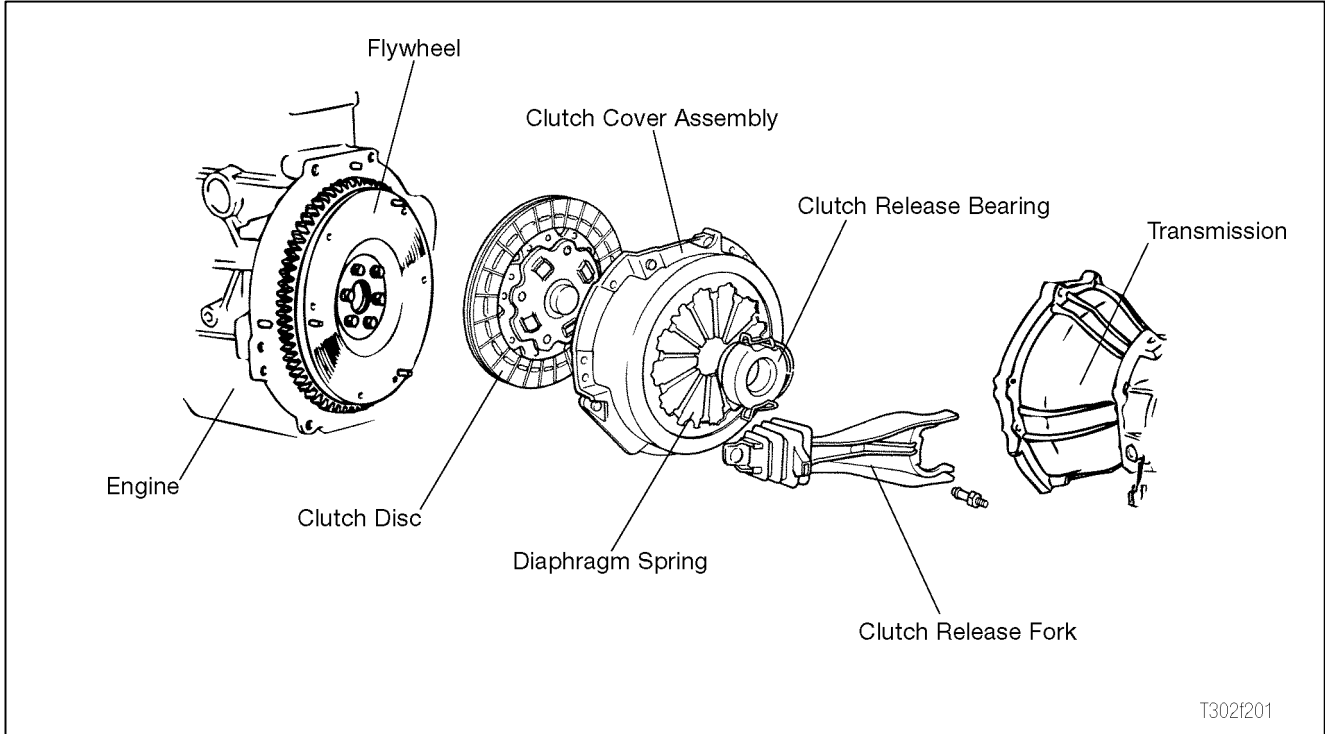


Section 2

Clutch Assembly



- Learning Objectives:**
1. Identify the purpose and function of the clutch
 2. Identify and describe the operation of the following clutch components:
 - a. Clutch disc
 - b. Clutch cover assembly
 - c. Flywheel
 - d. Hydraulic system
 - e. Release bearings and fork
 - f. Clutch cover assembly
 3. Identify and describe clutch service procedures
 - a. Clutch pedal free travel
 - b. Clutch slippage
 - c. Clutch spin down
 - d. Clutch pedal noise
 4. Identify and describe clutch component inspection procedures
 5. Identify and describe clutch removal and replacement procedures
 6. Identify and describe clutch assembly procedures
 7. Describe hydraulic system repair procedures

Clutch Assembly

Clutch Assembly

The **clutch assembly** interrupts the power flow between the engine and the transmission when the vehicle is brought to a stop with the engine running and when shifting gears. The clutch assembly consists of the following components:

- Clutch disc
- Flywheel
- Clutch cover assembly
- Clutch release bearing
- Clutch release fork

The **clutch disc** is connected to the input shaft of the transmission, and is located between the flywheel and clutch cover assembly. The **flywheel** is connected to the engine crankshaft and the **clutch cover assembly** is attached to the flywheel. The **clutch release fork** forces the **clutch release bearing** against the diaphragm spring of the clutch cover assembly.

Clutch Assembly Components

The clutch assembly contains several major parts: flywheel, clutch disc, clutch cover assembly, clutch release bearing, and clutch release fork.

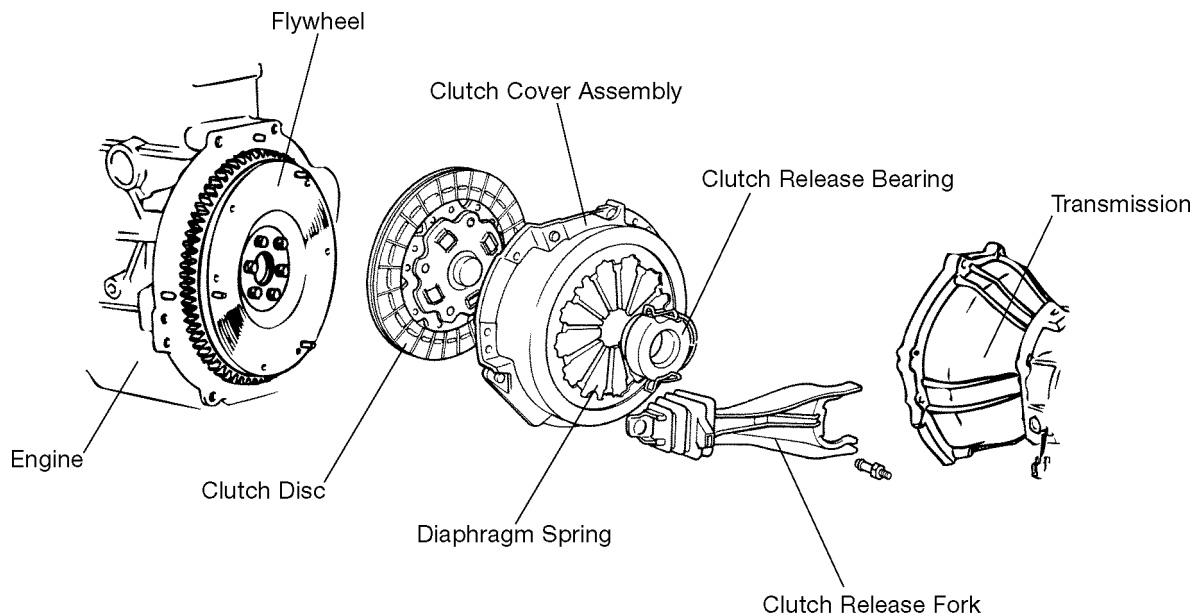


Fig. 2-1
T302f201

Flywheel The **flywheel** is connected to the engines crankshaft. A flywheel is very similar to a brake rotor in appearance. It is a large metal disc that stores and releases energy pulses from the crankshaft. It drives the clutch by providing a friction surface for the clutch disc. In addition, the flywheel provides a mounting surface for the clutch cover, and also dissipates heat.

Flywheel

A flywheel is very similar to a brake rotor in appearance. It is a large metal disc that stores and releases energy pulses from the crankshaft.

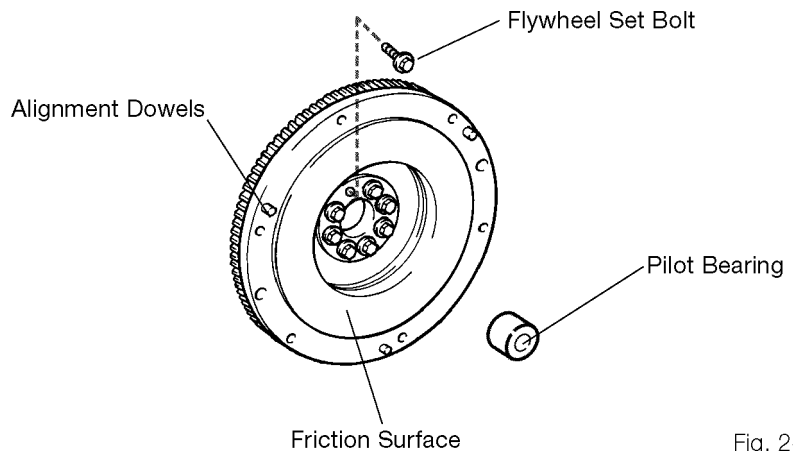


Fig. 2-2
T302f202

Pilot Bearing A pilot bearing supports the engine side of the input shaft. The pilot bearing used on Toyota vehicles is a ball bearing located in a bore in the end of the crankshaft. The pilot bearing only turns when the clutch is disengaged.

Clutch Disc The **clutch disc** is the connecting link between the engine and the transmission. A clutch disc provides a large surface area made of friction material on both sides. In the center, a damper assembly absorbs torsional vibration.

The facing, or friction material is riveted to the cushion plate on both sides and is similar to the composition of brake lining. The cushion plate has a wave design that allows the facings to compress when the pressure plate is engaged. This provides a smooth engagement of engine and transmission.

Clutch Disc

The clutch disc connects the engine and the transmission providing for smooth engagement.

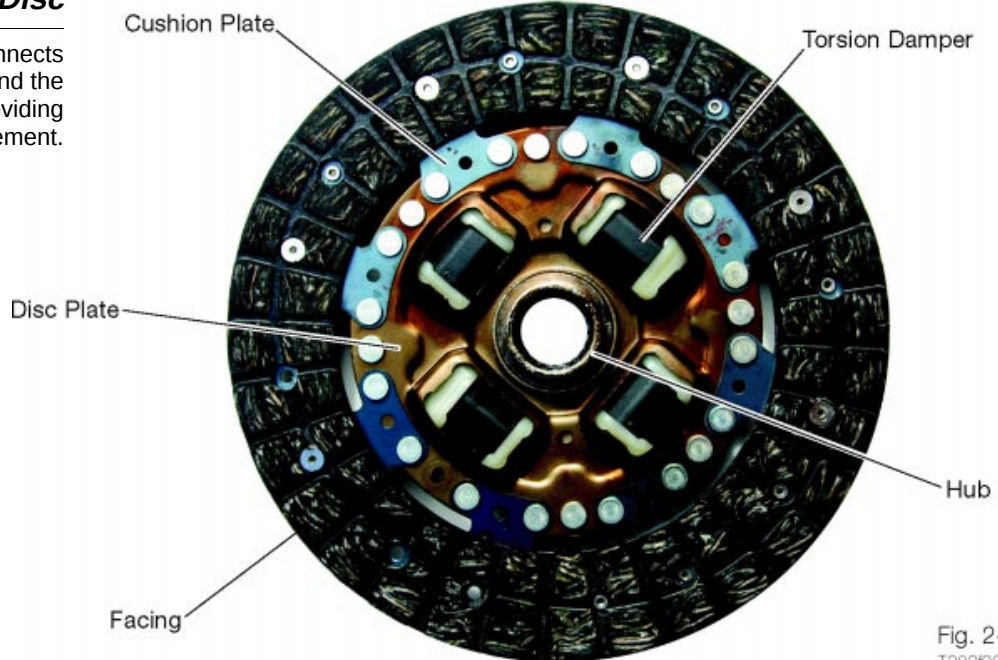


Fig. 2-3
T302f203

Grooves are provided in the clutch disc facing to eliminate the problem of the clutch disc adhering to the flywheel and the pressure plate of the clutch cover assembly. Air is trapped in the grooves when the clutch is engaged. When the clutch disc is released, the centrifugal force of the turning disc causes the trapped air to push against the flywheel and pressure plate. This action breaks the adhesion created between the flywheel, clutch disc facing and pressure plate.

Circular Groove

To eliminate the problem of the clutch disc adhering to the flywheel and pressure plate, grooves are provided in the clutch disc facing.

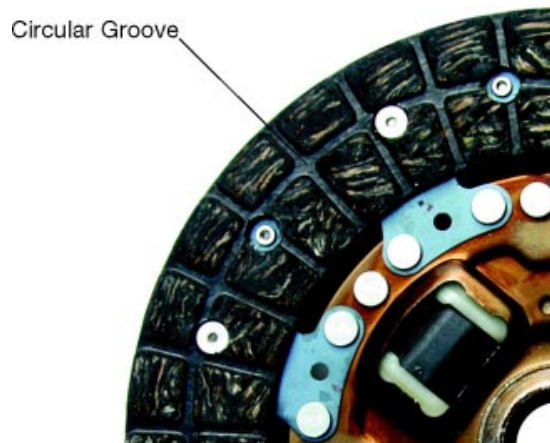


Fig. 2-4
T302f204

Clutch Hub & Damper Assembly

The internal splines of the **clutch hub** fit over the external splines of the transmission input shaft allowing the clutch hub to move back and forth smoothly. Most clutch discs include a **damper assembly** to reduce or eliminate torsional vibrations that occur from uneven engine and drivetrain power pulses.

Throughout the engine power cycle, the crankshaft speeds up and slows down during each revolution. The damper removes slight speed fluctuations, which prevent vibration, gear rattle, noise and wear to the transmission and drivetrain.

The damper assembly consists of a hub flange that pivots between the disc plate, and cover plate. Each of these components have four to six openings in which the torsion dampers are located, allowing torque to pass from the disc plate and cover plate to the hub flange and hub. The torsion dampers absorb the shock of: clutch engagement, acceleration and deceleration and power pulses from the engine.

Clutch Hub & Damper Assembly

The damper reduces or eliminates torsional vibrations that result from uneven engine and drivetrain power impulses.

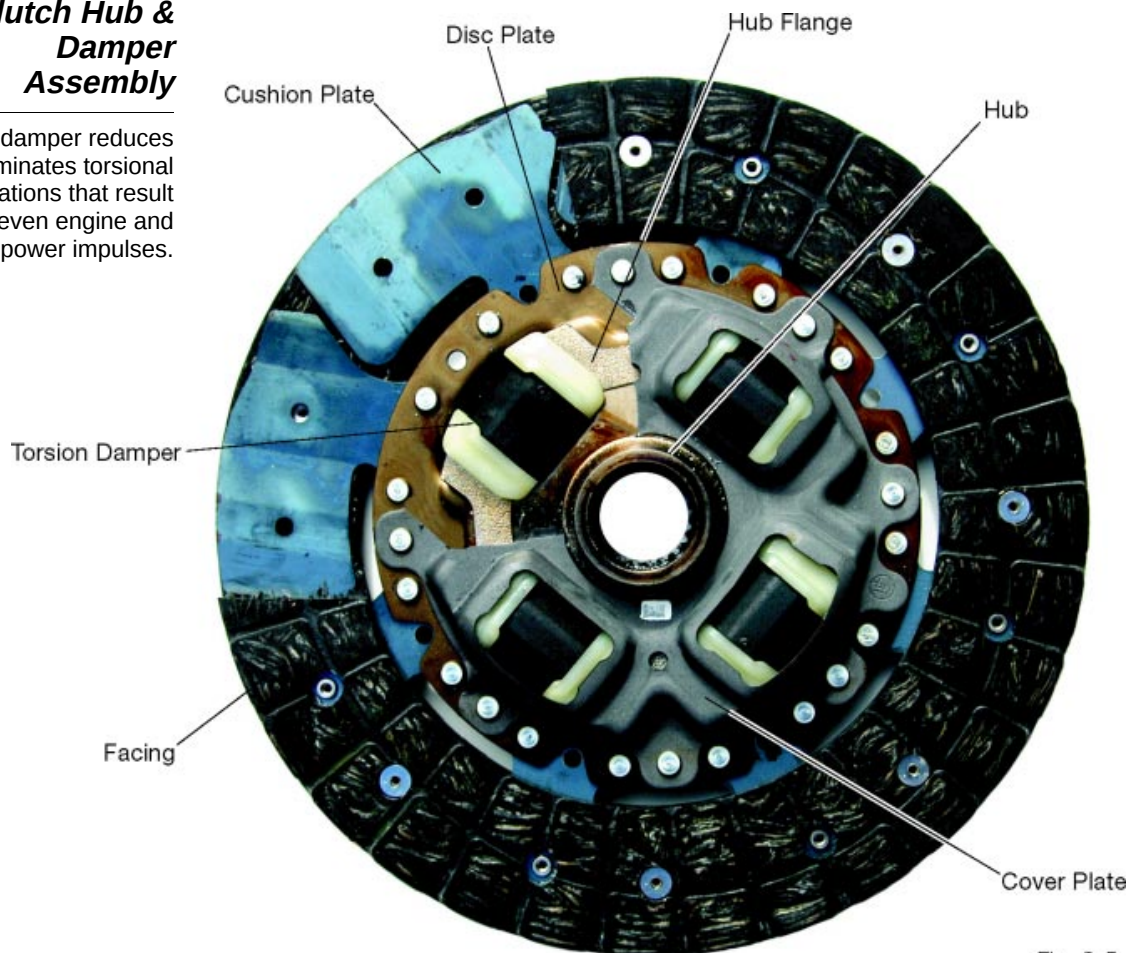
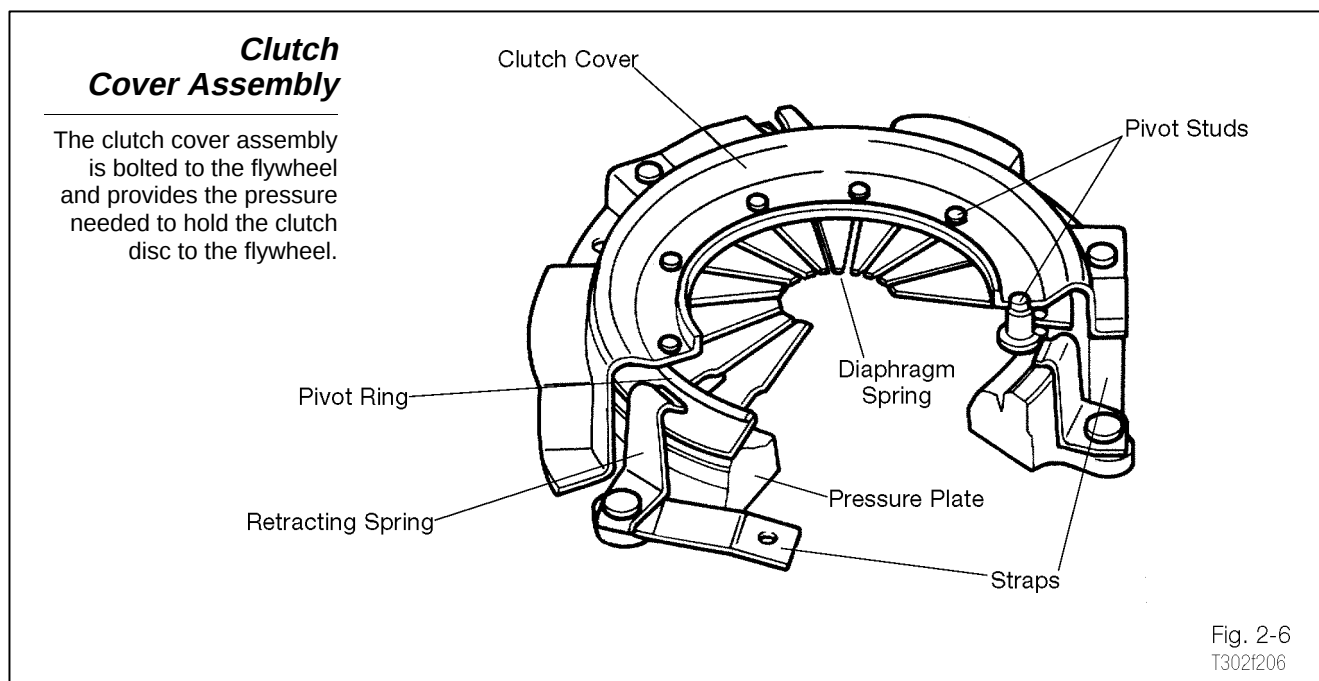


Fig. 2-5
T3021205

Clutch Cover Assembly The **clutch cover assembly** is bolted to the flywheel and provides the pressure needed to hold the clutch disc to the flywheel for proper power transmission. It is important that the assembly be well balanced and able to radiate the heat generated when the clutch disc is engaged.

Toyota uses two types of clutch cover assemblies:

- Diaphragm spring
- Diaphragm Spring Turnover (DST)



Diaphragm Spring The **diaphragm spring** is a round, conical shaped spring that provides the clamping force against the pressure plate. **Pivot rings** are installed on both sides of the diaphragm spring. They serve as a pivot point when the release bearing is forced against the diaphragm spring. The pivot stud connects the diaphragm spring to the clutch cover. The **retracting springs** connect the diaphragm spring and the pressure plate. The straps connect the pressure plate to the clutch cover and do not allow the pressure plate to move out of position. When the release bearing is pushed against the diaphragm spring, the spring folds inward and the pressure plate moves away from the clutch disc.

Diaphragm Spring Turnover (DST) The Diaphragm Spring Turnover (DST) type of clutch cover assembly differs from the conventional type only in construction. The DST cover does not use a separate pivot stud to connect the diaphragm spring to the cover. The cover is shaped so that the pivot points are part of the clutch cover. Since the **retracting springs** have been eliminated, the **strap springs** are used to disengage the **pressure plate** from the clutch disc. The diaphragm spring fingers are chrome plated in the area where the release bearing rides to help eliminate wear and noise. With this design, the clutch cover gives optimum release performance and is lightweight.

Diaphragm Spring Turnover (DST)

The DST cover does not use a separate pivot stud to connect the diaphragm spring to the cover.

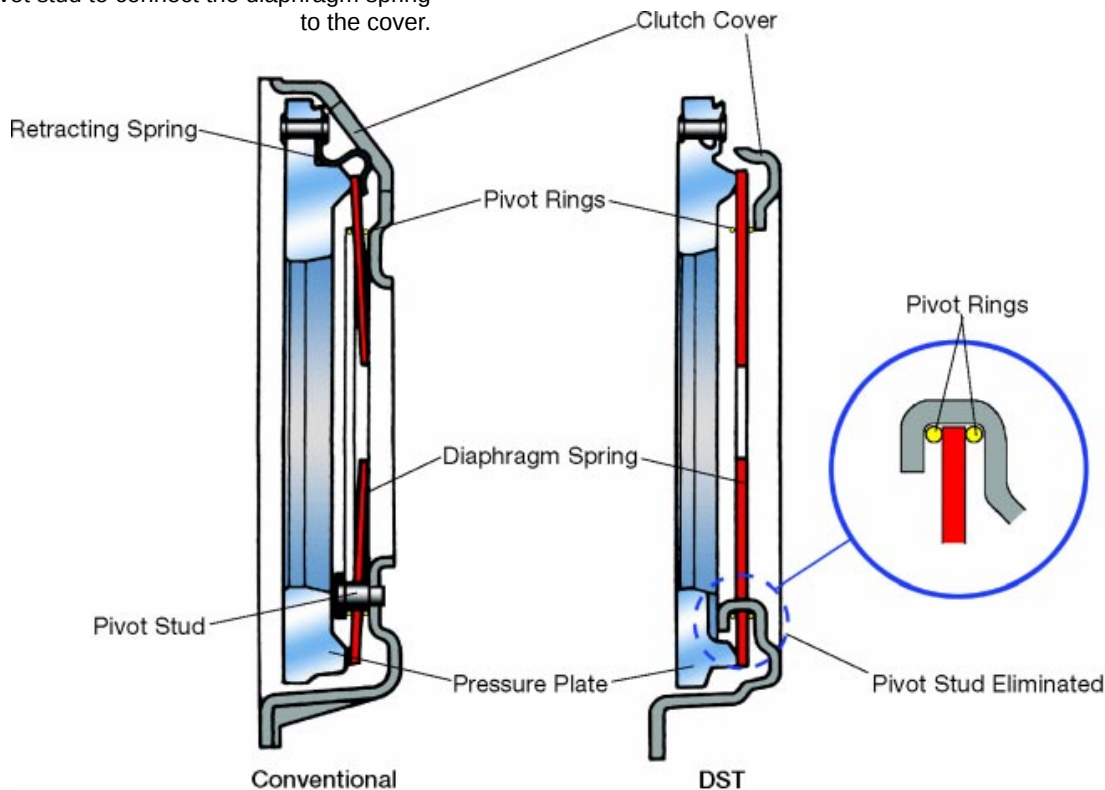


Fig. 2-7
T3021207

Clutch engagement begins when the pressure plate of the clutch cover and flywheel begin to rub against the clutch disc. The amount of torque transferred to the clutch increases as spring pressure against the **pressure plate** increases. When the clutch is engaged, pressure from the **clutch cover diaphragm** forces the pressure plate against the clutch disc and flywheel.

Clutch Release Bearing & Clutch Release Fork

The purpose of the **clutch release bearing** is to transfer the movement of the **clutch release fork** into the rotating diaphragm spring and clutch cover to disengage the clutch disc. There are two major types of release bearings used by Toyota. They are:

- Conventional
- Self-centering

Conventional Release Bearing

A sealed ball bearing is pressed on the release hub, which is attached to the release fork. The hub and release bearing slide on the transmission front bearing retainer sleeve. As the clutch pedal is depressed, the release fork moves the hub and release bearing toward the diaphragm spring of the clutch cover. When the release bearing comes in contact with the rotating diaphragm spring, the outer race of the bearing will begin to rotate. The outer race is made of a sintered alloy to reduce wear and noise during contact. The release fork continues to move the release bearing into the clutch cover and the pressure being applied to the clutch disc is released. On self adjusting clutches, the release bearing is in constant contact with the diaphragm spring. The outer race of the bearing is always rotating with the clutch cover.

Conventional Release Bearing

The main components of the conventional release bearing are the release bearing, clutch release bearing hub, retaining clip and clutch release fork.

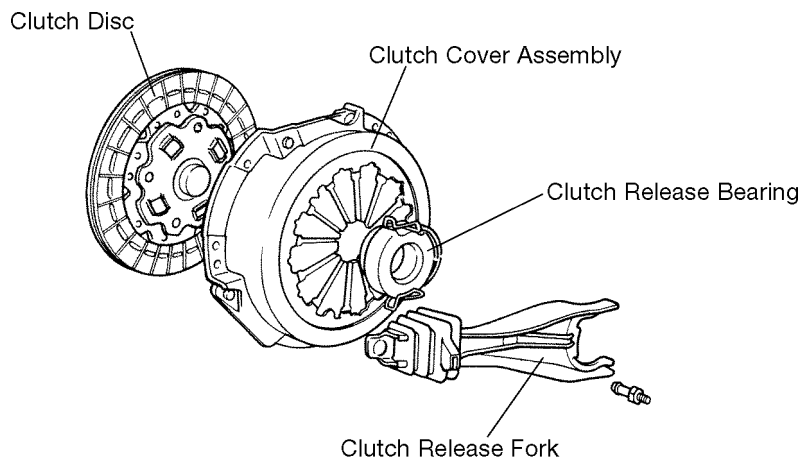


Fig. 2-8
T302f208

Self-Centering Release Bearing

A **self centering release bearing** is used to prevent noise caused by the release bearing pressing unevenly on the diaphragm spring. This noise occurs when the **centerline** between the crankshaft, clutch cover assembly, transaxle input shaft and release bearing is not the same. It is used on transaxles because the input shaft does not fit into a pilot bearing in the crankshaft like a transmission input shaft does. The transaxle input shaft is supported by bearings in the case. The self centering release bearing automatically compensates for this by aligning itself with the centerline of the diaphragm spring. This helps prevent noise associated with clutch disengagement.

Self-Centering Release Bearing

A self centering release bearing is used to prevent noise caused by the release bearing pressing unevenly on the diaphragm spring.

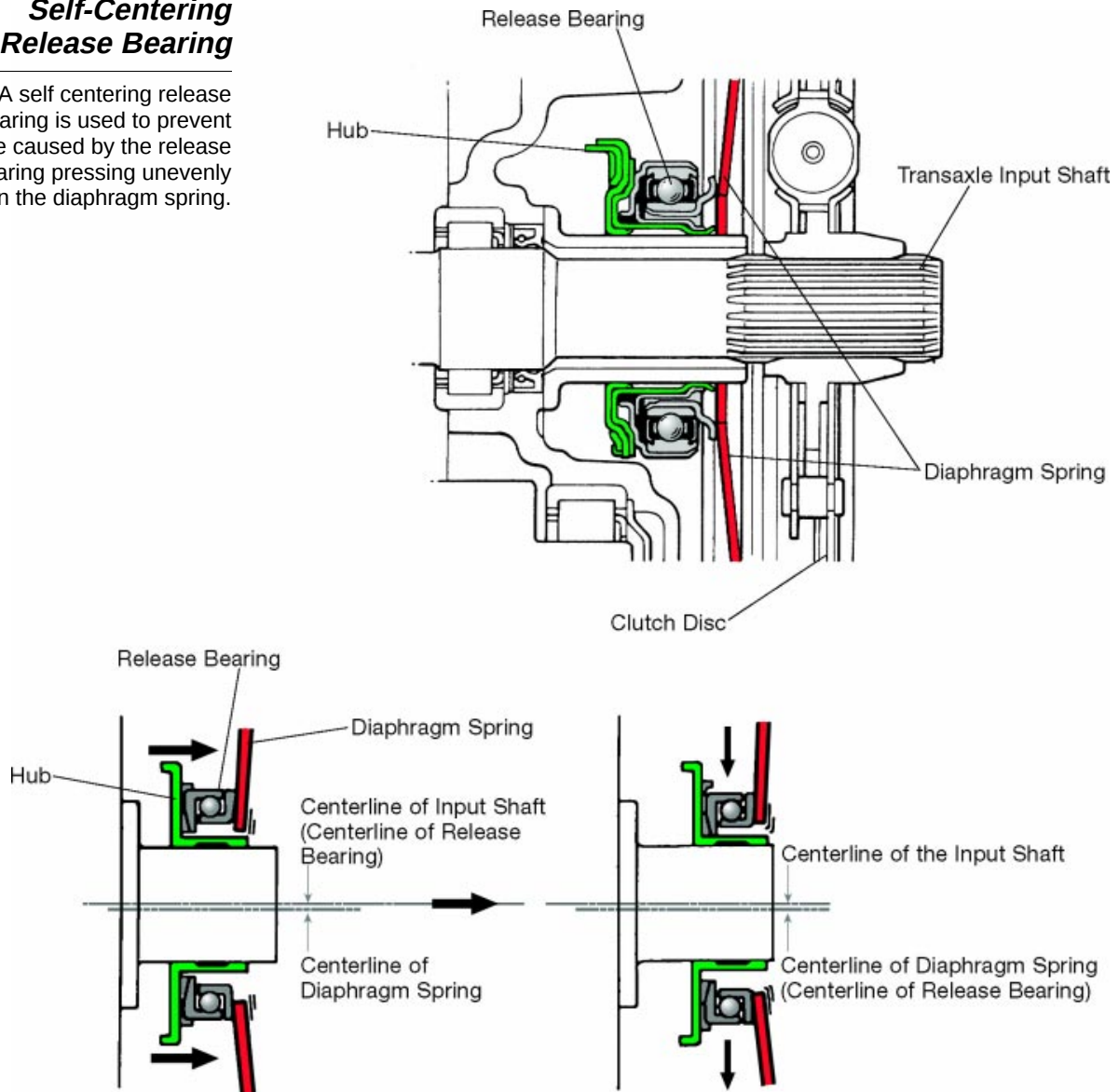


Fig. 2-9
T302f209

The hub of the self centering release bearing is made of **pressed steel**. The **bearing** is not pressed onto the hub as with the conventional release bearing. A **rubber seat**, **resin seat**, **bearing**, and **wave washer** are secured to the hub with a **snap ring**. The inner diameter of the release bearing ("B" in figure 2-10) is 1 to 2mm greater than the outer diameter of the hub ("A" in figure 2-10). This clearance allows the release bearing to move and self center to avoid wear.

Self-Centering Release Bearing

The hub of the self centering release bearing is made of pressed steel; a rubber seat, resin seat, bearing, and wave washer are secured to this hub with a snap ring. The inner diameter of the release bearing (A) is 1-2mm greater than that of the outer diameter of the hub (B).

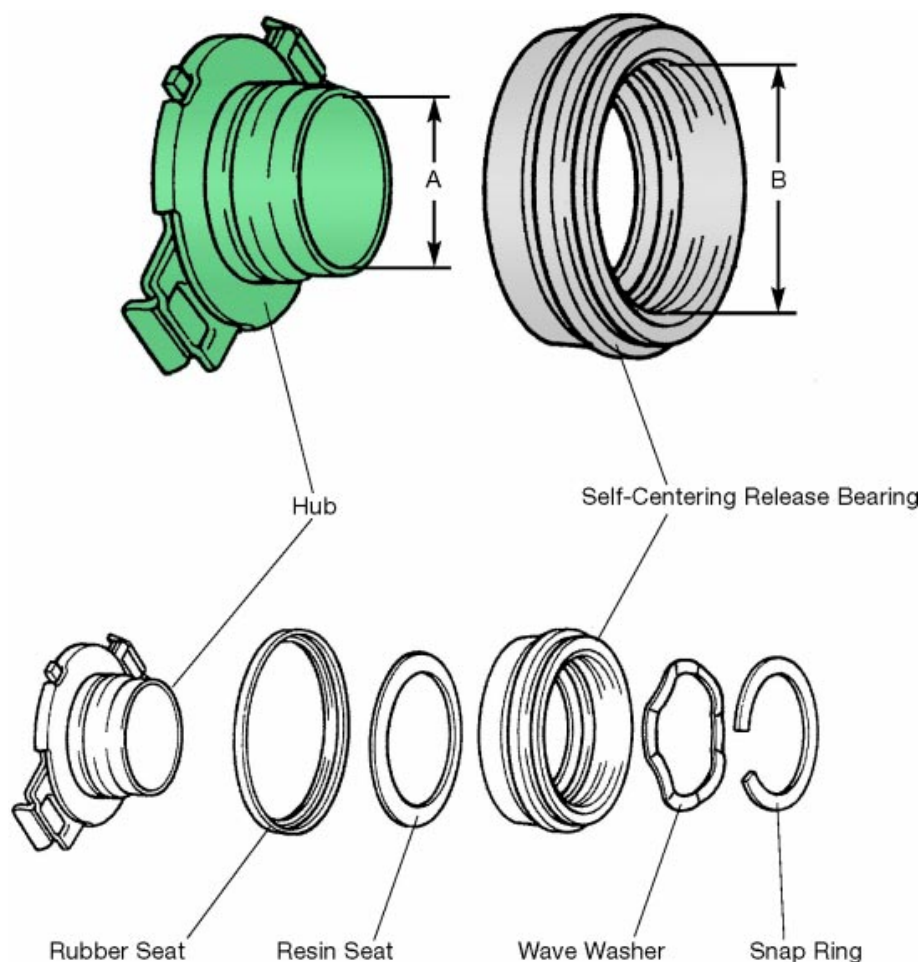


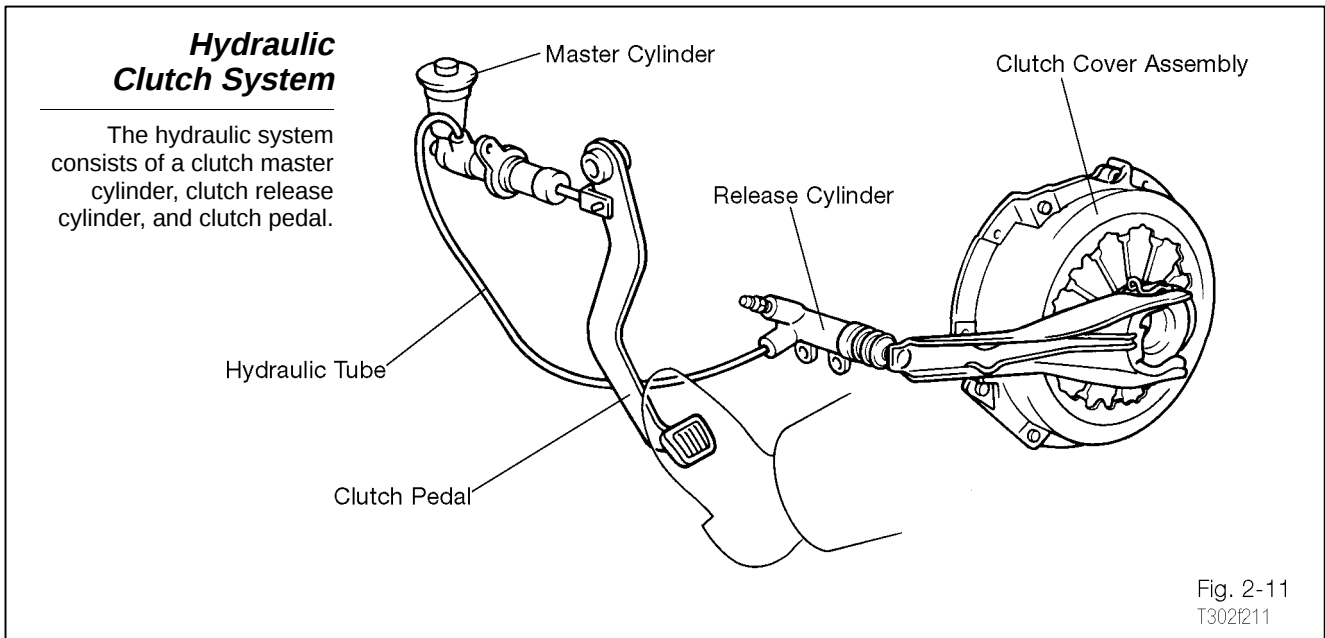
Fig. 2-10
T302f210

Hydraulic Clutch System

In a hydraulic clutch system, there are three major components:

- Master cylinder
- Release cylinder
- Clutch pedal

The **master cylinder** stores hydraulic fluid in the reservoir and provides pressure for system operation. When the **clutch pedal** is depressed, pressure is built up in the master cylinder forcing fluid into the **release cylinder**, which causes the clutch release fork to move. The release fork and release bearing compress the diaphragm spring of the clutch cover to disengage the clutch disc.



Master Cylinder

When force is applied to the pushrod, the piston displaces hydraulic fluid in chamber A of the master cylinder (as shown in figure 2-12). During initial piston travel, the compensating port in the master cylinder is closed by the piston. Further piston travel allows fluid to be displaced, transmitting force through the clutch line to the release cylinder located at the transmission. When the pushrod is released, the piston is returned to its initial position by a spring. With the compensating port open, pressure in chamber A equalizes with the reservoir. If the compensating port is blocked, any expansion of the fluid due to heat could cause pressure in chamber A to increase. During normal clutch wear, this condition may eventually cause the clutch to slip.

Master Cylinder

When the clutch pedal is depressed, the push rod forces the piston to move in the bore of the cylinder. When the clutch pedal is released, the return spring pushes the piston back in the bore of the cylinder.

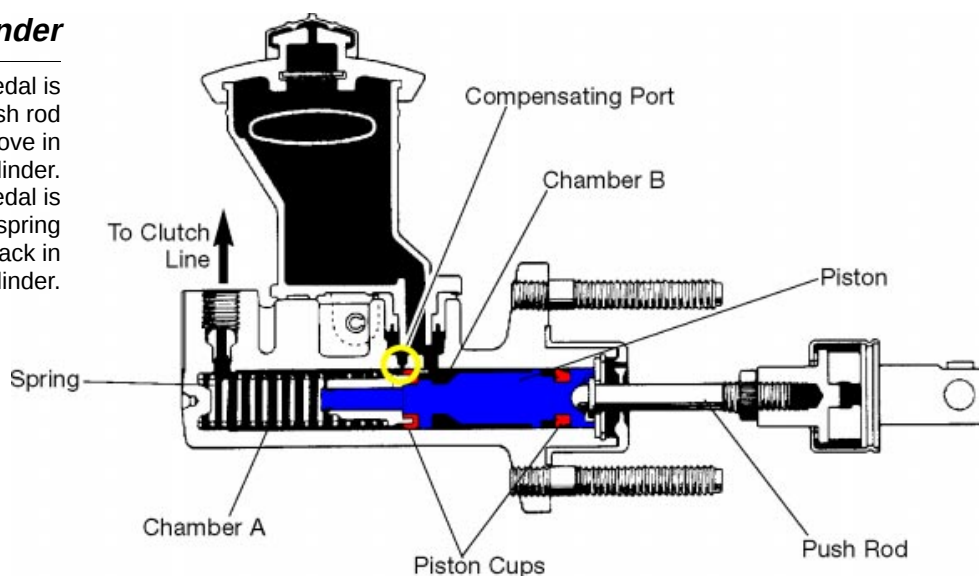


Fig. 2-12
T302f212

Clutch Release Cylinder

When the master cylinder directs fluid to the release cylinder, the piston in the release cylinder moves the push rod out against the release fork. Since the release bearing is connected to the release fork, the force is transmitted to the diaphragm spring of the clutch cover. The clutch disc is then disengaged. When the clutch pedal is released, the diaphragm spring in the clutch cover moves the push rod and piston back in the bore of the release cylinder. A conical spring exerts pressure against the release fork. So, the release bearing is in constant contact with the diaphragm spring.

Self-Adjusting Release Cylinder

The piston moves the push rod out against the release fork. The clutch disc is then disengaged.

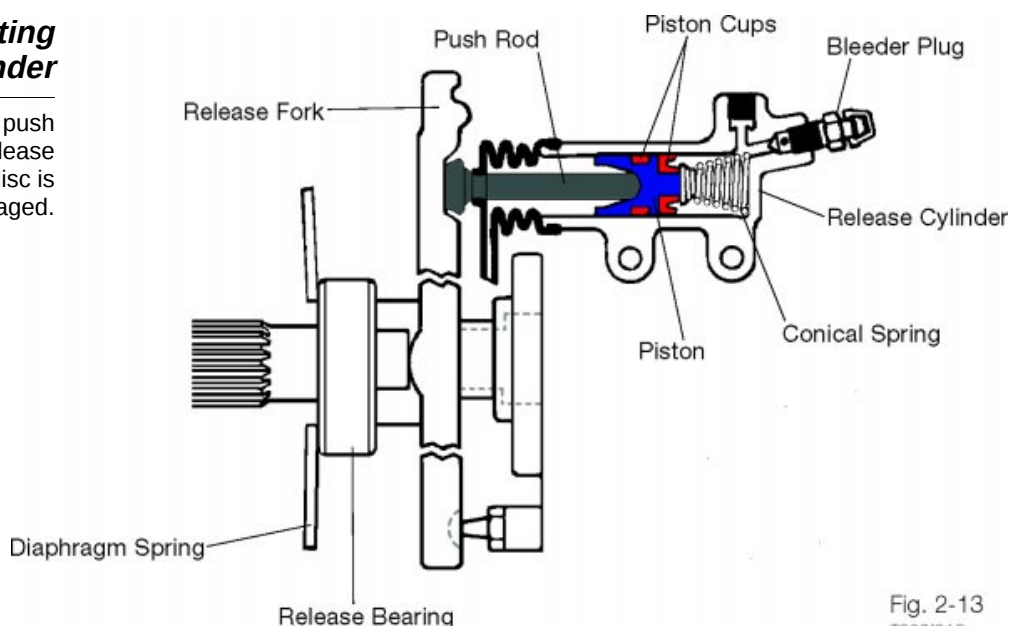


Fig. 2-13
T302f213

Since there is no free play, there is no need for adjustment since clutch wear causes the diaphragm spring to force the pushrod further into its bore. Any fluid displaced by the piston is pushed into the clutch master cylinder reservoir. The bleeder screw is used to remove air from the system.

NOTE

Although Toyota has not used mechanical clutch systems in recent years, understanding the contrast in how disc wear affects clutch pedal end play may be helpful for ASE testing.

Mechanical Clutch System

The mechanical clutch system consists of:

- Clutch pedal and release lever
- Clutch release cable
- Release fork
- Release bearing

The clutch pedal is mechanically connected to the release fork through a cable. Clutch pedal free play is indicated by the amount of clearance between the release bearing and diaphragm fingers.

In a mechanical system, disc wear causes the diaphragm spring fingers to move closer to the release bearing, which reduces free play. As normal disc wear continues, the clutch may begin to slip when there is no free play.

Free play adjustment is accomplished by changing the length of the cable housing. Shortening the cable housing increases clutch pedal free play.

Mechanical Clutch System

Disc wear causes the diaphragm spring fingers to move closer to the release bearing, which reduces free play.

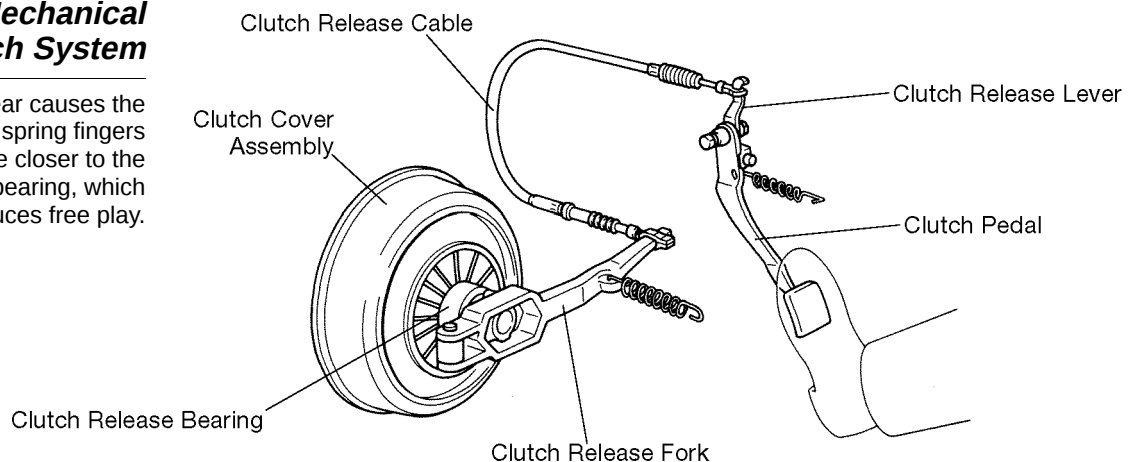


Fig. 2-14
T3021214

Clutch Component Inspection

Experienced technicians know the importance of visually inspecting each clutch component as it is disassembled. This helps determine if a part failed earlier than it should have, and helps locate any condition that needs correcting before the clutch is reassembled.

During disassembly, the flywheel, clutch cover assembly, clutch disc, release bearing and pilot bearing should be checked to determine if they were the cause of the failure. During each phase of reassembly, remember to check for proper clearances and operation. This ensures that any faulty parts or assemblies can be corrected early in the reassembly process.

Flywheel Inspection The flywheel must have a flat surface to prevent chatter, and the proper surface finish to provide the necessary coefficient of friction. The wear of the friction surface is usually concave. The new flat clutch disc will not seat completely against a worn flywheel. This can cause premature clutch wear, chatter or even clutch disc failure. Grooves, heat checks, and warping can occur if there is excessive slippage,

The flywheel should be checked for excessive runout if there is vibration or an odd wear pattern at the hub of the disc or clutch cover release levers.

Axial Runout To measure flywheel axial runout:

- With the dial indicator mounted with the measuring stem pointing directly toward the flywheel, adjust the indicator to read zero.
- While observing the dial indicator, rotate the flywheel; to eliminate crankshaft end play, maintain an even pressure during rotation.
- The amount of Axial runout is indicated by the variation in reading.

If the flywheel is to be removed:

- Place index marks at the crankshaft flange for faster alignment during reassembly.
- Inspect the starter ring gear teeth. If damaged, replace either the starter ring gear or flywheel.

Measuring Flywheel Axial Runout

Rotate flywheel and observe dial indicator. Axial runout is measured by the variation in the reading.

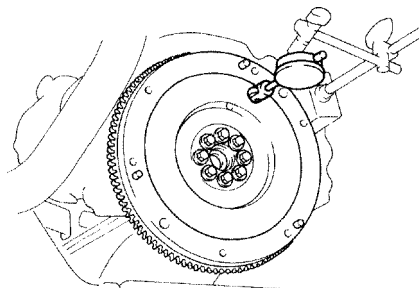


Fig. 2-15
T302f215

**Clutch Cover
Assembly
Inspection**

A used clutch cover assembly should be visually inspected for cover distortion and friction surface damage. The friction surface of the clutch cover assembly tends to polish or glaze from normal use. Excessive slippage can cause grooves, heat checks, and warping.

Set the clutch cover on the flywheel. The flywheel and clutch cover mounting points should meet evenly and completely. Inspect for gaps, as they indicate a distorted clutch cover. Additionally, inspect the clutch diaphragm for wear at the contact surface with the release bearing. Clutch diaphragm wear occurs at the contact point with the release bearing. Measure the width and depth of the wear to determine if it is within tolerable limits.

**Clutch Cover
Assembly
Inspection**

Measure the width and depth of the wear to determine if it is within tolerable limits.

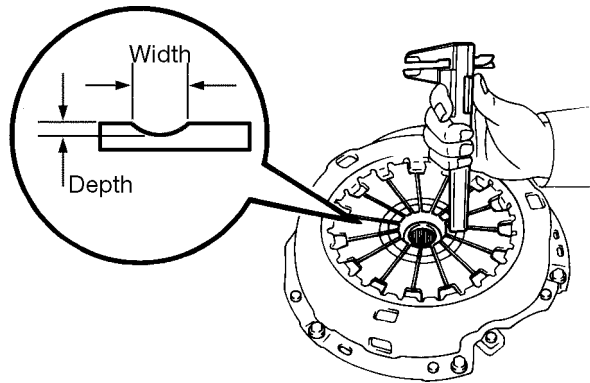


Fig. 2-16
T3021216

Inspect diaphragm spring finger alignment. Installed finger height should be within 0.020 in. Improper alignment may cause noise between the release bearing and the diaphragm spring fingers.

Clutch Disc Inspection Always check a used clutch disc for facing thickness, damper spring condition, hub spline wear, and warpage or axial runout by measuring the height of the facing surface above the rivets. The minimum depth should be 0.012 in. (0.3mm). The hub splines and damper springs should be visually checked for rust and shiny worn areas, and broken or missing springs.

Clutch Disc Inspection

To check facing thickness, measure the height of the facing surface above the rivets. The minimum depth should be 0.012 in. (0.3mm).

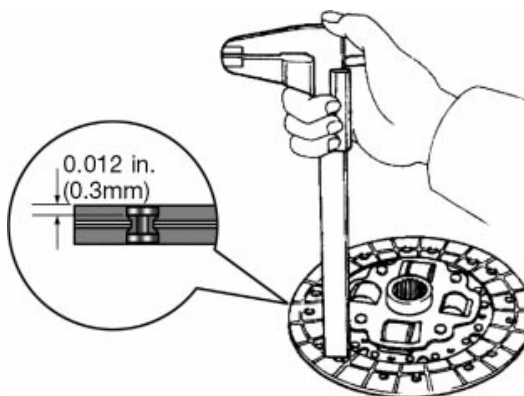


Fig. 2-17
T302f217

Disc Runout **Disc warpage** is checked by completing an axial runout check. The disc is rotated while watching for wobbling (runout) of the facing surfaces. More than 0.031 in. (0.8mm) is excessive, and the disc should be replaced.

Axial Runout Check

The disc is rotated while watching for wobbling (runout) of the facing surfaces. More than 0.031 in. (0.8mm) is excessive, and the disc should be replaced.

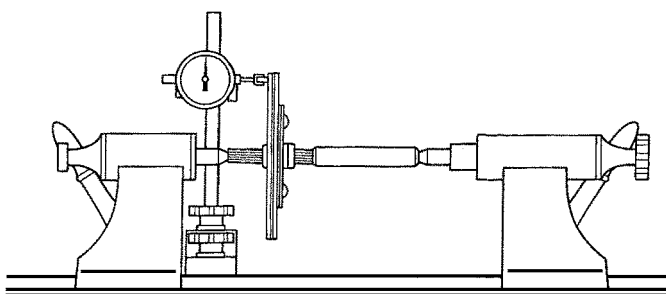


Fig. 2-18
T302f218

Disc warpage can also be checked by setting the disc against the flywheel. The disc facing should make even contact all around the flywheel.

**Release Bearing
Inspection**

Release bearings are checked by feeling for roughness and visually checked for obvious wear. They are normally replaced with the disc and clutch cover.

**Release Bearing
Inspection**

Release bearings are checked by feeling for roughness and visually checked for obvious wear.

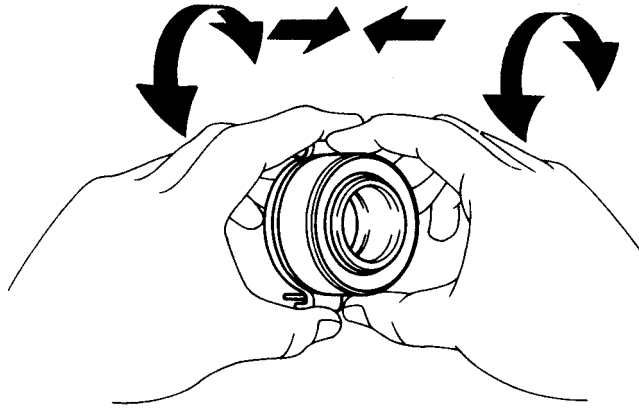


Fig. 2-19
T302f219

On self-adjusting release bearings, also check that the self-centering system is not sticking.

**Self-Adjusting
Release Bearing
Inspection**

On self-adjusting release bearings, also check that the self-centering system is not sticking.

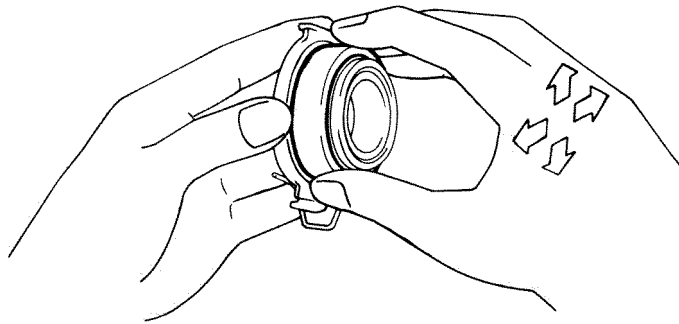


Fig. 2-20
T302f220

Clutch Pedal Adjustment

Normal service for a clutch includes checking the mechanical linkage systems for clutch pedal height and free play, and checking the hydraulic systems fluid levels.

Clutch Pedal Height To check for clutch pedal height, measure the distance from the vehicle floor (asphalt sheet under the carpet) to the top of the clutch pedal. Refer to the appropriate repair manual for vehicle specifications.

If the clutch pedal requires a height adjustment, it is adjusted using the pedal height adjust point. Always adjust clutch pedal height before adjusting clutch pedal free play.

Clutch Pedal Free Play To check and adjust clutch pedal free play, push the clutch pedal downward by hand until all play is removed and resistance is felt. The distance from this point to the pedal top position is free play.

Free play travel that is less than specifications indicates the need for adjustment of the push rod. Too little free play may result in the clutch master cylinder compensating port being blocked, preventing the return of fluid. This will result in difficulty in bleeding the hydraulic circuit and may also cause the clutch to slip as under hood temperatures cause fluid to expand pushing the release cylinder piston and release bearing.

Clutch Pedal Adjustment

Clutch pedal height is adjusted first, and then free play is adjusted.

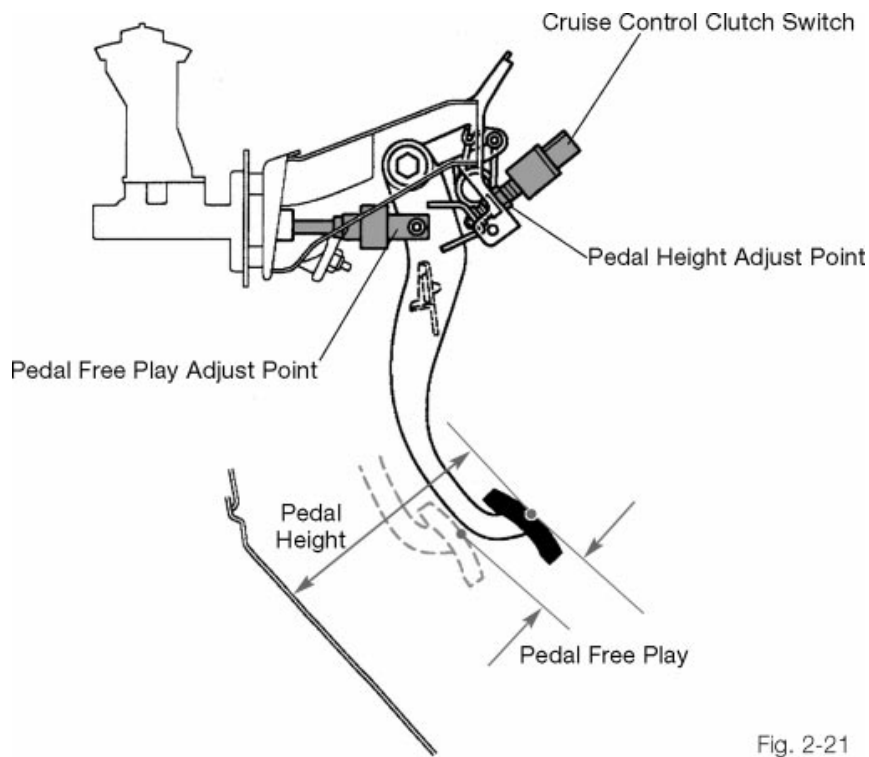


Fig. 2-21
T3021221

Clutch Release Point

To check the clutch release point:

- Pull the parking brake lever and install the wheel stopper.
- Start and idle the engine.
- Place the transmission in high gear and slowly engage the clutch.
- When the clutch begins to engage (tachometer speed begins to drop), this is the release point.
- Measure the stroke from the release point to the full stroke end position.
- Standard distance: 0.98 in. (25mm) or more (from pedal stroke end position to release point).
- If the distance is not as specified, perform the following checks:
 - Check pedal height.
 - Check push rod play and pedal free play.
 - Bleed clutch line.
 - Check clutch cover and disc.

Clutch Release Point Inspection

Measure the stroke from the release point to the full stroke end position.

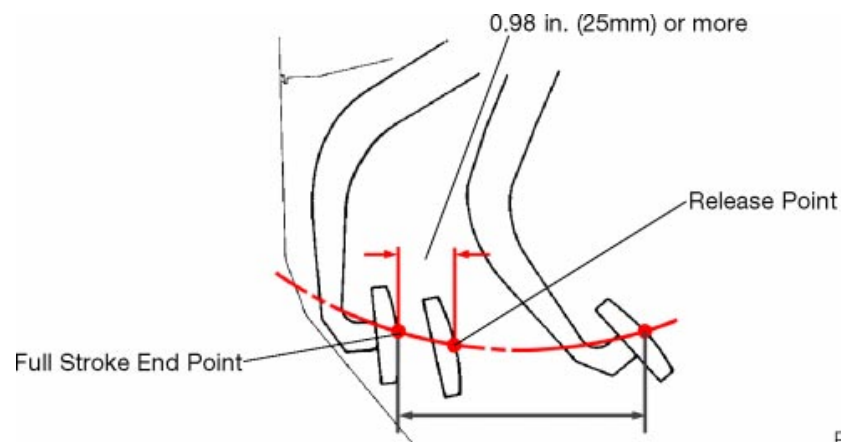


Fig. 2-22
T302H222

Clutch Start System Check

To check the clutch start system:

- Check that the engine does not start when the clutch pedal is released.
- Check that the engine starts when the clutch pedal is fully depressed. If the engine does not start, verify clutch start switch operation with a DVOM; replace as necessary.

Clutch Start System Check

Check that the engine starts when the clutch pedal is fully depressed, but not when fully released.

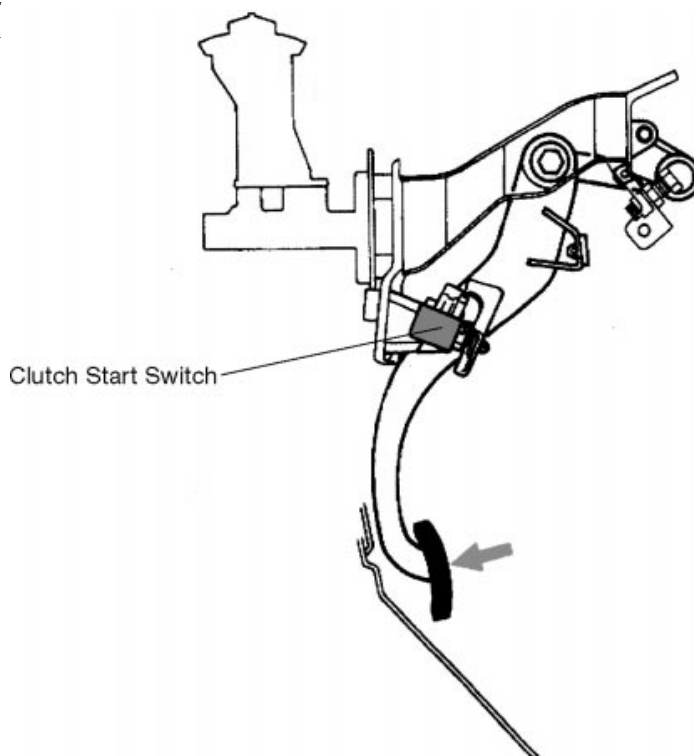


Fig. 2-23
T302f223

Clutch Service & Diagnosis

Clutch service can be broken into three operations:

- **Preventive maintenance** – check pedal free play, check fluid levels, and perform necessary adjustments to ensure correct system operation.
- **Problem diagnosis** – determine the cause of a concern in order to specify appropriate repair procedures.
- **Repair** – perform appropriate repair or component replacement tasks to attain proper vehicle operation.

This section describes normal maintenance, adjustments, and diagnostic procedures for common clutch system concerns.

Clutch Slippage Stationary check:

- Start the vehicle and warm up the engine to normal operating temperature, block the wheels, and apply the parking brake.
- Shift the transmission into the highest gear and release the clutch pedal in a smooth, normal motion. If the clutch is engaging correctly, the engine should stall immediately. A delay in engine stalling indicates slow engagement and a slipping clutch condition.

Road test:

- Once normal operating temperature is achieved, slowly accelerate to 15 - 20 mph in the highest transmission gear.
- Depress the accelerator completely to make a full throttle acceleration. The engine speed should increase steadily and smoothly as the vehicle speeds up. If engine rpm increases without a corresponding increase in vehicle speed, the clutch is slipping and needs service.

Clutch Chatter Clutch chatter is caused by a clutch that grabs and slips repeatedly, eventually marring the clutch cover pressure plate and flywheel surfaces. A grabbing or chattering clutch produces a severe vibration while engaging the clutch and the vehicle is accelerated from a stop. The vibration can be felt as well as heard and may transfer to the vehicle body causing secondary noise.

Clutch chatter may be caused by oil or grease on the clutch disc, glazed, loose or broken disc facings, worn torsion dampers, bent or distorted clutch disc, a loose clutch cover, missing flywheel dowel pins, or excessive flywheel runout. Hot spots on the flywheel or pressure plate can cause the clutch disc to be clamped unevenly resulting in chatter.

Influences outside of the clutch assembly may cause chattering such as; broken engine or transmission mounts, worn or damaged constant velocity (CV) axle joint or universal joints. Wear in the joints or loose motor mounts can cause the clutch to slip after initial engagement while the clutch pedal is released and the component reaches the end of its play. The abrupt change in rotational speed feeds back to the clutch causing slippage.

Clutch Drag Clutch drag is a condition where the clutch does not release completely. Symptoms can include hard shifting into gear from neutral and gear clash. A clutch spin down test checks for complete clutch disengagement. The clutch disc, input shaft and transmission gears should come to a complete stop within a few seconds after disengaging the clutch.

Checking clutch spin down:

- Start the vehicle and warm up the engine and transmission to operating temperature.
- With the transmission in neutral and the engine running at idle speed, push in the clutch pedal, wait nine seconds, and shift the transmission into reverse.
- Gear clash or grinding indicates a clutch that hasn't completely released.

If a vehicle fails the spin down test, the fault could be faulty clutch release controls, binding or seized pilot bearing, leaking oil seal, dragging clutch splines, or a faulty clutch disc or cover.

Clutch Assembly
Noise Check

The clutch assembly noise check is used to pinpoint the cause(s) of noises that happen as the clutch pedal is depressed. Common clutch bearing noise problems fall into four categories:

- **Transmission bearing or noise problem** – noise stops as the pedal is depressed.
- **Faulty release bearing** – noise starts as pedal is depressed beyond free play.
- **Faulty clutch cover to release bearing contact** – noise and vibration occur at one-fourth to one half pedal travel.
- **Faulty pilot bearing** – noise after clutch pedal is fully depressed.

To prepare for this check, the engine should be running at idle speed and the clutch linkage should be adjusted for correct free play:

- If noise is noticed as the clutch pedal is fully depressed and the transmission gears spin down, either the pilot bearing or release bearing causes it. To ensure the gears are completely stopped, shift the transmission into gear. If the noise becomes worse, the pilot bearing is the cause, because the crankshaft turns and the input shaft is stopped.
- Place the transmission in neutral and release the clutch pedal slightly until the gears are spinning. At this time the pilot bearing stops spinning but the release bearing is still turning. If the noise stops, it confirms that the pilot bearing is faulty. If the noise continues, a faulty release bearing causes it.
- When diagnosing a release bearing for noise, be sure to check the installed clutch cover diaphragm tip alignment as shown in the repair manual. Uneven alignment may cause slippage between the release bearing and the diaphragm resulting in noise.
- Some noises can be caused by vibration and a lack of lubrication at the pivot point of the release fork, release cylinder push rod contact to the release fork or the release fork to release bearing contact points. Be certain to lubricate these points with molybdenum disulfide grease.

Clutch Assembly Service

When a clutch assembly service is needed, a considerable time is required to remove and replace the transmission. The clutch disc and clutch cover assembly are often worn or damaged and require replacement. The release bearing and pilot bearing are replaced to ensure proper operation for the life of the clutch disc and clutch cover.

Clutch Removal When removing the clutch to confirm your diagnosis use the following procedures:

- Mark the flywheel and clutch cover with index marks for later realignment if the clutch cover assembly is to be reused.
- Remove the bolts securing the clutch cover to the flywheel two turns at a time, in an alternating fashion, across the clutch cover. Using this procedure prevents warping the clutch cover.
- Use a puller to remove the pilot bearing from the crankshaft.

Removing the Pilot Bearing from the Crankshaft

Remove the pilot bearing by securing it with an expanding-type puller.

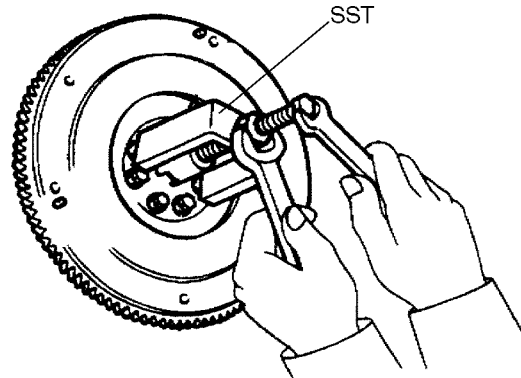


Fig. 2-24
T302f224

Clutch Reassembly Reassembly Tips:

- Check the flywheel bolts to make sure they are torqued to specifications. Also check the pilot bearing recess to ensure it is clean. Using the appropriate driver tool against the outer race, drive the new pilot bearing into the crankshaft recess.
- Place the new clutch disc over the transmission clutch shaft and ensure that it slides freely over the splines. Make sure the correct side of the disc is placed against the flywheel. If the damper assembly is not marked "flywheel side", it normally goes to the pressure plate side.
- Place the disc alignment tool through the disc and into the pilot bearing so that they are centered to each other.

Install Clutch Disc

Make sure the correct side of the clutch disc is placed against the flywheel. Place the disc alignment tool through the disc and into the pilot bearing so that they are centered to each other.

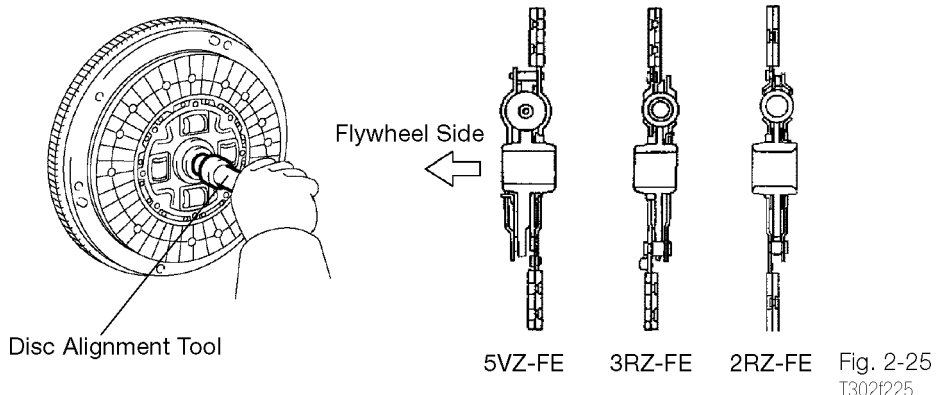


Fig. 2-25
T302f225

- Install the clutch cover over the disc, by properly aligning it with the dowel pins and mounting bolt holes. Install the mounting bolts.
- Tighten the mounting bolts in an alternating fashion, two turns at a time across the clutch cover.

Install Clutch Cover Assembly

Tighten the mounting bolts in an alternating fashion, two turns at a time across the clutch cover.

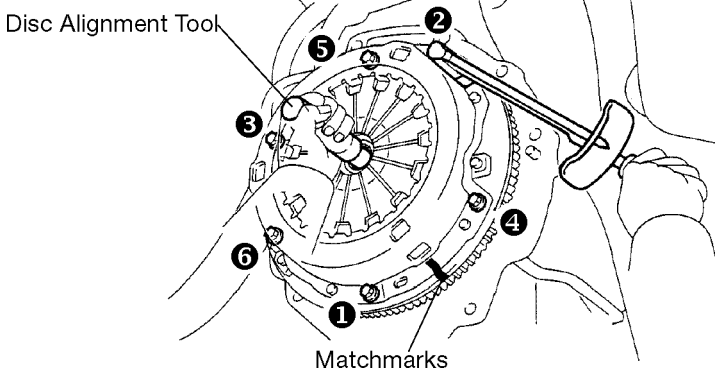


Fig. 2-26
T302f226

- Apply high temperature molybdenum disulphide grease to the fork pivot and the fork contact areas. Fill the groove inside of the release bearing collar with grease.
- Place the release bearing over the transmission bearing retainer and check for smooth movement of the bearing collar.

Grease Release Bearing, Release Fork, & Drive Shaft

Use high temperature molybdenum disulphide grease.

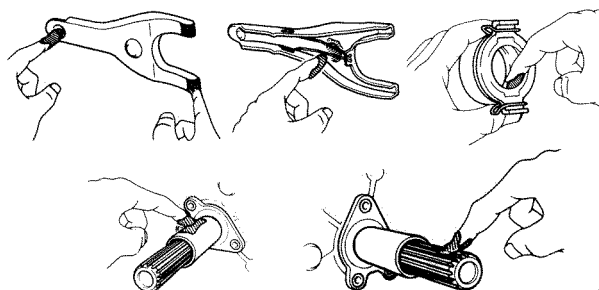


Fig. 2-27
T302f227

Transmission Replacement

To replace the transmission:

- Place a thin film of high temperature molybdenum disulphide grease on the clutch splines.
- Support the transmission while it is slid into place. **Never let the transmission hang on the clutch splines!** In order to make this installation easier, use a pair of alignment dowels to support the transmission.
- Place the transmission in low gear and rotate the output shaft or turn the flywheel to align the input shaft splines with the clutch hub.
- Push the transmission into position until the front of the transmission is flush against the engine block. **Do not force the transmission into place.**
- Install the transmission mounting bolts until lightly seated, and then tighten them to the proper torque.

Transmission Installation

Support the transmission while it is slid into place. Never let the transmission hang on the clutch splines!

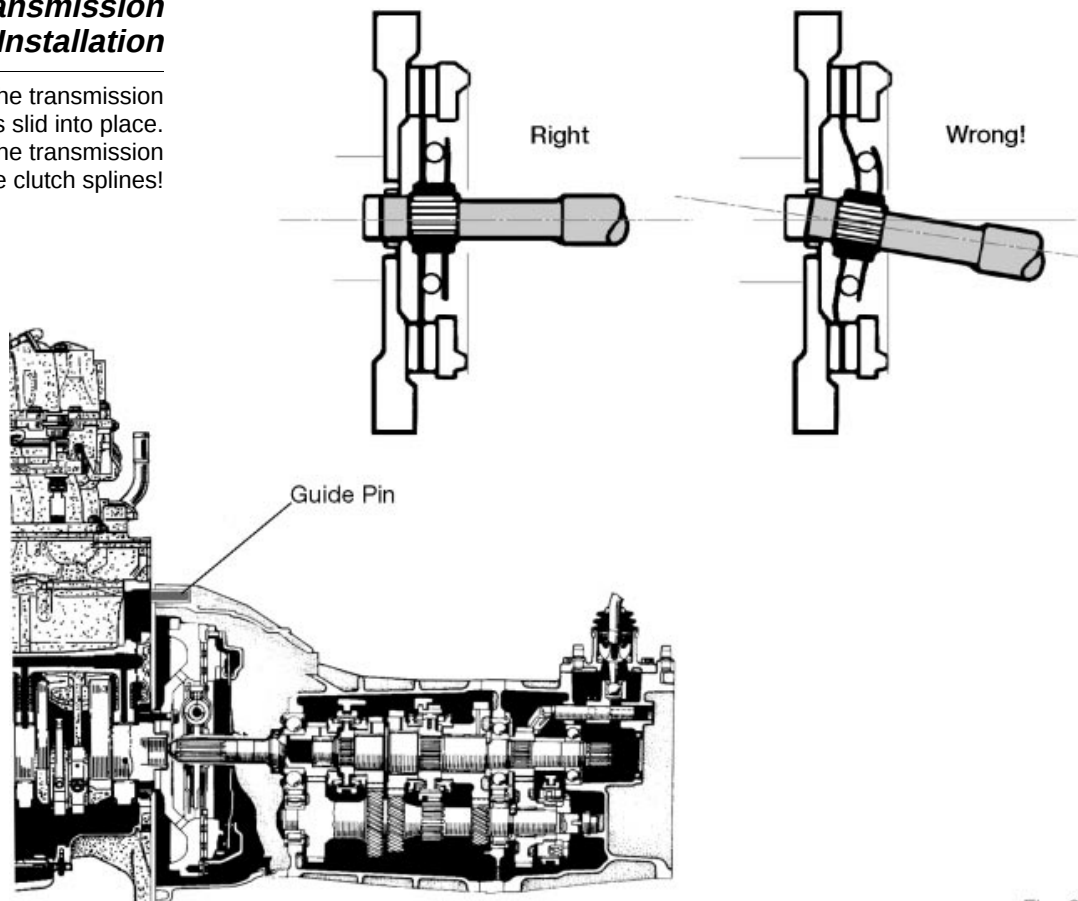


Fig. 2-28
T302/228

Supra Pull Release

The pull release style of clutch cover was introduced on the 1987 Toyota Supra, both naturally aspirated and turbo models. The early clutch cover is made of cast iron for increased strength and rigidity. With high engine power output, greater diaphragm spring pressures are required. By using the **pull release mechanism**, the diaphragm spring lever ratio can be increased to minimize additional pedal force required to disengage the clutch disc.

In 1990, the naturally aspirated Supra went to a conventional push type DST clutch cover; in the 1993.5 model year, the turbo Supra went to a stamped steel clutch cover with the pull release mechanism and flywheel damper.

The construction differences of the pull release mechanism compared to the conventional diaphragm clutch covers are:

- The release bearing and hub are fit into the diaphragm spring.
- The diaphragm spring is pulled out instead of pushed in.
- The pivot points are changed for releasing the clutch disc. (Pivot points are located near the outer diameter of the diaphragm spring).

Pull Release Mechanism

By using the pull release mechanism, the diaphragm spring lever ratio can be increased to minimize additional pedal force required to disengage the clutch disc.

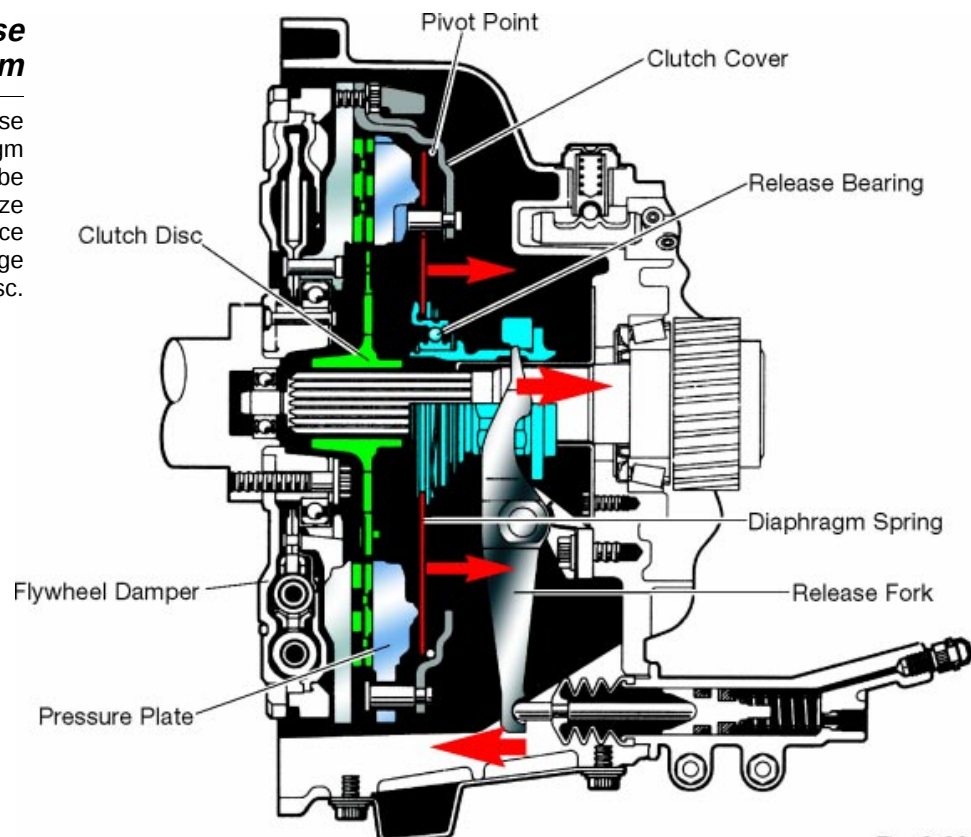


Fig. 2-29
T3021229

Pull Release Bearing The **pull release bearing** is used with the pull release mechanism clutch cover. The bearing is mounted on the clutch release bearing hub along with a thrust cone spring and plate washer. A snap ring is used to secure the parts on the hub. The assembly is installed in the diaphragm spring with a plate and wave washer. A snap ring is used to secure the assembly in the diaphragm spring.

Pull Release Bearing

This assembly is installed in the diaphragm spring with a plate and wave washer. A snap ring is used to secure the assembly.

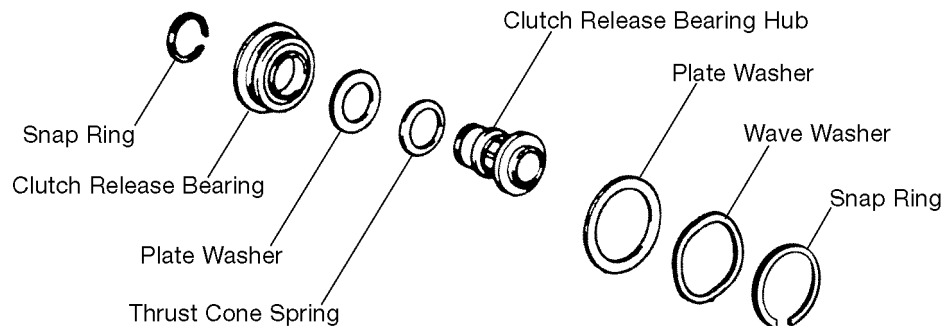


Fig. 2-30
T302f230

Flywheel Damper

The **flywheel damper** sometimes referred to as the **energy absorbing flywheel**, or **dual mass flywheel (DMF)**, is designed to isolate torsional crankshaft spikes created by engines with high compression ratios. By separating the mass of the flywheel between the engine and the transmission, torsional spikes can be isolated, eliminating potential damage to transmission gear teeth.

In 1993, the 2JZ-GTE engine model of the Supra used a super-long travel type flywheel damper. It contains a de-coupling mechanism, consisting of springs, which divides the flywheel into the engine and transmission sections. By decreasing the fluctuation of torque transmitted from the engine to the transmission, these springs help reduce drivetrain vibration and noise. The clutch disc is a solid type, in which the hub and plate are integrated.

NOTE

This assembly is replaced as a unit.

Construction The flywheel damper is fastened to the crankshaft via bolts, in the same way as conventional flywheels. The flywheel damper consists of the primary flywheel, which receives direct torque from the engine, arc springs and inner springs positioned in-line using a flange, and side plates riveted onto the secondary flywheel. The clutch disc and cover are attached to the secondary flywheel.

Flywheel Damper

The flywheel damper consists of the primary flywheel, arc springs and inner springs positioned in-line using a flange, and side plates riveted onto the secondary flywheel.

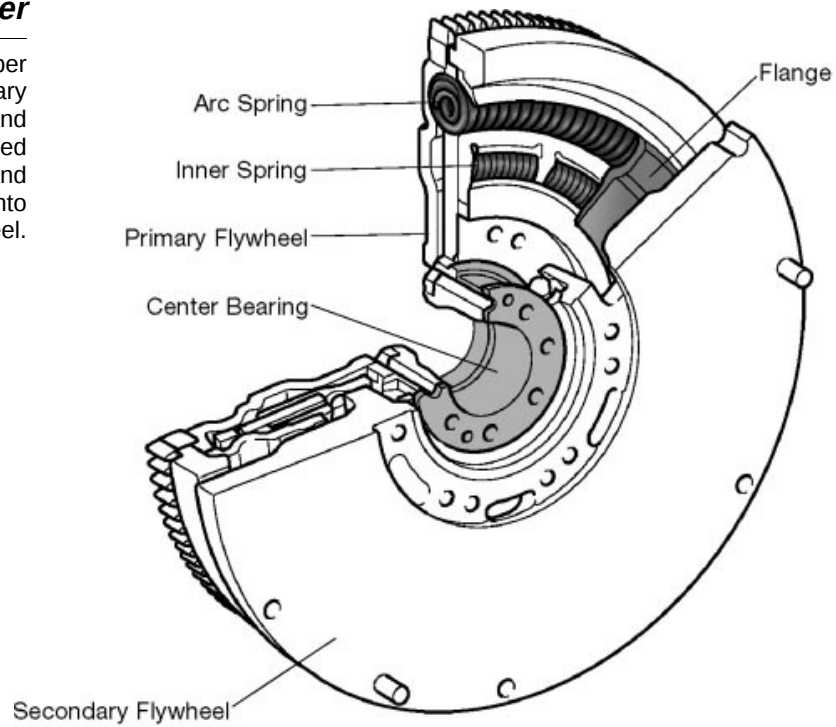


Fig. 2-31
T3021231

Center Bearing The **center bearing**—a sealed double row center ball bearing—carries the load between the inner and outer halves of the flywheel damper.

Operation The driving force of the engine is first transmitted from the primary flywheel to the arc springs. It is then transmitted from the arc springs to the flange and inner springs, causing the inner springs to be pressed against the side plates. The driving force is then transmitted to the clutch since the side plates are riveted onto the secondary flywheel. These processes help restrain torque fluctuation. The inner springs and arc springs provide an overall low spring force, while allowing for a high torque capacity sufficient for all driving conditions.

Flywheel Damper Operation

The driving force of the engine is first transmitted from the primary flywheel to the arc springs. It is then transmitted from the arc springs to the flange and inner springs, causing the inner springs to be pressed against the side plates and secondary flywheel.

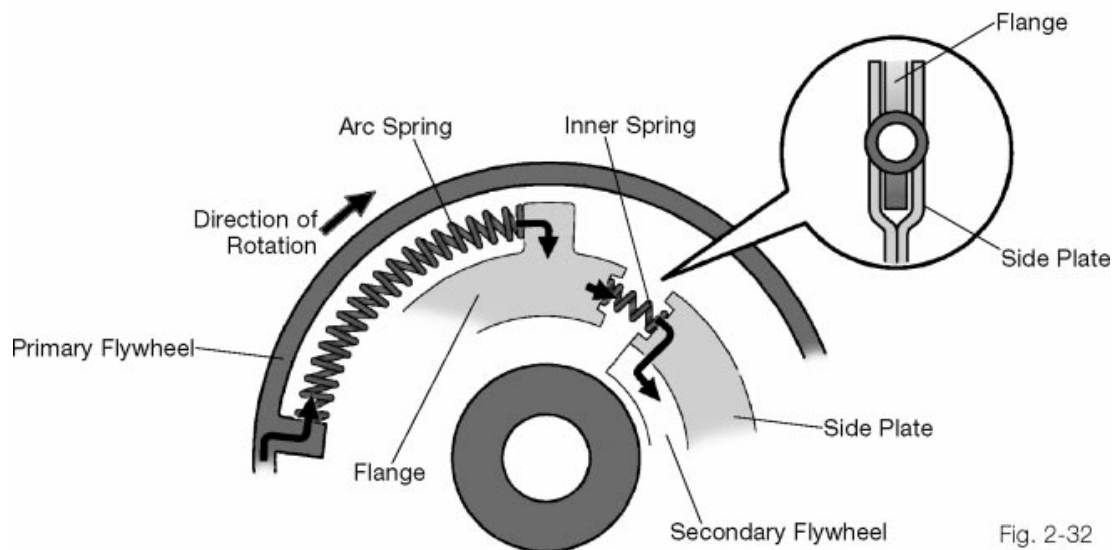
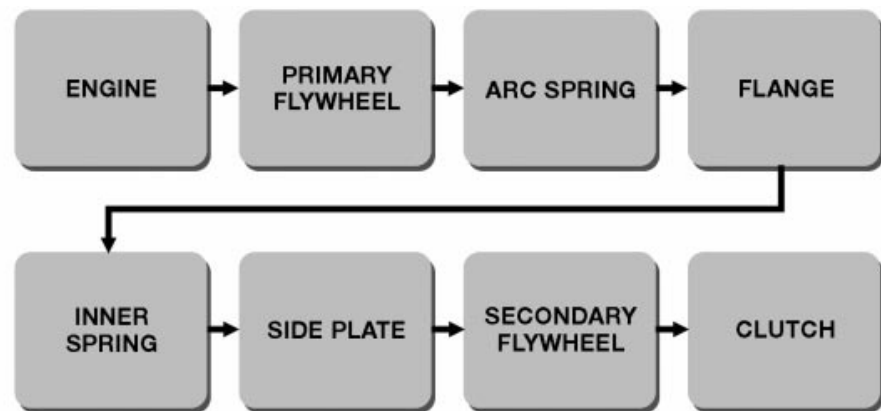


Fig. 2-32
T3021232

The flywheel damper cannot be disassembled. In case of a malfunction, it is necessary to determine whether the source of the problem is in the engine, drivetrain, or in the flywheel damper itself. For troubleshooting and diagnostic procedures, refer to the appropriate repair manual. The flywheel damper is not serviceable and should be replaced if worn or damaged.