

210 Clutch

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GENERAL

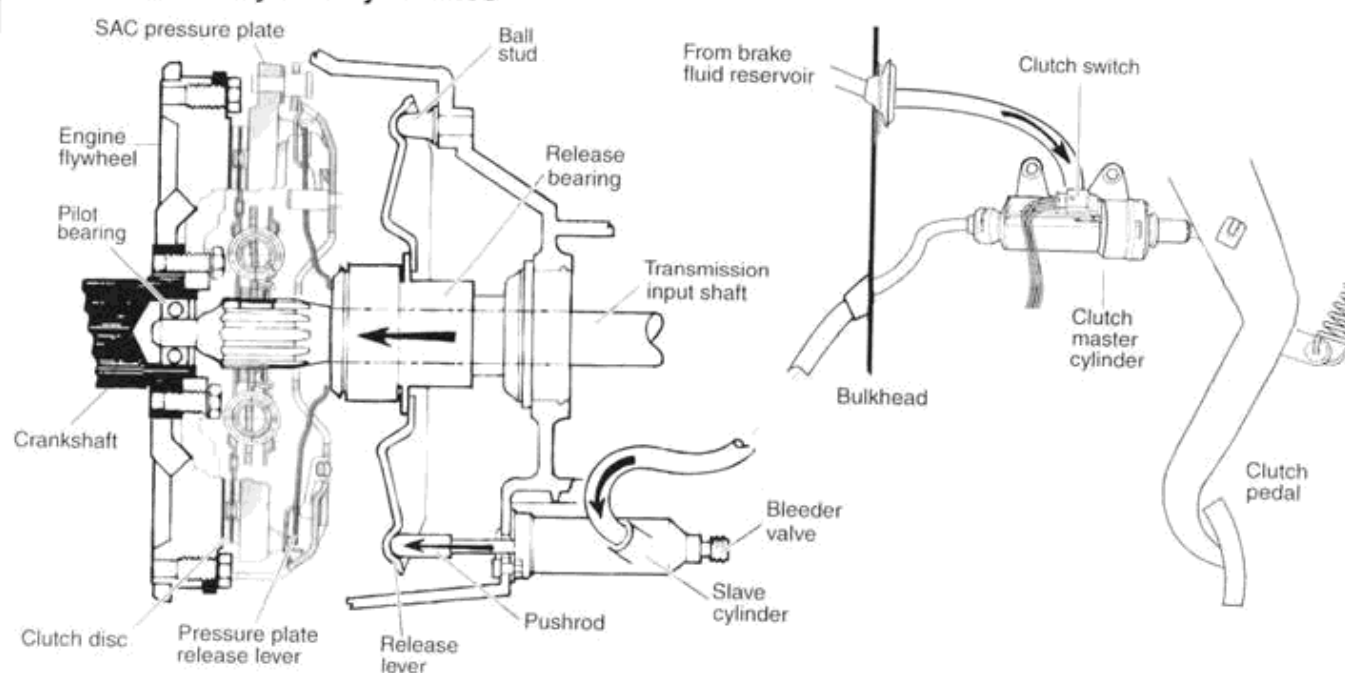
This repair group covers replacement of manual transmission clutch mechanical and hydraulic components.

See also:

- **200 Transmission-General** for transmission application information
- **230 Manual Transmission** for transmission removal
- **270 Transfer Case** for xDrive transfer case removal

Clutch system overview

Clutch assembly and hydraulics



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210-2 Clutch

Cautions

Cautions

CAUTION—

- When performing any repair which involves separating the engine and transmission, check that the bell housing dowels are undamaged and properly in place before reassembly. If the alignment of the engine flywheel to the transmission input shaft or torque converter is incorrect any of the following complaints may result: Clutch slipping, shudder, or poor disengagement; noise from transmission input shaft; transmission popping out of gear; difficulty changing gears; or internal damage to the transmission.
- When removing interior trim clips, avoid damaging trim pieces by using a plastic prying tool or a screwdriver with the tip wrapped with masking tape.
- Brake fluid is poisonous, highly corrosive and dangerous to the environment. Wear safety glasses and rubber gloves when working with brake fluid. Do not siphon brake fluid with your mouth. Immediately clean away any fluid spilled on painted surfaces and wash with water, as brake fluid removes paint.
- Use new brake fluid from a fresh, unopened container. Brake fluid absorbs moisture from the air. This can lead to corrosion problems in the hydraulic systems, and also lowers the brake fluid boiling point. Dispose of brake fluid properly.
- To avoid electrochemical corrosion to engine components made of aluminum-magnesium alloy, do not use steel fasteners. Use aluminum fasteners only.
- The end faces of aluminum fasteners are usually painted blue. For reliable identification, test fasteners for aluminum composition with magnet.
- Replace aluminum fasteners each time they are loosened.
- Follow torque instructions, including angle of rotation specifications, when installing aluminum fasteners.

CLUTCH HYDRAULICS

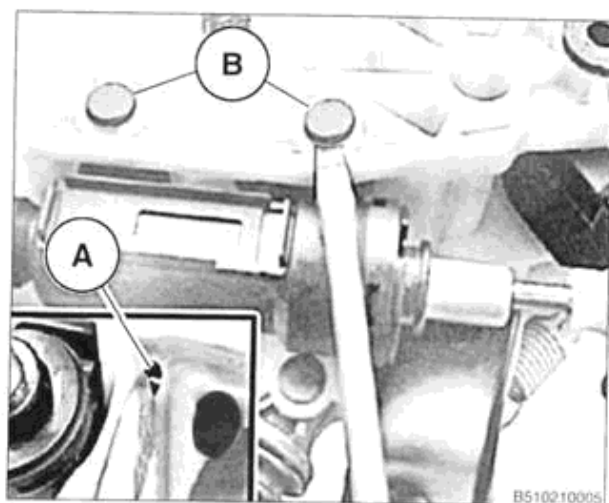
The clutch is hydraulically actuated by the master and slave cylinders. Clutch disc wear is automatically taken up through the self-adjusting clutch (SAC) pressure plate springs, making periodic adjustments unnecessary.

A soft or spongy feel to the clutch pedal, long pedal free-play, or grinding noises from the gears while shifting can all indicate problems with clutch hydraulics. In these circumstances it is best to start with a clutch fluid flush, followed, if necessary, by replacement of the hydraulic parts.

The clutch hydraulic system shares the fluid reservoir and fluid with the brake hydraulic system.

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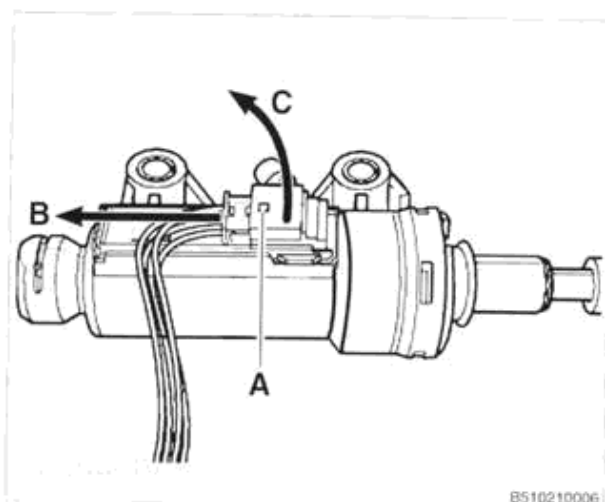
Clutch switch, replacing



- Working at clutch master cylinder mounting pins:
- Use screwdriver to remove locking clip (A).
 - Pry out mounting pins (B).
 - Lower master cylinder and detach fluid supply line.

CAUTION—

- Do not pull supply line completely into vehicle interior.

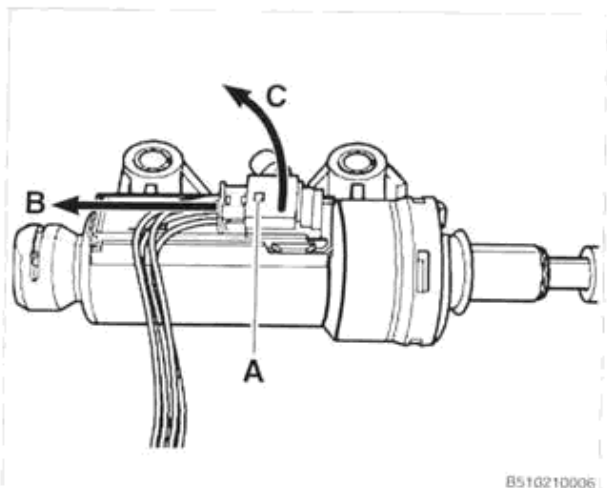


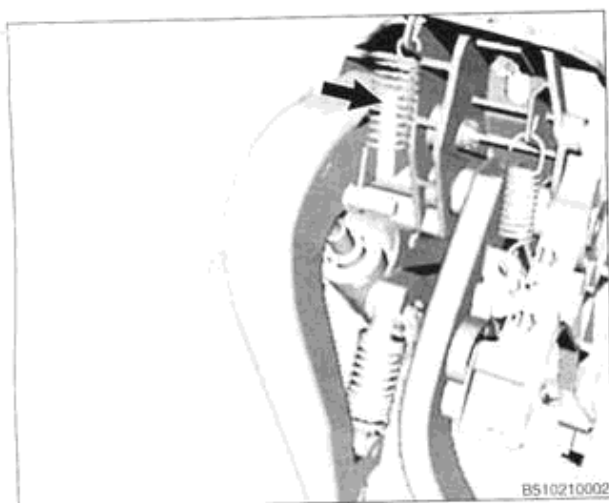
- Remove switch module from master cylinder.
- Press locking button (A) to release harness connector.
 - Pull harness connector (B) off switch module.
 - Use screwdriver to lever switch module (C) off master cylinder.
- Installation is reverse of removal. Keep in mind the following:
- Make sure switch module snaps audibly into place on master cylinder housing.
 - Reattach fluid supply hose before placing master cylinder in place on pedal cluster.
 - Press in master cylinder mounting pins until locking clips snap into place.
- Reattach fluid supply hose to brake fluid reservoir. Fill reservoir with clean fluid and bleed clutch hydraulics. See **Clutch hydraulic system, bleeding and flushing** in this repair group.

Clutch switch, replacing

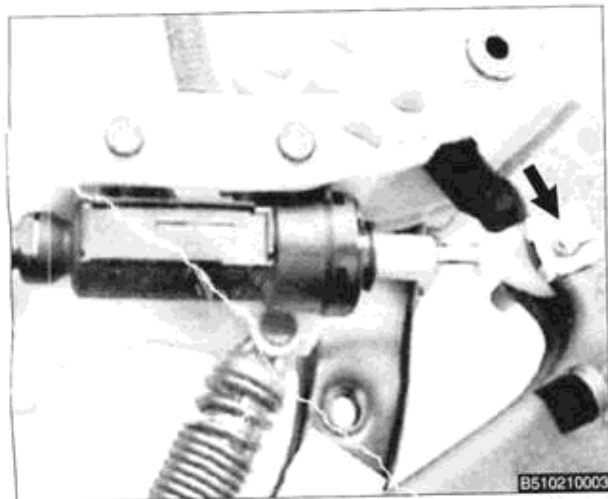
The clutch switch module is attached to the clutch master cylinder. It performs both cruise control and starter immobilization functions.

- Working at pedal cluster, remove lower left trim panel under dashboard (pedal cluster trim). See **513 Interior Trim**.
- Remove switch module from master cylinder.
- Press locking button (A) to release harness connector (B).
 - Use screwdriver to lever off switch module (C).
- Installation is reverse of removal. Make sure switch module snaps audibly into place on master cylinder housing.

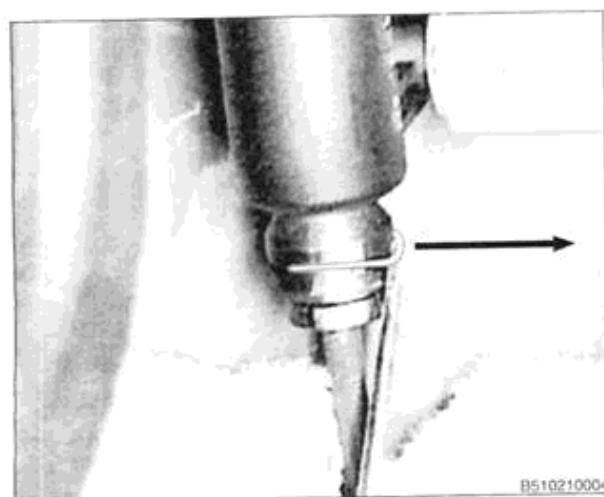




- Working underneath left side dashboard at pedal cluster, detach clutch pedal return spring (arrow).



- Using screwdriver, remove retaining clip (arrow), then push out pin mounting master cylinder push rod to clutch pedal.



- Use thin screwdriver to remove fluid pressure line retaining clip (arrow). Detach fluid line from clutch master cylinder.

CAUTION—

- To prevent brake fluid spill, wrap clutch master cylinder with shop towels when removing hydraulic fluid lines from master cylinder.
- Brake fluid damages paint and stains carpets. Clean off any brake fluid on or in the vehicle immediately.

Clutch hydraulic system, bleeding and flushing

If the clutch and brake fluid is murky or muddy, or has not been changed within the last two years, flush the system using a brake system pressure bleeder.

- Raise vehicle and support safely.

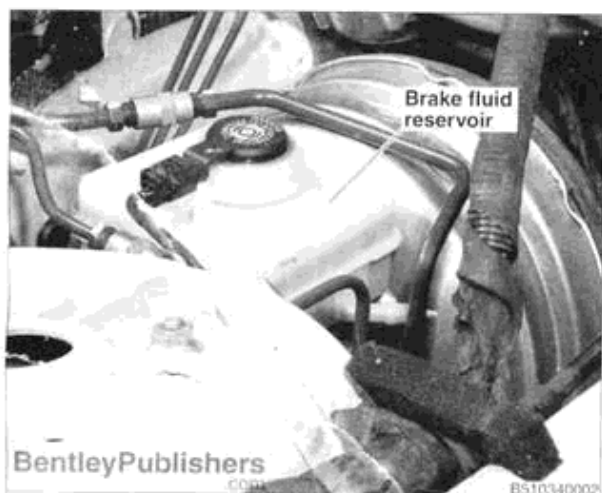
WARNING—

- Make sure the vehicle 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 splash shield under transmission. See **020 Maintenance**.
- Working at left rear of engine compartment, remove left cabin microfilter cover and housing. See **020 Maintenance**.
- Remove brake fluid reservoir cap. Using a clean syringe, remove brake fluid from reservoir. Refill reservoir with clean DOT4 low viscosity brake fluid.
- Attach pressure brake bleeder to fluid reservoir and pump bleeder a few times to pressurize hydraulic fluid system.

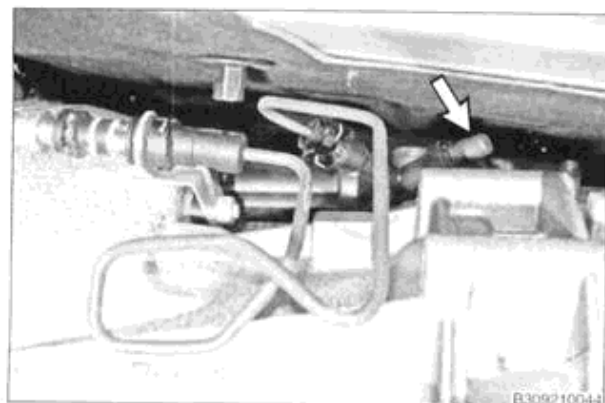
CAUTION—

- Do not exceed 2 bar (29 psi) pressure at the fluid reservoir when bleeding or flushing the hydraulic system.
- Brake fluid is poisonous, highly corrosive and dangerous to the environment. Wear safety glasses and rubber gloves when working with brake fluid. Do not siphon brake fluid with your mouth. Immediately clean away any fluid spilled on painted surfaces and wash with water, as brake fluid removes paint.
- Use new brake fluid from a fresh, unopened container. Brake fluid absorbs moisture from the air. This can lead to corrosion problems in the hydraulic systems, and also lowers the brake fluid boiling point. Dispose of brake fluid properly.



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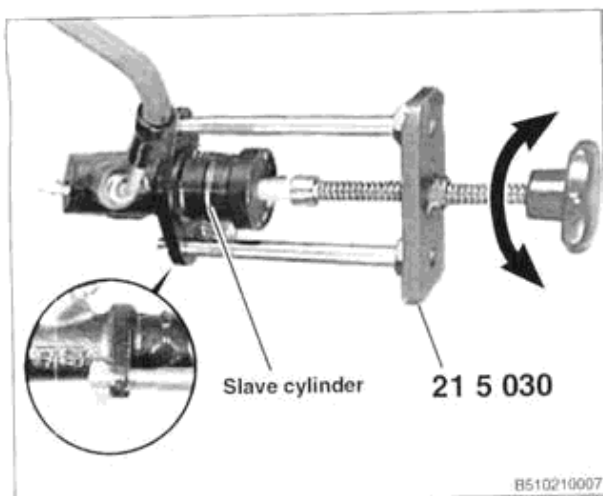
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Clutch hydraulics, bleeding

- Connect a length of hose from clutch slave cylinder bleeder valve (arrow) to a container.
- Open bleeder valve and allow brake fluid to expel until clean fluid comes out free of air bubbles.
- Close bleeder valve and disconnect pressure bleeding equipment from fluid reservoir. Hose on bleeder valve remains connected.
- Slowly operate clutch pedal about 10 times. Fill reservoir with clean fluid as necessary.

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Clutch master cylinder, replacing



Clutch hydraulics, bleeding using BMW special tool 21 5 030

- ◀ Working underneath vehicle, unbolt slave cylinder from transmission. Fit BMW special tool 21 5 030 to slave cylinder. Rotate threaded tool spindle to press slave cylinder pushrod completely into slave cylinder.
- Attach pressure brake bleeder to fluid reservoir.
- Hold slave cylinder so that bleeder valve is at highest point.
 - Open bleeder valve.
 - If bubble-free brake fluid emerges, use tool spindle to retract slave cylinder push rod slightly, then press in again.
 - If bubbles appear, repeat procedure until fluid runs clear and without bubbles.
 - Once brake fluid appears without air bubbles, close bleeder valve, release pressure bleeder and detach special tool. Disconnect bleeder hose.

CAUTION—

- Do not detach special tool from slave cylinder if fluid is pressurized. The slave cylinder push rod can blow out of the cylinder.

- Reinstall slave cylinder to transmission. Add clean brake fluid to reservoir as necessary. Check clutch operation.

Tightening torque

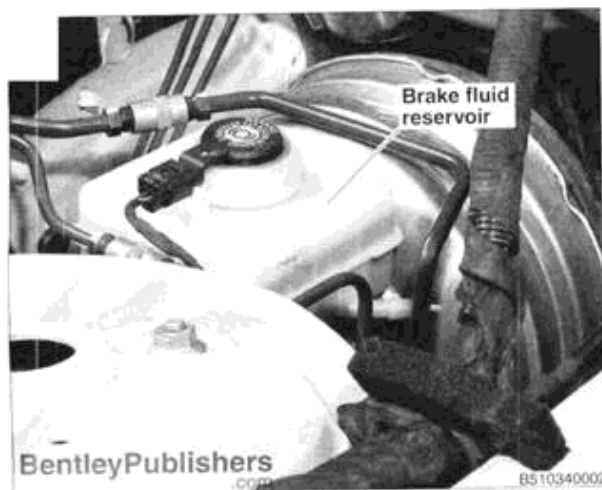
Clutch slave cylinder to transmission

22 Nm (16 ft-lb)

Clutch master cylinder, replacing

The clutch master cylinder is mounted to the pedal assembly directly above the clutch pedal.

- Working at left rear of engine compartment, remove left cabin microfilter cover and housing. See **020 Maintenance**.
- ◀ Remove brake fluid reservoir cap. Using a clean syringe, remove brake fluid from reservoir.
- Disconnect clutch fluid supply line from brake fluid reservoir. Place a pan under hose to catch dripping fluid.
- Working at pedal cluster, remove lower left trim panel under dashboard (pedal cluster trim). See **513 Interior Trim**.
- Remove light module. See **630 Lights**.



Clutch slave cylinder, replacing

The clutch slave cylinder is bolted to the left side of the transmission housing close to the clutch bell housing.

- Working at left rear of engine compartment, remove left cabin microfilter cover and housing. See **020 Maintenance**.
- Use hose pinch tool 13 3 010 or equivalent to pinch off clutch fluid supply line at brake fluid reservoir.
- Raise vehicle and support safely.

WARNING —

- Make sure the vehicle 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 lower engine and transmission splash shields as necessary. See **020 Maintenance**.



Working underneath transmission:

- Loosen union nut **A** to disconnect fluid line from slave cylinder. Place pan under line to catch dripping fluid.
- Loosen union nut **B** to detach metal line from fluid supply hose.
- Remove slave cylinder mounting nuts (**arrows**) from clutch bell housing and remove cylinder.

- Installation is reverse of removal. Note the following:
 - Check for wear on slave cylinder push rod. Any wear except on tip is caused by misalignment of clutch components.
 - Lightly coat pushrod tip with molybdenum disulfide grease (Molykote® Longterm or equivalent).
 - During installation be sure pushrod tip engages recess in clutch release lever.
 - Fill brake fluid reservoir with clean fluid and bleed clutch hydraulics. See **Clutch hydraulic system, bleeding and flushing** in this repair group.

Tightening torques

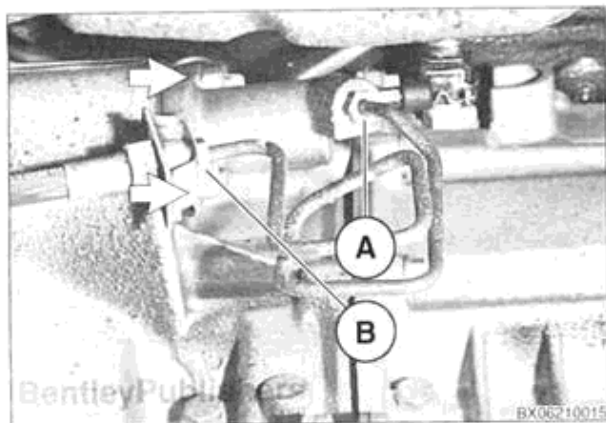
Clutch slave cylinder to transmission	22 Nm (16 ft-lb)
Fluid line to slave cylinder	14.5 Nm (11 ft-lb)

CLUTCH MECHANICAL

Clutch replacement requires removal of the transfer case (xDrive models) and transmission.

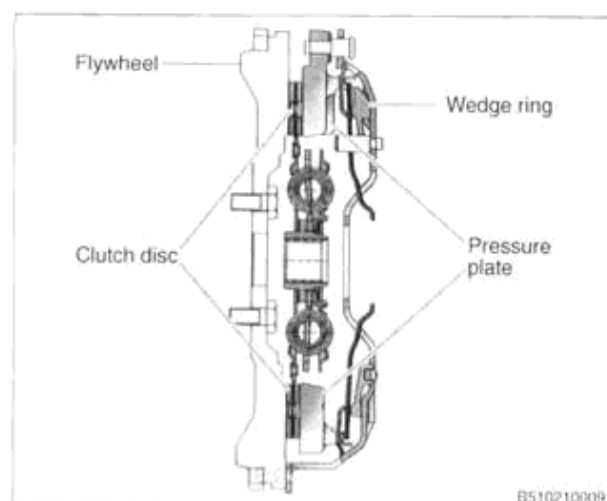
Clutch disc, pressure plate and release bearing are usually replaced during a clutch overhaul. Check flywheel for wear and scoring. Replace if necessary.

Be sure to check the bottom of the bell housing for oil. If engine oil is found, check for faulty rear crankshaft (rear main) oil seal. Rear main seal replacement is covered in **119 Lubrication System**.



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Clutch, removing



- ◀ The SAC pressure plate uses a wedge ring which rotates against the diaphragm springs to accommodate for clutch disc wear. The wedge ring adjusts by means of spring tension. Special tools are needed to apply and relieve spring tension as the clutch pressure plate is removed and installed.

Clutch, removing

- Disconnect negative (–) battery cable and cover battery terminal to keep cable from accidentally contacting terminal.

CAUTION—

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

- Raise vehicle and support safely.

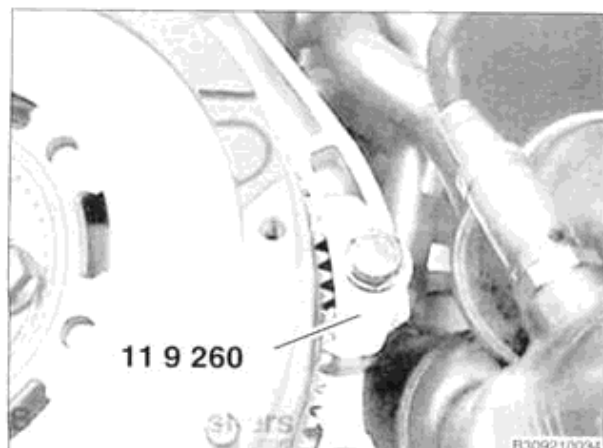
WARNING—

- Make sure the vehicle 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 splash shield under engine and transmission. See **020 Maintenance**.
- Remove front end reinforcement. Discard mounting bolts.
- Remove complete exhaust system. See **180 Exhaust System**.

WARNING—

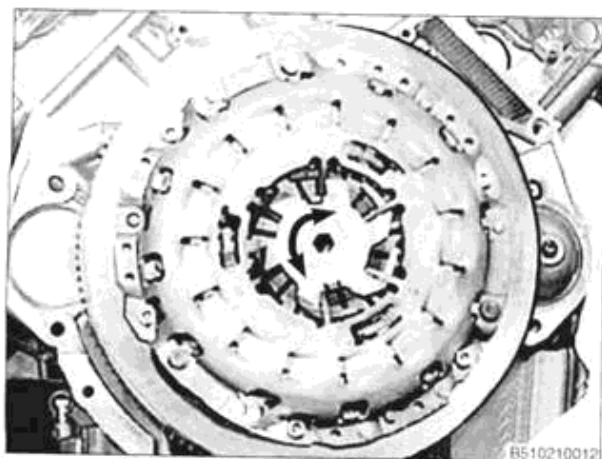
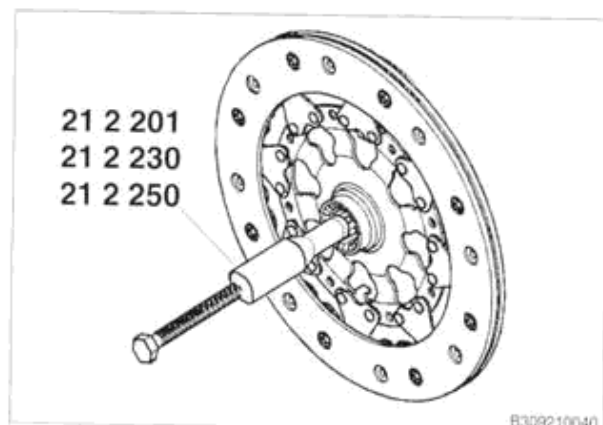
- Make sure exhaust system is fully cooled off before starting removal.



- Remove heat shields under transfer case (xDrive models) and rear driveshaft.
- Detach front (xDrive models) and rear driveshafts and tie to side. See **260 Driveshafts**.
- Remove transmission from engine. See **230 Manual Transmission**.
- ◀ Lock flywheel in position using BMW special tool 11 9 260 or equivalent.

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Clutch, installing (new SAC components)



- Clean release bearing guide sleeve.

CAUTION—

- Do not grease release bearing module or guide sleeve. If guide sleeve is greased, release bearing may stick to it.

Clutch, installing (new SAC components)

The SAC pressure plate, when new, comes from the factory with a lock plate at the center which maintains spring tension on the self-adjusting springs. Do not remove this lock plate until the pressure plate is securely installed on the flywheel with clutch disk in place.

CAUTION—

- Avoid contaminating clutch friction surfaces with oil or grease. Do not touch these surfaces.

- ◀ Center clutch disc on flywheel using the appropriate BMW (or equivalent) centering tool.

CAUTION—

- Be sure clutch disc is facing the correct way. The disc is marked "engine side" or "transmission side".

NOTE—

- The large bolt in the clutch disc centering tool is used to install and remove the tool only. Once the disc is in place on the flywheel, remove the bolt to make room for the SAC pressure plate.

- Lock flywheel in position using BMW special tool 11 9 260 or equivalent.
- Install SAC pressure plate on flywheel dowel pins. Install clutch mounting bolts and tighten each one turn at a time until pressure plate is fully seated. Torque to specification in 2 stages.

Tightening torque

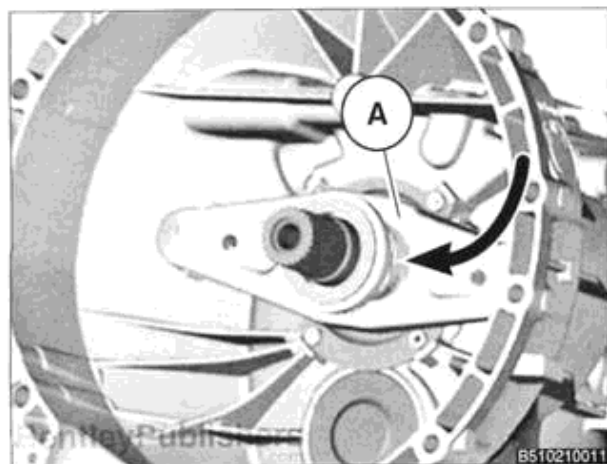
Clutch to flywheel (use new M8 ZNS bolts)	
• Stage 1	15 Nm (11 ft-lb)
• Stage 2	additional 90° ± 5°

- ◀ Use 14 mm Allen wrench to unscrew (clockwise or counterclockwise) lock plate in center of pressure plate.

NOTE—

- The spring lock plate may make snapping noises while being unscrewed.

- Using large bolt, pull out clutch disc centering tool.
- Remove flywheel locking tool.
- Inspect and clean clutch release bearing and lever module.



- Install clutch release module (A) by tilting over transmission input shaft (arrow). Be sure it clips securely to retaining spring clip.

— Install transmission. See 230 Manual Transmission.

CAUTION—

- Replace aluminum bolts each time they are loosened.
- Follow torque instructions, including angle of rotation specifications, when installing aluminum fasteners.

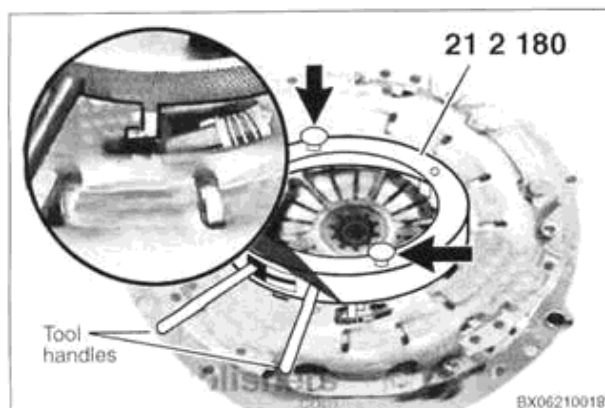
Tightening torques

Front end reinforcement to front end (use new fasteners):	
• Stage 1	56 Nm (41 ft-lb)
• Stage 2	additional 90°
Slave cylinder to transmission	22 Nm (16 ft-lb)
Transmission rear support to body (M8)	19 Nm (14 ft-lb)
Transmission mount to rear support (M8)	19 Nm (14 ft-lb)
Transmission to engine (use new aluminum bolts):	
• M10 x 30 mm	20 Nm
Stage 1	additional 90° - 110°
Stage 2	
• M10 x 85 mm	20 Nm
Stage 1	additional 180° - 200°
Stage 2	
• M12	25 Nm
Stage 1	additional 130° + 20°
Stage 2	
Vibration damper to transmission rear support (M10)	38 Nm (28 ft-lb)

Clutch, installing (used SAC components)

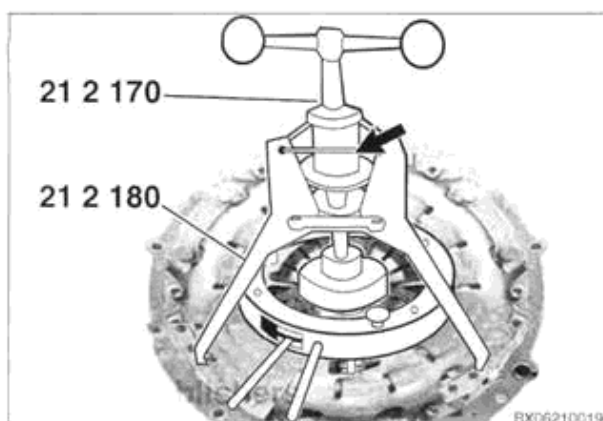
When reinstalling a previously used self-adjusting clutch (SAC), special tools are needed to reset the self-adjusting ring to its original position.

- Place SAC pressure plate on clean work surface.
- Place BMW special tool 21 2 180 on pressure plate.
- Note that locating hooks of special tool engage pressure plate adjusting ring openings (inset).
 - Grip tool firmly and squeeze special tool handles together.
 - Tighten down special tool knurled screws (arrows).
 - SAC adjustment ring is now in its original position.



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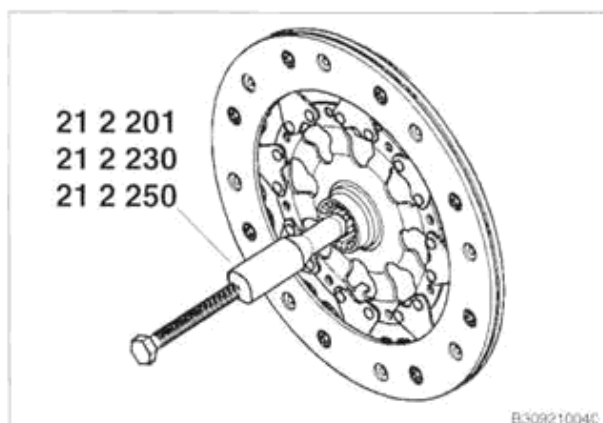
Clutch, installing (used SAC components)



- Install BMW special tool 21 2 170 on SAC pressure plate.
- Fit fingers of special tool in slots above dowel pin bores.
- Tighten down knurled nut (**arrow**) finger-tight.
- Screw in T-handle until pressure plate diaphragm spring is pretensioned to stop.

CAUTION—

- Avoid contaminating clutch friction surfaces with oil or grease. Do not touch these surfaces.



- Center clutch disc on flywheel using the appropriate BMW (or equivalent) centering tool.

CAUTION—

- Be sure clutch disc is facing the correct way. The disc is marked "engine side" or "transmission side".

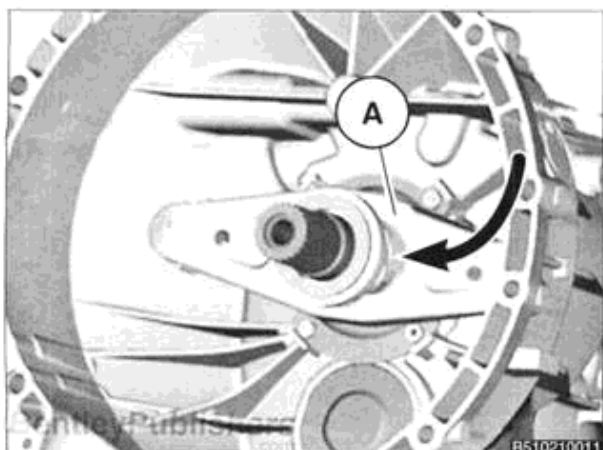
NOTE—

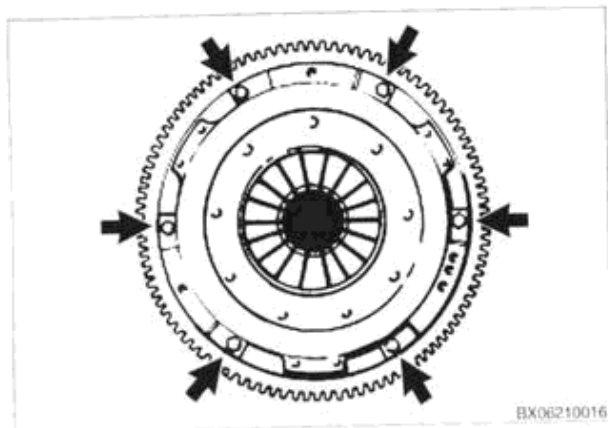
- The large bolt in the clutch disc centering tool is used to install and remove the tool only. Once the disc is in place on the flywheel, remove the bolt to make room for the SAC pressure plate.
- Lock flywheel in position using BMW special tool 11 9 260 or equivalent.
- Install SAC pressure plate on dowel pins at flywheel. Install clutch mounting bolts and tighten each one turn at a time until pressure plate is fully seated. Torque to specification in 2 stages.

Tightening torque

Clutch to flywheel (use new M8 ZNS bolts)	
• Stage 1	15 Nm (11 ft-lb)
• Stage 2	additional 90° ± 5°

- Using large bolt, pull out clutch disc centering tool.
- Remove flywheel locking tool.
- Inspect and clean clutch release bearing and lever module.
- Install clutch release module (**A**) by tilting over transmission input shaft (**arrow**). Be sure it clips securely to retaining spring clip.



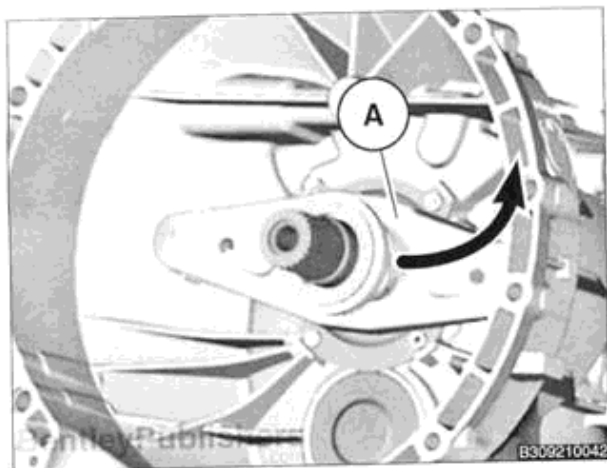


Loosen 6 clutch mounting bolts (arrows) evenly.

Remove pressure plate and clutch disc.

WARNING—

- Friction material in the clutch disc produces dangerous dust. Do not breathe in dust. Use water to wet down components and collect dripping mixture in a shop towel.



Remove clutch release bearing and lever module (A): Remove module from spring clip and tilt off transmission input shaft in direction of arrow.

CAUTION—

- To avoid installing incorrectly, do not remove bearing from release module.

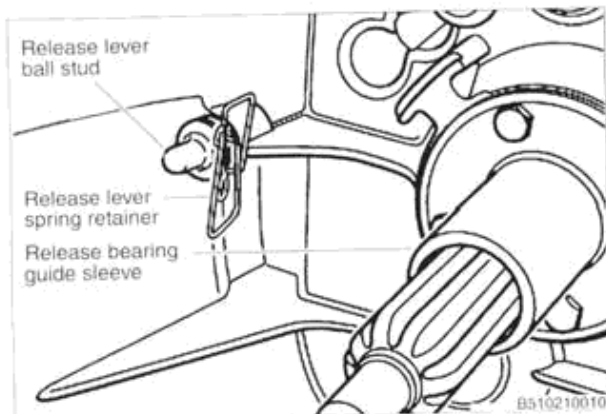
Clutch components, inspecting

- Inspect clutch disc for wear, cracks, loose rivets, contamination or excessive runout (warping). Replace if necessary.
- Measure depth of clutch lining at lining rivets. If shallowest rivet depth is less than 1 mm (0.04 in), replace clutch disk.
- Inspect flywheel for scoring, hot spots, cracks or loose or worn guide pins. Replace flywheel if any faults are found. See **Flywheel, removing and installing** in this repair group.

CAUTION—

- If flywheel is removed from engine, reinstall using new bolts.

- Check to make sure transmission pilot bearing rotates smoothly without play. Replace if faulty. See **Transmission pilot bearing, replacing** in this repair group.
- Inspect and clean release bearing module.
- Check release lever ball stud and spring retainer. Replace if damaged or worn.



- Install transmission. See **230 Manual Transmission**.

CAUTION—

- Replace aluminum bolts each time they are loosened.
- Follow torque instructions, including angle of rotation specifications, when installing aluminum fasteners.

Tightening torques

Front end reinforcement to front end (use new fasteners):	
• Stage 1	56 Nm (41 ft-lb)
• Stage 2	additional 90°
Slave cylinder to transmission	22 Nm (16 ft-lb)
Transmission rear support to body (M8)	19 Nm (14 ft-lb)
Transmission mount to rear support (M8)	19 Nm (14 ft-lb)
Transmission to engine (use new aluminum bolts):	
• M10 x 30 mm	20 Nm
Stage 1	additional 90° - 110°
Stage 2	
• M10 x 85 mm	20 Nm
Stage 1	additional 180° - 200°
Stage 2	
• M12	25 Nm
Stage 1	additional 130° + 20°
Stage 2	
Vibration damper to transmission rear support (M10)	38 Nm (28 ft-lb)

Self-adjusting clutch (SAC), breaking in

In normal driving, approx. 800 to 1000 gearshifts are needed for a new SAC clutch lining to be fully broken in. To ensure correct operation and long life, break in the SAC gradually, with light to medium loads. Fast sports-style driving and abrupt clutch engagement may destroy a new clutch. The following procedure helps to break in the clutch.

- Drive at 20 mph (30 kph) on level grade. Start, upshift and downshift through the gears at approx. 2000 rpm.
- Increase speed. Upshift and downshift through the gears at approx. 3500 - 4000 rpm.
- On medium grade (approx. 12% and up): Start off at approx. 2500 rpm 3 - 5 times.

210-14 Clutch

Flywheel, removing and installing

Flywheel, removing and installing

This procedure is for vehicle with manual transmission. Flywheel and torque plate removal for automatic transmission vehicle is covered in **240 Automatic Transmission**.

- Disconnect negative (–) battery cable and cover battery terminal to keep cable from accidentally contacting terminal.

CAUTION—

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

- Raise vehicle and support safely.

WARNING—

- Make sure the vehicle 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 splash shield under engine and transmission. See **020 Maintenance**.
- Remove front end reinforcement. Discard mounting bolts.
- Remove complete exhaust system. See **180 Exhaust System**.

WARNING—

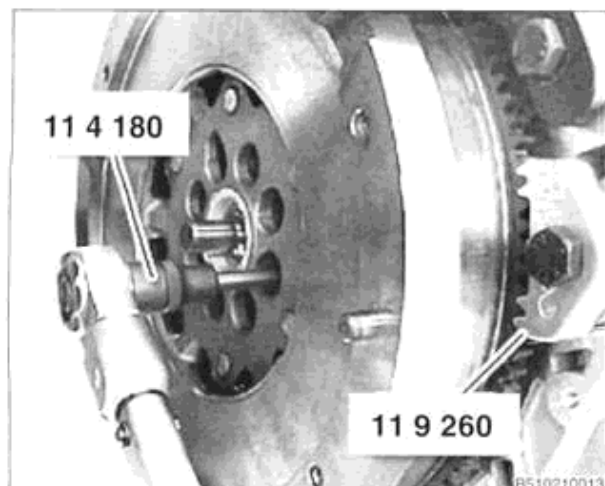
- Make sure exhaust system is fully cooled off before starting removal.

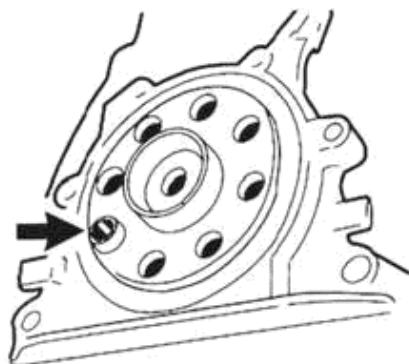
- Remove heat shields under transfer case (xDrive models) and rear driveshaft.
- Detach front (xDrive models) and rear driveshafts and tie to side. See **260 Driveshafts**.
- Remove transmission from engine. See **230 Manual Transmission**.
- Remove clutch. See **Clutch, removing** in this repair group.
- Inspect flywheel for scoring, hot spots, cracks or loose or worn guide pins. Replace flywheel if any faults are found.



Working at flywheel:

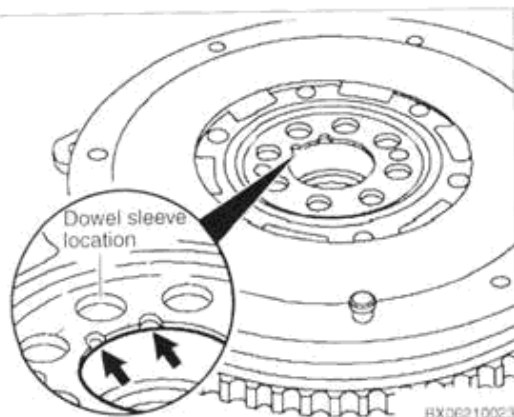
- Lock flywheel in position using BMW special tool 11 9 260 or equivalent.
 - Use BMW special tool 11 4 180 or equivalent (Torx T60 socket) to loosen and remove flywheel mounting bolts.
 - Remove flywheel.
- Clean flywheel bolt threads in crankshaft.





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- Check flywheel location dowel sleeve (arrow) for damage and correct installation.



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- When reinstalling flywheel, position dowel sleeve next to two locating notches (arrows).

- Install flywheel using new self-locking bolts.

Tightening torque

Flywheel to crankshaft
(use new self-locking bolts)

120 Nm (89 ft-lb)

CAUTION—

- Use new self-locking bolts to install flywheel. Do not reuse the old stretch-type bolts. Do not install bolts with Loctite® or similar thread-locking compound.

Transmission pilot bearing, replacing

- Disconnect negative (–) battery cable and cover battery terminal to keep cable from accidentally contacting terminal.

CAUTION—

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

- Raise vehicle and support safely.

WARNING—

- Make sure the vehicle 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 splash shield under engine and transmission. See 020 Maintenance.
- Remove front end reinforcement. Discard mounting bolts.
- Remove complete exhaust system. See 180 Exhaust System.

WARNING—

- Make sure exhaust system is fully cooled off before starting removal.

210-16 Clutch

Transmission pilot bearing, replacing

- Remove heat shields under transfer case (xDrive models) and rear driveshaft.
- Detach front (xDrive models) and rear driveshafts and tie to side. See **260 Driveshafts**.
- Remove transmission from engine. See **230 Manual Transmission**.
- Remove clutch. See **Clutch, removing** in this repair group.
- Remove flywheel. See **Flywheel, removing and installing** in this repair group.
- ◀ Use hydraulic press and BMW special tool 21 2 051 to press transmission pilot bearing out of dual-mass flywheel. Press from engine side of flywheel.

CAUTION—

- Do not drive bearing in or out using a chisel or punch.

- Place new pilot bearing on BMW special tool 21 2 052. Use hydraulic press to press bearing into flywheel as far as it will go. Press from clutch side of flywheel.

