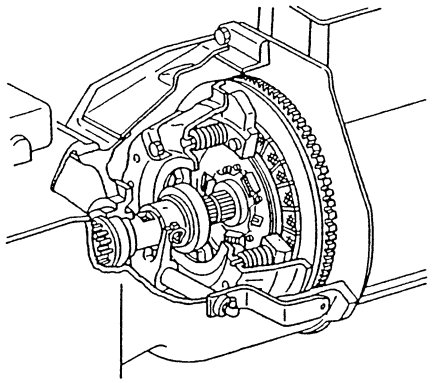
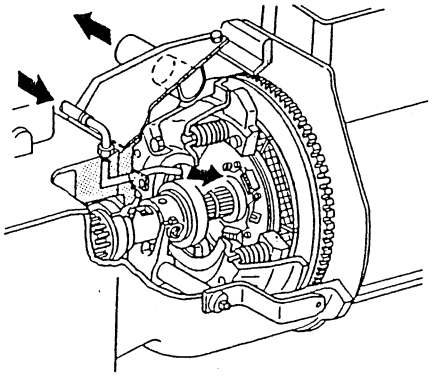
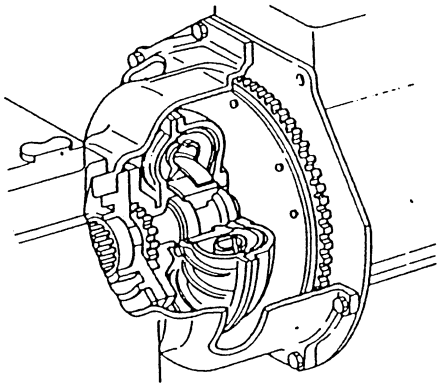
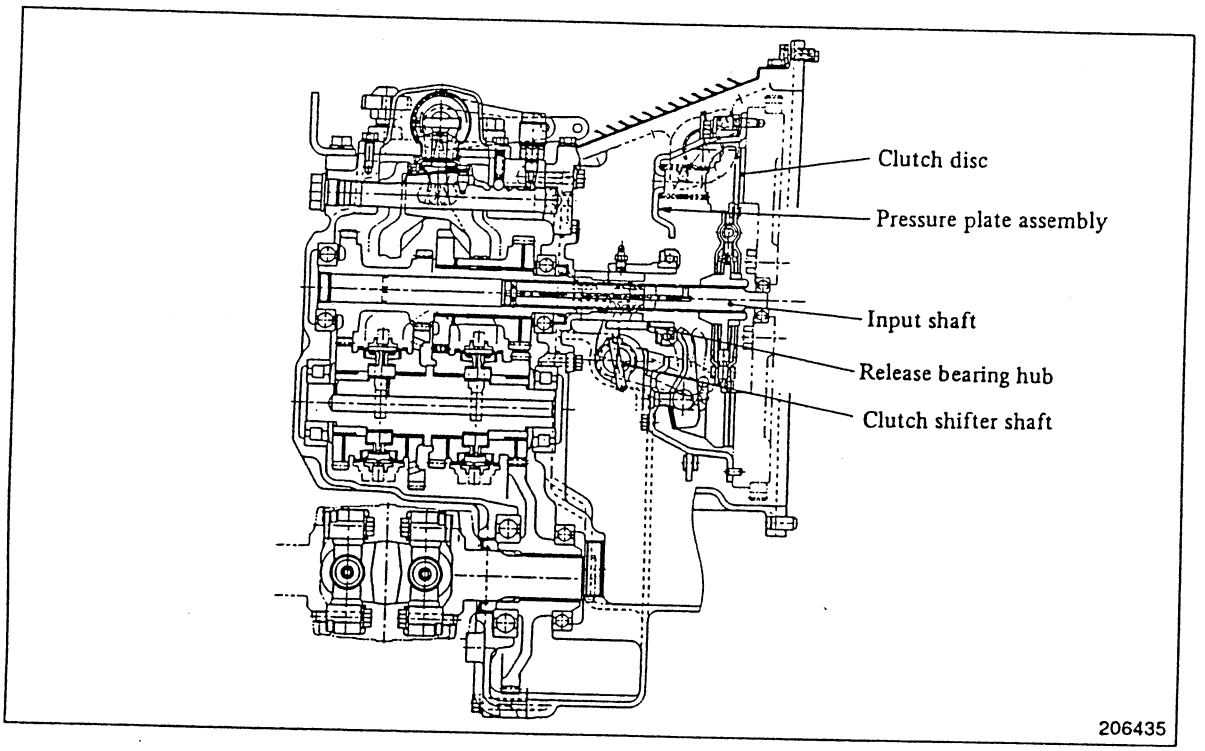
CLUTCHES

DESCRIPTION

Types of Drive

Type			What they are
Manual transmission	Dry-type clutch	 204797	• Is, among various types, most popular in design. If most of the work is generally normal and where the truck works with nearly constant loads, this clutch – combined with synchromesh transmission – ensures high power transmitting efficiency, helps keep fuel cost low. • The operator will be able to operate the clutch smoothly at the friction (slip) point to jockey his truck. This mode of clutch operation, if frequently used, will shorten the life of clutch disc prematurely, resulting in high operating costs.
	Wet-type clutch	 204798	• Can be compared to the dry-type clutch in feeling and power transmitting efficiency. An important advantage is that oil spray permits clutch disc to minimize initial friction during engagement and reduce heat buildup. This is why the disc lasts much longer in this clutch than in the dry-type clutch. • This clutch is ideal for applications in which the truck works with heavier loads for hours or roll clamp operations in which the operator has to operate the clutch frequently.
Powershift transmission	Torque converter	 200027	• Is combined with constant-mesh transmission having hydraulic clutch packs. It provides an infinite number of speed and power ratios within each gear selection. In addition, the converter instantly "senses" even the most minute changes in load and automatically increases or decreases the truck pull as needed – without clutching or shifting gears. • Because the drive is transmitted through the medium of fluid, the hourly rate of fuel consumption will be 20% more than that with the clutch, but, because the skill required of the operator in handling his truck is minimized, 10% more work will be done per horsepower and per hour.

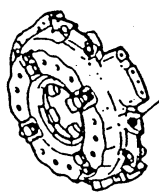
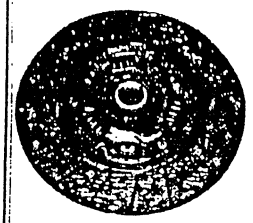
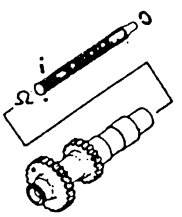
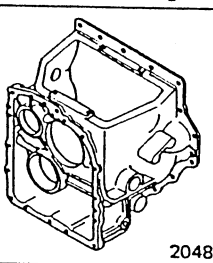
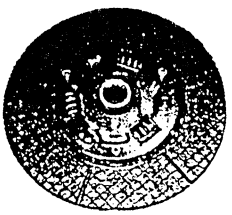
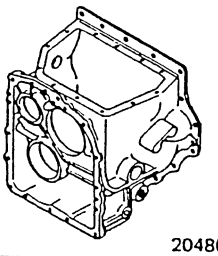
Dry-Type Clutch



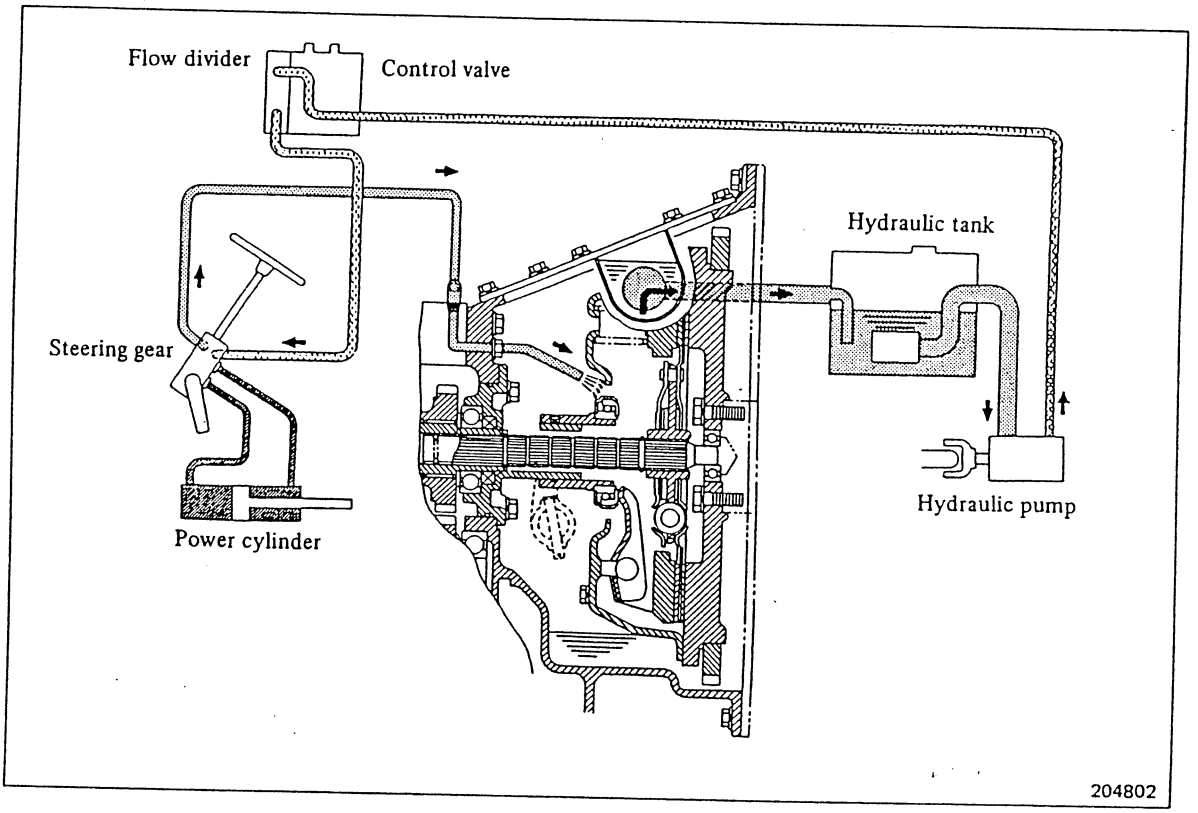
A wide opening in the top portion of clutch housing gives maximum clutch accessibility. The input shaft is not integral with the input gear. This design permits you to just slide the input shaft toward the transmission for easy removal of the disc.

The disc and pressure plate are common in size to all new models of Mitsubishi truck,, the only difference being the number of pressure springs.

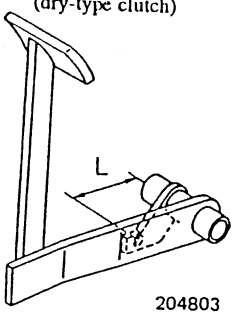
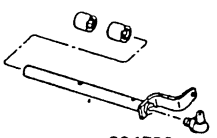
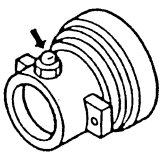
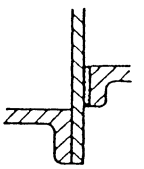
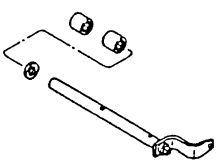
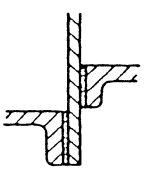
Difference between dry-type clutch and wet-type clutch

	Pressure plate assembly	Clutch disc	Input shaft	Clutch housing
Dry-type	<table><tr><th></th><th>1-ton models</th><th>2- and 3-ton models</th></tr><tr><td>Identification color</td><td>Green</td><td>White</td></tr><tr><td>No. of springs (color)</td><td>8 (red)</td><td>12 (red)</td></tr></table>  200028		 200031	 204800
Wet-type	<table><tr><th></th><th>Diesel models</th><th>Gasoline models</th></tr><tr><td>Identification color</td><td>Brown</td><td>Pink</td></tr><tr><td>No. of springs (color)</td><td>12 (brown)</td><td>10 (brown)</td></tr></table>			 204801

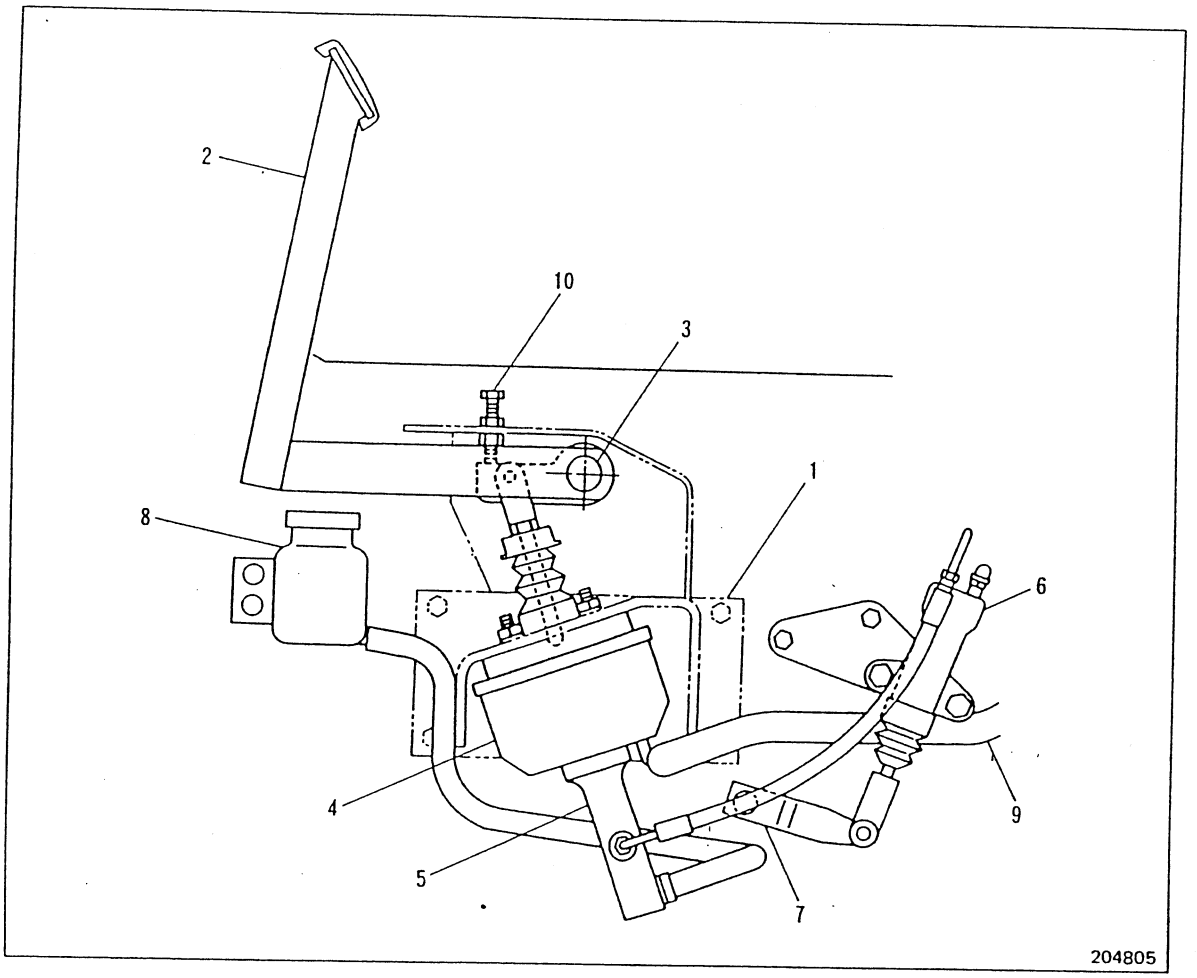
Wet-Type Clutch



The oil system of this clutch is a self-contained system and uses oil returning from the steering power cylinder. Having cooled the clutch, the oil is thrown against the walls of the housing by the centrifugal force created by the flywheel and returns to the hydraulic tank. The input shaft is identical in construction with that for the dry-type clutch. As for oil, use hydraulic oil (Diamond HDS-3).

	Clutch pedal	Clutch shifter shaft	Release bearing hub	Engine packing
Dry-type	L = 44 mm [1.73 in.] (dry-type clutch)  204803	Grease-lubricated  204799	With grease fitting 	 200042
Wet-type	L= 48 mm [1.89 in.] (wet-type clutch)	 204804	Without grease fitting 204917	 200043

Clutch Pedal (for Wet-Type Clutch)



1 Bracket
2 Clutch pedal
3 Clutch shaft
4 Clutch booster
5 Clutch master cylinder
6 Clutch release cylinder
7 Clutch shifter shaft
8 Fluid reservoir
9 To vacuum pump
10 Stopper bolt

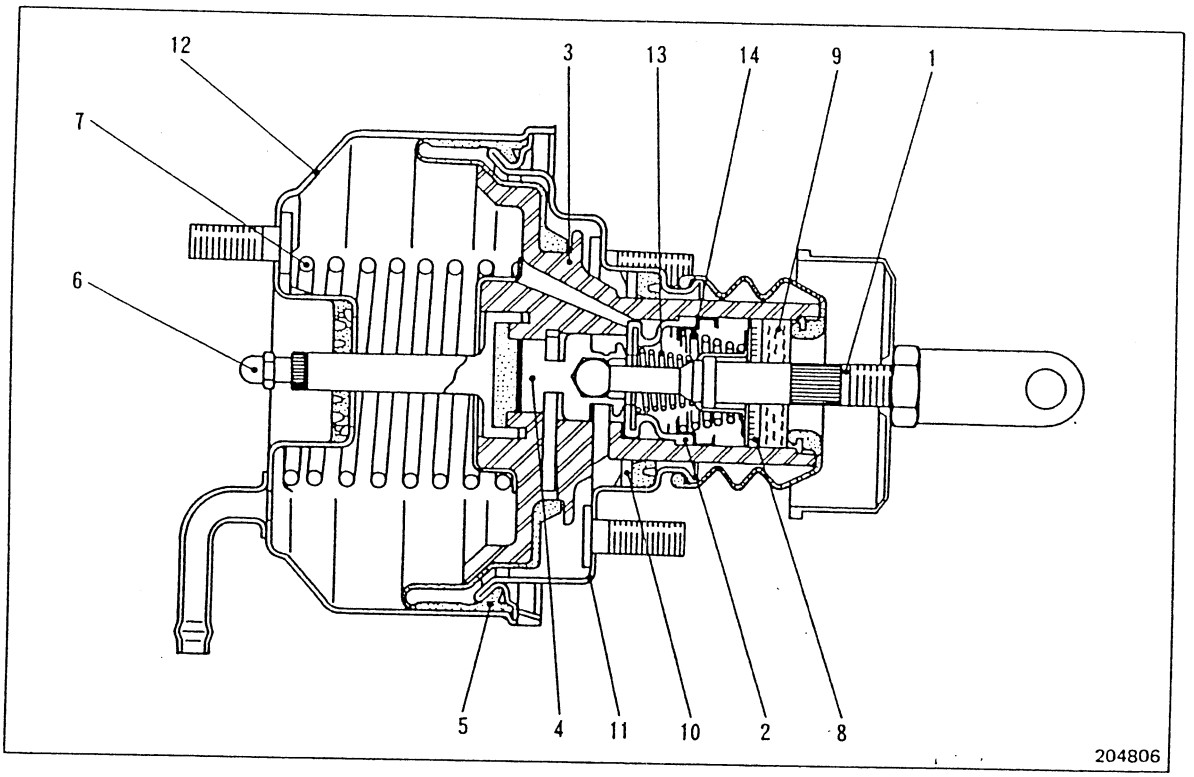
The power clutch used in the manual transmission models is a system of control linkage for the wet-type clutch.

The clutch release cylinder automatically compensates for changes in the position of the release levers due to wear of the clutch disc (fasings). Because of this feature, there is no need of adjusting the pedal if it is properly adjusted at the time of assembly.

NOTE

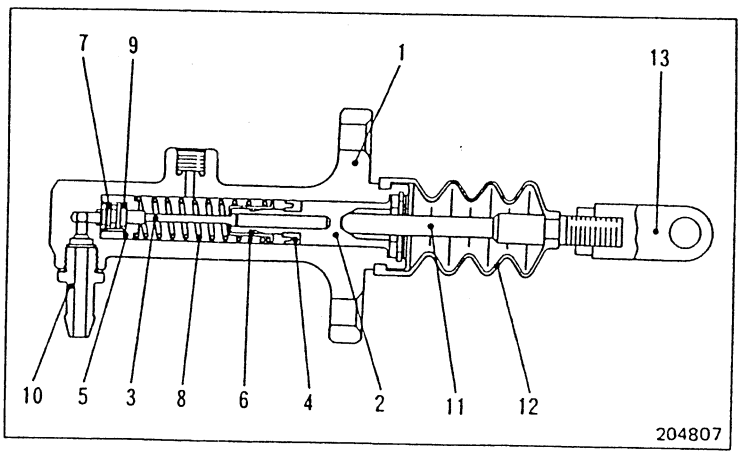
The dry-type clutch linkage is nearly identical with the wet-type clutch one, the only difference being the absence of clutch booster. In this linkage, the clutch pedal is directly connected to the master cylinder push rod.

Clutch Booster (for Wet-Type Clutch)



1 Operating rod
2 Poppet assembly
3 Valve body
4 Plunger valve
5 Diaphragm
6 Pushrod
7 Spring
8 Filter
9 Silencer
10 Bearing
11 Rear shell cylinder
12 Front shell cylinder
13 Spring
14 Spring

Clutch Master Cylinder



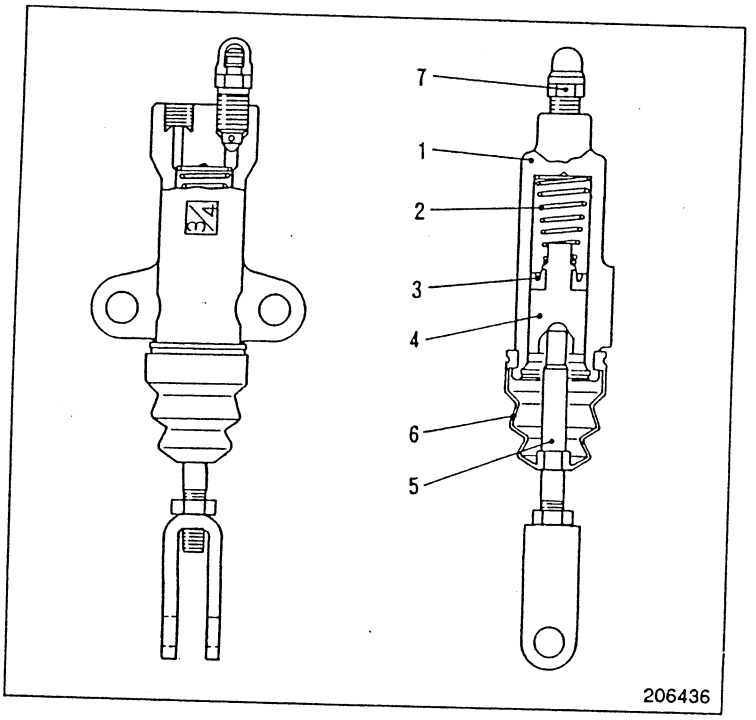
1 Body
2 Piston
3 Center valve stem
4 Piston cup
5 Center valve case
6 Spring seat
7 Valve seal
8 Return spring
9 Center valve spring
10 Joint
11 Pushrod
12 Boot
13 Clevis

NOTE

The clutch master cylinder shown is for the dry-type clutch. The cylinder for the wet-type clutch is identical with this cylinder, the only difference being the absence of pushrod, clevis and boot.

Clutch Release Cylinder

1 Body
2 Spring
3 Piston cup
4 Piston
5 Release rod
6 Boot
7 Bleeder valve



REMOVAL AND INSTALLATION

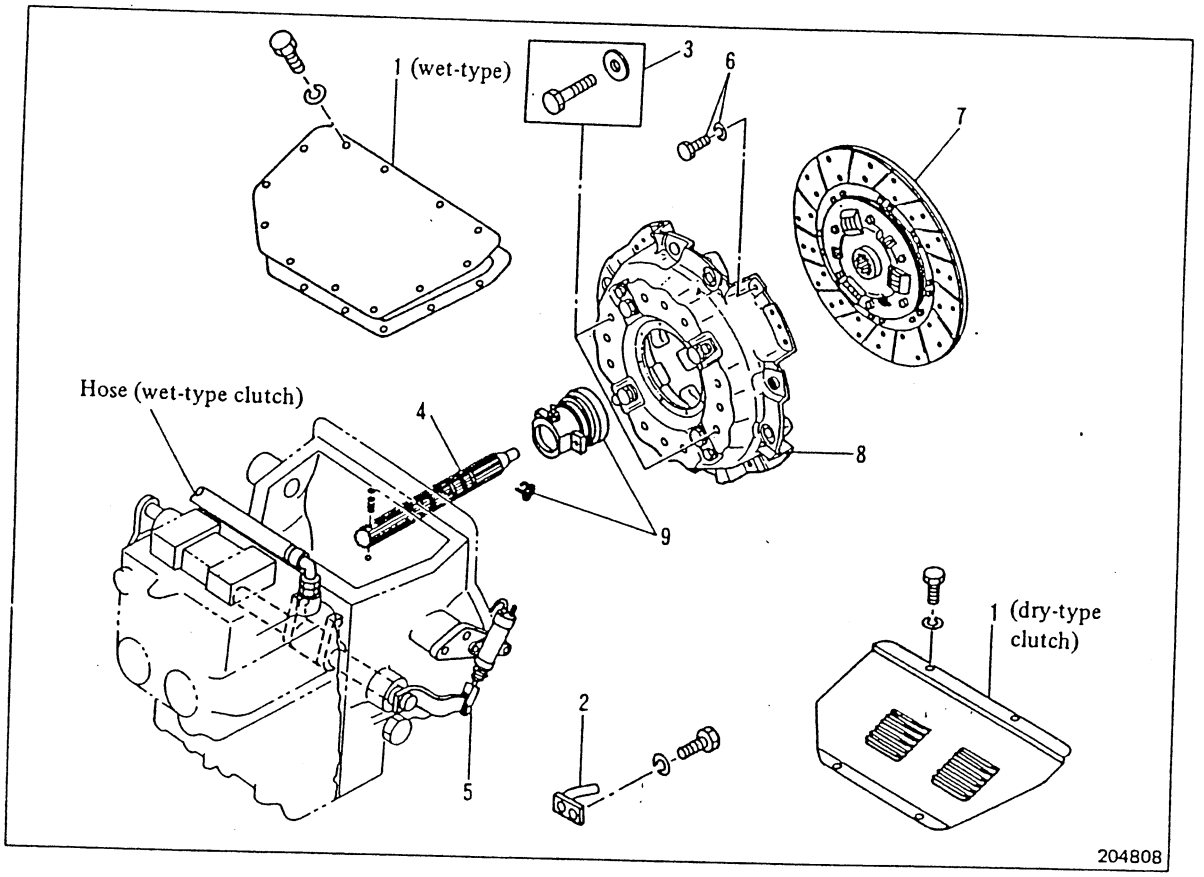
Suggestions

The input shaft of the manual transmission is 2-piece type, whether the clutch may be dry or wet type. This feature makes it possible to remove and install the clutch disc, release bearing, etc. without dismounting the engine & transmission assembly from the truck.

For removal of the fork and clutch shaft, however, it is necessary to dismount the assembly (because there is no space for removal of the clutch shaft if the assembly is on the truck).

Clutch and Pressure Plate

Removal



Sequence

1 Clutch cover
2 Pipe (wet-type clutch only)
3 Bolt, washer (special tool)
4 Input shaft, stopper ring, steel ball
5 Clutch release cylinder pin
6 Bolt, spring washer
7 Clutch disc assembly
8 Pressure plate assembly
9 Spring, release bearing, hub

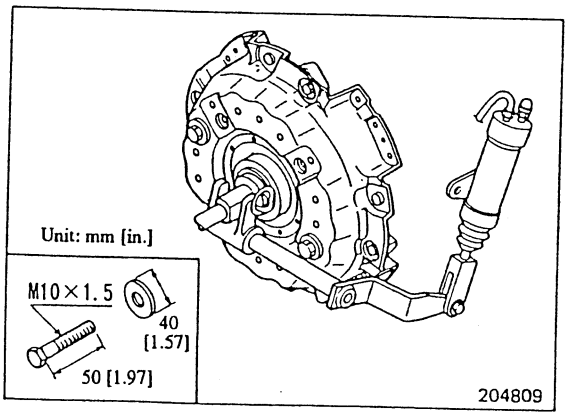
Suggestions

1. Compressing pressure plate assembly

Depress the clutch pedal, and run in two bolts (special tool) to compress the pressure springs.

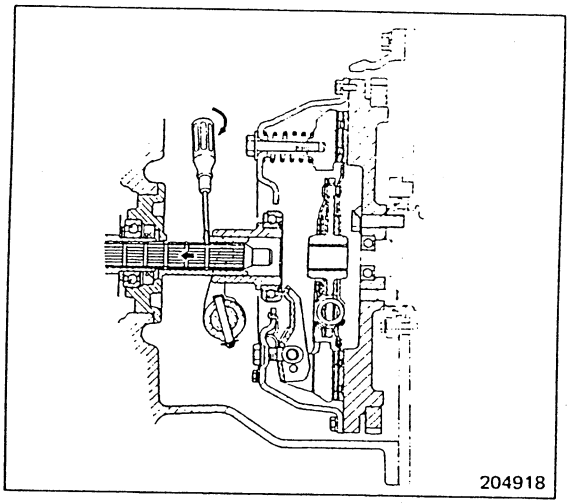
Special tool needed

Bolt	F1145-10050
Washer	92301-02700



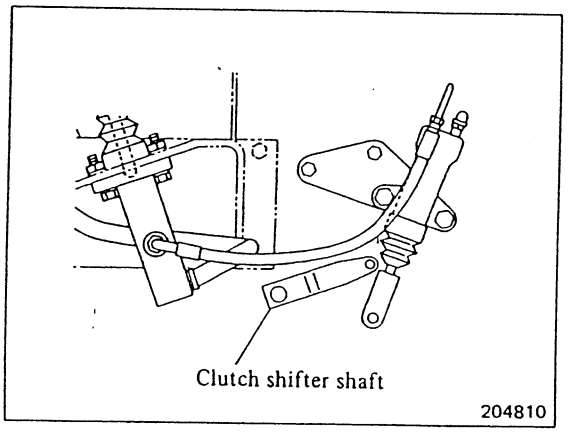
2. Sliding input shaft into transmission

Slide the input shaft into the clutch to expose the stopper ring on the transmission side. Remove the stopper ring, and slide the shaft into the transmission. The shaft is arrested in position by steel ball and will be too tight to slide at first.



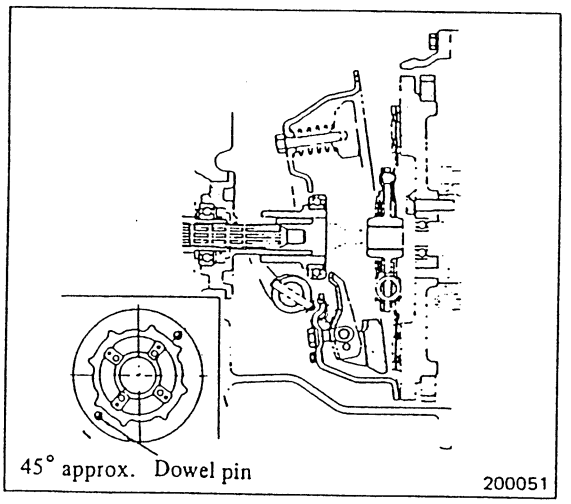
3. Removing clutch release cylinder pin

Loosen the bleeder valve of the release cylinder to relieve hydraulic pressure. Pull out the pin connecting the cylinder to the clutch shifter shaft, and raise the shaft by moving it away from the clevis of release cylinder rod.



4. Removing clutch disc assembly and pressure plate assembly

Position the flywheel dowel pins as shown.



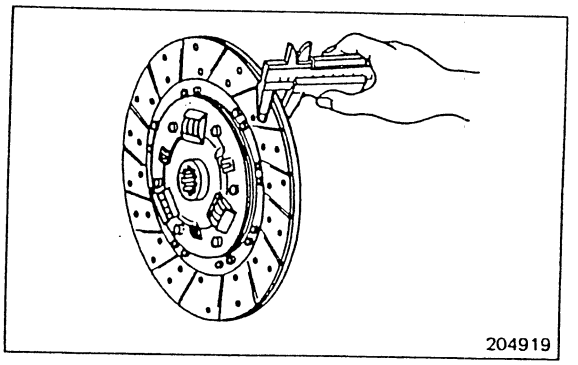
Inspection after removal

1. Clutch disc assembly

(1) Facing thickness

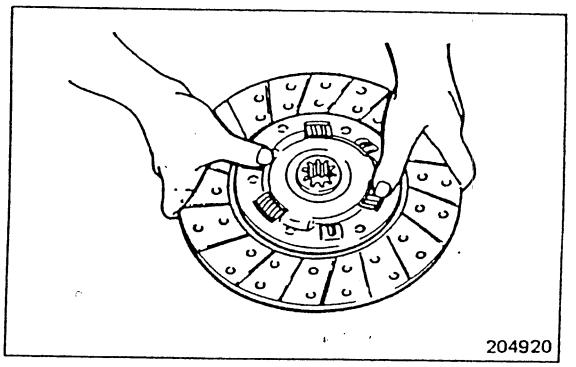
Unit: mm [in.]

		Dry-type clutch	Wet-type clutch
Facing thickness (both sides)	A	9.5 [0.37]	6.0 [0.24]
	B	21 [0.08] One side 1.5 [0.06]	0.8 [0.03] 0.4 [0.02]



(2) Tightness of facing rivets

Check the facing rivets for evidence of rattling, as shown:

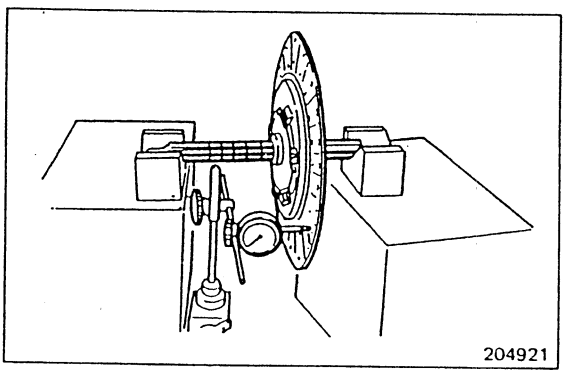


(3) Face runout

Using a dial gauge and "V" block, check the disc for runout.

Unit: mm [in.]

		Dry-type clutch	Wet-type clutch
Face runout (at rim)	A	1.0 [0.04], maximum	0.7 [0.03], maximum



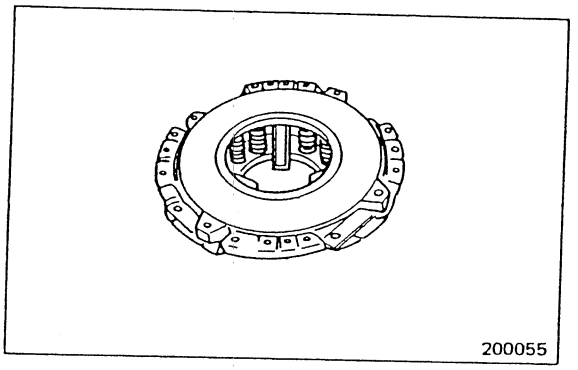
(4) Others

Inspect the hub splines for wear, the damper springs for weakening, and the facings for damage.

2. Pressure plate assembly

(1) Check the friction surface of the plate for burns and groove marks.

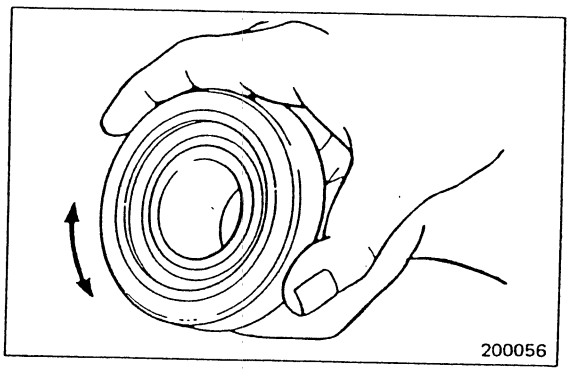
(2) Check the friction surface for warpage.



3. Release bearing

(1) Check the release bearing installed on the hub for smoothness of rotation by spinning its outer ring by hand.

(2) The release bearing must be replaced if it spins rough, making abnormal noise, or if its end face in contact with the release levers is badly worn.

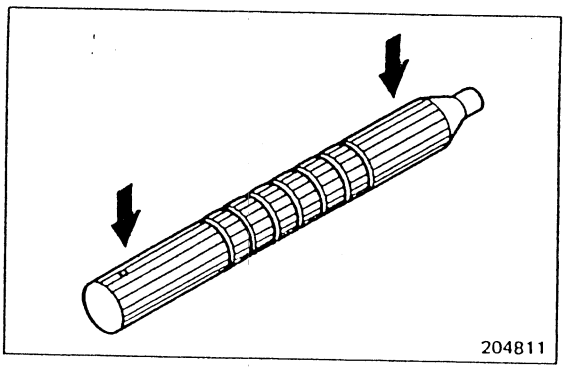


4. Shifter

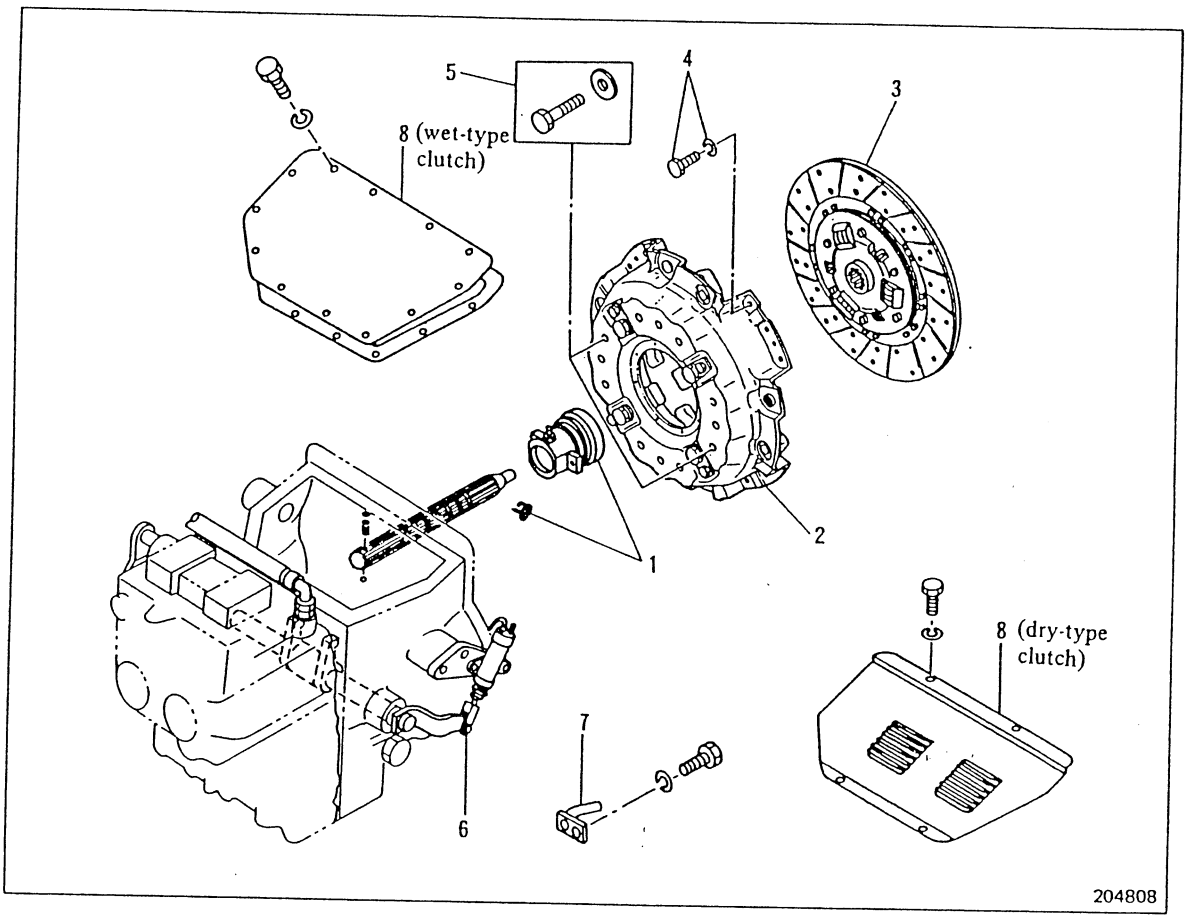
Check the fork groove for wear. See if the hub slides smoothly, without any evidence of binding.

5. Input shaft

Check for ridged splines.



Installation

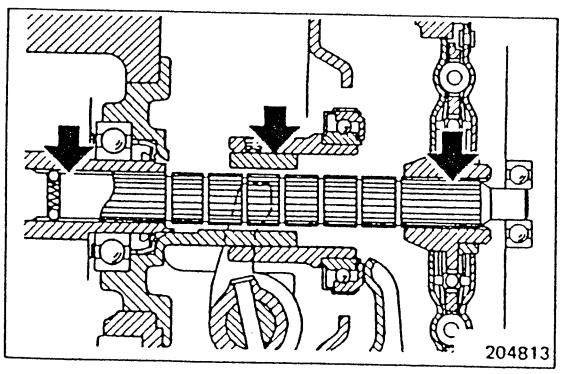


Sequence

1 Release bearing, hub, spring
2 Pressure plate assembly
3 Clutch disc assembly
4 Bolt, spring washer
5 Bolt, washer (special tool to be removed)
6 Clutch release cylinder pin
7 Pipe (wet-type clutch only)
8 Cover

Suggestions

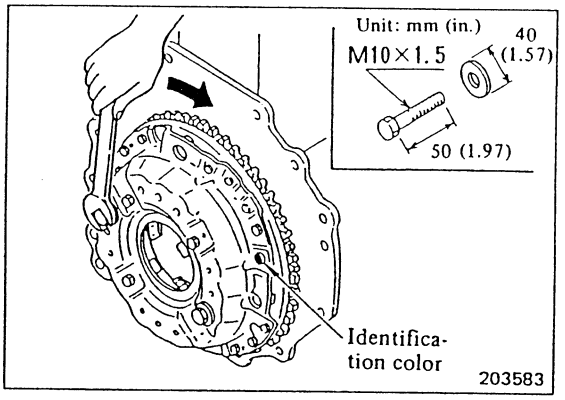
1. Apply a thin coat of molybdenum disulfide grease to the friction surfaces indicated by arrows.



2. Compressing pressure plate assembly

(1) Make sure of identification color (dry-type clutch).

	1-ton models	2- and 3-ton models
Pressure plate assembly	Green	White
Pressure springs (No. of springs)	Red (8)	Red (12)



(2) Make sure of identification color (wet-type clutch).

	Diesel models	Gasoline models
Pressure plate assembly	Brown	Pink
Pressure springs (No. of springs)	Brown (12)	Brown (10)

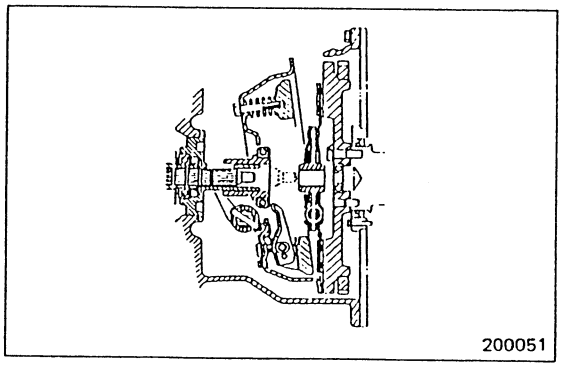
(3) Run in the bolts (special tool) to compress the pressure springs.

Special tool needed

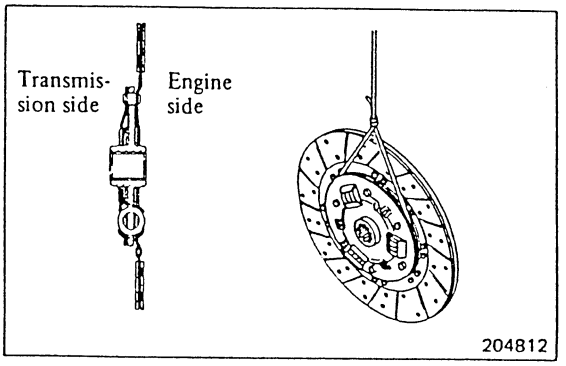
Bolt	F1145-10050
Washer	92301-02700

3. Installing clutch disc assembly

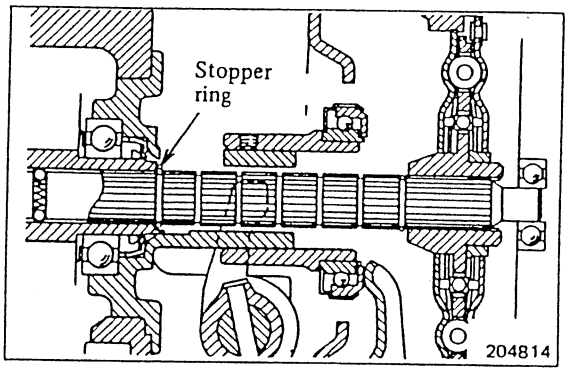
(1) Pull out the input shaft to the position indicated by dots.



(2) With the disc suspended on wire, align it with the input shaft as shown.



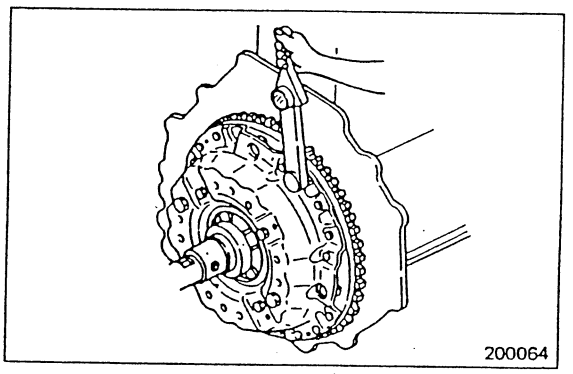
(3) Slide the input shaft into the clutch until the stopper ring touches the input gear. This will cause the locking ball to pop into the groove in the input gear.



4. Installing pressure plate assembly

Tighten the mounting bolts for both the plate and strap to the specified torque, and remove bolts and washers (special tool).

Tightening torque for plate mounting bolts	17 N·m (1.7 kgf·m) [12 lbf·ft]

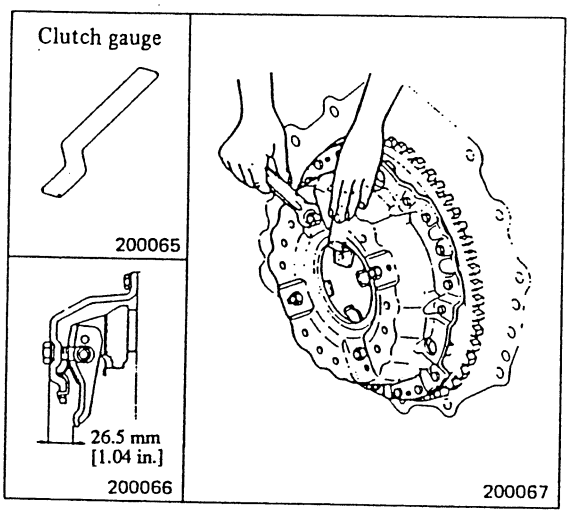


5. Release lever height adjustment

Use the clutch gauge (for adjusting release lever clearance). Push the gauge against the side of clutch cover, and run down lever nut.

Special tool needed

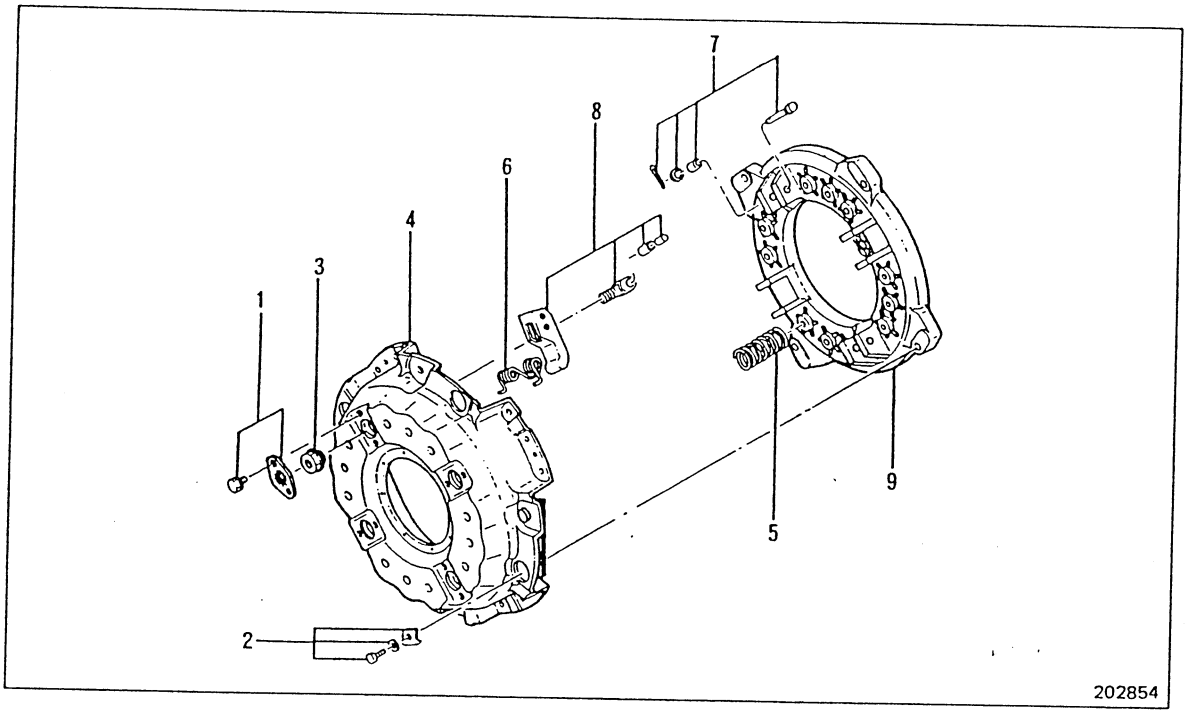
Clutch gauge	91268-02200



DISASSEMBLY AND REASSEMBLY

Pressure Plate Assembly

Disassembly

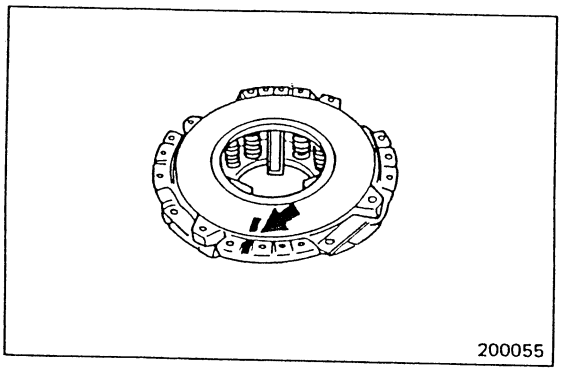


Sequence

1 Lock plate
2 Strap bolt
3 Support nut
4 Clutch cover
5 Pressure spring
6 Return spring
7 Split pin, washer, pin
8 Release lever, lever support assembly, pin
9 Pressure plate

Suggestions

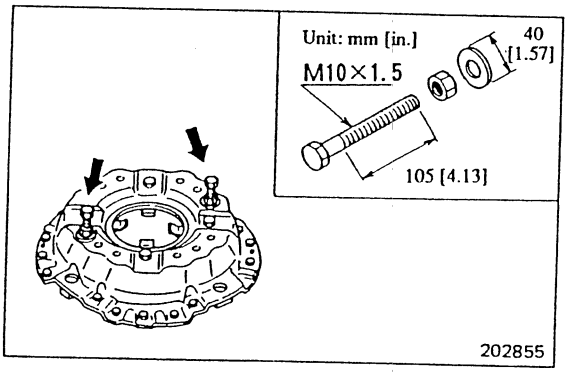
1. Mark across the clutch cover and pressure plate to aid reassembly.



2. Using the bolts (special tool), gradually loosen the clutch springs.

Special tool needed

Bolt	91268-01900
Washer	92301-02700
Nut	F2300-10000



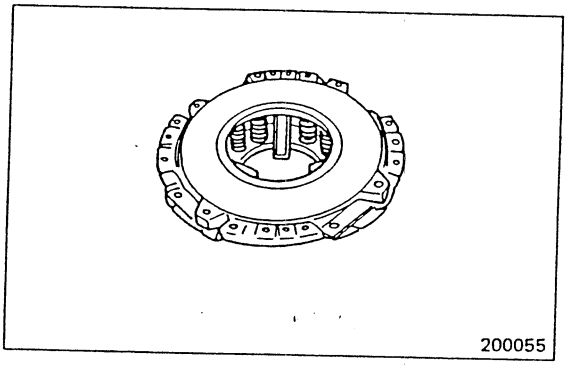
Inspection after disassembly

1. Pressure plate assembly

(1) Check the friction surface of the plate for burns and groove marks.

(2) Check the friction surface for warpage.

(3) Grind the friction surface of the plate, as necessary, and check its thickness. If the grinding operation has reduced the plate thickness to the service limit, replace it.

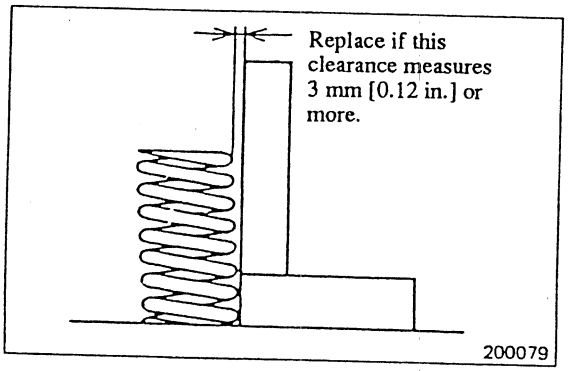


Unit: mm [in.]

		Dry-type clutch	Wet-type clutch
Pressure plate thickness	A	22.8 [0.90]	
	B	21.0 [0.83]	

2. Pressure springs

Check each pressure spring for squareness, cracks and fatigue and, if the limit is exceeded, replace the spring.

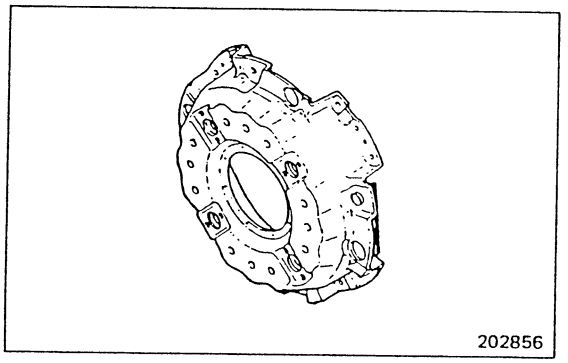


Unit: mm [in.]

		Dry-type clutch	Wet-type clutch
Free length	A	87.1 [3.43]	78.8 [3.10]
Test force, N (kgf) [lbf]	A	412 ± 49 (42 ± 5) [93 ± 11]	643 ± 49 (65.6 ± 5) [145 ± 11]
Length under test force	A	45.2 [1.77]	48.2 [1.90]

3. Clutch cover

Inspect the cover for distortion, cracks and wear.



4. Release levers

Check to be sure that each release lever is in sound condition, and not worn either badly or excessively at its contacting and sliding faces.

Reassembly

To reassemble, follow the reverse of disassembly sequence. Apply molybdenum disulfide grease to the following parts of the dry-type clutch:

(1) Friction surfaces of release lever and pressure plate

(2) Friction surfaces of release lever and lever support

Apply anti-seize lubricant to the following parts:

(1) Threads of lever nut

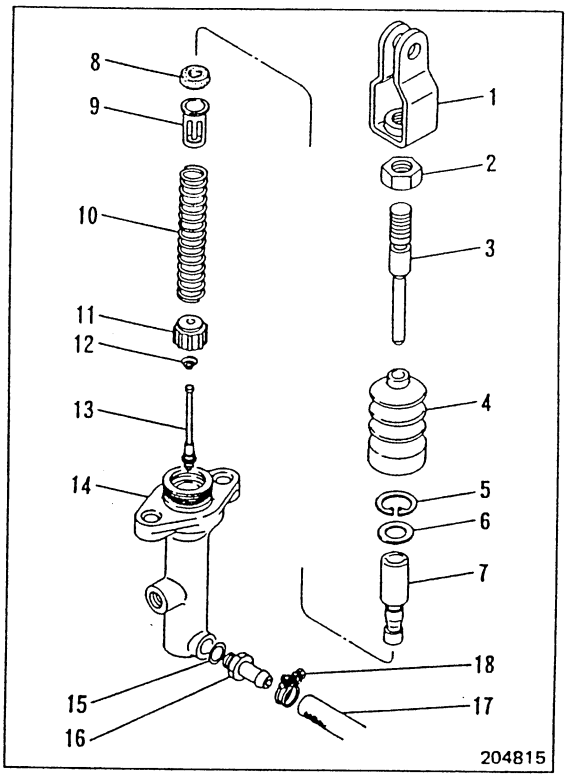
(2) Sphere of lever nut

Clutch Master Cylinder

Disassembly

Sequence

1 Clevis
2 Lock nut
3 Pushrod
4 Boots
5 Snap ring
6 Stopper ring
7 Piston
8 Piston cup
9 Spring seat
10 Return spring
11 Center valve case
12 Spring
13 Center valve stem (valve seal)
14 Cylinder body
15 Gasket
16 Joint
17 Hose
18 Hose clamp



NOTE

Use a repair kit for replacement of the parts 4 and 6 thru 13 (to be replaced periodically).

Inspection after disassembly

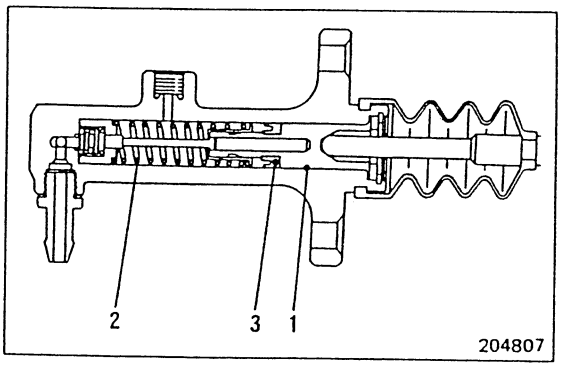
1. Cylinder body

(1) Check the bore for rusting, erosion and scoring.

(2) Check the inlet port and relief port for condition. Also check for stripped threads.

2. Piston

Check for condition. Replace the piston if defective. Insert the piston into the cylinder body, and check the clearance between the two. If this clearance is in excess of the service limit, replace the cylinder body and piston.



Unit: mm [in.]

Clearance between cylinder body and piston 1	A	0.016 to 0.086 [0.00063 to 0.00339]
	B	0.15 [0.0059]

3. Return spring

Measure the free length of return spring. If it is in excess of the service limit, replace the spring.

Unit: mm [in.]

Free length 2	A	85 ± 2.5 [3.3 ± 0.1]

4. Piston cup and valve seal

Check rubber parts for damage or swelling.

Unit: mm [in.]

Outside diameter of piston cup 3	A	17.0 ± 0.2 [0.7 ± 0.01]

Reassebly

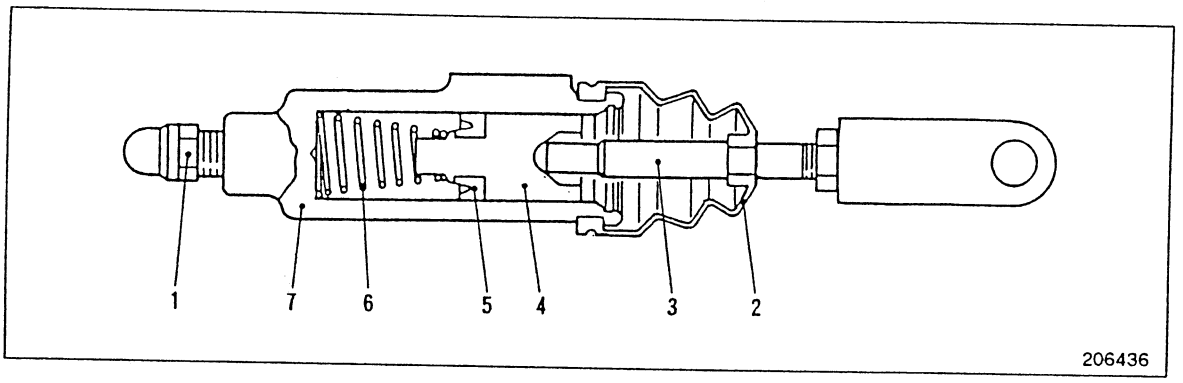
To reassemble follow the reverse of disassembly sequence, and do the following steps:

(1) Wash all metal parts with a volatile cleaning solvent and blow dry with compressed air.

(2) Apply a thin coat of rubber grease (METAL RUBBER #20) or brake fluid to the cylinder bore and piston cup.

Clutch Release Cylinder

Disassembly



Sequence

1 Bleeder valve
2 Boot
3 Release rod
4 Piston
5 Piston cup
6 Spring
7 Cylinder body

NOTE

Use a repair kit for replacement of the parts 2, 4, 5 and 6 (to be replaced periodically).

Inspection after disassembly

1. Cylinder body

(1) Check the bore for rusting, erosion and scoring.

(2) Check the threads of bleeder screw and oil pipe for damage.

2. Piston

(1) Check the sliding surface for rusting and scratching.

(2) Insert the piston into the cylinder body, and check the clearance between the two. Replace the cylinder body and piston if the clearance is in excess of the service limit.

Unit: mm [in.]

Clearance between piston and cylinder body	A	0.040 to 0.125 [0.00157 to 0.00492]
	B	0.15 [0.0059]

3. Piston cup

Check for swelling or other defects. Replace the cup at the time of overhaul or every 1 year.

Unit: mm [in.]

Diameter of piston cup lip	A	20.6 ± 2 [0.8 ± 0.1]

4. Boot

Replace the boot if it is hardened, damaged or otherwise deteriorated.

5. Return spring

Measure the free length of return spring. If it is in excess of the service limit, replace the spring.

Unit: mm [in.]

Free length of return spring	A	46 ± 1.5 [1.81 ± 0.06]

Reassembly

To reassemble, follow the reverse of disassembly. Do the following steps:

(1) Coat the piston cups and the inside surfaces of cylinder body with rubber grease (METAL RUBBER #20) or brake fluid.

(2) Be careful not to damage the lip of the cup.

INSPECTION AND ADJUSTMENT

Clutch Booster

Operation test

1. Test method using no tester

The clutch booster can be tested as follows:

(a) Run the engine for one to two minutes and stop it. Depress the clutch pedal to see how the pedal changes its stroke as you repeat depressing the pedal. If the pedal stroke decreases each time you depress the pedal, the booster is in satisfactory condition. No change in the stroke means that booster is faulty.

(b) Depress the clutch pedal several times with the engine stopped. Then, keep the pedal depressed, and start the engine. If the pedal goes down slightly when the engine is started, the booster is in good condition. The booster is faulty if the pedal fails to go down.

(c) Depress the clutch pedal with the engine running. Under this condition, stop the engine, and keep the pedal depressed for about 30 seconds. If the pedal height will not change, the booster is in good condition.

If the results of the above tests (a), (b) and (c) are good, the booster will be considered to be in good condition. If the results of two or more of these tests are unfavorable, the booster of vacuum hose would be faulty.

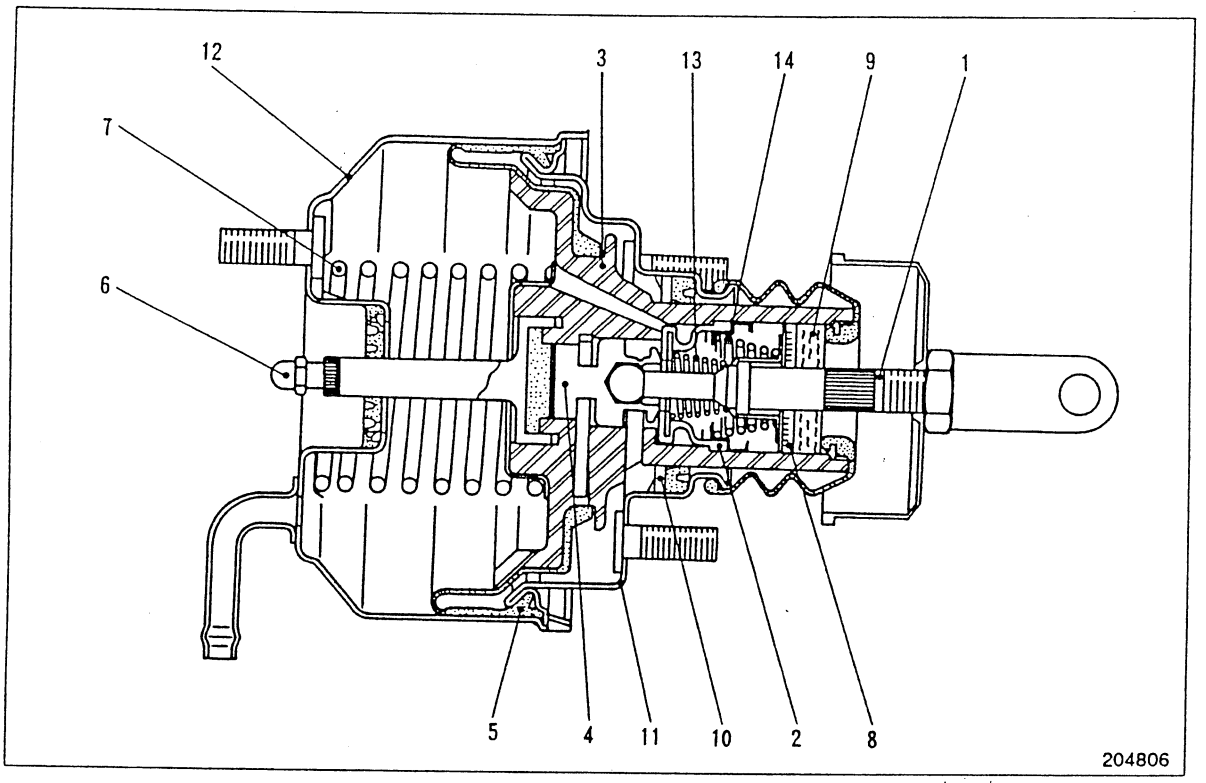
2. For the test using a tester, refer to the test of brake booster. The use of a tester makes it possible to carry out (a) No-load condition airtightness test, (b) Loaded condition airtightness test and (c) booster characteristic test.

NOTE

The operation test outlined above is a simplified field test. Be sure to test the booster on the test bench as specified by the manufacturer for vertification or careful analysis of the problem if the booster is faulty.

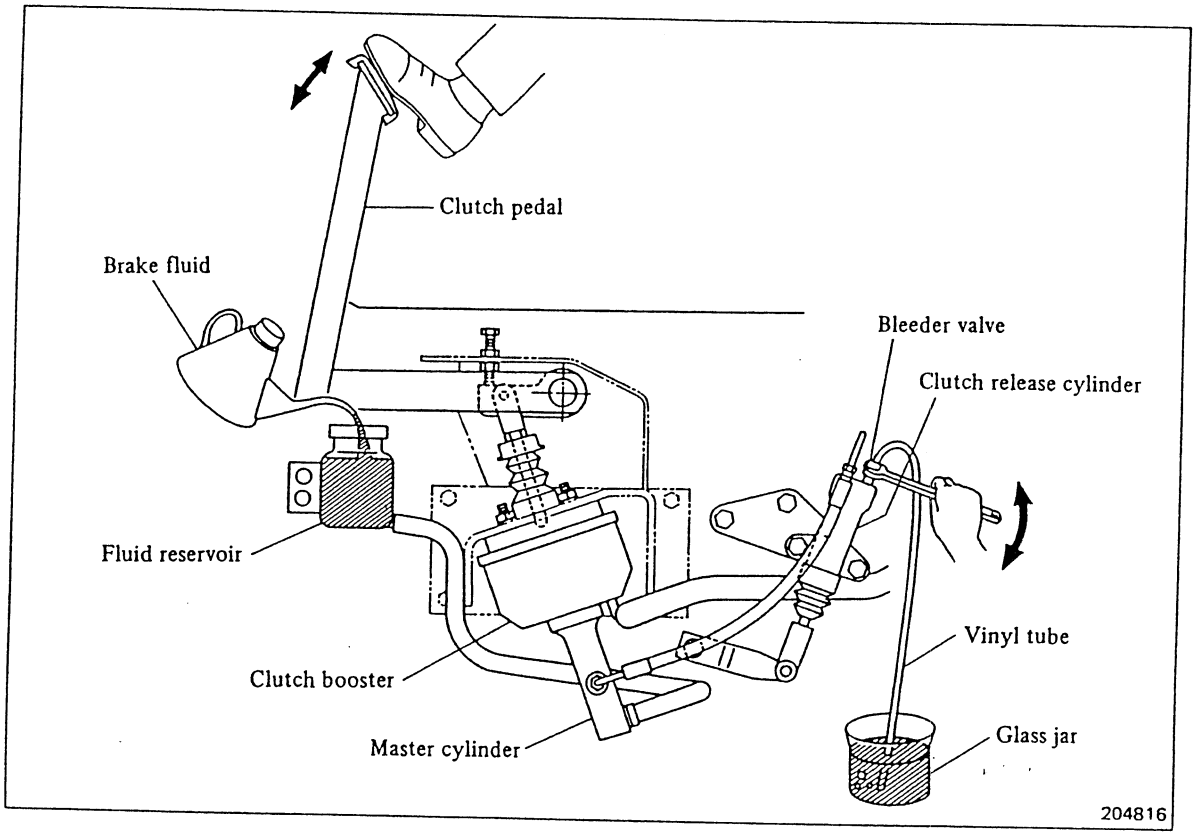
3. When the repair kit parts (the rubber parts listed below) of the booster have to be replaced after 4-year service, consult your Mitsubishi lift truck dealer.

Repair kit parts



1 Valve rod assembly
Consisting of (1) – (8)
(1) Poppet assembly
(2) Washer
(3) Retainer
(4) Rod
(5) Valve plunger
(6) Retainer
(7) Spring
(8) Spring
2 Diaphragm
3 Retainer
4 Filter
5 Silencer
6 Seal and retainer assembly
7 Bearing
8 Retainer
9 Plate and seal assembly
10 Retainer
11 Disc assembly
12 Guard

Bleeding Clutch Hydraulic System



Use two men - one at the clutch pedal and the other at the master cylinder reservoir - to bleed the hydraulic system of the clutch. Keep the engine idling during bleeding operation.

1. Fill the reservoir with fluid. Always keep the reservoir more than half full of the fluid during bleeding operation.
2. Remove the bleeder cap. Connect a transparent vinyl tube (whose inside diameter is 6 mm [0.24 in.]) to the bleeder valve with the other end of the tube put in a glass jar filled with the fluid. (Make sure the end of the tube is below the fluid level in the jar.)
3. Have someone get into the truck and pump the clutch pedal full stroke several times, allowing it to return slowly, then keep the pedal depressed. Loosen the bleeder valve to allow the fluid to flow into the jar.
4. Tighten the bleeder valve and release the pedal slowly.
5. Repeat Steps 3. and 4. above until the fluid flows from the vinyl tube into the jar in a solid stream that is free of air bubbles.
6. Replace the bleeder cap and fill the reservoir with the brake fluid up to the specified level.

Precautions for bleeding operation

(1) Maintain proper fluid level in the fluid reservoir.

(2) Be careful not to spill the fluid on the painted surface.

(3) Avoid mixing different types of fluids.

(4) Connect the vinyl tube to the bleeder screw in such a manner as to prevent fluid leaks.

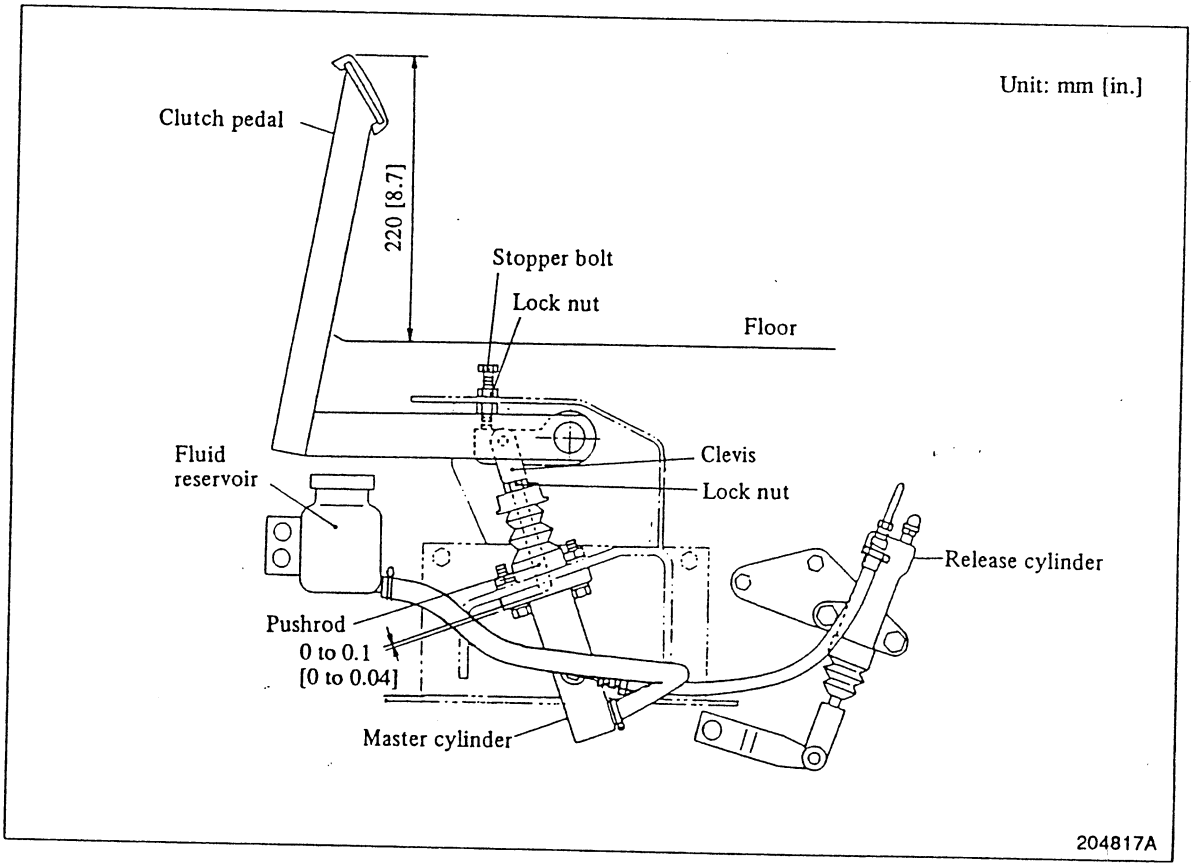
(5) When the bleeding operation is completed, make sure the fluid level in the reservoir is correct. Add fluid if necessary.

(6) Be sure to allow the pedal to return slowly when pumping it to prevent air from being sucked into the system on the pedal return strokes.

(7) Do not release the pedal before closing the bleeder valve.

(8) Do not attempt to reuse the fluid in the glass jar. It is likely to be contaminated or dirty.

Clutch Pedal Adjustment (for Dry-Type Clutch)

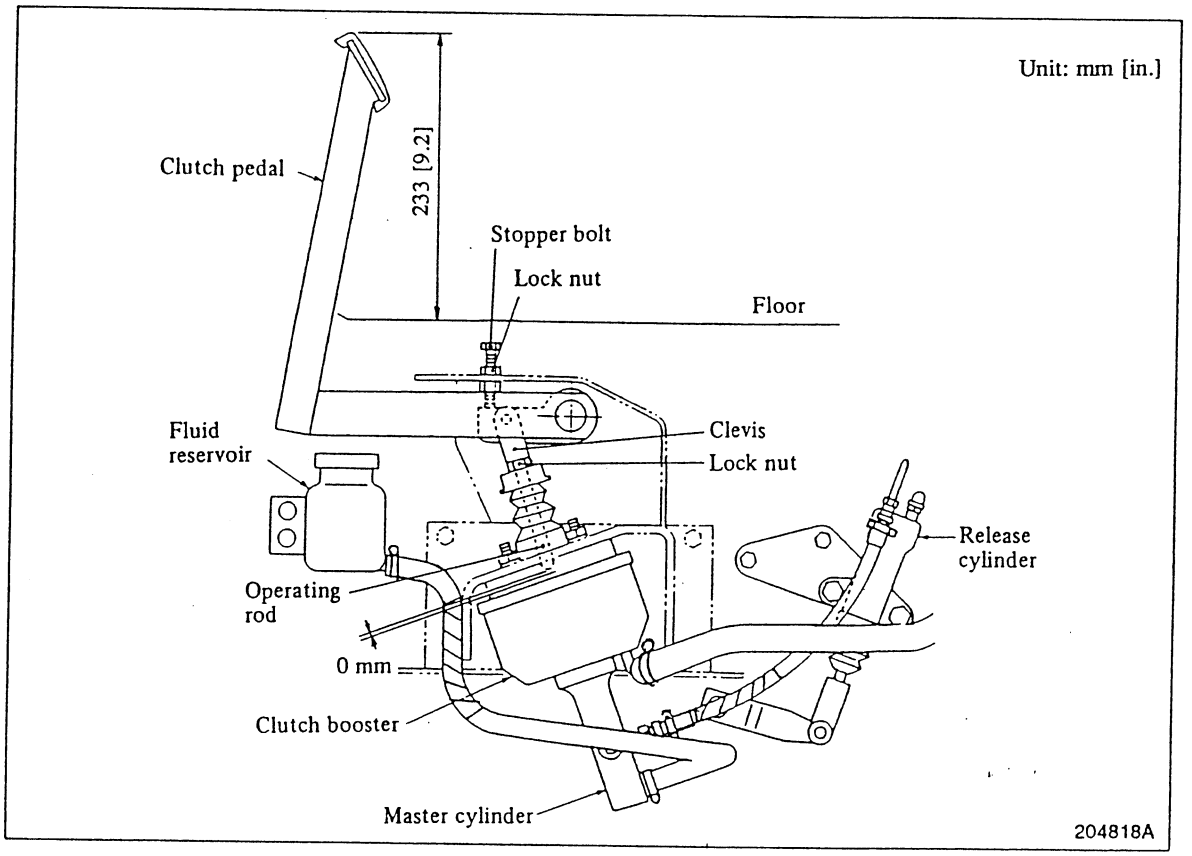


1. Bleed air out of the brake line from the reservoir through master cylinder to the release cylinder. (Bleed air at the bleeder valve on the clutch release cylinder.)
2. Screw the stopper bolt to set the clutch pedal height (from the floor to the top of pedal pad) to 220 mm [8.7 in.], and tighten the lock nut.
3. Loosen the lock nut securing the clevis at the top of pushrod.
4. Pull out the pin from the clevis of master cylinder pushrod, and loosen the lock nut. Adjust the length of the rod so that the clearance between the rod and master cylinder piston is 0 to 1 mm [0.04 in.], and tighten the lock nut.
5. Depress the clutch pedal by fingers until a resistance is encountered, and check to make sure the free play is correct.

Unit: mm (in.)

Free play of clutch pedal	A	1 to 10 [0.04 to 0.39]

Clutch Pedal Adjustment (for Wet-Type Clutch)



1. Bleed air out of the brake line from the reservoir through master cylinder to the release cylinder. (Bleed air at the bleeder valve on the clutch release cylinder.)

2. Screw the stopper bolt to set the clutch pedal height (from the floor to the top of pedal pad) to 233 mm [9.2 in.], and tighten the lock nut.

3. Loosen the lock nut for operating rod, and adjust the clearance between the operating rod and valve plunger in the booster to 0 mm.

4. Tighten the lock nut to secure the operating rod to the clevis.

5. With the engine stopped, depress the clutch pedal two or three times to reduce the vacuum in the clutch booster to zero. Then, depress the clutch pedal by fingers until a resistance is encountered, and check to make sure the free play is correct.

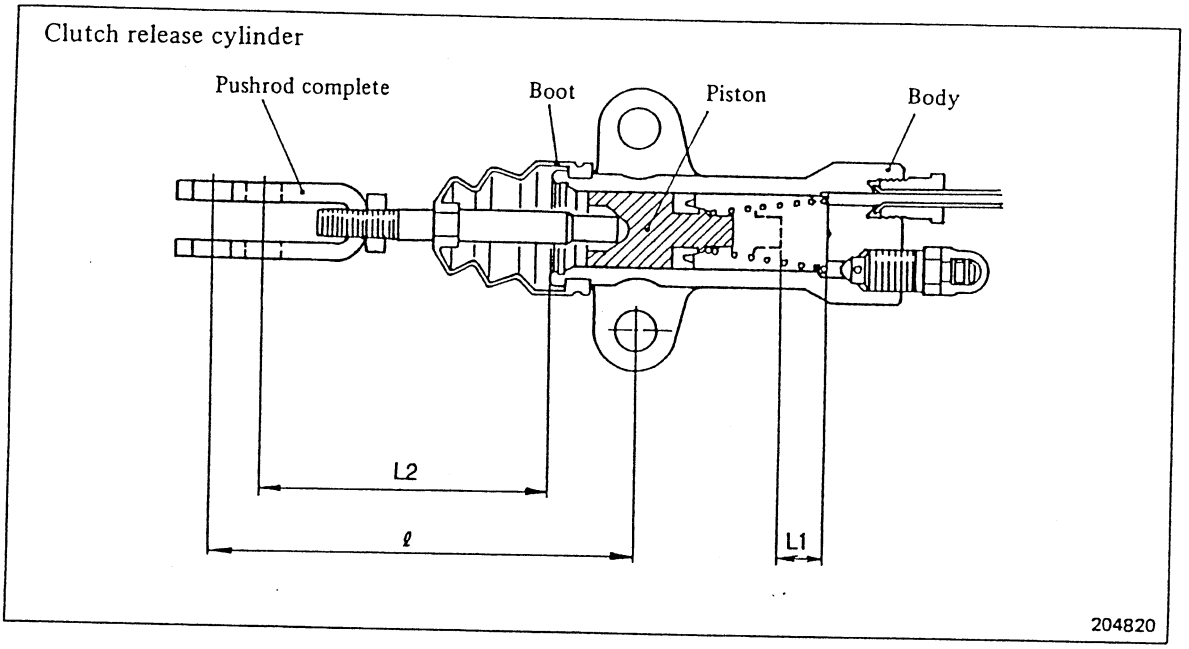
Unit: mm [in.]

Free play of clutch pedal	A	5 to 15 [0.2 to 0.6]

NOTE

If the clutch pedal has no free play, the pushrod will be pushing the piston in the master cylinder to allow it to cover the return port. This causes the clutch to slip, resulting in premature wear of the clutch facing. If the pedal has too much free play, it is an indication that the operating rod is not screwed into the clevis properly.

How to Determine Clutch Disc Wear Limit



ℓ Dimension to be met when release cylinder is assembled (97.5 mm [3.84 in.])
L1 Dimension to be met when release cylinder is connected to clutch shifter shaft (when clutch disc is new)
L2 Dimension to be met when release cylinder is connected to clutch shifter shaft (from end of body to center of pin)

Dimension L1 (reference) Unit: mm [in.]

Dry-type clutch	A	13.6 [0.54]
Wet-type clutch	A	

Dimension L2 Unit: mm [in.]

Dry-type clutch	A	91 [3.58]
	B	77.4 [3.05]
Wet-type clutch	A	91 [3.58]
	B	77.4 [3.05]

Measure the amount of disc wear, as outlined below, to determine whether or not the disc has reached the service (wear) limit:

1. With the release cylinder installed in position, remove the boot, and measure the dimension "L2." Make a record of this measurement.

NOTE

The dimension "L2" may sometimes be out of specification because of tolerances of related parts.

2. As the disc is worn down, the piston is pushed into the cylinder body, resulting in a decrease in the dimension "L2." Replace the disc if this dimension has reached the service limit.