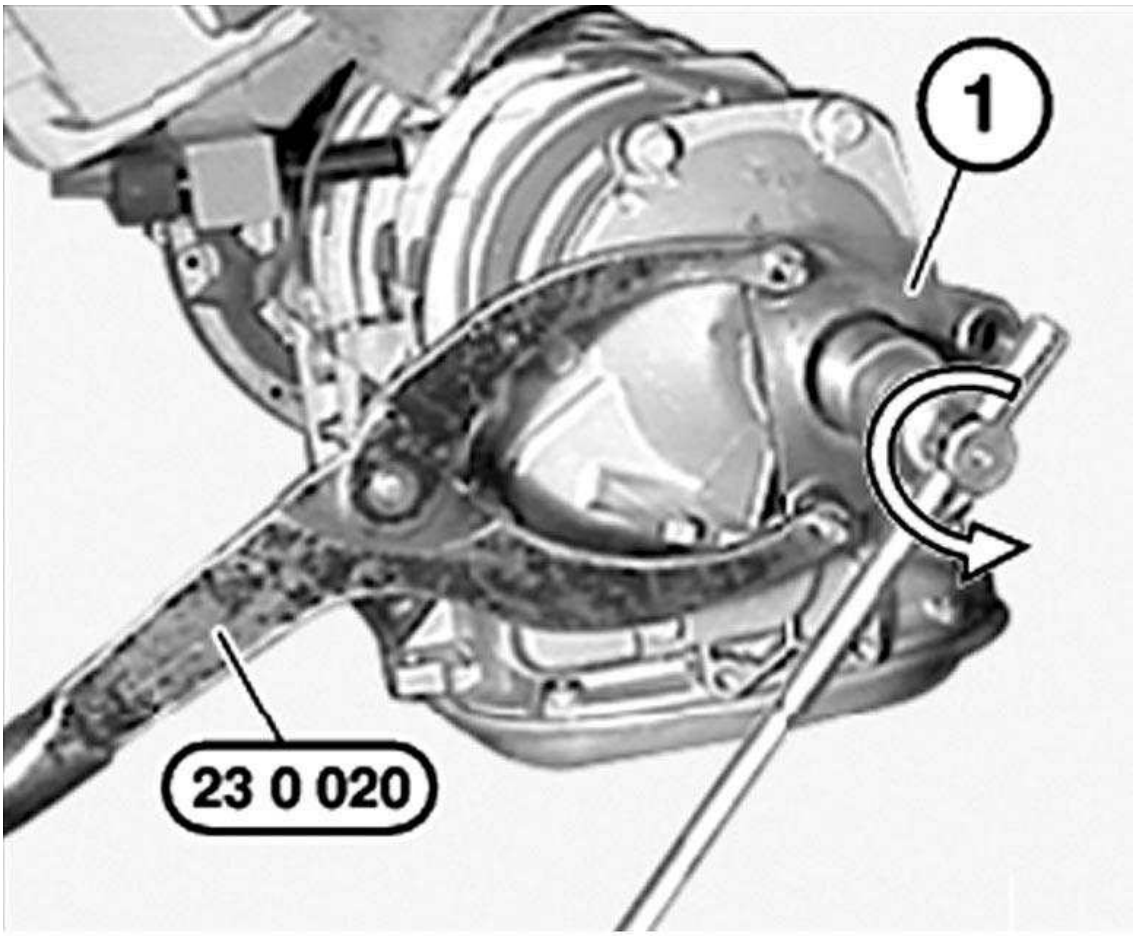
Remove heat shield (1). See **Fig. 44** .

Release screws. See **Fig. 48** . Upon installation: replace self-locking nuts and tighten to specification. See **TORQUE SPECIFICATIONS** .

Grip propeller shaft. Release nuts. See **Fig. 49** . Bend propeller shaft downwards at center bearing (1). Detach propeller shaft from transmission output flange and tie back to side on vehicle underbody. Upon installation, tighten nuts to specification. See **TORQUE SPECIFICATIONS** .

Grip output flange (1) with Special Tool (23 0 020). See **Fig. 66** . Release hexagon nut. Detach output flange (1). Upon installation, install hexagon nut with screw retaining compound and tighten to specification. See **TORQUE SPECIFICATIONS** .

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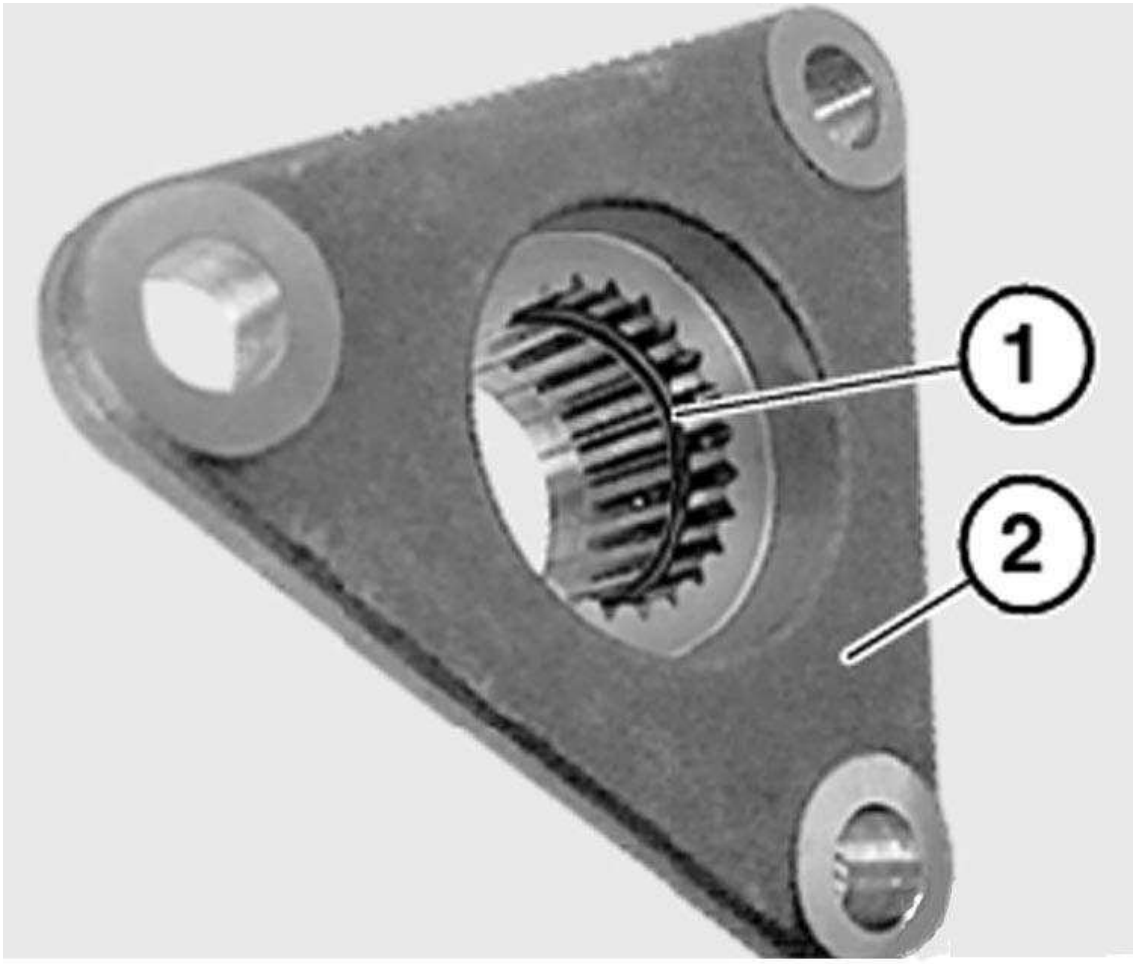


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Fig. 66: Detaching Output Flange
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: replace inner sealing ring (1) on output flange (2). See **Fig. 67** .

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Fig. 67: Replacing Inner Sealing Ring
Courtesy of BMW OF NORTH AMERICA, INC.

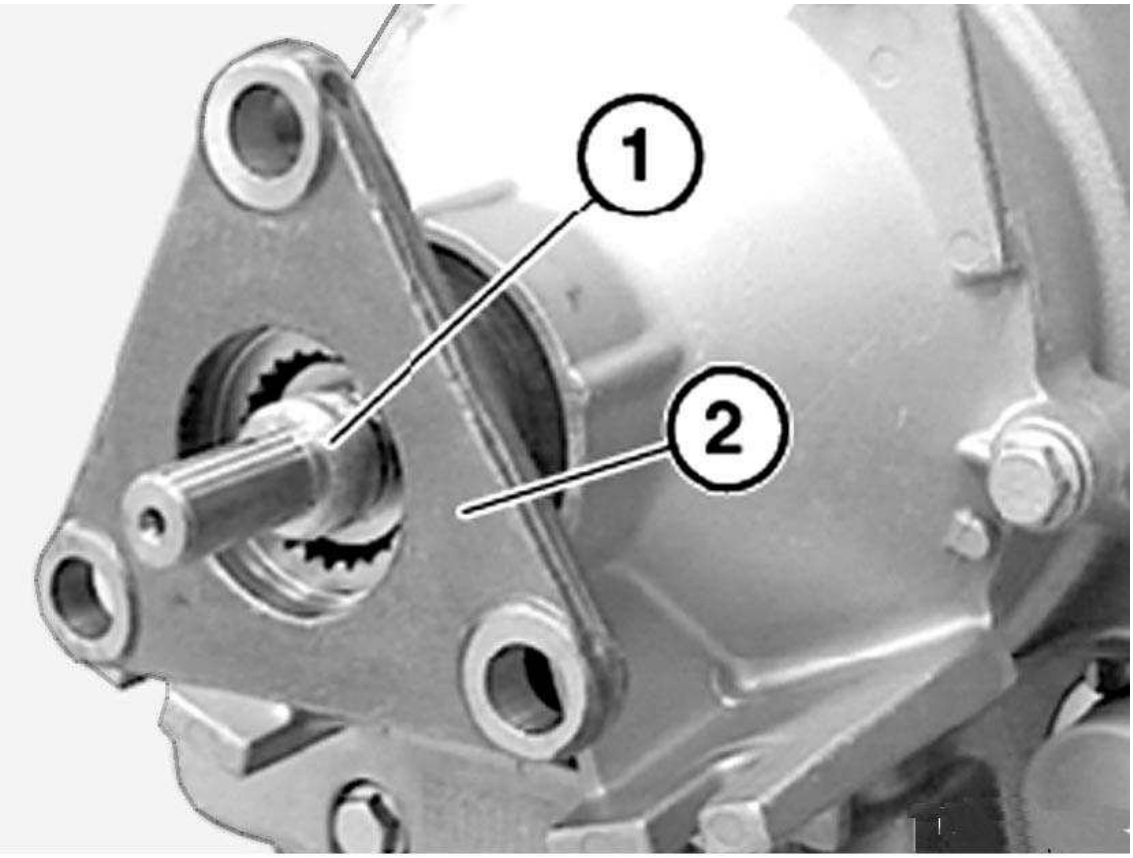
CAUTION: There are two different output flanges; DO NOT mix them up.

Version 1 (without spring washer) Identifying features:

- There is no spring washer fitted between the flange nut and output flange to secure the output flange (2) on the flange nut (1). See **Fig. 68** .
- When this output flange is replaced, the add-on kit detailed below must be retrofitted.

CAUTION: Only the modified version (Version 2) is still available as a replacement.

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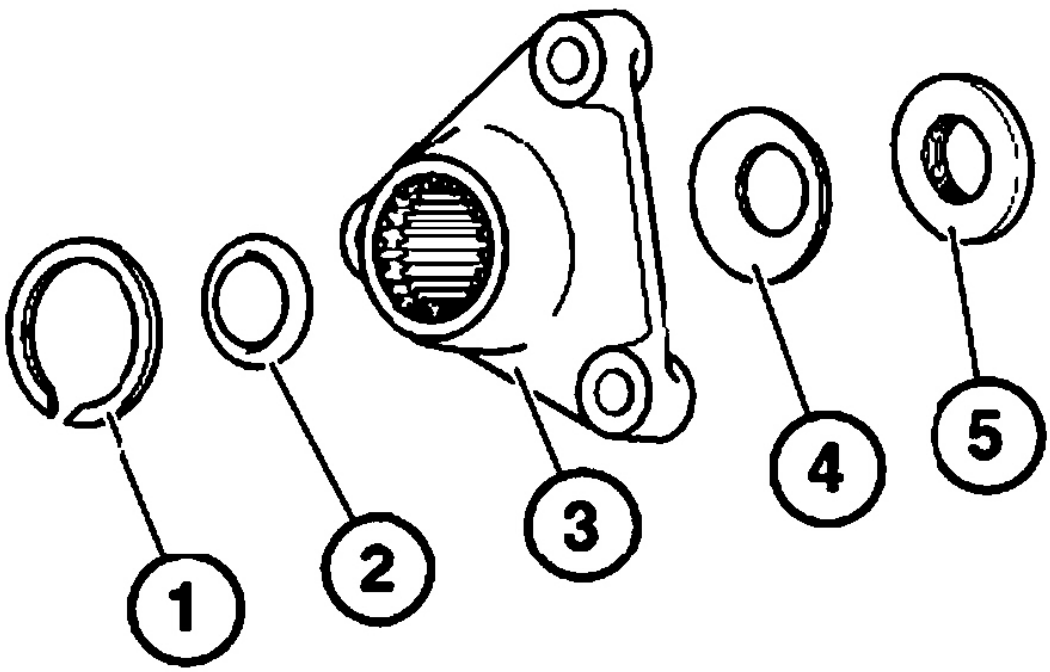


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Fig. 68: Identifying Version 1
Courtesy of BMW OF NORTH AMERICA, INC.

For retrofit kit, see **Fig. 69** . Install add-on kit for output flange.

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1 Snap ring

2 Sealing ring

3 Output flange

4 Spring washer

5 Flange nut

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Fig. 69: Identifying Retrofit Kit
Courtesy of BMW OF NORTH AMERICA, INC.

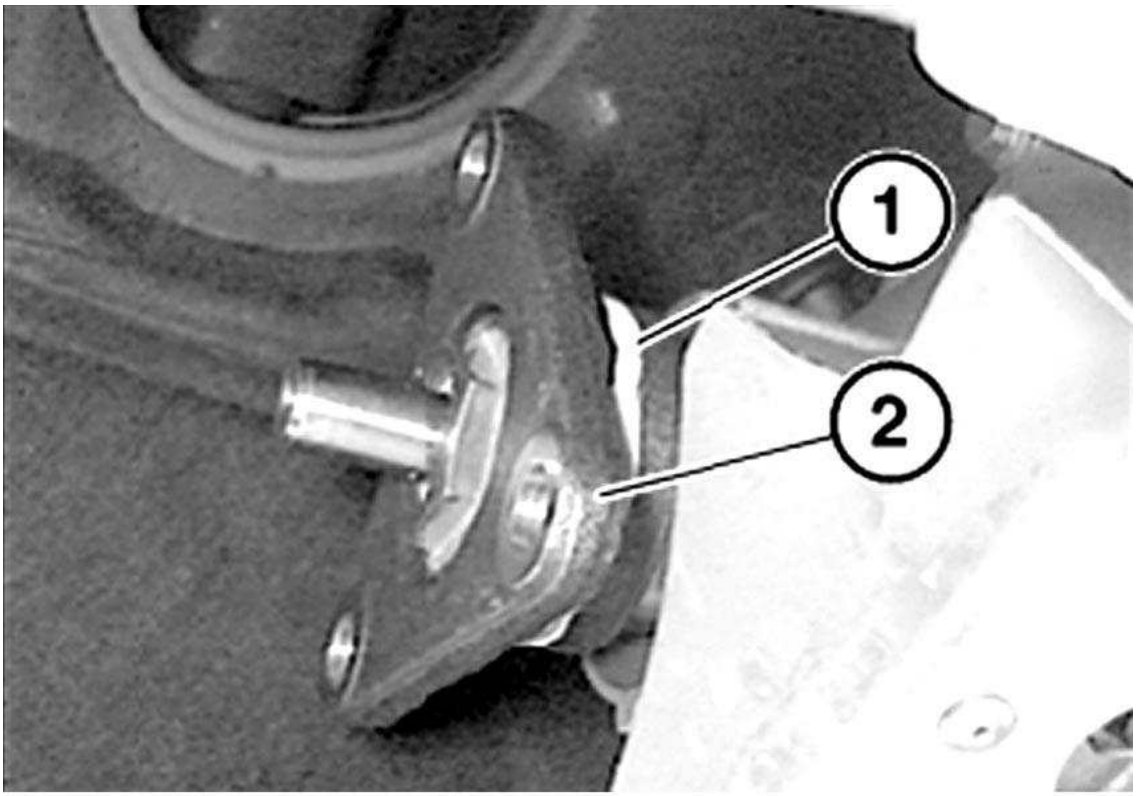
CAUTION: If the version 2 output flange is replaced by a version 2 model, the snap ring supplied in the add-on kit must not be replaced because the fitted snap ring is difficult to remove. See Fig. 69 The fitted snap ring must be left in the transmission

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NOTE: In series production, the output flange with spring washer is fitted from transmission serial number 7912 and has no color marking.

Version 2 (with spring washer) Identifying features:

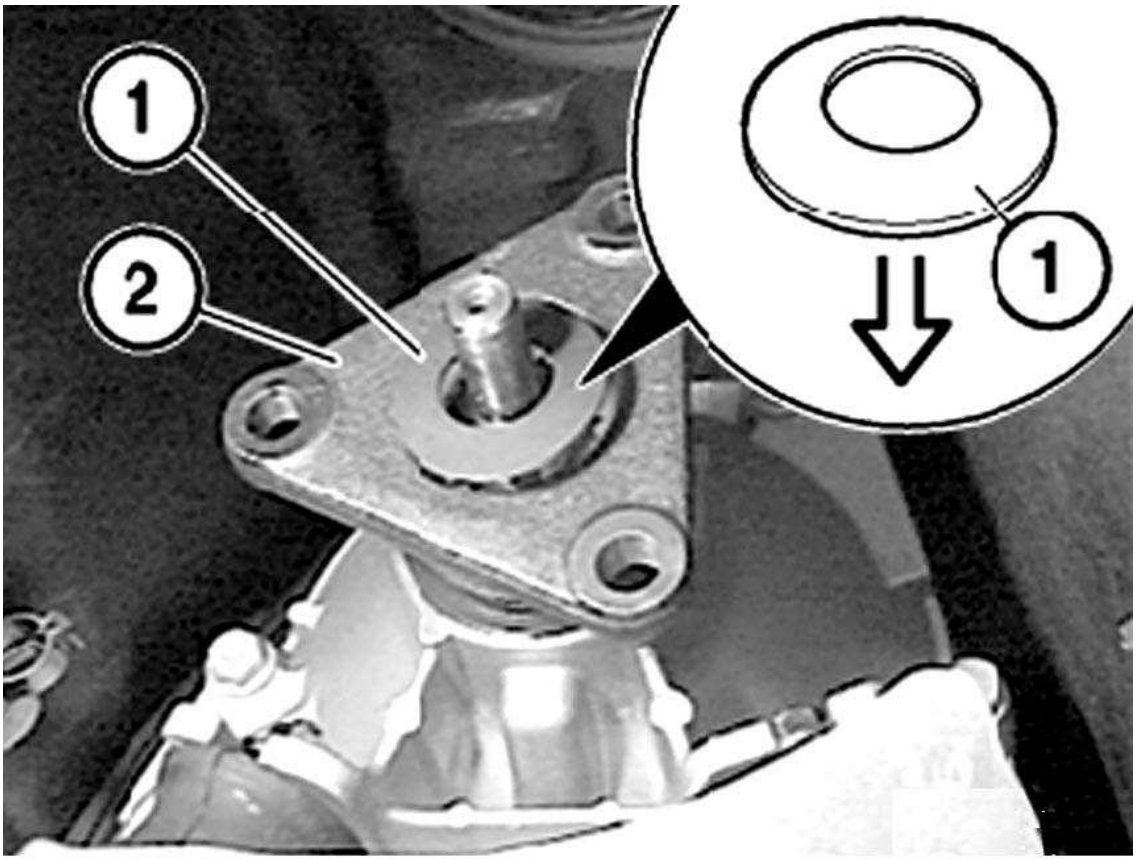
1. As the substitute, the output flange with spring washer (2) is identified with a white marking (1) around its circumference. See **Fig. 70** .
2. The spring washer (1) is fitted between flange nut and output flange (2). See **Fig. 71** .



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Fig. 70: Identifying Version 2
Courtesy of BMW OF NORTH AMERICA, INC.

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Fig. 71: Locating Spring Washer
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING PRESSURE REGULATOR FOR CONVERTER LOCKUP CLUTCH (AS5 360R / 390R, A4S 200R)

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 360R / 390R, A4S 200R / 310R) .

Remove shift unit. See **REMOVING AND INSTALLING/REPLACING SELECTOR UNIT (A5S 360R / 390R, A4S 200R)** .

Remove retaining spring. Pull out pressure regulator (1) for converter lockup clutch. See **Fig. 72** .

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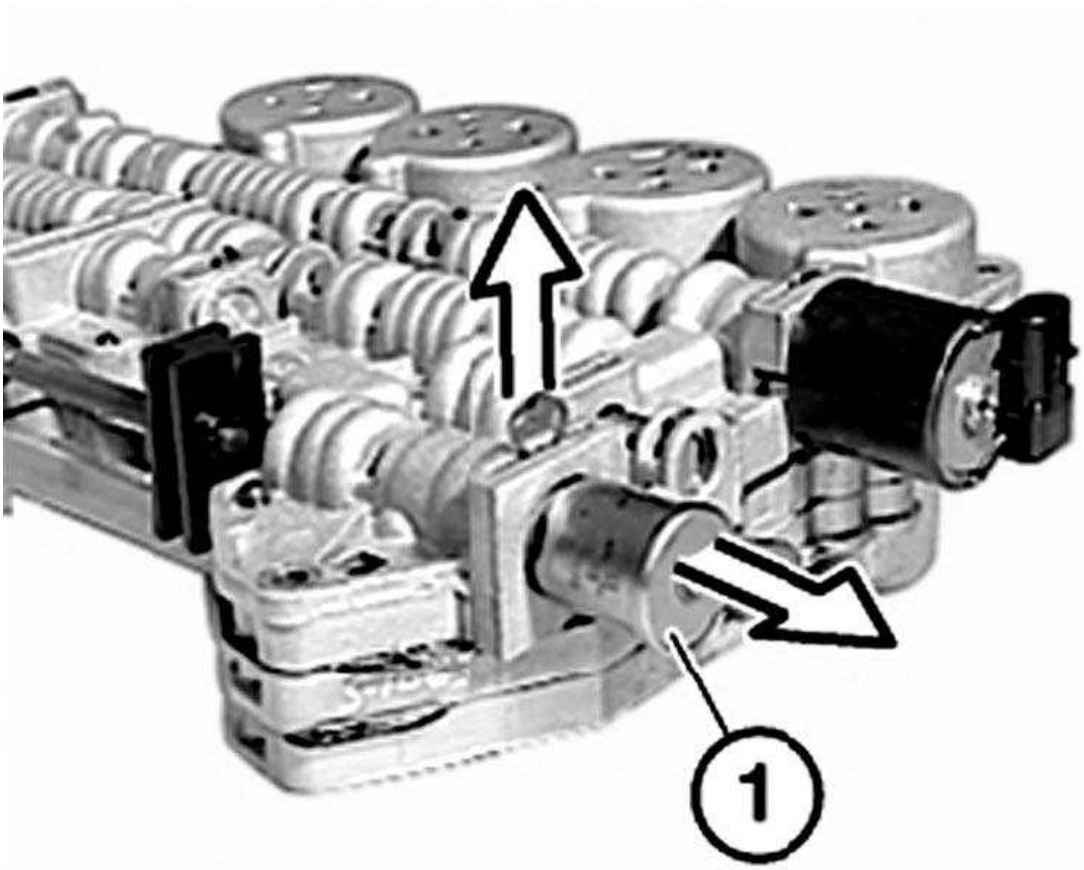


Fig. 72: Removing Pressure Regulator
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: coat new pressure regulator (1) for converter lockup clutch with automatic transmission fluid.

REPLACING PRESSURE REGULATOR FOR MAIN PRESSURE (A5S 360R/390R, A4S 200R)

NOTE: Numbers in text refer to numbers in figures.

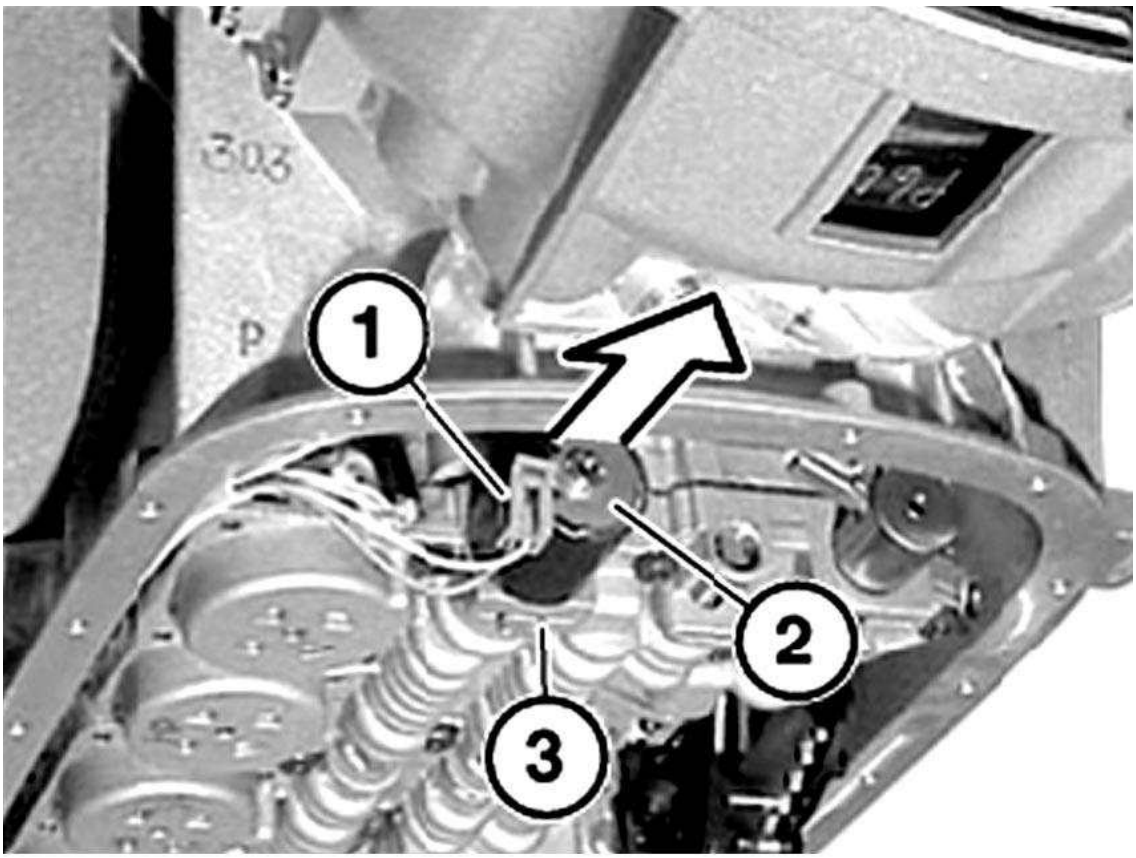
NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 360R / 390R, A4S 200R / 310R) .

Remove transmission sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION FLUID SUMP (A5S 360R / 390R, A4S 200R)** .

Remove transmission fluid screen. See **REMOVING AND INSTALLING/REPLACING TRANSMISSION SCREEN (A5S 360R / 390R, A4S 200R)** .

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Disconnect plug (1) from pressure regulator (2) for main pressure. See **Fig. 73** . Remove retaining spring (3). Remove pressure regulator (2) for main pressure. Upon installation: coat new pressure regulator (2) for main pressure with automatic transmission fluid.



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Fig. 73: Removing Pressure Regulator For Main Pressure
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING PRESSURE REGULATOR FOR SYSTEM PRESSURE (AS5 325Z)

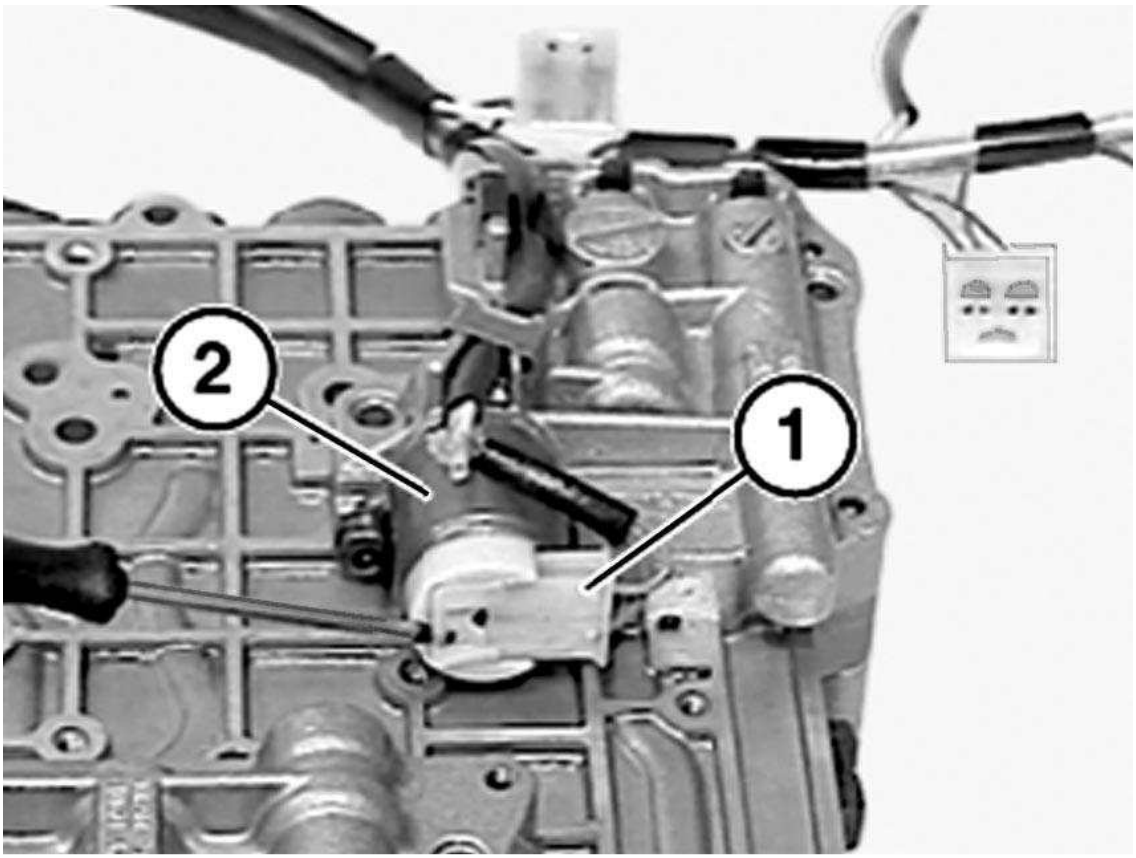
NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 325Z) .

Remove and install shift unit. See **REMOVING AND INSTALLING/REPLACING SHIFT UNIT (A5S 325Z)** .

Disconnect plug (1) from pressure regulator (2) for system pressure. See **Fig. 74** .

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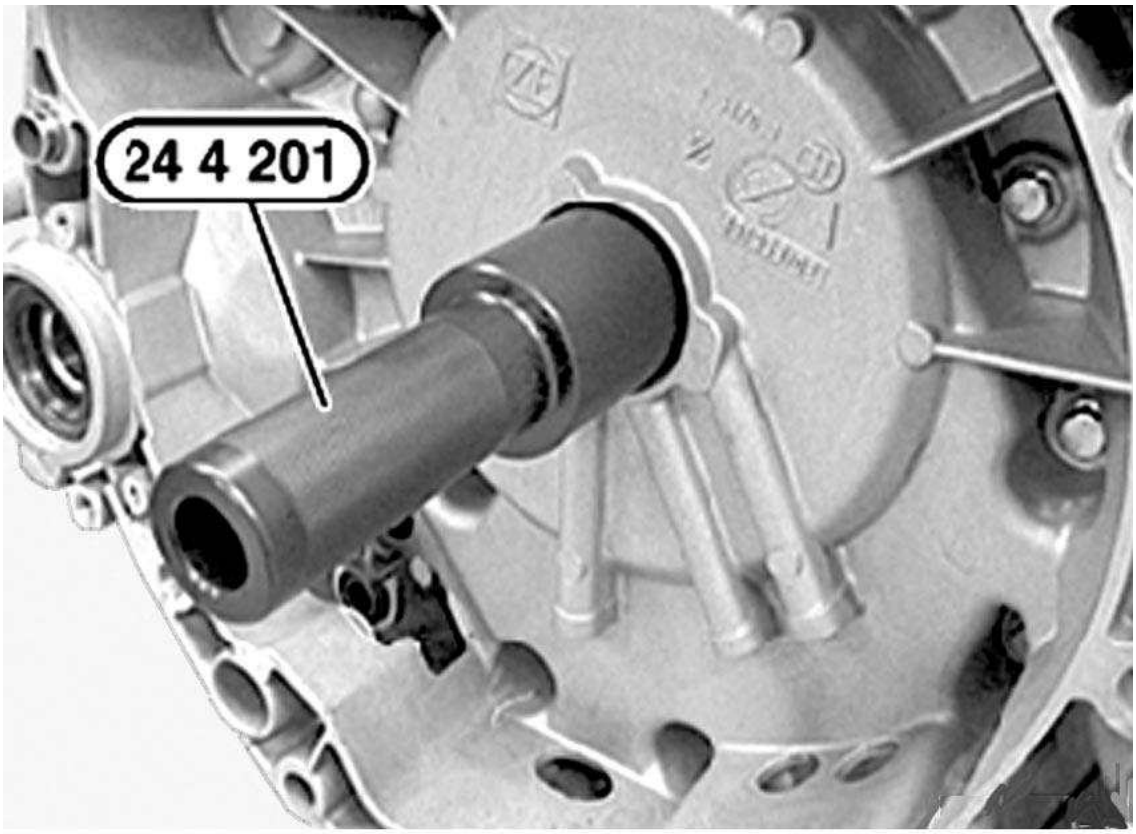


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Fig. 74: Disconnecting Plug From Pressure Regulator
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew bolt (1). See **Fig. 75** . Remove retaining plate (2). Remove pressure regulator (3) for system pressure. Upon installation: coat new pressure regulator (3) for system pressure with ATF.

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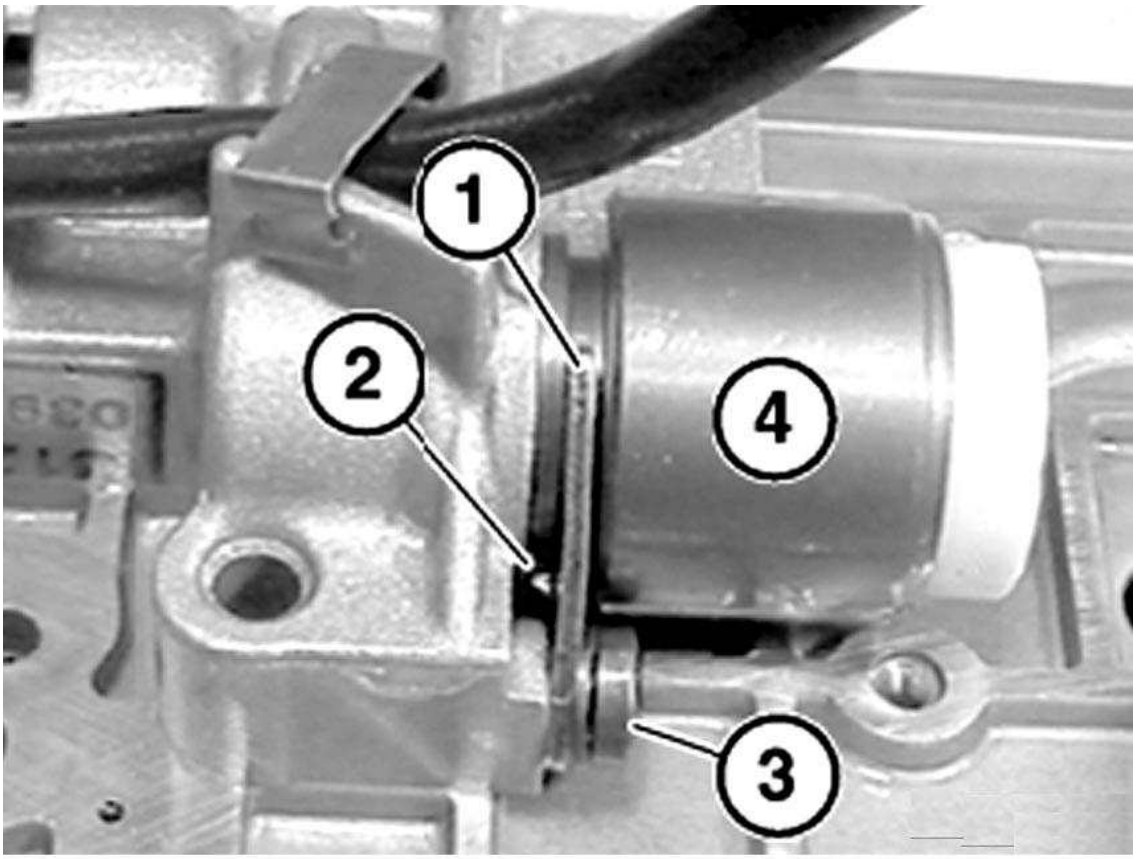


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Fig. 75: Removing Pressure Regulator For System Pressure
Courtesy of BMW OF NORTH AMERICA, INC.

Slide in pressure regulator (4). See **Fig. 76** . Install retaining plate (1) with lug (2) as illustrated. Install screw (3). Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .

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Fig. 76: Installing Pressure Regulator
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING PULSE GENERATOR (OUTPUT SPEED) (A5S 325Z)

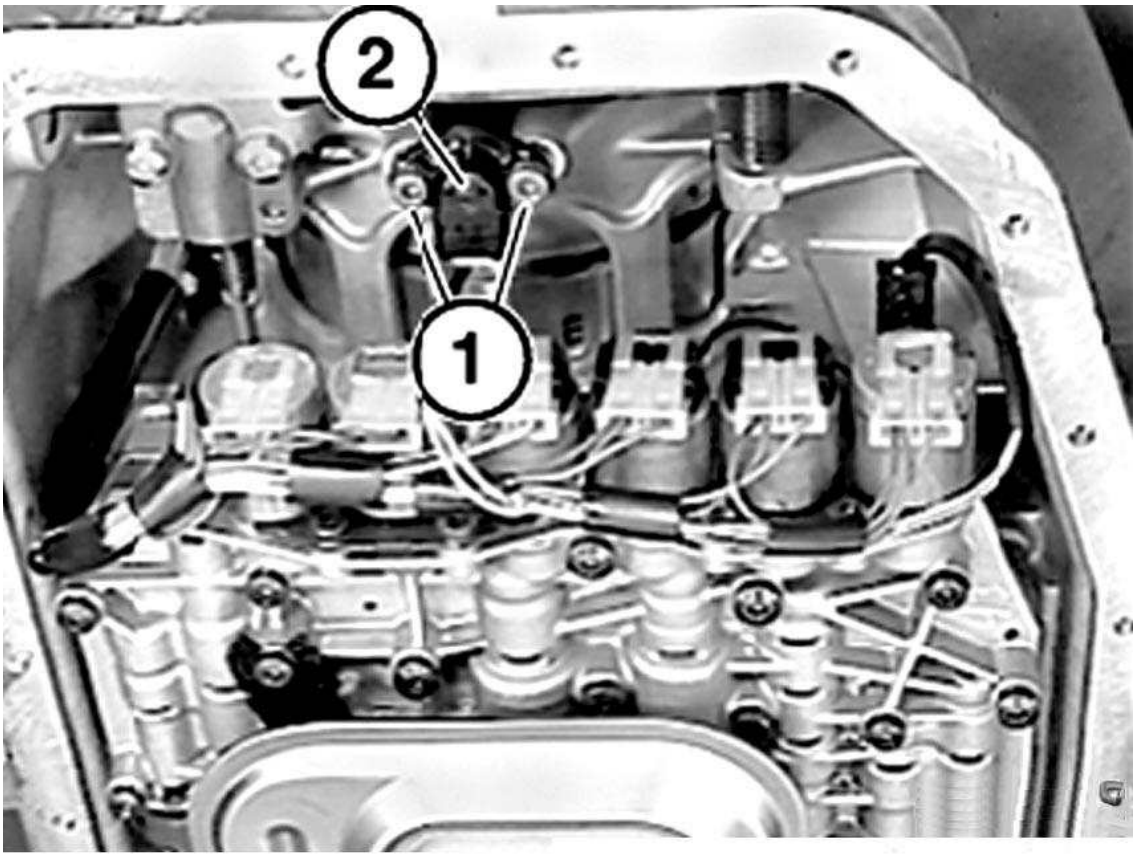
NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 325Z) .

Remove and install transmission oil sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION OIL SUMP (A5S 325Z)** .

Unscrew bolt (1). See **Fig. 77** . Remove pulse generator (2). Upon installation, tighten bolt to specification. See **TORQUE SPECIFICATIONS** .

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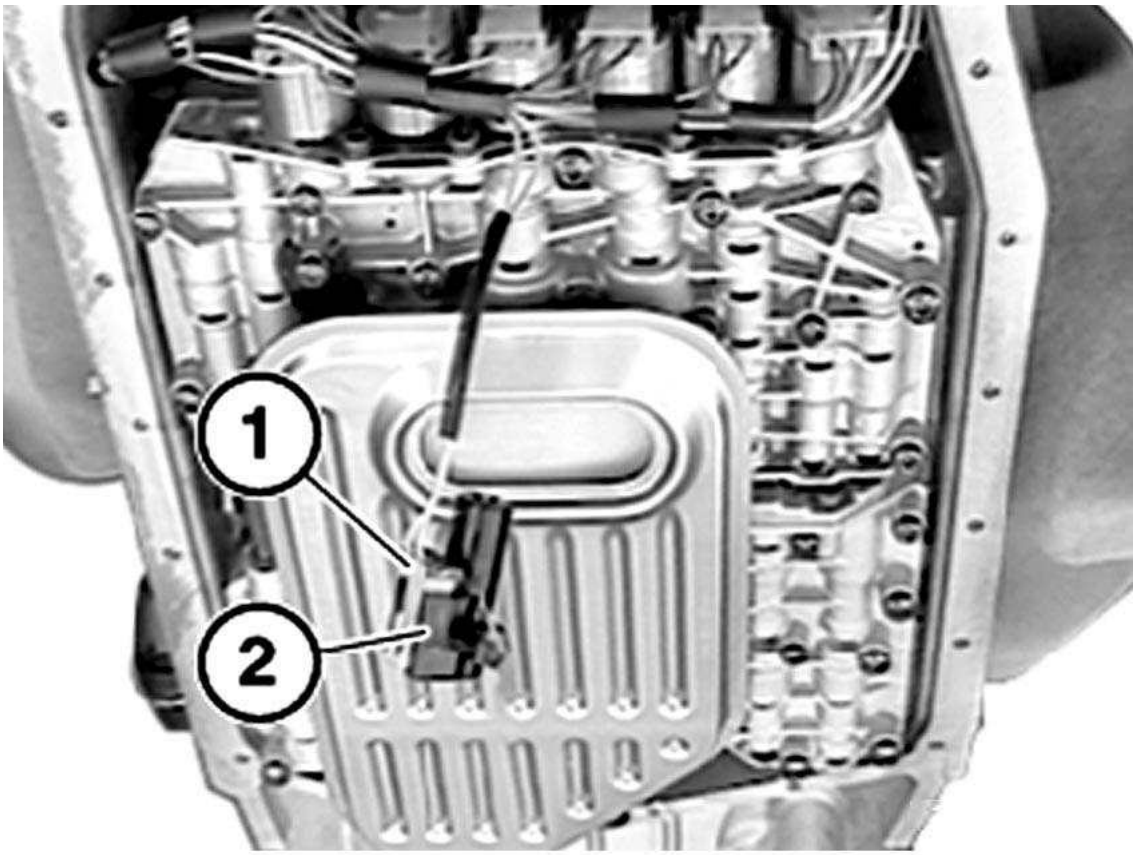


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Fig. 77: Removing Pulse Generator
Courtesy of BMW OF NORTH AMERICA, INC.

Detach plug (1) from pulse generator (2). See **Fig. 78** .

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Fig. 78: Detaching Plug From Pulse Generator
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING PULSE GENERATOR (OUTPUT SPEED) (A5S 360R / 390R, A4S 200R)

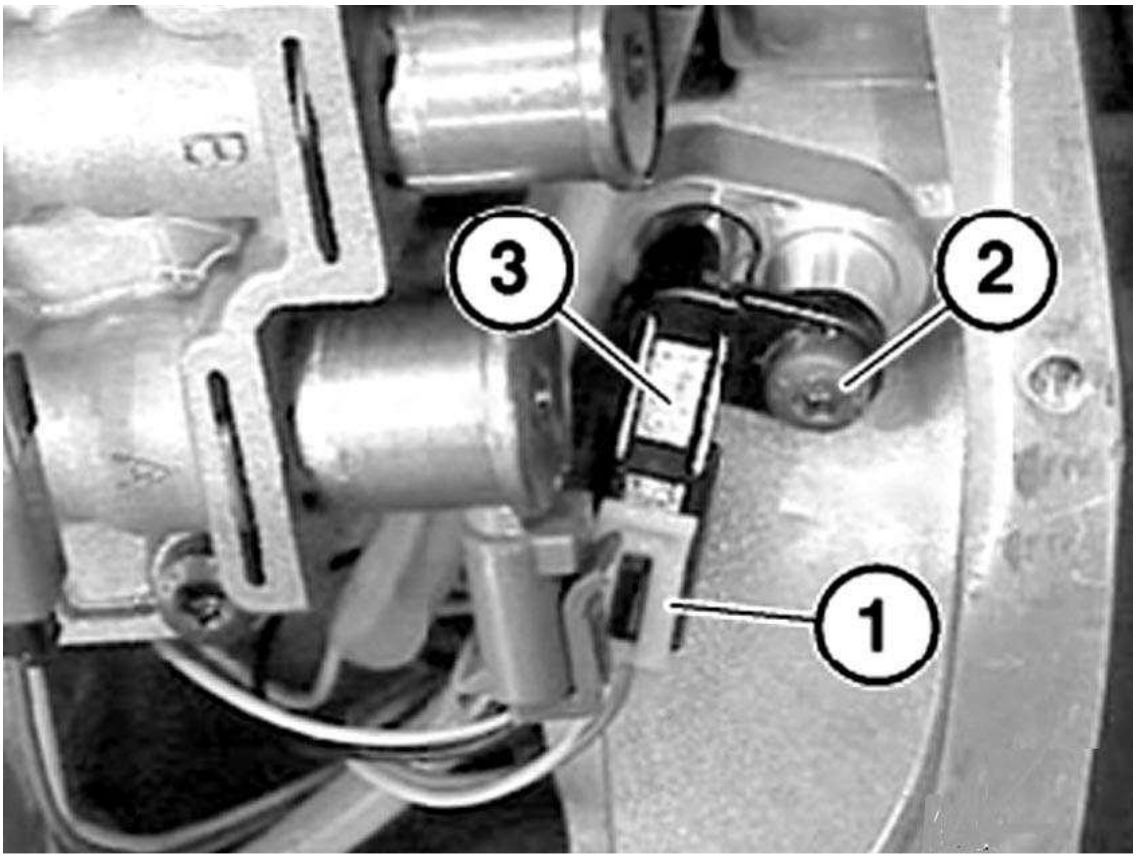
NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 360R / 390R, A4S 200R / 310R) .

Remove transmission oil sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION OIL SUMP (A5S 325Z)** .

Pull off plug (1). See **Fig. 79** . Unscrew bolt (2). Withdraw pulse generator (3). Upon installation, tighten bolt to specification. See **TORQUE SPECIFICATIONS** . Read out fault memory of EGS control unit. Check stored fault messages, eliminate faults and then clear fault memory.

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Fig. 79: Removing Output Speed Pulse Generator
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING PULSE GENERATOR (TURBINE SPEED) (A5S 325Z)

NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 325Z) .

Remove and install transmission oil sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION OIL SUMP (A5S 325Z)** .

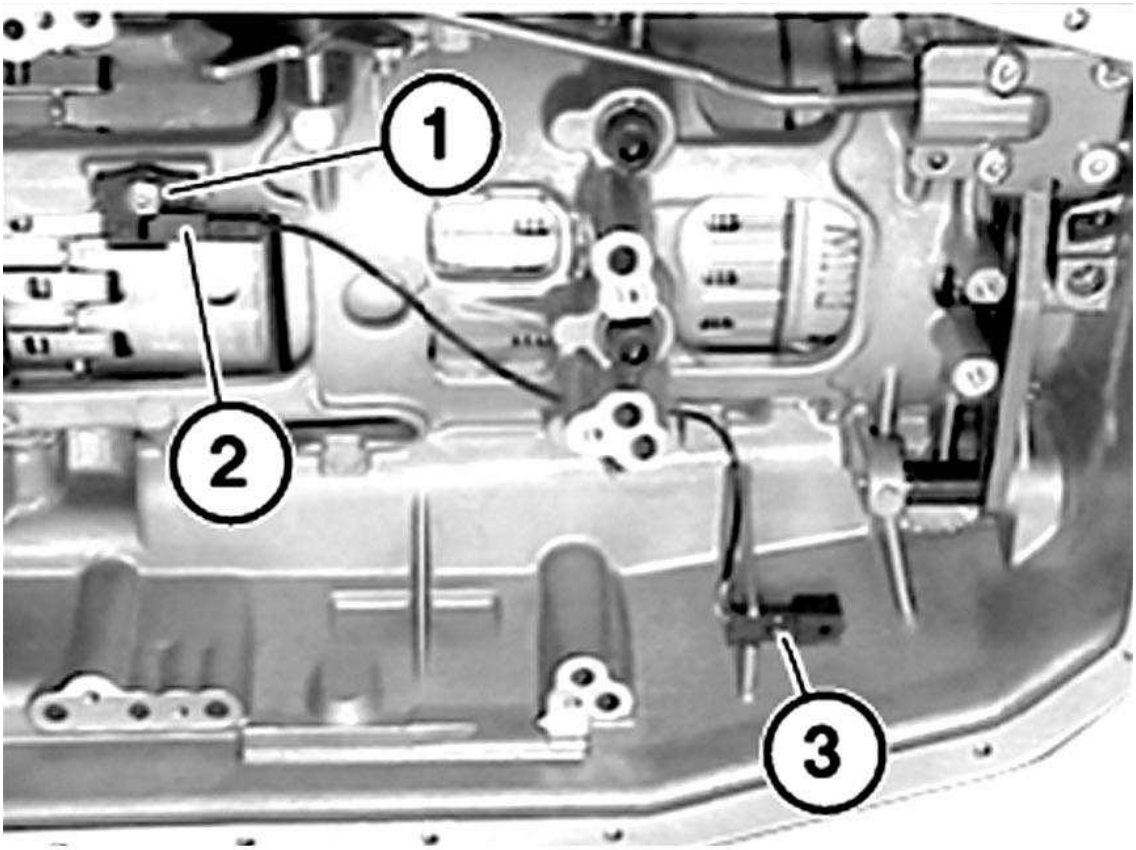
Remove and install transmission oil screen. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION OIL SUMP (A5S 325Z)** .

Remove and install shift unit. See **REMOVING AND INSTALLING/REPLACING SHIFT UNIT (A5S**

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325Z) .

Unscrew bolt (1). See **Fig. 80** . Withdraw pulse generator (2). Pull off connector (3). Upon installation, tighten bolt to specification. See **TORQUE SPECIFICATIONS** .



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Fig. 80: Removing Pulse Generator
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING PULSE GENERATOR (TURBINE SPEED) (A5S 360R / 390R, A4S 200R)

NOTE: Numbers in text refer to numbers in figures.

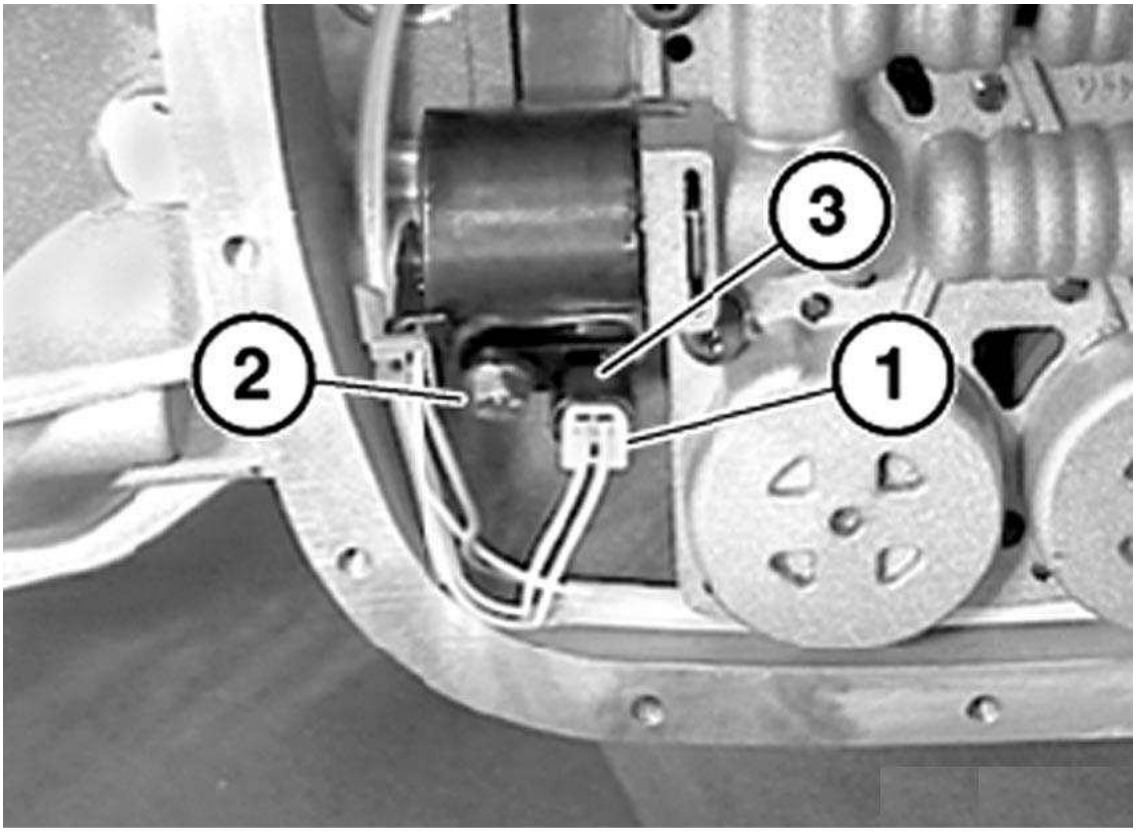
NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 360R / 390R, A4S 200R / 310R) .

Remove transmission oil sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION FLUID SUMP (A5S 360R / 390R, A4S 200R)** .

Pull off plug (1). See **Fig. 81** . Release screw (2). Withdraw pulse generator (3). Upon installation, tighten screw

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to specification. See **TORQUE SPECIFICATIONS** . Read out fault memory of EGS control unit. Check stored fault messages, eliminate faults and then clear fault memory.



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Fig. 81: Removing Turbine Speed Pulse Generator
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING RADIAL SEAL ON MANUAL SHIFT VALVE SHAFT (A5S 325Z)

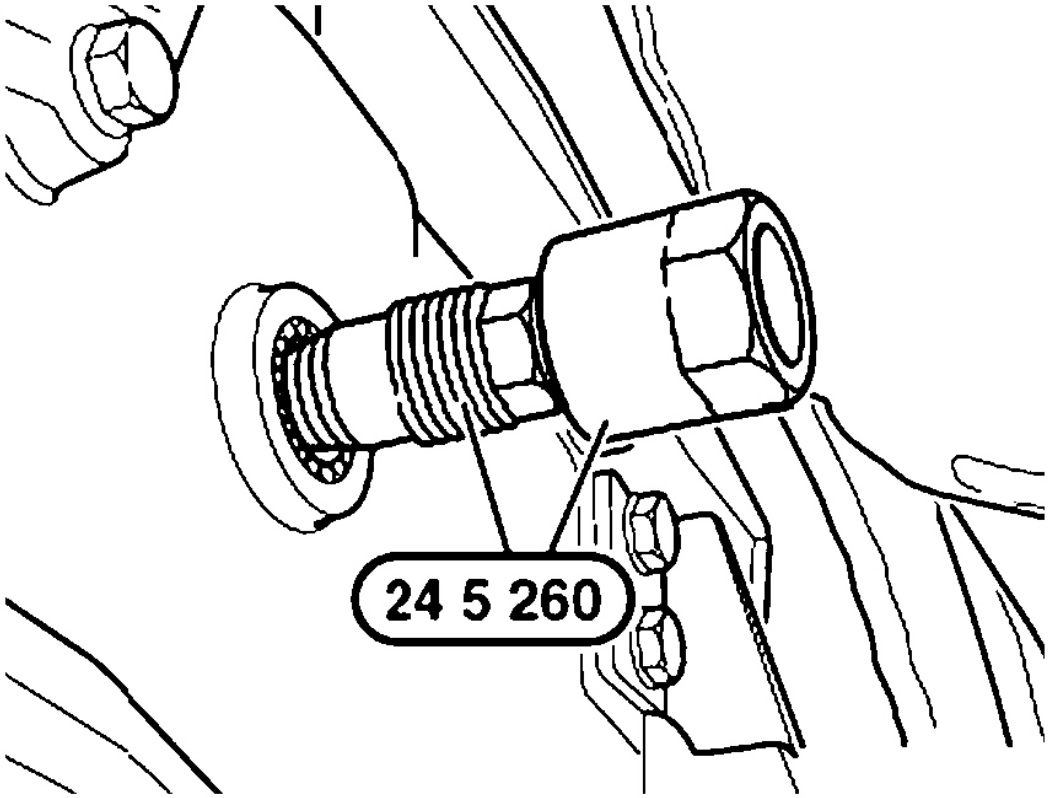
NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 325Z) .

Remove position switch from the manual shift valve shaft. See **REMOVING AND INSTALLING/REPLACING POSITION SWITCH (A5S 325Z)** .

Remove radial seal with Special Tool (24 5 260) from transmission housing. See **Fig. 82** .

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Fig. 82: Removing Radial Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: fit Special Tool (24 5 490) to the manual shift valve shaft. See **Fig. 83** . Coat sealing lip of new radial seal (1) with transmission oil. Slide radial seal onto manual shift valve shaft.

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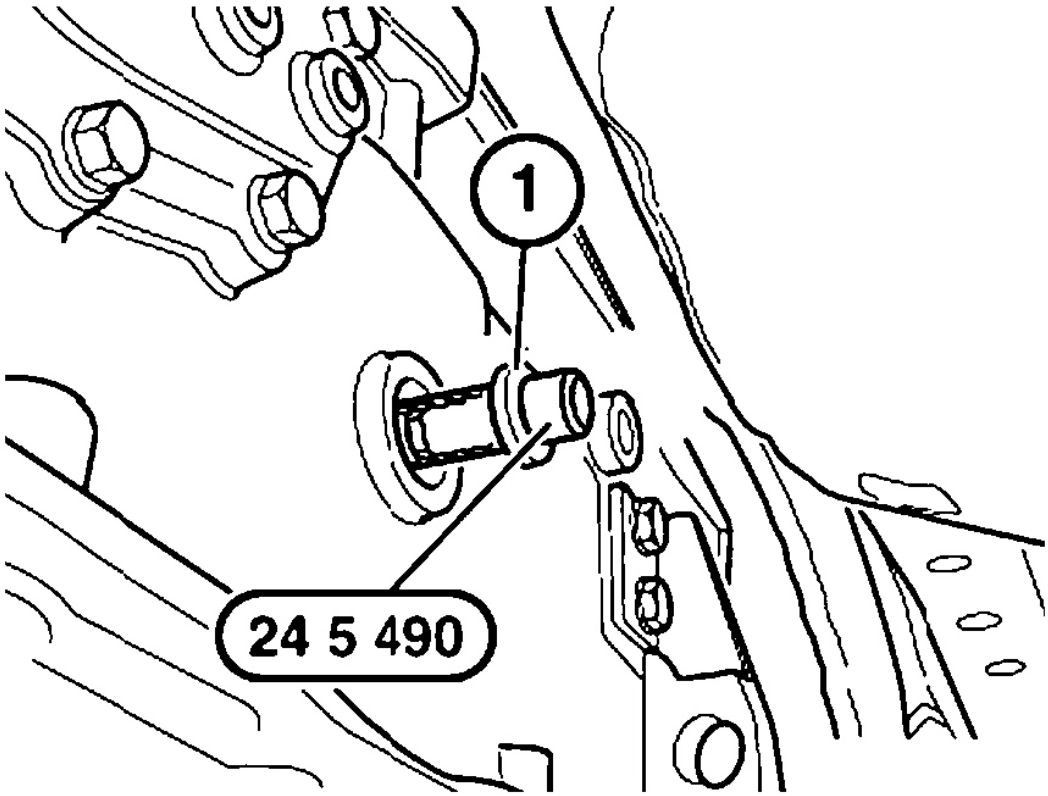


Fig. 83: Sliding Radial Seal Onto Manual Shift Valve Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: press radial seal into transmission case with Special Tool (24 5 250). See **Fig. 84** . Pull Special Tool (24 5 490) off manual shift valve shaft.

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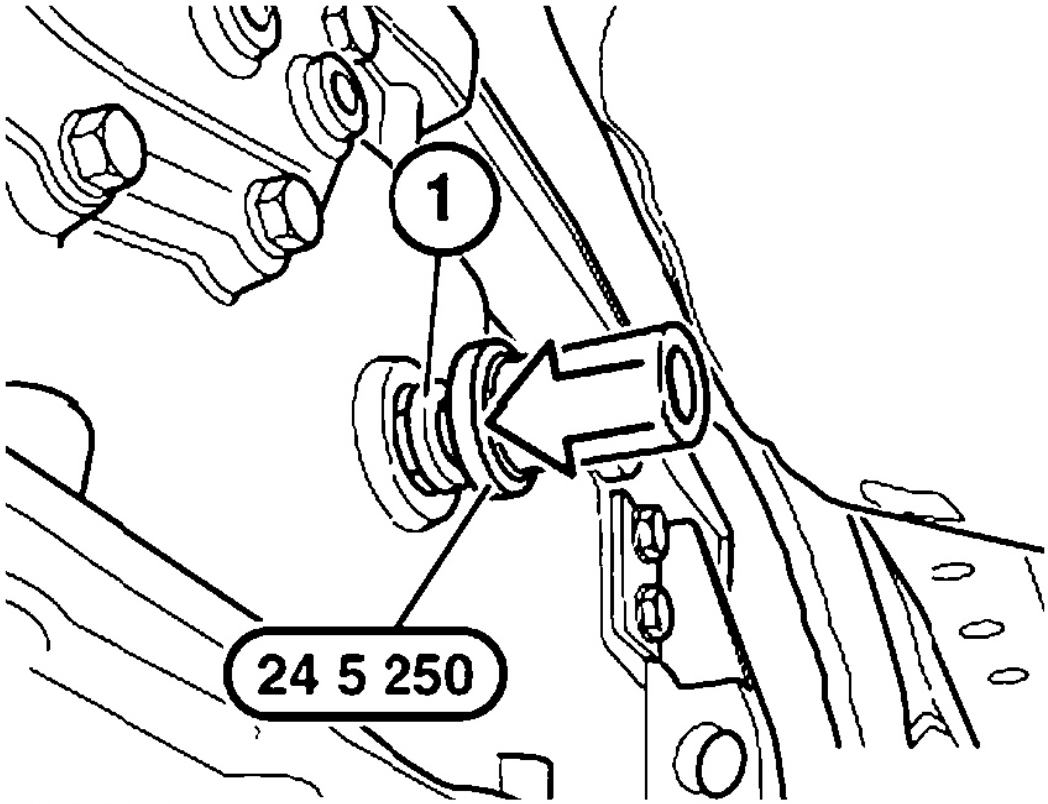


Fig. 84: Pressing Radial Seal Into Transmission Case
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING RADIAL SHAFT SEAL FOR MANUAL SHIFT VALVE SHAFT (A5S 360R / 390R, A4S 200R)

NOTE: Numbers in text refer to numbers in figures.

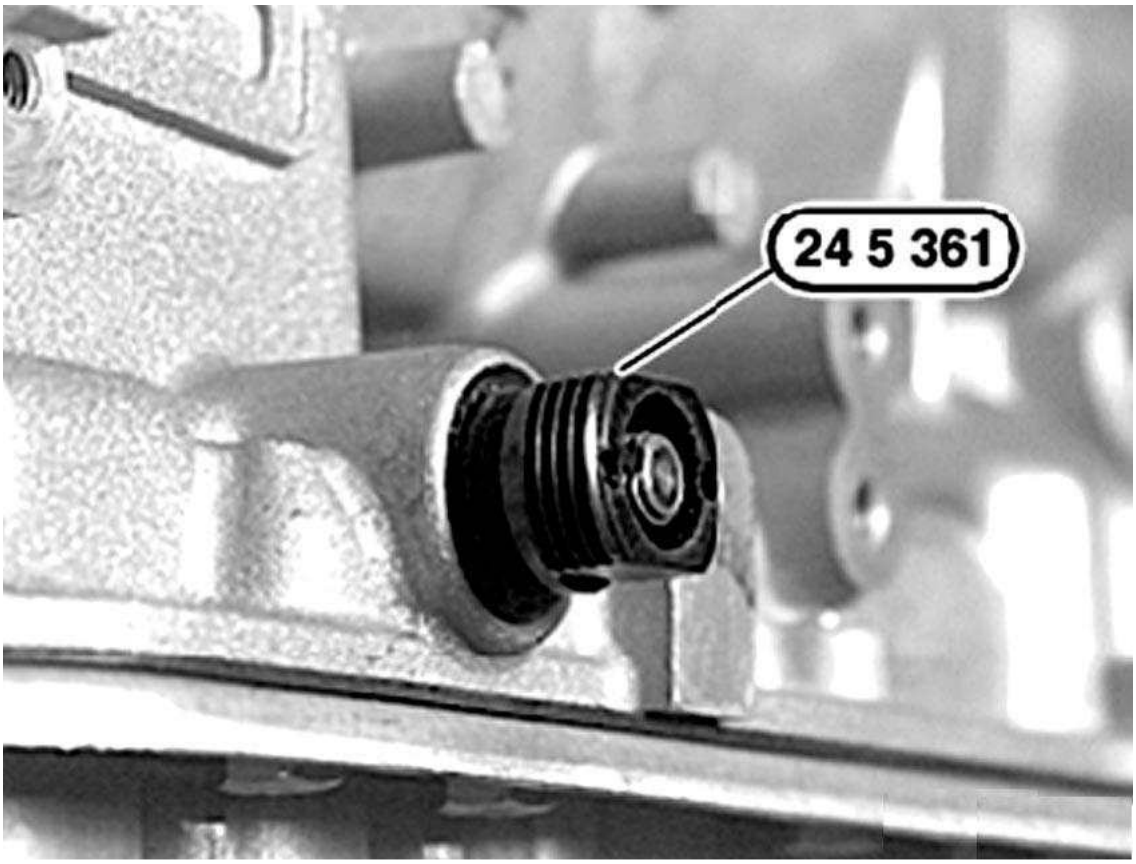
NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 360R / 390R, A4S 200R / 310R) .

Grip clamping sleeve (1). Loosen nut (2). See **Fig. 99** . Upon installation, tighten nut to specification. See **TORQUE SPECIFICATIONS** .

Unscrew nut (1). Remove selector lever (2). See **Fig. 100** . Upon installation, tighten nut to specification. See **TORQUE SPECIFICATIONS** .

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Screw Special Tool (24 5 361) into radial shaft seal. See **Fig. 85** .

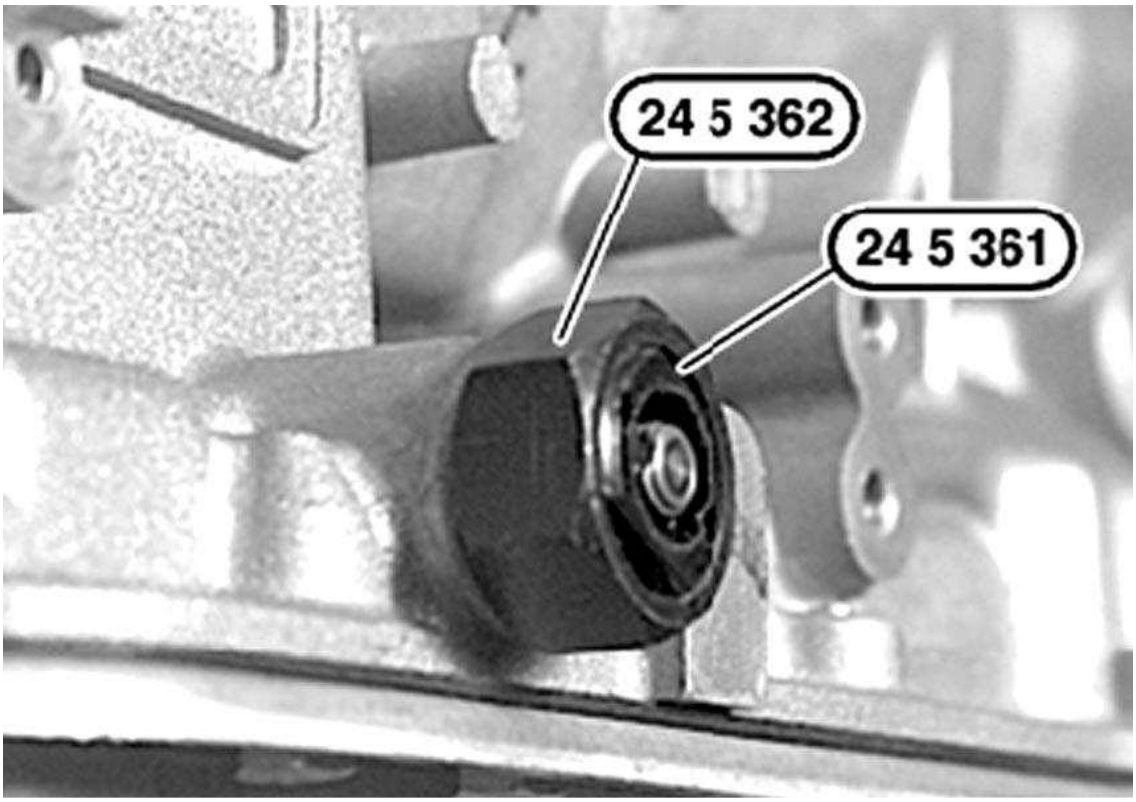


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Fig. 85: Screwing Special Tool Into Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Screw Special Tool (24 5 362) onto Special Tool (24 5 361) and tighten down. See **Fig. 86** . This pulls the radial shaft seal out of the transmission housing.

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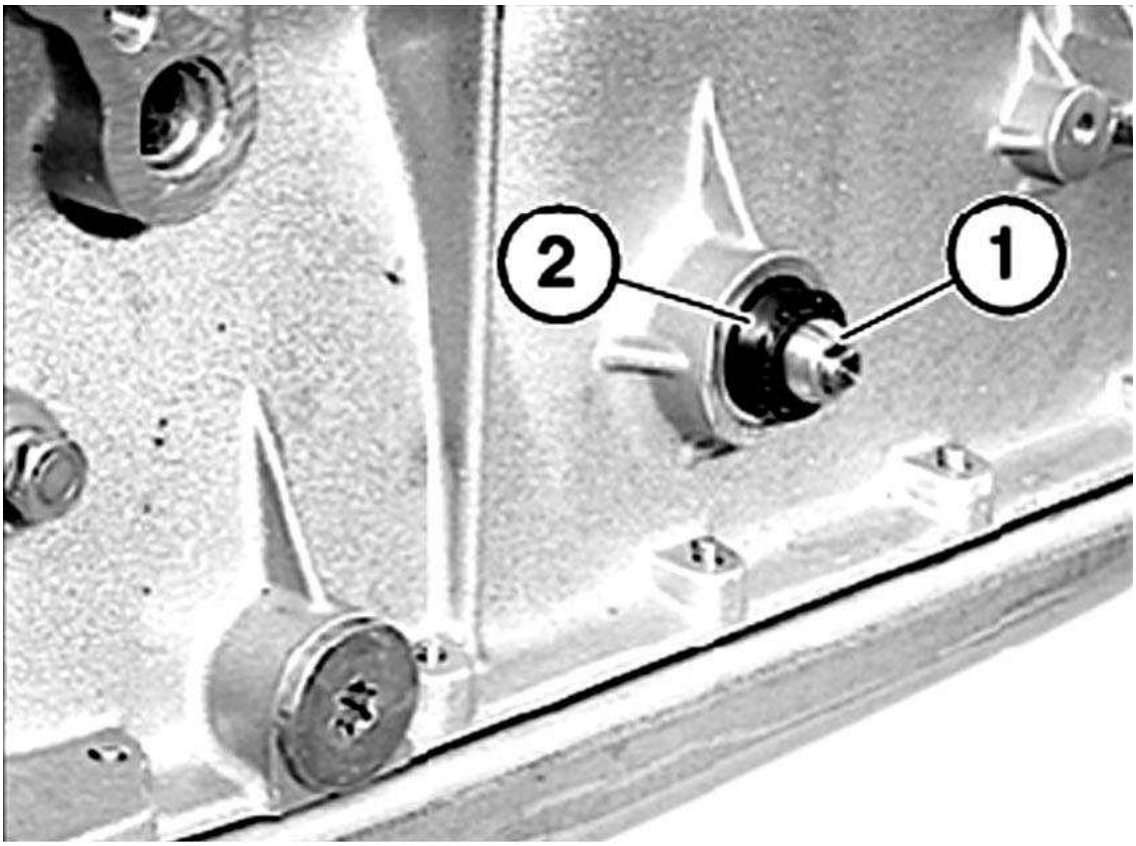


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Fig. 86: Removing Radial Shaft From Transmission Housing
Courtesy of BMW OF NORTH AMERICA, INC.

Screw adapter sleeve (1) from seal set onto manual shift valve shaft. See **Fig. 87** . Moisten sealing lips of radial shaft seal (2) with automatic transmission fluid. Push radial shaft seal (2) onto manual shift valve shaft. Press radial shaft seal (2) as far as possible into transmission housing. Grip radial shaft seal (2) firmly. Unscrew adapter sleeve (1) from manual shift valve shaft.

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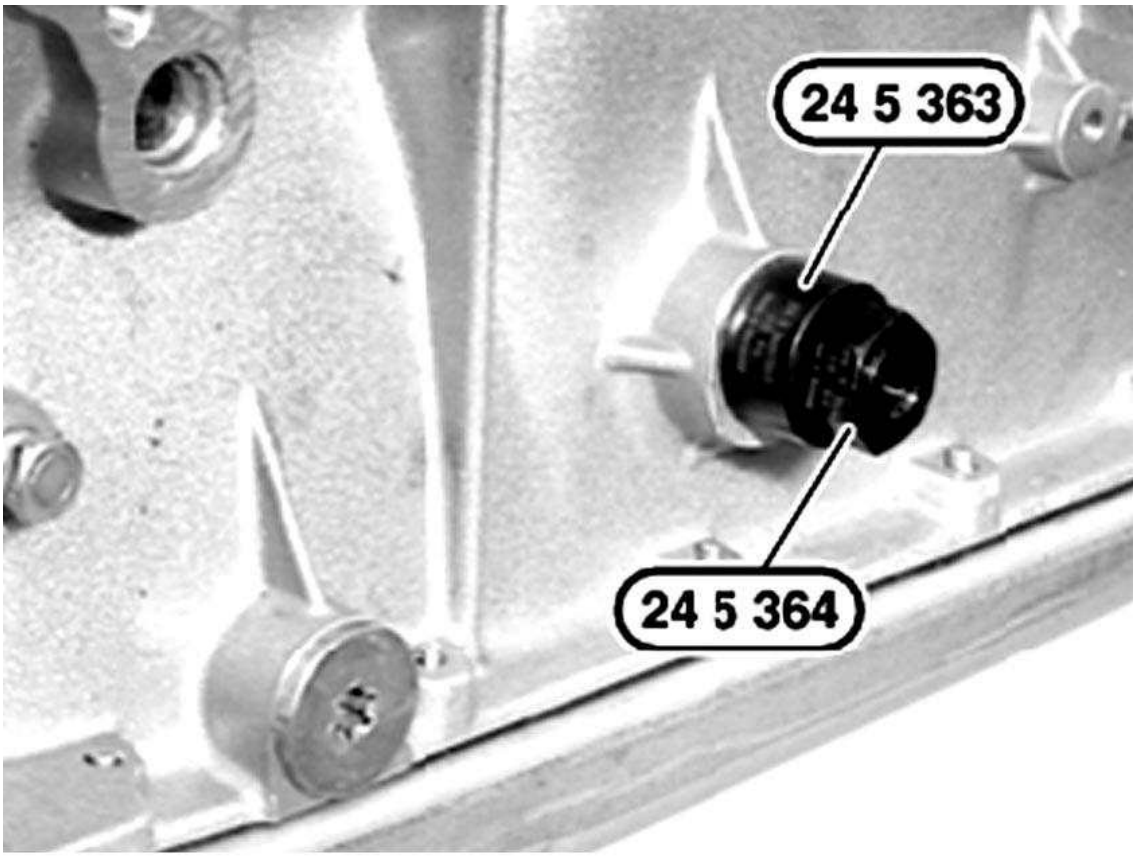


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Fig. 87: Removing Adapter Sleeve From Manual Shift Valve Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Pull radial shaft seal into transmission housing up to stop with Special Tools (24 5 363) and (24 5 364). See **Fig. 88** . Upon installation, adjust selector lever. See **ADJUSTING SELECTOR LEVER (A5S 360R / 390R, A4S 200R, 6HP26Z/19Z)** .

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Fig. 88: Pulling Radial Shaft Seal Into Transmission H
Courtesy of BMW OF NORTH AMERICA, INC.

E46 4WD: Selector Shaft Sealing Cap On Left Transmission Side Leaking

Lever out sealing cap (1) with a screwdriver (2). See **Fig. 89** .

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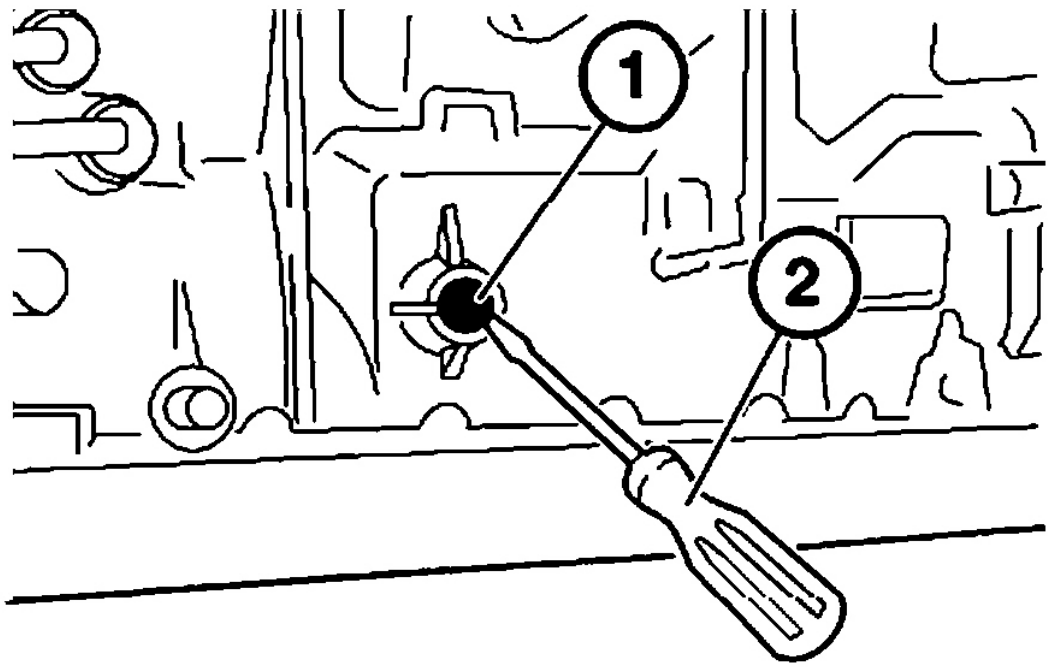


Fig. 89: Levering Out Sealing Cap
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: Drift (2) for driving in sealing cap is contained in repair kit.

Place new sealing cap (1) on drift (2). See **Fig. 90** .

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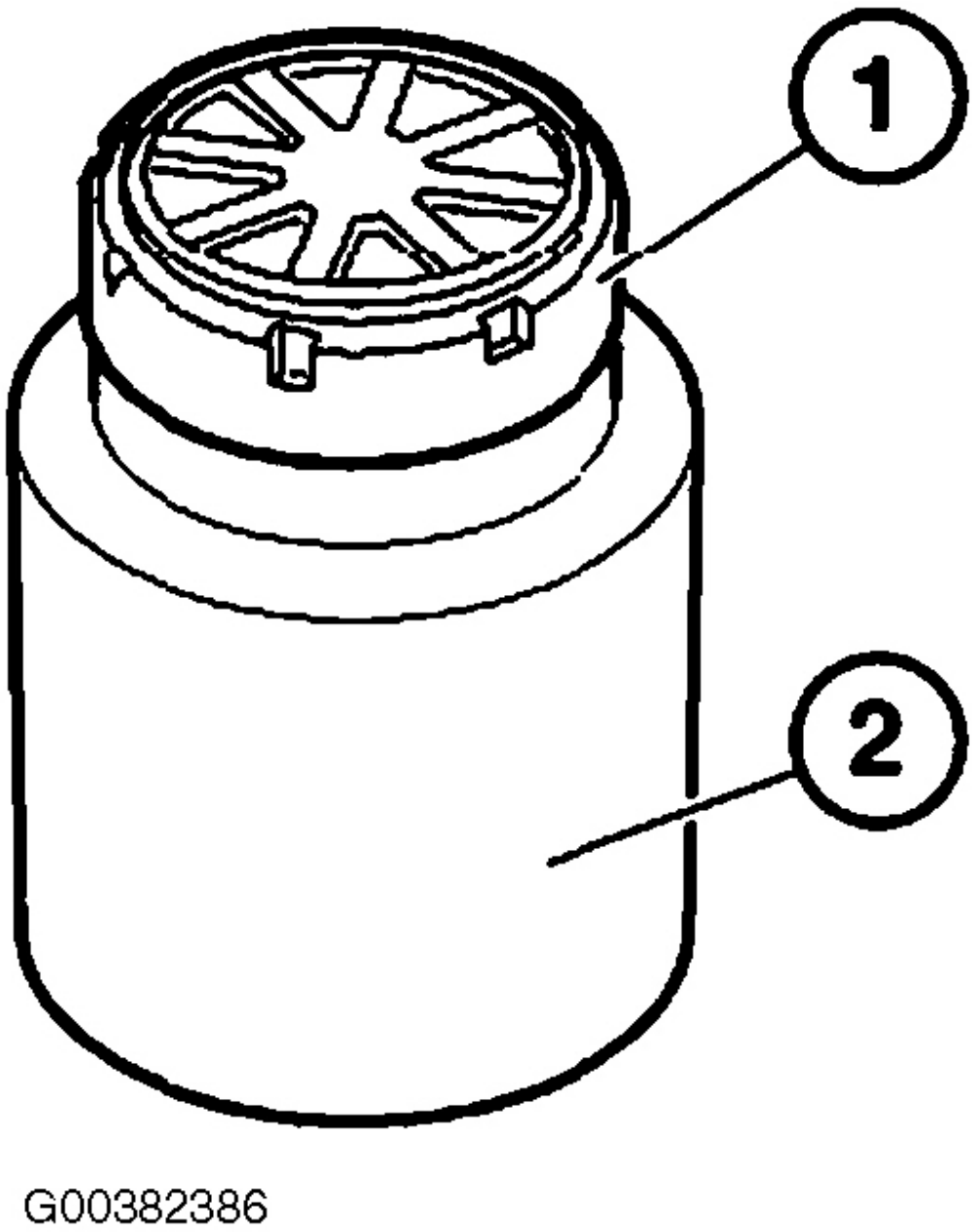
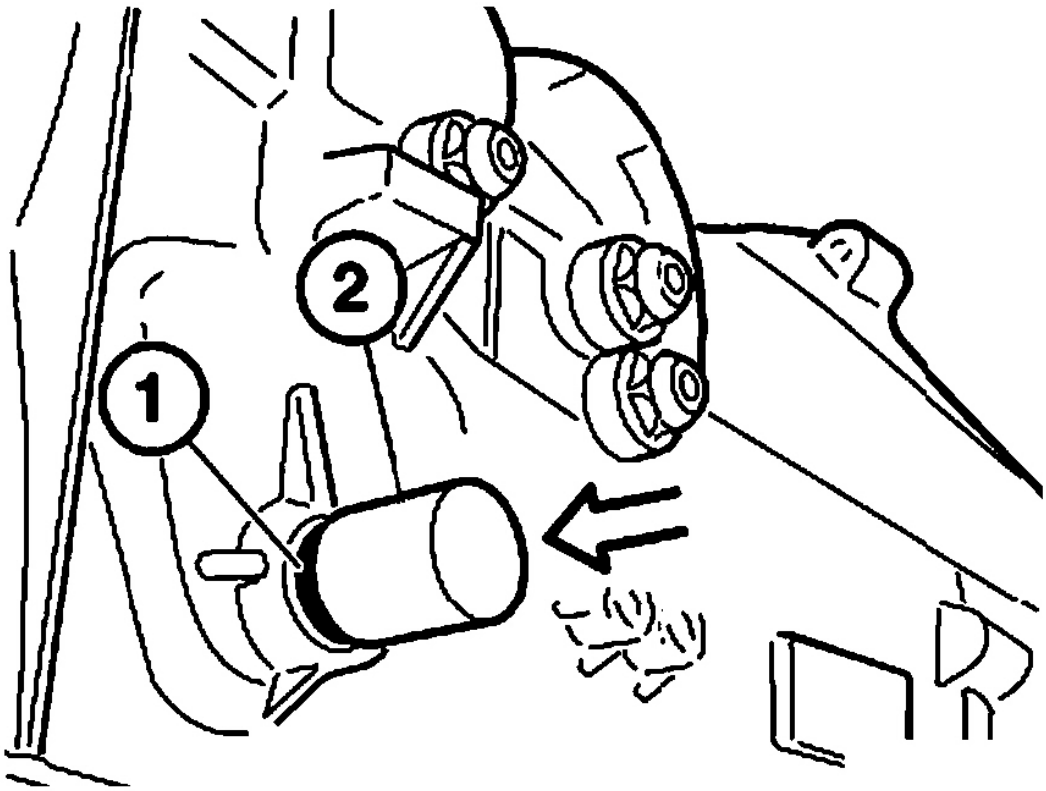


Fig. 90: Placing New Sealing Cap On Drift
Courtesy of BMW OF NORTH AMERICA, INC.

Drive in new sealing cap (1) with drift (2) as far as it will go. See **Fig. 91** .

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Fig. 91: Driving In New Sealing Cap
Courtesy of BMW OF NORTH AMERICA, INC.

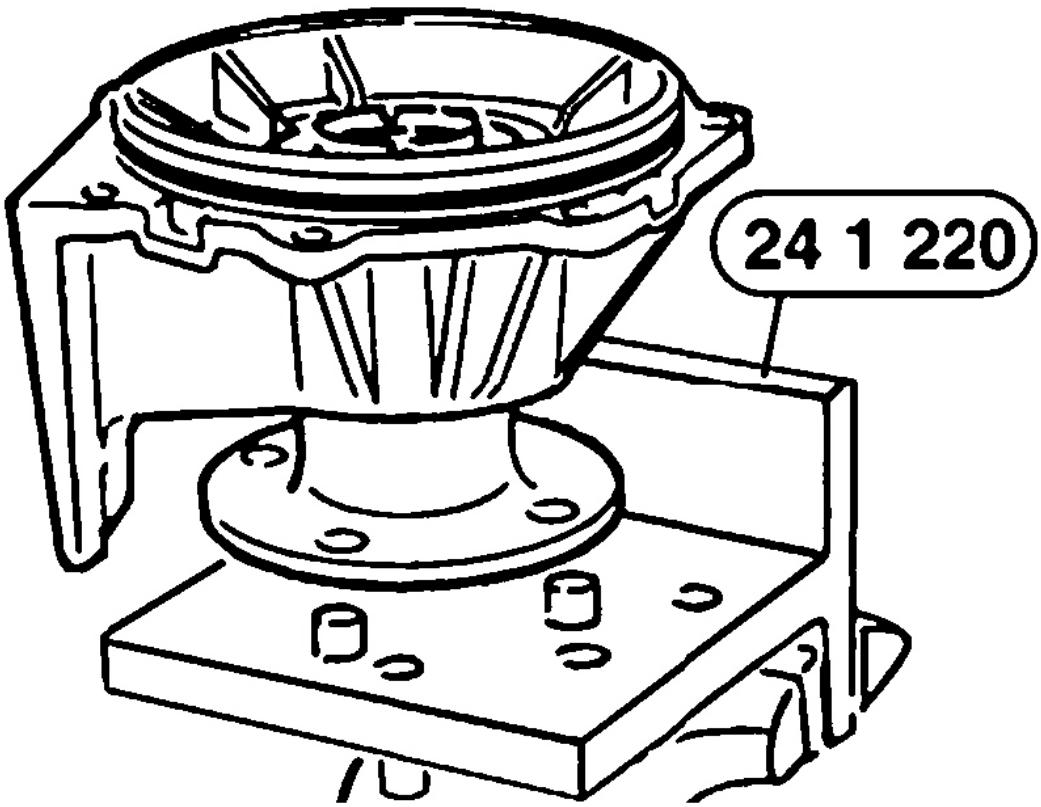
REPLACING RADIAL SEAL FOR OUTPUT FLANGE (A5S 325Z)

NOTE: Numbers in text refer to numbers in figures.

Remove transmission extension. See **REMOVING & INSTALLING TRANSMISSION EXTENSION (A5S 325Z)** .

Clamp Special Tool (24 1 220) in vise. Fit transmission extension to the special tool. See **Fig. 92** .

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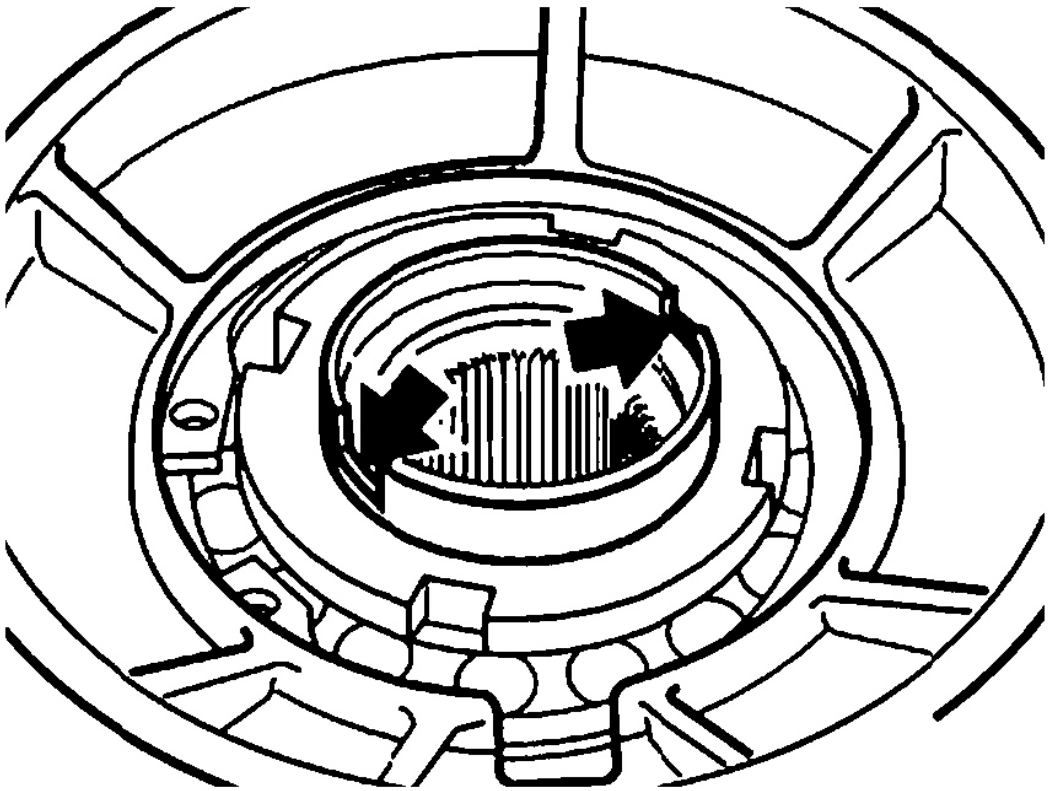


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Fig. 92: Fitting Transmission Extension To Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Knock back cotter pin in grooved nut. See **Fig. 93** . Upon installation, peen grooved nut to secure.

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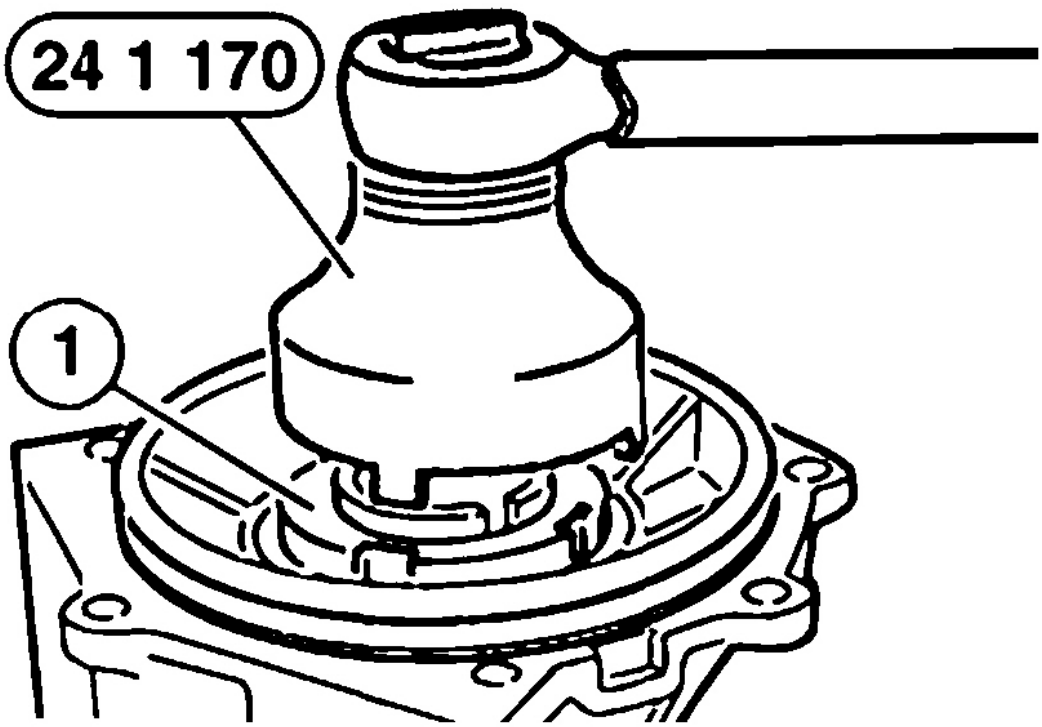


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Fig. 93: Knocking Back Cotter Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten grooved nut (1) with Special Tool (24 1 170). See **Fig. 94** . Upon installation, tighten to specification. See **TORQUE SPECIFICATIONS** .

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Fig. 94: Unfastening Grooved Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Remove transmission extension from special tool. Remove output flange from mounting. See **Fig. 95** .
Installation: coat sealing lip of radial seal and sealing surface of output flange with transmission oil.

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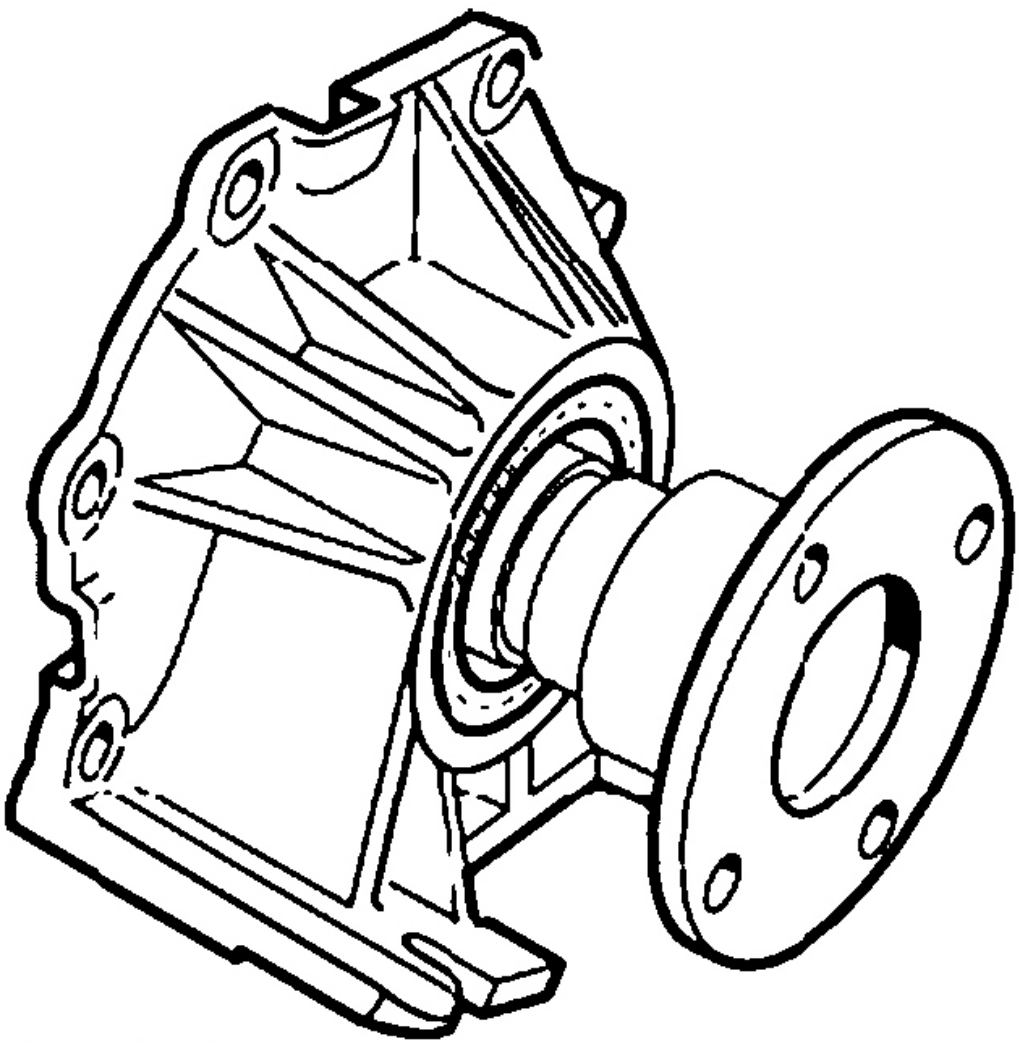


Fig. 95: Removing Output Flange From Mounting
Courtesy of BMW OF NORTH AMERICA, INC.

Lift out radial seal (1). See **Fig. 96** .

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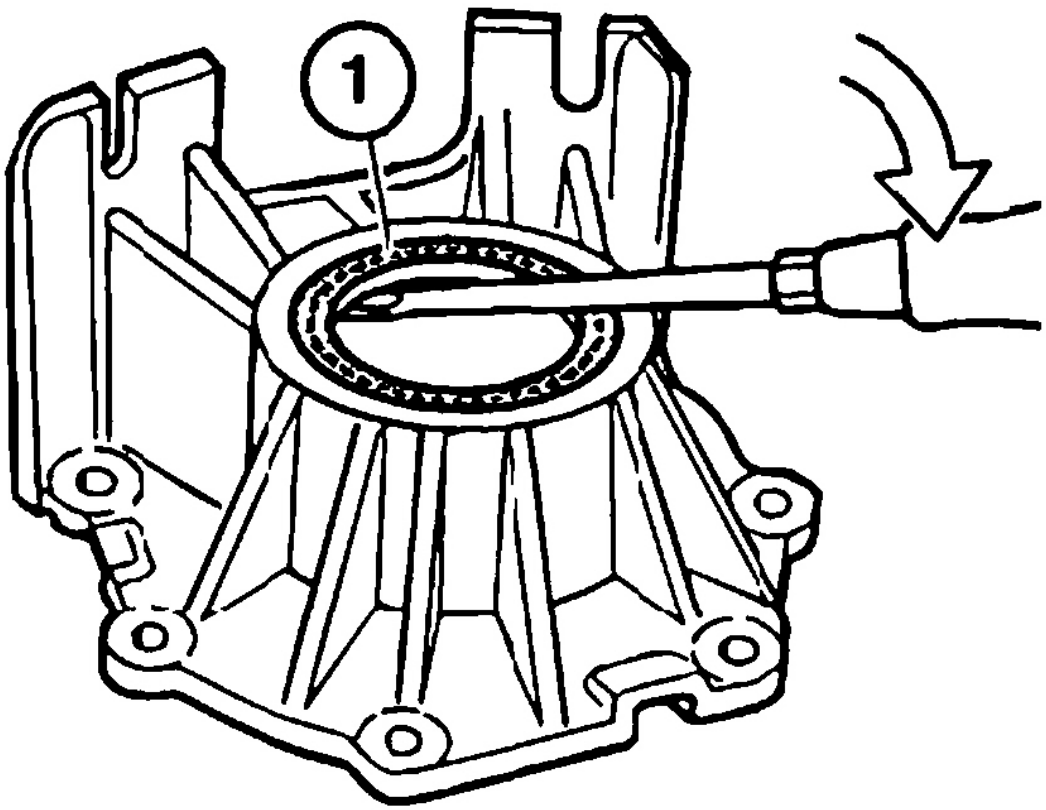
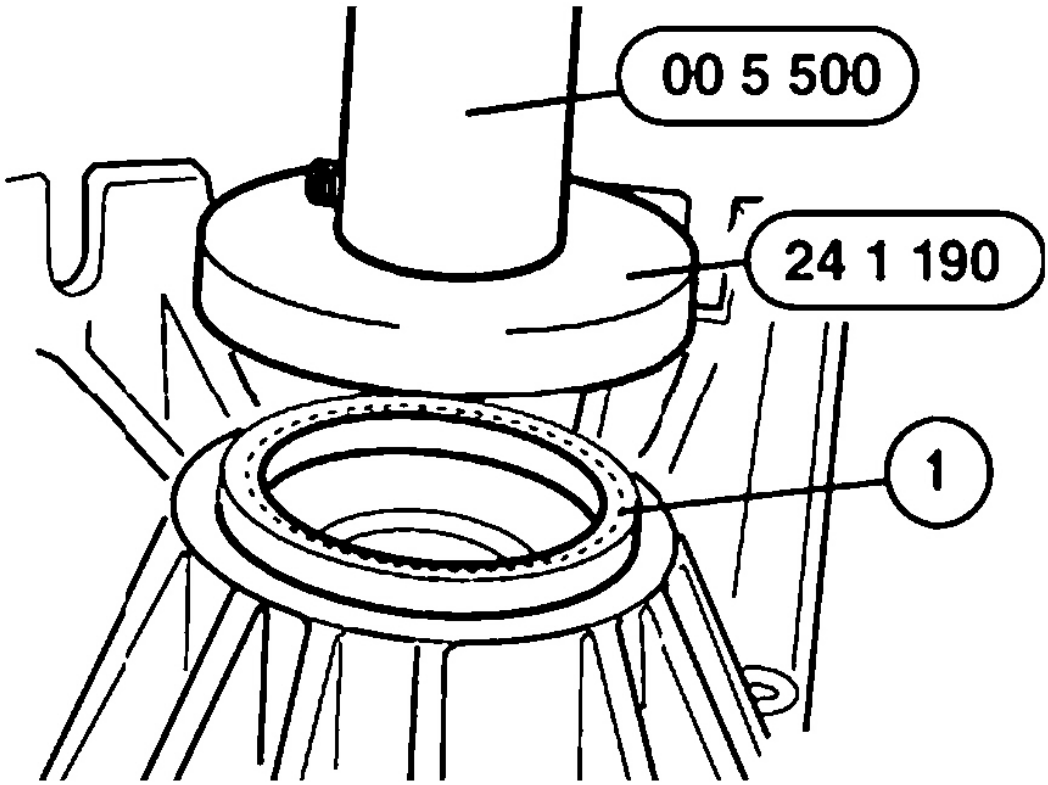


Fig. 96: Lifting Out Radial Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: drive in new radial seal (1) flush using Special Tool (00 5 500 / 24 1 190). See **Fig. 97** .

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Fig. 97: Driving In Radial Seal
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING RADIAL SEAL FOR OUTPUT FLANGE (A5S 360R / 390R)

To replace radial seal for output flange, see **REMOVING AND INSTALLING OR REPLACING TRANSMISSION EXTENSION HOUSING (A5S 360R / 390R)** .

REPLACING SOLENOID VALVE 1, 2 OR 3 (A5S 360R / 390R, A4S 200R)

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 360R / 390R, A4S 200R / 310R) .

Remove transmission oil sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION FLUID SUMP (A5S 360R / 390R, A4S 200R)** .

CAUTION: Note position of wiring harness.

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Disconnect plug from solenoid valve. Remove retaining spring and withdraw solenoid valve (1, 2 or 3). See **Fig. 98** . Upon installation: coat new solenoid valve with automatic transmission fluid.

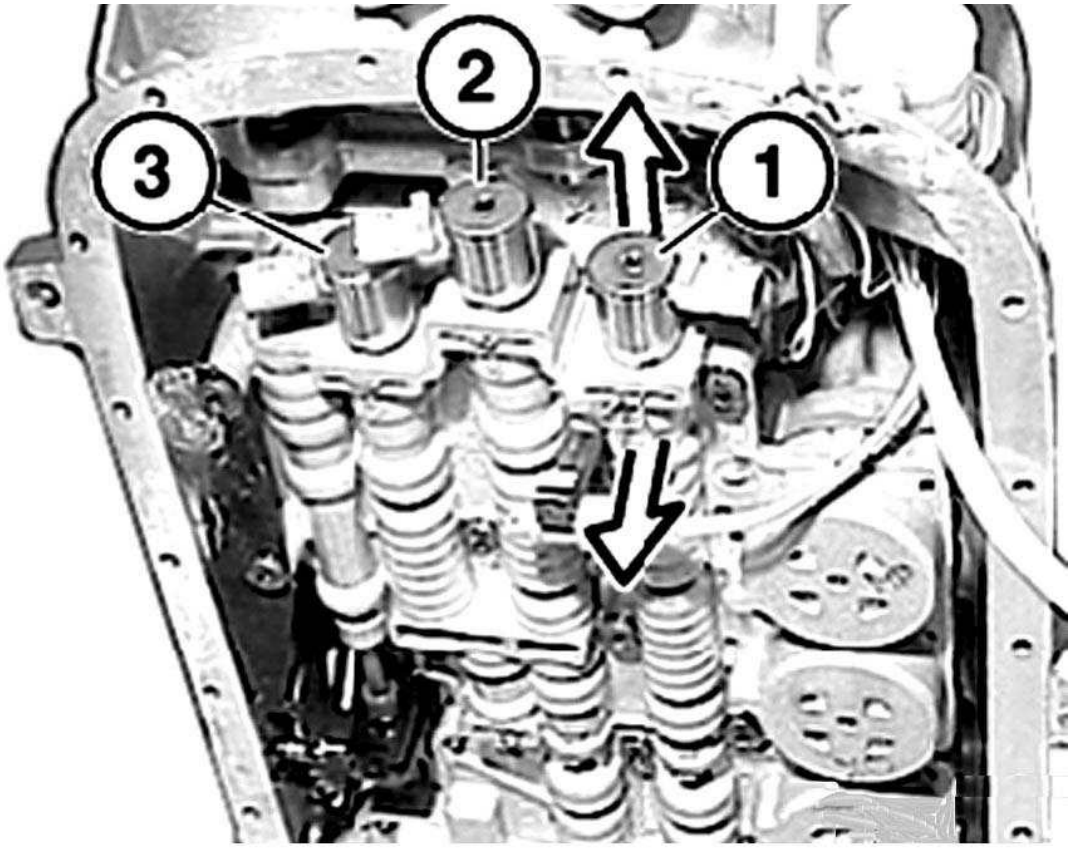


Fig. 98: Removing Solenoid Valve (1, 2 Or 3)
Courtesy of BMW OF NORTH AMERICA, INC.

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REPLACING TRANSMISSION SWITCH (A5S 360R / 390R, A4S 200R)

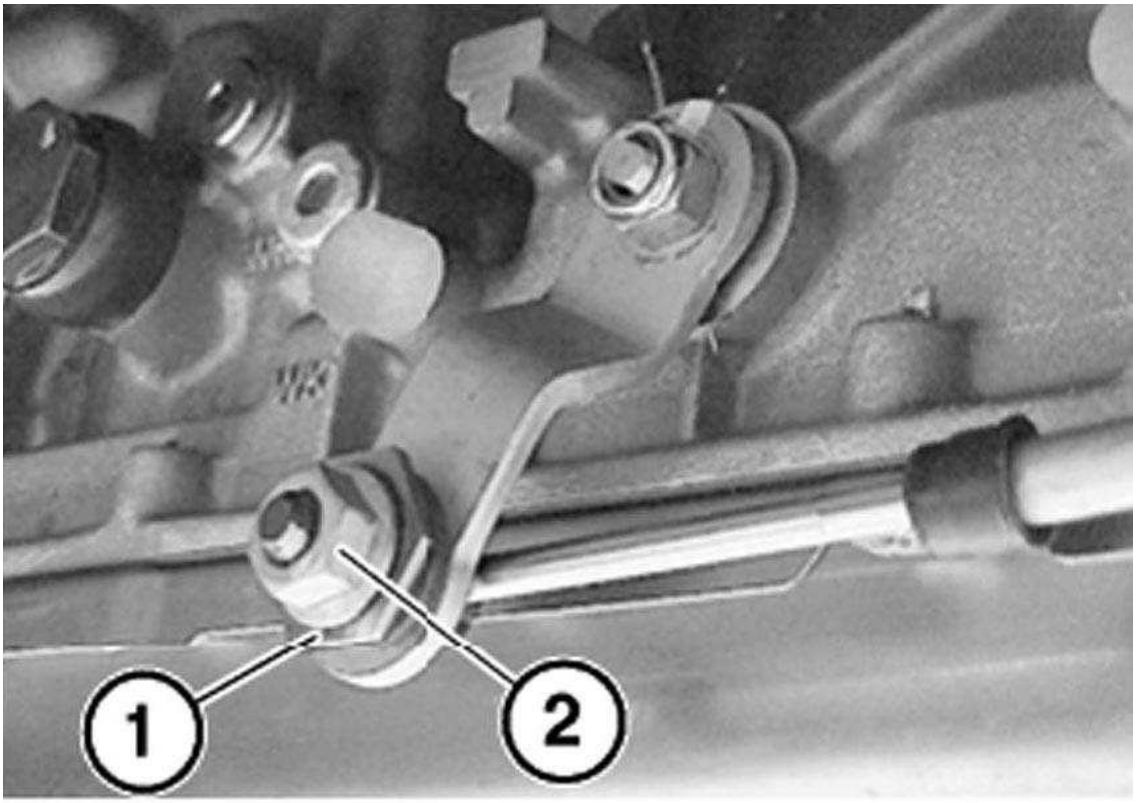
NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 360R / 390R, A4S 200R / 310R) .

Move selector lever to position "D". Remove transmission oil sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION FLUID SUMP (A5S 360R / 390R, A4S 200R)** .

Remove and install selector unit. See **REMOVING AND INSTALLING/REPLACING SELECTOR UNIT (A5S 360R / 390R, A4S 200R)** .

Grip clamping sleeve (1). Slacken nut (2). See **Fig. 99** .

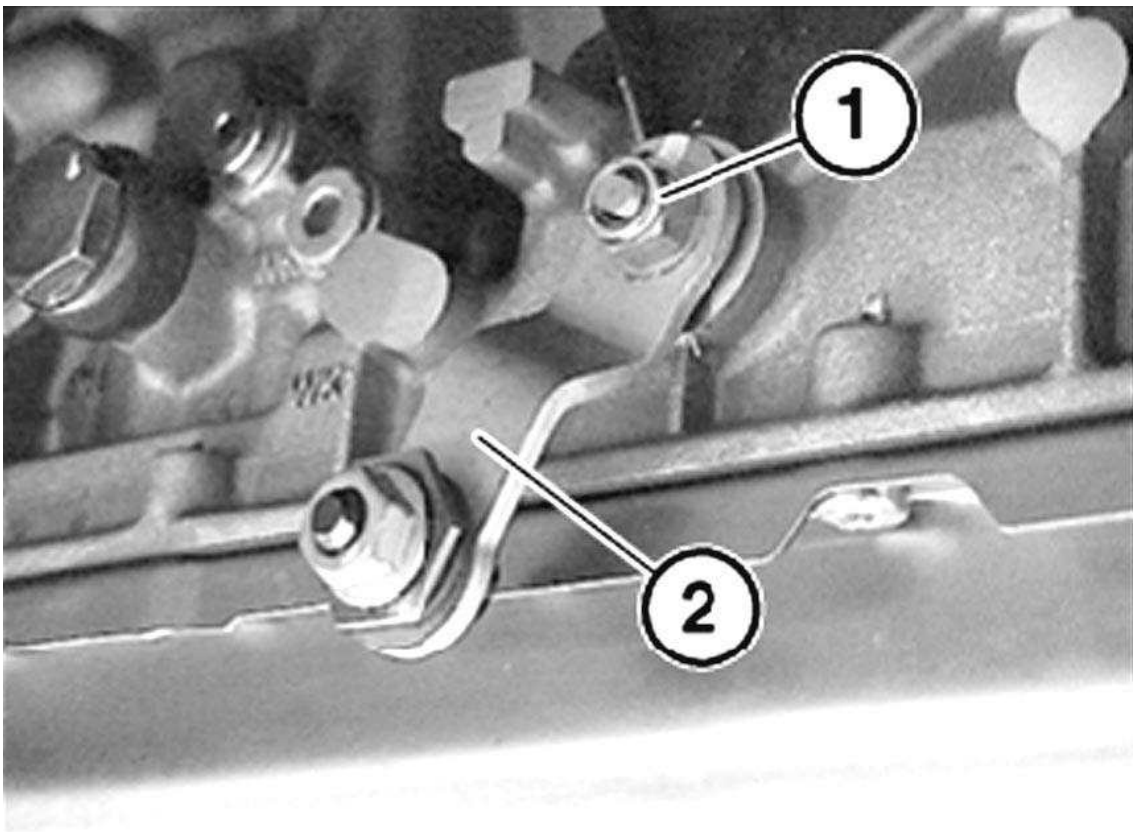


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Fig. 99: Releasing Selector Lever Nut
Courtesy of BMW OF NORTH AMERICA, INC.

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Release nut (1). See **Fig. 100** . Remove selector lever (2). Upon installation, tighten fasteners to specification. See **TORQUE SPECIFICATIONS** . Adjust selector lever. See **ADJUSTING SELECTOR LEVER (A5S 360R / 390R, A4S 200R, 6HP26Z/19Z)** .



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Fig. 100: Removing Selector Lever
Courtesy of BMW OF NORTH AMERICA, INC.

Drive spring pin (1) out of transmission switch (2). See **Fig. 101** . Withdraw manual shift valve shaft (3) from transmission only so far that transmission switch (2) can be removed. DO NOT remove parking gear rack. DO NOT move parking gear rack more than 10 mm; if necessary, secure with pointed pliers. Release notched disk on parking gear rack. Remove transmission switch (2) with detent disk.

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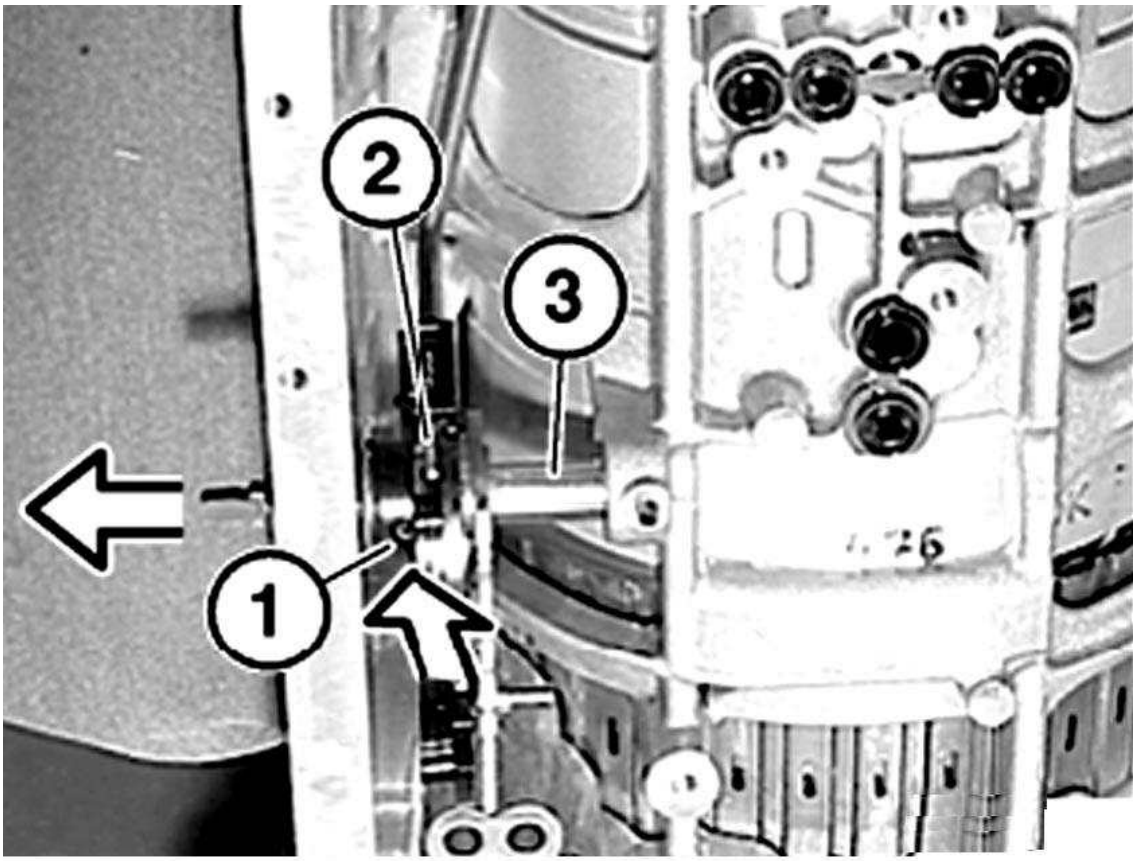
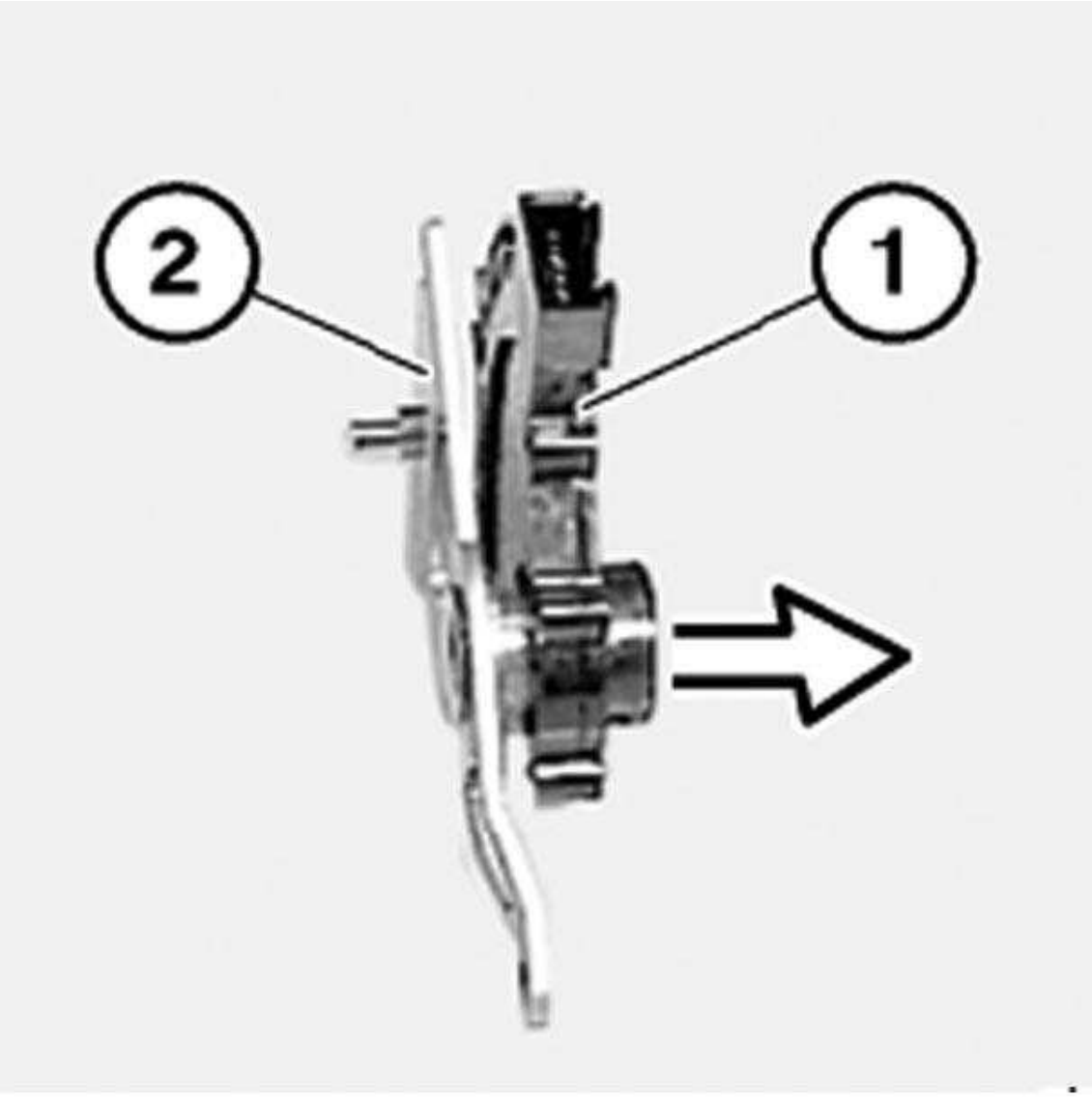


Fig. 101: Removing Transmission Switch
Courtesy of BMW OF NORTH AMERICA, INC.

Remove transmission switch (1) from detent disk (2). See **Fig. 102** . Upon installation: bore holes for spring pin in transmission switch (1) must overlap with bore holes of detent disk (2) and manual shift valve shaft.

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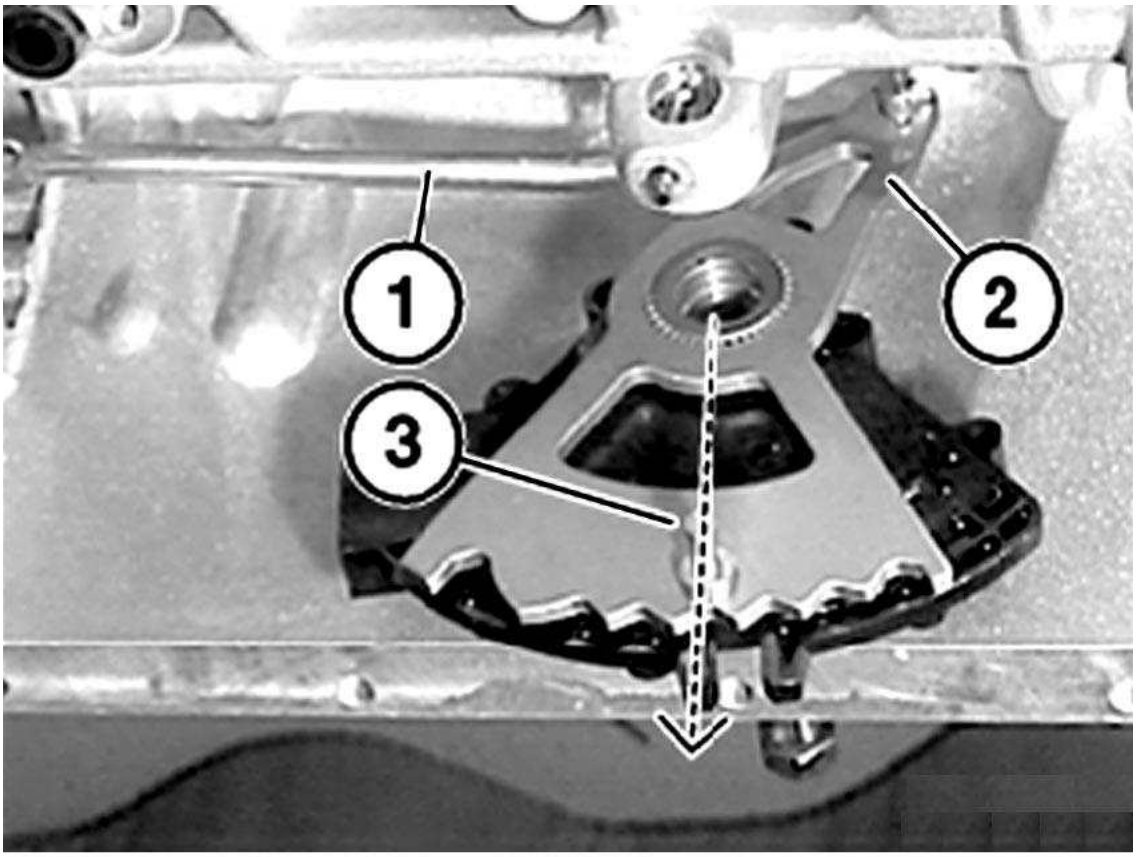


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Fig. 102: Removing Transmission Switch From Detent Disk
Courtesy of BMW OF NORTH AMERICA, INC.

Installation: attach parking gear rack (1) from rear in detent disk (2). See **Fig. 103** . Slide in manual shift valve shaft. Drive in spring pin. During entire installation work, journal (3) must be aligned vertically to manual shift valve shaft. After installation of detent spring, ensure that parking lock functions correctly. Press journal (3) forwards into "P" position, rotate propeller shaft and check that locking pawl engages.

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Fig. 103: Installing Parking Gear Rack In Detent Disk
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING WIRING HARNESS IN AUTOMATIC TRANSMISSION (A5S 325Z)

NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 325Z) .

Remove and install transmission oil sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION OIL SUMP (A5S 325Z)** .

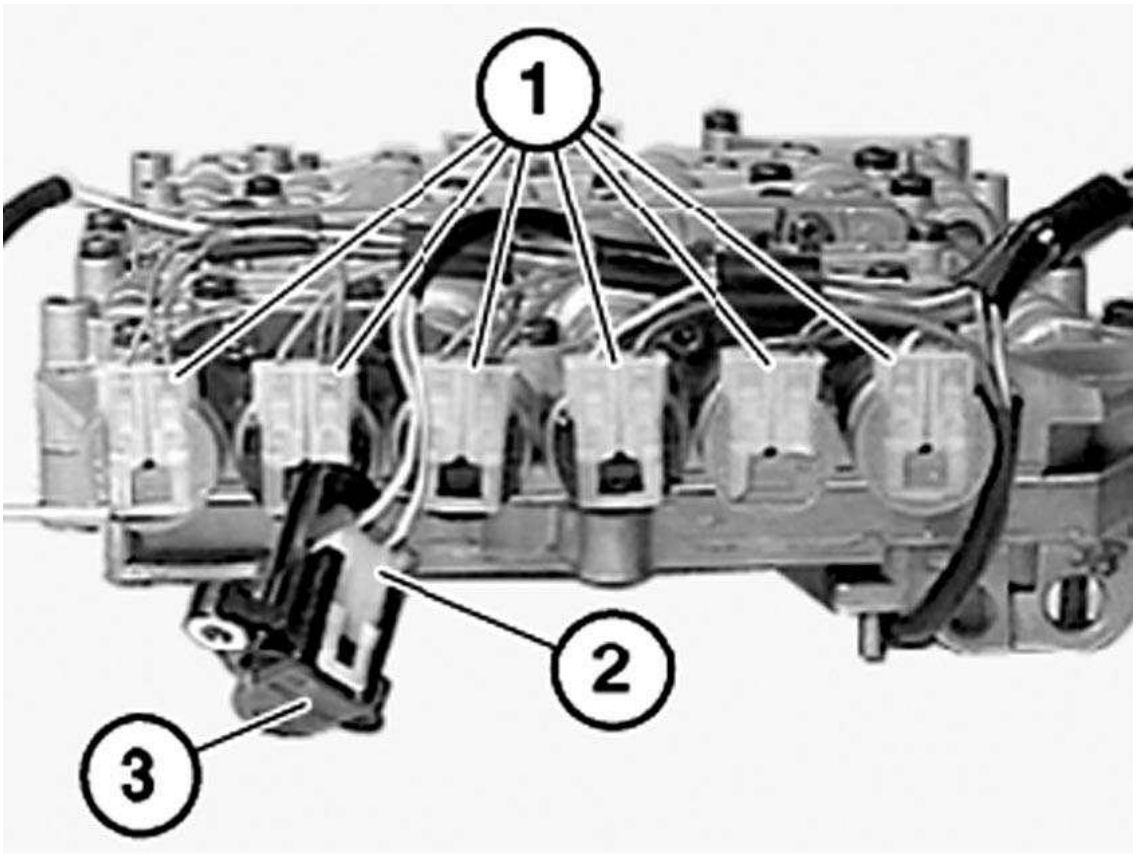
Remove and install transmission oil screen. See **REMOVING AND INSTALLING/REPLACING TRANSMISSION OIL SCREEN (A5S 325Z)** .

Remove and install shift unit. See **REMOVING AND INSTALLING/REPLACING SHIFT UNIT (A5S**

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325Z) .

Disconnect plug (1) from solenoid valve. See **Fig. 104** . Detach plug (2) from pulse generator (3).

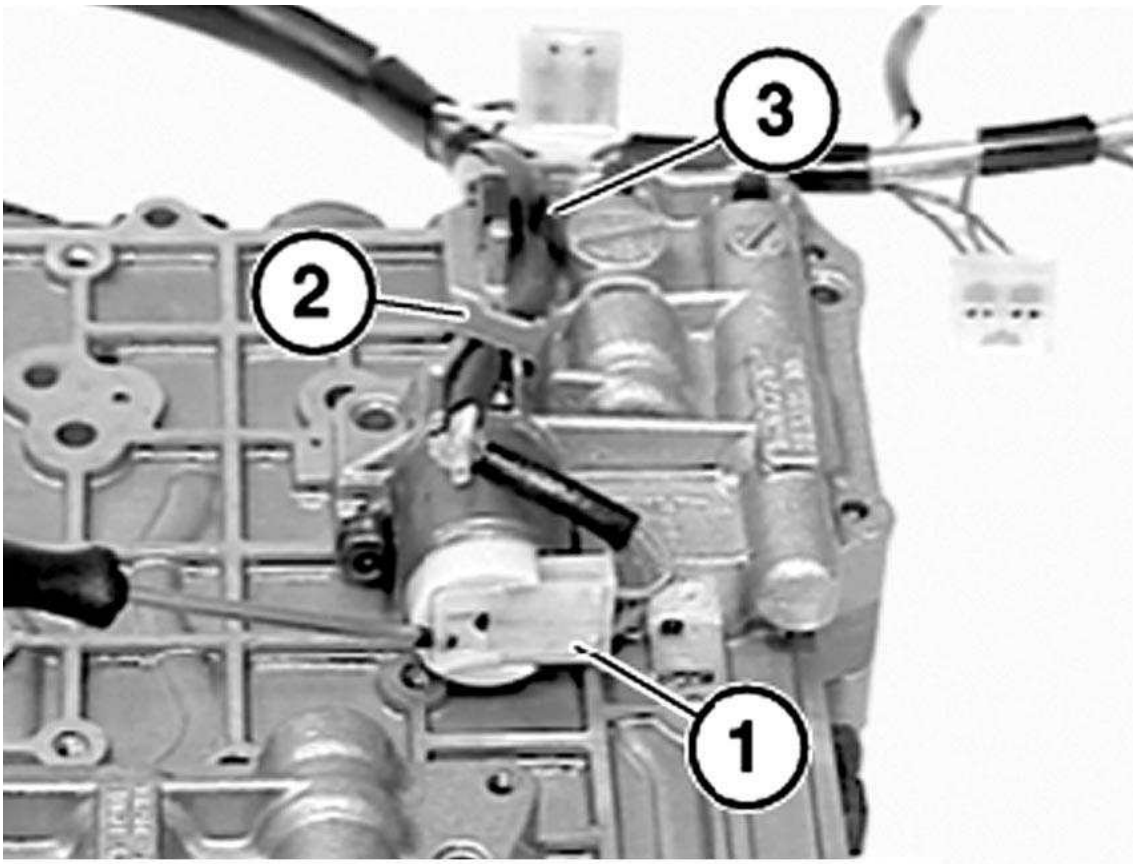


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Fig. 104: Disconnecting Plugs
Courtesy of BMW OF NORTH AMERICA, INC.

Remove connector (1). See **Fig. 105** . Remove retaining clip (2). Remove wiring harness from cable guide (3).

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Fig. 105: Removing Wiring Harness
Courtesy of BMW OF NORTH AMERICA, INC.

REPLACING WIRING HARNESS IN AUTOMATIC TRANSMISSION (A5S 360R/390R, A4S 200R)

NOTE: Numbers in text refer to numbers in figures.

NOTE: After completing work, top up ATF level. Check/top up fluid level in automatic transmission. See CHECKING/TOPPING UP FLUID LEVEL IN AUTOMATIC TRANSMISSION (A5S 360R / 390R, A4S 200R / 310R) .

Remove transmission oil sump. See **REMOVING AND INSTALLING/SEALING OR REPLACING TRANSMISSION FLUID SUMP (A5S 360R / 390R, A4S 200R)** .

Remove transmission plug at rear right.

Pull off transmission fluid screen (1) towards bottom and remove. See **Fig. 38** .

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NOTE: If the sealing ring (1) has remained in the pump housing, it must be removed and the transmission fluid screen replaced. See Fig. 39 .

Disconnect all plug connections on shift unit. Unclip temperature sensor (1) from holder. See **Fig. 28** .

NOTE: As of model year 2001 (04/2000), the temperature sensor is integrated in the wiring harness.

Remove retaining clip with screwdriver (2). See **Fig. 18** . Insert transmission plug (1) in transmission. Remove wiring harness from automatic transmission.

Installation: to facilitate installation, coat sealing rings with petroleum jelly. See **Fig. 19** . Make sure transmission plug is in correct position.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Bowden Cable On Shift Tower/Transmission	11 (15)
Center Mount-To-Body	15 (21)
Cross Member-To-Body	15 (21)
Flange Nut, Output Flange Without Spring Washer	22 (30)
Flange Nut, Output Flange With Spring Washer	44 (60)
Flexible Disk-To-Propeller Shaft & Transmission Output Flange	
M10 8.8 Thread	35 (48)
M10 10.9 Thread	47 (64)
M14 Thread	103 (140)
M12 10.9 Thread	74 (100)
Flexible Disk-To-Transmission Output Flange (Screw With Rolled-On Shim Only)	
Stage 1	37 (50)
Stage 2	Additional 90°
Oil Filler Plug	
A5S 360R	13 (18)
A5S 325Z	22 (30)
Oil Drain Plug (A5S 325Z)	26 (35)
Plug	15 (20)
Rubber Mounts-To-Cross Member Or Transmission	15 (21)
Slotted Nut/Output Flange	89 (120)
Transmission Extension	
A5S 325Z	18 (25)
A5S 360R	16 (22)
	INCH Lbs. (N.m)

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Clamping Screw On Shift Lever	89 (10)
Guide Plate/Parking Lock Mechanism	89 (10)
Oil Strainer	53 (6)
Pulse Generator, Output Speed	53 (6)
Pulse Generator, Turbine Speed	71 (8)
Pulse Sender	97 (11)
Retaining Plate For Solenoid Valves & Pressure Regulator On Shift Unit	53 (6)
Selector Lever On Transmission	89 (10)
Transmission Oil Sump	
A5S 325Z	53 (6)
A5S 360R	89 (10)
Valve Body-To-Transmission	
A5S 325Z	71 (8)
A5S 360R	97 (11)

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2004-05 MANUAL TRANSMISSIONS

Servicing - GS6-37BZ

APPLICATION

MANUAL TRANSMISSION APPLICATION

Application	Transmission Model
X3 (E83)	
2004-05	GS6-37BZ

LUBRICATION

SERVICE INTERVALS

Inspect fluid level when vehicle is serviced. DO NOT drain fluid.

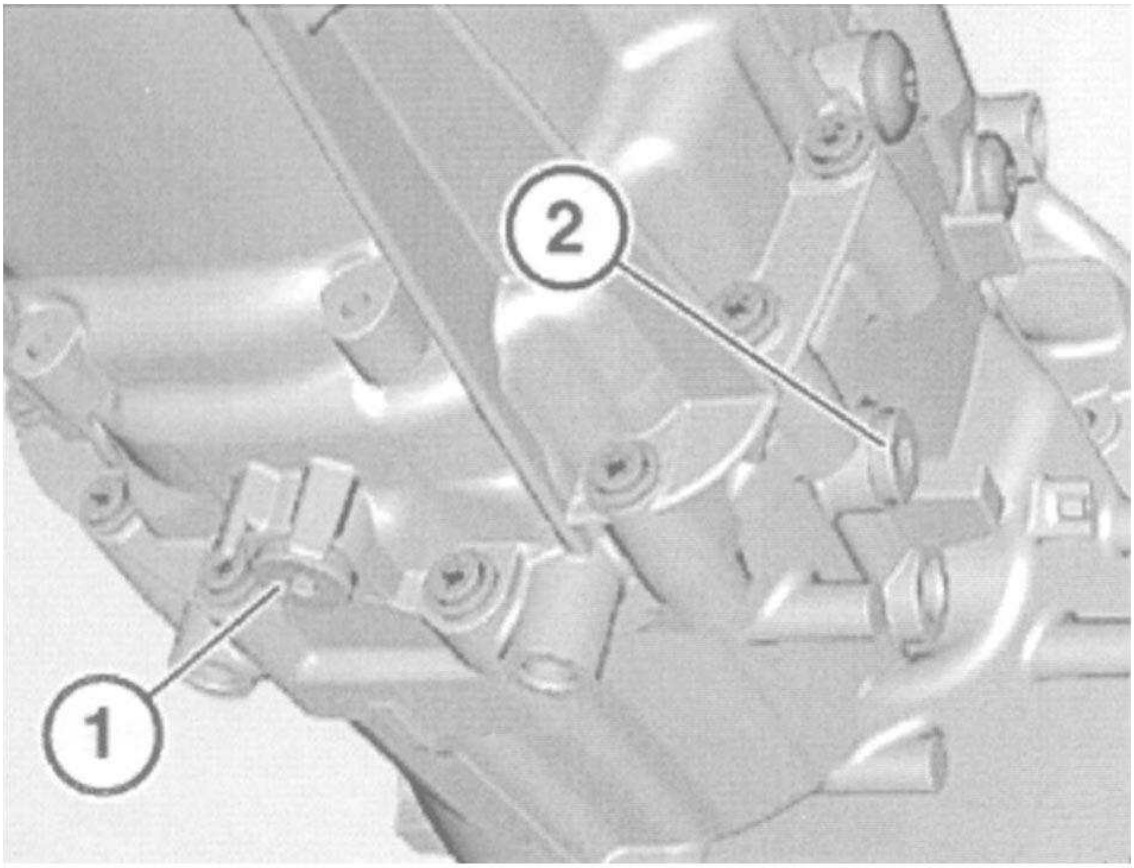
DRAINING/TOPPING UP GEAR OIL IN MANUAL TRANSMISSION

NOTE: Numbers in text refer to numbers in figures.

NOTE: Gearbox must be at normal operating temperature.

Draining gear oil: release oil drain plug (1) and filler plug (2). See **Fig. 1** . Clean oil drain plug (1) and screw in. Tighten to specification. See **TORQUE SPECIFICATIONS** . Fill transmission with gear oil. Pour in gear oil until overflowing. Tighten in filler screw (2) to specification. See **TORQUE SPECIFICATIONS** .

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Fig. 1: Locating Transmission Oil Drain & Filler Plug
Courtesy of BMW OF NORTH AMERICA, INC.

RECOMMENDED FLUID

From model year 2004, some manual transmissions are filled with Castrol MTF-LT-2 lifetime fluid. This fluid has the same properties as the MTF-LT-1 fluid. The MTF-LT-1 fluid may be mixed or substituted for the MTF-LT-2 manual transmission fluid.

FLUID CAPACITIES

Fluid capacity is approximately 1.4 qts. (1.3L). Transmission should be filled to bottom of filler plug hole.

ADJUSTMENTS

GEARSHIFT LINKAGE

No external adjustment is necessary.

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REMOVAL & INSTALLATION

REPLACING RADIAL SEAL FOR SELECTOR SHAFT (GS6-37BZ)

NOTE: Numbers in text refer to numbers in figures.

CAUTION: After completion of work, check transmission fluid level. See DRAINING/TOPPING UP GEAR OIL IN MANUAL TRANSMISSION . Use only approved transmission fluid. See RECOMMENDED FLUID . Failure to comply with this instruction will result in serious damage to the transmission.

Remove transfer box. See REMOVING AND INSTALLING TRANSFER BOX (ATC 400 X-DRIVE) . Shift transmission into 2nd gear.

Lever retaining ring (1) out of groove with a small screwdriver. See **Fig. 2** . Slide locking ring (1) towards rear. Drive out cylinder pin (2).

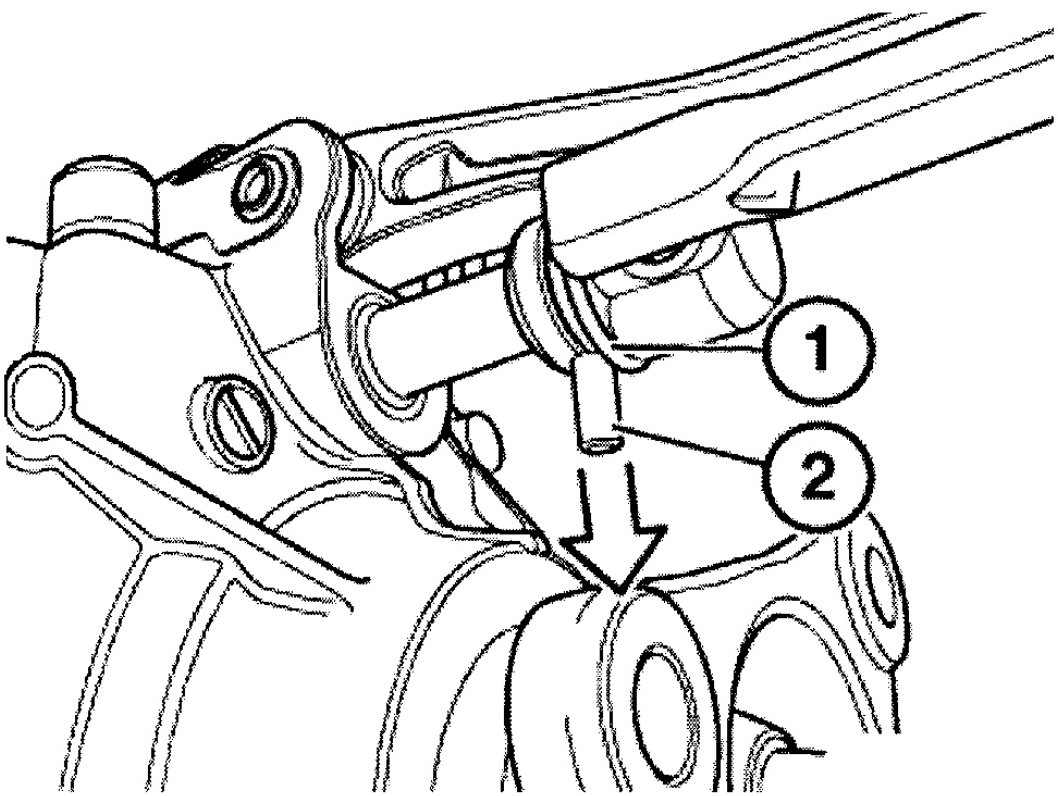
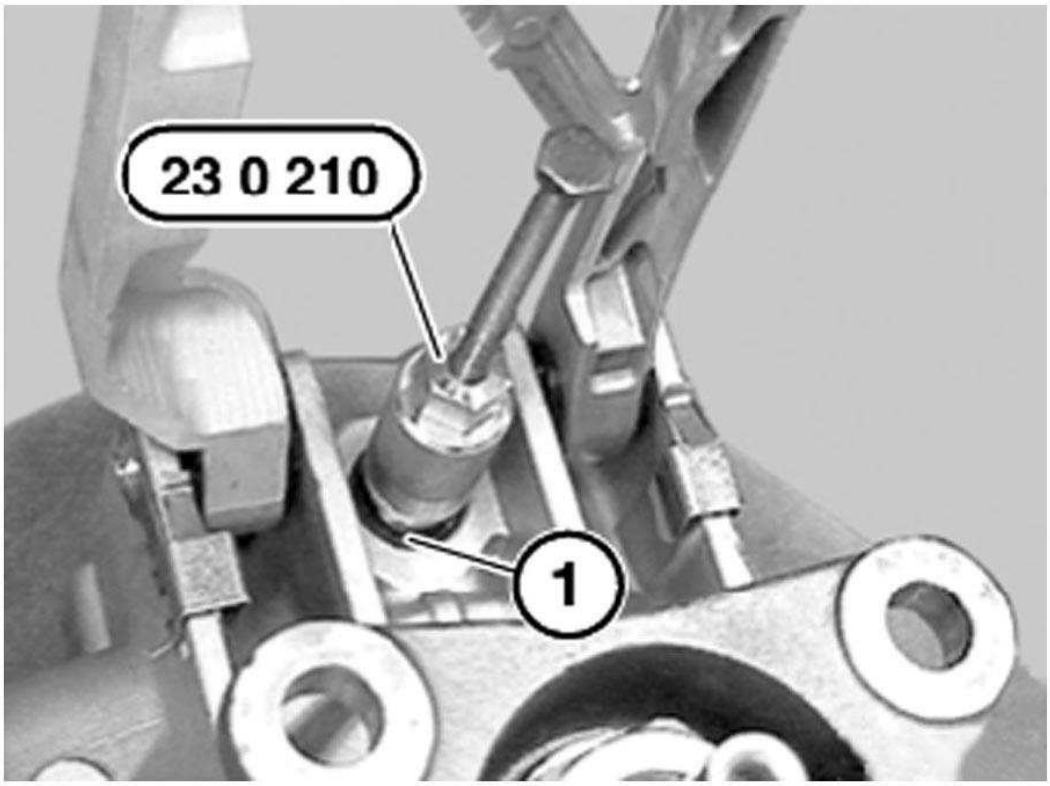


Fig. 2: Removing Retaining Ring

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Courtesy of BMW OF NORTH AMERICA, INC.

Screw in Special Tool (23 0 210) until it is firmly connected with radial seal (1). See **Fig. 3** . Pull out radial seal with Special Tool (23 0 210).

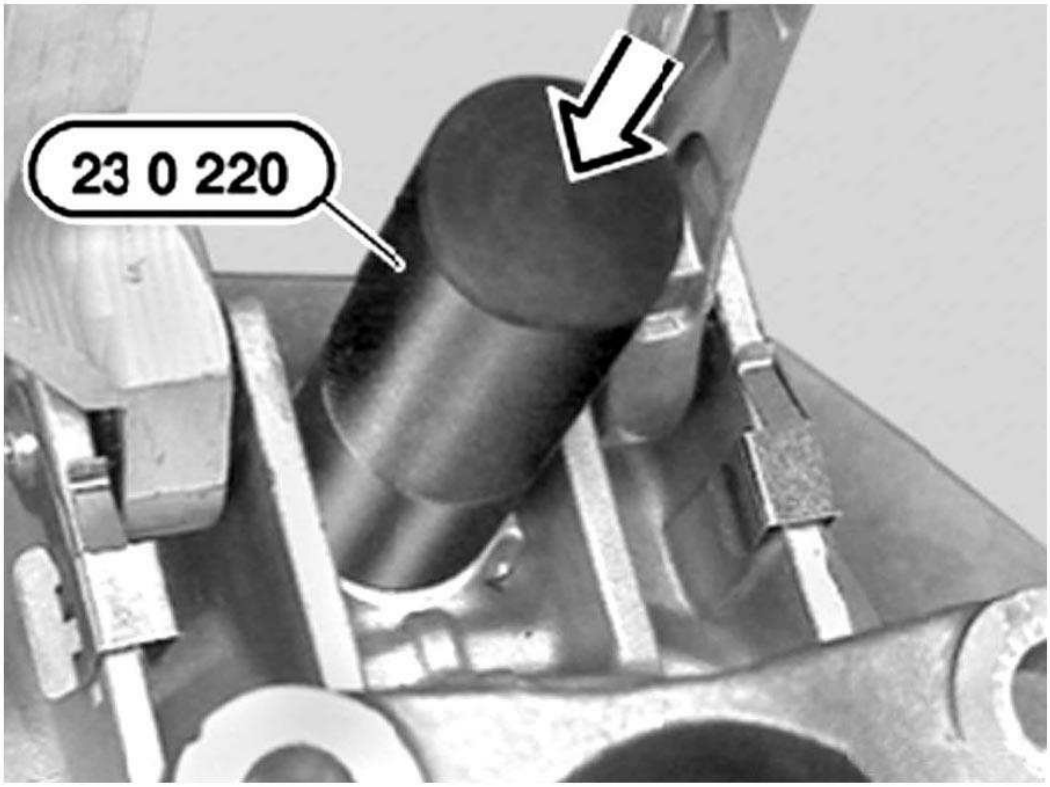


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Fig. 3: Pulling Out Radial Seal For Selector Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Coat sealing lips of radial seal and selector shaft with gear oil. Drive in radial seal with Special Tool (23 0 220). See **Fig. 4** .

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Fig. 4: Driving In Radial Seal For Selector Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Drain & Fill Plug	
M18x1.5 Thread Hexagon Socket	26 (35)
M12x1.5 Thread	18 (25)

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TRANSMISSION

Transfer Box - SI Techniques - X3

XDRIVE

VS-42 je

Baugruppe/Group: 27

weltweit

Datum/Date: 11/2003

27 01 03 (048)

Update: 02/2007

E53, E70, E83

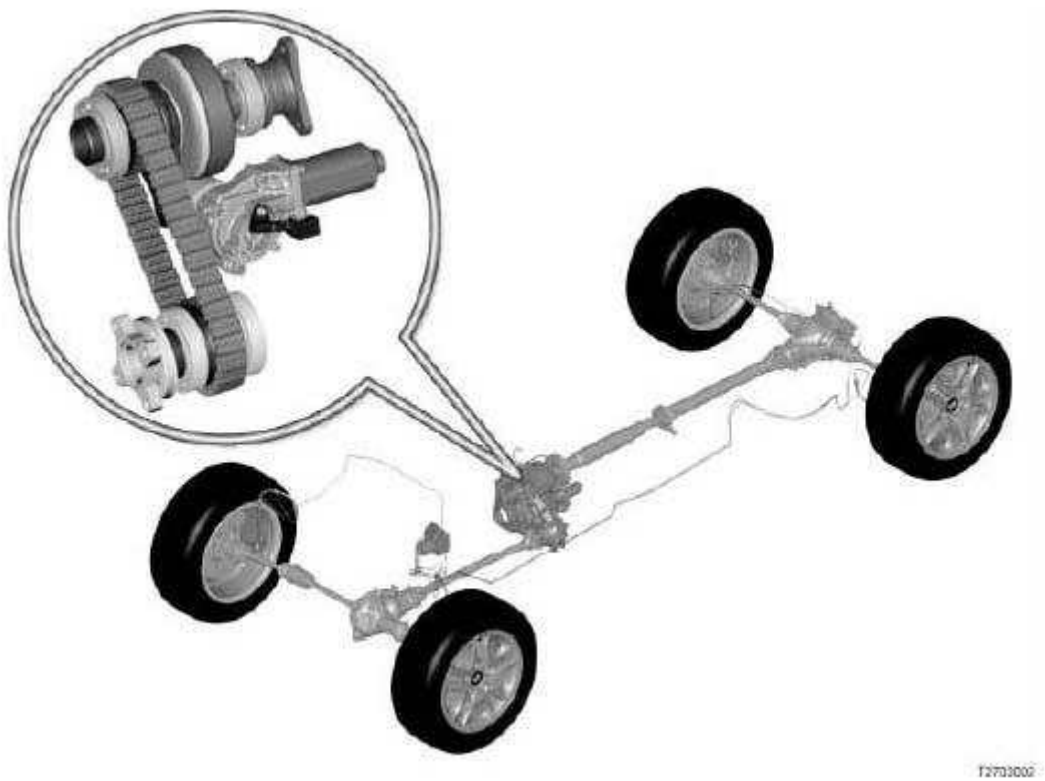


Fig. 1: Xdrive
Courtesy of BMW OF NORTH AMERICA, INC.

INTRODUCTION

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xDrive is an all-wheel drive system that links Dynamic Stability Control (DSC) system to an electronically controlled multi-plate clutch in the transfer box.

The electronically controlled multi-plate clutch smoothly distributes the drive torque as required to the front axle. The rear axle is always powered.

All of the drive torque is applied to the rear axle when the multi-plate clutch is separated.

- > E53, E83
- > E70

xDrive constantly communicates with the DSC. The drive-dynamic input information is computed in the DSC control unit.

Important information is:

- Accelerator pedal position
- Engine torque
- Drive-dynamic state

The DSC calculates the necessary locking torque. The locking torque is communicated to xDrive. This allows xDrive to register whether the vehicle is able to follow the driver's commands. xDrive intervenes to counter the threat of any tendency for wheel spin, oversteer or understeer. xDrive regulates drive torque distribution between the two axles to meet driving demands.

Only if xDrive cannot maintain the vehicle's course on its own will DSC also intervene. Engine output is reduced and individual wheels are specifically braked.

The drive torque is delivered to the axle that has better traction when road conditions change, such as on snow, ice or a loose road surface.

The transfer cases are matched to vehicles as follows:

- E53: ATC 500 transfer case

  (ATC = Active Torque Control)

- E70: ATC 700 transfer case
- E83: ATC 400 transfer case

The transfer cases differ in the following points:

- Different number of plates in the multi-plate clutches
- Different clearance between the input and output shafts to the front axle
- Propeller shaft inserted into the front axle differential on the E53, E70, and flange-mounted on the E83

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The transfer case is designed to be stronger on the E53, E70 in order to match the higher engine torques.

The advantages:

xDrive delivers the following advantages through demand-oriented drive torque distribution:

- Outstanding driving stability fully up to the limit range
- Optimal forward momentum
- Excellent traction in all road situations

xDrive is standard equipment on the E70, E83 and on the E53 from October 2003 with the new model version.

BRIEF DESCRIPTION OF COMPONENTS

xDrive consists of the following components:

- **Transfer case with multi-plate clutch**

  The electronically controlled multi-plate clutch is housed in the transfer case. The multi-plate clutch distributes the drive torque **smoothly and as required** between the front and rear axles.

- **VTG actuator motor with incremental sensor and classification resistor**

  The VTG actuator motor (VTG: transfer case) opens and closes the multi-plate clutch. The location of the actuator motor shaft and the adjustment rate are detected by the incremental sensor.

  The classification resistor ensures that mechanical tolerances in the transfer case are considered. Optimum function is thus ensured.

- **Actuator lever**

  The actuator lever converts the rotational motion of the VTG actuator motor into an axial motion.

- **VTG control unit**

  The VTG control unit regulates the locking torque at the multi-plate clutch in the transfer case in response to the following factors:

  - Demand for required locking torque (comes from the DSC control unit)
  - Condition of the transmission oil (calculated in the VTG control unit)
  - Multi-plate clutch wear (calculated in the VTG control unit)
  - Load on VTG actuator motor (calculated in the VTG control unit)
  - Transmission oil temperature (calculated in the VTG control unit)

  The VTG control unit supplies the following information to the DSC control unit:

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- The locking torque currently set
- All calculated data

The locking torque is limited whenever needed in order to reduce the frictional work.

- > E53, E83
- > E70

- **DSC: Dynamic Stability Control**

With xDrive, DSC includes the following functions:

- All-wheel control
- Automatic Differential Brake (ADB-X)
- Hill Descent Control (HDC)

All-wheel control

Dynamic Stability Control (DSC) specifies the nominal value for xDrive all-wheel control. The nominal value depends on the vehicle's tendency to oversteer or understeer and wheel slip. The nominal value is transmitted to the VTG control unit.

Automatic differential brake

The automatic differential brake (ADB-X) simulates the function of conventional limited-slip differentials by selectively applying brakes on individual wheels (known from the E53 and the E46 All-wheel drive).

Whenever a wheel displays a tendency to spin the ADB-X automatically brakes it down to a preset slip. This effect of this is to increase the drive torque on those wheels that have a higher friction coefficient on a lining.

Hill Descent Control

Hill Decent Control (HDC) is a cruise control on four-wheel drive cars for driving downhill (known from the E53 and the E46 All-wheel drive).

HDC can be activated and deactivated with a separate button.

When the HDC button is pressed, HDC automatically reduces road speed. The brakes are applied on all four wheels to reduce road speed to just above walking pace. HDC holds this speed constant (all DSC functions remain active).

The car's road speed can be freely varied within fixed values by pressing down on the accelerator pedal, brake pedal or the buttons for the cruise-control system.

The following control units and switches are incorporated in xDrive functions:

- **DME or DDE: Digital engine electronics or digital diesel electronics**

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The DME or DDE modifies the engine response as required by the DSC control unit (such as power reduction to prevent the driven wheels from spinning).

- **Instrument cluster display**

  System states are displayed as follows:

  - DSC/xDrive telltale and warning lights light up:

    DSC/xDrive not activated

  - DSC/xDrive telltale and warning lights light up and acoustic signal:

    DSC defective, ABS not affected, VTG control unit OK

    or

    DSC OK, VTG control unit defective

    - > All-wheel drive in emergency mode
  - DSC/xDrive telltale and warning lights, ABS telltale and warning lights and general brake warning lamp light up and acoustic signal:

    Total failure of the DSC and/or malfunction of the VTG control unit

    - > All-wheel drive in emergency mode
    - > E53, E83

    The instrument cluster is the data interface (= gateway) between the K-bus and the PT-CAN.

  - **JBE: Junction box electronics**
    - > E70

  The JBE is the data interface (= gateway) between the K-CAN and PT-CAN.

  The junction box comprises the JBE and the power distributor.

SYSTEM FUNCTIONS

xDrive comprises the following functions:

- Control of the locking torque for the multi-plate clutch
- Emergency operation

Control of the locking torque for the multi-plate clutch

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The locking torque for the multi-plate clutch in the transfer case can be regulated. This means that the front axle can be smoothly coupled to the drive train. The drive torque at the front axle can be increased or reduced in response to the road situation and conditions.

The DSC control unit calculates the locking torque for the multi-plate clutch as follows:

- Pre-activation = driver's command
- Driving dynamic control
- Detection of different tire rolling circumferences

Pre-activation

The pre-activation circuit reflects the driver's wishes. In other words. the pre-activation circuit is used to calculate the necessary locking torque.

The evaluation criteria below are taken into account to in determining the driver's command:

- Accelerator-pedal value
- Engine torque
- Engine speed
- Vehicle road speed
- Gear engaged
- Steering angle

Driving dynamic control

Driving dynamic control monitors the slip on the front and rear axles. Driving dynamic control has the task of achieving optimum traction and keeping the car stable or to stabilize it.

The following evaluation criteria are taken into account by the monitoring system:

- Wheel speeds
- Yaw rate
- Lateral acceleration
- Steering angle

The drive torque is distributed as follows in normal driving with all-wheel drive:

- 40 % to the front axle
- 60 % to the rear axle

Distribution of the drive torque is oriented upon the torque that can be supported by each axle. For instance, if the car is fully accelerated in 1st gear from a standing start the distribution of the dynamic axle-load creates a higher axle load on the rear axle. Therefore, the rear axle can convey a higher drive torque.

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Example: The front wheels are on a high-traction surface. The rear wheels are on, e.g. sheet ice (low traction). In this case, almost 100 % of the available drive torque would be transmitted to the front axle. The rear axle is under hardly any load any can support only a low drive torque.

When driving in a curve, the lateral acceleration causes centrifugal force that forces the car to the outside. The car leaves the stable driving condition when the centrifugal force is stronger than the maximum possible wheel lateral guiding forces. "Understeer" is the phrase used when the car presses outwards over the front wheels. Oversteer, on the other hand, is when the rear wheel adhesion becomes lower. The rear of the car presses outwards.

xDrive minimizes the tendency to understeer or oversteer by optimally distributing the driving power between the rear axle and front axle.

[more -]

Detection of different tire rolling circumferences

If the tire rolling circumferences are not the same the drive train twists due to different rotary speeds (when the multi-plate clutch is closed).

Differences in rotational speed can occur as a result of the following influences:

- When tires of different makes and types are fitted:

  The tire rolling circumference may fluctuate by up to 1 % due to tires of different makes and types being fitted or the tires are worn very differently.

- When an emergency wheel is fitted
- When the tires are worn very differently

Slip in the multi-plate clutch may compensate for differences in rotary speed when different tire rolling circumferences are detected.

Compensation is produced by reducing the locking torque in situations that do not have great driving dynamic control.

Emergency operation

Driving dynamic control and the ADB-X function are not possible in emergency operation.

The VTG control unit has an integral regulator for emergency control. The regulator provides redundancy for controlling the multi-plate clutch in the DSC control units.

The regulator is used to attempt to maintain all-wheel drive for as long as possible when the DSC control unit malfunctions or important sensor signals drop out.

Substitute values are calculated when individual sensor signals drop out. Functions are operated by using the

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substitute values until it is no longer possible to control the all-wheel drive effectively. This can lead to the complete loss of all-wheel drive.

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TRANSMISSION

Transfer Box - Special Tools - X3

27 TRANSFER BOX

27 1 390 DRIFT

Minimum set: Mechanical tools

Note: For driving in shaft seal of drive shaft Transfer box: ATC400

Series: E53, E83

Storage location: B48

SI number: 1 24 03 (040)

Order number: 27 1 390

Drift



Fig. 1: Drift (27 1 390)
Courtesy of BMW OF NORTH AMERICA, INC.

27 1 400 DRIFT

Minimum set: Mechanical tools

Note: For driving in shaft seal of output shaft to rear differential Transfer box: ATC400

Series: E53, E83

Storage location: B48

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SI number: 1 24 03 (040)

Order number: 27 1 400

Drift



Fig. 2: Drift (27 1 400)
Courtesy of BMW OF NORTH AMERICA, INC.

27 1 410 DRIFT

Minimum set: Mechanical tools

Note: For driving in shaft seal of output shaft to front differential Transfer box: ATC400

Series: E83

Storage location: B48

SI number: 1 24 03 (040)

Order number: 27 1 410

Drift

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Fig. 3: Drift (27 1 410)
Courtesy of BMW OF NORTH AMERICA, INC.

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TRANSMISSION

Transfer Box - Technical Data - X3

00 TRANSFER CASE, GENERAL

27 00 TRANSFER BOX IN GENERAL E83

TECHNICAL DATA - TRANSFER BOX GENERAL E83

Designation/Type	(X-Drive)	ATC 400 (X-Drive)
Oil grade: see operating instructions		
Oil change volume	ltr.	0.69
New oil filling volume	ltr.	0.8

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2007 TRANSMISSION

Transfer Box - Tightening Torques - X3

00 TRANSFER CASE GENERAL

27 00 TRANSFER BOX IN GENERAL

TRANSFER BOX IN GENERAL TIGHTENING TORQUES

	Type	Thread	Tightening specification	Measure
7AZ Plug	E30 / E34	M24 x 1.5		33 Nm
	E30 / E34	M14 x 1.5		33 Nm
	E30 / E34	M18 x 1.5		23 Nm
8AZ Transmission cross member to rubber mounts	E30 / E34	M12		80 Nm
Transmission cross member to body	E30 / E34	M8		24 Nm
9AZ Transfer box to transmission	E53 / E46 / E83 / E60 / E61 / E90 / E91 / E92 / E70	M10		43 Nm
10AZ Transmission cross member to rubber mounts	E46 / E53 / E83	M12		74 Nm
Transmission cross member to rubber mounts	E60 / E61 / E90 / E91 / E92	M12		68 Nm
Transmission cross-member to body	E53	M10		41 Nm
Transmission cross-member to body	E46 / E83	M8		21 Nm
Transmission cross-member to body	E60 / E61 / E90 / E91 / E92	M8		19 Nm
11AZ Plug	E53 / E46 / E83	M18		33 Nm
Oil filler and drain plugs	E60 / E61 / E90 / E91 / E92 / E70	M22		60 Nm
12AZ Vibration damper to transfer box	E53	M8		23 Nm
Vibration damper to transfer box	E83	M8		20.5 Nm
13AZ Servomotor to transfer box	E53 / E83 / E60 / E61 / E90/ E91/ E92 / E70	M8		22 Nm
14AZ Resistor to transfer case	E53 / E83 / E60 / E61 / E90/ E91/ E92 / E70	M5		5 Nm
15AZ Control unit holder to	E60 / E61 / E90 / E91 / E92	M6		8 Nm

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TRANSMISSION

Transfer Case - Operating Fluids

1.0 TRANSFER CASE OPERATING FLUIDS

TRANSFER CASE OPERATING FLUIDS SPECIFICATION

Model:	Fluid:	BMW Part Number:
E30 325iX	ATF Dexron® III formulation	
E46/16 325xi/xiT, 330xi	MTF-LT-1	83 22 9 408 942 (MTF-LT-2 = 5 Liters)
E53 All models produced up to 2/2005 with NV125 transfer case	ATF Dexron® III formulation	
E53 All models with X-Drive transfer case	TF0870	83 22 0 397 244 (1 Liter)
E60 All models	TF0870	83 22 0 397 244 (1 Liter)
E61 All models	TF0870	83 22 0 397 244 (1 Liter)
E70 All models	TF0870	83 22 0 397 244 (1 Liter)
E83 All models with X-Drive transfer case	TF0870	83 22 0 397 244 (1 Liter)
E90, E91 and E92 All models	TF0870	83 22 0 397 244 (1 Liter)

NOTE: Before opening the container, shake the container to evenly mix the additives with the oil.

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TRANSMISSION

Transfer Case - Repair Instructions - X3

00 TRANSFER CASE, GENERAL

00 DANGER OF POISONING IF OIL IS INGESTED/ABSORBED THROUGH THE SKIN

Danger of poisoning!

Ingesting oil or absorbing through the skin may cause poisoning!

Possible symptoms are:

- Headaches
- Dizziness
- Stomach aches
- Vomiting
- Diarrhoea
- Cramps/fits
- Unconsciousness

Protective measures/rules of conduct:

- Pour oil only into appropriately marked containers
- Do not pour oil into drinking vessels (drinks bottles, glasses, cups or mugs)
- Observe country-specific safety regulations

First aid measures:

- Do not induce vomiting.

  If the person affected is still conscious, he/she must rinse out their mouth with water, drink plenty of water and consult a doctor immediately.

  If the person affected is unconscious, do not administer anything by mouth, place the person in the recovery position and seek immediate medical attention.

00 RISK OF INJURY IF OIL COMES INTO CONTACT WITH EYES AND SKIN

Danger of injury!

Contact with eyes or skin may result in injury!

Possible symptoms are:

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- Impaired sight
- Irritation of the eyes
- Reddening of the skin
- Rough and cracked skin

Protective measures/rules of conduct:

- Wear protective goggles
- Wear oil-resistant protective gloves
- Observe country-specific safety regulations

First aid measures:

- Eye contact: Rinse eyes immediately with plenty of water for at least 15 minutes; if available, use an eye-rinsing bottle. If irritation of the eyes persists, consult a doctor.
- Skin contact: Wash off with soap and water immediately. If irritation persists, consult a doctor.

NOTE: Do not use solvents/thinners.

00 SAFETY INSTRUCTIONS FOR HANDLING OIL

WARNING: 00 DANGER OF POISONING IF OIL IS INGESTED/ABSORBED THROUGH THE SKIN .
00 RISK OF INJURY IF OIL COMES INTO CONTACT WITH EYES AND SKIN .

Recycling:

Observe country-specific waste-disposal regulations.

Measures if oil is unintentionally released:

- Personal precautionary measures: Danger of slipping! Keep non-involved persons away from the work area. Wear personal protective clothing/equipment.
- Environmental protection measures: Prevent oil from draining into drain channels, sewerage systems, pits, cellars, water and the ground.
- Limiting spread: Use oil blocks to prevent the surface spread of oil.
- Cleaning procedure: Bind and dispose of escaped oil with nonflammable absorbents.

NOTE: Do not flush oil away with water or aqueous cleaning agents.

27 00 ... TOPPING UP/CHANGING TRANSFER CASE OIL

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**IMPORTANT: Use only the approved gear oil in the transfer box.
Failure to comply with this requirement will result in serious damage to the transfer box!**

NOTE: Only change the oil when the transfer box is at normal operating temperature.

Checking/correcting transfer case oil level:

Undo oil filler plug (1).

Check transfer case oil level.

If necessary, pour in gear oil up to lower edge of opening for oil filler plug (1).

Installation:

Tightening torque: 27 00 11AZ, see **27 00 TRANSFER BOX IN GENERAL** .

Replace sealing ring.

Place oil collecting apparatus underneath.

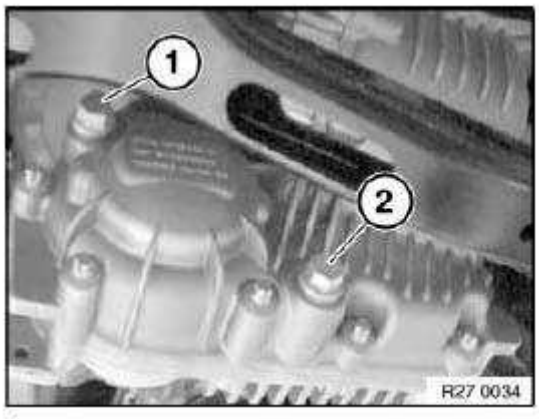


Fig. 1: Oil Filler Plug And Oil Drain Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Remove oil drain plug (2).

Drain and dispose of gear oil.

NOTE: Observe country-specific waste-disposal regulations

Replace sealing ring, screw in oil drain plug (2) and tighten down.

Tightening torque: 27 00 11AZ, see **27 00 TRANSFER BOX IN GENERAL** .

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Undo oil filler plug (1).

Pour in gear oil up to lower edge of opening for oil filler plug (1).

Tightening torque: 27 00 11AZ, see **27 00 TRANSFER BOX IN GENERAL** .

Replace sealing ring.

10 TRANSFER CASE

27 10 ... CHECKING FUNCTION OF FRONT DIFFERENTIAL AND TRANSFER CASE

NOTE: Fault diagnosis with DIS Tester.
Adhere to specified repair sequence in DIS.

27 10 010 REMOVING AND INSTALLING TRANSFER CASE (ATC 400 X-DRIVE)

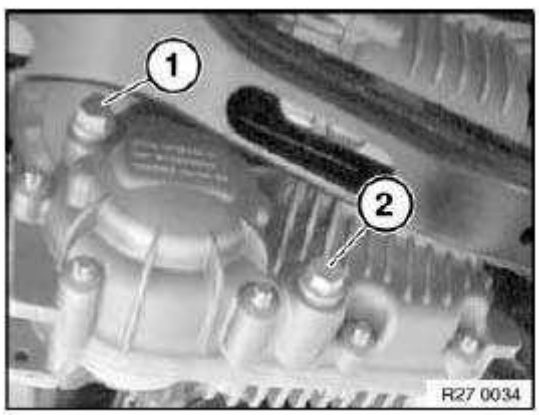
Special tools required:

- 00 2 030
- 24 5 301
- 24 5 305

IMPORTANT: After replacement, the "Repair" service function must be carried out with GT1.

IMPORTANT: After completing work, check gear oil level and top up if necessary.
Filler plug (1):
Tightening torque: 27 00 11AZ, see 27 00 TRANSFER BOX IN GENERAL .
Gear oil level up to filler edge of filler plug (1).
Use only the approved gear oil.

Failure to comply with this requirement will result in serious damage to the transfer case!



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Fig. 2: Oil Filler Plug And Oil Drain Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Necessary preliminary tasks:

- Remove complete exhaust system, see **18 00 020 REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM (M54)** .
- Remove heat shield.

Unfasten screws.

Tightening torque: 26 11 9AZ, see **26 11 PROPELLER SHAFT, COMPLETE** .

Remove front propeller shaft at output flange of transfer case and tie to one side.

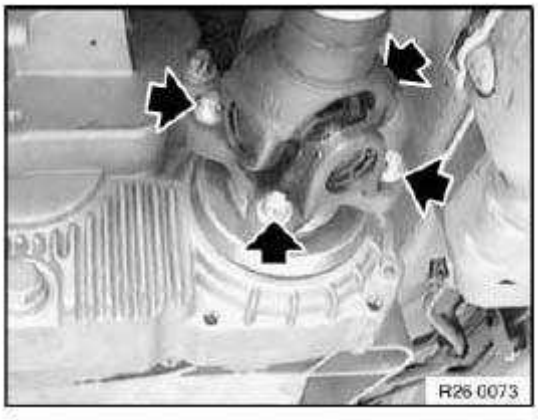


Fig. 3: Front Propeller Flange Shaft Screws
Courtesy of BMW OF NORTH AMERICA, INC.

- Remove propeller shaft from transmission.
- Release center bearing.
- Tie propeller shaft to one side.

Tasks are described in **26 11 000 REMOVING AND INSTALLING PROPELLER SHAFT (CARDAN UNIVERSAL JOINT) COMPLETELY** .

NOTE: **Automatic transmission:**

Support transmission with special tools 00 2 030 / 24 5 301 / 24 5 305.

Manual transmission:

Support manual transmission with hydraulic lifter.

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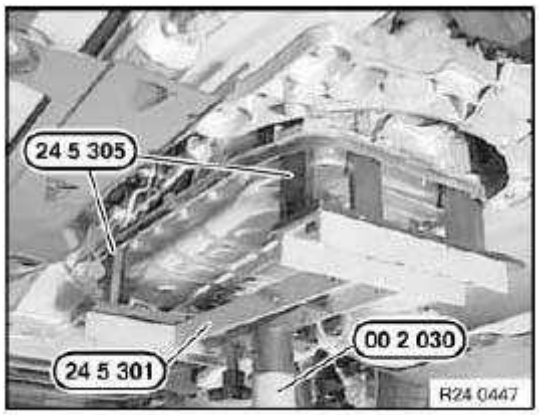


Fig. 4: Special Tools (00 2 030), (24 5 301) And (24 5 305)
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws and remove transmission cross-member.

Tightening torque: 27 00 10AZ, see **27 00 TRANSFER BOX IN GENERAL** .

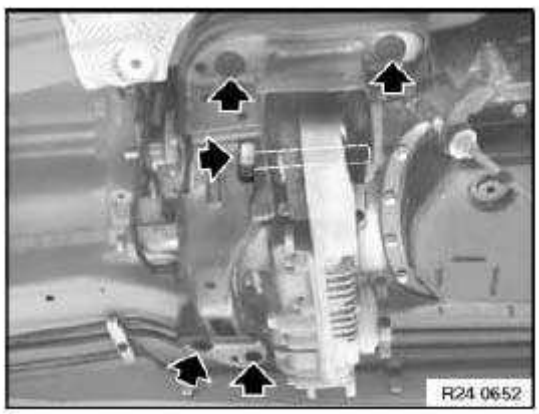


Fig. 5: Transmission Cross-Member Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Detach plugs (1) and (2) from servomotor.

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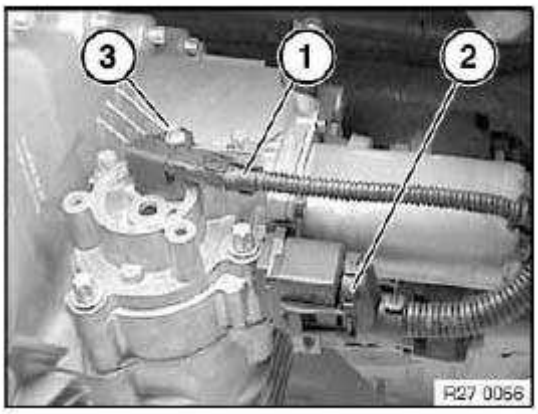


Fig. 6: Plugs And Servomotor
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw connection of transfer case.

Tightening torque: 27 00 9AZ, see **27 00 TRANSFER BOX IN GENERAL** .

Remove transfer case.

Installation:

Pay attention to dowel pin (1).

Grease dowel pin (1).

Apply a thin coat of grease to splines.

Grease: WEICON ANTI-SEIZE.

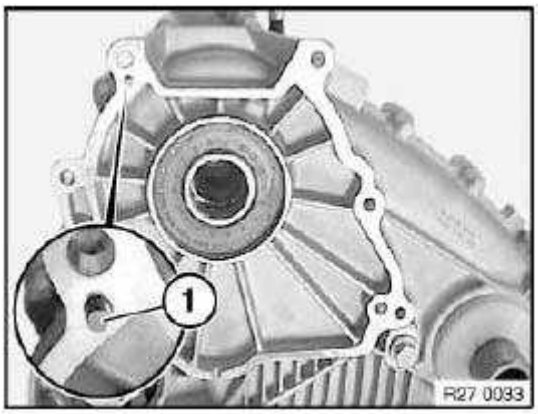


Fig. 7: Dowel Pin
Courtesy of BMW OF NORTH AMERICA, INC.

27 10 020 INSTALLING REPLACEMENT TRANSFER CASE (ATC 400 X-DRIVE)

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IMPORTANT: After replacement, the "Repair" service function must be carried out with GT1.

Recycling:

Catch and dispose of escaping transmission oil. Observe country-specific waste-disposal regulations.

IMPORTANT: After completing work, check gear oil level and top up if necessary.
Filler plug (1):
Tightening torque: 27 2 7AZ, see 27 00 TRANSFER BOX IN GENERAL .
Gear oil level to lower edge of filler plug (1).
Use only the approved transmission oil.

Failure to comply with this requirement will result in serious damage to the transfer case!

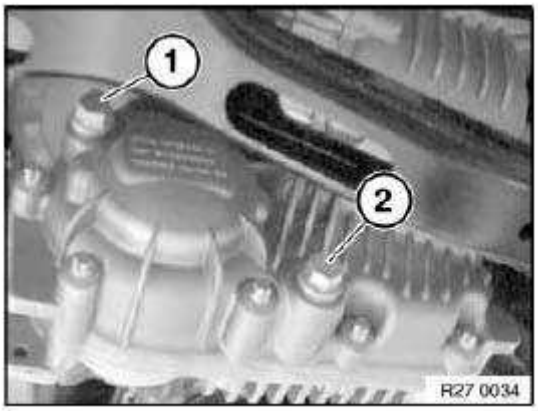


Fig. 8: Oil Filler Plug And Oil Drain Plug
Courtesy of BMW OF NORTH AMERICA, INC.

Necessary preliminary tasks:

- Drain gear oil at oil drain plug, see **00 11 572 CHANGING OIL IN TRANSFER BOX (ATC 400/500)** .

  Tightening torque: 27 2 11AZ, see **27 00 TRANSFER BOX IN GENERAL** .

- Remove transfer case, see **27 10 020 Installing replacement transfer case (ATC 400 X-Drive)**.

Convert following parts from previous transfer case to new transfer case.

- Covers and protective caps.
- Drive shaft transportation lock.
- Vent hose of transfer case.
- Vibration damper (M47T2).

  Tightening torque: 27 2 12AZ, see **27 00 TRANSFER BOX IN GENERAL**

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- Rubber mount for transfer case mounting, replace if necessary, see **22 31 001 REPLACING RUBBER MOUNT FOR TRANSMISSION MOUNTING**

27 10 020 INSTALLING REPLACEMENT TRANSFER BOX (ATC 350)

Special tools required:

- 22 1 044
- 22 1 046
- 33 4 460

IMPORTANT: Before and after replacement, execute the "Repair" service function with the BMW diagnosis system.

NOTE: Recycling: Catch and dispose of escaping transmission oil. Observe country-specific waste disposal regulations.

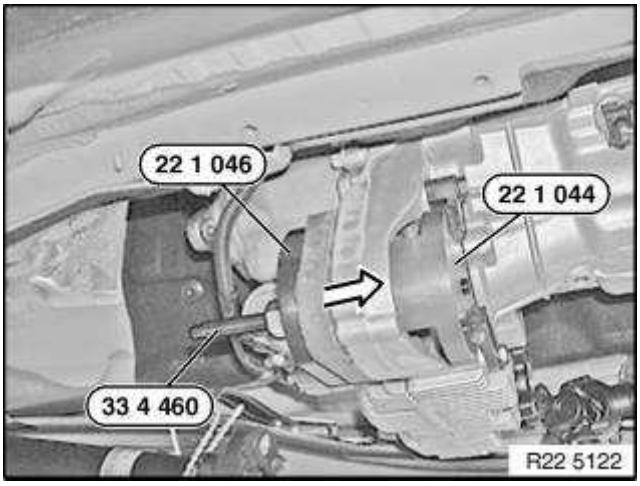
Necessary preliminary tasks:

- Drain transmission oil at oil drain plug
- Tightening torque, 27 10 2AZ
- Remove transfer box

Modify following parts:

- Covers and protective caps
- Drive shaft transportation retainer
- Vent hose of transfer box

Bolt special tool 22 1 044 to transfer box. Insert special tool 22 1 046 with pins into opening of rubber mount. Draw in rubber mount with special tool 33 4 460.



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Fig. 9: Bolt Special Tool 22 1 044 To Transfer Box
Courtesy of BMW OF NORTH AMERICA, INC.

Installation note: Pay attention to installation position of rubber mount (1).

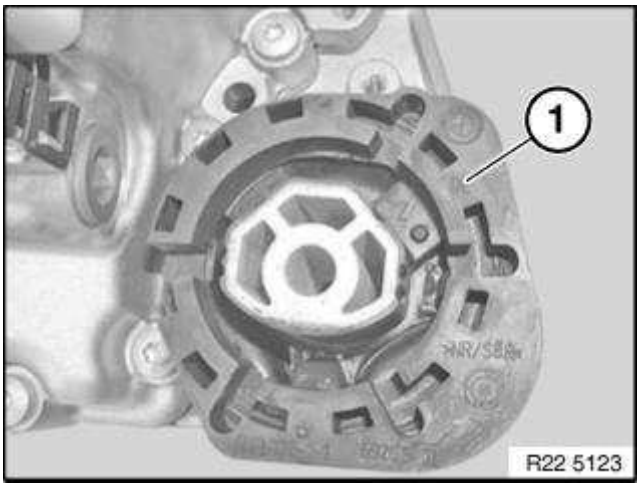


Fig. 10: Installation Position Of Rubber Mount (1)
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT:

- **After completing work, check transmission oil level and top up if necessary.**
- **Release filler plug (1).**
- **Check oil level.**
- **Tightening torque, see 27 10 11AZ in 27 00 TRANSFER BOX IN GENERAL .**
- **Pour in transmission oil up to lower edge of opening for filler plug (1).**
- **Use only the approved TRANSFER CASE OPERATING FLUIDS .**

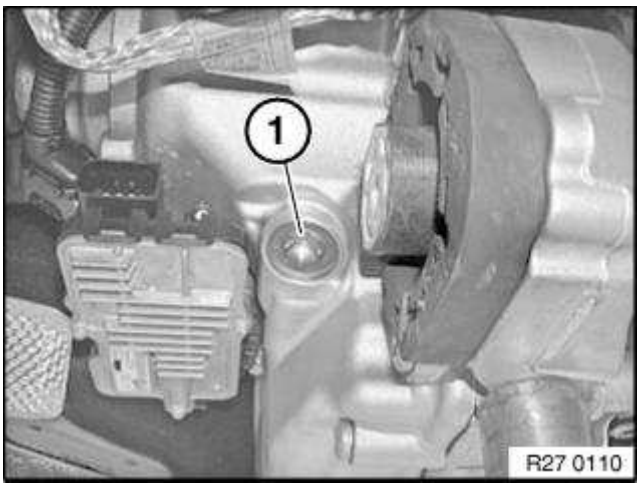


Fig. 11: Pour In Transmission Oil Up To Lower Edge Of Opening For Filler Plug (1)
Courtesy of BMW OF NORTH AMERICA, INC.

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Failure to comply with this requirement will result in serious damage to the transfer box!

27 10 050 REPLACING OUTPUT FLANGE FOR FRONT AXLE OUTPUT (ATC 400/500 X-DRIVE)

IMPORTANT: Do not move vehicle with engine power once propeller shaft has been removed.
Replace output flange only in conjunction with a new radial shaft seal.
After completion of work, check transmission oil level, see 00 11 572 CHANGING OIL IN TRANSFER BOX (ATC 400/500)
Use only approved transmission oil.
Failure to comply with this requirement will result in serious damage to the transfer box!

Operation is identical to Replacing radial shaft seal for front axle output, see **27 21 030 Replacing radial shaft seal for front axle output (ATC 400/500 X-Drive)**.

27 10 700 REMOVING AND INSTALLING / REPLACING CONTROL UNIT FOR TRANSFER CASE

IMPORTANT: Read and comply with 61 35 ... NOTES ON ESD PROTECTION (ELECTRO STATIC DISCHARGE)

After installation:

- After replacement, the "Repair" service function must be carried out with GT1.
- Replacement only: Carry out programming/coding

In vehicles before 03/05 the old diagnosis algorithm and in vehicles after 03/05 the new diagnosis algorithm must always be activated by way of coding!

Necessary preliminary tasks:

- Remove front panel for luggage compartment floor, see **51 47 131 REPLACING FRONT TRIM FOR LUGGAGE COMPARTMENT FLOOR** .

Unscrew nuts (1).

Unfasten plug connection and disconnect.

Remove control unit (2).

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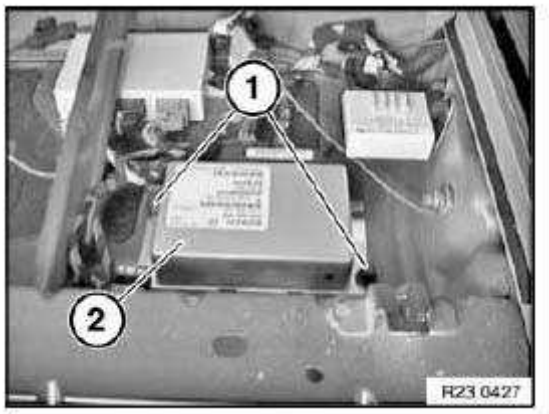


Fig. 12: Nuts And Control Unit
Courtesy of BMW OF NORTH AMERICA, INC.

27 10 710 REPLACING RESISTOR FOR SERVOMOTOR (ATC 400 X-DRIVE)

IMPORTANT: Delete previous resistance values when replacing the resistor. Using BMW diagnosis system, work through test program in accordance with instructions.

Release screws and remove transmission cross-member.

Tightening torque: 27 00 10AZ, see **27 00 TRANSFER BOX IN GENERAL** .

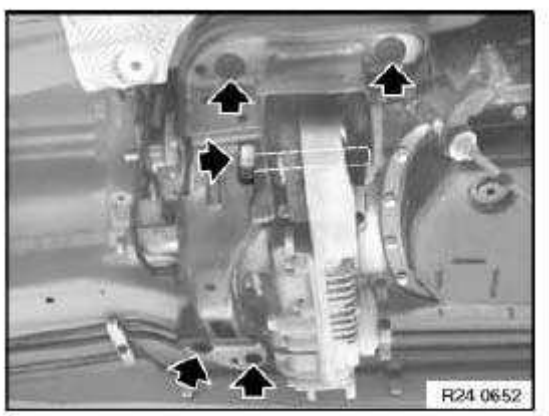


Fig. 13: Transmission Cross-Member Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Detach plug (1) from resistor.

Release screw (3) and remove resistor.

Tightening torque: 27 00 14AZ, see **27 00 TRANSFER BOX IN GENERAL** .

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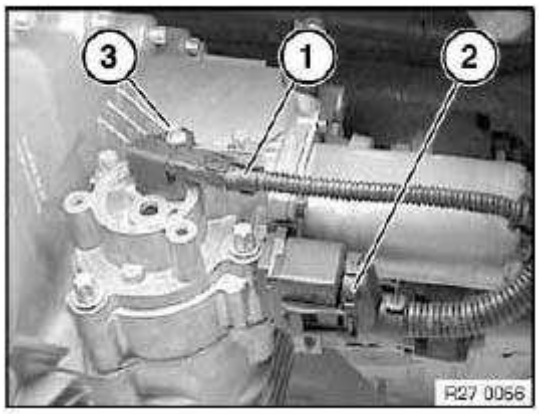


Fig. 14: Plugs And Servomotor
Courtesy of BMW OF NORTH AMERICA, INC.

27 10 720 REPLACING SERVOMOTOR (ATC 400 X-DRIVE)

IMPORTANT: After replacement, the "Repair" service function must be carried out with GT1.

Necessary preliminary tasks:

- Remove complete exhaust system, see **18 00 020 REMOVING AND INSTALLING COMPLETE EXHAUST SYSTEM (M54)** .
- Remove heat shield.

Release screws and remove transmission cross-member.

Tightening torque: 27 00 10AZ, see **27 00 TRANSFER BOX IN GENERAL** .

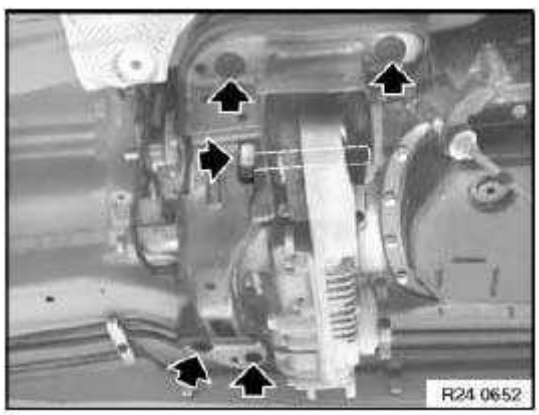


Fig. 15: Transmission Cross-Member Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plugs (1 and 2).

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Release screws and remove servomotor from transfer case.

Tightening torque: 27 00 13AZ, see **27 00 TRANSFER BOX IN GENERAL** .

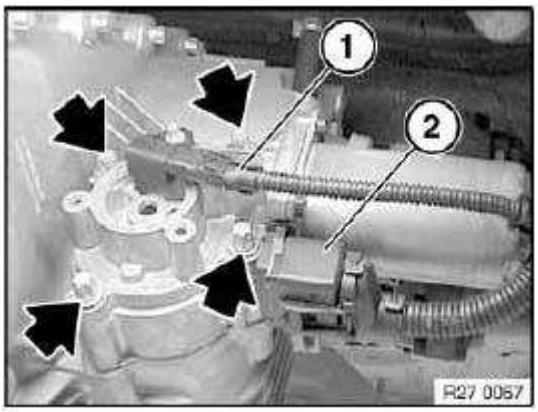


Fig. 16: Servomotor Plug And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

21 TRANSMISSION SHAFTS

27 21 010 REPLACING RADIAL SHAFT SEAL FOR DRIVE FLANGE (ATC 400/500 X-DRIVE)

Special tools required:

- **23 0 490 EXTRACTOR**
- **27 1 390 DRIFT**

IMPORTANT: After completion of work, check gear oil level and top up if necessary, see 00 11 572 CHANGING OIL IN TRANSFER BOX (ATC 400/500) and top up if necessary.
Use only approved gear oil in this transfer box.

Necessary preliminary tasks:

- Remove transfer box, see **27 10 010 Removing and installing transfer case (ATC 400 X-Drive)**.

Drive a hole into radial shaft seal (2) using a center punch (1).

IMPORTANT: Do not use a drill as drillings may result in transmission malfunction.

NOTE: Illustration shows NV125 transmission

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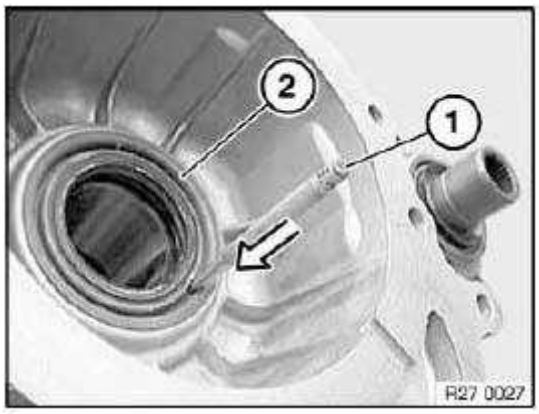


Fig. 17: Driving A Hole Into Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Screw in special tool 23 0 490.

Drive out radial shaft seal (1) with impact weight (2).

NOTE: Illustration shows NV125 transmission

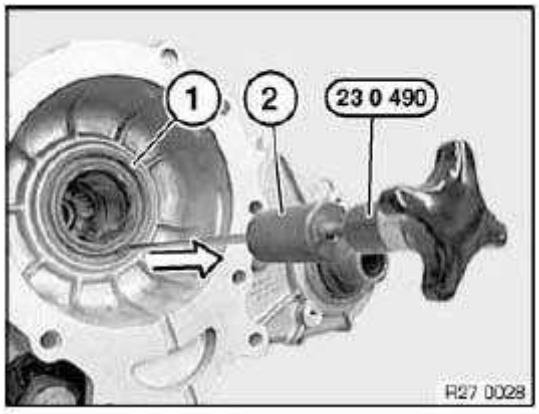


Fig. 18: Driving Out Radial Shaft Seal With Impact Weight
Courtesy of BMW OF NORTH AMERICA, INC.

Drive in radial shaft seal with special tool 27 1 390.

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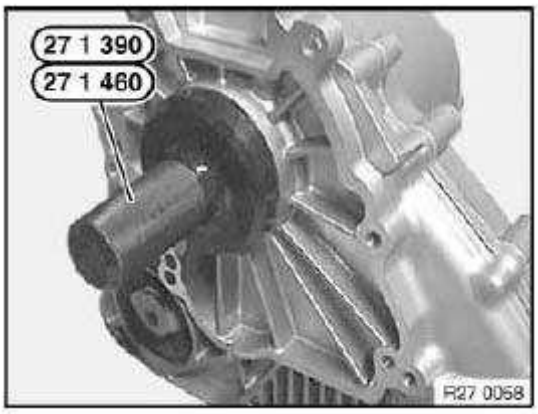


Fig. 19: Driving In Radial Shaft Seal With Special Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Add final details to vehicle.

Check oil level.

Check transmission for leaks.

27 21 020 REPLACING RADIAL SHAFT SEAL FOR OUTPUT FLANGE (ATC 400/500 X-DRIVE)

Special tools required:

- **23 0 490 EXTRACTOR**
- **27 1 400 DRIFT**
- **33 1 150 FIXTURE**

IMPORTANT: After completing tasks, check gear oil level and top up if necessary, see 00 11 572 CHANGING OIL IN TRANSFER BOX (ATC 400/500) .
Use only approved gear oil in this transfer box.

Necessary preliminary tasks:

- Remove transfer box, see **27 10 010 Removing and installing transfer case (ATC 400 X-Drive)**.

Release retaining ring (1).

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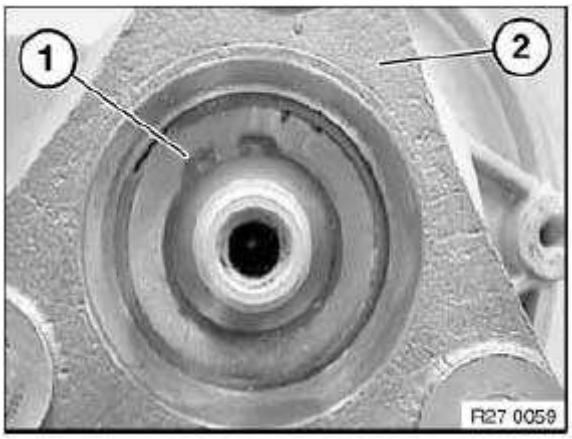


Fig. 20: Retaining Ring
Courtesy of BMW OF NORTH AMERICA, INC.

Remove drive flange with special tool 33 1 150.

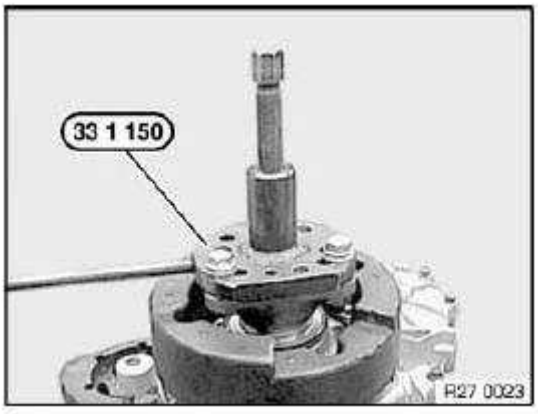


Fig. 21: Drive Flange And Special Tool (33 1 150)
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Replace O-ring in output flange.

Check that O-ring is in correct position.

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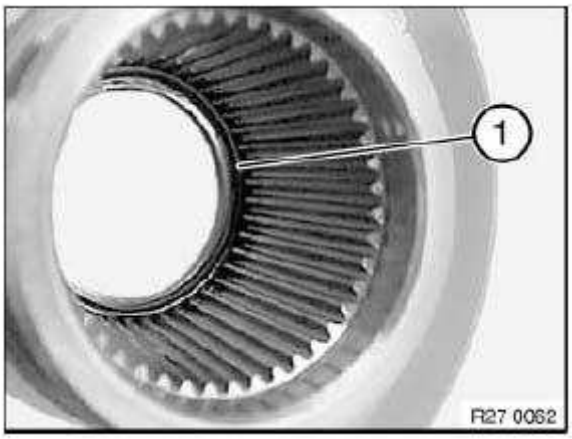


Fig. 22: O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: The propeller shaft may move when the output flange is pushed on. The retaining ring can thus no longer be fitted.

Installation:

Version: output shaft with mounting groove (1):

- Push on output flange
- Using 2 screwdrivers, press output flange downwards or output shaft (2) upwards until groove for retaining ring is completely visible.
- Fit retaining ring.

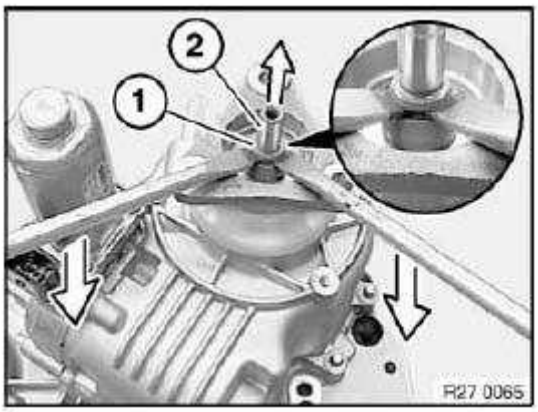


Fig. 23: Pressing Output Flange Downwards Or Output Shaft Upwards
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Version: transmission output shaft without mounting groove:

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- Support transfer box with a suitable sleeve (1) on transmission input shaft (2).
- Push on output flange
- Fit retaining ring.

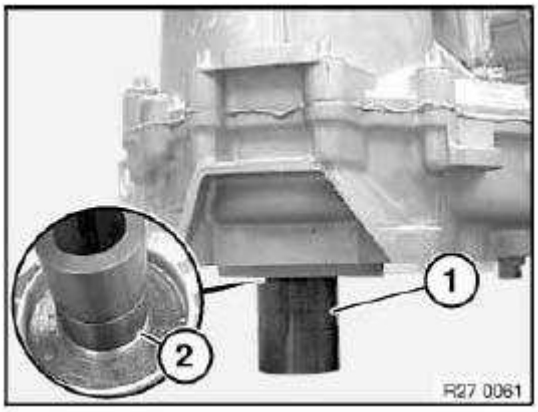


Fig. 24: Sleeve And Transmission Input Shaft
Courtesy of BMW OF NORTH AMERICA, INC.

Drive a hole into radial shaft seal (2) using a center punch (1).

See illustration.

IMPORTANT: Do not use a drill as drillings may result in transmission malfunction.

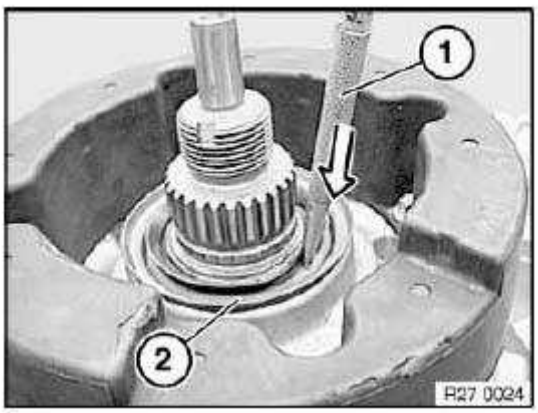


Fig. 25: Radial Shaft Seal And Center Punch
Courtesy of BMW OF NORTH AMERICA, INC.

Screw in special tool 23 0 490.

Drive out radial shaft seal (1) with impact weight (2).

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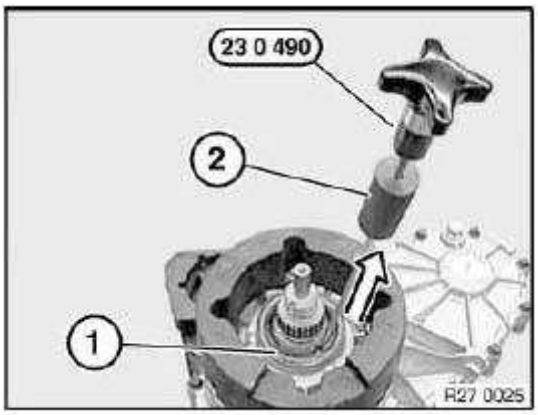


Fig. 26: Radial Shaft Seal, Impact Weight And Special Tool (23 0 490)
Courtesy of BMW OF NORTH AMERICA, INC.

Drive in radial shaft seal with special tool 27 1 400.

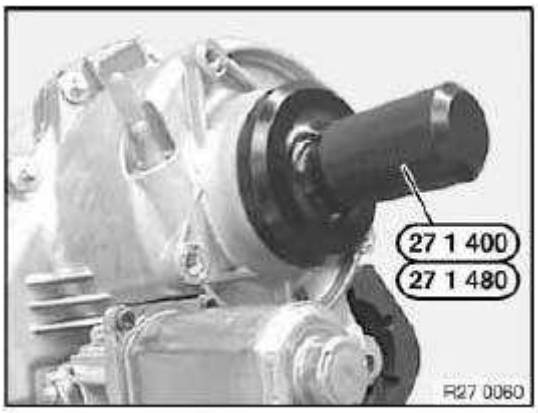


Fig. 27: Special Tool (27 1 400)
Courtesy of BMW OF NORTH AMERICA, INC.

Add final details to vehicle.

Check oil level.

Check transmission for leaks.

27 21 030 REPLACING RADIAL SHAFT SEAL FOR FRONT AXLE OUTPUT (ATC 400/500 X-DRIVE)

Special tools required:

- **23 0 490 EXTRACTOR**
- **27 1 410 DRIFT**
- 27 1 420

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IMPORTANT: After completion of work check transmission oil level, see 00 11 572 CHANGING OIL IN TRANSFER BOX (ATC 400/500)
Use only the approved gear oil in this transfer box.

Necessary preliminary tasks:

- Remove reinforcement plate (E53 only), see **31 10 010 REMOVING AND INSTALLING/REPLACING REINFORCEMENT PLATE** .
- Remove front propeller shaft, see **REMOVAL & INSTALLATION** .

Press out output flange (1) with a suitable tool (2) in direction of arrow.

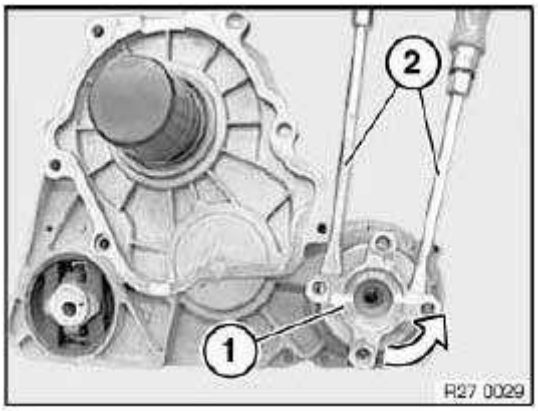


Fig. 28: Pressing Out Output Flange With Suitable Tool
Courtesy of BMW OF NORTH AMERICA, INC.

Remove protective cap (1) with a screwdriver.

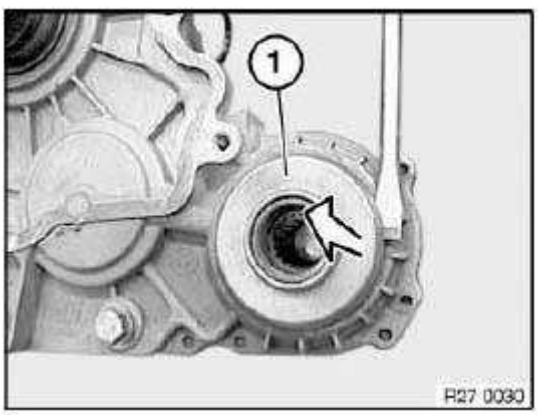


Fig. 29: Removing Protective Cap With Screwdriver
Courtesy of BMW OF NORTH AMERICA, INC.

Drive a hole into radial shaft seal (2) using a center punch (1).

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See illustration.

IMPORTANT: Do not use a drill as drillings may result in transmission malfunction.

NOTE: Illustration shows E46 drive flange.

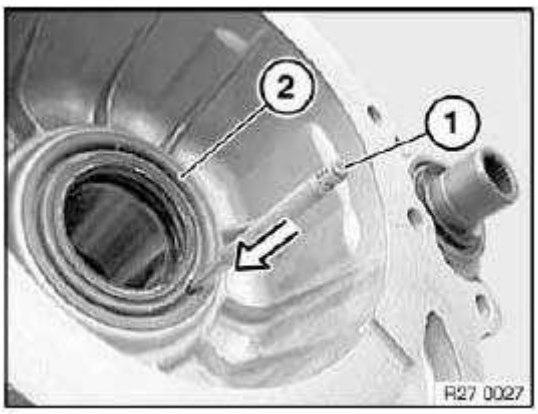


Fig. 30: Driving A Hole Into Radial Shaft Seal
Courtesy of BMW OF NORTH AMERICA, INC.

Screw in special tool 23 0 490.

Drive out radial shaft seal (1) with impact weight (2).

NOTE: Illustration shows E46 drive flange.

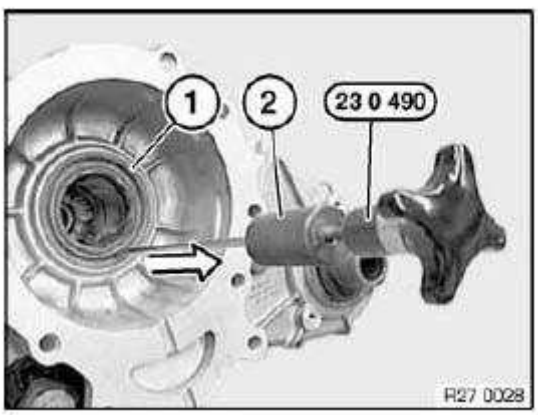


Fig. 31: Driving Out Radial Shaft Seal With Impact Weight
Courtesy of BMW OF NORTH AMERICA, INC.

Drive in radial shaft seal with a suitable special tool.

Special tool for E53 27 1 420

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Special tool for E83 27 1 410

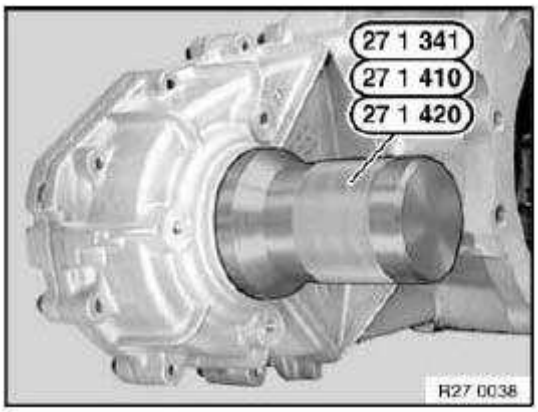


Fig. 32: Special Tools (27 1 410), (27 1 420) And (27 1 341)
Courtesy of BMW OF NORTH AMERICA, INC.

Add final details to vehicle.

Check oil level.

Check transmission for leaks.

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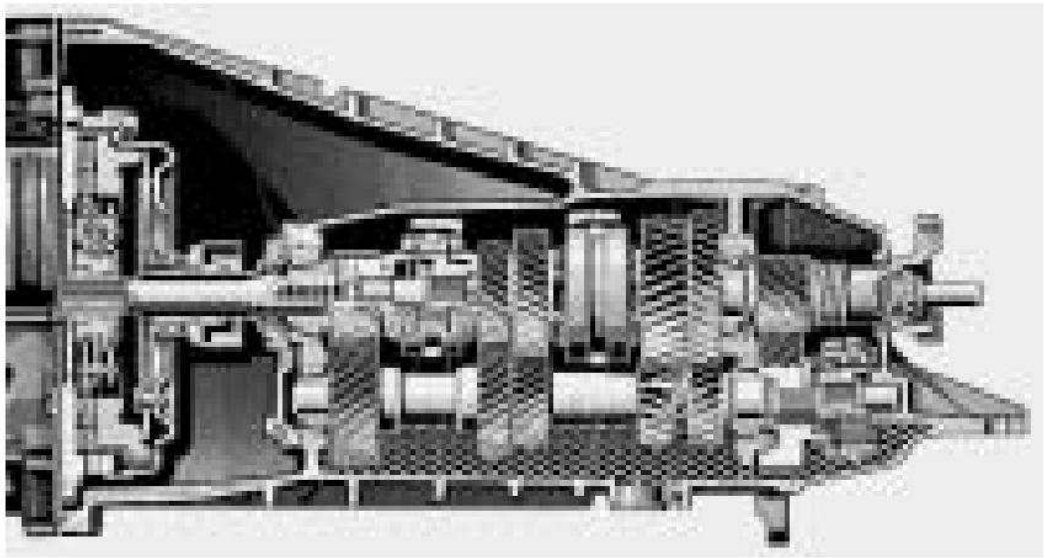
GENERAL INFORMATION

Transmission Fundamentals - Overview

TRANSMISSION FUNDAMENTALS

STANDARD/AUTOMATIC TRANSMISSION COMPARISON

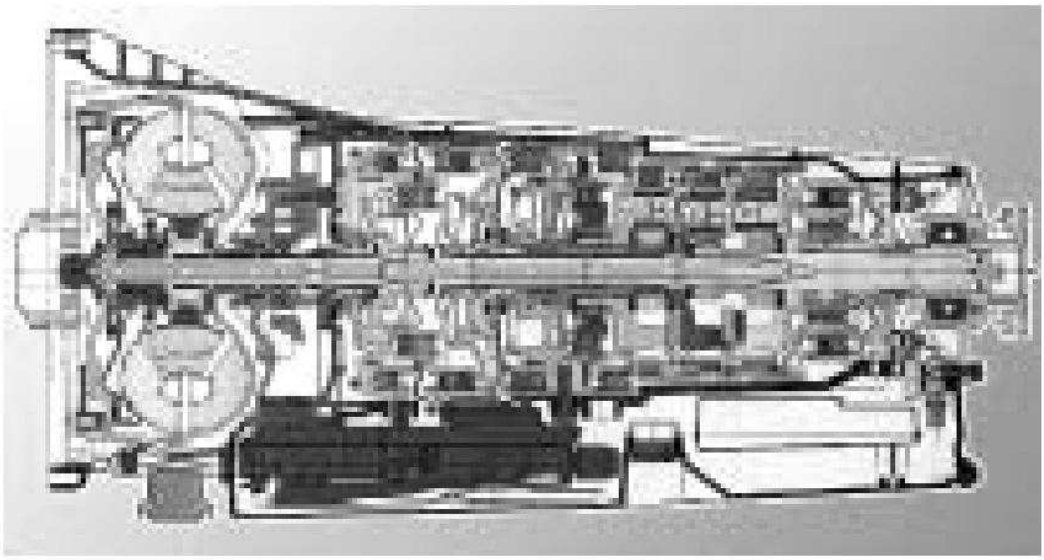
In today's modern vehicles, the automatic transmission has become a vital part of the powertrain. Automatic transmissions provide overall better fuel economy and efficiency while adapting to changing road conditions and driving habits. Standard transmissions offer more driver interaction with the vehicle, however automatic transmissions reduce driver fatigue and increase safety by shifting automatically. Automatic transmissions also offer improved driveability in stop and go traffic. If there is a disadvantage to an automatic transmission, it would be complexity and cost of manufacturing.



G03403720

Fig. 1: Identifying Standard Transmission
Courtesy of BMW OF NORTH AMERICA, INC.

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G03403721

Fig. 2: Identifying Automatic Transmission
Courtesy of BMW OF NORTH AMERICA, INC.

- Drive torque must be interrupted to change gears.
- Higher loads on driveline from abrupt clutch application.
- Clutch must be disengaged when vehicle is stopped to prevent stalling.
- High radial loads on housing.
- Gear set design requires more space than planetary type.
- Requires some Maintenance (clutch).
- Requires driver intervention for shifting.
- Gear teeth are in constant mesh due to planetary design.
- Smoother application of drive torque reduces loads on driveline.
- Due to fluid coupling in the torque converter, transmission can stay in gear when vehicle is stopped.
- Minimal radial loads on housing.
- Compact design of gear set. Space requirement is minimized.
- Maintenance free operation. (Lifetime fluid and no clutch).
- Automatic shifting reduces driver fatigue and increases safety.

HYDRAULIC TRANSMISSION VS. ELECTRO-HYDRAULIC TRANSMISSION

Since the introduction of the automatic transmission there have been numerous refinements to improve shift comfort as well as fuel economy. Early automatic transmissions used only hydraulic control, there was no

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electronic intervention. In 1986 BMW introduced their first EH (Electro-Hydraulic) transmission into production vehicles.

The acronym EGS is used by BMW for its electronic transmission control system. EGS stands for "Electronic Transmission Control" which comes from the German words "**E** lektronisch **G** etriebe **S** teurung". In order to comply with SAE terminology we will refer to the EGS control module as the TCM "**T** ransmission **C** ontrol **M** odule".

EH controlled transmissions allow for optimized shift points by closely monitoring changing conditions. Engine speed, road speed and throttle angle are some of the inputs that are monitored by the TCM to determine optimal shift points. The TCM will then process this information and control shift point via electronic solenoids mounted on the valve body.

With the introduction of Adaptive Transmission Control, shift comfort and fuel economy was further improved. The TCM now monitors throttle angle deviations, wheel speeds and CAN Bus information to fine tune shift points.

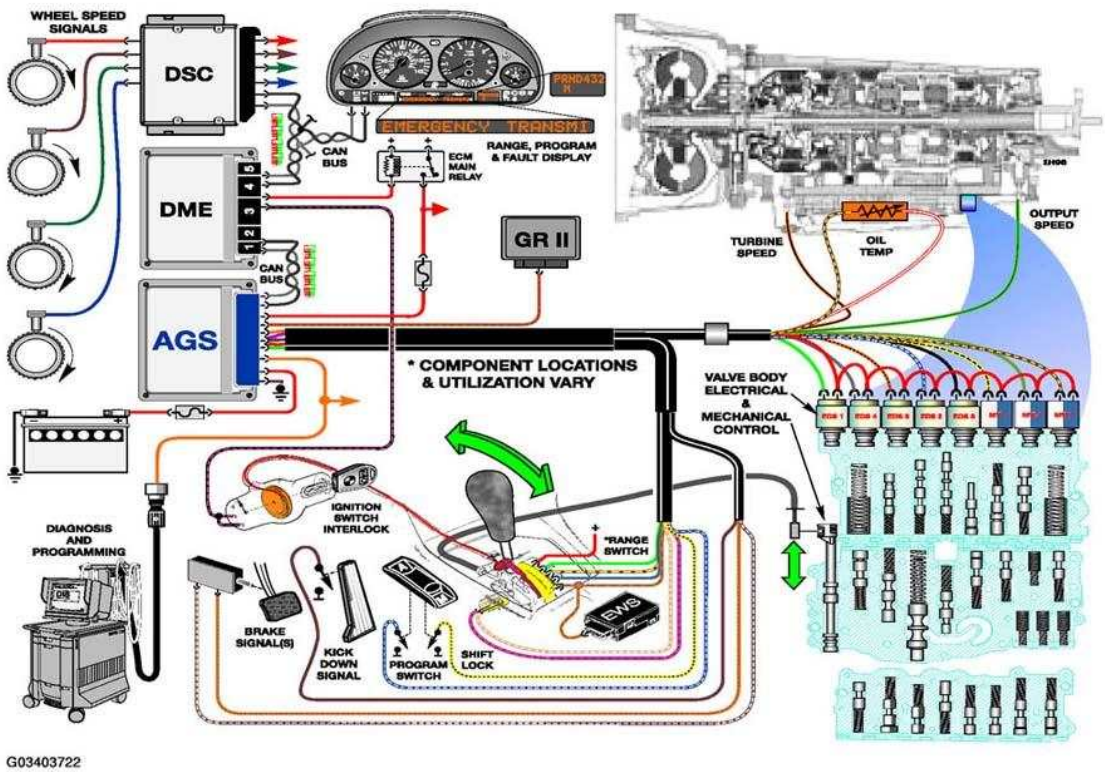


Fig. 3: Identifying Electro-Hydraulic Transmission Inputs/Outputs
Courtesy of BMW OF NORTH AMERICA, INC.

TRANSMISSION IDENTIFICATION

BMW automatic transmission are manufactured by two suppliers for the US market:

- **Zahnradfabrik Friedrichshafen:** Commonly referred to as ZF. ZF manufactures both manual and automatic transmissions.

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- **GM Powertrain - Hydramatic:** Hydramatic is a manufacturing division of General Motors located in Strasbourg France. Hydramatic supplies automatic transmissions to BMW for four and six-cylinder vehicles.

BMW has developed an internal numbering system for their transmissions for parts ordering, information research and identification. Also each manufacturer uses their own internal identification system. Here is a breakdown of these identification codes:

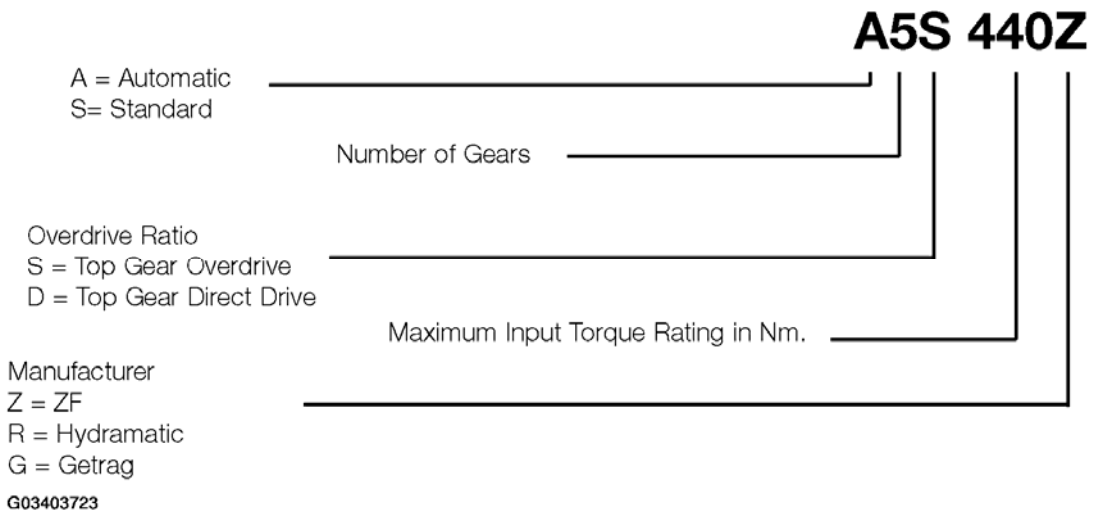


Fig. 4: Identifying BMW Identification Code Breakdown
Courtesy of BMW OF NORTH AMERICA, INC.

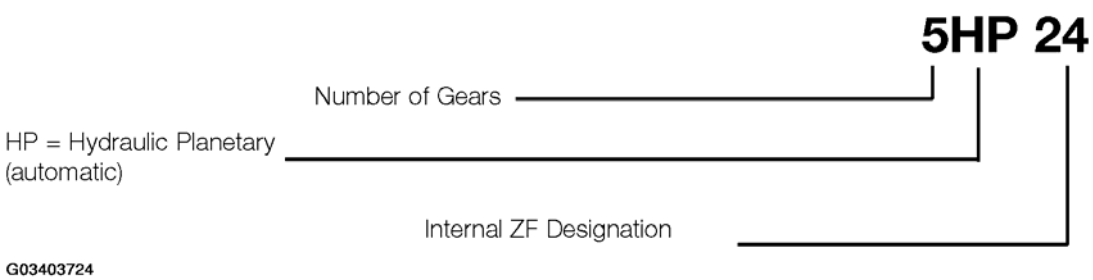


Fig. 5: Identifying ZF Identification Code Breakdown
Courtesy of BMW OF NORTH AMERICA, INC.

TRANSMISSION HYDRAULICS

Transmission Fluid (Oil)

The automatic transmission provides pressure regulated hydraulic fluid which is filtered for all of the transmissions functional requirements. All BMW automatic transmissions are designed to operate with specific

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fluids. Use of non-approved oil will cause malfunctions and irreparable transmission damage which is not covered by BMW warranty.

The transmission fluid provides the following functions:

- Lubricates mechanical components (planetary gears, bearings etc.).
- Removes heat and transfers heat to transmission cooling system. (Heat Exchanger).
- Removes debris and contaminants to sump and filter when circulated.
- Provides a transfer of kinetic energy in the torque converter.
- Allows hydraulic operation of mechanical components (clutches, brakes) via control of the valve body.

Also, transmission fluid has various properties to prevent oxidation and breakdown from heat and friction. Each type of transmission fluid has properties specific for each transmission application.

Fluid level is crucial in the proper operation of an automatic transmission. Improper fluid levels will cause improper operation and eventually irreparable transmission damage. Improper fluid level can cause:

- A low fluid level can cause an interruption in oil flow during fast acceleration or hard braking which can cause gear shift malfunctions.
- An excessively high fluid level can cause the rotating mechanical components to paddle in the oil. This produces foam which introduces air into the hydraulic system.
- A low fluid level can also cause transmission overheating causing premature transmission failure.

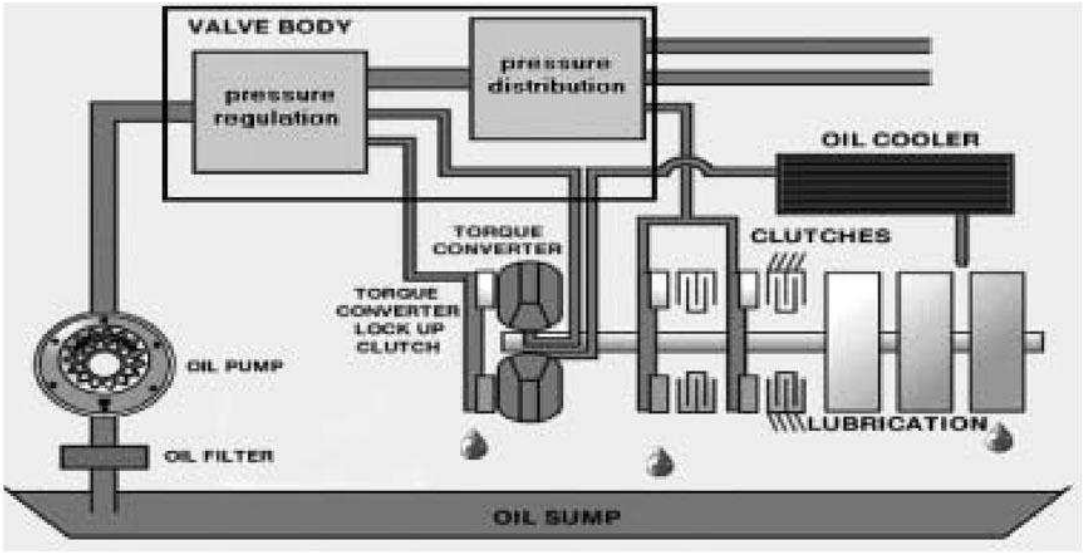


Fig. 6: Identifying Transmission Fluid Flow
Courtesy of BMW OF NORTH AMERICA, INC.

TRANSMISSION FLUID APPLICATION

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There are numerous types of transmission fluid used in BMW transmissions. With the exception of the early transmissions (4HP22/24, A4S310/270R and the A5S310Z) all current BMW transmissions use "Lifetime Fill" transmission fluid. There is no maintenance required for these transmissions. It is important to use the correct fluid. Incorrect use of the transmission fluid can cause non-warrantable transmission damage.

When performing repairs on transmissions with lifetime fluid, it is important to drain the transmission fluid in to a clean container for re-use. New fluid should only be used for transmission replacement and for topping off after repairs.

Also, transmission fluid level is vital to the proper operation of the transmission.

BMW AUTOMATIC TRANSMISSIONS FLUID SPECIFICATIONS

Transmission	Fluid Type	BMW Part #	Container	SIB Ref.
4HP22 **4HP24**	Dexron III Mercon	Available Commercially (Castrol or Texaco)	N/A	
A5S310Z 530i/iT (E34)	Dexron III	Available Commercially (Castrol or Texaco)	N/A	
M3 (E36)	ESSO LT 71141	83 22 9 407 807	20 liter container	B 24 03 95
A5S325Z	ESSO LT 71141	83 22 9 407 807	20 liter contalner	
A5S440Z	ESSO LT 71141	83 22 9 407 807	20 liter contalner	
A5S560Z 740 (E32), 540 (E34) 840Ci (E31- 6/93-12/94) 740i/iL-750iL (E38)	Shell LA2634	83 22 9 407 765	5 liter contalner	B 24 11 92
540i (3/96-12/96) 850Ci (10/94-6/97)	ESSO LT 71141	83 22 9 407 807	20 liter contalner	B 24 02 94
A4S310R **A4S270R** **(THM-R1)**	Dexron III Mercon	Available Commercially (Castrol or Texaco)	N/A	
A5S360R **A5S390R**	Texaco ETL 7045E Texaco ETL 8072B	83 22 0 026 922 83 22 0 024 359	25 liter contalner 25 liter contalner	
GA6HP26Z	Shell M1375.4	83 22 0 142 516		

TORQUE CONVERTER

In standard transmissions the crankshaft is linked to the transmission input shaft via the clutch assembly. Power flows from the crankshaft through the flywheel. The pressure plate transfers power to the clutch disc which is splined to the transmission input shaft. The pressure plate is used to disconnect (or interrupt) power flow to the transmission input shaft. Because the engine is mechanically connected to the driveline, power flow must be interrupted when the vehicle is stationary. Otherwise the engine would stall.

In automatic transmissions, there is a fluid coupling between the engine and transmission. This fluid coupling is more commonly referred to as the torque converter. In the torque converter there is no rigid connection between

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the engine and transmission (Except for lock up clutch). In order to understand the operation of the torque converter, we must first start with the components.

The breakdown of the components are as follows:

- The Impeller (1), which is rigidly connected to the torque converter housing.
- The Turbine (2) which is splined to the input shaft (turbine shaft) of the transmission.
- The Stator (3) which has a one-way clutch. The inner race of the one-way clutch is splined to a stationary shaft attached to the transmission.

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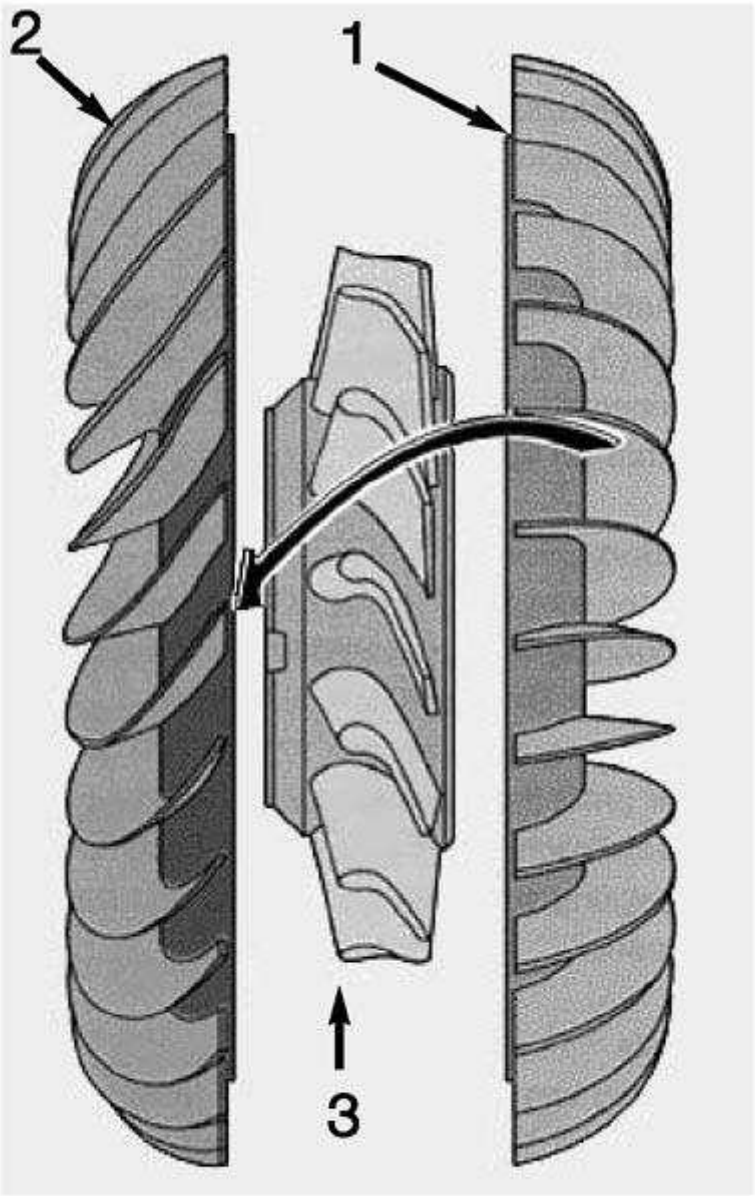


Fig. 7: Identifying Torque Converter Components
Courtesy of BMW OF NORTH AMERICA, INC.

The addition of the stator allows the fluid coupling to be referred to as a torque converter. The stator provides for a multiplication of torque at low speeds. Without the stator there would be no multiplication of torque.

When the engine is running, the impeller which is directly connected to the converter housing, rotates at engine speed. Fluid is directed from the impeller blades to the turbine blades. The fluid drives the turbine which is splined to the input (turbine) shaft of the transmission. This functions the same way as a waterfall acting on a

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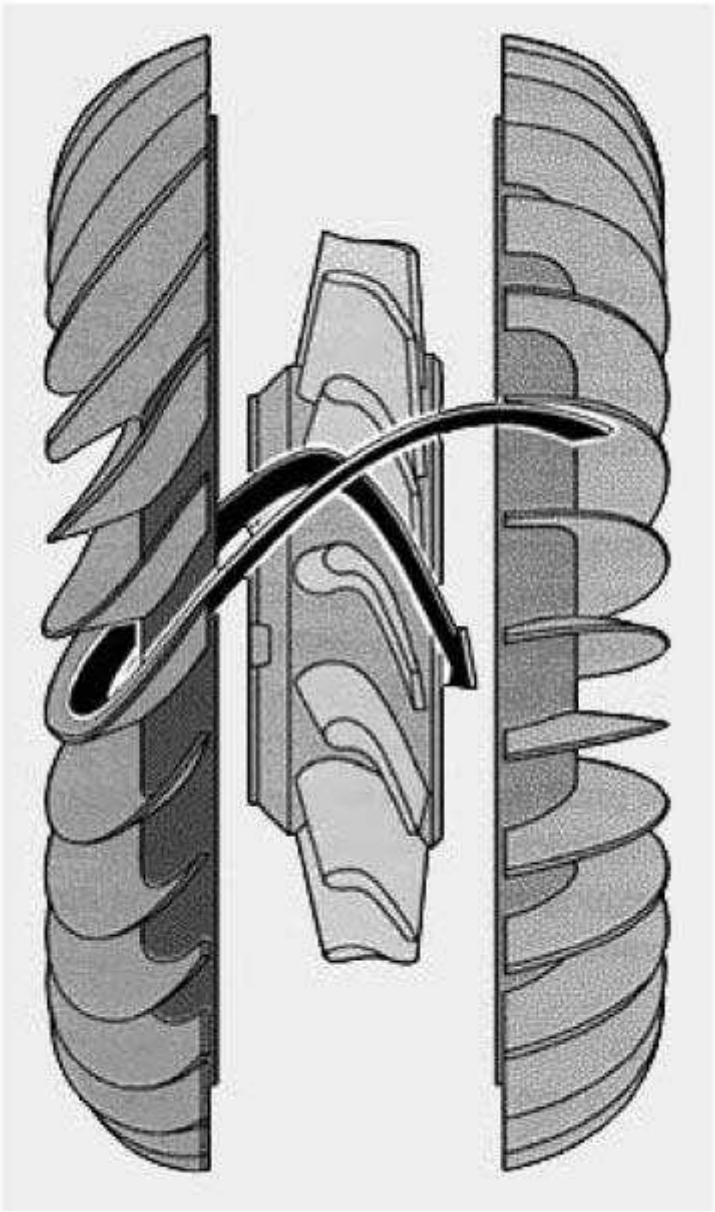
paddle wheel. The ratio of the impeller speed to turbine speed is approximately 1.1 to 1. This ratio is improved to 1:1 with the addition of the torque converter clutch which is discussed later.

Torque Converter

Torque Converter Operation At Low Speeds

1. At low engine speeds there is a large difference in rotational speed between the impeller and the turbine
2. Fluid flow is directed from the impeller to the turbine. Fluid strikes the vanes of the turbine. The turbine is driven forward in the direction of engine rotation.
3. Fluid flow is then directed back towards the impeller.
4. Before the fluid reaches the impeller, the fluid strikes the vanes of the stator.
5. When the fluid strikes the stator, the one way clutch prevents the stator from rotating.
6. The fluid is then re-directed by the curved vanes of the stator. The fluid is now flowing in the same direction as the impeller.
7. The fluid that is acting on the impeller increases the force on the impeller which multiplies torque.

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Fig. 8: Identifying Torque Converter Operation At Low Speeds
Courtesy of BMW OF NORTH AMERICA, INC.

Torque Converter Operation At High Speed

1. As engine speed increases, the turbine speed approaches the speed of the impeller.
2. The fluid flow is directed from the turbine to the back side of the impeller blades.
3. The one-way clutch in the stator unlocks and the stator blades turn in the direction of engine rotation.

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4. Fluid is no longer re-directed and torque multiplication no longer takes place.
5. This is referred to as "Coupling Speed". The turbine never reaches the same speed as the impeller as fluid flow would come to a halt. Ratio is approximately 1.1 to 1.

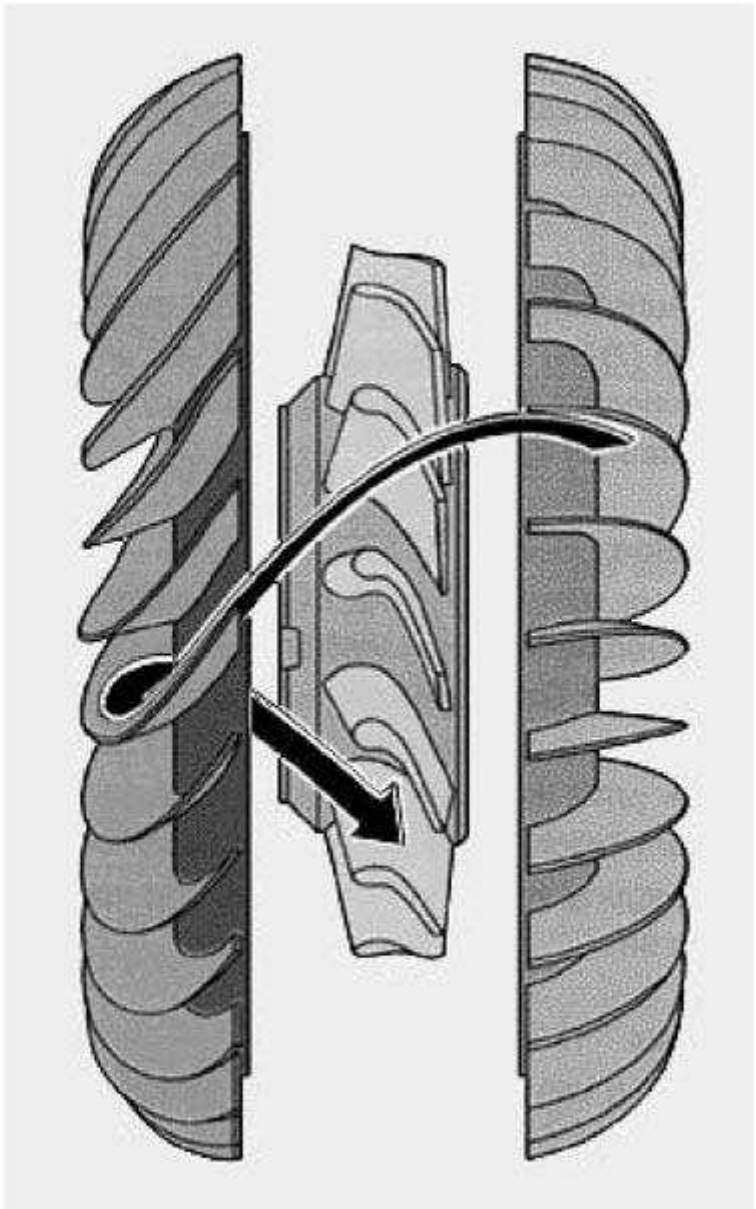


Fig. 9: Identifying Torque Converter Operation At High Speed
Courtesy of BMW OF NORTH AMERICA, INC.

TORQUE CONVERTER CLUTCH

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Since the efficiency of the torque converter at coupling speed is approximately 1.1 to 1, fuel economy is compromised. To offset this a torque converter clutch was added on EH controlled transmissions. The torque converter clutch locks the turbine to the converter housing. This creates a mechanical coupling with a ratio of 1:1. This can only be achieved at higher engine speeds, the torque converter clutch must be disengaged at low engine speeds to prevent stalling.

There are two methods for controlling the torque converter clutch on BMW transmissions:

- **A4S310/270R, 4HP22/24 EH, A5S310Z** - These transmission use an on/off control method to lock and unlock the torque converter. The TCC is either completely engaged or completely disengaged. This method of engagement provides an abrupt sensation when the TCC is locking and unlocking. This abrupt sensation can be unpleasant and undesirable to some drivers.
- **A5S560Z, A5S440Z, A5S325Z, GA6HP26Z, A5S360/390R** - These transmissions use a gradual approach to TCC control. The TCC is gradually applied and released, this method reduces the abrupt feel of the on/off type TCC. The TCC solenoid is controlled by pulse width modulation. This allows fluid to be gradually introduced and released to the TCC.

The TCC is spring loaded to the engaged position. Pressurized fluid releases the TCC, when the pressurized fluid is released, the TCC is engaged. Depending on transmission application, the TCC can be engaged in 3rd, 4th or 5th gear. The TCC must be disengaged at low speeds to prevent stalling.

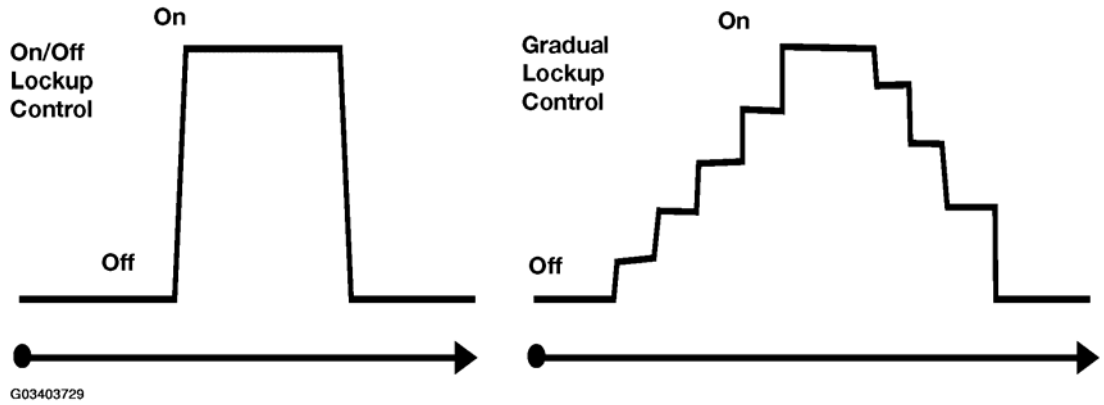


Fig. 10: Identifying Two Methods For Controlling Torque Converter Clutch On BMW Transmissions
Courtesy of BMW OF NORTH AMERICA, INC.

Example Of TCC Oil Control Circuit From The A5S440/560Z Transmission.

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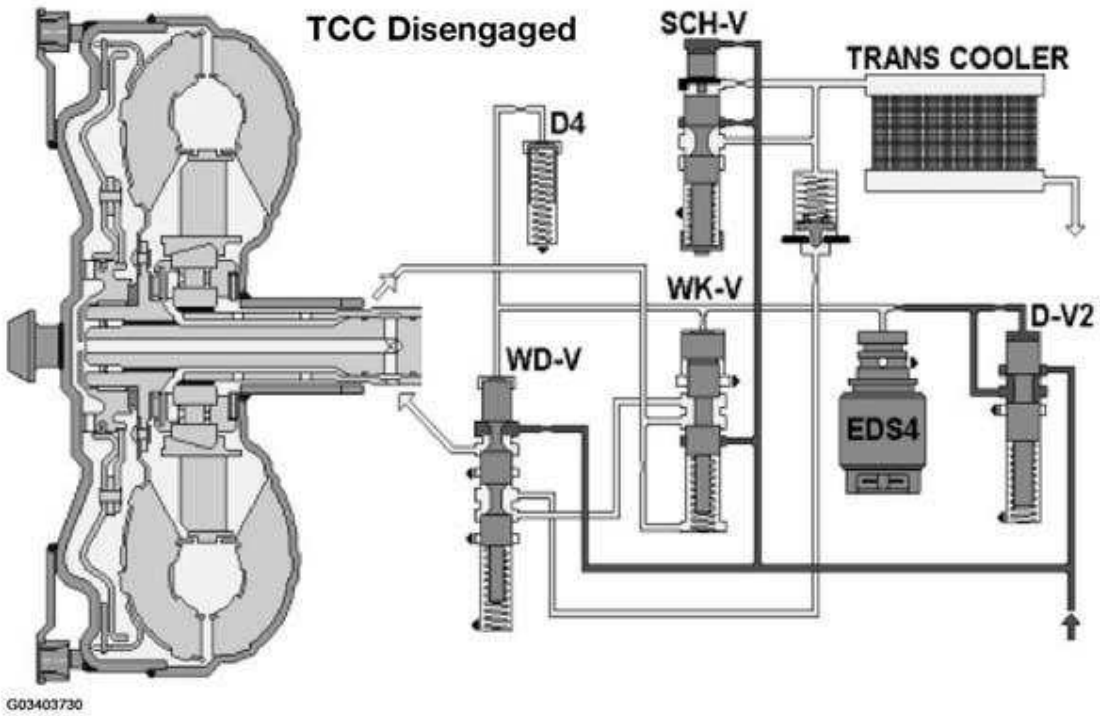
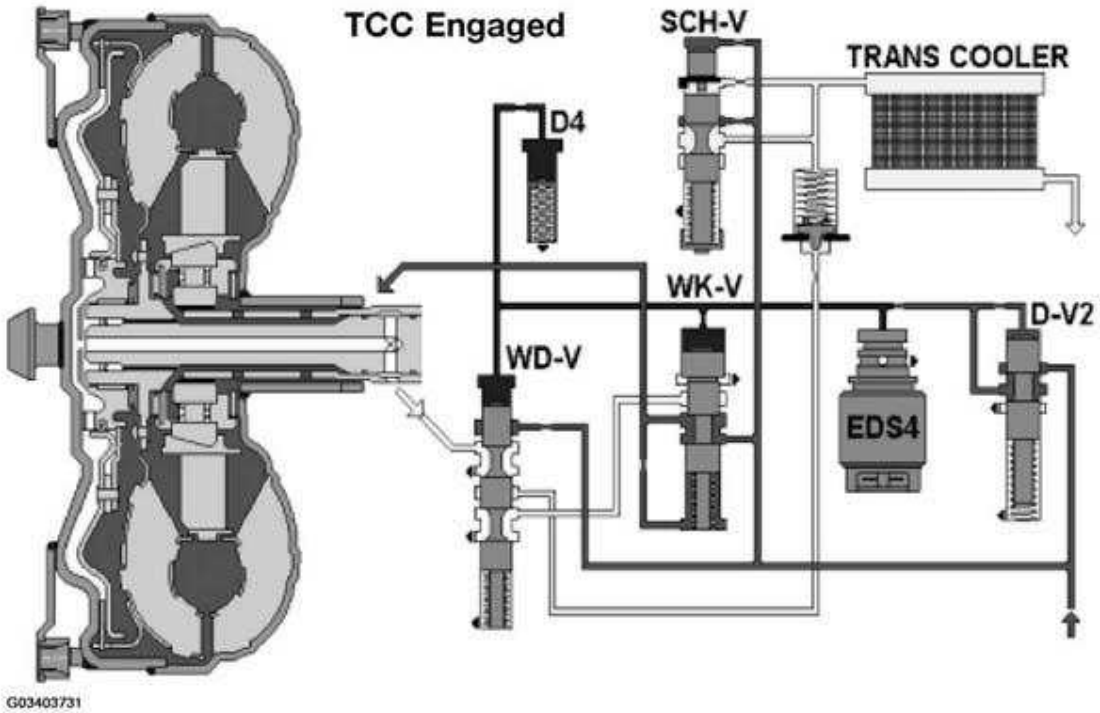


Fig. 11: Identifying TCC Oil Control Circuit From A5S440/560Z Transmission (TCC Disengaged)
Courtesy of BMW OF NORTH AMERICA, INC.



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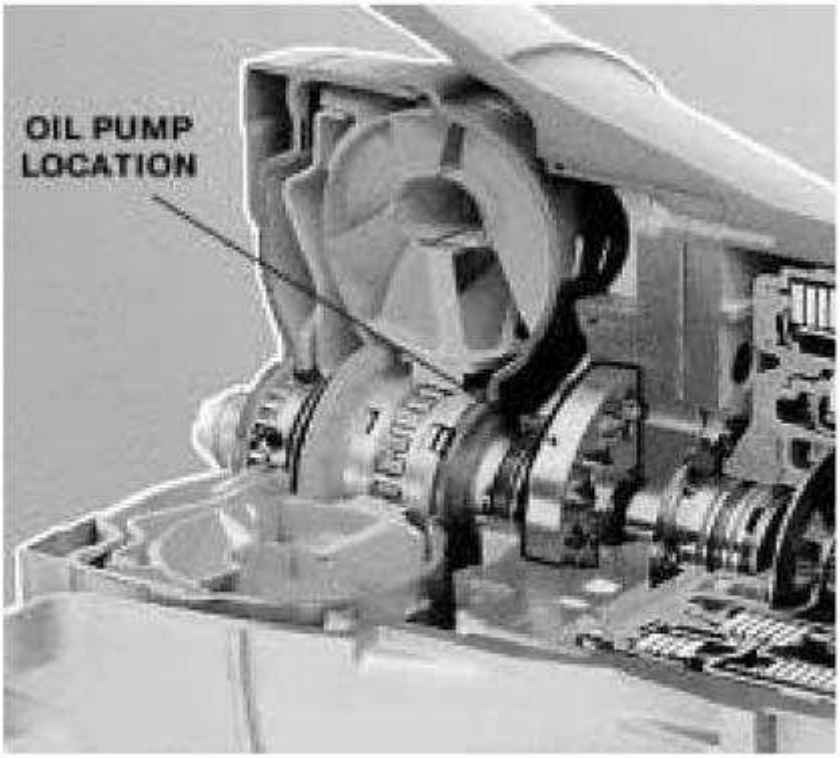
Fig. 12: Identifying TCC Oil Control Circuit From A5S440/560Z Transmission (TCC Engaged)
Courtesy of BMW OF NORTH AMERICA, INC.

OIL PUMP

The transmission oil pump is used to circulate oil and provide pressure for hydraulic operation.

The pump is driven by the torque converter shell and rotates with engine. Fluid is drawn from the sump through the filter and distributed to the various transmission hydraulic systems.

The output pressure is regulated to an operating pressure of approximately 25 bar.



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Fig. 13: Identifying Transmission Oil Pump Location
Courtesy of BMW OF NORTH AMERICA, INC.

Currently there are two types of oil pumps used in BMW transmissions; Crescent type and Vane type.

Crescent Type Oil Pump (All Except A5S360/390R)

The crescent type is an internal gear pump containing a drive gear and a driven gear. The inner gear is driven by the torque converter and acts as the impeller. The outer gear is driven by the inner gear.

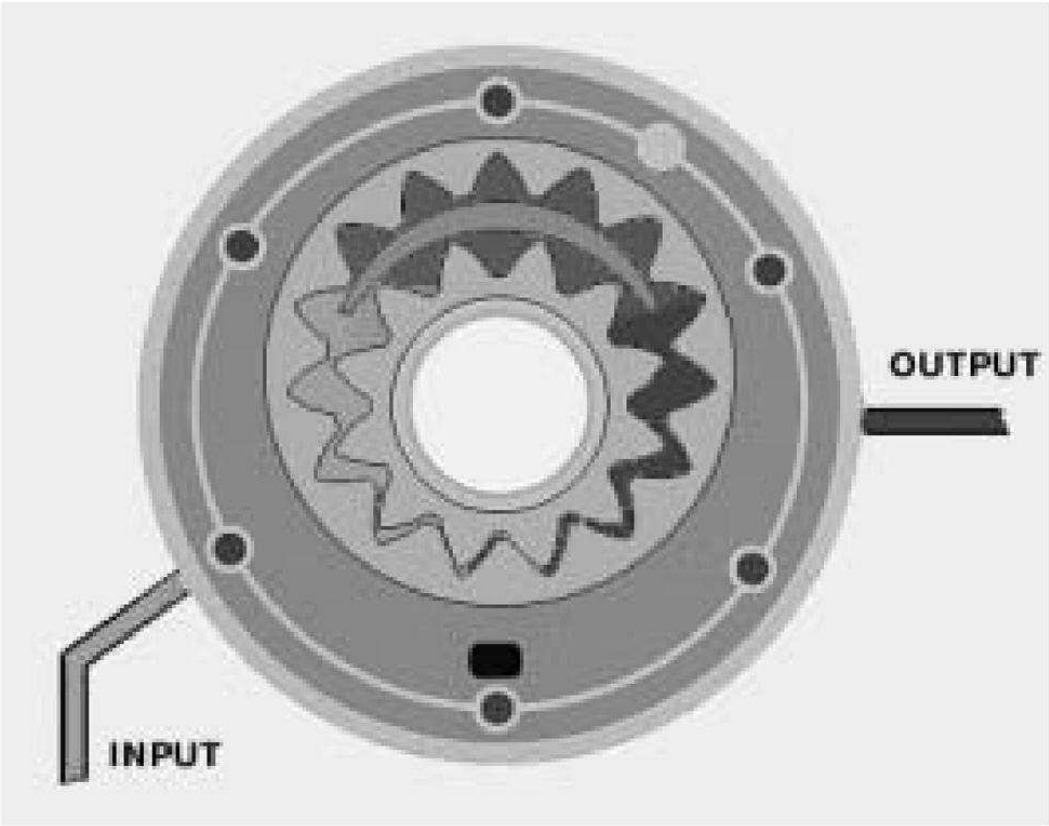
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The gap between the teeth varies from the input, through the crescent and to the output of the pump.

A low pressure area is created on the input side of the pump by the widening gap between the gear teeth.

The oil is drawn to the crescent and transferred to the output side of the pump, where the pressure is increased by the narrowing gap between the gear teeth.

The output pressure of the pump is controlled by spring loaded pressure regulator.



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Fig. 14: Identifying Crescent Type Oil Pump (All Except A5S360/390R)
Courtesy of BMW OF NORTH AMERICA, INC.

Oil Volume Control

On the A5S440Z transmission, oil pump output volume is controlled based on engine RPM. High oil volume is initially required at start up to quickly fill the transmission requirements. As engine RPM increases, the volume is greater than is required. The Oil Volume Control Damper regulates the pump output volume based on engine RPM. This helps improve fuel economy by reducing the load on the engine at high RPM.

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Vane Type Pump (A5S360/390R)

The new A5S360/390R (GM5) transmission uses a vane type pump. The torque converter drives the pump rotor and 13 vanes.

The rotor and vanes are placed inside a slide mechanism. As the rotor spins, the vanes sweep oil from the pump intake to the output along the mating surface on the vane ends and the interior surface of the slide.

The slide is mounted on a pivot pin. As it pivots, it changes the eccentricity of the rotor to slide mating surface. This in turn will alter the output oil volume. This provides the same function as the Oil Control Volume Damper on the A5S440Z.

The slide's position is influenced by a calibrated spring and hydraulic control pressure from the main pressure regulator solenoid on the valve body.

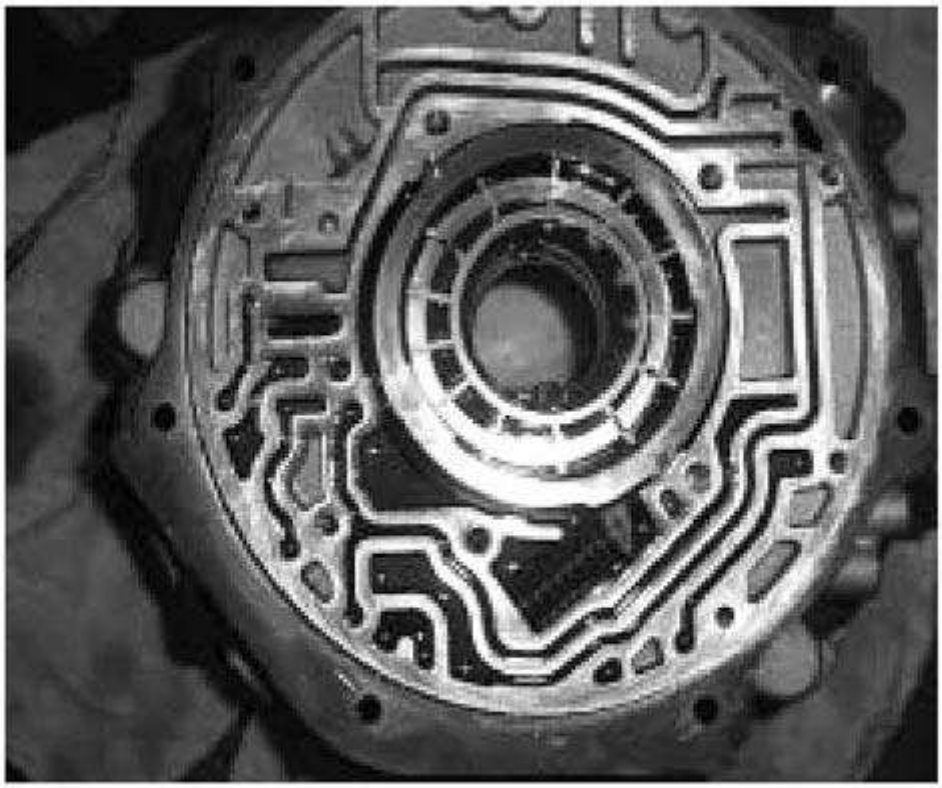


Fig. 15: Identifying Vane Type Pump (A5S360/390R)
Courtesy of BMW OF NORTH AMERICA, INC.

The benefit of changing the slide position is to optimize pump output volume to meet the following operating conditions:

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- Provide maximum volume during engine start-up. This condition provides a fast priming action of the pump for immediate lubrication and for hydraulic pressure operation.
- Regulated output volume at higher engine speeds. Maximum pump volume is not required at all times.

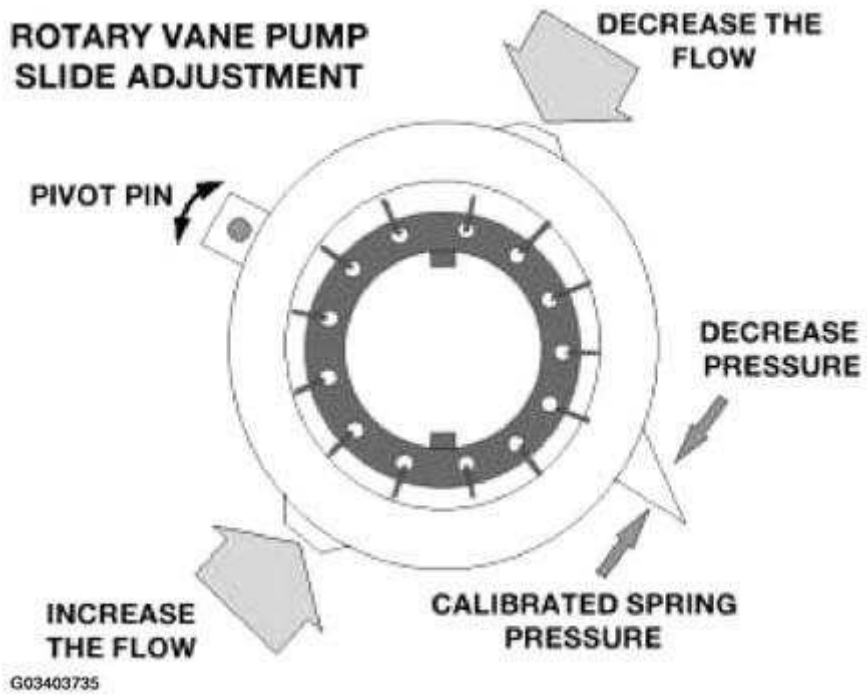


Fig. 16: Identifying Rotary Vane Pump
Courtesy of BMW OF NORTH AMERICA, INC.

HYDRAULIC CONTROL COMPONENTS

Electro/Hydraulic Valve Body

The valve body assembly is the main shift control element in the transmission. In non-EH transmissions the valve body was only hydraulically controlled. In the current EH (electrohydraulic) transmissions the valve body is similar in design, but now also housing a number of shift solenoids which are controlled by the TCM.

The valve body consists of a number of sub-assemblies. Each sub-assembly contains a number of spool valves which are hydraulically controlled. Most spool valves are opposed by spring pressure. The spool valves are used to direct hydraulic fluid flow to the various shift elements in the transmission. There is also a manual valve which is connected to the shift assembly by a cable. The manual valve allows the drivers to select the basic operating mode (or ratio).

The valve body is responsible for the following:

- Regulating Main Pressure
- Controlling fluid flow to shift elements for Upshifts and Downshifts.

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- Providing for manual operation by driver via manual valve.
- Reverse Lockout
- Fail-safe Operation
- Shift Comfort through: Overlap Shift Control (ZF) Pressure Accumulators (GM)
- Torque Converter Control
- Distribution of lubrication.

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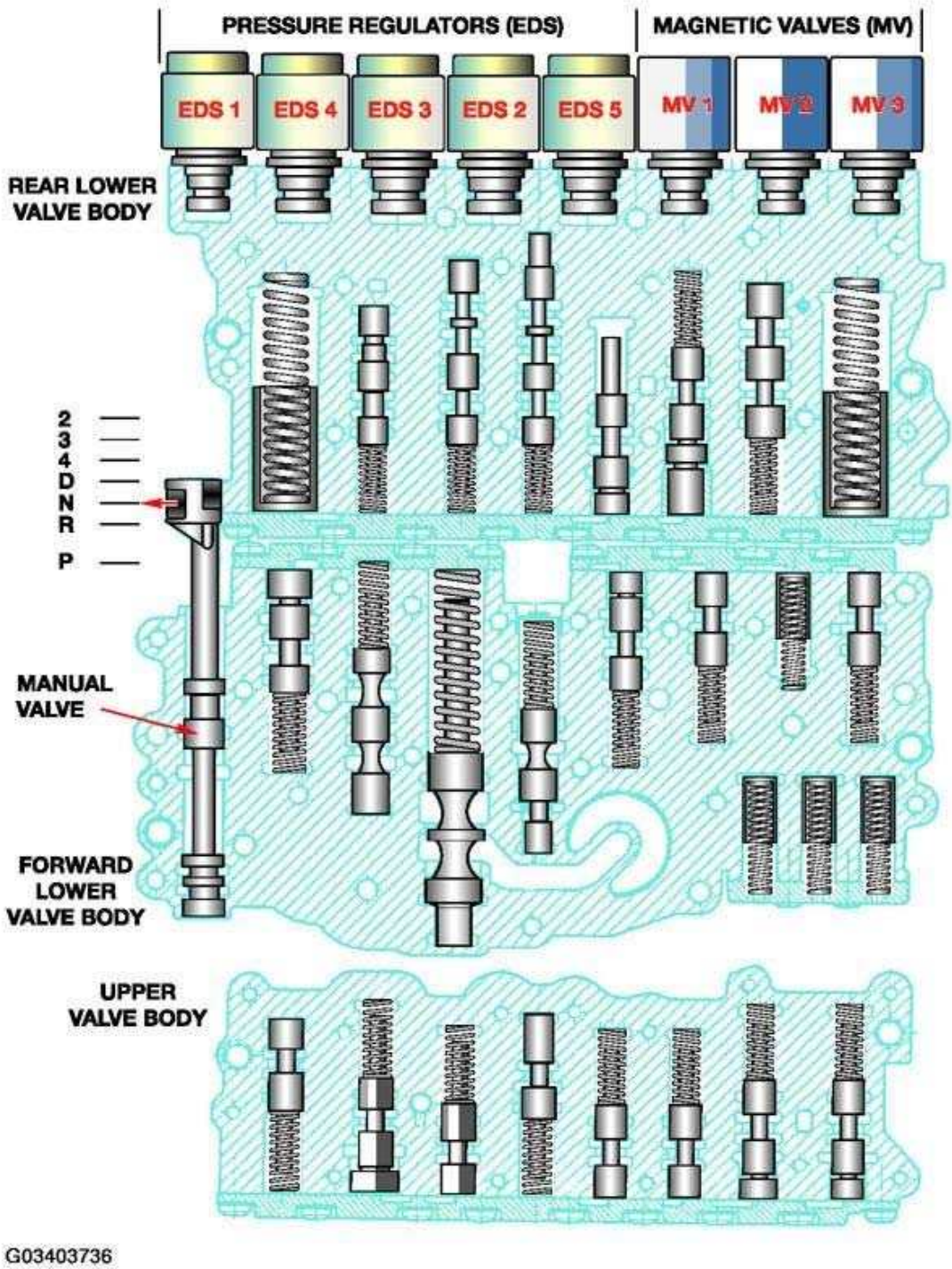


Fig. 17: Identifying Electro/Hydraulic Valve Body
Courtesy of BMW OF NORTH AMERICA, INC.

Shift Valves

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Shift valves are used to direct application pressure to the various shift elements. Shift valves are regulated by spring pressure and control pressure for the shift solenoids. Shift valves come in various configurations depending upon application and transmission type. The most basic is the 3/2 shift valve. The 3/2 shift valve has 2 positions which are switched through one or two control pressures.

With no control pressure from shift solenoid present, the shift valve is moved to its end travel (left) by spring pressure.

Operating pressure is blocked to the shift component. Also in this position any application pressure is drained from the shift component.

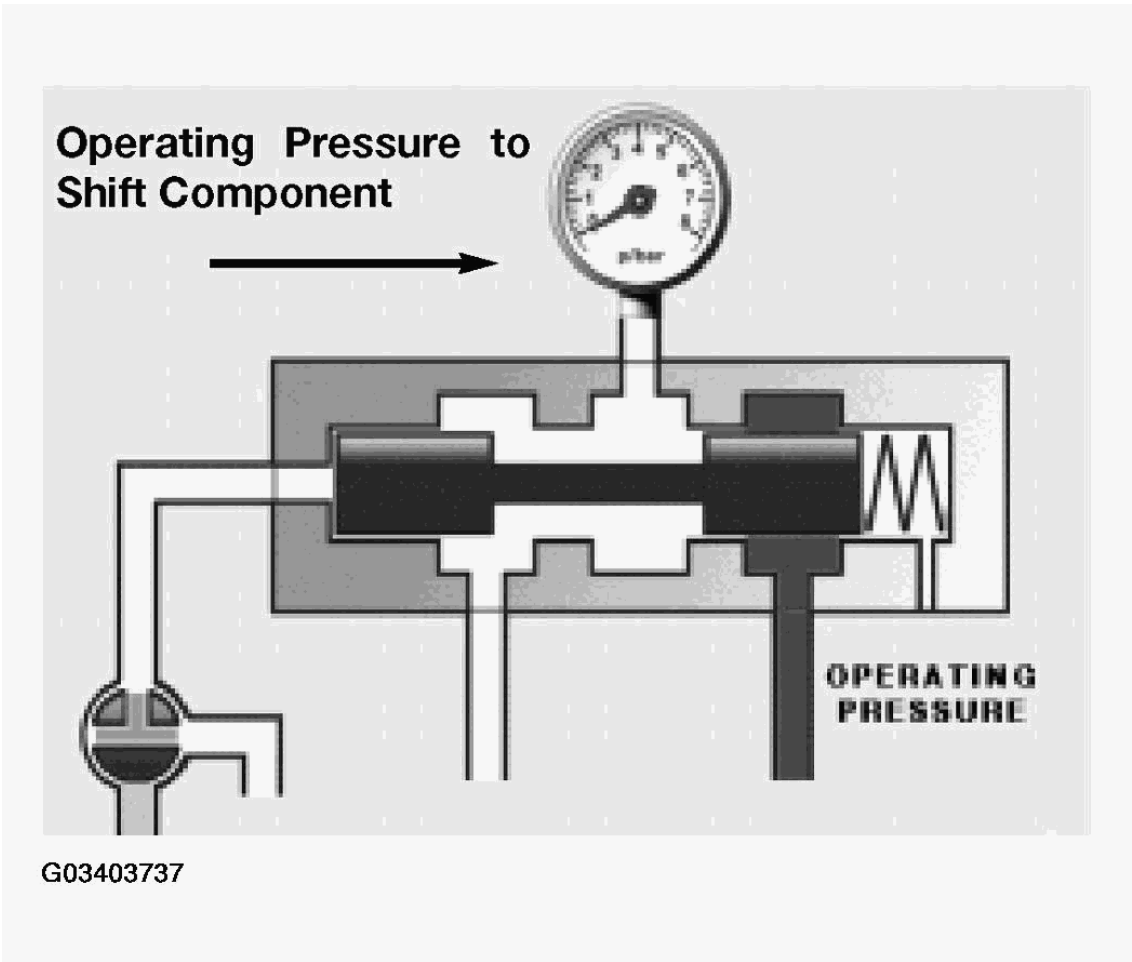


Fig. 18: Identifying Blocked Operating Pressure To Shift Component
Courtesy of BMW OF NORTH AMERICA, INC.

Once the control pressure is applied to the 3/2 shift valve, the shift valve moves to the right.

This allows operating pressure to reach the shift component.

When the control pressure is again reduced, spring pressure returns the 3/2 shift valve to the rest position. This drains and operating pressure from the shift component.

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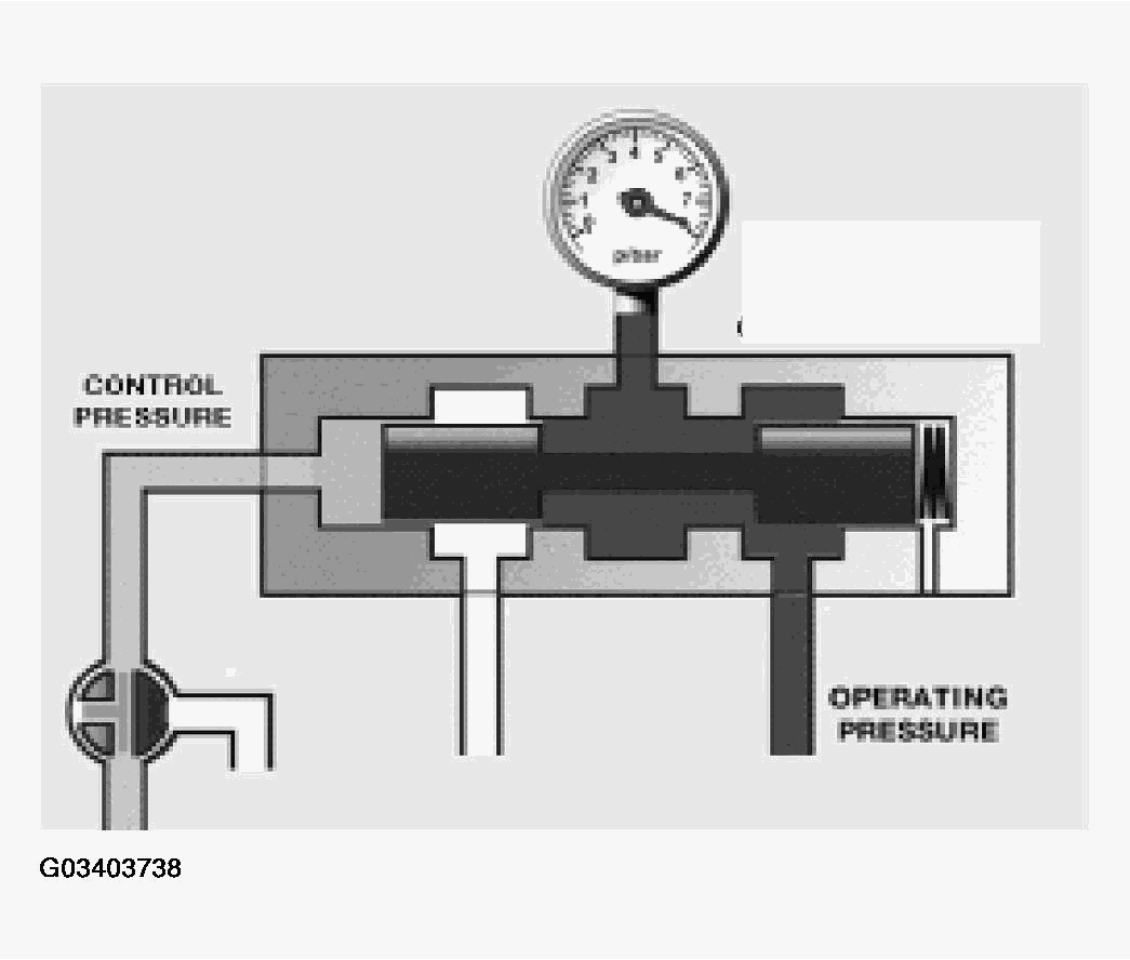
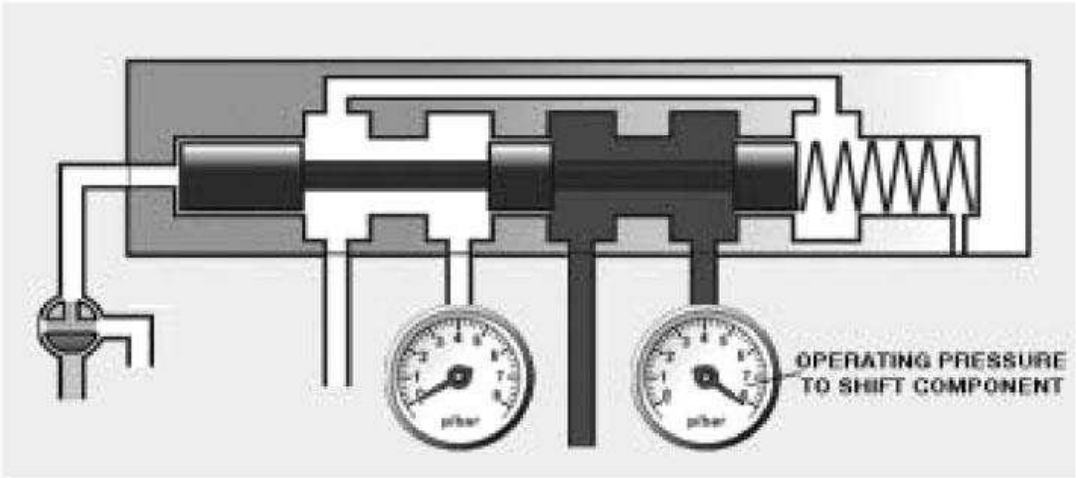


Fig. 19: Identifying Operating Pressure To Reach Shift Component
Courtesy of BMW OF NORTH AMERICA, INC.

The example shown at right is a 4/2 shift valve. The operation is similar to the 3/2 valve. The primary difference is that the 4/2 shift valve affects 2 shift components.

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Fig. 20: Identifying Primary Difference 4/2 Shift Valve Affects 2 Shift Components
Courtesy of BMW OF NORTH AMERICA, INC.

PRESSURE REGULATION

Pressurized oil from the pump must be regulated for use within the transmission. Otherwise, the high pressure directly from the pump would influence shift quality. The shifts would be more abrupt and harsh. In order to "fine tune" the pressures within the transmission, there is a pressure regulating valve and a pressure regulating solenoid. The pressure regulating valve is located in the oil pump housing or the valve body dependent upon transmission type.

The pressure regulating solenoid is a pulse width modulated (PWM) solenoid. Current is controlled by the TCM. The pressure regulating solenoid is normally closed, there is maximum line pressure available when minimum (or no) current is applied to the pressure regulating solenoid. Depending upon application, pressure regulating solenoid can be PWM with B- or B+ control. GM transmissions use B+ control with a constant ground supply. ZF transmissions uses B- control with a constant B+ supply.

There are also pressure regulators used in ZF transmissions that are used to control shift pressures. The A5S440Z and A5S560Z both use EDS solenoids for "Overlap Shift Control" this will be explained later in this text.

There are a few different names for pressure regulating solenoids depending upon the transmission type and manufacturer:

- ZF transmissions use the following terms - EDS solenoid (valve), or MV (magnetic valve).
- Hydramatic (GM) transmissions use the following terms: DR solenoid, Force Motor Solenoid or Variable Bleed Solenoid.

Transmission operating pressures are regulated based on engine speed, throttle angle and engine load. The regulated pressure from the pressure regulating solenoid is referred to as throttle pressure. This pressure is fed to

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the main pressure regulating valve.

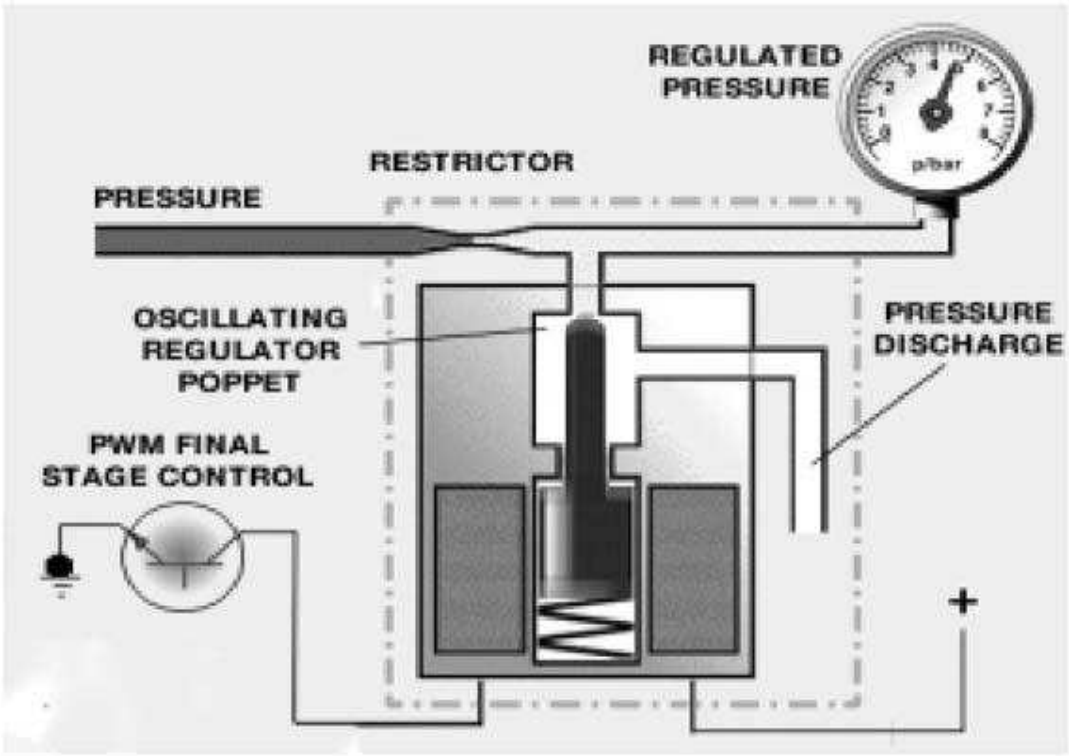


Fig. 21: Identifying Transmission Operating Pressures
Courtesy of BMW OF NORTH AMERICA, INC.

Pressure Regulation

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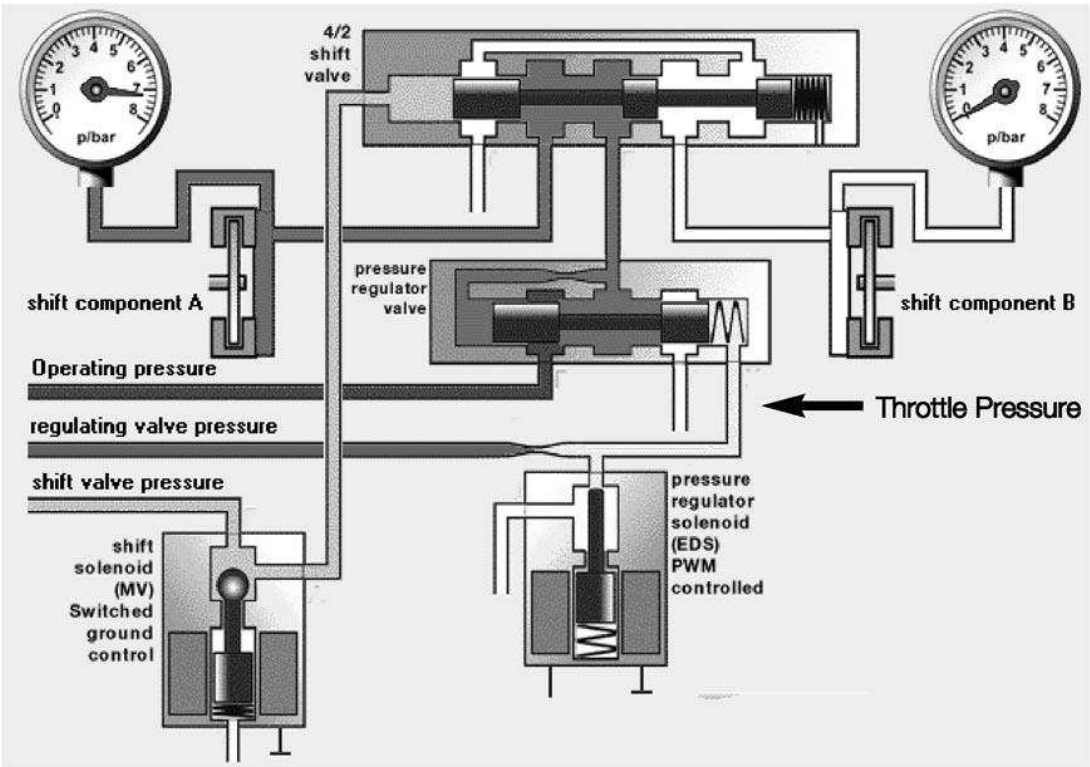


Fig. 22: Identifying Pressure Regulation
Courtesy of BMW OF NORTH AMERICA, INC.

As the diagram shows, regulating valve pressure is fed to the pressure regulating solenoid. This pressure is then regulated to create throttle pressure. Throttle pressure is modified based on throttle angle, engine speed and engine load. Throttle pressure is then fed to the pressure regulating valve. As throttle pressure increases, the regulating valve piston is moved to the left (with respect to the diagram). As the regulating valve piston is moved to the left, operating pressure is increased to the 4/2 shift valve. The operating pressure to the 4/'2 shift valve will be fed to Shift Component A or Shift Component B depending the position on the 4/2 shift valve. The operating pressure to the shift components will be increased or decreased depending upon the throttle valve pressure. As engine speed and load are increased, the operating pressure will be increased to provide higher clamping forces on the shift components.

When there is no electrical power present to the pressure regulator solenoid, throttle pressure will be a maximum. Therefore maximum operating pressure will be available at the 4/2 shift valve. This condition would exist if the transmission was operating in fail-safe mode.

APPLY COMPONENTS

Multi - Plate Clutches And Brakes

Multi Plate Clutches and Brakes are used to drive or hold members of the planetary gear set. As a general rule, Multi Plate Clutches connect one planetary member to another. Multi Plate Brakes connect a planetary member

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to the case to hold it stationary.

The clutches and brakes consist of a number of friction discs and steel discs. The friction discs are coated with a friction material and have engaging lugs (splines) on the inner perimeter. The steel discs are steel on both sides and have engaging lugs located on the outer perimeter. The engaging lugs on the friction discs are usually engaged with a planetary member. The engaging lugs on the steel discs are usually engaged with the clutch piston housing.

In addition to the friction and steel discs, there is also an apply piston, housing and return spring. Once hydraulic fluid is applied to the clutch assembly, the friction discs and steel discs will be locked together. Once hydraulic pressure is released, the return spring will cause the clutch piston to return to its rest position which will unlock the clutch assembly.

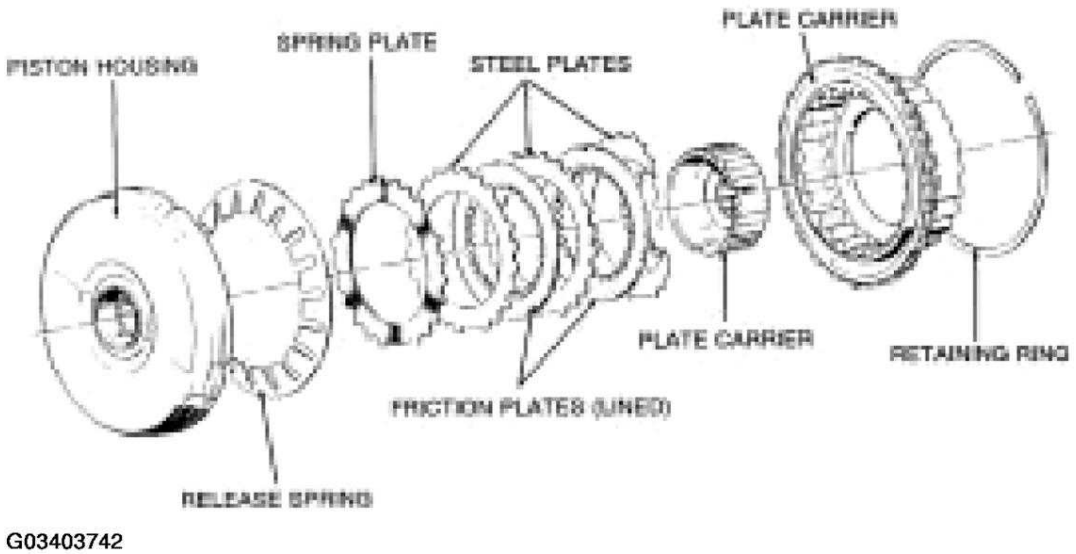


Fig. 23: Exploded View Of Multi - Plate Clutches
Courtesy of BMW OF NORTH AMERICA, INC.

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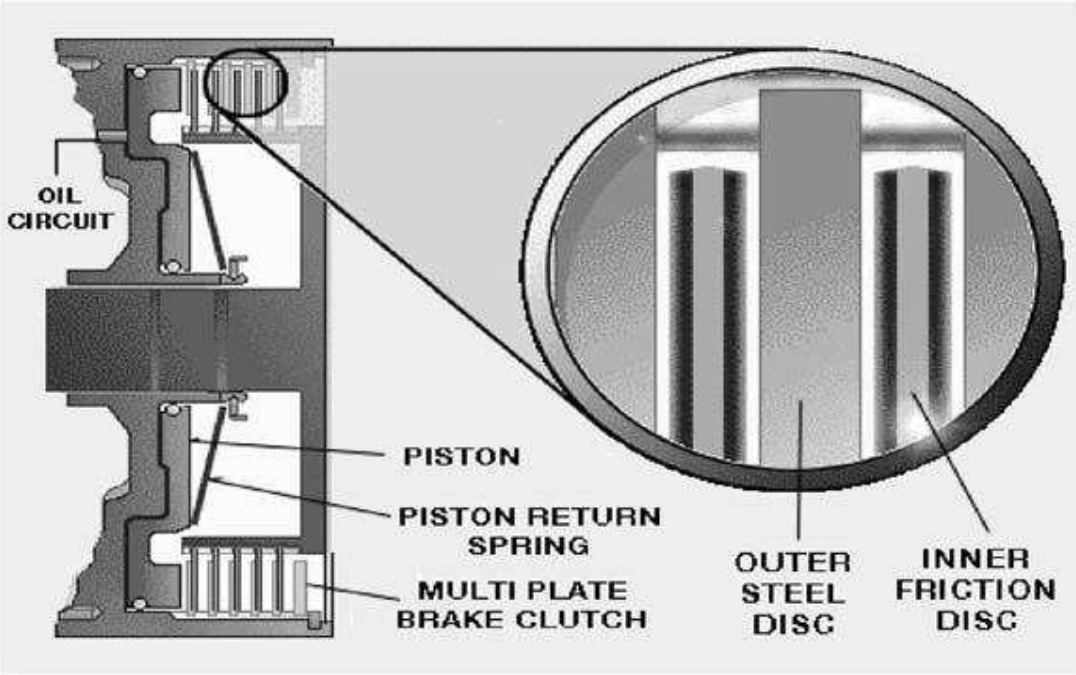


Fig. 24: Identifying Friction Discs And Steel Discs
Courtesy of BMW OF NORTH AMERICA, INC.

Multi - Plate Clutch Operation

In order to carry out a shift in ratio, fluid needs to be applied or released from the Multi - Plate Clutch (or Brake). As shown in the example , the following sequence occurs:

1. Fluid from a shift valve in the valve body is applied to the clutch assembly. (Figure A, see **Fig. 25**.)
2. Fluid pressure builds behind the apply piston and overcomes the resistance from the diaphragm spring. (Figure A, see **Fig. 25**.)
3. The friction and steel discs are compressed together and become locked, preventing any slippage between them. (Figure A, see **Fig. 25**.)
4. Two planetary members are now locked together.
5. When fluid pressure is released, the steel and friction discs are allowed to unlock. (Figure B, see **Fig. 25**.)
6. The diaphragm spring pushes against the apply piston and returns the piston back to the rest position. (Figure C, see **Fig. 25**.)
7. The check ball in the apply piston is unseated by centrifugal force which allows the clutch to drain completely.

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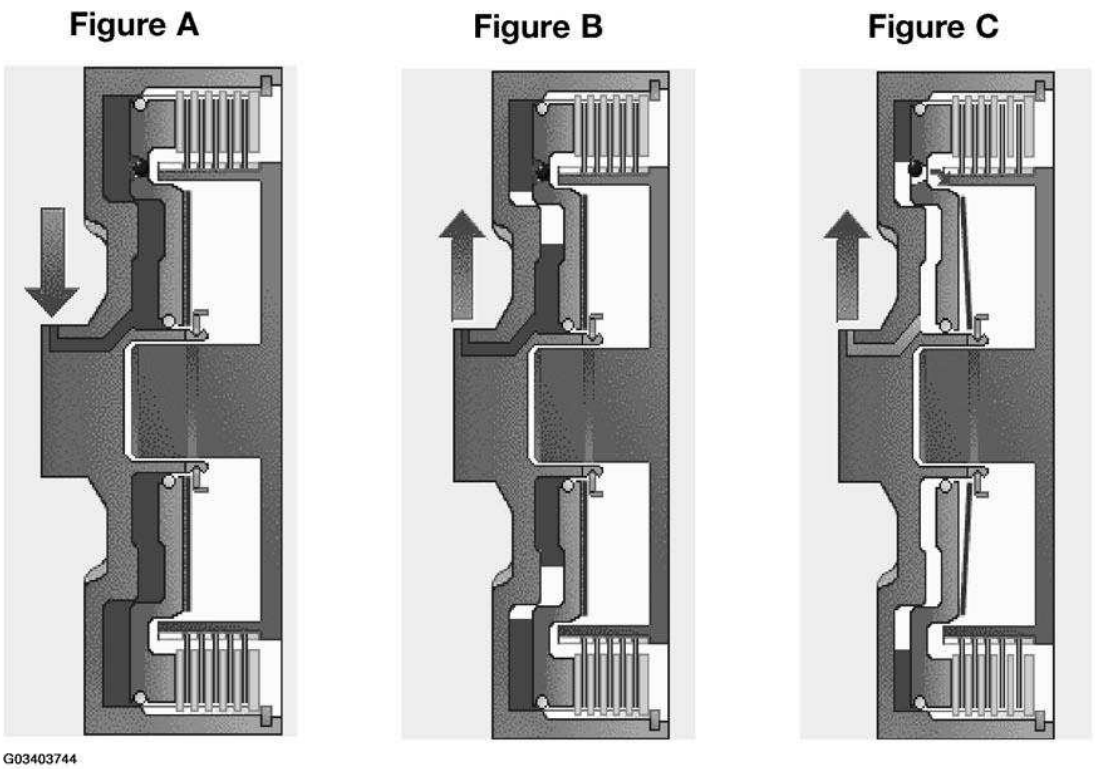


Fig. 25: Identifying Multi - Plate Clutch Operation
Courtesy of BMW OF NORTH AMERICA, INC.

Band Brakes

On some BMW transmissions there is a band type brake used for some applications. The A4S270/310R and the A5S310Z use a band type brake. The brake band is a circular band with friction material bonded to the inner surface. The band wraps around a particular planetary component (clutch drum) and locks that component to the transmission case. The brake band is applied and released by the clutch apply piston.

The brake band is not adjustable on the A5S310Z, however there is some adjustment allowed when needed on the A4S270/310R.

The brake band functions in the following manner on BMW transmissions:

- **A4S270/310R** - The brake band is active (applied) in first and second gear. The brake band holds the reaction sun drum stationary. The reaction sun drum is splined to the reaction sun gear.
- **A5S310Z** - The brake band is active (applied) in second, third and fifth gear. The brake band holds the forward sun gear to the case.

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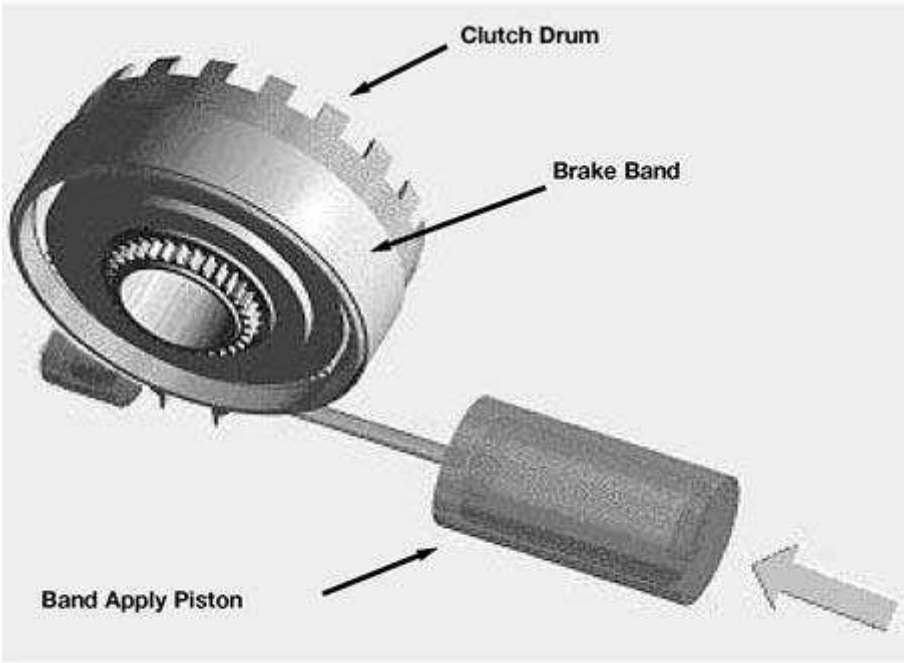


Fig. 26: Identifying Band Brakes
Courtesy of BMW OF NORTH AMERICA, INC.

One-Way Clutches (Freewheel)

The one way clutch consists of an inner and outer ring with a locking device between the two. The one way clutch is designed to lock in one direction and to allow free rotation in the other direction. Currently there are two types of one way clutches used in BMW transmissions:

- Roller type which consists of spring loaded rollers between the inner and outer race of the one way clutch. (Roller type is also used without springs on some applications)
- Sprag type which consists of asymmetrically shaped wedges located between the inner and outer race of the one way clutch.

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Fig. 27: Identifying Roller Type One Way Clutch
Courtesy of BMW OF NORTH AMERICA, INC.

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Fig. 28: Identifying Sprag Type One Way Clutch
Courtesy of BMW OF NORTH AMERICA, INC.

In both versions of the one way clutch (freewheel), rotation is only allowed in one direction. Using the diagrams above, imagine that the inner races were locked stationary. The outer race would only be allowed to turn counter clock wise. In the clock wise direction, the outer race of both versions would be locked. In the roller type, the helper springs would push the rollers up the ramp on the outer race. This would force the rollers in to the smaller area which would cause the outer race to lock, In the sprag type, the asymmetrical wedges would lock between the inner and outer race.

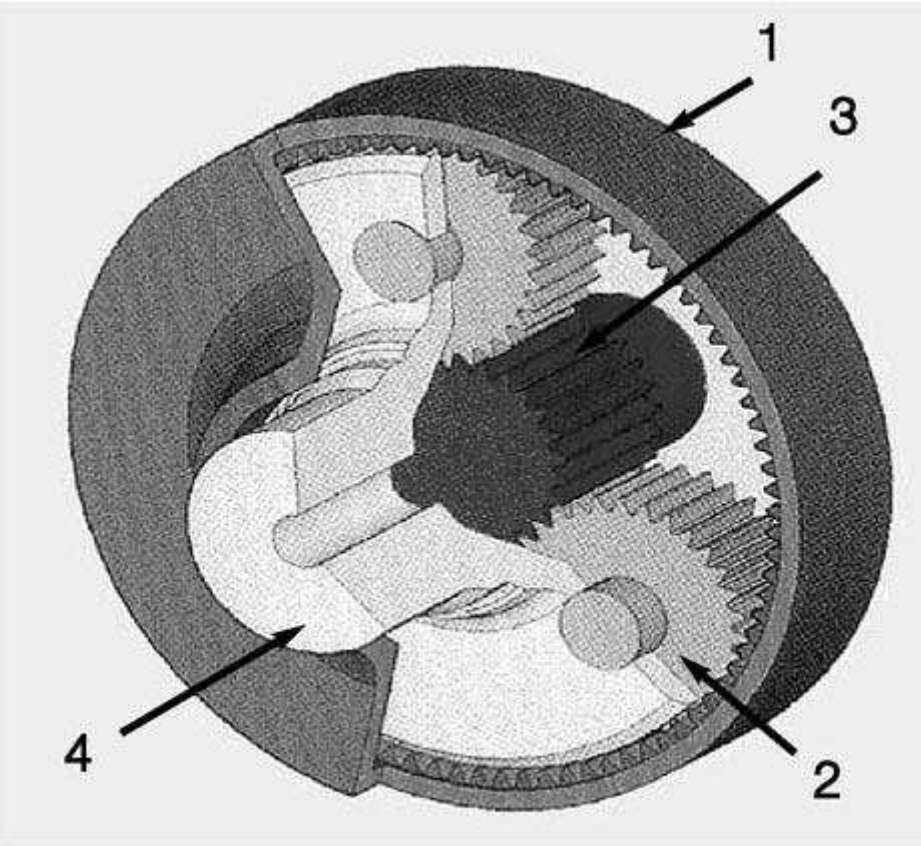
The one way clutches are used in the transmission to prevent an interruption of drive torque during certain gear shifts and to allow engine braking during coasting. Also there is a one way clutch in the stator of the torque converter.

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PLANETARY GEAR SET

Planetary gear seats are compact gear units that receive input drive torque and provide the required output ratios for all forward gears and reverse gear. The planetary gear set consists of four main components:

1. Internal Ring Gear
2. Planetary Gears (pinions)
3. Sun Gear
4. Planetary Gear Carrier



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Fig. 29: Identifying Planetary Gear Set
Courtesy of BMW OF NORTH AMERICA, INC.

Various ratios are obtained by driving or holding different components in the planetary gear set. The example shown at right is a simple planetary gear set. Today's modern transmissions use a combination of multiple planetary gear sets referred to as a compound planetary gear set.

Advantages Of Planetary Design

There are distinct advantages to the planetary gear set in comparison with a standard transmission gear set.

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Primarily, drive torque does not need to be interrupted to change gears. The planetary members are in constant mesh and there are more teeth engaged in any given ratio. This allows more torque to be transferred through the transmission.

Basic Power Flow

In the example shown at left, let's follow through an example of power flow in reverse gear:

The Planetary gear carrier (4) is held stationary. The sun gear (3) is driven in a clockwise direction. The planetary pinions (2) are driven counterclockwise, which in turn drives the internal ring gear (1) counter clockwise as well.

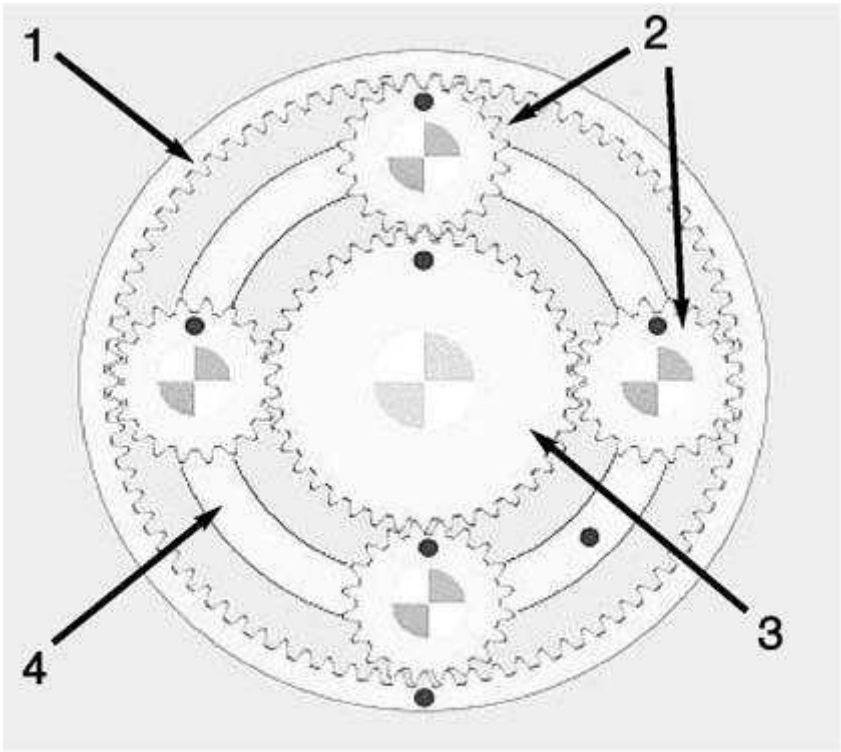


Fig. 30: Identifying Basic Power Flow
Courtesy of BMW OF NORTH AMERICA, INC.

COMPOUND PLANETARY GEAR SETS

Compound planetary gear sets use multiple planetary components which are a variation on the simple planetary gear set. Since the inception of the simple planetary gear set, there have been numerous compound gear sets introduced. BMW transmissions use the following gear sets:

- Simpson Gear Set - used on 4HP22 and 4HP24

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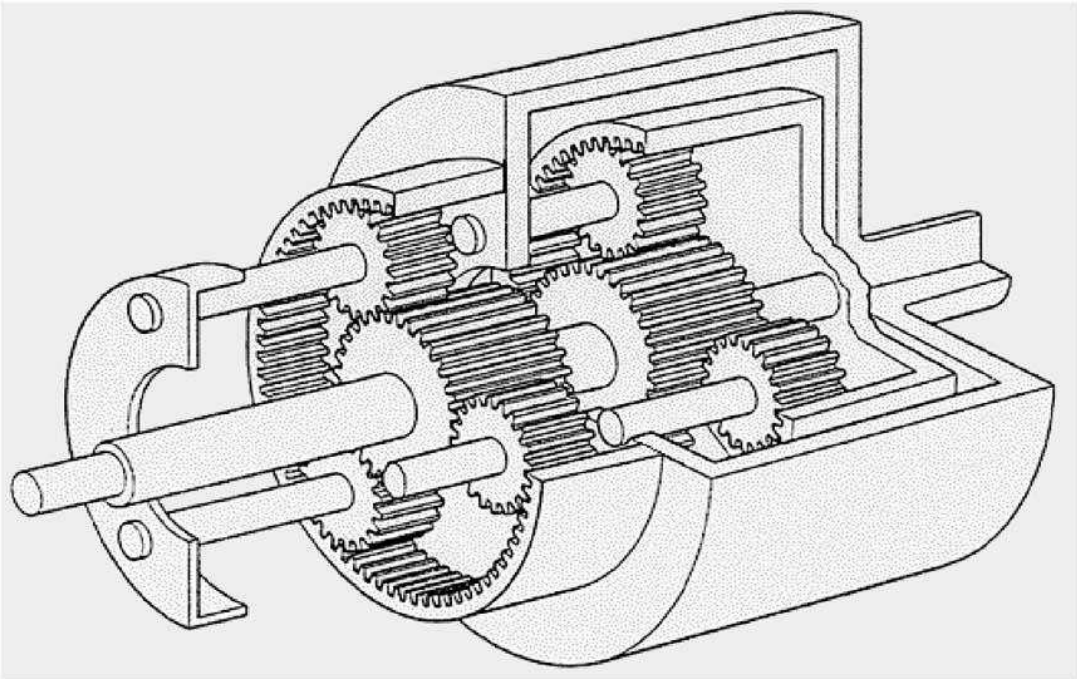
- Ravigneax Gear Set - used on A4S270R, A4S310R, A5S310Z, A5S325Z, A5S360R and A5S390R.
- Wilson Gear Set - used on A5S440Z and A5S560Z
- Lepelletier Gear Set - used on the GA6HP26Z.

Simpson Gear Set

The Simpson Gear Set is one of the early variations on the simple set. It is capable of 3 forward gears and one reverse. On BMW transmissions, the Simpson Gear set is used in the 4HP transmission which is a four speed automatic. Fourth gear (overdrive) is obtained by the addition of an auxiliary gear set (simple).

Characteristics of the Simpson Gear set are as follows:

- Two Internal Ring Gears, one rear input ring and one attached to the rear planetary carrier.
- Two Planetary carriers, each containing three planetary pinions.
- One common Sun gear, which meshes with both sets of planetary pinions.



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Fig. 31: Identifying Simpson Gear Set
Courtesy of BMW OF NORTH AMERICA, INC.

Ravigneaux Gear Set

A new variation on the planetary design is the Ravigneaux gear set. This gear set is capable of 4 forward gears and one reverse. However, depending upon application it may be used with an auxiliary gear set. Here are some examples:

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- A4S310/270R uses the Ravigneax set for 3 forward gears and one reverse. Overdrive is obtained by the auxiliary gear set.
- A5S310Z uses a combination of the Ravigneaux gear set and the auxiliary gear set to obtain 5 forward gear and one reverse. First, second and reverse gears are achieved by using a combination of both gear sets.
- The A5S360/390R uses a modified version of the ravigneaux set that provides five forward gears and one reverse. There is no auxiliary gear set used.

Characteristics of the Ravigneaux Gear Set are:

NOTE: The Ravigneaux Gear Set shown below is a typical representation, refer to Fig. 32. There are a few variations of this arrangement used on BMW transmissions.

- One planetary carrier which is common to both sets of planetary pinions.
- Two sets of planetary pinions, one long set with small diameter and one short set with large diameter.
- Two sun gears, one input sun gear and one reaction sun gear.
- One common ring gear.

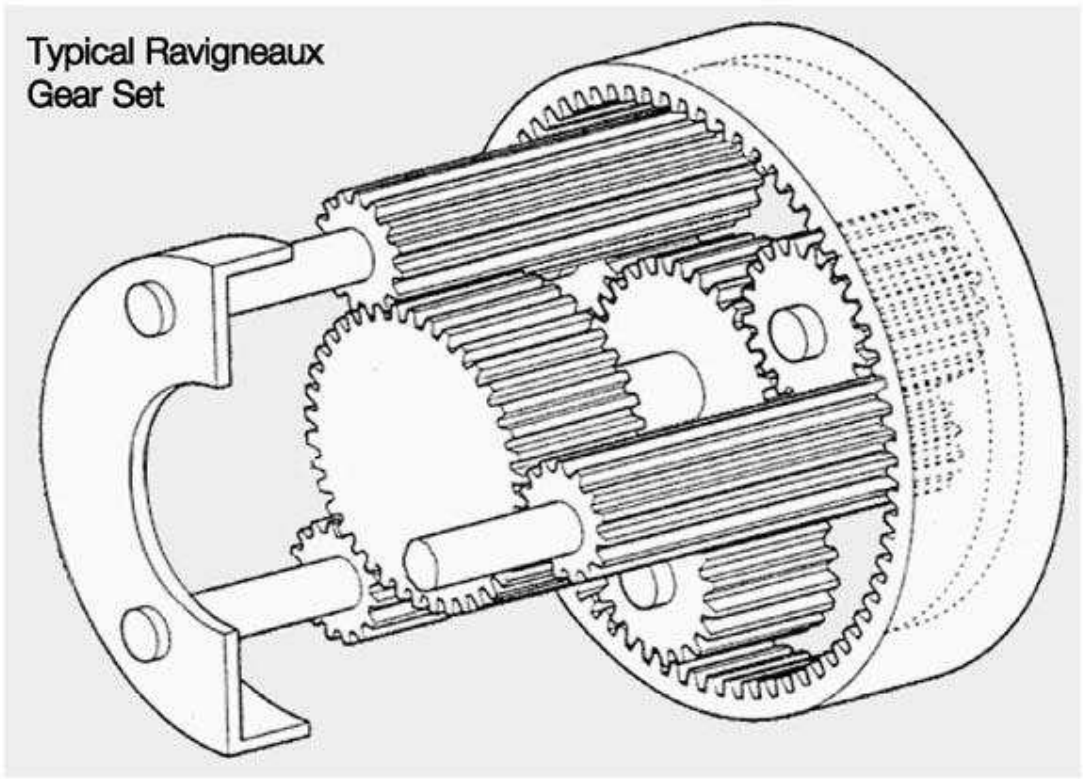


Fig. 32: Identifying Ravigneaux Gear Set
Courtesy of BMW OF NORTH AMERICA, INC.

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Wilson Gear Set

On BMW transmissions, the Wilson gear set is only used on the A5S440Z and A5S560Z. The Wilson Gear Set consists of three planetary gear sets.

The ring gear of the first gear set, the planetary carrier of the second gear set and the ring gear of the third planetary gear set and directly connected to the "Pot". The "Pot" is a cylindrical device that slides over all of the components to unitize the individual gear sets into an assembly.

The characteristics of the Wilson Gear Set are:

- Three planetary carriers.
- Three ring gears, with ring gear 1 and 3 meshed to "Pot" assembly.
- Three sun gears, sun gear 2 and 3 are common. (Attached). Sun gears 2 and 3 are also referred to as the "Double Sun Gear"

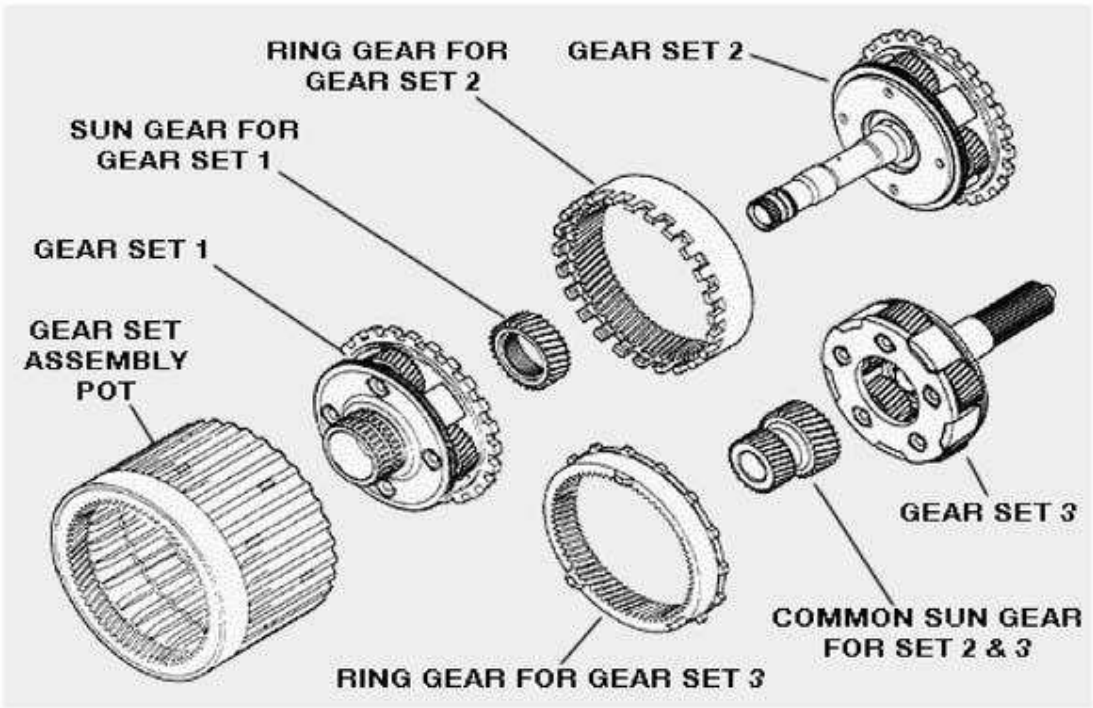


Fig. 33: Exploded View Of Wilson Gear Set
Courtesy of BMW OF NORTH AMERICA, INC.

Lepelletier Gear Set

The Lepelletier Gear Set was introduced to BMW on the ZF GA6HP26Z. This gear set allows for 6 forward speeds and one reverse gear using a light weight design. The planetary gear train consists of a single carrier planetary gear train and a downstream double planetary gear train.

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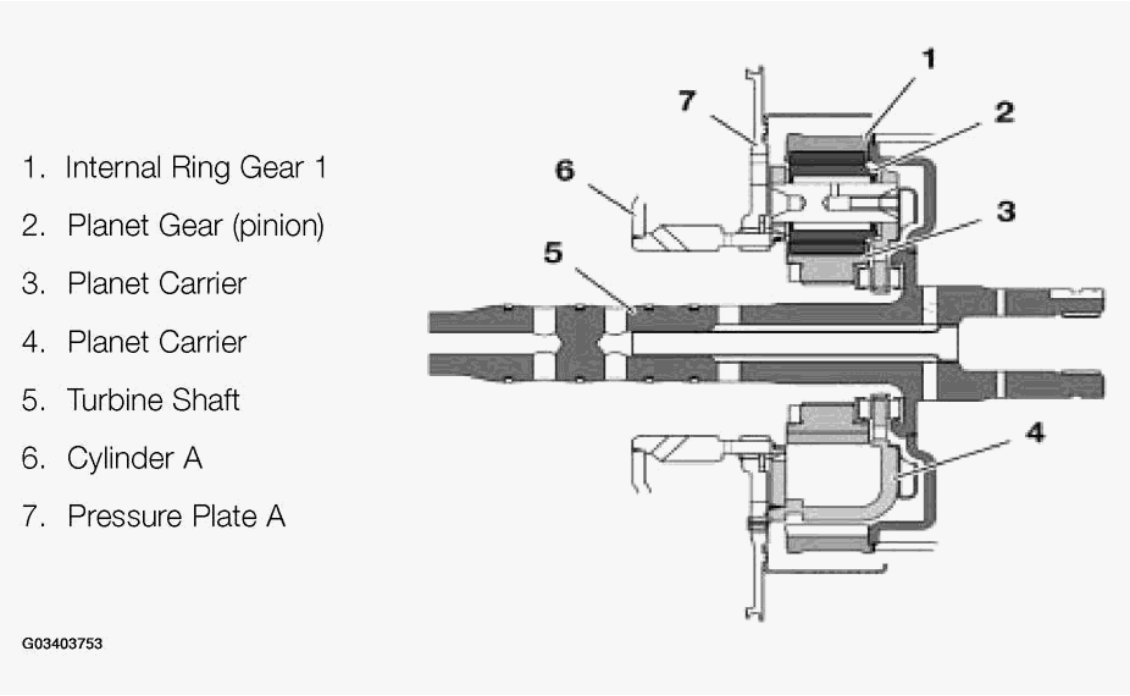


Fig. 34: Identifying Cross Section View Of Lepelletier Gear Set
Courtesy of BMW OF NORTH AMERICA, INC.

Double Planetary Set

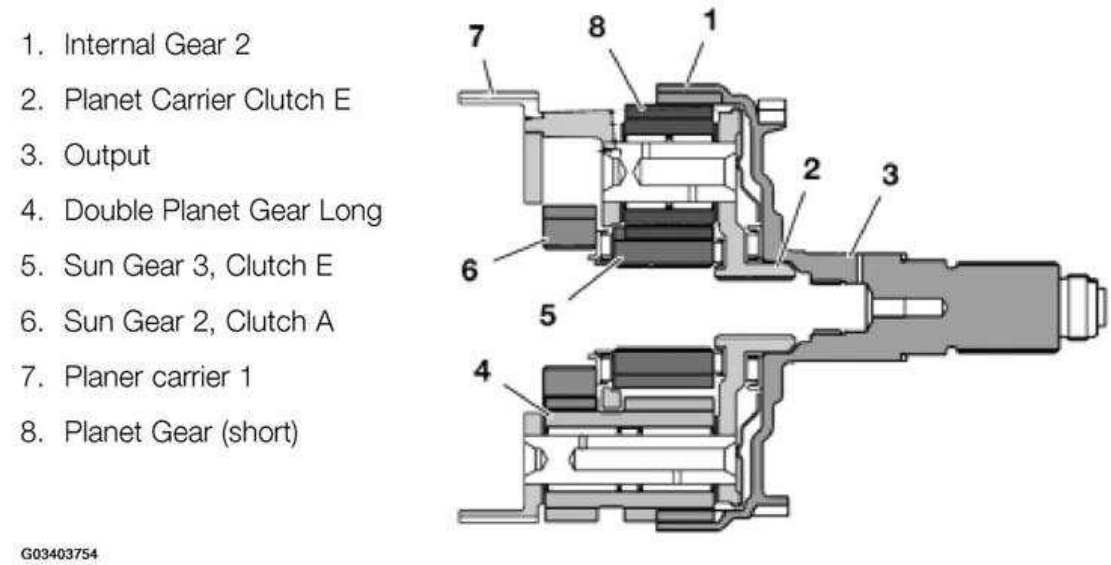


Fig. 35: Identifying Cross Section View Of Double Planetary Set
Courtesy of BMW OF NORTH AMERICA, INC.

PLANETARY GEAR SET OPERATION

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In order to understand planetary gear set operation, it is important to understand some basic rules of operation.

- It is assumed that engine rotation is clockwise when referring to power flow chart s and diagrams.
- Planetary pinions will always rotate in the same direction as the internal ring gear.
- When the sun gear is driven clockwise and the planetary carrier is held stationary the internal ring gear will rotate counter clockwise (reverse gear).
- When two or more planetary members are locked together, the assembly will rotate together. The ratio from input to output is 1:1.
- When the sun gear is held stationary and the planetary carrier is driven clockwise, the ring gear will be driven clockwise in an overdrive ratio. (i.e. .75:1)

When trying to understand power flow schematics, it is important to be able to draw a comparison between the actual planetary components and the schematic symbols. The diagram below outlines the relationship between these components and the power flow schematic. The schematic is a representation of a cross section of the transmission, but you only see the top half of the cross section. The transmission is shown as though it has been quartered lengthwise.

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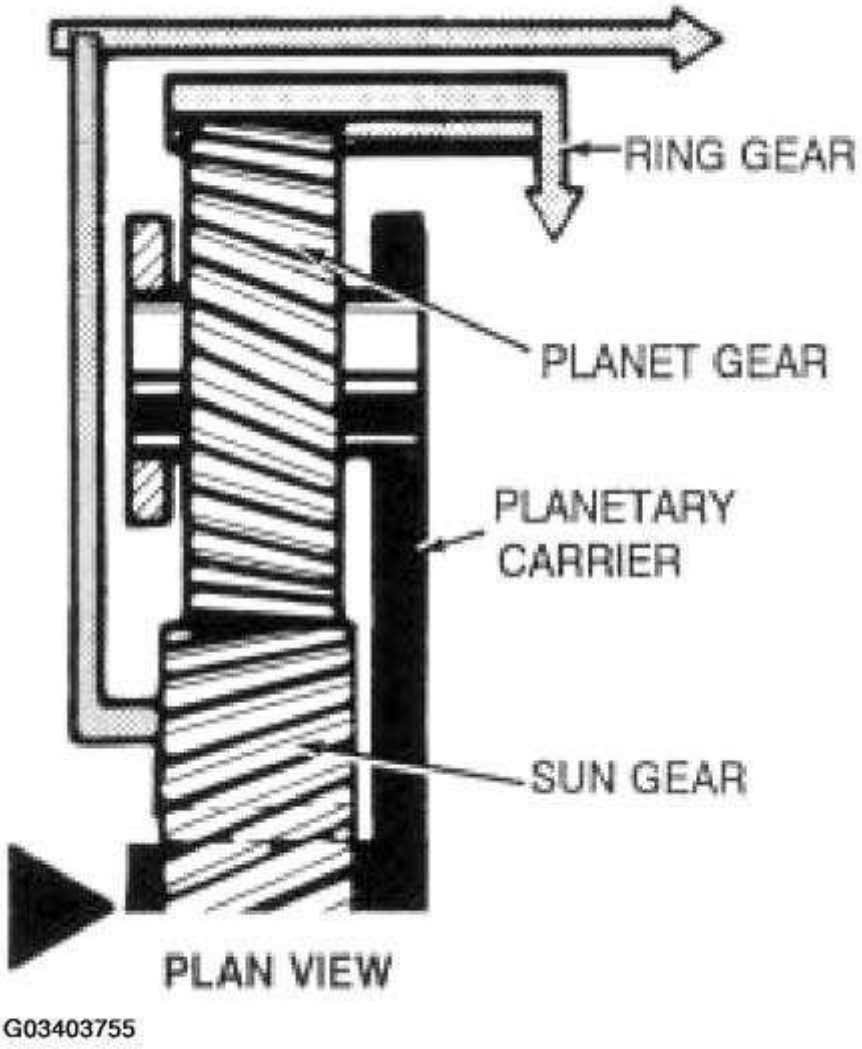


Fig. 36: Identifying Planetary Gear Set Power Flow - Plan View
Courtesy of BMW OF NORTH AMERICA, INC.

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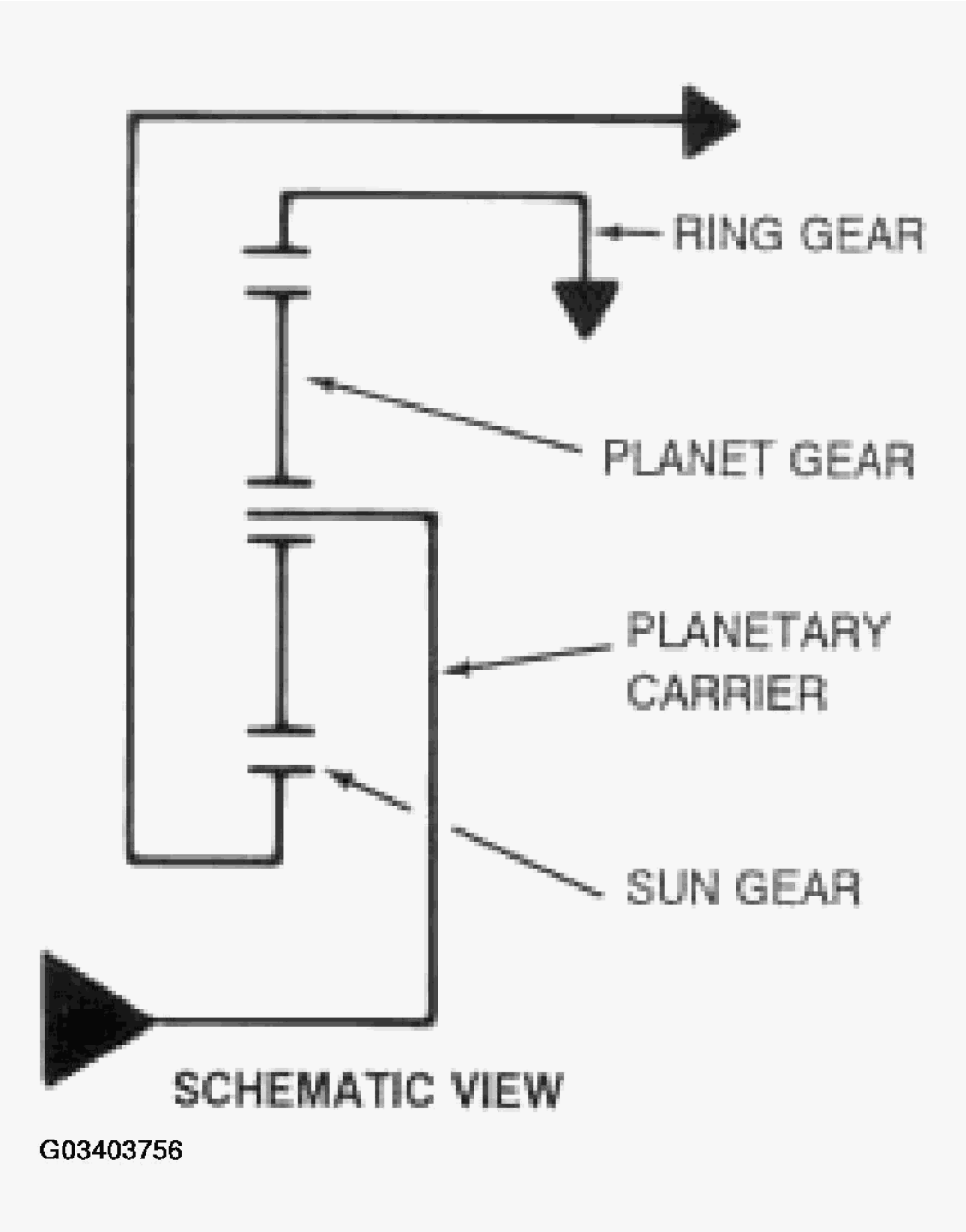


Fig. 37: Identifying Planetary Gear Set Power Flow - Schematic View
Courtesy of BMW OF NORTH AMERICA, INC.

Power Flow Schematic

In order to understand power flow schematics, a relationship must be drawn between the actual components and the schematic representation. In our example, we are going to use the 4HP22/24 power flow schematic. The

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4HP22/24 transmission uses a Simpson Planetary Gearset and an auxiliary gearset. The auxiliary gear set is a simple planetary gearset.

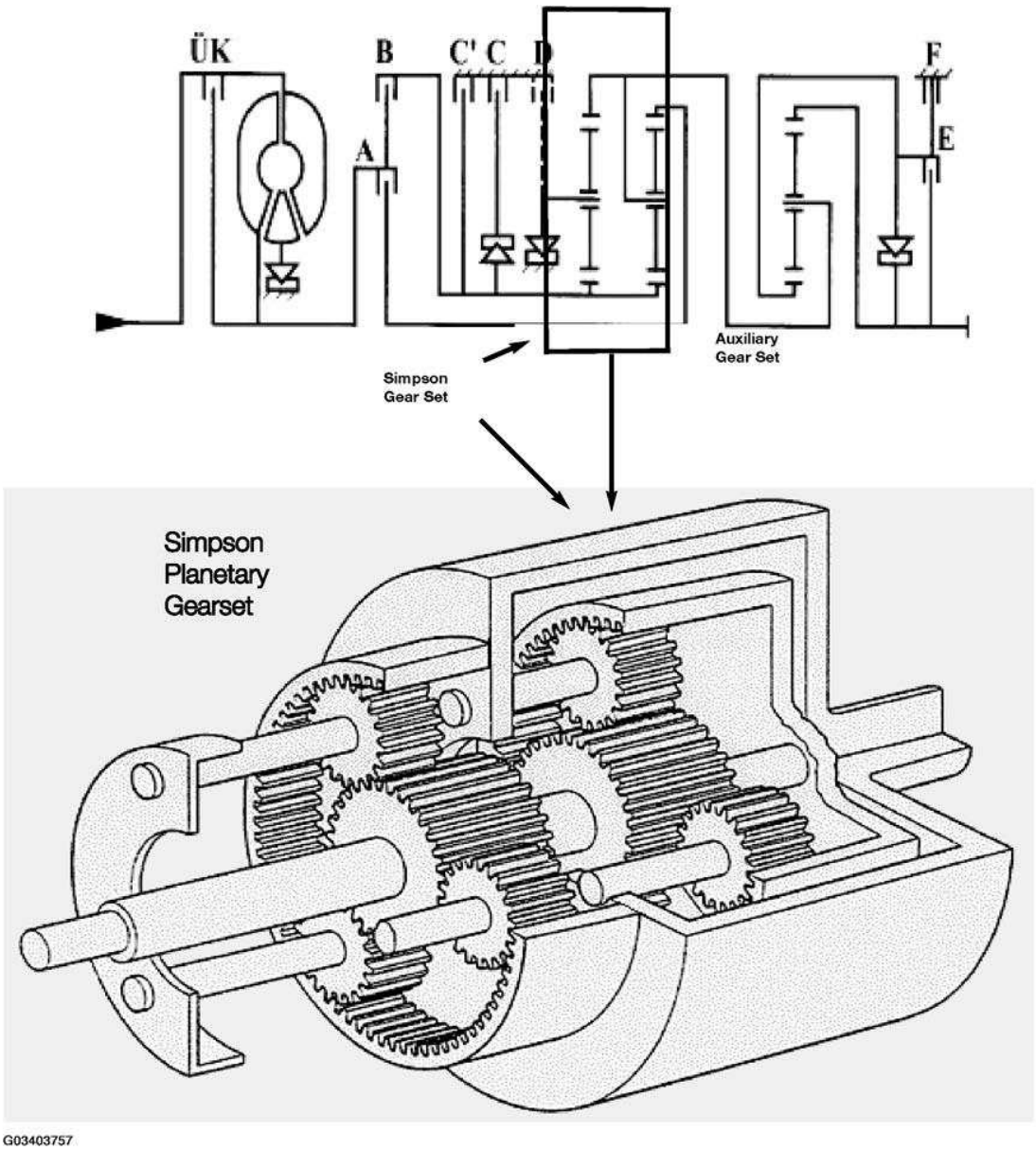


Fig. 38: Identifying Power Flow Schematic
Courtesy of BMW OF NORTH AMERICA, INC.

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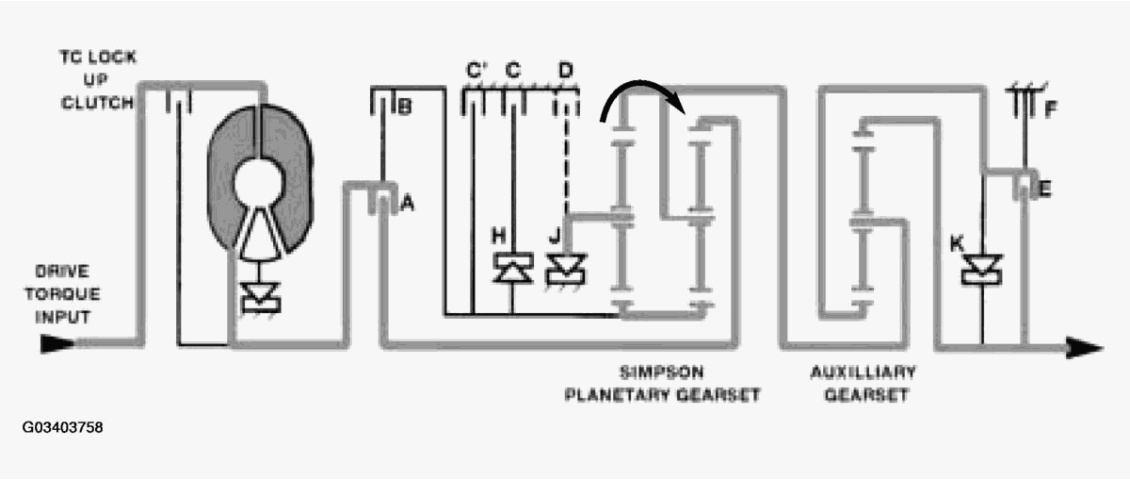


Fig. 39: Identifying Power Flow Schematic - First Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Power flow in first gear - Drive torque is applied to the torque converter impeller and transferred to the turbine. The turbine shaft rotates clockwise (CW). The "A" clutch locks the turbine shaft to the rear input ring gear. The rear input ring gear rotates CW driving the rear planet pinions CW. The planetary pinions drive the common sun gear CCW, which in turn drive the front planet pinions CW. The front planetary carrier is held from rotating CCW by one way clutch "J". The front planetary pinions which are rotating CW drive the front ring gear/rear carrier CW. The rear planetary carrier is rotating CW and is driving the planetary carrier from the auxiliary gear set. The "E" clutch in the auxiliary gear set is holding the Sun gear and the ring gear together. Therefore the auxiliary gear set is locked in a 1:1 ratio.

One Way Clutch "J" is locked prevent the front planetary carrier from rotating CCW. One Way Clutch "H" is not used and One Way Clutch "K" is locked. One way clutch "K" is used to prevent an interruption in power flow before the "E" clutch is locked during the 4-3 shift.

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POSITION GEAR	D				3			2		1	R
	1	2	3	4	1	2	3	1	2	1	R
Clutch A	X	X	X	X	X	X	X	X	X	X	
Clutch B			X	X			X				X
Clutch C'		X				X			X		
Clutch C		X	X	X		X	X		X		
One Way Clutch H		X				X			X		
Clutch D										X	X
One Way Clutch J	X				X			X		X	
Clutch E	X	X	X		X	X	X	X	X	X	X
One Way Clutch K	X	X	X		X	X	X	X	X	X	X
Clutch F				X							

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Fig. 40: Gear Position Chart - First Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Second Gear

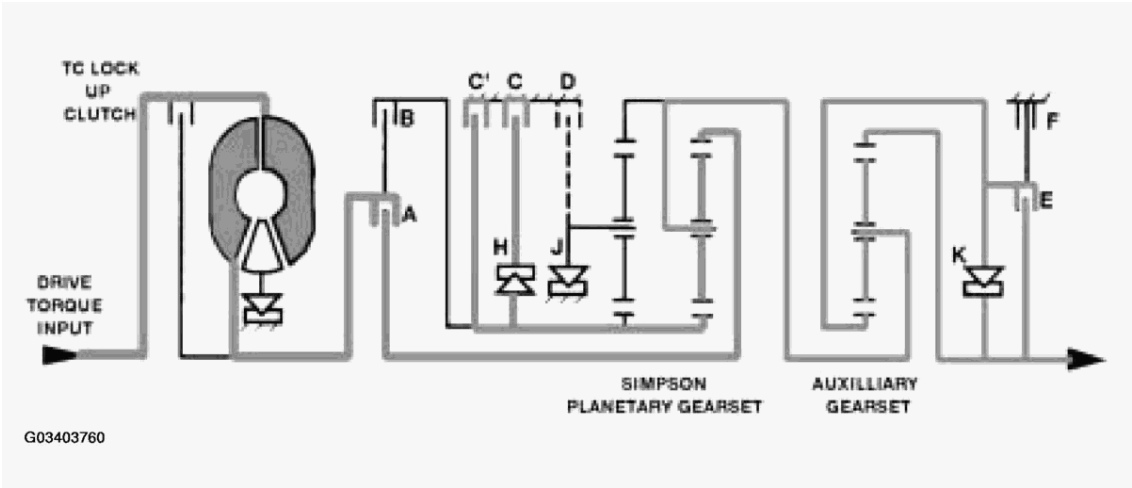


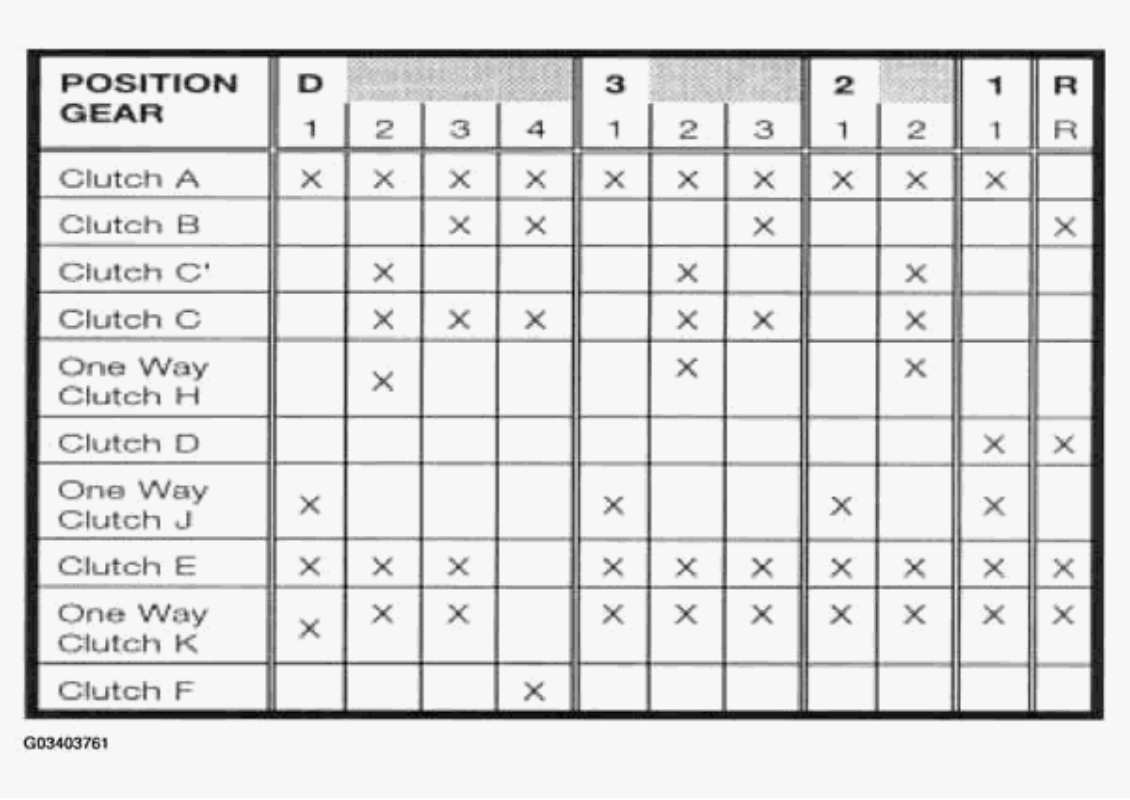
Fig. 41: Identifying Power Flow Schematic - Second Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Second Gear - Drive torque is applied to the torque converter impeller and transferred to the turbine. The turbine shaft rotates clockwise (CW). The "A" clutch locks the turbine shaft to the rear input ring gear. The rear

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input ring gear rotates CW driving the rear planet pinions CW. The sun gear is held stationary by the C' clutch. The rear planet pinions rotate around the fixed sun gear CW. The rear planetary carrier will rotate CW. The rear planetary carrier will drive the auxiliary gear set will rotate as a complete unit. The auxiliary gear set is locked in a 1:1 ratio due to the "E" clutch locking the sun and ring gear together.

The "C" clutch is locking the outer race of the "H" freewheel to the case. This is used for the 3/2 downshift. Freewheel "J" is not active and Freewheel "K" is locked.



POSITION GEAR	D				3			2		1	R
	1	2	3	4	1	2	3	1	2	1	R
Clutch A	X	X	X	X	X	X	X	X	X	X	
Clutch B			X	X			X				X
Clutch C'		X				X			X		
Clutch C		X	X	X		X	X		X		
One Way Clutch H		X				X			X		
Clutch D										X	X
One Way Clutch J	X				X			X		X	
Clutch E	X	X	X		X	X	X	X	X	X	X
One Way Clutch K	X	X	X		X	X	X	X	X	X	X
Clutch F				X							

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Fig. 42: Gear Position Chart - Second Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Third Gear

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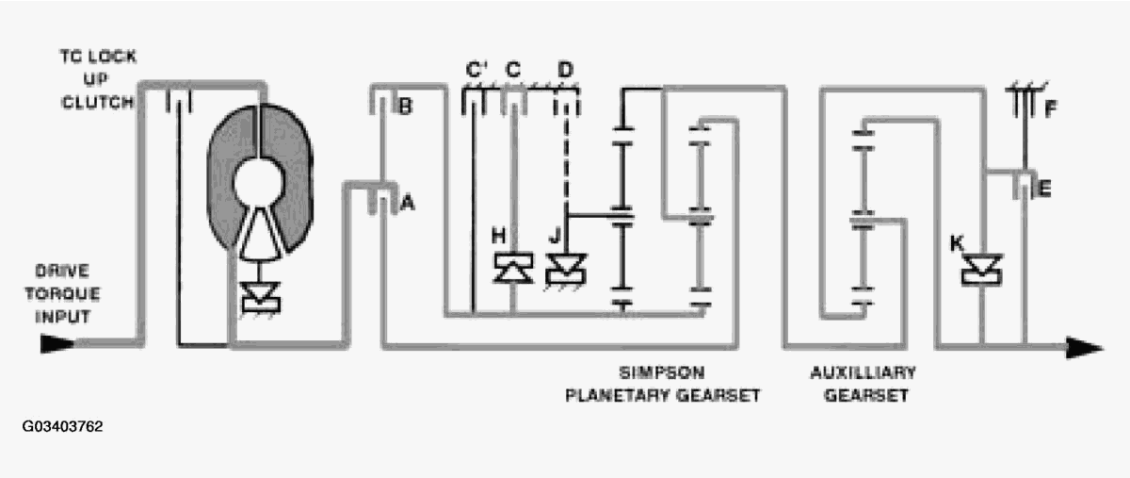


Fig. 43: Identifying Power Flow Schematic - Third Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Third Gear - Drive torque is applied to the torque converter impeller and transferred to the turbine. The turbine shaft rotates clockwise (CW). The "A" clutch and the "B" clutch are locked, this causes the rear input ring gear to be locked to the sun gear in the Simpson Gear set. The Simpson gear set is locked in a 1:1 ratio. The "E" clutch is locked which locks the ring gear to the sun gear in the Simpson gear set. The entire transmission planetary system is now locked in a 1:1 ratio.

Freewheel "H" is overrun and freewheel "J" is not used. Freewheel "K" continues to be locked.

POSITION GEAR	D				3			2		1	R
	1	2	3	4	1	2	3	1	2	1	R
Clutch A	X	X	X	X	X	X	X	X	X	X	
Clutch B			X	X			X				X
Clutch C'		X				X			X		
Clutch C		X	X	X		X	X		X		
One Way Clutch H		X				X			X		
Clutch D										X	X
One Way Clutch J	X				X			X		X	
Clutch E	X	X	X		X	X	X	X	X	X	X
One Way Clutch K	X	X	X		X	X	X	X	X	X	X
Clutch F				X							

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Fig. 44: Gear Position Chart - Third Gear
Courtesy of BMW OF NORTH AMERICA, INC.

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Fourth Gear

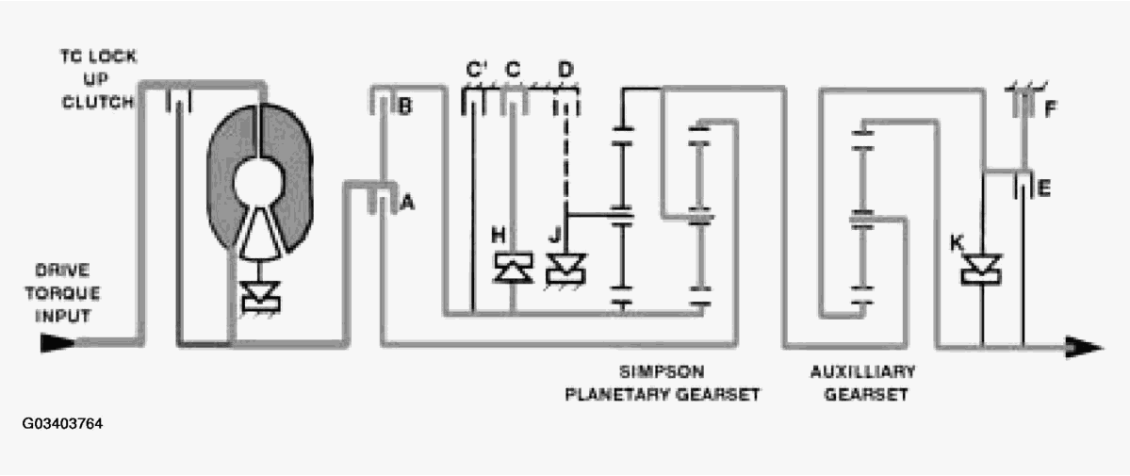


Fig. 45: Identifying Power Flow Schematic - Fourth Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Fourth Gear - Drive torque is applied to the torque converter impeller and transferred to the turbine. The turbine shaft rotates clockwise (CW). (The turbine shaft can also be driven by the lock up clutch when engaged). The "A" clutch and the "B" clutch are locked, this causes the rear input ring gear to be locked to the sun gear in the Simpson Gear set. The Simpson gear set is locked in a 1:1 ratio. The "F" clutch is locked which locks the sun gear in the auxiliary gear set to the case. The Simpson gear set drives the planetary carrier CW. The planet pinions walk around the fixed sun gear in a CW direction. This causes the ring gear to rotate CW as well. The ring gear, which is the output of the transmission is driven in a overdrive ratio.

Freewheel "H" and "K" are overrun. Freewheel "J" is not used.

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POSITION GEAR	D				3			2		1	R
	1	2	3	4	1	2	3	1	2	1	R
Clutch A	X	X	X	X	X	X	X	X	X	X	
Clutch B			X	X			X				X
Clutch C'		X				X			X		
Clutch C		X	X	X		X	X		X		
One Way Clutch H		X				X			X		
Clutch D										X	X
One Way Clutch J	X				X			X		X	
Clutch E	X	X	X		X	X	X	X	X	X	X
One Way Clutch K	X	X	X		X	X	X	X	X	X	X
Clutch F				X							

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Fig. 46: Gear Position Chart - Fourth Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Reverse Gear

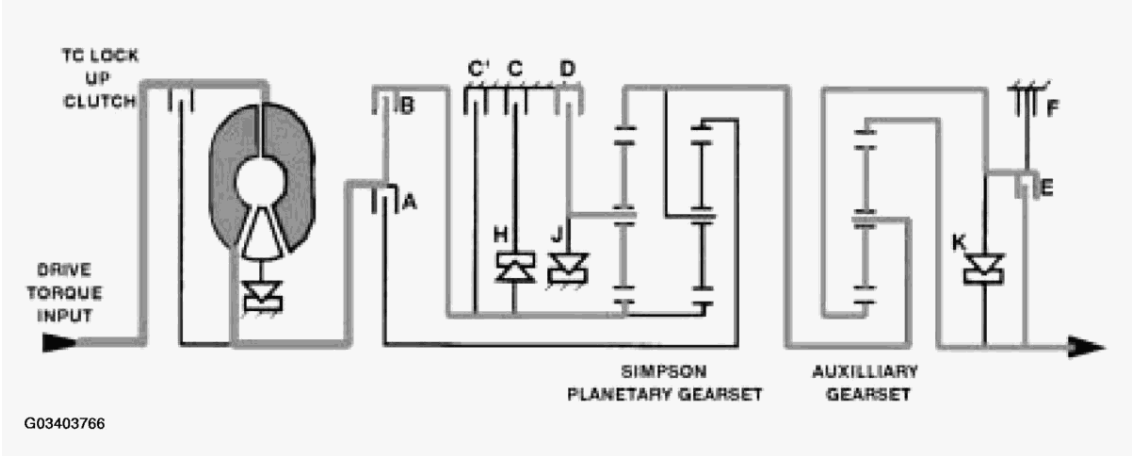


Fig. 47: Identifying Power Flow Schematic - Reverse Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Reverse Gear - Drive torque is applied to the torque converter impeller and transferred to the turbine. The turbine shaft rotates clockwise (CW). The "B" clutch is locked which drives the sun gear in the Simpson gear set CW. The sun gear drives the planet pinions CCW. The planetary carrier is held stationary by the "D" clutch. The planet pinions cause the front ring gear to rotate CCW. The front ring gear (and rear carrier) drive the

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auxiliary gear set CCW which rotates at a ratio of 1:1 due to the "E" clutch locking the sun and ring gear of the auxiliary gear set.

Freewheel "H" and "J" are not used. Freewheel "K" is locked.

POSITION GEAR	D				3			2		1	R
	1	2	3	4	1	2	3	1	2	1	R
Clutch A	X	X	X	X	X	X	X	X	X	X	
Clutch B			X	X			X				X
Clutch C'		X				X			X		
Clutch C		X	X	X		X	X		X		
One Way Clutch H		X				X			X		
Clutch D										X	X
One Way Clutch J	X				X			X		X	
Clutch E	X	X	X		X	X	X	X	X	X	X
One Way Clutch K	X	X	X		X	X	X	X	X	X	X
Clutch F				X							

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Fig. 48: Gear Position Chart - Reverse Gear
Courtesy of BMW OF NORTH AMERICA, INC.

SHIFT CONTROL

Freewheel Shifting

In order to prevent an interruption in power flow, freewheel (One Way Clutches) are used to lock members of the planetary gear set. Certain transmissions such as the 4HP22/24, A4S270/310R and the A5S360R use freewheel shifting on all gear shifts. Transmissions such as A5S310Z, A5S440Z, A5S560Z and GA6HP26Z use freewheel shifting for only specific shifts. Other shifts in these transmissions use overlap shifting technology.

The demonstrate how the freewheel is used, we will examine freewheel "H" in the 4HP22/24 transmission.

In third gear, the sun gear is rotating clockwise. Freewheel "H" is overrun (unlocked) allowing the sun gear to rotate. Clutch "C" is active which locks the outer race of freewheel "H" to the case. During a 3/2 downshift, clutch "B" is released. The sun gear is held from rotating counter clockwise by freewheel "H" and the C' clutch. Freewheel "H" is used to stop the counter clockwise rotation of the sun gear before the C' clutch can engage. This prevents an interruption of power flow during the 3/2 downshift. If freewheel "H" fails to operate, there would be an increase in engine RPM from 3rd to 2nd gear.

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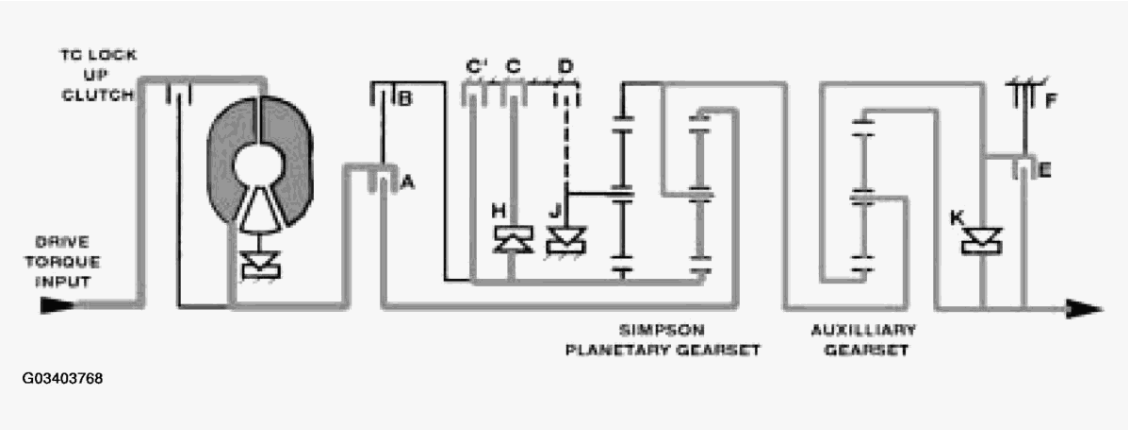


Fig. 49: Identifying Power Flow Freewheel Shifting Schematic - Second Gear
Courtesy of BMW OF NORTH AMERICA, INC.

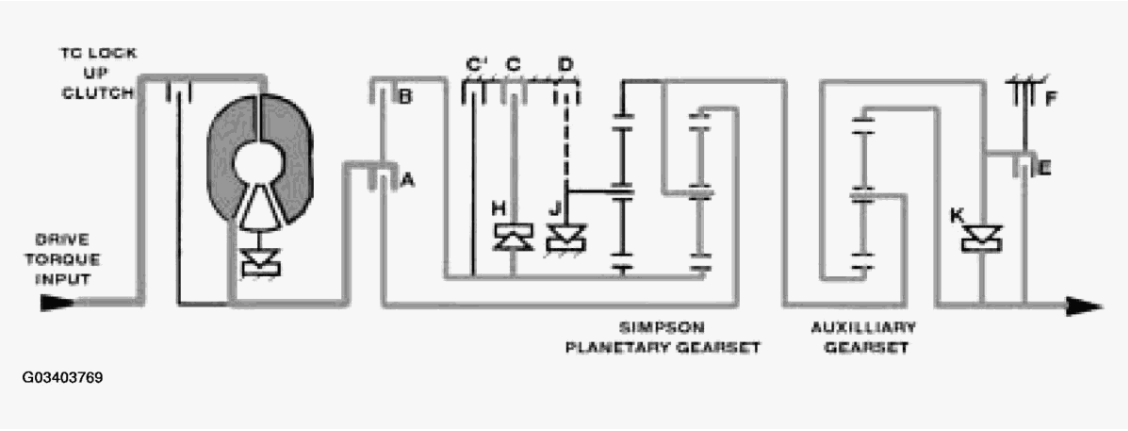


Fig. 50: Identifying Power Flow Freewheel Shifting Schematic - Third Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Overlap Shift Control

Overlap shift technology is currently used on ZF transmissions. The A5S310Z, A5S440Z, A5S560Z and the GA6HP26Z use overlap shift technology on most gear changes. The advantages of this design allows for the reduction of the use of One Way Clutches (freewheel) and a significant improvement in shift quality.

During an overlap shift, the releasing clutch pressure is reduced at the same rate that the engaging clutch pressure is increased. The result is a smooth transfer or torque between gear ratios.

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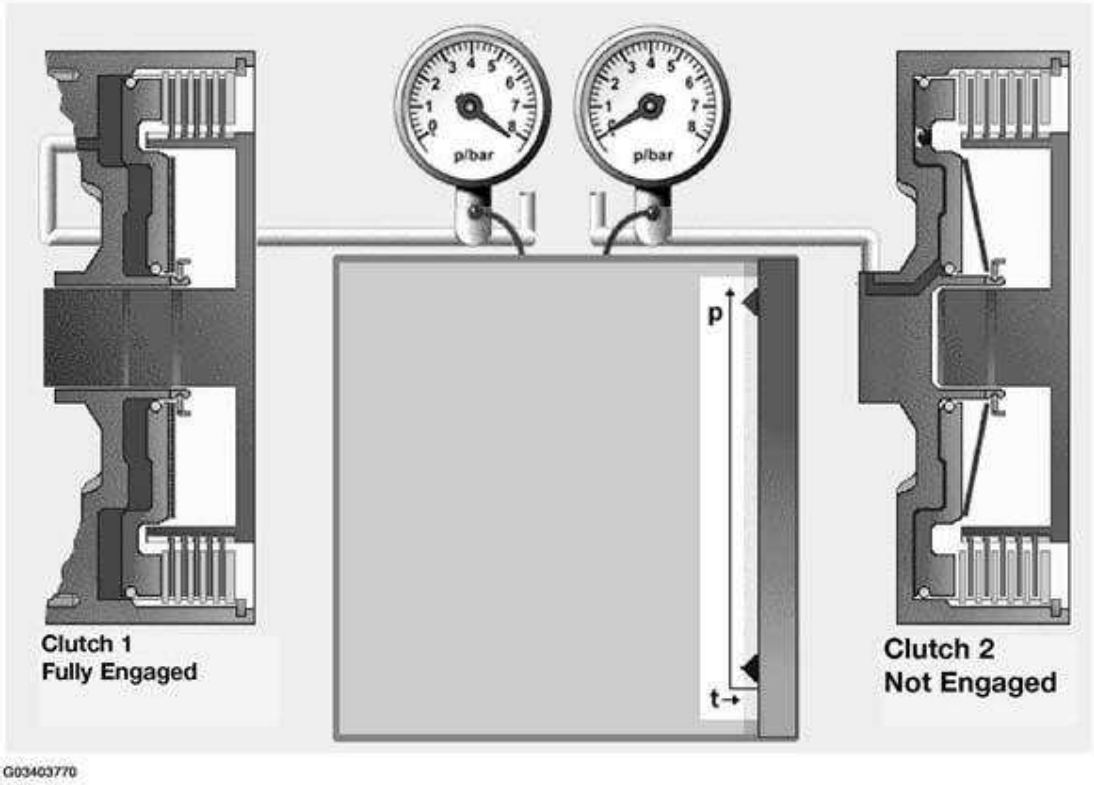


Fig. 51: Identifying Overlap Shift Technology
Courtesy of BMW OF NORTH AMERICA, INC.

As shown in the diagram above, Clutch 1 is fully engaged with maximum pressure. Clutch 2 is fully released.

During overlap shifting, the TCM closely monitors the rotational speeds of the turbine (input) shaft and output shaft. The TCM then uses the EDS solenoids to control pressures during shifting to provide the optimum shift timing and overlap control.

Overlap Shifting

During the transition of overlap, the clutches run through a slip zone. The torque is gradually transferred from the clutch that is releasing to the clutch that is engaging.

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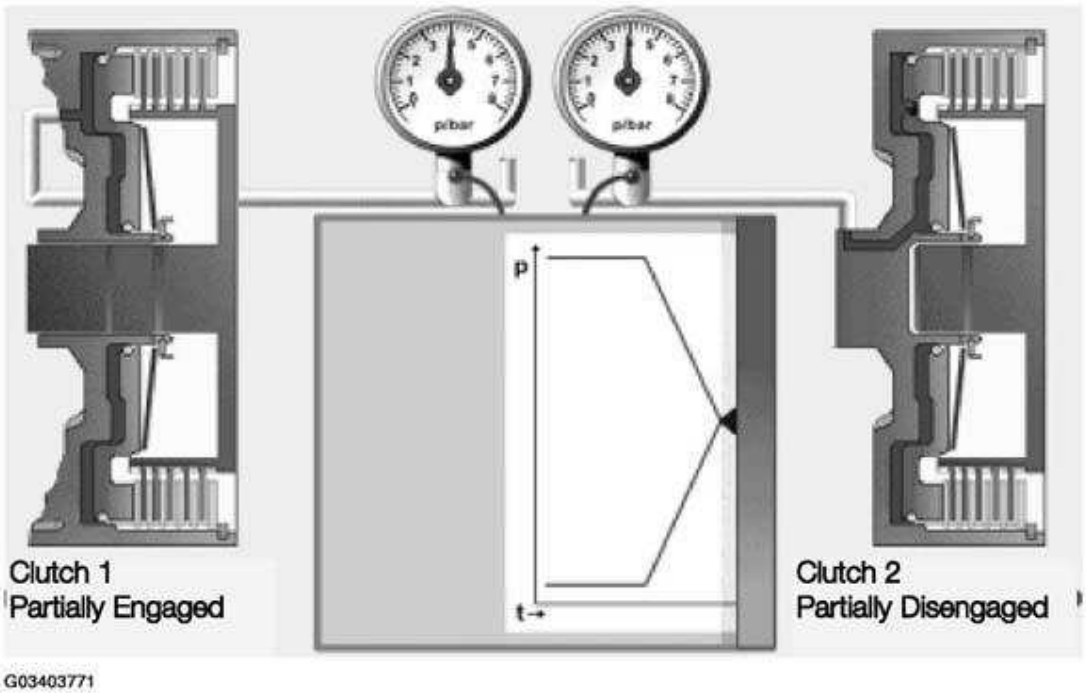


Fig. 52: Identifying Overlap Shifting (Clutch 1 Partially Engaged And Clutch 2 Partially Disengaged)
Courtesy of BMW OF NORTH AMERICA, INC.

The new gear engages the moment the torque level exceeds that of the first clutch. This is described as overlap. If the overlap is correct, (zero overlap) the engaging clutch takes over as much torque as the disengaging clutch releases. The result is a seemingly unnoticed shift of the best quality.

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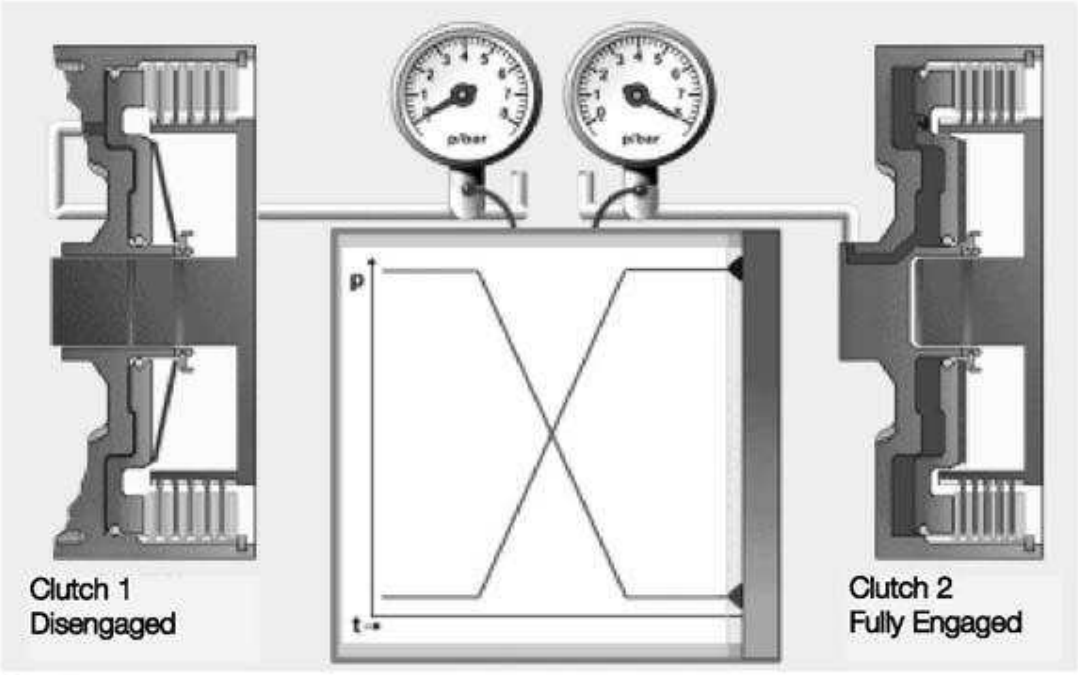


Fig. 53: Identifying Overlap Shifting (Clutch 1 Disengaged And Clutch 2 Fully Engaged)
Courtesy of BMW OF NORTH AMERICA, INC.

Negative Overlap

Negative overlap occurs when the engaging clutch takes over too late or the releasing clutch drops pressure too early.

The result is that the drive torque is briefly interrupted. When the engine is operating under load, the engine speed increases due to the interruption. When coasting the engine speed drops.

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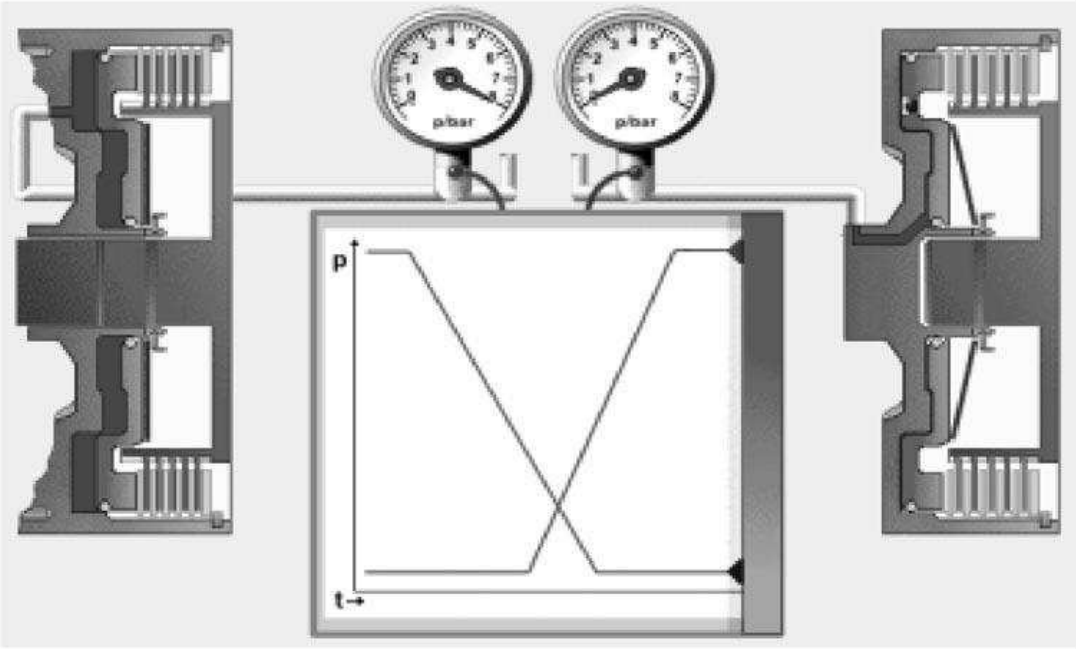


Fig. 54: Identifying Negative Overlap
Courtesy of BMW OF NORTH AMERICA, INC.

Positive Overlap

If positive overlap occurs, the engaging clutch takes over too early or the releasing clutch pressure drops too late. The gear set would become momentarily blocked if this condition occurs during an upshift. When this occurs the ratio of the gear set becomes 1:1 momentarily. The result is a loss in drive torque during a gear shift.

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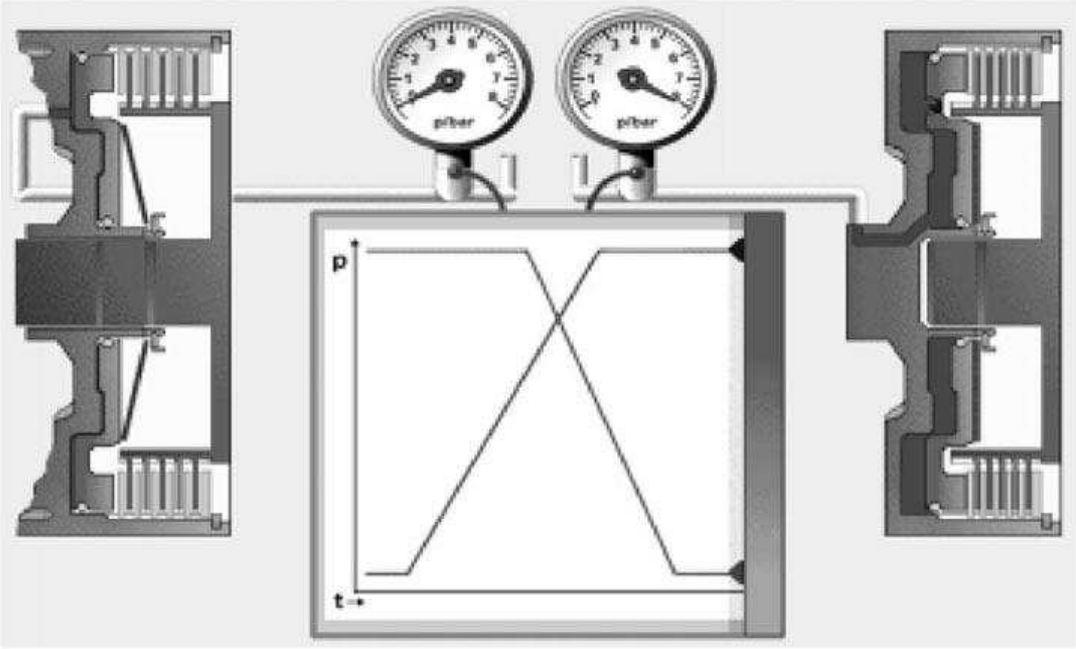


Fig. 55: Identifying Positive Overlap
Courtesy of BMW OF NORTH AMERICA, INC.

TRANSMISSION CONTROL MODULE

The TCM receives inputs, processes information and actuates the output elements to provide optimal shift points. The TCM is programmed for maximum shift comfort and fuel economy. The TCM on most BMW vehicles is located in the E-Box next to the ECM (DME).

There are several types of TCM housings:

- 35 Pin TCM (TCU) - used on the 4HP transmissions
- 55 Pin TCM used on the A4S310R (THM-R1)
- 88 Pin TCM used on all others up to 98
- 134 Pin TCM used on all BMW transmission from the 99 model year. (Note- the 134 pin TCM was introduced on the 98 Models equipped with the A5S440Z).

The 134 Pin TCM is also referred to as SKE (Standard Shell Construction). The SKE housing uses 5 separate connectors. On transmission applications only three connectors 1, 3 and 4) are used. Connectors 2 and 5 are blank and are NOT used. The connectors are blue in color to avoid confusion with the ECM (DME) connectors which are black.

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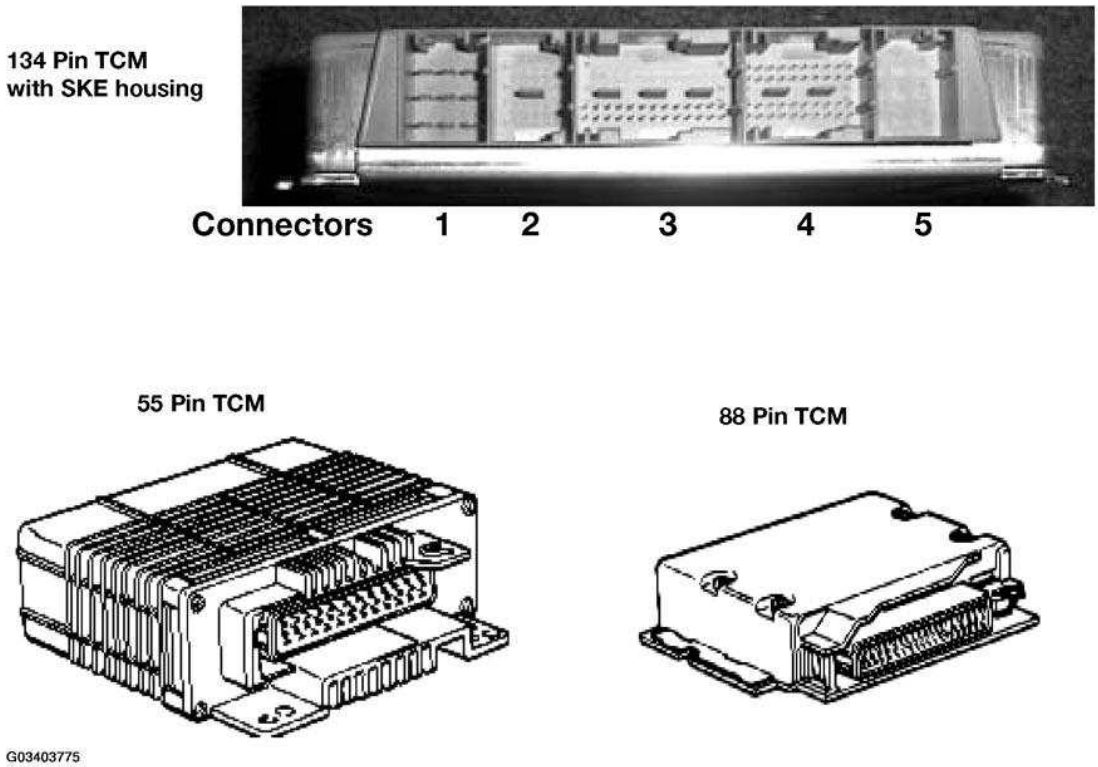


Fig. 56: Identifying Transmission Control Module
Courtesy of BMW OF NORTH AMERICA, INC.

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