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WORKSHOP MANUAL FOR TRACTOR
L3010/L3410/L3710/L4310/L4610

Part Number: 9789712191



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TO THE READER

This Workshop Manual has been prepared to provide servicing personnel with information on the mechanism, service and maintenance of KUBOTA Tractors L3010, L3410, L3710 and L4310. It is divided into two parts, "Mechanism" and "Servicing" for each section.

■ Mechanism

Information on the construction and function are included. This part should be understood before proceeding with troubleshooting, disassembling and servicing.

■ Servicing

Under the heading "General" section comes general precautions, check and maintenance and special tools. Other section, there are troubleshooting, servicing specification lists, checking and adjusting, disassembling and assembling, and servicing which cover procedures, precautions, factory specifications and allowable limits.

All information, illustrations and specifications contained in this manual are based on the latest production information available at the time of publication.

The right is reserved to make changes in all information at any time without notice.

June '98



SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and decals on the machine itself to warn of the possibility of personal injury. Read these instructions carefully. It is essential that you read the instructions and safety regulations before you attempt to repair or use this unit.



DANGER : Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING : Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION : Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



IMPORTANT : Indicates that equipment or property damage could result if instructions are not followed.



NOTE : Gives helpful information.

SAFETY SERVICING AND REPAIRING

- (1) Before working on the machine :
 - Park the machine on a firm and level ground, and set the parking brake.
 - Lower the implement or mower to the ground.
 - Stop the engine, and remove the key.
 - Disconnect the battery's ground cable.
 - Clean the work area and machine.
- (2) Do not work on the machine while under the influence of alcohol, medication, or other substances or while fatigued.
- (3) Do not wear a necktie, scarf, necklace, loose or bulky clothing when you work near machine tools or moving parts.
- (4) Use tools appropriate to the work. Makeshift tools, parts, and procedures will not make good repairs.
- (5) When servicing is performed together by two or more persons, take care to perform all work safely.
- (6) Do not work under the machine that is supported solely by a jack. Always support the machine by safety stands.

- (7) If the engine must be running to do same work, make sure the area is well ventilated. Never run the engine in a closed area. The exhaust gas contains poisonous carbon monoxide.
- (8) Do not touch the rotating or hot parts while the engine is running.
- (9) Fuel is extremely flammable and explosive under certain conditions. Do not smoke or allow flames or sparks in your working area.
- (10) To avoid sparks from an accidental short circuit, always disconnect the battery's ground cable first and connect it last.
- (11) Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, clothing and cause blindness if splashed into eyes. Keep electrolyte away from eyes, hands and clothing. If you spill electrolyte on yourself, flush with water, and get medical attention immediately.
- (12) Battery gas can explode. Keep sparks and open flame away from the top of battery, especially when charging the battery.
- (13) Never remove the radiator cap while the engine is running, or immediately after stopping. Otherwise, hot water will spout out from radiator. Wait for more than ten minutes to cool the radiator, before removing the cap.
- (14) Escaping fluid (fuel or hydraulic oil) under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or fuel lines. Tighten all connections before applying pressure.
- (15) Do not start the engine by shorting across starter terminals.
- (16) Unauthorized modifications to the machine may impair the function and / or safety and affect machine life.
- (17) Do not alter or remove any part of machine safety system.
- (18) Keep a first aid kit and fire extinguisher handy at all times.
- (19) Be sure to chock the wheels to prevent accident during servicing the machine.

SAFETY DECALS

- The following safety decals are installed on the machine.

If a decal becomes damaged, illegible or is not on the machine, replace it. The decal part number is listed in the parts list.

①Part No. TA040-4965-2



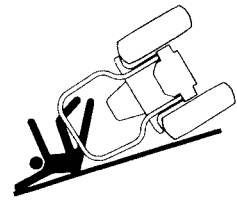
⚠ DANGER

TO AVOID POSSIBLE INJURY OR DEATH FROM A MACHINE RUNAWAY.

- Do not start engine by shorting across starter terminals or bypassing the safety start switch. Machine may start in gear and move if normal starting circuitry is bypassed.
- Start engine only from operator's seat with transmission and PTO OFF. Never start engine while standing on the ground.

②Part No. TA040-4932-2

⚠ WARNING




TO AVOID PERSONAL INJURY OR DEATH FROM ROLL-OVER:

- Kubota recommends the use of a Roll-Over Protective Structures (ROPS) and seat belt in almost all applications.
- Remove the ROPS only when it substantially interferes with operation or itself presents a safety risk. (Examples include work in orchards and vineyards.) ALWAYS REINSTALL IT BEFORE USING THE TRACTOR IN OTHER APPLICATIONS.
- Never use just the seat belt or just the ROPS. They must be used together. For further details, consult your Operator's Manual or your local dealer.

③Part No. TA040-4959-3

⚠ WARNING



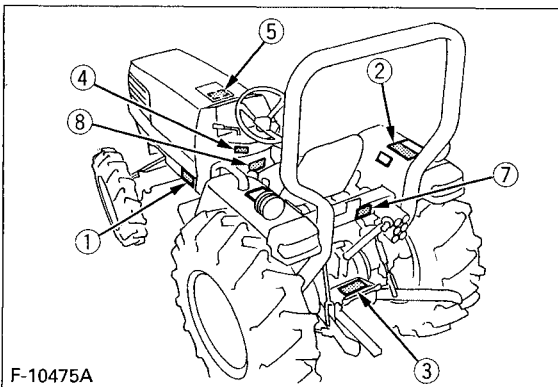
TO AVOID PERSONAL INJURY.

- Keep PTO shield in place at all times.
- Do not operate the PTO at speeds faster than the speed recommended by the implement manufacturer.
- For trailing PTO-driven implements, set drawbar at towing position. (see operator's manual)

④Part No. TA240-4991-1 [HST type]

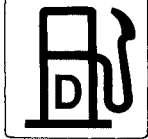
⚠ WARNING

Do not start engine with speed set lever engaged or control pedal operated.




⑤Part No. TA040-4956-2

Diesel fuel only



No fire



⑥Part No. TA040-4934-1

⚠ WARNING

TO AVOID PERSONAL INJURY:

Do not operate rear-PTO driven implements and mid-PTO driven implements at the same time.

⑦Part No. TA040-4935-1

⚠ WARNING

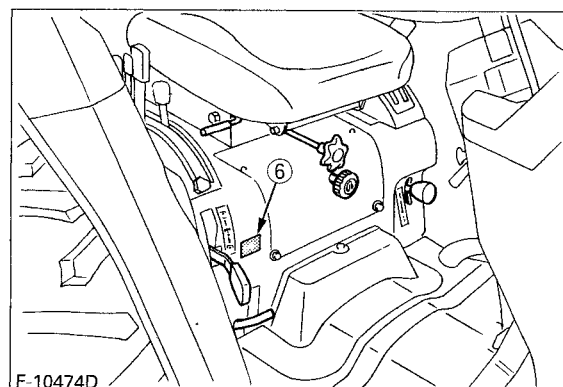
TO AVOID PERSONAL INJURY:

- Attach pulled or towed loads to the drawbar only.
- Use the 3-point hitch only with equipment designed for 3-point hitch usage.

⑧Part No. 35080-6528-2

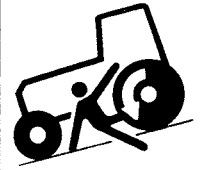
⚠ CAUTION

Pull the engine stop knob back and hold it until the engine stops in case of emergency.



⑨Part No. TA140-4992-1 [GST type]

▲ WARNING



BEFORE DISMOUNTING TRACTOR:
1. ALWAYS SET PARKING BRAKE.
 Leaving transmission in gear with the engine stopped will not prevent tractor from rolling.
2. PARK ON LEVEL GROUND WHENEVER POSSIBLE.
 If parking on a slope, position tractor across the slope.
3. LOWER ALL IMPLEMENTS TO THE GROUND.
 Failure to comply to this warning may allow the wheels to slip, and could cause injury or death.
4. LOCK SHUTTLE SHIFT LEVER IN NEUTRAL POSITION AND STOP THE ENGINE.

⑨Part No. TA240-4933-2 [HST type]

▲ WARNING



BEFORE DISMOUNTING TRACTOR:
1. ALWAYS SET PARKING BRAKE.
 Leaving transmission in gear with the engine stopped will not prevent tractor from rolling.
2. PARK ON LEVEL GROUND WHENEVER POSSIBLE.
 If parking on a slope, position tractor across the slope.
3. LOWER ALL IMPLEMENTS TO THE GROUND.
 Failure to comply to this warning may allow the wheels to slip, and could cause injury or death.
4. STOP THE ENGINE.

⑨Part No. TA140-4933-1 [Manual Transmission type]

▲ WARNING



BEFORE DISMOUNTING TRACTOR:
1. ALWAYS SET PARKING BRAKE.
2. PARK ON LEVEL GROUND WHENEVER POSSIBLE.
 If parking on a slope, position tractor across the slope.
3. LOWER ALL IMPLEMENTS TO THE GROUND.
 Failure to comply to this warning may allow the wheels to slip, and could cause injury or death.
4. LOCK SHUTTLE SHIFT LEVER IN NEUTRAL POSITION AND STOP THE ENGINE.

⑩Part No. 35260-3491-3

▲ CAUTION

TO AVOID PERSONAL INJURY:

1. Read and understand the operator's manual before operation
2. Before starting the engine, make sure that everyone is at a safe distance from the tractor and that the PTO is OFF.
3. Do not allow passengers on the tractor at any time
4. Before allowing other people to use the tractor, have them read the operator's manual.
5. Check the tightness of all nuts and bolts regularly.
6. Keep all shields in place and stay away from all moving parts
7. Lock the two brake pedals together before driving on the road.
8. Slow down for turns, or rough roads, or when applying individual brakes.
9. On public roads use SMV emblem and hazard lights, if required by local traffic and safety regulations.
10. Pull only from the drawbar.
11. Before dismounting, lower the implement, set the parking brake, stop the engine and remove the key.

⑫Part No. TA040-4957-1
 Stay clear of engine fan and fanbelt.



⑬Part No. TA040-4958-1
 Do not touch hot surface like muffler, etc.



⑪Part No. TA040-3015-1

DANGER EXPLOSIVE GASES

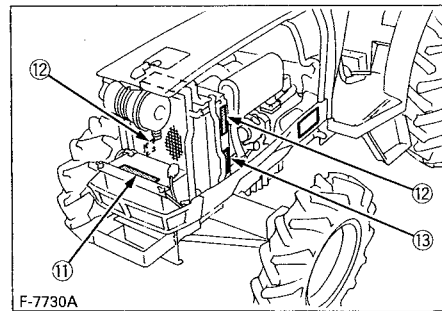
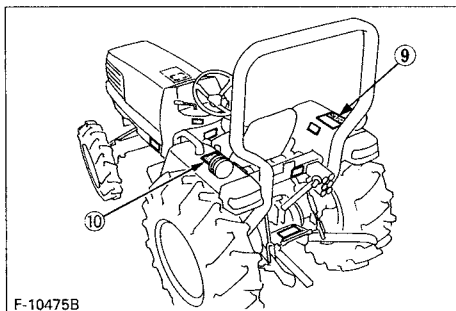
Cigarettes, flames or sparks could cause battery to explode. Always shield eyes and face from battery. Do not charge or use booster cables or adjust post connections without proper instruction and training.

KEEP VENT CAPS TIGHT AND LEVEL

POISON CAUSES SEVERE BURNS

Contains sulfuric acid. Avoid contact with skin, eyes or clothing. In event of accident flush with water and call a physician immediately.

KEEP OUT OF REACH OF CHILDREN



SPECIFICATIONS

Model		L3010			
		2WD	4WD	4WD-GST	4WD-HST
Maximum PTO power		19.1 kW (25.5 HP)*			17.9 kW (24.0 HP)*
Engine NET power		22.6 kW (30.4 HP)*			
Engine	Model	D1503-L-A			
	Type	Indirect injection, Vertical, Water-Cooled, 4-cycle diesel engine			
	Number of cylinders	3			
	Bore and stroke	83 x 92.4 mm (3.3 x 3.6 in.)			
	Total displacement	1499 cm ³ (91.5 cu.in.)			
	Rated revolution	45.0 r/s (2700 rpm)			
	Combustion chamber	Spherical type (E-TVCS)			
	Fuel injection pump	Bosch type mini pump (PFR3M)			
	Governor	Centrifugal ball mechanical governor			
	Injection nozzle	Throttle type			
	Injection timing	Before T.D.C. 0.314 rad (18°)			
	Injection order	1-2-3			
	Injection pressure	13.73 MPa (140 kgf/cm ² , 1991 psi)			
	Compression ratio	23 : 1			
	Lubricating system	Forced lubrication by trochoidal pump			
	Cooling system	Pressurized radiator, Forced circulation with water pump			
	Starting system	Electric starting with cell starter 12 V, 1.2 kW			
	Alternator	12 V, 480 W (40 AMPS)			
	Battery	12V, RC : 123 min, CCA : 490- Cold cranking Amps at -18 °C (-0.4 °F)			
	Fuel	Diesel fuel No. 1 [below - 10 °C (14 °F)] Diesel fuel No. 2 [above - 10 °C (14 °F)]			
Lubricating oil	CC or CD (API grade)				
Weight (Dry)	176 kg (388 lbs)				
Capacities	Fuel tank	35.0 ℓ (9.2 U.S.gals., 7.7 Imp.gals.)			
	Engine crankcase	5.5 ℓ (5.8 U.S.qts., 4.8 Imp.qts.)			
	Engine coolant	7.0 ℓ (7.4 U.S.qts., 6.2 Imp.qts.)			
	Transmission case	39.0 ℓ (10.3 U.S.gals., 8.6 Imp.gals.)			
	Front axle case	—	5.5 ℓ (5.8 U.S.qts., 4.8 Imp.qts.)		
Dimensions with Std. tires)	Overall length (without 3P)	2820 mm (111.0 in.)			
	Overall length (with 3P)	3060 mm (120.5 in.)			
	Overall width (minimum tread)	1325 mm (52.2 in.)			
	Overall height (Top of ROPS)	2090 mm (82.3 in.)			
	Overall height (Top of steering wheel)	1515 mm (59.6 in.)			
	Wheel base	1675 mm (65.9 in.)	1670 mm (65.7 in.)		
	Min. ground clearance (Under transmission)	325 mm (12.8 in.)			
	Tread	Front mm (in.)	960 (37.8), 1060 (41.7), 1160 (45.7), 1260 (49.6)	1105 (43.5)	
	Rear mm (in.)	1120 (44.1), 1220 (48.0), 1305 (51.4), 1405 (55.3)			

Note : * Manufacturer's estimate

Model			L3010				
			2WD	4WD	4WD-GST	4WD-HST	
Traveling system	Tire size (Std. tires)	Front	5.00 – 15	7.2 – 16			
		Rear	11.2 – 24				
	Clutch	Dry type single stage					
	Steering	Hydrostatic power steering					
	Transmission	Synchronized shuttle and synchronized transmission (8 forward and 8 reverse speeds)		Glide shift transmission 8 forward and 8 reverse speeds)		Hydrostatic transmission (3 speeds)	
	Brake	Traveling	Wet disc type				
		Parking	Connected with the traveling brake				
Differential	Bevel gear						
Hydraulic system	Hydraulic control system		Position control, Draft and Mixed control (if equipped)				
	Pump capacity (Max. flow rate)		Main pump 26.4 ℓ/min (7.0 GPM) Power steering pump 17.7 ℓ/min (4.7 GPM)				
	Three point hitch		SAE Category I				
	Maximum lifting capacity (24 in. behind lower link end)		1000 kg (2200 lbs)				
Rear PTO	PTO shaft		SAE 1–3/8, 6-splines (with overrunning clutch)				
	Revolution	Transmission PTO	1 speed : 9.0 r/s (540 rpm) / engine 44.5 r/s (2670 rpm)			—	
		Independent PTO	1 speed : 9.0 r/s (540 rpm) / engine 45.0 r/s (2700 rpm)			1 speed : 9.0 r/s (540 rpm) / engine 45.3 r/s (2713 rpm)	
Mid PTO	PTO shaft		USA No. 5 (KUBOTA 10-tooth) involute spline				
	Revolution	Transmission PTO	1 speed : 33.3 r/s (2000 rpm) / engine 43.7 r/s (2623 rpm)			—	
		Independent PTO	1 speed : 33.3 r/s (2000 rpm) / engine 44.2 r/s (2653 rpm)			1 speed : 33.3 r/s (2000 rpm) / engine 44.4 r/s (2666 rpm)	
Min. turning radius (with brake)			2.4 m (7.9 ft)	2.3 m (7.5 ft)	2.5 m (8.2 ft)		
Traction system			Fixed drawbar or swing drawbar (if equipped)				
Weight (with ROPS)			1160 kg (2560 lbs)	1230 kg (2710 lbs)	1235 kg (2720 lbs)	1245 kg (2745 lbs)	
Traveling speed (at rated engine speed with Std. tires)	Forward	1st	1.5 km/h (0.9 mph)			Low : 0 to 6.6 km/h (0 to 4.1 mph)	
		2nd	2.1 km/h (1.3 mph)				
		3rd	3.5 km/h (2.2 mph)			Middle : 0 to 12.4 km/h (0 to 7.7 mph)	
		4th	5.1 km/h (3.2 mph)				
		5th	7.3 km/h (4.5 mph)			High : 0 to 26.4 km/h (0 to 16.4 mph)	
		6th	10.3 km/h (6.4 mph)				
		7th	16.7 km/h (10.4 mph)				
		8th	24.7 km/h (15.3 mph)				
	Reverse	1st	1.4 km/h (0.8 mph)			Low : 0 to 6.6 km/h (0 to 4.1 mph)	
		2nd	2.0 km/h (1.2 mph)				
		3rd	3.2 km/h (2.0 mph)			Middle : 0 to 12.4 km/h (0 to 7.7 mph)	
		4th	4.7 km/h (2.9 mph)				
		5th	6.7 km/h (4.2 mph)			High : 0 to 21.1 km/h (0 to 13.1 mph)	
		6th	9.5 km/h (5.9 mph)				
		7th	15.3 km/h (9.5 mph)				
8th		22.7 km/h (14.1 mph)					

SPECIFICATIONS (Continued)

Model		L3410		
		4WD	4WD-GST	4WD-HST
Maximum PTO power		21.3 kW (28.5 HP)*		20.1 kW (27.0 HP)*
Engine NET power		24.9 kW (33.3 HP)*		
Engine	Model	D1703- A		
	Type	Indirect injection, Vertical, Water-Cooled, 4-cycle diesel engine		
	Number of cylinders	3		
	Bore and stroke	87 x 92.4 mm (3.4 x 3.6 in.)		
	Total displacement	1647 cm ³ (100.5 cu.in.)		
	Rated revolution	45.0 r/s (2700 rpm)		
	Combustion chamber	Spherical type (E-TVCS)		
	Fuel injection pump	Bosch type mini pump (PFR3M)		
	Governor	Centrifugal ball mechanical governor		
	Injection nozzle	Throttle type		
	Injection timing	Before T.D.C. 0.314 rad (18°)		
	Injection order	1-2-3		
	Injection pressure	13.73 MPa (140 kgf/cm ² , 1991 psi)		
	Compression ratio	23 : 1		
	Lubricating system	Forced lubrication by trochoidal pump		
	Cooling system	Pressurized radiator, Forced circulation with water pump		
	Starting system	Electric starting with cell starter 12 V, 1.2 kW		
	Alternator	12 V, 480 W (40 AMPS)		
	Battery	12V, RC : 123 min, CCA : 490- Cold cranking Amps at -18 °C (- 0.4 °F)		
	Fuel	Diesel fuel No. 1 [below - 10 °C (14 °F)] Diesel fuel No. 2 [above - 10 °C (14 °F)]		
Lubricating oil	CC or CD (API grade)			
Weight (Dry)	176 kg (388 lbs)			
Capacities	Fuel tank	35.0 ℓ (9.2 U.S.gals., 7.7 Imp.gals.)		
	Engine crankcase	5.5 ℓ (5.8 U.S.qts., 4.8 Imp.qts.)		
	Engine coolant	7.0 ℓ (7.4 U.S.qts., 6.2 Imp.qts.)		
	Transmission case	39.0 ℓ (10.3 U.S.gals., 8.6 Imp.gals.)		
	Front axle case	—	5.5 ℓ (5.8 U.S.qts., 4.8 Imp.qts.)	
Dimensions (with Std. tires)	Overall length (without 3P)	2850 mm (112.2 in.)		
	Overall length (with 3P)	3060 mm (120.5 in.)		
	Overall width (minimum tread)	1355 mm (53.5 in.)		
	Overall height (Top of ROPS)	2130 mm (83.9 in.)		
	Overall height (Top of steering wheel)	1530 mm (60.2 in.)		
	Wheel base	1670 mm (65.7 in.)		
	Min. ground clearance (Under transmission)	350 mm (13.8 in.)		
	Tread	Front mm (in.)	1105 (43.5)	
Rear mm (in.)		1120 (44.1), 1220 (48.0), 1305 (51.4), 1405 (55.3)		

Note : * Manufacturer's estimate

Model			L3410			
			4WD	4WD-GST	4WD-HST	
Traveling system	Tire size (Std. tires)	Front	7 – 16		7.2 – 16	
		Rear	12.4 – 24			
	Clutch	Dry type single stage				
	Steering	Hydrostatic power steering				
	Transmission	Synchronized shuttle and synchronized transmission (8 forward and 8 reverse speeds)	Glide shift transmission (8 forward and 8 reverse speeds)	Hydrostatic transmission (3 speeds)		
	Brake	Traveling	Wet disc type			
		Parking	Connected with the traveling brake			
Differential	Bevel gear					
Hydraulic system	Hydraulic control system		Position control, Draft and Mixed control (if equipped)			
	Pump capacity (Max. flow rate)		Main pump 26.4 ℓ/min (7.0 GPM) Power steering pump 17.7 ℓ/min (4.7 GPM)			
	Three point hitch		SAE Category I			
	Maximum lifting capacity (24 in. behind lower link end)		1000 kg (2200 lbs)			
Rear PTO	PTO shaft		SAE 1-3/8, 6-splines (with overrunning clutch)			
	Revolution	Transmission PTO	1 speed : 9.0 r/s (540 rpm) /engine 44.5 r/s (2670 rpm)		—	
		Independent PTO	1 speed : 9.0 r/s (540 rpm) /engine 45.0 r/s (2700 rpm)		1 speed : 9.0 r/s (540 rpm) / engine 45.3 r/s (2713 rpm)	
Mid PTO	PTO shaft		USA No. 5 (KUBOTA 10-tooth) involute spline			
	Revolution	Transmission PTO	1 speed : 33.3 r/s (2000 rpm) / engine 43.7 r/s (2623 rpm)		—	
		Independent PTO	1 speed : 33.3 r/s (2000 rpm) / engine 44.2 r/s (2653 rpm)		1 speed : 33.3 r/s (2000 rpm) / engine 44.4 r/s (2666 rpm)	
Min. turning radius (with brake)		2.3 m (7.6 ft)	2.5 m (8.2 ft)			
Traction system		Fixed drawbar or swing drawbar (if equipped)				
Weight (with ROPS)		1255 kg (2765 lbs)	1260 kg (2780 lbs)	1270 kg (2800 lbs)		
Traveling speed (at rated engine speed with Std. tires)	Forward	1st	1.6 km/h (1.0 mph)		Low : 0 to 6.6 km/h (0 to 4.1 mph)	
		2nd	2.3 km/h (1.4 mph)			
		3rd	3.7 km/h (2.3 mph)			
		4th	5.5 km/h (3.4 mph)		Middle : 0 to 12.4 km/h (0 to 7.7 mph)	
		5th	7.7 km/h (4.8 mph)			
		6th	11.0 km/h (6.8 mph)			
		7th	17.8 km/h (11.1 mph)			
		8th	26.3 km/h (16.3 mph)			
	Reverse	1st	1.5 km/h (0.9 mph)		Low : 0 to 6.6 km/h (0 to 4.1 mph)	
		2nd	2.1 km/h (1.3 mph)			
		3rd	3.4 km/h (2.1 mph)		Middle : 0 to 12.4 km/h (0 to 7.7 mph)	
		4th	5.0 km/h (3.1 mph)			
		5th	7.1 km/h (4.4 mph)			
		6th	10.0 km/h (6.2 mph)		High : 0 to 21.1 km/h (0 to 13.1 mph)	
		7th	16.3 km/h (10.1 mph)			
8th		24.1 km/h (15.0 mph)				

SPECIFICATIONS (Continued)

Model		L3710		
		4WD	4WD-GST	4WD-HST
Maximum PTO power		23.5 kW (31.5 HP)*		22.4 kW (30.0 HP)*
Engine NET power		27.3 kW (36.6 HP)*		
Engine	Model	V1903- A		
	Type	Indirect injection, Vertical, Water-Cooled, 4-cycle diesel engine		
	Number of cylinders	4		
	Bore and stroke	80 x 92.4 mm (3.1 x 3.6 in.)		
	Total displacement	1857 cm ³ (113.3 cu.in.)		
	Rated revolution	43.3 r/s (2600 rpm)		
	Combustion chamber	Spherical type (E-TVCS)		
	Fuel injection pump	Bosch type mini pump (PFR4M)		
	Governor	Centrifugal ball mechanical governor		
	Injection nozzle	Throttle type		
	Injection timing	Before T.D.C. 0.314 rad (18°)		
	Injection order	1-3-4-2		
	Injection pressure	13.73 MPa (140 kgf/cm ² , 1991 psi)		
	Compression ratio	23 : 1		
	Lubricating system	Forced lubrication by trochoidal pump		
	Cooling system	Pressurized radiator, Forced circulation with water pump		
	Starting system	Electric starting with cell starter 12 V, 1.4 kW		
	Alternator	12 V, 480 W (40 AMPS)		
	Battery	12V, RC : 137 min, CCA : 447- Cold cranking Amps at -18 °C (- 0.4 °F)		
	Fuel	Diesel fuel No. 1 [below - 10 °C (14 °F)] Diesel fuel No. 2 [above - 10 °C (14 °F)]		
Lubricating oil	CC or CD (API grade)			
Weight (Dry)	206.5 kg (455 lbs)			
Capacities	Fuel tank	35.0 ℓ (9.2 U.S.gals., 7.7 Imp.gals.)		
	Engine crankcase	7.6 ℓ (8.0 U.S.qts., 6.7 Imp.qts.)		
	Engine coolant	7.5 ℓ (7.9 U.S.qts., 7.0 Imp.qts.)		
	Transmission case	39.0 ℓ (10.3 U.S.gals., 8.6 Imp.gals.)		
	Front axle case	5.5 ℓ (5.8 U.S.qts., 4.8 Imp.qts.)		
Dimensions (with Std. tires)	Overall length (without 3P)	3000 mm (118.1 in.)		
	Overall length (with 3P)	3210 mm (126.4 in.)		
	Overall width (minimum tread)	1425 mm (56.1 in.)		
	Overall height (Top of ROPS)	2120 mm (83.5 in.)		
	Overall height (Top of steering wheel)	1525 mm (60.0 in.)		
	Wheel base	1805 mm (71.1 in.)		
	Min. ground clearance (Under transmission)	335 mm (13.2 in.)		
	Tread	Front mm (in.)	1155 (45.5)	
	Rear mm (in.)	1180 (46.5), 1200 (47.2), 1300 (51.2), 1450 (57.1), 1545 (60.8)		

Note : * Manufacturer's estimate

Model			L3710		
			4WD	4WD-GST	4WD-HST
Traveling system	Tire size (Std. tires)	Front	8.3 - 16		
		Rear	13.6 - 24		
	Clutch		Dry type single stage		
	Steering		Hydrostatic power steering		
	Transmission		Synchronized shuttle and synchronized transmission (8 forward)	Glide shift transmission (8 forward and 8 reverse speeds)	
	Brake	Traveling	Wet disc type		
		Parking	Connected with the traveling brake		
Differential		Bevel gear			
Hydraulic system	Hydraulic control system		Position control, Draft and Mixed control (if equipped)		
	Pump capacity (Max. flow rate)		Main pump 29.5 ℓ /min (7.8 GPM) Power steering pump 15.3 ℓ /min (4.0 GPM)		
	Three point hitch		SAE Category I		
	Maximum lifting capacity (24 in. behind lower link end)		1050 kg (2310 lbs)		
Rear PTO	PTO shaft		SAE 1-3/8, 6-splines (with overrunning clutch)		
	Revolution	Transmission PTO	1 speed : 9.0 r/s (540 rpm) / engine 40.8 r/s (2447 rpm)		—
		Independent PTO	1 speed : 9.0 r/s (540 rpm) / engine 41.3 r/s (2475 rpm)		1 speed : 9.0 r/s (540 rpm) / engine 40.6 r/s (2436 rpm)
Mid PTO	PTO shaft		USA No. 5 (KUBOTA 10-tooth) involute spline		
	Revolution	Transmission PTO	1 speed : 33.3 r/s (2000 rpm) / engine 40.1 r/s (2404 rpm)		—
		Independent PTO	1 speed : 33.3 r/s (2000 rpm) / engine 40.5 r/s (2432 rpm)		1 speed : 33.3 r/s (2000 rpm) / engine 39.9 r/s (2394 rpm)
Min. turning radius (with brake)			2.5 m (8.2 ft)		2.6 m (8.5 ft)
Traction system			Fixed drawbar or swing drawbar (if equipped)		
Weight (with ROPS)			1340 kg (2955 lbs)	1345 kg (2965 lbs)	1355 kg (2990 lbs)
Traveling speed (at rated engine speed with Std. tires)	Forward	1st	1.4 km/h (0.9 mph)		Low : 0 to 5.8 km/h (0 to 3.6 mph)
		2nd	2.0 km/h (1.2 mph)		
		3rd	3.2 km/h (2.0 mph)		
		4th	4.8 km/h (3.0 mph)		Middle : 0 to 10.8 km/h (0 to 6.7 mph)
		5th	6.8 km/h (4.2 mph)		
		6th	9.6 km/h (6.0 mph)		High : 0 to 23.1 km/h (0 to 14.4 mph)
		7th	15.6 km/h (9.7 mph)		
		8th	23.0 km/h (14.3 mph)		
	Reverse	1st	1.3 km/h (0.8 mph)		Low : 0 to 4.6 km/h (0 to 2.9 mph)
		2nd	1.8 km/h (1.1 mph)		
		3rd	3.0 km/h (1.9 mph)		Middle : 0 to 8.6 km/h (0 to 5.4 mph)
		4th	4.4 km/h (2.7 mph)		
		5th	6.2 km/h (3.9 mph)		High : 0 to 18.5 km/h (0 to 11.5 mph)
		6th	8.8 km/h (5.5 mph)		
		7th	14.3 km/h (8.9 mph)		
8th		21.1 km/h (13.1 mph)			

SPECIFICATIONS (Continued)













Model		L4310			
		2WD	4WD	4WD-GST	4WD-HST
Maximum PTO power		28.0 kW (37.5 HP)*			26.8 kW (36.0 HP)*
Engine NET power		32.1 kW (43.0 HP)*			
Engine	Model	V2203- A			
	Type	Indirect injection, Vertical, Water-Cooled, 4-cycle diesel engine			
	Number of cylinders	4			
	Bore and stroke	87 × 92.4 mm (3.4 × 3.6 in.)			
	Total displacement	2197 cm ³ (134.1 cu.in.)			
	Rated revolution	43.3 r/s (2600 rpm)			
	Combustion chamber	Spherical type (E-TVCS)			
	Fuel injection pump	Bosch type mini pump (PFR4M)			
	Governor	Centrifugal ball mechanical governor			
	Injection nozzle	Throttle type			
	Injection timing	Before T.D.C. 0.314 rad (18°)			
	Injection order	1-3-4-2			
	Injection pressure	13.73 MPa (140 kgf/cm ² , 1991 psi)			
	Compression ratio	23 : 1			
	Lubricating system	Forced lubrication by trochoidal pump			
	Cooling system	Pressurized radiator, Forced circulation with water pump			
	Starting system	Electric starting with cell starter 12 V, 1.4 kW			
	Alternator	12 V, 480 W (40 AMPS)			
	Battery	12V, RC : 137 min, CCA : 447- Cold cranking Amps at -18°C (-0.4°F)			
	Fuel	Diesel fuel No. 1 [below - 10 °C (14 °F)] Diesel fuel No. 2 [above - 10 °C (14 °F)]			
Lubricating oil	CC or CD (API grade)				
Weight (Dry)	206.5 kg (455 lbs)				
Capacities	Fuel tank	35.0 ℓ (9.2 U.S.gals., 7.7 Imp.gals.)			
	Engine crankcase	7.6 ℓ (8.0 U.S.qts., 6.7 Imp.qts.)			
	Engine coolant	7.5 ℓ (7.9 U.S.qts., 7.0 Imp.qts.)			
	Transmission case	39.0 ℓ (10.3 U.S.gals., 8.6 Imp.gals.)			
	Front axle case	—	5.5 ℓ (5.8 U.S.qts., 4.8 Imp.qts.)		
Dimensions (with Std. tires)	Overall length (without 3P)	3020 mm (118.9 in.)			
	Overall length (with 3P)	3230 mm (127.2 in.)			
	Overall width (minimum tread)	1585 mm (62.4 in.)			
	Overall height (Top of ROPS)	2145 mm (84.4 in.)			
	Overall height (Top of steering wheel)	1535 mm (60.4 in.)			
	Wheel base	1810 mm (71.3 in.)	1805 mm (71.1 in.)		
	Min. ground clearance (Under transmission)	370 mm (14.6 in.)			
	Tread	Front mm (in.)	1145 (45.1) 1245 (49.0) 1345 (53.0) 1445 (56.9)	1155 (45.5)	
Rear mm (in.)		1180 (46.5), 1200 (47.2), 1300 (51.2), 1450 (57.1), 1545 (60.8)			

Note : * Manufacturer's estimate

Model			L4310			
			2WD	4WD	4WD-GST	4WD-HST
Traveling system	Tire size (Std. tires)	Front	6.00 – 16	8.3 – 16		
		Rear	14.9 – 24			
	Clutch		Dry type single stage			
	Steering		Hydrostatic power steering			
	Transmission		Synchronized shuttle and synchronized transmission (8 forward and 8 reverse speeds)	Glide shift transmission (8 forward and 8 reverse speeds)		Hydrostatic transmission (3 speeds)
	Brake	Traveling	Wet disc type			
		Parking	Connected with the traveling brake			
Differential		Bevel gear				
Hydraulic system	Hydraulic control system		Position control, Draft and Mixed control (if equipped)			
	Pump capacity (Max. flow rate)		Main pump 29.5 ℓ/min (7.8 GPM) Power steering pump 15.3 ℓ/min (4.0 GPM)			
	Three point hitch		SAE Category I			
	Maximum lifting capacity (24 in. behind lower link end)		1050 kg (2310 lbs)			
Rear PTO	PTO shaft		SAE 1-3/8, 6-splines (with overrunning clutch)			
	Revolution	Transmission PTO	1 speed : 9.0 r/s (540 rpm) / engine 40.8 r/s (2447 rpm)			—
		Independent PTO	1 speed : 9.0 r/s (540 rpm) / engine 41.3 r/s (2475 rpm)			1 speed : 9.0 r/s (540 rpm) / engine 40.6 r/s (2436 rpm)
Min. turning radius (with brake)			2.5 m (8.2 ft)		2.6 m (8.5 ft)	
Traction system			Fixed drawbar or swing drawbar (if equipped)			
Weight (with ROPS)			1305 kg (2875 lbs)	1375 kg (3030 lbs)	1380 kg (3040 lbs)	1390 kg (3060 lbs)
Traveling speed (at rated engine speed with Std. tires)	Forward	1st	1.5 km/h (0.9 mph)			Low : 0 to 6.0 km/h (0 to 3.7 mph)
		2nd	2.1 km/h (1.3 mph)			
		3rd	3.3 km/h (2.1 mph)			Middle : 0 to 11.2 km/h (0 to 7.0 mph)
		4th	4.9 km/h (3.0 mph)			
		5th	7.0 km/h (4.3 mph)			High : 0 to 23.9 km/h (0 to 14.9 mph)
		6th	9.9 km/h (6.2 mph)			
		7th	16.1 km/h (10.0 mph)			
		8th	23.7 km/h (14.7 mph)			
	Reverse	1st	1.3 km/h (0.8 mph)			Low : 0 to 4.8 km/h (0 to 3.0 mph)
		2nd	1.9 km/h (1.2 mph)			
		3rd	3.1 km/h (1.9 mph)			Middle : 0 to 9.0 km/h (0 to 5.6 mph)
		4th	4.5 km/h (2.8 mph)			
		5th	6.4 km/h (4.0 mph)			High : 0 to 19.1 km/h (0 to 11.9 mph)
		6th	9.1 km/h (5.7 mph)			
		7th	14.7 km/h (9.1 mph)			
8th		21.8 km/h (13.5 mph)				

TRAVELING SPEEDS (WITH CREEP GEAR)

(at rated engine rpm)

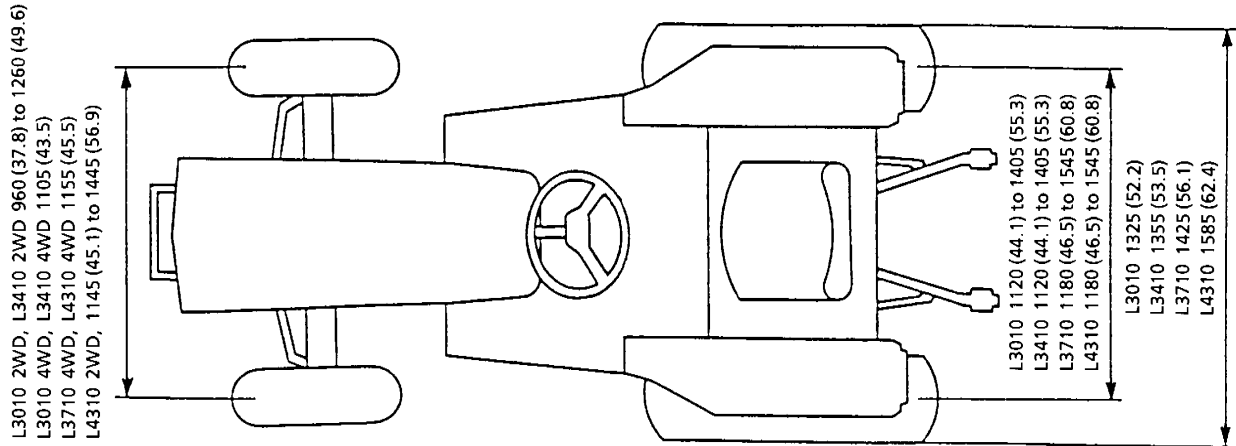
Model				L3010		L3410		L3710		L4310	
Tire size (Rear)				11.2-24		12.4-24		13.6-24		14.9-24	
	Creep speed shift lever	Hi-Lo shift lever	Main shift lever	km/h	mph	km/h	mph	km/h	mph	km/h	mph
Forward		 (Low)	1	0.17	0.11	0.18	0.11	0.16	0.10	0.16	0.10
			2	0.24	0.15	0.26	0.16	0.22	0.14	0.23	0.14
			3	0.39	0.24	0.41	0.26	0.36	0.22	0.37	0.23
			4	0.58	0.36	0.61	0.38	0.53	0.33	0.55	0.34
		 (High)	1	0.82	0.51	0.87	0.54	0.76	0.48	0.78	0.49
			2	1.16	0.72	1.23	0.77	1.07	0.67	1.11	0.69
			3	1.88	1.17	1.99	1.24	1.74	1.09	1.80	1.13
			4	2.77	1.73	2.94	1.84	2.57	1.61	2.66	1.66
	 (Off)	 (Low)	1	1.51	0.94	1.61	1.01	1.41	0.88	1.45	0.91
			2	2.14	1.34	2.28	1.42	1.99	1.24	2.06	1.29
			3	3.48	2.18	3.69	2.31	3.23	2.02	3.34	2.09
			4	5.13	3.21	5.46	3.41	4.77	2.98	4.93	3.08
		 (High)	1	7.28	4.55	7.74	4.84	6.77	4.23	7.00	4.38
			2	10.31	6.44	10.95	6.84	9.58	5.99	9.90	6.19
			3	16.73	10.46	17.78	11.11	15.55	9.72	16.07	10.04
			4	24.71	15.44	26.26	16.41	22.96	14.35	23.74	14.84
Reverse		 (Low)	1	0.16	0.10	0.16	0.10	0.15	0.09	0.15	0.09
			2	0.22	0.14	0.24	0.15	0.20	0.13	0.21	0.13
			3	0.36	0.22	0.38	0.23	0.33	0.21	0.34	0.21
			4	0.53	0.33	0.56	0.35	0.49	0.30	0.50	0.32
		 (High)	1	0.75	0.47	0.80	0.50	0.70	0.44	0.71	0.45
			2	1.06	0.66	1.13	0.70	0.98	0.61	1.02	0.64
			3	1.72	1.08	1.82	1.14	1.59	1.00	1.65	1.03
			4	2.54	1.59	2.69	1.68	2.36	1.47	2.44	1.52
	 (Off)	 (Low)	1	1.38	0.87	1.48	0.92	1.29	0.81	1.33	0.83
			2	1.96	1.23	2.09	1.31	1.82	1.14	1.89	1.18
			3	3.19	1.99	3.38	2.11	2.96	1.85	3.06	1.91
			4	4.70	2.94	5.00	3.13	4.37	2.73	4.52	2.82
		 (High)	1	6.67	4.17	7.09	4.43	6.21	3.88	6.42	4.01
			2	9.45	5.91	10.04	6.27	8.78	5.49	9.07	5.67
			3	15.33	9.58	16.30	10.19	14.25	8.91	14.73	9.21
			4	22.65	14.16	24.07	15.04	21.05	13.15	21.76	13.60

[HST Type]

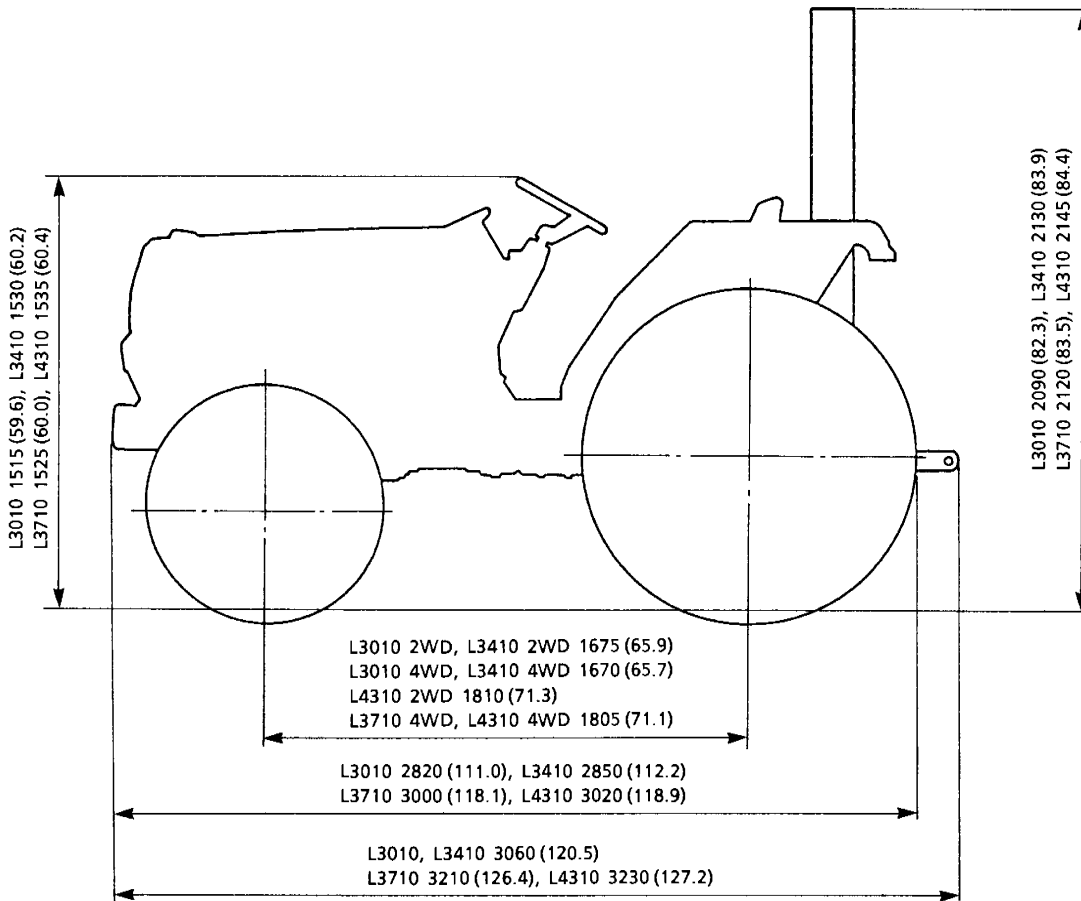
Model		L3010		L3410		L3710		L4310	
Tire size (Rear)		12.4-24		12.4-24		13.6-24		14.9-24	
Forward	Hi	0 to 6.6	0 to 4.1	0 to 6.6	0 to 4.1	0 to 5.8	0 to 3.6	0 to 6.0	0 to 3.7
	Mi	0 to 12.4	0 to 7.7	0 to 12.4	0 to 7.7	0 to 10.8	0 to 6.7	0 to 11.2	0 to 7.0
	Lo	0 to 26.4	0 to 16.4	0 to 26.4	0 to 16.4	0 to 23.1	0 to 14.4	0 to 23.9	0 to 14.9
Reverse	Hi	0 to 6.6	0 to 4.1	0 to 6.6	0 to 4.1	0 to 4.6	0 to 2.9	0 to 4.8	0 to 3.0
	Mi	0 to 12.4	0 to 7.7	0 to 12.4	0 to 7.7	0 to 8.6	0 to 5.4	0 to 9.0	0 to 5.6
	Lo	0 to 21.1	0 to 13.1	0 to 21.1	0 to 13.1	0 to 18.5	0 to 11.5	0 to 19.1	0 to 11.9

DIMENSIONS

Unit : mm (in.)



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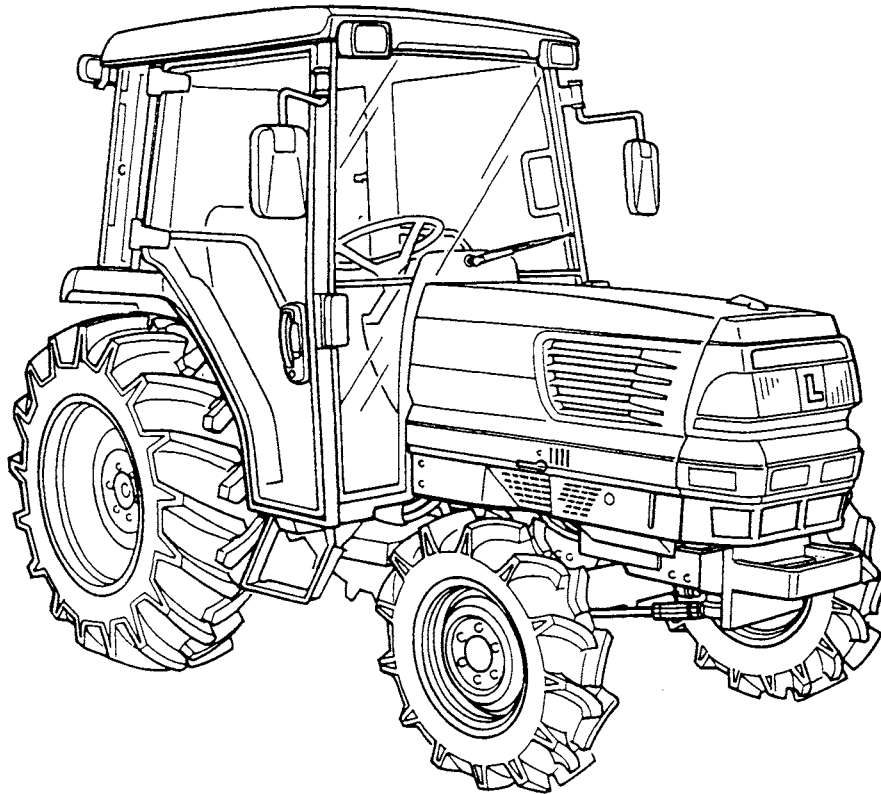


B161F004

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[1] FEATURES



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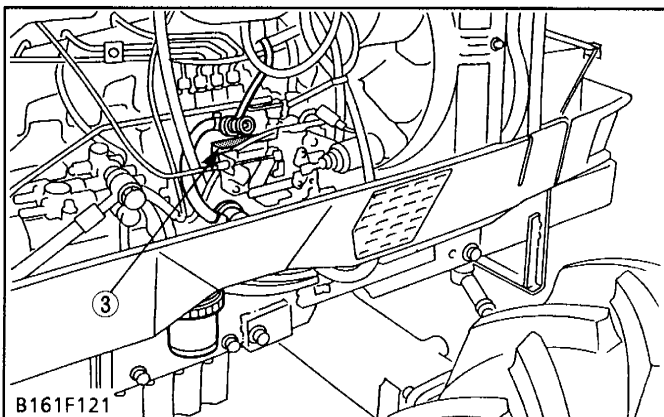
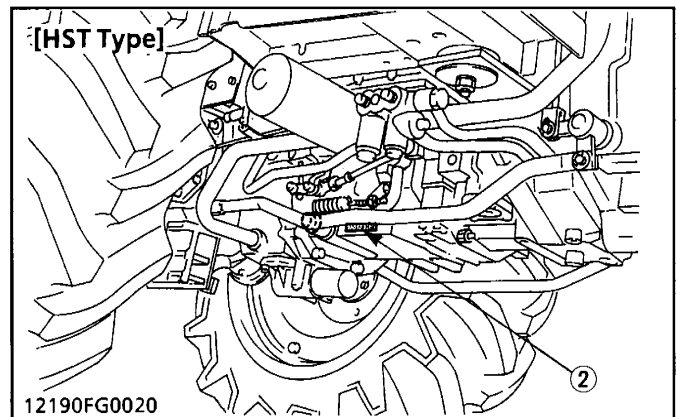
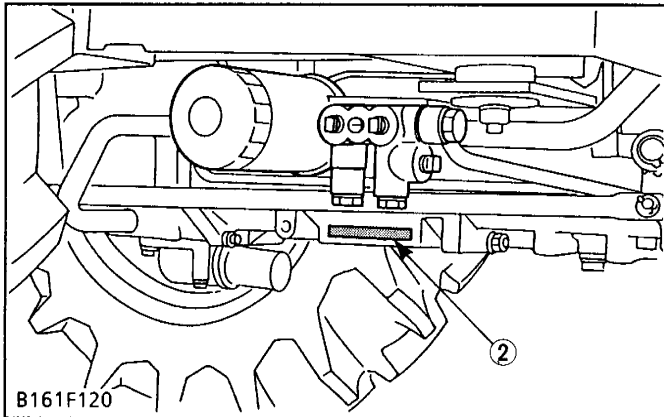
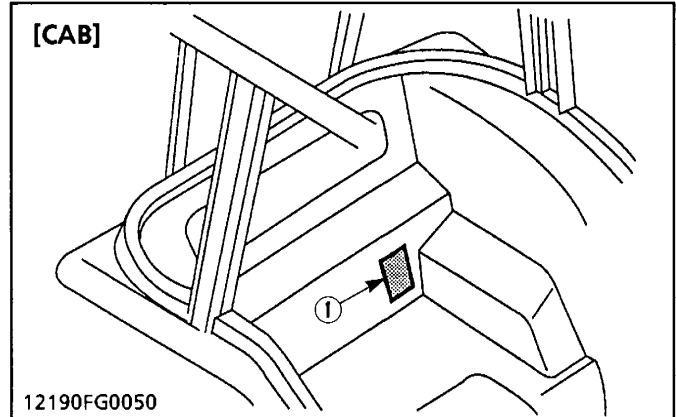
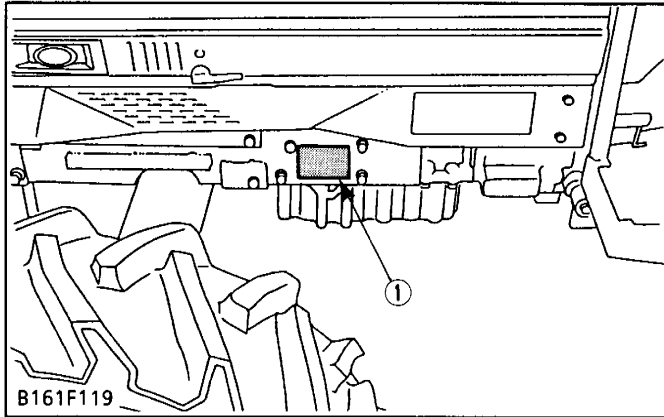
L3010, L3410, L3710 and L4310 tractors have the unique KUBOTA E-TVCS (Three Vortex Combustion System) Diesel Engine that delivers a more dynamic output and a greater torque with cleaner emissions.

The drive mechanisms are either Hydrostatic Transmission (HST), the GST (Glide Shift Transmission) or the Manual Transmission which incorporates the Synchro-Shuttle and the Full-Synchro Main Transmission. The some models are available CABIN specification. The comfortable integral cabin by KUBOTA.

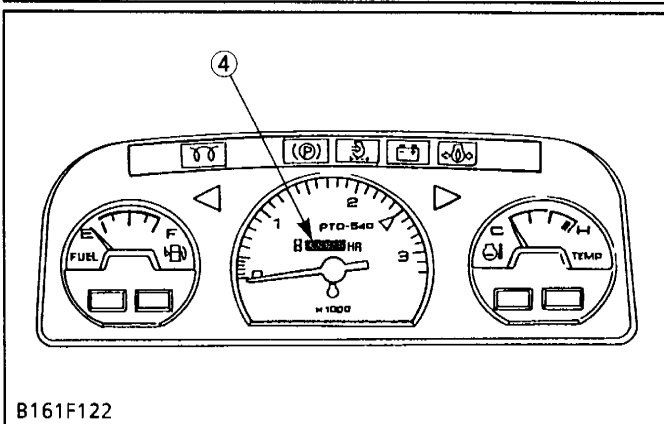
Other distinctive features which contribute to making tractors in this series outperform all other tractors in the same class in comfort, durability, maneuverability, mobility, and ease of operation include the hydraulically actuated Independent PTO, the large-capacity Clutch, the large lift capacity of the 3-Point Hitch, Hydrostatic Power Steering, the Full-Floating Type Flat Deck, and the Hanging-Type Pedals.

[2] TRACTOR IDENTIFICATION

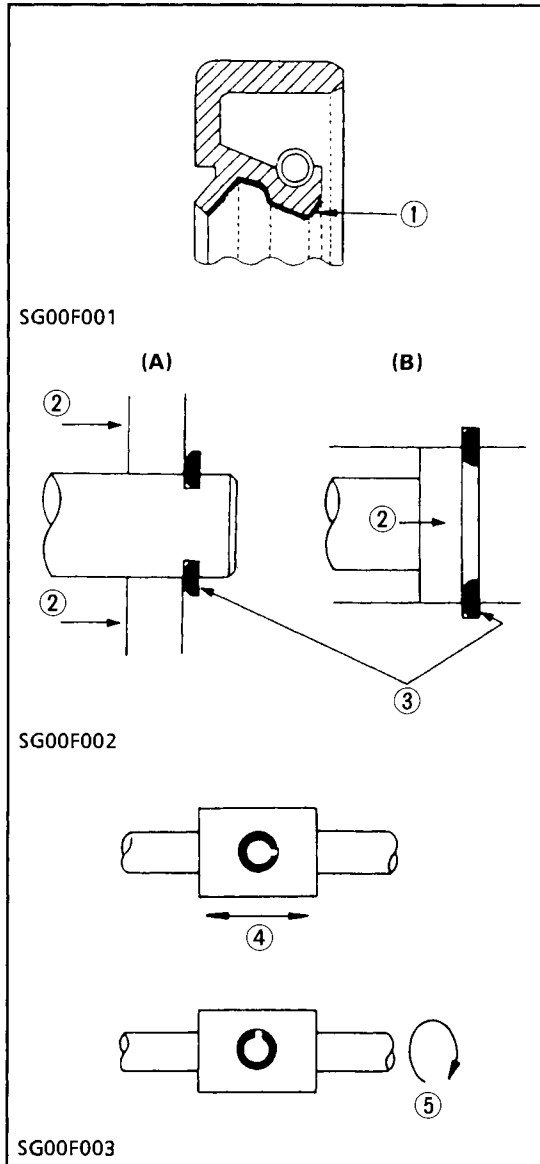
When contacting your local KUBOTA distributor, always specify engine serial number, tractor serial number and hourmeter reading.



- (1) Tractor Identification Plate
- (2) Tractor Serial Number
- (3) Engine Serial Number
- (4) Hour Meter
- (5) Cabin Identification Plate
Cabin Serial Number



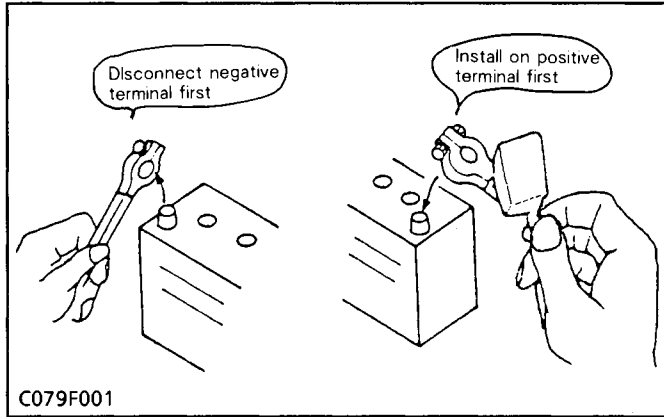
[3] GENERAL PRECAUTIONS



- During disassembly, carefully arrange removed parts in a clean area to prevent confusion later. Bolts and nuts should be installed in their original position to prevent reassembly errors.
- When special tools are required, use KUBOTA genuine special tools. Special tools which are not frequently used should be made according to the drawings provided.
- Before disassembling or servicing electrical wires, always disconnect the ground cable from the battery first.
- Remove oil and dirt from parts before measuring.
- Use only KUBOTA genuine parts for parts replacement to maintain tractor performance and to assure safety.
- Gaskets and O-rings must be replaced during reassembly. Apply grease to new O-rings or oil seals before assembling. See the figure left side.
- When reassembling external snap rings or internal snap rings, they must be positioned so that sharp edge faces against the direction from which a force is applied. See the figure left side.
- When inserting spring pins, their splits must face the direction from which a force is applied. See the figure left side.
- To prevent damage to the hydraulic system, use only specified fluid or equivalent.

- (1) Grease
 - (2) Force
 - (3) Sharp Edge
 - (4) Axial Force
 - (5) Rotating Movement
- [A] External Snap Ring
 - [B] Internal Snap Ring

[4] HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING

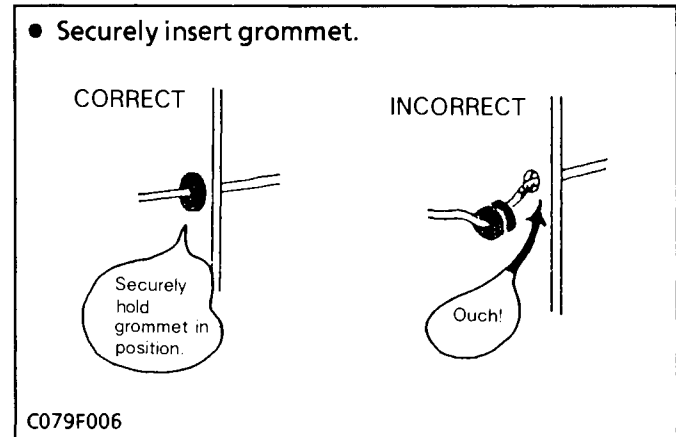
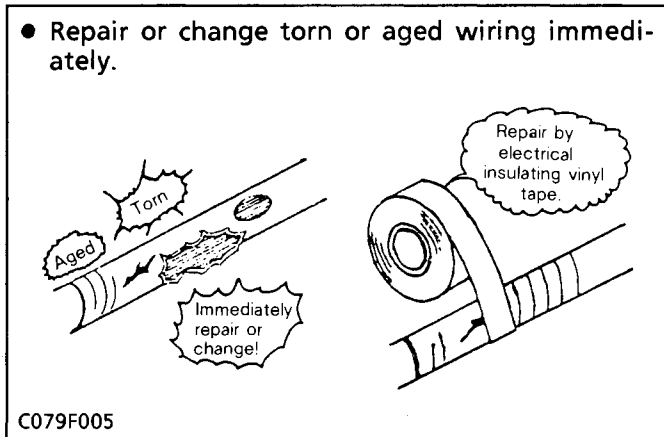
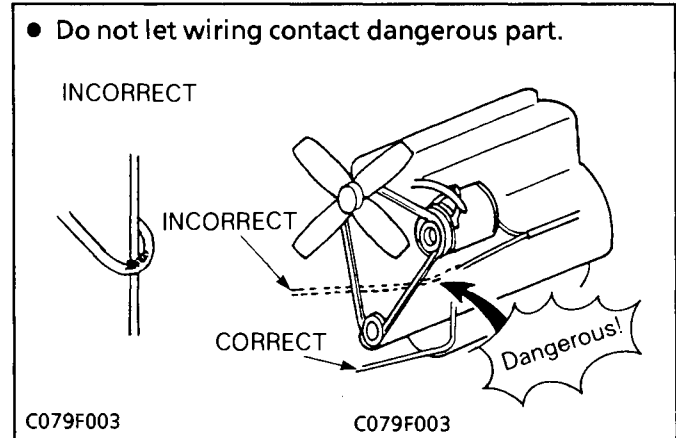
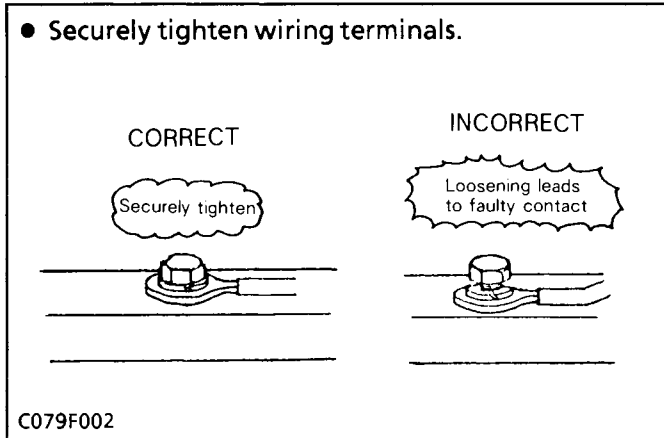


To ensure safety and prevent damage to the machine and surrounding equipment, heed the following precautions in handling electrical parts and wiring.

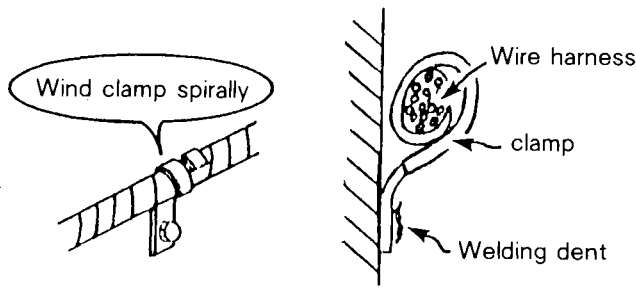
■ IMPORTANT

- Check electrical wiring for damage and loosened connection every year. To this end, educate the customer to do his or her own check and at the same time recommend the dealer to perform periodic check for a fee.
- Do not attempt to modify or remodel any electrical parts and wiring.
- When removing the battery cord, disconnect the negative wire first. When installing the battery cord, connect the positive wire first.

■ Wiring



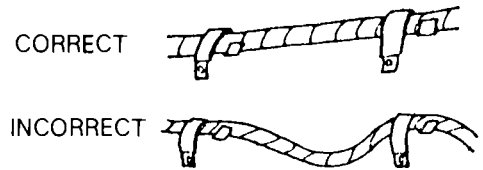
- Securely clamp, being careful not to damage wiring.



C079F007

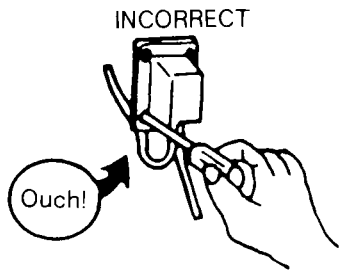
C079F008

- Clamp wiring so that there is no twist, unnecessary sag, or excessive tension, except for movable part, where sag may be required.



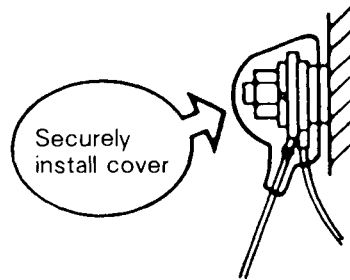
C079F009

- In installing a part, take care not to get wiring caught by it.



C079F010

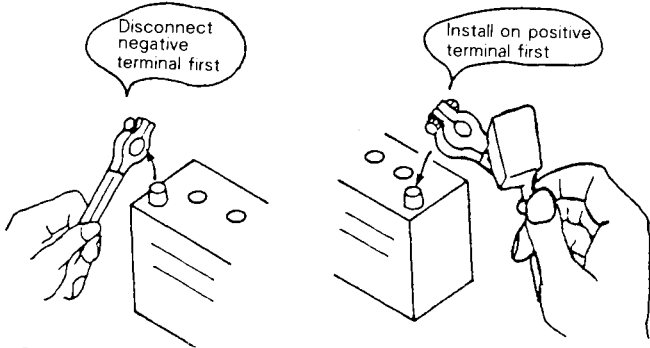
- After installing wiring, check protection of terminals and clamped condition of wiring, only then connect battery.



C079F011

Battery

Take care not to confuse positive and negative terminals.



C079F001

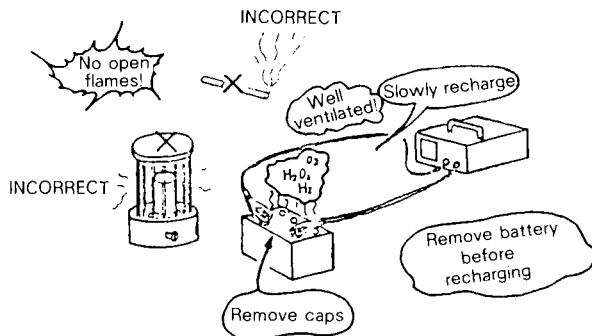
- When removing battery cord, disconnect negative wire first. When installing battery cord, check for polarity and connect positive wire first.
- Do not install any battery with capacity other than is specified (Ah).
- After connecting cord to battery terminals, apply grease to them and securely install terminal covers on them.
- Do not allow dirt and dust to collect on battery.

CAUTION

- Take care not to let battery liquid spill on your skin and clothes. If contaminated, wash it off with water immediately.
- Before recharging the battery, remove it from the machine.
- Before recharging, remove cell caps.

CAUTION

- Do recharging in a well-ventilated place where there is no open flame nearby, as hydrogen gas and oxygen are formed.



C079F013

■ Fuse

- Use fuses with specified capacity.
- Never use steel or copper wire in place of fuse.

Use the fuses with specified capacity

Neither too large or small capacity fuse is acceptable!

Do not substitute copper or steel wire!

C079F014

- Do not install working light, radio set, etc. on machine which is not provided with reserve power supply.
- Do not install accessories if fuse capacity of reserve power supply is exceeded.

Use reserve power supply for working light

It is dangerous to modify or remodel as you please

C079F015

■ Connector

- For connector with lock, push lock to separate.

Unlock

Push lock to remove

C079F016

- In separating connectors, do not pull wire harnesses.

CORRECT

Hold connector bodies to separate

INCORRECT

Ouch!

Getting torn off

C079F017

- Use sandpaper to remove rust from terminals.
- Repair deformed terminal. Make certain there is no terminal being exposed or displaced.

Use sandpaper remove rust from terminals.

No bending!

No displaced or exposed terminal

C079F018

C079F019

- Make certain that there is no female connector being too open.

CORRECT

INCORRECT

C079F020

CORRECT

INCORRECT

C079F021

- Make certain plastic cover is large enough to cover whole connector.

CORRECT

Plastic cover large enough to cover entire connector

INCORRECT

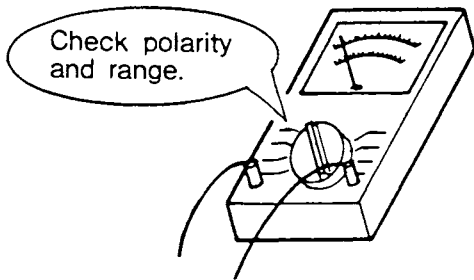
No coming off

No tear off

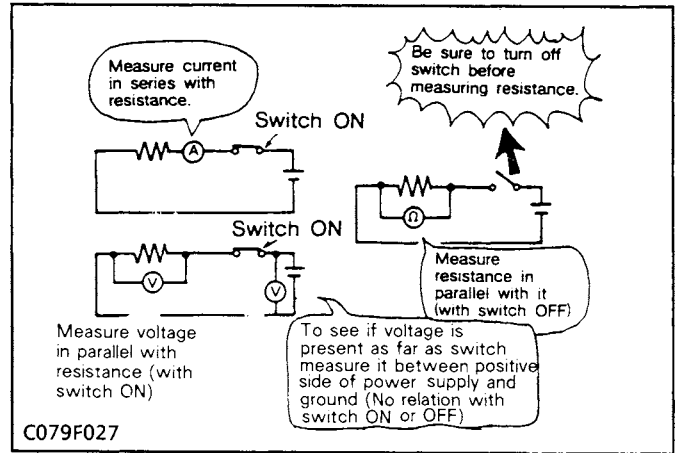
C079F028

■ Handling of Circuit Testers

- Use tester correctly following manual provided with tester.
- Check for polarity and range.



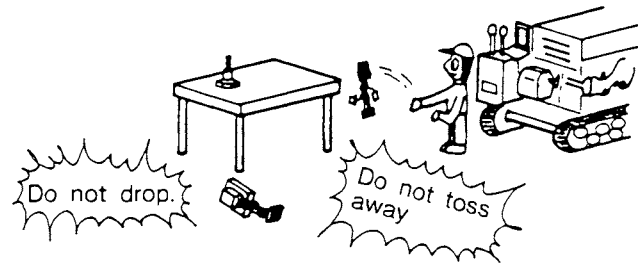
C079F026



C079F027

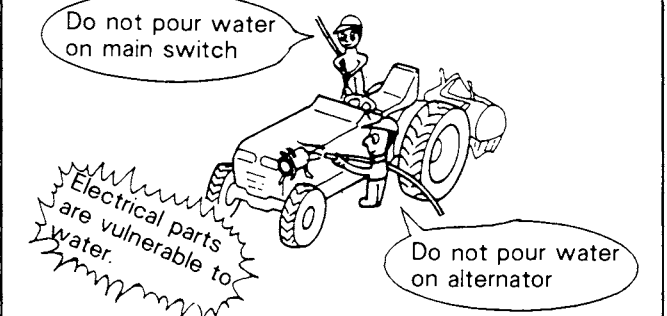
■ Handling of Parts

- Do not throw or drop electrical parts and wire harnesses.



C079F023

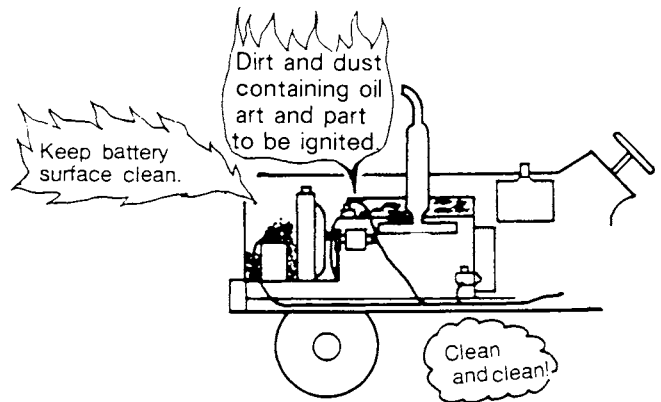
- Do not pour water on electrical parts such as main switch and alternator.



C079F025

■ Oil, Dust and Dirt

- If flammable material such as fuel, or lubricant spills, wipe it off with dry piece of cloth. Do not approach it with an open flame.
- Replace fuel pipe that is aged.
- Remove dirt and dust accumulated on heated part, wire harness, battery, etc.



C079F024




[5] LUBRICANTS, FUEL AND COOLING WATER

Place	Capacity				Lubricants, fuel and cooling water
	L3010	L3410	L3710	L4310	
Fuel tank	35 ℓ 9.2 U.S.gals. 7.7 Imp. gals.				No.2-D diesel fuel No.1-D diesel fuel if temperature is below - 10 °C (14 °F)
Cooling system	7.0 ℓ 7.4 U.S.qts. 6.2 Imp.qts.		7.5 ℓ 7.9 U.S.qts. 6.6 Imp.qts.		Fresh clean water with anti-freeze
Engine crankcase	5.5 ℓ 5.8 U.S.qts. 4.8 Imp.qts.		7.6 ℓ 8.0 U.S.qts. 7.0 Imp.qts.		Engine oil : API Service CC or CD Below 0 °C (32 °F) SAE10W, 10W-30 or 10W-40 0 to 25 °C (32 to 77 °F) SAE20, 10W-30 or 10W-40 Above 25 °C (77 °F) SAE30, 10W-30 or 10W-40
Transmission case	39 ℓ 41.2 U.S.qts. 34.3 Imp.qts.				KUBOTA SUPER UDT fluid *
Front axle case [4WD]	5.5 ℓ 5.8 U.S.qts. 4.8 Imp.qts.				KUBOTA SUPER UDT fluid * or SAE 80, 90 gear oil
Greasing					
Front wheel hub [2WD]	Until grease overflows			2 points	Bearing grease
Knuckle shaft [2WD]				2 points	SAE multi-purpose type grease
Top link				1 or 2 points	
Top link bracket (with draft control)				2 points	
Lift rod				1 point	
Power steering cylinder				1 point	
Battery terminal	Moderate amount			2 points	

* : KUBOTA original transmission hydraulic fluid

[6] TIGHTENING TORQUES (GENERAL USE SCREWS, BOLTS AND NUTS)

Screws, bolts and nuts whose tightening torques are not specified in this Workshop Manual should be tightened according to the table below.

Indication on top of bolt	 No-grade or 4T						 7T						 9T		
Material of bolt	SS400, S20C						S43C, S48C						SCr435, SCM435		
Material of opponent part	Ordinariness			Aluminum			Ordinariness			Aluminum			Ordinariness		
	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs
M 6 (6 mm, 0.24 in.)	7.84 to 9.31	0.80 to 0.95	5.79 to 6.87	7.84 to 8.83	0.80 to 0.90	5.79 to 6.51	9.80 to 11.2	1.00 to 1.15	7.24 to 8.32	7.84 to 8.83	0.80 to 0.90	5.79 to 6.51	12.3 to 14.2	1.25 to 1.45	9.05 to 10.5
M 8 (8 mm, 0.31 in.)	17.7 to 20.5	1.8 to 2.1	13.0 to 15.2	16.7 to 19.6	1.7 to 2.0	12.3 to 14.5	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
M10 (10 mm, 0.39 in.)	39.2 to 45.0	4.0 to 4.6	29.0 to 33.2	31.4 to 34.3	3.2 to 3.5	23.1 to 25.3	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5	60.8 to 70.5	6.2 to 7.2	44.9 to 52.1
M12 (12 mm, 0.47 in.)	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5				77.5 to 90.1	7.9 to 9.2	57.2 to 66.5	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5	103 to 117	10.5 to 12.0	76.0 to 86.8
M14 (14 mm, 0.55 in.)	108 to 125	11.0 to 12.8	79.6 to 92.5				124 to 147	12.6 to 15.0	91.2 to 108				167 to 196	17.0 to 20.0	123 to 144
M16 (16mm, 0.63 in.)	167 to 191	17.0 to 19.5	123 to 141				196 to 225	20.0 to 23.0	145 to 166				260 to 303	26.5 to 31.0	192 to 224
M18 (18 mm, 0.71 in.)	245 to 284	25.0 to 29.0	181 to 210				275 to 318	28.0 to 32.5	203 to 235				343 to 401	35.0 to 41.0	254 to 297
M20 (20mm, 0.79 in.)	334 to 392	34.0 to 40.0	246 to 289				368 to 431	37.5 to 44.0	272 to 318				490 to 568	50.0 to 58.0	362 to 420

[7] MAINTENANCE CHECK LIST

No.	Check point	Indication on hour meter (Change or check every interval shown below)																After purchase		Reference page
		50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	1 year	2 years	
1	Greasing	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			G-14	
2	Engine starting system checking	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			G-15	
3	Wheel bolt torque checking	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			G-16	
4	Battery condition checking		○		○		○		○		○		○		○				G-15	
5	Engine oil changing	⊙	○		○		○		○		○		○		○				G-12	
6	Air cleaner element cleaning ★		○		○		○		○		○		○		○				G-17	
7	Fuel filter element cleaning		○		○		○		○		○		○		○				G-17	
8	Fan belt tension adjustment		○		○		○		○		○		○		○				G-18	
9	Clutch pedal free travel adjustment	⊙	○		○		○		○		○		○		○				G-18	
10	Brake pedal free travel adjustment		○		○		○		○		○		○		○				G-18	
11	Engine oil filter cartridge replacement	⊙			○				○				○						G-12	
12	Hydraulic oil filter cartridge replacement	⊙			○				○				○						G-12	
13	Radiator hose and clamp checking				○				○				○						G-19	
14	Power steering oil line checking				○				○				○						G-19	
15	Fuel line checking				○				○				○						G-20	
16	Toe-in adjustment				○				○				○						G-19	
17	Transmission fluid changing	⊙							○								○		G-13	
18	Front axle case oil changing	⊙							○								○		G-13	
19	Front axle pivot adjustment	⊙											○						G-14	
20	Fuel filter element replacement								○								○		G-20	
21	Greasing (2WD front wheel hub)								○								○		G-20	
22	Engine valve clearance adjustment																○		G-21	
23	Air cleaner element replacement																○		G-22	
24	Radiator hose and clamp replacement																	○	G-22	
25	Power steering oil line replacement																	○	G-22	
26	Fuel line replacement																	○	G-23	

Note : The jobs indicated by ⊙ must be done by all means 50 hours after the break-in respectively.

The jobs indicated by ☆ service as required.

★ Air cleaner should be cleaned more often in dusty conditions than in normal conditions.

[7] MAINTENANCE CHECK LIST (Continued)

No.	Check point	Indication on hour meter (Change or check every interval shown below)																After purchase		Reference page	
		50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	1 year	2 years		
27	Engine cooling system cleaning																			○	G-23
28	Coolant changing																			○	G-23
29	Fuel system bleeding ☆																				G-24
30	Clutch housing water draining ☆																				G-24
31	Fuse replacement ☆																				G-25
32	Light bulb replacement ☆																				G-25
33	Transmission oil filter replacement [HST]	⊙			○				○					○				○			
34	Transmission strainer cleaning [HST]	⊙			○				○					○				○			
35	HST oil line checking [HST]				○				○					○				○			
36	HST Oil line replacement [HST]																			○	

Note : The jobs indicated by ⊙ must be done by all means 50 hours after the break-in respectively.

The jobs indicated by ☆ service as required.

★ Air cleaner should be cleaned more often in dusty conditions than in normal conditions.

[8] CHECK AND MAINTENANCE

CAUTION

- Be sure to check and service the tractor on a flat place with engine shut off, the parking brake on and chock the wheels.

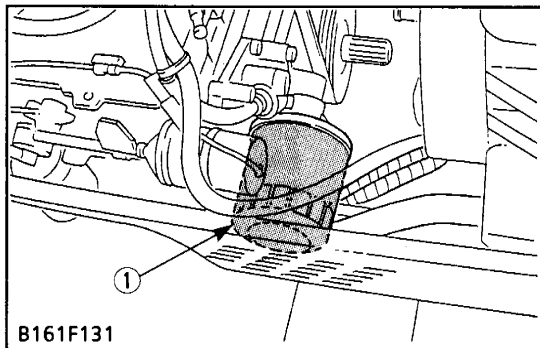
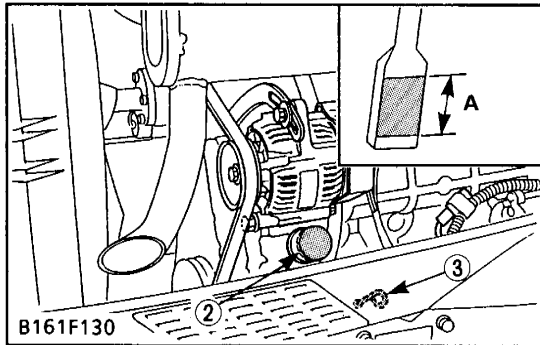
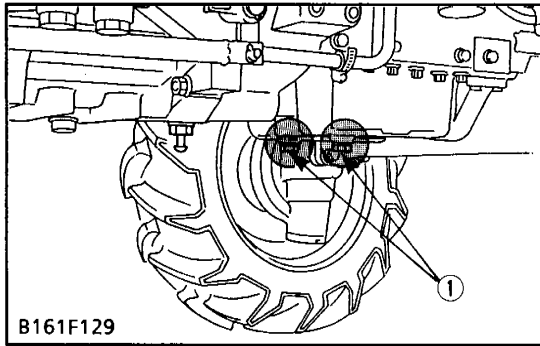
(1) Daily Check

To prevent trouble from occurring, it is important to know the condition of the tractor. Check the following items before starting.

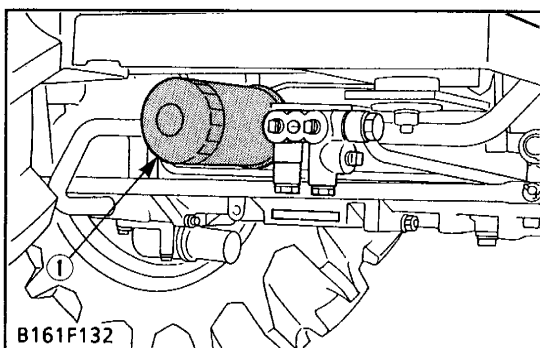
Checking

- Check areas where previous trouble was experienced.
- Walk around the tractor.
 - 1) Check the tire pressure, and check for wear and damage.
 - 2) Check for oil and water leaks.
 - 3) Check the engine oil level.
 - 4) Check the transmission fluid level.
 - 5) Check the coolant level.
 - 6) Check the condition of seat belt and ROPS attaching hardware.
 - 7) Check and clean the radiator screen.
 - 8) Check the bolts and nuts of the tires are tight.
 - 9) Check the SMV emblem for damage and cleaner replace as necessary if equipped.
 - 10) Check the front axle case oil level.
 - 11) Clean around the exhaust manifold and the muffler of the engine.
- While sitting in the operator's seat.
 - 1) Check the throttle pedal, brake pedals and clutch pedal.
 - 2) Check the parking brake.
 - 3) Check the steering wheel.
- Turning the key switch.
 - 1) Check the performance of the easy checker lights.
 - 2) Check head lights, tail lights and hazard lights. Clean if necessary.
 - 3) Check the performance of the meters and gauges.
 - 4) Check the horn if equipped.
- Starting the engine.
 - 1) Check to see that the lights on the Easy Checker go off.
 - 2) Check the color of the exhaust.
 - 3) Check the brakes for proper operation.

(2) Check Points of Initial 50 Hours



(1) Engine Oil Filter Cartridge



(1) Hydraulic Oil Filter Cartridge

Changing Engine Oil

1. Start and warm up the engine for approx. 5 minutes.
2. Place an oil pan underneath the engine.
3. To drain the used oil, remove the drain plugs (1) at the bottom of the engine and drain the oil completely.
4. Screw in the drain plug.
5. Fill new oil up to upper line on the dipstick.

■ IMPORTANT

- When using an oil of different manufacture or viscosity from the previous one, remove all of the old oil. Never mix two different types of oil.
- Use the proper SAE Engine Oil according to ambient temperatures. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-8.)

[A] Oil level is acceptable within this range.

- (1) Drain Plug (3) Dipstick
(2) Oil Inlet Plug

Replacing Engine Oil Filter Cartridge

1. Remove the engine oil filter cartridge (1).
2. When installing, apply the clean engine oil slightly to the rubber gasket.
3. Tighten the filter cartridge (1) quickly until it contacts the mounting surface. Tighten filter cartridge (1) by hand an additional 1/2 turn only.
4. After the new cartridge has been replaced the engine oil level normally decreases a little. Add engine oil to proper level. Check for oil leaks around filter gasket.

■ IMPORTANT

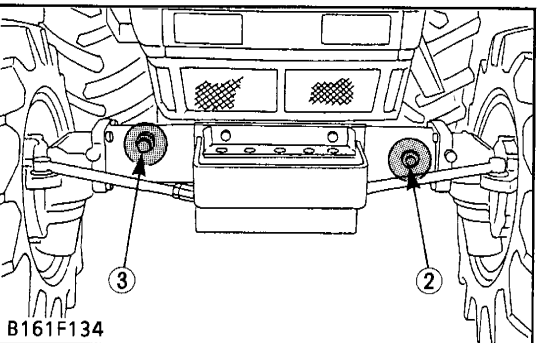
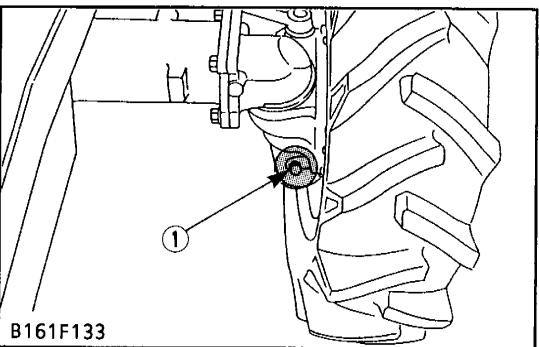
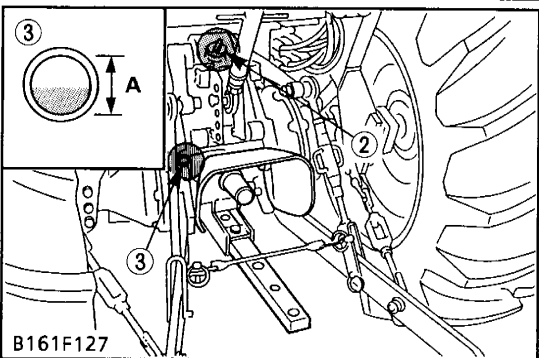
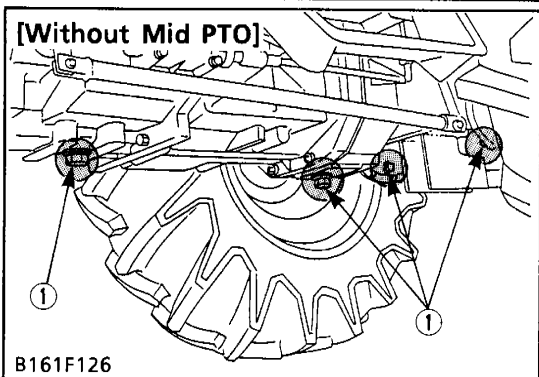
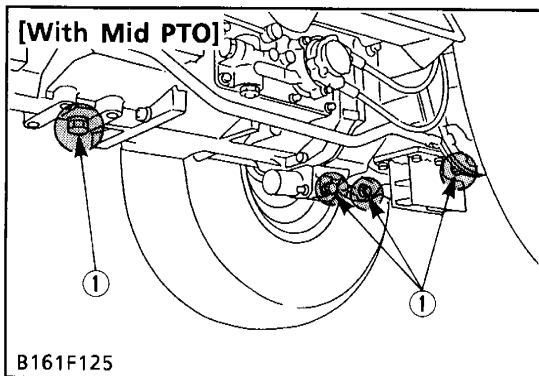
- To prevent serious damage to the engine, replacement oil filter cartridge must be highly efficient. Use only a genuine KUBOTA filter.

Replacing Hydraulic Oil Filter Cartridge

1. Remove the hydraulic oil filter cartridge (1).
2. When installing, apply the clean transmission oil slightly to the rubber gasket.
3. Tighten the hydraulic oil filter cartridge (1) quickly until it contacts the mounting surface. Tighten hydraulic oil filter cartridge (1) by hand an additional 1/2 turn only.
4. After the new cartridge has been replaced, the transmission fluid level normally decreases a little. Add KUBOTA SUPER UDT fluid to proper level. Check for oil leaks around filter gasket.

■ IMPORTANT

- To prevent serious damage to the hydraulic system, replacement oil filter cartridge must be highly efficient. Use only a genuine KUBOTA filter.



Changing Transmission Fluid

1. Place the oil pans underneath the transmission case.
2. Remove the drain plugs (1) to drain transmission fluid.
3. Screw in the drain plugs (1).
4. Remove the oil filling plug (2).
5. Fill in the transmission fluid until to reach the gauge (3). (Refer to figure.)
6. Reinstall the oil filling plug (2).
7. After running the engine for few minutes, stop it and check the oil level again. If low, add new fluid.

■ IMPORTANT

- Use only KUBOTA SUPER UDT fluid. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-8.)
- Never work the tractor immediately after changing the transmission fluid. Keeping the engine at medium speed for a few minutes to prevents damage to the transmission.

[A] Oil level is acceptable within this range.

- (1) Drain Plug (3) Gauge
(2) Filling Plug

Changing Front Axle Case Oil [4WD Type]

1. Place the oil pans underneath the front axle case.
2. Remove the drain plug (1) both sides and filling port plug (3) to drain the oil.
3. After draining, reinstall the drain plugs (1).
4. Remove the oil level check plug (2).
5. Fill with the new oil up to the check plug (2) port.
6. After filling, reinstall the check plug (2) and filling port plug (3).

■ IMPORTANT

- Use KUBOTA SUPER UDT fluid or SAE 80, 90 gear oil. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-8.)

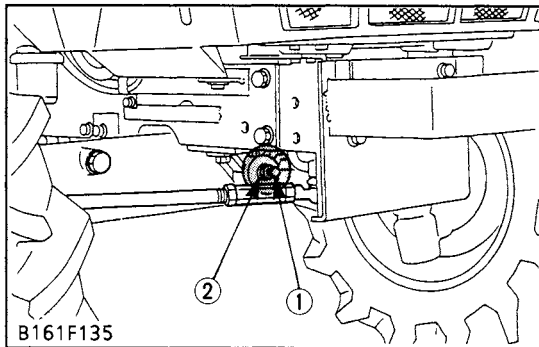
- (1) Drain Plug (3) Filling Port Plug
(2) Check Plug

Adjusting Clutch Pedal Free Travel

1. Refer to page G-18.

Replacing Transmission Oil Filter Cartridge and Cleaning Transmission Strainer

1. See page G-45.



Adjusting Front Axle Pivot *(Every 600 Hours)

1. Loosen the lock nut (2), tighten the adjusting screw (1) all the way, and then loosen the adjusting screw (1) by 1/6 turn.
2. Retighten the lock nut (2).

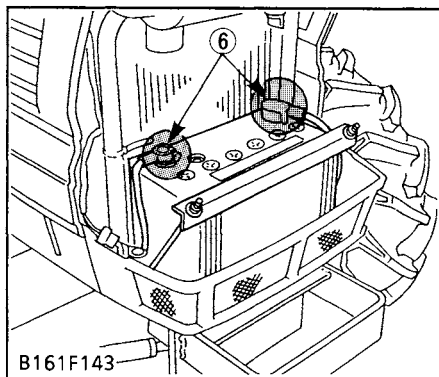
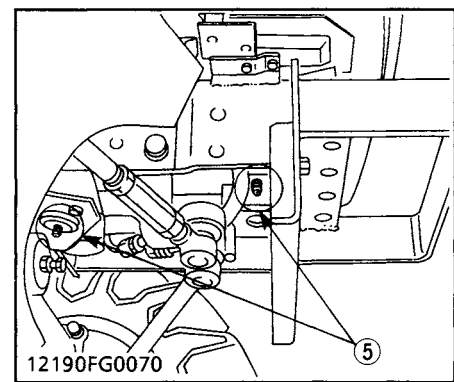
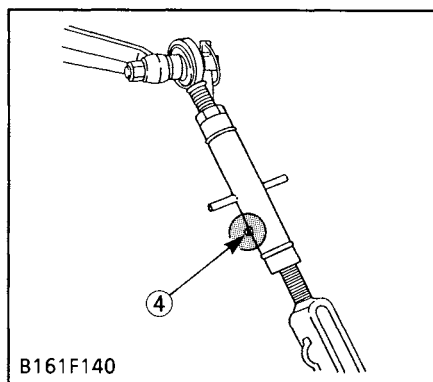
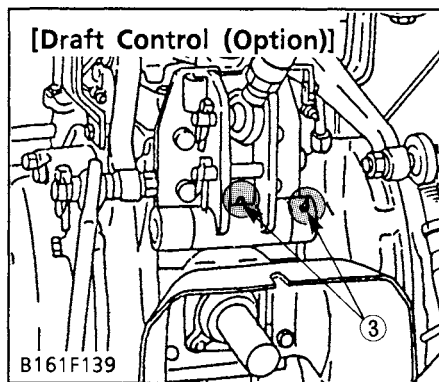
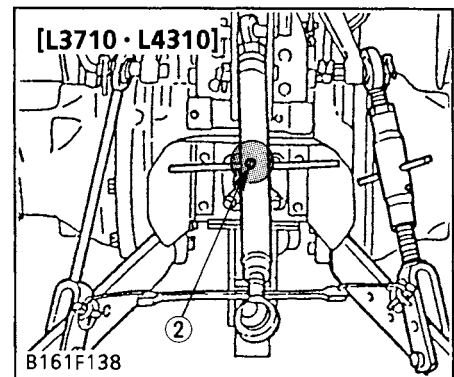
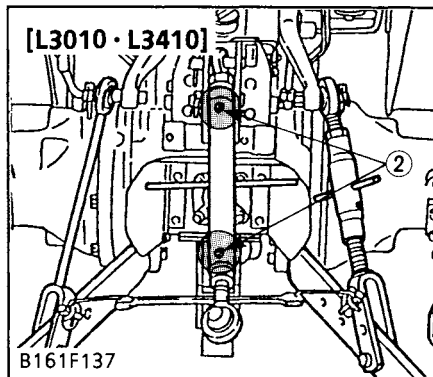
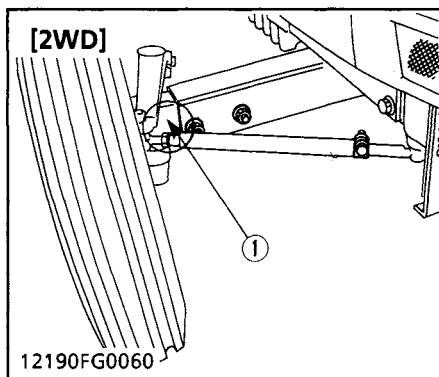
- (1) Adjusting Screw (2) Lock Nut

* This adjustment interval has been changed to Every 600 hours.

(3) Check Points of Every 50 Hours

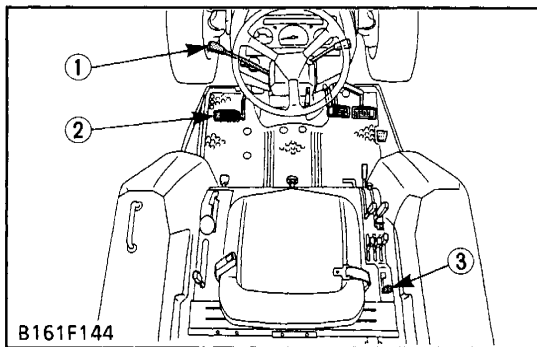
Greasing

1. Apply grease to the following points.



- (1) Knuckle Shaft Grease Nipple
 (2) Top Link Grease Nipple
 (3) Top Link Bracket Grease Nipple

- (4) Lift Rod Grease Nipple
 (5) Power Steering Cylinder Grease Nipple
 (6) Battery Terminals



(1) Shuttle Shift Lever (3) PTO Shift Lever
(2) Clutch Pedal

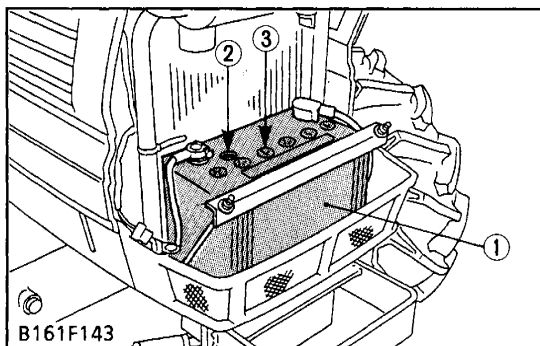
[HST Type]

■ Test 1 : Limit Switch of Built-in Range Gear Shift Lever

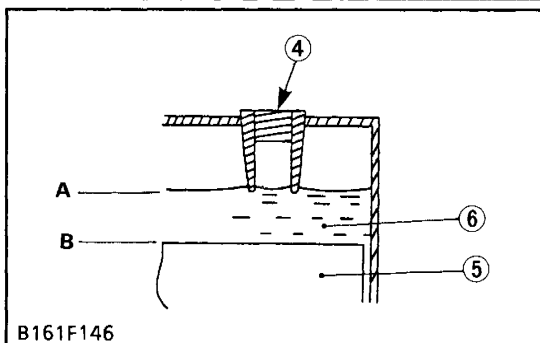
1. Sit on operator's seat.
2. Shift the range gear shift lever to the desired position.
3. Depress the clutch pedal fully.
4. Disengage the PTO gear shift lever. Follow the step 5 to 7.

■ Test 2 : Limit Switch of Built-in PTO Gear Shift Lever

1. Sit on operator's seat.
2. Engage the PTO gear shift lever.
3. Depress the clutch pedal fully.
4. Shift the range gear shift lever to the neutral position. Follow the step 5 to 7.



B161F143



B161F146

[A] Highest Level

[B] Lowest Level

- (1) Battery
(2) Indicator
(3) Vent Plug

- (4) Vent Well
(5) Separator
(6) Electrolyte

Checking Engine Starting System

⚠ CAUTION

- Do not allow anyone near the tractor while testing.
- If the tractor does not pass the test do not operate the tractor.

■ Preparation

1. Place the all control levers in the "NEUTRAL" position.
2. Set the parking brake and stop the engine.

[GST / Manual Transmission Type]

■ Test 1 : Limit Switch of Built-in PTO Shift Lever or PTO Clutch Control Lever

1. Sit on operator's seat.
2. Engage the PTO shift lever (3).
3. Depress the clutch pedal (2) fully.
4. Shift the shuttle shift lever (1) to the neutral position.
5. Pull out the engine stop knob and turn the key to "START" position.
6. The engine must not crank.
7. If crank, repair or replace the PTO limit switch or starter relay.

■ Test 2 : Limit Switch of Built-in Shuttle Shift Lever

1. Sit on operator's seat.
2. Shift the shuttle shift lever (1) to the forward or reverse position.
3. Depress the clutch pedal (2) fully.
4. Disengage the PTO shift lever (3) or PTO clutch control lever.
5. Pull out the engine stop knob and turn the key to "START" position.
6. The engine must not crank.
7. If crank, repair or replace the shuttle limit switch or starter relay.

Checking Battery Condition *(Every 100 Hours Checking)

⚠ CAUTION

- Never remove the vent plugs (3) while the engine is running.
- Keep electrolyte away from eyes, hands and clothes. If you are spattered with it, wash it away completely with water immediately and get medical attention.
- Wear eye protection and rubber gloves when working around battery.

■ NOTE

- The original battery is maintenance free type battery, but need some servicing.

■ How to Read the Indicator

- If the indicator (2) is blue color. Specific gravity of electrolyte and quantity of electrolyte are both in good condition.
- If the indicator (2) is white color
Need inspection :
 - ① Add only distilled water if the electrolyte level is low. (Proper level is shown in the figure left)
You can start work again if the indicator display turns to blue.
 - ② Change battery if the indicator display remains white.
 - ③ Change battery if the electrolyte level is normal.

* This checking interval has been changed from every 50 to every 100 hours.

Tractor Model	Battery TYPE	Volts (V)	Capacity at 5 H.R. (A.H.)
L3010 L3410	75D26R-MF	12	52
L3710 L4310	75D31R-MF	12	60

Tractor Model	Reserve Capacity (min)	Cold Cranking Amps	Normal Charging Rate (A)
L3010 L3410	123	490	5.2
L3710 L4310	137	447	6.0

Table 1

Battery Charging

⚠ CAUTION

- When the battery is being activated, hydrogen and oxygen gases in the battery are extremely explosive. Keep open sparks and flames away from the battery at all times, especially when charging the battery.
- When charging battery, remove battery vent plugs.
- When disconnecting the cable from the battery, start with the negative terminal first. When connecting the cable to the battery, start with the positive terminal first.
- Never check battery charge by placing a metal object across the posts. Use a voltmeter or hydrometer.

1. Make sure each electrolyte level is to the bottom of vent wells, if necessary add distilled water in a well-ventilated area.
2. The water in the electrolyte evaporates during recharging. Liquid shortage damages the battery. Excessive liquid spills over and damages the tractor body.
3. To slow charge the battery, connect the battery positive terminal to the charger positive terminal and the negative to the negative, then recharge in the standard fashion.
4. A boost charge is only for emergencies. It will partially charges the battery at a high rate and in a short time. When using a boost-charged battery, it is necessary to recharge the battery as early as possible. Failure to do this will shorten the battery's service life.
5. When the specific gravity of electrolyte become between 1.27 and 1.29 charge has completed.
6. When exchanging an old battery into new one, use battery of equal specification shown in table 1.

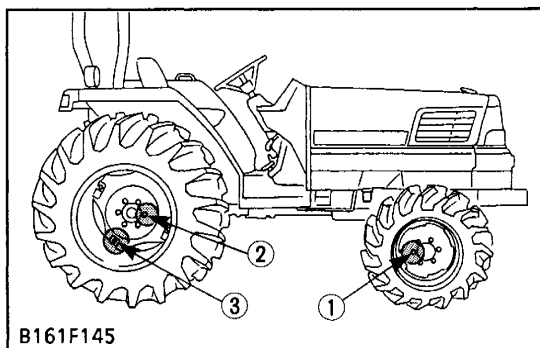
■ Direction for Storage

1. When storing the tractor for long periods of time, remove the battery from tractor, adjust the electrolyte to the proper level and store in a dry place out of direct sunlight.
2. The battery self-discharges while it is stored. Recharge it once every three months in hot seasons and once every six months in cold seasons.

Checking Wheel Mounting Screws and Nuts Tightening Torque

⚠ CAUTION

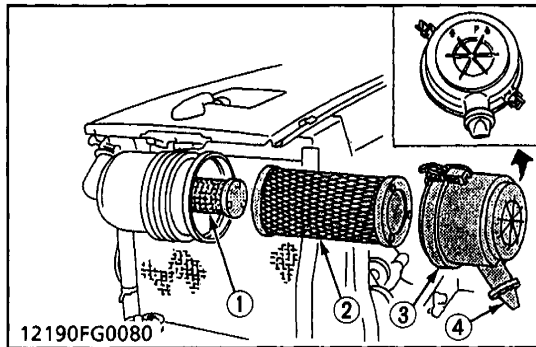
- Never operate tractor with a loose rim, wheel, or axle.
1. Check the tightening torque of wheel mounting screws and nuts all.



Tightening torque	Front wheel mounting lug nuts	137 N·m 14 kgf·m 100 ft-lbs
	Rear wheel mounting screws and nuts	215 N·m 22 kgf·m 160 ft-lbs
	Rear wheel rim mounting bolts and nuts	215 N·m 22 kgf·m 160 ft-lbs

- (1) Front Wheel Mounting Lug Nuts (3) Rear Wheel Rim Mounting Bolts and Nuts
 (2) Rear Wheel Mounting Screws and Nuts

(4) Check Points of Every 100 Hours



(1) Secondary Element (3) Cover
(2) Primary Element (4) Evacuator Valve

Changing Engine Oil

1. See page G-12.

Cleaning Air Cleaner Element

1. Remove the air cleaner cover (3) and primary element (2).
2. When dry dust adheres to the element, blow compressed air from the inside turning the element. Pressure of compressed air must be under 686 kPa (7 kgf/cm², 99 psi).
3. When carbon or oil adheres to the element, soak the element in detergent for 15 minutes then wash it several times in water, rinse with clean water and dry it naturally. After element is fully dried, inspect inside of the element with a light and check if it is damaged or not. (Referring to the instructions on the label attached to the element.)

NOTE

- Every year or every 6 times of cleaning, replace the air cleaner primary element (2).

IMPORTANT

- The air cleaner uses a dry element, never apply oil.
- Do not run the engine with filter element removed.
- Make sure the wing nut or bolt with rubber dust seal for the element is tight enough.
If it is loose, dust and dirt may be sucked in, wearing down the cylinder and piston rings earlier and thereby resulting in poor power output.

Evacuator Valve

1. Open the evacuator valve once a week under ordinary conditions – or daily when used in a dusty place – to get rid of large particles of dust and dirt.

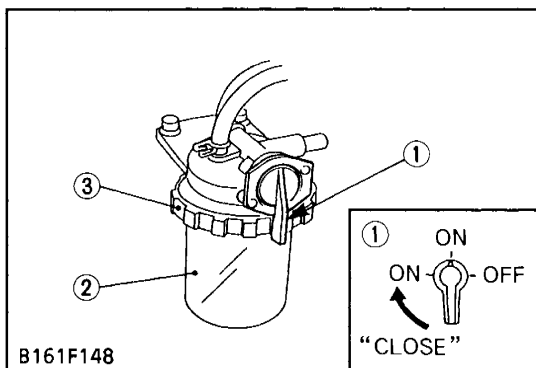
Cleaning Fuel Filter Element and Filter Bowl

1. Close the fuel filter cock (1).
2. Unscrew the retainer ring (3) and remove the filter bowl (2), and rinse the inside with kerosene.
3. Take out the element (5) and dip it in the kerosene to rinse.
4. After cleaning, reassemble the fuel filter, keeping out dust and dirt.
5. Bleed the fuel system. (See page G-24.)

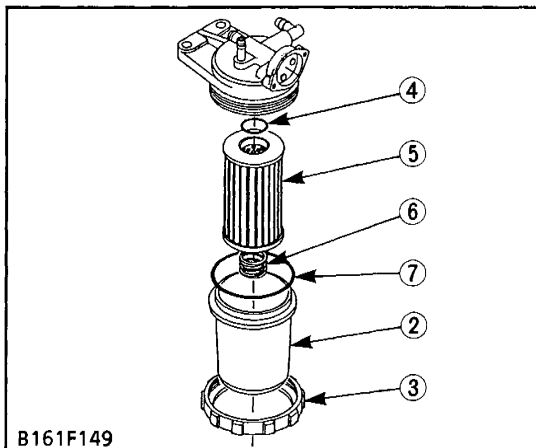
IMPORTANT

- This job should not be done in the field, but in a clean place.
- If dust and dirt enter the fuel, the fuel pump and injection nozzles are subject to quick wear.
To prevent this, be sure to clean the fuel filter bowl periodically.

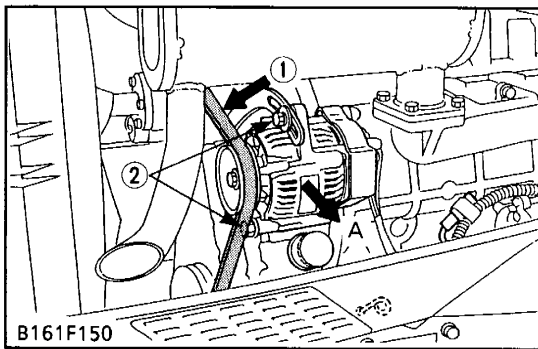
- | | |
|----------------------|--------------------|
| (1) Fuel Filter Cock | (5) Filter Element |
| (2) Filter Bowl | (6) Spring |
| (3) Retainer Ring | (7) O-ring |
| (4) O-ring | |



B161F148



B161F149



[A] To Tighten the Fan Belt

- (1) Check Part of Belt Tension
- (2) Alternator Mounting Bolt

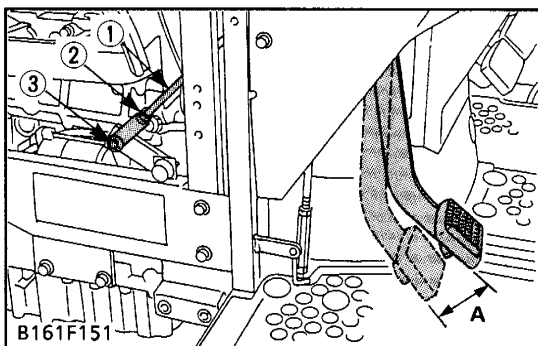
Adjusting Fan Belt Tension

CAUTION

- Be sure to stop the engine before checking fan belt tension.

1. Stop the engine and remove the key.
2. Apply moderate thumb pressure to belt between pulleys.
3. If tension is incorrect, loosen the alternator mounting bolts (2), and using a lever placed between the alternator and the engine block, pull the alternator out until the deflection of the belt falls within the factory specifications.
4. Replace fan belt if it is damaged.

Fan belt tension	Factory spec.	A deflection of between 7 to 9 mm (0.28 to 0.34 in.) when the belt is pressed in the middle of the span
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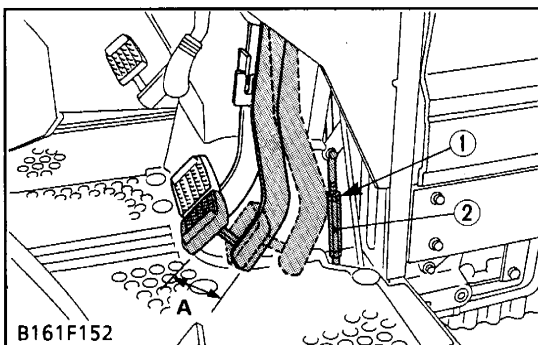
Adjusting Clutch Pedal Free Travel

1. Stop the engine and remove the key.
2. Slightly depress the clutch pedal and measure free travel (A) at top of pedal stroke.
3. If adjustment is needed, loosen the lock nut (2), remove the clevis pin (3) and adjust the clutch rod (1) length.
4. Retighten the lock nut (2) and split the cotter pin.

Clutch pedal free travel	Factory spec.	20 to 30 mm (0.8 to 1.2 in.) on the pedal
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[A] Free Travel

- (1) Clutch Rod
- (2) Lock Nut
- (3) Clevis Pin



[A] Free Travel

- (1) Lock Nut
- (2) Turnbuckle

Adjusting Brake Pedal Free Travel

1. Stop the engine and remove the key, then release the parking brake.
2. Slightly depress the brake pedals and measure free travel (A) at top of pedal stroke.
3. If adjustment is needed, loosen the lock nut (1) and turn the turnbuckle (2) to adjust the rod length.
4. Retighten the lock nut (1).

Brake pedal free travel	Factory spec.	15 to 20 mm (0.6 to 0.8 in.) on the pedal
		Keep the free travel in the right and left brake pedals equal

(5) Check Points of Every 200 Hours

Replacing Engine Oil Filter Cartridge

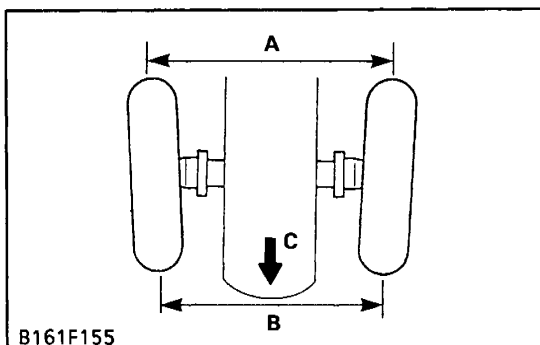
1. See page G-12.

Replacing Hydraulic Oil Filter Cartridge

1. See page G-12.

Replacing Transmission Oil Filter Cartridge [HST], Cleaning Transmission Strainer [HST] and Checking HST Oil Line

1. See page G-45.

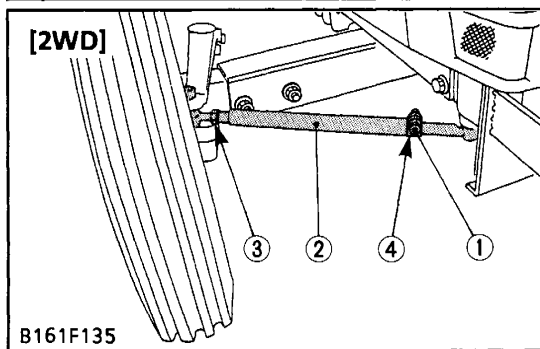


B161F155

Adjusting Toe-in

1. Park the tractor on the flat place.
2. Inflate the tires to the specified pressure.
3. Turn the front wheels straight ahead.
4. Measure the distance between the centers of front wheels at front and rear.
5. If the measurement is not within the factory specifications, adjust by changing the tie-rod length.

Toe-in (A - B)	Factory spec.	2 to 8 mm 0.1 to 0.3 in.
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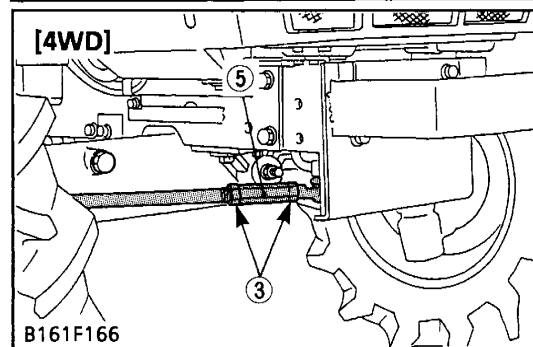
B161F135

Adjustment

1. Remove the tie-rod clamp nuts (1) and its screws. (2WD)
2. Loosen the lock nuts (3).
3. Turn the turnbuckle (2), (5) until to be factory specification.
4. Tighten the tie-rod clamp nuts (1) after reinstalling them. (2WD)
5. Tighten the lock nuts (3).

Tightening torque	Tie-rod clamp screw and nut (2WD)	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 29 to 36 ft-lbs
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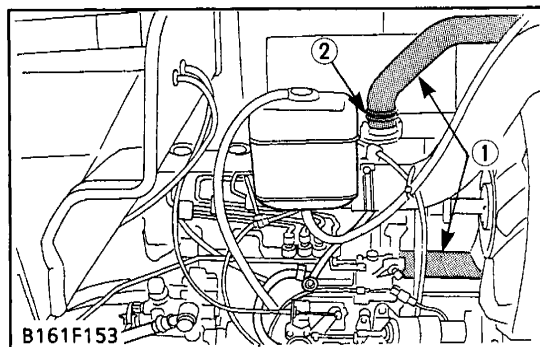
- (1) Tie-rod Clamp Screw and Nut
- (2) Turnbuckle
- (3) Lock Nut
- (4) Tie-rod Clamp
- (5) Turnbuckle



B161F166

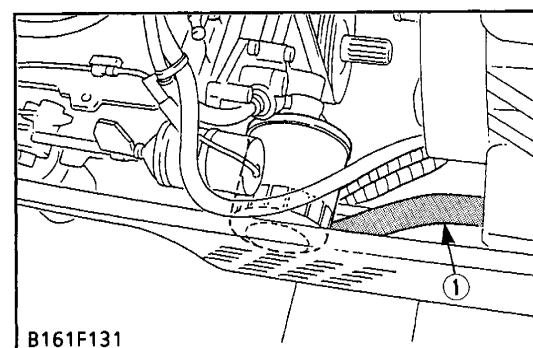
Checking Radiator Hose and Clamp

1. Check the radiator hoses (1) and their clamps (2).
2. If water leaks, retighten or replace them.



B161F153

- (1) Radiator Hoses
- (2) Clamps

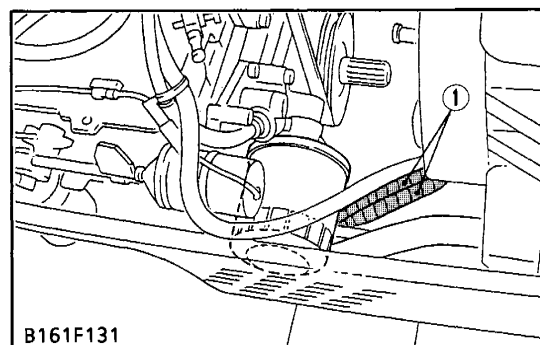


B161F131

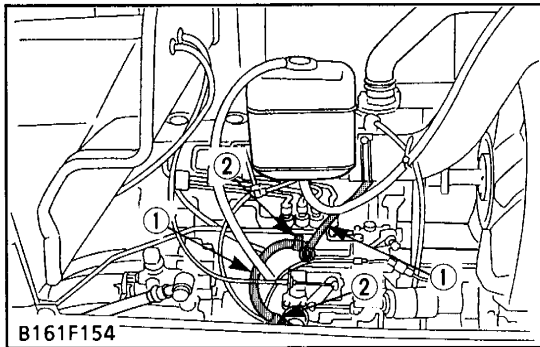
Checking Power Steering Oil Line

1. Check the power steering hydraulic hoses (1).
2. If oil leaks, retighten or replace them.

- (1) Power Steering Hydraulic Hoses



B161F131



B161F154

Checking Fuel Line

1. Check the fuel hoses (1) and their clamps (2).
2. If fuel leaks, retighten or replace them.

- (1) Fuel Hoses (2) Clamps

(6) Check Points of Every 400 Hours

Changing Transmission Fluid

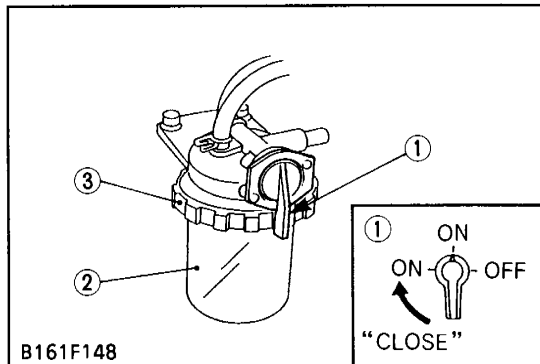
1. See page G-13.

Changing Front Axle Case Oil [4WD Type]

1. See page G-13.

Adjusting Front Axle Pivot (Every 600 Hours)

1. See page G-14.



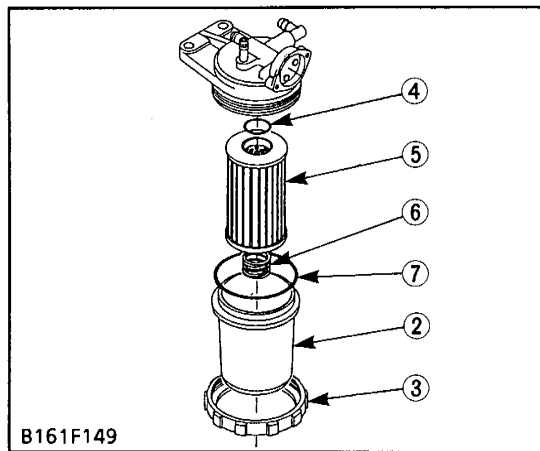
B161F148

Replacing Fuel Filter Element

1. Close the fuel filter cock.
2. Unscrew the retainer ring and remove the filter bowl and clean the inside with kerosene.
3. Take out the filter element (5) and reinstall the new one. Reassemble the fuel filter.
4. Bleed the fuel line. (See page G-24.)

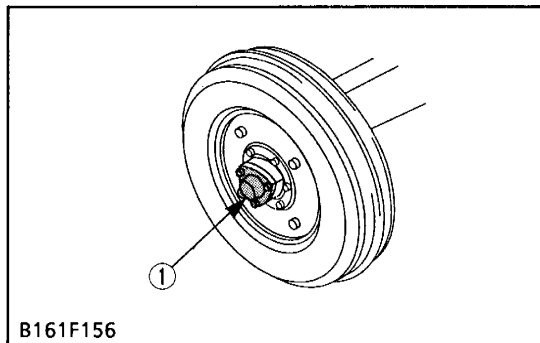
IMPORTANT

- This job should not be done in the field, but in a clean place.
 - If dust and dirt enter the fuel, the fuel pump and injection nozzles are subject to quick wear.
- To prevent this, be sure to clean the fuel filter bowl periodically.



B161F149

- (1) Fuel Filter Cock (5) Filter Element
 (2) Filter Bowl (6) Spring
 (3) Retainer Ring (7) O-ring
 (4) O-ring



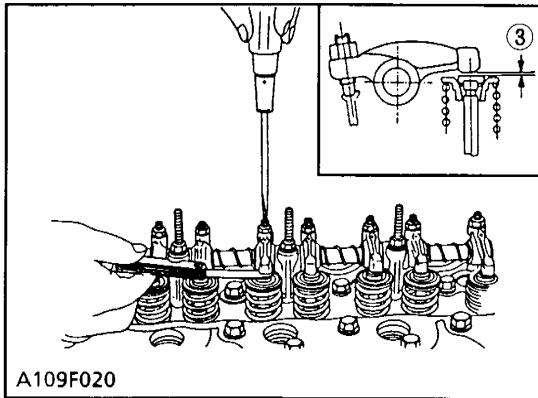
B161F156

Front Wheel Hub Greasing [2WD Type]

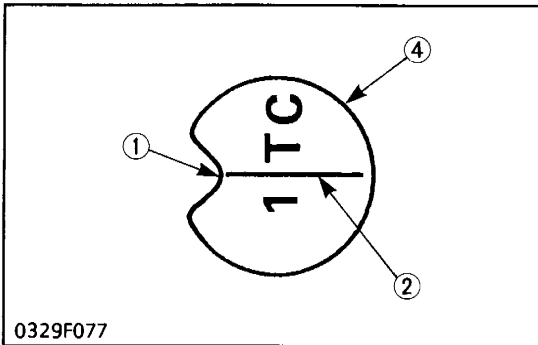
1. Detach the front wheel hub cover (1).
2. Apply bearing grease to the front wheel hub both sides.

- (1) Front Wheel Hub Cover

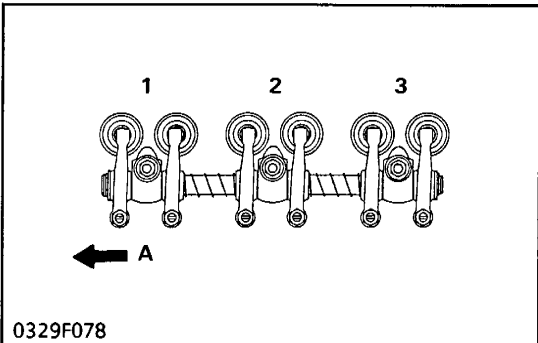
(7) Check Points of Every 800 Hours



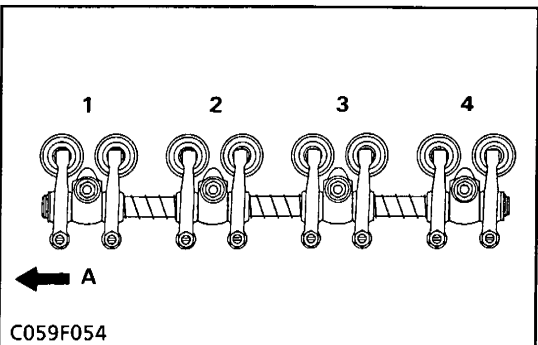
A109F020



0329F077



0329F078



C059F054

[A] Gear Case Side

- (1) Projection
- (2) TC Mark Line
- (3) Valve Clearance
- (4) Timing Window

Checking Valve Clearance

■ **IMPORTANT**

- Valve clearance must be checked and adjusted when engine is cold.

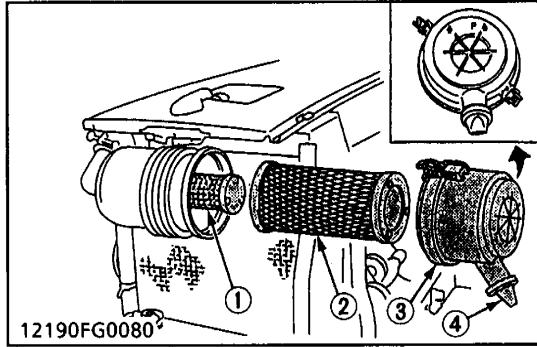
1. Remove the head cover, the glow plugs and the timing window cover on the flywheel housing.
2. Align the "1TC" mark on the flywheel and projection (1) on the housing so that the No. 1 piston comes to the compression or overlap top dead center.
3. Check the following valve clearance marked with "○" using a feeler gauge.
4. If the clearance is not within the factory specifications, adjust with the adjusting screw.

Valve clearance	Factory spec.	0.18 to 0.22 mm 0.0071 to 0.0087 in.
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■ **NOTE**

- The "TC" marking on the flywheel is just for No. 1 cylinder. There is no "TC" marking for the other cylinders.
- No. 1 piston comes to the T.D.C. position when the window on flywheel-housing. Turn the flywheel 0.26 rad. (15°) clockwise and counterclockwise to see if the piston is at the compression top dead center or the overlap position. Now referring to the table below, readjust the valve clearance. (The piston is at the top dead center when both the IN. and EX. valves do not move; it is at the overlap position when both the valves move.)
- Finally turn the flywheel 6.28 rad. (360°) and align the "TC" marking and the projection perfectly. Adjust all the other valve clearance as required.
- After turning the flywheel counterclockwise twice or three times, recheck the valve clearance.
- After adjusting the valve clearance, firmly tighten the lock nut of the adjusting screw.

Adjustable cylinder location of piston	Valve arrangement	Engine model		Engine model	
		D1403 D1703	D1403 D1703	V1903 V2203	V1903 V2203
		IN.	EX.	IN.	EX.
When No. 1 piston is compression top dead center	1st	○	○	○	○
	2nd		○	○	
	3rd	○			○
	4th	↘	↘		
When No. 1 piston is overlap position	1st				
	2nd	○			○
	3rd		○	○	
	4th	↘	↘	○	○

(8) Check Points of Every 1 Year

- (1) Secondary Element (3) Cover
 (2) Primary Element (4) Evacuator Valve

Replacing Air Cleaner Element

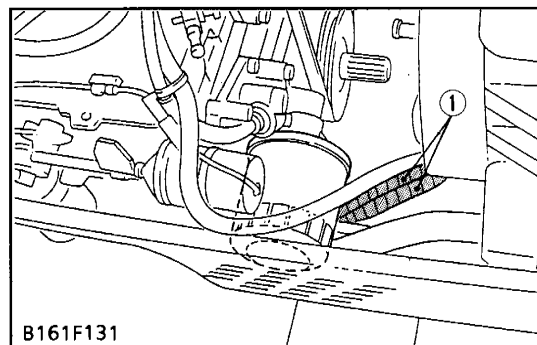
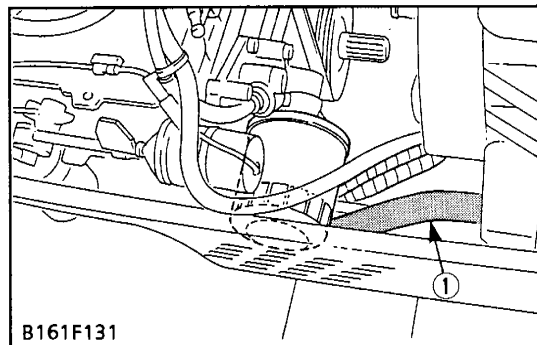
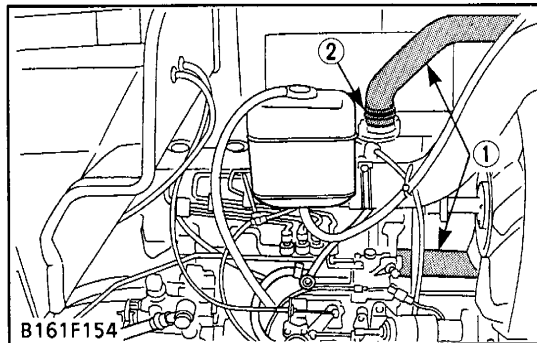
1. Replace the air cleaner primary and secondary elements (1), (2).

NOTE

- Every year or every 6 times of cleaning, replace the air cleaner primary and secondary elements (1), (2).

IMPORTANT

- The air cleaner uses a dry element, never apply oil.
- Do not run the engine with filter element removed.
- Make sure the wing nut or bolt with rubber dust seal for the element is tight enough.
 If it is loose, dust and dirt may be sucked in, wearing down the cylinder and piston rings earlier and thereby resulting in poor power output.

(9) Check Points of Every 2 Years**Replacing Radiator Hose and Clamp**

1. Replace the radiator hoses (1) and their clamps (2).

- (1) Radiator Hoses (2) Clamps

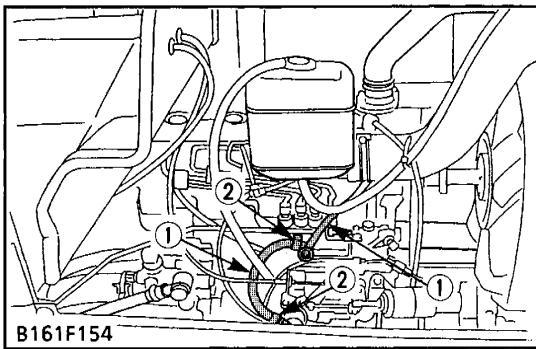
Replacing Power Steering Oil Line

1. Replace the power steering hydraulic hoses (1), if necessary.

- (1) Power Steering Hydraulic Hoses

Replacing HST Oil Line

1. Replace the hoses and clamps on the HST oil line.
2. See page G-45.

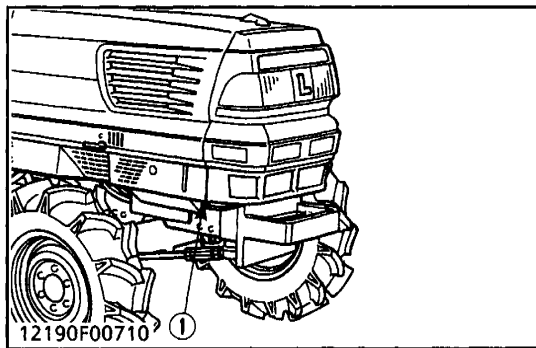


Fuel Line Replacement

1. Replace the fuel hoses (1) and their clamps (2), if necessary.
2. Bleed the fuel lines. (See page G-24.)

(1) Fuel Hoses

(2) Clamps



Cleaning Engine Cooling System and Changing Coolant

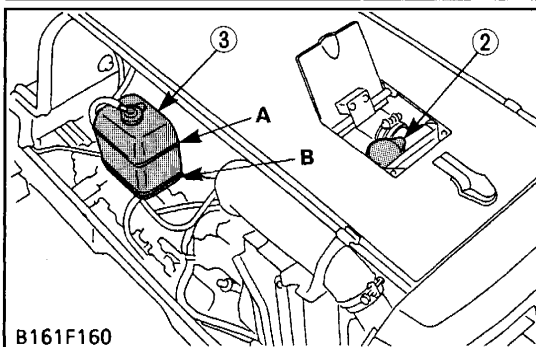
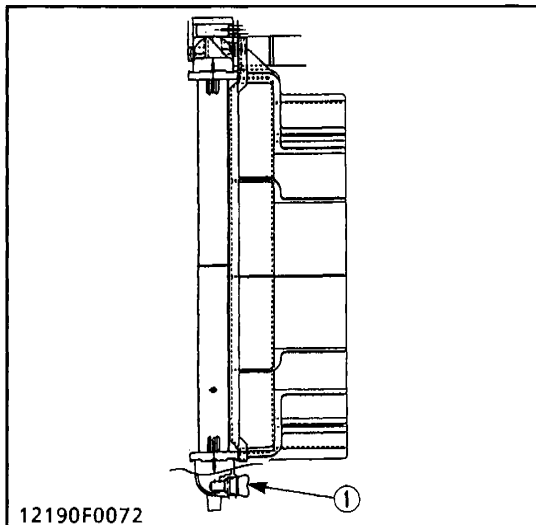
⚠ CAUTION

- Do not remove the radiator cap when the engine is hot. Then loosen cap slightly to the stop to relieve any excess pressure before removing cap completely.

1. Stop the engine and let cool down.
2. Loosen the drain plug (1) to drain the coolant.
3. Remove the radiator cap (2) to completely drain the coolant.
4. After all coolant is drained, retighten the drain plug (1).
5. Fill with clean water and cooling system cleaner.
6. Follow directions of the cleaner instruction.
7. After flushing, fill with clean water and anti-freeze until the coolant level is just below the port.
8. Install the radiator cap securely.
9. Fill with coolant up to the "FULL" mark of recovery tank (3).
10. Start and operate the engine for few minutes.
11. Stop the engine and let cool.
12. Check coolant level of recovery tank (3) and add coolant if necessary.

■ IMPORTANT

- Do not start engine without coolant.
- Use clean, fresh water and anti-freeze to fill the radiator and recovery tank.
- When the anti-freeze is mixed with water, the anti-freeze mixing ratio must be less than 50 %.
- Securely tighten radiator cap. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.



[A] FULL

[B] LOW

(1) Drain Plug
(2) Radiator Cap

(3) Recovery Tank

■ Anti-Freeze

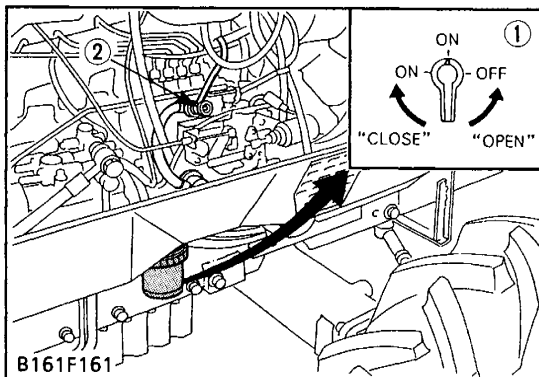
If it freezes, cooling water can damage the cylinders and radiator. It is necessary, if the ambient temperature falls below 0 °C (32 °F), to remove cooling water after operating or to add anti-freeze to it.

1. There are two types of anti-freeze available; use the permanent type (PT) for this engine.
2. Before adding anti-freeze for the first time, clean the radiator interior by pouring fresh water and draining it a few times.
3. The procedure for mixing of water and anti-freeze differs according to the make of the anti-freeze and the ambient temperature, basically it should be referred to SAE J1034 standard, more specifically also to SAE J814c.
4. Mix the anti-freeze with water, and then fill in to the radiator.

Vol % Anti-freeze	Freezing Point		Boiling Point*	
	°C	°F	°C	°F
40	- 24	- 12	106	222
50	- 37	- 34	108	226

*At 760 mmHg pressure (atmospheric). A higher boiling point is obtained by using a radiator pressure cap which permits the development of pressure within the cooling system.

(10) Others



Bleeding Fuel System

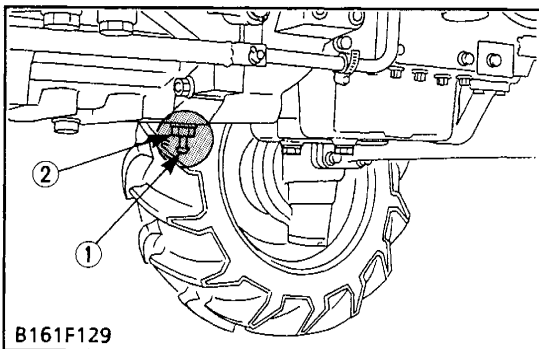
1. Fill the fuel to the fuel tank.
2. Open the fuel filter cock (1).
3. Open (counterclockwise) the air vent cock (2) on the fuel injection pump.
4. Start the engine and run for about 30 seconds, and then stop the engine.
5. Close (clockwise) the air vent cock (2).

■ IMPORTANT

- Always close the air vent cock except for bleeding fuel lines. Otherwise, engine runs irregularly or stalls frequently.

(1) Fuel Filter Cock

(2) Air Vent Cock

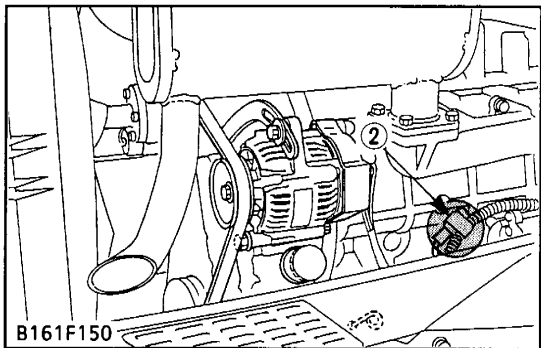
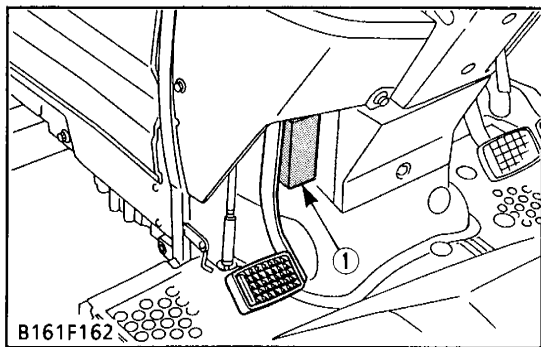


Draining Clutch Housing Water

1. The tractor is equipped with split pin plug under the clutch housing. After operating in rain, snow or tractor has been washed, water may get into the clutch housing. Check it by pushing in the split pin (1).
2. If water enters into the clutch housing, remove the drain plug (2) and drain the water, then install the drain plug (2) again.

(1) Split Pin

(2) Drain Plug



Replacing Fuse

1. The tractor electrical system is protected from potential damage by fuses.
A blown fuse indicates that there is an overload or short somewhere in the electrical system.
2. If any of the fuses should blow, replace with a new one of the same capacity.

■ IMPORTANT

- Before replacing a blown fuse, determine why the fuse blew and make any necessary repairs.

(1) Fuse Box

(2) Slow Blow Fuse

Light	Capacity
Head lights	25 W / 25 W
Tail light	8 W
Hazard light	27 W
Instrument panel light	3.4 W

Replacing Light Bulb

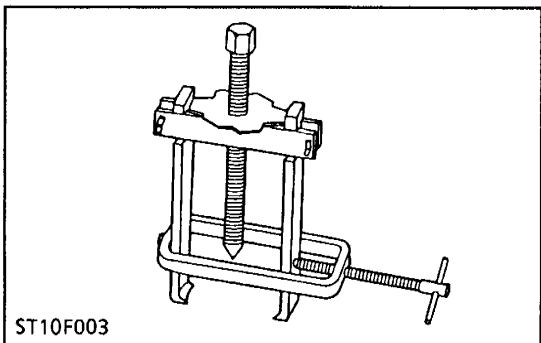
(Head lights and rear combination lights)

1. Take out the bulb from the light body and replace with a new one.

(Other lights)

1. Detach the lens and replace the bulb.

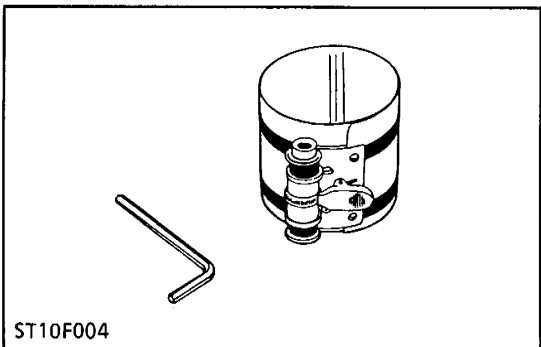
[9] SPECIAL TOOLS



Special Use Puller Set

Code No : 07916-09032

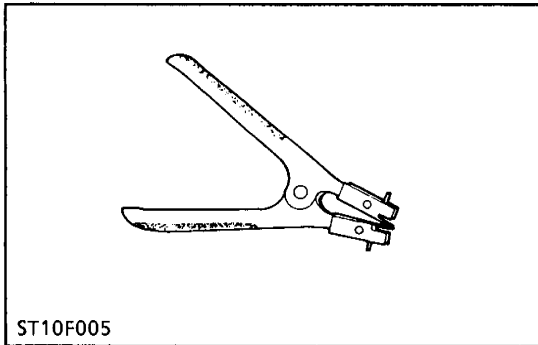
Application : Use exclusively for pulling out bearings, gears and other parts with ease.



Piston Ring Compressor

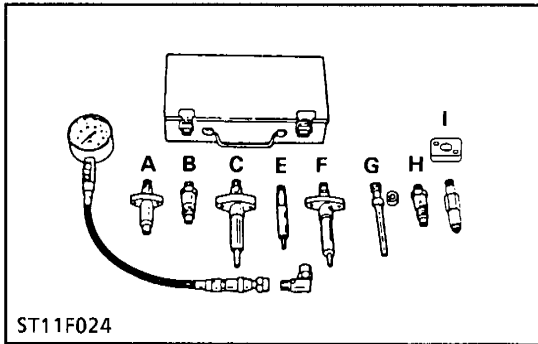
Code No : 07909-32111

Application : Use exclusively for pushing in the piston with ease.

**Piston Ring Tool**

Code No : 07909-32121

Application : Use exclusively for removing or installing the piston ring with ease.

**Diesel Engine Compression Tester**

Code No : 07909-30208 (Assembly)

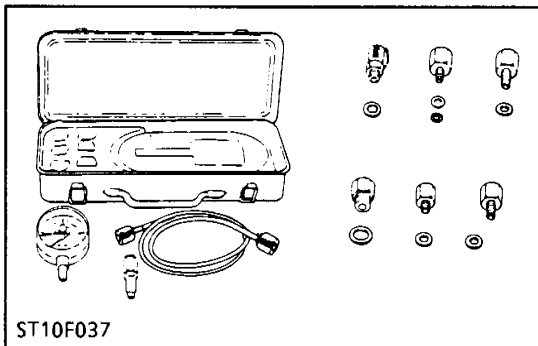
07909-30933 (A, B, C, E and F)

07909-31251 (G)

07909-31231 (H)

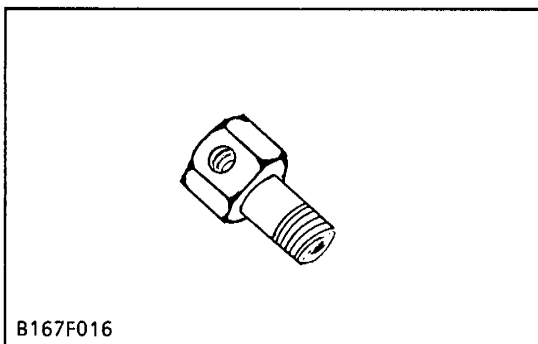
07909-31271 (I)

Application : Use for measuring diesel engine compression pressure.

**Diesel Engine Oil Pressure Tester**

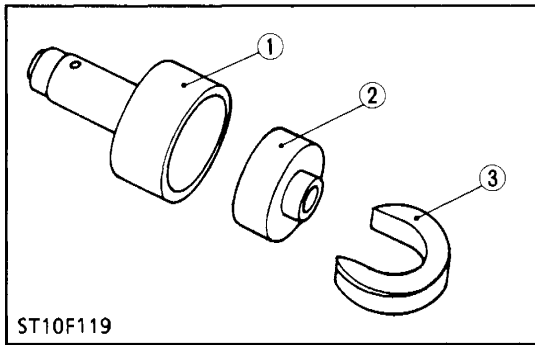
Code No : 07916-32032

Application : Use to measure lubricating, for all kinds of diesel engines.

**Adaptor 7 (For Diesel Engine Oil Pressure Tester)**

Code No : 07916-32591

Application : Use to check the relief valve setting pressure of GST.

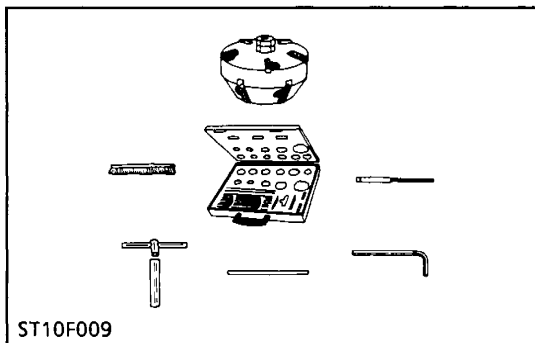


Auxiliary Socket For Fixing Crankshaft Sleeve

Code No : 07916-32091

Application : Use to fix the crankshaft sleeve of the diesel engine.

- (1) Auxiliary Socket for Pushing (3) Stopper
(2) Sleeve Guide

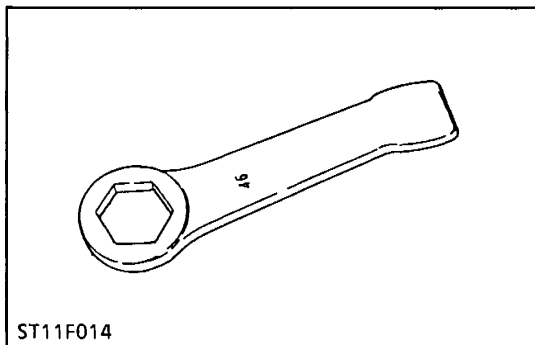


Valve Seat Cutter

Code No : 07909-33102

Application : Use to reseal valves.

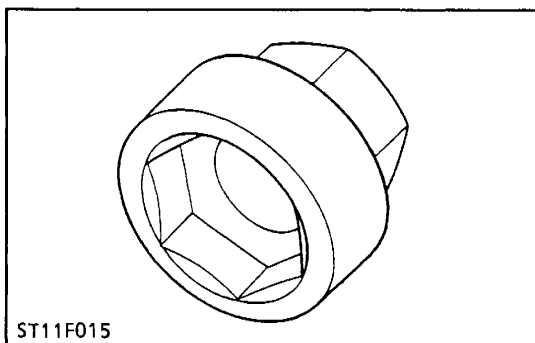
Angle : 0.785 rad. (45°)
0.262 rad. (15°)
0.523 rad. (30°) – Only 50.8 mm (2.000 in.)



Socket Wrench 46

Code No : 07916-30901

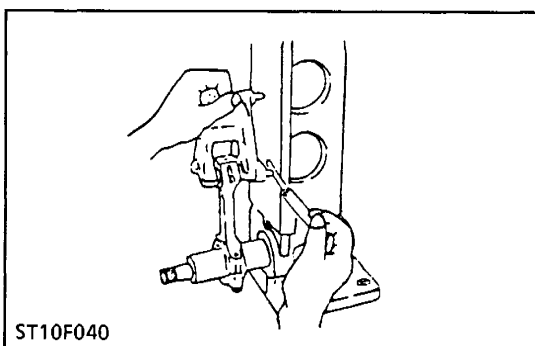
Application : Used also for the crankshaft-nut socket 46 to tighten or loosen the crankshaft nut.



Crankshaft-Nut Socket 46

Code No : 07916-30821

Application : Used also for the socket wrench 46 to tighten or loosen the crankshaft nut.

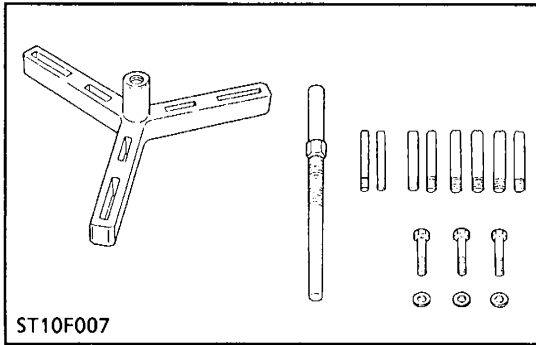


Connecting Rod Alignment Tool

Code No : 07909-31661

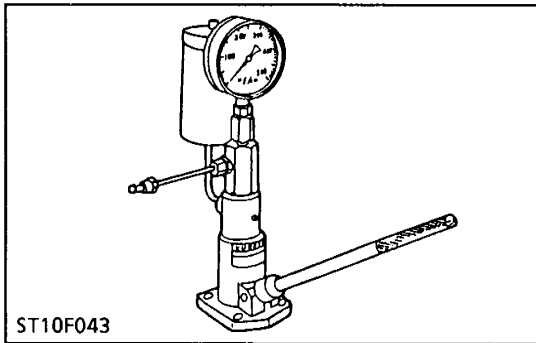
Application : Use to check the connecting rod alignment.

Applicable range : Connecting rod large end I.D. 30 to 75 mm
(1.18 to 2.95 in. dia.)
Connecting rod length
65 to 330 mm (2.56 to 12.99 in.)



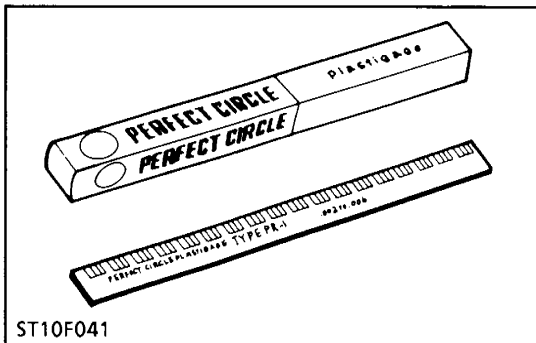
Flywheel Puller

Code No : 07916-32011
 Application : Use to remove the flywheel.



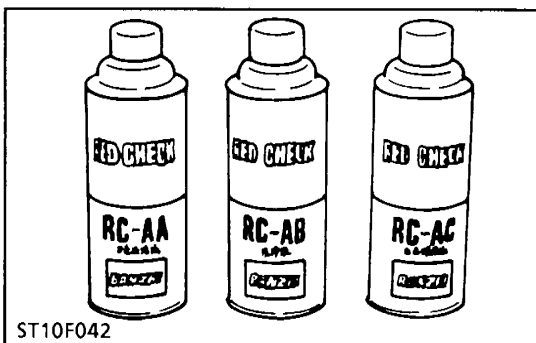
Nozzle Tester

Code No : 07909-31361
 Application : Use to check the fuel injection pressure and spraying condition of nozzle.
 Measuring range : 0 to 49 MPa (0 to 500 kgf/cm², 0 to 7112 psi)



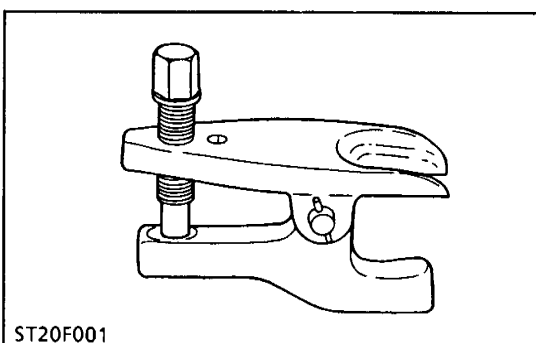
Press Gauge

Code No : 07909-30241
 Application : Use to check the oil clearance between crankshaft and bearing, etc.
 Measuring range : Green - 0.025 to 0.076 mm (0.001 to 0.003 in.)
 Red - 0.051 to 0.152 mm (0.002 to 0.006 in.)
 Blue - 0.102 to 0.229 mm (0.004 to 0.009 in.)



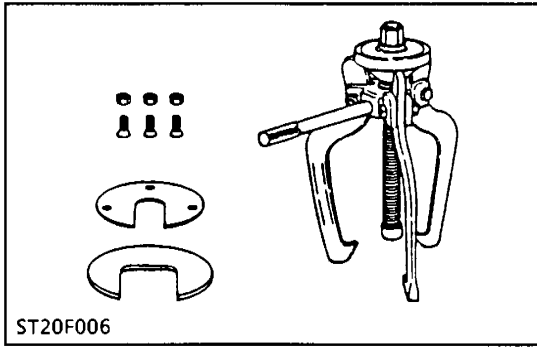
Red Check (Crack Check Liquid)

Code No : 07909-31371
 Application : Use to check cracks on cylinder head, cylinder block, etc.



Tie-rod End Lifter

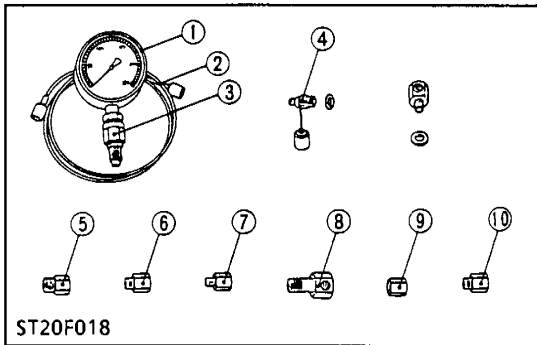
Code No : 07909-39021
 Application : This allows easy removal of tie-rod end from tractor.



Steering Wheel Puller

Code No : 07916-51090

Application : This allows easy removal of steering wheel without damaging steering shaft.

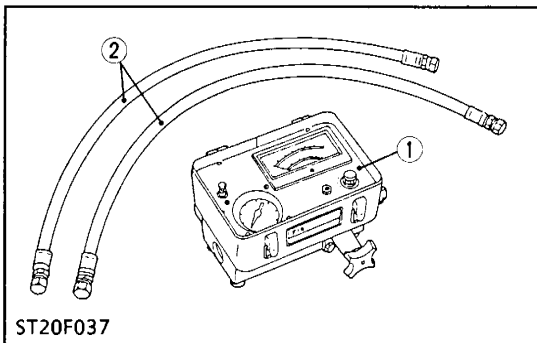


Relief Valve Pressure Tester

Code No : 07916-50045

Application : This allows easy measurement of relief set pressure for all tractor models.

- | | |
|--|---------------------------------------|
| (1) Gauge (07916-50321) | (7) Adaptor D (PT1/8) (07916-50381) |
| (2) Cable (07916-50331) | (8) Adaptor E (PS3/8) (07916-50392) |
| (3) Threaded Joint (07916-50401) | (9) Adaptor F (PF1/2) (07916-62601) |
| (4) Threaded Joint (07916-50341) | (10) Adaptor 58 (PT1/4) (07916-52391) |
| (5) Adaptor B (M18 x P1.5) (07916-50361) | |
| (6) Adaptor C (PS3/8) (07916-50371) | |



Flowmeter

Flowmeter

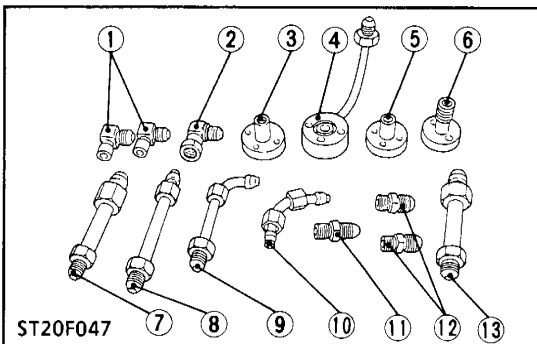
Code No : 07916-52791

Hydraulic Test Hose

Code No : 07916-52651 (1 pc.)

Application : This allows easy testing of hydraulic system.

- | | |
|----------------|-------------------------|
| (1) Flow Meter | (2) Hydraulic Test Hose |
|----------------|-------------------------|

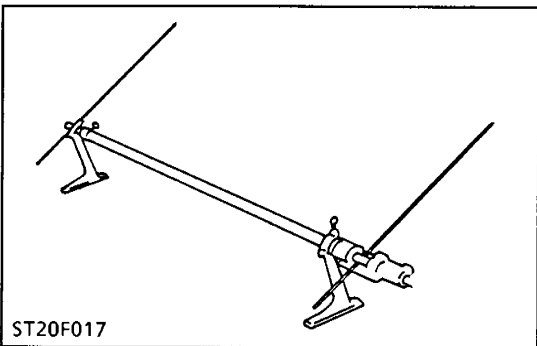


Adaptor Set

Code No : 07916-54031

Application : Use for checking hydraulic pumps.

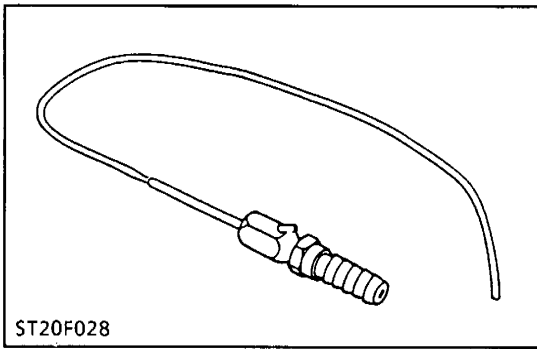
- | | |
|----------------|--------------------------|
| (1) Adaptor 52 | (8) Adaptor 65 |
| (2) Adaptor 53 | (9) Adaptor 66 |
| (3) Adaptor 54 | (10) Adaptor 67 |
| (4) Adaptor 61 | (11) Adaptor 68 |
| (5) Adaptor 62 | (12) Adaptor 69 |
| (6) Adaptor 63 | (13) Hydraulic Adaptor 1 |
| (7) Adaptor 64 | |



Toe-in Gauge

Code No : 07909-31681

Application : This allows easy measurement of toe-in for all tractor models.

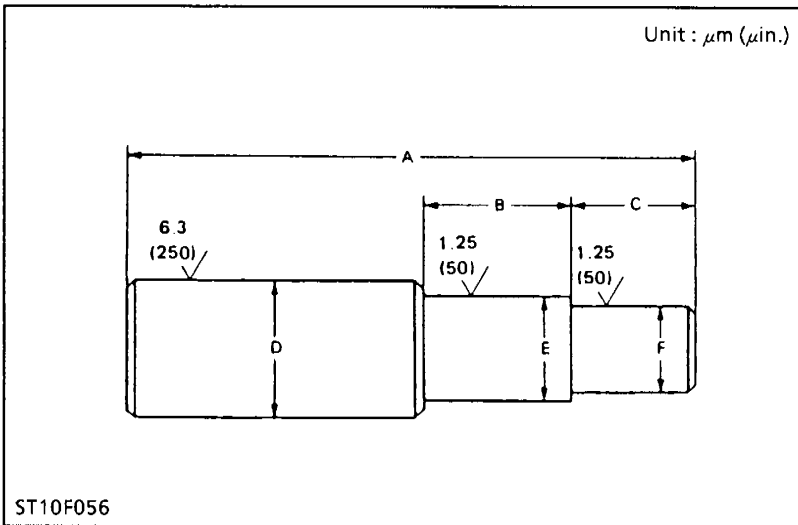


Injector CH3

Code No : 07916-52501

Application : Use for injecting liquid (water or calcium chloride solution) into, and removing it from tires.

ST20F028



ST10F056

Bushing Replacing Tools

Application : Use to press out and to press fit the bushing.

NOTE

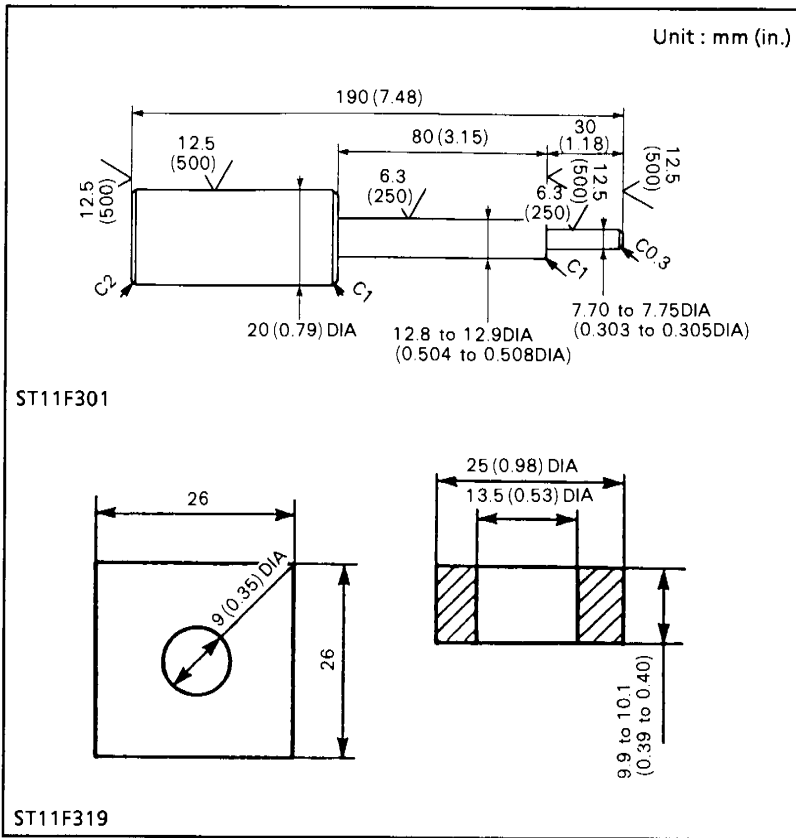
● This special tool is not provided, so make it referring to the figure.

(1) For connecting rod small end bushing

A	162 mm (8.8189 in.)
B	35 mm (1.3780 in.)
C	27 mm (1.0630 in.)
D	35 mm (1.3780 in.) DIA.
E	27.90 to 27.95 mm (1.0984 to 1.1004 in.) DIA.
F	25.002 to 25.011 mm (0.9843 to 0.9847 in.) DIA.

(2) For idle gear bushing

A	175 mm (9.8425 in.)
B	40 mm (1.5784 in.)
C	35 mm (1.3780 in.)
D	40 mm (1.5748 in.) DIA.
E	41.90 to 41.95 mm (1.6496 to 1.6516 in.) DIA.
F	37.959 to 37.975 mm (1.4950 to 1.4951 in.) DIA.

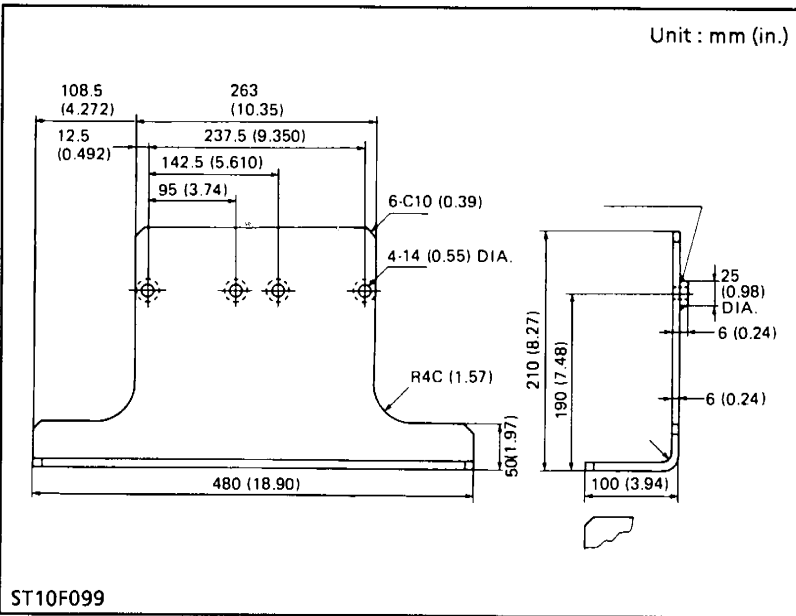


Valve Guide Replacing Tool

Application : Use to press out and press fit the valve guide.

■ **NOTE**

- This special tool is not provided, so make it referring to the figure.

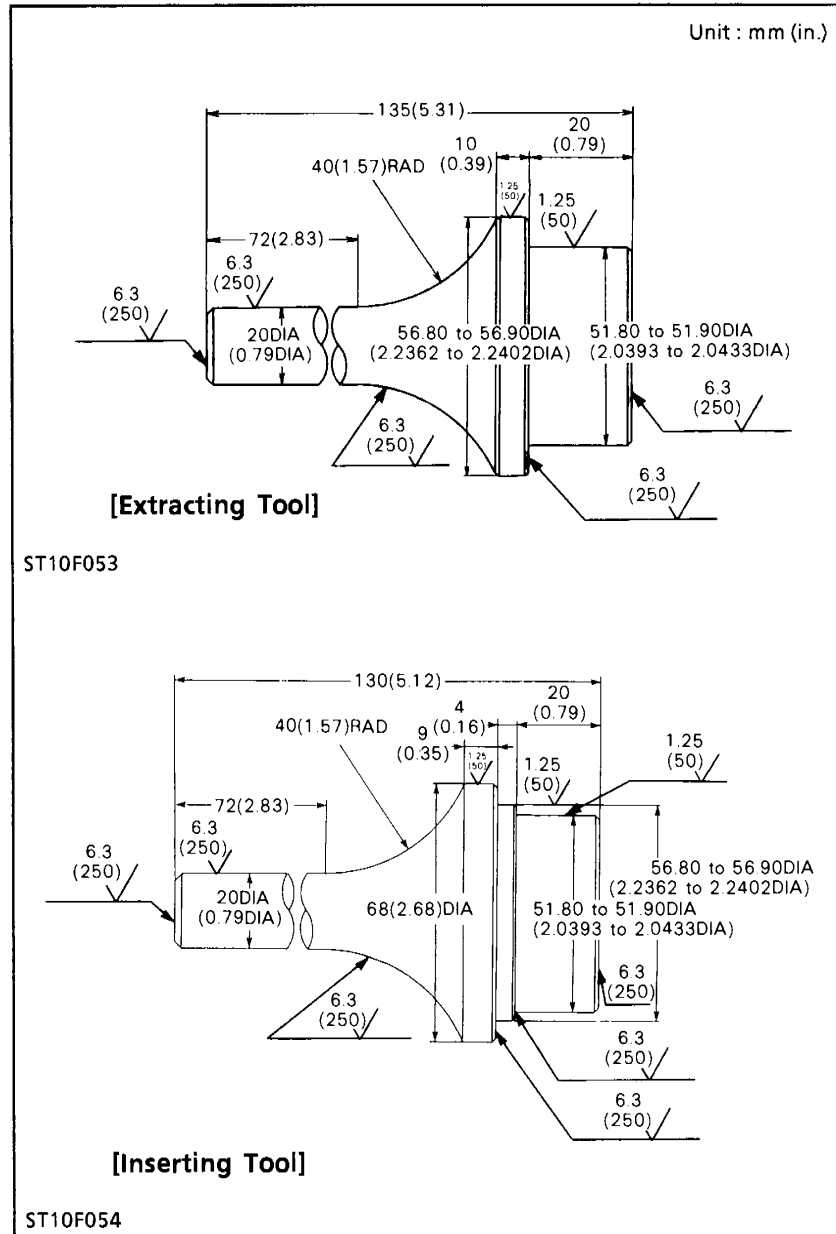


Engine Stand

Application : Use to support engine.

■ **NOTE**

- This special tool is not provided, so make it referring to the figure.

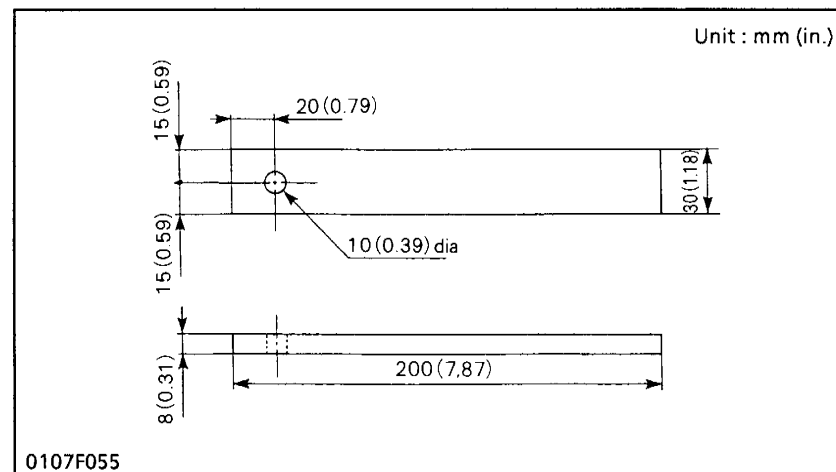


Crankshaft Bearing 1 Replacing Tool

Application: Use to press out and to press fit the crankshaft bearing 1.

■ **NOTE**

- This special tool is not provided, so make it referring to the figure.

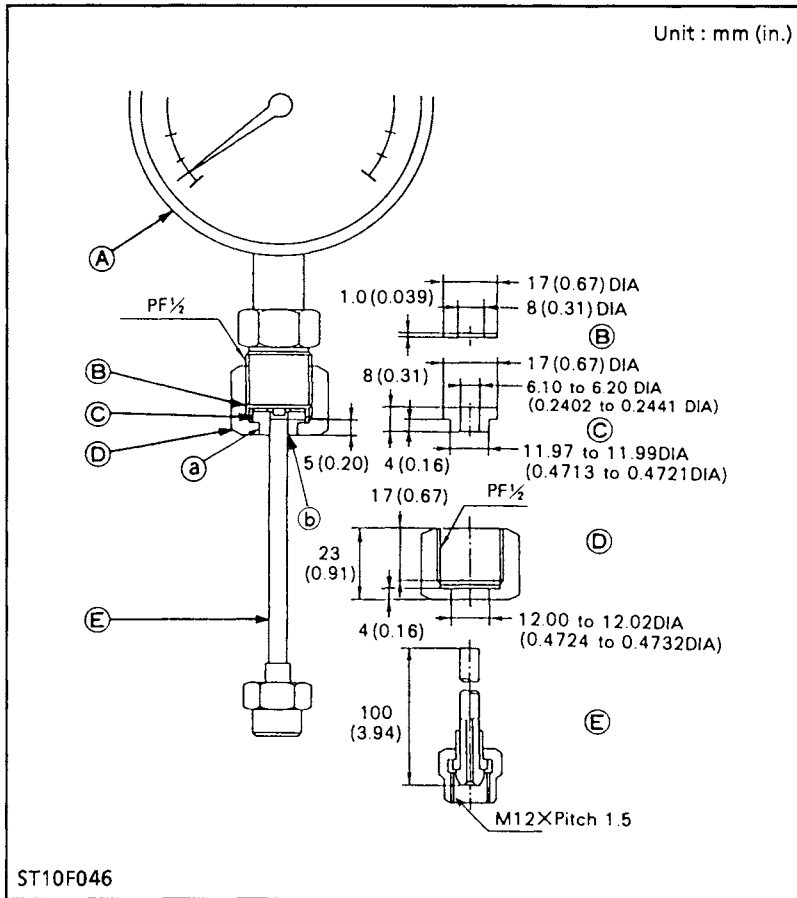


Flywheel Stopper

Application: Use to loosen and tighten the flywheel screw.

■ **NOTE**

- This special tool is not provided, so make it referring to the figure.



Injection Pump Pressure Tester

Application : Use to check fuel tightness of injection pumps.

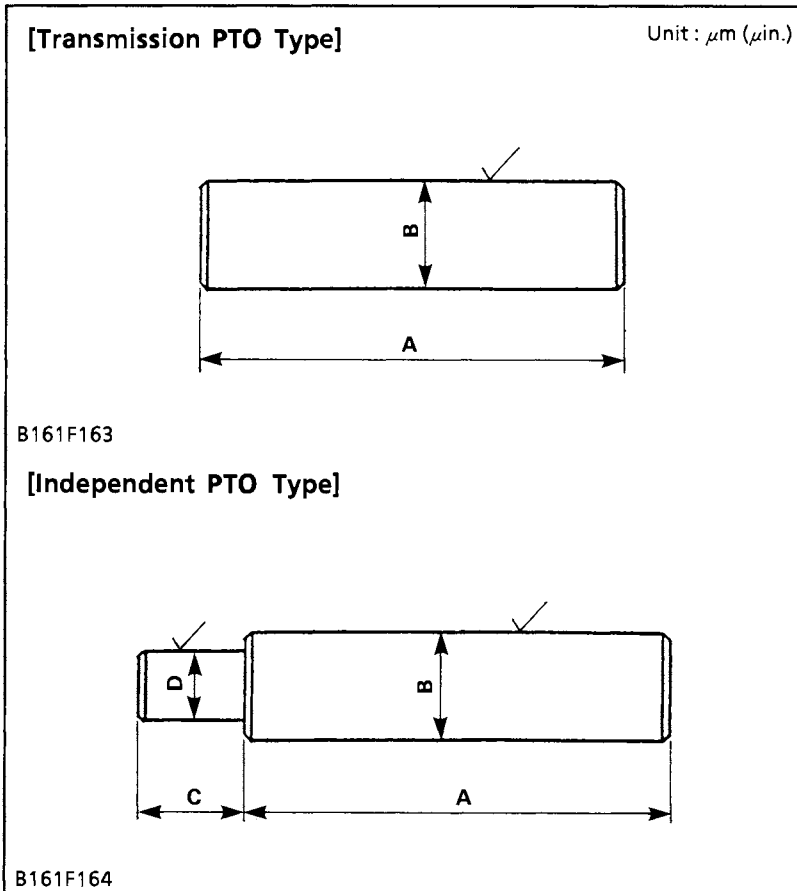
■ NOTE

- This special tool is not provided, so make it referring to the figure.

A	Pressure gauge full scale more than 29.4 MPa (300 kgf/cm ² , 4267psi)
B	Gasket (copper)
C	Flange (steel)
D	Hex. nut with across the flat 27 mm (1.06 in.)
E	Injection pipe

(a) Adhesive Application

(b) Fillet Welding on the Enter Circumference



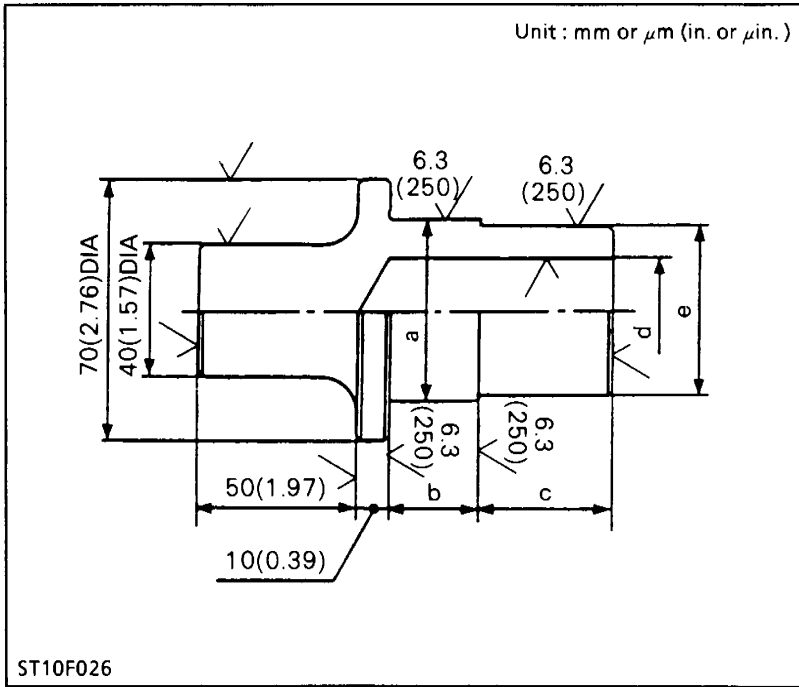
Clutch Center Tool

Application : Use for mounting a clutch disc to the flywheel.

■ NOTE

- This special tool is not provided, so make it referring to the figure.

A	250 to 300 mm (9.84 to 11.81 in.)
B	31.1 to 31.6 mm (1.224 to 1.244 in.) DIA.
C	30 mm (1.18 in.)
D	19.4 to 19.9 mm (0.764 to 0.783 in.) DIA.



(Reference)

- Unless otherwise specified : All surface 12.5 (500)

Hydraulic Arm Shaft Bushing

Press-Fitting Tool

Application: Use for replacing the hydraulic arm shaft bushings in the hydraulic cylinder body.

■ **NOTE**

- This special tool is not provided, so make it referring to the figure.

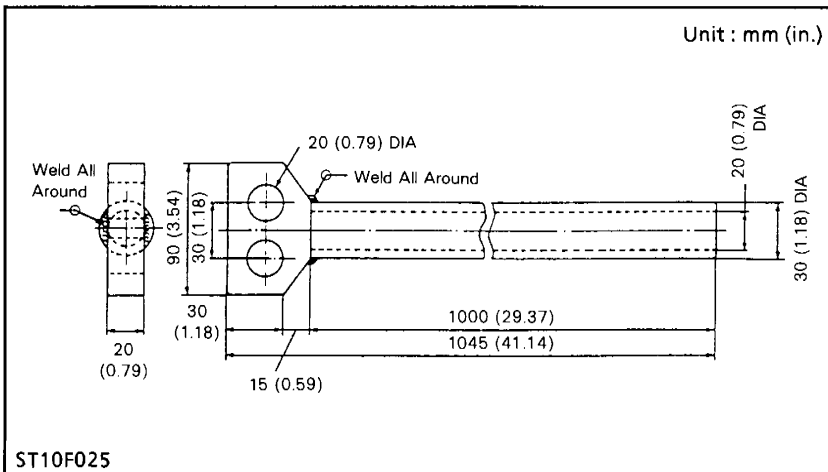
[Dimensions of hydraulic arm shaft bushing press-fitting tool]

[Right side]

a	49.7 to 49.9 mm (1.9567 to 1.9646 in.)
b	18.0 to 19.0 mm (0.71 to 0.75 in.)
c	40 mm (1.57 in.)
d	32 mm (1.26 in.)
e	44.7 to 44.9 mm (1.7598 to 1.7677 in.)

[Left side]

a	43.7 to 43.9 mm (1.7205 to 1.7283 in.)
b	20.0 to 21.0 mm (0.79 to 0.83 in.)
c	40 mm (1.57 in.)
d	30 mm (1.18 in.)
e	39.7 to 39.9 mm (1.5630 to 1.5709 in.)



Test Bar

Application: Use for checking the lift range and floating range of hydraulic draft control.

■ **NOTE**

- This special tool is not provided, so make it referring to the figure.

Front Axle Drive Shaft Tool

1. Refer to page 3-NS17.

[10] TIRES

(1) Types of Tire

The following tires can be mounted on models L3010, L3410, L3710 and L4310.

C045F069	C045F070	C045F074	B105F046
Farm Tire (Front Tire of 2WD only)	Farm Tire	Turf Tire	Industrial Tire

Model	Type of Tire	Front	Rear
L3010 2WD	Farm Tire	5.00 - 15 Std.	11.2 - 24 Std.
			12.4 - 24 Opt.
	Turf Tire	23 x 8.50 - 12 Opt. 25 x 8.50 - 14 Opt.	13.6 - 16 Opt.
			41 x 14.00 - 20 Opt. 355 / 80-D20 Opt.
L3010 4WD	Farm Tire	7.2 - 16 Std.	11.2 - 24 Std.
			12.4 - 24 Opt.
	Turf Tire	25 x 8.50 - 14 Opt. 27 x 8.50 - 15 Opt. 27 x 10.50 - 15 Opt. 29 x 12.50 - 15 Opt.	13.6 - 16 Opt.
			355 / 80-D20 Opt.
			41 x 14.00 - 20 Opt.
			21.5L - 16.1 Opt.
Industrial Tire	10 - 16.5 Opt.	420/70-24 Opt.	
L3410 2WD	Farm Tire	5.00 - 15 Std.	12.4 - 24 Std.
			13.6 - 16 Opt.
	Turf Tire	23 x 8.50 - 12 Opt. 25 x 8.50 - 14 Opt.	41 x 14.00 - 20 Opt.
			355 / 80-D20 Opt.
L3410 4WD	Farm Tire	7.2 - 16 Std.	12.4 - 24 Std.
			13.6 - 16 Opt.
	Turf Tire	25 x 8.50 - 14 Opt. 27 x 8.50 - 15 Opt. 27 x 10.50 - 15 Opt. 29 x 12.50 - 15 Opt.	13.6 - 16 Opt.
			41 x 14.00 - 20 Opt.
			355 / 80-D20 Opt.
			21.5L - 16.1 Opt.
Industrial Tire	10 - 16.5 Opt.	420 / 70 - 24 Opt.	

Model	Type of Tire	Front	Rear
L3710 4WD	Farm Tire	8.3 - 16 Std. 7.2 - 16 Opt.	13.6 - 24 Std.
			12.4 - 24 Opt.
	Turf Tire	27 x 8.50 - 15 Opt. 27 x 10.50 - 15 Opt. 29 x 12.50 - 15 Opt.	41 x 14.00 - 20 Opt.
			355 / 80-D20 Opt.
			21.5L - 16.1 Opt.
	Industrial Tire	10 - 16.5 Opt.	17.5L - 24 Opt.
L4310 2WD	Farm Tire	6.00 - 16 Std.	14.9 - 24 Std.
			13.6 - 24 Opt.
	Turf Tire	27 x 10.50 - 15 Opt. 29 x 12.50 - 15 Opt.	21.5L - 16.1 Opt.
L4310 4WD	Farm Tire	8.3 - 16 Std.	14.9 - 24 Std.
			13.6 - 24 Opt.
	Turf Tire	27 x 8.50 - 15 Opt. 27 x 10.50 - 15 Opt. 29 x 12.50 - 15 Opt.	41 x 14.00 - 20 Opt.
			355 / 80-D20 Opt.
			21.5L - 16.1 Opt.
	Industrial Tire	10 - 16.5 Opt.	17.5L - 24 Opt.

(2) Tread Adjustment

(2)-1 Front Wheels

[2WD Type]

With 2WD models, the front tread can be adjusted in 4 steps.

⚠ CAUTION

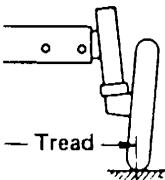
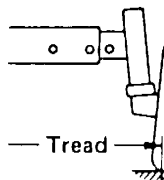
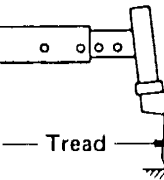
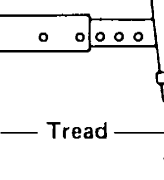
- When working on slopes or working with trailer, set the wheel tread as wide as practical for the job for maximum stability.

To change the tread

- Lift the front of the tractor with a jack.
- Remove the front axle mounting screws and the tie rod mounting screws.
- Move the front axles (right and left) to the desired position, and tighten them with the screws.

■ IMPORTANT

- After tread adjustment, adjust toe-in.
Toe-in : All models 2 to 8 mm (0.08 to 0.31 in.)

Models				
L3010, L3410 5.00 - 15 Farm	960 mm (37.8 in.)	1060 mm (41.7 in.)	1160 mm (45.7 in.)	1260 mm (49.6 in.)
L3710 5.00 - 15 Farm	1140 mm (44.9 in.)	1240 mm (48.8 in.)	1340 mm (52.8 in.)	1440 mm (56.7 in.)
L3710, L4310 6.00 - 16 Farm	1145 mm (45.1 in.)	1245 mm (49.0 in.)	1345 mm (53.0 in.)	1445 mm (56.9 in.)
L3010, L3410 23 × 8.50 - 12 Turf	1080 mm (42.4 in.)	1180 mm (46.5 in.)	1280 mm (50.4 in.)	1380 mm (54.3 in.)
L3010, L3410 25 × 8.50 - 14 Turf	1325 mm (52.2 in.)	1425 mm (56.1 in.)	1525 mm (60.0 in.)	1625 mm (64.0 in.)
L3710 25 × 8.50 - 14 Turf	1150 mm (45.3 in.)	1250 mm (49.2 in.)	1350 mm (53.1 in.)	1450 mm (57.1 in.)
L3710, L4310 27 × 10.50 - 15 Turf	1195 mm (47.0 in.)	1295 mm (51.0 in.)	1395 mm (54.9 in.)	1495 mm (58.9 in.)
L3710, L4310 29 × 12.50 - 15 Turf	1250 mm (49.2 in.)	1350 mm (53.1 in.)	1450 mm (57.1 in.)	1550 mm (61.0 in.)

■ IMPORTANT

- The front tread width for the front loader application on 2WD models should not be greater than 1060 mm (41.7 in.) for L3010 and L3410, 1150 mm (45.3 in.) for L3710 and L4310.

[4WD Type]

Front axle is not adjustable.

	Models	L3010, L3410					
	Tires	7.2-16 Farm	24 × 8.50-14 Turf	27 × 8.50-15 Turf	27 × 10.50-15 Turf	29 × 12.50-15 Turf	10-16.5 Industrial
	Tread	1105 mm (43.5 in.)	1135 mm (44.7 in.)	1150 mm (45.3 in.)	1180 mm (46.5 in.)	1230 mm (48.4 in.)	1180 mm (46.5 in.)
	Models	L3710	L3710, L4310				
	Tires	7.2-16 Farm	8.3-16 Farm	27 × 8.50-15 Turf	27 × 10.50-15 Turf	29 × 12.50-15 Turf	10-16.5 Industrial
Tread	1155 mm (45.5 in.)		1200 mm (47.2 in.)	1230 mm (48.4 in.)	1280 mm (50.4 in.)	1230 mm (48.4 in.)	

(2)-2 Rear Wheels

Rear tread can be adjusted in 6 steps depending on the model.

To change the tread

1. Lift the rear tires off the ground.
2. Follow the illustrations below to get the desired tread width.

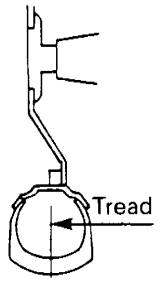
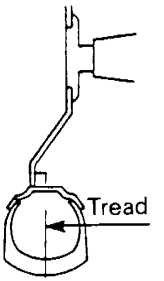
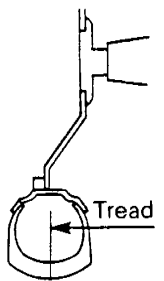
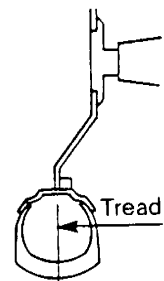
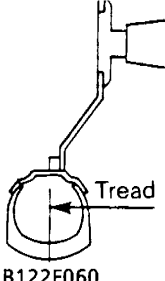
CAUTION

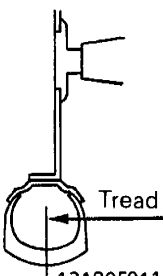
- When working on slopes or working with trailer, set the wheel tread as wide as practical for the job for maximum stability.

IMPORTANT

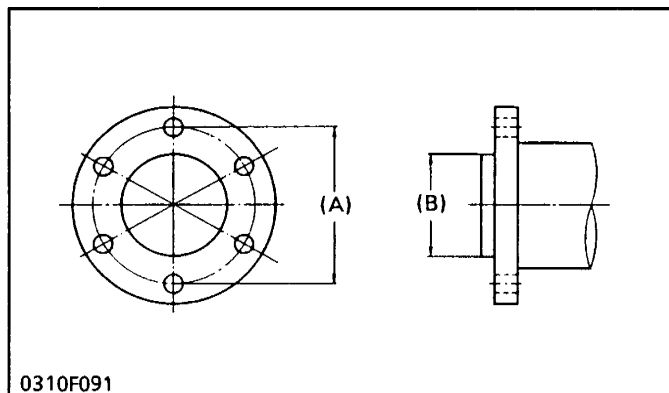
- Always attach tires as shown in the drawings below.
- If not attached as illustrated, transmission parts may be damaged.
- Do not use tires larger than specified.

Models						
L3010 11.2-24 Farm		1120 mm (44.1 in.)	1220 mm (48.0 in.)	1305 mm (51.4 in.)	1405 mm (55.3 in.)	
L3010, L3410 12.4-24 Farm		1120 mm (44.1 in.)	1220 mm (48.0 in.)	1305 mm (51.4 in.)	1405 mm (55.3 in.)	
L3710 12.4-24 Farm	1150 mm (45.3 in.)	1235 mm (48.6 in.)	1335 mm (52.6 in.)	1415 mm (55.7 in.)	1515 mm (59.6 in.)	
L3710, L4310 13.6-24 Farm	1180 mm (46.5 in.)	1200 mm (47.2 in.)	1300 mm (51.2 in.)	1450 mm (57.1 in.)	1545 mm (60.8 in.)	
L3710, L4310 14.9-24 Farm	1180 mm (46.5 in.)	1200 mm (47.2 in.)	1300 mm (51.2 in.)	1450 mm (57.1 in.)	1545 mm (60.8 in.)	

Models					 B122F060
L3010, L3410 420 / 70 – 24 Industrial			1245 mm (49.0 in.)	1280 mm (50.4 in.)	1390 mm (54.7 in.)
L3710, L4310 17.5L – 24 Industrial		1245 mm (49.0 in.)	1355 mm (53.3 in.)	1395 mm (54.9 in.)	1505 mm (59.3 in.)

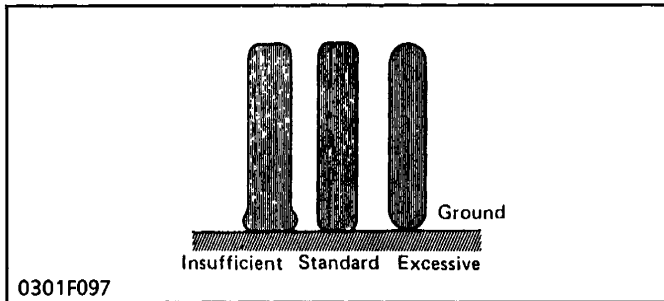
Models	 12190F01110
L3010, L3410 13.6 – 16 Turf	1135 mm (44.7 in.)
L3010, L3410 41 x 14.00 – 20 Turf	1150 mm (45.3 in.)
L3010, L3410 21.5L – 16.1 Turf	1350 mm (53.1 in.)
L3010, L3410 355 / 80-D20 Turf	1150 mm (45.3 in.)
L3710, L4310 41 x 14.00 – 20 Turf	1265 mm (49.8 in.)
L3710, L4310 21.5L – 16.1 Turf	1460 mm (57.5 in.)
L3710, L4310 355 / 80-D20 Turf	1265 mm (49.8 in.)

(3) Wheel Hub



	Front wheel hub	Rear wheel hub
Screw circle diameter (A)	152.4 mm (6 in.)	170 mm (6.7 in.)
Number of screws	6	6
Screw sizes	M14 x 1.5	M16 x 1.5
Hub pilot diameter (B)	117.4 mm (4.625 in.)	135 mm (5.315 in.)

(4) Tire Pressure



CAUTION

- Do not attempt to mount a tire. This should be done by a qualified person with the proper equipment. Qualified persons with the proper tire mounting equipment should recognize the following warning.

WARNING

- Never exceed 241 kPa (2.5 kgf/cm², 35 psi) when attempting to seat a bead. If beads have not been seated by the time the pressure reaches 241 kPa (2.5 kgf/cm², 35 psi), deflate the assembly, reposition the tire on the rim, relubricate and reinflate. After seating the bead, adjust inflation pressure as recommended in the inflation pressure chart.

Though the tire pressure is factory-set to the prescribed level, it naturally drops slowly in the course of time. Thus, check it everyday and inflate as necessary. To inflate the wheel tires, use an air compressor or hand pump.

- Recommended inflation pressure**
Maintain the pressure shown below.

	Tire sizes	Inflation Pressure
Rear	11.2 – 24, 4PR	140 kPa (1.4 kgf/cm ² , 20 psi)
	12.4 – 24, 4PR	140 kPa (1.4 kgf/cm ² , 20 psi)
	13.6 – 24, 4PR	140 kPa (1.4 kgf/cm ² , 20 psi)
	14.9 – 24, 4PR	140 kPa (1.4 kgf/cm ² , 20 psi)
	13.6 – 16, 4PR	220 kPa (2.2 kgf/cm ² , 32 psi)
	41 × 14.00 – 20, 4PR	170 kPa (1.7 kgf/cm ² , 24 psi)
	21.5L – 16.1, 6PR	170 kPa (1.7 kgf/cm ² , 24 psi)
	420 / 70 – 24, 6PR	140 kPa (1.4 kgf/cm ² , 20 psi)
	17.5L – 24, 6PR	140 kPa (1.4 kgf/cm ² , 20 psi)
	355 / 80 – 24, 4PR	100 kPa (1.0 kgf/cm ² , 14 psi)
Front	5.00 – 15, 4PR	220 kPa (2.2 kgf/cm ² , 32 psi)
	6.00 – 16, 4PR	220 kPa (2.2 kgf/cm ² , 32 psi)
	7.2 – 16, 4PR	150 kPa (1.5 kgf/cm ² , 22 psi)
	8.3 – 16, 4PR	150 kPa (1.5 kgf/cm ² , 22 psi)
	23 × 8.50 – 12, 4PR	150 kPa (1.5 kgf/cm ² , 22 psi)
	25 × 8.50 – 14, 4PR	70 kPa (0.7 kgf/cm ² , 10 psi)
	27 × 8.50 – 15, 4PR	85 kPa (0.9 kgf/cm ² , 12 psi)
	27 × 10.50 – 15, 4PR	85 kPa (0.9 kgf/cm ² , 12 psi)
	29 × 12.50 – 15, 4PR	140 kPa (1.4 kgf/cm ² , 20 psi)
10 – 16.5, 6PR	140 kPa (1.4 kgf/cm ² , 20 psi)	

(5) Tire Liquid Injection

Auxiliary weights can be used to increase traction force for plowing in fields or clayey grounds.

Another way is to inject water or another liquid, such as a calcium chloride solution in the tires. Water must not be used in winter since it freezes at 0 °C (32 °F). The calcium chloride solution will not freeze and moreover, affords higher effect than water since

its specific gravity is higher than that of water by about 20 %. Below is an explanation of calcium chloride solution injection.

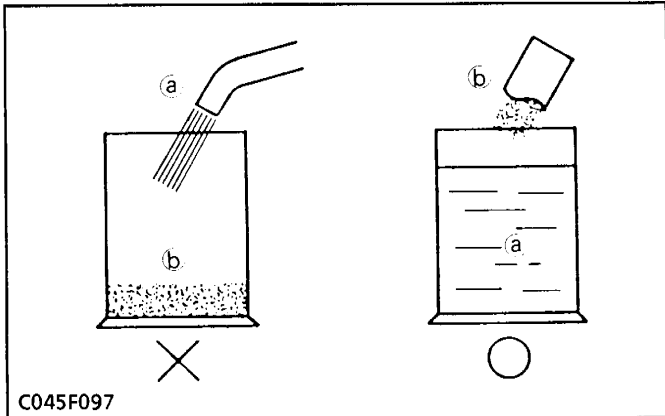
IMPORTANT

- Do not fill the front tires with liquid.

Preparation of Calcium Chloride Solution

CAUTION

- When making a calcium chloride solution, do not pour water over calcium chloride since this results in chemical reaction which will cause high temperature. Instead add a small amount of calcium chloride to the water at a time until the desired solution is achieved.

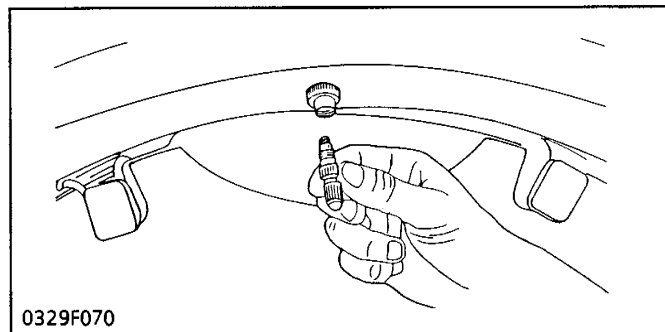


C045F097

(a) Water

(b) CaCl₂ (Calcium Chloride)

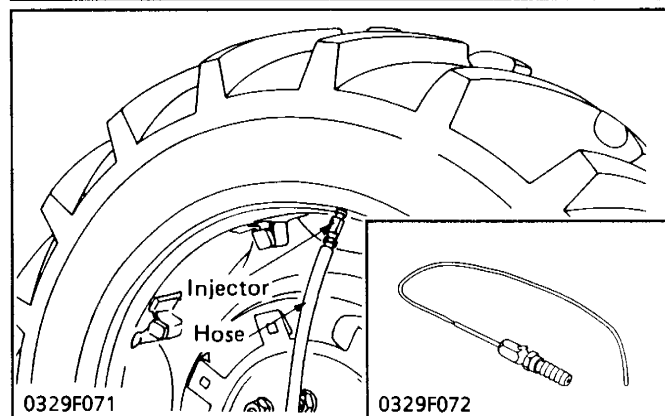
Freezing temp.	Weight of CaCl ₂ to be dissolved in 100 ℓ (26.5 U.S.gals. 22.0 Imp.gals.) of water
-5 °C (23 °F)	12 kg (26.4 lbs)
-10 °C (14 °F)	21 kg (46.3 lbs)
-15 °C (5 °F)	28 kg (61.7 lbs)
-20 °C (-4 °F)	34 kg (75.0 lbs)
-25 °C (-13 °F)	40 kg (88.2 lbs)
-30 °C (-22 °F)	44 kg (97.0 lbs)
-35 °C (-31 °F)	49 kg (108.0 lbs)
-40 °C (-40 °F)	52 kg (114.6 lbs)
-45 °C (-49 °F)	56 kg (123.5 lbs)
-50 °C (-58 °F)	61 kg (134.5 lbs)



0329F070

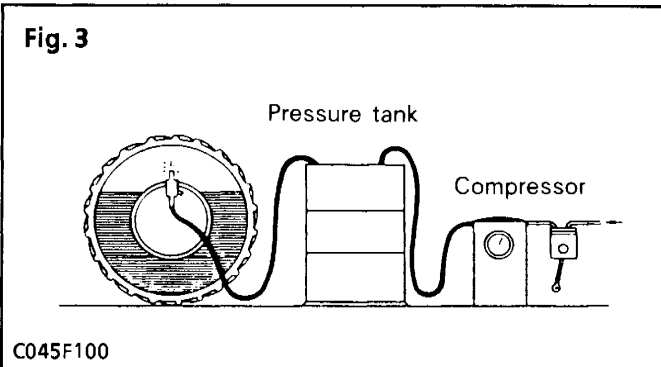
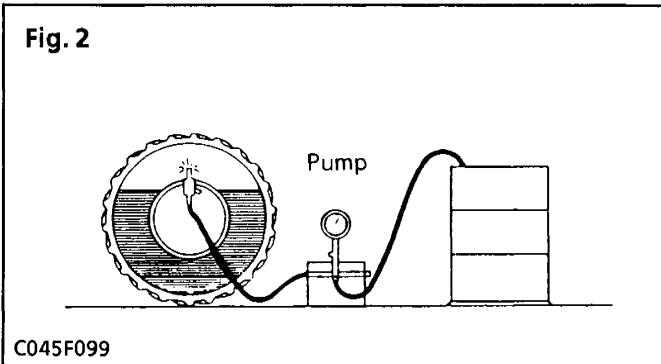
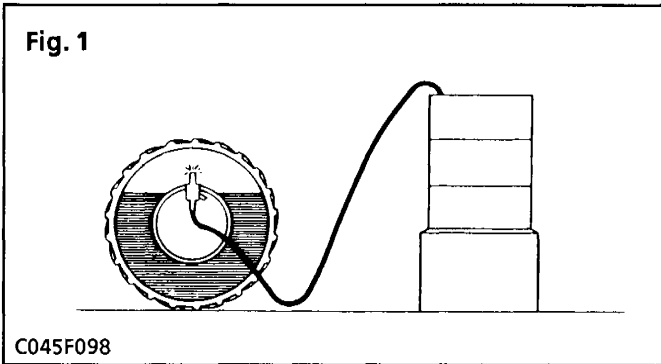
Attaching the Injector

- Lift the rear tires off the ground.
- Turn the tire so that the air valve is at the top.
- Remove the air valve, and attach the injector.
(Code No: 07916-52281)



0329F071

0329F072



Injection

CAUTION

- When a calcium chloride solution is used, cool it before pouring it into the tire.

The following four ways can be used to inject water or a calcium chloride solution into tires.

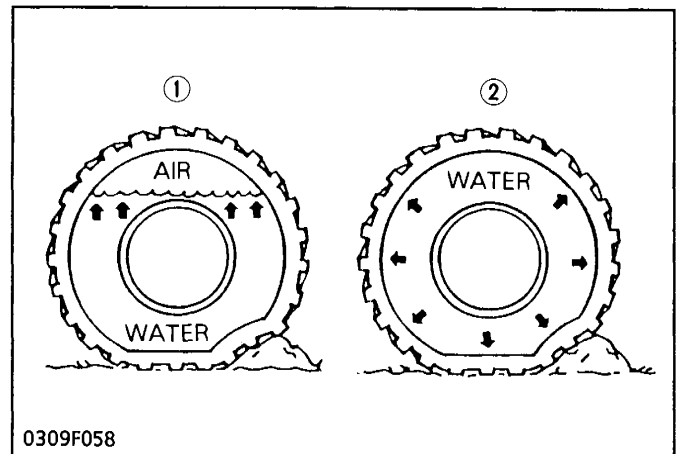
1. Gravity injection (Fig. 1)
2. Pump injection (Fig. 2)
3. Pressure tank injection (Fig. 3)
4. Injection directly from tap (only when water is being used).

NOTE

- Once injection is completed, reset the air valve, and pump air into the tire to the specified pressure.

CAUTION

- Do not fill tires with water or solution more than 75 % of full capacity (to the valve stem level).

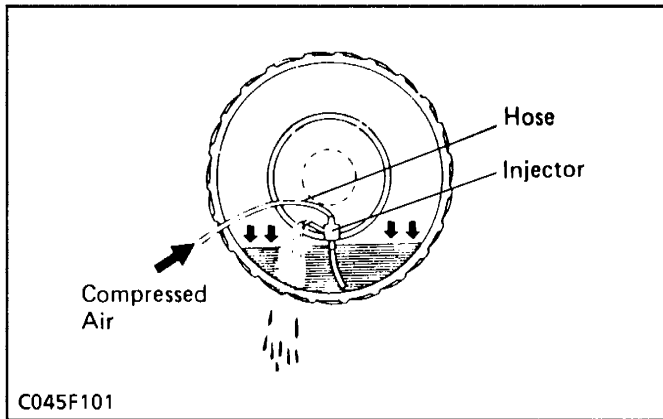


(1) Correct -75 %
Air compresses like a cushion

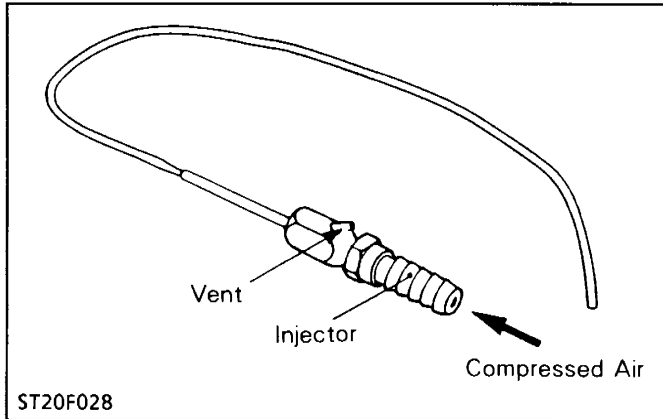
(2) Incorrect -100% Full
Water can not be compressed

Weight of Calcium Chloride Solution Filling 75 % of Full Capacity of a Tire.

Tire sizes	11.2 - 24	12.4 - 24	13.6 - 24	14.9 - 24	420 / 70 - 24	17.5L - 24
Slush free at -10 °C (13 °F) Solid at -30 °C (-23 °F) [Approx. 1 kg (2 lbs.) CaCl ₂ per 4 ℓ (1 gal) of water]	105 kg (231 lbs)	130 kg (287 lbs)	165 kg (364 lbs)	205 kg (452 lbs)	195 kg (430 lbs)	235 kg (518 lbs)
Slush free at -24 °C (-12 °F) Solid at -47 °C (-52 °F) [Approx. 1.5 kg (3.5 lbs.) CaCl ₂ per 4 ℓ (1 gal) of water]	110 kg (243 lbs)	135 kg (298 lbs)	175 kg (386 lbs)	215 kg (474 lbs)	205 kg (452 lbs)	250 kg (551 lbs)
Slush free at -47 °C (-52 °F) Solid at -52 °C (-62 °F) [Approx. 2.25 kg (5 lbs.) CaCl ₂ per 4 ℓ (1 gal) of water]	115 kg (254 lbs)	145 kg (320 lbs)	185 kg (408 lbs)	225 kg (496 lbs)	220 kg (485 lbs)	265 kg (584 lbs)



C045F101



ST20F028

Draining water or solution

1. Lift the rear tires off the ground.
2. Turn the tire so that the air valve is at the bottom.
3. Remove the air valve, and drain liquid (liquid can only be drained to the level of the valve and liquid under that level remains inside).
4. To drain liquid completely, use the injector, and direct compressed air into the tire to force out the liquid through the injector's vent.

[11] SPECIFICATIONS OF IMPLEMENT LIMITATIONS

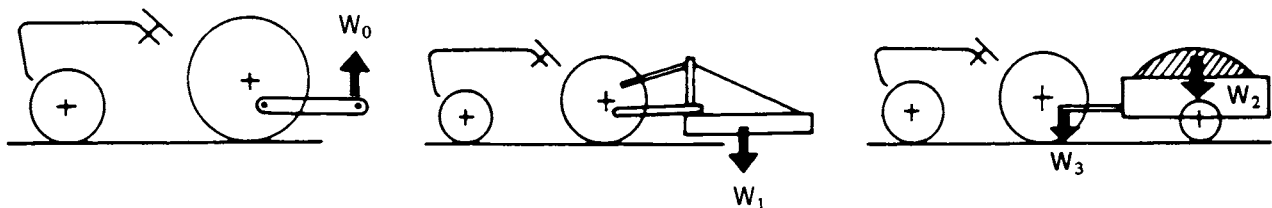
The KUBOTA Tractor has been through tested for proper performance with implements sold or approved by KUBOTA. Use with implements which exceed maximum specifications listed below, or otherwise unfit for use with the KUBOTA Tractor

may result in malfunctions or failures of the tractor, damage to other property and injury to the operator or others. (Any malfunctions or failures of the tractor resulting from use with improper implements are not covered by the warranty.)

	Tread (max. width) with farm tires			Lift capacity lower link end W_0
	Front		Rear	
	2WD	4WD		
L3010	1260 mm (49.6 in.)	1105 mm (43.5 in.)	1405 mm (55.3 in.)	1300 kg (2870 lbs)
L3410				
L3710	1445 mm (56.9 in.)	1155 mm (45.5 in.)	1545 mm (60.8 in.)	
L4310		1180 mm (46.5 in.)		

	Actual figures			Lift capacity 24 inch behind lower link end W_1
	Trailer loading weight W_2 Max. capacity		Max. Drawbar Load W_3 2WD, 4WD	
	2WD	4WD		
L3010	1500 kg (3300 lbs)		500 kg (1100 lbs)	1000 kg (2200 lbs)
L3410	2000 kg (4400 lbs)			
L3710	2500 kg (5500 lbs)		650 kg (1430 lbs)	1050 kg (2310 lbs)
L4310				

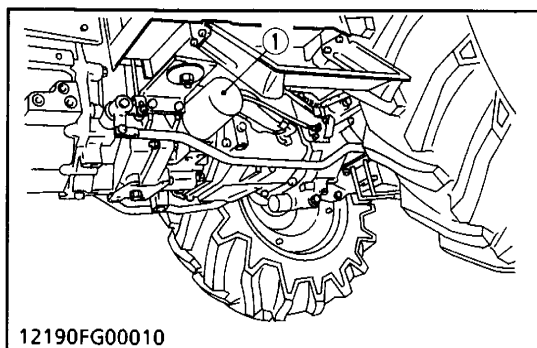
Lower link end max. lift capacity ... W_0
 Implement weight The implement's weight which can be put on the links : W_1
 Trailer loading weight The max. loading weight for trailer (without trailer's weight) : W_2



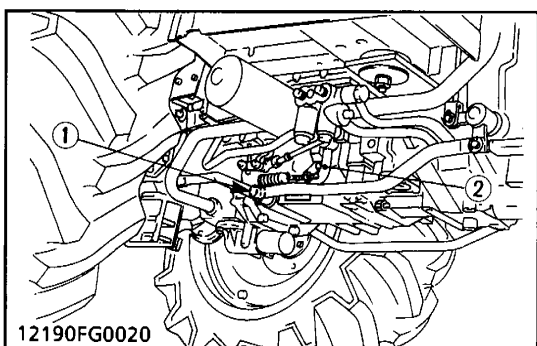
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No.	Implement		Remarks	L3010	L3410	L3710	L4310
1	Trailer		Max. Load Capacity	kg (lbs)	1500 (3300)	2000 (4400)	2500 (5500) 3000 (6600)
			Max. Drawbar Load	kg (lbs)	500 (1100)	650 (1430)	
2	Mower	Mid Mount	Max. Cutting Width	mm (in.)	1829 (72)		—
			Max. Weight	kg (lbs)	200 (440)		—
		Rotary-Cutter	Max. Cutting Width	mm (in.)	1829 (72)		
			Max. Weight	kg (lbs)	350 (770)	400 (880)	
		Flail Mower	Max. Cutting Width	mm (in.)	1524 (60)		
			Max. Weight	kg (lbs)	400 (880)		
		Sickle Bar	Max. Cutting Width	mm (in.)	2133 (84)		
			Max. Weight	kg (lbs)	500 (1100)		
3	Sprayer		Max. Tank capacity ℓ (gals.)	Rear mounted	300 (80)		400 (106)
				Pull type	800 (210)	1000 (265)	1200 (317)
4	Rotary Tiller		Max. Tilling Width	mm (in.)	1520 (60)		
5	Bottom Plow		Max. Size		12 in. x 2, 16 in. x 1	14 in. x 2	
6	Disc-harrow (Pull type)		Max. Harrowing Width	mm (in.)	1829 (72)	1981 (78)	
			Max. Weight	kg (lbs)	350 (770)	400 (880)	
7	Chisel Plow		Max. Cutting Width	mm (in.)	1829 (72)		
			Max. Weight	kg (lbs)	350 (770)		
8	Broad Caster		Max. Tank Capacity	ℓ (gals.)	200 (53)	250 (66)	300 (80)
			Max. Weight	kg (lbs)	100 (220)		
9	Manure Spreader		Max. Capacity	kg (lbs)	1500 (3300)	2000 (4400)	
10	Cultivator		Max. Width	mm (in.)	1829 (72)	2134 (84)	
			Number of Rows		1	2	
			Max. Weight	kg (lbs)	300 (660)	350 (770)	400 (880)
11	Front Blade		Max. Cutting Width	mm (in.)	1829 (72)		
			Max. Oil Pressure	kgf/cm ² (psi)	175 (2490)		
			Sub Frame		Necessary		
12	Rear Blade		Max. Cutting Width	mm (in.)	1829 (72)		
			Max. Oil Pressure	kgf/cm ² (psi)	175 (2490)		
13	Front-end Loader		Max. Lifting Capacity	kg (lbs)	480 (1060)	680 (1500)	
			Max. Oil Pressure (Extra Hydro Kit)	kgf/cm ² (psi)	175 (2490)		
			Sub Frame		Necessary		
14	Box Blade		Max. Cutting Width	mm (in.)	1321 (52)	1651 (65)	
			Max. Weight	kg (lbs)	295 (650)	350 (770)	
15	Back Hoe		Max. Digging Depth	mm (in.)	2288 (90)		
			Max. Weight	kg (lbs)	450 (990)		
			Sub Frame		Necessary		
16	Snow Blade		Max. Width	mm (in.)	1524 (60)		1830 (72)
			Max. Weight	kg (lbs)	300 (660)	350 (770)	
17	Snow Blower		Max. Working Width	mm (in.)	1524 (60)	1676 (66)	
			Max. Weight	kg (lbs)	250 (550)	280 (620)	

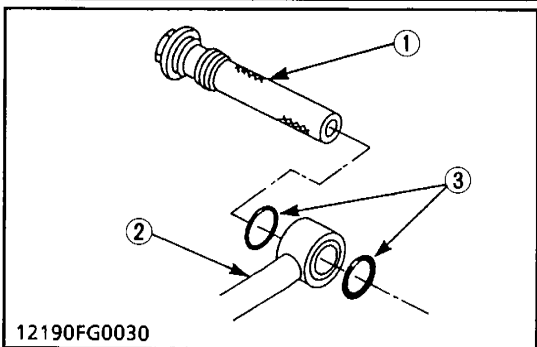
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(5) Check Points of Every 200 Hours [HST Type]

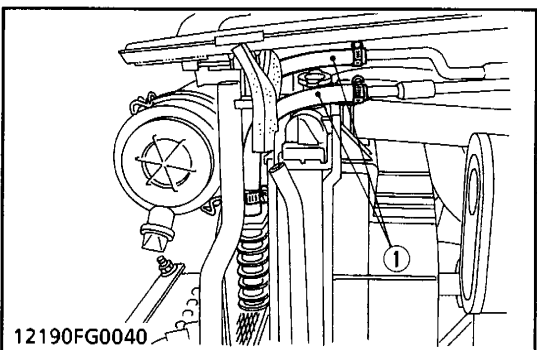
(1) Oil Filter Cartridge



12190FG0020



12190FG0030



12190FG0040

Replacing Transmission Oil Filter Cartridge [HST Type]

1. Put the oil pan under the transmission, drain transmission oil completely into it from drain plugs at the bottom of the transmission case.
2. Remove the transmission oil filter cartridge (1).
3. When installing, apply the clean transmission oil slightly to the rubber gasket.
4. Tighten the transmission oil filter cartridge (1) quickly until it contacts the mounting surface. Tighten hydraulic oil filter cartridge by hand an additional 1/2 turn only.
5. After the new cartridge has been replaced, fill with KUBOTA SUPER UDT fluid up to the upper line of the gauge located at the rear side of transmission.

■ IMPORTANT

- To prevent serious damage to the hydraulic system, use only a Kubota genuine filter.

Cleaning Transmission Strainer [HST Type]

1. When replacing the transmission oil filter, disassemble and rinse the strainer (1) with a nonflammable solvent completely clean off filings.

■ NOTE

- When reassembling, be careful not to damage the parts.
- Since the fine filings in the oil could impair the component parts of the precision built hydraulic system to withstand high pressure, the suction line end is provided with an oil strainer.

- (1) Strainer
(2) Suction Line

- (3) O-ring

Checking HST Oil Line [HST Type]

1. Check to see that all lines and hose clamps are tight and not damaged.
2. If hoses and clamps are found worn or damaged, replace or repair them at once.

- (1) HST Oil Line

MECHANISM

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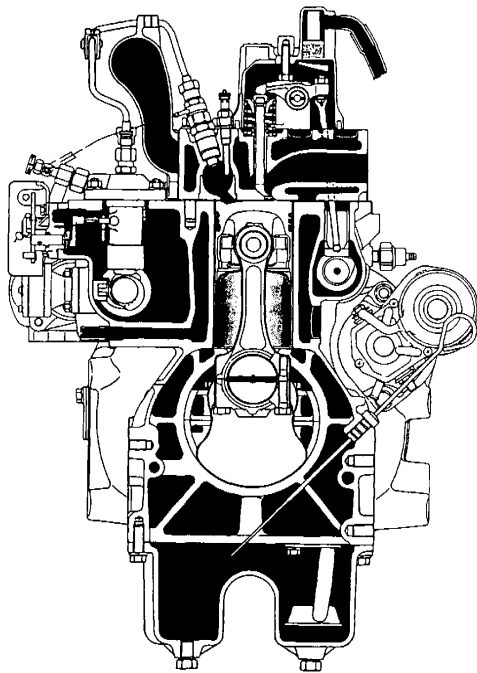
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(2) Cylinder Head	1-M2
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[1] FEATURES

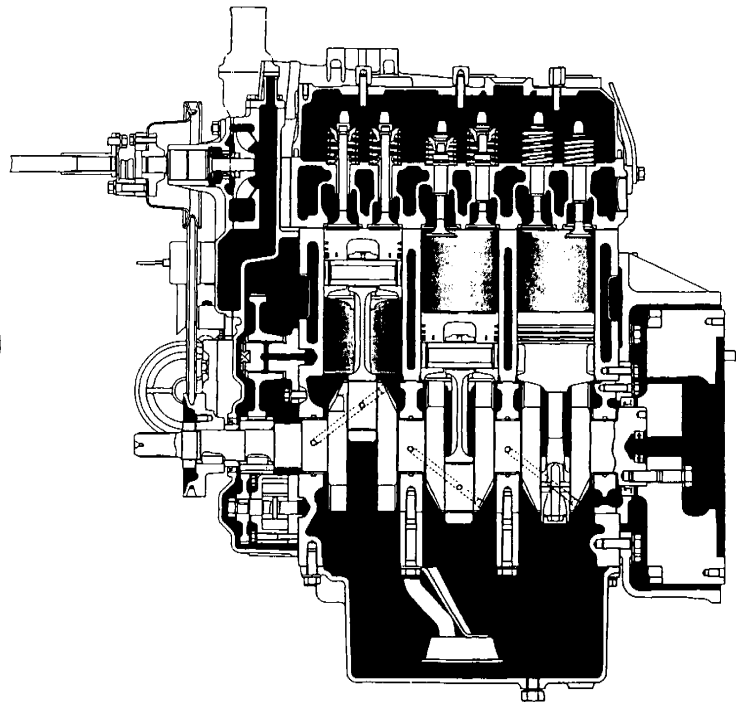
The D1503-L-A, D1703-A, V1903-A and V2203-A are vertical, water-cooled, 4-cycle diesel engine.

It is incorporated KUBOTA's foremost technologies. With KUBOTA's E-TVCS (Three Vortex

Combustion System), well-known Bosch type injection pump and the well-balanced designs, they give greater power, low fuel consumption, little vibration and quiet operation.



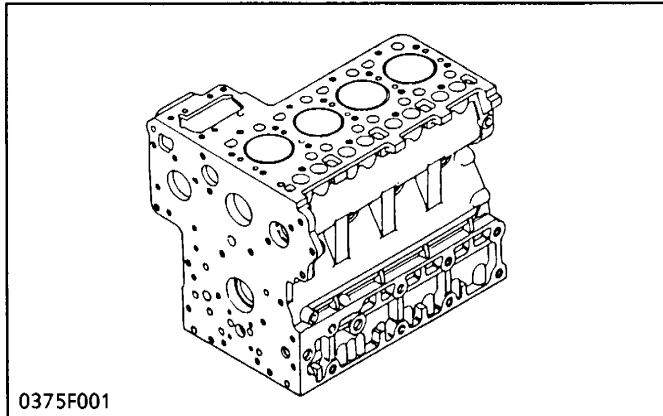
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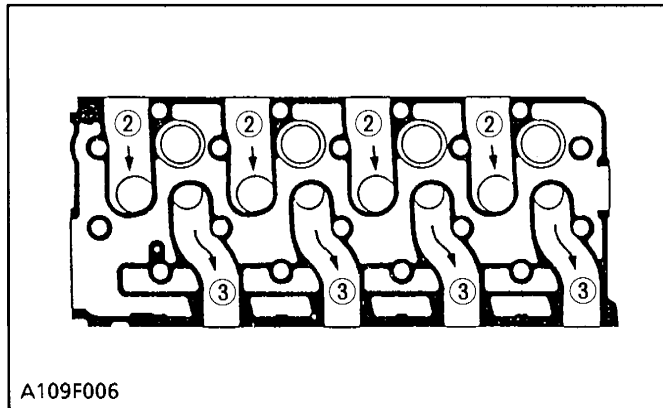
[2] ENGINE BODY

(1) Cylinder Block



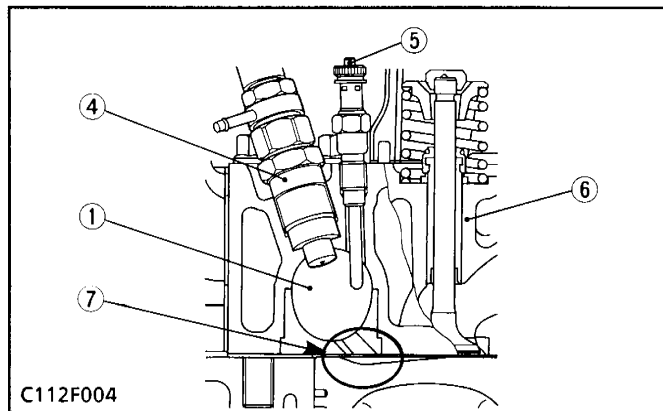
The engine has a high durability tunnel-type cylinder block in which the crank bearing component is a constructed body. Furthermore, liner less type, allow effective cooling, less distortion, and greater wear-resistance. The noise level is reduced to a minimum because each cylinder has its own chamber.

(2) Cylinder Head



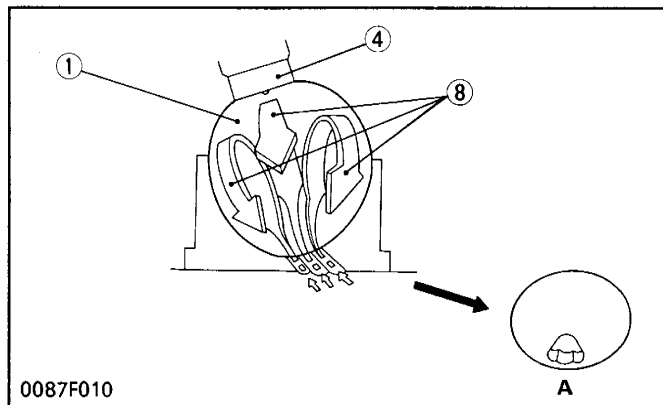
The cross-flow type intake/exhaust ports in this engine have their openings at both sides of the cylinder head. Because overlaps of intake/exhaust ports are smaller than in ports of other types which have openings on one side, the suction air can be protected from being heated and expanded by heated exhaust air. The cool, high density suction air has high volume efficiency and raises the power of the engine. Furthermore, distortion of the cylinder head by heated exhaust gas is reduced because intake ports are arranged alternately. The combustion chamber is of KUBOTA's exclusive E TVCS combustion chamber type. Suction air is whirled to be mixed effectively with fuel, prompting combustion and reducing fuel consumption.

In the combustion chamber are installed throttle type injection nozzle and rapid heating sheathed type glow plug. This glow plug assures easier than ever engine starts even at -15°C (5°F).

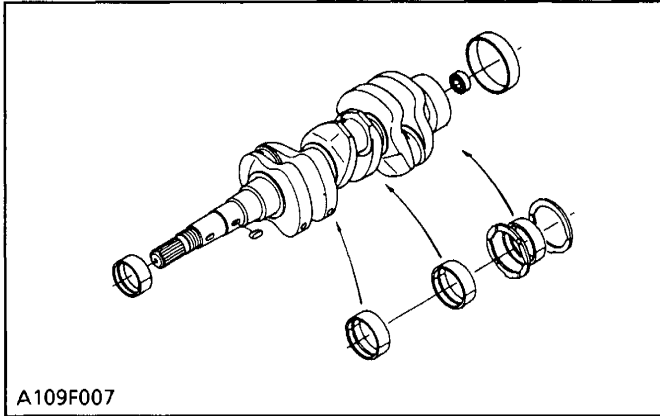


[A] Connect to Combustion Chamber

- | | |
|------------------------|--------------------|
| (1) Combustion Chamber | (5) Glow Plug |
| (2) Intake Port | (6) Cylinder Head |
| (3) Exhaust Port | (7) Depression |
| (4) Nozzle Assembly | (8) Compressed Air |



(3) Crankshaft



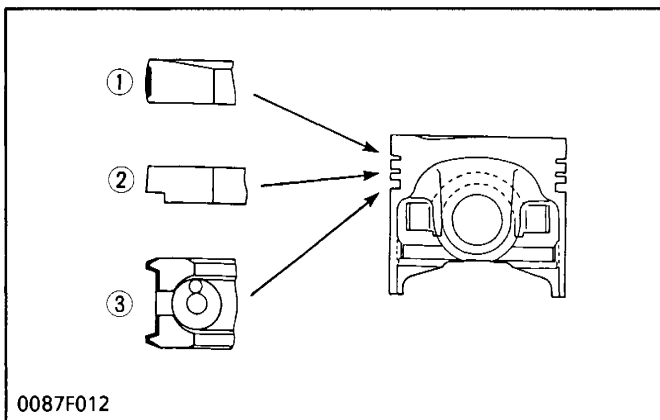
The crankshaft with the connecting rod converts the reciprocating motion of the piston into the rotating motion.

The crankshaft is made of tough special alloy steel, and the journals, pins and oil seal sliding portions are induction hardened to increase the hardness for higher wear resistance.

The front journal is supported by a solid type bearing, the intermediate journal by a split type, and the rear journal by a split type with thrust bearings.

The crankshaft is provided with an oil gallery, through which engine oil is fed to the crank pin portion, and lubricates it.

(4) Piston and Piston Rings



The piston has a slightly oval shape when cold (in consideration of thermal expansion) and a concave head.

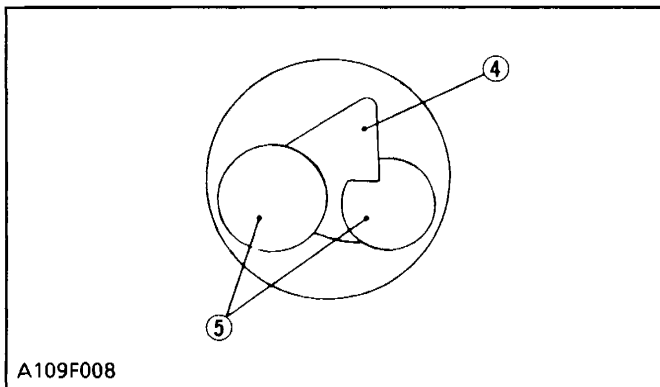
Three rings are installed in grooves in the piston.

The top ring (1) is a keystone type, which can stand against heavy loads, and the barrel face on the ring fits well to the cylinder wall.

The second ring (2) is an undercut type, which effectively prevents the oil from being carried up.

The oil ring (3) has chamfered contact faces and an expander ring, which increase the pressure of the oil ring against the cylinder wall.

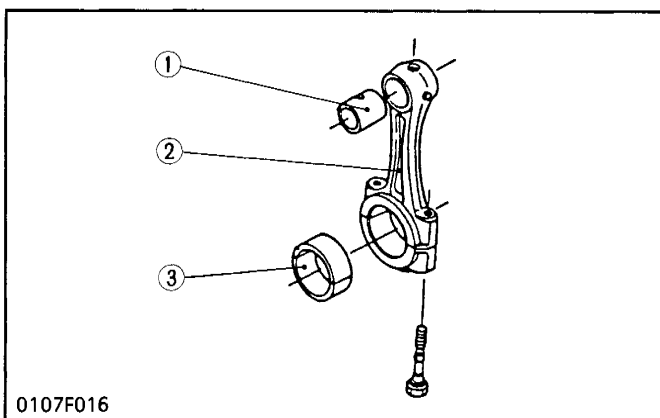
Several grooves are cut on the top land to help heat dissipate and to prevent scuffing.



- (1) Top Ring
- (2) Second Ring
- (3) Oil Ring

- (4) Depression
- (5) Valve Recess

(5) Connecting Rod

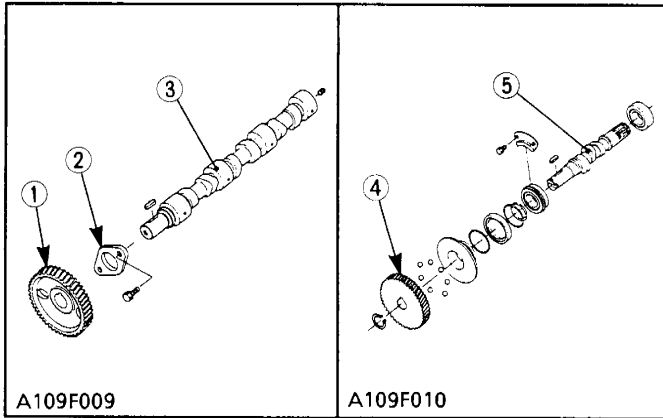


Connecting rod (2) is used to connect the piston with the crankshaft. The big end of the connecting rod has a crank pin bearing (3) (split type) and the small end has a small end bushing (1) (solid type).

- (1) Small End Bushing
- (2) Connecting Rod

- (3) Crank pin Bearing

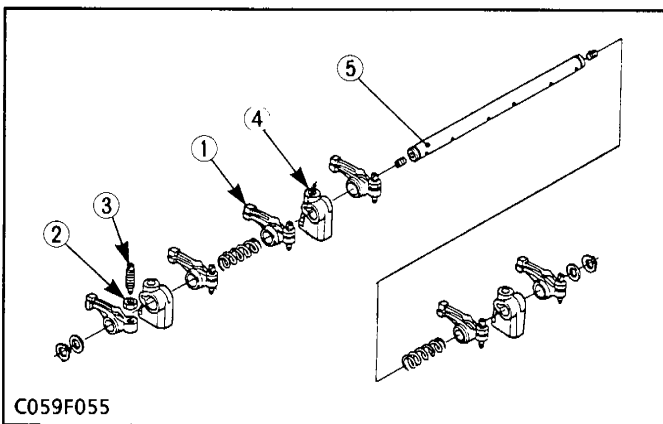
(6) Camshaft



The camshaft (3) is made of special cast iron and the journal and cam sections are quenched to resist wear. The journal sections are force-lubricated. The fuel camshaft (5) controls the reciprocating movement of the injection pump. The fuel camshaft is made of carbon steel and the cam sections are quenched and tempered to provide greater wear resistance.

- (1) Cam Gear
- (2) Camshaft Stopper
- (3) Camshaft
- (4) Injection Pump Gear
- (5) Fuel Camshaft

(7) Rocker Arm

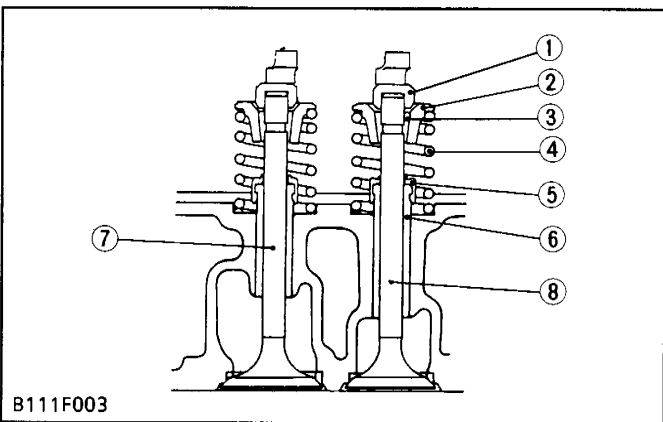


The rocker arm assembly includes the rocker arms (1), rocker arm brackets (4) and rocker arm shaft (5) push rods to an open/close movement of the inlet and exhaust valves.

Lubricating oil pressurized through the bracket to the rocker arm shaft, which serves as a fulcrum so that the rocker arm and the entire system are lubricated sufficiently.

- (1) Rocker Arm
- (2) Lock Nut
- (3) Adjusting Screw
- (4) Rocker Arm Bracket
- (5) Rocker Arm Shaft

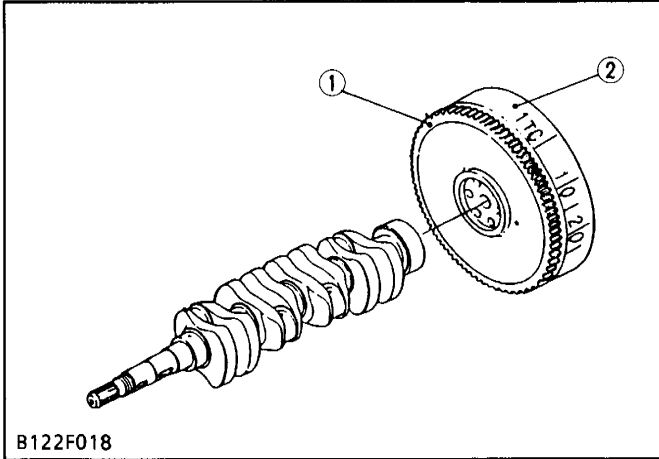
(8) Intake and Exhaust Valves



The intake and exhaust valves (7), (8) and their guides (6) are different from each other. Other parts, such as valve springs (4), valve spring retainers (2), valve spring collets (3), valve stem seals (5), and valve caps (1) are the same for both the inlet and exhaust valves. All contact or sliding parts are quenched and tempered to resist wear.

- (1) Valve Cap
- (2) Valve Spring Retainer
- (3) Valve Spring Collets
- (4) Valve Spring
- (5) Valve Stem Seal
- (6) Valve Guide
- (7) Intake Valve
- (8) Exhaust Valve

(9) Flywheel



The flywheel is installed on the rear end of the crankshaft. Its inertia keeps the flywheel turning at a constant speed, while the crankshaft tends to speed up during the power stroke and to slow down during other strokes.

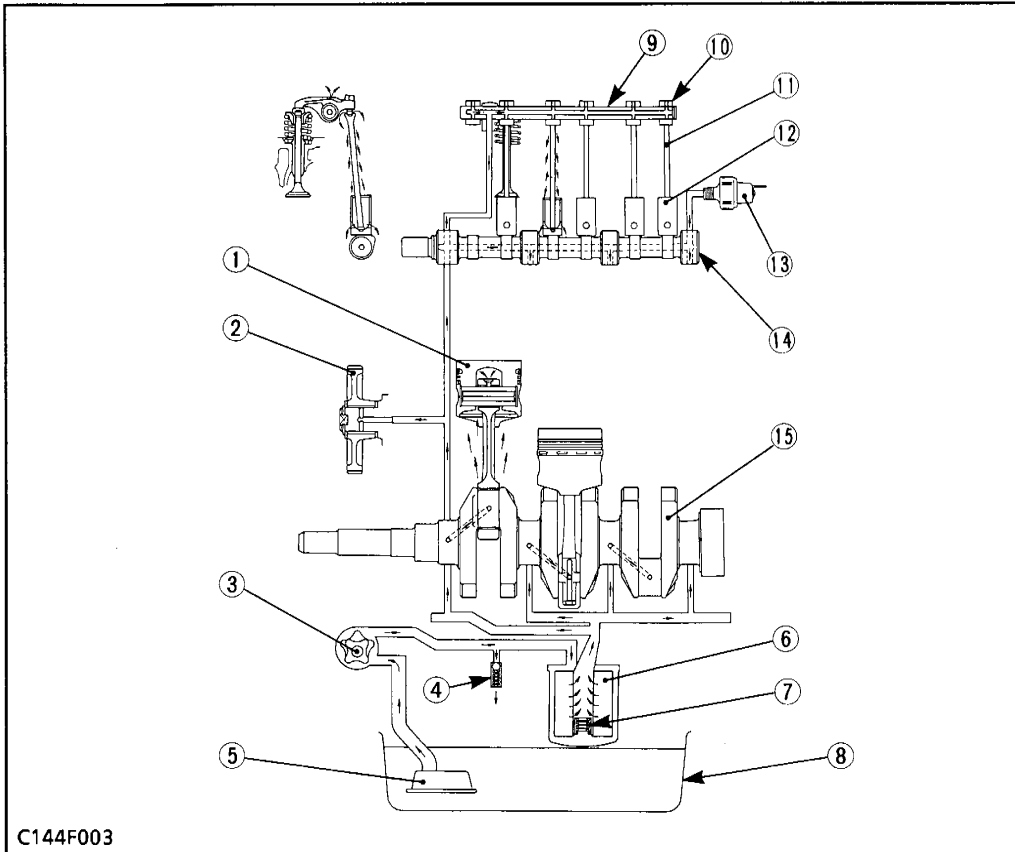
The flywheel has a ring gear (1), which mesh with the drive pinion of the starter.

The flywheel has also marks TC and fuel injection timing lines on its outer rim. The lines of fuel injection timing shows the fuel injection timing and the mark TC shows the piston's top dead center, when they are aligned with the mark of window on the clutch housing.

(1) Ring Gear

(2) Flywheel

[3] LUBRICATING SYSTEM

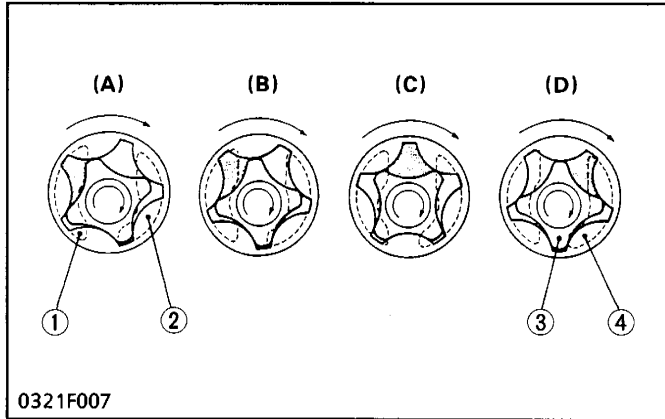


- (1) Piston
- (2) Idle Gear
- (3) Oil Pump
- (4) Relief Valve
- (5) Oil Filter
- (6) Oil Filter Element
- (7) Bypass Valve
- (8) Oil Pan
- (9) Rocker Arm Shaft
- (10) Rocker Arm
- (11) Push Rod
- (12) Tappet
- (13) Oil Pressure Switch
- (14) Camshaft
- (15) Crankshaft

The lubricating oil is forced to each journal through the oil passages of the cylinder block, cylinder head and shafts. The oil, splashed by the

crankshaft or thrown off from the bearings, lubricates other engine parts such as the push rods (11), tappets (12), piston pins and timing gears.

(1) Oil Pump



- (1) Inlet
- (2) Outlet
- (3) Inner Rotor
- (4) Outer Rotor

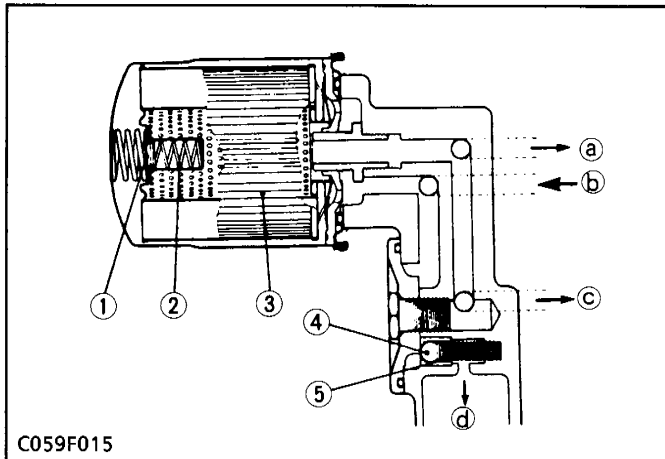
The oil pump is a gear pump, whose rotors have trochoid lobes. The inner rotor (3) has 4 lobes and the outer rotor (4) has 5 lobes, and they are eccentrically engaged with each other. The inner rotor, which is driven by the crankshaft through the gears, rotates the outer rotor in the same direction, varying the space between the lobes.

While the rotors rotate from (A) to (B), the space leading to the inlet port increases, which causes the oil to flow through the inlet port.

When the rotors rotate to (C), the port to which the space leads is changed from inlet to outlet.

At (D), the space decreases and sucked oil is discharged from the outlet port.

(2) Oil Filter and Relief Valve



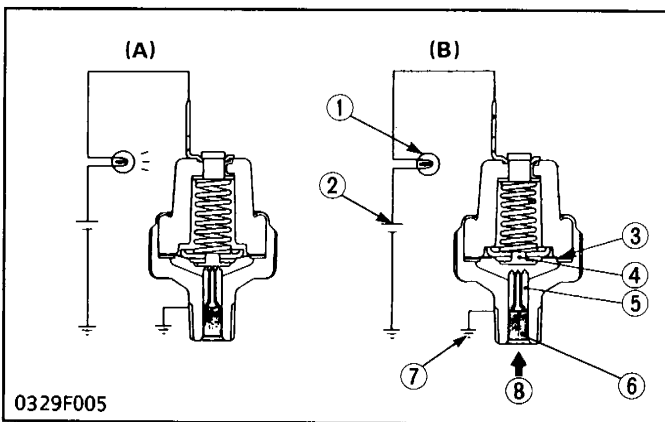
- (1) Bypass Valve
- (2) Bypass Adjusting Spring
- (3) Filter Element
- (4) Relief Valve Ball
- (5) Relief Adjusting Spring

The lubricating oil force-fed by the pump is filtered by the filter cartridge, passing through the filter element from the outside to the inside. When the filter element accumulates dirt and the pressure difference between the inside and outside rises more than 98 kPa (1.0 kgf/cm², 14 psi), the bypass valve (1) opens to allow the oil to flow from the inlet line to outlet line, bypassing the filter element.

The relief valve (4) in the inlet line allows oil to prevent damage to the lubricating system, when the oil pressure rises more than 441 kPa (4.5 kgf/cm², 64 psi).

- (a) To Idle Gear, Camshaft and Rocker Arm
- (b) From Oil Pump
- (c) To Crankshaft Journal and Crankpin
- (d) Drain of Relief Valve

(3) Engine Oil Pressure Switch



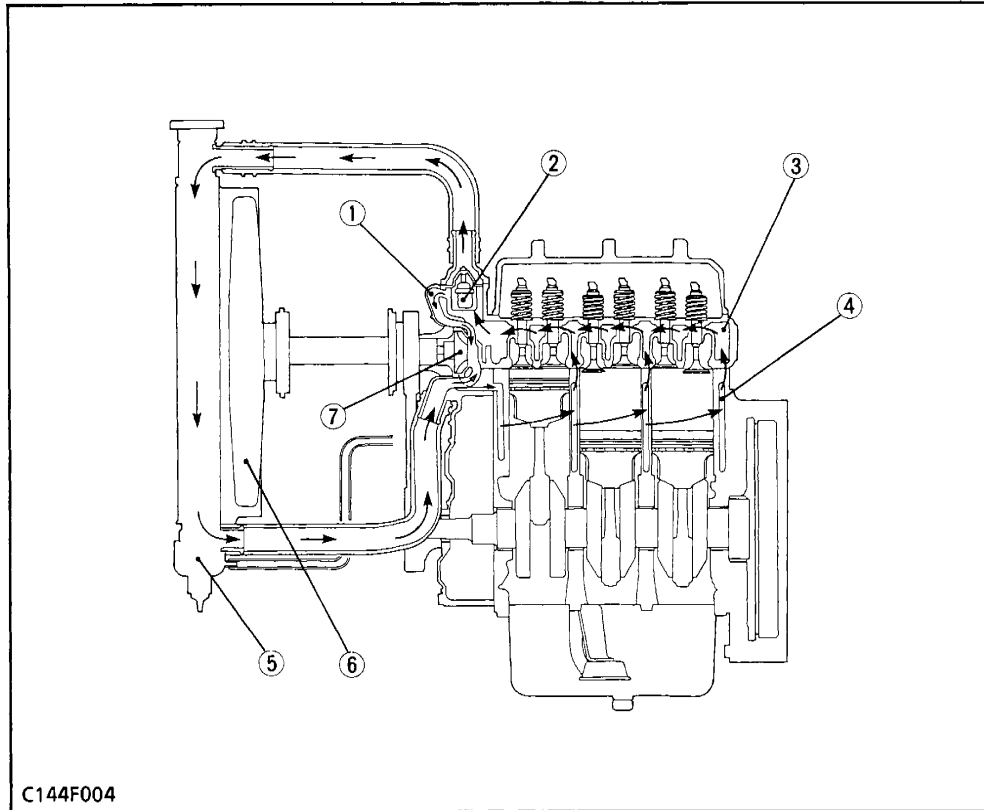
- (1) Warning Lamp
- (2) Battery
- (3) Rubber Gasket
- (4) Contact Rivet
- (5) Contact
- (6) Oil Passage
- (7) Cylinder Block
- (8) Oil

The engine oil pressure switch is installed on the cylinder block and leads to the oil passage of the lubricating oil.

When the oil pressure falls below the specified value, the contacts of the oil pressure switch closes to turn on the warning lamp (1).

- (A) At Lower Oil Pressure
(49 kPa, 0.5 kgf/cm², 7 psi or less)
- (B) At Proper Oil Pressure

[4] COOLING SYSTEM



- (1) Water Return Pipe
- (2) Thermostat
- (3) Cylinder Head Water Jacket
- (4) Cylinder Block Water Jacket
- (5) Radiator
- (6) Cooling Fan
- (7) Water Pump

C144F004

The cooling system consists of a radiator (5), a centrifugal water pump (7), a fan (6) and a thermostat (2).

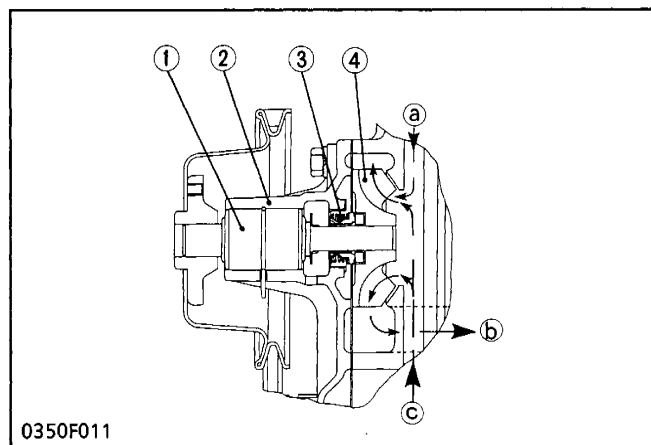
The water is cooled as it flows through the radiator core, and the cooling air through the radiator core by fan.

The water pump receives water from the radiator or from the cylinder head and force it into the cylinder block.

The thermostat opens or closes according to the water temperature. When the water temperature is high, the thermostat opens to allow the water to flow from the cylinder head to the radiator. When the water temperature is low, the thermostat close to flow the water only to the water pump.

The opening temperature of the thermostat is approx. 71 °C (159.8 °F).

(1) Water Pump



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- (1) Bearing
- (2) Pump Body
- (3) Mechanical Seal
- (4) Pump Impeller

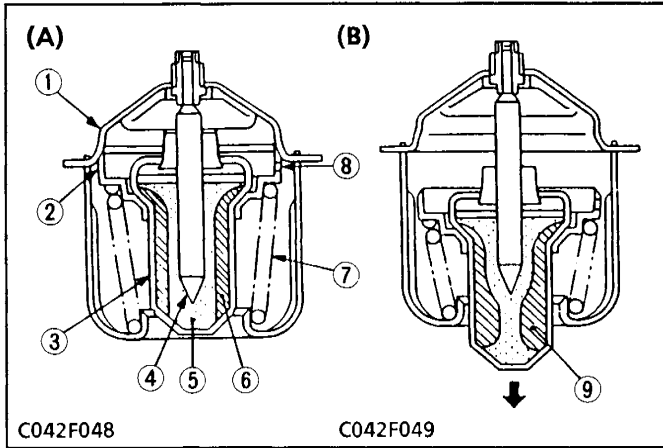
The water pump is driven with the fan drive pulley, which is on the water pump shaft and driven by the crankshaft with a belt.

The rotating impeller (4) in the water pump receives cool water from the bottom of the radiator and the water jacket of cylinder head, and sends it into the water jacket in the cylinder block.

The mechanical seal (3) prevents the water from entering the bearing (1).

- (a) From Thermostat
- (b) To Cylinder Block
- (c) From Radiator

(2) Thermostat



- | | |
|----------------------|------------------|
| (1) Seat | (6) Wax (Solid) |
| (2) Valve | (7) Spring |
| (3) Pellet | (8) Leak Hole |
| (4) Spindle | (9) Wax (Liquid) |
| (5) Synthetic Rubber | |

The thermostat is wax pellet type, which controls the flow of the cooling water to the radiator to keep the proper temperature.

The case has a seat (1) and the pellet (3) has a valve (2). The spindle (4) attached to the case is inserted into the synthetic rubber (5) in the pellet. The pellet is charged with wax (6).

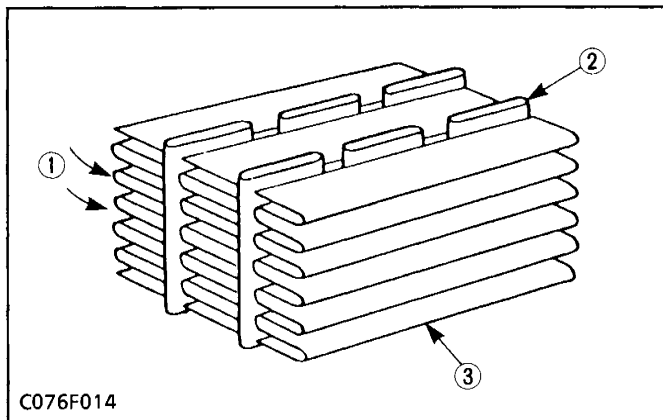
(A) At low temperature (lower than 71 °C, 159.8 °F)

The valve (2) is seated by the spring (7) and the cooling water circulates in the engine through the water return pipe but does not enter the radiator.

(B) At high temperature (higher than 71 °C, 159.8 °F)

As the water temperature rises, the wax in the pellet (3) turns liquid and expands, repelling the spindle (4). The pellet lowers and the valve (2) opens to send the cooling water to the radiator.

(3) Radiator



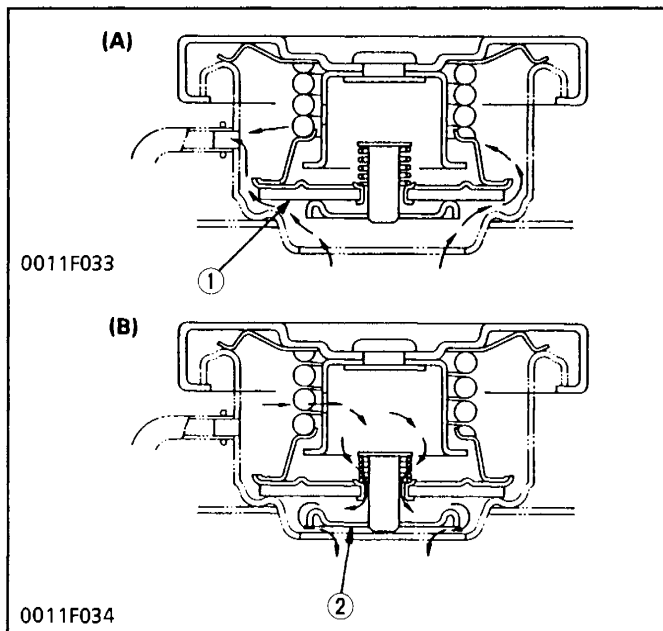
The radiator core consists of water carrying tubes (2) with fins (3) at a right angle to it.

The water in the radiator is cooled by the air flowing through between the tube wall and the fin.

The louverless corrugated fins are light in weight, high in heat exchange ratio and less in clogging by the dust.

- | | |
|-----------------|---------|
| (1) Cooling Air | (3) Fin |
| (2) Tube | |

(4) Radiator Cap



The pressure type cap is installed on the radiator, which prevents the pressure difference between the inside and the outside of the radiator from deforming the radiator.

(A) At high pressure (higher than 88 kPa, 0.9 kgf/cm², 13 psi)

When the water temperature rises and the pressure in the radiator increase above the specified pressure, the pressure valve (1) opens to reduce the internal pressure.

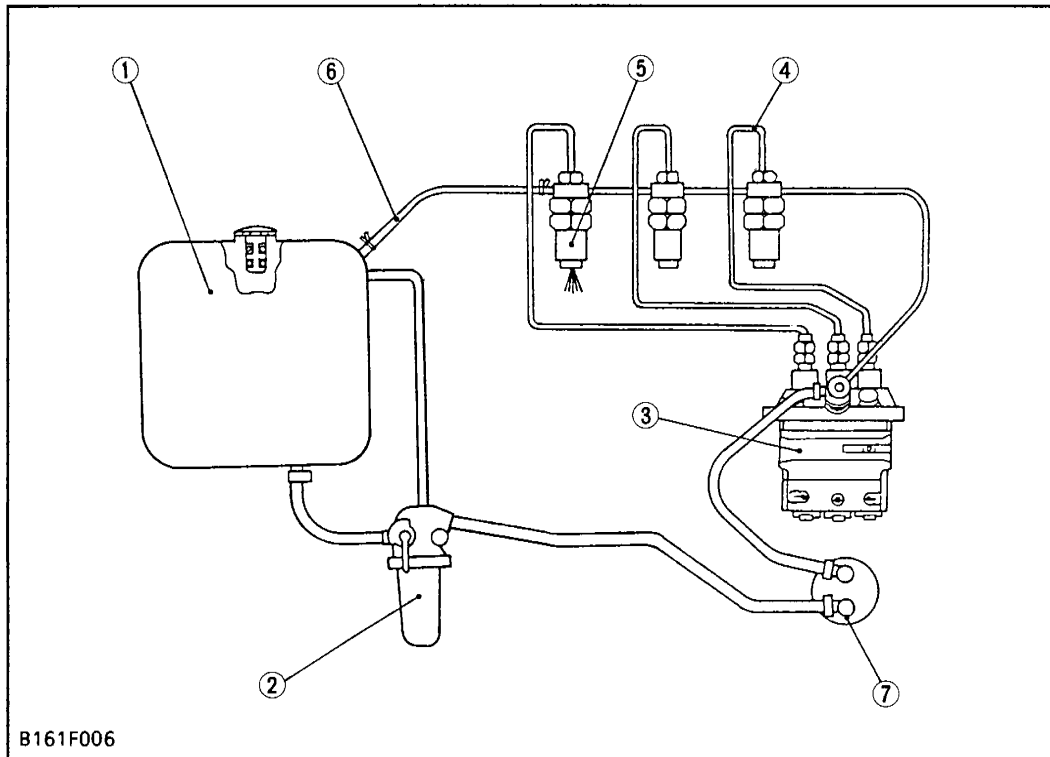
(B) At negative pressure

When the water temperature falls and a vacuum is formed in the radiator, the vacuum valve (2) opens to allow the air to enter the radiator.

- | | |
|--------------------|------------------|
| (1) Pressure Valve | (2) Vacuum Valve |
|--------------------|------------------|

[5] FUEL SYSTEM

(1) Fuel Lines



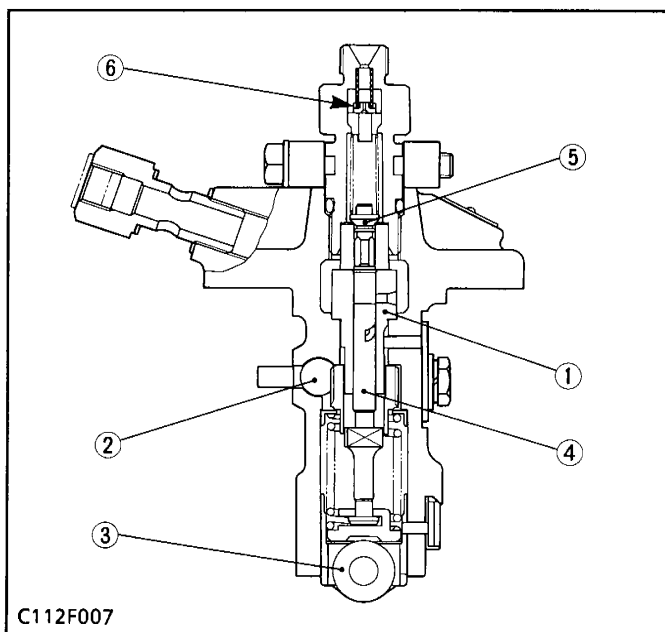
- (1) Fuel Tank
- (2) Fuel Filter
- (3) Injection Pump
- (4) Injection Pipe
- (5) Injection Nozzle
- (6) Fuel Overflow Pipe
- (7) Fuel Lift Pump

Fuel from the fuel tank (1) passes through the fuel filter (2), and then enters the injection pump (3) after impurities such as dirt, water, etc. are removed.

The fuel pressurized by the injection pump to the opening pressure (13.73 to 14.71 MPa, 140 to 150 kgf/cm², 1991 to 2062 psi), of the injection nozzle (5) is injected into the combustion chamber.

Part of the fuel fed to the injection nozzle (5) lubricates the moving parts of the plunger inside the nozzle, then returns to the fuel tank through the fuel overflow pipe (6) from the upper part of the nozzle holder.

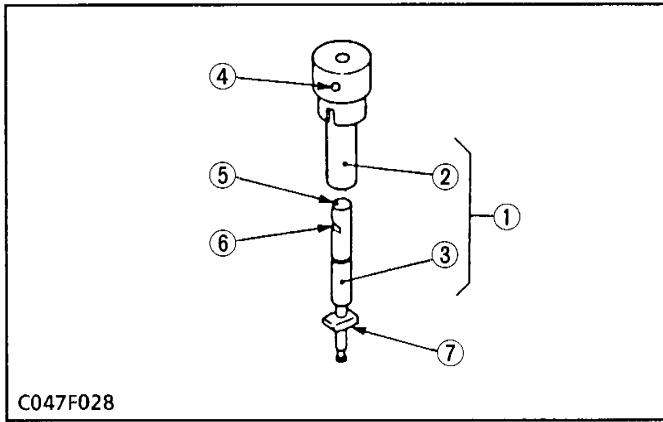
(2) Fuel Injection Pump



A Bosch type mini pump is used for the injection pump. It is small, lightweight and easy to handle.

The plunger (4) with a right-hand lead reciprocates via the tappet roller (3) by means of the camshaft fuel cam, causing the fuel to be delivered into the injection nozzle.

- (1) Cylinder
- (2) Control Rack
- (3) Tappet Roller
- (4) Plunger
- (5) Delivery Valve
- (6) Dumping Valve



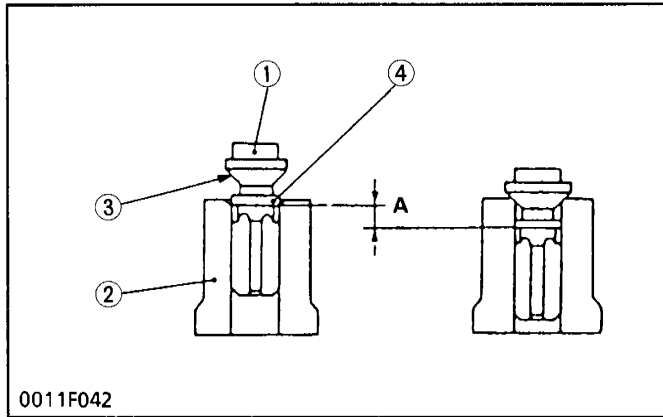
■ Pump Element

The pump element (1) is consist of the plunger (3) and cylinder (2).

The sliding surfaces are super-precision machined to maintain injection pressure at engine low speeds. Since the driving face (7) fits in the control sleeve, the plunger (3) is rotated by the movement of the control rack to increase or decrease of fuel delivery.

As described above, the plunger (3) is machined to have the slot (5) and the control groove (6).

- | | |
|------------------|--------------------|
| (1) Pump Element | (5) Slot |
| (2) Cylinder | (6) Control Groove |
| (3) Plunger | (7) Driving Face |
| (4) Feed Hole | |



■ Delivery Valve

The delivery valve consists of the delivery valve (1) and delivery valve seat (2).

The delivery valve performs the following functions.

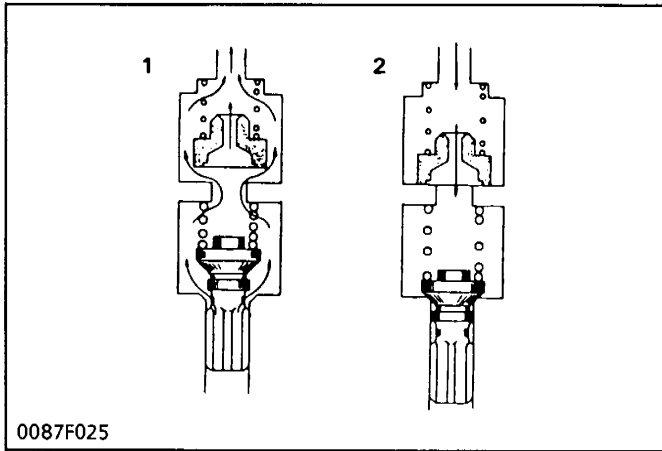
1. Reverse flow preventing function

If the fuel flow reverse from the injection nozzle side when the plunger lowers, the time lag between the next delivery start and the nozzle injection start increases. To avoid this, the delivery chamber to injection pipe interruption by delivery valve (1) prevents this reverse flow, thus keeping fuel always filled in the nozzle and pipe.

2. Suck-back function

After completing the fuel delivery, the delivery valve lowers, and the relief plunger (4) end contacts the delivery valve seat (2). The valve further lowers until its seat surface (3) seats firmly the delivery valve seat. During this time, the amount of fuel corresponding to (A) is sucked back from inside the injection pipe, the pressure inside the pipe is reduced, thus leading to an improved injection shut off and preventing after leakage dribbling.

- | | |
|-------------------------|--------------------|
| (1) Delivery Valve | (3) Seat Surface |
| (2) Delivery Valve Seat | (4) Relief Plunger |



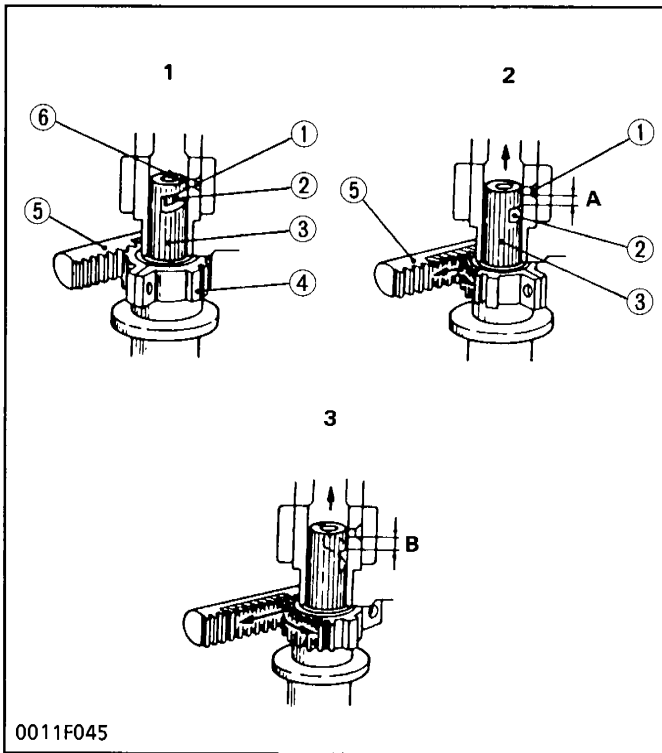
■ Dumping Valve

1. At fuel injection

Since dumping valve is pushed up to press the spring, fuel is pressure-fed to injection nozzle the same as without dumping valve.

2. At suck-back

At suck-back by delivery valve after fuel injection fuel returns through dumping valve orifice. Generally second injection is apt to occur by reflex pressure due to reaction of sudden pressure drop when changing into suck-back by delivery valve from high injection pressure. As a result of preventing this second injection perfectly by dumping valve and dissolving nozzle clogging, durability of injection nozzle is improved.



■ Injection Control

1. No fuel delivery ----- Engine stop

When the control rack (5) is set at the engine stop position, the plunger does not force fuel and no fuel is delivered since the feed hole (1) aligns with the slot (6) in the plunger (3).

2. Partial fuel delivery

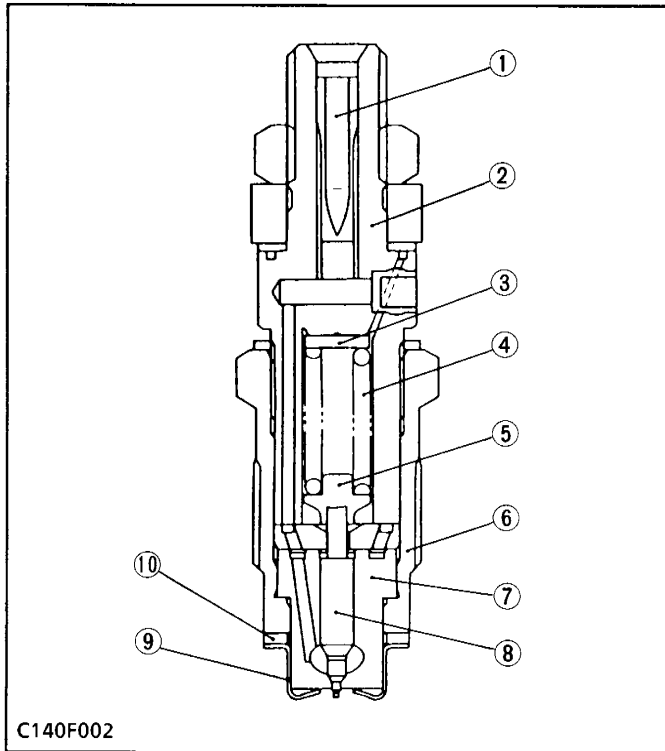
When the plunger (3) is rotated by the control rack (5) in the direction of arrow, the fuel is delivered to the injection nozzle. The amount of fuel corresponds to the effective stroke (A) from closing the feed hole (1) by the plunger head to contact of the control groove (2) with the feed hole.

3. Maximum fuel delivery

When the control rack is moved to the extreme end in the direction of the arrow, the effective stroke (B) of the plunger is at its maximum, thus the maximum fuel delivery occurs.

- | | |
|--------------------|--------------------|
| (1) Feed Hole | (4) Control Sleeve |
| (2) Control Groove | (5) Control Rack |
| (3) Plunger | (6) Slot |

(3) Fuel Injection Nozzle



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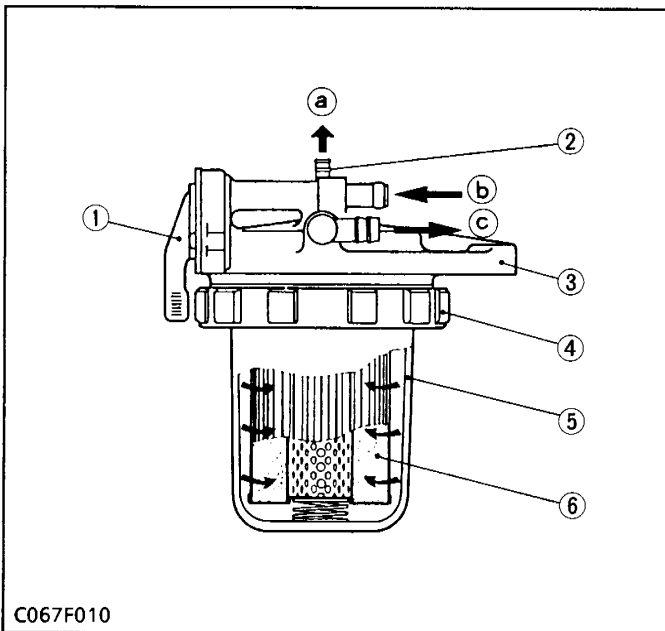
Used as the injection nozzle, the small-sized NIPPONDENSO-made OPD mini nozzle is of a flat-cut-provided double throttle type. This type of nozzle is designed to control the injection quantity when the lift rate is low at start of the injection, and to cut down on the knocking sound caused by excessive fuel injection by giving the needle valve section more taper than before to prevent the rapid increase in the injection quantity when the initial injection turns into the full-force injection.

Also, employed to prevent the injection quantity loss in the throttle section caused by carbon, the flat cut provided at the needle valve section helps the throttle withstand long use and reduce as much knocking sound as when it was new.

The heat seal is employed to improve the durability and reliability of the nozzle.

- | | |
|------------------------|-------------------|
| (1) Bar Filter | (6) Retaining Nut |
| (2) Nozzle Holder Body | (7) Nozzle Body |
| (3) Adjusting Washer | (8) Needle Valve |
| (4) Nozzle Spring | (9) Heat Seal |
| (5) Push Rod | (10) Packing |

(4) Fuel Filter



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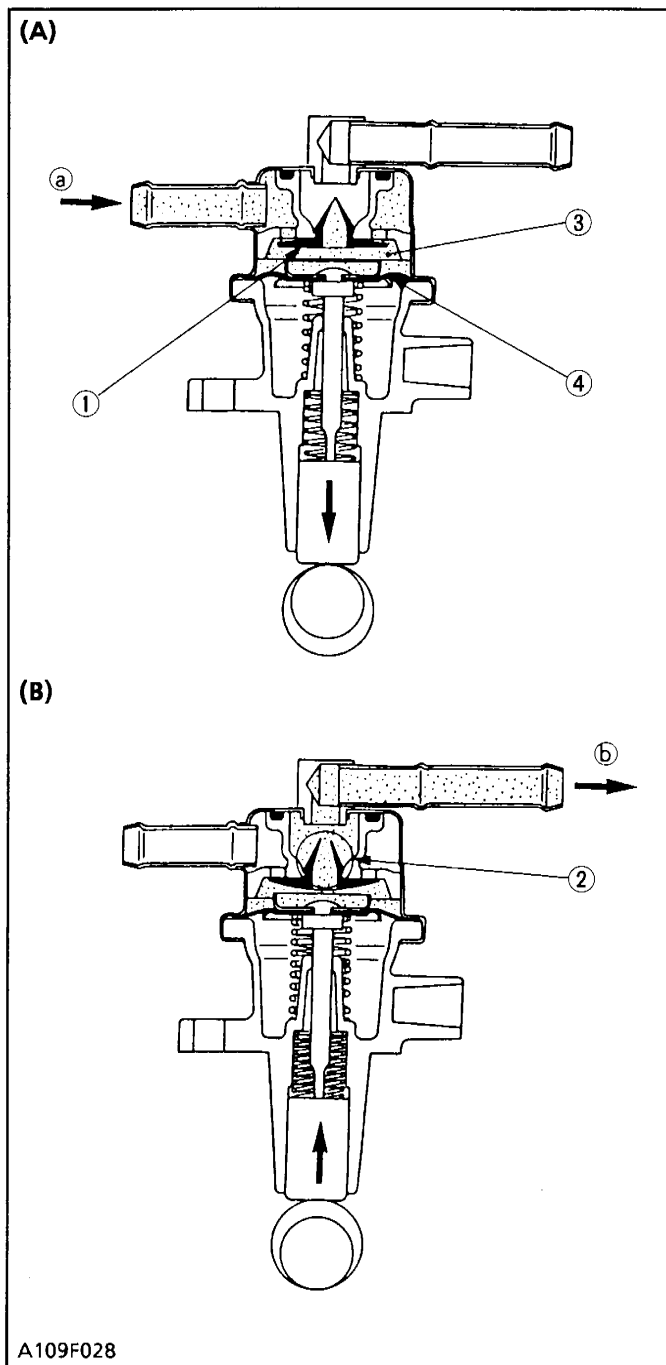
The fuel filter removes dirt and water with its fine filter paper, which collects particles of 15 microns (0.00059 in.) at 20 kPa (0.2 kgf/cm², 3 psi).

The fuel from the fuel tank is filtered by the filter element (6), while flowing through the filter element from its outside to inside.

The filter bracket (3) has an air vent (2) to take off air in the fuel line.

- | | |
|--------------------|-----------------------|
| (a) To Fuel Tank | (c) To Fuel Lift Pump |
| (b) From Fuel Tank | |
| (1) Cock | (4) Retainer Ring |
| (2) Air Vent | (5) Pot |
| (3) Filter Bracket | (6) Filter Element |

(5) Fuel Lift Pump

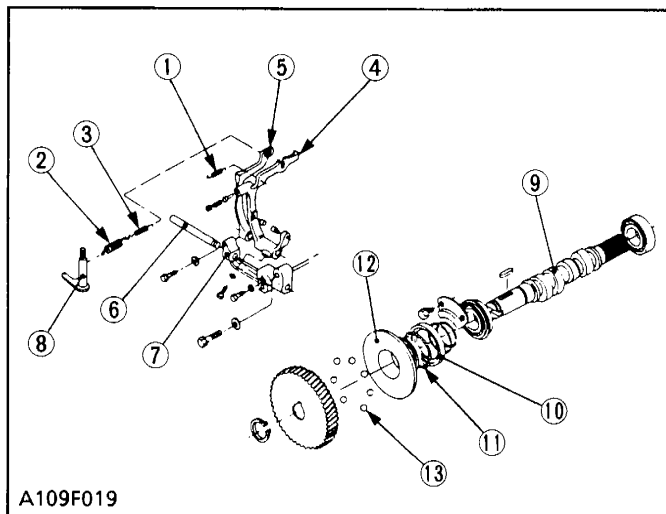


Filtered fuel is fed to the injection pump by the fuel lift pump. The fuel lift pump operates as shown in the figure. Power is applied to the tappet by an eccentric movement on the fuel camshaft. As the fuel camshaft rotates, the eccentric movement causes the tappet to move up and down. The tappet is linked to a flexible diaphragm (4) via the pull rod.

When the diaphragm is pulled down, a low vacuum or low pressure area is created above the diaphragm. This causes atmospheric pressure in the fuel tank to force fuel into the fuel lift pump. The inlet valve (1) opens to admit fuel into the chamber (3).

When the diaphragm is pushed up, pressure is created in the area above the diaphragm. This pressure closes the inlet valve and opens the outlet valve (2), forcing fuel from the pump through the fuel pipe to the injection pump.

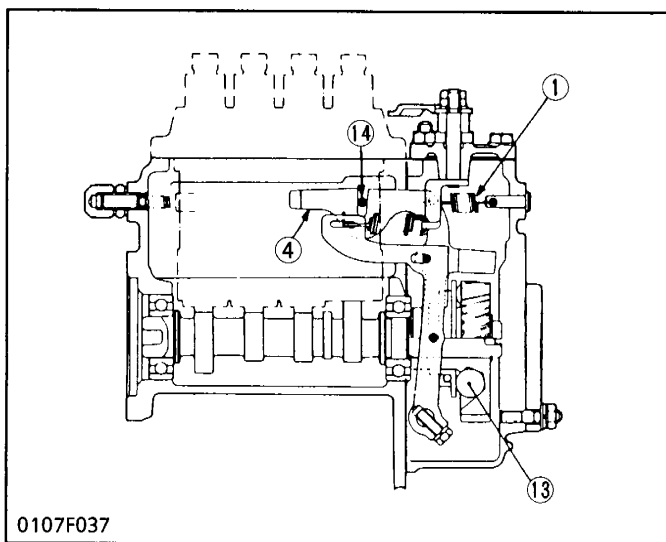
- | | |
|-----------------------------|------------------------------|
| [A] Inlet Stroke | [B] Discharge Stroke |
| (a) From Fuel Filter | (b) To Injection Pump |
| (1) Inlet Valve | (3) Chamber |
| (2) Outlet Valve | (4) Diaphragm |

(6) Governor

A109F019

The governor serves to keep engine speed constant by automatically adjusting the amount of fuel supplied to the engine according to changes in the load. This engine employs an all-speed governor which controls the centrifugal force of the steel ball (13) weight, produced by rotation of the fuel camshaft (9), and the tension of the governor spring 1 (2) and 2 (3) are balanced.

- | | |
|-----------------------|-------------------------|
| (1) Start Spring | (8) Governor Lever |
| (2) Governor Spring 1 | (9) Fuel Camshaft |
| (3) Governor Spring 2 | (10) Governor Ball Case |
| (4) Fork Lever 1 | (11) Steel Ball |
| (5) Fork Lever 2 | (12) Governor Sleeve |
| (6) Fork Lever Shaft | (13) Steel Ball |
| (7) Fork Lever Holder | |

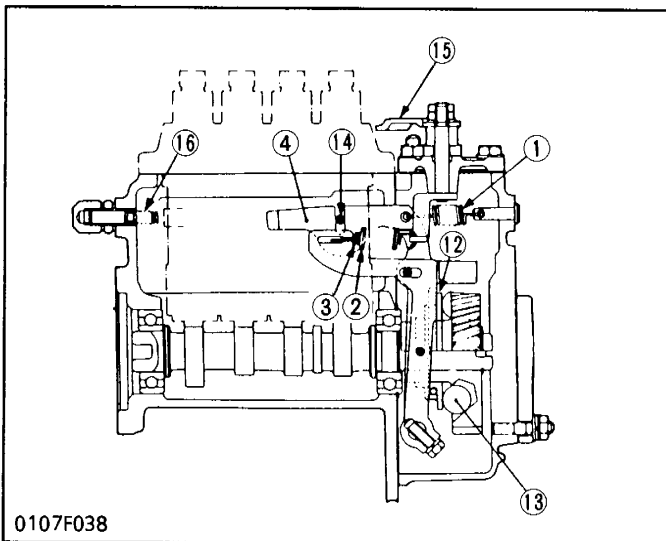


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■ At Start

Since the steel ball (13) have no centrifugal force, a fork lever 1 (4) is pulled to the right by the starter spring (1). Accordingly, the control rack (14) moves to the maximum injection position to assure easy starting.

- | | |
|------------------|-------------------|
| (1) Start Spring | (13) Steel Ball |
| (4) Fork Lever 1 | (14) Control Rack |



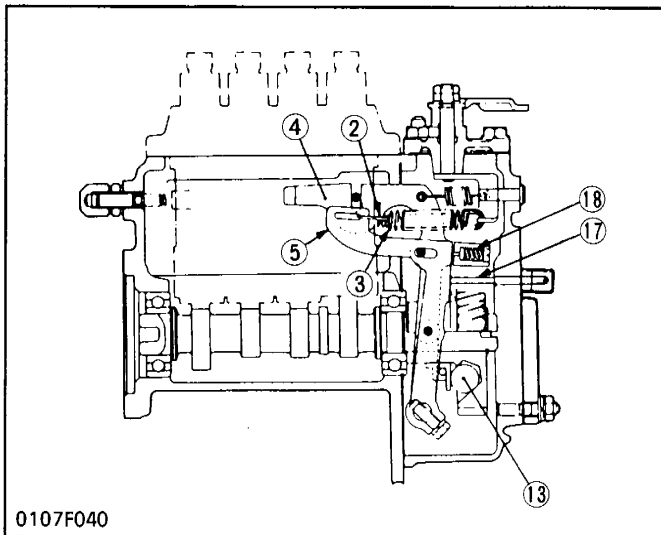
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■ At Idling

When the speed control lever (15) is set at the idling position after the engine starts, the governor spring 1 (2) does not work at all and the governor spring 2 (3) does only act slightly. The governor sleeve (12) is pushed leftward by a centrifugal force of steel ball (13).

Therefore, the fork lever 1 (4) and control rack (14) are moved to the left by the governor sleeve and then the idling limit spring (16) is compressed by the control rack. As a result, the control rack is kept at a position where a centrifugal force of steel ball and forces start spring (1), governor spring 2 and idling limit spring are balanced, providing stable idling.

- | | |
|-----------------------|--------------------------|
| (1) Start Spring | (13) Steel Ball |
| (2) Governor Spring 1 | (14) Control Rack |
| (3) Governor Spring 2 | (15) Speed Control Lever |
| (4) Fork Lever 1 | (16) Idling Limit Spring |
| (12) Governor Sleeve | |

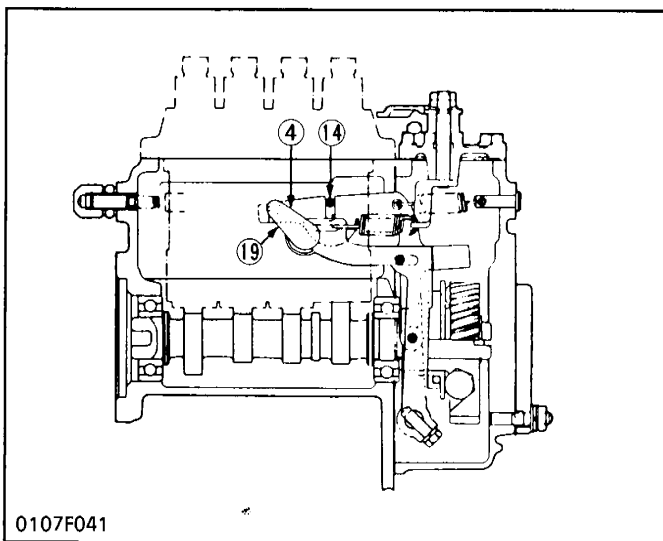


■ At High Speed Running with Overload

When an overload is applied to the engine running at a high speed, the centrifugal force of steel ball (13) becomes small as the engine speed is dropped, and fork lever 2 (5) is pulled to the right by the governor springs 1 (2) and 2 (3), increasing fuel injection. Though, fork lever 2 becomes ineffective in increasing fuel injection when it is stopped by the adjusting bolt (17).

After that, when the force of torque spring (18) becomes greater than the centrifugal force of the steel ball, fork lever 1 (4) moves rightward to increase fuel injection, causing the engine to run continuously at a high torque.

- | | |
|-----------------------|---------------------|
| (2) Governor Spring 1 | (13) Steel Ball |
| (3) Governor Spring 2 | (17) Adjusting Bolt |
| (4) Fork Lever 1 | (18) Torque Spring |
| (5) Fork Lever 2 | |



■ To Stop Engine

When the stop lever (19) is moved to STOP position, fork lever 1 (4) is moved leftward and the control rack (14) is moved to the non-injection position, stopping the engine.

- | | |
|-------------------|-----------------|
| (4) Fork Lever 1 | (19) Stop Lever |
| (14) Control Rack | |

SERVICING

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(1) Injection Pump	1-S45
(2) Injection Nozzle	1-S47
DISASSEMBLING AND ASSEMBLING	1-S48
(1) Injection Pump	1-S48
(2) Injection Nozzle	1-S48

TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	<ul style="list-style-type: none"> ● No fuel ● Air in the fuel system ● Water in the fuel system ● Fuel pipe clogged ● Fuel filter clogged ● Excessively high viscosity of fuel or engine oil at low temperature ● Fuel with low cetane number ● Fuel leak due to loose injection pipe retaining nut ● Incorrect injection timing ● Fuel camshaft worn ● Injection nozzle clogged ● Injection pump malfunctioning ● Seizure of crankshaft, camshaft, piston, cylinder or bearing ● Compression leak from cylinder ● Improper valve timing ● Piston ring and cylinder worn ● Excessive valve clearance 	Replenish fuel Bleed Change fuel and repair or replace fuel system Clean Change Use the specified fuel or engine oil Use the specified fuel Tighten nut Adjust Replace Clean Repair or replace Repair or replace Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder Correct or replace timing gear Replace Adjust	– G-24 – – G-20 G-8 G-8 1-S17 1-S45 1-S28 1-S46, S47 1-S26, S47 – 1-S15 1-S28 1-S36, S41 1-S16
Starter Does Not Run	<ul style="list-style-type: none"> ● Battery discharged ● Starter malfunctioning ● Main switch malfunctioning ● Shuttle limit switch or PTO limit switch improperly adjusted or defective ● Starter relay defective ● Wiring disconnected 	Charge Repair or replace Repair or replace Repair or replace Replace Connect	9-S7 9-S11 to S14 9-S8, S9 9-S9 9-S9 9-M1, M2
Engine Revolution Is Not Smooth	<ul style="list-style-type: none"> ● Fuel filter clogged or dirty ● Air cleaner clogged ● Fuel leak due to loose injection pipe retaining nut ● Injection pump malfunctioning ● Incorrect nozzle injection pressure ● Injection nozzle stuck or clogged ● Governor malfunctioning 	Change Clean or change Tighten nut Repair or replace Adjust Repair or replace Repair	G-20 G-17 1-S17 1-S26, S47 1-S46 1-S17, S47 1-S26, S28
Either White or Blue Exhaust Gas Is Observed	<ul style="list-style-type: none"> ● Excessive engine oil ● Piston ring and cylinder worn or stuck ● Incorrect injection timing ● Deficient compression 	Reduce to the specified level Repair or replace Adjust Adjust top clearance	1-S10 1-S36, S41 1-S45 1-S15
Either Black or Dark Gray Exhaust Gas Is Observed	<ul style="list-style-type: none"> ● Overload ● Low grade fuel used ● Fuel filter clogged ● Air cleaner clogged ● Deficient nozzle injection 	Lessen the load Use the specified fuel Change Clean or change Repair or replace the nozzle	– G-8 G-20 G-17 1-S17, S47

Symptom	Probable Cause	Solution	Reference Page
Deficient Output	<ul style="list-style-type: none"> ● Incorrect injection timing ● Engine's moving parts seem to be seizing ● Uneven fuel injection ● Deficient nozzle injection ● Compression leak 	Adjust Repair or replace Repair or replace the injection pump Repair or replace the nozzle Replace head gasket, tighten cylinder head bolt, glow plug and nozzle holder	1-S45 – 1-S46, S47 1-S17, S47 1-S15
Excessive Lubricant Oil Consumption	<ul style="list-style-type: none"> ● Piston ring's gap facing the same direction ● Oil ring worn or stuck ● Piston ring groove worn ● Valve stem and guide worn ● Oil leaking due to defective seals or packing 	Shift ring gap direction Replace Replace the piston Replace Replace	1-S32 1-S36 1-S36 1-S21 –
Fuel Mixed Into Lubricant Oil	<ul style="list-style-type: none"> ● Injection pump's plunger worn ● Deficient nozzle injection ● Injection pump broken 	Replace pump element or pump Repair or replace the nozzle Replace	1-S26, S47 1-S17, S47 1-S26
Water Mixed Into Lubricant Oil	<ul style="list-style-type: none"> ● Head gasket defective ● Cylinder block or cylinder head flawed 	Replace Replace	1-S19 1-S20
Low Oil Pressure	<ul style="list-style-type: none"> ● Engine oil insufficient ● Oil strainer clogged ● Relief valve stuck with dirt ● Relief valve spring weaken or broken ● Excessive oil clearance of crankshaft bearing ● Excessive oil clearance of crankpin bearing ● Excessive oil clearance of rocker arm ● Oil passage clogged ● Different type of oil ● Oil pump defective 	Replenish Clean Clean Replace Replace Replace Replace Clean Use the specified type of oil Repair or replace	1-S10 1-S31 – – 1-S37, S38 1-S39 1-S24 – G-8 1-S28, S42
High Oil Pressure	<ul style="list-style-type: none"> ● Different type of oil ● Relief valve defective 	Use the specified type of oil Replace	G-8 –
Engine Overheated	<ul style="list-style-type: none"> ● Engine oil insufficient ● Fan belt broken or elongated ● Cooling water insufficient ● Radiator net and radiator fin clogged with dust ● Inside of radiator corroded ● Cooling water flow route corroded ● Radiator cap defective ● Overload running ● Head gasket defective ● Incorrect injection timing ● Unsuitable fuel used 	Replenish Change or adjust Replenish Clean Clean or replace Clean or replace Replace Loosen the load Replace Adjust Use the specified fuel	1-S10 1-S43 G-23 – – – 1-S43 – 1-S19 1-S45 G-8

SERVICING SPECIFICATIONS

ENGINE BODY

Item		Factory Specification	Allowable Limit
Cylinder Head Surface	Flatness	-	0.05 mm / 100 mm 0.0019 in. / 4 in.
Compression Pressure (When Cranking with Starting Motor)		35.3 to 37.2 MPa / 250 rpm 36 to 38 kgf/cm ² / 250 rpm 512 to 540 psi / 250 rpm	24.5 MPa / 250 rpm 26 kgf/cm ² / 250 rpm 355 psi / 250 rpm
Difference among Cylinders		-	10 % or less
Top Clearance		0.55 to 0.70 mm 0.0217 to 0.0276 in.	-
Cylinder Head Gasket	Thickness (Free)	1.30 to 1.40 mm 0.0512 to 0.0551 in.	-
	Thickness (Tightened)	1.15 to 1.25 mm 0.0453 to 0.0492 in.	-
Valve Clearance (When Cold)		0.18 to 0.22 mm 0.0071 to 0.0087 in.	-
Valve Seat	Width (Intake)	2.12 mm 0.0835 in.	-
	Width (Exhaust)	2.12 mm 0.0835 in.	-
Valve Seat	Angle (Intake)	1.047 rad. 60°	-
	Angle (Exhaust)	0.785 rad. 45°	-
Valve Face	Angle (Intake)	1.047 rad. 60°	-
	Angle (Exhaust)	0.785 rad. 45°	-
Valve Stem to Valve Guide	Clearance	0.040 to 0.070 mm 0.00157 to 0.00276 in.	0.1 mm 0.0039 in.
Valve Stem	O.D.	7.960 to 7.975 mm 0.31339 to 0.31398 in.	-
Valve Guide	I.D.	8.015 to 8.030 mm 0.31555 to 0.31614 in.	-
Valve Recessing	Protrusion	0.05 mm 0.0020 in.	-
	Recessing	0.15 mm 0.0059 in.	0.4 mm 0.0157 in.

ENGINE BODY (Continued)

Item		Factory Specification	Allowable Limit
Valve Timing (Intake Valve)	Open	0.14 rad. 8° before T.D.C.	—
	Close	0.35 rad. 20° after B.D.C.	—
Valve Timing (Exhaust Valve)	Open	1.05 rad. 60° before B.D.C.	—
	Close	0.21 rad. 12° after T.D.C.	—
Valve Spring	Free Length	41.7 to 42.2 mm 1.6417 to 1.6614 in.	41.2 mm 1.6220 in.
	Setting Load	117.6 N 12.0 kgf 26.4 lbs	100.0 N 10.2 kgf 22.5 lbs
	Setting Length	35.0 mm 1.3780 in.	—
	Squareness	—	1.0 mm 0.039 in.
Rocker Arm Shaft to Rocker Arm	Clearance	0.016 to 0.045 mm 0.00063 to 0.00177 in.	0.15 mm 0.0059 in.
Rocker Arm Shaft	O.D.	13.973 to 13.984 mm 0.55012 to 0.55055 in.	—
Rocker Arm	I.D.	14.000 to 14.018 mm 0.55118 to 0.55189 in.	—
Push Rod	Alignment	—	0.25 mm 0.0098 in.
Tappet to Tappet Guide	Clearance	0.020 to 0.062 mm 0.00079 to 0.00244 in.	0.07 mm 0.0028 in.
Tappet	O.D.	23.959 to 23.980 mm 0.94327 to 0.94410 in.	—
Tappet Guide	I.D.	24.000 to 24.021 mm 0.94488 to 0.94571 in.	—
Timing Gear Crank Gear to Idle Gear	Backlash	0.0415 to 0.1122 mm 0.00163 to 0.00442 in.	0.15 mm 0.0059 in.
Idle Gear to Cam Gear	Backlash	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.	0.15 mm 0.0059 in.
Idle Gear to Injection Pump Gear	Backlash	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.	0.15 mm 0.0059 in.
Crank Gear to Oil Pump Gear	Backlash	0.0415 to 0.1090 mm 0.00163 to 0.00429 in.	0.15 mm 0.0059 in.

ENGINE BODY (Continued)

Item		Factory Specification	Allowable Limit
Idle Gear	Side Clearance	0.20 to 0.51 mm 0.0079 to 0.0201 in.	0.9 mm 0.0354 in.
Idle Gear Shaft to Idle Gear Bushing	Clearance	0.025 to 0.066 mm 0.00098 to 0.00260 in.	0.10 mm 0.0039 in.
Idle Gear Shaft	O.D.	37.959 to 37.975 mm 1.49445 to 1.49508 in.	-
Idle Gear Bushing	I.D.	38.000 to 38.025 mm 1.49606 to 1.49704 in.	-
Camshaft	Side Clearance	0.07 to 0.22 mm 0.0028 to 0.0087 in.	0.30 mm 0.0118 in.
Camshaft	Alignment	-	0.01 mm 0.0004 in.
Cam	Height (Intake / Exhaust)	33.47 mm 1.3177 in.	33.42 mm 1.3157 in.
Camshaft Journal to Camshaft Bushing	Clearance	0.050 to 0.091 mm 0.00197 to 0.00358 in.	0.15 mm 0.0059 in.
Camshaft Journal	O.D.	39.934 to 39.950 mm 1.57221 to 1.57284 in.	-
Camshaft Bearing	I.D.	40.000 to 40.025 mm 1.57480 to 1.57579 in.	-
Piston Pin Bore	I.D.	25.000 to 25.013 mm 0.98425 to 0.98477 in.	25.05 mm 0.9862 in.
Second Ring to Ring Groove	Clearance	0.093 to 0.120 mm 0.00366 to 0.00472 in.	0.20 mm 0.0079 in.
Oil Ring to Ring Groove	Clearance	0.020 to 0.052 mm 0.00079 to 0.00205 in.	0.15 mm 0.0059 in.
Top Ring Second Ring	Ring Gap	0.30 to 0.45 mm 0.0118 to 0.0177 in.	1.25 mm 0.0492 in.
Oil Ring	Ring Gap	0.25 to 0.45 mm 0.0098 to 0.0177 in.	1.25 mm 0.0492 in.
Connecting Rod	Alignment	-	0.05 mm 0.0020 in.
Piston Pin to Small End Bushing	Clearance	0.014 to 0.038 mm 0.00055 to 0.00150 in.	0.15 mm 0.0059 in.
Piston Pin	O.D.	25.002 to 25.011 mm 0.98433 to 0.98468 in.	-
Small End Bushing	I.D.	25.025 to 25.040 mm 0.98523 to 0.98582 in.	-
Crankshaft	Alignment	-	0.08 mm 0.0031 in.

ENGINE BODY (Continued)

Item		Factory Specification	Allowable Limit
Crankshaft Journal to Crankshaft Bearing 1	Oil Clearance	0.040 to 0.118 mm 0.00157 to 0.00465 in.	0.20 mm 0.0079 in.
	Crankshaft Journal O.D.	51.921 to 51.940 mm 2.04413 to 2.04488 in.	-
	Crankshaft Bearing 1 I.D.	51.980 to 52.039 mm 2.04645 to 2.04878 in.	-
Crankshaft Journal to Crankshaft Bearing 2	Oil Clearance	0.040 to 0.104 mm 0.00157 to 0.00409 in.	0.20 mm 0.0079 in.
	Crankshaft Journal O.D.	51.921 to 51.940 mm 2.04413 to 2.04488 in.	-
	Crankshaft Bearing 2 I.D.	51.980 to 52.025 mm 2.04645 to 2.04822 in.	-
Crankpin to Crankpin Bearing	Oil Clearance	0.025 to 0.087 mm 0.00098 to 0.00343 in.	0.20 mm 0.0079 in.
	Crankpin O.D.	46.959 to 46.975 mm 1.84878 to 1.84941 in.	-
	Crankpin Bearing I.D.	47.000 to 47.046 mm 1.85039 to 1.85220 in.	-
Crankshaft	Side Clearance	0.15 to 0.31 mm 0.0059 to 0.0122 in.	0.50 mm 0.0197 in.
Flywheel	Sway	-	0.05 mm 0.0020 in.
Crankshaft Sleeve	Wear	-	0.10 mm 0.0039 in.
Cylinder Bore [Standard]	I.D. (D1503)	83.000 to 83.022 mm 3.2677 to 3.2686 in.	83.17 mm 3.2744 in.
	I.D. (V1903)	80.000 to 80.022 mm 3.14960 to 3.15047 in.	80.17 mm 3.1563 in.
	I.D. (D1703 · V2203)	87.000 to 87.022 mm 3.42519 to 3.42606 in.	87.17 mm 3.4319 in.

LUBRICATING SYSTEM

Item		Factory Specification	Allowable Limit
Engine Oil Pressure	At Idle Speed	98 kPa or more 1.0 kgf/cm ² or more 14 psi or more	49 kPa 0.5 kgf/cm ² 7 psi
	At Rated Speed	294 to 441 kPa 3.0 to 4.5 kgf/cm ² 43 to 64 psi	245 kPa 2.5 kgf/cm ² 36 psi
Engine Oil Pressure Switch	Working Pressure	49 kPa 0.5 kgf/cm ² 7 psi	—
Inner Rotor to Outer Rotor	Clearance	0.10 to 0.16 mm 0.0039 to 0.0063 in.	0.20 mm 0.0079 in.
Outer Rotor to Pump Body	Clearance	0.11 to 0.19 mm 0.0043 to 0.0075 in.	0.25 mm 0.0098 in.
Inner Rotor to Cover	End Clearance	0.105 to 0.150 mm 0.0041 to 0.0059 in.	0.20 mm 0.0079 in.

COOLING SYSTEM

Fan Belt	Tension	7 to 9 mm (0.28 to 0.35 in.) deflection at 98 N (10 kgf, 22 lbs) of force	—
Thermostat	Valve Opening Temperature (At Beginning)	69.5 to 72.5 °C 157.1 to 162.5 °F	—
	Valve Opening Temperature (Opened Completely)	85 °C 185 °F	—
Radiator	Water Tightness	No leaks at 137 kPa 1.4 kgf/cm ² 20 psi	—
Radiator Cap	Pressure Falling Time	10 seconds or more for pressure falling from 88 to 59 kPa from 0.9 to 0.6 kgf/cm ² from 13 to 9 psi	—

FUEL SYSTEM

Item		Factory Specification	Allowable Limit
Injection Pump	Injection Timing	0.30 to 0.33 rad. 17 to 19° before T.D.C.	–
Pump Element	Fuel Tightness	–	14.7 MPa 150 kgf/cm ² 2133 psi
Delivery Valve	Fuel Tightness	10 seconds or more for pressure falling from 14.7 to 13.7 MPa from 150 to 140 kgf/cm ² from 2133 to 1990 psi	5 seconds for pressure falling from 14.7 to 13.7 MPa from 150 to 140 kgf/cm ² from 2133 to 1990 psi
Injection Nozzle	Injection Pressure	13.73 to 14.71 MPa 140 to 150 kgf/cm ² 1991 to 2133 psi	–
Injection Nozzle Valve Seat	Valve Seat Tightness	When the pressure is 12.75 MPa (130 kgf/cm ² , 1849 psi), the valve seat must be fuel tightness.	–

TIGHTENING TORQUES

Tightening torques of screws and nuts on the table below are especially specified.
(For general use screws and nuts : See page G-9)

Item	Size x Pitch	N·m	kgf·m	ft-lbs
Main delivery hose retaining nut	–	46.6 to 50.9	4.8 to 5.2	34.4 to 37.6
Turning delivery hoses retaining nut	–	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Joint bolt for delivery pipe and hydraulic block	–	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Joint bolt for GST delivery pipe and regulator valve (GST or independent PTO type only)	–	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Engine and clutch housing mounting screws, nuts	M12 x 1.25	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Engine and clutch housing mounting stud bolts	–	39.2 to 49.0	4.0 to 5.0	28.9 to 36.9
Front axle support mounting screws to engine	M12 x 1.25	102.9 to 117.6	10.5 to 12.0	76.0 to 86.8
Clutch mounting screw and reamer screw	–	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Regulator valve mounting screw	–	17.6 to 20.6	1.8 to 2.1	13.0 to 15.2
Cylinder head cover cap nuts	M8 x 1.25	6.9 to 8.8	0.7 to 0.9	5.1 to 6.5
* Cylinder head screws	M11 x 1.25	93.1 to 98.0	9.5 to 10.0	68.7 to 72.3
* Main bearing case screws 1	M9 x 1.25	46.1 to 50.9	4.7 to 5.2	34.0 to 37.6
* Main bearing case screws 2	M10 x 1.25	68.6 to 73.5	7.0 to 7.5	50.6 to 54.2
* Flywheel screws	M12 x 1.25	98.0 to 107.8	10.0 to 11.0	72.3 to 79.5
* Connecting rod screws	M8 x 1.0	44.1 to 49.0	4.5 to 5.0	32.5 to 36.2
* Rocker arm bracket nuts	M8 x 1.25	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
* Idle gear shaft screws	M8 x 1.25	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
* Crankshaft nut	M30 x 1.5	137.3 to 156.9	14.0 to 16.0	101.2 to 115.7
* Bearing case cover screws	M8 x 1.25	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Glow plugs	M10 x 1.25	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1
Nozzle holder assembly	M20 x 1.5	49.0 to 68.6	5.0 to 7.0	36.2 to 50.6
Nozzle holder	–	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Oil switch taper screw	PT 1/8	14.7 to 19.6	1.5 to 2.0	10.8 to 14.5
Injection pipe retaining nuts	M12 x 1.5	24.5 to 34.3	2.5 to 3.5	18.1 to 25.3
Overflow pipe assembly retaining nuts	–	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1

NOTE

- For * marked screws, bolts and nuts on the table, apply engine oil to their threads and seats before tightening.
- The letter "M" in Size x Pitch means that the screw, bolt or nut dimension stands for metric. The size is the nominal outside diameter in mm of the threads. The pitch is the nominal distance in mm between two threads.

CHECKING, DISASSEMBLING AND SERVICING

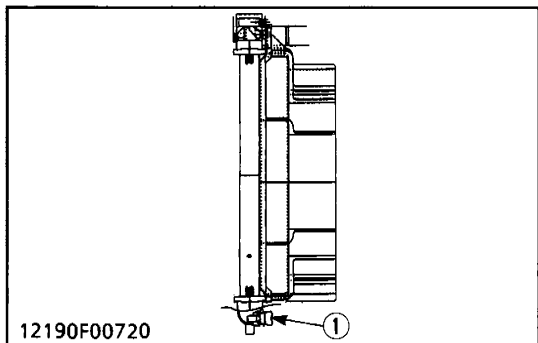
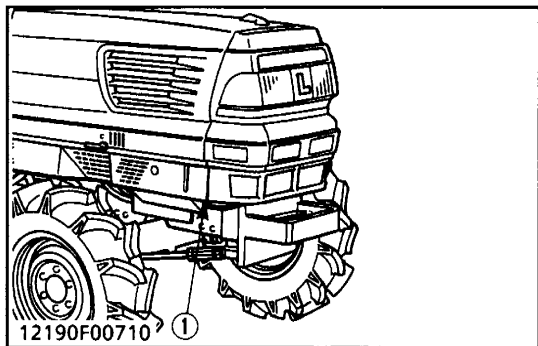
[1] SEPARATING ENGINE FROM TRACTOR

NOTE

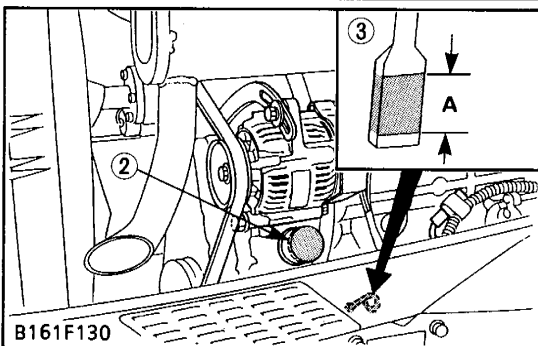
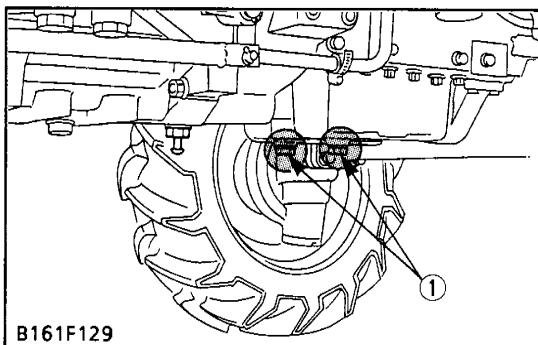
- If the tractors are cabin specifications, refer to section 10 CABIN [1] SEPARATING CABIN FROM TRACTOR BODY. (See page 10-S20.)

DISASSEMBLING AND ASSEMBLING

(1) Draining Coolant and Engine Oil



(1) Drain Plug



Draining Coolant

CAUTION

- Never remove the radiator cap until coolant temperature is well below its boiling point. Then loosen cap slightly to the stop to relieve any excess pressure before removing cap completely.

1. Stop the engine and let cool down.
2. Loosen the drain plug (1) to drain the coolant.
3. Remove the radiator cap to completely drain the coolant.
4. After all coolant is drained, retighten the drain plug (1).

Coolant	Capacity	L3010 L3410	7.0 ℓ 7.4 U.S.qts. 6.2 Imp.qts.
		L3710 L4310	7.5 ℓ 7.9 U.S.qts. 6.6 Imp.qts.

Draining Engine Oil

1. Start and warm up the engine for approx. 5 minutes.
2. Place an oil pan underneath the engine.
3. Remove the drain plugs (1) to drain oil.
4. Screw in the drain plugs (1).

(When refilling)

- Fill the engine oil up to the upper line on the dipstick (3).

Engine oil	Capacity	L3010 L3410	5.5 ℓ 5.8 U.S.qts. 4.8 Imp.qts.
		L3710 L4310	7.6 ℓ 8.0 U.S.qts. 7.0 Imp.qts.

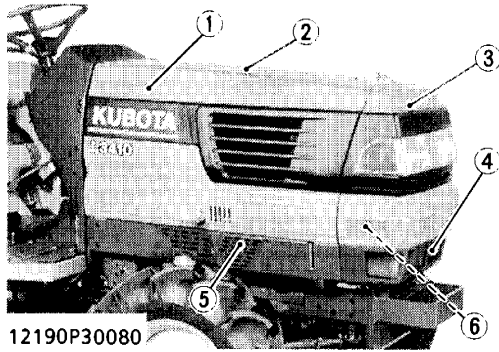
IMPORTANT

- Never mix two different type of oil.
- Use the proper SAE Engine Oil according to ambient temperatures. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-8.)

[A] Oil level is acceptable within this range.

- (1) Drain Plugs
- (2) Oil Inlet Plug
- (3) Dipstick

(2) Separating Panel Frame Assembly

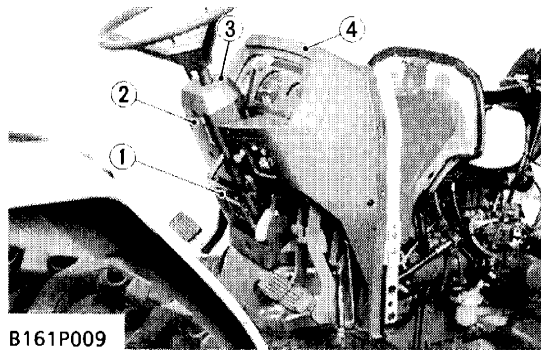


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Preparation 1

1. Open the front mask (3) and disconnect the battery negative cable (6).
2. Remove the right and left side covers (1).
3. Remove the front mask (3).
4. Remove the front grille (4).
5. Remove the right and left side skirts (5).
6. Remove the bonnet (2).

- | | |
|-------------------------|---------------------------|
| (1) Side Cover (RH, LH) | (4) Front Grille |
| (2) Bonnet | (5) Side Skirt (RH, LH) |
| (3) Front Mask | (6) Battery Negative Code |



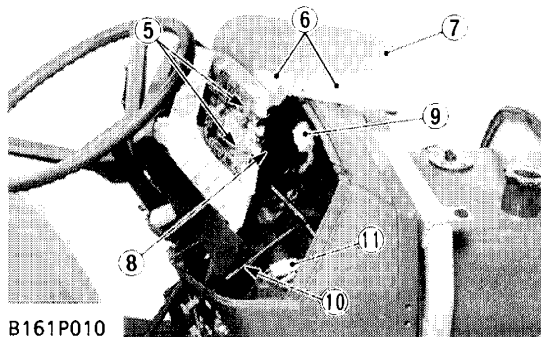
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Preparation 2

1. Remove the steering post covers (2), (3) and panel under cover (1).
2. Disconnect the meter cable (8) at the engine side.
3. Remove the meter panel mounting screws and open the meter panel (4).
4. Remove the meter panel cover (7) and disconnect the two connectors (5) and meter cable (8).
5. Take out the meter panel (4).
6. Disconnect the main switch connector (11) and combination switch connector (9).
7. Disconnect the engine stop cable (10) at the engine side.

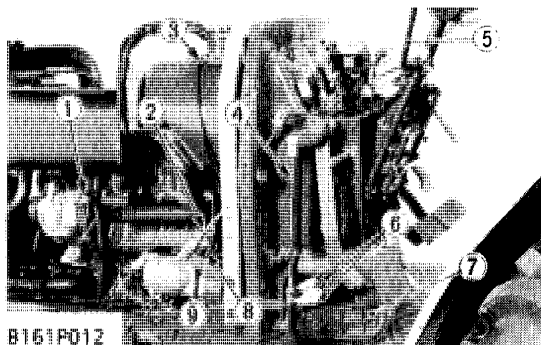
NOTE

- Do not remove the seals (6) on the meter panel cover (7).



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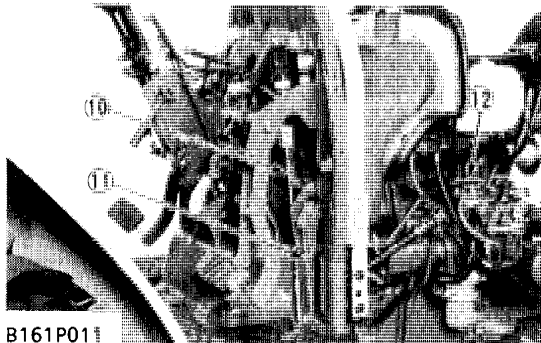
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|-------------------------|----------------------------------|
| (1) Panel Under Cover | (7) Meter Panel Cover |
| (2) Steering Post Cover | (8) Meter Cable |
| (3) Steering Post Cover | (9) Combination Switch Connector |
| (4) Meter Panel | (10) Engine Stop Cable |
| (5) Connectors | (11) Main Switch Connector |
| (6) Seals | |



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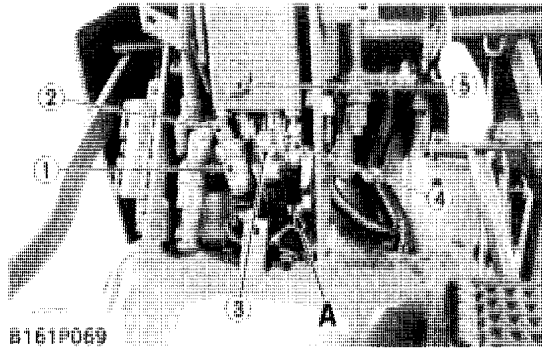
Preparation 3

1. Disconnect the brake rods (4), (10).
2. Disconnect the clutch rod (2).
3. Remove the accelerator rod (12).
4. Disconnect the foot accelerator rod (11).
5. Remove the panel frame cover (7) and disconnect the three connectors (6).
6. Remove the shuttle shift lever (5) after disconnecting the limit switch wire harness.
7. Disconnect the 2P connector for alternator (1), jumper leads for fuel level sensor (3) and starter (9).

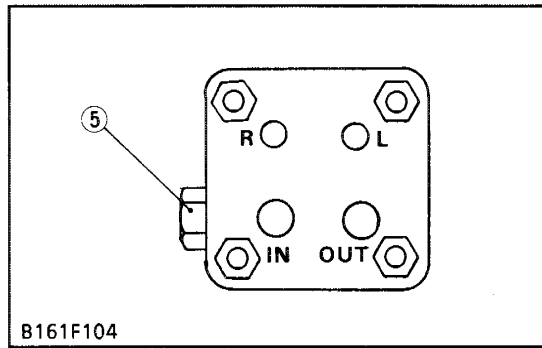


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- | | |
|---------------------------------------|--------------------------------|
| (1) 2P Connector for Alternator | (7) Panel Frame Cover |
| (2) Clutch Rod | (8) Jumper Lead for Oil Switch |
| (3) Jumper Lead for Fuel Level Sensor | (9) Jumper Lead for Starter |
| (4) Brake Rod (LH) | (10) Brake Rod (RH) |
| (5) Shuttle Shift Lever | (11) Foot Accelerator Rod |
| (6) Connectors | (12) Accelerator Rod |



B161P069



B161F104

Hydraulic Pipes

1. Disconnect the main delivery hose (1), return hose (2), right turning delivery hose (3) and left turning delivery hose (4).

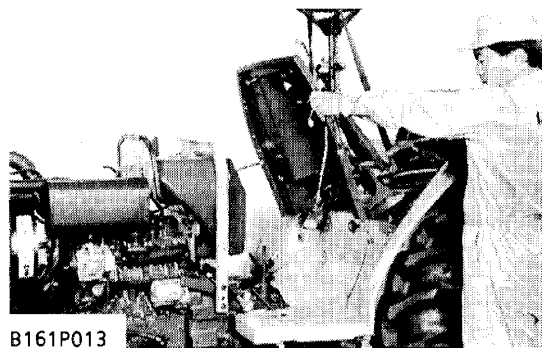
(When reassembling)

- In assembling the turning delivery hoses to the steering controller, connect the delivery hose with identification mark (tape) "A" to the L port of the steering controller. (Refer to figure left.)

Tightening torque	Main delivery hose retaining nut	46.6 to 50.9 N·m 4.8 to 5.2 kgf·m 34.4 to 37.6 ft-lbs
	Turning delivery hoses retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft-lbs

[A] Identification Mark (Tape)

- | | |
|---------------------------------|--------------------------------|
| (1) Main Delivery Hose | (4) Left Turning Delivery Hose |
| (2) Return Hose | (5) Relief Valve Plug |
| (3) Right Turning Delivery Hose | |



B161P013

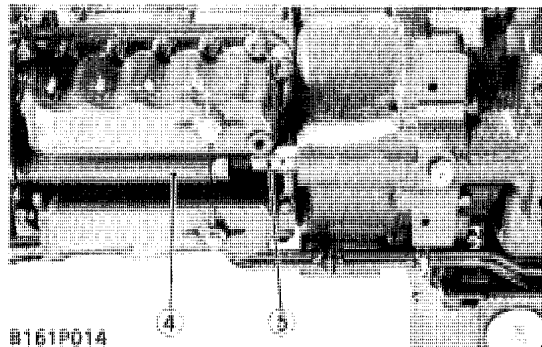
Panel Frame and Steering Assembly

1. Remove the panel frame mounting screws. (Two screws at upper part. Seven screws at lower part.)
2. Take out the panel frame and steering assembly as a unit.

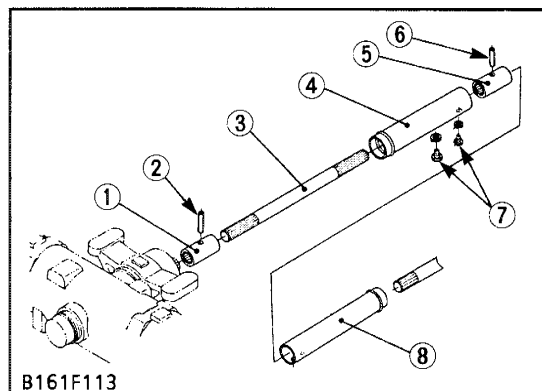
(When reassembling)

- Do not get in the wiring harness between panel frame and platform.

(3) Separating Engine



B161P014



B161F113

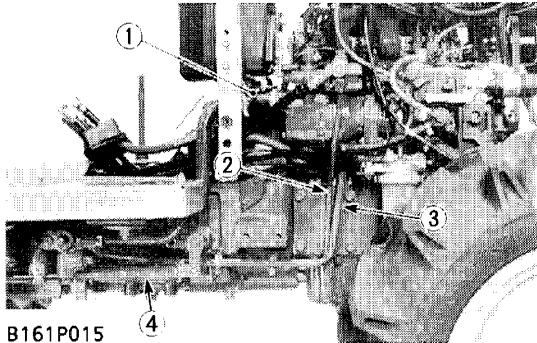
Propeller Shaft (4WD Only)

1. Slide the propeller shaft cover (4) after removing the screws (7).
2. Tap out the spring pin (6), and then slide the coupling (5) to the front.

(When reassembling)

- Apply grease to the splines of the propeller shaft.

- | | |
|---------------------------|---------------------------|
| (1) Coupling | (5) Coupling |
| (2) Spring Pin | (6) Spring Pin |
| (3) Propeller Shaft | (7) Screws |
| (4) Propeller Shaft Cover | (8) Propeller Shaft Cover |



B161P015

- (1) Rubber Hose
(2) GST Delivery Pipe
(3) Delivery Pipe
(4) Brake Rod

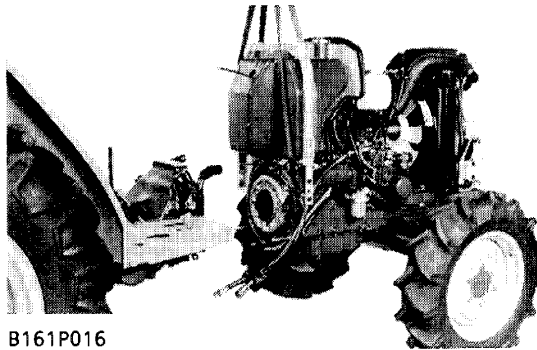
Hydraulic Pipes

1. Remove the brake rod (4) and delivery pipe (3).
2. Remove the GST delivery pipe (2). (GST or independent PTO type only.)
3. Slide the rubber hose (1).

(When reassembling)

- Reinstall the pipe clamp securely.

Tightening torque	Joint bolt for delivery pipe (3) and hydraulic block	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft-lbs
	Joint bolt for GST delivery pipe (2) and regulator valve (GST or independent PTO type only)	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs



B161P016

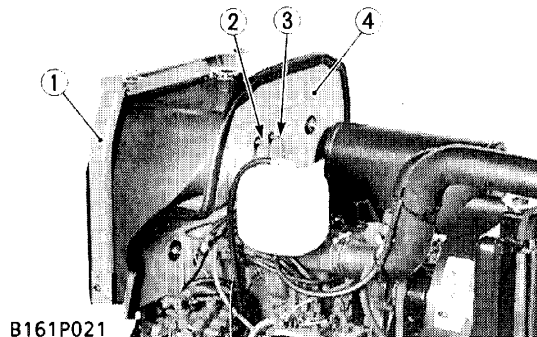
Separating the Engine from Clutch Housing

1. Place the jack under the clutch housing case.
2. Hoist the engine by the nylon lift strap at the tank support.
3. Remove the engine mounting screws, and then pull the engine to the front.

(When reassembling)

- Apply grease to the splines.
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the engine and clutch housing.

Tightening torque	Engine and clutch housing mounting screws, nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Engine and clutch housing mounting stud bolts	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft-lbs

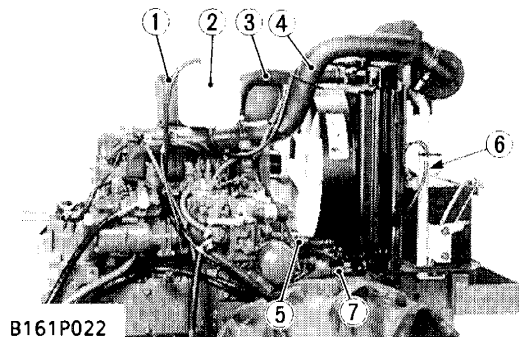


B161P021

Fuel Tank

1. Remove the shutter plate (4) mounting four screws.
2. Disconnect the fuel pipe from the fuel tank then drain the fuel.
3. Disconnect the fuel return pipes (2), (3).
4. Remove the fuel tank to the rear after removing the fuel tank mounting screws.
5. Remove the tank support (1).

- (1) Fuel Tank Support
(2) Fuel Return Pipe
(3) Fuel Return Pipe
(4) Shutter Plate

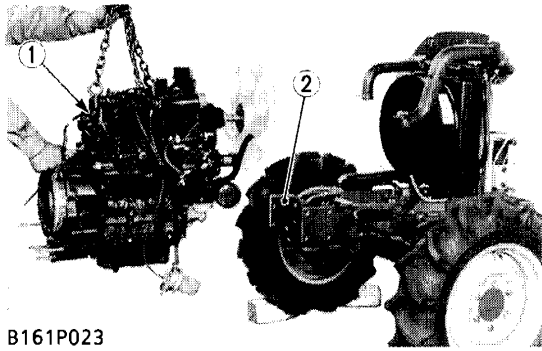


B161P022

Preparation

1. Remove the exhaust muffler (1) and recovery tank (2).
2. Remove the wiring harness (6) of the headlight and the air cleaner indicator from the clamp then move it to the front axle side.
3. Disconnect the radiator hoses (3), (5), (7) and air cleaner hose (4) at the engine side.

- (1) Exhaust Muffler
(2) Recovery Tank
(3) Radiator Hose
(4) Air Cleaner Hose
(5) Radiator Hose
(6) Wiring Harness
(7) Radiator Hose



B161P023

(1) Engine Hook

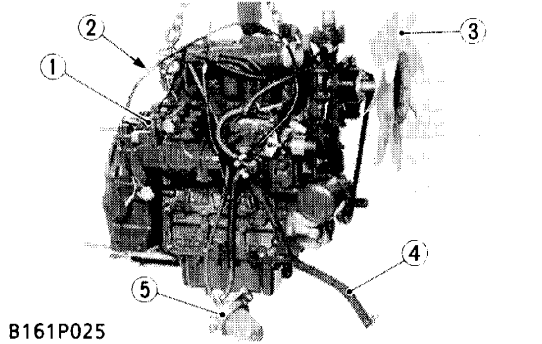
(2) Front Axle Support

Front Axle Support

1. Remove the hook at the left side of cylinder head, and then install it at the rear side of the cylinder head with screw (M8 x 1.25) for hoist the engine.
2. Hoist the engine by the hoist and chain.
3. Separate the front axle support (2) as a unit after removing the front axle support mounting screws.

(When reassembling)

Tightening torque	Front axle support mounting screws	102.9 to 117.6 N·m 10.5 to 12.0 kgf·m 76.0 to 86.8 ft·lbs
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B161P025

Outer Parts

1. Remove the regulator valve (1) and its delivery pipe together.
2. Remove the wiring harness (2), fan (3) and radiator hose (4).
3. Remove the fuel filter (5) with its hoses together.
4. Remove the clutch.

(When reassembling)

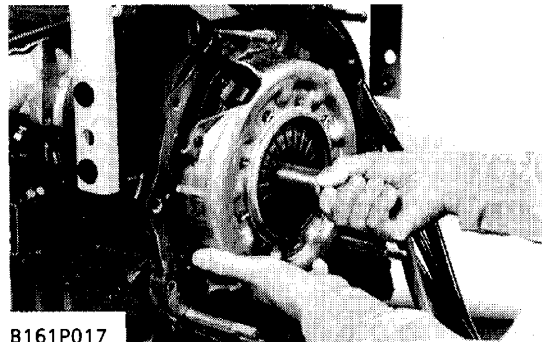
- Direct the shorter end of the clutch disc boss toward the flywheel.
- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the splines of clutch disc boss.
- Insert the pressure plate, noting the position of straight pins.

■ IMPORTANT

- Be sure to align the center of disc and flywheel by inserting the clutch center tool. (See page G-33.)

■ NOTE

- Do not allow grease and oil on the clutch disc facing.



B161P017

(1) Regulator Valve

(4) Radiator Hose

(2) Wiring Harness

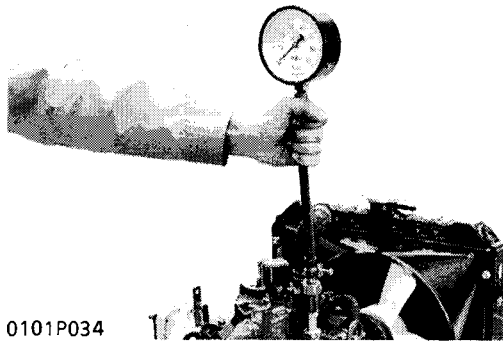
(5) Fuel Filter and Hoses

(3) Fan

Tightening torque	Clutch mounting screw and reamer screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft·lbs
	Joint bolt for delivery pipe and hydraulic pump	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft·lbs
	Regulator valve mounting screws	17.6 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft·lbs

[2] CYLINDER HEAD

CHECKING AND ADJUSTING



0101P034

Compression Pressure

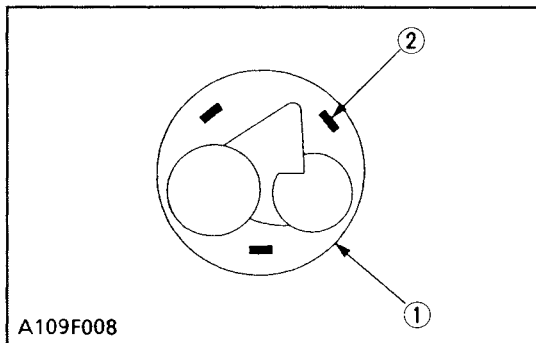
1. Warm up the engine.
2. Remove the air cleaner, the muffler and the nozzle holders from all the cylinders.
3. Set a compression tester to the cylinder to be measured.
4. Run the engine with the starter at 200 to 300 rpm and read constant maximum on the tester. Execute the test at least twice. (Run the engine for 5 to 10 seconds for each test.)

NOTE

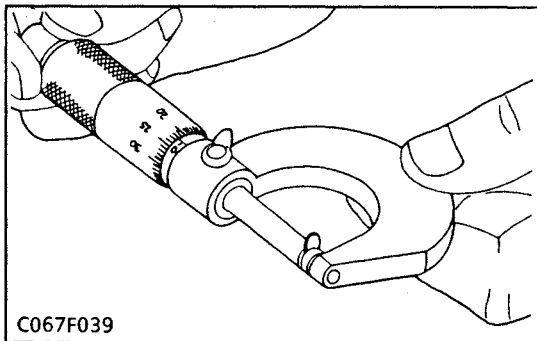
- For the test, use a fully charged battery and the specified valve clearance.
- If the compression pressure is below the given allowable limit, pour a small amount of oil through the nozzle holder hole and test again.
- If the pressure recovers to the standard level, inadequate pressure may be caused by wear or adhesion of the piston rings. Check the related points.
- If the pressure does not recover, cylinder head or valve problems may be the cause. Check the related points.
- If the compression differs more than 10 % among the cylinders, trace the cause of pressure variation and take corrective measures.

Reference compression pressure	Factory spec.	35.3 to 37.2 MPa 36 to 38 kgf/cm ² 512 to 540 psi
Compression pressure allowable limit should be more than 75% of reference compression pressure	Allowable limit	24.5 MPa 26 kgf/cm ² 355 psi

- Difference in compression pressure among cylinders should be within 10 %.



A109F008



C067F039

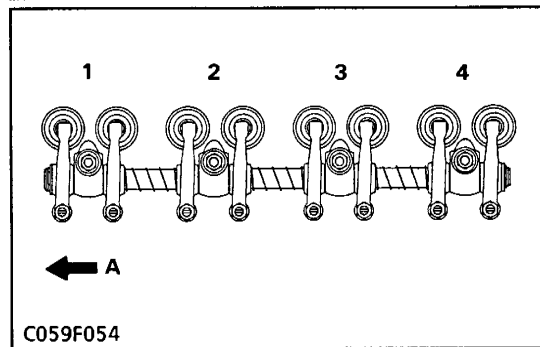
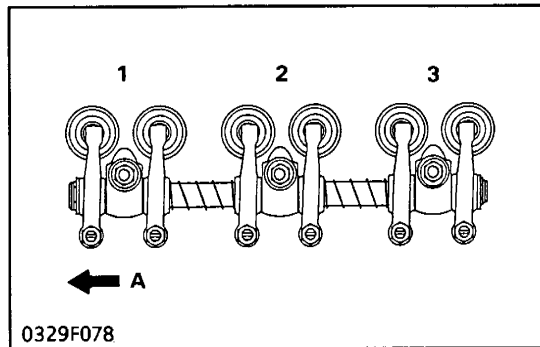
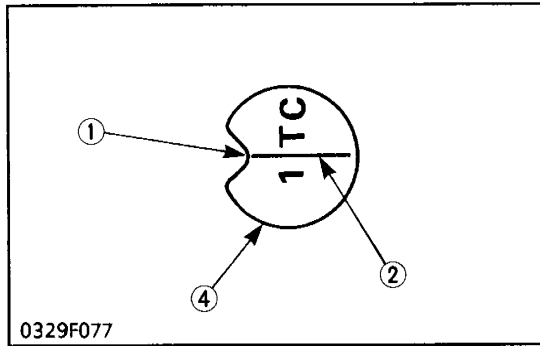
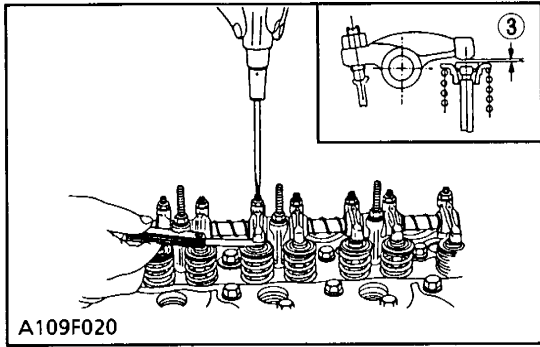
Top Clearance

1. Remove the cylinder head.
2. Move the piston up and stick a strip of fuse on the piston head at four position with grease.
3. Lower the piston and install the cylinder head. (Use a new cylinder head gasket and tighten with a specified tightening torque.)
4. Turn the flywheel until the piston passes through the T.D.C.
5. Remove the cylinder head and measure the thickness of the fuses.
6. If the measurement is not within the factory specifications, check the oil clearances between the crankpin and bearing and between the piston pin and bushing.

Top clearance	Factory spec.	0.55 to 0.70 mm 0.0217 to 0.0276 in.
Tightening torque	Cylinder head screws	93.1 to 98.0 N·m 9.5 to 10.0 kgf·m 68.7 to 72.3 ft·lbs

(1) Piston

(2) Fuses



[A] Gear Case Side

- (1) Projection
- (2) TC Mark Line
- (3) Valve Clearance
- (4) Timing Window

Valve Clearance

IMPORTANT

● Valve clearance must be checked and adjusted when engine is cold.

1. Remove the head cover, the glow plugs and the timing window cover on the flywheel housing.
2. Align the "1TC" mark on the flywheel and projection (1) on the housing so that the No. 1 piston comes to the compression or overlap top dead center.
3. Check the following valve clearance marked with "○" using a feeler gauge.
4. If the clearance is not within the factory specifications, adjust with the adjusting screw.

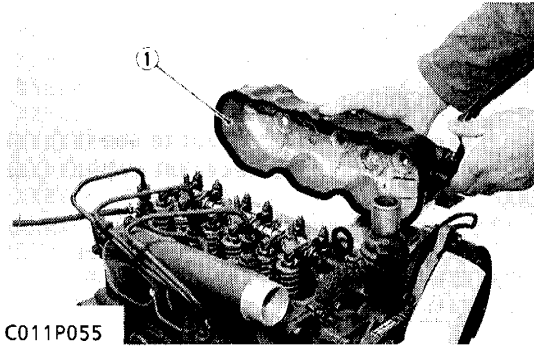
Valve clearance	Factory spec.	0.18 to 0.22 mm 0.0071 to 0.0087 in.
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NOTE

- The "TC" marking on the flywheel is just for No. 1 cylinder. There is no "TC" marking for the other cylinders.
- No. 1 piston comes to the T.D.C. position when the window on flywheel-housing. Turn the flywheel 0.26 rad. (15°) clockwise and counterclockwise to see if the piston is at the compression top dead center or the overlap position. Now referring to the table below, readjust the valve clearance. (The piston is at the top dead center when both the IN. and EX valves do not move; it is at the overlap position when both the valves move.)
- Finally turn the flywheel 6.28 rad. (360°) and align the "TC" marking and the projection perfectly. Adjust all the other valve clearance as required.
- After turning the flywheel counterclockwise twice or three times, recheck the valve clearance, firmly tighten the lock nut of the adjusting screw.

Adjustable cylinder location of piston	Engine model	D1403 D1703		V1903 V2203	
		Valve arrangement			
		IN.	EX.	IN.	EX.
When No. 1 piston is compression top dead center	1st	○	○	○	○
	2nd		○	○	
	3rd	○			○
	4th	△	△		
When No. 1 piston is overlap position	1st				
	2nd	○			○
	3rd		○	○	
	4th	△	△	○	○

DISASSEMBLING AND ASSEMBLING



C011P055

(1) Head Cover

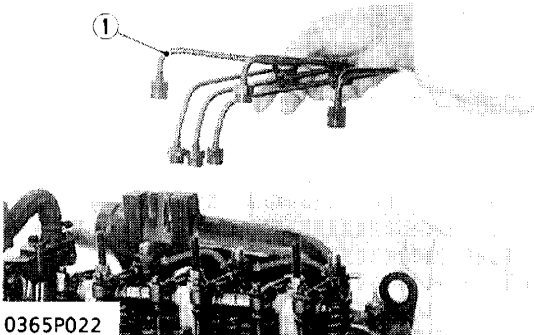
Cylinder Head Cover

1. Remove the head cover nuts.
2. Remove the head cover (1).

(When reassembling)

- Check to see if the head cover gasket is not defective.
- To prevent valve stem seizure, apply enough engine oil to the valve guide and valve stem.

Tightening torque	Cylinder head cover cap nuts	6.9 to 8.8 N·m 0.7 to 0.9 kgf·m 5.1 to 6.5 ft·lbs
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0365P022

(1) Injection Pipes

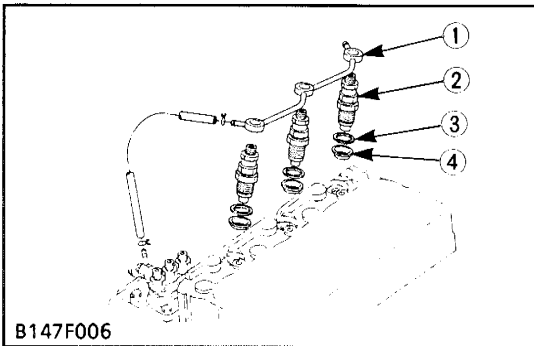
Injection Pipes

1. Loosen the screws on the pipe clamps.
2. Detach the injection pipes (1).

(When reassembling)

- Send compressed air into the pipes to blow out dust. Then, reassemble the pipes in the reverse order.

Tightening torque	Retaining nuts	24.5 to 34.3 N·m 2.5 to 3.5 kgf·m 18.1 to 25.3 ft·lbs
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B147F006

(1) Overflow Pipe Assembly
(2) Nozzle Holder
(3) Copper Gasket
(4) Heat Seal

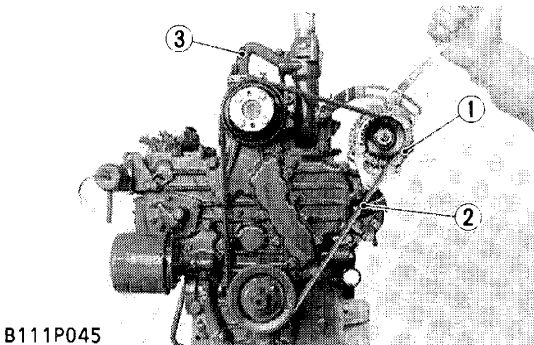
Nozzle Holder Assembly

1. Remove the overflow pipe assembly (1).
2. Detach the nozzle holders using a 21 mm deep socket wrench.
3. Remove the copper gasket (3) and heat seal (4).

(When reassembling)

- Replace the copper gasket and heat seal with new one.

Tightening torque	Nozzle holder assembly	49.0 to 68.6 N·m 5.0 to 7.0 kgf·m 36.2 to 50.6 ft·lbs
	Overflow pipe assembly retaining nut	19.6 to 24.5 N·m 2.0 to 2.5 kgf·m 14.5 to 18.1 ft·lbs



B111P045

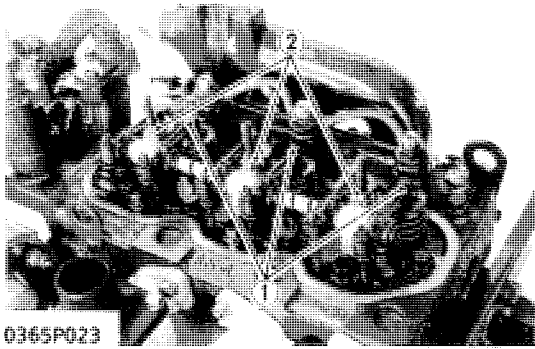
(1) Alternator
(2) Fan Belt
(3) Return Pipe

Fan, Fan Belt and Alternator

1. Remove the fan.
2. Loosen the nut and tension screw.
3. Detach the fan belt (2) and alternator (1).
4. Remove the return pipe (3).

(When reassembling)

- Check to see if the fan belt is placed in a correct position (where letters on the belt can be read from your side), and there is no oil or grease on the belt.
- Fan belt tension :
The belt should deflect approx. 7 mm (0.3 in.) when the center of the belt is depressed with a finger pressure of 98 N (10 kgf, 22 lbs).



0365P023

(1) Rocker Arms

(2) Rocker Arm Bracket Nuts

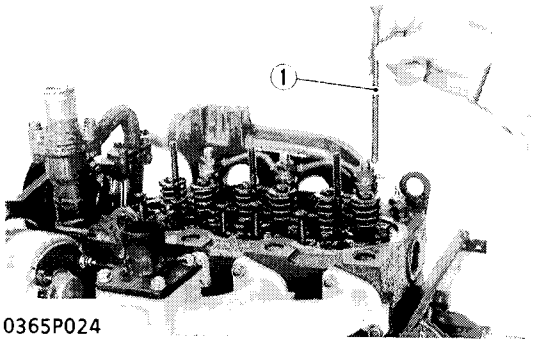
Rocker Arm

1. Remove the rocker arm bracket nuts (2).
2. Detach the whole rocker arm (1).

(When reassembling)

- Always adjust the valve clearance.
- Before installing the rocker arm bracket, check to see if there are any metallic particles on the surface on which the assembly is mounted.

Tightening torque	Rocker arm bracket nuts	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft·lbs
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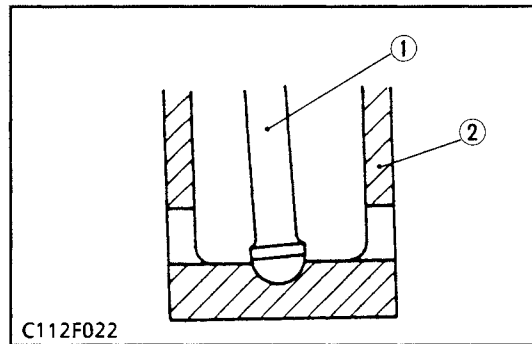
0365P024

Push Rods

1. Remove the push rods (1).

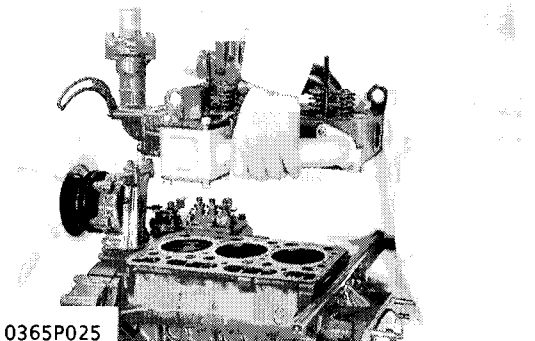
(When reassembling)

- When putting the push rods onto the tappets, check to see if their ends are properly engaged with the grooves.



(1) Push Rods
(2) Tappet

C112F022



0365P025

Cylinder Head

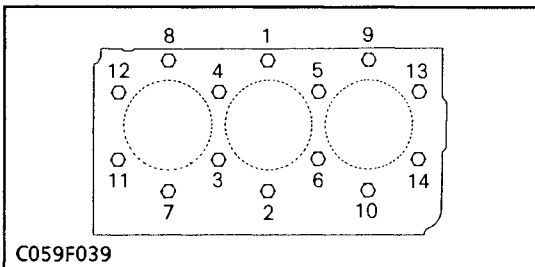
1. Remove the fourteen cylinder head screws.
2. Lift up the cylinder head to detach.

(When reassembling)

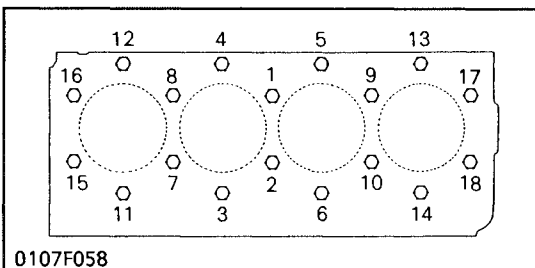
- Tighten the cylinder head screws after applying sufficient oil.
- Tighten the cylinder head screws in diagonal sequence starting from the center. (Refer to figure left.)
Tighten them uniformly, or the head may deform in the long run.

■ IMPORTANT

- When overhauling the engine, replace the gasket with a new one without confusing its front and back.
Retighten the cylinder head screws after running the engine for 30 minutes.

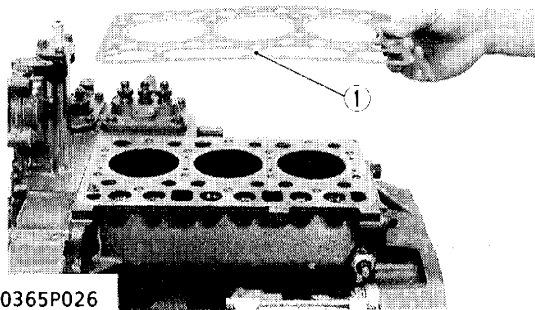


C059F039



0107F058

Tightening torque	Cylinder head screws	93.1 to 98.0 N·m 9.5 to 10.0 kgf·m 68.7 to 72.3 ft·lbs
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0365P026

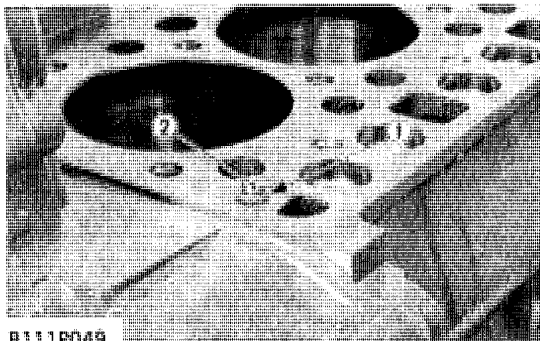
Cylinder Head Gasket

1. Detach the cylinder head gasket.

(When reassembling)

- Before installing the gasket, check to see there is no foreign matter on the cylinder head and the cylinder.

(1) Cylinder Head Gasket



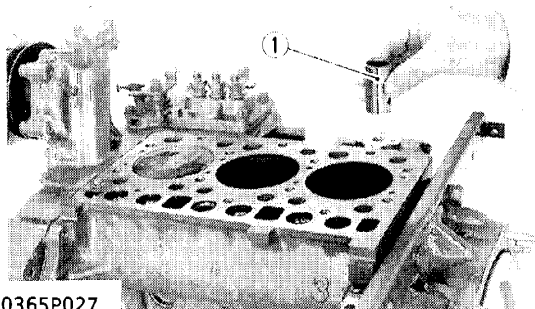
B111P049

O-ring

1. Remove the O-ring (1) from the periphery of the oil pipe on the crankcase.

(1) O-ring

(2) Pipe Pin



0365P027

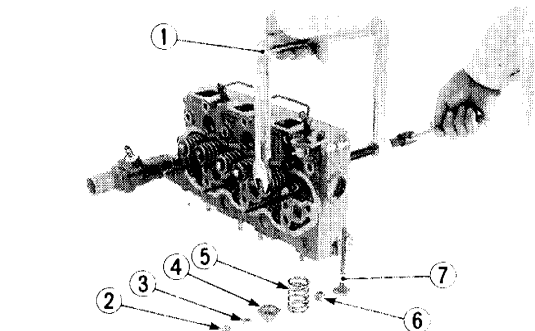
Tappets

1. Remove the tappets (1) from the crankcase.

(When reassembling)

- Visually check the contact between tappets and cams for proper rotation. If a defect is found, replace tappets.
- Before installing the tappets, apply engine oil thinly around them.

(1) Tappets



0365P028

Valves

1. Remove the valve caps (2).
2. Remove the valve spring collet (3), pushing the valve spring retainer (4) by valve spring replacer (1).
3. Remove the valve spring retainer (4), valve spring (5) and valve stem seal (6).
4. Remove the valve (7).

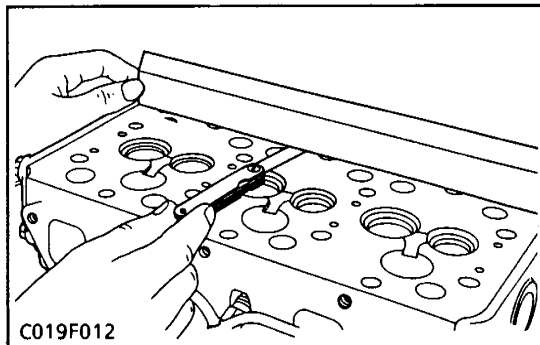
■ IMPORTANT

- Don't change the combination of valve and valve guide.

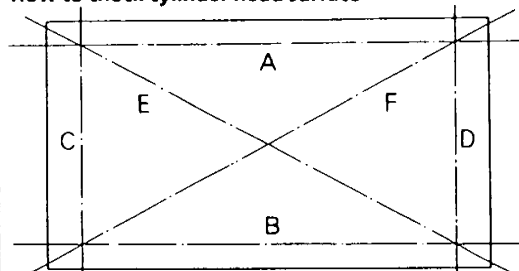
(1) Valve Spring Replacer
 (2) Valve Cap
 (3) Valve Spring Collet
 (4) Valve Spring Retainer

(5) Valve Spring
 (6) Valve Stem Seal
 (7) Valve

SERVICING



How to check cylinder head surface



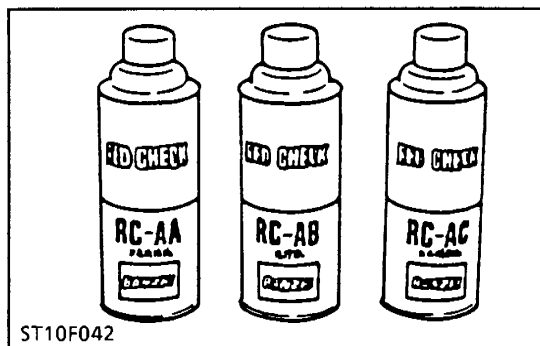
Flatness of Cylinder Head Surface

1. Clean the surface of the cylinder head.
2. Place a straight edge on each of the cylinder head's four sides and two diagonally as shown at the left to check the straightness of the surface.
3. Insert a feeler gauge between the straight edge and the cylinder head surface.
4. The maximum thickness that can be inserted is the amount of flatness.
5. If the measurement exceeds the allowable limit, correct with a surface grinder.

NOTE

- Do not place the straight edge on the combustion chamber.

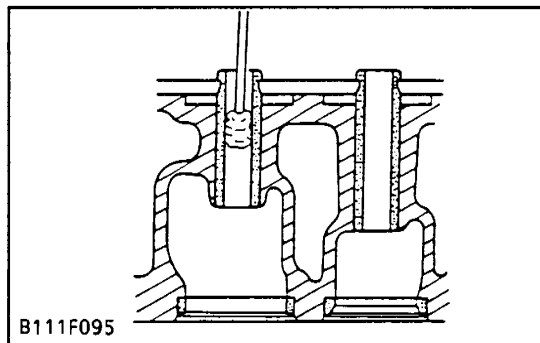
Flatness of cylinder head surface	Allowable limit	0.05 mm (0.0019 in.) per 100 mm (4 in.)
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Flaw of Cylinder Head Surface

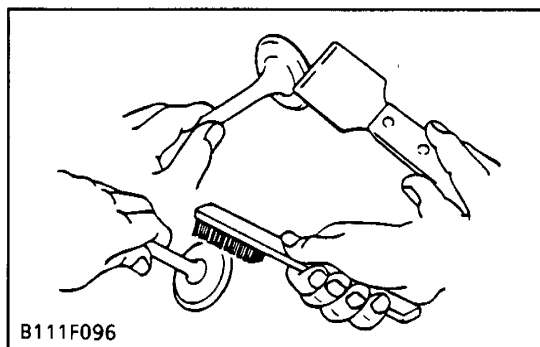
1. Clean the surface of the cylinder head.
2. Spray the cylinder head surface with the red permeative liquid.
3. Wash away the red permeative liquid on the cylinder head surface with the detergent.
4. Spray the cylinder head surface with the developer. If flawed, it can be identified as red marks.

Flaw of cylinder head surface	Factory spec.	Should be no flaw
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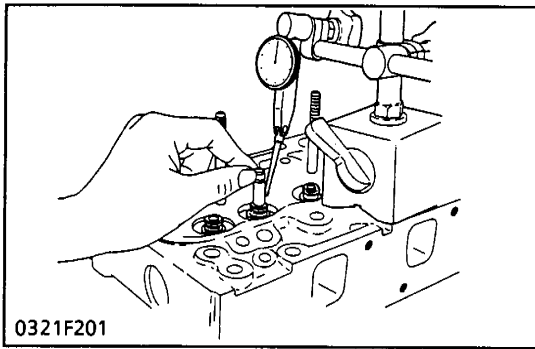
Clean the Valve Guide

1. Wash and clean the inner surface of the valve guide with kerosene or diesel fuel.



Clean the Valve

1. Use a scraper and remove carbon.
2. Use a wire brush and remove carbon completely.



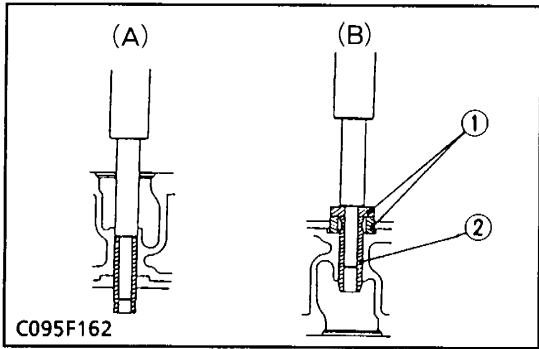
Valve Guide Clearance

1. Remove carbon from the valve guide.
2. After making sure that the valve stem is straight, insert the valve into the valve guide.
3. Measure the valve guide clearance with a dial gauge.
4. If the measurement exceeds the allowable limit, replace the valve guide and the valve.

Valve guide clearance	Factory spec.	0.040 to 0.070 mm 0.00157 to 0.00276 in.
	Allowable limit	0.1 mm 0.0039 in.

Valve guide bore I.D.	Factory spec.	8.015 to 8.030 mm 0.31555 to 0.31614 in.
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Valve stem O.D.	Factory spec.	7.960 to 7.975 mm 0.31339 to 0.31398 in.
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Replace the Valve Guide

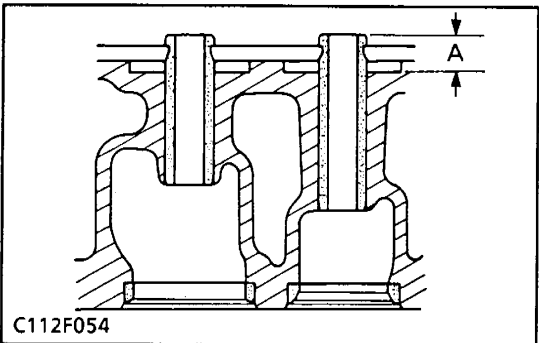
1. Remove the spacer (1).
2. Press out the used valve guide from the cylinder head's lower end.
3. Before pressing in, apply oil on the outer surface of the valve guide, place a spacer of the specified protrusion allowance (A) on the cylinder head, and press in the spacer from above.
4. After press-fitting, finish the valve guide by means of reamer machining to specified dimension.

NOTE

- Be careful not to strike valve guides with a hammer, etc. during replacement.

Valve guide bore I.D.	Factory spec.	8.015 to 8.030 mm 0.31555 to 0.31614 in.
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Valve guide protrusion	Factory spec.	9.8 to 10.2 mm 0.39 to 0.40 in.
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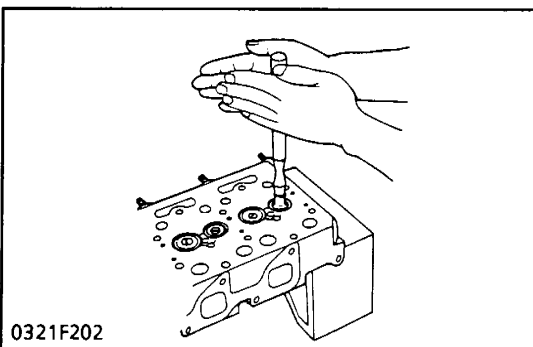
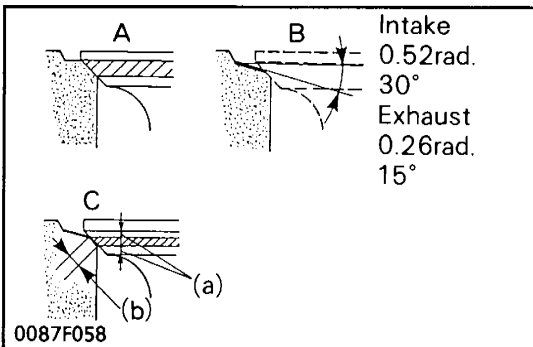
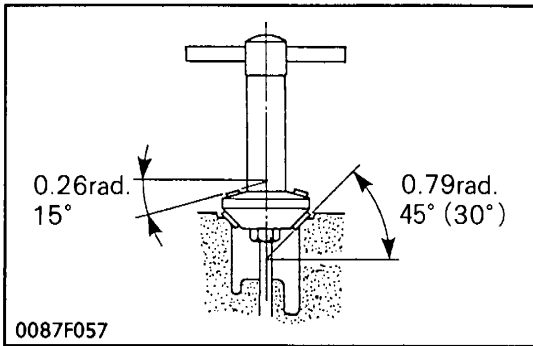
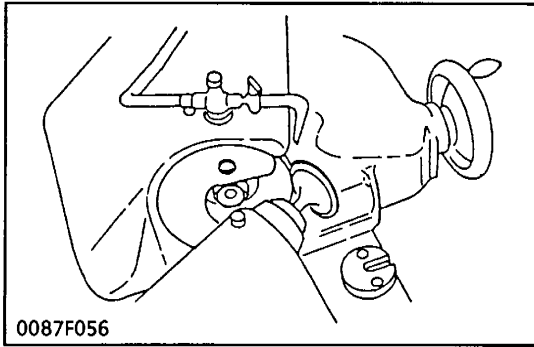


[A] Take Out

[B] Insert

(1) Spacer

(2) Valve Guide



Correcting Valve and Valve Seat

NOTE

- Before correcting the valve and seat, check the valve stem and the I.D. of the valve guide section, and repair them if necessary.
- After correcting the valve seat, be sure to check the valve recessing.

1) Correcting Valve

1. Correct the valve with a valve refacer.

2) Correcting Valve Seat

1. Slightly correct the seat surface with a 60° (Intake valve) or 45° (Exhaust valve) seat cutter (1) (Code No: 07909-33102).
2. Resurface the seat surface with 30° valve seat cutter to intake valve seat and with 15° valve seat cutter to exhaust valve seat so that the width is close to specified valve seat width. (2.12 mm 0.0835 in.)
3. After resurfacing the seat, inspect for even valve seating, apply a thin film of compound between the valve face and the valve seat, and fit them with valve lapping tool.
4. Check valve sealing with prussian blue, the valve seating surface should show good contact all the way around.

[A] Check Contact

[B] Correct Seat Width

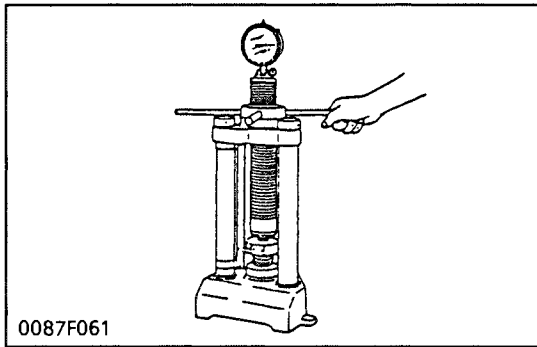
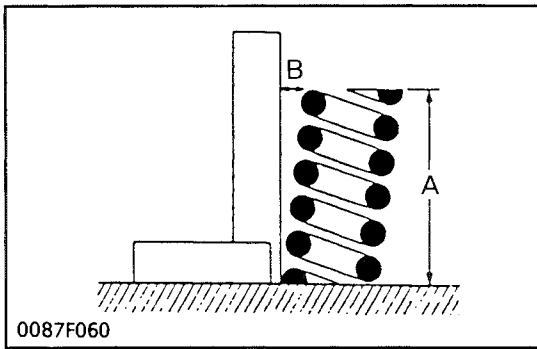
(a) Identical Dimensions

[C] Check Contact

(b) Valve Seat Width

Valve Lapping

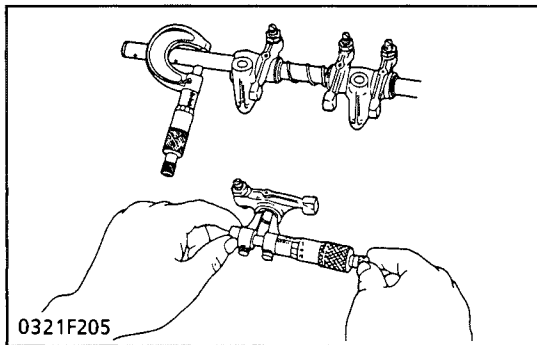
1. Apply compound on the valve face evenly.
2. Put the valve on its seat hold it with the valve flapper.
3. Turn and flap the valve back and forth on the valve seat to lap.
4. Remove the compound and clean the valve and the seat.
5. Apply oil on the valve face and finish to complete fitting.
6. Repeat lapping until the valve seats correctly, checking the seating.



Valve Spring

1. Measure the length (A) with vernier calipers. If the measurement is less than the allowable limit, replace the valve spring.
2. Put the spring on a surface plate, place a square on the side of the spring, and check to see if the entire side is in contact with the square. Rotate the spring and measure the maximum (B). If the measurement exceeds the allowable limit, replace the valve spring.
3. Check the entire surface of the spring for scratches. Replace it, if any.
4. Place the spring on a tester and compress it to the same length it is actually compressed in the engine. Read the compression load on the gauge. If the measurement exceeds the allowable limit, replace it.

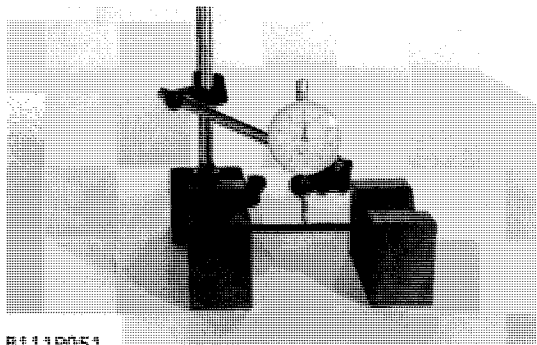
Free length	Factory spec.	41.7 to 42.2 mm 1.6417 to 1.6614 in.
	Allowable limit	41.2 mm 1.6220 in.
Tilt	Factory spec.	1.0 mm 0.039 in.
Setting load / Setting length	Factory spec.	117.6 N / 35.0 mm 12.0 kgf / 35.0 mm 26.4 lbs. / 1.3780 in.
	Allowable limit	100.0 N / 35.0 mm 10.2 kgf / 35.0 mm 22.5 lbs. / 1.3780 in.



Oil Clearance of Rocker Arm Shaft and Rocker Arm

1. Measure the rocker arm I.D. with an inside micrometer.
2. Measure the rocker arm shaft O.D. with an outside micrometer, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace them.

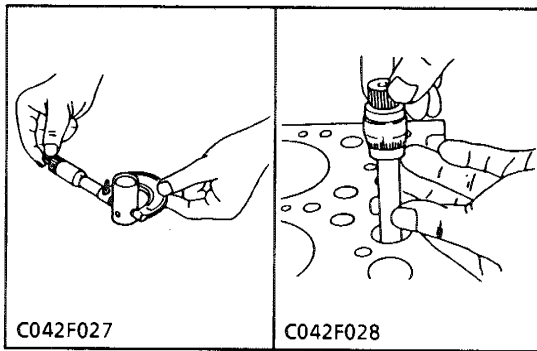
Oil clearance of rocker arm shaft and rocker arm	Factory spec.	0.016 to 0.045 mm 0.00063 to 0.00177 in.
	Allowable limit	0.15 mm 0.0059 in.
Rocker arm shaft O.D.	Factory spec.	13.973 to 13.984 mm 0.55012 to 0.55055 in.
Rocker arm I.D.	Factory spec.	14.000 to 14.018 mm 0.55118 to 0.55189 in.



Bend of Push Rod

1. Place the V blocks on the surface plate and put the push rod on the V blocks.
2. Place the dial gauge at the center of the push rod, rotate the push rod, and set the dial gauge to "0" when the push rod is at its lowest position.
3. Rotate the push rod and read the maximum value on the dial gauge.
4. If the alignment exceeds the allowable limit, replace the push rod.

Push rod alignment	Allowable limit	0.25 mm 0.0098 in.
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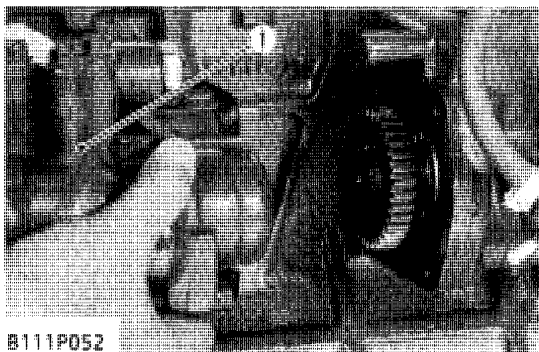
Tappet and Guide Bore Clearance

1. Measure the tappet guide bore I.D. of the cylinder block with an inside micrometer.
2. Measure the tappet O.D. with an outside micrometer.
3. If the clearance exceeds the allowable limit or the sliding surface is scored, replace the tappet.

Clearance between tappet and guide bore	Factory spec.	0.020 to 0.062 mm 0.00079 to 0.00244 in.
	Allowable limit	0.07 mm 0.0028 in.
Tappet O.D.	Factory spec.	23.959 to 23.980 mm 0.94327 to 0.94410 in.
Guide bore I.D.	Factory spec.	24.000 to 24.021 mm 0.94488 to 0.94571 in.

[3] TIMING GEARS

DISASSEMBLING AND ASSEMBLING



B111P052

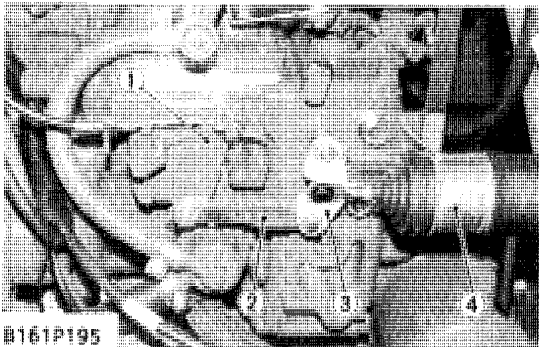
Cylinder Head Assembly

1. Remove the cylinder head assembly. (See page 1-518.)

Hydraulic Pump

1. Remove the hydraulic pump mounting screws.
2. Detach the hydraulic pump (1).

(1) Hydraulic Pump



B161P195

- (1) Engine Stop Lever (3) Stop Lever 2
(2) Stop Lever 1 (4) Solenoid

Solenoid

1. Disconnect the stop lever 1 (2) from the engine stop lever (1).
2. Remove the solenoid (4) with its support, after removing them mounting screws.

(When reassembling)

- Loosen the solenoid mounting screws.
- Install the support and complete the linkage between the solenoid and the engine stop lever.
- Pushing the solenoid plunger to the bottom, pull the stop lever 2 (3) with it until the engine stop lever (1) is turned to the end, then tighten the screws.

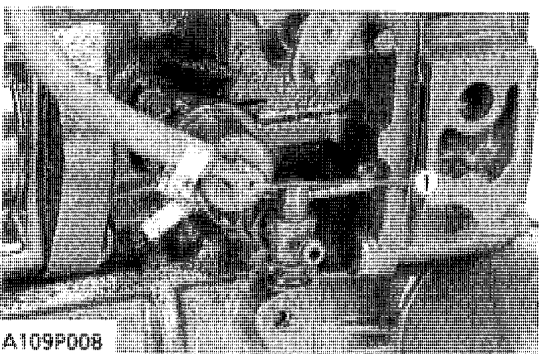
Fuel Lift Pump

1. Loosen the pipe clamp and remove the fuel pipe from the injection pump side.
2. Remove the fuel lift pump (1).

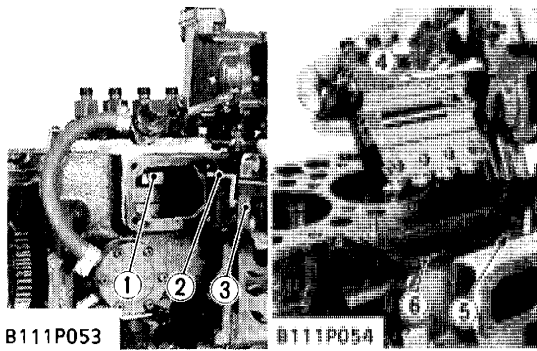
(When reassembling)

- Apply a liquid gasket (Three Bond 1215 or equivalent) to the both sides of fuel lift pump gasket.

(1) Fuel Lift Pump

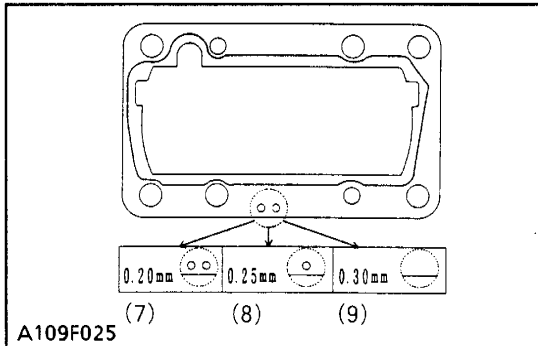


A109P008



B111P053

B111P054



A109F025

Injection Pump

1. Remove the injection pump cover (3) with the engine stop lever (2).
2. Remove the injection pump mounting screws and nuts.
3. Align the control rack pin (4) with the groove (5) on the crankcase, then remove the injection pump.

(When reassembling)

- Install the injection pump so that its control rack pin (4) engages with the groove (5) of fork lever 1.
- Install the injection pump cover with the arm of engine stop lever (2) at the right of the arm of fork lever 1 (1).

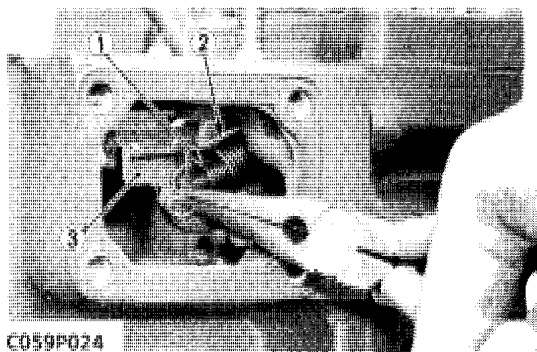
[Engine serial number : D1503-L-A ; ~ 1229 / D1703-A ; ~ 1213 / V1903-A ; ~ 1122 / V2203-A ; ~ 1157]

- Insert the same number of shims as used before between crank case and pump.
- Addition or reduction of shim (0.15 mm, 0.0059 in.) delays or advances the injection timing by approx. 0.026 rad. (1.5°).
- Apply liquid gasket (Three Bond 1215 or equivalent) to both sides of the injection pump shim before reassembling.

[Engine serial number : D1503-L-A ; 1230 ~ / D1703-A ; 1214 ~ / V1903-A ; 1123 ~ / V2203-A ; 1158 ~]

- The sealant is applied to both sides of the shim (soft metal gasket shim). The liquid gasket is not required for assembling.
- Addition or reduction of shims (0.05 mm, 0.0020 in.) delays or advances the injection timing by approx. 0.0087 rad (0.5°).
- In disassembling and replacing, be sure to use the same number of new shims with the same thickness.
- Refer to left figure to check the thickness of the shims.

- | | |
|--------------------------|---|
| (1) Fork Lever 1 | (6) Shims |
| (2) Engine Stop Lever | (7) 2-holes : 0.20 mm (0.0079 in.) |
| (3) Injection Pump Cover | (8) 1-hole : 0.25 mm (0.0098 in.) |
| (4) Control Rack Pin | (9) Without hole : 0.30 mm (0.0118 in.) |
| (5) Groove | |



C059P024

Governor Spring

1. Disconnect the governor spring 1 (1) and 2 (2) from the fork lever 2 (3).

(When reassembling)

- Fix the governor spring to the speed control lever, and pull the spring or wire through the window of the injection pump, and spring will be able to be hooked on the governor fork with ease.
Bend the end of the governor spring to prevent it from falling off.

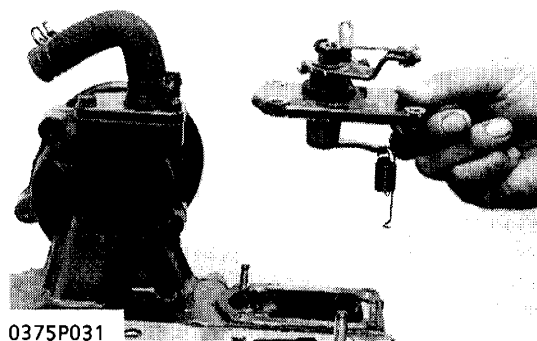
- | | |
|-----------------------|------------------|
| (1) Governor Spring 1 | (3) Fork Lever 2 |
| (2) Governor Spring 2 | |

Speed Control Plate

1. Remove the speed control plate and governor spring.

(When reassembling)

- Be careful not to drop the governor spring in the gear case.



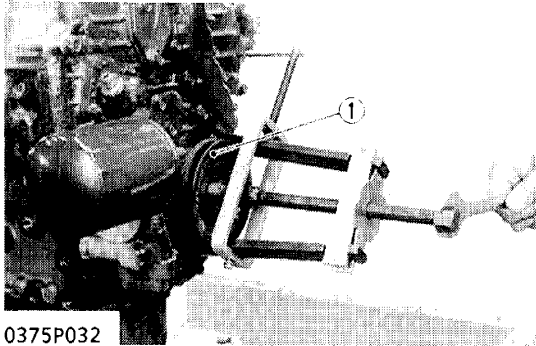
0375P031



B111F152

Start Spring

1. Remove the start spring from the gear case.



0375P032

(1) Fan Drive Pulley

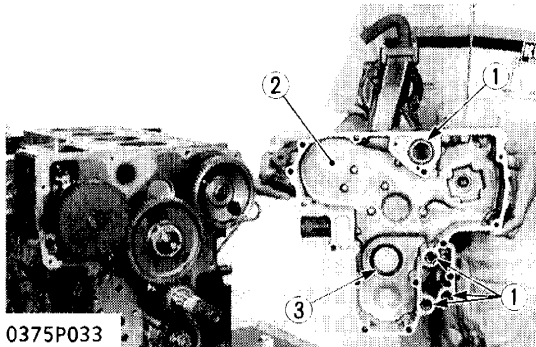
Fan Drive Pulley

1. Loosen and remove the crankshaft nut.
2. Draw out the fan drive pulley (1) with a puller.

(When reassembling)

- Do not tighten the nut excessively, it may damage the oil slinger, causing oil leakage.

Tightening torque	Crankshaft nut	137.3 to 156.9 N·m 14.0 to 16.0 kgf·m 101.3 to 115.7 ft-lbs
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0375P033

(1) O-rings
(2) Gear Case

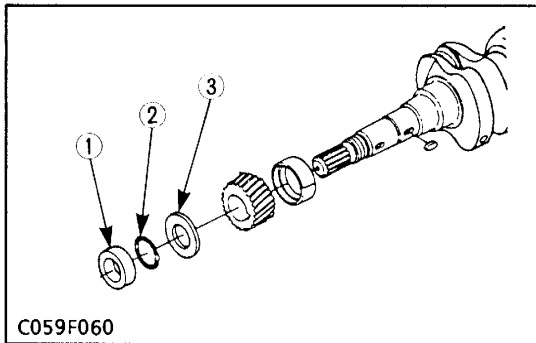
(3) Oil Seal

Gear Case

1. Remove the oil filter assembly.
2. Remove the gear case (2).
3. Remove the O-rings (1).

(When reassembling)

- Check to see if there are four O-rings (1) inside the gear case (2).
- Apply a thin film of engine oil to the oil seal (3), and install it, noting the lip come off.
- Before installing the gear case gasket, apply a non-drying adhesive.

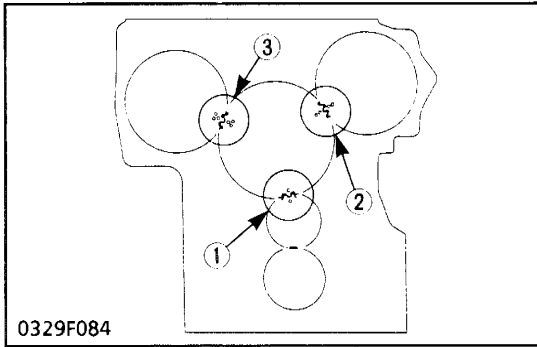


C059F060

(1) Crankshaft Collar
(2) O-ring
(3) Crankshaft Oil Slinger

Crankshaft Oil Slinger

1. Remove the feather key.
2. Remove the crankshaft collar (1).
3. Remove the O-ring (2).
4. Detach the crankshaft oil slinger (3).



Idle Gear

1. Remove the external snap ring.
2. Detach the idle gear collar 2.
3. Detach the idle gear.
4. Detach the idle gear collar 1.

(When reassembling)

- Check to see each gear is aligned with its aligning mark:
 - ① Idle gear and crank gear
 - ② Idle gear and camshaft gear
 - ③ Idle gear and injection pump gear

Tappets

1. See page 1-S19.

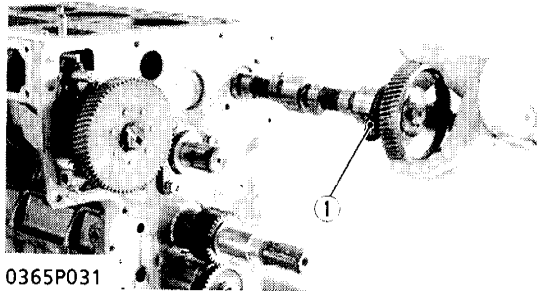
Gear and Camshaft

1. Remove the camshaft stopper mounting screws.
2. Draw out the camshaft and the cam gear.

(When reassembling)

- Apply a thin film of engine oil to the camshaft before installation.

- (1) Camshaft Stopper



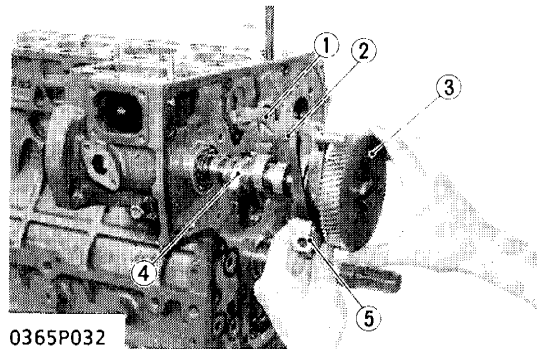
Fuel Camshaft and Fork Lever Assembly

1. Detach the fuel camshaft stopper.
2. Remove the three fork lever holder mounting screws.
3. Draw out the fuel camshaft assembly (3), (4) and fork lever assembly (1), (2), (5) at the same time.

(When reassembling)

- After installation, check to see that the fork lever 1 (1) and 2 (2) are fixed to the fork lever shaft, and that they can turn smoothly in the holder (5).

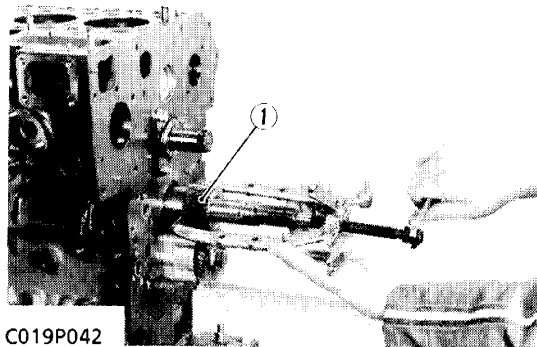
- (1) Fork Lever 1
- (2) Fork Lever 2
- (3) Injection Pump Gear
- (4) Fuel Camshaft
- (5) Fork Lever Holder

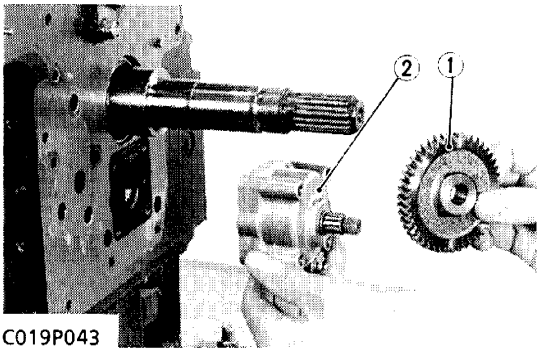


Crank Gear

1. Draw out the crank gear (1) with a puller.
2. Remove the feather key.

- (1) Crank Gear





C019P043

Oil Pump

1. Straighten the claw of the claw washer of the oil pump, and remove the nut.
2. Draw out the oil pump drive gear (1) with gear puller.
3. Remove the four oil pump mounting screws. Detach the oil pump (2).

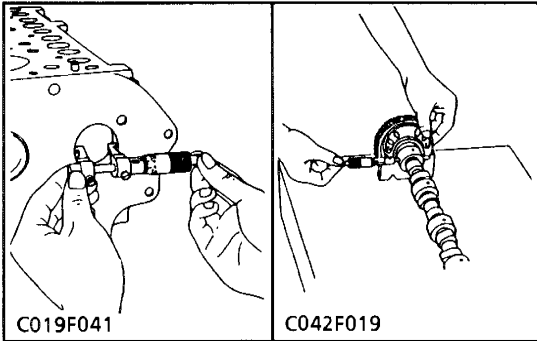
(When reassembling)

- Be sure to bend the claw of claw washer.

(1) Pump Drive Gear

(2) Oil Pump

SERVICING



C019F041

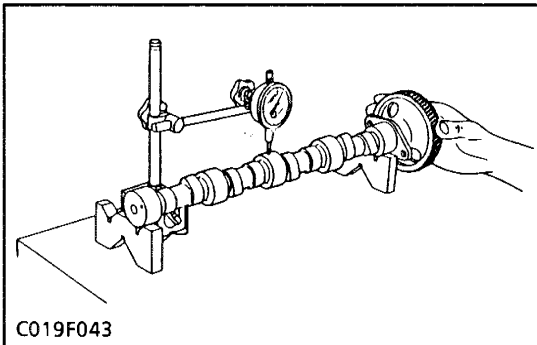
C042F019

Oil Clearance of Camshaft

1. Measure the camshaft bearing in the crankcase with an inside micrometer.
2. Measure the camshaft journal with an outside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the camshaft.

Oil clearance of camshaft	Factory spec.	0.050 to 0.091 mm 0.00197 to 0.00358 in.
	Allowable limit	0.15 mm 0.0059 in.

Camshaft bearing journal O.D.	Factory spec.	39.934 to 39.950 mm 1.57221 to 1.57284 in.
Camshaft bearing I.D.	Factory spec.	40.000 to 40.025 mm 1.57480 to 1.57579 in.

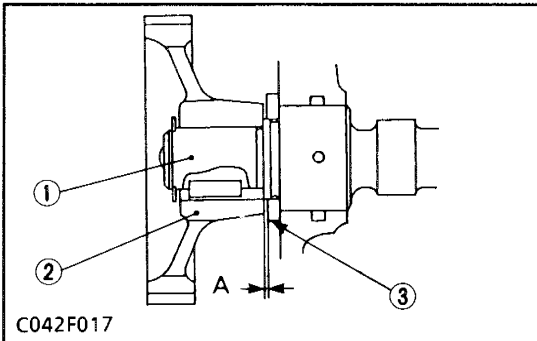


C019F043

Camshaft Alignment

1. Gently put the camshaft on V blocks.
2. Set a dial gauge to the journal.
3. While slowly rotating the camshaft, read the dial gauge. The camshaft flexure is half of the reading.
4. If the measurement exceeds the allowable limit, replace the camshaft.

Camshaft alignment	Allowable limit	0.01 mm 0.0004 in.
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C042F017

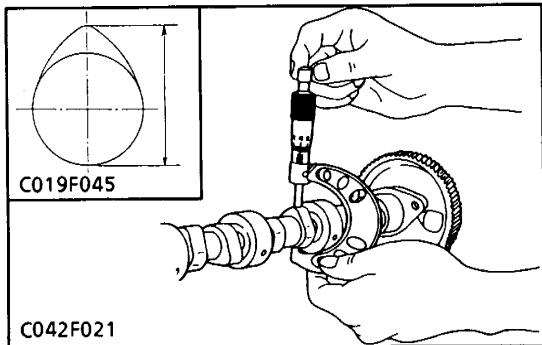
(1) Camshaft
(2) Cam Gear

(3) Stopper

Camshaft Side Clearance

1. Pull the cam gear (2) with the camshaft (1) to its end.
2. Measure the clearance "A" between the cam gear (2) and the camshaft stopper (3).
3. If the clearance exceeds the allowable limit, replace the camshaft stopper (3).

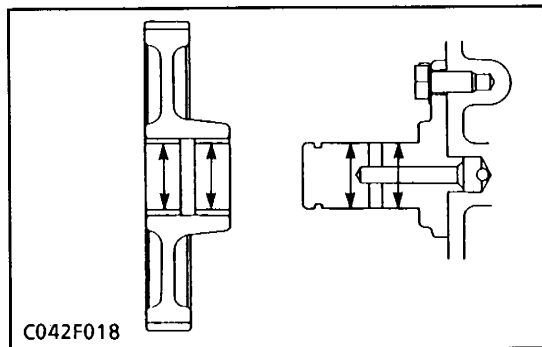
Side clearance	Factory spec.	0.07 to 0.22 mm 0.0028 to 0.0087 in.
	Allowable limit	0.30 mm 0.0118 in.



Cam Heights of Intake and Exhaust

1. Measure the height of the cam at its highest point with a micrometer.
2. If the measurement is less than the allowable limit, replace the camshaft.

Cam heights of intake and exhaust	Factory spec.	33.47 mm 1.3177 in.
	Allowable limit	33.42 mm 1.3157 in.

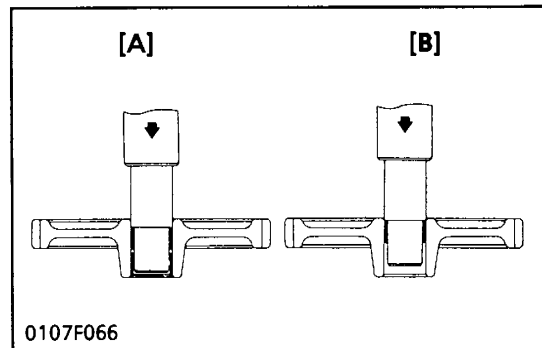


Clearance between Idle Gear Shaft and Idle Gear Bushings

1. Measure the idle gear shaft O.D. with an outside micrometer.
2. Measure the idle gear bushings I.D. with an inside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the bushings.

Clearance between idle gear shaft and idle gear bushings	Factory spec.	0.025 to 0.066 mm 0.00098 to 0.00260 in.
	Allowable limit	0.1 mm 0.0039 in.

Idle gear shaft O.D.	Factory spec.	37.959 to 37.975 mm 1.49445 to 1.49508 in.
Idle gear bushing I.D.	Factory spec.	38.000 to 38.025 mm 1.49606 to 1.49704 in.

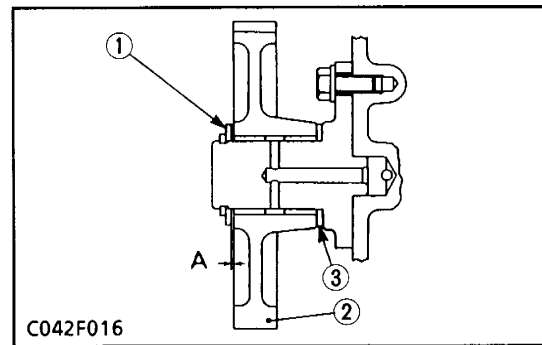


Replace the Idle Gear Bushings

1. Prepare the necessary tool. (See page G-30.)
2. Press out the used bushes and press a new part in, using this tool.
3. After pressing in the bushing, finish with a reamer to the specified factory specification.

[A] Take Out

[B] Insert

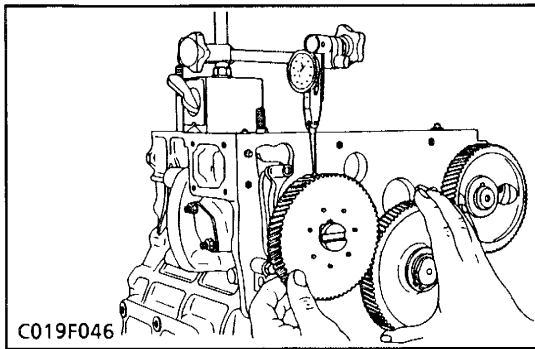


Idle Gear Side Clearance

1. Pull the idle gear collar 2 (1) and push the idle gear (2) to each end.
2. Measure the clearance "A" between the idle gear and the idle gear collar 2 with a feeler gauge.
3. If the clearance exceeds the allowable limit, replace the idle gear collar 1 (3).

Side clearance	Factory spec.	0.20 to 0.51 mm 0.0079 to 0.0201 in.
	Allowable limit	0.9 mm 0.0354 in.

- (1) Idle Gear Collar 2
- (2) Idle Gear
- (3) Idle Gear Collar 1



Timing Gear Backlash

1. Set a dial indicator (lever type) with its tip on the gear tooth.
2. Move the gear to measure the backlash, holding its mating gear.
3. If the backlash exceeds the allowable limit, check the oil clearance of the shafts and gear.
4. If the oil clearance is proper, replace the gear.

Crank gear / Idle gear	Factory spec.	0.0415 to 0.1122 mm 0.00163 to 0.00442 in.
	Allowable limit	0.15 mm 0.0059 in.
Idle gear / Cam gear	Factory spec.	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.
	Allowable limit	0.15 mm 0.0059 in.
Idle gear / Injection pump gear	Factory spec.	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.
	Allowable limit	0.15 mm 0.0059 in.
Crank gear / Oil pump gear	Factory spec.	0.0415 to 0.1090 mm 0.00163 to 0.00429 in.
	Allowable limit	0.15 mm 0.0059 in.

[4] CRANKCASE

DISASSEMBLING AND ASSEMBLING

Cylinder Head Assembly

1. Remove the cylinder head assembly. (See page 1-S17 to 1-S19.)

Timing Gears

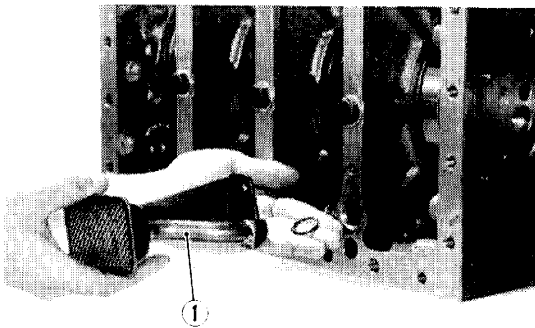
1. Remove the timing gears. (See page 1-S25 to 1-S28.)

Oil Pan and Oil Filter 1

1. Lay the engine on the engine cradle on its side.
2. Remove the oil pan mounting screws.
3. Detach the oil pan by lightly tapping the groove of the pan with a wooden hammer.
4. Remove the mounting screw of oil filter 1 (1).
5. Detach oil filter 1, being careful of the O-ring.

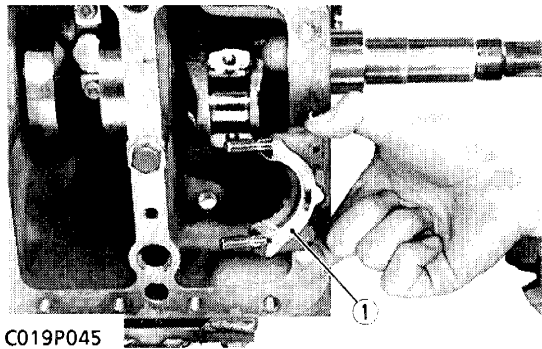
(When reassembling)

- After cleaning the oil filter 1 (1), check to see that the filter mesh is clean, and install it.
- Visually check the O-ring, apply engine oil, and install it.
- After checking to see that the O-ring is securely installed, attach the oil filter 1 (1).



C019P044

(1) Oil Filter 1



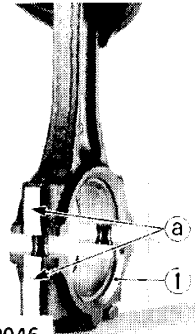
C019P045

Connecting Rod Cap

1. Remove the connecting rod screws from connecting rod cap.
2. Detach the connecting rod caps (1).

IMPORTANT

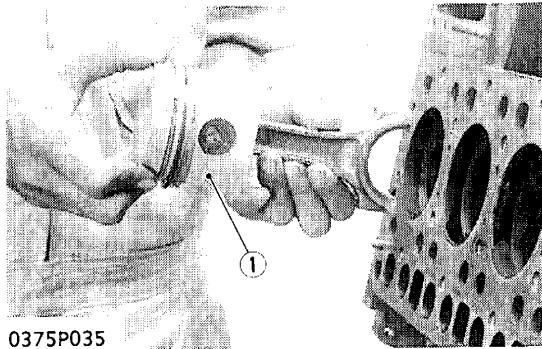
- Apply engine oil to the connecting rod screws and tighten them to 44.1 to 49.0 N·m (4.5 to 5.0 kgf·m, 32.5 to 36.2 ft-lbs).



C019P046

- (a) Align the marks with each other.
(Face the marks toward the injection pump)

(1) Connecting Rod Cap



O375P035

Pistons

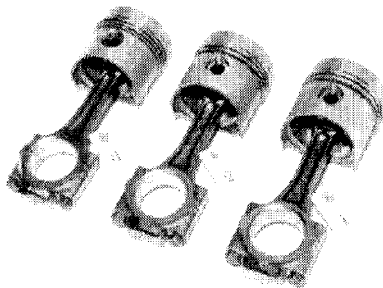
1. Turn the crankshaft by 3.14 rad. (180°) and bring the piston to top dead center.
2. Draw out the piston (1) upward by lightly tapping it from the bottom of the crankcase with the grip of a hammer.
3. Draw out the other piston in the same method as above.

(When reassembling)

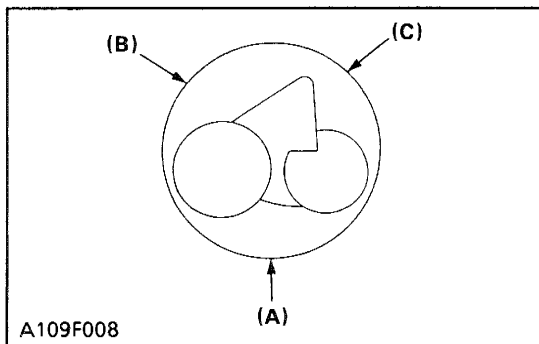
- Before inserting the pistons into the cylinders, apply enough engine oil to the pistons.

IMPORTANT

- Place the piston rings so that there are gaps every 2.09 rad. (120°) with no gap facing the piston pin in the cylinder. (See figure.)
- Attach a ring to the pistons securely with a piston ring compressor, and set them to the cylinder, being careful about the cylinder number and the position of the connecting rod (Connecting rods must be installed with their ends bearing the number toward the fuel injection pump.).
- Carefully insert the pistons. Otherwise, their chrome-plated section may be scratched, causing trouble inside the cylinder.



0011P056

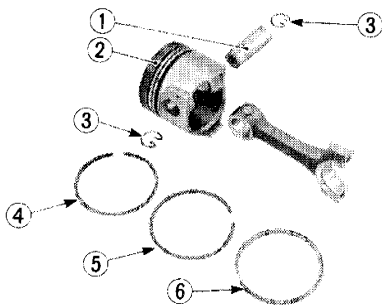


A109F008

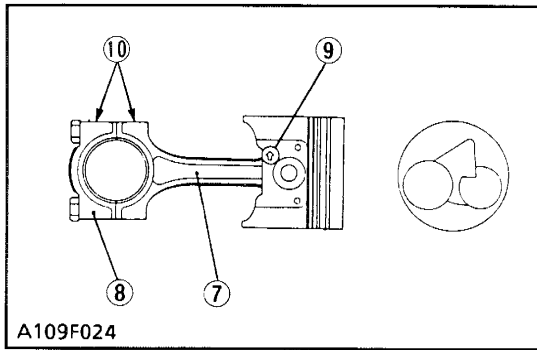
- [A] Top Ring Gap
- [B] Second Ring Gap

[C] Oil Ring Gap

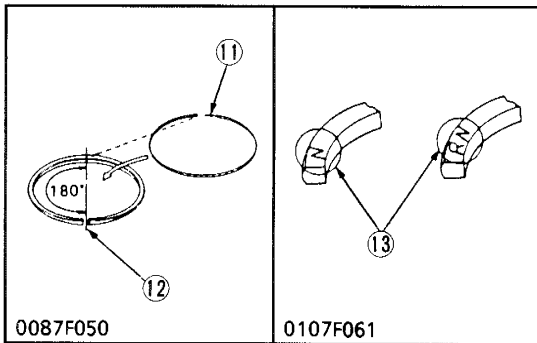
(1) Piston



0107P046

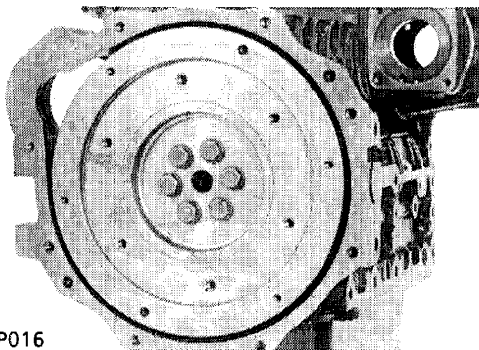


A109F024



0087F050

0107F061



A109P016

Piston Ring and Connecting Rod

1. Remove the piston rings using a piston ring tool.
2. Remove the piston pin (1), and separate the connecting rod (7) from the piston (2).

(When reassembling)

- When installing the ring, assemble the rings so that the manufacturer's mark (13) near the gap faces the top of the piston.
- When installing the oil ring onto the piston, place the expander joint (11) on the opposite side of the oil ring gap (12).
- Apply engine oil to the piston pin.
- When installing the connecting rod to the piston, immerse the piston in 80 °C (176 °F) oil for 10 to 15 minutes and insert the piston pin to the piston.

NOTE

- When installing the connecting rod to the piston, align the mark (10) on the connecting rod to the arrow's direction of casting mark (9) on the piston.

IMPORTANT

- Mark the same number on the connecting rod and the piston so as not to change the combination.

- | | |
|---------------------------|--------------------------|
| (1) Piston Pin | (8) Connecting Rod Cap |
| (2) Piston | (9) Casting Mark |
| (3) Piston Pin Snap Rings | (10) Marks |
| (4) Compression Ring 1 | (11) Expander Joint |
| (5) Compression Ring 2 | (12) Oil Ring Gap |
| (6) Oil Ring | (13) Manufacturer's Mark |
| (7) Connecting Rod | |

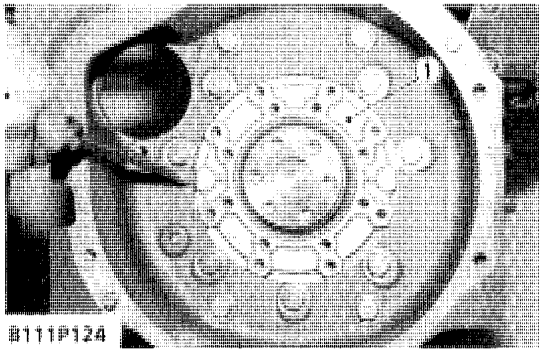
Flywheel

1. Lock the flywheel not to turn using the flywheel stopper.
2. Remove the flywheel screws, except for two which must be loosened and left as they are.
3. Set a flywheel puller, and remove the flywheel.

(When reassembling)

- Apply engine oil to the flywheel screws.
- Check to see that there are no metal particles left on the flywheel mounting surface.
- To ease alignment of the crankshaft and the flywheel, bring the crank of No.1 cylinder to TC (top dead center). Make sure of the flywheel 1TC, align it in the window on flywheel housing.

Tightening torque	Flywheel screws	98.0 to 107.8 N·m 10.0 to 11.0 kgf·m 72.3 to 79.5 ft·lbs
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#111P124

Bearing Case Cover

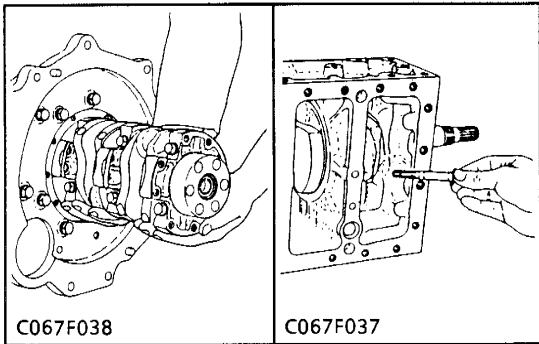
1. Loosen the screws first inside and next outside, and lift the cover (1).

(When reassembling)

- Apply grease to the oil seal lip and take care that it is not rolled when installing.

Tightening torque	Bearing case cover screws	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
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(1) Bearing Case Cover



C067F038

C067F037

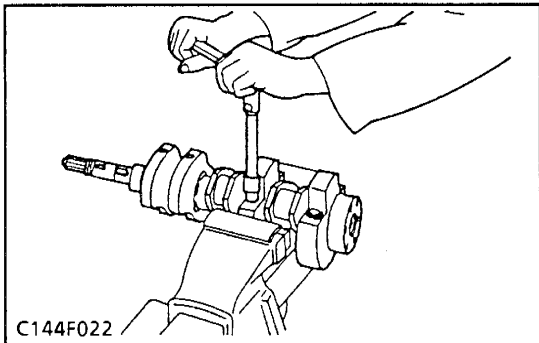
Crankshaft

1. Remove the main bearing case screws 2.
2. Pull out the crankshaft, taking care not to damage the crankshaft bearing 1.

(When reassembling)

- Apply oil to the main bearing case screws 2.
- Clean the oil passage of the crankshaft with compressed air.

Tightening torque	Main bearing case screws 2	68.6 to 73.5 N·m 7.0 to 7.5 kgf·m 50.6 to 54.2 ft-lbs
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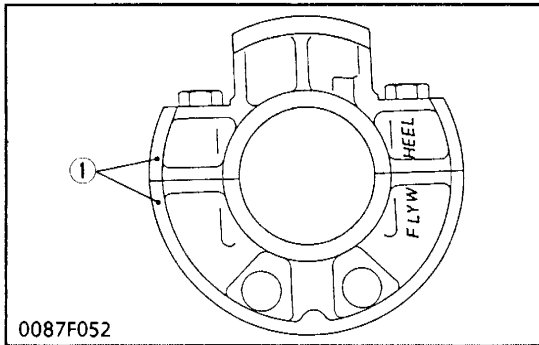
C144F022

Main Bearing Case Assembly

1. Remove the two main bearing case screws 1, and remove the main bearing case assembly 1, being careful with the thrust bearing and crankshaft bearing 2.
2. Remove the main bearing case assembly 2 and 3 as above.

(When reassembling)

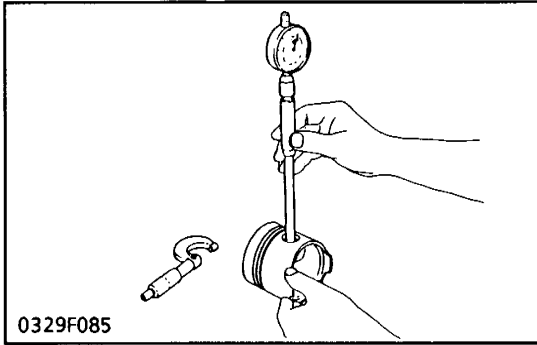
- Clean the oil passage in the main bearing case.
- Apply clean engine oil on the bearings.
- Install the main bearing case assemblies in the original positions. Since diameters of main bearing cases vary, install them in order of markings (A, B, C) from the gear case side.
- Match the alignment numbers (1) on the main bearing case.
- When installing the main bearing case 1, 2 and 3, face the mark " FLYWHEEL " to the flywheel.
- Install the thrust bearing with its oil groove facing outward.
- Confirm that the main bearing case moves smoothly after tightening the main bearing case screw 1 to the specified torque.



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Tightening torque	Main bearing case screws 1	46.1 to 50.9 N·m 4.7 to 5.2 kgf·m 34.0 to 37.6 ft-lbs
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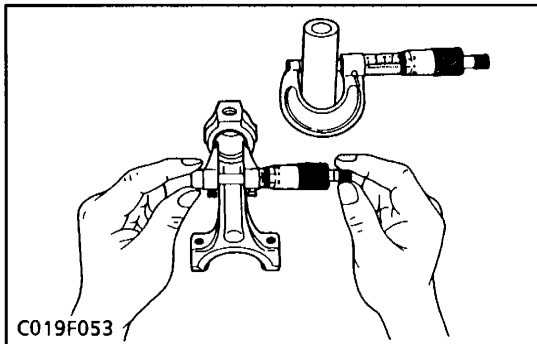
SERVICING



Inside Diameter of Piston Pin Bosses

1. Measure the I.D. of piston pin bosses with a cylinder gauge. Set the cylinder gauge's reference measurement to 25 mm (0.98425 in.), and carry out zero point adjustment with an outside micrometer.
2. If the measurement exceeds the allowable limit, replace the piston.

Inside diameter of piston pin bosses	Factory spec.	25.000 to 25.013 mm 0.98425 to 0.98477 in.
	Allowable limit	25.05 mm 0.9862 in.

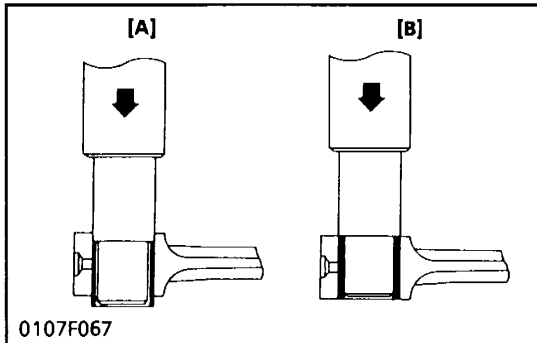


Clearance between Piston Pin and Small End Bushing

1. Measure the O.D. of piston pin with an outside micrometer.
2. Measure the I.D. of connecting rod small end bushing with an inside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the bushing.

Clearance between piston pin and small end bushing	Factory spec.	0.014 to 0.038 mm 0.00055 to 0.00150 in.
	Allowable limit	0.15 mm 0.0059 in.

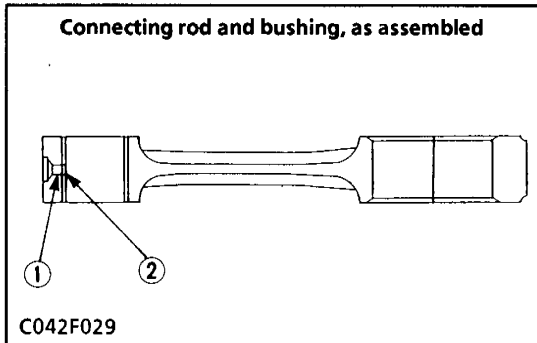
Piston pin O.D.	Factory spec.	25.002 to 25.011 mm 0.98433 to 0.98468 in.
Small end bushing I.D.	Factory spec.	25.025 to 25.040 mm 0.98523 to 0.98582 in.



Replace the Small End Bushing

1. Prepare the necessary tool. (See page G-30.)
2. Press out the used bushing and, using this tool, press a new bushing in, taking due care to see that the connecting rod hole matches the bushing hole. (See figure.)
3. After pressing in the bushing, finish with a reamer to the specified factory specification.

Small end bushing I.D.	Factory spec.	25.025 to 25.040 mm 0.98523 to 0.98582 in.
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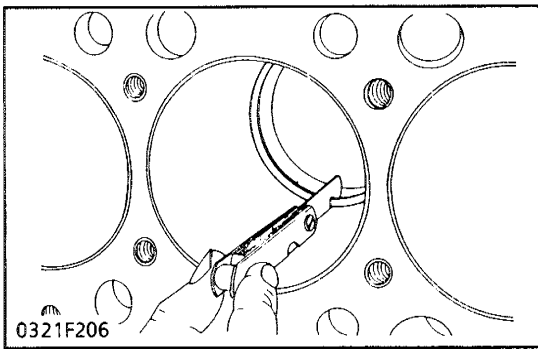


[A] Take Out

(1) Connecting Rod Hole

[B] Insert

(2) Bushing Hole



0321F206

Piston Ring Gap

1. Put the piston ring in the cylinder.
2. Turn the piston upside down and push the ring into the cylinder with the piston head.
3. Insert a feeler gauge into the piston ring gap.
4. If the clearance exceeds the allowable limit, replace it.

IMPORTANT

- Measure the piston ring gap at the point of the minimum inside diameter of the cylinder.

Piston ring gap	Top ring Second ring	Factory spec.	0.30 to 0.45 mm 0.0118 to 0.0177 in.
		Allowable limit	1.25 mm 0.0492 in.
	Oil ring	Factory spec.	0.25 to 0.45 mm 0.0098 to 0.0177 in.
		Allowable limit	1.25 mm 0.0492 in.

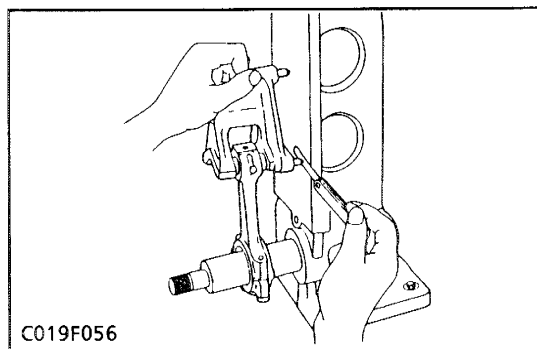


B111P056

Piston Ring Clearance

1. Clean the rings and the ring grooves.
2. Measure the clearance between the ring and the groove with a feeler gauge.
3. If the clearance exceeds the allowable limit, replace the piston rings.
4. If the clearance still exceeds the allowable limit with new ring, replace the piston.

Piston ring clearance	Second ring	Factory spec.	0.093 to 0.120 mm 0.00366 to 0.00472 in.
		Allowable limit	0.20 mm 0.0079 in.
	Oil ring	Factory spec.	0.020 to 0.052 mm 0.00079 to 0.00205 in.
		Allowable limit	0.15mm 0.0059 in.



C019F056

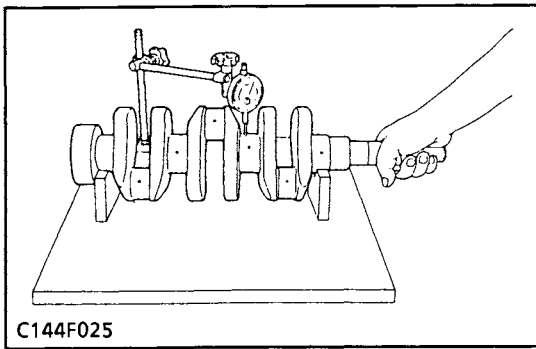
Connecting Rod Alignment

1. Remove the crankpin bearing and tighten the connecting rod screws.
2. Set the connecting rod to a connecting rod aligner. (See page G-27.)
3. Place the gauge on the piston pin. Measure the gap between the pin of the gauge and the flat surface of the aligner.
4. If the measurement exceeds the allowable limit, replace the connecting rod.

IMPORTANT

- Because the I.D. of the connecting rod small end bushing is used as the basis for this check, check it is not worn beforehand.

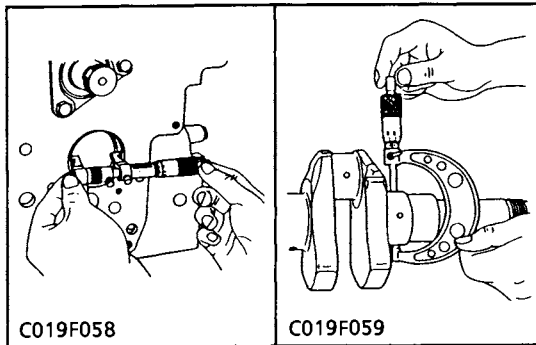
Connecting rod alignment	Allowable limit	0.05 mm 0.0020 in.
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Crankshaft Alignment

1. Place V blocks on the surface plate, and support the journals at both ends of the crankshaft on the V blocks.
2. Set a dial gauge to the central journal.
3. Read the dial gauge while rotating the crankshaft slowly. Crankshaft flexure is half of the reading.
4. If the reading exceeds the allowable limit, replace the crankshaft.

Crankshaft alignment	Allowable limit	0.08 mm 0.0031 in.
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Oil Clearance between Crankshaft Journal and Crankshaft

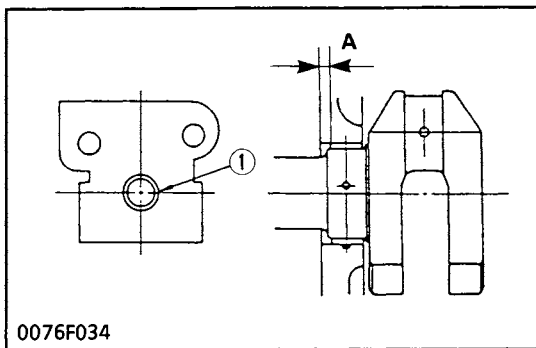
Bearing 1

1. Measure the crankshaft journal (on the side of the crankshaft bearing 1) with an outside micrometer.
2. Measure the crankshaft bearing 1 with an inside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the crankshaft bearing 1.
4. If the crankshaft journal O.D. exceeds the factory specification, machine the crankshaft journal, and use an undersize crankshaft bearing 1.

Oil clearance between crankshaft journal and crankshaft bearing 1	Factory spec.	0.040 to 0.118 mm 0.00157 to 0.00465 in.
	Allowable limit	0.2 mm 0.0079 in.

Crankshaft journal O.D.	Factory spec.	51.921 to 51.940 mm 2.04413 to 2.04488 in.
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Crankshaft bearing 1 I.D.	Factory spec.	51.980 to 52.039 mm 2.04645 to 2.04878 in.
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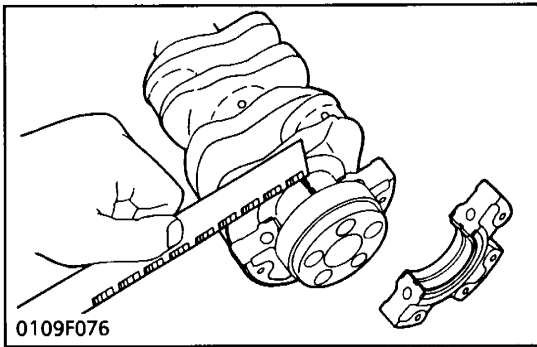


Replace the Crankshaft Bearing 1

1. Prepare the necessary tool. (See page G-32.)
2. Press out the bearing 1, using the extracting tool.
3. Insert a new bearing 1, using the inserting tool, taking due care to see that the seam (1) of bearing 1 faces the exhaust manifold side.

A : 4.2 to 4.5 mm (0.1654 to 0.1772 in.)

(1) Seam



0109F076

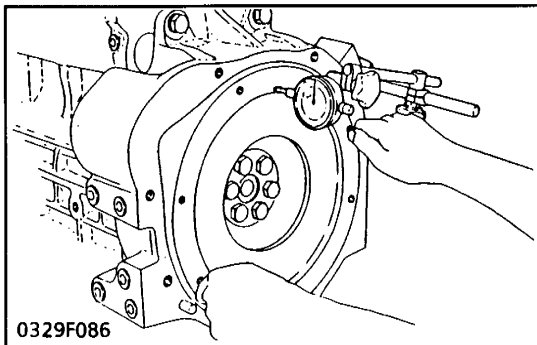
Oil Clearance between Crankshaft Journals and Crankshaft

Bearings 2

1. Paste a press gauge with grease on the crankshaft bearing.
2. Tighten the crankshaft bearing case onto the crankshaft journal to the specified torque (46.1 to 50.9 N·m, 4.7 to 5.2 kgf·m, 34.0 to 37.6 ft-lbs).
3. Detach the bearing case slowly, and measure the depression of the press gauge with a sheet of gauge (paper).
4. If the measurement exceeds the allowable limit, replace the crankshaft bearing 2.
5. If the crankshaft journal O.D. exceeds the factory specification, machine the crankshaft journal, and use an undersize crankshaft bearing 2.

Oil clearance between crankshaft journal and crankshaft bearing 2	Factory spec.	0.040 to 0.104 mm 0.00157 to 0.00409 in.
	Allowable limit	0.20 mm 0.0079in.

Crankshaft journal O.D.	Factory spec.	51.921 to 51.940 mm 2.04413 to 2.04488 in.
Crankshaft bearing 2 I.D.	Factory spec.	51.980 to 52.025 mm 2.04645 to 2.04822 in.



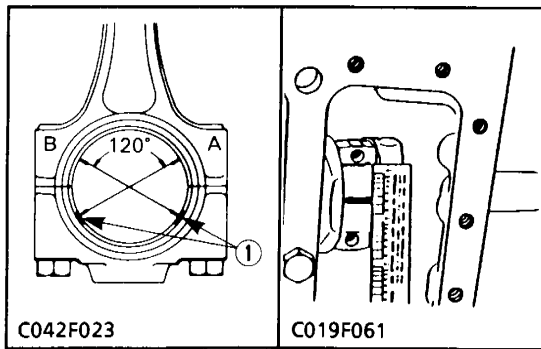
0329F086

Flywheel Sway and Crankshaft Side Clearance

1. Set a dial indicator with its tip on the rear friction face of the flywheel near the edge.
2. Turn the flywheel and measure the sway.
3. If the measurement exceeds the allowable limit, remove the flywheel and check the contact faces of the crankshaft and flywheel.
4. Move the crankshaft with flywheel back and forth to each end and measure the side clearance.
5. If the side clearance exceeds the allowable limit, replace the side bearing.
6. If an oversize bearing is to be used, machine the crankshaft.

Sway	Allowable limit	0.05 mm 0.0020 in.
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Side clearance	Factory spec.	0.15 to 0.31 mm 0.0059 to 0.0122 in.
	Allowable limit	0.50 mm 0.0197in.



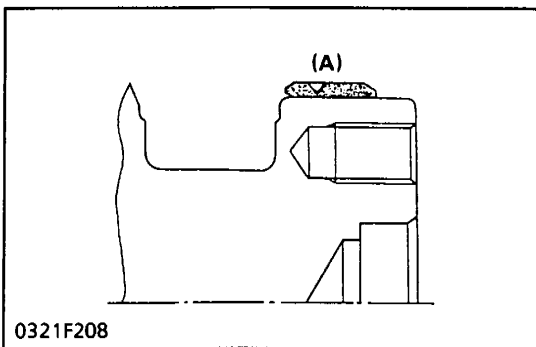
(1) Press Gauge

Oil Clearance between Crankpins and Crankpin Bearings

1. Paste a press gauge onto the crankpin bearing with grease.
2. Tighten the connecting rod onto the crankpin to the specified torque (44.1 to 49.0 N-m, 4.5 to 5.0 kgf-m, 32.5 to 36.2 ft-lbs).
3. Remove the connecting rod gently, and measure the depression of the press gauge with a sheet of gauge (paper).
4. If the measurement exceeds the allowable limit, replace the crankpin bearing.
5. If an undersize bearing is to be used, machine the crankshaft.

Oil clearance between crankpin and crankpin bearing	Factory spec.	0.025 to 0.087 mm 0.00098 to 0.00343 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankpin O.D.	Factory spec.	46.959 to 46.975 mm 1.84878 to 1.84941 in.
Crankpin bearing I.D.	Factory spec.	47.000 to 47.046 mm 1.85039 to 1.85220 in.



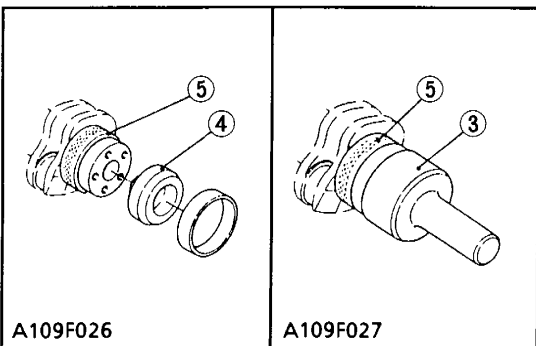
0321F208

Crankshaft Sleeve Wear

1. Measure the wear (A) of the crankshaft sleeve with a surface roughness tester.
2. If the wear exceeds the allowable limit, replace the crankshaft sleeve.

Wear (A)	Allowable limit	0.10 mm 0.0039 in.
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[A] Wear



A109F026

A109F027

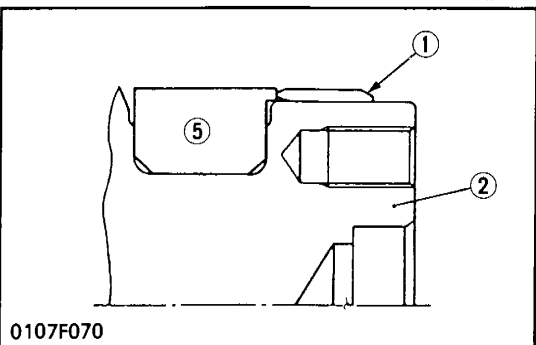
Replacing Crankshaft Sleeve

1. Remove the used crankshaft sleeve using a special-use puller set.
2. Set the sleeve guide (4) to the crankshaft.
3. Set the stopper (5) to the crankshaft as shown in figure.
4. Heat a new sleeve to a temperature between 150 and 200 °C (302 and 392 °F), and fix the sleeve to the crankshaft as shown in figure.
5. Press fit the sleeve using the auxiliary socket for pushing (3).

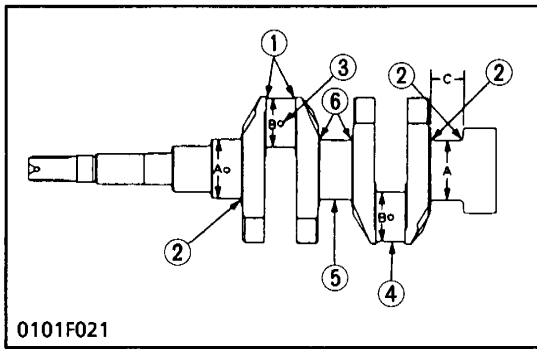
NOTE

- Mount the sleeve with its largely chamfered surface facing outward.

- (1) Crankshaft Sleeve
- (2) Crankshaft
- (3) Auxiliary Socket for Pushing
- (4) Sleeve Guide
- (5) Stopper



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0101F021

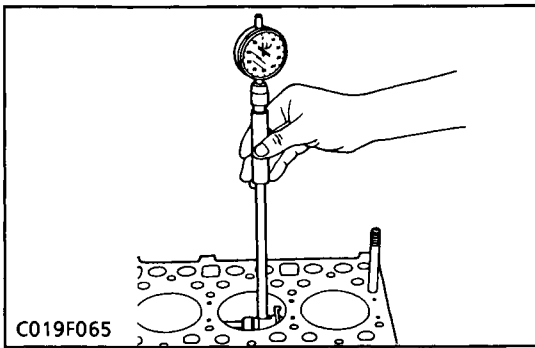
Undersized and Oversized Bearing

If the standard-size bearing cannot be employed due to excessive wear of the crankpin and crank journal, employ under-size or over-size bearings.

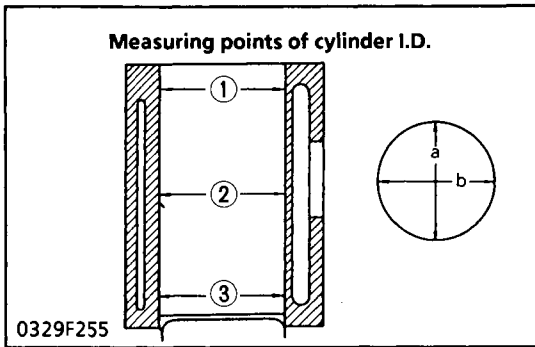
For under size or oversize bearing use, take the precautions noted below.

1. The crankpin (4), crank journal (5) and crank journal side surface (6) must be fine-finished to higher than $0.4\text{-}S$ (0.000016 in.-S) $\nabla\nabla\nabla\nabla$
2. Grind the crankpin (4) and journal (5) with a wheel which has specified round corner and width without shoulder.
3. Be sure to chamfer the oil hole circumference (3) with an oil stone.
 - (1) 3.3 to 3.7 mm radius (0.1299 to 0.1457 in. radius)
 - (2) 2.8 to 3.2 mm radius (0.1102 to 0.1260 in. radius)
 - (3) Oil hole must be 1.0 to 1.5 mm radius (0.0394 to 0.0591 in. radius)

Size	Name of bearing	Bearing mark	Crankshaft processing dimension	
-0.2 mm -0.008 in.	Crankshaft bearing 1 (0.2 minus)	020 US	A	51.721 to 51.740 mm 2.0363 to 2.0370 in.
-0.4 mm -0.016 in.	Crankshaft bearing 1 (0.4 minus)	040 US		51.521 to 51.540 mm 2.0284 to 2.0291 in.
-0.2 mm -0.008 in.	Crankshaft bearing 2 (0.2 minus)	020 US	D	51.721 to 51.740 mm 2.0363 to 2.0370 in.
-0.4 mm -0.016 in.	Crankshaft bearing 2 (0.4 minus)	040 US		51.521 to 51.540 mm 2.0284 to 2.0291 in.
-0.2 mm -0.008 in.	Crank pin bearing (0.2 minus)	020 US	B	46.759 to 46.775 mm 1.8409 to 1.8415 in.
-0.4 mm -0.016 in.	Crank pin bearing (0.4 minus)	040 US		46.559 to 46.575 mm 1.8330 to 1.8337 in.
+0.2 mm +0.008 in.	Thrust bearing 1 (0.2 plus)	020 OS	C	26.20 to 26.25 mm 1.0315 to 1.0335 in.
	Thrust bearing 2 (0.2 plus)			
+0.4 mm +0.016 in.	Thrust bearing 1 (0.4 plus)	040 OS		26.40 to 26.45 mm 1.0394 to 1.0413 in.
	Thrust bearing 2 (0.4 plus)			



C019F065



0329F255

- (a) Right-angle to the Piston Pin
- (b) Parallel to the Piston Pin

- (1) Top
- (2) Middle
- (3) Bottom (Skirt)

Wear of Cylinder

1. Set a cylinder gauge and adjust it to the reference value of the cylinder I.D. with an outside micrometer.
2. To find out the maximum wear, measure the diameters at six points on the cylinder with the cylinder gauge, as shown below.

NOTE

- When the cylinder is worn beyond the allowable limit, rebore and hone it by 0.5 mm (0.0197 in.).
 - For the finish dimensions of the oversized cylinder, refer to the table below.
 - The cylinder which has been oversized by 0.5 mm (0.0197 in.) should use a piston and ring of the same oversize. (See the Table 2)
- When the oversized cylinder is worn beyond the allowable limit, replace the cylinder block.

Cylinder I.D.	D1503	Factory spec.	83.000 to 83.022 mm 3.26771 to 3.26858 in.
		Allowable limit	83.17 mm 3.2744 in.
	V1903	Factory spec.	80.000 to 80.022 mm 3.14960 to 3.15047 in.
		Allowable limit	80.17 mm 3.1563 in.
	D1703 V2203	Factory spec.	87.000 to 87.022 mm 3.4252 to 3.4261 in.
		Allowable limit	87.17 mm 3.4319 in.

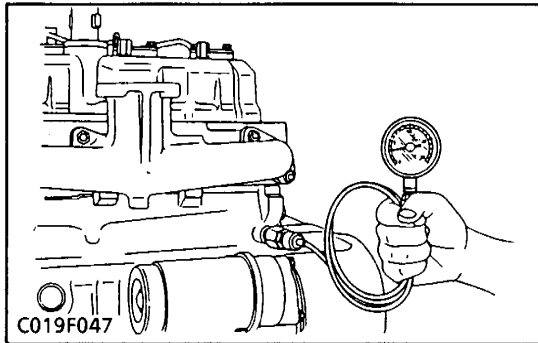
Table 1

Model	Oversized Cylinder I.D.	Finishing
D1503	83.500 to 83.522 mm 3.28740 to 3.28826 in.	Hone to 1.2 to 2.0 μR max.
V1903	80.500 to 80.522 mm 3.16929 to 3.17015 in.	
D1703 V2203	87.500 to 87.522 mm 3.44488 to 3.44574 in.	

Table 2

Oversize	Name of parts	Mark
0.5 mm 0.0197 in.	Piston 05	05 OS
	Piston ring 05 assembly	

[5] LUBRICATING SYSTEM CHECKING AND ADJUSTING



Oil Pressure

1. Remove the engine oil pressure switch and set a pressure gauge.
2. Start the engine. Measure the oil pressure both at idling and at the rated speed.
3. If the measurement is not within the factory specification, check the oil pump, oil-ways, oil clearances and pressure regulating valve.

(When reassembling)

- Supply the specified amount of recommended oil.
- The oil filter must not be clogged or broken.

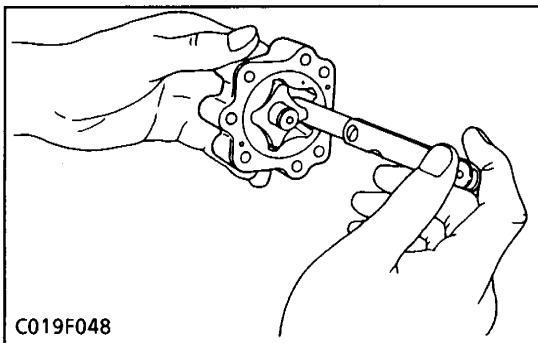
Oil pressure	At idle speed	Factory spec.	More than 98 kPa 1.0 kgf/cm ² 14 psi
		Allowable limit	49 kPa 0.5 kgf/cm ² 7 psi
	At rated speed	Factory spec.	294 to 441 kPa 3.0 to 4.5 kgf/cm ² 43 to 64 psi
		Allowable limit	245 kPa 2.5 kgf/cm ² 36 psi

DISASSEMBLING AND ASSEMBLING

Oil Pump Assembly

1. Remove the oil pump assembly. (See page 1-S29.)

SERVICING

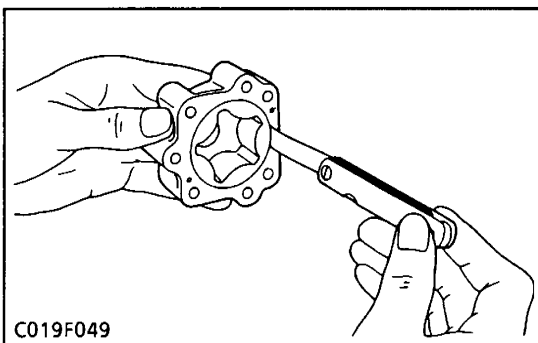


Oil Pump (Rotor type)

1) Checking Rotor Lobe Clearance

1. Insert a feeler gauge into the gap between the inner and outer rotors and measure the clearance.
2. If the clearance exceeds the allowable limit, replace the pump.

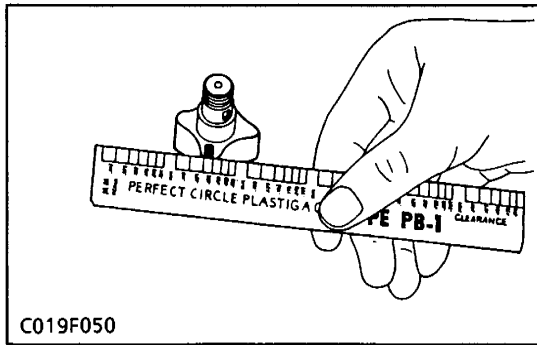
Outer and inner rotor clearance	Factory spec.	0.10 to 0.16 mm 0.0039 to 0.0063 in.
	Allowable limit	0.20 mm 0.0079 in.



2) Radial Clearance between Outer Rotor and Pump Body

1. Insert a feeler gauge into the gap between the oil pump body and the outer rotor and measure the clearance.
2. If the measurement exceeds the allowable limit, replace the pump.

Radial clearance between outer rotor and pump body	Factory spec.	0.11 to 0.19 mm 0.0043 to 0.0075 in.
	Allowable limit	0.25 mm 0.0098 in.



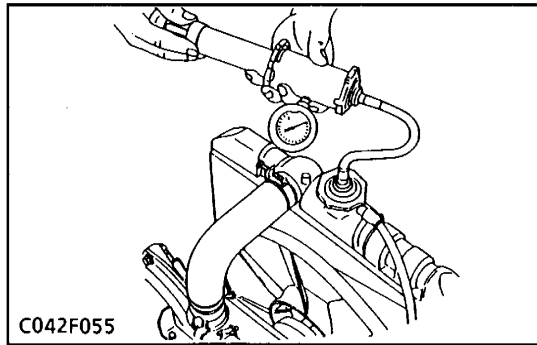
C019F050

3) End Clearance between Rotor and Cover

1. Paste a press gauge to the surface of the gear with grease.
2. Attach the cover.
3. Gently remove the cover. Measure the clearance by placing the gauge (paper) on the press gauge where it is crushed.
4. If the measurement exceeds the allowable limit, replace the pump.

End clearance between rotor and cover	Factory spec.	0.105 to 0.150 mm 0.0041 to 0.0059 in.
	Allowable limit	0.20 mm 0.0079 in.

**[6] COOLING SYSTEM
CHECKING AND ADJUSTING**

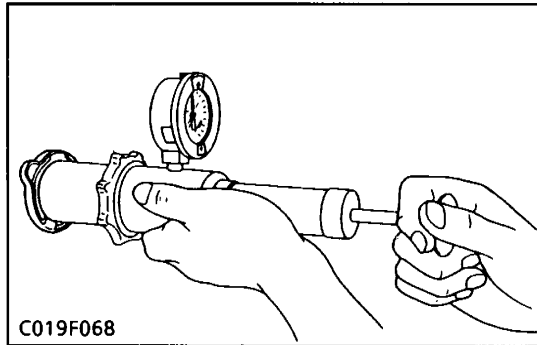


C042F055

Water Tightness of Radiator

1. Pour the specified amount of water into the radiator.
2. Warm up the engine.
3. Set a radiator tester. Increase to the specified pressure.
4. Check to see if water leaks from any part.

Water tightness	Factory spec.	No leak at 137 kPa 1.4 kgf/cm ² 20 psi
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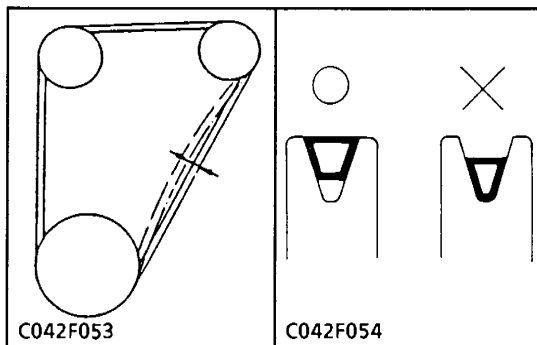


C019F068

Radiator Cap Tightness

1. Set a radiator tester on the radiator cap.
2. Apply 88 kPa (0.9 kgf/cm², 13psi) of pressure and measure the pressure for 10 seconds.
3. If the pressure falls below 59 kPa (0.6 kgf/cm², 9 psi), replace the radiator cap.

Radiator cap tightness	Factory spec.	more than 10 seconds for pressure fall from 88 to 59 kPa (from 0.9 to 0.6 kgf/cm ² , from 13 to 9 psi)
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C042F053

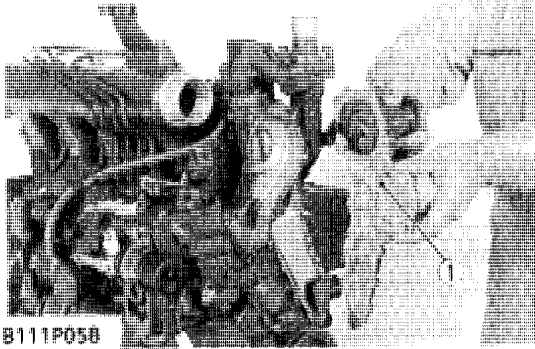
C042F054

Fan Belt Tension

1. Measure the deflection, depressing the belt halfway between the fan drive pulley and the alternator pulley at 98 N (10 kgf, 22 lbs) of force.
2. If the deflection is not within the factory specifications, loosen the bolts, and relocate the alternator to adjust.
3. If the belt is damaged or worn (see figure), replace the belt.

Belt tension (deflection)	Factory spec.	7 to 9 mm (0.28 to 0.35 in.) at 98 N (10 kgf, 22 lbs) of force
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DISASSEMBLING AND ASSEMBLING

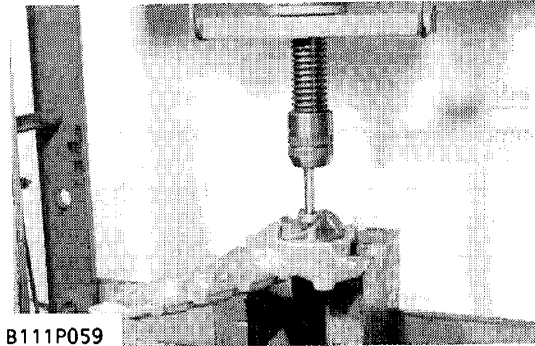


B111P058

Water Pump Assembly

1. Loosen the alternator mounting bolts and remove the fan belt.
2. Remove the fan pulley.
3. Remove the water pump assembly mounting screws and remove the water pump assembly.

(1) Water Pump Assembly



B111P059

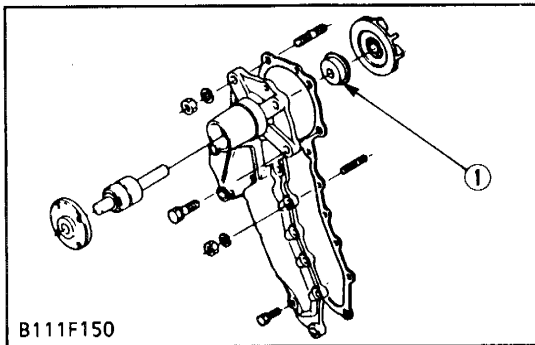
Mechanical Seal Assembly

1. Use a press and press out the water pump shaft from the water pump impeller side.
2. Remove the mechanical seal assembly (1) from the water pump body.

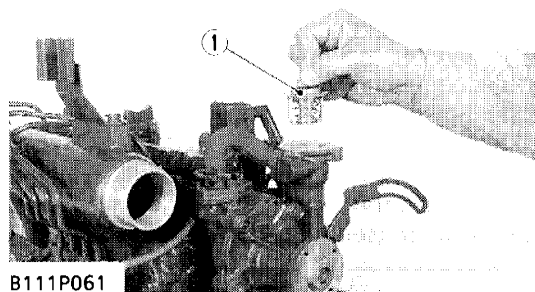
■ IMPORTANT

- Do not disassembly the mechanical seal assembly.

(1) Mechanical Seal Assembly



B111F150



B111P061

Thermostat Assembly

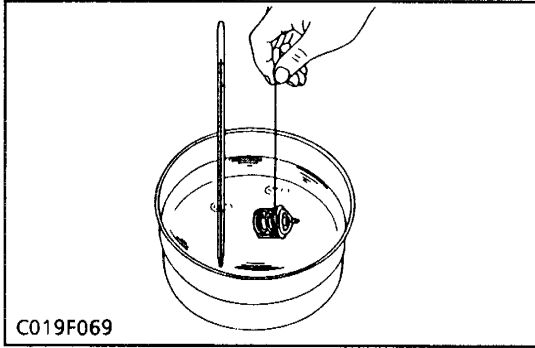
1. Remove the thermostat cover mounting screws and remove the thermostat cover.
2. Remove the thermostat assembly.

(When reassembling)

- Put the rib of the thermostat assembly in place in the recess of the water flange.

(1) Thermostat Assembly

SERVICING



Operating Temperature of Thermostat

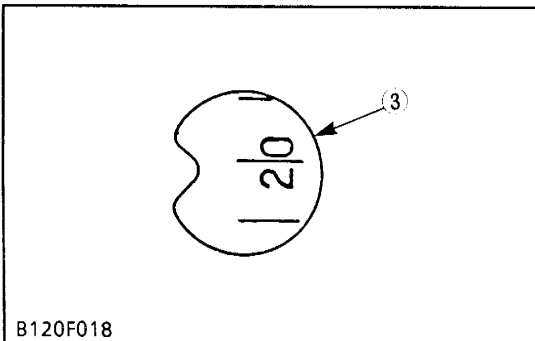
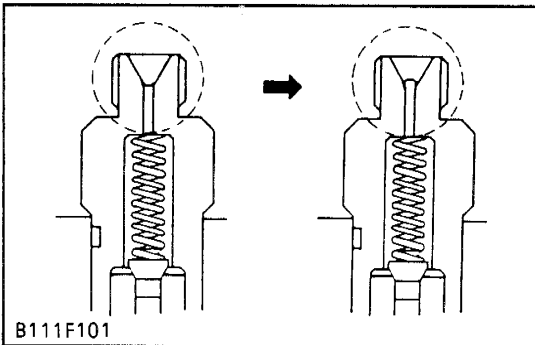
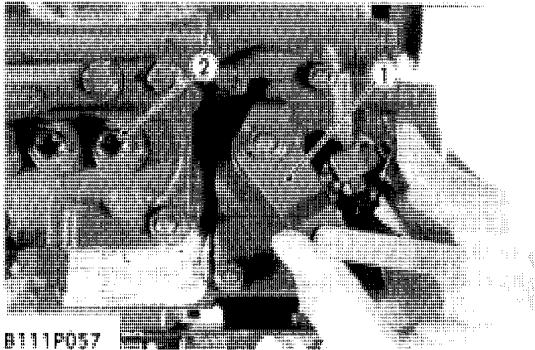
1. Place a thermostat and a thermometer in water and heat the water.
2. Check to see if the thermostat begins to open at 69.5 to 72.5 °C (157.1 to 162.5 °F).
3. Check to see if the thermostat opens fully around 85 °C (185.5 °F).
4. If the measurement is defective, replace the thermostat.

Reference value		
Temperature at which thermostat should start to open	Temperature at which thermostat completely opens	Distance of lift
69.5 to 72.5 °C 157.1 to 162.5 °F	85 °C 185.5 °F	8 mm 0.3150 in.

[7] FUEL SYSTEM

CHECKING AND ADJUSTING

(1) Injection Pump



Injection Timing [Engine serial number : D1503-L-A ; ~1229 / D1703-A ; ~ 1214 / V1903-A : ~ 1122 / V2203-A ; ~ 1157]

1. Remove the injection pipes.
2. Set the speed control lever (1) to maximum fuel discharge position.
3. Turn the flywheel counterclockwise (facing the flywheel) until the fuel fills up to the hole of the delivery valve holder (2) for 1st cylinder.
4. Turn the flywheel further and stop turning when the fuel begins to flow over, to get the present injection timing.
5. (The flywheel has mark 1TC and four lines indicating every 0.087 rad. (5°) of crank angle from 0.175 rad. (10°) to 0.436 rad. (25°) before mark 1TC.) Calculate the angle which the projection of the window points out. If the calculation differs from specified injection timing, add or remove the shim to adjust.

Injection timing	Factory spec.	0.24 to 0.27 rad. (17 to 19°) before T.D.C.

NOTE

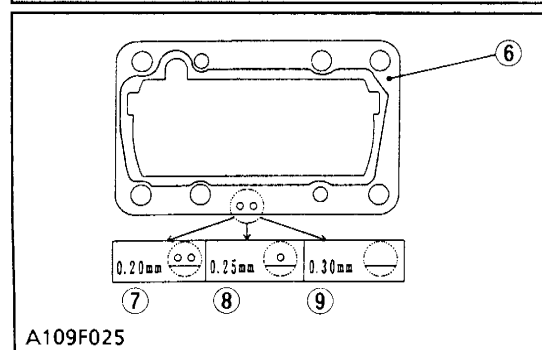
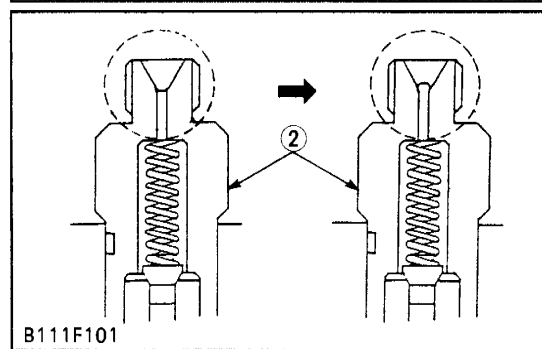
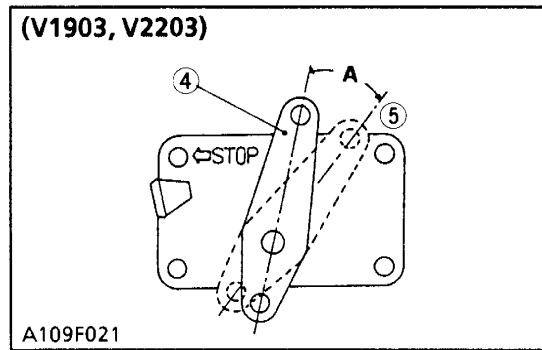
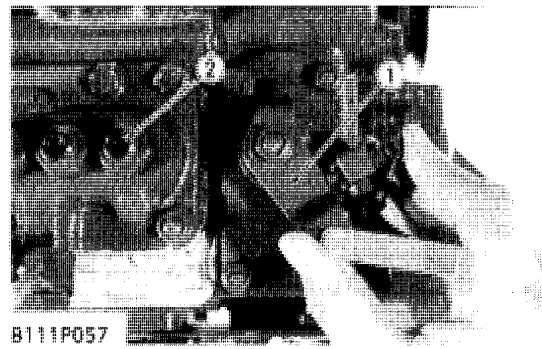
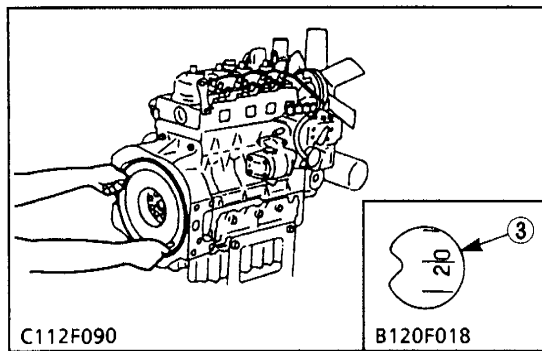
- Apply liquid gasket (Three Bond 1215 or equivalent) to the shim, when reassembling.

(Reference)

- The timing advances by removing 0.15 mm (0.006 in.) of shim and retards by adding one, approx. 0.026 rad. (1.5°) of crank angle.

- (1) Speed Control Lever
(2) Delivery Valve Holder

- (3) Timing Window



Injection Timing [Engine serial number : D1503-L-A ; 1230 ~ / D1703-A ; 1214 ~ / V1903-A : 1123 ~ / V2203-A ; 1158 ~]

1. Remove the injection pipes.
2. Set the speed control lever (1) to maximum fuel discharge position. (D1503, D1703)
Pull the stop lever (4) from its free position (5) by 0.401 to 0.471 rad. (23 to 27°) toward the stop position. (V1903, V2203 only)
3. Turn the flywheel counterclockwise (facing the flywheel) until the fuel fills up to the hole of the delivery valve holder (2) for 1st cylinder.
4. Turn the flywheel further and stop turning when the fuel begins to flow over, to get the present injection timing.
5. (The flywheel has mark 1TC and four lines indicating every 0.087 rad. (5°) of crank angle from 0.175 rad. (10°) to 0.436 rad. (25°) before mark 1TC.) Calculate the angle which the projection of the window points out. If the calculation differs from specified injection timing, add or remove the shim to adjust.

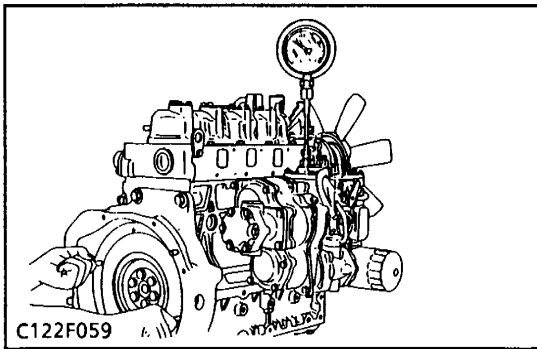
Injection timing	Factory spec.	0.24 to 0.27 rad. (17 to 19°) before T.D.C.
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NOTE

- The sealant is applied to both sides of the shim (soft metal gasket shim). The liquid gasket is not required for assembling.
- Shims are available in thickness of 0.20 mm, 0.25 mm and 0.30 mm. combine these shims for adjustments.
- Addition or reduction of shim (0.05 mm, 0.0020 in.) delays or advances the injection timing by approx. 0.0087 rad. (0.5°).
- In disassembling and replacing, be sure to use the same number of new shims with the same thickness.
- Refer to figure left to check the thickness of the shims.

[A] 0.401 to 0.471 rad. (23 to 27°)

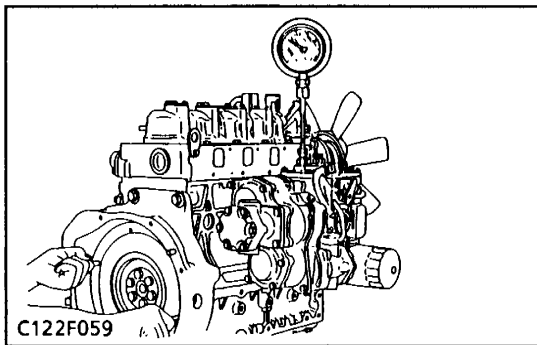
- | | |
|---------------------------------|---|
| (1) Speed Control Lever | (6) Shim (Soft Metal Gasket Shim) |
| (2) Delivery Valve Holder | (7) Two-holes : 0.20 mm (0.0079 in.) |
| (3) Timing Window | (8) One-hole : 0.25 mm (0.0098 in.) |
| (4) Stop Lever | (9) without hole : 0.30 mm (0.0118 in.) |
| (5) Stop Lever in Free Position | |



Fuel Tightness of Pump Element

1. Remove the injection pipe.
2. Install the injection pump pressure tester to the injection pump.
3. Set the speed control lever to the maximum speed position.
4. Turn the flywheel ten times or more to increase the pressure.
5. If the pressure can not reach the allowable limit, replace the pump element or injection pump assembly.

Fuel tightness of pump element	Allowable limit	14.7 MPa 150 kgf/cm ² 2133 psi
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Fuel Tightness of Delivery Valve

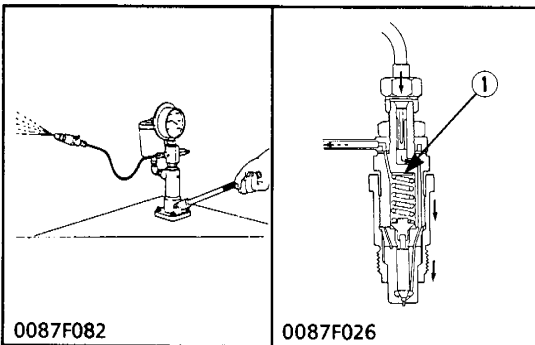
1. Set a pressure tester to the fuel injection pump.
2. Rotate the flywheel and raise the pressure to approx. 15.7 MPa (160 kgf/cm², 2275 psi).
3. Now turn the flywheel back about half a turn (to keep the plunger free). Maintain the flywheel at this position and clock the time taken for the pressure to drop from 14.7 to 13.7 MPa (from 150 to 140 kgf/cm², from 2133 to 1990 psi).
4. Measure the time needed to decrease the pressure from 14.7 to 13.7 MPa (from 150 to 140 kgf/cm², from 2133 to 1990 psi).
5. If the measurement is less than allowable limit, replace the delivery valve.

Fuel tightness of delivery valve	Allowable limit	5 seconds 14.7 → 13.7 MPa 150 → 140 kgf/cm ² 2133 → 1990 psi
----------------------------------	-----------------	--

(2) Injection Nozzle

CAUTION

- Check the nozzle injection pressure and condition after confirming that there is nobody standing in the direction the fume goes.
If the fume from the nozzle directly contacts the human body, cells may be destroyed and blood poisoning may be caused.



(1) Adjusting Washer

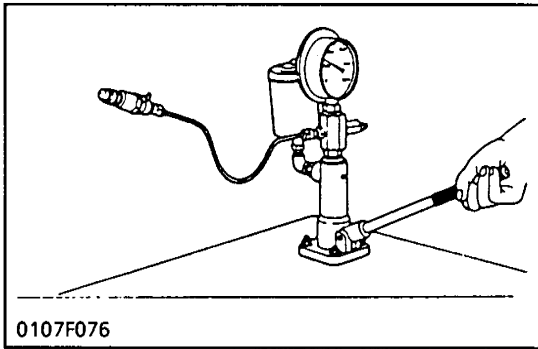
Nozzle Injection Pressure

1. Set the injection nozzle to the nozzle tester.
2. Slowly move the tester handle to measure the pressure at which fuel begins jetting out from the nozzle.
3. If the measurement is not within the factory specifications, disassemble the injection nozzle, and change adjusting washer (1) until the proper injection pressure is obtained.

(Reference)

- Pressure variation with 0.1 mm (0.004 in.) difference of adjusting washer thickness.
Approx. 981 kPa (10 kgf/cm², 142 psi)

Fuel injection pressure	Factory spec.	13.73 to 14.71 MPa 140 to 150 kgf/cm ² 1991 to 2133 psi
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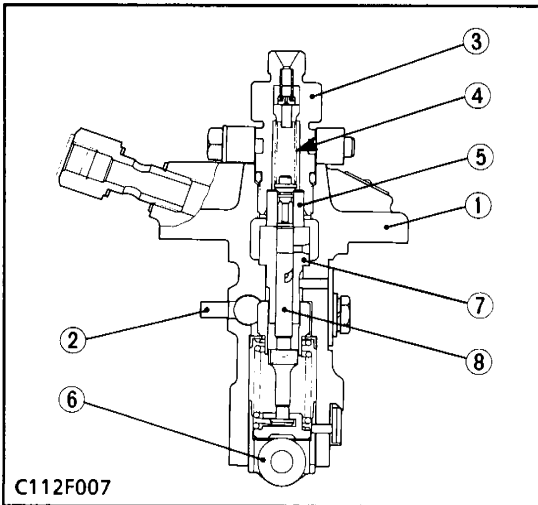
Fuel Tightness of Needle Valve Seat

1. Set the injection nozzle to a nozzle tester.
Apply a pressure 12.75 MPa (130 kgf/cm², 1849 psi).
2. After keeping the nozzle under this pressure for 10 seconds, check to see if fuel leaks from the nozzle.
3. If fuel should leak, replace the nozzle piece.

Valve seat tightness	Factory spec.	No fuel leak at 12.75 MPa 130 kgf/cm ² 1849 psi
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DISASSEMBLING AND ASSEMBLING

(1) Injection Pump

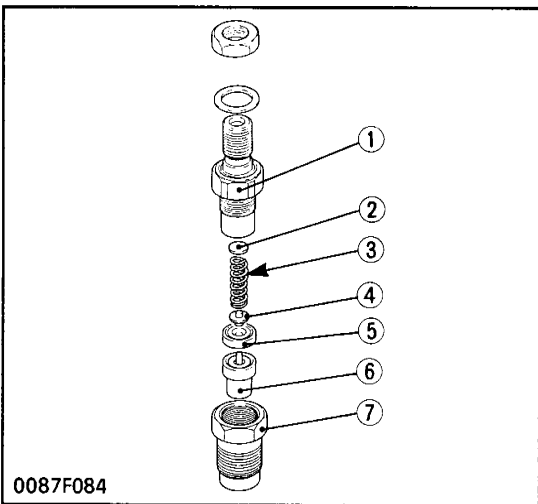


IMPORTANT

- If replacing the pump element, the amount of fuel injection should be adjusted on a specified bench.

- | | |
|---------------------------|--------------------|
| (1) Pump Body | (5) Delivery Valve |
| (2) Control Rack | (6) Tappet Roller |
| (3) Delivery Valve Holder | (7) Cylinder |
| (4) Delivery Valve Spring | (8) Plunger |

(2) Injection Nozzle



Nozzle Holder

1. Secure the nozzle retaining nut (7) with a vise.
2. Remove the nozzle holder (1), and take out parts inside.

(When reassembling)

- Assemble the nozzle in clean fuel oil.
- Install the push rod (4), noting its direction.
- After assembling the nozzle, be sure to adjust the fuel injection pressure.

Tightening torque	Nozzle holder	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs
	Overflow pipe nut	19.6 to 24.5 N·m 2.0 to 2.5 kgf·m 14.5 to 18.1 ft-lbs
	Nozzle holder assembly	49.0 to 68.6 N·m 5.0 to 7.0 kgf·m 36.2 to 50.6 ft-lbs

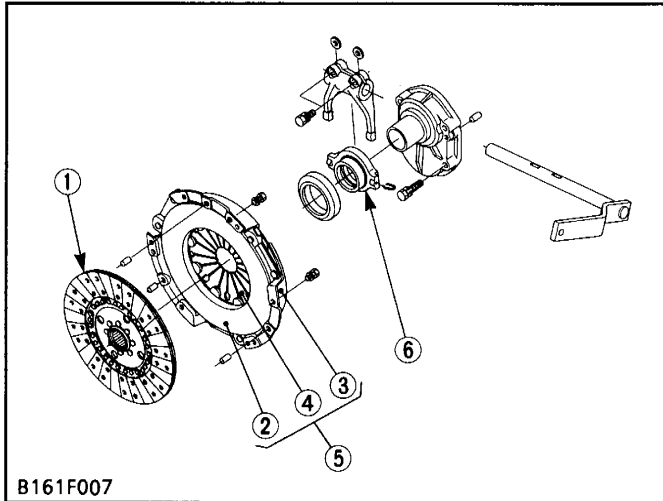
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|----------------------|--------------------------|
| (1) Nozzle Holder | (5) Distance Piece |
| (2) Adjusting Washer | (6) Nozzle Piece |
| (3) Nozzle Spring | (7) Nozzle Retaining Nut |
| (4) Push Rod | |

MECHANISM

CONTENTS

[1] FEATURES	2-M1
[2] LINKAGE MECHANISM	2-M1
[3] OPERATION	2-M2

[1] FEATURES



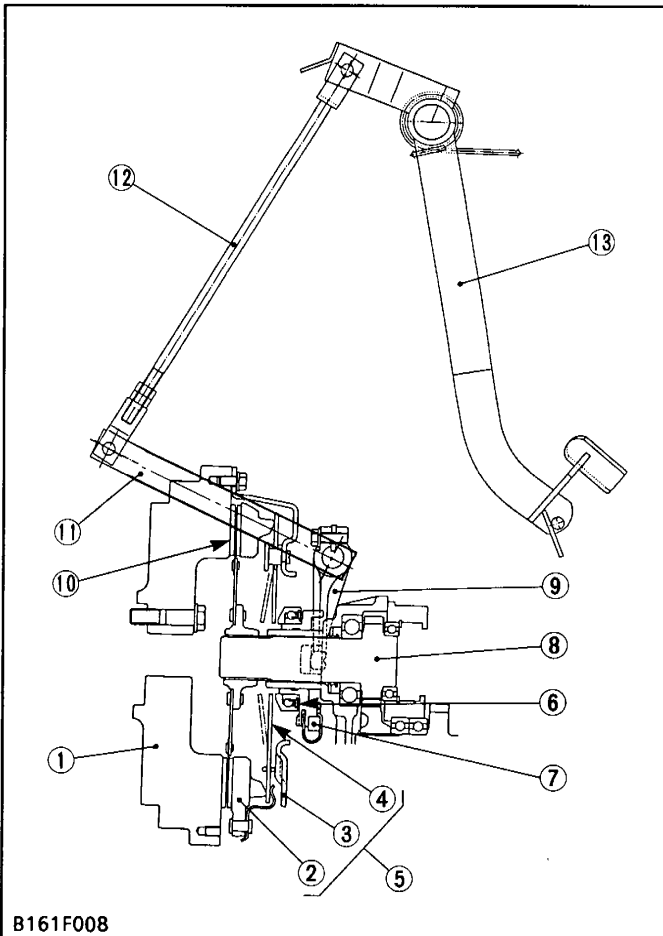
This tractor is used dry single plate type clutch.

The clutch is located between the engine and transmission and is operated by stepping on the clutch pedal.

When the clutch pedal is depressed, the clutch is disengaged and when it is released, the clutch is engaged and power from the engine is transmitted to the transmission.

- | | |
|--------------------|-----------------------------|
| (1) Clutch Disc | (4) Diaphragm Spring |
| (2) Pressure Plate | (5) Pressure Plate Assembly |
| (3) Clutch Cover | (6) Release Hub |

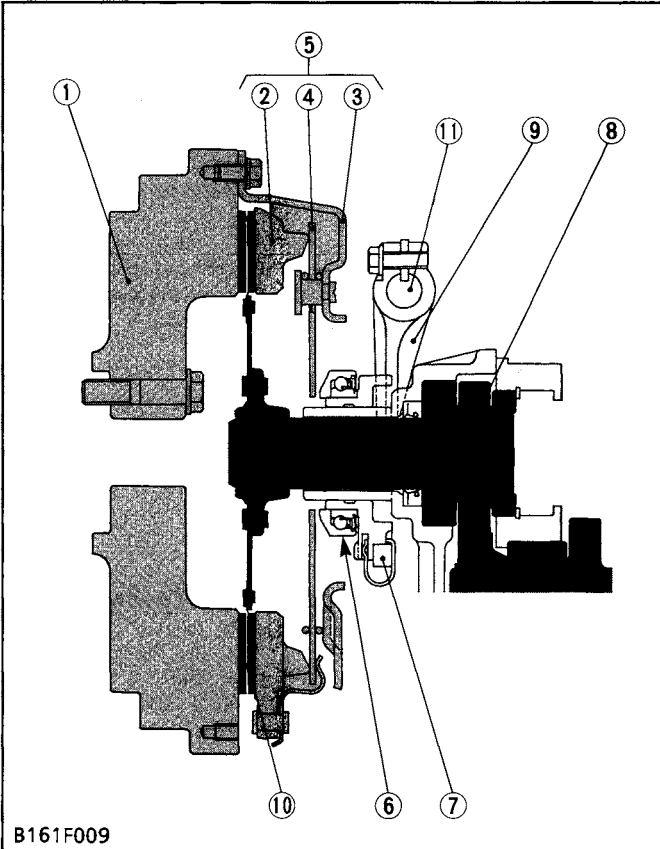
[2] LINKAGE MECHANISM



This tractor uses hanging type clutch pedal to have wider space about the platform.

- | | |
|-----------------------------|-------------------|
| (1) Flywheel | (8) Gear Shaft |
| (2) Pressure Plate | (9) Release Fork |
| (3) Clutch Cover | (10) Clutch Disc |
| (4) Diaphragm Spring | (11) Clutch Lever |
| (5) Pressure Plate Assembly | (12) Clutch Rod |
| (6) Release Bearing | (13) Clutch Pedal |
| (7) Release Hub | |

[3] OPERATION



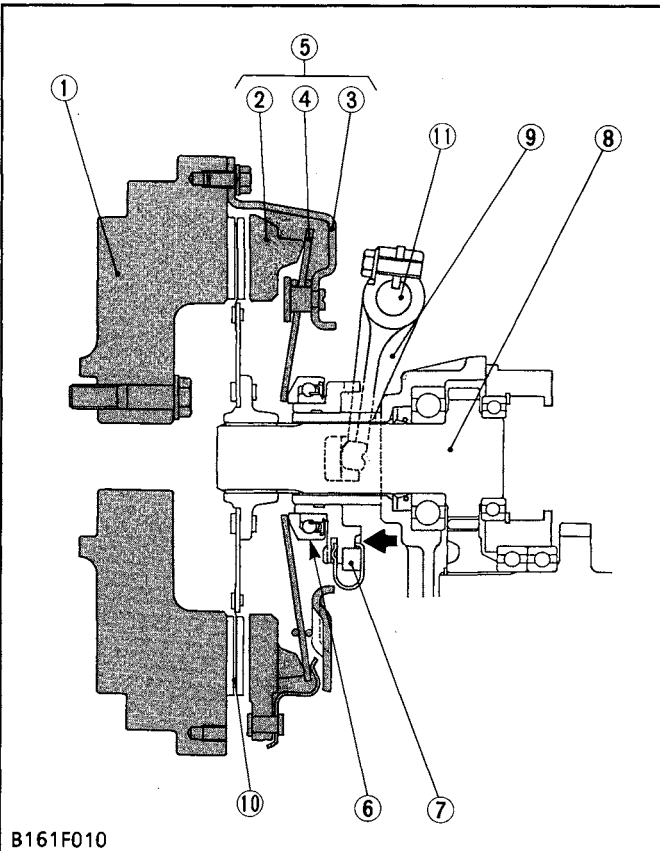
B161F009

■ Clutch "Engaged"

When the clutch pedal is not depressed, the clutch release bearing (6) and the fingers of diaphragm spring (4) are not connected to each other.

Accordingly, the pressure plate (2) is tightly pressed against the flywheel (1) by the diaphragm spring (4). As a result, rotation of the flywheel (1) is transmitted to the transmission through the gear shaft (8) due to the frictional force among the flywheel (1), clutch disc (10) and pressure plate (2).

- | | |
|-----------------------------|-------------------|
| (1) Flywheel | (7) Release Hub |
| (2) Pressure Plate | (8) Gear Shaft |
| (3) Clutch Cover | (9) Release Fork |
| (4) Diaphragm Spring | (10) Clutch Disc |
| (5) Pressure Plate Assembly | (11) Clutch Lever |
| (6) Release Bearing | |



B161F010

■ Clutch "Disengaged"

When the clutch pedal is depressed, the clutch rod is pulled to move the clutch lever (11). Then, the release fork (9) pushes the release hub (7) and release bearing (6) toward the flywheel. Simultaneously, the release bearing (6) pushes the diaphragm spring (4).

As the pressure plate (2) is pulled by the diaphragm spring (4), the frictional force among the flywheel (1), clutch disc (10) and pressure plate (2) disappears.

Therefore, rotation of the flywheel (1) is not transmitted to the clutch disc (10), and then the rotation of the gear shaft (8) stops.

- | | |
|-----------------------------|-------------------|
| (1) Flywheel | (7) Release Hub |
| (2) Pressure Plate | (8) Gear Shaft |
| (3) Clutch Cover | (9) Release Fork |
| (4) Diaphragm Spring | (10) Clutch Disc |
| (5) Pressure Plate Assembly | (11) Clutch Lever |
| (6) Release Bearing | |

SERVICING

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(3) Removing Clutch	2-S6
SERVICING	2-S7

TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Clutch Drags	<ul style="list-style-type: none"> ● Clutch pedal free play excessive ● Dust on clutch disc generated from clutch disc facing ● Release fork broken ● Clutch disc or pressure plate warped ● Wire ring of the pressure plate worn or broken 	Adjust Remove rust Replace Replace Replace (Pressure plate assembly)	2-S3 - 2-S7 2-S6, S7, S8 2-S6
Clutch Slips	<ul style="list-style-type: none"> ● Clutch pedal free play too small ● Clutch disc excessively worn ● Grease or oil on clutch disc facing ● Clutch disc or pressure plate warped ● Diaphragm spring weaken or broken ● Wire ring of the pressure plate worn or broken 	Adjust Replace Replace Replace Replace Replace (Pressure plate assembly)	2-S3 2-S7 2-S6 2-S6, S7, S8 2-S6, S8 2-S6, S8
Chattering	<ul style="list-style-type: none"> ● Grease or oil on clutch disc facing ● Clutch disc or pressure plate warped ● Clutch disc boss spline worn or rusted ● Gear shaft bent ● Pressure plate or flywheel face cracked or scored ● Clutch disc boss spline and gear shaft spline worn ● Diaphragm spring strength uneven or diaphragm spring broken 	Replace Replace Replace or remove rust Replace Replace Replace Replace	2-S6 2-S6, S7, S8 2-S6 3-S16 2-S8 1-S33 2-S6 2-S6, S8
Rattle During Running	<ul style="list-style-type: none"> ● Clutch disc boss spline worn ● Thrust ball bearing worn or sticking 	Replace Replace	2-S6 2-S7
Clutch Squeaks	<ul style="list-style-type: none"> ● Thrust ball bearing sticking or dry ● Clutch disc excessively worn 	Replace or lubricate Replace	2-S7 2-S6, S7
Vibration	<ul style="list-style-type: none"> ● Gear shaft bent ● Clutch disc rivet worn or broken ● Clutch parts broken 	Replace Replace Replace	3-S17 2-S6 2-S7

SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Clutch Pedal	Free play	20 to 30 mm 0.8 to 1.2 in.	–
Clutch Pedal Stopper Bolt	Height	18 to 22 mm 0.70 to 0.87 in.	–
Clutch Disc	Disc Surface to Rivet Top (Depth)	–	0.3 mm 0.012 in.
Clutch Disc Boss to Gear Shaft	Backlash (Displacement Around Disc Edge)	–	2.0 mm 0.079 in.
Pressure Plate	Flatness	–	0.2 mm 0.008 in.
Diaphragm Spring	Mutual Difference	–	0.5 mm 0.020 in.

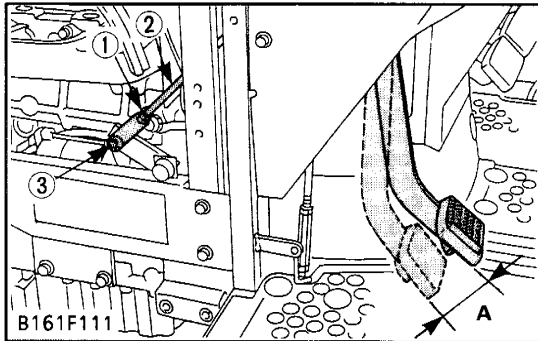
TIGHTENING TORQUES

Tightening torques of screws and nuts on the table below are especially specified.
(For general use screws and nuts : See page G-9)

Item	N·m	kgf·m	ft·lbs
Clutch mounting screws	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Release fork setting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Power steering main delivery hose retaining nut	46.6 to 50.9	4.8 to 5.2	34.4 to 37.6
Power steering turning delivery hoses retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Joint bolt for delivery pipe and hydraulic block of three point linkage hydraulic system	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Joint bolt for delivery pipe and regulator valve of GST system (Only GST or independent PTO type)	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Engine and clutch housing mounting screws, nuts	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Engine and clutch housing mounting stud bolts	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2

CHECKING, DISASSEMBLING AND SERVICING

CHECKING AND ADJUSTING



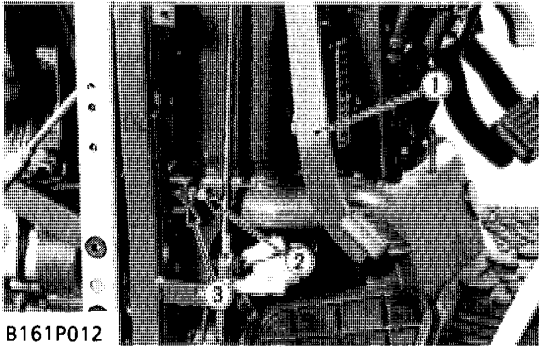
Clutch Pedal Free Play

1. Stop the engine and remove the key.
2. Slightly depress the clutch pedal and measure free travel (A) at top of pedal stroke.
3. If adjustment is needed, loosen the lock nut (1), remove the clevis pin (3) and adjust the clutch rod (2) length.
4. Retighten the lock nut (3) and split the cotter pin.

Clutch pedal free travel (A)	Factory spec.	20 to 30 mm (0.8 to 1.2 in.) on the pedal
------------------------------	---------------	---

(1) Lock Nut
(2) Clutch Rod

(3) Clevis Pin



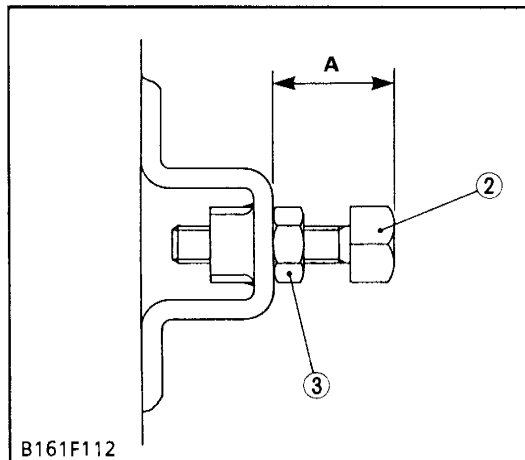
(1) Clutch Pedal
(2) Stopper Bolt

(3) Lock Nut

Clutch Pedal Stopper Bolt

1. Measure the height (A) of stopper bolt (2).
2. If the measurement is not within the factory specifications, adjust it.
3. After adjustment, tighten the lock nut (3) firmly.

Height (A) of clutch pedal stopper bolt	Factory spec.	18 to 22 mm 0.70 to 0.87 in.
---	---------------	---------------------------------

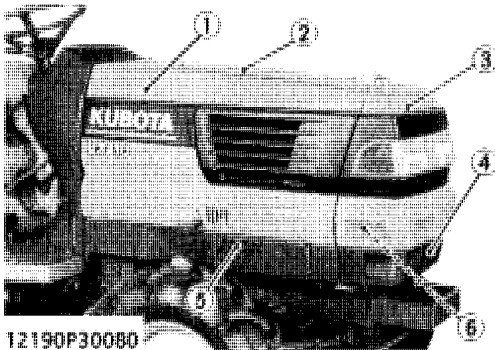


DISASSEMBLING AND ASSEMBLING

(1) Separating Panel Frame Assembly

NOTE

- If the tractors are cabin specifications, refer to section 10 CABIN [1] SEPARATING CABIN FROM TRACTOR BODY. (See page 10-S20.)

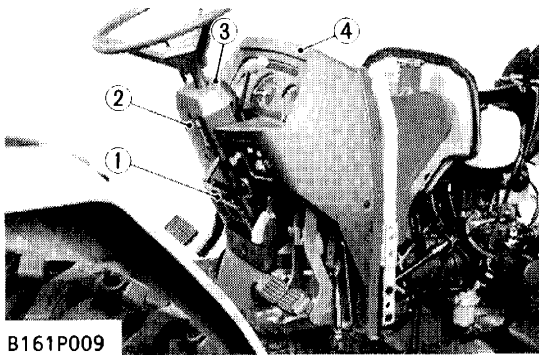


Preparation 1

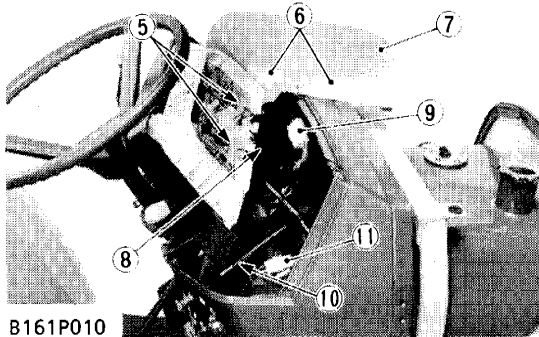
1. Open the front mask (3) and disconnect the battery negative cable (6).
2. Remove the right and left side covers (1).
3. Remove the front mask (3).
4. Remove the front grille (4).
5. Remove the right and left side skirts (5).
6. Remove the bonnet (2).

(1) Side Cover (RH, LH)
(2) Bonnet
(3) Front Mask

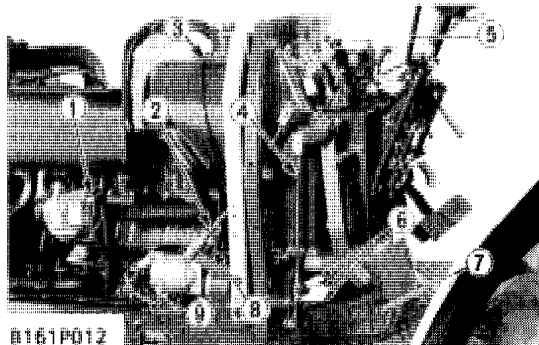
(4) Front Grille
(5) Side Skirt (RH, LH)
(6) Battery Negative Code



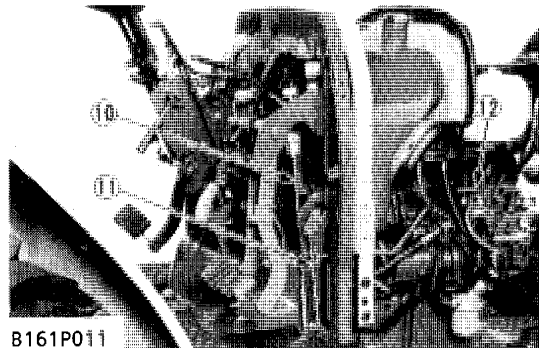
B161P009



B161P010



B161P012



B161P011

Preparation 2

1. Remove the steering post covers (2), (3) and panel under cover (1).
2. Disconnect the meter cable (8) at the engine side.
3. Remove the meter panel mounting screws and open the meter panel (4).
4. Remove the meter panel cover (7), and then disconnect the two connectors (5) and meter cable (8).
5. Take out the meter panel (4).
6. Disconnect the main switch connector (11) and combination switch connector (9).
7. Disconnect the engine stop cable (10) at the engine side.

NOTE

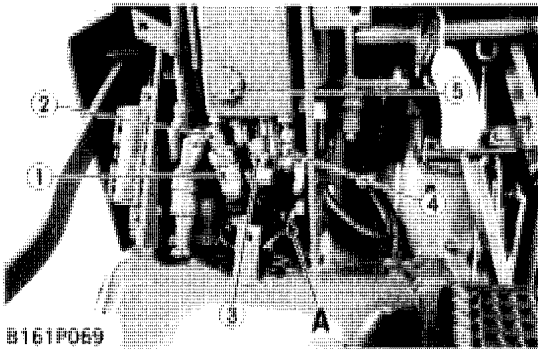
- Do not remove the seals (6) on the meter panel cover (7).

- | | |
|-------------------------|----------------------------------|
| (1) Panel Under Cover | (7) Meter Panel Cover |
| (2) Steering Post Cover | (8) Meter Cable |
| (3) Steering Post Cover | (9) Combination Switch Connector |
| (4) Meter Panel | (10) Engine Stop Cable |
| (5) Connectors | (11) Main Switch Connector |
| (6) Seals | |

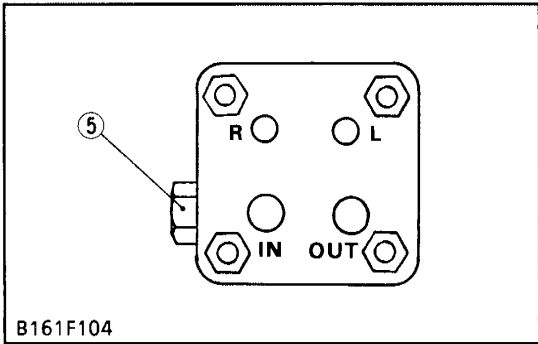
Preparation 3

1. Disconnect the brake rods (4), (10).
2. Disconnect the clutch rod (2).
3. Remove the accelerator rod (12).
4. Disconnect the foot accelerator rod (11).
5. Remove the panel frame cover (7) and disconnect the three connectors (6).
6. Remove the shuttle shift lever (5) after disconnecting the limit switch wire harness.
7. Disconnect the 2P connector for alternator (1), jumper leads for fuel level sensor (3) and starter (9).

- | | |
|---------------------------------------|--------------------------------|
| (1) 2P Connector for Alternator | (7) Panel Frame Cover |
| (2) Clutch Rod | (8) Jumper Lead for Oil Switch |
| (3) Jumper Lead for Fuel Level Sensor | (9) Jumper Lead for Starter |
| (4) Brake Rod (LH) | (10) Brake Rod (RH) |
| (5) Shuttle Shift Lever | (11) Foot Accelerator Rod |
| (6) Connectors | (12) Accelerator Rod |



B161P069



B161F104

Hydraulic Pipes

1. Disconnect the main delivery hose (1), return hose (2), right turning delivery hose (3) and left turning delivery hose (4).

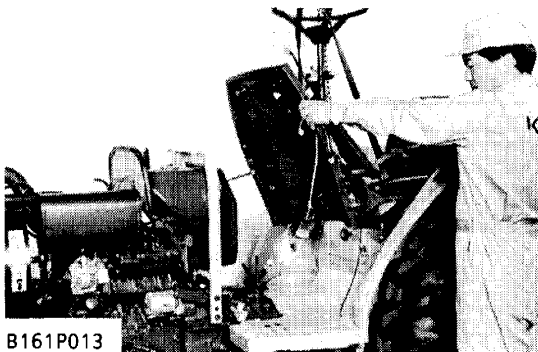
(When reassembling)

- In assembling the turning delivery hoses to the steering controller, connect the delivery hose with identification mark (tape) "A" to the L port of the steering controller. (Refer to figure left.)

Tightening torque	Main delivery hose retaining nut	46.6 to 50.9 N·m 4.8 to 5.2 kgf·m 34.4 to 37.6 ft-lbs
	Turning delivery hoses retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft-lbs

[A] Identification Mark (Tape)

- | | |
|---------------------------------|--------------------------------|
| (1) Main Delivery Hose | (4) Left Turning Delivery Hose |
| (2) Return Hose | (5) Relief Valve Plug |
| (3) Right Turning Delivery Hose | |



B161P013

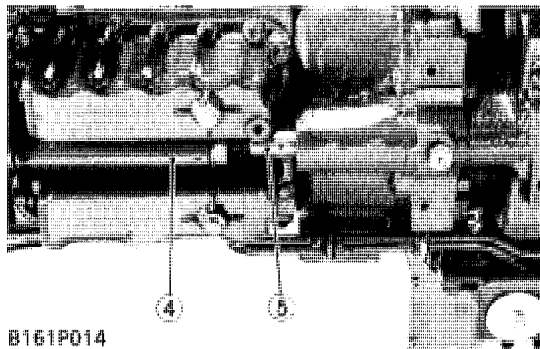
Panel Frame and Steering Assembly

1. Remove the panel frame mounting screws. (Two screws at upper part. Seven screws at lower part.)
2. Take out the panel frame and steering assembly as a unit.

(When reassembling)

- Do not get in the wiring harness between panel frame and platform.

(2) Separating Engine and Clutch Housing Case



B161P014

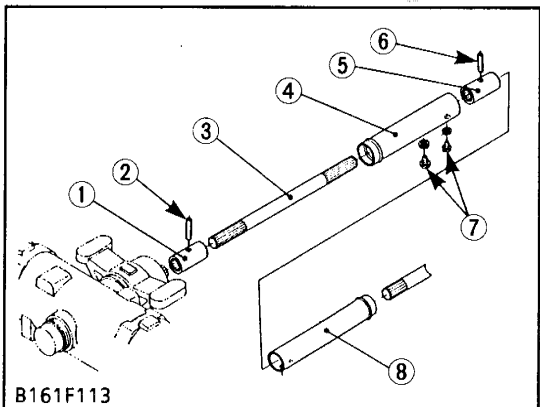
Propeller Shaft (4WD Only)

1. Slide the propeller shaft covers (4), (8) after removing the screws (7).
2. Tap out the spring pin (6), and then slide the coupling (5) to the front.

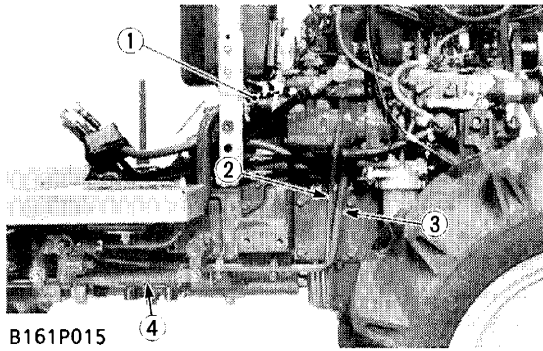
(When reassembling)

- Apply grease to the splines of the propeller shaft.

- | | |
|---------------------------|---------------------------|
| (1) Coupling | (5) Coupling |
| (2) Spring Pin | (6) Spring Pin |
| (3) Propeller Shaft | (7) Screws |
| (4) Propeller Shaft Cover | (8) Propeller Shaft Cover |



B161F113



B161P015

- (1) Rubber Hose
- (2) Delivery Pipe
- (3) Delivery Pipe
- (4) Brake Rod

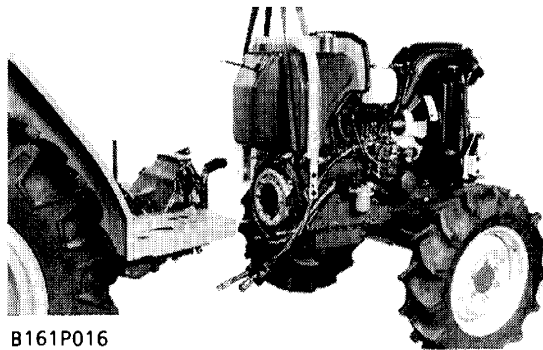
Hydraulic Pipes

1. Remove the brake rod (4) and delivery pipe (3).
2. Remove the delivery pipe (2). (Only GST or independent PTO type)
3. Slide the rubber hose (1).

(When reassembling)

- Reinstall the pipe clamp securely.

Tightening torque	Joint bolt for delivery pipe (3) and hydraulic block	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft-lbs
	Joint bolt for delivery pipe (2) and regulator valve (Only GST or independent PTO type)	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs



B161P016

Separating the Engine from Clutch Housing

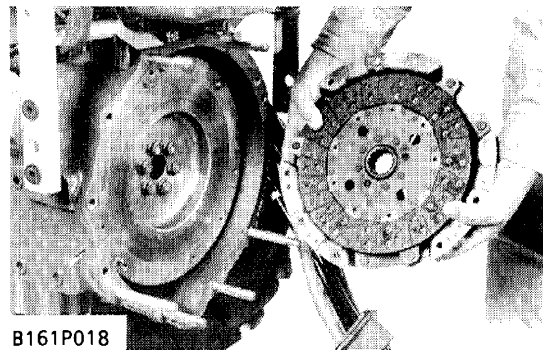
1. Place the jack under the clutch housing case.
2. Hoist the engine by the nylon lift strap at the tank support.
3. Remove the engine mounting screws, and then pull the engine to the front.

(When reassembling)

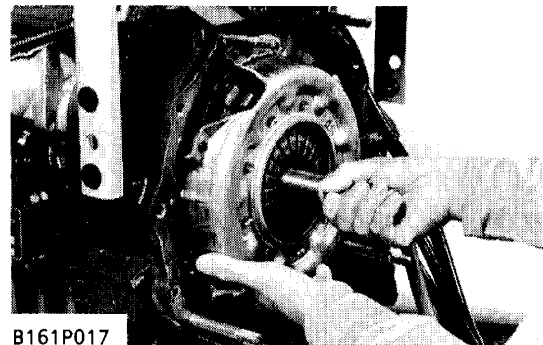
- Apply grease to the splines.
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the engine and clutch housing.

Tightening torque	Engine and clutch housing mounting screws, nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Engine and clutch housing mounting stud bolts	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft-lbs

(3) Removing Clutch



B161P018



B161P017

Removing Clutch

1. Remove the clutch from the flywheel.

(When reassembling)

- Direct the shorter end of the clutch disc boss toward the flywheel.
- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the splines of clutch disc boss.
- Install the pressure plate, noting the position of straight pins.

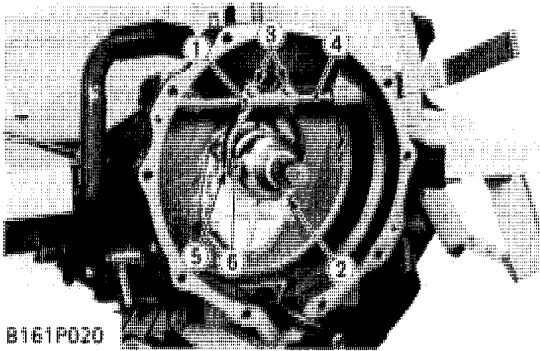
■ IMPORTANT

- Align the center of disc and flywheel by inserting the clutch center tool. (See page G-33.)

■ NOTE

- Do not allow grease and oil on the clutch disc facing.

Tightening torque	Clutch mounting screws	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
-------------------	------------------------	---



B161P020

- (1) Release Fork
- (2) Release Bearing
- (3) Setting Screws
- (4) Clutch Lever
- (5) Snap Pins
- (6) Release Holder

Release Holder and Clutch Lever

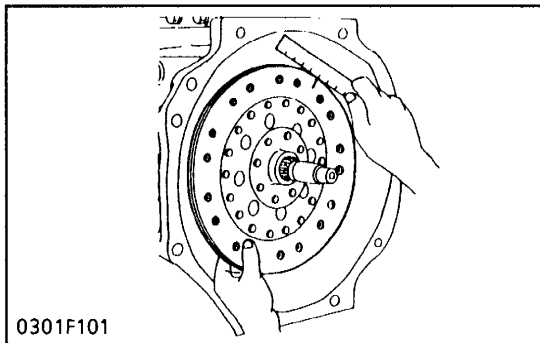
1. Draw out the clutch release holder (6) and the release bearing (2) as a unit.
2. Remove the release fork setting screws (3).
3. Draw out the clutch lever (4) to remove the release fork (1).

(When reassembling)

- Make sure the direction of the release fork (1) is correct.
- Inject grease to the release holder (6).
- Be sure to set the snap pins (5).

Tightening torque	Release fork setting screws	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
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SERVICING

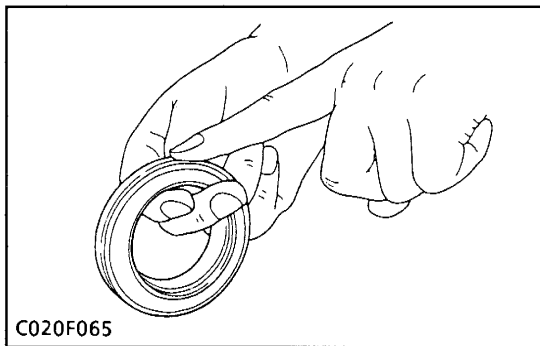


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Backlash between Clutch Disc Boss and Gear Shaft

1. Mount the clutch disc to the gear shaft.
2. Hold the gear shaft so that it may not turn.
3. Rotate disc lightly and measure the displacement around the disc edge.
4. If the measurement exceeds the allowable limit, replace the disc.

Displacement around disc edge	Allowable limit	2.0 mm 0.079 in.
-------------------------------	-----------------	---------------------



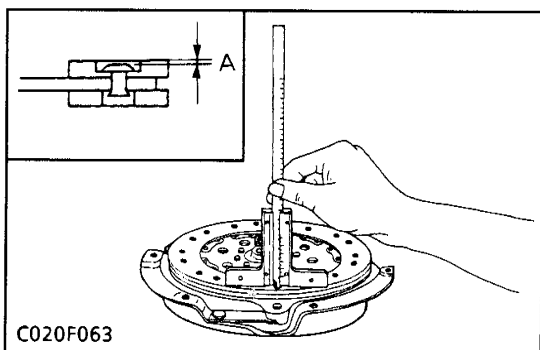
C020F065

Thrust Ball Bearing

1. Remove the thrust ball bearing from release holder with a puller.
2. Check for abnormal wear on contact surface.
3. Hold bearing inner race and rotate outer race, while applying pressure to it.
4. If the bearing rotation is rough or noisy, replace the bearing.

NOTE

- Do not depress outer race, when installing thrust ball bearing.



C020F063

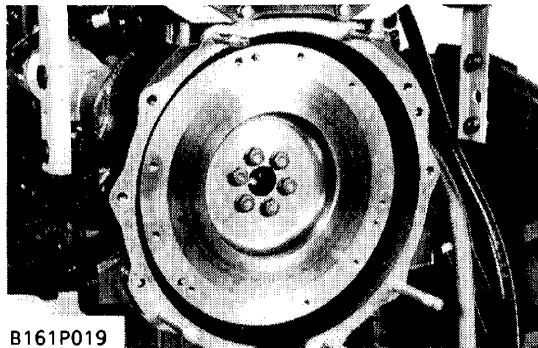
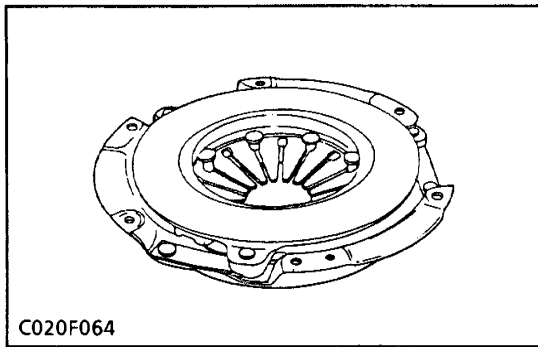
Clutch Disc Wear

1. Measure the depth from clutch disc surface to the top of rivet at least 10 points with a depth gauge.
2. If the depth is less than the allowable limit, replace the disc.
3. If oil is sticking to clutch disc, or disc surface is carbonized, replace the disc.

In this case, inspect transmission gear shaft oil seal, engine rear oil seal and other points for oil leakage.

Disc surface to rivet top (Depth)	Allowable limit	0.3 mm 0.012 in.
-----------------------------------	-----------------	---------------------

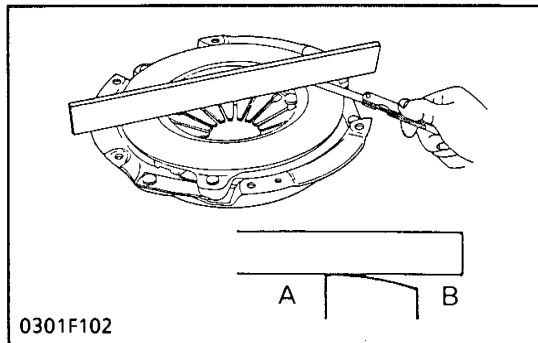
[A] More than 0.3 mm (0.012 in.)



Checking Pressure Plate Assembly and Flywheel

1. Wash the disassembling parts except clutch disc with a suitable cleaning solvent to remove dirt and grease before making inspection and adjustment.
2. Check friction surface of pressure plate and flywheel for scoring or roughness.
 - Slight roughness may be smoothed by using fine emery cloth.
 - If these parts have deep scores or grooves on their surface, they should be replaced.
3. Check the surface of the diaphragm spring for wear. If excessive wear is found, replace clutch cover assembly.
4. Inspect thrust rings (wire ring) for wear or damage. As these parts are invisible from outside, shake pressure plate assembly up and down to listen for chattering noise, or lightly hammer on rivets for a slightly cracked noise. Any of these noises indicates need of replace as a complete assembly.

Diaphragm spring mutual difference	Allowable limit	0.5 mm 0.020 in.
------------------------------------	-----------------	---------------------



Pressure Plate Flatness

1. Place a straight edge on the pressure plate and measure clearance with a feeler gauge at several points.
2. If the clearance exceeds the allowable limit, replace it.
3. When the pressure plate is worn around its outside and its inside surface only is in contact with the straight edge, replace even if the clearance is within the allowable limit.

Clearance between pressure plate and straight edge	Allowable limit	0.2 mm 0.008 in.
--	-----------------	---------------------

[A] Inside

[B] Outside

MECHANISM

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[2] POWER TRAIN

The transmission consists of a series of gears and shafts shown previously. It offers the most suitable speed for traveling and operation by combination of these gears. It transmits power to the front axle (4WD Type), rear axle and PTO shaft.

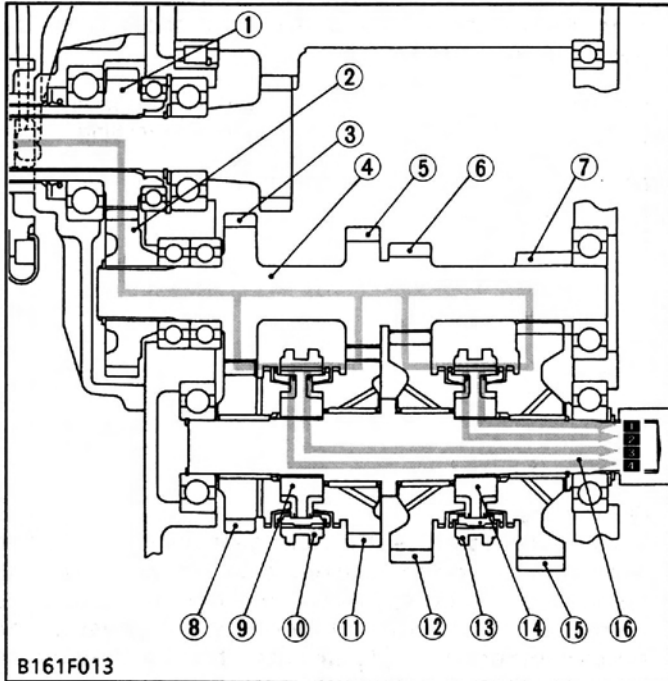
L3010, L3410, L3710 and L4310 are equipped a transmission with 8 forwards and 8 reverses. (16

forwards and 16 reverses, if the tractors are equipped creep speed gear.)

The traveling system consists of main gear shift section, shuttle shift section, Hi-Lo range shift section and creep speed shift section (option).

The PTO system offers 540 rpm on the rear PTO speed and 2000 rpm on the mid PTO speed.

(1) Main Gear Shift Section



- | | |
|--|--------------------|
| (1) 24T Gear Shaft | (8) 24T Gear |
| (2) 27T Gear | (9) Hub |
| (3) 22T Gear (22T-18T-13T-10T Main Gear Shaft) | (10) Shifter |
| (4) Main Gear Shaft | (11) 29T Gear |
| (5) 18T Gear (22T-18T-13T-10T Main Gear Shaft) | (12) 34T Gear |
| (6) 13T Gear (22T-18T-13T-10T Main Gear Shaft) | (13) Shifter |
| (7) 10T Gear (22T-18T-13T-10T Main Gear Shaft) | (14) Hub |
| | (15) 37T Gear |
| | (16) Counter Shaft |

The main shift section uses a synchro-mesh type transmission.

Rotary power which is transmitted from the engine to the gear shaft via the clutch is changed in four ways by operating the main shift lever to shift the shifters, and transmits to the counter shaft.

The power is transmitted as follows.

1 1st Speed

24T Gear Shaft (1) → 27T Gear (2) → Main Gear Shaft (4) → 10T Gear (7) → 37T Gear (15) → Shifter (13) → Hub (14) → Counter Shaft (16).

2 2nd Speed

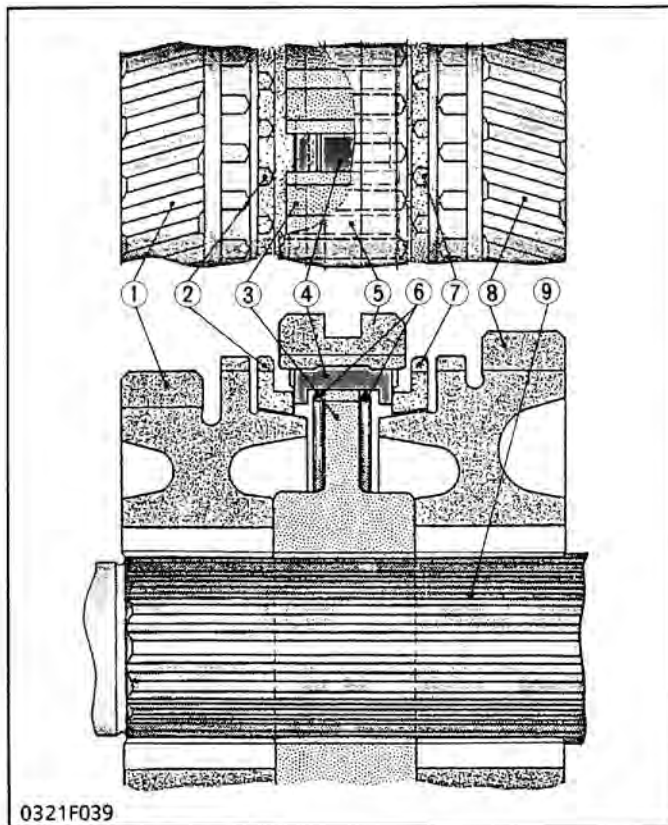
24T Gear Shaft (1) → 27T Gear (2) → Main Gear Shaft (4) → 13T Gear (6) → 34T Gear (12) → Shifter (13) → Hub (14) → Counter Shaft (16).

3 3rd Speed

24T Gear Shaft (1) → 27T Gear (2) → Main Gear Shaft (4) → 18T Gear (5) → 29T Gear (11) → Shifter (10) → Hub (9) → Counter Shaft (16).

4 4th Speed

24T Gear Shaft (1) → 27T Gear (2) → Main Gear Shaft (4) → 22T Gear (3) → 24T Gear (8) → Shifter (10) → Hub (9) → Counter Shaft (16).

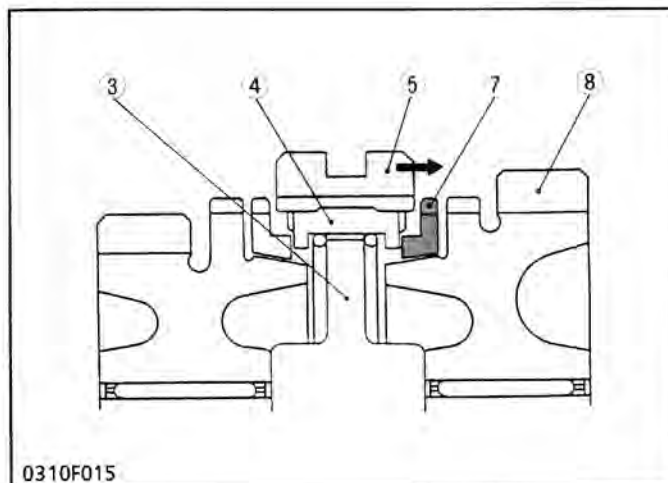


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**Block-type Synchronismesh Mechanism
(For Main Gear Shift, Hi-Lo Range Shift Section)**

The hub (3) is splined to the counter shaft (9) and the shifter (5) is mounted on the hub (3). The two synchronizer springs (6) hold the synchronizer keys (4) out against the shifter (5). The bronze synchronizer rings (2), (7) each has three slots into which the ends of the synchronizer keys (4) fit. The inner surfaces of the synchronizer rings (2), (7) are cone-shaped and match the conical shape of the gear (1), (8) shoulders which they contact. These cone-shaped surfaces provide the frictional force to synchronize the speed of the first shaft with the gears (1), (8).

- | | |
|-----------------------|-------------------------|
| (1) Gear | (6) Synchronizer Spring |
| (2) Synchronizer Ring | (7) Synchronizer Ring |
| (3) Hub | (8) Gear |
| (4) Synchronizer Key | (9) Counter Shaft |
| (5) Shifter | |

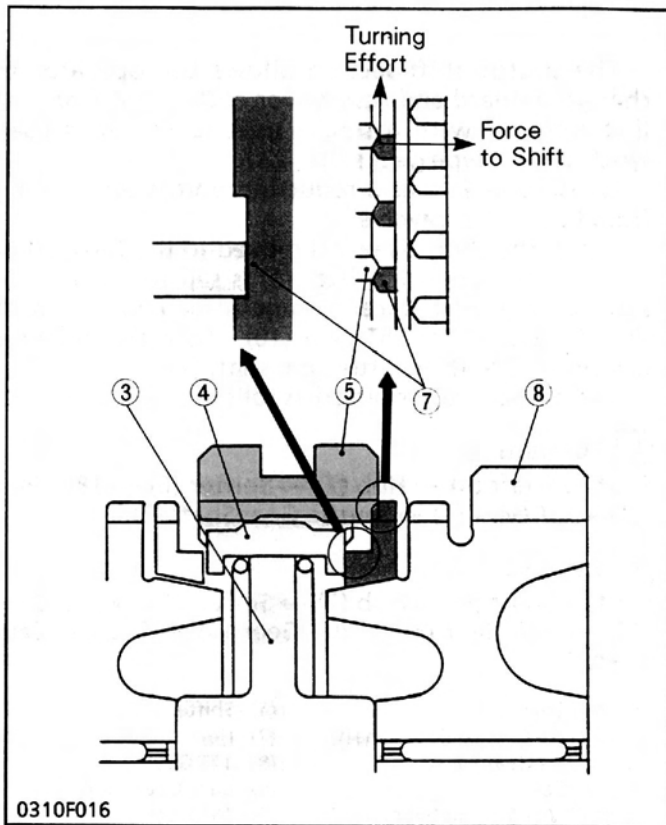


0310F015

First Stage

An effort to place the main gear shift lever to the 3rd or 4th speed causes the shifter (5) and synchronizer keys (4) to move slightly. Then, the end surface of the synchronizer key (4) presses the synchronizer ring (7) against the cone-shaped portion of the gear (8). The frictional force generated at the cone-shaped portion rotates the synchronizer ring (7), synchronizer keys (4) and hub (3) which is splined to the counter shaft.

- | | |
|----------------------|-----------------------|
| (3) Hub | (7) Synchronizer Ring |
| (4) Synchronizer Key | (8) Gear |
| (5) Shifter | |

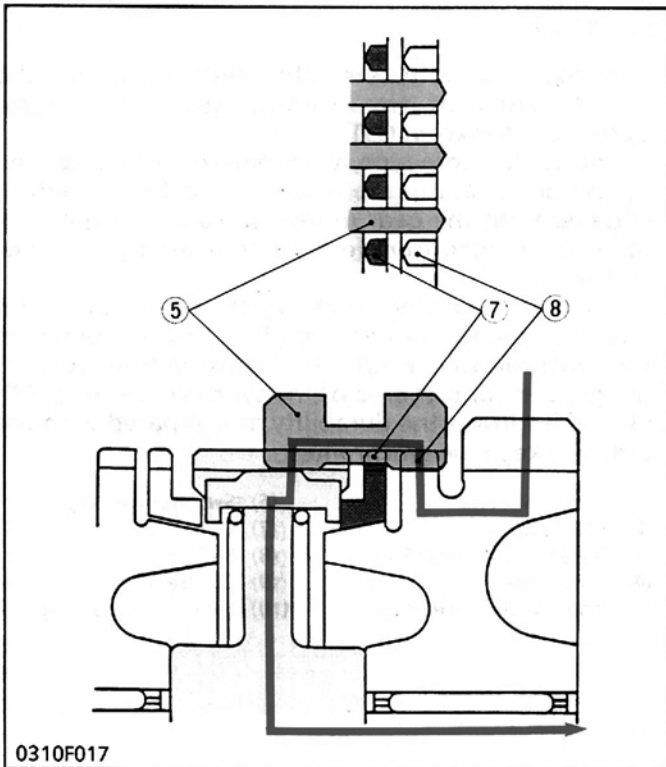


■ Second Stage

When the synchronizer keys (4) are prevented by the synchronizer ring (7) from sliding, the synchronizer keys (4) are disengaged from the shifter (5). The synchronizer keys (4) go into the grooves provided in the synchronizer ring (7).

However, since the width of the grooves is wider than that of the keys, the synchronizer keys begin rotating at the same speed with the shifter (5) and hub (3) with a time lag. In the meantime, the shifter (5) in its sliding direction and the synchronizer ring (7) in its rotating direction press each other at their chamfered portions to synchronize the speed of the synchronizer ring (7) with that of the gear (8).

- | | |
|----------------------|-----------------------|
| (3) Hub | (7) Synchronizer Ring |
| (4) Synchronizer Key | (8) Gear |
| (5) Shifter | |



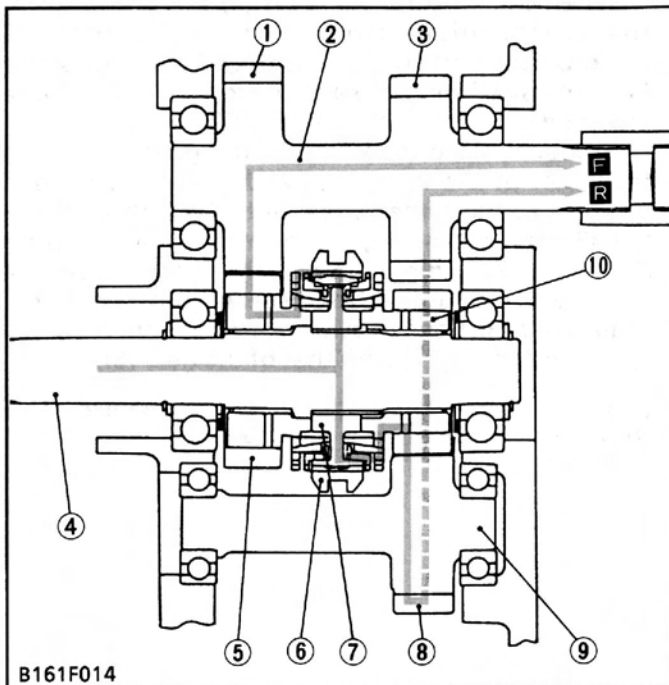
■ Final Stage

When the speed of the shifter (5) becomes the same as that of the gear (8), the force of the synchronizer ring (7) in its rotating direction is not applied to the shifter (5) and the rotation of the synchronizer ring (7) is no longer transmitted to the shifter (5).

Therefore, the shifter (5) engages with the synchronizer ring (7) and further engages with the gear (8) for complete connection.

- | | |
|-----------------------|----------|
| (5) Shifter | (8) Gear |
| (7) Synchronizer Ring | |

(2) Shuttle Shift Section



B161F014

The shuttle shift section allows the operator to change forward and reverse for each speed from the first to eight with a single shift lever. It is used synchromesh type gear shift.

It also operates as a reduction unit when shifting from forward to reverse.

When the shuttle lever is moved to the forward or reverse position, the shifter (6) is slid to the rear or front by the mechanical linkage to be engaged with the 18T gear (5) or 15T gear (10). Then the power is transmitted to the shuttle gear shaft (2).

The power is transmitted as follows.

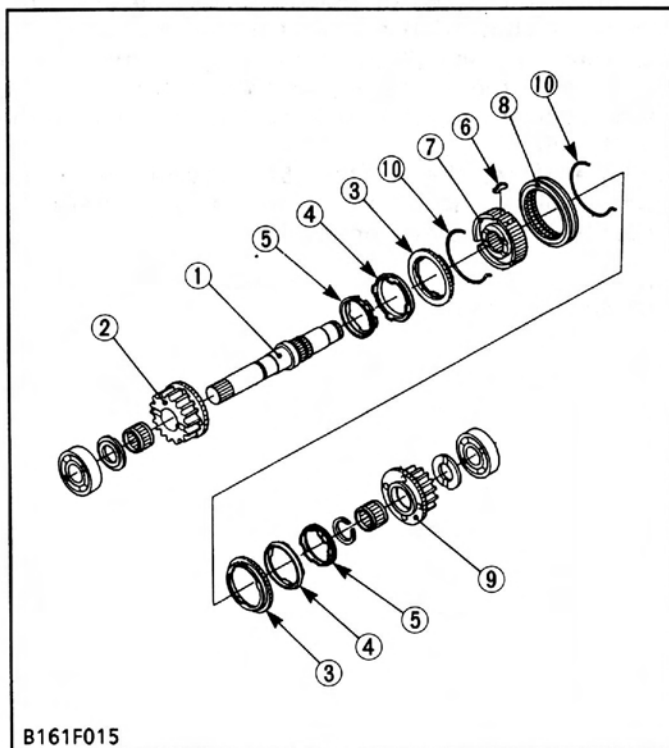
F Forward

Shuttle Shaft (4) → Hub (7) → Shifter (6) → 18T Gear (5) → 22T Gear (1) → Shuttle Gear Shaft (2).

R Reverse

Shuttle Shaft (4) → Hub (7) → Shifter (6) → 15T Gear (10) → 17T Gear (8) → 20T Gear (3) → Shuttle Gear Shaft (2).

- | | |
|--|--|
| (1) 22T Gear
(22T-20T Shuttle Gear Shaft) | (6) Shifter |
| (2) Shuttle Gear Shaft | (7) Hub |
| (3) 20T Gear
(22T-20T Shuttle Gear Shaft) | (8) 17T Gear |
| (4) Shuttle Shaft | (9) Back Gear Shaft |
| (5) 18T Gear | (10) 15T Gear
(15T Back Gear Shaft) |



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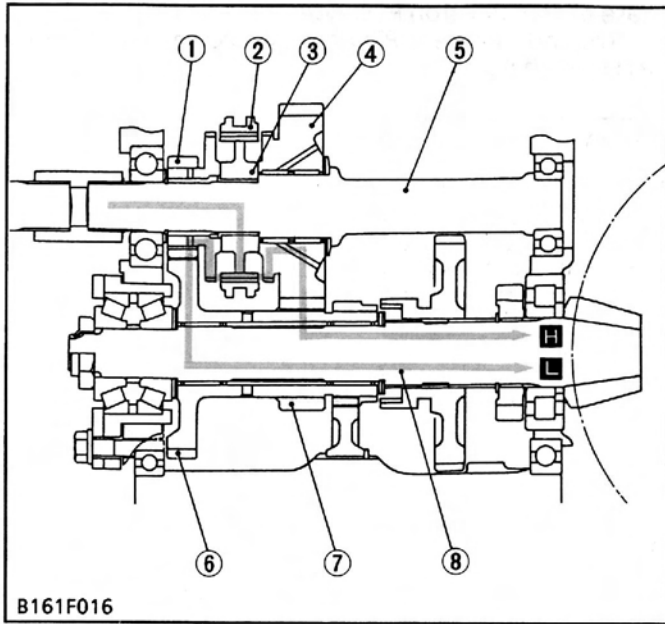
A double cone type synchromesh is used for the shuttle shift of the manual gear shift type transmission (except GST).

The double core type synchromesh is characterized by its light operating force and durability because it engages with the gear in reverse rotation when the speed is changed from forward to reverse position or vice versa.

Two synchronizing rings (3), (5) are installed on one side, and the center ring (4) is provided between the synchronizing rings. This construction doubles the ground contact area of the synchronizer rings (3), (5) and improves the durability as compared with the ordinary key type synchromesh.

- | | |
|-----------------------------|--------------------------|
| (1) Shuttle Shaft | (6) Synchronizer Key |
| (2) 18T Gear (F) | (7) Hub |
| (3) Outer Synchronizer Ring | (8) Shifter |
| (4) Center Ring | (9) 15T Gear (R) |
| (5) Inner Synchronizer Ring | (10) Synchronizer Spring |

(3) Hi-Lo Range Shift Section



Besides neutral, two ways of power flow from Hi-Lo shaft (5) to the spiral bevel pinion (8) are available by operating the Hi-Lo shift lever (manual gear shift type transmission) or Hi-Lo shift piston (GST).

The power is transmitted as follows.

L Lo-Range

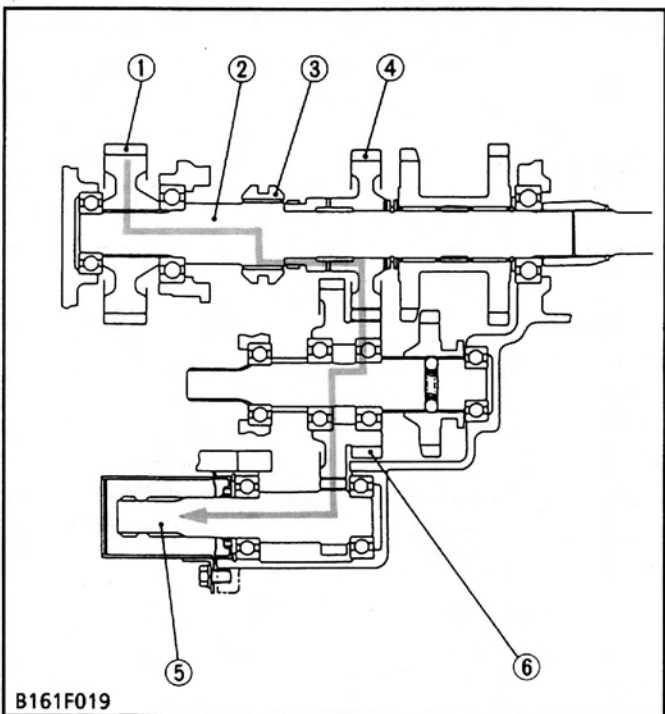
Hi-Lo Shaft (5) → Hub (3) → Shifter (2) → 18T Gear (1) → 42T Gear (6) → Spiral Bevel Pinion (8).

H Hi-Range

Hi-Lo Shaft (5) → Hub (3) → Shifter (2) → 33T Gear (4) → 16T Gear (7) → Spiral Bevel Pinion (8).

- (1) 18T Gear
- (2) Shifter
- (3) Hub
- (4) 33T Gear
- (5) Hi-Lo Shaft
- (6) 42T Gear (42T-16T Gear)
- (7) 16T Gear (42T-16T Gear)
- (8) Spiral Bevel Pinion

(4) Mid PTO Section



In these tractors, the power can be taken out from the mid case by installing the mid PTO system. (Factory option)

The power is transmitted to the mid PTO shaft (5) from the rear PTO drive shaft. Therefore the mid PTO is rotated, while mid PTO and rear PTO are engaged.

[Mid PTO Speed]

Model		Mid PTO rpm / Engine rpm
L3010 L3410	Transmission PTO	2000 min ⁻¹ (33.3 r/s, 2000 rpm) / 2623 min ⁻¹ (43.7 r/s, 2623 rpm)
	Independent PTO	2000 min ⁻¹ (33.3 r/s, 2000 rpm) / 2653 min ⁻¹ (44.2 r/s, 2653 rpm)
L3710	Transmission PTO	2000 min ⁻¹ (33.3 r/s, 2000 rpm) / 2404 min ⁻¹ (40.1 r/s, 2404 rpm)
	Independent PTO	2000 min ⁻¹ (33.3 r/s, 2000 rpm) / 2432 min ⁻¹ (40.5 r/s, 2432 rpm)

The power is transmitted as follows.

■ Engagement

Rear PTO Drive Shaft → 30T Gear (1) → PTO Drive Shaft (2) → Shifter (3) → 28T Gear (4) → 24T-42T Gear (6) → Mid PTO Shaft with 13T Gear (5).

- (1) 30T Gear
- (2) PTO Drive Shaft
- (3) Shifter
- (4) 28T Gear
- (5) Mid PTO Shaft with 13T Gear
- (6) 24T-42T Gear

(5) Rear PTO Shift Section

The rear PTO system offers a speed as shown in the table below.

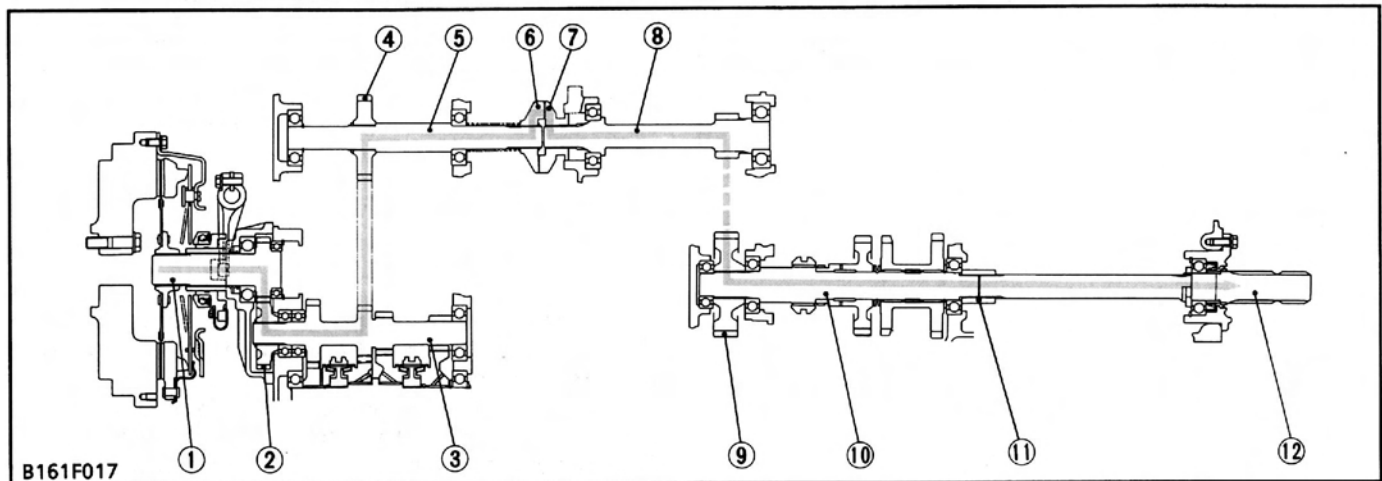
The one-way clutch cam is moved to left by the PTO gear shift lever linkage to disengage the PTO in

case of transmission PTO type.

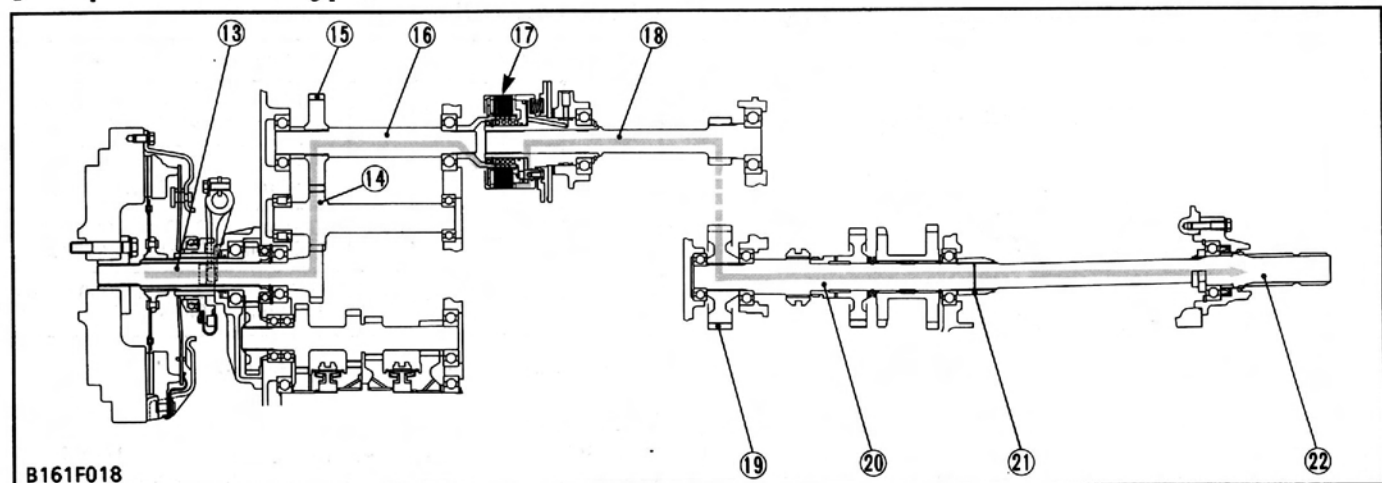
The independent PTO type is accomplished by the PTO clutch pack.

Model		PTO speed / at Engine speed
L3010 L3410	Transmission PTO	540 min ⁻¹ (9.0 r/s, 540 rpm) / 2670 min ⁻¹ (44.5 r/s, 2670 rpm)
	Independent PTO	540 min ⁻¹ (9.0 r/s, 540 rpm) / 2700 min ⁻¹ (45.0 r/s, 2700 rpm)
L3710 L4310	Transmission PTO	540 min ⁻¹ (9.0 r/s, 540 rpm) / 2447 min ⁻¹ (40.8 r/s, 2447 rpm)
	Independent PTO	540 min ⁻¹ (9.0 r/s, 540 rpm) / 2475 min ⁻¹ (41.3 r/s, 2475 rpm)

[Transmission PTO Type]



[Independent PTO Type]



- | | | | |
|---------------------------------------|--|-----------------------------------|---|
| (1) 24T Gear Shaft | (7) One-way Clutch Cam | (12) PTO Shaft | (18) PTO Gear Shaft with 11T Gear (L3010, L3410) with 12T Gear (L3710, L4310) |
| (2) 27T Gear | (8) PTO Gear Shaft with 11T Gear (L3010, L3410) with 12T Gear (L3710, L4310) | (13) PTO Gear Shaft with 18T Gear | (19) 30T Gear |
| (3) Main Gear Shaft (22T-18T-13T-10T) | (9) 30T Gear | (14) PTO Idle Shaft with 21T Gear | (20) PTO Drive Shaft |
| (4) 29T Gear | (10) PTO Drive Shaft | (15) 33T Gear | (21) Coupling |
| (5) PTO Counter Shaft | (11) Coupling | (16) PTO Counter Shaft | (22) PTO Shaft |
| (6) One-way Clutch Cam | | (17) PTO Clutch Pack | |

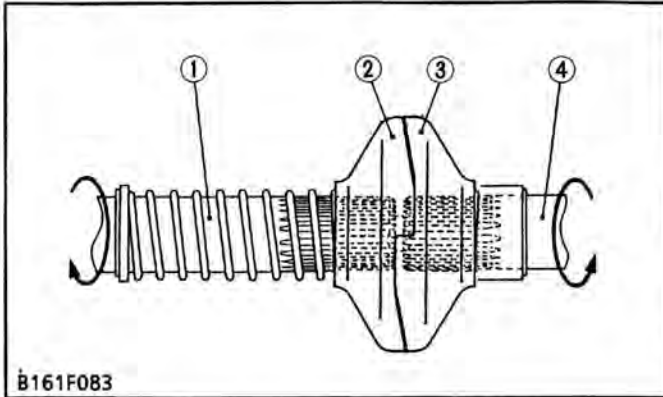
■ PTO Speed 540 rpm of Transmission PTO Type

24T Gear Shaft (1) → 27T Gear (2) → 22T-18T-13T-10T Main Gear Shaft (3) → 29T Gear (4) → PTO Counter Shaft (5) → One-way Clutch Cam (6) → One-way Clutch Cam (7) → PTO Gear Shaft with 11T Gear or 12T Gear (8) → 30T Gear (9) → PTO Drive Shaft (10) → Coupling (11) → PTO Shaft (12).

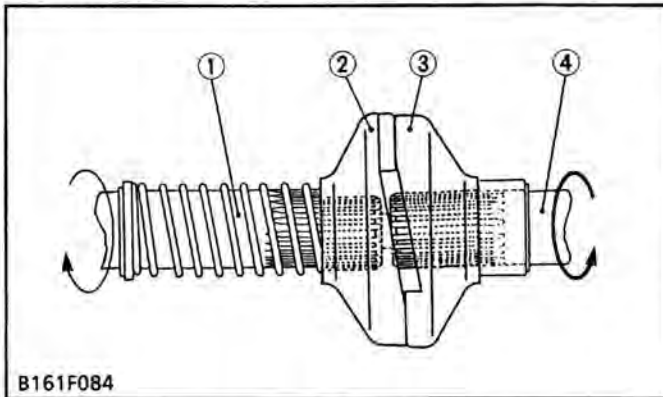
■ PTO Speed 540 rpm of Independent PTO Type

PTO Gear Shaft with 18T Gear (13) → PTO Idle Shaft with 21T Gear (14) → 33T Gear (15) → PTO Counter Shaft (16) → PTO Clutch Pack (17) → PTO Gear Shaft with 11T or 12T Gear (18) → 30T Gear (19) → PTO Drive Shaft (20) → Coupling (21) → PTO Shaft (22).

(6) One-way Clutch



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The transmission PTO type tractors are equipped with a one-way clutch.

The one-way clutch is located between the PTO counter shaft (1) and the PTO gear shaft (4). It is composed of a pair of slant cams and a clutch spring.

One of the slant cams is splined to the PTO counter shaft (1), and the other is splined to the PTO gear shaft (4).

These two slant cams are engaged with each other by the force of the clutch spring. While the PTO counter shaft (1) is driving the PTO gear shaft (4), these two slant cams will remain engaged.

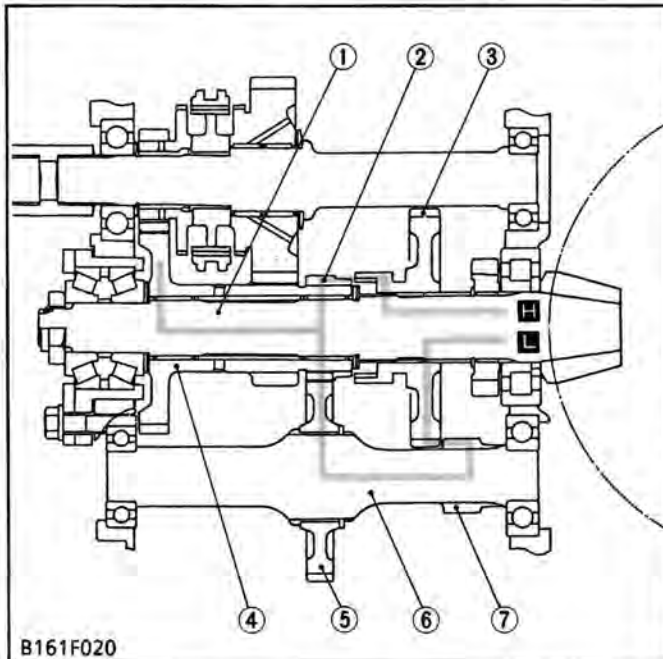
However, when the PTO shaft drives a rotary mower, for example, and if the engine speed is lowered, the slant cam (2), (3) on the PTO gear shaft (4) will overrun.

This overrunning is caused by the inertia of the mower's blades. Then, engagement will not take place until the PTO counter shaft (1) is running faster than the PTO gear shaft (4).

In this way, the one-way clutch protects the transmission and engine against damage, by allowing the PTO shaft, PTO drive shaft and PTO gear shaft (4) to overrun if PTO shaft overspeeds.

- (1) PTO Counter Shaft
- (2) Slant Cam
- (3) Slant Cam
- (4) PTO Gear Shaft

(7) Creep Speed Shift Section (Option)



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Creep speed section is located under the Hi-Lo range shift section to reduce a travelling speed. It is shifted by the creep shift lever.

The power is transmitted as follows.

[L] Low Speed (Creep Speed)

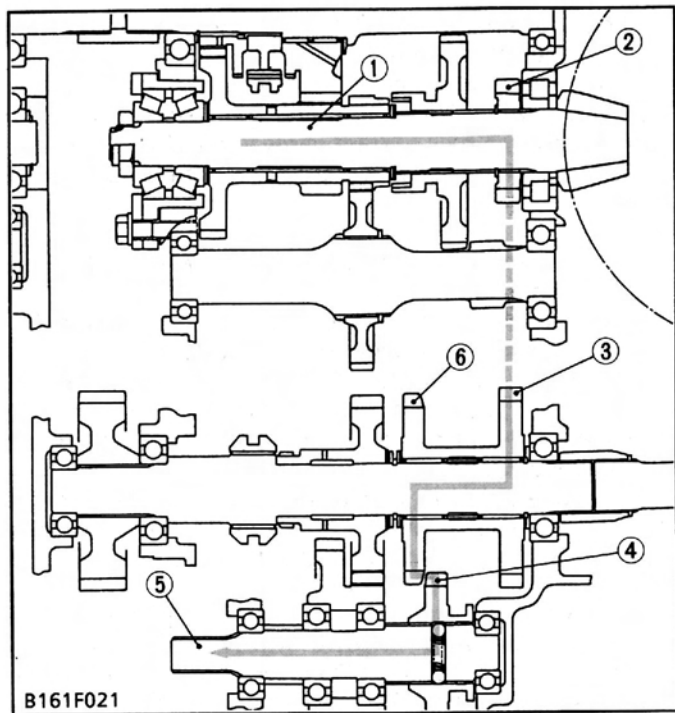
42T-16T Gear (4) → 18T Gear (2) → 41T Gear (5) → Creep Gear Shaft (6) → 12T Gear (7) → 47T Gear (3) → Spiral Bevel Pinion (1).

[H] High Speed (Normal Speed)

42T-16T Gear (4) → 18T Gear (2) → 47T Gear (3) → Spiral Bevel Pinion (1).

- (1) Spiral Bevel Pinion
- (2) 18T Gear (42T-16T-18T Gear)
- (3) 47T Gear
- (4) 42T-16T-18T Gear
- (5) 41T Gear
- (6) Creep Gear Shaft with 12T Gear
- (7) 12T Gear (Creep Gear Shaft with 12T Gear)

(8) Front Wheel Drive Section (For Four Wheel Drive Tractor)



Two wheel drive or four wheel drive is selected by operating the front wheel drive lever to shift the 24T shift gear (4).

When the front wheel drive lever is set to "Disengage", 24T shift gear (4) is in "Neutral" and power is not transmitted to the front drive shaft (5).

When the front wheel drive lever is set to "Engage", 24T shift gear (4) splined with front drive shaft (5) slides to the right side to engage with 29T gear (6). Then power is transmitted as follows.

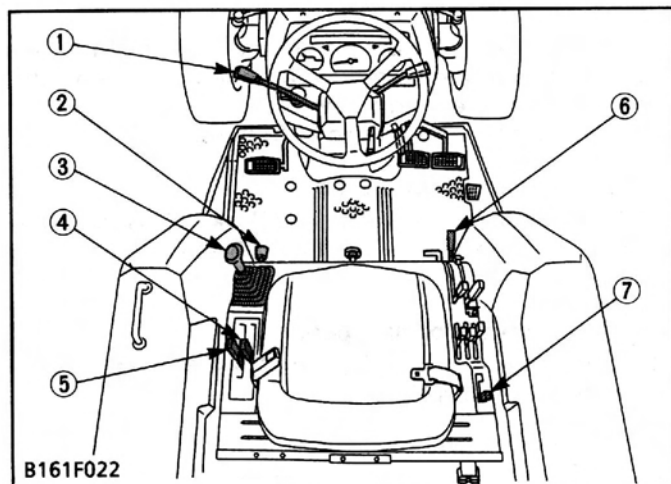
■ Engage

Spiral Bevel Pinion (1) → 17T or 18T Gears (2) → 29T or 31T Gears (3) → 29T Gear (6) → 24T Shift Gear (4) → Front Drive Shaft (5).

- | | |
|--|-----------------------|
| (1) Spiral Bevel Pinion | (4) 24T Shift Gear |
| (2) 17T Gear (L3010, L3410)
18T Gear (L3710, L4310) | (5) Front Drive Shaft |
| (3) 29T Gear (L3010, L3410)
31T Gear (L3710, L4310) | (6) 29T Gear |

[3] SHIFT LINKAGE MECHANISM

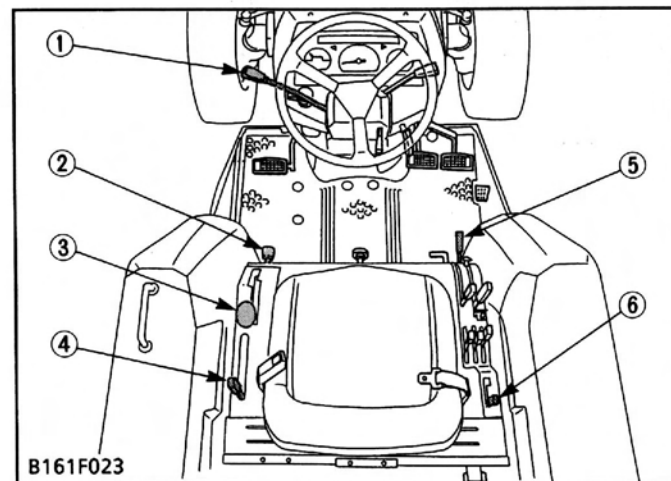
(1) Shift Levers



■ Manual Shift Transmission

The shuttle shift lever (1) is located at the steering post. The main shift lever (3), Hi-Lo shift lever (5) and creep speed shift lever (4) are located left side of the seat.

- | | |
|---|---------------------------------------|
| (1) Shuttle Shift Lever | (5) Hi-Lo Shift Lever |
| (2) Front Wheel Drive Lever (4WD Only) | (6) Mid PTO Shift Lever (If Equipped) |
| (3) Main Shift Lever | (7) PTO Shift Lever |
| (4) Creep Speed Shift Lever (If Equipped) | |

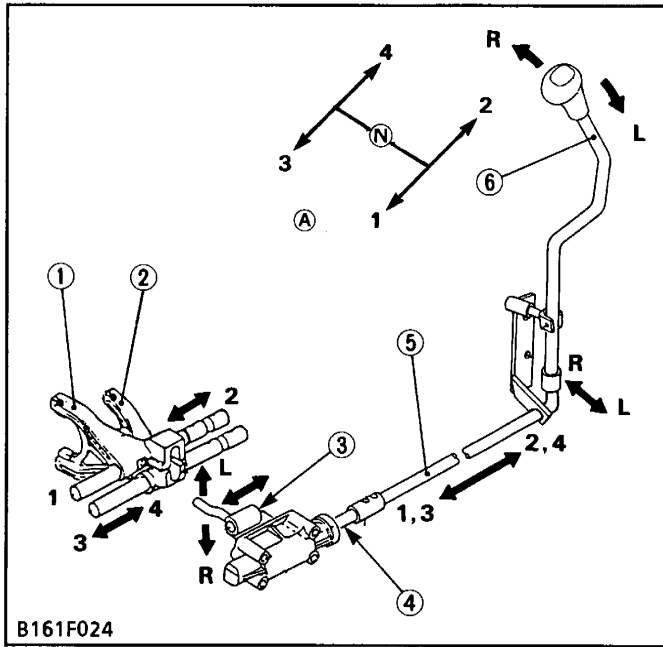


■ Glide Shift Transmission

The shuttle shift lever (1) is located at the steering post. The main shift lever (3), creep speed shift lever (4) are located left side of the seat. The glide shift transmission is not equipped with a Hi-Lo shift lever.

- | | |
|--|---|
| (1) Shuttle Shift Lever | (4) Creep Speed Shift Lever (If Equipped) |
| (2) Front Wheel Drive Lever (4WD Only) | (5) Mid PTO Lever (If Equipped) |
| (3) Main Shift Lever | (6) PTO Shift Lever |

(2) Main Gear Shift



■ **Manual Shift Transmission**

The links are connected from the shift lever (6) to the shift forks (1), (2) as shown in the left diagram. Each speed from the 1st to 4th can be changed by a single shift lever (6).

When the shift lever (6) is moved to the left, the shift arm (3) is engaged with the 1-2 shift fork (1), allowing the operator to change the 1st or the 2nd speed.

When the shift lever (6) is moved to the right, the shift arm (3) is engaged with the 3-4 shift fork (2), allowing the operator to change the 3rd or the 4th speed.

R: Right Movement
L: Left Movement

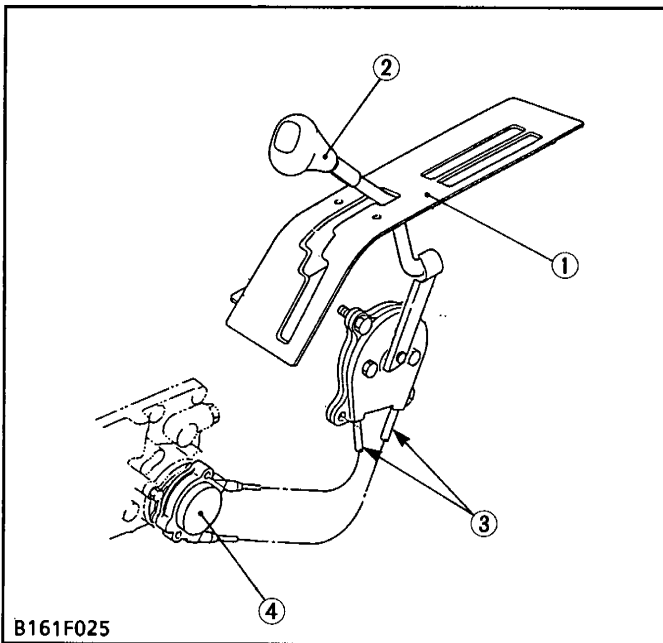
A: Front Side

1: 1st Shift
2: 2nd Shift

3: 3rd Shift
4: 4th Shift

(1) 1-2 Shift Fork
(2) 3-4 Shift Fork
(3) Shift Arm

(4) Shift Rod 1
(5) Shift Rod 2
(6) Shift Lever



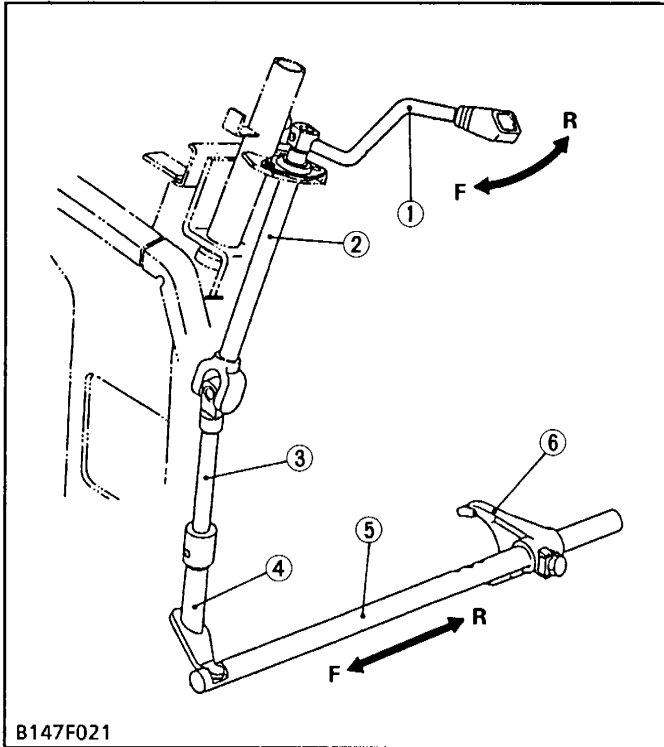
■ **Glide Shift Transmission**

Shifting of the main shift lever (2) makes the rotary valve (4) rotate forcibly via a wire cable (3). The rotary valve (4) distributes oil to the shift valves for the selected speeds.

(1) Lever Guide
(2) Main Shift Lever

(3) Wire Cable
(4) Rotary Valve

(3) Shuttle Shift



The links are connected from the shift lever (1) to the shift fork (6) as shown in the left figure.

When the shift lever (1) is moved to the F side, the shift fork (6) is moved toward the F side, allowing the operator to shift to forward by means of the shuttle universal joint (2), shuttle shift shaft (3), shift arm (4), and shuttle fork rod (5).

When the shift lever (1) is moved to the R side, the shift fork (6) is shifted to reverse position.

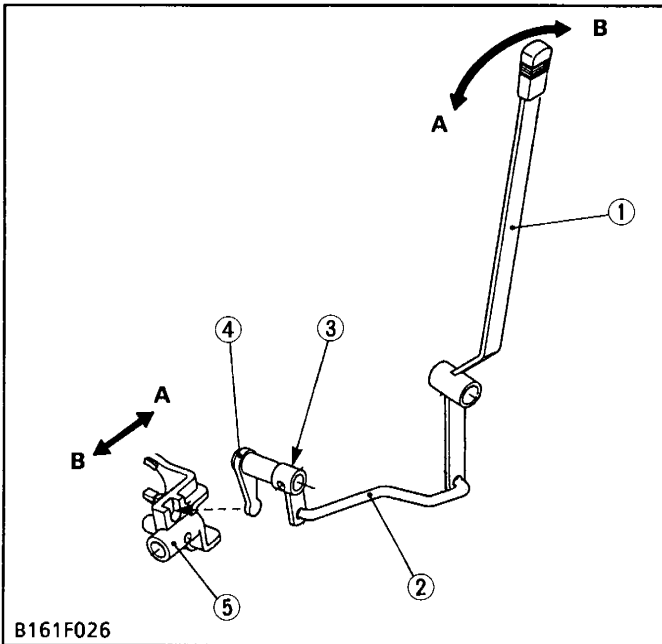
F : Forward Shift

R : Reverse Shift

- (1) Shuttle Shift Lever
- (2) Shuttle Universal Joint
- (3) Shuttle Shift Shaft

- (4) Shift Arm
- (5) Shuttle Fork Rod
- (6) Shift Fork

(4) Hi-Lo Shift (Except Glide Shift Transmission)



The links from the shift lever (1) to the shift fork (5) are connected as shown in the left figure.

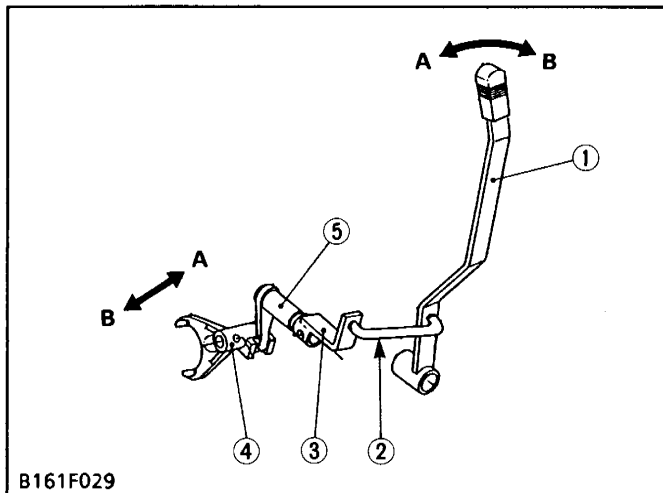
When the shift lever (1) is moved to the A side, the shift fork (5) is moved to the A side by means of the rod (2), sub-arm (3), and shift arm (4), changing the shift arm to the Lo-speed side. When the shift lever (1) is moved to the B side, the shift fork (5) is moved to the Hi-speed side.

A : Lo-speed Shift

B : Hi-speed Shift

- (1) Shift Lever
- (2) Rod
- (3) Sub-arm

- (4) Shift Arm
- (5) Shift Fork

(7) Creep Speed Shift

The links are connected from the shift lever (1) to the shift fork (4) as shown in the left figure.

When the shift lever (1) is moved to the A side, the shift fork (4) is moved to the A side by means of the rod (2), creep lever (3), and shift arm (5), thereby causing the creep shift.

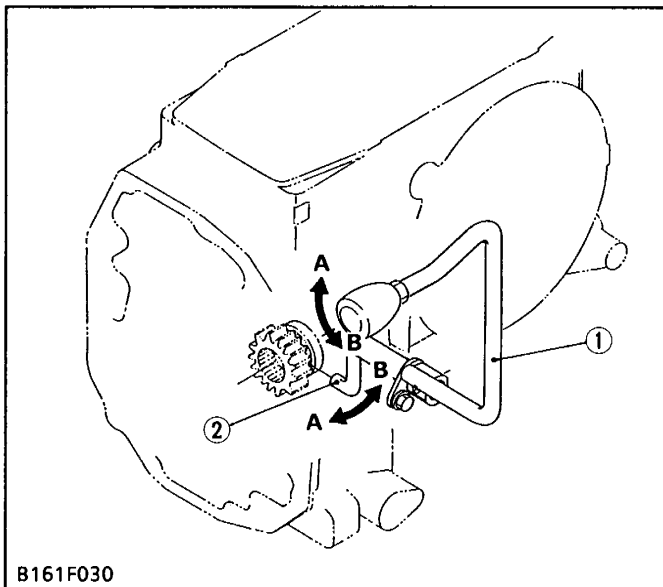
When the shift lever (1) is moved to the B side, the shift fork (4) is moved to the B side to cause the normal shift.

A : Creep Speed Shift

B : Normal Speed Shift

- (1) Shift Lever
- (2) Rod
- (3) Creep Lever

- (4) Shift Fork
- (5) Shift Arm

(8) Front Wheel Drive Shift

The shift lever (1) is connected directly to the shift fork (2).

When the shift lever (1) is moved to the A side, the shift fork (2) is also moved to the A side, then the front wheel drive is "Engaged".

When the shift lever (1) is moved to the B side, the front wheel drive is "Disengaged".

A : Engaged

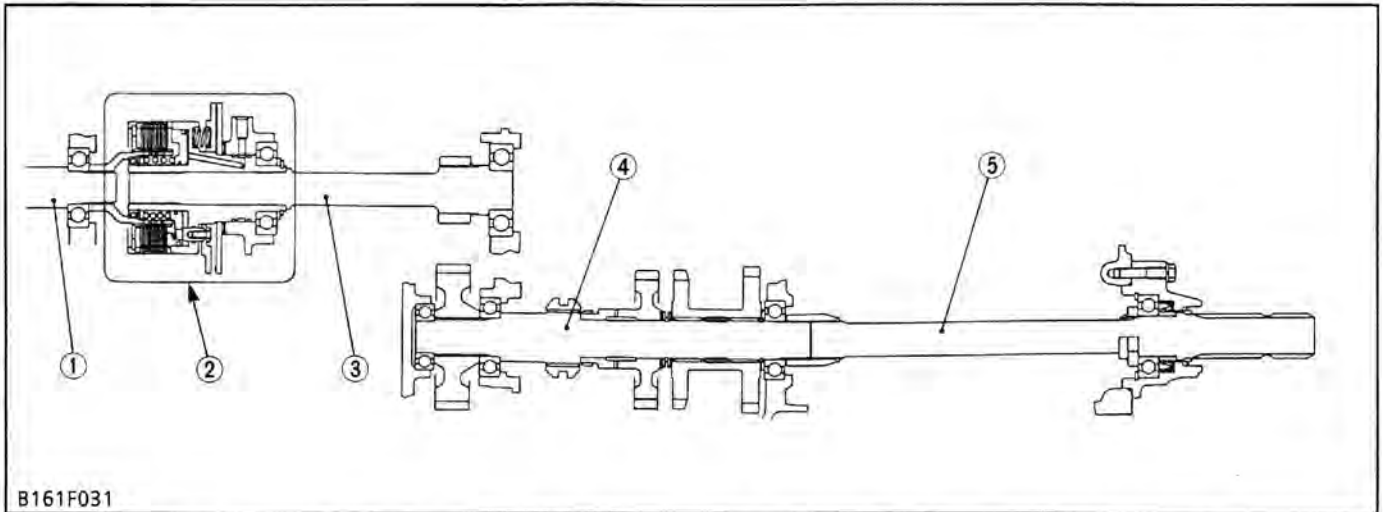
B : Disengaged

- (1) Shift Lever

- (2) Shift Fork

[4] INDEPENDENT PTO SYSTEM

(1) Structure

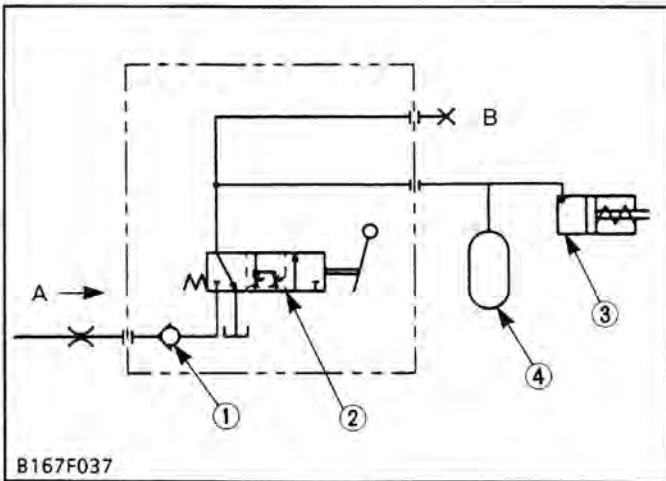


- (1) PTO Counter Shaft
- (2) PTO Clutch Pack
- (3) Gear Shaft
- (4) PTO Drive Shaft
- (5) PTO Shaft

The hydraulic multiple disk clutch is used for tractor with independent PTO. This PTO is controlled by the clutch and is independent of the driving

system. PTO is "ENGAGED" or "DISENGAGED" by operating the shift lever of the PTO clutch valve.

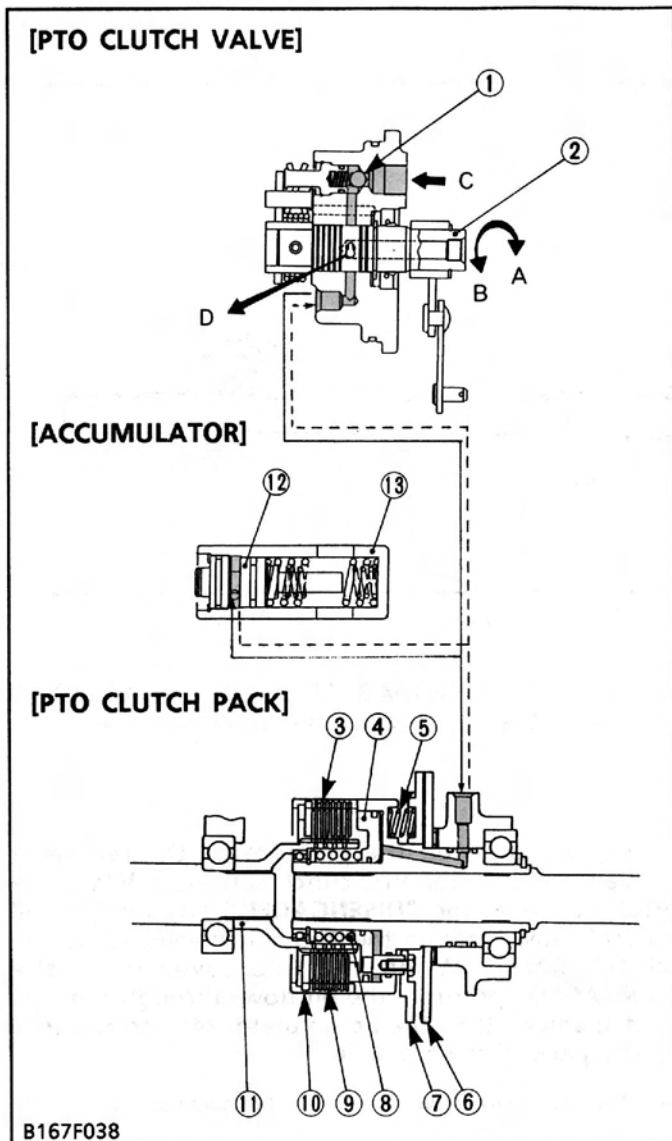
(2) Hydraulic Circuit



The oil adjusted the pressure by the regulator valve flows into the PTO clutch valve (2). When the PTO lever is at the "DISENGAGED" position, the oil doesn't flow through the PTO clutch valve (2) to the clutch pack. When the PTO lever is at the "ENGAGED" position, the oil flows through the PTO clutch valve (2) to the accumulator (4) and the PTO clutch pack (3) to engage it.

- A : From Regulator Valve
- B : Pressure Check Port
- (1) Check Valve
- (2) PTO Clutch Valve
- (3) PTO Clutch Pack
- (4) Accumulator

(3) Oil Flow



The oil from the regulator valve flows into the clutch valve and opens the check valve (1). When the shift lever is set at the "ENGAGED" position, the spool (2) is turned to A position, then the oil flows through the spool (2) into the accumulator and the clutch pack. Oil entering the clutch pack pushes the piston (4) to engage the clutch pack. The accumulator absorbs the engaging shock of the clutch pack.

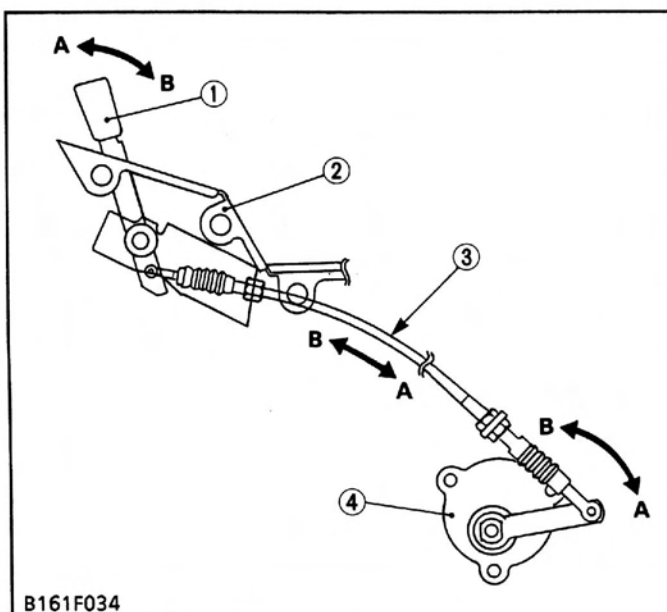
When the shift lever is set at the "DISENGAGED" position, the spool (2) is turned to B position, then the oil from the regulator valve is stopped by the spool (2) and the oil in the PTO clutch pack and accumulator is drained into the transmission case. Thus the piston (4) is pushed back by the return spring (8).

When the piston (4) is pushed back, the brake plate (7) is also moved to contact the brake disc (6) so as to stop the rotation and the drag of the PTO shaft.

- | | |
|--------------------------------|---|
| A : ENGAGED Position | C : From Regulator Valve |
| B : DISENGAGED Position | D : Drain
(To the Transmission Case) |

- | | |
|------------------|---------------------------|
| (1) Check Valve | (8) Return Spring |
| (2) Spool | (9) Clutch Discs |
| (3) Plate | (10) Back Plate |
| (4) Piston | (11) Clutch Hub |
| (5) Brake Spring | (12) Accumulator Piston |
| (6) Brake Disc | (13) Mid PTO Bearing Case |
| (7) Brake Plate | |

(4) Shift Linkage



The shift lever (1) and the PTO clutch valve (4) are connected by the shift cable (3) as shown in the left figure.

When the shift lever is moved to the B side, the PTO clutch valve (4) is set at "ENGAGED" position. Then the oil flows to clutch pack through the PTO clutch valve (4), and the clutch pack is engaged and the PTO shaft rotates. When the shift lever is moved to the A side, the PTO clutch valve (4) is set at the "DISENGAGED" position.

- | | |
|-----------------|----------------------|
| (1) Shift Lever | (3) Shift Cable |
| (2) Lever Guide | (4) PTO Clutch Valve |

[5] GLIDE SHIFT TRANSMISSION

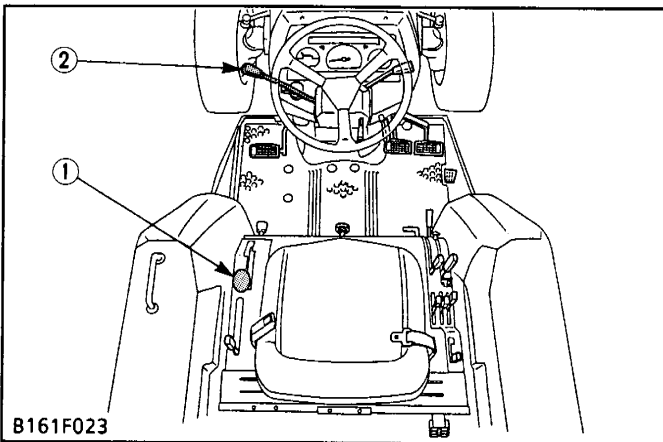
(1) Characteristic and Outline

A series of mechanical operations are instantly performed hydraulically by the new GST, an upgraded version of the GST, without having to step on the clutch. Simply move either the main shift lever (1) or the shuttle shift lever (2), and the hydraulic clutch is automatically disengaged, shifting takes place to the appropriate synchronized gear, and the hydraulic clutch is once more engaged.

To make possible smooth, swift, and shock resistant gear shift operations and to ensure the best possible clutch engagement for each tractor speed,

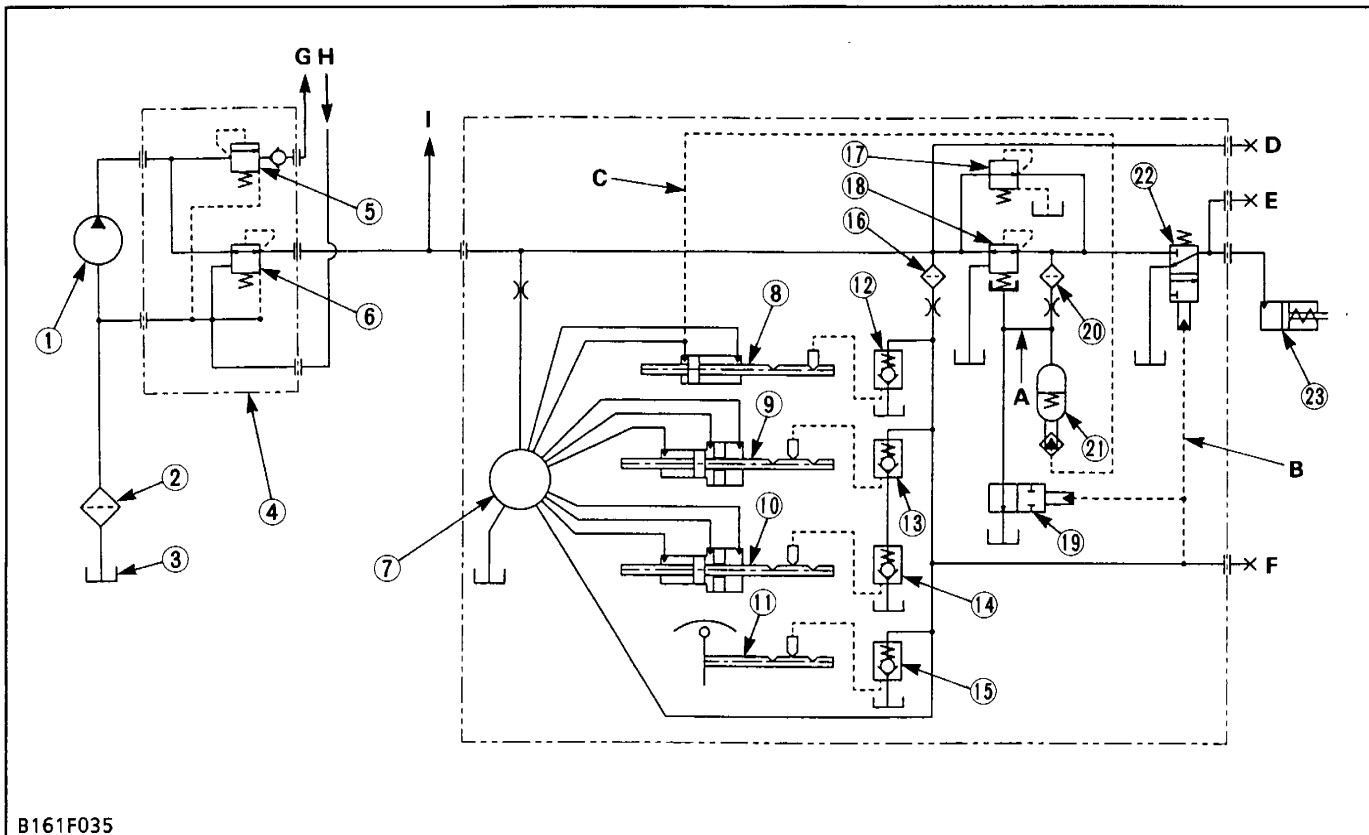
the hydraulic clutch pack exhibits separate "Pressure rise control characteristics" for "Low-speed shifting" (N → 1st → 2nd → 3rd → 4th) and "High-speed shifting" (4th → 5th → 6th → 7th → 8th).

Made possible by the incorporation of superior KUBOTA hydraulic technology, this exceptionally advanced transmission permits swift shifting with minimal power loss between 1st and 8th gears as well as between forward and reverse without using the clutch.



(1) Main Shift Lever

(2) Shuttle Shift Lever

(2) Hydraulic Circuit

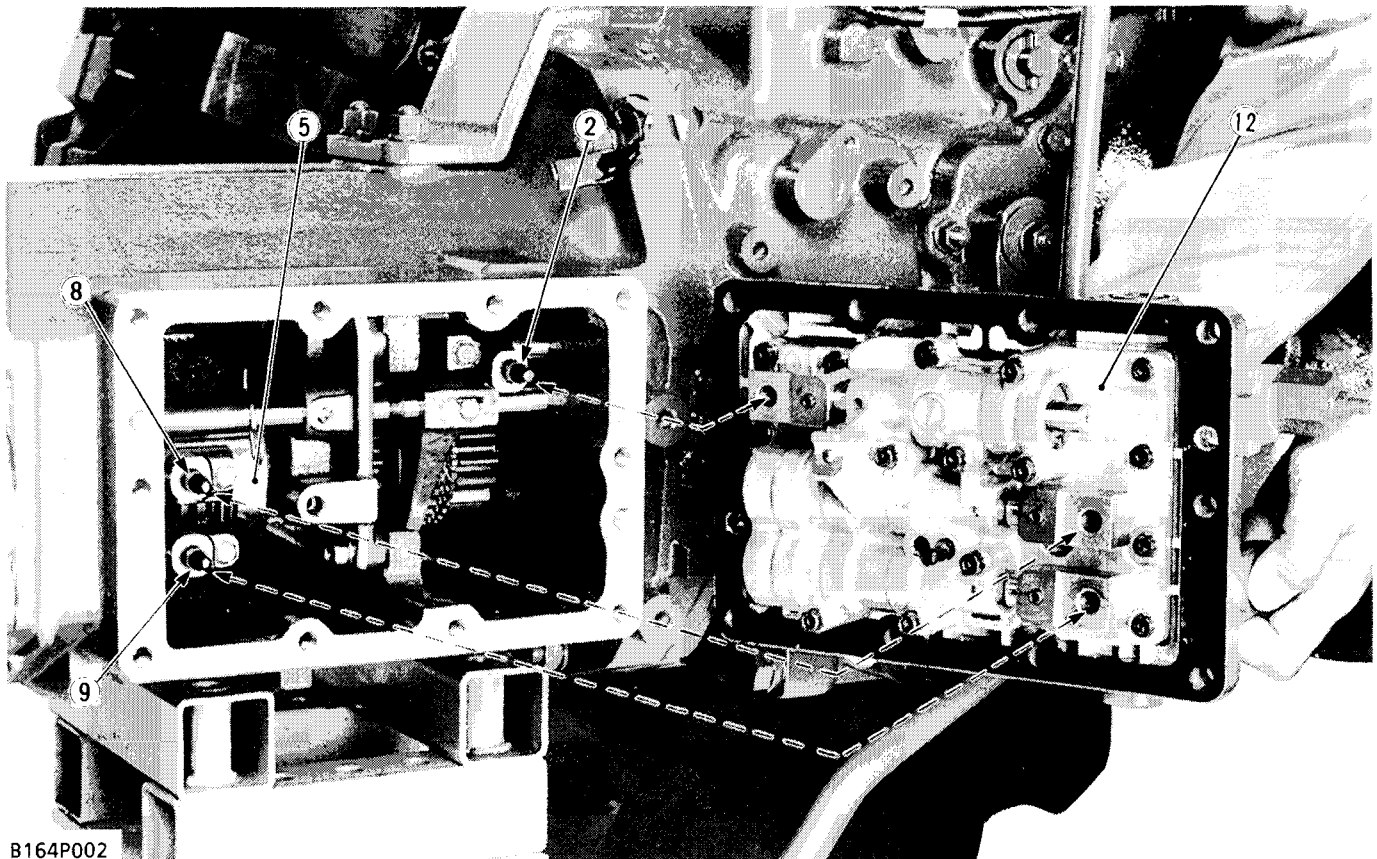
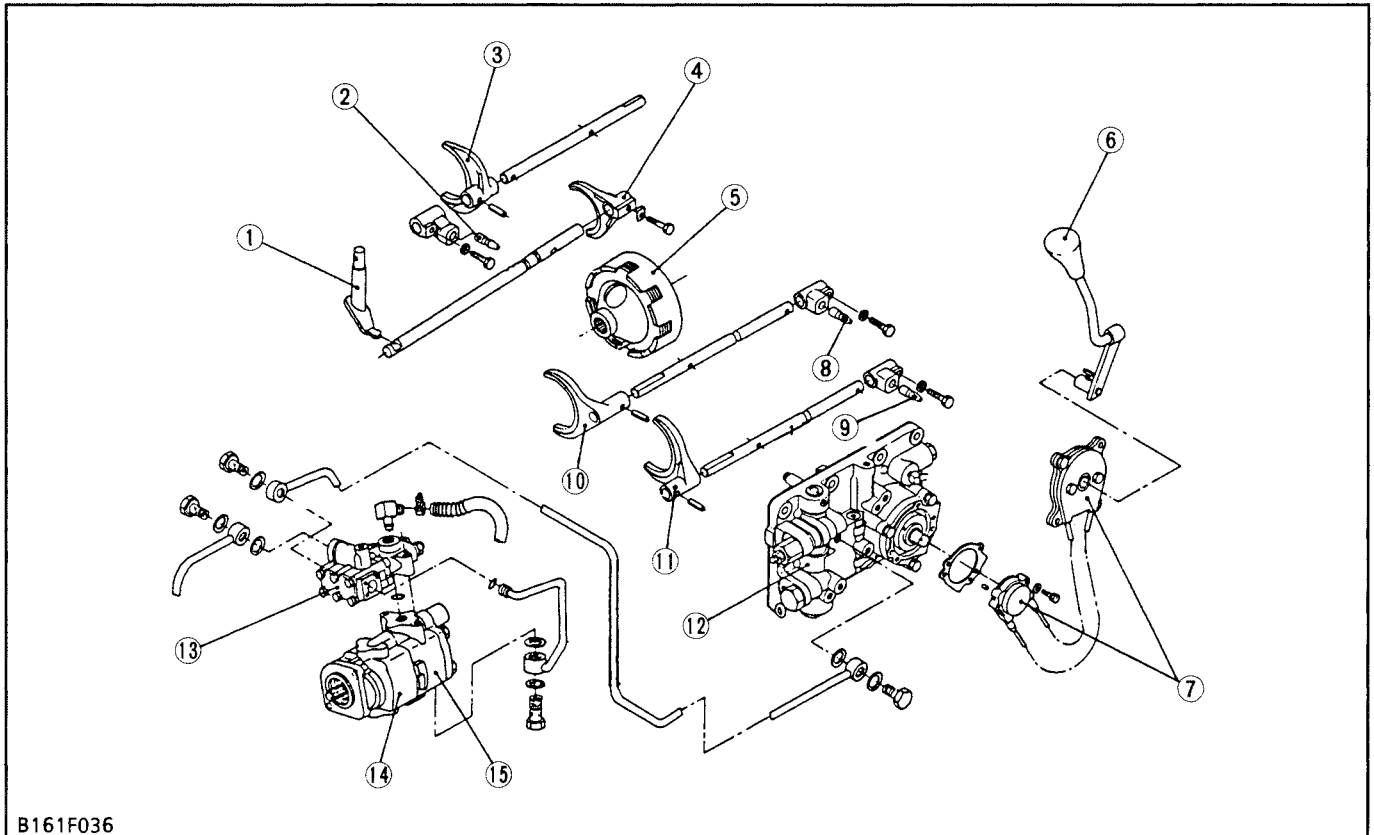
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- | | | | |
|------------------------------|----------------------------------|--|---|
| (1) Hydraulic Pump | (10) Shift Piston (1, 2) | (19) Modulating Check Valve | D : Check Port
(GST System Pressure) |
| (2) Oil Filter | (11) Shuttle Shift Rod | (20) Line Filter | E : Check Port
(Clutch Pack Pressure) |
| (3) Oil Tank | (12) Shift Check Valve (H, L) | (21) Accumulator | F : Check Port (Pilot Pressure) |
| (4) Regulator Valve Assembly | (13) Shift Check Valve (3, 4) | (22) Clutch Valve | G : To Power Steering Circuit |
| (5) Relief Valve | (14) Shift Check Valve (1, 2) | (23) Clutch Pack | H : From Power Steering Circuit |
| (6) Reducing Valve | (15) Shift Check Valve (Shuttle) | | I : To Independent PTO Clutch |
| (7) Rotary Valve | (16) Line Filter | A : Modulating Feedback Circuit | |
| (8) Shift Piston (H, L) | (17) Low-pass Valve | B : Pilot Circuit | |
| (9) Shift Piston (3, 4) | (18) Modulating Valve | C : Accumulator Pilot Circuit | |

- When the engine is started, hydraulic pump (1) rotates and sucks in the oil from the oil tank (3). The oil is filtered through the oil filter (2).
- The oil entering the regulator valve (4) flows through the reducing valve (6) to the GST circuit. The oil pressure is maintained at a fixed level by the reducing valve (6). Other oil flows through the relief valve (5) to the power steering circuit.
- When the main shift lever is moved, the rotary valve (7) is activated to drain the oil in the pilot circuit (B), and the clutch pack (23) is disengaged.
- Then, the oil is supplied from the rotary valve (7) to the shift pistons (8), (9), (10) to shift the gear. When the gear is shifted, the shift check valves (12), (13), (14), (15) are closed, pressurizing the pilot circuit (B). When the gear is shifted to the Hi-speed side (5th, 6th, 7th, 8th speed) during the above oil flow, the accumulator pilot circuit (C) is pressurized.

- The clutch valve (22) is opened and the modulating check valve (19) is closed by the pressure of the pilot circuit (B).
- The clutch valve (22) is opened and the oil flows to the clutch pack (23) through the low-pass valve (17), the modulating valve (18). During this period, the pressure is built up gradually by the low-pass valve (17), modulating valve (18), and accumulator (21), causing the clutch to be engaged smoothly. When the speed is changed to the Hi-speed side (5th, 6th, 7th, 8th speed), the volume of the accumulator (21) is reduced and the pressurizing time is changed.

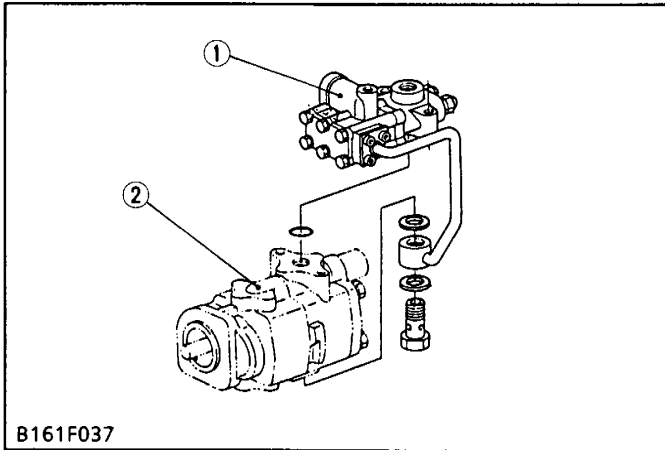
(3) Structure



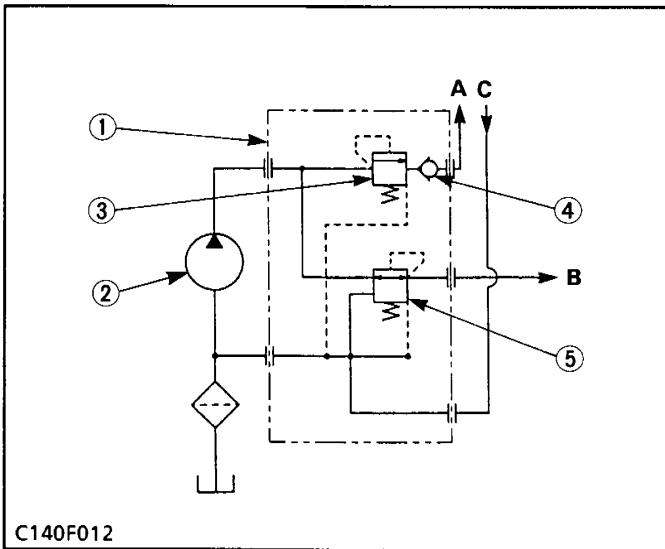
- | | | | |
|-------------------------|----------------------|-------------------------------|--|
| (1) Shuttle Shift Lever | (6) Main Shift Lever | (10) Shift Fork 3-4 | (14) Hydraulic Pump for Three Points Linkage |
| (2) Shift Pin H-L | (7) Shift Cable | (11) Shift Fork 1-2 | (15) Hydraulic Pump for Power Steering |
| (3) Shift Fork H-L | (8) Shift Pin 3-4 | (12) GST Valve Assembly | |
| (4) Shuttle Shift Fork | (9) Shift Pin 1-2 | (13) Regulator Valve Assembly | |
| (5) Clutch Pack | | | |

(4) Construction Parts

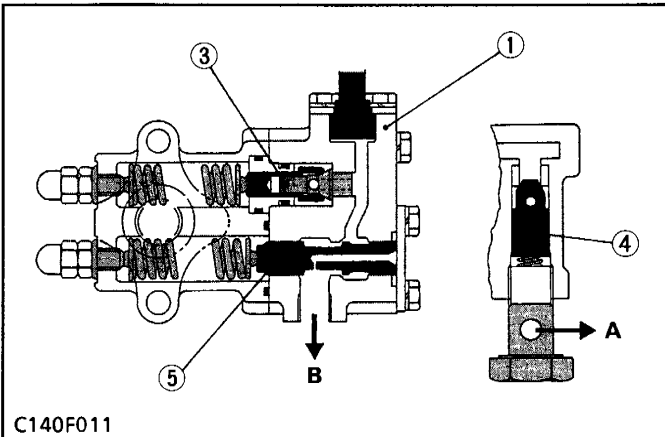
(4)-1 Regulator Valve



B161F037



C140F012



C140F011

■ Function

The oil from the hydraulic pump for the power steering system flows to the GST circuit to set the pressure of the circuit. Other oils flow to the power steering circuit.

■ Oil Flow

The oil from the power steering hydraulic pump (2) flows through the reducing valve (5) to the GST circuit. When the oil is filled into the circuit, the reducing valve (5) is closed to maintain the pressure in the GST system circuit to 2.45 MPa (25.0 kgf/cm², 356 psi).

The oil from the power steering pump passes through the relief valve (3) and check valve (4), then it flows to power steering circuit. The relief valve (3) is provided to maintain 2.94 MPa (30.0 kgf/cm², 427 psi) at inlet pressure of the reducing valve (5) except when the power steering is operated. Thereby the GST circuit pressure is gotten to 2.45 MPa (25.0 kgf/cm², 356 psi).

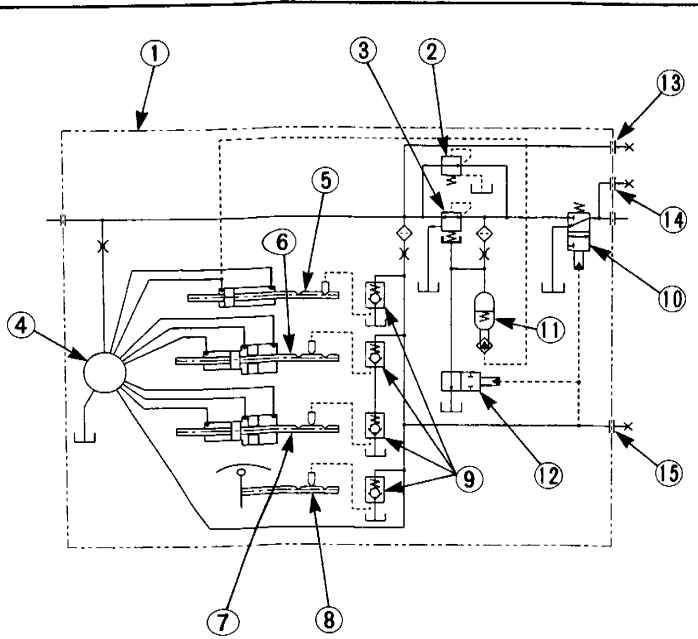
A : To Power Steering Circuit
B : To GST Circuit

C : From Power Steering Circuit

- (1) Regulator Valve
- (2) Hydraulic Pump
- (3) Relief Valve

- (4) Check Valve
- (5) Reducing Valve

4)-2 GST Valve Assembly



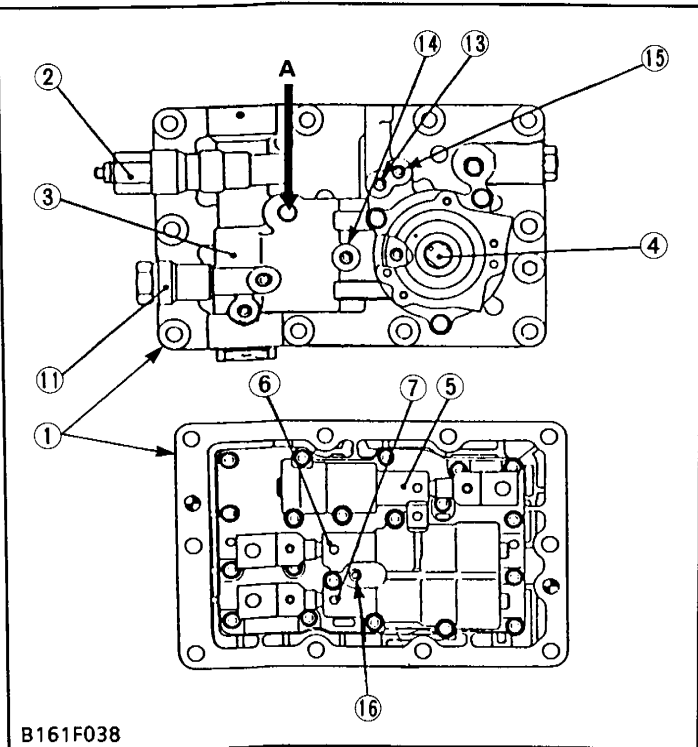
C140F010

■ Function

The GST valve assembly (1) is installed at the left side of the transmission. In the GST valve assembly, many parts comprising the system are installed, including the rotary valve (4), low-pass valve (2), modulating valve (3), clutch valve (10), accumulator (11), modulating check valve (12), shift pistons (5), (6), (7), and shift check valves (9). The GST valve assembly functions as the central unit of the GST system.

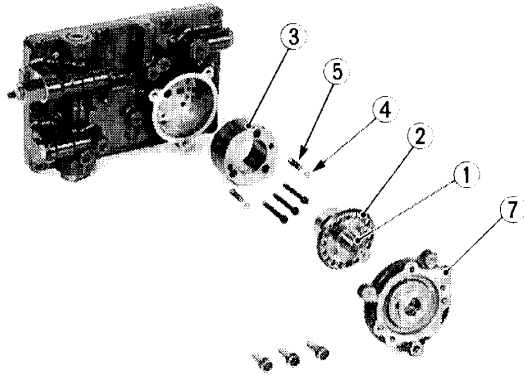
A : From Regulator Valve

- | | |
|-------------------------|---|
| (1) GST Valve Assembly | (10) Clutch Valve |
| (2) Low-pass Valve | (11) Accumulator |
| (3) Modulating Valve | (12) Modulating Check Valve |
| (4) Rotary Valve | (13) Check Port
(GST System Pressure) |
| (5) Shift Piston (H, L) | (14) Check Port
(Clutch Pack Pressure) |
| (6) Shift Piston (3, 4) | (15) Check Port (Pilot Pressure) |
| (7) Shift Piston (1, 2) | (16) Clutch Port |
| (8) Shuttle Shift Rod | |
| (9) Shift Check Valves | |

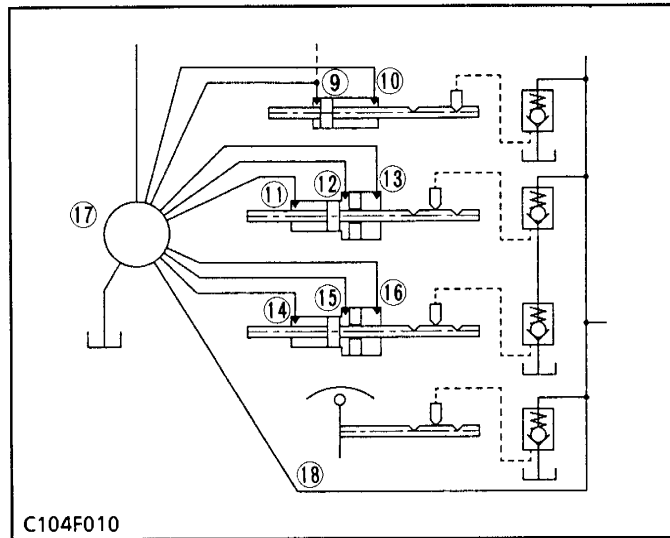


B161F038

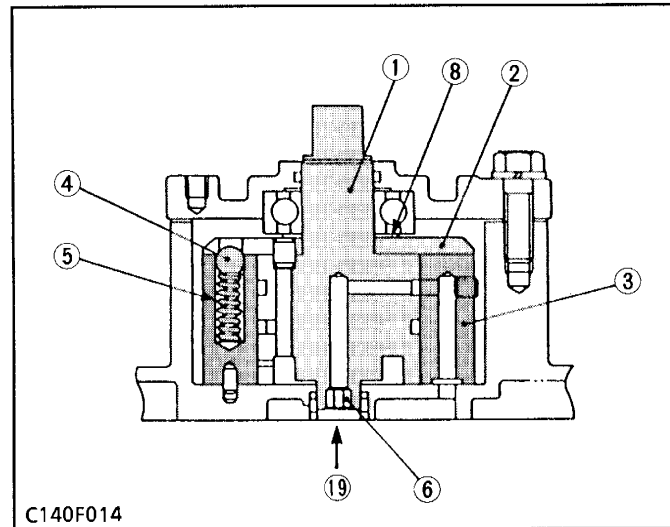
(4)-3 Rotary Valve



C143P070



C104F010



C140F014

Function

When the main shift lever is moved, the rotary valve (17) is actuated and oil is distributed to each shift piston. Also, the oil in the pilot circuit is drained and the clutch pack is disengaged, thereby shifting the gear.

Oil Flow

When the rotor (1) is rotated by the main shaft lever, the oil is drained from the pilot circuit and the modulate feedback circuit. At the same time, the oil from the regulator valve is supplied to the shift pistons according to the gear shifting operation. Oil distribution of the rotary valve (17) is shown in the table below.

[Pressure Port Table]

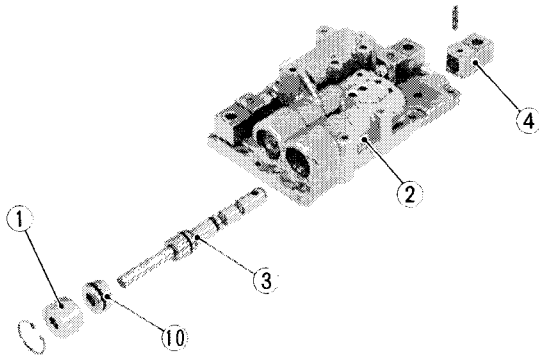
Shift range	Ports							
	H (10)	H (9)	1st (14)	2nd (15)	n1-2 (16)	3rd (11)	4th (12)	n3-4 (13)
Neutral	—	—	○	—	○	○	—	○
1st	○	—	○	—	—	○	—	○
2nd	○	—	—	○	—	○	—	○
3rd	○	—	○	—	○	○	—	—
4th	○	—	○	—	○	—	○	—
5th	—	○	○	—	—	○	—	○
6th	—	○	—	○	—	○	—	○
7th	—	○	○	—	○	○	—	—
8th	—	○	○	—	○	—	○	—

* Circles represent the oil pressurized ports. Minus signs represent the drain ports.

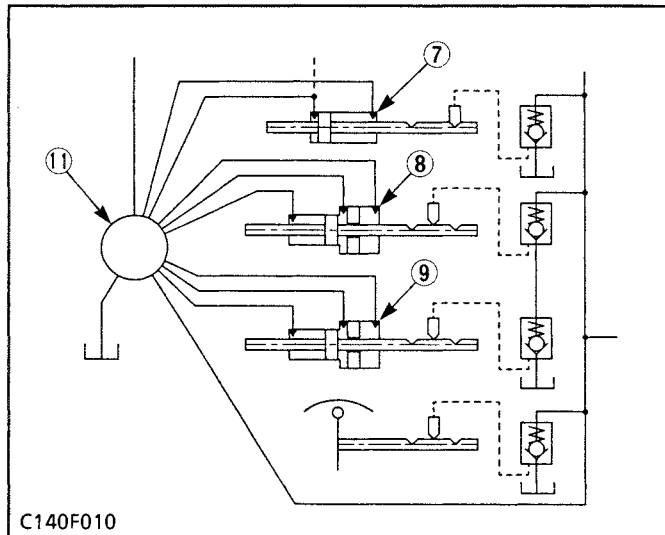
* During the gear shift, the pilot port (18) operates as the drain circuit in the rotary valve and is closed after the speed is changed.

- (1) Rotor
- (2) Detente Plate
- (3) Valve Case
- (4) Ball
- (5) Detente Spring
- (6) Orifice
- (7) Rotary Valve Case
- (8) 20 Thrust Collar
- (9) H Port
- (10) L Port
- (11) 3rd Port
- (12) 4th Port
- (13) n3-4 Port
- (14) 1st Port
- (15) 2nd Port
- (16) n1-2 Port
- (17) Rotary Valve
- (18) Pilot Port
- (19) Pump Port

(4)-4 Shift Pistons



B164P004



C140F010

Function

The shift pistons (7), (8), (9) are actuated by the oil distributed by the rotary valve (11). At the tip of these shift pistons are installed the shifters (4), which are connected to each shift rod and shift the gear.

Oil Flow

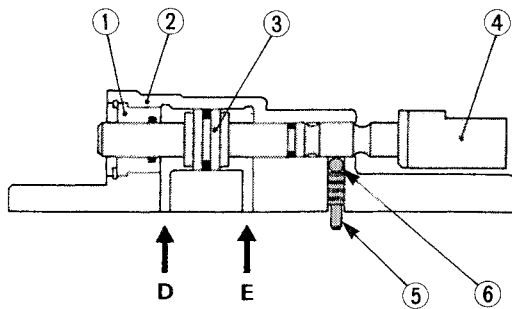
The shift piston H-L (7) allows the oil to flow to the L port (E) for low shift (1st, 2nd, 3rd, 4th) and to the H port (D) for high shift (5th, 6th, 7th, 8th), thus changing the speed accordingly.

The shift piston 1-2 (9) and the shift piston 3-4 (8) allow the oil to flow to the 1st port (C) or the 3rd port (C) for the 1st or 3rd shift and to flow to the 2nd port (B) or 4th port (B) for the 2nd or 4th shift, causing the shift piston (3) to move to shift the gear. When set at the neutral position, the oil is flow to the n1-2 port (A) or the n3-4 port (A) and the 1st port (C) or the 3rd port (C), thereby maintaining the neutral position.

- | | |
|-----------------------------------|-------------------|
| A : n1-2 Port or n3-4 Port | D : H Port |
| B : 2nd Port or 4th Port | E : L Port |
| C : 1st Port or 3rd Port | |

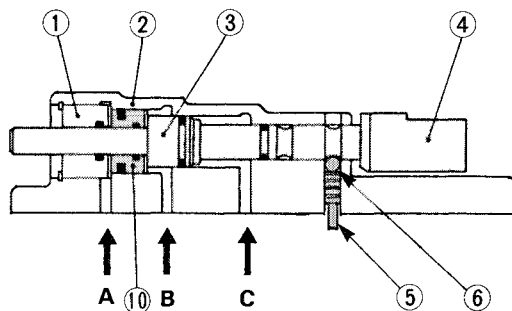
- | | |
|----------------------|----------------------|
| (1) Cover | (7) Shift Piston H-L |
| (2) Shift Valve Body | (8) Shift Piston 3-4 |
| (3) Shift Piston | (9) Shift Piston 1-2 |
| (4) Shifter | (10) Neutral Piston |
| (5) Check Pin | (11) Rotary Valve |
| (6) Ball | |

[SHIFT PISTON H-L]



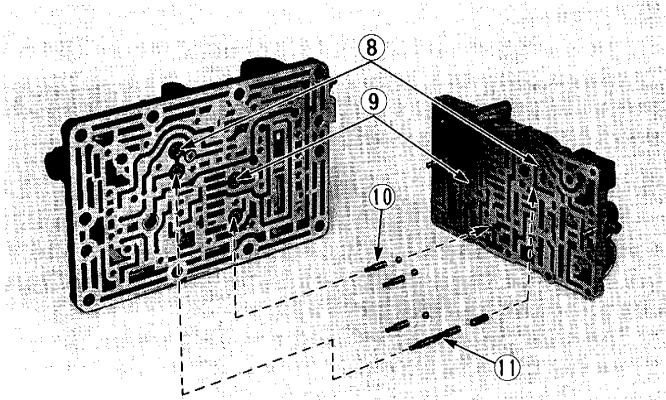
B161F039

[SHIFT PISTON 1-2, 3-4]

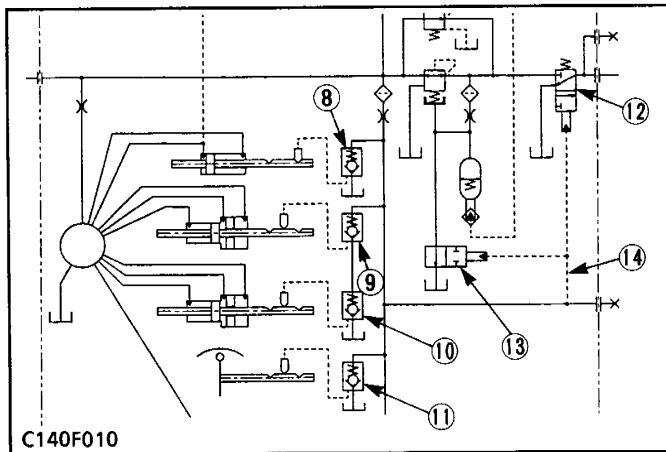


C140F015

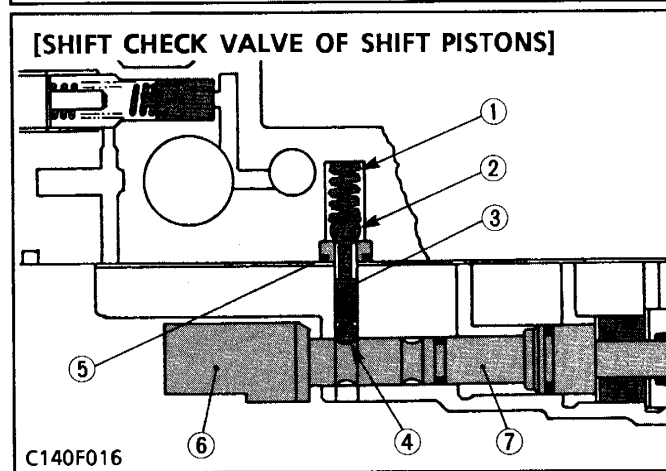
(4)-5 Shift Check Valves



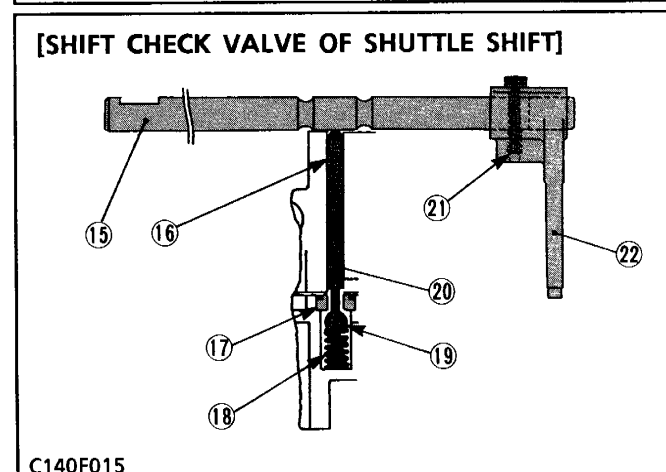
C143P072



C140F010



C140F016



C140F015

■ Function

The shift check valves (8), (9), (10), (11) are provided on the shift pistons (7) of the shift piston H-L, shift piston 1-2, shift piston 3-4 and the shuttle shift rod. These shift check valves detect the start and end of gear shifting.

■ Oil Flow

From the start to the end of gear shifting, the shift check valves (8), (9), (10) of the shift pistons are opened because the ball (4) of the check pin (3) is on the straight portion of the shift piston (7). Therefore, between this portion, the oil in the pilot circuit of the clutch valve (12) and modulate check valve (13) passes through the shift check valves (8), (9), (10), (11) to be drained into the tank, causing the clutch pack to be disengaged.

When the gear shifting is completed, the ball (4) of the check pin (3) enters the groove of the shift piston (7), the check valve is closed, causing the pilot circuit pressure to rise and the clutch valve (12) to open. Thus, the oil flows into the clutch pack to engage it.

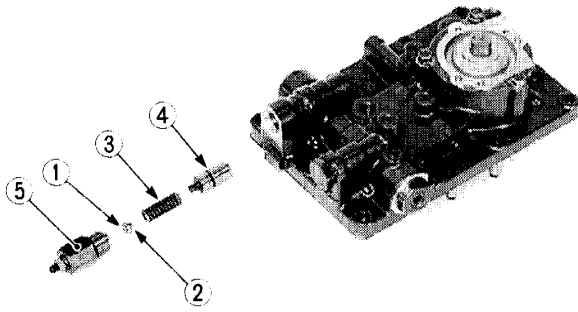
The shift check valve (1-2) (10) and the shift check valve (3-4) (9) compose a serial circuit. When either valve is closed, the oil in the pilot circuit will not be drained into the tank.

In the case of the shuttle shift, the shift check valve (11) is opened and closed by the groove of the shuttle shift fork rod (15).

Note that the shuttle shift fork rod (15) has a slot into which the shift fork mounting bolt (21) is inserted. Therefore, when the shuttle shift lever is moved, the shuttle shift fork rod (15) is moved before the shuttle shift fork (22) is moved, disengaging the clutch pack and thus moving the shuttle shift fork (22).

- | | |
|----------------------------------|-----------------------------|
| (1) Check Spring | (12) Clutch Valve |
| (2) Ball | (13) Modulate Check Valve |
| (3) Check Pin | (14) Pilot Circuit |
| (4) Ball | (15) Shuttle Shift Fork Rod |
| (5) Check Valve Seat | (16) Pin |
| (6) Shifter | (17) Check Valve Seat |
| (7) Shift Piston | (18) Spring |
| (8) Shift Check Valve (H-L) | (19) Ball |
| (9) Shift Check Valve (3-4) | (20) Check Pin |
| (10) Shift Check Valve (1-2) | (21) Bolt |
| (11) Shift Check Valve (Shuttle) | (22) Shuttle Shift Fork |

(4)-6 Low-pass Valve



Function

After completion of the gear shifting, the low-pass valve opens immediately to flow oil into the clutch pack (8), to promote the engagement of the clutch pack.

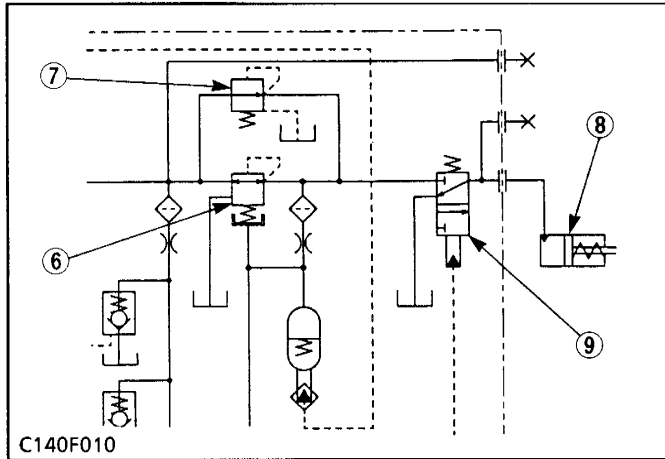
When the gear shifting starts, the oil in the clutch pack (8) passes the clutch valve (9) to be drained into the tank.

So prior to the beginning of the clutch pack engagement and after completion of shifting. It is necessary to flow oil quickly to the clutch pack (8). It is the low-pass valve that does this operation.

Oil Flow

The oil from the regulator valve flows in from the **IN-port (A)**, passes through the low-pass spool, flows out from the **OUT-port (B)**, and flows to the clutch pack (8). When the pressure on the side of the **OUT-port (B)** reaches fixed pressure, the low-pass spool (4) pushes the spring (3) to close the circuit.

C143P073



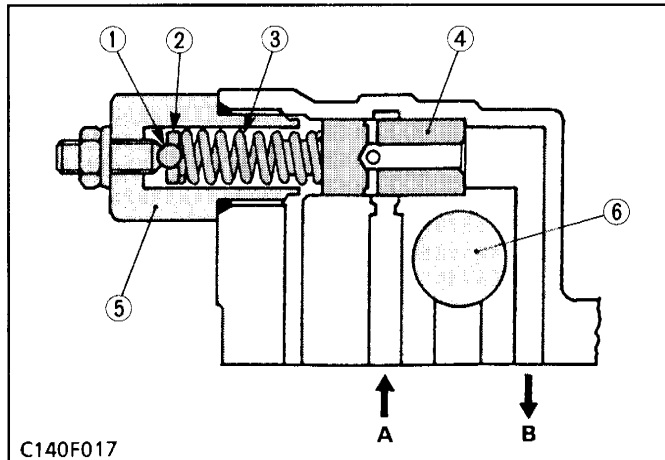
C140F010

A : IN-Port

B : OUT-Port

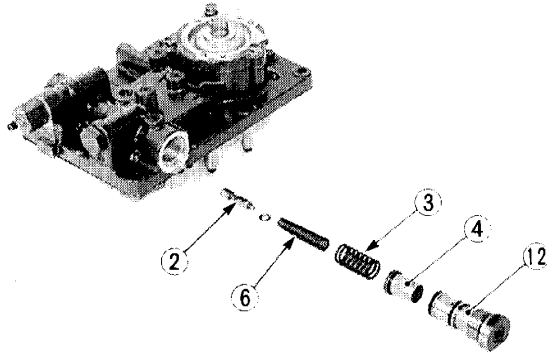
- (1) Ball
- (2) Spring Support
- (3) Spring
- (4) Low-pass Spool
- (5) Plug

- (6) Modulating Valve
- (7) Low-pass Valve
- (8) Clutch Pack
- (9) Clutch Valve

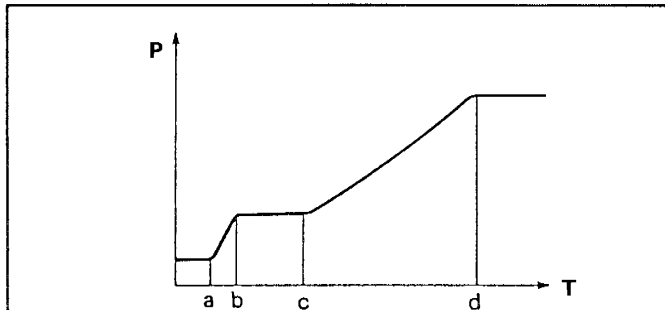


C140F017

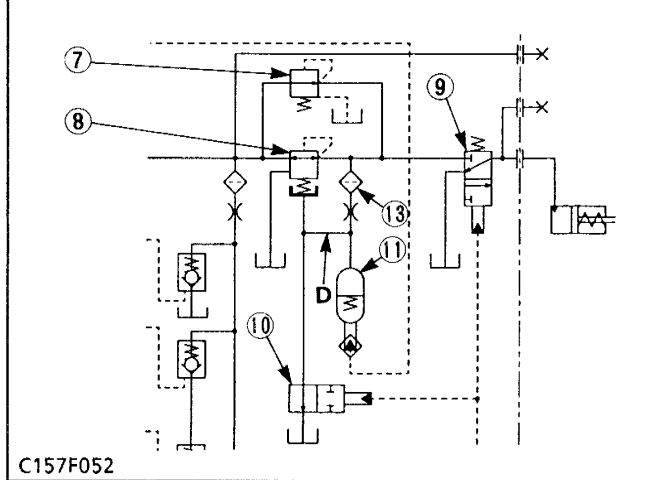
(4)-7 Modulating Valve



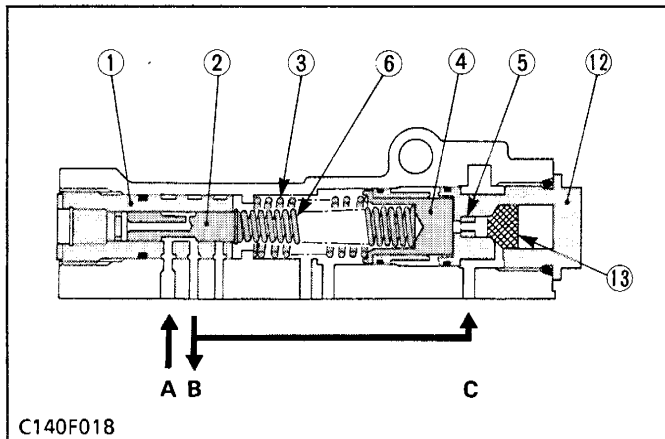
C143P071



C140F019



C157F052



C140F018

Function

After the gear shifting is completed, pressure of the clutch pack is gradually increased in order to engage the clutch pack smoothly with reduced shock.

Oil Flow

When the gear shifting is completed, the clutch valve (9) is opened and at the same time, the modulating check valve (10) is closed.

As stated above, the oil is filled into the clutch pack through the low-pass valve (7). (a to b, b to c)

At the same time, the modulating valve (8) starts operation, too. The oil flowing to the clutch pack also flows to the modulate feedback circuit (D), enters the back of the modulating piston (4), increases the tensile force of the modulating spring (6), and the modulating spool (2) is moved to open position.

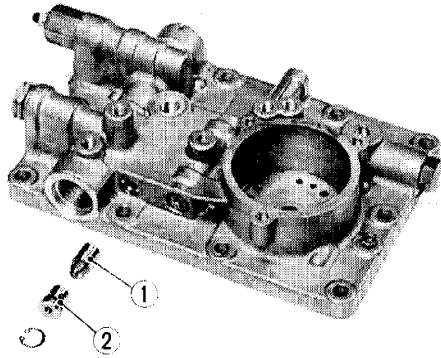
Therefore, the oil from the regulator valve flows to the clutch pack again. After that, the modulating spool (2) is closed again to repeat the same movement, so that the pressure to the clutch pack is gradually increased to the set pressure 2.45 MPa (25.0 kgf/cm², 356 psi) of the reducing valve. (c to d)

- A : From Regulator Valve
- B : To Clutch Pack
- C : To Modulating Valve

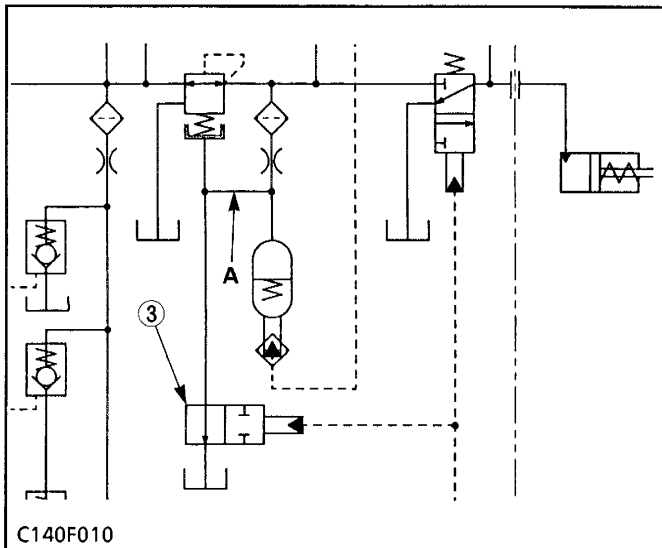
- D : Modulating Feedback Circuit
- P : Pressure (MPa, kgf/cm², psi)
- T : Time (sec.)

- (1) Valve Housing
- (2) Modulating Spool
- (3) Return Spring
- (4) Modulating Piston
- (5) Orifice
- (6) Modulating Spring
- (7) Low-pass Valve
- (8) Modulating Valve
- (9) Clutch Valve
- (10) Modulating Check Valve
- (11) Accumulator
- (12) Sleeve
- (13) Line Filter

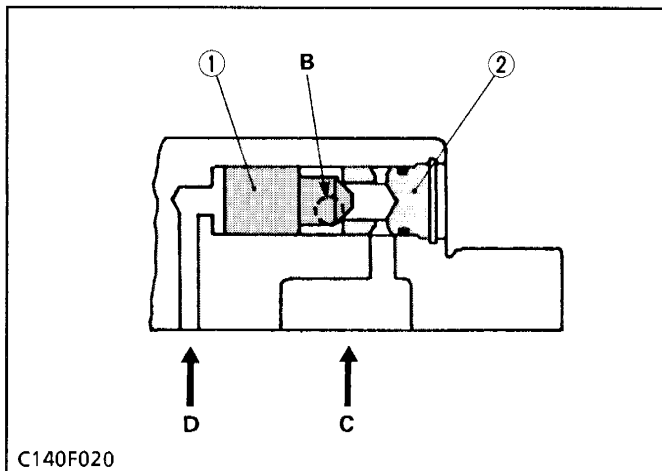
(4)-8 Modulating Check Valve



C143P069



C140F010



C140F020

■ Function

From the start to the end of gear shifting, the modulating check valve (3) drains the oil of the modulating feedback circuit (A). By this action, the pressure rise pattern of the clutch pack is made the same regardless of the speed of operating the shift lever.

■ Oil Flow

The oil of the modulate feedback circuit (A) flows in from the C-port. The oil of the pilot circuit flows in from the D-port. Therefore, when the pressure is present in the pilot circuit, the poppet (1) is closed, and when the pressure is not present in the pilot circuit, the poppet (1) is pushed open.

A : Modulating Feedback Circuit

B : Tank-Port

C : C-Port

From Modulating Feedback Circuit

D : D-Port

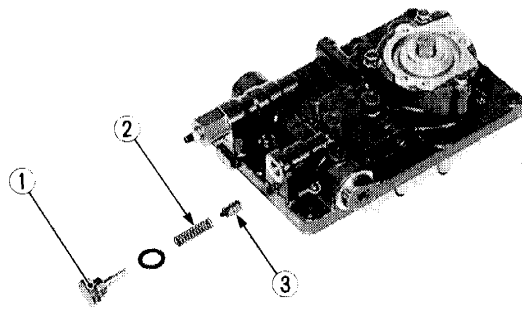
From Pilot Circuit

(1) Poppet

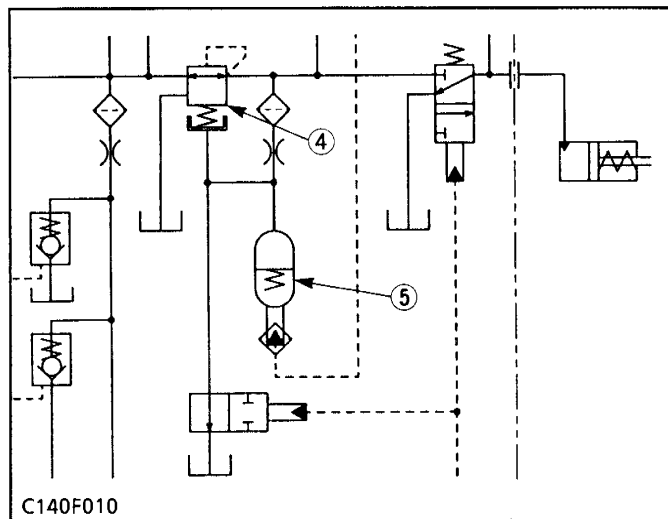
(3) Modulating Check Valve

(2) Valve Seat

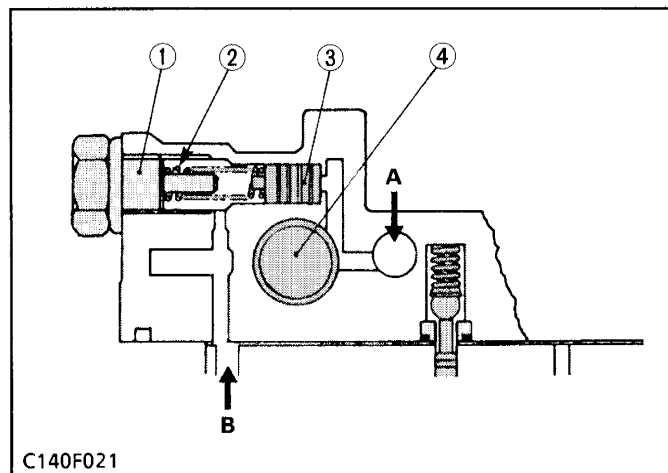
(4)-9 Accumulator



C143P074



C140F010



C140F021

Function

The accumulator is provided to reduce the shock during the clutch pack engagement.

When the gear shifting is completed, the clutch valve is opened and the oil starts flowing to the clutch pack.

As the oil flows to the clutch pack, the high pressure generated temporarily during the clutch connection is absorbed to prevent the shock.

The accumulator is operated only by Lo shift. Because the accumulator is not necessary on the Hi side where the required driving torque is large, the oil is flown to the back of the accumulator piston (3) to prevent the accumulator operation.

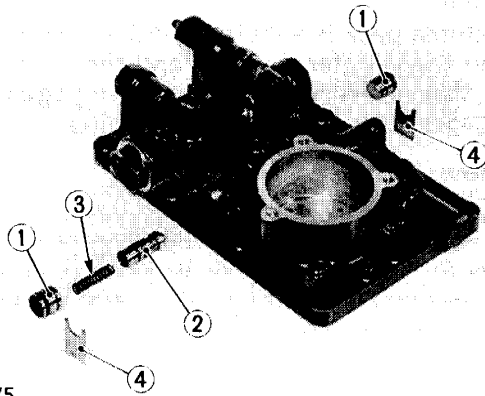
Oil Flow

Oil flows in from the A-port to push the accumulator piston (3). When the Hi-Lo shift is moved to the Hi-speed side, the oil flows in from the B-port to push the accumulator piston (3) to prevent the accumulator from operating.

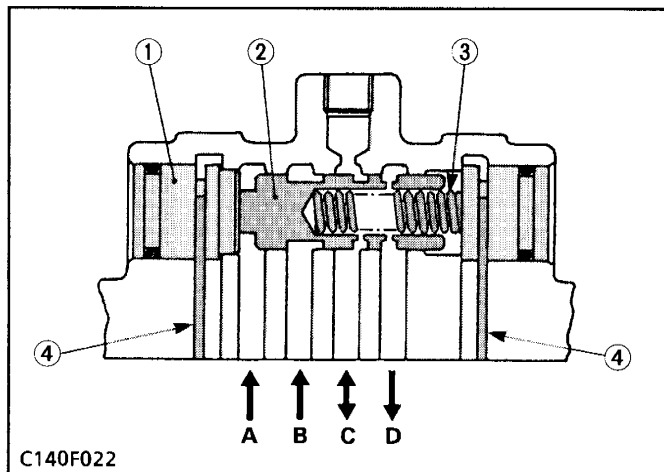
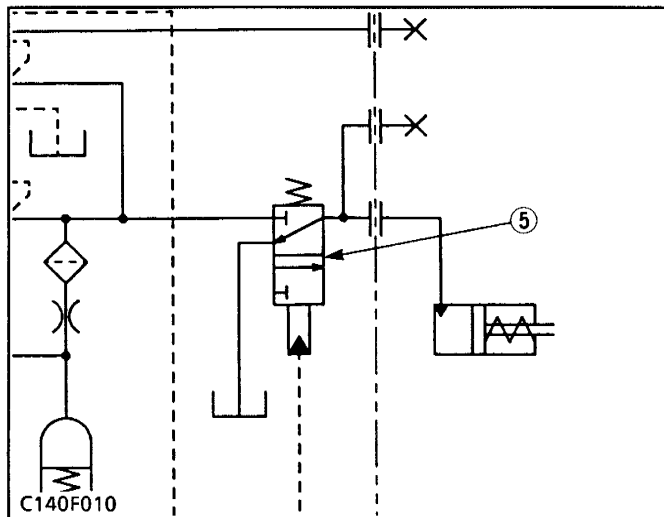
- A : A-Port
From Modulating Valve
- B : B-Port
From Shift Piston H-L

- (1) Plug
- (2) Spring
- (3) Accumulator Piston
- (4) Modulating Valve
- (5) Accumulator Assembly

(4)-10 Clutch Valve



C143P075



Function

The clutch valve (5) changes the flow of the oil flowing to the clutch pack to carry out "ENGAGED" / "DISENGAGED" of the clutch pack.

Oil Flow

Except for the gear shifting, when the pilot circuit is pressurized, the oil of the pilot circuit flows in from the A-port to push the spool (2) to the right. Therefore, the oil from the modulate valve flows in from the B-port, flows out from the C-port, and flows to the clutch pack.

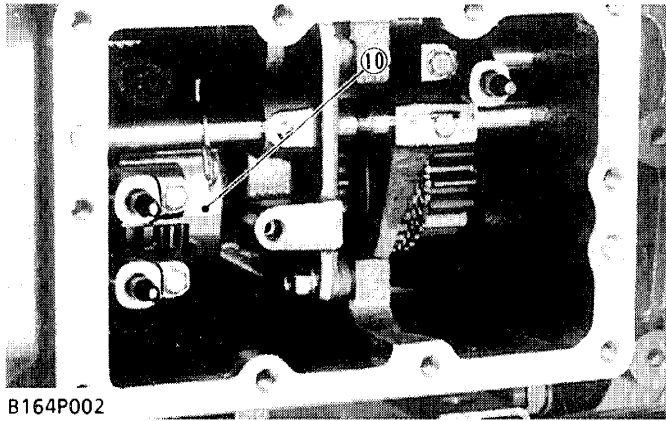
When the pilot circuit pressure is not built from the start to the end of gear shifting, the spool (2) is pushed to the left by the spring (3) to cut the oil flow from the modulate valve of the B-port, stopping the oil flow to the clutch pack.

Furthermore, the oil of the clutch pack flows in from the C-port, drained from the D-port, and the clutch pack is disengaged.

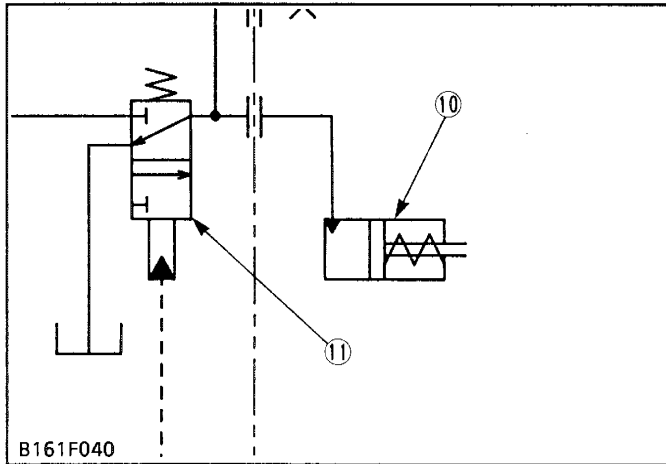
- A : A-Port
From Pilot Circuit
- B : B-Port
From Shift Piston H-L
- C : C-Port
To Clutch Pack or From Clutch Pack
- D : D-Port
To Tank

- (1) Plug
- (2) Spool
- (3) Spring
- (4) Stop Plate
- (5) Clutch Valve

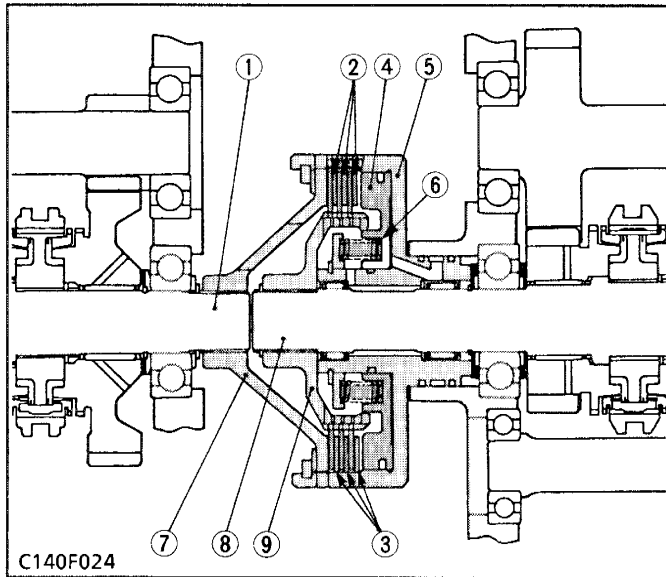
(4)-11 Clutch Pack



B164P002



B161F040



C140F024

Function

The clutch pack is a multiple disk clutch provided between the counter shaft (1) and the shuttle shaft (8) of the transmission and "engages" and "disengages" the power from the engine.

Oil Flow

The oil from the clutch valve (11) flows in from the A-port to push the return spring (6) and the piston (4). The piston (4) is pushed to the left by the oil, thereby pushing the clutch discs (2) and the plate (3) to transmit the power.

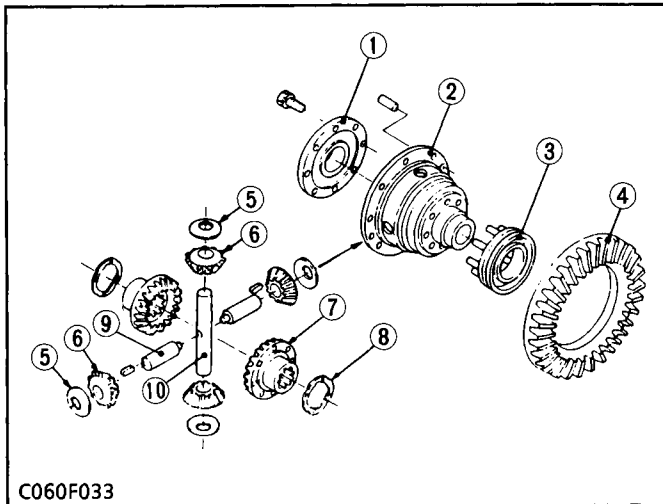
When the engine power is disengaged, the oil of the clutch pack (10) is pushed by the return spring (6) and flows out from the A-port.

**A : A-Port
From Clutch Valve or
To Clutch Valve**

- | | |
|-------------------|-----------------------|
| (1) Counter Shaft | (7) Clutch Input Hub |
| (2) Clutch Disc | (8) Shuttle Shaft |
| (3) Plate | (9) Clutch Output Hub |
| (4) Piston | (10) Clutch Pack |
| (5) Clutch Case | (11) Clutch Valve |
| (6) Return Spring | |

[6] DIFFERENTIAL GEAR

(1) Structure



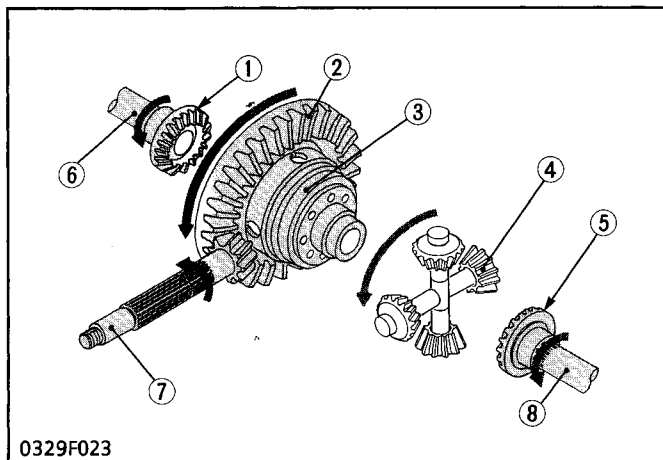
The differential gear assembly is a mechanism to provide smooth steering. It automatically provides different optimum torques to the right and left wheels according to road resistance and braking friction at the wheels.

The differential gear assembly is composed of the differential case, differential pinions, differential side gears, differential pinion shaft, ring gear, etc.

- | | |
|--------------------------------|-----------------------------------|
| (1) Differential Case Cover | (7) Differential Side Gear |
| (2) Differential Case | (8) Differential Side Gear Washer |
| (3) Differential Lock Shifter | (9) Differential Pinion Shaft 2 |
| (4) Ring Gear | (10) Differential Pinion Shaft |
| (5) Differential Pinion Washer | |
| (6) Differential Pinion | |

(2) Operation

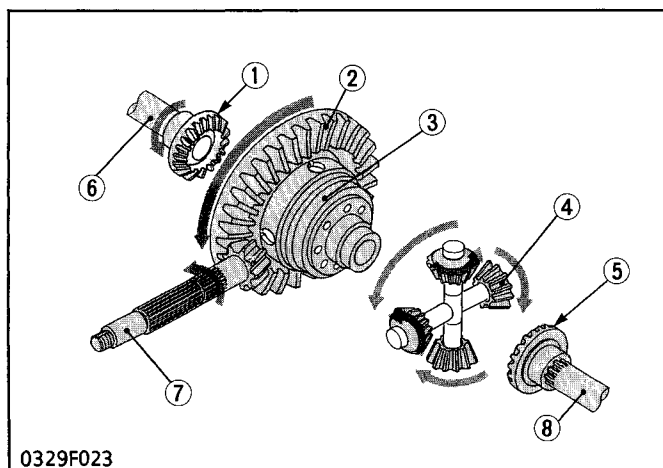
■ Traveling Straight Ahead



Rotation of the spiral bevel pinion (7) is transmitted to the ring gear (2) bolted to the differential case (3). When road resistance to the right and left wheels are equal, the differential pinions (4), and differential side gears (1), (5) are carried around by the ring gear (2), and differential case (3) rotate as a unit. Differential gear shaft (6), (8) receive the same rotation and both wheels travel at the same speed.

- | | |
|----------------------------|-----------------------------|
| (1) Differential Side Gear | (5) Differential Side Gear |
| (2) Ring Gear | (6) Differential Gear Shaft |
| (3) Differential Case | (7) Spiral Bevel Pinion |
| (4) Differential Pinion | (8) Differential Gear Shaft |

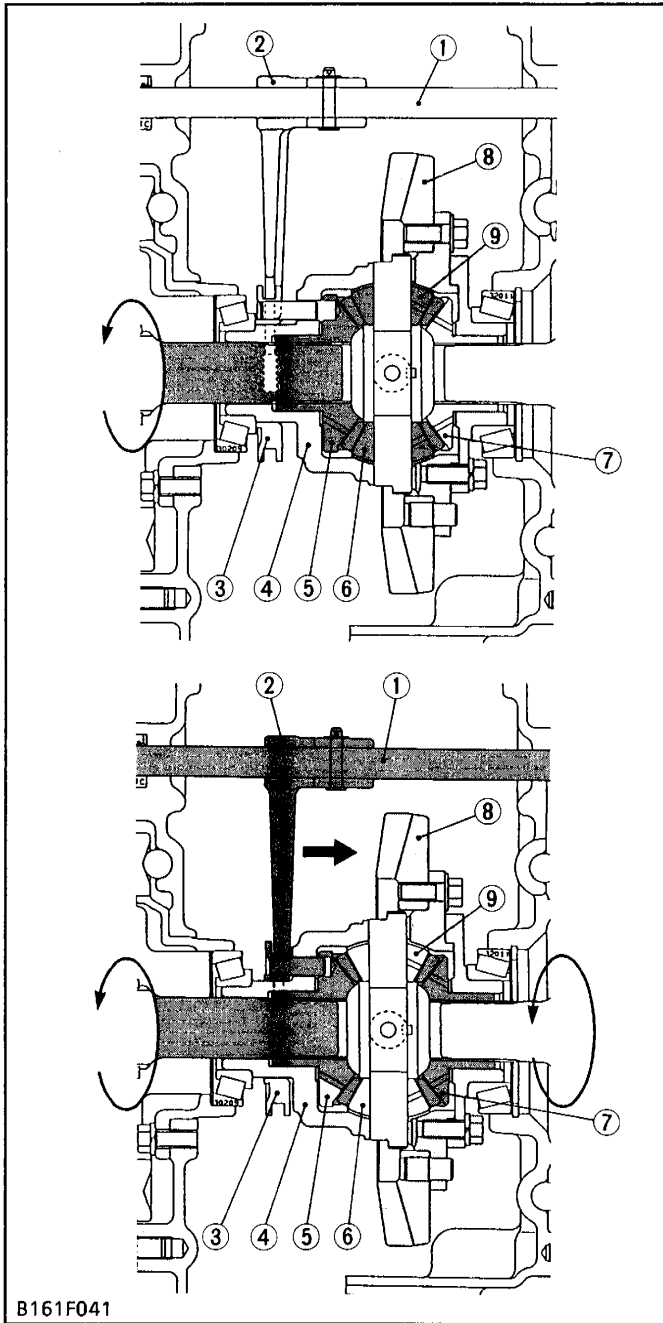
■ Turning a Corner



The power from the engine on spiral bevel pinion (7) rotates ring gear (2). When turning a corner, the outer wheel must travel farther than the inner one. While differential pinions (4) rotate with the differential case (3), they spin on differential pinion shaft to transmit more rotation to one differential side gear than to the other. As one differential gear shaft rotates faster, the other rotates slower by the same amount.

- | | |
|----------------------------|-----------------------------|
| (1) Differential Side Gear | (5) Differential Side Gear |
| (2) Ring Gear | (6) Differential Gear Shaft |
| (3) Differential Case | (7) Spiral Bevel Pinion |
| (4) Differential Pinion | (8) Differential Gear Shaft |

■ Differential Lock



When resistances to the right and left tires are different due to ground conditions or type of work, the wheel with less resistance slips and prevents the tractor from moving ahead. To compensate for this, the differential lock restricts the differential function and causes both rear axles to rotate as a unit.

When the differential lock pedal is stepped on, it causes the differential lock cam shaft (1), differential lock shift fork (2) and differential lock shifter (3) are moved forward the ring gear (8).

The pins on the differential lock shifter (3) go into the holes in the differential side gear (5) through the holes in the differential case (4) to cause the differential case, differential lock shifter and differential side gear to rotate as a unit. Therefore the differential pinions (6), (9), can not rotate on their axles, and the rotation of the spiral bevel pinion is transmitted to the both rear axles evenly. It means the tractor going straight ahead.

When the drive wheels regain equal traction, the lock will disengage automatically by the force of differential lock pedal return spring, while released differential lock pedal.

- | | |
|----------------------------------|----------------------------|
| (1) Differential Lock Cam Shaft | (5) Differential Side Gear |
| (2) Differential Lock Shift Fork | (6) Differential Pinion |
| (3) Differential Lock Shifter | (7) Differential Side Gear |
| (4) Differential Case | (8) Ring Gear |
| | (9) Differential Pinion |

SERVICING

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TROUBLESHOOTING

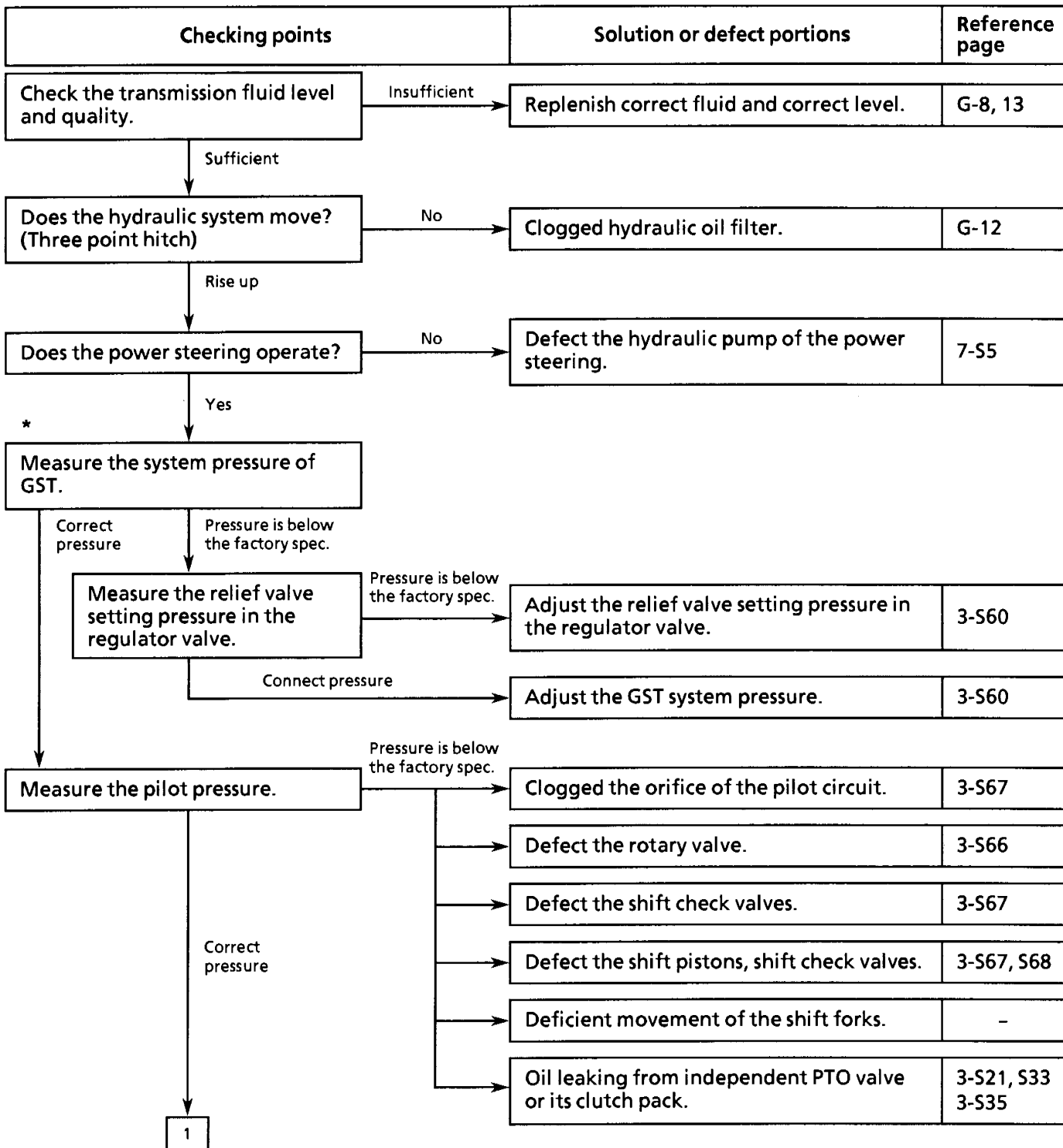
Symptom	Probable Cause	Solution	Reference Page
Excessive Transmission Noise	<ul style="list-style-type: none"> ● Transmission fluid insufficient ● Gear worn or backlash improper ● Bearings worn or broken ● Shift fork worn ● Spline worn ● Snap rings on the shaft come off ● Spiral bevel pinion lock nut improperly tightened ● Improper backlash between spiral bevel pinion and spiral bevel gear ● Improper backlash between differential pinion and differential side gear 	Replenish Replace Replace Replace Replace Repair or replace Tighten Adjust Adjust	G-8, 13 – 3-S18, S36, S54 3-S19, S36, S55 3-S19, S55 – 3-S47 3-S57 3-S58
Gear Slip Out of Mesh	<ul style="list-style-type: none"> ● Shift linkages rusted ● Shifter or shift fork worn or damaged ● Shift fork interlock ball spring weaken or damaged ● Interlock ball fallen ● Gears worn or broken ● Synchronizer unit damaged 	Repair Replace Replace Reassemble Replace Replace	– 3-S19, S36, S55 – 3-S17 – 3-S19, S20, S36 3-S37, S55, S56
Hard Shifting	<ul style="list-style-type: none"> ● Shifter or shift fork worn or damaged ● Shift fork bent ● Shift linkage rusted ● Shaft part of shift arms rusted ● Synchronizer unit damaged 	Replace Replace Repair Repair Replace	3-S19, S36, S55 – – – 3-S19, S20, S36 3-S37, S55, S56
Gears Clash When Shifting	<ul style="list-style-type: none"> ● Clutch does not release ● Gears worn or damaged ● Synchronizer unit damaged 	Adjust or repair Replace Replace	2-S3 – 3-S19, S20, S36 3-S37, S55, S56
Differential Lock Can Not Be Set	<ul style="list-style-type: none"> ● Differential lock shift fork damaged ● Differential lock shift fork mounting clevis pin damaged ● Differential lock shifter pin bent or damaged ● Differential lock fork shaft bent or damaged 	Replace Replace Replace Replace	3-S47 3-S47 3-S53 3-S47
Differential Lock Pedal Does Not Return	<ul style="list-style-type: none"> ● Differential lock pedal return spring weaken or damaged ● Differential lock shifter pin bent or damaged ● Differential lock fork shaft bent 	Replace Replace Replace	– 3-S53 3-S47
Excessive or Unusual Noise at All Time	<ul style="list-style-type: none"> ● Improper backlash between spiral bevel pinion and spiral bevel gear ● Improper backlash between differential pinion and differential side gear ● Bearings worn ● Insufficient or improper type of transmission fluid used 	Adjust Adjust Replace Replenish or replace	3-S57 3-S58 3-S18, S36, S54 G-8, 13
Noise While Turning	<ul style="list-style-type: none"> ● Differential pinions or differential side gears worn or damaged ● Differential lock binding (does not disengage) ● Bearing worn 	Replace Replace Replace	3-S54 – 3-S18, S36, S54

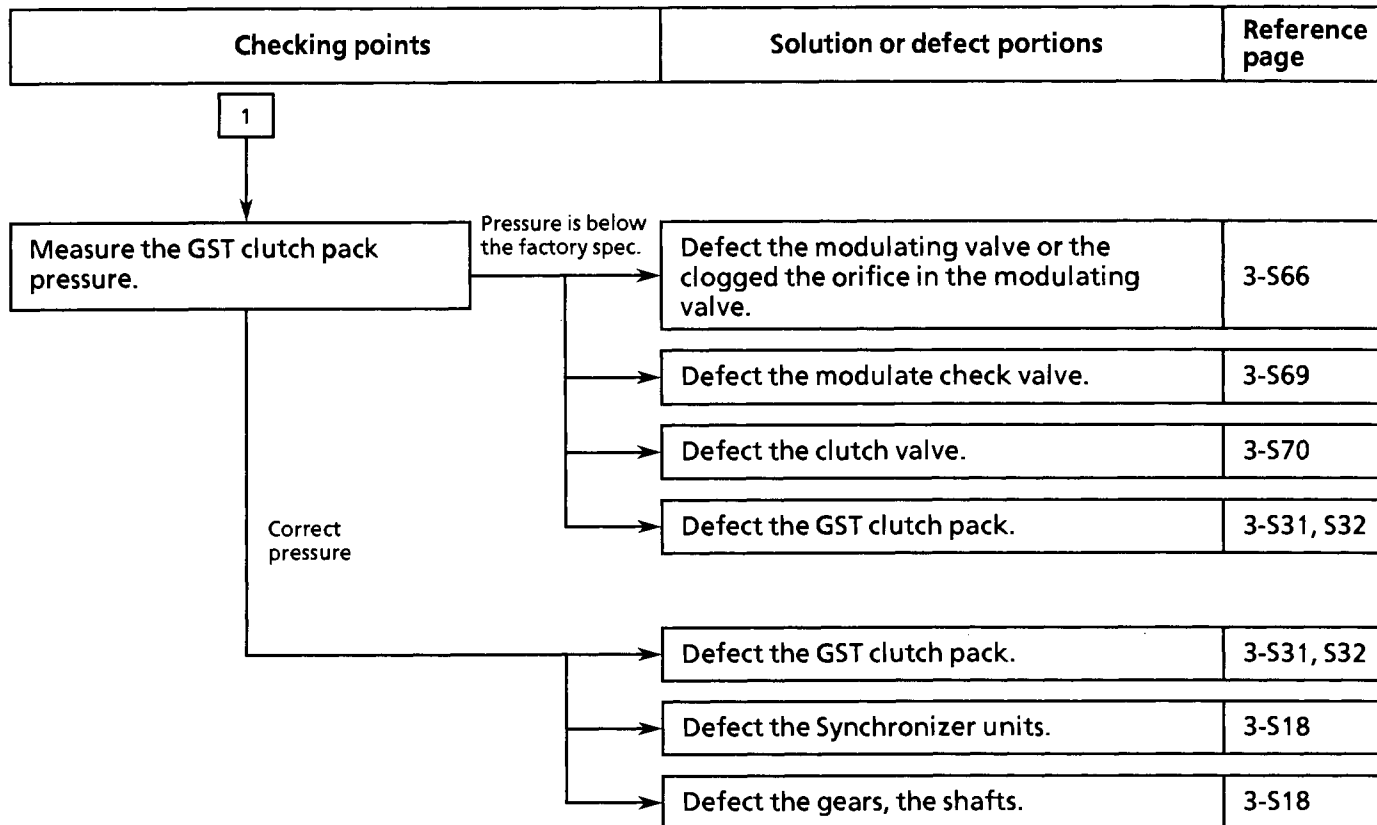
GST SYSTEM

1. The tractor moves when main shift lever is neutral position.

Checking points	Solution or defect portions	Reference page
Check the shift cable.	Adjust the shift cable.	3-S59

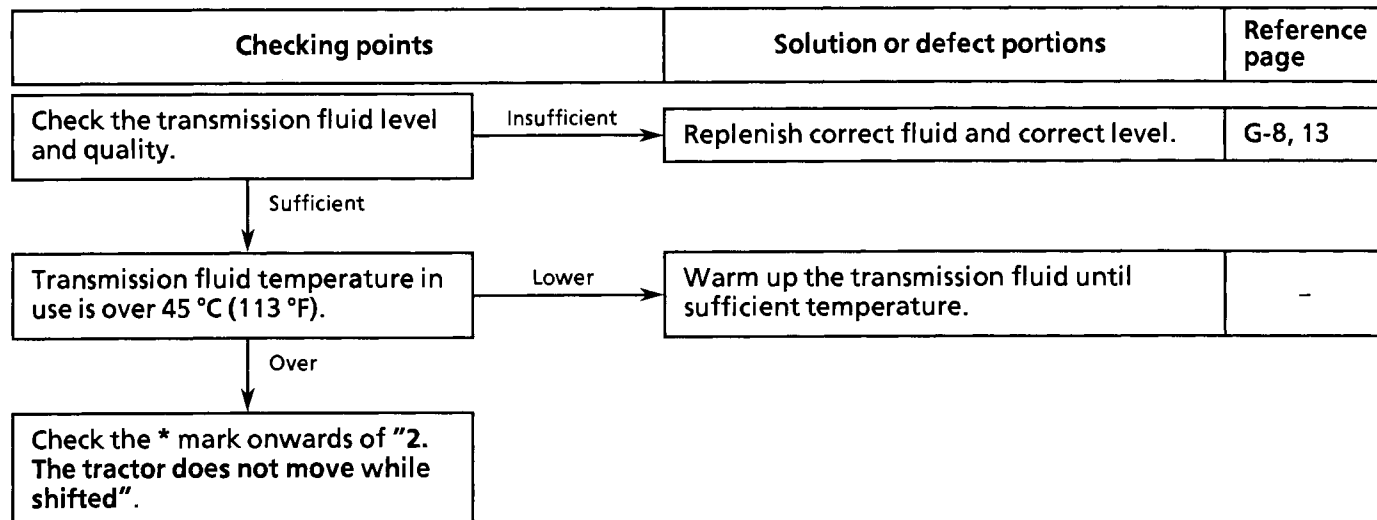
2. The tractor does not move while shifted.





3. The time needed to start the tractor.

4. Quick engagement while starting.



SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Gear to Spline, Hub to Spline	Clearance	0.030 to 0.078 mm 0.00118 to 0.00307 in.	0.2 mm 0.008 in.
Shift Fork to Shift Groove	Clearance	0.1 to 0.3 mm 0.004 to 0.012 in.	0.8 mm 0.031 in.
Gear and Shaft	Clearance	0.021 to 0.054 mm 0.00083 to 0.00213 in.	0.1 mm 0.004 in.
Synchronizer Ring to Gear (In Contact)	Side Clearance	–	0.35 mm 0.0138 in.
GST Clutch Disc	Thickness	2.55 to 2.65 mm 0.100 to 0.104 in.	2.50 mm 0.098 in.
GST Steel Plate	Thickness	1.55 to 1.65 mm 0.061 to 0.065 in.	1.5 mm 0.059 in.
Independent PTO Clutch Disc	Thickness	1.70 to 1.90 mm 0.067 to 0.075 in.	1.55 mm 0.061 in.
Independent PTO Steel Plate	Thickness	1.15 to 1.25 mm 0.045 to 0.049 in.	1.10 mm 0.043 in.
GST Piston	Flatness	–	0.15 mm 0.006 in.
GST Steel Plate	Flatness	–	0.30 mm 0.012 in.
Independent PTO Piston	Flatness	–	0.15 mm 0.006 in.
Independent PTO Steel Plate	Flatness	–	0.30 mm 0.012 in.
GST Piston Return Spring	Free Length	19.9 to 20.1 mm 0.78 to 0.79 in.	18.0 mm 0.71 in.
Independent PTO Return Spring	Free Length	40.5 mm 1.59 in.	37.5 mm 1.48 in.
Independent PTO Brake Spring	Free Length	20.3 mm 0.80 in.	18.0 mm 0.71 in.
GST, Independent PTO Seal Rings	Thickness	2.45 to 2.50 mm 0.096 to 0.098 in.	2.0 mm 0.079 in.
Spiral Bevel Pinion and Differential Assembly	Combined Turning Torque	3.92 to 6.37 N·m 0.40 to 0.65 kgf·m 2.89 to 4.70 ft-lbs	–
Spiral Bevel Pinion to Spiral Bevel Gear	Backlash	0.15 to 0.30 mm 0.006 to 0.012 in.	–
	Tooth Contact	–	More than 35 %
	Center of Tooth Contact	–	1/3 to 1/2 of the entire width from the small end

Item		Factory Specification	Allowable Limit
Differential Case Bore (Differential Case Cover Bore) to Differential Side Gear Boss	Clearance	0.050 to 0.151 mm 0.00197 to 0.00594 in.	0.35 mm 0.0138 in.
	Differential Case Bore	I.D. 40.500 to 40.550 mm 1.59449 to 1.59646 in.	-
	Differential Case Cover Bore	I.D. 40.500 to 40.550 mm 1.59449 to 1.59646 in.	-
	Differential Side Gear Boss	O.D. 40.388 to 40.450 mm 1.59008 to 1.59252 in.	-
Differential Pinion Shaft to Differential Pinion	Clearance	0.060 to 0.102 mm 0.00236 to 0.00402 in.	0.25 mm 0.0098 in.
	Differential Pinion Shaft	O.D. 19.959 to 19.980 mm 0.78579 to 0.78661 in.	-
	Differential Pinion	I.D. 20.040 to 20.061 mm 0.78898 to 0.78980 in.	-
Differential Pinion to Differential Side Gear	Backlash	0.15 to 0.30 mm 0.006 to 0.012 in.	0.40 mm 0.016 in.
	Differential Side Gear Washer 1	Thickness 1.5 mm 0.059 in.	-
	Differential Side Gear Washer 2	Thickness 1.6 mm 0.063 in.	-
	Differential Side Gear Washer 3	Thickness 1.7 mm 0.067 in.	-
GST System Pressure Condition		2.45 to 2.55 MPa 25.0 to 26.0 kgf/cm ² 356 to 370 psi	-
<ul style="list-style-type: none"> ● Engine Idling Speed ● Oil Temperature ... 40 to 60 °C 104 to 140 °F 			
GST Relief Valve Setting Pressure Condition		2.84 to 2.94 MPa 29.0 to 30.0 kgf/cm ² 412 to 427 psi	-
<ul style="list-style-type: none"> ● Engine Maximum Speed ● Oil Temperature ... 40 to 60 °C 104 to 140 °F 			
GST Pilot Pressure Condition		2.45 to 2.55 MPa 25.0 to 26.0 kgf/cm ² 356 to 370 psi	-
<ul style="list-style-type: none"> ● Engine Maximum Speed ● Oil Temperature ... 40 to 60 °C 104 to 140 °F ● Main Shift Lever to Be "1st" ● Shuttle Shift Lever To Be "Forward" or "Reverse" 			
GST Clutch Pack Pressure Condition		2.45 to 2.55 MPa 25.0 to 26.0 kgf/cm ² 356 to 370 psi	-
<ul style="list-style-type: none"> ● Engine Idling Speed ● Oil Temperature ... 40 to 60 °C 104 to 140 °F ● Main Shift Lever "Neutral" to "1st" ~ "8th" ● Shuttle Shift Lever "Neutral" to "Forward" and "Reverse" 			
Independent PTO Operating Pressure		2.45 to 2.55 MPa 25.0 to 26.0 kgf/cm ² 356 to 370 psi	-

TIGHTENING TORQUES

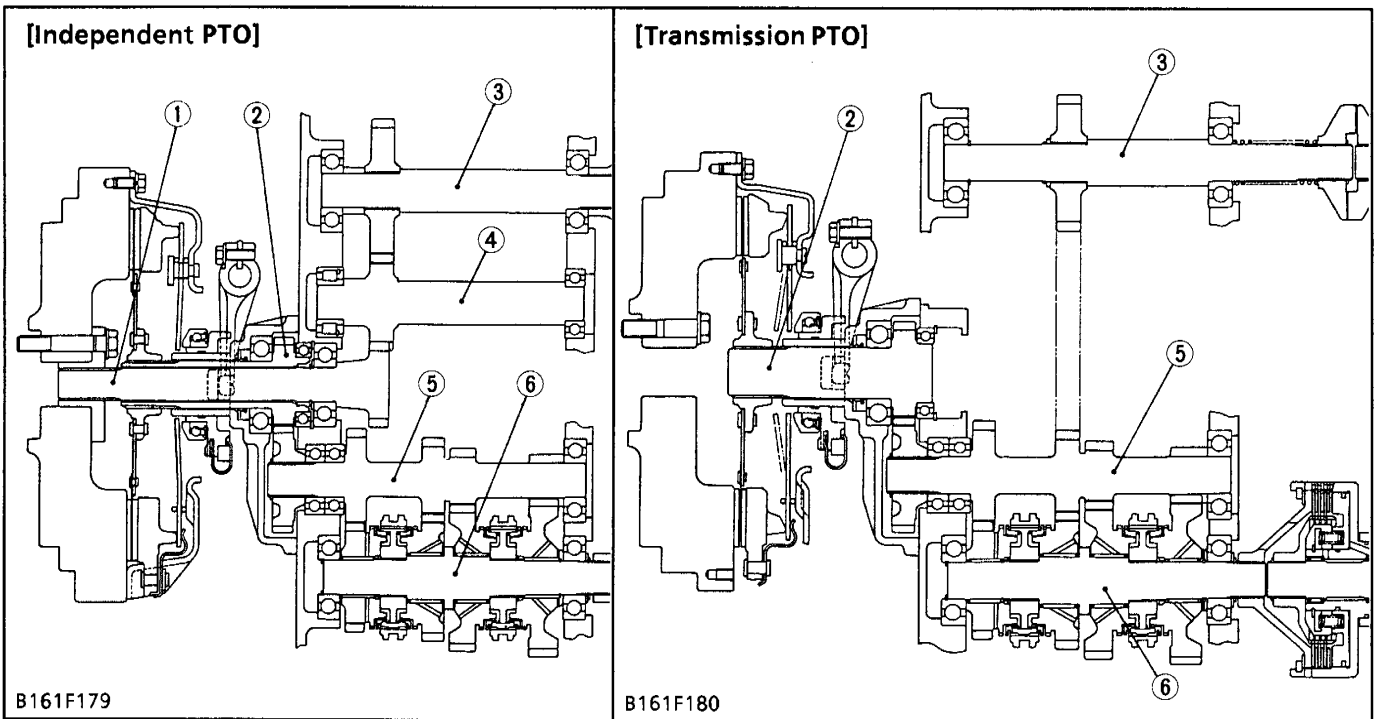
Tightening torques of screws and nuts on the table below are especially specified.
(For general use screws and nuts : See page G-9)

Item	N·m	kgf·m	ft-lbs
Power steering main delivery hose retaining nut to controller	46.6 to 50.9	4.8 to 5.2	34.4 to 37.6
Turning delivery hoses retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Joint bolt for delivery pipe and front hydraulic block	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Joint bolt for GST delivery pipe and regulator valve (GST or independent PTO type only)	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Joint bolt (with orifice) for GST delivery pipe and independent PTO valve (Independent PTO type only)	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Engine and clutch housing case mounting			
Screws and nuts	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Stud bolts	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2
ROPS mounting screws			
M12, grade 7 screws	77.5 to 90.2	7.9 to 9.2	57 to 66
M14, grade 9 screws	166.7 to 196.1	17.0 to 20.0	123 to 144
M16, grade 11 screws	260.9 to 304.0	26.6 to 31.0	192 to 224
9/16-18 UNF, grade 8 screws	149.1 to 179.5	15.2 to 18.3	110 to 132
Floor seat and platform mounting screws and nuts	196.1 to 225.6	20.0 to 23.0	144.7 to 166.4
GST shift cable mounting screws	7.8 to 8.8	0.8 to 0.9	5.8 to 6.5
GST shift pin mounting screws	12.7 to 14.7	1.3 to 1.5	9.4 to 10.8
GST valve mounting screws	42.2 to 48.1	4.3 to 4.9	31.1 to 35.4
Joint bolt for GST delivery pipe on GST valve	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Clutch housing case and mid case mounting			
Screws	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Nuts	102.9 to 117.6	10.5 to 12.0	76.9 to 86.8
Stud bolts	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2
Main shift base mounting screws	23.5 to 27.4	2.4 to 2.8	17.4 to 20.2
Main shift arm setting screw	9.8 to 11.3	1.00 to 1.15	7.2 to 8.3
Gear shaft case mounting screws	23.5 to 27.4	2.4 to 2.8	17.4 to 20.2
Release fork setting screws	23.5 to 27.4	2.4 to 2.8	17.4 to 20.2
Clutch housing bearing holder mounting screws	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Stopper screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Mid case and transmission case mounting			
Screws, nuts	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Stud bolts	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2
Independent PTO valve mounting screws	23.5 to 27.4	2.4 to 2.8	17.4 to 20.2
Mid case bearing holder mounting screws	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Shuttle shift fork setting screw (Manual shift transmission)	12.7 to 14.7	1.3 to 1.5	9.4 to 10.8
Shuttle shift fork setting screw (GST)	12.7 to 14.7	1.3 to 1.5	9.4 to 10.8
Independent PTO brake plate mounting screws	9.8 to 11.2	1.0 to 1.15	7.2 to 8.3
Hydraulic cylinder assembly mounting			
Stud bolt	34.3 to 49.0	3.5 to 5.0	25.3 to 36.2
Screws, nuts	77.4 to 90.2	7.9 to 9.2	57.1 to 66.5
Rear axle case mounting			
M10 screws	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
M10 nuts (L3010 · L3410)	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
M10 nuts (L3710 · L4310)	60.8 to 70.5	6.2 to 7.2	44.9 to 52.1
M12 screws and nuts	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Stud bolts	24.5 to 31.4	2.5 to 3.2	18.1 to 23.1
Rear wheel mounting screws and nuts	197 to 226	20 to 23	145 to 166
Brake case mounting			
Stud bolts	38.2 to 45.1	3.9 to 4.6	28.2 to 33.3
Screws, nuts	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Lever shaft screw	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5
Spiral bevel pinion lock nut	147 to 196	15 to 20	108 to 145
Spiral bevel pinion bearing case mounting screws	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Transmission bearing holder mounting screws	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2

Item	N·m	kgf·m	ft-lbs
Mid PTO case mounting screws	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Rear PTO bearing case mounting lock nut	147 to 196	15 to 20	108 to 145
Rear PTO bearing case mounting screws	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Differential support mounting screws	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Differential case cover mounting screws	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Spiral bevel gear UBS screws	68.6 to 88.3	7.0 to 9.0	50.6 to 65.1
Joint bolt for power steering delivery hose and regulator valve	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Joint bolt for delivery pipe and hydraulic pump	39.3 to 49.0	4.0 to 5.0	29.0 to 36.2
Regulator valve mounting screws	17.6 to 20.6	1.8 to 2.1	13.0 to 15.2
Regulator valve			
Joint bolt	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Plate	9.8	1.0	7.2
Regulator valve case and regulator support mounting screws	9.8	1.0	7.2
GST rotary valve			
Valve case mounting hex. socket head cap screws	7.8	0.8	5.8
Valve cover mounting screws	8.8 to 9.8	0.9 to 1.0	6.5 to 7.2
GST modulate valve sleeve	58.8	6.0	43.4
GST valve lower body mounting hex. socket head cap screws	9.8	1.0	7.2
Low-pass valve plug	49.0	5.0	36.2

CHECKING, DISASSEMBLING AND SERVICING

[1] CLUTCH HOUSING



B161F179

B161F180

- (1) 18T Gear Shaft
- (2) 24T Gear Shaft

- (3) PTO Counter Shaft
- (4) PTO Idle Shaft

- (5) Main Gear Shaft

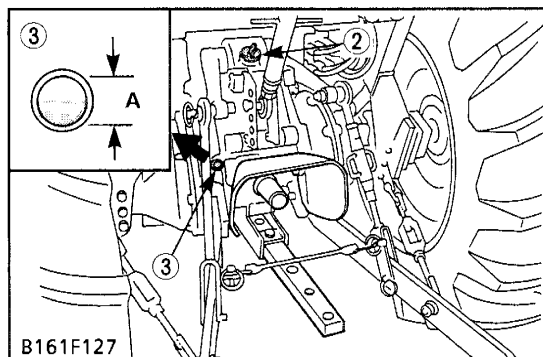
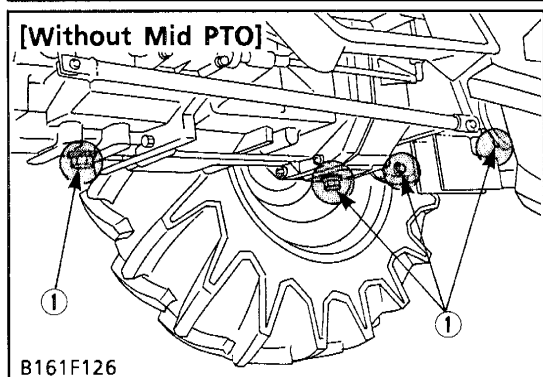
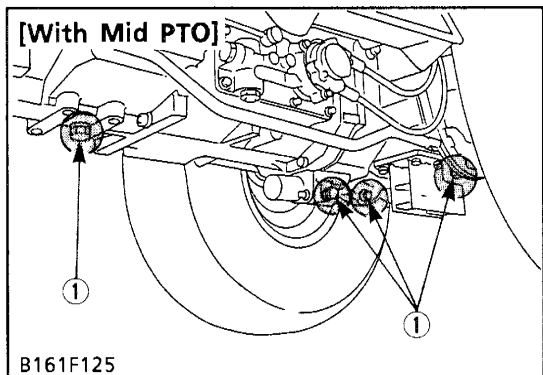
- (6) Counter Shaft

DISASSEMBLING AND ASSEMBLING

NOTE

- If the tractors are cabin specifications, refer to section 10 CABIN [1] SEPARATING CABIN FROM TRACTOR BODY. (See page 10-S20.)

(1) Draining the Transmission Fluid



Draining the Transmission Fluid

1. Place oil pans underneath the transmission case.
2. Remove the four drain plugs (1).
3. Drain the transmission fluid.
4. Reinstall the four drain plugs (1).

(When refilling)

- Fill up from filling port after removing the filling plug (2) until reaching the gauge (3).
- After running the engine for few minutes, stop it and check the oil level again, add the fluid to prescribed level if it is not correct level.

Capacity	Transmission fluid	39.0 ℓ 41.2 U.S.qts. 34.3 Imp.qts.
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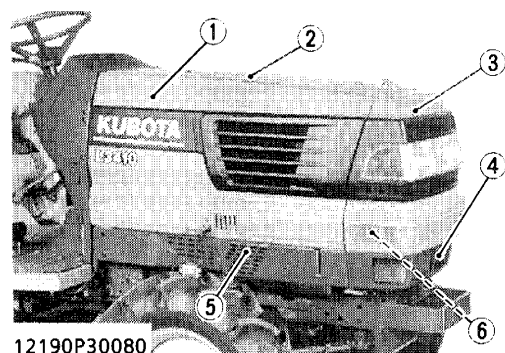
IMPORTANT

- Use only KUBOTA SUPER UDT fluid. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-8.)
- Do not mix different brands of fluid together.

[A] Oil level is acceptable within this range.

- (1) Drain Plugs (3) Gauge
(2) Filling Plug

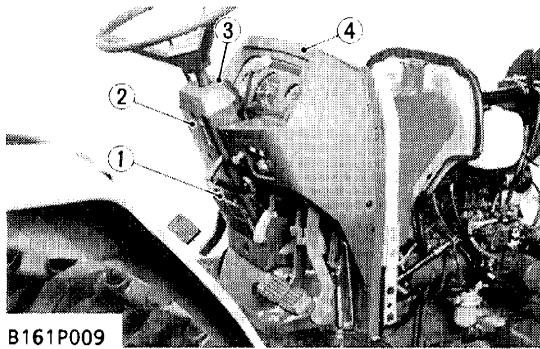
(2) Separating Panel Frame Assembly



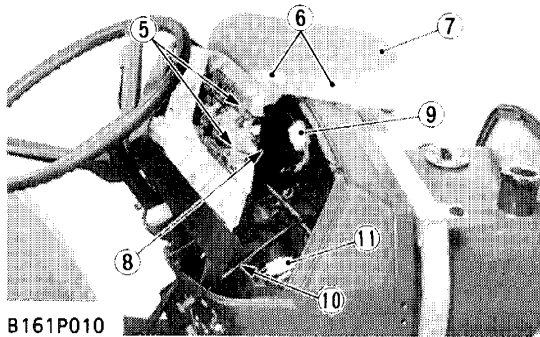
Preparation 1

1. Open the front mask (3) and disconnect the battery negative cable (6).
2. Remove the right and left side covers (1).
3. Remove the front mask (3).
4. Remove the front grille (4).
5. Remove the right and left side skirts (5).
6. Remove the bonnet (2).

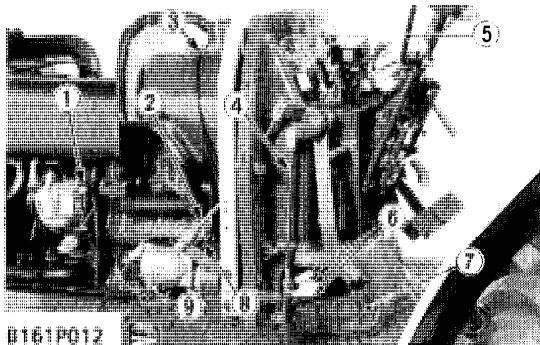
- (1) Side Cover RH, LH (4) Front Grille
(2) Bonnet (5) Side Skirt RH, LH
(3) Front Mask (6) Battery Negative Cable



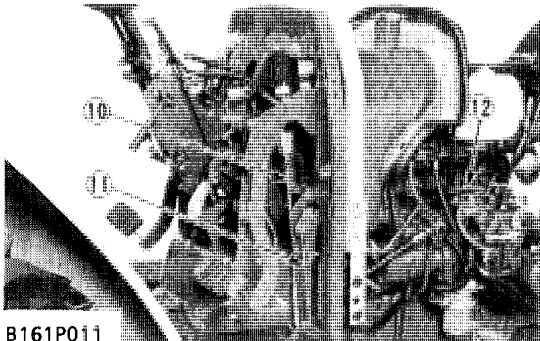
B161P009



B161P010



B161P012



B161P011

Preparation 2

1. Remove the steering post covers (2), (3) and panel under cover (1).
2. Disconnect the meter cable (8) at the engine side.
3. Remove the meter panel mounting screws and open the meter panel (4).
4. Remove the meter panel cover (7), and disconnect the two connectors (5) and meter cable (8).
5. Take out the meter panel (4).
6. Disconnect the main switch connector (11) and light switch connector (9).
7. Disconnect the engine stop cable (10) at the engine side.

NOTE

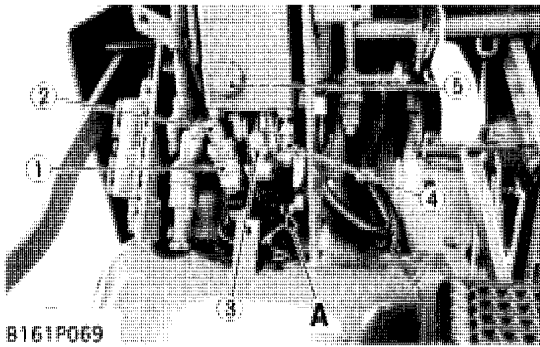
- Do not remove the seals (6) on the meter panel cover (7).

(1) Panel Under Cover	(7) Meter Panel Cover
(2) Steering Post Cover	(8) Meter Cable
(3) Steering Post Cover	(9) Light Switch Connector
(4) Meter Panel	(10) Engine Stop Cable
(5) Connectors	(11) Main Switch Connector
(6) Seals	

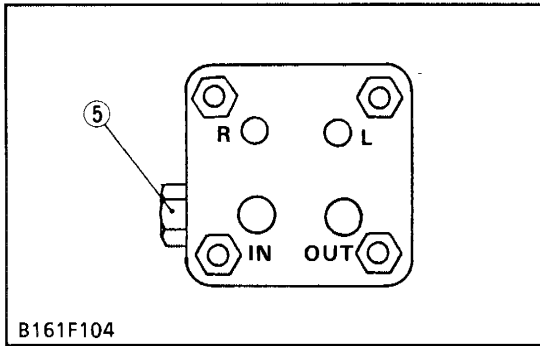
Preparation 3

1. Disconnect the brake rods (4), (10).
2. Disconnect the clutch rod (2).
3. Remove the accelerator rod (12).
4. Disconnect the foot accelerator rod (11).
5. Remove the panel frame cover (7) and disconnect the three connectors (6).
6. Remove the shuttle shift lever (5) after disconnecting the limit switch wire harness.
7. Disconnect the 2P connector for alternator (1) and the jumper leads for fuel level sensor (3) and starter (9).

(1) 2P Connector for Alternator	(7) Panel Frame Cover
(2) Clutch Rod	(8) Jumper Lead for Oil Switch
(3) Jumper Lead for Fuel Level Sensor	(9) Jumper Lead for Starter
(4) Brake Rod LH	(10) Brake Rod RH
(5) Shuttle Shift Lever	(11) Foot Accelerator Rod
(6) Connectors	(12) Accelerator Rod



B161P069



B161F104

Hydraulic Pipes

1. Disconnect the main delivery hose (1), return hose (2), right turning delivery hose (3) and left turning delivery hose (4).

(When reassembling)

- In assembling the turning delivery hoses to the steering controller, connect the delivery hose with identification mark (tape) "A" to the L port of the steering controller. (Refer to figure left.)

Tightening torque	Main delivery hose retaining nut	46.6 to 50.9 N·m 4.8 to 5.2 kgf·m 34.4 to 37.6 ft·lbs
	Turning delivery hoses retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft·lbs

[A] Identification Mark (Tape)

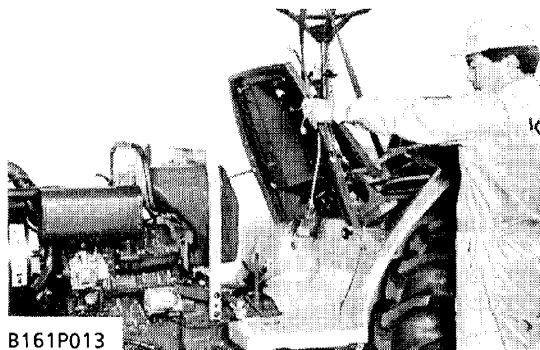
- | | |
|---------------------------------|--------------------------------|
| (1) Main Delivery Hose | (4) Left Turning Delivery Hose |
| (2) Return Hose | (5) Relief Valve Plug |
| (3) Right Turning Delivery Hose | |

Panel Frame and Steering Assembly

1. Remove the panel frame mounting screws. (Two screws at upper part. Seven screws at lower part.)
2. Take out the panel frame and steering assembly as a unit.

(When reassembling)

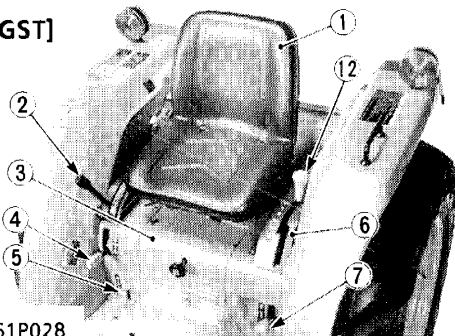
- Do not get in the wiring harness between panel frame and platform.



B161P013

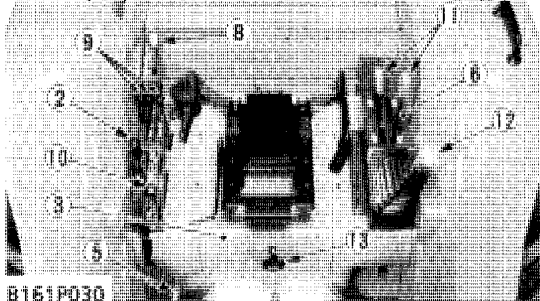
(3) Separating Rear Fenders and Platform Assembly

[GST]

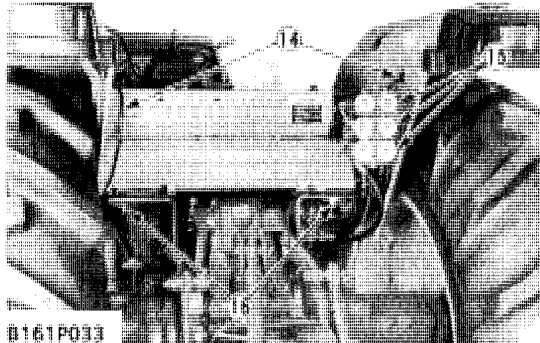


B161P028

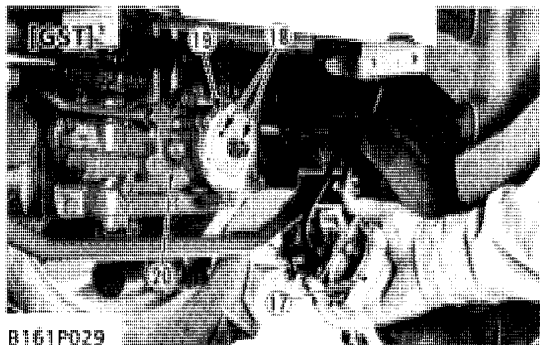
[Manual Shift Transmission (with Creep, Draft, Remote Control Valve)]



B161P030



B161P033



B161P029

Preparation

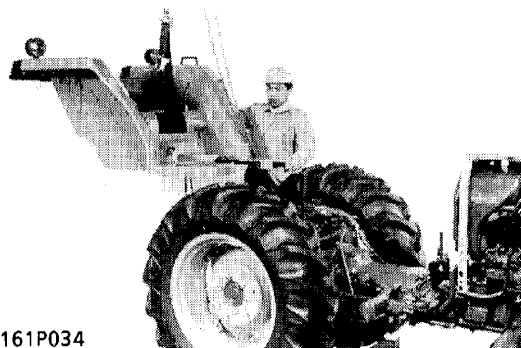
1. Take out the ROPS.
2. Remove the seat assembly (1).
3. Remove the mid PTO lever (4) (if equipped) and grips (2), (7), (8), (9), (10), (11), (12), (13).
4. Remove the shift lever guide (6).
5. Remove the seat under cover (3), and then remove the extension bar of the hydraulic lowering valve.
6. Disconnect the differential lock rod and differential lock lever (5).
7. Remove the quick couplers (15) as a unit. (If equipped.)
8. Disconnect the PTO shift cable at the PTO shift lever.
9. Loosen and remove the floor seat mounting two screws (16) and platform mounting two screws.
10. Disconnect the wiring harness (14) for hazard lights.
11. Remove the shift cable (17) as a unit at the GST valve (20) side. (GST only.)

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face of the rotary valve cover (19) and shift cable. (GST only.)
- Set the main shift lever at the neutral position, align the punched marks (18), and then assemble the shift cable (17). (GST only.)
- Check and adjust the PTO shift cable. (See page 10-528.)

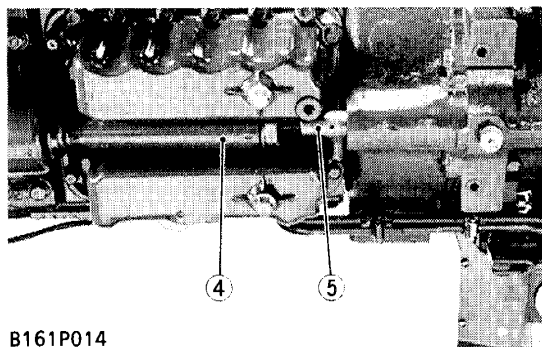
Tightening torque	ROPS mounting screws	M12, grade 7 screws	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft·lbs
		M14, grade 9 screws	166.7 to 196.1 N·m 17.0 to 20.0 kgf·m 123 to 144 ft·lbs
		M16, grade 11 screws	260.9 to 304.0 N·m 26.6 to 31.0 kgf·m 192 to 224 ft·lbs
		9/16-18 UNF, grade 8 screws	149.1 to 179.5 N·m 15.2 to 18.3 kgf·m 110 to 132 ft·lbs
	Floor seat and platform mounting screws and nuts	196.1 to 225.6 N·m 20.0 to 23.0 kgf·m 144.7 to 166.4 ft·lbs	
Shift cable mounting screws	7.8 to 8.8 N·m 0.8 to 0.9 kgf·m 5.8 to 6.5 ft·lbs		

- | | |
|-----------------------------|---------------------------------|
| (1) Seat | (11) Grips |
| (2) Grip | (12) Grip |
| (3) Seat Under Cover | (13) Grip |
| (4) Mid PTO Lever | (14) Wiring Harness |
| (5) Differential Lock Lever | (15) Quick Couplers |
| (6) Shift Lever Guide | (16) Floor Seat Mounting Screws |
| (7) Grip | (17) Shift Cable |
| (8) Grip | (18) Punched Mark |
| (9) Grips | (19) Rotary Valve Cover |
| (10) Grip | (20) GST Valve |

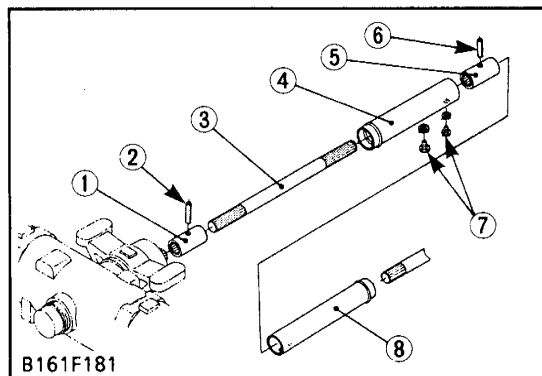


B161P034

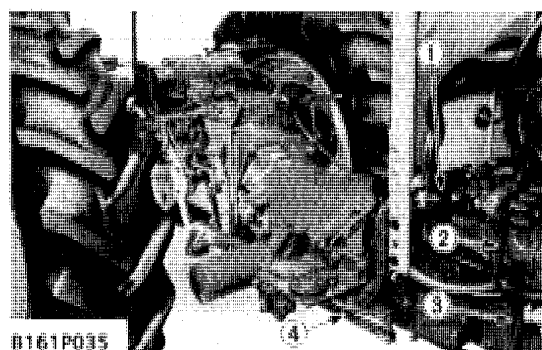
(4) Separating Clutch Housing Case



B161P014



B161F181



B161P035

- (1) Rubber Hose
- (2) GST Delivery Pipe
- (3) Delivery Pipe
- (4) Brake Rod

Fender, Floor Seat and Platform Assembly

1. Remove the fender, floor seat and platform as a unit.

Propeller Shaft [4WD Type Only]

1. Slide the propeller shaft cover, (8) after removing the screws (7).
2. Tap out the spring pin (6), and then slide the coupling (5) to the front.

(When reassembling)

- Apply grease to the splines of the propeller shaft.

- (1) Coupling
- (2) Spring Pin
- (3) Propeller Shaft
- (4) Propeller Shaft Cover
- (5) Coupling
- (6) Spring Pin
- (7) Screws
- (8) Propeller Shaft Cover

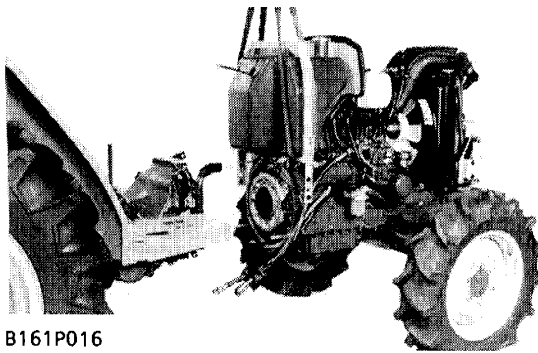
Hydraulic Pipes

1. Remove the brake rod (4) and delivery pipe (3).
2. Remove the GST delivery pipe (2). (GST or independent PTO type only.)
3. Slide the rubber hose (1).

(When reassembling)

- Reinstall the pipe clams securely.

Tightening torque	Joint bolt for delivery pipe (3) and front hydraulic block	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft-lbs
	Joint bolt for GST delivery pipe (2) and regulator valve (GST or independent PTO type only)	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs



B161P016

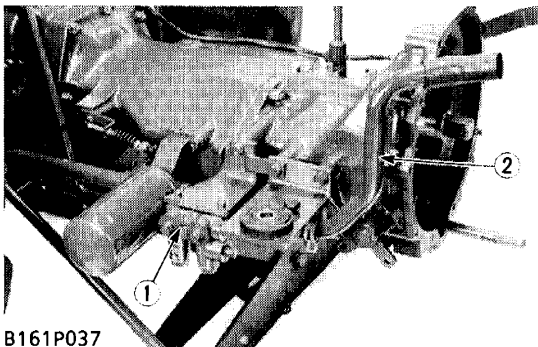
Separating the Engine from Clutch Housing

1. Place the jack under the clutch housing case.
2. Hoist the engine by the nylon lift strap at the tank support.
3. Remove the engine mounting screws, and then pull the engine to the front.

(When reassembling)

- Apply grease to the splines.
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the engine and clutch housing.

Tightening torque	Engine and clutch housing mounting screws, nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Engine and clutch housing mounting stud bolts	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft-lbs

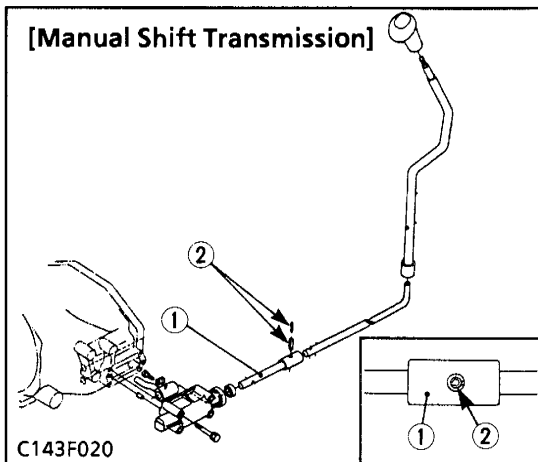


B161P037

Hydraulic Pipes

1. Disconnect the brake rod LH.
2. Remove the front hydraulic block (1) with mounting stay.
3. Remove the inlet pipe (2).

- (1) Front Hydraulic Block (2) Inlet Pipe



C143F020

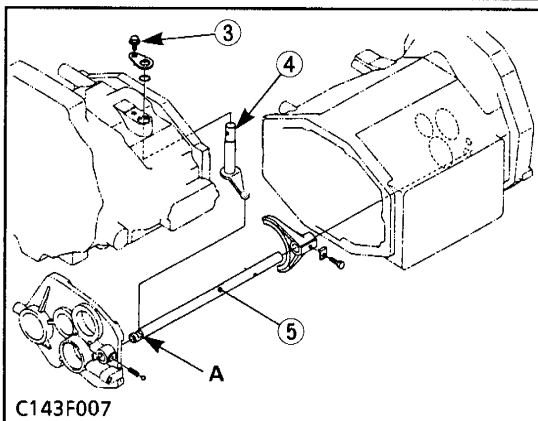
Shift Levers

1. Tap out the spring pins (2) of main shift rod 1 (1). (Manual transmission only.)
2. Remove the shuttle shift arm stopper mounting screw (3), and then pull the shuttle shift arm (4) up.

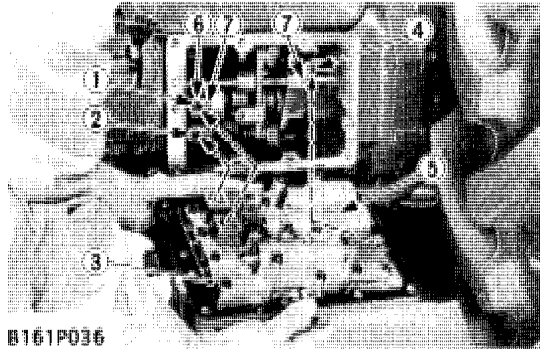
(When reassembling)

- Tap in the spring pins (2) so that their split portion may face forward.
- When reassembling the shuttle shift arm (4) to the shuttle fork rod (5), be sure to install it to the groove (A).

- (1) Main Shift Rod 1 (4) Shuttle Shift Arm
 (2) Spring Pins (5) Shuttle Fork Rod
 (3) Screw



C143F007



B161P036

- (1) 3-4 Shift Pin
- (2) 1-2 Shift Pin
- (3) GST Valve
- (4) Hi-Lo Shift Pin
- (5) Shuttle Check Pin
- (6) Shifter
- (7) Shifter Mounting Screw

GST Valve Assembly (GST Only)

1. Remove the GST valve (3) as a unit after removing the GST delivery pipe.
2. Remove the shift pins (1), (2), (4).

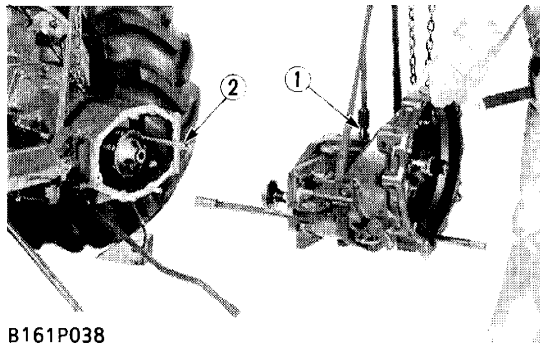
NOTE

- Do not fall down the shuttle check pin (5) while disassembling.

(When reassembling)

- Place the 1-2 (2) and the 3-4 shift pins (1) at neutral position and Hi-Lo shift pins (4) at Hi-shift position (right side), and then assemble the GST valve.
- Install the GST valve (3) by hand, and then tighten the screws. Do not use the hummer.

Tightening torque	Shifter mounting screws	12.7 to 14.7 N·m 1.3 to 1.5 kgf·m 9.4 to 10.8 ft·lbs
	GST valve mounting screws	42.2 to 48.1 N·m 4.3 to 4.9 kgf·m 31.1 to 35.4 ft·lbs
	Joint bolt for GST delivery pipe on GST valve	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft·lbs



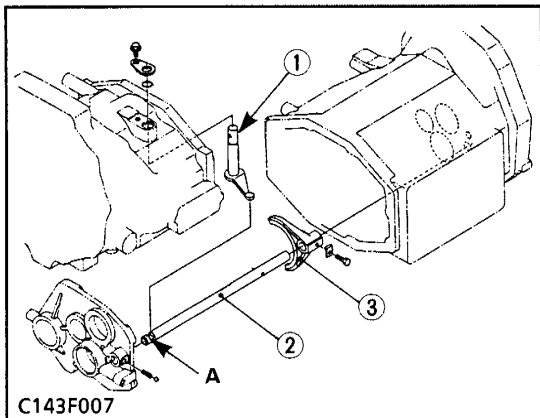
B161P038

Separating Clutch Housing Case

1. Lift up the shuttle shift arm (1).
2. Separate clutch housing from mid case after removing its mounting screws.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of clutch housing and mid case after eliminating the water, oil and stuck liquid gasket.
- When reassembling the shuttle shift arm (1) to the shuttle fork rod (2), be sure to install it to the groove (A).

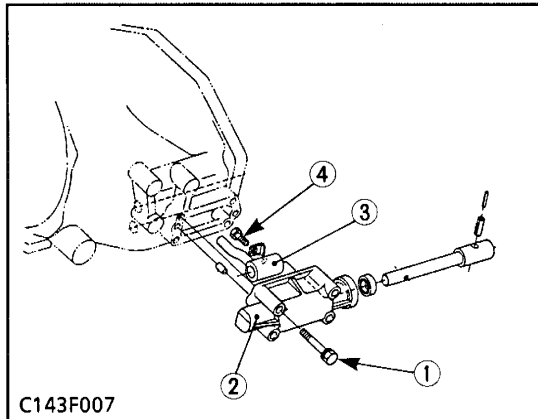


C143F007

Tightening torque	Clutch housing and mid case mounting screws	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft·lbs
	Clutch housing and mid case mounting nuts	102.9 to 117.6 N·m 10.5 to 12.0 kgf·m 76.9 to 86.8 ft·lbs
	Clutch housing and mid case mounting stud bolts	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft·lbs

- (1) Shuttle Shift Arm
- (2) Shuttle Fork Rod
- (3) Shuttle Shift Fork

(5) Disassembling Clutch Housing Case



C143F007
 (1) Screw (3) Main Shift Arm
 (2) Main Shift Base (4) Setting Screw

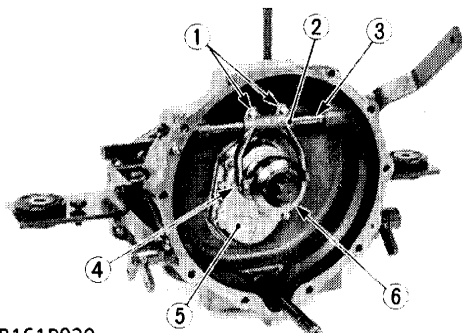
Main Shift Base (Manual Shift Transmission)

1. Remove the main shift base mounting screws (1).
2. Take out the main shift base (2) and main shift arm (3) as a unit.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the clutch housing case and main shift base after eliminate the water, oil and stuck liquid gasket.
- The main shift arm should be fitted on to the shift fork grooves after setting the shift forks to neutral position.

Tightening torque	Main shift base mounting screws	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs
	Main shift arm setting screw	9.8 to 11.3 N·m 1.00 to 1.15 kgf·m 7.2 to 8.3 ft-lbs



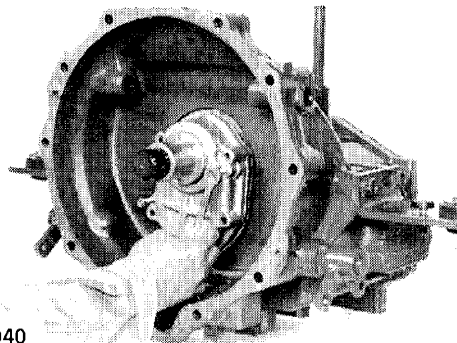
B161P039

Gear Shaft Case

1. Remove the release fork setting screws.
2. Draw out the clutch lever (3) to remove the release fork (2).
3. Take out the thrust ball bearing (6) and the release hub together.
4. Remove the gear shaft case mounting screws.
5. Screw down the two M6 screws into the gear shaft case (5) and pull it out.
6. Take out the gear shaft case (5).

(When reassembling)

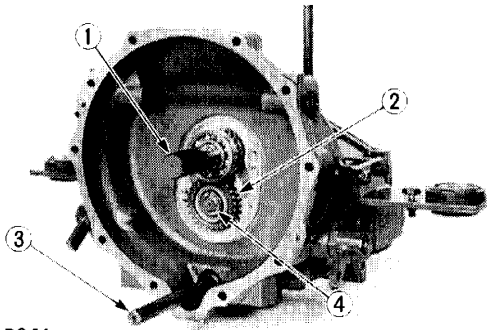
- Apply grease to the sliding surface of the clutch release hub.
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint surface of the gear shaft case and clutch housing case after eliminate the water, oil and stuck liquid gasket.



B161P040

Tightening torque	Gear shaft case mounting screws	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs
	Release fork setting screws	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

(1) Setting Screws (4) Snap Pin
 (2) Release Fork (5) Gear Shaft Case
 (3) Clutch Lever (6) Thrust Ball Bearing



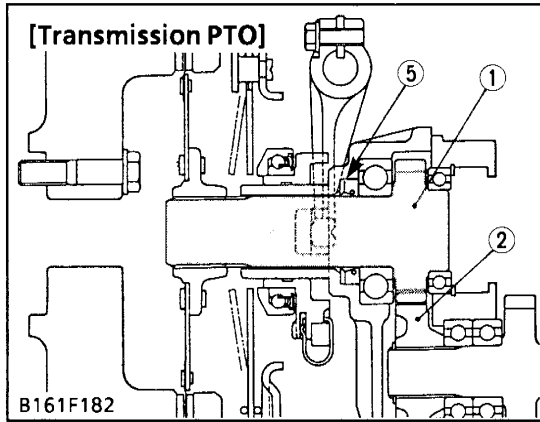
B161P041

24T Gear Shaft, 27T Gear and Front Axle Drive Shaft

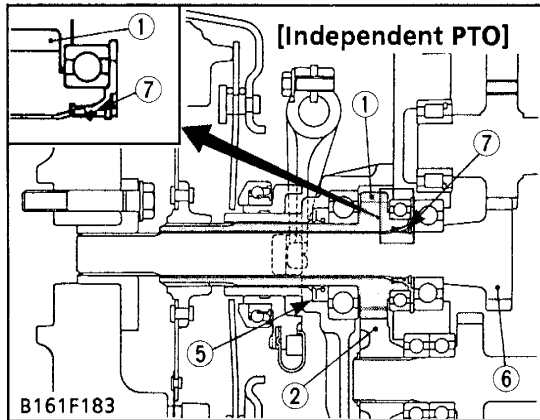
1. Remove the 27T gear (2) after removing the external snap ring (4).
2. Pull out the 24T gear shaft (1).
3. Pull out the front axle drive shaft (3) to the rear side. (4WD only.)

(When reassembling)

- Install the oil seal (7) on the 18T gear shaft (6), noting the direction of the oil seal (7) as shown in the figure left. (Independent PTO type only.)
- Direct the boss side of the 27T gear (2) to the bearing side.
- Install the front axle drive shaft (3) from front side after assembling the clutch housing case and mid case. Then install the sleeve (11), bearing (10), collar (9), sleeve (12) and oil seals (8) in order by using front axle drive shaft tool. (See page 3-NS17.) (Refer to the figure below.) (4WD only.)
- Apply small amount of the grease to the oil seal (5), (7), (8).



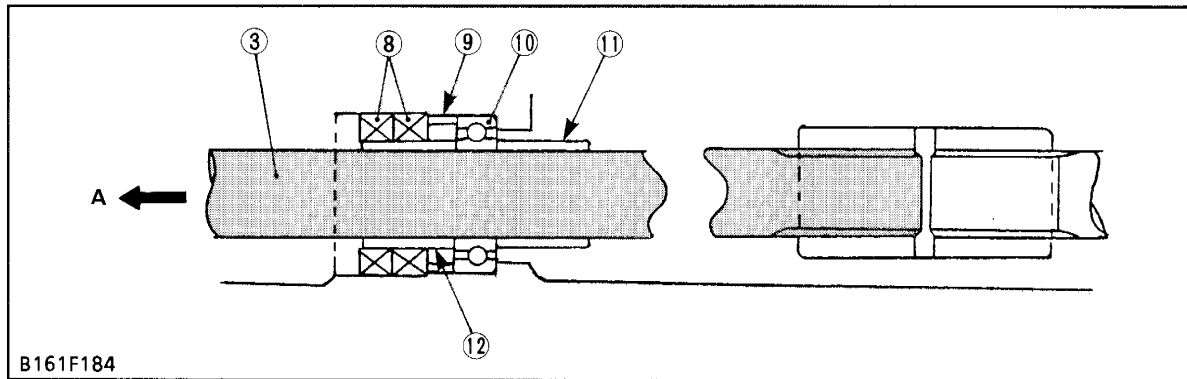
B161F182



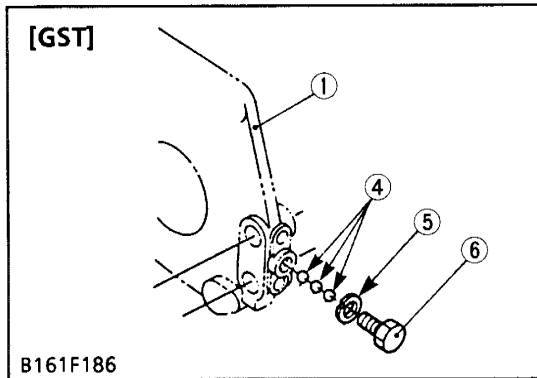
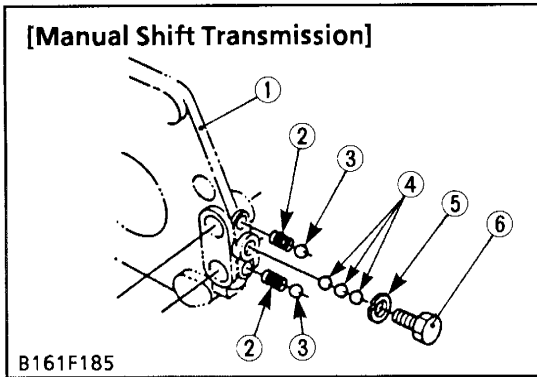
B161F183

[A] To Front Axle

- | | |
|----------------------------|---------------|
| (1) 24T Gear Shaft | (7) Oil Seal |
| (2) 27T Gear | (8) Oil Seals |
| (3) Front Axle Drive Shaft | (9) Collar |
| (4) External Snap Ring | (10) Bearing |
| (5) Oil Seal | (11) Sleeve |
| (6) 18T Gear Shaft | (12) Sleeve |



B161F184



Clutch Housing Bearing Holder

1. Remove the three interlock balls (4) after removing the stopper screw (6).
2. Remove the external snap ring (8) and take out the one-way clutch cam (7), spring (9). (Transmission PTO only.)
3. Pull out the clutch housing bearing holder (1) with using two jack bolts (10).

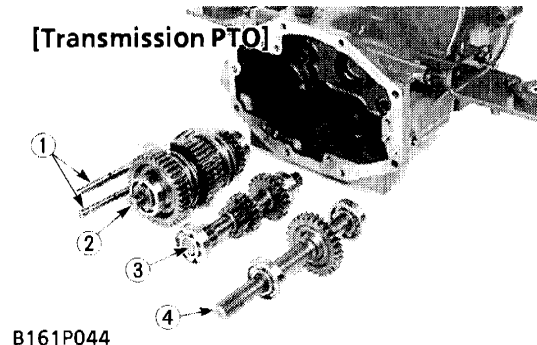
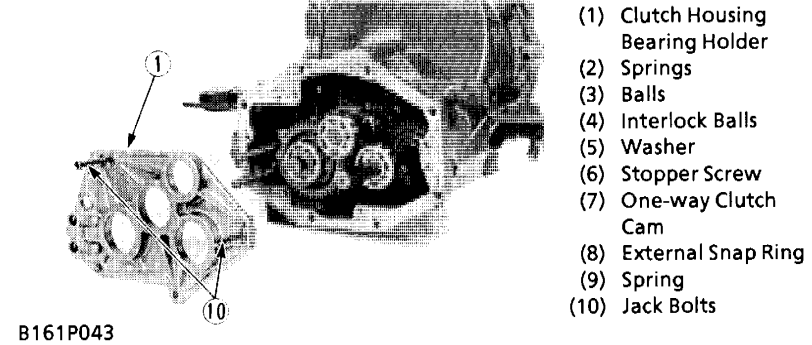
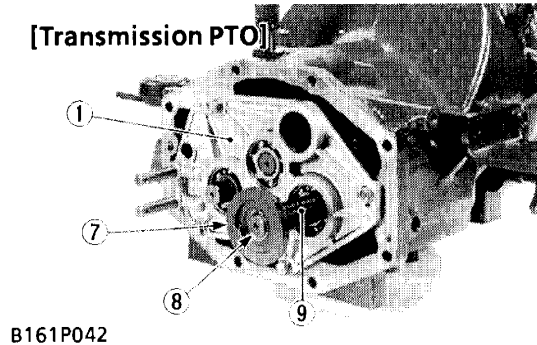
NOTE

- Take care not to fly out the balls (3) and springs (2) when pull out the bearing holder (1).

(When reassembling)

- Tap in the clutch housing bearing holder (1) with plastic hammer until contact to clutch housing case, and then tighten the screws to specified torque.
- Install the three interlock balls (4) with a small amount of grease to the clutch housing bearing holder (1) after setting the shift forks and shift rods to the neutral position.

Tightening torque	Clutch housing bearing holder mounting screws	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft·lbs
	Stopper screw	34.3 to 44.1 N·m 3.5 to 4.5 kgf·m 25.3 to 32.5 ft·lbs

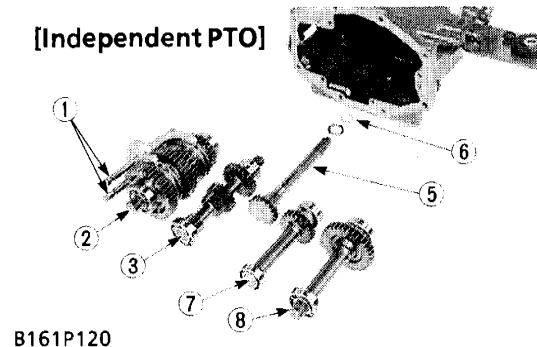


Shaft Assemblies

1. Remove the external snap ring (6). (Independent PTO type only.)
2. Draw out the shaft assemblies (2), (3), (4). (Transmission PTO type.)
3. Draw out the shaft assemblies (2), (3), (5), (7), (8). (Independent PTO type.)

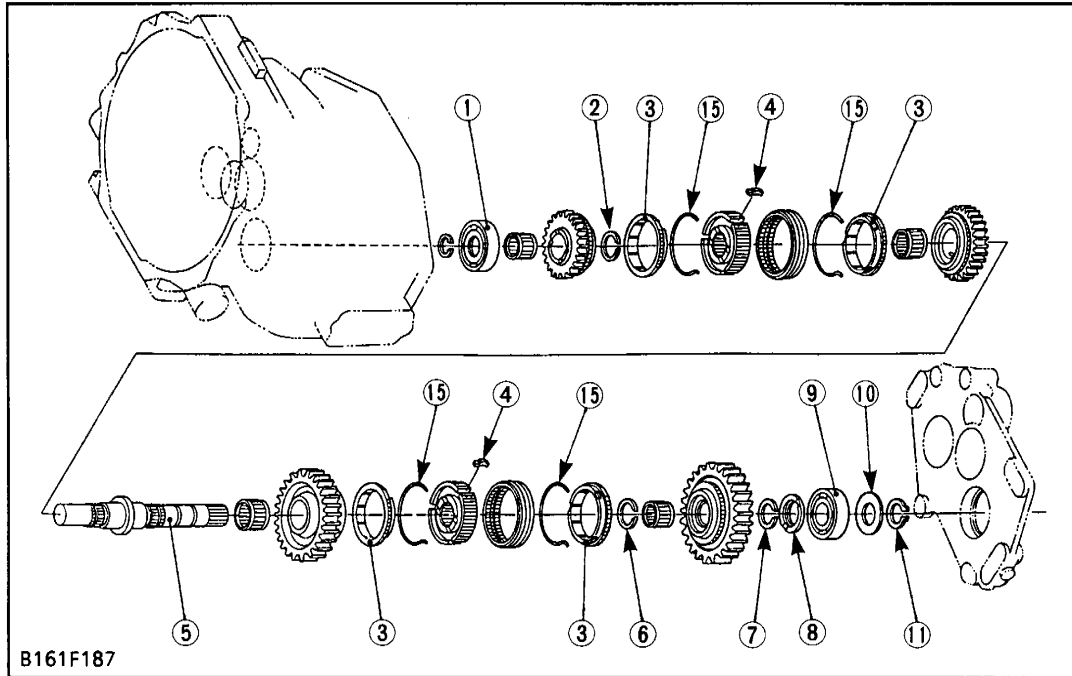
NOTE

- When too tight to draw out the shaft assemblies, tap out them by the fine bar using the small holes on the clutch housing wall.



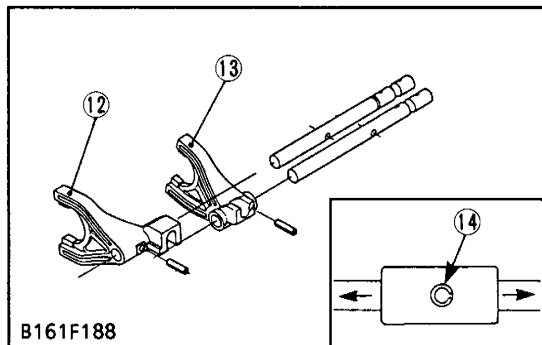
- (1) Shift Rods
- (2) Counter Shaft Assembly
- (3) Main Gear Shaft Assembly
- (4) PTO Counter Shaft Assembly (Transmission PTO)
- (5) 18T Gear Shaft Assembly
- (6) External Snap Ring
- (7) Idle Shaft Assembly (Independent PTO)
- (8) PTO Counter Shaft Assembly (Independent PTO)

Counter Shaft



- (1) Bearing
- (2) External Snap Ring
- (3) Synchronizer Ring
- (4) Synchronizer Keys
- (5) Counter Shaft
- (6) External Snap Ring
- (7) External Snap Ring
- (8) Thrust Collar
- (9) Bearing
- (10) Collar
- (11) External Snap Ring
- (12) Shift Fork (3-4)
- (13) Shift Fork (1-2)
- (14) Spring Pins
- (15) Synchronizer Springs

B161F187

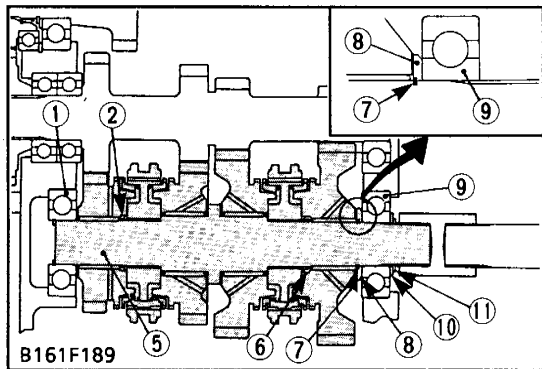


B161F188

1. Remove the external snap ring (11).
2. Remove the bearings (1), (9) by the bearing puller.
3. Remove the gears on the counter shaft (5) and external snap ring (6).

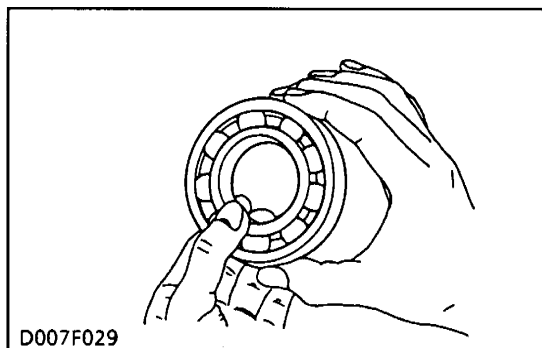
(When reassembling)

- Tap in the spring pins (14) so that their split portion may face forward. (Refer to the left figure.)
- Direct the groove side of the thrust collar (8) to the gear side.
- Reinstall the synchronizer keys (4) in the key grooves of the synchronizer rings (3) firmly.



B161F189

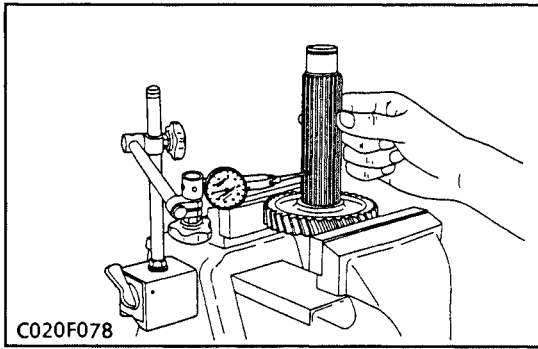
SERVICING



D007F029

Checking Bearing

1. Hold the inner race, and push and pull the outer race in all directions to check for wear and roughness.
2. Apply transmission fluid to the bearing, and hold the inner race. Then, turn the outer race to check rotation.
3. If there is any defect, replace it.

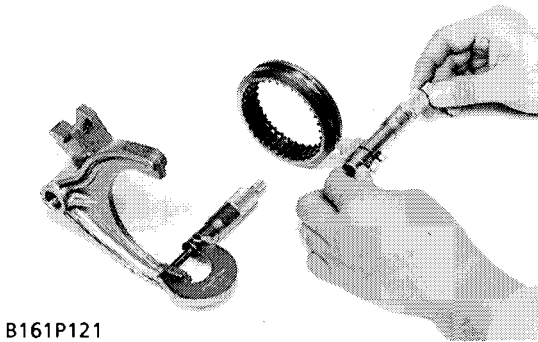


C020F078

Clearance between Gear and Spline or Hub and Spline

1. Secure the gear or the hub in a vise.
2. Set a dial gauge (lever type) with its finger on the spline.
3. Move the shaft to measure the clearance.
4. If the clearance exceeds the allowable limit, replace them.

Clearance between gear and spline or hub and spline	Factory spec.	0.030 to 0.078 mm 0.00118 to 0.00307 in.
	Allowable limit	0.2 mm 0.008 in.

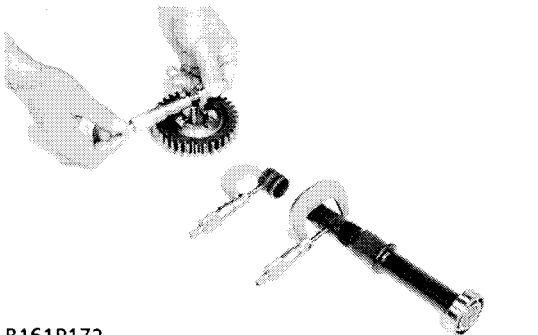


B161P121

Clearance between Shift Fork and Shifter Groove

1. Measure the width of shift fork.
2. Measure the shifter groove width, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

Clearance between shift fork and shifter groove	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.
	Allowable limit	0.8 mm 0.031 in.



B161P172

Clearance between Gear and Shaft

1. Measure the shaft O.D. (rubbing surface).
2. Measure the gear I.D. (rubbing surface).
3. Measure the O.D. of the two needles installed diagonally in the needle bearing.
4. Calculate the clearance.
(Clearance = Gear I.D. - {(2 x needle O.D.) + shaft O.D.})
5. If the clearance exceeds the allowable limit, replace them.

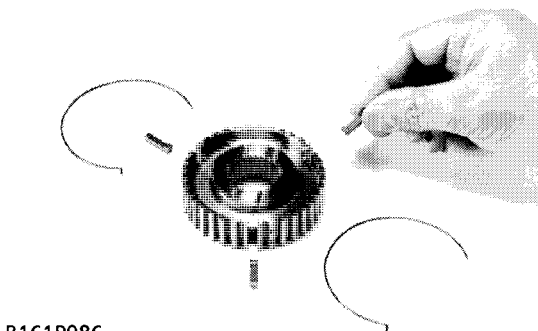
Clearance between gear and shaft	Factory spec.	0.021 to 0.054 mm 0.00083 to 0.00213 in.
	Allowable limit	0.1 mm 0.004 in.



B161P085

Checking Contact between Coupling and Shifter

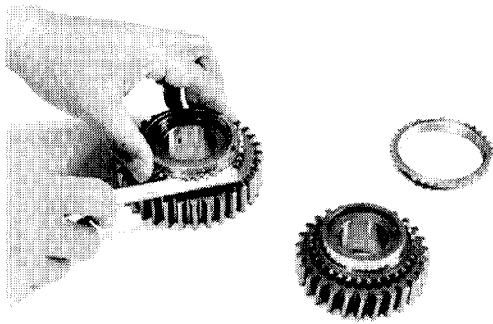
1. Check to see if there is any flaw or wear on the spline of the coupling and shifter, and the key groove on the coupling.
2. Engage the shifter with the coupling, and check that they slide smoothly.
3. Similarly, check that there is any flaw or wear on the gear splines.
4. If there is any defect, replace them.



B161P086

Flaw on Synchronizer Key and Spring

1. Check the projection in the center of the synchronizer key for wear.
2. Check the spring for fatigue or wear on the area where the spring contacts with the keys.
3. If there is any defect, replace them.



B161P087

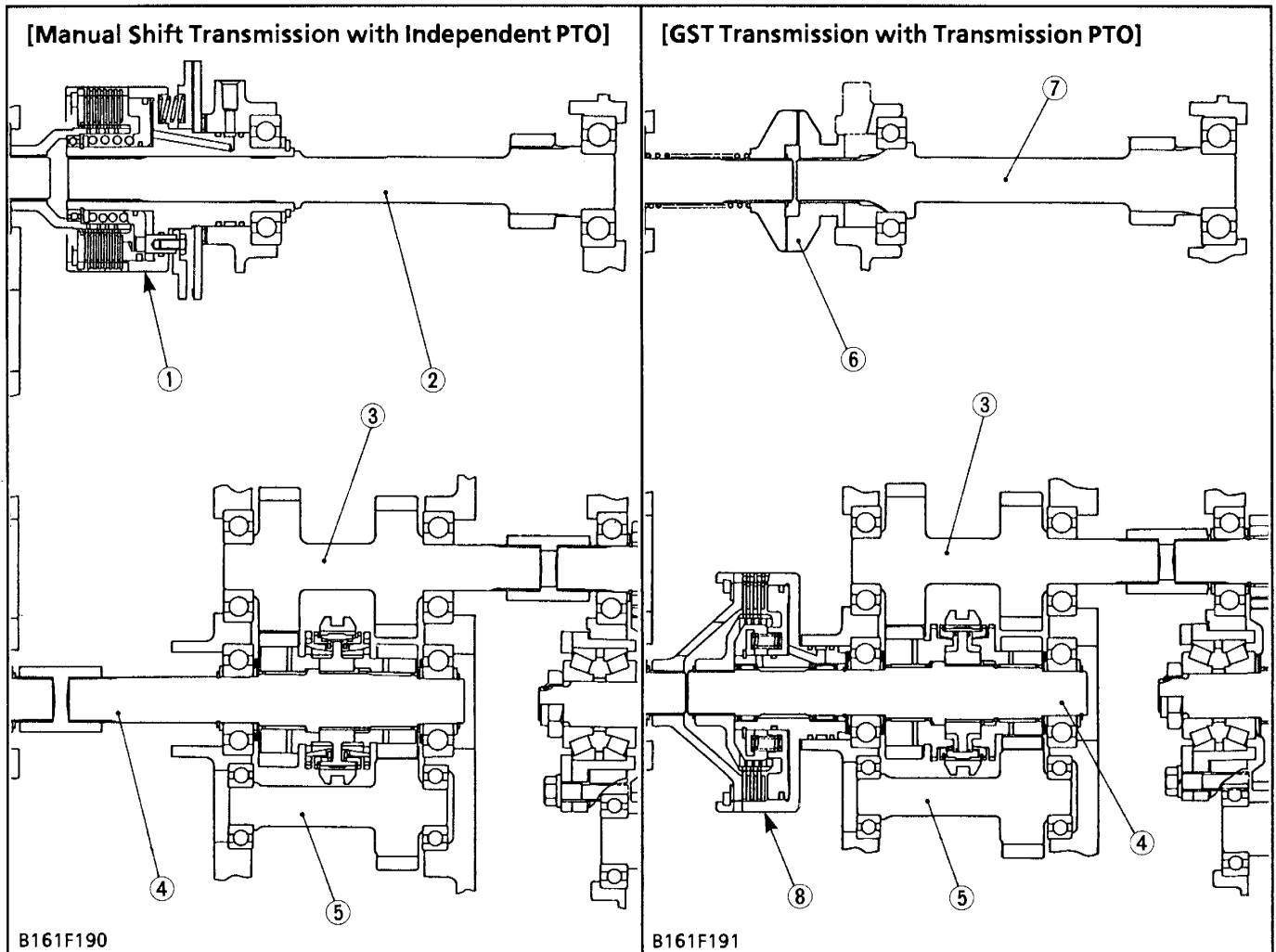
Side Clearance between Synchronizer Ring and Gear

(in Contact)

1. Press the synchronizer ring against the tapered portion of the gear, and measure the side clearance.
2. Apply thin film of red lead to the tapered portion, press the ring against it by hand, rub them together a few times, and check the contact.
3. Check the tooth surface and key grooves of the ring for wear.
4. If the side clearance exceeds the allowable limit or if there is any defect, replace the synchronizer ring.

Side clearance	Allowable limit	0.35 mm 0.0138 in.
Contact condition of tapered portion	Allowable limit	More than 80 %

[2] MID CASE

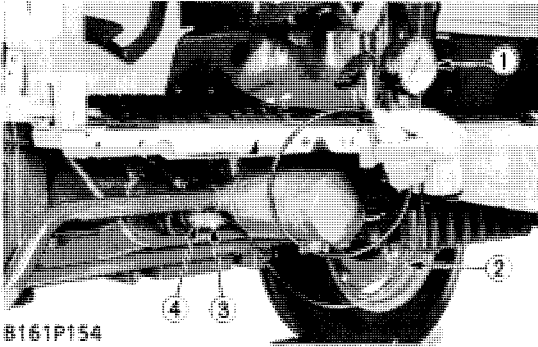


B161F190

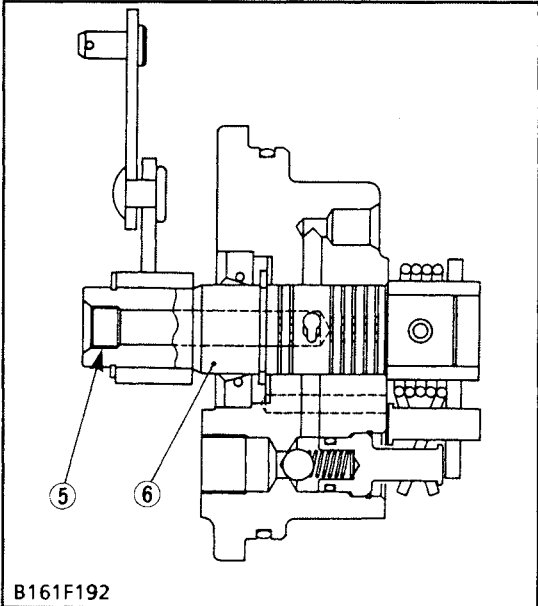
B161F191

- | | | | |
|---------------------------------|------------------------|----------------------------|---------------------------------|
| (1) Independent PTO Clutch Pack | (3) Shuttle Gear Shaft | (5) Reverse Gear Shaft | (7) Transmission PTO Gear Shaft |
| (2) Independent PTO Gear Shaft | (4) Shuttle Shaft | (6) PTO One-way Clutch Cam | (8) GST Clutch Pack |

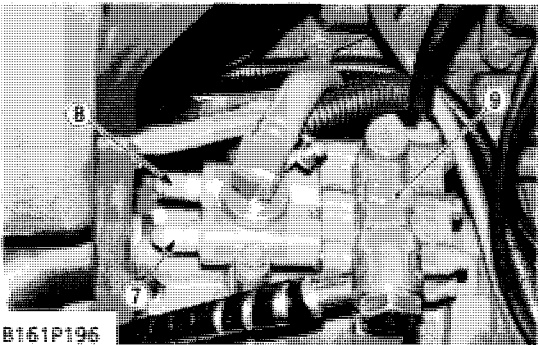
CHECKING AND ADJUSTING



B161P154



B161F192



B161P196

Checking Independent PTO Pressure

(Independent PTO Type Only)

1. Start the engine and warm up the transmission fluid, and then stop the engine.
2. Remove the plug (5) (PT 1/8) on the PTO valve spool (6).
3. Set the adaptor 4 (4), threaded joint (3), cable (2) and pressure gauge (1).
4. Start the engine and measure the pressure.
5. For adjustment, use the reducing valve adjuster (7) of the regulator valve (9).

■ IMPORTANT

- Do not connect the universal joint of the implement to the tractor PTO shaft while testing.

■ NOTE

- The setting pressure of independent PTO is the system pressure of GST. (GST type.)

Independent PTO pressure	When PTO shift lever is "ENGAGED" position	2.45 to 2.55 MPa 25.0 to 26.0 kgf/cm ² 356 to 370 psi
	When PTO shift lever is "DISENGAGED" position	No pressure

Condition

- Engine speed Idling speed
- Oil temperature 40 to 60 °C
104 to 140 °F

(Reference)

- Turn to clockwise direction → Pressure is increased
- Turn to counterclockwise direction → Pressure is decreased

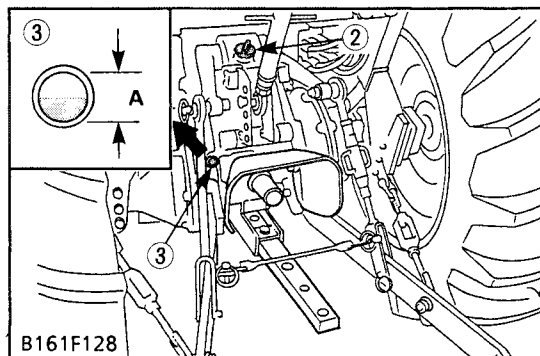
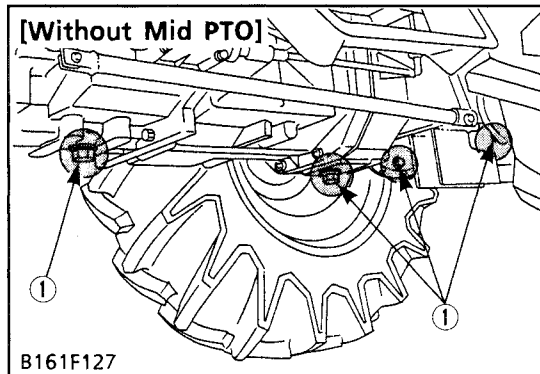
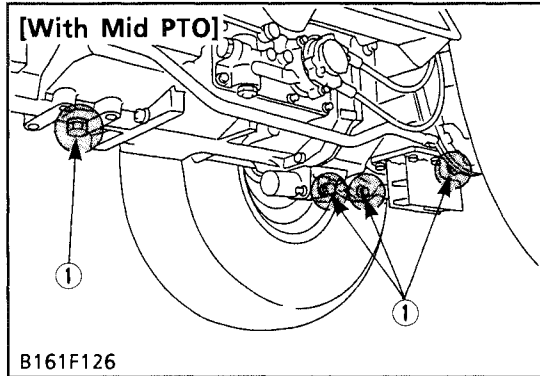
- | | |
|--------------------|-----------------------------|
| (1) Pressure Gauge | (6) Spool |
| (2) Cable | (7) Reducing Valve Adjuster |
| (3) Threaded Joint | (8) Relief Valve Adjuster |
| (4) Adaptor 4 | (9) Regulator Valve |
| (5) Plug (PT 1/8) | |

DISASSEMBLING AND ASSEMBLING

NOTE

- If the tractors are cabin specifications, refer to section 10 CABIN [1] SEPARATING CABIN FROM TRACTOR BODY. (See page 10-S20.)

(1) Draining the Transmission Fluid



Draining the Transmission Fluid

1. Place oil pans underneath the transmission case.
2. Remove the four drain plugs (1).
3. Drain the transmission fluid.
4. Reinstall the four drain plugs (1).

(When refilling)

- Fill up from filling port after removing the filling plug (2) until reaching the gauge (3).
- After running the engine for few minutes, stop it and check the oil level again, add the fluid to prescribed level if it is not correct level.

Capacity	Transmission fluid	
		39.0 ℓ
		41.2 U.S.qts.
		34.3 Imp.qts.

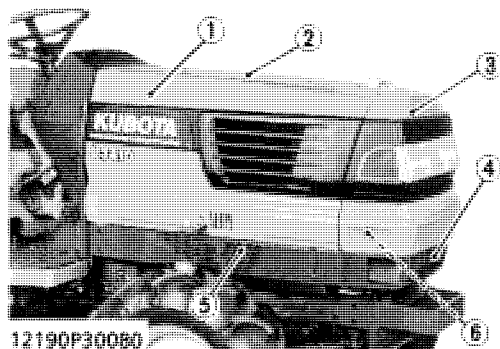
IMPORTANT

- Use only KUBOTA SUPER UDT fluid. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-8.)
- Do not mix different brands fluid together.

[A] Oil level is acceptable within this range.

- (1) Drain Plug (3) Gauge
 (2) Filling Plug

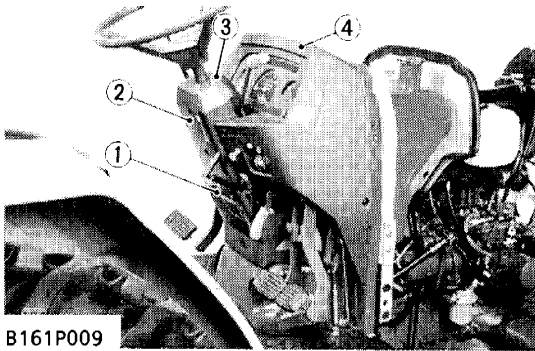
(2) Separating Panel Frame Assembly



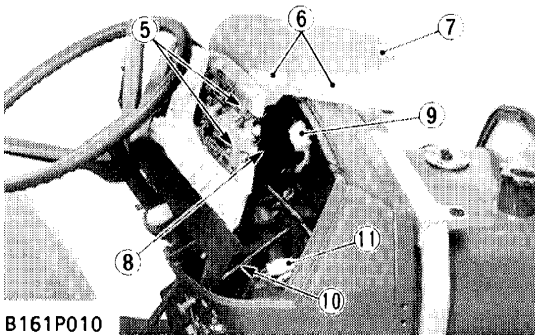
Preparation 1

1. Open the front mask (3) and disconnect the battery negative cable (6).
2. Remove the right and left side covers (1).
3. Remove the front mask (3).
4. Remove the front grille (4).
5. Remove the right and left side skirts (5).
6. Remove the bonnet (2).

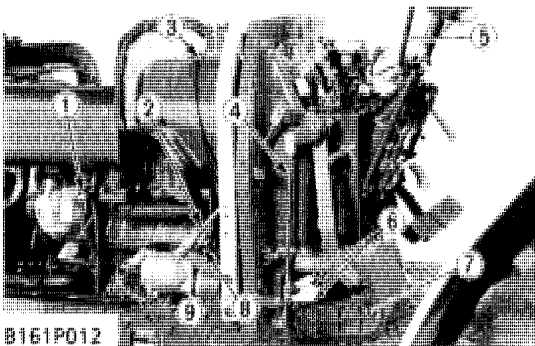
- (1) Side Cover RH, LH (4) Front Grille
 (2) Bonnet (5) Side Skirt RH, LH
 (3) Front Mask (6) Battery Negative Cable



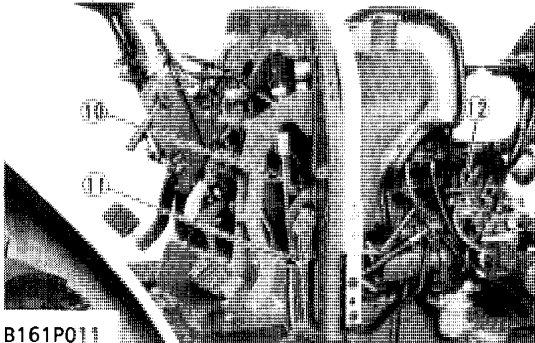
B161P009



B161P010



B161P012



B161P011

Preparation 2

1. Remove the steering post covers (2), (3) and panel under cover (1).
2. Disconnect the meter cable (8) at the engine side.
3. Remove the meter panel mounting screws and open the meter panel (4).
4. Remove the meter panel cover (7), and disconnect the two connectors (5) and meter cable (8).
5. Take out the meter panel (4).
6. Disconnect the main switch connector (11) and light switch connector (9).
7. Disconnect the engine stop cable (10) at the engine side.

NOTE

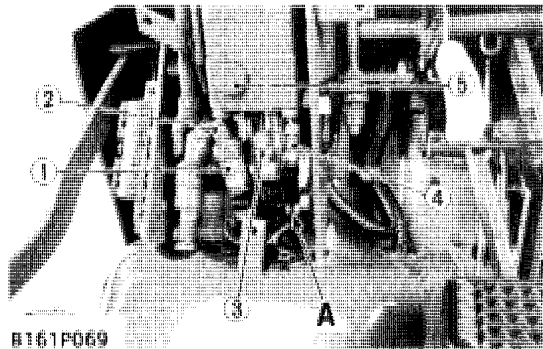
- Do not remove the seals (6) on the meter panel cover (7).

- | | |
|-------------------------|----------------------------|
| (1) Panel Under Cover | (7) Meter Panel Cover |
| (2) Steering Post Cover | (8) Meter Cable |
| (3) Steering Post Cover | (9) Light Switch Connector |
| (4) Meter Panel | (10) Engine Stop Cable |
| (5) Connectors | (11) Main Switch Connector |
| (6) Seals | |

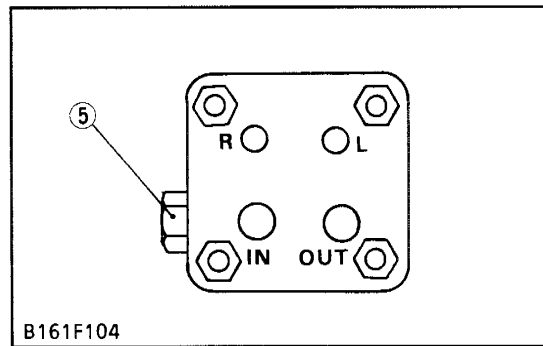
Preparation 3

1. Disconnect the brake rods (4), (10).
2. Disconnect the clutch rod (2).
3. Remove the accelerator rod (12).
4. Disconnect the foot accelerator rod (11).
5. Remove the panel frame cover (7) and disconnect the three connectors (6).
6. Remove the shuttle shift lever (5) after disconnecting the limit switch wire harness.
7. Disconnect the 2P connector for alternator (1) and the jumper leads for fuel level sensor (3) and starter (9).

- | | |
|---------------------------------------|--------------------------------|
| (1) 2P Connector for Alternator | (7) Panel Frame Cover |
| (2) Clutch Rod | (8) Jumper Lead for Oil Switch |
| (3) Jumper Lead for Fuel Level Sensor | (9) Jumper Lead for Starter |
| (4) Brake Rod LH | (10) Brake Rod RH |
| (5) Shuttle Shift Lever | (11) Foot Accelerator Rod |
| (6) Connectors | (12) Accelerator Rod |



B161P069



B161F104

Hydraulic Pipes

1. Disconnect the main delivery hose (1), return hose (2), right turning delivery hose (3) and left turning delivery hose (4) from the power steering controller.

(When reassembling)

- In assembling the turning delivery hoses to the steering controller, connect the delivery hose with identification mark (tape) "A" to the L port of the steering controller. (Refer to figure left.)

Tightening torque	Main delivery hose retaining nut	46.6 to 50.9 N·m 4.8 to 5.2 kgf·m 34.4 to 37.6 ft-lbs
	Turning delivery hose retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft-lbs

[A] Identification Mark (Tape)

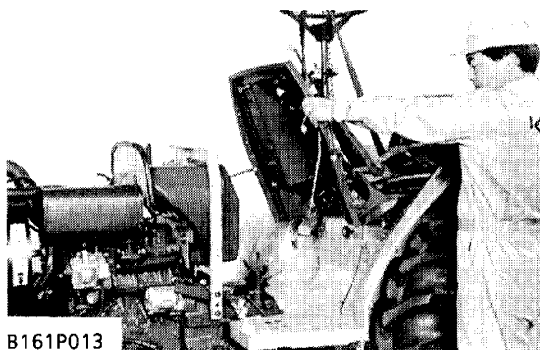
- | | |
|---------------------------------|--------------------------------|
| (1) Main Delivery Hose | (4) Left Turning Delivery Hose |
| (2) Return Hose | (5) Relief Valve Plug |
| (3) Right Turning Delivery Hose | |

Panel Frame and Steering Assembly

1. Remove the panel frame mounting screws. (Two screws at upper port. Seven screws at lower part.)
2. Take out the panel frame and steering assembly as a unit.

(When reassembling)

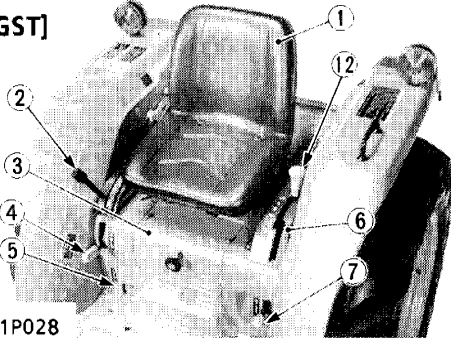
- Do not get in the wiring harness between panel frame and platform.



B161P013

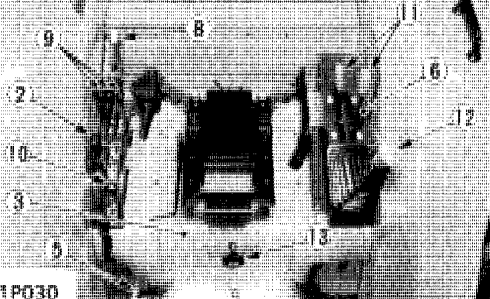
(3) Separating Rear Fenders and Platform Assembly

[GST]

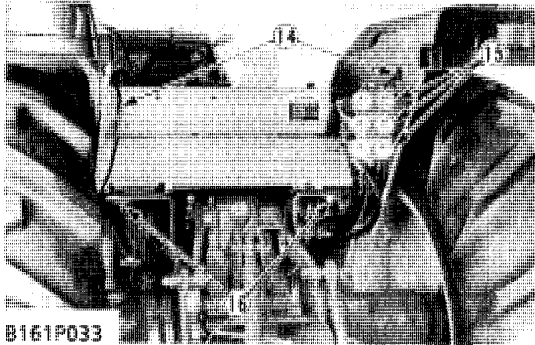


B161P028

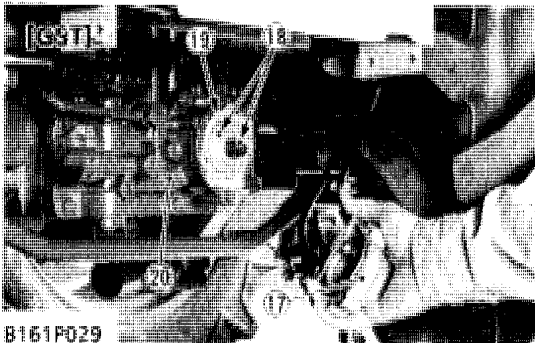
[Manual Shift Transmission (with Creep, Draft, Remote Control Valve)]



B161P030



B161P033



B161P029

Preparation

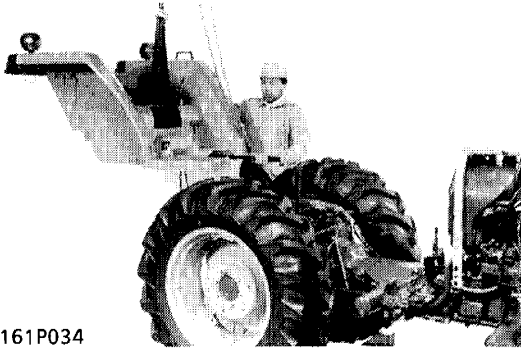
1. Take out the ROPS.
2. Remove the seat assembly (1).
3. Remove the mid PTO lever (4) (if equipped) and grips (2), (7), (8), (9), (10), (11), (12), (13).
4. Remove the shift lever guide (6).
5. Remove the seat under cover (3), and then remove the extension bar of the hydraulic lowering valve.
6. Disconnect the differential lock rod and differential lock lever (5).
7. Remove the quick couplers (15) as a unit. (If equipped.)
8. Disconnect the PTO shift cable at the PTO shift lever.
9. Loosen and remove the floor seat mounting two screws (16) and platform mounting two screws.
10. Disconnect the wiring harness (14) for hazard lights.
11. Remove the shift cable (17) as a unit at the GST valve (20) side. (GST only.)

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face of the rotary valve cover (19) and shift cable. (GST only.)
- Set the main shift lever at the neutral position, align the punched marks (18), and then assemble the shift cable (17). (GST only.)
- Check and adjust the PTO shift cable. (See page 10-S28.)

Tightening torque	ROPS mounting screws	M12, grade 7 screws	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft·lbs
		M14, grade 9 screws	166.7 to 196.1 N·m 17.0 to 20.0 kgf·m 123 to 144 ft·lbs
		M16, grade 11 screws	260.9 to 304.0 N·m 26.6 to 31.0 kgf·m 192 to 224 ft·lbs
		9/16-18 UNF, grade 8 screws	149.1 to 179.5 N·m 15.2 to 18.3 kgf·m 110 to 132 ft·lbs
		Floor seat and platform mounting screws and nuts	196.1 to 225.6 N·m 20.0 to 23.0 kgf·m 144.7 to 166.4 ft·lbs
	Shift cable mounting screws	7.8 to 8.8 N·m 0.8 to 0.9 kgf·m 5.8 to 6.5 ft·lbs	

- | | |
|-----------------------------|---------------------------------|
| (1) Seat | (11) Grips |
| (2) Grip | (12) Grip |
| (3) Seat Under Cover | (13) Grip |
| (4) Mid PTO Lever | (14) Wiring Harness |
| (5) Differential Lock Lever | (15) Quick Couplers |
| (6) Shift Lever Guide | (16) Floor Seat Mounting Screws |
| (7) Grip | (17) Shift Cable |
| (8) Grip | (18) Punched Mark |
| (9) Grips | (19) Rotary Valve Cover |
| (10) Grip | (20) GST Valve |

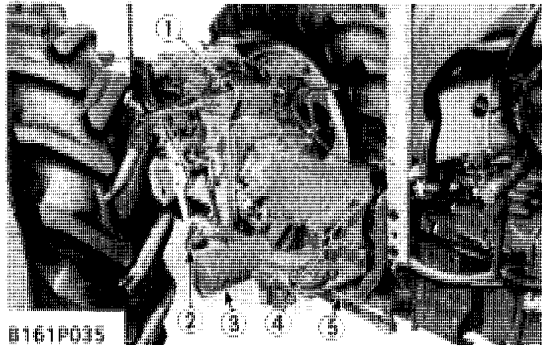


B161P034

Fender, Floor Seat and Platform Assembly

1. Remove the fender, floor seat and platform as a unit.

(4) Separating Mid Case



B161P035

Hydraulic Pipes

1. Remove the delivery pipe (1), inlet pipe (2), hydraulic filter (3) with its support and GST delivery pipe (4).
2. Remove the brake rods RH (5) and LH.

(When reassembling)

Tightening torque	Joint bolt for GST delivery pipe (4) and regulator valve (GST or independent PTO type only)	34.3 to 39.2 N-m 3.5 to 4.0 kgf-m 25.3 to 28.9 ft-lbs
	Joint bolt (with orifice) for GST delivery pipe (4) and independent PTO valve (Independent PTO type only)	34.3 to 39.2 N-m 3.5 to 4.0 kgf-m 25.3 to 28.9 ft-lbs

- (1) Delivery Pipe
- (2) Inlet Pipe
- (3) Hydraulic Filter
- (4) GST Delivery Pipe
- (5) Brake Rod RH

GST Valve Assembly (GST Only)

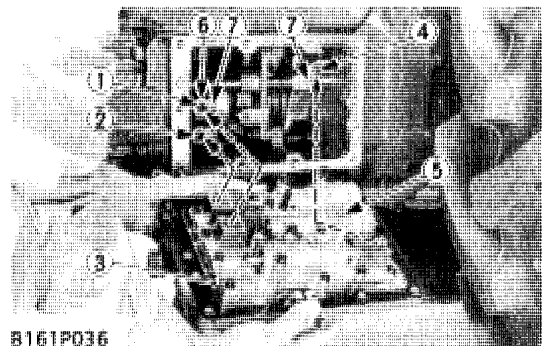
1. Remove the GST valve (3) as a unit after removing the GST delivery pipe.
2. Remove the shift pins (1), (2), (4).

NOTE

- Do not fall down the shuttle check pin (5) while disassembling.

(When reassembling)

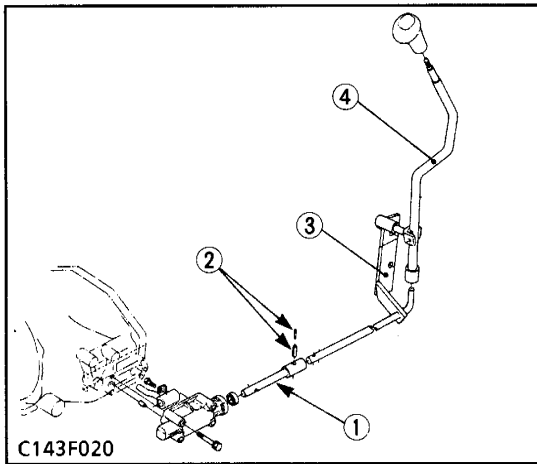
- Place the 1-2 (2) and the 3-4 shift pins (1) at neutral positions and Hi-Lo shift pins (4) at Hi-shift position (right side), and then assemble the GST valve.
- Install the GST valve (3) by hand, and then tighten the screws. Do not use the hummer.



B161P036

- (1) 3-4 Shift Pin
- (2) 1-2 Shift Pin
- (3) GST Valve
- (4) Hi-Lo Shift Pin
- (5) Shuttle Check Pin
- (6) Shifter
- (7) Shifter Mounting Screw

Tightening torque	Shifter mounting screws	12.7 to 14.7 N-m 1.3 to 1.5 kgf-m 9.4 to 10.8 ft-lbs
	GST valve mounting screws	42.2 to 48.1 N-m 4.3 to 4.9 kgf-m 31.1 to 35.4 ft-lbs
	Joint bolt for GST delivery pipe on GST valve	34.3 to 39.2 N-m 3.5 to 4.0 kgf-m 25.3 to 28.9 ft-lbs



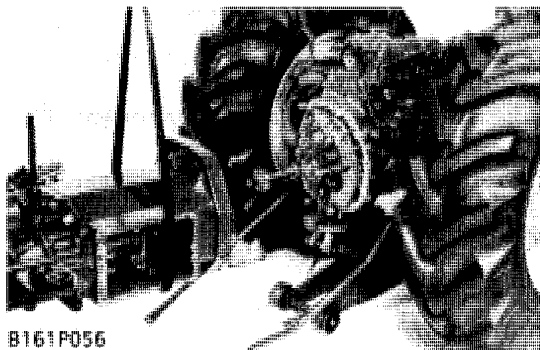
Main Shift Lever (Manual Shift Transmission Only)

1. Tap out the spring pins (2) of main shift rod (1).
2. Remove the main shift lever (4) with the support (3).

(When reassembling)

- Tap in the spring pins (2) so that their split portion may face forward.

- (1) Main Shift Rod
- (2) Spring Pins
- (3) Support
- (4) Main Shift Lever



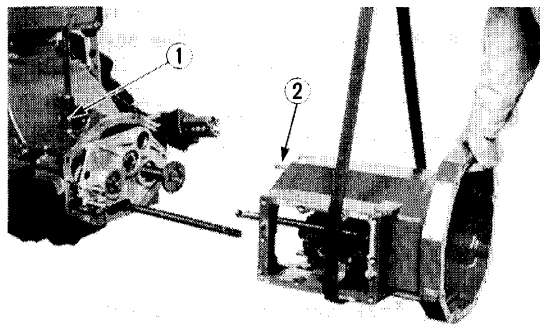
Separating Mid Case and Transmission Case

1. Separate the mid case and transmission case after removing their mounting screws.

(When reassembling)

- Confirm to insert the PTO shaft to one-way clutch firmly, turning the PTO shaft.
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the clutch housing and mid case after eliminating the water, oil and stuck liquid gasket.

Tightening torque	Mid case and transmission case mounting screws, nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Mid case and transmission case mounting stud bolts	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft-lbs

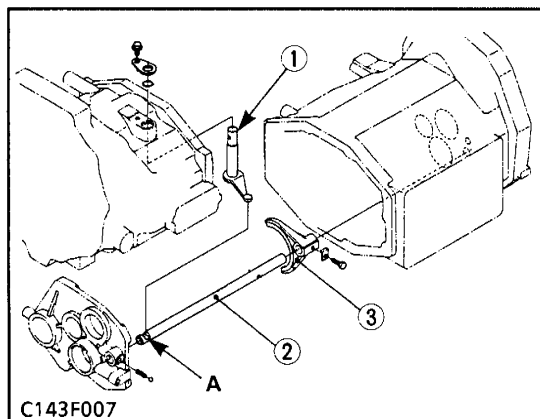


Separating Mid Case

1. Lift up the shuttle shift arm (1).
2. Separate the mid case from the clutch housing after removing their mounting screws.

(When reassembling)

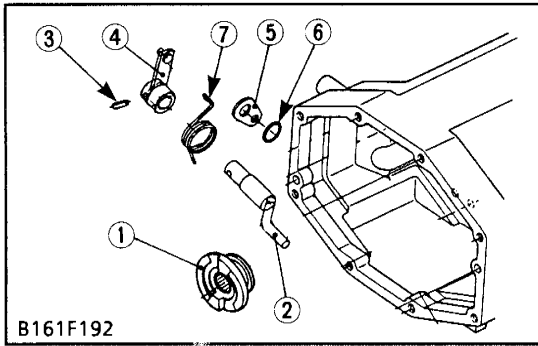
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of clutch housing and mid case after eliminating the water, oil and stuck liquid gasket.
- When reassembling the shuttle shift arm (1) to the shuttle fork rod (2), be sure to install it to the groove (A).



Tightening torque	Clutch housing and mid case mounting screws	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Clutch housing and mid case mounting nuts	102.9 to 117.6 N·m 10.5 to 12.0 kgf·m 76.9 to 86.8 ft-lbs
	Clutch housing and mid case mounting stud bolts	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft-lbs

- (1) Shuttle Shift Arm
- (2) Shuttle Fork Rod
- (3) Shuttle Shift Fork

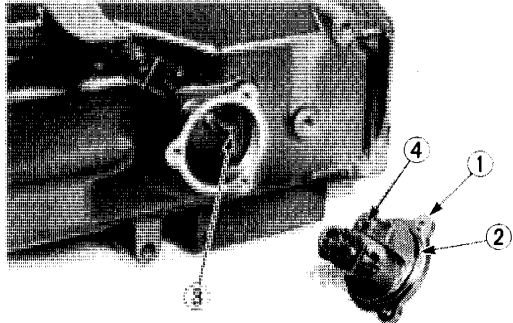
(5) Disassembling Mid Case of Manual Shift Transmission



PTO Shift Levers (Transmission PTO Type)

1. Remove the one-way clutch cam (1).
2. Tap out the spring pin (3), and remove the shift arm (4) and spring (7).
3. Remove the holder (5) and shift fork (2).

- (1) One-way Clutch Cam
- (2) Shift Fork
- (3) Spring Pin
- (4) Shift Arm
- (5) Holder
- (6) O-ring
- (7) Spring



Independent PTO Valve (Independent PTO Type)

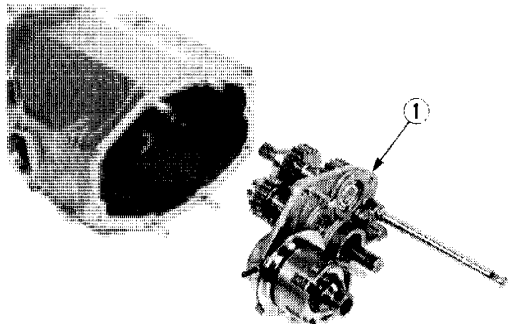
1. Remove the independent PTO valve (1) as a unit.

(When reassembling)

- Apply small amount of grease for the O-ring (2).
- Install the pipe (3) to the hole (4) of the independent PTO valve (1) firmly.

Tightening torque	Independent PTO valve mounting screws	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs
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- (1) Independent PTO Valve
- (2) O-ring
- (3) Pipe
- (4) Hole



Mid Case Bearing Holder with Gears

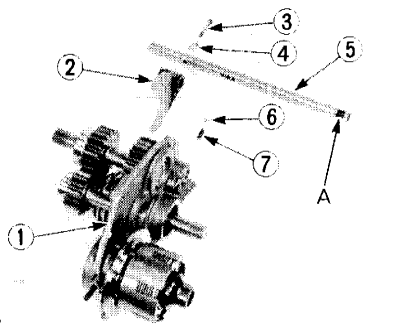
1. Remove the mid case bearing holder mounting screws, and then take out the bearing holder (1) with gears as a unit.

(When reassembling)

- Tap in the mid case bearing holder (1) with plastic hammer until contact to mid case, and then tighten the screws to specified torque.

Tightening torque	Mid case bearing holder mounting screws	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
-------------------	---	---

- (1) Mid Case Bearing Holder



Shuttle Shift Fork

1. Remove the shuttle shift fork setting screw (3) after removing the stake of the lock washer (4).
2. Draw out the shuttle shift fork rod (5) and take out the shuttle shift fork (2).

NOTE

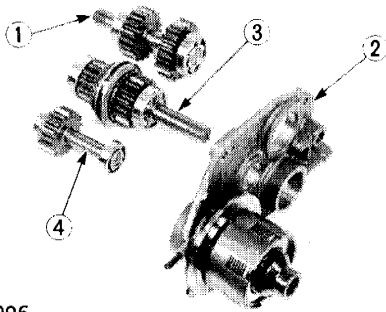
- Take care not to fly out the ball (6) and spring (7) when pull out the shuttle shift fork rod (5).

(When reassembling)

- Direct the shorter end of the shuttle shift fork boss to mid bearing holder side.
- Direct the grooved side (A) of fork rod (5) to upward.
- Install the spring (7) and ball (6) to the mid case bearing holder (1) firmly.
- Bend the lock washer (4) against one side of the shuttle shift fork setting screw.

- (1) Mid Case Bearing Holder
- (2) Shuttle Shift Fork
- (3) Shuttle Shift Fork Setting Screw
- (4) Lock Washer
- (5) Shuttle Shift Fork Rod
- (6) Ball
- (7) Spring

Tightening torque	Shuttle shift fork setting screw	12.7 to 14.7 N·m 1.3 to 1.5 kgf·m 9.4 to 10.8 ft-lbs
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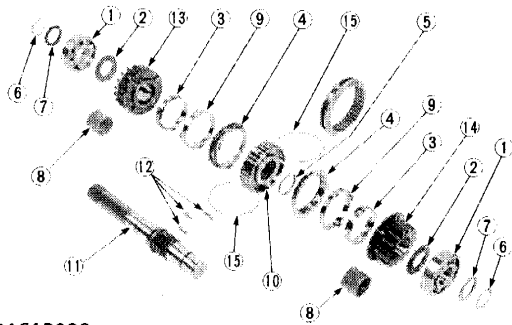


Shaft Assemblies

1. Take out the shuttle shaft assembly (3), shuttle gear shaft assembly (1) and reverse gear shaft assembly (4) from the mid bearing holder (2).

- (1) Shuttle Gear Shaft Assembly
- (2) Mid Case Bearing Holder
- (3) Shuttle Shaft Assembly
- (4) Reverse Gear Shaft Assembly

B161P096



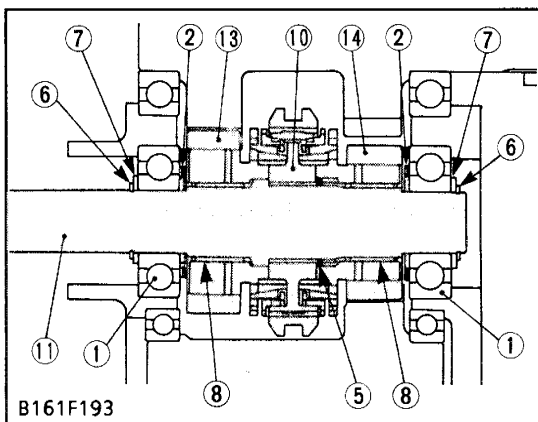
Shuttle Shaft

1. Remove the external snap rings (6) and collars (7).
 2. Draw out the bearings (1) by the bearing puller.
 3. Remove the gears, collars and etc.
 4. Remove external snap ring (5), and then remove the hub (10).

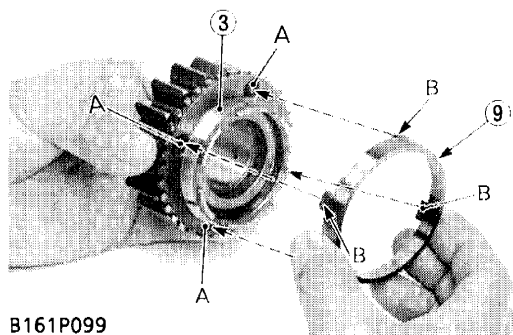
(When reassembling)

- Apply enough transmission fluid to the synchronizer portion, needle bearings (8) and thrust collars (2).
- Direct the grooved side of the thrust collars (2) to the needle bearing (8) side.
- Install the protrusion portions (B) of the center rings (9) to the holes (A) of the gears (13), (14) firmly. (Refer to photo left.)
- Install the protrusion portions (D) of the outer synchronizer rings (4) to the grooves (C) of the inner synchronizer rings (3). (Refer to photo left.)
- Install the external snap ring (5) to the groove of the shuttle shaft (11) firmly.
- Install the synchronizer keys (12) in the key grooves of the outer synchronizer rings (4) firmly.

B161P098

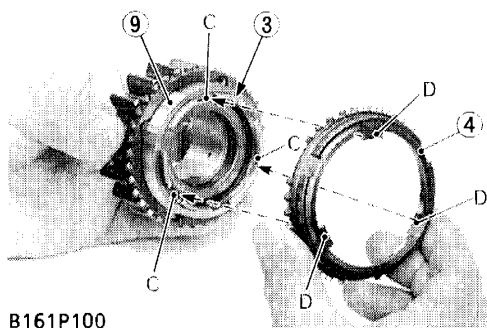


- [A] Holes of the Gear
- [B] Protrusion Portions of the Center Ring
- [C] Groove of the Inner Synchronizer Ring
- [D] Protrusion Portion of the Outer Synchronizer Ring



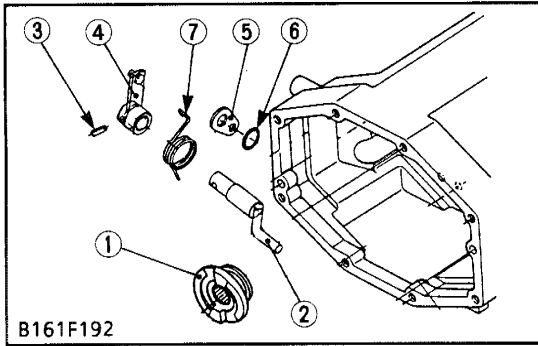
- (1) Bearings
- (2) Thrust Collars
- (3) Inner Synchronizer Rings
- (4) Outer Synchronizer Rings
- (5) External Snap Ring
- (6) External Snap Rings
- (7) Collars
- (8) Needle Bearings
- (9) Center Rings
- (10) Hub
- (11) Shuttle Shaft
- (12) Synchronizer Keys
- (13) 18T Gear
- (14) 15T Gear
- (15) Synchronizer Key Spring

B161P099



B161P100

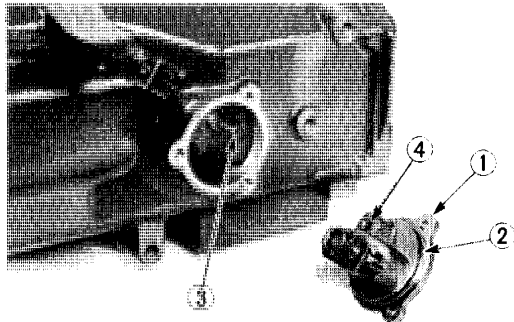
(6) Disassembling Mid Case of GST Transmission



PTO Shift Levers (Transmission PTO Type)

1. Remove the one-way clutch cam (1).
2. Tap out the spring pin (3), and remove the shift arm (4) and spring (7).
3. Remove the holder (5) and shift fork (2).

- | | |
|------------------------|------------|
| (1) One-way Clutch Cam | (5) Holder |
| (2) Shift Fork | (6) O-ring |
| (3) Spring Pin | (7) Spring |
| (4) Shift Arm | |



Independent PTO Valve (Independent PTO Type)

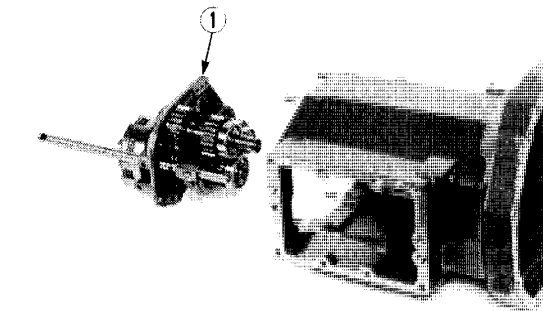
1. Remove the independent PTO valve (1) as a unit.

(When reassembling)

- Apply small amount of grease for the O-ring (2).
- Install the pipe (3) to the hole (4) of the independent PTO valve (1) firmly.

Tightening torque	Independent PTO valve mounting screws	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs
-------------------	---------------------------------------	---

- | | |
|---------------------------|----------|
| (1) Independent PTO Valve | (3) Pipe |
| (2) O-ring | (4) Hole |



Mid Case Bearing Holder with Gears

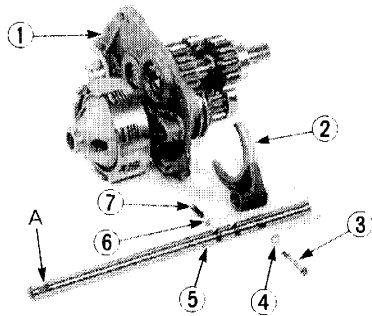
1. Remove the mid case bearing holder mounting screws, and then take out the bearing holder (1) with gears as a unit.

(When reassembling)

- Tap in the mid case bearing holder (1) with plastic hammer until contact to mid case, and then tighten the screws to specified torque.

Tightening torque	Mid case bearing holder mounting screws	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
-------------------	---	---

- (1) Mid Case Bearing Holder



B161P048

- (1) Mid Case Bearing Holder
- (2) Shuttle Shift Fork
- (3) Shuttle Shift Fork Setting Screw
- (4) Lock Washer
- (5) Shuttle Shift Fork Rod
- (6) Ball
- (7) Spring

Shuttle Shift Fork

1. Remove the shuttle shift fork setting screw (3) after removing the stake of the lock washer (4).
2. Draw out the shuttle shift fork rod (5) and take out the shuttle shift fork (2).

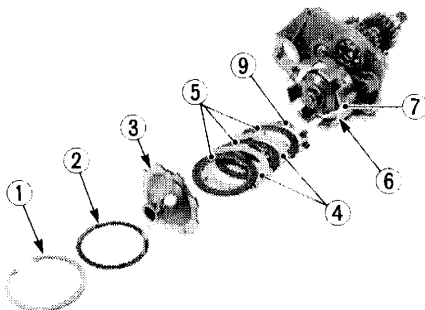
NOTE

- Take care not to fly out the ball (6) and spring (7) when pull out the shuttle shift fork rod (5).

(When reassembling)

- Direct the shorter end of the shuttle shift fork boss to mid bearing holder side.
- Direct the grooved side (A) of fork rod (5) to upward.
- Install the spring (7) and ball (6) to the mid case bearing holder (1) firmly.
- Bend the lock washer (4) against one side of the shuttle shift fork setting screw.
- Confirm that the shuttle shift fork (2) moves freely about 5 mm (0.2 in.) after tightening the shuttle shift fork setting screw (3).

Tightening torque	Shuttle shift fork setting screw	12.7 to 14.7 N·m 1.3 to 1.5 kgf·m 9.4 to 10.8 ft-lbs
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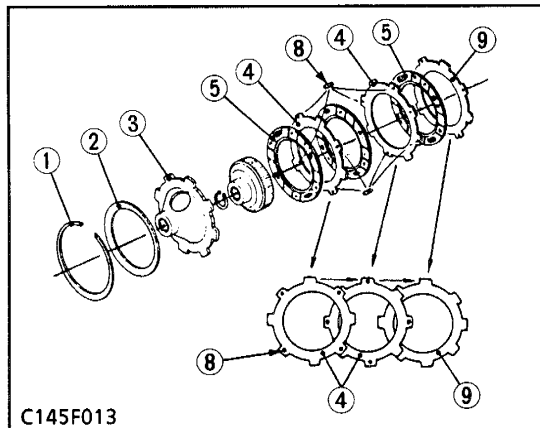
B161P049

GST Clutch Discs

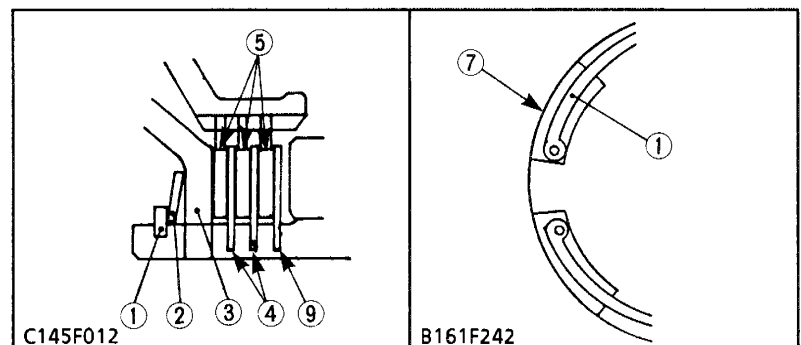
1. Remove the internal snap ring (1).
2. Take out the disc spring (2), hub (3), clutch discs (5) and steel plates (4), (9).

(When reassembling)

- Assemble the two steel plates (4) with plug rubbers to the hub (3) side, one steel plate (9) without plug rubber to the piston (6) side.
- Do not pile up the plug rubber (8) portion on the steel plates (4) while reassembling. (Refer to the figure left.)
- Assemble the disc spring (2) as shown in the figure below.
- Confirm the moving of the piston (6) smoothly when pressure air at 0.29 to 0.39 MPa (3 to 4 kgf/cm², 42 to 57 psi) is sent to clutch pack. (Refer to the photo left.)
- Install the internal snap ring (1) to the clutch case (7) as shown in the figure below.



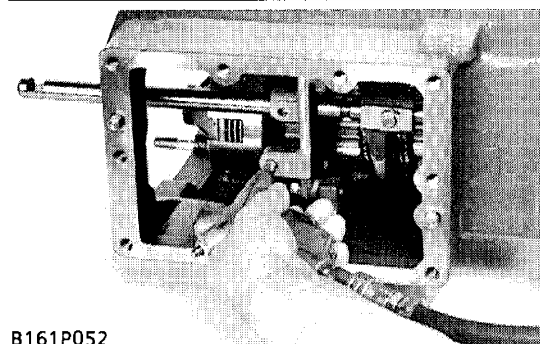
C145F013



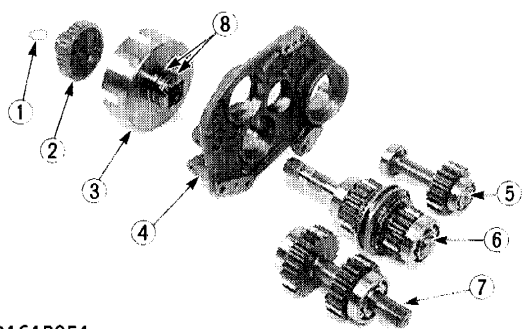
C145F012

B161F242

- (1) Internal Snap Ring
- (6) Piston
- (2) Disc Spring
- (7) Clutch Case
- (3) Hub
- (8) Plug Rubber
- (4) Steel Plates (With Plug Rubber)
- (9) Steel Plate (Without Plug Rubber)
- (5) Clutch Discs



B161P052



B161P051

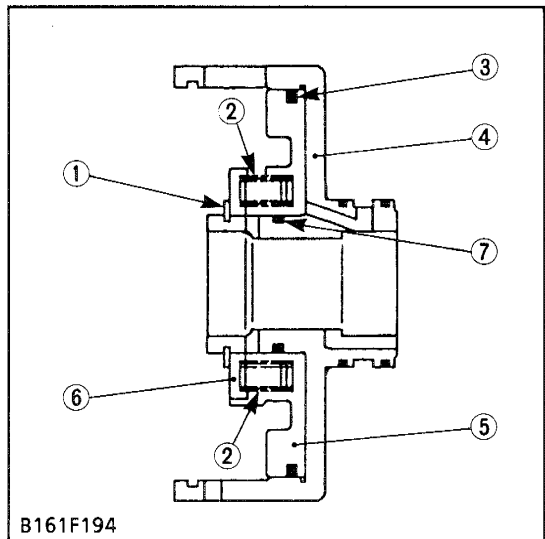
Clutch Case and Shaft Assemblies

1. Remove the external snap ring (1), and then draw out the hub (2) and clutch case (3).
2. Take out the shuttle shaft (6), shuttle gear shaft (7) and reverse gear shaft (5) as a unit.

(When reassembling)

- Apply small amount of the grease to the seal rings (8) while assembling the clutch case (3).

- | | |
|-----------------------------|------------------------|
| (1) External Snap Ring | (5) Reverse Gear Shaft |
| (2) Hub | (6) Shuttle Shaft |
| (3) Clutch Case | (7) Shuttle Gear Shaft |
| (4) Mid Case Bearing Holder | (8) Seal Rings |



B161F194

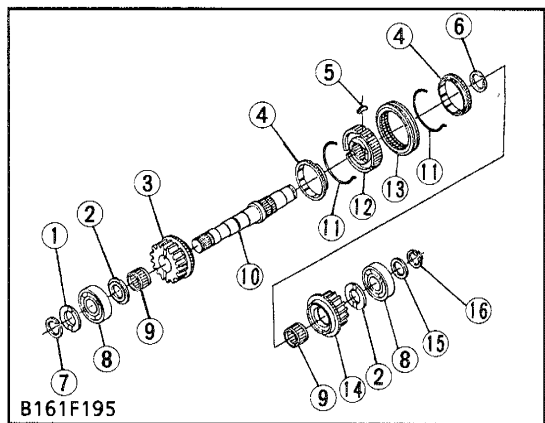
GST Clutch Piston

1. Remove the external snap ring (1) while pushing the spring retainer (6) by hand press.
2. Take out the spring retainer (6), springs (2) and piston (5).

(When reassembling)

- Apply enough transmission fluid to the seal rings (3), (7).

- | | |
|------------------------|---------------------|
| (1) External Snap Ring | (5) Piston |
| (2) Springs | (6) Spring Retainer |
| (3) Seal Ring | (7) Seal Ring |
| (4) Clutch Case | |



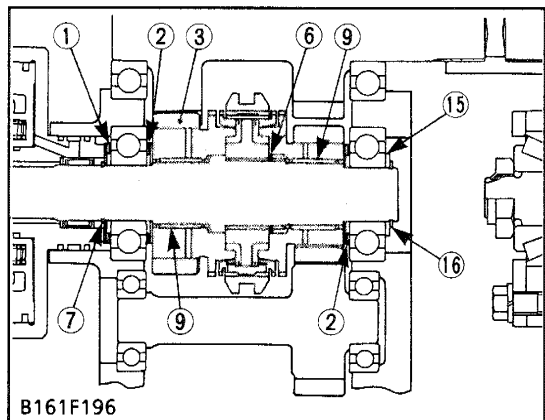
B161F195

Shuttle Shift Gears

1. Remove the external snap rings (7), (16).
2. Remove the bearings (8) by the bearing puller.
3. Remove the gears on the shuttle shaft (10) and external snap ring (6).

(When reassembling)

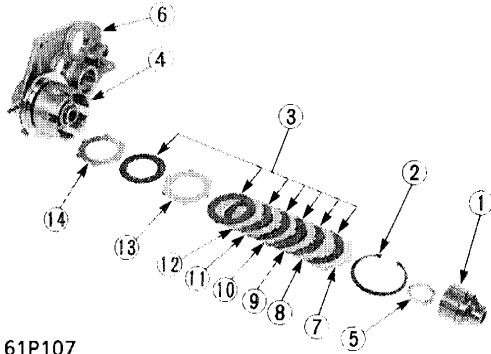
- Direct the groove side of the thrust collars (2) to the gear side.
- Reinstall the synchronizer keys (5) in the key grooves of the synchronizer rings (4) firmly.
- Direct the groove side of the thrust collar (1) to the GST clutch pack side.
- Install the external snap ring (6) to the groove of the shuttle shaft (10) firmly.



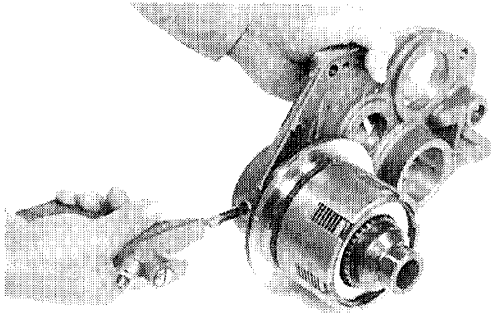
B161F196

- | | |
|------------------------|-------------------------------|
| (1) Thrust Collar | (9) Needle Bearing |
| (2) Thrust Collars | (10) Shuttle Shaft |
| (3) 18T Gear | (11) Synchronizer Key Springs |
| (4) Synchronizer Rings | (12) Hub |
| (5) Synchronizer Keys | (13) Shifter |
| (6) External Snap Ring | (14) 15T Gear |
| (7) External Snap Ring | (15) Collar |
| (8) Bearings | (16) External Snap Ring |

(7) Disassembling Independent PTO Clutch Pack and Valve



B161P107



B161P108

Clutch Hub and Clutch Discs

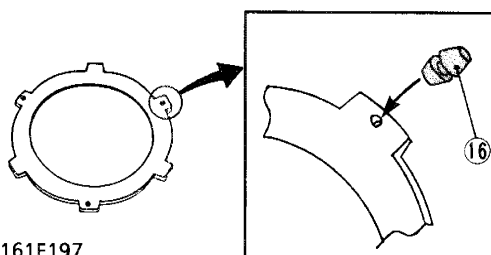
1. Remove the internal snap ring (2), and then take out the clutch discs (3), the back plate (7), the steel plates (8), (9), (10), (11), (12), (13), (14), the hub (1) and the bearings (5).

(When reassembling)

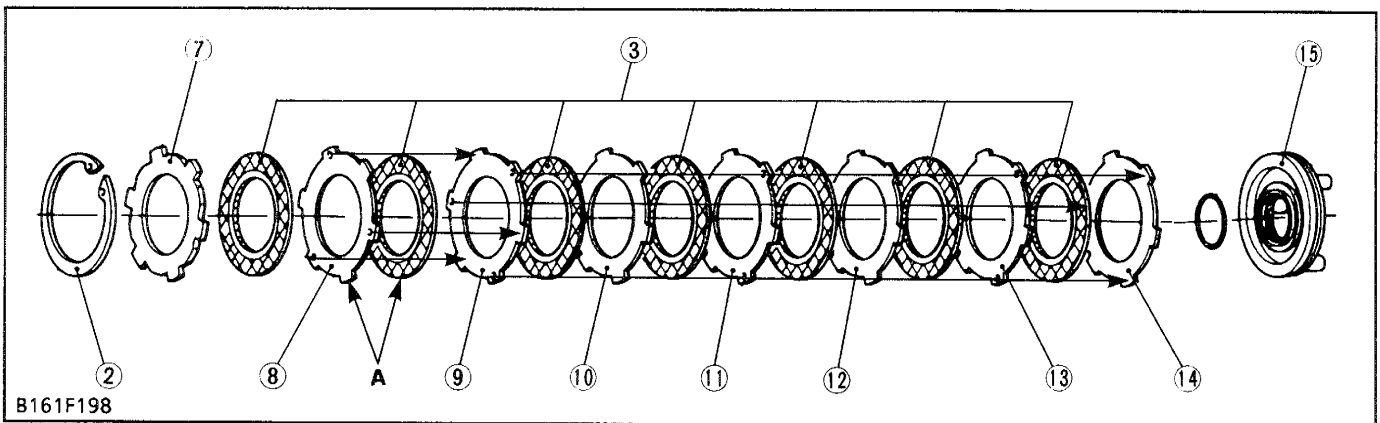
- Install the clutch discs (3) and steel plates (8), (9), (10), (11), (12), (13), (14) mutually. (Refer to figure below.)
- Do not confuse the two types steel plates. The steel plates with the plug rubbers (16) are (8), (9), (11), (13) and without plug rubbers (16) are (10), (12), (14).
- Do not confuse the back plate (7) and steel plates. The back plate (7) is thicker than the steel plates.
- Assemble the plug rubbers portion of the three steel plates (9), (11), (13) are same positions while assembling them, and do not pile up the plug rubbers portions of the another steel plate (8) with the steel plate (9). (Refer to figure below.)
- Apply enough transmission fluid to the discs (3).
- Confirm the moving of the piston (15) smoothly when pressure air at 0.29 to 0.39 MPa (3 to 4 kgf/cm², 42 to 57 psi) is sent to clutch pack (Refer to the photo left.)

- | | |
|-------------------------------------|---|
| (1) Hub | (9) Steel Plate (With Plug Rubbers) |
| (2) Internal Snap Ring | (10) Steel Plate (Without Plug Rubbers) |
| (3) Clutch Discs | (11) Steel Plate (With Plug Rubbers) |
| (4) Clutch Case | (12) Steel Plate (Without Plug Rubbers) |
| (5) Bearing | (13) Steel Plate (With Plug Rubbers) |
| (6) Mid Case Bearing Holder | (14) Steel Plate (Without Plug Rubbers) |
| (7) Back Plate | (15) Piston |
| (8) Steel Plate (With Plug Rubbers) | (16) Plug Rubber |

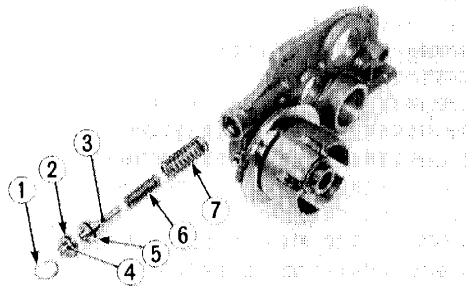
[Plate with the Plug Rubber]



B161F197



B161F198

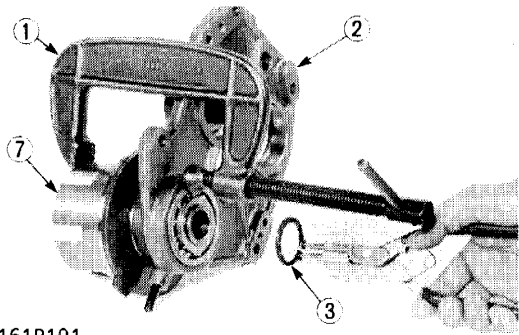


B167P032

Accumulator

1. Remove the internal snap ring (1).
2. Pull out the cover (4) by the chain nose cutting plier.
3. Take out the piston (3) and springs (6), (7).

- (1) Internal Snap Ring
- (2) O-ring
- (3) Piston
- (4) Cover
- (5) Seal
- (6) Spring
- (7) Spring



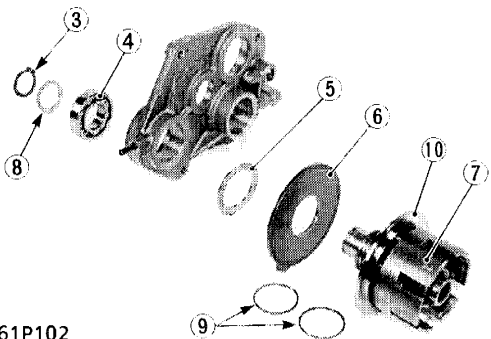
B161P101

Clutch Case

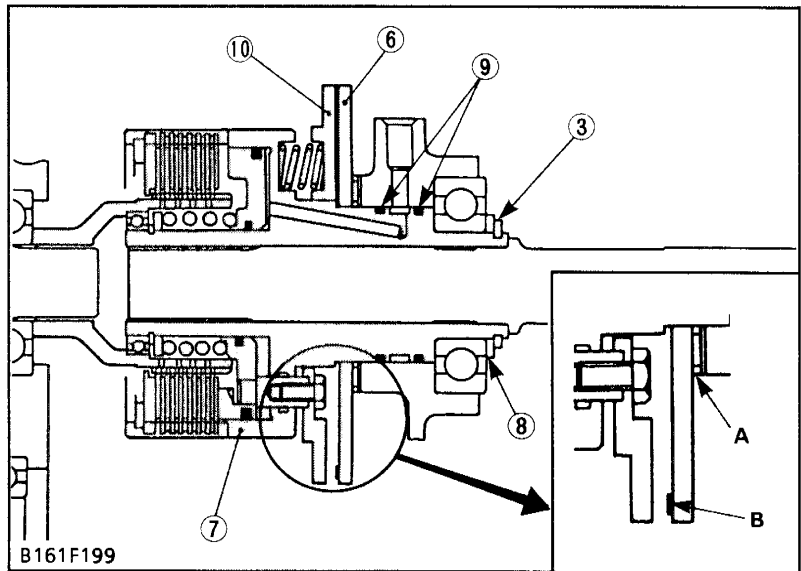
1. Clamp the mid case bearing holder (2) and clutch case (7) by the "C" clamp (1), and then remove the external snap ring (3). (Refer to photo left.)
2. Remove the clutch case (7), brake disc (6), thrust needle bearing (5), seal rings (9), bearing (4) and collar (8).

(When reassembling)

- Direct the needle side of the thrust needle bearing (5) to the brake disc (6) side. (Refer to left figure "A".)
- Direct the contact part of the brake disc (6) to the brake plate (10). (Refer to left figure "B".)
- Apply small amount of the grease to the seal rings (9).



B161P102



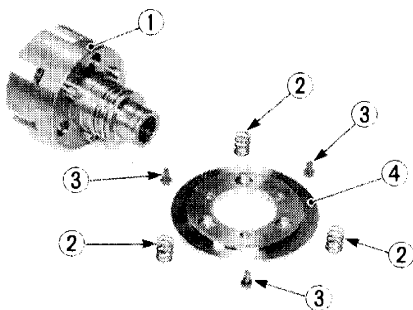
B161F199

[A] Direction of the Needle

- (1) "C" Clamp
- (2) Mid Case Bearing Holder
- (3) External Snap Ring
- (4) Bearing
- (5) Thrust Needle Bearing

[B] Direction of the Contact Part

- (6) Brake Disc
- (7) Clutch Case
- (8) Collar
- (9) Seal Rings
- (10) Brake Plate



B161P103

Brake Plate

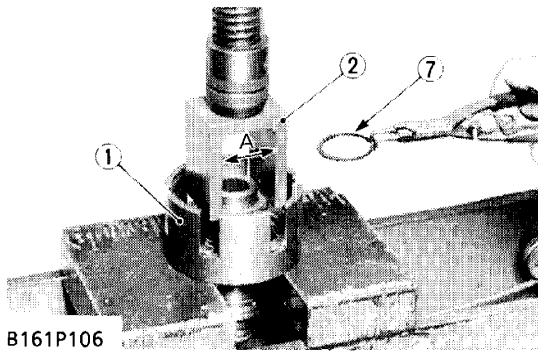
1. Remove the brake plate mounting screws (3), and then take out the brake plate (4) and the springs (2).

(When reassembling)

- Apply liquid lock (Three Bond 1372 or equivalent) to the brake plate mounting screws (3).

Tightening torque	Brake plate mounting screws	9.8 to 11.2 N·m 1.0 to 1.15 kgf·m 7.2 to 8.3 ft-lbs
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- (1) Clutch Case
- (2) Springs
- (3) Screws
- (4) Brake Plate



B161P106

Piston

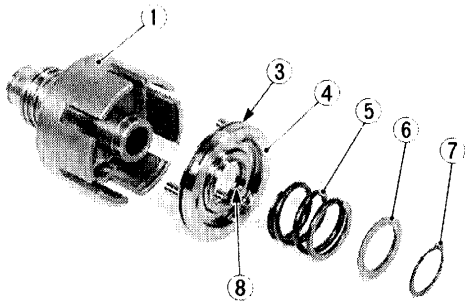
1. Press the washer (6) lightly by the hand press, using the hand made jig. (Refer to the left photo.)
2. Draw out the piston (4).

(When reassembling)

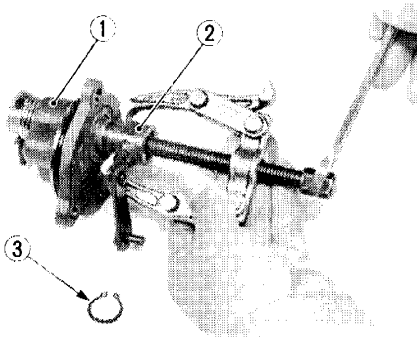
- Apply enough transmission fluid to seal rings (3), (8).

[A] 41 mm (1.6 in.)

- | | |
|-----------------|------------------------|
| (1) Clutch Case | (5) Spring |
| (2) Jig | (6) Washer |
| (3) Seal Ring | (7) External Snap Ring |
| (4) Piston | (8) Seal Ring |



B161P104



B161P109

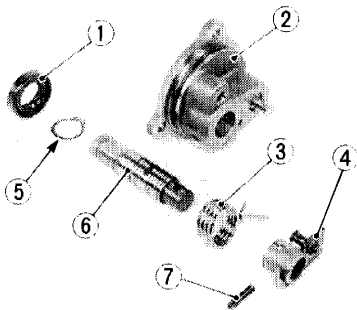
Clutch Valve Lever Arm

1. Make a marks on the spool and the lever arm (2).
2. Draw out the lever arm (2) by the bearing puller after removing the external snap ring (3).

(When reassembling)

- Assemble them with aligning the marks.

- | | |
|------------------|------------------------|
| (1) Clutch Valve | (3) External Snap Ring |
| (2) Lever Arm | |



B161P110

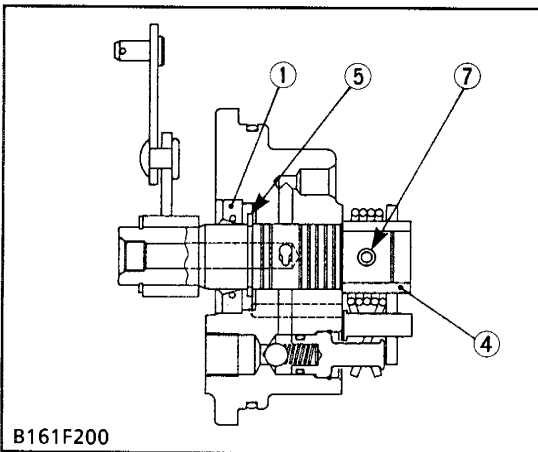
Clutch Valve Spool

1. Remove the oil seal and the external snap ring (5).
2. Draw out the spool (6).
3. Make a marks on the spool (6) and the lever (4).
4. Remove the spring (3) and tap out the spring pin (7), and then remove the lever (4).

(When reassembling)

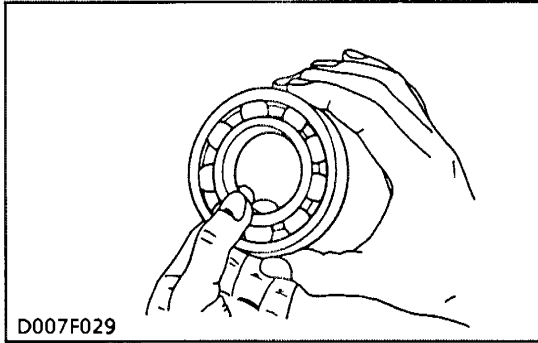
- Replace the oil seal (1).
- Assemble the spool (6) and lever (4) with aligning the marks.

- | | |
|-----------------------|------------------------|
| (1) Oil Seal | (5) External Snap Ring |
| (2) Clutch Valve Case | (6) Spool |
| (3) Spring | (7) Spring Pin |
| (4) Lever | |



B161F200

SERVICING



D007F029

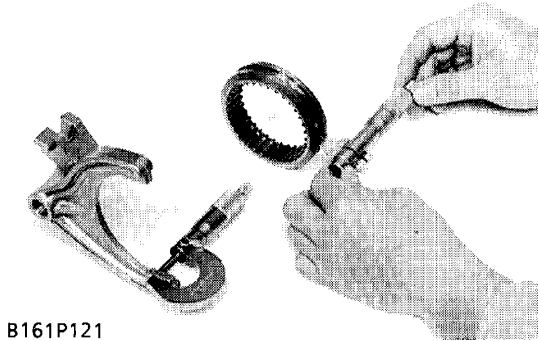
Checking Bearing

1. Hold the inner race, and push and pull the outer race in all directions to check for wear and roughness.
2. Apply transmission fluid to the bearing, and hold the inner race. Then, turn the outer race to check rotation.
3. If there is any defect, replace it.

Clearance between Shift Fork and Shifter Groove

1. Measure the width of shift fork.
2. Measure the shifter groove width, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

Clearance between shift fork and shifter groove	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.
	Allowable limit	0.8 mm 0.031 in.

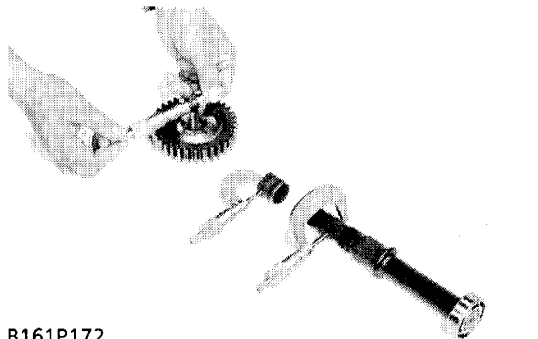


B161P121

Clearance between Gear and Shaft

1. Measure the shaft O.D. (rubbing surface).
2. Measure the gear I.D. (rubbing surface).
3. Measure the O.D. of the two needles installed diagonally in the needle bearing.
4. Calculate the clearance.
(Clearance = Gear I.D. - {(2 x needle O.D.) + shaft O.D.})
5. If the clearance exceeds the allowable limit, replace them.

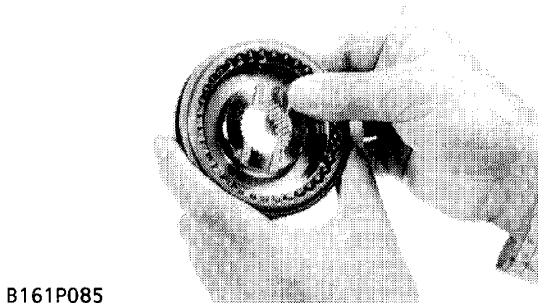
Clearance between gear and shaft	Factory spec.	0.021 to 0.054 mm 0.00083 to 0.00213 in.
	Allowable limit	0.1 mm 0.004 in.



B161P172

Checking Contact between Coupling and Shifter

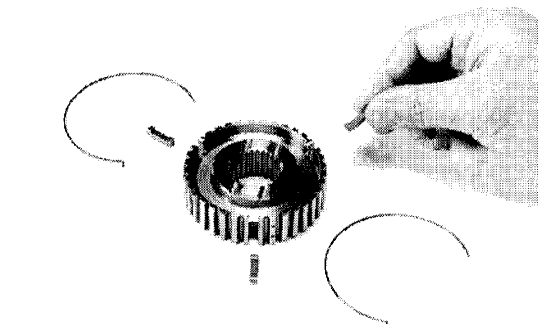
1. Check to see if there is any flaw or wear on the spline of the coupling and shifter, and the key groove on the coupling.
2. Engage the shifter with the coupling, and check that they slide smoothly.
3. Similarly, check that there is any flaw or wear on the gear splines.
4. If there is any defect, replace them.



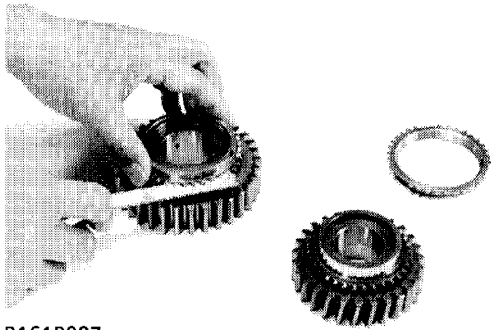
B161P085

Flaw on Synchronizer Key and Spring

1. Check the projection in the center of the synchronizer key for wear.
2. Check the spring for fatigue or wear on the area where the spring contacts with the keys.
3. If there is any defect, replace them.



B161P086



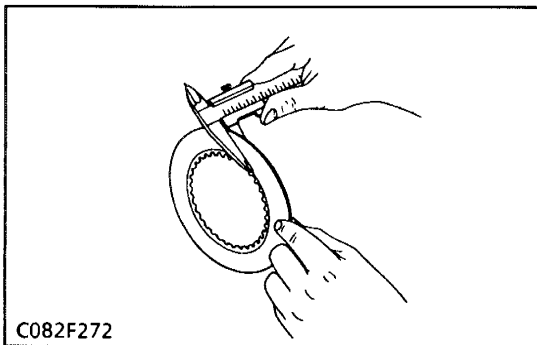
B161P087

Side Clearance between Synchronizer Ring and Gear

(in Contact)

1. Press the synchronizer ring against the tapered portion of the gear, and measure the side clearance.
2. Apply thin film of red lead to the tapered portion, press the ring against it by hand, rub them together a few times, and check the contact.
3. Check the tooth surface and key grooves of the ring for wear.
4. If the side clearance exceeds the allowable limit or if there is any defect, replace the synchronizer ring.

Side clearance	Allowable limit	0.35 mm 0.0138 in.
Contact condition of tapered portion	Allowable limit	More than 80 %



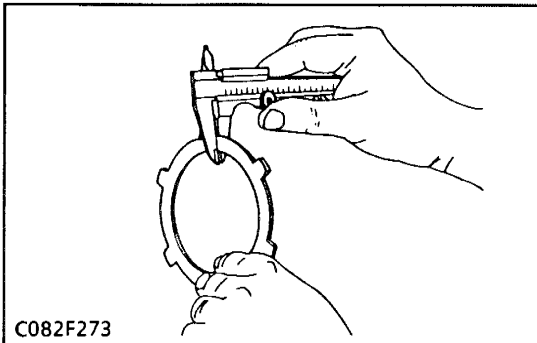
C082F272

Clutch Disc, Steel Plate Wear

1. Measure the thickness of clutch disc with vernier calipers.
2. Measure the thickness of steel plate with vernier calipers.
3. If the thickness is less than the allowable limit, replace it.

Thickness of GST clutch disc	Factory spec.	2.55 to 2.65 mm 0.100 to 0.104 in.
	Allowable limit	2.50 mm 0.098 in.

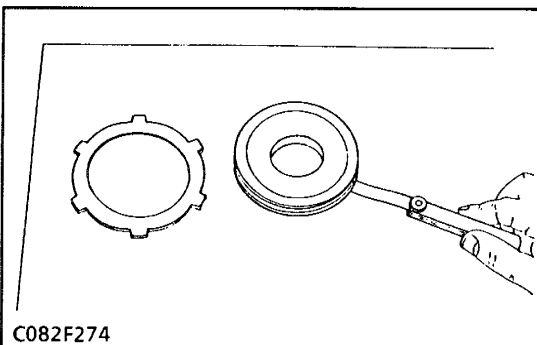
Thickness of GST steel plate	Factory spec.	1.55 to 1.65 mm 0.061 to 0.065 in.
	Allowable limit	1.50 mm 0.059 in.



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Thickness of independent PTO clutch disc	Factory spec.	1.70 to 1.90 mm 0.067 to 0.075 in.
	Allowable limit	1.55 mm 0.061 in.

Thickness of independent PTO steel plate	Factory spec.	1.15 to 1.25 mm 0.045 to 0.049 in.
	Allowable limit	1.10 mm 0.043 in.



C082F274

Flatness of Piston and Steel Plate

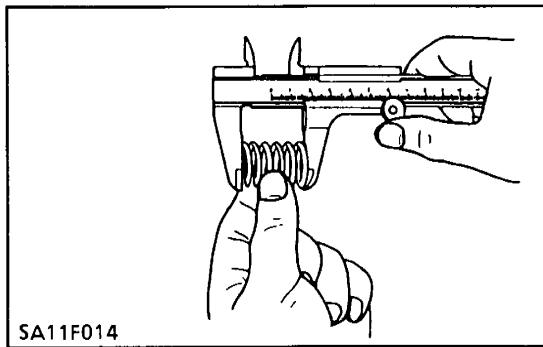
1. Place the part on a surface plate.
2. Check it unable to insert a feeler gauge (allowable limit size) underneath it at least four points.
3. If the gauge can be inserted, replace it.

Flatness of GST piston	Allowable limit	0.15 mm 0.006 in.
------------------------	-----------------	----------------------

Flatness of GST steel plate	Allowable limit	0.30 mm 0.012 in.
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Flatness of independent PTO piston	Allowable limit	0.15 mm 0.006 in.
------------------------------------	-----------------	----------------------

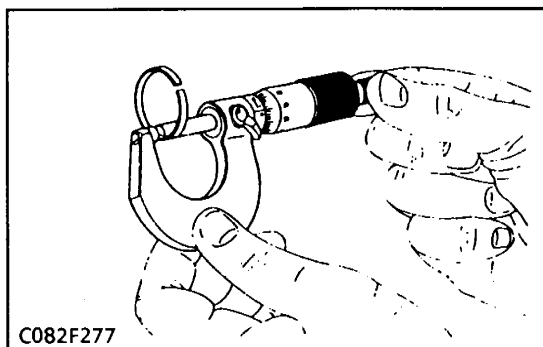
Flatness of independent PTO steel plate	Allowable limit	0.30 mm 0.012 in.
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Piston Return Spring Free Length

1. Measure the free length of spring with vernier calipers.
2. If the measurement is less than the allowable limit, replace it.

GST piston return spring free length	Factory spec.	19.9 to 20.1 mm 0.78 to 0.79 in.
	Allowable limit	18.0 mm 0.71 in.
Independent PTO return spring free length	Factory spec.	40.5 mm 1.59 in.
	Allowable limit	37.5 mm 1.48 in.
Independent PTO brake spring free length	Factory spec.	20.3 mm 0.80 in.
	Allowable limit	18.0 mm 0.71 in.

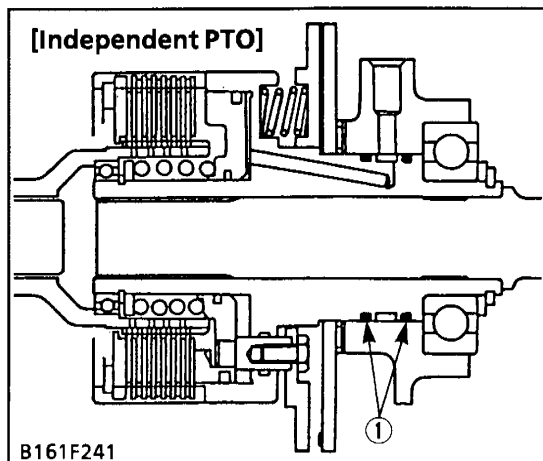
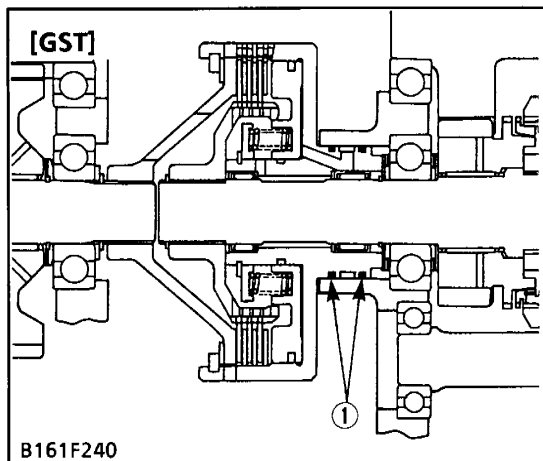


Thickness of Seal Ring

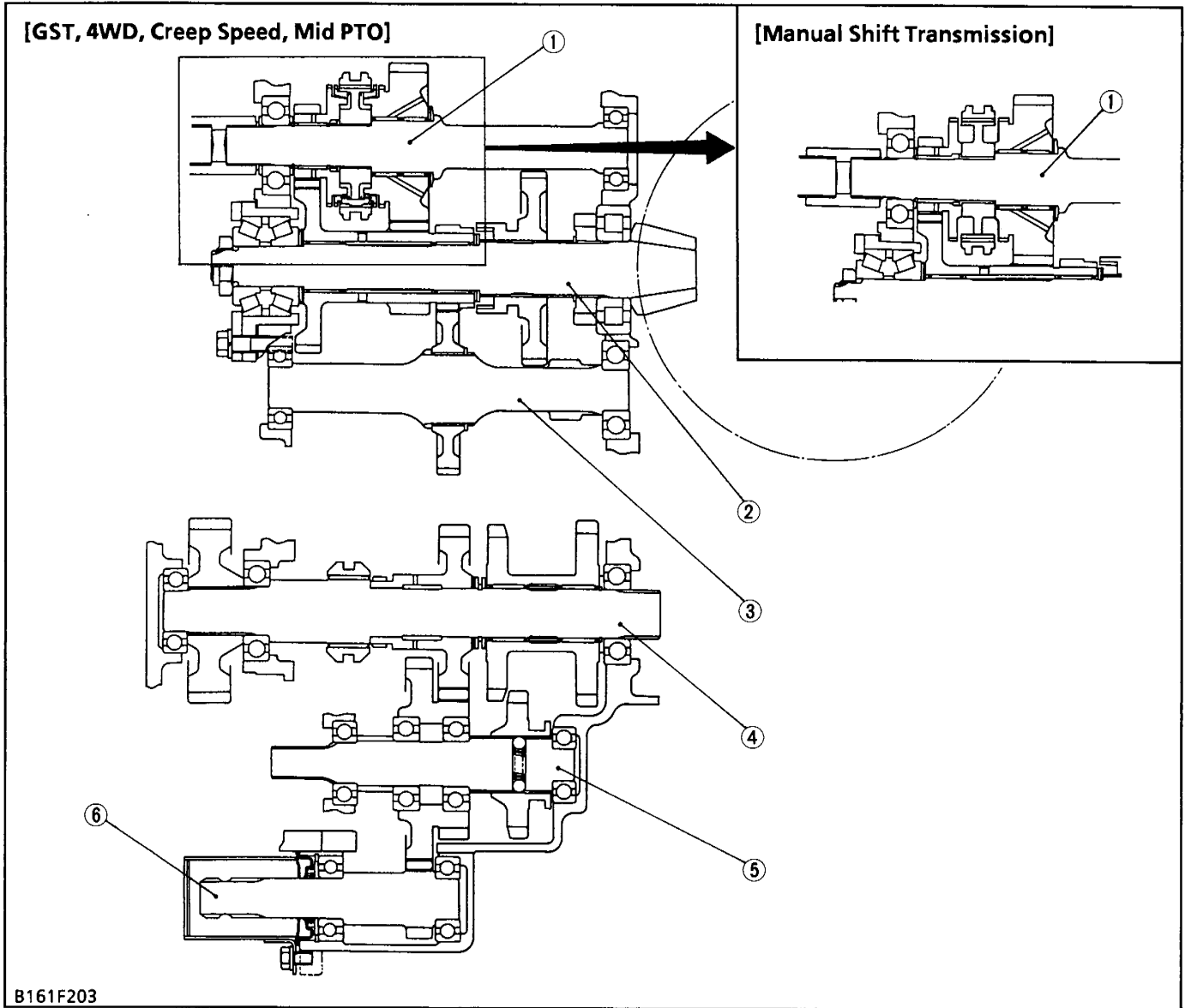
1. Measure the thickness of seal rings (1) with an outside micrometer.
2. If the measurement is less than the allowable limit, replace it.

Thickness of seal ring	Factory spec.	2.45 to 2.50 mm 0.096 to 0.098 in.
	Allowable limit	2.0 mm 0.079 in.

(1) Seal Rings



[3] TRANSMISSION CASE



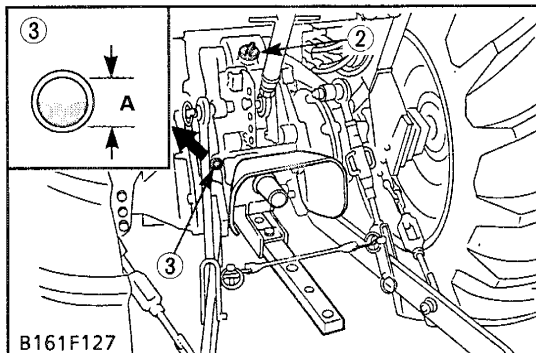
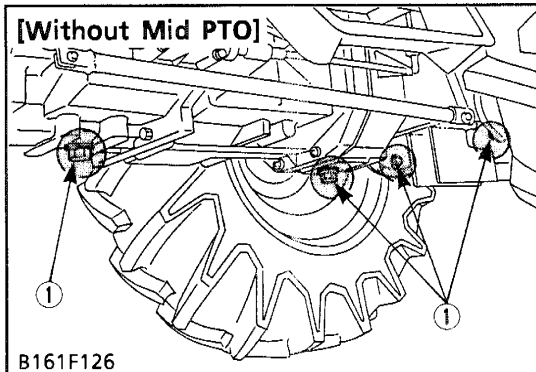
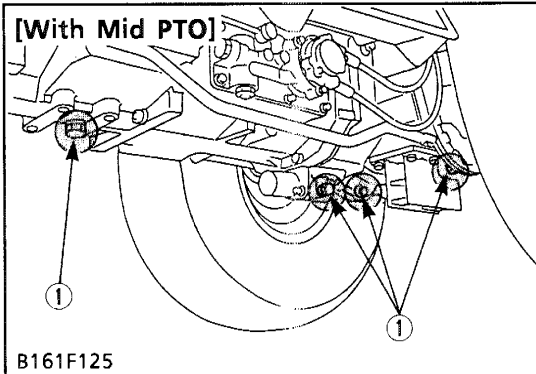
- (1) Hi-Lo Shaft
- (2) Spiral Bevel Pinion
- (3) Creep Gear Shaft (Option)
- (4) PTO Drive Shaft
- (5) Front Drive Shaft (4WD or Mid PTO Type Only)
- (6) Mid PTO Shaft (Mid PTO Type Only)

DISASSEMBLING AND ASSEMBLING

NOTE

- If the tractors are cabin specifications, refer to section 10 CABIN [1] SEPARATING CABIN FROM TRACTOR BODY. (See page 10-S20.)

(1) Draining the Transmission Fluid



Draining the Transmission Fluid

1. Place oil pans underneath the transmission case.
2. Remove the four drain plugs (1).
3. Drain the transmission fluid.
4. Reinstall the four drain plugs (1).

(When refilling)

- Fill up from filling port after removing the filling plug (2) until reaching the gauge (3).
- After running the engine for few minutes, stop it and check the oil level again, add the fluid to prescribed level if it is not correct level.

Capacity	Transmission fluid	
		39.0 ℓ
		41.2 U.S.qts.
		34.3 Imp.qts.

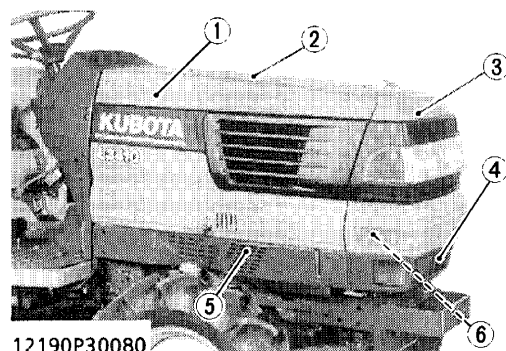
IMPORTANT

- Use only KUBOTA SUPER UDT fluid. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-8.)
- Do not mix different brands fluid together.

[A] Oil level is acceptable within this range.

- (1) Drain Plug (3) Gauge
(2) Filling Plug

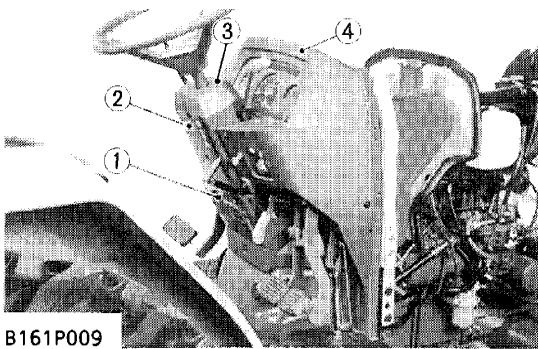
(2) Separating Panel Frame Assembly



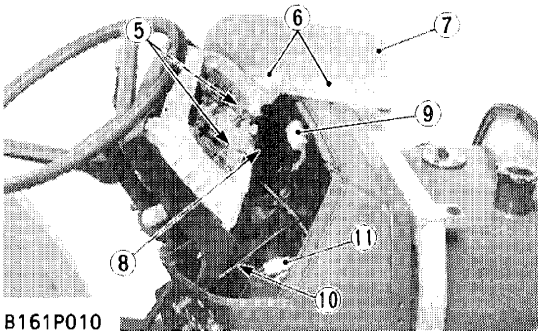
Preparation 1

1. Open the front mask (3) and disconnect the battery negative cable (6).
2. Remove the right and left side covers (1).
3. Remove the front mask (3).
4. Remove the front grille (4).
5. Remove the right and left side skirts (5).
6. Remove the bonnet (2).

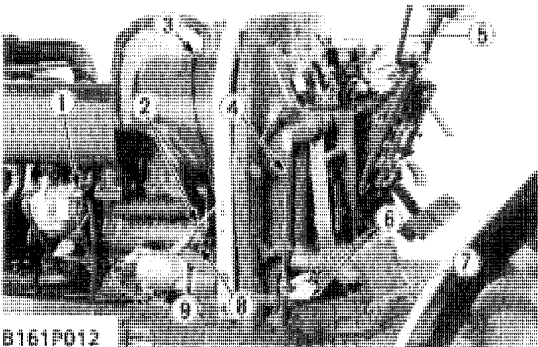
- (1) Side Cover RH, LH (4) Front Grille
(2) Bonnet (5) Side Skirt RH, LH
(3) Front Mask (6) Battery Negative Cable



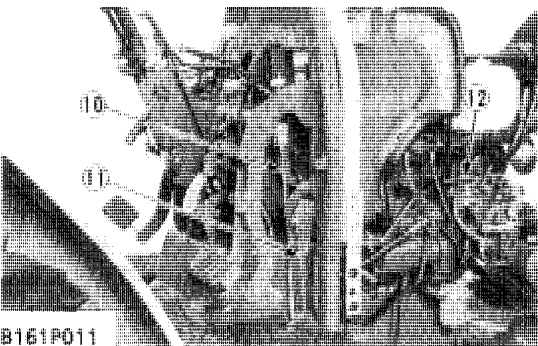
B161P009



B161P010



B161P012



B161P011

Preparation 2

1. Remove the steering post covers (2), (3) and panel under cover (1).
2. Disconnect the meter cable (8) at the engine side.
3. Remove the meter panel mounting screws and open the meter panel (4).
4. Remove the meter panel cover (7), and disconnect the two connectors (5) and meter cable (8).
5. Take out the meter panel (4).
6. Disconnect the main switch connector (11) and light switch connector (9).
7. Disconnect the engine stop cable (10) at the engine side.

NOTE

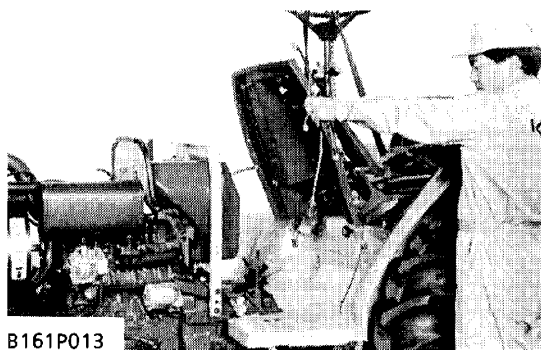
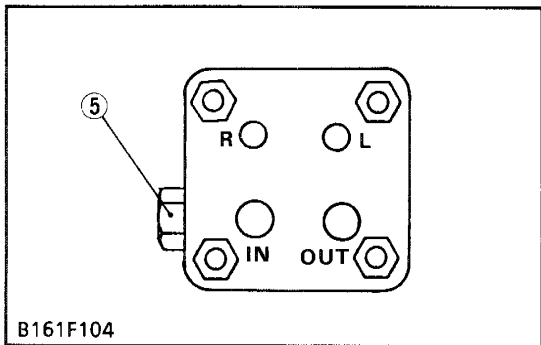
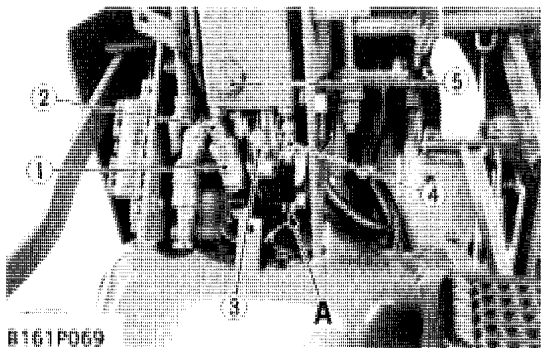
- Do not remove the seals (6) on the meter panel cover (7).

- | | |
|-------------------------|----------------------------|
| (1) Panel Under Cover | (7) Meter Panel Cover |
| (2) Steering Post Cover | (8) Meter Cable |
| (3) Steering Post Cover | (9) Light Switch Connector |
| (4) Meter Panel | (10) Engine Stop Cable |
| (5) Connectors | (11) Main Switch Connector |
| (6) Seals | |

Preparation 3

1. Disconnect the brake rods (4), (10).
2. Disconnect the clutch rod (2).
3. Remove the accelerator rod (12).
4. Disconnect the foot accelerator rod (11).
5. Remove the panel frame cover (7) and disconnect the three connectors (6).
6. Remove the shuttle shift lever (5) after disconnecting the limit switch wire harness.
7. Disconnect the 2P connector for alternator (1) and the jumper leads for fuel level sensor (3) and starter (9).

- | | |
|---------------------------------------|--------------------------------|
| (1) 2P Connector for Alternator | (7) Panel Frame Cover |
| (2) Clutch Rod | (8) Jumper Lead for Oil Switch |
| (3) Jumper Lead for Fuel Level Sensor | (9) Jumper Lead for Starter |
| (4) Brake Rod LH | (10) Brake Rod RH |
| (5) Shuttle Shift Lever | (11) Foot Accelerator Rod |
| (6) Connectors | (12) Accelerator Rod |



Hydraulic Pipes

1. Disconnect the main delivery hose (1), return hose (2), right turning delivery hose (3) and left turning delivery hose (4) from the power steering controller.

(When reassembling)

- In assembling the turning delivery hoses to the steering controller, connect the delivery hose with identification mark (tape) "A" to the L port of the steering controller. (Refer to figure left.)

Tightening torque	Main delivery hose retaining nut	46.6 to 50.9 N·m 4.8 to 5.2 kgf·m 34.4 to 37.6 ft-lbs
	Turning delivery hoses retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft-lbs

[A] Identification Mark (Tape)

- (1) Main Delivery Hose
- (2) Return Hose
- (3) Right Turning Delivery Hose
- (4) Left Turning Delivery Hose
- (5) Relief Valve Plug

Panel Frame and Steering Assembly

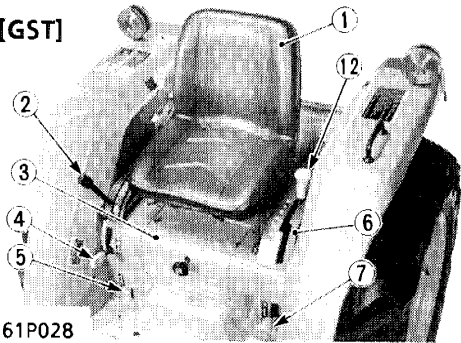
1. Remove the panel frame mounting screws. (Two screws at upper part. Seven screws at lower part.)
2. Take out the panel frame and steering assembly as a unit.

(When reassembling)

- Do not get in the wiring harness between panel frame and platform.

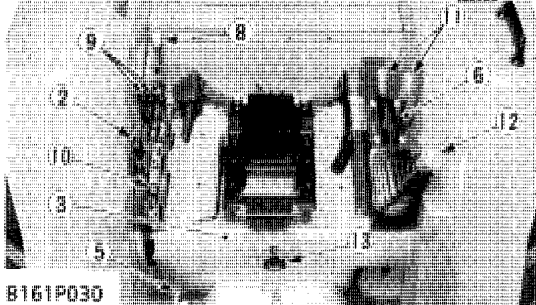
(3) Separating Rear Fenders and Platform Assembly

[GST]

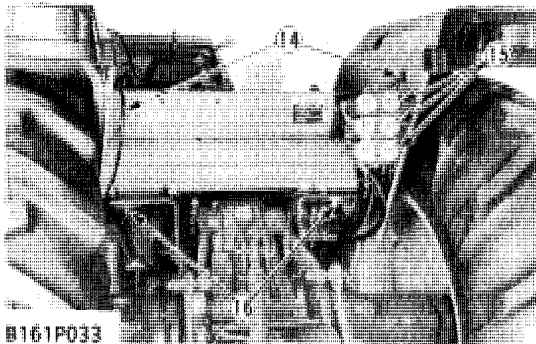


B161P028

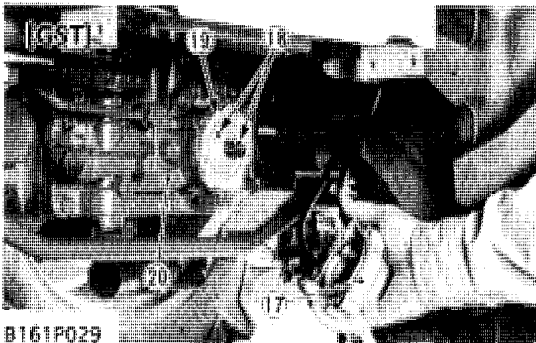
[Manual Shift Transmission (with Creep, Draft, Remote Control Valve)]



B161P030



B161P033



B161P029

Preparation

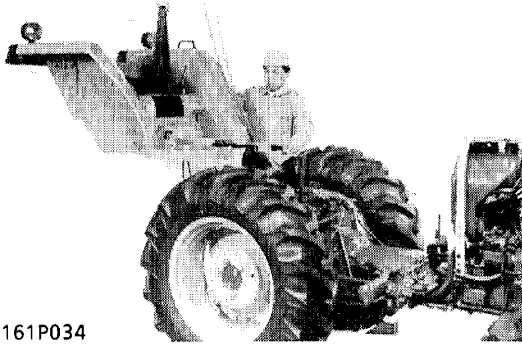
1. Take out the ROPS.
2. Remove the seat assembly (1).
3. Remove the mid PTO lever (4) (if equipped) and grips (2), (7), (8), (9), (10), (11), (12), (13).
4. Remove the shift lever guide (6).
5. Remove the seat under cover (3), and then remove the extension bar of the hydraulic lowering valve.
6. Disconnect the differential lock rod and differential lock lever (5).
7. Remove the quick couplers (15) as a unit. (If equipped.)
8. Disconnect the PTO shift cable at the PTO shift lever.
9. Loosen and remove the floor seat mounting two screws (16) and platform mounting two screws.
10. Disconnect the wiring harness (14) for hazard lights.
11. Remove the shift cable (17) as a unit at the GST valve (20) side. (GST only.)

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face of the rotary valve cover (19) and shift cable. (GST only.)
- Set the main shift lever at the neutral position, align the punched marks (18), and then assemble the shift cable (17). (GST only.)
- Check and adjust the PTO shift cable. (See page 10-S28.)

Tightening torque	ROPS mounting screws	M12, grade 7 screws	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft·lbs
		M14, grade 9 screws	166.7 to 196.1 N·m 17.0 to 20.0 kgf·m 123 to 144 ft·lbs
		M16, grade 11 screws	260.9 to 304.0 N·m 26.6 to 31.0 kgf·m 192 to 224 ft·lbs
		9/16-18 UNF, grade 8 screws	149.1 to 179.5 N·m 15.2 to 18.3 kgf·m 110 to 132 ft·lbs
	Floor seat and platform mounting screws and nuts		196.1 to 225.6 N·m 20.0 to 23.0 kgf·m 144.7 to 166.4 ft·lbs
Shift cable mounting screws		7.8 to 8.8 N·m 0.8 to 0.9 kgf·m 5.8 to 6.5 ft·lbs	

- | | |
|-----------------------------|---------------------------------|
| (1) Seat | (11) Grips |
| (2) Grip | (12) Grip |
| (3) Seat Under Cover | (13) Grip |
| (4) Mid PTO Lever | (14) Wiring Harness |
| (5) Differential Lock Lever | (15) Quick Couplers |
| (6) Shift Lever Guide | (16) Floor Seat Mounting Screws |
| (7) Grip | (17) Shift Cable |
| (8) Grip | (18) Punched Mark |
| (9) Grips | (19) Rotary Valve Cover |
| (10) Grip | (20) GST Valve |

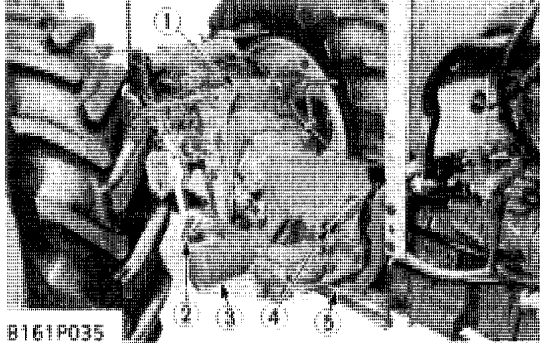


B161P034

Fender, Floor Seat and Platform Assembly

1. Remove the fender, floor seat and platform as a unit.

(4) Separating Transmission Case



B161P035

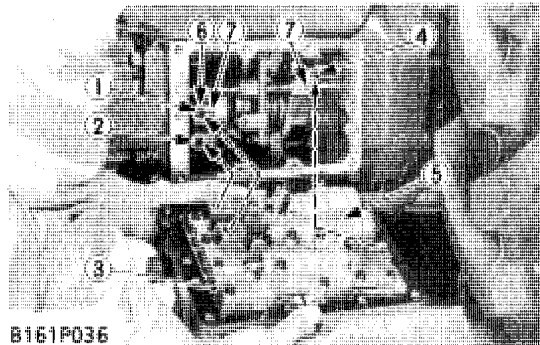
Hydraulic Pipes

1. Remove the delivery pipe (1), inlet pipe (2), hydraulic filter (3) with its support and GST delivery pipe (4).
2. Remove the brake rods RH (5) and LH.

(When reassembling)

Tightening torque	Joint bolt for GST delivery pipe (4) and regulator valve	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs
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- (1) Delivery Pipe
- (2) Inlet Pipe
- (3) Hydraulic Filter
- (4) GST Delivery Pipe
- (5) Brake Rod RH



B161P036

GST Valve Assembly (GST Only)

1. Remove the GST valve (3) as a unit after removing the GST delivery pipe.
2. Remove the shift pins (1), (2), (4).

NOTE

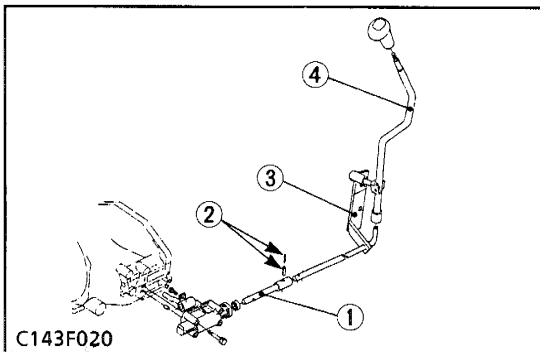
- Do not fall down the shuttle check pin (5) while disassembling.

(When reassembling)

- Place the 1-2 (2) and the 3-4 shift pins (1) at neutral position and Hi-Lo shift pins (4) at Hi-shift position (right side), and then assemble the GST valve.
- Install the GST valve (3) by hand, and then tighten the screw. Do not use the hummer.

- (1) 3-4 Shift Pin
- (2) 1-2 Shift Pin
- (3) GST Valve
- (4) Hi-Lo Shift Pin
- (5) Shuttle Check Pin
- (6) Shifter
- (7) Shifter Mounting Screw

Tightening torque	Shifter mounting screws	12.7 to 14.7 N·m 1.3 to 1.5 kgf·m 9.4 to 10.8 ft-lbs
	GST valve mounting screws	42.2 to 48.1 N·m 4.3 to 4.9 kgf·m 31.1 to 35.4 ft-lbs
	Joint bolt for GST delivery pipe on GST valve	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs



C143F020

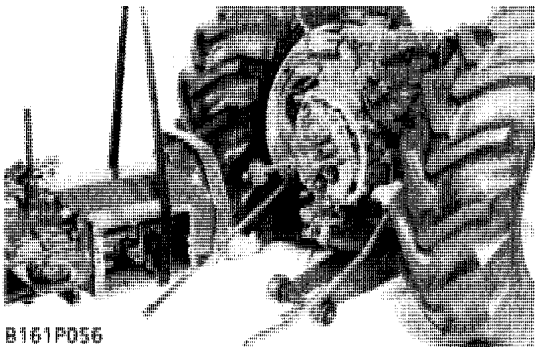
Main Shift Lever (Manual Shift Transmission Only)

1. Tap out the spring pins (2) of main shift rod (1).
2. Remove the main shift lever (4) with the support (3).

(When reassembling)

- Tap in the spring pins (2) so that their split portion may face forward.

- (1) Main Shift Rod
- (2) Spring Pins
- (3) Support
- (4) Main Shift Lever



B161P056

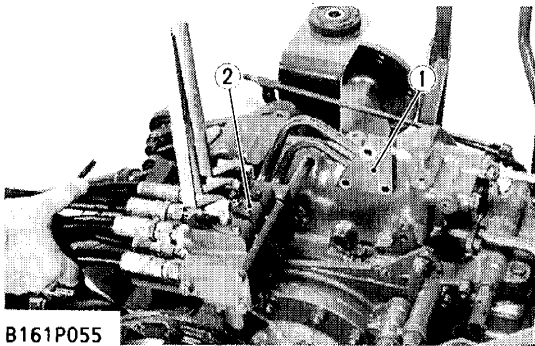
Separating Mid Case and Transmission Case

1. Separate the mid case and transmission case after removing the their mounting screws.

(When reassembling)

- Confirm inserting the PTO shaft to one-way clutch firmly with turning the PTO shaft.
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the clutch housing and mid case after eliminate the water, oil and stuck liquid gasket.

Tightening torque	Mid case and transmission case mounting screws, nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Mid case and transmission case mounting stud bolts	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft-lbs



B161P055

Auxiliary Control Valves (If Equipped)

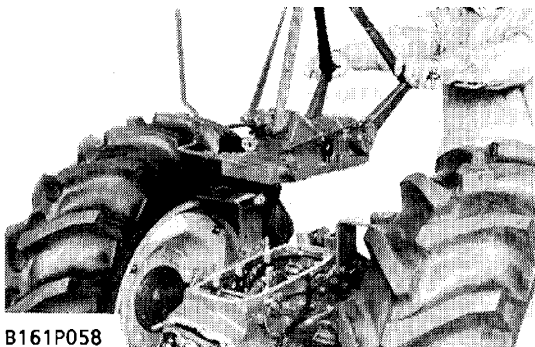
1. Loosen and remove the hydraulic pipe mounting three screws.
2. Loosen and remove the auxiliary control valves mounting two screws from floor seat support RH.
3. Take out the auxiliary control valves (2), hydraulic pipe (1) and quick couplers as a unit.

(When reassembling)

- Take care not to damage the O-rings.

(1) Hydraulic Pipe

(2) Auxiliary Control Valves



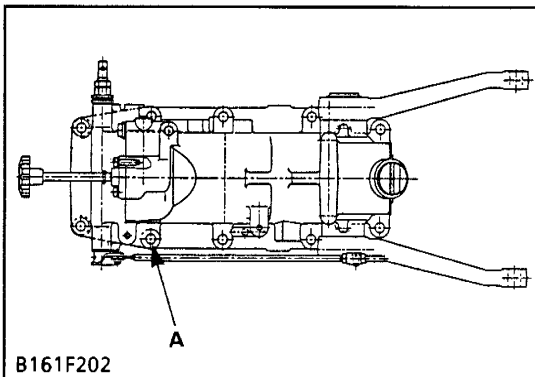
B161P058

Hydraulic Cylinder Assembly

1. Disconnect the draft control rod from the top link bracket. (If equipped.)
2. Disconnect the lift rods from lift arms.
3. Remove the delivery pipe (from front hydraulic block to hydraulic cylinder assembly).
4. Loosen and remove the hydraulic cylinder assembly mounting screws and nut.
5. Support the hydraulic cylinder assembly with nylon lift strap and hoist, and then take out it.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the hydraulic cylinder assembly and transmission case after eliminating the water, oil and stuck liquid gasket.
- When replacing the hydraulic cylinder assembly mounting stud bolts, apply liquid lock (three Bond 1372 or equivalent) to "A" portion of the stud bolt.

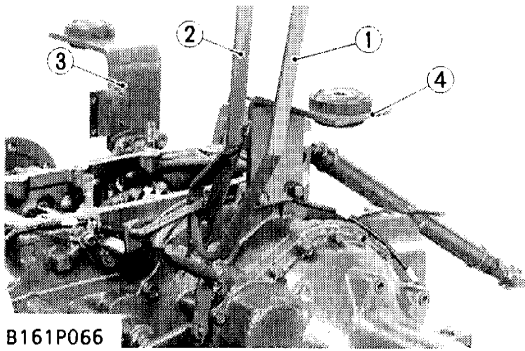


B161F202

Tightening torque	Hydraulic cylinder assembly mounting stud bolts	34.3 to 49.0 N·m 3.5 to 5.0 kgf·m 25.3 to 36.2 ft-lbs
	Hydraulic cylinder assembly mounting screws and nuts	77.4 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

NOTE

- Reassemble the hydraulic cylinder assembly to the tractor, be sure to adjust the position control feedback rod and draft control rod (if equipped). (See page 8-S9, S10.)

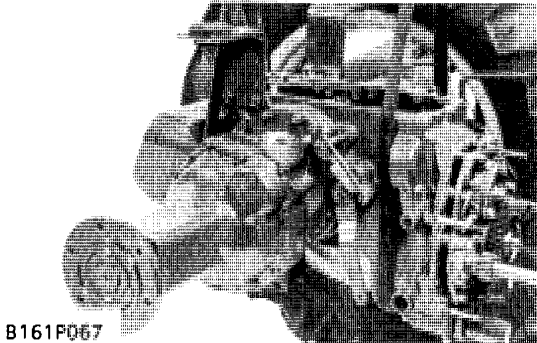


B161P066

Shift Lever

1. Remove the Hi-Lo shift lever (1) and creep speed shift lever (2). (If equipped.)
2. Remove the mid PTO lever from lever shaft. (If equipped.)
3. Remove the fender supports RH (3) and LH (4).

- (1) Hi-Lo Shift Lever
- (2) Creep Speed Shift Lever
- (3) Fender Support RH
- (4) Fender Support LH



B161P067

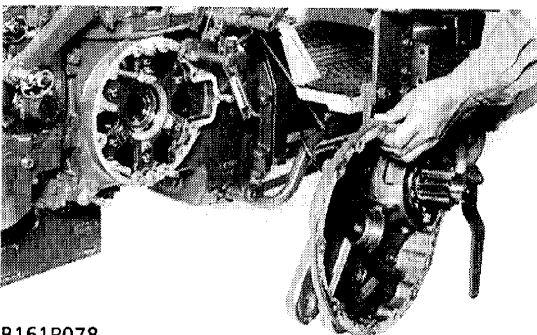
Rear Axle

1. Remove the rear wheels.
2. Support the transmission case with nylon lift strap and hoist.
3. Loosen and remove the rear axle case mounting screws and nuts.
4. Support the rear axle case with nylon lift strap and hoist.
5. Separate the rear axle case from brake case.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the rear axle case and brake case, after eliminate the water, oil and stuck liquid gasket.

Tightening torque	Rear wheel mounting screws and nuts		196 to 226 N·m 20 to 23 kgf·m 145 to 166 ft-lbs
	Rear axle case mounting screws and nuts	M10 screws and nuts	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
		M10 nuts (L3710 - L4310 only)	60.8 to 70.5 N·m 6.2 to 7.2 kgf·m 44.9 to 52.1 ft-lbs
		M12 screws and nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Stud bolts		24.5 to 31.4 N·m 2.5 to 3.2 kgf·m 18.1 to 23.1 ft-lbs



B161P078

Brake Case

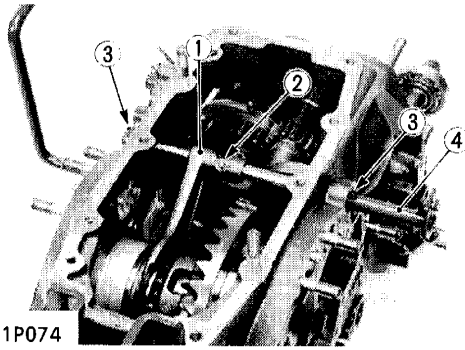
1. Loosen and remove the brake case mounting screws and nuts.
2. Support the floor seat support with nylon lift strap and hoist.
3. Separate the brake case, tapping the brake cam lever lightly.

(When reassembling)

- Apply grease to the brake ball seats. (Do not grease excessively.)
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the brake case and transmission case, after eliminate the water, oil and stuck liquid gasket.
- Before installing the brake case to the transmission case, install the cam plate to the transmission case.

Tightening torque	Brake case mounting stud bolts		38.2 to 45.1 N·m 3.9 to 4.6 kgf·m 28.2 to 33.3 ft-lbs
	Brake case mounting screws and nuts		77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Brake case mounting lever shaft screw		62.8 to 72.5 N·m 6.4 to 7.4 kgf·m 46.3 to 53.5 ft-lbs

(5) Disassembling Transmission Case



B161P074

Differential Lock Shift Fork

1. Tap out the spring pin (3).
2. Remove the cotter pin and take out the clevis pin (2).
3. Draw out the differential lock fork shaft (4) and take out the differential lock shift fork (1).

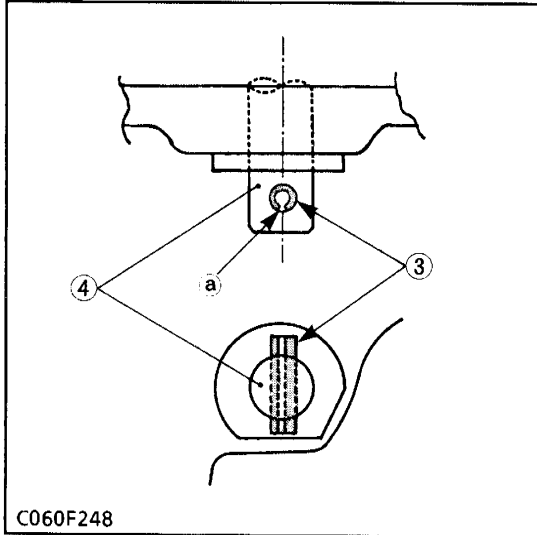
(When reassembling)

- Apply grease to the left and right oil seals on the transmission case.
- Insert the clevis pin (2) from the bottom and install the washer and cotter pin.
- Tap in the spring pin (3) so that its split portion (a) may face outward as shown in the figure.

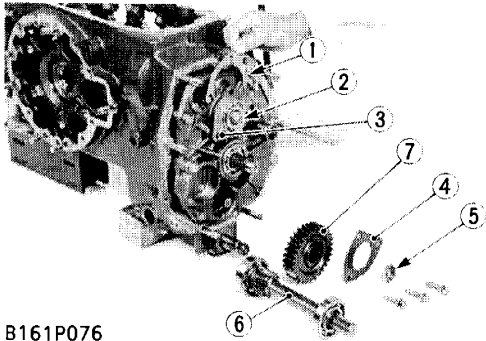
(a) Split Portion

- (1) Differential Lock Shift Fork
 (2) Clevis Pin

- (3) Spring Pin
 (4) Differential Lock Fork Shaft



C060F248



B161P076

Pinion Bearing Cover

1. Remove the stake of lock nut (5).
2. Remove the lock nut (5).
3. Remove the pinion bearing case mounting screws.
4. Take out the pinion bearing cover (4) and shims (1).
5. Take out the 30T gear (7) and 12T gear shaft (6).

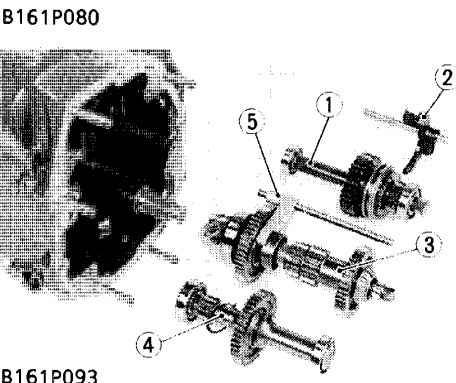
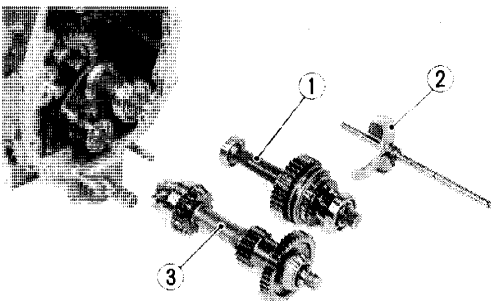
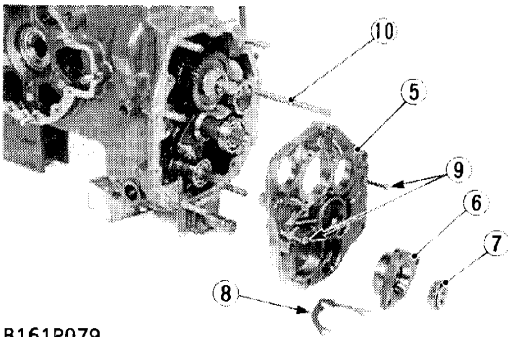
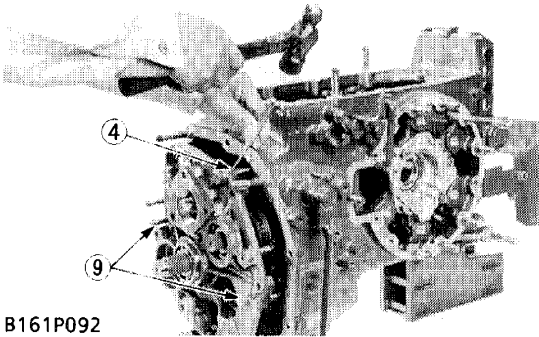
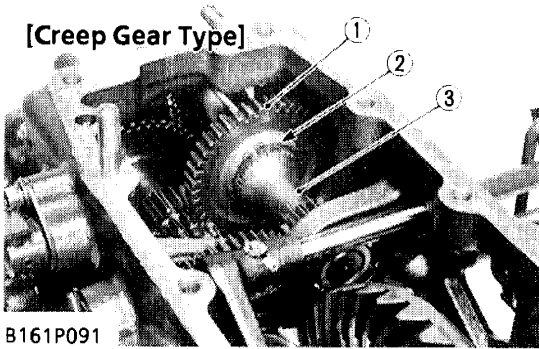
(When reassembling)

- Make sure of the number of shims in the pinion bearing case.
- Replace the lock nut (5) with a new one, and stake the lock nut firmly after installing the parts on the shaft.
- Direct the boss side of 30T gear to transmission bearing holder.

- (1) Shim
 (2) Spiral Bevel Pinion
 (3) Pinion Bearing Case
 (4) Pinion Bearing Cover
 (5) Lock Nut
 (6) 12T Gear Shaft
 (7) 30T Gear

Tightening torque	Lock nut	147 to 196 N·m 15 to 20 kgf·m 108 to 145 ft-lbs
	Pinion bearing case mounting screws	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs

[Creep Gear Type]



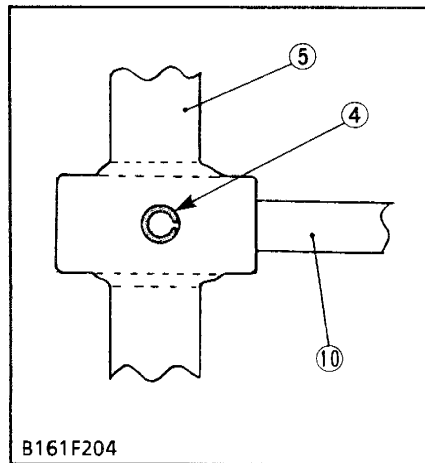
Transmission Bearing Holder

1. Move the external snap ring (2) of the creep shaft (3) to the rear. (Creep gear type only.)
2. Remove the transmission bearing holder (5) by using the two lift screws (9).
3. Lift up the bearing cover a little by using the two lift screws (9), and then tap out the spring pin (4) on the creep shift rod (10). (Creep gear type only.)

(When reassembling)

- Tap in the transmission bearing holder with soft hammer until contact to transmission case, and then tighten the screws to specified torque.
- Tap in the spring pin (4) so that its split portion may face forward. (Refer to figure below.)

Tightening torque	Transmission bearing holder mounting screws	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft·lbs
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- (1) Creep Gear
- (2) External Snap Ring
- (3) Creep Shaft
- (4) Spring Pin
- (5) Transmission Bearing Holder
- (6) Pinion Bearing Case
- (7) Thrust Bearing
- (8) Shim
- (9) Lift Screws
- (10) Creep Shift Rod

Shaft Assemblies (without Creep Gear)

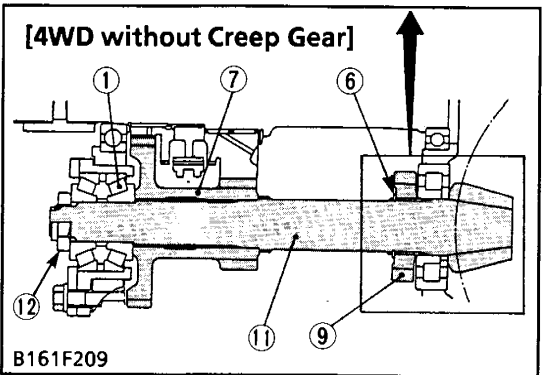
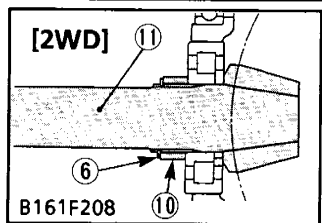
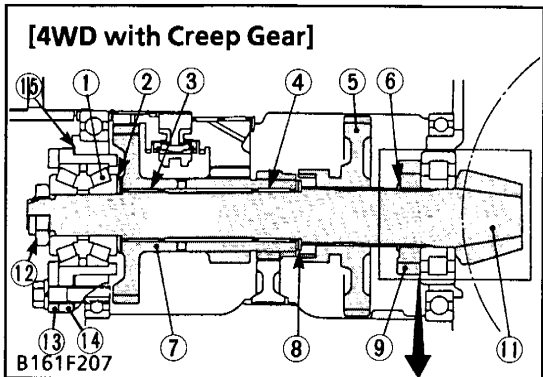
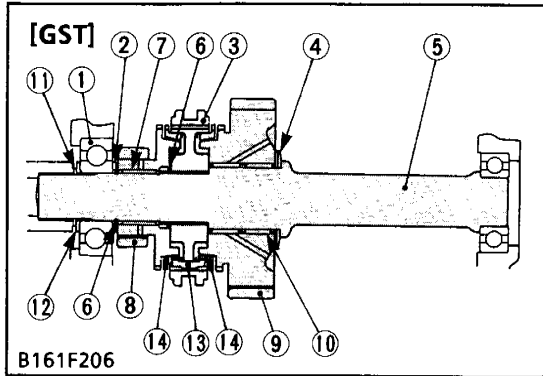
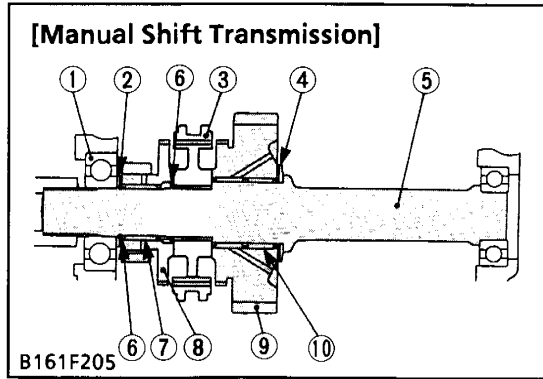
1. Take out Hi-Lo shaft assembly (1) with the shift fork (2) and the spiral bevel pinion (3).

- (1) Hi-Lo Shaft
- (2) Hi-Lo Shift Fork
- (3) Spiral Bevel Pinion

Shaft Assemblies (with Creep Gear)

1. Take out the Hi-Lo shaft assembly (1) with the shift fork (2), spiral bevel pinion assembly with shift fork (5) and creep gear shaft assembly (4).

- (1) Hi-Lo Shaft
- (2) Hi-Lo Shift Fork
- (3) Spiral Bevel Pinion
- (4) Creep Gear Shaft
- (5) Creep Shift Fork



Hi-Lo Shaft

1. Remove the external snap ring (11). (GST only.)
2. Remove the bearing (1) by the bearing puller, and pull out the gears.

(When reassembling)

- Direct the groove side of the thrust collars (2), (4) to the needle bearings (7), (10) side.
- Reinstall the synchronizer keys (13) in the key grooves of the synchronizer rings (14) firmly.
- Install the external snap rings (6) to the groove of the Hi-Lo shaft (5) firmly.

- | | |
|------------------------|-------------------------|
| (1) Bearing | (8) 18T Gear |
| (2) Thrust Collar | (9) 33T Gear |
| (3) Shifter | (10) Needle Bearing |
| (4) Thrust Collar | (11) External Snap Ring |
| (5) Hi-Lo Shaft | (12) Collar |
| (6) External Snap Ring | (13) Synchronizer Key |
| (7) Needle Bearing | (14) Synchronizer Ring |

Spiral Bevel Pinion Shaft

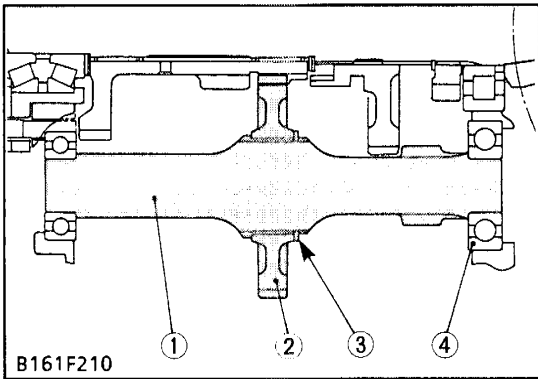
1. Remove the taper roller bearing (1) by the bearing puller.
2. Take out the gears, bearings and etc.

(When reassembling)

- Direct the groove side of the thrust collars (2), (8) to the needle bearings (3), (4) side. (Creep gear type only.)
- Be careful with the direction of the front axle drive gear (9).

Tightening torque	Spiral bevel pinion shaft lock nut	147 to 196 N·m 15 to 20 kgf·m 108 to 145 ft-lbs
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- | | |
|--------------------------|--------------------------------|
| (1) Taper Roller Bearing | (9) Front Axle Drive Gear |
| (2) Thrust Collar | (10) Collar |
| (3) Needle Bearing | (11) Spiral Bevel Pinion Shaft |
| (4) Needle Bearing | (12) Lock Nut |
| (5) 47T Gear | (13) Bearing Cover |
| (6) External Snap Ring | (14) Bearing Case |
| (7) 42T-16T Gear | (15) Shim |
| (8) Thrust Collar | |

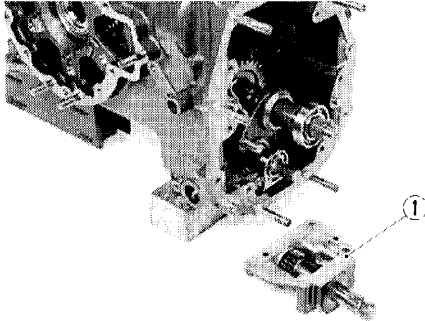


B161F210

Creep Gear Shaft (If Equipped)

1. Remove the bearing (4) by the bearing puller.
2. Remove the external snap ring (3), and then take out the 41T gear (2).

- (1) Creep Gear Shaft
- (2) 41T Gear
- (3) External Snap Ring
- (4) Bearing



B161P082

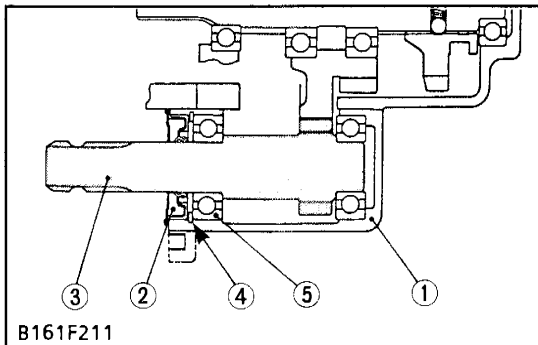
Mid PTO Case (Mid PTO Type Only)

1. Remove the mid PTO case as a unit.
2. Remove the oil seal (2), and then remove the internal snap ring (4).
3. Tap out the mid PTO shaft (3) and bearing (5).

(When reassembling)

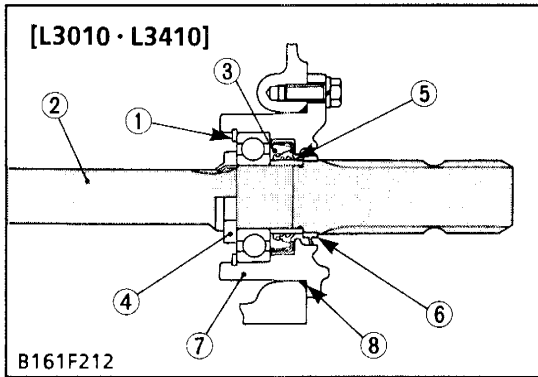
- Replace the oil seal (2) with a new one.

Tightening torque	Mid PTO case mounting screws	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs
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B161F211

- (1) Mid PTO Case
- (2) Oil Seal
- (3) Mid PTO Shaft
- (4) Internal Snap Ring
- (5) Bearing



B161F212

[L3010 · L3410]

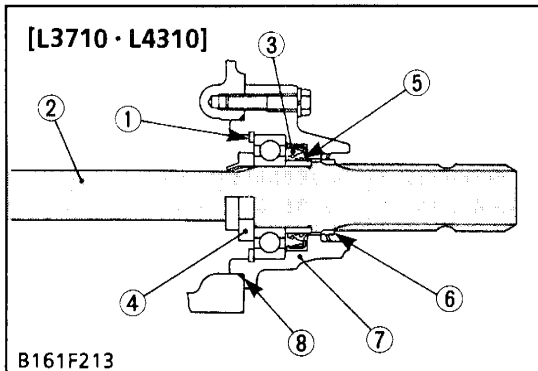
PTO Shaft

1. Remove the bearing case mounting screws, and draw out the PTO shaft (2) with bearing case.
2. Take out the coupling.
3. Remove the internal snap ring (1).
4. Tap out the PTO shaft (2) to the front.

(When reassembling)

- If the lock nut (4) was removed, replace it with a new one. After replacing, be sure to stake it firmly.
- Install the slinger (6) firmly.
- Apply grease to the oil seal (3) and install it, noting its direction.

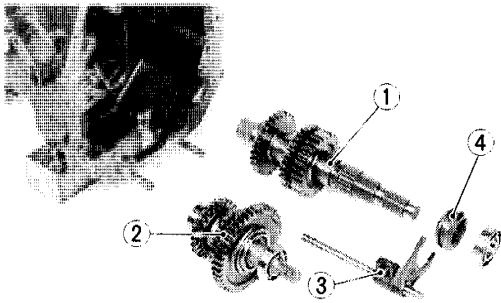
Tightening torque	Lock Nut	147 to 196 N·m 15 to 20 kgf·m 108 to 145 ft-lbs
	Bearing case mounting screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs



B161F213

[L3710 · L4310]

- (1) Internal Snap Ring
- (2) PTO Shaft
- (3) Oil Seal
- (4) Lock Nut
- (5) Oil Seal Collar
- (6) Slinger
- (7) Bearing Case
- (8) O-ring

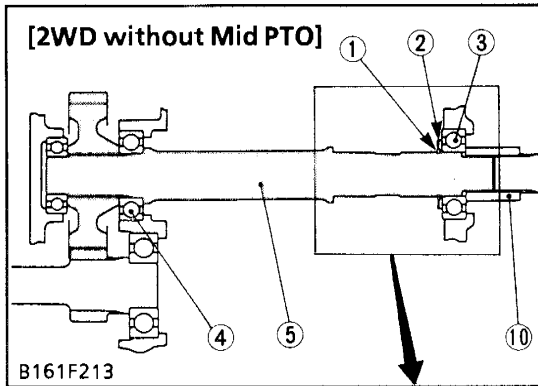


Shaft Assemblies

1. Take out the PTO drive shaft assembly with shift fork (3) and shifter (4).
2. Take out the front drive shaft assembly (2). (4WD or mid PTO type only.)

- | | |
|-----------------------|------------------------|
| (1) PTO Drive Shaft | (3) Mid PTO Shift Fork |
| (2) Front Drive Shaft | (4) Shifter |

B161P084



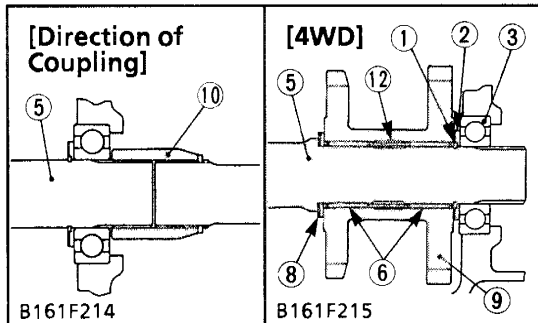
B161F213

PTO Drive Shaft

1. Remove the bearing (3) by the bearing puller, and then take out the thrust collar (2) and external snap ring (1).
2. Take out the 29T-29T gear (9) or 29T-31T gear (9). (4WD only.)
3. Remove the external snap ring (13), and then take out the thrust collar (11), 28T gear (7) and shifter (14). (Mid PTO type only.)

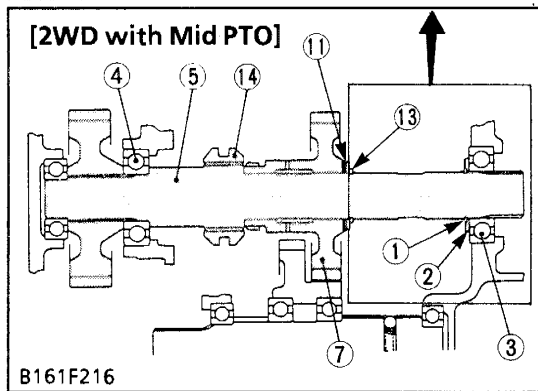
(When reassembling)

- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the 28T gear (7). (Mid PTO type only.)
- Direct the taper portion of the coupling (10) to the rear. (Refer to figure left.)
- Direct the thrust collars (2), (8) to the needle bearing (6) side.
- Direct the thrust collar (11) to the 28T gear (7) side.
- Install the external snap ring (1), (13) to the groove of the PTO drive shaft (5) firmly.
- Be careful with the direction of shifter (14). The chamfer side of shifter should be set to the 28 gear side (7).



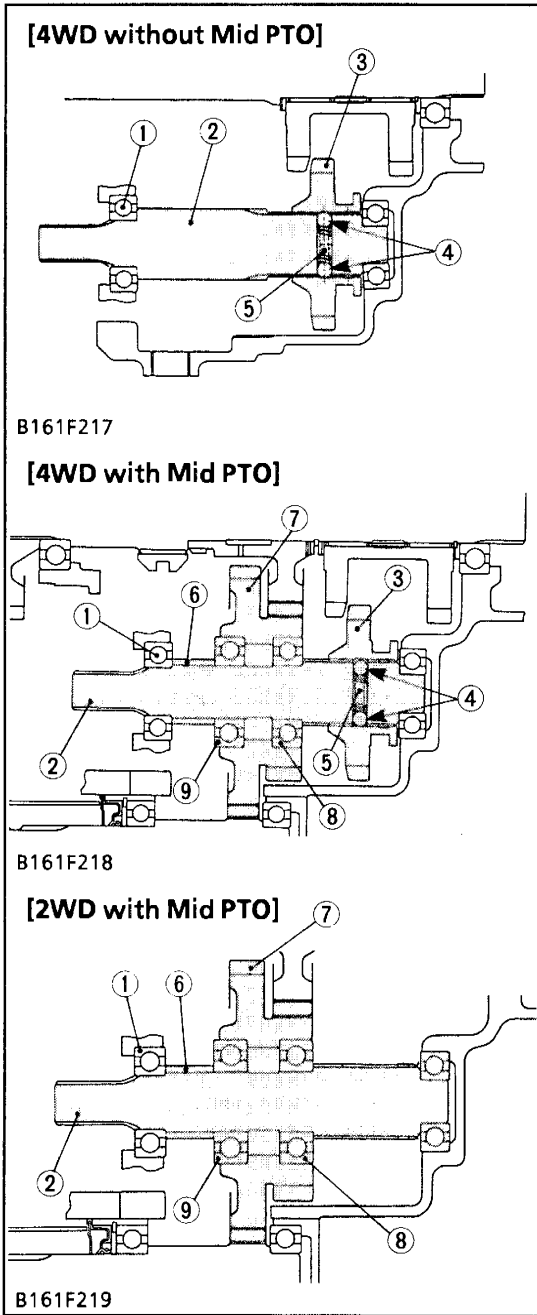
B161F214

B161F215



B161F216

- | | |
|------------------------|----------------------------------|
| (1) External Snap Ring | (9) 29T-29T Gear (L3010 · L3410) |
| (2) Thrust Collar | 29T-31T Gear (L3710 · L4310) |
| (3) Bearing | (10) Coupling |
| (4) Bearing | (11) Thrust Collar |
| (5) PTO Drive Shaft | (12) Collar |
| (6) Needle Bearing | (13) External Snap Ring |
| (7) 28T Gear | (14) Shifter |
| (8) Thrust Collar | |



Front Drive Shaft

1. Remove the bearing (1) by the bearing puller.
2. Take out the collar (6), bearings (8), (9) and 24T-42T gear (7).
3. Take out the 24T gear (3), balls (4) and spring (5).

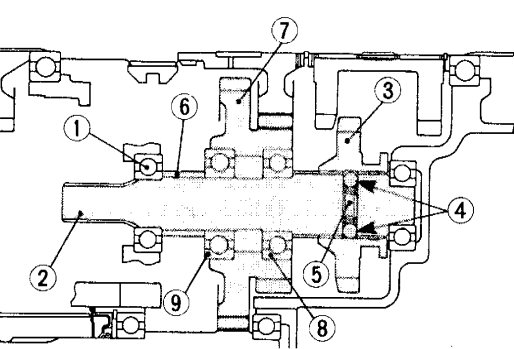
NOTE

- Take care not to fly out the balls (4) and spring (5) when take out the 24T gear (3).

- | | |
|-----------------------|------------------|
| (1) Bearing | (6) Collar |
| (2) Front Drive Shaft | (7) 24T-42T Gear |
| (3) 24T Gear | (8) Bearing |
| (4) Balls | (9) Bearing |
| (5) Spring | |

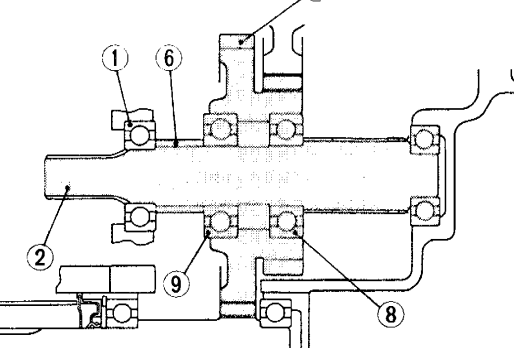
B161F217

[4WD with Mid PTO]



B161F218

[2WD with Mid PTO]



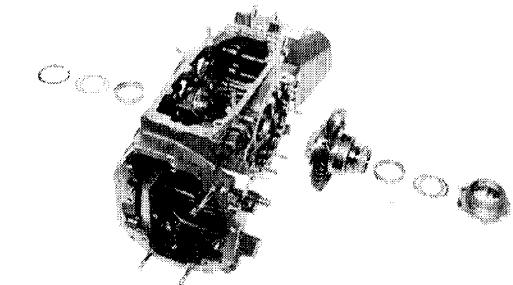
B161F219

Differential Gear Assembly

1. Remove the differential support, noting the number of left shims.
2. Take out the differential gear assembly, noting the number of right shims.

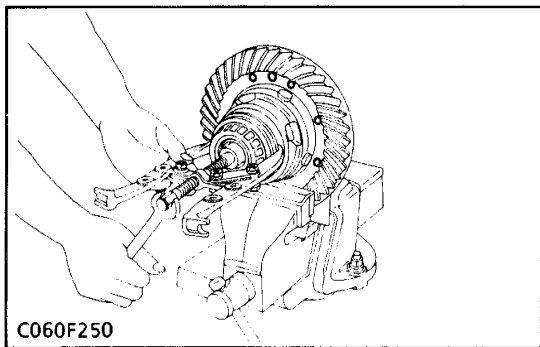
(When reassembling)

- Check the spiral bevel gear for wear or damage. If it is no longer serviceable, replace it. Then, also replace the spiral bevel pinion.
- Be sure to install the differential support to position the casting mark "上" on it upward.
- Use same number of shims as before disassembling.



B161P197

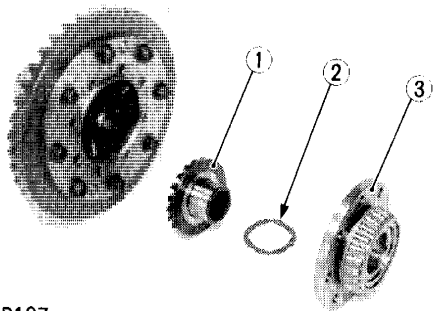
Tightening torque	Differential support mounting screws	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft·lbs
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C060F250

Bearing and Differential Lock Shifter

1. Secure the differential gear in a vise.
2. Remove the differential lock shifter and taper roller bearing as a unit with a puller.



C060P107

Differential Case Cover and Differential Side Gear

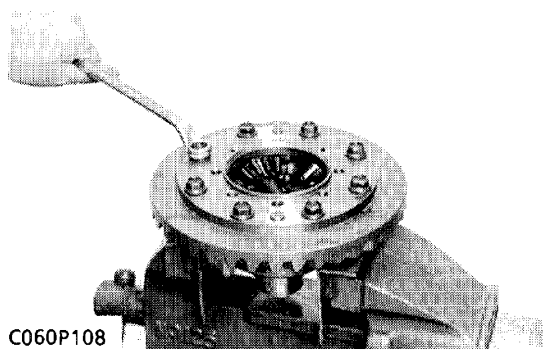
1. Remove the differential case cover (3).
2. Remove the differential side gear (1) and differential side gear washer (2).

(When reassembling)

- Apply liquid lock (Three Bond 1372 or equivalent) to the differential case cover mounting screws.

Tightening torque	Differential case cover mounting screws	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs
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- (1) Differential Side Gear (3) Differential Case Cover
(2) Differential Side Gear Washer



C060P108

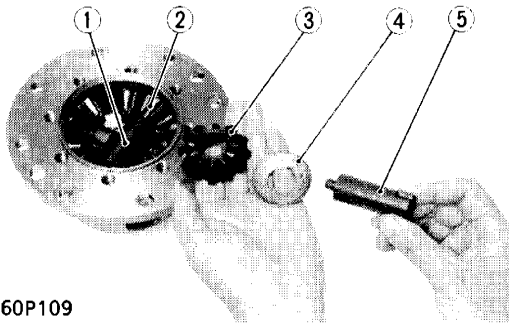
Spiral Bevel Gear

1. Remove the spiral bevel gear.

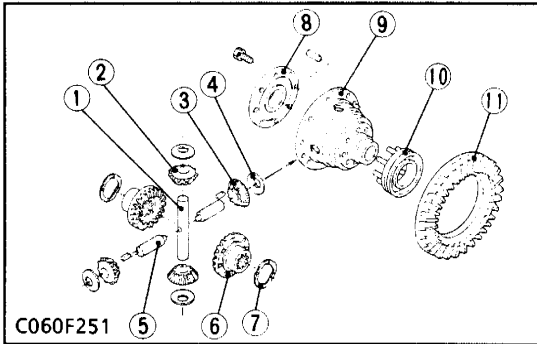
(When reassembling)

- Check the spiral bevel gear for wear or damage. If it is no longer serviceable, replace it. Then, also replace the spiral bevel pinion.
- Apply liquid lock (Three Bond 1372 or equivalent) to the spiral bevel gear UBS screws.

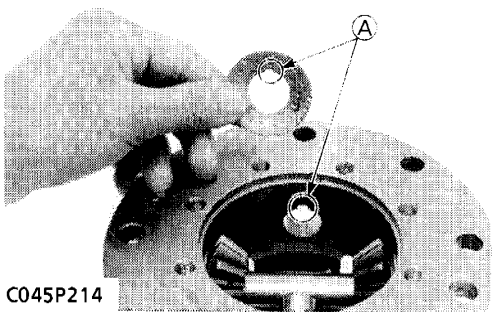
Tightening torque	Spiral bevel gear UBS screws	68.6 to 88.3 N·m 7.0 to 9.0 kgf·m 50.6 to 65.1 ft-lbs
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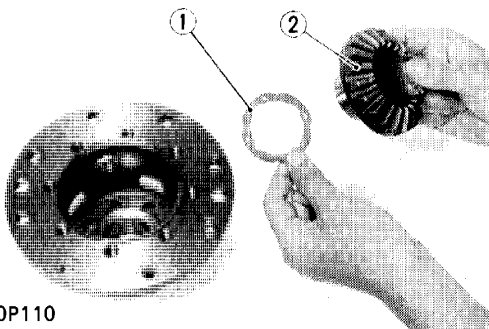
C060P109



C060F251

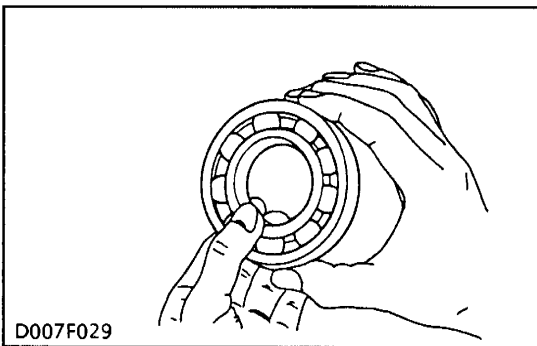


C045P214



C060P110

SERVICING



D007F029

Differential Pinion Shaft and Differential Pinion

1. Draw out the differential pinion shaft 2 (5), and take out the differential pinion (3) and differential pinion washer (4).
2. Draw out the differential pinion shaft (1), and take out the differential pinion (2) and differential pinion washer.

NOTE

- Arrange the parts to know their original position.

(When reassembling)

- Check the differential pinions (2), (3) and pinion shaft (1), (5) for excessive wear. If these parts are damaged or excessively worn, replace their parts they are in mesh with, or they sliding on.
- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential pinions.
- Install the parts to their original position.
- Install the differential pinion washer (4), noting its groove position.

[A] Fit Groove

- | | |
|---------------------------------|-----------------------------------|
| (1) Differential Pinion Shaft | (7) Differential Side Gear Washer |
| (2) Differential Pinion | (8) Differential Case Cover |
| (3) Differential Pinion | (9) Differential Case |
| (4) Differential Pinion Washer | (10) Differential Lock Shifter |
| (5) Differential Pinion Shaft 2 | (11) Spiral Bevel Gear |
| (6) Differential Side Gear | |

Differential Side Gear

1. Take out the differential side gear (2) and differential side gear washer (1).

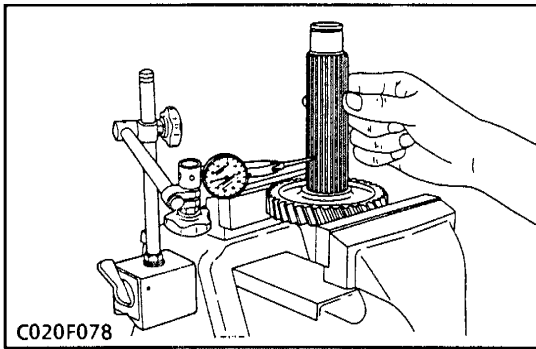
(When reassembling)

- Check the thrust and bearing surface of both differential side gears (2). If they are worn or damaged, bores in the differential case may also be damaged. Be sure to replace their parts.

- | | |
|-----------------------------------|----------------------------|
| (1) Differential Side Gear Washer | (2) Differential Side Gear |
|-----------------------------------|----------------------------|

Checking Bearing

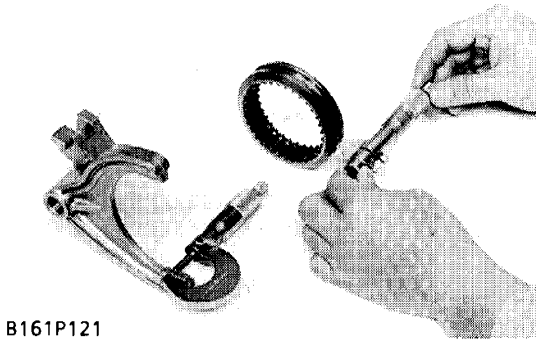
1. Hold the inner race, and push and pull the outer race in all directions to check for wear and roughness.
2. Apply transmission fluid to the bearing, and hold the inner race. Then, turn the outer race to check rotation.
3. If there is any defect, replace it.



Clearance between Gear and Spline or Hub and Spline

1. Secure the gear or the hub in a vise.
2. Set a dial gauge (lever type) with its finger on the spline.
3. Move the shaft (or hub) to measure the clearance.
4. If the clearance exceeds the allowable limit, replace them.

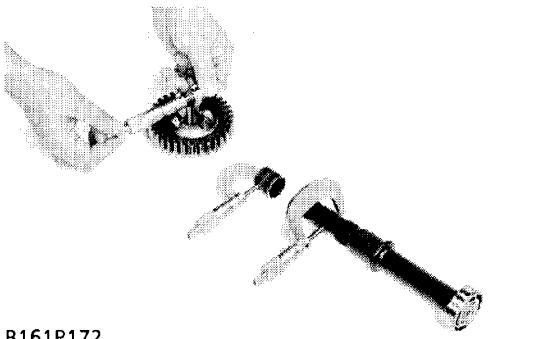
Clearance between gear and spline or hub and spline	Factory spec.	0.030 to 0.078 mm 0.00118 to 0.00307 in.
	Allowable limit	0.2 mm 0.008 in.



Clearance between Shift Fork and Shifter Groove

1. Measure the width of shift fork.
2. Measure the shifter groove width, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

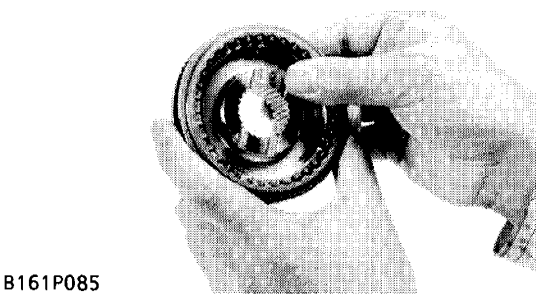
Clearance between shift fork and shifter groove	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.
	Allowable limit	0.8 mm 0.031 in.



Clearance between Gear and Shaft

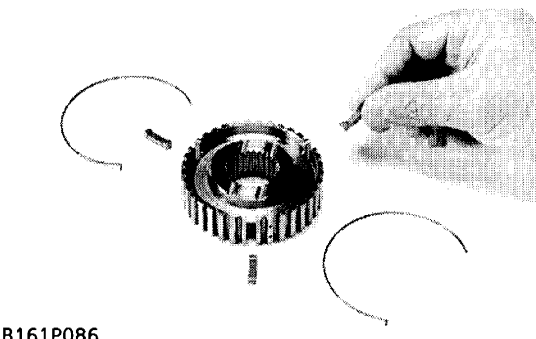
1. Measure the shaft O.D. (rubbing surface).
2. Measure the gear I.D. (rubbing surface).
3. Measure the O.D. of the two needles installed diagonally in the needle bearing.
4. Calculate the clearance.
(Clearance = Gear I.D. - {(2 x needle O.D.) + shaft O.D.})
5. If the clearance exceeds the allowable limit, replace them.

Clearance between gear and shaft	Factory spec.	0.021 to 0.054 mm 0.00083 to 0.00213 in.
	Allowable limit	0.1 mm 0.004 in.



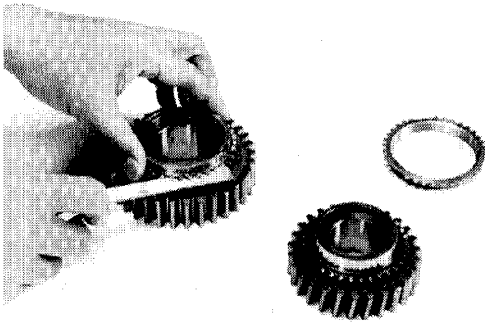
Checking Contact between Coupling and Shifter

1. Check to see if there is any flaw or wear on the spline of the coupling and shifter, and the key groove on the coupling.
2. Engage the shifter with the coupling, and check that they slide smoothly.
3. Similarly, check that there is any flaw or wear on the gear splines.
4. If there is any defect, replace them.



Flaw on Synchronizer Key and Spring

1. Check the projection in the center of the synchronizer key for wear.
2. Check the spring for fatigue or wear on the area where the spring contacts with the keys.
3. If there is any defect, replace them.



B161P087

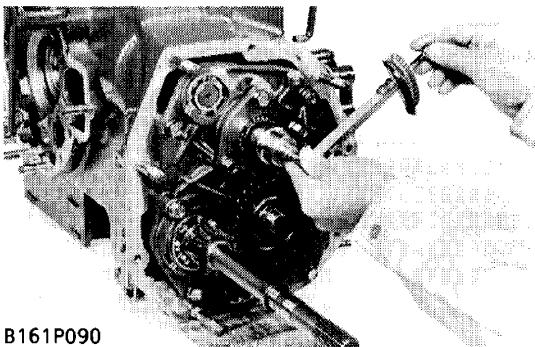
Side Clearance between Synchronizer Ring and Gear

(In Contact)

1. Press the synchronizer ring against the tapered portion of the gear, and measure the side clearance.
2. Apply thin film of red lead to the tapered portion, press the ring against it by hand, rub them together a few times, and check the contact.
3. Check the tooth surface and key grooves of the ring for wear.
4. If the side clearance exceeds the allowable limit or if there is any defect, replace the synchronizer ring.

Side clearance	Allowable limit	0.35 mm 0.0138 in.
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Contact condition of tapered portion	Allowable limit	More than 80 %
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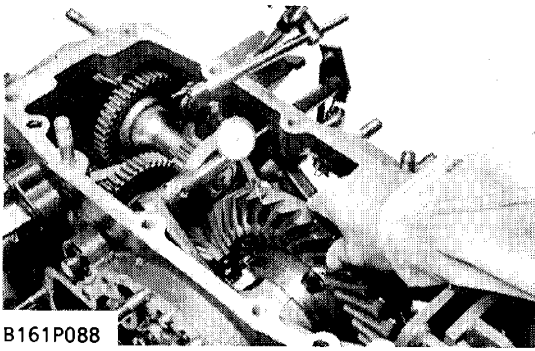


B161P090

Spiral Bevel Pinion Turning Torque (with Differential Gear)

1. Grip the spiral bevel pinion nut with a torque wrench and measure the turning torque.
2. If the turning torque is not within the factory specifications, check the differential gear turning force, backlash and tooth contact again.

Turning torque (with differential gear)	Factory spec.	3.92 to 6.37 N·m 0.40 to 0.65 kgf·m 2.89 to 4.70 ft-lbs
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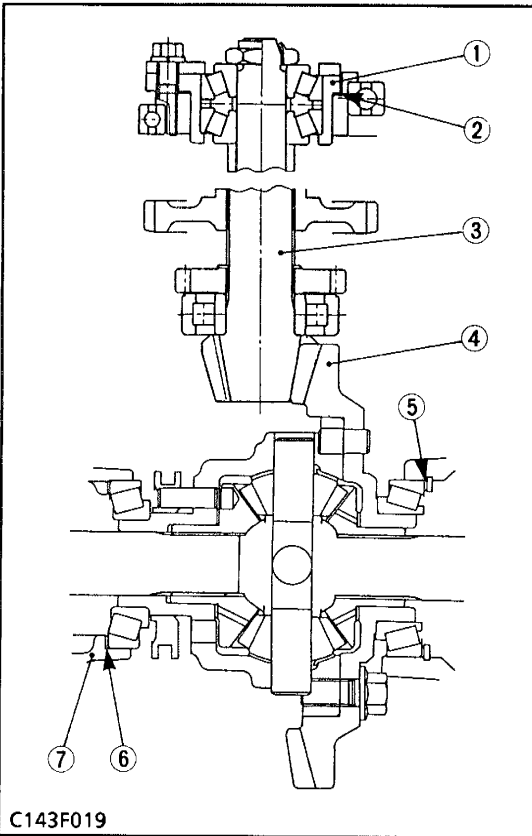


B161P088

Backlash and Tooth Contact between Spiral Bevel Gear and Spiral Bevel Pinion

1. Set a dial gauge (lever type) with its finger on the tooth surface of spiral bevel gear.
2. Measure the backlash by fixing the spiral bevel pinion (3) and moving spiral bevel gear (4) by hand.
3. If the backlash exceeds the factory specification, decrease the number of shims (5) and insert the removed shims to the differential support (7). If the backlash is less than the factory specification, decrease the number of shims (6) at differential support (7) and insert the removed shims to the opposite side.
4. Adjust the backlash properly by repeating the above procedures.

Backlash between spiral bevel gear and spiral bevel pinion	Factory spec.	0.15 to 0.30 mm 0.006 to 0.012 in.
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C143F019

5. Apply red lead lightly over several teeth at three positions equally spaced on the spiral bevel gear (4).
6. Turn the spiral bevel pinion (3) while pressing a wooden piece against the periphery of the spiral bevel gear (4).
7. Check the tooth contact. If not proper, adjust according to the instructions below.

(Reference)

- Thickness of shims (2) :
0.1 mm (0.004 in.) 0.5 mm (0.020 in.)
0.2 mm (0.008 in.)
- Thickness of shims (5) :
0.4 mm (0.016 in.) 0.9 mm (0.035 in.)
0.5 mm (0.020 in.) 1.0 mm (0.039 in.)
0.6 mm (0.024 in.) 1.2 mm (0.047 in.)
0.7 mm (0.028 in.) 1.4 mm (0.055 in.)
0.8 mm (0.031 in.)
- Thickness of shims (6) :
0.4 mm (0.016 in.) 1.0 mm (0.039 in.)
0.6 mm (0.024 in.) 1.2 mm (0.047 in.)
0.8 mm (0.031 in.) 1.6 mm (0.063 in.)

● **Proper Contact**

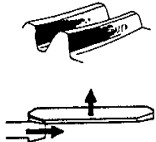


More than 35 % red lead contact area on the gear tooth surface. The center of tooth contact at 1/3 of the entire width from the small end.

C065F198

- (1) Pinion Bearing Case
- (2) Shim
- (3) Spiral Bevel Pinion
- (4) Spiral Bevel Gear
- (5) Shim
- (6) Shim
- (7) Differential Support

● **Heel Contact**



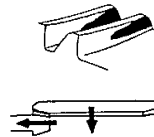
● **Tip Contact**



0329F097

Replace adjusting shim (2) with thinner one to move the bevel pinion shaft backward. And place the right side shim (5) to the left to move the bevel gear rightward. Repeat above until the proper tooth contact and backlash are achieved.

● **Toe Contact**

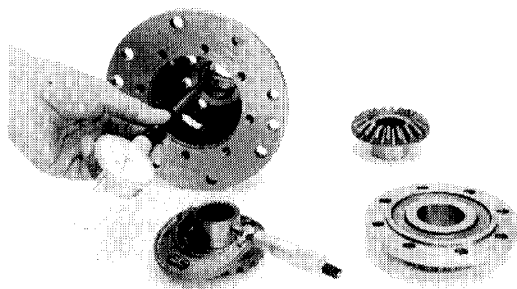


● **Base Contact**



0329F098

Replace adjusting shim (2) with thicker one to move the bevel pinion shaft forward. And place the left side shim (6) to the right to move the bevel gear leftward. Repeat above until the proper tooth contact and backlash are achieved.



C045P215

Clearance between Differential Case Bore (Differential Case Cover Bore) and Differential Side Gear Boss

1. Measure the bore I.D. of the differential case and differential case cover.
2. Measure the differential side gear boss O.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

Clearance between differential case bore and differential side gear boss	Factory spec.	0.050 to 0.151 mm 0.00197 to 0.00594 in.
	Allowable limit	0.35 mm 0.0138 in.

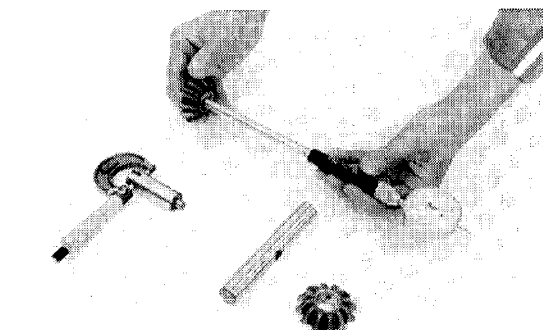
Differential case bore I.D.	Factory spec.	40.500 to 40.550 mm 1.59449 to 1.59646 in.
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Differential side gear boss O.D.	Factory spec.	40.388 to 40.450 mm 1.59008 to 1.59252 in.
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Clearance between differential case cover bore and differential side gear boss	Factory spec.	0.050 to 0.151 mm 0.00197 to 0.00594 in.
	Allowable limit	0.35 mm 0.0138 in.

Differential case cover bore I.D.	Factory spec.	40.500 to 40.550 mm 1.59449 to 1.59646 in.
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Differential side gear boss O.D.	Factory spec.	40.388 to 40.450 mm 1.59008 to 1.59252 in.
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C045P216

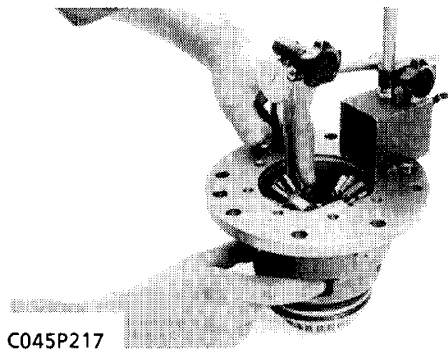
Clearance between Differential Pinion Shaft and Differential Pinion

1. Measure the differential pinion shaft O.D.
2. Measure the differential pinion I.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

Clearance between differential pinion shaft and differential pinion	Factory spec.	0.060 to 0.102 mm 0.00236 to 0.00402 in.
	Allowable limit	0.25 mm 0.0098 in.

Differential pinion shaft O.D.	Factory spec.	19.959 to 19.980 mm 0.78579 to 0.78661 in.
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Differential pinion I.D.	Factory spec.	20.040 to 20.061 mm 0.78898 to 0.78980 in.
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C045P217

Backlash between Differential Pinion and Differential Side Gear

1. Set a dial indicator (lever type) on the tooth of the differential pinion.
2. Hold the differential side gear and move the differential pinion to measure the backlash.
3. If the measurement is not within the factory specifications, adjust with the differential side gear washer.

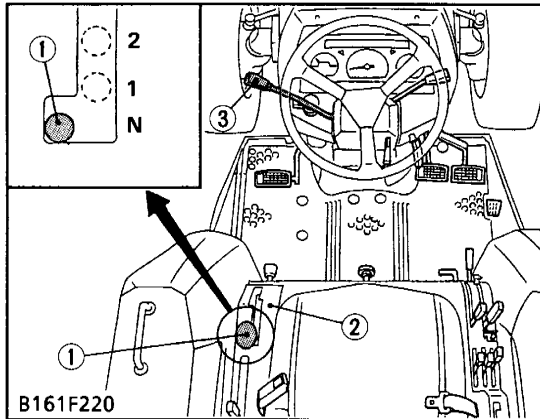
Backlash between differential pinion and differential side gear	Factory spec.	0.15 to 0.30 mm 0.006 to 0.012 in.
	Allowable limit	0.40 mm 0.016 in.

(Reference)

- Thickness of differential side gear washers :
1.5 mm (0.059 in.)
1.6 mm (0.063 in.)
1.7 mm (0.067 in.)

[4] GST VALVES

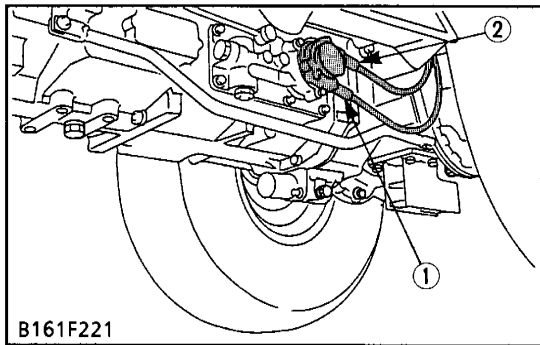
CHECKING AND ADJUSTING



Checking Shift Cable

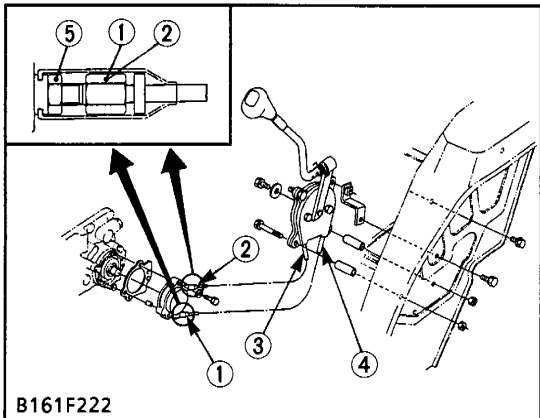
1. Check the main shift lever (1) to be "Neutral" position on the main shift lever guide (2).
2. Set the main shift lever (1) and shuttle shift lever (3) to the "Neutral" position.
3. Start the engine, and then shift the shuttle shift lever (3) to "Forward" or "Reverse" position.
4. Check the tractor does not move at main shift lever (1) to be "Neutral" position, and then check the tractor moves when main shift lever (1) is shifted "1st" to "8th" and "8th" to "1st".
5. If any abnormality is present, adjust the shift cable. (Refer to adjusting shift cable.)

- (1) Main Shift Lever (3) Shuttle Shift Lever
(2) Main Shift Lever Guide

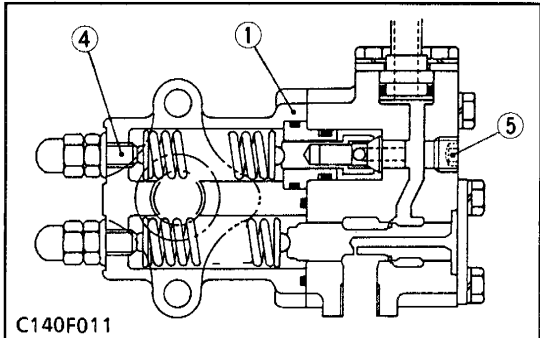
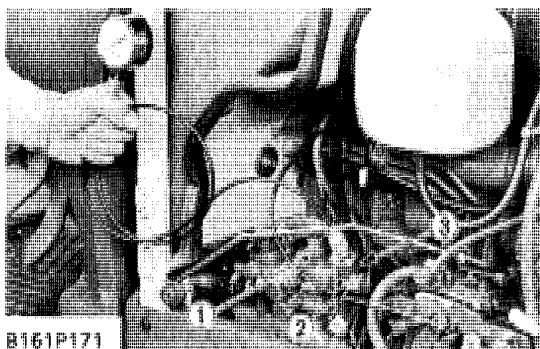
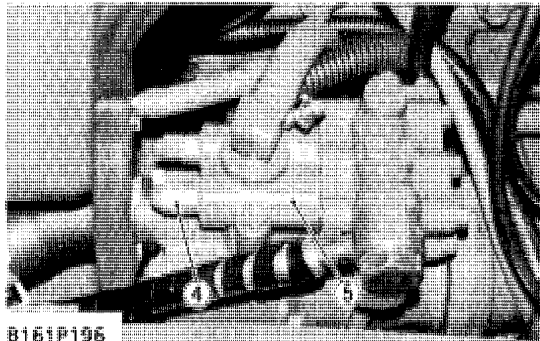
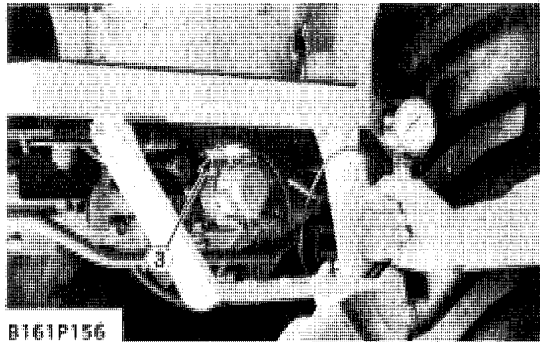
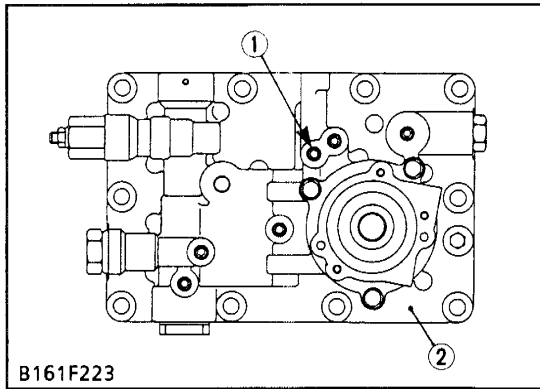


Adjusting Shift Cable

1. When the tractor moves with the main shift lever at "Neutral" position.
 - Extend the cable adjuster "B" (2) and shorten the cable adjuster "A" (1).
2. When the tractor does not move with the main shift lever at "1st" shift position.
 - Shorten the cable adjuster "B" (2) and extend the cable adjuster "A" (1).
3. After the adjustment, check that "C" portion (3) and "D" portion (4) does not have free play, and then tighten the lock nut (5).



- (1) Cable Adjustor "A" (4) "D" Portion
(2) Cable Adjustor "B" (5) Lock Nut
(3) "C" Portion



- (1) Regulator Valve
- (2) Adaptor "7"
- (3) Adaptor "D"
- (4) Relief Valve Adjustor
- (5) Checking Port (PT 1/8)

Checking GST System Pressure

1. Start the engine and warm up the transmission fluid, and then stop the engine.
2. Remove the GST system pressure checking port (1) plug (PT 1/8) on the GST valve (2).
3. Install the adaptor "D" to checking port (1), and then install the threaded joint, cable and pressure gauge.
4. Start the engine and set the idling speed. Set the shift levers to "Neutral".
5. Measure the pressure.
6. If the measurement is not within factory specifications, adjust the reducing valve adjustor (4) on the regulator valve (5).

GST system pressure	Factory spec.	2.45 to 2.55 MPa 25.0 to 26.0 kgf/cm ² 356 to 370 psi
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Condition

- Engine speed Idling speed
- Oil temperature 40 to 60 °C
104 to 140 °F

(Reference)

- Turn to clockwise direction → Pressure is increased
- Turn to counterclockwise direction → Pressure is decreased

- (1) GST System Pressure Checking Port (PT 1/8)
- (2) GST Valve
- (3) Adaptor "D"
- (4) Reducing Valve Adjustor
- (5) Regulator Valve

Checking Relief Valve Setting Pressure

1. Start the engine and warm up the transmission fluid, and then stop the engine.
2. Remove the relief valve setting pressure checking port (5) plug (PT 1/8).
3. Install the adaptor "7" to the checking port (5), and then install the adaptor "D", the threaded joint, cable and pressure gauge.
4. Start the engine and set the maximum engine speed. Set the shift levers to "Neutral".
5. Measure the pressure. (Do not turn the steering wheel.)
6. If the measurement is not within factory specifications, adjust the relief valve adjustor (4) on the regulator valve (1).

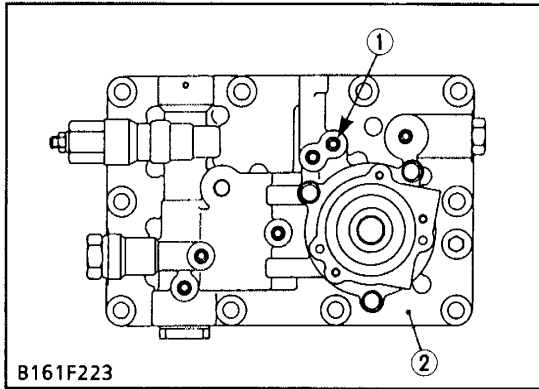
Relief valve setting pressure	Factory spec.	2.84 to 2.94 MPa 29.0 to 30.0 kgf/cm ² 412 to 427 psi
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Condition

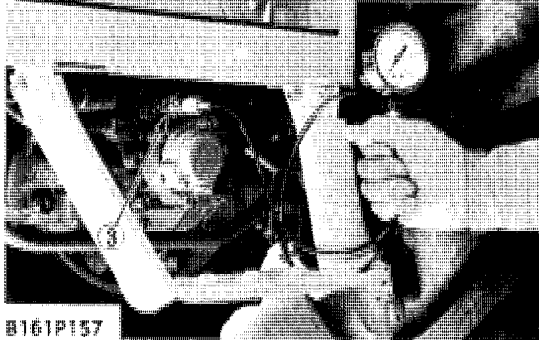
- Engine speed Maximum speed
- Oil temperature 40 to 60 °C
104 to 140 °F

(Reference)

- Turn to clockwise direction → Pressure is increased
- Turn to counterclockwise direction → Pressure is decreased



B161F223



B161P157

- (1) Pilot Pressure Checking Port (PT 1/8)
- (2) GST Valve
- (3) Adaptor "D"

Checking Pilot Pressure

1. Start the engine and warm up the transmission fluid, and then stop the engine.
2. Remove the pilot pressure checking port plug (PT 1/8) on the GST valve (2).
3. Install the adaptor "D" (3) to the checking port (1), and then install the threaded joint, cable and pressure gauge.
4. Start the engine and set the maximum speed.
5. Disengage the clutch and shift the main shift lever to "1st" position, shuttle shift lever to "Forward" or "Reverse" position.
6. Measure the pressure.
7. When the pilot pressure is not within factory specifications :
 Check the pilot orifice is clogged, modulating check valve, movement of the shift forks (1-2, 3-4, Hi-Lo, shuttle shifts), shift pistons and shift check valves.
 When the pilot pressure is correct :
 Measure the clutch pack pressure.

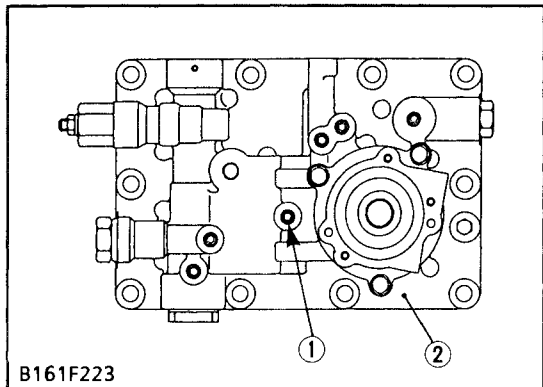
■ IMPORTANT

- Do not engage the clutch while checking.

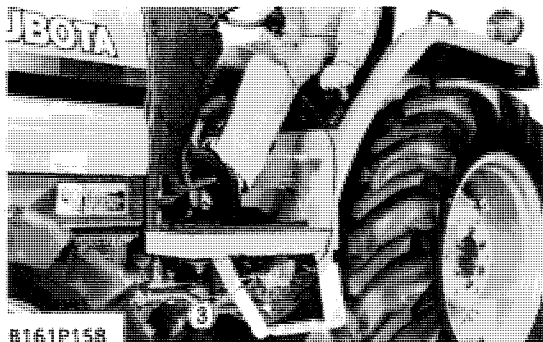
Pilot pressure	Factory spec.	2.45 to 2.55 MPa 25.0 to 26.0 kgf/cm ² 356 to 370 psi
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Condition

- Engine speed Maximum speed
- Oil temperature 40 to 60 °C
104 to 140 °F
- Shifting Main shift lever to be "1st".
Shuttle shift lever to be "Forward" or "Reverse".



B161F223



B161P155

- (1) Clutch Pack Pressure Checking Port (PT 1/8)
- (2) GST Valve
- (3) Adaptor "D"

Checking Clutch Pack Pressure

1. Start the engine and warm up the transmission fluid, and then stop the engine.
2. Remove the clutch pack pressure checking port plug (PT 1/8) on the GST valve (2).
3. Install the adaptor "D" to the checking port (1), and then install the threaded joint, cable and pressure gauge.
4. Start the engine and set the idling speed.
5. Disengage the clutch and shift the main shift lever to "1st" position, shuttle sift lever to "Forward" position.
6. Measure the pressure.
7. When the clutch pack pressure is not within factory specifications :
Check the modulating valve, clutch valve and clutch pack.
8. Check the clutch pack pressure drops and raise up again quickly while shifting the shuttle shift lever "Reverse" to "Forward" and shifting the main shift lever from "Neutral" to "8th".
9. If the pressure does not change correctly, check the modulating check valve and modulating valve.

IMPORTANT

- Do not engage the clutch while checking.

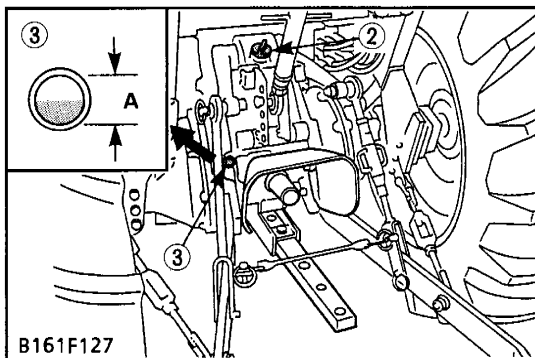
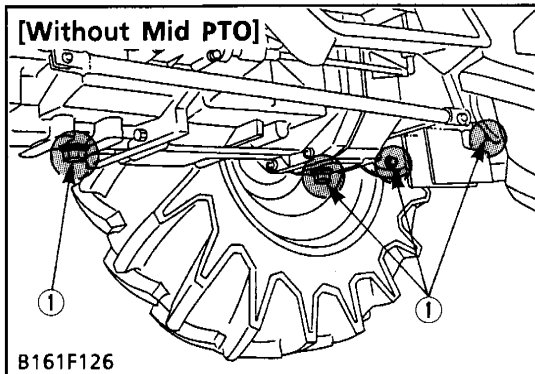
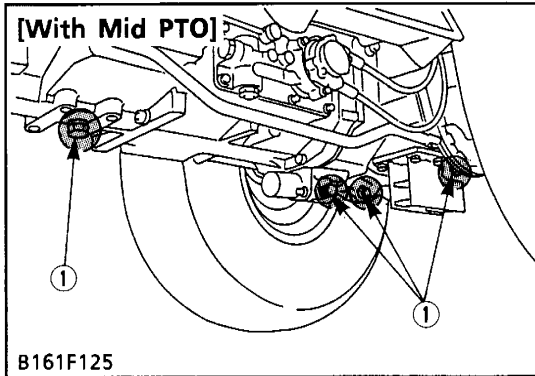
Clutch pack pressure	Factory spec.	2.45 to 2.55 MPa 25.0 to 26.0 kgf/cm ² 356 to 370 psi
Pressure changing while shifting the shuttle shift lever and main shift lever		Once drops and raise up again quickly

Condition

- Engine speed Idling speed
- Oil temperature 40 to 60 °C
104 to 140 °F
- Shifting Main shift lever "Neutral" to "1st" to "8th"
Shuttle shift lever "Neutral" to "Forward" and "Reverse"

DISASSEMBLING AND ASSEMBLING

(1) Draining the Transmission Fluid



Draining the Transmission Fluid

1. Place oil pans underneath the transmission case.
2. Remove the four drain plugs (1).
3. Drain the transmission fluid.
4. Reinstall the four drain plugs (1).

(When refilling)

- Fill up from filling port after removing the filling plug (2) until reaching the gauge (3).
- After running the engine for few minutes, stop it and check the oil level again, add the fluid to prescribed level if it is not correct level.

Capacity	Transmission fluid	
		39.0 ℓ
		41.2 U.S.qts.
		34.3 Imp.qts.

■ IMPORTANT

- Use only KUBOTA SUPER UDT fluid. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-8.)
- Do not mix different brands fluid together.

[A] Oil level is acceptable within this range.

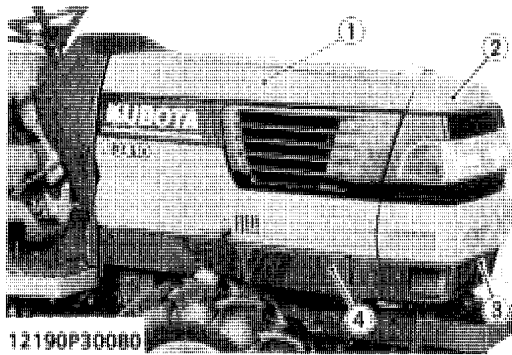
- (1) Drain Plug
(2) Filling Plug

(3) Gauge

(2) Disassembling GST Valves

■ NOTE

- The GST valve has been precisely machined and assembled. It is advisable not to disassemble it. If unavoidably necessary to do it, take the following precautions.
 1. Tighten up the screws and nuts to their specified torques.
 2. Be sure to clean the disassembled parts and dry them up with compressed air.
 3. Do not wear any gloves other than rubber ones not use waste cloth. This is important for keeping the parts clean and free from rust.
 4. Be careful not to drop the parts on the floor or workbench. Check any part, if dropped, for hit mark, scratch and burr.
 5. Be sure to use a rubber or plastic hammer for reassembling.
 6. Do not use a wire brush nor polish any part with sandpaper.
 7. Apply super UDT oil to the O-rings and oil seals before reassembling. Do not use any metal-cleaning liquid.



B12190P30080

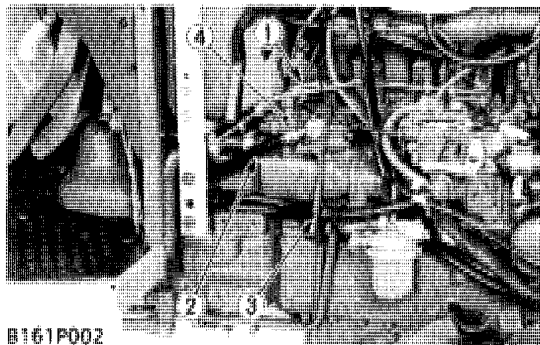
Front Mask, Side Cover and Skirt

1. Remove the side cover RH (1) and front mask (2).
2. Remove the front grille (3) and side skirt RH (4).

(When reassembling)

- Tighten the side skirt mounting screws with pressing the side skirt RH (4) to the tractor side.

- | | |
|-------------------|-------------------|
| (1) Side Cover RH | (3) Front Grille |
| (2) Front Mask | (4) Side Skirt RH |



B161P002

Hydraulic Pipes

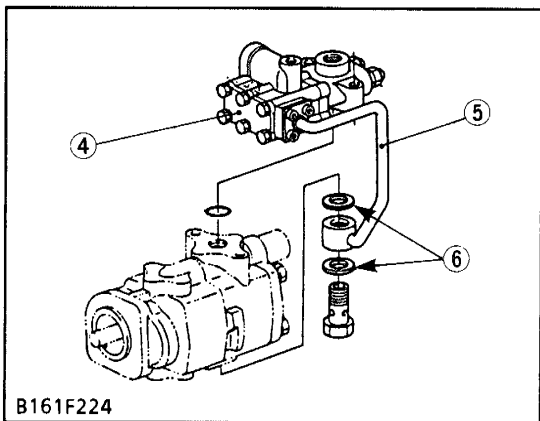
1. Disconnect the GST delivery pipe (3), power steering delivery hose (2) and power steering return hose (1) from regulator valve (4).
2. Remove the delivery pipe (5).

(When reassembling)

- Apply grease to the O-rings and take care not to damage them.
- Install the copper washers (6) firmly.

Tightening torque	Joint bolt for GST delivery pipe (3) and regulator valve	34.3 to 39.2 N-m 3.5 to 4.0 kgf-m 25.3 to 28.9 ft-lbs
	Joint bolt for power steering delivery hose (2) and regulator valve	49.0 to 58.8 N-m 5.0 to 6.0 kgf-m 36.2 to 43.4 ft-lbs
	Joint bolt for delivery pipe (5) and hydraulic pump	39.3 to 49.0 N-m 4.0 to 5.0 kgf-m 29.0 to 36.2 ft-lbs

- | | |
|----------------------------------|---------------------|
| (1) Power Steering Return Hose | (4) Regulator Valve |
| (2) Power Steering Delivery Hose | (5) Delivery Pipe |
| (3) GST Delivery Pipe | (6) Copper Washers |



B161F224

Regulator Valve Assembly

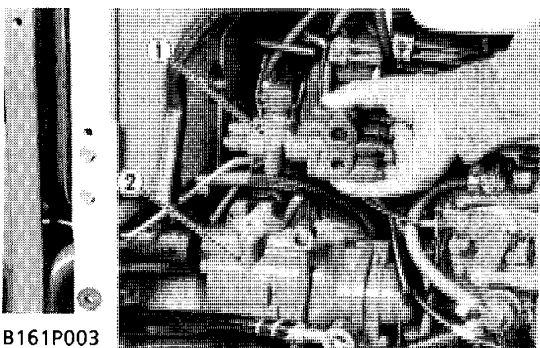
1. Loosen and remove the regulator valve mounting screws.
2. Take out the regulator valve (1) from the power steering hydraulic pump (2).

(When reassembling)

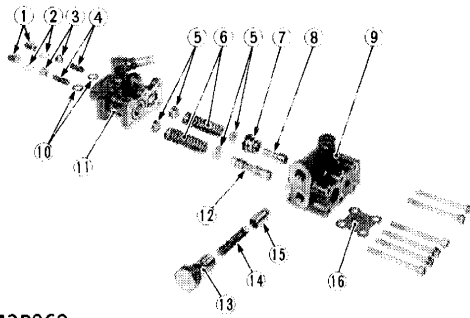
- Apply grease to the O-ring and take care not to damage it.

Tightening torque	Regulator valve mounting screws	17.6 to 20.6 N-m 1.8 to 2.1 kgf-m 13.0 to 15.2 ft-lbs
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- | | |
|---------------------|-----------------------------------|
| (1) Regulator Valve | (2) Power Steering Hydraulic Pump |
|---------------------|-----------------------------------|



B161P003



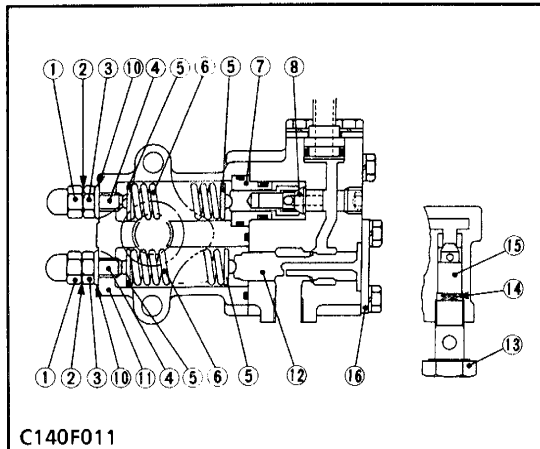
Regulator Valve

1. Remove the plate (16) and take out reducing spool (12), spring retainer (5) and spring (6).
2. Separate the regulator valve case (9) and regulator support (11).
3. Take out the bush (7) and poppet (8).
4. Remove the joint bolt (13), and then take out the spring (14) and the poppet (15).
5. Take out the spring retainer (5) and spring (6).

(When reassembling)

- Take care not to damage the O-rings.

C143P069



Tightening torque	Joint bolt (13)	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft·lbs
	Plate (16)	9.8 N·m 1.0 kgf·m 7.2 ft·lbs
	Regulator valve case and regulator support mounting screws	9.8 N·m 1.0 kgf·m 7.2 ft·lbs

- | | |
|---------------------|--------------------------|
| (1) Cap Nuts | (9) Regulator Valve Case |
| (2) Gaskets | (10) Washer with Rubber |
| (3) Nuts | (11) Regulator Support |
| (4) Adjustor | (12) Reducing Spool |
| (5) Spring Retainer | (13) Joint Bolt |
| (6) Spring | (14) Spring |
| (7) Bush | (15) Poppet |
| (8) Poppet | (16) Plate |

C140F011

GST Valve Assembly

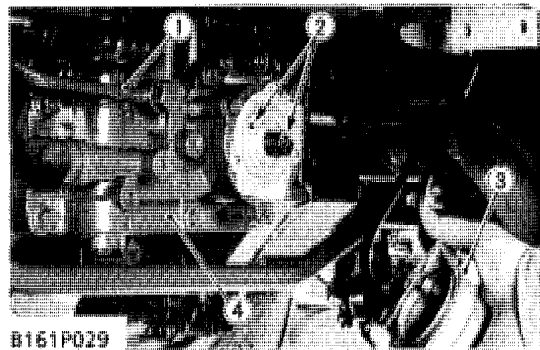
1. Disconnect the GST delivery pipe (1) on the GST valve (4).
2. Remove the shift cable (3).
3. Remove the GST valve (4) as a unit after removing its mounting screws.

NOTE

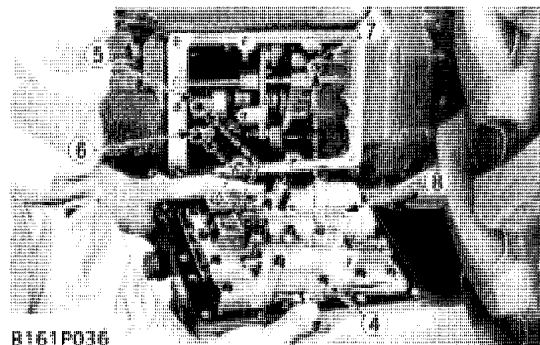
- Do not fall down the shuttle check pin (8) while disassembling.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face of the rotary valve cover and the shift cable (3).
- Set the main shift lever at the neutral position, align the punched marks (2), then assemble the shift cable (3).
- Place the 1-2 (6) and the 3-4 shift pins (5) at neutral position and Hi-Lo shift pin (7) at Hi-shift position (right side), and then assemble the GST valve (4).
- Install the GST valve (4) by hand, and then tighten the screws. Do not use the hummer.



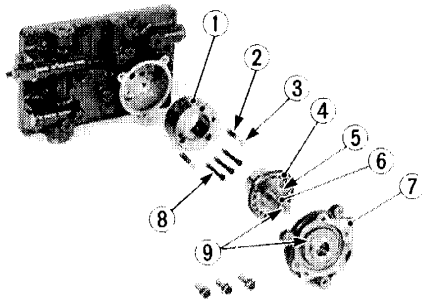
B161P029



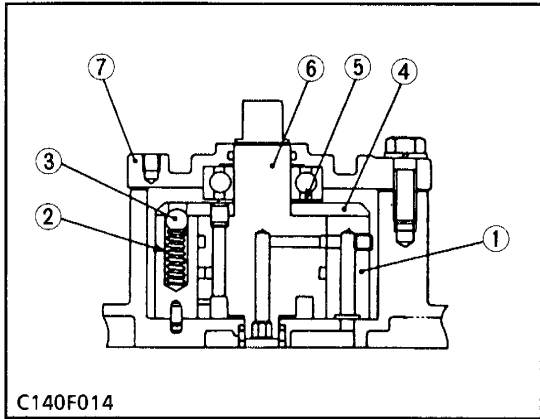
B161P036

- | | |
|-----------------------|-----------------------|
| (1) GST Delivery Pipe | (5) 3-4 Shift Pin |
| (2) Punched Mark | (6) 1-2 Shift Pin |
| (3) Shift Cable | (7) Hi-Lo Shift Pin |
| (4) GST Valve | (8) Shuttle Check Pin |

Tightening torque	Joint bolt for GST delivery pipe (1) on GST valve	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft·lbs
	Shift cable (3) mounting screws	7.8 to 8.8 N·m 0.8 to 0.9 kgf·m 5.8 to 6.5 ft·lbs
	GST valve (4) mounting screws	42.2 to 48.1 N·m 4.3 to 4.9 kgf·m 31.1 to 35.4 ft·lbs



C143P070



C140F014

Rotary Valve

1. Remove the cover (7), then take out the thrust collar (5), rotor (6), detent plate (4), balls (3) and detent spring (2).
2. Remove the hex. socket head cap screws (8) and take out the valve case (1).

(When reassembling)

- Align the punched marks (9). (Neutral position.)

Tightening torque	Valve case (1) mounting hex. socket head cap screws	7.8 N·m 0.8 kgf·m 5.8 ft-lbs
	Cover (7) mounting screws	8.8 to 9.8 N·m 0.9 to 1.0 kgf·m 6.5 to 7.2 ft-lbs

- | | |
|--------------------|---------------------------------|
| (1) Valve Case | (6) Rotor |
| (2) Detent Springs | (7) Cover |
| (3) Balls | (8) Hex. Socket Head Cap Screws |
| (4) Detent Plate | (9) Punched Marks |
| (5) Thrust Collar | |

Modulating Valve

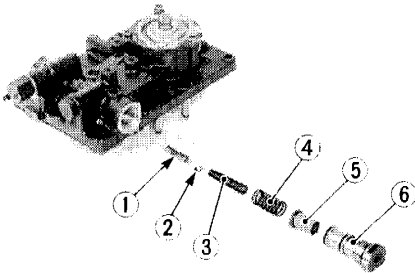
1. Remove the sleeve (6).
2. Take out the modulating piston (5), return spring (4), modulating spring (3) and modulating spool (1).

■ IMPORTANT

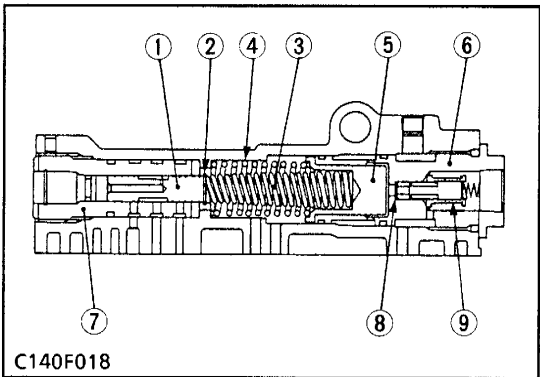
- Do not remove the sleeve (6), otherwise pressure rising curve will change.

(When reassembling)

- Be sure to clean the orifice portion (8) of the sleeve (6) and dry it up with compressed air before assembling.



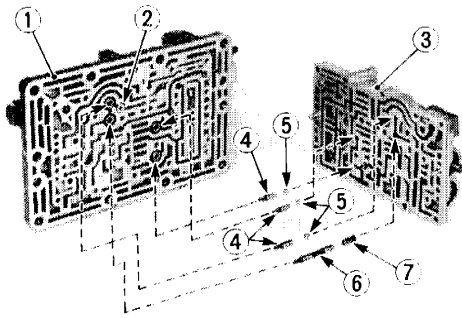
C143P071



C140F018

Tightening torque	Sleeve (6)	58.8 N·m 6.0 kgf·m 43.4 ft-lbs
-------------------	------------	--------------------------------------

- | | |
|-----------------------|-------------------|
| (1) Modulating Spool | (6) Sleeve |
| (2) Washer | (7) Valve Housing |
| (3) Modulating Spring | (8) Orifice |
| (4) Return Spring | (9) Line Filter |
| (5) Modulating Piston | |



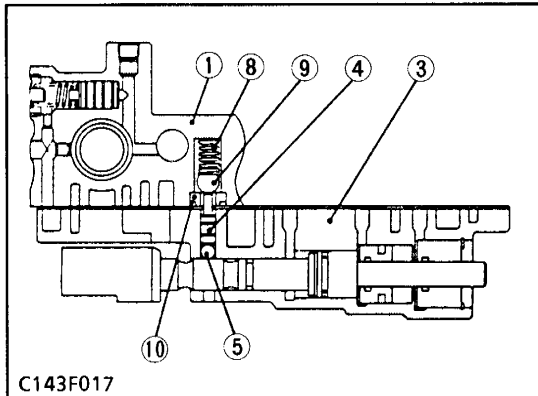
Shift Check Valve and Orifice

1. Remove the rotary valve case mounting hex. socket head cap screws. (Refer to rotary valve.)
2. Separate the upper body (1) and lower body (3) after removing the lower body mounting hex. socket head cap screws.
3. Take out the shift check pins (4), (6), balls (5) and pin (7).

(When reassembling)

- Be sure to clean the orifice (2) and dry it up with compressed air before assembling.

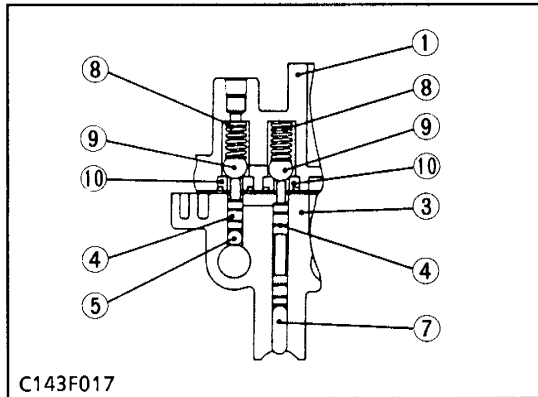
C143P072



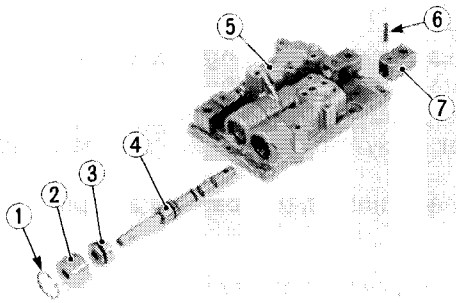
C143F017

Tightening torque	Rotary valve case mounting hex. socket head cap screws	7.8 N·m 0.8 kgf·m 5.8 ft-lbs
	Lower body mounting hex. socket head cap screws	9.8 N·m 1.0 kgf·m 7.2 ft-lbs

- | | |
|----------------------|-----------------------|
| (1) Upper Body | (6) Shift Check Pin |
| (2) Orifice | (7) Pin |
| (3) Lower Body | (8) Check Spring |
| (4) Shift Check Pins | (9) Balls |
| (5) Balls | (10) Check Valve Seat |



C143F017



C140P005

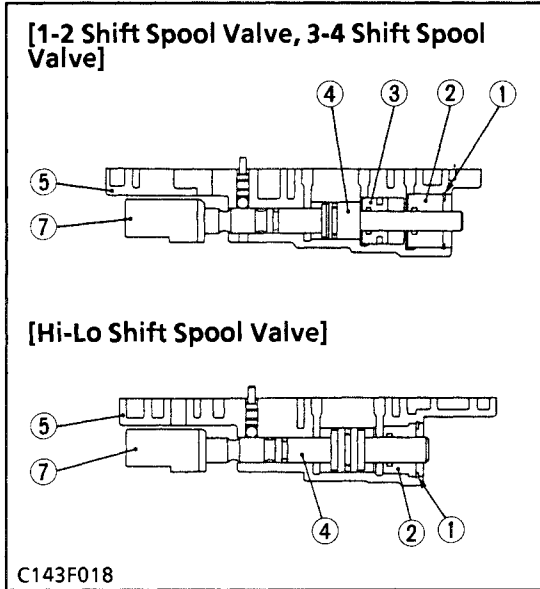
Shift Pistons

1. Tap out the spring pins (6), and then remove the shifters (7).
2. Remove the internal snap rings (1), and then take out the covers (2) and shift pistons (4).
3. Pull out the neutral pistons (3) from the shift pistons (4).

(When reassembling)

- Take care not to damage the O-rings and piston seals.

- | | |
|-------------------------|------------------|
| (1) Internal Snap Rings | (5) Lower Bodies |
| (2) Covers | (6) Spring Pins |
| (3) Neutral Pistons | (7) Shifters |
| (4) Shift Pistons | |



C143F018

Low-pass Valve

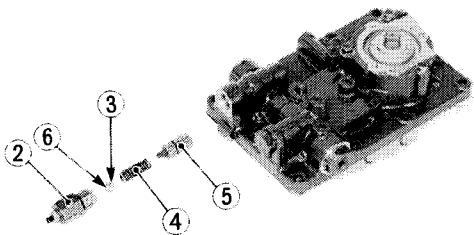
NOTE

- Do not turn the adjuster (1).

1. Remove the plug (2) without adjusting the adjuster (1).
2. Take out the ball (6), spring support (3), control spring (4) and low-pass spool (5).

IMPORTANT

- Do not adjust or remove the adjuster (1), otherwise the GST clutch engagement feeling will change.

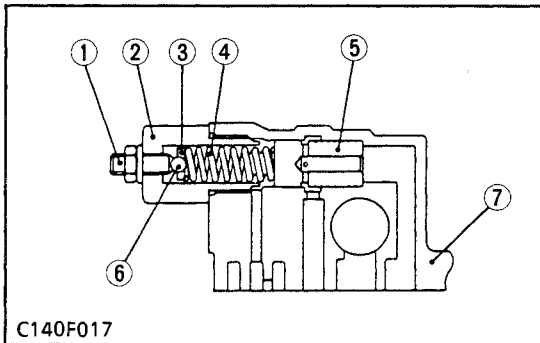


C143P073

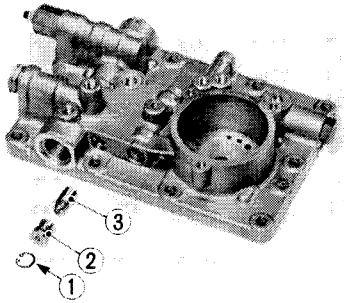
(When reassembling)

Tightening torque	Plug (2)	49.0 N·m 5.0 kgf·m 36.2 ft·lbs
-------------------	----------	--------------------------------------

- | | |
|--------------------|--------------------|
| (1) Adjuster | (5) Low-pass Spool |
| (2) Plug | (6) Ball |
| (3) Spring Support | (7) Upper Body |
| (4) Control Spring | |



C140F017

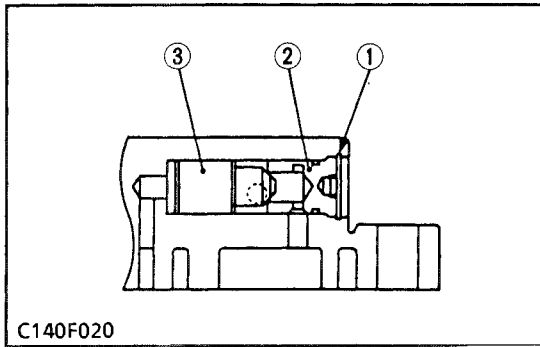


Modulate Check Valve

1. Remove the internal snap ring (1), and then take out the valve seat (2) and the poppet (3).

- (1) Internal Snap Ring
- (2) Valve Seat
- (3) Poppet

B161P162

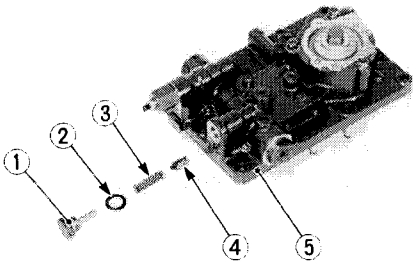


C140F020

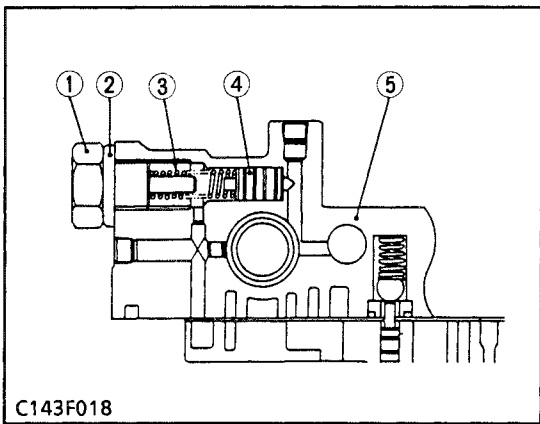
Accumulator

1. Remove the plug (1), and then take out the accum-piston (4).

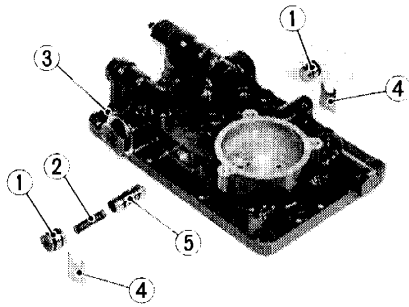
- (1) Plug
- (2) Washer with Rubber
- (3) Spring
- (4) Accum-piston
- (5) Upper Body



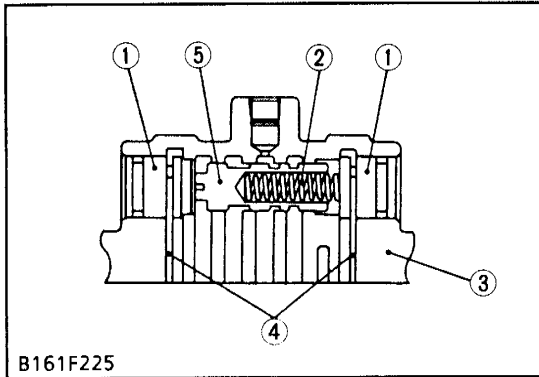
C143P074



C143F018



C140P075



B161F225

Clutch Valve

1. Separate the upper body (3) and lower body. (Refer to "Shift Check Valve and Orifice".)
2. Remove the stopper plates (4), and then take out the plugs (1), spool (5) and the spring (2).

(When reassembling)

- Be careful of the direction of the spool (5) and the plugs (1).

- | | |
|----------------|--------------------|
| (1) Plugs | (4) Stopper Plates |
| (2) Spring | (5) Spool |
| (3) Upper Body | |

MECHANISM

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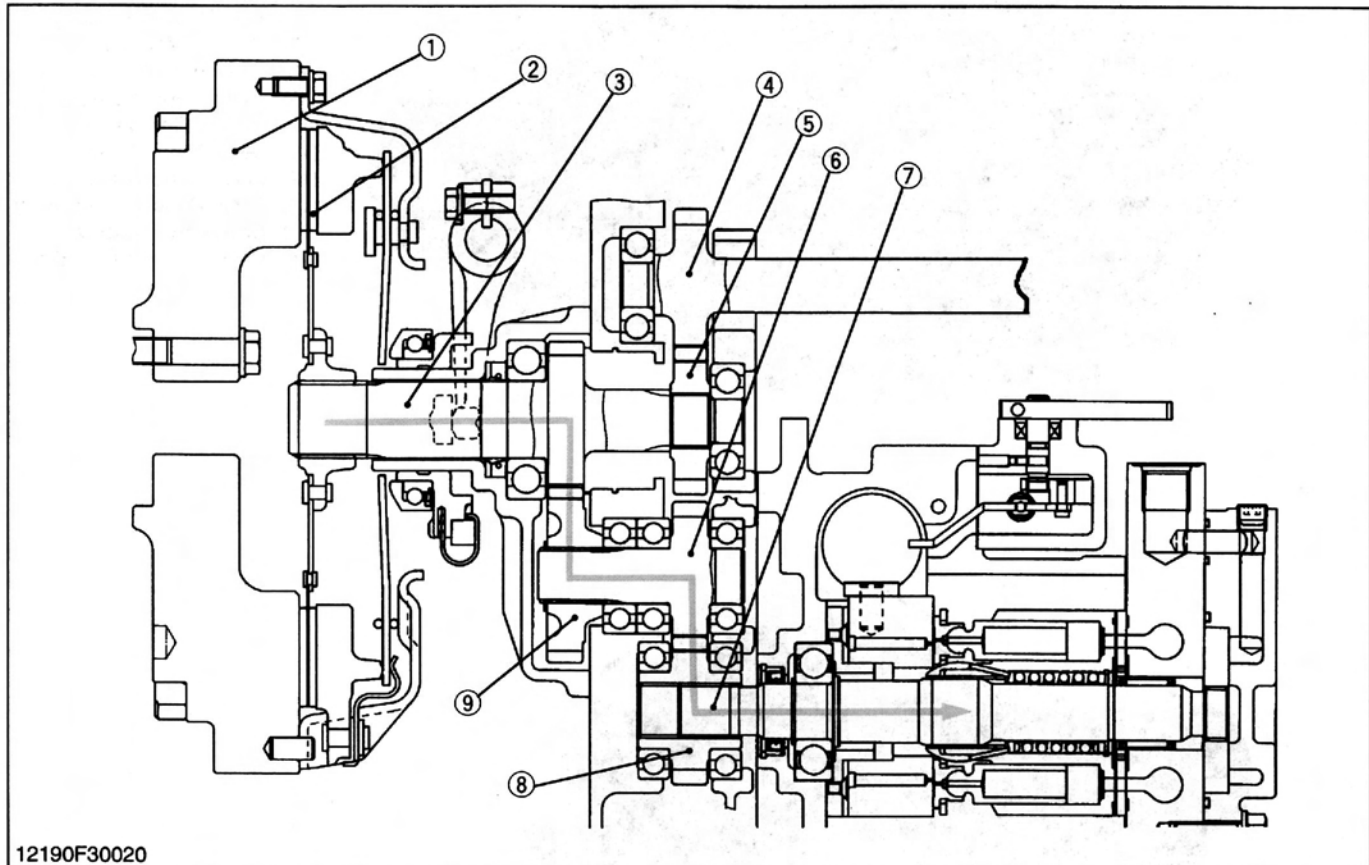
[2] POWER TRAIN

The transmission consists of a series of gears, shafts and hydrostatic transmission shown previously. It offers the most suitable speed for travelling and operation of these.

It transmits power to the front or rear axle and PTO shafts, which are classified respectively as the travelling system and PTO system.

12190M30010

(1) Clutch Housing Section



12190F30020

- | | | | |
|--------------------|------------------------------|---------------------|--------------------|
| (1) Flywheel | (4) 20T Gear Shaft (for PTO) | (6) 18T Gear Shaft | (8) 18T Gear Shaft |
| (2) Clutch Disc | (5) 19T Gear | (7) HST Input Shaft | (9) 27T Gear |
| (3) 24T Gear Shaft | | | |

Engine power is transmitted to the HST input shaft as show in the following.

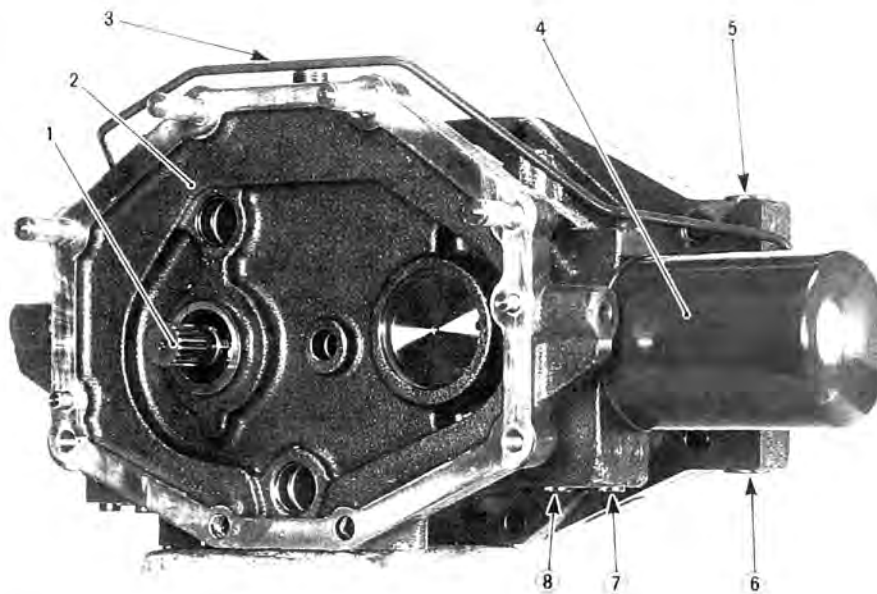
■ Power Train

Flywheel (1) (Engine) → Clutch Disc (2) → 24T Gear Shaft (3) → 27T Gear (9) → 18T Gear Shaft (6) → 18T Gear Shaft (8) → HST Input shaft (7).

12190M30020

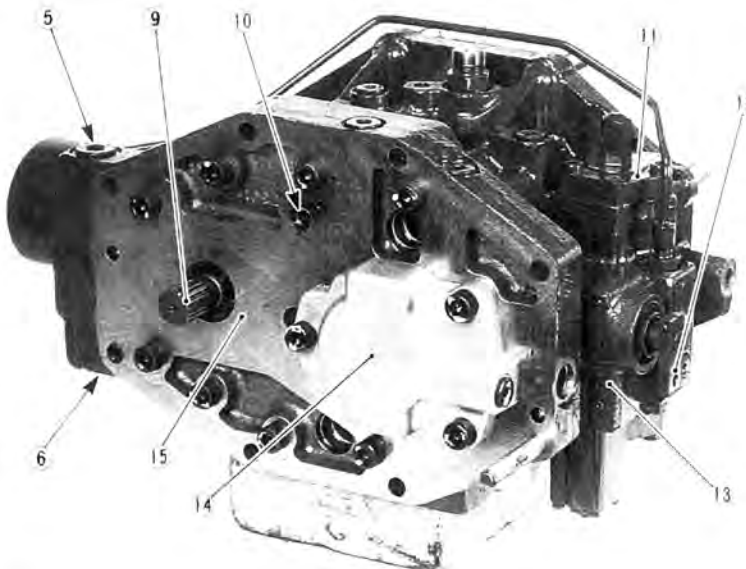
(2) Hydrostatic Transmission Section

(2)-1 Features



- (1) Input Shaft (Pump Shaft)
- (2) Housing
- (3) Bypass Pipe
- (4) Oil Filter Cartridge
- (5) Check and High Pressure Relief Valve (Reverse)
- (6) Check and High Pressure Relief Valve (Forward)
- (7) Charge Relief Valve
- (8) Filter Protective Relief Valve
- (9) Output Shaft (Motor Shaft)
- (10) Case Relief Valve
- (11) Servo Piston Assembly
- (12) Servo Control Lever
- (13) Servo Regulator Assembly
- (14) Charge Pump Assembly
- (15) Center Section (Port Block)

12190P30010

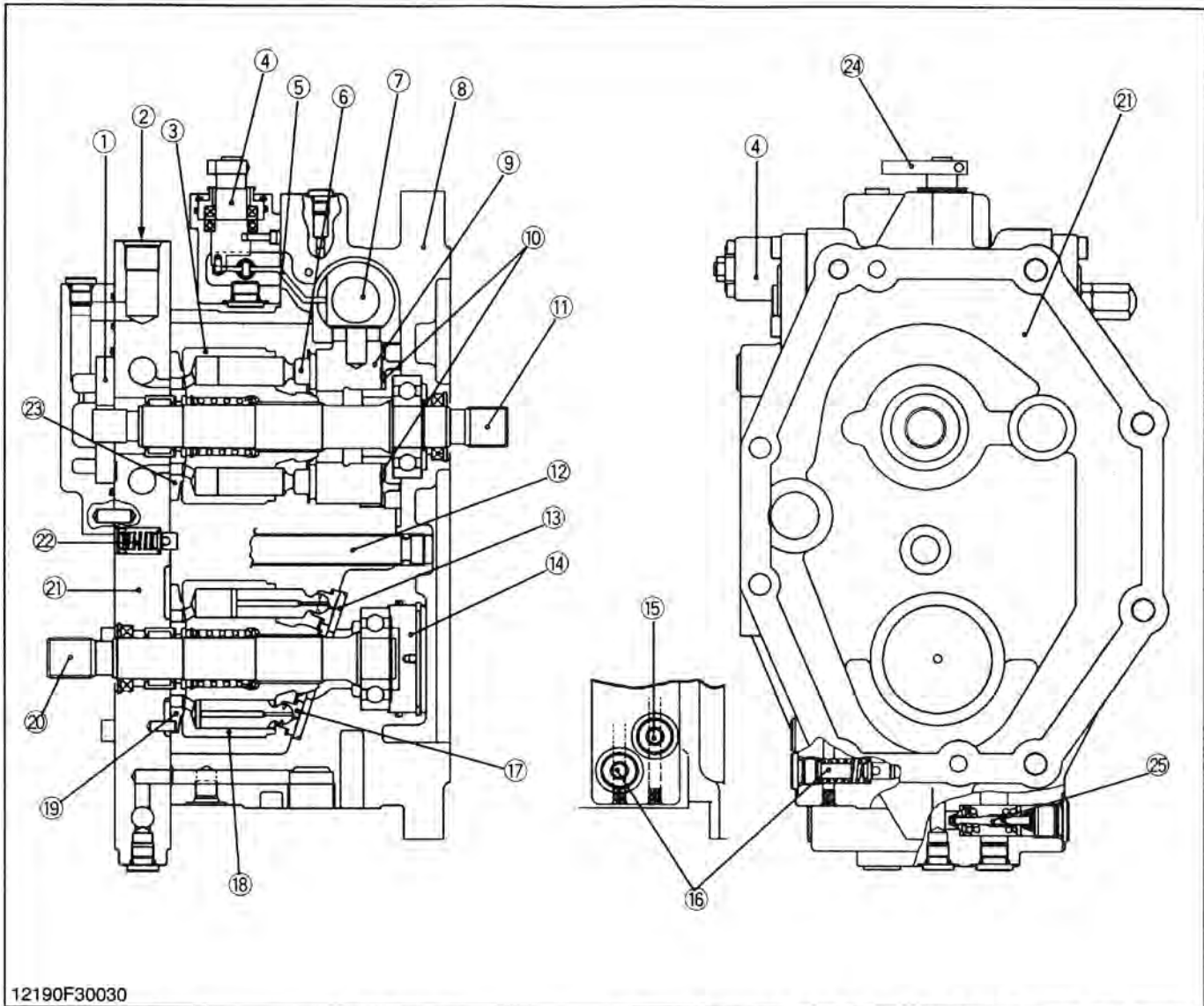


12190P30020

This hydrostatic transmission is the HST unit which is composed of variable displacement piston pump, fixed displacement piston motor, charge pump, valves and servomechanism. The rotation of input shaft is transferred to that of output shaft, which is changeable

steeplessly that is variable speed device. The servomechanism, connected to HST foot pedal, permits simple operation of the tractor, starting, stopping, increasing or decreasing speeds, changing the travelling direction, and even going up or down hills.

12190M30030

(2)-2 Structure

12190F30030

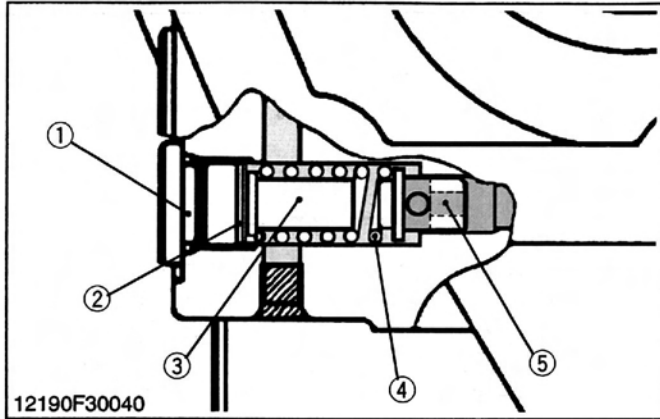
- | | | | |
|---------------------------|-------------------------------|-------------------------------------|---|
| (1) Charge Pump | (8) HST Housing | (15) Filter Protective Relief Valve | (21) Center Section (Port Block) |
| (2) Suction Port | (9) Variable Swashplate | (16) Charge Relief Valve | (22) Case Relief Valve |
| (3) Cylinder Block (Pump) | (10) Cradle Bearing | (17) Motor Piston | (23) Valve Plate |
| (4) Regulator | (11) Input Shaft (Pump Shaft) | (18) Cylinder Block (Motor) | (24) Control Lever |
| (5) Feedback Rod | (12) Connecting Pipe | (19) Valve Plate | (25) Check and High Pressure Relief Valve (Reverse) |
| (6) Pump Piston | (13) Thrust Plate | (20) Output Shaft (Motor Shaft) | |
| (7) Servo Piston | (14) Shaft Cover | | |

The hydrostatic transmission consists of a variable displacement piston pump (3), (6), fixed displacement piston motor (17), (18), charge pump (1), regulator (4), check and high pressure relief valve (25), charge relief valve (16) and filter protective relief valve (15).

HST pedal is connected to the regulator (4), (24) by the mechanical linkages. The servo piston (7) is operated by the regulator through hydraulic oil and operates variable swashplate (9).

12190M30040

(2)-3 Function of Each Components



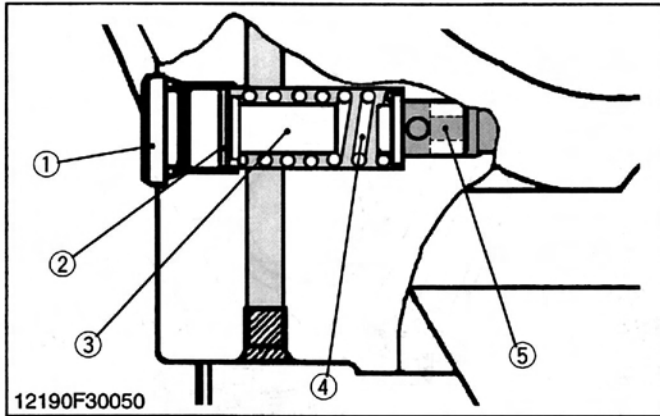
Charge Pump and Charge Relief Valve

The charge pump feeds oil to the HST main circuit (closed circuit) and the regulator. Oil may leak out of the HST main circuit (in the HST housing) depending on the pressure, oil temperature and other factors. With this in mind, oil must be constantly fed. The charge relief valve is located on the secondary side of the filter and serves to set the discharge pressure of the charge pump.

Oil temperature	Valve operating pressure
50 °C (122 °F)	2.35 to 2.55 MPa 24 to 26 kgf/cm ² 342 to 370 psi

- (1) Plug
- (2) Shim
- (3) Spring Guide
- (4) Spring
- (5) Valve Poppet

12190M30050

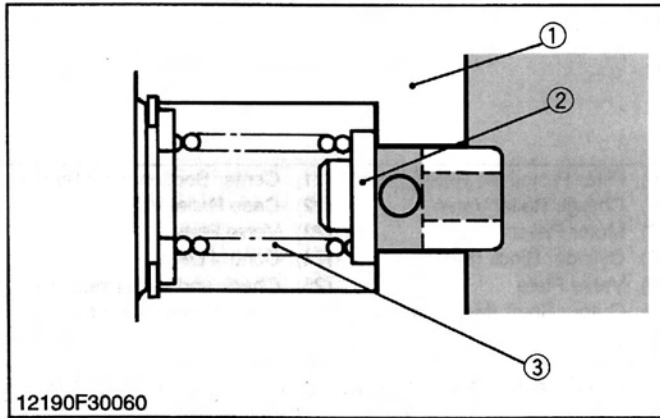


Filter Protective Relief Valve

Located on the primary side of the filter, this valve serves to prevent an overpressure that would occur due to a resistance through the filter at a low-temperature start. A setting pressure of this valve is set about 3 kgf/cm² (294 kPa, 43 psi) more than charge relief valve setting pressure.

- (1) Plug
- (2) Shim
- (3) Spring Guide
- (4) Spring
- (5) Valve Poppet

12190M30060

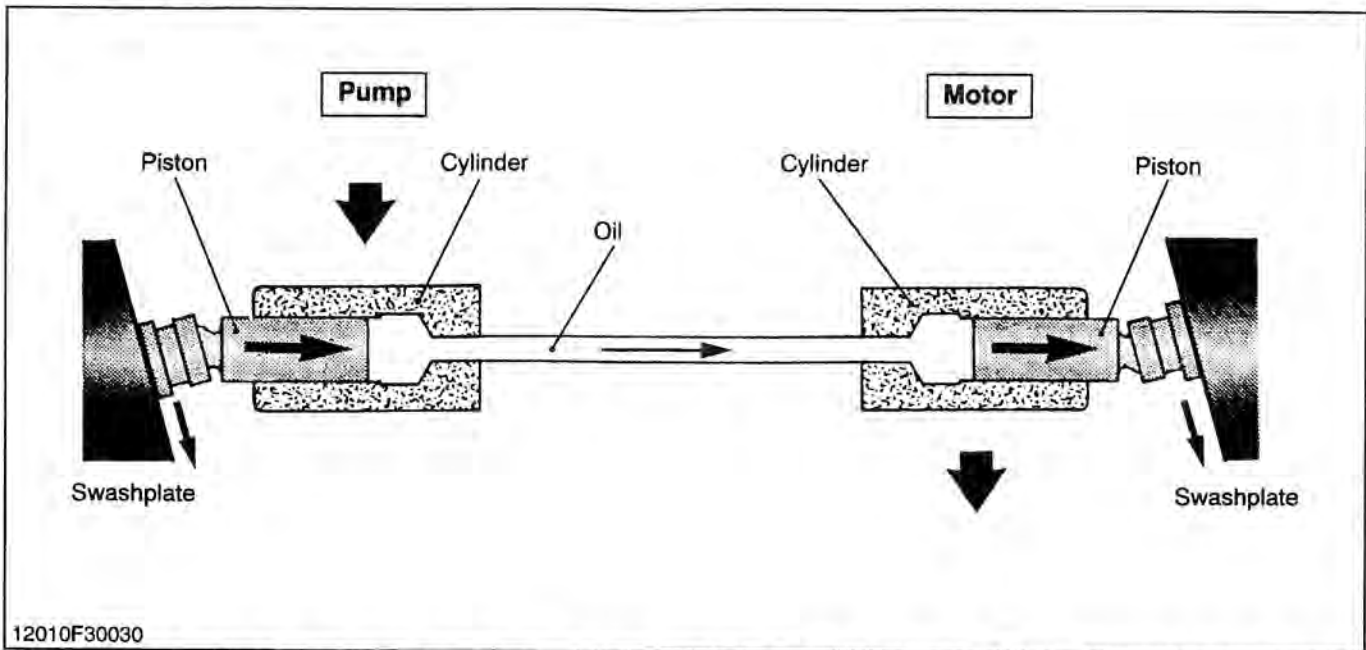


Case Relief Valve

The case relief valve monitors the oil pressure in the hydrostatic transmission case. When the oil pressure rised, it opens and flows the oil directly to the transmission case, so that the oil may not leak against the sealings.

12190M30070

■ Pump and Motor



12010F30030

Pump and motor cylinder, each containing pistons, are connected by lines. Cylinders and lines are filled with oil. Pistons ride against swashplates located in pump and motor.

In the pump, as the cylinder rotates, pistons move across the sloping face of swashplate and slide in or out

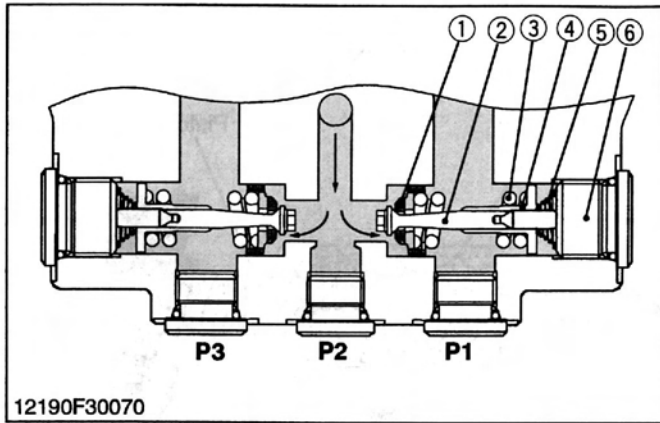
of their cylinder bores. The oil, forced out by the pump pistons, causes the motor pistons to slide out of their cylinder bores.

In the motor, sliding out of the cylinder and moving across the sloping face of swashplate, the pistons rotate the cylinder.

12190M30080

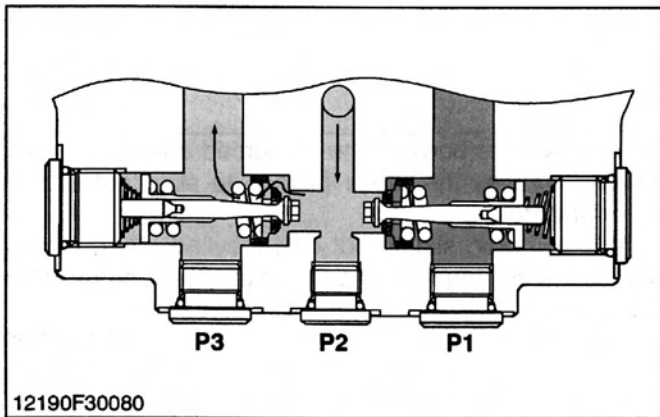
Check and Hig Pressure Relief Valve

(In Neutral)



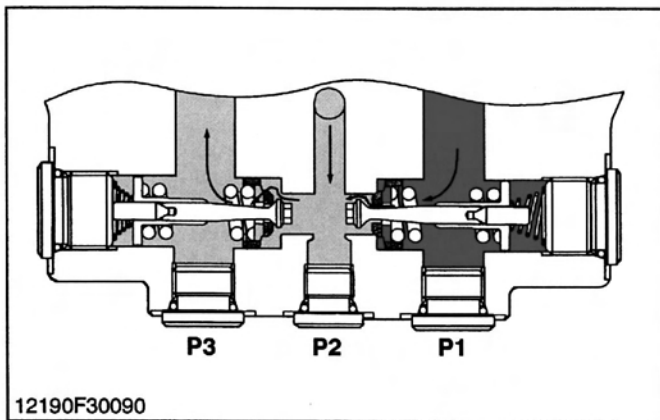
12190F30070

(When Check Valve Activating)



12190F30080

(When High Pressure Relief Valve Activating)



12190F30090

The cartridge-type check and high-pressure relief valve consists of pressure poppet (2), check valve seat (1), relief valve spring (3), spring guide (4) and check valve spring (5). The spring guide (4) is provided with an anti-rotation, which keeps the threads tight after a pressure has been set.

The valve is used to prevent an overload that would happen at a quick start, sudden stop or even during usual running. This valve doubles as a check valve.

The check and high-pressure relief valves are laid out facing each other as shown in the figure.

In neutral, both valves are open and charging oil enters into the main oil circuit through the valves.

At normal operation, the check valve in the high pressure side is closed and it pushes and opens the another one. An excessive charge flow goes through the charge relief valve into HST housing.

The check and high-pressure relief valve along the high-pressure line serves as a high-pressure relief valve. If the pressure exceeds a high-pressure limit level, the pressure poppet opens itself against the relief valve spring (3) force and opens the valve seat that is located between the check valve seat (1) and the pressure poppet (2). Now the flow goes from P1 to P2 and P3.

If the P1 pressure drops, the relief valve spring forces the valve seat closed against the pressure. the high-pressure oil at P1 does not flow to P2 any longer.

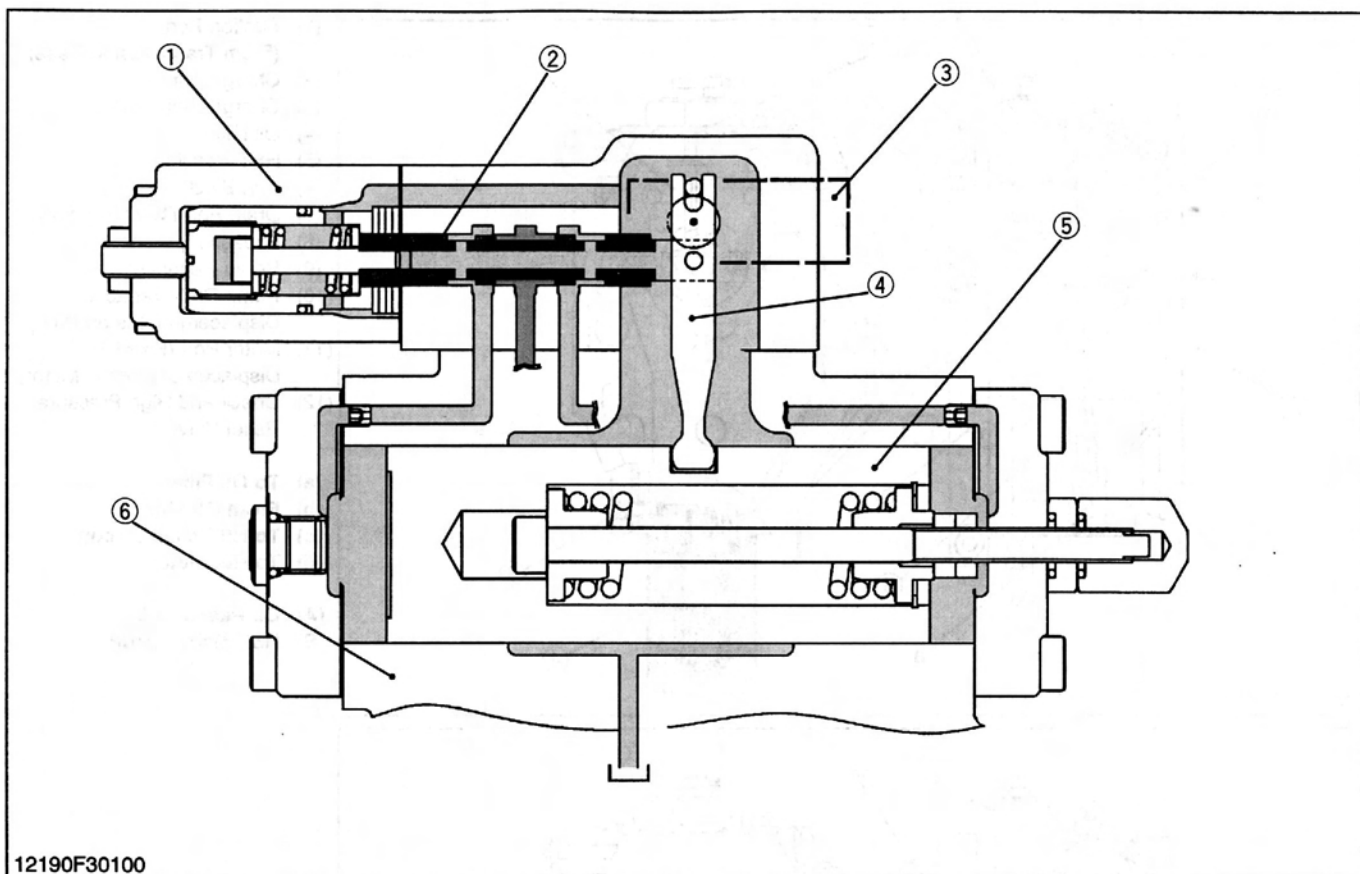
As discussed above, the check and high-pressure relief valve protects engines, pumps, motors, gears and even the machine itself from overload.

Oil temperature	Valve operating pressure
50 to 60 °C (122 to 140 °F)	33.3 to 35.3 MPa 340 to 360 kgf/cm ² 4836 to 5124 psi

- (1) Check Valve Seat
- (2) Pressure Poppet
- (3) Relief Valve Spring
- (4) Spring Guide
- (5) Check Valve Spring
- (6) Valve Plug

12190M30090

■ Servomechanism



12190F30100

(1) Regulator Assembly
(2) Spool

(3) Control Leber
(4) Feedback Lever

(5) Servo Piston

(6) HST Housing

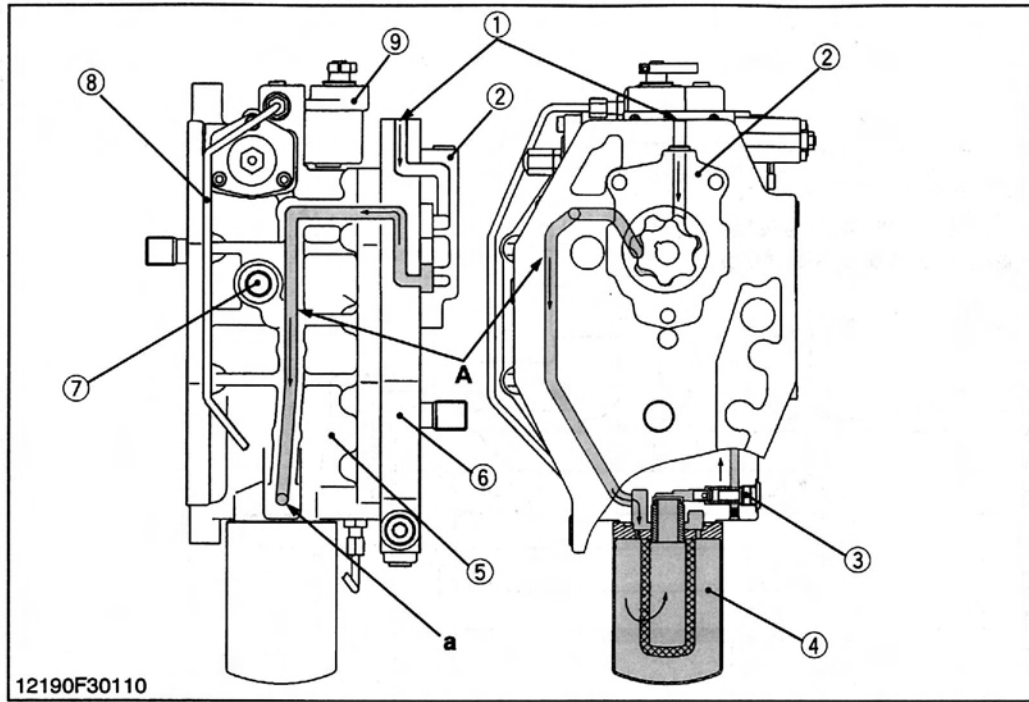
The servomechanism is adopted in this HST, and a smooth pedal operation can be done. As for the servomechanism, the regulator (1) and servo piston (5) are chiefly composed. The regulator is connected to the HST pedal through linkages, and it controls the flow of oil

in the servo piston by the pedal operation.

The servo piston moved by hydraulic force, is connected to the variable swashplate therefore a tilt angle of swashplate is varied by servo piston movement.

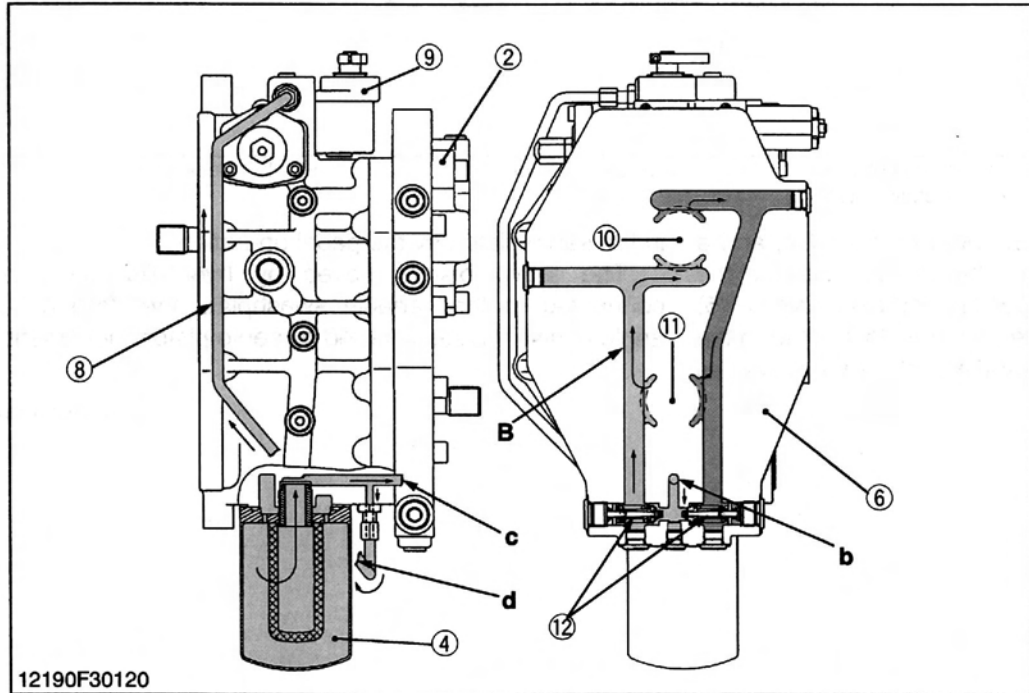
12190M30100

(2)-4 Oil Flow



- (1) Suction Port (From Transmission Case)
- (2) Charge Pump
- (3) Charge Relief Valve
- (4) Oil Filter
- (5) HST Housing
- (6) Port Block
- (7) Drain Port (To Oil Cooler)
- (8) Bypass Pipe
- (9) Servo Regulator
- (10) Pump Port (Variable Displacement Piston Pump)
- (11) Motor Port (Fixed Displacement Piston Motor)
- (12) Check and High Pressure Relief Valve
- (a) To Oil Filter
- (b) From Oil Filter
- (c) To HST Main Circuit
- (d) To Regulator
- (A) Oil Passage A
- (B) HST Main Circuit

12190F30110



12190F30120

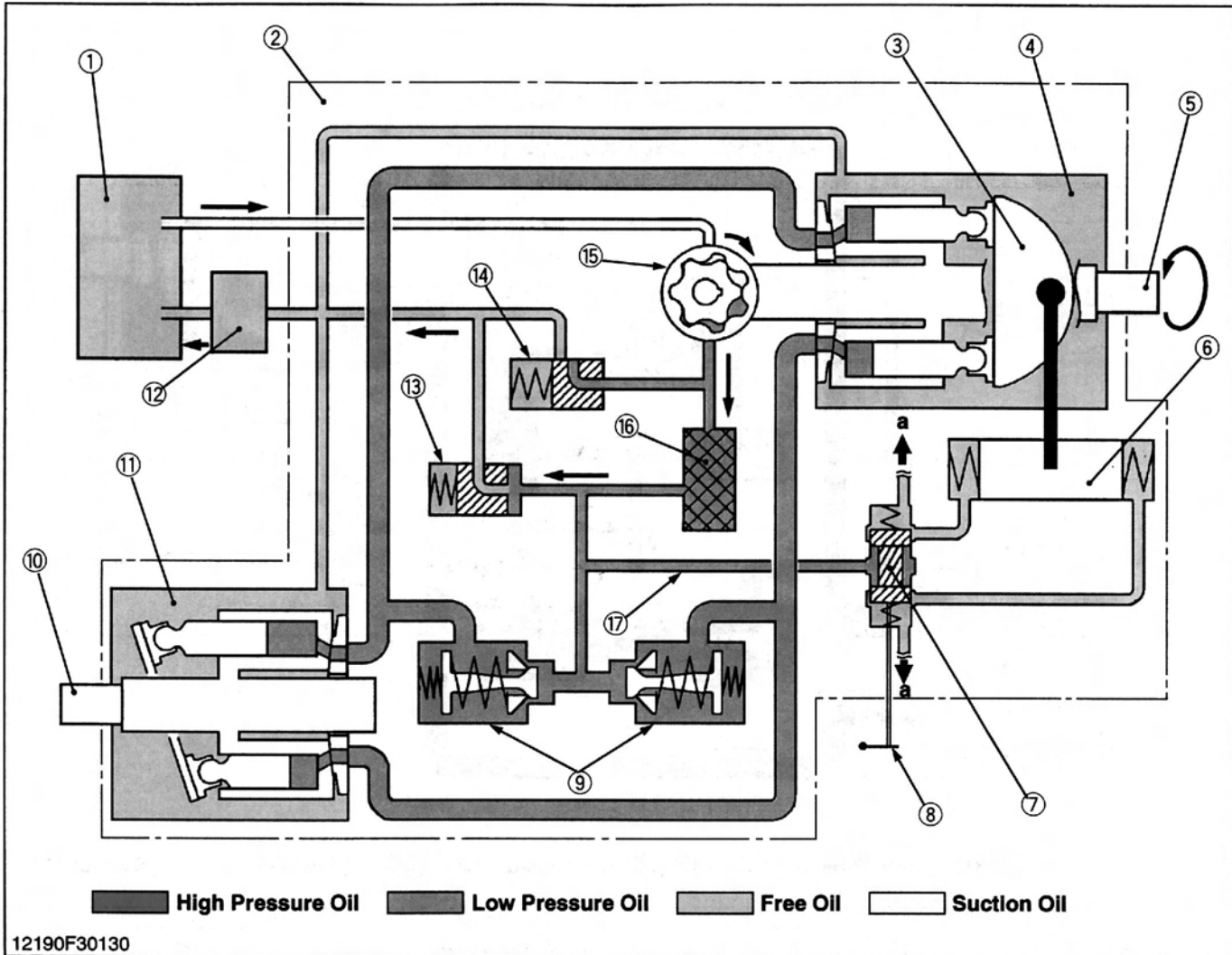
The oil comes in from the charge pump's suction port (1) and flows through the charge pump (2), oil passage "A", filter (4), and charge relief valve (3) into the housing (5). The oil in the HST housing goes out of the drain port (7). The oil in the HST housing coming into the filter (4) is baranced into the charge relief valve (3), HST main circuit (closed circuit), and regulator (9).

The oil in the HST main circuit gets circulated between the variable displacement piston pump (10) and the fixed displacement motor (11), which forms a closed circuit.

12190M30110

(2)-5 Operation

i) Neutral



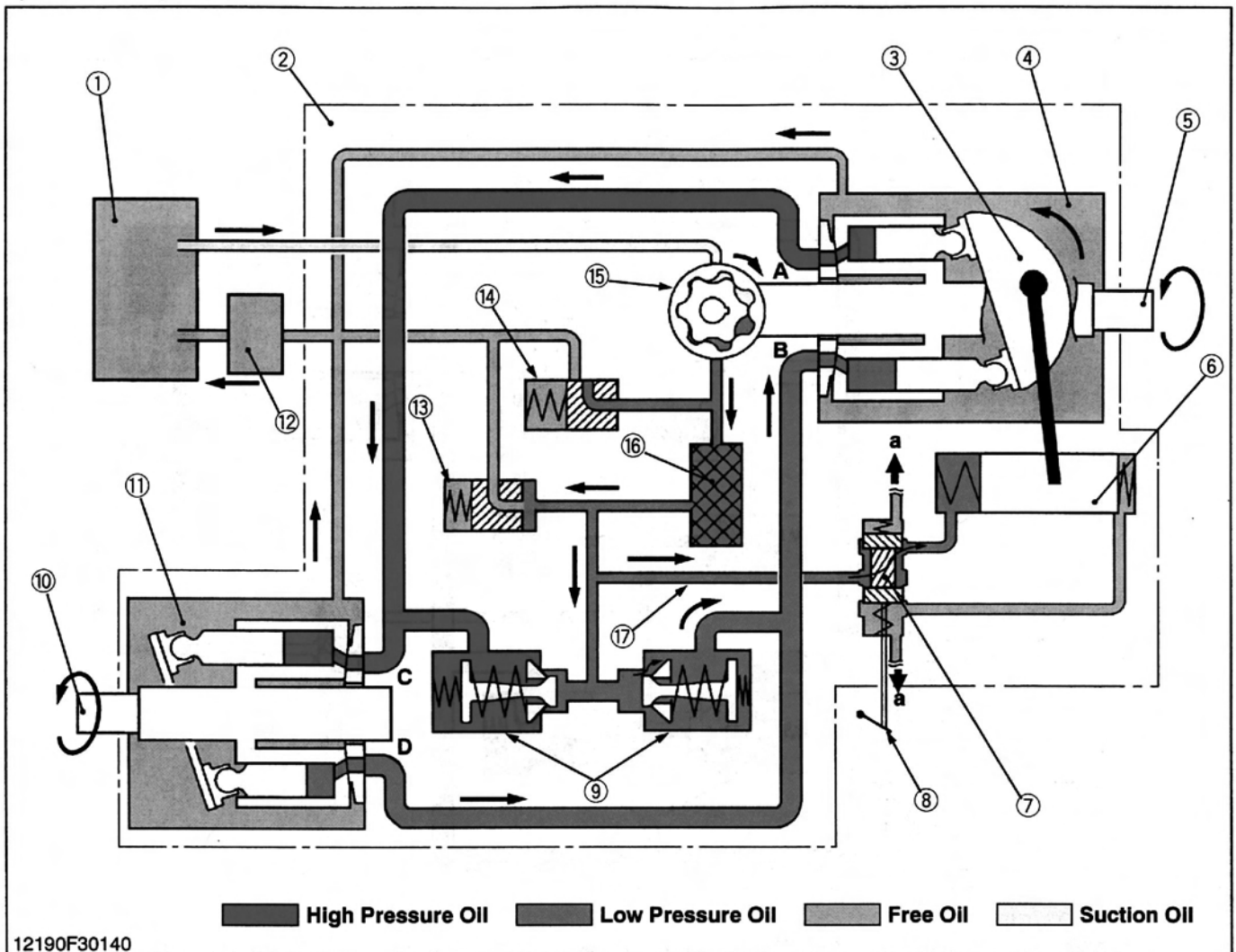
- | | | | |
|-------------------------|--|--------------------------|------------------|
| (1) Transmission Case | (6) Servo Piston | (10) Output Shaft | (15) Charge Pump |
| (2) HST Housing | (7) Regulator | (11) Motor Cylinder | (16) Oil Filter |
| (3) Variable Swashplate | (8) HST Pedal (Control Lever) | (12) Oil Cooler | (17) Bypass Pipe |
| (4) Pump Cylinder | (9) Check and High Pressure Relief Valve | (13) Charge Relief Valve | |
| (5) Input Shaft | (14) Filter Protective Relief Valve | (a) To HST Housing | |

The sucked oil from the transmission case (1) by the charge pump (15) flows into the HST housing (2) and regulator (7) through the oil filter (16) and charge relief valve (13). Overflow oil from HST housing (2) returns to the transmission case (1) through the oil cooler (12).

When the HST pedal (8) is in neutral, regulator (7) is not activated, so the variable swashplate (3) is at right angles to the pump pistons and they only rotate with cylinder block (4) without reciprocation. Since the oil is not being pumped to motor, the cylinder block in the motor (11) is stationary and the output shaft (10) does not rotate.

12190M30120

ii) Forward Operation



12190F30140

- | | | | |
|-------------------------|--|--------------------------|------------------|
| (1) Transmission Case | (6) Servo Piston | (10) Output Shaft | (15) Charge Pump |
| (2) HST Housing | (7) Regulator | (11) Motor Cylinder | (16) Oil Filter |
| (3) Variable Swashplate | (8) HST Pedal (Control Lever) | (12) Oil Cooler | (17) Bypass Pipe |
| (4) Pump Cylinder | (9) Check and High Pressure Relief Valve | (13) Charge Relief Valve | |
| (5) Input Shaft | (14) Filter Protective Relief Valve | (a) To HST Housing | |

When the HST pedal (8) is stepped on and in forward, the regulator (7) is actuated, so the variable swashplate (3) is tilted as shown in figure above.

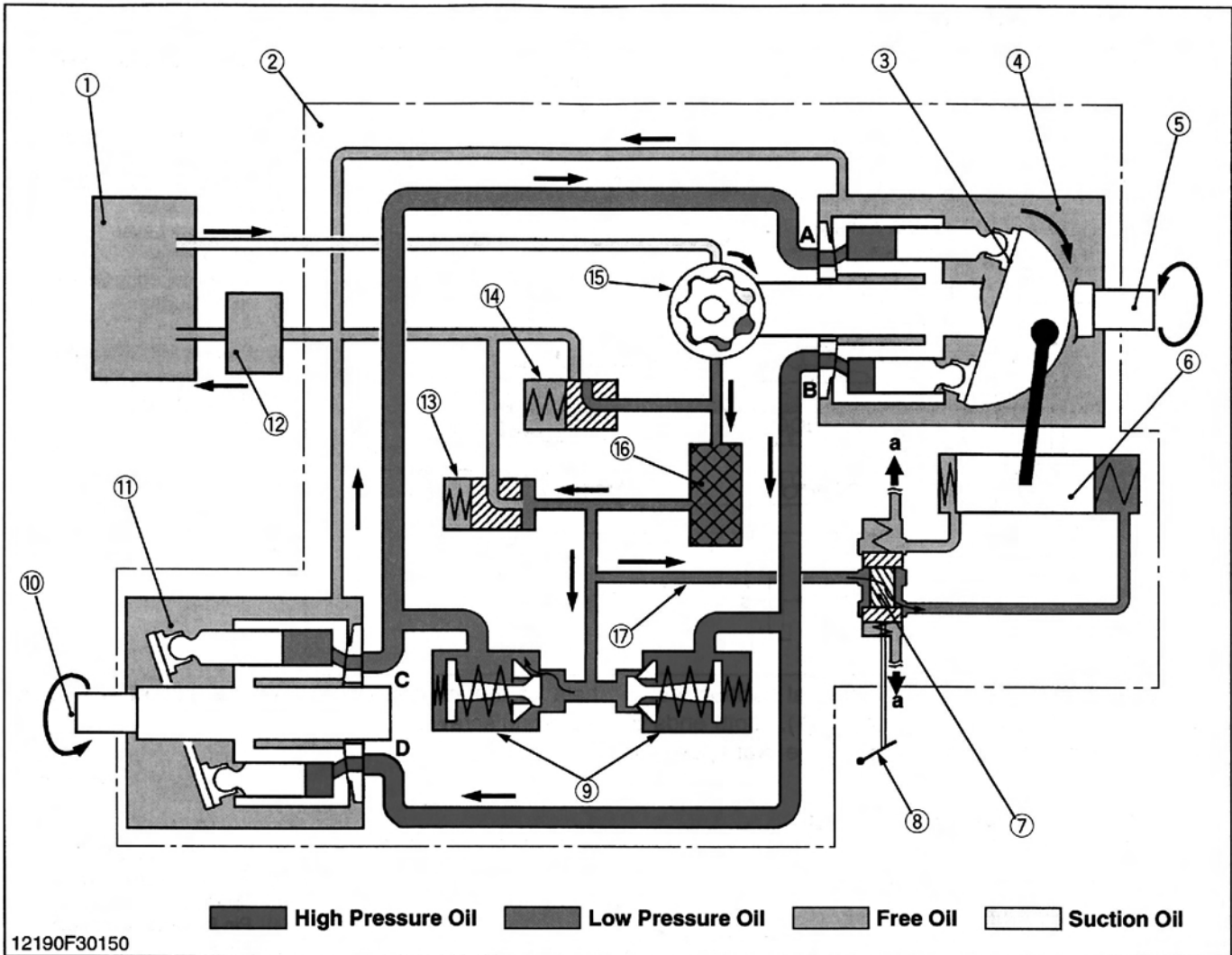
As the pump cylinder block (4) rotates with the input shaft (5), oil is forced out of pump port A at high pressure. As pressure oil enters motor port C, the pistons, which align with port C, are pushed against the thrust plate and slide down inclined surface.

Then the output shaft (10) rotates with the motor cylinder block (11). This drives the machine forward and the angle of pump swashplate determines the output shaft speed.

As the motor cylinder block continues to rotate, oil is forced out of motor port D at low pressure and returns to the pump.

12190M30130

iii) Reverse Operation



(1) Transmission Case

(2) HST Housing

(3) Variable Swashplate

(4) Pump Cylinder

(5) Input Shaft

(6) Servo Piston

(7) Regulator

(8) HST Pedal (Control Lever)

(9) Check and High Pressure

Relief Valve

(10) Output Shaft

(11) Motor Cylinder

(12) Oil Cooler

(13) Charge Relief Valve

(14) Filter Protective Relief Valve

(15) Charge Pump

(16) Oil Filter

(17) Bypass Pipe

(a) To HST Housing

When the HST pedal (8) is stepped on and in reverse, the variable swashplate (3) is tilted as shown in figure above.

As the pump cylinder block (4) rotates with the input shaft (5), oil is forced out of pump port B at high pressure. As pressure oil enters motor port D, the pistons, which align with port D, are pushed against the thrust plate and slide down inclined surface.

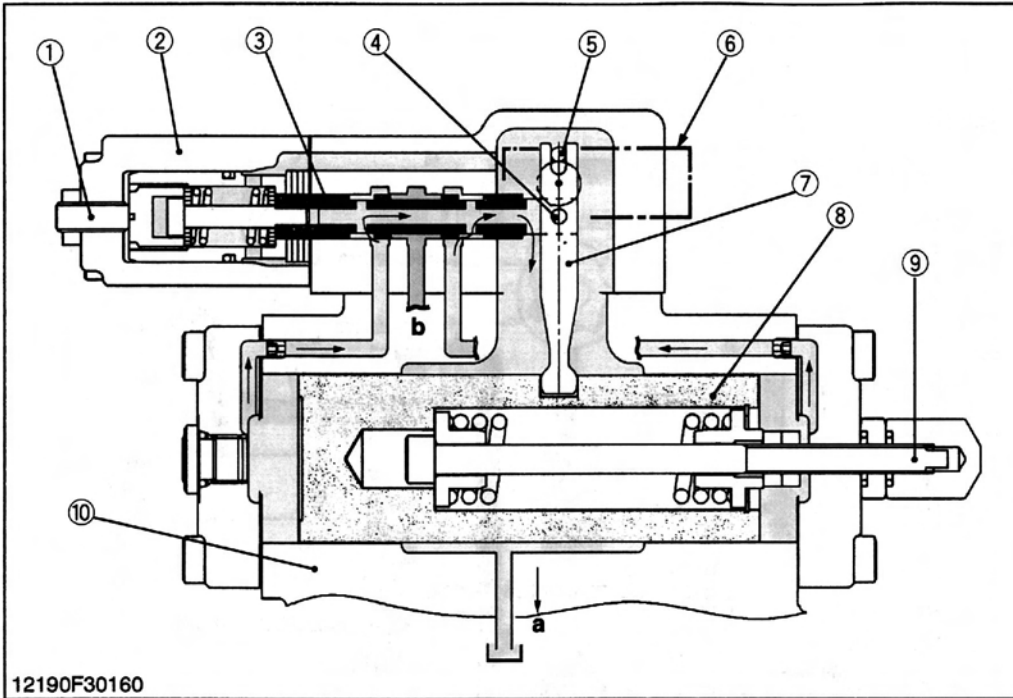
Then the output shaft (10) rotates with the motor cylinder block (11). This drives the machine rearward and the angle of pump swashplate determines the output shaft speed.

As the motor cylinder block continues to rotate, oil is forced out of motor port C at low pressure and returns to the pump.

12190M30140

Regulator and Servo Piston Operation

i) Control Lever at Neutral



- (1) Servo Adjusting Screw
 - (2) Regulator Assembly
 - (3) Spool
 - (4) Pin B (Fixed with Spool)
 - (5) Pin A (Fixed with Control Lever)
 - (6) Control Lever
 - (7) Feedback Lever
 - (8) Servo Piston
 - (9) Piston Adjusting Screw
 - (10) HST Housing
- (a) Drain to HST Housing
 (b) From Bypass Pipe (Pilot Pressure)

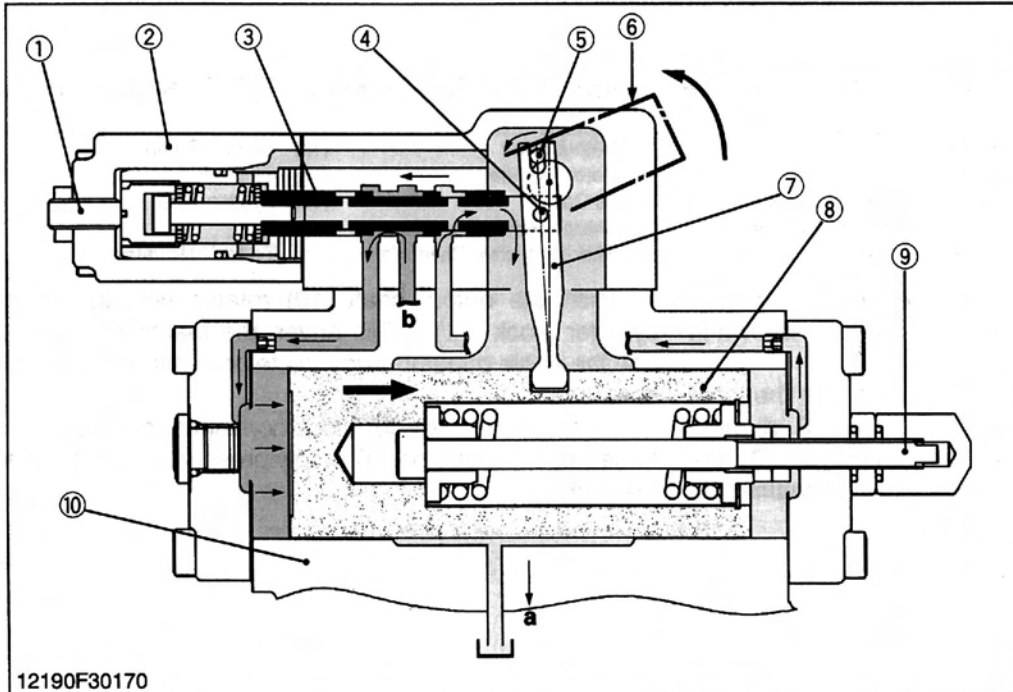
12190F30160

This spool (3) is situated at the neutral position that is preset with the servo adjusting screw (1). Both ends of the servo piston (8) get connected to the drain port and

held at the neutral position that is preset with piston adjusting screw (9).

12190M30150

ii) Control Lever Activated (First Step)



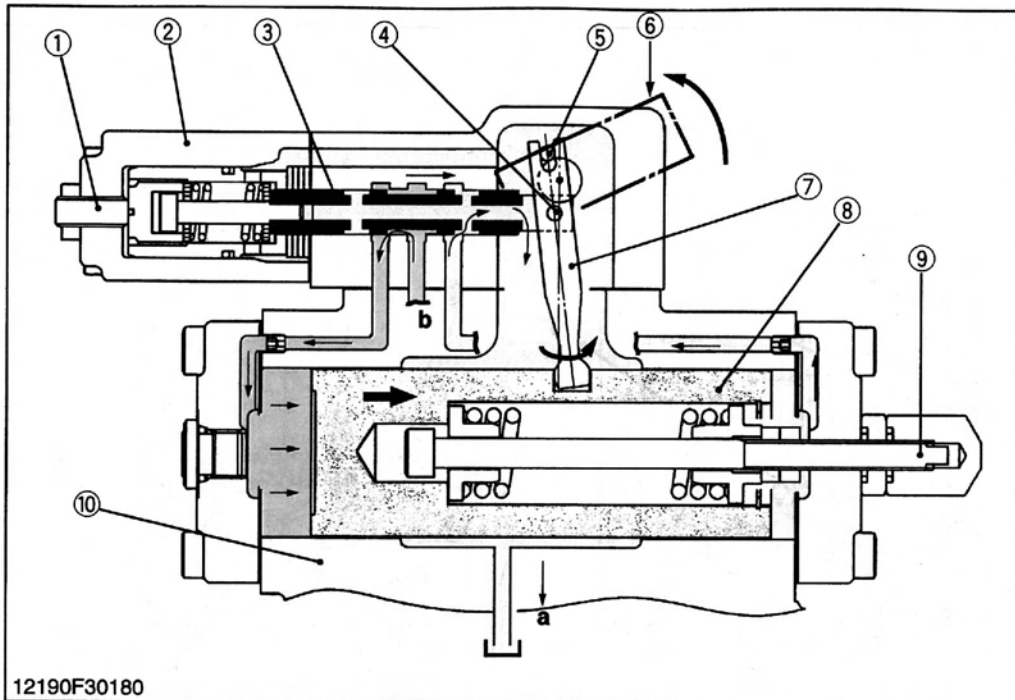
- (1) Servo Adjusting Screw
 - (2) Regulator Assembly
 - (3) Spool
 - (4) Pin B (Fixed with Spool)
 - (5) Pin A (Fixed with Control Lever)
 - (6) Control Lever
 - (7) Feedback Lever
 - (8) Servo Piston
 - (9) Piston Adjusting Screw
 - (10) HST Housing
- (a) Drain to HST Housing
 (b) From Bypass Pipe (Pilot Pressure)

12190F30170

When the control lever (6) is activated, the feedback lever (7) starts also moving to shift the spool (3). The servo piston (8), now under the pilot pressure at one

end, is pushed in the direction of arrow as shown in figure.

12190M30160

(Second Step)

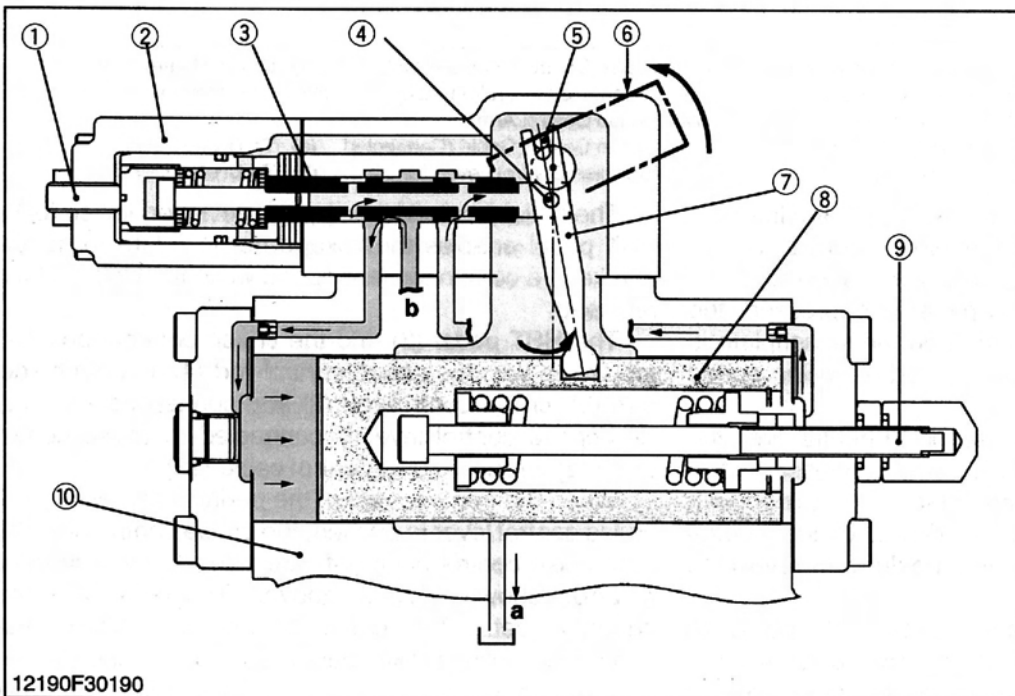
- (1) Servo Adjusting Screw
- (2) Regulator Assembly
- (3) Spool
- (4) Pin B (Fixed with Spool)
- (5) Pin A (Fixed with Control Lever)
- (6) Control Lever
- (7) Feedback Lever
- (8) Servo Piston
- (9) Piston Adjusting Screw
- (10) HST Housing

- (a) Drain to HST Housing
- (b) From Bypass Pipe (Pilot Pressure)

12190F30180

By this motion of the servo piston (8), the feedback lever (7) causes the spool (3) to come back to its original position.

12190M30170

ii) Control Lever Deactivated

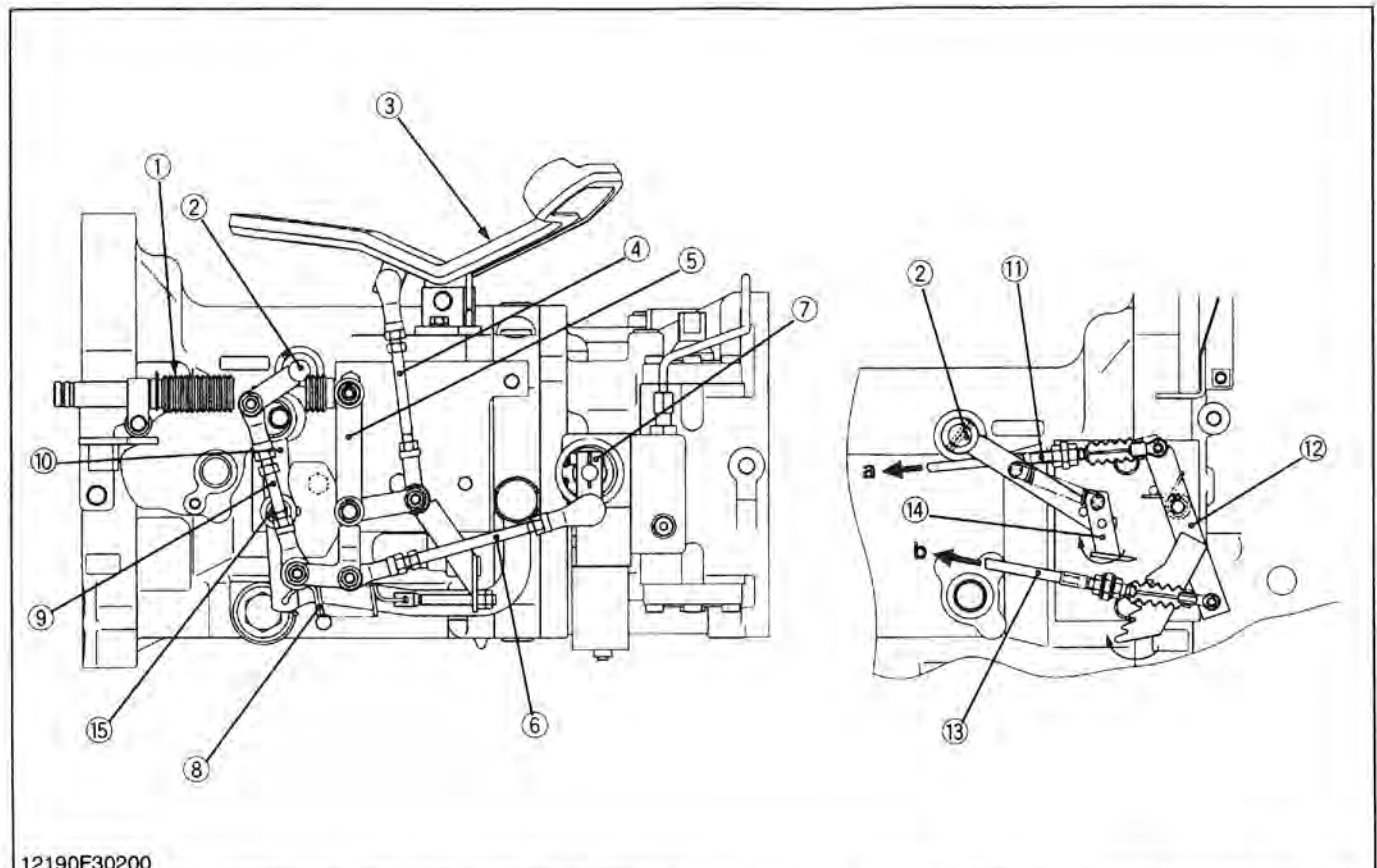
- (1) Servo Adjusting Screw
- (2) Regulator Assembly
- (3) Spool
- (4) Pin B (Fixed with Spool)
- (5) Pin A (Fixed with Control Lever)
- (6) Control Lever
- (7) Feedback Lever
- (8) Servo Piston
- (9) Piston Adjusting Screw
- (10) HST Housing
- (11) Slot Guide (Connected with Variable Swashplate)

- (a) Drain to HST Housing
- (b) From Bypass Pipe (Pilot Pressure)

12190F30190

When the control lever (6) is deactivated, the spool (3) finally goes back to the position shown in the figure. The servo piston (8) gets well balanced according to the turning angle of the control lever (6).

12190M30180

(2)-6 Control Linkage

12190F30200

- | | | | |
|------------------------|---------------------------|---|--------------------------|
| (1) Damper | (6) Neutral Adjusting Rod | (11) Cruise Control Release Cable | (14) Cruise Control Hook |
| (2) Connecting Shaft | (7) HST Control Lever | (12) Cruise Control Arm | (15) Ball Bearing |
| (3) HST Pedal | (8) Neutral Spring | (13) Cruise Control Cable (Connected to Cruise Control Lever) | (a) To Brake Pedal |
| (4) Speed Control Rod | (9) Cruise Control Rod | | (b) To Cruise Lever |
| (5) Neutral Holder Arm | (10) Neutral Holder | | |

The speed control pedal (HST pedal) (3) and the HST control lever (7) are linked with the speed control rod (4), neutral holder arm (5) and neutral adjusting rod (6).

As the front footrest of the pedal is depressed, the HST control lever (7) is rotated, then the swashplate is tilted by servomechanism and forward travelling speed increases.

Then, the swashplate is returned to neutral with the neutral holder arm (5), when the pedal is released. The ball bearing (15) on the neutral holder (10) pulled with the neutral spring (8) seats the detent of the neutral holder arm (5) so that the neutral holder arm returns to neutral.

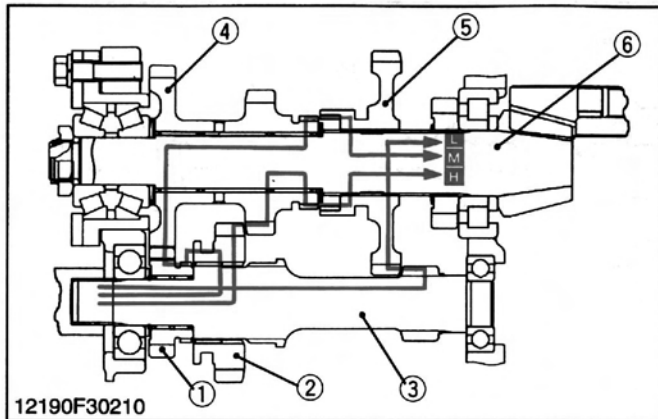
The damper (1) is connected to the HST pedal (3) through speed control rod (4) and neutral holder arm (5), restricts the movement of the linkage to prevent abrupt operation or reversing.

The cruise control lever (speed set lever) linked to the HST pedal enables the linkage not to return to neutral and keep a certain forward speed while the HST pedal is released.

The HST pedal (3) and the cruise control hook (14) are linked with the speed control rod (4), neutral holder arm (5), cruise control rod (9) and connecting shaft (2). The cruise control lever is connected to cruise control arm (12) through cruise control cable (13).

When the front footrest of the pedal is depressed and cruise control lever is pushed, the cruise control arm (12) and cruise control hook (14) are moved in the direction of arrow shown in figure above. The result was that speed is set. The cruise control arm (12) is also connected with brake pedal through cruise control release cable (11), so it can be released while depressed brake pedal.

12190M30190

(3) Range Gear Shift Section

Besides neutral, three ways of power flow from 13T gear shaft (3) to the spiral bevel pinion shaft (7) are available by operating the range gear shift lever.

The power is transmitted as follows.

[L] Lo-Range

13T Gear Shaft (3) → 46T Shifter Gear (5) → Spiral Bevel Pinion Shaft (6).

[M] Mi-Range

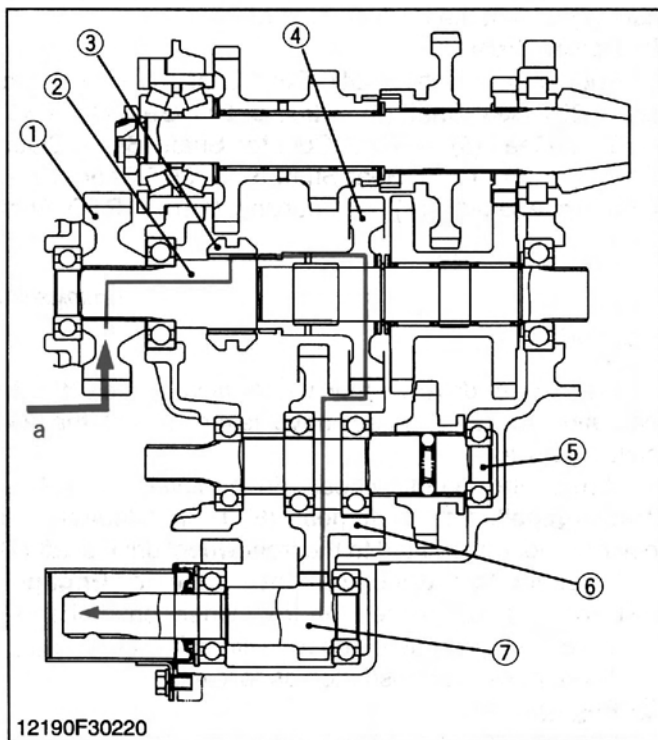
13T Gear Shaft (3) → 26T Shifter Gear (2) → 17T Gear (1) → 32T-23T Gear (4) → 46T Shifter Gear (5) → Spiral Bevel Pinion Shaft (6).

[H] Hi-Range

13T Gear Shaft (3) → 26T Shifter Gear (2) → 32T-23T Gear (4) → 46T Shifter Gear (5) → Spiral Bevel Pinion Shaft (6).

- | | |
|----------------------|-------------------------------|
| (1) 17T Gear | (4) 32T-23T Gear |
| (2) 26T Shifter Gear | (5) 46T Shifter Gear |
| (3) 13T Gear Shaft | (6) Spiral Bevel Pinion Shaft |

12190M30200

(4) Mid PTO Section

In these tractors, the power can be taken out from the mid case by installing the Mid PTO system. (Factory option.)

The power is transmitted to the Mid PTO shaft (7) from the rear PTO drive shaft.

Therefore the Mid PTO is rotated, while the rear PTO is engaged.

[Mid PTO Speed]

Model	Mid PTO rpm / Engine rpm
L3010 HST L3410 HST	2000 min. ⁻¹ (32.3 r/s, 2000 rpm) / 2666 min. ⁻¹ (44.4 r/s, 2666 rpm)
L3710 HST	2000 min. ⁻¹ (32.3 r/s, 2000 rpm) / 2394 min. ⁻¹ (39.9 r/s, 2394 rpm)

The power is transmitted as follows

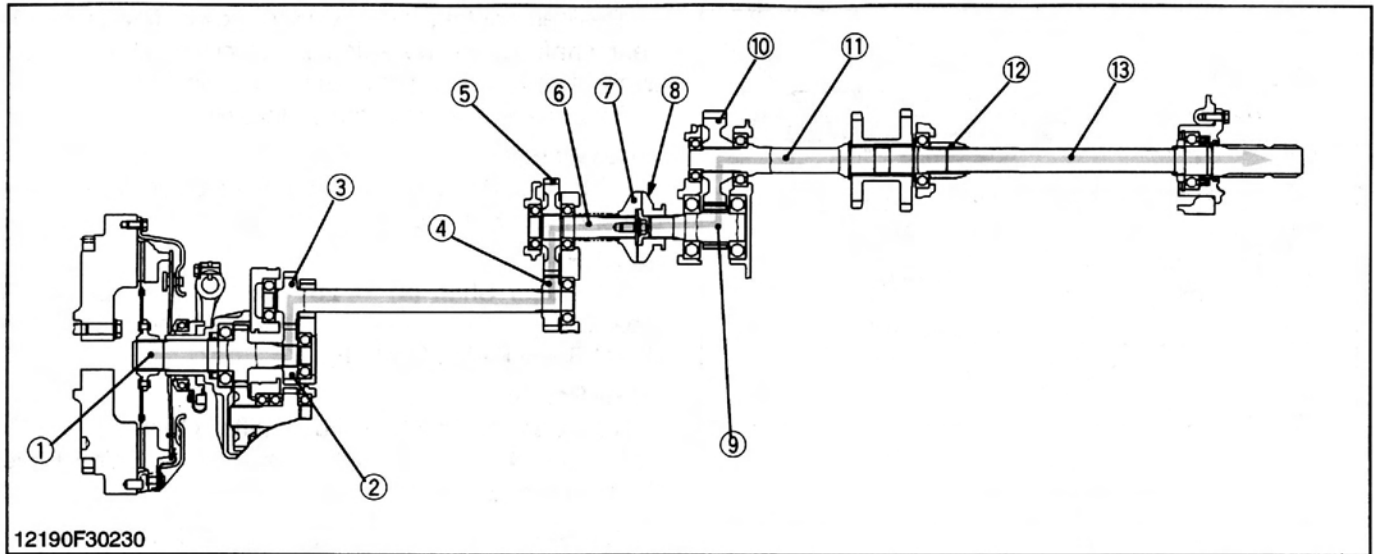
■ Engagement

Rear PTO Drive Shaft → 30T Gear (1) → PTO Drive Shaft (2) → Shifter (3) → 28T Gear Shaft (4) → 24T-42T Gear (6) → Mid PTO Shaft with 13T Gear (7).

- | | |
|-----------------------|---------------------------------------|
| (1) 30T Gear | (6) 24T-42T Gear |
| (2) PTO Drive Shaft | (7) Mid PTO Shaft with 13T Gear |
| (3) Shifter | |
| (4) 28T Gear Shaft | a : Power from PTO Drive Shaft |
| (5) Front Drive Shaft | |

12190M30210

(5) Rear PTO Shift Section



12190F30230

- | | | | |
|--------------------|------------------------------|-----------------------|----------------------|
| (1) 24T Gear Shaft | (4) 20T Gear (L3010 · L3410) | (6) PTO Counter Shaft | (10) 30T Gear |
| (2) 19T Gear | 21T Gear (L3710 · L4310) | (7) Clutch Cam (IN) | (11) PTO Drive Shaft |
| (3) 20T Gear Shaft | (5) 35T Gear (L3010 · L3410) | (8) Clutch Cam (OUT) | (12) Coupling |
| | 33T Gear (L3710 · L4310) | (9) 11T Gear Shaft | (13) PTO Shaft |

The rear PTO system offers a speed as shown in the table below.

The PTO lever moves the PTO one-way clutch cam (8) to shift the PTO.

Model	PTO speed / Engine speed
L3010 H, L3410 H	540 min. ⁻¹ (9.0 r/s, 540 rpm) / 2713 min. ⁻¹ (45.2 r/s, 2713 rpm)
L3710 H, L4310 H	540 min. ⁻¹ (9.0 r/s, 540 rpm) / 2436 min. ⁻¹ (40.6 r/s, 2436 rpm)

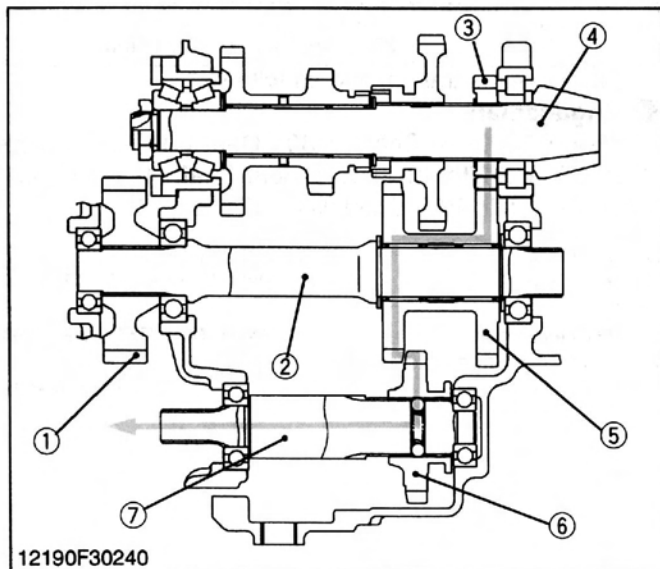
The PTO shift lever moves the PTO one-way clutch cam (8) to shift the PTO operation.

Power Train

Engine → Clutch → 24T Gear Shaft (1) → 19T Gear (2) → 20T Gear Shaft (3) → 20T or 21T Gear (4) → 35T or 33 T Gear (5) → PTO Counter Shaft (6) → Clutch Cams (7), (8) → 11T Gear Shaft (9) → 30T Gear (10) → PTO Drive Shaft (11) → Coupling (12) → PTO Shaft (13).

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(6) Front Wheel Drive Section (For Four Wheel Drive)



12190F30240

Two wheel drive or four wheel drive is selected by operating the front wheel drive lever to shift the 24T shifter gear (6).

When the front wheel drive lever is set to "Disengage", 24T shift gear (6) is in "Neutral" and power is not transmitted to the front wheel drive shaft (7).

When the front wheel drive lever is set to "Engage", 24T shift gear (6) splined the front wheel drive shaft (7) slides to the right side to engage with 29T-31T gear (5).

Then, power is transmitted as follows.

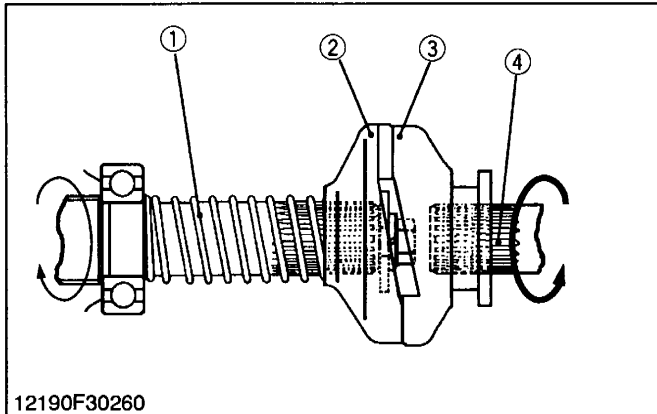
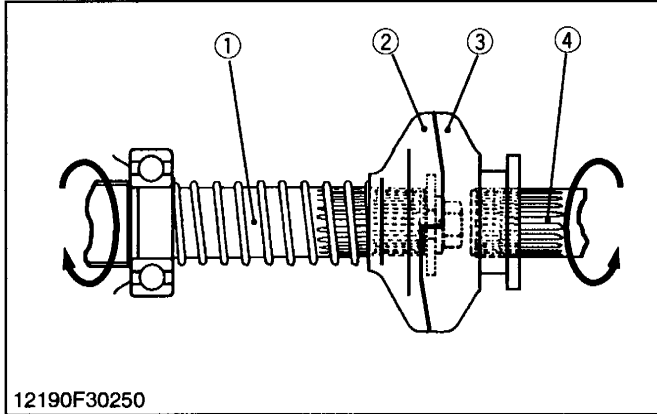
Engagement

Spiral Bevel Pinion Shaft (4) → 29T-31T Gear (5) → 24T Shifter Gear (6) → Front Wheel Drive Shaft (7).

- | | |
|-----------------------------|-------------------------------|
| (1) 30T Gear | (4) Spiral Bevel Pinion Shaft |
| (2) PTO Drive Shaft | (5) 29T-31T Gear |
| (3) 17T Gear (L3010, L3410) | (6) 24T Shifter Gear |
| 18T Gear (L3710, L4310) | (7) Front Wheel Drive Shaft |

12190M30230

(7) One-way Clutch



The PTO connecting system is equipped with a one-way clutch.

The one-way clutch is located between the PTO counter shaft (1) and the PTO gear shaft (4). It is composed of the slant cam, slant shifter cam and a clutch spring.

The slant cam is splined to the PTO counter shaft (1), and the slant shifter cam is splined to the PTO gear shaft (4).

When PTO shift lever is **ON** position, these two slant cams are engaged with each other by the force of the clutch spring. While the PTO counter shaft (1) is driving the PTO gear shaft (4), these two slant cams will remain engaged.

However, when the PTO shaft drives a rotary mower, for example, and if the engine speed is lowered, the slant cam (2), (3) on the PTO gear shaft (4) will overrun.

This overrunning is caused by the inertia of the mower's blades. Then, engagement will not take place until the PTO counter shaft (1) is running faster than the PTO gear shaft (4).

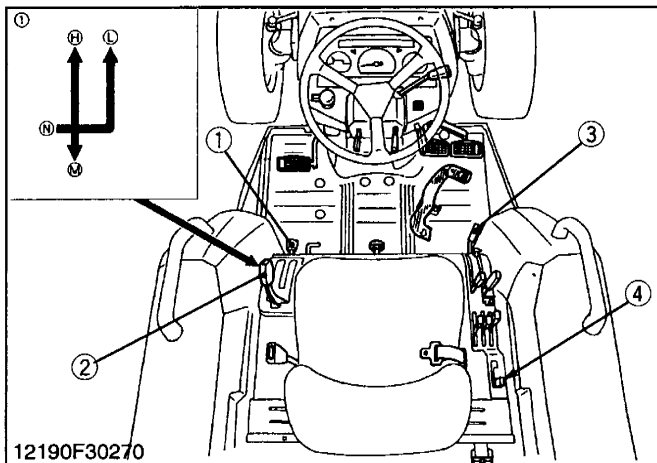
In this way, the one-way clutch protects the transmission and engine against damage, by allowing the PTO shaft, PTO drive shaft and PTO gear shaft (4) to overrun if PTO shaft overspeeds.

- | | |
|-----------------------|-----------------------|
| (1) PTO Counter Shaft | (3) Slant Shifter Cam |
| (2) Slant Cam | (4) PTO Gear Shaft |

12190M30240

[3] SHIFT LINKAGE MECHANISM

(1) Shift Levers

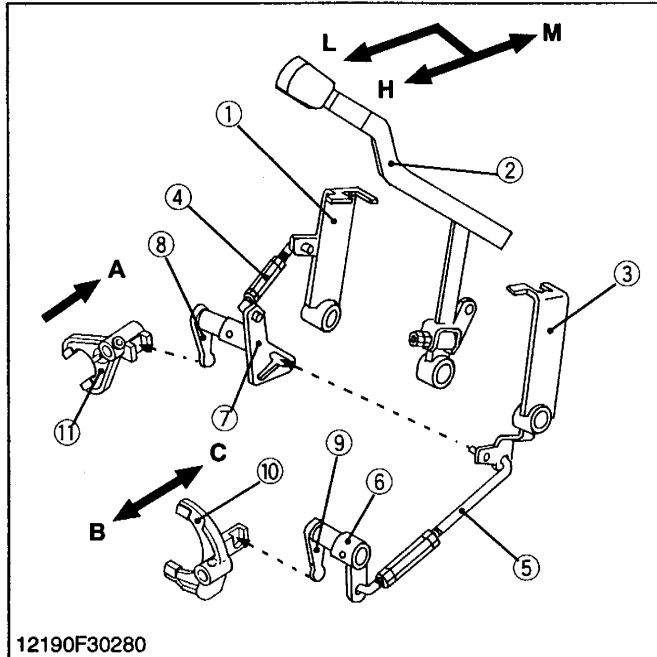


Each of the shift levers are arranged as shown in the left figure.

- | | |
|-----------------------------------|---------------------------------------|
| (1) Front Wheel Drive Shift Lever | (3) Mid PTO Shift Lever (If equipped) |
| (2) Range Gear Shift Lever | (4) PTO Shift Lever |

12190M30250

(2) Range Gear Shift Lever



The links from the shift levers (1), (2), (3) to shift forks (10), (11) are connected as shown in the left figure.

When the shift main lever (2) is moved to the L side, the shift lever L (1) is pushed to the front and shift fork L (11) is moved to the A side by means of the rod L (4), lever (7) and shift arm L (8), then low speed gears are engaged.

When the shift main lever (2) is moved to the M side (or H side), the shift lever H-M (3) is pushed to the rear (front), and shift fork H-M (10) is moved to the B side (C side) by means of the rod H-M (5), lever H-M (6) and shift arm H-M (9), then medium speed (high speed) gears are engaged.

- | | |
|---------------------------------|---------------------|
| (1) Range Gear Shift Lever L | (7) Lever L |
| (2) Range Gear Shift Main Lever | (8) Shift Arm L |
| (3) Range Gear Shift Lever H-M | (9) Shift Arm H-M |
| (4) Rod L | (10) Shift Fork H-M |
| (5) Rod H-M | (11) Shift Fork L |
| (6) Lever H-M | |

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(3) Rear PTO Shift Lever

Refer to page 3-M13.

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(4) Mid PTO Shift Lever

Refer to page 3-M13.

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(5) Front Wheel Drive Shift Lever

Refer to page 3-M31 and 3-M32.

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[4] DIFFERENTIAL GEAR

Refer to page 3-M31 and 3-M32.

12190M30290

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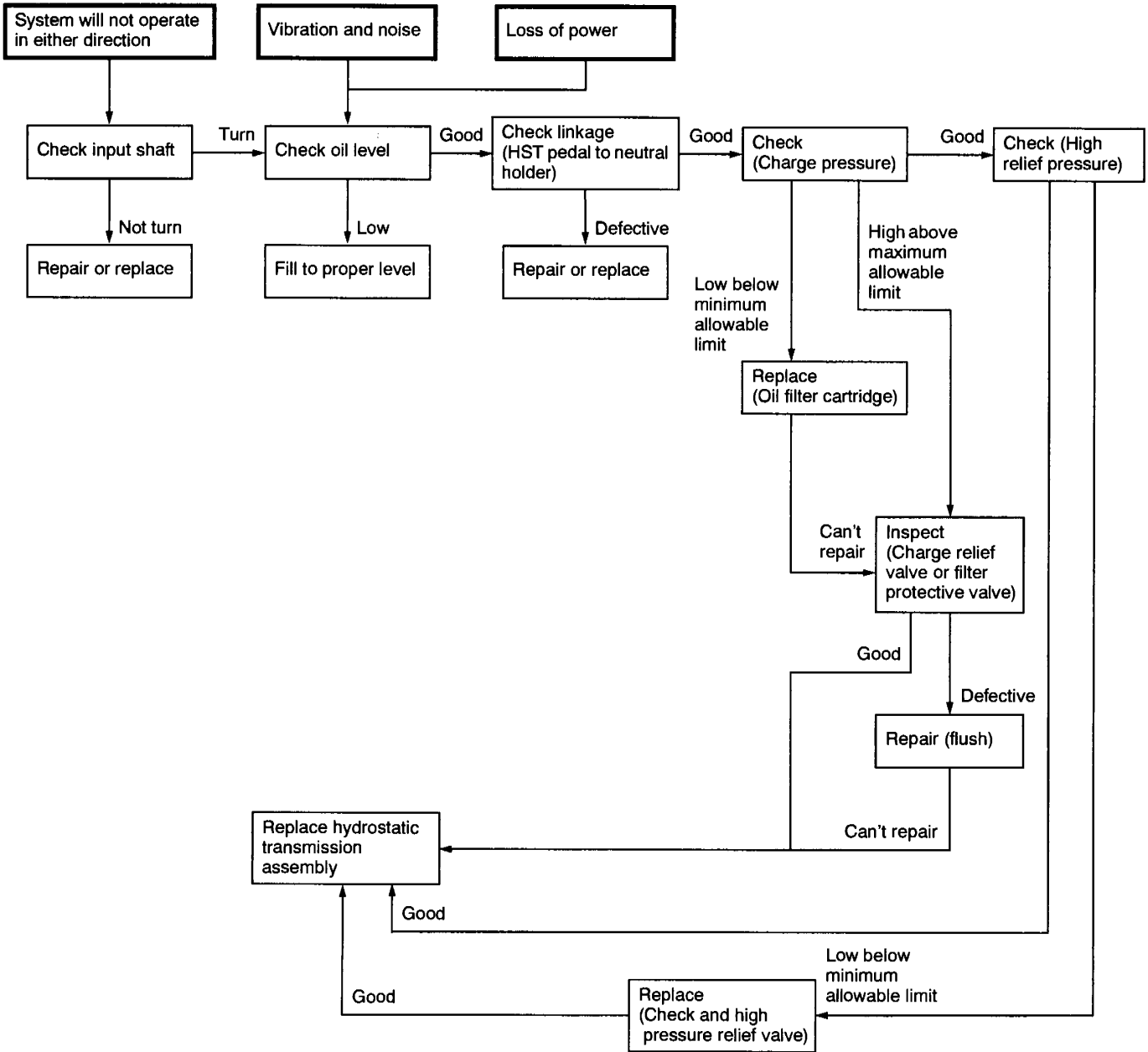
TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Excessive Transmission Noise	<ul style="list-style-type: none"> • Transmission fluid insufficient • Gear worn or backlash improper • Bearings worn or broken • Shift fork worn • Spline worn • Snap rings on the shaft come off • Spiral bevel pinion lock nut improperly tightened • Improper backlash between spiral bevel pinion and spiral bevel gear • Improper backlash between differential pinion and differential side gear 	Replenish Replace Replace Replace Replace Repair or replace Tighten Adjust Adjust	3-NS10 — 3-NS22, 28,40 3-NS33 3-NS22, 41 — 3-NS33 3-NS42 3-NS44
Gear Slip Out of Mesh	<ul style="list-style-type: none"> • Shift linkages rusted • Shifter or shift fork worn or damaged • Gears worn or broken 	Repair Replace Replace	— — —
Hard Shifting	<ul style="list-style-type: none"> • Shifter or shift fork worn or damaged • Shift fork bent • Shift linkage rusted • Shaft part of shift arms rusted 	Replace Replace Repair Repair	— — — —
Gears Clash When Shifting	<ul style="list-style-type: none"> • Clutch does not release • Gears worn or damaged 	Adjust or repair Replace	2-S3 —
Differential Lock Can Not Be Set	<ul style="list-style-type: none"> • Differential lock shift fork damaged • Differential lock shift fork mounting clevis pin damaged • Differential lock shifter pin bent or damaged • Differential lock fork shaft bent or damaged 	Replace Replace Replace Replace	3-NS33 3-NS33 3-NS33 3-NS33
Differential Lock Pedal Does Not Return	<ul style="list-style-type: none"> • Differential lock pedal return spring weaken or damaged • Differential lock shifter pin bent or damaged • Differential lock fork shaft bent 	Replace Replace Replace	— 3-NS33 3-NS33
Excessive or Unusual Noise at All Time	<ul style="list-style-type: none"> • Improper backlash between spiral bevel pinion and spiral bevel gear • Improper backlash between differential pinion and differential side gear • Bearings worn • Insufficient or improper type of transmission fluid used 	Adjust Adjust Replace Replenish or replace	3-NS42 3-NS44 3-NS22, 28, 40 G-8, 13
Noise While Turning	<ul style="list-style-type: none"> • Differential pinions or differential side gears worn or damaged • Differential lock binding (does not disengage) • Bearing worn 	Replace Replace Replace	3-NS40 — 3-NS22, 28, 40

12190S30010

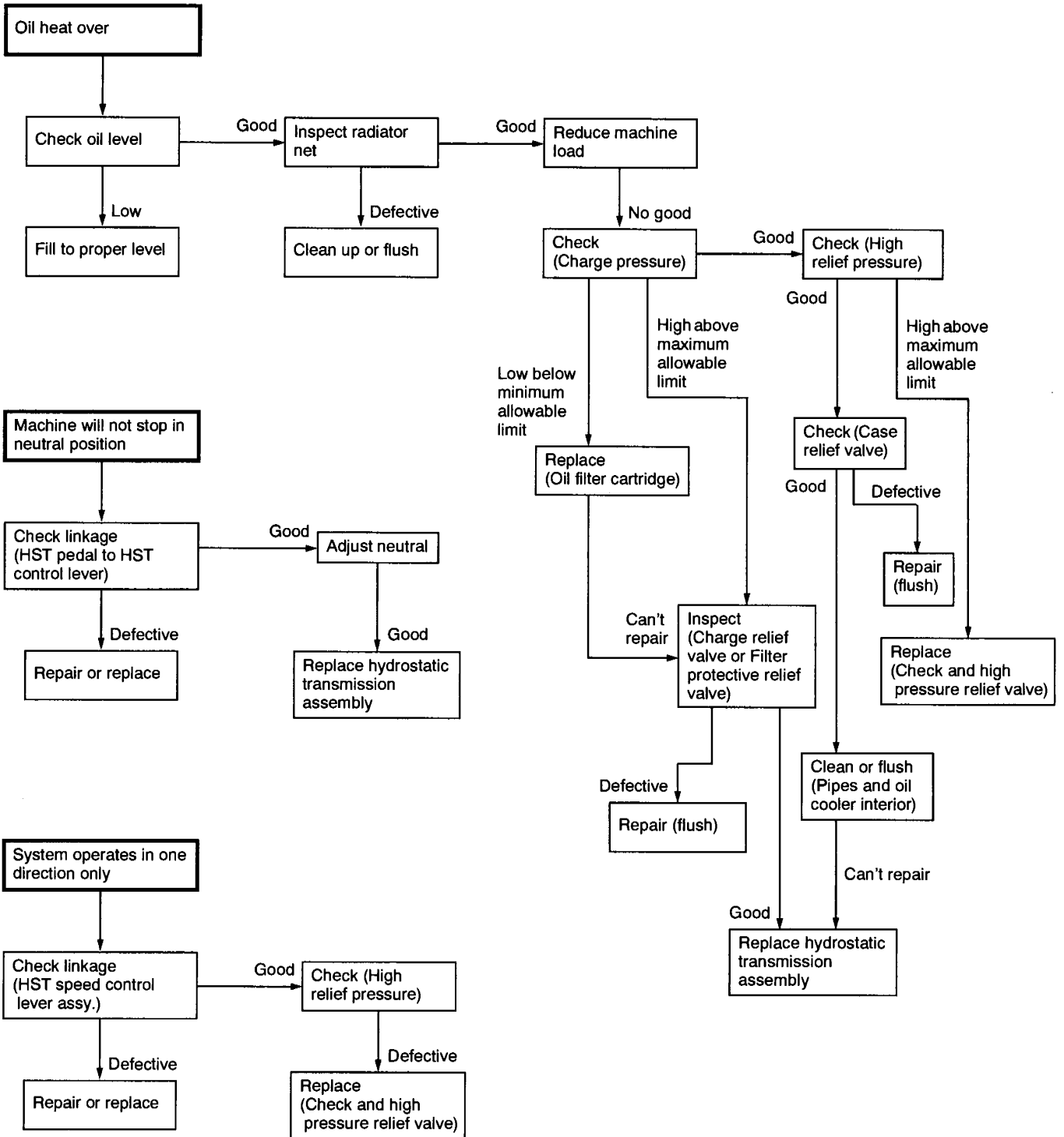
TROUBLESHOOTING (CONTINUED)

HYDROSTATIC TRANSMISSION



12190S30020

TROUBLESHOOTING (CONTINUED)



12190S30030

SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Gear to Spline, Hub to Spline	Clearance	0.030 to 0.078 mm 0.00118 to 0.00307 in.	0.2 mm 0.008 in.
Spiral Bevel Pinion and Differential Assembly	Combined Turning Torque	4.81 to 9.31 N·m 0.49 to 0.95 kgf·m 3.54 to 6.87 ft-lbs	—
Spiral Bevel Pinion to Spiral Bevel Gear	Backlash	0.15 to 0.30 mm 0.006 to 0.012 in.	—
	Tooth Contact	—	More than 35 %
	Center of Tooth Contact	—	1/3 to 1/2 of the entire width from the small end
Differential Case Bore (Differential Case Cover Bore) to Differential Side Gear Boss	Clearance	0.050 to 0.151 mm 0.00197 to 0.00594 in.	0.35 mm 0.0138 in.
Differential Case Bore	I.D.	40.500 to 40.550 mm 1.59449 to 1.59646 in.	—
Differential Case Cover Bore	I.D.	40.500 to 40.550 mm 1.59449 to 1.59646 in.	—
Differential Side Gear Boss	O.D.	40.388 to 40.450 mm 1.59008 to 1.59252 in.	—
Differential Pinion Shaft to Differential Pinion	Clearance	0.060 to 0.102 mm 0.00236 to 0.00402 in.	0.25 mm 0.0098 in.
Differential Pinion Shaft	O.D.	19.959 to 19.980 mm 0.78579 to 0.78661 in.	—
Differential Pinion	I.D.	20.040 to 20.061 mm 0.78898 to 0.78980 in.	—
Differential Pinion to Differential Side Gear	Backlash	0.15 to 0.30 mm 0.006 to 0.012 in.	0.40 mm 0.016 in.
Differential Side Gear Washer 1	Thickness	1.5 mm 0.059 in.	—
Differential Side Gear Washer 2	Thickness	1.6 mm 0.063 in.	—
Differential Side Gear Washer 3	Thickness	1.7 mm 0.067 in.	—
HST Neutral Spring	Length	100 mm 3.94 in.	—
Check and High Pressure Relief Valve	Setting Pressure (Relief Valve)	33.3 to 35.3 MPa 340 to 360 kgf/cm ² 4836 to 5124 psi	—
Charge Relief Valve	Setting Pressure	2.35 to 2.55 MPa 24 to 26 kgf/cm ² 342 to 370 psi	—

12190S30040

TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts : See page G-9.)

Item	N·m	kgf·m	ft-lbs
Power steering main delivery hose retaining nut to controller	46.6 to 50.9	4.8 to 5.2	34.4 to 37.6
Power steering turning delivery hose retaining nut to controller	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
ROPS mounting screw and nut M12 (L3710, L4310)	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
M14	124 to 147	12.6 to 15.0	91.2 to 108
Floor seat and platform mounting bolt and nut	196 to 225	20 to 23	145 to 166
Joint bolt for delivery pipe and front hydraulic block	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Joint nut for oil cooler pipe	108 to 127	11 to 13	79.6 to 94.0
Engine and clutch housing mounting Screw and nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Stud bolt	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2
HST and Mid case mounting Screw and nut	103 to 117.6	10.5 to 12.0	76.9 to 86.8
Stud bolt	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2
Joint bolt for HST suction pipe (HST side)	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Joint bolt for HST suction pipe (T/M case side)	108 to 127	11 to 13	79.6 to 94.0
Clutch housing and HST mounting Nut (M14)	176.4 to 186.2	18.0 to 19.0	130.2 to 137.4
Screw and nut (M12)	117.7	12.0	86.8
Stud bolt	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2
Front mission gear shaft case mounting screw	23.5 to 27.4	2.4 to 2.8	17.4 to 20.2
Release fork setting screw	23.5 to 27.4	2.4 to 2.8	17.4 to 20.2
Front mission bearing holder mounting screw	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Mid case and transmission mounting Screw and nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Stud bolt	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2
Mid case bearing holder mounting screw	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
One-way clutch cam mounting screw	60.8 to 70.6	6.2 to 7.2	44.8 to 52.1
PTO counter shaft bearing holder mounting screw	23.5 to 27.4	2.4 to 2.8	17.4 to 20.2
Hydraulic cylinder assembly mounting Screw and nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Stud bolt	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2
Rear wheel mounting screw and nut	197 to 226	20 to 23	145 to 166
Rear axle case mounting M10 screw	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
M10 nut (L3010, L3410)	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
M10 nut (L3710, L4310)	60.8 to 70.5	6.2 to 7.2	44.9 to 52.1
M12 screw	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Stud bolt	24.5 to 31.4	2.5 to 3.2	18.1 to 23.1
Brake case mounting Screw and nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Stud bolt	38.2 to 45.1	3.9 to 4.6	28.2 to 33.3
Lever shaft screw	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5
Spiral bevel pinion lock nut	147 to 196	15 to 20	108 to 145
Spiral bevel pinion bearing case mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Transmission case bearing holder mounting screw	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Mid PTO gear case mounting screw	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Rear PTO shaft lock nut	147 to 196	15 to 20	108 to 145
Rear PTO bearing case mounting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Differential support mounting screw	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Differential case cover mounting screw	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Spiral bevel gear UBS screw	68.6 to 88.3	7.0 to 9.0	50.6 to 65.1

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Item	N·m	kgf·m	ft-lbs
(HST)			
Charge pump case mounting hex. socket head screw	98 to 123	10 to 12.5	72.3 to 90.4
Port block mounting hex. socket head screw	98 to 123	10 to 12.5	72.3 to 90.4
Check and high pressure relief l valve hex. socket head screw plug	54 to 69	5.5 to 7.0	39.8 to 50.6
Cradle bearing mounting hex. socket head screw	28 to 35	2.9 to 3.6	21 to 26
Charge relief l valve hex. socket head screw plug	30 to 37	3.1 to 3.8	22.4 to 27.5
Filter protective relief valve hex. socket head screw plug	30 to 37	3.1 to 3.8	22.4 to 27.5
Regulator mounting hex. socket head screw	6.9 to 8.3	0.7 to 0.85	5.1 to 6.1
Servo piston assembly mounting hex. socket head screw	28 to 35	2.9 to 3.6	21 to 26

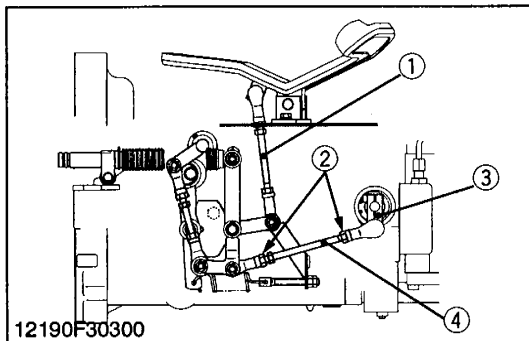
12190S30060

CHECKING AND ADJUSTING

Neutral

1. Disengage the front wheel drive lever. (Drive only rear wheels.)
2. Lift the rear of the tractor so that the rear wheels are off the ground and run the engine at low idling and drive only rear wheels.
3. Depress the one end of speed control pedal and release, and do the same at the other end.
4. If the rear wheels do not stop turning, adjust as following procedure.

12190S30070



Adjusting Neutral

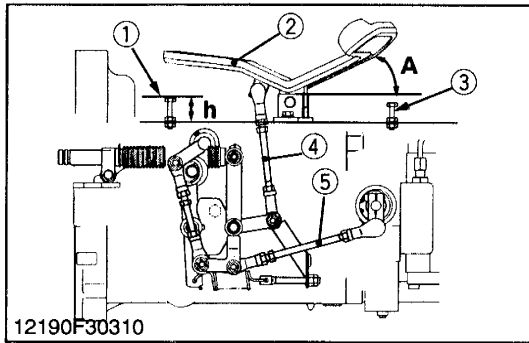
NOTE

- Be sure to tighten lock nuts firmly.

1. Loosen the lock nuts (2) of neutral adjusting rod (4).
(When rear wheels tends to turn forward.)
2. Shorten the neutral adjusting rod (4) so that the rear wheels turn reverse.
3. Then lengthen it until wheels stop completely.
(When rear wheels tends to turn reverse)
2. Lengthen the neutral adjusting rod (4) so that the rear wheels turn forward.
3. Then shorten it until wheels stop completely.

- | | |
|-----------------------|---------------------------|
| (1) Speed Control Rod | (3) HST Control Lever |
| (2) Lock Nut | (4) Neutral Adjusting Rod |

12190S30080



Adjusting Pedal Stroke

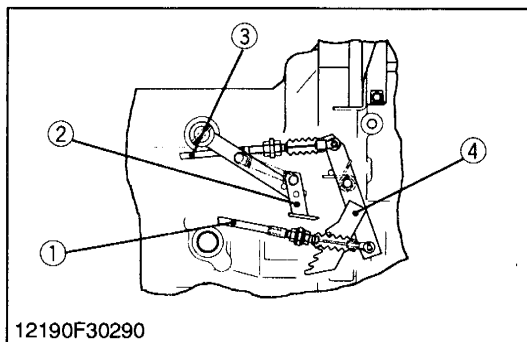
NOTE

- Stop the engine when adjusting the HST pedal stroke.
 - Be sure to tighten lock nuts firmly.
1. Check that angle "A" of the HST pedal forward side is 25 to 27 degrees in neutral position. If not adjust with speed control rod (4).
 2. Shorten the stopper bolt front (3) to the position where the length of the bolt is not touched to the HST pedal (2) even if the HST pedal is fully depressed forward.
 3. Lengthen the length of the stopper bolt front (3) gradually with the HST pedal (2) fully depressed and lengthen the one turn from the position where the head of the stopper bolt touches the HST pedal further.
 4. Set the height "h" of the stopper bolt rear to 80 to 90 % shorter than front stopper bolt.
 5. Tighten the lock nut for both stopper bolts (1), (3).

- (1) Stopper Bolt Rear
- (2) HST Pedal
- (3) Stopper Bolt Front
- (4) Speed Control Rod
- (5) Neutral Adjusting Rod

A : Pedal Angle A : 25 to 27°
h : Stopper Bolt Height h

12190S30090

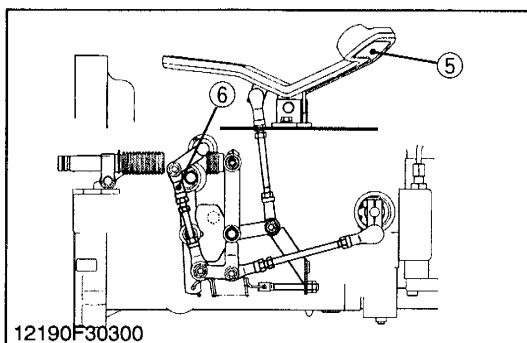


Adjusting Cruise Control

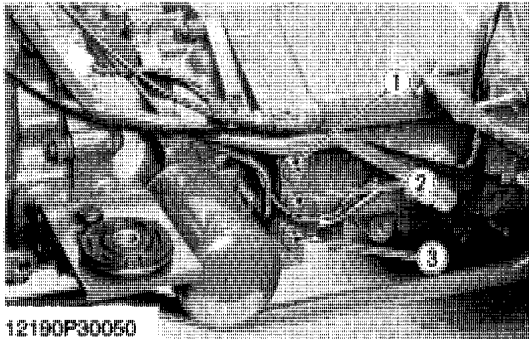
NOTE

- Stop the engine when adjusting the cruise control linkages.
 - Adjust the cruise control linkages after checking the correct adjusting of the neutral position and pedal stroke.
 - Be sure to tighten lock nuts firmly.
1. Check if cruise control hook (2) catches the lowest notch of the cruise control arm (4) when cruise control lever is set a position that the HST pedal (5) is fully depressed to forward.
 2. If not adjust with the cruise control adjusting rod (6).

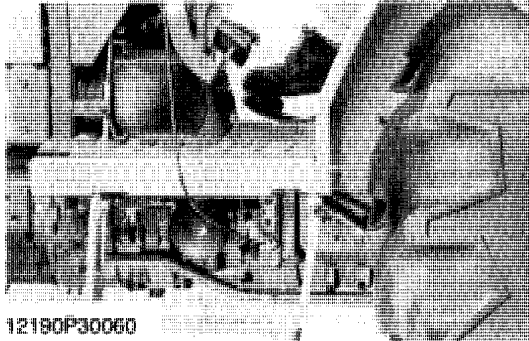
- (1) Cruise Control Cable (Connected to the Cruise Control Lever)
- (2) Cruise Control Hook
- (3) Cruise Control Release Cable (Connected to the Brake Pedal)
- (4) Cruise Control Arm
- (5) HST Pedal
- (6) Cruise Control Adjusting Rod



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12190P30050



12190P30060

Checking High Pressure Relief Valve Pressure

⚠ CAUTION

- **When checking, park the machine on flat ground, apply the parking brake.**
1. Remove the hex. socket head plug from **P1** or **P3** port. (**P3** is for forward and **P1** is for reverse.)
 2. Assemble adaptor **C** (07916-50371) and threaded joint (07916-50341) with the gasket between them.
 3. Install the assembled adaptor **C** and threaded joint to **P3** (forward) or **P1** (reverse) port.
 4. Install the cable, threaded joint in relief valve set pressure tester and high pressure gauge to threaded joint in order.
 5. Run the engine at maximum speed.
 6. Place the range gear shift lever in **H** position.
 7. Depress the speed control pedal, and measure the check and high pressure relief valve pressure.
 8. If the measurement is not factory specification, check the check and high relief valve assembly. (See page 3-NS25)

Check and high relief pressure (Oil temperature at 50 to 60 °C (122 to 140 °F))	Factory spec.	33.3 to 35.3 MPa 340 to 360 kgf/cm ² 4836 to 5124 psi
---	---------------	--

■ IMPORTANT

- **Measure quickly so that the relief valve may not be in operation more than 10 seconds.**

■ NOTE

- **High pressure gauge is 40 MPa (400 kgf/cm², 5800 psi) full scale.**

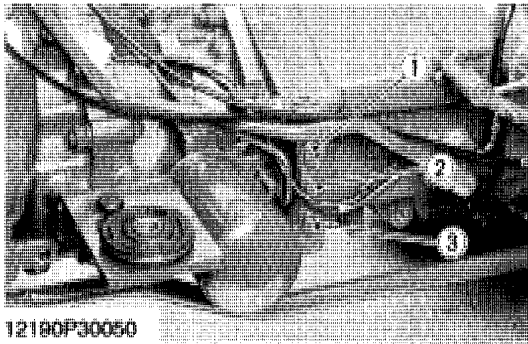
(When reassembling)

- Install the hex. socket head plug to the port with O-ring.

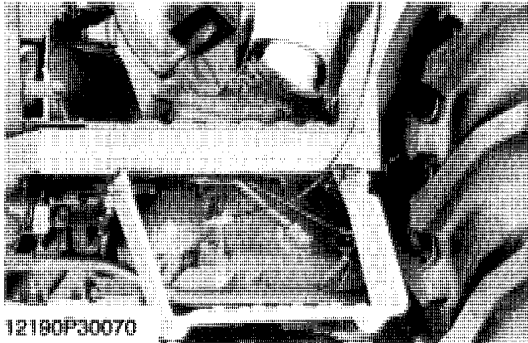
(1) P1 Port
(2) P2 Port

(3) P3 Port

12190S30100



12190P30050



12190P30070

Checking Charge Relief Pressure

CAUTION

- When checking, park the machine on flat ground, apply the parking brake.

NOTE

- Use a new transmission oil filter.
1. Remove the hex. socket head plug from **P2** port.
 2. Assemble adaptor **58** (07916-52391) and thread joint (07916-50341) with the gasket between them.
 3. Install the assembled adaptor **58** and thread joint to **P2** port.
 4. Install the cable, thread joint in relief valve set pressure tester and low pressure gauge to threaded joint in order.
 5. Run the engine at maximum speed.
 6. Place the range gear shift lever in neutral.
 7. Release the HST pedal to set in neutral, and measure the charge pressure.
 8. If the measurement is not within the factory specifications, check charge relief valve. (See page 3-NS25)

Charge pressure (Oil temperature at 50 to 60 °C (122 to 140 °F))	Factory spec.	2.35 to 2.55 MPa 24 to 26 kgf/cm ² 342 to 370 psi
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NOTE

- Low pressure gauge is 5 MPa (50 kgf/cm², 711 psi) full scale. (When reassembling)
- Install the hex. socket head plug to the **P2** port with O-ring.

- (1) P1 Port
- (2) P2 Port
- (3) P3 Port

12190S30110

DISASSEMBLING AND SERVICING

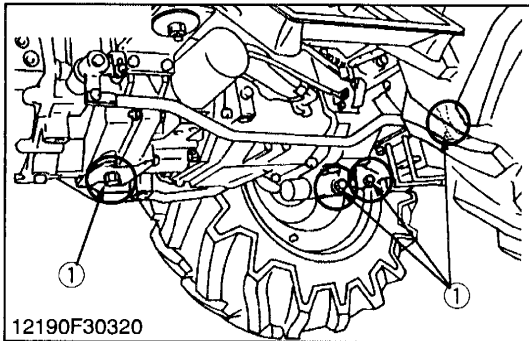
[1] CLUTCH HOUSING AND HST DISASSEMBLING AND ASSEMBLING

NOTE

- If the tractors are cabin specifications, refer to section 10 CABIN [1] SEPARATING CABIN FROM TRACTOR BODY. (See page 10-S20.)

12190S30120

(1) Draining the Transmission Fluid

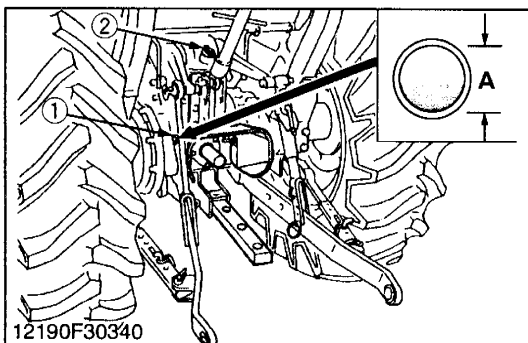


Draining the Transmission Fluid

1. Place oil pans underneath the transmission case.
2. Remove the four drain plugs (1).
3. Drain the transmission fluid.
4. Reinstall the four drain plugs (1).

(When refilling)

- Fill up from filling port after removing the filling plug (2) until reaching the gauge (3).
- After running the engine for few minutes, stop it and check the oil level again, add the fluid to prescribed level if it is low.



Capacity	Transmission fluid	39.0 L 41.2 U.S.qts. 34.3 Imp.qts.
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IMPORTANT

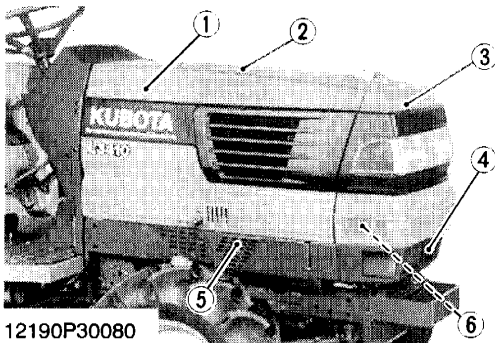
- Use only KUBOTA SUPER UDT fluid. Use of other oils may damage the transmission or hydraulic system.
- Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-8.)
- Do not mix different brands of fluid together.

- (1) Drain Plugs
(2) Filling Plug
(3) Gauge

(A) Oil level is acceptable within this range.

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(2) Separating Panel Frame Assembly



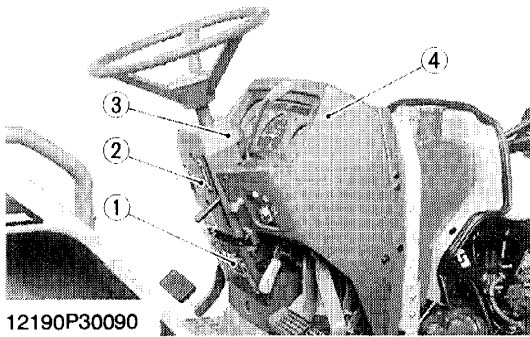
Preparation 1

1. Disconnect the battery negative cable (6).
2. Remove the right and left side covers (1).
3. Remove the front mask (3).
4. Remove the front grille (4).
5. Remove the right and left side skirts (5).
6. Remove the bonnet (2).

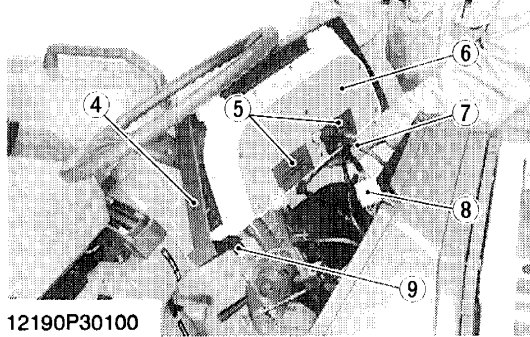
- (1) Side Cover RH, LH
(2) Bonnet
(3) Front Mask

- (4) Front Grille
(5) Side Skirt RH, LH
(6) Battery Negative Cable

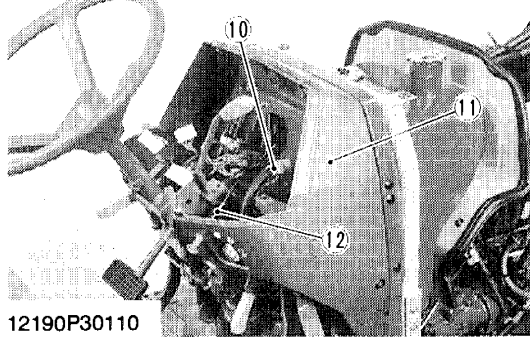
12190S30140



12190P30090



12190P30100



12190P30110

Preparation 2

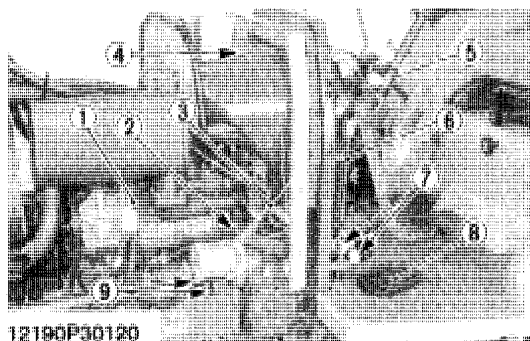
1. Remove the steering post covers (2), (3) and panel under cover (1).
2. Disconnect the hourmeter cable (7) at the engine side.
3. Remove the meter panel mounting screw and open the meter panel (4).
4. Disconnect the hourmeter cable (7).
5. Remove the meter panel cover (6) and disconnect the two connectors.
6. Disconnect the combination switch connector (8) and hazard switch connector (9).
7. Take out the meter panel (4).
8. Disconnect the main switch connector (10) and disconnect the engine stop cable (12) at the engine side.
9. Remove the cowl panel (11).

NOTE

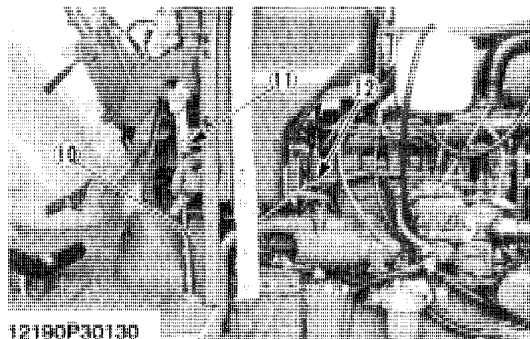
- Do not remove the seals (5) on the meter panel cover (6).

- | | |
|-------------------------|----------------------------------|
| (1) Panel Under Cover | (7) Hourmeter Cable |
| (2) Steering Post Cover | (8) Combination Switch Connector |
| (3) Steering Post Cover | (9) Hazard Switch Connector |
| (4) Meter Panel | (10) Main Switch Connector |
| (5) Seals | (11) Cowl Panel |
| (6) Meter Panel Cover | (12) Engine Stop Cable |

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12190P30120



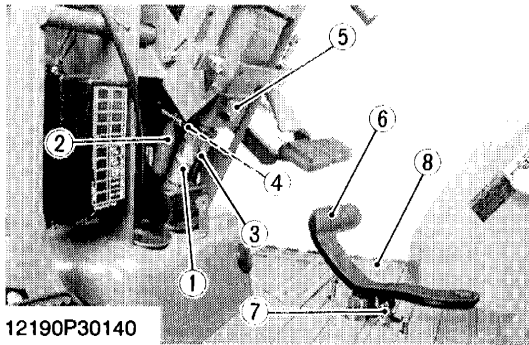
12190P30130

Preparation 3

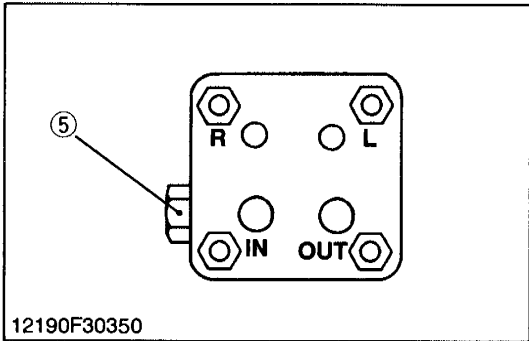
1. Remove the brake rods (6), (10).
2. Remove the clutch rod (3).
3. Remove the accelerator rod (12).
4. Remove the panel frame cover (8) and disconnect the three connectors (7).
5. Disconnect the 2P connector for alternator (1) and the jumper leads for fuel level sensor (4), oil switch (2) and starter (9).
6. Disconnect the HST cruise control lever cable (5) and cruise control release cable (11).

- | | |
|---------------------------------------|---------------------------------------|
| (1) 2P Connector for Alternator | (7) Connectors |
| (2) Jumper Lead for Oil Switch | (8) Panel Frame Cover |
| (3) Clutch Rod | (9) Jumper Lead for Starter |
| (4) Jumper Lead for Fuel Level Sensor | (10) Brake Rod RH |
| (5) HST Cruise Control Lever Cable | (11) HST Cruise Control Release Cable |
| (6) Brake Rod LH | (12) Accelerator Rod |

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12190F30350

Preparation 4

1. Disconnect the main delivery hose (1), return hose (2), right turning delivery hose (3) and left turning delivery hose (4).
2. Disconnect the speed control rod (7) and remove the HST pedal (6).
3. Remove the floor sheet.

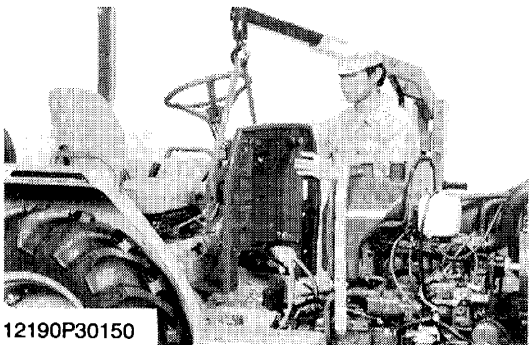
(When reassembling)

- In assembling the turning delivery hoses to the steering controller, connect the delivery hose with identification mark (tape) to the L port of the steering controller. (Refer to figure left.)
- If this identification mark is not shown, put a mark on the delivery hose before disconnecting.

Tightening torque	Main delivery hose retaining nut	46.6 to 50.9 N·m 4.8 to 5.2 kgf·m 34.4 to 37.6 ft-lbs
	Turning delivery hoses retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft-lbs

- | | |
|---------------------------------|-----------------------|
| (1) Main Delivery Hose | (5) Relief Valve Plug |
| (2) Return Hose | (6) HST Pedal |
| (3) Right Turning Delivery Hose | (7) Speed Control Rod |
| (4) Left Turning Delivery Hose | (8) Floor Sheet |

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12190P30150

Panel Frame and Steering Assembly

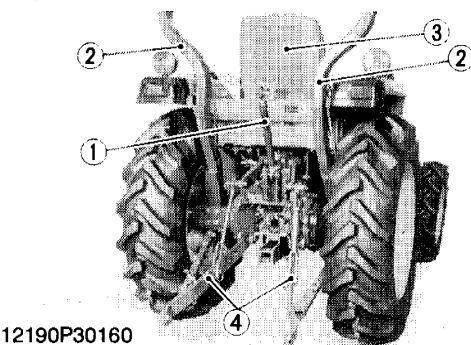
1. Remove the upper cushion and remove two panel frame mounting screws (longer size) at upper side.
2. Remove the other eight panel frame mounting screws at lower side.
3. Remove the band for combination the wiring harness with the return hose.
4. Lift up and take out the panel frame and steering assembly as a unit.

(When reassembling)

- Do not get in the wiring harness between panel frame and platform.

12190S30180

(3) Separating Rear Fenders and Platform Assembly



12190P30160

Preparation 1

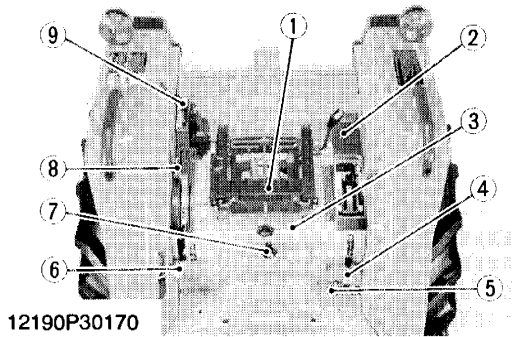
1. Remove the seat (3).
2. Remove the top link (1).
3. Remove the right and left side lower link assemblies (4).
4. Remove the one side rear wheel and take out the ROPS (2) as a unit. After removing the ROPS, re-install the rear wheel.

(When reassembling)

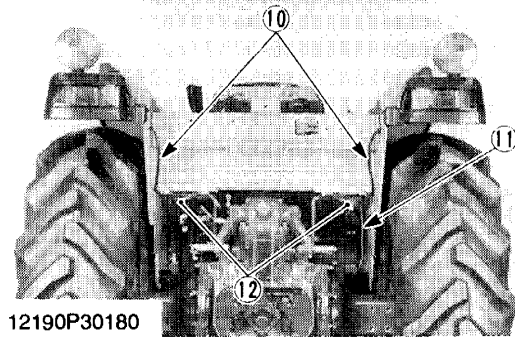
Tightening torque	ROPS mounting screw, bolt and nut (M14)	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 ft-lbs
	ROPS mounting screw (M12) (L3710, L4310)	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

- | | |
|--------------|-------------------------|
| (1) Top Link | (3) Seat |
| (2) ROPS | (4) Lower Link Assembly |

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12190P30170



12190P30180

Preparation 2

1. Remove the seat base (1).
2. Remove the lever grip for front wheel drive lever (4), Mid PTO shift lever (6), lowering speed adjusting lever (7) and hydraulic position control lever (8).
3. Remove the range gear shift lever guide (2).
4. Remove the seat under cover (3) and then remove the extension rod of the lowering speed adjusting valve lever (7).
5. Disconnect the differential lock pedal (5) from the differential lock rod.
6. Disconnect the rear PTO shift cable (11) and safety switch connector at the rear PTO shift lever (9) side.
7. Remove the Mid PTO shift lever (6).
8. Remove the auxiliary control valve lever grips and the quick couplers as a unit. (If equipped.)
9. Disconnect the wiring harness (10) for hazard light and combination light.
10. Loosen and remove the floor seat mounting bolt and nut (12) and platform mounting bolt and nut.

(When reassembling)

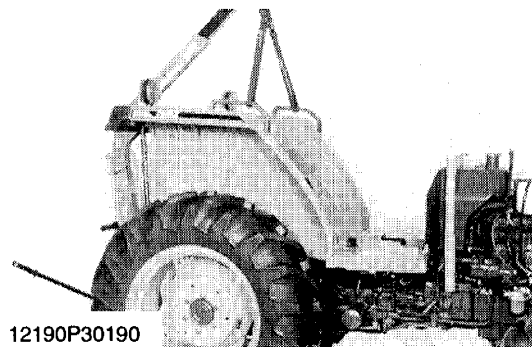
Tightening torque	Floor seat and platform mounting bolt and nut	197 to 226 N·m 20 to 23 kgf·m 145 to 166 ft·lbs
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- | | |
|----------------------------------|---------------------------------------|
| (1) Seat Base | (7) Lowering Speed Adjusting Lever |
| (2) Range Gear Shift Lever Guide | (8) Position Control Lever |
| (3) Seat Under Cover | (9) Rear PTO Shift Lever |
| (4) Front Wheel Drive Lever | (10) Wiring Harness |
| (5) Differential Lock Pedal | (11) PTO Shift Cable |
| (6) Mid PTO Shift Lever | (12) Floor Seat Mounting Bolt and Nut |

12190S30200

Fender, Floor Seat and Platform Assembly

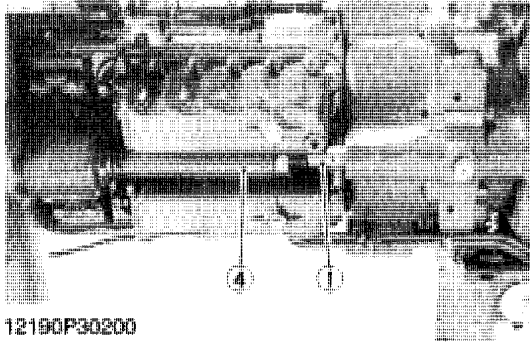
1. Remove the fender, floor seat and platform.



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12190S30210

(4) Separating Clutch Housing Case with HST Assembly



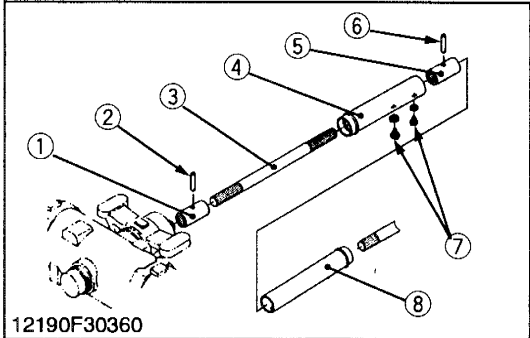
Propeller Shaft

1. Slide the propeller shaft cover (4), after removing the screws (7).
2. Tap out the spring pin (6), and then slide the coupling (5) to the front.

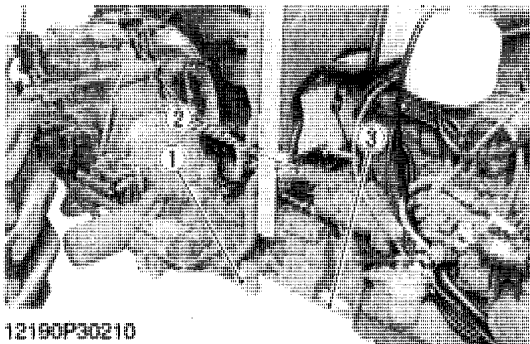
(When reassembling)

- Apply grease to the splines of the propeller shaft.

- | | |
|---------------------------|---------------------------|
| (1) Coupling | (5) Coupling |
| (2) Spring Pin | (6) Spring Pin |
| (3) Propeller Shaft | (7) Screws |
| (4) Propeller Shaft Cover | (8) Propeller Shaft Cover |



12190S30220



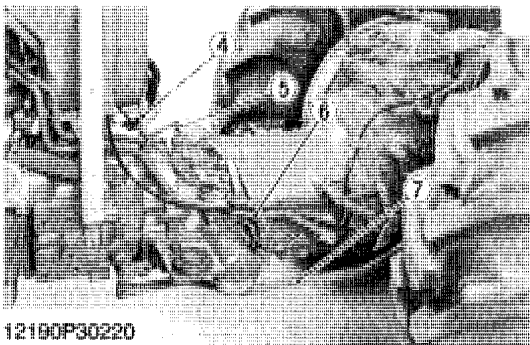
Hydraulic Pipes and Brake Rod

1. Disconnect the brake rod (1), (7).
2. Remove the delivery pipe (3).
3. Loosen the clamp and slide the rubber hose (2) for inlet pipe.
4. Disconnect the oil cooler pipes (5), (6) and return hose (4) at the tractor body side.

(When reassembling)

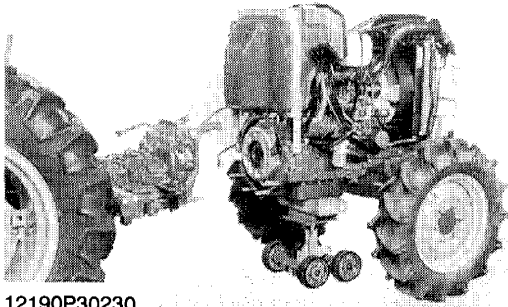
- Reinstall the pipe clamp securely.

Tightening torque	Joint bolt for delivery pipe (3) and front hydraulic block	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft·lbs
	Joint nut for oil cooler pipe	108 to 127 N·m 11 to 13 kgf·m 79.6 to 94.0 ft·lbs



- | | |
|-------------------|---------------------------------------|
| (1) Brake Rod RH | (5) Oil Cooler Pipe (To Oil Cooler) |
| (2) Rubber Hose | (6) Oil Cooler Pipe (From Oil Cooler) |
| (3) Delivery Pipe | (7) Brake Rod LH |
| (4) Return Hose | |

12190S30230



12190P30230

Separating Engine and Clutch Housing

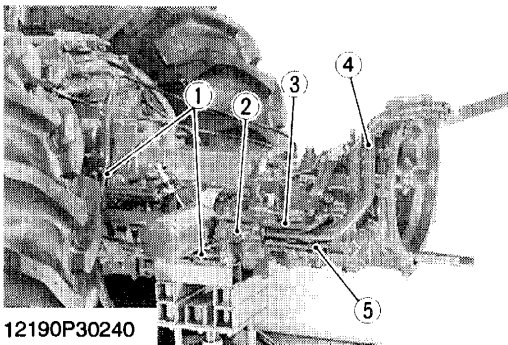
1. Place disassembling stand under the mid case and engine oil pan, and support them.
2. Remove the engine mounting screws, and then pull the engine to the front.

(When reassembling)

- Apply grease to the splines.
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the engine and clutch housing.

Tightening torque	Engine and clutch housing mounting screw and nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft·lbs
	Engine and clutch housing mounting stud bolt	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.3 to 36.2 ft·lbs

12190S30240



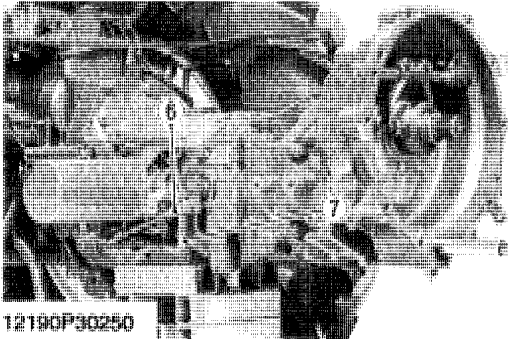
12190P30240

Separating Clutch Housing with HST Assembly

1. Remove the delivery pipe (1).
2. Remove the front hydraulic block (2) with mounting stay (3).
3. Remove the inlet pipe (4) and hydraulic pipe (5).
4. Disconnect the speed control rod (6) at the HST side.
5. Remove the suction pipe (7).
6. Place disassembling stand under the clutch housing.
7. Separate clutch housing with HST assembly from the mid case after removing its mounting screw and nut.

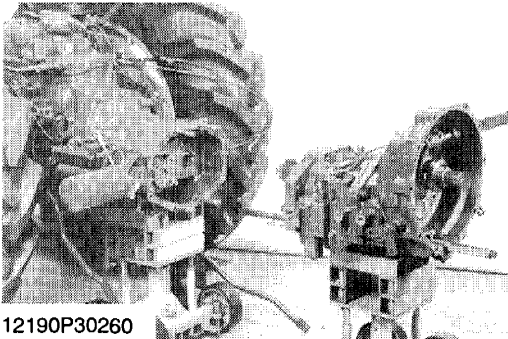
(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of HST and mid case after eliminating the water, oil and stuck liquid gasket.



12190P30250

Tightening torque	HST and mid case mounting screw and nut	103 to 117.6 N·m 10.5 to 12.0 kgf·m 76.9 to 86.8 ft·lbs
	HST and mid case mounting stud bolt	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft·lbs
	Joint bolt for HST suction pipe (HST side)	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.1 to 43.4 ft·lbs
	Joint bolt for HST suction pipe (T/M Case side)	108 to 127 N·m 11 to 13 kgf·m 79.6 to 94.0 ft·lbs

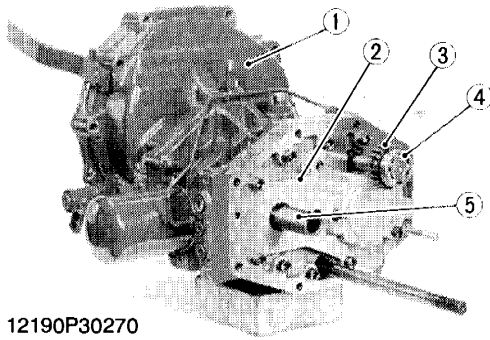


12190P30260

- | | |
|---------------------------|---|
| (1) Delivery Pipe | (5) Hydraulic Pipe
(To Front Mission Case) |
| (2) Front Hydraulic Block | (6) Speed Control Rod |
| (3) Mounting Stay | (7) Suction Pipe |
| (4) Inlet Pipe | |

12190S30250

(5) Disassembling Clutch Housing



12190P30270

Separating Clutch Housing and HST Assembly

1. Remove the 21T gear (3) and ball bearing (4) together by a gear puller.
2. Remove the spline boss (5).
3. Remove the HST mounting screws and nuts and separate the HST assembly (2) and clutch housing (1).

(When reassembling)

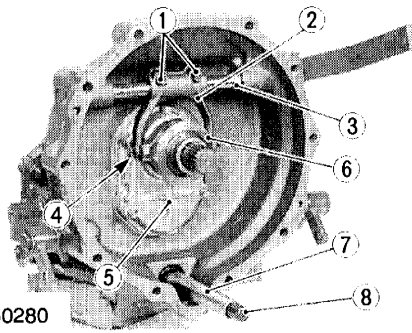
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the clutch housing and HST assembly after eliminating the water, oil and stuck liquid gasket.

Tightening torque	Clutch housing and HST mounting nut (M14)	176.4 to 186.2 N·m 18.0 to 19.0 kgf·m 130.2 to 137.4 ft-lbs
	Clutch housing and HST mounting screw and nut (M12)	117.7 N·m 12.0 kgf·m 86.8 ft-lbs
	Clutch housing and HST mounting stud bolt (M12 and M14)	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft-lbs

- (1) Clutch Housing
- (2) HST Assembly
- (3) 21T Gear

- (4) Ball Bearing
- (5) Spline Boss

12190S30260



12190P30280

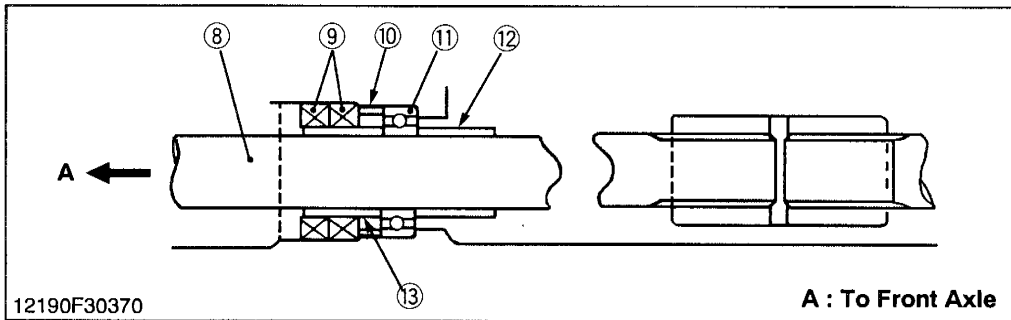
Gear Shaft Cover and Front Axle Drive Shaft

1. Remove the two O-rings and collar (7) and pull out the front axle drive shaft (8) to the rear side (4WD only).
2. Remove the release fork setting screws.
3. Draw out the clutch lever (3) to remove the release fork (2).
4. Take out the thrust ball bearing (6) and the release hub together.
5. Remove the gear shaft case mounting screws.
6. Screw down the two M6 screws into the gear shaft case (5) and pull it out.
7. Take out the gear shaft case (5).

(When reassembling)

- Apply grease to the sliding surface of the clutch release hub.
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint surface of the gear shaft case and clutch housing case after eliminating the water, oil and stuck liquid gasket.
- Install the front axle drive shaft (8) from front side after assembling the clutch housing case, HST and mid case. Then install the sleeve (12), bearing (11), collar (10), sleeve (13) and oil seals (9) in order, (Refer to the figure) by using front axle drive shaft tool. (Refer to figure below.)

Tightening torque	Gear shaft case mounting screw	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft·lbs
	Release fork setting screw	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft·lbs

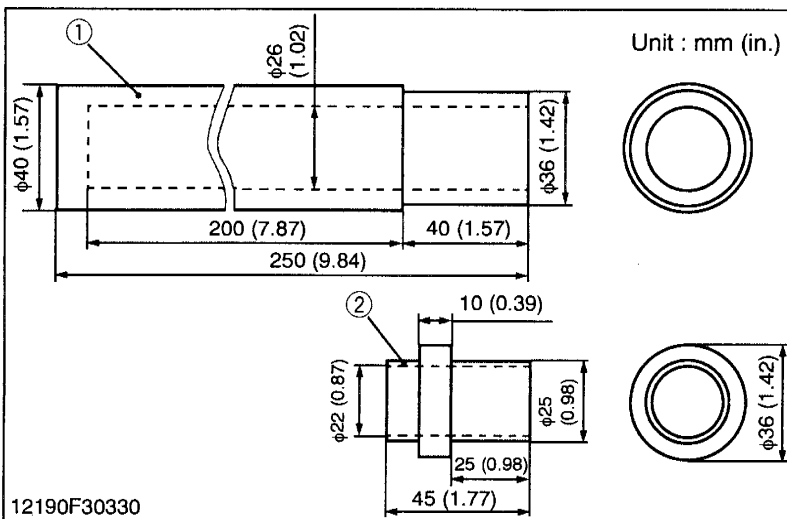


12190F30370

A : To Front Axle

- (1) Setting Screws
- (2) Release Fork
- (3) Clutch Lever
- (4) Snap Pin
- (5) Gear Shaft Case
- (6) Thrust Ball Bearing
- (7) Collar
- (8) Front Axle Drive Shaft
- (9) Oil Seals
- (10) Collar
- (11) Bearing
- (12) Sleeve
- (13) Sleeve

12190S30270



12190F30330

Front Axle Drive Shaft Tool

Application: Use for installing a bearing, oil seals and sleeves for front axle drive shaft.

Bearing and oil seal : (1)
Sleeves : (1) and (2)

12190S30800

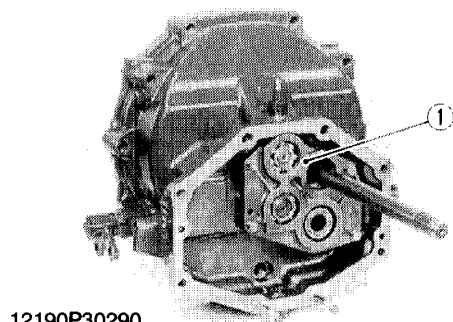
Gears and Gear Shaft for Front Mission Case

1. Remove the bearing holder (1).
2. Pull out the 20T gear shaft (4).
3. Tap the 24T gear shaft (3) from rear side slightly and remove the 19T gear (2), then pull out the 24T gear shaft (3) to front.
4. Remove the 27T gear (8) after removing the external snap ring (7).
5. Remove the 18T gear shaft (6) and 18T gear shaft (5).

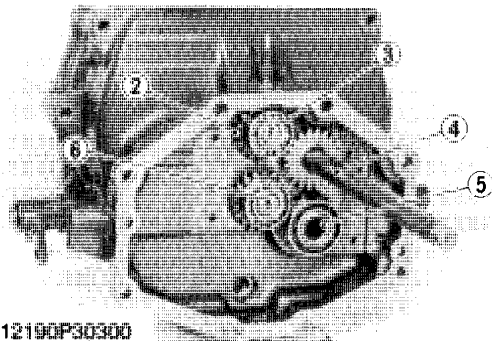
(When reassembling)

Tightening torque	Bearing holder mounting screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft·lbs
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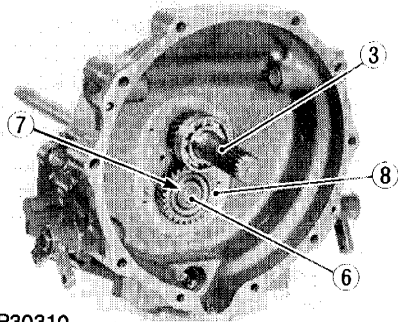
- | | |
|--------------------|------------------------|
| (1) Bearing Holder | (5) 18T Gear Shaft |
| (2) 19T Gear | (6) 18T Gear Shaft |
| (3) 24T Gear Shaft | (7) External Snap Ring |
| (4) 20T Gear Shaft | (8) 27T Gear |



12190P30290



12190P30300



12190P30310

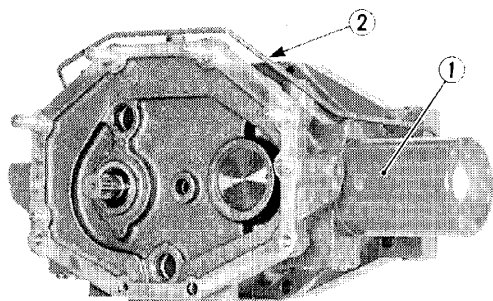
12190S30280

(6) Disassembling Hydrostatic Transmission

Oil Filter Cartridge and Bypass Pipe

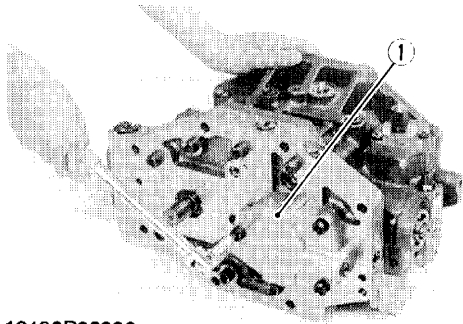
1. Remove the oil filter cartridge (1) and drain an oil.
2. Remove the bypass pipe (2).

- | | |
|--------------------------|-----------------|
| (1) Oil Filter Cartridge | (2) Bypass Pipe |
|--------------------------|-----------------|



12190P30320

12190S30290



12190P30330

Charge Pump

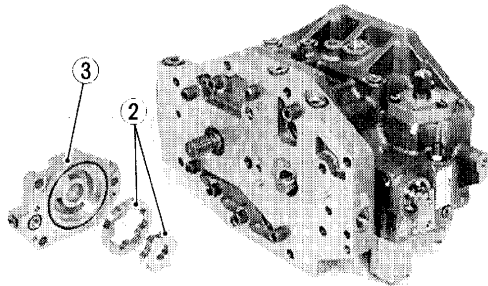
1. Remove the charge pump mounting hex. socket head screws, and remove the charge pump assembly (1) from the HST housing.

(When reassembling)

■ **NOTE**

- Take care not to damage the O-ring.

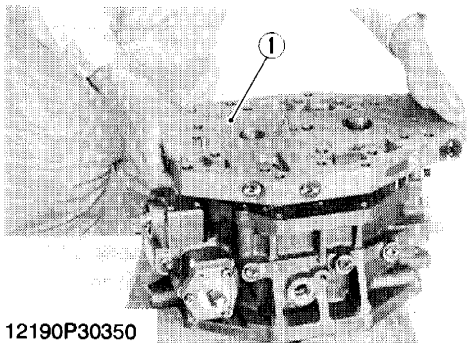
Tightening torque	Charge pump case mounting screw	98 to 123 N·m 10 to 12.5 kgf·m 72.3 to 90.4 ft·lbs
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12190P30340

- (1) Charge Pump Assembly
- (2) Gerotor Assembly
- (3) Charge Pump Housing

12190S30300



12190P30350

Port Block

1. Remove the port block mounting hex. socket head screws.
2. Lift and remove the port block (1) from the HST housing.

(When reassembling)

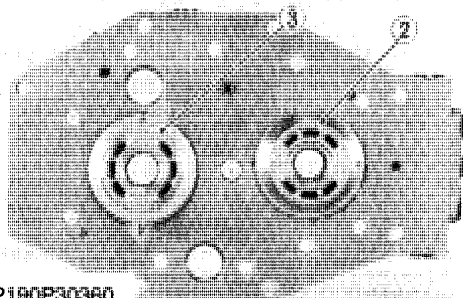
- Install port block with O-ring, valve plates and new gasket in place.

■ **IMPORTANT**

- Valve plates (2), (3) may stick to the port block but they are not fixed. Take care not to drop them. And these valve plates are not interchangeable.

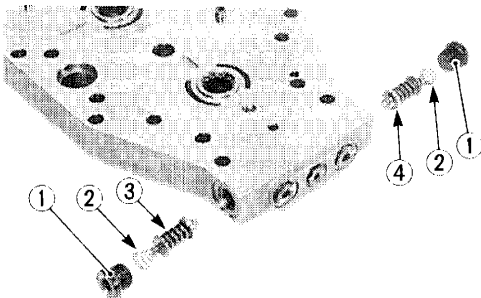
Tightening torque	Port block mounting hex. socket screw	98 to 123 N·m 10 to 12.5 kgf·m 72.3 to 90.4 ft·lbs
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- (1) Port Block
- (2) Valve Plate of Motor
- (3) Valve Plate of Pump



12190P30360

12190S30310



12190P30370

Check and High Pressure Relief Valve

1. Remove the hex. socket head plug (1) and remove the spring (2) and relief valve assembly (3), (4).

(When reassembling)

- Take care not to damage the O-ring on the plug.

Tightening torque	Hex. socket head plug	54 to 68 N·m 5.5 to 7.0 kgf·m 39.8 to 50.6ft·lbs
-------------------	-----------------------	--

- (1) Plug
- (2) Spring
- (3) Check and High Pressure Relief Valve Assembly (Forward)
- (4) Check and High Pressure Relief Valve Assembly (Reverse)

12190S30320

Pipes and Cylinder Block Assemblies

1. Remove three pipes (1), (2), (4).
2. Remove both motor and pump cylinders (3), (5) with pistons.

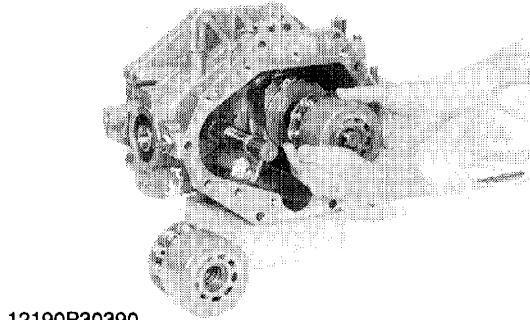
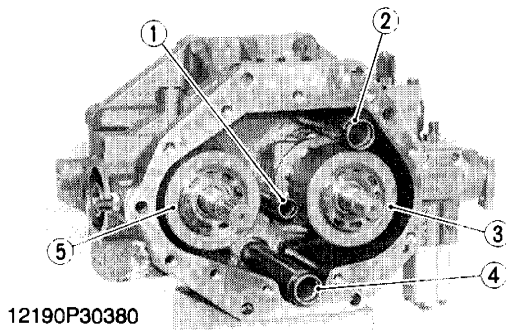
(When reassembling)

- Apply clean hydrostatic transmission oil to cylinder blocks, pistons and O-rings.
- Apply grease to the O-rings of pipes.

NOTE

- Take care not to damage the surface of cylinder blocks, pistons and O-rings.
- Do not interchange pistons between pump and motor cylinder block.

- | | |
|-------------------------------|--------------------------------------|
| (1) Pipe for Transmission Oil | (4) Pipe for Front Wheel Drive Shaft |
| (2) Pipe for PTO Shaft | (5) Motor Cylinder Block |
| (3) Pump Cylinder Block | |



12190S30330

Motor Shaft

1. Remove the internal snap ring (3).
2. Pull out the shaft cover (1) with M5 bolt (2).
3. Tap the motor shaft (4) with a plastic hammer slightly to slide out it to the front side.
4. Remove the thrust plate (5).

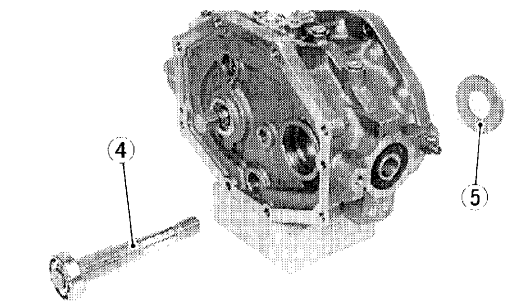
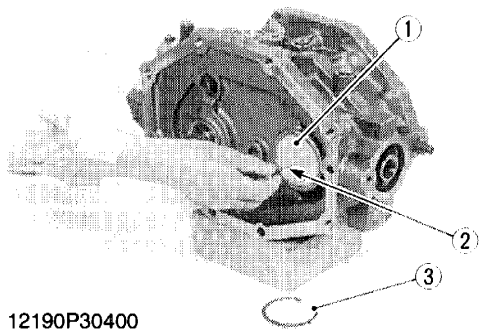
(When reassembling)

- Install the snap ring with its rounded edge facing the gear so that its sharp edge in the groove keep itself in place against the face.
- Apply clean hydrostatic transmission oil to the thrust plate.

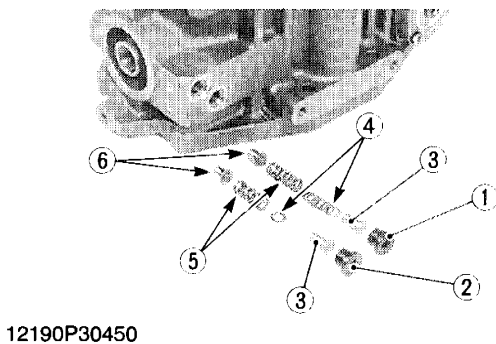
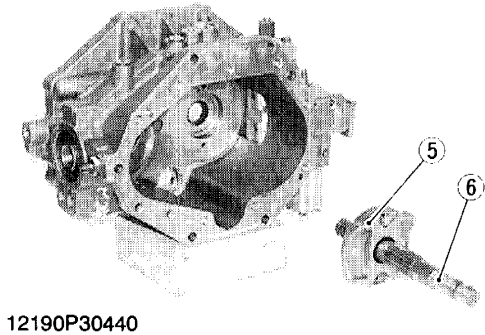
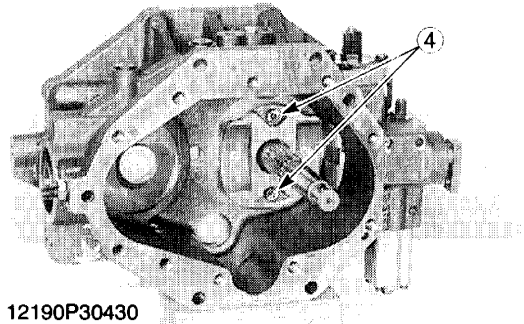
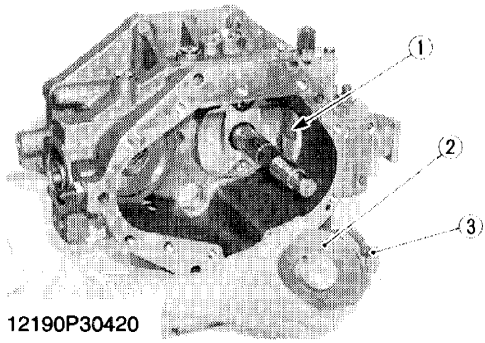
NOTE

- Take care not to damage the O-ring.

- | | |
|------------------------|------------------|
| (1) Shaft Cover | (4) Motor Shaft |
| (2) M5 Bolt | (5) Thrust Plate |
| (3) Internal Snap Ring | |



12190S30340



Washplate and Pump Shaft

1. Remove the swashplate (2).
2. Remove the cradle bearing bracket mounting hex. head screws (4).
3. Tap the pump shaft (6) with a plastic hammer slightly to slide out it with cradle bearing bracket (5) to the rear side.

(When reassembling)

- Place the swashplate (2) into the housing, align the slot guide (3) of swashplate and groove (1) of servo piston.
- Apply clean hydrostatic transmission oil to the surface of swashplate and cradle bearing.

Tightening torque	Cradle bearing mounting hex. socket head screw	28 to 35 N·m 2.9 to 3.6 kgf·m 21 to 26 ft·lbs
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- | | |
|----------------|--------------------------------------|
| (1) Groove | (4) Bracket Mounting Hex. Head Screw |
| (2) Swashplate | (5) Cradle Bearing Bracket |
| (3) Slot Guide | (6) Pump Shaft |

12190S30350

Charge Relief Valve and Filter Protective Relief Valve

1. Remove the hex. socket head plug (1), (2).
2. Remove the spring guide (3), shim (4), spring (5) and valve poppet (6).

(When reassembling)

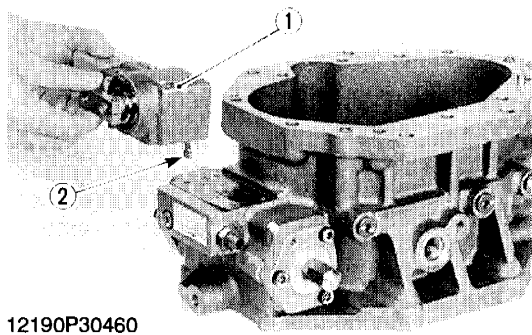
NOTE

- Install either valve component, noting the number of shims (4) in the charge relief valve and the filter protective relief valve.
- Take care not to damage the O-ring of the both relief valves.

Tightening torque	Hex. socket head plug	30 to 37 N·m 3.1 to 3.8 kgf·m 22.4 to 27.5 ft·lbs
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- | | |
|--|------------------|
| (1) Hex. Socket Head Plug for Filter Protective Relief Valve | (3) Spring Guide |
| (2) Hex. Socket Head Plug for Charge Relief Valve | (4) Shim |
| | (5) Spring |
| | (6) Valve Poppet |

12190S30360



12190P30460

Servo Regulator Assembly

1. Remove the regulator mounting hex. head screw.
2. Remove the servo regulator assembly (1).

(When reassembling)

- Place a new gasket on the housing.
- Install the servo regulator assembly to the housing, align the feedback lever (2) of regulator and groove of servo piston.

NOTE

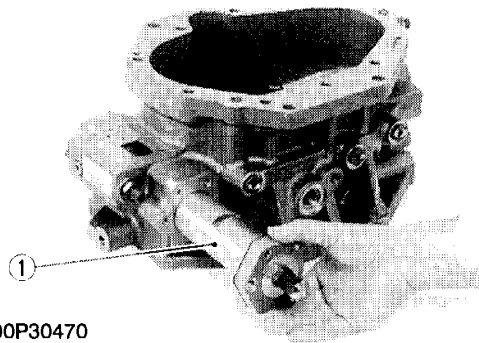
- Do not disassemble the regulator assembly, since it has been factory-adjusted.

Tightening torque	Regulator mounting hex. socket head screw	6.9 to 8.3 N·m 0.7 to 0.85 kgf·m 5.1 to 6.1 ft·lbs
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(1) Servo Regulator Assembly

(2) Feedback Lever

12190S30370



12190P30470

Servo Piston Assembly

1. Remove the servo piston assembly mounting hex. head screw.
2. Pull out the servo piston assembly (1).

(When reassembling)

NOTE

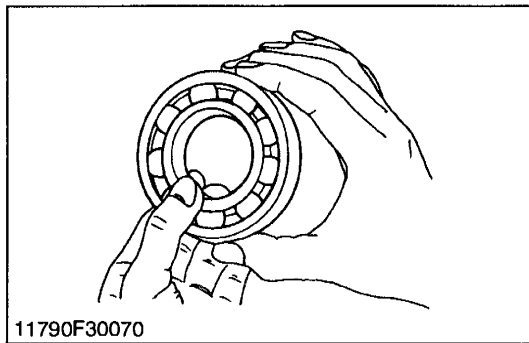
- Take care not to damage the surface of servo piston.
- Do not disassemble the servo piston assembly, since it has been factory-adjusted.

Tightening torque	Servo piston mounting hex. head screw	28 to 35 N·m 2.9 to 3.6 kgf·m 21 to 26 ft·lbs
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(1) Servo Piston Assembly

12190S30380

SERVICING

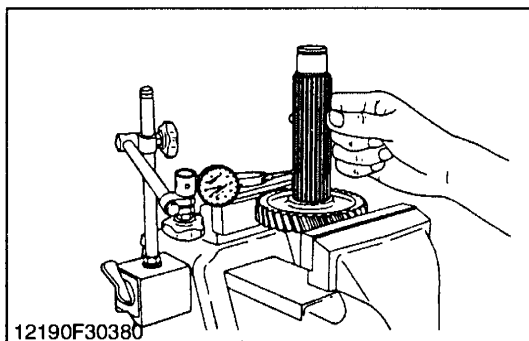


11790F30070

Checking Bearing

1. Hold the inner race, and push and pull the outer race in all directions to check for wear and roughness.
2. Apply transmission fluid to the bearing, and hold the inner race. Then, turn the outer race to check rotation.
3. If there is any defect, replace it.

11790S30180



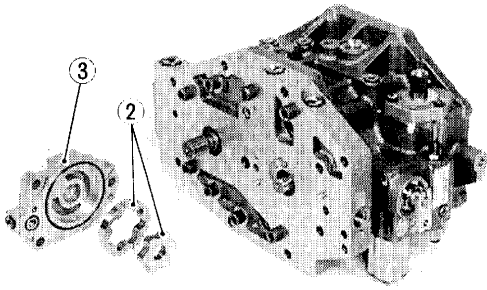
12190F30380

Clearance between Gear and Spline or Hub and Spline

1. Secure the gear or the hub in a vise.
2. Set a dial gauge (lever type) with its finger on the spline.
3. Move the shaft to measure the clearance.
4. If the clearance exceeds the allowable limit, replace them.

Clearance between gear and spline or hub and spline	Factory spec.	0.030 to 0.078 mm 0.00118 to 0.00307 in.
	Allowable limit	0.2 mm 0.008 in.

12190S30390



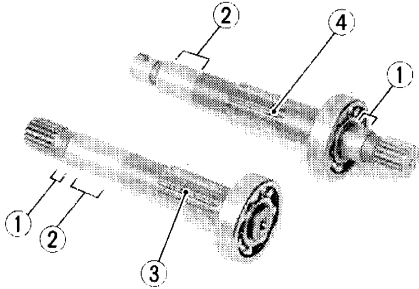
12190P30340

Charge Pump

1. Check the charge pump housing (2) and the gerotor assembly (1) for scratches and wear.
2. If scratch or worn, replace the charge pump complete assembly.

(1) Gerotor Assembly (2) Charge Pump Housing

12190S30400



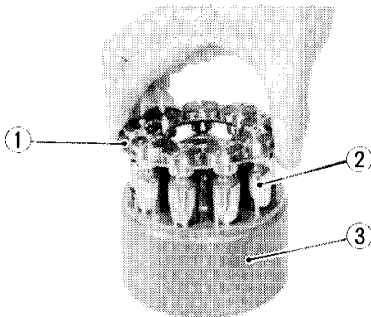
12190P30480

Pump Shaft and Motor Shaft

1. Check the seal surface (1) and the bearing surface (2).
2. If the shaft is rough or groove, replace it.

(1) Seal Surface (3) Motor Shaft
(2) Bearing Surface (4) Pump Shaft

12190S30410



12190P30490

Cylinder Block Bore and Pistons

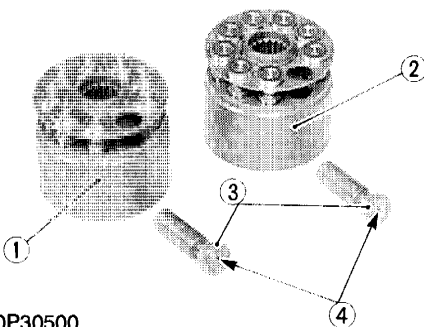
1. Lift all the pistons gently with the retainer plate (1).
2. Check the pistons for their free movement in the cylinder block bores.
3. If the piston or the cylinder block bore is scored, replace cylinder block assembly.

IMPORTANT

- Do not interchange pistons between pump and motor cylinder block.

(1) Retainer Plate (3) Cylinder Block
(2) Piston

12190S30420



12190P30500

Piston Slipper

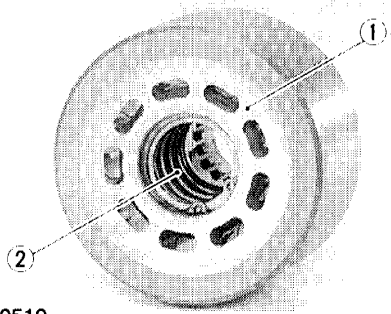
1. Check the slipper (3) for flatness.
2. If rounded, replace.
3. Measure the thickness of piston slipper.
4. If the measurement is less than the allowable limit, replace.
5. Check the lubricant hole (4) for clogging.

IMPORTANT

- Do not interchange pistons between pump and motor cylinder block.

(1) Pump Cylinder (3) Piston Slipper
(2) Motor Cylinder (4) Lubricant Hole

12190S30430



12190P30510

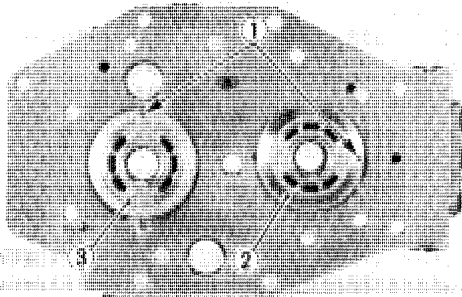
Cylinder Block Face

1. Check the polished face (1) of cylinder block for scoring.
2. If scored, replace cylinder block assembly.
3. Check the spring (2) for breakage.
4. If broken, replace cylinder block assembly.

(1) Polished Face

(2) Spring

12190S30440



12190P30360

Valve Plate

1. Check the engagement of the valve plate (2), (3) and the anchor pin (1).
2. Pushing the valve plate against the anchor pin, lift it to remove.
3. Check the valve plate for foreign particles.
4. Clean the valve plate and dry with compressed air.
5. Check the valve plate for scratches, wear and erosion. (Run a finger nail across the valve plate surface. If worn, it will be felt.)
6. If worn or scored, replace.

NOTE

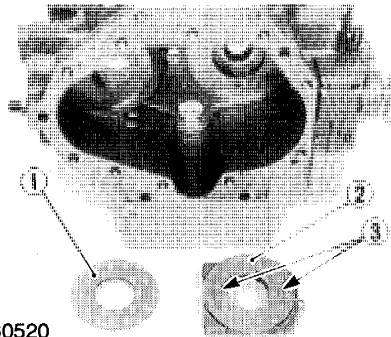
- After checking, coat them with hydrostatic transmission oil.
- Valve plates are not interchangeable.

(1) Anchor Pin

(3) Valve Plate (Pump)

(2) Valve Plate (Motor)

12190S30450



12190P30520

Thrust Plate, Swashplate and Cradle Bearing

1. Check the thrust plate (1) for scratches and excessive wear.
2. If worn or scored, replace.
3. Check the piston contact face of swashplate (2) for scratches and excessive wear and check the holes (3) of swashplate (2) for clogged.
4. If worn or scored, replace and if holes are clogged, clean them.
5. Check the surface of cradle bearings (4) for scratches and excessive wear.
6. If worn or scored, replace.

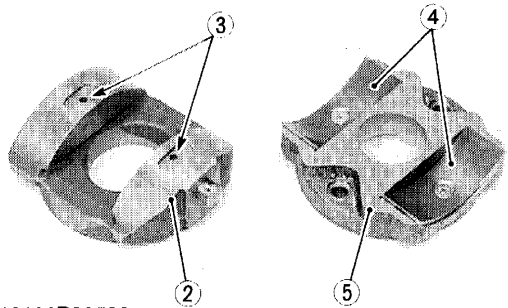
(1) Thrust Plate

(4) Cradle Bearing

(2) Swashplate

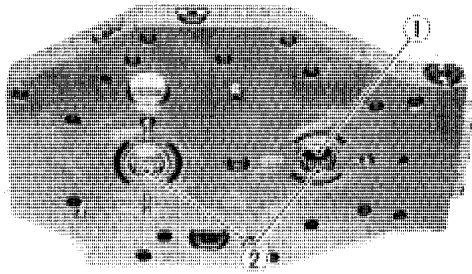
(5) Cradle Bearing Bracket

(3) Hole



12190P30530

12190S30460



12190P30540

Oil Seals and Bearings for Shaft

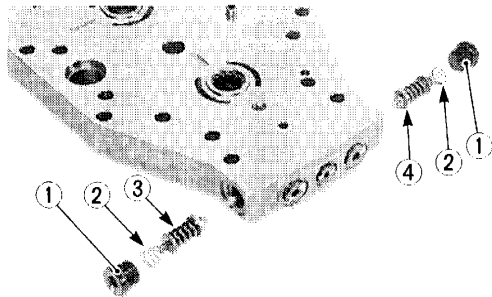
1. Remove the internal snap ring and check the oil seals (1) for damage.
2. Check the bearings (2) for wear.
3. If the bearings are worn, replace.

NOTE

- After checking, coat the bearing with hydrostatic transmission oil and the oil seal lip with grease.

- (1) Oil Seal (2) Needle Bearing

12190S30470



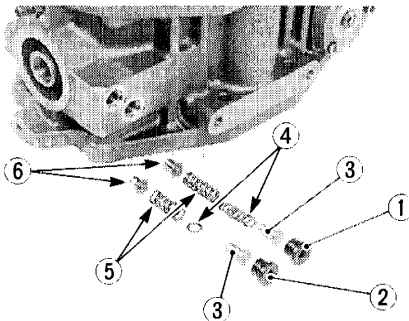
12190P30370

Check and High Pressure Relief Valve

1. Check the valve plug (1) and valve (3) for scratches and damage.
2. Check the valve seat in the port block for damage.
3. Check the spring (2) for breakage and wear.
4. If anything unusual, replace the check and high pressure relief valve assembly.

- (1) Valve Plug (4) Check and High Pressure Relief Valve Assembly (Reverse)
 (2) Spring (3) Check and High Pressure Relief Valve Assembly (Forward)

12190S30480



12190P30450

Charge Relief Valve and Filter Protective Relief Valve

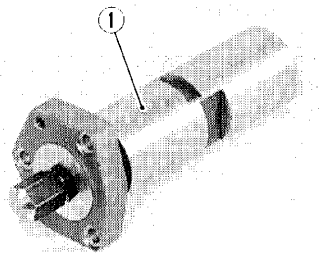
1. Check the spring guide (3), spring (5) and valve poppet (6) for scratches, breakage and damage.
2. If anything unusual, replace.

NOTE

- When re-installing the both relief valves, never change the number of shims.

- (1) Plug for Filter Protective Relief Valve (4) Shim
 (2) Plug for Charge Relief Valve (5) Spring
 (3) Spring Guide (6) Valve Poppet

12190S30490



12190P30550

Servo Piston

1. Check the surface of servo piston for scratches and excessive wear.
2. If worn or scored, replace the servo piston assembly.

- (1) Servo Piston Assembly

12190S30500

[2] MID CASE DISASSEMBLING AND ASSEMBLING

(1) Draining the Transmission Fluid

Refer to page 3-NS10.

12190S30810

(2) Separating Panel Frame Assembly

Refer to page 3-NS10.

12190S30810

(3) Separating Rear Fenders and Platform Assembly

Refer to page 3-NS12.

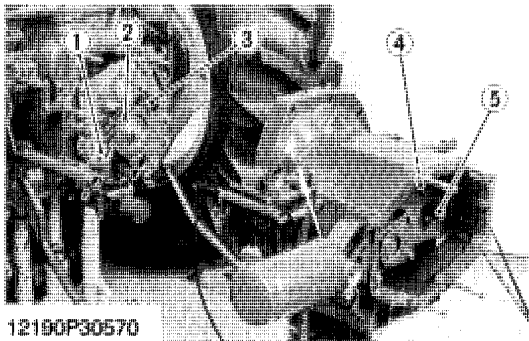
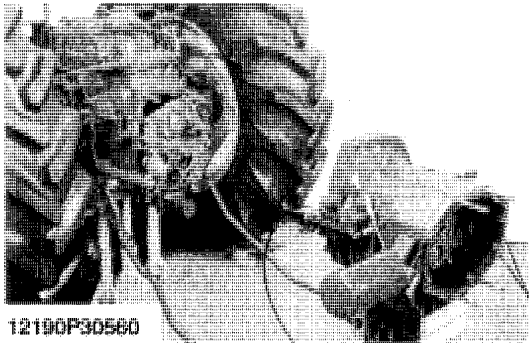
12190S30820

(4) Separating Clutch Housing with HST Assembly

Refer to page 3-NS14.

12190S30830

(5) Separating Mid Case



Separating Mid Case from Transmission Case

1. Place disassembling stand under the mid case and transmission case, then support them.
2. Remove the mid case mounting screw and nut and separate the mid case.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the transmission case and mid case after eliminating the water, oil and stuck liquid gasket.
- Before connecting the mid case with transmission case, install the ball bearing (1) and 30T gear (2) on the transmission case side.

Align the 16T gear shaft (4) to the coupling (3) by turning the 22T gear shaft (5). And connect the mid case with the transmission case. The two shafts should be aligned to the bearings.

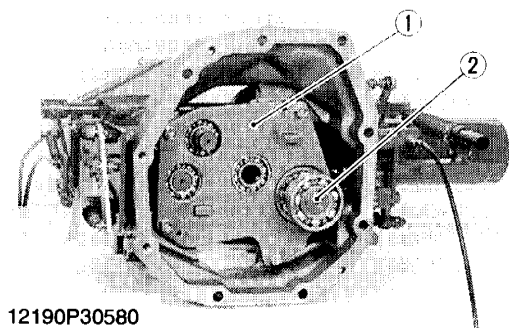
Tightening torque	Mid case and transmission case mounting screw and nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft·lbs
	Mid case and transmission case mounting stud bolt	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft·lbs

- (1) Bearing
(2) 30T Gear
(3) Coupling

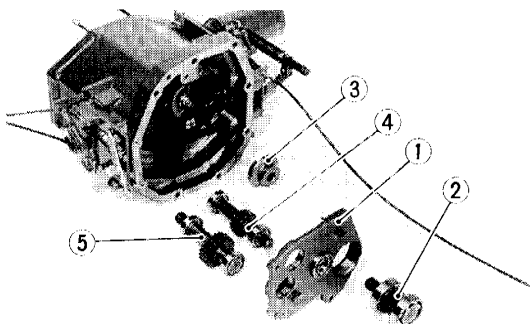
- (4) 16T Gear Shaft
(5) 22T Gear Shaft

12190S30510

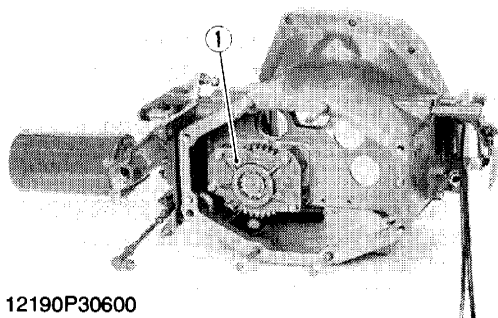
(6) Disassembling Mid Case



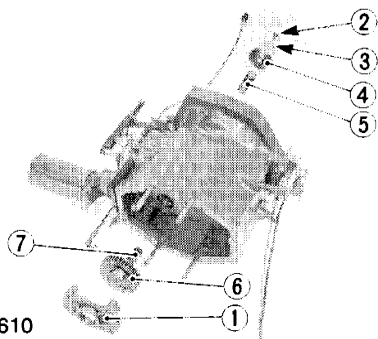
12190P30580



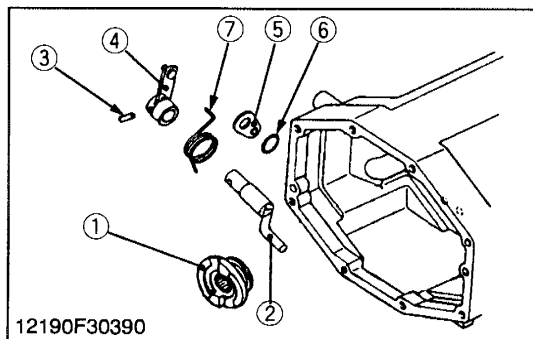
12190P30590



12190P30600



12190P30610



12190F30390

Bearing Holder, 16T Gear Shaft and 22T Gear Shaft

1. Pull out the 11T gear shaft (2) with bearings.
2. Remove the mid case bearing holder mounting screws, and set the jack screws. Then, turn the jack screws to remove the bearing holder (1).
3. Pull out the 16T gear shaft (4) with ball bearings.
4. Pull out the 22T gear shaft (5) with ball bearings.

(When reassembling)

- Tap in the mid case bearing holder (1) with plastic hammer until contact to mid case, and then tighten the screws to specified torque.

Tightening torque	Mid case bearing holder mounting screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft·lbs
-------------------	--	---

- | | |
|-----------------------------|--------------------|
| (1) Mid Case Bearing Holder | (4) 16T Gear Shaft |
| (2) 11T Gear Shaft | (5) 22T Gear Shaft |
| (3) PTO Clutch Cam, OUT | |

12190S30520

PTO Counter Shaft and Bearing Holder

1. Remove the bearing holder (1).
2. Lock the 33T gear (6) and loosen the one-way clutch cam mounting screw (2).
3. After removing the clutch cam and spring, tap out the PTO counter shaft with 33T gear and bearing to the front.

(When reassembling)

Tightening torque	One-way clutch cam mounting screw	60.8 to 70.6 N·m 6.2 to 7.2 kgf·m 44.8 to 52.1 ft·lbs
	Bearing holder mounting screw	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft·lbs

- | | |
|--|------------------------|
| (1) Bearing Holder for PTO Counter Shaft | (4) PTO Clutch Cam, IN |
| (2) One-way Clutch Cam Mounting Screw | (5) Spring |
| (3) Plain Washer | (6) 33T Gear |
| | (7) PTO Counter Shaft |

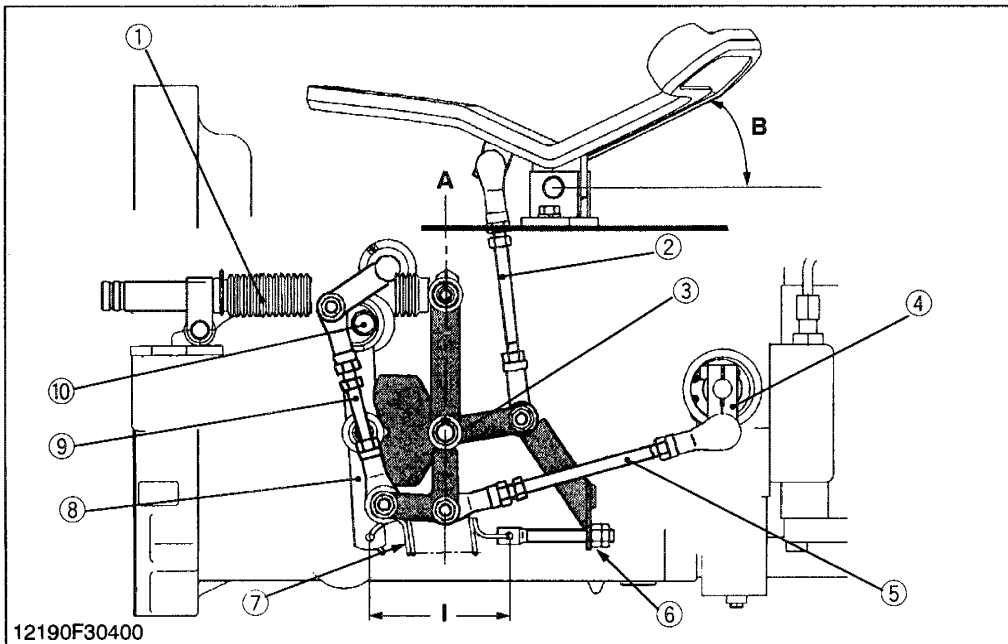
12190S30530

PTO Shift Levers

1. Tap out the spring pin (3), and remove the shift arm (4) and spring (7).
2. Remove the holder (5) and shift fork (2).

- | | |
|------------------------|------------|
| (1) One-way Clutch Cam | (5) Holder |
| (2) Shift Fork | (6) O-ring |
| (3) Spring Pin | (7) Spring |
| (4) Shift Arm | |

12190S30540

HST Linkage

- (1) Damper
- (2) Speed Control Rod
- (3) Neutral Holder Arm
- (4) HST Control Lever
- (5) Neutral Adjusting Rod
- (6) Spring Adjusting Screw
- (7) Spring
- (8) Neutral Holder Assembly
- (9) Cruise Control Adjusting Rod
- (10) Neutral Adjuster

12190F30400

1. Remove the damper (1).
2. Remove the cruise control adjusting rod (9).
3. Disconnect the spring (7).
4. Remove the neutral adjusting rod (5), speed control rod (2) and neutral holder arm (3) as a unit.
5. Remove the bracket with neutral holder assembly (8), (10).

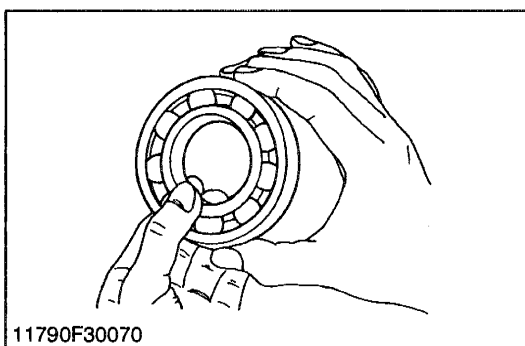
(When reassembling)**NOTE**

- Be sure to tighten lock nuts firmly.

(When reassembling)

- Do not change the length for cruise control adjusting rod (9), speed control rod (2), neutral adjusting rod (5) and spring adjusting screw (6) since it has been factory adjusted. If these length or position were changed or replaced with new parts following the below adjusting procedure.
 - i) Adjust for line "A" of neutral holder arm (3) to make a right angle with the body by neutral adjuster (10).
 - ii) Adjust for the length "I" of spring (7) to become 100 mm (3.94 in.).
 - iii) Adjust neutral adjusting rod (5) to become a position where the position of the HST control lever (4) does not change at the unit.
 - iv) Adjust speed control rod (2) so that angle "B" of the HST pedal may become 25 to 27 degree in neutral position.

12190S30550

SERVICING

11790F30070

Checking Bearing

1. Hold the inner race, and push and pull the outer race in all directions to check for wear and roughness.
2. Apply transmission fluid to the bearing, and hold the inner race. Then, turn the outer race to check rotation.
3. If there is any defect, replace it.

11790S30180

[3] TRANSMISSION CASE DISASSEMBLING AND ASSEMBLING

(1) Draining the Transmission Fluid

Refer to page 3-NS10.

12190S30810

(2) Separating Panel Frame Assembly

Refer to page 3-NS10.

12190S30810

(3) Separating Rear Fender and Platform Assembly

Refer to page 3-NS12.

12190S30820

(4) Separating Clutch Housing with HST

Refer to page 3-NS14.

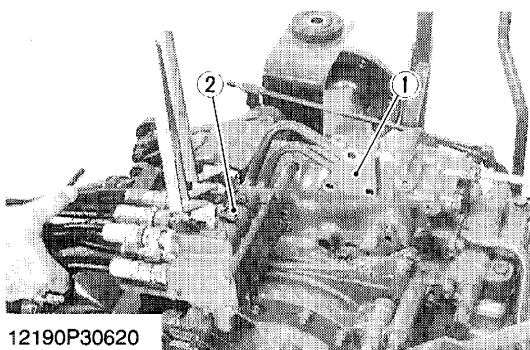
12190S30830

(5) Separating Mid Case

Refer to page 3-NS26.

12190S30840

(6) Separating Hydraulic Cylinder and Rear Axle Case



12190P30620

Auxiliary Control Valves (If Equipped)

1. Loosen and remove the hydraulic pipe mounting three screws.
2. Loosen and remove the auxiliary control valves mounting two screws from floor seat support RH.
3. Take out the auxiliary control valves (2), hydraulic pipe (1) and quick couplers as a unit.

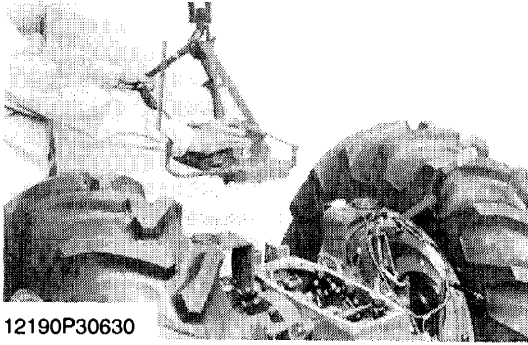
(When reassembling)

- Take care not to damage the O-rings.

(1) Hydraulic Pipe

(2) Auxiliary Control Valves

12190S30560

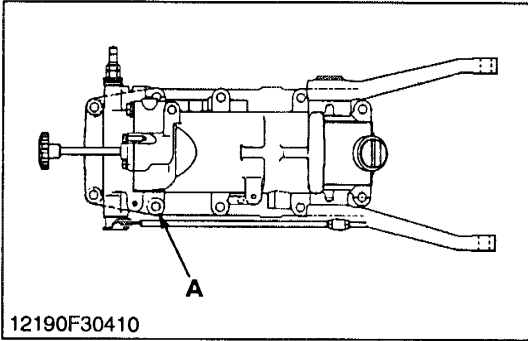


Hydraulic Cylinder Assembly

1. Remove the wiring harness.
2. Disconnect the draft control rod from the top link bracket. (If equipped.)
3. Loosen and remove the hydraulic cylinder assembly mounting screws and nut.
4. Support the hydraulic cylinder assembly with nylon lift strap and hoist, and then take out it.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the hydraulic cylinder assembly and transmission case after eliminating the water, oil and stuck liquid gasket.
- When replacing the hydraulic cylinder assembly mounting stud bolts, apply liquid lock (Three Bond 1372 or equivalent) to “A” portion of the stud bolt.

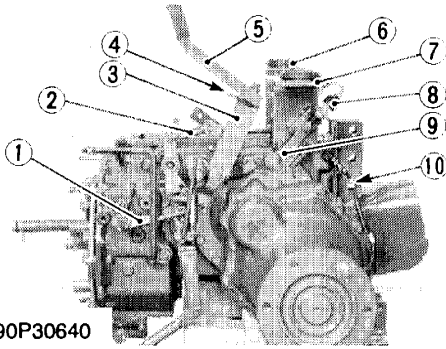


Tightening torque	Hydraulic cylinder assembly mounting stud bolt	34.3 to 49.0 N-m 3.5 to 5.0 kgf-m 25.3 to 362 ft-lbs
	Hydraulic cylinder assembly mounting screw and nut	77.4 to 90.2 N-m 7.9 to 9.2 kgf-m 57.1 to 66.5 ft-lbs

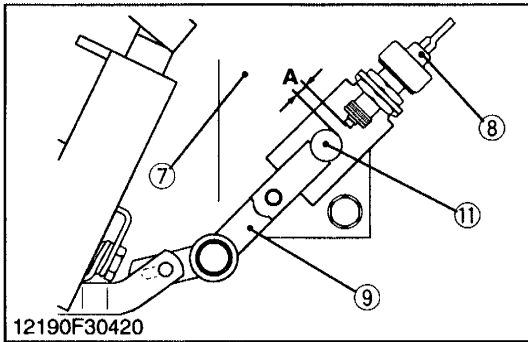
NOTE

- Reassemble the hydraulic cylinder assembly to the tractor, be sure to adjust the position control feedback rod and draft control rod (if equipped). (See page 8-S9, S10.)

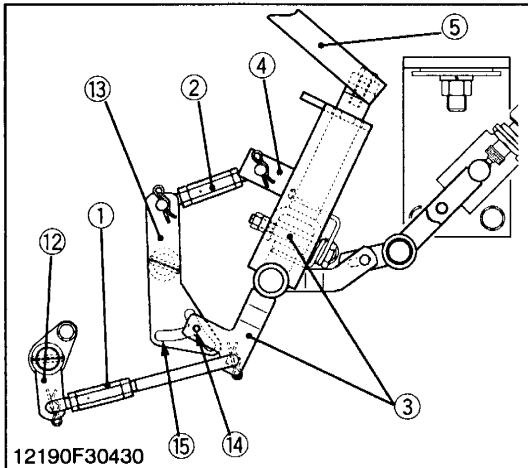
12190S30570



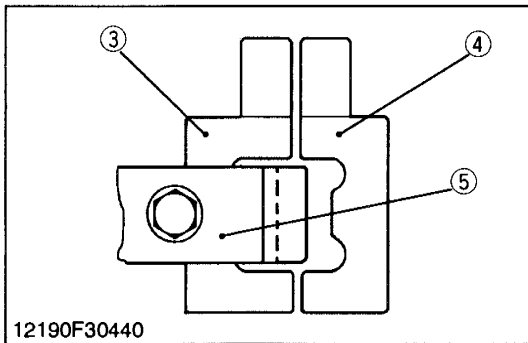
12190P30640



12190F30420



12190F30430



12190F30440

Fender Mount Stay and Range Gear Shift Levers

1. Remove the both rear wheels and support rear axles with stand.
2. Remove the wiring harness (4).
3. Remove the fender mount stay RH (6) and fender mount stay LH (7) with safety switch (8).
4. Remove the shift rod H-M (1) and shift rod L (2).
5. Remove the external snap ring and remove the range gear shift levers (3), (4), (5).
6. Remove the external snap ring and remove the neutral switch link (9) with neutral switch rod (11).

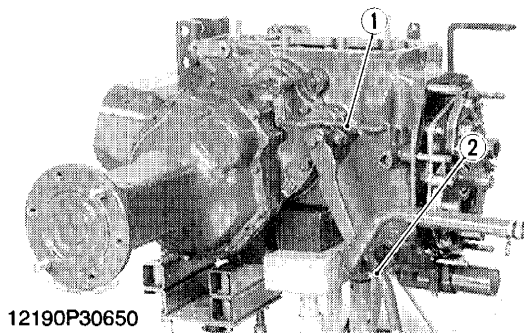
(When reassembling)

- Adjust clearance “A” between safety switch (8) and neutral switch rod (11), when range gear shift lever is M position.
- If the length of shift rod H-M (1) and shift rod L (2) are changed or replace with new ones, adjust the their length following below procedure.
 - i) Set lever H-M (12) and lever L (13) to neutral position.
 - ii) Assemble all the parts.
 - iii) Adjust for pin “B” (14) of range gear shift lever H-M (3) to become center of T shape hole (15) of lever L (13) with shift rod H-M (1). (See figure left.)
 - iv) Adjust shift rod L (2) length until the top of the range gear shift lever H-M (3) and lever L (4) get in alignment as shown figure.

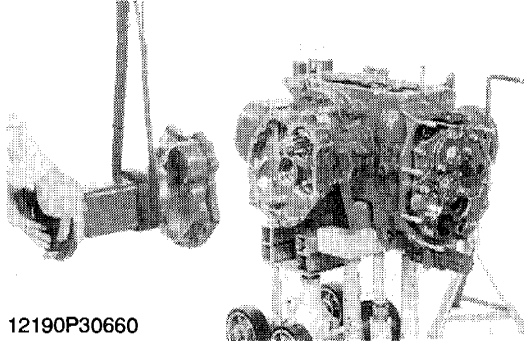
Tightening torque	Rear wheel mounting screws and nuts	197 to 226 N·m 20 to 23 kgf·m 145 to 166 ft·lbs
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- | | |
|---------------------------------|-------------------------|
| (1) Shift Rod H-M | (10) Wiring Harness |
| (2) Shift Rod L | (11) Neutral Switch Rod |
| (3) Range Gear Shift Lever H-M | (12) Lever H-M |
| (4) Range Gear Shift Lever L | (13) Lever L |
| (5) Range Gear Shift Main Lever | (14) Pin B |
| (6) Fender Mount Stay RH | (15) T Shape Hole |
| (7) Fender Mount Stay LH | |
| (8) Safety Switch | |
| (9) Neutral Switch Link | |
- A : Clearance A : 4 to 5 mm (0.16 to 0.20 in.)**

12190S30580



12190P30650



12190P30660

Rear Axle

1. Remove the brake rod (2).
2. Remove the Mid PTO shift linkage (1). (Right side only.)
3. Support the rear axle case with nylon lift strap and hoist.
4. Remove the rear axle case mounting screws and nuts.
5. Separate the rear axle case from brake case.

(When reassembling)

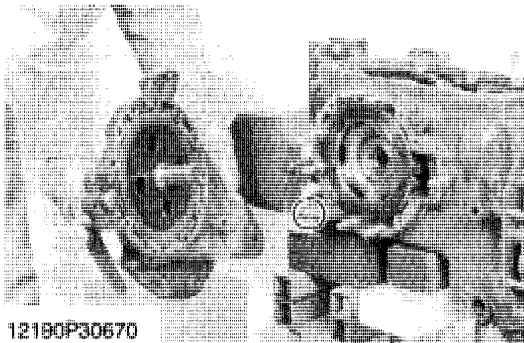
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the rear axle case and brake case, after eliminating the water, oil and stuck liquid gasket.

Tightening torque	Rear axle case mounting screw and nut	M10 screws and nut	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
		M10 nut (L3600·L4200 only)	60.8 to 70.5 N·m 6.2 to 7.2 kgf·m 44.9 to 52.1 ft-lbs
		M12 screw and nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
		Stud bolt	24.5 to 31.4 N·m 2.5 to 3.2 kgf·m 18.1 to 23.1 ft-lbs

(1) Mid PTO Shift Linkage

(2) Brake Rod

12190S30590



12190P30670

Brake Case

1. Remove the brake case mounting screws, nuts and pin.
2. Separate the brake case, by tapping the brake cam lever lightly.
3. Remove the cam plate and six steel balls.

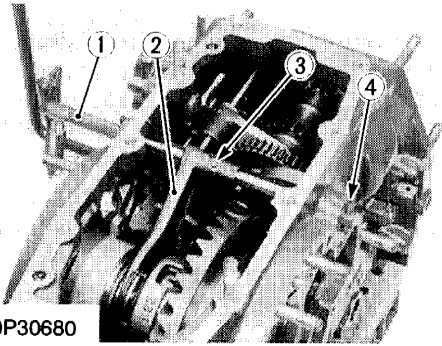
(When reassembling)

- Apply grease to the brake ball seats. (Do not grease excessively.)
- Before installing the brake case to the transmission case, install the steel balls and the cam plate to the transmission case.
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the brake case and transmission case, after eliminating the water, oil and stuck liquid gasket.
(Especially do not forget to apply liquid gasket to the part surrounded by "O".

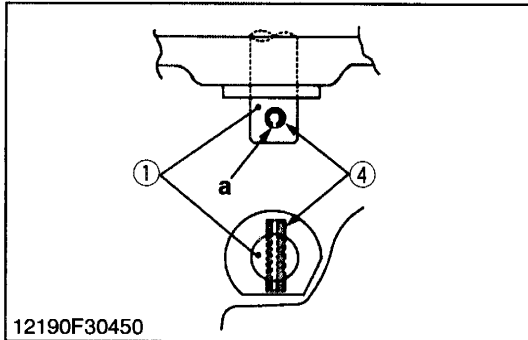
Tightening torque	Brake case mounting stud bolt	38.2 to 45.1 N·m 3.9 to 4.6 kgf·m 28.2 to 33.3 ft-lbs
	Brake case mounting screw and nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Brake case mounting lever shaft screw	62.8 to 72.5 N·m 6.4 to 7.4 kgf·m 46.3 to 53.5 ft-lbs

12190S30600

(7) Disassembling Transmission Case



12190P30680



12190F30450

Differential Lock Shift Fork

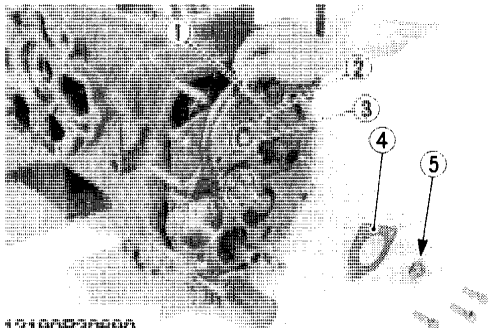
1. Tap out the left side spring pin (4).
2. Remove the cotter pin and take out the clevis pin (3).
3. Draw out the differential lock fork shaft (1) and take out the differential lock shift fork (2).

(When reassembling)

- Apply grease to the left and right oil seals on the transmission case.
- Insert the clevis pin (3) from the bottom and install the washer and cotter pin.
- Tap in the spring pin (4) so that its split portion (a) may face outward as shown in the figure.

- (1) Differential Lock Fork Shaft
 - (2) Differential Lock Shift Fork
 - (3) Clevis Pin
 - (4) Spring Pin
- (a) Split Portion

12190S30610



12190P30690

Pinion Bearing Cover

1. Remove the stake of lock nut (5).
2. Remove the lock nut (5).
3. Remove the pinion bearing case mounting screws.
4. Take out the pinion bearing cover (4) and shims (1).

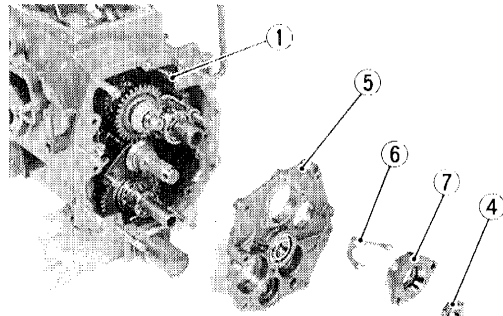
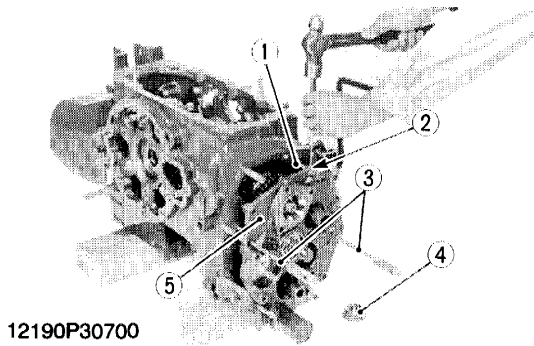
(When reassembling)

- Make sure of the number of shims in the pinion bearing case.
- Replace the lock nut (5) with a new one, and stake the lock nut firmly after installing the parts on the shaft.

Tightening torque	Lock nut	147 to 196 N·m 15 to 20 kgf·m 108 to 145 ft·lbs
	Pinion bearing case mounting screw	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft·lbs

- (1) Shim
- (2) Pinion Bearing Case
- (3) Spiral Bevel Pinion
- (4) Pinion Bearing Cover
- (5) Lock Nut

12190S30620



Transmission Bearing Holder

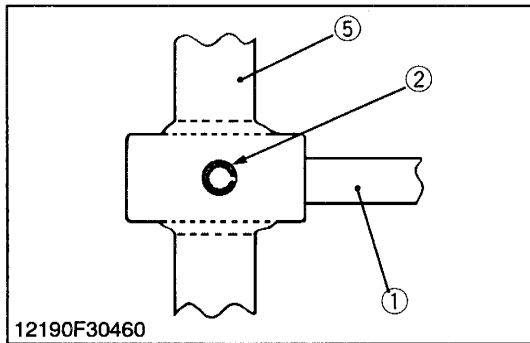
1. Remove the transmission bearing holder mounting screws.
2. Jack up the bearing holder (5) by using the two jack screws (3) until the taper roller bearing (4) can be removed.
3. Tap out the spring pin (2) on the shift rod L (1).
4. Jack up more and remove the transmission bearing holder (5).

(When reassembling)

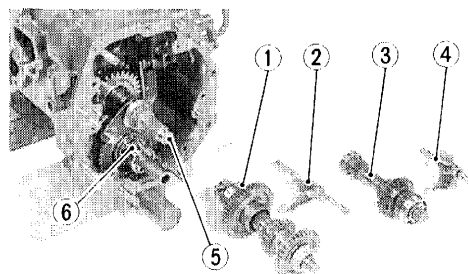
- Tap in the transmission bearing holder with soft hammer until contact to transmission case, and then tighten the screws to specified torque.
- Tap in the spring pin (2) so that its split portion may face forward. (Refer to figure left.)

Tightening torque	Transmission bearing holder mounting screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft·lbs
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- | | |
|--------------------------|---------------------------------|
| (1) Shift Rod L | (5) Transmission Bearing Holder |
| (2) Spring Pin | (6) Shim |
| (3) Jack Screws | (7) Pinion Bearing Case |
| (4) Taper Roller Bearing | |



12190S30630



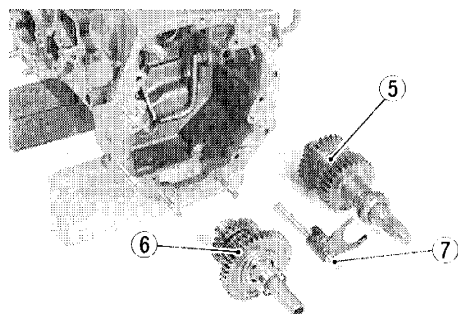
Shaft Assemblies

1. Remove the shift fork rod L (2) and fork.
2. Pull out the 13T gear shaft assembly (3) with the shift fork rod H-M (4) and fork.
3. Pull out the spiral bevel pinion shaft assembly (1).
4. Draw out the PTO drive shaft assembly (5) with shift fork rod (7) and fork.
5. Draw out the front wheel drive shaft assembly (6). (4WD or Mid PTO type only.)

(When reassembling)

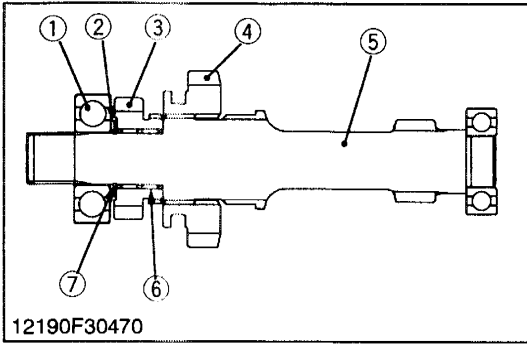
- At first, place PTO drive shaft assembly (5) and front wheel drive shaft assembly (6) just before complete setting, then, place 13T gear shaft assembly (3) and spiral bevel pinion shaft assembly (1) in half setting at the same time. And set (push) the each shaft completely in following order ; 1. Front wheel drive shaft assembly, 2. 13T gear shaft assembly, 3. PTO drive shaft assembly and 4. Spiral bevel pinion shaft assembly.

12190P30720



- | | |
|--|--------------------------------------|
| (1) Spiral Bevel Pinion Shaft Assembly | (5) PTO Drive Shaft Assembly |
| (2) Shift Fork Rod L | (6) Front Wheel Drive Shaft Assembly |
| (3) 13T Gear Shaft Assembly | (7) Mid PTO Shift Fork Rod |
| (4) Shift Fork Rod H-M | |

12190S30640



13T Gear Shaft

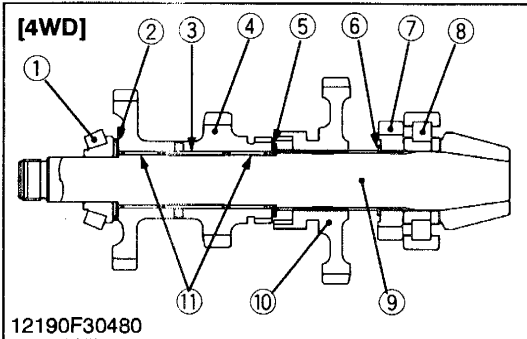
1. Remove the ball bearing (1) and remove the thrust collar (2).
Remove the external snap ring (7) and draw out the 17T gear (3), needle bearing (6) and 26T shifter gear (4).

(When reassembling)

- Direct the groove side of thrust collar (2) to the needle bearing (6) side.
- Install the external snap ring (7) to the groove of the 13T gear shaft (5) firmly.

- | | |
|----------------------|------------------------|
| (1) Ball Bearing | (5) 13T Gear Shaft |
| (2) Thrust Collar | (6) Needle Bearing |
| (3) 17T Gear | (7) External Snap Ring |
| (4) 26T Shifter Gear | |

12190S30650



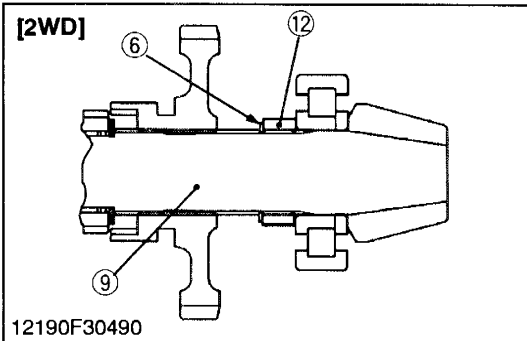
Spiral Bevel Pinion Shaft

1. Remove the taper roller bearing (1).
2. Take out the thrust collar (2), 32T-23T gear (4) needle bearings (11), collar (3), thrust collar (5) and 46T shifter gear (10).
3. Remove the external snap ring (6) and remove the 17T gear (7) (4WD type) or collar (12) (2WD type).
4. Remove the ball bearing (8).

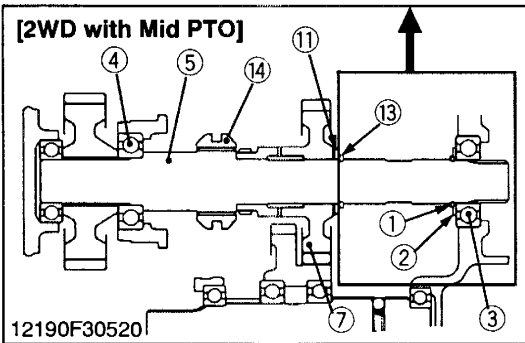
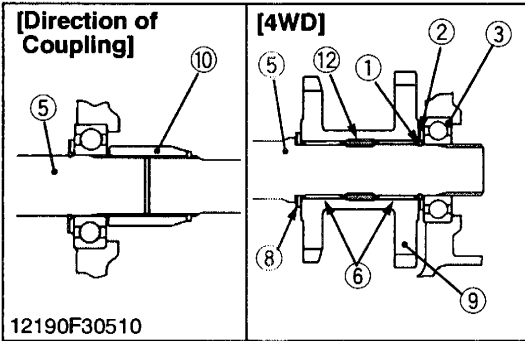
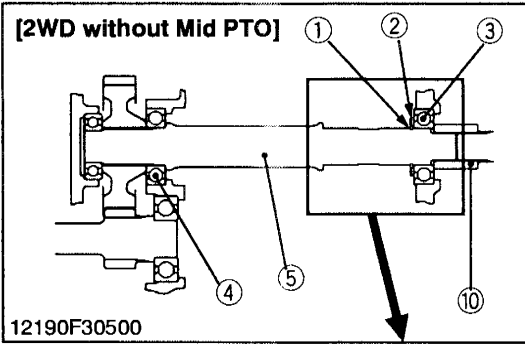
(When reassembling)

- Direct the groove side of the thrust collars (2), (5) to the needle bearings side.
- Be careful with the direction of the 17T gear (front wheel drive gear) (7).

- | | |
|--------------------------|-------------------------------|
| (1) Taper Roller Bearing | (7) 17T Gear |
| (2) Thrust Collar | (8) Ball Bearing |
| (3) Collar | (9) Spiral Bevel Pinion Shaft |
| (4) 32T-23T Gear | (10) 46T Shifter Gear |
| (5) Thrust Collar | (11) Needle Bearing |
| (6) External Snap Ring | (12) Collar |



12190S30660



PTO Drive Shaft

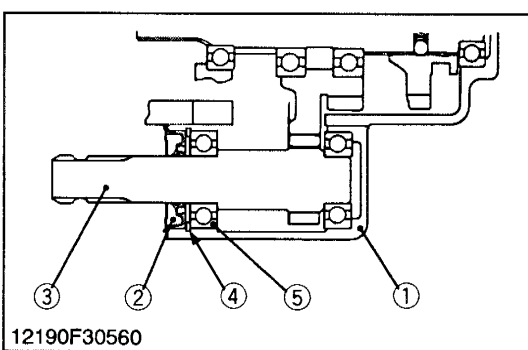
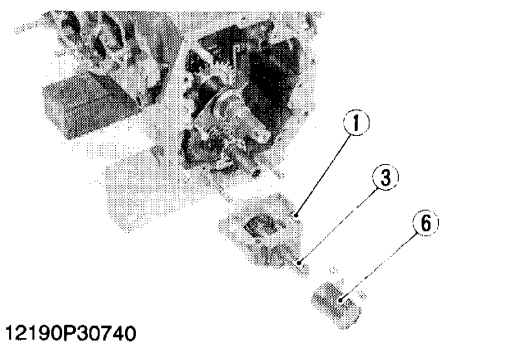
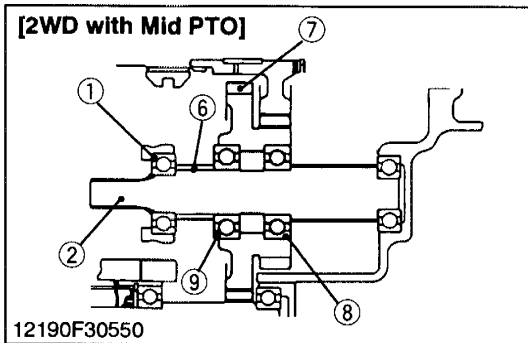
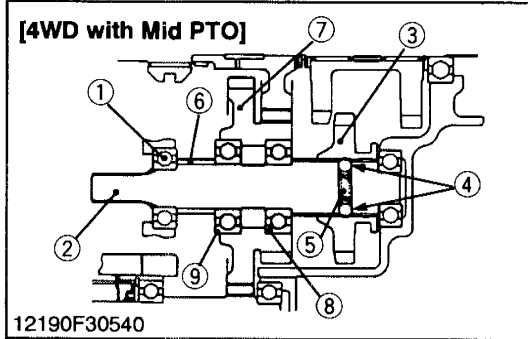
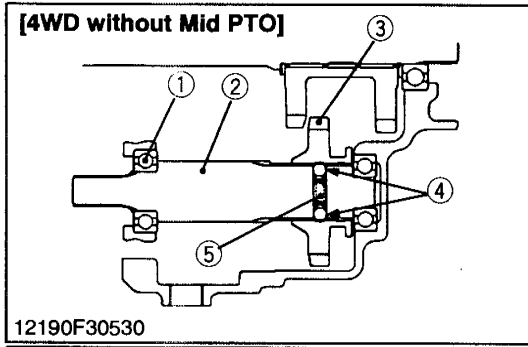
1. Remove the bearing (3) by the bearing puller, and then take out the thrust collar (2) and external snap ring (1).
2. Take out the 29T-29T gear (9) or 29T-31T gear (9). (4WD only.)
3. Remove the external snap ring (13), and then take out the thrust collar (11), 28T gear (7) and shifter (14). (Mid PTO type only.)

(When reassembling)

- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the 28T gear (7). (Mid PTO type only.)
- Direct the taper portion of the coupling (10) to the rear. (Refer to figure left.)
- Direct the thrust collars (2), (8) to the needle bearing (6) side.
- Direct the thrust collar (11) to the 28T gear (7) side.
- Install the external snap ring (1), (13) to the groove of the PTO drive shaft (5) firmly.
- Be careful with the direction of shifter (14), the chamfer side should be set to the 28T gear side (7).

- | | |
|------------------------|----------------------------------|
| (1) External Snap Ring | (9) 29T-29T Gear (L3010 · L3410) |
| (2) Thrust Collar | 29T-31T Gear (L3710 · L4310) |
| (3) Bearing | (10) Coupling |
| (4) Bearing | (11) Thrust Collar |
| (5) PTO Drive Shaft | (12) Collar |
| (6) Needle Bearing | (13) External Snap Ring |
| (7) 28T Gear | (14) Shifter |
| (8) Thrust Collar | |

12190S30670



Front Wheel Drive Shaft

1. Remove the bearing (1) by the bearing puller.
2. Take out the collar (6), bearings (8), (9) and 24T-42T gear (7).
3. Take out the 24T shifter gear (3), balls (4) and spring (5).

NOTE

- Take care not to fly out the balls (4) and spring (5) when take out the 24T shifter gear (3).

- | | |
|-----------------------------|------------------|
| (1) Bearing | (6) Collar |
| (2) Front Wheel Drive Shaft | (7) 24T-42T Gear |
| (3) 24T Shifter Gear | (8) Bearing |
| (4) Balls | (9) Bearing |
| (5) Spring | |

12190S30680

Mid PTO Case (Mid PTO Type Only)

1. Remove the PTO shaft cover (6).
2. Remove the Mid PTO case as a unit.
3. Remove the oil seal (2), and then remove the internal snap ring (4).
4. Tap out the Mid PTO shaft (3) and bearing (5).

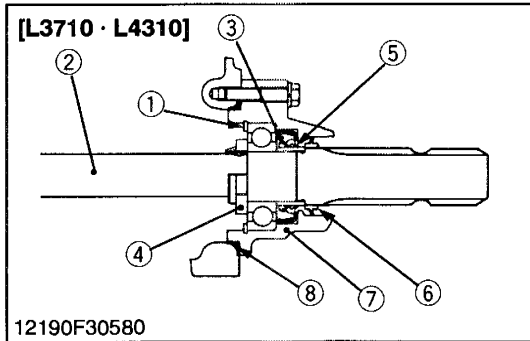
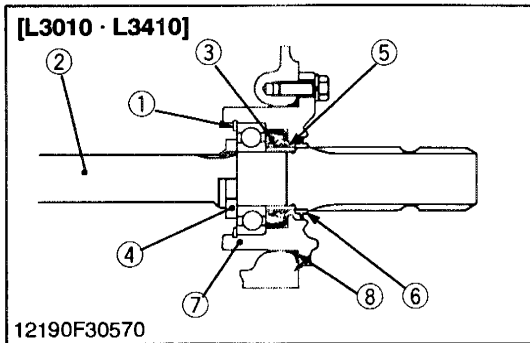
(When reassembling)

- Replace the oil seal (2) with a new one.

Tightening torque	Mid PTO case mounting screws	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft·lbs
-------------------	------------------------------	---

- | | |
|-------------------|------------------------|
| (1) Mid PTO Case | (4) Internal Snap Ring |
| (2) Oil Seal | (5) Bearing |
| (3) Mid PTO Shaft | (6) PTO Shaft Cover |

12190S30690



PTO Shaft

1. Remove the bearing case mounting screws, and draw out the PTO shaft (2) with bearing case.
2. Take out the coupling.
3. Remove the internal snap ring (1).
4. Tap out the PTO shaft (2) to the front.

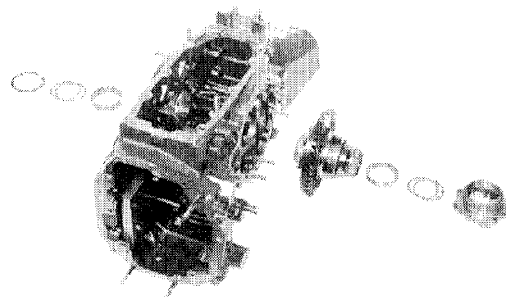
(When reassembling)

- If the lock nut (4) was removed, replace it with a new one. After replacing, be sure to stake it firmly.
- Install the slinger (6) firmly.
- Apply grease to the oil seal (3) and install it, noting its direction.

Tightening torque	Lock Nut	147 to 196 N·m 15 to 20 kgf·m 108 to 145 ft·lbs
	Bearing case mounting screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft·lbs

- (1) Internal Snap Ring
- (2) PTO Shaft
- (3) Oil Seal
- (4) Lock Nut
- (5) Oil Seal Collar
- (6) Slinger
- (7) Bearing Case
- (8) O-ring

12190S30700



12190P30750

Differential Gear Assembly

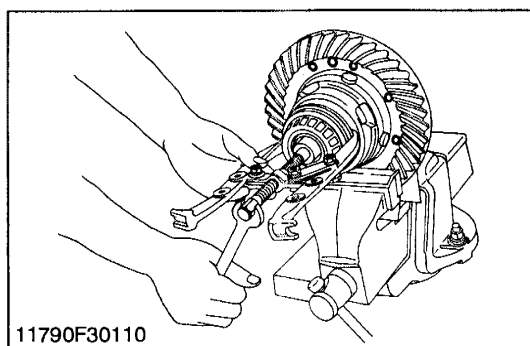
1. Remove the differential support, noting the number of left shims.
2. Take out the differential gear assembly, noting the number of right shims.

(When reassembling)

- Check the spiral bevel gear for wear or damage. If it is no longer serviceable, replace it. Then, also replace the spiral bevel pinion.
- Be sure to install the differential support to position the casting mark “上” on it upward.
- Use same number of shims as before disassembling.

Tightening torque	Differential support mounting screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft·lbs
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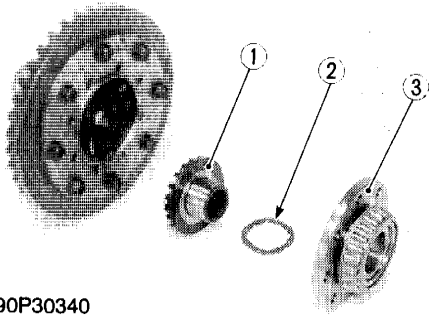
12190S30710



Bearing and Differential Lock Shifter

1. Secure the differential gear in a vise.
2. Remove the differential lock shifter and taper roller bearing as a unit with a puller.

11790S30330



11790P30340

Differential Case Cover and Differential Side Gear

1. Remove the differential case cover (3).
2. Remove the differential side gear (1) and differential side gear washer (2).

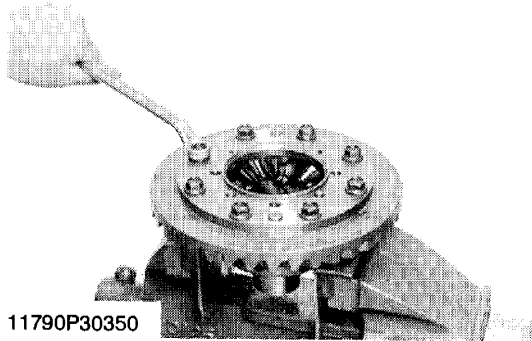
(When reassembling)

- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential side gear boss.

Tightening torque	Differential case cover mounting screw	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
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- (1) Differential Side Gear (3) Differential Case Cover
 (2) Differential Side Gear Washer

11790S30341



11790P30350

Spiral Bevel Gear

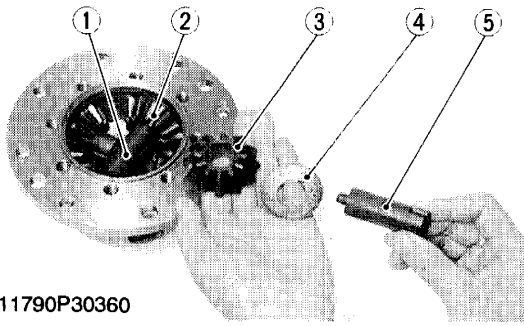
1. Remove the spiral bevel gear.

(When reassembling)

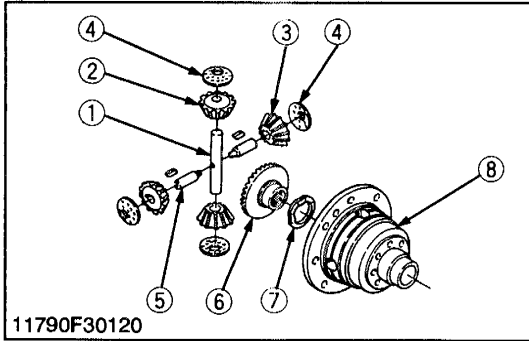
- Check the spiral bevel gear for wear or damage. If it is no longer serviceable, replace it. Then, also replace the spiral bevel pinion shaft.
- Apply liquid lock (Three Bond 1372 or equivalent) to the spiral bevel gear UBS screws.

Tightening torque	Spiral bevel gear UBS screw	68.6 to 88.3 N·m 7.0 to 9.0 kgf·m 50.6 to 65.1 ft-lbs
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12190S30720



11790P30360



11790F30120

Differential Pinion Shaft and Differential Pinion

1. Draw out the differential pinion shaft 2 (5), and take out the differential pinion (3) and differential pinion washer (4).
2. Draw out the differential pinion shaft (1), and take out the differential pinion (2) and differential pinion washer.

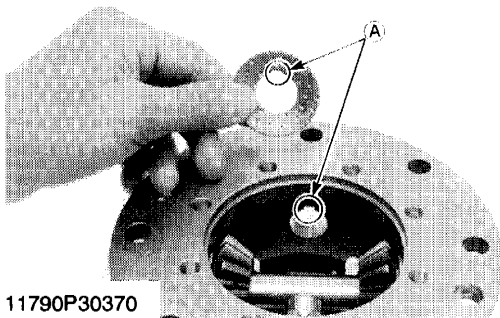
NOTE

- Arrange the parts to know their original position.

(When reassembling)

- Check the differential pinions (2) and (3), and pinion shaft (1) and (5) for excessive wear. If these parts are damaged or excessively worn, replace their parts they are in mesh with, or they sliding on.
- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential pinions.
- Install the parts to their original position.
- Install the differential pinion washer (4), noting its groove position.

- | | |
|---------------------------------|-----------------------------------|
| (1) Differential Pinion Shaft | (6) Differential Side Gear |
| (2) Differential Pinion | (7) Differential Side Gear Washer |
| (3) Differential Pinion | (8) Differential Case |
| (4) Differential Pinion Washer | |
| (5) Differential Pinion Shaft 2 | (A) Fit Groove |



11790P30370

11790S30360

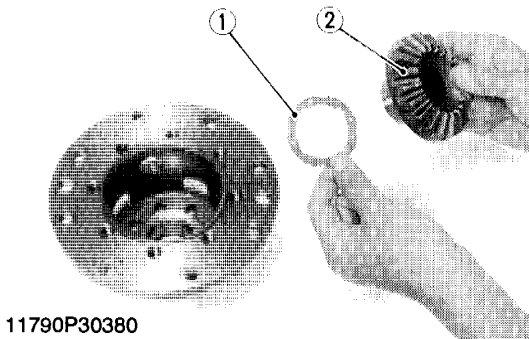
Differential Side Gear

1. Take out the differential side gear (2) and differential side gear washer (1).

(When reassembling)

- Check the thrust and bearing surface of both differential side gears (2). If they are worn or damaged, bores in the differential case may also be damaged. Be sure to replace their parts.

- | | |
|-----------------------------------|----------------------------|
| (1) Differential Side Gear Washer | (2) Differential Side Gear |
|-----------------------------------|----------------------------|

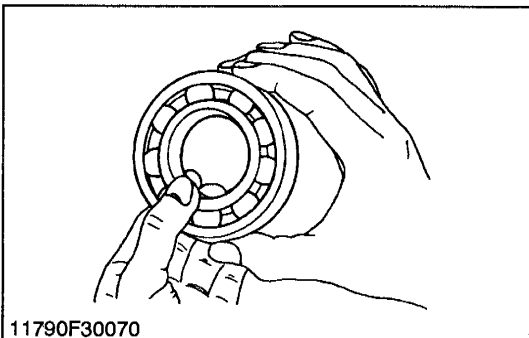


11790P30380

11790S30370

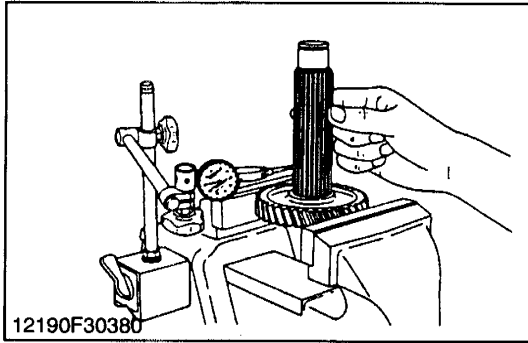
Checking Bearing

1. Hold the inner race, and push and pull the outer race in all directions to check for wear and roughness.
2. Apply transmission fluid to the bearing, and hold the inner race. Then, turn the outer race to check rotation.
3. If there is any defect, replace it.



11790F30070

11790S30180

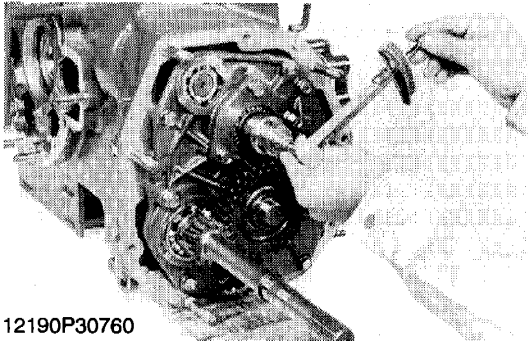


Clearance between Gear and Spline or Hub and Spline

1. Secure the gear or the hub in a vise.
2. Set a dial gauge (lever type) with its finger on the spline.
3. Move the shaft (or hub) to measure the clearance.
4. If the clearance exceeds the allowable limit, replace them.

Clearance between gear and spline or hub and spline	Factory spec.	0.030 to 0.078 mm 0.00118 to 0.00307 in.
	Allowable limit	0.2 mm 0.008 in.

12190S30730

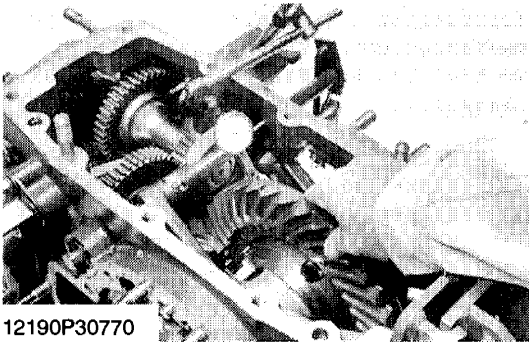


Spiral Bevel Pinion Turning Torque (with Differential Gear)

1. Grip the spiral bevel pinion nut with a torque wrench and measure the turning torque.
2. If the turning torque is not within the factory specifications, check the differential gear turning force, backlash and tooth contact again.

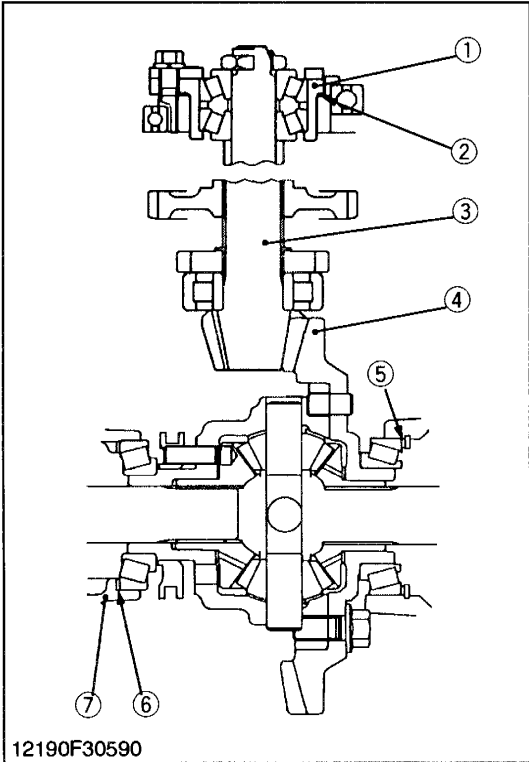
Turning torque (with differential gear)	Factory spec.	3.92 to 6.37 N·m 0.40 to 0.65 kgf·m 2.89 to 4.70 ft·lbs
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12190S30740



Backlash and Tooth Contact between Spiral Bevel Gear and Spiral Bevel Pinion Shaft

1. Set the dial indicator (lever type) with its finger on the tooth surface.
2. Measure the backlash by fixing the spiral bevel pinion shaft (3) and moving the spiral bevel gear (4) by hand.
3. When the backlash is too large, decrease the number of shims (5) in the side of the spiral bevel gear, and insert the shims (6) of the same thickness as the removed ones to the opposite side. When the backlash is too small, do the opposite way of exceed backlash.
4. Adjust the backlash properly by repeating the above procedure.
5. Apply red lead lightly over several teeth at three positions equally spaced on the spiral bevel gear.
6. Turn the spiral bevel pinion shaft, while pressing a wooden piece against the periphery of the spiral bevel gear.
7. Check the tooth contact. If not proper, adjust according to the instructions next page.



Backlash between spiral bevel gear and spiral bevel pinion shaft	Factory spec.	0.15 to 0.30 mm 0.006 to 0.012 in.
	Allowable limit	0.4 mm 0.016 in.






(Reference)

- Thickness of shims (2) :
0.1 mm (0.004 in.) 0.2 mm (0.008 in.) 0.5 mm (0.020 in.)
- Thickness of shims (5) :
0.4 mm (0.016 in.) 0.7 mm (0.028 in.) 1.0 mm (0.039 in.)
0.5 mm (0.020 in.) 0.8 mm (0.031 in.) 1.2 mm (0.047 in.)
0.6 mm (0.024 in.) 0.9 mm (0.035 in.) 1.4 mm (0.055 in.)
- Thickness of shims (6) :
0.4 mm (0.016 in.) 0.8 mm (0.031 in.) 1.2 mm (0.047 in.)
0.6 mm (0.024 in.) 1.0 mm (0.039 in.) 1.6 mm (0.063 in.)

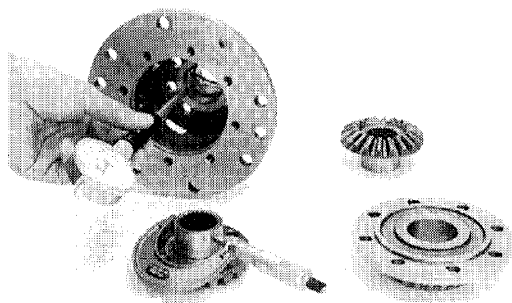
- | | |
|-------------------------|--------------------------|
| (1) Pinion Bearing Case | (5) Shim |
| (2) Shim | (6) Shim |
| (3) Spiral Bevel Pinion | (7) Differential Support |
| (4) Spiral Bevel Gear | |

12190S30750

■ Tooth Contact Instructions

<p>[Proper Contact]</p>  <p>11790F30160</p>	<p>More than 35 % red lead contact area on the gear tooth surface. The center of tooth contact at 1/3 of the entire width from the small end.</p>
<p>[Shallow Contact]</p>  <p>[Heel Contact]</p>  <p>11790F30170</p>	<p>Replace adjusting shim (2) with thicker one to move the spiral bevel pinion shaft backward. For move the spiral bevel gear rightward, reduce right side shim (5) and add shim (6) of the same thickness as the right side to left side.</p>
<p>[Deep Contact]</p>  <p>[Toe Contact]</p>  <p>11790F30180</p>	<p>Replace adjusting shim (2) with thinner one to move the spiral bevel pinion shaft forward. For move the spiral bevel gear leftward, reduce left side shim (6) and add shim (5) of the same thickness as the left side to right side. Repeat above until the proper tooth contact and backlash are achieved.</p>

12190S30770



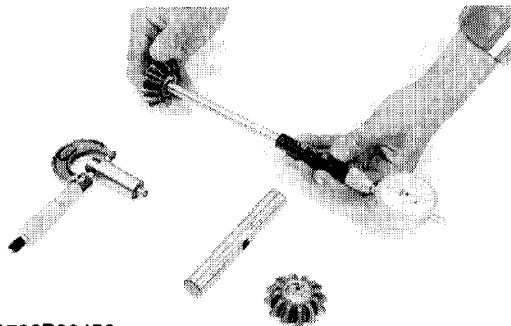
11790P30440

Clearance between Differential Case Bore (Differential Case Cover Bore) and Differential Side Gear Boss

1. Measure the bore I.D. of the differential case and differential case cover.
2. Measure the differential side gear boss O.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

Clearance between differential case bore and differential side gear boss	Factory spec.	0.050 to 0.151 mm 0.00197 to 0.00594 in.
	Allowable limit	0.35 mm 0.0138 in.
Differential case bore I.D.	Factory spec.	40.500 to 40.550 mm 1.59449 to 1.59646 in.
Differential side gear boss O.D.	Factory spec.	40.388 to 40.450 mm 1.59008 to 1.59252 in.
Clearance between differential case cover bore and differential side gear boss	Factory spec.	0.050 to 0.151 mm 0.00197 to 0.00594 in.
	Allowable limit	0.35 mm 0.0138 in.
Differential case cover bore I.D.	Factory spec.	40.500 to 40.550 mm 1.59449 to 1.59646 in.
Differential side gear boss O.D.	Factory spec.	40.388 to 40.450 mm 1.59008 to 1.59252 in.

11790S30440



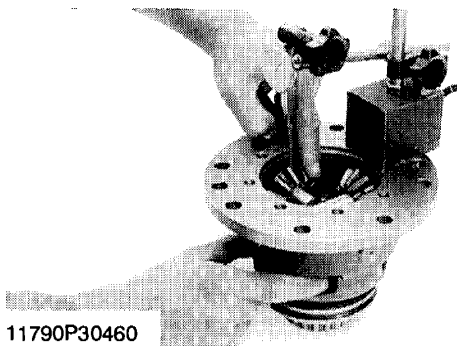
11790P30450

Clearance between Differential Pinion Shaft and Differential Pinion

1. Measure the differential pinion shaft O.D.
2. Measure the differential pinion I.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

Clearance between differential pinion shaft and differential pinion	Factory spec.	0.060 to 0.102 mm 0.00236 to 0.00402 in.
	Allowable limit	0.25 mm 0.0098 in.
Differential pinion shaft O.D.	Factory spec.	19.959 to 19.980 mm 0.78579 to 0.78661 in.
Differential pinion I.D.	Factory spec.	20.040 to 20.061 mm 0.78898 to 0.78980 in.

11790S30450



11790P30460

Backlash between Differential Pinion and Differential Side Gear

Gear

1. Set a dial indicator (lever type) on the tooth of the differential pinion.
2. Hold the differential side gear and move the differential pinion to measure the backlash.
3. If the measurement is not within the factory specifications, adjust with the differential side gear washer.

Backlash between differential pinion and differential side gear	Factory spec.	0.15 to 0.30 mm 0.0059 to 0.0118 in.
	Allowable limit	0.4 mm 0.016 in.

(Reference)

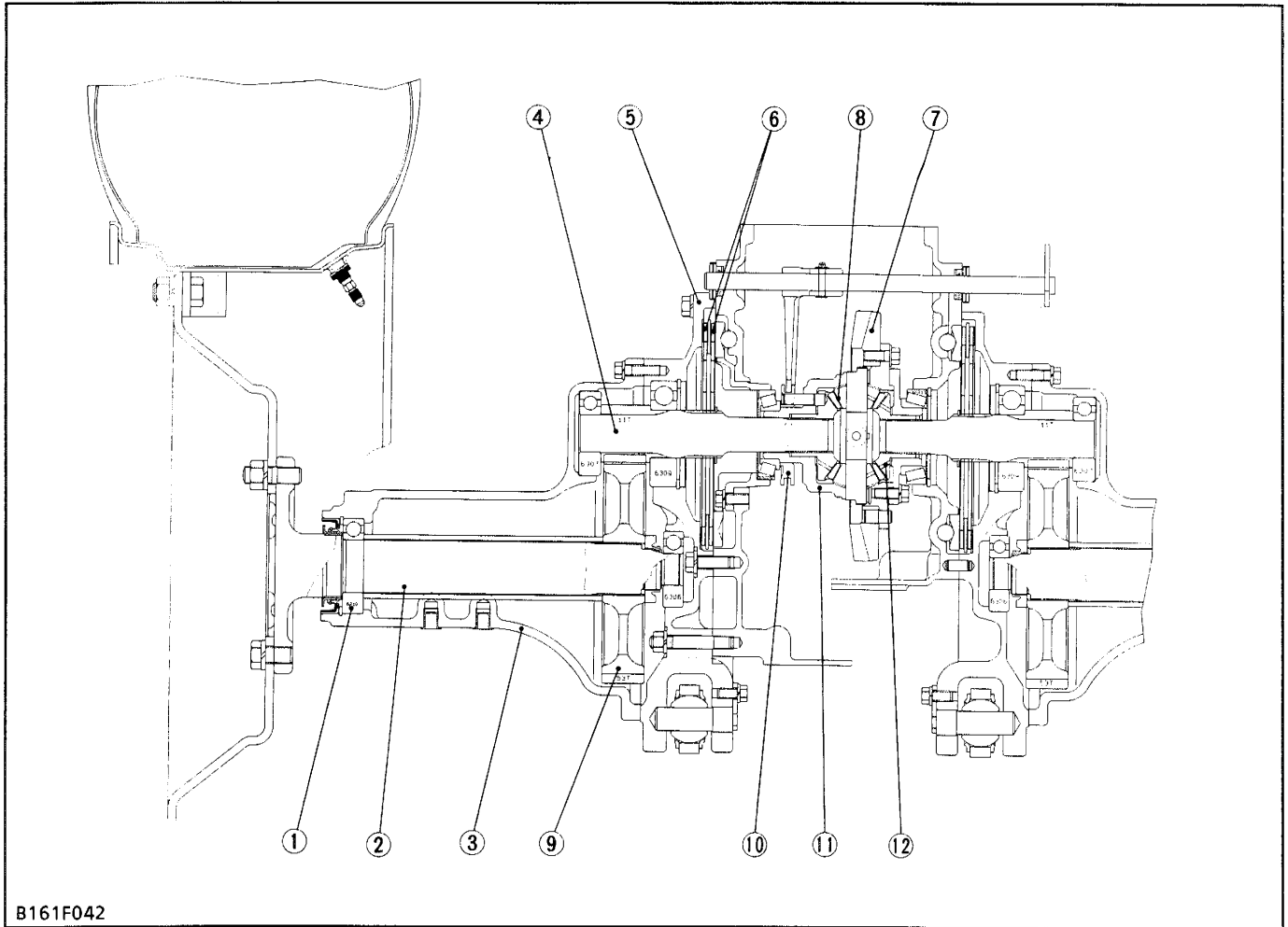
- Thickness of differential side gear washer :
 1.5 mm (0.059 in.) 1.7 mm (0.067 in.)
 1.6 mm (0.063 in.)

12190S30760

MECHANISM

CONTENTS

[1] FEATURES	4-M1
--------------------	------

[1] FEATURES

- | | | | |
|--------------------|-----------------------------|-------------------------|--------------------------------|
| (1) Ball Bearing | (4) Differential Gear Shaft | (7) Ring Gear | (10) Differential Lock Shifter |
| (2) Rear Axle | (5) Brake Case | (8) Differential Pinion | (11) Differential Case |
| (3) Rear Axle Case | (6) Brake Disc | (9) Final Gear | (12) Differential Side Gear |

The final gears (9) are final reduction mechanism which further reduces the speed of rotation. The direction of power transmitted is changed by the differential gear.

The rear axles (2) are the final transmission mechanisms which transmit the power from the transmission to the rear wheels. The rotation speed

is reduced by the final gears (9).

The rear axles are the semi-floating type with the ball bearing (1) between the rear axle (2) and rear axle case (3), which support the rear wheel load besides transmitting power to the rear wheel. The rear axles also support the weight of the tractor.

SERVICING

CONTENTS

TIGHTENING TORQUES	4-51
CHECKING, DISASSEMBLING AND SERVICING	4-51
DISASSEMBLING AND ASSEMBLING	4-51
(1) Separating Rear Axle Case from Brake Case	4-51
(2) Disassembling Rear Axle	4-53

TIGHTENING TORQUES

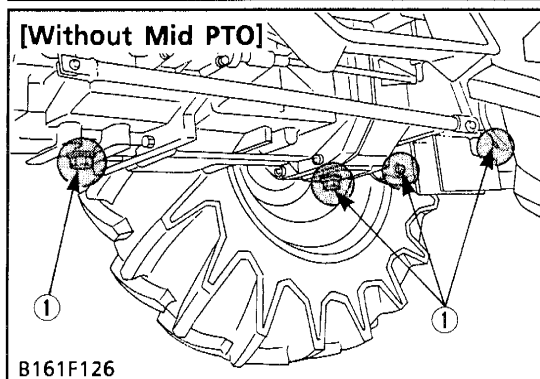
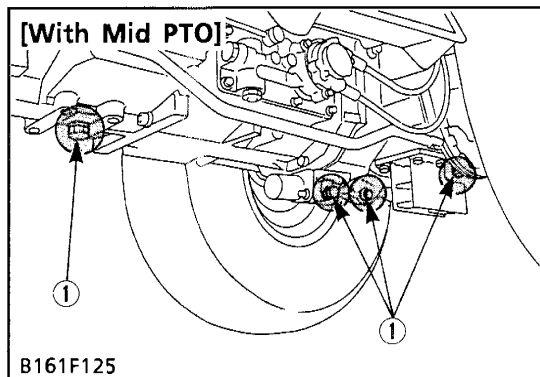
Tightening torques of screws and nuts on the table below are especially specified.
(For general use screws and nuts : See page G-9)

Item	N·m	kgf·m	ft·lbs
ROPS mounting screws			
M12, grade 7 screw	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
M14, grade 9 screw	166.7 to 196.1	17.0 to 20.0	123 to 144
M16, grade 11 screw	260.9 to 304.0	26.6 to 31.0	192 to 224
9/16-18 UNF, grade 8 screw	149.1 to 179.5	15.2 to 18.3	110 to 132
Rear wheel mounting stud bolt	98.1 to 112.7	10.0 to 11.5	72.3 to 83.1
Rear wheel mounting screw and nut	197 to 226	20 to 23	145 to 166
Rear axle case mounting			
M10 screws	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
M10 nuts (L3010 · L3410)	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
M10 nuts (L3710 · L4310)	60.8 to 70.5	6.2 to 7.2	44.9 to 52.1
M12 screws and nuts	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Stud bolts	24.5 to 31.4	2.5 to 3.2	18.1 to 23.1
Rear axle lock nut	196 to 245	20 to 25	145 to 181

CHECKING, DISASSEMBLING AND SERVICING

DISASSEMBLING AND ASSEMBLING

(1) Separating Rear Axle Case from Brake Case



[A] Oil level is acceptable within this range.

- (1) Drain Plug
(2) Filling Plug

(3) Gauge

Draining the Transmission Fluid

1. Place oil pans underneath the transmission case.
2. Remove the four drain plugs (1).
3. Drain the transmission fluid.
4. Reinstall the four drain plugs (1).

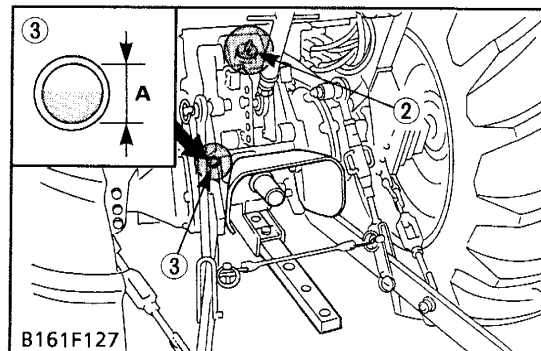
(When refilling)

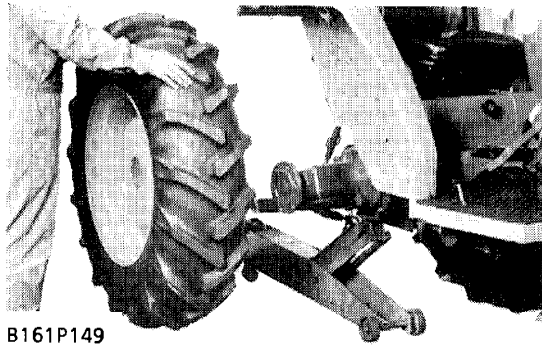
- Fill up from filling port after removing the filling plug (2) until reaching the gauge (3).
- After running the engine for few minutes, stop it and check the oil level again, add the fluid to prescribed level if it is not correct level.

Capacity	Transmission fluid	39.0 ℓ 41.2 U.S.qts. 34.3 Imp.qts.
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■ IMPORTANT

- Use only KUBOTA SUPER UDT fluid. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-8.)
- Do not mix different brands fluid together.





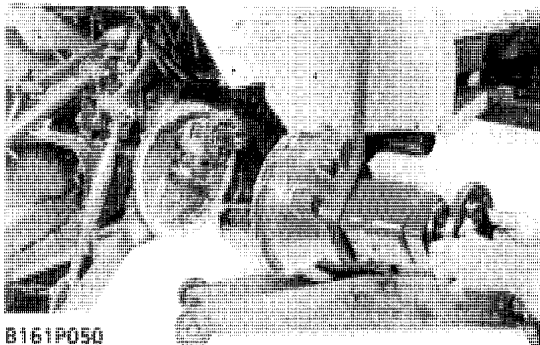
B161P149

ROPS and Rear Wheel

1. Remove the ROPS.
2. Place a jack under the brake case.
3. Loosen and remove the rear wheel mounting screws and nuts.
4. Take out the rear wheel.
5. The other side is same as above.

(When reassembling)

Tightening torque	ROPS mounting screws	M12, grade 7 screws	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
		M14, grade 9 screws	166.7 to 196.1 N·m 17.0 to 20.0 kgf·m 123 to 144 ft-lbs
		M16, grade 11 screws	260.9 to 304.0 N·m 26.6 to 31.0 kgf·m 192 to 224 ft-lbs
		9/16-18 UNF, grade 8 screws	149.1 to 179.5 N·m 15.2 to 18.3 kgf·m 110 to 132 ft-lbs
		Rear wheel mounting stud bolts	98.1 to 112.7 N·m 10.0 to 11.5 kgf·m 72.3 to 83.1 ft-lbs
	Rear wheel mounting screws and nuts	196 to 226 N·m 20 to 23 kgf·m 145 to 166 ft-lbs	



B161P050

Rear Axle Case

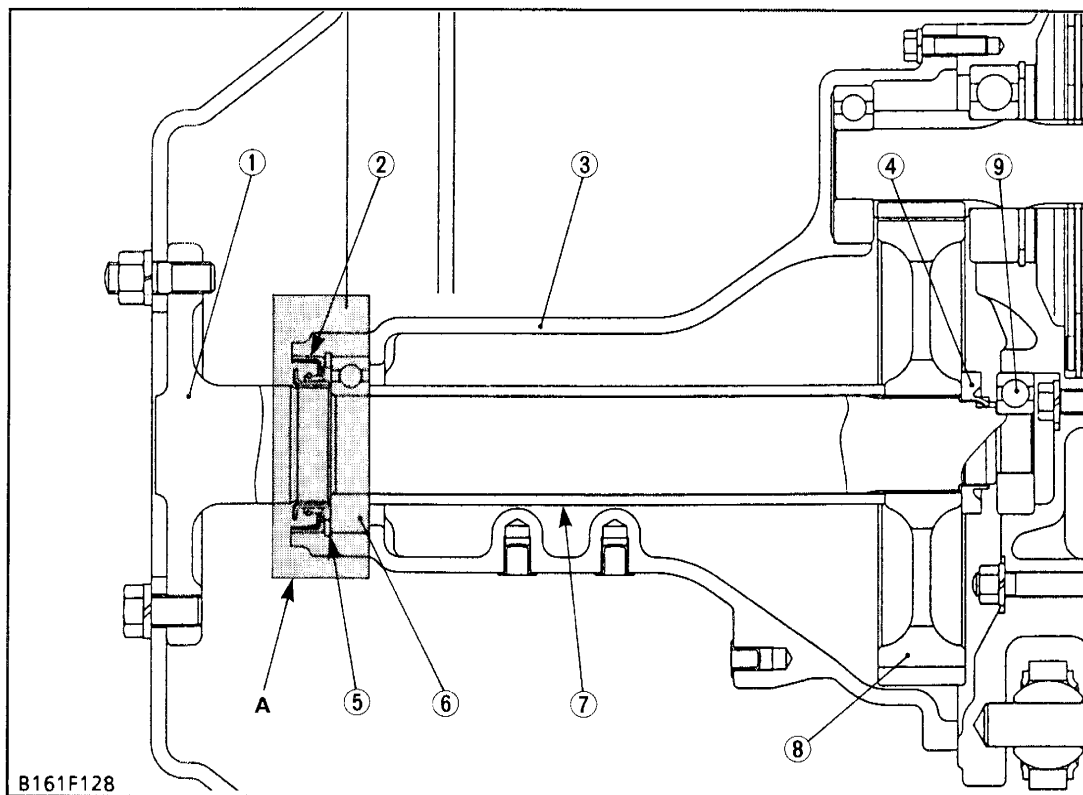
1. Place a jack under the transmission case.
2. Loosen and remove the rear axle case mounting screws and nuts.
3. Support the rear axle case with nylon lift strap and hoist.
4. Separate the rear axle case from brake case.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the rear axle case and brake case, after eliminate the water, oil and stuck liquid gasket.

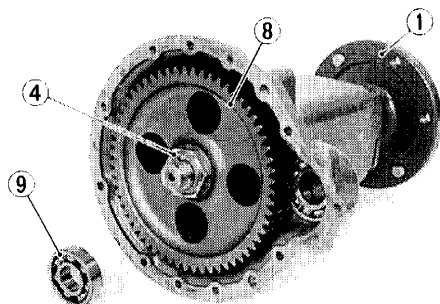
Tightening torque	Rear axle case mounting screws and nuts	M10 screws	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
		M10 nuts (L3010 · L3410)	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
		M10 nuts (L3710 · L4310)	60.8 to 70.5 N·m 6.2 to 7.2 kgf·m 44.9 to 52.1 ft-lbs
		M12 screws and nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
		Stud bolts	24.5 to 31.4 N·m 2.5 to 3.2 kgf·m 18.1 to 23.1 ft-lbs

(2) Disassembling Rear Axle



- (1) Rear Axle
- (2) Oil Seal
- (3) Rear Axle Case
- (4) Lock Nut
- (5) Internal Snap Ring
- (6) Ball Bearing
- (7) Spacer
- (8) Gear
- (9) Ball Bearing

B161F128



Rear Axle

1. Remove the ball bearing (9) with a puller.
2. Remove the stake of lock nut (4).
3. Secure the rear axle (1) in a vise and remove the lock nut.
4. Take out the gear (8) and spacer (7).
5. Tap out the rear axle (1).

(When reassembling)

- Apply grease to the oil seal (2) and install it.
- Replace the lock nut with new one, and after tightening it to specified torque, stake it firmly.
- Assemble the oil seal (2) with correct direction. (See figure above (A) portion.)

0329P104

[A] Oil Seal Portion

- (1) Rear Axle
- (4) Lock Nut
- (8) Gear
- (9) Ball Bearing

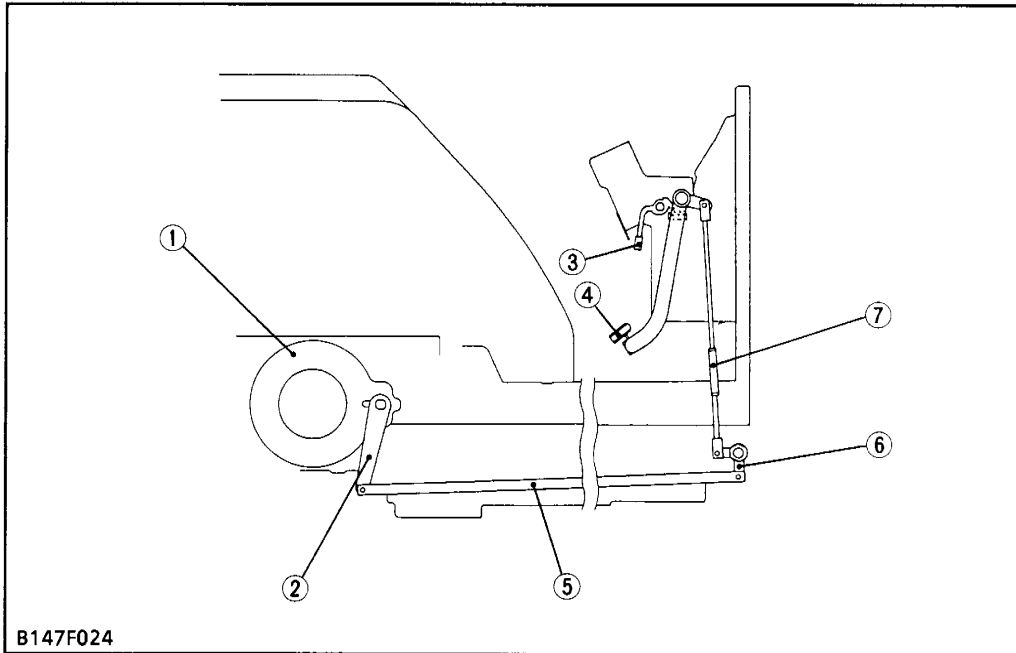
Tightening torque	Lock nut	196 to 245 N·m 20 to 25 kgf·m 145 to 181 ft·lbs
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MECHANISM

CONTENTS

[1] FEATURES	5-M1
[2] OPERATION	5-M2

[1] FEATURES



- (1) Brake Case
- (2) Brake Cam Lever
- (3) Parking Brake Lever
- (4) Brake Pedal
- (5) Brake Rod
- (6) Brake Lever
- (7) Turnbuckle

These tractors are used hanging type brake pedals to have wider space of the platform.

Independent mechanical wet disc brakes are used for the right and left traveling brakes. They are operated by the brake pedals through the mechanical linkages.

■ Features of Wet Disc Brakes

1. Reduced disc wear

Although wet discs are worn by approx. several tens of microns depending on the accuracy of parts during the initial contact in initial period of 50 hours or so, almost no wear occurs afterwards. This means that very little brake adjustments are required.

2. Stable braking

Since the brake discs are immersed in transmission oil, Fade* is rarely caused even after repeated braking and a stable braking force is obtained.

3. Pedal stroke does not change under influence of heat.

Unlike internal expanding type brakes, the drum-to-shoe clearance of the wet disc brake does not increase due to thermal expansion and the increased pedal stroke does not result. Thus, the wet disc brake provides a constant pedal stroke.

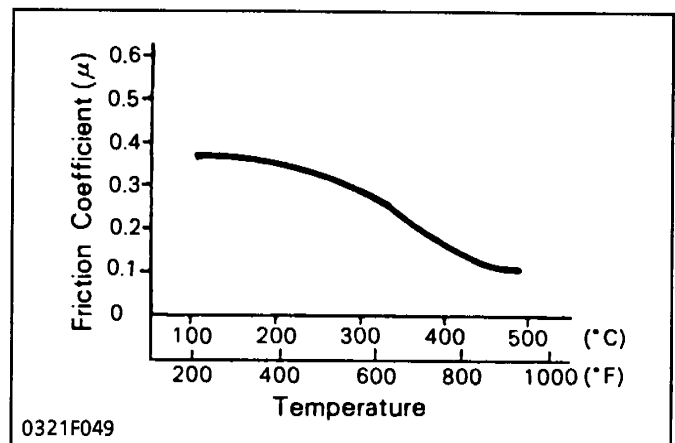
The parking brake is a mechanical type which is designed to actuate the traveling brakes. Pulling the parking brake lever (3) results in the same state as that obtained when the brake pedals are pressed.

Fade*

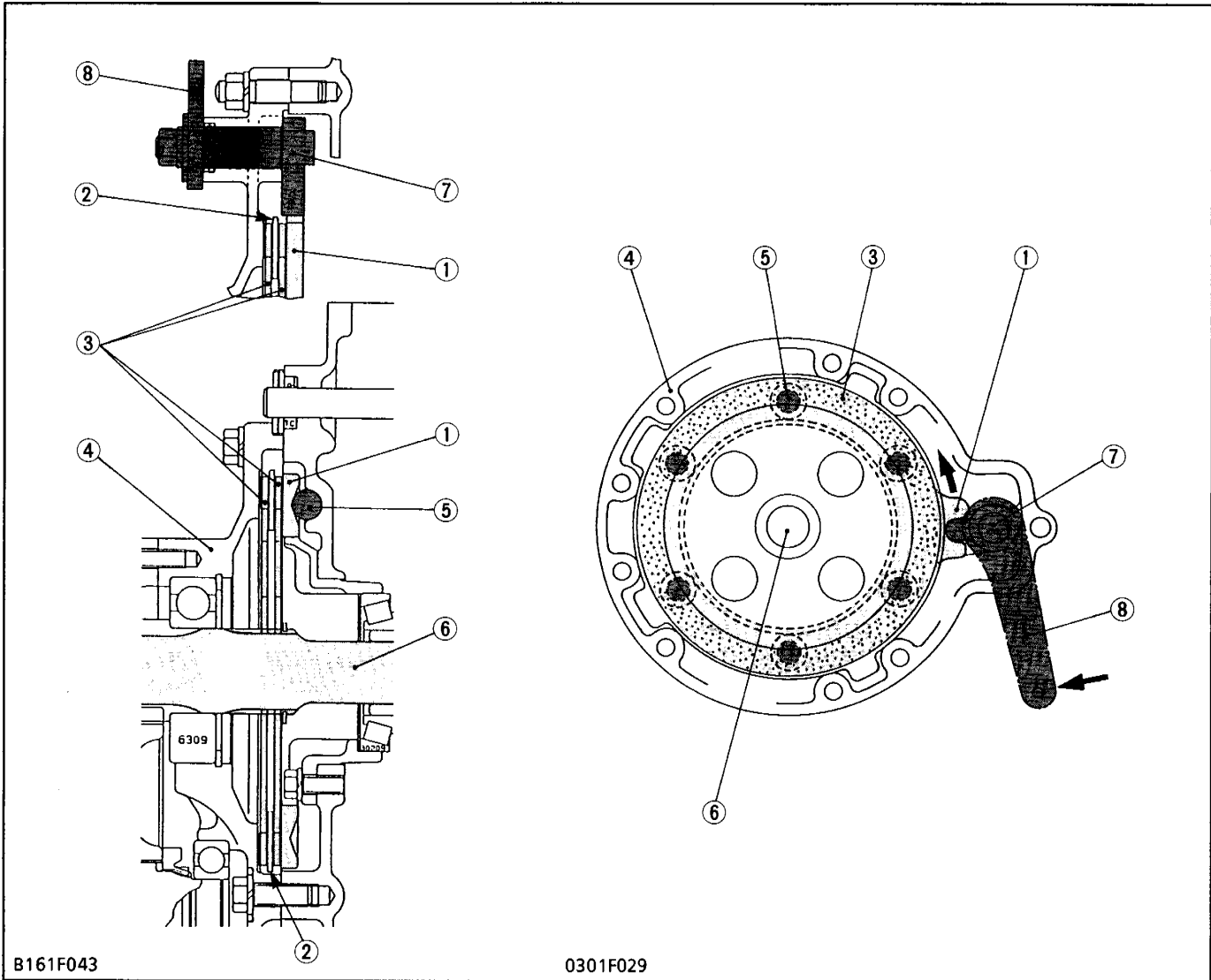
Fade is a phenomenon of braking force loss caused by the heat generated in repeated braking. Generally, the friction coefficient of brake disc tends to lower and the braking force reduces with the rise of the temperature of the brake disc.

(Reference)

- Relationship between temperature and friction coefficient of brake disc.



[2] OPERATION



B161F043

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- | | | | |
|-----------------|----------------|--|---------------------|
| (1) Cam Plate | (4) Brake Case | (6) Brake Shaft
(Differential Gear Shaft) | (7) Brake Cam |
| (2) Steel Plate | (5) Steel Ball | | (8) Brake Cam Lever |
| (3) Brake Disc | | | |

The brake body is incorporated in the brake case (4) filled with transmission oil and is designed to brake when the brake disc (3) splined with the differential gear shaft (6) is pressed against the cam plate (1) by means of the cam mechanism incorporating steel balls (5).

For greater braking force, two brake discs are provided at the right and left sides respectively, and the steel plate (2) fixed to the brake case is arranged between the brake discs.

■ During Braking

When the brake pedal is pressed, the linkage causes the brake cam lever (8) and brake cam (7) to turn into the direction of arrow shown in the above figure.

Therefore, the cam plate (1) also moves the direction of arrow. At this time, since the cam plate (1) rides on the steel balls (5) set in the grooves of the transmission case to press the brake disc (3), the differential gear shaft (6) is braked by the frictional force generated by the cam plate (1) and brake disc (3).

SERVICING

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TROUBLESHOOTING	5-S1
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CHECKING, DISASSEMBLING AND SERVICING	5-S2
[1] BRAKE PEDAL	5-S2
CHECKING AND ADJUSTING	5-S3
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[2] BRAKE CASE	5-S4
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(1) Separating Brake Case from Transmission Case	5-S4
(2) Disassembling Brake Case	5-S8
SERVICING	5-S8

TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Uneven Braking Force	<ul style="list-style-type: none"> ● Brake pedal play unevenly adjusted ● Brake disc worn ● Cam plate warped 	Adjust Replace Replace	5-S3 5-S9 5-S8
Brake Drags	<ul style="list-style-type: none"> ● Brake pedal play too small ● Ball holes of cam plate for uneven wear ● Brake pedal return spring weaken or broken ● Brake cam rusted 	Adjust Replace Replace Repair	5-S3 5-S9 5-S2 5-S8
Poor Braking Force	<ul style="list-style-type: none"> ● Brake pedal play excessive ● Brake disc worn ● Cam plate warped ● Brake cam or lever damaged ● Transmission fluid improper 	Adjust Replace Replace Replace Change	5-S3 5-S9 5-S8 5-S8 5-S4

SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Brake Pedal	Free Travel	15 to 20 mm 0.6 to 0.8 in.	–
Brake Lever Link Shaft to Bushing	Clearance	0.125 to 0.195 mm 0.00492 to 0.00768 in.	1.0 mm 0.039 in.
Brake Lever Link Shaft	O.D.	19.955 to 19.975 mm 0.78563 to 0.78642 in.	–
Brake Lever Link Bushing	I.D.	20.100 to 20.150 mm 0.79134 to 0.79331 in.	–
Cam Plate	Flatness	–	0.3 mm 0.012 in.
Cam Plate and Ball	Height	20.9 to 21.1 mm 0.8228 to 0.8307 in.	20.5 mm 0.8071 in.
Brake Disc	Thickness	4.6 to 4.8 mm 0.181 to 0.189 in.	4.2 mm 0.165 in.
Plate	Thickness	2.54 to 2.66 mm 0.1000 to 0.1047 in.	2.10 mm 0.0827 in.

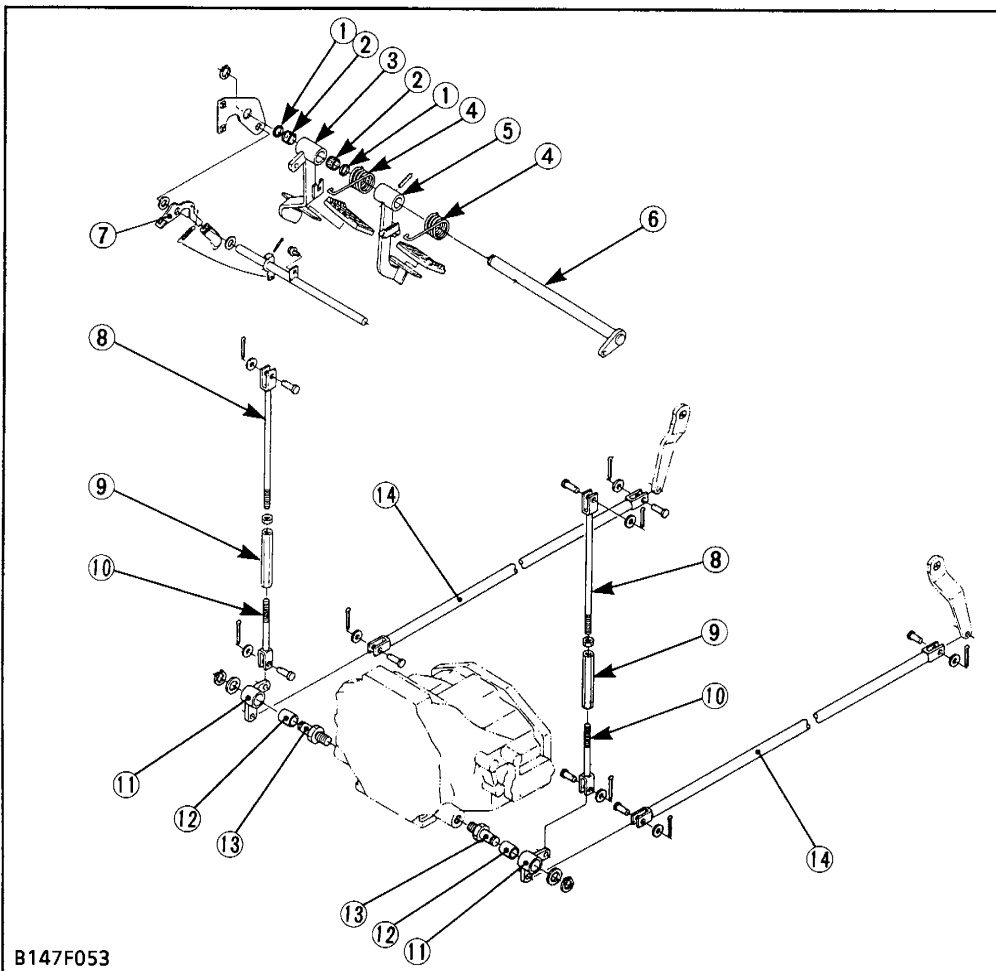
TIGHTENING TORQUES

Tightening torques of screws and nuts on the table below are especially specified.
 (For general use screws and nuts : See page G-9)

Item	N·m	kgf·m	ft-lbs
ROPS mounting screws			
M12, grade 7 screw	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
M14, grade 9 screw	166.7 to 196.1	17.0 to 20.0	123 to 144
M16, grade 11 screw	260.9 to 304.0	26.6 to 31.0	192 to 224
9/16-18 UNF, grade 8 screw	149.1 to 179.5	15.2 to 18.3	110 to 132
Rear wheel mounting stud bolt	98.1 to 112.7	10.0 to 11.5	72.3 to 83.1
Rear wheel mounting screw and nut	197 to 226	20 to 23	145 to 166
GST shift cable mounting screw	7.8 to 8.8	0.8 to 0.9	5.8 to 6.5
Floor seat mounting bolt and nut	197 to 226	20 to 23	145 to 166
Rear axle case mounting			
M10 screws	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
M10 nuts (L3010 · L3410)	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
M10 nuts (L3710 · L4310)	60.8 to 70.5	6.2 to 7.2	44.9 to 52.1
M12 screws and nuts	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Stud bolts	24.5 to 31.4	2.5 to 3.2	18.1 to 23.1
Brake case mounting stud bolt	38.2 to 45.1	3.9 to 4.6	28.2 to 33.3
Brake case mounting screw and nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Brake case mounting lever shaft screw	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5

CHECKING, DISASSEMBLING AND SERVICING

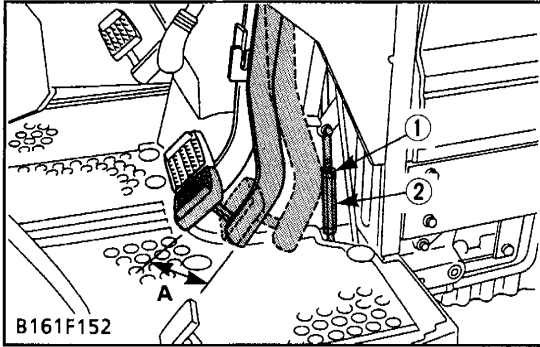
[1] BRAKE PEDAL



- (1) Oil Seal
- (2) Needle Bearing
- (3) Brake Pedal RH
- (4) Return Spring
- (5) Brake Pedal LH
- (6) Brake Pedal Shaft
- (7) Parking Brake Lock
- (8) Brake Rod 1
- (9) Turnbuckle
- (10) Brake Rod 2
- (11) Brake Lever
- (12) Bushing
- (13) Brake Lever Link Shaft
- (14) Brake Rod 3

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CHECKING AND ADJUSTING



[A] Free Travel

(1) Lock Nut

(2) Turnbuckle

Checking Brake Pedal Free Travel

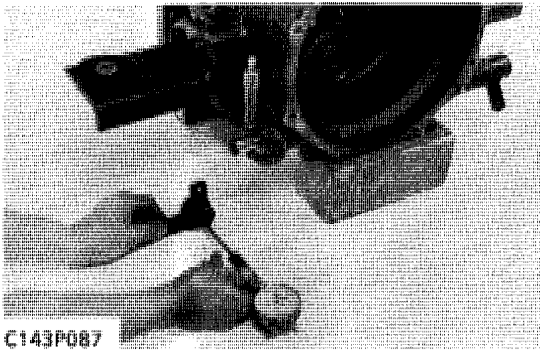
⚠ CAUTION

- Stop the engine and remove the key, then chock the wheels before checking brake pedal.

1. Release the parking brake.
2. Slightly depress the brake pedals and measure free travel at top of pedal stroke.
3. If the measurement is not within the factory specifications, loosen the lock nut (1) and adjust with the turnbuckle (2).
4. Retighten the lock nut (1).

Brake pedal free travel	Factory spec.	15 to 20 mm (0.6 to 0.8 in.) on the pedal
	Factory spec.	Keep the free travel in the right and left brake pedals equal

SERVICING



Clearance between Brake Lever Link Shaft and Bushing

1. Measure the brake lever link shaft O.D. with an outside micrometer.
2. Measure the brake lever link bushing I.D. with a cylinder gauge.
3. Calculate the clearance.
4. If the clearance exceeds the allowable limit, replace the bushing.

Clearance between brake lever link shaft and brake lever link bushing	Factory spec.	0.125 to 0.195 mm 0.00492 to 0.00768 in.
	Allowable limit	1.0 mm 0.039 in.

Brake lever link shaft O.D.	Factory spec.	19.955 to 19.975 mm 0.78563 to 0.78642 in.
Brake lever link bushing I.D.	Factory spec.	20.100 to 20.150 mm 0.79134 to 0.79331 in.

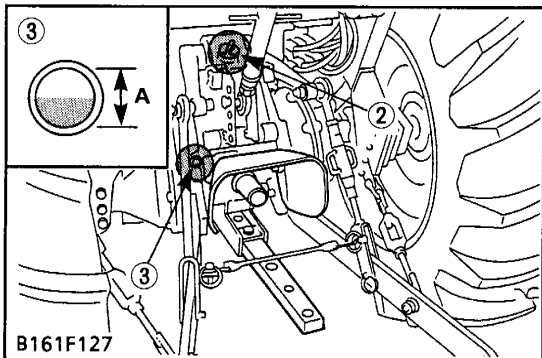
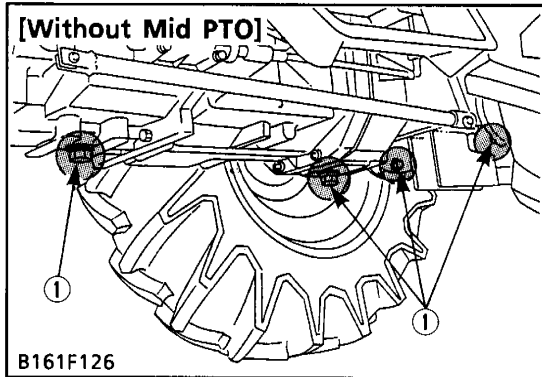
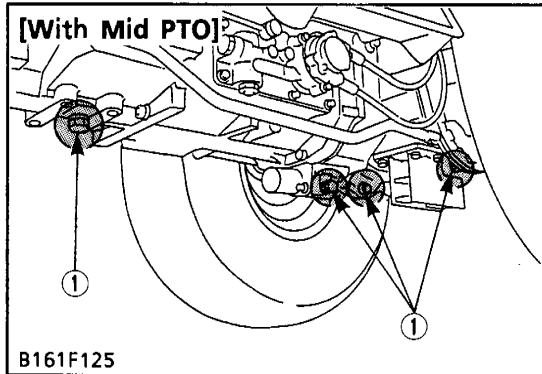
[2] BRAKE CASE

DISASSEMBLING AND ASSEMBLING

(1) Separating Brake Case from Transmission Case

NOTE

- If the tractors are cabin specifications, refer to section 10 CABIN [1] SEPARATING CABIN FROM TRACTOR BODY. (See page 10-S20.)



Draining the Transmission Fluid

1. Place oil pans underneath the transmission case.
2. Remove the four drain plugs (1).
3. Drain the transmission fluid.
4. Reinstall the four drain plugs (1).

(When refilling)

- Fill up from filling port after removing the filling plug (2) until reaching the gauge (3).
- After running the engine for few minutes, stop it and check the oil level again, add the fluid to prescribed level if it is not correct level.

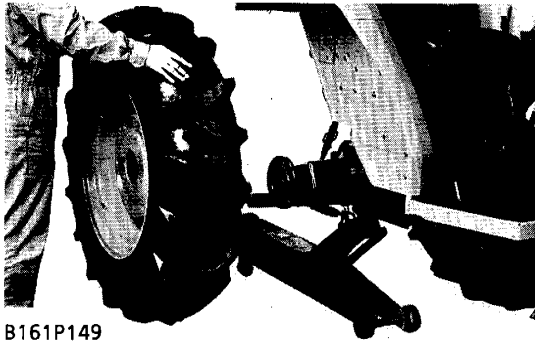
Capacity	Transmission fluid	39.0 ℓ 41.2 U.S.qts. 34.3 Imp.qts.
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IMPORTANT

- Use only KUBOTA SUPER UDT fluid. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-8.)
- Do not mix different brands fluid together.

[A] Oil level is acceptable with in this range.

- (1) Drain Plugs
- (2) Filling Plug
- (3) Gauge



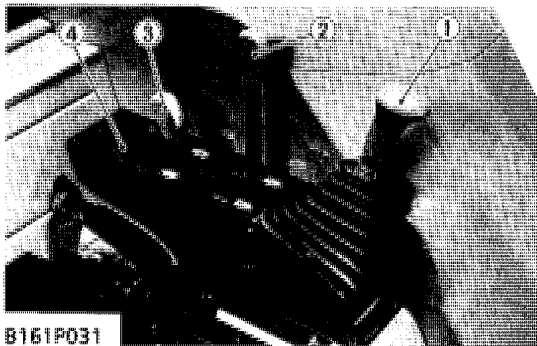
B161P149

ROPS and Rear Wheels

1. Remove the ROPS.
2. Place a jack under the brake case.
3. Loosen and remove the rear wheel mounting screws and nuts.
4. Take out the rear wheel.
5. The other side is same as above.

(When reassembling)

Tightening torque	ROPS mounting screws	M12, grade 7 screws	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
		M14, grade 9 screws	166.7 to 196.1 N·m 17.0 to 20.0 kgf·m 123 to 144 ft-lbs
		M16, grade 11 screws	260.9 to 304.0 N·m 26.6 to 31.0 kgf·m 192 to 224 ft-lbs
		9/16-18 UNF, grade 8 screws	149.1 to 179.5 N·m 15.2 to 18.3 kgf·m 110 to 132 ft-lbs
		Rear wheel mounting stud bolts	98.1 to 112.7 N·m 10.0 to 11.5 kgf·m 72.3 to 83.1 ft-lbs
	Rear wheel mounting screws and nuts	197 to 226 N·m 20 to 23 kgf·m 145 to 166 ft-lbs	



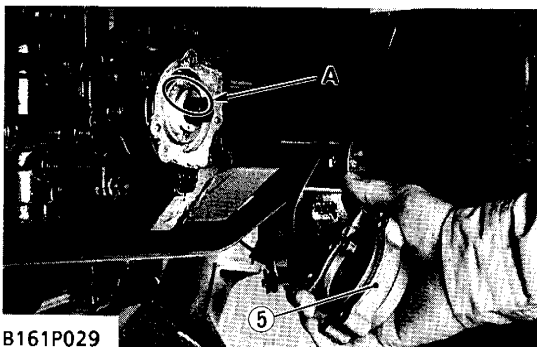
B161P031

Preparation 1

1. Remove the seat.
2. Loosen and remove the main gear shift (GST shift) lever grip (1).
3. Take out the Hi-Lo shift lever grip (2).
4. Take out the creep speed shift lever grip (3). (If equipped.)
5. Remove the shift lever guide (4).
6. Remove the GST shift cable (5). (GST type only.)
7. Disconnect the jumper leads for hazard light and tail light.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to the joint face between rotary valve cover and GST shift cable (5).
- GST shift lever to neutral position, then align the punched marks (A) of the rotary valve case and rotary valve shaft when install the GST shift cable (5). (GST type only.)

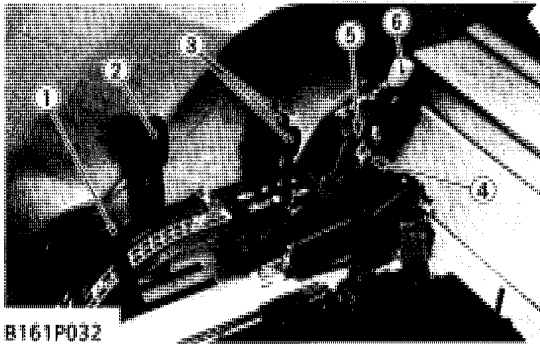


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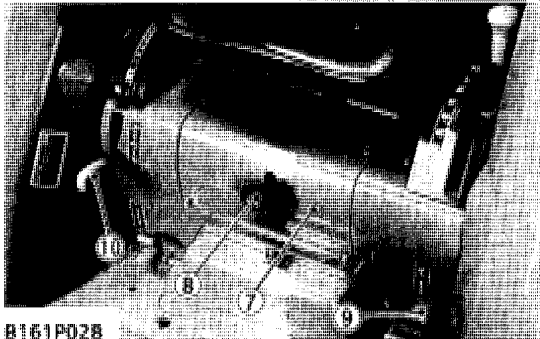
Tightening torque	GST shift cable mounting screws	7.8 to 8.8 N·m 0.8 to 0.9 kgf·m 5.8 to 6.5 ft-lbs
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[A] Punched Marks

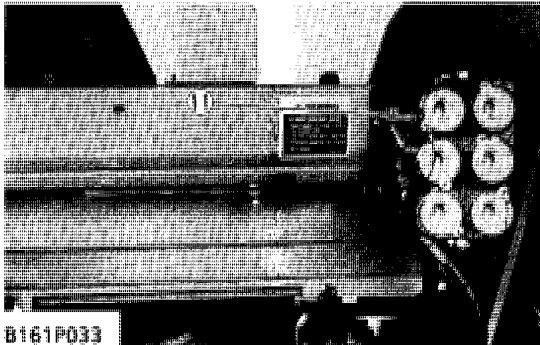
- | | |
|--|--|
| <ol style="list-style-type: none"> (1) Main Gear Shift (GST Shift) Lever Grip (2) Hi-Lo Shift Lever Grip | <ol style="list-style-type: none"> (3) Creep Speed Shift Lever Grip (If Equipped) (4) Shift Lever Guide (5) GST Shift Cable (GST Type Only) |
|--|--|



B161P032



B161P028



B161P033

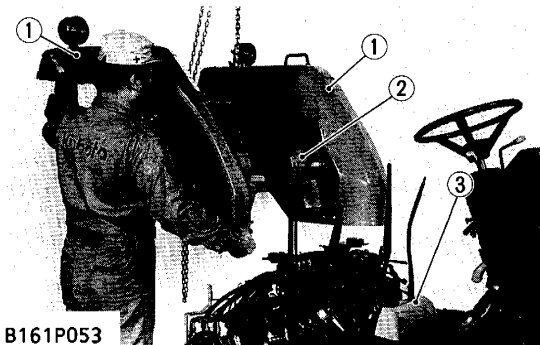
Preparation 2

1. Take out the position control lever grip (2).
2. Take out the draft control lever grip (1). (If equipped.)
3. Take out the auxiliary control lever grips (3). (If equipped.)
4. Disconnect the PTO shift cable (4) from the PTO shift lever (6).
5. Disconnect the PTO limit switch (5) leads.
6. Take out the lowering speed adjusting knob (8), and then remove the seat under cover (7).
7. Remove the mid PTO shift lever (10). (Mid PTO type only.)
8. Loosen and remove the front wheel drive shift lever grip (9). (4WD type only.)
9. Disconnect the jumper leads for hazard light and tail light.
10. Remove the quick coupler assembly (11). (If equipped.)

(When reassembling)

- Check and adjust the PTO shift cable. (See page 10-S28.)

- | | |
|---|--|
| (1) Draft Control Lever Grip (If Equipped) | (7) Seat Under Cover |
| (2) Position Control Lever Grip | (8) Lowering Speed Adjusting Knob |
| (3) Auxiliary Control Lever Grips (If Equipped) | (9) Front Wheel Drive Shift Lever Grip (4WD Type Only) |
| (4) PTO Shift Cable | (10) Mid PTO Shift Lever (Mid PTO Type Only) |
| (5) PTO Limit Switch | (11) Quick Coupler Assembly (If Equipped) |
| (6) PTO Shift Lever | |



B161P053

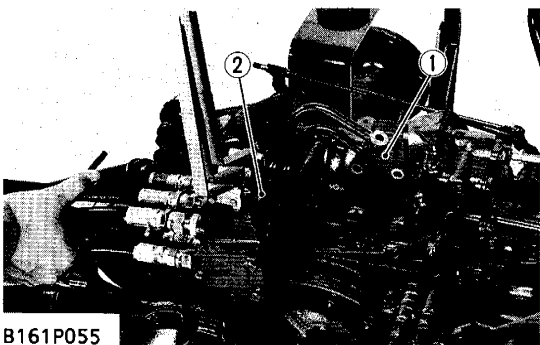
- (1) Fenders (2) Floor Seat (3) Platform

Fender and Floor Seat

1. Loosen and remove the fenders and floor seat mounting screws to the platform (3).
2. Loosen and remove the floor seat mounting two bolts and nuts.
3. Support the floor seat with nylon lift strap and hoist.
4. Remove the fenders (1) and floor seat (2) as a unit.

(When reassembling)

Tightening torque	Floor seat mounting bolts and nuts	197 to 226 N·m 20 to 23 kgf·m 145 to 166 ft·lbs
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B161P055

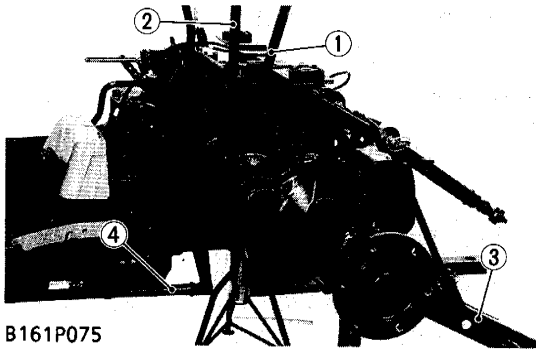
Auxiliary Control Valve (if Separating Right Side)

1. Disconnect the draft control feedback rod.
2. Loosen and remove the hydraulic pipe mounting three screws.
3. Loosen and remove the auxiliary control valves mounting two screws to floor seat support RH.
4. Take out the auxiliary control valves (2), hydraulic pipe (1) and quick couplers as a unit.

(When reassembling)

- Take care not to damage the O-rings.

- | | |
|--------------------|------------------------------|
| (1) Hydraulic Pipe | (2) Auxiliary Control Valves |
|--------------------|------------------------------|



B161P075

Preparation 3

1. Remove the Hi-Lo shift lever (1) and creep speed shift lever (2). (If separating left side.)
2. Disconnect the lower link (3) from brake case.
3. Remove the mid PTO lever from lever shaft. (Mid PTO type only.)
4. Disconnect the brake rod 3 (4).

- | | |
|-----------------------------|-----------------|
| (1) Hi-Lo Shift Lever | (3) Lower Link |
| (2) Creep Speed Shift Lever | (4) Brake Rod 3 |



B161P077

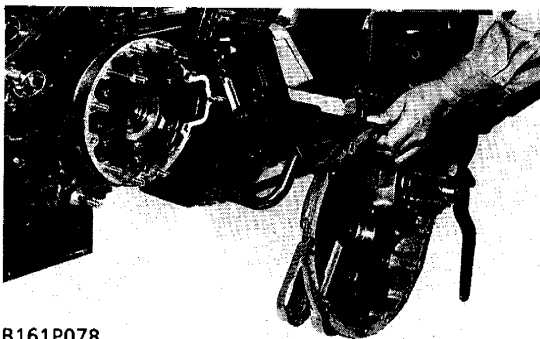
Rear Axle Case

1. Support the transmission case with nylon lift strap and hoist.
2. Loosen and remove the rear axle case mounting screws and nuts.
3. Support the rear axle case with nylon lift strap and hoist.
4. Separate the rear axle case from brake case.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the rear axle case and brake case, after eliminate the water, oil and stuck liquid gasket.

Tightening torque	Rear axle case mounting screws and nuts	M10 screws	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
		M10 nuts (L3010 · L3410)	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
		M10 nuts (L3710 · L4310)	60.8 to 70.5 N·m 6.2 to 7.2 kgf·m 44.9 to 52.1 ft-lbs
		M12 screws and nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
		Stud bolts	24.5 to 31.4 N·m 2.5 to 3.2 kgf·m 18.1 to 23.1 ft-lbs



B161P078

Brake Case

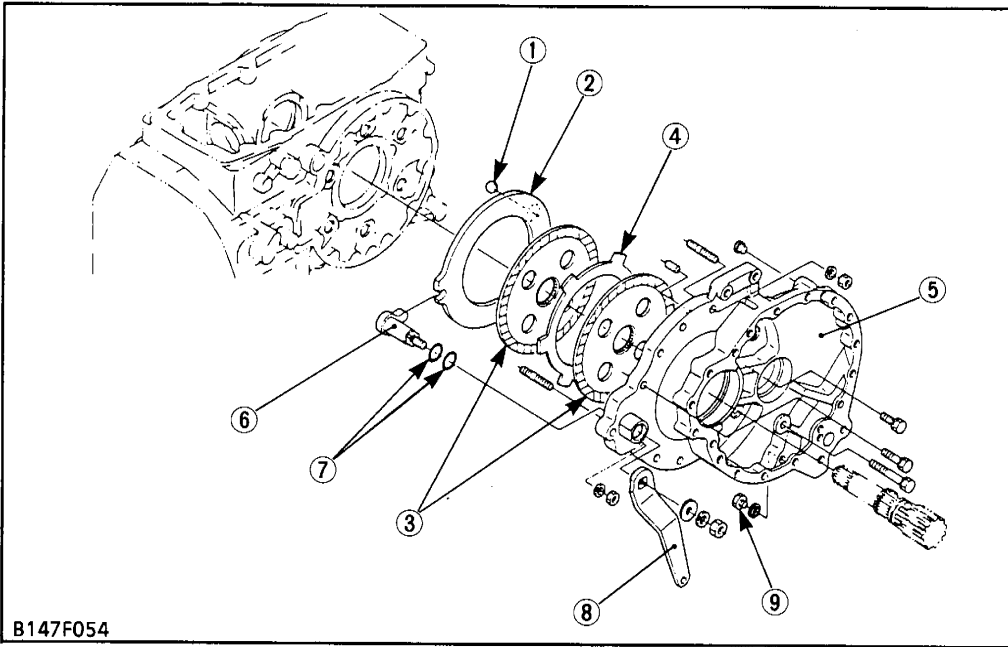
1. Loosen and remove the brake case mounting screws and nuts.
2. Support the floor seat support with nylon lift strap and hoist.
3. Separate the brake case, tapping the brake cam lever lightly.

(When reassembling)

- Apply grease to the brake ball seats. (Do not grease excessively.)
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the brake case and transmission case, after eliminate the water, oil and stuck liquid gasket.
- Before installing the brake case to the transmission case, install the cam plate to the transmission case.

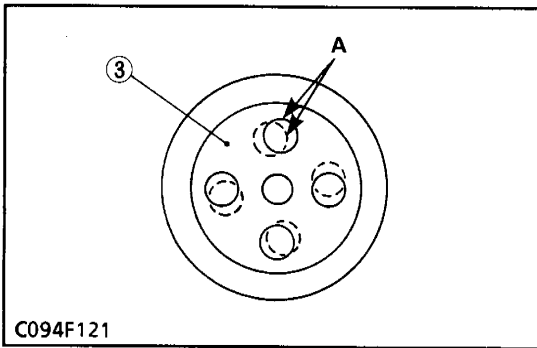
Tightening torque	Brake case mounting stud bolts	38.2 to 45.1 N·m 3.9 to 4.6 kgf·m 28.2 to 33.3 ft-lbs
	Brake case mounting screws and nuts	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Brake case mounting lever shaft screw	62.8 to 72.5 N·m 6.4 to 7.4 kgf·m 46.3 to 53.5 ft-lbs

(2) Disassembling Brake Case



- (1) Ball
- (2) Cam Plate
- (3) Brake Disc
- (4) Plate
- (5) Brake Case
- (6) Brake Cam
- (7) O-ring
- (8) Brake Cam Lever
- (9) Drain Plug

B147F054



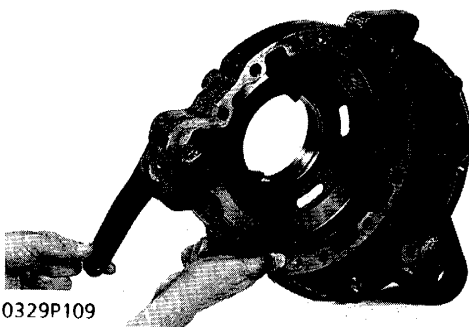
C094F121

■ It is possible to disassemble as shown in the figure above.

(When reassembling)

- Place the brake discs (3) so that the hole "A" of the second disc should be overlapped 50 % or more.
- Apply grease to the O-rings (7) and take care not to damage them.

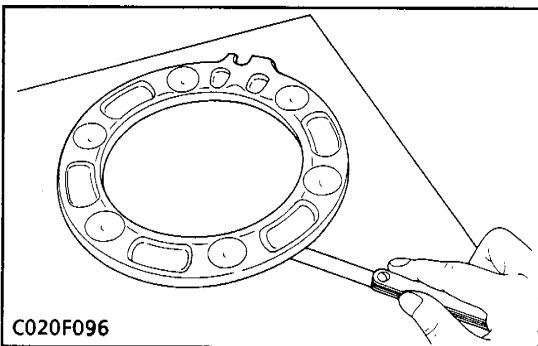
SERVICING



0329P109

Brake Cam Lever Movement

1. Move the brake cam lever by hand to check the movement.
2. If the movement is heavy, refine the brake cam with sandpaper.

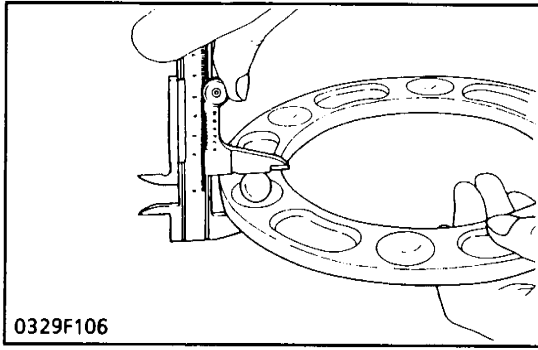


C020F096

Cam Plate Flatness

1. Place the cam plate on the surface plate.
2. Use a feeler gauge of 0.3 mm (0.012 in.) thick for judgment of the cam plate flatness.
Measure the flatness diagonally at more than four locations.
3. If the measurement is above the allowable limit, replace it.

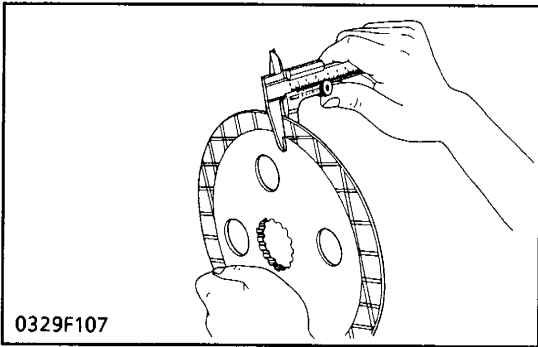
Cam plate flatness	Allowable limit	0.3 mm 0.012 in.
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Height of Cam Plate and Ball

1. Measure the dimensions of the cam plate with the ball installed.
2. If the measurement is less than the allowable limit, replace the cam plate and balls.
3. Inspect the ball holes of cam plate for uneven wear. If the uneven wear is found, replace it.

Height of cam plate and ball	Factory spec.	20.9 to 21.1 mm 0.8228 to 0.8307 in.
	Allowable limit	20.5 mm 0.8071 in.



Brake Disc Wear

1. Measure the brake disc thickness with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

Brake disc thickness	Factory spec.	4.6 to 4.8 mm 0.181 to 0.189 in.
	Allowable limit	4.2 mm 0.165 in.

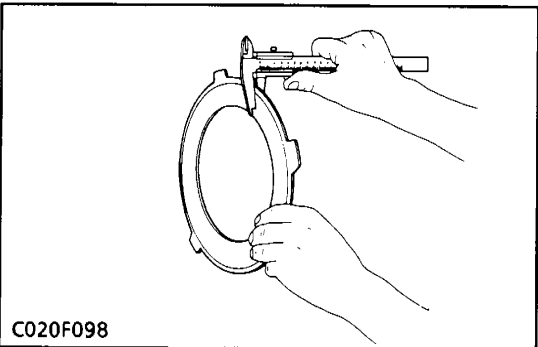


Plate Wear

1. Measure the plate thickness with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

Plate thickness	Factory spec.	2.54 to 2.66 mm 0.1000 to 0.1047 in.
	Allowable limit	2.10 mm 0.0827 in.

MECHANISM

CONTENTS

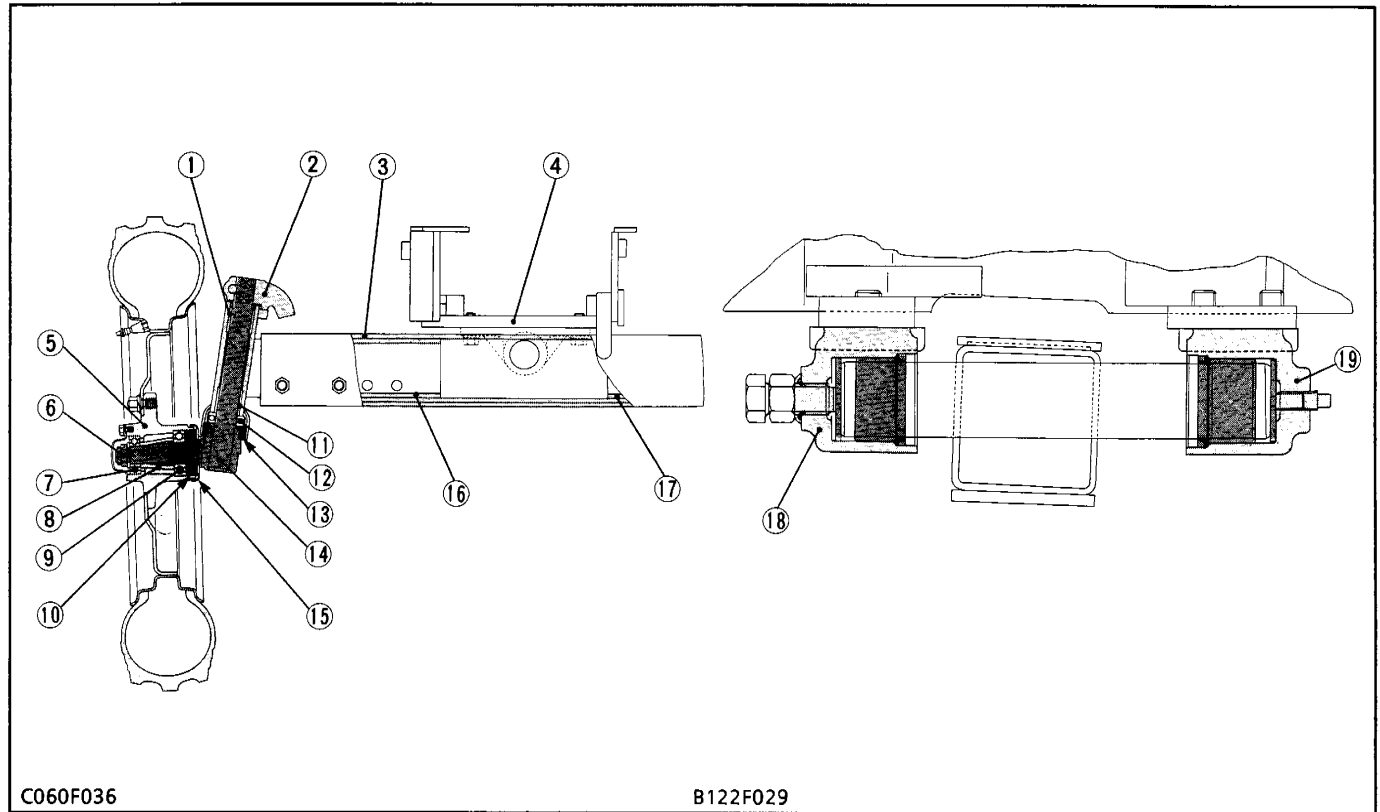
[1] STRUCTURE	6-M1
(1) 2WD Type	6-M1
(2) 4WD Type	6-M2
[2] FRONT WHEEL ALIGNMENT	6-M3

[1] STRUCTURE

The front axle supports the front of tractor and facilitates steering. There are two kinds of front axles. The two wheel drive axle has free-running

front wheels and the four wheel drive axle has powered front wheels.

(1) 2WD Type

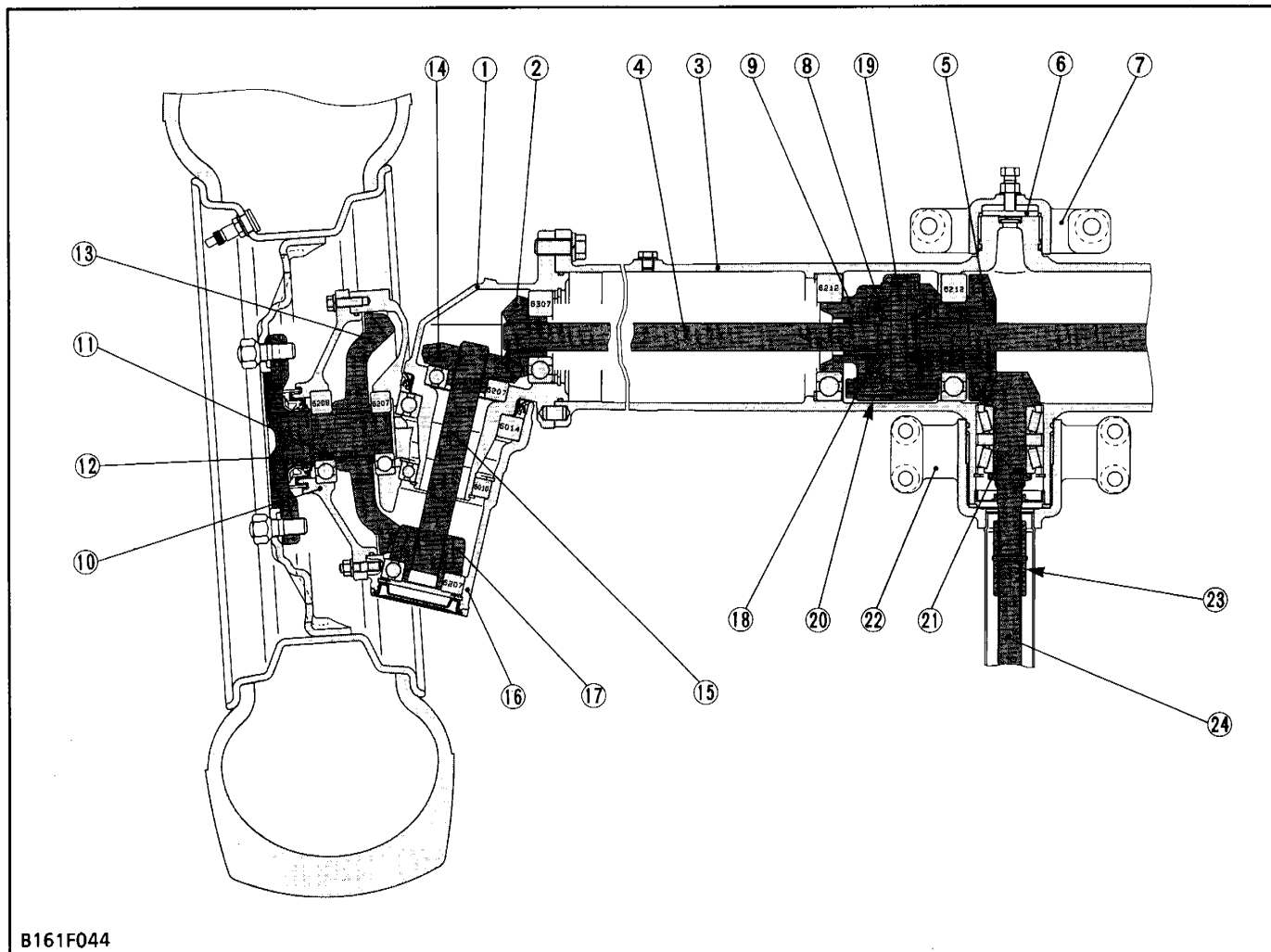


- | | | | |
|-----------------------|------------------|--------------------------|--------------------------------|
| (1) Bushing | (6) Slotted Nut | (11) Bushing | (16) Front Axle Right |
| (2) Knuckle Arm | (7) Ball Bearing | (12) Thrust Ball Bearing | (17) Front Axle Left |
| (3) Front Axle Middle | (8) Spacer | (13) Oil Seal | (18) Front Axle Bracket, Front |
| (4) Front Axle Frame | (9) Ball Bearing | (14) Knuckle Shaft | (19) Front Axle Bracket, Rear |
| (5) Front Wheel Hub | (10) Oil Seal | (15) Dust Cover | |

The front axle of the 2WD type is constructed as shown above. The shape of the front axle is relatively simple, and the front axle is supported at its center

with the front axle brackets (18), (19) on the front axle frame (4), so that steering operation is stable even on uneven grounds in a farm field.

(2) 4WD Type



B161F044

- | | | | |
|-----------------------------|-------------------------------|-----------------------------|--------------------------------|
| (1) Bevel Gear Case | (7) Front Axle Bracket, Front | (13) Bevel Gear | (19) Pinion Shaft |
| (2) Bevel Gear | (8) Differential Pinion | (14) Bevel Gear | (20) Differential Assembly |
| (3) Front Axle Case | (9) Differential Case | (15) Bevel Gear Shaft | (21) Spiral Bevel Pinion Shaft |
| (4) Differential Yoke Shaft | (10) Axle Flange | (16) Front Gear Case | (22) Front Axle Bracket, Rear |
| (5) Spiral Bevel Gear | (11) Collar | (17) Bevel Gear | (23) Coupling |
| (6) Collar | (12) Axle | (18) Differential Side Gear | (24) Propeller Shaft |

The front axle of the 4WD is constructed as shown above. Power is transmitted from the transmission through the propeller shaft (24) and to the spiral bevel pinion shaft (21), then to the spiral bevel gear (5) after that to the differential gear.

The power through the differential is transmitted to the differential yoke shaft (4), and to the bevel gear shaft (15) in the bevel gear case (1).

The revolution is greatly reduced by the bevel gears (17), (13), then the power is transmitted to the axle (12).

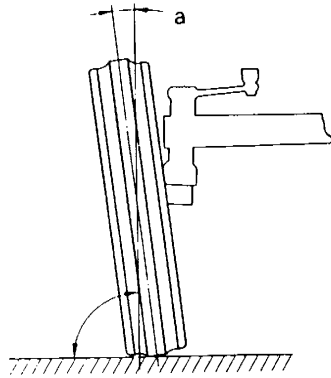
The differential system allows each wheel to rotate at a different speed to make turning easier.

[2] FRONT WHEEL ALIGNMENT

To assure smooth mobility or maneuverability and enhance stable and straight running, the front wheels are mounted at an angle to the right, left and

forward directions. This arrangement is referred to as the Front Wheel Alignment.

[Camber]



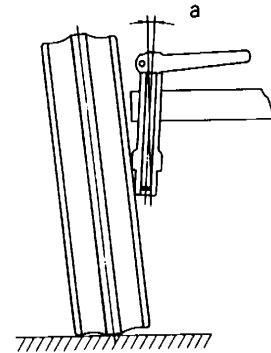
C045F051

The front wheels are tilted from the vertical as viewed from the front, upper wheels are spreader than lower ones.

This inclination is called camber (a). Camber reduces bending or twisting of the front axle caused by vertical load or running resistance, and also maintains the stability in running.

	2WD	4WD
Camber	0.035 rad. 2°	0.070 rad. 4°

[Kingpin Angle]



C045F053

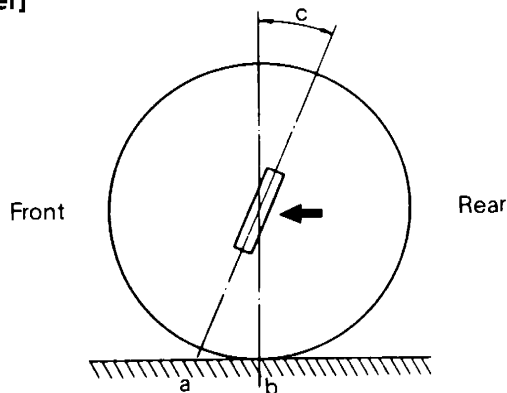
The kingpin is tilted from the vertical as viewed from the front.

This angle is called kingpin angle (a). As with the camber, kingpin angle reduces rolling resistance of the wheels, and prevents any shimmy motion of the steering wheel.

It also reduces steering effort.

	2WD	4WD
Kingpin inclination	0.131 to 0.146 rad. 7.5 to 8.5°	0.218 rad. 12.5°

[Caster]



C045F052

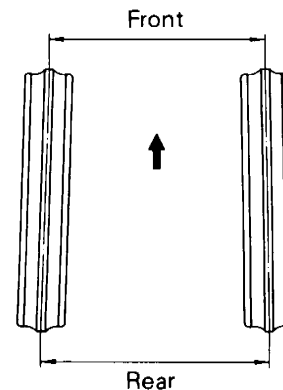
The kingpin is tilted forward as viewed from the side. The point (b) of the wheel center line is behind the point (a) of the kingpin shaft center line.

This inclination is called caster (c). Caster helps provide steering stability.

As with the kingpin inclination, caster reduces steering effort.

Caster	0.026 rad. 1.5°
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[Toe-in]



C045F054

Viewing the front wheels from above reveals that the distance between the toes of the front wheels is smaller than that between the heels.

It is called toe-in. The front wheels tend to roll outward due to the camber, but toe-in offsets it and ensures parallel rolling of the front wheels. Another purpose of toe-in is to prevent excessive and uneven wear of tires.

Toe-in	2 to 8 mm 0.08 to 0.32 in.
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SERVICING

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(1) Separating Front Axle	6-S6
(2) Disassembling 2WD Type Front Axle	6-S8
(3) Disassembling 4WD Type Front Axle	6-S10
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(1) 2WD Type	6-S13
(2) 4WD Type	6-S14

TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Front Wheels Wander to Right or Left	<ul style="list-style-type: none"> ● Tire pressure uneven ● Improper toe-in adjustment (improper alignment) ● Clearance between front axle middle boss and front axle shaft bracket bushing excessive [2WD Type] ● Clearance between front axle case boss and front axle bracket (front, rear) bushing excessive [4WD Type] ● Knuckle shaft bushings worn [2WD Type] ● Front axle rocking force too small ● Front wheel sway excessive ● Tie-rod end loose ● Air sucked in power steering circuit 	Adjust Adjust Replace Replace Replace Adjust Replace Tighten Bleed	G-39 6-S5 6-S13 6-S17 6-S13 6-S6 6-S5 6-S7 7-S11
Front Wheels Can Not Be Driven [4WD Type]	<ul style="list-style-type: none"> ● Propeller shaft broken ● Front wheel drive gears in transmission broken ● Front differential gear broken ● Shift fork broken ● Coupling displaced 	Replace Replace Replace Replace Reassemble	6-S7 – 6-S12 – 6-S7
Noise [4WD Type]	<ul style="list-style-type: none"> ● Gear backlash excessive ● Oil insufficient ● Bearings damaged or broken ● Gears damaged or broken ● Spiral bevel pinion shaft turning force improper 	Adjust or replace Replenish Replace Replace Adjust	6-S14 to S16 G-13 – – 6-S15

SERVICING SPECIFICATIONS

2WD TYPE

Item		Factory Specification	Allowable Limit
Front Wheel Alignment	Toe-in	2 to 8 mm 0.08 to 0.32 in.	–
Front Wheel	Axial Sway	Less than 5 mm 0.20 in.	–
Front Axle	Rocking Force	49.0 to 117.7 N 5.0 to 12.0 kgf 11.0 to 26.5 lbs	–
Knuckle Shaft to Bushing	Clearance	0.000 to 0.285 mm 0.00000 to 0.01122 in.	0.4 mm 0.016 in.
Knuckle Shaft	O.D.	27.880 to 27.900 mm 1.09764 to 1.09842 in.	–
Bushing	I.D.	27.900 to 28.165 mm 1.09842 to 1.10886 in.	–
Front Axle Middle Boss to Front Axle Shaft Bracket Bushing	Clearance	0.000 to 0.177 mm 0.00000 to 0.00697 in.	0.3 mm 0.012 in.
Front Axle Middle Boss	O.D.	39.938 to 40.000 mm 1.57236 to 1.57480 in.	–
Bushing	I.D.	40.000 to 40.115 mm 1.57480 to 1.57933 in.	–

4WD TYPE

Front Wheel Alignment	Toe-in	2 to 8 mm 0.08 to 0.32 in.	–
Front Wheel	Axial Sway	Less than 5 mm 0.20 in.	–
Front Axle	Rocking Force	49.0 to 117.7 N 5.0 to 12.0 kgf 11.0 to 26.5 lbs	–
Front Axle Case Boss (Front) to Bracket Bushing	Clearance	0.025 to 0.160 mm 0.00098 to 0.00630 in.	0.35 mm 0.0138 in.
Front Axle Case Boss (Front)	O.D.	49.950 to 49.975 mm 1.96653 to 1.96752 in.	–
Bushing	I.D.	50.000 to 50.110 mm 1.96850 to 1.97283 in.	–
Front Axle Case Boss (Rear) to Bracket Bushing	Clearance	0.025 to 0.190 mm 0.00098 to 0.00748 in.	0.35 mm 0.0138 in.
Front Axle Case Boss (Rear)	O.D.	70.000 to 70.035 mm 2.75590 to 2.75728 in.	–
Bushing	I.D.	70.060 to 70.190 mm 2.75826 to 2.76338 in.	–

4WD TYPE (Continued)

Item		Factory Specification	Allowable Limit
Differential Case, Differential Case Cover to Differential Side Gear		0.050 to 0.151 mm 0.00197 to 0.00594 in.	0.35 mm 0.0138 in.
Differential Case	I.D.	32.000 to 32.064 mm 1.25984 to 1.26228 in.	—
Differential Case Cover	I.D.	32.000 to 32.025 mm 1.25984 to 1.26083 in.	—
Differential Side Gear	O.D.	31.911 to 31.950 mm 1.25634 to 1.25787 in.	—
Pinion Shaft to Differential Pinion		0.064 to 0.100 mm 0.00252 to 0.00394 in.	0.25 mm 0.0096 in.
Pinion Shaft	O.D.	13.950 to 13.968 mm 0.54921 to 0.54992 in.	—
Differential Pinion	I.D.	14.032 to 14.050 mm 0.55244 to 0.55315 in.	—
Differential Pinion to Differential Side Gear		0.1 to 0.3 mm 0.004 to 0.012 in.	—
Shim	Thickness	0.4 mm 0.016 in.	—
		0.6 mm 0.024 in.	—
		0.8 mm 0.031 in.	—
		1.0 mm 0.039 in.	—
		1.2 mm 0.047 in.	—
Spiral Bevel Pinion Shaft (Pinion Shaft Only)		98.1 to 117.7 N 10 to 12 kgf 22.0 to 26.5 lbs	—
	Turning Torque	0.98 to 1.18 N·m 0.1 to 0.12 kgf·m 0.72 to 0.89 ft-lbs	—
Spiral Bevel Pinion Shaft to Spiral Bevel Gear		0.1 to 0.3 mm 0.004 to 0.012 in.	—
11T Bevel Gear to 16T Bevel Gear		0.15 to 0.35 mm 0.0059 to 0.0138 in.	—
Shim	Thickness	0.8 mm 0.031 in.	—
		1.0 mm 0.039 in.	—
		1.2 mm 0.047 in.	—

4WD TYPE (Continued)

Item		Factory Specification	Allowable Limit
11T Bevel Gear to 42T Bevel Gear	Backlash	0.15 to 0.35 mm 0.0059 to 0.0138 in.	-
Shim	Thickness	1.0 mm 0.039 in.	-
		1.2 mm 0.047 in.	-
		1.4 mm 0.055 in.	-
		1.6 mm 0.063 in.	-
		1.8 mm 0.071 in.	-
		2.0 mm 0.079 in.	-
		2.2 mm 0.087 in.	-

TIGHTENING TORQUES

Tightening torques of screws and nuts on the table below are especially specified.
(For general use screws and nuts : See page G-9)

[2WD TYPE]

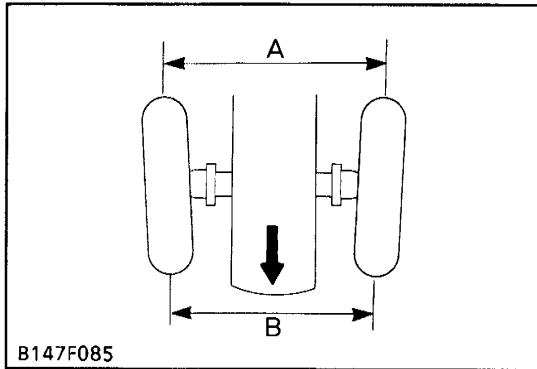
Item	N·m	kgf·m	ft-lbs
Tie-rod clamp screw and nut	39.2 to 49.0	4.0 to 5.0	28.9 to 36.1
Slotted nut of tie-rod end	49.0 to 68.6	5.0 to 7.0	36.2 to 50.6
Front axle shaft brackets mounting screw	77.4 to 90.2	7.9 to 9.2	57.2 to 66.5
Front wheel mounting stud bolt	63.7 to 73.5	6.5 to 7.5	47.0 to 54.2
Front wheel mounting lug nut	137.3	14.0	101.3
Front wheel hub slotted nut	78.5 to 117.7	8.0 to 12.0	57.9 to 86.8
Knuckle arm mounting bolt and nut	77.5 to 90.2	7.9 to 9.2	57.2 to 66.5

[4WD TYPE]

Slotted nut of tie-rod end	39.2 to 45.1	4.0 to 4.6	28.9 to 33.3
Front axle shaft bracket (front) mounting screw	167 to 196	17 to 20	123 to 145
Front axle shaft bracket (rear) mounting screw	98.1 to 117.7	10.0 to 12.0	72.3 to 86.8
Front wheel mounting stud bolt	63.7 to 73.5	6.5 to 7.5	47.0 to 54.2
Front wheel mounting lug nut	137.3	14.0	101.3
Bevel gear case mounting screw	123.5 to 147.0	12.6 to 15.0	91.2 to 108.4
Axle flange mounting screw and nut	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Axle flange mounting stud bolt	11.8 to 15.7	1.2 to 1.6	8.7 to 11.5
Differential case cover mounting screw	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2

CHECKING, DISASSEMBLING AND SERVICING

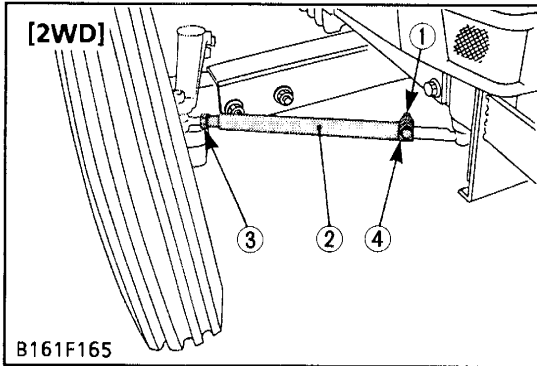
CHECKING AND ADJUSTING



Toe-in

1. Inflate the tires to the specified pressure.
2. Turn the front wheels straight ahead.
3. Measure the toe-in (A-B).
4. If the measurement is not within the factory specifications, adjust the tie-rod length.

Toe-in (A-B)	Factory spec.	2 to 8 mm 0.08 to 0.32 in.
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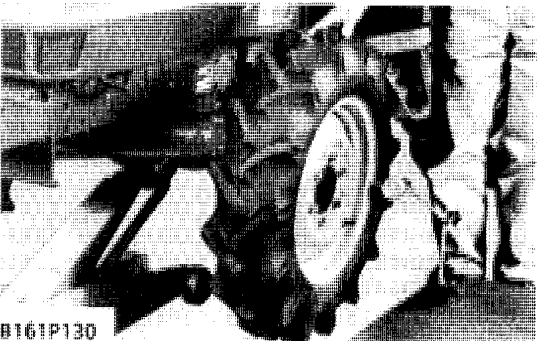
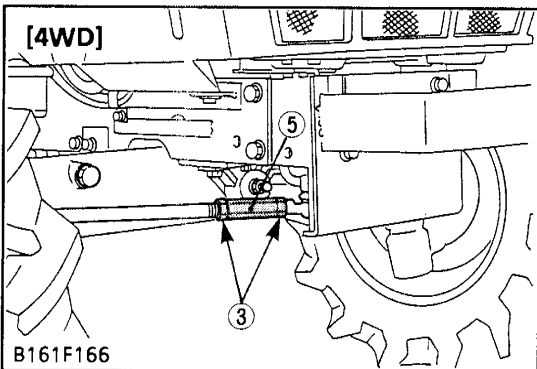


Toe-in Adjustment

1. Remove the tie-rod clamp nut (1) and its screw. (2WD)
2. Loosen the lock nuts (3).
3. Turn the turnbuckle (2), (5) until to be factory specification.
4. Tighten the tie-rod clamp nut (1) after reinstalling them. (2WD)
5. Tighten the lock nuts (3).

Tightening torque	Tie-rod clamp screw and nut (2WD)	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.1 ft·lbs
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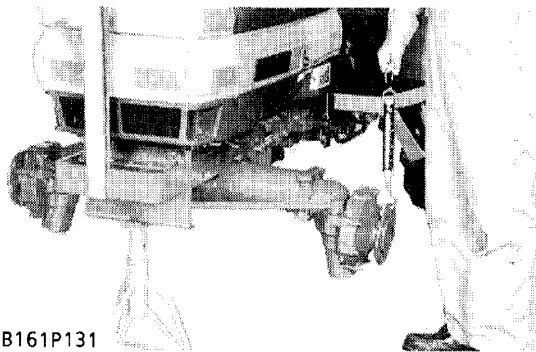
- | | |
|-----------------------|-------------------|
| (1) Tie-rod Clamp Nut | (4) Tie-rod Clamp |
| (2) Turnbuckle | (5) Turnbuckle |
| (3) Lock Nut | |



Axial Sway of Front Wheel

1. Jack up the front side of tractor.
2. Set a dial gauge on the outside of rim.
3. Turn the wheel slowly and read the runout of rim.
4. If the runout exceeds the factory specifications, check the bearing, rim, and front wheel hub.

Axial sway of front wheel	Factory spec.	Less than 5.0 mm 0.20 in.
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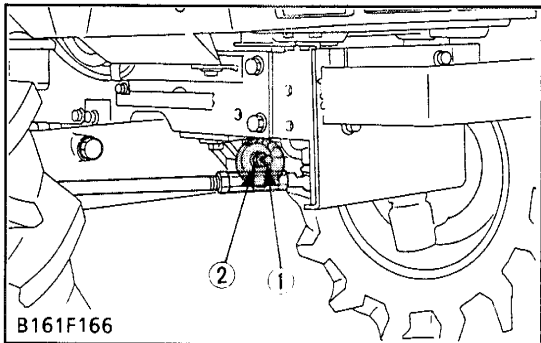


B161P131

Front Axle Rocking Force

1. Jack up the front side of tractor.
2. Set a spring balance to the front axle flange.
3. Measure the front axle rocking force.
4. If the measurement is not within the factory specifications, adjust with the adjusting screw (1).
5. Tighten the lock nut (2) firmly.

Front axle rocking force	Factory spec.	49.0 to 117.7 N 5.0 to 12.0 kgf 11.0 to 26.5 lbs
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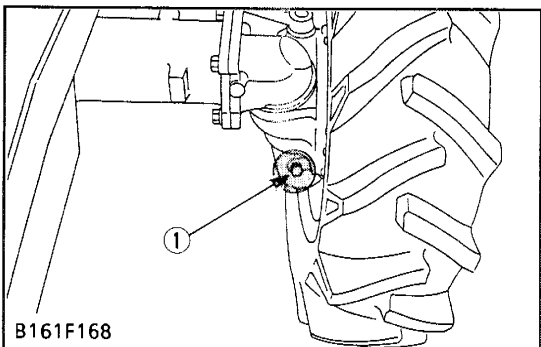
B161F166

(1) Adjusting Screw

(2) Lock Nut

DISASSEMBLING AND ASSEMBLING

(1) Separating Front Axle



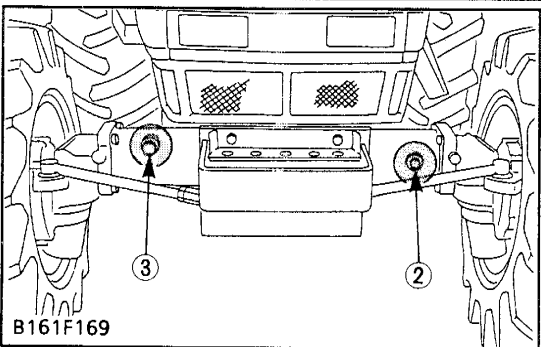
B161F168

Draining Front Axle Case Oil [4WD Type]

1. Place oil pans underneath the front axle case.
2. Remove the drain plug (1) both sides and filling port plug (3) to drain the oil.
3. After draining, reinstall the drain plugs (1) and filling port plug (3).

(When refilling)

- Remove the filling port plug (3) and check plug (2).
- Fill with the new oil up to the check plug port.
- After filling, reinstall the check plug (2) and filling port plug (3).



B161F169

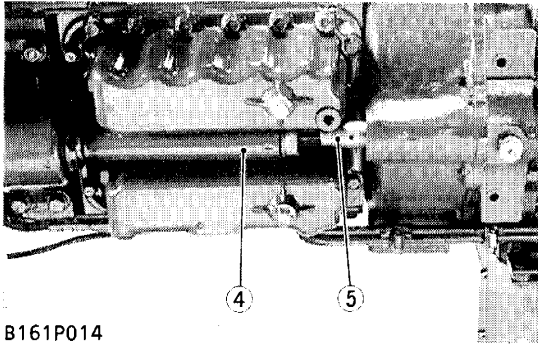
Capacity	Front axle case oil	5.5 ℓ 5.8 U.S.qts. 4.8 Imp.qts.
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■ IMPORTANT

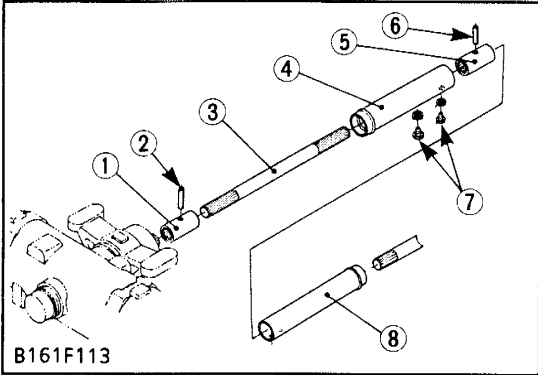
- Use KUBOTA SUPER UDT fluid or SAE 80, 90 gear oil. Refer to "LUBRICANTS, FUEL AND COOLING WATER". (See page G-8.)

(1) Drain Plug
(2) Check Plug

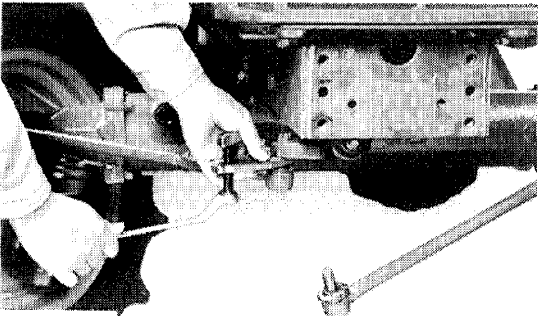
(3) Filling Port Plug



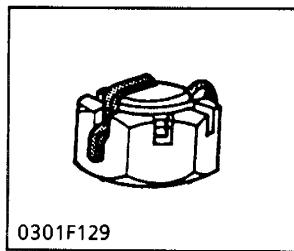
B161P014



B161F113



B161P132



0301F129

Propeller Shaft [4WD Type Only]

1. Slide the propeller shaft cover (4), (8) after removing the screws (7).
2. Tap out the spring pin (6), and then slide the coupling (5) to the front.

(When reassembling)

- Apply grease to the splines of the propeller shaft.

- | | |
|---------------------------|---------------------------|
| (1) Coupling | (5) Coupling |
| (2) Spring Pin | (6) Spring Pin |
| (3) Propeller Shaft | (7) Screws |
| (4) Propeller Shaft Cover | (8) Propeller Shaft Cover |

Bumper and Tie-rods

1. Remove the bumper.
2. Remove the tie-rods with the tie-rod end lifter.
In this case, take special care not to damage the tie-rod end nut (slotted nut). (It is preferable to replace it with an unrequired nut.)
3. Reinstall the bumper.

(When reassembling)

Tightening torque	Tie-rod end nut	2WD	49.0 to 68.6 N·m 5.0 to 7.0 kgf·m 36.2 to 50.6 ft-lbs
		4WD	39.2 to 45.1 N·m 4.0 to 4.6 kgf·m 28.9 to 33.3 ft-lbs
	Tie-rod clamp screw and nut		39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.1 ft-lbs

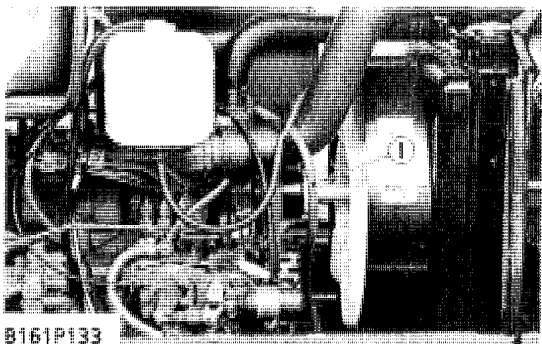
■ IMPORTANT

- After tightening the tie-rod end nut to the specified torque, install a cotter pin as shown in the figure left.

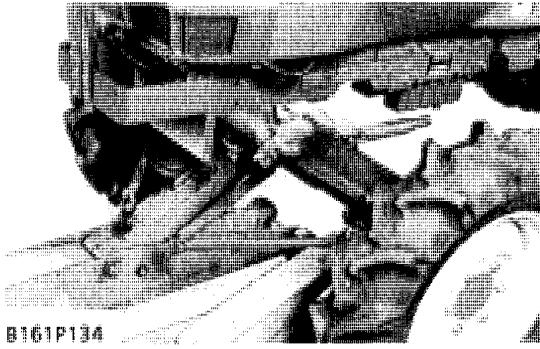
Breather Pipe [4WD Type Only]

1. Remove the breather pipe (1) clamp.

- (1) Breather Pipe



B161P133



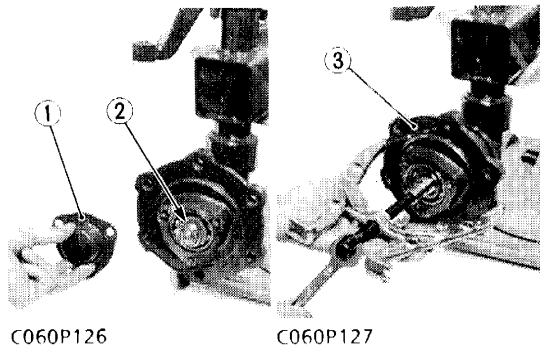
Front Axle

1. Place the jacks under the front axle, and hang up the front bumper by the hoist to support it.
2. Remove the shaft bracket 1 mounting screws or nuts and shaft bracket 2 mounting screws.
3. Separate the front axle from the front axle support.
4. Remove the front wheels.

(When reassembling)

Tightening torque	Shaft bracket 1 (front) mounting screws or nuts [4WD Type]	167 to 196 N·m 17 to 20 kgf·m 123 to 145 ft-lbs
	Shaft bracket 1 (front) mounting stud bolt [4WD Type]	63.7 to 73.5 N·m 6.5 to 7.5 kgf·m 47.0 to 54.2 ft-lbs
	Shaft bracket 2 (rear) mounting screws [4WD Type]	98.1 to 117.7 N·m 10.0 to 12.0 kgf·m 72.3 to 86.8 ft-lbs
	Shaft brackets (front, rear) mounting screws [2WD Type]	77.4 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Front wheel mounting lug nuts	137.3 N·m 14.0 kgf·m 101.3 ft-lbs
	Front wheel mounting stud bolts	63.7 to 73.5 N·m 6.5 to 7.5 kgf·m 47.0 to 54.2 ft-lbs

(2) Disassembling 2WD Type Front Axle



Front Wheel Hub

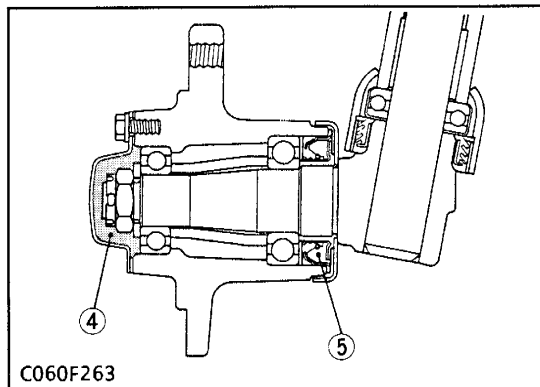
1. Remove the front wheel hub cap (1).
2. Draw out the cotter pin.
3. Remove the slotted nut (2).
4. Remove the collar.
5. Remove the front wheel hub (3) with a puller.

(When reassembling)

- Replace cotter pin with a new one.
- Apply grease to the oil seal in the front wheel hub.

■ IMPORTANT

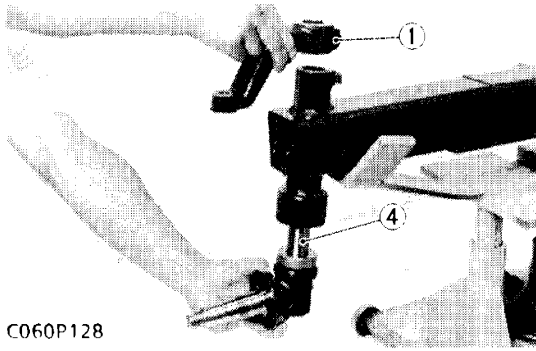
- After tightening the slotted nut to the specified torque, insert a cotter pin and bend it as shown in the figure.
- Pack in the grease to the bearing in the front wheel hub.



Tightening torque	Front wheel hub slotted nut	78.5 to 117.7 N·m 8.0 to 12.0 kgf·m 57.9 to 86.8 ft-lbs
-------------------	-----------------------------	---

- | | |
|-------------------------|--------------|
| (1) Front Wheel Hub Cap | (4) Grease |
| (2) Slotted Nut | (5) Oil Seal |
| (3) Front Wheel Hub | |





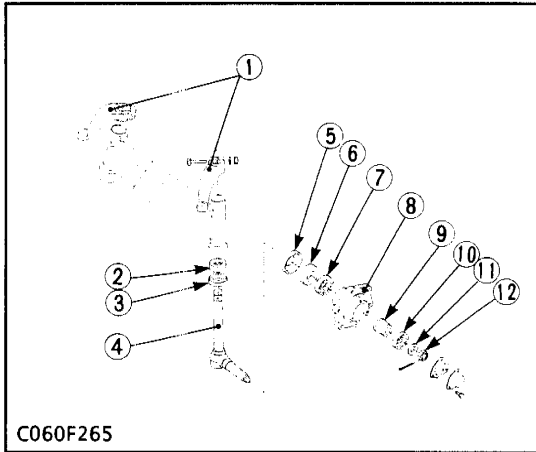
C060P128

Knuckle Shaft

1. Remove the knuckle arm (1) and draw out the knuckle shaft (4) from the front axle.

(When reassembling)

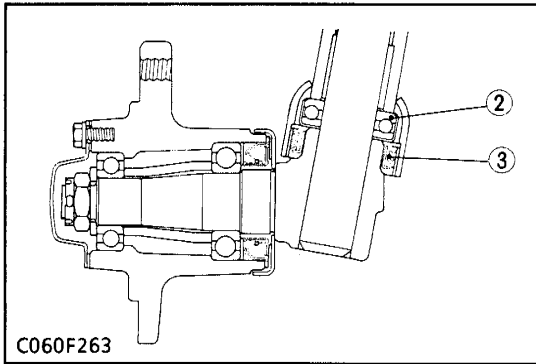
- Install the thrust ball bearing (2) and oil seal (3), noting its direction.
- Apply grease to the oil seals (3), (6).
- Do not interchange right and left knuckle arms.
- When lift the knuckle shaft, the knuckle arms must be mounted so that the clearance between the knuckle arms and front axle is 0.3 to 1.0 mm (0.012 to 0.039 in.).



C060F265

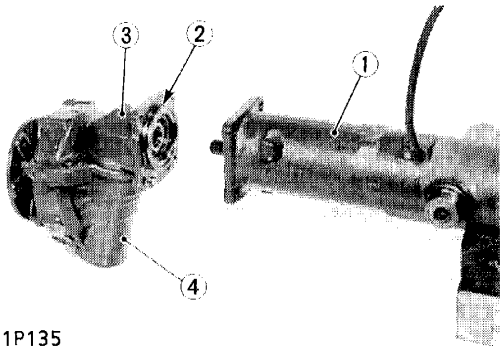
Tightening torque	Knuckle arm mounting bolt and nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
-------------------	-----------------------------------	---

- | | |
|-------------------------|---------------------|
| (1) Knuckle Arm | (7) Ball Bearing |
| (2) Thrust Ball Bearing | (8) Front Wheel Hub |
| (3) Oil Seal | (9) Spacer |
| (4) Knuckle Shaft | (10) Ball Bearing |
| (5) Dust Cover | (11) Washer |
| (6) Oil Seal | (12) Slotted Nut |



C060F263

(3) Disassembling 4WD Type Front Axle



B161P135

- (1) Front Axle Case
- (2) O-ring
- (3) Bevel Gear Case
- (4) Front Gear Case

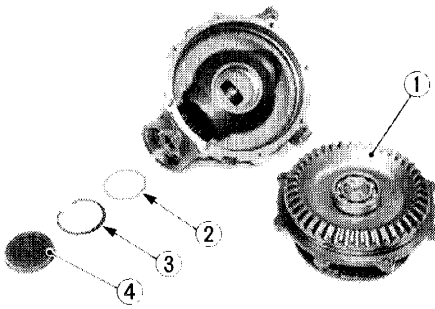
Bevel Gear Case and Front Gear Case

1. Remove the bevel gear case mounting screws.
2. Remove the bevel gear case (3) and front gear case (4) as a unit from the front axle case (1).

(When reassembling)

- Apply grease to the O-ring (2) and take care not to damage it.
- Do not interchange right and left bevel gear case assemblies and front gear case assemblies.

Tightening torque	Bevel gear case mounting screw	123.5 to 147.0 N·m 12.6 to 15.0 kgf·m 91.2 to 108.4 ft-lbs
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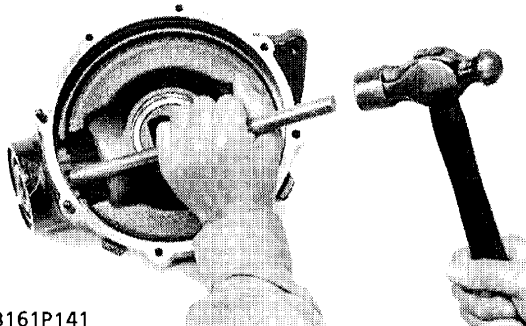
B161P140

Bevel Gear Case, Axle Flange and Front Gear Case

1. Remove the plug (4).
2. Remove the internal snap ring (3) and shim (2).
3. Remove the axle flange (1).
4. Tap out the bevel gear (6) and ball bearing.
5. Draw out the bevel gear shaft (7).
6. Remove the external snap ring (5).
7. Tap the bevel gear case (8), and separate it from the front gear case (9).

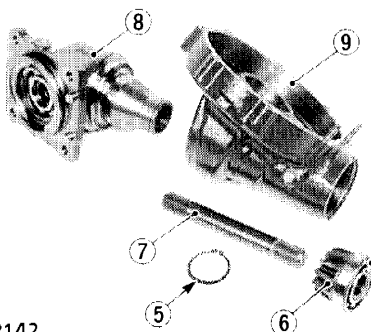
(When reassembling)

- Apply grease to the O-rings of axle flange (1).
- Tighten the axle flange mounting screws and nuts diagonally in several steps.
- Install the oil seal (10) of bevel gear case, noting its direction as shown in the figure below.

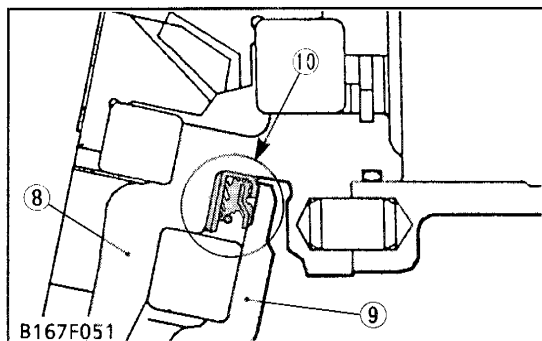


B161P141

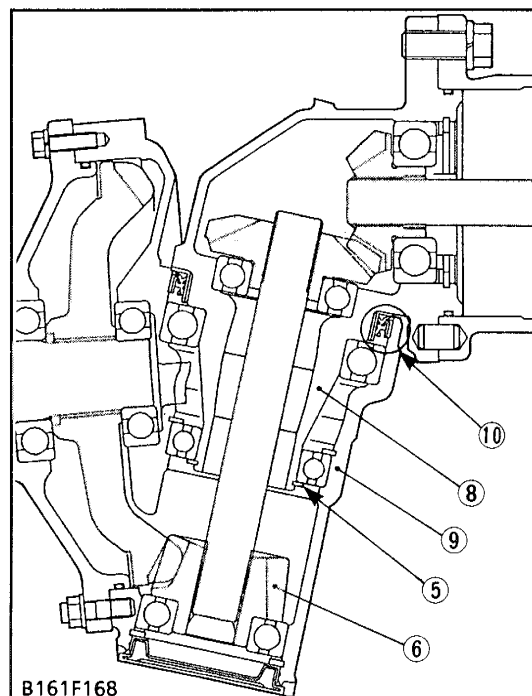
Tightening torque	Axle flange mounting stud bolt	11.8 to 15.7 N·m 1.2 to 1.6 kgf·m 8.7 to 11.5 ft-lbs
	Axle flange mounting screws and nuts	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs



B161P142

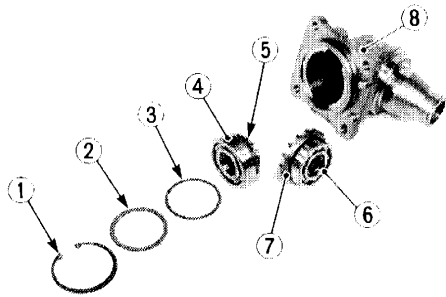


B167F051



B161F168

- (1) Axle Flange
- (2) Shim
- (3) Internal Snap Ring
- (4) Plug
- (5) External Snap Ring
- (6) Bevel Gear
- (7) Bevel Gear Shaft
- (8) Bevel Gear Case
- (9) Front Gear Case
- (10) Oil Seal



B161P143

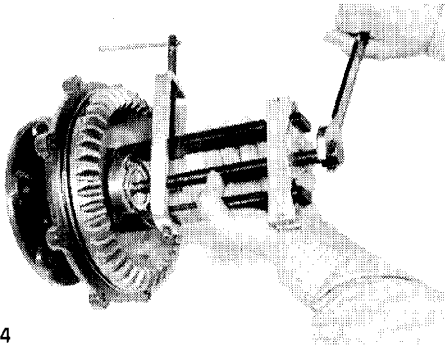
Bevel Gear Case Gears

1. Remove the internal snap ring (1).
2. Take out the bevel gears (5), (7) with ball bearings (4), (6), collar (2) and shims (3).

(When reassembling)

- Install the same shims (3) before they are removed.

- | | |
|------------------------|---------------------|
| (1) Internal Snap Ring | (5) Bevel Gear |
| (2) Collar | (6) Ball Bearing |
| (3) Shims | (7) Bevel Gear |
| (4) Ball Bearing | (8) Bevel Gear Case |



B161P144

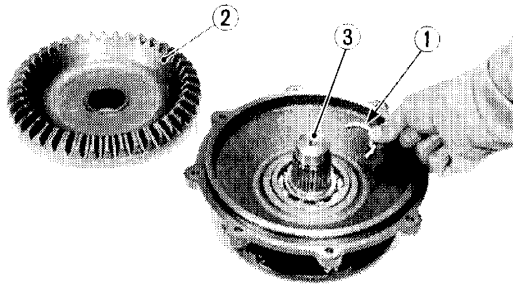
Axle

1. Remove the bearing with a special use puller set.
2. Take out the bevel gear (2).
3. Take out the collar (1).
4. Tap out the axle (3).

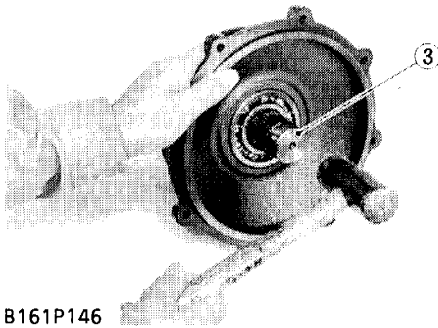
(When reassembling)

- Install the oil seal (5) of axle flange (4), noting its direction as shown in the figure below.

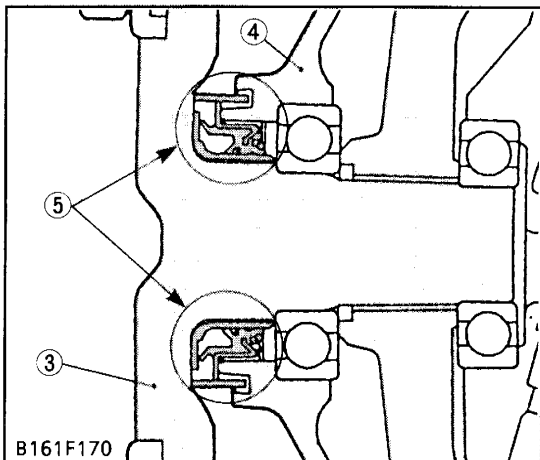
- | | |
|----------------|-----------------|
| (1) Collar | (4) Axle Flange |
| (2) Bevel Gear | (5) Oil Seal |
| (3) Axle | |



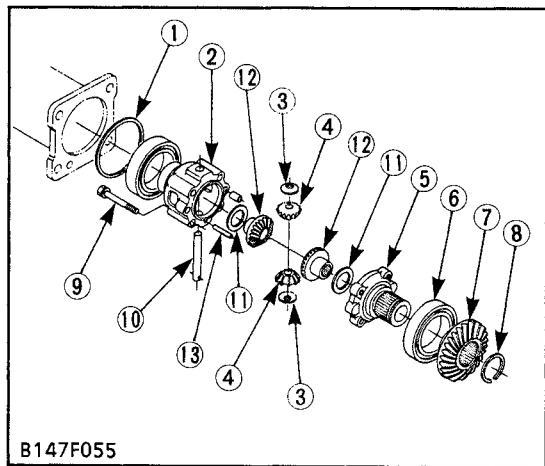
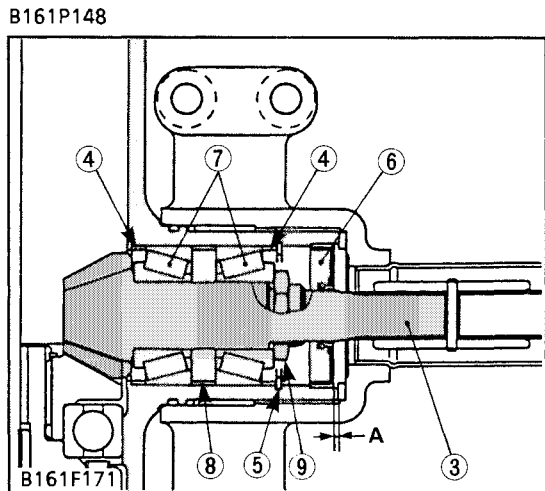
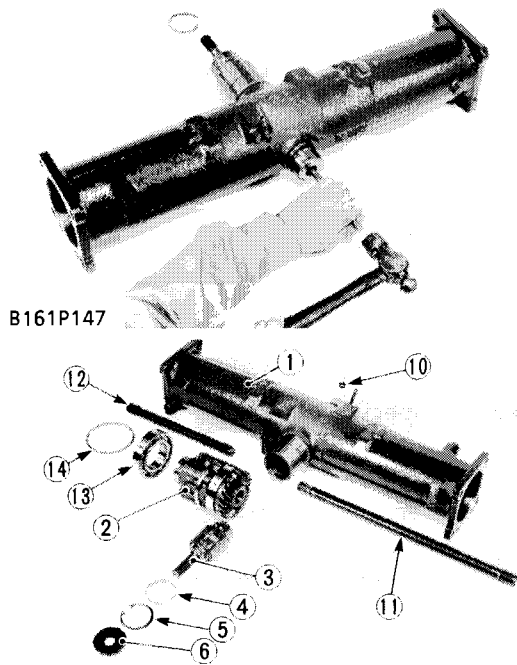
B161P145



B161P146



B161F170



- (1) Shim
- (2) Differential Case
- (3) Thrust Collar
- (4) Differential Pinion
- (5) Differential Case Cover
- (6) Ball Bearing
- (7) Spiral Bevel Gear
- (8) External Snap Ring
- (9) Screws
- (10) Pinion Shaft
- (11) Shim
- (12) Differential Side Gear
- (13) Straight Pin

Spiral Bevel Pinion Shaft and Differential Gear Assembly

1. Take out the differential yoke shaft (11), (12) both sides.
2. Remove the oil seal (6) and internal snap ring (5).
3. Remove the plug (10), and then tap out the spiral bevel pinion shaft (3) by the brass rod and hammer.
4. Take out the differential gear assembly (2), ball bearing (13) and shim (14) from right side of front axle case (1).
5. Remove the stake of lock nut (9), and then remove the lock nut (9).
6. Remove the taper roller bearings (7).

(When reassembling)

- Replace the lock nut (9), oil seal (6) and plug (10) with new ones.
- Apply grease to the oil seal (6).
- Install the same shims and collars before they are removed.
- Install the taper roller bearings correctly, noting their direction, and apply gear oil to them.
- When press-fitting a oil seal (6), observe the dimension "A" described in the figure.
- Stake the lock nut (9) firmly.
- Tighten up the lock nut (9) until the turning force of the spiral bevel pinion shaft reaches the factory specifications. (See page 6-S15.)

Spiral bevel pinion shaft turning torque	Factory spec.	0.98 to 1.18 N·m 0.1 to 0.12 kgf·m 0.72 to 0.89 ft·lbs
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[A] 1 mm (0.039 in.)

- (1) Front Axle Case
- (2) Differential Gear Assembly
- (3) Spiral Bevel Pinion Shaft
- (4) Adjusting Collar
- (5) Internal Snap Ring
- (6) Oil Seal
- (7) Taper Roller Bearings
- (8) Collar
- (9) Lock Nut
- (10) Plug
- (11) Differential Yoke Shaft RH
- (12) Differential Yoke Shaft LH
- (13) Ball Bearing
- (14) Shim

Differential Gear

1. Remove the differential case cover mounting screws (9) and then take out the differential case cover (5), ball bearing (6) and spiral bevel gear (7) as a unit.
2. Remove the external snap ring (8), and then remove the ball bearing (6) and spiral bevel gear (7) as a unit with a puller.
3. Remove the straight pin (13).
4. Pull out the pinion shaft (10) and take out the differential pinions (4) and differential side gears (12).

NOTE

- Arrange the parts to know their original position.

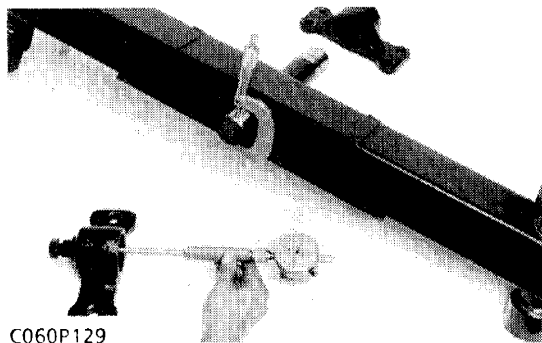
(When reassembling)

- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential side gears (12) and differential pinions (4).
- Install the pinion shaft (10) so that the hole on it may align with the hole on differential case (2), and install the straight pin (13).

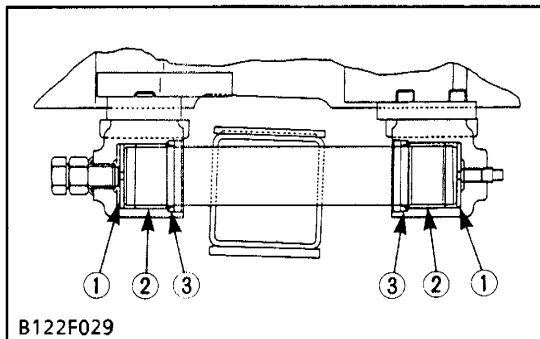
Tightening torque	Differential case cover mounting screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft·lbs
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SERVICING

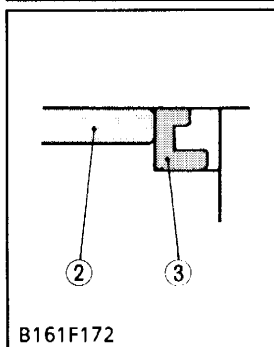
(1) 2WD Type



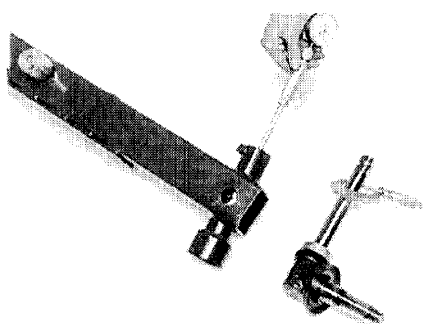
C060P129



B122F029



B161F172



C060P130

Clearance between Front Axle Middle Boss and Shaft Bracket

Bushing

1. Measure the front axle middle boss O.D. at several points where it contacts with the bushing.
2. Measure the shaft bracket 1 bushing I.D. and bracket 2 bushing I.D. in the same method, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

(When reassembling)

- Before press-fitting the bushing, install the new thrust collar.
- Install the oil seals, noting their direction. (Refer to figure left.)

■ IMPORTANT

- After replacing the bushing, be sure to adjust the front axle rocking force. (See page 6-S6.)

Clearance between front axle middle boss and bushing	Factory spec.	0.000 to 0.177 mm 0.00000 to 0.00697 in.
	Allowable limit	0.3 mm 0.012 in.
Front axle middle boss O.D.	Factory spec.	39.938 to 40.000 mm 1.57236 to 1.57480 in.
Bushing I.D.	Factory spec.	40.000 to 40.115 mm 1.57480 to 1.57933 in.

- (1) Thrust Collars
(2) Bushings

- (3) Oil Seals

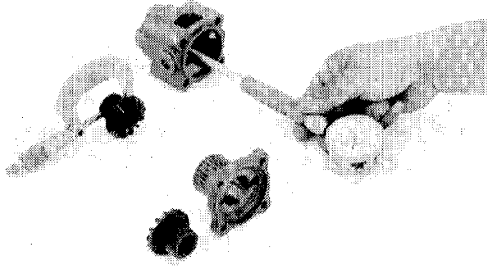
Clearance between Knuckle Shaft (Kingpin) and Bushing

1. Measure the shaft O.D. at several points where it contacts with the bushings.
2. Measure the bushing I.D. in the same method, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the bushing.

(When reassembling)

- Remove the bushing with a bushing puller.

Clearance between knuckle shaft (kingpin) and bushing	Factory spec.	0.000 to 0.285 mm 0.00000 to 0.01122 in.
	Allowable limit	0.4 mm 0.016 in.
Knuckle shaft O.D.	Factory spec.	27.880 to 27.900 mm 1.09764 to 1.09842 in.
Bushing I.D.	Factory spec.	27.900 to 28.165 mm 1.09842 to 1.10886 in.

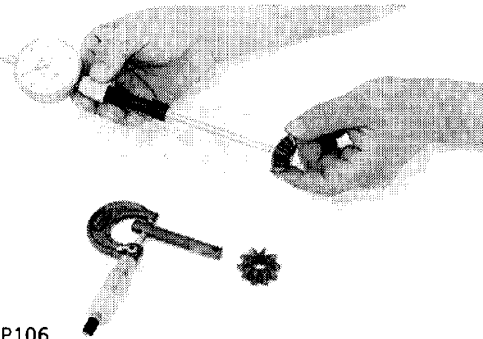
(2) 4WD Type

C094P105

Clearance between Differential Case (Differential Case Cover) and Differential Side Gear

1. Measure the differential side gear boss O.D.
2. Measure the differential case bore I.D. and calculate the clearance.
3. Measure the differential case cover bore I.D. and calculate the clearance.
4. If the clearance exceeds the allowable limit, replace faulty parts.

Clearance between differential case (Differential case cover) and differential side gear	Factory spec.	0.050 to 0.151 mm 0.00197 to 0.00594 in.
	Allowable limit	0.35 mm 0.0138 in.
Differential case bore I.D.	Factory spec.	32.000 to 32.064 mm 1.25984 to 1.26228 in.
Differential case cover bore I.D.	Factory spec.	32.000 to 32.025 mm 1.25984 to 1.26083 in.
Differential side gear O.D.	Factory spec.	31.911 to 31.950 mm 1.25634 to 1.25787 in.

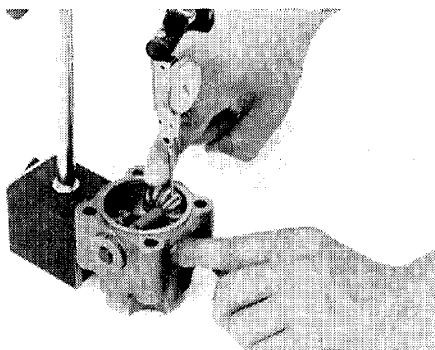


C094P106

Clearance between Pinion Shaft and Differential Pinion

1. Measure the pinion shaft O.D.
2. Measure the differential pinion I.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace faulty parts.

Clearance between pinion shaft and differential pinion	Factory spec.	0.064 to 0.100 mm 0.00252 to 0.00394 in.
	Allowable limit	0.25 mm 0.0096 in.
Pinion shaft O.D.	Factory spec.	13.950 to 13.968 mm 0.54921 to 0.54992 in.
Differential pinion I.D.	Factory spec.	14.032 to 14.050 mm 0.55244 to 0.55315 in.



C094P107

Backlash between Differential Pinion and Differential Side**Gear**

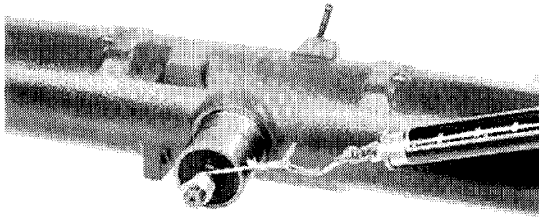
1. Set a dial gauge (lever type) on a tooth of the differential pinion.
2. Fix the differential side gear and move the differential pinion to measure the backlash.
3. If the measurement exceeds the factory specifications, adjust with the differential side gears shims.

Backlash between differential pinion and differential side gear	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.
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(Reference)

- Thickness of adjusting shims :

0.4 mm (0.016 in.)	1.0 mm (0.039 in.)
0.6 mm (0.024 in.)	1.2 mm (0.047 in.)
0.8 mm (0.031 in.)	
- Tooth contact : More than 35 %
- Center of tooth contact :
1/3 to 1/2 of the entire width from the small end.



B161P136

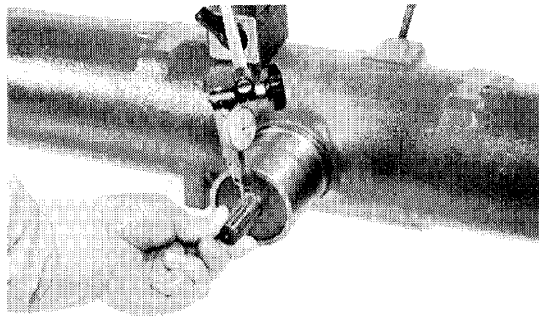
Turning Force of Spiral Bevel Pinion Shaft (Pinion Shaft Only)

1. Install the spiral bevel pinion shaft assembly to the front axle case.
2. Wind a string around the spiral bevel pinion shaft and attach spring balance to the tip of the string.
3. Slowly pull the spring balance in a direction at right angle to the spiral bevel pinion shaft to measure the turning force.
4. If the turning force is not within the factory specifications, adjust with the lock nut.

Turning force	Factory spec.	98.1 to 117.7 N 10 to 12 kgf 22.0 to 26.5 lbs
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NOTE

- The turning torque is figured by multiplying the radius (distance from the center of the spiral bevel pinion shaft to a point on the circumference from which the string is pulled) by the reading on the spring balance.
- After turning torque adjustment, be sure to stake the lock nut.



B161P137

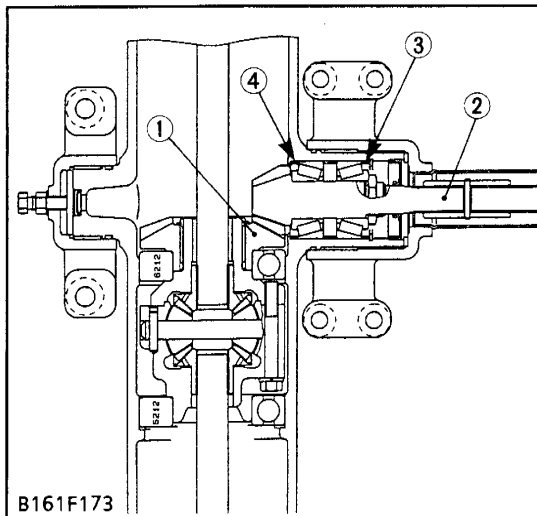
Backlash between Spiral Bevel Pinion Shaft and Spiral Bevel

Gear

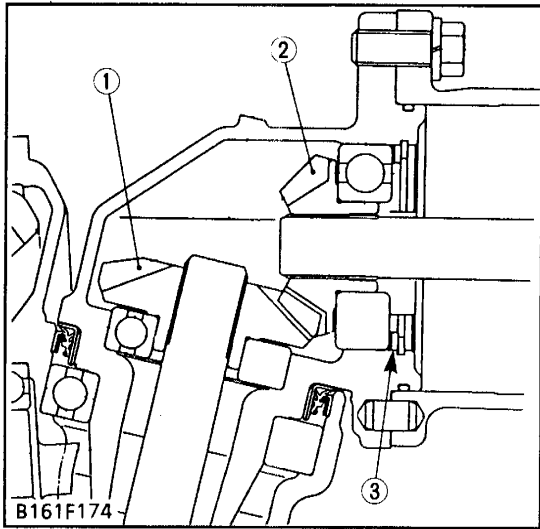
1. Set a dial gauge (lever type) with its finger on the spline of spiral bevel pinion shaft.
2. Measure the backlash by moving the spiral bevel pinion shaft by hand lightly.
3. If the backlash is not within the factory specifications, change the adjusting collars (3), (4). Change the adjusting collar (4) to 0.1 mm (0.004 in.) smaller size, and change the adjusting collar (3) to 0.1 mm (0.004 in.) larger size.
4. Adjust the backlash properly by repeating the above procedures.

Backlash between spiral bevel pinion shaft and spiral bevel gear	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.
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- (1) Spiral Bevel Gear
- (2) Spiral Bevel Pinion Shaft
- (3) Adjusting Collar
- (4) Adjusting Collar



B161F173



(1) 16T Bevel Gear (2) 11T Bevel Gear (3) Shim

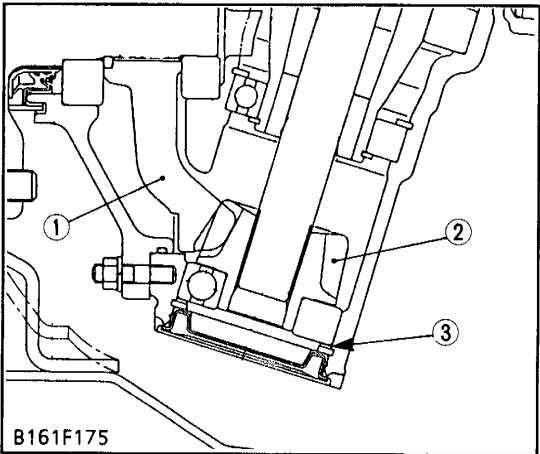
Backlash between 11T Bevel Gear and 16T Bevel Gear

1. Stick a strip of fuse to three spots on the 16T bevel gear (1) with grease.
2. Fix the front axle case, bevel gear case and front gear case.
3. Turn the axle.
4. Remove the bevel gear case from front axle case and measure the thickness of the fuses with an outside micrometer.
5. If the backlash is not within the factory specifications, adjust with shim (3).

Backlash between 11T bevel gear and 16T bevel gear	Factory spec.	0.15 to 0.35 mm 0.0059 to 0.0138 in.
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(Reference)

- Thickness of adjusting shims (3) :
0.8 mm (0.031 in.) 1.2 mm (0.047 in.)
1.0 mm (0.039 in.)
- Tooth contact : More than 35 %



(1) 42T Bevel Gear (2) 11T Bevel Gear (3) Shim

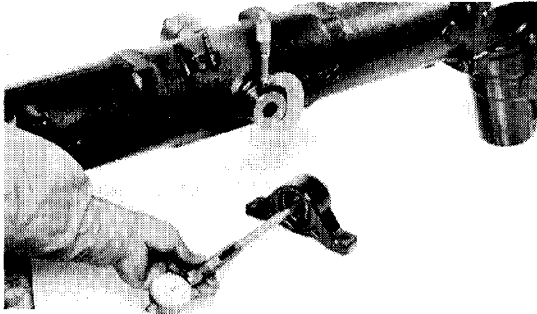
Backlash between 11T Bevel Gear and 42T Bevel Gear

1. Stick a strip of fuse to three spots on the 42T bevel gear (1) with grease.
2. Fix the axle flange and front gear case.
3. Turn the axle.
4. Remove the axle flange from front gear case and measure the thickness of the fuse with an outside micrometer.
5. If the backlash is not within the factory specifications, adjust with shim (3).

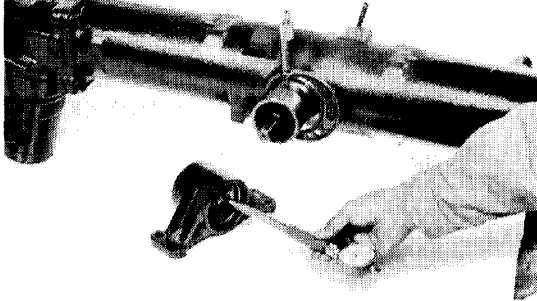
Backlash between 11T bevel gear and 42T bevel gear	Factory spec.	0.15 to 0.35 mm 0.0059 to 0.0138 in.
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(Reference)

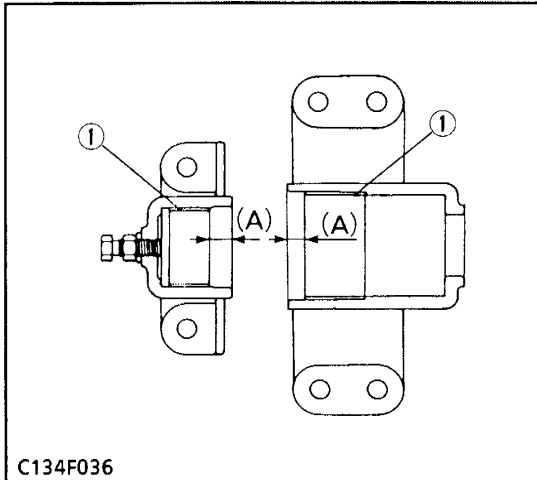
- Thickness of adjusting shims (3) :
1.0 mm (0.039 in.) 1.8 mm (0.071 in.)
1.2 mm (0.047 in.) 2.0 mm (0.079 in.)
1.4 mm (0.055 in.) 2.2 mm (0.087 in.)
1.6 mm (0.063 in.)
- Tooth contact : More than 35 %



B161P139



B161P138



C134F036

(1) Bushing

Clearance between Front Axle Case Bosses and Bracket

Bushings

1. Measure the front axle case bosses O.D. with an outside micrometer.
2. Measure the bracket bushing I.D. with an inside micrometer and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the bracket bushing.
4. If the clearance still exceeds the allowable limit, replace the front axle case.

Clearance between front axle case boss (front) and bracket bushing (front)	Factory spec.	0.025 to 0.160 mm 0.00098 to 0.00630 in.
	Allowable limit	0.35 mm 0.0138 in.

Front axle case boss (front) O.D.	Factory spec.	49.950 to 49.975 mm 1.96653 to 1.96752 in.
Bracket bushing (front) I.D.	Factory spec.	50.000 to 50.110 mm 1.96850 to 1.97283 in.

Clearance between front axle case boss (rear) and bracket bushing (rear)	Factory spec.	0.025 to 0.190 mm 0.00098 to 0.00748 in.
	Allowable limit	0.35 mm 0.0138 in.

Front axle case boss (rear) O.D.	Factory spec.	70.000 to 70.035 mm 2.75590 to 2.75728 in.
Bracket bushing (rear) I.D.	Factory spec.	70.060 to 70.190 mm 2.75826 to 2.76338 in.

Press-fitting Bushing

- When press-fitting a new bushing, observe the dimension described in the figure.

Press-fit depth of bushing (A)	Factory spec.	12 mm 0.47 in.
--------------------------------	---------------	-------------------

NOTE

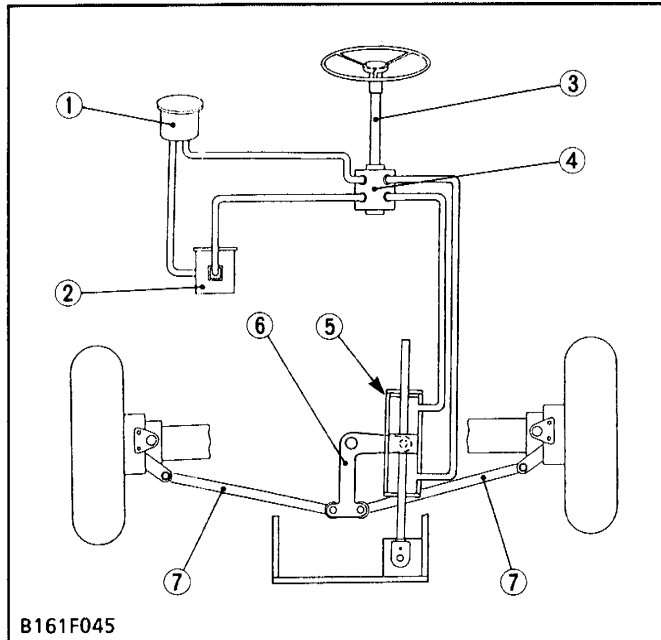
- After replacing the bushing, be sure to adjust the front axle rocking force. (See page 6-S6.)

MECHANISM

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[1] FEATURES	7-M1
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(3) Relief Valve (with Check Valve)	7-M4
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[6] STEERING CYLINDER	7-M6

[1] FEATURES



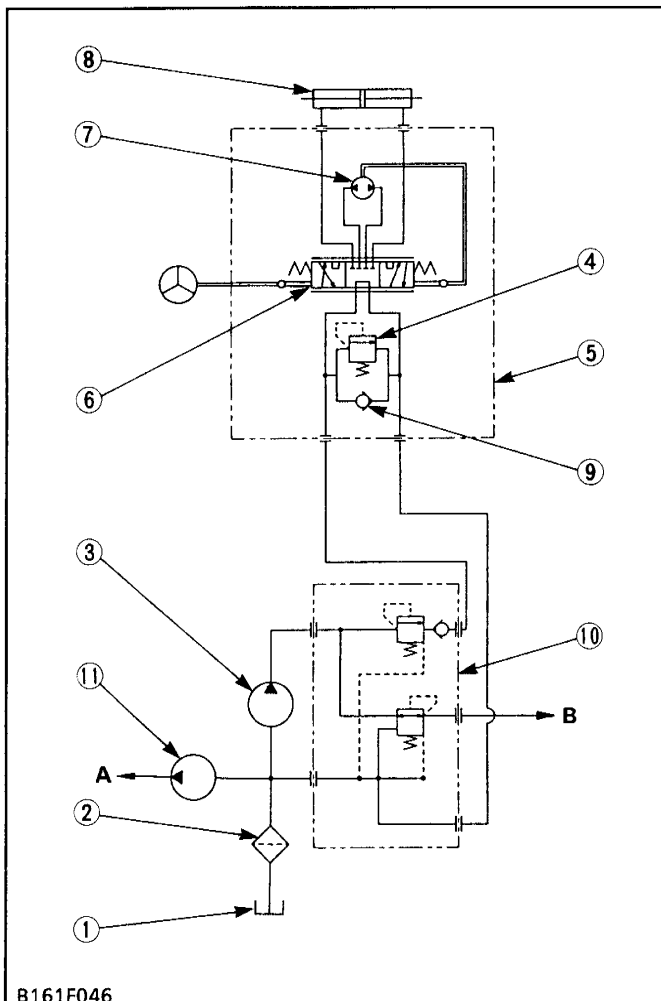
These tractors are provided with a hydrostatic power steering. The steering controller is connected to the steering cylinder with the hydraulic pipes only.

This steering is actuated by oil pressure. Accordingly, it does not have mechanical transmitting parts such as steering gear, drag link, etc.

Therefore, it is simple in construction. In these models, the non-road reaction type is used. With this type, the wheels maintain their position when the operator releases his hands from the steering wheel. Vibration at the wheels is not transmitted to the steering wheel.

- | | |
|-------------------------|-----------------------|
| (1) Transmission Case | (5) Steering Cylinder |
| (2) Hydraulic Pump | (6) Pitman Arm |
| (3) Steering Joint | (7) Tie-rod |
| (4) Steering Controller | |

[2] HYDRAULIC CIRCUIT FOR POWER STEERING SYSTEM



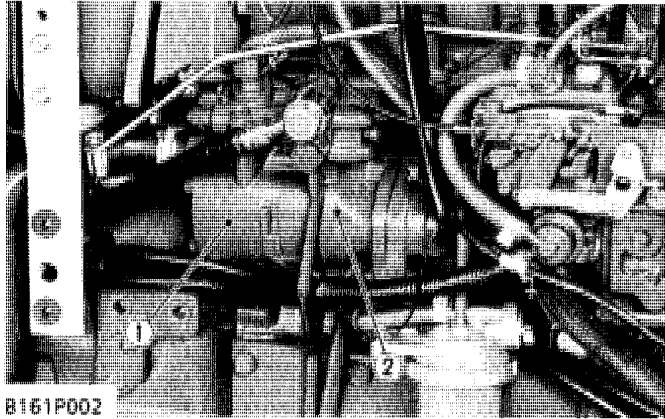
■ Hydraulic Oil Flow

1. Power steering hydraulic pump (3), driven by the engine, sucks oil from transmission case (1), and it to steering controller (5) through the regulator valve (10).
2. The oil which has entered steering controller (5) is directed to control valve (6). As the steering wheel is turned, control valve (6) operates, and the oil passes through gerotor (7) and into steering cylinder (8). The cylinder rod then moves to control the directional movement of the front wheels.
3. Return oil from steering cylinder (8) passes through control valve (6) and back into transmission case (1).
4. When the engine is not operating, and the steering wheel is turned, gerotor (7) rotates to supply oil in the pipe to steering cylinder (8). Thus the machine can be steered manually. Under this condition, check valve (9) opens, and oil returning from the steering cylinder, which would otherwise return to transmission case (1), flows to the pipe leading to the hydraulic pump.

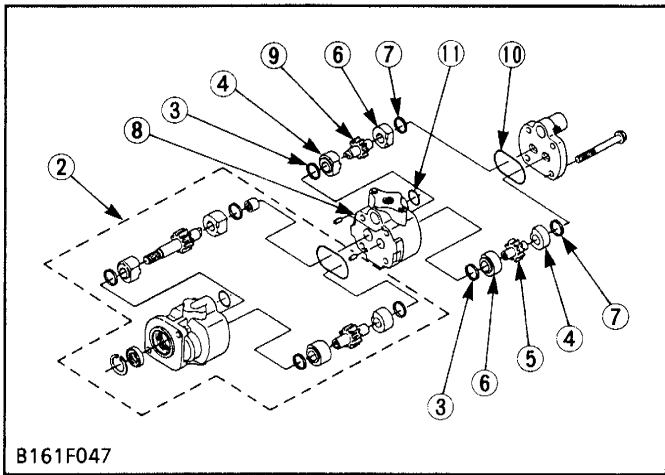
A : To Three Point Hydraulic System
B : To GST System

- | | |
|-----------------------------------|--|
| (1) Transmission Case | (7) Gerotor |
| (2) Oil Filter | (8) Steering Cylinder |
| (3) Power Steering Hydraulic Pump | (9) Check Valve |
| (4) Relief Valve | (10) Regulator Valve |
| (5) Steering Controller | (11) Three Point System Hydraulic Pump |
| (6) Control Valve | |

[3] HYDRAULIC PUMP

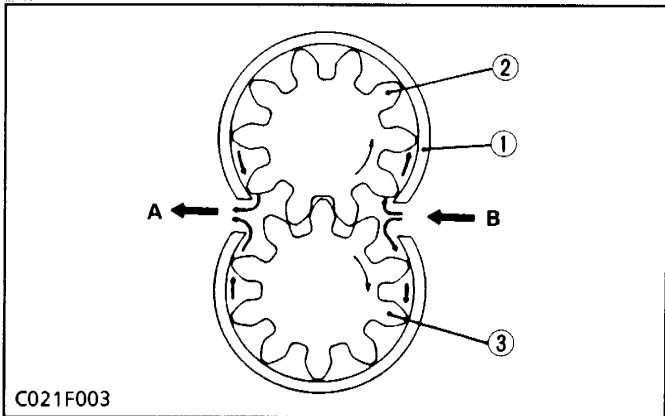


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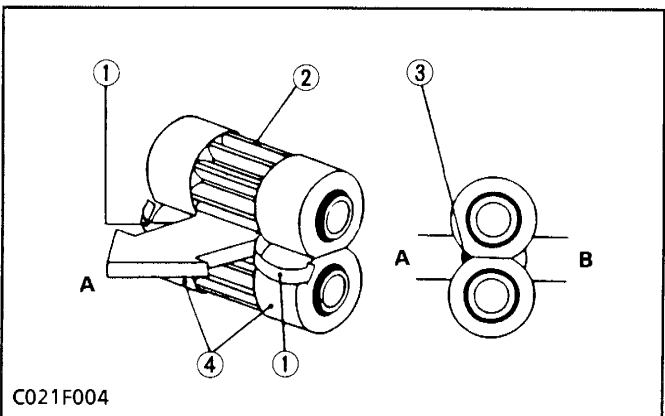


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■ Operation



C021F003



C021F004

The three point system hydraulic pump pressure-feeds the oil drawn from the transmission case through the oil filter to the control valve. The three point system hydraulic pump is driven by the engine fuel camshaft.

This hydraulic pump is pressure loading type gear pump with high volumetric efficiency.

(Reference)

Pump discharge per revolution		6.068 cc/rev. 0.370 cu.in./rev.
Pump discharge at no pressure	L3010 L3410	17.7 ℓ / min 4.68 U.S.gal / min 3.89 Imp.gal / min
	L3710 L4310	15.3 ℓ / min 4.04 U.S.gal / min 3.37 Imp.gal / min
Pump discharge at rated pressure	L3010 L3410	17.2 ℓ / min 4.54 U.S.gal / min 3.78 Imp.gal / min
	L3710 L4310	14.8 ℓ / min 3.91 U.S.gal / min 3.26 Imp.gal / min

- (1) Power Steering Hydraulic Pump
- (2) Three Point System Hydraulic Pump
- (3) Seal Ring
- (4) Bushing
- (5) Driven Gear
- (6) Bushing
- (7) Seal Ring
- (8) Pump Body
- (9) Drive Gear
- (10) O-ring
- (11) O-ring

The hydraulic pump has two meshing gears (2), (3) whose teeth run close to the casing (1). One gear is a drive gear which drives the driven gear.

When the drive gear is driven in the direction of the arrow by the fuel camshaft, the gear traps oil between the gear teeth and the casing. The higher the engine speed, the more the pump discharges.

- A : Outlet
- B : Inlet
- (1) Casing
- (2) Gear
- (3) Gear

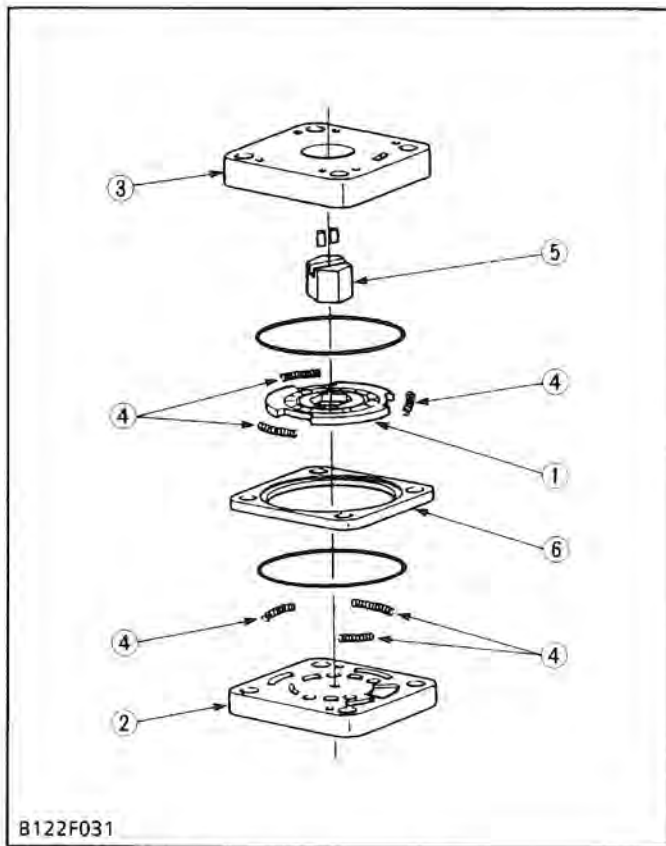
The pressure loading system automatically decreases the clearance between the gear and the bushings. A small amount of pressurized oil is fed behind the bushings, pressing them against the gears and forming a tighter seal against leakage. Therefore, leakage from the delivery side (high pressure) to the inlet side (low pressure) does not increase even if the pressure on the delivery side increases.

- A : Outlet
- B : Inlet
- (1) Loading Pressure
- (2) Gear
- (3) Pressure Introducing Port
- (4) Bushings

[4] STEERING CONTROLLER

The steering controller mainly consists of a control valve, a metering device and a relief valve with check valve. The metering device comprises a set of special gear called "Gerotor".

(1) Control Valve

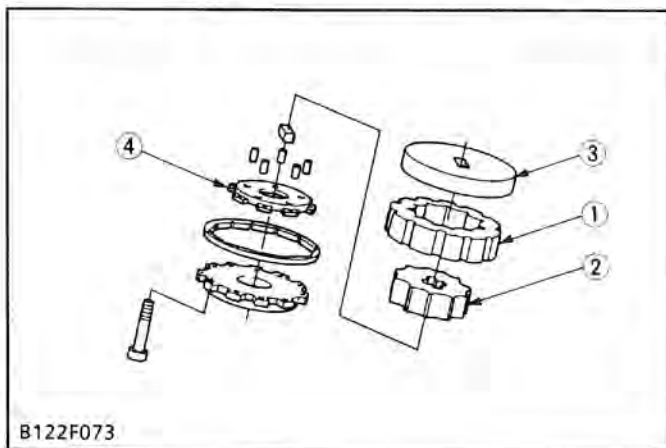


The control valve is a rotary plate type valve. When the steering wheel is not turned, the position of the valve plate (1) and the manifolds (2), (3) is kept neutral by the centering springs (4). This causes the forming of a "Neutral" oil circuit.

When the steering wheel is turned either clockwise or counterclockwise, the position of the valve plate (1) and manifolds (2), (3) changes against the centering spring. This allows the forming of a "Right Turning" or "Left Turning" oil circuit. At the same time, the gerotor rotates with the valve plate and sends the oil to the cylinder corresponding to the rotation of the steering wheel.

- | | |
|------------------------|-------------------------|
| (1) Valve Plate | (4) Centering Spring |
| (2) Port Manifold | (5) Hex. Drive Assembly |
| (3) Isolation Manifold | (6) Valve Ring |

(2) Metering Device (Gerotor)

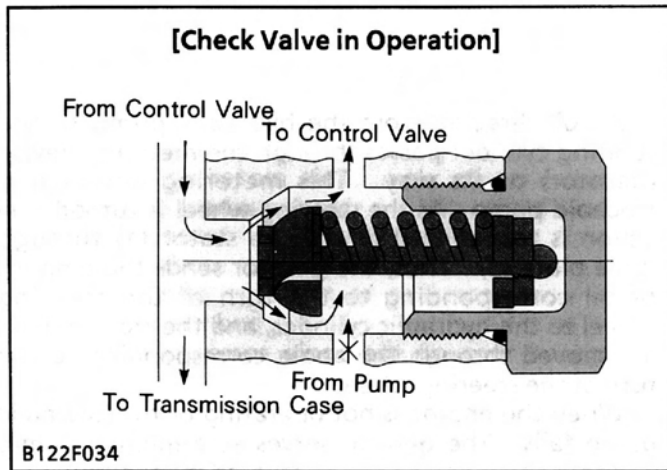
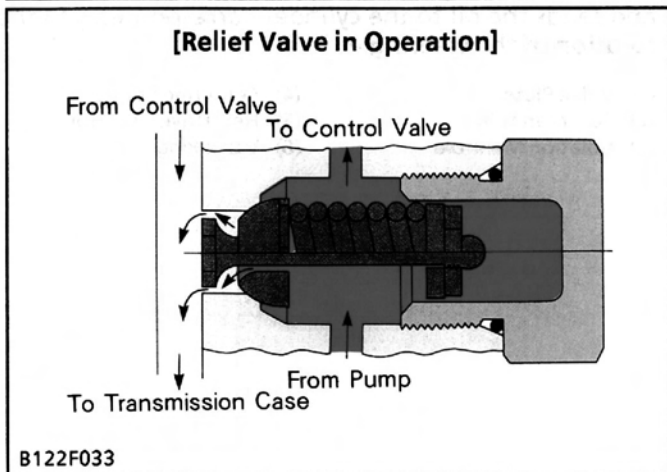
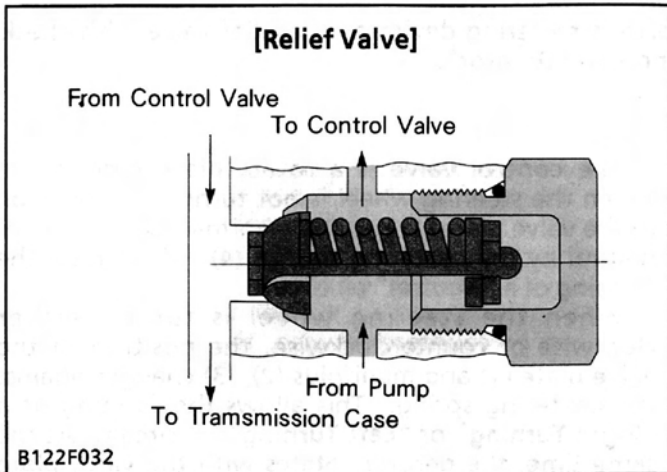


All oil directed from the hydraulic pump to the steering cylinder passes through the metering device (gerotor) on its way. This metering device is a trochoid pump. As the steering wheel is turned, the action is transmitted directly to stator (1) through drive plate (3). Thus, the gerotor sends the amount of oil corresponding to the turn of the steering wheel to the hydraulic cylinder, and the front wheels are moved through the angle corresponding to the turn of the steering wheel.

When the engine is not operating or the hydraulic pump fails. The gerotor serves as a manual pump, and thus the machine can be steered manually.

- | | |
|------------|-----------------|
| (1) Stator | (3) Drive Plate |
| (2) Rotor | (4) Commutator |

(3) Relief Valve (with Check Valve)

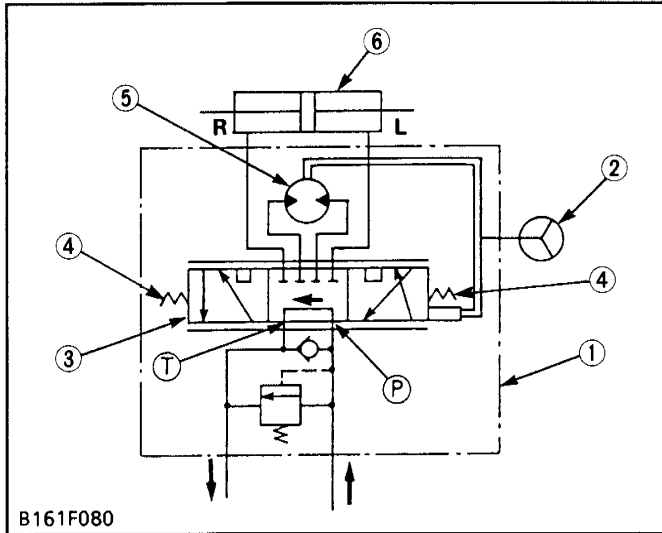


If the pressure in the hydraulic circuit rises above the set pressure of the relief valve, the relief valve will actuate to prevent the pressure from rising further and protect the hydraulic system. Also, if no oil is supplied from the hydraulic pump, the relief valve will act as a check valve and help draw oil from the return oil line to the transmission case, thus making it possible to steer the machine manually.

(Reference)

- Relief valve setting pressure : [2WD]
 - 5.1 to 6.1 MPa
 - 52 to 62 kgf/cm²
 - 740 to 882 psi
 - [4WD]
 - 10.7 to 11.7 MPa
 - 109 to 119 kgf/cm²
 - 1550 to 1693 psi
- Engine speed : Maximum
- Oil temperature : 40 to 60 °C
104 to 140 °F

[5] OIL FLOW



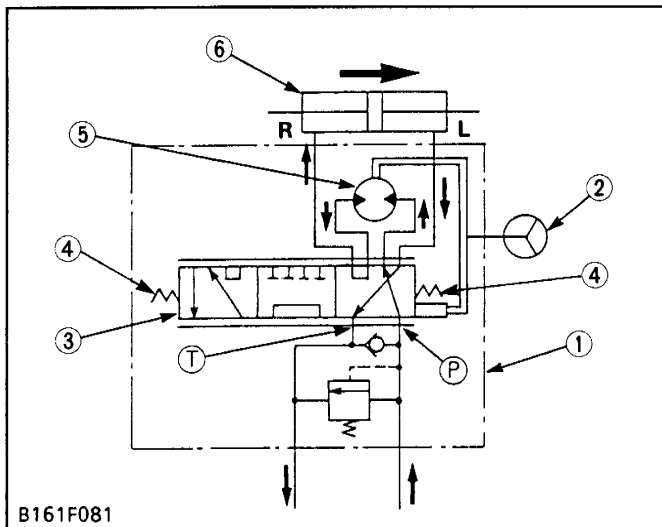
■ Neutral Position

When the steering wheel (2) is not being turned, valve plate (3) is held in the neutral position by centering springs (4). Under this condition, an oil passage is formed between port P (from pump) and port T (to transmission case) in the control valve, and all oil from the hydraulic pump flows to port T.

Also, the passage from cylinder ports R and L are closed off in the control valve. Consequently, steering cylinder does not operate even if subjected to an external force, and the front wheels are held in the straight ahead position, or at a given angle of turn.

P : Pump Port
T : Tank Port
R : Cylinder Port R
L : Cylinder Port L

- (1) Steering Controller
- (2) Steering Wheel
- (3) Valve Plate
- (4) Centering Spring
- (5) Gerotor
- (7) Steering Cylinder



■ Right Turn

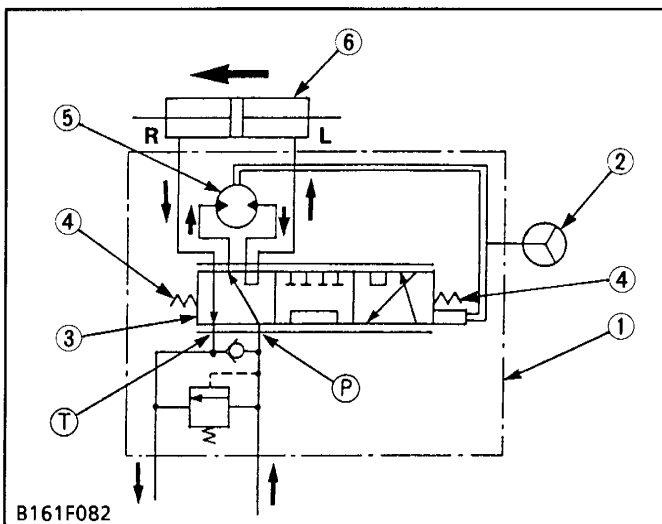
When the steering wheel is turned to the right, the action is transmitted through the drive plate, gerotor, and drive link to the control valve. Valve plate (3) then rotates to the right on manifolds, located on the opposite faces of the valve plate (3). Thus, the port P passage in the control valve is connected with gerotor (5).

The stator of gerotor (5) turns by the amount corresponding to the turn of the steering wheel (2), and the gerotor performs the metering function and lets oil through it, the amount of which corresponds to the turn of the steering wheel (2).

The oil which has passed through gerotor (5) flows back to the control valve, in which it is directed to cylinder port R to operate steering cylinder (6). Consequently, the front wheels are moved to the right through the angle corresponding to the amount of the oil.

When steering cylinder (6) operates, oil returning to cylinder port L flows back to the transmission case through the passage connected to port T in the control valve.

- P : Pump Port
T : Tank Port
R : Cylinder Port R
L : Cylinder Port L
- (1) Steering Controller
 - (2) Steering Wheel
 - (3) Valve Plate
 - (4) Centering Spring
 - (5) Gerotor
 - (6) Steering Cylinder



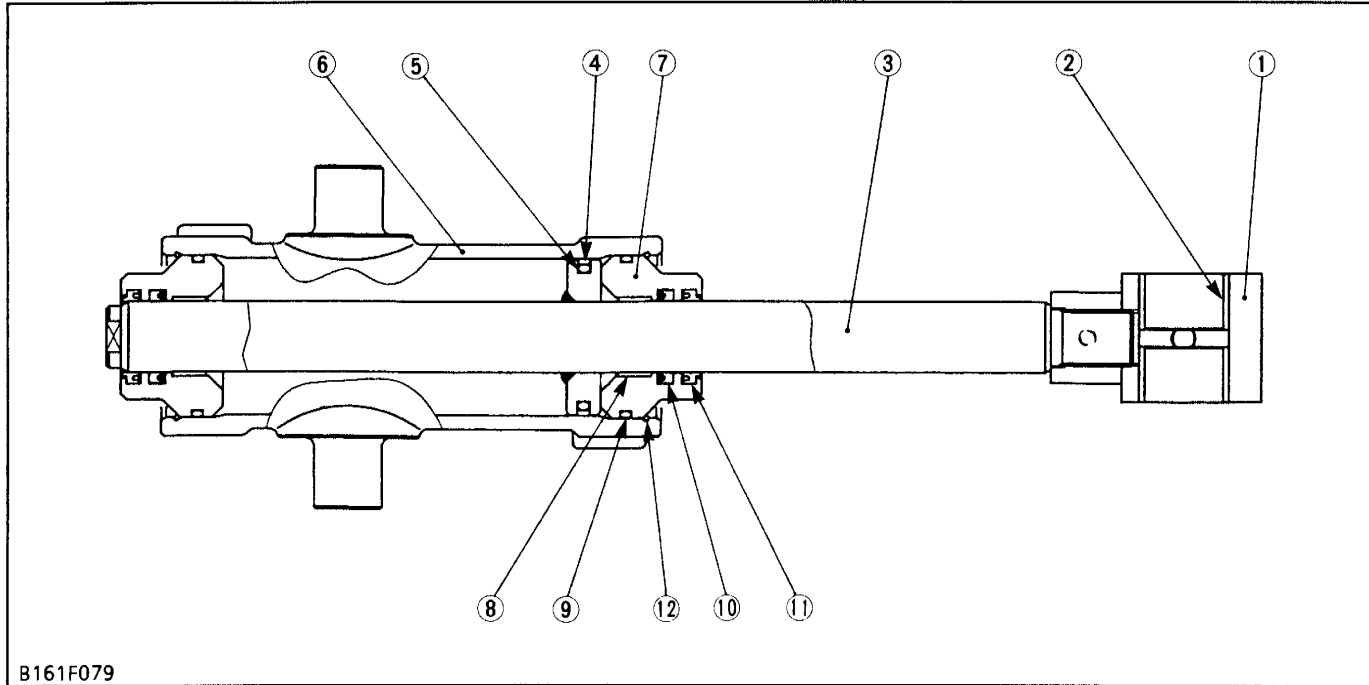
■ Left Turn

The steering system operates in the same way at a left-turn as well, except that oil flows into and out of steering cylinder in the directions opposite to those at a right-turn.

P : Pump Port
T : Tank Port
R : Cylinder Port R
L : Cylinder Port L

- (1) Steering Controller
- (2) Steering Wheel
- (3) Valve Plate
- (4) Centering Spring
- (5) Gerotor
- (6) Steering Cylinder

[6] STEERING CYLINDER



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- | | | | |
|------------------|-------------------|-------------|-------------------------|
| (1) Rod End | (4) Packing | (7) Cover | (10) Packing |
| (2) Bushing | (5) O-ring | (8) Bushing | (11) Dust Seal |
| (3) Rod Assembly | (6) Cylinder Tube | (9) O-ring | (12) Internal Snap Ring |

The steering cylinder is single piston both rod double-acting type.

The steering cylinder provide force in both directions.

Depending upon direction the steering wheel is turned pressure oil enters at one end of the cylinder to extend, or the other end to retract it, thereby turning front wheel of the tractor.

SERVICING

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TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Tractor Can Not Be Steered	<ul style="list-style-type: none"> ● Steering controller broken ● Steering linkage broken ● Pipe broken 	Replace Replace Replace	7-S11 to S20 7-S23 to S25 –
Front Wheels Vibrate	<ul style="list-style-type: none"> ● Pitman arm bushing worn ● Rod end bushing worn ● Centering spring weaken or broken ● Improper toe-in adjustment ● Air in the hydraulic system ● Improperly mounted wheels ● Tie-rod end loose or worn ● Front wheel hub bearings worn ● Clearance between front axle center pivots and brackets bushings excessive 	Replace Replace Replace Adjust Bleed Retighten Retighten or replace Replace Replace	7-S25 7-S24 7-S17 6-S5 7-S11 G-16 7-S22 6-S8, S10 6-S17
Hard Steering	<ul style="list-style-type: none"> ● Steering linkage bushings sticking ● Hydraulic pump malfunctioning ● Overload ● Transmission fluid improper or insufficient ● Oil leak from pipe joint ● Insufficient tire pressure ● Steering controller malfunctioning ● Relief valve malfunctioning 	Replace Replace – Change Retighten Inflate Replace Replace	7-S23 to S25 7-S4 to S8 – G-13 7-S6, S11 7-S22 G-39 7-S11 to S20 7-S9, S10
Steering Force Fluctuates	<ul style="list-style-type: none"> ● Air sucked in pump due to leaking or missing of oil ● Air sucked in pump from suction circuit 	Replenish Repair	– –
Excessive Steering Wheel Play	<ul style="list-style-type: none"> ● Steering linkage worn 	Replace	7-S23 to S25
Front Wheels Wander to Right or Left	<ul style="list-style-type: none"> ● Centering spring weaken or broken ● Air sucked in pump due to leak of oil ● Air sucked in pump from suction circuit ● Tire pressure uneven ● Insufficient bleeding ● Improper toe-in adjustment ● Clearance between front axle center pivots and brackets bushings excessive ● Tie-rod end loose or worn ● Steering linkage worn 	Replace Replenish Repair Inflate Bleed Adjust Replace Retighten or replace Replace	7-S17 – – G-39 7-S11 6-S5 6-S17 7-S22 7-S23 to S25
Wheels Are Turned to a Direction Opposite to Steering Direction	<ul style="list-style-type: none"> ● Piping connected in reverse 	Repair	7-S11, S22
Noise	<ul style="list-style-type: none"> ● Air sucked in pump due to lack of oil ● Air sucked in pump from suction circuit ● Pipe deformed 	Replenish Repair Replace	– – –

SERVICING SPECIFICATIONS

POWER STEERING HYDRAULIC PUMP

Item		Factory Specification	Allowable Limit
Hydraulic Pump Condition <ul style="list-style-type: none"> ● Engine Speed [L3010 · L3410] .. Approx. 2700 rpm [L3710 · L4310] .. Approx. 2600 rpm ● Rated Pressure [2WD Type] 5.1 to 6.1 MPa 52 to 62 kgf/cm² 740 to 882 psi [4WD Type] 10.7 to 11.7 MPa 109 to 119 kgf/cm² 1550 to 1693 psi ● Oil Temperature ... 40 to 60 °C 104 to 140 °F 	Delivery at No Pressure [L3010 · L3410]	Above 17.7 ℓ / min 4.68 U.S.gal / min 3.89 Imp.gal / min	–
	[L3710 · L4310]	Above 15.3 ℓ / min 4.04 U.S.gal / min 3.37 Imp.gal / min	–
	Delivery at Rated Pressure [L3010 · L3410]	Above 17.2 ℓ / min 4.54 U.S.gal / min 3.78 Imp.gal / min	15.4 ℓ / min 4.07 U.S.gal / min 3.39 Imp.gal / min
	[L3710 · L4310]	Above 14.8 ℓ / min 3.91 U.S.gal / min 3.26 Imp.gal / min	13.3 ℓ / min 3.51 U.S.gal / min 2.93 Imp.gal / min
Housing	Depth of Scratch	–	0.09 mm 0.0035 in.
Bushing to Gear Shaft	Clearance	–	0.15 mm 0.0059 in.
Bushing	Length	15.79 to 15.80 mm 0.6217 to 0.6220 in.	15.60 mm 0.6142 in.

STEERING CONTROLLER

Relief Valve Condition <ul style="list-style-type: none"> ● Engine Speed Maximum ● Oil Temperature ... 40 to 60 °C 104 to 140 °F 	Setting Pressure [2WD Type]	5.1 to 6.1 MPa 52 to 62 kgf/cm ² 740 to 882 psi	–
	[4WD Type]	10.7 to 11.7 MPa 109 to 119 kgf/cm ² 1550 to 1693 psi	–
Rotor Set	Clearance	–	0.08 mm 0.0031 in.

STEERING CYLINDER

Item		Factory Specification	Allowable Limit
Cylinder Tube	I.D.	55.000 to 55.074 mm 2.16535 to 2.16826 in.	55.100 mm 2.16929 in.
Rod to Cylinder Cover Bushing	Clearance	0.020 to 0.134 mm 0.00079 to 0.00528 in.	0.145 mm 0.00571 in.
Rod	O.D.	24.947 to 24.980 mm 0.98216 to 0.98346 in.	–
Cylinder Cover Bushing	I.D.	25.000 to 25.081 mm 0.98425 to 0.98744 in.	–

STEERING LINKAGE

Steering Wheel Condition ● Engine Speed Idling Speed	Free Play	20 to 50 mm 0.79 to 1.97 in.	–
Rod End Shaft to Rod End Bushing	Clearance	0.025 to 0.135 mm 0.00098 to 0.00531 in.	0.35 mm 0.0138 in.
Rod End Shaft	O.D.	27.950 to 27.975 mm 1.10039 to 1.10138 in.	–
Rod End Bushing	I.D.	28.000 to 28.085 mm 1.10236 to 1.10571 in.	–
Cylinder Tube Pin to Pitman Arm Bushing	Clearance	0.020 to 0.122 mm 0.00079 to 0.00480 in.	0.35 mm 0.0138 in.
Cylinder Tube Pin	O.D.	23.959 to 23.980 mm 0.94327 to 0.94409 in.	–
Pitman Arm Bushing	I.D.	24.000 to 24.081 mm 0.94488 to 0.94807 in.	–
Pitman Arm Shaft to Pitman Arm Bushing	Clearance	0.025 to 0.135 mm 0.00098 to 0.00531 in.	0.35 mm 0.0138 in.
Pitman Arm Shaft	O.D.	39.950 to 39.975 mm 1.57283 to 1.57382 in.	–
Pitman Arm Bushing	I.D.	40.000 to 40.085 mm 1.57480 to 1.57815 in.	–

TIGHTENING TORQUES

Tightening torques of screws and nuts on the table below are especially specified.
(For general use screws and nuts : See page G-9)

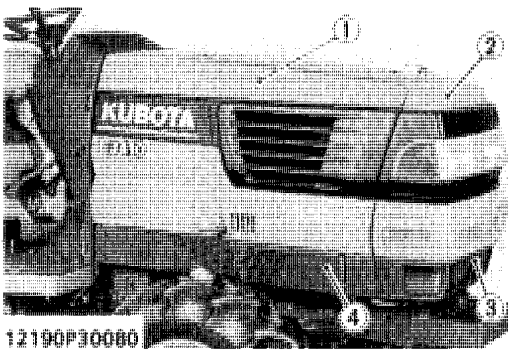
Item	N·m	kgf·m	ft·lbs
Delivery pipe joint bolt (Power steering hydraulic pump to regulator valve)	39.3 to 49.0	4.0 to 5.0	29.0 to 36.2
GST · independent PTO delivery pipe joint bolt	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Power steering delivery hose joint bolt	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Regulator valve mounting screws	17.6 to 20.6	1.8 to 2.1	13.0 to 15.2
Hydraulic pump assembly mounting screw and nut	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Main delivery hose retaining nut	46.6 to 50.9	4.8 to 5.2	34.4 to 37.6
Turning delivery hose retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Steering controller mounting nuts	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Steering controller retaining nuts	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Gerotor assembling hex. socket head cap screws	1.24 to 1.47	0.13 to 0.15	0.94 to 1.08
Rod end shaft stopper mounting screws	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Pitman arm cap mounting reamer screws	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Tie-rod end nut [2WD Type]	49.0 to 68.6	5.0 to 7.0	36.2 to 50.6
[4WD Type]	39.2 to 45.1	4.0 to 4.6	28.9 to 33.3
Pitman arm shaft stopper mounting screw	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
Rod end	196 to 294	20 to 30	145 to 217
Rod end stopper screws	12.3 to 14.2	1.25 to 1.45	9.0 to 10.5

CHECKING, DISASSEMBLING AND SERVICING

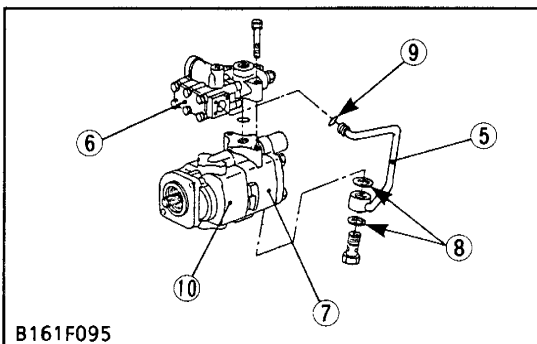
[1] POWER STEERING HYDRAULIC PUMP

CHECKING

(1) Pump Test Using Flow-meter



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Preparation

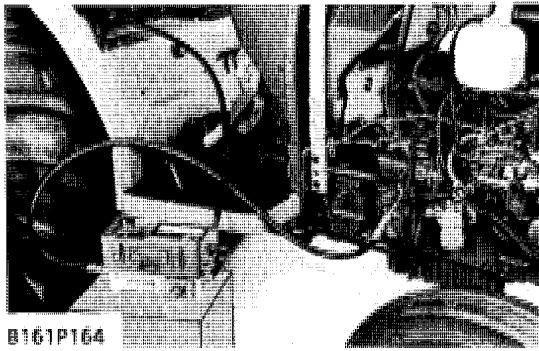
1. Remove the side cover RH (1) and front mask (2).
2. Remove the front grille (3) and side skirt RH (4).
3. Remove the delivery pipe (5) between the regulator valve (6) and power steering hydraulic pump (7).

(When reassembling)

- Install the copper washers (8) firmly.
- Apply grease to the O-ring (9) and take care not to damage it.

Tightening torque	Delivery pipe joint bolt	39.3 to 49.0 N·m 4.0 to 5.0 kgf·m 29.0 to 36.2 ft·lbs
-------------------	--------------------------	---

- | | |
|-------------------|--|
| (1) Side Cover RH | (6) Regulator Valve |
| (2) Front Mask | (7) Power Steering Hydraulic Pump |
| (3) Front Grille | (8) Copper Washers |
| (4) Side Skirt RH | (9) O-ring |
| (5) Delivery Pipe | (10) Three Point System Hydraulic Pump |



Condition

- Engine speed
[L3010 · L3410] Approx. 2700 rpm
[L3710 · L4310] Approx. 2600 rpm
- Rated pressure
[2WD Type] 5.1 to 6.1 MPa
52 to 62 kgf/cm²
740 to 882 psi
[4WD Type] 10.7 to 11.7 MPa
109 to 119 kgf/cm²
1550 to 1693 psi
- Oil temperature..... 40 to 60 °C
104 to 140 °F

Hydraulic Flow Test

■ **IMPORTANT**

- When using a flowmeter other than KUBOTA specified flowmeter, be sure to use the instructions with that flowmeter.
- Do not close the flowmeter loading valve completely, before testing, because it has no relief valve.

1. Install the adaptor 69 (PF 3/8) and adaptor 66 to the pump discharge port.
2. Connect the hydraulic test hose to the adaptor 66 and flowmeter inlet port.
3. Connect the other hydraulic test hose to the flowmeter outlet port and to transmission fluid filling plug hole.
4. Open the flowmeter loading valve completely. (Turn counterclockwise.)
5. Start the engine and set the engine speed at 2000 to 2200 rpm.
6. Slowly close the loading valve to generate pressure approx. 9.8 MPa (100 kgf/cm², 1422 psi). Hold in this condition until oil temperature reaches approx. 40 °C (104 °F).
7. Open the loading valve completely.
8. Set the engine speed. (Refer to Condition.)
9. Read and note the pump delivery at no pressure.
10. Slowly close the loading valve to increase rated pressure. (Refer to Condition.) As the load is increased, engine speed drops, therefore, reset the engine speed.
11. Read and note the pump delivery at rated pressure.
12. Open the loading valve completely and stop the engine.
13. If the pump delivery does not reach the allowable limit, check the pump suction line, oil filter or hydraulic pump.

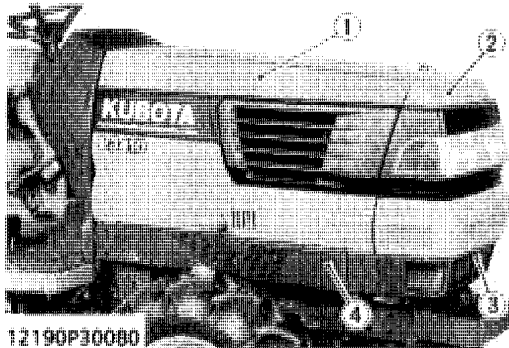
Hydraulic pump delivery at no pressure	Factory spec.	L3010 L3410	Above 17.7 ℓ / min 4.68 U.S.gal / min 3.89 Imp.gal / min
		L3710 L4310	Above 15.3 ℓ / min 4.04 U.S.gal / min 3.37 Imp.gal / min
Hydraulic pump delivery at rated pressure	Factory spec.	L3010 L3410	Above 17.2 ℓ / min 4.54 U.S.gal / min 3.78 Imp.gal / min
		L3710 L4310	Above 14.8 ℓ / min 3.91 U.S.gal / min 3.26 Imp.gal / min
	Allowable limit	L3010 L3410	15.4 ℓ / min 4.07 U.S.gal / min 3.39 Imp.gal / min
		L3710 L4310	13.3 ℓ / min 3.51 U.S.gal / min 2.93 Imp.gal / min

DISASSEMBLING AND ASSEMBLING

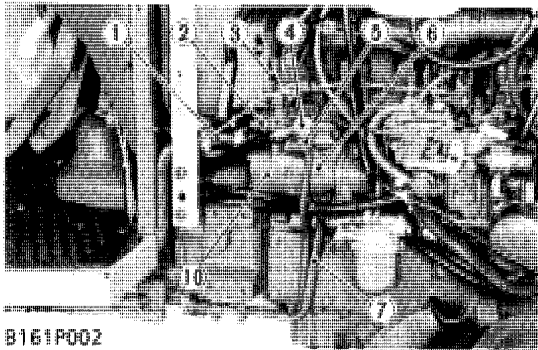
■ IMPORTANT

- The hydraulic pump is precision machined and assembled : if disassembled once, it may be unable to maintain its original performance. Therefore, when the hydraulic pump fails, replacement should be carried out with the hydraulic pump assembled except when emergency repair is unavoidable.
- When repair is required, follow the disassembly and servicing procedures shown below with utmost care.
- Be sure to test the hydraulic pump with a flowmeter before disassembling.
- After reassembly, be sure to perform break-in operation and ensure that there is nothing abnormal with the hydraulic pump.

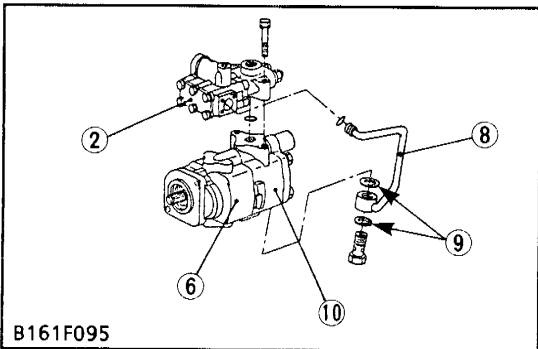
(1) Removing Hydraulic Pump Assembly



12190P30080



B161P002



B161F095

Preparation 1

1. Remove the side cover RH (1) and front mask (2).
2. Remove the front grille (3) and side skirt RH (4).

- (1) Side Cover RH
- (2) Front Mask
- (3) Front Grille
- (4) Side Skirt RH

Preparation 2

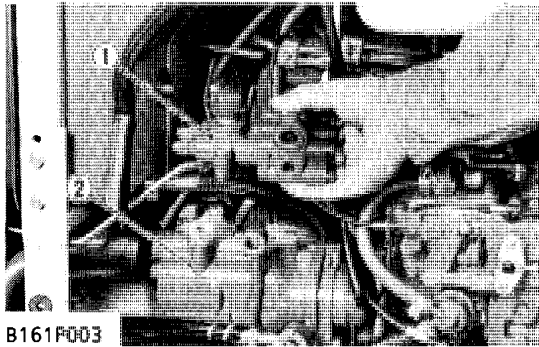
1. Disconnect the GST-independent PTO delivery pipe (5), power steering delivery hose (4) and power steering return hose (3) from the regulator valve (2).
2. Remove the delivery pipe (8).
3. Disconnect the delivery pipe (7) from the three point system hydraulic pump (6).
4. Disconnect the suction rubber hose (1).

(When reassembling)

- Apply grease to the O-rings and take care not to damage them.
- Install the copper washers (9) firmly.

Tightening torque	GST-independent PTO delivery pipe joint bolt	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs
	Power steering delivery hose joint bolt	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft-lbs
	Delivery pipe (8) joint bolt	39.3 to 49.0 N·m 4.0 to 5.0 kgf·m 29.0 to 36.2 ft-lbs

- (1) Suction Rubber Hose
- (2) Regulator Valve
- (3) Power Steering Return Hose
- (4) Power Steering Delivery Hose
- (5) GST-Independent PTO Delivery Pipe
- (6) Three Point System Hydraulic Pump
- (7) Delivery Pipe
- (8) Delivery Pipe
- (9) Copper Washers
- (10) Power Steering Hydraulic Pump



B161P003

Regulator Valve

1. Loosen and remove the regulator valve mounting screws.
2. Take out the regulator valve (1) from the power steering hydraulic pump (2).

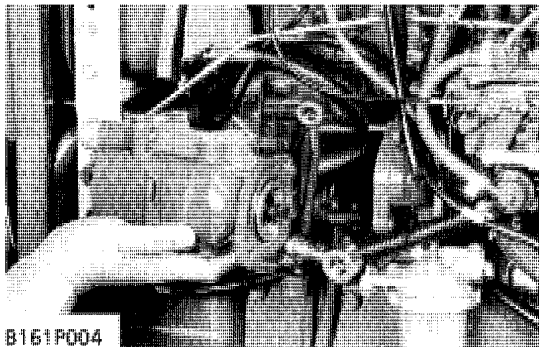
(When reassembling)

- Apply grease to the O-ring and take care not to damage it.

Tightening torque	Regulator valve mounting screws	17.6 to 20.6 N-m 1.8 to 2.1 kgf-m 13.0 to 15.2 ft-lbs
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(1) Regulator Valve

(2) Power Steering Hydraulic Pump



B161P004

Removing Hydraulic Pump Assembly

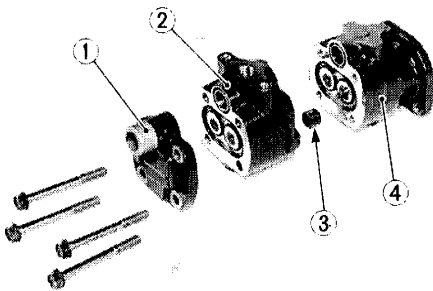
1. Loosen and remove the hydraulic pump assembly mounting screw and nut.
2. Take out the hydraulic pump assembly.

(When reassembling)

- Apply grease to the O-ring and take care not to damage it.

Tightening torque	Hydraulic pump assembly mounting screw and nut	23.6 to 27.4 N-m 2.4 to 2.8 kgf-m 17.4 to 20.2 ft-lbs
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(2) Disassembling Power Steering Hydraulic Pump



B161P005

Separating Power Steering Hydraulic Pump

1. Remove the pump cover mounting four screws.
2. Separate the power steering hydraulic pump (2) from the three point system hydraulic pump (4).

(When reassembling)

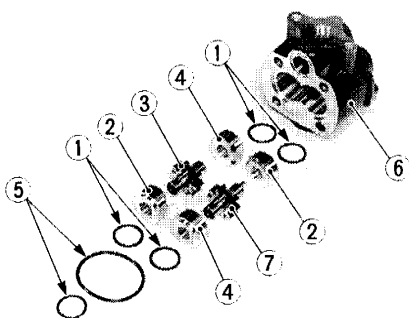
- Take care not to damage the O-ring.

(1) Pump Cover

(3) Coupling

(2) Power Steering Hydraulic Pump

(4) Three Point System Hydraulic Pump



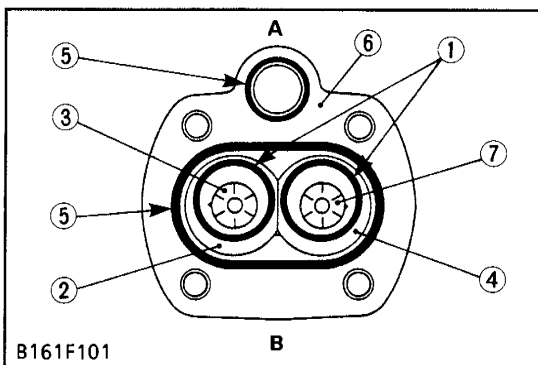
B161P006

Disassembling Power Steering Hydraulic Pump

1. Remove the O-ring (5) and seal ring (1).
2. Remove the bushings (2), (4) of cover side as a unit.
3. Take out the drive gear (7) and driven gear (3).
4. Take out the bushings (2), (4) in back of pump housing (6) as a unit.

(When reassembling)

- Install the driven gear (3), noting its original direction.
- When installing the bushings (2), (4), be sure to reassemble them to the each original position.
- Take care not to damage the seal rings and O-rings.
- After reassembling the hydraulic pump assembly, mount an arm approx. 100 mm (3.39 in.) long to the drive gear to check for smooth rotation.



B161F101

[A] Inlet

[B] Outlet

(1) Seal Ring

(5) O-ring

(2) Bushing

(6) Pump Housing

(3) Driven Gear

(7) Drive Gear

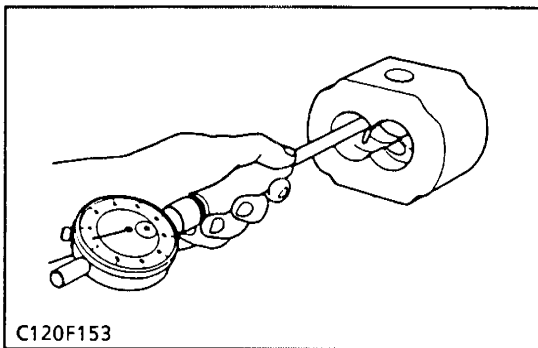
(4) Bushing

Hydraulic Pump Running-In

After reassembly, perform break-in operation in the following manner, and check the pump for abnormality before use. If the pump temperature should rise noticeably during running-in, recheck should be performed.

1. Install the hydraulic pump to the tractor, and mount the suction pipe and delivery pipe securely.
2. Set the engine speed at 1300 to 1500 rpm, and operate the hydraulic pump at no load for about 10 minutes.
3. Set the engine speed at 2000 to 2200 rpm, and with the hydraulic pump applied with 2.94 MPa (30 kgf/cm², 427 psi) to 4.90 MPa (50 kgf/cm², 711 psi) pressure, operate it for approx. 15 minutes.
4. With the engine set to maximum speed, fully turn the steering wheel to the left or right, then actuate the relief valve five times for 25 seconds (one time 5 seconds).

SERVICING



C120F153

Housing Bore (Depth of Scratch)

1. Check for the scratch on the interior surface of the housing caused by the gear.
2. If the scratch reaches more than half the area of the interior surface of the housing, replace at pump assembly.
3. Measure the housing I.D. where the interior surface is not scratched, and measure the housing I.D. where the interior surface is scratched.
4. If the values obtained in the two determinations differ by more than the allowable limit, replace the hydraulic pump as a unit.

Depth of scratch	Allowable limit	0.09 mm 0.0035 in.
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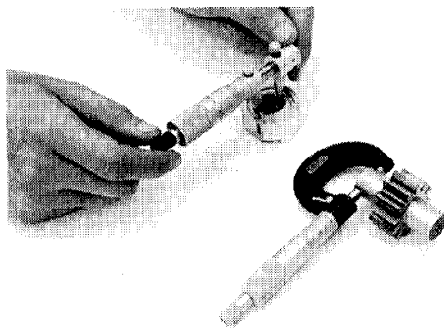
(Reference)

- Use a cylinder gauge to measure the housing I.D.

Clearance between Bushing and Gear Shaft

1. Measure the gear shaft O.D. with an outside micrometer.
2. Measure the bushing I.D. with an inside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the gear shaft and the bushings as a unit.

Clearance between bushing and gear shaft	Allowable limit	0.15 mm 0.0059 in.
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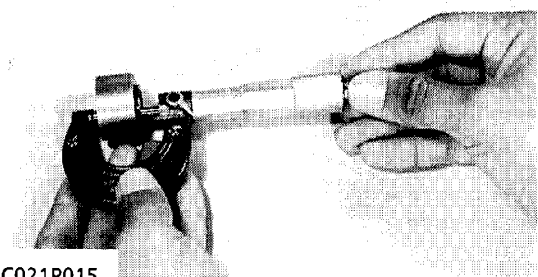


C045P249

Bushing Length

1. Measure the bushing length with an outside micrometer.
2. If the length is less than the allowable limit, replace the bushings and gears as a unit.

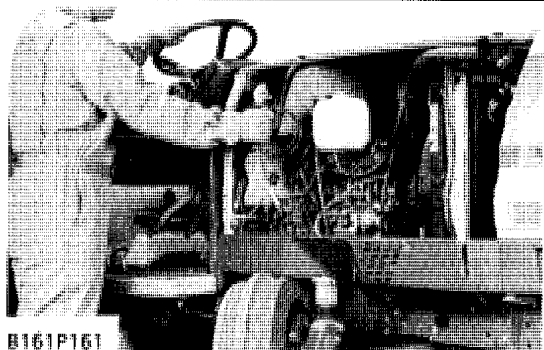
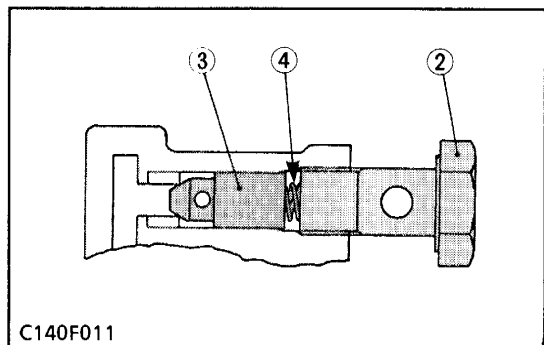
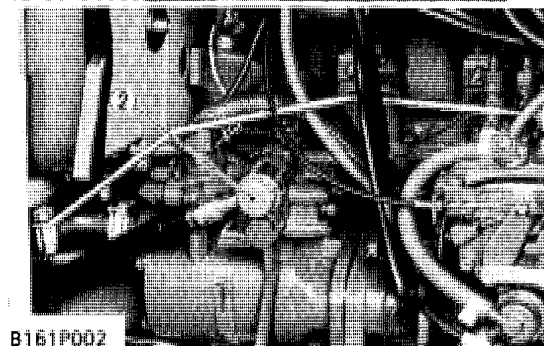
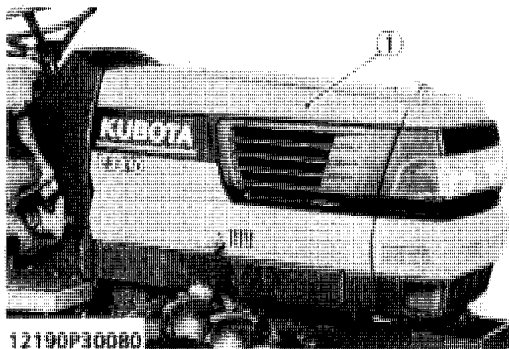
Bushing length	Factory spec.	15.79 to 15.80 mm 0.6217 to 0.6220 in.
	Allowable limit	15.60 mm 0.6142 in.



C021P015

[2] RELIEF VALVE

CHECKING



Relief Valve Setting Pressure Test

1. Remove the side cover RH (1).
2. Disconnect the delivery hose joint bolt (2) which connects delivery hose and regulator valve.
3. Take out the spring (4) and check valve (3).
4. Install the adaptor E and adaptor 58 of relief valve setting pressure tester to the regulator valve, and then set a thread joint, cable and pressure gauge.
5. Start the engine and set the engine speed at max. speed.
6. Fully turn the steering wheel to the left or right and read the pressure when the relief valve functions.
7. Stop the engine.
8. If the pressure is not within the factory specifications, check the pump delivery line, replace the relief valve assembly or repair the power steering.

Power steering relief valve setting pressure	Factory spec.	2WD	5.1 to 6.1 MPa 52 to 62 kgf/cm ² 740 to 882 psi
		4WD	10.7 to 11.7 MPa 109 to 119 kgf/cm ² 1550 to 1693 psi

(When reassembling)

- Install the spring (4) and check valve (3) firmly.
- Install the copper washers firmly.

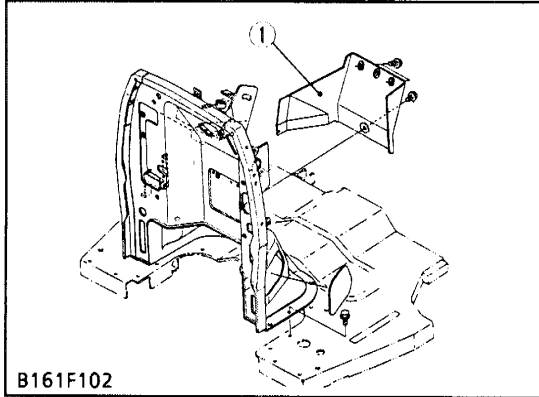
Tightening torque	Power steering delivery hose joint bolt	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft·lbs
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Condition

- Engine speed Maximum
- Oil temperature 40 to 60 °C
104 to 140 °F

- (1) Side Cover RH
- (2) Delivery Hose Joint Bolt
- (3) Check Valve
- (4) Spring

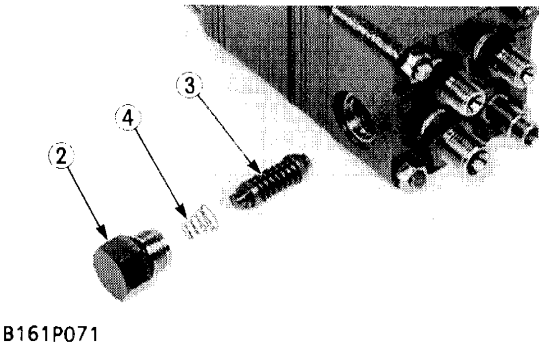
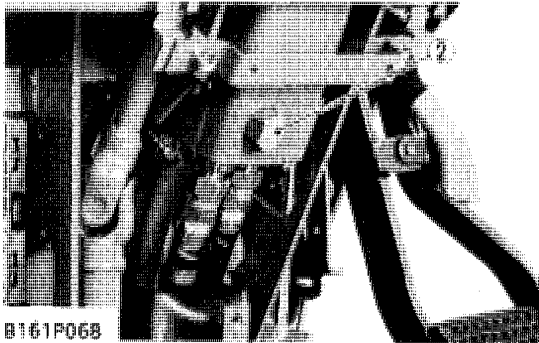
DISASSEMBLING AND ASSEMBLING



Relief Valve Assembly

1. Remove the steering post under cover (1).
2. Remove the relief valve plug (2) and relief valve assembly (3).

- | | |
|-------------------------------|----------------------------|
| (1) Steering Post Under Cover | (3) Relief Valve Assembly |
| (2) Relief Valve Plug | (4) Spring (2WD Type Only) |



[3] STEERING CONTROLLER

DISASSEMBLING AND ASSEMBLING

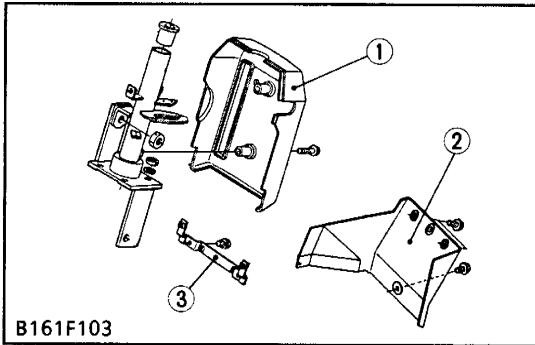
■ IMPORTANT

- Use only the transmission fluid (See page G-8), in no case use mixture of oils of different brands.
- Before disassembling the power steering system hydraulic components, check the performance of hydraulic pump and power steering using a flowmeter.
Do not disassemble the power steering needlessly.
- After removing or disassembling the power steering hydraulic components, be sure to bleed air.
- If disassembly of power steering is needed, perform disassembly carefully following the instructions given below.
 1. Since the sliding surfaces of those parts have been precisely finished, do not brush or grind with sandpaper. Use transmission fluid for cleaning and compressed air for blowing off.
 2. When reassembling, inspect each part for wear and damage. If seriously damaged, replace parts as sub-assembly or assembly.
It is desirable to replace O-rings and seals with new ones.

[Bleeding]

1. Start the engine.
2. Turn the steering wheel slowly in both directions all the way alternately several times, and stop the engine.

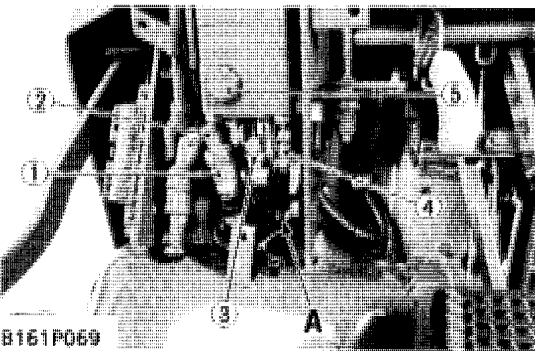
(1) Removing Steering Controller



Preparation

1. Remove the steering post cover (1), steering post under cover (2) and cover stay (3).

- (1) Steering Post Cover
- (2) Steering Post Under Cover
- (3) Cover Stay

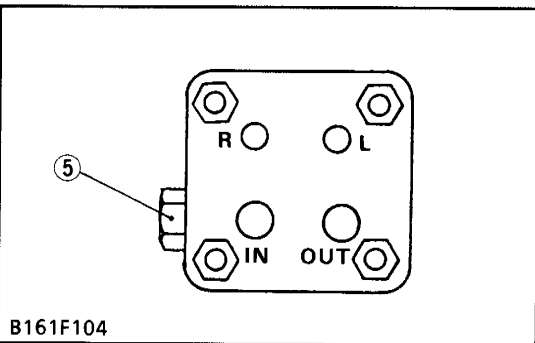


Hydraulic Hoses

1. Disconnect the main delivery hose (1), return hose (2), right turning delivery hose (3) and left turning delivery hose (4).

(When reassembling)

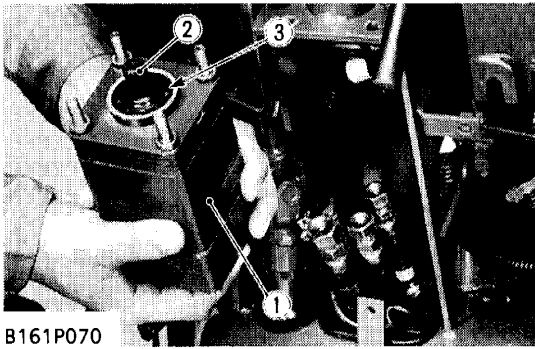
- In assembling the turning delivery hoses to the steering controller, connect the delivery hose with identification mark (tape) "A" to the L port of the steering controller. (Refer to figure left)



Tightening torque	Main delivery hose retaining nut	46.6 to 50.9 N·m 4.8 to 5.2 kgf·m 34.4 to 37.6 ft·lbs
	Turning delivery hose retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7ft·lbs

[A] Identification Mark (Tape)

- (1) Main Delivery Hose
- (2) Return Hose
- (3) Right Turning Delivery Hose
- (4) Left Turning Delivery Hose
- (5) Relief Valve Plug



B161P070

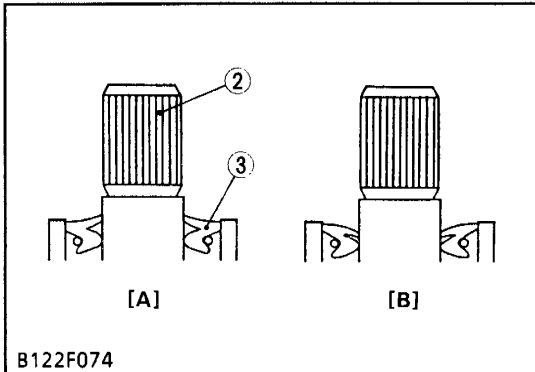
Removing Steering Controller

1. Loosen and remove the steering controller mounting nuts.
2. Take out the steering controller (1) and joint shaft (2) as a unit.
3. Pull out the joint shaft (2) from the steering controller (1).

(When reassembling)

- Apply grease to the joint shaft (2).
- After install the joint shaft (2) to the steering controller (1), check the dust seal (3). (Refer to figure left)

Tightening torque	Steering controller mounting nuts	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
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B122F074

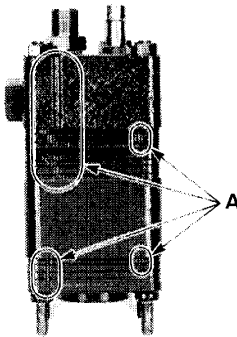
[A] Correct

[B] Incorrect

- (1) Steering Controller
(2) Joint Shaft

- (3) Dust Seal

(2) Disassembling Steering Controller

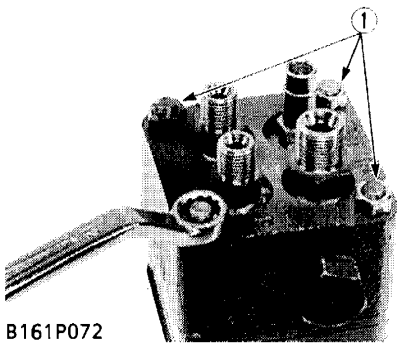


B161P073

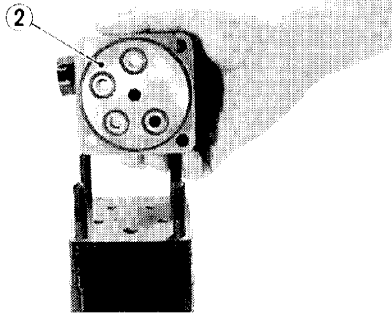
■ IMPORTANT

- Components of the steering controller with alignment grooves must be assembled so that their alignment grooves are positioned as figured for the unit to function.

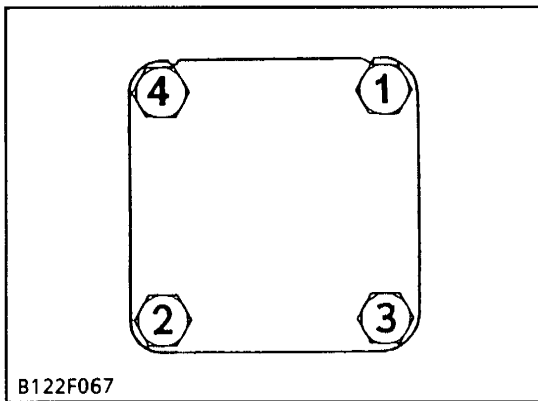
[A] Alignment Grooves



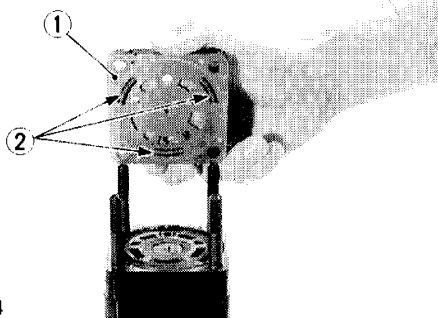
B161P072



B122P003



B122F067



B122P004

(1) Port Manifold

(2) Springs

Port Cover Assembly

1. Slightly hold the steering controller assembly with a vise.
2. Remove the four retaining nuts (1) from the port cover assembly (2).
3. Remove the port cover assembly (2).

(When reassembling)

- Apply clean grease to the four O-rings and seal ring.
- Install retaining nuts onto bolts. Tighten each one gradually until resistance is felt.

Tightening torque	Retaining nuts	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs

(1) Retaining Nut

(2) Port Cover Assembly

Port Manifold and Springs

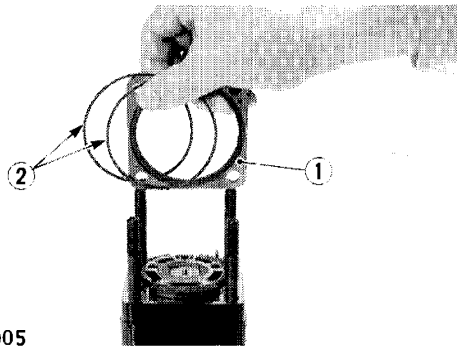
1. Carefully lift the port manifold (1) from the unit.
2. Remove the three springs (2) from the port manifold pockets.

NOTE

- Be prepared to catch three springs (2) which may become disengaged when removing the port manifold (1).

(When reassembling)

- Apply a few drops of oil to the valve plate.
- Install three springs [length : 25 mm (0.98 in.)] (2) into the spring pockets.
- Assemble the port manifold with the springs toward the valve plate.
- Be careful not to pinch a spring during installation.
- The two alignment pins, in the valve plate, will engage the holes in the port manifold.
- The pin on the hex. drive assembly must engage the center hole in the port manifold (1).



B122P005

Valve Ring

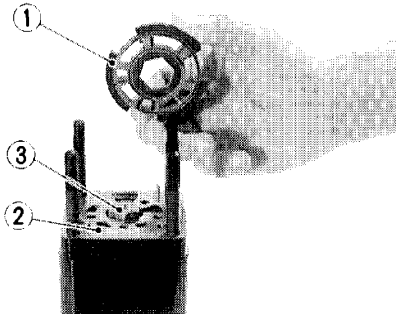
1. Remove the valve ring (1) with the two seal rings (2).

(When reassembling)

- Apply clean grease to the seal rings (2).
- Install the valve ring (1) over the bolts and alignment pins with seal ring facing the isolation manifold.

(1) Valve Ring

(2) Seal Rings



B122P006

Valve Plate and Hex. Drive Assembly

1. Remove the valve plate (1) by lifting it from the isolation manifold (2).
2. Pull out the hex. drive assembly (3) from the drive link.

(When reassembling)

- Aligning the three springs slots of the valve plate (1) centrally over the three springs placed in the isolation manifold (2).
- Place hex. drive assembly (3), pin side up, through the hole in the isolation manifold (2).

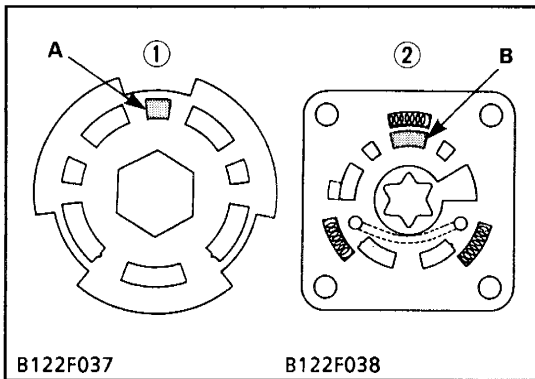
■ IMPORTANT

- Place the valve plate (1) with the surface that reads "shaft side" down over the hex. drive assembly (3).
- Aligning the "A" part of the valve plate (1) and the "B" part of the isolation manifold (2).

(1) Valve Plate

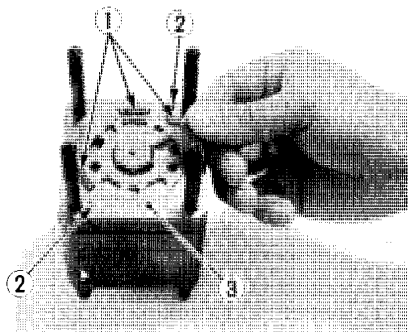
(3) Hex. Drive Assembly

(2) Isolation Manifold



B122F037

B122F038



B122P007

Springs and Isolation Manifold

1. Remove the three springs (1) from the isolation manifold pockets.
2. Remove the two alignment pins (2).
3. Remove the isolation manifold (3).

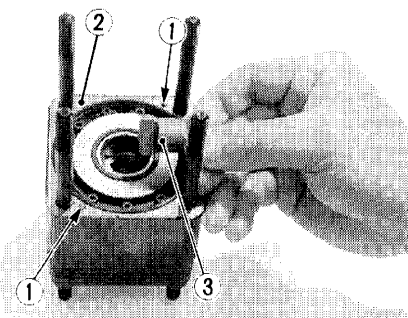
(When reassembling)

- Install three springs [length : 15 mm (0.59 in.)] (1) into the spring pockets.

(1) Springs

(3) Isolation Manifold

(2) Alignment Pins



B122P008

Alignment Pins and Drive Link

1. Remove the two alignment pins (1) from the metering ring (2).
2. Remove the drive link (3) from the metering package.

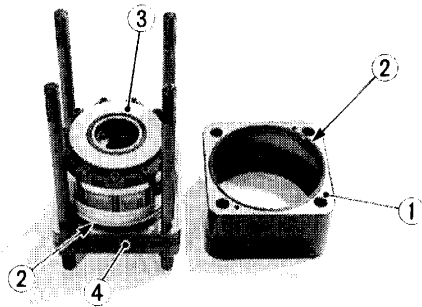
(When reassembling)

- Insert large tang of the drive link (3) into the slot in the rotor.

(1) Alignment Pins

(3) Drive Link

(2) Metering Ring



B122P009

Metering Ring and Metering Package

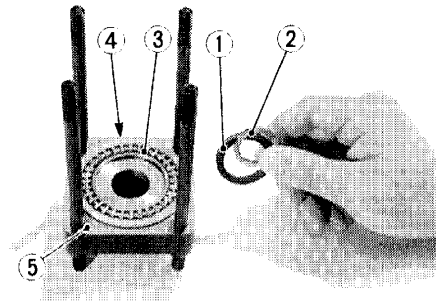
1. Remove the metering ring (1) and discard the two seal rings (2).
2. Lift the metering package (3) from the upper cover plate (4).

(When reassembling)

- Apply clean grease to the metering seal rings (2).
- Apply a small amount of clean grease on the drive plate.

(1) Metering Ring
(2) Seal Ring

(3) Metering Package
(4) Upper Cover Plate



B122P010

Face Seal, Face Seal Spacer, Thrust Bearing and Bearing Spacer

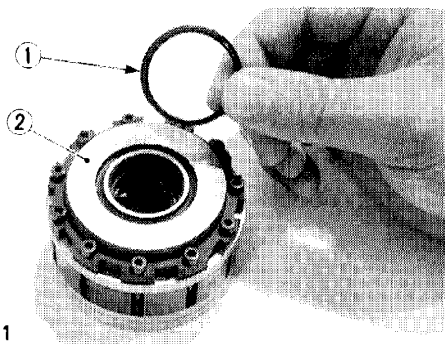
1. Remove the face seal (1), face seal spacer (2), thrust bearing (3) and bearing spacer (4) from the upper cover plate (5).

(When reassembling)

- Apply clean grease to the thrust bearing (3).

(1) Face Seal
(2) Face Seal Spacer
(3) Thrust Bearing

(4) Bearing Spacer
(5) Upper Cover Plate



B122P011

Commutator Seal

1. Remove and discard the commutator seal (1) from the commutator cover (2).

(When reassembling)

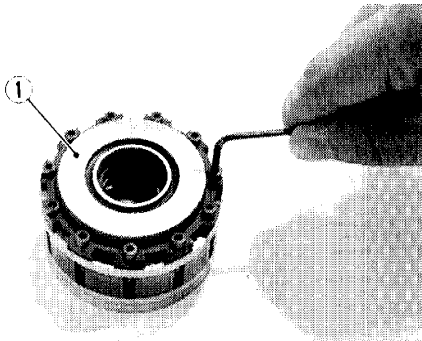
- Apply clean grease to the commutator seal (1).

■ IMPORTANT

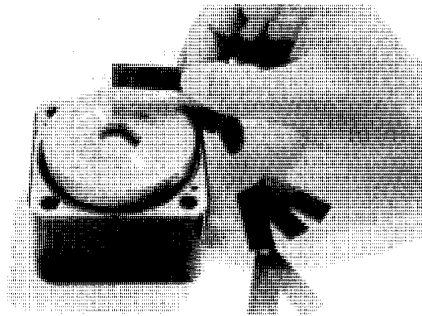
- The rubber portion (the softer side) of the commutator seal (1) with the yellow mark must be placed into the seal groove.

(1) Commutator Seal

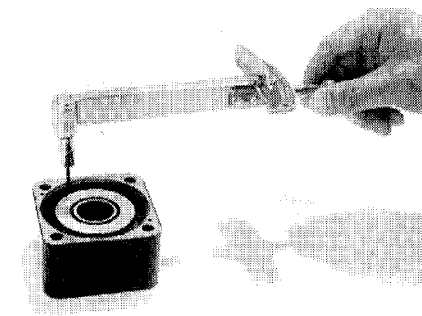
(2) Commutator Cover



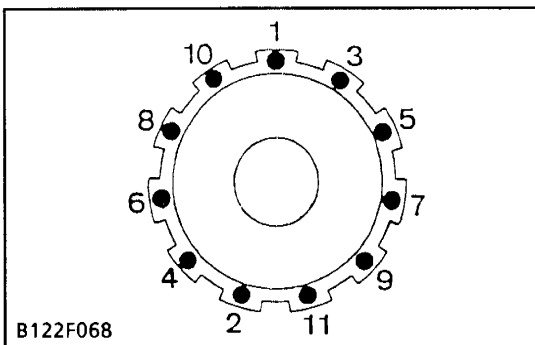
B122P012



B122P013



B122P014



B122F068

Commutator Cover

1. Remove the eleven hex. socket head cap screws.
2. Lift the commutator cover (1) from the metering package.

(When reassembling)

- Align screw holes in commutator cover (1) with screw holes in drive plate, and then screw the eleven hex. socket head cap screws loosely into the metering package.

■ IMPORTANT

- The commutator ring must be concentric with drive plate within 0.127 mm (0.005 in.) total indicator reading after tightening the eleven hex. socket head cap screws.
- The next procedures are a method of achieving the concentricity.

1. Place the metering ring on a hard flat surface.
2. Place the assembled metering package into the metering ring with the commutator cover down, such that the drive plate is partially out of the metering ring. (A suitable wood block under the metering package.)
3. Place one piece of 0.18 mm (0.007 in.) shim stock approximately 13 mm (0.5 in.) wide x 38 mm (1.5 in.) long between the metering ring and drive plate in three places approximately equal distance around the outside diameter of the drive plate.
4. Place another piece of the 0.18 mm (0.007 in.) shim stock between the drive plate and each of the three pieces of shim stock already in place.
5. Lift the metering ring and metering package and remove the wood block.
6. Push the metering package and shims into the metering ring until the drive plate and shims are at least flush with the metering ring.
7. Reverse the metering ring and metering package as a unit on the flat surface.
8. Push down on the metering package until the drive plate is on the flat surface.
9. Be sure the cap screws are loose enough to allow the commutator ring and drive plate to align themselves concentrically in the metering ring bore.
10. Gradually tighten the eleven cap screws, following the sequence shown in figure.
11. Remove the metering package and shims from the metering ring.

Tightening torque	Hex. socket head cap screw	1.24 to 1.47 N·m 0.13 to 0.15 kgf·m 0.94 to 1.08 ft·lbs
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⚠ CAUTION

- Use care and eye protection while adding and removing shims from metering ring as the shims will be under spring tension and could fly into the air causing injury.

(1) Commutator Cover