

Document Title: Description and operation, engine clutch	Function Group: 413	Information Type: Service Information	Date: 2015/9/29
Profile: GRD, G780B [GB]			

Description and operation, engine clutch

Description

All G700B motor graders are equipped with a 13.5" diameter wet clutch. The clutch is controlled by a foot pedal and is used when you start from a complete stop, change direction, and stop the grader. It allows the grader to start moving under high loads without putting undue force on the drivetrain. You do not need to use the clutch for up or down shifting when the grader is moving forward or backward.

The clutch assembly is bolted to the engine flywheel and is enclosed by a two-piece clutch housing assembly. The clutch housing assembly consists of a cast iron bearing support housing attached to an aluminum clutch housing. The aluminum clutch housing, which is attached to the engine flywheel housing, dissipates heat quickly and is light in weight for easy handling.

The clutch assembly includes four friction discs and three separator plates. The release bearing and sleeve assembly is supported on the clutch shaft by two needle roller bearings.

System Operation

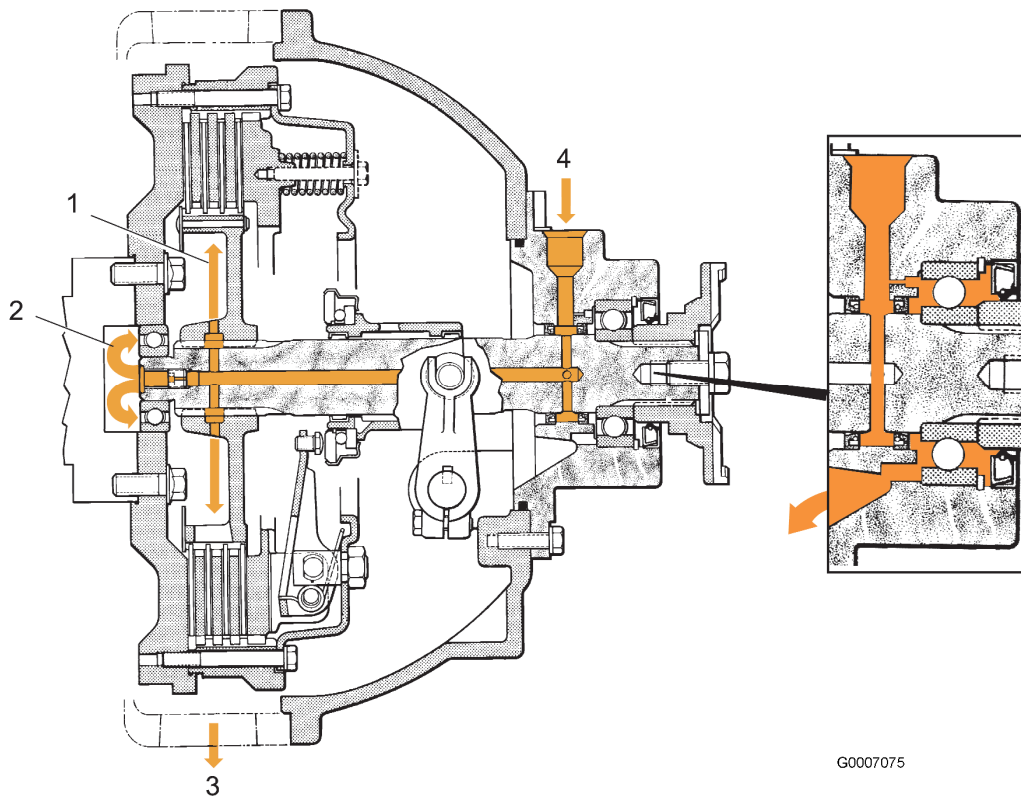
The engine clutch is activated through a hydraulically operated master cylinder and slave cylinder.

The clutch master cylinder is hydraulically boosted by a priority flow of oil from the transmission pump. The pump is mounted on the engine. A mechanical linkage connects the clutch pedal to the clutch master cylinder and booster assembly. The force you apply to the clutch pedal is increased by the clutch booster. The increased force moves the clutch master cylinder piston. The displaced fluid from the clutch master cylinder reservoir flows through a hydraulic hose to the slave cylinder. The slave cylinder is attached to the clutch housing and cross shaft arm. The fluid causes the slave cylinder piston to extend and move the cross shaft arm, which rotates the cross shaft. Inside the clutch housing, a yoke, which is attached to the cross shaft, moves the release bearing and sleeve assembly toward the clutch release levers. The release bearing contacts the release levers and pushes them toward the flywheel. The release levers then pull back the pressure plate, which in turn disengages the clutch friction discs and separator plates.

Oil is used to cool and lubricate the clutch driven members and bearings. Oil flows from the transmission sump, through a suction screen and the suction hose to the transmission pump. The pump is mounted to an accessory drive on the engine. The pump divides the oil into priority flow and excess flow. The priority flow supplies a constant 22,7 L/m (6 gpm) first to the clutch booster and then the brake booster. After the brake booster, the oil joins the transmission lubricating circuit through a fitting at the transmission pressure regulator valve. The excess flow from the transmission pump circulates through the transmission oil cooler and the transmission oil filter. The oil continues from the filter to the transmission pressure regulator valve. The pump also supplies oil to the parking brake valve.

To maintain lockup pressure, most of the oil is discharged internally to the lubrication pressure regulator section of the valve. A hydraulic hose connected to an additional fitting at the transmission pressure regulator valve supplies lubrication and cooling oil to the engine clutch assembly. Finally, the oil drains to the bottom of the flywheel housing and returns to the transmission sump through the drain hose.

The flow rate through the engine clutch assembly is limited by internal restrictors and the lubrication pressure of the transmission. The flow rate should not exceed 22,7 L/m (6 gpm) at full engine rpm.



G0007075

Figure 1
Clutch cooling and lubrication

1. Oil cools and lubricates clutch plates
2. Pilot bearing lubrication
3. Oil drains to the transmission sump
4. Lubrication oil from transmission circuit enters here

Oil circuit within the clutch

Oil enters through a fitting at point **(4)** in the bearing support housing. Most of the oil enters the two cross-drillings and the rifle drilling in the clutch shaft between the two clutch shaft oil seals. Some oil exits through the orifice plug at the end of the clutch shaft to lubricate the pilot bearing. The rest of the oil in the clutch shaft leaves the cross drillings at the clutch hub to be centrifugally forced through the friction discs and separator plates where it cools and lubricates the driven members. On leaving the driven members and the pilot bearing, the oil lubricates the clutch assembly pivots and splines, the release bearing, and the needle roller bearings in the release bearing sleeve. The splash action of the oil also lubricates the cross shaft bushings.

A small quantity of oil is diverted when entering the bearing support housing at point **(4)**. The oil passes through a cross-drilled passage to lubricate the clutch shaft bearing. From the clutch shaft bearing, the oil drains through openings at the bottom of the bearing support housing to the clutch housing. The oil exits at point **(3)** in the engine flywheel housing.

Clutch components

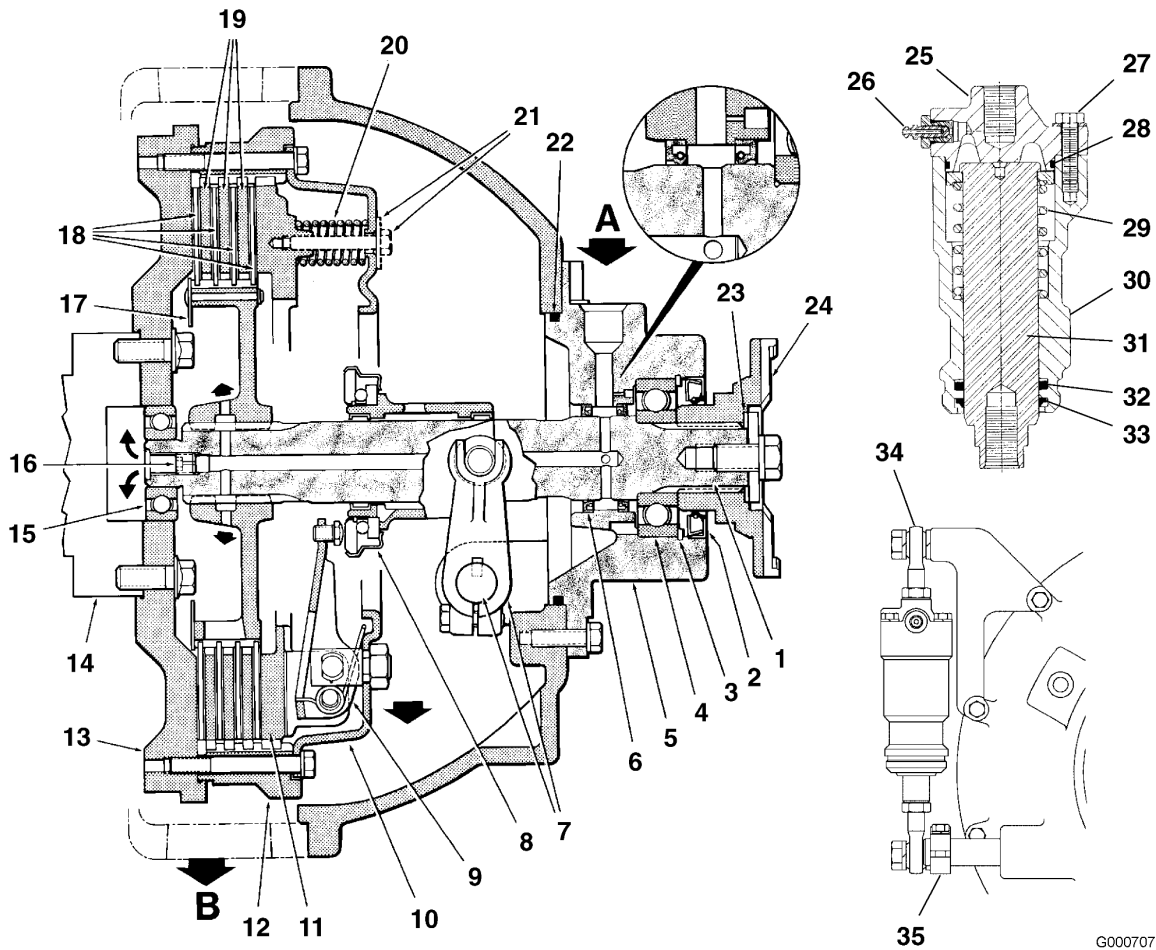


Figure 2
Clutch assembly

1. Clutch shaft
2. Output yoke seal
3. Snap ring
4. Clutch shaft bearing
5. Bearing support housing
6. Clutch shaft seals (qty. 2)
7. Cross shaft and yoke
8. Throw-out bearing
9. Clutch fingers
10. Backing plate
11. Pressure plate
12. Adapter drive ring
13. Flywheel
14. Crankshaft
15. Pilot bearing
16. Orifice plug
17. Oil deflector and clutch hub
18. Friction plates
19. Steel spacers
20. Clutch springs (see a)
21. Caging capcrew and washer (for clutch assembly servicing only)
22. O-ring
23. Gasket
24. Output yoke

NOTE!

See slave cylinder assembly items 25 to 35

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25. End cap
26. Bleeder screw
27. Bolt
28. O-ring
29. Spring
30. Housing
31. Piston
32. Cup
33. Wiper
34. Rod end
35. Cross shaft arm

NOTE!

a. G710B and G720B - 15 springs 4 plate disc and hub assembly. G726B, G730B, G740B, G746B and G780B - 15 springs 5 plate disc and hub assembly.

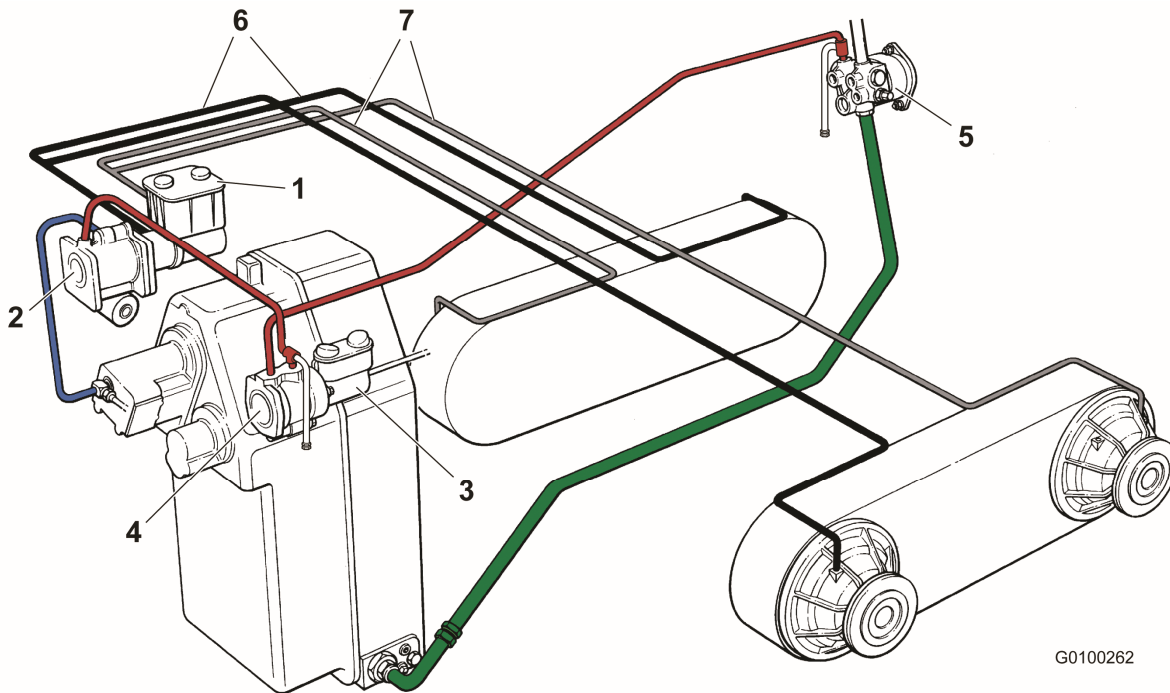
Document Title: Description, clutch master cylinder and booster	Function Group: 413	Information Type: Service Information	Date: 2015/9/29
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Description, clutch master cylinder and booster

All hydraulic boosters multiply pedal effort and transfer it to a master cylinder. Two boosters are used. One with a dual reservoir master cylinder for a diagonal brake application circuit and one with a single reservoir master cylinder for a clutch disengagement circuit. The brake booster features an integral electric back-up pump, designed to provide sufficient boost to bring the machine to a safe stop, or hold the machine on a slope until the parking brake is applied.

Clutch circuit

The priority outlet of the engine mounted transmission/booster hydraulic pump provides oil for the brake and clutch booster circuit. A relief valve is incorporated into the pump outlet. Unlike the steering and main hydraulic circuits, this circuit is open center. Therefore, oil circulates through the boosters until required. Oil passes through the clutch booster first, exits and passes through the brake booster and then drains back into the transmission case.

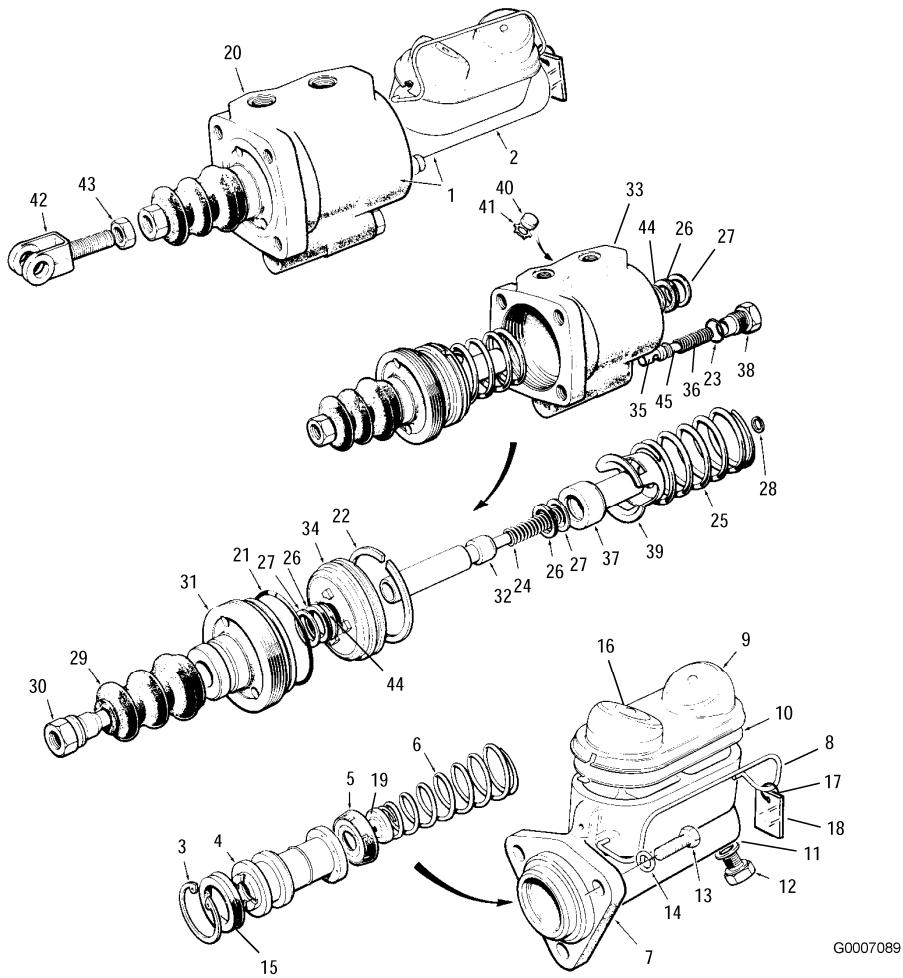


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Figure 1
Clutch master cylinder and booster circuit

1. Brake master cylinder
2. Brake booster c/w electric back-up pump
3. Clutch master cylinder
4. Clutch booster
5. Transmission/booster hydraulic pump
6. Brake circuit
7. Brake circuit

Clutch master cylinder and booster components



G0007089

Figure 2
Components

1. Booster
2. Master cylinder
3. Retaining ring
4. Piston
5. Cup
6. Spring
7. Housing
8. Bail hook
9. Cover
10. Diaphragm
11. Washer
12. Connector
13. Bolt
14. Lock washer
15. Cup
16. Decal
17. Ring
18. Warning label
19. Retainer
20. Power booster
21. O-ring
22. Piston ring
23. O-ring
24. Spring
25. Spring

26. Cup
27. Back-up ring
28. Retaining ring
29. Boot
30. Push rod
31. End plug
32. Piston
33. Housing
34. Piston
35. Piston
36. Spring
37. Piston
38. End plug
39. Retainer
40. Snubber
41. Retaining ring
42. Clevis
43. Jam nut
44. Retaining ring
45. Shim

Document Title: Clutch Housing - Removal	Function Group: 413	Information Type: Service Information	Date: 2015/9/29
Profile: GRD, G780B [GB]			

Clutch Housing - Removal

Op nbr 413-011

NOTE!

Place the grader in the **Service Position** before starting this overhaul procedure. Refer to [191 Service positions](#).

1. Steam clean the grader. Remove the air intake and muffler stacks. Cover the intake and muffler openings.
2. Remove the engine cowling side panels and hood.
3. Remove the side panels located under both sides of the fuel tank.
4. With the fuel level below the return port, disconnect the diesel fuel return hose from the engine. Promptly plug the hose and the port to avoid contamination.
5. Remove fuel tank mounted components as they apply to the machine. Examples are: air filter assembly, windshield washer tank, and air conditioning receiver/dryer.
6. Disconnect the fuel level sender wires at the top of the fuel tank.
7. From the front of the fuel tank stand, remove the U-bolt that retains the hydraulic hoses and wiring harnesses passing under the fuel tank.
8. Close the fuel tank shut-off tap at the tank sump and disconnect the fuel supply hose. Promptly plug the hose and the fitting on the shut-off tap to avoid contamination. Remove the bolts and washers retaining the fuel tank stand to the grader frame.
9. Use a safe lifting device to remove the fuel tank and stand from the grader frame.
10. Identify and tag all hoses connected to the clutch housing. This will help during assembly.
11. Remove the transmission vent hose from the clutch housing port at the two o'clock position (viewed from the front of the grader).
12. Remove the differential lock valve oil return hose from the bottom of the clutch housing.
13. Disconnect the oil supply hose from the bearing support housing.
14. Promptly plug all hoses and ports to avoid contamination.
15. Cut the tie-wraps and remove the retaining clamps that secure the hoses and wiring harnesses.
16. Move the hoses and wiring harnesses away from the work area.
17. Disconnect and remove the upper driveshaft.
18. Remove the bracket securing the slave cylinder to the clutch housing.
19. Loosen the bolt retaining the arm on the cross shaft. Remove the arm.

20. Move the slave cylinder away from the work area.
21. Remove the output yoke retaining bolt, washers and gasket.
22. Remove the yoke.
23. Remove the bolts and lock washers retaining the support bearing housing to the clutch housing.
24. Remove the bearing support housing, together with the clutch shaft, from the clutch housing and place it on a workbench.
25. It may be necessary to use a dull, flat chisel to separate the bearing support housing from the clutch housing.

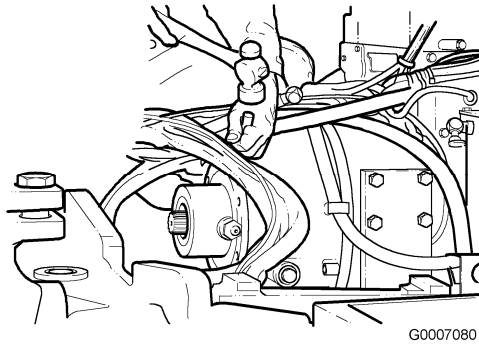


Figure 1
Removing bearing support housing

NOTE!

You can easily damage the aluminum surface of the clutch housing if the chisel is not used carefully.

26. Remove the clutch housing retaining bolts.
27. Remove the clutch housing.
28. If you cannot remove the clutch housing easily, use a rubber mallet to tap around the outside of the housing.

NOTE!

You can easily damage the aluminum clutch and flywheel housings if you use excessive force during removal.

29. Remove and discard the clutch housing gasket.

Document Title: Clutch assembly, removing	Function Group: 413	Information Type: Service Information	Date: 2015/9/29
Profile: GRD, G780B [GB]			

Clutch assembly, removing

Op nbr 413-012

NOTE!

Place the grader in the **Service Position** before starting this overhaul procedure. Refer to [191 Service positions](#).

1. Insert the clutch shaft into the clutch assembly hub.
2. Use three 3/8" x 2 1/4" long bolts (caging bolts) with flat washers to retain the pressure plate to the backing plate. Insert each bolt through the center hole of the five holes between the release lever pivot block nuts.

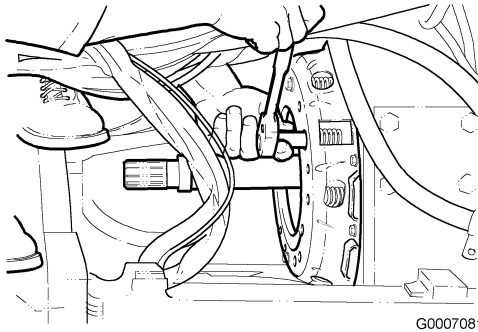


Figure 1
Installing clutch assembly caging bolts

3. Remove the clutch assembly bolts at the ten o'clock and two o'clock positions. Install threaded dowel pins in these positions.
4. Ensure that the pressure plate is retained by the three caging bolts. Remove the remaining bolts from the clutch assembly.
5. Remove the clutch assembly and the drive ring.

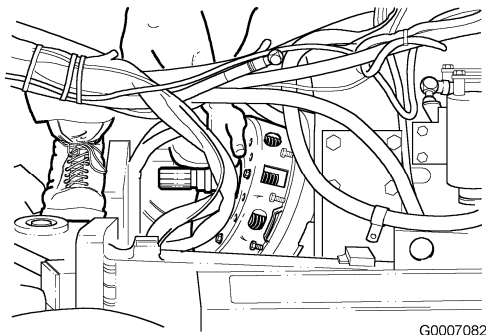


Figure 2
Removing clutch assembly and drive ring

NOTE!

The clutch assembly and drive ring may stick together due to a slight friction fit. They may separate unexpectedly.

Document Title: Clutch assembly, installing	Function Group: 413	Information Type: Service Information	Date: 2015/9/29
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Clutch assembly, installing

Op nbr 413-013

NOTE!

Place the grader in the **Service Position** before starting this overhaul procedure. Refer to [191 Service positions](#).

1. Install the flywheel to the engine and torque-tighten the bolts according to the engine specifications.
2. Install threaded dowel pins at the ten o'clock and two o'clock positions in the flywheel housing. Install the drive ring.
3. Insert the clutch shaft from the closed side of the hub and clutch assembly.
4. Use the clutch shaft as a pilot tool when installing the hub and clutch assembly into the drive ring. Make sure that the dished side of the hub faces the flywheel.
5. Engage the separator plates one at a time into the drive ring.

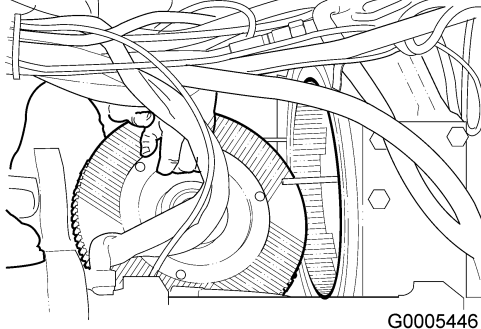


Figure 1
Installing clutch hub with dished side toward flywheel

6. Align the stamped mark of the drive ring with the stamped mark on the backing plate before installing the clutch assembly onto the dowel pins.
7. Install 10 of the original 3/8 in. x 3 1/4 in. long bolts and lock washers to retain the clutch assembly to the flywheel. Remove the dowel pins and replace them with the remaining bolts and lock washers.
8. Ensure the backing plate is properly positioned in the locating counterbore of the drive ring.
9. Torque-tighten the 12 bolts evenly and in a diagonal sequence to 32 N•m (3 kgf•m)(23 lbf•ft).

NOTE!

Remember to remove the three caging bolts to release the pressure plate from the backing plate after the clutch assembly retaining bolts have been torque-tightened.

10. Remove the clutch shaft from the clutch assembly.

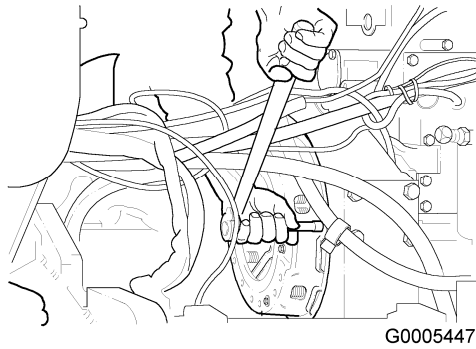


Figure 2

Torque-tightening clutch assembly bolts

The installation of the clutch assembly is now complete.

11. Use a proper size seal driver to install the clutch shaft oil seals in their respective bores. Ensure that the cupped sides of the seals face each other.

Document Title: Clutch Housing Installation	Function Group: 413	Information Type: Service Information	Date: 2015/9/29
Profile: GRD, G780B [GB]			

Clutch Housing Installation

Op nbr 413-014

1. Apply petroleum jelly or grease on both sides of a new paper gasket.
2. Install the gasket on the clutch housing.
3. Install two threaded dowel pins in the flywheel housing at the nine o'clock and three o'clock positions.
4. Position the clutch housing correctly on the dowel pins and move it against the flywheel housing (the cross shaft must be horizontal and underneath the clutch shaft).
5. Install the retaining bolts and lock washers. Install the slave cylinder bracket at the correct location and retain with the two longer bolts and lock washers.
6. Remove the dowel pins and install the remaining clutch housing retaining bolts and lock washers.

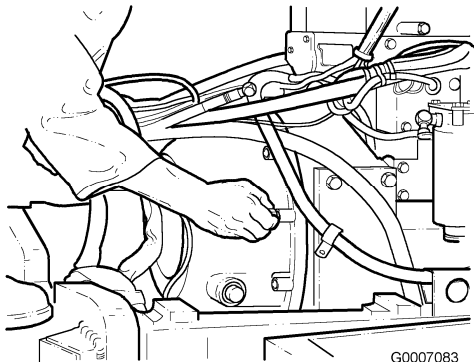


Figure 1
Installing clutch housing and bolts

7. Torque-tighten the clutch housing bolts in a diagonal sequence to **32 N•m (3 kgf•m)(23 lbf•ft)**.

NOTE!

The clutch housing and the engine flywheel housing are made of aluminum. DO NOT torque-tighten the bolts into the aluminum housings beyond the specified values. Thread damage to the aluminum housings may occur.

8. Engage the release bearing sleeve into the yoke trunnions ensuring that the oil supply hole points to the top.

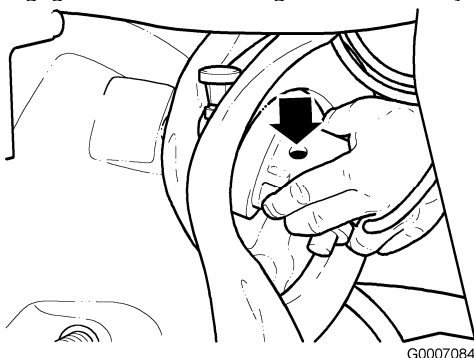


Figure 2**Engaging release bearing sleeve into yoke trunnions**

9. Temporarily insert the clutch shaft and bearing support housing assembly in the clutch housing and through the release bearing sleeve. Ensure the cross shaft and yoke assembly moves the release bearing sleeve freely on the clutch shaft.
10. Remove the clutch shaft and bearing support housing assembly.
11. Use a brass drift and hammer to install the woodruff key for the cross shaft arm.
12. Install the arm on the cross shaft and secure it with the woodruff key.
13. Torque-tighten the bolt to **32 N•m (3 kgf•m)(23 lbf•ft)**.

Document Title: Bearing Support Housing Installation	Function Group: 413	Information Type: Service Information	Date: 2015/9/29
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Bearing Support Housing Installation

Op nbr 413-016

1. Coat the clutch housing to bearing support housing mating surfaces with a thin film of RTV silicone, or equivalent. Make sure there is no oil or debris on surfaces.
2. Lubricate the bearing support housing O-ring with system oil or petroleum jelly.
3. Insert the clutch shaft and bearing support housing assembly in the clutch housing and through the release bearing sleeve.

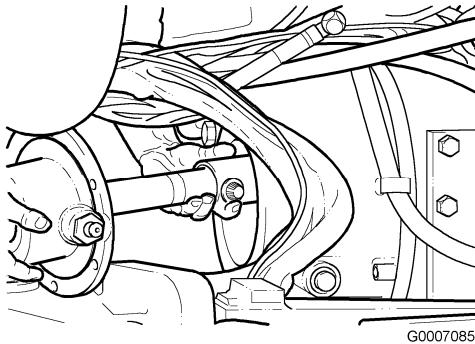


Figure 1
Installing clutch shaft and bearing support housing assembly

4. Install the oil inlet fitting at the three o'clock position (viewed from the front of the grader).
5. Install the retaining bolts and lock washers. Torque-tighten the bolts to **32 N•m (3 kgf•m)(23 lbf•ft)**.

NOTE!

The clutch housing is made of aluminum. DO NOT torque-tighten the bolts into the aluminum housing beyond the specified value. Thread damage to the aluminum housing may occur.



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Document Title: Clutch Slave Cylinder and Pedal Free Play Adjustment	Function Group: 413	Information Type: Service Information	Date: 2015/9/29
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Clutch Slave Cylinder and Pedal Free Play Adjustment

Op nbr 413-017

Final installation and adjustment

1. Measure the clutch free play by moving the cross shaft arm up and down. Use a wrench on the bolt that attaches the bottom eyebolt of the slave cylinder to the cross shaft arm and move the arm up and down. The free play should be 3.1 to 3.9 mm (1/8 to 5/32 in.)

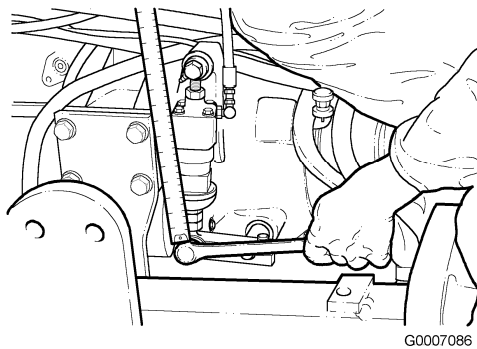


Figure 1
Measuring release bearing free play

2. Adjust the free play by loosening the bottom locknut and turning the slave cylinder eyebolt. Tighten the locknut after the adjustment is made.

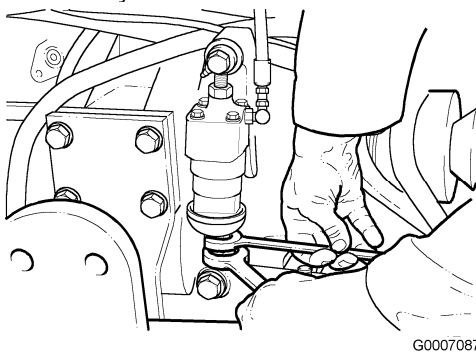


Figure 2
Adjusting release bearing free play

3. Lubricate the yoke oil seal with system oil or petroleum jelly.
4. Install the yoke, gasket, washer, lock washer and retaining bolt.
5. Torque-tighten the bolt to **149 N•m (15 kgf•m)(110 lbf•ft)**.
6. Install the upper drive shaft.

7. Torque-tighten the bolts retaining the driveshaft bearing crosses to **47 N•m (5 kgf•m)(35 lbf•ft)**.
8. Install the elbow fitting at the two o'clock port on the clutch housing (viewed from the front of the grader).
9. Connect the transmission vent hose to this fitting.
10. Connect the differential lock valve return hose to the elbow fitting at the six o'clock position on the clutch housing. If necessary, install the elbow and breather at the 10 o'clock position on the clutch housing.
NOTE!
Do not use Teflon tape sealer on the pipe thread of the breather and elbow. Use Teflon sealant paste instead.
11. Use a safe lifting device to position the fuel tank and the fuel tank stand on the frame. Install the bolts and washers.
12. Retain the hoses and wiring harnesses passing under the fuel tank with the U-bolt. Install the U-bolt to the front of the tank stand.
13. Connect any wiring harnesses in the engine area.
14. Secure all hoses and wiring harnesses with the retaining clamps and new tie-wraps to ensure that they do not rub or contact sharp edges.
15. Connect the fuel supply hose to the fuel tank shut-off tap at the tank sump. Open the shut-off tap.
16. Install fuel tank mounted components as they apply to the machine. Examples are: air filter assembly, windshield washer tank, air conditioning receiver/dryer, and equipment for cold starting.
17. Connect the fuel level sender wires at the top of the fuel tank.
18. Connect the diesel fuel return hose from the engine.
19. Install the hood, muffler and air intake stacks, rain cap or pre cleaner cap, and side panels under both sides of the fuel tank.
20. Install the cowling side panels.

NOTE!

Test the grader to ensure that there are no problems with the mechanical function of the engine clutch or hydraulic leaks.

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