CLUTCH REMOVAL

NOTE

Always mark clutch cover and flywheel with a center-punch before removing clutch to facilitate reinstalling clutch in same position.

1. Use three spring retention tools (17-T-1123 for CL-28, 40 and 50 series, 17-T-1766 for CL-47 series) or retaining cups as shown in Figure 4 -1, when removing a clutch assembly from the flywheel.

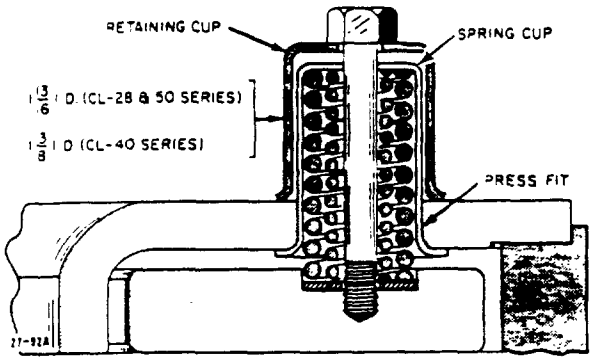


Figure 4-1. Retaining Cups

To use spring retention tools, bottom screws in tapped holes in pressure plate. Set tool nuts up snugly against tool bracket. Tighten tool nuts evenly to relieve spring tension on pressure plate. Not used on CL-58 Series.

2. Remove two clutch-to-flywheel capscrews with lockwashers at the ten o'clock and two o'clock positions of the flywheel and install two long headless guide studs to support the clutch assembly during removal of the remaining attaching capscrews.

3. After removal of all capscrew fasteners, carefully remove heavy clutch and disc assembly from flywheel counterbore and place on bench. Be careful not to drop driven disc assembly which is now free. Also remove the temporary guide studs from flywheel.

CLUTCH INSTALLATION

1. Using spring retention tools, bottom screws in tapped holes in pressure plate. Set tool nuts up snugly against tool bracket. Not used on CL-58 Series.

NOTE

Three retaining cups and screws are used to hold a new clutch assembly together until it is installed on the flywheel. Spring cups are pressed into the clutch cover hence the retaining cups are necessary to prevent spring cups loosening and slipping out of the cover during handling. Retaining cups and screws must be removed after the clutch is assembled to the flywheel. A tag is attached to new clutches (CL-28, 40 and 50 Series) calling attention to this fact and cups and screws are painted red for ready identification.

2. Engage splined end of clutch disc aligning mandrel or a spare main driving pinion with hub splines of driven disc from rear of long hub side. Then position driven disc assembly in flywheel so that spigot end of shaft engages inner race of clutch pilot bearing mounted in flywheel. This arrangement positions the disc assembly in proper alignment until clutch is completely assembled and secured in flywheel.

3. Install two long guide studs in the ten and two o'clock positions in flywheel rim. Mount clutch assembly on guide studs and push unit into flywheel bore until clutch cover flange enters counterbored pilot provided. Be careful not to disturb disc aligning mandrel.

4. Lubricate and install cover-to-flywheel capscrews with their lock washers. Tighten capscrews a few turns at a time so that cover will not be misaligned and forced into flywheel pilot by the tightening of the capscrews. Remove the two guide studs and replace with capscrews and their lock washers. Remove aligning mandrel.

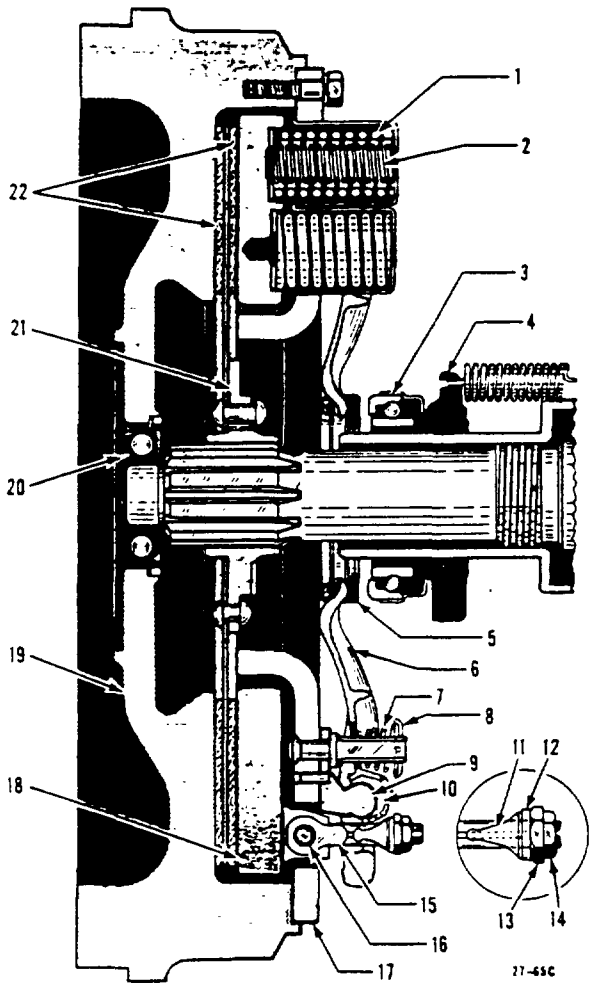
CL-28 and 40 SERIES

Description

CL-28, -40 Series assemblies are single plate, dry disc pusher type clutches. They consist of a pressure plate, a cover, and a driven disc which is splined to the transmission main driving pinion shaft. When

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engaged, the driven disc is clamped between the pressure plate and the flywheel by the pressure of coil springs which are mounted in cups on the cover. Drive is transmitted to the pressure plate by pressure plate lugs which fit in the cover openings. Six release levers have ball pivots and are linked to the pressure plate by eyebolts. The inner ends of the levers are held by the notched release thrust washer. See Figure 4-2.



1. Clutch Spring (outer)
2. Clutch Spring (inner, where used)
3. Release Bearing
4. Release Collar
5. Thrust Washer
6. Release Lever
7. Lever Spring
8. Spring Washer
9. Lever Pivot
10. Lever Bushing
11. Eyebolt Fulcrum
12. Washer
13. Fulcrum Adjustment Nut
14. Lock Nut
15. Eyebolt
16. Eyebolt Pin
17. Cover Plate
18. Pressure Plate
19. Flywheel
20. Pilot Bearing
21. Driven Disc Assembly
22. Driven Disc Facings

Figure 4-2. Sectional View of CL-28. 40 Series Clutch

Disassembly

NOTE

Before disassembly of the various parts, it is good practice to mark these parts with a center-punch. so that at reassembly, they can be reassembled in their original positions. This is necessary in order not to disturb the dynamic balance of the clutch.

1. Before removing the three spring retention tools, compress clutch release lever springs, remove washer pins, then remove washers and release lever springs. Pry off snap ring from thrust washer. Remove eyebolt nuts, fulcrums, and clutch release levers.

CAUTION

If retaining cups are used instead of tool (17-T-1123), clamp the cover in a press before removing the cups. This is necessary because the screw used does not have sufficient thread length to completely release the spring load before coming out of the pressure plate.

2. While holding spring retention tool screws, back off tool nuts alternately making one turn at a time. When spring is entirely relieved, back out the three tool screws.

3. Remove clutch cover and springs. If heat-insulating washers are removed from pressure plate spring pockets, retain them for reassembly. The eyebolts need not be removed unless inspection reveals distortion or loose fit on pins.

Inspection and Repair

Remove all traces of dirt and oil with a suitable safe solvent. Inspect parts carefully for cracks, distortion or excessive wear.

1. If cover is cracked or distorted, replace. Tack-weld loose spring cups (on covers having this construction) replace worn or loose ball-fulcrums. Replace loose or bent pin rivets.

2. Replace springs if cracked or defective. Check all springs on a spring tester. Replace all that do not meet specifications.

3. Replace thrust washer if worn, bent or defective.

4. Replace worn release levers, springs and ball seats. Check levers with a straightedge and 11/16 inch ball (17-T-1126), see Figure 4-3, and if bent so that dimension (1) is more than 11/32 inch when measured at a point where distance (2) is 2-1/2 inch, replace the lever.

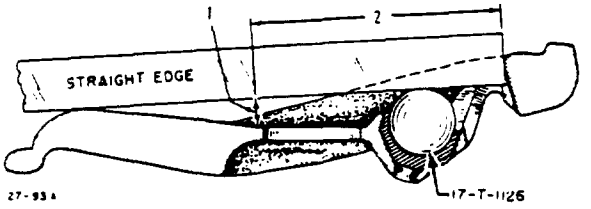


Figure 4-3. Checking Release Lever for Bend

5. If pressure plate is scored, heat checked, or warped more than 0.020 inch, it must be replaced or refaced. Remove only enough metal to obtain a smooth flat surface. Finish with a light cut and polish with emery cloth. When thickness (1) becomes less than the worn limit given in specifications, the plate must be replaced. Measure at outer spring pocket, see Figure 4-4. Measuring at inner pocket is not accurate, if pressure plate is dished. If cleft lugs are worn, cracked or distorted, replace the plate. Replace eyebolts if they are distorted, have worn threads or keyways.

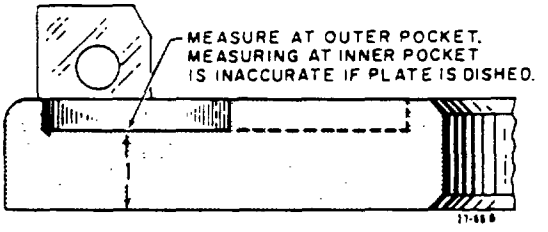


Figure 4-4. Pressure Plate Thickness Dimension

6. If flywheel is warped or heat checked and surface is refinished, maintain the 1.594 inch dimension between disc surface and bolting face for proper release lever adjustment. See Figure 4-5. No more than .070 inch maximum may be removed by grinding.

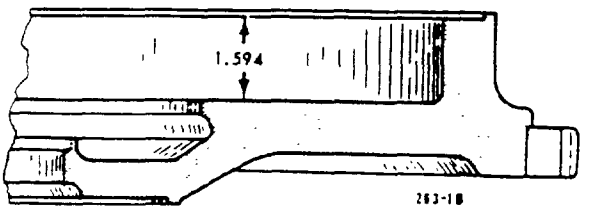


Figure 4-5. Flywheel Rubbing Surface-to-Clutch Cover Bolting Surface Dimension

7. Inspect driven disc assembly for cracks, loose rivets, worn splines, warped or dished condition. If cracked, or hub splines are worn excessively, replace disc assembly. If facings are worn down nearly even with countersunk facing-retaining rivet heads and provided assembly is in otherwise good condition, it may be rebuilt.

8. Pilot bearing should be removed, cleaned and checked each time clutch or engine is removed. Discard bearing if balls or races are chipped or scored. After inspection, hand-pack bearing with recommended clutch pilot bearing grease and install bearing in flywheel. Tap into place with shielded side toward clutch and snap ring seated in counterbore.

NOTE

Old bearings without a snap ring cannot be used in new through-bored flywheels.

After bearing is properly installed, pack the cavity in back of the bearing with recommended clutch pilot grease.

NOTE

To prevent damage to the bearing seal when the transmission is assembled to the engine, the space occupied by the main driving pinion pilot must not be filled with grease. See Figure 4-6.

All current Mack-made engine flywheels have been manufactured by boring the clutch pilot bearing hole straight-through and counterboring a recess to provide proper positioning for the snap ring type pilot bearings now in use.

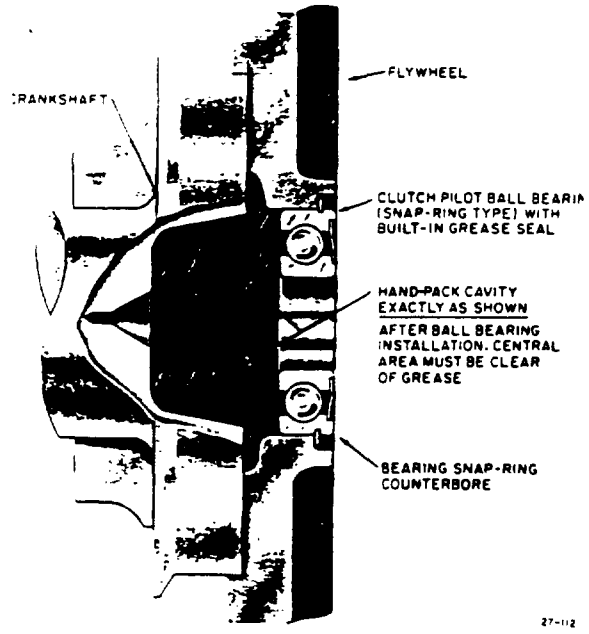


Figure 4-6. Cut-away View of Clutch Pilot Bearing Grease Reservoir Correctly Packed

CAUTION

Do not install a new snap ring bearing in an old flywheel without removing the snap ring and discarding. In old flywheels without the counterbore, the snap ring would position the bearing too far rearward, which would result in early bearing failure and considerable damage to costly components. Use only the recommended snap ring type bearings specified. These bearings will function without premature failure where slight misalignment exists between engine and transmission.

Before assembling the clutch, a positive wear check should be made to insure that it will provide maximum disc wear. This check will uncover any wear conditions that might prevent full release lever travel and allow corrections to be made before the clutch is assembled.

Place the pressure plate assembly and cover (without springs) into position as shown in Figure 4-7, making sure that shims of the correct thickness (.200) are inserted between cover and spacer (17-T-1763). Install each release lever and while pressing firmly on the fulcrum, measure distance (1) inboard end of lever is above cover.

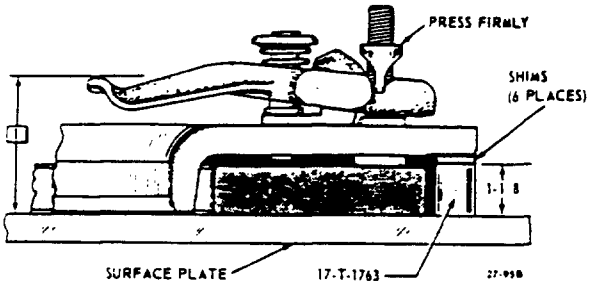


Figure 4-7. Wear Check

Correct height for the CL-28 Series, 3-9/32 inches, for the CL-40 Series, 3 inches.

Reassembly

1. Remove the shims used for the wear check. Lightly lubricate pivot ball bushing, fulcrum groove, eyebolt pin and inboard end of release lever with clutch lever grease.

2. Place the pressure plate on a face plate with the spring pockets of the pressure plate up. Place heat-insulating washers and the springs in the pressure plate spring pockets.

NOTE

If pressure plate was refaced, insert washers into the spring cups of a thickness equal to the metal removed from the pressure plate. Shellac the washers in place to facilitate retention.

3. Place the cover in position, align the springs in the pockets. Bottom the screws of the three spring retention tools into the threaded holes of the pressure plate and bring the tool nuts down snugly against the tool bracket. Tighten the tool nuts alternately, one turn at a time, guiding the pressure plate lugs into the clutch cover holes until the inside face of the cover is 1.125 inch from the face of the pressure plate. Special tool (17-T-1763), is used to facilitate obtaining this dimensions, see Figure 4-8.

4. Place the clutch release levers on the ball fulcrums and eyebolt shanks. Place the lever springs on the spring pins with the small diameter against the release levers.

assembled in their original positions. This is necessary in order not to disturb the dynamic balance of the clutch.

1. Equally space three steel blocks 3/8 inch thick, on bed of arbor or drill press.

2. Place clutch with pressure plate side down, on blocks. (This is done in order to raise clutch to permit disassembly).

3. Place a block of wood, such as a two by four, across cover plate in a position that does not interfere with tips of release levers, as shown in Figure 4-10. Compress clutch assembly slightly, removing lever adjusting screw locknuts.

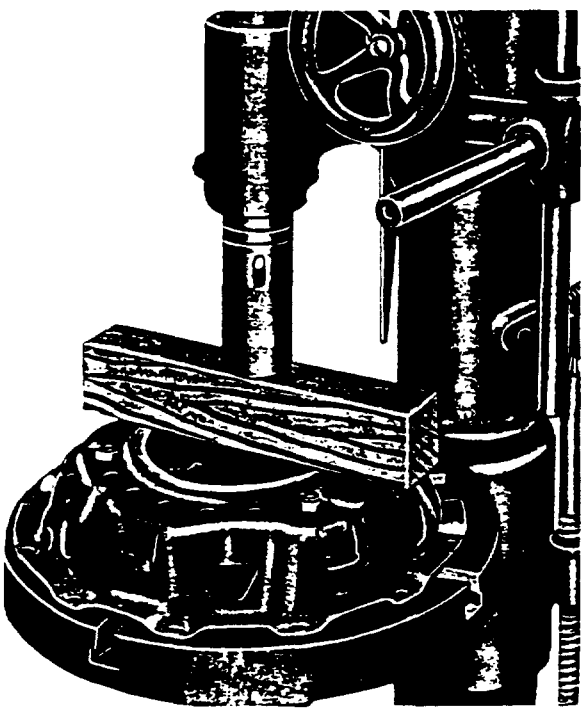


Figure 4-10. Compressing Clutch

4. Turn each lever adjusting screw down (clockwise), a few turns with a screwdriver, releasing spring tension a small amount. Repeat operation until all lever adjusting screws are entirely free of cover plate. Release remaining spring tension, and lift cover plate off pressure springs.

5. Pressure springs may now be removed. After extracting cotter pins and lever pins, remove release levers.

Inspection and Repair

Clean all parts thoroughly with a suitable safe solvent, then inspect carefully for excessive wear, distortion, or cracks as outlined below:

1. Check cover plate for distortion, excessive wear at indentations which register between drive bosses on pressure plate, and for stripped threads in holes accommodating release lever adjusting screws. If the above mentioned conditions are apparent, replacement of cover plate is required.

2. Replace springs if cracked or defective. Check all springs on a spring tester. Replace all that do not meet specifications.

3. Replace release levers that are badly worn on tips (this is an indication of a sticking release bearing), worn threads on lever adjusting screws and nuts, or where binding appears to be present, which retards free back and forth movement.

NOTE

Release levers are serviced as a subassembly only, and consist of lever, adjusting screw, roller, roller block, lever spring and spring retaining pin.

4. If pressure plate shows signs of scoring, excessive wear at lever pin holes, inside of drive bosses, heat checking, or if warped more than .020 inch, plate must be refaced or replaced. (When refacing pressure plate, remove only sufficient metal to obtain a smooth flat surface.)

NOTE

When pressure plate thickness becomes less than 1.141 inch, replacement is necessary.

5. If flywheel is warped or heat checked and surface is refinished, maintain the 1.188 inch dimension between disc surface and bolting face for proper release lever adjustment. No more than .070 inch maximum may be removed by grinding.

6. Inspect driven disc assembly for cracks, loose rivets, worn splines, warped or dished condition. If cracked, or hub splines are worn excessively, replace disc assembly.

If facings are worn down nearly even with countersunk, facing-retaining rivet heads and provided assembly is in otherwise good condition, it may be rebuilt.

7. Pilot bearing should be removed, cleaned and checked each time clutch or engine is removed. Discard bearing if balls or races are chipped or scored. After inspection, hand-pack bearing with clutch pilot bearing grease and install bearing in flywheel. Tap into place with shielded side toward clutch.

After bearing is properly installed, pack the entire cavity in back of the bearing with the same specified clutch pilot grease.

NOTE

To prevent damage to the bearing seal when the transmission is assembled to the engine, the space occupied by the main driving pinion pilot must not be filled with grease. See Figure 4-11.

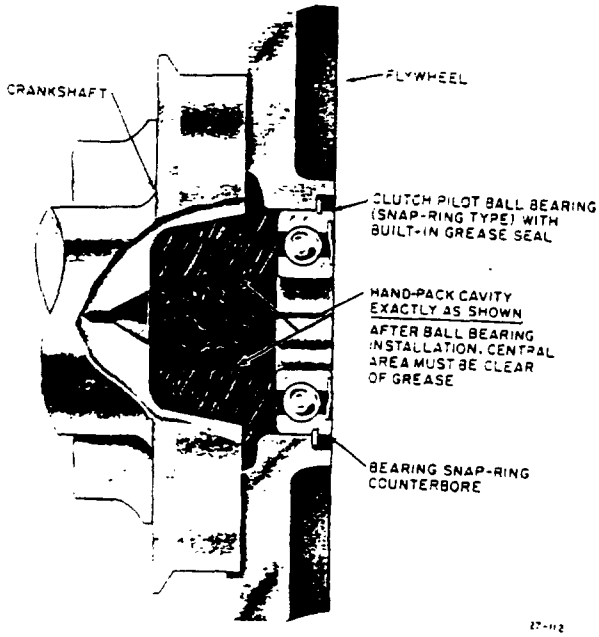


Figure 4-11. Cut-away View of Clutch Pilot Bearing Grease Reservoir Correctly Packed

Use only the recommended pilot bearings specified. These bearings will function without premature failure where slight misalignment exists between engine and transmission.

Reassembly

1. Mount release lever assemblies on pressure plate. Set pressure plate assembly on three equally spaced steel blocks 3/8 inch thick, on bed of arbor or drill press, plate side down.

2. Place pressure springs in position on pressure plate, as shown in Figure 4-12.

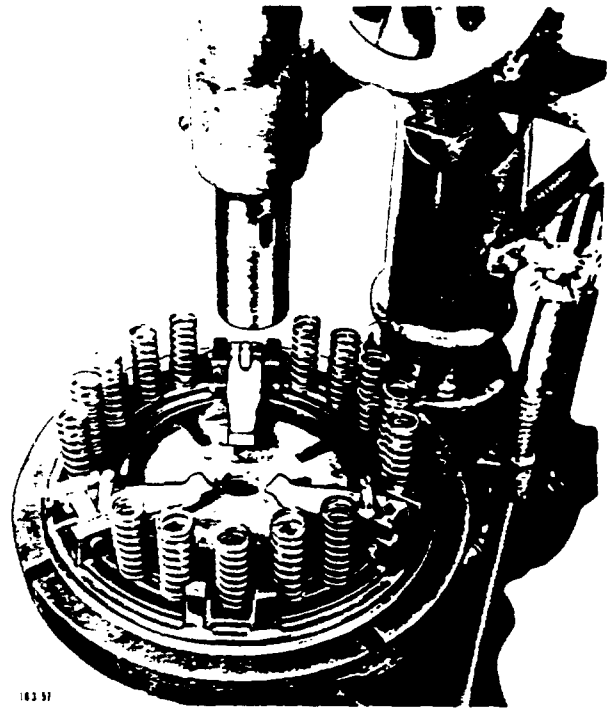


Figure 4-12. Assembling Clutch

3. Lay cover plate over springs, being sure that all springs are seated on bosses of pressure plate, and around indentations on inside of cover.

4. If pressure plate was refaced, it will be necessary at assembly, to add shims under each pressure spring equal to total metal removed.

5. Compress assembly slowly, aligning lever adjusting screws with threaded holes in cover plate. (The indentations inside cover, should enter the spaces between drive bosses on pressure plate freely.) With screwdriver, thread ends of adjusting screws into cover evenly, until screws protrude about 1/2 inch. Hold assembly compressed, while placing locknuts in position, but do not tighten.

6. To facilitate installation on flywheel, place wood blocks approximately 3/8 inch thick, between the tops of release levers and inner rim of cover plate. (Be sure these stay in position as all tension is released).

7. Insert the three spring retention tools (17-T-1766), through cover and bottom in tapped holes in pressure plate (center hole of each five series in cover). With pres-

sure plate face down on smooth surface. insert three clutch cover spacer gages (17-T-1767) (3/4 inch) at three equidistant points around edge of cover. These gages may be held with bolts, but do not allow bolts to extend beyond lower face of gages.

8. Holding bolt head of spring retention tool, draw up nuts evenly until blocks can be removed from between release levers and cover. After removing blocks, release tension by backing off nuts until pressure plate and cover spacers rest evenly on smooth surface. Using lever setting gage (17-T-1768), check distance from release lever tips to smooth surface. Adjust screws until desired setting is obtained. See specifications. Then lock screws in position with locknuts.

CL-50 SERIES

Description

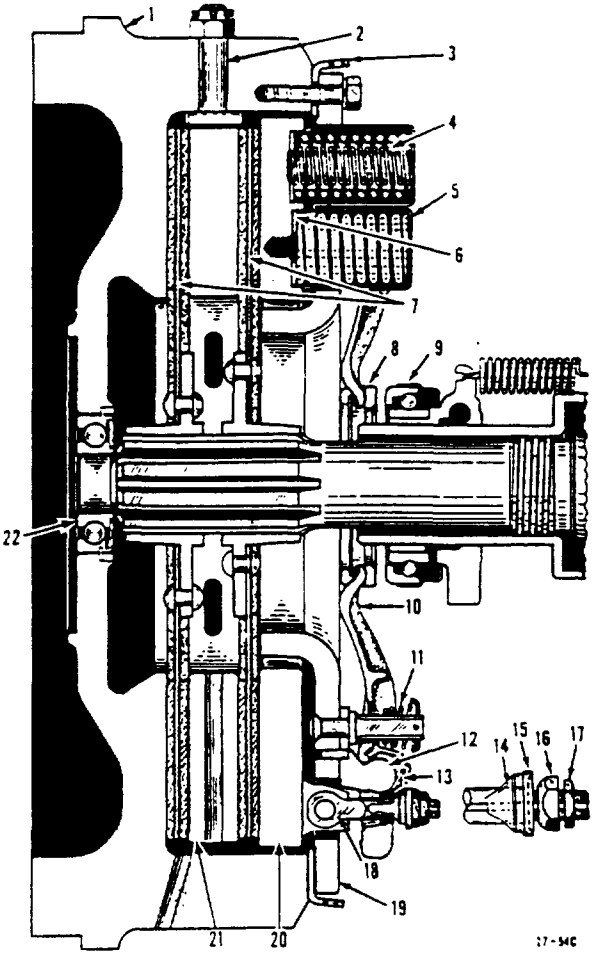
CL-50 Series assemblies are two-plate, dry disc pusher type clutches. In engagement, the two driven discs and the intermediate plate are clamped between the pressure plate and the flywheel by the force of multiple-helical springs backed up by the cover which is bolted to the flywheel. Six lugs in the flywheel, drive the intermediate plate, but permit free longitudinal movement. Pressure plate drive is transmitted by six cleft lugs which fit openings in the cover. The release levers have ball pivots and are linked to the pressure plate by eyebolts. The inner ends of the levers are held by the notched release thrust washer. See Figure 4-13.

Disassembly

NOTE

Before disassembly of the various parts, it is good practice to mark these parts with a centerpunch, so that at reassembly, they can be reassembled in their original positions. This is necessary in order not to disturb the dynamic balance of the clutch.

1. Before removing the three spring retention tools, compress clutch release lever springs, remove washer pins, then remove washers and release lever springs. Pry off snap ring from thrust washer. Remove eyebolt nuts, fulcrums, and clutch release levers.



1. Flywheel
2. Intermediate Plate Drive Pin
3. Adjusting Spacer
4. Clutch Spring
5. Spring Cup
6. Insulating Washer
7. Driven Disc
8. Thrust Washer
9. Release Bearing
10. Release Lever
11. Lever Spring
12. Lever Pivot
13. Lever Bushing
14. Eyebolt Fulcrum
15. Adjusting Nut Washer
16. Eyebolt Adjusting Nut
17. Eyebolt Lock Nut
18. Eyebolt
19. Clutch Cover
20. Pressure Plate
21. Intermediate Plate
22. Pilot Bearing

Figure 4-13. Sectional View of CL-50 Series Clutch

CAUTION

If retaining cups are used instead of tool (17-T-1123), clamp the cover in a press before removing the cups. This is necessary because the screw used does not have sufficient thread length to completely release the spring load before coming out of the pressure plate.

2. While holding spring retention tool screws, back off tool nuts alternately, making one turn at a time. When spring is entirely relieved, back out the three tool screws.

3. Remove clutch cover and springs. If heat-insulating washers are removed from pressure plate spring pockets, retain them for reassembly. The eyebolts need not be removed, unless inspection reveals distortion or loose fit on pins.

Inspection and Repair

Remove all traces of dirt and oil with a suitable safe solvent. Inspect parts carefully for cracks, distortion or excessive wear as follows:

1. If cover is cracked or distorted, replace. Tack-weld loose spring cups (on covers having this construction) replace worn or loose ball-fulcrums. Replace loose or bent release lever spring pins.

2. Replace springs if cracked or defective. Check all springs on a spring tester. Replace all that do not meet specifications.

3. Replace thrust washer if worn, bent or defective.

4. Replace worn release levers, springs and ball seats. Check levers with a straightedge and 11/16 inch ball (17-T-1126) as illustrated, in Figure 4-14 and if bent so that dimension (1) is more 11/32 inch when measured at a point where distance (2) is 2-1/2 inch, replace the lever.

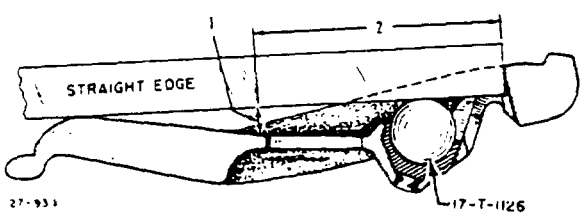


Figure 4-14. Checking Release Lever for Bend

5. If pressure and intermediate plates are scored, heat checked, or warped more than 0.020 inch, they must be replaced or refaced. Remove only enough metal to obtain a smooth flat surface. Finish with a light cut and polish with emery cloth. When thickness (1) becomes less than the worn limit given in specifications, the plate must be replaced. Measure at outer spring pocket as shown in Figure 4-15. Measuring at inner pocket is not accurate if pressure plate is dished. If cleft lugs are worn, cracked or distorted, replace the plate. The intermediate plate features a double set of drive slots for increased service life. At clutch installations after rebuild, it is recommended that the set with less wear be used. Replace eyebolts if they are distorted, have worn threads or keyways.

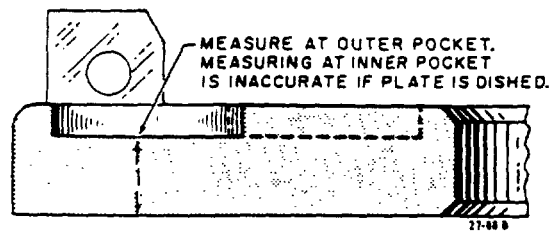


Figure 4-15. Pressure Plate Thickness Dimension

6. If flywheel is warped or heat checked and surface is refinished, maintain the 2.797 inch dimension between disc surface and bolting face for proper release lever adjustment. See Figure 4-16. No more than .070 inch maximum may be removed by grinding.

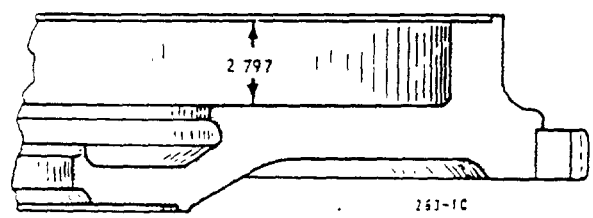


Figure 4-16. Flywheel Rubbing Surface-to-Clutch Cover Bolting Surface Dimension

Intermediate plate drive pins should be inspected for abnormal wear.

When pins have been removed to permit flywheel machining, or require replacement, squareness between flywheel friction and pin drive faces must be maintained at installation. A positioning tool will assist in establishing necessary alignment.

Suitable for this purpose, will be a slotted steel block 4 inches long, 2-1/2 inches wide and 1-1/2 inches thick. One 2-1/2 inches x 4 inches face should be ground for maximum flatness, as it will constitute the major working surface. A 3/16 inch x 45° chamfer along all edges of this face will tend to prevent burrs that would affect accuracy. See Figure 4-17.

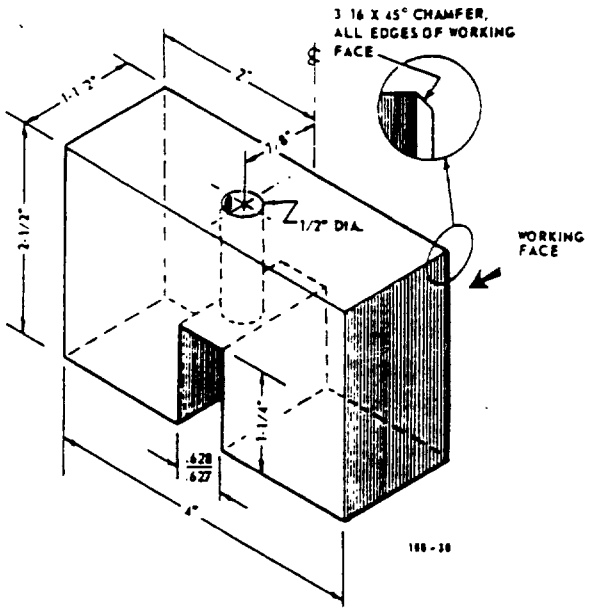


Figure 4-17. Drive Pin Positioning Tool

Midway between ends of the 4 inch length, a .628/.627 inch wide slot 1-1/4 inch deep should be machined through the 1-1/2 inch thickness. The slot must be exactly square with the ground face for it will determine flywheel to drive pin head alignment. A half -inch drift pin clearance hole, drilled from the side opposite, and intersecting with, the slot will complete the tool. Hole centerline should be 7/8 inch from the ground face, so that driving force will be centered over the head. Magnetizing the block will minimize movement during driving and lessen possibility of marring flywheel face.

In use, the threaded portion of the pin is inserted in the flywheel hole. The positioning tool slot is placed over the drive head, with the ground surface held flat against the flywheel friction face. The pin is then driven until fully seated.

7. Inspect driven disc assembly for cracks, loose rivets, worn splines, warped or dished condition. If cracked, or hub splines are worn excessively, replace disc assembly. If facings are worn down nearly even with countersunk facing-retaining rivet heads and assembly is in otherwise good condition, it may be rebuilt.

8. Pilot bearing should be removed, cleaned and checked each time clutch or engine is removed. Discard bearing if balls or races are chipped or scored. After inspection, hand-pack bearing with clutch pilot bearing grease and install bearing in flywheel. Tap into place with shielded side toward clutch and snap ring seated in counterbore. Old bearings without a snap ring cannot be used in new through-bored flywheels.

After bearing is properly installed, pack the entire cavity in back of the bearing with the same specified clutch pilot grease.

NOTE

To prevent damage to the bearing seal when the transmission is assembled to the engine, the space occupied by the main driving pinion pilot must not be filled with grease. See Figure 4-18.

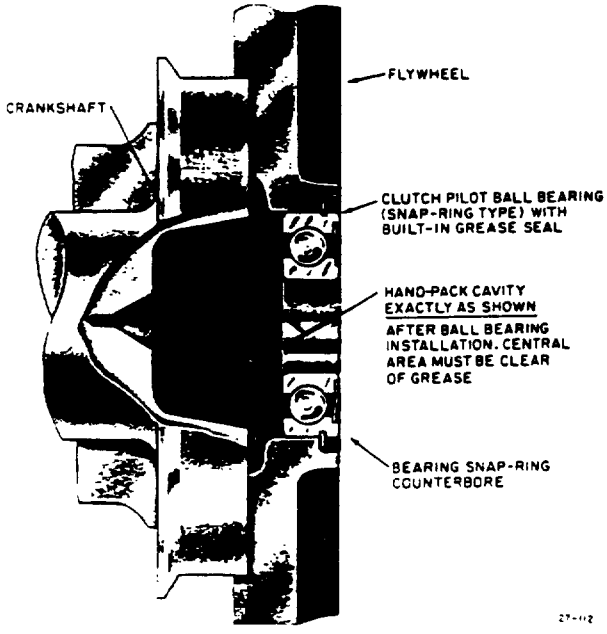


Figure 4-18. Cut-away View of Clutch Pilot Bearing Grease Reservoir Correctly Packed

All current Mack-made engine flywheels have been manufactured by boring the clutch pilot bearing hole straight-through and counterboring a recess to provide proper positioning for the snap ring type pilot bearings now in use.

CAUTION

Do not install a new snap ring bearing in an old flywheel without removing the snap ring and discarding. In old flywheels without the counterbore, the snap ring would position the bearing too far rearward, which would result in

early bearing failure and considerable damage to costly components. Use only the recommended snap ring type bearings specified. These bearings will function without premature failure where slight misalignment exists between engine and transmission.

Before assembling the clutch, a positive wear check should be made to insure that it will provide maximum disc wear. This check will uncover any interference that might prevent full release lever travel and allow corrections to be made before the clutch is assembled.

Place the pressure plate assembly and cover (without springs) into position as shown in Figure 4-19, making sure that shims of the correct thickness (.250) are inserted between cover and spacer (17-T-1763). Install each release lever and while pressing firmly on the fulcrum, measure distance (1) inboard end of lever is raised above cover. Correct height is 3-11/32 inches. Remove any interference that prevents obtaining this dimension.

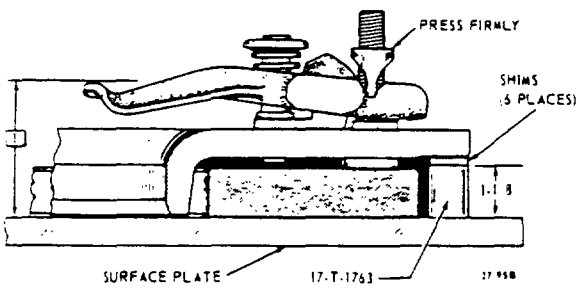


Figure 4-19. Wear Check

Reassembly

1. Remove the shims used for the wear check. Lightly lubricate pivot ball bushing, fulcrum groove, eyebolt pin and inboard end of release lever with clutch lever grease.

2. Place the pressure plate on a surface plate with the spring pockets of the pressure plate up. Place heat-insulating washers and the springs in the pressure plate spring pockets.

NOTE

If pressure plate and intermediate plate were refaced, insert washers into the spring cups of a thickness equal to the metal removed from the pressure plate and intermediate plate. Shellac the washers in place to facilitate retention.

3. Place the cover in position, align the springs in the pockets. Bottom the screws of the three spring retention tools into the threaded holes of the pressure plate and bring the tool nuts down snugly against the tool bracket. Tighten the tool nuts alternately, one turn at a time, guiding the pressure plate lugs into the clutch cover holes until the inside face of the cover is 1.1875 inch from the face of the pressure plate. Special tool (17-T-1763) and a 1/16 inch spacer (17-T-11337), is used to facilitate obtaining this dimension. See Figure 4-20.

NOTE

If the intermediate driving plate is worn or has been machined, the consequent reduction in thickness will produce the same effect as worn clutch discs when the clutch assembly is installed in a vehicle. In an extreme case, one-half the available release collar wear travel may be used up before the vehicle is put back into service.

To compensate for this condition, shims of appropriate thickness must be inserted between cover and spacers (17-T-1763) while the clutch is adjusted. Measure thickness of the intermediate driving plate which will be used with clutch being adjusted and compare with new thickness as shown in specifications. If plate is .010 inch or more below new thickness, secure shims equal in thickness to amount of metal removed and insert them between clutch cover and spacers (17-T-1763) at equally spaced intervals. See Figure 4-20.

4. Place the clutch release levers on the ball fulcrums and eyebolt shanks. Place the lever springs on the spring pins with the small diameter against the release levers. Place the spring washers in position, com-

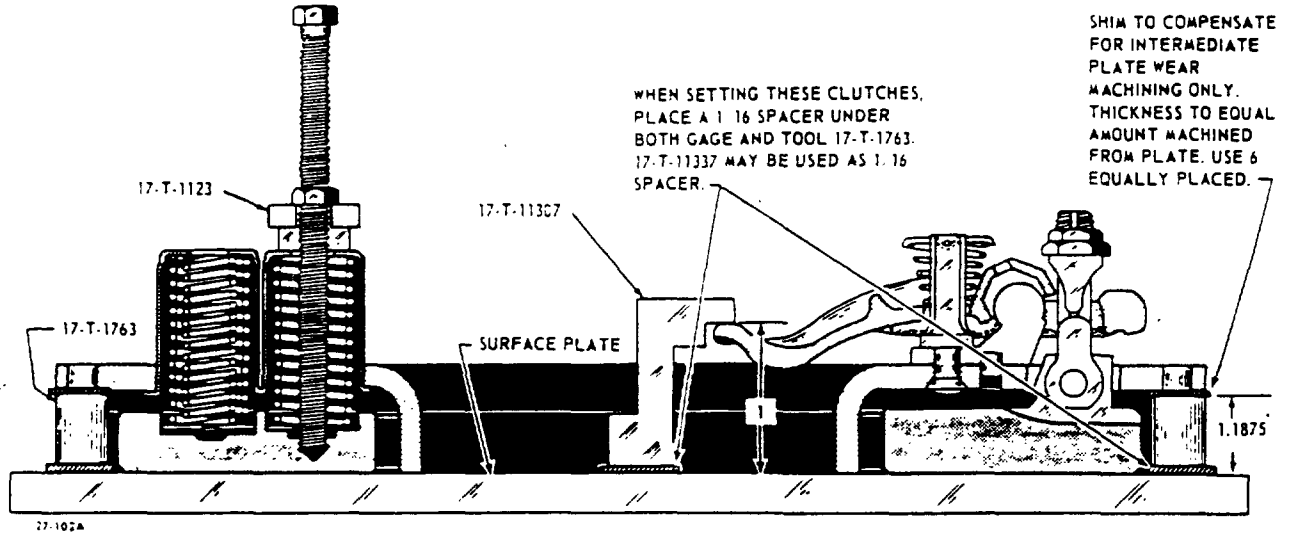


Figure 4-20. Method of Setting Clutch

press, and insert the washer lock pins. Install the fulcrums and adjust the nuts until the distance between the convex surface of each lever to the pressure plate (dimension (1), Figure 4-20) agrees with specifications. Special tools (17-T-11307) and a 1/16 inch spacer (17-T-11337) are used to facilitate obtaining this dimension. See Figure 4-20 showing use of these tools. Torque eyebolt locknut 40 to 45 lbs. ft. Install the thrust washer on the release levers and lock it in place with the snap ring.

CL-58 SERIES

Description

The CL-58 Series clutches are of the conventional single-plate, dry-disc pusher-type. They consist of a cast iron pressure plate, a cast iron cover and a rigid-type driven disc which is splined to the transmission main driving pinion shaft. When engaged, the driven disc is clamped between the pressure plate and flywheel web by the pressure of thirty-six compressed helical main springs reacting on the rigid cast iron cover. The springs are arranged symmetrically in groups of six between each pair of levers. Drive from cover-to-pressure plate is by engagement of six pairs of integral lugs on the pressure plate which are straddled by six pairs of mating lugs integral with the cover. The six forged and hardened steel release levers have anti-friction needle roller bearing mounting to the plate at the drive lugs and pivot in similar anti-friction needle roller bearings supported by yokes bolted to the cover. All six release levers are provided with individual anti-rattle springs. The notched release lever thrust washer ring is held in engagement with the lever tips by wire clamp extensions of three alternate lever anti-rattle springs. See Figure 4-21.

Disassembly

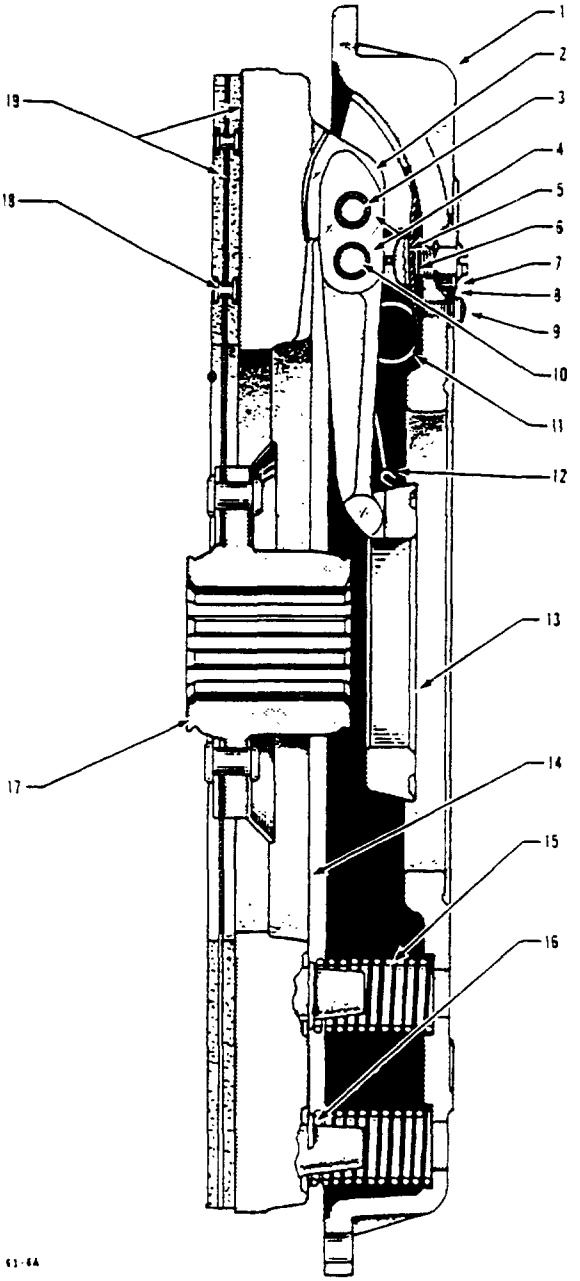
NOTE

Before disassembly of the various parts, it is good practice to mark these parts with a centerpunch, so that at reassembly, they can be reassembled in their original positions. This is necessary in order not to disturb the dynamic balance of the clutch.

1. With a screwdriver, unhook the wire clamps that retain slotted thrust washer ring to the lever tips and remove ring.

2. With pressure plate side down, position clutch assembly on rebuild machine table. With a suitable clamping device, compress the spring-loaded cover assembly. Remove nut lock plate retaining screws, lockwashers, nut lock plates and lever adjusting nuts from cover and put aside for use at reassembly. See Figure 4-22. Clamping pressure on the clutch cover may now be relieved.

3. Remove inverted leaf springs from lever yoke stems, helical main springs, and



1. Clutch Cover
2. Release Cover
3. Release Lever Pin
4. Needle Bearings
5. Release Lever Yoke
6. Yoke Leaf Spring
7. Lever Adjusting Nut
8. Adjusting Nut Lock Plate
9. Lock Plate Lock Screw
10. Yoke Clevis Pin
11. Double Torsion Anti-Rattle Spring
12. Thrust Washer Clamp
13. Lever Thrust Washer Ring
14. Pressure Plate
15. Helical, Main Spring
16. Heat Insulator Ring
17. Driven Disc Assembly
18. Facing Rivet
19. Driven Disc Facings

Figure 4-21. Sectional View of CL-58 Series Clutch

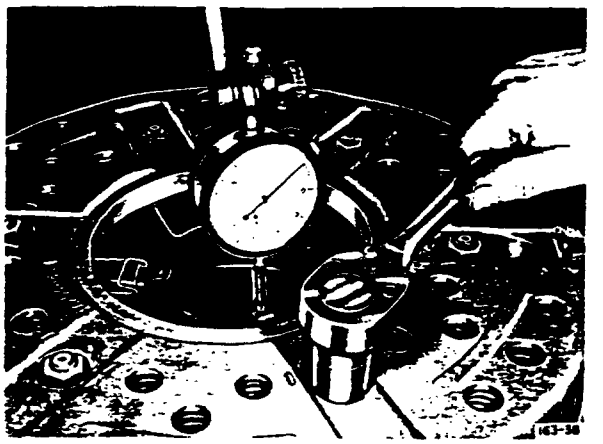


Figure 4-22. Removing Lever Adjusting Nut Lock Plates

main spring insulator washers from pressure plate bosses.

NOTE

Do not remove the six lever anti-rattle springs from the cover unless replacement is necessary.

4. Lay pressure plate on bench and with a soft metal drift, drive hardened lever pins out of pressure plate drive lugs to free release levers. With a pair of pliers, remove cotter pin from each lever yoke clevis pin and then press out each yoke clevis pin by hand.

NOTE

When removing levers from pressure plate drive lugs and lever yoke, be very careful not to lose any of the small uncaged needle rollers.

Inspection and Repair

Remove all traces of dirt and oil with a suitable safe solvent. Inspect parts carefully for cracks, distortion or excessive wear as follows:

1. Replace springs if cracked or defective. Check all springs on a spring tester. Replace all that do not meet specifications.

2. If pressure plate is scored, heat checked, or warped more than .025 inch, it must be replaced or refaced. Remove only enough metal to obtain a smooth flat surface. No more than .070 inch maximum may be removed by grinding.

3. Inspect clutch release lever tips and clevis pin holes for excessive wear. Make sure levers are not bent. Replace where necessary.

4. Inspect release lever yokes for condition of threads. Slight thread damage may be cleaned up with a three-cornered Swiss file. Replace lever yokes if clevis pin holes are elongated.

5. Check clevis pins and lever pins for wear. Replace if wear is excessive. Check lever slotted thrust washer ring for excessive wear. Replace if slots are excessively worn.

6. Check lever needle roller bearings for wear. If flats are such that rollers slide rather than roll, replace rollers.

7. Inspect driven disc assembly for cracks, loose rivets, worn splines, warped or dished condition. If cracked, or hub splines are worn excessively, replace disc assembly.

If facings are worn down nearly even with countersunk facing-retaining rivet heads and provided assembly is in otherwise good condition, it may be rebuilt.

8. If flywheel is warped or heat checked and surface is refinished, maintain dimensions shown in Figure 4-23 between disc surface and bolting face for proper release lever adjustment. No more than .070 inch maximum may be removed by grinding.

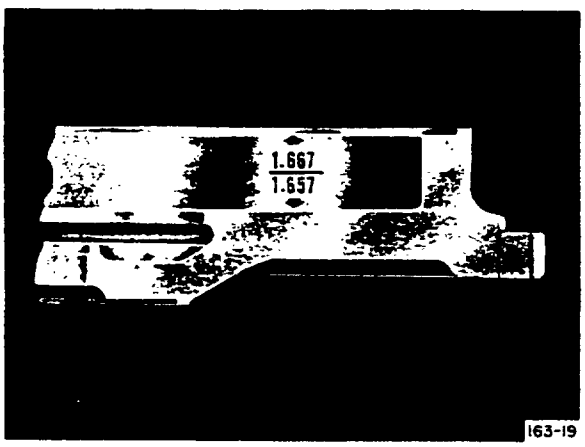


Figure 4-23. Flywheel Rubbing Surface-to-Clutch Cover Bolting Surface Dimension

9. Pilot bearing should be removed, cleaned and checked each time clutch or engine is removed. Discard bearing if balls or races are chipped or scored. After inspection, hand-pack bearing with clutch pilot bearing grease specified and install bearing in flywheel. Tap into place with shielded side toward clutch and snap ring seated in counterbore.

After bearing is properly installed, pack the entire cavity in back of the bearing with the same specified clutch pilot grease.

NOTE

To prevent damage to the bearing seal when the transmission is assembled to the engine, the space occupied by the main driving pinion pilot must not be filled with grease. See Figure 4-24.

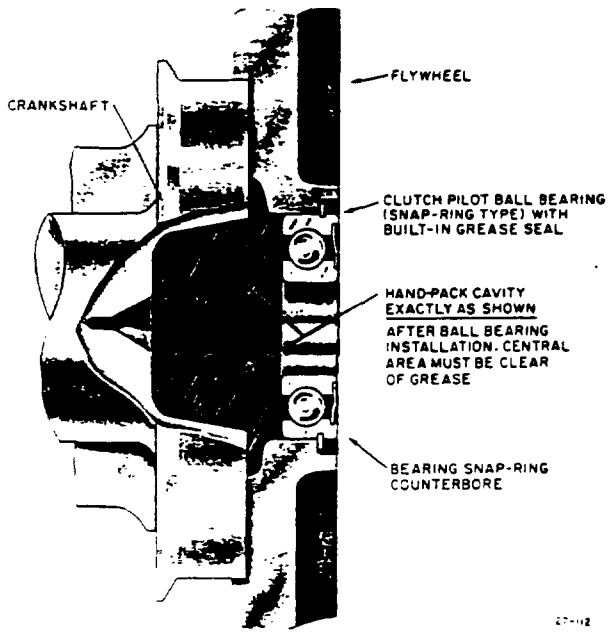


Figure 4-24. Cut-away View of Clutch Pilot Bearing Grease Reservoir Correctly Packed

Use only the recommended snap ring type bearings. These bearings will function without premature failure where slight misalignment exists between engine and transmission.

Reassembly

1. Apply a light coat of clutch lever grease on the loose needle bearings and install rollers in each pin hole of levers. When bearings are installed, apply additional grease to each assembled bearing group.

2. Spread a thin coat of lever grease on the two rubbing flats of each lever and on all yoke rubbing surfaces. Center lever

yoke clevis pin holes over lever inner bearing-lined pin holes and carefully insert clevis pin through the aligned holes. Lock pin in position with cotter pin.

3. Apply a thin even coat of lever grease on all pressure plate drive lug rubbing surfaces. Carefully position lever assembly between drive lugs. Align pin holes in drive lugs with assembled needle rollers and push pin through lugs and bearing opening.

NOTE

Remove all excess grease.

4. Position clutch pressure plate and lever assembly in clutch overhaul machine, arbor press, drill press or whatever clamping arrangement being used. After centering thereon, install heat insulator washers on the spring heat grids, then main springs in their correct specified positions.

NOTE

Except as specified below, install BLACK or COLORLESS main springs on all locating bosses remaining without springs.

CL-58, install an all RED spring on each No. 1 and No. 3 spring boss. CL-581, install an all WHITE spring on each No. 4 and 5 spring boss.

CL-582, install an all WHITE spring on each No. 6 spring locating boss. See Figure 4-25. Install inverted yoke springs on yoke stems.

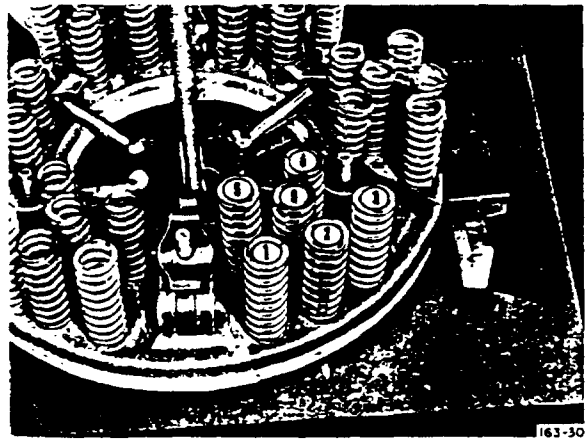


Figure 4-25. Main Spring Arrangement In One of the Six Identical Pressure Plate Segments

NOTE

Make sure leaf springs are inverted on yoke stems and parallel to levers so that their upturned ends will bear against under side of cover when assembled, thus spring-loading each yoke.

5. Position yokes vertically. Position clutch cover over assembly. After centering all main springs in their counterbored seats in cover, set up clamping arrangement and compress springs slowly. Make sure ALL yoke stems are in alignment, then continue to compress springs until all six stems are sticking out of their cover holes.

6. Apply a very thin coat of clutch lever grease to adjusting nut spherical seats in cover. Then install adjusting nuts. Clamping pressure on clutch cover may now be relieved.

7. Lay engine flywheel on bench. Make up four spacers exactly .402 inch thick each and arrange them on flywheel rubbing surface. The spacer thickness of .402 inch corresponds to the mean driven disc assembly thickness under load. See Figure 4-26. Then without disturbing the .402 inch spacer arrangement, position clutch in flywheel counterbore. Install clutch in flywheel counterbore. Install clutch cover-to-flywheel capscrews with their lock washers. Tighten capscrews a turn or two at a time, in rotation, so cover will not be cocked and forced into flywheel pilot by the tightening of the screws.

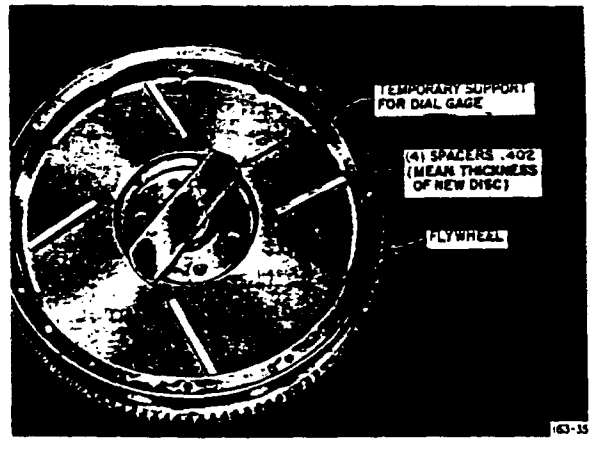
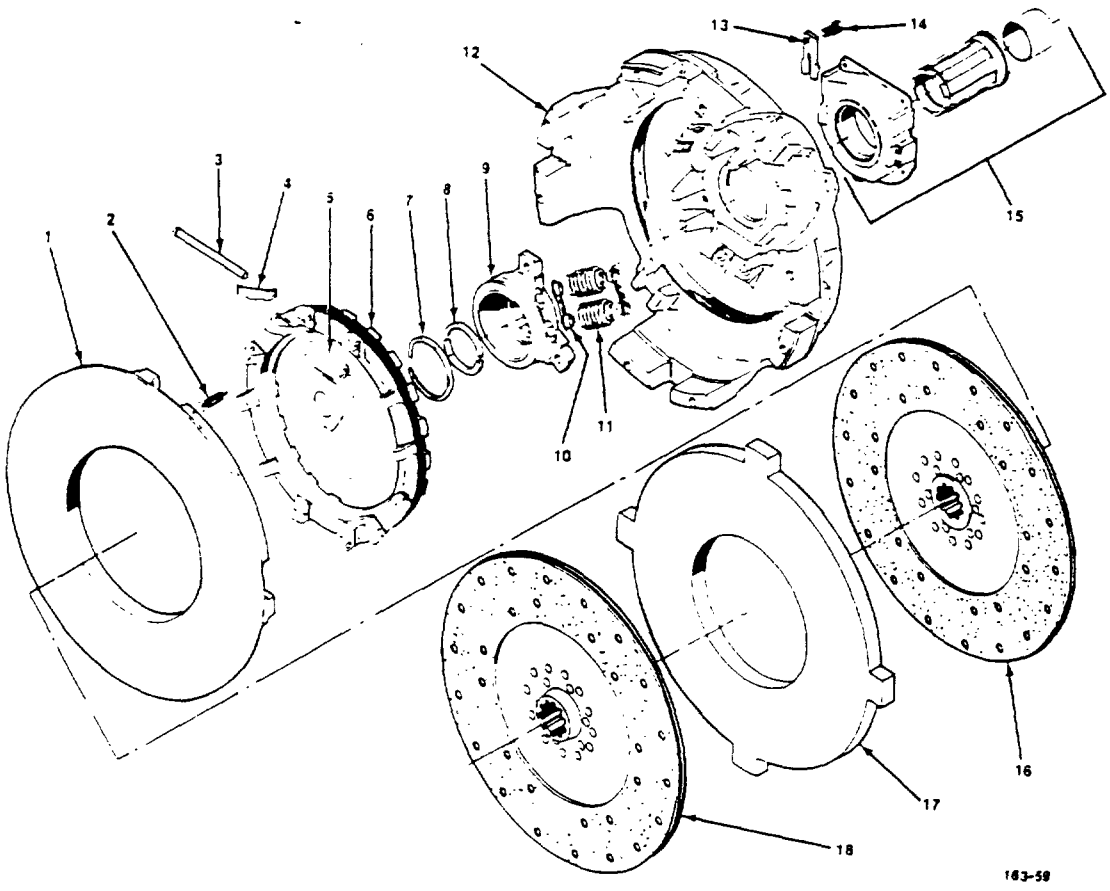


Figure 4-26. Clutch Lever Adjustment Spacer Arrangement in Flywheel



1. Pressure Plate
2. Return Spring
3. Pivot Pin
4. Spring Clip
5. Adjusting Ring
6. Lever
7. Snap Ring
8. Release Sleeve Ring
9. Release Sleeve Retainer
10. Spring Pivot
11. Pressure Spring
12. Flywheel Ring
13. Adjusting Ring Lock
14. Bolt & Lock Washer Assy
15. Release Bearing & Bearing Assy
16. Driven Rear Disc
17. Intermediate Plate
18. Driven Front Disc

Figure 4-33. Exploded View AS-1550 Series Clutch Assembly

Removal and Disassembly

A suitable "sling" or transmission jack should be used to properly support and maintain the engine/transmission alignment when removing or installing a transmission on an engine. DO NOT let the rear end of the transmission drop down and hang unsupported in the splined hubs of the clutch discs to avoid bending or distorting the friction discs. Disconnect the external linkage from the clutch release arm to permit the release yoke to turn up and pull free of the release bearing thrust pads.

1. Prior to actual clutch removal, assemble a clutch disc aligning tool to the driven disc and release bearing assembly.

It is important that two 3/4 inch blocks of wood as shown in Figures 4-34 and 4-35 be inserted between the clutch release bearing housing and clutch flywheel ring as the clutch mounting bolts are loosened around the flywheel. These blocks will relieve the heavy internal spring load, preventing cocking and bending within the clutch and insure easy removal of remaining mounting bolts.

2. When all bolts have been removed, slide clutch assembly back and off using caution to keep aligning tool in place to retain discs and intermediate plate.

3. Carefully remove aligning tool, rear disc, intermediate plate and front disc.

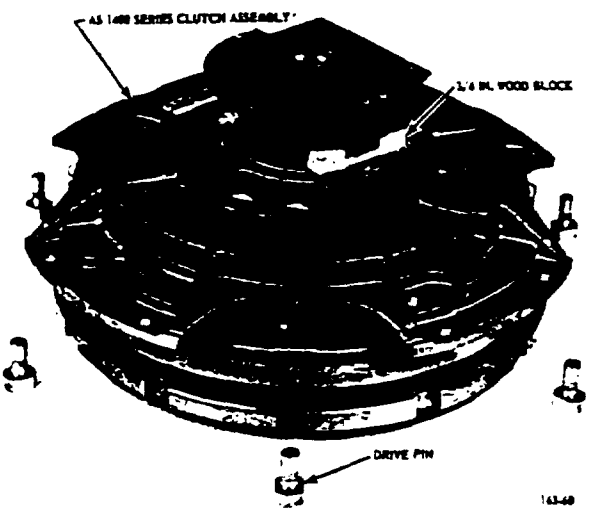


Figure 4-34. Location of Support Block AS-1400 Series

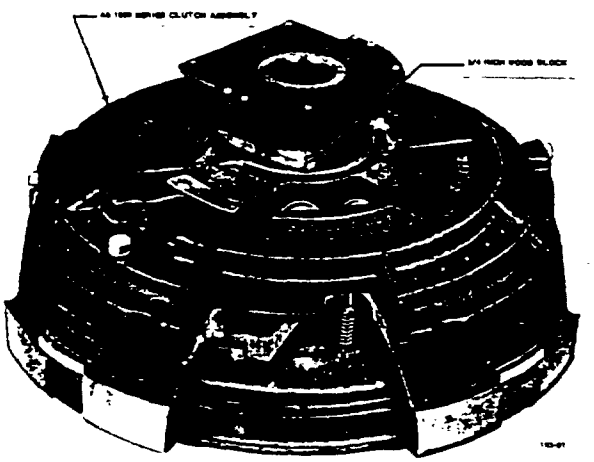


Figure 4-35. Location of Support Block AS-1550 Series

4. Remove bolt and lockwasher assembly and adjusting ring lock. Use screwdriver or similar wedge to remove adjusting ring lock. See Figure 4-36.

5. Set clutch assembly (without driven discs and intermediate plate) upside down on a flat table or workbench. Unhook four return springs from flywheel ring and lift pressure plate off. See Figure 4-37.

NOTE

Mark pressure plate in relation to flywheel ring for reassembly purposes.

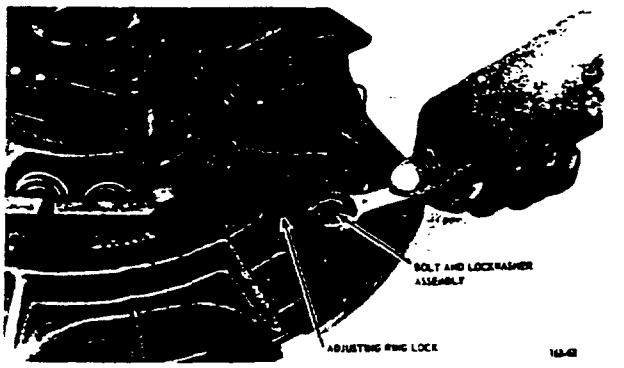


Figure 4-36. Removing Adjusting Ring Lock

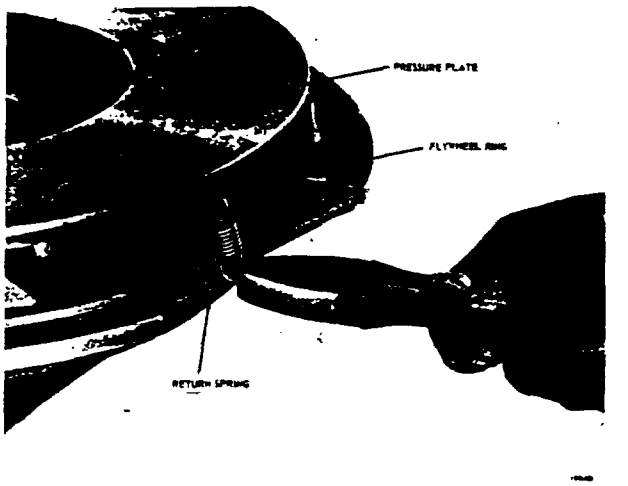


Figure 4-37. Removing Return Spring

6. Turn the adjusting ring and lever assembly counter-clockwise until free of flywheel ring. Then lift and remove assembly. See Figure 4-38.



Figure 4-38. Turning Adjusting Ring

7. Remove snap ring from release sleeve retainer. See Figure 4-39.

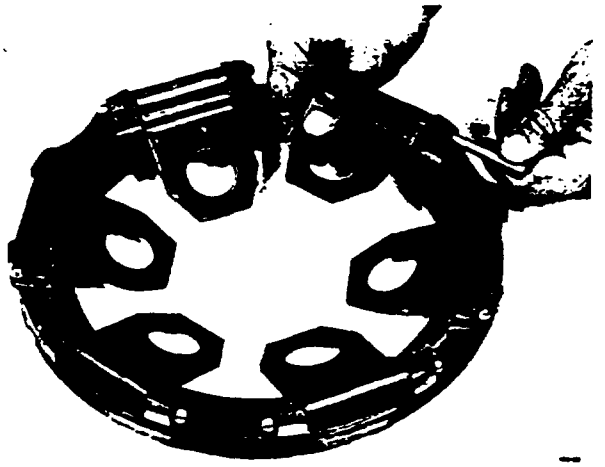
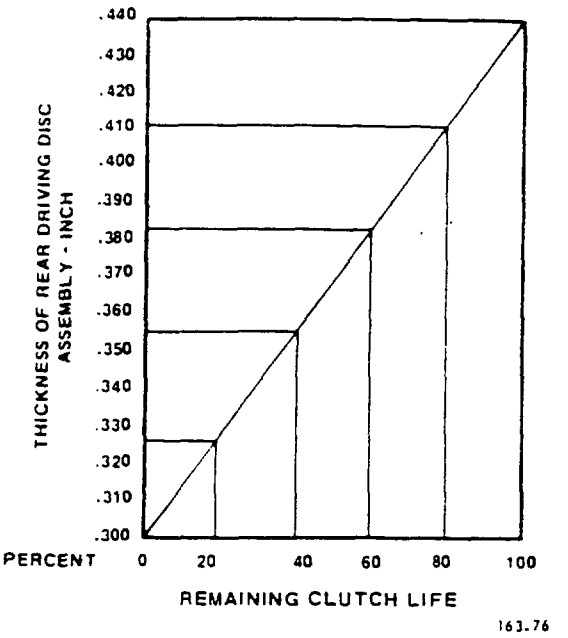


Figure 4-43. Removing Retainer Clip

Remaining Clutch Life Chart - %



Inspection and Repair

Clean all parts thoroughly with a suitable safe solvent.

Many clutches are replaced as a preventative maintenance item at low mileage during repairs of the transmission or engine. Before the Clutch Assembly is replaced, the unit should be inspected for the following items:

1. Heat cracks in the pressure plate.
2. Excessive wear in all drive slots.
3. Broken springs.
4. Dry or damaged release bearing.
5. Broken intermediate plate.
6. Excessive driven disc hub spline wear.
7. Burned facings.
8. Excessive wear on drive pins or intermediate plate slots.

If the preceding list has been inspected and looks to be in good condition, use the chart to determine the approximate remaining clutch life by measuring the thickness of the rear driven disc assembly.

Find thickness of rear disc on column to left then follow curve on right then drop this point down to read % of clutch life remaining.

Driven Discs

Inspect disc assembly for cracks, loose rivets, worn splines, warped or dished condition. Re-straighten if dished or warped - 0.015 inch maximum runout. Replace if hub is cracked, or splines are worn excessively.

Replace facings if they are glazed, scored, worn down to rivet heads, burned, or if grease or oil are on them.

The riveted asbestos facing driven discs, use high-quality facings riveted to the steel disc. They may be furnished with rigid disc or damper type. Used discs can be reworked in the field by drilling out the rivets to remove old facings. Use the correct size drill when removing old rivets to avoid enlarging holes in disc. Use proper facings and a star set anvil to reline used discs.

Ceramic friction material, a combination of metal and ceramic, is relatively new to the clutch facing industry. It is used in producing round or trapezoidal buttons which are riveted to steel discs. These clutch

discs, available with either rigid or damper hubs, offer many advantages for heavy-duty applications. Reworking these discs in the field is not recommended because the ceramic buttons must be assembled and ground to hold thickness as well as squareness with splines.

Super-duty discs have six trapezoidal ceramic buttons and are available with rigid or damper hubs. These S-D discs are thinner than standard discs while the intermediate plate is thicker. This combination of more ceramic buttons and thicker intermediate plate provides longer life and increased torque capacity.

A super-duty kit consisting of two driven discs and an intermediate plate is available for converting a standard Angle-Spring clutch into a super-duty A-S clutch. It is very important that the kit be installed as a unit and its components should never be intermixed with standard components.

Flywheel Ring

Inspect the flywheel ring for cracks. Replace if cracks are visible. Check slots for indentation caused by wear of pressure plate driving lugs. See Specification Chart for slot limits.

Inspect bolt circle face and pilot for nicks and burrs due to removal or handling. Remove burrs with file to insure proper seating and squareness when clutch is mounted to flywheel.

Adjusting Ring

Check pivot pin holes for wear. Clearance may not exceed 0.010 inch between pin and hole. Inspect for cracks; replace if cracks are visible.

Pressure Plate

Inspect fulcrum for wear. If wear exceeds 0.015 inch, remachine. See Specification Chart for maximum rework.

Inspect friction surface of pressure plate for scoring, burning, heat checking or distortion. If friction surface is badly scored, heat checked, warped or dished in excess of 0.010 inch; resurface or replace with new pressure plate. Smooth and flat pressure plate surfaces must be used for satisfactory clutch life.

Check drive lugs for wear per Specification Chart.

Intermediate Plate

Inspect friction surfaces of intermediate plate for heat checks, scoring or distortion. If friction surface is badly scored, heat checked, warped or dished in excess of 0.020 inch, resurface or replace with new intermediate plate. Smooth and flat intermediate plate surfaces must be used for satisfactory clutch life. Inspect driving slots of intermediate plate for wear per Specification Chart.

Release Levers

Inspect levers for excessive wear at points of contact with pressure plate, release sleeve retainer, and pivot pin. If levers are bent or worn, replace with new levers. It is good preventive maintenance to replace levers during clutch rebuild.

Release Sleeve Retainer

Inspect for wear in lever groove and internal splines. Refer to specifications for driving slot clearance between flywheel ring drive slots and release sleeve retainer drive lugs.

Spring Pivots

Inspect for cracks; if visible, replace.

Release Sleeve Sub-Assembly

Check bushing for excessive wear. Check bearing diameter for tight fit. Refer to Specifications Chart and replace if necessary.

Release Bearing and Sleeve Assembly

It is recommended that the release bearing and sleeve assembly be replaced as a unit at the time of clutch rebuild. Assemblies are available as service replacement items.

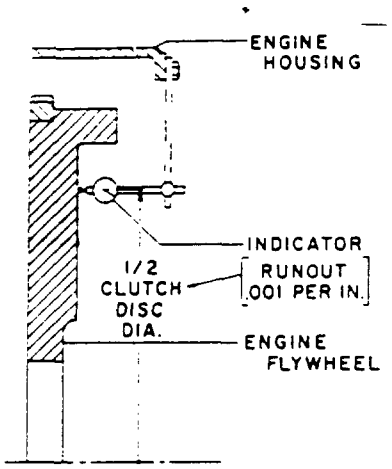


Figure 4-82. Checking Flywheel Face Runout

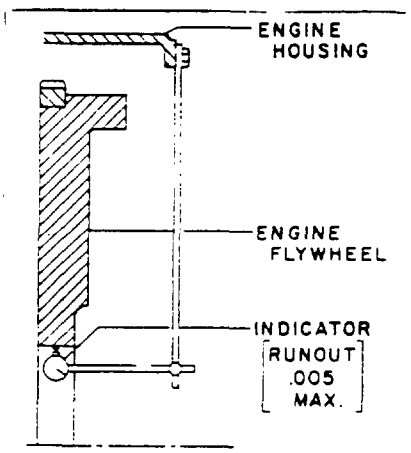


Figure 4-83. Checking Flywheel Bore Runout

2. Check recessed type flywheel for correct depth. See specifications.

3. Replace release bearing and carrier, if worn, and flywheel pilot bearing. Pilot bearing should be a hand press fit in the flywheel recess and on the transmission drive gear. The release yoke or fork should contact the release bearing carrier pads evenly to prevent a bind on the front bearing cap extension.

4. The friction face of the flywheel must be free from heat cracks, score marks and taper. The presence of any of these conditions will have an adverse effect on clutch function and life.

Installing Clutch Assembly

It is a good idea to try the cover assembly on the flywheel without the disc assembly to check fit where cover is piloted at O.D.

Install driven disc, making sure that it is properly positioned and insert an aligning shaft. Normally the long end of the driven disc hub extends toward the transmission, but in a few instances the long end may face toward the engine. Make sure that the driven disc hub does not come within 5/32 inch of the pilot bearing.

Bolt the cover assembly to the flywheel, tightening each capscrew gradually until the cover is drawn up tight. Extreme care must be exercised to make sure flywheel ring or cover is seated in piloting rim on recessed type flywheels.

Some cover assemblies are piloted to the flywheel by capscrews with a ground shank which fits the reamed holes in the cover.

The machined shank extends through the cover into a recessed or counterbored hole in the flywheel. If a flywheel has been reground there is a chance that the counterbores could be too shallow and may require deepening. If the flywheel has been remachined several times to remove heat cracks or scores, the counterbored holes may not be deep enough to allow complete tightening of the capscrews. This will necessitate replacing the flywheel.

Dimension 'A'

Dimension 'A' is the distance from the top of the clutch flywheel ring (cover) to ends of release levers. See Figure 4-84.

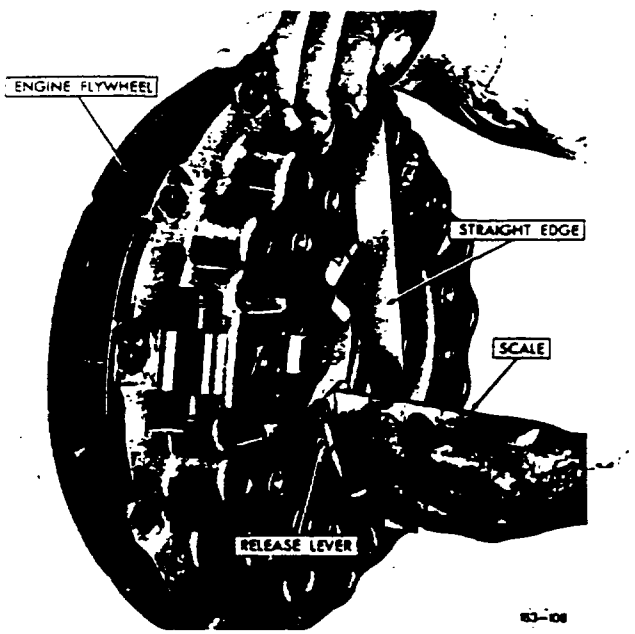


Figure 4-84. Checking 'A' Dimension

Check specification chart for correct 'A' Dimension. Satisfactory operation of the clutch depends greatly upon the accuracy of the lever setting, as this controls the parallel movement of the pressure plate.

3/8 inch capscrews. 7/16 inch capscrews are used for 15-1/2 inch - 2 applications.

The pressure plate is driven by means of driving lugs extending into mating slots of the flywheel ring (cover). The intermediate plate is driven by drivepins located in the engine flywheel.

Depressing the clutch pedal pulls the release bearing toward the transmission. The release bearing being connected to the release levers thus retracts the pressure plate from contact with the driven disc assembly, thereby relieving the pressure on the intermediate plate and the forward driven disc assembly which disengages the clutch.

Releasing the clutch pedal allows the release bearing assembly to move toward the engine permitting the pressure plate to move toward the flywheel gripping the discs, causing engagement.

Clutch Installation

Before installing the clutch on the flywheel, check for free fit of cover assembly to flywheel and flywheel alignment before proceeding with installation. See Figures 4-80, 4-81, 4-82 and 4-83.

Be sure that intermediate drive pins are a press fit in holes in flywheel rim and that the heads are perfectly square to the friction surface. Drive pins must be square to provide proper clearance for the drive slots in the intermediate plate. A machinist's square and feeler gage may be used to check for squareness.

After the pins are installed and properly squared, try the intermediate plate for fit over the pins. With new pins and a new intermediate plate, there should be from 0.006 inch to 0.014 inch clearance. Try the plate in different positions and select the position which provides the greatest freedom of movement. Mark the plate for location to the flywheel. Lock the drive pins in place with the socket head or Allen set screws.

Driven discs are marked, "Pressure Plate Side" and "Flywheel Side", to indicate their proper positions. Install as indicated.

The cover assembly may now be installed on the flywheel but, before tightening capscrews, install an aligning shaft through the two hubs and into pilot bearing.

Cover capscrews may now be tightened progressively around the flywheel using 35 to 40 ft. lbs. of torque.

Remove the three hold down bolts from cover before removing splined aligning shaft or disc assemblies may fall out of position.

3. Inspect oil drain line to be sure it is not clogged or restricted.

4. Inspect oil supply line for restriction, deterioration or possibility of leaking under pressure. Be sure check valve is working properly and not restricted.

5. Inspect turbocharger mounting pad, on exhaust manifold, for erosion, flatness and to be sure old gasket is removed.

6. Place new gasket on exhaust manifold, position turbocharger and install attaching bolts.

7. Connect compressor inlet and outlet piping. Check to be sure all clamps and bolts are tight. Be sure piping is not producing strain on compressor cover.

8. Connect oil inlet line to turbocharger.

9. Crank the engine, without firing, until a steady flow of oil is noted coming from the oil drain outlet of the turbocharger or charge the system from an external pressurized oil source.

10. Stop cranking engine or charging system and connect oil drain line to engine. Be sure drain line slopes downward throughout its length with no sharp bends or kinks.

This guide is to acquaint the mechanic with troubles peculiar to turbochargers. Common sense and good shop practices are to be exercised. Check out the easier and more probable causes first, then proceed to the more complicated or time consuming items.

Trouble and Symptoms	Probable Causes Check causes given in sequence shown.
Noisy	9, 10, 11, 12, 13, 14, 15, 17, 20, 23, 25, 26, 27, 28, 29, 30
Low turbocharger speed	1, 3, 4, 7, 8, 13, 15, 16, 20, 23, 25, 26, 27, 29, 30, 34
Low turbocharger pressure	1, 3, 5, 7, 14, 11, 12, 13, 15, 16, 23
Cracked turbocharger housings or flanges	1, 3, 5, 7, 30, 11, 12, 13, 15, 16, 19, 20, 23, 26, 27, 28, 31, 32, 33
Engine lacks power	
Black smoke	1, 2, 3, 5, 16, 24, 7, 19, 15
Blue smoke	24, 2, 7, 4, 22, 34
Lubrication oil consumption excessive	19, 21, 22, 3, 1, 5, 18, 24, 25, 34
Lubrication oil leakage	21, 19, 18, 22, 24, 25, 34
Insufficient lubrication	19, 21, 17, 31
Oil in Air Inlet System	
Before turbocharger	1, 2, 3, 4, 5, 7, 18, 19, 34
After turbocharger	1, 2, 3, 4, 7, 5, 22, 24, 25, 28, 34
Oil in Exhaust System	
Before turbocharger	12
After turbocharger	22, 24, 25
Unbalance of rotating assembly	25, 23, 9, 3, 11, 12, 13, 18, 19, 20
Drag or bind in rotating assembly	9, 26, 27, 28, 30, 25, 18, 19, 20, 17, 13 22, 29, 11, 12, 31, 32, 33, 34
Damaged turbine wheel	12, 13, 15, 25, 27, 28, 30, 32, 33
Damaged compressor impeller	6, 9, 11, 13, 25, 26, 27, 28, 30, 33
Worn bearings or journals	17, 18, 19, 20, 21, 26, 27, 28, 30, 31, 32, 33