Manual Transmission and Clutch

Inspection and Verification

NOTICE: If transmission noise is reported, first check the fluid level. The vehicle should not be driven if the fluid level is low.

NOTE: *If any evaluation or inspection reveals an obvious concern, repair the vehicle.*

NOTE: *Before attempting to rectify any concerns, road test the vehicle to ascertain in which system the concern falls.*

The technician should have a thorough knowledge of transmission/clutch operation and accepted general transmission/clutch guidelines to detect any problems.

A gear driven unit will produce a certain amount of noise. Some noise is acceptable and audible at certain speeds or under various driving conditions. Certain conditions, such as, road and weather, will amplify normal vehicle noise.

The following overview is a guide to diagnose a transmission/clutch concern:

- Verify and document the customer concern.
  - During the customer interview, if a leak was noticed or if a leak is the concern, check the transmission fluid. The vehicle should not be driven if the fluid level is low.
- Check fluid level and condition.
- Evaluation of the clutch hydraulic system.
- Evaluation of the clutch.
- Inspect gearshift mechanism.
- Road test.
- Find the cause of the problem and correct it.

Verify Customer Concern

1. Verify and document the customer concern.
   1. When was it first noticed?
   2. Did it appear suddenly or gradually?
   3. Did anything unusual occur that would coincide with it or precede it?
   4. Identify when the condition occurs:
      - Hot or cold vehicle operating conditions.
      - Type of terrain.
      - City/highway driving.
      - Driving at a particular speed.
        - coasting.
        - hard acceleration.
      - Shifting.
        - upshifts.
        - downshifts.
        - in a particular gear.
        - in all gears.
      - Hot or cold ambient temperatures.
   5. Has the transmission/clutch been repaired before or components installed?
      - Check the vehicle service record. Note any repairs.
   6. Check TSBs, SSMs and OASIS messages.

Check Fluid Level and Condition

NOTICE: The vehicle should not be driven if the fluid level is low.

NOTICE: Excessive temperatures may break down the transmission lubricant. If there is reason to believe that the transmission has been subjected to temperatures exceeding 275°F, change the lubricant immediately.

An incorrect level may affect the transmission operation and can result in transmission damage. To correctly check and add fluid to the transmission, refer to Specifications in this section.

A low fluid level can result in poor transmission shifting, engagement or damage. It can also indicate a leak in one of the transmission seals or gaskets.

1. Check the fluid condition.
    - Observe the color and the odor of the fluid. Allow the fluid to drip onto a white cloth and examine the stain. Check the fluid for contamination or metal particles.
        - Fluid should appear reddish in color.

Evaluation of Clutch Hydraulic System

1. Verify that the clutch hydraulic fluid reservoir is filled to the correct level.
    - If the fluid level is correct, proceed to clutch check.
    - If the fluid level is low, add fluid as necessary. Check the clutch hydraulic system for leaks and repair as necessary.

Evaluation Of The Clutch

1. Depress and release the clutch pedal slowly to check if the pedal is binding. Make sure the clutch pedal can be fully depressed and is not restricted by the floor mat.

2. Measure the clutch reserve. GO to Pinpoint Test A.

3. With the engine idling, the parking brake on and the clutch pedal up, gently move the gearshift lever forward into and out of reverse gear, until gear clash can be heard. Depress the clutch pedal slowly.
    - If the gears cease to clash (full disengage at 1 to 1.5 inch from the floor), then hold the pedal at the point of disengagement and increase engine to 4,000 rpm. The clutch should remain disengaged, clutch OK.
    - Any concerns indicate a worn or damaged clutch. Repair as necessary.

4. With the engine idling, move the gearshift lever into fourth gear. Increase the rpm to 2,000 and slowly release the clutch pedal.
    - If the engine stalls, clutch is OK.
    - If the engine does not stall, clutch slipping. Repair as necessary.

5. Compare the clutch evaluation results with the following table. The following list of conditions are typical faults into which clutch concerns will fall.

Symptom Chart

Conditions/Sources	Action
• **Clutch Slippage** ▪ Clutch pedal reserve. ▪ Diaphragm springs. ▪ Clutch pressure plate. ▪ Clutch disc facing. ▪ Hardened or oiled clutch disc facing surface. ▪ Flywheel.	• GO to Pinpoint Test A.
• **Clutch Chatter, Rattle or Shudder** ▪ Engine mounts. ▪ Oil on clutch disc facing. ▪ Diaphragm springs. ▪ Clutch pressure plate. ▪ Clutch disc facing. ▪ Flywheel. ▪ Clutch disc.	• GO to Pinpoint Test B.
• **Clutch System Leakage** ▪ Clutch master cylinder. ▪ Clutch slave cylinder. ▪ Clutch hydraulic tubes.	• GO to Pinpoint Test C.
• **Clutch Drag** ▪ Insufficient clutch fluid. ▪ Air in hydraulic system. ▪ Clutch pedal reserve.	• GO to Pinpoint Test D.

Conditions/Sources	Action
▪ Diaphragm springs. ▪ Clutch disc. ▪ Clutch disc splines. ▪ Oil on facing.	
• **Hard Shifting** ▪ Insufficient clutch fluid. ▪ Clutch pedal reserve. ▪ Transmission concern.	• GO to Pinpoint Test D.
• **Clutch Pedal Pulsation** ▪ Clutch and brake pedal pivot shaft not correctly lubricated. ▪ Flywheel. ▪ Worn springs in pressure plate.	• GO to Pinpoint Test E.
• **Clutch Related Vibrations** ▪ Engine component grounding against frame. ▪ Accessory drive belt. ▪ Flywheel bolts. ▪ Flywheel. ▪ Imbalanced clutch pressure plate.	• GO to Pinpoint Test F.
• **Excessive Noise** ▪ Clutch pedal reserve. ▪ Clutch slave cylinder. ▪ Pilot bearing. ▪ Excessive crankshaft end play.	• GO to Pinpoint Test G.
If the clutch was the concern, REPAIR the clutch system. TEST the system for normal operation.	

Inspect The Gearshift Mechanism

1. Inspect the gearshift mechanism for:
    - signs of damage.
    - missing or loose fasteners.
    - binding.
    - Repair any concerns as necessary.

Road Test the Vehicle

1. During the road test, use the following driving methods to diagnose the problem.
    - Start the engine.
    - Evaluate the noise in NEUTRAL while the vehicle is parked.
        - Check whether the noise is present with the clutch fully disengaged (pedal fully depressed). Check to see if the pedal pulsates abnormally (for clutch diaphragm finger run out).
        - Check whether the noise is present with the gearshift in the NEUTRAL position and the clutch fully engaged (foot off pedal). With the parking brake engaged, move the gearshift towards the 1st gear position. Apply very slight pressure and note if the gear noise level is reduced. (for gear rollover noise).
        - With the clutch fully engaged (foot off pedal) check whether the noise is present as the engine speed is raised. If the noise reduces, note the engine speed at which this occurs.
    - Listen for any change in noise while depressing and releasing the clutch pedal.
    - Listen for any change in noise while changing the engine rpm.
    - Drive the vehicle and shift through all of the gear ranges, including reverse. Listen for any change in noise in a particular gear.
    - Drive the vehicle in the gear in which the noise is most noticeable. Depress the clutch pedal and leave the gear engaged. Listen for any change in noise.
    - Drive the vehicle in the gear in which is most noticeable. Depress the clutch pedal and shift the transmission into NEUTRAL. Release the clutch pedal and allow the vehicle to coast.

2. Compare the road test results with the following symptom chart. It is a list of conditions that are typical faults into which the transmission will fall:

GO to Symptom Chart in this section.

Symptom Chart

Symptom Chart

Condition	Possible Causes	Action
• Transmission difficult to shift	• Lubricant.	• ADD or DRAIN AND FILL with specified lubricant.
	• Internal shift mechanism.	• CHECK the internal shift mechanism for smooth operation. REPAIR or INSTALL a new mechanism as necessary.
	• Sliding gears, synchronizers.	• CHECK for free movement of gears and synchronizers. REPAIR or INSTALL new components as necessary.
	• Housings, shaft.	• CHECK for binding condition between the input shaft and the engine crankshaft pilot bearing or bushing. REPAIR or INSTALL new components as necessary. REFER to Section 308-03A or Section 308-03B.
	• Loose pressure plate to flywheel bolts.	• CHECK for loose bolts at the pressure plate. INSTALL new components as necessary. REFER to Section 308-01.
• Transmission will not shift — gearshift lever moves	• Gearshift lever damaged.	• INSTALL a new gearshift lever.
	• Damaged or worn offset lever, shift plate or selector arm. Loose shift rail bushings.	• CHECK the internal shift components. INSTALL new component as necessary.
• **NOTE:** *While verifying the condition, determine whether the noise is gear rollover noise, release bearing rub or some other transmission-related noise. Gear rollover noise, inherent in manual transmissions, is caused by the constant mesh gears turning at the engine idle speed while the clutch is engaged and the transmission is in NEUTRAL. Release bearing rub is sometimes mistaken for mainshaft bearing noise. Gear rollover noise will disappear when the clutch is disengaged or when the transmission is engaged in gear. Release bearing rub will disappear when the clutch is engaged. In the event that a bearing is damaged, the noise is more pronounced while engaged in gear under load or coast than in NEUTRAL.* • Noisy in forward gears	• Lubricant.	• ADD or DRAIN AND FILL with specified lubricant.
	• Components grounding out on the transmission.	• CHECK for screws, bolts, etc., of body or other components grounding out. CORRECT as necessary.
	• Components housing bolts.	• CHECK the torque on the transmission-to-flywheel housing bolts and the flywheel housing-to-engine block bolts. TIGHTEN the bolts to specification. REFER to Section 308-01.

	• Bearings or gears.	• INSPECT the bearings. INSPECT the gears and gear teeth for wear or damage. INSTALL new components as necessary. REFER to Section 308-03A or Section 308-03B.
• Gears clash when shifting from one forward gear to another	• Pilot bearing.	• CHECK for a binding condition between the input shaft and the engine crankshaft pilot bearing. INSTALL new components as necessary. REFER to Section 308-01.
	• Gear teeth and/or synchronizer.	• REPAIR or INSTALL new components as necessary. REFER to Section 308-03A or Section 308-03B.
	• Damaged shift forks or worn shift fork inserts.	• INSPECT for wear or damage. INSTALL new components as necessary. REFER to Section 308-03A or Section 308-03B.
• Transmission jumps out of gear	• Transmission range selector lever boot.	• INSTALL a new boot if exceptionally stiff. REFER to Section 308-03A or Section 308-03B.
	• Transmission-to-engine mounting bolts.	• TIGHTEN the bolts to specification.
	• Crankshaft pilot bearing.	• INSTALL a new bearing.
	• Internal damage.	• INSPECT the synchronizer sleeves for free movement on their hubs. INSPECT the synchronizer blocking rings for widened index slots, rounded clutch teeth and smooth internal surface. CHECK countershaft cluster gear for excessive end play. CHECK shift forks for worn or loose mounting on shift rails. INSPECT the synchronizer sliding sleeve and the gear clutch teeth for wear or damage. REPAIR or INSTALL a new component as necessary.
	• Gear teeth.	• If worn or damaged, INSTALL new gears. REFER to Section 308-03A or Section 308-03B.
• Transmission will not shift into one gear — all others OK	• Manual shift linkage.	• REPAIR or INSTALL new components as necessary.
	• Backup switch ball.	• If REVERSE is the problem, CHECK backup switch for ball frozen in extended position.
	• Internal components.	• INSPECT the shift rail and fork system, synchronizer system and the gear clutch teeth for restricted travel. REPAIR or INSTALL new components as necessary.
• Transmission is locked in one gear and cannot be shifted out of that gear	• Internal components.	• INSPECT the problem gears, shift rails, forks and the synchronizer for wear or damage. REPAIR as necessary. REFER to Section 308-03A or Section 308-03B.
	• Fork on rail, offset lever or shift rail.	• CHECK the shift rail interlock system. REFER to Section 308-03A or Section 308-03B.

• Transmission leaks	• Lubricant. • Other component leaking. • False report. • Internal components. • Fill and drain plugs.	• CHECK the level and type. • IDENTIFY leaking fluid as engine, power steering, or transmission fluid. REPAIR as necessary. • REMOVE all traces of lube on the exposed transmission surfaces. CHECK the vent for free breathing. OPERATE the transmission and INSPECT for new leakage. REPAIR as necessary. REFER to Section 308-03A or Section 308-03B. • INSPECT for leaks at the input shaft bearing retainer seal and the shift rail expansion plug. REFER to Section 308-03A or Section 308-03B. INSPECT for leaks at the top cover gasket. INSPECT the case for sand holes or cracks. REPAIR or INSTALL a new case as necessary. REFER to Section 308-03A or Section 308-03B. • CHECK fill and drain plugs and bore threads. REPAIR as necessary. TIGHTEN plugs to specified torque value. REFER to Section 308-03A or Section 308-03B.
• Bearing failure	• Other part failure. • Raceways or rollers. • Lubricant. • Towing vehicle further than 80 km (50 miles) with driveshaft installed. Mainshaft tapered bearing and needle caged bearings are especially susceptible to damage. • Vibration break-up of retainer and brinelling of races. • Bearing(s). • Shafts or bore. • Overloading of vehicle. • Incorrect preload. • Input shaft oil dam. • Oil baffle in the input bearing shim pack.	• REMOVE, DISASSEMBLE and CLEAN the transmission. Inspect for damaged parts and install new components as necessary. (Note: RESET the bearing preload if any new tapered bearings are installed). REFER to Section 308-03A or Section 308-03B. • DETERMINE the cause of vibration and CORRECT. Otherwise PROCEED as above. • INSTALL new components as necessary and VERIFY the oil dam installation is correct. REFER to Section 308-03A or Section 308-03B. CHECK for correct installation of the snap ring on the mainshaft next to the oil dam. • INSTALL a new oil baffle, making sure it is not damaged during assembly. REFER to Section 308-03A or Section 308-03B.

Pinpoint Tests

PINPOINT TEST A : CLUTCH SLIPPAGE

A1 INSPECT THE CLUTCH PEDAL

- Ignition OFF.
- Block the wheels and apply the parking brake.
- Depress and slowly release the clutch pedal.

Does the clutch pedal release without binding?

Yes	GO to A2.
No	INSPECT the clutch pedal. REFER to Section 308-02.

A2 CHECK THE HYDRAULIC SYSTEM

- Ignition OFF.
- Depress and release the clutch pedal.

Is there residual hydraulic pressure at the bleed screw?

Yes	INSTALL a new clutch master cylinder. REFER to Section 308-02.
No	GO to A3.

A3 CARRY OUT A STALL TEST

- Start the engine.
- Block the wheels and apply the parking brake.
- Place the transmission in 4th gear.
- Increase the engine speed to 2000 rpm and slowly release the clutch pedal.

Does the engine stall within 5 seconds?

Yes	The clutch is not slipping. VERIFY the customer concern.
No	INSPECT the clutch components for damage.

PINPOINT TEST B : CLUTCH CHATTER OR SHUDDER

B1 CHECK THE ENGINE OR TRANSMISSION MOUNTS

- Inspect all the engine and transmission mounts for loose fasteners or damage.

Are any of the engine or transmission mounts loose or damaged?

Yes	TIGHTEN or INSTALL new engine mounts or transmission mounts as necessary. TEST the system for normal operation.
No	GO to B2.

B2 INSPECT THE PRESSURE PLATE BOLTS

- Inspect the pressure plate-to-flywheel bolts.

Are any of the pressure plate-to-flywheel bolts loose?

Yes	TIGHTEN or INSTALL new bolts as necessary. REFER to Section 308-01. TEST the system for normal operation.
No	GO to B3.

B3 INSPECT THE PRESSURE PLATE

- Remove the clutch pressure plate. Refer to Section 308-01.
- Inspect the clutch pressure plate. Refer to Clutch Pressure Plate Check in this section.

Are any signs of damage present on the clutch pressure plate?

Yes	INSTALL a new clutch pressure plate. REFER to Section 308-01. TEST the system for normal operation.
No	GO to B4.

B4 CHECK THE CLUTCH DISC

- Carry out the clutch disc inspection procedure. Refer to Clutch Disc Check in this section.

Is the clutch disc OK?

Yes	GO to B5.
No	INSTALL a new clutch disc. REFER to Section 308-01. TEST the system for normal operation.

B5 INSPECT THE FLYWHEEL

- Inspect the flywheel for damage and runout. Refer to Flywheel Runout Check in this section.

Is the flywheel OK?

Yes	GO to B6.
No	REPAIR or INSTALL a new flywheel as necessary. TEST the system for normal operation.

B6 INSPECT THE PILOT BEARING

- Inspect the pilot bearing for wear or damage.

Are there signs of wear or damage?

Yes	INSTALL a new pilot bearing. REFER to Section 308-01.
No	GO to B7.

B7 INSPECT THE INPUT SHAFT

- Inspect the input shaft for signs of wear or damage.

Are any signs of wear or damage present on the input shaft?

Yes	INSTALL a new input shaft. REFER to Section 308-03A or Section 308-03B.
No	VERIFY the customer concerns. GO to Symptom Chart if necessary.

PINPOINT TEST C : CLUTCH HYDRAULIC SYSTEM CHECK

C1 CHECK THE FLUID LEVEL

- **NOTE:** *Do not check the hydraulic system after the road test. Allow the vehicle to cool down before carrying out the clutch hydraulic system check.*

  Remove the brake and clutch reservoir cap.

- Check the fluid level of the brake and clutch reservoir.

Is the fluid level at or above the step mark?

Yes	INSTALL the reservoir cap. GO to C2 .
No	ADD brake fluid to the specified level. GO to C2 .

C2 INSPECT THE HYDRAULIC SYSTEM FOR LEAKAGE

- Check the reservoir and reservoir lines for leakage.
- Check the master cylinder and hydraulic line for leakage.
- Check the clutch slave cylinder and the hydraulic line connection for leakage.

Are there any signs of leakage?

Yes	INSTALL new components as necessary. TEST the system for normal operation.
No	GO to C3.

C3 CHECK INTERNAL OPERATION

- Remove the reservoir cap.
- Have an assistant slowly depress and release the clutch pedal.
- On the down stroke, the fluid level should not increase by more than 1 mm (0.039 in).

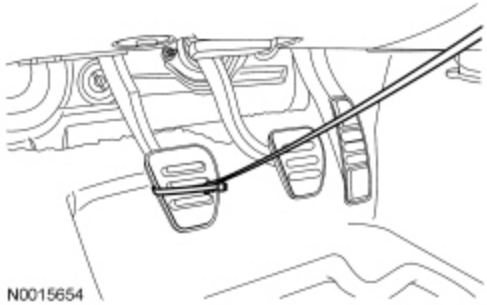
Does the fluid level increase more than 1 mm (0.039 in)?

Yes	INSTALL a new cylinder master cylinder assembly.
No	GO to C4.

C4 CHECK THE CLUTCH PEDAL RESERVE

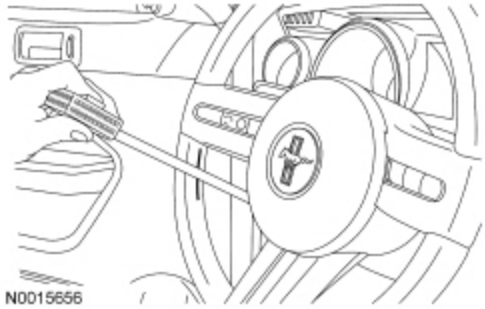
NOTE: *The clutch reserve is the distance between the clutch pedal when fully depressed and the position when the vehicle starts to move forward.*

- Park the vehicle on a level surface.
- Check for obstructions behind clutch pedal.
- Attach a cable tie to the lower clutch pedal.

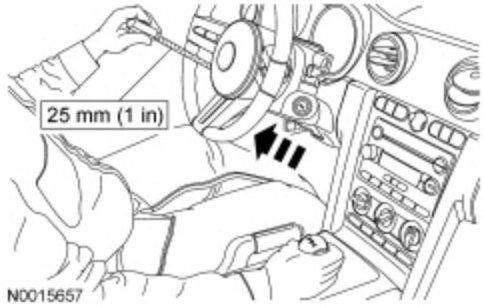


- Attach a tape measure to the cable tie.
- Depress the clutch fully and start the vehicle.
- Shift the transmission into 1st gear.

- Use the seam on the steering wheel as a reference point.



- While observing the tape measure, slowly engage the clutch, noting when the vehicle starts to move forward.



Is the clutch pedal reserve greater than or equal to 25 mm (1 in)?

Yes	The clutch hydraulic system is OK. TEST the system for normal operation.
No	GO to C5.

C5 CHECK THE CLUTCH PRESSURE PLATE

- Remove the clutch pressure plate. Refer to Section 308-01.
- Inspect the clutch pressure plate for wear or runout. Refer to Clutch Pressure Plate Check in this section.

Are there any signs of excessive wear or runout to the clutch pressure plate?

Yes	INSTALL a new clutch pressure plate. REFER to Section 308-01.
No	GO to C6.

C6 INSPECT THE CLUTCH DISC

NOTE: *Vehicles equipped with a 4.0L engine use an inner floating damper design disc. When inspecting the disc, a rattle type noise can be heard. This is a normal condition.*

- Carry out the clutch disc inspection procedure in this section.

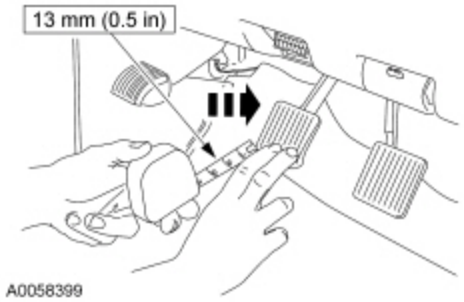
Is the clutch disc OK?

Yes	GO to C7.
No	INSTALL a new clutch disc. REFER to Section 308-01. TEST the system for normal operation.

C7 CHECK CLUTCH PEDAL FREE PLAY

NOTE: *The clutch pedal free play is the distance between the clutch pedal when fully released and the position when slight resistance is felt on downward motion.*

- Engine OFF.
- Attach a tape measure to the cable tie.
- While observing the tape measure, slowly push downward on the clutch pedal until a slight resistance is felt.



Is the clutch pedal free play less than 13 mm (0.5 in)?

Yes	The clutch hydraulic system is OK. TEST the system for normal operation.
No	BLEED the clutch hydraulic system. REFER to Clutch System Bleeding in this section. TEST the system for normal operation.

PINPOINT TEST D : CLUTCH DRAG/HARD SHIFTING

D1 CHECK FLUID LEVEL

- Ignition OFF.
- Remove the reservoir cap.
- Inspect the fluid level in the brake and clutch reservoir.

Is the fluid level at or above the step mark?

Yes	INSTALL the reservoir cap. GO to D2 .
No	ADD brake fluid. GO to D2 and CHECK for leaks. TEST the system for normal operation.

D2 INSPECT THE CLUTCH HYDRAULIC SYSTEM FOR LEAKAGE

- Inspect the clutch master cylinder and the hydraulic lines for leakage.
- Inspect the reservoir and reservoir line for leakage.
- Inspect the clutch slave cylinder and the hydraulic line connection for leakage.

Are there any signs of leakage?

Yes	INSTALL new components as necessary. Test the system for normal operation.
No	GO to D3.

D3 CHECK INTERNAL OPERATION

- Remove the reservoir cap.
- Have an assistant slowly depress and release the clutch pedal.
- On the down stroke, the fluid level should not increase by more than 1 mm (0.039 in).

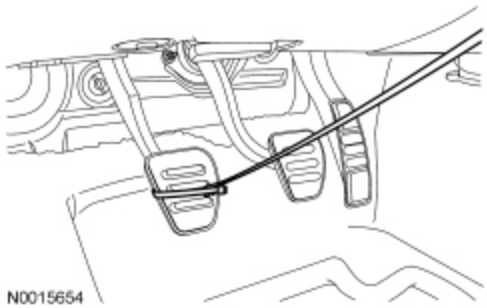
Does the fluid level increase more than 1 mm (0.039 in)?

Yes	INSTALL a new cylinder master cylinder assembly.
No	GO to D4.

D4 CHECK THE CLUTCH PEDAL RESERVE

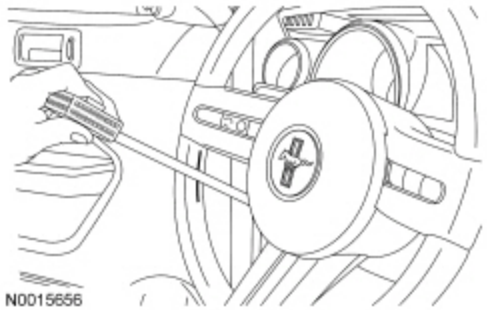
NOTE: *The clutch reserve is the distance between the clutch pedal when fully depressed and the position when the vehicle starts to move forward.*

- Park the vehicle on a level surface.
- Check for obstructions behind the clutch pedal. Check the carpet for correct installation. Remove the floor mat.
- Attach a cable tie to the lower clutch pedal.

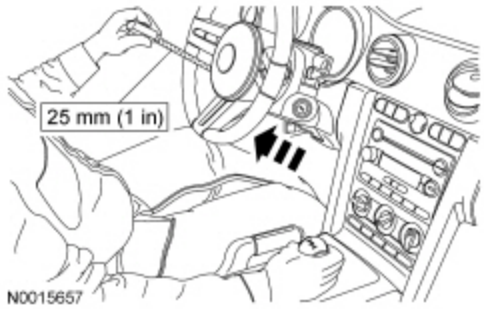


- Attach a tape measure to the cable tie.
- Depress the clutch fully and start the vehicle.
- Shift the transmission into 1st gear.

- Use the seam on the steering wheel as a reference point.



- While observing the tape measure, slowly engage the clutch, noting when the vehicle starts to move forward.



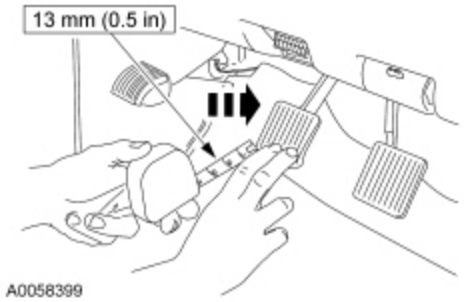
Is the clutch pedal reserve greater than or equal to 25 mm (1 in)?

Yes	The clutch hydraulic system is OK. TEST the system for normal operation.
No	GO to D5.

D5 CHECK THE CLUTCH PEDAL FREE PLAY

NOTE: *The clutch pedal free play is the distance between the clutch pedal when fully released and the position when slight resistance is felt on downward motion.*

- Engine OFF.
- Attach a tape measure to the cable tie.
- While observing the tape measure, slowly push downward on the clutch pedal until a slight resistance is felt.



Is the clutch pedal free play less than 13 mm (0.5 in)?

Yes	The clutch hydraulic system is OK. TEST the system for normal operation.
No	GO to D6.

D6 CHECK THE CLUTCH PRESSURE PLATE

- Remove the clutch pressure plate. Refer to Section 308-01.
- Inspect the clutch pressure plate for wear or runout. Refer to Clutch Pressure Plate Check in this section.

Are there any signs of excessive wear or runout to the clutch pressure plate?

Yes	INSTALL a new clutch pressure plate. REFER to Section 308-01.
No	GO to D7.

D7 INSPECT THE CLUTCH DISC

NOTE: *Vehicles equipped with a 4.0L engine use an inner floating damper design disc. When inspecting the disc, a rattle type noise can be heard. This is a normal operation.*

- Carry out the clutch disc inspection procedure in this section.

Is the clutch disc OK?

Yes	GO to D8.
No	INSTALL a new clutch disc. REFER to Section 308-01. TEST the system for normal operation.

D8 INSPECT THE TRANSMISSION

- Remove the transmission.
- Disassemble the transmission. Refer to Section 308-03B.
- Carry out the following:
  - Inspect all the shift rails for excessive scuffing or wear.
  - Check the interlock pins on the shift rail.
  - Make sure the interlock bolts are tightened to 31 Nm (23 lb-ft).
  - Inspect the shift pads for wear or cracking.
  - Inspect the shift forks for wear or damage.
  - Check the synchronizer rings of the affected gear for wear or damage.
  - Check the synchronizer hubs of the affected gear for wear or damage.
  - Inspect the clutching teeth of the affected gear.

Are there any internal components worn or damaged?

Yes	INSTALL new components or REPAIR as necessary. TEST the system for normal operation.
No	ASSEMBLE and INSTALL the transmission. TEST the system for normal operation.

PINPOINT TEST E : CLUTCH PEDAL PULSATION

E1 CHECK THE CLUTCH PEDAL PULSATION

- Start the engine.
- With the transmission in NEUTRAL, slowly press the clutch pedal.

Does the clutch pedal pulsate while being pressed?

Yes	GO to E2.
No	VERIFY customer concern. GO to Symptom Chart if necessary.

E2 INSPECT THE PRESSURE PLATE BOLTS

- Inspect the pressure plate-to-flywheel bolts.

Are any of the pressure plate-to-flywheel bolts loose?

Yes	TIGHTEN or INSTALL new bolts. REFER to Section 308-01. TEST the system for normal operation.
No	GO to E3.

E3 INSPECT THE CLUTCH PRESSURE PLATE

- Remove the clutch pressure plate. Refer to Section 308-01.
- Inspect the clutch pressure plate for damage. Refer to Clutch Pressure Plate Check in this section.

Are there any signs of damage present on the clutch pressure plate?

Yes	INSTALL a new clutch pressure plate. REFER to Section 308-01. TEST the system for normal operation.
No	GO to E4.

E4 INSPECT THE CLUTCH DISC

- Carry out the clutch disc inspection procedure. Refer to Clutch Disc Check in this section.

Is the clutch disc OK?

Yes	GO to E5.
No	INSTALL a new clutch disc. REFER to Section 308-01. TEST the system for normal operation.

E5 INSPECT THE FLYWHEEL

- Inspect the flywheel for damage and runout. Refer to Flywheel Runout Check in this section.

Is flywheel OK?

Yes	VERIFY customer concern. GO to Symptom Chart if necessary.
No	TIGHTEN or INSTALL a new flywheel as necessary. REFER to Section 308-01. TEST the system for normal operation.

PINPOINT TEST F : CLUTCH-RELATED VIBRATIONS

F1 CHECK FOR ENGINE COMPONENT GROUNDING

- Raise the vehicle on a hoist. Refer to Section 100-02.
- Check the engine and transmission mounts for grounding.
- Check for exhaust manifolds or other engine component grounding on the body or frame.

Is there evidence of grounding on the body or frame?

Yes	REPAIR the components as necessary. TEST the system for normal operation.
No	GO to F2.

F2 CHECK FOR ACCESSORY DRIVE VIBRATIONS

- Start the engine.
- Remove the accessory drive belt.

Does the vibration stop when the accessory drive belt is removed from the engine?

Yes	REFER to Section 303-05 to diagnose the accessory drive belt components.
No	STOP the engine and INSTALL the drive belt. GO to F3 .

F3 CHECK FOR CLUTCH RELEASE BEARING NOISE

NOTE: *With the transmission in NEUTRAL, transmission rollover noise can be heard. Make sure to distinguish between rollover noise and clutch release bearing noise.*

- Start the engine.
- Depress and hold the clutch pedal.

Is a whirring, grating, or grinding noise present only when pedal is pushed?

Yes	INSTALL a new clutch release bearing. REFER to Section 308-01.
No	GO to F4.

F4 INSPECT THE FLYWHEEL

- Ignition OFF.
- Remove the transmission. Refer to Section 308-03A or Section 308-03B.
- Carry out a flywheel check. Refer to Flywheel Runout Check in this section.

Is the flywheel OK?

Yes	VERIFY customer concern. GO to Symptom Chart if necessary.
No	TIGHTEN or INSTALL a new flywheel. REFER to Section 308-01. TEST the system for normal operation.

PINPOINT TEST G : EXCESSIVE NOISE

G1 TRANSMISSION NEUTRAL GEAR ROLLOVER TEST

- Start the engine and let it idle with the transmission in NEUTRAL and the clutch engaged (pedal up). If noise is excessive, depress the clutch pedal to stop the transmission input shaft from rotating.

Does the noise stop when the clutch pedal is depressed?

Yes	INSPECT the clutch component for damage.
No	GO to G2.

G2 CHECK THE PILOT BEARING

- Inspect the pilot bearing for damage. Refer to Pilot Bearing Check in this section.

Is the pilot bearing OK?

Yes	GO to G3.
No	INSTALL a new pilot bearing. REFER to Section 308-01.

G3 CHECK THE TORSION SPRINGS

- Inspect the torsion springs for fatigue or breakage.

Are there any signs of fatigue or breakage?

Yes	INSTALL a new clutch disc. REFER to Section 308-01. TEST the system for normal operation.
No	INSPECT the crankshaft end play. REFER to Section 303-00.

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