

230 Manual Transmission

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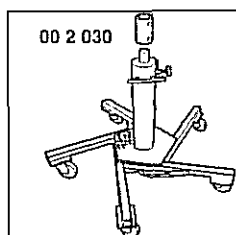
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GENERAL

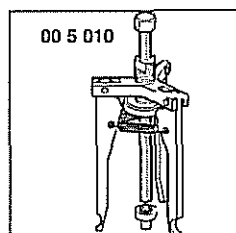
This repair group covers external transmission service, including removal and installation of the transmission unit. Internal transmission repair is not covered. Special tools and procedures are required to disassemble and service the internal geartrain.

Special tools

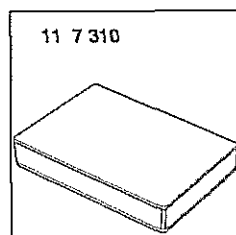
BMW specified tools are required for removal and installation of the manual transmission, as well as the removal and installation of seals at the transmission input, output, and selector shafts. If these tools are unavailable, equivalent tools may be substituted.



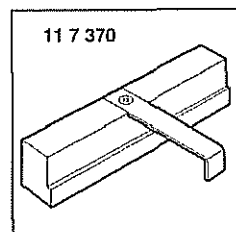
◀ Transmission jack
(Tool No. BMW 00 2 030)



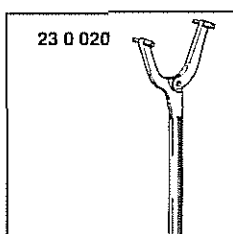
◀ Seal puller
(Tool No. BMW 00 5 010)



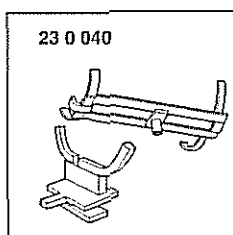
◀ Engine support block (V-8 models)
(Tool No. BMW 11 7 310)



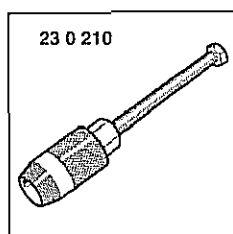
◀ Engine support block (6 cylinder models)
(Tool No. BMW 11 7 370)



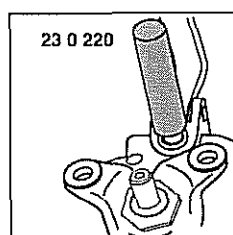
- Transmission flange counterhold tool
(Tool No. BMW 23 0 020)



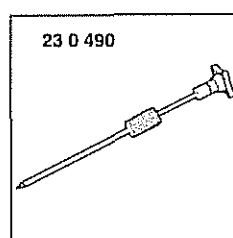
- Transmission support (for use with transmission jack)
(Tool No. BMW 23 0 040)



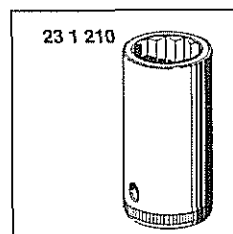
- Selector seal extractor
(Tool No. BMW 23 0 210)



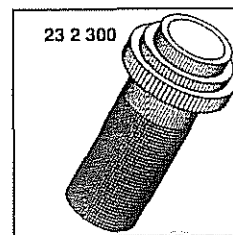
- Selector seal installation drift
(Tool No. BMW 23 0 220)



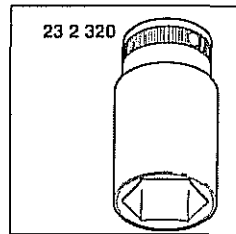
- Input shaft seal puller (slide hammer)
(Tool No. BMW 23 0 490)



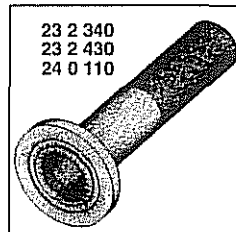
- Output shaft flange nut socket (27 mm)
(Tool No. 23 1 210)



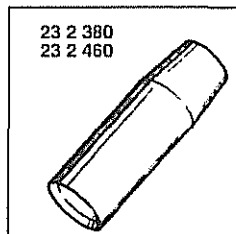
- Output seal installation drift
(Tool No. BMW 23 2 300)



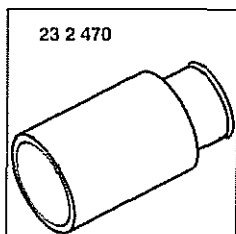
- Output shaft flange nut socket (36 mm)
(Tool No. BMW 23 2 320)



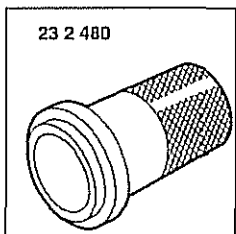
- Seal installation drift
(Tool No. BMW 23 2 340, 23 2 430, 24 0 110)



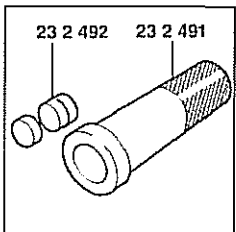
- Input shaft seal installation sleeve
(Tool No. BMW 23 2 380, 23 2 460)



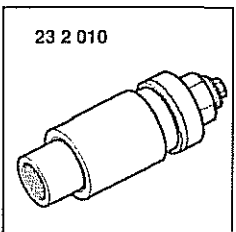
- Output flange nut retaining plate installer
(6-speed transmission) (Tool No. BMW 23 2 470)



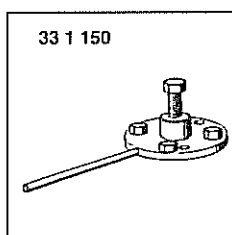
- Output shaft seal installation drift
(6-speed transmission) (Tool No. BMW 23 2 480)



- Input shaft seal installation tools (6-speed transmission)
(Tool No. BMW 23 2 490 (23 2 491 and 23 2 492))



- Output flange installation tool
(6-speed transmission) (Tool No. BMW 23 3 010)



◀ Output flange puller (Tool No. BMW 33 1 150)

Manual transmission applications

Manual transmissions used are based on engine application. See **Table a. Manual transmission applications**. For gear ratio specifications, see **Table b. Manual transmission gear ratios**.

Table a. Manual transmission applications

Model	Year	Engine	Transmission
525i			
Sedan	2001-2002	M54	Getrag S5D 250G
Sport Wagon	2001-2002	M54	ZF S5D 320Z
528i all	1997-2000	M52, M52 TU	ZF S5D 320Z
530i Sedan	2001-2002	M54	ZF S5D 320Z
540i Sedan	1997-2002	M62, M62 TU	ZF S6S 420G

NOTE —

Do not rely on casting numbers for transmission code identification.

Table b. Manual transmission gear ratios

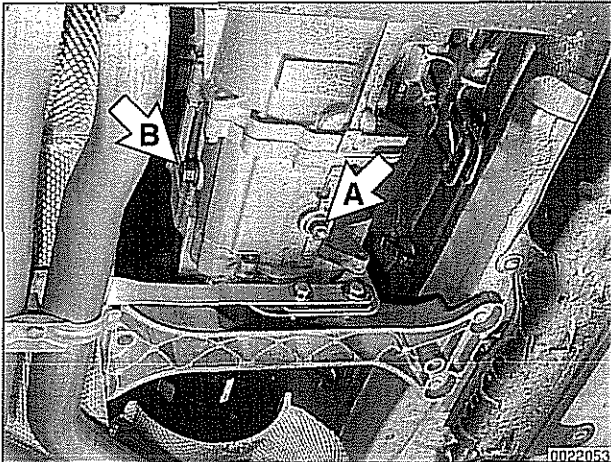
Gear	Getrag S5D 250G 5-speed	ZF S5D 320Z 5-speed	Getrag S6S 420G 6-speed
1 st	4.23	4.21	4.23
2 nd	2.52	2.49	2.53
3 rd	1.66	1.66	1.67
4 th	1.22	1.24	1.23
5 th	1.00	1.00	1.00
6 th			0.83
Reverse	4.04	3.89	3.75
Final drive	3.15	525i: 3.23 528i, 530i: 2.93	2.81

TRANSMISSION FLUID SERVICE

Manual transmissions installed in the 5 Series are normally filled with a "Lifetime" manual transmission fluid (BMW MTF LT-1) and do not require periodic fluid changes. Transmissions filled with MTF LT-1 lifetime oil are identified with a yellow label near the transmission fill plug labeled "Lifetime Oil MTF-LT-1".

Transmission fluid level, checking

- Drive vehicle for a few miles to warm transmission.
- Raise and safely support vehicle to access transmission filler plug.



CAUTION—

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

- Remove side filler plug (B). Insert finger into hole to check fluid level. If fluid level is up to bottom of filler hole (finger is wetted by transmission fluid), level is correct.

NOTE—

- Check and fill transmission with car on level surface.
- 5-speed transmission shown in illustration. 6-speed transmission is similar.

- Install and torque filler plug.

Tightening torque

Transmission drain or fill plug
to transmission case

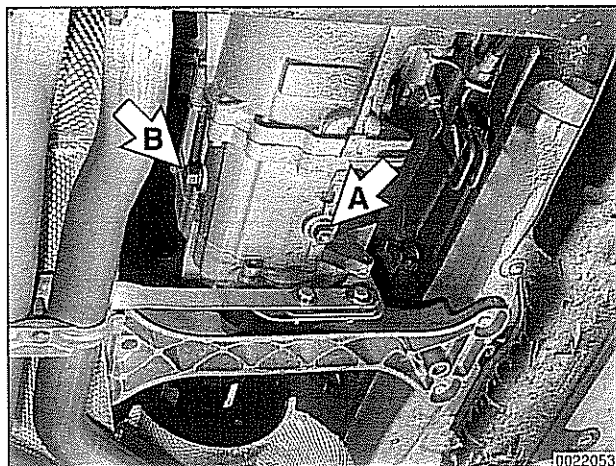
50 Nm (37 ft-lb)

Transmission fluid, replacing

- Drive vehicle for a few miles to warm transmission.
- Raise and safely support vehicle to access drain plug.

CAUTION—

- Make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.
- Check that the fill plug is not seized prior to draining transmission fluid.



- Place drain pan under transmission and remove drain plug (A) at bottom of transmission.

- Drain fluid.
- Install and torque drain plug.
- Remove fill plug (B) from side of transmission.
- Slowly fill transmission with fluid until fluid overflows fill hole.
- Install and torque fluid fill plug.

NOTE —

5-speed transmission shown in illustration. 6-speed transmission is similar.

Fluid capacity

Transmission	Initial fill new/rebuilt unit	Fluid change
Getrag S5D 250G	1.1 liter (1.2 US qt)	1.0 liter (1.1 US qt)
Getrag S6S 420G	1.9 liter (2.0 US qt)	1.7 liter (1.8 US qt)
ZF S5D 320Z	1.3 liter (1.4 US qt)	1.2 liter (1.3 US qt)

Tightening torque

Transmission drain or fill plug to transmission case	50 Nm (37 ft-lb)
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TRANSMISSION EXTERNAL SERVICE

Back-up light switch, replacing

- Raise and safely support vehicle to access back-up light switch.

WARNING —

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

- Unscrew switch from transmission.

NOTE —

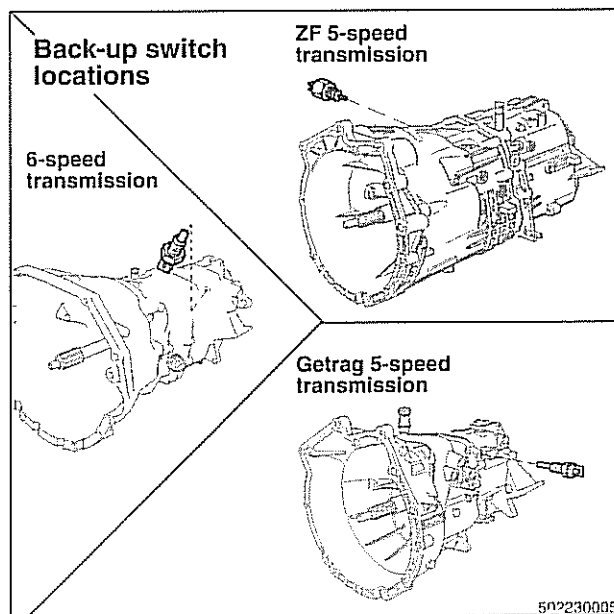
Back-up light switch location on transmission varies. Refer to illustration.

- Install new switch.

Tightening torque

Back-up light switch to transmission	18 Nm (13 ft-lb)
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- Check transmission fluid level before lowering vehicle.



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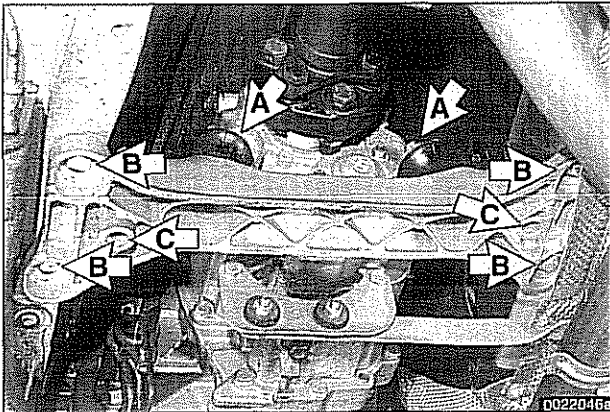
Selector shaft seal, replacing (transmission installed)

- Put transmission into second gear.
- Raise and safely support vehicle.

WARNING —

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

- 6-speed transmission: Remove rear engine splash shield.
- Remove exhaust system and heat shields. See **180 Exhaust System**.
- Support transmission with transmission jack.
- Disconnect driveshaft at transmission and tie to side. See **260 Driveshaft**.



- Remove transmission crossmember:
 - Where applicable, release electrical harnesses from transmission crossmember.
 - Remove transmission mounting bolts (A).
 - Remove transmission crossmember bolts (B).
 - Where applicable, remove bolts (C).

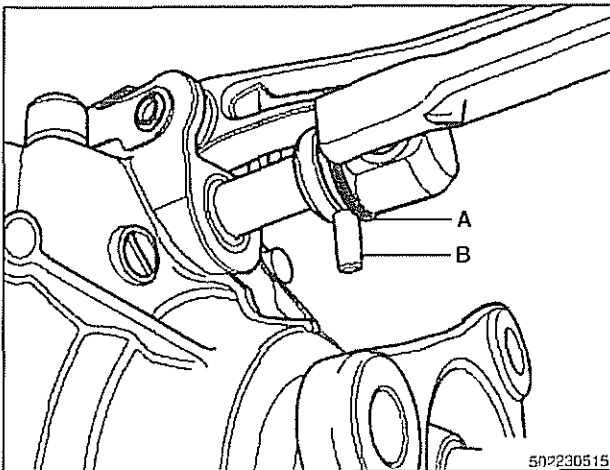
NOTE —

5-speed transmission shown in illustration. 6-speed transmission is similar.

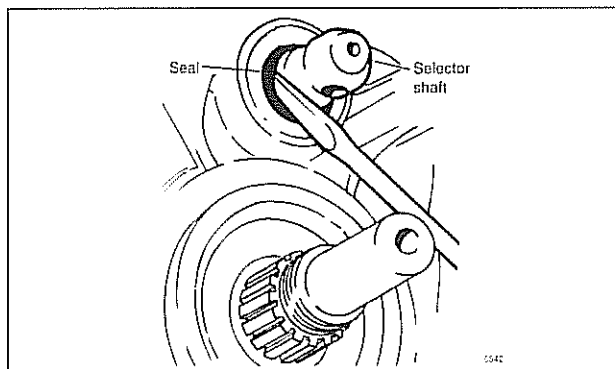
- Tilt down rear of transmission.

CAUTION —

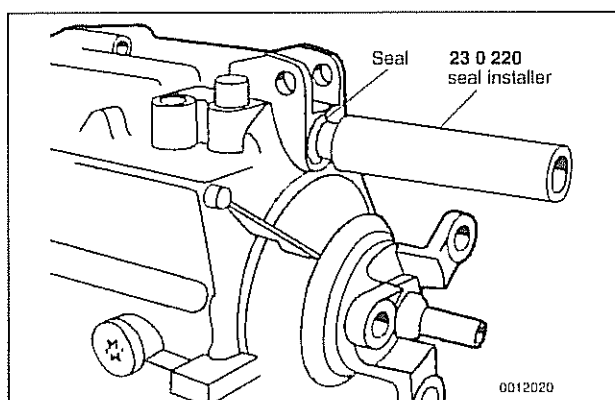
Tilting the engine to lower the transmission can lead to damage to various components due to lack of clearance.



- Pry spring locking ring (A) out of groove and press pin (B) out of shift rod.
 - Detach shift rod from selector shaft and tie aside.



- Carefully pry out selector shaft oil seal with BMW special tool 23 0 210, or with a narrow seal remover or small screwdriver.



- Coat new selector shaft seal with transmission fluid. Drive new seal in flush with housing. Use BMW special seal installation tool 23 0 220 or equivalent and a soft-faced (plastic) hammer.

- Remainder of installation is reverse of removal, noting the following:
 - Install driveshaft using new lock nuts.
 - Check transmission oil level, topping up as necessary.

Tightening torques

Aluminum driveshaft to flex-disc

- M12 (use Dacromet-coated washers) 90 Nm (66 ft-lb)

Driveshaft CV joint to final drive flange

- M10 (Torx bolt) 70 Nm (51 ft-lb)
- M8 (compression nut) 32 Nm (24 ft-lb)

Flex-disc to transmission flange or driveshaft

- M10 (8.8 grade) 48 Nm (35 ft-lb)
- M10 (10.9 grade) 60 Nm (44 ft-lb)
- M12 (8.8 grade) 81 Nm (60 ft-lb)
- M12 (10.9 grade) 100 Nm (74 ft-lb)
- M14 140 Nm (103 ft-lb)

Transmission crossmember

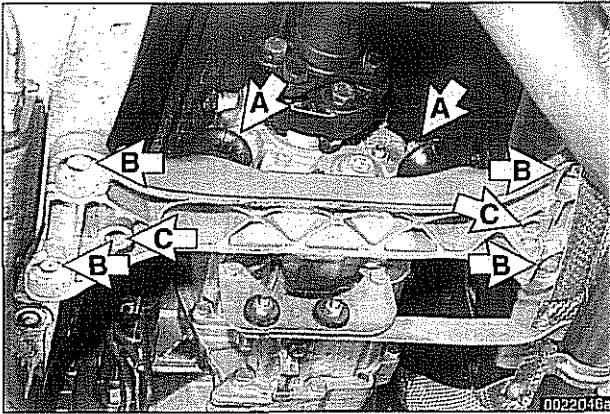
- to transmission (M8) 21 Nm (15 ft-lb)
- to chassis (M10) 42 Nm (30 ft-lb)

Output shaft seal, replacing (5-speed transmission) (transmission installed)

- Raise and safely support vehicle.

WARNING—

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



- Remove exhaust system and heat shields. See **180 Exhaust System**.
- Support transmission with transmission jack.
- Disconnect driveshaft at transmission output flange, and hang driveshaft to side. See **260 Driveshaft**.

➤ Remove transmission crossmember:

- If applicable, release electrical harnesses from transmission crossmember.
- Remove transmission mounting bolts (A).
- Remove transmission crossmember bolts (B).
- Where applicable, remove bolts (C).

- Tilt down rear of transmission.

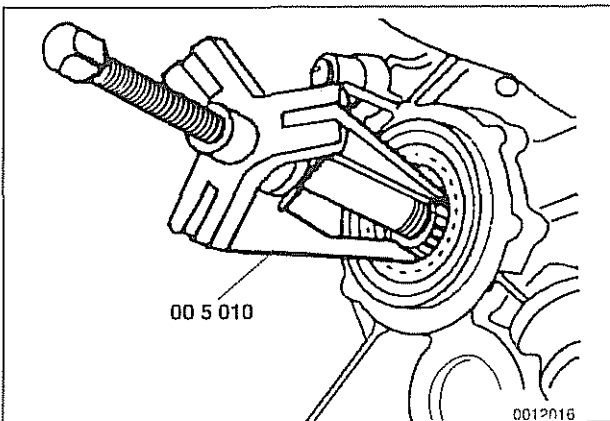
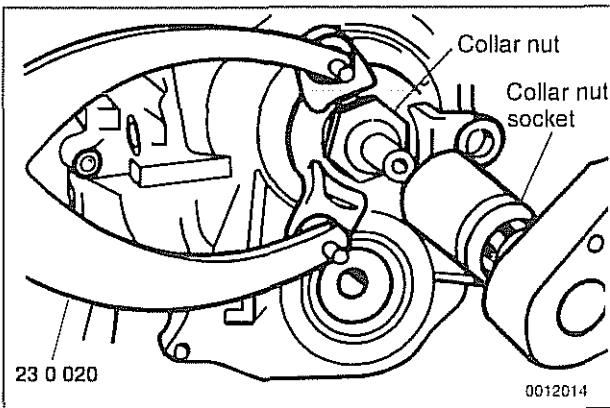
CAUTION—

Tilting the engine to lower the transmission can lead to damage to various components due to lack of clearance.

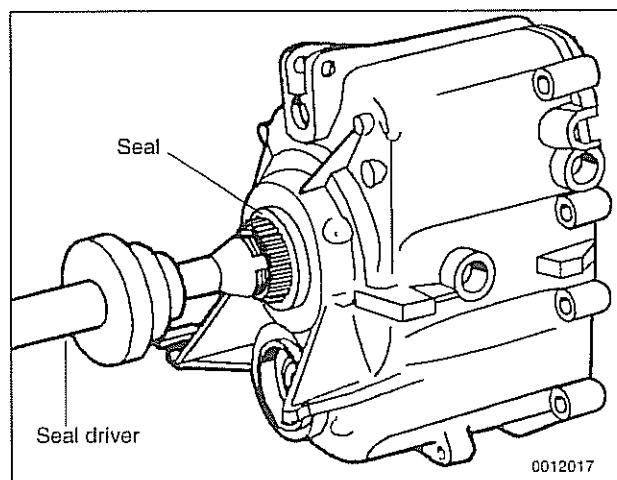
- Remove collar nut with BMW special tool (see table below) or suitable thin-walled deep socket. Use BMW special tool 23 0 020 or equivalent to counterhold output flange.

Collar nut sockets

Transmission	BMW special tool
Getrag S5D 250G	23 1 210 (27 mm)
ZF S5D 320Z	23 2 320 (36 mm)



- Use puller (BMW special tool 33 1 150 or equivalent) to remove output flange.
- Use BMW special tool 00 5 010 or other suitable seal puller to remove seal from transmission housing.



- ◀ Coat new seal with transmission fluid. Use seal installation drift (see table below) to drive seal into position until it is flush with housing.

Output seal drives

Transmission	BMW special tool
Getrag S5D 250G	24 0 110
ZF S5D 320Z	23 2 300

- Inspect sealing surface on output flange. Replace if flange surface is worn or damaged.
- Heat output flange to about 176° F (80° C) to aid in installation. This can be done by placing flange in hot water. Reinstall output flange to output shaft.
- Coat flange nut with Loctite® 243 and reinstall. Torque in two stages.

Tightening torques

Output flange to output shaft

- Stage I 190 Nm (140 ft-lb)
- Stage II (after loosening) 120 Nm (89 ft-lb)

- Remainder of installation is reverse of removal, noting the following:
 - Install driveshaft using new nuts. See **260 Driveshaft**.
 - Check transmission fluid level, topping up as necessary.

Tightening torques

Aluminum driveshaft to flex-disc

- M12 (use Dacromet-coated washers) 90 Nm (66 ft-lb)

Driveshaft CV joint to final drive flange

- M10 (Torx bolt) 70 Nm (51 ft-lb)
- M8 (compression nut) 32 Nm (24 ft-lb)

Flex-disc to transmission flange or driveshaft

- M10 (8.8 grade) 48 Nm (35 ft-lb)
- M10 (10.9 grade) 60 Nm (44 ft-lb)
- M12 (8.8 grade) 81 Nm (60 ft-lb)
- M12 (10.9 grade) 100 Nm (74 ft-lb)
- M14 140 Nm (103 ft-lb)

Transmission crossmember

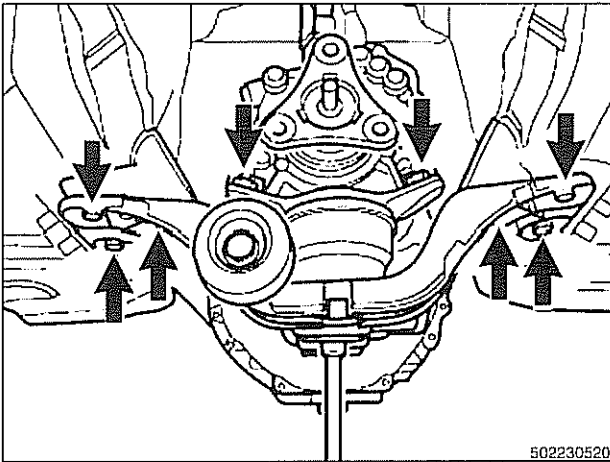
- to transmission (M8) 21 Nm (15 ft-lb)
- to chassis (M10) 42 Nm (30 ft-lb)

Output shaft seal, replacing (6-speed transmission) (transmission installed)

- Raise and safely support vehicle.

WARNING —

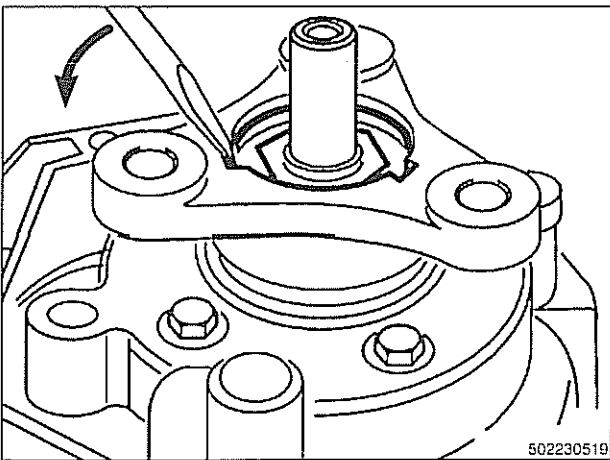
Make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.



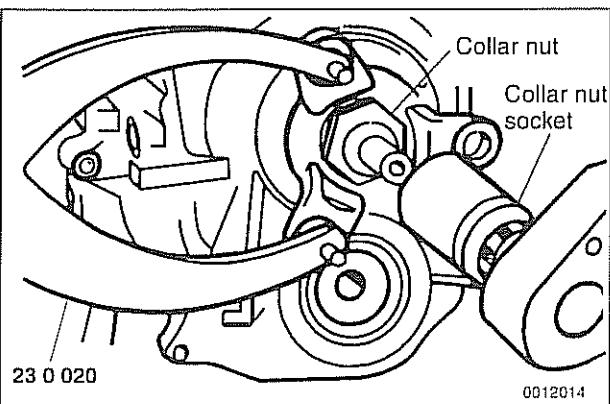
- Remove exhaust system and heat shields. See **180 Exhaust System**.
- Support transmission with transmission jack.
- Disconnect driveshaft at transmission output flange, and hang driveshaft to side. See **260 Driveshaft**.
- Remove transmission crossmember:
 - If applicable, release electrical harnesses from transmission crossmember.
 - Remove transmission and crossmember mounting bolts (arrows).
- Tilt down rear of transmission.

CAUTION —

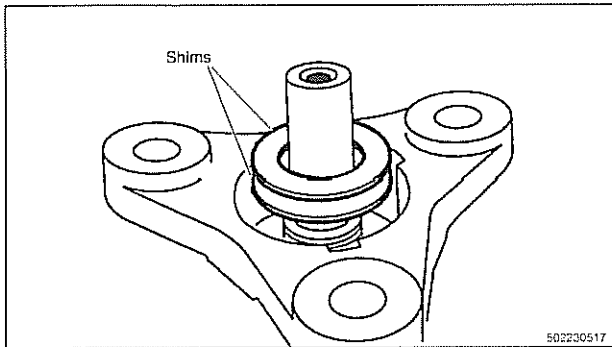
Tilting the engine to lower the transmission can lead to damage to various components due to lack of clearance.



- Use screwdriver to pry out output flange collar nut retaining plate.

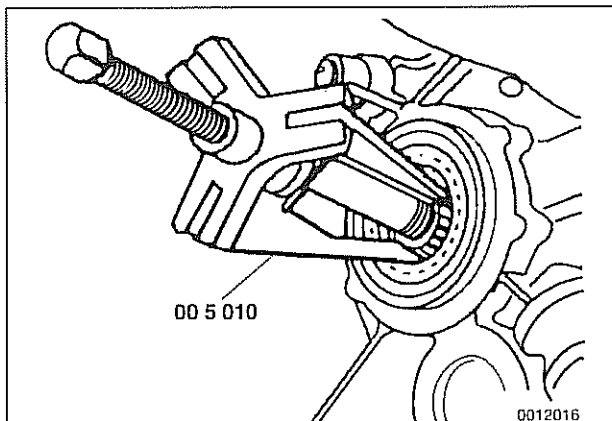


- Remove collar nut with BMW special tool 23 2 320 or equivalent thin-walled deep socket (36 mm). Use BMW special tool 23 0 020 or equivalent to counterhold output flange.

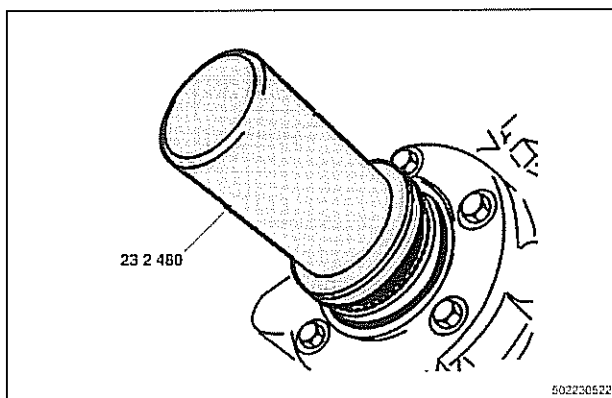


➤ Remove shims under collar nut and set aside.

— Use puller to remove output flange.



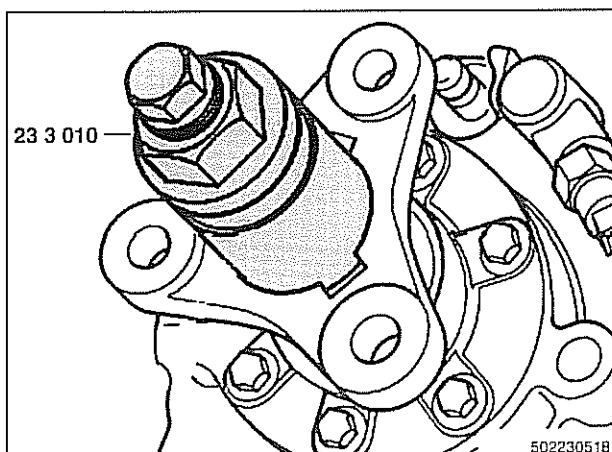
➤ Use BMW special tool 00 5 010 or other suitable seal puller to remove seal from transmission housing.



➤ Coat new seal with transmission fluid. Use seal installation drift, BMW special tool 23 2 480 or equivalent, to drive seal into housing as far as it will go.

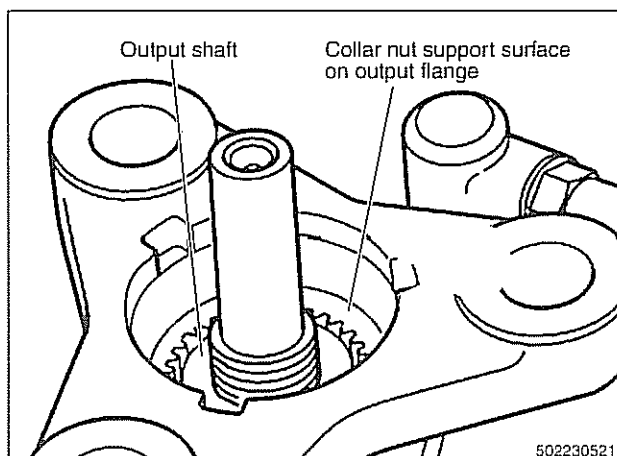
— Inspect sealing surface on output flange. Replace if worn or damaged.

— Coat sealing lip of seal, sealing surface of output flange and transmission splined shaft with transmission oil.



➤ Press output flange on output shaft using BMW special tool 23 3 010.

- Counterhold flange with BMW special tool 23 0 020.
- Tighten special tool 23 2 010 to 200 Nm (148 ft-lb).
- Remove special tools.



- ◀ If installing new output flange: Recalculate thickness of shims based on difference in height between output shaft surface and collar nut support surface. Shims must be within the output flange preload specification below the collar nut support surface.

Output flange preload

Difference between heights of shaft and output flange sealing surface MINUS thickness of shims	0.05 - 0.22 mm (0.002 - 0.009 in)
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NOTE —

Shims are available in increasing sizes of 0.1 mm from 1.4 mm to 2.1 mm (0.055 in to 0.083 in) from BMW parts.

- Install shims. Install and torque flange collar nut.

Tightening torques

Output flange to output shaft

• Stage I	190 Nm (140 ft-lb)
• Stage II (after loosening)	120 Nm (89 ft-lb)

- Use BMW special tool 23 2 470 to install flange nut retaining plate.
- Remainder of installation is reverse of removal, noting the following:
 - Install driveshaft using new nuts. See **260 Driveshaft**.
 - Check transmission fluid level, topping up as necessary.

Tightening torques

Aluminum driveshaft to flex-disc

• M12 (use Dacromet-coated washers)	90 Nm (66 ft-lb)
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Driveshaft CV joint to final drive flange

• M10 (Torx bolt)	70 Nm (51 ft-lb)
• M8 (compression nut)	32 Nm (24 ft-lb)

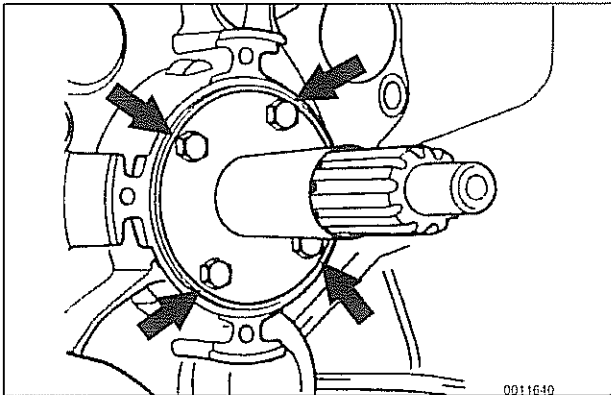
Flex-disc to transmission flange or driveshaft

• M10 (8.8 grade)	48 Nm (35 ft-lb)
• M10 (10.9 grade)	60 Nm (44 ft-lb)
• M12 (8.8 grade)	81 Nm (60 ft-lb)
• M12 (10.9 grade)	100 Nm (74 ft-lb)
• M14	140 Nm (103 ft-lb)

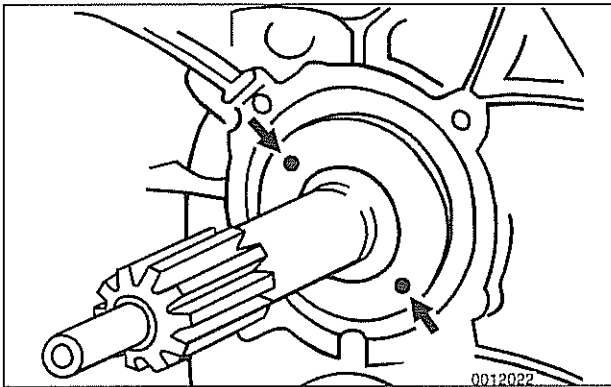
Transmission crossmember

• to transmission (M8)	21 Nm (15 ft-lb)
• to chassis (M10)	42 Nm (30 ft-lb)

Input shaft seal, replacing (transmission removed)



- Remove transmission from vehicle as described later in this group.
- Remove clutch release bearing and release bearing lever from inside bellhousing.
- Remove bolts (**arrows**) for clutch release-bearing guide sleeve, noting bolt lengths (Getrag transmission shown). Remove sleeve and any spacers (shims) under it.



- Two covered removal holes (**arrows**) are present in seal. Thread BMW special tool 23 0 490 or equivalent slide hammer seal puller into one hole and remove seal.
- Getrag S5D 250G transmission:
 - Place BMW special tool 23 2 460 or similar protective sleeve over input shaft.
 - Coat sealing lip of new seal with transmission oil and push over protective sleeve up to transmission housing.
 - Remove protective sleeve from input shaft.
 - Use BMW special tool 23 2 430 or similar drift to drive seal until fully seated.
- ZF S5D 320Z transmission:
 - Place BMW special tool 23 2 380 or similar protective sleeve over input shaft.
 - Coat sealing lip of new seal with transmission oil and push over protective sleeve up to transmission housing.
 - Remove protective sleeve from input shaft.
 - Use BMW special tool 23 2 340 or similar drift to drive seal until fully seated.
- 6-speed transmission:
 - Fit cap of BMW special tool 23 2 492 over tool sleeve.
 - Coat sealing lip of new seal with transmission oil and push on tool sleeve. Remove tool cap from tool sleeve.
 - Push sleeve with seal on input shaft.
 - Use BMW special tool 23 2 491 or similar drift to drive seal until fully seated.
 - Remove protective sleeve from input shaft.

- Thoroughly clean guide sleeve mounting bolts, sealing surfaces, and threads. Apply Loctite®243 or equivalent thread locking compound to guide sleeve bolts. Reinstall guide sleeve and spacer(s).

Tightening torques

Guide sleeve to transmission case

• M6	10 Nm (89 in-lb)
• M8 x 22	18 Nm (13 ft-lb)
• M8 x 30	25 Nm (18 ft-lb)

- Reinstall transmission.

TRANSMISSION REMOVAL AND INSTALLATION

Removal and installation of the transmission is best accomplished on a lift using a transmission jack. The engine must be supported using appropriate support equipment. This allows the engine to pivot on its mounts to access the upper Torx-head bolts at the bellhousing.

WARNING—

- *Make sure the car is stable and well supported at all times. Use a professional automotive lift or jack stands designed for the purpose. A floor jack is not adequate support.*
- *The removal of the transmission may upset the balance of the vehicle on a lift.*

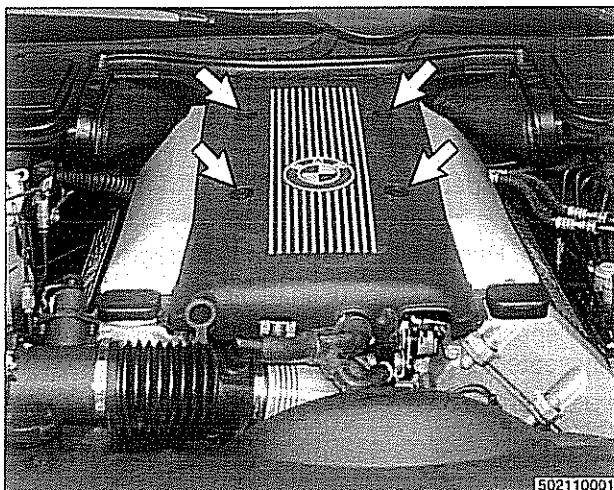
Transmission, removing and installing

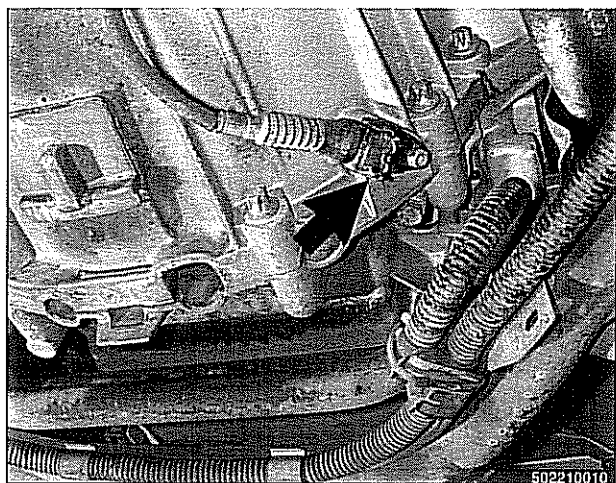
- Disconnect negative (-) cable from battery.

CAUTION—

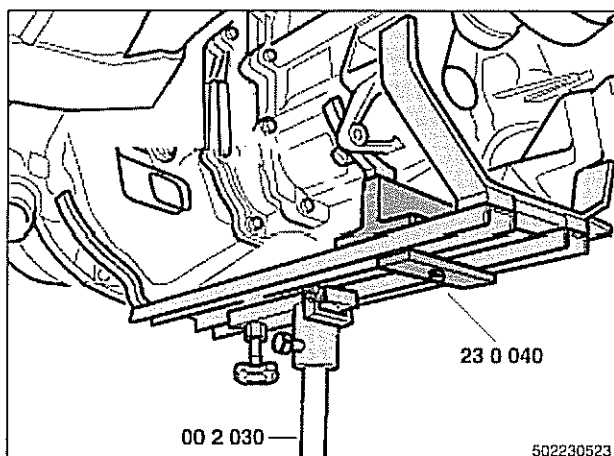
Prior to disconnecting the battery, read the battery disconnection cautions given in 001 Warnings and Cautions.

- ◀ V-8 engine: Remove plastic engine cover.
 - Early models: pry out protective caps (**arrows**), then remove nuts securing cover. Lift off cover.
 - Later models: depress four studs to release, then lift off cover.
- Raise and safely support vehicle.
- Remove engine splash shield from underside of vehicle.
- Remove exhaust system and heat shields. See **180 Exhaust System**.

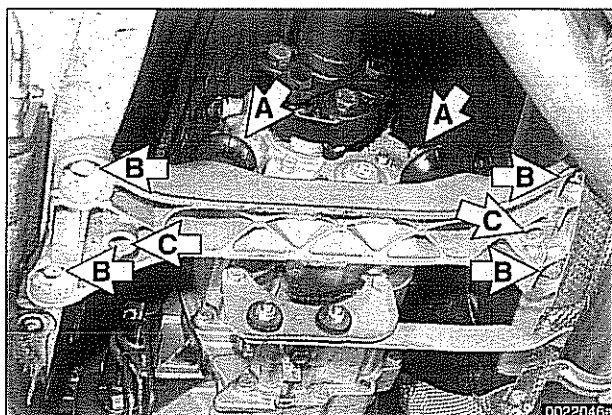




- V-8 engine: Remove heat shield from left front axle support.
- V-8 engine: Remove engine speed reference sensor from transmission.
- Where applicable, remove brackets for transmission underbody protection (adjacent to transmission).



- Support transmission with transmission jack.
- Where applicable, remove reinforcing cross brace from below driveshaft at transmission.
- Disconnect harness connector from back-up light switch on transmission.
- Free harnesses for oxygen sensors and back-up lights from crossmember and transmission.



- Remove transmission crossmember:
 - Remove transmission mount bolts (A).
 - Remove transmission crossmember bolts (B).
 - Where applicable, remove bolts (C).

NOTE—

5-speed transmission shown in illustration. Crossmember assembly for 6-speed transmission is similar.

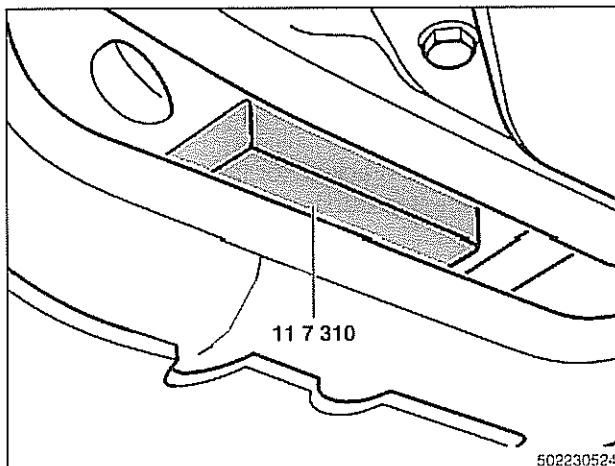
- Disconnect driveshaft from transmission and hang to one side. See 260 Driveshaft.

CAUTION—

Do not damage constant velocity joint or protective boot at rear differential.

- 6-cylinder engine: Remove stabilizer bar links and swivel stabilizer bar upwards.

Manual Transmission



- Unbolt clutch slave cylinder from side of transmission. Do not disconnect fluid hose. Suspend slave cylinder from chassis using stiff wire.

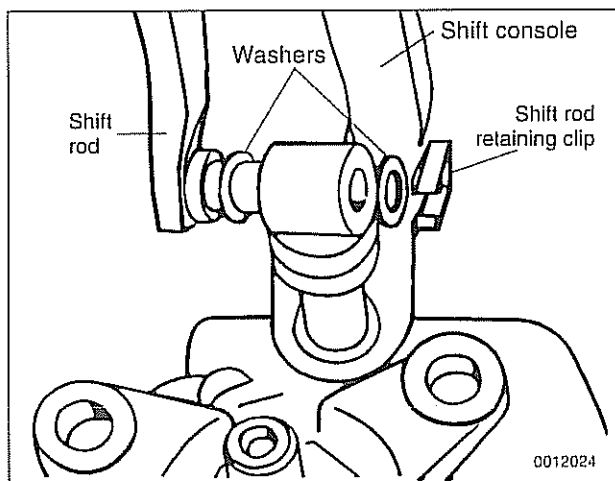
CAUTION—

- *Unbolt clutch slave cylinder slowly to prevent air being drawn into hydraulic system.*
- *Do not operate clutch pedal with slave cylinder removed from transmission.*

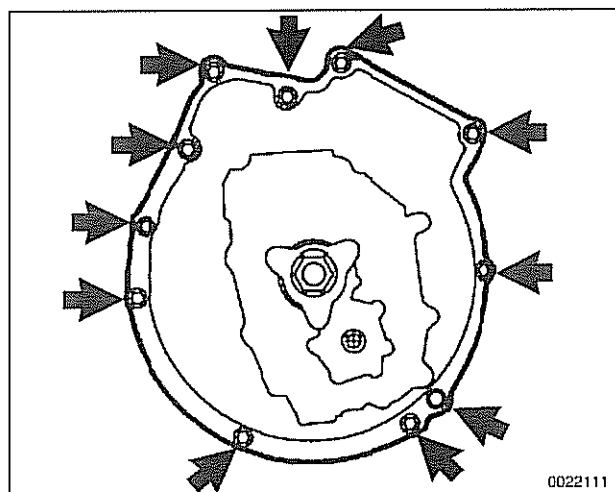
- Put BMW special tool 11 7 370 or appropriate sized spacer between engine oil sump and front axle support. Lower transmission until engine is supported on spacer.

CAUTION—

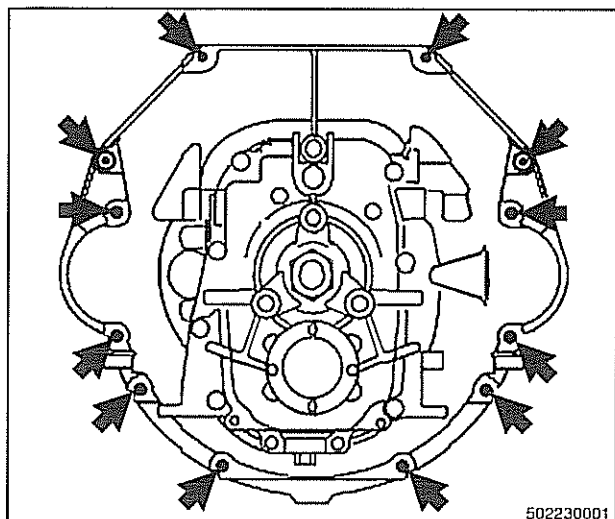
- *V-8 vehicle: Turn front wheels to prevent strain from being placed on center tie rod.*
- *All vehicles: Tilting the engine to lower the transmission can lead to damage to various components due to lack of clearance at rear of engine. Lower transmission slowly.*



- Support front of engine with floor jack.
- Disconnect shift rod from selector shaft coupling.
- Disconnect shift console from top of transmission. See **250 Gearshift Linkage**.



- 6-cylinder: Remove transmission mounting Torx-head bolts (arrows). Note length and location of bolts.
- Remove transmission by pulling backward until transmission input shaft clears clutch disc splines, then pull downwards. Lower transmission jack to remove transmission.



◀ V-8 engine: Remove transmission mounting Torx-head bolts (arrows). Note length and location of bolts.

- Remove transmission by pulling backward until transmission input shaft clears clutch disc splines, then pull downwards. Lower transmission jack to remove transmission.

— Installation is reverse of removal, keeping in mind the following:

- When installing a new transmission, be sure to transfer parts from old transmission if applicable.
- Thoroughly clean input shaft and clutch disc splines. Lightly lubricate transmission input shaft before installing.
- Be sure bellhousing alignment dowel sleeves are located correctly. Replace damaged sleeves.
- Center rear of transmission in driveshaft tunnel before tightening transmission support bracket.

NOTE —

In order to avoid difficulties in transmission removal at a future time, use washers with Torx-head mounting bolts.

- Reinstall driveshaft. Use new nuts when mounting driveshaft to transmission/flex disc. See **260 Driveshaft**.
- Refill transmission with appropriate lubricant before starting or towing car. See **Transmission fluid service** earlier in this repair group.

Tightening torques

Flex-disc to transmission output flange

• M10 (8.8 grade)	48 Nm (35 ft-lb)
• M10 (10.9 grade)	60 Nm (44 ft-lb)
• M12 (8.8 grade)	81 Nm (60 ft-lb)
• M12 (10.9 grade)	100 Nm (74 ft-lb)
• M14	140 Nm (103 ft-lb)

Rubber mount to transmission or crossmember (M8)	21 Nm (15 ft-lb)
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Slave cylinder to transmission	22 Nm (16 ft-lb)
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Transmission crossmember to chassis or transmission

• M8	21 Nm (15 ft-lb)
• M10	42 Nm (32 ft-lb)

Transmission to engine (Torx-head)

• M8	22 Nm (16 ft-lb)
• M10	43 Nm (32 ft-lb)
• M12	72 Nm (53 ft-lb)

Transmission drain/fill plug to transmission case	50 Nm (37 ft-lb)
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