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WSM

WORKSHOP MANUAL

TRACTOR

B2410

B2710

B2910

Kubota

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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 Tractor B2410, B2710 and B2910. 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.

February 2000

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⚠ 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.**

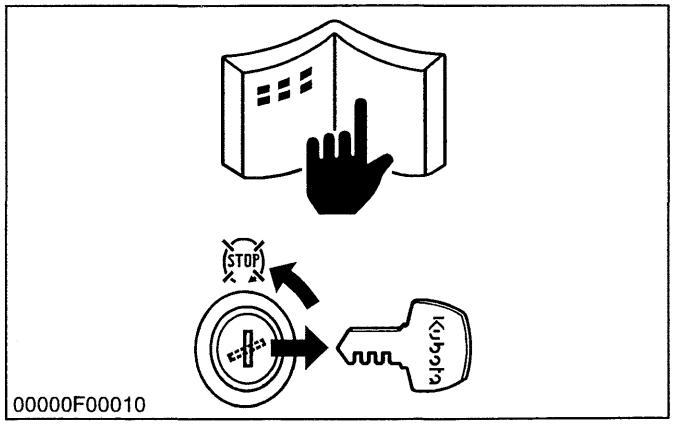
⚠ **WARNING : Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

⚠ **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.**

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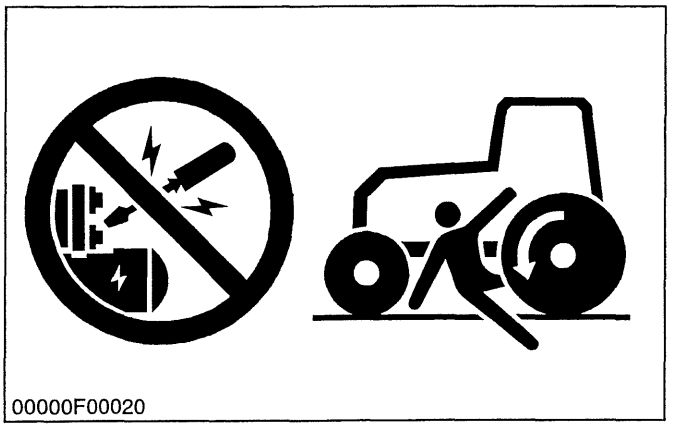
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BEFORE SERVICING AND REPAIRING

(1) Read all instructions and safety instructions in this manual and on your machine safety decals.
(2) Clean the work area and machine.
(3) Park the machine on a firm and level ground, and set the parking brake.
(4) Lower the implement to the ground.
(5) Stop the engine, and remove the key.
(6) Disconnect the battery negative cable.
(7) Hang a **"DO NOT OPERATE"** tag in operator station.

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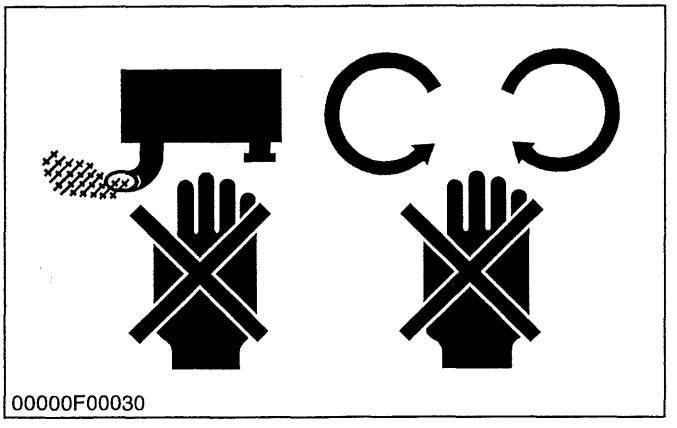
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SAFETY STARTING

(1) Do not start the engine by shorting across starter terminals or bypassing the safety start switch.
(2) Do not alter or remove any part of machine safety system.
(3) Before starting the engine, make sure that all shift levers are in neutral positions or in disengaged positions.
(4) Never start the engine while standing on ground. Start the engine only from operator's seat.

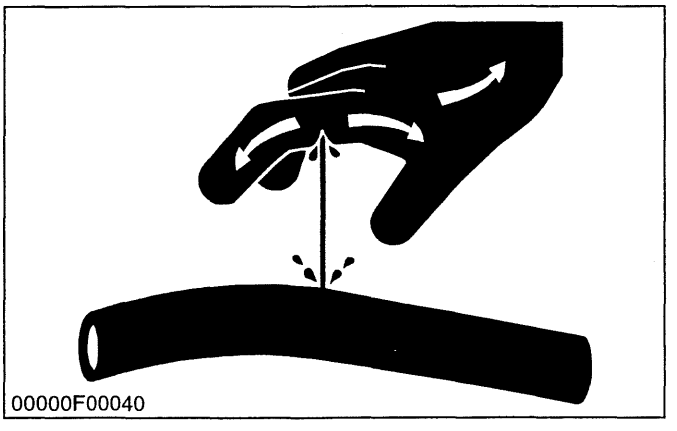
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SAFETY WORKING

(1) Do not work on the machine while under the influence of alcohol, medication, or other substances or while fatigued.
(2) Wear close fitting clothing and safety equipment appropriate to the job.
(3) Use tools appropriate to the work. Makeshift tools, parts, and procedures are not recommended.
(4) When servicing is performed together by two or more persons, take care to perform all work safely.
(5) Do not work under the machine that is supported solely by a jack. Always support the machine by safety stands.
(6) Do not touch the rotating or hot parts while the engine is running.
(7) Never remove the radiator cap while the engine is running, or immediately after stopping. Otherwise, hot water will spout out from radiator. Only remove radiator cap when cool enough to touch with bare hands. Slowly loosen the cap to first stop to relieve pressure before removing completely.
(8) 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.

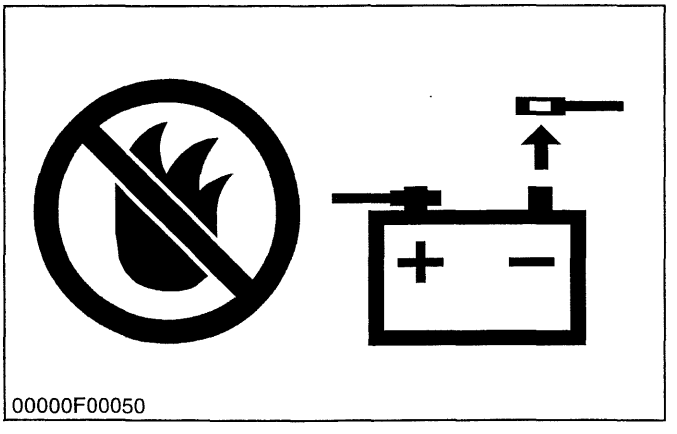
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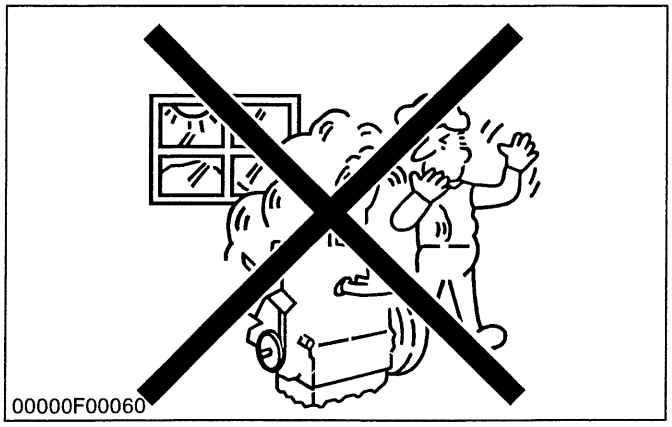

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AVOID FIRES

(1) Fuel is extremely flammable and explosive under certain conditions. Do not smoke or allow flames or sparks in your working area.
(2) To avoid sparks from an accidental short circuit, always disconnect the battery negative cable first and connect it last.
(3) Battery gas can explode. Keep sparks and open flame away from the top of battery, especially when charging the battery.
(4) Make sure that no fuel has been spilled on the engine.

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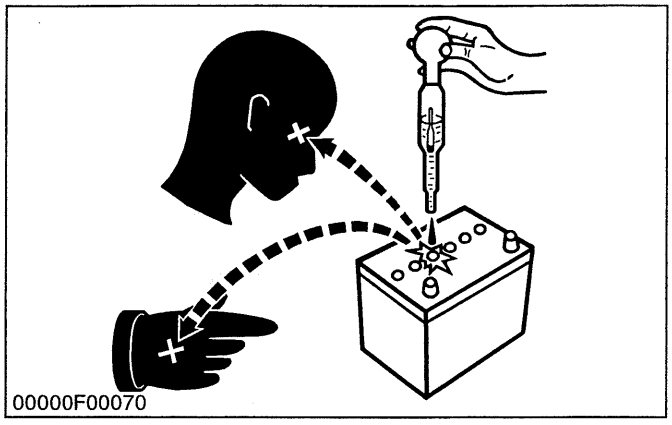

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VENTILATE WORK AREA

(1) If the engine must be running to do some work, make sure the area is well ventilated. Never run the engine in a closed area. The exhaust gas contains poisonous carbon monoxide.

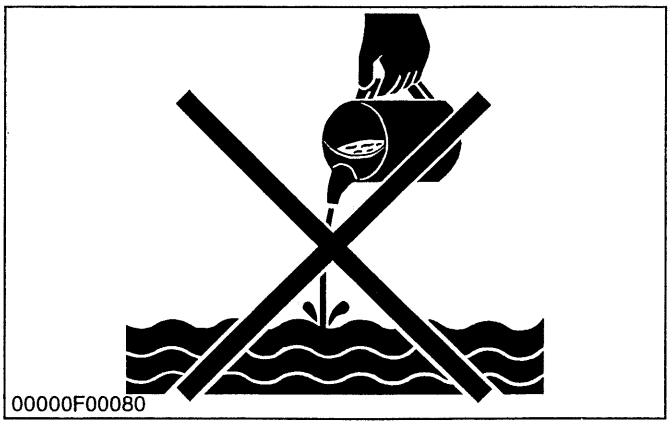
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PREVENT ACID BURNS

(1) 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.

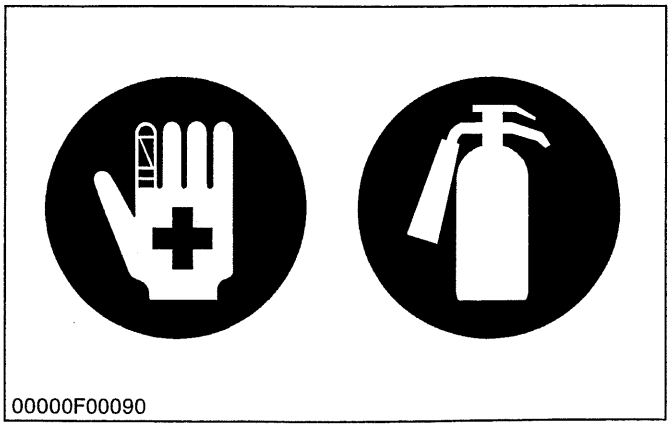
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DISPOSE OF FLUIDS PROPERLY

(1) Do not pour fluids into the ground, down a drain, or into a stream, pond, or lake. Observe relevant environmental protection regulations when disposing of oil, fuel, coolant, electrolyte and other harmful waste.

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PREPARE FOR EMERGENCIES

(1) Keep a first aid kit and fire extinguisher handy at all times.
(2) Keep emergency numbers for doctors, ambulance service, hospital and fire department near your telephone.

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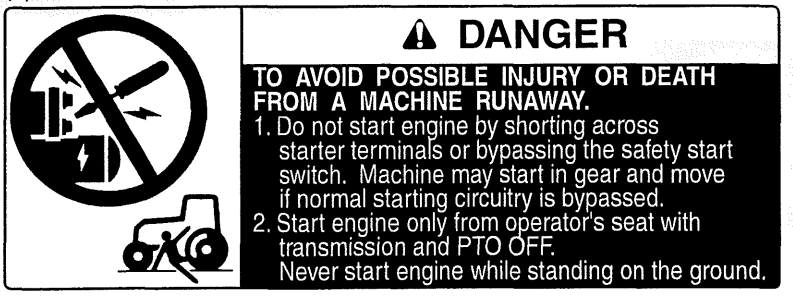
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SAFETY DECALS

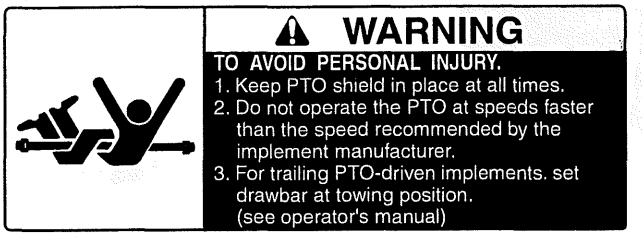
- **The following safety decals are installed on the machine.**
  If a decal becomes damaged, illegible or is not on the machine, replace it. The decal part number is listed in the parts list.

[B2410]

(1) Part No. TA040-4965-2



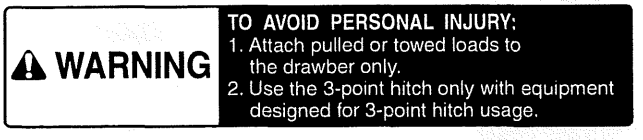
(2) Part No. TA040-4959-3



(3) Part No. 6C040-4741-2
No. fire



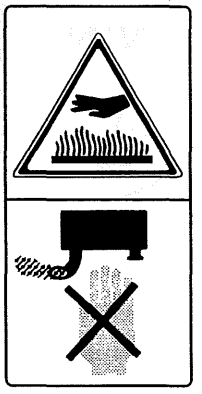
(4) Part No. 6C140-4744-1

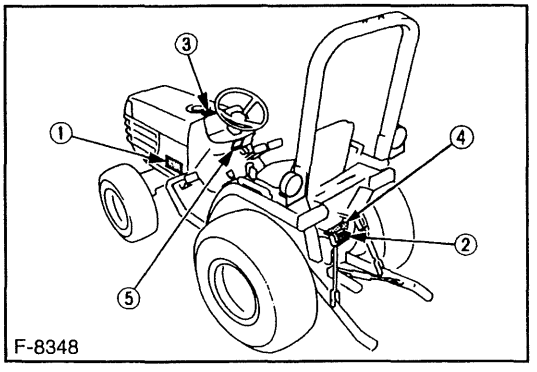


(5) Part No. 6C150-4743-1

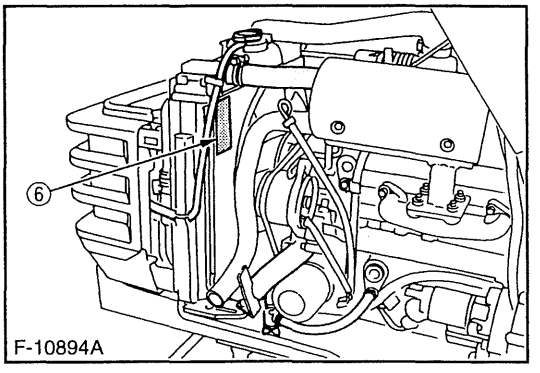


(6) Part No. TA040-4958-1
Do not touch hot surface like muffler, etc.





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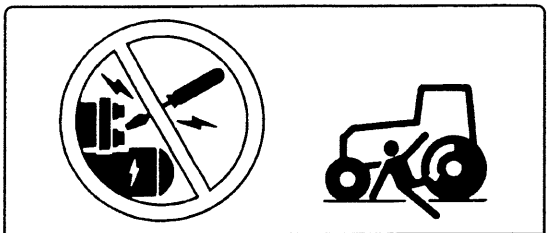
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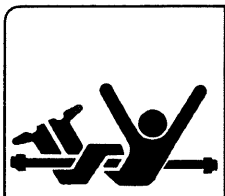
(1) Part No. 6C090-4965-1



⚠ DANGER

TO AVOID POSSIBLE INJURY OR DEATH FROM A MACHINE RUNAWAY.
1. 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.
2. Start engine only from operator's seat with transmission and PTO OFF. Never start engine while standing on the ground.

(2) Part No. TA040-4959-3



⚠ WARNING

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

(3) Part No. 6C040-4741-2
No. fire



(4) Part No. 6C140-4744-1

⚠ WARNING

TO AVOID PERSONAL INJURY:
1. Attach pulled or towed loads to the drawbar only.
2. Use the 3-point hitch only with equipment designed for 3-point hitch usage.

(5) Part No. 6C150-4743-1

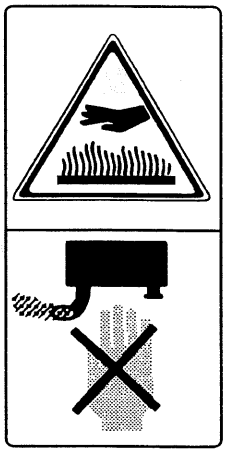
⚠ WARNING

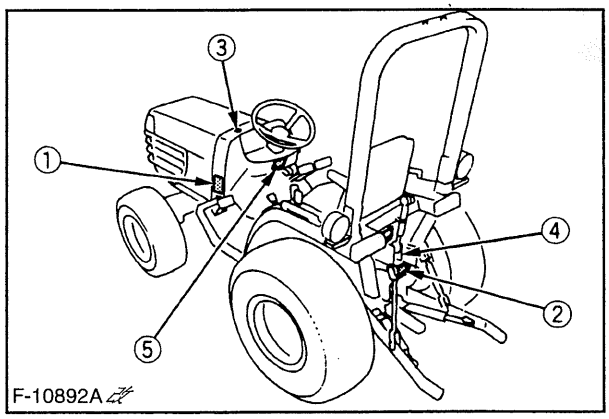


BEFORE DISMOUNTING TRACTOR:
1. ALWAYS SET PARKING BRAKE.
2. PARK ON LEVEL GROUND WHENEVER POSSIBLE. If parking on a slope, position tractor across the slope.
3. LOWER ALL IMPLEMENTS TO THE GROUND.
4. STOP THE ENGINE.

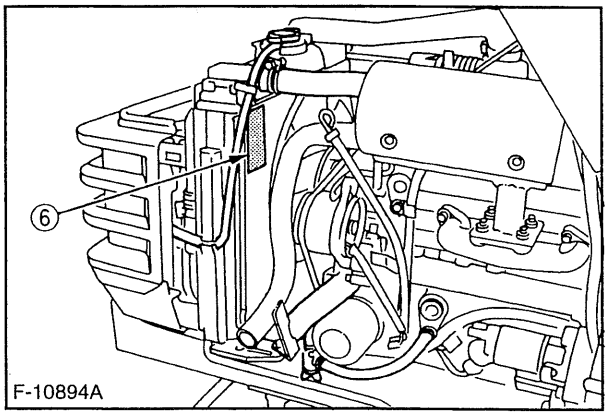
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(6) Part No. TA040-4958-1
Do not touch hot surface like muffler, etc.





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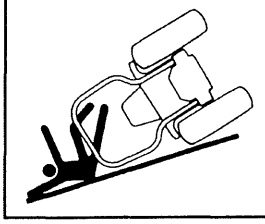
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[B2410, B2710, B2910]

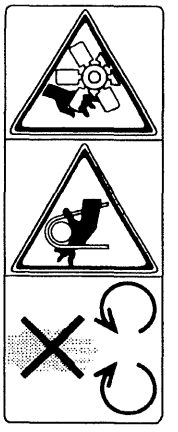
(7) Part No. TA040-4932-2

⚠ WARNING



TO AVOID PERSONAL INJURY OR DEATH FROM ROLL-OVER:
1. Kubota recommends the use of a Roll-Over Protective Structures (ROPS) and seat belt in almost all applications.
2. 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.
3. 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.

(8) Part No. 32751-4958-1
Stay clear of engine fan and fanbelt.



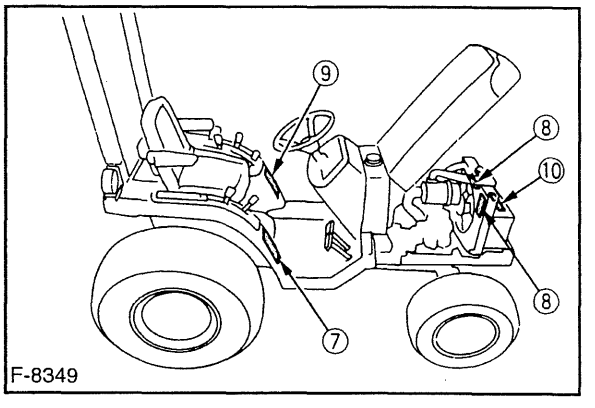
(9) Part No. 6C040-4742-1

⚠ C A U T I O N

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 red 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.

(10) Part No. 6C040-5559-1

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



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CARE OF DANGER, WARNING AND CAUTION LABELS

1. Keep danger, warning and caution labels clean and free from obstructing material.
2. Clean danger, warning and caution labels with soap and water, dry with a soft cloth.
3. Replace damaged or missing danger, warning and caution labels with new labels.
4. If a component with danger, warning or caution label (s) affixed is replace with new part, make sure new label (s) is (are) attached in the same locations (s) as the replaced component.
5. Mount new danger, warning and caution labels by applying on a clean dry surface and pressing any bubbles to outside edge.

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SPECIFICATIONS (B2410)

Model			B2410HSDB	B2410HSD	B2410HSE
PTO power			13.4 kW (18.0 HP)		
Engine	Maker		KUBOTA		
	Model		D1105-E-D16		
	Type		Indirect Injection. Vertical, water-cooled, 4-cycle diesel		
	Number of cylinders		3		
	Bore and stroke		78 × 78.4 mm (3.07 × 3.09 in.)		
	Total displacement		1123 cm^3 (68.5 cu.in.)		
	Engine net power (DIN)		17.9 kW (24.0 HP)		
	Rated revolution (min^{-1})		43.3 r/s (2600 rpm)		
	Maximum torque		67 N·m (50 ft-lbs)		
	Battery		12 V, RC : 79 min, CCA : 433 A		
	Starting system		Electric starting with cell starter 12 V, 1.0 kW		
	Lubricating system		Forced lubrication by trochoidal pump		
	Cooling system		Pressurized radiator, forced circulation with water pump		
	Fuel		Diesel fuel No. 2-D [above –10 °C (14 °F)], Diesel fuel No. 1 [below –10 °C (14 °F)]		
Capacities	Fuel tank		24 L (6.3 U.S.gals, 5.3 Imp.gal)		
	Engine crankcase (with filter)		3.0 L (3.2 U.S.qts, 2.6 Imp.qts)		
	Engine coolant		3.8 L (4.0 U.S.qts, 3.3 Imp.qts)		
	Transmission case		12.5 L (3.30 U.S.gals, 2.75 Imp.gals)		
	Front axle case		4.5 L (4.8 U.S.qts, 4.0 Imp.qts)	3.7 L (3.9 U.S.qts, 3.3 Imp.qts)	–
Dimensions	Overall length (without 3P)		2330 mm (91.7 in.)		
	Overall width		1175 mm (46.3 in.)		
	Overall height (with ROPS)		1965 mm (77.4 in.)		
	Overall height (top of steering wheel)		1372 mm (54.0 in.)		
	Wheel base		1500 mm (59.0 in.)		
	Minimum ground clearance		285 mm (11.2 in.)	325 mm (12.8 in.)	
	Tread	Front	835 mm (32.9 in.)		900 mm (35.4 in.)
		Rear	890 to 1064 mm (35.0 to 41.9 in.)		
Weight (with ROPS)			680 kg (1500 lbs)	670 kg (1477 lbs)	620 kg (1367 lbs)
Clutch			Dry single plate		
Travelling system	Tires	Front	7-12		6.5-10
		Rear	11.2-16		
	Steering		Integral type power steering		
	Transmission		Main-hydrostatic transmission, High-Low gear shift (2 forward and 2 reverse)		
	Brake		Wet disk type		
	Min. turning radius (with brake)		2.1 m (6.9 feet)		2.0 m (6.6 feet)
	Differential		Bevel gear		
Hydraulic system	Hydraulic control system		Position Control		
	Pump capacity		3P: 16.6 L (4.4 U.S.GPM, 3.7 Imp.GPM), PS: 9.8 L (2.6 U.S.GPM, 2.2 Imp.GPM)		
	Three point hitch		SAE Category I		
	Max. lift force	At lift points	750 kg (1655 lbs)		
		(24 in, behind lift points)	590 kg (1300 lbs)		
PTO system	Rear	PTO shaft	SAE 1-3/8, 6 splines		
		Revolution	1 speed (540 min^{-1} (rpm) at 2584 engine min^{-1} (rpm))		
	Mid.	PTO shaft	USA No. 5 (KUBOTA 10-tooth) involute spline		
		Revolution	1 speed (2537 min^{-1} (rpm) at 2600 engine min^{-1} (rpm))		

Note : * Manufacture's estimate the company reserves the right to change the specifications without notice.

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SPECIFICATIONS (B2710 • B2910)

Model			B2710HSD	B2910HSD
PTO power			14.9 kW (20.0 HP)	16.4 kW (22.0 HP)
Engine	Maker		KUBOTA	
	Model		V1305-E-D12	V1505-E-D16
	Type		Indirect Injection. Vertical, water-cooled, 4-cycle diesel	
	Number of cylinders		4	
	Bore and stroke		76 × 73.6 mm (2.99 × 2.90 in.)	78 × 78.4 mm (3.07 × 3.09 in.)
	Total displacement		1335 cm^3 (81.5 cu.in.)	1498 cm^3 (91.5 cu.in.)
	Engine net power (DIN)		20.1 kW (27.0 HP)	22.3 kW (30.0 HP)
	Rated revolution (min^{-1})		43.3 r/s (2600 rpm)	
	Maximum torque		79 N·m (59 ft-lbs)	89 N·m (66 ft-lbs)
	Battery		12 V, RC : 79 min, CCA : 433 A	
	Starting system		Electric starting with cell starter 12 V, 1.4 kW	
	Lubricating system		Forced lubrication by trochoidal pump	
	Cooling system		Pressurized radiator, forced circulation with water pump	
	Fuel		Diesel fuel No. 2-D [above –10 °C (14 °F)], Diesel fuel No. 1 [below –10 °C (14 °F)]	
Capacities	Fuel tank		26 L (6.9 U.S.gals, 5.7 Imp.gal)	
	Engine crankcase (with filter)		4.1 L (4.3 U.S.qts, 3.6 Imp.qts)	
	Engine coolant		4.5 L (4.8 U.S.qts, 4.0 Imp.qts)	
	Transmission case		14.5 L (3.83 U.S.gals, 3.19 Imp.gals) [B2710 Affected Serial No.: below 15496 14.0 L (3.70 U.S.gals, 3.08 Imp.gals)]	
	Front axle case		4.5 L (4.8 U.S.qts, 4.0 Imp.qts)	
Dimensions	Overall length (without 3P)		2520 mm (99.2 in.)	
	Overall width		1366 mm (53.8 in.)	
	Overall height (with ROPS)		1995 mm (78.5 in.)	
	Overall height (top of steering wheel)		1365 mm (53.7 in.)	
	Wheel base		1666 mm (65.6 in.)	
	Minimum ground clearance		370 mm (14.6 in.)	
	Tread	Front	935 mm (36.8 in.)	
		Rear	1050 mm (41.3 in.)	
Weight (with ROPS)			790 kg (1740 lbs)	800 kg (1763 lbs)
Clutch			Dry single plate	
Travelling system	Tires	Front	7-12	
		Rear	12.4-16	
	Steering		Integral type power steering	
	Transmission		Main-hydrostatic transmission, range-gear shift (3 forward and 3 reverse)	
	Brake		Wet disk type	
	Min. turning radius (with brake)		2.1 m (6.9 feet)	
	Differential		Bevel gear	
Hydraulic system	Hydraulic control system		Position Control	
	Pump capacity		3P: 24.4 L (6.4 U.S.GPM, 5.4 Imp.GPM), PS: 11.7 L (3.1 U.S.GPM, 2.6 Imp.GPM)	
	Three point hitch		SAE Category I	
	Max. lift force	At lift points	750 kg (1655 lbs)	
		(24 in, behind lift points)	590 kg (1300 lbs)	
PTO system	Rear	PTO shaft	SAE 1-3/8, 6 splines	
		Revolution	1 speed (540 min^{-1} (rpm) at 2584 engine min^{-1} (rpm))	
	Mid.	PTO shaft	USA No. 5 (KUBOTA 10-tooth) involute spline	
		Revolution	1 speed (2537 min^{-1} (rpm) at 2600 engine min^{-1} (rpm))	

Note : * Manufacture's estimate the company reserves the right to change the specifications without notice.

12271Z00060

TRAVELLING SPEED

(At rated engine rpm)

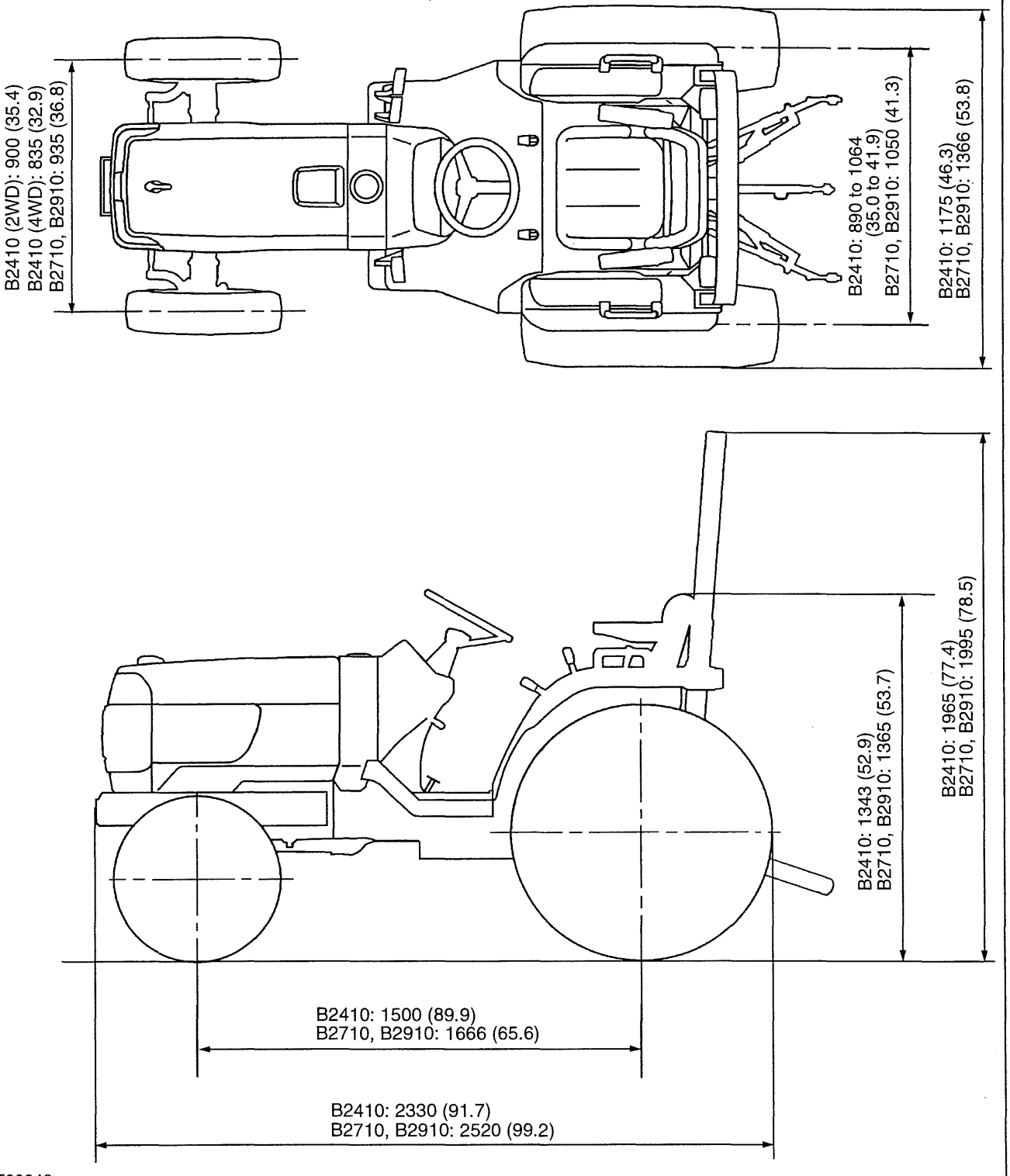
Model		B2410		B2710, B2910	
Tire size (Rear)		11.2-16 Farm		12.4-16 Farm	
Range gear shift lever		km/h	mph	km/h	mph
Forward	Low	0 to 6.6	0 to 4.1	0 to 5.0	0 to 3.1
	Middle	–	–	0 to 8.6	0 to 5.3
	High	0 to 16.5	0 to 10.2	0 to 19.1	0 to 11.9
Reverse	Low	0 to 5.3	0 to 3.3	0 to 4.0	0 to 2.5
	Middle	–	–	0 to 6.9	0 to 4.3
	High	0 to 13.2	0 to 8.2	0 to 15.2	0 to 9.4

The Company reserves the right to change the specifications without notice.

12271Z00070

DIMENSIONS

Unit mm (in.)



12271F00040

12271Z00080

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GENERAL

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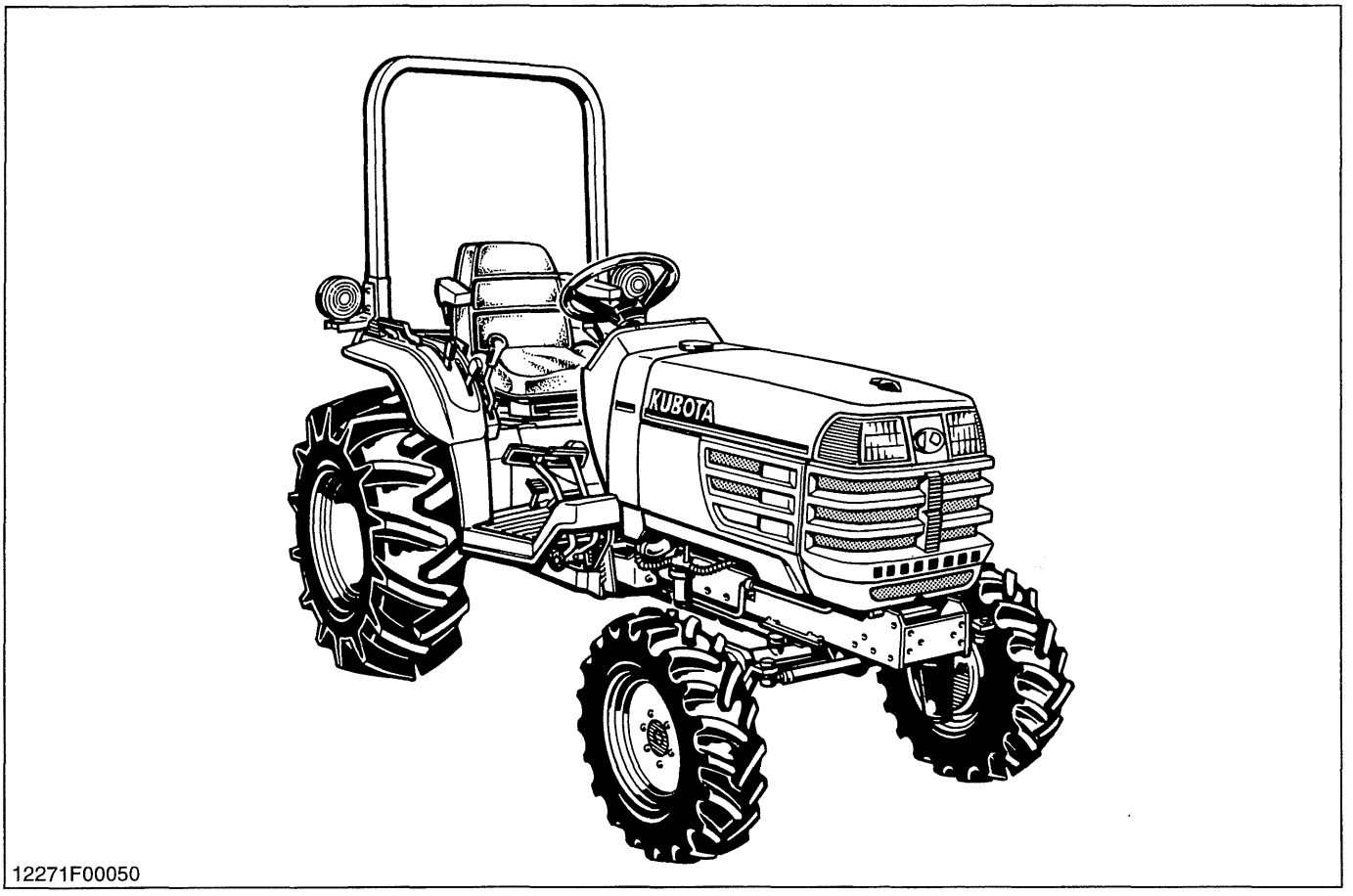
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[1] FEATURES

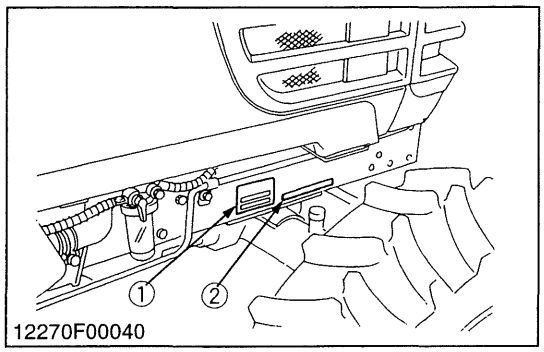


12271F00050

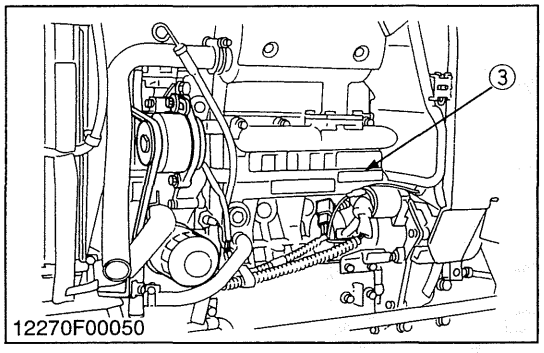
(1) Integral Power Steering
(2) E-TVCS (Three Vortex Combustion System) Diesel Engine
(3) Engine Key Shut-Off System
(4) Hydrostatic Transmission (HST)
(5) 3 Range of Speed (B2710, B2910)
(6) Bi-speed Turn (B2410 Only)
(7) Cruise Control (B2910 Only)
(8) Wet Disc Brake
(9) Standard Mid-PTO
(10) Simultaneous Mounting of Both the Mid. Mount Mower and Front Loader
(11) Combination Panel of Easy Checker
(12) Large Hydraulic Pump
(13) Position Control Valve
(14) Hydraulic Block Type Outlet

12271G00010

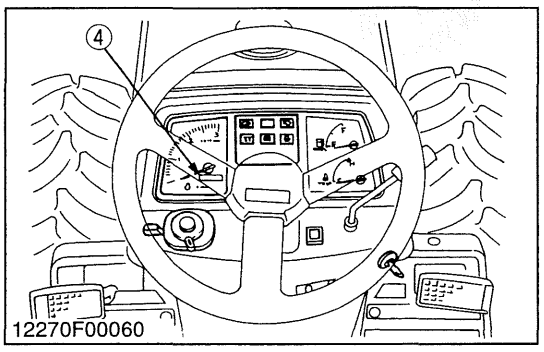
[2] TRACTOR IDENTIFICATION



12270F00040



12270F00050



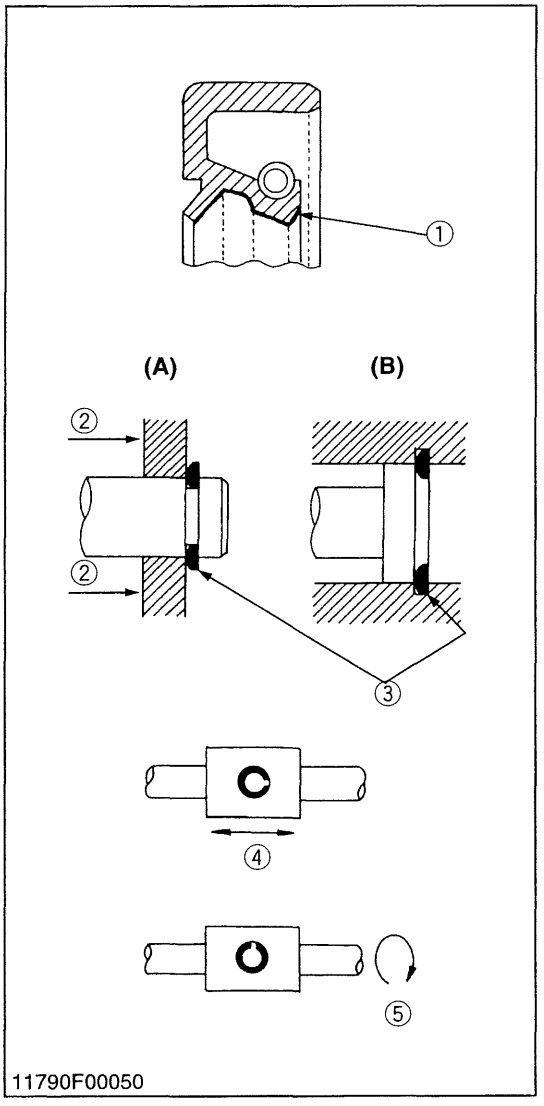
12270F00060

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

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

12270G00020

[3] GENERAL PRECAUTIONS



11790F00050

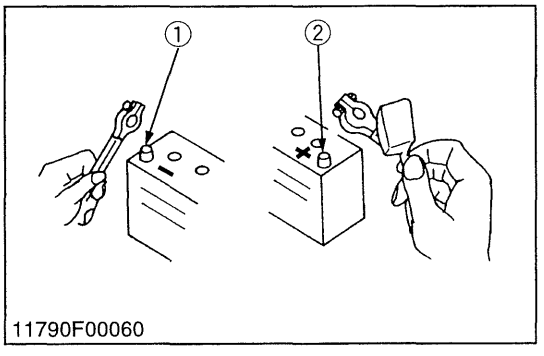
- During disassembly, carefully arrange removed parts in a clean area to prevent confusion later. Bolts and nuts should be installed in their original position to prevent reassembly errors.
- When special tools are required, use KUBOTA genuine special tools. Special tools which are not frequently used 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

11790G00030

[4] HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING



11790F00060

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

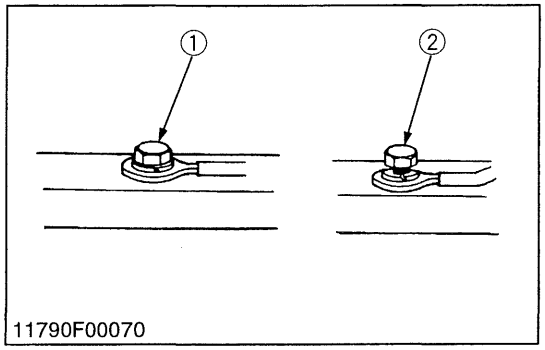
■ IMPORTANT

- **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 cables, disconnect the negative cable first. When installing the battery cables, connect the positive cable first.**

(1) Negative Terminal (2) Positive Terminal

11790G00041

(1) Wiring

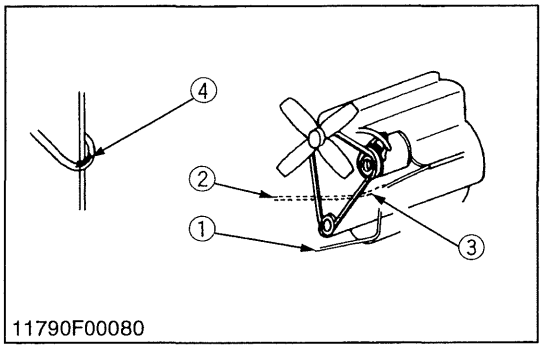


11790F00070

- Securely tighten wiring terminals.

(1) Correct (Securely Tighten)
(2) Incorrect (Loosening Leads to Faulty Contact)

11790G00050

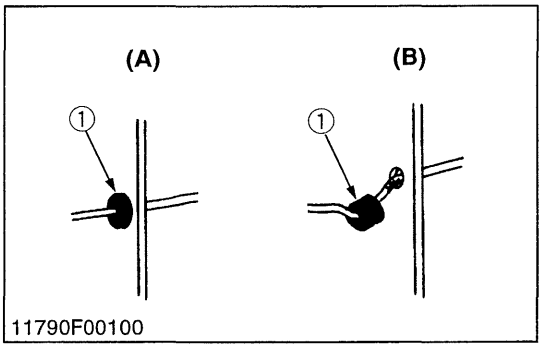


11790F00080

- Do not let wiring contact dangerous part.

(1) Wiring (Correct)
(2) Wiring (Incorrect)
(3) Dangerous Part
(4) Dangerous Part

11790G00060



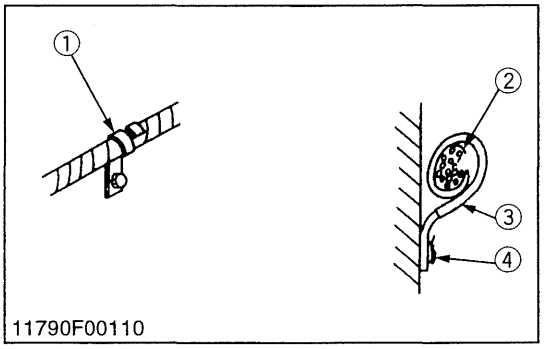
11790F00100

- Securely insert grommet.

(1) Grommet

(A) Correct
(B) Incorrect

11790G00080

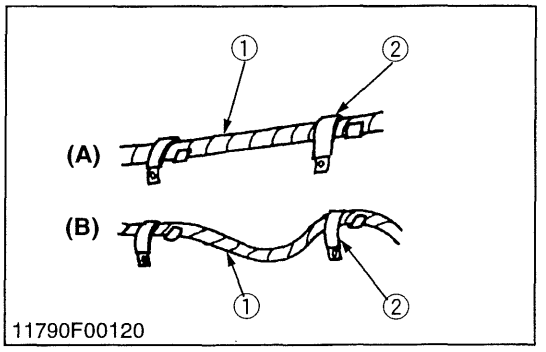


11790F00110

- Securely clamp, being careful not to damage wiring.

(1) Clamp
  • Wind Clamp Spirally
(2) Wire Harness
(3) Clamp
(4) Welding Dent

11790G00090

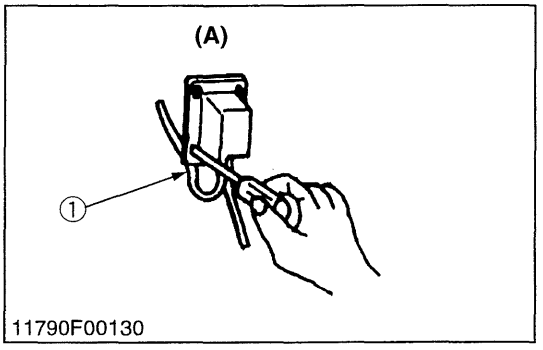


11790F00120

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

(1) Wiring
(2) Clamp
(A) Correct
(B) Incorrect

11790G00100

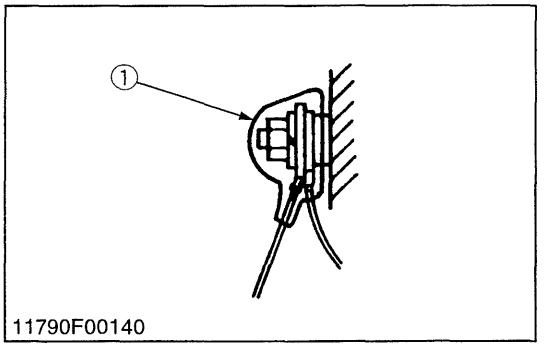


11790F00130

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

(1) Wiring
(A) Incorrect

11790G00110



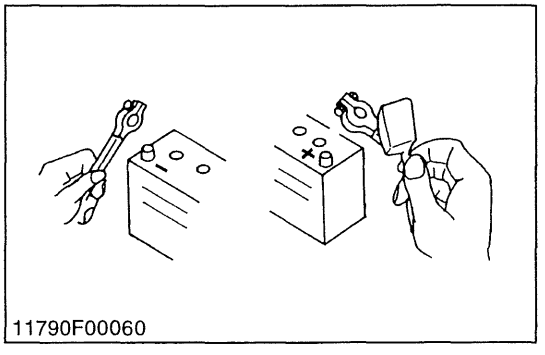
11790F00140

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

(1) Cover
- Securely Install Cover

11790G00120

(2) Battery


11790F00060

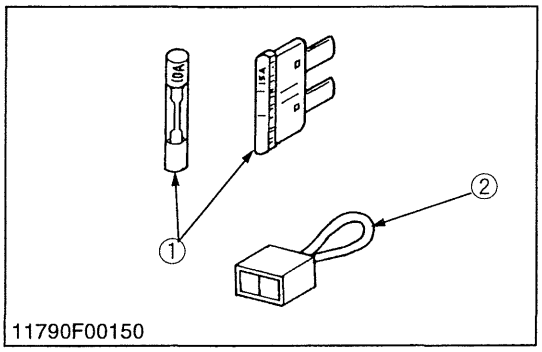
- Take care not to confuse positive and negative terminal posts.
- When removing battery cables, disconnect negative cable first. When installing battery cables, check for polarity and connect positive cable first.
- Do not install any battery with capacity other than is specified (Ah).
- After connecting cables to battery terminal posts, apply high temperature 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.**
- **Do recharging in a well-ventilated place where there is no open flame nearby, as hydrogen gas and oxygen are formed.**

11790G00131

(3) Fuse



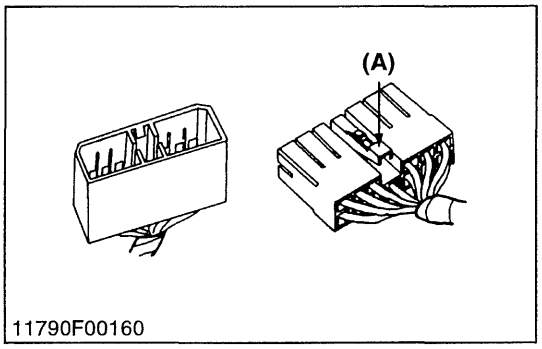
11790F00150

- Use fuses with specified capacity.
  Neither too large or small capacity fuse is acceptable.
- Never use steel or copper wire in place of fuse.
- 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.

(1) Fuse
(2) Fusible Link

11790G00140

(4) Connector

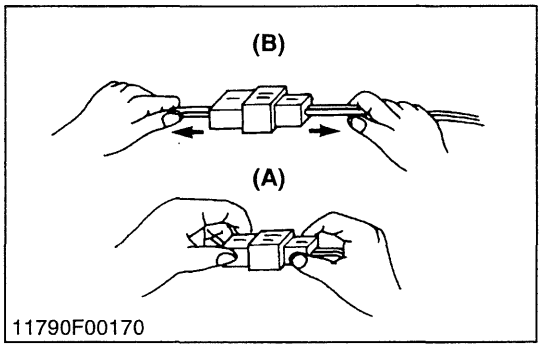


11790F00160

- For connector with lock, push lock to separate.

(A) Push

11790G00150

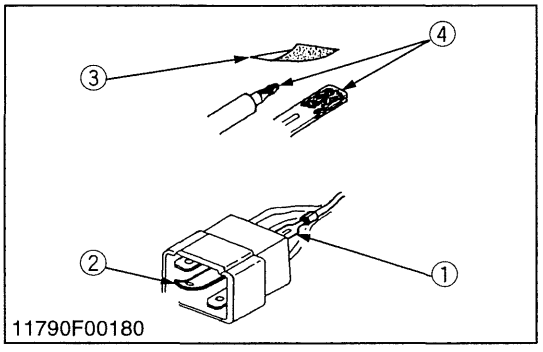


11790F00170

- In separating connectors, do not pull wire harnesses.
- Hold connector bodies to separate.

(A) Correct
(B) Incorrect

11790G00160



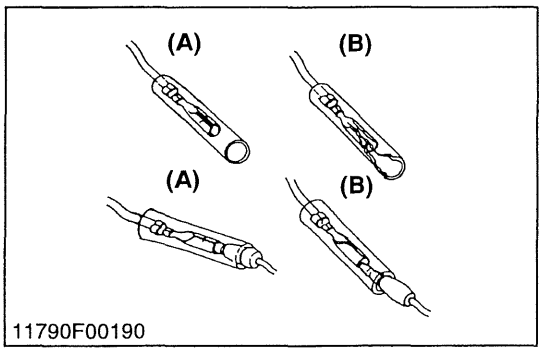
11790F00180

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

(1) Exposed Terminal
(2) Bend Terminal
(3) Sandpaper
(4) Rust

11790G00170

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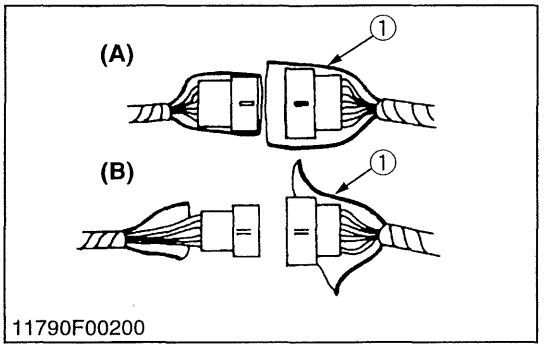


11790F00190

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

(A) Correct **(B) Incorrect**

11790G00180



11790F00200

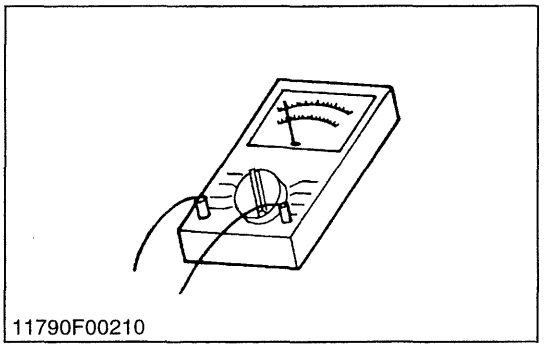
- Make certain plastic cover is large enough to cover whole connector.

(1) Cover

(A) Correct
(B) Incorrect

11790G00190

(5) Handling of Circuit Tester


11790F00210

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

11790G00200

[5] LUBRICANTS, FUEL AND COOLANT

	Place	Capacity			Lubricants, fuel and coolant
		B2410HSD	B2710	B2910	
1	Fuel tank	24 L 6.3 U.S.gals. 5.3 Imp.gals.	26 L 6.9 U.S.gals. 5.7 Imp.gals.		No. 2-D diesel fuel No. 1-D diesel fuel if temperature is below – 10 °C (14 °F)
2	Cooling system with recovery tank	3.8 L 4.0 U.S.qts. 3.3 Imp.qts.	4.5 L 4.7 U.S.qts. 4.0 Imp.qts.		Fresh clean water with anti-freeze
3	Engine crankcase	3.0 L 3.2 U.S.qts. 2.6 Imp.qts	4.1 L 4.3 U.S.qts. 3.6 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
4	Transmission case	12.5 L 3.3 U.S.gals 2.75 Imp.gals.	Affected Serial No.: below 15496 14.0 L 3.70 U.S.gals. 3.08 Imp.gals. Affected Serial No.: above 50101 14.5 L 3.83 U.S.gals. 3.19 Imp.gals.	14.5 L 3.83 U.S.gals 3.19 Imp.gals.	KUBOTA SUPER UDT fluid *
5	Front axle case	4WD Model 3.7 L 3.9 U.S.qts. 3.3 Imp.qts Bi-speed Turn Type 4.5 L 4.8 U.S.qts. 4.0 Imp.qts.	4.5 L 4.8 U.S.qts. 4.0 Imp.qts.		KUBOTA SUPER UDT fluid * or SAE80, 90 gear oil

Greasing

	Place	No. of greasing point	Capacity	Type of grease
6	Speed control pedal (HST pedal)	1	Until grease overflows	Multipurpose type grease
	Top link	1		
	Lift rod	1		
	Battery terminal	2	Moderate amount	
	Knuckle shaft (2WD)	2		
	Front axle support (2WD)	2		

* KUBOTA original transmission hydraulic fluid.

12271G00020

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[6] TIGHTENING TORQUES

(1) 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	⬡ 4 No-grade or 4T						⬡ 7 7T						⬡ 9 9T		
Material of bolt	SS400, S20C						S43C, S48C						SCr435, SCM435		
Material of opponent part	Ordinariness			Aluminum			Ordinariness			Aluminum			Ordinariness		
Unit / Diameter	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
M6 (6 mm, 0.24 in.)	7.85 to 9.31	0.80 to 0.95	5.79 to 6.87	7.85 to 8.82	0.80 to 0.90	5.79 to 6.50	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31	7.85 to 8.82	0.80 to 0.90	5.79 to 6.50	12.3 to 14.2	1.25 to 1.45	9.05 to 10.4
M8 (8 mm, 0.31 in.)	17.7 to 20.5	1.8 to 2.1	13.1 to 15.1	16.7 to 19.6	1.7 to 2.0	12.3 to 14.4	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2	17.7 to 20.5	1.8 to 2.1	13.1 to 15.1	29.5 to 34.3	3.0 to 3.5	21.7 to 25.3
M10 (10 mm, 0.39 in.)	39.3 to 45.1	4.0 to 4.6	29.0 to 33.2	31.4 to 34.3	3.2 to 3.5	23.2 to 25.3	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2	39.3 to 44.1	4.0 to 4.5	29.0 to 32.5	60.9 to 70.6	6.2 to 7.2	44.9 to 52.0
M12 (12 mm, 0.47 in.)	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5				77.5 to 90.2	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 86.7
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 (16 mm, 0.63 in.)	167 to 191	17.0 to 19.5	123 to 141				197 to 225	20.0 to 23.0	145 to 166				260 to 304	26.5 to 31.0	192 to 224
M18 (18 mm, 0.71 in.)	246 to 284	25.0 to 29.0	181 to 209				275 to 318	28.0 to 32.5	203 to 235				344 to 402	35.0 to 41.0	254 to 296
M20 (20 mm, 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				491 to 568	50.0 to 58.0	362 to 419

11790G00761

(2) Stud Bolts

Material of opponent part	Ordinariness			Aluminum		
Unit / Diameter	N·m	kgf·m	ft-lbs	N·m	kgf·m	ft-lbs
M8 (8 mm, 0.31 in.)	11.8 to 15.6	1.2 to 1.6	8.68 to 11.5	8.82 to 11.8	0.90 to 1.2	6.51 to 8.67
M10 (10 mm, 0.39 in.)	24.6 to 31.3	2.5 to 3.2	18.1 to 23.1	19.7 to 25.4	2.0 to 2.6	14.5 to 18.8
M12 (12 mm, 0.47 in.)	29.5 to 49.0	3.0 to 5.0	21.7 to 36.1	31.4	3.2	23.1

11790G00762

[7] MAINTENANCE

No.	Item		Period	Indication on hour meter																	After purchase		Important		Reference page
				50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	1500	3000	1 year	2 years			
1	Engine oil		Change	★	☆		☆		☆		☆		☆		☆		☆		☆							G-12
2	Engine oil filter		Replace	★			☆				☆				☆				☆							G-12
3	Transmission fluid		Change	★					☆						☆											G-13
4	Hydraulic oil filter (for HST)		Replace	★					☆						☆											G-13
5	Hydraulic oil filter		Replace	★					☆						☆											G-13
6	Transmission oil strainer		Clean	★					☆						☆											G-14
7	Front axle case oil		Change						☆						☆											G-25
8	Front axle pivot		Adjust								☆								☆							G-26
9	Engine start system		Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆							G-17
10	Greasing		–	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆							G-16
11	Greasing (2WD front wheel hub)		–								☆								☆							G-25
12	Wheel bolt torque		Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆							G-18
13	Battery condition		Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆							G-19
14	Air cleaner element [Double type]	Primary element	Clean		☆		☆		☆		☆		☆		☆		☆		☆					*	@	G-20
			Replace																			☆		**		G-20
		Secondary element	Replace																			☆				G-20
15	Fuel filter element		Clean		☆		☆		☆		☆		☆		☆		☆		☆						@	G-21
			Replace								☆								☆							G-21
16	Fan belt		Adjust		☆		☆		☆		☆		☆		☆		☆		☆							G-22
17	Clutch		Adjust	★	☆		☆		☆		☆		☆		☆		☆		☆							G-15
18	Brake		Adjust		☆		☆		☆		☆		☆		☆		☆		☆							G-22
19	Fuel line		Check		☆		☆		☆		☆		☆		☆		☆		☆						@	G-23
			Replace																			☆				G-23
20	Intake air line		Check				☆				☆				☆				☆						@	G-24
			Replace																			☆		***		G-24
21	Radiator hose and clamp		Check				☆				☆				☆				☆							G-23
			Replace																			☆				G-23
22	Toe-in		Adjust				☆				☆				☆				☆							G-24
23	Engine valve clearance		Adjust																☆							G-26
24	Cooling system		Flush																			☆				G-27
25	Coolant		Change																			☆				G-27
26	Fuel injection nozzle injection pressure		Check																	☆					@	G-26
27	Injection pump		Check																		☆				@	G-26

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[7] MAINTENANCE (Continued)

No.	Item / Period		Indication on hour meter																	After purchase		Important		Reference page
			50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	1500	3000	1 year	2 years		
28	Fuel system	Bleed																			Service as required			G-28
29	Fuse	Replace																						G-29
30	Light bulb	Replace																						G-30

IMPORTANT :

The jobs indicated by ★ must be done after the first 50 hours of operation.

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

**** Every year or every 6 times of cleaning.**

***** Replace only if necessary.**

- **The items listed above (@ marked) are registered as emission related critical parts by KUBOTA in the U.S.EPA nonroad emission regulation. As the engine owner, you are responsible for the performance of the required maintenance on the engine according to the above instruction. Please see the Warranty Statement in detail.**

12271G00040

[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.**

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(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 and grill.
8) Check the bolts and nuts of the tires are tight.
9) Check the number plate or SMV emblem for damage and cleaner replace as necessary if equipped.
10) Care of danger, warning and caution labels.
11) Clean around the exhaust manifold and the muffler of the engine.

- While sitting in the operator's seat.

1) Check the HST pedal, brake pedals and clutch pedal.
2) Check the parking brake.
3) Check the steering wheel.

- Turning the key switch.

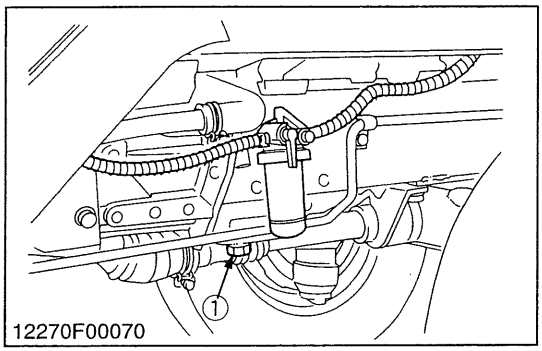
1) Check the performance of the easy checker lights.
2) Check head lights, tail lights and hazard lights. Clean if necessary.
3) Check the performance of the meters and gauges.

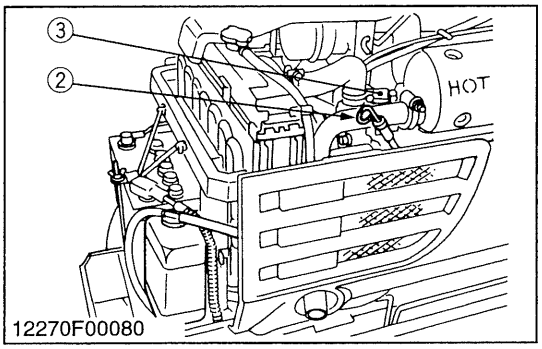
- Starting the engine.

1) Check to see that the lights on the Easy Checker go off.
2) Check the color of the exhaust gas.
3) Check the brakes for proper operation.

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(2) Check Points of Initial 50 Hours





Changing Engine Oil

CAUTION

- **Before changing oil, be sure to stop the engine.**

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 plug (1) at the bottom of the engine and drain the oil completely.
4. Screw in the drain plug (1).
5. Fill new oil up to upper line on the dipstick (2).

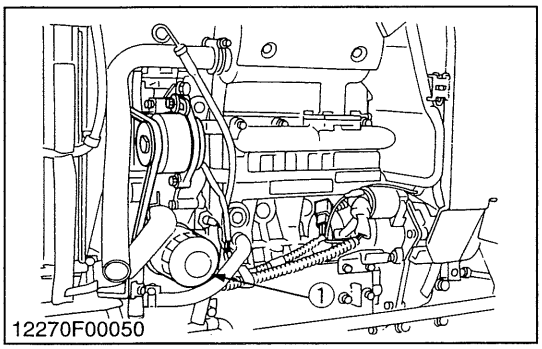
IMPORTANT

- **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 COOLANT". (See page G-8.)**

Engine oil capacity	B2410	3.0 L 3.2 U.S.qts 2.6 Imp.qts
	B2710 B2910	4.1 L 4.3 U.S.qts 3.6 Imp.qts

(1) Drain Plug
(2) Dipstick
(3) Oil Inlet
(A) Oil level is acceptable within this range.

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Replacing Engine Oil Filter Cartridge

CAUTION

- **Be sure to stop the engine before changing oil filter cartridge.**

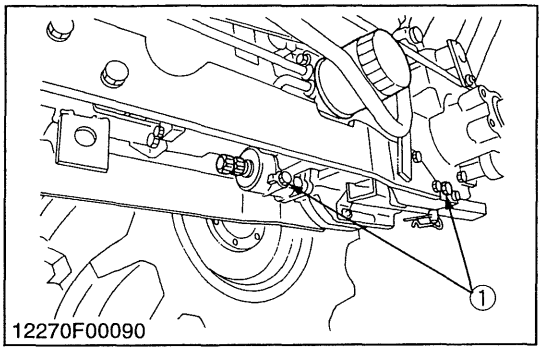
1. Remove the oil filter cartridge with the filter wrench.
2. Apply a slight coat of oil onto the cartridge gasket.
3. To install the new cartridge, screw it in by hand. Over tightening may cause deformation of rubber gasket.
4. After the new cartridge has been replaced, the engine oil normally decrease a little. Thus see that the engine oil does not leak through the seal and be sure to read the oil level on the dipstick. Then, replenish the engine oil up to the specified level.

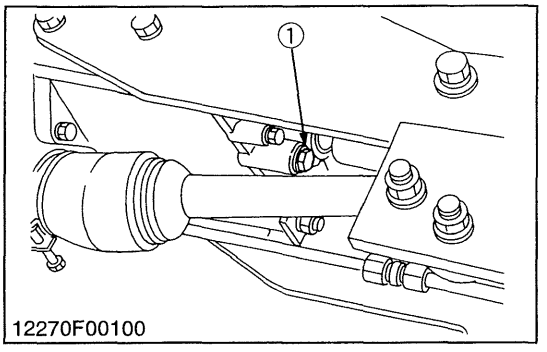
IMPORTANT

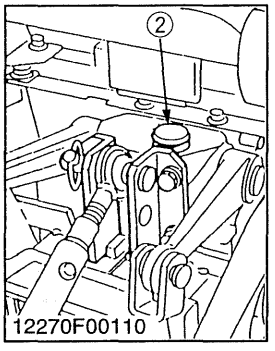
- **To prevent serious damage to the engine, replacement element must be highly efficient. Use only a KUBOTA genuine filter or its equivalent.**

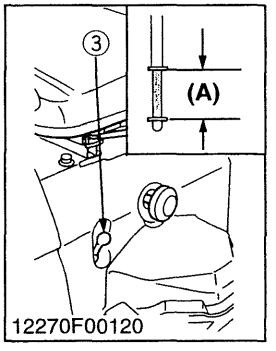
(1) Engine Oil Filter

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Changing Transmission Fluid

CAUTION

- **Be sure to stop the engine checking and changing the transmission fluid.**

1. Place an oil pan under the tractor.
2. Remove the drain plugs (1) at the bottom of the rear axle cases and oil tank.
3. Drain the transmission fluid.
4. After draining, screw in the three drain plugs.
5. Fill new oil from filling port after removing the filling plug (2) up to the upper notch on the dipstick.
6. After running the engine for a few minutes, stop it and check the oil level again, if low, add oil prescribed level.

IMPORTANT

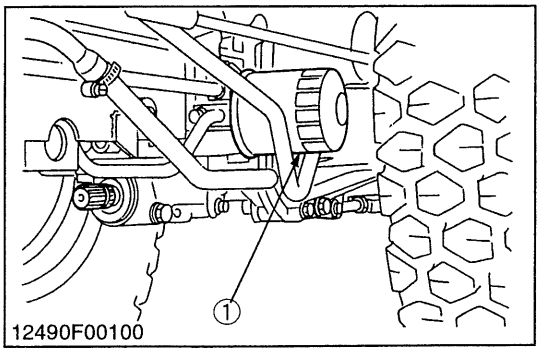
- **Use only multi-grade transmission oil. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS AND FLUID" (See page G-8).**
- **Never work the tractor immediately after changing the transmission oil. Keeping the engine at medium speed for a few minutes to prevents damage to the transmission.**
- **Do not mix different blands oil together.**

Transmission fluid capacity	B2410	12.5 L 3.30 U.S.gals. 2.75 Imp.gals.
	B2710	Affeted Serial No.: below 15496 14.0 L 3.70 U.S.gals. 3.08 Imp.gals. Affeted Serial No.: above 50101 14.5 L 3.83 U.S.gals. 3.19 Imp.gals.
	B2910	14.5 L 3.83 U.S.gals. 3.19 Imp.gals.

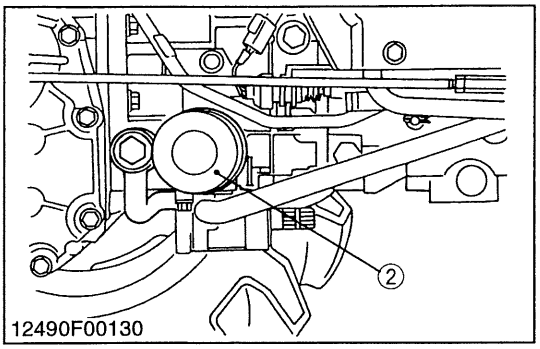
(1) Drain Plug
(2) Filling Plug
(3) Dipstick

(A) Oil level acceptable within this range.

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Replacing Hydraulic Oil Filter Cartridge

⚠ CAUTION

- **Be sure to stop the engine before changing the oil filters.**

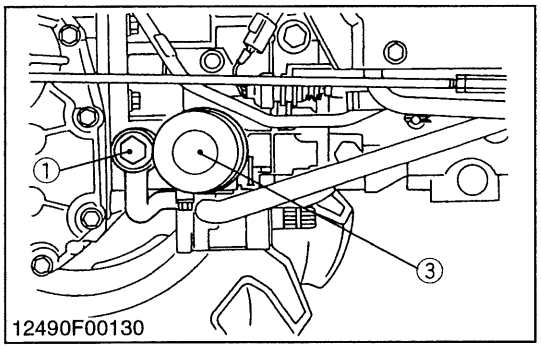
1. Drain the transmission fluid.
2. Remove the oil filter cartridge by using a filter wrench.
3. Apply a slight coat of oil onto the cartridge gasket.
4. To install the new cartridge, screw it in by hand. Over tightening may cause deformation of rubber gasket.
5. After the new cartridge has been replaced, the transmission fluid level will normally decrease slightly. Make sure that the transmission fluid does not leak through the seal. Check the fluid level.

■ IMPORTANT

- **To prevent serious damage to the hydraulic system. Use only a genuine KUBOTA filter or its equivalents.**

(1) Hydraulic Oil Filter (for HST) (2) Hydraulic Oil Filter

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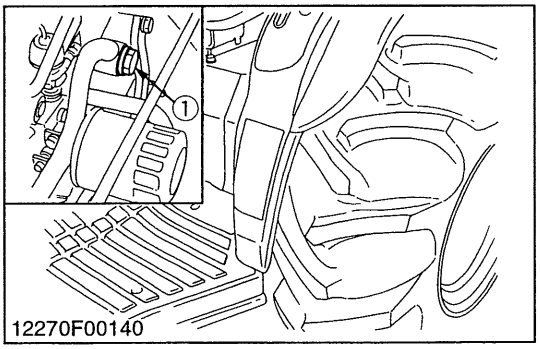
Cleaning Transmission Oil Strainer

1. Clean the strainer with nonflammable solvent.

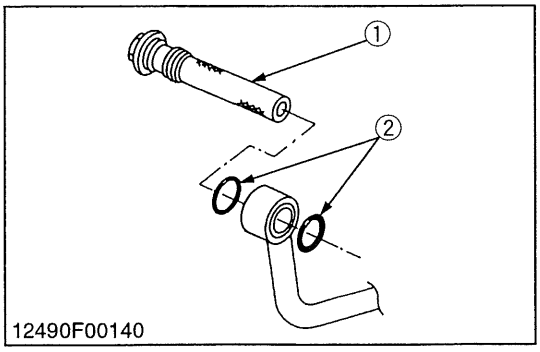
■ NOTE

- **When changing the transmission fluid, disassemble and rinse the strainer with nonflammable solvent to completely clean off fillings.**
  When reassembling, be careful not to damage the parts.
- **Since the fine fillings in the oil could impair the component parts of the hydraulic system precision built to withstand high pressure, the suction line end is provided with an oil strainer.**
- **Please do the replacing oil filter cartridge (3) and the cleaning oil strainer (1) at the same time. And when replacing, reinstall the oil strainer first.**

(1) Strainer (3) Hydraulic Oil Filter Cartridge
(2) O-ring



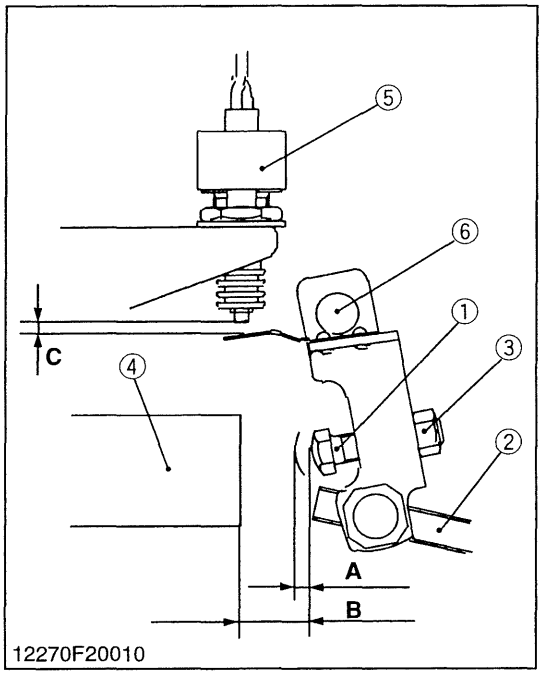
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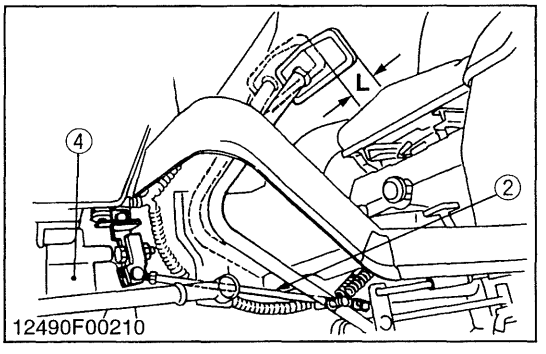
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Checking Clutch Pedal Free Travel

CAUTION

- **When checking, park the tractor on flat ground, apply the parking brake, stop the engine and remove the key.**

1. Slightly depress the clutch pedal and measure stroke **"A"** at top of stopper bolt (1).
2. If the measurement is not within the factory specifications, loosen the lock nut and adjust the clutch pedal rod (2) length.
3. After adjusting it, measure total stroke **"B"** between stopper bolt (1) and clutch housing (4).
4. If the measurement not within the factory specifications, adjust it with the clutch pedal stopper bolt (1).
5. And at same time, adjust the clearance **"C"** between safety switch (5) and clutch rod (6).

NOTE

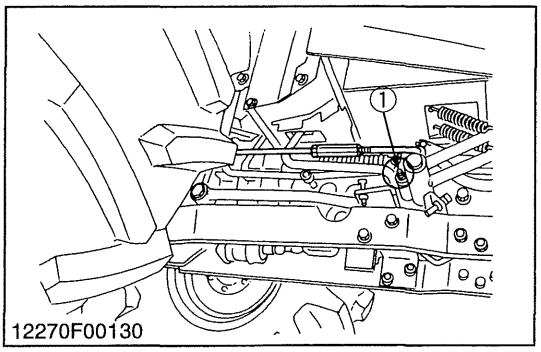
- **After adjustment, sure the stopper bolt with the lock nut (3).**

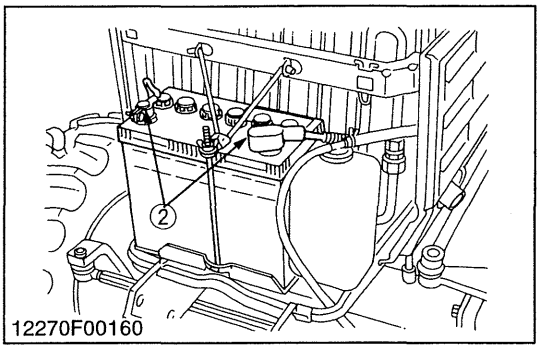
Clutch pedal free travel on stopper bolt stroke **"A"**	Factory spec.	1.0 to 1.5 mm 0.039 to 0.059 in.
Reference : Clutch pedal free travel **"L"** on top of clutch pedal		20 to 30 mm 0.78 to 1.18 in.
Clutch pedal total stroke **"B"**	Factory spec.	8.0 to 9.0 mm 0.31 to 0.35 in.
Clearance **"C"**	Factory spec.	1.5 to 2.5 mm 0.059 to 0.098 in.

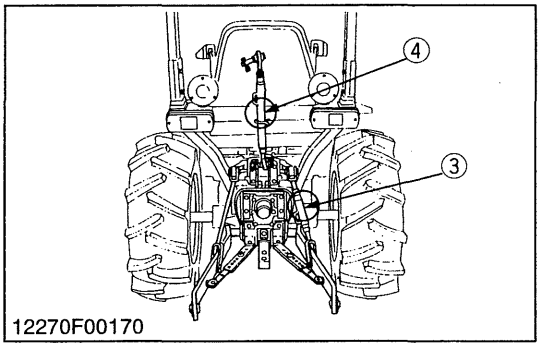
(1) Stopper Bolt
(2) Clutch Pedal Rod
(3) Lock Nut for Stopper Bolt
(4) Clutch Housing
(5) Safety Switch
(6) Clutch Rod

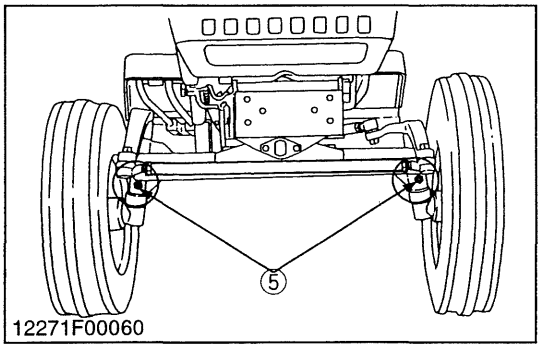
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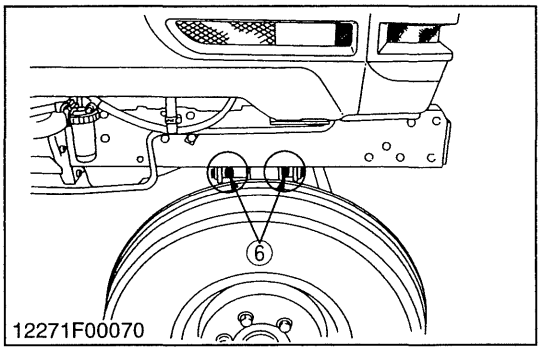
(3) Check Points of Every 50 Hours











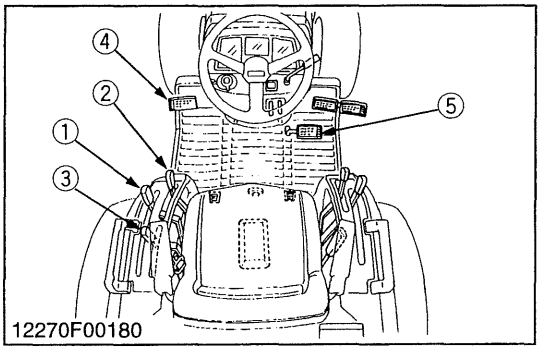
Greasing

1. Apply a grease to the following position as figures.

(1) Grease Fitting (HST Pedal)
(2) Battery Terminals
(3) Grease Fitting (Lifting Rod RH)
(4) Grease Fitting (Top Link)
(5) Knuckle Shaft Grease Fitting
(6) Front Axle Support Grease Fitting

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Checking Engine Start 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 before testing

1. Sit on operator's seat.
2. Set the parking brake and stop the engine.
3. Shift the range gear shift lever in **"NEUTRAL"** position.
4. Shift the rear PTO gear shift lever and mid-PTO gear shift lever to **"OFF"** position.
5. Fully depress the clutch pedal.

■ Test 1 : for safety switch on the clutch linkage

1. Release the clutch pedal.
2. Turn the key to **"START"** position.
3. The engine must not crank.

■ Test 2 : for safety switch on the range gear shift linkage

[Only B2710 Affected Serial No.: below 15496]

1. Fully depress the clutch pedal again.
2. Shift the range gear shift lever to "Desired" position.
3. Turn the key to **"START"** position.
4. The engine must not crank.

■ Test 3 : for safety switch on the speed control pedal linkage

1. Fully depress the clutch pedal again.
2. Depress the pedal to Foward to Reverse.
3. Turn the key to **"START"** position.
4. The engine must not chank.

■ Test 4 : for safety switch on the rear PTO gear shift linkage

1. Shift the range gear shift lever to **"NEUTRAL"** position.
2. Shift the rear PTO gear shift lever to **"ON"** position.
3. Turn the key to **"START"** position.
4. The engine must not crank.

■ Test 5 : for safety switch on the mid-PTO gear shift linkage

1. Shift the range gear shift lever to **"NEUTRAL"** position.
2. Shift the mid-PTO gear shift lever to **"ON"** position.
3. Turn the key to **"START"** position.
4. The engine must not crank.

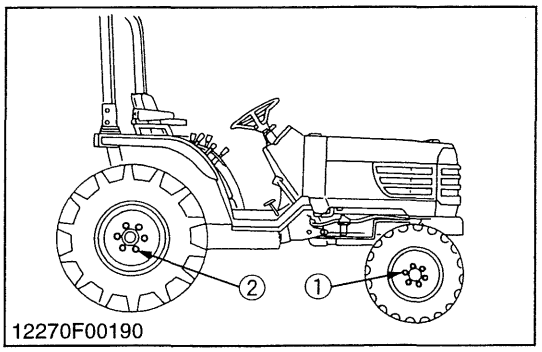
■ After testing :If crank any test of the above, adjust or replace the required safety switch.

When adjusting the safety switches keep the each linkage at condition indicated below.

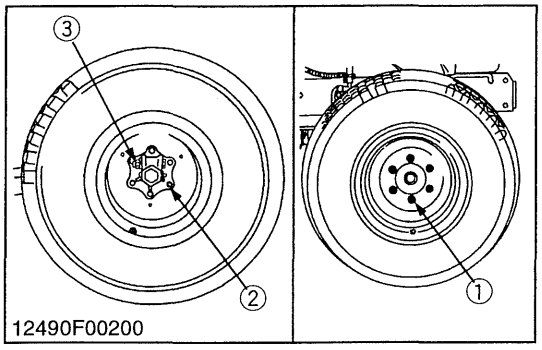
1. Clutch pedal linkage → Fully depress the clutch pedal.
2. Range gear shift linkage → Shift the range gear shift lever to **"NEUTRAL"** position.
3. Speed control pedal linkage → Release the speed control pedal to neutral position.
4. PTO gear shift linkage → Shift rear PTO and mid-PTO gear shift lever to **"OFF"** position.

(1) Range Gear Shift Lever
(2) Mid-PTO Gear Shift Lever
(3) Rear PTO Gear Shift Lever
(4) Clutch Pedal
(5) Speed Control Pedal

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Checking Wheel Mounting Screws and Nuts Tightening Torque

⚠ CAUTION

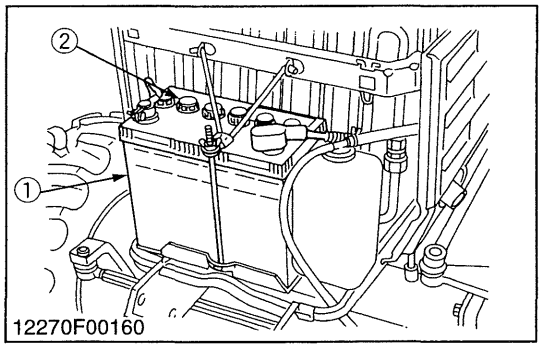
- **Never operate tractor with a loose rim, wheel, or axle.**
- **Any time bolts and nuts are loosened, retighten to specified torque.**
- **Check all bolts and nuts frequently and keep them tight.**

1. Check wheel bolts and nuts regularly especially when new. If there are loosened, tighten as follows.

Tightening torque	Rear wheel hub mounting nut	B2410	108 to 125 N·m 11.0 to 12.8 kgf·m 80 to 93 ft-lbs
	Cotter setting bolt and nut		123 to 147 N·m 12.6 to 15.0 kgf·m 91 to 108 ft-lbs
	Front wheel mounting nuts	B2410 B2710 B2910	77 to 90 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Rear wheel mounting screws and nuts	B2710 B2910	108 to 125 N·m 11.0 to 12.8 kgf·m 80 to 93 ft-lbs

(1) Front Wheel Mounting Nuts
(2) Rear Wheel Mounting Screws and Nuts
(3) Cotter Setting Bolt and Nut

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Checking Battery Condition

⚠ CAUTION

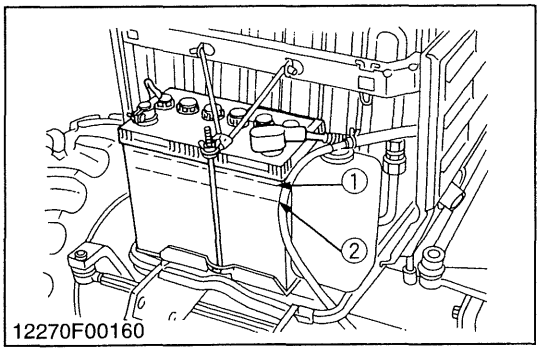
- **Never remove the vent plugs while the engine is running.**
- **Keep electrolyte away from eyes, hands and clothes. If you are spattered with it, wash it away completely with water immediately and get medical attention.**
- **Wear eye protection and rubber gloves when working around battery.**

1. Mishandling the battery shortens the service life and adds to maintenance costs.
2. The original battery is maintenance free type battery, but need some servicing.
   If the battery is weak, the engine is difficult to start and the lights become dim. It is important check the battery periodically.

(1) Battery
(2) Vent Plug

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Table 1

Battery Type	Volts (V)	Capacity at 5H.R (A.H.)	Reserve Capacity (min.)	Cold Cranking Amps	Normal Charging Rate (A)
55B24L (S)-MF	12	36	79	433	4.5

■ 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.

(1) Highest Level (2) Lowest Level

12270G00150

(4) Check Points of Every 100 Hours

Changing Engine Oil

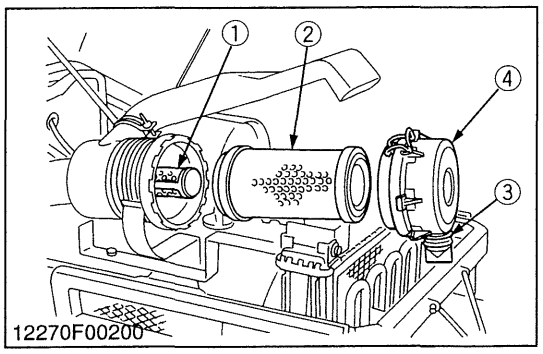
1. See page G-12.

12270G00360

Checking Clutch Pedal Free Travel

1. See page G-15.

12490G00430



Cleaning Air Cleaner Element

1. Remove the air cleaner cover (4) and primary element (2).
2. Clean the primary element if:
- 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/cm^2, 99 psi).
- 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.
3. When replacing the air cleaner primary element (2), replace the secondary element (1) as well :
   Once a year or after every six times of cleaning, whichever comes first.

■ IMPORTANT

- **The air cleaner uses a dry element, never apply oil.**
- **Do not run the engine with filter element removed.**
- **Be sure to refit the dust cup with the arrow ↑ (on the rear of cup) upright. If the dust cup is improperly fitted, evacuator valve will not function and dust will adhere to the element.**
- **Do not touch the secondary element except in cases where replacing is required.**

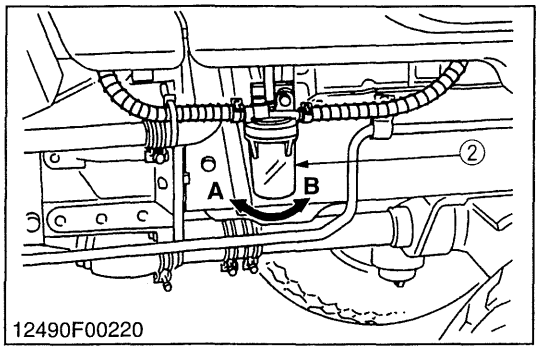
■ Evacuator Valve

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.

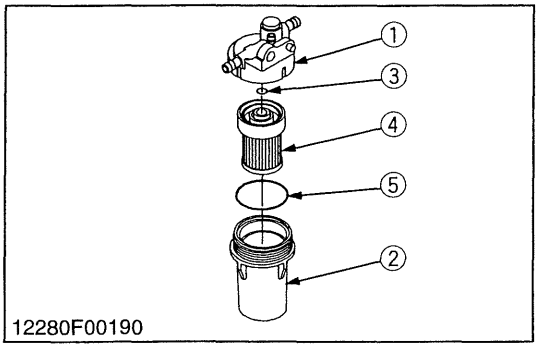
(1) Secondary (Safety) Element
(2) Primary Element
(3) Evacuator Valve
(4) Cover

12270G00170

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12280F00190

Cleaning Fuel Filter

This job should not be done in the field, but in a clean place.

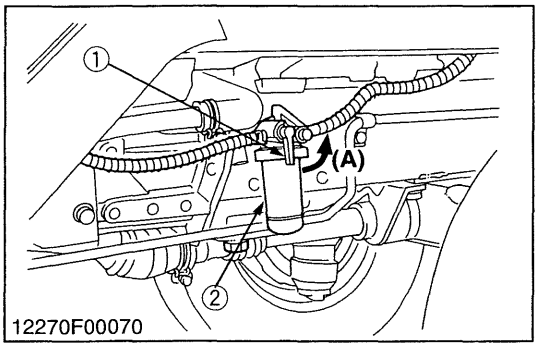
1. Loosen and remove the fuel filter bowl (2), and rinse the inside with kerosene.
2. Take out the filter element (4) and dip it in the kerosene to rinse.
3. After cleaning, reassemble the fuel filter, keeping out dust and dirt.
4. Bleed the fuel system. (See page G-28.)

■ NOTE

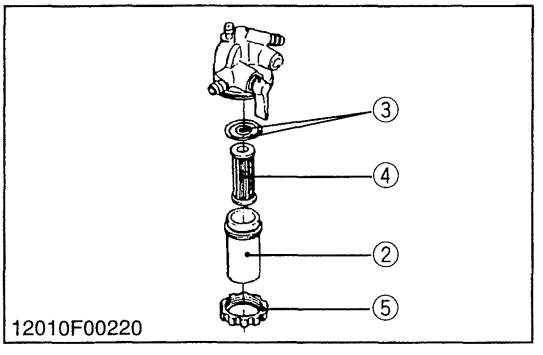
- **When the fuel filter bowl has been removed, fuel stops flowing from the fuel tank. If the fuel tank is almost full, however, the fuel will flow back from the fuel return pipe to the fuel filter. Before the above checking, make sure the fuel tank is less than half-full.**

(1) Filter Bracket
(2) Fuel Filter Bowl
(3) O-ring
(4) Filter Element
(5) O-ring
(A) Loosen
(B) Tighten

12271G00310



12270F00070



12010F00220

Cleaning Fuel Filter

[Only B2710 Affected Serial No.: below 15496]
This job should not be done in the field, but in a clean place.

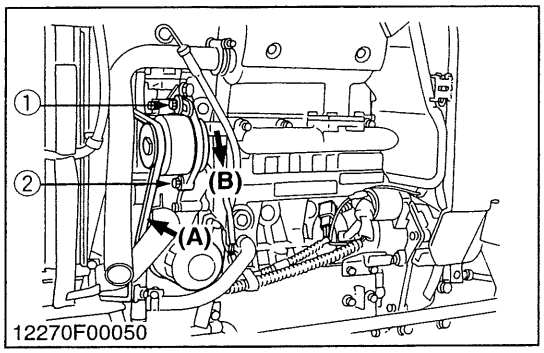
1. Close the fuel filter cock (1).
2. Unscrew the screw ring and remove the fuel filter bowl (2), and rinse the inside with kerosene.
3. Take out the filter element (4) and dip it in the kerosene to rinse.
4. After cleaning, reassemble the fuel filter, keeping out dust and dirt.
5. Bleed the fuel system. (See page G-28.)

■ IMPORTANT

- **If dust and dirt enters the fuel system the fuel pump and injection nozzles are subject to premature wear. To prevent this, be sure to clean the fuel filter bowl periodically.**

(1) Fuel Cock
(2) Fuel Filter Bowl
(3) O-ring
(4) Filter Element
(5) Screw Ring
(A) Close

12271G00110



12270F00050

Checking Fan Belt Tension

CAUTION

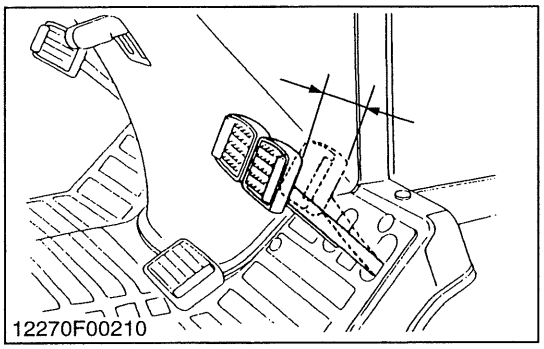
- **Be sure to stop engine before checking belt tension.**

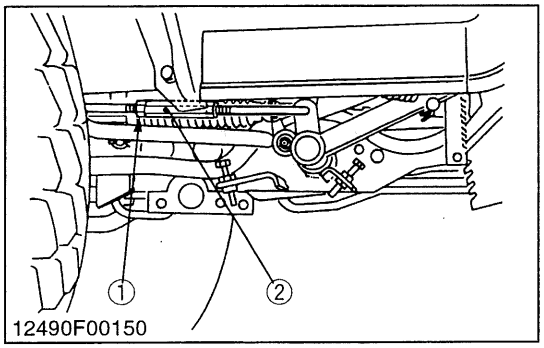
1. Stop the engine and remove the key.
2. Apply moderate thumb pressure to belt between pulleys.
3. If tension is incorrect, loosen the alternator mounting bolts and, using a lever placed between the alternator and the engine block, pull the alternator out until the deflection of the belt falls within acceptable limits.
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.

(1) Adjusting Screw
(2) Tension Bolt
(A) Check the belt tension
(B) To Tighten

12271G00120


12270F00210



12490F00150

Checking Brake Pedal Free Travel

CAUTION

- **Stop the engine and chock the wheels before checking brake pedal.**
- **The difference between the right and left pedal plays must be less than 4.0 mm (0.16 in.).**

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 and turn the turnbuckle to adjust the brake rod length.
4. Retighten the lock nut securely.
   Keep the free travel in the right and left brake pedals equal.

Brake pedal free travel	Factory spec.	30 to 40 mm 1.18 to 1.57 in.

(1) Lock Nut
(2) Turnbuckle

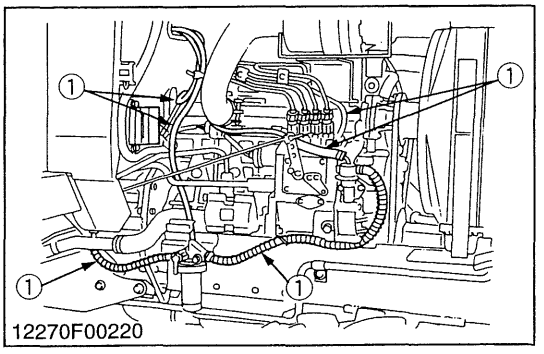
12490G00190

(5) Check Points of Every 200 Hours

Replacing Engine Oil Filter Cartridge

1. See page G-12.

12270G00370



Checking Fuel Line

CAUTION

- **Stop the engine when attempting the check and change prescribed below.**
- **Remember to check the fuel line periodically. The fuel line is subject to wear and aging, fuel may leak out onto the running engine, causing a fire.**

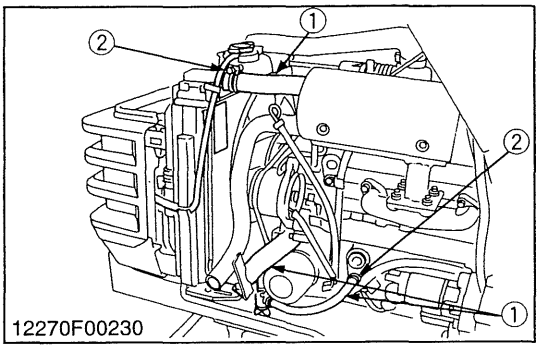
1. Check to see that all line and hose clamps are tight and not damaged.
2. If hoses and clamps are found worn or damaged, replace or repair them at once.
3. The fuel line is made of rubber and ages regardless of period of service. Replace the fuel pipe together with the clamp every two years and securely tighten.
4. However if the fuel pipe and clamp are found damaged or deteriorated earlier than two years, then change or remedy.
5. After the fuel line and clamp have been changed, bleed the fuel system.

IMPORTANT

- **When the fuel line is disconnected for change, close both ends of the fuel line with a piece of clean cloth or paper to prevent dust and dirt from entering. Entrance of dust and dirt causes malfunction of the fuel injection pump. In addition, particular care must be taken not to admit dust and dirt into the fuel pump.**

(1) Fuel Hoses

12270G00210



Checking Radiator Hose and Hose Clamp

Check to see if radiator hoses are properly fixed every 200 hours of operation or six months, whichever comes first.

1. If hose clamps are loose or water leaks, tighten bands securely.
2. Replace hoses and tighten hose clamps securely, if radiator hoses are swollen, hardened or cracked.
   Replace hoses and hose clamps every 2 years or earlier if checked and found that hoses are swollen, hardened or cracked.

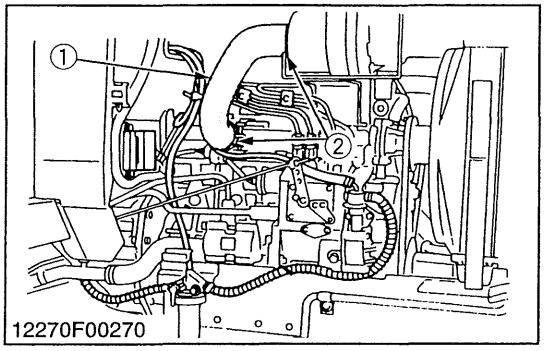
Precaution at Overheating

Take the following actions in the event the coolant temperature be nearly or more than the boiling point, what is called **"Overheating"**.

1. Stop the machine operation in a safe place and keep the engine unloaded idling.
2. Don't stop the engine suddenly, but stop it after about 5 minutes of unloaded idling.
3. Keep yourself well away from the machine for further 10 minutes or while the steam blown out.
4. Checking that there gets no danger such as burn, get rid of the causes of overheating according to the manual, see **"Troubleshooting"** section, and then, start again the engine.

(1) Radiator Hose (2) Clamp

12270G00220

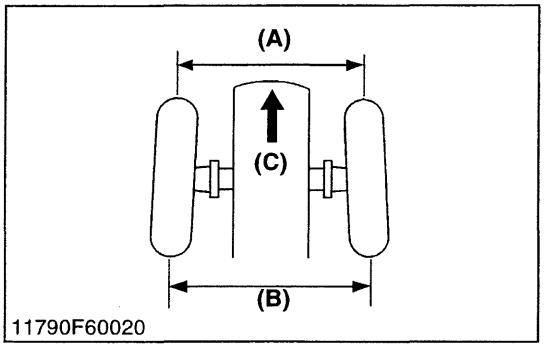


Checking Intake Air Line

1. Check to see that hoses 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) Hose (2) Hose Clamps

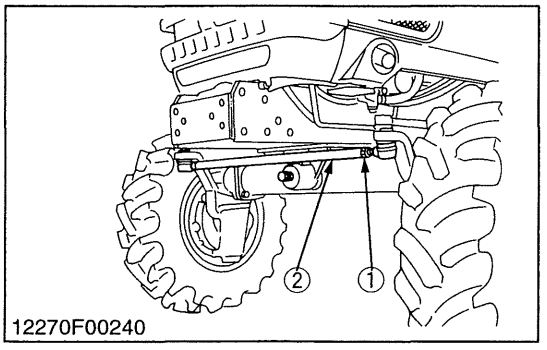
12270G00460



Adjusting Toe-in

1. Park the tractor on the flat place.
2. Inflate the tires to the specified pressure.
3. Turn steering wheel so front wheels are in the straight ahead position.
4. Lower the implement, lock the parking brake and stop the engine.
5. Measure distance between tire beads at front of tire, hub height.
6. Measure distance between tire beads at rear of tire, hub height.
7. Front distance should be 0 to 7 or 10 mm (0 to 0.28 or 0.39 in.) less than rear distance.
8. If the measurement is not within the factory specifications, adjust by changing the tie rod length.

Toe-in (B – A)	Factory spec.	B2410	0 to 10 mm 0 to 0.39 in.
		B2710 B2910	0 to 7 mm 0 to 0.28 in.



■ Adjusting

1. Loosen the lock nuts and turn the tie rod to adjust the rod length until the proper toe-in measurement is obtained.
2. Retighten the lock nuts.

(1) Lock Nut
(2) Tie Rod

(A) Wheel to Wheel Distance at front
(B) Wheel to Wheel Distance at rear
(C) Front

12271G00130

(6) Check Points of Every 300 Hours

Changing Transmission Fluid

1. See page G-13.

12270G00390

Cleaning Transmission Oil Strainer

1. See page G-14.

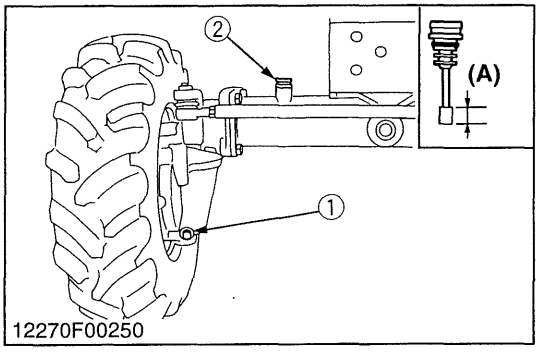
12270G00240

Replacing Hydraulic Oil Filter Cartridge

1. See page G-14.

12490G00230

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12270F00250

Changing Front Axle Case Oil

1. Place the oil pans underneath the front axle case.
2. Remove the both right and left hand side drain plugs (1) and filling plug (2) to drain the oil.
3. After draining, reinstall the drain plugs (1).
4. Fill with new oil up to the upper notch on the dipstick.

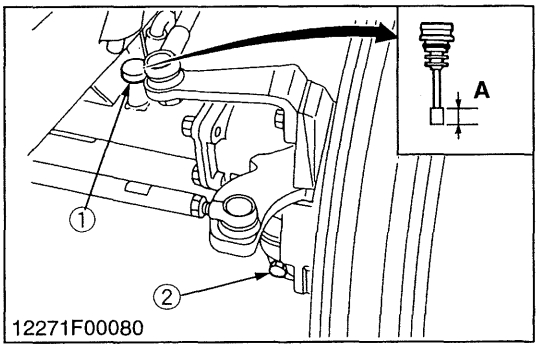
■ IMPORTANT

- **After ten minutes, check the oil level again, add oil to prescribed level.**
- **Use KUBOTA SUPER UDT fluid or SAE 80, 90 gear oil. Refer to "LUBRICNATS, FUEL AND COOLANT". (See page G-8.)**

Front axle case oil capacity	B2410	3.7 L 3.9 U.S.qts 3.3 Imp.qts
	B2710 B2910	4.5 L 4.8 U.S.qts 4.0 Imp.qts

(1) Filling Plug with Dipstick
(2) Drain Plug
(A) Oil level is acceptable within this range.

12271G00140



12271F00080

Draining Front Axle Case Oil (Bi-speed Turn Type)

1. Place oil pans underneath the front axle case.
2. Remove both right and left drain plugs (2) and filling plug (1) to drain the oil.
3. Remove the right and left breather plugs.
4. After draining, reinstall the drain plugs (2).
5. Fill with new oil up to the upper notch on the dipstick.
6. After filling, reinstall the filling plug and breather plugs.

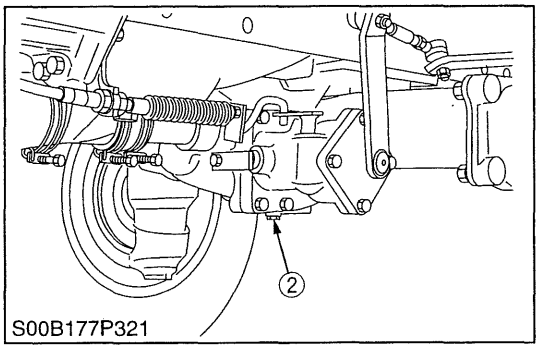
Front axle case oil capacity	4.5 L 4.8 U.S.qts. 4.0 Imp.qts.

■ IMPORTANT

- **After ten minutes, check the oil level again, add oil to prescribed level.**
- **Use KUBOTA SUPER UDT fluid or SAE80, 90 gear oil. Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-8)**

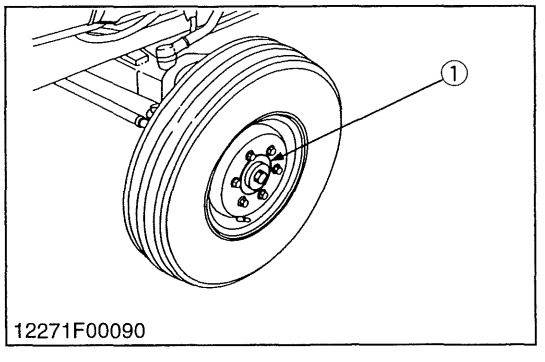
(1) Filling Plug with Dipstick
(2) Drain Plug
(A) Oil level is acceptable within this range.

12271G00150



S00B177P321

(7) Check Points of Every 400 Hours



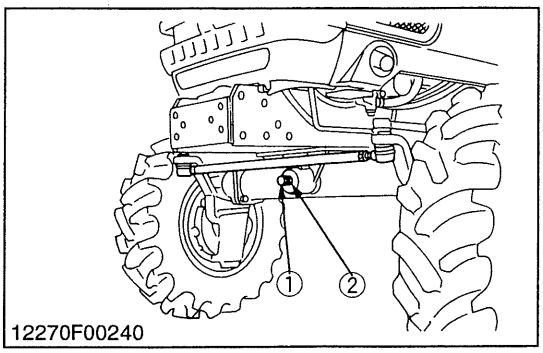
12271F00090

Lubricate Grease Fitting (2WD Model)

1. Detach the cover, and apply bearing grease.

(1) Front Wheel Hub Cover

12271G00160



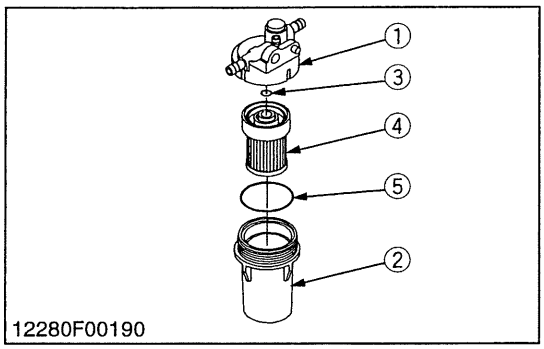
12270F00240

Adjusting Front Axle Pivot

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

12270G00260



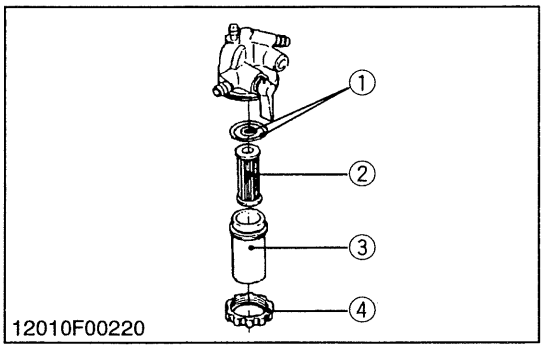
12280F00190

Replacing Fuel Filter Element

1. The fuel filter element should be replaced every 400 hours. See page G-19.

(1) Filter Bracket
(2) Fuel Filter Bowl
(3) O-ring
(4) Filter Element
(5) O-ring

12280G00250



12010F00220

Replacing Fuel Filter Element

[Only B2710 Affected Serial No.: below 15496]

1. The fuel filter element should be replaced every 400 hours. See page G-21.

(1) O-ring
(2) Element
(3) Filter Bowl
(4) Screw Ring

12271G00170

(8) Check Points of Every 800 Hours

Checking Valve Clearance

1. See page 1-S17.

12270G00420

(9) Check Points of Every 1500 Hours

Checking Fuel Injection Nozzle Injection Pressure

1. See page 1-S51.

12270G00440

(10) Check Points of Every 3000 Hours

Checking Injection Pump

1. See page 1-S50.

12270G00450

(11) Check Points of Every 1 Year

Replacing Air Cleaner Primary Element and Secondary Element

1. See page G-20.

12270G00430

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(12) Check Points of Every 2 Years

Replacing Radiator Hose (Water Pipes)

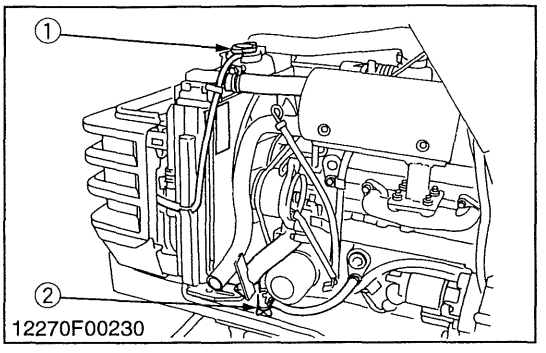
1. Replace the hoses and clamps.
   Refer to **"Checking Radiator Hose and Hose Clamp"**. (See page G-23.)

12271G00180

Replacing Fuel Hose

1. Replace the fuel hoses and clamps, if necessary.
   Refer to **"Checking Fuel Line"**. (See page G-23.)

12271G00190



12270F00230

Flush 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. To drain the coolant, open the radiator drain cock, and remove radiator cap. The radiator cap must be removed to completely drain the coolant.
3. After all coolant is drained, close the drain plug.
4. Fill with clean water and cooling system cleaner.
5. Follow directions of the cleaner instruction.
6. After flushing, fill with clean water and anti-freeze until the coolant level is just below the port.
7. Start and operate the engine for few minutes.
8. Stop the engine. Check coolant level and add coolant if necessary.
9. Install the radiator cap securely.

IMPORTANT

- **Do not start engine without coolant.**
- **Use clean, fresh water and anti-freeze to fill the radiator.**
- **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.**

Coolant capacity (with recovery tank)	B2410	3.8 L 4.0 U.S.qts 3.3 Imp.qts
	B2710 B2910	4.5 L 4.8 U.S.qts. 4.0 Imp.qts.

(1) Radiator Cap (2) Drain Plug

12271G00200

Flush Cooling System and Changing Coolant (Continued)

■ **Anti-Freeze**

If coolant freezes, it can damage the cylinders and radiator. It is necessary, if the ambient temperature falls below 0 °C (32 °F), to remove coolant 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 is 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.

■ **NOTE**

- **The above date represent industry standards that necessitate a minimum glycol content in the concentrated anti-freeze.**
- **When the coolant level drops due to evaporation, add water only. In case of leakage, add anti-freeze and water in the specified mixing ratio.**
- **Anti-freeze absorbs moisture. Keep unused anti-freeze in a tightly sealed container.**
- **Do not use radiator cleaning agents when anti-freeze has been added to the coolant. (Anti-freeze contains an anti-corrosive agent, which will react with the radiator cleaning agent forming sludge which will affect the engine parts.)**

12010G00400

(13) Others

Bleeding Fuel System

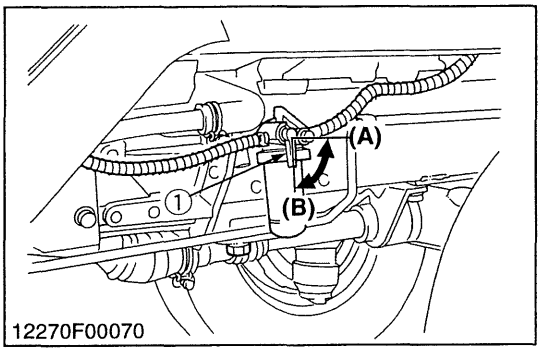
Air must removed:

1. When the fuel filter or lines are removed.
2. When tank is completely empty.
3. After the tractor has not been used for a long period of time.

Bleeding procedure is as follows:

1. Fill the fuel tank with fuel.
2. Start the engine and run for about 30 seconds, and then stop the engine.

12280G00290



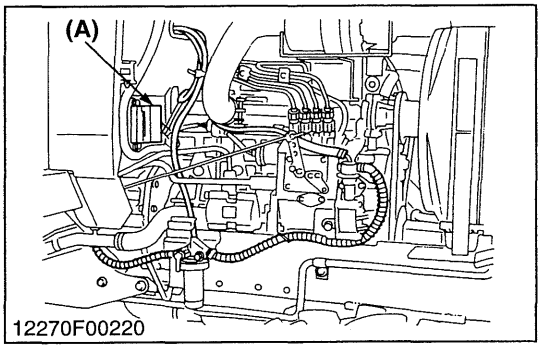
Bleeding Fuel System

[Only B2710 Affected Serial No.: below 15496]
Air must removed:
1. When the fuel filter or lines are removed.
2. When tank is completely empty.
3. After the tractor has not been used for a long period of time.

Bleeding procedure is as follows:
1. Fill the fuel tank with fuel, and open the fuel cock (1).
2. Start the engine and run for about 30 seconds, and then stop the engine.

(1) Fuel Cock
(A) Close
(B) Open

12271G00210



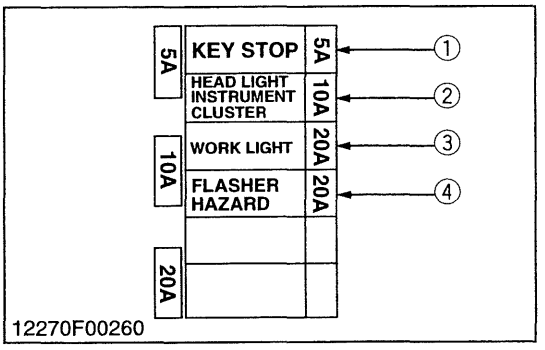
Replacing Fuse

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.

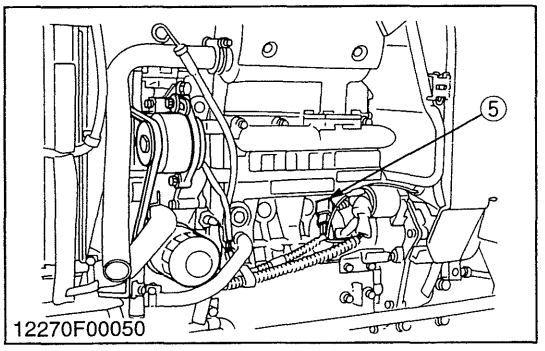
■ IMPORTANT

- **Before replacing a blown fuse, determine why the fuse blew and make any necessary repairs. Failure to follow this procedure may result in serious damage to the tractor electrical system. Refer to troubleshooting section of this manual or your local KUBOTA dealer for specific information dealing with electrical problems.**
  If any of them should blow, replace with a new one of the same capacity.

■ Protected Circuit



Fuse No.	Capacity (A)	Protected circuit
①	5	Key stop
②	10	Head lights, Instrument cluster
③	20	Work light
④	20	Hazard lights
⑤	Slow blow fuse	Check circuit against wrong battery connection



(A) Fuse Box

12270G00290

Replacing Light Bulb

1. Head lights.
   Take the bulb out of the light body and replace with a new one.
2. Other lights
   Detach the lens and replace the bulb.

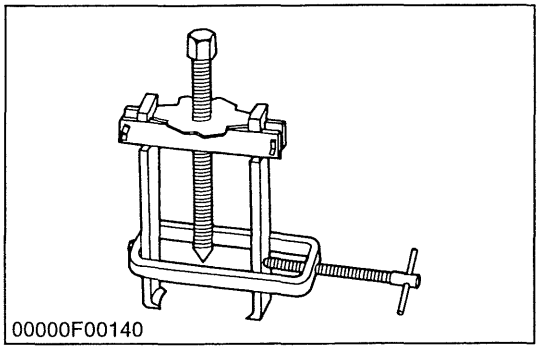
Light	Capacity
Head lights	23 W
Tail light	8 W
Turn signal / Hazard light	27 W
Illumination	1.7 W
Hazard light indicator	0.6 W

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[9] SPECIAL TOOLS

(1) Special Tools for Engine

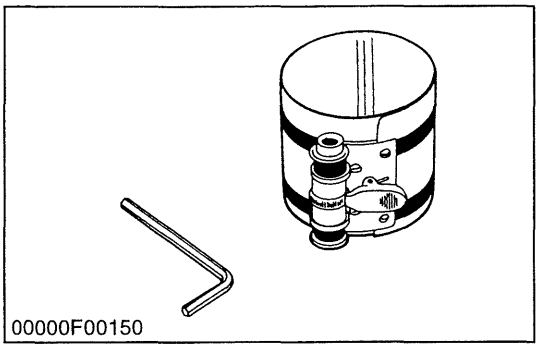

00000F00140

Special Use Puller Set

Code No : 07916-09032

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

00000G00010

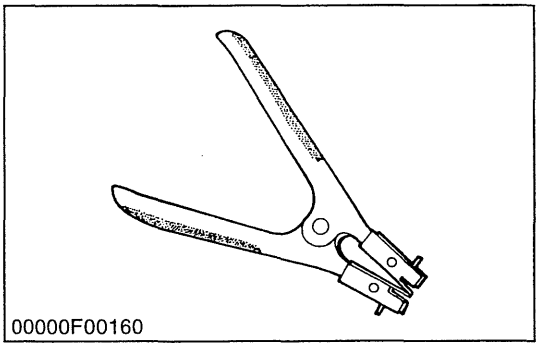

00000F00150

Piston Ring Compressor

Code No : 07909-32111

Application: Use exclusively for pushing in the piston with piston rings into the cylinder.

00000G00020

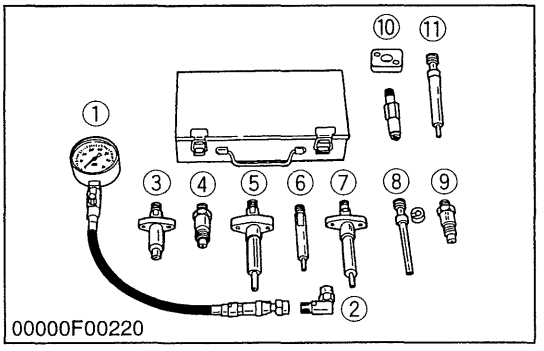

00000F00160

Piston Ring Tool

Code No : 07909-32121

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

00000G00030



00000F00220

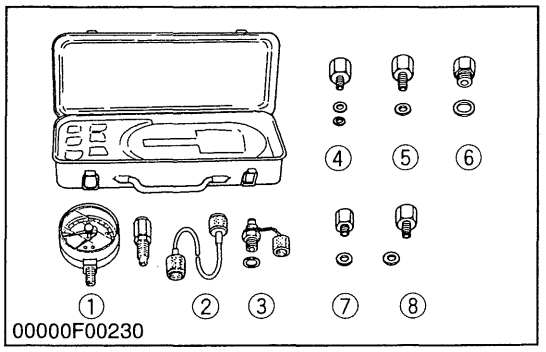
Diesel Engine Compression Tester

Code No : 07909-30208 (Assembly) 07909-31251 (G)
07909-30934 (A to F) 07909-31271 (I)
07909-31211 (E and F) 07909-31281 (J)
07909-31231 (H)

Application : Use to measure diesel engine compression and diagnostics of need for major overhaul.

(1) Gauge
(2) **L** Joint
(3) Adaptor **A**
(4) Adaptor **B**
(5) Adaptor **C**
(6) Adaptor **E**
(7) Adaptor **F**
(8) Adaptor **G**
(9) Adaptor **H**
(10) Adaptor **I**
(11) Adaptor **J**

00000G00070



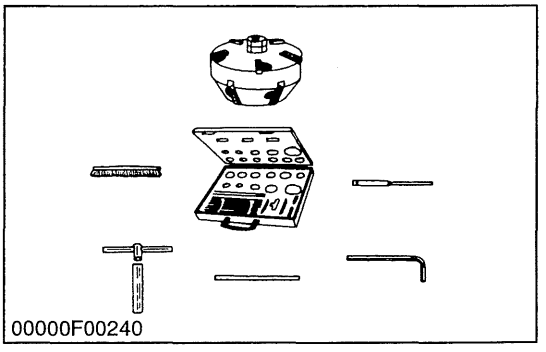
00000F00230

Oil Pressure Tester

Code No : 07916-32032
Application : Use to measure lubricating oil pressure.

(1) Gauge
(2) Cable
(3) Threaded Joint
(4) Adaptor **1**
(5) Adaptor **2**
(6) Adaptor **3**
(7) Adaptor **4**
(8) Adaptor **5**

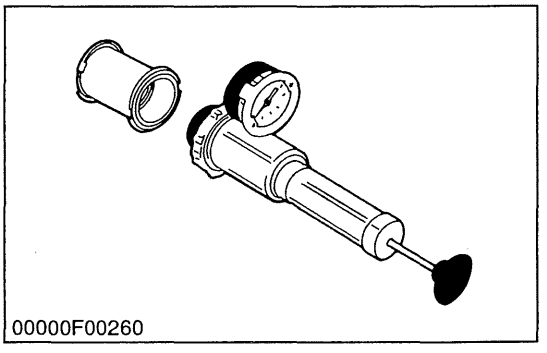
00000G00080


00000F00240

Valve Seat Cutter

Code No : 07909-33102
Application : Use to reseat valves.
Angle : 0.785 rad. (45°)
0.262 rad. (15°)
Diameter : 28.6 mm (1.126 in.)
31.6 mm (1.244 in.)
35.0 mm (1.378 in.)
38.0 mm (1.496 in.)
41.3 mm (1.626 in.)
50.8 mm (2.000 in.)

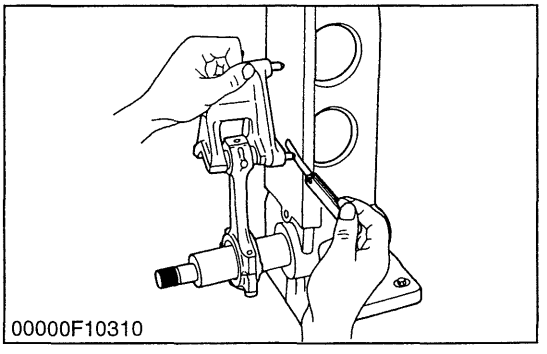
00000G00090


00000F00260

Radiator Tester

Code No : 07909-31551
Application : Use to check of radiator cap pressure, and leaks from cooling system.

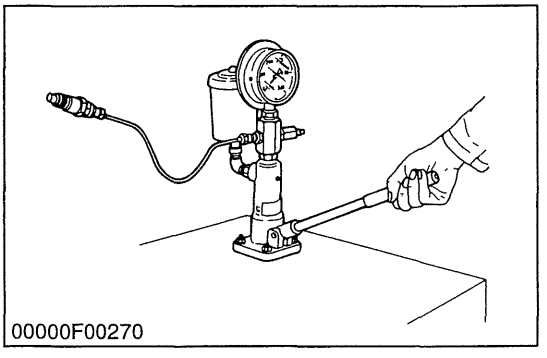
00000G00130


00000F10310

Connecting Rod Alignment Tool

Code No : 07909-31661
Application : Use to check the connecting rod alignment.
Applicable : Connecting rod big end I.D.
range 30 to 75 mm (1.18 to 2.95 in.) dia.
Connecting rod length
65 to 300 mm (2.56 to 11.81 in.)

00000G00110

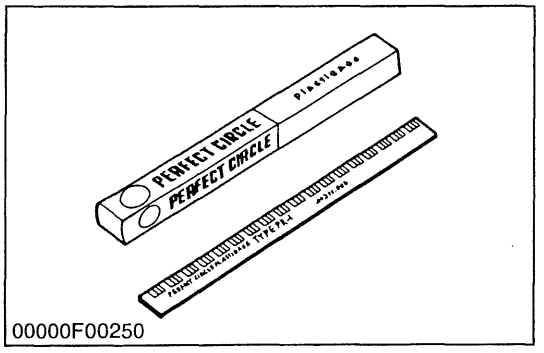

00000F00270

Nozzle Tester

Code No : 07909-31361
Application : Use to check the fuel injection pressure and spray pattern of nozzle.
Measuring : 0 to 50 MPa
range (0 to 500 kgf/cm^2, 0 to 7000 psi)

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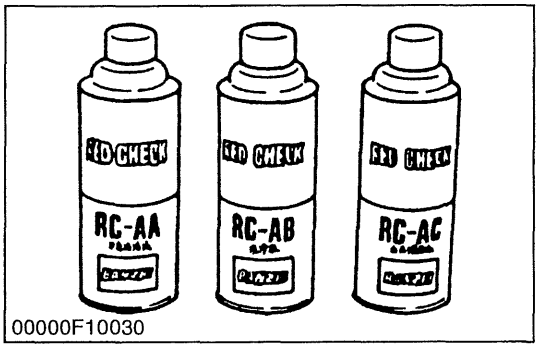


00000F00250

Plastigage

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.)

00000G00100

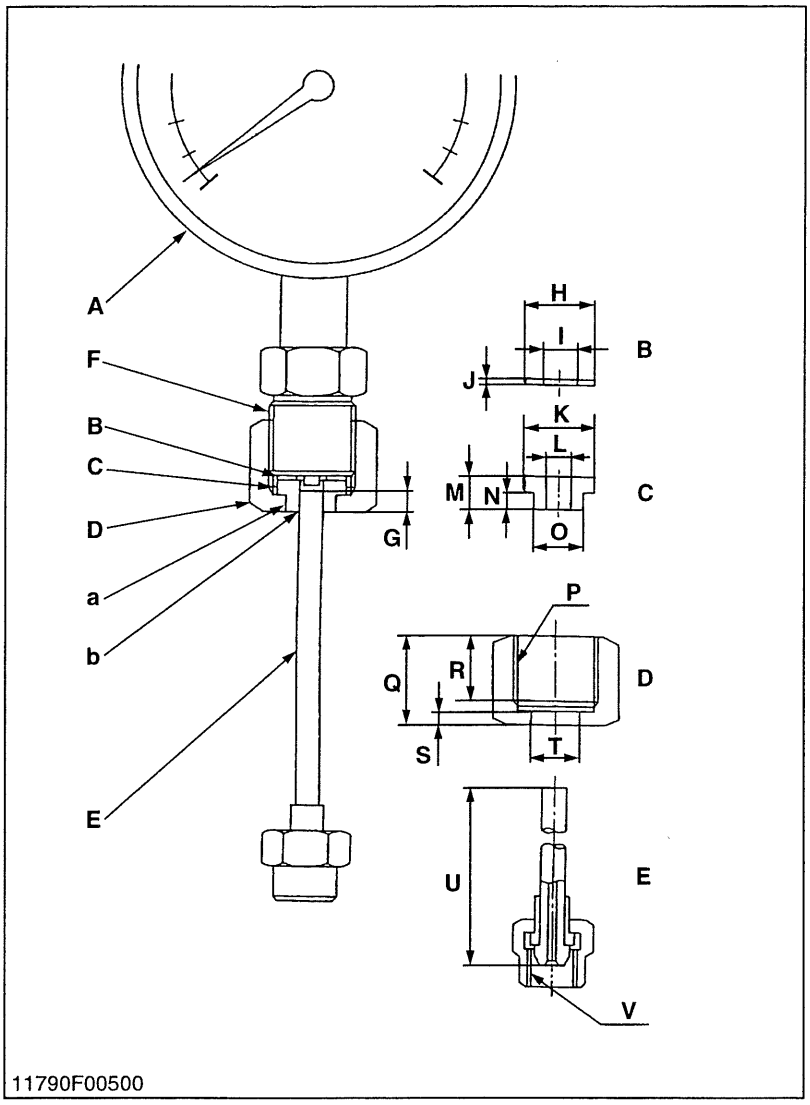


00000F10030

Red Check

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

00000G00120



11790F00500

Injection Pump Pressure Tester

Application: Use to check fuel tightness of injection pumps.

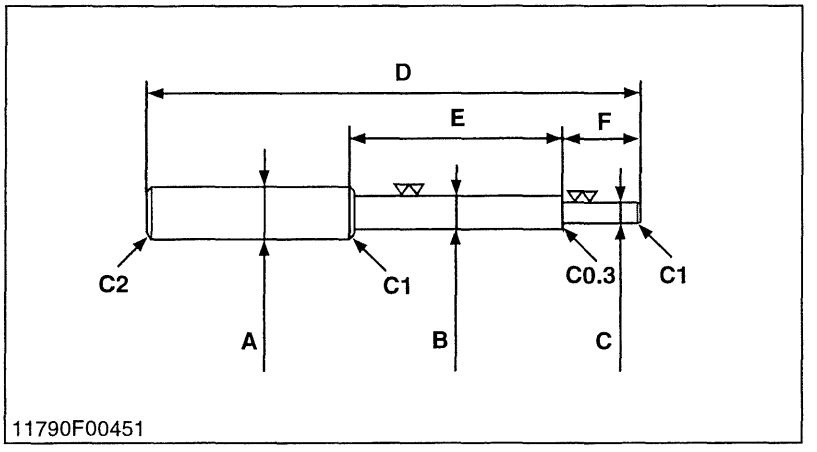
■ **NOTE**

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

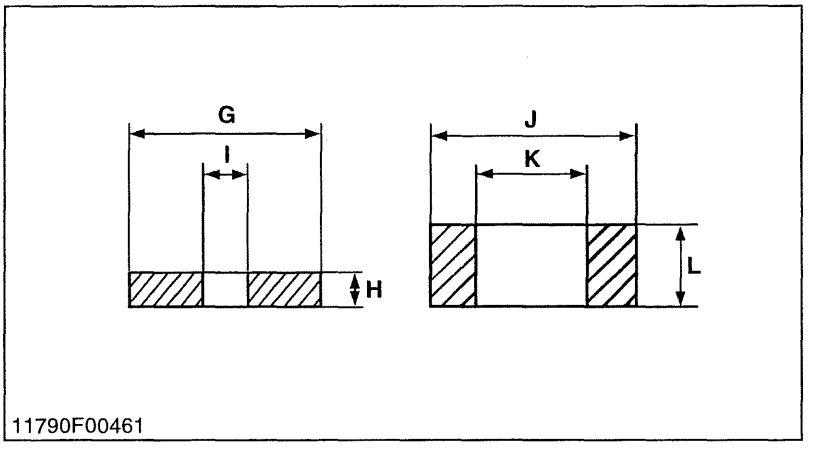
A	Pressure gauge full scale more than 29.4 MPa (300 kgf/cm^2, 4267 psi)
B	Gasket (Copper)
C	Flange (Steel)
D	Hex. nut with across the flat 27 mm (1.06 in.)
E	Injection pipe
F	PF 1/2
G	5 mm (0.20 in.)
H	17 mm DIA. (0.67 in. DIA.)
I	8 mm DIA. (0.31 in. DIA.)
J	1.0 mm (0.039 in.)
K	17 mm DIA. (0.67 in. DIA.)
L	6.10 to 6.20 mm DIA. 0.2402 to 0.2441 in. DIA.
M	8 mm (0.31 in.)
N	4 mm (0.16 in.)
O	11.97 to 11.99 mm DIA. 0.4713 to 0.4721 in. DIA.
P	PF 1/2
Q	23 mm (0.91 in.)
R	17 mm (0.67 in.)
S	4 mm (0.16 in.)
T	12.00 to 12.02 mm DIA. 0.4724 to 0.4732 in. DIA.
U	100 mm (3.94 in.)
V	M12 × P1.5
a	Adhesive application
b	Fillet welding on the enter circumference

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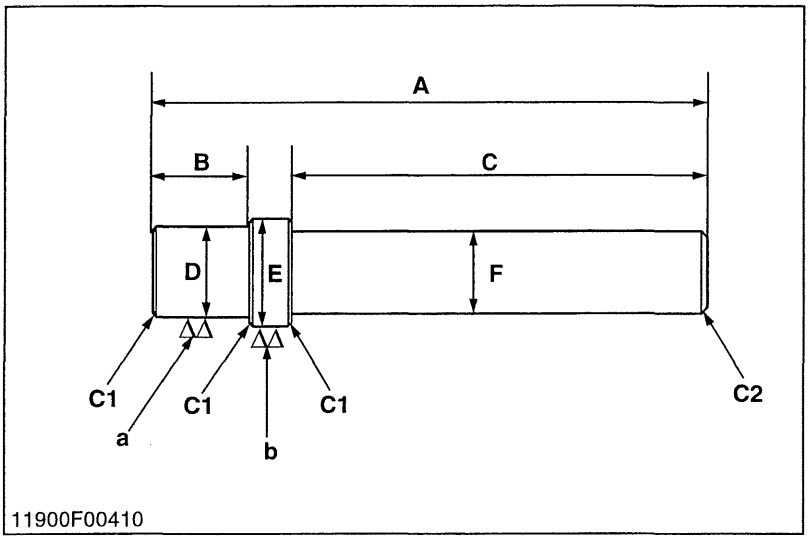
11790F00461

Valve Guide Replacing Tool

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

A	20 mm dia. (0.79 in. dia.)
B	11.7 to 11.9 mm dia. 0.460 to 0.468 in. dia.
C	6.5 to 6.6 mm dia. 0.256 to 0.259 in. dia.
D	225 mm (8.86 in.)
E	70 mm (2.76 in.)
F	45 mm (1.77 in.)
G	25 mm (0.98 in.)
H	5 mm (0.197 in.)
I	6.7 to 7.0 mm dia. (0.263 to 0.275 in. dia.)
J	20 mm dia. (0.787 in. dia.)
K	12.5 to 12.8 mm dia. (0.492 to 0.504 in. dia.)
L	8.9 to 9.1 mm (0.350 to 0.358 in.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)
C0.3	Chamfer 0.3 mm (0.012 in.)

11790G00622



11900F00410

Bushing Replacing Tool

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

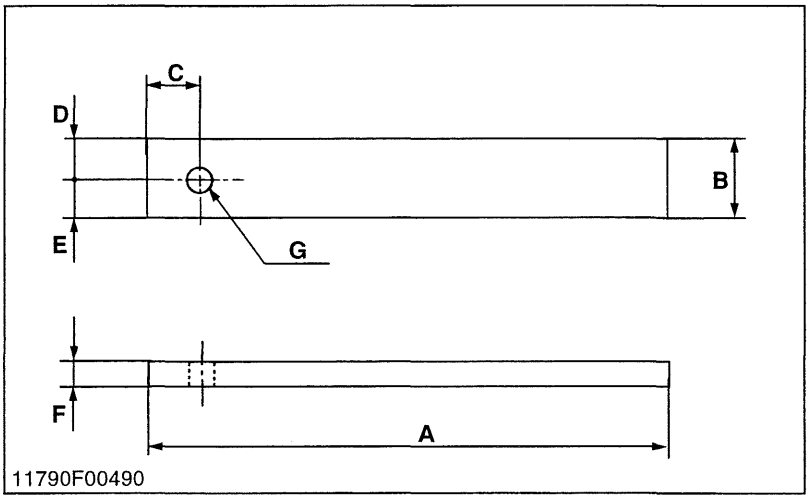
1. For small end bushing

A	157 mm (6.1811 in.)
B	24 mm (0.9449 in.)
C	120 mm (4.7244 in.)
D	21.8 to 21.9 mm (0.8583 to 0.8622 in.)
E	24.8 to 24.9 mm (0.9764 to 0.9803 in.) DIA.
F	20 mm (0.7874 in.)
a	6.3 µm (250 µin.)
b	6.3 µm (250 µin.)

2. For idle gear bushing

A	196 mm (7.7165 in.)
B	26 mm (1.0236 in.)
C	150 mm (5.9055 in.)
D	25.8 to 25.9 mm (1.0157 to 1.0197 in.)
E	28.8 to 28.9 mm (1.0157 to 1.0197 in.) DIA.
F	20 mm (0.7874 in.)
a	6.3 µm (250 µin.)
b	6.3 µm (250 µin.)

11900G00441



11790F00490

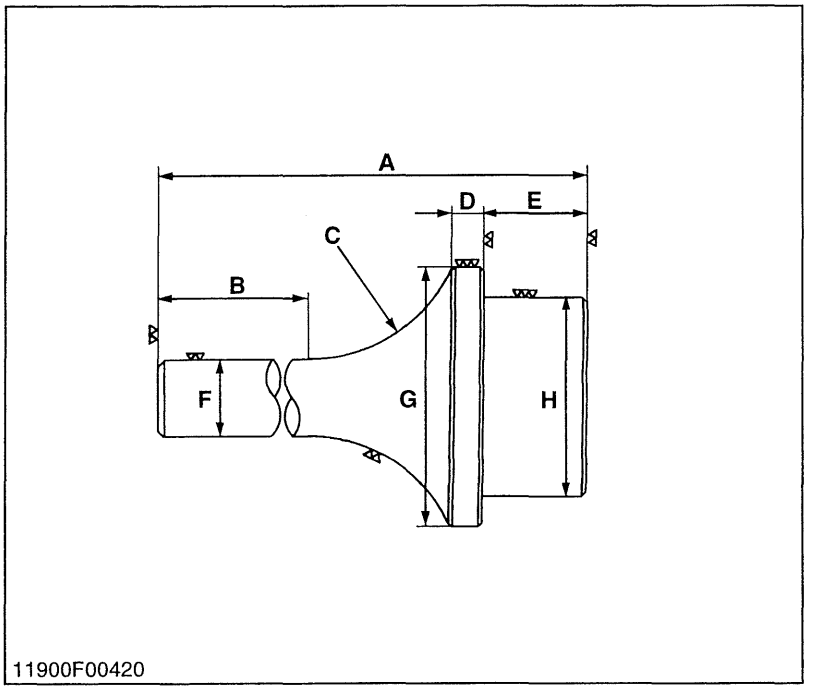
Flywheel Stopper

Application: Use to loosen and tighten the flywheel screw.

A	200 mm (7.87 in.)
B	30 mm (1.18 in.)
C	20 mm (0.79 in.)
D	15 mm (0.59 in.)
E	15 mm (0.59 in.)
F	8 mm (0.31 in.)
G	10 mm DIA. (0.39 in. DIA.)

11790G00801

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11900F00420

Crankshaft Bearing 1 Replacing Tool

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

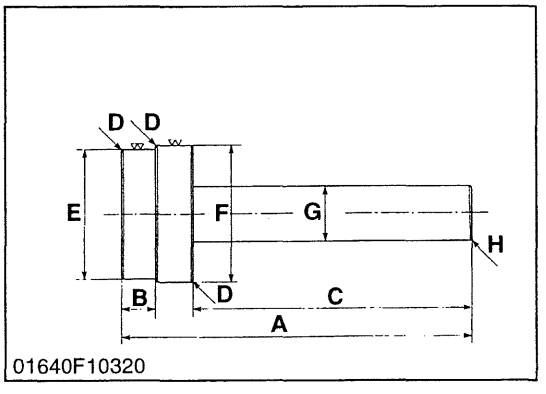
[Press Out]

A	135 mm (5.31 in.)
B	72 mm (2.83 in.)
C	1.57 rad. (40°)
D	10 mm (0.39 in.)
E	20 mm (0.79 in.)
F	20 mm (0.79 in.)
G	56.80 to 56.90 mm dia. 2.2362 to 2.2402 in. dia.
H	51.80 to 51.90 mm dia. 2.0393 to 2.0433 in. dia.

[Press Fit]

A	130 mm (5.12 in.)
B	72 mm (2.83 in.)
C	1.57 rad. (40°)
D	9 mm (0.35 in.)
E	24 mm (0.95 in.)
F	20 mm dia. (0.79 in. dia.)
G	68 mm dia. (2.68 in. dia.)
H	47.38 to 47.48 mm dia. 1.865 to 1.869 in. dia.

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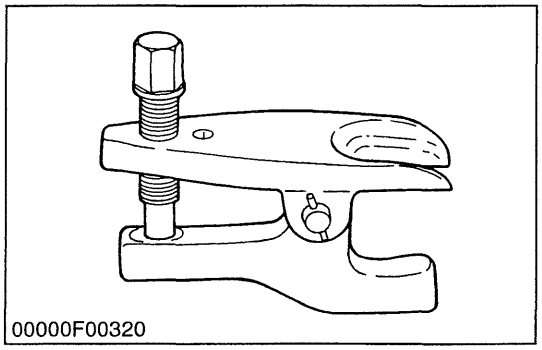
Governor Gear Holder Bushing Replacing Tool

Application: Use to press out and to press fit the governor gear holder bushing.

A	188 mm (7.4 in.)
B	18 mm (0.7 in.)
C	150 mm (5.9 in.)
D	C1 : Chamfer 1.0 mm (0.039 in.)
E	73.9 to 74.0 mm dia. (29.09 to 29.13 in. dia.)
F	69.8 to 69.9 mm dia. (2.748 to 2.751 in. dia.)
G	30 mm dia. (1.181 in. dia.)
H	C2 : Chamfer 2.0 mm (0.079 in.)

01640S10260

(2) Special Tools for Tractor

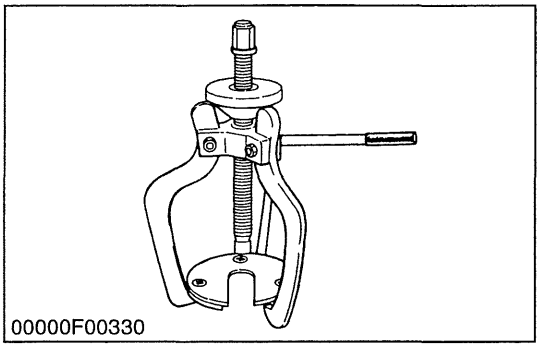

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Tie-rod End Lifter

Code No : 07909-39051

Application : Use for removing the tie-rod end with ease.

00000G00190

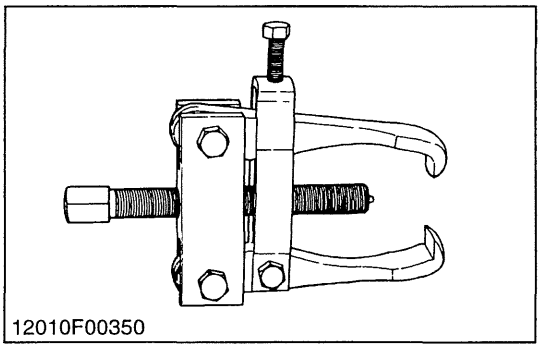

00000F00330

Steering Wheel Puller

Code No : 07916-51090

Application : Use for removing the steering wheel without damaging the steering shaft.

00000G00200

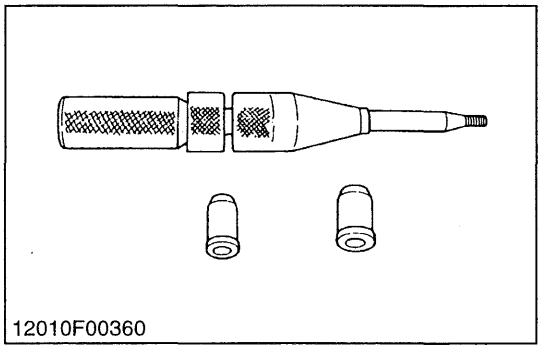

12010F00350

Pitman Arm Puller

Code No : 07909-39011

Application : Use for pulling out pitman arm from tractor.

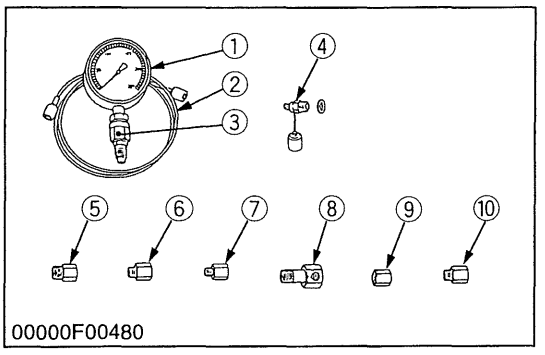
12010G00440


12010F00360

Clutch Center Tool (For B and L Series Tractors)

Application : The clutch center tool can be used for all **B** and **L** series tractors with a diaphragm clutch by changing tip guides. Center piece diameter is 14 mm (0.55 in.)

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00000F00480

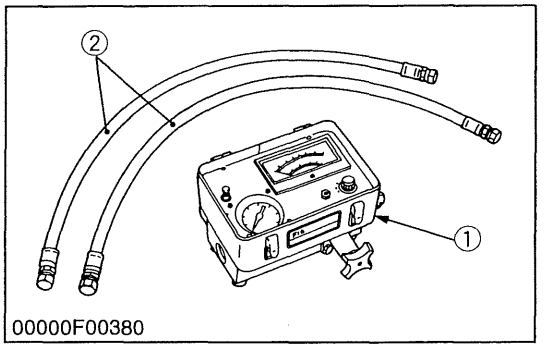
Relief Valve Pressure Tester

Code No : 07916-50045

Application : This allows easy measurement of relief set pressure.

(1) Gauge (07916-50322)
(2) Cable (07916-50331)
(3) Threaded Joint (07916-50401)
(4) Threaded Joint (07916-50341)
(5) Adaptor **B** (M18 × P1.5) (07916-50361)
(6) Adaptor **C** (PS3/8) (07916-50371)
(7) Adaptor **D** (PT1/8) (07916-50381)
(8) Adaptor **E** (PS3/8) (07916-50392)
(9) Adaptor **F** (PF1/2) (07916-62601)
(10) Adaptor **58** (PT1/4) (07916-52391)

00000G00351



00000F00380

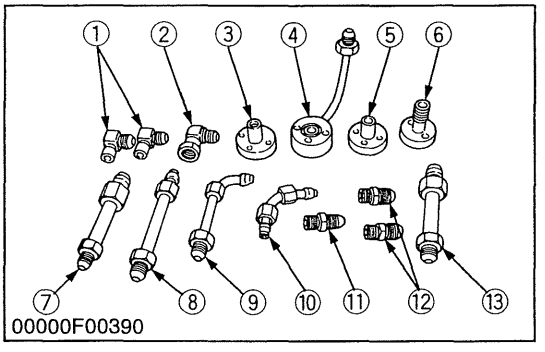
Flow Meter

Code No : 07916-52791 (Flow Meter)
07916-52651 (Hydraulic Test Hose)

Application : This allows easy testing of hydraulic system.

(1) Flow Meter
(2) Hydraulic Test Hose

00000G00250



00000F00390

Adaptor Set for Flow Meter

Code No : 07916-54031

Application : Use for testing the hydraulic system.

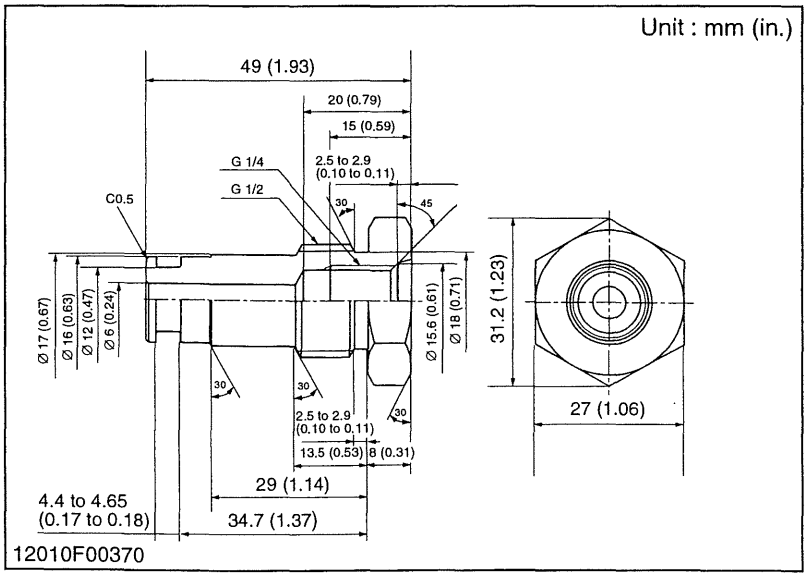
(1) Adaptor **52**
(2) Adaptor **53**
(3) Adaptor **54**
(4) Adaptor **61**
(5) Adaptor **62**
(6) Adaptor **63**
(7) Adaptor **64**
(8) Adaptor **65**
(9) Adaptor **66**
(10) Adaptor **67**
(11) Adaptor **68**
(12) Adaptor **69**
(13) Hydraulic Adaptor **1**

00000G00260

■ NOTE

- **The following special tools are not provided, so make them referring to the figure.**

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12010F00370

HST Adaptor (A)

Application : Use for checking the charge relief valve setting pressure and high pressure relief valve setting pressure.

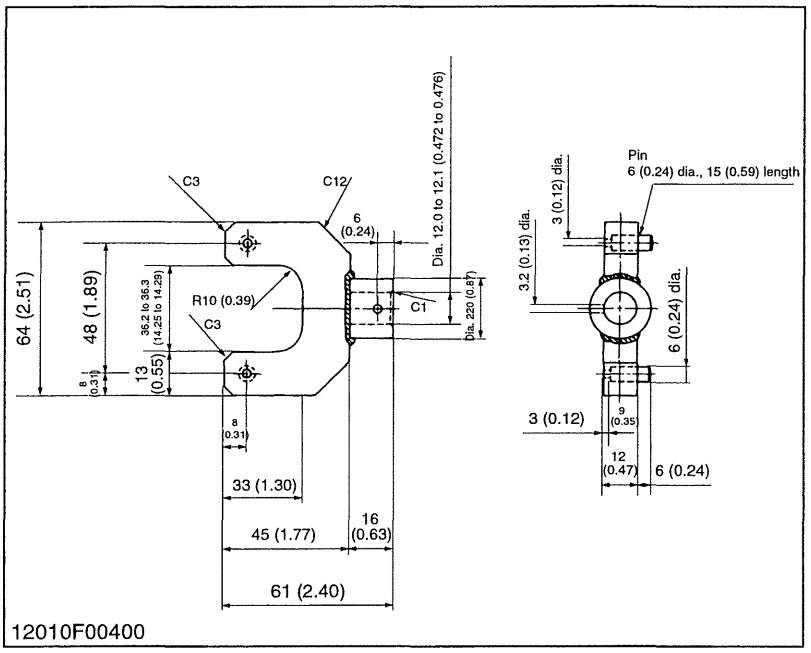
■ NOTE

- **When using, attach with following parts.**
  O-ring : 04811-06170
  Backup ring : 66363-39631

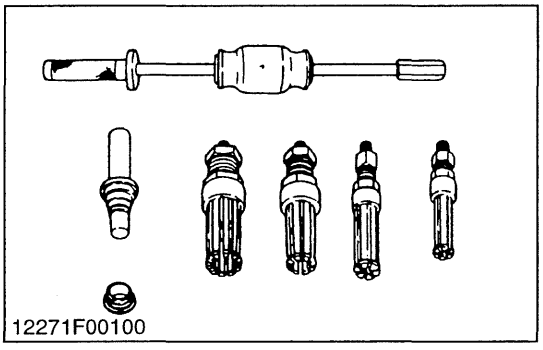
12010G00460

PS Plug Wrench

Application: Use for tighten the plug for ball nut assembling.



12270G00310



Knuckle Spindle Bushing Replacement Tool

Code No.: 07916-51030

Application: This allows easy press fitting and removal of knuckle spindle bushing for front axle without use of press.

12271G00220

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[10] TIRES

(1) Tire Pressure

CAUTION

- **Do not attempt mount a tire. This should be done by a qualified person with the proper equipment.**
- **Always maintain the correct tire pressure.**
  Do not inflate tires above the recommended pressure shown in the operator's manual.

IMPORTANT

- **Do not use tires larger than specified.**
- **When you intend to mount different size of tires from equipped ones, consult your dealer about front drive gear ratio for detail.**
  Excessive wear of tires may occur due to improper gear ratio.

(B2410)

Type		Tire sizes	Inflation pressure
Farm (2WD)	Front	6.50 – 10 4PR	200 kPa 2.0 kgf/cm^2 28 psi
	Rear	11.2 – 16 4PR	130 kPa 1.3 kgf/cm^2 18 psi
Farm (4WD)	Front	7 – 12 4PR	170 kPa 1.7 kgf/cm^2 24 psi
	Rear	11.2 – 16 4PR	130 kPa 1.3 kgf/cm^2 18 psi
Turf	Front	23 × 8.50 – 12 4PR	160 kPa 1.6 kgf/cm^2 23 psi
	Rear	33 – 12.5 – 15 4PR	140 kPa 1.4 kgf/cm^2 20 psi
Bar	Front	21 × 8.00 – 10 4PR	160 kPa 1.6 kgf/cm^2 23 psi
	Rear	31 × 15.5 – 15 4PR	140 kPa 1.4 kgf/cm^2 20 psi

(B2710, B2910)

Type		Tire sizes	Inflation pressure
Farm	Front	7 – 12 4PR	170 kPa 1.7 kgf/cm^2 24 psi
	Rear	12.4 – 16 4PR	110 kPa 1.1 kgf/cm^2 16 psi
Turf	Front	23 × 8.50 – 12 4PR	150 kPa 1.5 kgf/cm^2 22 psi
	Rear	13.6 – 16 4PR	96.5 kPa 1.0 kgf/cm^2 14 psi
Industry	Front	23 × 8.50 – 14 Ind. 4PR	241 kPa 2.5 kgf/cm^2 35 psi
	Rear	12.4 – 16 Ind. 4PR	138 kPa 1.4 kgf/cm^2 20 psi

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.

12271G00230

(2) Tread

CAUTION

- **Support tractor securely on stands before removing a wheel.**
- **Never operate tractor with a loose rim, wheel or axle.**

IMPORTANT

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

12490G00340

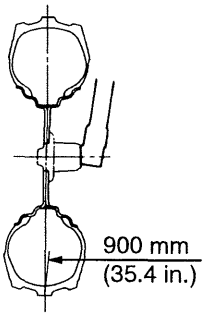
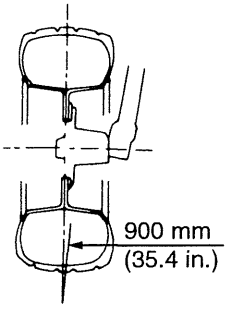
(2)-1 Front Wheels

Front wheel tread cannot be adjusted.

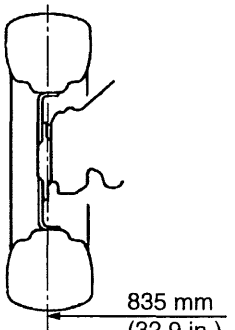
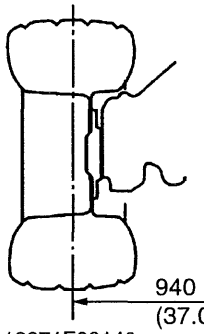
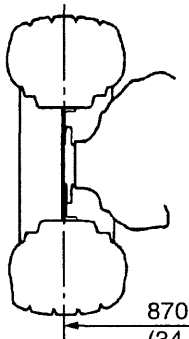
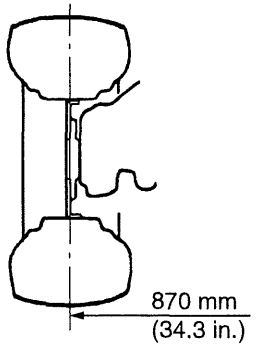
■ IMPORTANT

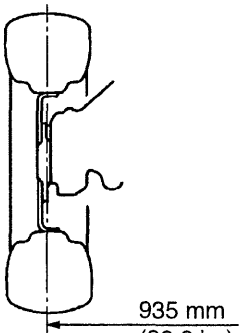
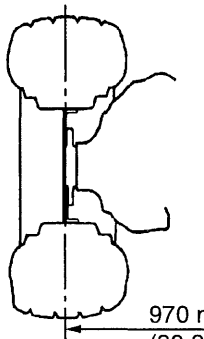
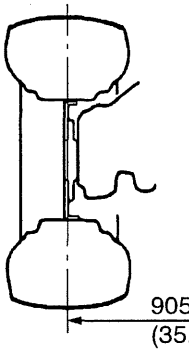
- **Do not turn front discs to obtain wider tread. In setting up the front wheels, make sure that the inflation valve stem of the tires face outward.**

[2WD Model]

Models	B2410	B2410
Tires	6.50 – 10 Farm	23 × 8.50 – 12 Turf
Tread	 12271F00110	 12271F00120

[4WD Model]

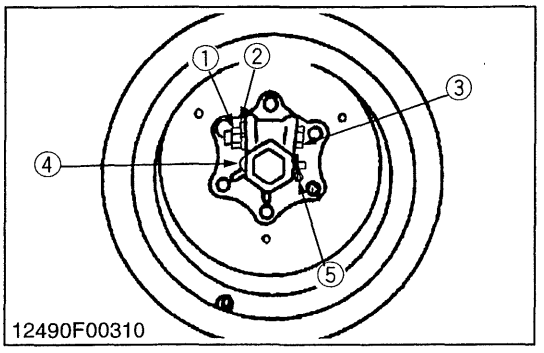
Models	B2410	B2410	B2410	B2410
Tires	7 – 12 Farm	21 × 8.00 - 10 Turf	23 × 8.50 – 12 Turf	23 × 8.50 - 12 Ind.
Tread	 12271F00130	 12271F00140	 12271F00150	 12271F00160

Models	B2710 / B2910	B2710 / B2910	B2710 / B2910
Tires	7 – 12 Farm	23 × 8.50 - 12 Turf	23 × 8.50 - 14 Ind.
Tread	 12271F00130	 12271F00150	 12271F00160

12271G00240

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(2)-2 Rear Wheels



12490F00310

(1) Nut
(2) Spring Washer
(3) Bolt
(4) Wheel Hub Pin
(5) Snap Pin

⚠ CAUTION

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

Rear tread can be adjusted in 2 or 3 steps depending on the model.
To change the tread.

1. Loosen the nut (1) of cotter pin bolt.
2. Remove the snap pin (5) and wheel hub pin (4).
3. Change the tread to desired position.
4. Re-set the wheel hub pin, snap pin and cotter pin bolt.

■ IMPORTANT

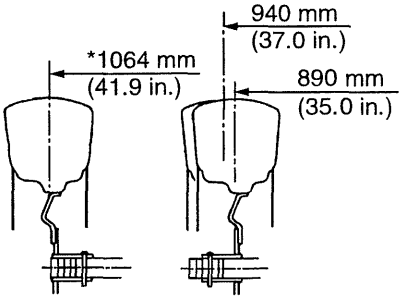
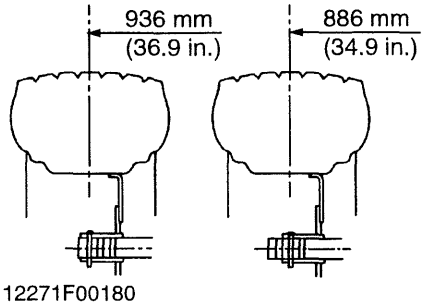
- **When re-fitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m (200 yards) and there after daily check service.**

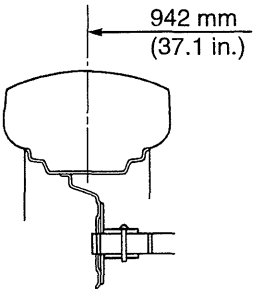
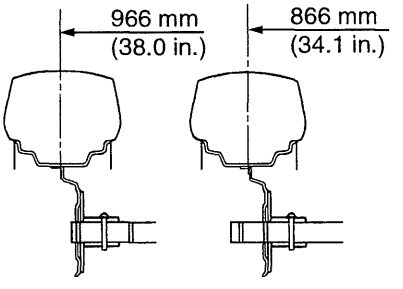
* Remove the wheel hub and reinstall it on the other side of the wheel disk, then set the wheel as shown.

(When adjusting tread)

Tightening torque	Cotter setting bolt and nut	123 to 147 N·m 12.6 to 15.0 kgf·m 91 to 108 ft-lbs
	Wheel hub mounting nut	108 to 125 N·m 11.0 to 12.8 kgf·m 80 to 93 ft-lbs

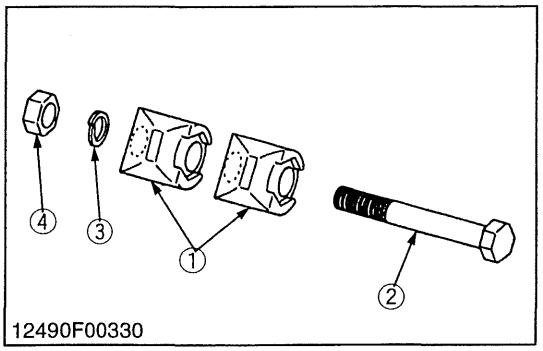
12271G00250

Models	B2410	B2410
Tires	11.2 – 16 Farm	33 × 12.5 – 15 Turf
Tread	 12271F00170	 12271F00180

Models	B2410	B2410
Tires	31 × 15.5 – 15 Bar	12 – 16.5 Ind.
Tread	 12271F00190	 12271F00200

12271G00260

(2)-2 Rear Wheels (Continued)



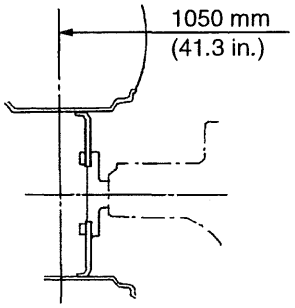
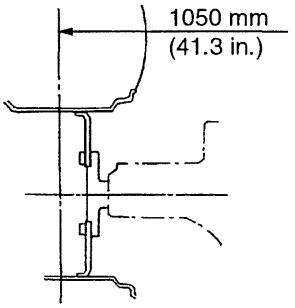
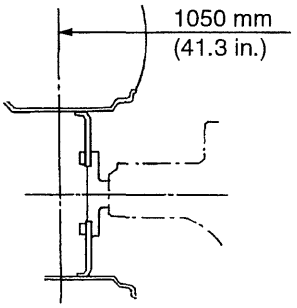
12490F00330

■ **NOTE**

- **Insert the bolt (2) from the indented side of both cotters and tighten the nut (4) with flat side of cotter as shown in figure.**

(1) Cotter
(2) Bolt
(3) Spring Lock Washer
(4) Nut

12490G00380

Models	B2710 / B2910	B2710 / B2910	B2710 / B2910
Tires	12.4 – 16 Farm	12.4 × 16 Ind.	13.6 – 16 Turf
Tread	 12271F00210	 12271F00210	 12271F00210

12271G00300

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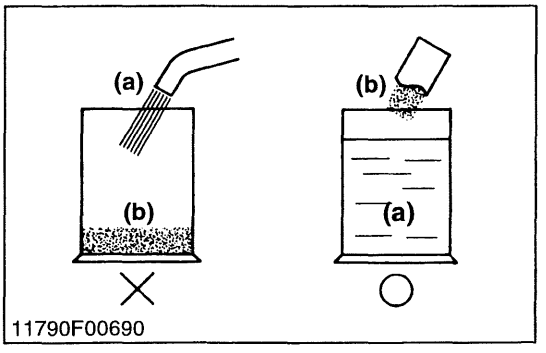
(3) Tire Liquid Injection

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.**



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Preparation of Calcium Chloride Solution

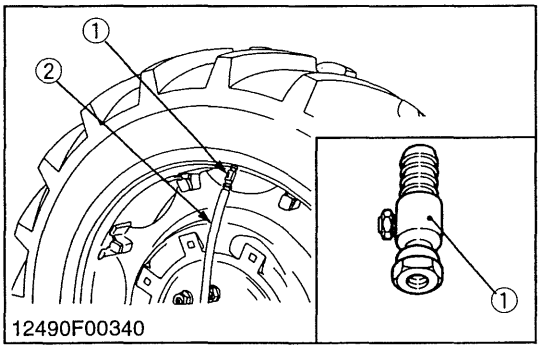
⚠ CAUTION

- **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.**

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)
– 33 °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)

(a) Water **(b) $CaCl_2$ (Calcium Chloride)**

11790G00690



12490F00340

Attaching Injector

1. Lift the rear tires off the ground.
2. Turn the tire so that the air valve is at the top.
3. Remove the air valve, and attach the injector. (Code No. 07916-52511)

(1) Injector (2) Hose

12490G00390

Fig. 1

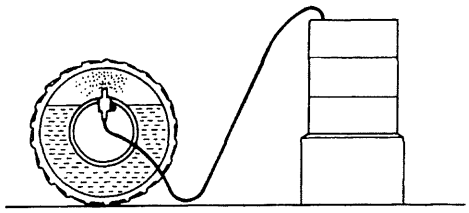


Fig. 2

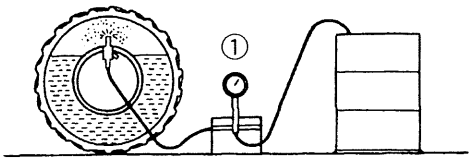
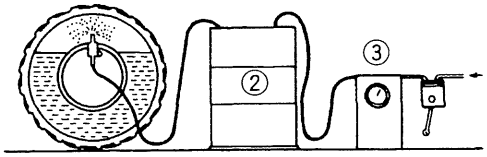
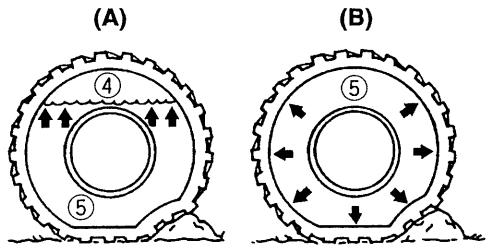


Fig. 3



11790F00720



11790F00730

Injection

CAUTION

- **When a calcium chloride solution is used, cool it before pouring it into the tire.**
- **Do not fill tires with water or solution more than 75 % of full capacity (to the valve stem level).**

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.**

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

Tire sizes	11.2-16	12.4-16
Slush free at – 10 °C (14 °F) Solid at – 30 °C (– 22 °F) [Approx. 1 kg (2 lbs.) $CaCl_2$ per 4 L (1 gal.) of water]	70 kg (155 lbs)	85 kg (187 lbs)
Slush free at – 24 °C (– 11 °F) Solid at – 47 °C (– 53 °F) [Approx. 1.5 kg (3.5 lbs.) $CaCl_2$ per 4 L (1 gal.) of water]	74 kg (163 lbs)	89 kg (196 lbs)
Slush free at – 47 °C (– 53 °F) Solid at – 52 °C (– 62 °F) [Approx. 2.25 kg (5 lbs.) $CaCl_2$ per 4 L (1 gal.) of water]	78 kg (172 lbs)	94 kg (207 lbs)

(1) Pump
(2) Pressure Tank
(3) Compressor
(4) Air
(5) Water

(A) Correct – 75 %
Air Compresses Like A Cushion
(B) Incorrect – 100 % Full
Water Can Not Be Compressed

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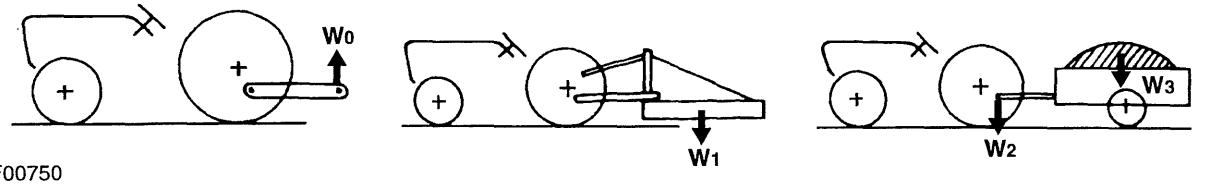
[11] IMPLEMENT LIMITATIONS

The KUBOTA Tractor has been thoroughly tested for proper performance with implements sold or approved by KUBOTA. Use with implements which exceed the maximum specifications listed below, or which are 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		Lower link end max. loading weight W_0
	Front	Rear	
B2410	2WD : 900 mm (35.4 in.) 4WD : 835 mm (32.9 in.)	1064 mm (39.6 in.)	300 kg (660 lbs)
B2710	935 mm (36.8 in.)	1050 mm (41.3 in.)	360 kg (800 lbs)
B2910			

	Actual figures		
	Implement weight W1 and / or size	Max. Drawbar Load W2	Trailer loading weight W3 Max. capacity
B2410	As in the following list (Shown on the next page)	300 kg (660 lbs)	1000 kg (2200 lbs)
B2710		500 kg (1100 lbs)	1500 kg (3300 lbs)
B2910			

Lower link end max. hydraulic lifting capacity W0
Implement weight ..... The implement's weight which can be put on the lower link : W1
Max. drawbar load W2
Trailer loading weight ..... The max. loading weight for trailer (without trailer's weight) : W3



11790F00750

NOTE :

- **Implement size may vary depending on soil operating conditions.**

12271G00280

Implement		Remarks	B2410	B2710, B2910
Mower	Mid-Mount	Max. cutting width	1524 mm (60 in.)	1830 mm (72 in.)
		Max. weight	140 kg (300 lbs)	205 kg (451 lbs)
	Rotary-Cutter (1 Blade)	Max. cutting width	1220 mm (48 in.)	1220 mm (48 in.)
		Max. weight	180 kg (400 lbs)	227 kg (500 lbs)
	Rear-Mount (2 or 3 Blade)	Max. cutting width	1830 mm (72 in.)	
		Max. weight	227 kg (500 lbs)	
	Flail Mower	Max. cutting width	1220 mm (48 in.)	
	Sickle Bar	Max. cutting width	1524 mm (60 in.)	
Rotary Tiller		Max. tilling width	1270 mm (50 in.)	1270 mm (50 in.)
		Max. weight	210 kg (465 lbs)	250 kg (550 lbs)
Bottom Plow		Max. size	360 mm (14 in.)	305 mm (12 in.)
Disc Plow		Max. size	560 mm (22 in.)	559 mm (22 in.)
Cultivator		Max. size	1370 mm (54 in.) 1 Row	1524 mm (60 in.) 1 Row
Disc Harrow		Max. harrowing width	1524 mm (60 in.)	1676 mm (66 in.)
		Max. weight	190 kg (420 lbs)	250 kg (550 lbs)
Sprayer		Max. tank capacity	190 L (50 U.S.gals.)	246 L (65 U.S.gals.)
Front Blade		Max. cutting width	1524 mm (60 in.)	1676 mm (66 in.)
		Sub frame	Necessary	Necessary
Rear Blade		Max. cutting width	1524 mm (60 in.)	1676 mm (66 in.)
		Max. weight	180 kg (400 lbs)	250 kg (550 lbs)
Front Loader		Max. lifting capacity	350 kg (770 lbs)	400 kg (880 lbs)
		Max. width	1270 mm (50 in.)	1524 mm (60 in.)
		Sub frame	Necessary	Necessary
Box Blade		Max. cutting width	1320 mm (52 in.)	
		Max. weight	227 kg (500 lbs)	
Back Hoe		Max. digging depth	1830 mm (72 in.)	1830 mm (72 in.)
		Max. weight	320 kg (700 lbs)	363 kg (600 lbs)
		Sub frame	Necessary	Necessary
Snow Blower		Max. working width	1520 mm (60 in.)	1524 mm (60 in.)
		Max. weight	200 kg (450 lbs)	227 kg (500 lbs)
		Sub frame	Necessary	Necessary
Trailer		Max. load capacity	1000 kg (2200 lbs)	1500 kg (3300 lbs)
		Max. drawbar load	300 kg (660 lbs)	360 kg (800 lbs)

NOTE :

- **Implement size may vary depending on soil and operating conditions.**

12271G00290

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MECHANISM

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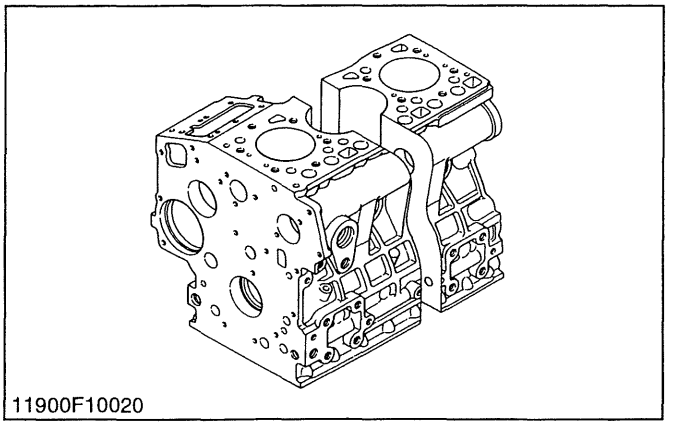
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[1] ENGINE BODY

(1) Cylinder Block


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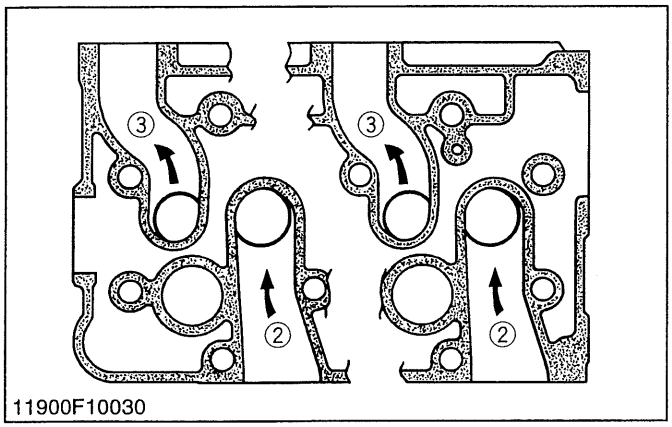
The engine has a high durability tunnel-type cylinder block in which the crank bearing component is a constructed body.

Furthermore, liner less type, allow effective cooling, less distortion, and greater wear-resistance.

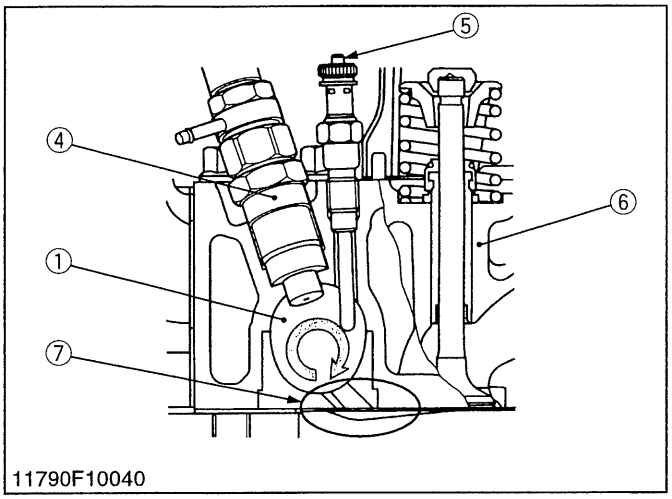
The noise level is reduced to a minimum because each cylinder has its own chamber.

11900M10020

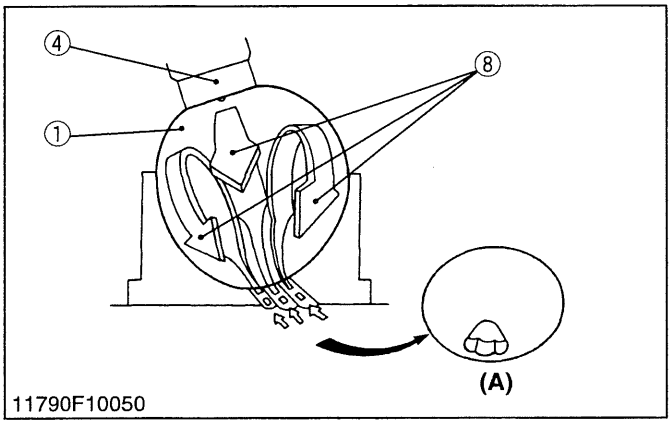
(2) Cylinder Head



11900F10030



11790F10040



11790F10050

The cross-flow tape 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 shirled 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).

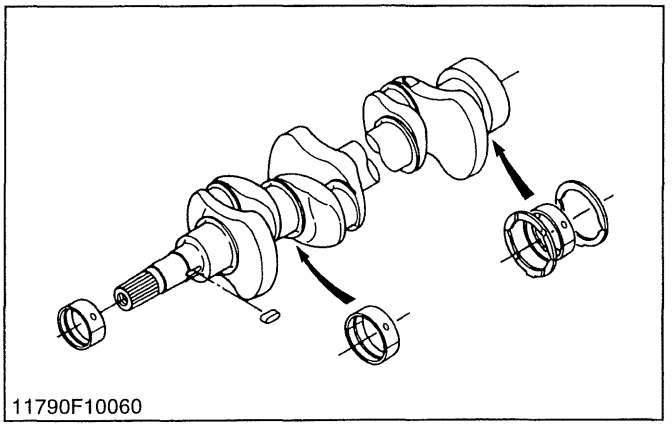
(1) Combustion Chamber
(2) Intake Port
(3) Exhaust Port
(4) Nozzle Assembly
(5) Glow Plug
(6) Cylinder Head
(7) Depression
(8) Compressed Air

(A) Connect to Combustion Chamber

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(3) Crankshaft


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

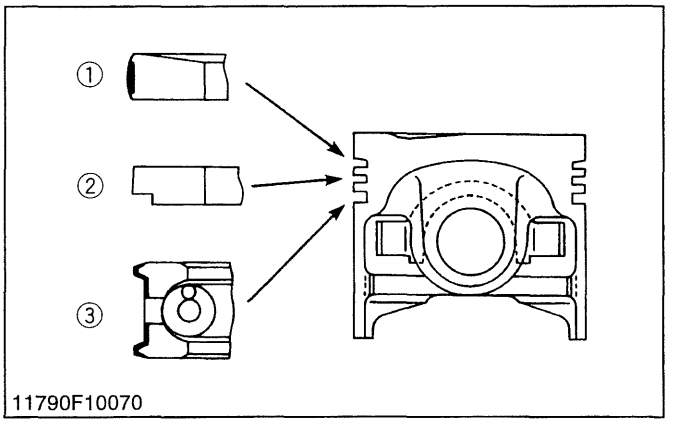
The crankshaft is made of tough special alloy steel, and the journals, pins and oil seal sliding portions are induction hardened to increase the hardness for higher wear resistance.

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.

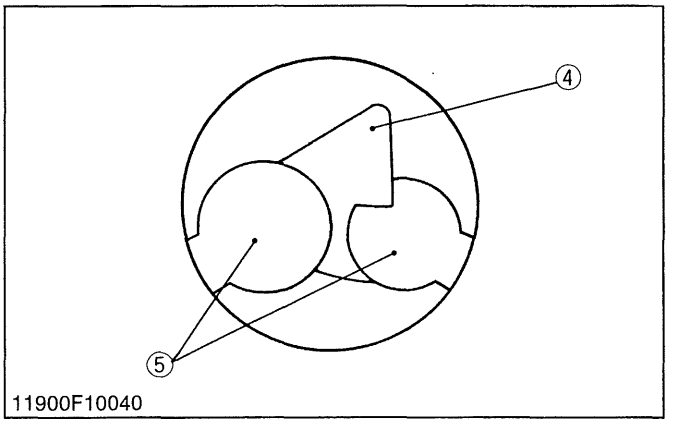
The crankshaft is provided with an oil gallery, through which engine oil is fed to the crankpin portion, and lubricates it.

11790M10040

(4) Piston and Piston Rings



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11900F10040

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.

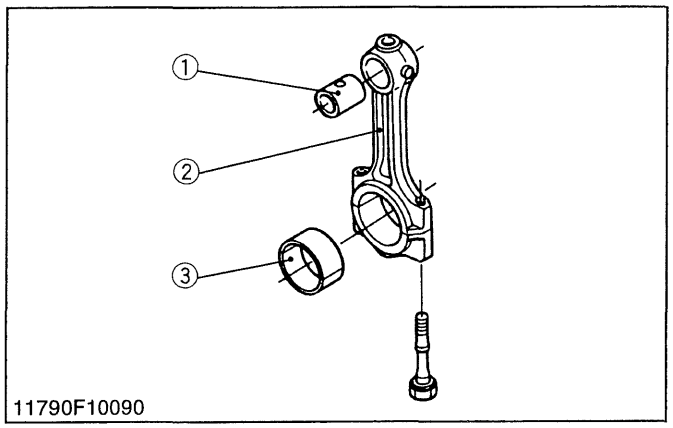
The oil ring (3) has chamfered contact faces and an expander ring, which increase the pressure of the oil ring against the cylinder wall.

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

11900M10041

(5) Connecting Rod



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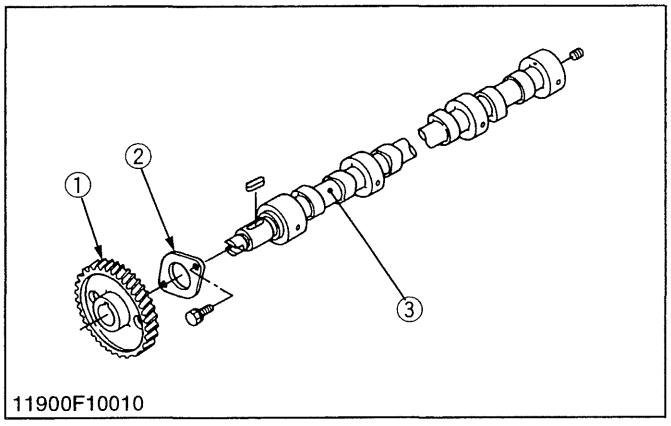
The connecting rod (2) is used to connect the piston with the crankshaft.

The big end of the connecting rod has a crankpin bearing (3) (split type) and the small end has a small end bushing (1) (solid type).

(1) Small End Bushing
(2) Connecting Rod
(3) Crankpin Bearing

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(6) Camshaft



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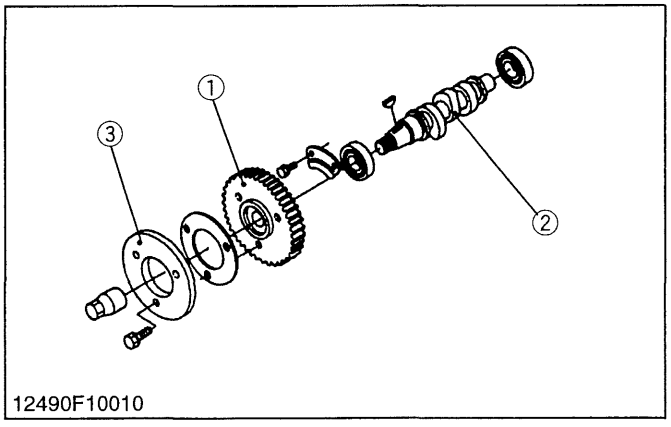
The camshaft (3) is made of special cast iron, and the journal and cam sections are chilled to resist wear.

The journal sections are force-lubricated.

(1) Cam Gear
(2) Camshaft Stopper
(3) Camshaft

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(7) Fuel Camshaft



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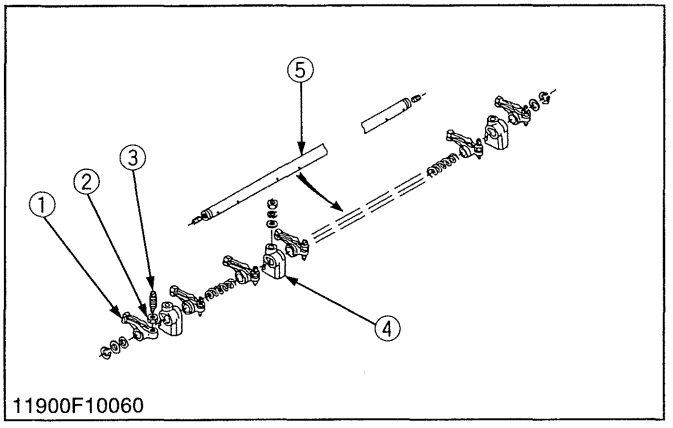
The fuel camshaft (2) controls the reciprocating movement of the injection pump.

The fuel camshaft is made of carbon steel and the cam sections are quenched and tempered to provide greater wear resistance.

(1) Injection Pump Gear
(2) Fuel Camshaft
(3) Fuel Feed Pump Cam

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(8) Rocker Arm



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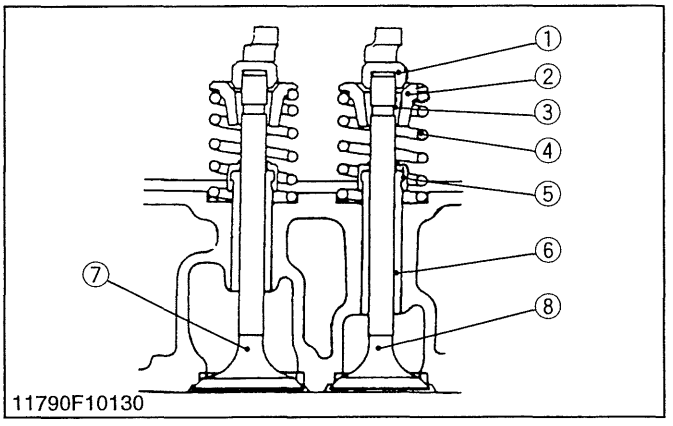
The rocker arm assembly includes the rocker arms (1), rocker arm brackets (4) and rocker arm shaft (5), and converts the reciprocating movement of the push rods to an open / close movement of the intake and exhaust valves.

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

11900M10070

(9) Intake and Exhaust Valve



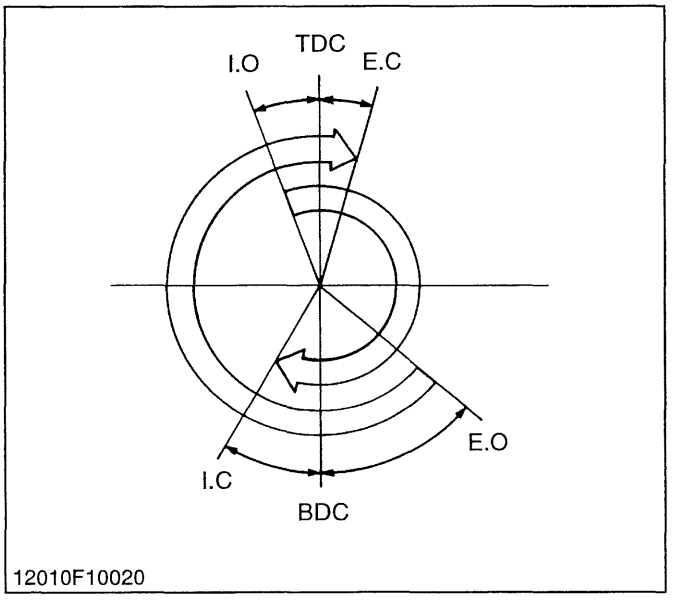
11790F10130

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 Collet
(4) Valve Spring
(5) Valve Stem Seal
(6) Valve Guide
(7) Intake Valve
(8) Exhaust Valve

11790M10100

(10) Valve Timing



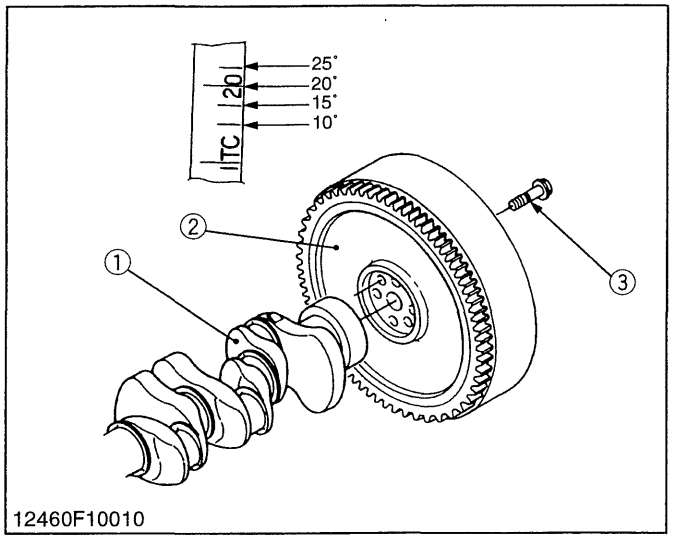
12010F10020

The valve opening and closing timing is extremely important for effectively intaking air into the cylinder and sufficiently exhaust gas. An appropriate timing can be obtained by aligning the alignment marks on the crank gear and cam gear.

Inlet valve open (I.O)	0.24 rad. (14°) before T.D.C.
Inlet valve close (I.C)	0.52 rad. (30°) after B.D.C.
Exhaust valve open (E.O)	0.96 rad. (55°) Before B.D.C.
Exhaust valve close (E.C)	0.24 rad. (14°) after T.D.C.

12010M10020

(11) Flywheel



12460F10010

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, which mesh with the drive pinion of the starter.

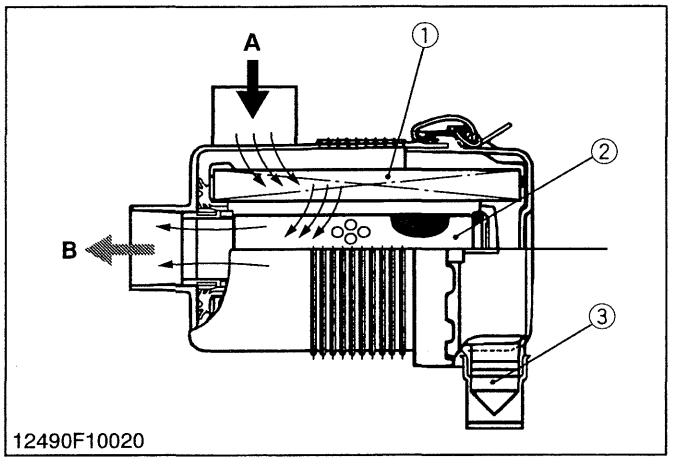
The flywheel has also marks **TC** and fuel injection timing lines on its outer rim. The lines of fuel injection timing shows the fuel injection timing and the mark **TC** shows the piston's top dead center, when they are aligned with the alignment mark on the rear end plate.

On the circumference of the flywheel are stamped the top dead center (1TC) mark for the 1st cylinder 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.

(1) Crankshaft
(2) Flywheel
(3) Flywheel Screw

12460M10100

(12) Air Cleaner



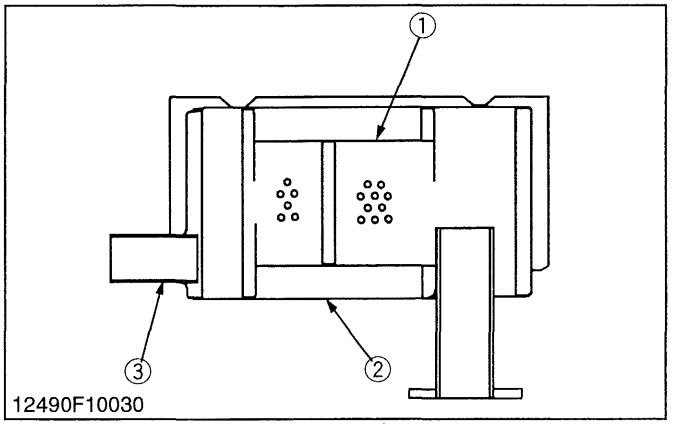
12490F10020

The air cleaner is of a dry type with evacuator valve (3) for easy maintenance, consisting of a dual structure element. The dust, while circulating in the air flow, is absorbed by the element (1) and thus prevented from entering the engine.

(1) Primary Element
(2) Secondary (Safety) Element
(3) Evacuator Valve
(A) From Air Inlet
(B) Into Cylinder

12490M10030

(13) Muffler



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The muffler consists of an inner tube (1) with a series of holes and outer tube (2).

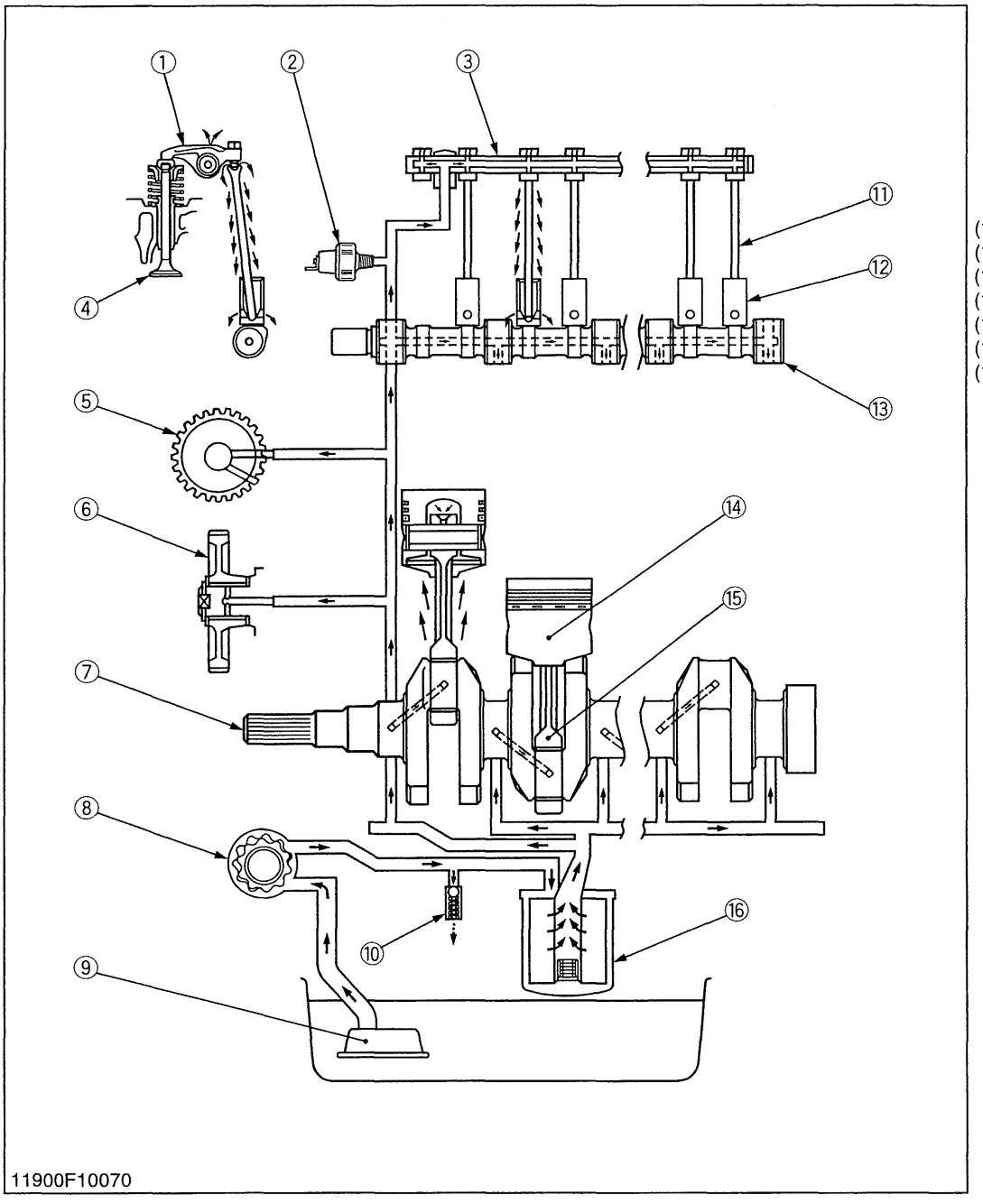
The exhaust noises are absorbed and dumped, while the gas pass through a series of holes on the inner tube (1).

(1) Inner Tube
(2) Outer Tube
(3) Exhaust Tube

12490M10040

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[2] LUBRICATING SYSTEM



(1) Rocker Arm
(2) Oil Pressure Switch
(3) Rocker Arm Shaft
(4) Valve
(5) Governor Shaft
(6) Idle Gear
(7) Crankshaft
(8) Oil Pump
(9) Oil Strainer
(10) Relief Valve
(11) Push Rod
(12) Tappet
(13) Camshaft
(14) Piston
(15) Connecting Rod
(16) Oil Filter Cartridge

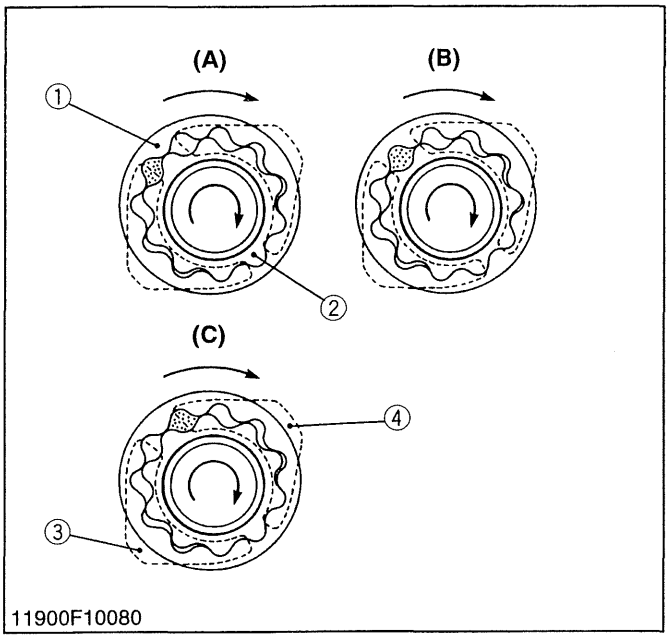
This engine's lubricating system consists of oil strainer (9), oil pump (8), relief valve (10), oil filter cartridge (16) and oil pressure switch (2).

The oil pump sucks lubricating oil from the oil pan through the oil strainer and the oil flows down to the filter cartridge, where it is further filtered. Then the oil is forced to crankshaft (7), connecting rods (15), idle gear (6), governor shaft (5), camshaft (13) and rocker arm shaft (3) to lubricate each part.

Some part of oil, splashed by the crankshaft or leaking and dropping from gaps of each part, lubricates these parts : pistons (14), cylinders, small ends of connecting rods, tappets (12), push rods (11), inlet and exhaust valves (4) and timing gears.

11900M10090

(1) Oil Pump



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The oil pump is a trochoid pump.

Inside the pump body, the 10 lobe inner rotor (2) is eccentrically engaged with the 11 lobe outer rotor (1). The inner rotor is driven by the crankshaft, which in turn rotate the outer rotor.

When the inner rotor rotates, the outer rotor also rotates in the same direction. The two rotors have differences in lobe number and center, which generates space between lobes as shown in the figure.

At position **(A)**, there is little space between lobes in the inlet port (3). As the rotors rotate, the space between the lobes becomes larger, creating a negative pressure which sucks in oil.

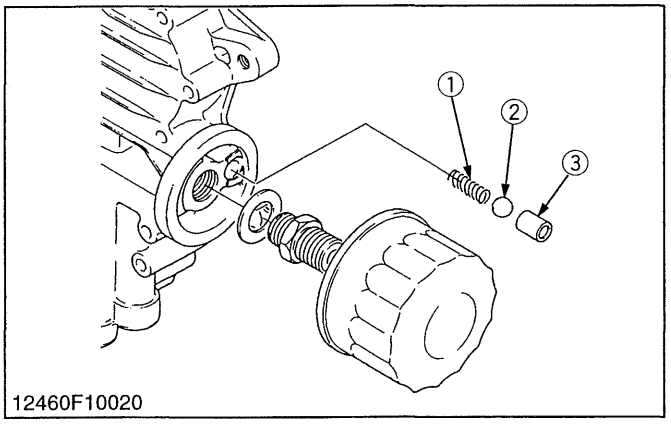
When the rotors rotate to position **(B)**, the port to which the space leads is changed from inlet to outlet.

At position **(C)**, the space decreases and sucked oil is discharged from the outlet port (4).

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

11900M10100

(2) Relief Valve



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The relief valve prevents the damage of the lubricating system due to high oil pressure. This relief valve is a ball type direct acting relief valve, and is best suited for low pressures.

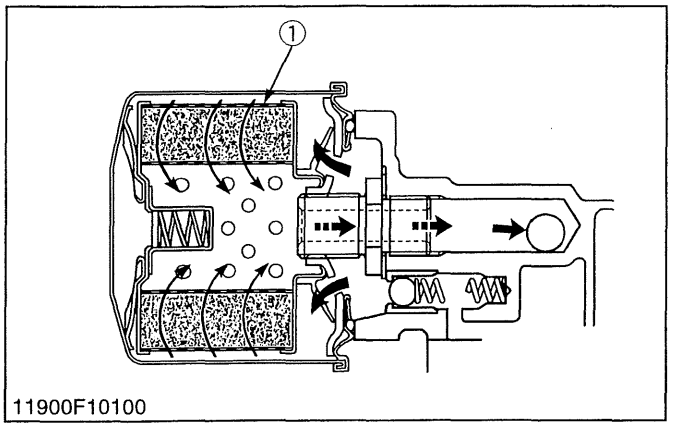
When oil pressure exceeds the upper limit, the ball (2) is pushed back by the oil pressure and the oil escapes.

(1) Spring
(2) Ball
(3) Valve Seat

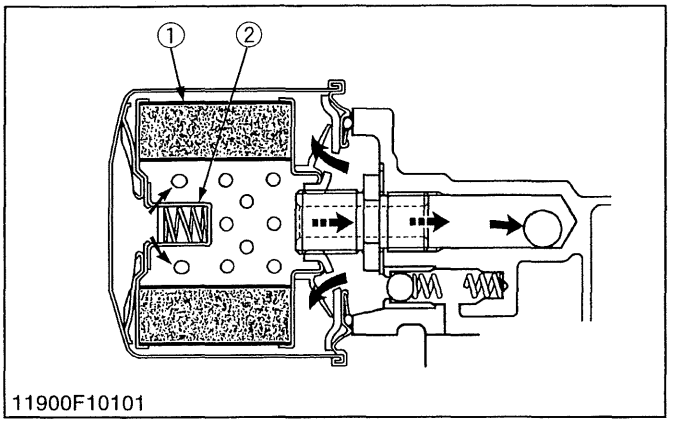
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(3) Oil Filter Cartridge



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11900F10101

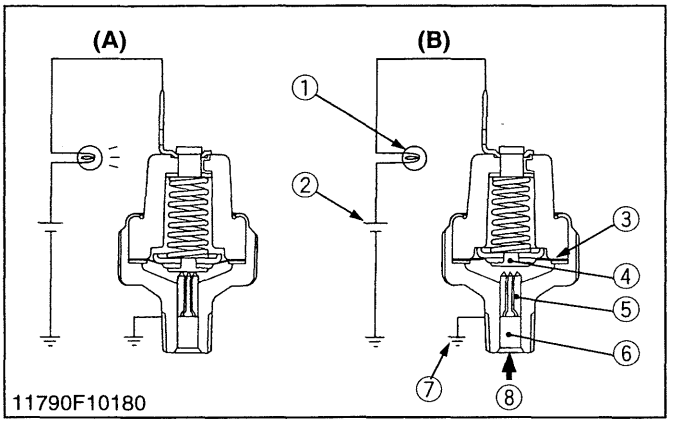
Impurities in engine oil can cause to wear and seize components as well as impairing the physical and chemical properties of the oil itself. Impurities contained in force-fed engine oil are absorbed on the filter paper for removal as they pass through the filter element (1).

When the filter element is clogged and the oil pressure in inlet line builds up by 98 kPa (1.0 kgf/cm^2, 14 psi) more than the outlet line, the bypass valve (2) opens and the oil flows from inlet to outlet bypassing the filter element.

(1) Filter Element
(2) Bypass Valve

11900M10120

(4) Oil Pressure Switch



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The oil pressure switch is mounted on the cylinder block, to warn the operator that the lubricating oil pressure is poor.

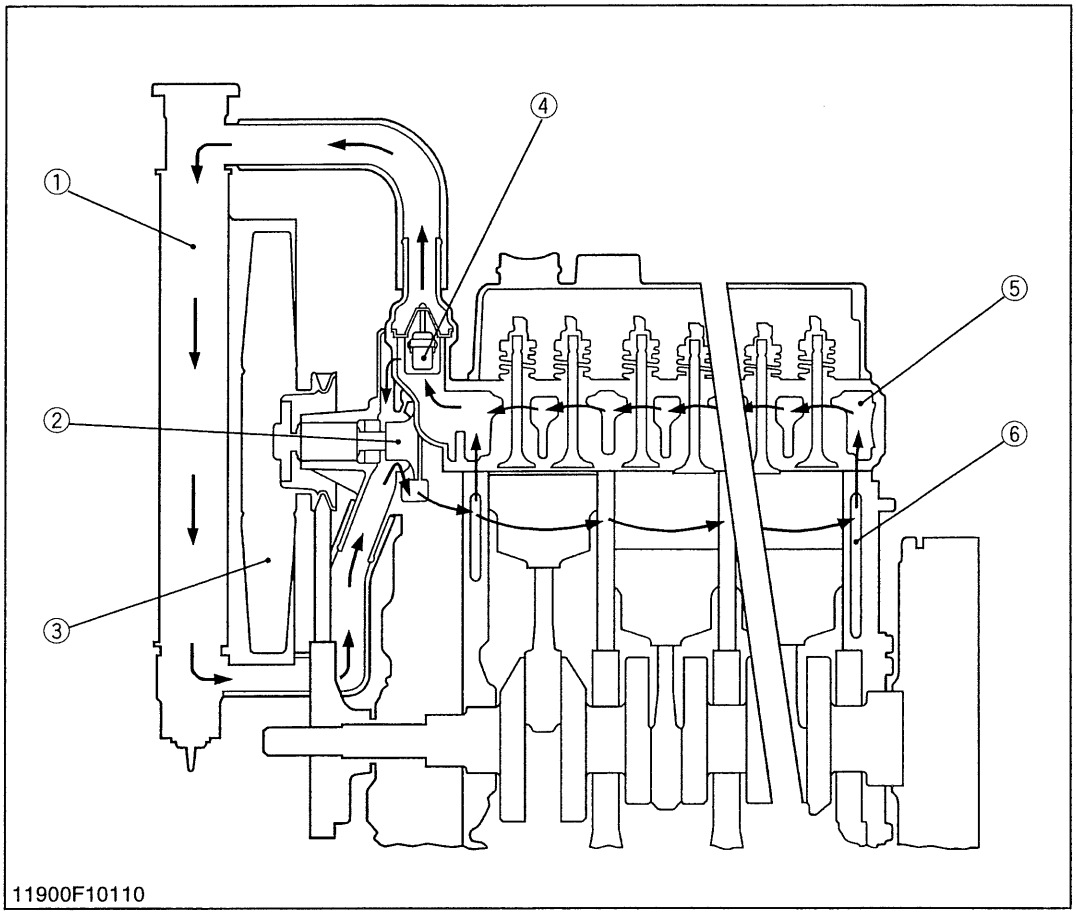
If the oil pressure falls below the specified value, the oil warning lamp will light up, warning the operator. In this case, stop the engine immediately and check the cause of prssure drop.

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

(A) At Lower Oil Pressure (49 kPa, 0.5 kgf/cm^2, 7 psi or less)
(B) At Proper Oil Pressure

11790M10151

[3] COOLING SYSTEM



11900F10110

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

The cooling system consists of a radiator (1), a centrifugal water pump (2), a cooling fan (3) and a thermostat (4).

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

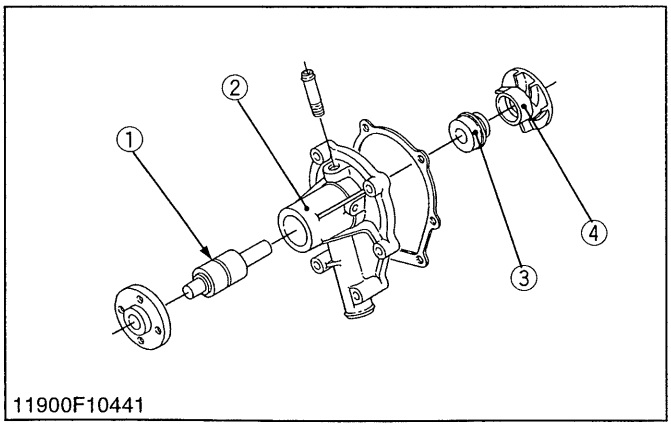
The water pump receives water from the radiator or from the cylinder head and force it into the cylinder block.

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. 82 °C (180 °F).

11900M10130

(1) Water Pump



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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.

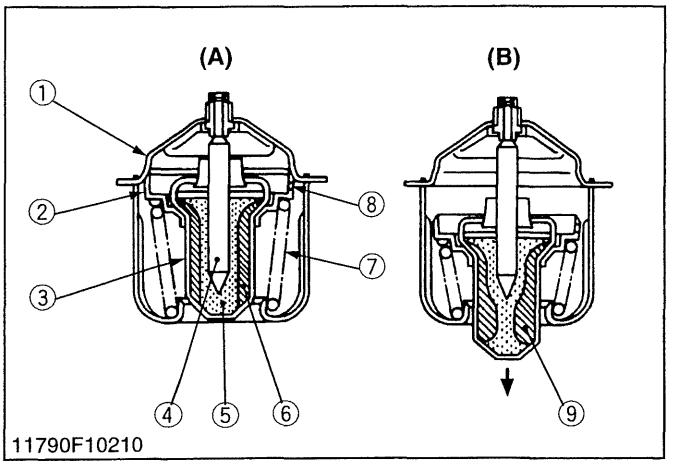
The mechanical seal (3) prevents the water from entering the bearing (1).

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

11900M10140

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(2) Thermostat



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The thermostat maintains the cooling water at correct temperature. KUBOTA's engine uses a wax pellet type thermostat. Wax is enclosed in the pellet. The wax is solid at low temperatures, but turns liquid at high temperatures, expands and opens the valve.

(A) At low temperature (lower than 82 °C, 180 °F)

As the thermostat is closed, cooling water circulates in the engine through the water return pipe without running to the radiator.

Air in the water jacket escapes to the radiator side through leak hole (8) of the thermostat.

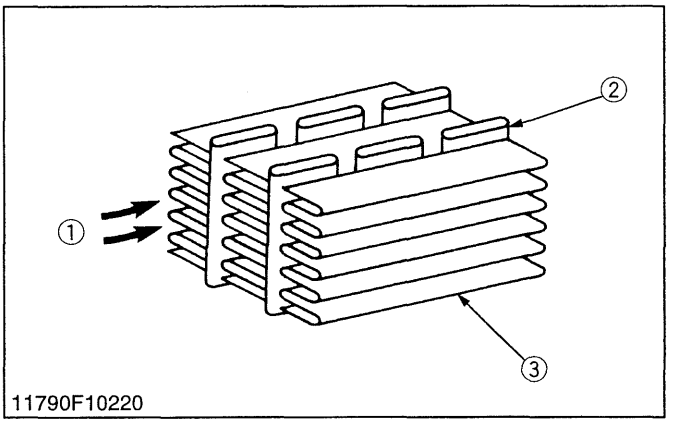
(B) At high temperature (higher than 82 °C, 180 °F)

When the temperature of cooling water exceeds 82 °C (180 °F), wax in the pellet turns liquid and expands. Because the spindle (4) is fixed, the pellet (3) is lowered, the valve (2) is separated from the seat (1), and then cooling water is sent to the radiator.

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

11790M10181

(3) Radiator



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

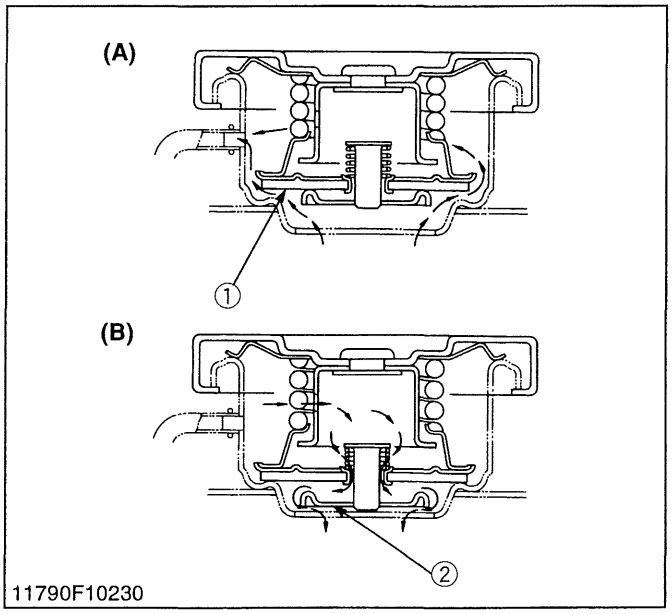
The water in the radiator is cooled by the air flowing through between the tube wall and the fin.

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

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

11790M10190

(4) Radiator Cap



11790F10230

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/cm^2, 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.

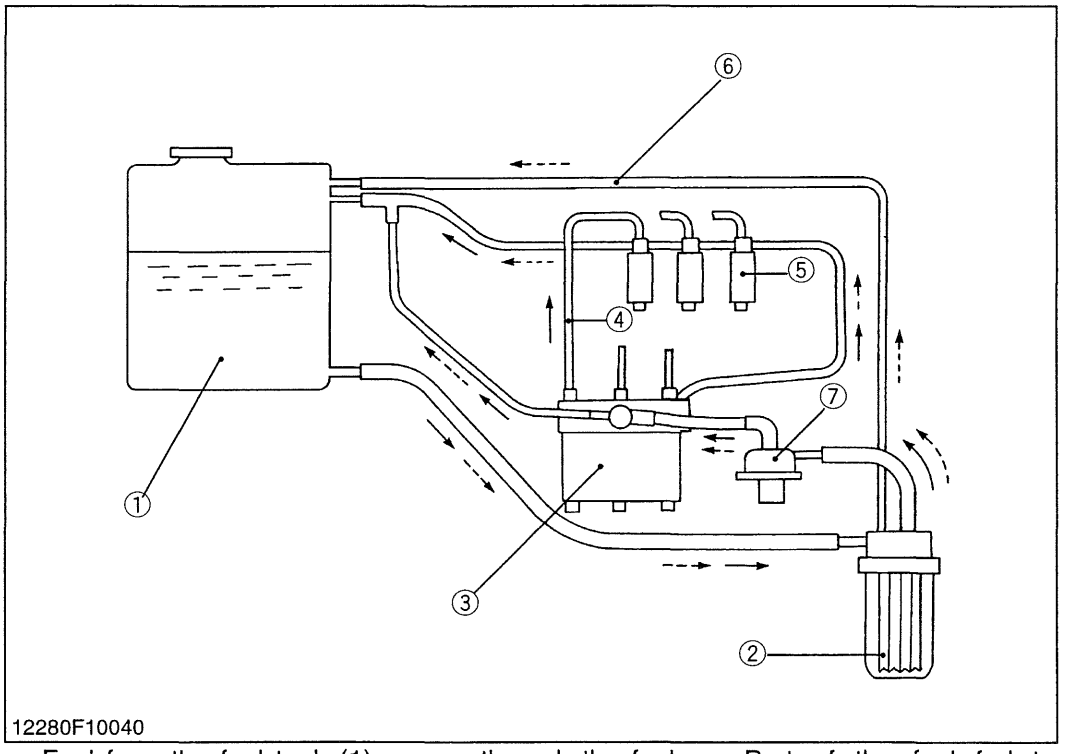
(B) At negative pressure
When the water temperature falls and a vacuum is formed in the radiator, the vacuum valve (2) opens to allow the air to enter the radiator.

(1) Pressure Valve (2) Vacuum Valve

11790M10200

[4] FUEL SYSTEM

(1) Fuel Line



12280F10040

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

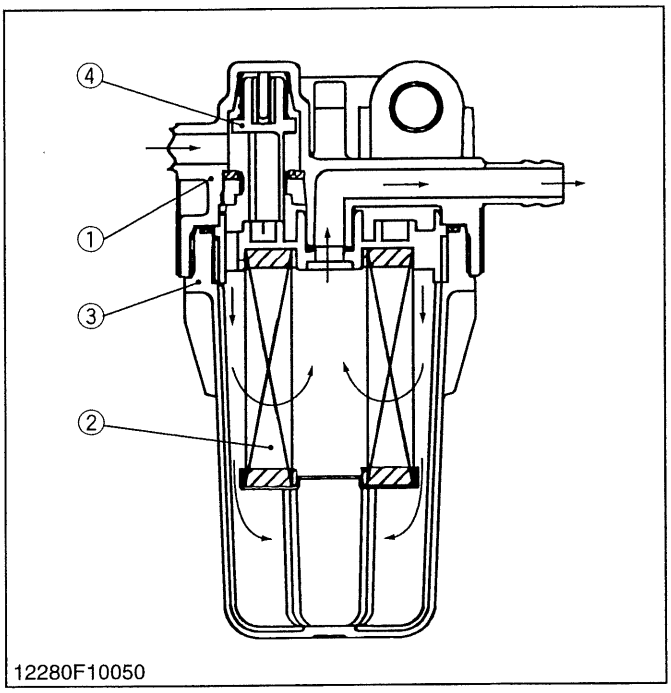
The fuel pressurized by the injection pump to the opening pressure (13.73 to 14.71 MPa, 140 to 150 kgf/cm^2, 1991 to 2062 psi), of the injection nozzle (5) is injected into the combustion chamber.

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.

12280M10060

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(2) Fuel Filter



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The fuel filter is installed between the fuel tank and fuel lift pump, and serves to remove dirt and impurities from the fuel.

Fuel from the fuel tank enters the outside of the filter element (2) and passes through the filter element under its own pressure. As it passes through, the dirt and impurities in the fuel are filtered out, allowing only clean fuel to enter the interior of the filter element. The fuel exits from the outlet of the filter bracket (1) and is sent to the fuel lift pump.

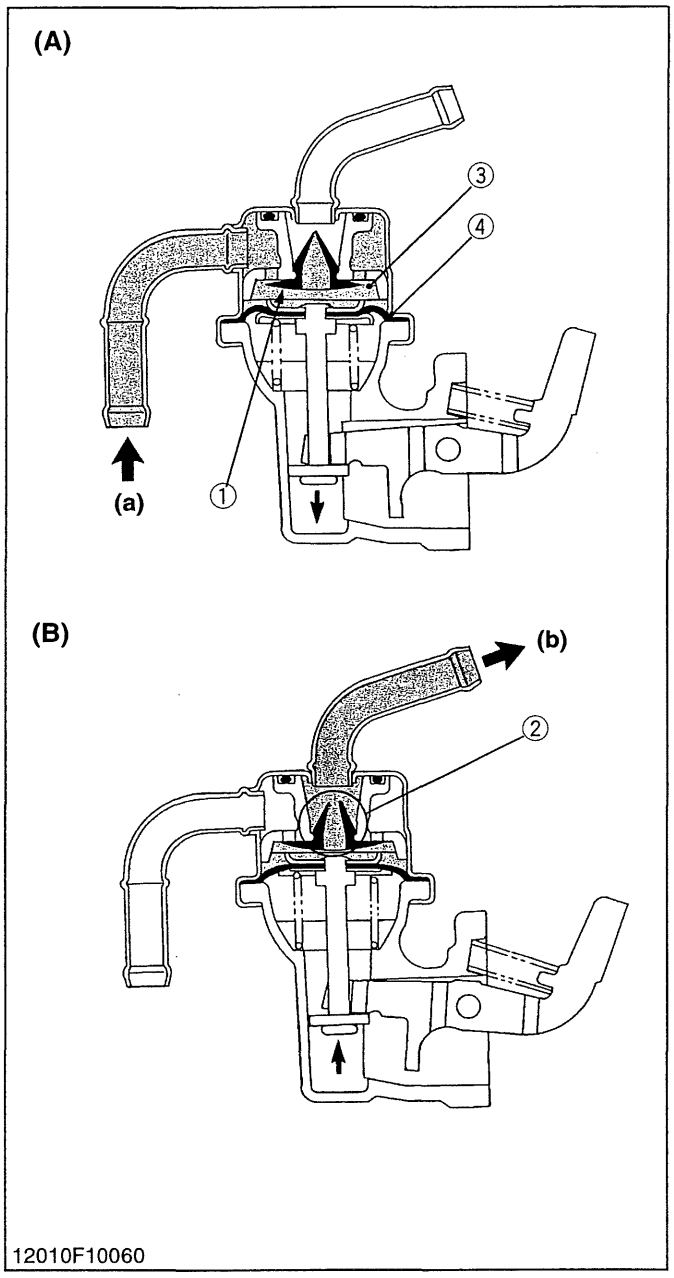
And to prevent the fuel from flowing out when the element was removed, the valve (4) is installed in this filter.

Type of filter element	According-pleated paper type
Filter mesh	20 to 40 μm 0.00079 to 0.00157 in.

(1) Filter Bracket
(2) Filter Element
(3) Filter Cap
(4) Valve

12280M10070

(3) Fuel Feed Pump



12010F10060

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.

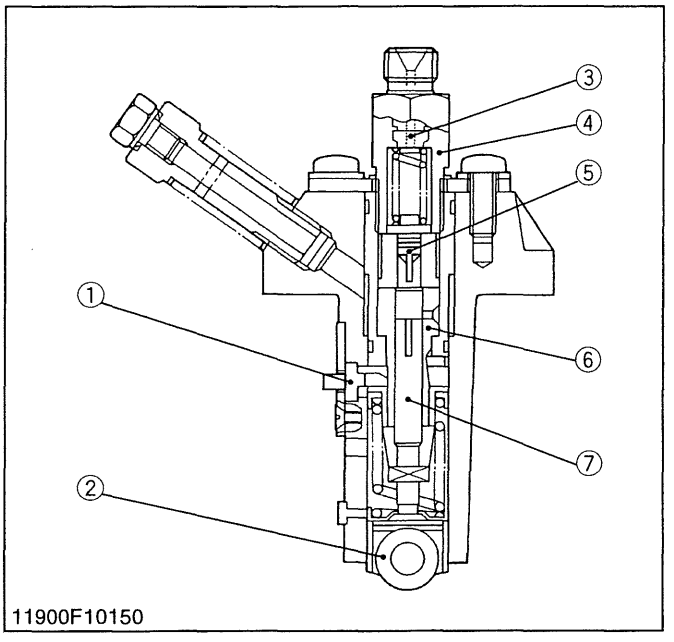
(1) Inlet Valve
(2) Outlet Valve
(3) Chamber
(4) Diaphragm

(a) From Fuel Filter
(b) To Injection Pump

(A) Inlet Stroke
(B) Discharge Stroke

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(4) Injection Pump



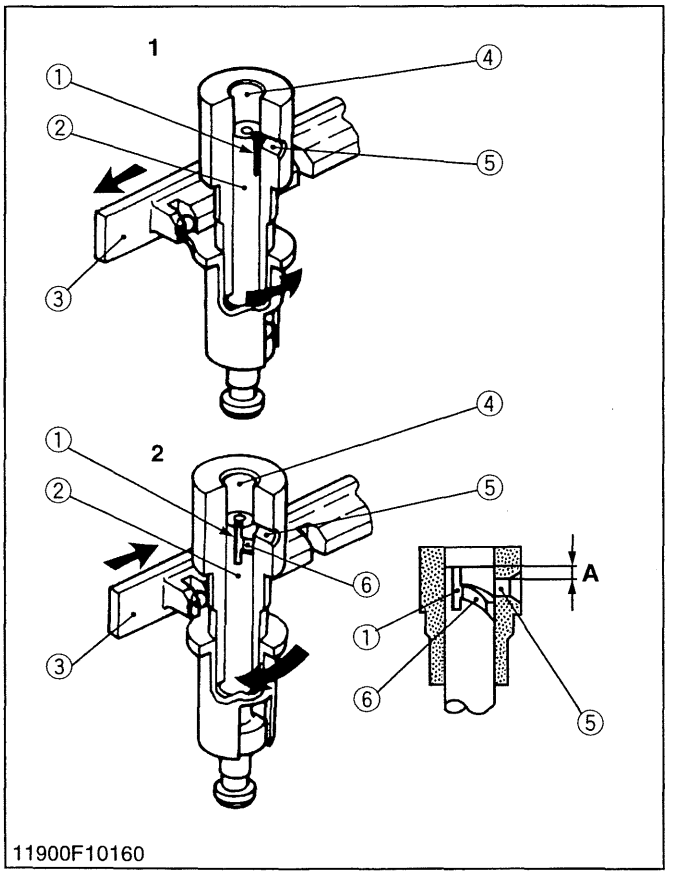
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A Bosch MD type mini pump is used for the injection pump. It is small, lightweight and easy to handle.

The plunger (7) with a left-hand lead reciprocates via the tappet roller (2) by means of the fuel camshaft, causing the fuel to be delivered into the injection nozzle.

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

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■ Injection Control

1. No fuel delivery (Engine stop)

At the engine stop position of the control rack (3), the lengthwise slot (1) on the plunger (2) aligns with the feed hole (5). And the delivery chamber (4) is led to the feed hole during the entire stroke of the plunger.

The pressure in the delivery chamber does not build up and no fuel can be forced to the injection nozzle.

2. Fuel delivery

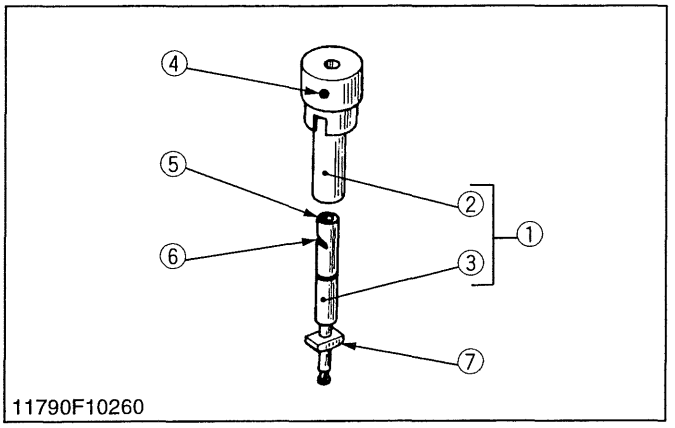
The plunger (2) is rotated (see figure) by the control rack (3).

When the plunger is pushed up, the feed hole (5) is closed. The pressure in the delivery chamber (4) builds up and forcefeeds the fuel to the injection nozzle until the control groove (6) meets the feed hole (5).

The amount of the fuel corresponds to the distance "**A**".

(1) Slot
(2) Plunger
(3) Control Rack
(4) Delivery Chamber
(5) Feed Hole
(6) Control Groove

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■ Pump Element

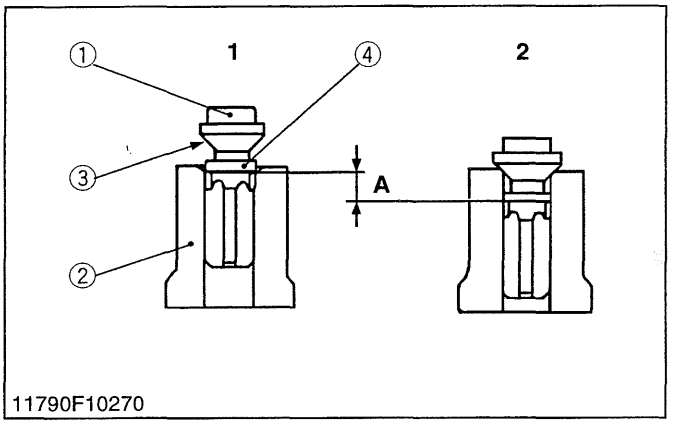
The pump element (1) is consist of the plunger (3) and cylinder (2).

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
(2) Cylinder
(3) Plunger
(4) Feed Hole
(5) Slot
(6) Control Groove
(7) Driving Face

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■ 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

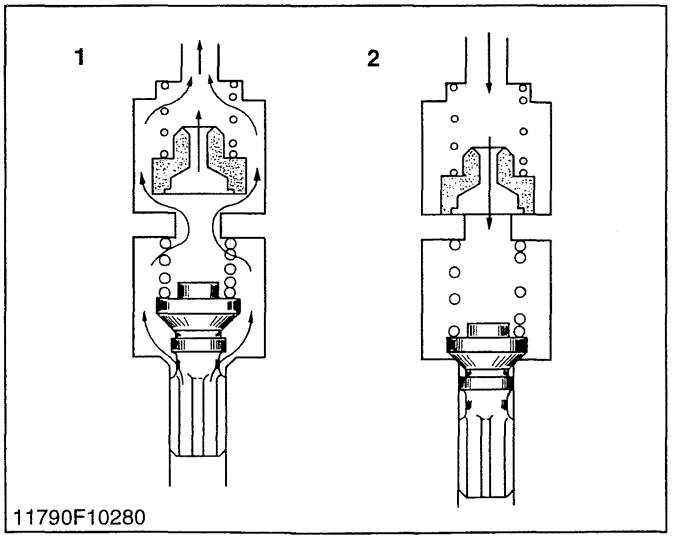
If the fuel flow reverse from the injection nozzle side when the plunger lowers, the time lag between the next delivery start and the nozzle injection start increases. To avoid this, the delivery chamber to injection pipe interruption by delivery valve (1) prevents this reverse flow, thus keeping fuel 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
(2) Delivery Valve Seat
(3) Seat Surface
(4) Relief Plunger

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■ 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

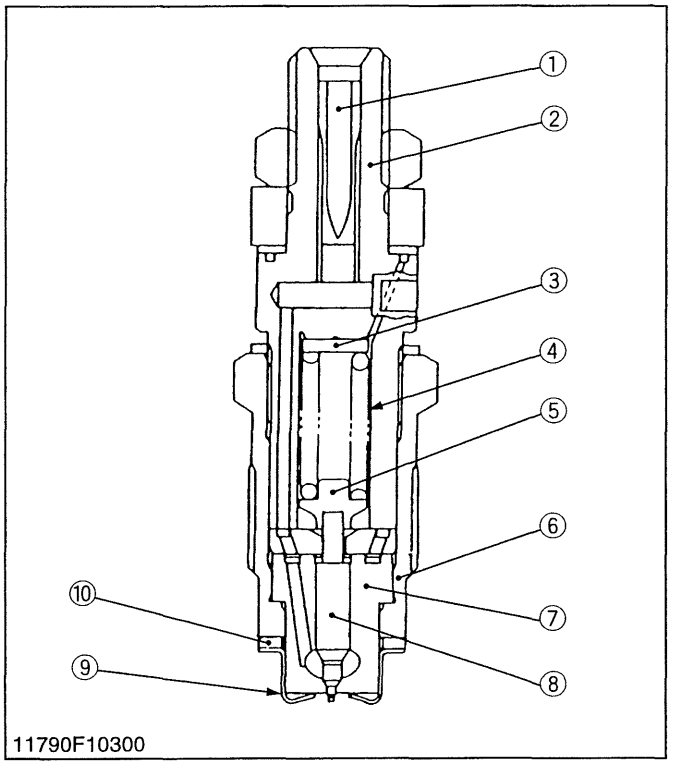
At suck-back by delivery valve after fuel injection fuel returns through dumping valve orifice. Generally second injection is apt to occur by reflex pressure due to reaction of sudden pressure drop when changing into suck-back by delivery valve from high injection pressure.

As a result of preventing this second injection perfectly by dumping valve and dissolving nozzle clogging, durability of injection nozzle is improved.

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(5) Injection Nozzle



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This 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.

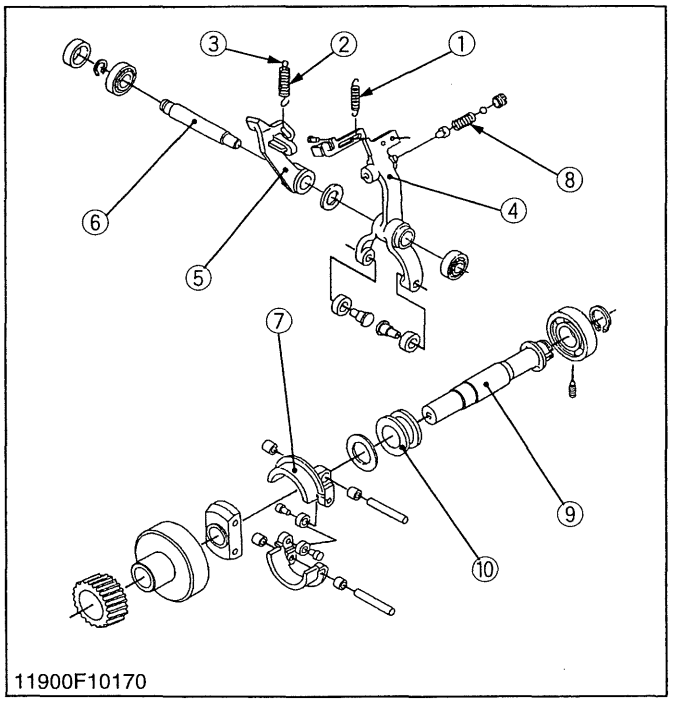
The heat seal is employed to improve the durability and reliability of the nozzle.

The injection pressure is 13.73 to 14.71 MPa (140 to 150 kgf/cm^2, 1991 to 2133 psi), and is adjusted with adjusting washers (3).

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

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(6) Governor



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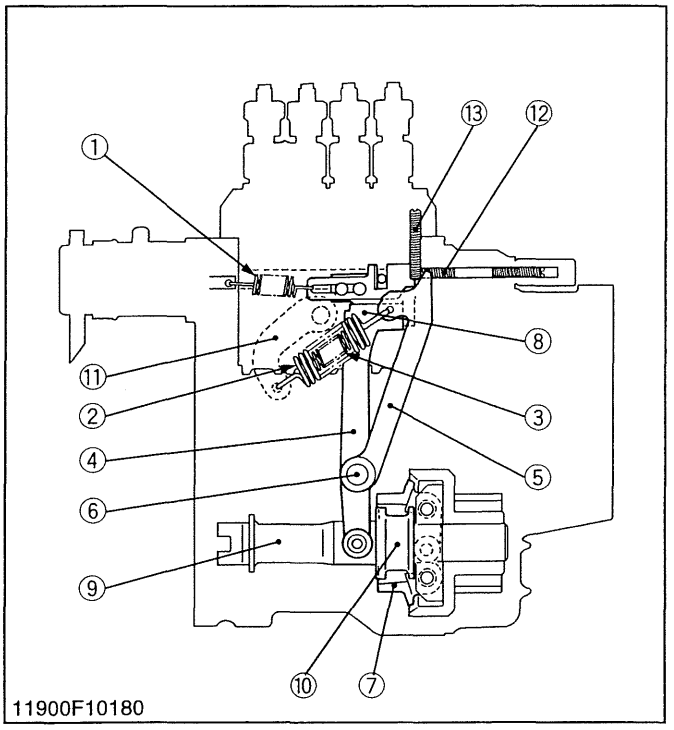
This mechanism maintains engine speed at a constant level even under fluctuating loads, provides stable idling and regulates maximum engine speed by controlling the fuel injection rate.

This engine uses a mechanical governor that controls the fuel injection rate at all speed ranges (from idling to maximum speed) by utilizing the balance between the flyweight's centrifugal force and spring tension.

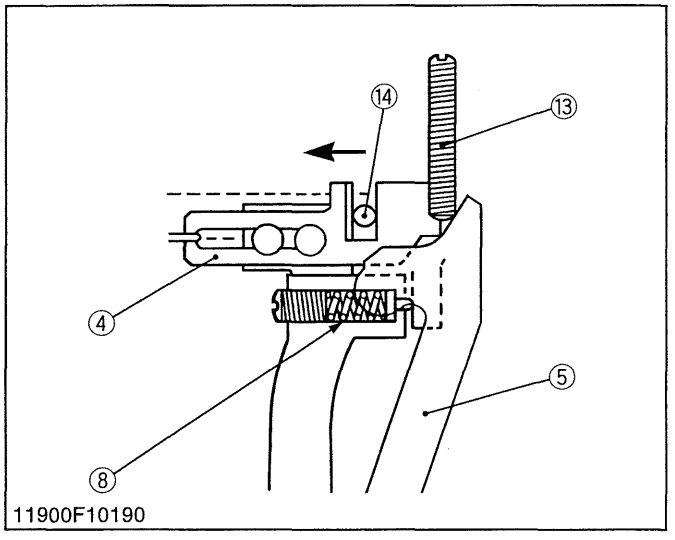
A governor shaft for monitoring engine speed is independent of the injection pump shaft and rotates at twice the speed of conventional types, providing better response to load fluctuation and delivering greater engine output.

(1) Start Spring
(2) Governor Spring 1
(3) Governor Spring 2
(4) Fork Lever 1
(5) Fork Lever 2
(6) Fork Lever Shaft
(7) Flyweight
(8) Torque Spring
(9) Governor Shaft
(10) Governor Sleeve

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■ At Start

As no centrifugal force is applied to flyweight (7), low tension of start spring (1) permits control rack to move to the starting position, supplying the amount of fuel required to start the engine.

■ At Idling

Setting speed control lever (11) to the idling position during engine rotation permits the low tension of governor spring 2 (3), start spring (1) and idle limit spring (12) to balance the centrifugal force of flyweight (7) without activating high tension governor spring 1 (2). In this way, the fuel injection rate can be controlled to ensure stable idling.

■ At High Speed Running with Overload

Governor spring 1 (2) and 2 (3) control the fuel injection rate. To maintain the required engine speed, fuel is supplied according to the speed control lever setting and load by balancing the tension of governor springs 1 and 2 with the centrifugal force of flyweight (7).

In addition, idle limit spring (12) provides stable engine rotation.

■ During Overload

At load increases, the engine speed decreases, reducing the flyweight's centrifugal force. Governor springs 1 (2) and 2 (3), therefore, pull fork levers 1 (4) and 2 (5), increasing the fuel injection rate and maintaining engine speed.

If engine speed decreases due to a further increase in load, fork lever 2 (5) will come in contact with the fuel limit bolt, stopping a further increase in the fuel injection rate.

Torque spring (8) incorporated in fork lever 1 (4) moves the lever in the direction of fuel injection rate increase, thereby boosting torque and providing greater engine output.

(1) Start Spring
(2) Governor Spring 1
(3) Governor Spring 2
(4) Fork Lever 1
(5) Fork Lever 2
(6) Fork Lever Shaft
(7) Flyweight
(8) Torque Spring
(9) Governor Shaft
(10) Governor Sleeve
(11) Speed Control Lever
(12) Idle Limit Spring
(13) Fuel Limit Adjust Bolt
(14) Control Rack Pin

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SERVICING

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TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	• No fuel	Replenish fuel	–
	• Air in the fuel system	Bleed	G-28
	• Water in the fuel system	Change fuel and repair or replace fuel system	–
	• Fuel pipe clogged	Clean	–
	• Fuel filter clogged	Change	G-20
	• Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	G-8
	• Fuel with low cetane number	Use specified fuel	G-8
	• Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S18
	• Incorrect injection timing	Adjust	1-S53
	• Fuel camshaft worn	Replace	1-S24
	• Injection nozzle clogged	Clean	1-S55
	• Injection pump malfunctioning	Repair or replace	1-S24
	• Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	1-S28, S31
	• Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S20
	• Improper valve timing	Correct or replace timing gear	1-S26
	• Piston ring and cylinder worn	Replace	1-S29
	• Excessive valve clearance	Adjust	1-S17
(Starter Does Not Run)	• Battery discharged	Charge	9-S5
	• Starter malfunctioning	Repair or replace	9-S11
	• Main switch malfunctioning	Repair or replace	9-S7
	• The movement of poppet (safety switch of range gear shift) is heavy (In winter, oil viscosity increase) (B2710 Affected Serial No.: below 15496)	Range gear shift lever is moved several times	9-M7
	• Safety switches malfunctioning	Adjust or replace	9-S10
	• Wiring disconnected	Connect	–
Engine Revolution Is Not Smooth	• Fuel filter clogged or dirty	Change	G-20
	• Air cleaner clogged	Clean or replace	G-20
	• Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S18
	• Injection pump malfunctioning	Repair or replace	1-S24
	• Incorrect nozzle injection pressure	Adjust	1-S55
	• Injection nozzle stuck or clogged	Repair or replace	1-S56
	• Governor malfunctioning	Repair	1-S26
Either White or Blue Exhaust Gas Is Observed	• Excessive engine oil	Reduce to specified level	G-12
	• Piston ring and cylinder worn or stuck	Repair or replace	1-S29
	• Incorrect injection timing	Adjust	1-S53
	• Deficient compression	Adjust top clearance	1-S16

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Symptom	Probable Cause	Solution	Reference Page
Either Black or Dark Gray Exhaust Gas Is Observed	• Overload	Lessen load	–
	• Low grade fuel used	Use specified fuel	G-8
	• Fuel filter clogged	Replace	G-20
	• Air cleaner clogged	Clean or replace	G-20
	• Deficient nozzle injection	Repair or replace nozzle	1-S56
Deficient Output	• Incorrect injection timing	Adjust	1-S53
	• Engine's moving parts seem to be seizing	Repair or replace	–
	• Uneven fuel injection	Repair or replace injection pump	1-S24
	• Deficient nozzle injection	Repair or replace nozzle	1-S56
	• Compression leak	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S20
Excessive Lubricant Oil Consumption	• Piston ring's gap facing the same direction	Shift ring gap direction	1-S29
	• Oil ring worn or stuck	Replace	1-S29
	• Piston ring groove worn	Replace piston	1-S29
	• Valve stem and valve guide worn	Replace	1-S32
	• Oil leaking due to defective seals or packing	Replace	–
Fuel Mixed into Lubricant Oil	• Injection pump's plunger worn	Replace pump element or injection pump	1-S24
	• Deficient nozzle injection	Repair or replace nozzle	1-S56
	• Injection pump broken	Replace	1-S24
Water Mixed into Lubricant Oil	• Head gasket defective	Replace	1-S20
	• Cylinder block or cylinder head flawed	Replace	1-S20
Low Oil Pressure	• Engine oil insufficient	Replenish	G-8
	• Oil strainer clogged	Clean	1-S27
	• Oil filter cartridge clogged	Replace	G-12
	• Relief valve stuck with dirt	Clean	–
	• Relief valve spring weaken or broken	Replace	–
	• Excessive oil clearance of crankshaft bearing	Replace	1-S45
	• Excessive oil clearance of crankpin bearing	Replace	1-S44
	• Excessive oil clearance of rocker arm	Replace	1-S35
	• Oil passage clogged	Clean	–
	• Different type of oil	Use specified type of oil	G-8
	• Oil pump defective	Repair or replace	1-S49
High Oil Pressure	• Different type of oil	Use specified type of oil	G-8
	• Relief valve defective	Replace	–

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Symptom	Probable Cause	Solution	Reference Page
Engine Overheated	• Engine oil insufficient	Replenish	G-8
	• Fan belt broken or tensioned improperly	Replace or adjust	G-21, 1-S18
	• Cooling water insufficient	Replenish	G-8
	• Radiator net and radiator fin clogged with dust	Clean	–
	• Inside of radiator corroded	Clean or replace	G-27
	• Cooling water flow route corroded	Clean or replace	G-27
	• Radiator cap defective	Replace	–
	• Radiator hose damaged	Replace	–
	• Overload running	Loosen load	–
	• Head gasket defective	Replace	1-S20
	• Incorrect injection timing	Adjust	1-S53
	• Unsuitable fuel used	Use specified fuel	G-8

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SERVICING SPECIFICATIONS

ENGINE BODY

Item		Factory Specification	Allowable Limit
Cylinder Head Surface	Flatness	–	0.05 mm 0.0020 in.
Compression Pressure (When Cranking with Starting Motor)		2.84 to 3.24 MPa 29 to 33 kgf/cm^2 412 to 469 psi	2.26 MPa 23 kgf/cm^2 327 psi
Difference among Cylinders		–	10 % or less
Top Clearance		0.55 to 0.70 mm 0.0217 to 0.0276 in.	–
Valve Clearance (When Cold)		0.145 to 0.185 mm 0.00571 to 0.00866 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	0.035 to 0.065 mm 0.0014 to 0.0026 in.	0.10 mm 0.0039 in.
Valve Stem	O.D.	6.960 to 6.975 mm 0.2740 to 0.2746 in.	–
Valve Guide	I.D.	7.010 to 7.025 mm 0.2760 to 0.2766 in.	–
Valve Recessing	Protrusion	0.05 mm 0.0020 in.	–
	Recessing	0.15 mm 0.0059 in.	0.40 mm 0.0157 in.
Rocker Arm Shaft to Rocker Arm	Clearance	0.016 to 0.045 mm 0.0006 to 0.0018 in.	0.10 mm 0.0039 in.
Rocker Arm Shaft	O.D.	11.973 to 11.984 mm 0.4714 to 0.4718 in.	–
Rocker Arm	I.D.	12.000 to 12.018 mm 0.4724 to 0.4732 in.	–

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ENGINE BODY (Continued)

Item		Factory Specification	Allowable Limit
Valve Timing (Intake Valve)	Open	0.24 rad. (14°) before T.D.C.	–
	Close	0.52 rad. (30°) after B.D.C.	–
Valve Timing (Exhaust Valve)	Open	0.96 rad. (55°) before B.D.C.	–
	Close	0.24 rad. (14°) after T.D.C.	–
Valve Spring	Free Length	37.0 to 37.5 mm 1.457 to 1.476 in.	36.5 mm 1.437 in.
	Setting Load	117.6 N 12.0 kgf 26.4 lbs	100.0 N 10.2 kgf 22.5 lbs
	Setting Length	31.0 mm 1.220 in.	–
	Tilt	–	1.0 mm 0.039 in.
Push Rod	Alignement	–	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.	19.959 to 19.980 mm 0.78579 to 0.78661 in.	–
Tappet Guide	I.D.	20.000 to 20.021 mm 0.78740 to 0.78823 in.	–
Timing Gear (D1105)			
Crank Gear to Idle Gear	Backlash	0.032 to 0.115 mm 0.0012 to 0.0045 in.	0.15 mm 0.0059 in.
Idle Gear to Cam Gear	Backlash	0.036 to 0.114 mm 0.0014 to 0.0045 in.	0.15 mm 0.0059 in.
Idle Gear to Injection Pump Gear	Backlash	0.034 to 0.116 mm 0.0013 to 0.0046 in.	0.15 mm 0.0059 in.
Injection pump Gear to Governor Gear	Backlash	0.030 to 0.117 mm 0.0012 to 0.0046 in.	0.15 mm 0.0059 in.

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ENGINE BODY (Continued)

Item		Factory Specification	Allowable Limit
Timing Gear (V1305, V1505)			
Crank Gear to Idle Gear 1	Backlash	0.032 to 0.115 mm 0.0012 to 0.0045 in.	0.15 mm 0.0059 in.
Idle Gear 1 to Cam Gear	Backlash	0.036 to 0.114 mm 0.0014 to 0.0045 in.	0.15 mm 0.0059 in.
Idle Gear 1 to Injection Pump Gear	Backlash	0.034 to 0.116 mm 0.0013 to 0.0046 in.	0.15 mm 0.0059 in.
Idle Gear 1 to Idle Gear 2	Backlash	0.033 to 0.117 mm 0.0013 to 0.0046 in.	0.15 mm 0.0059 in.
Idle Gear 2 to Governor Gear	Backlash	0.030 to 0.117 mm 0.0012 to 0.0046 in.	0.15 mm 0.0059 in.
Idle Gear (D1105)	Side Clearance	0.20 to 0.51 mm 0.0079 to 0.0200 in.	0.8 mm 0.0315 in.
Idle Gear 1 (V1305, V1505)	Side Clearance	0.050 to 0.150 mm 0.0020 to 0.0059 in.	–
Idle Gear 2 (V1305, V1505)	Side Clearance	0.20 to 0.51 mm 0.0079 to 0.0200 in.	0.9 mm 0.0354 in.
Idle Gear Shaft to Gear Bushing	Clearance	0.020 to 0.054 mm 0.0008 to 0.0021 in.	0.10 mm 0.0039 in.
Idle Gear Shaft	O.D.	25.967 to 25.980 mm 1.0223 to 1.0228 in.	–
Gear Bushing	I.D.	26.000 to 26.021 mm 1.0236 to 1.0244 in.	–
Camshaft	Side Clearance	0.07 to 0.22 mm 0.0028 to 0.0087 in.	0.30 mm 0.0118 in.
Camshaft	Alignement	–	0.01 mm 0.0004 in.
Cam Height	Intake	28.80 mm 1.1339 in.	28.75 mm 1.1319 in.
	Exhaust	29.00 mm 1.1417 in.	28.95 mm 1.1398 in.
Camshaft Journal to Cylinder Block Bore	Oil Clearance	0.050 to 0.091 mm 0.00197 to 0.00358 in.	0.15 mm 0.0059 in.
Camshaft Journal	O.D.	35.934 to 35.950 mm 1.41473 to 1.41535 in.	–
Cylinder Block Bore	I.D.	36.000 to 36.025 mm 1.41732 to 1.41831 in.	–
Piston Pin Bore	I.D.	22.000 to 22.013 mm 0.86614 to 0.86665 in.	22.05 mm 0.8681 in.
Second Ring to Ring Groove	Clearance	0.085 to 0.112 mm 0.0034 to 0.0044 in.	0.20 mm 0.0079 in.

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ENGINE BODY (Continued)

Item		Factory Specification	Allowable Limit
Oil Ring to Ring Groove	Clearance	0.020 to 0.060 mm 0.00079 to 0.00217 in.	0.15 mm 0.0059 in.
Top Ring and 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.	22.002 to 22.011 mm 0.86622 to 0.86657 in.	–
Small End Bushing	I.D.	22.025 to 22.040 mm 0.86713 to 0.86771 in.	–
Crankshaft	Alignment	–	0.02 mm 0.0008 in.
Crankshaft	Side Clearance	0.15 to 0.31 mm 0.0059 to 0.0122 in.	0.50 mm 0.0197 in.
Crankpin to Crankpin Bearing	Oil Clearance	0.029 to 0.091 mm 0.00114 to 0.00358 in.	0.20 mm 0.0079 in.
Crankpin	O.D.	39.959 to 39.975 mm 1.57319 to 1.57382 in.	–
Crankpin Bearing	I.D.	40.004 to 40.050 mm 1.57496 to 1.57677 in.	–
Crankshaft Journal to Crankshaft Bearing 1 (Front Side)	Oil Clearance	0.034 to 0.114 mm 0.00134 to 0.00449 in.	0.20 mm 0.0079 in.
Crankshaft Journal	O.D.	47.934 to 47.950 mm 1.88717 to 1.88779 in.	–
Crankshaft Bearing 1	I.D.	47.984 to 48.048 mm 1.88913 to 1.89165 in.	–
Crankshaft Journal to Crankshaft Bearing 2 (Rear Side)	Oil Clearance	0.034 to 0.095 mm 0.00134 to 0.00374 in.	0.20 mm 0.0079 in.
Crankshaft Journal	O.D.	47.934 to 47.950 mm 1.88716 to 1.88779 in.	–
Crankshaft Bearing 2	I.D.	47.984 to 48.029 mm 1.88913 to 1.89091 in.	–

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ENGINE BODY (Continued)

Item			Factory Specification	Allowable Limit
Crankshaft Journal to Crankshaft Bearing 3 (Intermediate)		Oil Clearance	0.034 to 0.098 mm 0.00134 to 0.00386 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 3		I.D.	51.974 to 52.019 mm 2.04622 to 2.04799 in.	–
[Standard] Cylinder	V1305	I.D.	76.000 to 76.019 mm 2.99212 to 2.99287 in.	76.169 mm 2.99878 in.
	D1105 V1505	I.D.	78.000 to 78.019 mm 3.07086 to 3.07161 in.	78.169 mm 3.07751 in.
[Oversize : 0.5 mm (0.0197 in.)] Cylinder	V1305	I.D.	76.500 to 76.519 mm 3.01181 to 3.01255 in.	76.669 mm 3.01846 in.
	D1105 V1505	I.D.	78.500 to 78.519 mm 3.09055 to 3.09129 in.	78.669 mm 3.09720 in.

LUBRICATING SYSTEM

Engine Oil Pressure	At Idle Speed	49 kPa or more 0.5 kgf/cm^2 or more 7 psi or more	–
	At Rated Speed	196 to 441 kPa 2.0 to 4.5 kgf/cm^2 36 to 64 psi	147 kPa 1.5 kgf/cm^2 27 psi
Inner Rotor to Outer Rotor	Clearance	0.06 to 0.18 mm 0.0024 to 0.0071 in.	–
Outer Rotor to Pump Body	Clearance	0.100 to 0.180 mm 0.0039 to 0.0071 in.	–
Rotor to Cover	Clearance	0.030 to 0.085 mm 0.0012 to 0.0033 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	–
Radiator	Water Leakage Test Pressure	No leaks at 137 kPa 1.4 kgf/cm^2 20 psi	–

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COOLING SYSTEM (Continued)

Item		Factory Specification	Allowable Limit
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	–
Thermostat	Valve Opening Temperature (At Beginning)	80.5 to 83.5 °C 176.9 to 182.3 °F	–
	Valve Opening Temperature (Opened Completely)	95 °C 203 °F	–

FUEL SYSTEM

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, 1849psi), the valve seat must be fuel tightness.	–

FRONT AXLE

Bi-speed Turn Cable

Bi-speed Turn Cable Outer (Clutch Housing Side)	Distance A	18 mm 0.71 in.	–
Bi-speed Turn Cable Inner (Front Axle Case Side)	Distance B	10 mm 0.39 in.	–

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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
Steering wheel mounting nut		29.4 to 49.0	3.0 to 5.0	21.7 to 36.2
Delivery pipe nut for HST		34 to 39	3.5 to 4.0	25.3 to 28.9
Oil cooler pipe nut		50 to 58	5.1 to 5.9	36.9 to 42.8
Delivery pipe nut for power steering		65 to 75	6.6 to 7.2	47.9 to 55.3
Clutch housing and engine mounting	M8	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
screw, bolt and nut	M10	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
Clutch cover mounting screw		23.5 to 27.5	2.4 to 2.8	17.4 to 20.3

Item	Size × Pitch	N·m	kgf·m	ft-lbs
Cylinder head cover cap nut	M7 × 1.0	6.9 to 8.8	0.7 to 0.9	5.1 to 6.5
Injection pipe retaining nut	M12 × 1.5	24.5 to 34.3	2.5 to 3.5	18.1 to 25.3
Nozzle holder assembly	M20 × 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
Overflow pipe assembly retaining nut	M12 × 1.5	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1
Glow plug	M8 × 1.0	7.8 to 14.7	0.8 to 1.5	5.8 to 10.8
Bearing nut on idle gear shaft	–	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Lock nut for bearing nut	–	24.5 to 34.3	2.5 to 3.5	18.1 to 25.3
* Rocker arm bracket nut	M7 × 1.0	21.6 to 26.5	2.2 to 2.7	15.9 to 19.5
* Cylinder head screw	M10 × 1.25	63.7 to 68.6	6.5 to 7.0	47.0 to 50.6
* Crankshaft screw	M14 × 1.5	235.4 to 245.2	24.0 to 25.0	173.6 to 180.8
* Connecting rod screw	M8 × 1.0	41.2 to 46.1	4.2 to 4.7	30.3 to 33.9
* Flywheel screw	M10 × 1.25	53.9 to 58.8	5.5 to 6.0	39.8 to 43.4
* Main bearing case screw 1	M8 × 1.25	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
* Main bearing case screw 2	M9 × 1.25	49.0 to 53.9	5.0 to 5.5	36.2 to 39.8
Bearing case cover screw	M6 × 1.0	9.8 to 11.3	1.00 to 1.15	7.2 to 8.3
* Idle gear shaft 1 mounting screw	M6 × 1.0	9.8 to 11.3	1.00 to 1.15	7.2 to 8.3
* Oil pressure switch	PT 1/8	14.7 to 19.6	1.5 to 2.0	10.8 to 14.5
Idle adjust screw cap nut	M6 × 1.0	7.8 to 9.8	0.8 to 1.0	5.8 to 7.2
Fuel limit cap nut	M6 × 1.0	7.8 to 9.8	0.8 to 1.0	5.8 to 7.2

■ NOTE

- **In removing and applying the bolts and nuts marked with "*", a pneumatic wrench or similar pneumatic tool, if employed, must be used with enough care not to get them seized.**
- **For * marked screws, bolts and nuts on the table, apply engine oil to their threads and seats before tightening.**
- **The letter "M" in size × 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.**

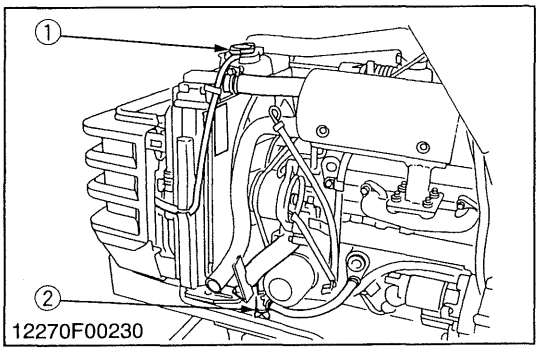
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CHECKING, DISASSEMBLING AND SERVICING

[1] SEPARATING ENGINE

(1) Draining Coolant, Engine Oil and Transmission Fluid



Draining Coolant

CAUTION

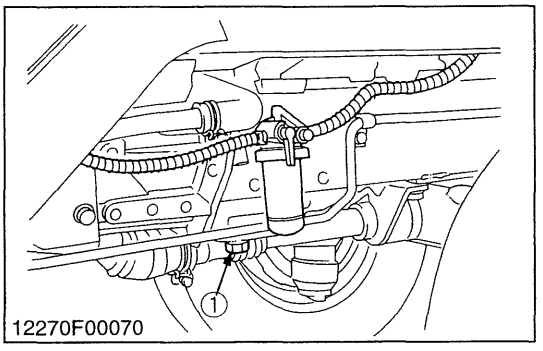
- **Never open the radiator cap while operating or immediately after stopping. Otherwise, hot water will spout out from the radiator. Wait for more than ten minutes to cool the radiator, before opening the cap.**

1. Loosen the drain cock (2) from the radiator hose to drain cooling water.
2. Remove the radiator cap (1) to drain coolant completely.

Coolant capacity (with recovery rank)	B2410	3.8 L 4.0 U.S.qts. 3.3 Imp.qts.
	B2710 B2910	4.5 L 4.7 U.S.qts. 4.0 Imp.qts.

(1) Radiator Cap (2) Drain Cock

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Draining Engine Oil

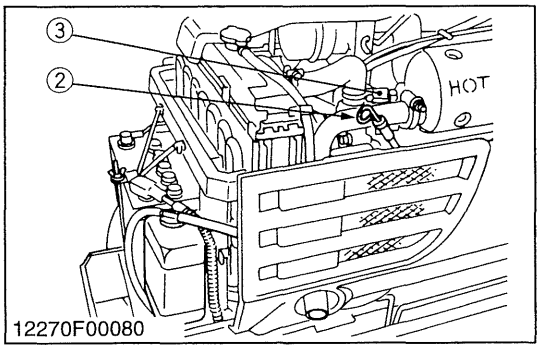
1. Start and warm up the engine for approx. 5 minutes.
2. Place an oil pan underneath the engine.
3. Remove the drain plug (1) to drain oil.
4. Screw in the drain plug (1).

(When refilling)

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

IMPORTANT

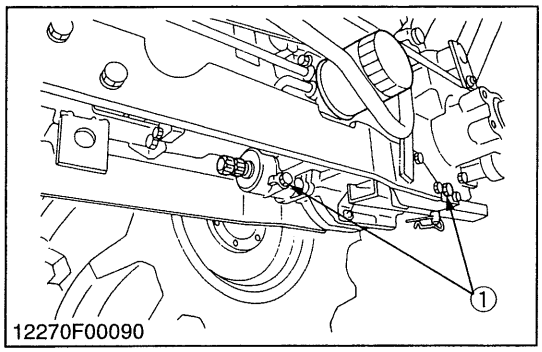
- **Never mix two different type of oil.**
- **Use the proper SAE Engine Oil according to ambient temperature.**
  Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-8)

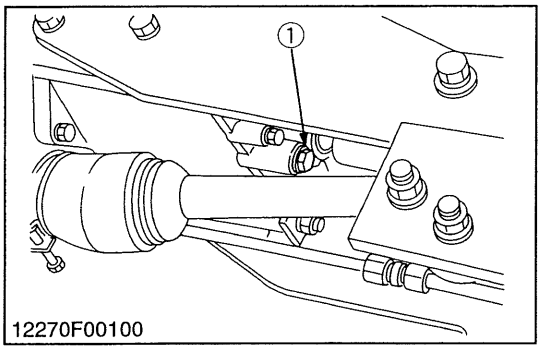


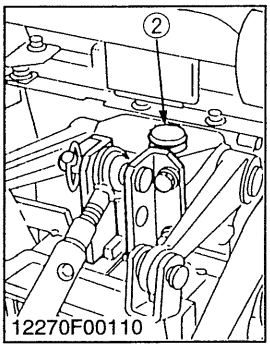
Engine oil capacity	B2410	3.0 L 3.2 U.S.qts. 2.6 Imp.qts.
	B2710 B2910	4.1 L 4.3 U.S.qts. 3.6 Imp.qts.

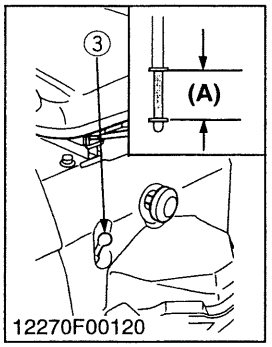
(1) Drain Plug (3) Dipstick
(2) Oil Inlet Plug

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Draining Transmission Fluid

1. Place oil pan underneath the transmission case, and remove the drain plugs (1).
2. Drain the transmission fluid.
3. Reinstall the drain plug (1).

(When refilling)

- Fill new oil from filling port after remaining the filling plug (2) up to the upper notch on the dipstick (3).
- After running the engine for few minutes, stop it and check the oil level again, if low, add oil prescribed level.

■ IMPORTANT

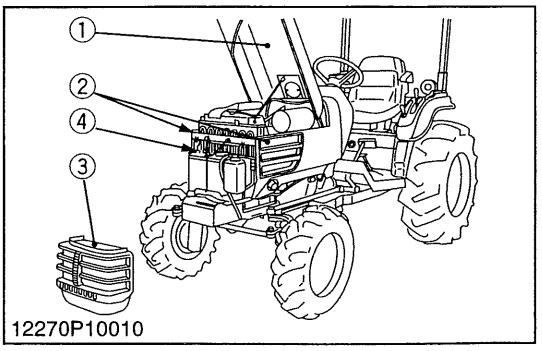
- **Use only KUBOTA SUPER UDT fluid-Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-8.)**
- **Never work the tractor immediately after changing the transmission oil. Keeping the engine at medium speed for a few minutes to prevents damage to the transmission.**
- **Do not mix different blands oil together.**

Transmission fluid capacity	B2410	12.5 L 3.30 U.S.gals. 2.75 Imp.gals.
	B2710	Affeted Serial No.: below 15496 14.0 L 3.70 U.S.gals. 3.08 Imp.gals. Affeted Serial No.: above 50101 14.5 L 3.83 U.S.gals. 3.19 Imp.gals.
	B2910	14.5 L 3.83 U.S.gals. 3.19 Imp.gals.

(1) Drain Plug
(2) Filling Port
(3) Dipstick

(A) Oil level is acceptable within this range.

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Hood, Side Cover and Battery Cord

1. Open the hood (1) and remove the front grille (3).
2. Disconnect the battery grounding cord (4).
3. Disconnect the head light connectors and remove the hood and side covers (2).

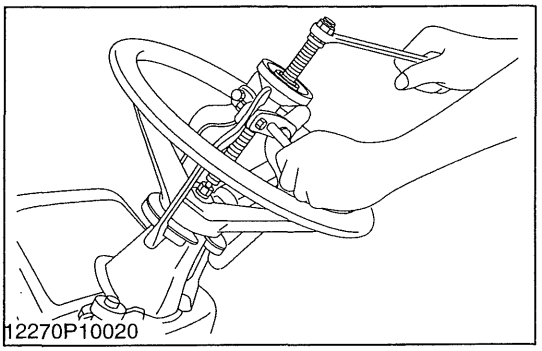
■ NOTE

- **When disconnecting the battery cords, disconnect the grounding cord first. When connecting, positive cord first.**

(1) Hood
(2) Side Cover
(3) Front Grille
(4) Battery Cord

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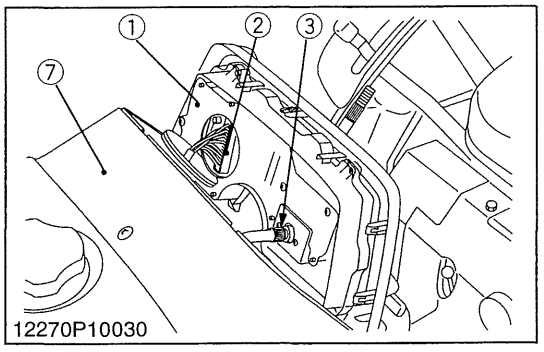
Steering Wheel

1. Remove the steering wheel cap.
2. Remove the steering wheel mounting nut and remove the steering wheel with a steering wheel puller (Code No. 07916-51090).

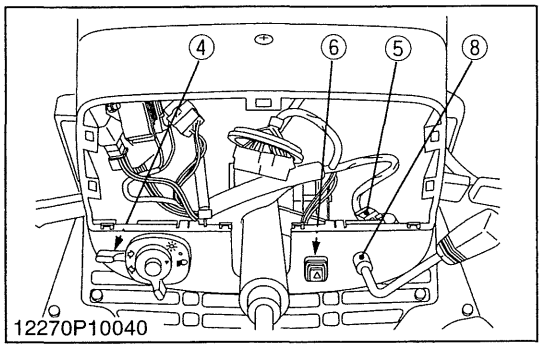
(When reassembling)

Tightening torque	Steering wheel mounting nut	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft-lbs

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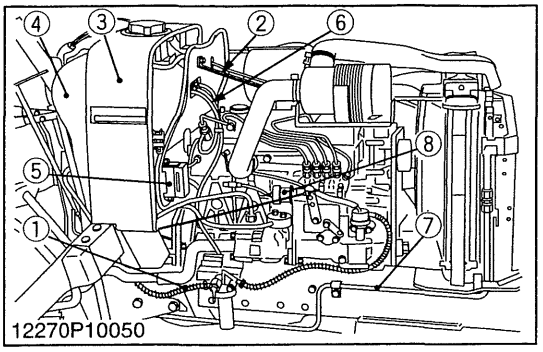
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Meter Panel and Panel Under Cover

1. Open the meter panel (1) and disconnect the meter panel connector (2) and hour-meter cable (3). Then remove the meter panel.
2. Disconnect the combination switch connector (4), main switch connector (5) and hazard switch connector (6).
3. Tap out the spring pin and remove the hand accelerator lever (8).
4. Remove the panel under cover (7).

(1) Meter Panel
(2) Meter Panel Connector
(3) Hour-meter Cable
(4) Combination Switch Connector
(5) Main Switch Connector
(6) Hazard Switch Connector
(7) Panel Under Cover
(8) Hand Accelerator Lever

12270S10130



Fuel Tank

1. Disconnect the fuel hose (1) at the fuel filter side, then drain fuel completely.
2. Remove the fuel tank frame stay (2).
3. Disconnect the hazard unit, starter relay and regulator connectors and remove the lead wire for fuel gauge.
4. Remove the fuse box (5).
5. Disconnect the overflow hoses (6) of fuel line.
6. Remove the tank frame (3) with fuel tank (4).
7. Disconnect the hydraulic pipes (7) and remove the battery stay with oil cooler.
8. Disconnect the 2P connector and remove the engine stop solenoid (8).

(When reassembling)

- Apply a thin coat of liquid gasket (Three Bond 1215 or equivalent) to both surface of the engine stop solenoid (8).

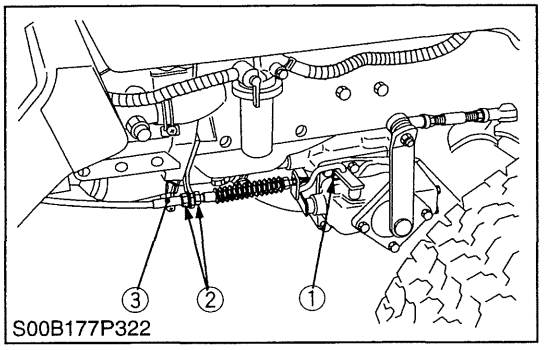
■ NOTE

- **For fastening hydraulic pipe nut, use two wrenches. Hold the fitting with a wrench, turn the pipe nut with another wrench to avoid damage at fitting installed part.**

Tightening torque	Delivery pipe nut for HST	34 to 39 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs
	Oil cooler pipe nut	50 to 58 N·m 5.1 to 5.9 kgf·m 36.9 to 42.8 ft-lbs
	Delivery pipe nut for power steering	65 to 75 N·m 6.6 to 7.7 kgf·m 47.9 to 55.3 ft-lbs

(1) Fuel Hose
(2) Fuel Tank Frame Stay
(3) Fuel Tank Frame
(4) Fuel Tank
(5) Fuse Box
(6) Overflow Hose
(7) Hydraulic Pipe
(8) Engine Stop Solenoid

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Bi-speed Turn Cable

1. Remove the spring lock pin (1) and loosen the lock nuts (2) and then remove the bi-speed turn cable (3).

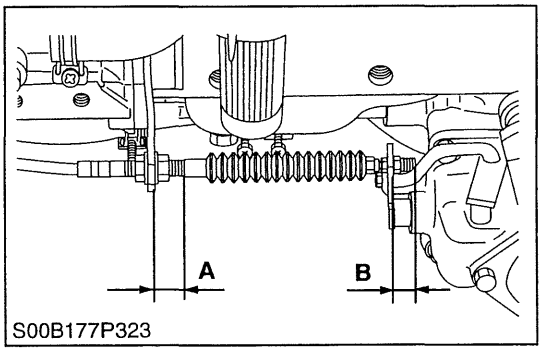
(When reassembling)

- When reassembling the bi-speed turn cable (3), make sure the distance **A**.

Distance **A**	Factory spec.	18 mm 0.71 in.

(Reference)

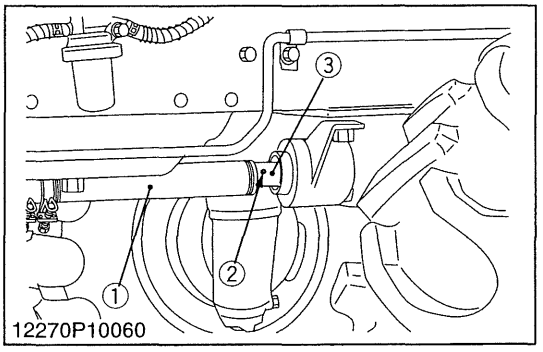
Distance **B**	Factory spec.	10 mm 0.39 in.



(1) Spring Lock Pin
(2) Lock Nut
(3) Bi-speed Turn Cable

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Propeller Shaft Cover and Coupling

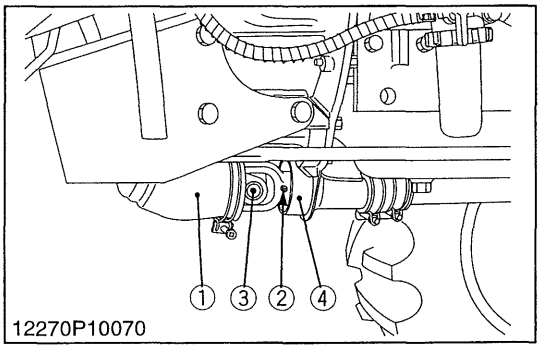
1. Loosen the clamp and slide the propeller shaft cover (1) to the rear.
2. Tap out the spring pin (2) and then slide the coupling (3) to the rear.

(When reassembling)

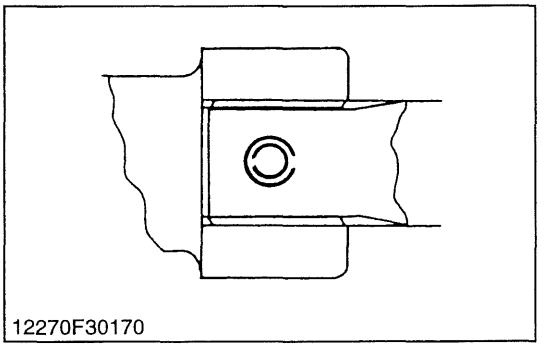
- Apply grease to the splines of the propeller shaft and coupling.

(1) Propeller Shaft Cover
(2) Spring Pin
(3) Coupling

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Universal Joint and Bearing Holder

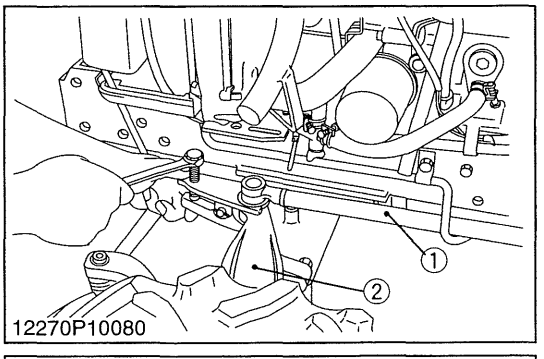
1. Loosen the clamp and slide the universal joint cover (1) to the rear.
2. Tap out the spring pins (2) and then slide the universal joint (3) to the rear.
3. Remove the bearing holder (4) with propeller shaft and universal joint.

(When reassembling)

- Apply grease to the splines of the propeller shaft and universal joint.
- When inserting the spring pins (2), face their splits in the direction parallel to the universal joint as shown in the figure.

(1) Universal Joint Cover
(2) Spring Pin
(3) Universal Joint
(4) Bearing Holder

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Drag Link

1. Remove the cotter pin and loosen the slotted nut.
2. Disconnect the drag link (1) with a pitman arm puller from the knuckle arm (2).

(When reassembling)

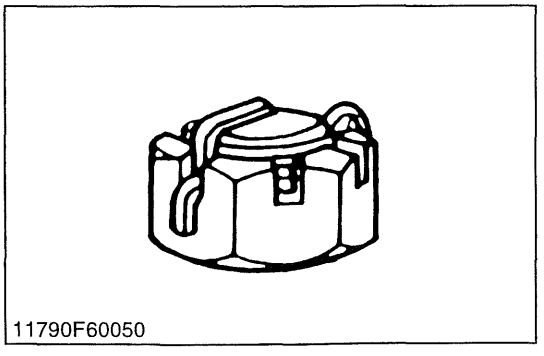
■ IMPORTANT

- **Do not loosen the slotted nut to align the hole.**
- **Install the cotter pin as shown in the figure**

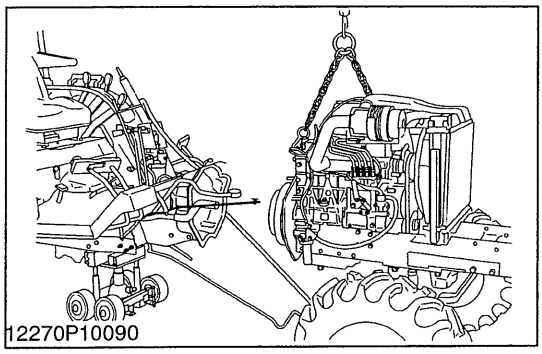
(Reference)

Tightening torque	Slotted nut	17.7 to 34.5 N·m 1.8 to 3.5 kgf·m 13.0 to 25.3 ft-lbs

(1) Drag Link
(2) Knuckle Arm


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Separating the Engine from Clutch Housing

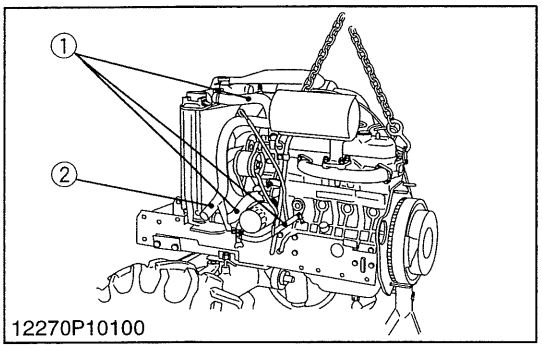
1. Disconnect the three point hitch delivery pipe and suction hose.
2. Disconnect the glow plug lead wire and thermo sensor lead wire. And then disconnect the connector for dynamo and starter motor lead wire.
3. Place the jack under the center frame.
4. Hoist the engine by the chain at the engine hook.
5. Remove the engine mounting screws and separate the engine from the clutch housing.

(When reassembling)

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

Tightening torque	Engine mounting M8 screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs
	Engine mounting M10 nut	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs

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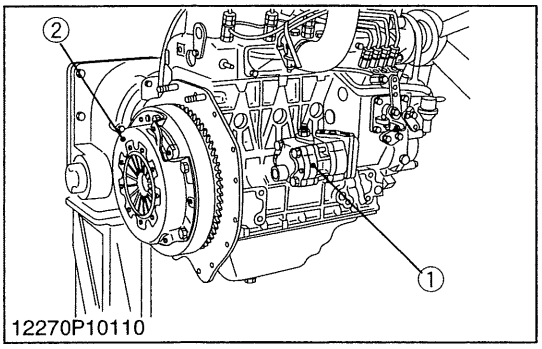
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Separating Front Axle Assembly

1. Disconnect the radiator hoses (1).
2. Remove the muffler pipe (2).
3. Hoist the engine by the chain at the engine hook.
4. Remove the front axle frame mounting screws and separate the front axle assembly from the engine.

(1) Radiator Hose (2) Muffler Pipe

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Outer Parts

1. Remove the hydraulic pump (1).
2. Remove the clutch assembly (2).

(When reassembling)

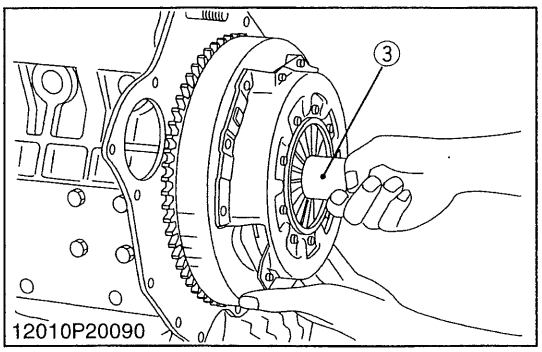
- Direct the shorter end of the clutch disc boss toward the flywheel.
- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the splines of clutch disc boss.
- Insert the pressure plate noting the position of straight pins.

■ IMPORTANT

- **Be sure to align the center of disc and flywheel by inserting the clutch center tool (3).**

■ NOTE

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



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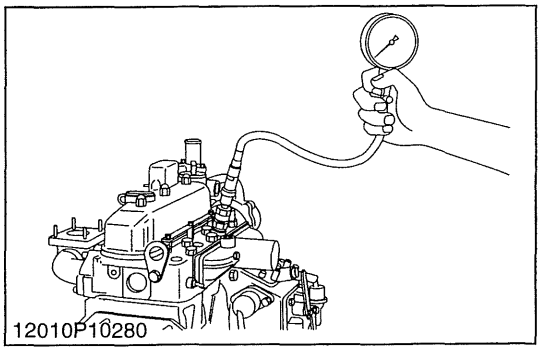
Tightening torque	Clutch cover mounting screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs

(1) Hydraulic Pump (3) Clutch Center Tool
(2) Clutch Assembly

12270S10200

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[2] ENGINE BODY
CHECKING AND ADJUSTING


12010P10280

Compression Pressure

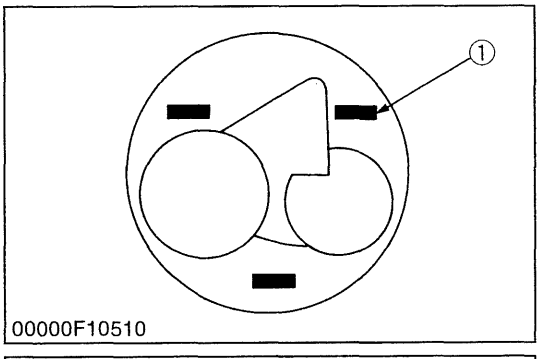
1. Run the engine until it is warmed up.
2. Stop the engine and disconnect the **2P** connector from the engine stop solenoid.
3. Remove the air cleaner, the muffler and all injection nozzles.
4. Set a compression tester (Code No. 07909-30208) with the adaptor to the nozzle hole.
5. While cranking the engine with the starter, measure the compression pressure.
6. Repeat steps 4 through 6 for each cylinder.
7. If the measurement is below the allowable limit, apply a small amount of oil to the cylinder wall through the nozzle hole and measure the compression pressure again.
8. If the compression pressure is still less than the allowable limit, check the top clearance, valve and cylinder head.
9. If the compression pressure increases after applying oil, check the cylinder wall and piston rings.

■ NOTE

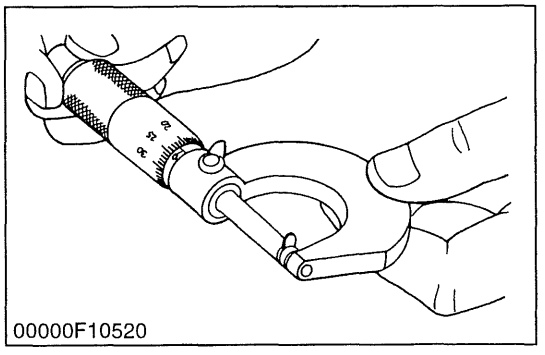
- **Check the compression pressure with the specified valve clearance.**
- **Always use a fully charged battery for performing this test.**
- **Variances in cylinder compression values should be under 10 %.**

Compression pressure	Factory spec.	2.84 to 3.24 MPa 29 to 33 kgf/cm^2 412 to 469 psi
	Allowable limit	2.26 MPa 23 kgf/cm^2 327 psi

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Top Clearance

1. Remove the cylinder head. (Do not attempt to remove the cylinder head gasket.)
2. Move the piston up, and stick a strip of fuse [1.5 mm dia. (0.059 in. dia.), 5 to 7 mm long (0.197 to 0.276 in. long)] on the piston head at three positions with grease so as to avoid the intake and exhaust valves and the combustion chamber ports.
3. Lower the piston, and install the cylinder head and tighten the cylinder head screws to the specified torque.
4. Turn the crankshaft until the piston exceeds its top dead center.
5. Remove the cylinder head, and measure the thickness of the squeezed fuses.
6. If the measurement is not within the factory specifications, check the oil clearance between the crankpin and crankpin bearing and between the piston pin and small end bushing.

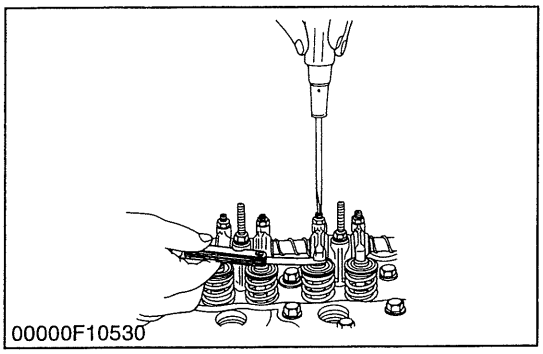
■ NOTE

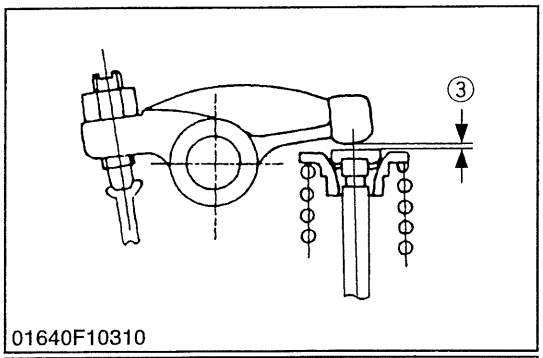
- **After checking the top clearance, be sure to assemble the cylinder head with a new cylinder head gasket.**

Top clearance	Factory spec.	0.55 to 0.70 mm 0.0217 to 0.0276 in.

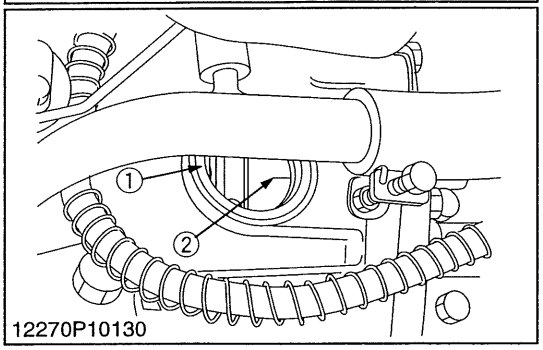
(1) Fuse

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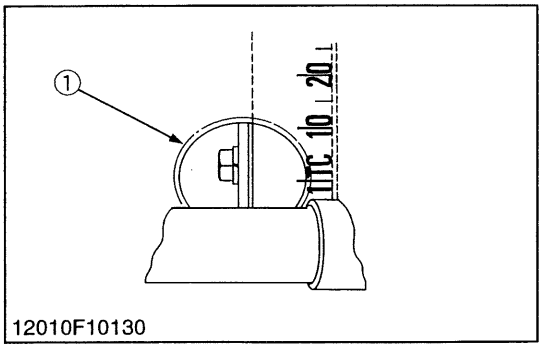

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Valve Clearance

■ 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 clutch housing.
2. Align the **"1TC"** mark line on the flywheel and center of timing window 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.	0.145 to 0.185 mm 0.0057 to 0.0073 in.

■ NOTE

- **The "TC" marking line 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 "TC" marking is aligned with center of timing window on clutch-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 compression 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 line and the center of timing window. 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.**
- **The sequence of cylinder numbers is given as No. 1, No. 2, No. 3 and No. 4 starting from the gear case side.**

Adjustable cylinder location of piston \ Valve arrangement		IN.		EX.	
		3 cyd.	4 cyd.	3 cyd.	4 cyd.
When No. 1 piston is compression top dead center	1st	☆	☆	☆	☆
	2nd		☆	☆	
	3rd	☆			☆
	4th	–	☆	–	
When No.1 piston is overlap position	1st				
	2nd	☆			☆
	3rd		☆	☆	
	4th	–		–	☆

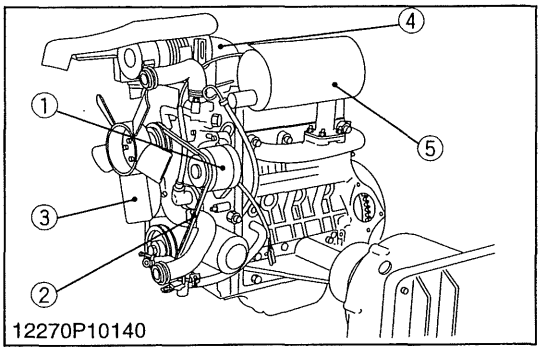
(1) Timing Window
(2) TC Mark Line
(3) Valve Clearance

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DISASSEMBLING AND ASSEMBLING

(1) Cylinder Head and Valves



12270P10140

Dynamo, Fan Belt and Muffler

1. Remove the dynamo (1) and fan belt (2).
2. Remove the cooling fan (3) and fan pulley.
3. Remove the air cleaner assembly and stay.
4. Remove the muffler (5).

(When reassembling)

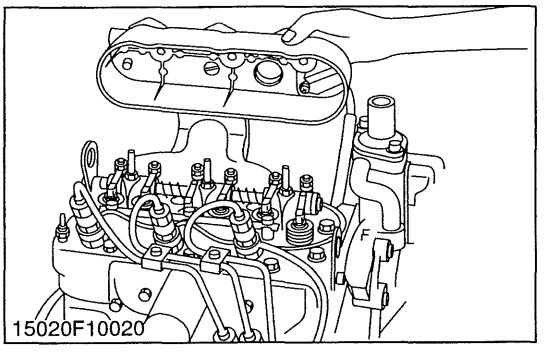
- Check to see that there are no cracks on the belt surface.

■ IMPORTANT

- **After reassembling the fan belt, be sure to adjust the fan belt tension (See page G-22).**

(1) Dynamo
(2) Fan Belt
(3) Cooling Fan
(4) Air Cleaner
(5) Muffler

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Cylinder Head Cover and Injection Pipes

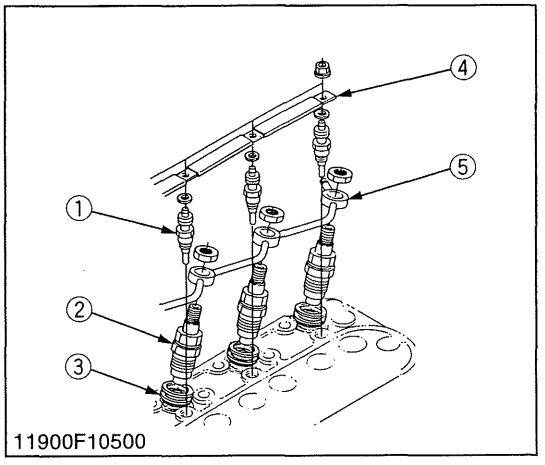
1. Remove the head cover cap nuts.
2. Remove the cylinder head cover.
3. Loosen the screws on the pipe clamps.
4. Detach the injection pipes.

(When reassembling)

- Check to see if the cylinder head cover gasket is not defective.
- Sent compressed air into the pipes to blow out dust. Then, reassemble the pipes in the reverse order.

Tightening torque	Cylinder head cover cap nut	6.9 to 8.8 N·m 0.7 to 0.9 kgf·m 5.1 to 6.5 ft-lbs
	Injection pipe retaining nut	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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Nozzle Holder Assembly and Glow Plug

1. Remove the overflow pipe assembly (5).
2. Remove the nozzle holder assemblies (2).
3. Remove the copper gasket and heat seal (3).
4. Remove the lead (4) from the glow plugs.
5. Remove the glow plugs (1).

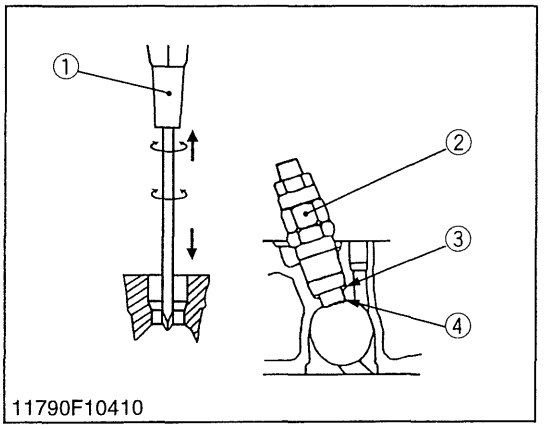
(When reassembling)

- 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
	Glow plug	7.8 to 14.7 N·m 0.8 to 1.5 kgf·m 5.8 to 10.8 ft-lbs

(1) Glow Plug
(2) Nozzle Holder Assembly
(3) Heat Seal
(4) Lead
(5) Overflow Pipe Assembly

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Nozzle Heat Seal Service Removal Procedure

■ IMPORTANT

- **Use a plus (phillips head) screw driver (1) that has a Dia. which is bigger than the heat seal hole (Approx. 6 mm) 1/4 in.**

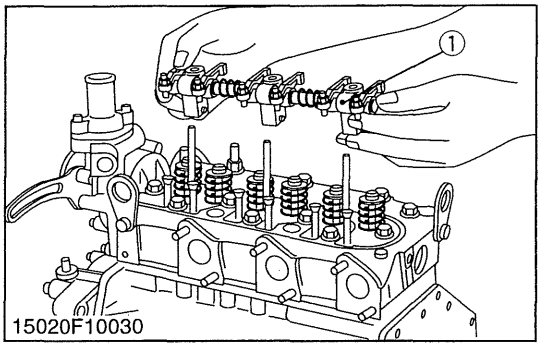
1. Drive screw driver (1) lightly into the heat seal hole.
2. Turn screw driver three or four times each way.
3. While turning the screw driver, slowly pull the heat seal (4) out together with the copper gasket (3).
4. If the heat seal drops, repeat the above procedure.

(When reassembling)

- Heat seal and copper gasket must be changed when the injection nozzle is removed for cleaning or for service.

(1) Plus Screw Driver
(2) Nozzle Holder
(3) Copper Gasket
(4) Heat Seal

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Rocker Arm and Push Rod

1. Remove the rocker arm bracket nuts.
2. Detach the rocker arm assembly (1).
3. Remove the push rods (2).

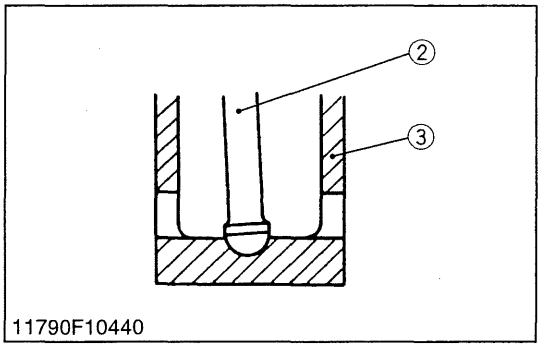
(When reassembling)

- When putting the push rods (2) onto the tappets (3), check to see if their ends are properly engaged with the grooves.

■ IMPORTANT

- After installing the rocker arm, be sure to adjust the valve clearance.

Tightening torque	Rocker arm bracket nut	21.6 to 26.5 N·m 2.2 to 2.7 kgf·m 15.9 to 19.5 ft-lbs

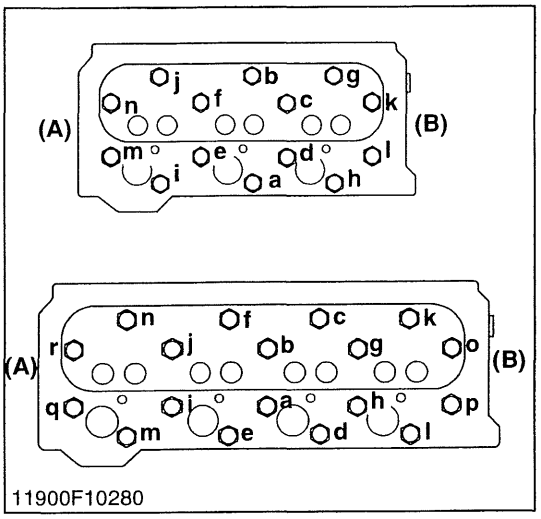


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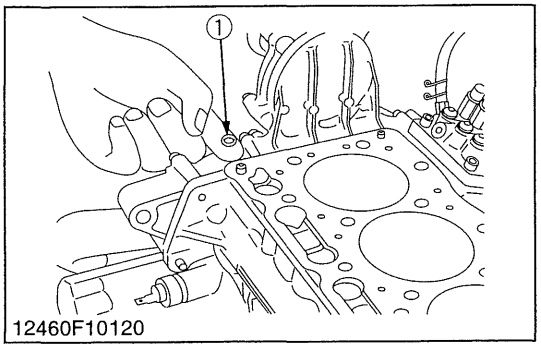
(1) Rocker Arm Assembly
(2) Push Rod
(3) Tappet

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Cylinder Head

1. Loosen the pipe clamp, and remove the water return pipe.
2. Remove the cylinder head screw in the order of **(n)** or (**r**) to **(a)**.
3. Lift up the cylinder head to detach.
4. Remove the cylinder head gasket and O-ring (1).

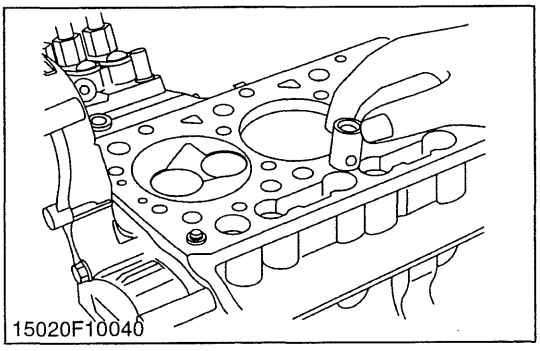
(When reassembling)

- Replace the cylinder head gasket with a new one.
- Securely fit the O-ring (1) to the pipe pin.
- Tighten the cylinder head screws after applying sufficient oil.
- Tighten the cylinder head screws gradually screw in the order of **(a)** to **(n)** or (**r**).
- Tighten them uniformly, or the head may deform in the long run.
- Retighten the cylinder head screws after running the engine for 30 minutes.

Tightening torque	Cylinder head screw	63.7 to 68.6 N·m 6.5 to 7.0 kgf·m 47.0 to 50.6 ft-lbs

(A) Flywheel Side
(B) Gear Case Side
(n) or (r) to (a) : To Loosen
(a) to (n) or (r) : To Tighten
(1) O-ring

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Tappets

1. Remove the tappets from the crankcase.

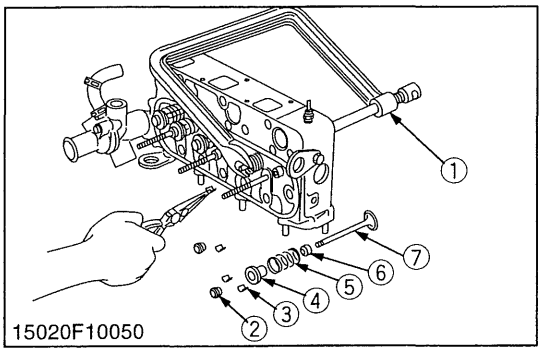
(When reassembling)

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

■ IMPORTANT

- **Do not change the combination of tappet and tappet guide.**

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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).

(When reassembling)

- Wash the valve stem and valve guide hole, and apply engine oil sufficiently
- After installing the valve spring collets, lightly tap the stem to assure proper fit with a plastic hammer.

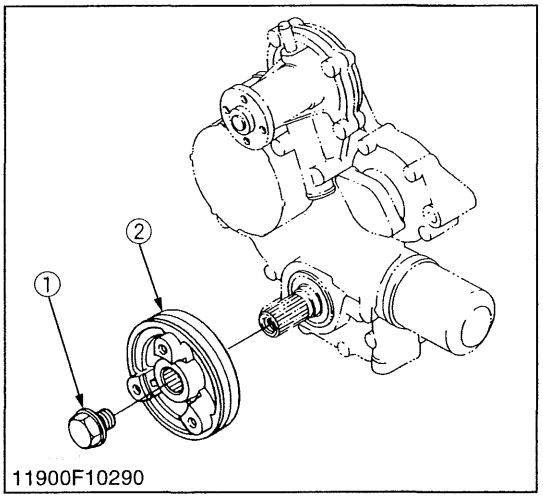
■ IMPORTANT

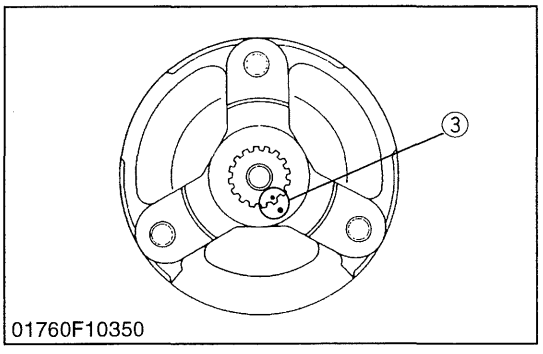
- **Don't change the combination of valve and valve guide.**

(1) Valve Spring Replacer
(2) Valve Cap
(3) Valve Spring Collet
(4) Valve Spring Retainer
(5) Valve Spring
(6) Valve Stem Seal
(7) Valve

12280S10220

(2) Timing Gears, Camshaft and Fuel Camshaft





Fan Drive Pulley

1. Set the stopper to the flywheel.
2. Remove the fan drive pulley screw (1).
3. Draw out the fan drive pulley (2) with a puller.

(When reassembling)

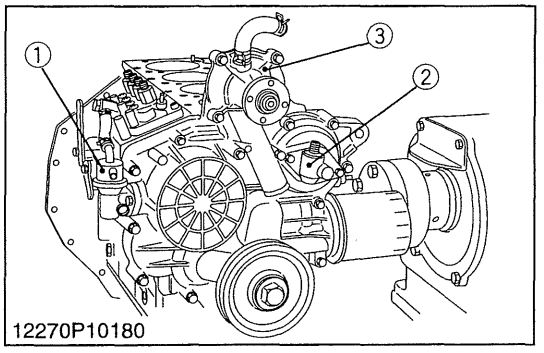
- Install the fan drive pulley to the crankshaft, aligning the marks (3) on them. (D1105 only).

Tightening torque	Fan drive pulley retaining screw	235.4 to 245.2 N·m 24.0 to 25.0 kgf·m 173.6 to 180.8 ft-lbs

(1) Fan Drive Pulley Screw
(2) Fan Drive Pulley
(3) Aligning Mark

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12270P10180

Fuel Pump, Hour Meter Gear Case and Water Pump

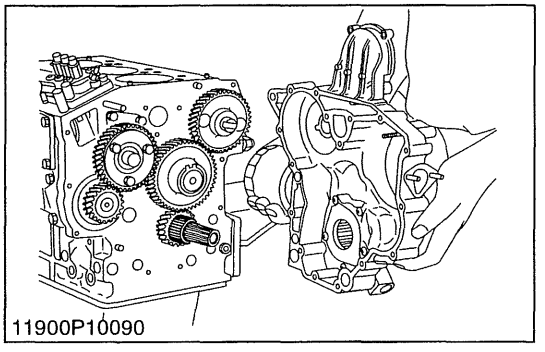
1. Remove the fuel pump (1).
2. Remove the hour meter gear case (2).
3. Remove the water pump flange.

(When reassembling)

- Before installing the hour meter gear case gasket, apply liquid gasket (Three Bond 1215 or equivalent) to the both side.

(1) Fuel Pump
(2) Hour Meter Gear Case
(3) Water Pump Flange

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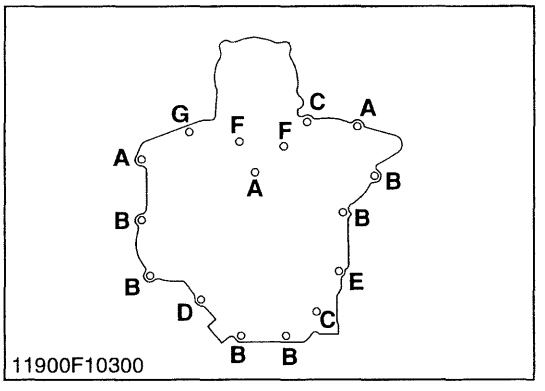

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Gear Case

1. Remove the gear case.
2. Remove the crankshaft collar and O-rings.

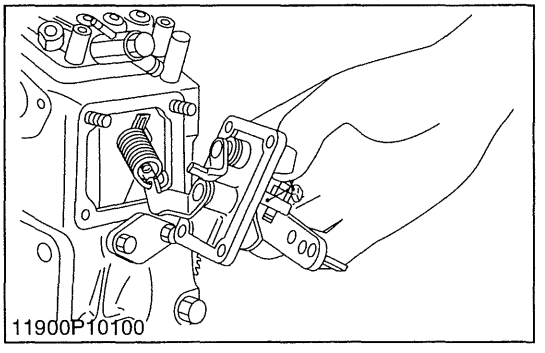
(When reassembling)

- Replace the gear case gasket with a new one.
- Be sure to set four O-rings inside the gear case and the O-ring on the crankshaft.
- Apply a thin film of engine oil to the oil seal, and install it, noting the lip come off.
- Length of the gear case mounting screws. (Refer to the figure.)
  A : 45 mm (1.77 in.)
  B : 50 mm (1.97 in.)
  C : 55 mm (2.17 in.)
  D : 59 mm (2.32 in.)
  E : 68 mm (2.68 in.)
  F : 80 mm (3.15 in.)
  G : Nut



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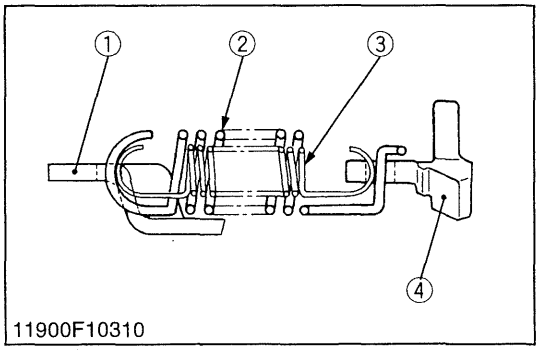
Speed Control Plate

1. Remove the speed control plate and governor lever (1) from the governor springs 1 (2) and 2 (3).

(When reassembling)

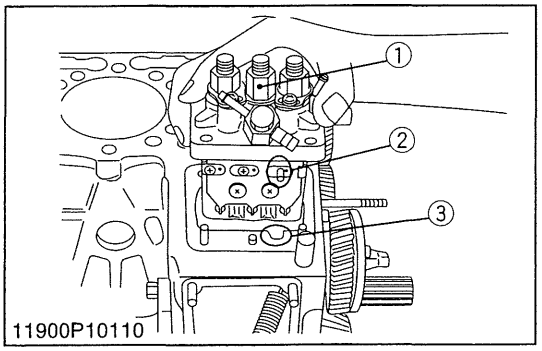
- Securely catch the governor springs 1 and 2 on the governor lever as shown in the figure.
- Apply a liquid gasket (Three Bond 1215 or equivalent) to both sides of the speed control plate gasket.

(1) Governor Lever
(2) Governor Spring 1
(3) Governor Spring 2 (D1105 only)
(4) Fork Lever 2

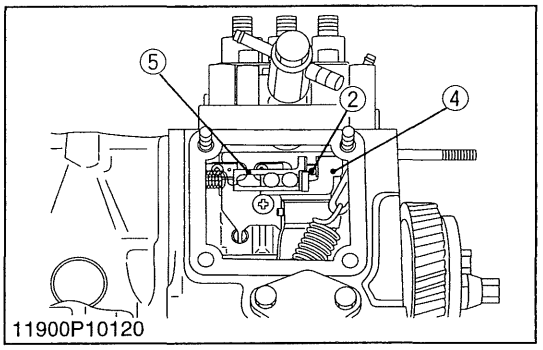


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Injection Pump

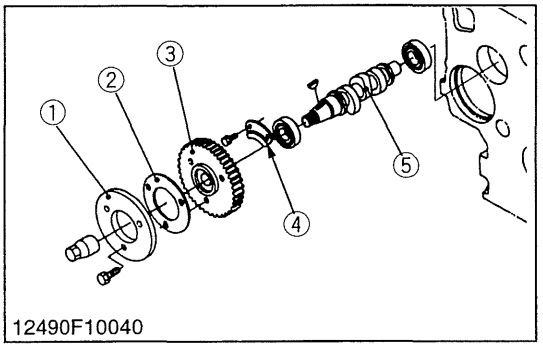
1. Remove the injection pump mounting screws and nuts.
2. Align the control rack pin (2) with the notch (3) on the crankcase, then remove the injection pump (1).
3. Remove the injection pump timing shims.
4. In principle, the injection pump should not be disassembled.

(When reassembling)

- Securely fit the control rack pin (2) to the grooves of the fork lever 1 (4) and thrust lever (5).
- 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.

(1) Injection Pump
(2) Control Rack Pin
(3) Notch
(4) Fork Lever 1
(5) Thrust Lever

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Fuel Camshaft

1. Remove the fuel camshaft stopper (4).
2. Draw out the fuel camshaft (5) and injection pump gear (3).
3. Remove the fuel feed pump cam (1) from the injection pump gear (3).

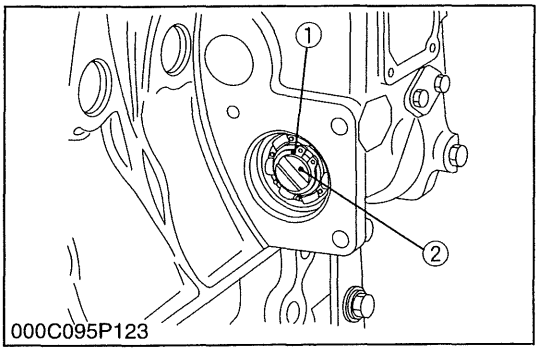
(When reassembling)

- Apply engine oil thinly to the fuel camshaft before installation.
- Check to see each aligning marks of cam (1) and gear (3) are aligned.

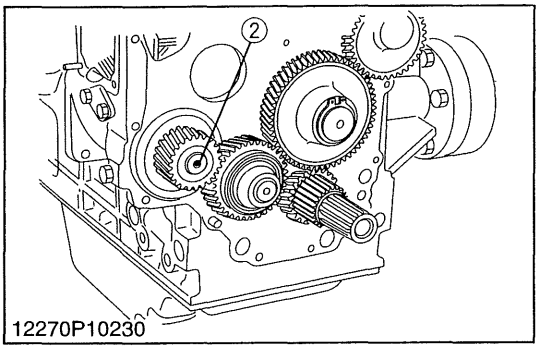
(1) Fuel Feed Pump Cam
(2) Washer
(3) Injection Pump Gear
(4) Fuel Camshaft Stopper
(5) Fuel Camshaft

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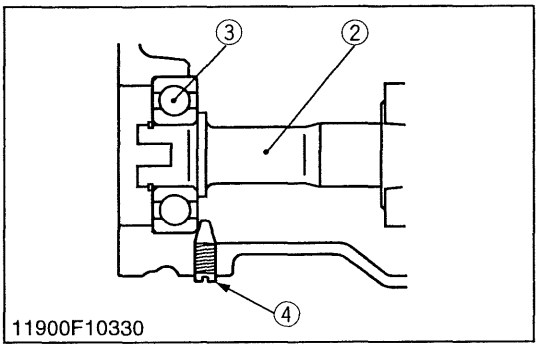
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Governor Shaft

1. Remove the external snap ring (1) from the governor shaft.
2. Pull out the governor shaft (2).

(When reassembling)

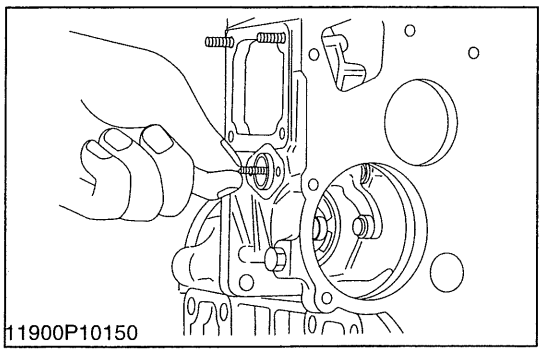
- Make sure assembling the external snap ring of the governor shaft.
- Check the governor shaft for smooth rotation.

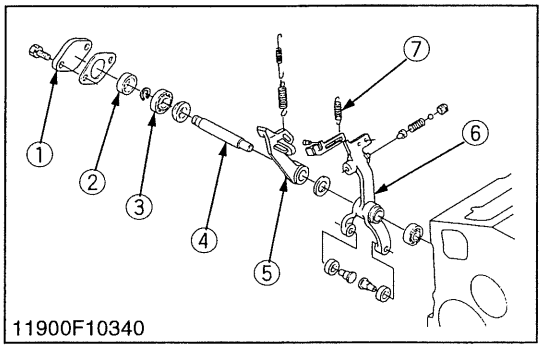
■ IMPORTANT

- **When replacing the ball bearing of governor shaft, securely fit the ball bearing (3) to the crankcase, apply an adhesive (Three Bond 1324B or equivalent) to the set screw (4), and fasten the screw until its tapered part contacts the circumferential end of the ball bearing.**

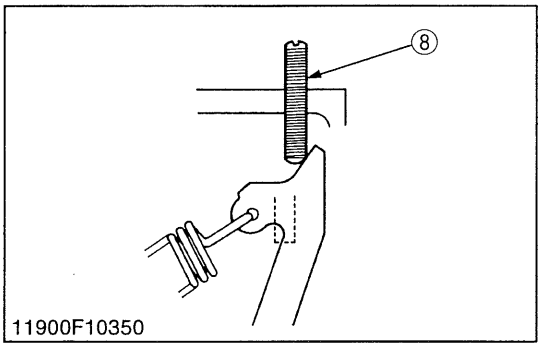
(1) External Snap Ring
(2) Governor Shaft
(3) Ball Bearing
(4) Set Screw

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Fork Lever

1. Remove the start spring (7).
2. Remove the fork lever shaft cover (1).
3. Pull out the fork lever shaft (4), and remove the spacer (2), bearing (3), fork levers 1 (6) and 2 (5).

(When reassembling)

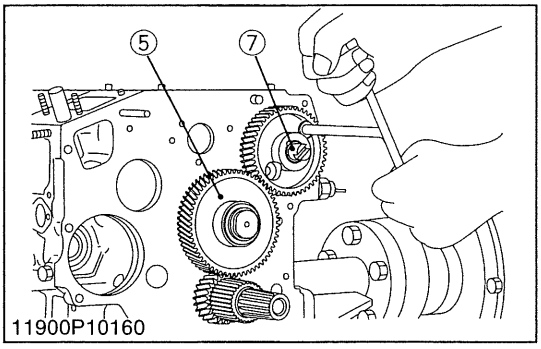
- Apply a liquid gasket (Three Bond 1215 or equivalent) to the both sides of the fork lever shaft cover, and fit the fork lever shaft cover with the **"UP"** mark facing upwards.
- Securely fit the start spring.

■ IMPORTANT

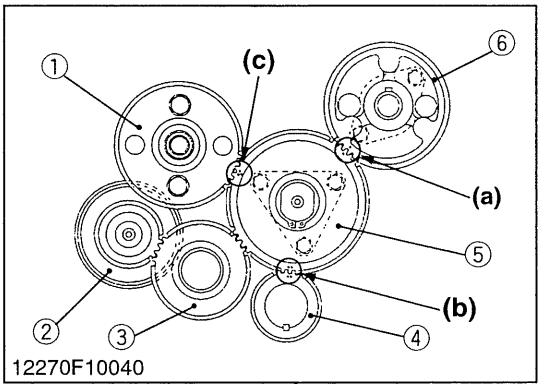
- **Install the fork lever 2 (5) to position it on the right side of the maximum output limit bolt (8) as shown in the figure.**

(1) Fork Lever Shaft Cover
(2) Spacer
(3) Bearing
(4) Fork Lever Shaft
(5) Fork Lever 2
(6) Fork Lever 1
(7) Start Spring
(8) Maximum Output Limit Bolt

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Camshaft and Idle Gear 1

1. Remove the external snap ring, and then remove the idle gear 1 (5).
2. Remove the camshaft stopper mounting screw, and pull out the camshaft (7).

(When reassembling)

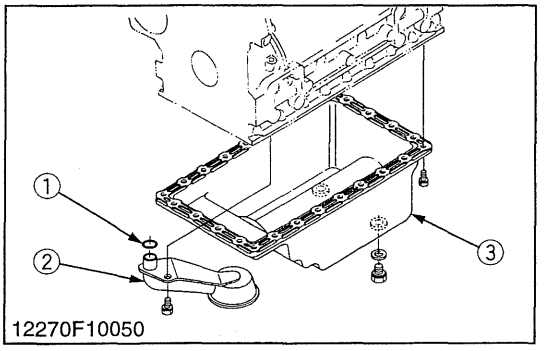
- When installing the idle gear 1, be sure to align the alignment marks **(a)**, **(b)**, **(c)** on the gears.
- Securely fit the external snap ring and stopper.

(1) Injection Pump Gear
(2) Governor Gear
(3) Idle Gear 2 (V1305, V1505)
(4) Crank Gear
(5) Idle Gear 1
(6) Cam Gear
(7) Camshaft
(a) Alignment Mark (Idle Gear 1 and Cam Gear)
(b) Alignment Mark (Idle Gear 1 and Crank Gear)
(c) Alignment Mark (Idle Gear 1 and Injection Pump Gear)

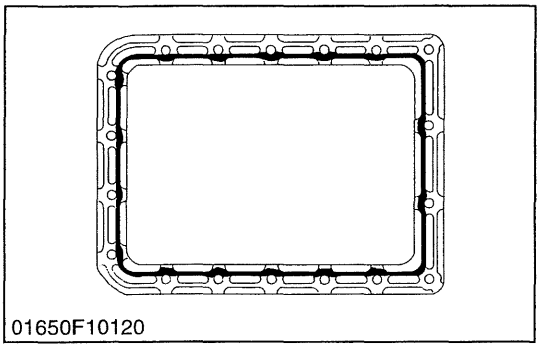
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(3) Piston and Connecting Rod



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Oil Pan and Oil Strainer

1. Remove the oil pan mounting screws.
2. Remove the oil pan (3) by lightly tapping the rim of the pan with a wooden hammer.
3. Remove the oil strainer (2).

(When reassembling)

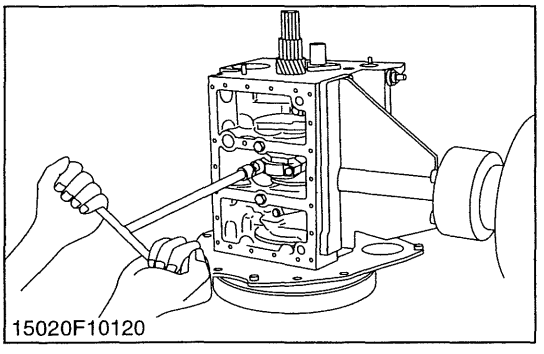
- After cleaning the oil strainer, check to see that the filter mesh in clean, and install it.
- Visually check the O-ring (1), apply engine oil, and install it.
- Securely fit the O-ring to the oil strainer.
- Apply a liquid gasket (Three Bond 1215 or equivalent) to the oil pan.
- To avoid uneven tightening, tighten oil pan mounting screws in diagonal order from the center.

■ IMPORTANT

- **Scrape off the old adhesive completely. Wipe the sealing surface clean using waste cloth soaked with gasoline. Now apply new adhesive 3 to 5 mm (0.12 to 0.20 in.) thick all over the contact surface. Apply the adhesive also on the center of the flange as well as on the inner wall of each bolt hole.**
- **Cut the nozzle of the "liquid gasket" (Three Bond 1207D or equivalent) container at its second notch. Apply "liquid gasket" about 5 mm (0.20 in.) thick.**
  Within 20 minutes after the application of fluid sealant, reassemble the components. Wait then for about 30 minutes, and pour oil in the crankcase.

(1) O-ring
(2) Oil Strainer
(3) Oil Pan

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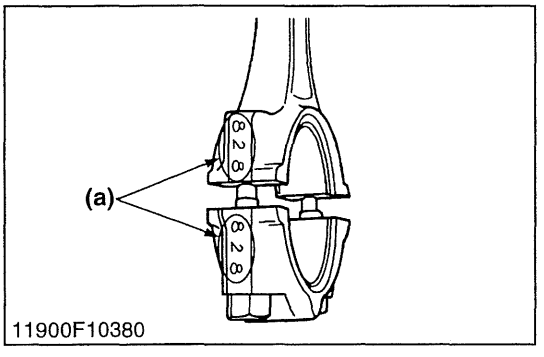
Connecting Rod Cap

1. Remove the connecting rod caps.

(When reassembling)

- Align the marks **(a)** with each other. (Face the marks toward the injection pump.)
- Apply engine oil to the connecting rod screws and lightly screw it in by hand, then tighten it to the specified torque.
  If the connecting rod screw won't be screwed in smoothly, clean the threads.
  If the connecting rod screw is still hard to screw in, replace it.

Tightening torque	Connecting rod screw	41.2 to 46.1 N·m 4.2 to 4.7 kgf·m 30.3 to 33.9 ft-lbs

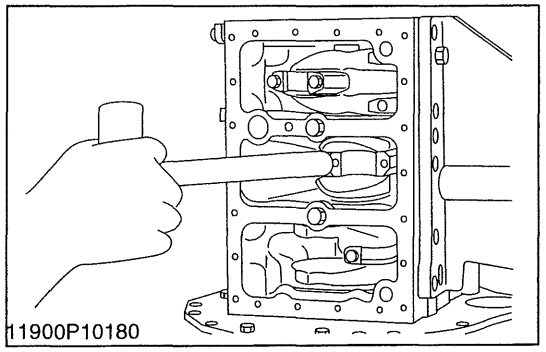


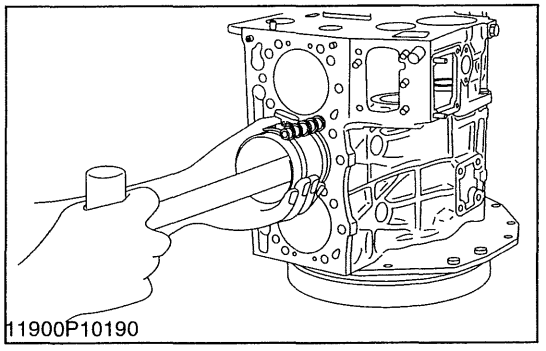
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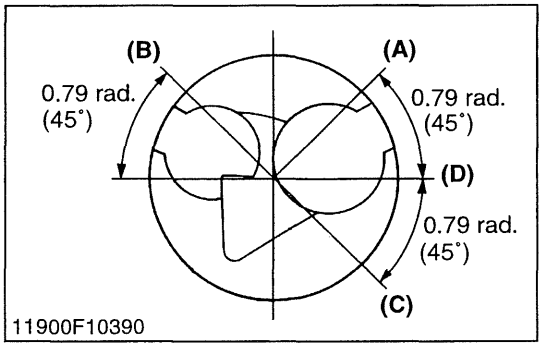
(a) Mark

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Pistons

1. Turn the flywheel and bring the piston to top dead center.
2. Draw out the piston 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 piston into the cylinder, apply enough engine oil to the piston.
- When inserting the piston into the cylinder, face the mark on the connecting rod to the injection pump.

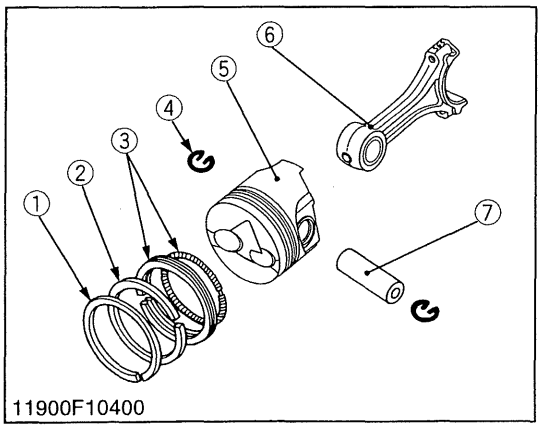
■ IMPORTANT

- **Do not change the combination of cylinder and piston. Make sure of the position of each piston by marking. For example, mark "1" on the No.1 piston.**
- **Place the piston rings with their gaps at 0.79 rad. (45°) from the piston pin's direction as shown in the figure.**
- **Carefully insert the pistons using a piston ring compressor. Otherwise, their chrome-plated section may be scratched, causing trouble inside the cylinder.**

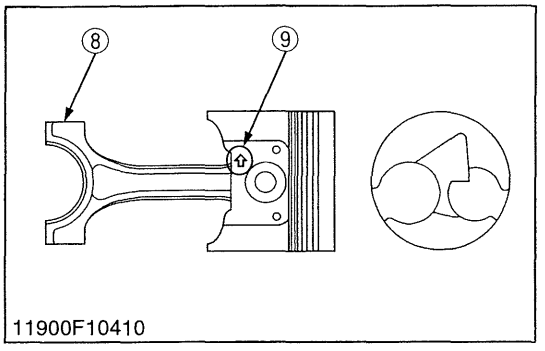
(A) Top Ring Gap
(B) Second Ring Gap
(C) Oil Ring Gap
(D) Piston Pin Hole

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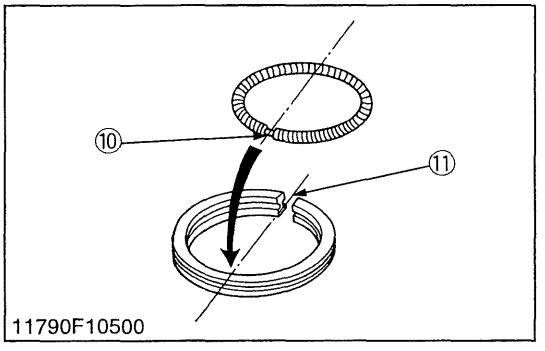
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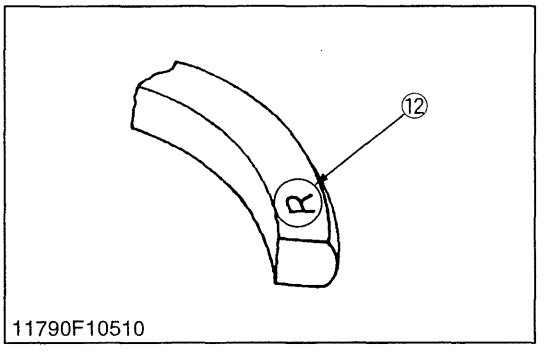
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Piston Ring and Connecting Rod

1. Remove the piston rings using a piston ring tool (Code No. 07909-32121).
2. Remove the piston pin (7), and separate the connecting rod (6) from the piston (5).

(When reassembling)

- When installing the ring, assemble the rings so that the manufacturer's mark (12) near the gap faces the top of the piston.
- When installing the oil ring onto the piston, place the expander joint (10) on the opposite side of the oil ring gap (11).
- 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.

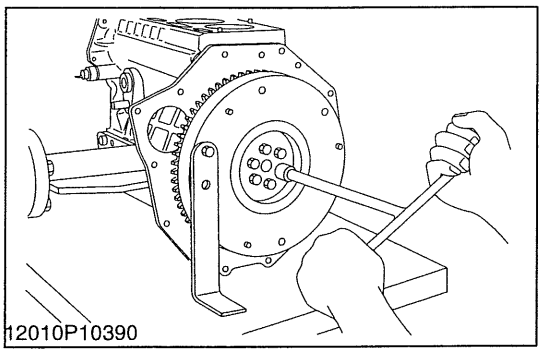
■ NOTE

- **When installing the connecting rod to the piston, align the mark (8) on the connecting rod to the arrow's direction of casting mark (9) on the piston.**
- **Mark the same number on the connecting rod and the piston so as not to change the combination.**

(1) Top Ring
(2) Second Ring
(3) Oil Ring
(4) Piston Pin Snap Ring
(5) Piston
(6) Connecting Rod
(7) Piston Pin
(8) Mark
(9) Casting Mark
(10) Expander Joint
(11) Oil Ring Gap
(12) Manufacturer's Mark

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(4) Crankshaft


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Flywheel

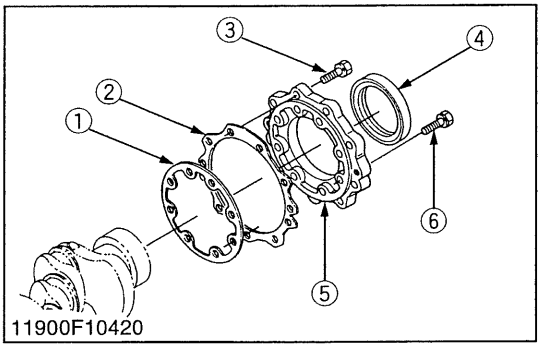
1. Fit the stopper to the flywheel.
2. Remove the flywheel screws and then remove the flywheel.

(When reassembling)

- Fit the flywheel giving care to the position of the knock pin.
- Apply engine oil to the threads and the undercut surface of the flywheel bolt and fit the bolt.

Tightening torque	Flywheel screw	53.9 to 58.8 N·m 5.5 to 6.0 kgf·m 39.8 to 43.4 ft-lbs

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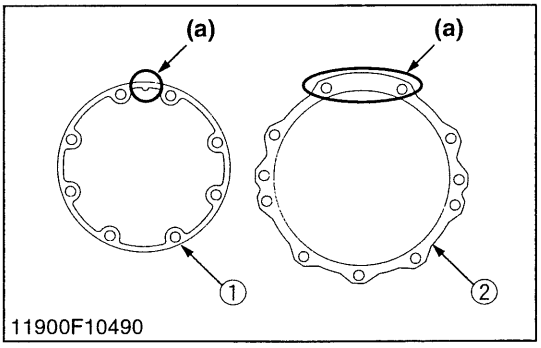
Bearing Case Cover

1. Remove the bearing case cover mounting screws. First, remove inside screws (6) and then outside screws (3).
2. Screw two removed screws into the screw hole of bearing case cover (5) to remove it.

(When reassembling)

- Fit the bearing case gasket (1) and the bearing case cover gasket (2) with correct directions.
- Install the bearing case cover to position the casting mark **"UP"** on it upward.
- Apply engine oil to the oil seal lip and take care that it is not rolled when installing.
- Tighten the bearing case cover mounting screws with even force on the diagonal line.

Tightening torque	Bearing case cover mounting screw	9.8 to 11.3 N·m 1.00 to 1.15 kgf·m 7.2 to 8.3 ft-lbs



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(1) Bearing Case Gasket
(2) Bearing Case Cover Gasket
(3) Bearing Case Cover Mounting Screw
(4) Oil Seal
(5) Bearing Case Cover
(6) Bearing Case Cover Mounting Screw
(a) Upside

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Crankshaft Assembly

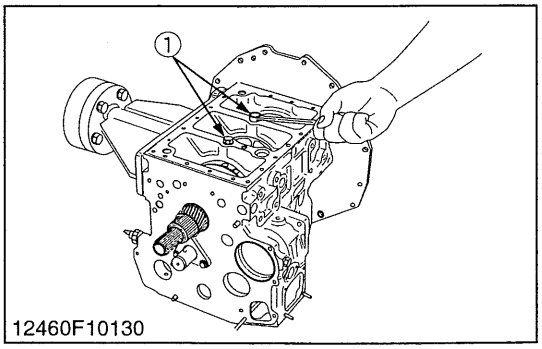
1. Remove the main bearing case screw 2 (1).
2. Pull out the crankshaft assembly.

■ IMPORTANT

- **Take care to protect crankshaft bearing 1 from scratches caused by the crank gear, etc. (Wrap the gear in vinyl tape, etc.)**

(When reassembling)

- Clean the oil passage of the crankshaft with compressed air.
- Apply oil to the main bearing case screw 2 (1).
- Install the crankshaft assembly, aligning the screw hole of main bearing case with the screw hole of crankcase.
- Clean the oil passage of the crankshaft with compressed air.

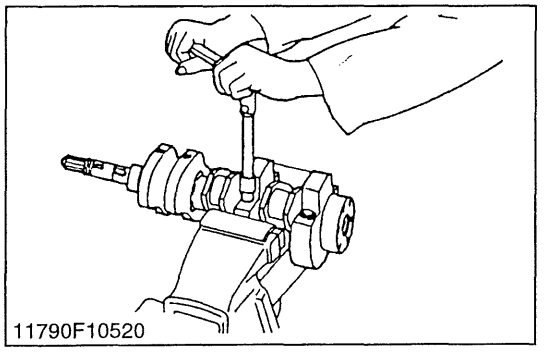


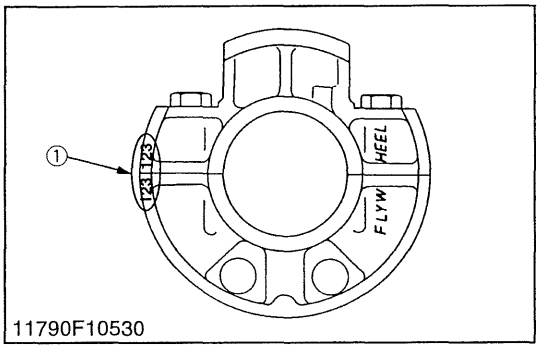
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Tightening torque	Main bearing case screw 2	49.0 to 53.9 N·m 5.0 to 5.5 kgf·m 36.2 to 39.8 ft-lbs

(1) Main Bearing Case Screw 2

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Main Bearing Case Assembly

1. Remove the two main bearing case screws 1, and remove the main bearing case assembly, being careful with the thrust bearing and crankshaft bearing 2.
2. Remove the main bearing case assembly 1, 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 case vary, install them in order of makings [**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.

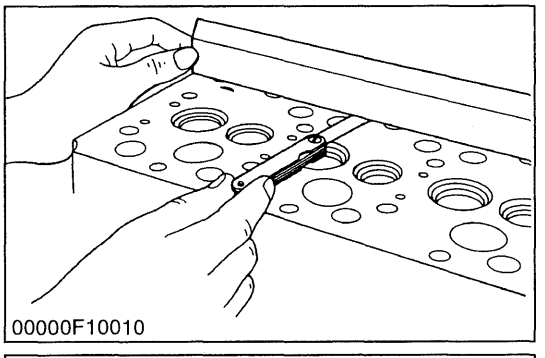
Tightening torque	Main bearing case screw 1	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs

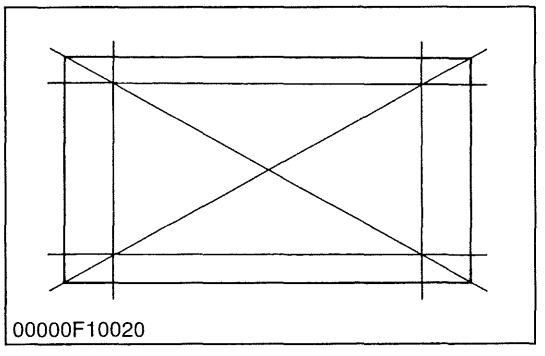
(1) Alignment Number

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SERVICING

(1) Cylinder Head and Valves


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Cylinder Head Surface Flatness

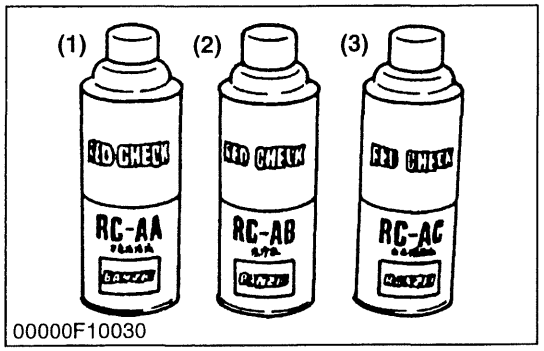
1. Clean the cylinder head surface.
2. Place a straightedge on the cylinder head's four sides and two diagonal as shown in the figure.
3. Measure the clearance with a feeler gauge.
4. If the measurement exceeds the allowable limit, correct it with a surface grinder.

■ IMPORTANT

- **Do not place the straightedge on the combustion chamber.**
- **Be sure to check the valve recessing after correcting.**

Cylinder head surface flatness	Allowable limit	0.05 mm 0.0019 in.

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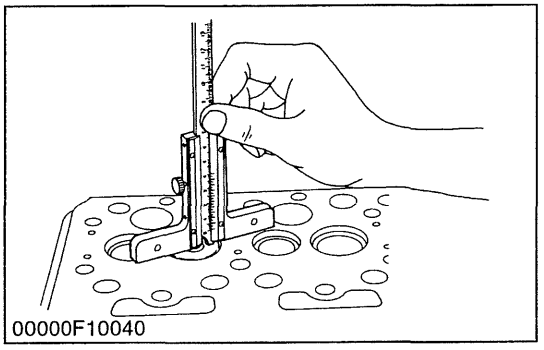
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Cylinder Head Flaw

1. Prepare an air spray red check (Code No. 07909-31371).
2. Clean the surface of the cylinder head with detergent (2).
3. Spray the cylinder head surface with the red permeative liquid (1). Leave it five to ten minutes after spraying.
4. Wash away the red permeative liquid on the cylinder head surface with the detergent (2).
5. Spray the cylinder head surface with white developer (3).
6. If flawed, it can be identified as red marks.

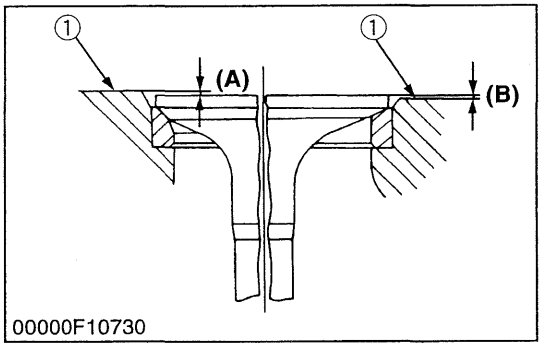
(1) Red Permeative Liquid
(2) Detergent
(3) White Developer

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Valve Recessing

1. Clean the cylinder head surface, valve face and valve seat.
2. Insert the valve into the valve guide.
3. Measure the valve recessing with a depth gauge.
4. If the measurement exceeds the allowable limit, replace the valve.
5. If it still exceeds the allowable limit after replacing the valve, correct the valve seat face of the cylinder head with a valve seat cutter (Code No. 07909-33102) or valve seat grinder.
6. Then, correct the cylinder head surface with a surface grinder, or replace the cylinder head.



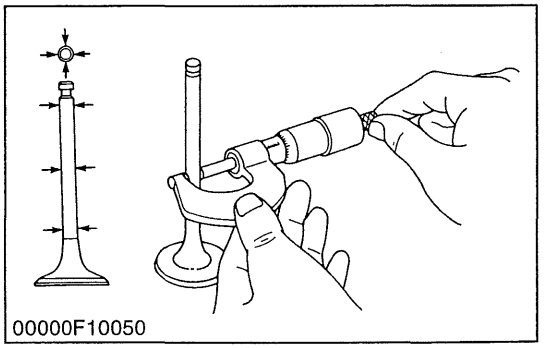
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Valve recessing	Factory spec.	0.05 (protrusion) to 0.15 (recessing) mm 0.0020 (protrusion) to 0.0059 (recessing) in.
	Allowable limit	0.40 (recessing) mm 0.0157 (recessing) in.

(1) Cylinder Head Surface

(A) Recessing
(B) Protrusion

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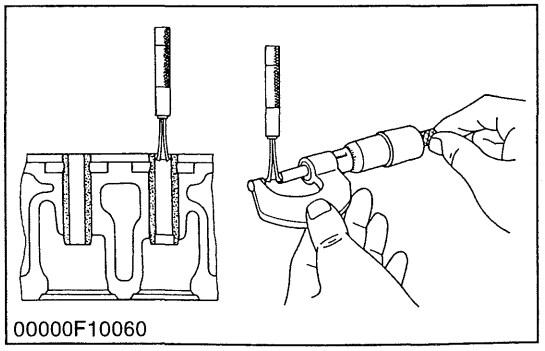

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Clearance between Valve Stem and Valve Guide

1. Remove carbon from the valve guide section.
2. Measure the valve stem O.D. with an outside micrometer.
3. Measure the valve guide I.D. with a small hole gauge, and calculate the clearance.
4. If the clearance exceeds the allowable limit, replace the valves. If it still exceeds the allowable limit, replace the valve guide.

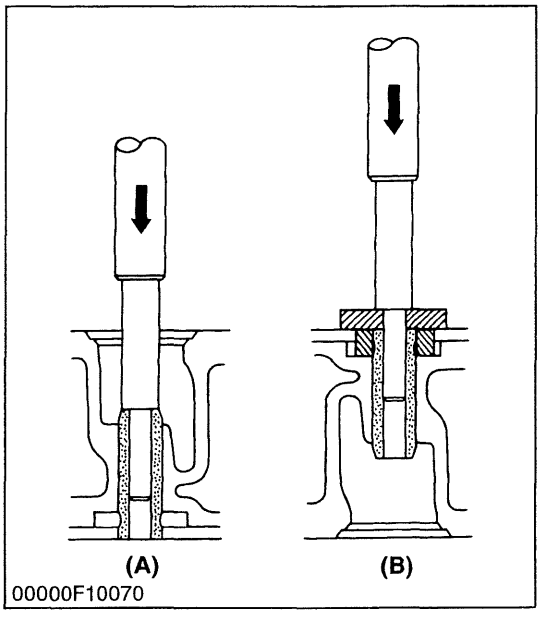
Clearance between valve stem and valve guide	Factory spec.	0.035 to 0.065 mm 0.00138 to 0.00256 in.
	Allowable limit	0.10 mm 0.0039 in.

Valve stem O.D.	Factory spec.	6.960 to 6.975 mm 0.27402 to 0.27461 in.
Valve guide I.D.	Factory spec.	7.010 to 7.025 mm 0.27599 to 0.27657 in.


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Replacing Valve Guide

(When removing)

1. Press out the used valve guide using a valve guide replacing tool.

(When installing)

1. Clean a new valve guide and valve guide bore, and apply engine oil to them.
2. Press in a new valve guide using a valve guide replacing tool.
3. Ream precisely the I.D. of the valve guide to the specified dimension.

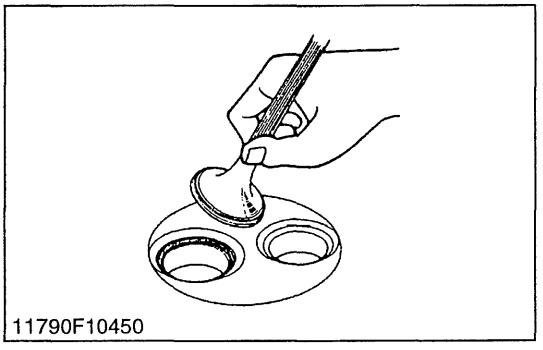
Valve guide I.D. (Intake and exhaust)	Factory spec.	7.010 to 7.025 mm 0.27599 to 0.27657 in.

■ IMPORTANT

- **Do not hit the valve guide with a hammer during replacement.**

(A) When Removing **(B) When Installing**

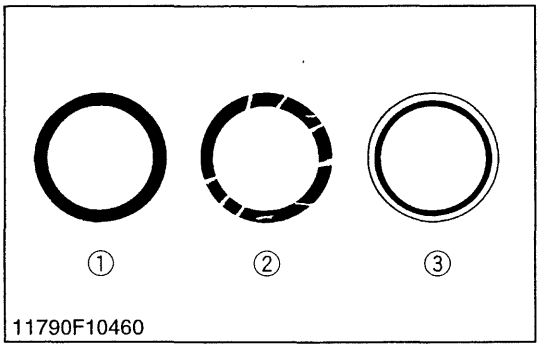
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Valve Seating

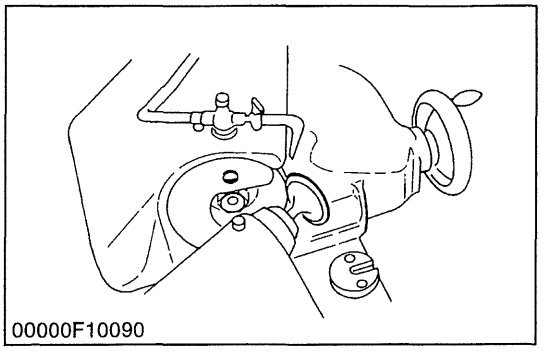
1. Coat the valve face lightly with prussian blue and put the valve on its seat to check the contact.
2. If the valve does not seat all the way around the valve seat or the valve contact is less than 70 %, correct the valve seating as follows.
3. If the valve contact does not comply with the reference value, replace the valve or correct the contact of valve seating.

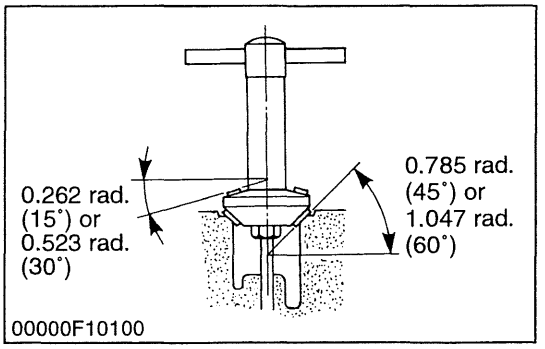
(1) Correct
(2) Incorrect
(3) Incorrect



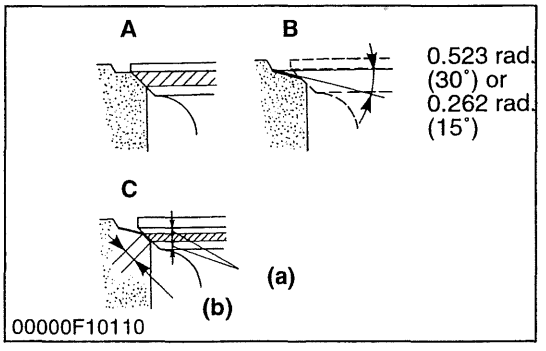
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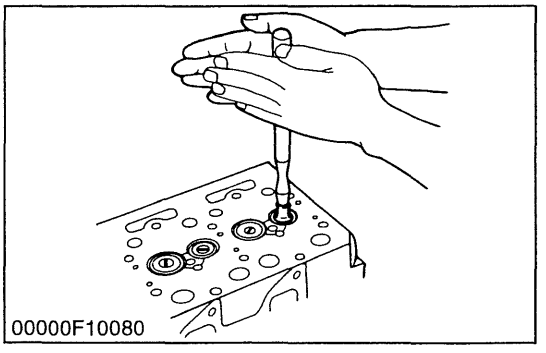

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Correcting Valve and Valve Seat

■ 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 1.047 rad. (60°) (intake valve) or 0.785 rad. (45°) (exhaust valve) seat cutter (Code No. 07909-33102).
2. Resurface the seat surface with a 0.523 rad. (30°) valve seat cutter to intake valve seat and with a 0.262 rad. (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 valve seat, and fit them with valve lapping tool.
4. Check the valve seating with prussian blue. The valve seating surface should show good contact all the way around.

(a) Identical Dimensions
(b) Valve Seat Width
(A) Check Contact
(B) Correct Seat Width
(C) Check Contact

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Valve Lapping

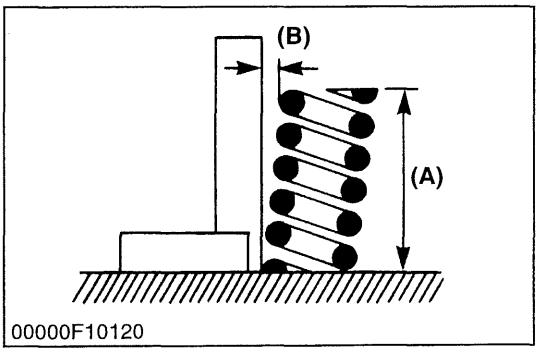
1. Apply compound evenly to the valve lapping surface.
2. Insert the valve into the valve guide. Lap the valve onto its seat with a valve flapper or screwdriver.
3. After lapping the valve, wash the compound away and apply oil, then repeat valve lapping with oil.
4. Apply prussian blue to the contact surface to check the seated rate. If it is less than 70 %, repeat valve lapping again.

■ IMPORTANT

- **When valve lapping is performed, be sure to check the valve recessing and adjust the valve clearance after assembling the valve.**

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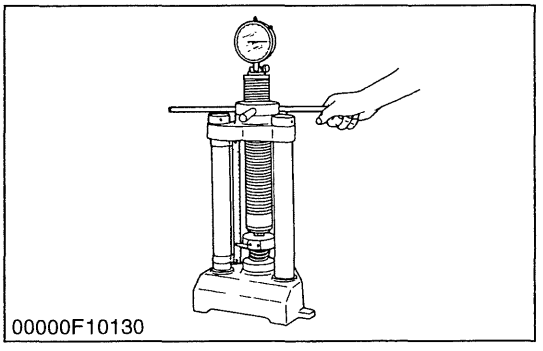
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Free Length and Tilt of Valve Spring

1. Measure the free length **(A)** of valve spring with vernier calipers. If the measurement is less than the allowable limit, replace it.
2. Put the valve spring on a surface plate, place a square on the side of the valve spring.
3. Check to see if the entire side is in contact with the square. Rotate the valve spring and measure the maximum tilt **(B)**. If the measurement exceeds the allowable limit, replace it. Check the entire surface of the valve spring for scratches. If there is any defect, replace it.

Free length **(A)**	Factory spec.	37.0 to 37.5 mm 1.457 to 1.476 in.
	Allowable limit	36.5 mm 1.437 in.
Tilt **(B)**	Allowable limit	1.0 mm 0.039 in.

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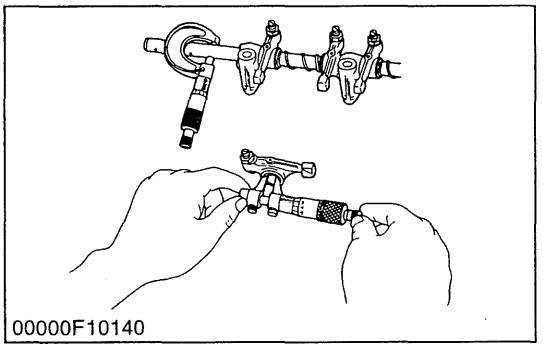

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Valve Spring Setting Load

1. Place the valve spring on a tester and compress it to the same length it is actually compressed in the engine.
2. Read the compression load on the gauge.
3. If the measurement is less than the allowable limit, replace it.

Setting load / Setting length	Factory spec.	117.6 N / 31.0 mm 12.0 kgf / 31.0 mm 26.4 lbs / 1.220 in.
	Allowable limit	100.0 N / 31.0 mm 10.2 kgf / 31.0 mm 22.5 lbs / 1.220 in.

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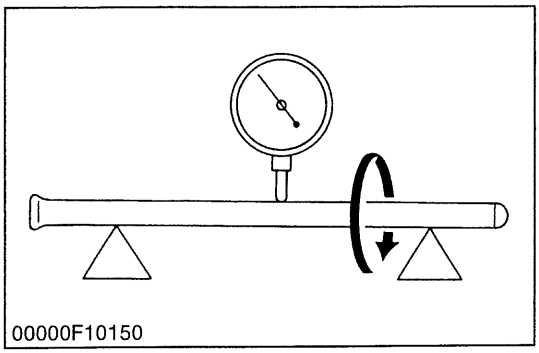

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Oil Clearance between Rocker Arm and Rocker Arm Shaft

1. Measure the rocker arm shaft O.D. with an outside micrometer.
2. Measure the rocker arm I.D. with an inside micrometer, and then calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace the rocker arm and measure the oil clearance again. If it still exceeds the allowable limit, replace also the rocker arm shaft.

Oil clearance between rocker arm and rocker arm shaft	Factory spec.	0.016 to 0.045 mm 0.00063 to 0.00177 in.
	Allowable limit	0.10 mm 0.0039 in.
Rocker arm shaft O.D.	Factory spec.	11.973 to 11.984 mm 0.47138 to 0.47181 in.
Rocker arm I.D.	Factory spec.	12.000 to 12.018 mm 0.47244 to 0.47315 in.

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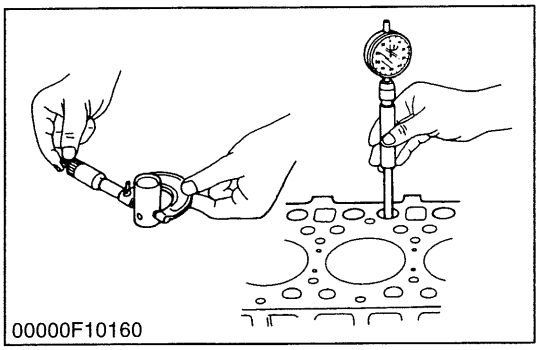

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Push Rod Alignment

1. Place the push rod on V blocks.
2. Measure the push rod alignment.
3. If the measurement exceeds the allowable limit, replace the push rod.

Push rod alignment	Allowable limit	0.25 mm 0.0098 in.

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Oil Clearance between Tappet and Tappet Guide Bore

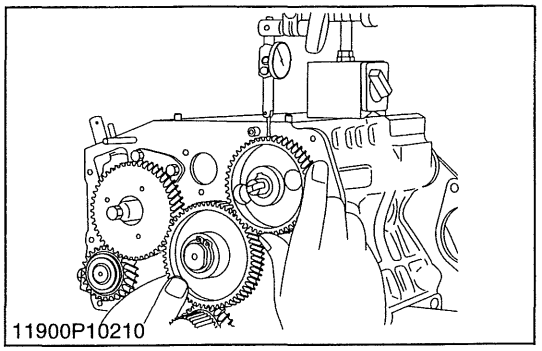
1. Measure the tappet O.D. with an outside micrometer.
2. Measure the I.D. of the tappet guide bore with a cylinder gauge, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit or the tappet is damaged, replace the tappet.

Oil Clearance between tappet and tappet 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.	19.959 to 19.980 mm 0.78579 to 0.78661 in.
Tappet guide bore I.D.	Factory spec.	20.000 to 20.021 mm 0.78740 to 0.78823 in.

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(2) Timing Gears, Camshaft and Fuel Camshaft



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 the gear.
4. If the oil clearance is proper, replace the gear.

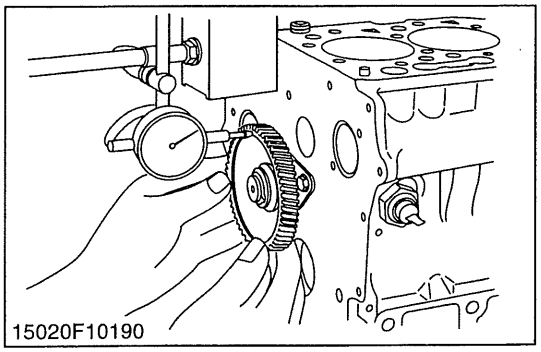
[D1105]

Backlash between idle gear and crank gear	Factory spec.	0.032 to 0.115 mm 0.00120 to 0.00453 in.
	Allowable limit	0.15 mm 0.0059 in.
Backlash between idle gear and cam gear	Factory spec.	0.036 to 0.114 mm 0.00142 to 0.00449 in.
	Allowable limit	0.15 mm 0.0059 in.
Backlash between idle gear and injection pump gear	Factory spec.	0.034 to 0.116 mm 0.00134 to 0.00457 in.
	Allowable limit	0.15 mm 0.0059 in.
Backlash between injection pump gear and governor gear	Factory spec.	0.030 to 0.117 mm 0.00118 to 0.00461 in.
	Allowable limit	0.15 mm 0.0059 in.

[V1305, V1505]

Backlash between idle gear 1 and crank gear	Factory spec.	0.032 to 0.115 mm 0.00120 to 0.00453 in.
	Allowable limit	0.15 mm 0.0059 in.
Backlash between idle gear 1 and cam gear	Factory spec.	0.036 to 0.114 mm 0.00142 to 0.00449 in.
	Allowable limit	0.15 mm 0.0059 in.
Backlash between idle gear 1 and injection pump gear	Factory spec.	0.034 to 0.116 mm 0.00134 to 0.00457 in.
	Allowable limit	0.15 mm 0.0059 in.
Backlash between idle gear 1 and idle gear 2	Factory spec.	0.033 to 0.117 mm 0.0013 to 0.0046 in.
	Allowable limit	0.15 mm 0.0059 in.
Backlash between gear 2 and governor gear	Factory spec.	0.030 to 0.117 mm 0.00118 to 0.00461 in.
	Allowable limit	0.15 mm 0.0059 in.

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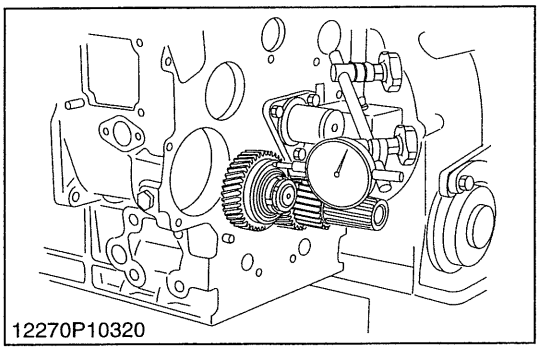

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Idle Gear Side Clearance

1. Set a dial indicator with its tip on the idle gear.
2. Measure the side clearance by moving the idle gear to the front and rear.
3. If the measurement exceeds the allowable limit, replace the idle gear collar.

Idle gear side clearance	Factory spec.	0.050 to 0.150 mm 0.0020 to 0.0059 in.

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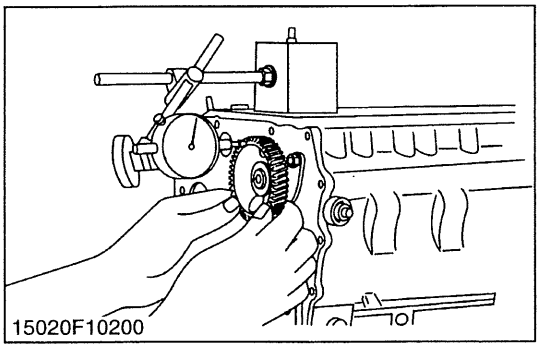

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Idle Gear 2 Side Clearance (V1305, V1505)

1. Set a dial indicator with its tip on the idle gear.
2. Measure the side clearance by moving the idle gear to the front and rear.
3. If the measurement exceeds the allowable limit, replace the idle gear collar.

Idle gear 2 side clearance	Factory spec.	0.20 to 0.51 mm 0.0079 to 0.0201 in.
	Allowable limit	0.9 mm 0.0354 in.

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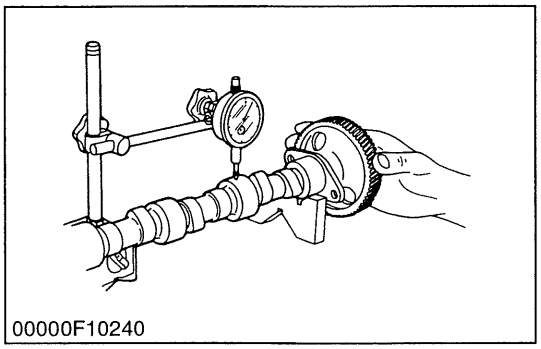

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Camshaft Side Clearance

1. Set a dial indicator with its tip on the camshaft.
2. Measure the side clearance by moving the cam gear to the front and rear.
3. If the measurement exceeds the allowable limit, replace the camshaft stopper.

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

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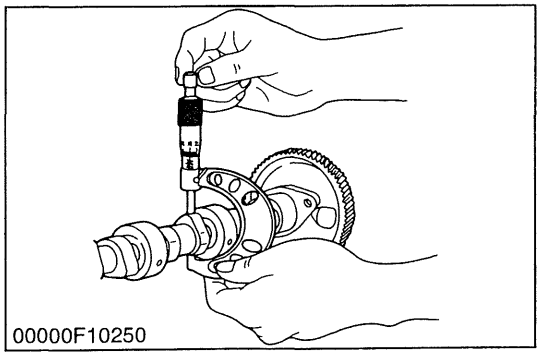
Camshaft Alignment

1. Support the camshaft with V blocks on the surface plate at both end journals.
2. Set a dial indicator with its tip on the intermediate journal.
3. Measure the camshaft alignment.
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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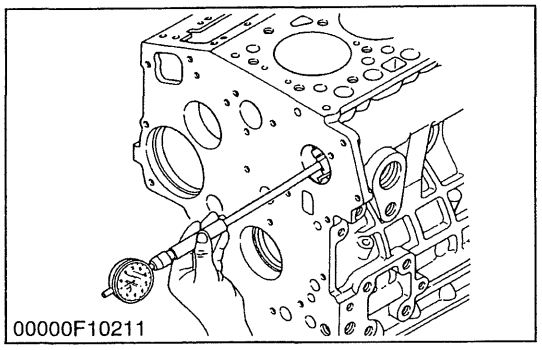
Cam Height

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

Cam height of intake	Factory spec.	28.80 mm 1.1339 in.
	Allowable limit	28.75 mm 1.1319 in.

Cam height of exhaust	Factory spec.	29.00 mm 1.1417 in.
	Allowable limit	28.95 mm 1.1398 in.

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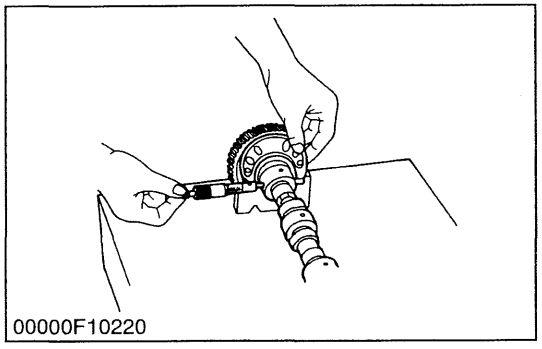

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Oil Clearance of Camshaft Journal

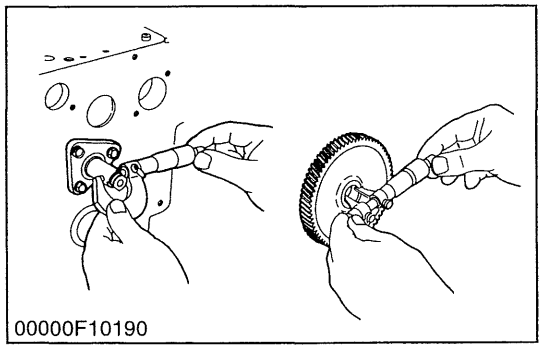
1. Measure the camshaft journal O.D. with an outside micrometer
2. Measure the cylinder block bore I.D. for camshaft with a cylinder gauge, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace the camshaft.

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

Camshaft journal O.D.	Factory spec.	35.934 to 35.950 mm 1.41473 to 1.41535 in.
Cylinder block bore I.D.	Factory spec.	36.000 to 36.025 mm 1.41732 to 1.41830 in.


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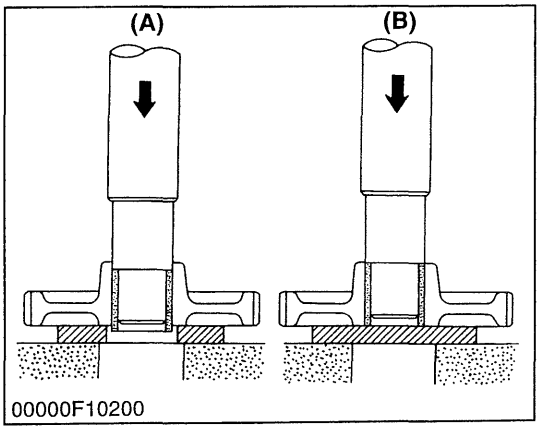
Oil Clearance between Idle Gear Shaft and Idle Gear Bushing

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

Oil clearance between idle gear shaft and Idle Gear Bushing	Factory spec.	0.020 to 0.054 mm 0.00079 to 0.00213 in.
	Allowable limit	0.10 mm 0.0039 in.

Idle gear shaft O.D	Factory spec.	25.967 to 25.980 mm 1.02232 to 1.02283 in.
Idle gear bushing I.D	Factory spec.	26.000 to 26.021 mm 1.02362 to 1.02445 in.

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Replacing Idle Gear Bushing

(When removing)

1. Press out the used idle gear bushing using an idle gear bushing replacing tool.

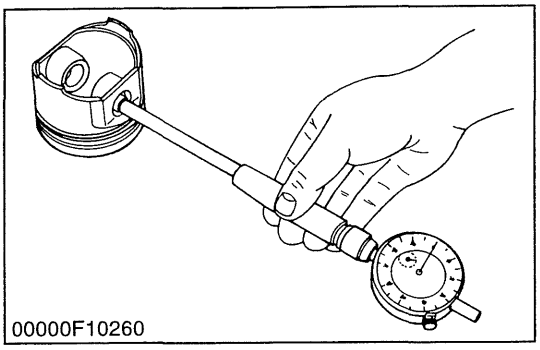
(When installing)

1. Clean a new idle gear bushing and idle gear bore, and apply engine oil to them.
2. Press in a new bushing using an idle gear bushing replacing tool, until it is flush with the end of the idle gear.

(A) When Removing **(B) When Installing**

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(3) Piston and Connecting Rod

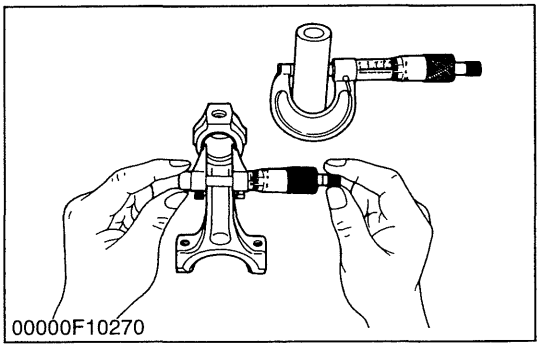


Piston Pin Bore I.D.

1. Measure the piston pin bore I.D. in both the horizontal and vertical directions with a cylinder gauge.
2. If the measurement exceeds the allowable limit, replace the piston.

Piston pin bore I.D.	Factory spec.	22.000 to 22.013 mm 0.86614 to 0.86665 in.
	Allowable limit	22.05 mm 0.8681 in.

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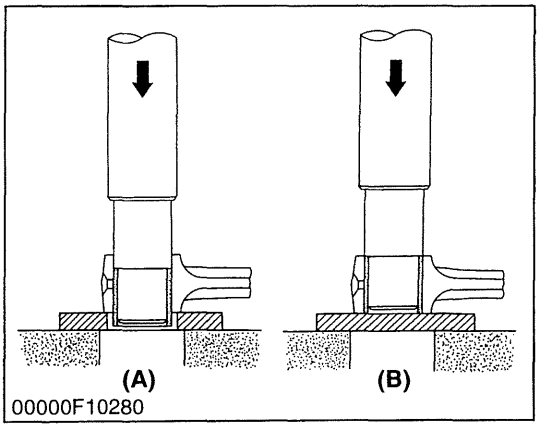
Oil Clearance between Piston Pin and Small End Bushing

1. Measure the piston pin O.D. where it contacts the bushing with an outside micrometer.
2. Measure the small end bushing I.D. with an inside micrometer, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace the bushing. If it still exceeds the allowable limit, replace the piston pin.

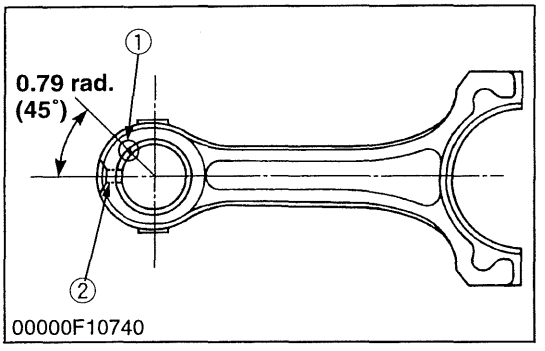
Oil clearance between piston pin and small end bushing	Factory spec.	0.014 to 0.038 mm 0.00055 to 0.00150 in.
	Allowable limit	0.15 mm 0.0059 in.
Piston pin O.D.	Factory spec.	22.002 to 22.011 mm 0.86622 to 0.86657 in.
Small end bushing I.D.	Factory spec.	22.025 to 22.040 mm 0.86713 to 0.86771 in.

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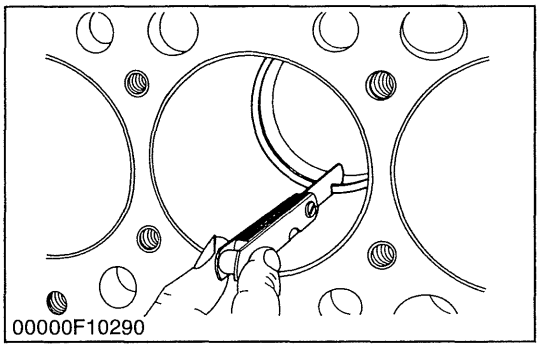
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Replacing Small End Bushing

(When removing)

1. Press out the used bushing using a small end bushing replacing tool.

(When installing)

1. Clean a new small end bushing and bore, and apply engine oil to them.
2. Insert a new bushing onto the tool and press-fit it with a press so that the seam (1) of bushing positions as shown in the figure, until it is flash with the connecting rod.
3. Drill a hole to the bushing with aligning the oil hole (2) of connecting rod using 4.0 mm dia. (0.157 in. dia.) drill.

■ NOTE

- **Be sure to chamfer the oil hole circumference with an oil stone.**

(1) Seam
(2) Oil Hole

(A) When Removing
(B) When Installing

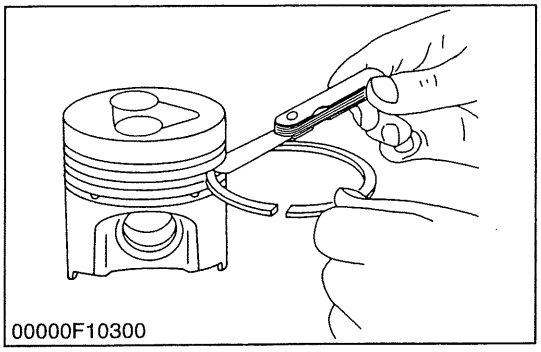
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Piston Ring Gap

1. Insert the piston ring into the lower part of the cylinder (the least worn out part) with a piston ring compressor and piston.
2. Measure the ring gap with a feeler gauge.
3. If the measurement exceeds the allowable limit, replace the piston ring.

Piston ring gap	Top ring Second ring	Factory spec.	0.25 to 0.40 mm 0.0098 to 0.0157 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.

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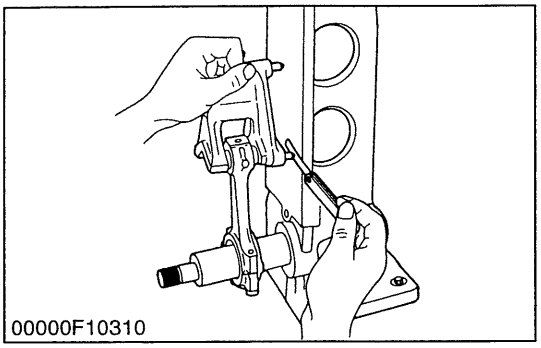

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Clearance between Piston Ring and Piston Ring Groove

1. Clean the rings and the ring grooves, and install each ring in its groove.
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 ring.
4. If the clearance still exceeds the allowable limit with new ring, replace the piston.

Clearance between piston ring and piston ring groove	Second ring	Factory spec.	0.085 to 0.112 mm 0.00335 to 0.00441 in.
		Allowable limit	0.20 mm 0.0079 in.
	Oil ring	Factory spec.	0.020 to 0.055 mm 0.00079 to 0.00217 in.
		Allowable limit	0.15 mm 0.0059 in.

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Connecting Rod Alignment

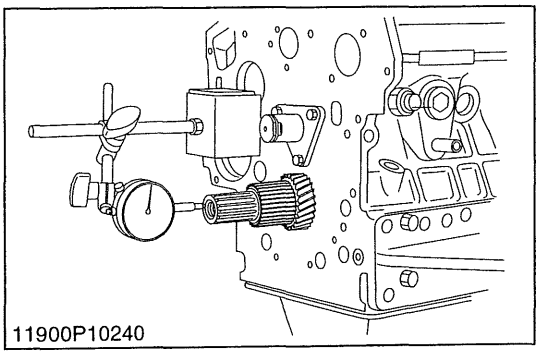
1. Remove the crankpin bearing, and install the connecting rod cap.
2. Install the piston pin in the connecting rod.
3. Install the connecting rod on the connecting rod alignment tool (Code No. 07909-31661).
4. Put a gauge over the piston pin, and move it against the face plate.
5. If the gauge does not fit squarely against the face plate, measure the space between the pin of the gauge and the face plate.
6. If the measurement exceeds the allowable limit, replace the connecting rod.

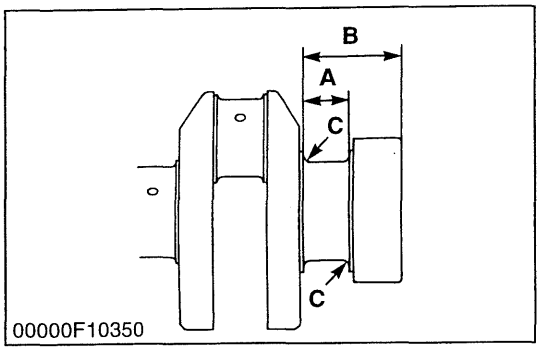
Space between gauge pin and face plate	Allowable limit	0.05 mm 0.0020 in.

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(4) Crankshaft


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Crankshaft Side Clearance

1. Set a dial indicator with its tip on the end of the crankshaft.
2. Measure the side clearance by moving the crankshaft to the front and rear.
3. If the measurement exceeds the allowable limit, replace the thrust bearings.
4. If the same size bearing is useless because of the crankshaft journal wear, replace it with an oversize one referring to the table and figure.

Crankshaft side clearance	Factory spec.	0.15 to 0.31 mm 0.0059 to 0.0122 in.
	Allowable limit	0.50 mm 0.0197 in.

(Reference)

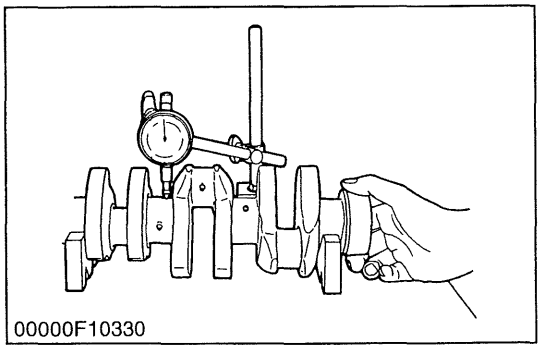
- Oversize thrust bearing

Oversize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Thrust bearing 1 02	15521-23951	020 OS
	Thrust bearing 2 02	19202-23971	020 OS
0.4 mm 0.016 in.	Thrust bearing 1 04	15521-23961	040 OS
	Thrust bearing 2 04	19202-23981	040 OS

- Oversize dimensions of crankshaft journal

Over-size / Dimension	0.2 mm 0.008 in.	0.4 mm 0.016 in.
A	28.20 to 28.25 mm 1.1102 to 1.1122 in.	28.40 to 28.45 mm 1.1181 to 1.1201 in.
B	51.5 to 51.7 mm 2.028 to 2.035 in.	51.6 to 51.8 mm 2.031 to 2.039 in.
C	2.3 to 2.7 mm radius 0.091 to 0.106 in. radius	2.3 to 2.7 mm radius 0.091 to 0.106 in. radius
The crankshaft journal must be fine-finished to higher than (0.8-S) ▽▽▽▽.		

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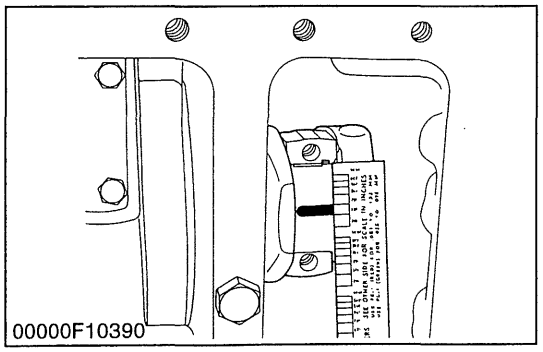

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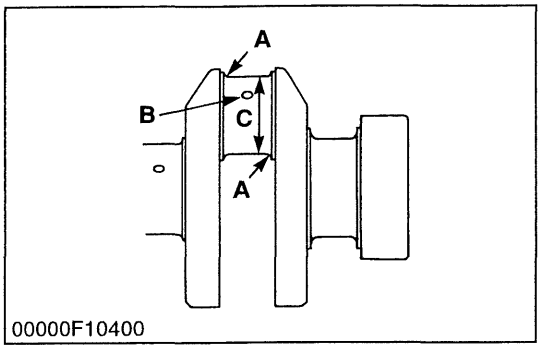
Crankshaft Alignment

1. Support the crankshaft with V blocks on the surface plate at both end journals.
2. Set a dial indicator with its tip on the intermediate journal.
3. Measure the crankshaft alignment.
4. If the measurement exceeds the allowable limit, replace the crankshaft.

Crankshaft alignment	Allowable limit	0.02 mm 0.0008 in.

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Oil Clearance between Crankpin and Crankpin Bearing

1. Clean the crankpin and crankpin bearing.
2. Put a strip of plastigage (Code No. 07909-30241) on the center of the crankpin.
3. Install the connecting rod cap and tighten the connecting rod screws to the specified torque, and remove the cap again.
4. Measure the amount of the flattening with the scale, and get the oil clearance.
5. If the oil clearance exceeds the allowable limit, replace the crankpin bearing.
6. If the same size bearing is useless because of the crankpin wear, replace it with an undersize one referring to the table and figure.

■ **NOTE**

- **Never insert the plastigage into the crankpin oil hole.**
- **Be sure not to move the crankshaft while the connecting rod screws are tightened.**

Oil clearance between crankpin and crankpin bearing	Factory spec.	0.029 to 0.091 mm 0.00114 to 0.00358 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankpin O.D.	Factory spec.	39.959 to 39.975 mm 1.57319 to 1.57382 in.
Crankpin bearing I.D.	Factory spec.	40.004 to 40.050 mm 1.57496 to 1.57677 in.

(Reference)

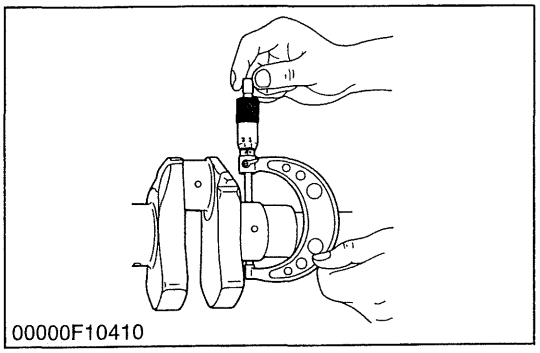
- Undersize crankpin bearing

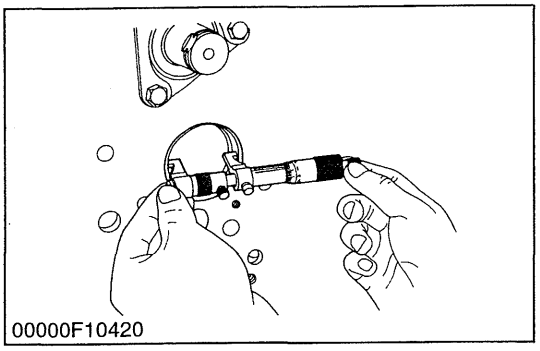
Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankpin bearing 02	16241-22971	020 US
0.4 mm 0.016 in.	Crankpin bearing 04	16241-22981	040 US

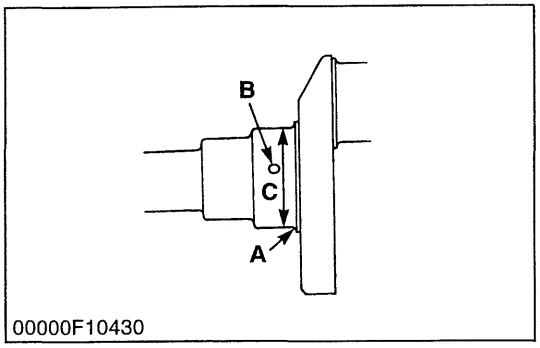
- Undersize dimensions of crankpinl

Undersize / Dimension	0.2 mm 0.008 in.	0.4 mm 0.016 in.
A	2.8 to 3.2 mm radius 0.1102 to 0.1260 in.radius	2.8 to 3.2 mm radius 0.1102 to 0.1260 in.radius
B	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius
C	39.759 to 39.775 mm 1.56531 to 1.56594 in.	39.559 to 39.575 mm 1.55744 to 1.55807 in.
The crankpin must be fine-finished to higher than (0.8-S) ▽▽▽▽.		

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Oil Clearance between Crankshaft Journal and Crankshaft Bearing 1

1. Measure the O.D. of the crankshaft front journal with an outside micrometer.
2. Measure the I.D. of the crankshaft bearing 1 with an inside micrometer, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace the crankshaft bearing 1.
4. If the same size bearing is useless because of the crankshaft journal wear, replace it with an undersize one referring to the table and figure.

Oil clearance between crankshaft journal and crankshaft bearing 1	Factory spec.	0.034 to 0.114 mm 0.00134 to 0.00449 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankshaft journal O.D.	Factory spec.	47.934 to 47.950 mm 1.88716 to 1.88779 in.
Crankshaft bearing 1 I.D.	Factory spec.	47.984 to 48.048 mm 1.88913 to 1.89165 in.

(Reference)

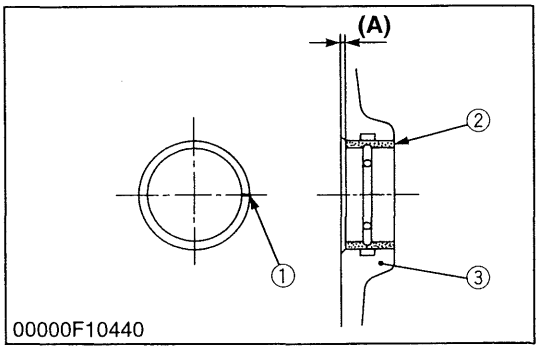
- Undersize crankshaft bearing 1

Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankshaft bearing 1 02	16241-23911	020 US
0.4 mm 0.016 in.	Crankshaft bearing 1 04	16241-23921	040 US

- Undersize dimensions of crankshaft journal

Dimension \ Undersize	0.2 mm 0.008 in.	0.4 mm 0.016 in.
A	2.3 to 2.7 mm radius 0.0906 to 0.1063 in.radius	2.3 to 2.7 mm radius 0.0906 to 0.1063 in.radius
B	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius	1.0 to 1.5 mm radius 0.0394 to 0.0591 in. radius
C	47.734 to 47.750 mm 1.87929 to 1.87992 in.	47.534 to 47.550 mm 1.87142 to 1.87204 in.
The crankshaft journal must be fine-finished to higher than (0.8-S) ∇∇∇∇.		

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Replacing Crankshaft Bearing 1

(When removing)

1. Press out the used crankshaft bearing 1 using a crankshaft bearing 1 replacing tool.

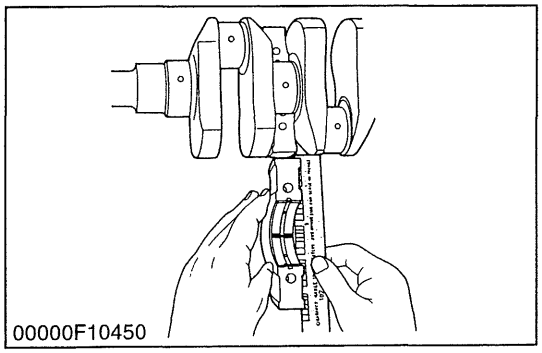
(When installing)

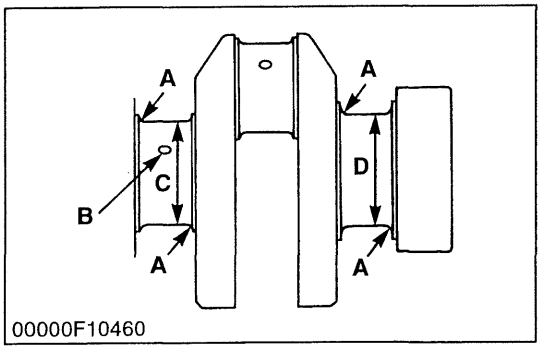
1. Clean a new crankshaft bearing 1 and crankshaft journal bore, and apply engine oil to them.
2. Using a crankshaft bearing 1 replacing tool, press in a new bearing 1 (2) so that its seam (1) directs toward the exhaust manifold side. (See figure)

Dimension **(A)**	Factory spec.	0 to 0.3 mm 0 to 0.0118 in.

(1) Seam
(2) Crankshaft Bearing 1
(3) Cylinder Block

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Oil Clearance between Crankshaft Journal and Crankshaft Bearing 2 (Crankshaft Bearing 3)

1. Put a strip of plastigage (Code No. 07909-30241) on the center of the journal.
2. Install the bearing case and tighten the bearing case screws 1 to the specified torque, and remove the bearing case again.
3. Measure the amount of the flattening with the scale, and get the oil clearance.
4. If the oil clearance exceeds the allowable limit, replace the crankshaft bearing 2 (crankshaft bearing 3).
5. If the same size bearing is useless because of the crankshaft journal wear, replace it with an undersize one referring to the table and figure.

■ **NOTE**

- **Be sure not to move the crankshaft while the bearing case screws are tightened.**

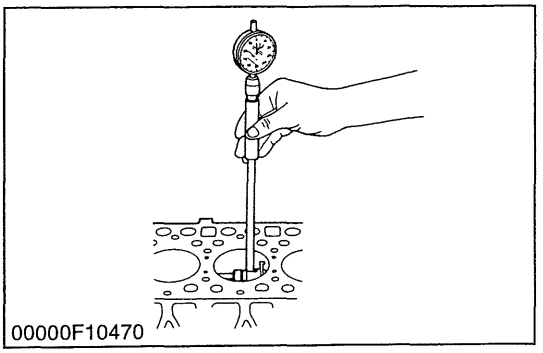
Oil clearance between crankshaft journal and crankshaft bearing 2	Factory spec.	0.034 to 0.095 mm 0.00134 to 0.00374 in.
	Allowable limit	0.20 mm 0.0079 in.
Crankshaft journal O.D. (Intermediate)	Factory spec.	47.934 to 47.950 mm 1.88716 to 1.88779 in.
Crankshaft bearing 2 I.D.	Factory spec.	47.984 to 48.029 mm 1.88913 to 1.89091 in.

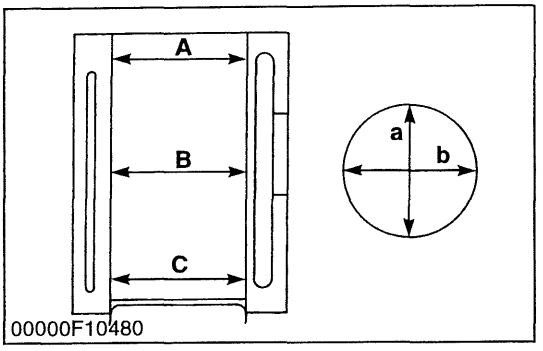
Oil clearance between crankshaft journal and crankshaft bearing 3	Factory spec.	0.034 to 0.098 mm 0.00134 to 0.00386 in.
	Allowable limit	0.20 mm 0.0079 in.
Crankshaft journal O.D. (Flywheel side)	Factory spec.	51.921 to 51.940 mm 2.04413 to 2.04488 in.
Crankshaft bearing 3 I.D.	Factory spec.	51.974 to 52.019 mm 2.04622 to 2.04799 in.

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(5) Cylinder


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Cylinder Wear

1. Measure the I.D. of the cylinder at the six positions (see figure) with a cylinder gauge to find the maximum and minimum I.D.'s.
2. Get the difference (Maximum wear) between the maximum and the minimum I.D.'s
3. If the wear exceeds the allowable limit, bore and hone to the oversize dimension. (Refer to **"Correcting Cylinder"**)
4. Visually check the cylinder wall for scratches. If deep scratches are found, the cylinder should be bored. (Refer to **"Correcting Cylinder"**)

[D1105, V1505]

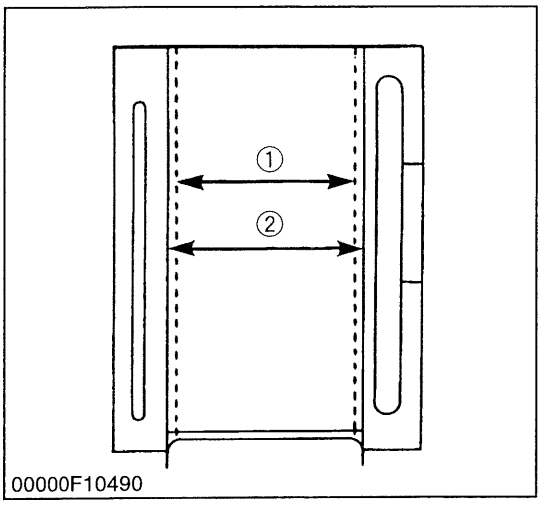
Cylinder liner I.D.	Factory spec.	78.000 to 78.019 mm 3.01086 to 3.07161 in.
	Allowable limit	78.169 mm 3.07751 in.

[V1305]

Cylinder liner I.D.	Factory spec.	76.000 to 76.019 mm 2.9921 to 2.9929 in.
	Allowable limit	76.169 mm 2.99878 in.

(A) Top
(B) Middle
(C) Bottom (Skirt)
(a) Right-angled to Piston Pin
(b) Piston Pin Direction

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Correcting Cylinder

1. When the cylinder is worn beyond the allowable limit, bore and hone it to the specified dimension.

[D1105, V1505]

Oversized cylinder liner I.D	Factory spec.	78.500 to 78.519 mm 3.09055 to 3.09129 in.
	Allowable limit	78.669 mm 3.09720 in.
Finishing	Hone to 1.2 to 2.0 mR max. ∇∇∇ (0.000047 to 0.0079 in.R max.)	

[V1305]

Oversized cylinder liner I.D.	Factory spec.	76.500 to 76.519 mm 3.01181 to 3.01256 in.
	Allowable limit	76.669 mm 3.0185 in.
Finishing	Hone to 1.2 to 2.0 mR max. ∇∇∇ (0.000047 to 0.0079 in.R max.)	

2. Replace the piston and piston rings with oversize ones.

[D1105, V1505]

Oversize	Part Name	Code Number	Marking
0.25 mm 0.0098 in.	Piston	16281-21910	0.5 OS
	Piston ring assembly	16261-21090	0.5 OS

[V1305]

Oversize	Part Name	Code Number	Marking
0.5 mm 0.0197 in.	Piston 05	16251-21910	05 OS
	Piston ring 05 assembly	16271-21090	05 OS

■ NOTE

- **When the oversize cylinder is worn beyond the allowable limit, replace the cylinder block with a new one.**

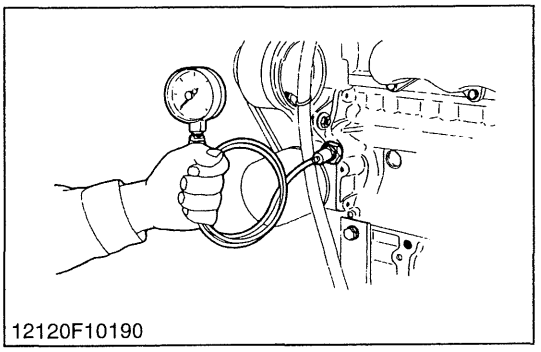
(1) Cylinder I.D. (Before Correction) (2) Oversized Cylinder I.D.

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[3] LUBRICATING SYSTEM

CHECKING


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Engine Oil Pressure

1. Remove the engine oil pressure switch, and set a oil pressure tester (Code No. 07916-32032).
2. Start the engine. After warming up, measure the oil pressure of both idling and rated speeds.
3. If the oil pressure is less than the allowable limit, check the following.

- Engine oil insufficient
- Oil pump defective
- Oil strainer clogged
- Oil filter cartridge clogged
- Oil gallery clogged
- Excessive oil clearance
- Foreign matter in the relief valve

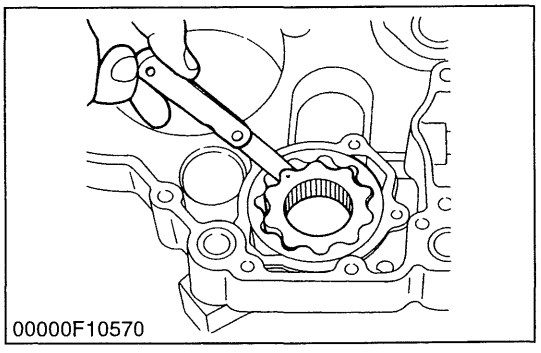
Engine oil pressure	At idle speed	Factory spec.	More than 49 kPa 0.5 kgf/cm^2 7 psi
	At rated speed	Factory spec.	196 to 441 kPa 2.0 to 4.5 kgf/cm^2 36 to 64 psi
		Allowable limit	147 kPa 1.5 kgf/cm^2 27 psi

(When reassembling)

- After checking the engine oil pressure, tighten the engine oil pressure switch to the specified torque.

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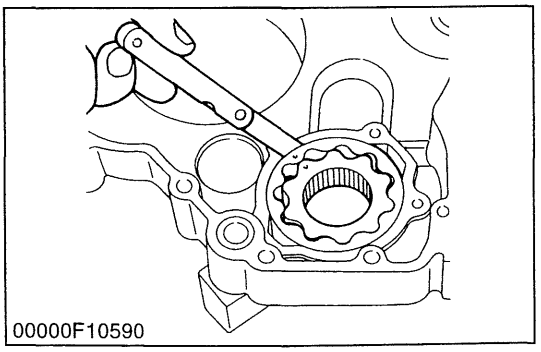

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Rotor Lobe Clearance

1. Measure the clearance between lobes of the inner rotor and the outer rotor with a feeler gauge.
2. If the clearance exceeds the factory specifications, replace the oil pump rotor assembly.

Rotor lobe clearance	Factory spec.	0.06 to 0.18 mm 0.0024 to 0.0071 in.

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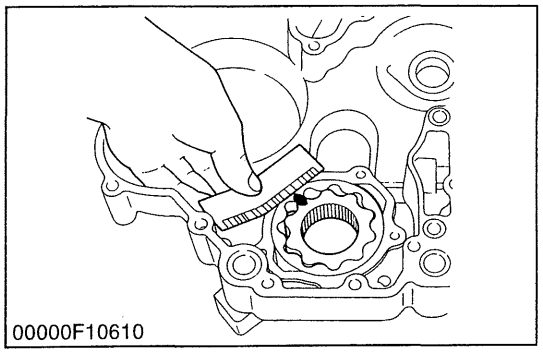

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Clearance between Outer Rotor and Pump Body

1. Measure the clearance between the outer rotor and the pump body with a feeler gauge.
2. If the clearance exceeds the factory specifications, replace the oil pump rotor assembly.

Clearance between outer rotor and pump body	Factory spec.	0.100 to 0.180 mm 0.0039 to 0.0071 in.

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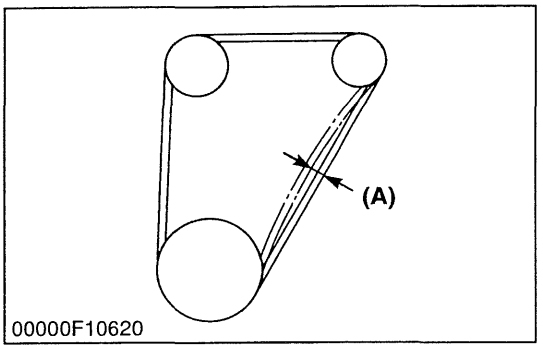
Clearance between Rotor and Cover

1. Put a strip of plastigage (Code No. 07909-30241) onto the rotor face with grease.
2. Install the cover and tighten the screws.
3. Remove the cover carefully, and measure the amount of the flattening with the scale and get the clearance.
4. If the clearance exceeds the factory specifications, replace oil pump rotor assembly.

Clearance between rotor and cover	Factory spec.	0.030 to 0.085 mm 0.0012 to 0.0033 in.

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[4] COOLING SYSTEM CHECKING AND ADJUSTING



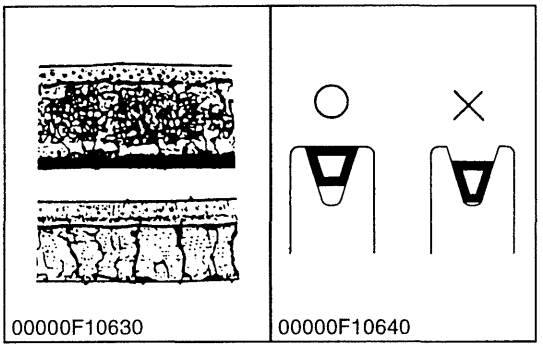
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Fan Belt Tension

1. Measure the deflection **(A)**, depressing the belt halfway between the fan drive pulley and alternator pulley at specified force (98 N, 10 kgf, 22 lbs).
2. If the measurement is not within the factory specifications, loosen the alternator mounting screws and relocate the alternator to adjust.

Deflection **(A)**	Factory spec.	7 to 9 mm 0.28 to 0.35 in.

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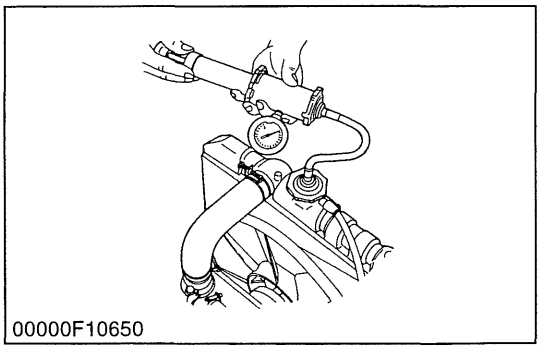

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Fan Belt Damage and Wear

1. Check the fan belt for damage.
2. If the fan belt is damaged, replace it.
3. Check if the fan belt is worn and sunk in the pulley groove.
4. If the fan belt is nearly worn out and deeply sunk in the pulley groove, replace it.

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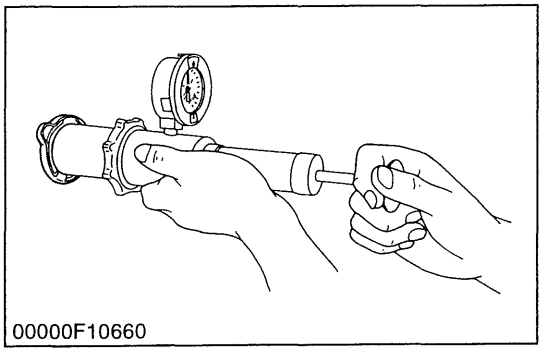
Radiator Water Leakage

1. Pour a specified amount of water into the radiator.
2. Set a radiator tester (Code No. 07909-31551) and raise the water pressure to the specified pressure.
3. Check the radiator for water leaks.
4. For water leak from the pinhole, replace the radiator or repair with the radiator cement. When water leak is excessive, replace the radiator.

Radiator water leakage test pressure	Factory spec.	137 kPa 1.4 kgf/cm^2 20 psi

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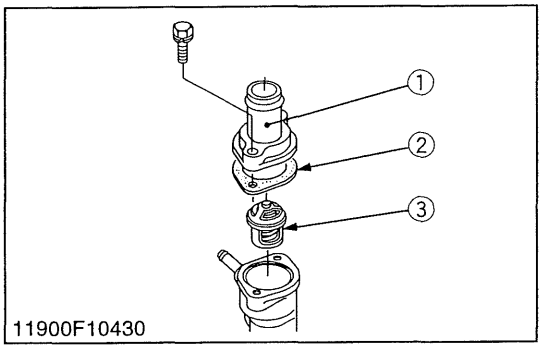
Radiator Cap Air Leakage

1. Set a radiator tester (Code No. 07909-31551) on the radiator cap.
2. Apply the specified pressure (88 kPa, 0.9 kgf/cm^2, 13 psi), and measure the time for the pressure to fall to 59 kPa (0.6 kgf/cm^2, 9 psi).
3. If the measurement is less than the factory specification, replace the radiator cap.

Pressure falling time	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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DISASSEMBLING AND ASSEMBLING



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Thermostat Assembly

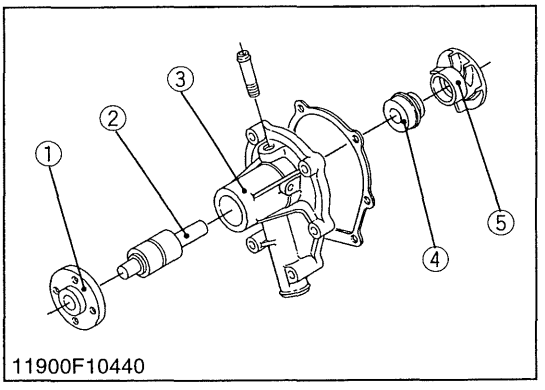
1. Remove the thermostat cover mounting screws, and remove the thermostat cover (1).
2. Remove the thermostat assembly (3).

(When reassembling)

- Apply a liquid gasket (Three Bond 1215 or equivalent) only at the thermostat cover side of the gasket (2).

(1) Thermostat Cover
(2) Thermostat Cover Gasket
(3) Thermostat Assembly

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Water Pump Assembly

1. Loosen the alternator mounting bolts, and remove the fan belt.
2. Remove the fan and fan pulley.
3. Remove the water pump assembly from the gear case cover.
4. Remove the water pump flange (1).
5. Press out the water pump shaft (2) with the impeller (5) on it.
6. Remove the impeller from the water pump shaft.
7. Remove the mechanical seal (4).

(When reassembling)

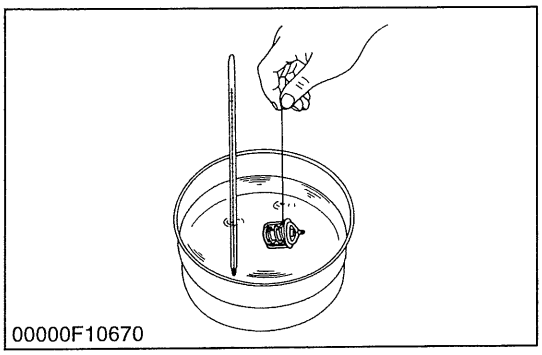
- Apply a liquid gasket (Three Bond 1215 or equivalent) to the both sides of gasket.
- Replace the mechanical seal with new one.

(1) Water Pump Flange
(2) Water Pump Shaft
(3) Water Pump Body
(4) Mechanical Seal
(5) Impeller

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SERVICING


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Thermostat Valve Opening Temperature

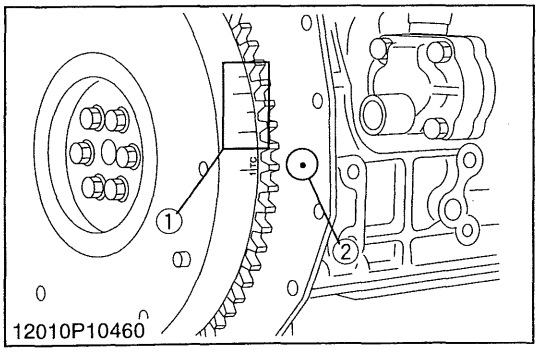
1. Suspend the thermostat in the water by a string with its end inserted between the valve and seat.
2. Heating the water gradually, read the temperature when the valve opens and leaves the string.
3. Continue heating and read the temperature when the valve opens approx. 6 mm (0.236 in.).
4. If the measurement is not within the factory specifications, replace the thermostat.

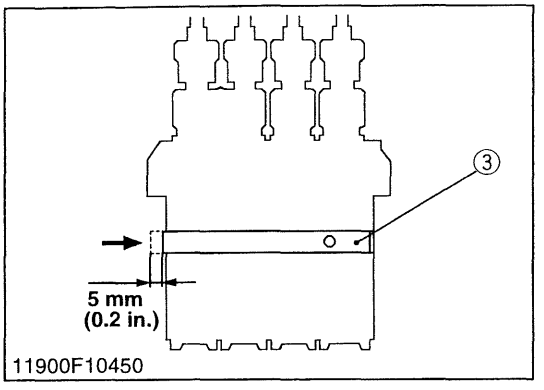
Thermostat's valve opening temperature	Factory spec.	80.5 to 83.5 °C 176.9 to 182.3 °F
Temperature at which thermostat completely opens	Factory spec.	95 °C 203 °F

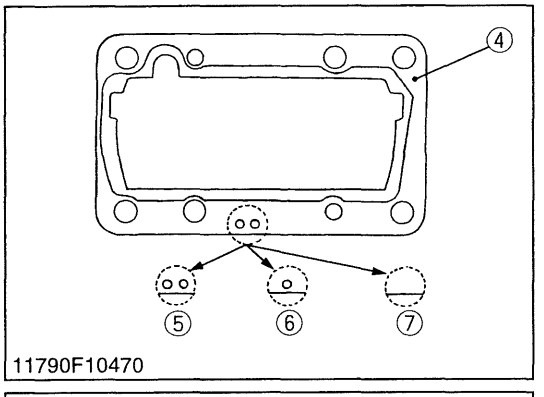
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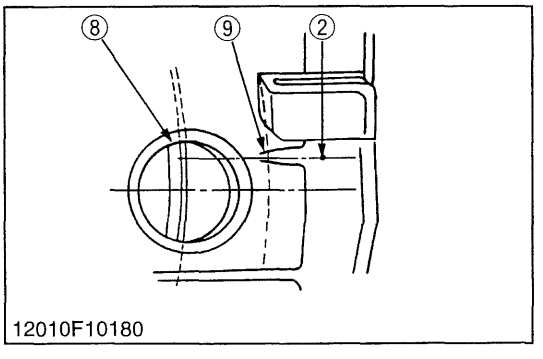
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[5] FUEL SYSTEM
CHECKING AND ADJUSTING
(1) Injection Pump









Injection Timing

1. Remove the injection pipes.
2. Remove the engine stop solenoid, push in the control rack (3) of the injection pump by 5 mm (0.2 in.) and hold it at that position.
3. Turn the flywheel counterclockwise (facing the flywheel) until fuel flows from the delivery valve holder.
4. Continue to turn the flywheel slowly, and stop it as soon as the fuel level at the tip of the delivery valve holder begins to increase.
5. Check to see if the timing angle lines on the flywheel is aligned with the alignment mark (2).
6. If the injection timing is out of adjustment, readjust the timing with shims.

Injection timing	Factory spec.	0.30 to 0.33 rad. (17 to 19°) before T.D.C.

■ NOTE

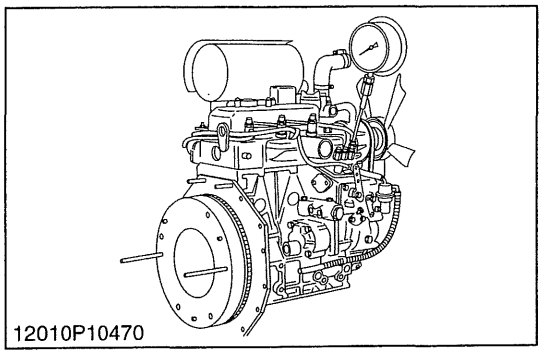
- **The sealant is applied to both sides of the shim (soft metal gasket shim). The liquid gasket is not required for assembling.**
- **Shims are available in thickness of 0.20 mm (0.0079 in.), 0.25 mm (0.0098 in.) and 0.30 mm (0.0118 in.). Combine these shims for adjustments.**
- **Addition or reduction 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 the injection pump, be sure to use the same number of new shims with the same thickness.**
- **Refer to figure below to check the thickness of the shims.**

(Reference)

- The alignment mark (2) of the injection timing (1) is not in alignment with the center of the timing window (8).
- The above mark comes aligned with the center of the clutch housing rib (9).

(1) Timing
(2) Alignment Mark
(3) Control Rack
(4) Shim (Soft Metal Gasket Shim)
(5) Two-holes : 0.20 mm (0.0079 in.)
(6) One-hole : 0.25 mm (0.0098 in.)
(7) Without hole : 0.30 mm (0.0118 in.)
(8) Timing Window
(9) Rib

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Fuel Tightness of Pump Element

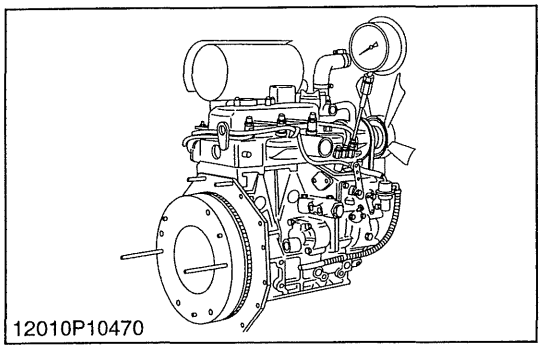
1. Remove the engine stop solenoid.
2. Remove the injection pipes and glow plugs.
3. Install the injection pump pressure tester to the injection pump.
4. Set the speed control lever to the maximum speed position.
5. Turn the flywheel ten times or more to increase the pressure.
6. If the pressure can 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

■ NOTE

- **Apply a liquid gasket (Three Bond 1215 or equivalent) to both sides of the solenoid cover gasket.**

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12010P10470

Fuel Tightness of Delivery Valve

1. Remove the engine stop solenoid.
2. Remove the injection pipes and glow plugs.
3. Set a pressure tester to the fuel injection pump.
4. Turn the flywheel and raise the pressure to approx. 14.7 MPa (150 kgf/cm^2, 2133 psi).
5. 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/cm^2, from 2133 to 1990 psi).
6. Measure the time needed to decrease the pressure from 14.7 to 13.7 MPa (from 150 to 140 kgf/cm^2, from 2133 to 1990 psi).
7. 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

■ NOTE

- **Apply a liquid gasket (Three Bond 1215 or equivalent) to both sides of the solenoid cover gasket.**

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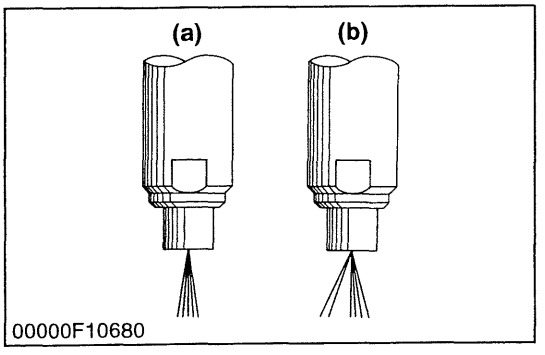
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(2) Injection Nozzle

CAUTION

- **Check the 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.

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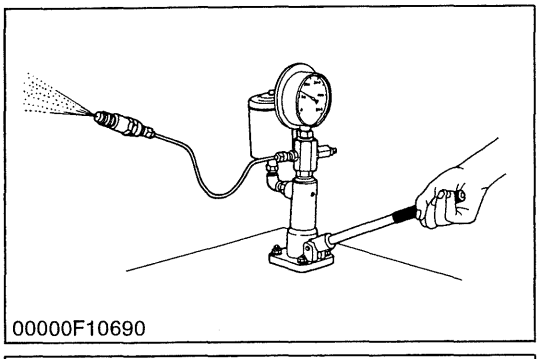


Nozzle Spraying Condition

1. Set the injection nozzle to a nozzle tester (Code No. 07909-31361), and check the nozzle spraying condition.
2. If the spraying condition is defective, replace the nozzle piece.

(a) Good **(b) Bad**

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Fuel Injection Pressure

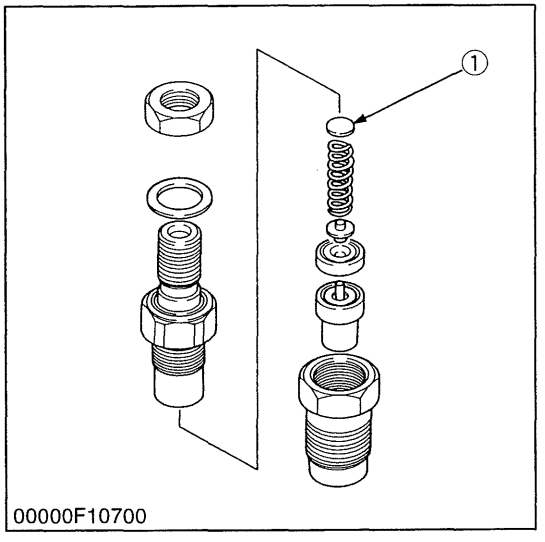
1. Set the injection nozzle to a nozzle tester (Code No. 07909-31361).
2. Slowly move the tester handle to measure the pressure at which fuel begins jetting out from the nozzle.
3. If the measurement is not within the factory specifications, replace the adjusting washer (1) in the nozzle holder to adjust it.

Fuel injection pressure	Factory spec.	13.73 to 14.71 MPa 140 to 150 kgf/cm^2 1991 to 2133 psi

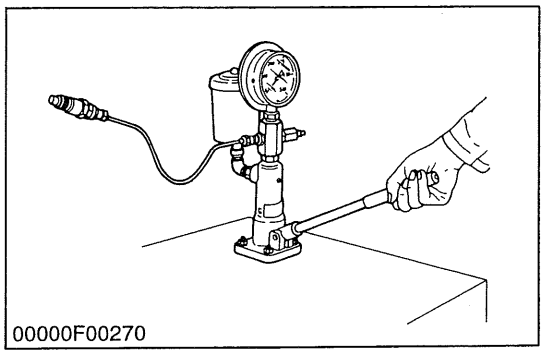
(Reference)

- Pressure variation with 0.01 mm (0.0004 in.) difference of adjusting washer thickness.
  Approx. 235 kPa (2.4 kgf/cm^2, 34 psi)

(1) Adjusting Washer



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Valve Seat Tightness

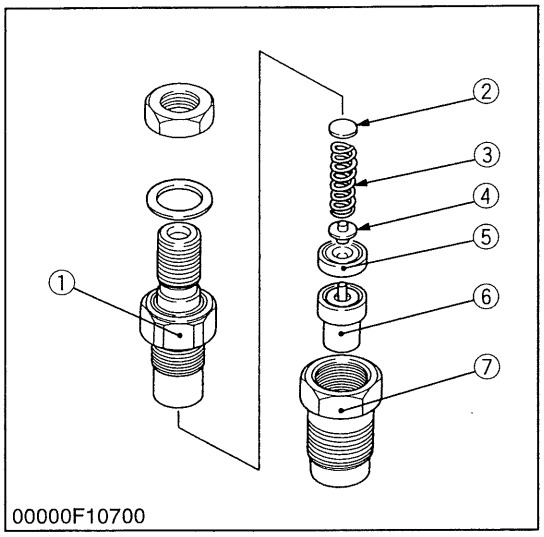
1. Set the injection nozzle to a nozzle tester (Code No. 07909-31361).
2. Raise the fuel pressure, and keep at 12.75 MPa (130 kgf/cm^2, 1849 psi) for 10 seconds.
3. If any fuel leak is found, replace the nozzle piece.

Valve seat tightness	Factory spec.	No fuel liek at 12.75 MPa 130 kgf/cm^2 1849 psi

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DISASSEMBLING AND ASSEMBLING

(1) Injection Nozzle



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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

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

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MECHANISM

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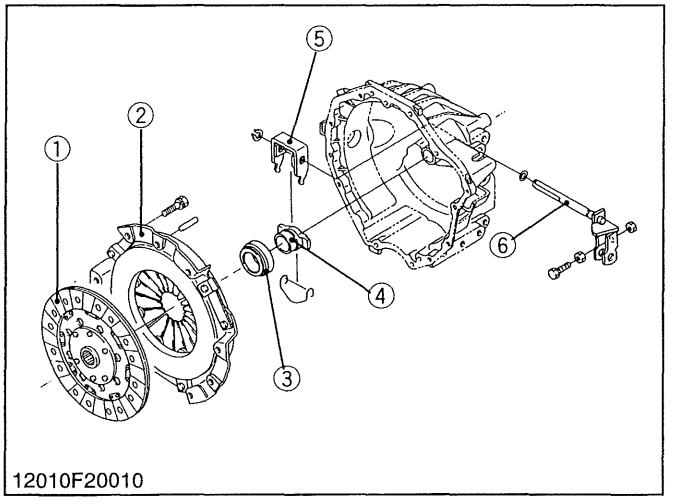
[1] FEATURES 2-M1
[2] LINKAGE MECHANISM 2-M2
[3] OPERATION 2-M3

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[1] FEATURES



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This tractor is used dry single plate type clutch.

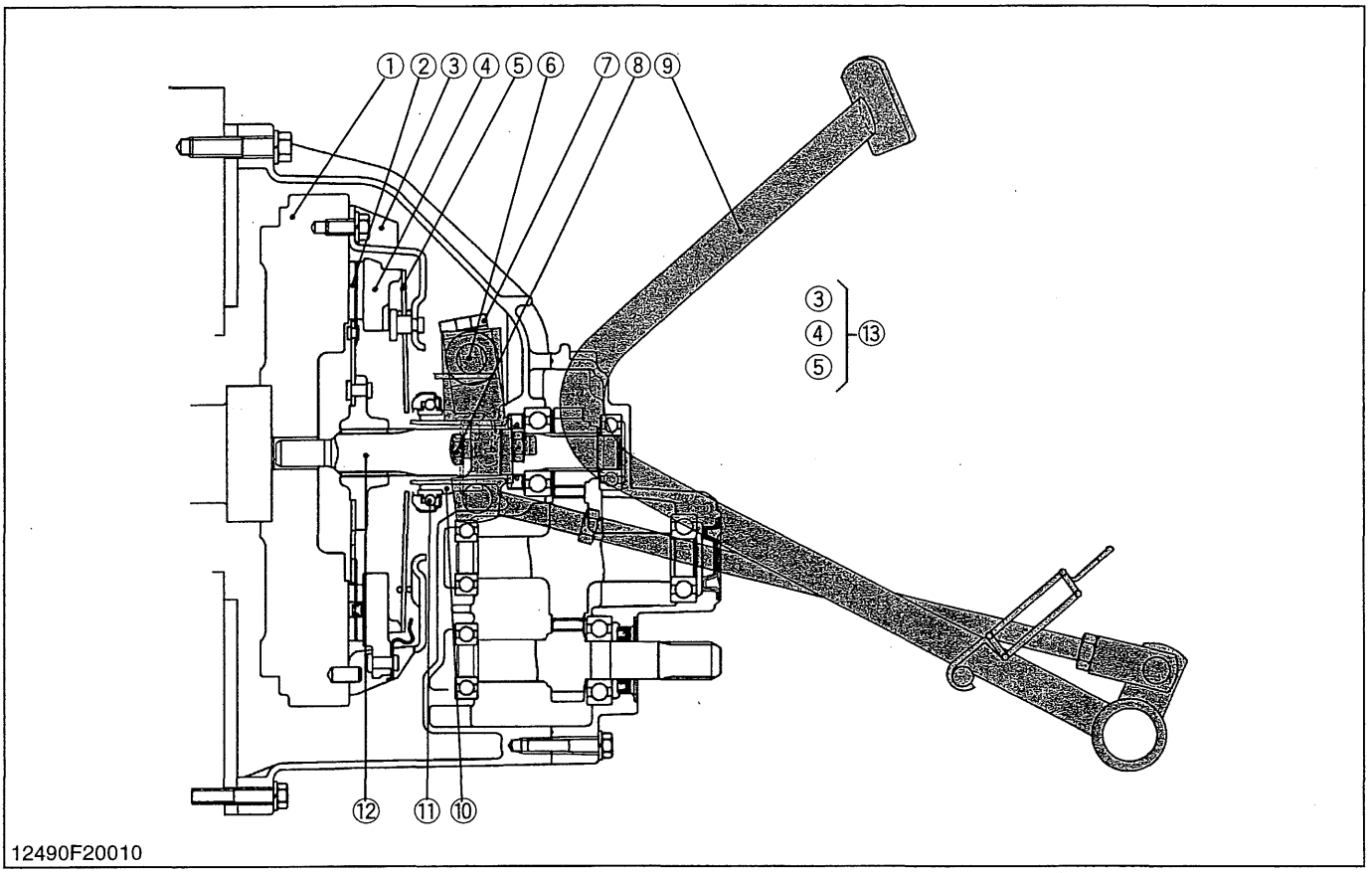
The clutch is located between the engine and transmission and is operated by stepping on the clutch pedal.

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
(2) Pressure Plate Assembly
(3) Release Bearing
(4) Release Hub
(5) Release Fork
(6) Clutch Rod

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[2] LINKAGE MECHANISM



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

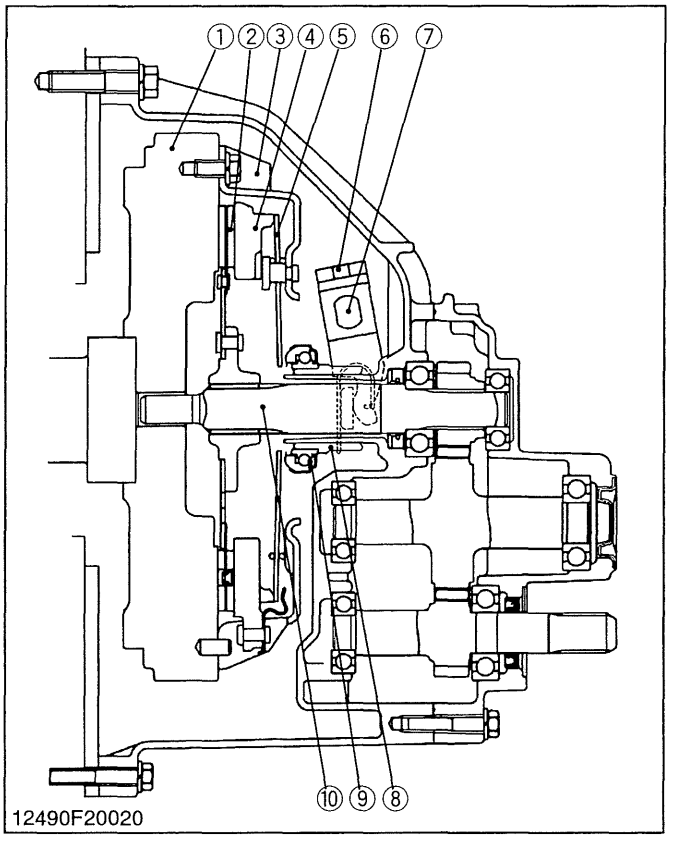
Engine torque is transmitted to the pressure plate assembly (13) via the flywheel (1) which is connected to the engine crankshaft. Therefore, the clutch cover constantly runs with engine. The clutch disc (2) is located between the flywheel (1) and the pressure plate (4) of pressure plate assembly. Torque is transmitted to the clutch disc (2) by the pressure created by diaphragm spring (5) installed in pressure plate assembly. Then, the torque is transmitted to the transmission via the clutch shaft (12).

When the pedal (9) is depressed, the clutch release hub (10) and the clutch release bearing (11) move towards the flywheel and push the fingers of the diaphragm spring (5). In other words, this movement pulls the pressure plate (4) up and disengages the clutch.

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[3] OPERATION



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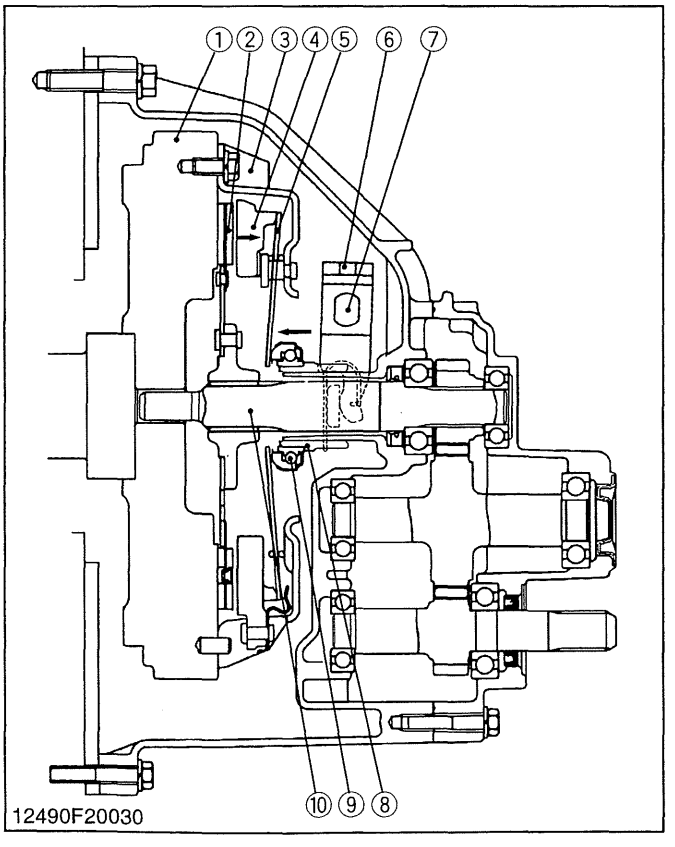
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■ Clutch "Engaged"

When the clutch pedal is not depressed, the clutch release bearing (9) and the fingers of diaphragm spring (5) are not connected to each other.

Accordingly, the pressure plate (4) is tightly pressed against the flywheel (1) by the diaphragm spring (5). As a result, rotation of the flywheel (1) is transmitted to the transmission through the clutch shaft (10) due to the frictional force among the flywheel (1), clutch disc (2) and pressure plate (4).

(1) Flywheel
(2) Clutch Disc
(3) Clutch Cover
(4) Pressure Plate
(5) Diaphragm Spring
(6) Release Fork
(7) Clutch Rod
(8) Release Hub
(9) Release Bearing
(10) Clutch Shaft



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■ Clutch "Disengaged"

When the clutch pedal is depressed, the clutch pedal rod is pulled to move the clutch rod (7). Then, the release fork (6) pushes the release hub (8) and release bearing (9) toward the flywheel. Simultaneously, the release bearing (6) pushes the diaphragm spring (5).

As the pressure plate (4) is pulled by the diaphragm spring (5), the frictional force among the flywheel (1), clutch disc (2) and pressure plate (4) disappears.

Therefore, rotation of the flywheel (1) is not transmitted to the clutch disc (2), and then the rotation of the clutch shaft (10) stops.

(1) Flywheel
(2) Clutch Disc
(3) Clutch Cover
(4) Pressure Plate
(5) Diaphragm Spring
(6) Release Fork
(7) Clutch Rod
(8) Release Hub
(9) Release Bearing
(10) Clutch Shaft

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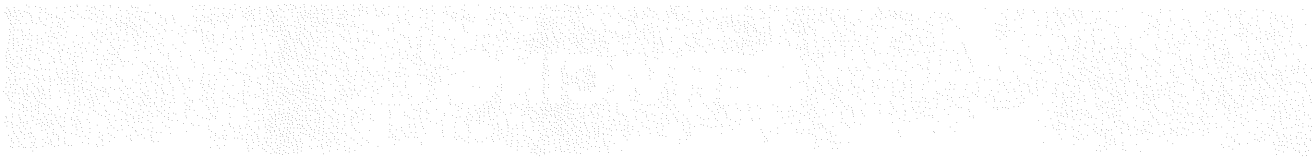
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SERVICING

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TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Clutch Drags	• Clutch pedal free travel excessive	Adjust	2-S3
	• Dust on clutch disc generated from clutch disc facing	Remove rust	2-S8
	• Release fork broken	Replace	2-S9
	• Clutch disc or pressure plate warped	Replace	2-S8
	• Wire ring of the pressure plate worn or broken	Replace (Pressure plate assembly)	2-S8
Clutch Slips	• Clutch pedal free travel too small	Adjust	2-S3
	• Clutch disc excessively worn	Replace	2-S8
	• Grease or oil on clutch disc facing	Replace	2-S8
	• Clutch disc or pressure plate warped	Replace	2-S8
	• Diaphragm spring weaken or broken	Replace	2-S8
	• Wire ring of the pressure plate worn or broken	Replace (Pressure plate assembly)	2-S8
Chattering	• Grease or oil on clutch disc facing	Replace	2-S8
	• Clutch disc or pressure plate warped	Replace	2-S8
	• Clutch disc boss spline worn or rusted	Replace or remove rust	2-S8
	• Clutch shaft bent	Replace	3-S17
	• Pressure plate or flywheel face cracked or scored	Replace	1-S28, 2-S8
	• Clutch disc boss spline and clutch shaft spline worn	Replace	2-S8
	• Diaphragm spring strength uneven or diaphragm spring broken	Replace	2-S8
Rattle During Running	• Clutch disc boss spline worn	Replace	2-S8
	• Replace bearing worn or sticking	Replace	2-S8
Clutch Squeaks	• Replace bearing sticking or dry	Replace	2-S8
	• Clutch disc excessively worn	Replace	2-S8
Vibration	• Clutch shaft bent	Replace	3-S17
	• Clutch disc rivet worn or broken	Replace	2-S8
	• Clutch parts broken	Replace	2-S8

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SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Clutch Pedal	Free travel on Stopper Bolt	1.0 to 1.5 mm 0.039 to 0.059 in.	–
	(Reference) on Clutch Pedal	20 to 30 mm 0.8 to 1.2 in.	–
Clutch Pedal Stopper Bolt	Clearance "B" between Stopper Bolt and Clutch Housing	8.0 to 9.0 mm 0.30 to 0.35 in.	–
Safety Switch Setting Position	Clearance "C" of Safety Switch when Clutch Pedal Released	1.5 to 2.5 mm 0.059 to 0.098 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.
Bi-speed Turn Cable Outer (Clutch Housing Side)	Distance A	18 mm 0.71 in.	–
Bi-speed Turn Cable Inner (Front Axle Case Side)	Distance B	10 mm 0.39 in.	–

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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.)

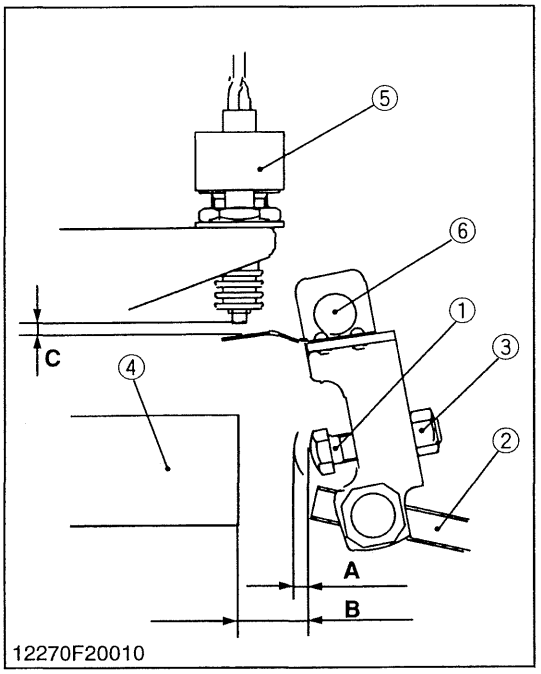
Item	N·m	kgf·m	ft-lbs
Steering wheel mounting nut	29.4 to 49.0	3.0 to 5.0	21.7 to 36.2
Delivery pipe nut for HST	34 to 39	3.5 to 4.0	25 to 28
Oil cooler pipe nut	50 to 58	5.1 to 5.9	36.9 to 42.8
Delivery pipe nut for power steering	65 to 75	6.6 to 7.7	47.9 to 55.3
Drag link slotted nut	17.7 to 34.5	1.8 to 3.5	13.0 to 25.3
Clutch housing and engine mounting screw and nut M8	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
M10	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
Clutch cover mounting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.2

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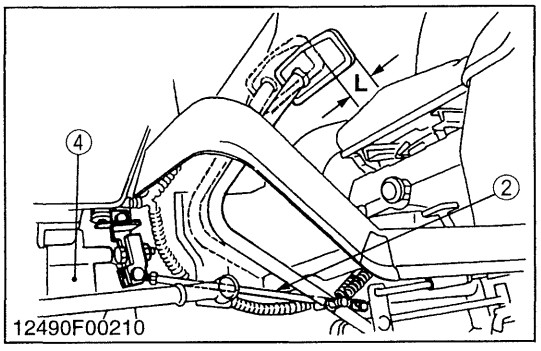
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CHECKING, DISASSEMBLING AND SERVICING

CHECKING AND ADJUSTING



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Checking Clutch Pedal Free Travel

CAUTION

- **When checking, park the tractor on flat ground, apply the parking brake, stop the engine and remove the key.**

1. Slightly depress the clutch pedal and measure stroke **"A"** at top of stopper bolt (1).
2. If the measurement is not within the factory specifications, loosen the lock nut and adjust the clutch pedal rod (2) length.
3. After adjusting it, measure total stroke **"B"** between stopper bolt (1) and clutch housing (4).
4. If the measurement not within the factory specifications, adjust it with the clutch pedal stopper bolt (1).
5. And at same time, adjust the clearance **"C"** between safety switch (5) and clutch rod (6).

NOTE

- **After adjustment, sure the stopper bolt with the lock nut (3).**

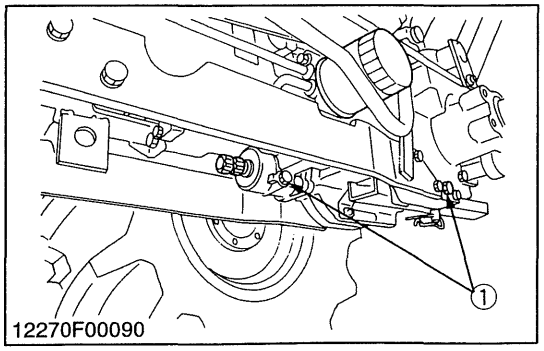
Clutch pedal free travel on stopper bolt stroke **"A"**	Factory spec.	1.0 to 1.5 mm 0.039 to 0.059 in.
Reference : Clutch pedal free travel **"L"** on top of clutch pedal		20 to 30 mm 0.78 to 1.18 in.
Clutch pedal total stroke **"B"**	Factory spec.	8.0 to 9.0 mm 0.31 to 0.35 in.
Clearance **"C"**	Factory spec.	1.5 to 2.5 mm 0.059 to 0.098 in.

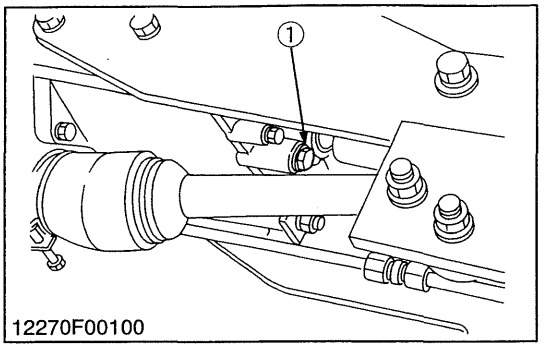
(1) Stopper Bolt
(2) Clutch Pedal Rod
(3) Lock Nut for Stopper Bolt
(4) Clutch Housing
(5) Safety Switch
(6) Clutch Rod

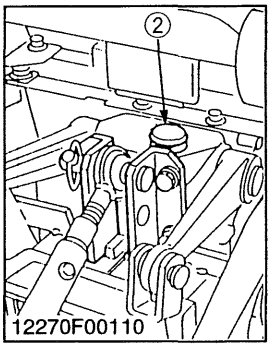
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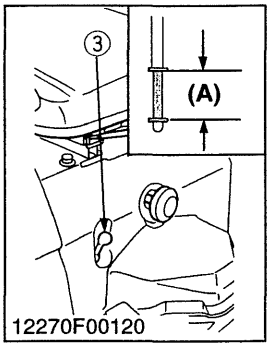
DISASSEMBLING AND ASSEMBLING

[1] SEPARATING ENGINE FROM CLUTCH HOUSING









Draining Transmission Fluid

1. Place oil pan underneath the transmission case, and remove the drain plugs (1).
2. Drain the transmission fluid.
3. Reinstall the drain plug (1).

(When refilling)

- Fill new oil from filling port after remaining the filling plug (2) up to the upper notch on the dipstick (3).
- After running the engine for few minutes, stop it and check the oil level again, if low, add oil prescribed level.

■ IMPORTANT

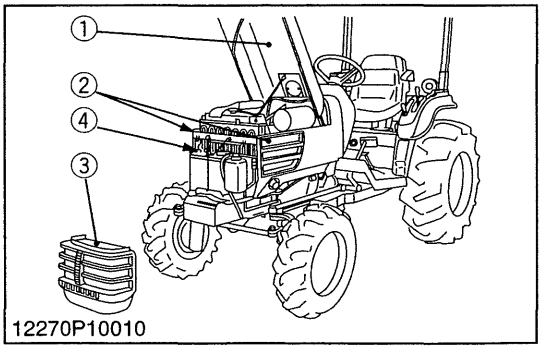
- **Use only KUBOTA SUPER UDT fluid-Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-8.)**
- **Never work the tractor immediately after changing the transmission oil. Keeping the engine at medium speed for a few minutes to prevents damage to the transmission.**
- **Do not mix different blands oil together.**

Transmission fluid capacity	B2410	12.5 L 3.30 U.S.gals. 2.75 Imp.gals.
	B2710	Affeted Serial No.: below 15496 14.0 L 3.70 U.S.gals. 3.08 Imp.gals. Affeted Serial No.: above 50101 14.5 L 3.83 U.S.gals. 3.19 Imp.gals.
	B2910	14.5 L 3.83 U.S.gals. 3.19 Imp.gals.

(1) Drain Plug
(2) Filling Port
(3) Dipstick

(A) Oil level is acceptable within this range.

12271S10110



Hood, Side Cover and Battery Cord

1. Open the hood (1) and remove the front grille (3).
2. Disconnect the battery grounding cord (4).
3. Disconnect the head light connectors and remove the hood and side covers (2).

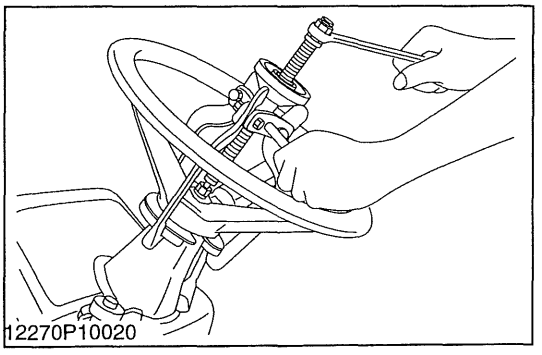
■ NOTE

- **When disconnecting the battery cords, disconnect the grounding cord first. When connecting, positive cord first.**

(1) Hood
(2) Side Cover
(3) Front Grille
(4) Battery Cord

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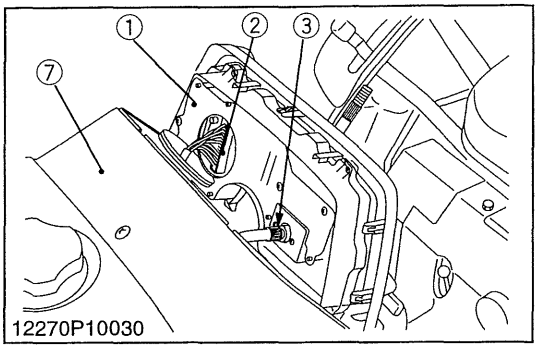
Steering Wheel

1. Remove the steering wheel cap.
2. Remove the steering wheel mounting nut and remove the steering wheel with a steering wheel puller (Code No. 07916-51090).

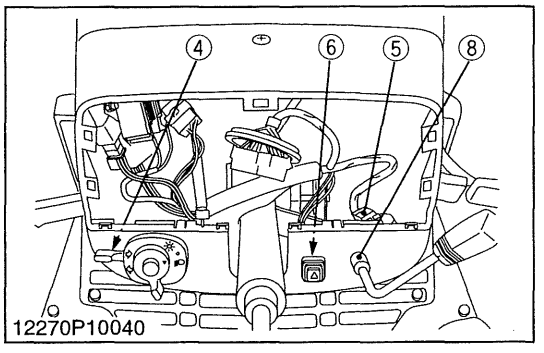
(When reassembling)

Tightening torque	Steering wheel mounting nut	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft-lbs

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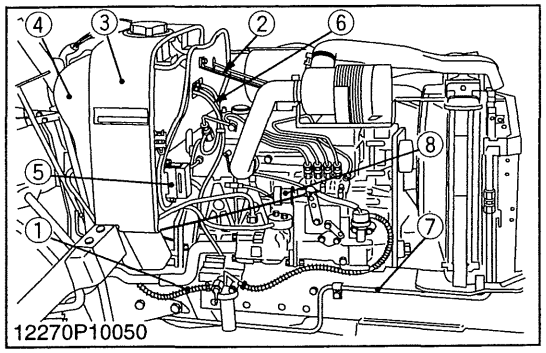
12270P10040

Meter Panel and Panel Under Cover

1. Open the meter panel (1) and disconnect the meter panel connector (2) and hour-meter cable (3). Then remove the meter panel.
2. Disconnect the combination switch connector (4), main switch connector (5) and hazard switch connector (6).
3. Tap out the spring pin and remove the hand accelerator lever (8).
4. Remove the panel under cover (7).

(1) Meter Panel
(2) Meter Panel Connector
(3) Hour-meter Cable
(4) Combination Switch Connector
(5) Main Switch Connector
(6) Hazard Switch Connector
(7) Panel Under Cover
(8) Hand Accelerator Lever

12270S10130



Fuel Tank

1. Disconnect the fuel hose (1) at the fuel filter side, then drain fuel completely.
2. Remove the fuel tank frame stay (2).
3. Disconnect the hazard unit, starter relay and regulator connectors and remove the lead wire for fuel gauge.
4. Remove the fuse box (5).
5. Disconnect the overflow hoses (6) of fuel line.
6. Remove the tank frame (3) with fuel tank (4).
7. Disconnect the hydraulic pipes (7) and remove the battery stay with oil cooler.
8. Disconnect the 2P connector and remove the engine stop solenoid (8).

(When reassembling)

- Apply a thin coat of liquid gasket (Three Bond 1215 or equivalent) to both surface of the engine stop solenoid (8).

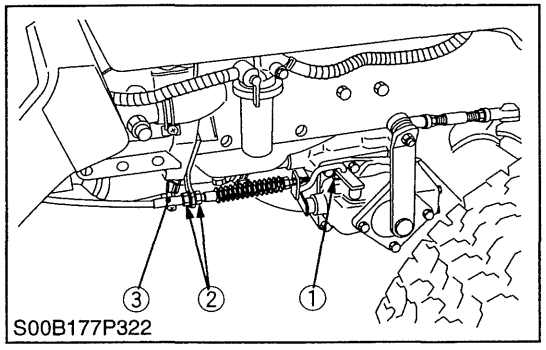
■ NOTE

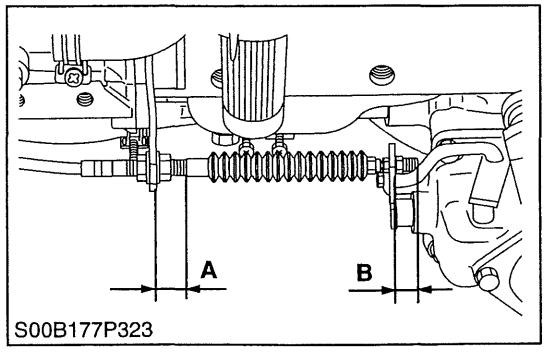
- **For fastening hydraulic pipe nut, use two wrenches. Hold the fitting with a wrench, turn the pipe nut with another wrench to avoid damage at fitting installed part.**

Tightening torque	Delivery pipe nut for HST	34 to 39 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs
	Oil cooler pipe nut	50 to 58 N·m 5.1 to 5.9 kgf·m 36.9 to 42.8 ft-lbs
	Delivery pipe nut for power steering	65 to 75 N·m 6.6 to 7.7 kgf·m 47.9 to 55.3 ft-lbs

(1) Fuel Hose
(2) Fuel Tank Frame Stay
(3) Fuel Tank Frame
(4) Fuel Tank
(5) Fuse Box
(6) Overflow Hose
(7) Hydraulic Pipe
(8) Engine Stop Solenoid

12270S10140





Bi-speed Turn Cable

1. Remove the spring lock pin (1) and loosen the lock nuts (2) and then remove the bi-speed turn cable (3).

(When reassembling)

- When reassembling the bi-speed turn cable (3), make sure the distance **A**.

Distance **A**	Factory spec.	18 mm 0.71 in.

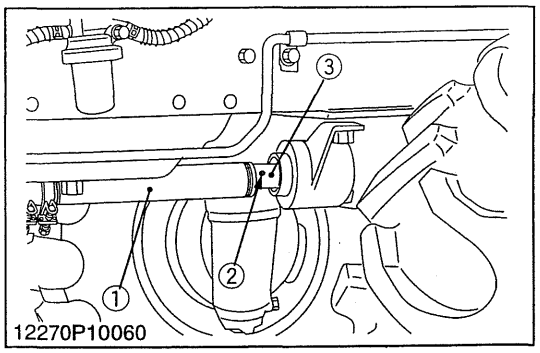
(Reference)

Distance **B**	Factory spec.	10 mm 0.39 in.

(1) Spring Lock Pin
(2) Lock Nut
(3) Bi-speed Turn Cable

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Propeller Shaft Cover and Coupling

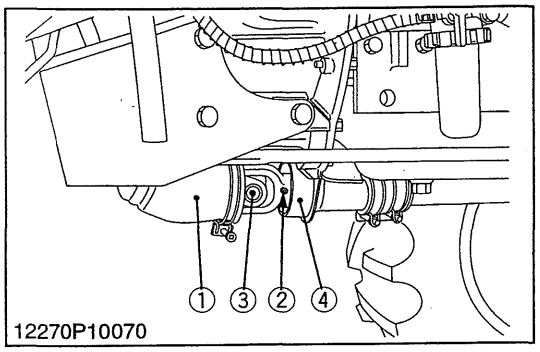
1. Loosen the clamp and slide the propeller shaft cover (1) to the rear.
2. Tap out the spring pin (2) and then slide the coupling (3) to the rear.

(When reassembling)

- Apply grease to the splines of the propeller shaft and coupling.

(1) Propeller Shaft Cover
(2) Spring Pin
(3) Coupling

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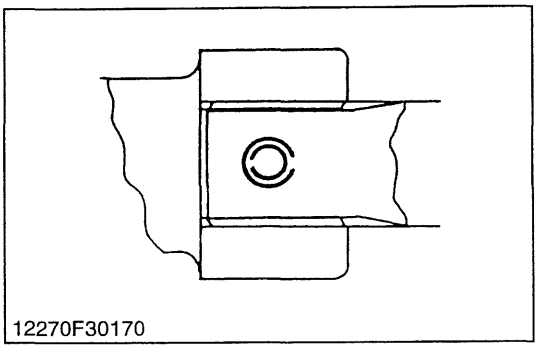
12270P10070

Universal Joint and Bearing Holder

1. Loosen the clamp and slide the universal joint cover (1) to the rear.
2. Tap out the spring pins (2) and then slide the universal joint (3) to the rear.
3. Remove the bearing holder (4) with propeller shaft and universal joint.

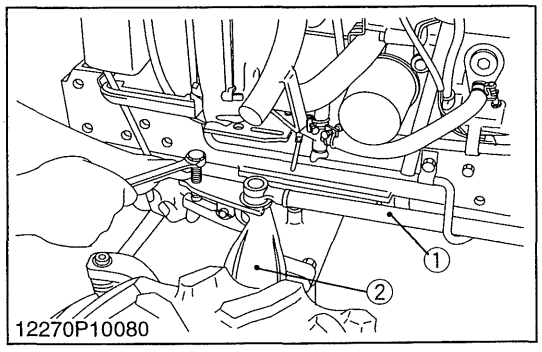
(When reassembling)

- Apply grease to the splines of the propeller shaft and universal joint.
- When inserting the spring pins (2), face their splits in the direction parallel to the universal joint as shown in the figure.


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(1) Universal Joint Cover
(2) Spring Pin
(3) Universal Joint
(4) Bearing Holder

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Drag Link

1. Remove the cotter pin and loosen the slotted nut.
2. Disconnect the drag link (1) with a pitman arm puller from the knuckle arm (2).

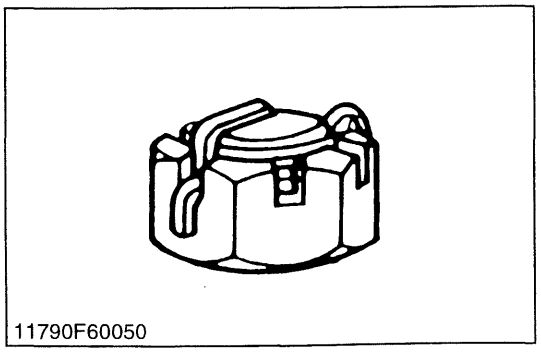
(When reassembling)

■ IMPORTANT

- **Do not loosen the slotted nut to align the hole.**
- **Install the cotter pin as shown in the figure**

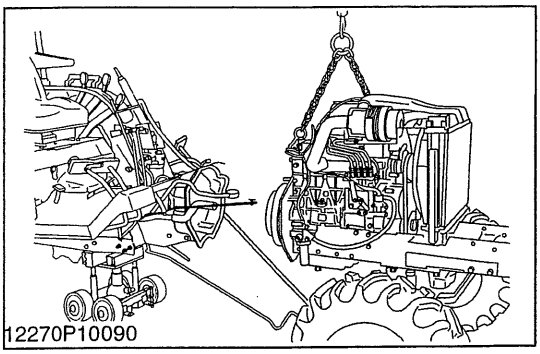
(Reference)

Tightening torque	Slotted nut	17.7 to 34.5 N·m 1.8 to 3.5 kgf·m 13.0 to 25.3 ft-lbs


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(1) Drag Link
(2) Knuckle Arm

12270S10170


12270P10090

Separating the Engine from Clutch Housing

1. Disconnect the three point hitch delivery pipe and suction hose.
2. Disconnect the glow plug lead wire and thermo sensor lead wire. And then disconnect the connector for dynamo and starter motor lead wire.
3. Place the jack under the center frame.
4. Hoist the engine by the chain at the engine hook.
5. Remove the engine mounting screws and separate the engine from the clutch housing.

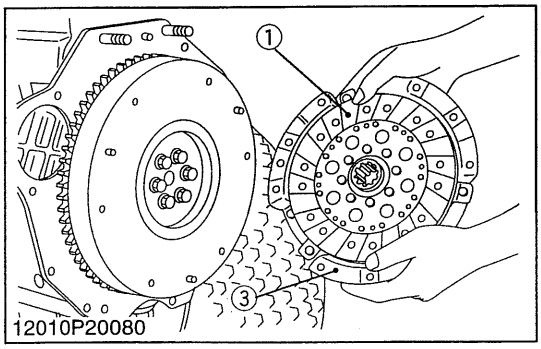
(When reassembling)

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

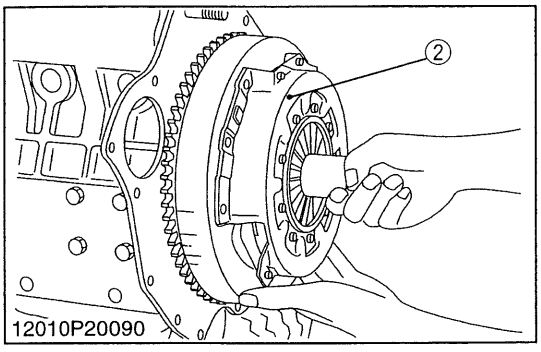
Tightening torque	Engine mounting M8 screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs
	Engine mounting M10 nut	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs

12270S10180

[2] SEPARATING CLUTCH ASSEMBLY



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12010P20090

Separating the Clutch Assembly

1. Remove the clutch assembly (2) 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 clutch disc and flywheel by inserting the clutch center tool.**

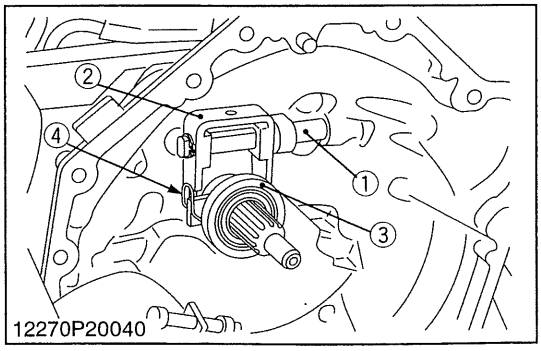
■ NOTE

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

Tightening torque	Clutch mounting screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

(1) Clutch Disc
(2) Clutch Assembly
(3) Clutch Cover

12010S20110



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Clutch Rod and Clutch Release Fork

1. Remove the clutch pedal rod.
2. Remove the external snap ring at the end of clutch rod (1) and remove the clutch release fork (2) and release bearing (3) with release hub.

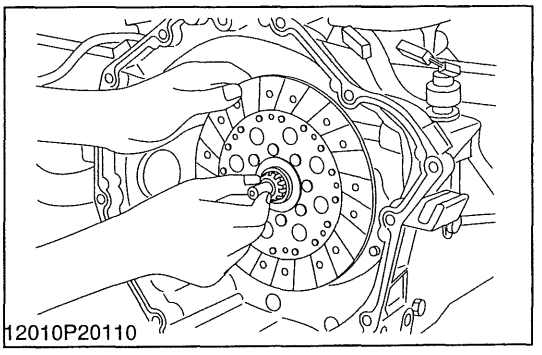
(When reassembling)

- Set the clutch release fork and release hub with set spring (4) in the correct direction.

(1) Clutch Rod
(2) Clutch Release Fork
(3) Release Bearing
(4) Set Spring

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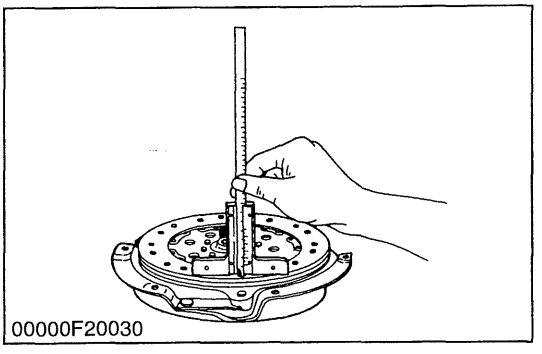

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Backlash between Clutch Disc and Clutch Shaft

1. Mount the clutch disc onto the propeller shaft.
2. Hold the propeller shaft so that it does not rotate.
3. Slightly move the disc and measure the displacement around disc edge.
4. If the measurement exceeds the allowable limit, replace clutch disc.

Displacement around disc edge	Allowable limit	2.0 mm 0.079 in.

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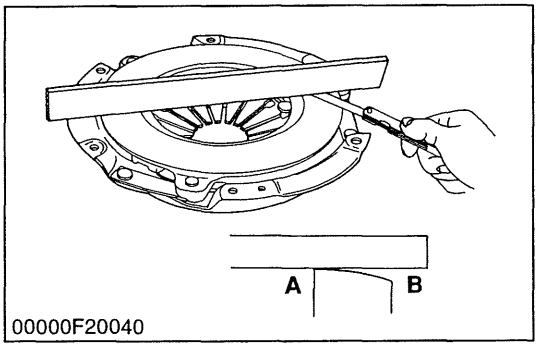

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Clutch Disc Wear

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 clutch disc.

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

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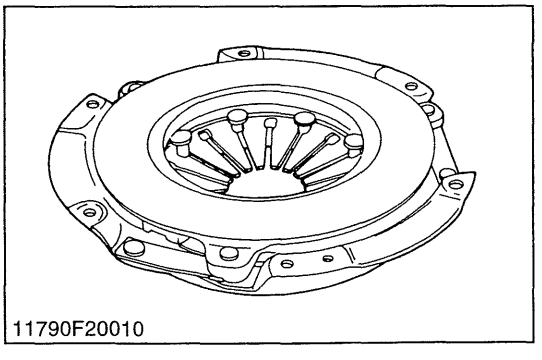
Pressure Plate Flatness

1. Place a straightedge 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 straightedge, replace even if the clearance is within the allowable limit.

Clearance between pressure plate and straightedge	Allowable limit	0.2 mm 0.008 in.

(A) Inside **(B) Outside**

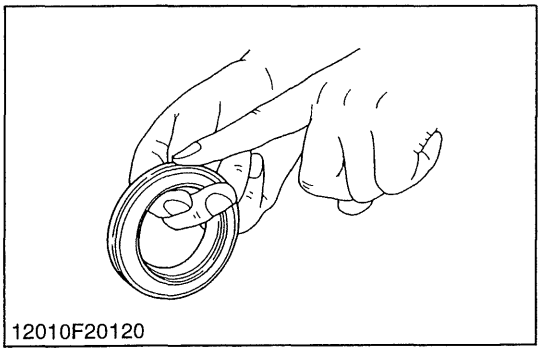
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Checking Pressure Plate and Diaphragm

1. Check the pressure plate and if scratched on its surface, correct with sandpaper or replace it.
2. Check the diaphragm for cracke and scratches. If defects are found, replace it.

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Checking Clutch Release Bearing

1. Check the clutch release bearing. If surface is worn excessively, or abnormal sounds occur, replace it.

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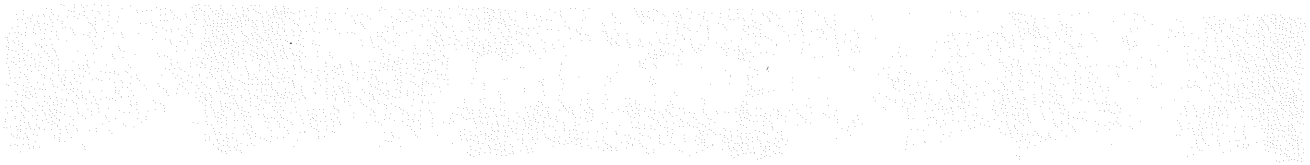
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MECHANISM

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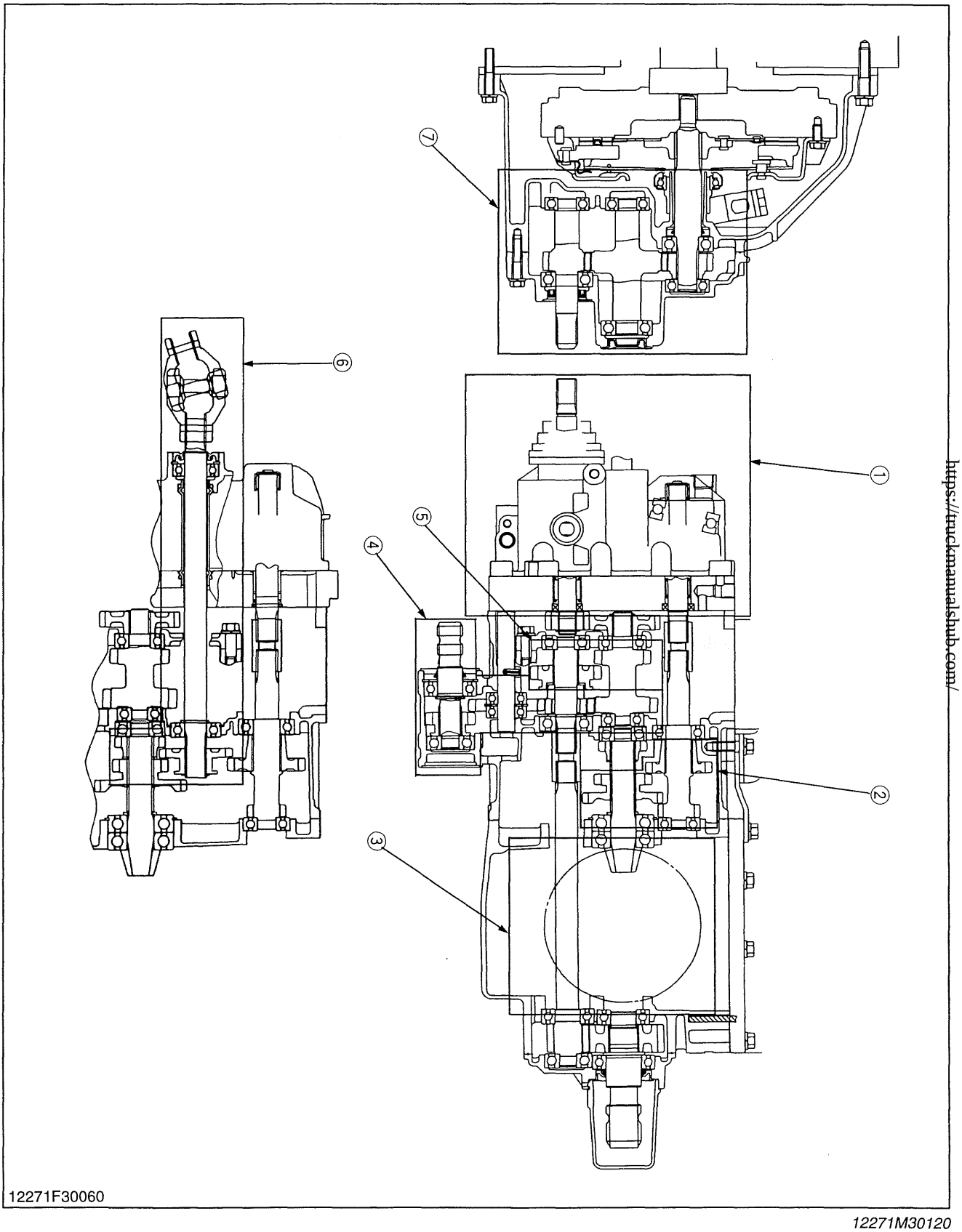
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[1] STRUCTURE

(1) B2410

(1) Hydrostatic Transmission Section
(2) Hi-Lo Shift Section
(3) Differential Gear Section
(4) Mid-PTO Shift Section
(5) Rear-PTO Shift Section
(6) Front Wheel Drive Section
(7) Clutch Housing Section

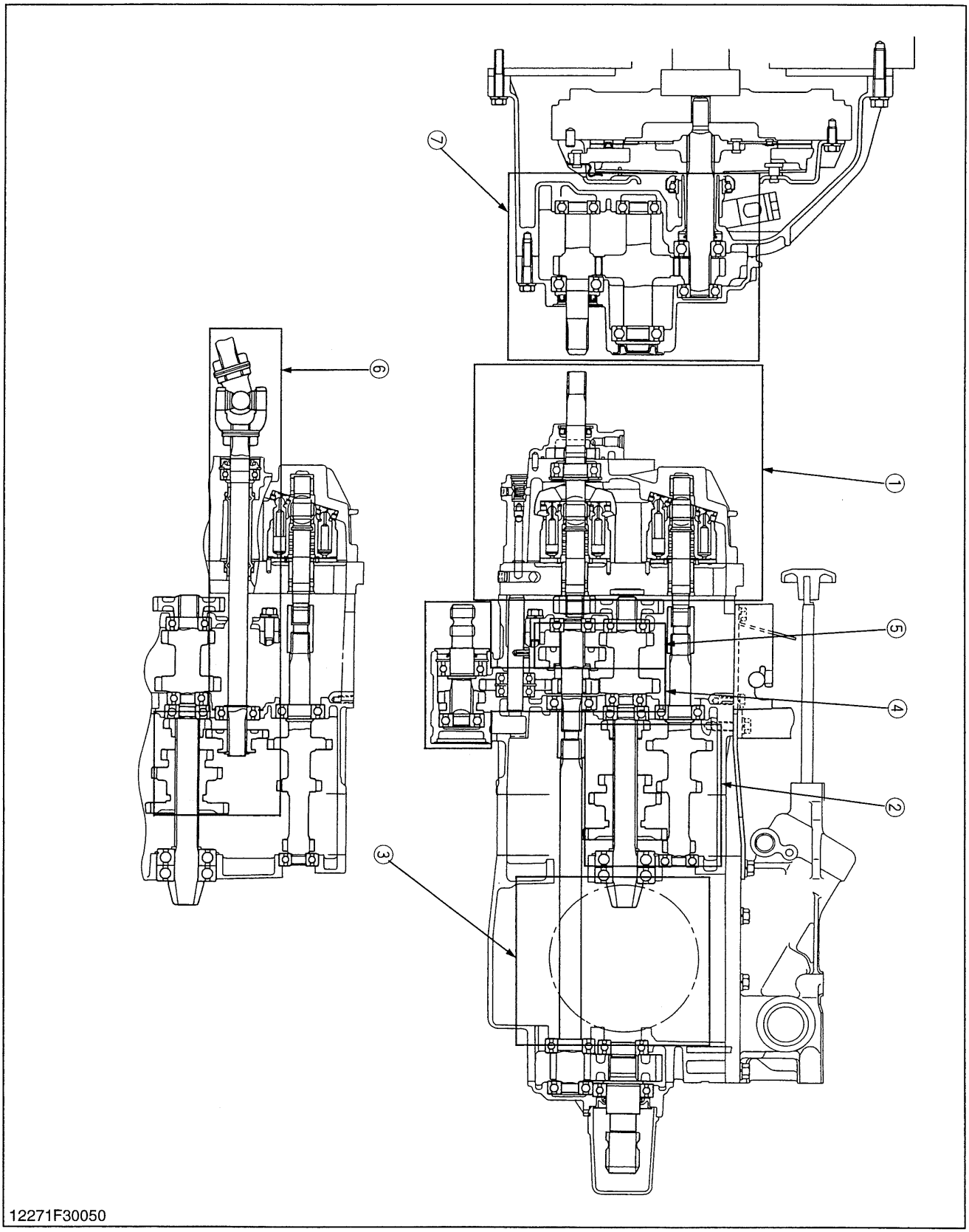


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(2) B2710 • B2910



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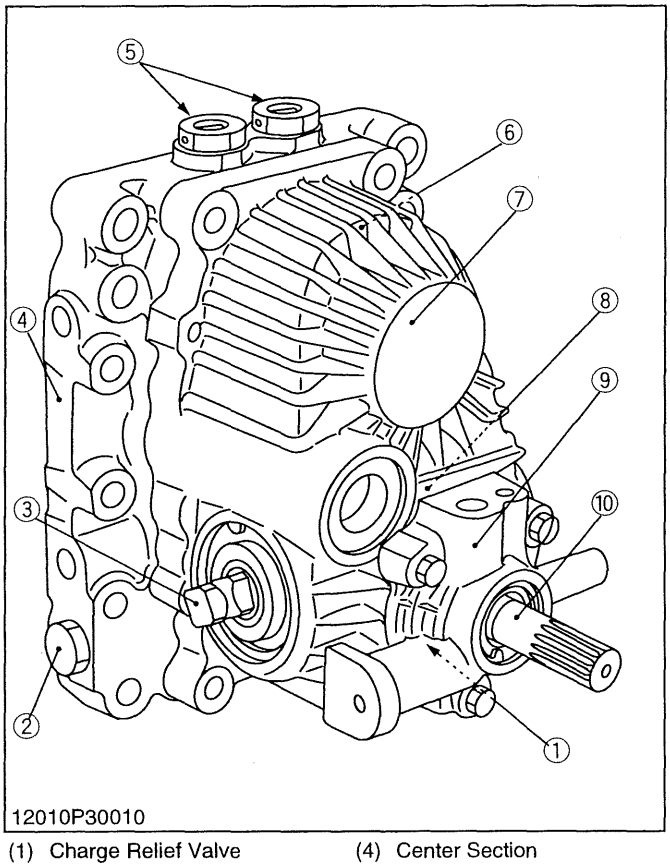
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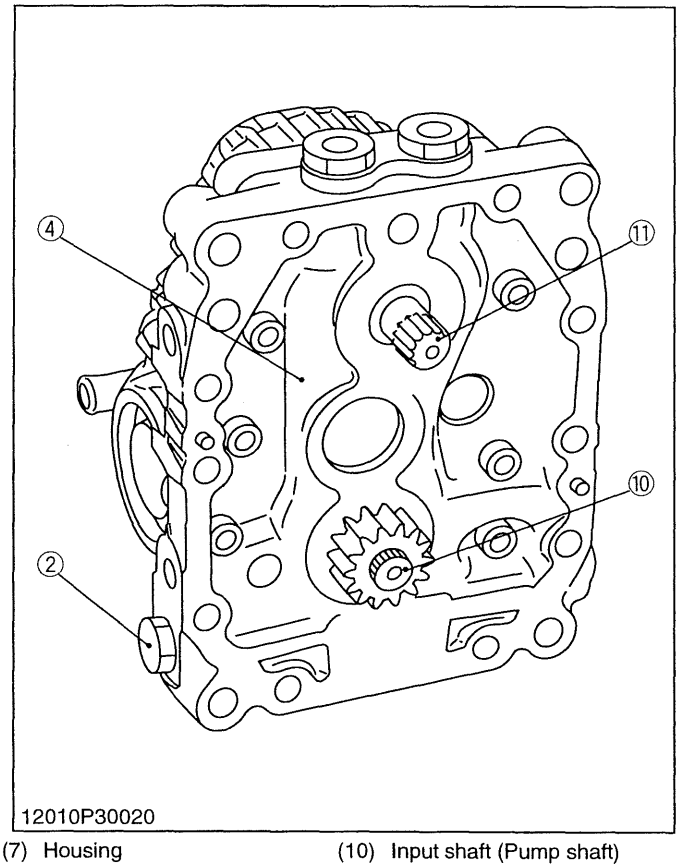
[2] TRAVELLING SYSTEM

(1) Hydrostatic Transmission

(1)-1 Structure



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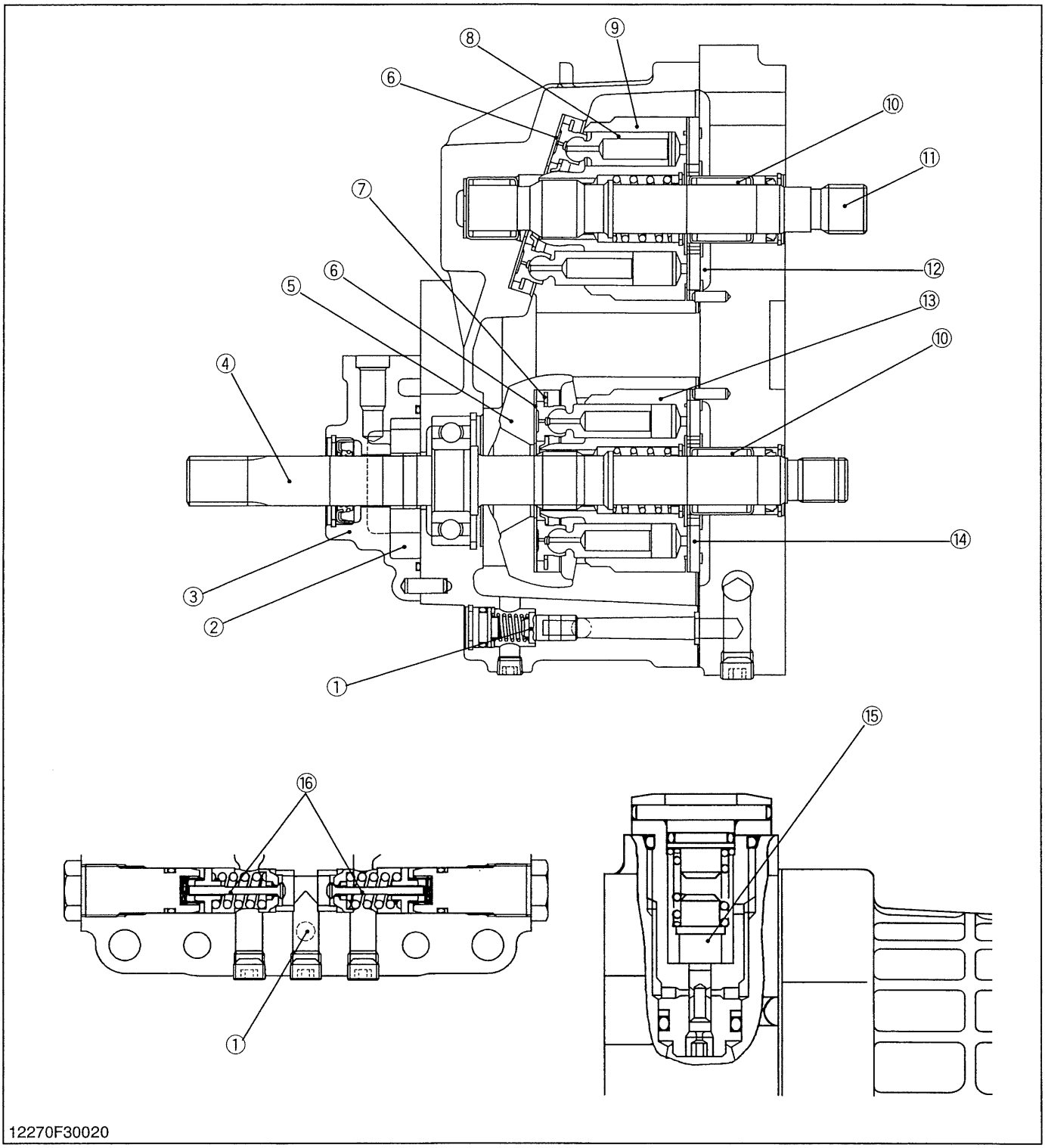
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(1) Charge Relief Valve
(2) Check and High Pressure Relief Valve
(3) Turnion Shaft
(4) Center Section
(5) Neutral Valve
(6) Fixed Displacement Piston Motor
(7) Housing
(8) Variable Displacement Piston Pump
(9) Charge Pump
(10) Input shaft (Pump shaft)
(11) Output Shaft

Hydrostatic transmission is composed of variable displacement piston pump, fixed displacement piston motor, charge pump and valve system.

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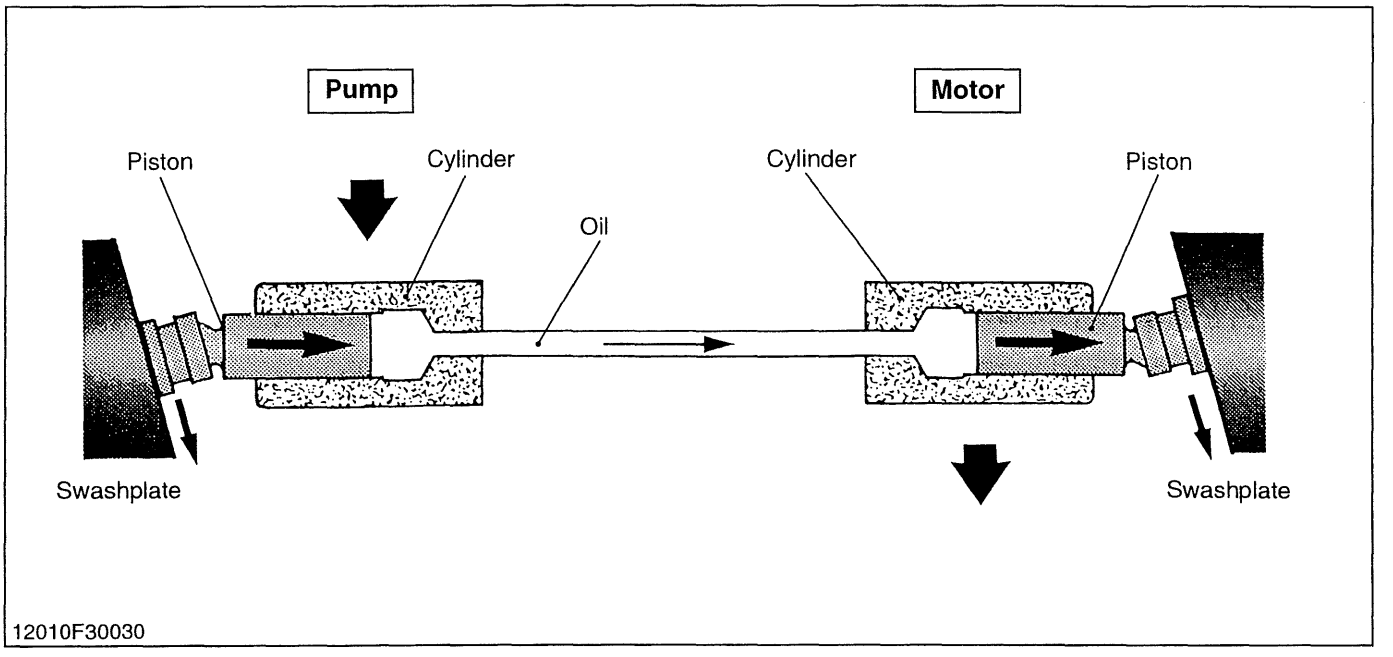
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(1) Charge Relief Valve
(2) Charge Pump
(3) Charge Pump Case
(4) Pump Shaft
(5) Variable Swashplate
(6) Thrust Collar
(7) Retainer Plate
(8) Piston
(9) Cylinder Block (Motor)
(10) Needle Bearing
(11) Motor Shaft
(12) Valve Plate (Motor)
(13) Cylinder Block (Pump)
(14) Valve Plate (Pump)
(15) Neutral Valve
(16) Check and High Pressure Relief Valve

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(1)-2 Pump and Motor



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.

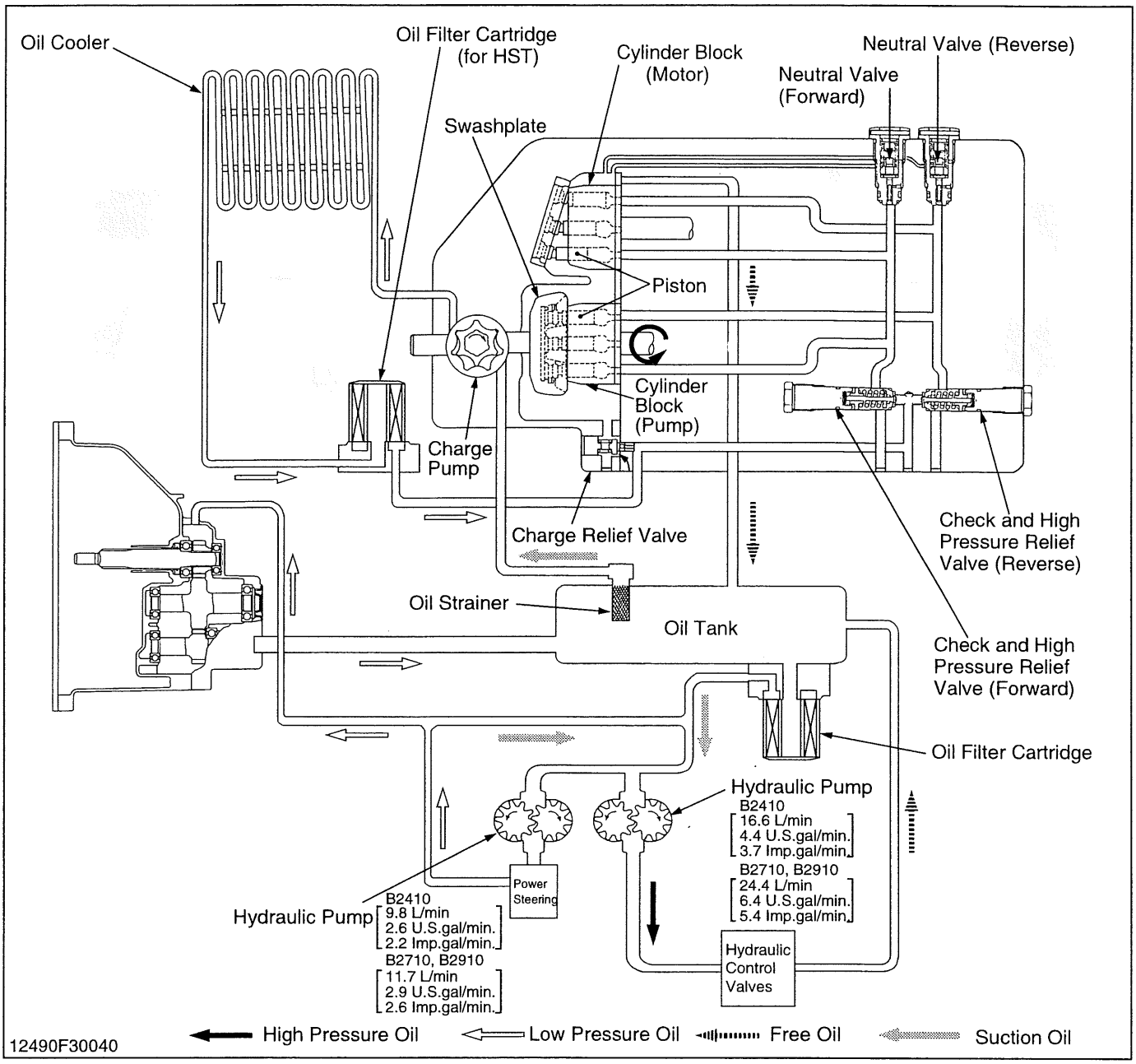
In the pump, as the cylinder rotates, pistons move across the sloping face of swashplate and slide in or out of their cylinder bores. The oil, forced out by the pump pistons, causes the motor pistons to slide out of their cylinder bores.

In the motor, sliding out of the cylinder and moving across the sloping face of swashplate, the pistons rotate the cylinder.

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(1)-3 Oil Flow and Valves



The pump and motor are joined in a closed hydraulic loop and most of oil circulates within the main oil circuit. A little oil lubricates and oozes out from the clearance between the moving parts of the case. Then oil in the main oil circuit of the HST needs to be supplied a want.

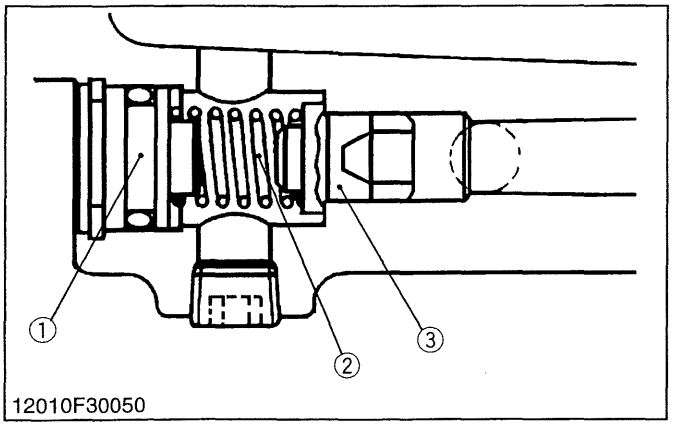
So all of oil fed from charge pump flow to hydrostatic transmission for charging and cooling.

The charge oil aids smooth operation of pistons for pump and motor. The charge oil passes through the oil cooler and oil filter cartridge to charge relief valve port. The rest of oil passes through the charge relief valve into the HST housing. And overflow oil from HST housing return to the transmission case.

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■ Charge Relief Valve



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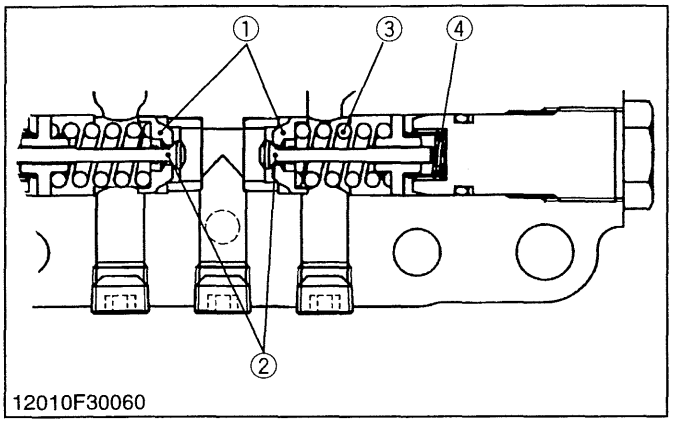
While pumped and filtered oil flows into the main oil circuit through the check and high pressure relief valves, and excessive oil passes to the housing through the charge relief valve.

Oil temperature	Valve operating pressure
50 °C (122 °F)	500 to 800 kPa 5.1 to 8.2 kgf/cm^2 73 to 116 psi

(1) Plug
(2) Spring
(3) Charge Relief Poppet

12270M30030

■ Check and High Pressure Relief Valve



12010F30060

The check and high pressure relief valves monitor the oil pressure in each line of the main oil circuit.

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.

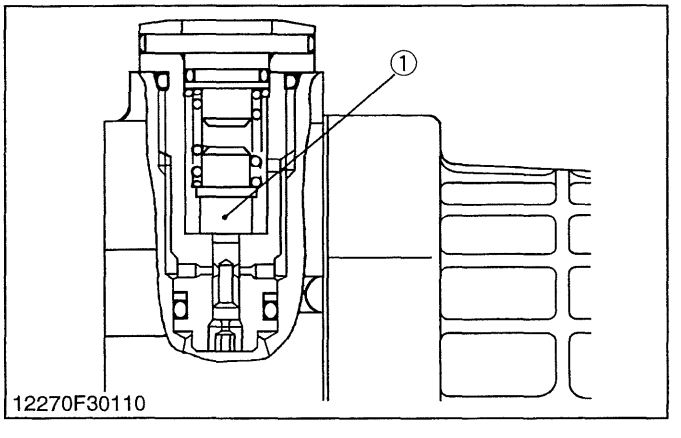
When excessively high pressure is built up in one line, the high pressure relief valve located in this line is open and the oil flows into another line.

Oil temperature	Valve operating pressure
50 °C (122 °F)	30.9 to 31.9 MPa 315 to 325 kgf/cm^2 4480 to 4622 psi

(1) Check Valve Seat
(2) Relief Poppet
(3) Relief Spring
(4) Check Spring

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■ Neutral Valve



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The neutral valves in the main oil circuit lines are open and pass the oil to the case when in neutral, and the oil pressure in their lines becomes low. And when the oil pressure in the high pressure line increases to a specified pressure, the neutral valve closes.

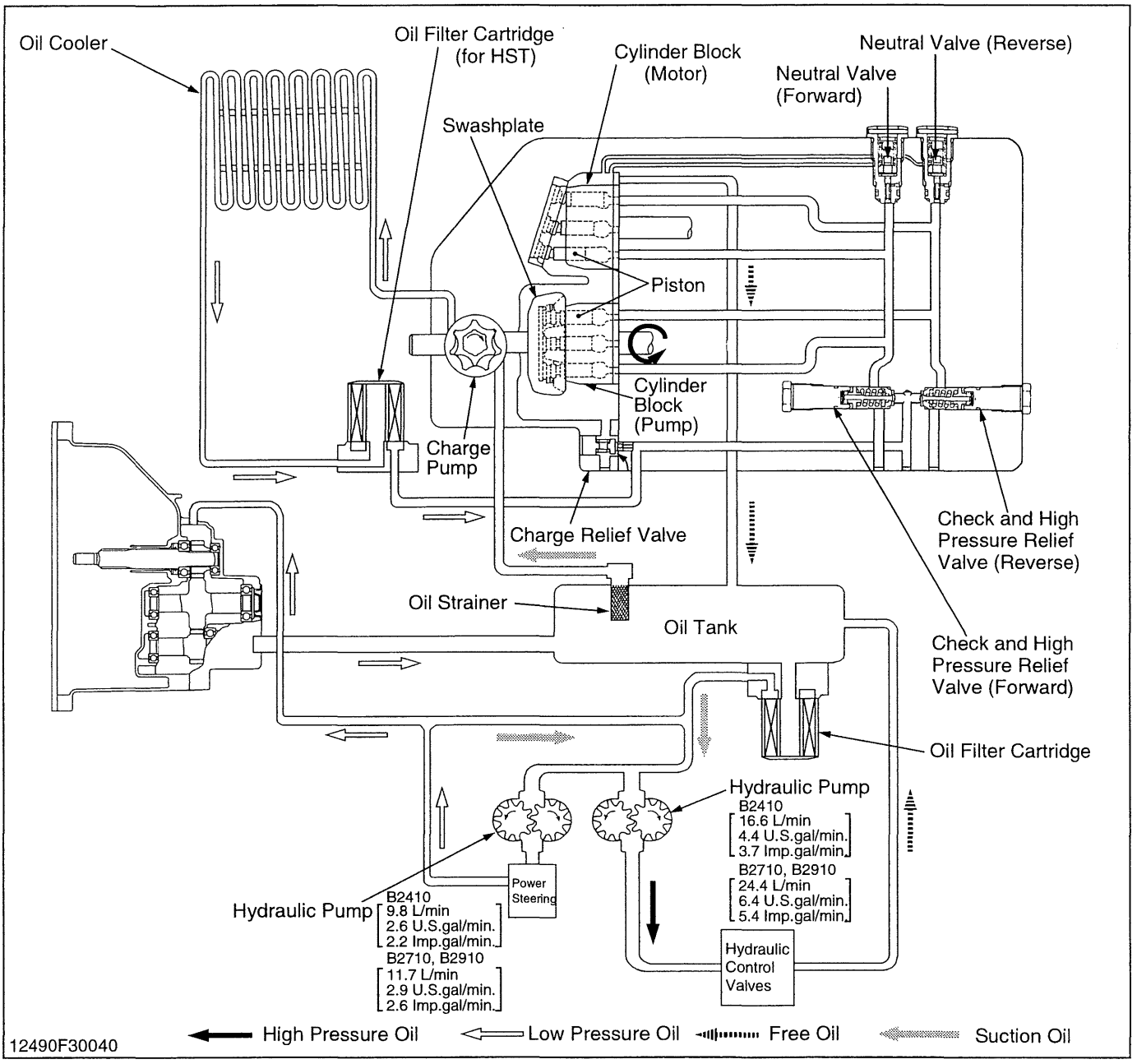
Oil temperature	Valve operating pressure	
50 °C (122 °F)	Close	7.36 to 9.81 MPa 75 to 100 kgf/cm^2 1067 to 1422 psi
	Open	1.47 to 2.45 MPa 15 to 25 kgf/cm^2 213 to 356 psi

(1) Neutral Valve

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(1)-4 Operation

■ Neutral

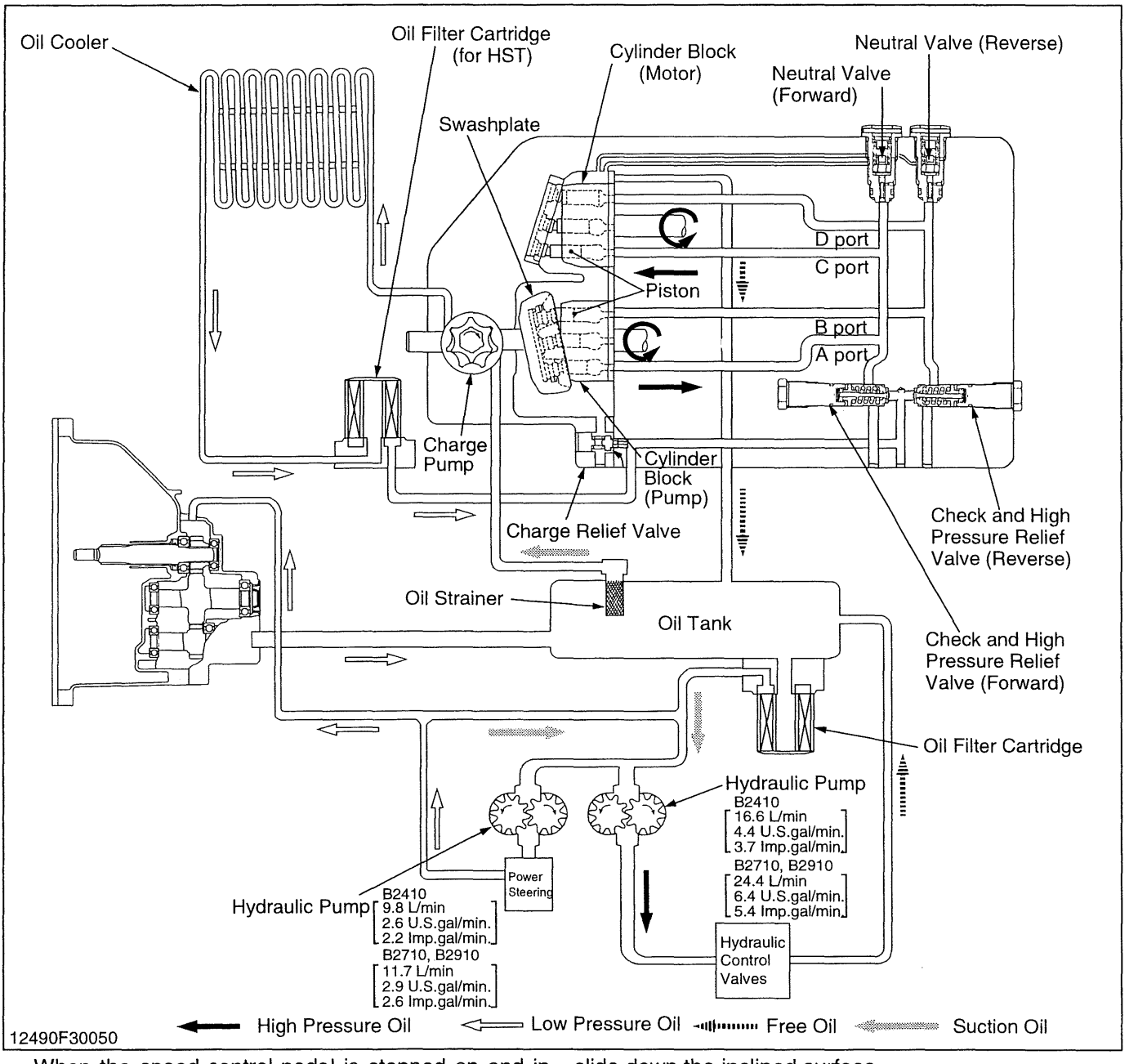


When the speed control pedal is in neutral, the variable swashplate is at right angles to the pump pistons and they only rotate with cylinder block without reciprocating. Since the oil is not being pumped to the motor, the cylinder block in the motor is stationary and the output shaft does not move.

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Forward



When the speed control pedal is stepped on and in forward, the variable swashplate is tilted as shown in figure above.

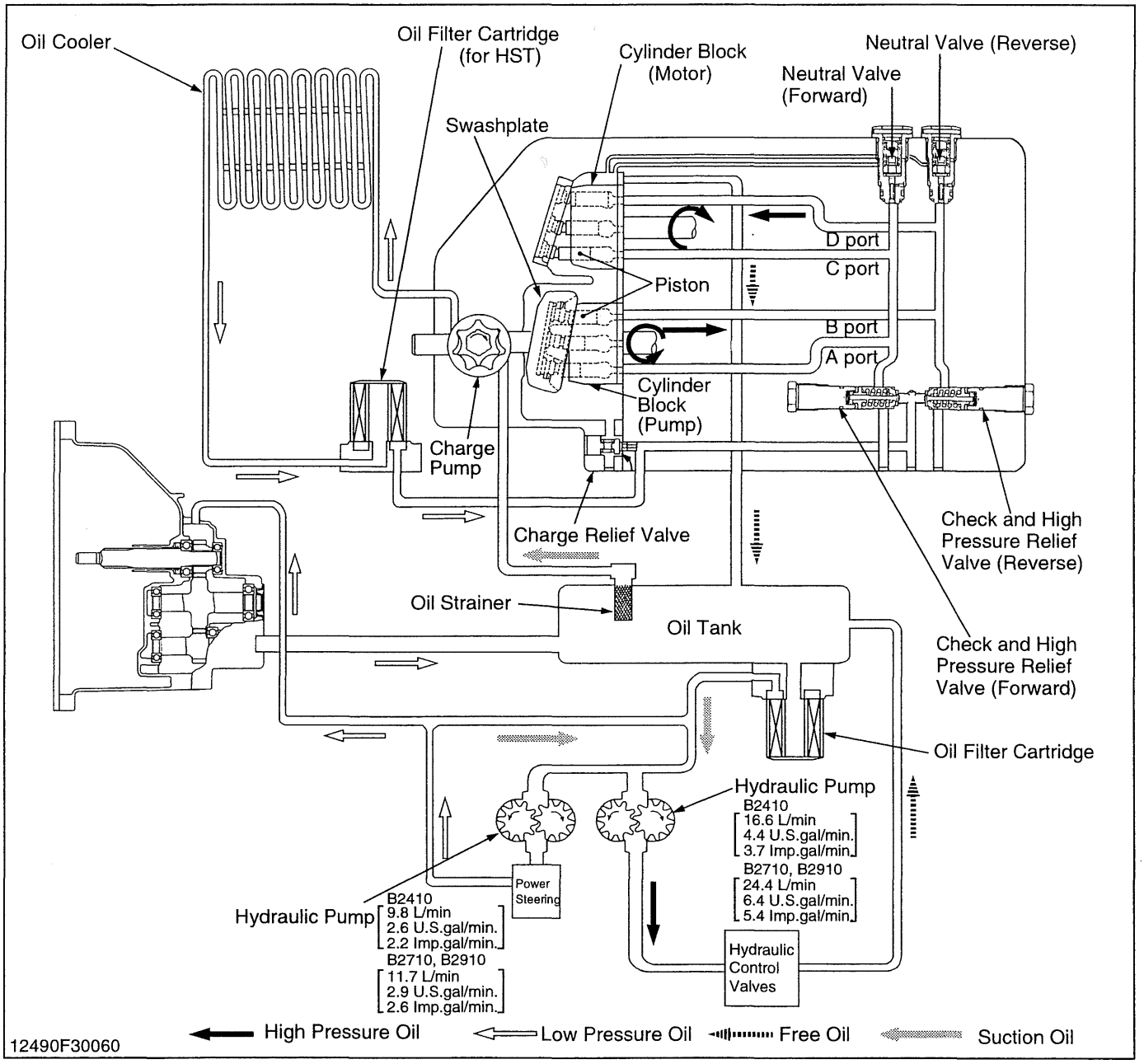
As the pump cylinder block rotates with the input shaft, oil is forced out of pump port **A** at high pressure. As pressure oil enters motor port **C**, the pistons, which align with port **C**, are pushed against the swashplate and slide down the inclined surface.

Then the output shaft rotates with the motor cylinder block. 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.

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■ Reverse



When the speed control pedal is stepped on and in reverse, the variable swashplate is tilted as shown in figure above.

As the pump cylinder block rotates with the input shaft, 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 swashplate and slide down the inclined surface.

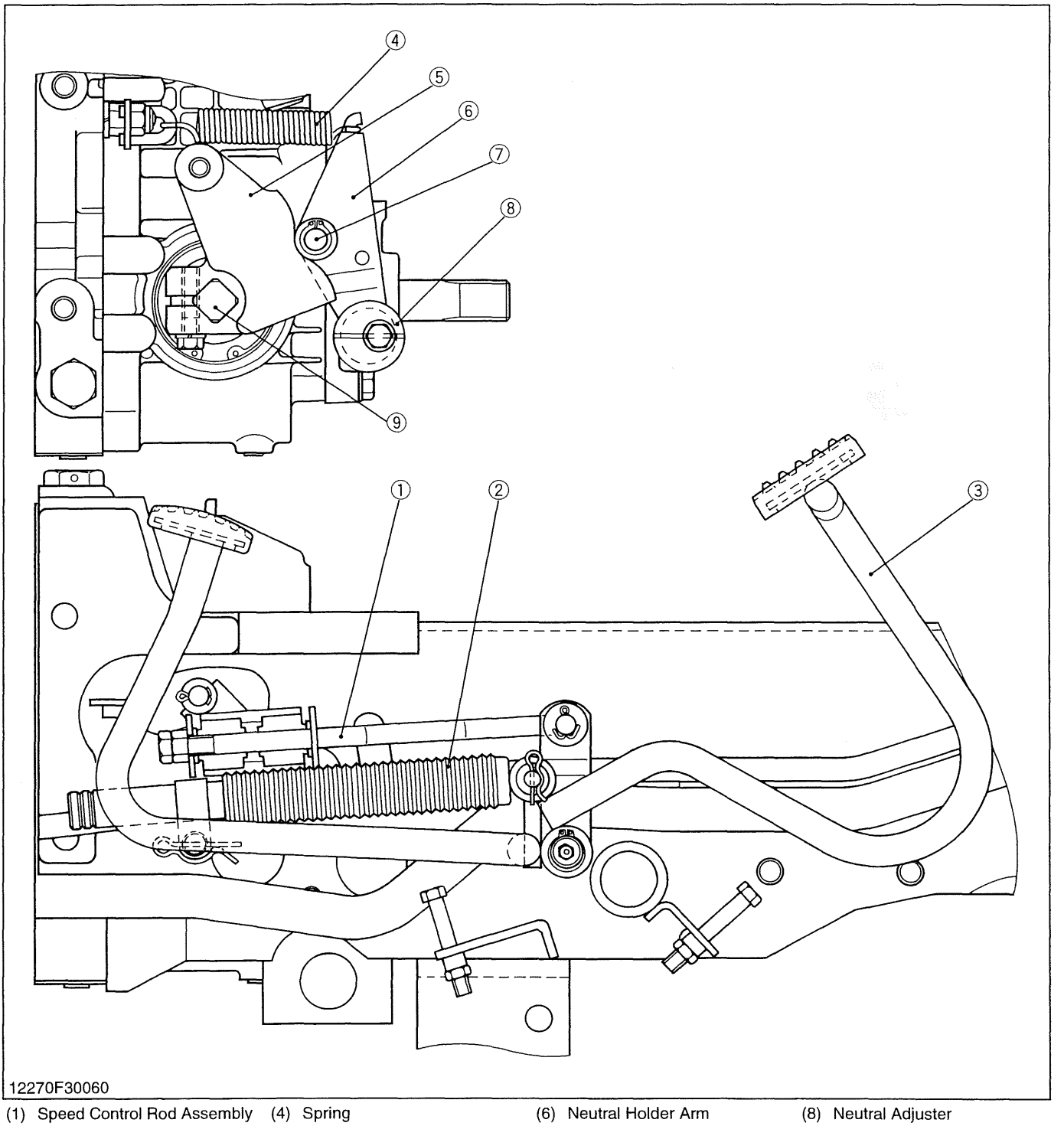
Then the output shaft rotates with the motor cylinder block. This drives the machine rearward and the angle of pump swashplate determines the output shaft speed.

As the motor cylinder block continues to rotate, oil is forced out of motor port **C** at low pressure and returns to the pump.

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(1)-5 Control Linkage



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(1) Speed Control Rod Assembly
(2) Damper
(3) Speed Control Pedal
(4) Spring
(5) Neutral Holder
(6) Neutral Holder Arm
(7) Roller
(8) Neutral Adjuster
(9) Trunnion Shaft

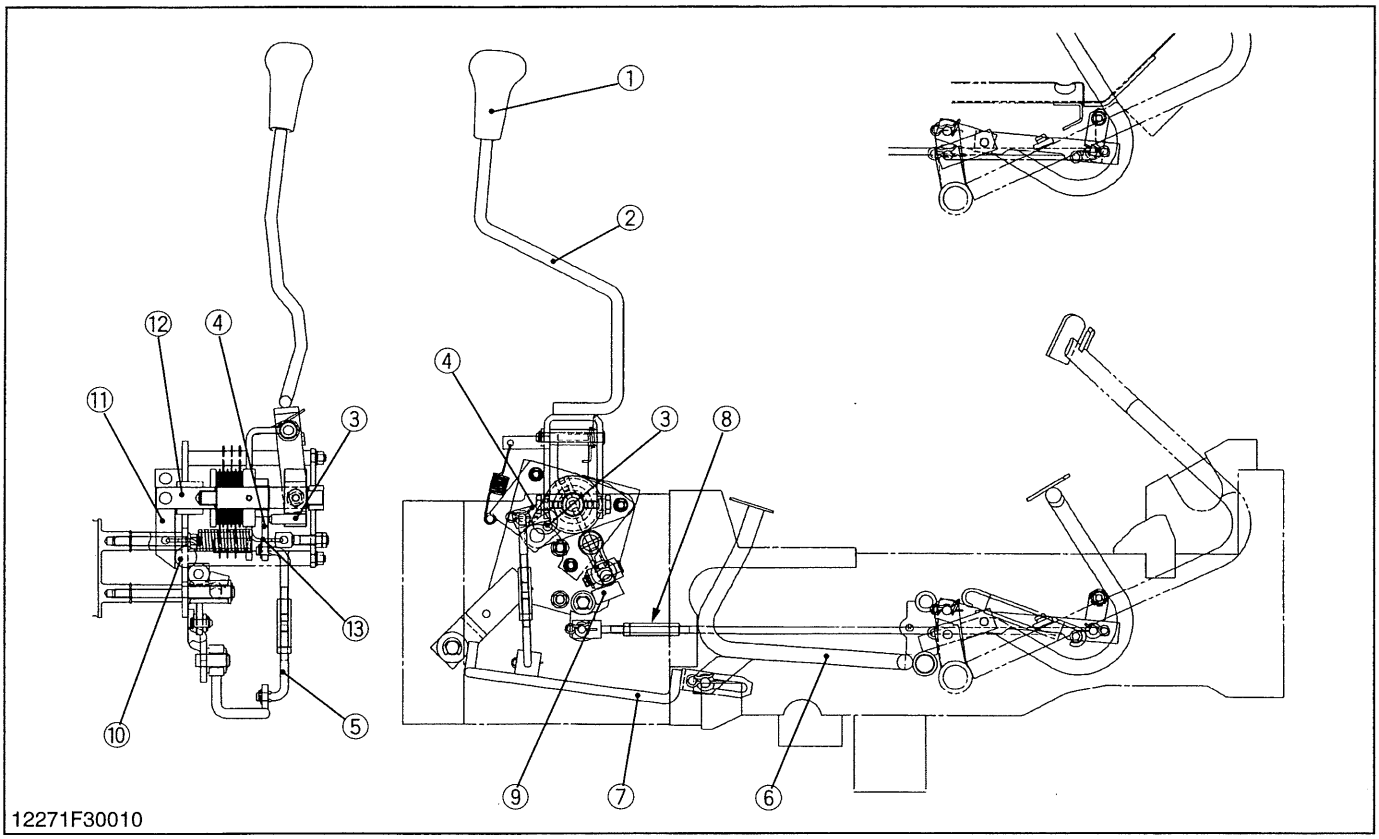
The speed control pedal (3) and the trunnion shaft (9) of variable swashplate are linked with the speed control rod (1) and the neutral holder (5). As the front footrest of the pedal is depressed, the swashplate rotates and forward travelling speed increases. Depressing the rear footrest increases reverse speed.

The roller (7) on the neutral holder arm (6) is held with spring seats the detent of the neutral holder (5) so that the neutral holder returns to neutral. Then, the swashplate is returned to neutral with the neutral holder, when the pedal is released. The damper (2) connected to the speed control pedal restricts the movement of the linkage to prevent abrupt operation or reversing.

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(1)-6 Cruise Control Linkage (B2910 Only)



(1) Grip
(2) Cruise Control Lever
(3) Lever Pin
(4) Cruise Control Arm
(5) Cruise Control Rod
(6) HST Pedal
(7) HST Pedal Lever
(8) HST Release Rod
(9) Release Lever 1
(10) Release Lever 2
(11) Release Arm
(12) Cruise Control Shaft
(13) Spring

Tilt the cruise control lever (2) to the right, and the lever pin (3) is activated to lift the cruise control arm (4).

Move the above lever forward, and the HST pedal lever (7) rises by the cruise control rod (5) that is coupled with the cruise control arm (4). (The HST pedal (6) is now in the depressed position.)

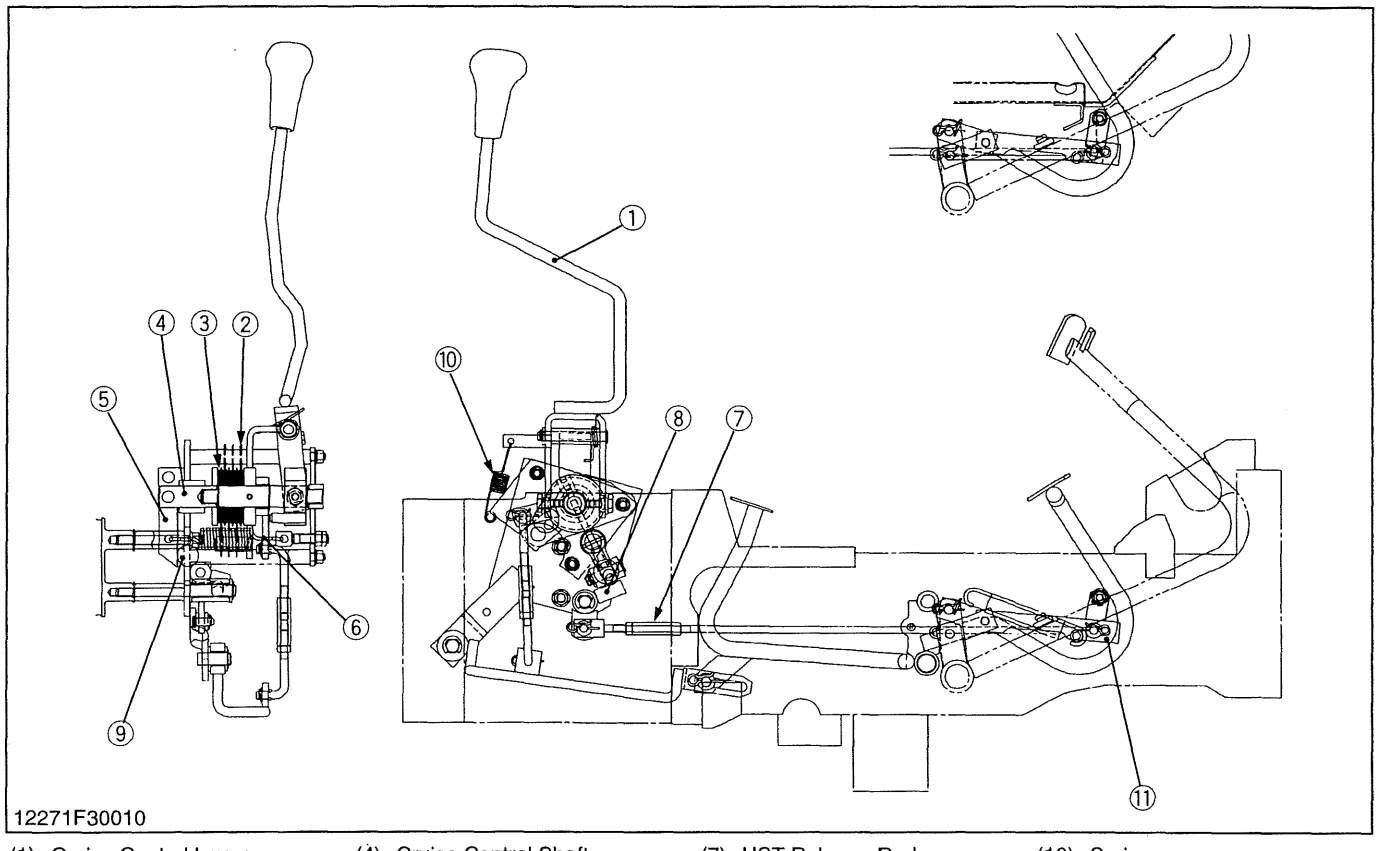
Now the cruise control lever (2) can be fixed (set) to a desired position through the disc (friction) and the plate under spring (13) force.

With the cruise control lever (2) set at the center on the lever guide, the HST pedal (6) is given an allowance by the oval hole of the HST pedal lever (7). This pedal can be stepped further down by this allowance. (This means that the machine speed can be accelerated from a setting and that when the HST pedal is released, the machine speed comes down to the setting.)

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(1)-7 Cruise Control Release System (B2910 Only)



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(1) Cruise Control Lever
(2) Plate
(3) Friction Disc
(4) Cruise Control Shaft
(5) Release Arm
(6) Spring
(7) HST Release Rod
(8) Release Lever 1
(9) Release Lever 2
(10) Spring
(11) Brake Link

This is release system of the cruise the cruise control back to neutral automatically when brake pedals are depressed.

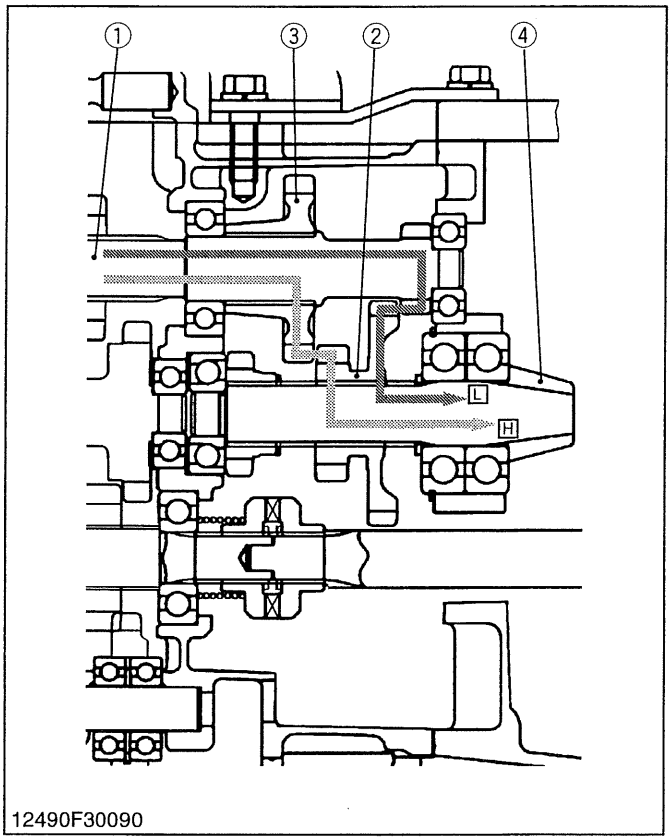
Cruise control lever (1) is set with plate (2), friction disc (3) by the cruise control shaft (4), release arm (5) and spring (6).

When brake pedals are depressed, brake link (11) pull the HST release rod (7), release lever 1 (8) and release lever 2 (9). Afterwards, cruise control shaft is pulled though release arm (5).

As a result, the holding force of cruise control lever (1) is lost. And, cruise control lever (1) returns to neutrality by force of the spring (10) and the return force of HST.

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(2)-1 Hi-Lo Gear Shift Section (B2410)



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Two kinds of power flow (from 4th shaft to spiral bevel pinion shaft) are available by operating the high-low gear shift lever to shift the gear (2) on the spiral bevel pinion shaft (4).

■ Low Position

4th Gear Shaft (1) → Shifter Gear (2) → Spiral Bevel Pinion Shaft (4)

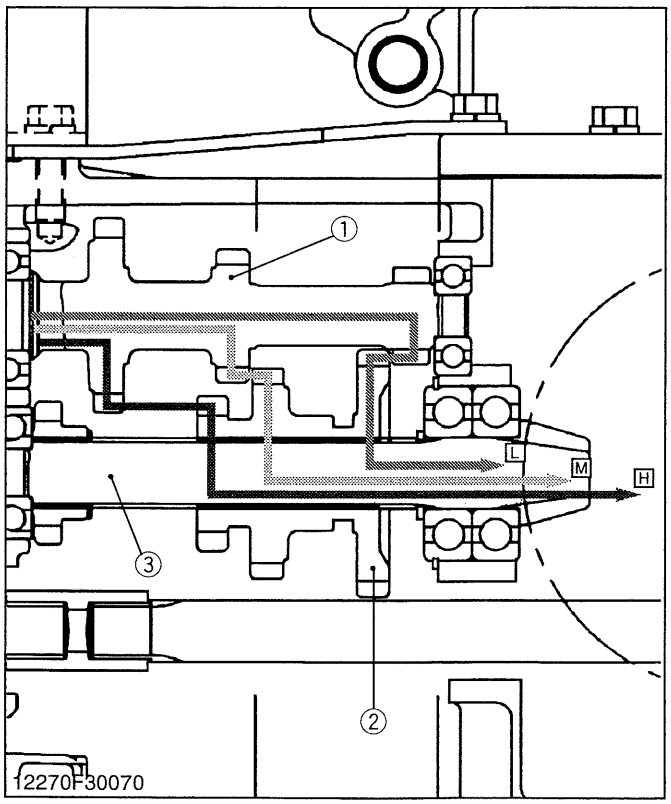
■ High Position

4th Shaft (1) → Shifter Gear (2) → Spiral Bevel Pinion Shaft (4)

(1) 4th Gear Shaft with 11T Gear
(2) 15T-29T Shifter Gear
(3) 18T Gear
(4) Spiral Bevel Pinion Shaf

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(2)-2 Range Gear Shift Section (B2710 • B2910)



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Three kinds of power flow (from 4th shaft to spiral bevel pinion shaft) are selected by operating the range gear shift lever to shift the gears (2) on the spiral bevel pinion shaft (3) and the 4th shaft (1).

■ Low Position

4th Gear shaft 11T (1) → Shifter Gear (2) → Spiral Bevel Pinion Shaft (3).

■ Middle Position

4th Gear Shaft 16T (1) → Shifter Gear (2) → Spiral Bevel Pinion Shaft (3)

■ High Position

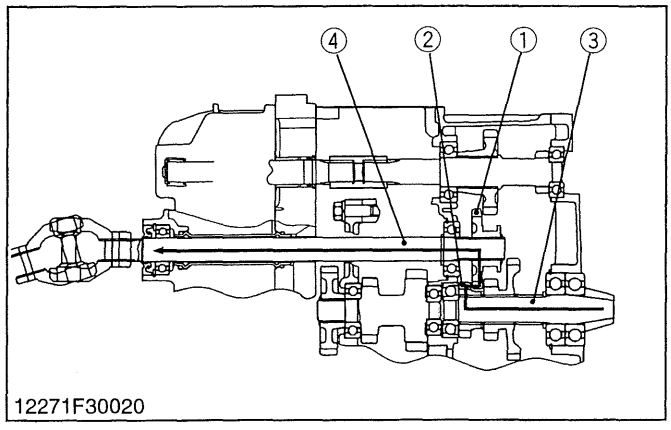
4th Gear Shaft 21T (1) → Shifter Gear (2) → Spiral Bevel Pinion Shaft (3).

(1) 4th Gear Shaft
(2) 16T – 27T – 32T Shifter Gear
(3) Spiral Bevel Pinion Shaft

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(3)-1 Front Wheel Drive Section (B2410)



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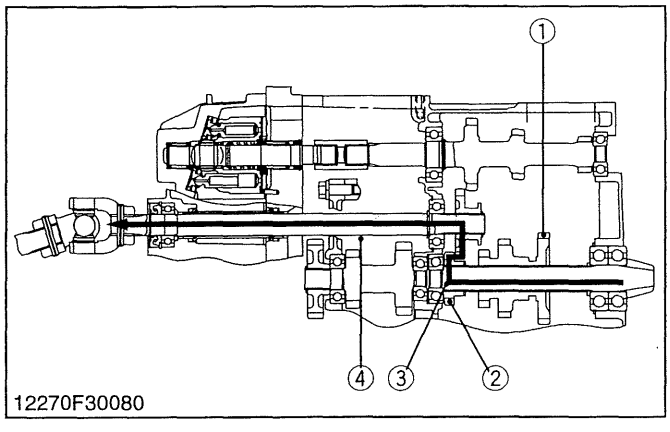
2-wheel drive or 4-wheel drive is selected by changing the position of 20T shift gear (1) with the front wheel drive lever. When the front wheel drive lever is set to "**Disengaged**", the 20T shift gear (1) is neutral and power is not transmitted to the front wheel drive shaft (4).

When the front wheel drive lever is set to "**Engaged**", the 20T shift gear (1) slides to the right to engage with 13T gear (2) on the spiral bevel pinion shaft (3). Therefore, the front drive shaft is actuated to drive the front wheels.

(1) 20T Shift Gear
(2) 13T Gear
(3) Spiral Bevel Pinion Shaft
(4) Front Wheel Drive Shaft

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(3)-2 Front Wheel Drive Section (B2710 • B2910)



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2-wheel drive or 4-wheel drive is selected by changing the position of 19T shift gear (1) with the front wheel drive lever. When the front wheel drive lever is set to **"Disengaged"**, the 19T shift gear (1) is neutral and power is not transmitted to the front wheel drive shaft (4).

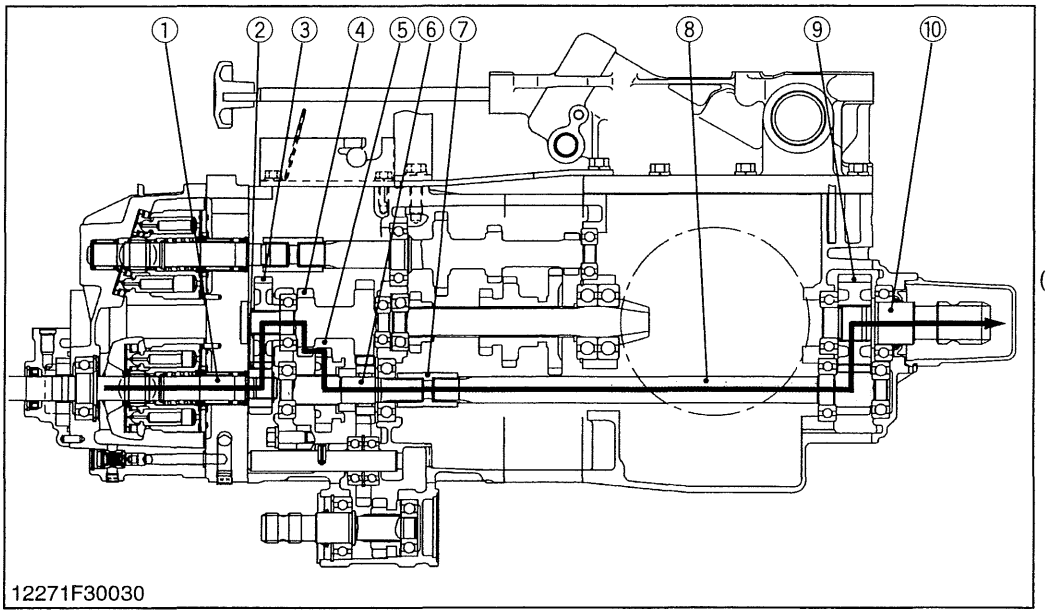
When the front wheel drive lever is set to **"Engaged"**, the 19T shift gear (1) slides to the right to engage with 14T gear (2) on the spiral bevel pinion shaft (3). Therefore, the front drive shaft is actuated to drive the front wheels.

(1) 19T Shift Gear
(2) 14T Gear
(3) Spiral Bevel Pinion Shaft
(4) Front Wheel Drive Shaft

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[3] PTO SYSTEM

(1) Rear PTO Section



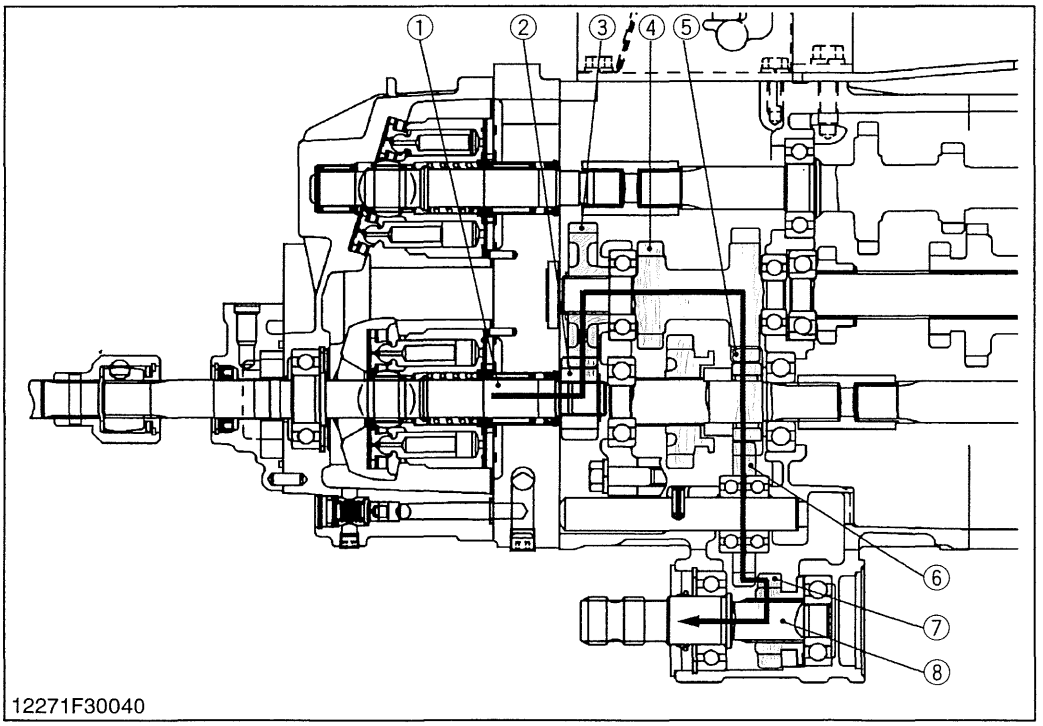
(1) HST Pump Shaft
(2) 14T Gear
(3) 27T Gear
(4) 2nd Gear Shaft with 13T and 18T Gear
(5) 17T Shifter Gear
(6) 3rd Shaft
(7) Coupling
(8) 5th Shaft with 11T Gear
(9) 24T Gear
(10) Rear PTO shaft

■ Rear PTO Shift Lever ON Position

HST Pump Shaft (1) → 14T Gear (2) → 27T Gear (3) → 2nd Gear Shaft with 13T Gear (4) → 17T Shifter Gear (5) → 3rd Shaft (6) → Coupling (7) → 5th Shaft with 11T Gear (8) → 24T Gear (9) → Rear PTO Shaft (10).

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(2) Mid-PTO Section



(1) HST Pump Shaft
(2) 14T Gear
(3) 27T Gear
(4) 2nd Gear Shaft with 13T and 18T Gear
(5) 13T Gear
(6) 19T Gear
(7) 11T Shifter Gear
(8) Mid-PTO Shaft

■ Mid-PTO Shift Lever ON Position

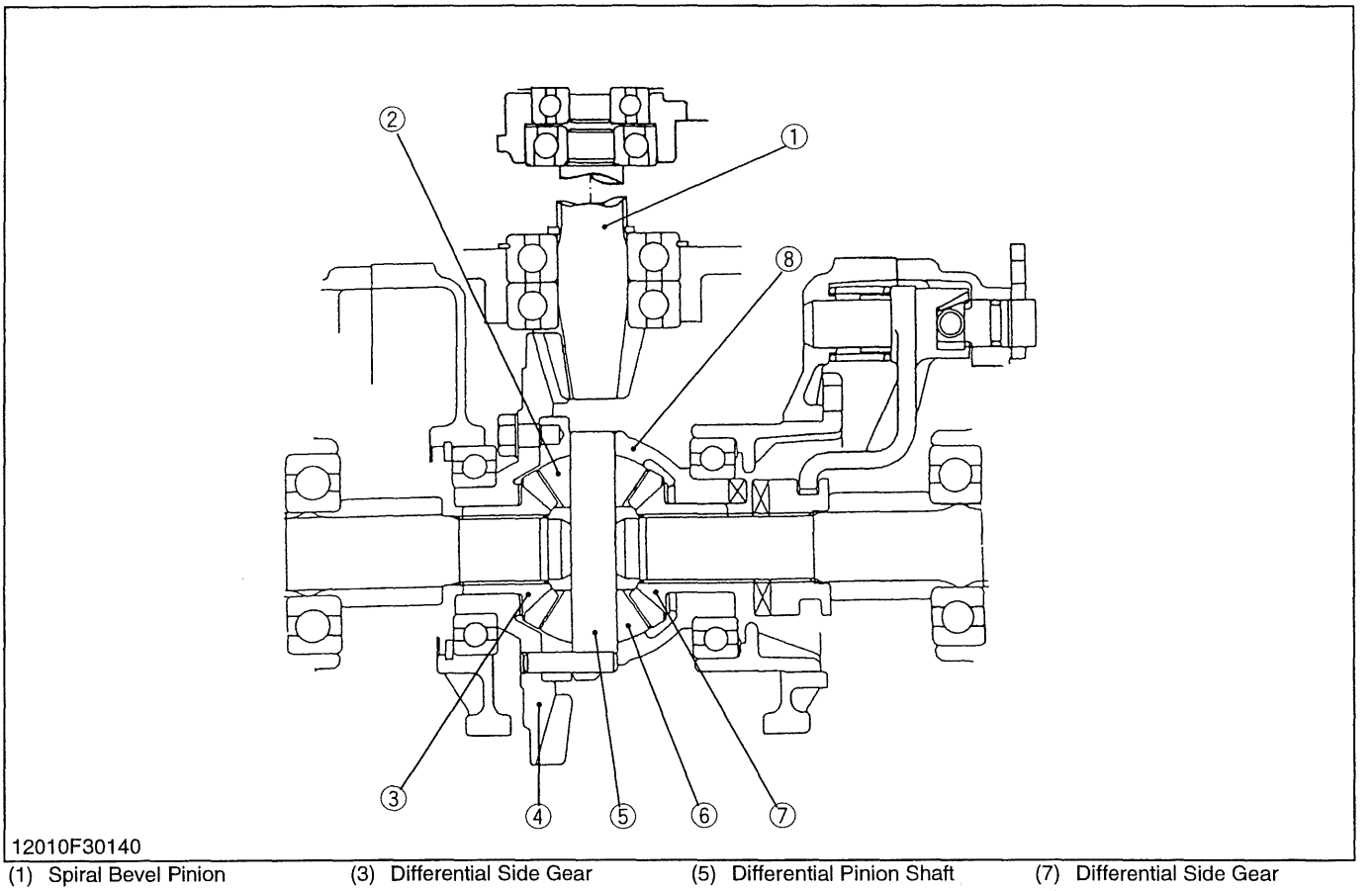
HST Pump Shaft (1) → 14T Gear (2) → 27T Gear (3) → 2nd Gear Shaft with 18T Gear (4) → 13T Gear (5) → 19T Gear (6) → 11T Shifter Gear (7) → Mid-PTO Shaft (8).

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[4] DIFFERENTIAL GEAR SYSTEM

(1) Differential Function



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(1) Spiral Bevel Pinion
(2) Differential Pinion
(3) Differential Side Gear
(4) Spiral Bevel Gear
(5) Differential Pinion Shaft
(6) Differential Pinion
(7) Differential Side Gear
(8) Differential Case

1. During Straight Running

Rotation of the spiral begvel pinion (1) is transmitted to the spiral bevel gear (4) and differential case (8).

When road resistance to the right and left wheels are equal, differential pinions (2), (6) and differential side gears (3), (7) are all rotate as a unit. Both rear axles received equal input, and both wheels turn at the same speed, allowing the tractor to go straight ahead.

At this time, differential pinions (2), (6) do not rotate around the differential pinion shaft (5).

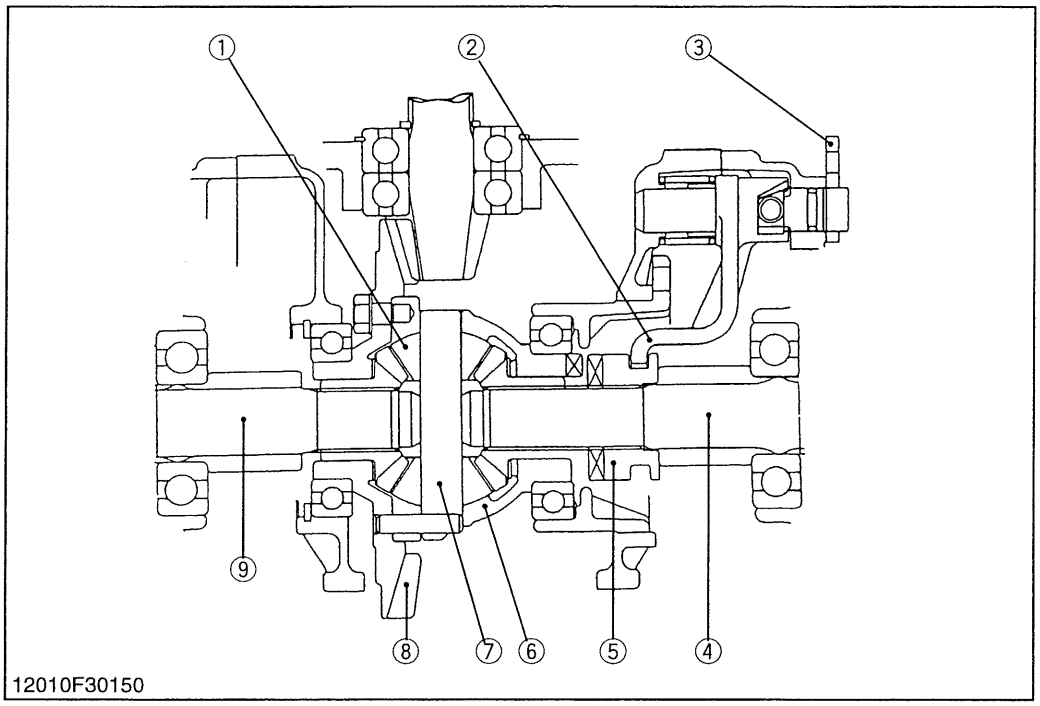
2. During Turning

When the tractor turns, the road resistance to the inside tire increases (as if braking is applied to that side only). In other words, if one of tires slows down, revolution difference is generated in the differential side gears (3), (7). When rotation of one differential side gear becomes lower than the other, differential pinions (2), (6) begin rotating around differential pinion shaft (5). The other differential side gear is increased in speed by the speed increment of differential pinion shaft (5). This means that rotation of one rear axle is slowed down and that of the other rear axle is increased. Thus, the tractor turn smoothly without power loss.

The combined number of revolutions of the right and left differential side gears is always twice that of the spiral bevel gear (4). When spiral bevel gear revolution is 100 rpm, and if one of the differential side gears stops moving, the revolution of the other differential side gear becomes 200 rpm and if one rotates at 50 rpm, the other rotates at 150 rpm.

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(2) Differential Lock



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(1) Differential Pinions
(2) Shift Fork
(3) Differential Lock Levere
(4) Differential Gear Shaft
(5) Differential Lock Clutch
(6) Differential Case
(7) Differential Pinion Shaft
(8) Spiral Bevel Gear
(9) Differential Gear Shaft

When resistance to the right and left tires are greatly different due to ground conditions or type of work, the tire with less resistance slips and prevents the tractor from moving ahead. To compensate for this drawback, the differential lock restricts the differential action and causes both rear axles to rotate as a unit.

When the differential lock pedal is stepped on, it causes the differential lock lever (3) to rotate, which will move the shift fork (2) and the differential lock clutch (5) toward the spiral bevel gear (8). The differential lock clutch (5) engaged with the teeth of the differential case (6) to cause the differential case (6) and the differential lock clutch (5) to rotate as a unit.

Therefore, differential pinions (1) are unable to rotate around differential pinion shaft (7) and identical revolutions are transmitted to the right and left differential gear shaft (4), (9).

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SERVICING

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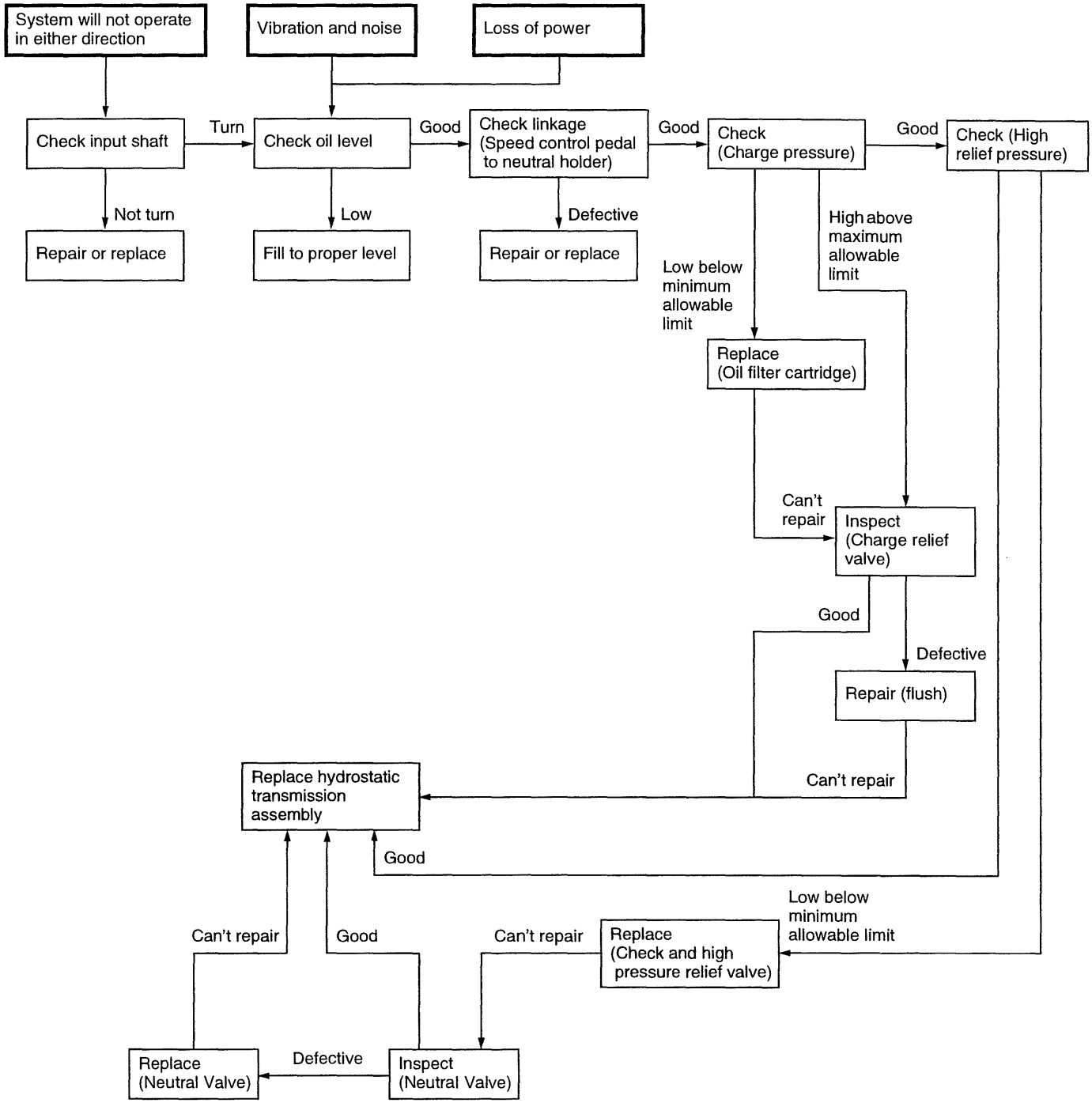
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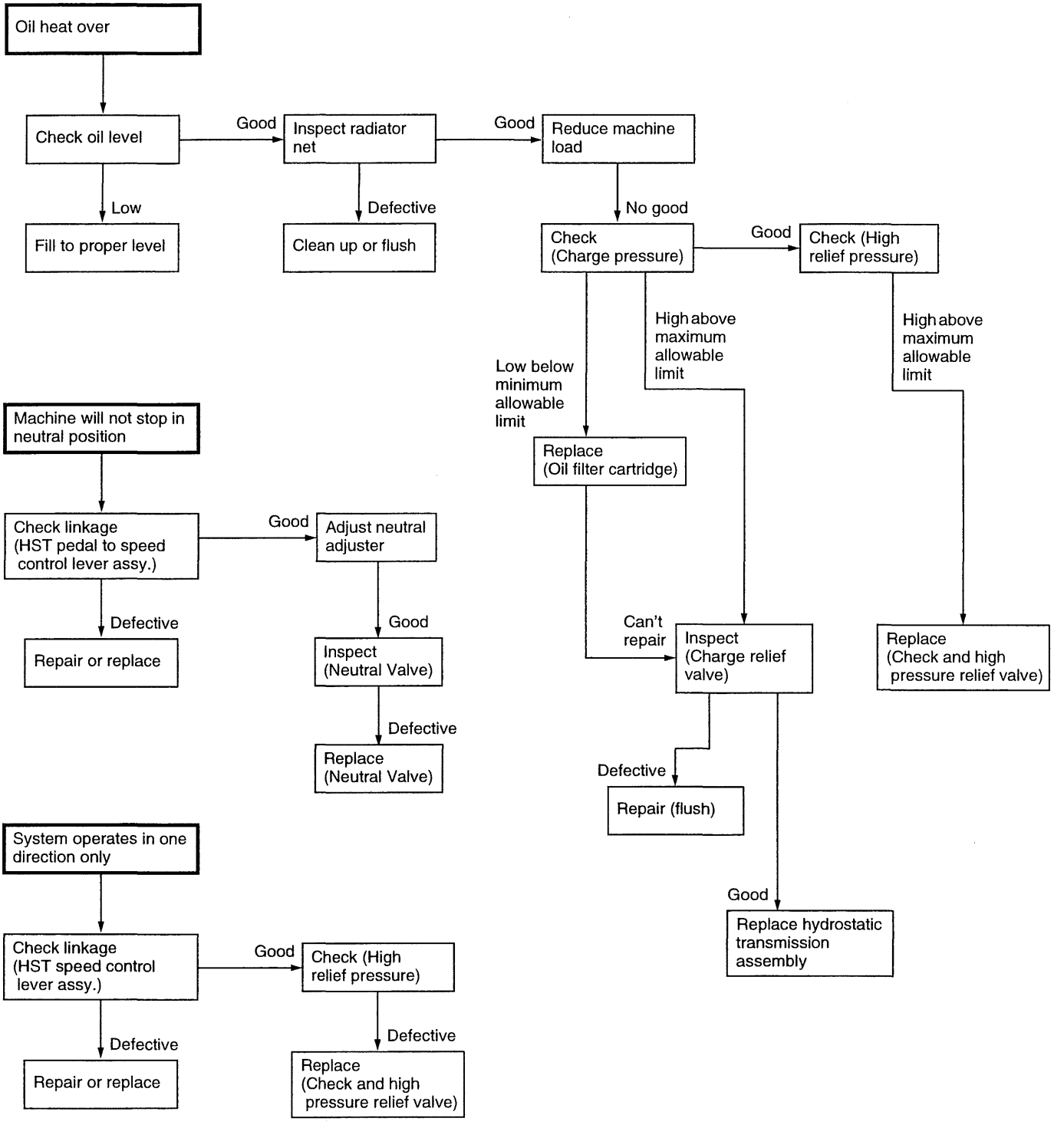
TROUBLESHOOTING

HYDROSTATIC TRANSMISSION



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TROUBLESHOOTING (Continued)



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TROUBLESHOOTING (Continued)

CLUTCH HOUSING

Symptom	Probable Cause	Solution	Reference Page
Noise from Clutch Housing	• Transmission oil insufficient • Gear worn or broken • Bearing worn	Refill Replace Replace	3-S11 3-S17 3-S17

TRANSMISSION CASE SECTION

Noise from Transmission	• Transmission oil insufficient • Gear worn or broken • Improper backlash between spiral bevel pinion and bevel gear • Improper backlash between differential pinion and differential side gear • Bearings worn	Refill Replace Adjust Adjust Replace	3-S11 – 3-S35 3-S34 –
Gear Slip Out of Mesh	• Shift fork spring tension insufficient • Shift fork or shifter worn • Shift fork bent	Replace Replace Replace	– 3-S25, S26 3-S24, S25

DIFFERENTIAL CASE SECTION

Excessive or Unusual Noise at All Time	• Improper backlash between spiral bevel pinion and bevel gear • Improper backlash between differential pinion and differential side gear • Bearing worn • Insufficient or improper type of transmission fluid used	Adjust Adjust Replace Replenish or Replace	3-S35 3-S34 – G-8
Noise while Turning	• Differential pinions or differential side gears worn or damaged • Differential lock binding (does not disengage) • Bearings worn	Replace Replace Replace	3-S28 3-S22, 4-S5 3-S28
Differential Lock Can Not Be Set	• Differential lock shift fork damaged • Differential lock shifter mounting pin damaged • Differential lock clutch damaged	Replace Replace Replace	4-S5 4-S5 4-S5
Differential Lock Pedal Does Not Return	• Differential lock pedal return spring weaken or damaged • Differential lock fork shaft rusted	Replace Repair	4-S5 4-S5

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SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Check and High Pressure Relief Valve	Setting Pressure [Relief Valve]	30.9 to 31.9 MPa 315 to 325 kgf/cm^2 4480 to 4622 psi	–
Charge Relief Valve	Setting Pressure	500 to 800 kPa 5.1 to 8.2 kgf/cm^2 73 to 116 psi	–
Gears	Backlash	0.10 to 0.20 mm 0.0039 to 0.0079 in.	0.4 mm 0.016 in.
Gear to Spline	Clearance	0.03 to 0.08 mm 0.0012 to 0.0031 in.	0.20 mm 0.0079 in.
Shift Fork to Shift Gear Groove	Clearance	0.10 to 0.35 mm 0.004 to 0.014 in.	0.50 mm 0.020 in.
13T Gear to 3rd Shaft	Clearance	0.007 to 0.046 mm 0.0003 to 0.0018 in.	0.10 mm 0.0039 in.
3rd Shaft	O.D.	21.987 to 22.000 mm 0.8656 to 0.8661 in.	–
13T Gear	I.D.	30.007 to 30.021 mm 1.1026 to 1.1032 in.	–
Needle	O.D.	3.994 to 4.000 mm 0.1572 to 0.1575 in.	–
Spiral Bevel Pinion	Side Clearance	Less than 0.15 mm Less than 0.0059 in.	–
Spiral Bevel Pinion to Spiral Bevel Gear	Backlash	0.10 to 0.20 mm 0.0039 to 0.0079 in.	0.4 mm 0.016 in.
Adjusting Shim	Thickness	0.2 mm, 0.008 in. 0.5 mm, 0.020 in.	– –
Differential Pinion to Differential Side Gear	Backlash	0.1 to 0.3 mm 0.004 to 0.012 in.	0.4 mm 0.016 in.
Adjusting Shim	Thickness	0.8 mm, 0.0315 in. 1.0 mm, 0.0394 in. 1.2 mm, 0.0472 in.	– – –
Differential Case to Differential Side Gear	Clearance	0.025 to 0.066 mm 0.0016 to 0.0029 in.	0.30 mm 0.0118 in.
Differential Case	I.D.	32.000 to 32.025 mm 1.2598 to 1.2608 in.	–
Spiral Bevel Gear	I.D.	32.000 to 32.025 mm 1.2598 to 1.2608 in.	–
Differential Side Gear	O.D.	31.959 to 31.975 mm 1.2582 to 1.2589 in.	–

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Item		Factory Specification	Allowable Limit
Differential Pinion Shaft to Differential Pinion	Clearance	0.016 to 0.045 mm 0.0006 to 0.0018 in.	0.30 mm 0.0118 in.
Differential Pinion Shaft	O.D.	15.973 to 15.984 mm 0.6289 to 0.6293 in.	–
Differential Pinion	I.D.	16.000 to 16.018 mm 0.6299 to 0.6306 in.	–
Piston to Bore (HST)	Clearance	0.02 mm 0.0008 in.	0.04 mm 0.0016 in.
Piston Slipper (HST)	Thickness	3.00 mm 0.118 in.	2.90 mm 0.1142 in.
Bi-speed Turn Cable Outer (Clutch Housing Side)	Distance A	18 mm 0.71 in.	–
Bi-speed Turn Cable Inner (Front Axle Case Side)	Distance B	10 mm 0.39 in.	–
Bi-speed Turn Cable Inner (Bi-speed Turn Lever Rod Side)	Distance A	8 mm 0.31 in.	–
Bi-speed Turn Cable Outer (Bi-speed Turn Cable Support Side)	Distance B	19 mm 0.75 in.	–
Cruise Control Lever	Force to move the lever	49.0 to 58.8 N 5.0 to 6.0 kgf 11.0 to 13.2 lbs	–

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TIGHTENING TORQUES

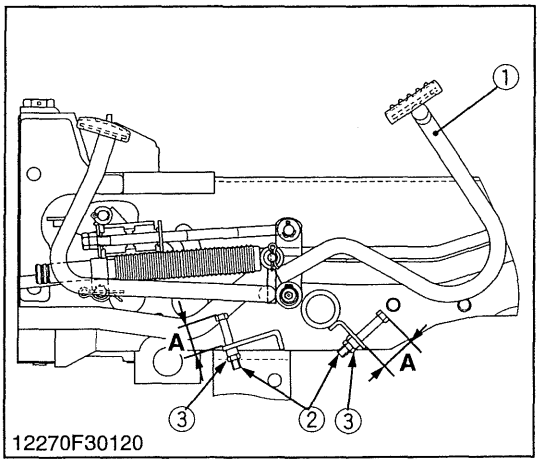
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts : See page G-9.)

Item	N·m	kgf·m	ft-lbs
Rear wheel mounting screw and nut	108 to 125	11.0 to 12.8	80 to 93
3-Point hitch shaft setting screw	14.7 to 19.6	1.5 to 2.0	10.8 to 14.5
3-Point hitch shaft setting screw lock nut	43 to 47	4.4 to 4.8	31.7 to 35.4
Drawber frame mounting screw	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5
ROPS frame and frame top connecting bolt and nut	149.1 to 179.5	15.2 to 18.3	109.9 to 132.4
ROPS connecting plate mounting screw	47.1 to 56.9	4.8 to 5.8	34.7 to 42.0
ROPS frame mounting screw	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Steering wheel mounting nut	29.4 to 49.0	3.0 to 5.0	21.7 to 36.2
Delivery pipe nut for HST	34.0 to 39.0	3.5 to 4.0	25.3 to 28.9
Oil cooler pipe nut	50 to 58	5.1 to 5.9	36.9 to 42.8
Delivery pipe nut for power steering	65 to 75	6.6 to 7.7	47.9 to 55.3
Pitman arm mounting nut	120 to 150	14.4 to 15.3	88.5 to 110.6
Power steering assembly mounting screw	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Clutch housing and engines mounting screw and nut			
M8 screw	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
M10 nut	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
Clutch housing and center frame mounting screw and nut	62.8 to 72.6	6.4 to 7.4	46.3 to 53.5
Clutch housing rear cover mounting screw	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Speed control rod screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
3-point hitch delivery pipe joint bolt	34.0 to 39.0	3.5 to 4.0	25.3 to 28.9
HST (transmission case) and center frame mounting screw and nut	62.8 to 72.6	6.4 to 7.4	46.3 to 53.5
Spring holder mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Connecting plate mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Hydraulic cylinder mounting screw and nut	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Rear axle case mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Transmission case mounting screw and nut	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Mid-PTO case mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Neutral adjuster lock screw	17.7 to 20.5	1.8 to 2.1	13.0 to 15.2
Neutral holder mounting screw	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Charge pump mounting screw	17.7 to 20.5	1.8 to 2.1	13.0 to 15.2
Center section mounting hex. socket screw	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
Check and high pressure relief valve plug	118 to 147	12.0 to 15.0	86.8 to 108.5
Neutral valve cap screw	58.8 to 68.6	6.0 to 7.0	43.4 to 50.6
3rd shaft, 2nd gear shaft bearing holder mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Bearing holder mounting screw	50.0 to 55.0	5.1 to 5.6	36.9 to 40.1
Rear PTO cover mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Differential gears bearing holder mounting screw	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Spiral bevel gear UBS screw	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3

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CHECKING AND ADJUSTING



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Adjusting Maximum Speed

1. Depress the speed control pedal (1) all the way and measure the tractor speed.
2. If the measurement is not within factory specifications, loosen the lock nut (3) and adjust with the bolt (2).

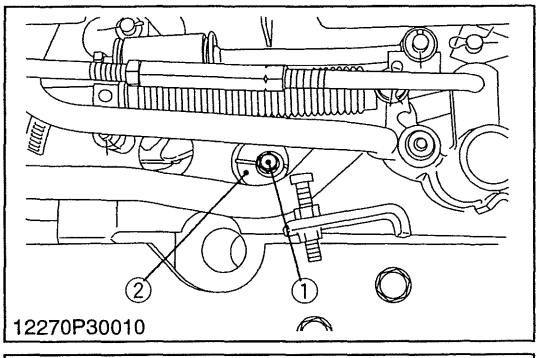
Maximum speed (at 2600 rpm)	Factory spec.	B2410	Forward	16.0 to 17.0 km/h 10.0 to 10.6 mph
		B2710 B2910		18.6 to 19.6 km/h 11.6 to 12.3 mph
		B2410	Reverse	12.7 to 13.7 km/h 7.9 to 8.6 mph
		B2710 B2910		14.7 to 15.7 km/h 9.2 to 9.8 mph

(Reference)

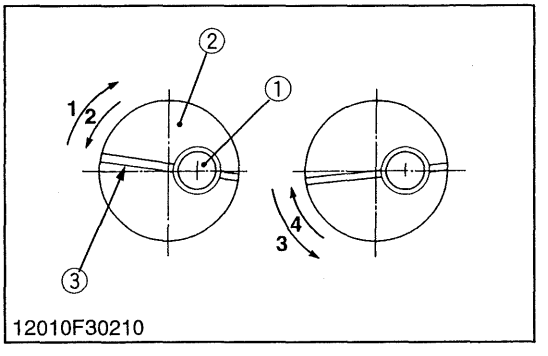
- Length **"A"** : 23 to 24 mm (0.87 to 0.94 in.)

(1) Speed Control Pedal (HST Pedal) (3) Lock Nut
(2) Adjusting Bolt

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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. Slightly loosen the neutral adjuster setting screw (1).
4. Rotate the neutral adjuster (2) clockwise so the rear wheels turn reverse.
5. Then rotate it counterclockwise until wheels stop completely.
6. Put a mark on the center frame aligning the groove (3) on neutral adjuster.
7. Rotate the neutral adjuster (2) counterclockwise so the rear wheels turn forward.
8. Then rotate it clockwise until wheels stop completely.
9. Put a mark on the center frame aligning the groove (3) on neutral adjuster.
10. Hold the neutral adjuster so its groove is at the middle of the marks and tighten the setting screw (1).

■ NOTE

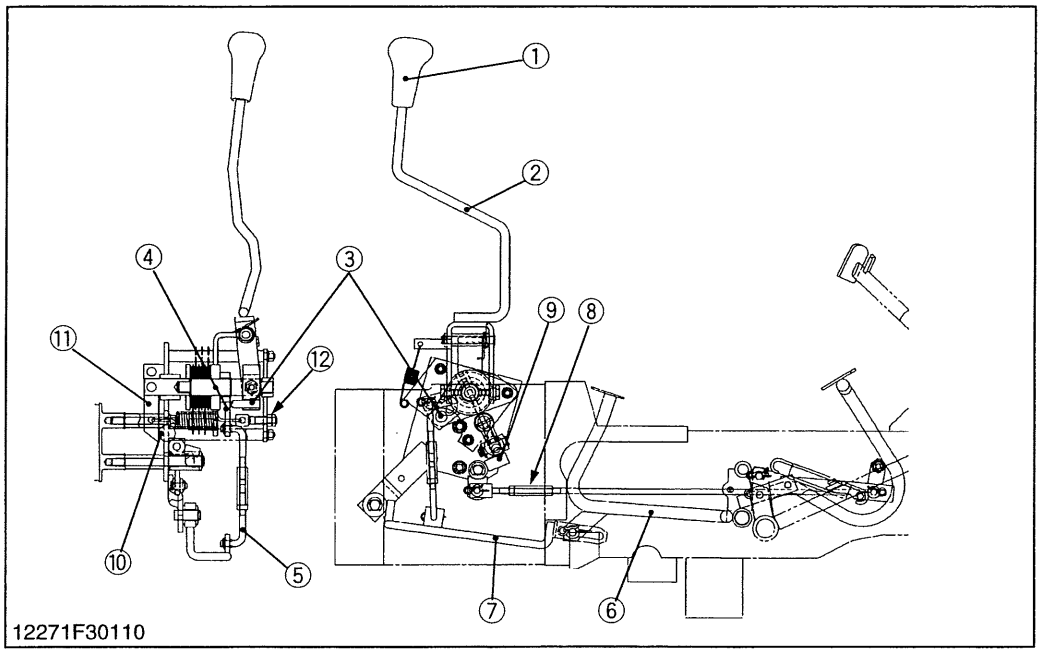
- **When the wheels tend to turn forward, rotate neutral adjuster clockwise.**
- **When the wheels tend to turn reverse, rotate neutral adjuster counterclockwise.**

(1) Neutral Adjuster Setting Screw (3) Groove
(2) Neutral Adjuster

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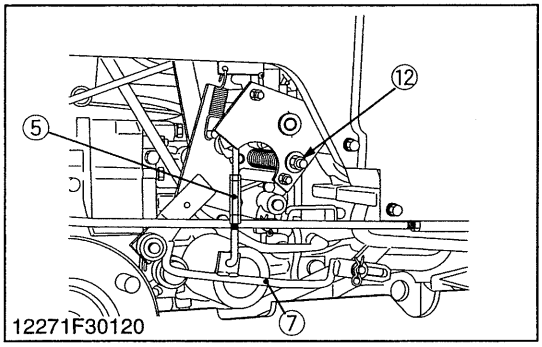
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Cruise Control Linkage

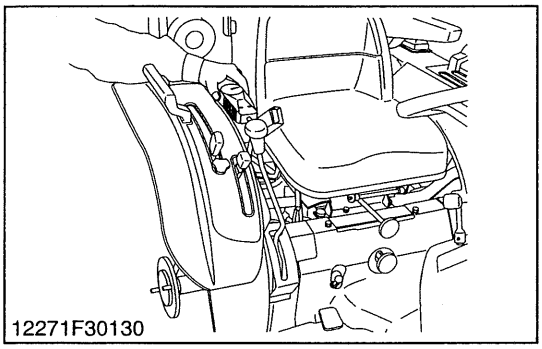


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(1) Grip
(2) Cruise Control Lever
(3) Lever Pin
(4) Cruise Control Arm
(5) Cruise Control Rod
(6) HST Pedal
(7) HST Pedal Lever
(8) HST Release Rod
(9) Release Lever 1
(10) Release Lever 2
(11) Release Arm
(12) Nut



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■ Adjusting Cruise Control Linkage

With the cruise control lever (2) at the **N** position on the lever guide, check for a gap between the lever pin (3) and the cruise control arm (4). Adjust the cruise control rod (5), when required, to leave no gap between them.

At the same time, make sure that there is no gap between the rear end of the oval hole of the HST pedal lever (7) and the pin of the HST pedal (6).

Finally step down the HST pedal (6) all the way to make sure that the cruise control lever (2) can hold the HST pedal in place.

■ Adjusting Cruise Control Release Linkage

Adjust the brake pedals play first. Then adjust the HST release rod (8) turnbuckle to allow no gap between the release levers 1 (9) and 2 (10) as well as between the release lever 2 (10) and the release rod (11).

Now step on one of the brake pedals to make sure the cruise control is not released. Also step on both the brake pedals coupled together to make sure that the cruise control is released.

■ Cruise Control Lever

1. After adjusting the cruise control linkage, measure the force to move the cruise control lever (2) forward at its top (grip).
2. If the force is not within the factory specifications, loosen the lock nut and turn the nut (12) to adjust.
3. Retighten the lock nut securely.

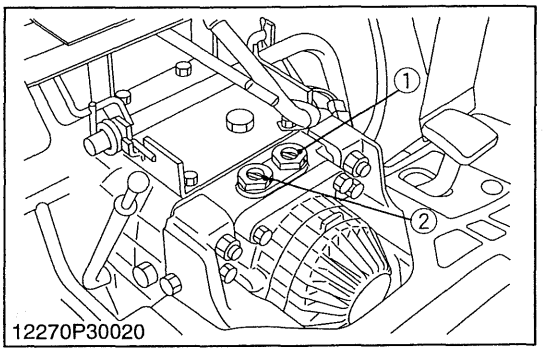
Force to move the lever	Factory spec.	49.0 to 58.8 N 5.0 to 6.0 kgf 11.0 to 13.2 lbs

■ IMPORTANT

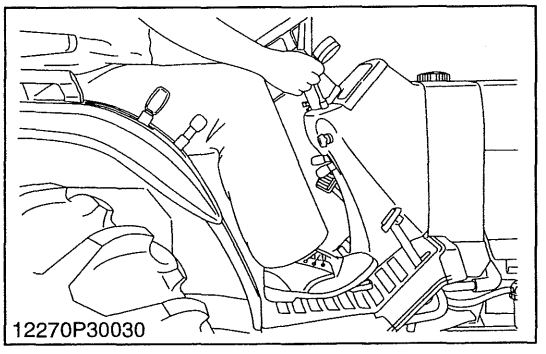
- **After adjusting the linkage, be sure that the cruise control lever (2) can be held anywhere within its working range.**

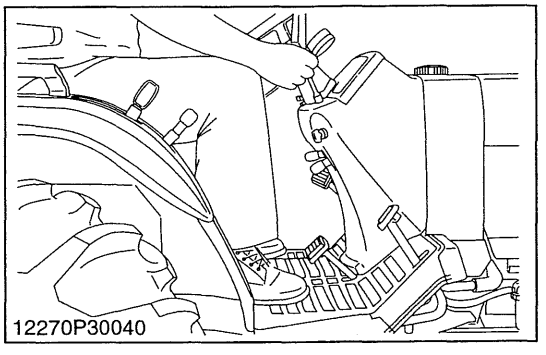
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Charge Relief Pressure and High Relief Pressure

CAUTION

- **When checking, park the tractor on flat ground and fully engage the parking brake.**

1. Remove the lowering speed adjusting knob and dipstick, then remove the seat under cover.
2. Assemble the HST adaptor **A** and threaded joint with O-ring and back up ring (Refer to G-38).

Charge Relief Pressure

1. Remove the neutral valve assembly one side (forward (1) or reverse (2)) then install the assembled HST adaptor **A** to its neutral valve port.
2. Install the cable and low pressure gauge to HST adaptor **A**.
3. Change the range gear shift lever to **Low** position.
4. Start the engine and run it at the maximum speed.
5. Read the low pressure gauge to measure the charge relief pressure.
6. If the measurement is not same as factory specification, check the charge relief valve and related hydraulic components.

High Relief Pressure

1. Remove the neutral valve assembly forward (1), then install the assembled HST adaptor **A** to its neutral valve port.
2. Install the cable and high pressure gauge to HST adaptor **A**.
3. Change the range gear shift lever to **High** position.
4. Start the engine and run it at the maximum speed.
5. Depress the speed control pedal forward and read the high pressure gauge to measure the forward high relief pressure.
6. Stop the engine and change the installation of HST adaptor **A** and pressure gauge from forward neutral valve port to reverse.
7. Start engine and repeat above method (4. and 5.) to measure the reverse high relief pressure.
8. If the measurement is not same as factory specification, check the high pressure relief valve and related hydraulic components.

Charge relief pressure	Factory spec. (Oil temperature at 50 °C, 122 °F)	500 to 800 kPa 5.1 to 8.2 kgf/cm^2 73 to 116 psi
High relief pressure	Factory spec. (Oil temperature at 50 °C, 122 °F)	30.9 to 31.9 MPa 315 to 325 kgf/cm^2 4480 to 4622 psi

Tightening torque	Neutral valve cap screw	58.8 to 68.6 N·m 6.0 to 7.0 kgf·m 43.4 to 50.6 ft-lbs

IMPORTANT

- **Measure quickly so that the high pressure relief valve may not be in operation more than 10 seconds.**

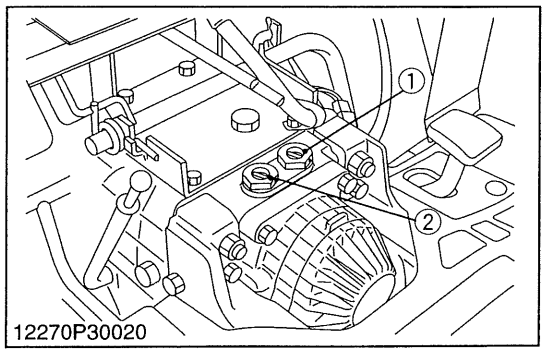
NOTE

- **High pressure gauge is 40 MPa (400 kgf/cm^2, 5800 psi) full scale.**
- **Low pressure gauge is 2 MPa (20 kgf/cm^2, 290 psi) full scale.**
- **When reinstall the neutral valve, take care not to damage the O-ring.**

(1) Neutral Valve (Forward) (2) Neutral Valve (Reverse)

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Neutral Valve Actuation Test

WARNING

To avoid personal injury :

- **Do not operate if tractor moves on level ground with foot off speed control pedal.**

(Checking Procedure)

CAUTION

- **When checking, park the tractor on flat ground, apply the parking brake.**

1. Disengage the front wheel drive lever.
2. Disconnect the brake rod, one side.
3. Lift the rear of tractor, one side.
4. Set the engine speed to 1500 rpm.
5. Shift the range gear shift lever to **Hi** position.
6. Move the HST pedal from the forward to the neutral position make sure that the tire comes to stop. Check the same way for the movement from rearward to the neutral position.
   In this time, make sure that the neutral range of HST.
7. If the tire fail to stop or neutral range is point, check the each neutral valve.

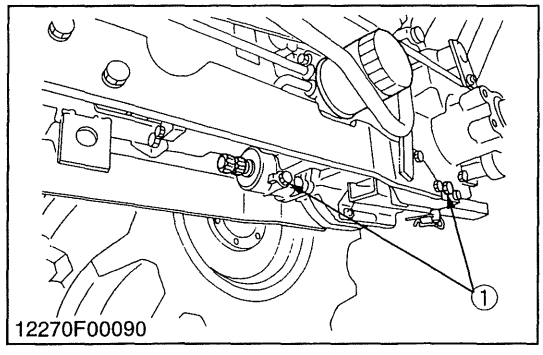
(1) Neutral Valve (Forward) (2) Neutral Valve (Reverse)

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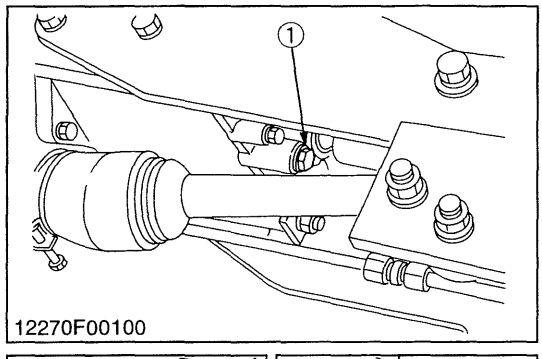
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DISASSEMBLING AND ASSEMBLING

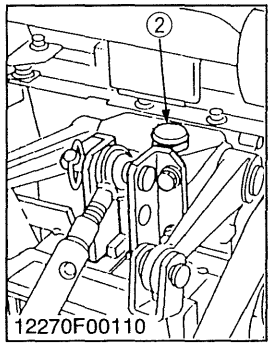
[1] SEPARATING ENGINE FROM CLUTCH HOUSING



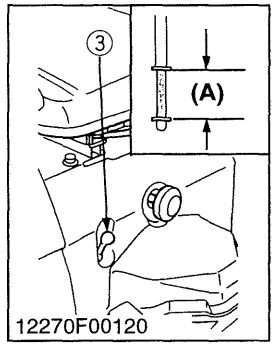
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Draining Transmission Fluid

⚠ CAUTION

- **Be sure to stop the engine before checking and changing the transmission fluid.**

1. Place oil pan under the tractor.
2. Remove the drain plugs (1) at the bottom of the rear axle case and oil tank.
3. Drain the transmission fluid and reinstall the drain plugs.

(When refilling)

- Fill new oil from filling port after removing the filling plugs (2) up to the upper notch on the dipstick (3).
- After running the engine for few minutes, stop it and check the oil level again, if low, add oil prescribed level.

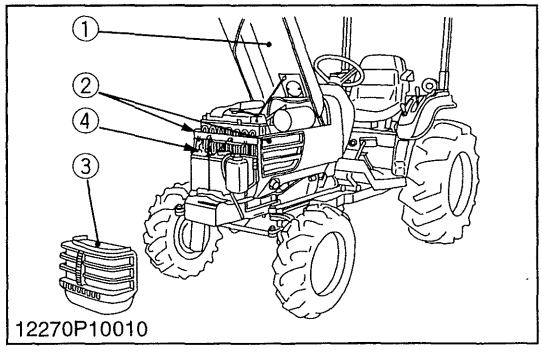
■ IMPORTANT

- **Use only multi-grade transmission oil. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLANT" (See page G-8).**
- **Never work the tractor immediately after changing the transmission oil. Keeping the engine at medium speed for a few minutes to prevents damage to the transmission.**
- **Do not mix different blands oil together.**

Transmission fluid capacity	B2410	12.5 L 3.30 U.S.gals. 2.75 Imp.gals.
	B2710	Affeted Serial No.: below 15496 14.0 L 3.70 U.S.gals. 3.08 Imp.gals. Affeted Serial No.: above 50101 14.5 L 3.83 U.S.gals. 3.19 Imp.gals.
	B2910	14.5 L 3.83 U.S.gals. 3.19 Imp.gals.

(1) Drain Plug
(2) Filling Plug
(3) Dipstick
(A) Oil level is acceptable within this range

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Hood, Side Cover and Battery Cord

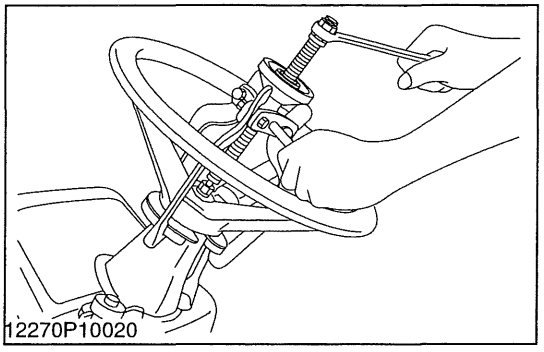
1. Open the hood (1) and remove the front grille (3).
2. Disconnect the battery grounding cord (4).
3. Disconnect the head light connectors and remove the hood and side covers (2).

■ NOTE

- **When disconnecting the battery cords, disconnect the grounding cord first. When connecting, positive cord first.**

(1) Hood
(2) Side Cover
(3) Front Grille
(4) Battery Cord

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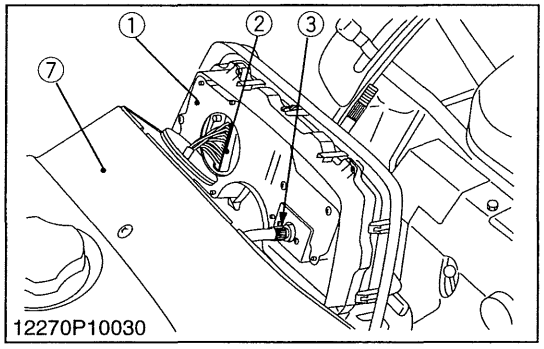
Steering Wheel

1. Remove the steering wheel cap.
2. Remove the steering wheel mounting nut and remove the steering wheel with a steering wheel puller (Code No. 07916-51090).

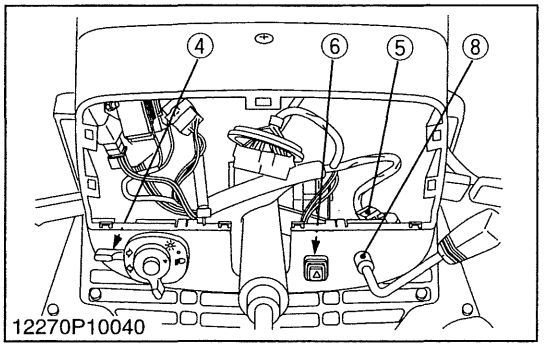
(When reassembling)

Tightening torque	Steering wheel mounting nut	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft-lbs

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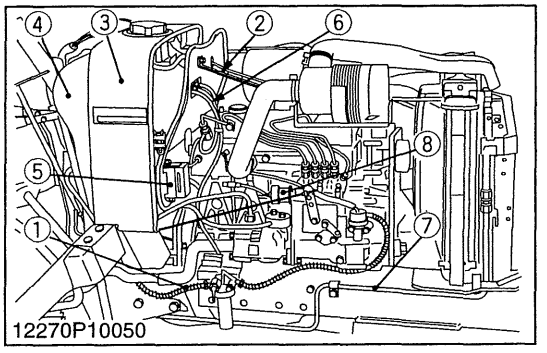
Meter Panel and Panel Under Cover

1. Open the meter panel (1) and disconnect the meter panel connector (2) and hour-meter cable (3). Then remove the meter panel.
2. Disconnect the combination switch connector (4), main switch connector (5) and hazard switch connector (6).
3. Tap out the spring pin and remove the hand accelerator lever (8).
4. Remove the panel under cover (7).

(1) Meter Panel
(2) Meter Panel Connector
(3) Hour-meter Cable
(4) Combination Switch Connector
(5) Main Switch Connector
(6) Hazard Switch Connector
(7) Panel Under Cover
(8) Hand Accelerator Lever

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Fuel Tank

1. Disconnect the fuel hose (1) at the fuel filter side, then drain fuel completely.
2. Remove the fuel tank frame stay (2).
3. Disconnect the hazard unit, starter relay and regulator connectors and remove the lead wire for fuel gauge.
4. Remove the fuse box (5).
5. Disconnect the overflow hoses (6) of fuel line.
6. Remove the tank frame (3) with fuel tank (4).
7. Disconnect the hydraulic pipes (7) and remove the battery stay with oil cooler.
8. Disconnect the 2P connector and remove the engine stop solenoid (8).

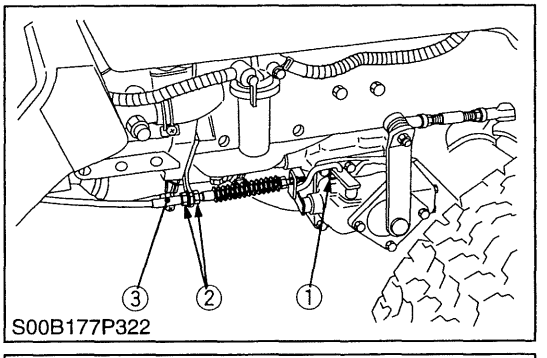
(When reassembling)

- Apply a thin coat of liquid gasket (Three Bond 1215 or equivalent) to both surface of the engine stop solenoid (8).

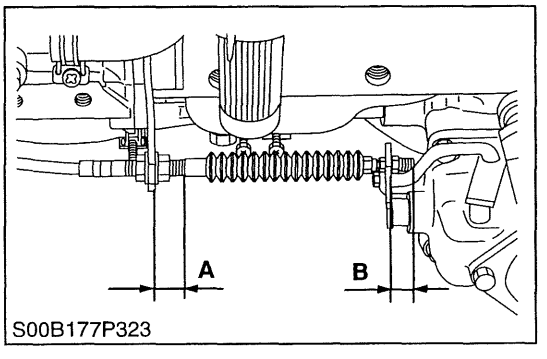
Tightening torque	Delivery pipe nut for HST	34 to 39 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs
	Oil cooler pipe nut	50 to 58 N·m 5.1 to 5.9 kgf·m 36.9 to 42.8 ft-lbs

(1) Fuel Hose
(2) Fuel Tank Frame Stay
(3) Fuel Tank Frame
(4) Fuel Tank
(5) Fuse Box
(6) Overflow Hose
(7) Hydraulic Pipe
(8) Engine Stop Solenoid

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S00B177P323

Bi-speed Turn Cable

1. Remove the spring lock pin (1) and loosen the lock nuts (2) and then remove the bi-speed turn cable (3).

(When reassembling)

- When reassembling the bi-speed turn cable (3), make sure the distance **A**.

Distance **A**	Factory spec.	18 mm 0.71 in.

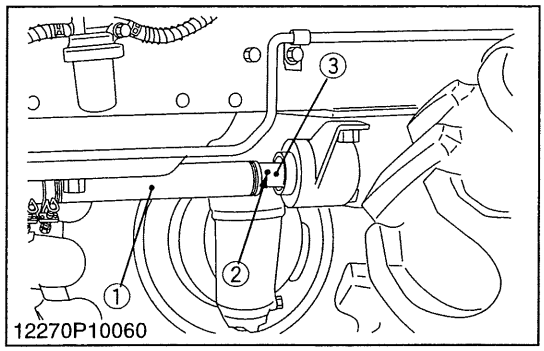
(Reference)

Distance **B**	Factory spec.	10 mm 0.39 in.

(1) Spring Lock Pin
(2) Lock Nut
(3) Bi-speed Turn Cable

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Propeller Shaft Cover and Coupling

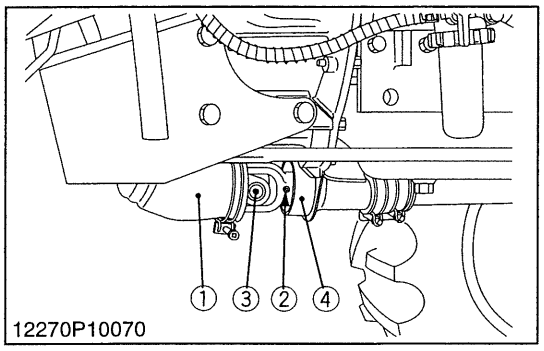
1. Loosen the clamp and slide the propeller shaft cover (1) to the rear.
2. Tap out the spring pin (2) and then slide the coupling (3) to the rear.

(When reassembling)

- Apply grease to the splines of the propeller shaft and coupling.

(1) Propeller Shaft Cover
(2) Spring Pin
(3) Coupling

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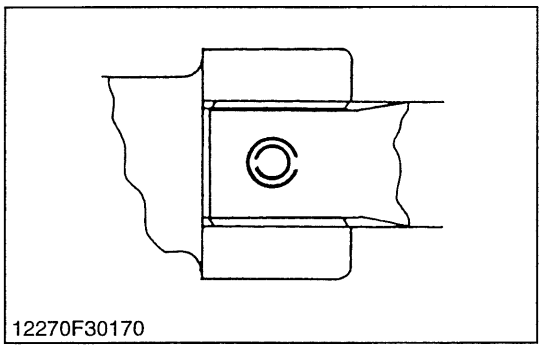
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Universal Joint and Bearing Holder

1. Loosen the clamp and slide the universal joint cover (1) to the rear.
2. Tap out the spring pins (2) and then slide the universal joint (3) to the rear.
3. Remove the bearing holder (4) with propeller shaft and universal joint.

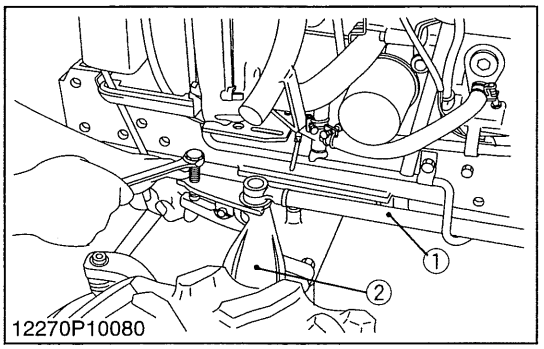
(When reassembling)

- Apply grease to the splines of the propeller shaft and universal joint.
- When inserting the spring pins (2), face their splits in the direction parallel to the universal joint as shown in the figure.


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(1) Universal Joint Cover
(2) Spring Pin
(3) Universal Joint
(4) Bearing Holder

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Drag Link

1. Remove the cotter pin and loosen the slotted nut.
2. Disconnect the drag link (1) with a pitman arm puller from the knuckle arm (2).

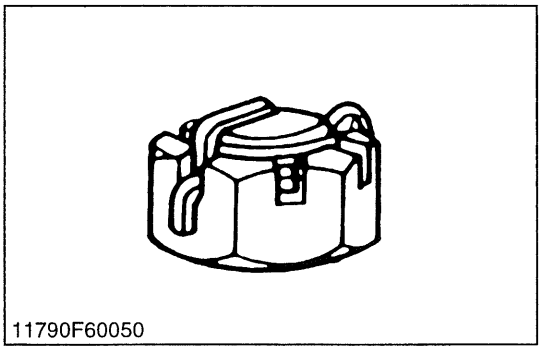
(When reassembling)

■ IMPORTANT

- **Do not loosen the slotted nut to align the hole.**
- **Install the cotter pin as shown in the figure**

(Reference)

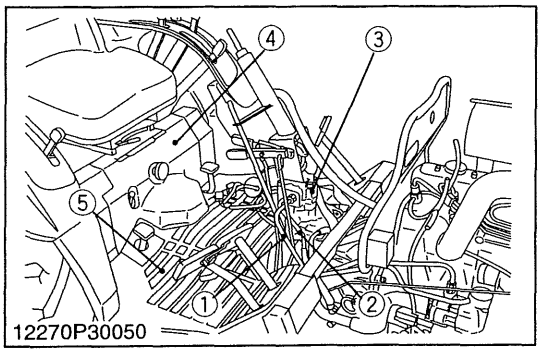
Tightening torque	Slotted nut	17.7 to 34.5 N·m 1.8 to 3.5 kgf·m 13.0 to 25.3 ft-lbs


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(1) Drag Link
(2) Knuckle Arm

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12270P30050

Power Steering Assembly

1. Remove the seat under cover (4), rubber mat (5) and left hand side step.
2. Remove the power steering delivery pipe (1) and return pipe (2).
3. Disconnect the speed set rod and parking brake rod.
4. Remove the power steering assembly (3) from the center frame.

(When reassembling)

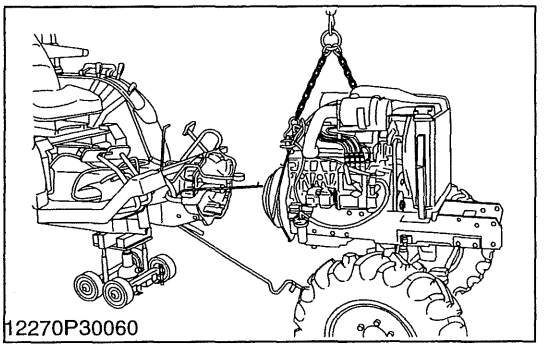
■ NOTE

- **For fastening hydraulic pipe nut, use two wrenches. Hold the fitting with a wrench, turn the pipe nut with another wrench to avoid damage at fitting installed part.**

Tightening torque	Delivery pipe nut for power steering	65 to 75 N·m 6.6 to 7.7 kgf·m 47.9 to 55.3 ft-lbs
	Power steering assembly mounting screw	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs

(1) Power Steering Delivery Pipe
(2) Power Steering Return Pipe
(3) Power Steering Assembly
(4) Seat Under Cover
(5) Rubber Mat

12270S30090


12270P30060

Separating the Engine from Clutch Housing

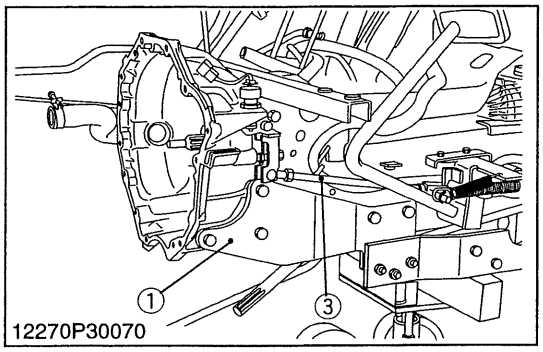
1. Disconnect the three point hitch delivery pipe and suction hose.
2. Disconnect the glow plug lead wire and thermo sensor lead wire. And then disconnect the connectors for dynamo of 2P for alternator connector and starter motor lead wire.
3. Place the jack under the center frame.
4. Hoist the engine by the chain at the engine hook.
5. Remove the engine mounting screws and separate the engine from the clutch housing.

(When reassembling)

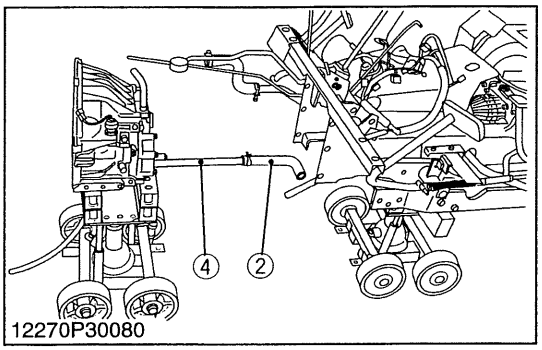
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the engine and clutch housing.

Tightening torque	Engine mounting screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs
	Engine mounting nut	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs

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Separating Clutch Housing

1. Remove the bracket (1).
2. Remove the clutch pedal rod (3).
3. Disconnect the hose to hydraulic pipe.
4. Loosen the clamp and disconnect connecting hose (2).
5. Separate the clutch housing from center frame.
6. Remove the hydraulic pipe (4).

(When reassembling)

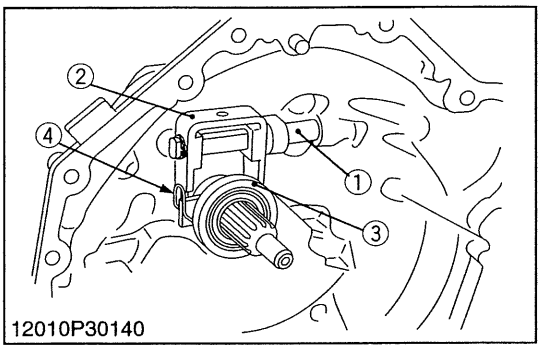
- Apply grease to the splines of propeller shaft and ball joint.

Tightening torque	Clutch housing mounting screw and nut	62.8 to 72.6 N·m 6.4 to 7.4 kgf·m 46.3 to 53.5 ft-lbs

(1) Bracket
(2) Connecting Hose
(3) Clutch Pedal Rod
(4) Hydraulic Pipe

12270S30110

[2] DISASSEMBLING CLUTCH HOUSING



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Clutch Rod and Clutch Release Fork

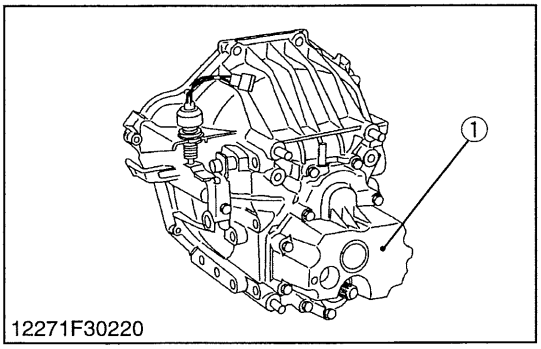
1. Remove the external snap ring at the end of clutch rod.
2. Draw out the clutch rod (1) and remove the clutch release fork (2).
3. Take out the release hub with release bearing (3).

(When reassembling)

- Set the clutch release fork and release hub with set spring (4) in the correct direction.

(1) Clutch Rod
(2) Clutch Release Fork
(3) Release Bearing
(4) Set Spring

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Clutch Housing Rear Cover

1. Remove the clutch housing rear cover (1).

(When reassembling)

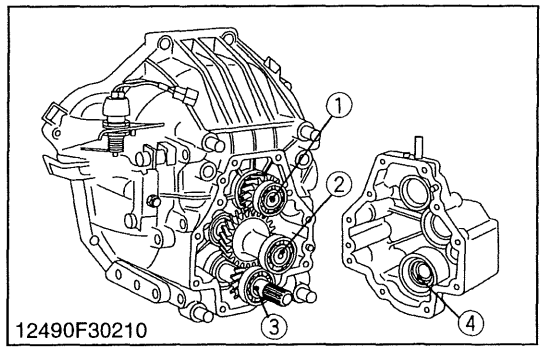
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of clutch housing and rear cover (1).

Tightening torque	Clutch housing rear cover mounting screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs

(1) Clutch Housing Rear Cover

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Clutch Shaft and Others

1. Pull out the clutch shaft assembly (1).
2. Pull out the 2nd gear shaft, front assembly (2).
3. Pull out the 3rd shaft, front assembly (3).

(When reassembling)

- Apply small amount of the grease to the oil seal (4).

(1) Clutch Shaft Assembly
(2) 2nd Gear Shaft, Front Assembly
(3) 3rd Shaft, Front Assembly
(4) Oil Seal

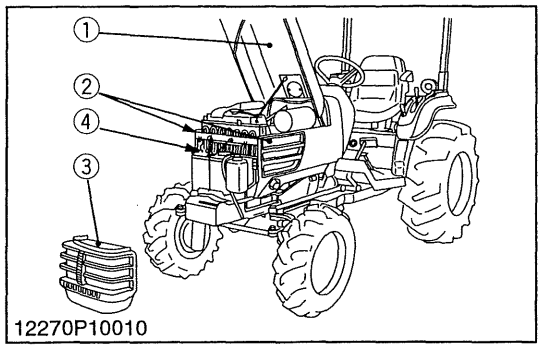
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[3] SEPARATING CENTER FRAME AND TRANSMISSION CASE

Draining Transmission Fluid

1. See page 3-S12.

12271S30050



Battery Connector

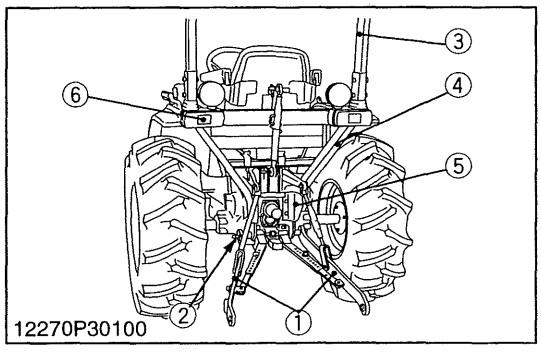
1. Open the hood (1) and remove the front grille (3).
2. Disconnect the battery grounding cord (4).

■ NOTE

- **When disconnecting the battery cords, disconnect the grounding cord first. When connecting, the positive cord first.**

(1) Hood
(2) Side Cover
(3) Front Grille
(4) Battery Cord

12270S30130



Roll-Over Protective Structures (ROPS) and 3 Point Hitch

1. Disconnect the wire harness of tail lamps.
2. Remove the ROPS frame top (3).
3. Remove the lower link (1) and the collar from the 3-point hitch shaft (2).
4. Remove the both sides reflectors (6) with frame.
5. Remove the both sides fender mounting screws.
6. Remove the PTO shaft cover (5) and connecting plate.
7. Remove the ROPS left, right frames and 3-point hitch shaft (2).

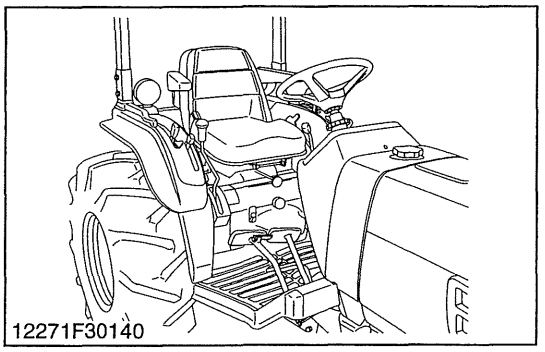
(When reassembling)

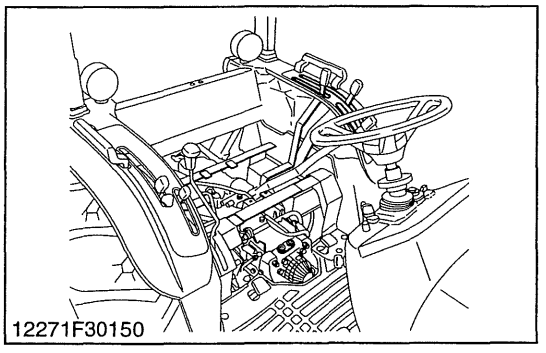
Tightening torque	Connecting plate mounting screw	47.1 to 56.9 N·m 4.8 to 5.8 kgf·m 34.7 to 42.0 ft-lbs
	ROPS frame and frame top mounting bolt and nut	149.1 to 179.5 N·m 15.2 to 18.3 kgf·m 109.9 to 132.4 ft-lbs
	ROPS frame mounting screw	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	3-Point hitch shaft setting screw	14.7 to 19.6 N·m 1.5 to 2.0 kgf·m 10.8 to 14.5 ft-lbs
	3-Point hitch shaft setting screw lock nut	43.0 to 47.0 N·m 4.4 to 4.8 kgf·m 31.7 to 35.4 ft-lbs

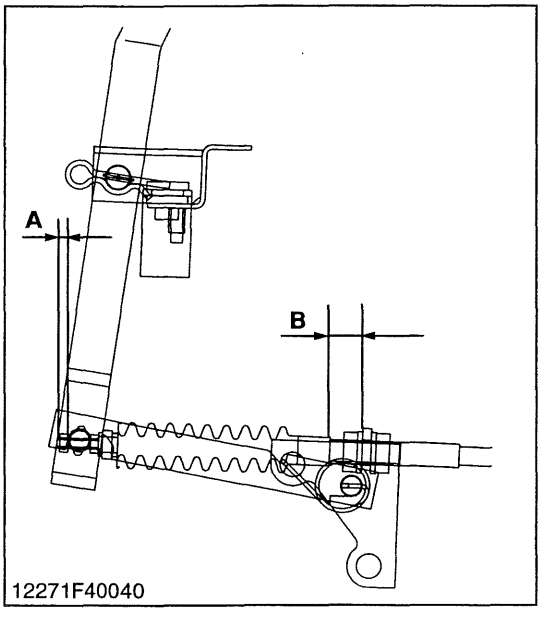
(1) Lower Link
(2) 3-Point Hitch Shaft
(3) ROPS Frame, Top
(4) ROPS Frame
(5) PTO Shaft Cover
(6) Tail Lamp

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12271F30150



12271F40040

Seat, Fender, Steering Wheel, Panel, Step and Others

1. Remove the seat, seat adjuster, lowering speed adjusting knob, seat under cover and fender cover (B2910 only).
2. Remove the position control lever grip, front wheel drive lever grip and bi-speed turn lever grip (Bi-speed Turn Type).
3. Remove the fender RH.
4. Remove the mid-PTO gear shift lever grip, rear PTO shift lever grip and range gear shift lever grip or Hi-Lo shift lever grip.
5. Remove the fender LH.
6. Loosen the lock nuts and disconnect the bi-speed turn cable (Bi-speed Turn Type).
7. Remove the fender stay and bi-speed turn lever as a unit (Bi-speed Turn Type).
8. Remove the cruise control lever grip (B2910 only), lever guide (B2910 only), tool box and fender stay.
9. Remove the steering wheel, panel and panel under cover.
10. Remove the fuel tank frame set screws and fuel tank stay.
11. Remove the clutch and brake springs (B2410 only).
12. Lift up the fuel tank frame and then remove the steps.
13. Disconnect the speed set rod, HST release rod (B2910 only) and brake pedal link.
14. Place the jack under the transmission case, and then set the rigid rack under the rear axles.
15. Remove the tires.

■ IMPORTANT

- **When refitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m (200 yards) and there after daily check service (B2410 only).**

(When reassembling)

Tightening torque	Cotter setting bolt and nut	B2410	123 to 147 N·m 12.6 to 15.0 kgf·m 91 to 108 ft-lbs
	Rear wheel mounting screw and nut	B2710 B2910	108 to 125 N·m 11.0 to 12.8 kgf·m 80 to 93 ft-lbs

- When reassembling the bi-speed turn cable, make sure to set the distance **A**.

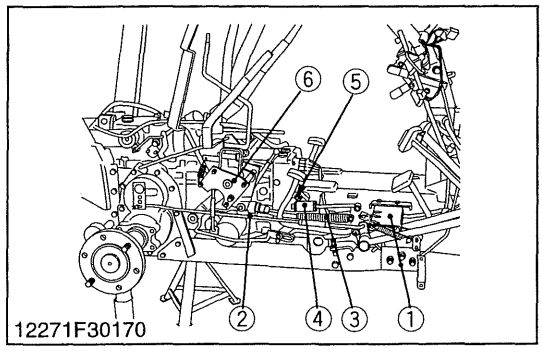
Distance **A**	Factory spec.	8 mm 0.31 in.

(Reference)

Distance **B**	Factory spec.	19 mm 0.75 in.

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HST Pedal

1. Remove the brake springs and spring stay (1).
2. Remove the brake rod RH (2).
3. Remove the cruise control assembly (6) (B2910 only).
4. Remove the damper (3) and speed control rod assembly (4).
5. Remove the HST pedal.
6. Remove the speed control rod screw (5) from the neutral holder.

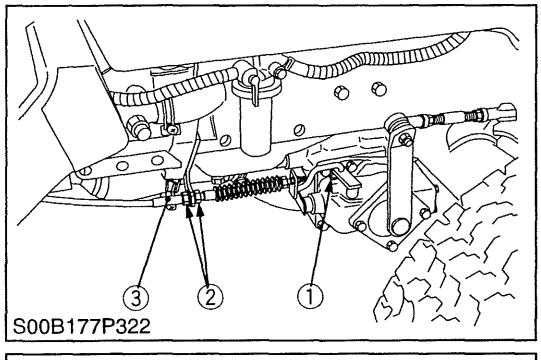
(When reassembling)

- Apply liquid lock (Three Bond 1324B or equivalent) to the speed control rod screw (5).

Tightening torque	Speed control rod screw	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs

(1) Spring Stay
(2) Brake Rod RH
(3) Damper
(4) Speed Control Rod Assembly
(5) Speed Control Rod Screw
(6) Cruise Control Assembly

12271S30110



S00B177P322

Bi-speed Turn Cable

1. Remove the spring lock pin (1) and loosen the lock nuts (2) and then remove the bi-speed turn cable (3).

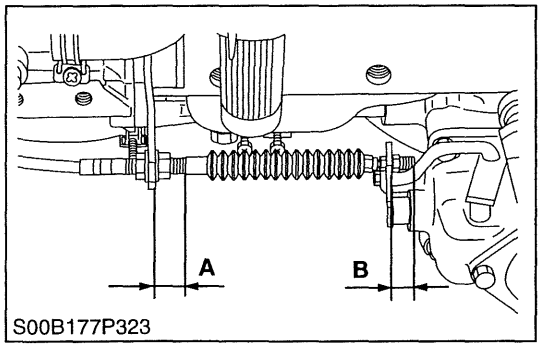
(When reassembling)

- When reassembling the bi-speed turn cable (3), make sure the distance **A**.

Distance **A**	Factory spec.	18 mm 0.71 in.

(Reference)

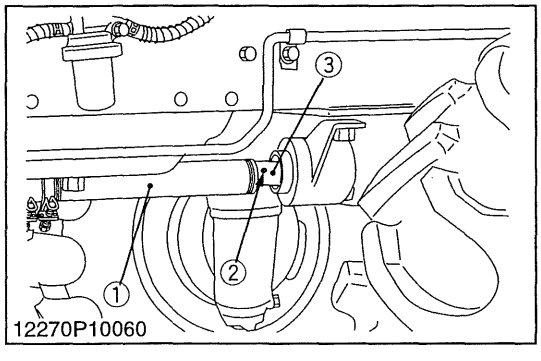
Distance **B**	Factory spec.	10 mm 0.39 in.



S00B177P323

(1) Spring Lock Pin
(2) Lock Nut
(3) Bi-speed Turn Cable

12271S60190



12270P10060

Propeller Shaft Cover and Coupling

1. Loosen the clamp and slide the propeller shaft cover (1) to the rear.
2. Tap out the spring pin (2) and then slide the coupling (3) to the rear.

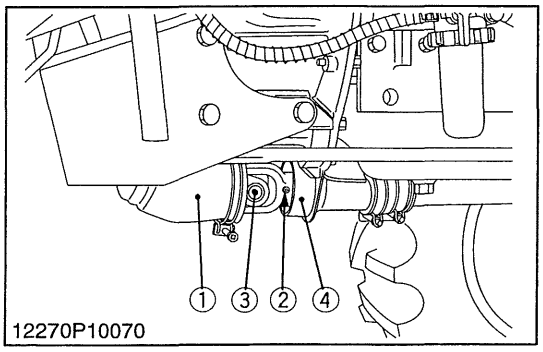
(When reassembling)

- Apply grease to the splines of the propeller shaft and coupling.

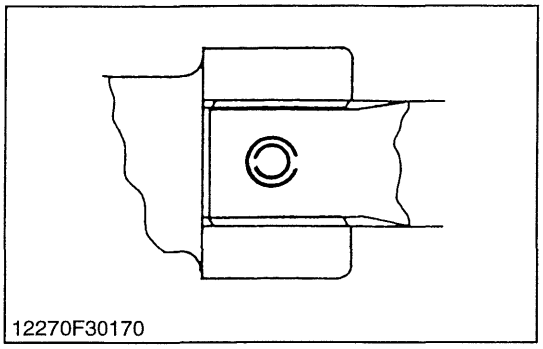
(1) Propeller Shaft Cover
(2) Spring Pin
(3) Coupling

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12270P10070


12270F30170

Universal Joint and Bearing Holder

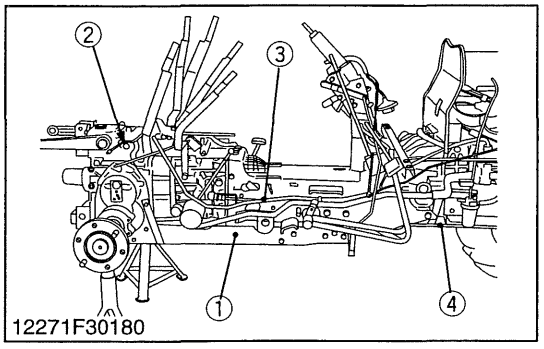
1. Loosen the clamp and slide the universal joint cover (1) to the rear.
2. Tap out the spring pins (2) and then slide the universal joint (3) to the rear.
3. Remove the bearing holder (4) with propeller shaft and universal joint.

(When reassembling)

- Apply grease to the splines of the propeller shaft and universal joint.
- When inserting the spring pins (2), face their splits in the direction parallel to the universal joint as shown in the figure.

(1) Universal Joint Cover
(2) Spring Pin
(3) Universal Joint
(4) Bearing Holder

12270S10160



12271F30180

Sub Frame RH, HST Delivery Pipe and Pipe Clamp

1. Remove the sub frame RH (1).
2. Remove the pips clamps and pipe joint bolt (2).
3. Remover the HST safety switch holder with neutral rod (3). (B2710 Affected Serial No.: above 50101)
4. Disconnect the HST delivery pipe (4).

(When reassembling)

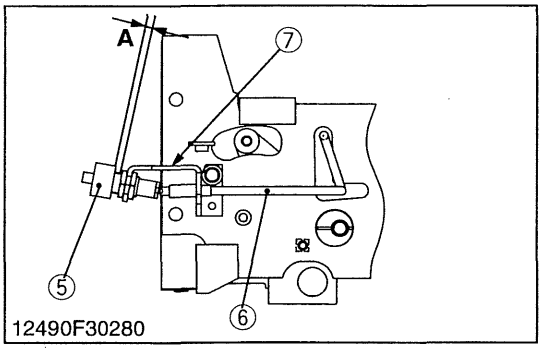
■ IMPORTANT

- **When HST safety switch (5) has been removed, be sure to adjust the length A.**

(Reference)

- Length **A** : 7.5 to 8.5 mm (0.29 to 0.33 in.)

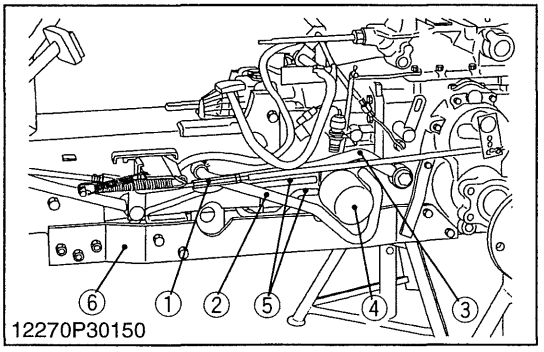
Tightening torque	Joint bolt (3P delivery pipe)	34.0 to 39.0 N·m 3.5 to 4.0 kgf·m 25.1 to 28.7 ft-lbs
	HST delivery pipe nut	34.0 to 39.0 N·m 3.5 to 4.0 kgf·m 25.1 to 28.7 ft-lbs



12490F30280

(1) Sub Frame RH
(2) Pipe Joint Bolt
(3) HST Safety Switch with Neutral Rod
(4) HST Delivery Pipe
(5) HST Safety Switch
(6) HST Neutral Rod
(7) Safety Switch Holder

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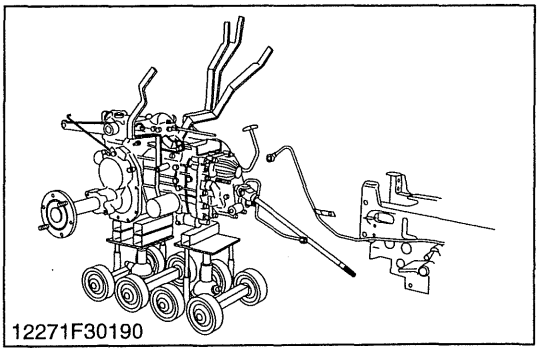
Sub Frame RH, Hydraulic Pipes and Others

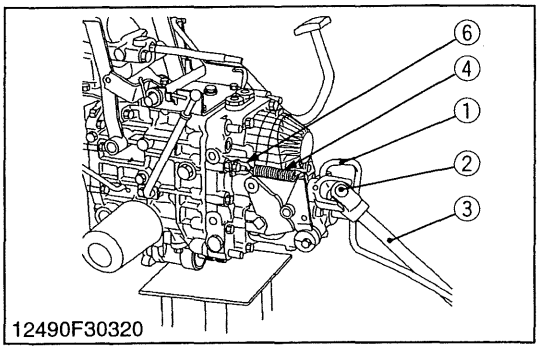
1. Remove the brake rod RH (1).
2. Remove the connecting pipe (2).
3. Remove the HST suction pipe (3).
4. Remove the sub frame RH (6).
5. Remove the hydraulic oil filter assembly (4) and pipes (5).

(1) Brake Rod RH
(2) Connecting Pipe
(3) HST Suction Pipe
(4) Hydraulic Oil Filter Assembly
(5) Return Pipe
(6) Sub Frame RH

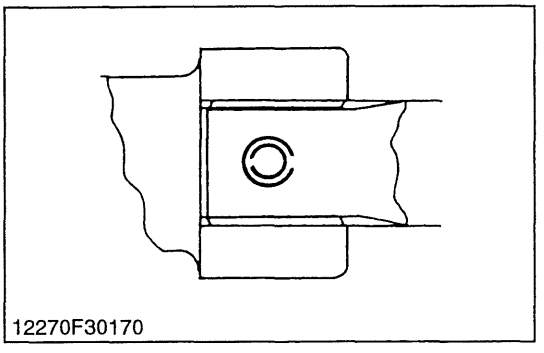
12270S30190

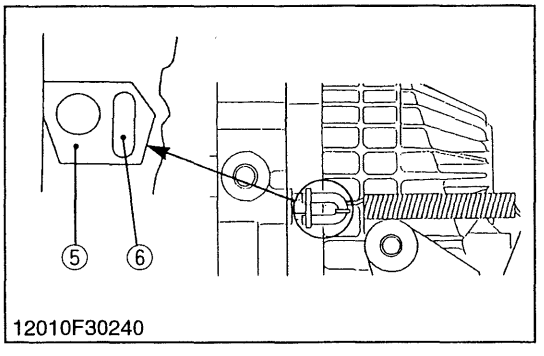
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12010F30240

Separating Transmission Case from Center Frame and Hydrostatic Transmission (HST)

1. Separate transmission case and center frame.
2. Remove the propeller shaft, front wheel drive shaft (1) and HST delivery pipe (2).
3. Remove the neutral spring (4) and remove the spring holder (5).
4. Separate the HST from transmission case.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the HST and transmission case.
- When inserting the spring pins, face their splits in the direction at a right angle to the universal joint and propeller shaft as shown in figure.
- Apply grease to the spline of the HST pump shaft, front wheel propeller shaft, universal joint and ball coupling.

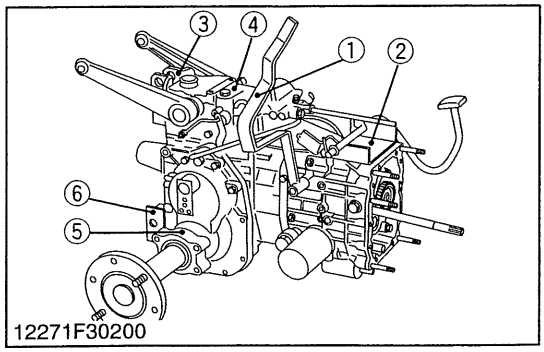
■ NOTE

- **When reassembling the spring holder, spring hook (6) must be inside as shown in figure.**

Tightening torque	Spring holder mounting screw	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs
	HST and center frame mounting screw and nut	62.8 to 72.6 N·m 6.4 to 7.4 kgf·m 46.3 to 53.5 ft-lbs

(1) HST Delivery Pipe
(2) Universal Joint
(3) Front Wheel Propeller Shaft
(4) Neutral Spring
(5) Spring Holder
(6) Spring Hook

12270S30200



12271F30200

Separating Hydraulic Cylinder, Rear Axle Cases and Others

1. Remove the front wheel drive lever (1).
2. Remove the differential lock pedal support (2).
3. Remove the top link bracket LH (3) and remove the hydraulic cylinder (4).
4. Remove the rear axle case (5) and drawber frame (6).

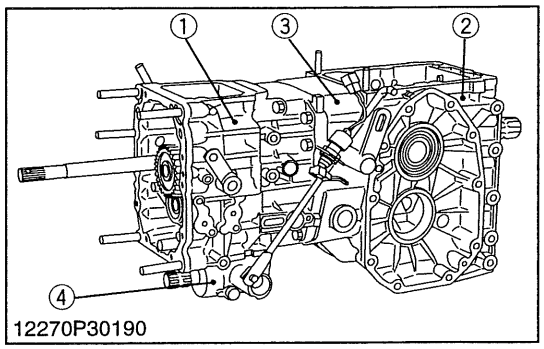
(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the differential case to hydraulic cylinder and rear axle cases.

Tightening torque	Hydraulic cylinder mounting screw and nut	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs
	Rear axle 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) Front Wheel Drive Lever
(2) Differential Lock Pedal Support
(3) Top Link Bracket LH
(4) Hydraulic Cylinder
(5) Rear Axle Case
(6) Drawber Frame

12270S30210



12270P30190

Separating Mid-PTO Case, Transmission Case and Differential Case

1. Remove the mid-PTO case mounting screws and separate the mid-PTO case (4) and transmission case (1).
2. Remove the transmission case mounting screws and nuts and separate the differential case (2) and transmission case (1) with middle case (3) as a unit.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the transmission case and differential case.

Tightening torque	Transmission case mounting screw and nut	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs

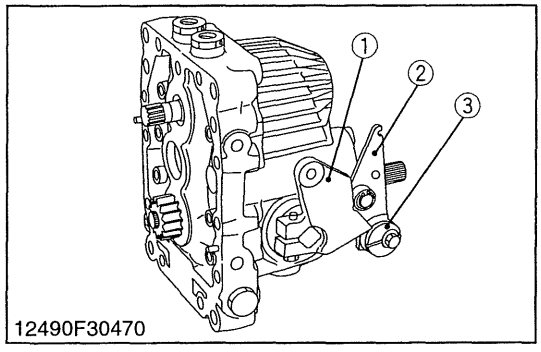
(1) Transmission Case
(2) Differential Case
(3) Middle Case (B2710, B2910)
(4) Mid-PTO Case

12270S30220

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[4] DISASSEMBLING TRANSMISSION CASE

(1) Hydrostatic Transmission



12490F30470

Neutral Holder and Neutral Holder Arm

1. Place parting marks on the neutral adjuster (3) and the neutral holder arm (2).
2. Remove the neutral holder arm (2) with neutral adjuster (3).
3. Remove the screw and pull out the neutral holder (1).

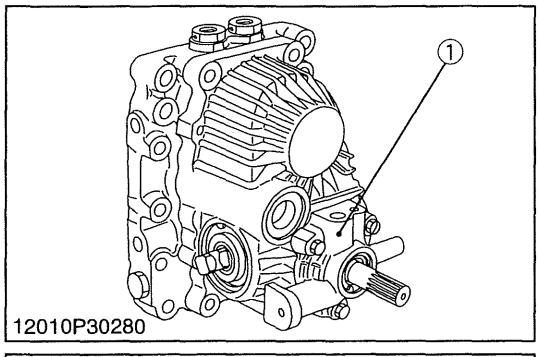
(When reassembling)

- Align the parting marks and install the neutral adjuster and the neutral holder arm.

Tightening torque	Neutral adjuster lock screw	17.7 to 20.5 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs
	Neutral holder mounting screw	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2ft-lbs

(1) Neutral Holder
(2) Neutral Holder Arm
(3) Neutral Adjuster

12490S30270



12010P30280

Charge Pump

1. Remove the charge pump mounting screws, and remove the charge pump assembly (1) from the HST housing.

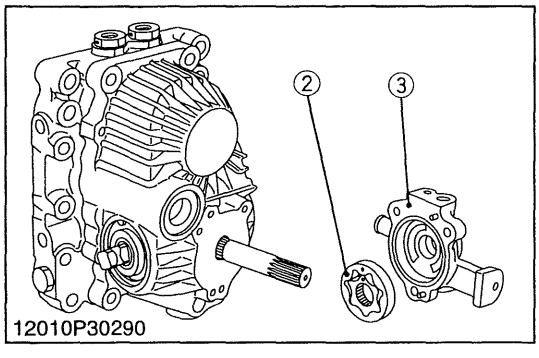
(When reassembling)

■ NOTE

- **Take care not to damage the O-ring.**

Tightening torque	Charge pump mounting screw	17.7 to 20.5 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs

(1) Charge Pump Assembly
(2) Gerotor Assembly
(3) Charge Pump Housing



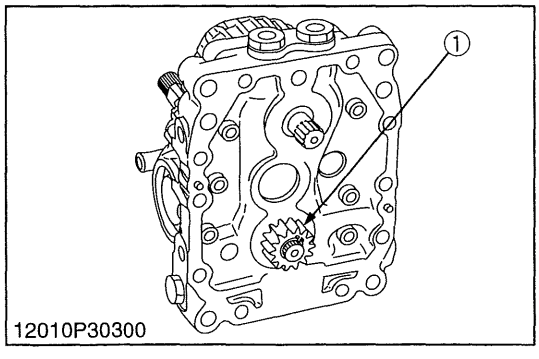
12010P30290

12010S30260

14T Gear

1. Remove the external snap ring and draw out the 14T gear (1).

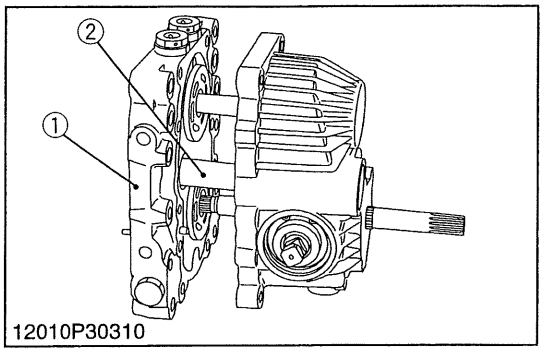
(1) 14T Gear



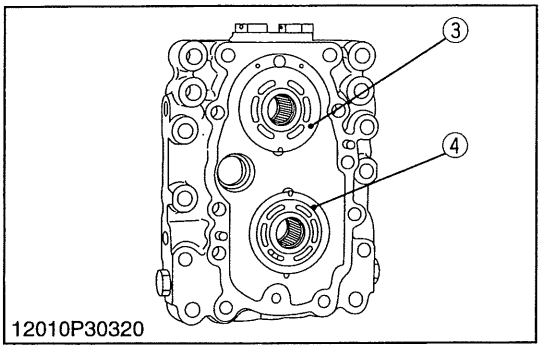
12010P30300

12010S30270

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12010P30310



12010P30320

Center Section

1. Remove the center section mounting hex. socket head screws.
2. Tap the front of center section flange with a soft hammer and separate the center section (1) from HST housing.

(When reassembling)

- Cover the splines of each shaft with thin tape to protect sealing lip.
- Install center section with gasket, O-ring and valve plates in place.

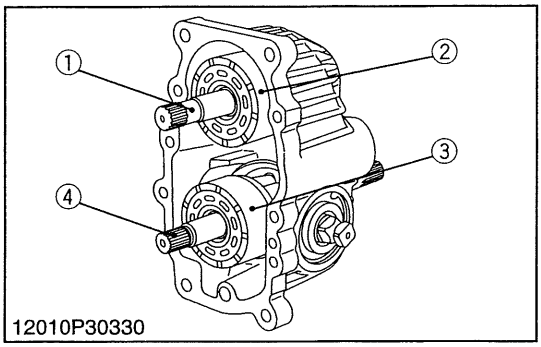
■ IMPORTANT

- **Valve plates (3), (4) may stick to the center section but they are not fixed. Take care not to drop them.**
- **Valve plates are not interchangeable. Valve plate of pump has two notches and the one of motor has no.**

Tightening torque	Center section mounting hex. socket screw	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs

(1) Center Section
(2) Front Wheel Drive Shaft Pipe
(3) Valve Plate of Motor
(4) Valve Plate of Pump

12010S30280

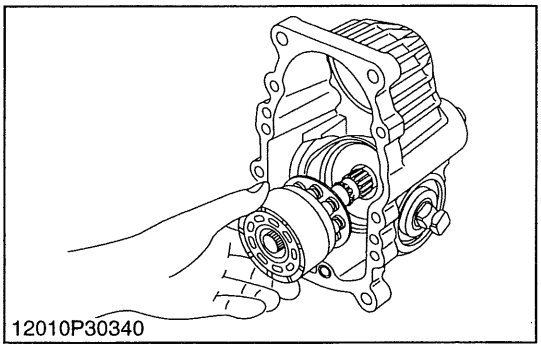


12010P30330

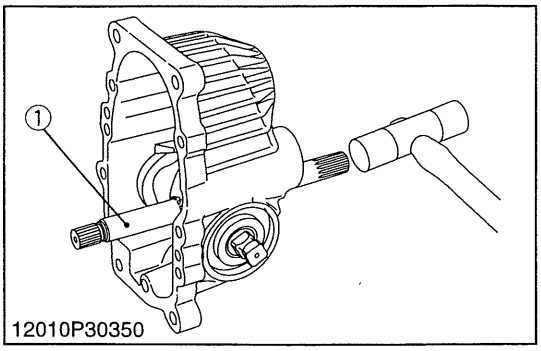
Motor Cylinder Block and Pump Cylinder Block

1. Pull out the output shaft (1) and motor cylinder block (2) with pistons as a unit.
2. Slide out the pump cylinder block (3) with pistons.

(1) Output Shaft
(2) Motor Cylinder Block
(3) Pump Cylinder Block
(4) Input Shaft


12010P30340

12010S30290



12010P30350

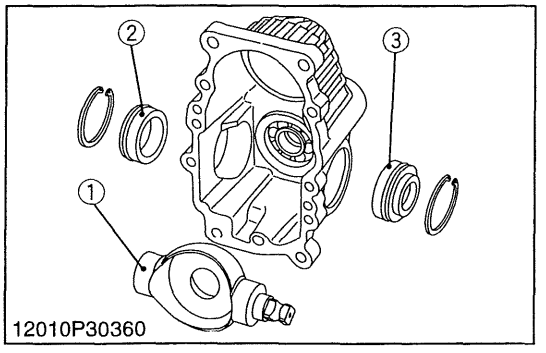
Input Shaft

1. Tap out the input shaft (1) to the rear.

(1) Input Shaft

12010S30300

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12010P30360

Cover A, B and Trunnion Shaft

1. Remove the internal snap rings both side.
2. Tap the trunnion shaft (1) using a soft hammer to create a clearance between the case and the cover **B** (2).
   Then, pry the cover **B** (2) open with a screw-driver. Pry the cover **A** (3) in the same way.
3. Take out the trunnion shaft (1).

(When reassembling)

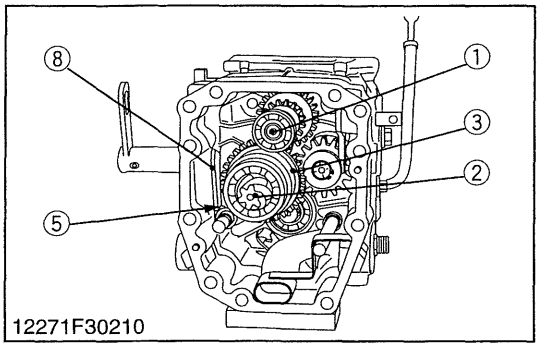
■ NOTE

- **Take care not to damage the O-rings.**

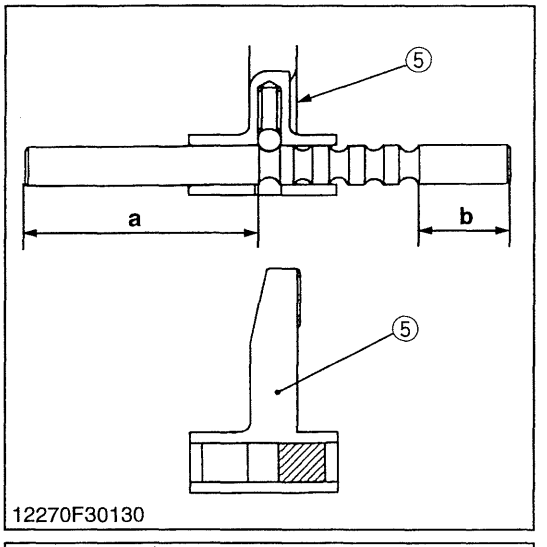
(1) Trunnion Shaft
(2) Cover **B**
(3) Cover **A**

12010S30310

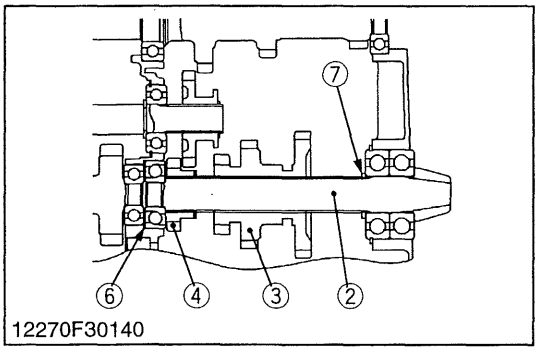
(2) Transmission Case



12271F30210



12270F30130



12270F30140

4th Gear Shaft and Spiral Bevel Pinion Shaft

1. Remove the spiral bevel pinion shaft (2) with 15T-29T (B2410) or 16T-27T-32T shifter gear (3), 13T (B2410) or 14T gear (4) and shift fork (5).
2. Remove the 4th gear shaft (1).

(When reassembling)

- When installing the spiral bevel pinion shaft, be sure to install the shims (6).

■ IMPORTANT

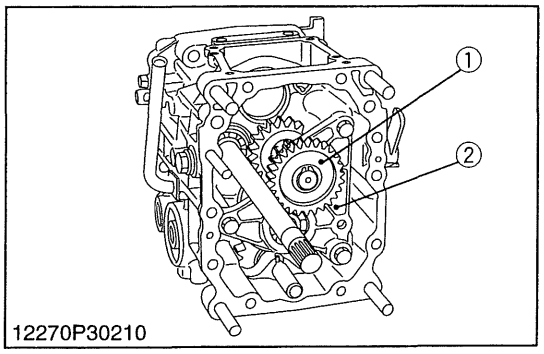
- **When disassembling the spiral bevel pinion shaft (2), be sure to replace the external snap ring (7) with new one.**
- **When set the shift fork (5) and shift lever (8), make sure to the shift lever set position at rear groove (shown in figure).**

(1) 4th Gear Shaft
(2) Spiral Bevel Pinion Shaft
(3) 15T-29T Shifter Gear (B2410)
16T-27T-32T Shifter Gear (B2710, B2910)
(4) 13T Gear (B2410)
14T Gear (B2710, B2910)
(5) Shift Fork
(6) Shim
(7) External Snap Ring
(8) Shift Lever

a : Front
b : Rear

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12270P30210

Bearing Holder

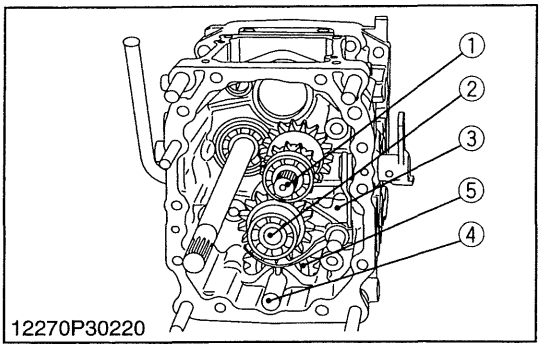
1. Remove the external snap ring and remove the 27T gear (1).
2. Remove the bearing holder mounting screws and remove the bearing holder (2).

(When reassembling)

Tightening torque	Bearing holder mounting screw	50 to 55 N·m 5.1 to 5.6 kgf·m 36.9 to 40.1 ft-lbs

(1) 27T Gear
(2) Bearing Holder

12270S30240



12270P30220

2nd Gear Shaft and Middle Shaft

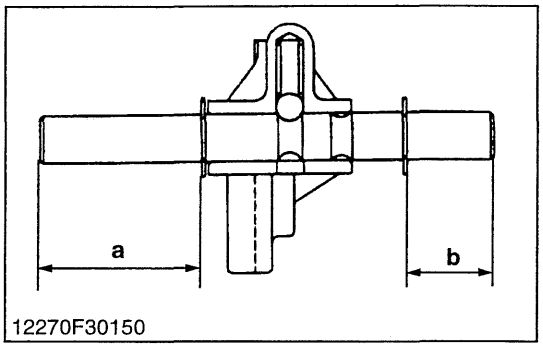
1. Remove the 2nd gear shaft (1) with bearings.
2. Remove the 3rd shaft assembly (2) and shift fork (3) with shift rod.
3. Remove the middle shaft (4) and 19T gear (5) with bearing.

(When reassembling)

- When assembling the 19T gear (5), face the chamfer side to the rear.

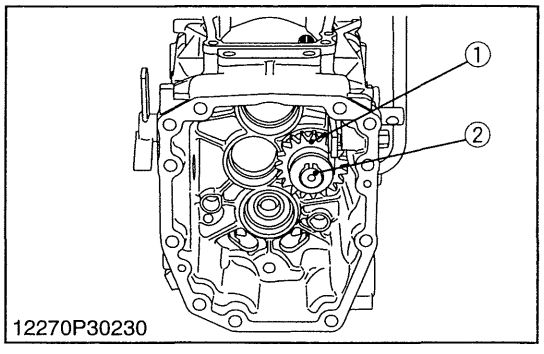
(1) 2nd Gear Shaft
(2) 3rd Shaft Assembly
(3) Shift Fork
(4) Middle Shaft
(5) 19T Gear

a : Front
b : Rear



12270F30150

12270S30250



12270P30230

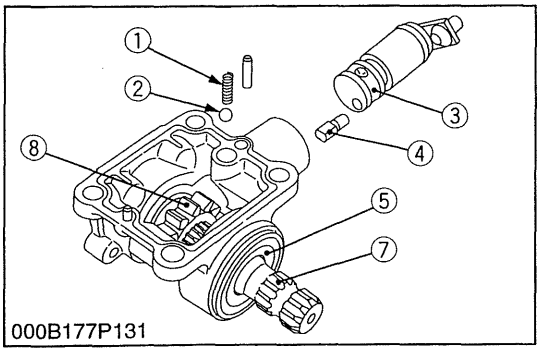
Front Wheel Drive Shaft

1. Remove the external snap ring and remove the 20T shifter gear (1).
2. Draw out the front wheel drive shaft (2) to the front.

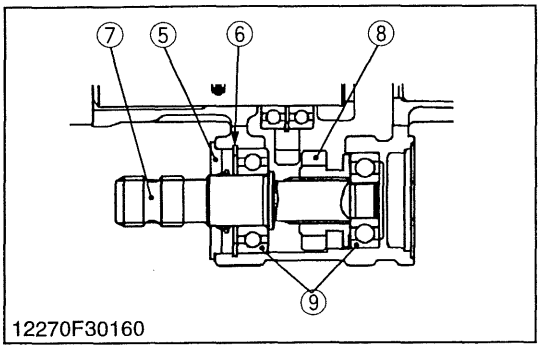
(1) 20T Shifter Gear
(2) Front Wheel Drive Shaft

12270S30260

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12270F30160

Mid-PTO Shaft

1. Remove the spring (1) and ball (2).
2. Draw out the dowel pin and remove the shift arm (3) with shifter (4).
3. Remove the oil seal (5) and internal snap ring (6).
4. Remove the mid-PTO shaft (7) with 11T shifter gear (8) and bearings (9).

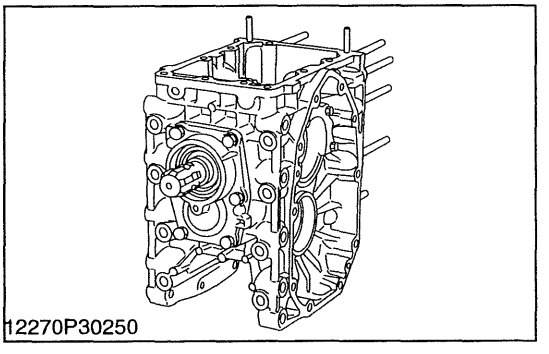
(When reassembling)

- Apply grease to lip and outer of oil seal.

(1) Spring
(2) Ball
(3) Shift Arm
(4) Shifter
(5) Oil Seal
(6) Internal Snap Ring
(7) Mid-PTO Shaft
(8) 11T Shifter Gear
(9) Bearing

12270S30270

[5] DISASSEMBLING DIFFERENTIAL GEAR CASE


12270P30250

PTO Shaft

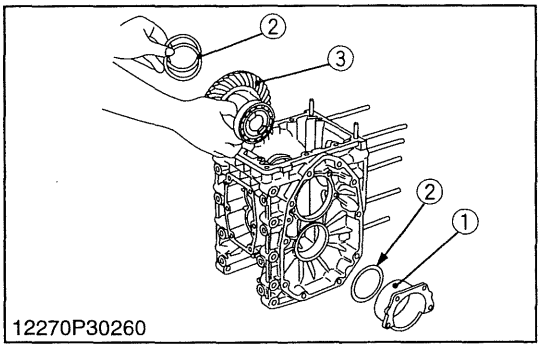
1. Remove the PTO cover mounting screws and remove the PTO cover assembly.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of differential gear case and PTO cover.

Tightening torque	PTO cover mounting screw	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs

12270S30280



12270P30260

Differential Gear Assembly

1. Remove the bearing holder mounting screws and remove the bearing holder (1).
2. Take out the differential gear assembly (3).

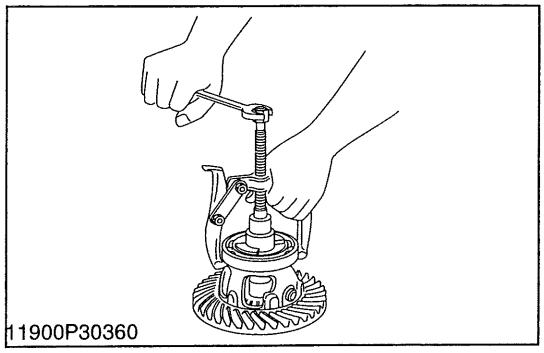
(When reassembling)

- Install the differential gear assembly, noting the number of shims (2) in the differential case left side and bearing holder side.

Tightening torque	Differential gears bearing holder mounting screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs

(1) Bearing Holder
(2) Adjusting Shim
(3) Differential Gear Assembly

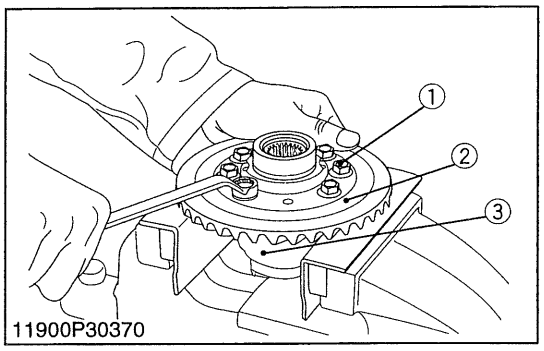
12270S30290


11900P30360

Bearings

1. Remove the right and left bearings from the differential case.

11900S30490



11900P30370

Spiral Bevel Gear

1. Remove the spiral bevel gear UBS screws (1).
2. Remove the spiral bevel gear (2) from differential case (3).

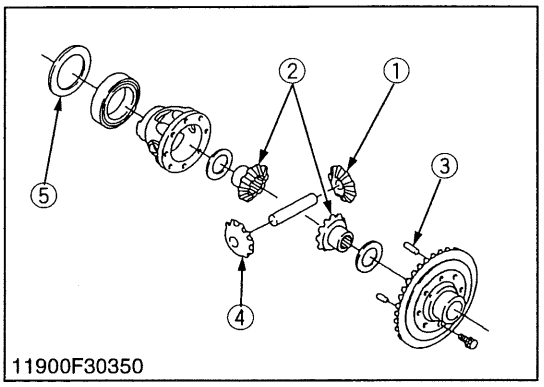
(When reassembling)

- Apply liquid lock (Three Bond 1324B or its equivalent) to the spiral bevel gear UBS screws.

Tightening torque	Spiral bevel gear UBS screw	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs

(1) Spiral Bevel Gear UBS Screw
(2) Spiral Bevel Gear
(3) Differential Case

11900S30500



11900F30350

Differential Side Gear and Differential Pinion

1. Put parting marks on the differential pinion (1) and the differential side gear (2).
2. Tap out the dowel pin (3).
3. Remove the differential pinion shaft.
4. Remove the differential pinion (4), differential side gear (2) and shim (5).

(When reassembling)

- Install the differential pinion and differential side gear, aligning the parting marks.

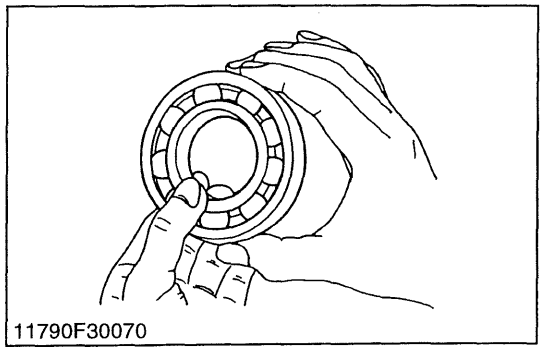
(1) Differential Pinion
(2) Differential Side Gear
(3) Dowel Pin
(4) Differential Pinion
(5) Shim

11900S30510

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SERVICING

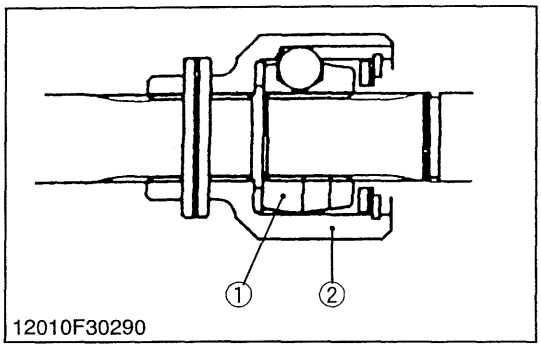
[1] CLUTCH HOUSING


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



12010F30290

Checking Propeller Shaft Ball Coupling

1. Hold the ball coupling outer, and push and pull, and rotate the ball coupling inner in all directions to check for wear and roughness.
2. If there is any defect, replace it.

(When reassembling)

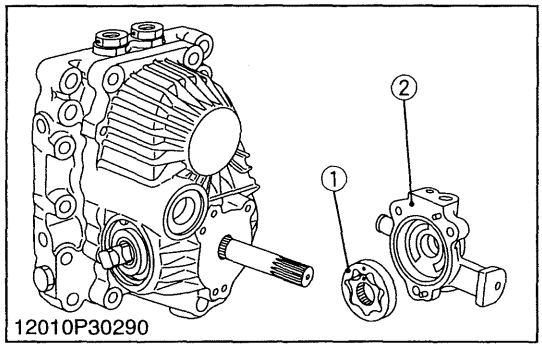
- Apply grease to the inner parts of ball coupling and splines of ball coupling inner.
- When replacing the ball coupling assembly, install the ball coupling inner (1) with balls so that its ball position inside of ball coupling outer (2) as shown in the figure.

(1) Inner, Coupling (2) Outer, Coupling

12010S30380

[2] TRANSMISSION CASE

(1) Hydrostatic Transmission



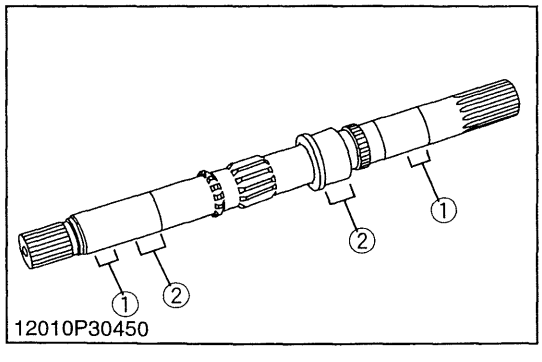
12010P30290

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

12010S30390



12010P30450

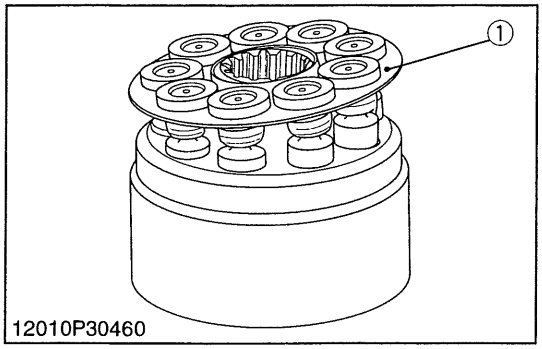
Input Shaft

1. Pull out the input shaft from the case.
2. Check the seal surface (1), the bearing surface (2) and the bearing.
3. If the shaft is rough or grooved, replace.
4. If the bearing is worn, replace.

(1) Seal Surface (2) Bearing Surface

12010S30400

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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.

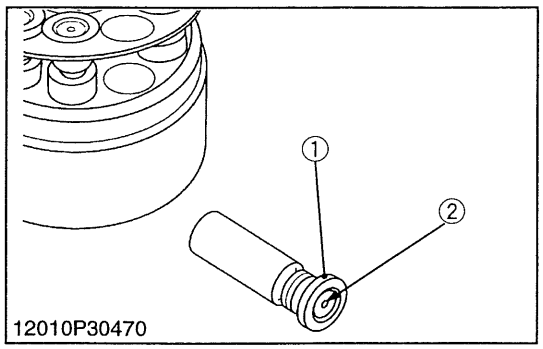
■ IMPORTANT

- **Do not interchange pistons between pump and motor cylinder block. Pistons and cylinder blocks are matched.**

Clearance between piston and bore	Factory spec.	0.02 mm 0.0008 in.
	Allowable limit	0.04 mm 0.0016 in.

(1) Retainer Plate

12270S30320



Piston Slipper and Retainer Plate

1. Check the slipper (1) 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 (2) for clogging.

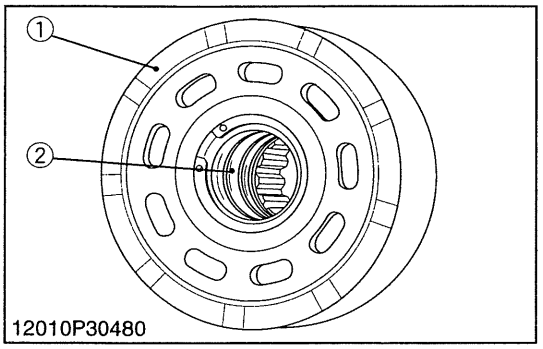
■ IMPORTANT

- **Do not interchange pistons between pump and motor cylinder block. Pistons and cylinder blocks are matched.**

Thickness of slipper	Factory spec.	3.00 mm 0.118 in.
	Allowable limit	2.90 mm 0.114 in.

(1) Piston Slipper (2) Lubricant Hole

12010S30420

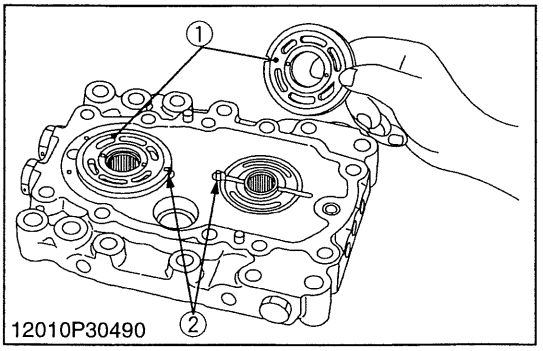


Cylinder Block Face

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

12010S30430



Valve Plate

1. Check the engagement of the valve plate (1) and the anchor pin (2).
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.

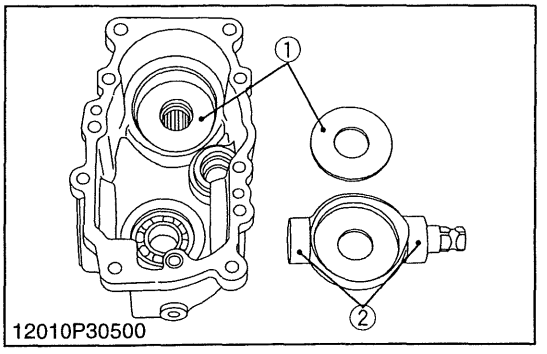
■ NOTE

- **After checking, coat them with hydrostatic transmission oil.**

(1) Valve Plates (2) Anchor Pin

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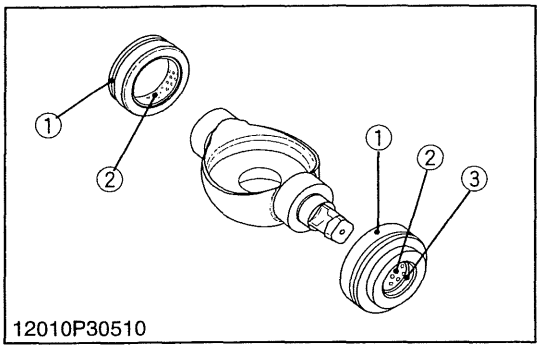


Thrust Plate and Swashplate

1. Check the thrust plate (1) for scratches and excessive wear.
2. If worn or scored, replace.
3. Check the bearing surface (2) of trunnion shaft (swashplate) for scratches and excessive wear.
4. If worn or scored, replace.

(1) Thrust Plate (2) Bearing Surface

12010S30450



Trunnion Shaft Cover

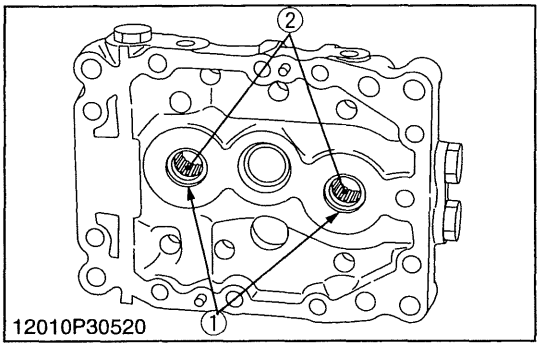
1. Check the bearing (2) for scratches and excessive wear.
2. If worn or scored, replace.
3. Check the oil seal (3) and the O-rings (1) for damage.

■ NOTE

- **After checking, coat the bearings with hydrostatic transmission oil, and the oil seal lip and the O-rings (1) with grease.**

(1) O-ring (3) Oil Seal
(2) Bearing

12010S30460



Oil Seals and Bearings for Shaft

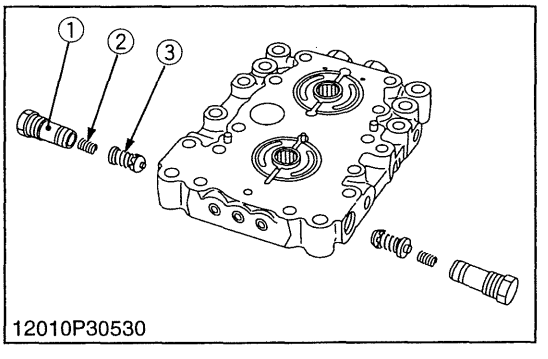
1. Remove the internal snap ring and check the oil seals (1) for damage.
2. Check the bearings (2) for wear.
3. If the bearings are worn, replace.

■ NOTE

- **After checking, coat the bearing with hydrostatic transmission oil and the oil seal lip with grease.**

(1) Oil Seal (2) Needle Bearing

12010S30470



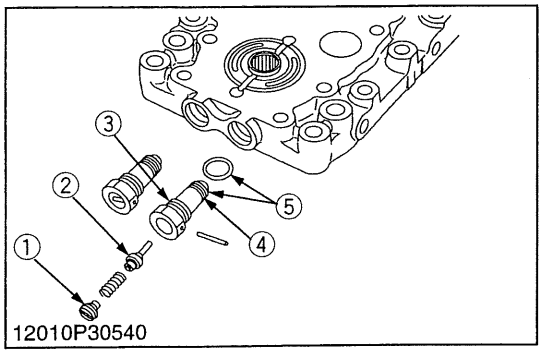
Check and High Pressure Relief Valve

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.

Tightening torque	Valve plug	118 to 147 N·m 12.0 to 15.0 kgf·m 86.8 to 108.5 ft-lbs

(1) Valve plug (3) Valve
(2) Spring

12010S30480



12010P30540

Neutral Valve

1. Check the holes of the valve body (3) and the neutral valve (2) for clogging.
2. If clogged, open hole with compressed air.
3. Check the O-rings (1), (5) and the backup ring (4) for scratches and damage.
4. Check the springs for breakage and wear.
5. If the valve surface is scored, replace.
6. If anything unusual, replace.

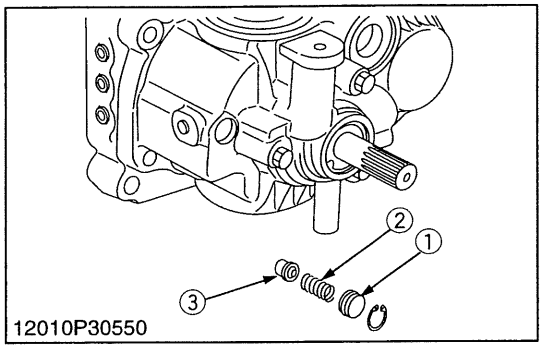
■ **NOTE**

- **When reassembling, replace the O-rings and the backup rings.**

Tightening torque	Cap screw	58.5 to 68.6 N·m 6.0 to 7.0 kgf·m 43.4 to 50.6 ft-lbs

(1) O-ring
(2) Neutral Valve
(3) Valve Body
(4) Backup Ring
(5) O-ring

12010S30490



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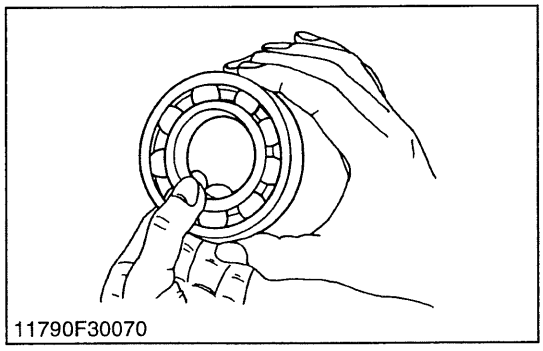
Charge Relief Valve

1. Check the spring (2) for breakage and wear.
2. If it unusual, replace.

(1) Valve Plug
(2) Spring
(3) Valve Poppet

12010S30500

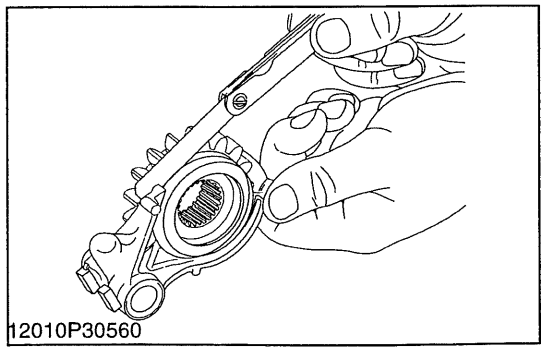
(2) Transmission Case


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.

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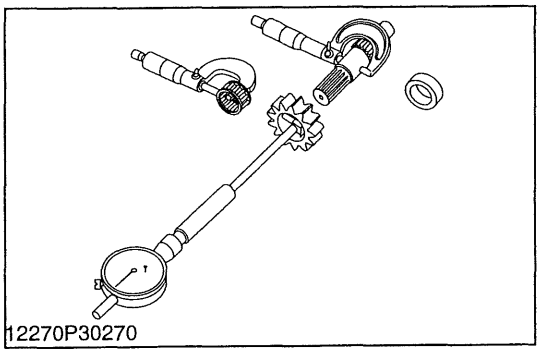
Clearance between Shift Fork and Shift Gear Groove

1. Insert the fork into the shift gear groove and measure the clearance with a feeler gauge.
2. If the clearance exceeds the allowable limit, replace it.

Clearance between shift fork and shift gear groove	Factory spec.	0.10 to 0.35 mm 0.004 to 0.014 in.
	Allowable limit	0.5 mm 0.020 in.

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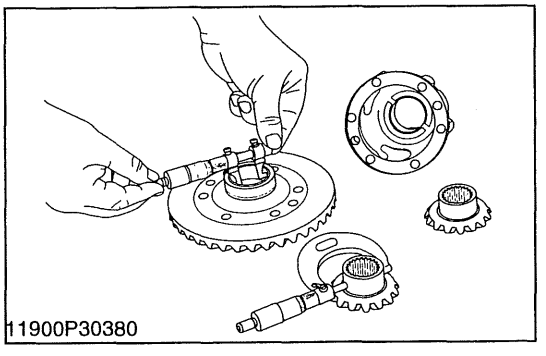
Clearance between 13T Gear and 3rd Shaft

1. Measure the 13T gear I.D. with an inside micrometer, and then 3rd shaft O.D. with an outside micrometer.
2. Measure the O.D. of two needles in the needle bearing with an outside micrometer.
3. Clearance is the difference between the gear I.D. and the sum of shaft O.D. and two needle O.D..
4. If the clearance exceeds the allowable limit, replace it.

Clearance between 13T gear and 3rd shaft	Factory spec.	0.007 to 0.046 mm 0.0003 to 0.0018 in.
	Allowable limit	0.10 mm 0.0039 in.
3rd shaft O.D.	Factory spec.	21.987 to 22.000 mm 0.8656 to 0.8661 in.
13T gear I.D.	Factory spec.	30.007 to 30.021 mm 1.1026 to 1.1032 in.
Needle O.D.	Factory spec.	3.994 to 4.000 mm 0.1572 to 0.1575 in.

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[3] DIFFERENTIAL GEAR


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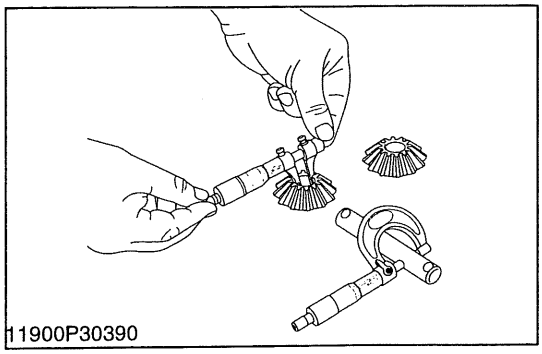
Clearance between Differential Case (Spiral Bevel Gear) and Differential Side Gear

1. Measure the differential side gear boss O.D. with an outside micrometer.
2. Measure the differential case I.D. and the spiral bevel gear I.D. with an inside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace faulty parts.

Clearance between differential case (spiral bevel gear) and differential side gear	Factory spec.	0.025 to 0.066 mm 0.0010 to 0.0026 in.
	Allowable limit	0.30 mm 0.0118 in.
Differential case I.D.	Factory spec.	32.000 to 32.025 mm 1.2598 to 1.2608 in.
Spiral bevel gear I.D.	Factory spec.	32.000 to 32.025 mm 1.2598 to 1.2608 in.
Differential side gear O.D.	Factory spec.	31.959 to 31.975 mm 1.2582 to 1.2589 in.

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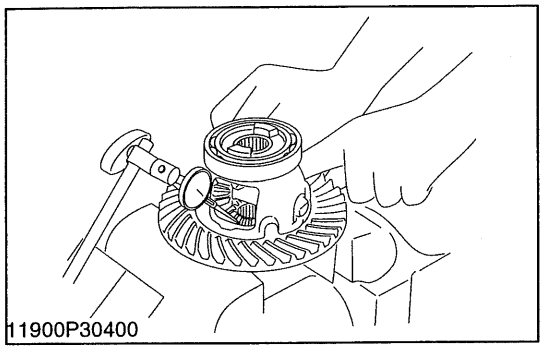
Clearance between Differential Pinion Shaft and Differential Pinion

1. Measure the differential pinion shaft O.D. with an outside micrometer.
2. Measure the differential pinion I.D. with an inside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace faulty parts.

Clearance between differential pinion shaft and differential pinion	Factory spec.	0.016 to 0.045 mm 0.0006 to 0.0018 in.
	Allowable limit	0.30 mm 0.0118 in.

Differential pinion I.D.	Factory spec.	16.000 to 16.018 mm 0.6299 to 0.6306 in.
Differential pinion shaft O.D.	Factory spec.	15.973 to 15.984 mm 0.6289 to 0.6293 in.

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Backlash between Differential Pinion and Differential Side Gear

1. Secure the differential case with a vise.
2. Set the dial indicator (lever type) with its finger on the tooth of the differential side gear.
3. Press differential pinion and side gear against the differential case.
4. Hold the differential pinion and move the differential side gear to measure the backlash.
5. If the backlash exceeds the allowable limit, adjust with differential side gear shims.

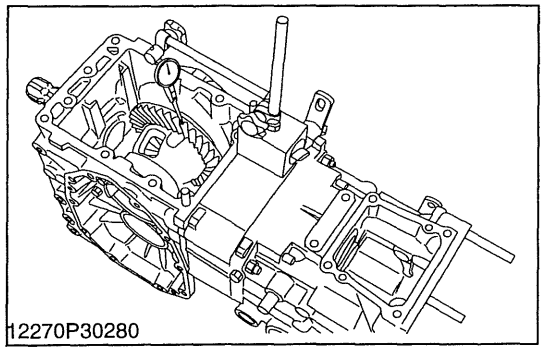
Backlash between differential pinion and differential side gear	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.
	Allowable limit	0.4 mm 0.016 in.

■ NOTE

- **Thickness of shims :**
  0.8 mm (0.0315 in.), 1.0 mm (0.0394 in.), 1.2 mm (0.0472 in.)

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Backlash between Spiral Bevel Pinion and Spiral Bevel Gear

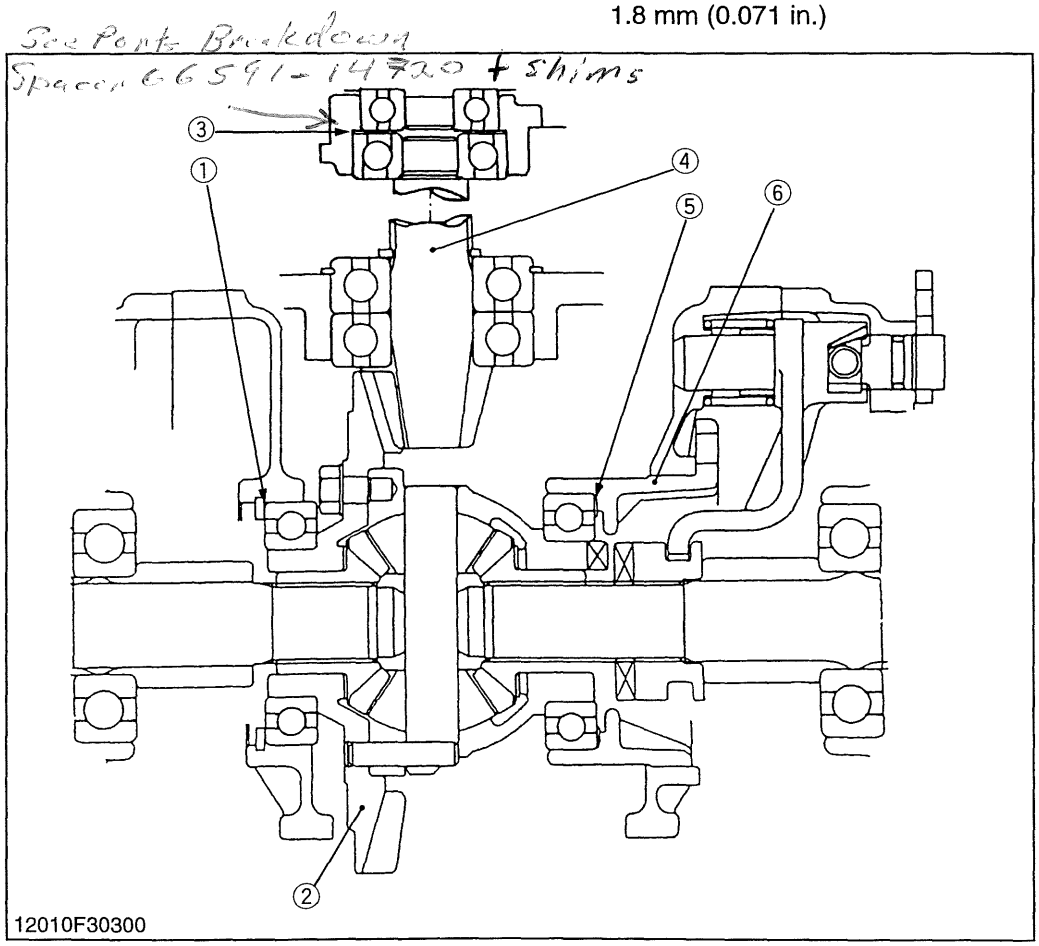
1. Set the dial indicator (lever type) with its finger on the end of spiral bevel pinion (4).
2. Move the spiral bevel pinion back and forth to each end and measure the side clearance.
3. If the side clearance exceeds the factory specifications, adjust with the shims (3) at front end of spiral bevel pinion.
4. Set the dial indicator (lever type) with its finger on the tooth surface of bevel gear.
5. Measure the backlash by fixing the spiral bevel pinion (4) and moving bevel gear (2) by hand.
6. If the backlash exceeds the factory specifications, adjust with the shims (1), (5) at bearing holder (6) and differential case.
7. Adjust the backlash properly by repeating the above procedures.

(When adjusting)

Side clearance of spiral bevel pinion	Factory spec.	Less than 0.15 mm 0.0059 in.
Backlash between spiral bevel pinion and spiral bevel gear	Factory spec.	0.10 to 0.20 mm 0.0039 to 0.0079 in.

(Reference)

- Thickness of shims (1), (5) :
  0.2 mm (0.008 in.) 0.5 mm (0.020 in.)
- Thickness of shims (3) :
  0.2 mm (0.008 in.) 1.4 mm (0.055 in.)
  1.8 mm (0.071 in.)



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(1) Shim
(2) Bevel Gear
(3) Shim
(4) Spiral Bevel Pinion
(5) Shim
(6) Bearing Holder

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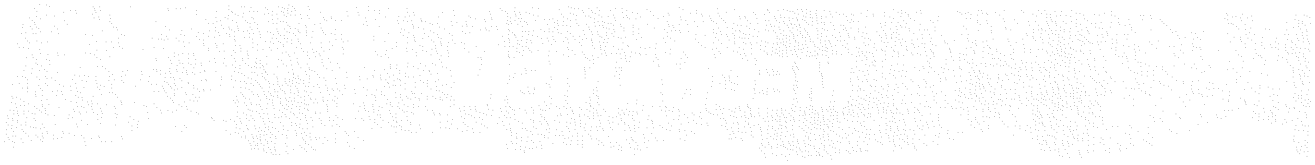
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MECHANISM

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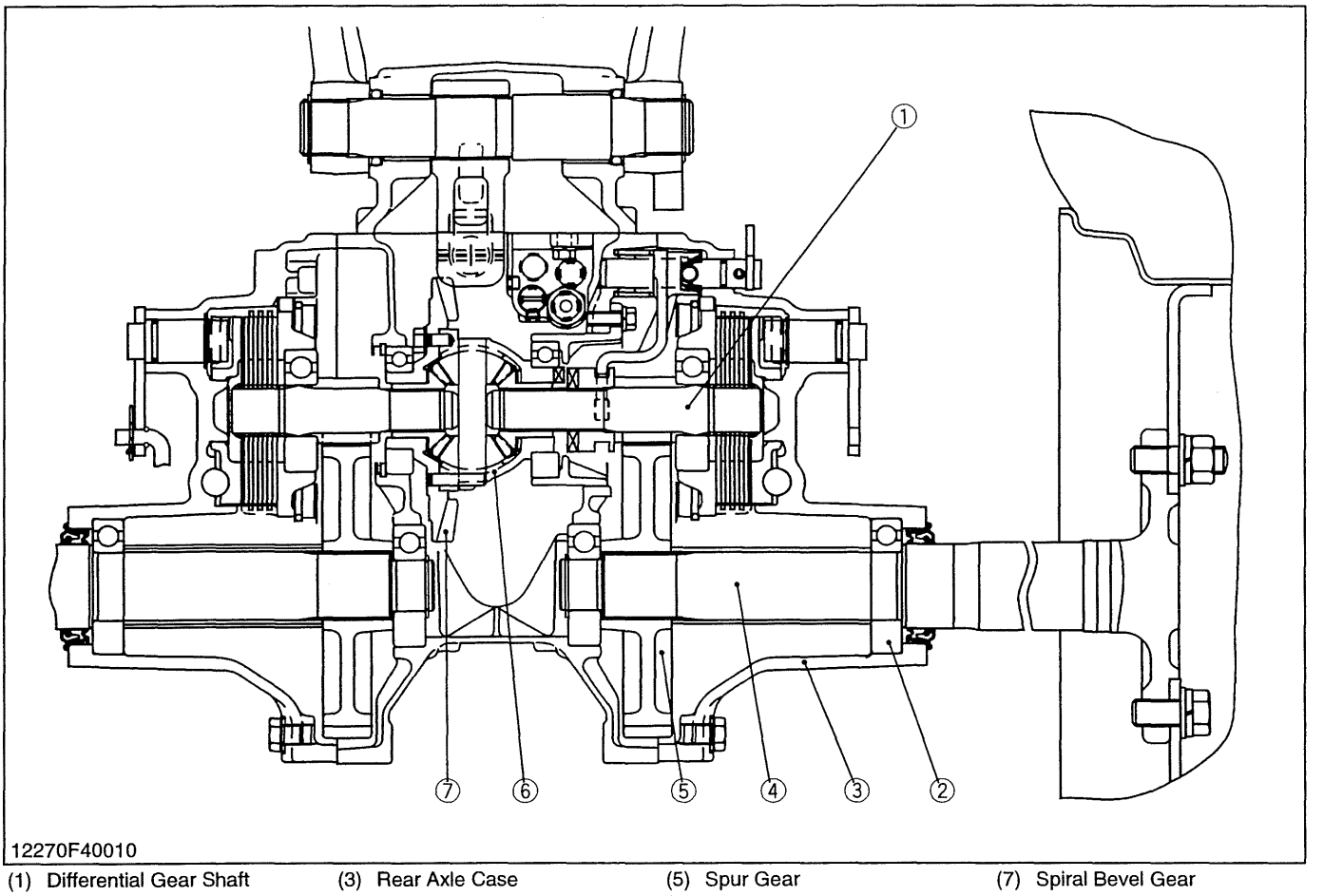
[1] FEATURES 4-M1

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[1] FEATURES



12270F40010

(1) Differential Gear Shaft
(2) Ball Bearing
(3) Rear Axle Case
(4) Rear Axle
(5) Spur Gear
(6) Differential Gear
(7) Spiral Bevel Gear

The rear axles are the semifloating type with ball bearings (2) between the rear axle (4) and the rear axle case (3), which supports the rear wheel load as well as transmitting power to the rear wheels.

The differential gears (6) automatically controls the revolution of right and left wheels when the rear wheels encounter unequal road resistance during turning.

12270M40010

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SERVICING

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[2] DISASSEMBLING REAR AXLE CASE 4-S5

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SERVICING SPECIFICATIONS

Bi-Speed Turn Model

Item		Factory Specification	Allowable Limit
Bi-speed Turn Cable Inner (Bi-speed Turn Lever Rod Side)	Distance A	8 mm 0.31 in.	–
Bi-speed Turn Cable Outer (Bi-speed Turn Cable Support Side)	Distance B	19 mm 0.75 in.	–

12271S40010

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
(B2410)			
Rear wheel hub mounting nut	108 to 125	11.0 to 12.8	80 to 93
Cotter setting bolt and nut	123 to 147	12.6 to 15.0	91 to 108
Rear axle case mounting screw	29.2 to 44.1	4.0 to 4.5	28.9 to 32.5
(B2710, B2910)			
Rear wheel mounting screw and nut	108 to 125	11.0 to 12.8	80 to 93
Rear axle case mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5

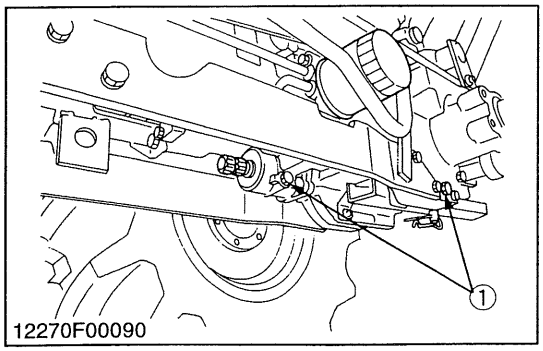
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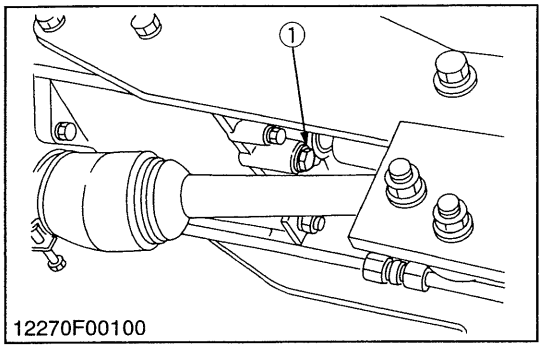
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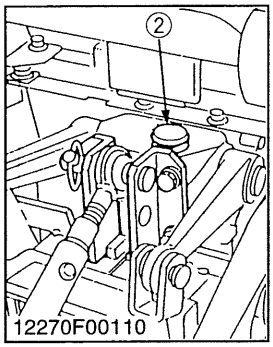
CHECKING, DISASSEMBLING

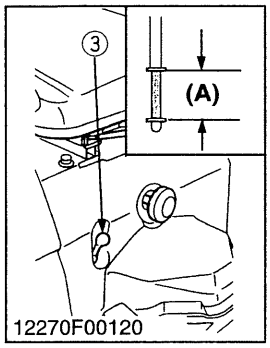
[1] SEPARATING REAR AXLE CASE

(1) Draining Transmission Fluid









Draining Transmission Fluid

⚠ CAUTION

- **Be sure to stop the engine before checking and changing the transmission fluid.**

1. Place oil pan under the tractor.
2. Remove the drain plugs (1) at the bottom of the rear axle case and oil tank.
3. Drain the transmission fluid and reinstall the drain plugs.

(When refilling)

- Fill new oil from filling port after removing the filling plugs (2) up to the upper notch on the dipstick (3).
- After running the engine for few minutes, stop it and check the oil level again, if low, add oil prescribed level.

■ IMPORTANT

- **Use only multi-grade transmission oil. Use of other oils may damage the transmission or hydraulic system. Refer to "LUBRICANTS, FUEL AND COOLANT" (See page G-8).**
- **Never work the tractor immediately after changing the transmission oil. Keeping the engine at medium speed for a few minutes to prevents damage to the transmission.**
- **Do not mix different blands oil together.**

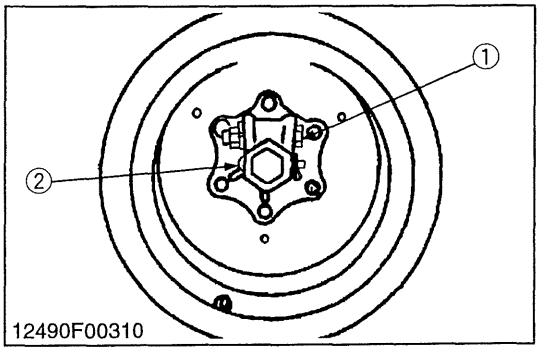
Transmission fluid capacity	B2410	12.5 L 3.30 U.S.gals. 2.75 Imp.gals.
	B2710	Affeted Serial No.: below 15496 14.0 L 3.70 U.S.gals. 3.08 Imp.gals. Affeted Serial No.: above 50101 14.5 L 3.83 U.S.gals. 3.19 Imp.gals.
	B2910	14.5 L 3.83 U.S.gals. 3.19 Imp.gals.

(1) Drain Plug
(2) Filling Plug
(3) Dipstick

(A) Oil level is acceptable within this range

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Rear Wheels (B2410 Only)

1. Place a jack under the transmission case.
2. Loosen the rear wheel cotter setting bolt and nut (1).
3. Take out the wheel hub pin (2).
4. Take out the rear wheel.

■ IMPORTANT

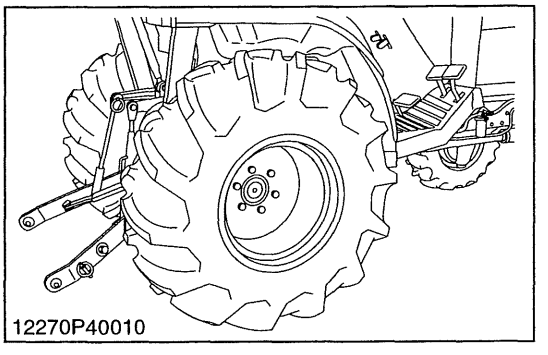
- **When re-fitting or adjusting a wheel, tighten the bolts to the following torques and then recheck them after driving the tractor approximately 200 m (200 yards).**

(When reassembling)

Tightening torque	Rear wheel cotter setting bolt and nut	123 to 147 N·m 12.6 to 15.0 kgf·m 91 to 108 ft-lbs
	Rear wheel hub mounting nut	108 to 125 N·m 11.0 to 12.8 kgf·m 80 to 93 ft-lbs

(1) Cotter Setting Bolt (2) Wheel Hub Pin

12271S40030



Rear Wheels (B2710, B2910)

1. Place hydraulic jack under the main frame rear side and jack up the tractor.
2. Remove the tires.
3. Remove the hydraulic jack and place rear side of tractor body on the ground.

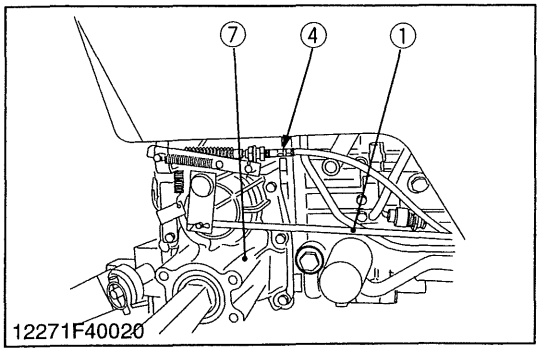
(When reassembling)

Tightening torque	Rear wheel mounting screw and nut	108 to 125 N·m 11.0 to 12.8 kgf·m 80 to 93 ft-lbs

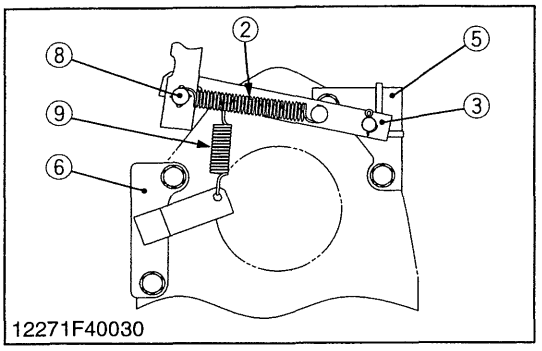
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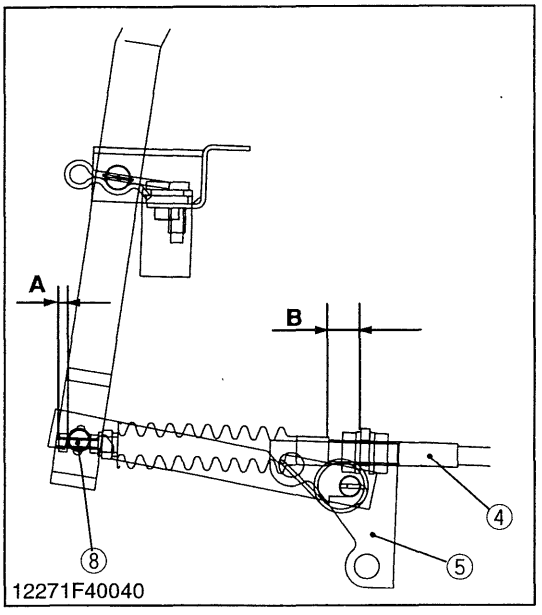
(2) Separating Rear Axle Case from Differential Gear Case



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12271F40030



12271F40040

Rear Axle Case (Bi-speed Turn Type Only)

1. Disconnect the brake rod (1).
2. Loosen the lock nuts and remove the bi-speed turn cable (4) from cable support (5).
3. Remove the spring (2), (9) and lever holding plate (3) with cable support (5).
4. Disconnect the differential lock rod.
5. Remove the rear axle case mounting screws.
6. Separate the rear axle case (7) from the differential case.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the rear axle case and differential gear ease after eliminating the water, oil and stuck liquid gasket.
- When reassembling the bi-speed turn cable (4), make sure to set the distance **A**.

Tightening torque	Rear axle case mounting screws	39 to 44 N·m 4.0 to 4.5 kgf·m 29 to 33 ft-lbs

Distance **A**	Factory spec.	8 mm 0.31 in.

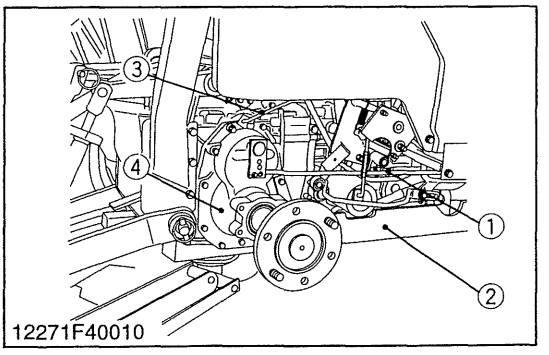
(Reference)

Distance **B**	Factory spec.	19 mm 0.75 in.

(1) Brake Rod
(2) Spring
(3) Lever Holding Plate
(4) Bi-speed Turn Cable
(5) Cable Support
(6) Bracket
(7) Rear Axle Case
(8) Bi-speed Turn Lever Rod
(9) Spring

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Rear Axle Case (B2710, B2910)

1. Remove the brake rod (1).
2. Remove the sub frame (2).
3. Disconnect the differential lock rod (3) at the pedal side.
4. Remove the rear axle case mounting screws and nuts and separate the rear axle case (4) from the differential case.

(When reassembling)

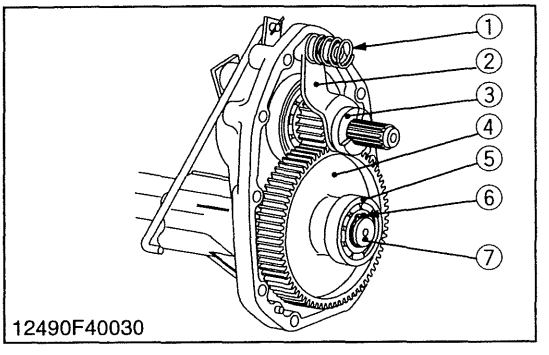
- Apply liquid gasket (Three Bond 1208 or equivalent) to joint face of the rear axle case and differential gear case after eliminating the water, oil and stuck liquid gasket.

Tightening torque	Rear axle 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) Brake Rod
(2) Sub Frame
(3) Differential Lock Rod
(4) Rear Axle Case

12271S40050

[2] DISASSEMBLING REAR AXLE CASE



12490F40030

Differential Lock Shift Fork, Differential Lock Clutch (Right Side Only), 57T Gear and Rear Axle

1. Remove the spring (1).
2. Draw out the differential lock shift fork (2) and differential lock clutch (3).
3. Remove the external snap ring (6) and remove the bearing (5).
4. Draw out the 57T gear (4) from the rear axle (7).
5. Tap out the rear axle (7) to the outside of the rear axle case.

(1) Spring
(2) Differential Lock Shift Fork
(3) Differential Lock Clutch
(4) 57T Gear
(5) Bearing
(6) External Snap Ring
(7) Rear Axle

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MECHANISM

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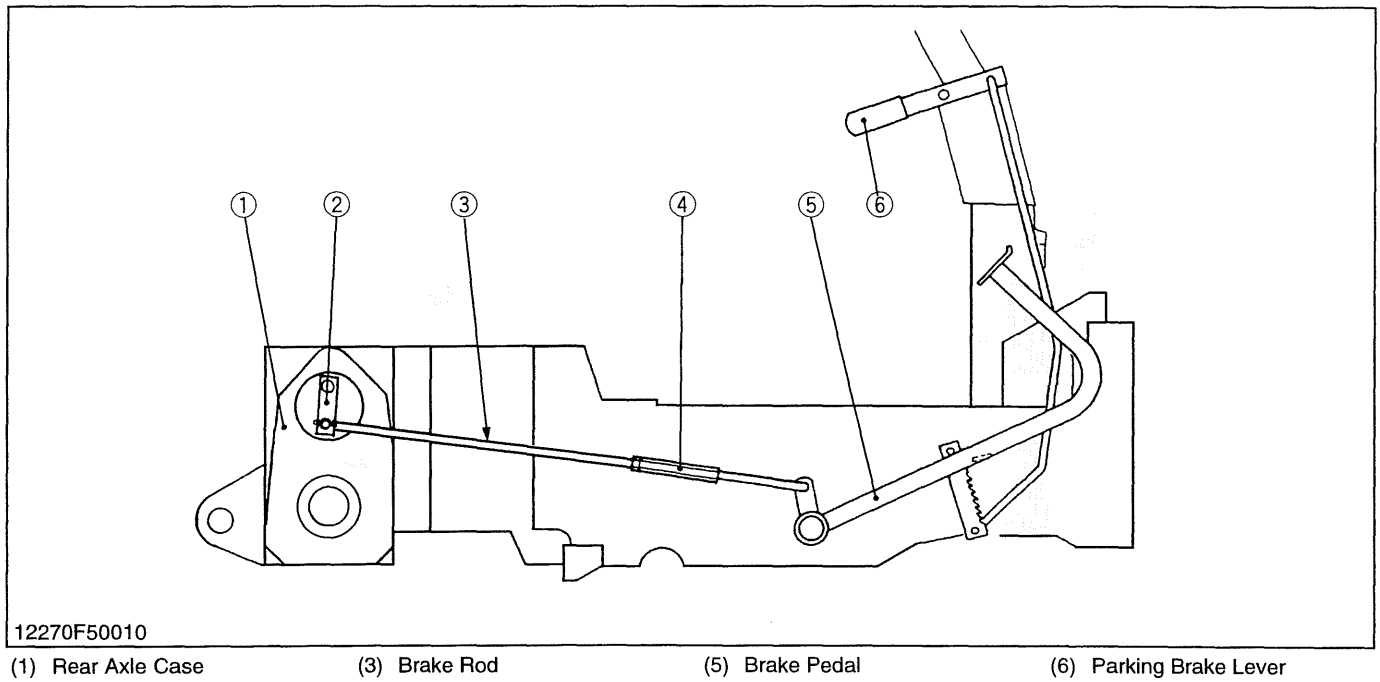
[1] FEATURES 5-M1
[2] OPERATION 5-M2

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[1] FEATURES



(1) Rear Axle Case
(2) Brake Cam Lever
(3) Brake Rod
(4) Turnbuckle
(5) Brake Pedal
(6) Parking Brake Lever

Independent mechanical wet disc brakes are used for the right and left travelling brakes. They are operated by the brake pedals through the mechanical linkages and provide stable braking and require little adjustment.

■ Features of Wet Disc Brakes

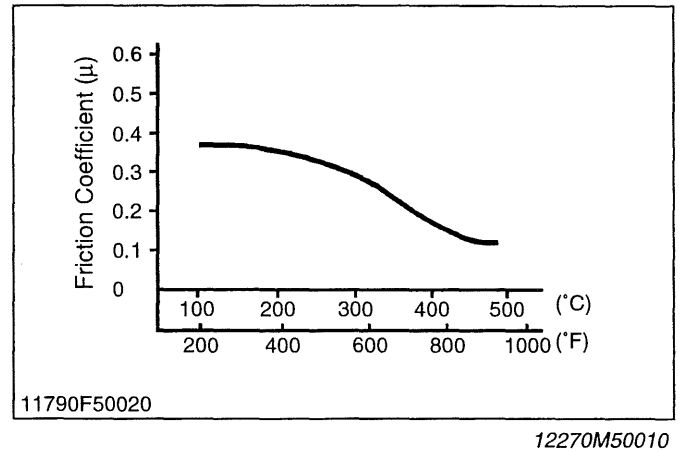
1. **Reduced disc wear**
   Although wet discs are worn by approx. several tens of microns depending on the accuracy of parts during the initial contact in initial period of 50 hours or so, almost no wear occurs afterward. This means that very little brake adjustments are required.
2. **Stable braking**
   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 travelling brakes through the linkages. Pulling the parking brake lever (6) results in the same state as the 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)

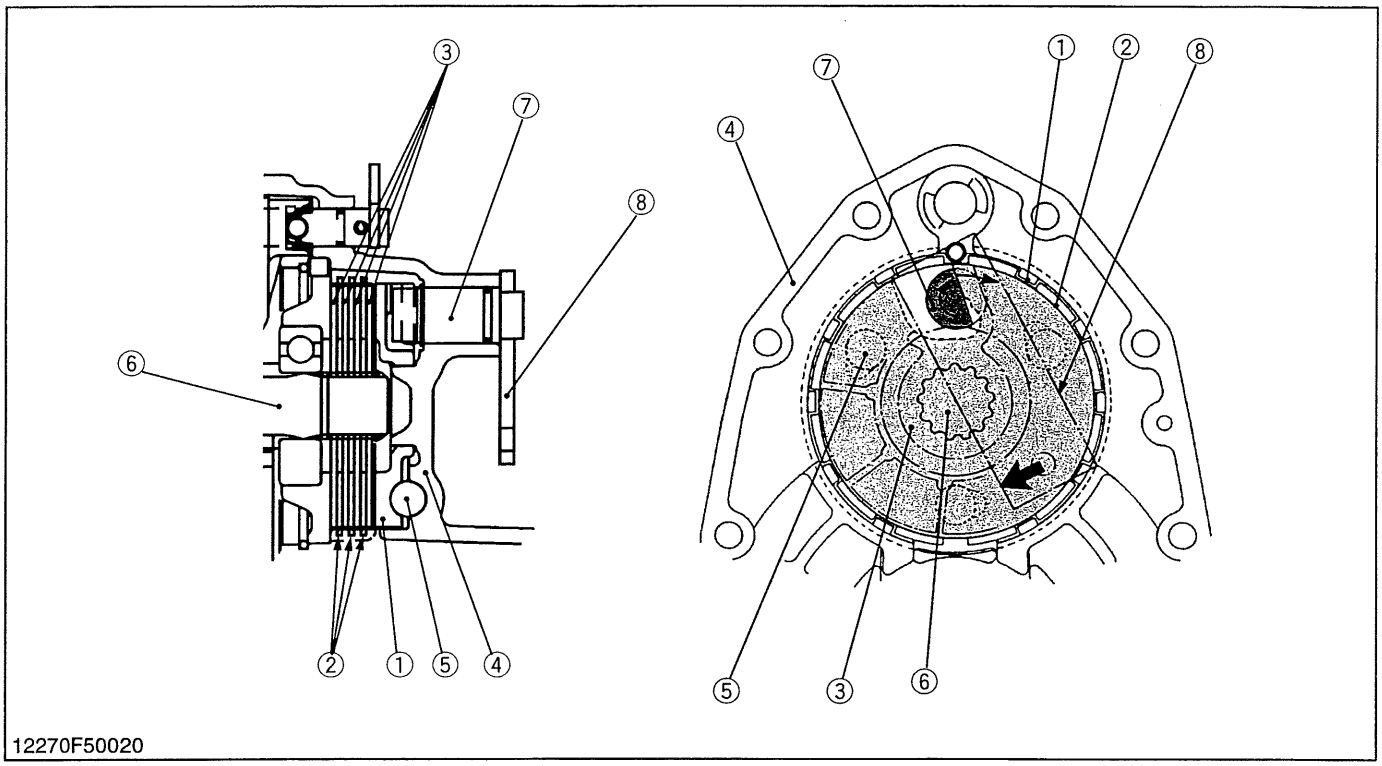
- Relationship between temperature and friction coefficient of brake disc.



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[2] OPERATION



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(1) Cam Plate
(2) Friction Plate
(3) Brake Disc
(4) Rear Axle Case
(5) Steel Ball
(6) Brake Shaft (Differential Gear Shaft)
(7) Brake Cam
(8) Brake Cam Lever

The brake body is incorporated in the rear axle 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, four brake discs are provided at the right and left sides respectively, and the friction plate (2) fixed to the rear axle 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 rear axle 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).

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SERVICING

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[1] BRAKE PEDAL 5-S2
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[1] SEPARATING REAR AXLE CASE WITH BRAKE ASSEMBLY 5-S4
[2] DISASSEMBLING BRAKE ASSEMBLY 5-S4
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TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Uneven Braking Force	• Brake pedal free travel unevenly adjusted • Brake disc worn • Cam plate warped	Adjust Replace Replace	5-S2 5-S5 5-S5
Brake Drags	• Brake pedal free travel 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-S2 5-S5 – 5-S5
Poor Braking Force	• Brake pedal free travel excessive • Brake disc worn • Cam plate warped • Brake cam or lever damaged • Transmission fluid improper	Adjust Replace Replace Replace Change	5-S2 5-S5 5-S5 5-S5 G-8, 4-S2

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SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Brake Pedal	Free Travel	30 to 40 mm 1.18 to 1.57 in.	–
Pedal Shaft to Pedal Shaft Bush	Clearance	0 to 0.165 mm 0 to 0.00649 in.	1.0 mm 0.039 in.
Pedal Shaft	O.D.	24.916 to 25.030 mm 0.98094 to 0.98543 in.	–
Bush	I.D.	25.03 to 25.081 mm 0.98543 to 0.98744 in.	–
Cam Plate and Bearing Holder	Flatness	–	0.3 mm 0.012 in.
Cam Plate and Ball	Height	22.89 to 22.99 mm 0.9012 to 0.9051 in.	22.40 mm 0.8819 in.
Brake Disc	Thickness	3.3 to 3.5 mm 0.130 to 0.138 in.	3.0 mm 0.118 in.
Friction Plate	Thickness	1.92 to 2.08 mm 0.0756 to 0.0819 in.	1.52 mm 0.0598 in.
Bi-speed Turn Cable Inner (Bi-speed Turn Lever Rod Side)	Distance A	8 mm 0.31 in.	–
Bi-speed Turn Cable Outer (Bi-speed Turn Cable Support Side)	Distance B	19 mm 0.75 in.	–

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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.)

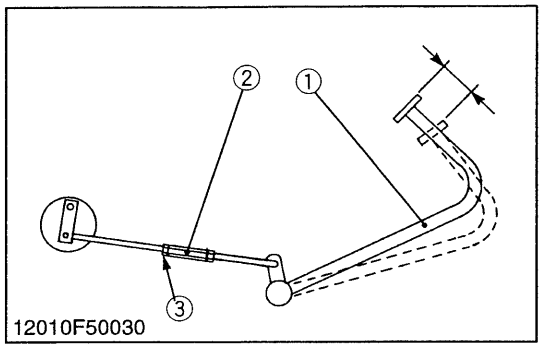
Item	N·m	kgf·m	ft-lbs
(B2410)			
Rear wheel hub mounting nut	108 to 125	11.0 to 12.8	80 to 93
Cotter setting bolt and nut	123 to 147	12.6 to 15.0	91 to 108
Rear axle case mounting screw	29.2 to 44.1	4.0 to 4.5	28.9 to 32.5
(B2710, B2910)			
Rear wheel mounting screw and nut	108 to 125	11.0 to 12.8	80 to 93
Rear axle case mounting screw	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5

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CHECKING, DISASSEMBLING AND SERVICING

CHECKING, ADJUSTING AND SERVICING

[1] BRAKE PEDAL



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Adjusting Brake Pedal Free Travel

CAUTION

- **Stop the engine and chock the wheels before checking brake pedal.**
- **The difference between the right and left pedal plays must be less than 4.0 mm (0.16 in.).**

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 and turn the turnbuckle to adjust the brake rod length.
4. Retighten the lock nut securely.
   Keep the free travel in the right and left brake pedals equal.

Brake pedal free travel	Factory spec.	30 to 40 mm 1.18 to 1.57 in.

NOTE

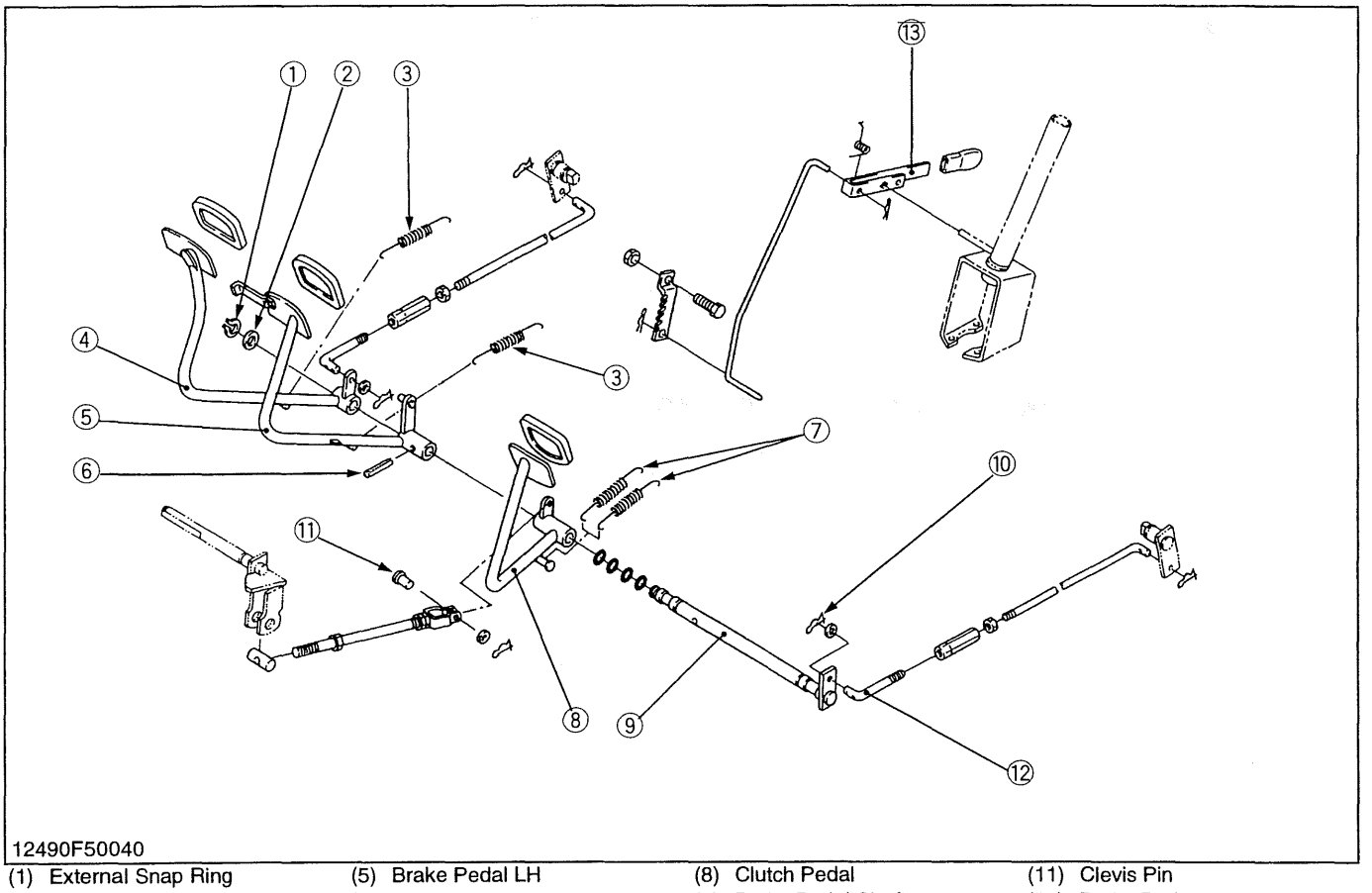
- **After checking brake pedal free play, be sure to engage the parking brake lever fully and check to see that the brake pedals are securely locked.**

(1) Brake Pedal
(2) Turnbuckle
(3) Lock Nut

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Separating Brake Pedal



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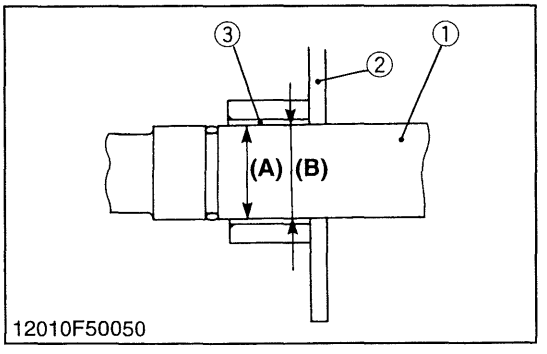
(1) External Snap Ring
(2) Collar
(3) Return Spring
(4) Brake Pedal RH
(5) Brake Pedal LH
(6) Spring Pin
(7) Return Spring
(8) Clutch Pedal
(9) Brake Pedal Shaft
(10) Spring Lock Pin
(11) Clevis Pin
(12) Brake Rod
(13) Parking Brake Lever

1. Remove the spring lock pin (10) of brake rod (12) and pull out the brake rod (12).
2. Remove the return spring (3), (7).
3. Remove the external snap ring (1) at the end of the brake pedal shaft (9).
4. Remove the spring pin (6) of the brake pedal LH (5).
5. Remove the clevis pin (11) of the clutch pedal (8).
6. Pull the right and left brake pedals from the brake pedal shaft (9).
7. Tap out the brake pedal shaft (9) to the left, and remove it with the clutch pedal (8).

(When reassembling)

- Apply grease to the brake pedal shaft.
- When inserting the spring pin, face its split in the direction at right angle to the brake pedal shaft.

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Clearance between Brake Pedal Shaft and Center Frame Bush

1. Measure the brake pedal shaft O.D. with an outside micrometer.
2. Measure the bush (3) I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace it.

Clearance between brake pedal shaft and center frame bush	Factory spec.	0 to 0.165 mm 0 to 0.00649 in.
	Allowable limit	1.0 mm 0.039 in.
Brake pedal shaft O.D.	Factory spec.	24.916 to 25.030 mm 0.98094 to 0.98543 in.
Center frame bush I.D.	Factory spec.	25.030 to 25.081 mm 0.98543 to 0.98744 in.

(1) Brake Pedal Shaft
(2) Center Frame
(3) Bush
(A) Bush I.D.
(B) Brake Pedal Shaft O.D.

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DISASSEMBLING AND ASSEMBLING

[1] SEPARATING REAR AXLE CASE WITH BRAKE ASSEMBLY

Draining Transmission Fluid

1. See page 4-S2.

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Rear Wheels

1. See page 4-S3.

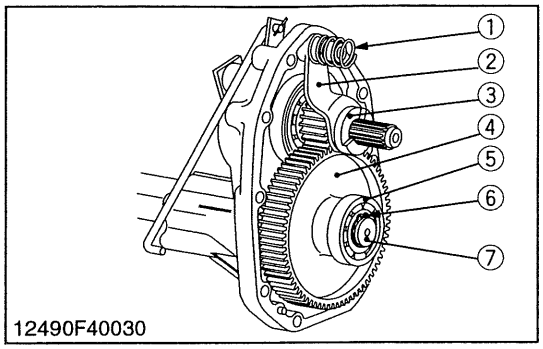
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Rear Axle Case

1. See page 4-S5.

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[2] DISASSEMBLING BRAKE ASSEMBLY



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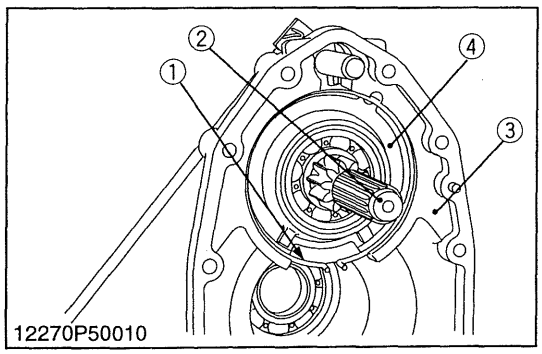
Differential Lock Shift Fork, Differential Lock Clutch (Right Side Only), 57T Gear and Rear Axle

1. Remove the spring (1).
2. Draw out the differential lock shift fork (2) and differential lock clutch (3).
3. Remove the external snap ring (6) and remove the bearing (5).
4. Draw out the 57T gear (4) from the rear axle (7).
5. Tap out the rear axle (7) to the outside of the rear axle case.

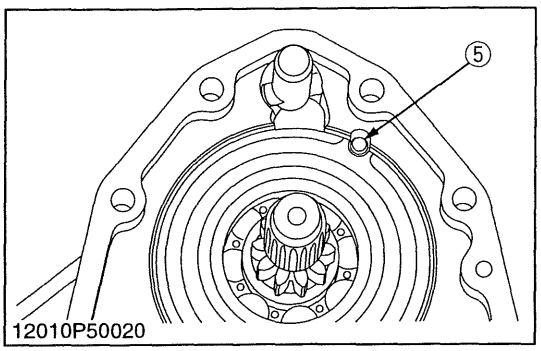
(1) Spring
(2) Differential Lock Shift Fork
(3) Differential Lock Clutch
(4) 57T Gear
(5) Bearing
(6) External Snap Ring
(7) Rear Axle

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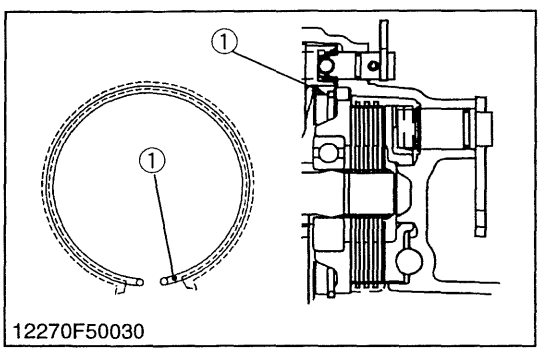
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Brake Assembly

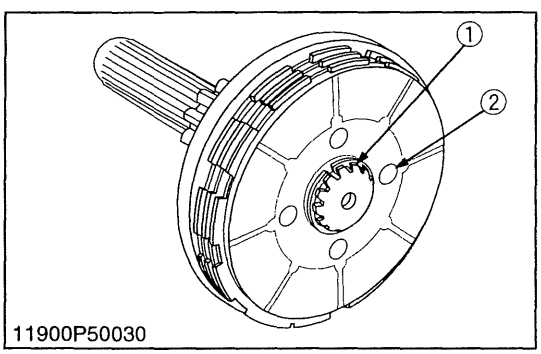
1. Remove the internal snap ring (1).
2. Remove the brake shaft (2) with brake discs.

(When reassembling)

- When installing the internal snap ring (1) to rear axle case (3) as shown in the figure.
- When installing the bearing holder (4) to the rear axle case (3), do not forget to install the straight pin (5).

(1) Internal Snap Ring
(2) Brake Shaft
(3) Rear Axle Case
(4) Bearing Holder
(5) Straight Pin

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Brake Discs and Friction Plate

1. Remove the external snap ring (1), and remove the brake discs and friction plate.
2. Remove the cam plate and balls.
3. Remove the external snap ring and pull out the brake cam lever.

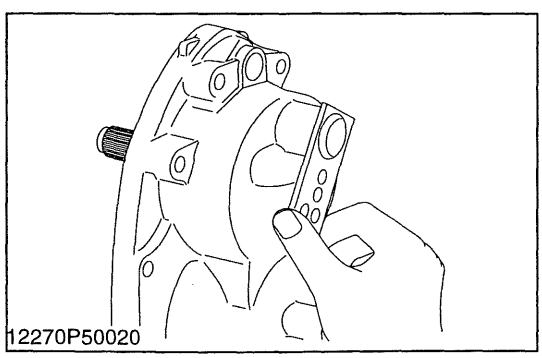
(When reassembling)

- Install the brake discs with their holes (2) deviation at less than 1/3 of the total hole area.

(1) External Snap Ring
(2) Hole

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SERVICING

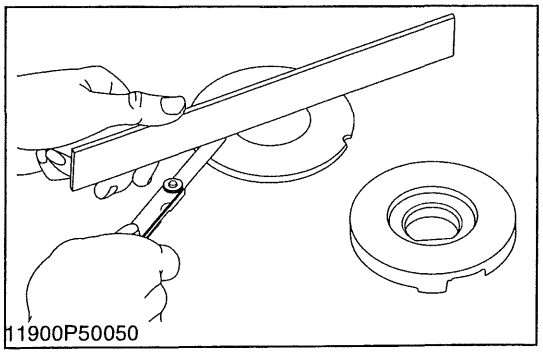

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Brake Cam Lever Movement

1. Move the brake cam lever by hand to check the movement.
2. If the movement is heavy, refine the brake cam with emery paper.

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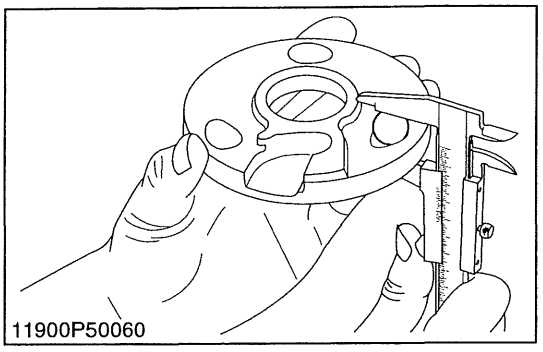
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Cam Plate Flatness and Bearing Holder Wear

1. Place a straightedge of 150 mm (5.91 in.) or more in length on the contacting surface of the cam plate and the bearing holder.
2. Inspect the friction surface of the cam plate and the bearing holder with the straightedge, and determine if a 0.30 mm (0.0118 in.) feeler gauge will fit on the part of wear.
3. If it will fit, resurface.

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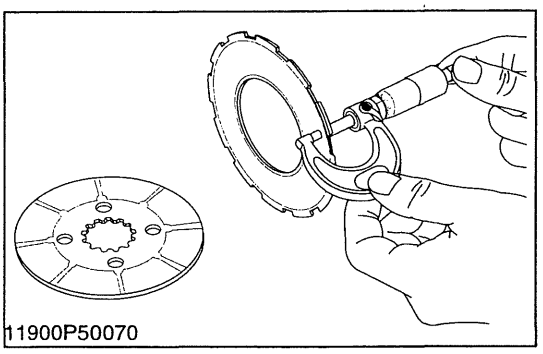

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Height of Cam Plate and Ball

1. Measure the height 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.
4. If the uneven wear is found, replace it.

Height of cam plate and ball	Factory spec.	22.89 to 22.99 mm 0.9012 to 0.9051 in.
	Allowable limit	22.40 mm 0.8819 in.

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Brake Disc and Friction Plate Wear

1. Measure the brake disc thickness and the friction plate thickness with an outside micrometer.
2. If the thickness is less than the allowable limit, replace it.

Brake disc thickness	Factory spec.	3.3 to 3.5 mm 0.130 to 0.138 in.
	Allowable limit	3.0 mm 0.118 in.
Friction plate thickness	Factory spec.	1.92 to 2.08 mm 0.0756 to 0.0819 in.
	Allowable limit	1.52 mm 0.0598 in.

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MECHANISM

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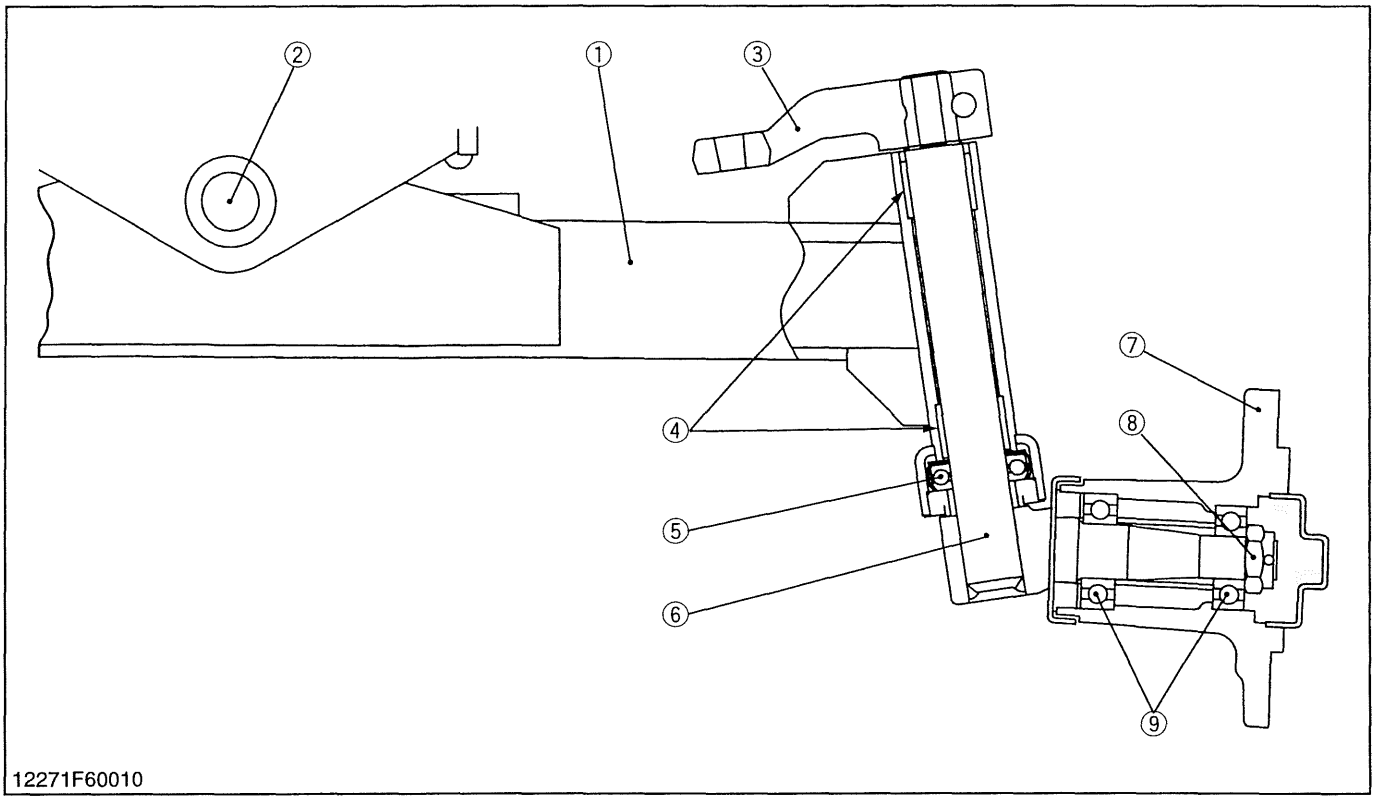
[1] STRUCTURE 6-M1
(1) 2 Wheel Drive Model 6-M1
(2) 4 Wheel Drive Model 6-M2
(3) Bi-speed Turn Type 6-M3
[2] FRONT WHEEL ALIGNMENT 6-M6

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[1] STRUCTURE

(1) 2 Wheel Drive Model



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(1) Front Axle
(2) Center Pin
(3) Knuckle Arm
(4) Bushing
(5) Thrust Ball Bearing
(6) Knuckle Shaft
(7) Front Wheel Hub
(8) Slotted Nut
(9) Ball Bearing

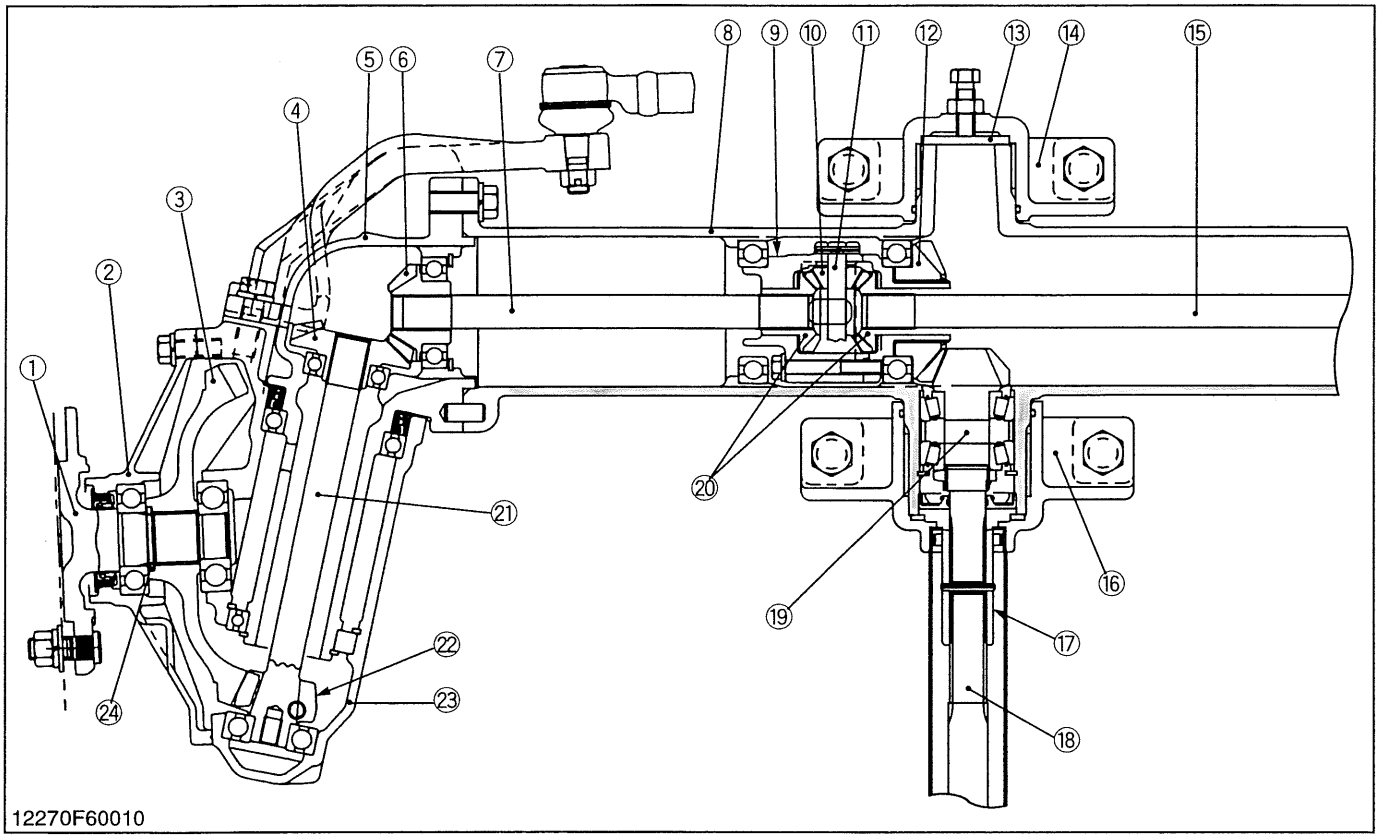
The front axle of the 2WD model is constructed as shown above.

the knuckle shaft (6) is attached to the front axle (1) by the **"RUMOAN"** method.

With this method, the shape of the front axle is relatively simple, and the front axle is supported at its center with center pin (2), so that steering operation is stable even on an uneven ground encountered in a farm fields.

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(2) 4 Wheel Drive Model



(1) Axle
(2) Axle Flange
(3) Bevel Gear
(4) Bevel Gear
(5) Bevel Gear Case
(6) Bevel Gear
(7) Differential Yoke Shaft, LH
(8) Front Axle Case
(9) Differential Gear Assembly
(10) Differential Pinion Gear
(11) Pinion Shaft
(12) Spiral Bevel Gear
(13) Collar
(14) Front Axle Bracket, Front
(15) Differential Yoke Shaft, RH
(16) Front Axle Bracket, Rear
(17) Coupling
(18) Propeller Shaft
(19) Spiral Bevel Pinion Shaft
(20) Differential Side Gear
(21) Bevel Gear Shaft
(22) Bevel Gear
(23) Front Gear Case
(24) Collar

The front axle of the 4WD is constructed as shown above. Power is transmitted from the transmission through the propeller shaft (18) to the spiral bevel pinion shaft (19), then to the spiral bevel gear (12) and to the differential side gear (20).

The power through the differential side gear is transmitted to the differential yoke shaft (7), (15), and to the bevel gear shaft (21) through the bevel gears (4), (6) in the bevel gear case (5).

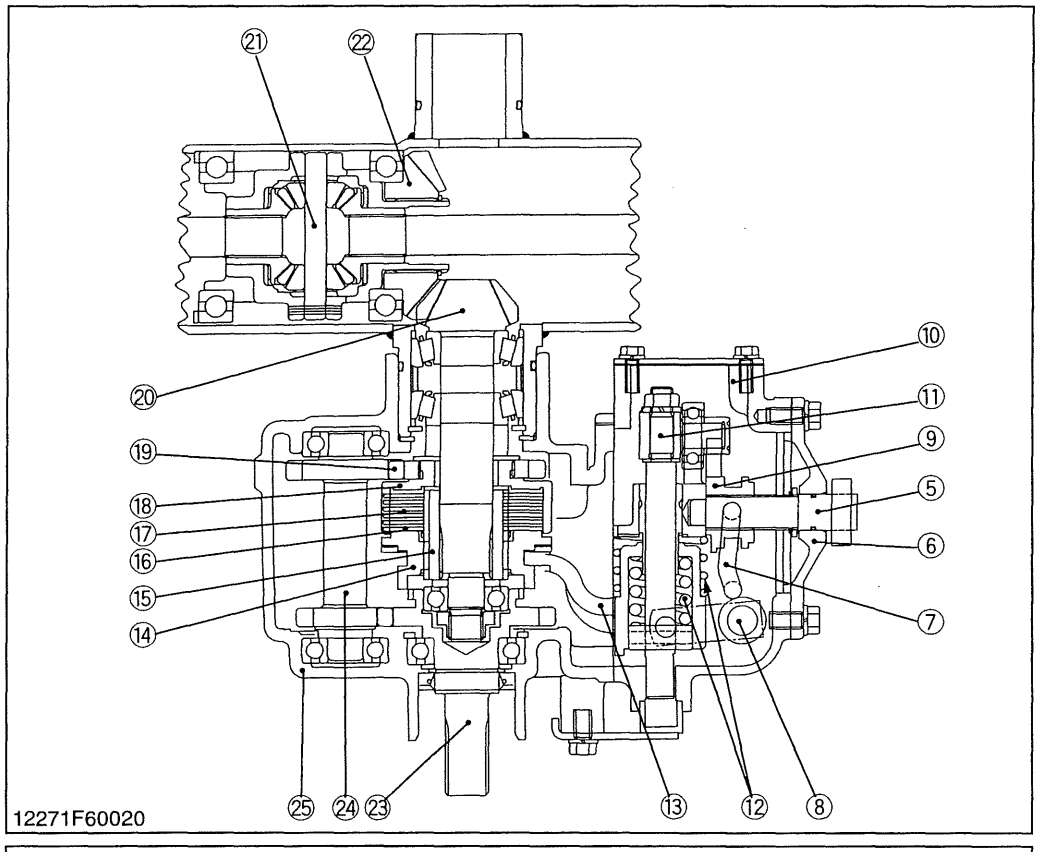
The revolution is greatly reduced by the bevel gears (22), (3), then the power is transmitted to the axle (1).

The differential system allows each wheel to rotate at a different speed to make turning easier.

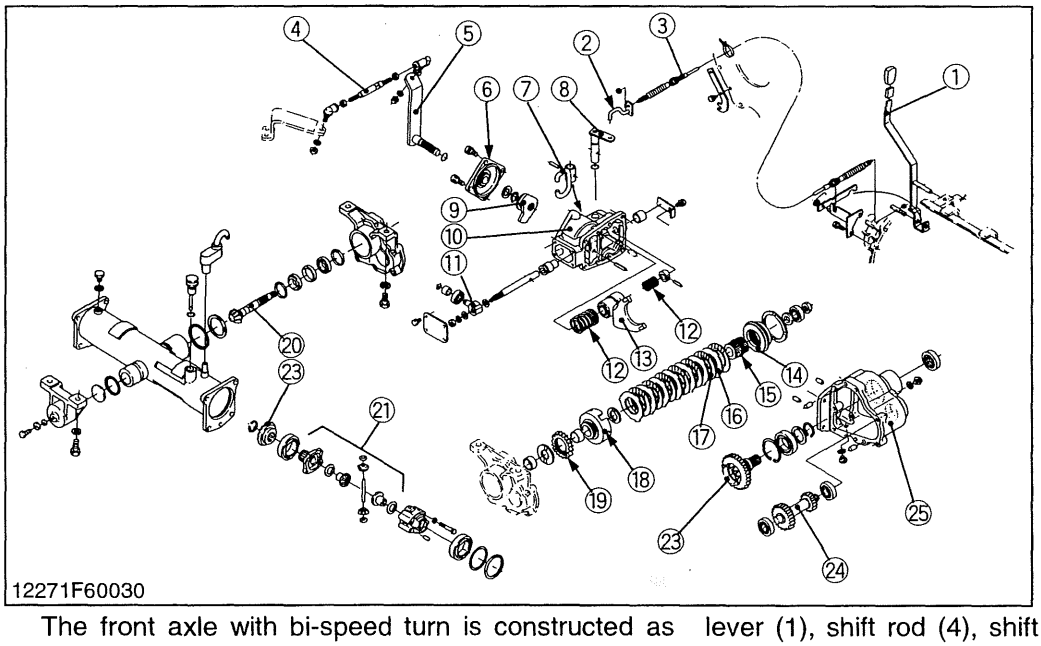
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(3) Bi-speed Turn Type



(1) Bi-speed Turn Lever
(2) Bi-speed Turn Rod
(3) Bi-speed Turn Change Cable
(4) Shift Rod
(5) Shift Lever
(6) Shift Lever Fulcrum
(7) Change Fork
(8) Change Lever
(9) Shift Cam
(10) Bi-speed Turn Case
(11) Shift Roller Shaft
(12) Spring
(13) Bi-speed Turn Shift Fork
(14) Shifter
(15) Coupling
(16) Clutch Disc
(17) Friction Plate
(18) Clutch Drum
(19) 18T Gear
(20) Spiral Bevel Pinion Shaft
(21) Front Differential Assembly
(22) Bevel Gear
(23) Gear Shaft
(24) Gear Shaft
(25) Bi-speed Turn Gear Case



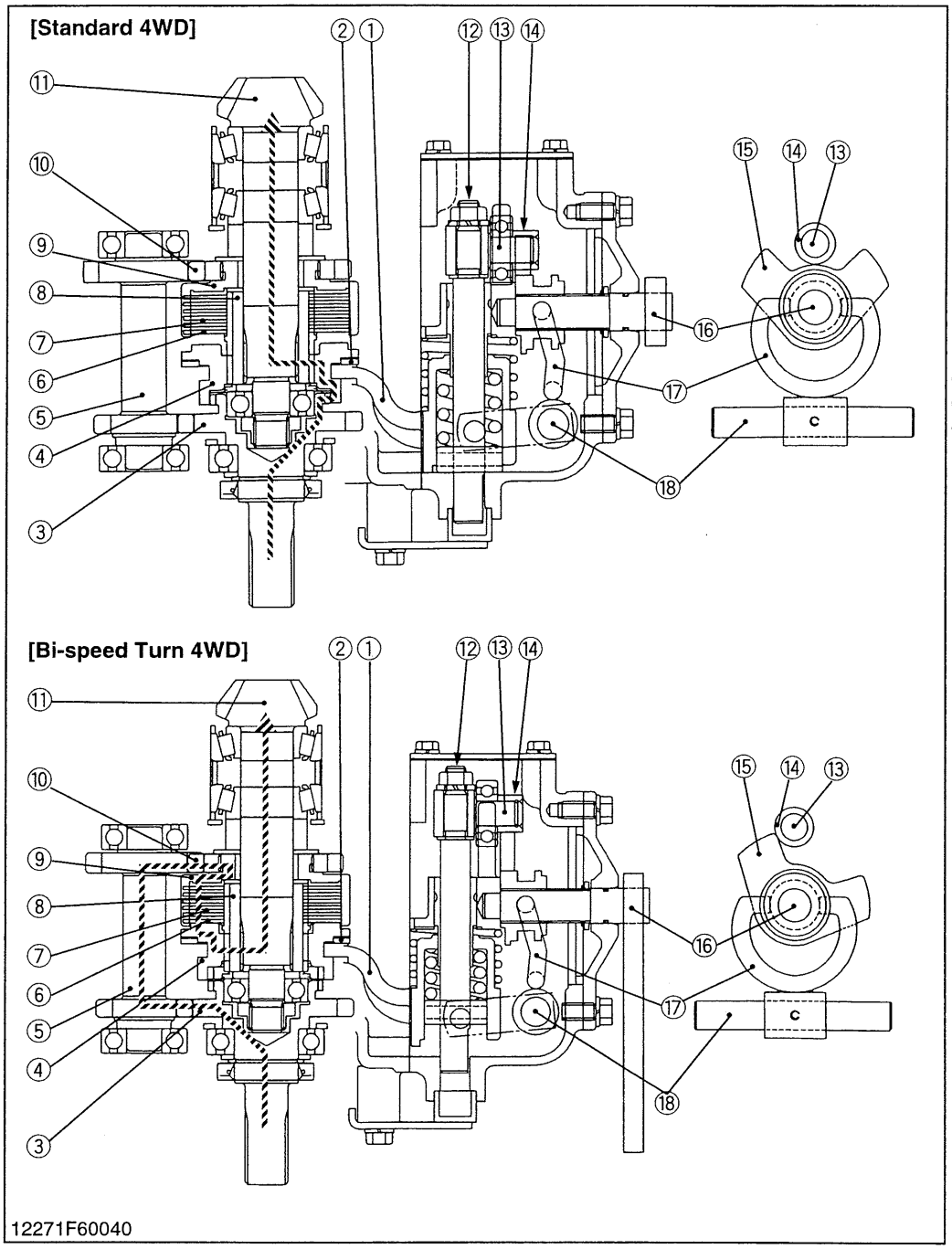
The front axle with bi-speed turn is constructed as shown above. Front wheel speed change mechanism, which is located in the bi-speed turn gear case (25) and bi-speed turn case (10), consists of the bi-speed turn lever (1), shift rod (4), shift cam (9), shift fork (13), bi-speed turn clutch assembly (14 to 18), gears (19) (23) (24) and so on.

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■ Bi-speed Turn Power Train

Bi-speed clutch is mechanically engaged when front wheel reaches approximately 0.42 rad. (24°) turning angle. This bi-speed turn front wheel speed is 1.53 times higher than the standard front wheel speed.



(1) Shift Fork
(2) Shift Collar
(3) 21T Gear Shaft
(4) Shifter
(5) 13T-10T Gear Shaft
(6) Clutch Disk
(7) Friction Plate
(8) Bi-speed Turn Coupling
(9) Bi-speed Turn Clutch Drum
(10) 18T Gear
(11) Spiral Bevel Pinion Shaft
(12) Shift Rod
(13) Shift Roller Shaft
(14) Shift Roller
(15) Shift Cam
(16) Shift Lever
(17) Change Fork
(18) Change Lever

■ Standard 4WD

21T Gear Shaft (3) → Shifter (4) → Bi-speed Turn Coupling (8) → Spiral Bevel Pinion Shaft (11) → Front Axle.

■ Bi-speed Turn 4WD

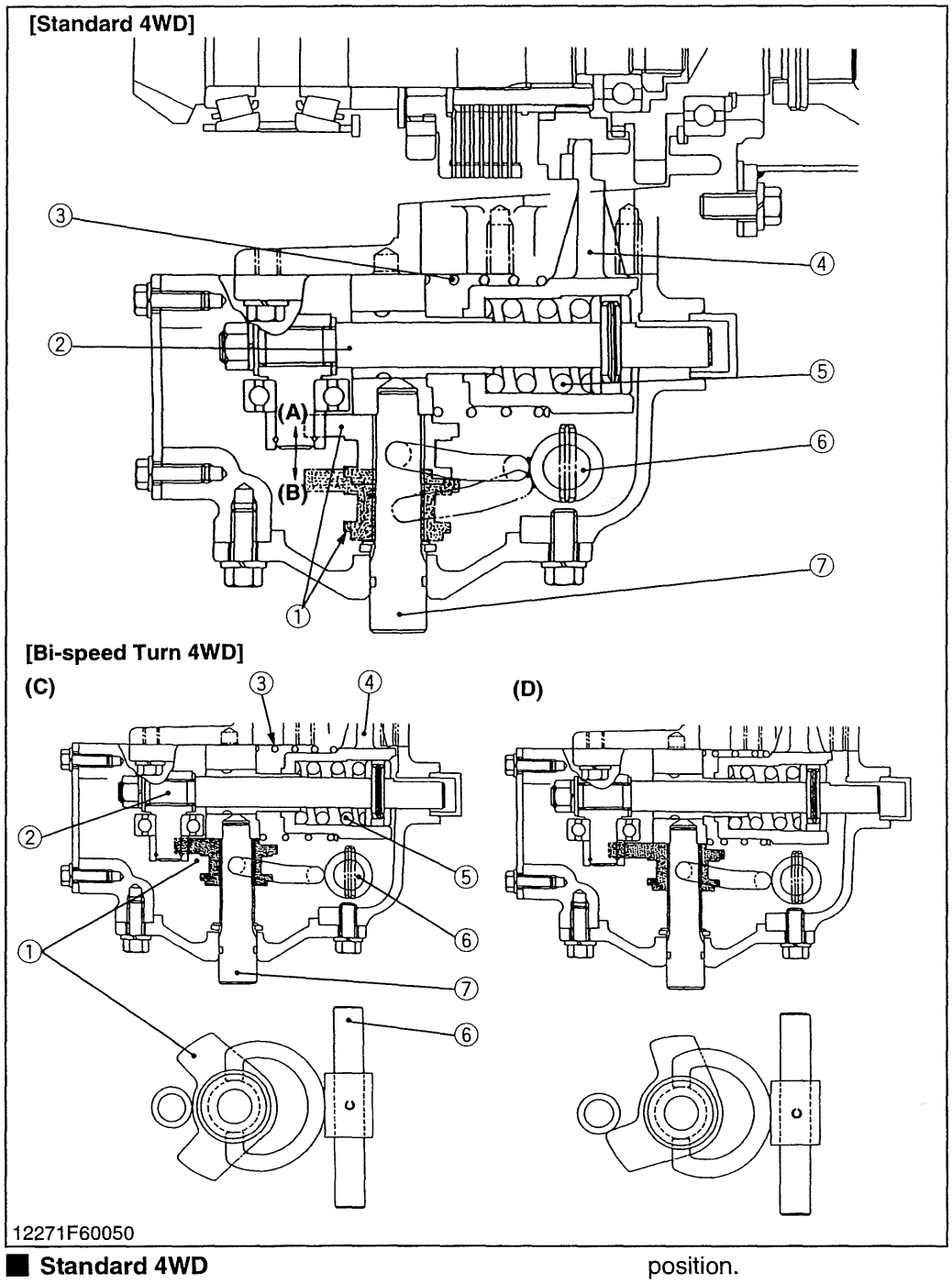
21T Gear Shaft (3) → 13T-10T Gear Shaft (5) → 18T Gear (10) → Bi-speed Turn Clutch Drum (9) → Friction Plate (7) → Clutch Disc (6) → Bi-speed Turn Coupling (8) → Spiral Bevel Pinion Shaft (11) → Front Axle.

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■ Bi-speed Cam

Bi-speed turn 4WD and standard 4WD positions are selected by change lever (6) to move the position of shift cam (1). This lever is operated by the bi-speed turn change lever located on the right side of the clutch housing.



(1) Shift Cam
(2) Shift Rod
(3) Spring
(4) Shift Fork
(5) Spring
(6) Change Lever
(7) Shift Lever

(A) Bi-speed turn "ON"
(B) Bi-speed turn "OFF"
(C) Less than 0.40 rad. (23°) turning angle
(D) More than 0.44 rad. (25°)

■ Standard 4WD

The bi-speed turn change lever is shifted to the **"OFF"** position.

The shift cam (1) is free to turn, so that the shift rod (2) and shift fork (4) are remained in standard 4WD position by springs (3), (5).

■ Bi-speed Turn 4WD

The bi-speed turn change lever is shifted to the **"ON"** position.

When the steering wheel is turned more than approx. 0.44 rad. (25°) turning angle, the shift lever (7) and shift cam (1) are turned together. This cam make the shift rod (2) move the arrow direction so that the shifter is engaged with the bi-speed turn clutch.

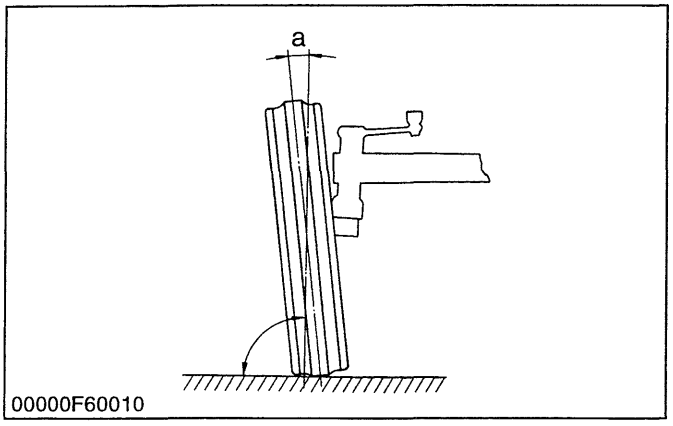
When the steering wheel is turned less than approx. 0.40 rad. (23°) turning angle, the shift rod doesn't move in spite of the cam rotation.

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[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.



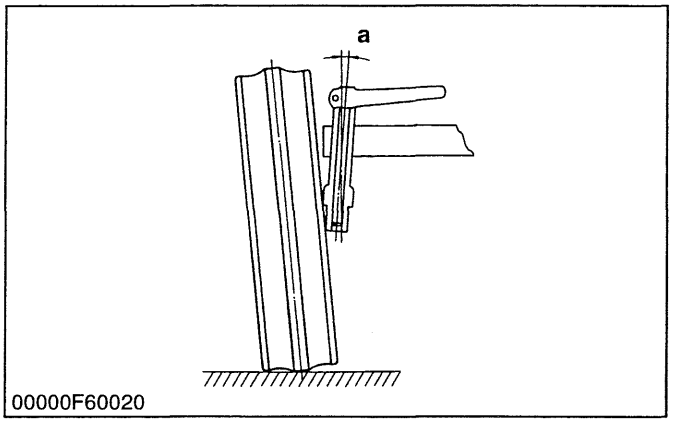
■ Camber

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.

Camber	0.035 rad. 2°

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■ Kingpin Angle

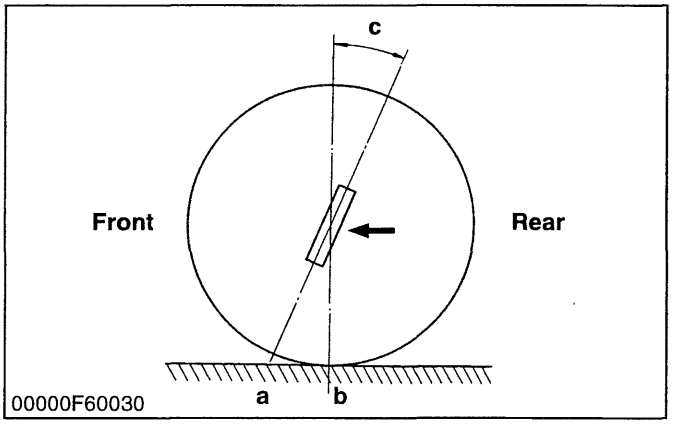
The kingpin is tilted from the vertical as viewed from the front.

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.

Kingpin angle	2WD	0.140 rad. 8 °
	4WD	0.209 rad. 12 °

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■ Caster

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.

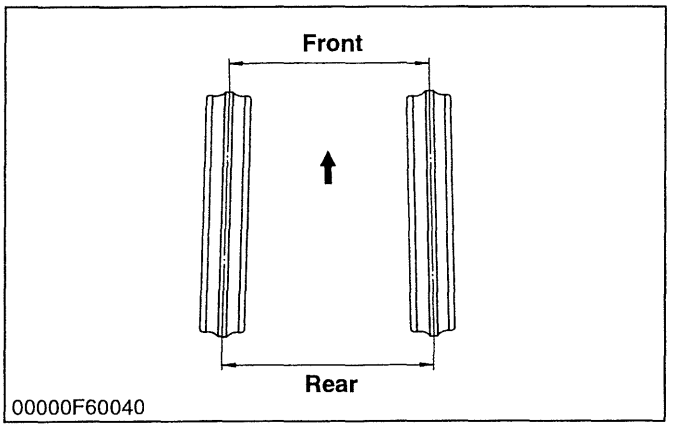
This inclination is called caster (**c**). Caster helps provide steering stability.

As with the kingpin inclination, caster reduces steering effort.

Caster	0 rad. 0 °

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■ Toe-in

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	B2410	0 to 10 mm 0 to 0.39 in.
	B2710 B2910	0 to 7 mm 0 to 0.28 in.

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SERVICING

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TROUBLESHOOTING

[2WD Model]

Symptom	Probable Cause	Solution	Reference Page
Front Wheels Wander to Right or Left	• Clearance between center pin and pin support excessive (2WD)	Replace	6-S9
	• Improper toe-in adjustment (improper alignment)	Adjust	–
	• Knuckle shaft bushing worn (2WD)	Replace	6-S9
	• Tire pressure uneven	Adjust	G-41

[4WD Model]

Front Wheels Wander to Right or Left	• Tire pressure uneven	Adjust	G-41
	• Improper toe-in adjustment (improper alignment)	Adjust	6-S6 6-S11
	• Clearance between front axle case boss and front axle bracket bushing (front, rear) excessive	Replace	6-S6
	• Front axle rocking force too small	Adjust	6-S8, S12
	• Tie-rod end loose	Tighten	–
	• Air sucked in power steering circuit	Bleed	
Front Wheels Can Not Be Driven	• Front wheel driving gears in front axle gear case broken	Replace	6-S13
	• Universal joint broken	Replace	–
	• Front wheel drive gears in transmission broken	Replace	3-S26
	• Front differential gear broken	Replace	6-S16
	• Coupling displaced	Reassembling	–
Noise	• Gear backlash excessive	Adjust or replace	6-S14
	• Oil insufficient	Replenish	6-S10
	• Bearings damaged or broken	Replace	–
	• Gears damaged or broken	Replace	–
	• Spiral bevel pinion shaft turning force improper	Adjust	6-S24

[BI-SPEED TURN Type]

Bi-speed Turn System Does Not Operate or Slipping	• Bi-speed turn clutch friction torque too low	Adjust	6-S27
	• Shift fork spring weaken or damaged	Replace	6-S28
	• Shift fork deformed, worn or broken	Replace	6-S28
	• Change fork deformed or broken	Replace	6-S21
	• Shift cam rusted	Repair or replace	6-S20
	• Shift roller worn	Replace	6-S20
	• Clutch disc worn	Replace	6-S22
	• Friction plate worn or deformed	Replace	6-S22
	• Gear broken	Replace	6-S21
	• Shifter collar worn	Replace	6-S22
	• Wrong assembly of shift cam	Reinstall	6-S20
	• Wrong linkage adjustment	Readjust	6-S7
Bi-speed Turn Does Not Return to Standard 4WD Position	• Shift fork deformed	Replace	6-S22
	• Shift cam deformed	Replace	6-S30
	• Wrong linkage adjustment	Readjust	6-S7

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Symptom	Probable Cause	Solution	Reference Page
Different Be-speed Turn Starting Angle Between Right and Left Turning	• Shift rod improperly adjusted • Shift lever and shift cam improperly assembled • Shift cam worn	Adjust Reassemble Replace	6-S7 6-S20 6-S20

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SERVICING SPECIFICATIONS

[2WD Model]

Item		Factory Specification	Allowable Limit
Front Wheel Alignment	Toe-in	0 to 10 mm 0 to 0.39 in.	–
Center Pin to Pin Support	Clearance	0.05 to 0.25 mm 0.0020 to 0.0098 in.	0.70 mm 0.0276 in.
Center Pin	O.D.	24.90 to 25.00 mm 0.9803 to 0.9842 in.	–
Pin Support	I.D.	25.05 to 25.15 mm 0.9862 to 0.9901 in.	–
Knuckle Shaft to Bushing	Clearance	0.040 to 0.105 mm 0.0016 to 0.0041 in.	0.50 mm 0.0197 in.
Knuckle Shaft	O.D.	24.948 to 24.980 mm 0.9822 to 0.9835 in.	–
Bushing	I.D.	25.020 to 25.053 mm 0.9850 to 0.9863 in.	–
Front Wheel Alignment	Toe-in	0 to 0.10 mm 0 to 0.39 in.	–
	Camber Angle	0.035 rad. 2.0°	–
	Caster Angle	0 rad. 0°	–
	King Pin Inclination	0.209 rad. 12°	–
Front Wheel	Steering Angle	0.84 to 0.87 rad. 48 to 50°	–
	Axial Sway	0 to 3 mm 0 to 0.118 in.	–

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[4WD Model]

Item			Factory Specification	Allowable Limit
Front Wheel Alignment	Toe-in	B2410	0 to 10 mm 0 to 0.39 in.	–
		B2710 B2910	0 to 7 mm 0 to 0.28 mm	–
Front Axle	Rocking Force		49.0 to 98.1 N 5.0 to 11.0 kgf 11.0 to 22.1 lbs	–
Differential Case, Differential Case Cover to Differential Side Gear	Clearance		0.040 to 0.082 mm 0.00157 to 0.00323 in.	0.17 mm 0.0067 in.
Differential Case	I.D.		26.000 to 26.021 mm 1.02362 to 1.02445 in.	–
Differential Case Cover	I.D.		26.000 to 26.021 mm 1.02362 to 1.02445 in.	–
Differential Side Gear	O.D.		25.939 to 25.960 mm 1.02122 to 1.02205 in.	–
Pinion Shaft to Differential Pinion	Clearance		0.038 to 0.068 mm 0.00150 to 0.00268 in.	0.17 mm 0.0067 in.
Pinion Shaft	O.D.		9.972 to 9.987 mm 0.39260 to 0.39312 in.	–
Differential Pinion	I.D.		10.025 to 10.040 mm 0.39469 to 0.39528 in.	–
Differential Pinion to Differential Side Gear	Backlash		0.1 to 0.3 mm 0.004 to 0.012 in.	–
Spiral Bevel Pinion Shaft	Turning Torque		0.8 to 1.0 N·m 0.08 to 0.10 kgf·m 0.59 to 0.73 ft-lbs	–
Spiral Bevel Pinion shaft to Spiral Bevel Gear	Backlash		0.10 to 0.30 mm 0.0039 to 0.0118 in.	–
11T Bevel Gear to 16T Bevel Gear	Backlash		0.10 to 0.30 mm 0.0039 to 0.0118 in.	–
Front Axle Case Boss to Bracket Bushing (Front)	Clearance		0.125 to 0.280 mm 0.0049 to 0.0110 in.	0.45 mm 0.018 in.
Front Axle Case Boss	O.D.		49.950 to 49.975 mm 1.9665 to 1.9675 in.	–
Bracket Bushing	I.D.		50.10 to 50.23 mm 1.9722 to 1.9774 in.	–

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Item		Factory Specification	Allowable Limit
Front Axle Case Boss to Bracket Bushing (Rear)	Clearance	0.090 to 0.250 mm 0.0035 to 0.0098 in.	0.45 mm 0.018 in.
Front Axle Case Boss	O.D.	64.94 to 64.97 mm 2.5567 to 2.5579 in.	–
Bracket Bushing	I.D.	65.06 to 65.19 mm 2.5614 to 2.5665 in.	–

[BI-SPEED TURN Type]

Bi-speed Turn Clutch	Dynamic Friction Torque of Bi-speed Turn Clutch on the Front Axle Wheel Hub	441.3 to 490.4 N·m 45 to 50 kgf·m 325.5 to 361.7 ft-lbs	–
Shift Fork to Shifter Groove (with Shifter Collar)	Clearance	0.1 to 0.7 mm 0.004 to 0.028 in.	1.0 mm 0.04 in.
Bi-speed Turn Spring (Short)	Free Length	32.5 mm 1.280 in.	28.5 mm 1.220 in.
	Maximum Setting Length	Load 1613 N / 25.5 mm 164.5 kgf / 25.5 mm 362.7 lbs / 1.00 in.	Load 1411 N / 25.5 mm 143.9 kgf / 25.5 mm 317.4 lbs / 1.00 in.
Bi-speed Turn Spring (Long)	Free Length	52.0 mm 2.047 in.	45.5 mm 1.791 in.
	Maximum Setting Length	Load 86.3 N / 35.0 mm 8.8 kgf / 35.0 mm 19.4 lbs / 1.378 in.	Load 75.5 N / 35.0 mm 7.7 kgf / 35.0 mm 17.0 lbs / 1/378 in.
Bi-speed Turn Clutch Disc	Thickness	1.7 to 1.9 mm 0.067 to 0.075 in.	1.4 mm 0.055 in.
Bi-speed Turn Friction Plate	Thickness	0.95 to 1.05 mm 0.037 to 0.041 in.	0.8 mm 0.0315 in.
Bi-speed Turn Shift Rod	Distance A	84 mm 3.31 in.	–
Bi-speed Turn Cable Outer (Clutch Housing Side)	Distance A	18 mm 0.71 in.	–
Bi-speed Turn Cable Inner (Front Axle Case Side)	Distance B	10 mm 0.39 in.	–

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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.)

[2WD Model]

Item	N·m	kgf·m	ft-lbs
Front wheel mounting screw	77.4 to 90.2	7.9 to 9.2	57.2 to 66.5
Front wheel hub slotted nut	117.6 to 156.8	12 to 16	86.8 to 115.7
Knuckle arm mounting bolts and nuts	77.4 to 90.2	7.9 to 9.2	57.2 to 66.5
Tie-rod end slotted nut	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Center pin slotted nut	Less than 9.8	Less than 1.0	Less than 7.2
Lock plate mounting nut	17.7 to 19.6	1.8 to 2.0	13.0 to 14.5

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[4WD Model]

Front wheel mounting nut	77.5 to 90.1	7.9 to 9.2	57.1 to 66.5
Front axle bracket mounting screw	200 to 230	20.4 to 23.5	147.5 to 169.6
Bevel gear case mounting screw	77.5 to 90.1	7.9 to 9.2	57.1 to 66.5
Knuckle arm mounting screw	103.0 to 117.7	10.5 to 12.0	76.0 to 86.8
Axle flange mounting screw	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Differential case cover mounting screw	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3

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[BI-SPEED TURN Type]

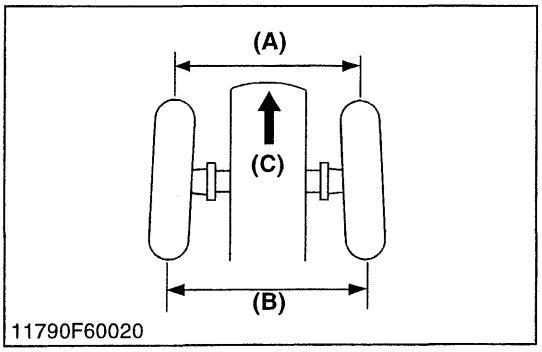
Shift lever fulcrum mounting screws	17.7 to 20.5	1.8 to 2.1	13.0 to 15.2
Bi-speed turn case mounting screws	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Bi-speed turn gear case mounting screws	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Bearing holder mounting screws	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
Case cover mounting screw	17.7 to 20.5	1.8 to 2.1	13.0 to 15.2
Bi-speed turn gear case mounting screw	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Spiral bevel pinion shaft staking nut	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3

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CHECKING, DISASSEMBLING AND SERVICING

CHECKING AND ADJUSTING



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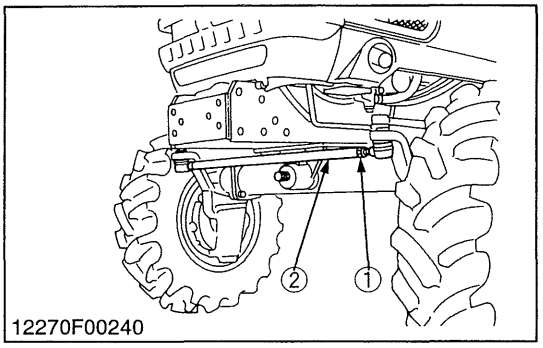
Toe-in

1. Inflate the tires to the specified pressure.
2. Turn the front wheels straight ahead.
3. Measure the toe-in (**B-A**).
4. If the measurement is not within the factory specifications, adjust the tie-rod length.

Toe-in (**B-A**)	Factory spec.	B2410	0 to 10 mm 0 to 0.39 in.
		B2710 B2910	0 to 7 mm 0 to 0.28 in.

(A) Wheel to Wheel Distance at front **(C) Front**
(B) Wheel to Wheel Distance at rear

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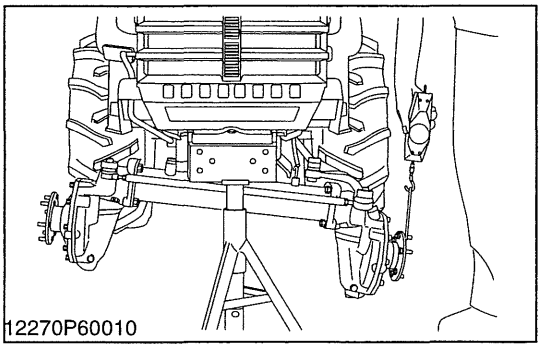
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Toe-in Adjusting

1. Loosen the lock nuts (1).
2. Turn the tie-rod (2) until to be factory specification.
3. Tighten the lock nuts (1).

(1) Lock Nut (2) Tie-rod

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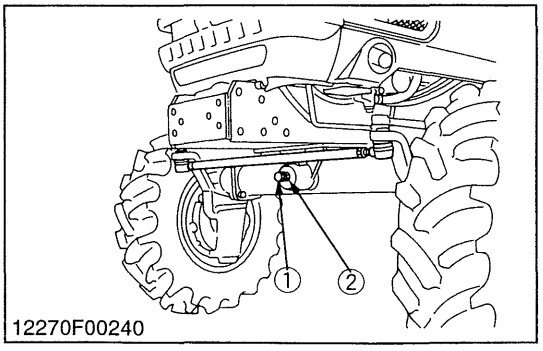

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Front Axle Rocking Force

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 98.1 N 5.0 to 10.0 kgf 11.0 to 22.1 lbs

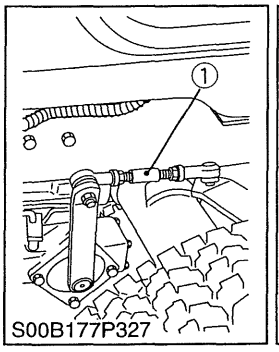
(1) Adjusting Screw (2) Lock Nut



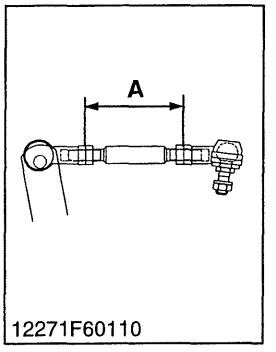
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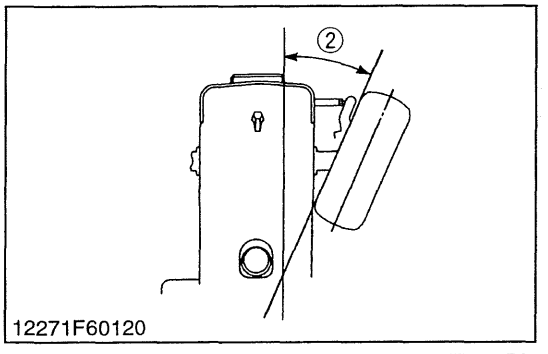
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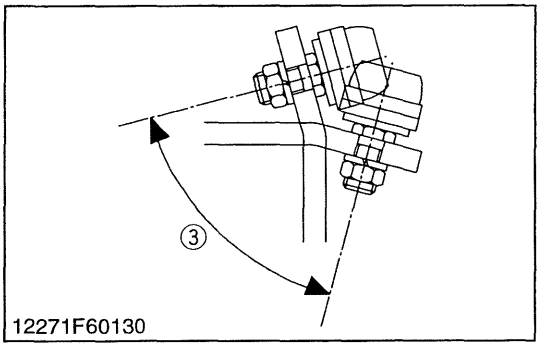
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12271F60130

Bi-speed Turn Shift Rod (Bi-speed Turn Type)

1. Set the front wheel drive lever to the 4WD position.
2. Hoist the front of the tractor to a position where you can turn the front wheels with your hands.
3. Turn the steering wheel and set the steering angle of thew inside tire to 0.42 rad. (24˚). At this time, make sure both the left and right tires turn simultaneously in the same direction.
4. If both tires do not turn in the same direction, adjust length **A** of the bi-speed turn shift rod while being careful not to change the steering angle.
   (Set the neutral position when 4WD and bi-speed changes at 0.42 rad. (24˚).)
5. When the wheels are steered to more than 0.44 rad. (25˚), the bi-speed turn starts to work.

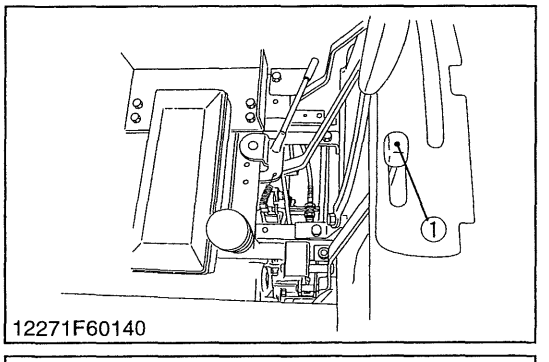
Distance **A**	Factory spec.	84 mm 3.31 in.
Steering inner angle (2) (When bi-speed turn neutral)	Factory spec.	0.40 to 0.44 rad. 23˚ to 25˚

■ NOTE

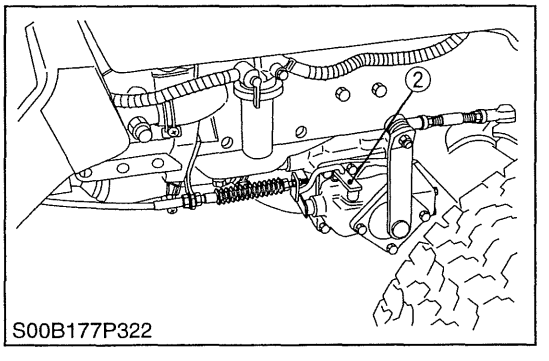
- **When you adjust the bi-speed turn shift rod, be sure the angle of the shift rod end is the same as the angle in the figure left.**

(1) Bi-speed Turn Shift Rod
(2) Steering Inner Angle
(3) 0.90 rad. (52˚)

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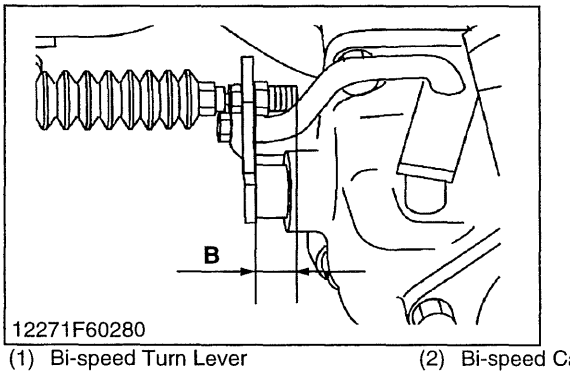
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Bi-speed Turn Change Cable (Bi-speed Turn Type)

1. Set the bi-speed turn lever (1) to the bi-speed **ON** position.
2. Push the bi-speed case change lever (2) to the rear (bi-speed **ON** direction), and make sure there is no play in the lever.
3. If there is play in the lever, adjust the bi-speed turn cable inner length **B**.

(Reference)

Cable inner length **B**	Factory spec.	10 mm 0.39 in.

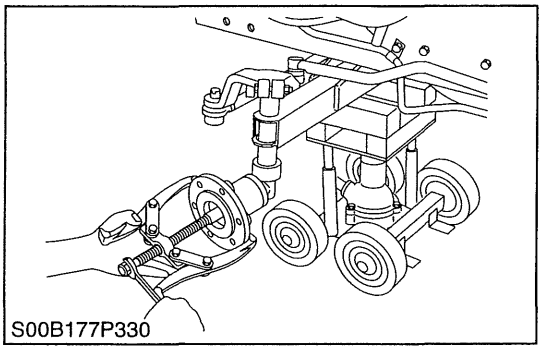


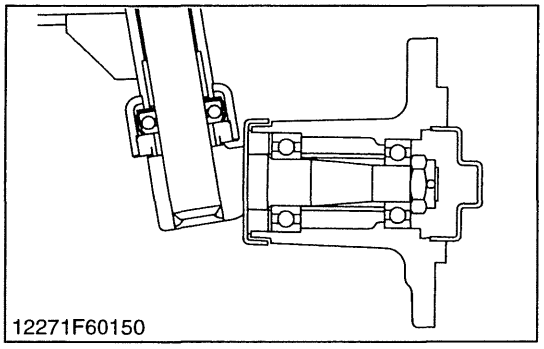
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(1) Bi-speed Turn Lever
(2) Bi-speed Case Change Lever

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DISASSEMBLING AND ASSEMBLING (2WD MODEL)


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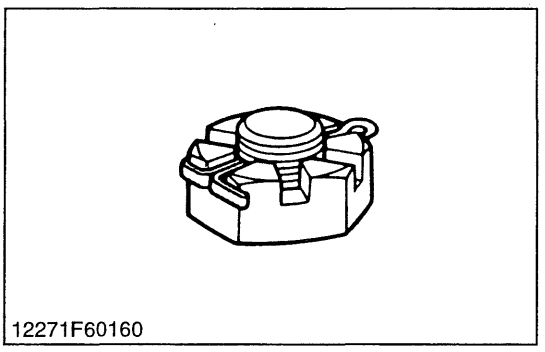
Front Wheel Hub

1. Remove the front wheels.
2. Remove the front wheel caps.
3. Remove the cotter pin and slotted nut.
4. Remove the front wheel hub with a puller.

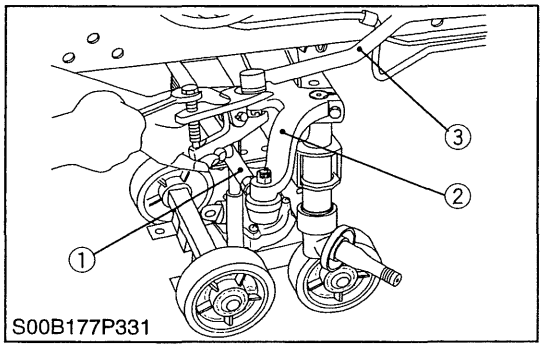
(When reassembling)

- Bend the cotter pin as shown in the figure below.

Tightening torque	Front wheel mounting screw	77.4 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Slotted nut	118 to 157 N·m 12 to 16 kgf·m 86.8 to 115.7 ft-lbs


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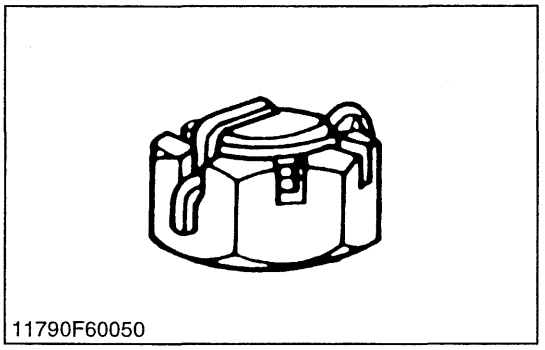
Tie-rod and Knuckle Arm

1. Pull out the cotter pins, and loosen the slotted nuts.
2. Remove the tie-rod (1) and drag link (3) with the tie-rod end lifter. (Code No. 07909-39021)
3. Remove the knuckle arm (2).

(When reassembling)

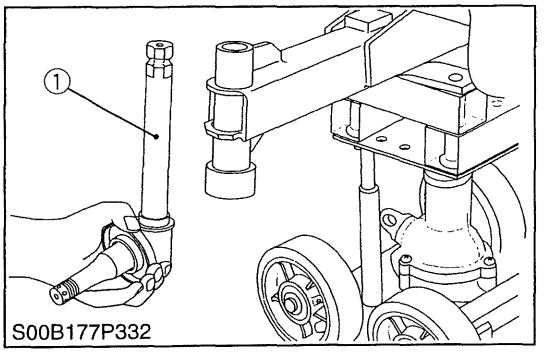
Tightening torque	Knuckle arm mounting bolt and nut	77.4 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Slotted nut for tie-rod end	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs

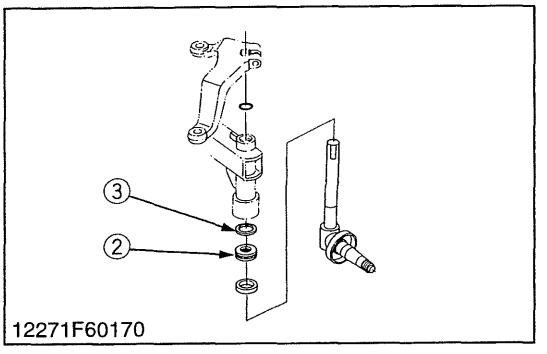
(1) Tie-rod
(2) Knuckle Arm
(3) Drag Link


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Knuckle Shaft

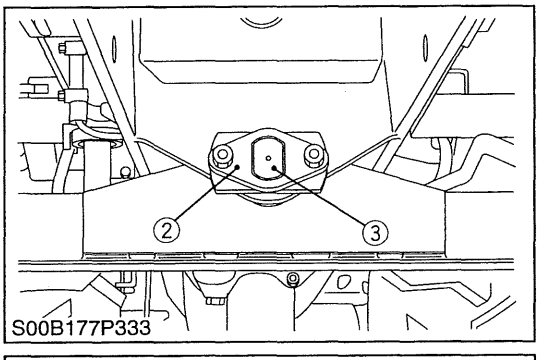
1. Remove the knuckle shaft (1) from the front axle assembly.

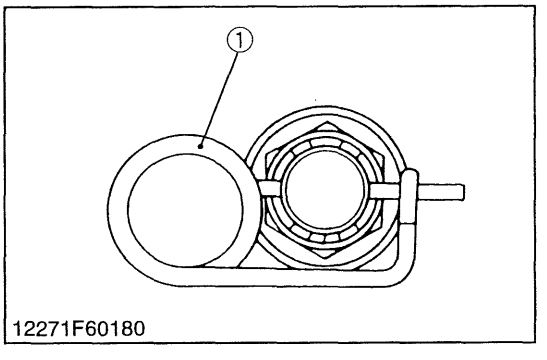
(When reassembling)

- Install the thrust bearing (2) and collar (3) is its proper direction.

(1) Knuckle Shaft
(2) Thrust Bearing
(3) Collar

12271S60130





Separation of Front Axle and Front Axle Frame

1. Remove the set spring (1).
2. Remove the slotted nut.
3. Remove the lock plate (2), and pull out the center pin (3) to forward.
4. Separate the front axle from the front axle frame.

(When reassembling)

- After reassembling the center pin, apply grease until it overflows from the end.

Tightening torque	Slotted nut	Less than 9.8 N·m 1.0 kgf·m 7.23 ft-lbs
	Lock plate mounting nut	17.7 to 19.6 N·m 1.8 to 2.0 kgf·m 13.0 to 14.5 ft-lbs

■ NOTE

- **Tighten the slotted nut to 9.8 N·m (1.0 kgf·m, 7,23 ft-lbs). If the slot and pin hole do not meet, loosen the nut until they do meet, and then install the set spring.**
- **When installing the set spring (1), insert it from the left side, as shown in figure.**

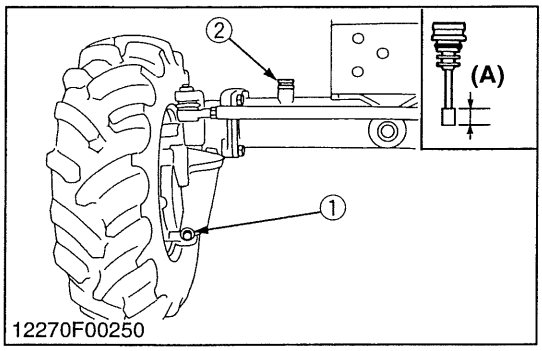
(1) Set Spring
(2) Lock Plate
(3) Center Pin

12271S60140

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DISASSEMBLING AND ASSEMBLING (4WD MODEL)

(1) Separating Front Axle Assembly



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Draining Front Axle Case Oil

1. Place the oil pans underneath the front axle case.
2. Remove the both right and left hand side drain plugs (1) and filling plug (2) to drain the oil.
3. After draining, reinstall the drain plugs (1).
4. Fill with new oil up to the upper notch on the dipstick.

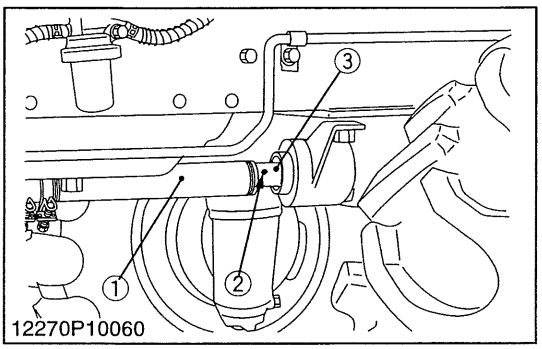
■ IMPORTANT

- **After ten minutes, check the oil level again, add oil to prescribed level.**
- **Use KUBOTA SUPER UDT fluid or SAE 80, 90 gear oil. Refer to "LUBRICNATS, FUEL AND COOLANT". (See page G-8.)**

Front axle case oil capacity	B2410	3.7 L 3.9 U.S.qts. 3.3 Imp.qts.
	B2710 B2910	4.5 L 4.8 U.S.qts. 4.0 Imp.qts.

(1) Drain Plug
(2) Filling Plug with Dipstick
(A) Oil level is acceptable within this range.

12271S60150



12270P10060

Disconnecting Propeller Shaft

1. Loosen the clamps and side the propeller shaft cover (1) to the rear.
2. Tap out the spring pin (2) and slide the coupling (3) to the rear.

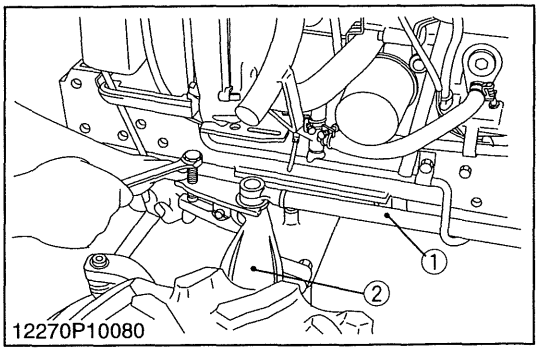
(When reassembling)

- Apply grease to the splines of the propeller shaft.

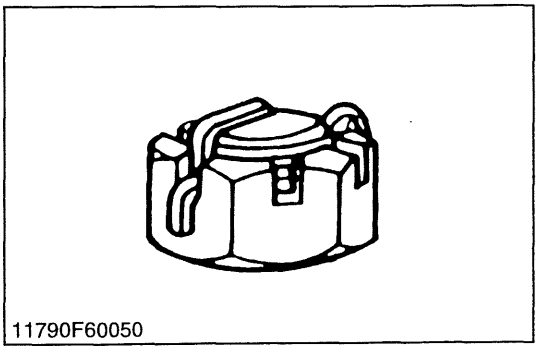
(1) Propeller Shaft Cover
(2) Spring Pin
(3) Coupling

12270S60090

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12270P10080


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Drag Link

1. Remove the cotter pin and loosen the slotted nut.
2. Disconnect the drag link (1) with a pitman arm puller from the knuckle arm (2).

(When reassembling)

■ IMPORTANT

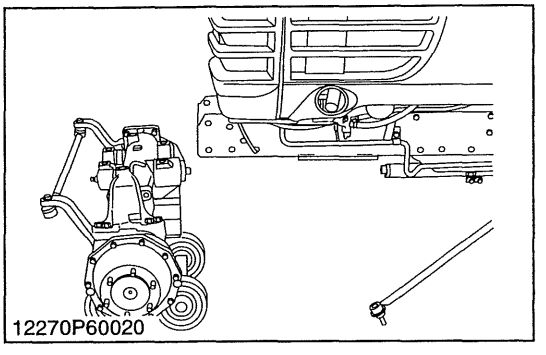
- **Do not loosen the slotted nut to align the hole.**
- **Install the cotter pin as shown in the figure**

(Reference)

Tightening torque	Slotted nut	17.7 to 34.5 N·m 1.8 to 3.5 kgf·m 13.0 to 25.3 ft-lbs

(1) Drag Link (2) Knuckle Arm

12270S10170


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Front Axle Assembly

1. Lift up the front side of tractor and place the disassembling stand under the front axle frame.
2. Remove the front wheels.
3. Place the disassembling stand under the front axle.
4. Remove the front axle brackets (Front and Rear) mounting screws.
5. Separate the front axle from the front axle frame.

(When reassembling)

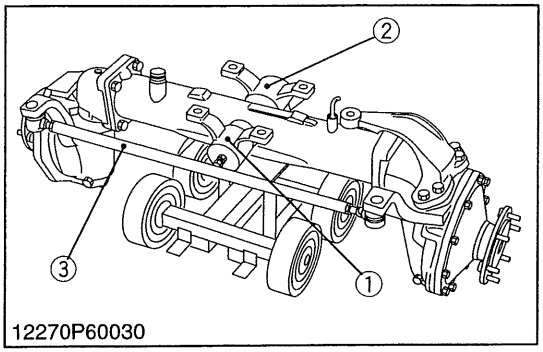
- After mounting the front axle assembly to the front axle frame, be sure to adjust the front axle rocking force. (See page 6-S6)

Tightening torque	Front wheel mounting nut	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Front axle bracket mounting screw	200 to 230 N·m 20.4 to 23.5 kgf·m 147.5 to 169.6 ft-lbs

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(2) Disassembling Front Axle Assembly



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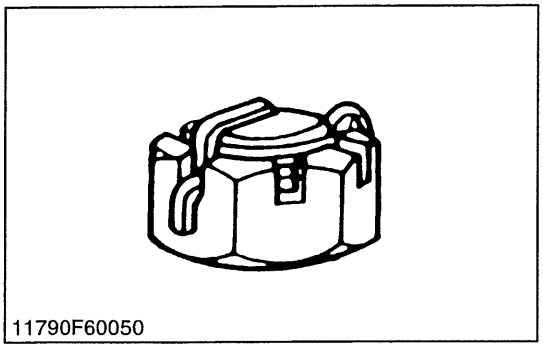
Tie-rod and Axle Bracket

1. Remove the slotted nut and remove the tie-rod (3).
2. Remove the front axle brackets (1), (2).

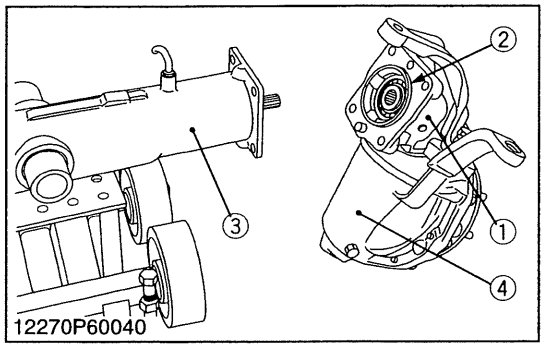
(When reassembling)

- Apply grease to the thrust collar of front axle bracket.
- Apply grease to the O-ring and take care not to damage it.
- After tightening the slotted nut to the specified torque, install the cotter pin as shown in the figure.

(1) Front Axle Bracket (Front)
(2) Front Axle Bracket (Rear)
(3) Tie-rod


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Bevel Gear Case and Front Gear Case

1. Remove the bevel gear case mounting screws.
2. Remove the bevel gear case (1) and front gear case (4) as a unit from the front axle case (3).

(When reassembling)

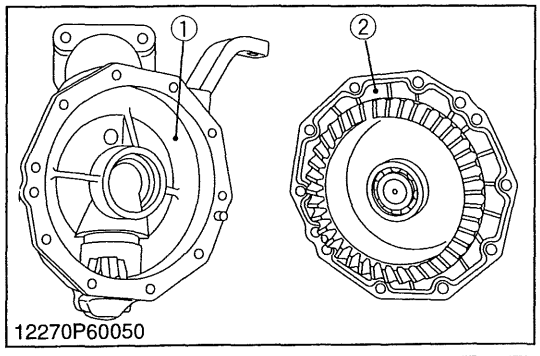
- Apply grease to the O-ring (2) and take care not to damage it.
- Do not interchange right and left bevel gear case assemblies and right and left gear case assemblies.

Tightening torque	Bevel gear case mounting screw	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

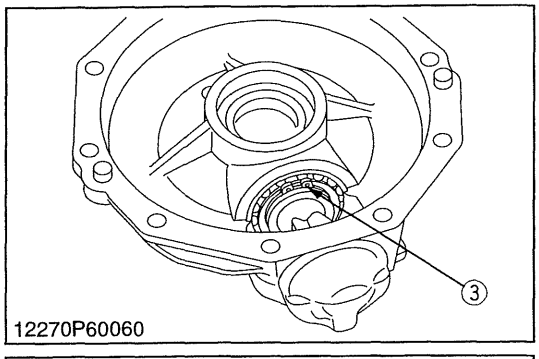
(1) Bevel Gear Case
(2) O-ring
(3) Front Axle Case
(4) Front Gear Case

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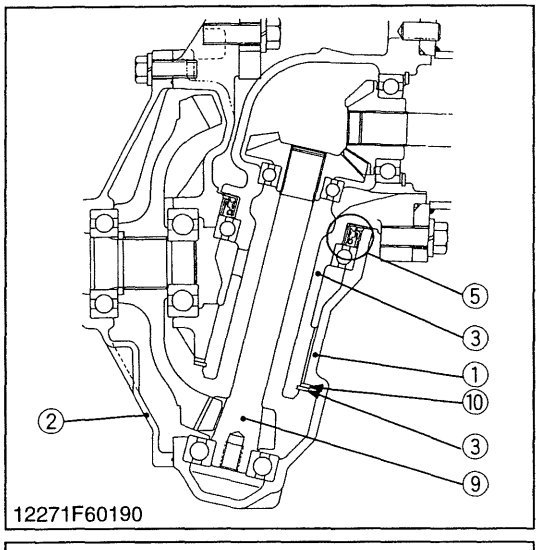
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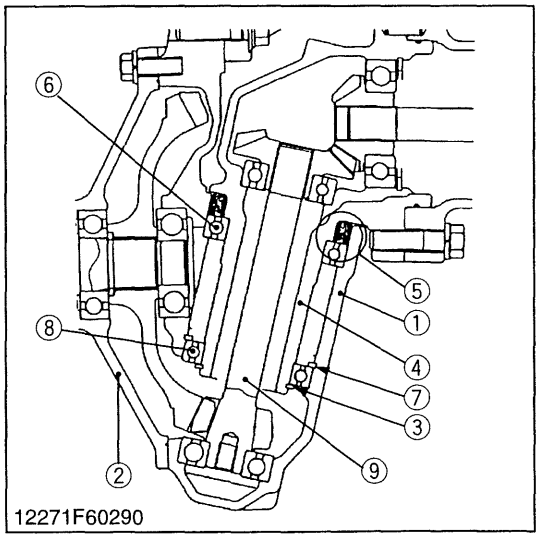
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Front Gear Case

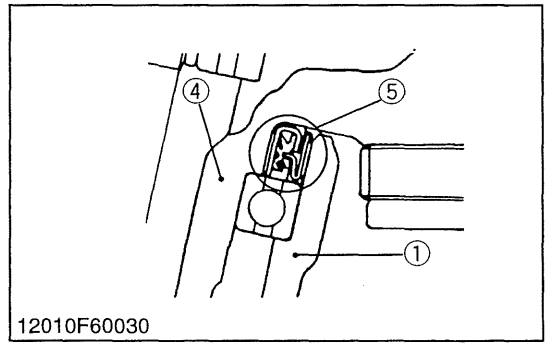
1. Remove the knuckle arm (Left side only).
2. Remove the axle flange (2).
3. Remove the external snap ring (3).
4. Remove the bevel gear case (4) from front gear case (1).
5. Remove the oil seal (5). (B2710, B2910)
6. Remove the ball bearing 1 (6). (B2710, B2910)
7. Remove the internal snap ring (7) and remove the ball bearing 2 (8). (B2710, B2910)
8. Remove the bevel gear shaft (9) with ball bearing.

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the axle flange (2) and front gear case (1) after eliminate the water, oil and stuck liquid gasket.
- Tighten the axle flange mounting screws and nuts diagonally in several steps.
- Install the oil seal (5) of bevel gear case, noting its direction as shown in the figure.

Tightening torque	Knuckle arm mounting screw	103.0 to 117.7 N·m 10.5 to 12.0 kgf·m 76.0 to 86.8 ft-lbs
	Axle flange mounting screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs

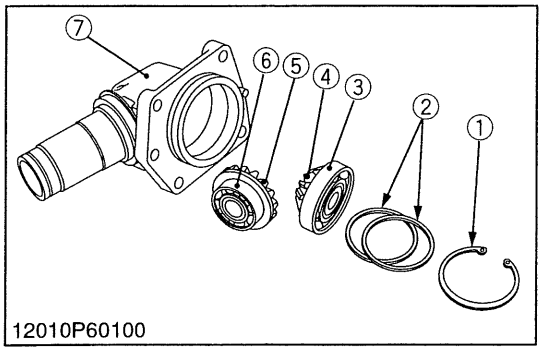
(1) Front Gear Case
(2) Axle Flange
(3) External Snap Ring
(4) Bevel Gear Case
(5) Oil Seal
(6) Ball Bearing 1
(7) Internal Snap Ring
(8) Ball Bearing 2
(9) Bevel Gear Shaft
(10) Thrust Collar



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12010P60100

Bevel Gear Case Gears

1. Remove the internal snap ring (1).
2. Take out the bevel gears (4), (5) with ball bearings (3), (6) and shims (2).

(When reassembling)

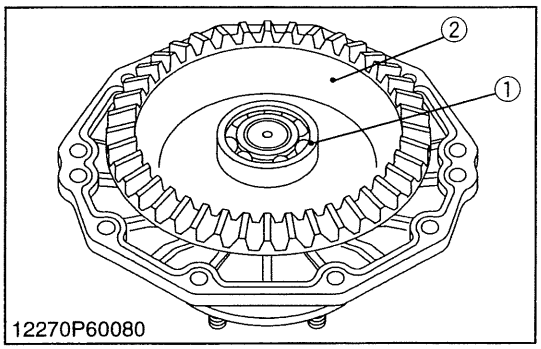
- Install the shims (2) to their original position.

(Reference)

- Thickness of adjusting shims :
  0.8 mm (0.031 in.) 1.2 mm (0.047 in.)
  1.0 mm (0.039 in.)

(1) Internal Snap Ring
(2) Shim
(3) Ball Bearing
(4) Bevel Gear
(5) Bevel Gear
(6) Ball Bearing
(7) Bevel Gear Case

12010S60150



12270P60080

Axle

1. Remove the bearing (1).
2. Take out the bevel gear (2).
3. Take out the collar (3).
4. Tap out the axle (7).

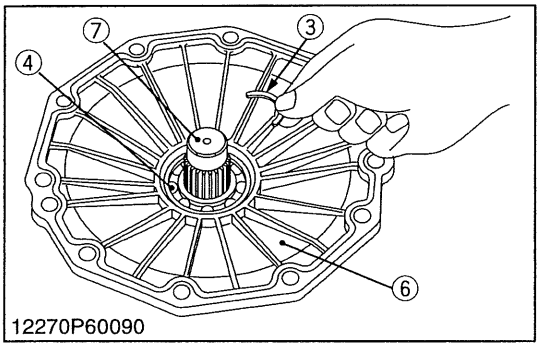
(When reassembling)

- Install the oil seal (8) of axle flange (6), noting its direction as shown in the figure.
- Install the shims (5) to their original position. (B2710, B2910)

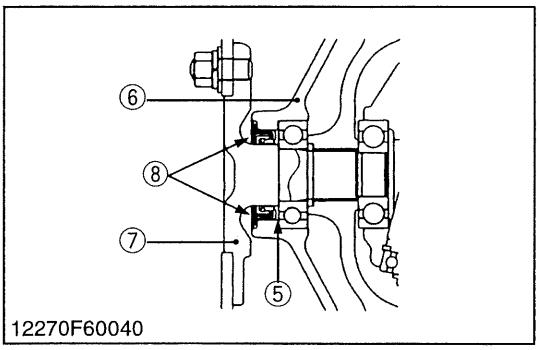
(Reference)

- Thickness of adjusting shims :
  0.2 mm (0.008 in.) 0.3 mm (0.012 in.)

(1) Ball Bearing
(2) Bevel Gear
(3) Collar
(4) Ball Bearing
(5) Shim
(6) Axle Flange
(7) Axle
(8) Oil Seal



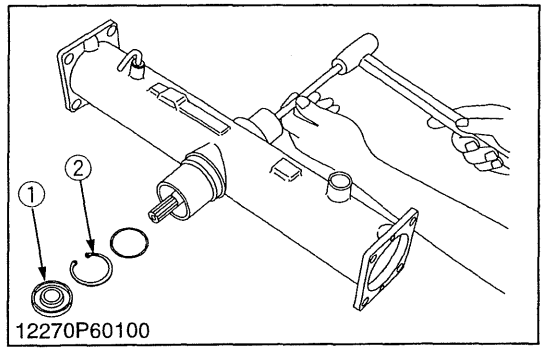
12270P60090



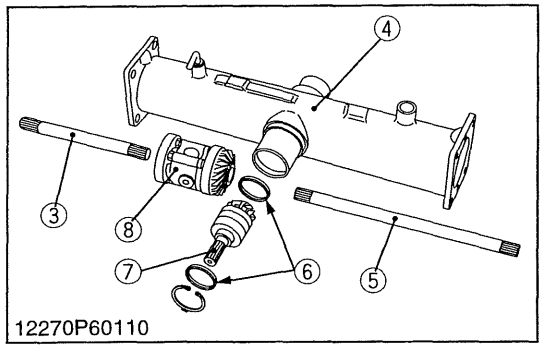
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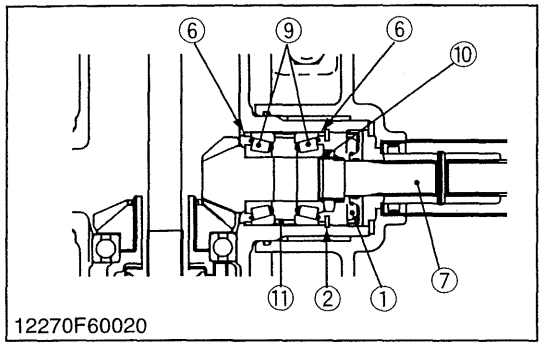
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12270P60110



12270F60020

Spiral Bevel Pinion Shaft and Differential Gear Assembly

1. Take out the differential yoke shaft (3), (5).
2. Remove the oil seal (1).
3. Remove the internal snap ring (2).
4. Tap out the spiral bevel pinion shaft (7) by the brass rod and hammer.
5. Take out the differential gear assembly (8), from right side of front axle case (4).
6. Remove the stake of lock nut (10), and then remove the lock nut (10).
7. Remove the taper roller bearings (9).

(When reassembling)

- Apply gear oil to the taper roller bearings (9) and install them correctly, noting their direction.
- Replace the lock nut (10) and oil seal (1) with new ones.
- After tighten the lock nut (10) to the specified torque, stake it firmly.
- Install the adjusting collars (6) to their original position.

(Reference)

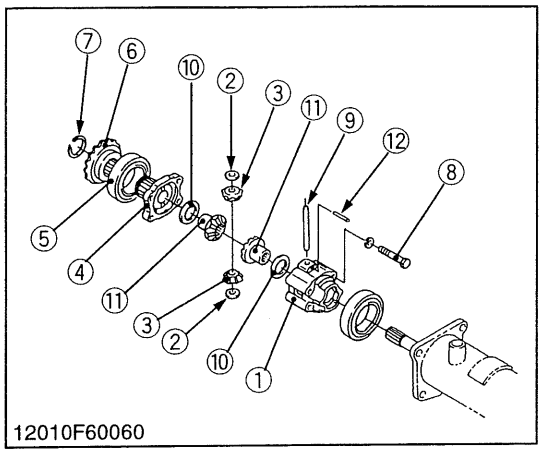
- Thickness of adjusting collars :

3.4 mm (0.134 in.)	4.1 mm (0.161 in.)
3.6 mm (0.142 in.)	4.2 mm (0.165 in.)
3.8 mm (0.150 in.)	4.4 mm (0.173 in.)
4.0 mm (0.157 in.)	4.6 mm (0.181 in.)

(1) Oil Seal
(2) Internal Snap Ring
(3) Differential Yoke shaft LH
(4) Front Axle Case
(5) Differential Yoke Shaft RH
(6) Adjusting Collar
(7) Spiral Bevel Pinion Shaft
(8) Differential Gear Assembly
(9) Taper Roller Bearing
(10) Lock Nut
(11) Collar

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Differential Gear

1. Remove the differential case cover mounting screws (8) and then take out the differential case cover (4), ball bearing (5) and spiral bevel gear (6) as a unit.
2. Remove the external snap ring (7), and then remove the ball bearing (5) and spiral bevel gear (6) as a unit with a puller.
3. Remove the straight pin (12).
4. Pull out the pinion shaft (9) and take out the differential pinions (3) and differential side gears (11).

■ 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 (11) and differential pinions (3).
- Install the pinion shaft (9) so that the hole on it may align with the hole on differential case (1), and install the straight pin (12).

Tightening torque	Differential case cover mounting screw	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs

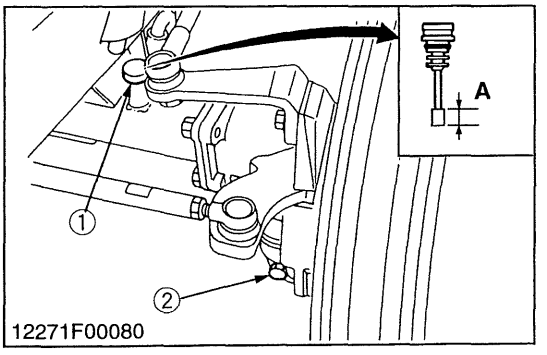
(1) Differential Case
(2) Thrust Collar
(3) Differential Pinion
(4) Differential Case Cover
(5) Ball Bearing
(6) Spiral Bevel Gear
(7) External Snap Ring
(8) Screws
(9) Pinion Shaft
(10) Shim
(11) Differential Side Gear
(12) Straight Pin

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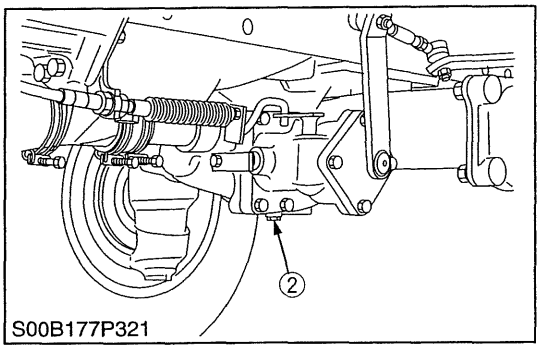
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DISASSEMBLING AND ASSEMBLING (BI-SPEED TURN TYPE)

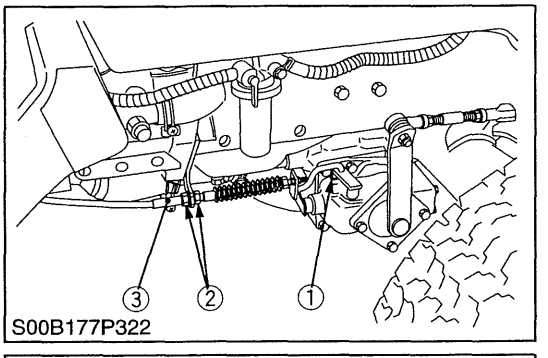
(1) Separating Front Axle Assembly



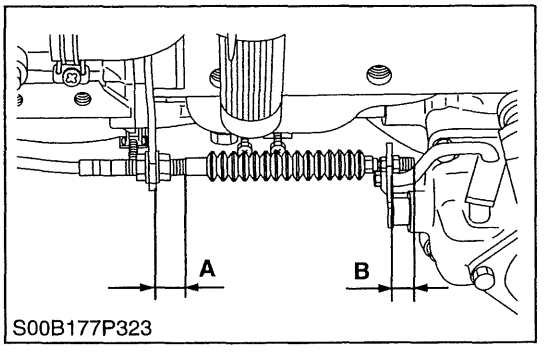
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S00B177P322



S00B177P323

Draining Front Axle Case Oil

1. Place oil pans underneath the front axle case.
2. Remove both right and left drain plugs (2) and filling plug (1) to drain the oil.
3. Remove the right and left breather plugs.
4. After draining, reinstall the drain plugs (2).
5. Fill with new oil up to the upper notch on the dipstick.
6. After filling, reinstall the filling plug and breather plugs.

Front axle case oil capacity	4.5 L 4.8 U.S.qts. 4.0 Imp.qts.

■ IMPORTANT

- **After ten minutes, check the oil level again, add oil to prescribed level.**
- **Use KUBOTA SUPER UDT fluid or SAE80, 90 gear oil. Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-8)**

(1) Filling Plug with Dipstick
(2) Drain Plug
(A) Oil level is acceptable within this range.

12271S60180

Bi-speed Turn Cable

1. Remove the spring lock pin (1) and loosen the lock nuts (2) and then remove the bi-speed turn cable (3).

(When reassembling)

- When reassembling the bi-speed turn cable (3), make sure the distance **A**.

Distance **A**	Factory spec.	18 mm 0.71 in.

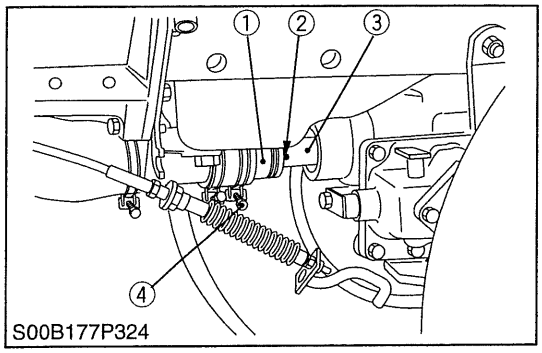
(Reference)

Distance **B**	Factory spec.	10 mm 0.39 in.

(1) Spring Lock Pin
(2) Lock Nut
(3) Bi-speed Turn Cable

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S00B177P324

Propeller Shaft

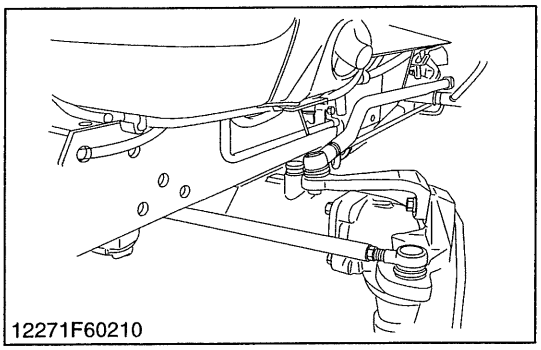
1. Loosen the clamp (4) and slide the propeller shaft cover (1) to the rear.
2. Tap out the spring pin (2), and then slide the coupling (3) to the rear.

(When reassembling)

- Apply grease to the splines of the propeller shaft.

(1) Propeller Shaft Cover
(2) Spring Pin
(3) Coupling
(4) Clamp

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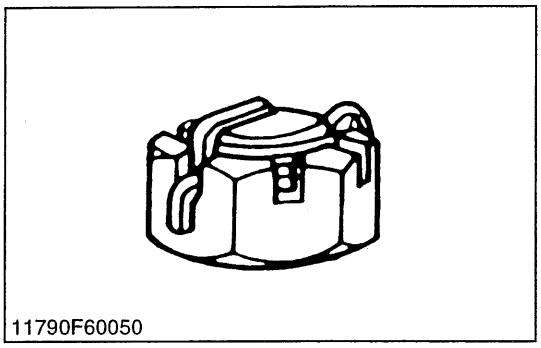
Drag Link

1. Steer the front wheels to the left.
2. Remove the slotted nut and disconnect the drag link from the knuckle arm.

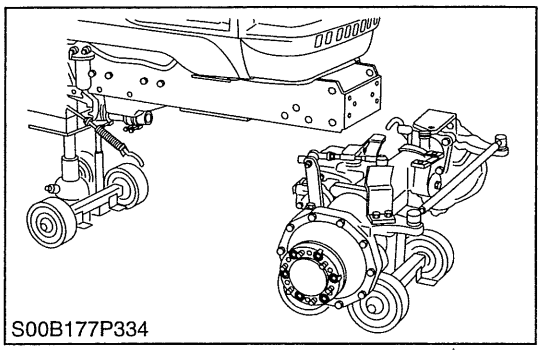
■ IMPORTANT

- **After tightening the slotted nut to the specified torque, install the cotter pin as shown in the figure left.**

Tightening torque	Slotted nut	17.7 to 34.3 N·m 1.8 to 3.5 kgf·m 13.0 to 25.3 ft-lbs


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Front Axle

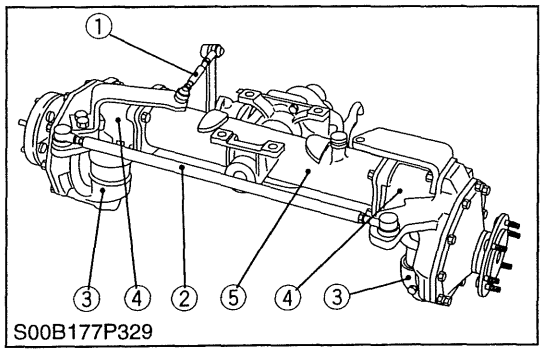
1. Place the jack under the clutch housing.
2. Place the jack under the front axle.
3. Remove the front wheels.
4. Remove the front axle brackets (Front and Rear) mounting screws.
5. Separate the front axle from the front axle frame.

Tightening torque	Front axle bracket mounting screws	124 to 147 N·m 12.6 to 15.0 kgf·m 91.1 to 108.5 ft-lbs
	Front wheel mounting screws	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

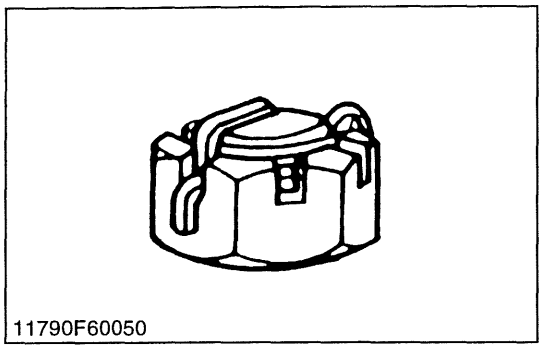
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(2) Disassembling Front Axle Assembly



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Tie-rod and Bevel Gear Case Assembly

1. Remove the bi-speed turn rod (1).
2. Remove the slotted nut and disconnect the tie-rod (2) from the front gear case (3).
3. Remove the bevel gear case (4) and front gear case (3) as a unit from the front axle case (5).

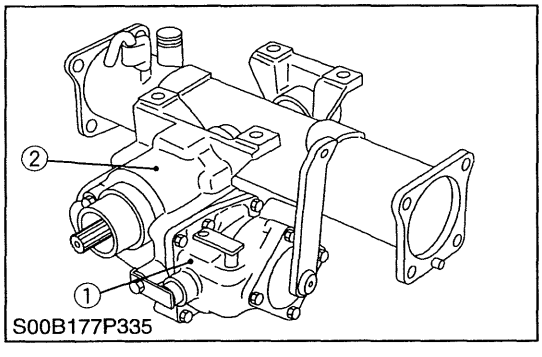
(When reassembling)

- Apply grease to the O-ring and take care not to damage it.
- Do not interchange right and left bevel gear case assemblies.
- After tightening the slotted nut to the specified torque, install the cotter pin as shown in the figure.

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

(1) Bi-speed Turn Rod
(2) Tie-rod
(3) Front Gear Case
(4) Bevel Gear Case
(5) Front Axle Case

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Separation of Bi-speed Turn Case

1. Remove the bi-speed turn case mounting screws and separate the bi-speed turn case (1) from the bi-speed turn gear case (2).

(When reassembling)

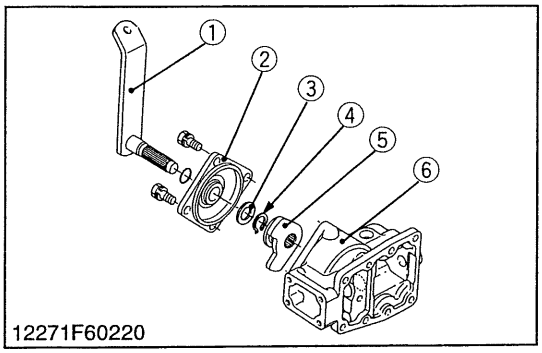
- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the bi-speed turn case (1) and bi-speed turn gear case.
- Install the bi-speed turn case to the bi-speed turn gear case, noting the position of shifter collar. (Place the shifter collar between shift fork and shifter)
- After shifting the bi-speed turn shifter to the spiral bevel pinion shaft side, mount the shift fork on the shifter and install the case to the gear case.

Tightening torque	Bi-speed turn case mounting screw	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

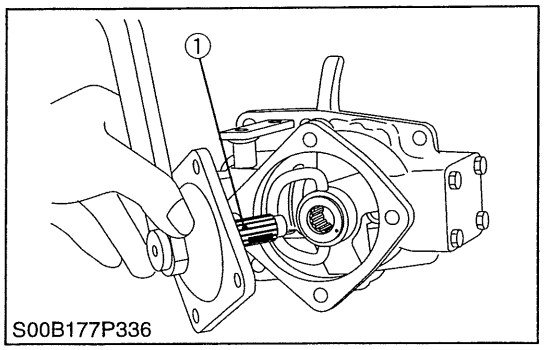
(1) Bi-speed Turn Case
(2) Bi-speed Turn Gear Case

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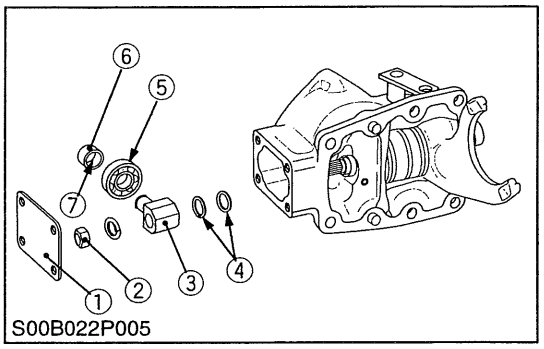
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S00B177P336



S00B022P005

Shift Cam

1. Remove the case cover (2) with the shift lever and shift cam (5).
2. Remove the external snap ring (4) and collar (3).
3. Remove the shift lever (1).

■ NOTE

- **The white marks is painted on the shift lever (1) for aligning the shift cam.**

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the bi-speed turn case (6) and case cover (2).
- When installing the shift cam, be sure to align the marks on the shift cam and shift lever.

Tightening torque	Case cover mounting screw	17.7 to 20.5 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs

(1) Shift Lever
(2) Case Cover
(3) Collar
(4) External Snap Ring
(5) Shift Cam
(6) Bi-speed Turn Case

12271S60250

Shift Roller Shaft

1. Remove the cover (1).
2. Remove the nut (2) and the shift roller shaft assembly.
3. Tap out the shift roller shaft (3), while holding the bearing (5) to remove the shift roller (6). The retainer ring (7) is mounted inside of the roller.

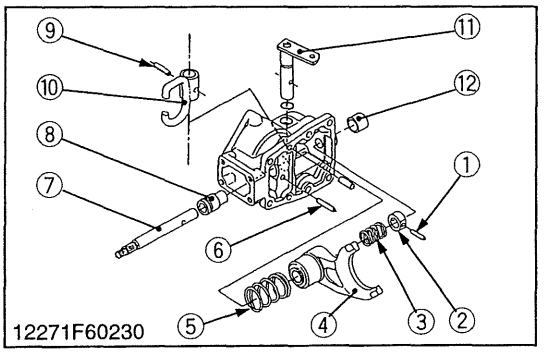
(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to joint face of the cover (1) and bi-speed turn case.

(1) Cover
(2) Nut
(3) Shift Roller Shaft
(4) Adjusting Shim
(5) Ball Bearing
(6) Shift Roller
(7) Retainer Ring

12271S60260

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Shift Fork, Shift Rod and Change Lever

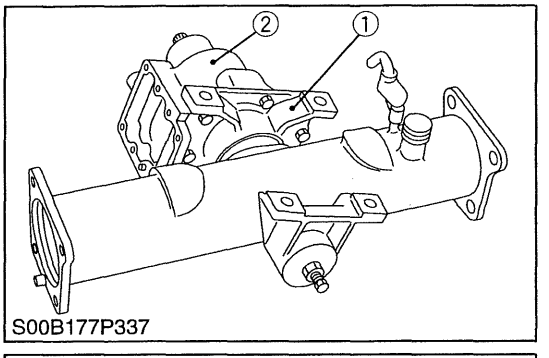
1. Push the shift fork to the front till the spring pin (1) can be seen and tap out the spring pin (1).
2. Remove the cap (12) and tap out the shift rod (7) to the front.
3. Tap out the spring pin (6).
4. Tap out the shift rod collar (8) by the rod to the front.
5. Take off the shift fork (4), springs (3) (5) and pressure collar (2) together.
6. Tap out the spring pin (9), using the screw hole for the fulcrum mounting screw on the case. Remove the change lever (11) and change fork (10).

(When reassembling)

- Apply adhesive to the cap.

(1) Spring Pin
(2) Pressure Collar
(3) Spring
(4) Shift Fork
(5) Spring
(6) Spring Pin
(7) Shift Rod
(8) Shift Rod Collar
(9) Spring Pin
(10) Change Fork
(11) Change Lever
(12) Cap

12271S60270



Separation of Bi-speed Turn Gear Case

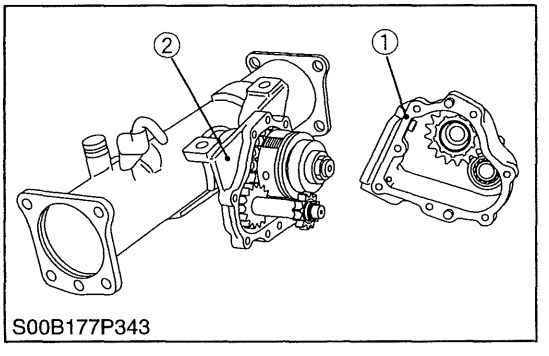
1. Remove the bi-speed turn gear case mounting screws (1).
2. Separate the bi-speed turn gear case (2) from the bearing holder (3).

(When reassembling)

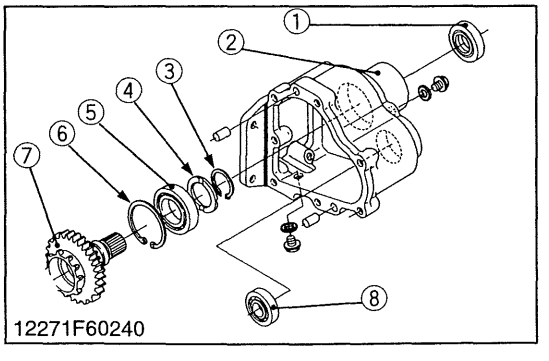
- Apply liquid gasket (Three Bond 1208D or equivalent) to the bi-speed turn gear case.

Tightening torque	Bi-speed turn gear case mounting screw	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

(1) Bi-speed Turn Gear Case
(2) Bearing Holder



12271S60280



Ball Bearing and Oil Seal

1. Remove the oil seal (1) and remove the external snap ring (3) and thrust collar (4).
2. Tap out the gear shaft (7).
3. Remove the internal snap ring (6) and remove the ball bearing (5) from the bi-speed turn gear case (2).
4. Remove the ball bearing (8) from the bi-speed turn gear case (2).

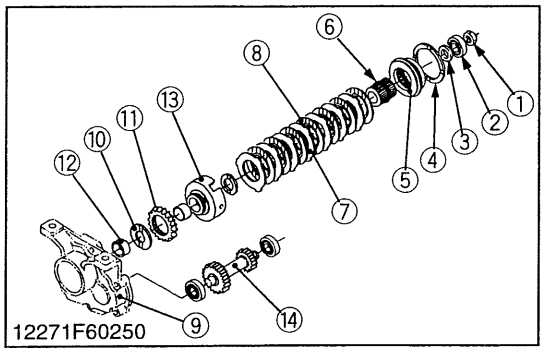
(When reassembling)

- Apply grease to the oil seal.

(1) Oil Seal
(2) Bi-speed Turn Gear Case
(3) External Snap Ring
(4) Thrust Collar
(5) Ball Bearing
(6) Internal Snap Ring
(7) Gear Shaft
(8) Ball Bearing

12271S60290

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Bi-speed Turn Clutch Assembly

1. Put back the stakes of the nut (1) and remove it.
2. Pull out the ball bearing (2) with a puller and remove the plain washer (3) shifter collar (4) and shifter (5).
3. Remove the bi-speed turn coupling (6), clutch discs (7), friction plates (8), and bi-speed turn clutch drum (13).
4. Remove the thrust collar (10), bi-speed turn gear (11) and inner ring (12) from the bi-speed turn clutch drum (13).
5. Remove the gear shaft (14).

(When reassembling)

- Apply molybdenum desulphid (Three Bond 1901 or equivalent) to the inner ring.
- Replace the staking nut with a new one and after checking the turning torque of staking nut (1), be sure to stake it.
- After installing the gear shaft (14) with the bearing, reinstall the bi-speed turn clutch assembly.

Tightening torque	Staking nut	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs

■ IMPORTANT

- **After tightening the staking nut (1) to the specified torque, be sure to check the turning torque (0.8 to 1.0 N·m, 0.08 to 0.10 kgf·m, 0.59 to 0.73 ft-lbs) of spiral bevel pinion shaft assembly.**

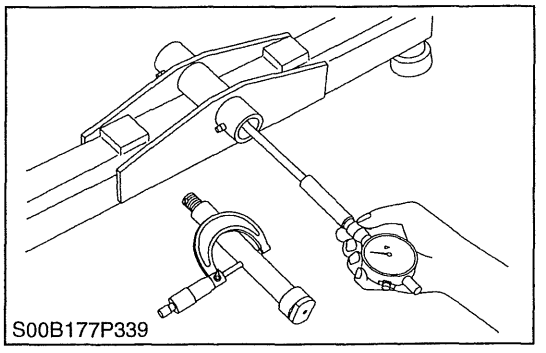
(1) Nut
(2) Ball Bearing
(3) Plain Washer
(4) Shifter Collar
(5) Shifter
(6) Bi-speed Turn Coupling
(7) Clutch Disc
(8) Friction Plate
(9) Bearing Holder
(10) Thrust Collar
(11) Bi-speed Turn Gear
(12) Inner Ring
(13) Bi-speed Turn Clutch Drum
(14) Gear Shaft

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SERVICING

(1) 2WD Model

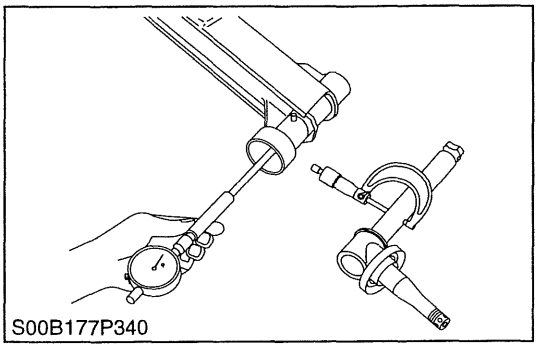

S00B177P339

Clearance between Center Pin and Pin Support

1. Measure the center pin O.D. with an outside micrometer.
2. Measure the pin support I.D. of the front axle with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace it.

Clearance between center pin and pin support	Factory spec.	0.05 to 0.25 mm 0.0020 to 0.0098 in.
	Allowable limit	0.70 mm 0.0276 in.
Center pin O.D.	Factory spec.	24.90 to 25.00 mm 0.9803 to 0.9842 in.
Pin support I.D.	Factory spec.	25.05 to 25.15 mm 0.9862 to 0.9901 in.

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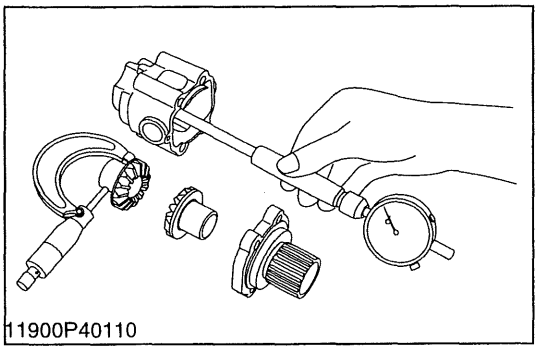
Clearance between Knuckle Shaft and Bushing

1. Measure the knuckle shaft O.D. at several points with an outside micrometer. (The knuckle shaft tends to show concentrated wear.)
2. Similarly, measure the knuckle shaft bushing I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace.

Clearance between knuckle shaft and bushing	Factory spec.	0.040 to 0.105 mm 0.0016 to 0.0041 in.
	Allowable limit	0.50 mm 0.0197 in.
Knuckle shaft O.D.	Factory spec.	24.948 to 24.980 mm 0.9822 to 0.9835 in.
Bushing I.D.	Factory spec.	25.020 to 25.053 mm 0.9850 to 0.9863 in.

12271S60320

(2) 4WD Model

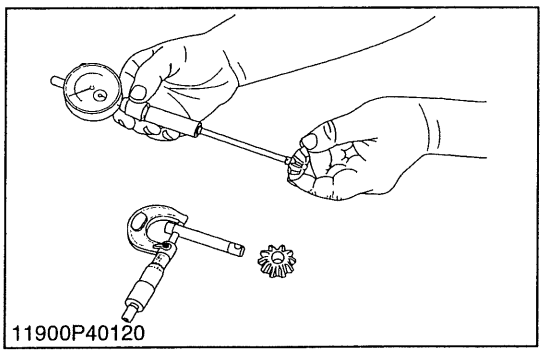

11900P40110

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.5

Clearance between differential case (differential case cover) and differential side gear	Factory spec.	0.040 to 0.082 mm 0.00157 to 0.00323 in.
	Allowable limit	0.17 mm 0.0067 in.
Differential case bore I.D.	Factory spec.	26.000 to 26.021 mm 1.02362 to 1.02445 in.
Differential case cover bore I.D.	Factory spec.	26.000 to 26.021 mm 1.02362 to 1.02445 in.
Differential side gear O.D.	Factory spec.	25.939 to 25.960 mm 1.02122 to 1.02205 in.

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11900P40120

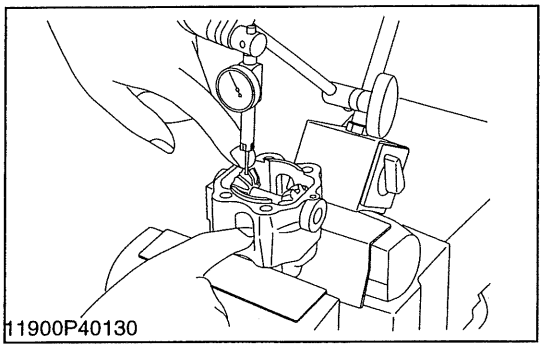
Clearance between Differential Pinion Shaft and Differential Pinion

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 faulty parts.

Clearance between differential pinion shaft and differential pinion	Factory spec.	0.038 to 0.068 mm 0.00150 to 0.00268 in.
	Allowable limit	0.17 mm 0.0067 in.

Differential pinion shaft O.D.	Factory spec.	9.972 to 9.987 mm 0.39260 to 0.39312 in.
Differential side gear I.D.	Factory spec.	10.025 to 10.040 mm 0.39469 to 0.39528 in.

11900S40210


11900P40130

Backlash between Differential Pinion and Differential Side Gear

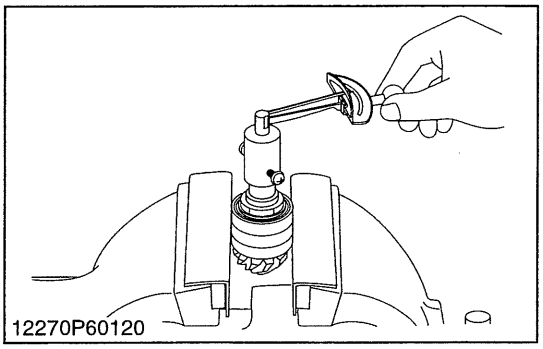
1. Set a dial gauge (lever type) on a tooth of the differential pinion.
2. Fix the differential side gear, and move the differential pinion to measure the backlash.
3. If the measurement exceeds the factory specifications, adjust with the differential side gears shims.

Backlash between differential pinion and differential side gear	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.

(Reference)

- Thickness of adjusting shims :
  0.8 mm (0.031 in.), 1.0 mm (0.039 in.), 1.2 mm (0.047 in.)

11900S40220


12270P60120

Turning Torque of Spiral Bevel Pinion Shaft

1. Cramp the spiral bevel pinion shaft assembly to the vise and tighten the staking nut.
2. Measure the turning torque of bevel pinion shaft.
3. If the turning torque is not within the factory specifications, adjust with the lock nut.

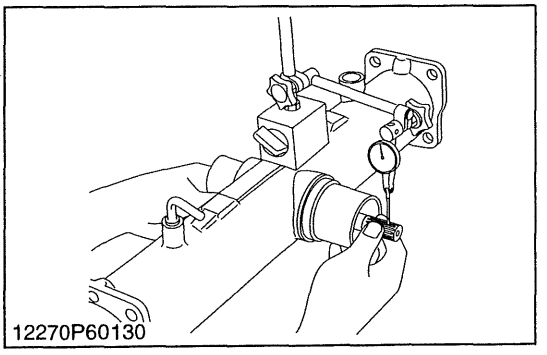
Turning torque	Factory spec.	0.8 to 1.0 N·m 0.08 to 0.10 kgf·m 0.59 to 0.73 ft-lbs

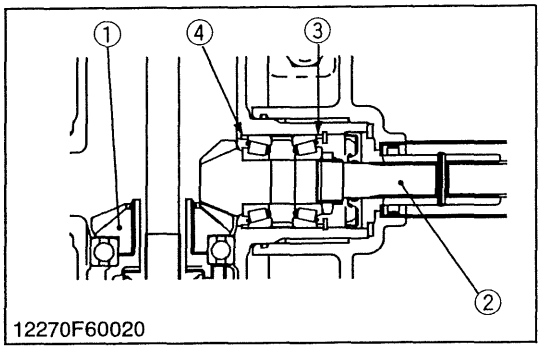
■ NOTE

- **After turning force adjustment, be sure to stake the lock nut.**

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12270P60130



12270F60020

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 be 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). For example 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.	0.10 to 0.30 mm 0.0039 to 0.0118 in.

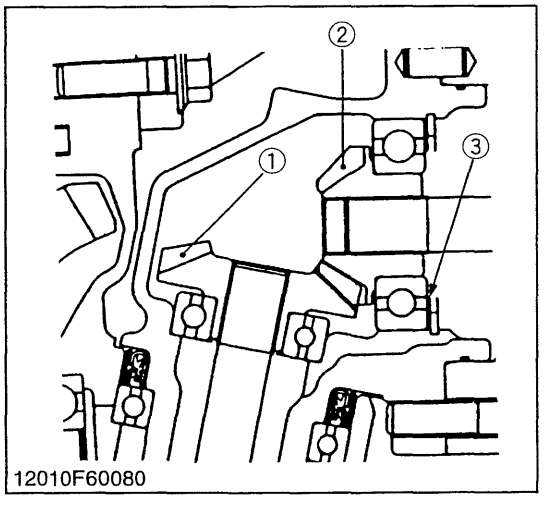
(Reference)

- Above factory specification should be measured on the tooth of spiral bevel pinion. When measuring the backlash on the spline of its shaft, factory specification will be 0.0571 to 0.1714 mm (0.00225 to 0.00675 in.).
- Thickness of adjusting collars (3), (4) :

3.4 mm (0.134 in.)	4.1 mm (0.161 in.)
3.6 mm (0.142 in.)	4.2 mm (0.165 in.)
3.8 mm (0.150 in.)	4.4 mm (0.173 in.)
4.0 mm (0.157 in.)	4.6 mm (0.181 in.)

(1) Spiral Bevel Gear
(2) Spiral Bevel Pinion Shaft
(3) Adjusting Collar
(4) Adjusting Collar

12270S60170



12010F60080

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.	0.10 to 0.30 mm 0.0039 to 0.0118 in.

(Reference)

- Thickness of adjusting shims (3) :

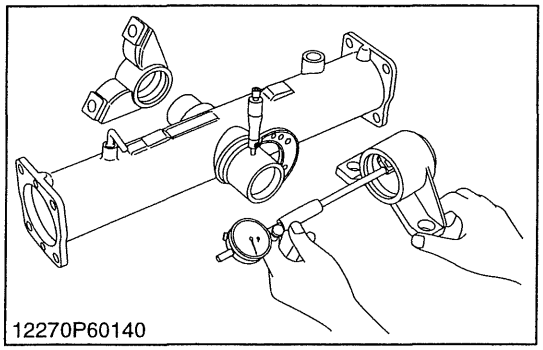
0.8 mm (0.031 in.)	1.2 mm (0.047 in.)
1.0 mm (0.039 in.)	1.4 mm (0.055 in.)

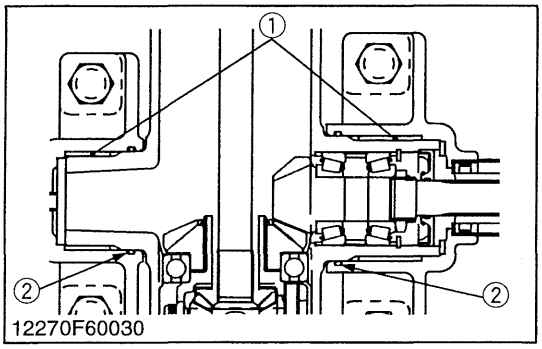
- Tooth contact : More than 35 %

(1) 16T Bevel Gear
(2) 11T Bevel Gear
(3) Shim

12010S60210

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12270P60140



12270F60030

Clearance between Front Axle Case Bosses and Bracket Bushing

1. Measure the front axle case bosses O.D. with an outside micrometer.
2. Measure the bracket busing I.D. with a cylinder gauge, 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.	0.125 to 0.280 mm 0.0049 to 0.0110 in.
	Allowable limit	0.45 mm 0.018 in.
Front axle case boss (front) O.D.	Factory spec.	49.950 to 49.975 mm 1.9665 to 1.9675 in.
Bracket bushing (front) I.D.	Factory spec.	50.10 to 50.23 mm 1.9722 to 1.9774 in.
Clearance between front axle case boss (rear) and bracket bushing (rear)	Factory spec.	0.090 to 0.250 mm 0.0035 to 0.0098 in.
	Allowable limit	0.45 mm 0.018 in.
Front axle case boss (rear) O.D.	Factory spec.	64.94 to 64.97 mm 2.5567 to 2.5579 in.
Bracket bushing (rear) I.D.	Factory spec.	65.06 to 65.19 mm 2.5614 to 2.5665 in.

■ Press-fitting Bushing

- When replacing the bushings (1), press-fit it until bushing contact to inside of front axle case.
- Apply grease to the O-rings (2) and take care not to damage it.

■ NOTE

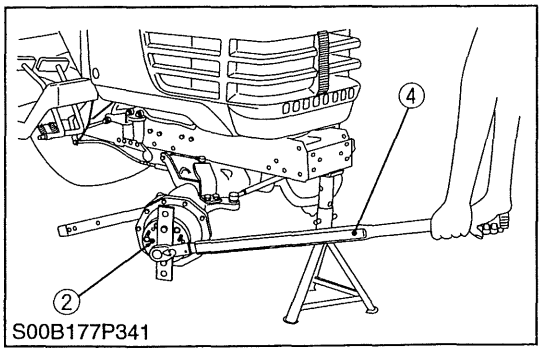
- **After replacing the bushing, be sure to adjust the front axle rocking force. (See page 6-S6.)**

(1) Bushing (2) O-ring

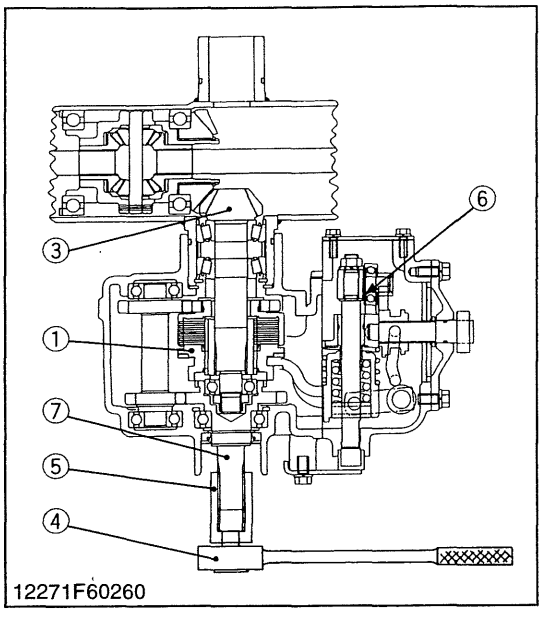
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(3) Bi-Speed Turn Type



S00B177P341



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Bi-speed Turn Clutch Friction Torque

1. Lift up the front of tractor and set the stand.
2. Remove the front tires.
3. Shift the front wheel drive lever to **"ON"** position.
4. Shift the bi-speed turn lever to **"ON"** position.
5. Set the parking brake.
6. Fully turn the steering wheel to the left or right to set the bi-speed turn **"ON"** position.
7. Set the torque wrench (4) with the special jig on the font wheel hub (2) and set the special jig (locking bar) on the other side of front wheel hub.
8. Measure the torque, when the bi-speed turn clutch is slipped.
9. If the torque is not within the factory specifications, adjust it with the shims (6).

Dynamic friction torque of bi-speed turn clutch on the front wheel hub	Factory spec.	441.3 to 490.4 N·m 45 to 50 kgf·m 325.5 to 361.7 ft-lbs

(Reference)

- Thickness of shims:
  1.0 mm (0.039 in.), 1.5 mm (0.059 in.)
- When the dynamic friction torque of bi-speed turn clutch is measured on the gear shaft (7), its factory specifications as follows.

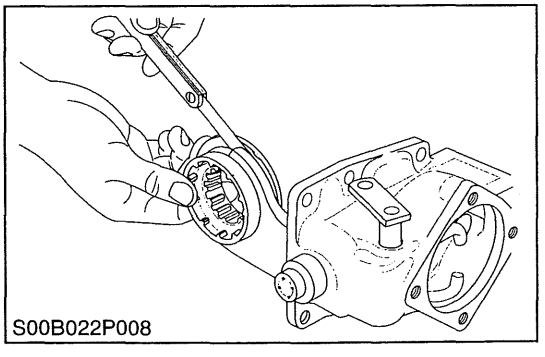
Dynamic friction torque of bi-speed turn clutch on the gear shaft	Factory spec.	86.40 to 96.01 N·m 8.81 to 9.79 kgf·m 63.65 to 70.81 ft-lbs

■ NOTE

- **Check the springs, clutch discs and friction plates if the correct torque can't be adjusted.**

(1) Bi-speed Turn Clutch
(2) Front Wheel Hub
(3) Spiral Bevel Pinion Shaft
(4) Torque Wrench
(5) Jig
(6) Shim
(7) Gear Shaft

12271S60330


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Clearance between Shift Fork and Shifter Groove

1. Place the shift fork in the shifter groove and measure the clearance with a feeler gauge.
2. If the clearance exceeds the allowable limit, replace.

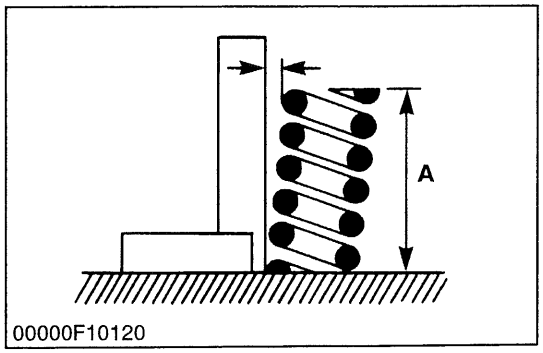
■ NOTE

- **When measuring the clearance, be sure to place the shifter collar between the shift fork and shifter.**

Clearance between shift fork and shifter groove	Factory spec.	0.1 to 0.7 mm 0.004 to 0.028 in.
	Allowable limit	1.0 mm 0.04 in.

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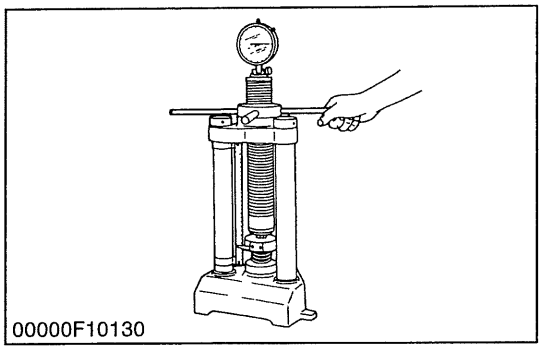
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Free Length of Bi-speed Turn Spring

1. Measure the free length of the spring with vernier calipers.
2. If the measurement is less than the allowable limit, replace it.

Free length **(A)** of bi-speed turn spring (short)	Factory spec.	32.5 to 32.6 mm 1.280 to 1.283 in.
	Allowable limit	28.5 mm 1.22 in.
Free length **(A)** of bi-speed turn spring (long)	Factory spec.	52.0 mm 2.047 in.
	Allowable limit	45.5 mm 1.791 in.

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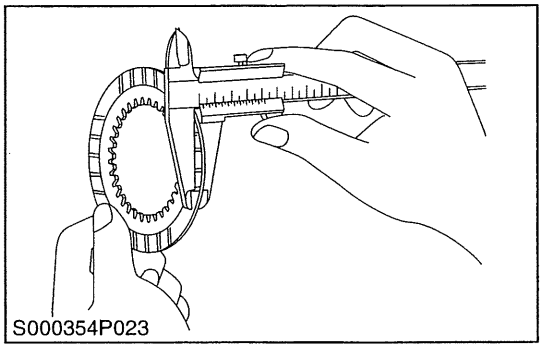

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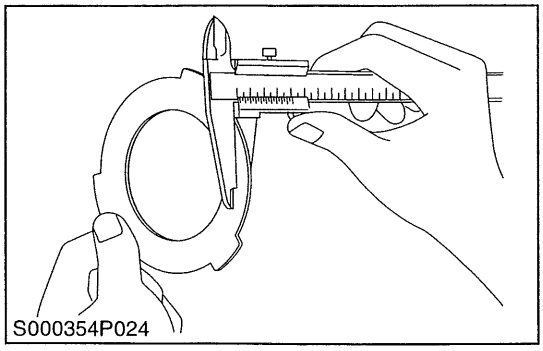
Working Load of Bi-speed Turn Spring

1. Put the spring on the spring tester and compress it to the specified length.
2. Read the compression load on the gauge.
3. If the measurement is less than the allowable limit, replace it.

Working load of bi-speed turn spring (short)	Factory spec.	Load 1613 N / 25.5 mm 164.5 kgf / 25.5 mm 362.7 lbs / 1.00 in.
	Allowable limit	Load 1411 N / 25.5 mm 143.9 kgf / 25.5 mm 317.4 lbs / 1.00 in.
Working load of bi-speed turn spring (long)	Factory spec.	Load 86.3 N / 35.0 mm 8.8 kgf / 35.0 mm 19.4 lbs / 1.378 in.
	Allowable limit	Load 75.5 N / 35.0 mm 7.7 kgf / 35.0 mm 17.0 lbs / 1.378 in.

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Clutch Disc Wear and Friction Plate Wear

1. Measure the thickness of the clutch disc and friction plate (steel plate) with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

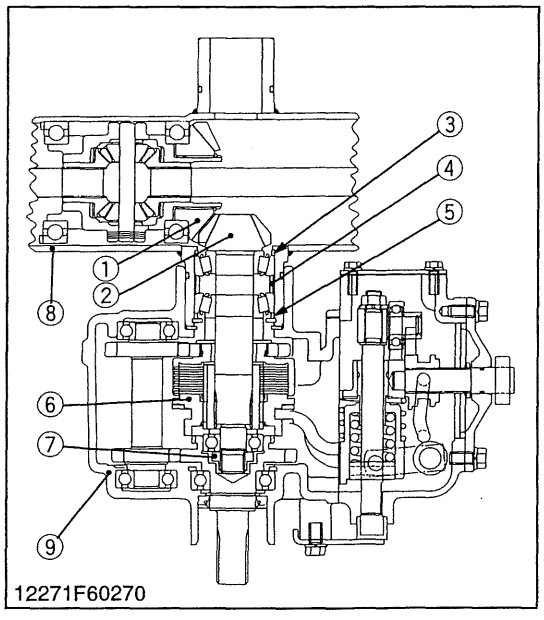
(When reassembling)

- After keeping clutch discs in transmission oil for several seconds and apply transmission oil to friction plate, reassembling them in order.

Thickness of clutch disc	Factory spec.	1.7 to 1.9 mm 0.067 to 0.075 in.
	Allowable limit	1.4 mm 0.055 in.
Thickness of friction plate	Factory spec.	0.95 to 1.05 mm 0.037 to 0.075 in.
	Allowable limit	0.8 mm 0.0315 in.

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Turning Force of Spiral Bevel Pinion Shaft and Backlash between Spiral Bevel Pinon Shaft and Spiral Bevel Gear

1. Reassemble the spiral bevel pinion shaft (2) and bi-speed turn clutch assembly (6) and tighten the staking nut (7) to the minimum specified torque.

■ IMPORTANT

- **Before assemble the front axle case (8) and bi-speed turn case (9), noting the combination of the adjusting collars (3), (5) as shown below.**

	Thickness of collar	
	Collar (3)	Collar (5)
Combination 1	4.4 mm 0.173 in.	2.9 mm 0.112 in.
Combination 2	4.2 mm 0.165 in.	2.7 mm 0.106 in.
Combination 3	4.6 mm 0.181 in.	3.1 mm 0.122 in.

2. Measure the turning torque of spiral bevel pinion shaft.
3. If the measurement is not within the factory specifications, adjust with retightening the staking nut.
4. Stick the strip of fuse on the spiral bevel gear (1) with grease.
5. Carefully rotate the spiral bevel pinion shaft (2) on full turn.
6. Remove the fuse and measure the thickness of the fuse.
7. If the measurement is not within the factory specification, change the adjusting collar (3), (4) and (5).
8. Adjust the backlash properly by repeating the above procedures.
9. After adjusting the backlash, stake the staking nut (7).

Turning torque	Factory spec.	0.8 to 1.0 N·m 0.08 to 0.10 kgf·m 0.59 to 0.73 ft-lbs

Tightening torque	Staking nut	27.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs

Backlash between spiral bevel pinion shaft and spiral bevel gear	Factory spec.	0.1 to 0.3 mm 0.004 to 0.012 in.

(1) Spiral Bevel Gear
(2) Spiral Bevel Pinion Shaft
(3) Collar
(4) Collar
(5) Collar
(6) Bi-speed Turn Clutch Assembly
(7) Staking Nut
(8) Front Axle Case
(9) Bi-speed Turn Case

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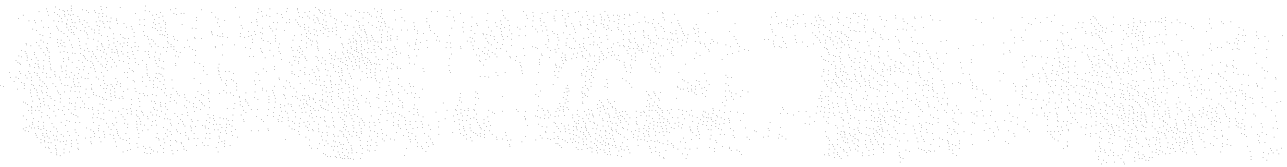
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MECHANISM

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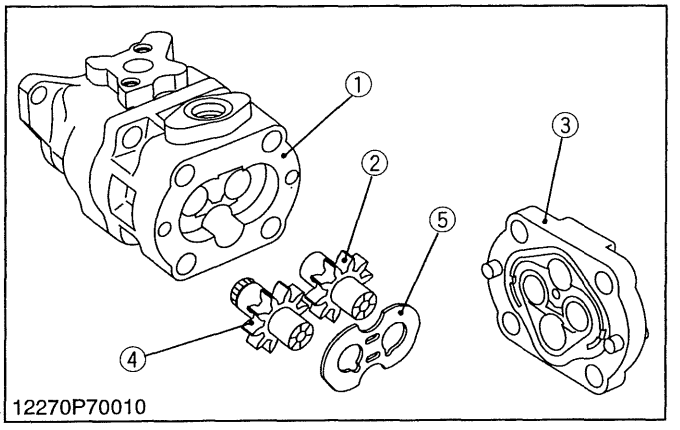
[1] HYDRAULIC PUMP 7-M1
[2] HYDRAULIC CIRCUIT FOR POWER STEERING SYSTEM 7-M2
[3] POWER STEERING BODY 7-M3
[4] OIL FLOW 7-M4

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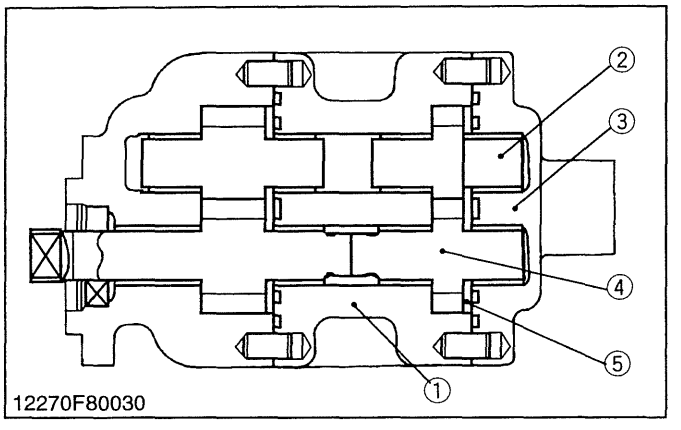


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[1] HYDRAULIC PUMP



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The hydraulic pump is composed of the casing (1), cover (3), side plate (5), and two spur gears (drive gear (4) and driven gear (2)) that are in mesh.

Hydraulic pump is driven by the fuel camshaft.

Maximum displacement is as follows.

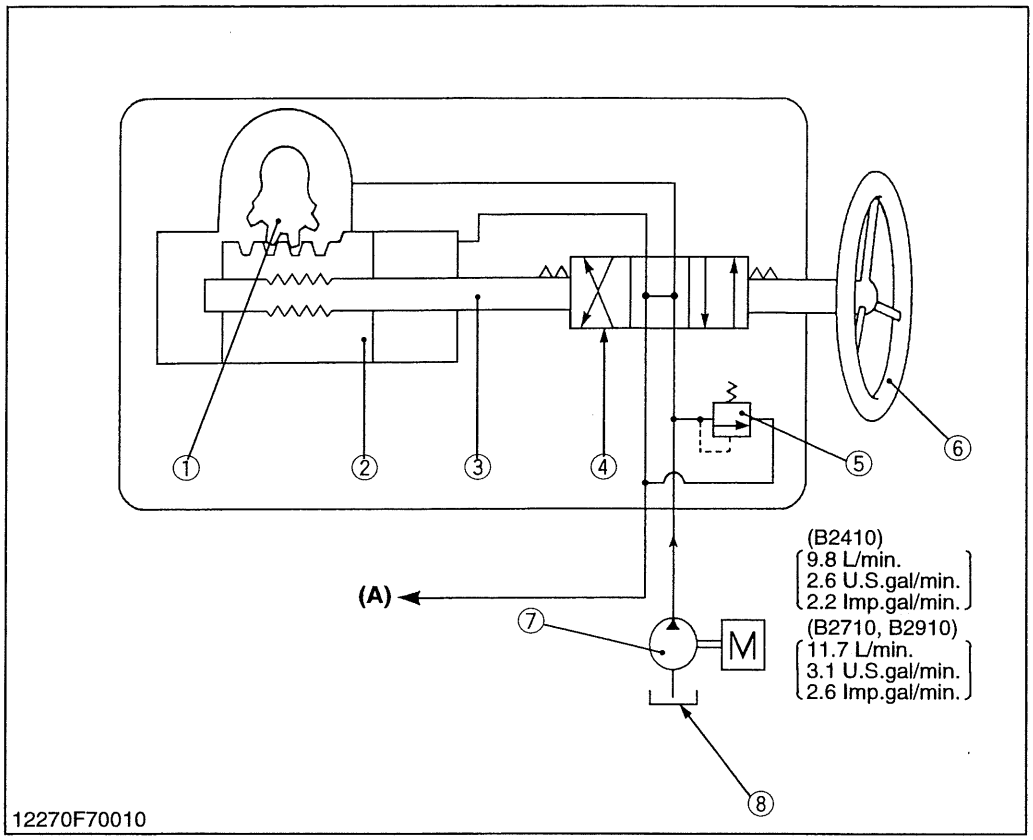
	Displacement	Engine speed	Condition
B2410	9.8 L/min. 2.6 U.S.gal/min. 2.2 Imp.gal/min.	At 2600 rpm	at no load
B2710 B2910	11.7 L/min. 3.1 U.S.gal/min. 2.6 Imp.gal/min.		

(1) Casing
(2) Driven Gear
(3) Cover
(4) Drive Gear
(5) Side Plate

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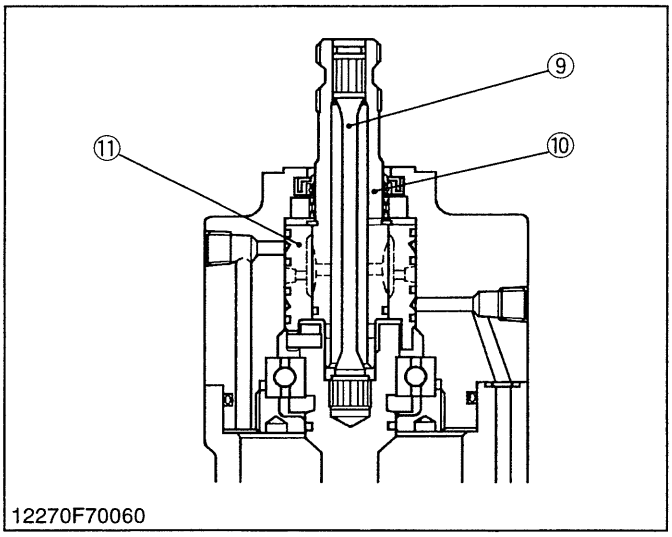
[2] HYDRAULIC CIRCUIT FOR POWER STEERING SYSTEM



12270F70010

(1) Sector Gear Shaft
(2) Rack (Piston)
(3) Worm Shaft
(4) Control Valve
(5) Relief Valve
(6) Steering Wheel
(7) Pump
(8) Transmission Case

(A) Return Suction Line and Front Transmission Case



12270F70060

(9) Torsion Bar
(10) Stub Shaft (Spool)
(11) Sleeve

All models are equipped with integral type power steering that of rotary type control valve with torsion bar. (Note that this torsion bar doubles as a centering spring)

The mechanical gear section operates in the same way as ordinary manual steering system.

The input shaft (stub shaft) (10) and the worm shaft (3), which can separate from each other, are jointed together via a torsion bar (9). One end of the torsion bar is fixed by a pin with the stub shaft (10), where as the other end is press fitted to the end of the worm shaft (3).

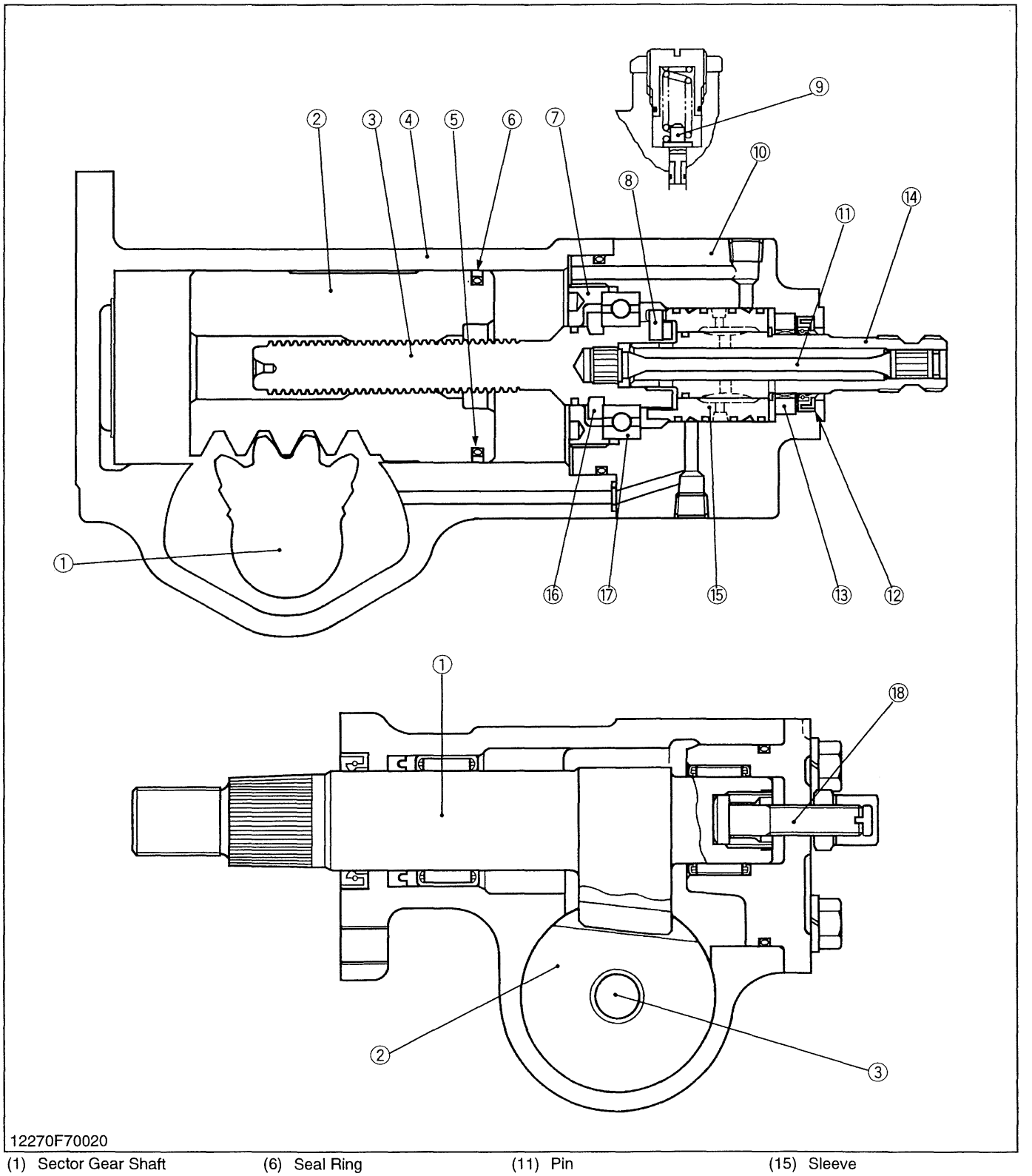
The control valve (4) consists of a sleeve (11) and a spool (10). The sleeve is coupled by a pin to the worm shaft (3), and the spool is provided on the stub shaft (10).

When a turning torque in either direction is given to the stub shaft (10), the counterforce of the tires is produced from the sector gear shaft (1) through the drag link, pitman arm and other parts. The torsion bar (9) then gets under torsional force. In this way, the positional relation between the sleeve (11) and spool (10) changes, thereby switching the direction of the oil flowing into the right and left cylinders.

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[3] POWER STEERING BODY



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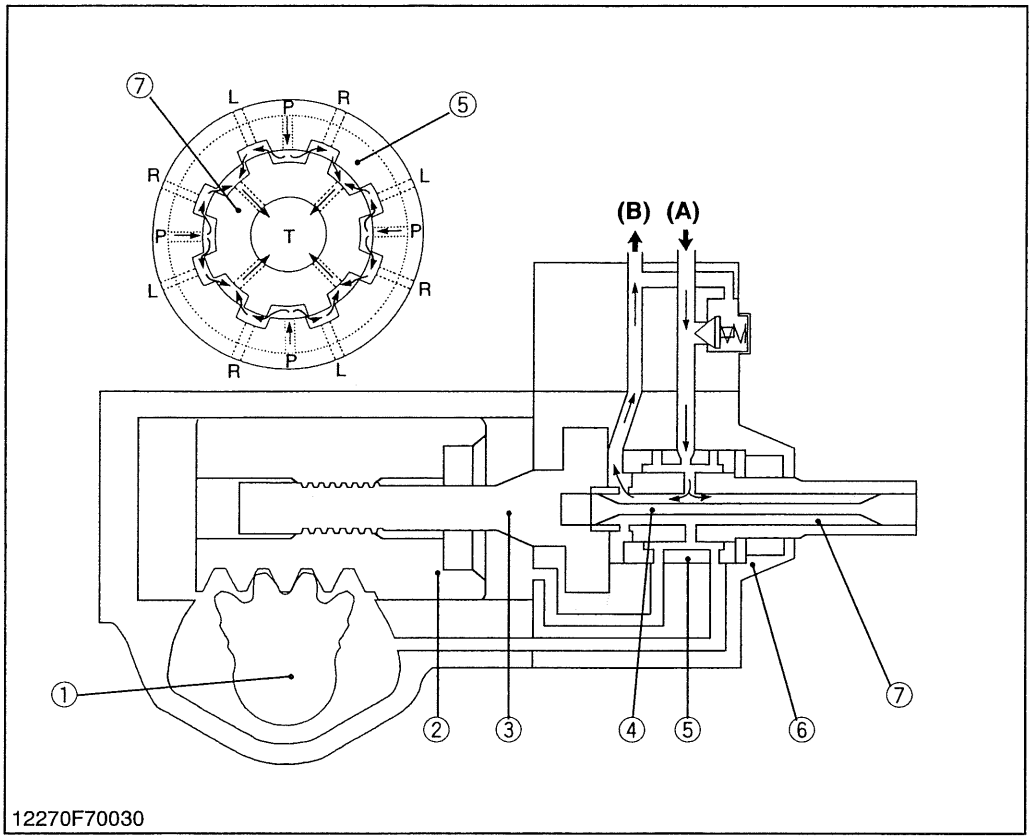
(1) Sector Gear Shaft
(2) Rack (Piston)
(3) Worm Shaft
(4) Gear Case
(5) O-ring
(6) Seal Ring
(7) Plug
(8) Relief Valve
(9) Valve Housing
(10) Torsion Bar
(11) Pin
(12) Oil Seal
(13) Bearing
(14) Stub Shaft
(15) Sleeve
(16) Staking Ring
(17) Ball Bearings
(18) Adjusting Screw for Play

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[3] OIL FLOW

■ Neutral Position



12270F70030

(1) Sector Gear Shaft
(2) Rack (Piston)
(3) Worm Shaft
(4) Torsion Bar
(5) Sleeve
(6) Valve Housing
(7) Stub Shaft (Spool)

(A) From Pump
(B) Return Suction Line

P : Pump Port
T : Return Port
L : Cylinder L Port
R : Cylinder R Port

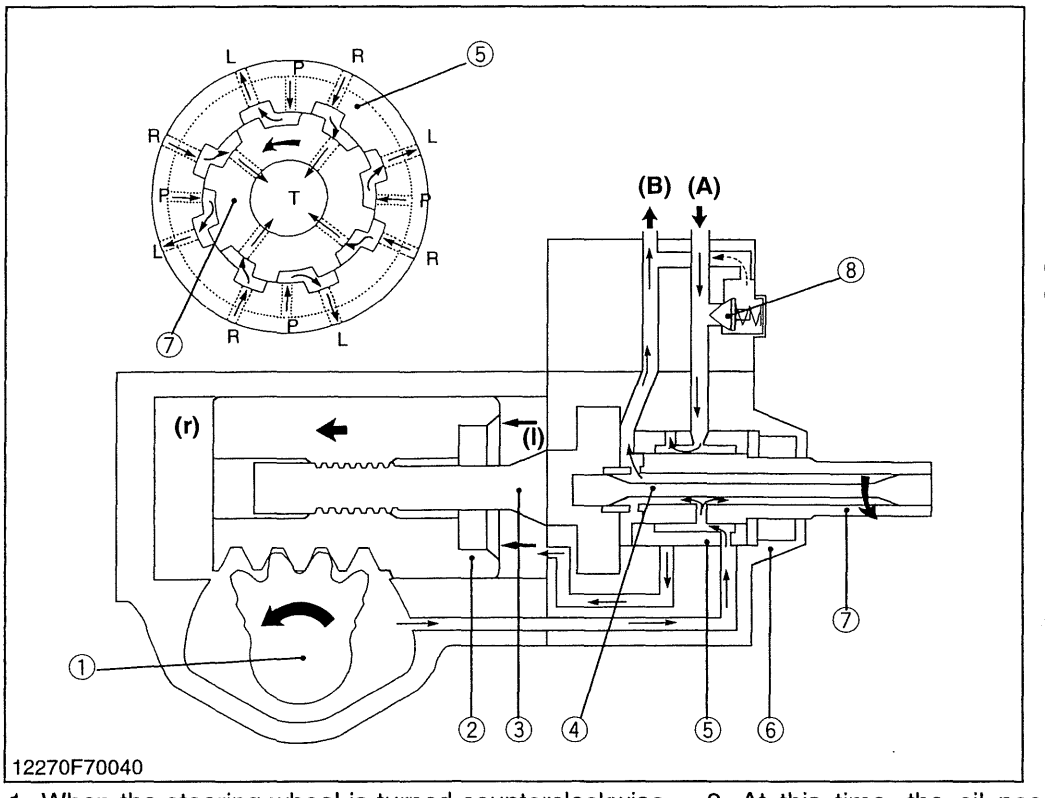
When the steering wheel is not turned, there is no relative displacement between stub shaft (7) and worm shaft (3). And spool part of the stub shaft (7) and sleeve (5) are placed in the neutral position.

Therefore, pressure-fed oil from pump flows to return line through the clearance between spool and sleeve. As a result pressure in the cylinder does not rise, so the front wheels keep the direction.

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■ Left Turning



12270F70040

(1) Sector Gear Shaft
(2) Rack (Piston)
(3) Worm Shaft
(4) Torsion Bar
(5) Sleeve
(6) Valve Housing
(7) Stub Shaft (Spool)
(8) Relief Valve

(A) From Pump
(B) Return Suction Line

(l) Chamber "l"
(r) Chamber "r"

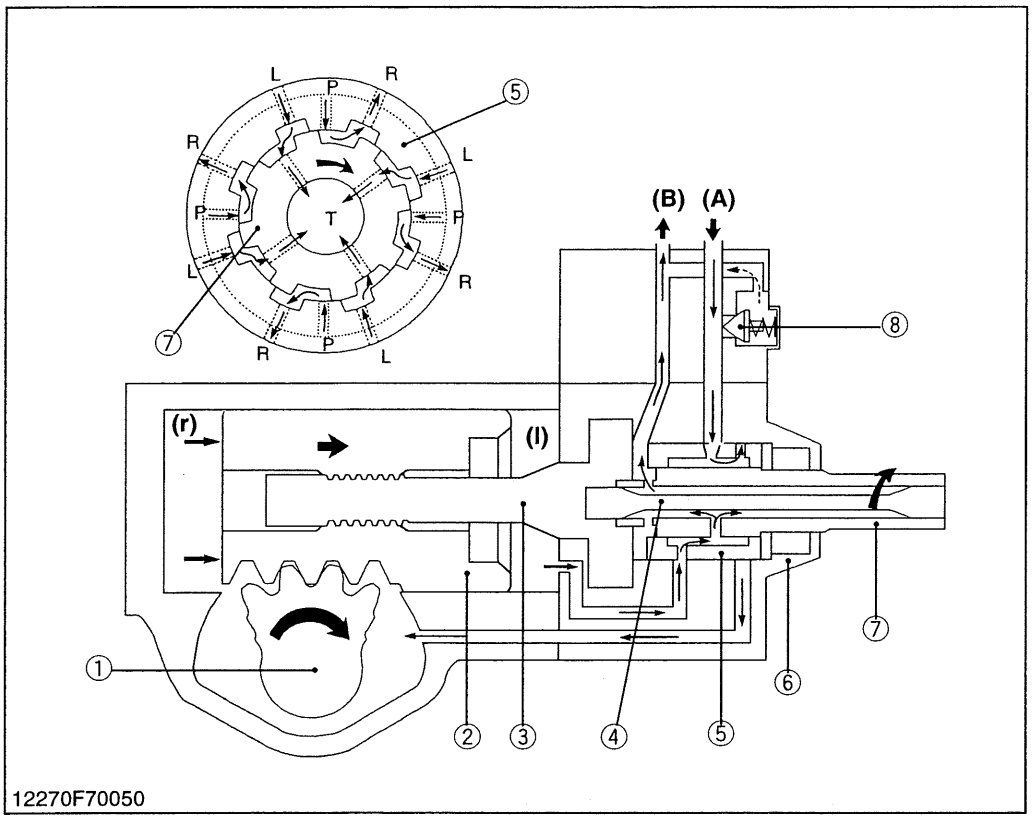
P : Pump Port
T : Return Port
L : Cylinder L Port
R : Cylinder R Port

1. When the steering wheel is turned counterclockwise, the stub shaft (7) starts turning, but the sector gear shaft (1), rack (piston) (2) and worm shaft (3) remain motionless under the load of the tires.
   This means that the torsion bar (4) gets under torsional force and that stub shaft (7) and the worm shaft (3) start turning in a relative displacement, the spool part of the stub shaft (7) turns counterclockwise with respect to the sleeve (5).
2. At this time, the oil passage from pump port **P** to cylinder port **R** and return port **T** are closed. At the same time, the oil passage from pump port **P** to cylinder port **L** is opened.
   Therefore, the pressure-fed oil from pump flows to the chamber **"l"** through cylinder port **L**. Thus, the rack (piston) (2) is pushed, and the sector gear shaft (1) is rotated in the direction of the arrow.
3. On the other hand, oil in the chamber **"r"** flows to return line through the cylinder port **R** and return port **T**.

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■ Right Turning



12270F70050

(1) Sector Gear Shaft
(2) Rack (Piston)
(3) Worm Shaft
(4) Torsion Bar
(5) Sleeve
(6) Valve Housing
(7) Stub Shaft (Spool)
(8) Relief Valve

(A) From Pump
(B) Return Suction Line

(l) Chamber "l"
(r) Chamber "r"

P : Pump Port
T : Return Port
L : Cylinder L Port
R : Cylinder R Port

Operation mechanism for left turning is the same as that for right turning, except for directions of oil flow from and to the cylinder ports.

12270M70050

■ Manual Operation

(When Engine Stops or Hydraulic Circuit Troubles)

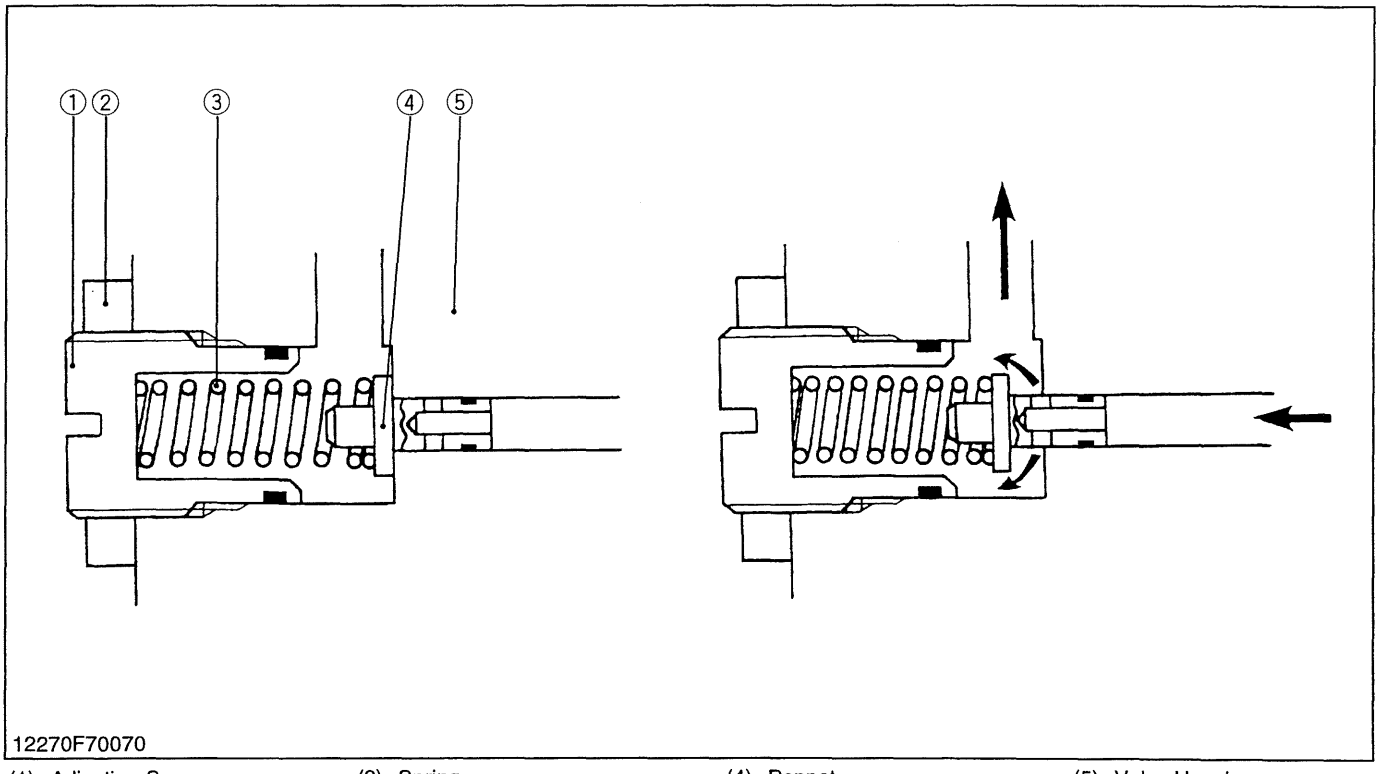
Even when the engine stops or hydraulic circuit malfunctions thus leading to hydraulic operation stop, manual operation is possible. However, naturally, steering wheel requires a larger operating power.

If the steering wheel is turned when hydraulic circuit ceases to operate, the worm shaft (3) which is connected with stub shaft (7) moves slightly by steering force, then the worm shaft (3) and rack (piston) (2) have same relationship with the manual steering gear.

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■ Operation of Relief Valve



12270F70070

(1) Adjusting Screw
(2) Lock Nut
(3) Spring
(4) Poppet
(5) Valve Housing

This power steering is equipped with a direct-acting relief valve to restrict the maximum pressure in the hydraulic circuit and to prevent breakage of the hydraulic equipment.

When the pressure in the hydraulic circuit exceeds the relief valve setting pressure in such a case that the maximum steering angle of the front wheels is reached or road resistance to the front tires is too great, the spring (3) is compressed to generate a gap between the poppet (4) and the valve housing (5). The pressure-fed oil flows to tank port through the gap so that pressure rise is restricted.

The relief valve setting pressure can be adjusted by turning the adjusting screw (1).

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SERVICING

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TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Excessive Steering Wheel Play	• Backlash between sector gear shaft and rack (piston) too large	Adjust	7-S12
	• Steering linkage worn	Replace	–
	• Sector gear shaft worn	Replace	7-S10
Tractor Pulls to Right or Left	• Tire pressure uneven	Adjust	G-38
	• Steering wheel play too small	Adjust	7-S12
	• Improper toe-in adjustment	Adjust	G-23
Front Wheels Vibration	• Steering linkage worn	Replace	–
	• Improper toe-in adjustment	Adjust	G-23
Hard Steering	• Transmission fluid improper or insufficient	Change	G-8
	• Oil leak from pipe joint	Retighten	–
	• Hydraulic pump malfunctioning	Replace	7-S5
	• Improper relief valve adjustment	Adjust	7-S7
	• Relief valve malfunctioning	Replace	7-S11
	• Valve housing and sleeve malfunctioning	Replace	7-S11
	• Seals in the steering gear box damaged	Replace	–
	• Backlash between sector gear shaft and rack (piston) too small	Adjust	7-S12
	• Air in the hydraulic pipes	Air vent	–
Low Operating Pressure	• Hydraulic pump malfunctioning	Replace	7-S5
	• Improper relief valve adjustment	Adjust	7-S7
	• Relief valve malfunctioning	Replace	7-S11
	• Seals in the steering gear box damaged	Replace	–
	• Rack (piston) malfunctioning	Replace rack (piston) assembly	7-S11
	• Oil leak from pipe or pipe broken	Replace	–
Steering Wheel Does Not Return to Neutral Position	• Valve housing and sleeve jammed	Repair or Replace	7-S11
	• Valve housing oil seal damaged	Replace	–
Steering Force Fluctuates	• Insufficient oil	Replenish	G-8
	• Insufficient bleeding	Bleed	–
	• Control valve malfunctioning	Replace	7-S11
Noise	• Insufficient oil	Replenish	G-8
	• Air sucked in pump from suction circuit	Repair	–
	• Pipe deformed	Replace	–

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SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
[Hydraulic Pump] Pump Delivery at Engine 2600 rpm, Oil Temperature 50 °C, 122 °F	at no pressure	[B2410] 9.8 L/min. 2.6 U.S.gal/min. 2.2 Imp.gal/min.	–
		[B2710, B2910] 11.7 L/min. 3.1 U.S.gal/min. 2.6 Imp.gal/min.	–
	at 11.3 to 12.3 MPa 115 to 125 kgf/cm^2 1636 to 1778 psi	[B2410] 8.3 L/min. 2.2 U.S.gal/min. 1.8 Imp.gal/min.	–
		[B2710, B2910] 10.0 L/min. 2.6 U.S.gal/min. 2.2 Imp.gal/min.	–
Gear to Casing	Clearance	–	0.15 mm 0.0059 in.
Gear Shaft to Bushing	Clearance	0.020 to 0.091 mm 0.0008 to 0.0036 in.	0.12 mm 0.0047 in.
Gear Shaft	O.D.	14.970 to 14.980 mm 0.5894 to 0.5898 in.	–
Bushing	I.D.	15.000 to 15.061 mm 0.5906 to 0.5930 in.	–
Side Plate	Thickness	2.48 to 2.50 mm 0.0976 to 0.0984 in.	2.40 mm 0.0945 in.

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Item		Factory Specification	Allowable Limit
Steering Wheel	Play	5.0 to 30.0 mm 0.2 to 1.2 in.	–
	Operation Force Condition : • Engine Speed ; Approx. 2600 rpm	Less than 10 N 1.2 kgf 2.2 lbs	–
Relief Valve	Setting Pressure Condition : • Engine Speed ; Approx. 2600 rpm • Oil Temperature ; 45 to 55 °C 113 to 131 °F	11.3 to 12.3 MPa 115 to 125 kgf/cm^2 1636 to 1778 psi	–
Steering Gear Box to Rack (Piston)	Clearance	0.030 to 0.079 mm 0.0012 to 0.0031 in.	0.14 mm 0.0055 in.
Gear Box Bore	I.D.	61.000 to 61.030 mm 2.4016 to 2.4028 in.	–
Rack (Piston)	O.D.	60.951 to 60.970 mm 2.3996 to 2.4004 in.	–
Rack (Piston) Assembly	Axial Play	0 to 0.02 mm 0 to 0.00079 in.	0.04 mm 0.00157 in.
Valve Housing to Sleeve	Clearance	0.17 to 0.28 mm 0.0067 to 0.0110 in.	0.40 mm 0.0157 in.
Sleeve	O.D.	35.77 to 35.83 mm 1.4083 to 1.4106 in.	–
Valve Housing	I.D.	36.00 to 36.05 mm 1.4173 to 1.4193 in.	–
Sector Gear Shaft to Rack (Piston)	Backlash Deflection measured at pitman arm end	Less than 0.30 mm 0.0118 in.	–

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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.)

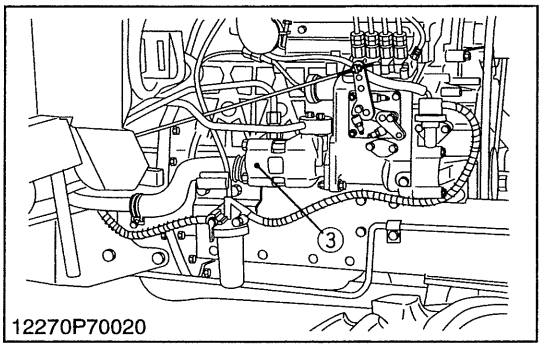
Item	N·m	kgf·m	ft-lbs
Pitman arm mounting nut	117.7 to 147.1	12.0 to 15.0	86.8 to 108
Oil cooler pipe nut	50 to 58	5.1 to 5.9	36.9 to 42.8
Power steering assembly mounting screw	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Power steering delivery pipe nut	65.0 to 75.0	6.6 to 7.7	47.9 to 55.3
Steering wheel mounting nut	29.4 to 49.0	3.0 to 5.0	21.7 to 36.2
Steering column mounting screw	17.7 to 20.6	1.8 to 2.1	13.1 to 15.1
Valve housing mounting hex head screw	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2
Side cover mounting screw	19.6 to 29.4	2.0 to 3.0	14.5 to 21.7
Relief pressure adjusting screw lock nut	49.1 to 78.5	5.0 to 8.0	36.2 to 57.8
Plug	8.8 to 10.8	0.9 to 1.1	6.5 to 8.0

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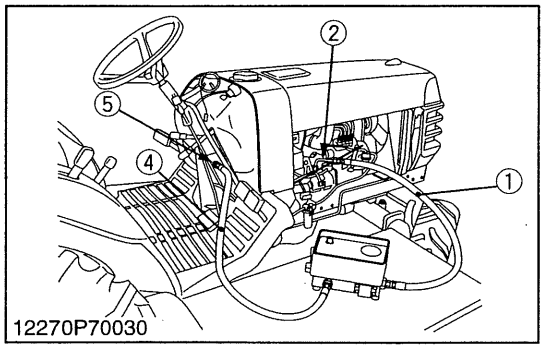
CHECKING, DISASSEMBLING AND SERVICING

[1] HYDRAULIC PUMP

CHECKING AND ADJUSTING



12270P70020



12270P70030

Flowmeter Connecting and Test Preparation

■ **IMPORTANT**

- **When using a flowmeter other than KUBOTA specified flowmeter (Code No: 07916-52792), be sure to use the instructions with that flowmeter.**
- **In this hook-up, there is no relief valve. Therefore while testing, do not close the flowmeter loading valve completely.**

1. Remove the steering wheel, meter panel and panel under cover.
2. Remove the power steering delivery pipe and pipe joint of **IN** port of power steering body.
3. Set the adaptor **66** (2) to the hydraulic pump (3).
4. Install the adaptor **69** (5) to the **IN** port of power steering body.
5. Connect the hydraulic test hose (1) (Code No: 07916-52651) to the adaptor **66** and flowmeter (code No: 07916-52791) inlet port.
6. Connect the another hydraulic test hose (4) to flowmeter outlet port and **IN** port of power steering body.
7. Open the flowmeter loading valve completely. (Turn counterclockwise)
8. Start the engine and set the engine speed at **2600 rpm**.
9. Slowly close the loading valve to generate the pressure **approx. 12.3 MPa (125 kgf/cm^2, 1778 psi)**.
10. Hold in this condition until oil temperature reaches approx. 50 °C (122 °F).

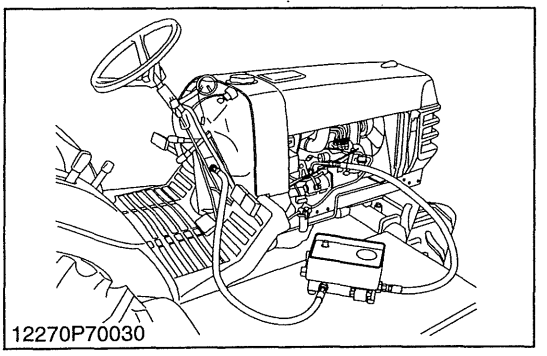
(Reference)

- Adaptor is included in the adaptor set (Code No: 07916-54031).

(1) Hydraulic Test Hose
(2) Adaptor **66**
(3) Hydraulic Pump
(4) Hydraulic Test Hose
(5) Adaptor **69**

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Condition

- Engine speed .....Approx. 2600 rpm
- Rated pressure .....12.3 MPa
  125 kgf/cm^2
  1778 psi
- Oil temperature .....50 °C
  122 °F

Pump Test

■ **NOTE**

- **Before pump testing, perform the flowmeter connecting and test preparation. (See page 8-S4.)**

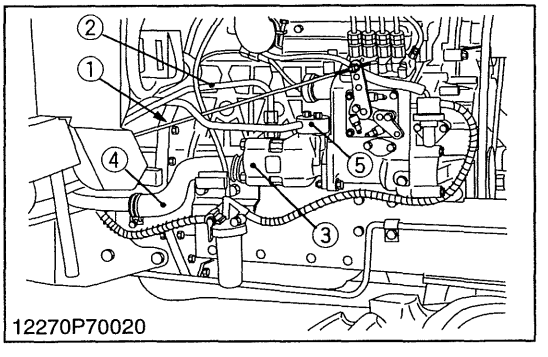
1. Open the loading valve completely.
2. Start the engine and set at approx. 2600 rpm.
3. Read and note the pump delivery at no pressure.
4. Slowly close the loading valve to increase pressure approx. 12.7 MPa (130 kgf/cm^2, 1849 psi).
5. Read and note the pump flow at rated pressure.
6. Open the loading valve and stop the engine.

(Reference)

Hydraulic pump delivery at no pressure	Factory spec.	B2410	9.8 L/min. 2.6 U.S.gal/min. 2.2 Imp.gal/min.
		B2710 B2910	11.7 L/min. 3.1 U.S.gal/min. 2.6 Imp.gal/min.
Hydraulic pump delivery at rated pressure	Factory spec.	B2410	8.3 L/min. 2.2 U.S.gal/min. 1.8 Imp.gal/min.
		B2710 B2910	10.0 L/min. 2.6 U.S.gal/min. 2.2 Imp.gal/min.

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DISASSEMBLING AND ASSEMBLING



12270P70020

Removing Hydraulic Pump

1. Open the bonnet then remove the grille side cover (RH) and disconnect the battery grounding cord.
2. Disconnect the connector of the engine stop solenoid (3) and accelerator rod (1).
3. Disconnect the power steering delivery pipe (2) and 3-point hitch delivery pipe (6).
4. Disconnect the suction hose (5) and remove the hydraulic pump (4).

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to engine stop solenoid.

■ **NOTE**

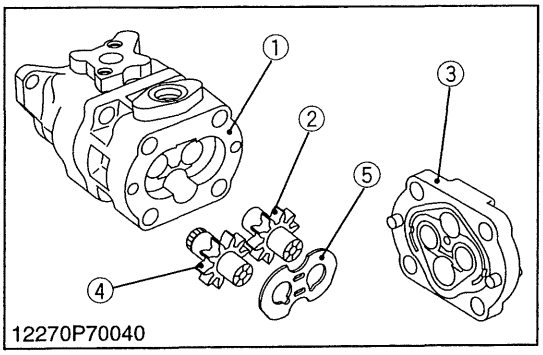
- **For fastening hydraulic pipe nut, use two wrenches. Hold the fitting with a wrench, turn the pipe nut another wrench to avoid damage at fitting installed part.**

Tightening torque	Delivery pipe nut for power steering	65 to 75 N·m 6.6 to 7.7 kgf·m 47.9 to 55.3 ft-lbs

(1) Accelerator Rod
(2) Power Steering Delivery Pipe
(3) Engine Stop Solenoid
(4) Hydraulic Pump
(5) Suction Hose
(6) 3-Point Hitch Delivery Pipe

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Cover, Side Plate and Gear

1. Secure the hydraulic pump with a vise, and remove the cover (3).
2. Remove the side plate (5).
3. Remove the drive gear (4) and driven gear (2) from the casing (1).

(When reassembling)

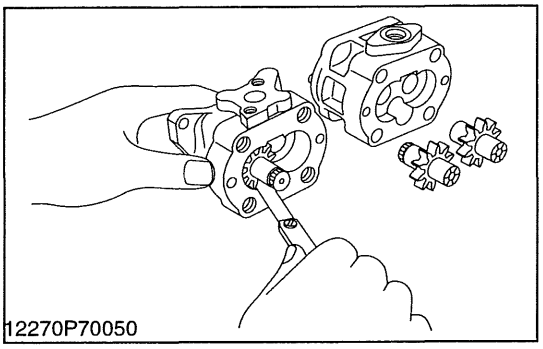
- Take care not to damage the O-ring.
- Align the holes of the cover and casing.
- Install the side plate, noting its location and direction.
- Install the gears, noting its direction.

Tightening torque	Cover mounting screw	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs

(1) Casing
(2) Driven Gear
(3) Cover
(4) Drive Gear
(5) Side Plate

12270S70080

SERVICING

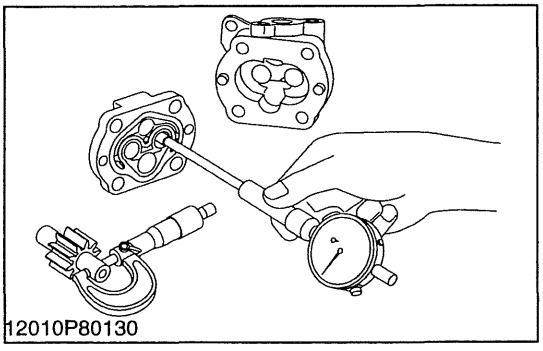

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Clearance between Tip of Gear Tooth and Casing

1. Measure the gear O.D. with an outside micrometer.
2. Measure the casing I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace the assembly.

Clearance between tip of gear tooth and casing	Allowable limit	0.15 mm 0.0059 in.

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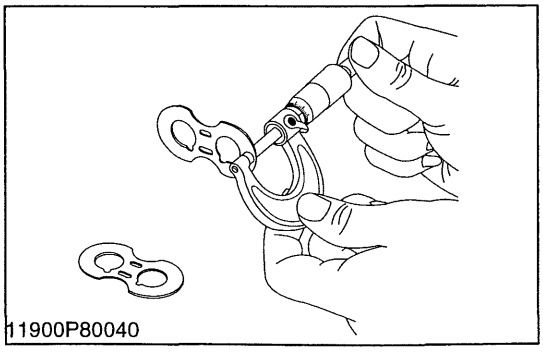

12010P80130

Clearance between Bushing and Shaft

1. Measure the shaft O.D. with an outside micrometer.
2. Measure the bushing I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace it.

Clearance between bushing and shaft	Factory spec.	0.020 to 0.091 mm 0.0008 to 0.0036 in.
	Allowable limit	0.12 mm 0.0047 in.
Shaft O.D.	Factory spec.	14.970 to 14.980 mm 0.5894 to 0.5898 in.
Bushing I.D.	Factory spec.	15.000 to 15.061 mm 0.5906 to 0.5930 in.

12010S80110


11900P80040

Side Plate Thickness

1. Measure the side plate thickness with an outside micrometer.
2. If the thickness is less than the allowable limit, replace it.

Side plate thickness	Factory spec.	2.48 to 2.50 mm 0.0976 to 0.0984 in.
	Allowable limit	2.40 mm 0.0945 in.

11900S80110

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[2] POWER STEERING

CHECKING

■ **IMPORTANT**

- **Use only the transmission fluid (See page G-8), in no case use mixture of oils of different brands.**
- **Do not disassemble the hydraulic pump and power steering needlessly.**
- **After installing or reassembling the power steering hydraulic components, be sure to bleed air.**

(Bleeding)

- Start the engine, then turn the steering wheel slowly in both directions all the way alternately several times, and stop the engine.

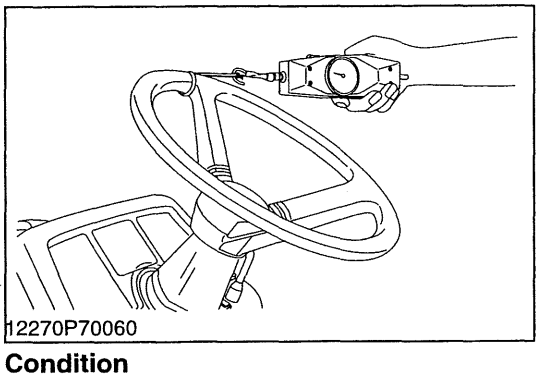
12010S70040

Steering Wheel Play

1. Refer to the backlash between sector gear shaft and rack (piston) on page 7-S12.

Power steering wheel play	Reference value	5.0 to 30.0 mm 0.2 to 1.2 in.

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12270P70060

Steering Wheel Operating Force

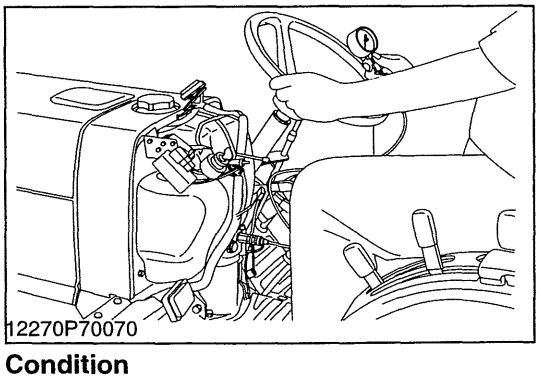
Condition

- Engine speed .....Approx. 2600 rpm
- Oil temperature .....45 to 55 °C
  113 to 131 °F
- Tractor by itself
  (without any implement and weight)

1. Park the tractor on flat concrete place.
2. Start the engine. After warming up, set the engine speed at **approx. 2600 rpm**.
3. Set a spring balance to the steering wheel to measure the operating force.
4. If the measurement exceeds the factory specification, check the suction line, delivery line, and the performance of hydraulic pump.
   And then, check the power steering assembly.

Steering wheel operating force	Factory spec.	Less than 10 N 1.2 kgf 2.2 lbs

12270S70100


12270P70070

Relief Valve Setting Pressure

Condition

- Engine speed .....Approx. 2600 rpm
- Oil temperature .....45 to 55 °C
  113 to 131 °F

1. Open the bonnet and disconnect the battery grounding cord.
2. Remove the meter panel and panel under cover.
3. Remove the plug of power steering body and then set the relief valve pressure tester (use adaptor **D**).
4. Start the engine. After warming up, set the engine speed at approx. 2600 rpm.
5. Fully turn the steering wheel to the left end to read the relief pressure. After reading, stop the engine.
6. If the pressure is not factory specification, check the pump delivery line and adjust the relief valve setting pressure (Refer to 7-S8).

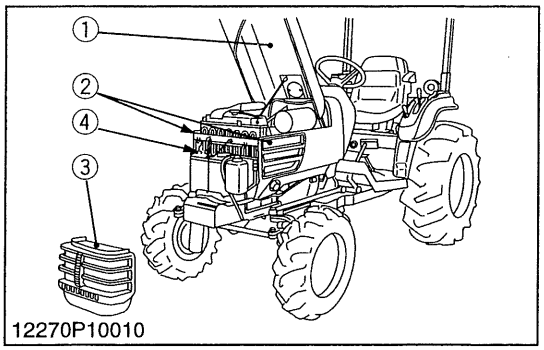
Power steering relief valve setting pressure	Factory spec.	11.3 to 12.3 MPa 115 to 125 kgf/cm^2 1636 to 1778 psi

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DISASSEMBLING AND ASSEMBLING

(1) Separating Power Steering Assembly



12270P10010

Hood, Side Cover and Battery Cord

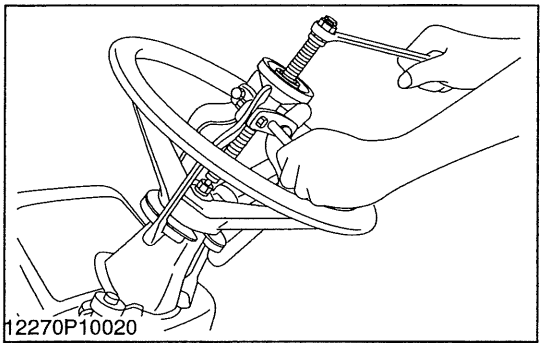
1. Open the hood (1) and remove the front grille (3).
2. Disconnect the battery grounding cord (4).
3. Disconnect the head light connectors and remove the hood and side covers (2).

■ **NOTE**

- **When disconnecting the battery cords, disconnect the grounding cord first. When connecting, positive cord first.**

(1) Hood
(2) Side Cover
(3) Front Grille
(4) Battery Cord

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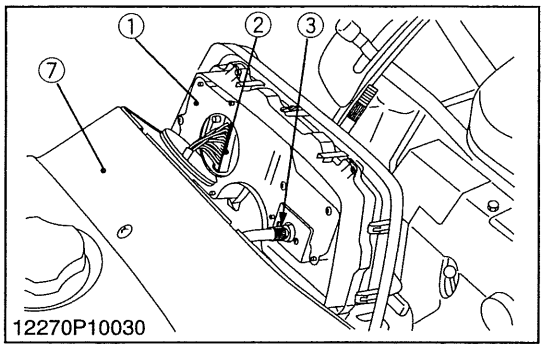
Steering Wheel

1. Remove the steering wheel cap.
2. Remove the steering wheel mounting nut and remove the steering wheel with a steering wheel puller (Code No. 07916-51090).

(When reassembling)

Tightening torque	Steering wheel mounting nut	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft-lbs

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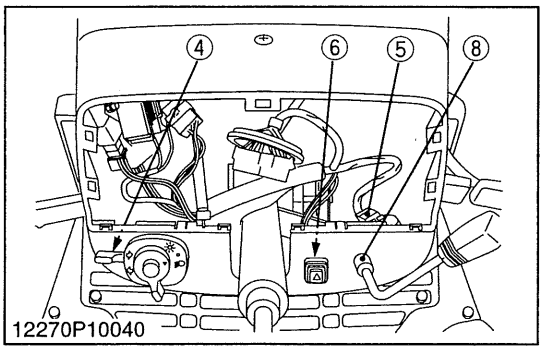


12270P10030

Meter Panel and Panel Under Cover

1. Open the meter panel (1) and disconnect the meter panel connector (2) and hour-meter cable (3). Then remove the meter panel.
2. Disconnect the combination switch connector (4), main switch connector (5) and hazard switch connector (6).
3. Tap out the spring pin and remove the hand accelerator lever (8).
4. Remove the panel under cover (7).

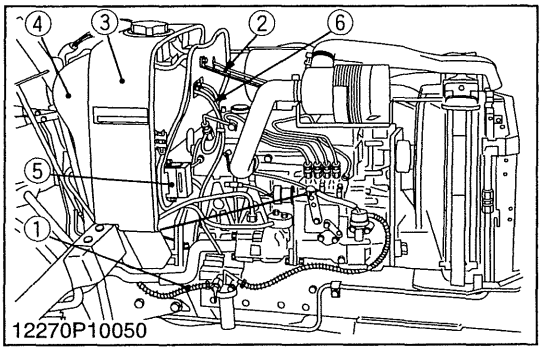
(1) Meter Panel
(2) Meter Panel Connector
(3) Hour-meter Cable
(4) Combination Switch Connector
(5) Main Switch Connector
(6) Hazard Switch Connector
(7) Panel Under Cover
(8) Hand Accelerator Lever



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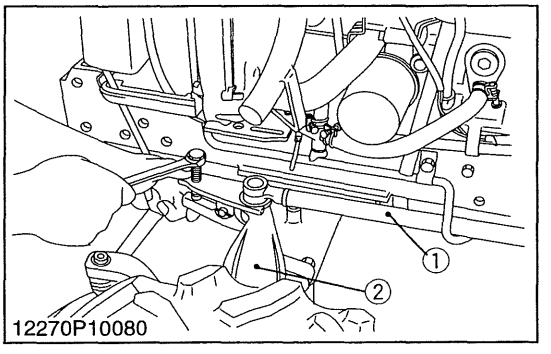


Fuel Tank

1. Disconnect the fuel hose (1) at the fuel filter side, then drain fuel completely.
2. Remove the fuel tank frame stay (2).
3. Disconnect the hazard unit, starter relay and regulator connectors and remove the lead wire for fuel gauge.
4. Remove the fuse box (5).
5. Disconnect the overflow hoses (6) of fuel line.
6. Remove the tank frame (3) with fuel tank (4).

(1) Fuel Hose
(2) Fuel Tank Frame Stay
(3) Fuel Tank Frame
(4) Fuel Tank
(5) Fuse Box
(6) Overflow Hose

12271S70030



Drag Link

1. Remove the cotter pin and loosen the slotted nut.
2. Disconnect the drag link (1) with a pitman arm puller from the knuckle arm (2).

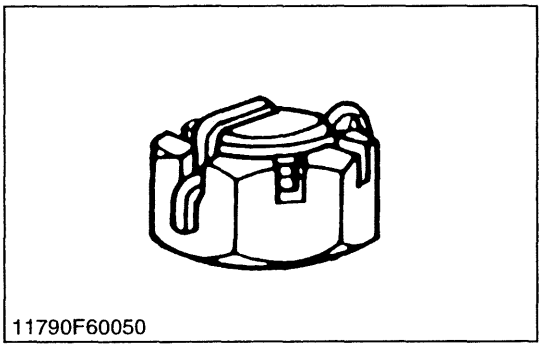
(When reassembling)

■ IMPORTANT

- **Do not loosen the slotted nut to align the hole.**
- **Install the cotter pin as shown in the figure**

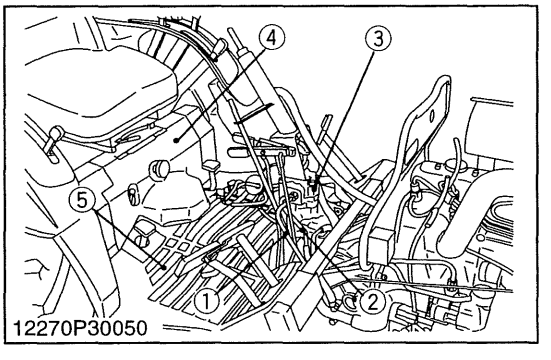
(Reference)

Tightening torque	Slotted nut	17.7 to 34.5 N·m 1.8 to 3.5 kgf·m 13.0 to 25.3 ft-lbs



(1) Drag Link
(2) Knuckle Arm

12270S10170



Power Steering Assembly

1. Remove the seat under cover (4), rubber mat (5) and left hand side step.
2. Remove the power steering delivery pipe (1) and return pipe (2).
3. Disconnect the speed set rod and parking brake rod.
4. Remove the power steering assembly (3) from the center frame.

(When reassembling)

■ NOTE

- **For fastening hydraulic pipe nut, use two wrenches. Hold the fitting with a wrench, turn the pipe nut with another wrench to avoid damage at fitting installed part.**

Tightening torque	Delivery pipe nut for power steering	65 to 75 N·m 6.6 to 7.7 kgf·m 47.9 to 55.3 ft-lbs
	Power steering assembly mounting screw	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs

(1) Power Steering Delivery Pipe
(2) Power Steering Return Pipe
(3) Power Steering Assembly
(4) Seat Under Cover
(5) Rubber Mat

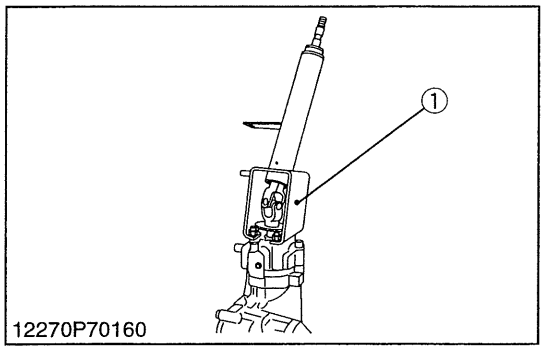
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(2) Disassembling Power Steering Body

■ **NOTE**

- **Carefully clean up the disassembled parts and sub-assemblies with fresh oil. Blow them dry with compressed air.**
- **Replace all the disassembled sealing parts (O-ring, U-seal, oil seal, slipper seal, etc.) with new ones.**
- **Check all the cleaned-up part for scratches, excessive wear, cracks and other defects. Place them in order on a clean workbench. Be also careful to keep off dust and dirt.**

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Steering Column

1. Turn the steering shaft several times to drain oil.
2. Loose the steering column mounting screws, and remove the steering column with steering shaft and universal joint.

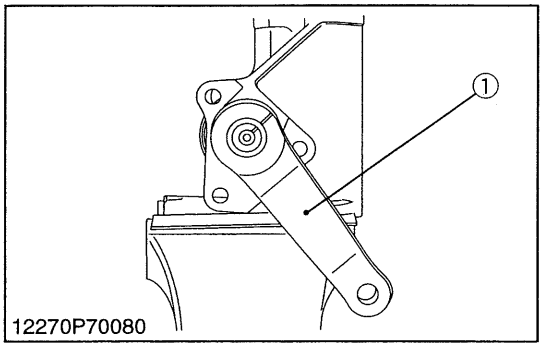
(When reassembling)

- Apply liquid lock (Three Bond 1324B or equivalent) to the steering column mounting screw.

Tightening torque	Steering column mounting screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.1 to 15.1 ft-lbs

(1) Steering Column

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Pitman Arm

1. Remove the pitman arm mounting nut and remove the pitman arm with pitman arm puller (Code No. 07909-39011).

(When reassembling)

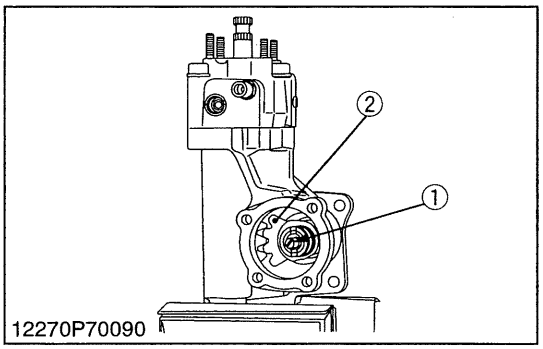
■ **IMPORTANT**

- **Install the pitman arm to the sector gear shaft so that their marks align.**

Tightening torque	Pitman arm mounting nut	117.7 to 147.1 N·m 12.0 to 15.0 kgf·m 86.8 to 108 ft-lbs

(1) Pitman Arm

12270S70120



(1) Adjusting Screw (2) Sector Gear Shaft

Side Cover and Sector Gear Shaft

1. Loosen the lock nut.
2. Remove the side cover mounting screws.
3. Screw in the adjusting screw (1) to remove the side cover.
4. Tap out the sector gear shaft (2) toward the side cover.

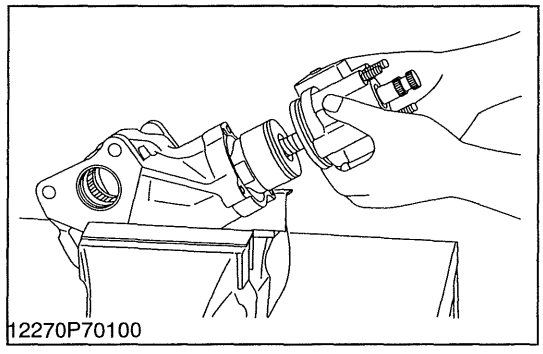
(When reassembling)

- Turn the worm shaft so that the rack (piston) is centered in its travel. Then, install the sector gear shaft so that the center of its teeth engages the center teeth of the rack (piston).
- Be sure to adjust the backlash between sector gear shaft and rack (piston). (See page 7-S12.)

Tightening torque	Side cover mounting screw	19.6 to 29.4 N·m 2.0 to 3.0 kgf·m 14.5 to 21.7 ft-lbs

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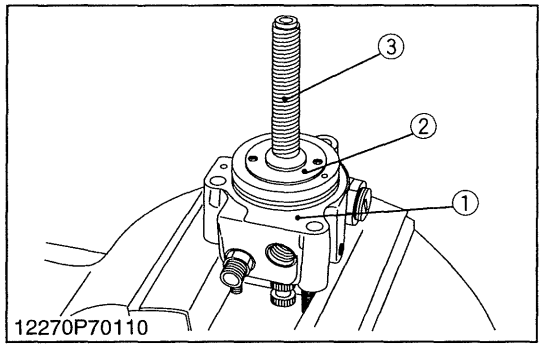
Valve Assembly and Rack (Piston)

1. Remove the valve housing mounting hex. head screws.
2. Draw out the valve assembly and rack (piston) as a unit.

(When reassembling)

Tightening torque	Valve housing mounting hex. head screw	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft-lbs

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12270P70110

(1) Valve Housing
(2) Plug
(3) Worm Shaft

Valve Assembly

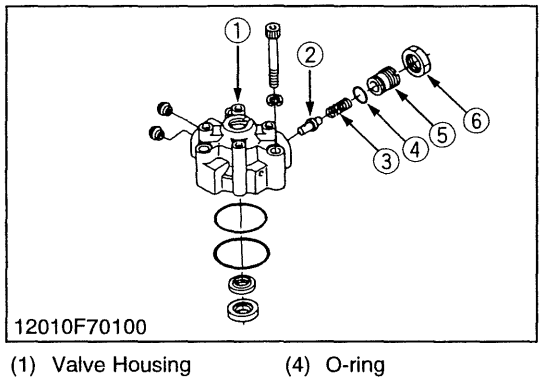
1. Remove the plug (2).
2. Pull out the worm shaft (3) with sleeve and stub shaft from valve housing (1).

(When reassembling)

- When tighten the plug, use the PS plug wrench (Refer to G-40).
- Be sure to tighten the plug to specified torque and staking the plug (2).
  If the plug is tightened to excessive torque, it may cause damage to the thrust races and thrust bearings.

Tightening torque	Plug	8.8 to 10.8 N·m 0.9 to 1.1 kgf·m 6.5 to 8.0 ft-lbs

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(1) Valve Housing
(2) Relief Valve Poppet
(3) Relief Spring
(4) O-ring
(5) Adjusting Screw
(6) Lock Nut

Disassembling Valve Housing

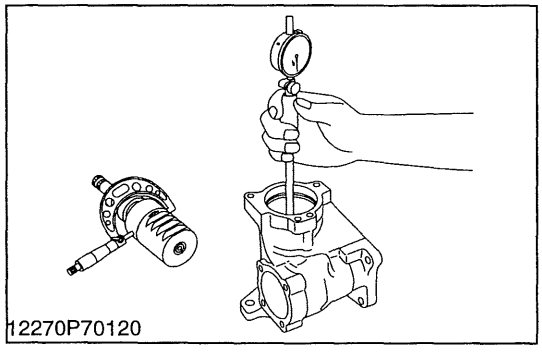
■ IMPORTANT

- **Do not disassemble the relief valve needlessly, since it has been factory-adjusted.**
- **If the relief valve is disassembled, replace the adjusting screw with new one, and after reassembly, be sure to adjust the setting pressure, then stake the adjusting screw with a punch.**

Tightening torque	Relief pressure adjusting screw lock nut	49.1 to 78.5 N·m 5.0 to 8.0 kgf·m 36.2 to 57.8 ft-lbs

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SERVICING

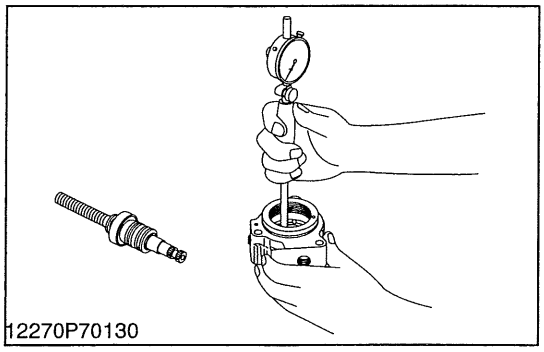

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Clearance between Steering Gear Box and Rack (Piston)

1. Measure the steering gear box cylinder I.D. with a cylinder gauge.
2. Measure the rack (piston) O.D. with an outside micrometer, and calculate this clearance.
3. If the clearance exceeds the allowable limit, replace the steering gear box or rack (piston) assembly.

Clearance between steering gear box and rack (piston)	Factory spec.	0.030 to 0.079 mm 0.0012 to 0.0031 in.
	Allowable limit	0.14 mm 0.0055 in.

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Clearance between Valve Housing and Sleeve

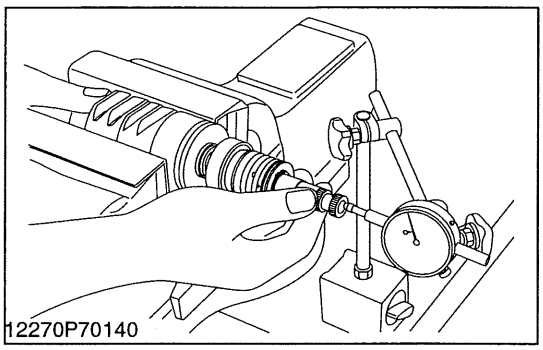
1. Measure the valve housing I.D. with a cylinder gauge and the sleeve O.D. with an outside micrometer, and calculate this clearance.
2. If the clearance exceeds the allowable limit, replace the valve housing or sleeve assembly.

■ IMPORTANT

- **Check to see if the slipper seals of sleeve do not have excessive wear.**

Clearance between valve housing and sleeve	Factory spec.	0.17 to 0.28 mm 0.0067 to 0.0110 in.
	Allowable limit	0.40 mm 0.0157 in.

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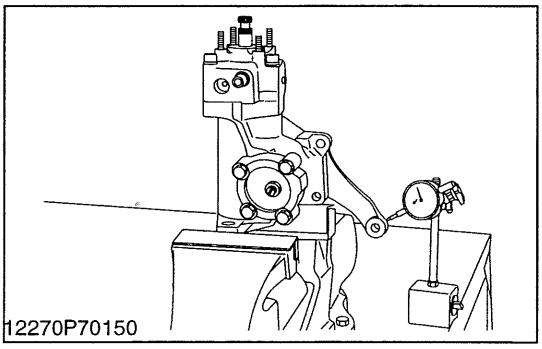

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Axial Play of Rack (Piston) Assembly

1. Secure the rack (piston) assembly in a vise.
2. Set a dial indicator with its finger on the worm shaft of the rack (piston) assembly.
3. Move the worm shaft axially and measure the play.
4. If the play exceeds the allowable limit, replace the rack (piston) assembly.

Axial play of rack (piston) assembly	Factory spec.	0 to 0.02 mm 0 to 0.00079 in.
	Allowable limit	0.04 mm 0.00157 in.

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Backlash between Sector Gear Shaft and Rack (Piston)

1. Attach the pitman arm having no play.
2. Set a dial indicator with its finger on the pitman arm
3. Move the pitman arm lightly, and measure the deflection.
4. If the measurement is not within the factory specification, adjust the backlash with the adjusting screw.

Backlash between sector gear shaft and rack (piston)	Factory spec.	Less than 0.30 mm 0.0118 in.

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MECHANISM

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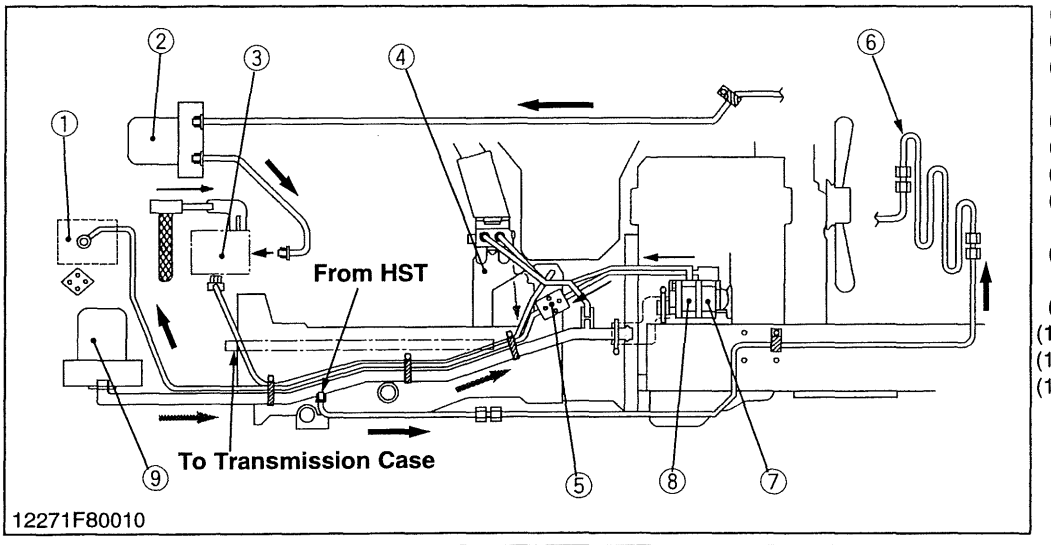
[1] HYDRAULIC CIRCUIT 8-M1
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[3] HYDRAULIC BLOCK TYPE OUTLET 8-M2
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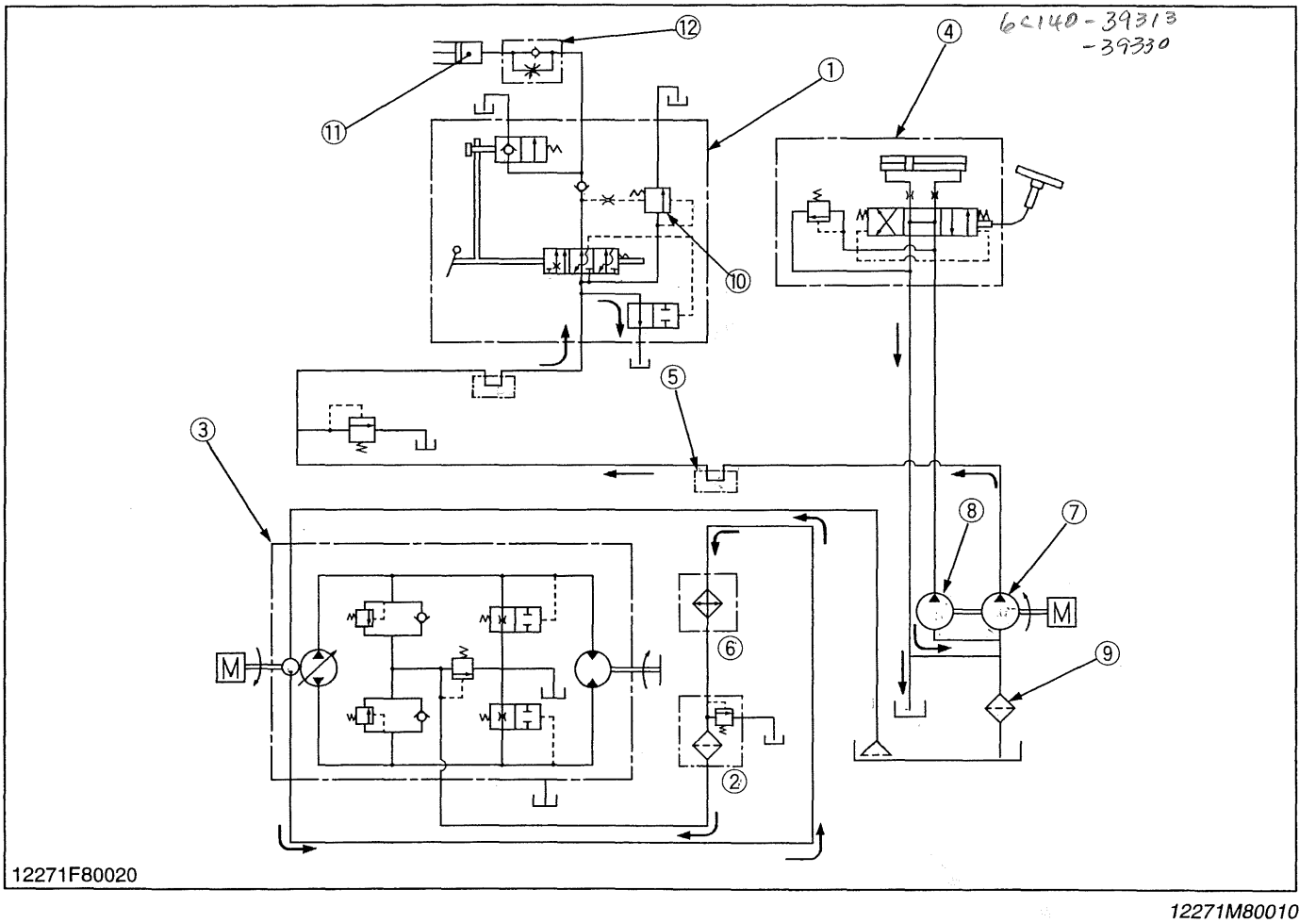
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[1] HYDRAULIC CIRCUIT



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(1) Hydraulic Control Valve
(2) Oil Filter (for HST)
(3) Hydrostatic Transmission (HST)
(4) Power Steering (Controller)
(5) Hydraulic Block Type Outlet
(6) Oil Cooler
(7) Hydraulic Pump (for 3-Point Hitch)
(8) Hydraulic Pump (for Power Steering)
(9) Oil Filter
(10) Relief Valve
(11) Hydraulic Cylinder
(12) Lowering Speed Adjusting Valve



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■ Hydraulic System

The hydraulic system of these tractors are composed of a hydraulic pump, hydraulic block type outlet, control valve, hydraulic cylinder, hydraulic oil filter and other components.

This system has the following functions.

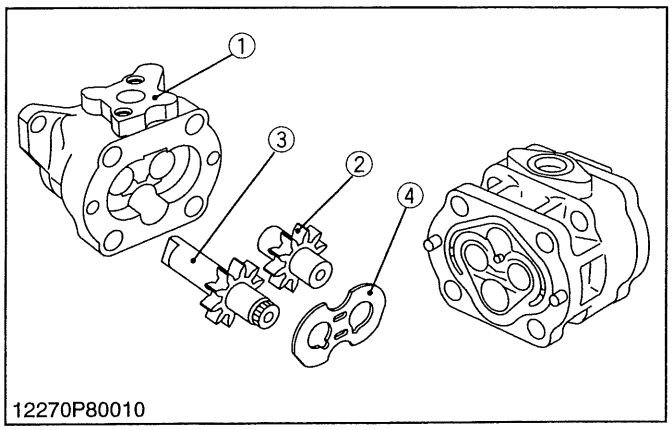
1. Hydraulic power take off from the hydraulic block type outlet to operate the implements such as a front loader, front blade and etc.

- Oil is supplied by a hydraulic pump connected to the engine. When a engine is started, a hydraulic pump starts running, sucks oil from a transmission case. The hydraulic pump forces out the oil to hydraulic block type outlet, control valve and hydraulic cylinder.

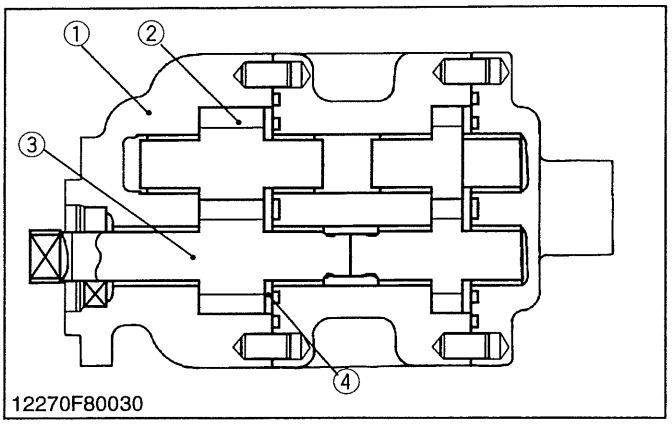
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[2] HYDRAULIC PUMP



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The hydraulic pump is composed of the casing (1), side plate (4), and two spur gears (drive gear (3) and driven gear (2)) that are in mesh.

Hydraulic pump is driven by the fuel camshaft.

Maximum displacement is as follows.

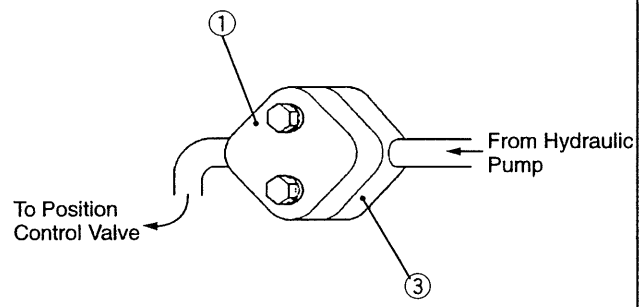
	Displacement	Engine speed	Condition
B2410	16.6 L/min. 4.4 U.S.gal/min. 3.7 Imp.gal/min.	At 2600 rpm	at no load
B2710 B2910	24.4 L/min. 6.4 U.S.gal/min. 5.4 Imp.gal/min.		

(1) Casing
(2) Driven Gear
(3) Drive Gear
(4) Side Plate

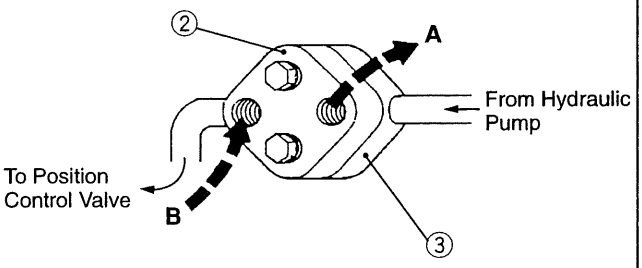
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[3] HYDRAULIC BLOCK TYPE OUTLET

When implement is not attached



When implement is attached



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The hydraulic block type outlet is located at the right hand side of the engine.

This hydraulic block type outlet is provided to take power out from the tractor to operate the hydraulic cylinders on the implement, such as front end loader, front blade and so on.

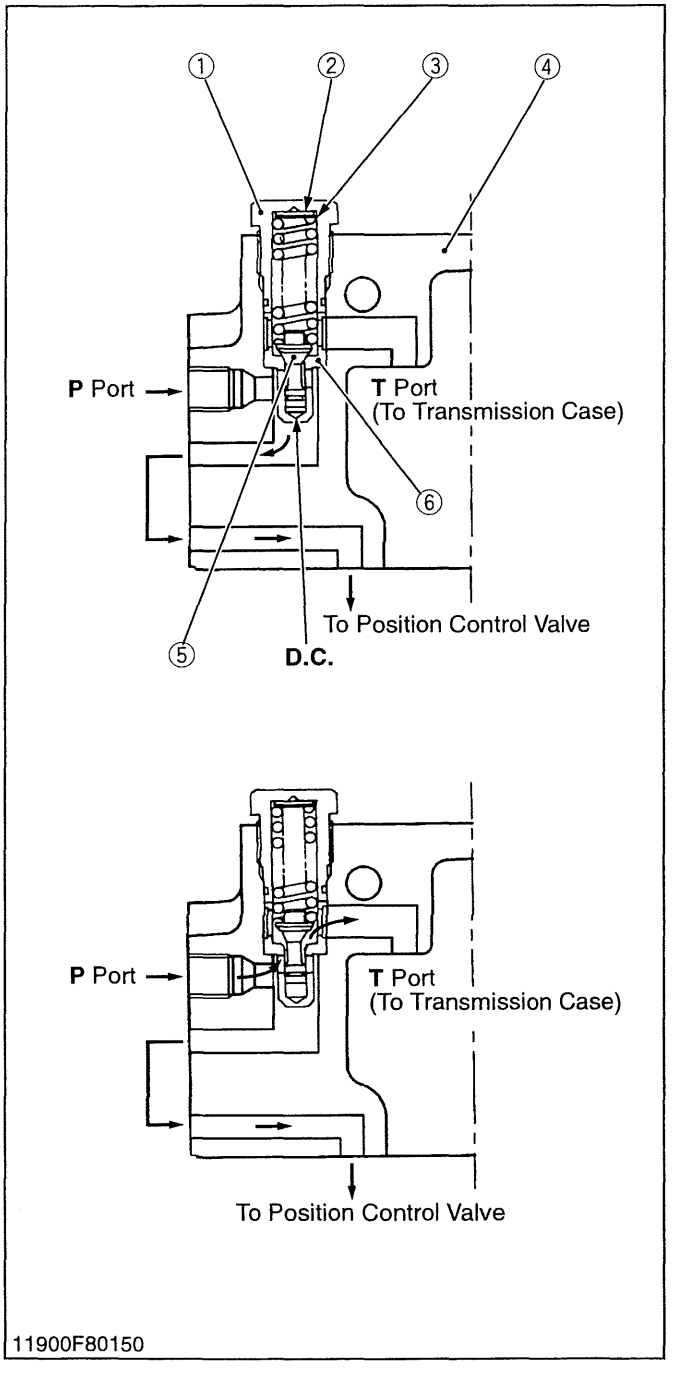
(1) Block Cover
(2) Block Outlet Cover (Option)
(3) Hydraulic Block

(A) To implement (Inlet)
Max. flow 22.4 L/min.
(6.4 U.S.gal/min.,
5.4 Imp.gal/min.)
No relief valve in the hydraulic block.
(B) From implement (Outlet)

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[4] RELIEF VALVE



The implement control system circuit has a relief valve to restrict the maximum pressure in the circuit. The relief valve is located top of the hydraulic cylinder body.

The relief valve is of the guide piston type with damping effect.

Among direct acting relief valves, this type is suited to higher pressure and has large capacity. Furthermore, this type is free from unstable operation, such as chattering, which occurs often in direct acting relief valves.

As shown in the figure, the guide is attached to the poppet (5) and a valve chamber **D.C.** (called the damping chamber) is formed at the bottom of the guide piston. The inlet of the valve leads to the chamber via a clearance between the sliding portion of the guide and the seat (6), minimizing valve vibration with the damping effect of the chamber.

When the oil pressure in the circuit is lower than the setting pressure of the relief valve, the relief valve is not operated and the oil fed to the relief valve from the hydraulic pump flows into the implement control valve.

As the oil pressure in the circuit increases, so does the pressure in the damping chamber **D.C.** When the pressure rises above the valve setting and overcomes the spring force, the valve opens. Oil then flows out to the transmission case through **T** port, preventing any further rise in pressure. The valve closes again when enough oil is released to drop pressure below the valve setting.

(Reference)

- Relief valve setting pressure : 13.2 to 13.7 MPa
  135 to 140 kgf/cm^2
  1920 to 1991 psi
- Engine speed : Maximum
- Oil temperature : 40 to 50 °C
  104 to 122 °F

(1) Plug
(2) Washer
(3) Shim
(4) Hydraulic Cylinder Body
(5) Poppet
(6) Seat

D.C.: Damping Chamber
P : Pump Port
T : Tank Port

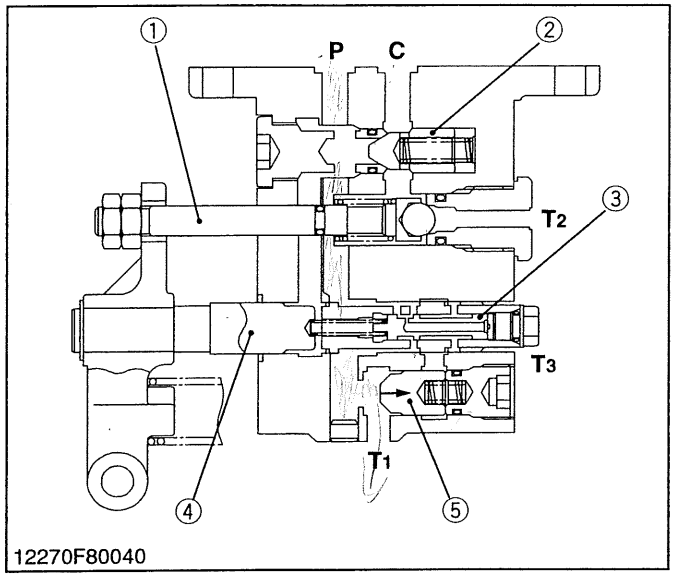
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[5] POSITION CONTROL VALVE

This position control valve is located under the hydraulic cylinder block.

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■ Neutral

Oil forced into the control valve through the **P** port pushes open the unload poppet (5) and then returns to the transmission case through the **T1** port.

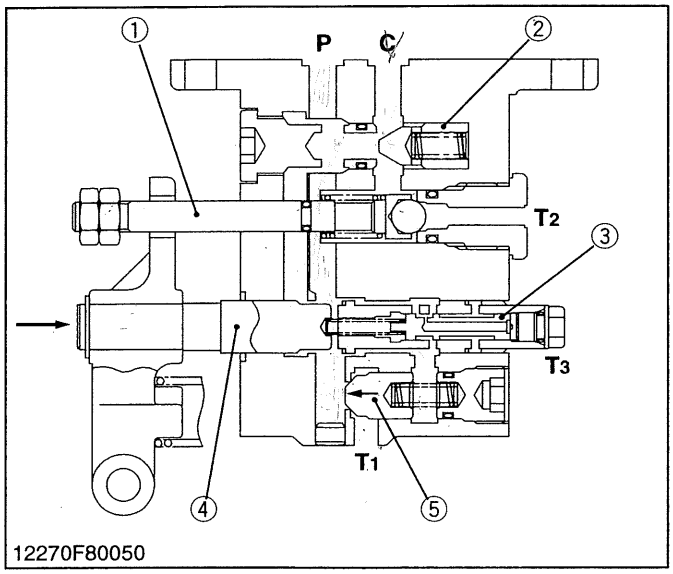
Oil behind the unload poppet (5) returns to the transmission case through the spool (4) and the **T3** port.

Since the poppet 2 (1) and poppet 1 (2) are closed, oil in the hydraulic cylinder does not flow to the transmission case. Thus, the implement remains at its fixed position.

(1) Poppet 2
(2) Poppet 1
(3) Plunger
(4) Spool
(5) Unload Poppet

P : Pump Port
C : Cylinder Port
T1, T2, T3 :Tank Port

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■ Lift

When the control lever is set to the **LIFT** position, the spool (4) is move to the right.

The oil forced into the control valve through the **P** port flows to the back of the unload poppet (5) to close it.

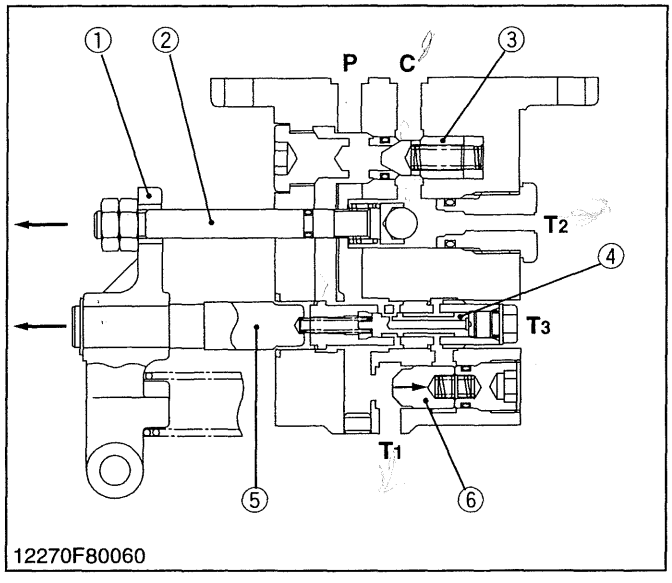
The oil pushes open the poppet 1 (2), and flows into the hydraulic cylinder through the **C** port to lift the implement.

(1) Poppet 2
(2) Poppet 1
(3) Plunger
(4) Spool
(5) Unload Poppet

P : Pump Port
C : Cylinder Port
T1, T2, T3 :Tank Port

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■ Down

When the control lever is moved to **DOWN** position, the spool (5) is move to the left, and the poppet 2 (2) is also move to the left by the lever (1).

Oil in the hydraulic cylinder is forced out to the transmission case through the **T2** port by the weight of the implement, causing the implement to lower.

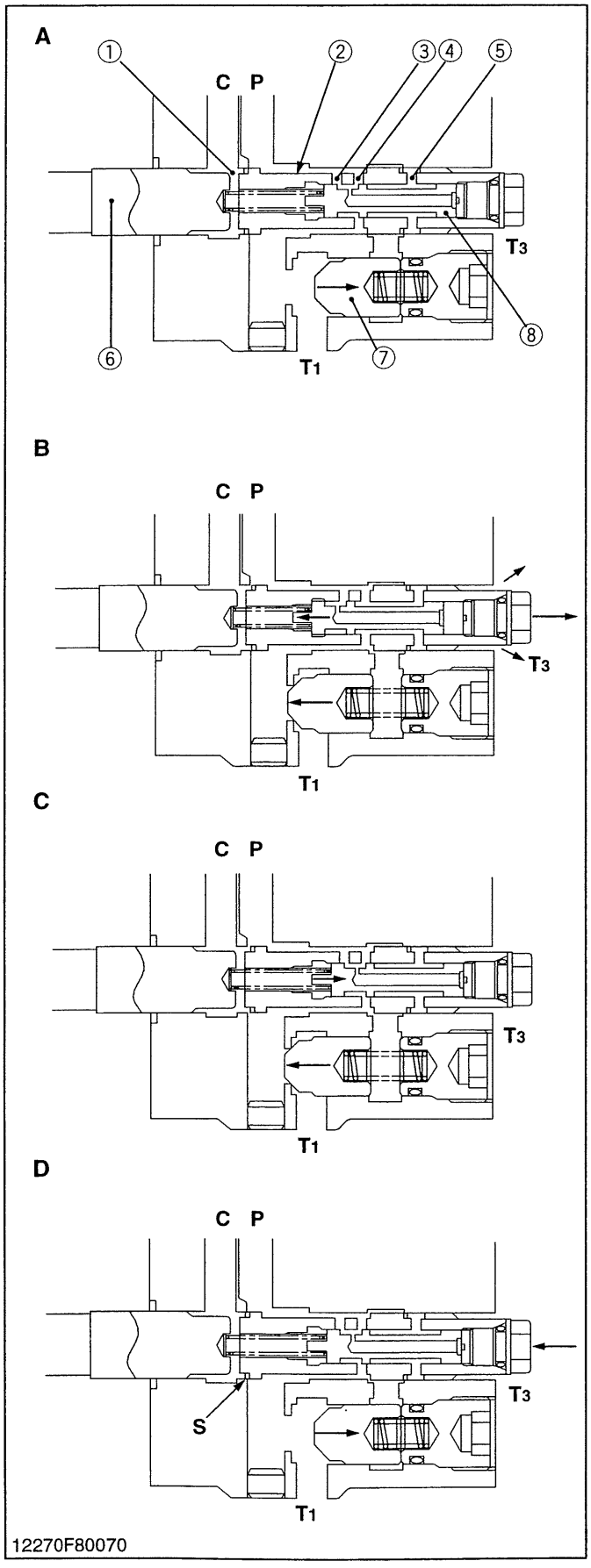
Oil forced into the control valve through the **P** port pushes open the unload poppet (6) and returns to the transmission case through the **T1** port.

(1) Lever
(2) Poppet 2
(3) Poppet 1
(4) Plunger
(5) Spool
(6) Unload Poppet

P : Pump Port
C : Cylinder Port
T1, T2, T3 :Tank Port

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■ Shockless Mechanism

The control valve is provided with a shockless mechanism. This is intended to reduce a sudden change of the oil pressure and flow when the three point linkage system begins to going up or stop going up. As a result, operator does not feel the unpleasant shock.

1. When the three point linkage system starts going up, the spool (6) is located slightly at the right from the neutral position. (Fig. **B**)
   A small amount of oil is kept constantly flowing from the pump through the slit into the cylinder port. (A fixed flowrate is guaranteed.)
2. The oil fed from hydraulic pump flows in passages 3 (3) and 4 (4) by the difference of the hole diameter, and pushes the plunger (8) to the left. Then the passages 4 (4) and 5 (5) connect to each other, and the oil between them return to the transmission case through the clearance between the valve body and the spool (6) and through the T3 port. In this way, the plunger (8) returns to the rightmost position. (Fig. **B** and **C**)
   Some of the oil coming from the pump is drained into the T3 port, which controls the flowrate of the oil going into the cylinder.
3. As a result, the oil pressure is controlled not to rise suddenly. The shock at the start of lifting is thus reduced.
4. When the spool (6) comes close to the neutral position by the motions of feedback linkage, the oil pressure gradually drops by the slit provided in the spool (6). Therefore the shock at the stop of lifting is reduced. (Fig. **D**)

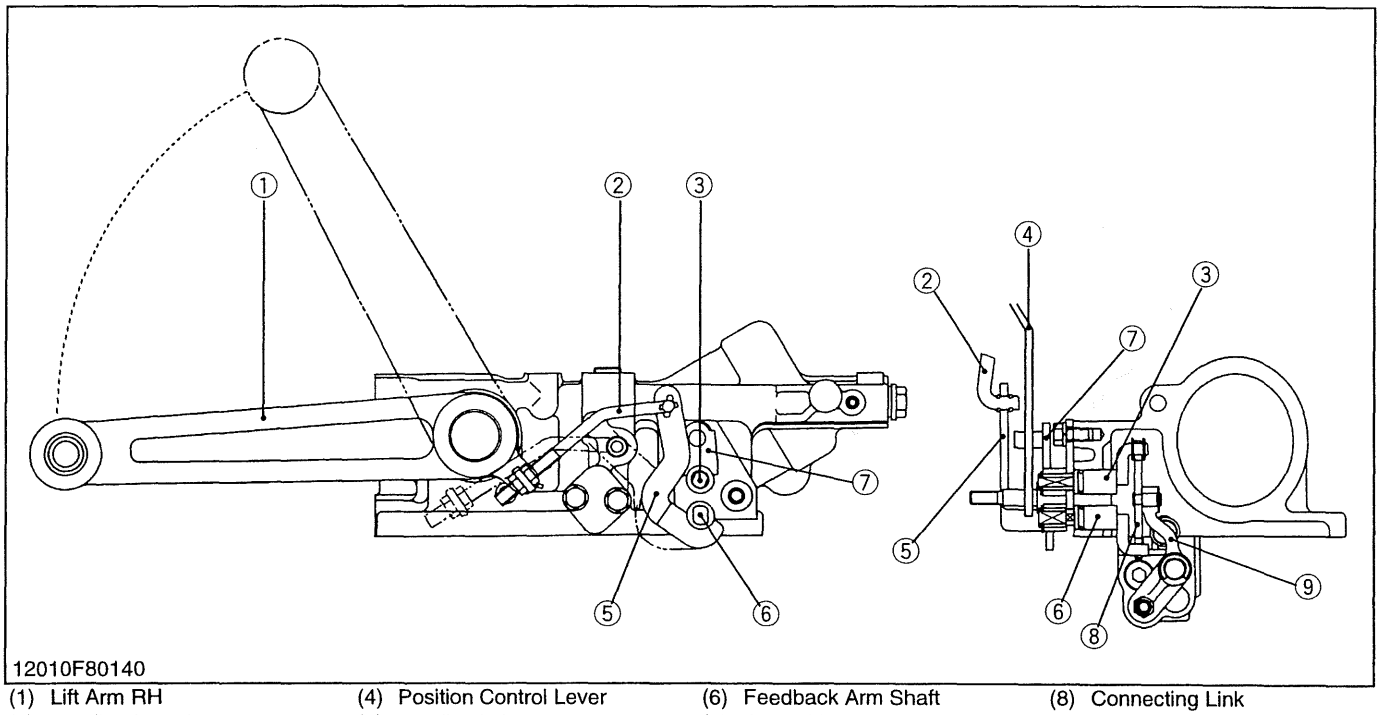
(1) Passage 1
(2) Passage 2
(3) Passage 3
(4) Passage 4
(5) Passage 5
(6) Spool
(7) Unload Poppet
(8) Plunger

P : Pump Port
C : Cylinder Port
S : Slit
T1, T3 :Tank Port

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[6] FEEDBACK LINKAGE FOR POSITION CONTROL



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(1) Lift Arm RH
(2) Feedback Rod
(3) Control Lever Shaft
(4) Position Control Lever
(5) Feedback Arm
(6) Feedback Arm Shaft
(7) Control Lever Arm
(8) Connecting Link
(9) Lever

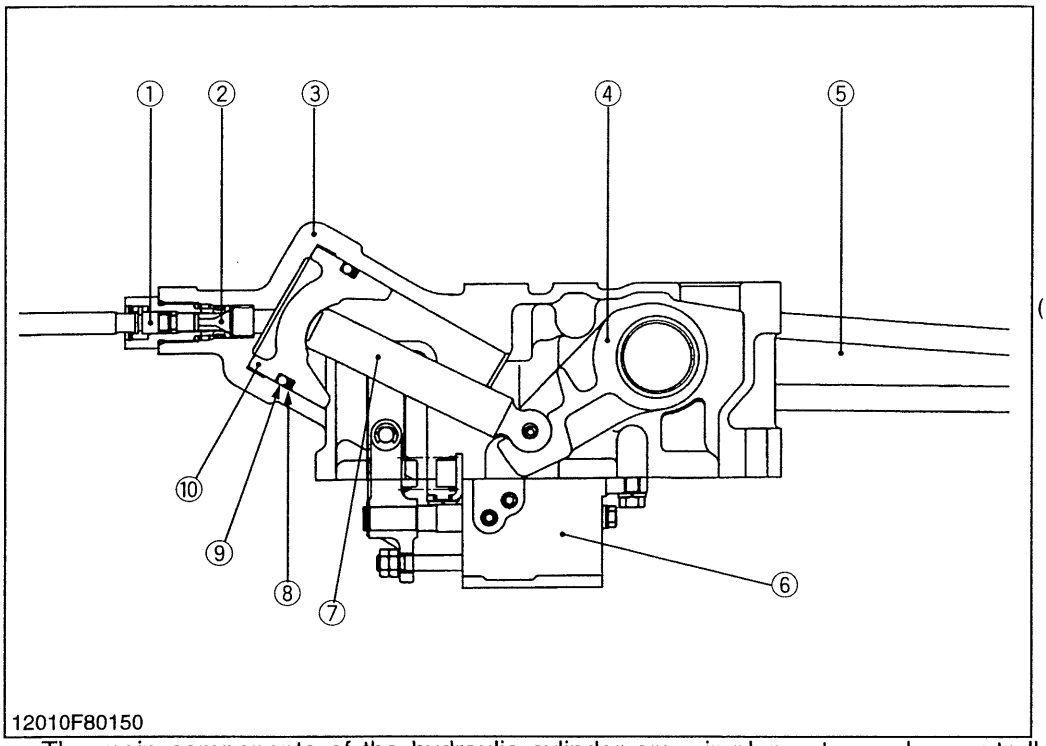
When the position control lever (4) moved to rearward to lift the implement, the spool of the position control valve is pushed in to form a raising circuit by the motions of control lever arm (7), control lever shaft (3), connecting link (8) and the lever (9). And after the lift arm (1) moves upward, the spool is pulled out and return to form a neutral circuit by the motions of feedback rod (2), feedback arm (5), feedback arm shaft (6), connecting link (8) and the lever (9).

As a result, the implement height can be easily determined in proportion to the set position of the position control lever (4).

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[7] HYDRAULIC CYLINDER



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(1) Lowering Speed Adjusting Shaft
(2) Lowering Speed Adjusting Valve
(3) Hydraulic Cylinder
(4) Hydraulic Arm
(5) Lift Arm
(6) Position Control Valve
(7) Hydraulic Rod
(8) Back-up Ring
(9) O-ring
(10) Piston

The main components of the hydraulic cylinder are shown in the figure above.

While the lift arm (5) is rising, oil from the hydraulic pump flows into the hydraulic cylinder through the position control valve (6). Then oil pushes out the piston (10).

While the lift arm (5) is lowering, oil in the hydraulic cylinder is discharged to the transmission case through the position control valve (6) by the weight of the implement. At this time, the lowering speed of the implement can be controlled by the lowering speed adjusting valve (2) attached to the hydraulic cylinder (3). Turning the lowering speed adjusting knob clockwise decreases the lowering speed, and counterclockwise increases lowering speed. When the lowering speed adjusting valve (2) is completely closed, the lift arm (5) is held at its position since oil in the hydraulic cylinder is sealed between the piston (10) and lowering speed adjusting valve (2).

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SERVICING

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TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Implement Does Not Rise (No Noise)	• Control valve broken	Replace	8-S10
	• Control valve improperly adjusted	Adjust	8-S12
	• Control valve improperly assembled	Repair	8-S12
	• Relief valve spring damaged	Replace	8-S12
	• Spool sticks	Repair	8-S12
	• Piston O-ring or cylinder damaged	Replace	8-S11
(Noise)	• Oil filter cartridge clogged	Clean or Replace	–
	• Suction pipe loosen or broken	Repair or Replace	–
	• Suction pipe connecting hose loosen or broken	Repair or Replace	–
	• Suction pipe O-ring broken	Replace	–
	• Insufficient transmission oil	Refill	G-8
	• Relief valve setting pressure too low	Adjust or Replace	8-S7
	• Hydraulic pump broken	Replace	8-S5
Implement Does Not Reach Maximum Height	• Feedback rod improperly adjusted	Adjust	8-S8
Implement Does Not Lower	• Control valve malfunctioning	Repair or Replace	8-S10
Implement Drops by Its Weight	• Hydraulic cylinder worn or damaged	Replace	–
	• Piston O-ring worn or damaged	Replace	8-S11
	• Control valve malfunctioning	Replace	8-S10
Implement Hunts	• Control valve improperly adjusted	Adjust	8-S12

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SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
[Hydraulic Pump] Pump Delivery at Engine 2600 rpm, Oil Temperature 50 °C, 122 °F	at no pressure	[B2410] 16.6 L/min. 4.4 U.S.gal/min. 3.7 Imp.gal/min.	–
		[B2710, B2910] 24.4 L/min. 6.4 U.S.gal/min. 5.4 Imp.gal/min.	–
	at 13.7 MPa 140 kgf/cm^2 1991 psi	[B2410] 15.8 L/min. 4.2 U.S.gal/min. 3.5 Imp.gal/min.	–
		[B2710, B2910] 23.0 L/min. 6.1 U.S.gal/min. 5.1 Imp.gal/min.	–
Gear to Casing	Clearance	–	0.15 mm 0.0059 in.
Gear Shaft to Bushing	Clearance	0.020 to 0.091 mm 0.0008 to 0.0036 in.	0.12 mm 0.0047 in.
Gear Shaft	O.D.	14.970 to 14.980 mm 0.5894 to 0.5898 in.	–
Bushing	I.D.	15.000 to 15.061 mm 0.5906 to 0.5930 in.	–
Side Plate	Thickness	2.48 to 2.50 mm 0.0976 to 0.0984 in.	2.40 mm 0.0945 in.
Relief Valve	Setting Pressure	13.2 to 13.7 MPa 135 to 140 kgf/cm^2 1920 to 1991 psi	–
Lift Arm	Free Play	5 to 10 mm 0.20 to 0.40 in.	–
Hydraulic Cylinder	I.D.	70.05 to 70.10 mm 2.7579 to 2.7598 in.	70.15 mm 2.7618 in.

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Item		Factory Specification	Allowable Limit
Hydraulic Arm shaft to Bushing	Clearance	0.020 to 0.110 mm 0.0008 to 0.0043 in.	0.30 mm 0.0118 in.
Hydraulic Arm Shaft, Right	O.D.	37.925 to 37.950 mm 1.4931 to 1.4941 in.	–
Hydraulic Arm Shaft, Left	O.D.	33.925 to 33.950 mm 1.3356 to 1.3366 in.	–
Bushing, Right	I.D.	37.970 to 38.035 mm 1.4949 to 1.4974 in.	–
Bushing, Left	I.D.	33.970 to 34.035 mm 1.3374 to 1.3400 in.	–
Bi-speed Turn Cable Inner (Bi-speed Turn Lever Rod Side)	Distance A	8 mm 0.31 in.	–
Bi-speed Turn Cable Outer (Bi-speed Turn Cable Support Side)	Distance B	19 mm 0.75 in.	–

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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
Delivery pipe nut for power steering	65 to 75	6.6 to 7.7	47.9 to 55.3
Hydraulic pump cover mounting screw	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Connecting plate mounting screws and nuts	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Joint bolt for delivery pipe to hydraulic cylinder	33.3 to 38.2	3.4 to 3.9	24.6 to 28.2
Relief valve plug	49.0 to 68.6	5.0 to 7.0	36.2 to 50.6
Hydraulic cylinder assembly mounting screws and nuts	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Position control valve mounting screws	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Plug 1	29.4 to 49.0	3.0 to 5.0	21.7 to 36.2
Plug 2	29.4 to 49.0	3.0 to 5.0	21.7 to 36.2
Plug 3	39.2 to 58.8	4.0 to 6.0	28.9 to 43.4
Plug 4	7.85 to 11.77	0.8 to 1.2	5.79 to 8.68
Rear wheel mounting screw and nut	196 to 226	20.0 to 23.1	145 to 167

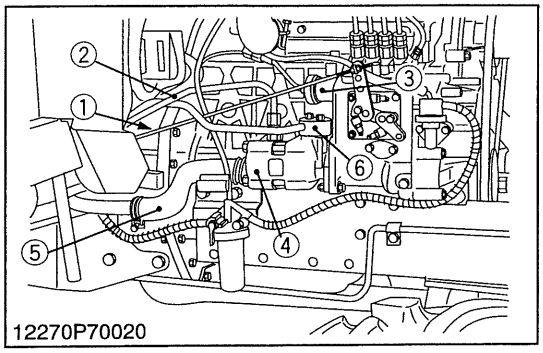
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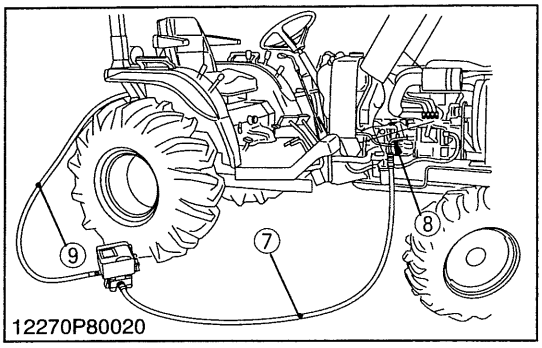
CHECKING, DISASSEMBLING AND SERVICING

[1] HYDRAULIC PUMP

CHECKING AND ADJUSTING



12270P70020



12270P80020

Flowmeter Connecting and Test Preparation

■ **IMPORTANT**

- **When using a flowmeter other than KUBOTA specified flowmeter (Code No: 07916-52792), be sure to use the instructions with that flowmeter.**
- **In this hook-up, there is no relief valve. Therefore while testing, do not close the flowmeter loading valve completely.**

1. Open the hood, then remove the front grille, side cover (RH) and disconnect the battery grounding cord.
2. Remove the steering wheel, meter panel and panel under cover.
3. Disconnect the accelerator rod (1).
4. Remove the engine stop solenoid (3).
5. Remove the power steering delivery pipe and pipe cramps.
6. Disconnect the hydraulic delivery pipe for 3-point hitch (6).
7. Install the adaptor **61** (8) to the hydraulic pump for 3-point hitch.
8. Reassemble the power steering delivery pipe.
9. Reinstall the engine stop solenoid and accelerator rod.
10. Connect the hydraulic test hose (7) (Code No: 07916-52651) to the adaptor **61** and flowmeter (Code No: 07916-52791) inlet port.
11. Connect the another hydraulic test hose (9) to flowmeter outlet port and transmission oil filling port.
12. Open the flowmeter loading valve completely. (Turn counterclockwise)
13. Start the engine and set the engine speed at **2600 rpm**.
14. Slowly close the loading valve to generate the pressure **approx. 13.7 MPa (140 kgf/cm^2, 1991 psi)**.
15. Hold in this condition until oil temperature reaches approx. 50 °C (122 °F).

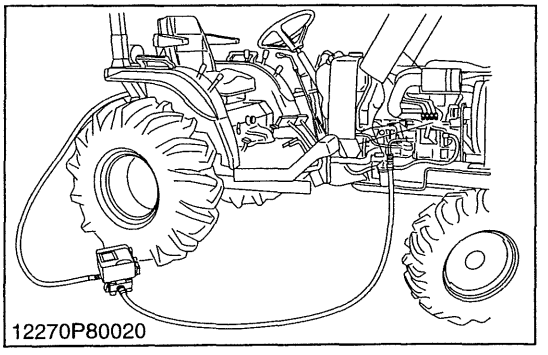
(Reference)

- Adaptor is included in the adaptor set (Code No: 07916-54031).

(1) Accelerator Rod
(2) Power Steering Delivery Pipe
(3) Engine Stop Solenoid
(4) Hydraulic Pump
(5) Suction Hose
(6) Hydraulic Delivery Pipe for 3-Point Hitch
(7) Hydraulic Test Hose
(8) Adaptor **61**
(9) Hydraulic Test Hose

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12270P80020

Condition

- Engine speed .....Approx. 2600 rpm
- Rated pressure .....13.7 MPa
  140 kgf/cm^2
  1991 psi
- Oil temperature .....50 °C
  122 °F

Pump Test

■ NOTE

- **Before pump testing, perform the flowmeter connecting and test preparation. (See page 8-S4.)**

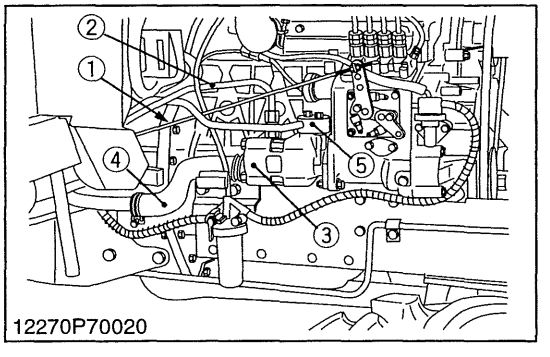
1. Open the loading valve completely.
2. Start the engine and set at approx. 2600 rpm.
3. Read and note the pump delivery at no pressure.
4. Slowly close the loading valve to increase pressure approx. 13.7 MPa (140 kgf/cm^2, 1991 psi).
5. Read and note the pump flow at rated pressure.
6. Open the loading valve and stop the engine.

(Reference)

Hydraulic pump delivery at no pressure	Factory spec.	B2410	Above 16.6 L/min. 4.4 U.S.gal/min. 3.7 Imp.gal/min.
		B2710 B2910	Above 24.4 L/min. 6.4 U.S.gal/min. 5.4 Imp.gal/min.
Hydraulic pump delivery at rated pressure	Factory spec.	B2410	Above 15.8 L/min. 4.2 U.S.gal/min. 3.5 Imp.gal/min.
		B2710 B2910	Above 23.0 L/min. 6.1 U.S.gal/min. 5.1 Imp.gal/min.

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DISASSEMBLING AND ASSEMBLING



12270P70020

Removing Hydraulic Pump

1. Open the bonnet then remove the grille side cover (RH) and disconnect the battery grounding cord.
2. Disconnect the connector of the engine stop solenoid (3) and accelerator rod (1).
3. Disconnect the power steering delivery pipe (2) and 3-point hitch delivery pipe (6).
4. Disconnect the suction hose (5) and remove the hydraulic pump (4).

(When reassembling)

- Apply liquid gasket (Three Bond 1208D or equivalent) to engine stop solenoid.

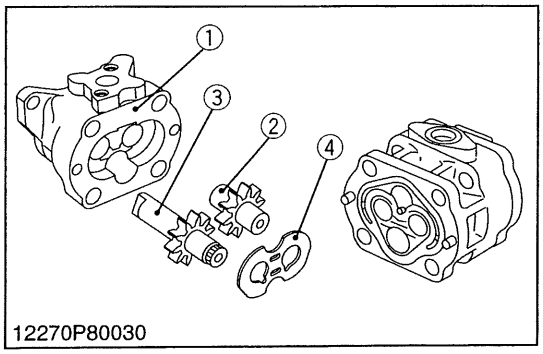
■ NOTE

- **For fastening hydraulic pipe nut, use two wrenches. Hold the fitting with a wrench, turn the pipe nut another wrench to avoid damage at fitting installed part.**

Tightening torque	Delivery pipe nut for power steering	65 to 75 N·m 6.6 to 7.7 kgf·m 47.9 to 55.3 ft-lbs

(1) Accelerator Rod
(2) Power Steering Delivery Pipe
(3) Engine Stop Solenoid
(4) Hydraulic Pump
(5) Suction Hose
(6) 3-Point Hitch Delivery Pipe

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Cover, Side Plate and Gear

1. Secure the hydraulic pump with a vise, and remove the cover.
2. Remove the side plate (4).
3. Remove the drive gear (3) and driven gear (2) from the casing (1).

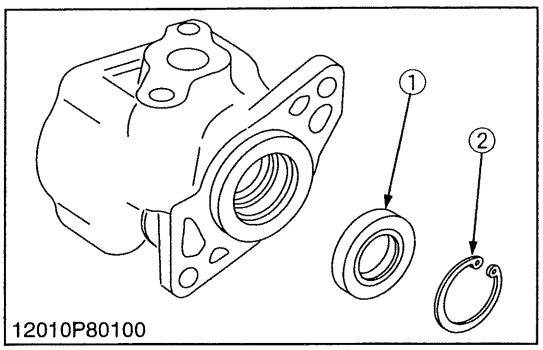
(When reassembling)

- Take care not to damage the O-ring.
- Align the holes of the cover and casing.
- Install the side plate, noting its location and direction.
- Install the gears, noting its direction.

Tightening torque	Cover mounting screw	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs

(1) Casing
(2) Driven Gear
(3) Drive Gear
(4) Side Plate

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Oil Seal

1. Remove the internal snap ring (2), and remove the oil seal (1).

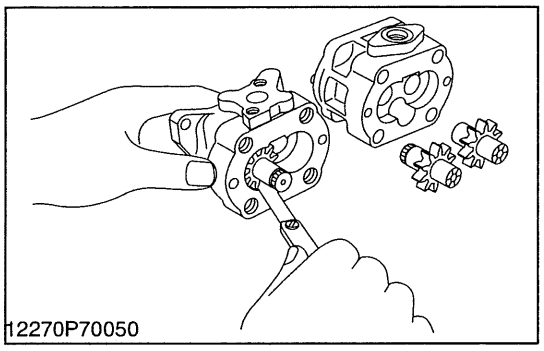
(When reassembling)

- If the oil seal is defective, worn or scratched, replace it.

(1) Oil Seal
(2) Internal Snap Ring

12010S80080

SERVICING

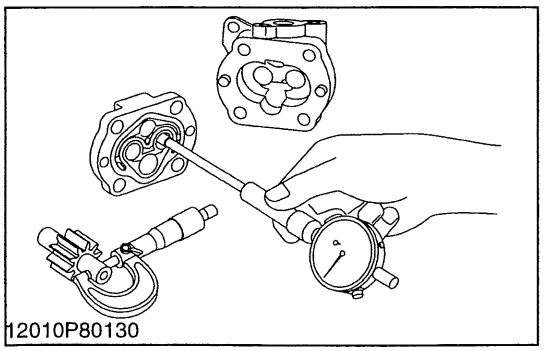

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Clearance between Tip of Gear Tooth and Casing

1. Measure the gear O.D. with an outside micrometer.
2. Measure the casing I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace the assembly.

Clearance between tip of gear tooth and casing	Allowable limit	0.15 mm 0.0059 in.

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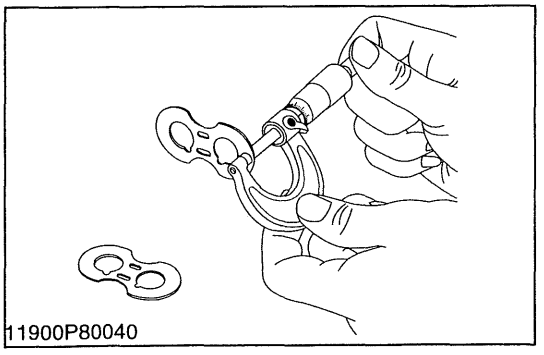
Clearance between Bushing and Shaft

1. Measure the shaft O.D. with an outside micrometer.
2. Measure the bushing I.D. with a cylinder gauge.
3. If the clearance exceeds the allowable limit, replace it.

Clearance between bushing and shaft	Factory spec.	0.020 to 0.091 mm 0.0008 to 0.0036 in.
	Allowable limit	0.12 mm 0.0047 in.
Shaft O.D.	Factory spec.	14.970 to 14.980 mm 0.5894 to 0.5898 in.
Bushing I.D.	Factory spec.	15.000 to 15.061 mm 0.5906 to 0.5930 in.

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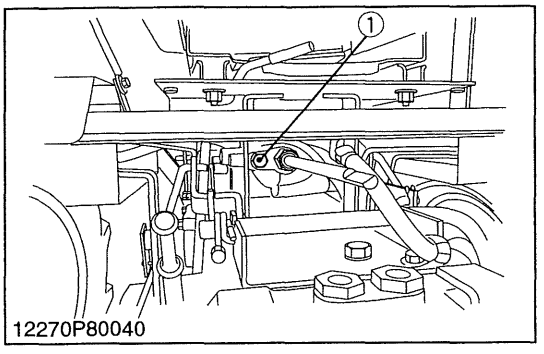
Side Plate Thickness

1. Measure the side plate thickness with an outside micrometer.
2. If the thickness is less than the allowable limit, replace it.

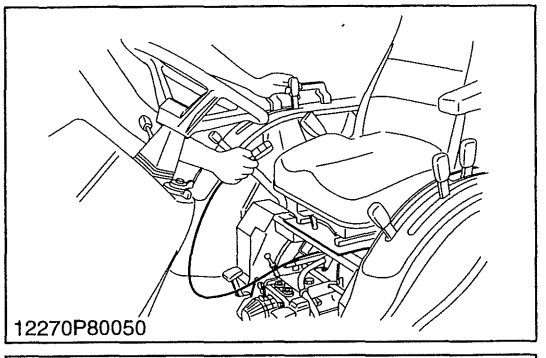
Side plate thickness	Factory spec.	2.48 to 2.50 mm 0.0976 to 0.0984 in.
	Allowable limit	2.40 mm 0.0945 in.

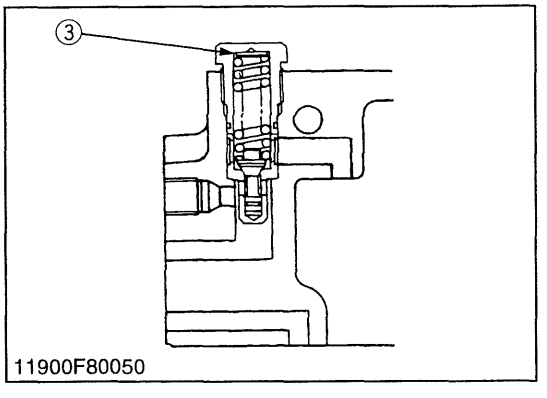
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[2] HYDRAULIC CYLINDER ASSEMBLY AND HYDRAULIC BLOCK CHECKING AND ADJUSTING



12270P80040


12270P80050



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Relief Valve Setting Pressure

1. Remove the seat under cover.
2. Remove the plug (1) from front of hydraulic cylinder body.
3. Install the adaptor **58**. Then connect the cable and pressure gauge to adaptor **58**.
4. Remove the feedback rod lock nut and spring.
5. Start the engine and set at maximum speed.
6. Move the hydraulic control lever all way up to operate the relief valve and read the gauge.
7. If the pressure is not factory specifications, remove the hydraulic cylinder assembly (refer to 8-S8 to 8-S9) and adjust relief valve (2) with the adjusitng shims (3).
8. Reinstall the hydraulic cylinder assembly. After checking the pressure, reinstall the spring and feedback rod lock nut.

Relief valve setting pressure	Factory spec.	13.2 to 13.7 MPa 135 to 140 kgf/cm^2 1920 to 1991 psi

Condition

- Engine speed .....Maximum
- Oil temperature ...45 to 55 °C
  113 to 131 °F

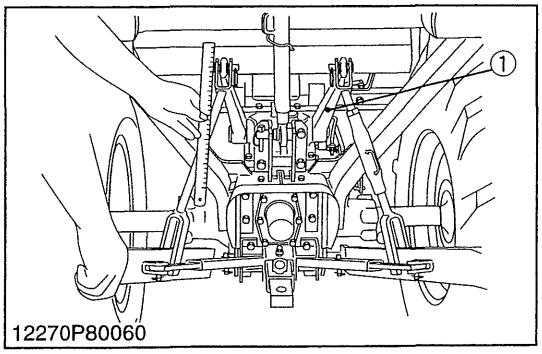
(Reference)

- Thickness of shims (3) : 0.1 mm (0.0039 in.), 0.2 mm (0.0079 in.)

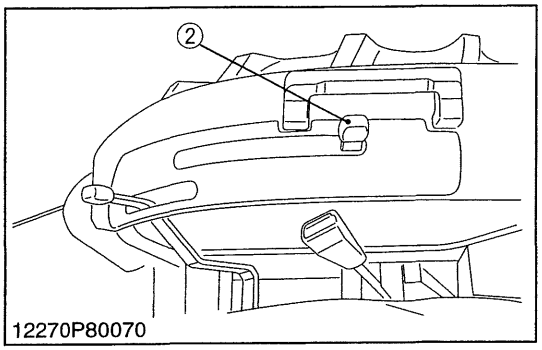
(1) Plug
(2) Relief Valve
(3) Shim

12271S80040

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12270P80070

Lift Arm Free Play

1. Set the position control lever (2) to the lowest position.
2. Start the engine, and set at the idling speed.
3. Move the position control lever (2) to the uppermost position.
4. Move the lift arm (1) to the upper end by hand and measure the free play.
5. If the measurement is not within the factory specifications, adjust the free play by changing the position control feedback rod setting length.

Lift arm free play	Factory spec.	5 to 10 mm 0.20 to 0.40 in.

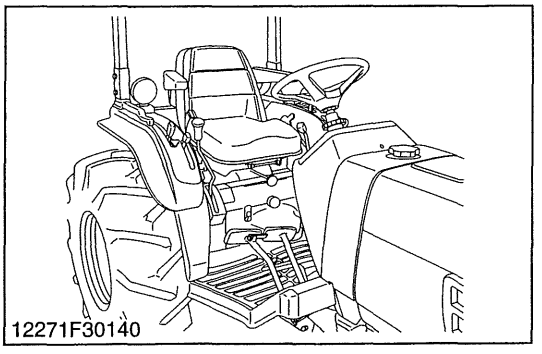
(1) Lift Arm
(2) Position Control Lever

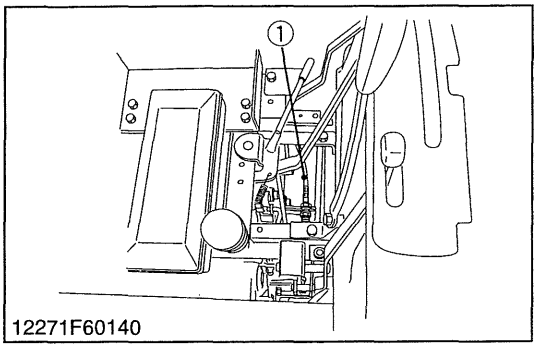
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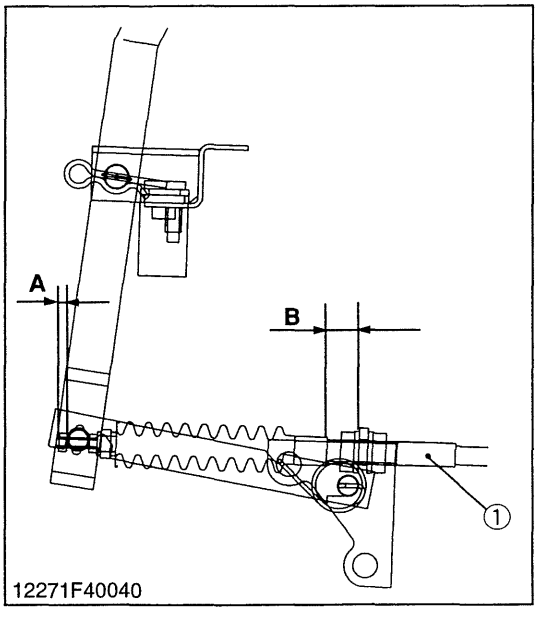
DISASSEMBLING AND ASSEMBLING

(1) Separating Hydraulic Cylinder Assembly


12271F30140



12271F60140



12271F40040

Seat and Seat Stay

1. Remove the seat and fender cover (B2910 only).
2. Remove the lowering speed adjusting knob and dipstick, then remove the seat under cover.
3. Remove the cruise control lever grip (B2910 only), lever guide (B2910 only).
4. Loosen the lock nuts and disconnect the bi-speed turn cable and bi-speed turn lever (Bi-speed Turn Type).
5. Remove the tool box and the seat stay assembly.
6. Remove the covers and fender stay.
7. Disconnect the wiring harness.

(When reassembling)

- When reassembling the bi-speed turn cable (1), make sure to set the distance **A**.

Distance **A**	Factory spec.	8 mm 0.31 in.

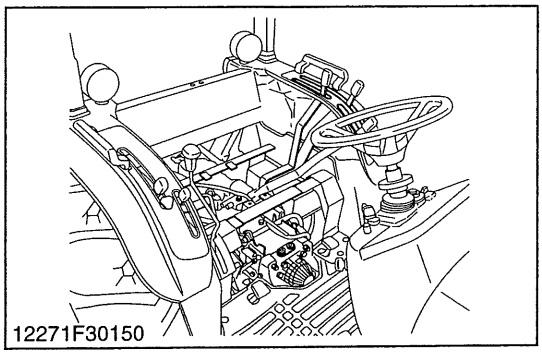
(Reference)

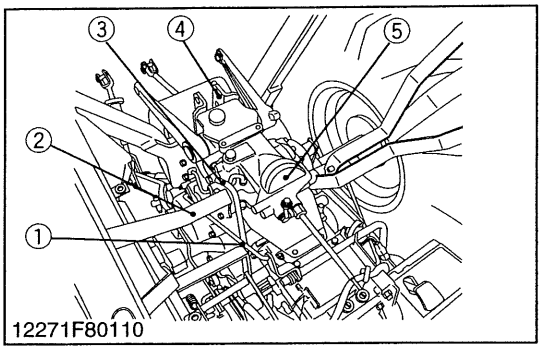
Distance **B**	Factory spec.	19 mm 0.75 in.

(1) Bi-speed Turn Cable

12271S80050

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12271F80110

Hydraulic Cylinder Assembly

1. Remove the top link and disconnect the lift rods.
2. Remove the mid-PTO geawr shift lever grip, rear PTO shift lever grip and range shift lever grip or Hi-Lo shift lever grip.
3. Remove the fender LH and rear fender.
4. Disconnect the differential lock rod (1) and remove the position control lever (2).
5. Disconnect the delivery pipe for 3-point hitch (3).
6. Remove the left hand side top link bracket (4) and connecting plate mounting screws.
7. Remove the hydraulic cylinder assembly (5) with connecting plate.

(When reassembling)

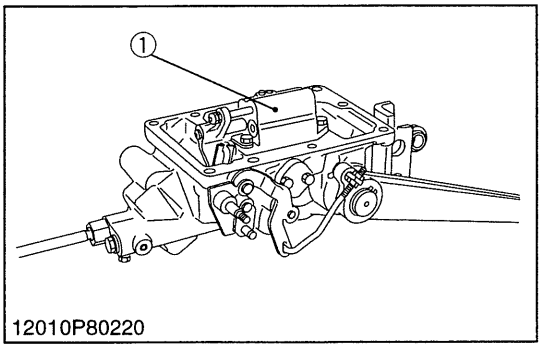
- Apply liquid gasket to joint face of the differential case and the hydraulic cylinder.

Tightening torque	Connecting plate mounting screw	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs
	Hydraulic cylinder mounting screw and nut	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs
	Delivery pipe joint bolt	33.3 to 38.2 N·m 3.4 to 3.9 kgf·m 24.6 to 28.2 ft-lbs

(1) Differential Lock Rod
(2) Position Control Lever
(3) Delivery Pipe for 3-Point Hitch
(4) Top Link Bracket LH
(5) Hydraulic Cylinder

12271S80060

(2) Disassembling Hydraulic Cylinder Assembly



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Position Control Valve

1. Remove the position control valve mounting screws, and remove the position control valve (1).

(When reassembling)

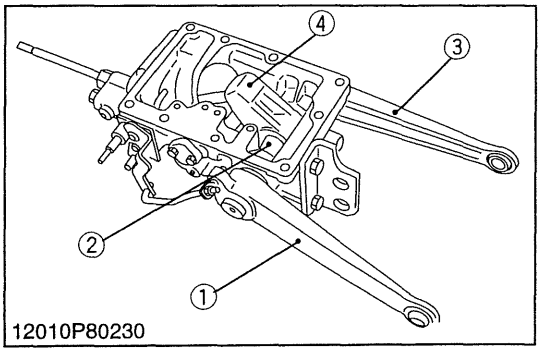
- Take care not to damage the O-rings.

Tightening torque	Position control valve mounting screws	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

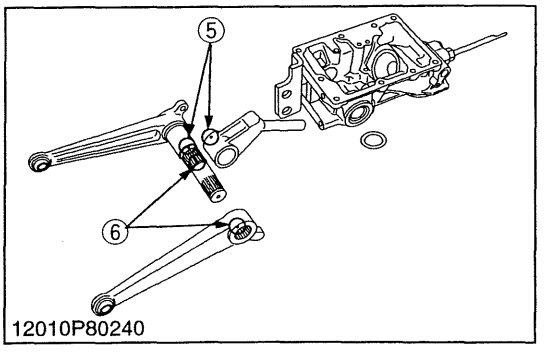
(1) Position Control Valve

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12010P80240

Lift Arm, Hydraulic Arm Shaft and Hydraulic Arm

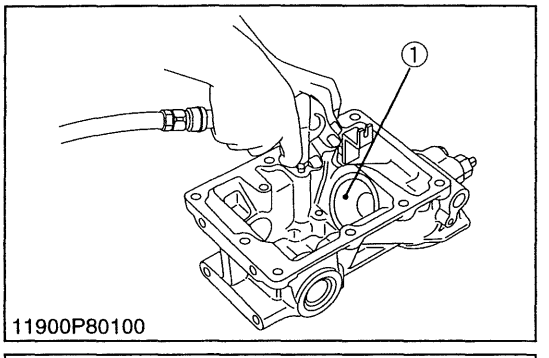
1. Remove the external snap ring, and remove the lift arm LH (3).
2. Draw out the hydraulic arm shaft (2) and lift arm RH (1) as a unit.

(When reassembling)

- Align the alignment marks (5) of the hydraulic arm and hydraulic arm shaft.
- Align the alignment marks (6) of the lift arm LH and hydraulic arm shaft.
- Apply grease to the right and left bushings and O-rings.
- Take care not to damage the O-rings.

(1) Lift Arm RH
(2) Hydraulic Arm Shaft
(3) Lift Arm LH
(4) Hydraulic Arm
(5) Alignment Marks
(6) Alignment Marks

12010S80180



11900P80100

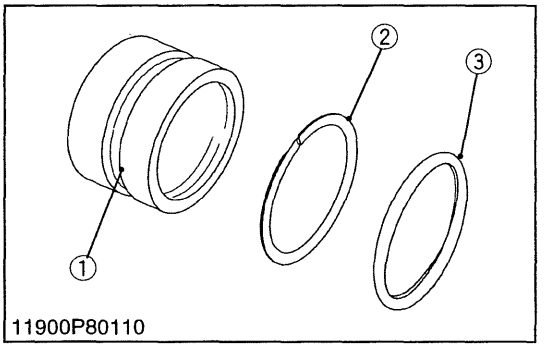
Hydraulic Piston

1. Inject the compressed air into the hydraulic cylinder, and take out the hydraulic piston (1).

(When reassembling)

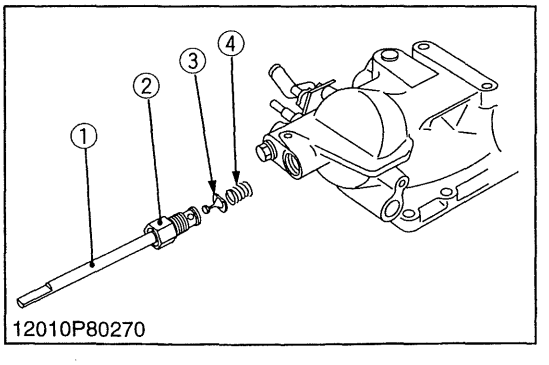
- Take care not to damage the O-ring (3) and backup ring (2).
- Apply transmission fluid to the O-ring.
- Replace the O-ring if it is defective, worn or scratched, which may case oil leakage.

(1) Hydraulic Piston
(2) Backup Ring
(3) O-ring



11900P80110

11900S80230



12010P80270

Lowering Speed Adjusting Valve

1. Remove the lowering speed adjusting valve body (2) with the lowering speed adjusting shaft (1).
2. Draw out the poppet (3) and spring (4).

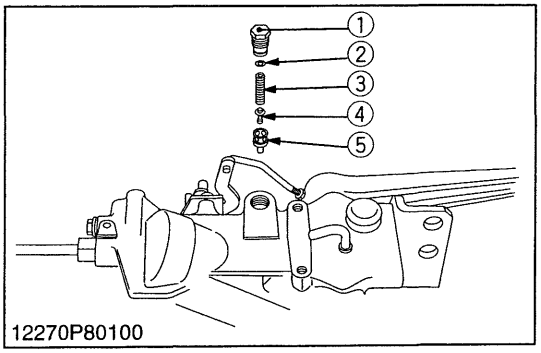
(When reassembling)

- Take care not to damage the O-rings.

(1) Lowering Speed Adjusting Shaft
(2) Lowering Speed Adjusting Valve Body
(3) Poppet
(4) Spring

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12270P80100

Relief Valve

1. Remove the plug (1), and draw out the shim (2), spring (3), poppet (4) and the valve seat (5).

(When reassembling)

- Take care not to damage the O-ring.

Tightening torque	Relief valve plug	49.0 to 68.6 N·m 5.0 to 7.0 kgf·m 36.2 to 50.6 ft-lbs

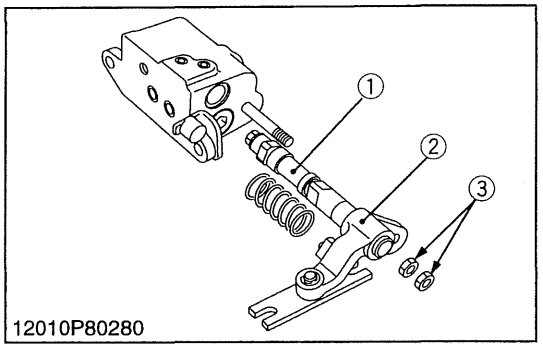
■ IMPORTANT

- **After disassembling and assembling the relief valve, be sure to adjust the relief valve setting pressure.**

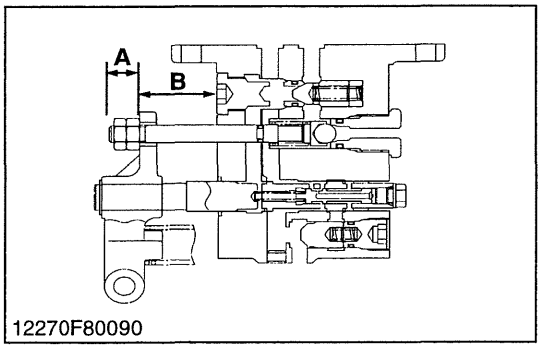
(1) Plug
(2) Shim
(3) Spring
(4) Poppet
(5) Valve Seat

12270S80110

(3) Disassembling Position Control Valve



12010P80280



12270F80090

Spool

1. Remove the nuts (3).
2. Draw out the spool (1) with the lever (2).

■ IMPORTANT

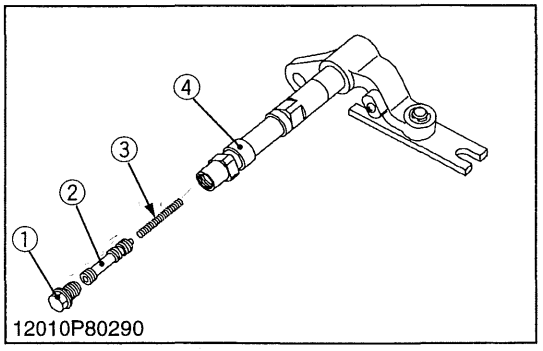
- **Measure the length (A) before disassembling, and make sure to reset it when reassembling.**

(Reference)

- When the poppet 2 is completely closed, the distance **(B)** between valve body and nut becomes approximately 32.3 to 32.5 mm (1.27 to 1.28 in.).

(1) Spool
(2) Lever
(3) Nuts

12270S80120



12010P80290

Plunger

1. Remove the plug 4 (1), and draw out the plunger (2) and spring (3) from the spool (4).

(When reassembling)

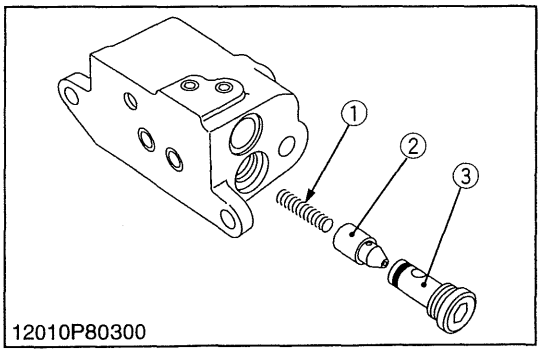
- Take care not to damage the O-ring.

Tightening torque	Plug 4	7.85 to 11.77 N·m 0.8 to 1.2 kgf·m 5.79 to 8.68 ft-lbs

(1) Plug 4
(2) Plunger
(3) Spring
(4) Spool

12010S80220

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12010P80300

Poppet 1

1. Remove the plug 1 (3), and draw out the poppet 1 (2) and spring (1).

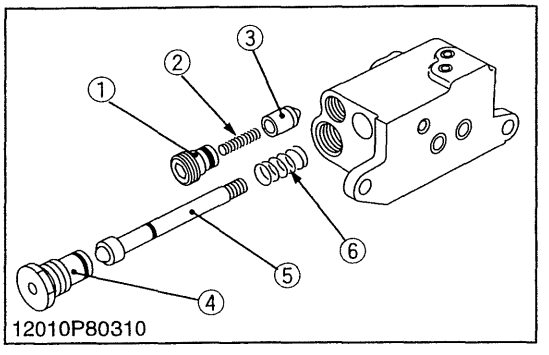
(When reassembling)

- Take care not to damage the O-ring.

Tightening torque	Plug 1	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft-lbs

(1) Spring
(2) Poppet 1
(3) Plug 1

12010S80230



12010P80310

Poppet 2 and Unload Poppet

1. Remove the plug 3 (4), and draw out the poppet 2 (5) and spring (6).
2. Remove the plug 2 (1), and draw out the unload poppet (3) and spring (2).

(When reassembling)

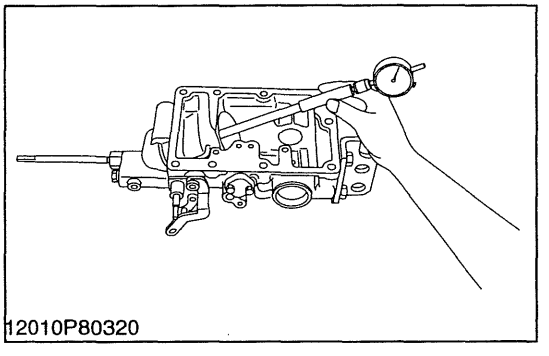
- Take care not to damage the O-ring.

Tightening torque	Plug 3	39.2 to 58.8 N·m 4.0 to 6.0 kgf·m 28.9 to 43.4 ft-lbs
	Plug 2	29.4 to 49.0 N·m 3.0 to 5.0 kgf·m 21.7 to 36.2 ft-lbs

(1) Plug 2
(2) Spring
(3) Unload Poppet
(4) Plug 3
(5) Poppet 2
(6) Spring

12010S80240

SERVICING


12010P80320

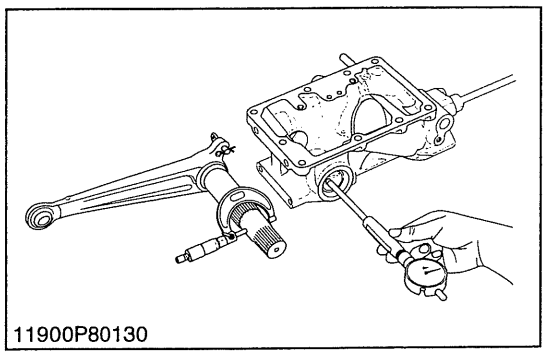
Hydraulic Cylinder Bore

1. Check the cylinder internal surface for spring or damage.
2. Measure the cylinder I.D. with a cylinder gauge.
3. If the measurement exceeds the allowable limit, replace the hydraulic cylinder block.

Cylinder I.D.	Factory spec.	70.05 to 70.10 mm 2.7579 to 2.7598 in.
	Allowable limit	70.15 mm 2.7618 in.

12010S80250

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Clearance between Hydraulic Arm Shaft and Bushing

1. Measure the hydraulic arm shaft O.D. with an outside micrometer.
2. Measure the bushing I.D. with a cylinder gauge, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the bushing.

Clearance between hydraulic arm shaft and bushing	Factory spec.	0.020 to 0.110 mm 0.0008 to 0.0043 in.
	Allowable limit	0.30 mm 0.0118 in.

Hydraulic arm shaft O.D.	Factory spec.	Right	37.925 to 37.950 mm 1.4931 to 1.4941 in.
		Left	33.925 to 33.950 mm 1.3356 to 1.3366 in.

Bushing I.D. (after press fitted)	Factory spec.	Right	37.970 to 38.035 mm 1.4949 to 1.4974 in.
		Left	33.970 to 34.035 mm 1.3374 to 1.3400 in.

12490S80150

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MECHANISM

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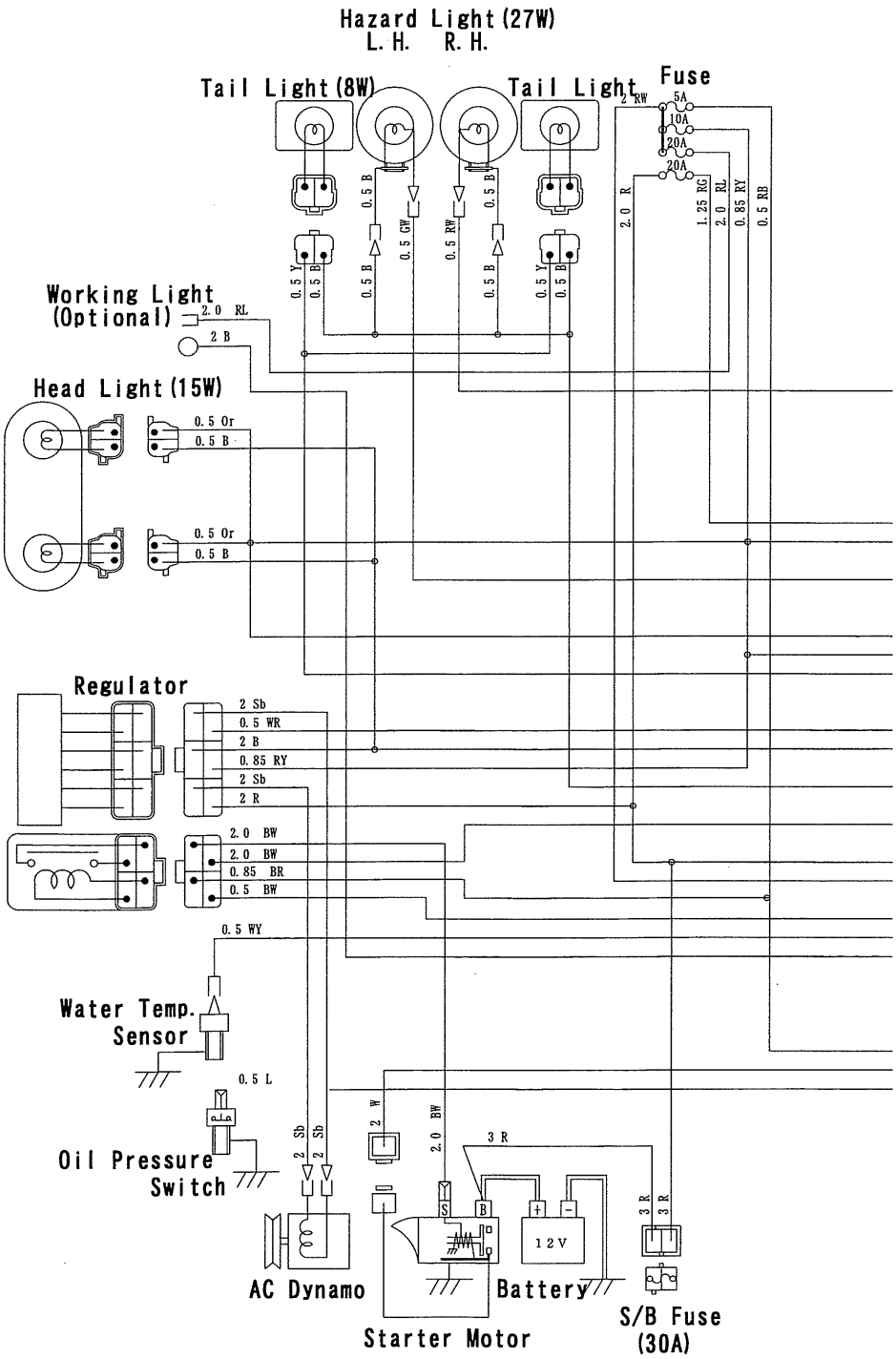
MEMO

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[1] WIRING DIAGRAM

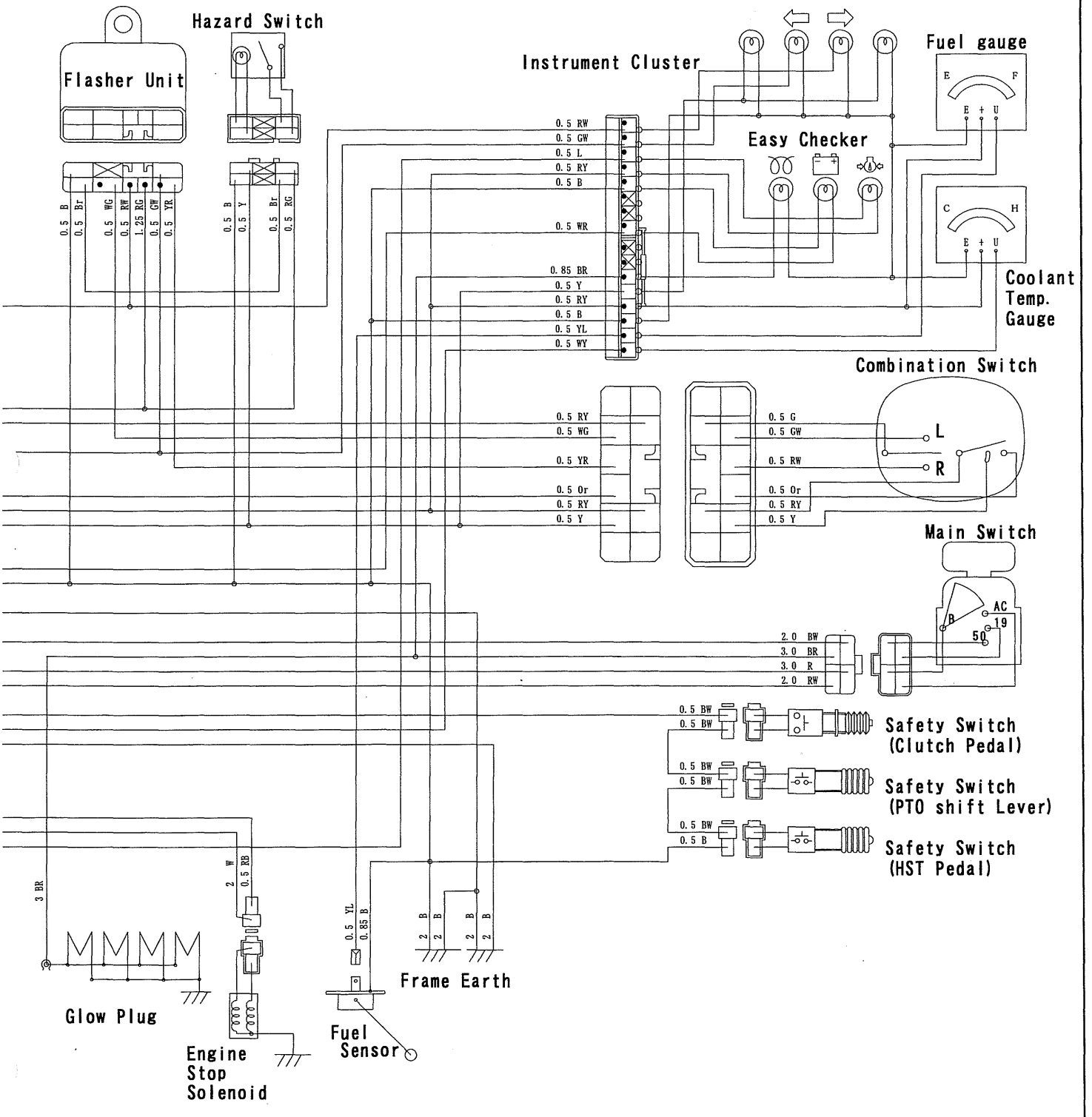
- **Color of Wiring**

W	White
R	Red
L	Blue
Y	Yellow
B	Black
G	Green
P	Pink
Lg	Light Green
Br	Brown
Or	Orange
Sb	Sky Blue
WG	White / Green
WB	White / Black
WR	White / Red
WY	White / Yellow
WL	White / Blue
RW	Red / White
RL	Red / Blue
RY	Red / Yellow
RB	Red / Black
RG	Red / Green
BW	Black / White
BL	Black / Blue
BR	Black / Red
LY	Blue / Yellow
LW	Blue / White
LG	Blue / Green
LR	Blue / Red
LB	Blue / Black
LOr	Blue / Orange
YG	Yellow / Green
YR	Yellow / Red
YB	Yellow / Black
GR	Green / Red
GW	Green / White
LgY	Light Green / Yellow
LgB	Light Green / Black



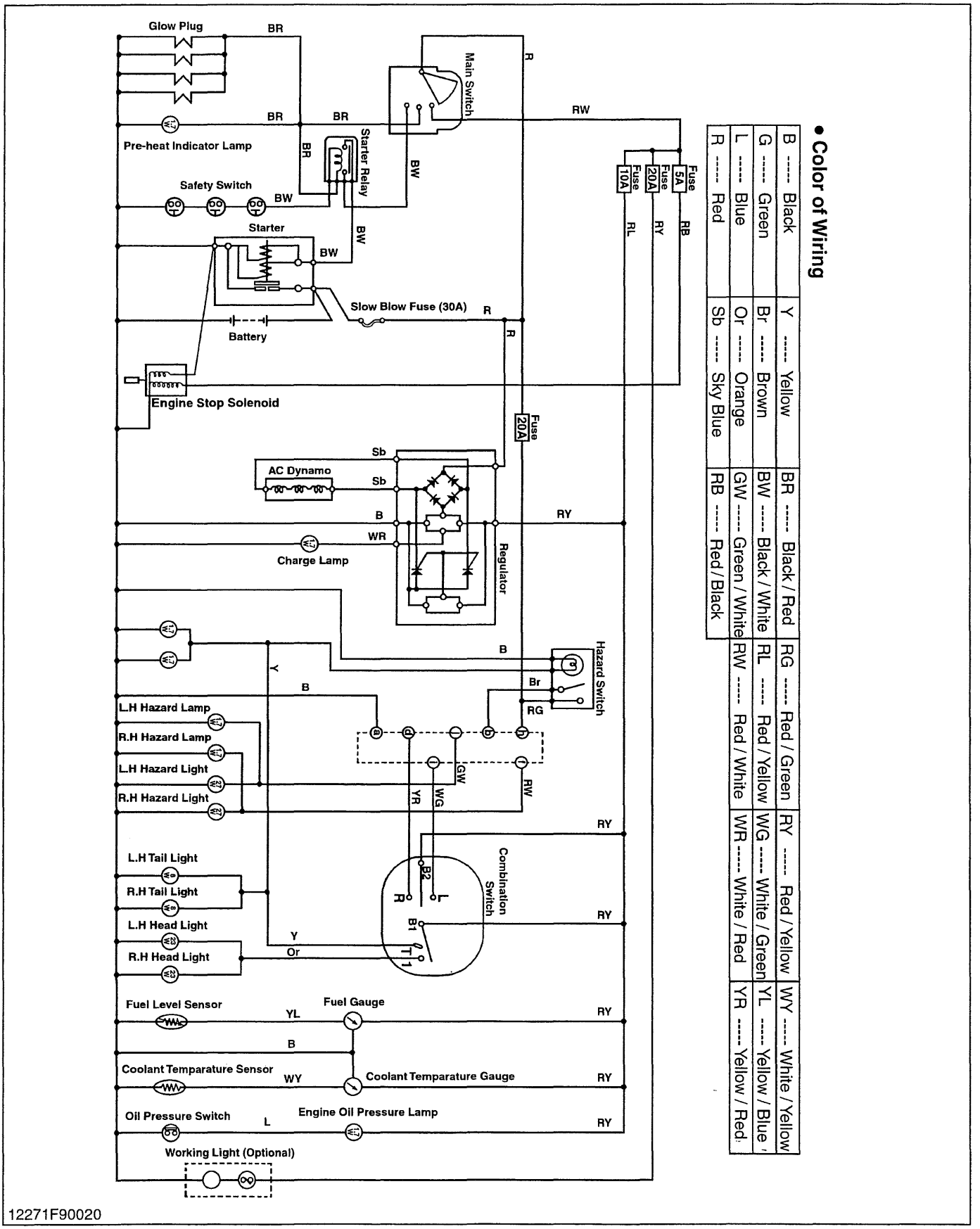
1227190010

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[2] ELECTRICAL CIRCUIT



• Color of Wiring

B ----- Black	Y ----- Yellow	BR ----- Black / Red	RG ----- Red / Green	RY ----- Red / Yellow	WY ----- White / Yellow
G ----- Green	Br ----- Brown	BW ----- Black / White	RL ----- Red / Yellow	WG ----- White / Green	YL ----- Yellow / Blue
L ----- Blue	Or ----- Orange	GW ----- Green / White	RW ----- Red / White	WR ----- White / Red	YR ----- Yellow / Red
R ----- Red	Sb ----- Sky Blue	RB ----- Red / Black			

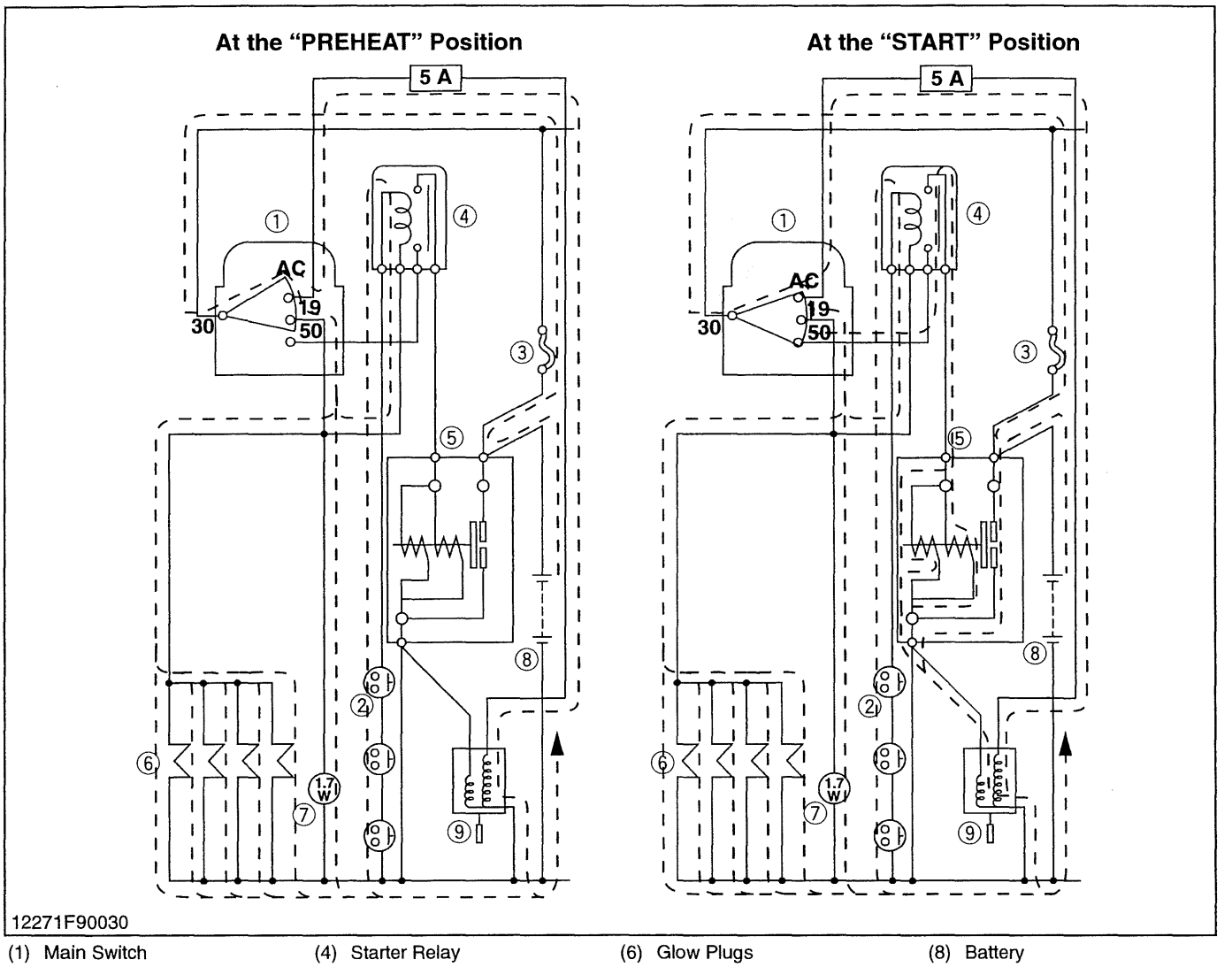
12271F90020

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[3] STARTING SYSTEM

Main Switch Table				
Terminal / Key Position	30	AC	19	50
OFF	●			
ON	●	●		
PREHEAT	●	●	●	
START	●	●	●	●



(1) Main Switch
(2) Safety Switches
(3) Slow Blow Fuse
(4) Starter Relay
(5) Starter Motor
(6) Glow Plugs
(7) Pre-heat Indicator Lamp
(8) Battery
(9) Engine Stop Solenoid

When the main switch (1) is turned to the **PREHEAT** position, the terminal **30** is connected to the terminals **19** and **AC**. The glow plugs (6) become red-hot, and at the same time, the pre-heat indicator lamp (7) also lights on.

When the main switch is then turned to the **START** position with the safety switches (2) on, the terminal **30** is connected to the terminals **50** and **AC**. Consequently, battery current flows to the coil **C1** of the starter relay (4), and relay contact point **S1** is turned on.

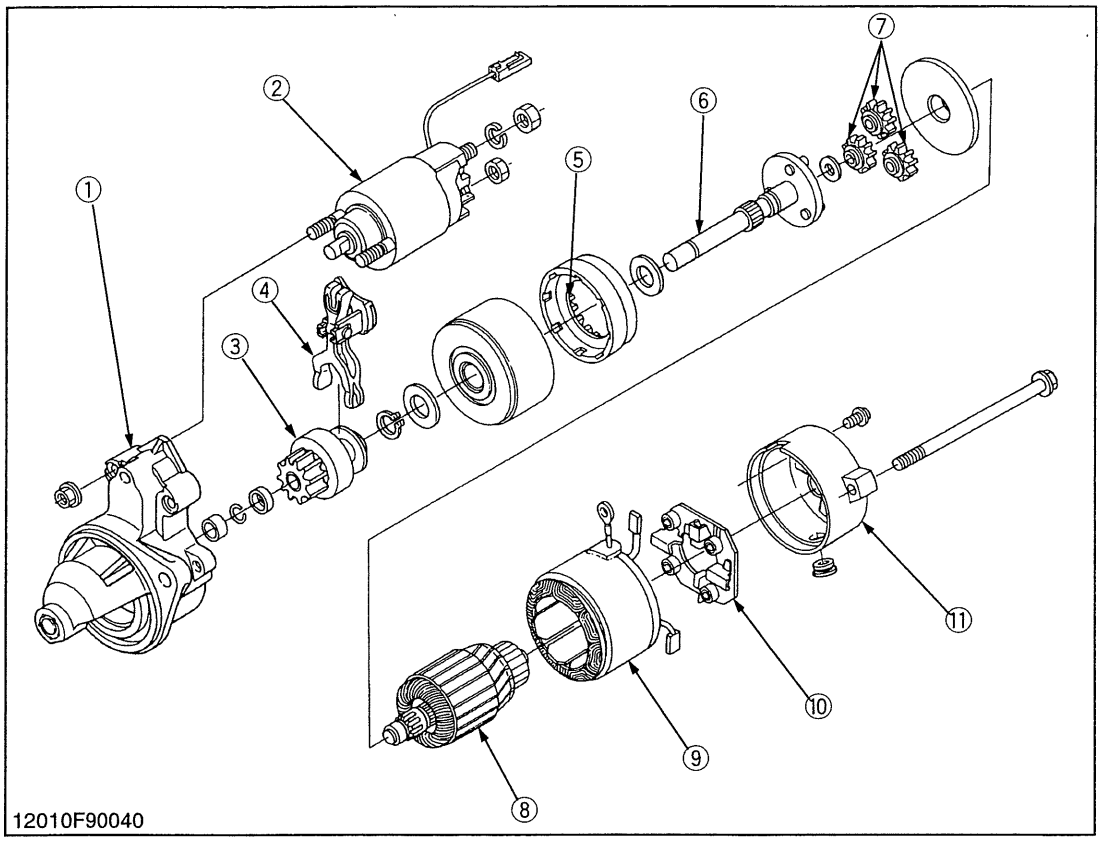
This actuates starter motor (5) and the glow plugs are kept red-hot.

The main switch automatically returns to the **ON** position, the terminal **30** is connected only to the terminal **AC**, thereby causing the starting circuit to be opened, stopping the starter motor.

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(1)Starter



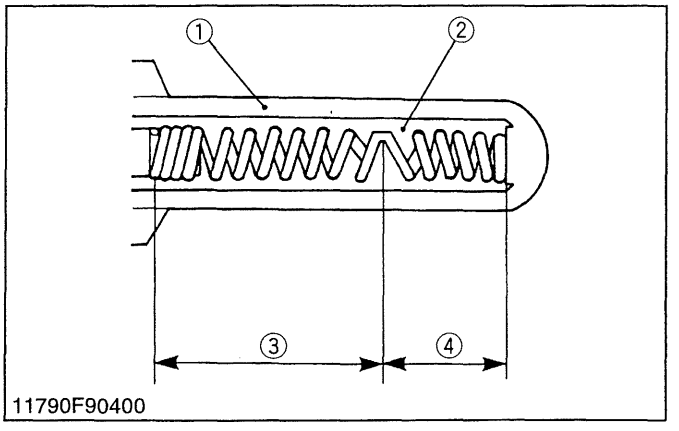
(1) Housing
(2) Magnetic Switch
(3) Overrunning Clutch
(4) Drive Lever
(5) Internal Gear
(6) Gear Shaft
(7) Planetary Gear
(8) Armature Shaft
(9) Yoke
(10) Brush Holder
(11) Rear End Frame

The starter is a reduction type.
The reduction system is used planetary gears, and the speed of gear shaft (6) is reduced to approximately one fifth of the armature shaft (8).

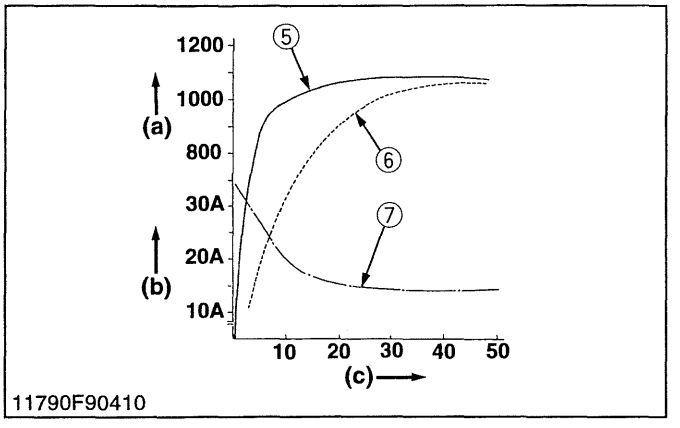
12010M90020

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(2) Glow Plug



11790F90400



11790F90410

This plug is a two-material type QGS (Quick Glow System) for quick temperature rise, and has self-controlling function as well as excellent durability.

The heater (4) connected in series to the heater (3), which also functions as the resistor, is incorporated in the sheath tube (1) of the super glow plug.

The resistance of this heater (3) cum resistor is small when the temperature is low, while the resistance becomes large when the temperature rises.

Therefore, because sufficient current is flown to the heater (4) during the initial period of energization, the temperature rises quickly and the resistance grows with the rise in the temperature of the resistor, the flowing current is reduces to prevent the heater (4) from being heated.

The ignition point is in the area of 2 to 3 mm (0.079 to 0.118 in.) from the tip of the plug in order to reduce its projection into the combustion chamber.

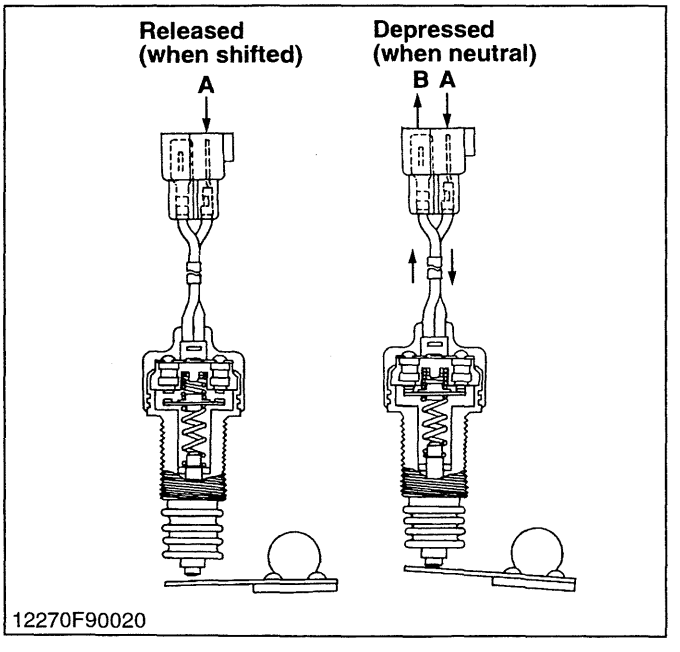
(1) Sheath Tube
(2) Insulation Powder
(3) Heater also functioning as a Resistor
(4) Heater
(5) Super Glow Plug
(6) Conventional Quick-heating type Glow Plug
(7) Glow Plug Current

(a) Glow Plug Temperature (˚C)
(b) Current (A)
(c) Time (Sec.)

12010M90030

(3) Safety Switch

■ Clutch Pedal, PTO Gear Shift Lever and HST Pedal



12270F90020

The safety switch prevents current from flowing to the starter when the safety switches are not depressed. This is to ensure safe starting.

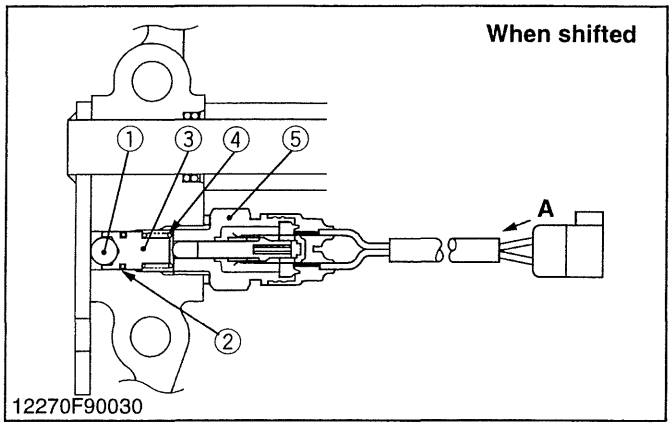
The safety switches are located three (Clutch pedal, PTO gear shift lever, HST pedal and range gear shift lever) different position.

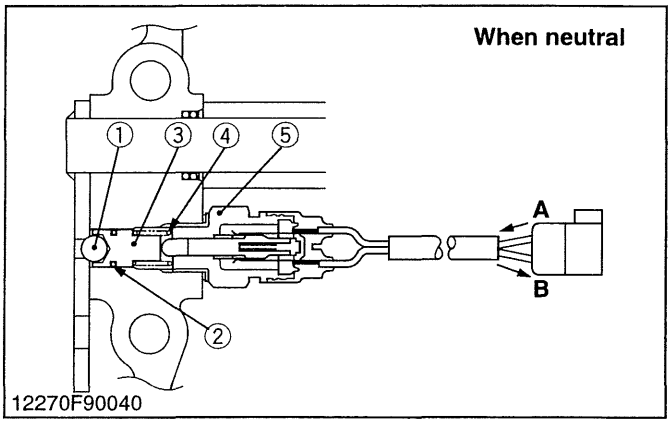
(A) From Main Switch
(B) To Starter

12270M90020

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■ Range Gear Shift Lever [Only B2710 Affected Serial No.: below 15496]





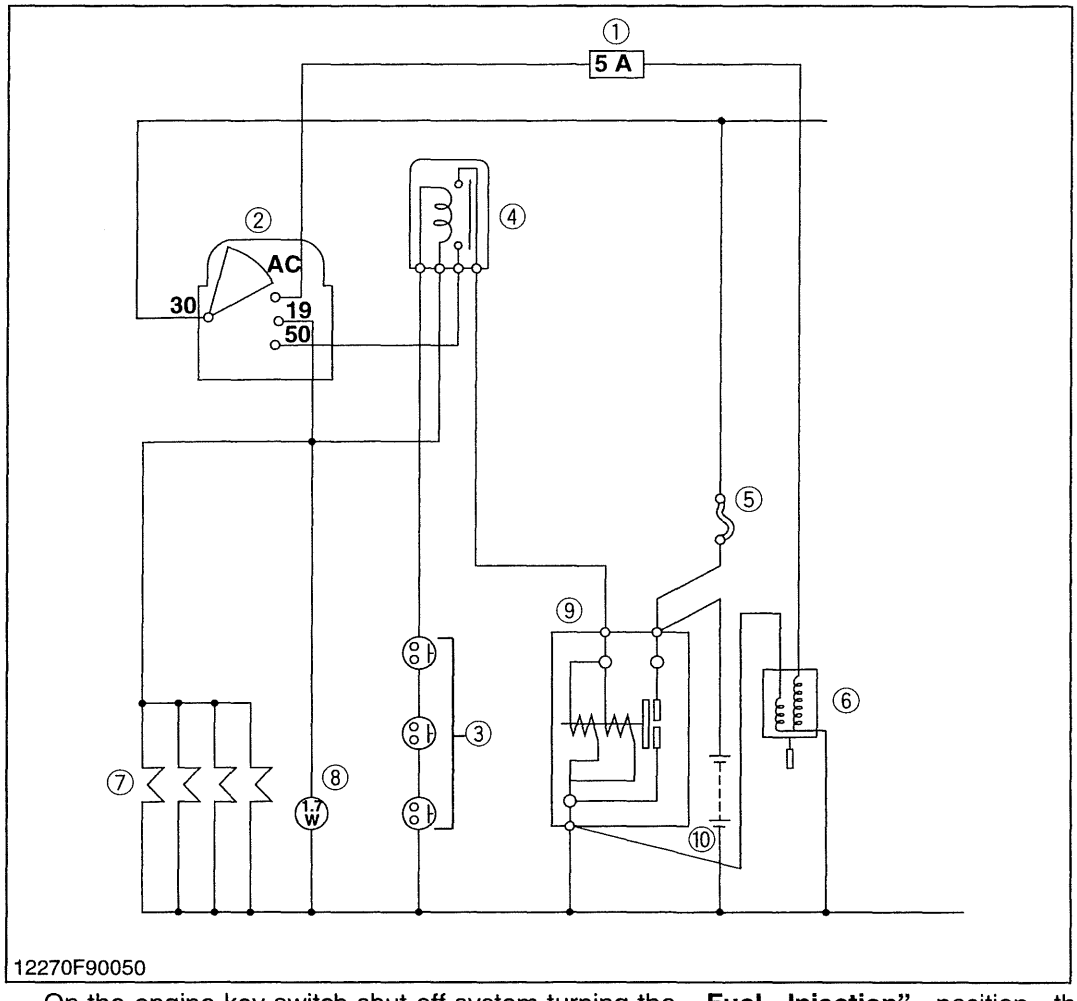
(1) Ball
(2) O-ring
(3) Poppet
(4) Spring
(5) Safety Switch

(A) From Main Switch
(B) To Starter

12271M90030

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[4] ENGINE KEY SWITCH SHUT-OFF SYSTEM



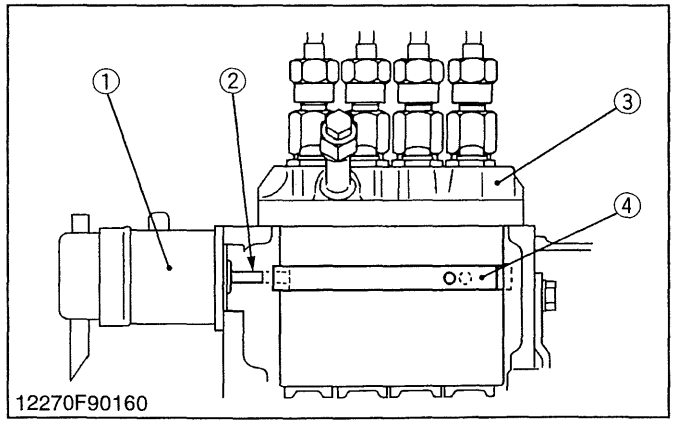
12270F90050

(1) Fuse
(2) Main Switch
(3) Safety Switches
(4) Starter Relay
(5) Slow Blow Fuse
(6) Engine Solenoid
(7) Glow Plugs
(8) Pre-heat Indicator Lamp
(9) Starter
(10) Battery

On the engine key switch shut-off system turning the main switch from the **ON** position to the **OFF** position moves the fuel injection pump control rack to the **"No Fuel Injection"** position through the fuel cut-off solenoid.

12270M90040

(1) Engine Stop Solenoid



12270F90160

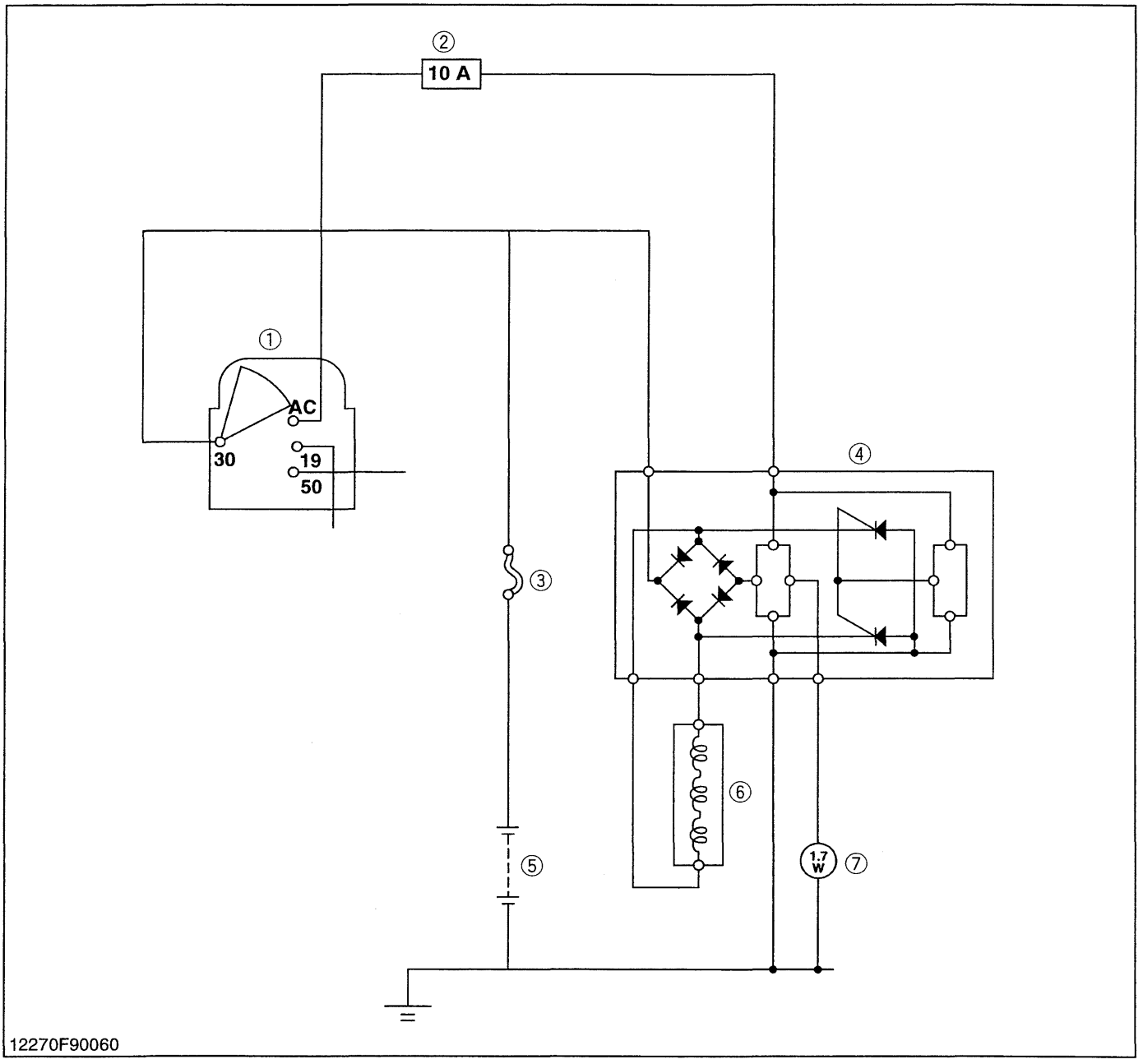
Flowing of the battery current into the fuel cut off solenoid, the plunger (2) move to left side so that the movement of control rack (4) becomes free. When the battery current stops, the plunger (2) is returned to the original position by the spring to keep the control rack (4) in **"No fuel injection"** position.

(1) Engine Stop Solenoid
(2) Plunger
(3) Injection Pump
(4) Control Rack

12270M90050

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[5] CHARGING SYSTEM



(1) Main Switch
(2) Fuse
(3) Slow Blow Fuse
(4) Regulator
(5) Battery
(6) AC Dynamo
(7) Charge Lamp

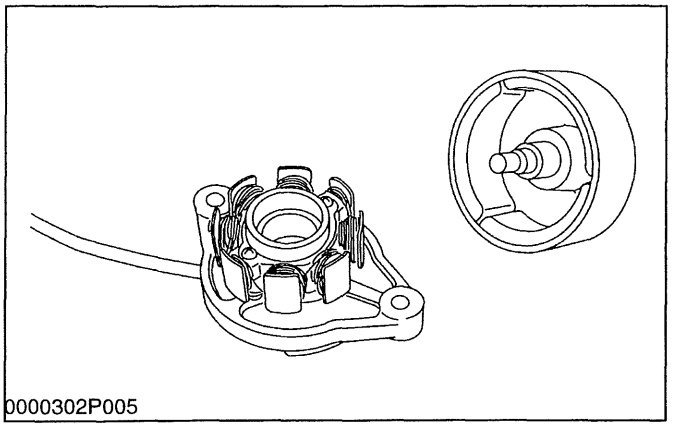
The charging system supplies electric power for various electrical devices and also charges the battery while the engine runs.

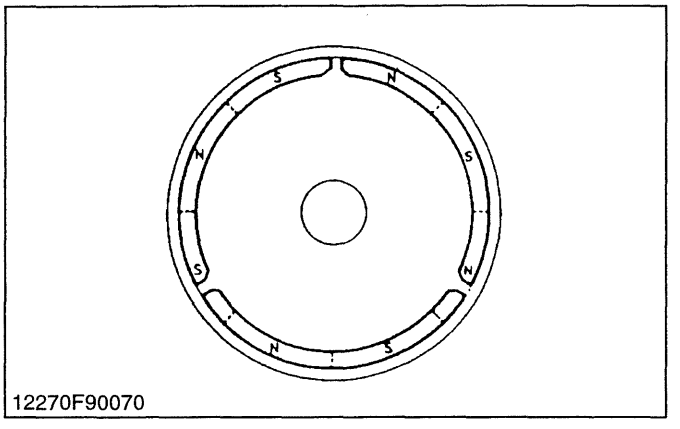
It consists of a AC dynamo and a regulator.

12270M90060

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(1) AC Dynamo


0000302P005



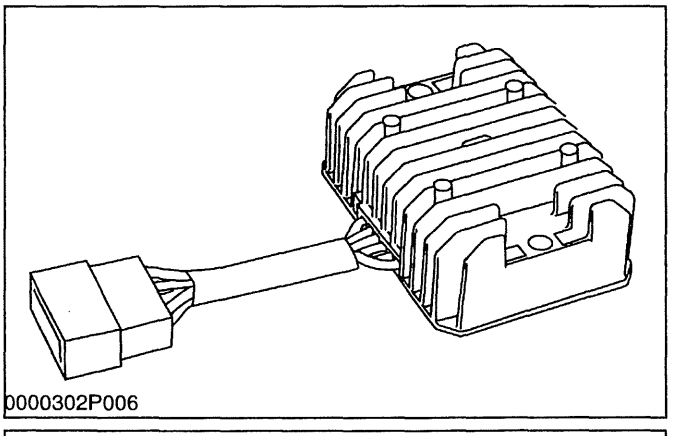
12270F90070

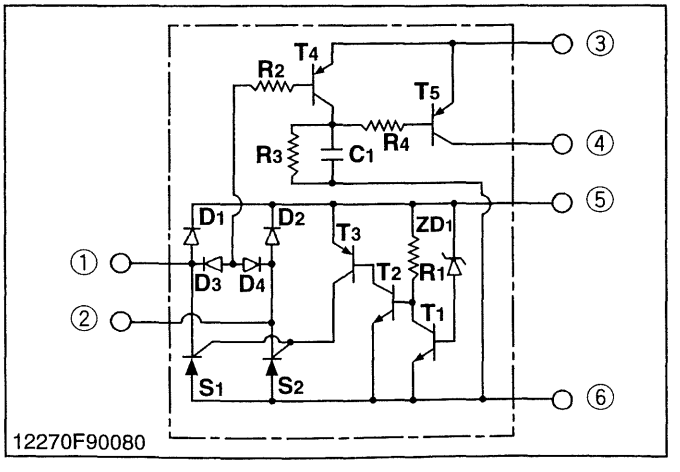
The dynamo is an 8-8 pole rotating magnet type generator. It is simple in construction, consisting of a stator and rotor. The rotor is made up of eight permanent magnet pole pieces assembled on a shaft and rotates on the center of the stator around which eight electromagnetic coils are provided for.

This dynamo produces higher voltage in slow speed rotation, and charges electric current to the battery during engine idling.

12270M90070

(2) Regulator


0000302P006



12270F90080

A regulator has two functions:

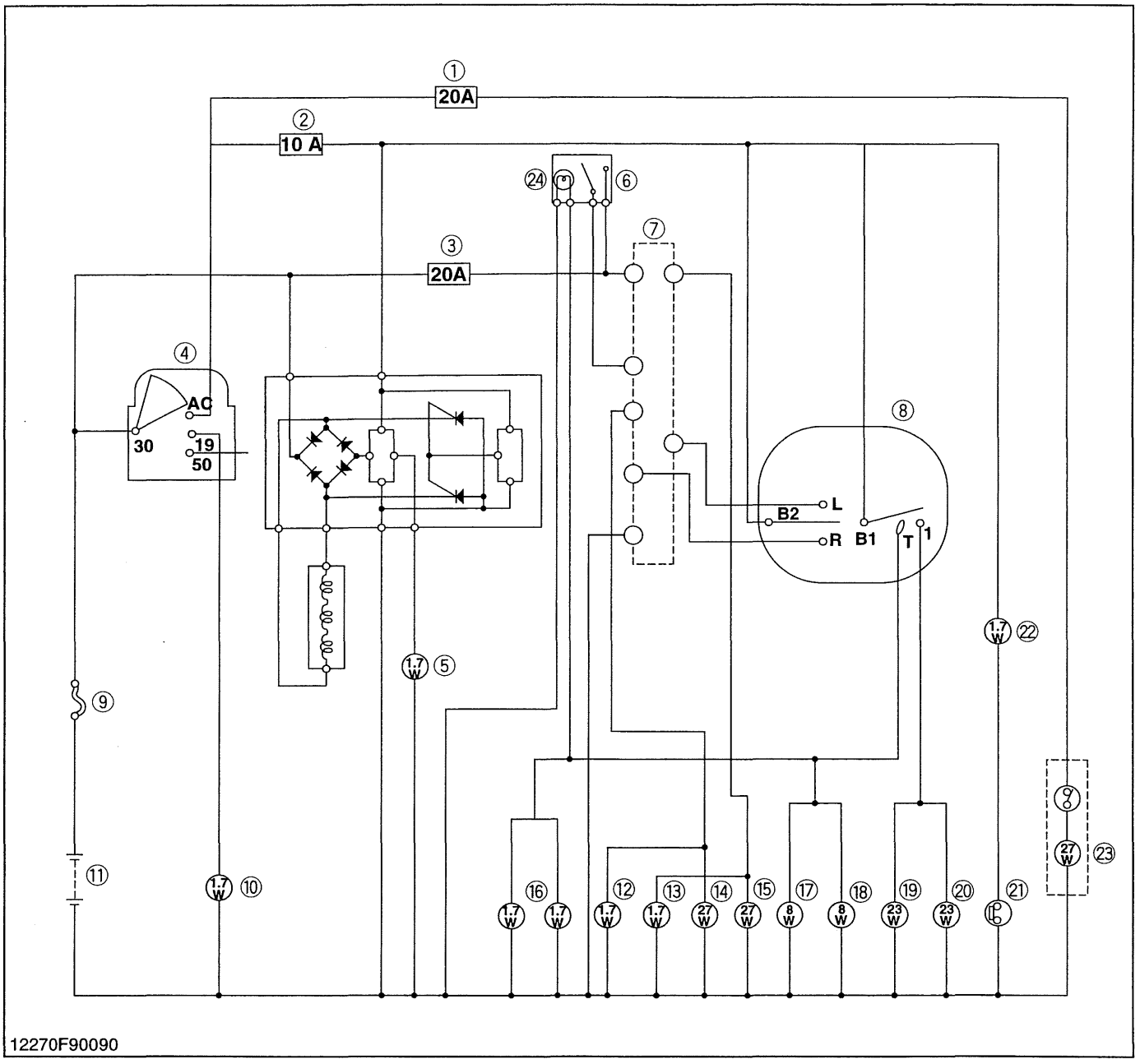
1. When the battery voltage is low, it turns the SCR on to form a charging circuit to the battery.
2. During charging, it turns the charging lamp off.

(1) Light Green (AC Dynamo)
(2) Light Green (AC Dynamo)
(3) Red / Yellow (Main Switch Terminal AC)
(4) White Red (Charge Lamp)
(5) Red (Main Switch Terminal No. 30)
(6) Black (Ground)
C1: Capacitor
D1: Diode
D2: Diode
D3: Diode
D4: Diode
R1: Resistor
R2: Resistor
R3: Resistor
R4: Resistor
S1: SCR (Silicon Controlled Rectifier)
S2: SCR (Silicon Controlled Rectifier)
T1: Transistor
T2: Transistor
T3: Transistor
T4: Transistor
T5: Transistor
ZD1: Zener Diode

12270M90080

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[6] LIGHTING SYSTEM



12270F90090

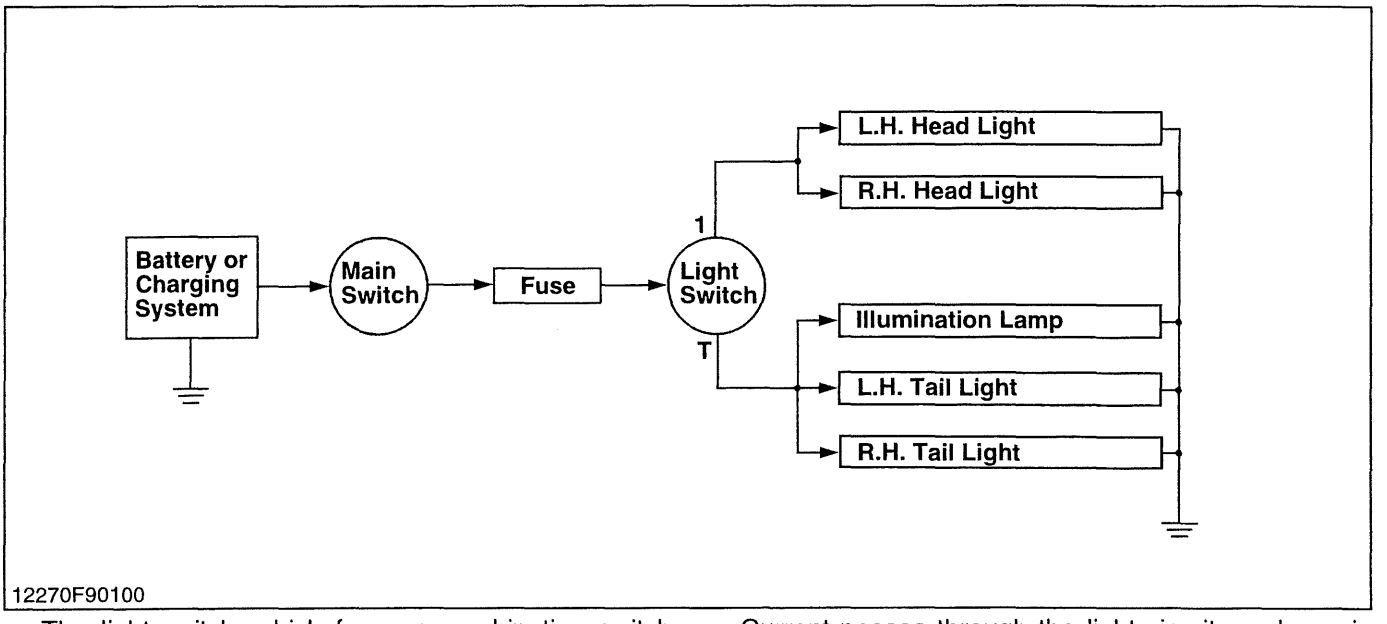
(1) Fuse
(2) Fuse
(3) Fuse
(4) Main Switch
(5) Charge Lamp (1.7 W)
(6) Hazard Switch
(7) Flasher Unit
(8) Combination Switch
(9) Slow Blow Fuse
(10) Pre-heat Indicator Lamp (1.7 W)
(11) Battery
(12) L.H. Hazard Lamp (1.7 W)
(13) R.H. Hazard Lamp (1.7 W)
(14) L.H. Hazard Light (27 W)
(15) R.H. Hazard Light (27 W)
(16) Illumination Lamp (1.7 W)
(17) L.H. Tail Light (8 W)
(18) R.H. Tail Light (8 W)
(19) L.H. Head Light (Hi) (23 W)
(20) R.H. Head Light (Hi) (23 W)
(21) Oil Pressure Switch
(22) Oil Pressure Indicator Lamp (1.7 W)
(23) Working Light (Optional) (27 W)
(24) Hazard Lamp

The lighting system consists of combination switch (light switch and hazard switch), head lights, tail lights, hazard lights, etc.

12270M90090

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(1) Head Light

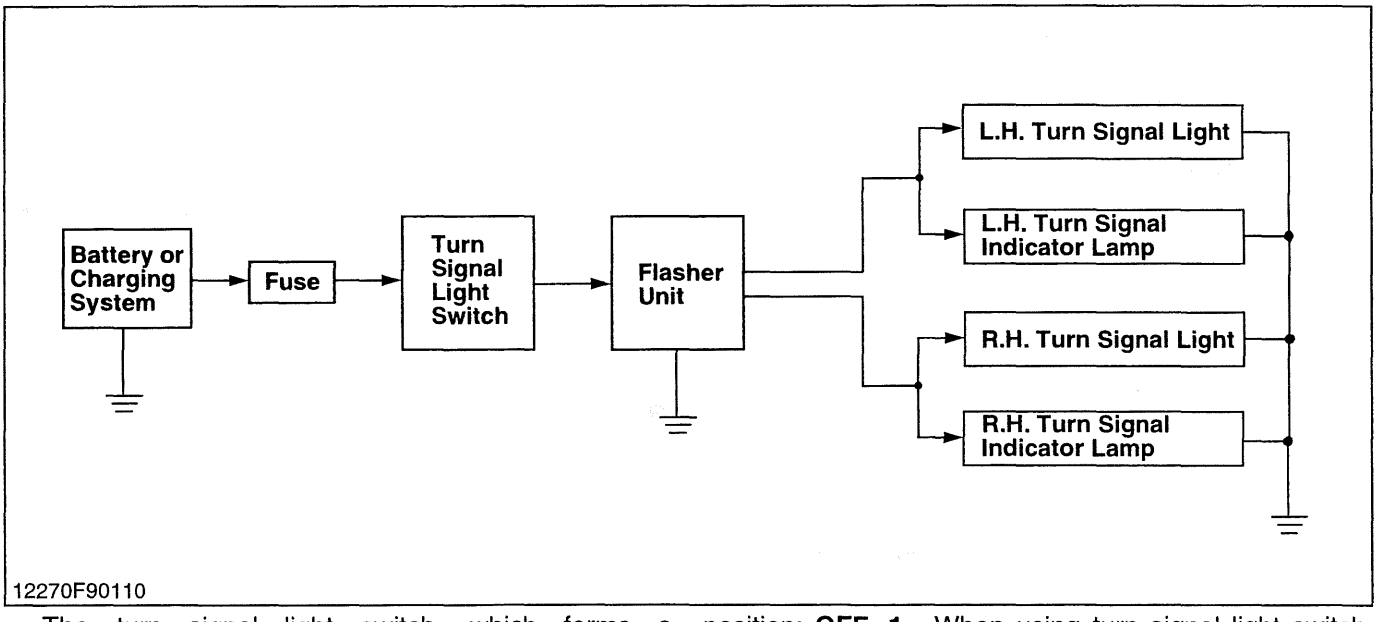


The light switch, which forms a combination switch with the hazard switch, has two position; **OFF** and **ON**.

Current passes through the light circuit as shown in the figure above.

12270M90100

(2) Turn Signal Light

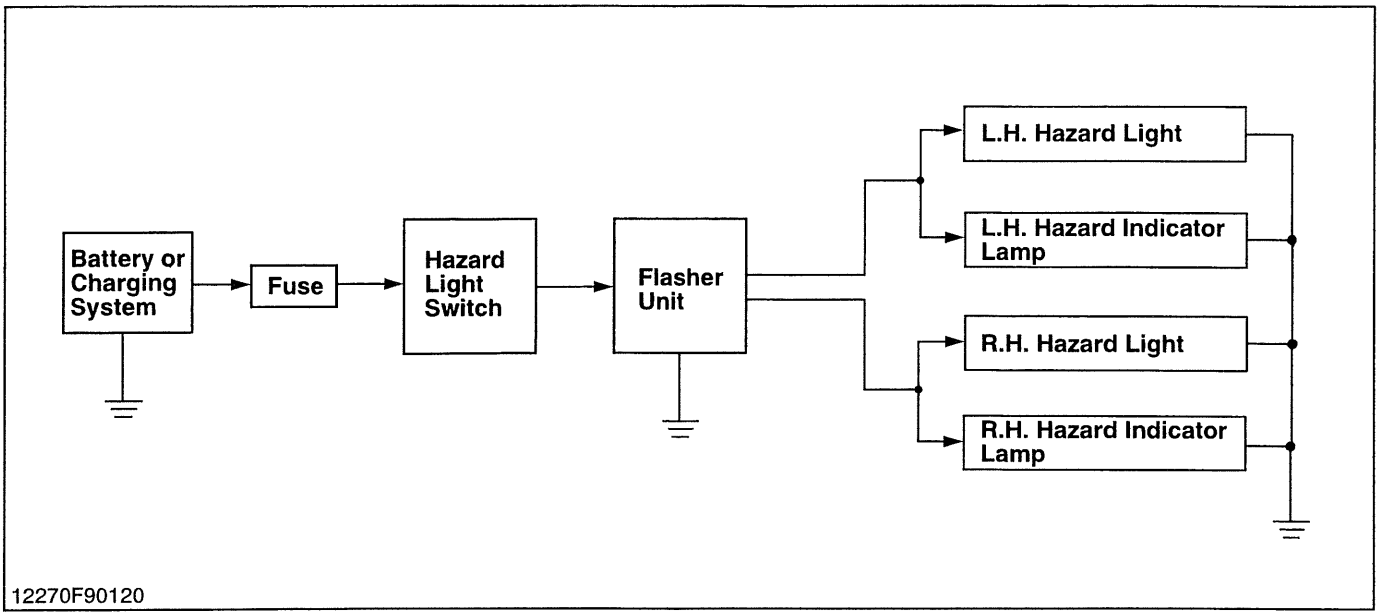


The turn signal light switch, which forms a combination switch with the light switch, has two position; **OFF**, **1**. When using turn signal light switch, blinks only one side light and other one stays on.

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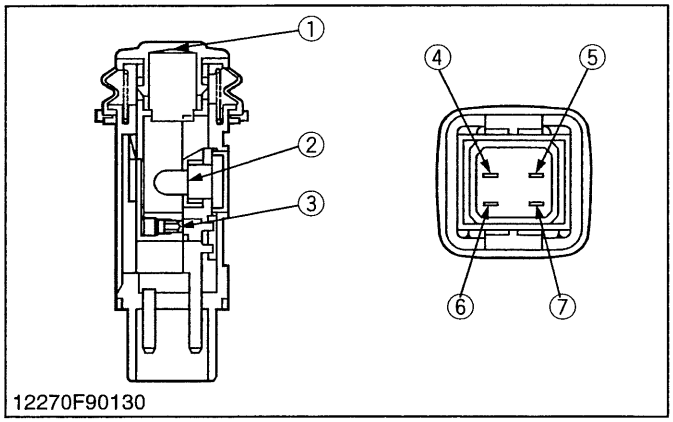
(3) Hazard Light



12270F90120

Hazard switch has two positions; **ON** and **OFF**. Blinking the hazard lights and indicator lamps as shown in the figure above.

12270M90120



12270F90130

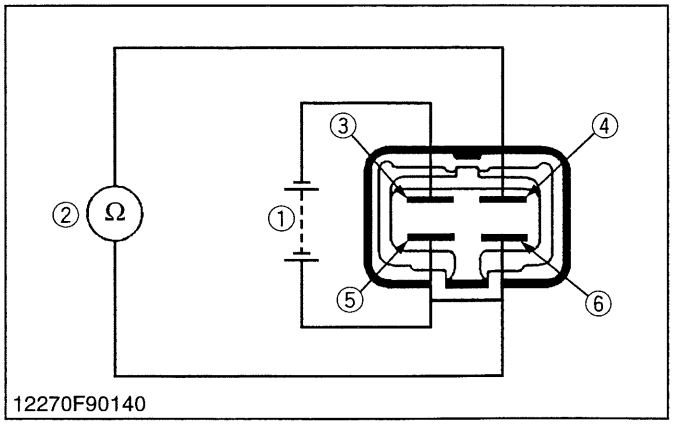
■ Hazard Switch

This is a pushing type switch to turn on the hazard lamps. The lamp (2) in the switch is lighted up by the current from out side of the switch, when the switch is **"ON"**. The circuit in the switch is shown below.

Terminal	a	c	d	e
OFF			● — Lamp	— ●
ON	●	— ●	● — Lamp	— ●

(1) Lens
(2) Lamp
(3) Contact Portion
(4) Terminal a
(5) Terminal d
(6) Terminal c
(7) Terminal e

12270M90130



12270F90140

■ Starter Relay

The starter relay is used in the hazard light circuit. The circuit in the relay is shown figure left.

(1) Battery
(2) Ohmmeter
(3) Terminal Coil
(4) Terminal COM.
(5) Terminal Coil
(6) Terminal NO

12270M90140

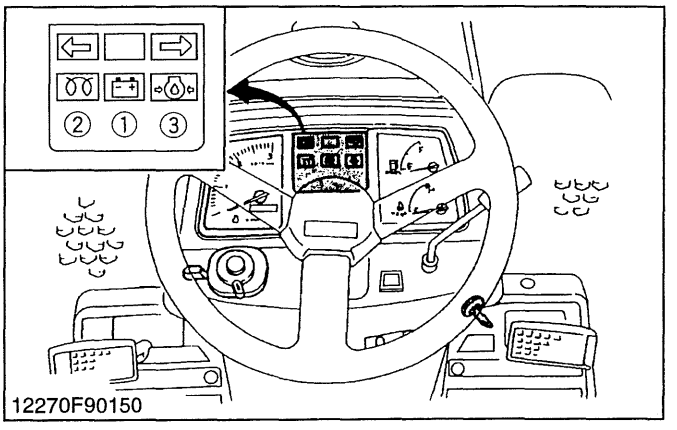
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[7] EASY CHECKER

To check the conditions of tractor easily before and during operation, easy checker combination of lamps on the easy checker board is provided.

12010M90100

(1) Indication Items



12270F90150

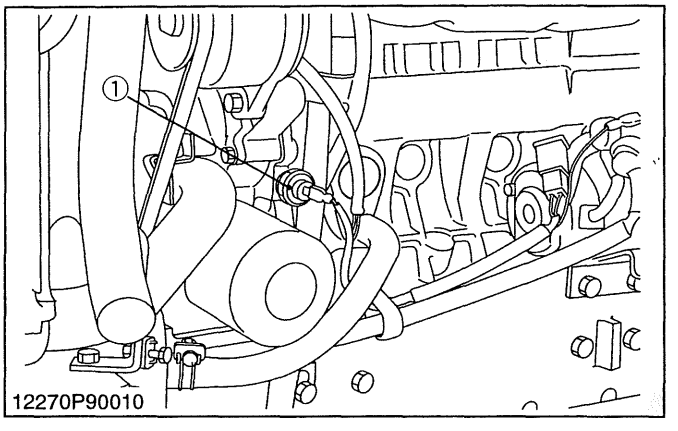
(1) Charge Lamp
When the charging system is not functioning properly, this lamp illuminates.

(2) Pre-heat Indicator Lamp
When the key switch is in the **"Pre-heat"** position, the pre-heat indicator lamp illuminates.

(3) Oil Pressure Lamp
When the engine oil pressure is low, this lamp illuminates.

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(2) Engine Oil Pressure Alarm

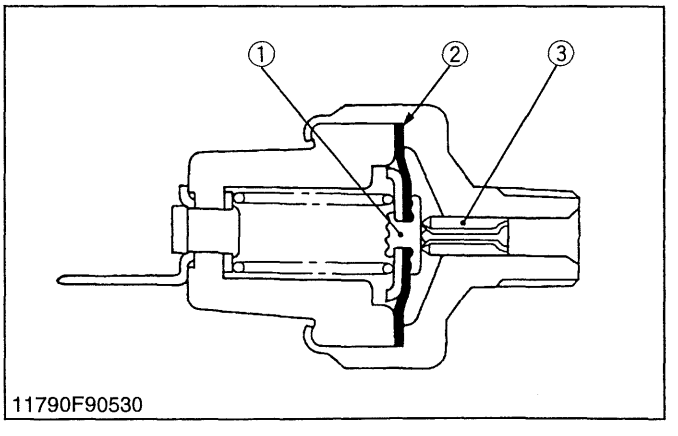


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When the engine oil pressure has dropped, the engine oil pressure switch is activated to let the current flow from the main switch and to light up the lamp.

(1) Oil Pressure Switch

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■ Engine Oil Pressure Switch

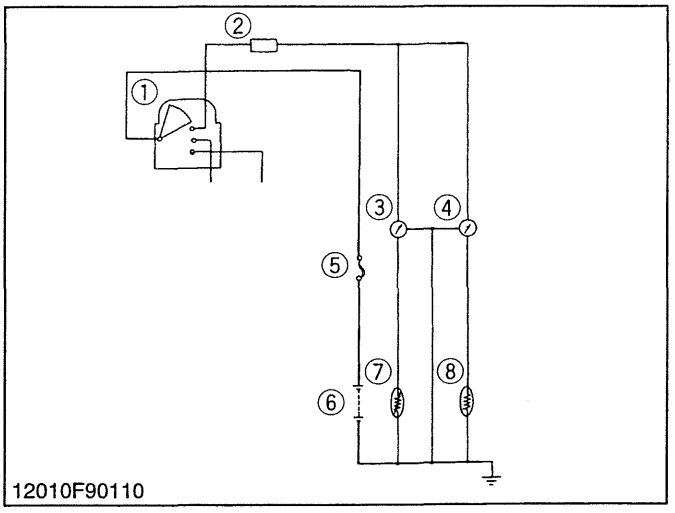
While oil pressure is high and the force applied to the diaphragm (2) is larger than the spring tension, the terminal contact (1) is open separated from the body contact (3). If the pressure drops below approx. 49 kPa (0.5 kgf/cm^2, 7.1 psi), the contact closes.

(1) Terminal Contact
(2) Diaphragm
(3) Body Contact

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[8] GAUGE

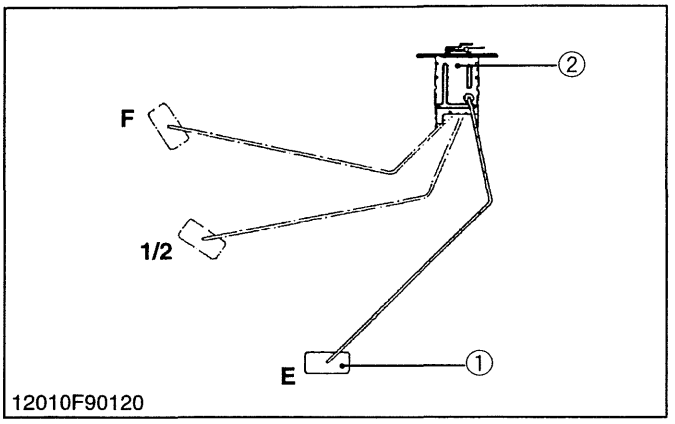


The fuel quantity and coolant temperature are indicated by the ammeters. The ammeters indicate each amperage flowing through the fuel level sensor (7) for the fuel quantity detection and through the coolant temperature sensor (8) for the coolant temperature detection.

(1) Main Switch
(2) Fuse (10 A)
(3) Fuel Gauge
(4) Water Temperature Gauge
(5) Slow Blow Fuse
(6) Battery
(7) Fuel Level Sensor
(8) Water Temperature Sensor

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(1) Fuel Quantity



■ Fuel Level Sensor

The remaining fuel quantity is detected by the fuel level sensor installed in the fuel tank and indicated on the fuel gauge. For detection, a float and a resistor are used.

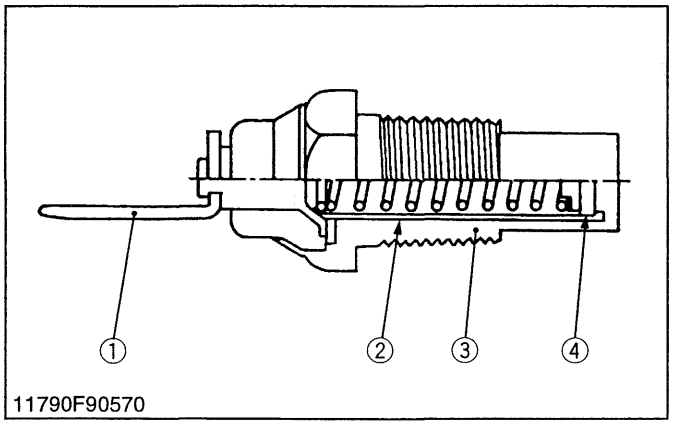
As the float (1) lowers, the resistance of the variable resistor (2) varies. The relation between the amount of fuel and the resistance is as follows.

F	1/2	E
1 to 5 Ω	27.5 to 37.5 Ω	103 to 117 Ω

(1) Float
(2) Variable Resistor

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(2) Coolant Temperature



■ Coolant Temperature Sensor

The coolant temperature sensor is installed to the cylinder head of engine, and its tip is in touch with the coolant. It contains a thermistor (4) whose electrical resistance decreases as the temperature increases.

Current varies with changes in the coolant temperature, and the increases or decreases in the current move the pointer of gauge.

Characteristics of Thermistor	
Temperature	Resistance
50 °C (122 °F)	148.8 Ω
80 °C (176 °F)	50.3 Ω
120 °C (248 °F)	16.0 Ω
170 °C (338 °F)	5.6 Ω

(1) Terminal
(2) Insulator
(3) Body
(4) Thermistor

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SERVICING

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TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
All Electrical Equipments Do Not Operate	• Battery discharged or defective	Recharge or Replace	9-S5, S6
	• Battery positive cable disconnected or improperly connected	Repair or Replace	9-S5
	• Battery negative cable disconnected or improperly connected	Repair or Replace	9-S5
	• Slow blow fuse blown	Replace	G-29
Fuse Blown Frequently	• Short-circuited	Repair or Replace	–

BATTERY

Battery Discharges Too Quickly	• Battery defective	Recharge or Replace	9-S5, S6
	• Dynamo defective	Repair or Replace	9-S15, S16
	• IC Regulator defective	Replace	–
	• Wiring harness disconnected or improperly connected (between battery positive terminal and regulator **B** terminal)	Repair or Replace	9-S15
	• Cooling fan belt slipping	Adjust tension	G-22

STARTING SYSTEM

Starter Motor Does Not Operate	• Battery discharged or defective	Recharge or Replace	9-S5, S6
	• Slow blow fuse blown	Replace	–
	• Safety switch improperly adjusted or defective	Repair or Replace	9-S10
	• Wiring harness disconnected or improperly connected (between main switch 50 terminal and safety switches, between safety switches and starter motor, between battery positive terminal and starter motor)	Repair or Replace	9-S7
	• Starter relay defective	Replace	9-S9
	• Starter motor defective	Repair or Replace	9-S11
	• Main switch defective	Replace	9-S7
Pre-heat Indicator Lamp Does Not Light When Main Switch Is in Pre-heat Position	• Battery discharged or defective	Recharge or Replace	9-S5, S6
	• Slow blow fuse blown	Replace	–
	• Wiring harness disconnected or improperly connected (between main switch 19 terminal and pre-heat indicator, between pre-heat indicator and glow plugs)	Repair or Replace	9-S7
	• Main switch defective	Replace	9-S11
	• Pre-heat indicator defective	Replace	9-S21

ENGINE KEY SWITCH SHUT-OFF SYSTEM

Engine Does Not Stop When Main Switch Is Turned OFF	• Fuse blown (5 A)	Replace	G-29
	• Wiring harness disconnected or improperly connected (between main switch AC terminal and engine stop solenoid)	Repair or Replace	9-S14
	• Engine stop solenoid defective	Replace	–
Engine Does Not Start	• Engine stop solenoid defective	Replace	–

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CHARGING SYSTEM

Symptom	Probable Cause	Solution	Reference Page
Charging Lamp Does Not Light when Main Switch Is Turned ON	• Fuse blown (10 A) • Wiring harness disconnected or improperly connected (between main switch **AC** terminal and panel board, between panel board and alternator) • Dynamo defective • Regulator defective	Replace Repair or Replace Repair or Replace Replace	– 9-S15 9-S15, S16 9-S15
Charging Lamp Does Not Go Off When Engine Is Running	• Wiring harness disconnected or improperly connected (between main switch **30** terminal and alternator, between panel board and alternator) • Dynamo defective • Regulator defective	Repair or Replace Repair or Replace Replace	9-S15 – 9-S15, S16 9-S15

LIGHTING SYSTEM

Head Light Does Not Light	• Fuse blown (10 A) • Bulb blown • Wiring harness disconnected or improperly connected (between main switch **AC** terminal and combination switch **B1** terminal, between combination switch **1** terminal and headlight, between combination switch **2** terminal and head light)	Replace Replace Repair or Replace	G-29 G-29 9-S17
Tail Light Does Not Light	• Fuse blown (10 A) • Bulb blown • Wiring harness disconnected or improperly connected (between main switch **AC** terminal and combination switch **B1** terminal, between combination switch **T** terminal and tail light)	Replace Replace Repair or Replace	G-29 G-29 9-S17
Illumination Light Does Not Light	• Fuse blown (10 A) • Bulb blown • Wiring harness disconnected or improperly connected (between main switch **AC** terminal and combination switch **B1** terminal, between combination switch **T** terminal and panel board)	Replace Replace Repair or Replace	G-29 G-29 9-S17
Hazard Light Does Not Light	• Fuse blown (10 A) • Bulb blown • Wiring harness disconnected or improperly connected • Flasher unit defective • Hazard switch defective	Replace Replace Repair or Replace Replace Replace	G-29 G-29 – 9-S19 9-S18
Hazard Indicator Lamp Does Not Light	• Bulb blown • Wiring harness disconnected or improperly connected	Replace Repair or Replace	9-S21 9-S18
Hazard Light Does Not Flicker	• Flasher unit defective	Replace	9-S19

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LIGHTING SYSTEM (Continued)

Symptom	Probable Cause	Solution	Reference Page
Turn Signal Light Does Not Light	• Fuse blown (10 A) • Bulb blown • Wiring harness disconnected or improperly connected • Flasher unit defective • Combination switch defective	Replace Replace Repair or Replace Replace Replace	G-29 G-29 9-S16 9-S19 9-S16
Turn Signal Light Indicator Lamp Does Not Light	• Bulb blown • Wiring harness disconnected or improperly connected (between combination switch **R** or **L** terminal and panel board)	Replace Repair or Replace	– 9-S16
Turn Signal Light Does Not Flicker	• Flasher unit defective • Combination switch defective	Replace Replace	9-S19 9-S16

EASY CHECKER

Oil Pressure Lamp Lights Up When Engine Is Running	• Engine oil pressure too low • Engine oil insufficient • Oil pressure switch defective • Short circuit between oil pressure switch lead and chassis • Circuit in panel board defective	Repair engine Replenish Replace Repair Replace	– G-12 9-S20 9-S20 –
Oil Pressure Lamp Does Not Light When Main Switch Is Turned ON and Engine Is Not Running	• Bulb blown • Oil pressure switch defective • Wiring harness disconnected or improperly connected (between panel board and oil pressure switch) • Circuit in panel board defective	Replace Replace Repair or Replace Replace	– – 9-S20 –

GAUGES

Fuel Gauge Does Not Function	• Fuel gauge defective • Fuel level sensor defective • Wiring harness disconnected or improperly connected (between panel board and fuel level sensor) • Circuit in panel board defective	Replace Replace Repair or Replace Replace	9-S21 9-S21 9-S21 –
Coolant Temperature Gauge Does Not Function	• Coolant temperature gauge defective • Coolant temperature sensor defective • Wiring harness disconnected or improperly connected (between panel board and coolant temperature sensor) • Circuit in panel board defective	Replace Replace Repair or Replace Replace	9-S22 9-S22 9-S22 –

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SERVICING SPECIFICATIONS

STARTER

Item		Factory Specification	Allowable Limit
Commutator	O.D.	28.0 mm 1.102 in.	27.0 mm 1.063 in.
	Difference of O.D.'s	Less than 0.02 mm 0.0008 in.	0.05 mm 0.0020 in.
Mica	Undercut	0.60 mm 0.0236 in.	0.20 mm 0.0079 in.
Brush	Length	14.0 mm 0.551 in.	9.0 mm 0.354 in.

GLOW PLUG

Glow Plug	Resistance	Approx. 0.9 ohms	–

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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
Starter			
• **M** terminal nut	8.8 to 11.8	0.9 to 1.2	6.5 to 8.7
• **C** terminal nut	7.9 to 11.8	0.8 to 1.2	5.8 to 8.7
• Magnetic switch mounting nut	5.9 to 10.8	0.6 to 1.1	4.4 to 7.9
• Through bolt	4.42 to 7.35	0.45 to 0.75	3.26 to 5.42

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CHECKING, DISASSEMBLING AND SERVICING

⚠ CAUTION

- **To avoid accidental short circuit, be sure to attach the positive cable to the positive terminal before the negative cable is attached to the negative terminal.**
- **Never remove the battery cap 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.**
- **Keep open sparks and flames away from the battery at all times. Hydrogen gas mixed with oxygen becomes very explosive.**

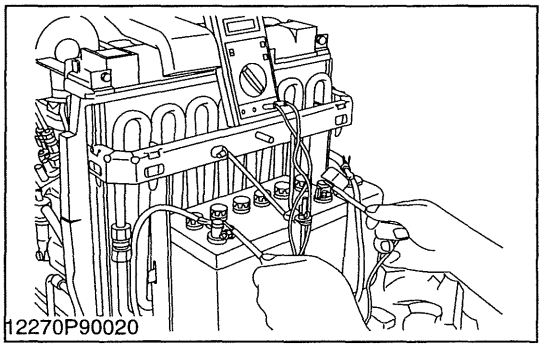
■ IMPORTANT

- **If the machine is to be operated for a short time without battery (using a slave battery for starting), use additional current (lights) while engine is running and insulate terminal of battery. If this advice is disregarded, damage to alternator and regulator may result.**

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[1] BATTERY

CHECKING

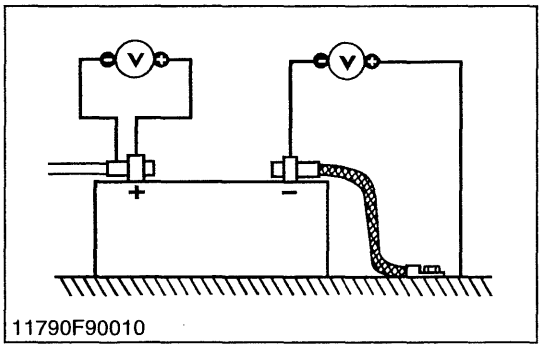

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Battery Voltage

1. Stop the engine and turn the main switch off.
2. Connect the COM (–) lead of the voltmeter to the battery's negative terminal post and the (+) lead to the positive terminal post, and measure the battery voltage.
3. If the battery voltage is less than the factory specification, check the battery specific gravity and recharge the battery.

Battery voltage	Factory spec.	More than 12 V

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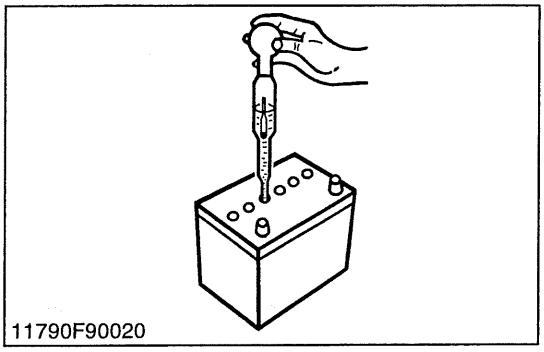
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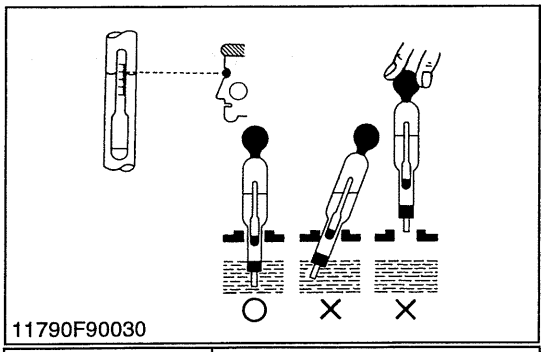
Battery Terminal Connection

1. Turn the main switch on, and turn on the head light.
2. Measure the voltage with a voltmeter across the battery's positive terminal post and the cable terminal, and the voltage across the battery's negative terminal post and the chassis.
3. If the measurement exceeds the factory specification, clean the battery terminal posts and cable clamps, and tighten them firmly.

Potential difference	Factory spec.	Less than 0.1 V

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Specific Gravity	State of Charge
1.260 Sp. Gr.	100 % Charged
1.230 Sp. Gr.	75 % Charged
1.200 Sp. Gr.	50 % Charged
1.170 Sp. Gr.	25 % Charged
1.140 Sp. Gr.	Very Little Useful Capacity
1.110 Sp. Gr.	Discharged

At an electrolyte temperature of 20 °C (68 °F)

Battery Specific Gravity

1. Check the specific gravity of the electrolyte in each cell with a hydrometer.
2. When the electrolyte temperature differs from that at which the hydrometer was calibrated, correct the specific gravity reading following the formula mentioned in **(Reference)**.
3. If the specific gravity is less than 1.215 (after it is corrected for temperature), charge or replace the battery.
4. If the specific gravity differs between any two cells by more than 0.05, replace the battery.

■ NOTE

- **Hold the hydrometer tube vertical without removing it from the electrolyte.**
- **Do not suck too much electrolyte into the tube.**
- **Allow the float to move freely and hold the hydrometer at eye level.**
- **The hydrometer reading must be taken at the highest electrolyte level.**

(Reference)

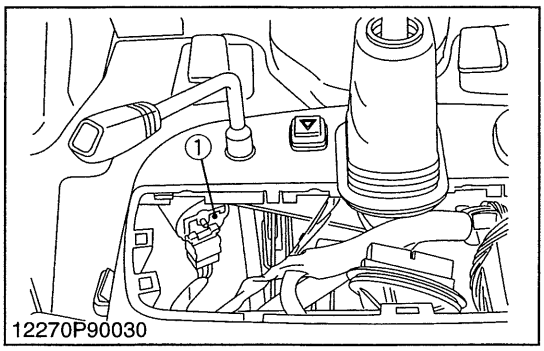
- Specific gravity slightly varies with temperature. To be exact, the specific gravity decreases by 0.0007 with an increase of 1°C (0.0004 with an increase of 1 °F) in temperature, and increases by 0.0007 with a decreases of 1 °C (0.0004 with a decrease of 1 °F).
  Therefore, using 20 °C (68 °F) as a reference, the specific gravity reading must be corrected by the following formula :
  - Specific gravity at 20 °C = Measured value + 0.0007 × (electrolyte temperature – 20 °C)
  - Specific gravity at 68 °F = Measured value + 0.0004 × (electrolyte temperature – 68 °F)

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[2] STARTING SYSTEM

CHECKING

(1) Main Switch



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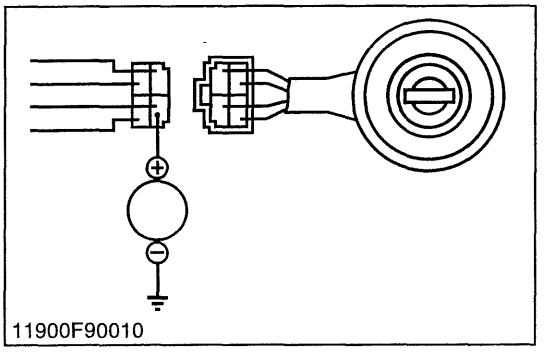
Main Switch

1. Remove the panel board.
2. Disconnect the **4P** connector and remove the main switch (1).
3. Perform the following checks.

(1) Main Switch

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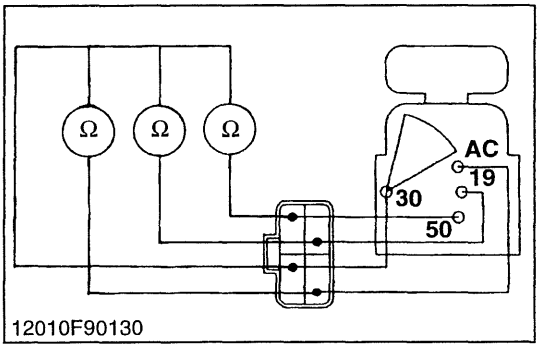

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Connector Voltage

1. Measure the voltage with a voltmeter across the connector **30** terminal and chassis.
2. If the voltage differs from the battery voltage (11 to 14 V), the wiring harness is faulty.

Voltage	Connector **30** terminal – chassis	Approx. battery voltage

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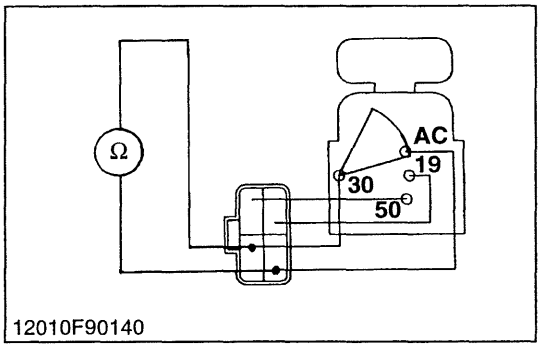
Main Switch Continuity

1) Main Switch Key at OFF Position

1. Set the main switch **OFF** position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **AC** terminal, **30** terminal and **50** terminal, **30** terminal and **19** terminal.
3. If infinity is not indicated, the contacts of the main switch are faulty.

Resistance	**30** terminal – **AC** terminal	Infinity
	30 terminal – **50** terminal	
	30 terminal – **19** terminal	

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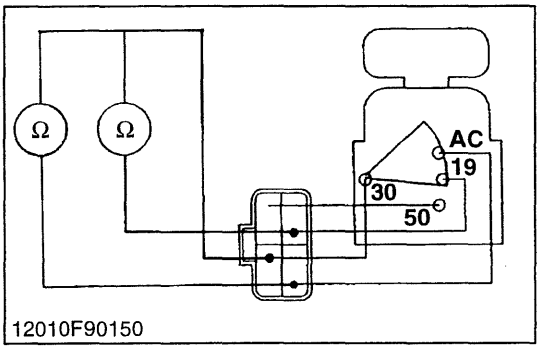
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2) Main Switch Key at ON Position

1. Set the main switch **ON** position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **AC** terminal.
3. If 0 ohm is not indicated, the **30** – **AC** contact of the main switch are faulty.

Resistance	**30** terminal – **AC** terminal	0 ohm

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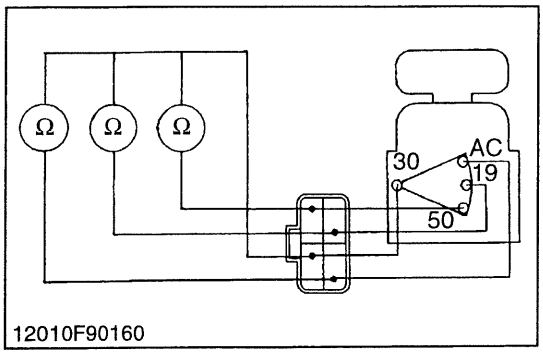
3) Main Switch Key at PREHEAT Position

1. Set and hold the main switch key at the **PREHEAT** position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **19** terminal, and measure the resistance across the **30** terminal and the **AC** terminal.
3. If 0 ohm is not indicated, these contacts of the main switch are faulty.

Resistance	**30** terminal – **19** terminal	0 ohm
	30 terminal – **AC** terminal	

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4) Main Switch Key at START Position

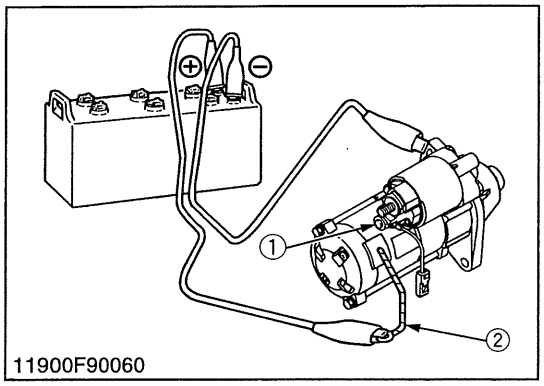
1. Set and hold the main switch key at the **START**position.
2. Measure the resistance with an ohmmeter across the **30** terminal and the **19** terminal, across the **30** terminal and the **50** terminal, and across the **30** terminal and the **AC** terminal.
3. If 0 ohm is not indicated, these contacts of the main switch are faulty.

Resistance	**30** terminal – **19** terminal	0 ohm
	30 terminal – **50** terminal	
	30 terminal – **AC** terminal	

Key position \ Terminal	30	AC	19	50
OFF	●			
ON	●	●		
PREHEAT	●	●	●	
START	●	●	●	●

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(2) Starter



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(1) **C** Terminal (2) Connecting Lead

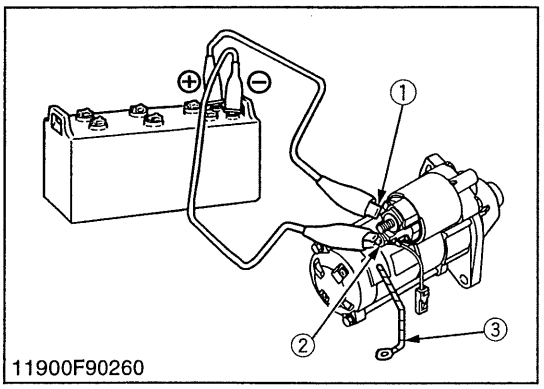
Motor Test

CAUTION

- **Secure the starter to prevent it from jumping up and down while testing the motor.**

1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable and the leads from the starter **M** terminal.
3. Remove the starter from the engine.
4. Disconnect the connecting lead (2) from the starter **C** terminal (1).
5. Connect a jumper lead from the connecting lead (2) to the battery positive terminal post.
6. Connect a jumper lead momentarily between the starter motor housing and the battery negative terminal post.
7. If the motor does not run, check the motor.

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(1) **S** Terminal (3) Connecting Lead
(2) **C** Terminal

Magnetic Switch Test

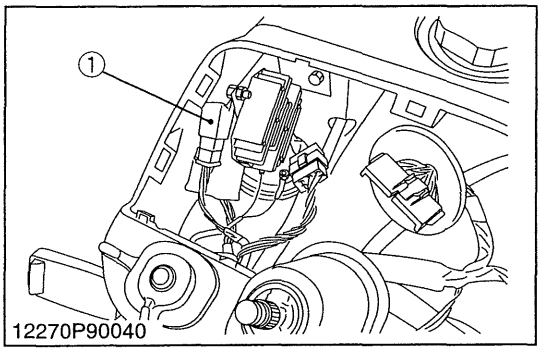
1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable and the leads from the starter **M** terminal.
3. Remove the starter from the engine.
4. Disconnect the connecting lead (3) from the starter **C** terminal (2).
5. Connect a jumper lead from the starter **S** terminal (1) to the battery positive terminal post.
6. Connect a jumper lead momentarily between the starter **C** terminal (2) and the battery negative terminal post.
7. If the pinion gear does not pop out, check the magnetic switch.

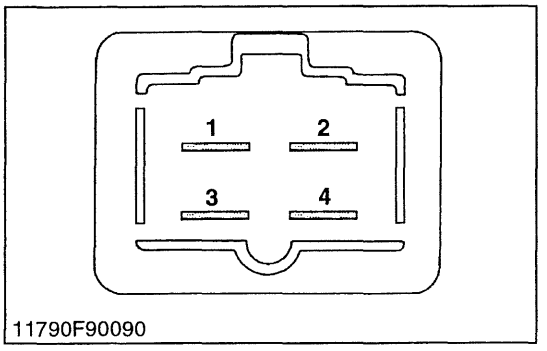
NOTE

- **This test should be carried out for a short time, about 3 to 5 seconds.**

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Starter Relay

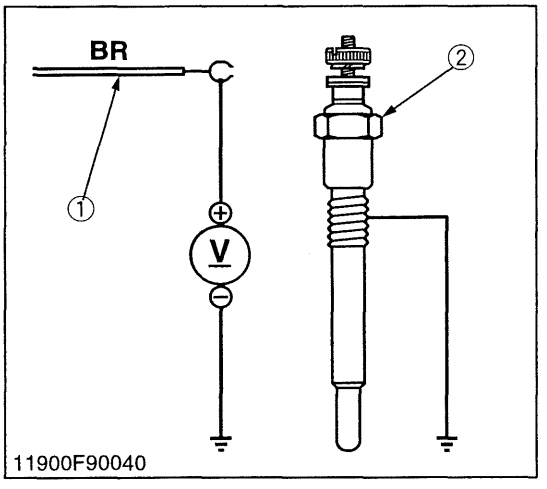
1. Open the panel board and remove out the starter relay.
2. Apply battery voltage across terminal **2** and **4**, and check for continuity across terminal **1** and **3**.
3. If 0 ohm is not indicated, renew the starter relay.

Resistance	**2 – 4**	Battery voltage is applied **1 – 3**	0 ohm

(1) Starter Relay

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(3) Glow Plug



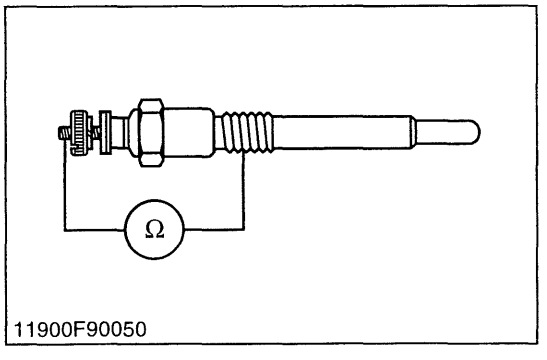
Lead Terminal Voltage

1. Disconnect the wiring lead (1) from the glow plug (2) after turning the main switch off.
2. Turn the main switch key to the **"PREHEAT"** position, and measure the voltage between the lead terminal and the chassis.
3. Turn the main switch key to the **"START"** position, and measure the voltage with a voltmeter between the lead terminal and the chassis.
4. If the voltage at either position differs from the battery voltage, the wiring harness or main switch is faulty.

Voltage (Lead terminal – Chassis)	Main switch key at **"PREHEAT"**	Approx. battery voltage
	Main switch key at **"START"**	Approx. battery voltage

(1) Wiring Lead (2) Glow Plug

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Glow Plug Continuity

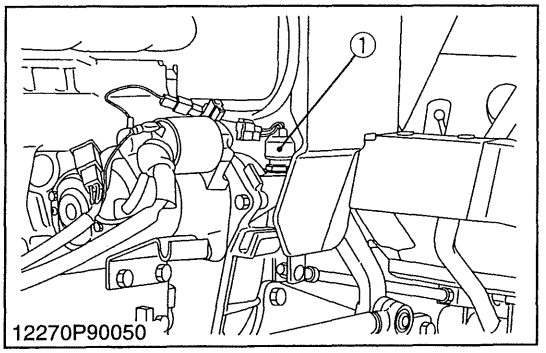
1. Disconnect the lead from the glow plugs.
2. Measure the resistance with an ohmmeter between the glow plug terminal and the chassis.
3. If 0 ohm is indicated, the screw at the tip of the glow plug and the housing are short-circuited.
4. If the factory specification is not indicated, the glow plug is faulty.

Glow plug resistance	Factory spec.	Approx. 0.9 ohms

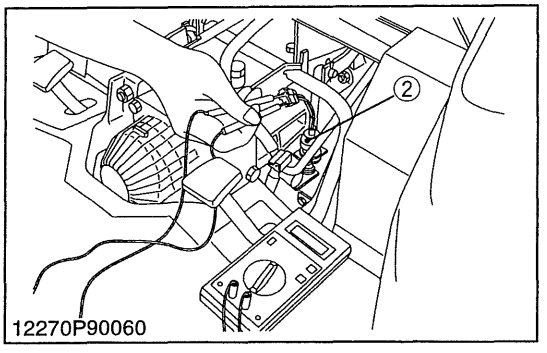
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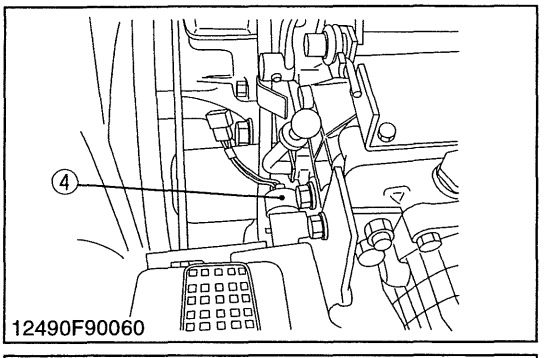
(4) Safety Switch



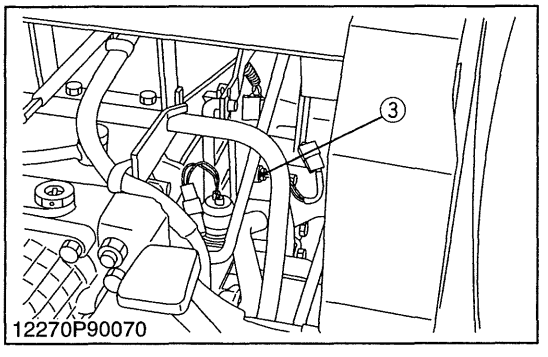
12270P90050



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12270P90070

Safety Switch Continuity

1. Remove the safety switch leads.
2. Connect the circuit tester to the safety switch leads.
3. Measure the resistance between leads.
4. If the safety switch is defective, replace it.

Resistance (Across switch terminal) of (1), (2) and (4)	When switch push is pushed	0 ohm
	When switch push is released	Infinity
Resistance (Across switch terminal) of (3)	When switch push is pushed	Infinity
	When switch push is released	0 ohm

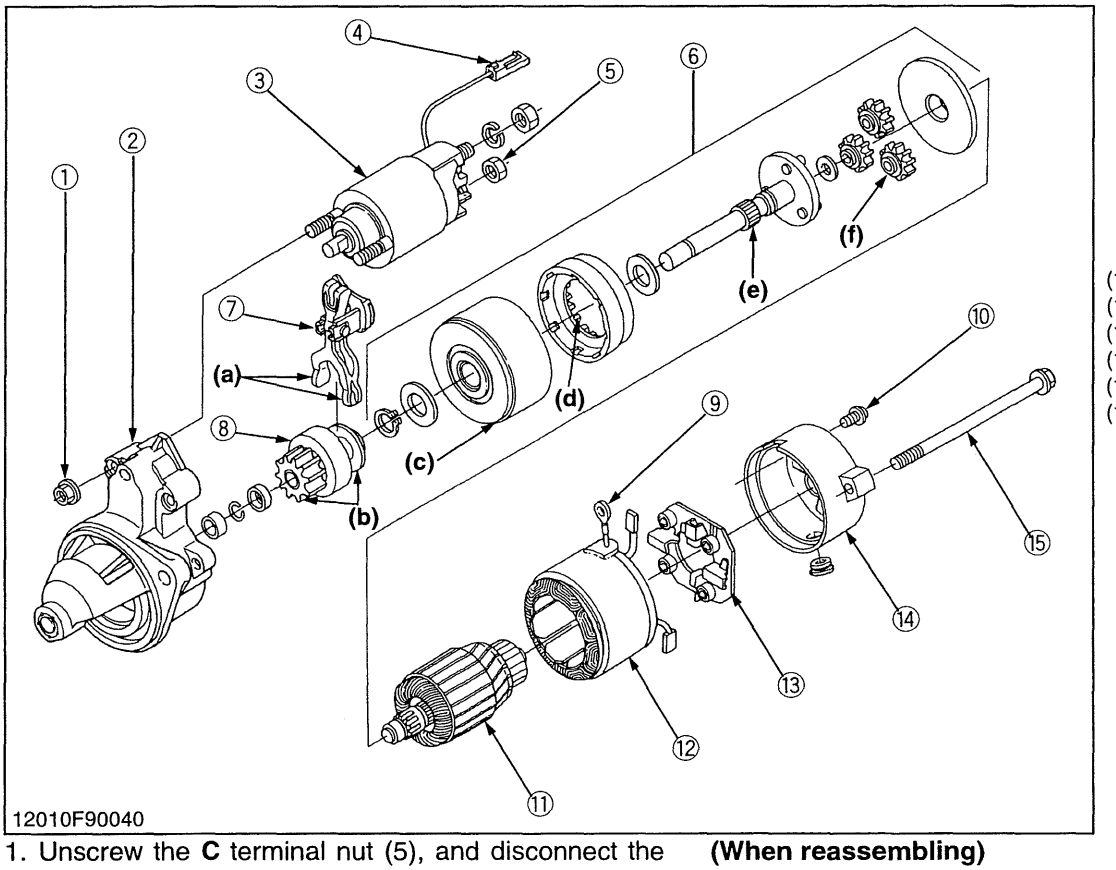
(1) Safety Switch for Clutch Pedal
(2) Safety Switch for PTO Gear Shift Lever
(3) Safety Switch for Range Gear Shift Lever(Only B2710 Affected Serial No.: below 15496)
(4) Safety Switch for HST

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DISASSEMBLING AND ASSEMBLING

Disassembling Starter



(1) Magnetic Switch Mounting Nut
(2) Housing
(3) Magnetic Switch
(4) Connecting Lead
(5) **C** Terminal Nut
(6) Shaft Assembly
(7) Drive Lever
(8) Overrunning Clutch
(9) Connecting Lead
(10) Mounting Screw
(11) Armature
(12) Yoke
(13) Brush Holder
(14) Rear End Frame
(15) Through Bolt

1. Unscrew the **C** terminal nut (5), and disconnect the connecting leads (4), (9).
2. Unscrew the magnetic switch mounting nuts (1), and remove the magnetic switch (3) from the housing (2).
3. Unscrew the through bolts (15) and mounting screws (10), and remove the rear end frame (14).
4. Remove the brush from the brush holder while holding the spring up.
5. Remove the brush holder (13).
6. Draw out the armature (11) and yoke (12) from the housing.
7. Draw out the shaft assembly (6) with the drive lever (7) and overrunning clutch (8) from the the housing.

■ NOTE

- **Do not damage to the brush and commutator.**

(When reassembling)

- Apply grease (NIPPONDENSO No.50 or equivalent) to the parts indicated in the figure.

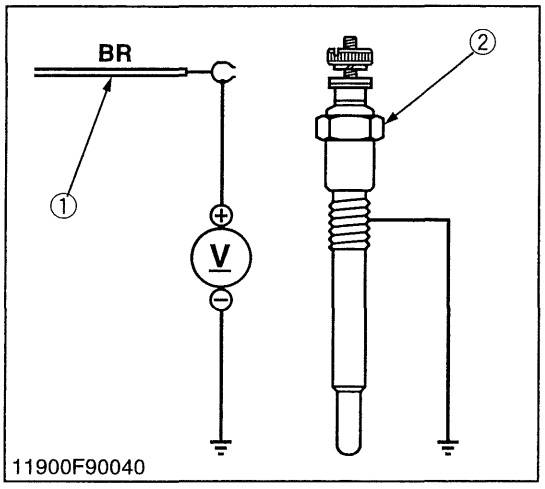
(a) Drive lever
(b) Teeth of pinion gear
(c) Center bearing
(d) Internal gear
(e) Shaft
(f) Planetary gear

Tightening torque	**C** terminal nut (5)	7.9 to 11.8 N·m 0.8 to 1.2 kgf·m 5.8 to 8.7 ft-lbs
	Magnetic switch mounting nut (1)	5.9 to 10.8 N·m 0.6 to 1.1 kgf·m 4.4 to 7.9 ft-lbs
	Through bolt (15)	4.42 to 7.35 N·m 0.45 to 0.75 kgf·m 3.26 to 5.42 ft-lbs

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SERVICING



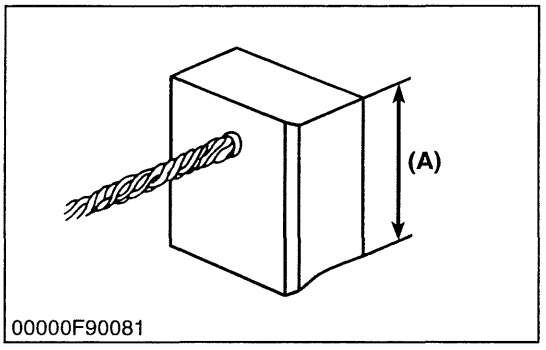
Lead Terminal Voltage

1. Disconnect the wiring lead (1) from the glow plug (2) after turning the main switch off.
2. Turn the main switch key to the **"PREHEAT"** position, and measure the voltage between the lead terminal and the chassis.
3. Turn the main switch key to the **"START"** position, and measure the voltage with a voltmeter between the lead terminal and the chassis.
4. If the voltage at either position differs from the battery voltage, the wiring harness or main switch is faulty.

Voltage (Lead terminal – Chassis)	Main switch key at **"PREHEAT"**	Approx. battery voltage
	Main switch key at **"START"**	Approx. battery voltage

(1) Wiring Lead (2) Glow Plug

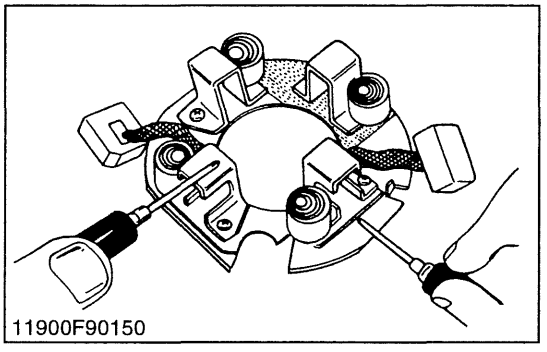
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Brush Wear

1. If the contact face of the brush is dirty or dusty, clean it with emery paper.
2. Measure the brush length **(A)** with vernier calipers.
3. If the length is less than the allowable limit, replace the yoke assembly and brush holder.

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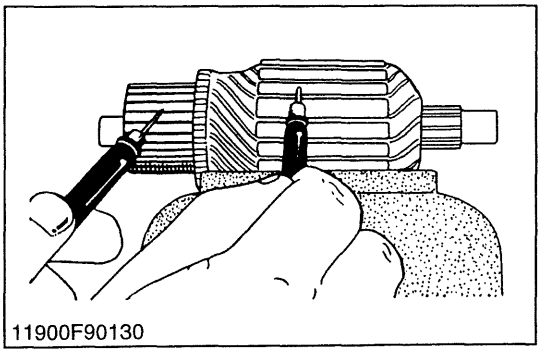


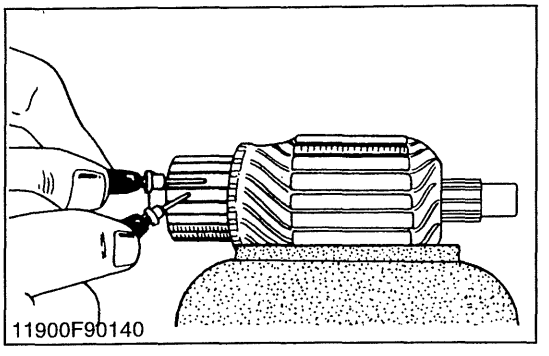
Brush Holder

1. Check the continuity between the brush holder and the holder support with an ohmmeter.
2. If it conducts, replace the brush holder.

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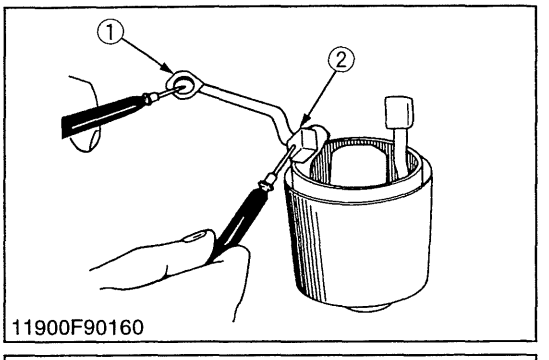

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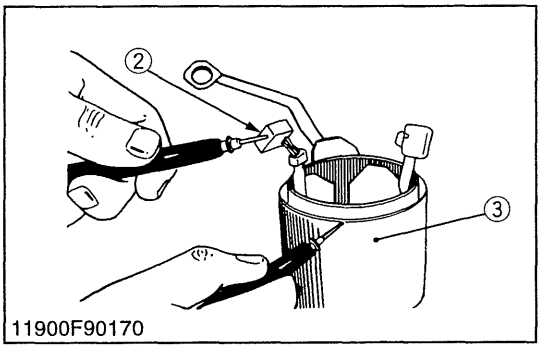
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Armature Coil

1. Check the continuity between the commutator and armature coil core with an ohmmeter.
2. If it conducts, replace the armature.
3. Check the continuity between the segments of the commutator with an ohmmeter.
4. If it does not conduct, replace the armature.



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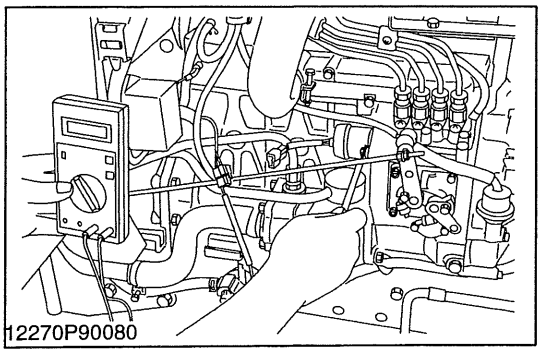
Field Coil

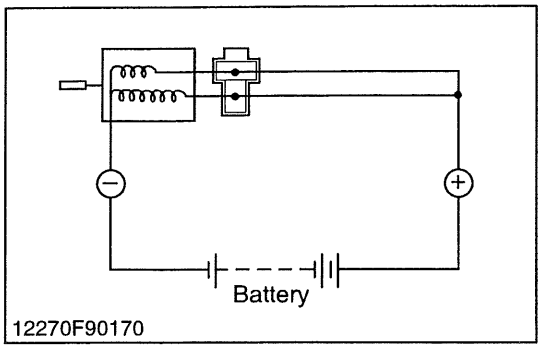
1. Check the continuity between the connecting lead (1) and the brush (2) with an ohmmeter.
2. If it does not conduct, replace the yoke assembly.
3. Check the continuity between the brush (2) and the yoke (3) with an ohmmeter.
4. If it conducts, replace the yoke assembly.

(1) Connecting Lead
(2) Brush
(3) Yoke

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[3] ENGINE KEY SWITCH SHUT-OFF SYSTEM CHECKING


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Engine Stop Solenoid

1) Lead Terminal Voltage

1. Disconnect the connector of engine stop solenoid.
2. Turn the main switch **"ON"**.
3. Measure the voltage with voltmeter across the terminal **1** and **2** (red, black and white) of the wiring harness side and the chassis.
4. If the battery voltage (11 to 14 V) is not indicated, the fuse, the main switch or wiring harness are faulty.

Voltage	Terminal **1** and **2** – chassis	Approx. battery voltage

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2) Engine Stop Solenoid Test

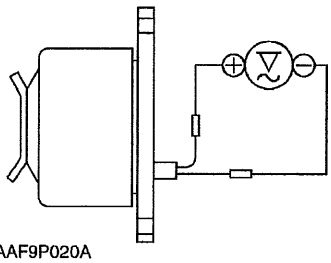
1. Disconnect the lead from the engine stop solenoid after turning the main switch off.
1. Connect jumper leads from the battery positive terminal to the engine stop solenoid terminal **1** (red, black) and **2** (white), then from the battery negative terminal to the engine stop solenoid body.
2. If the solenoid plunger is not attracted, the engine stop solenoid is faulty.

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The Correct Voltage Output

[INCORRECT]



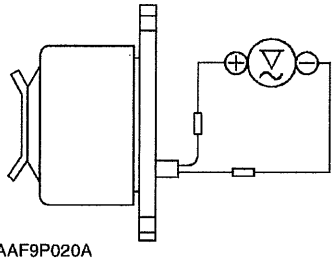
3TBAAAF9P020A

Dynamo No-load Voltage

1. Disconnect the lead wires from the dynamo.
2. Start the engine, and check the generating voltage of the dynamo.

Factory spec.	Voltage	14 to 15 V
	Dynamo speed	5200 min^{-1} (rpm)

[CORRECT]



3TBAAAF9P020A

Dynamo No-load Voltage

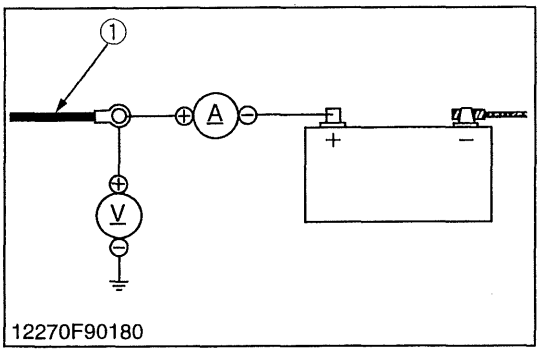
3. Disconnect the lead wires from the dynamo.
4. Start the engine, and check the generating voltage of the dynamo.

Factory spec.	Voltage	14 to 15 V (at engine low idling speed)
		36 to 39 V (at engine high idling speed)

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[4] CHARGING SYSTEM CHECKING



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Battery Charging Current

1. After starting the engine, disconnect the battery positive cord (+), and connect an ammeter and voltmeter. Then switch on all electrical loads (such as headlights) and measure the charging current.

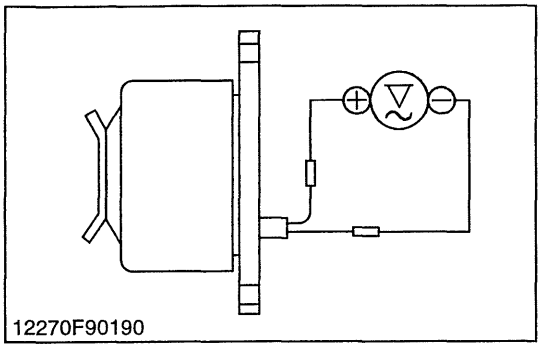
■ NOTE

- **Connect an ammeter only after starting the engine.**
- **When the electrical loads is considerably low or the battery is fully charged, the specified reading may not be obtained.**

Factory spec.	Current	14 to 15 A
	Dynamo speed	5200 rpm

(1) Battery Positive Cord

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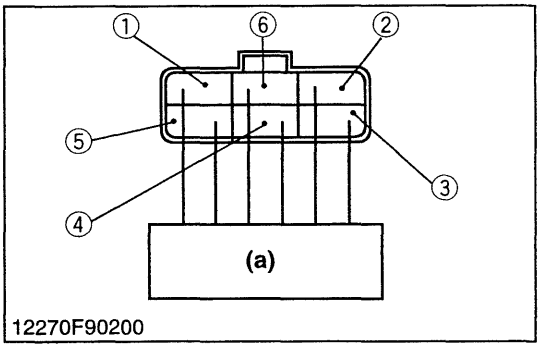
12270F90190

Dynamo No-load Voltage

1. Disconnect the lead wires from the dynamo.
2. Start the engine, and check the generating voltage of the dynamo.

Factory spec.	Voltage	14 to 15 V
	Dynamo speed	5200 rpm

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(1) Light Green
(2) Light Green
(3) Red
(4) Red / Yellow
(5) White / Red
(6) Black
(a) Regulator

Continuity across Regulator's Terminals

1. Remove the regulator coupler.
2. Check with a tester whether the regulator is in optimum condition or not.

■ Check Table

■ NOTE

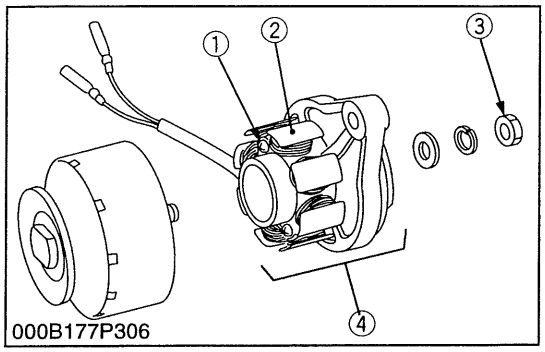
- **Type to use a high-resistance tester as far as possible.**
- **The judgement should be as below table. "ON" if the indicator moves, otherwise "OFF".**

Tester + terminal / Tester − terminal		Cord colors					
		Light Green	Light Green	Red	Red / Yellow	White / Red	Black
Cord colors	Light Green		OFF	**ON**	OFF	**ON**	OFF
	Light Green	OFF		**ON**	OFF	OFF	OFF
	Red	OFF	OFF		OFF	OFF	OFF
	Red / Yellow	**ON**	**ON**	**ON**		OFF	**ON**
	White / Red	OFF	OFF	OFF	OFF		OFF
	Black	OFF	OFF	OFF	OFF	OFF	

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DISASSEMBLING AND ASSEMBLING



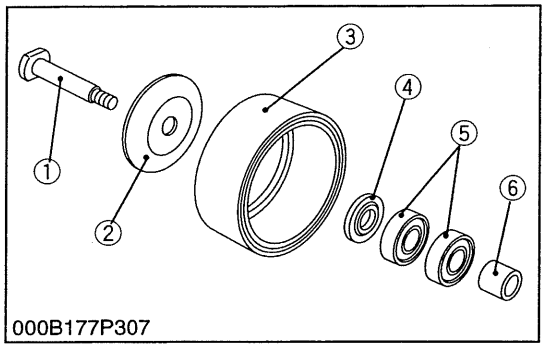
000B177P306

Stator

1. Remove the nut (3) and separate the stator comp. (4).
2. Unscrew the screws (1) and remove the stator (2).

(1) Screw
(2) Stator
(3) Nut
(4) Stator Comp.

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Rotor

1. Tap out the shaft (1) from the rotor (3).

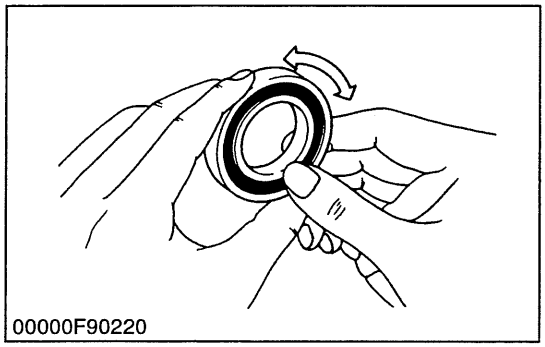
(When reassembling)

- Take care the direction of the collar (4), the flat side should face to the pulley (2) side.

(1) Shaft
(2) Pulley
(3) Rotor
(4) Collar
(5) Bearings
(6) Collar

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SERVICING


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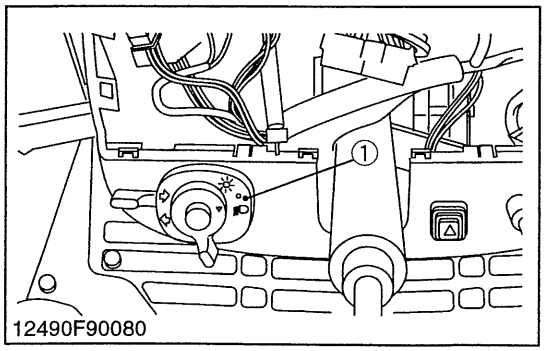
Bearing

1. Check the bearing for smooth rotation.
2. If it does not rotate smoothly, replace it.

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[5] LIGHTING SYSTEM

CHECKING



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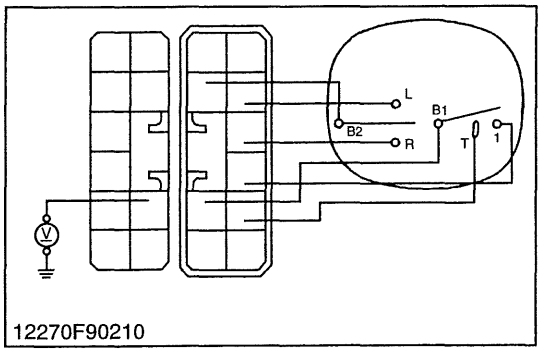
Combination Switch

1. Remove the meter panel, and disconnect the combination switch connector.
2. Remove the combination switch (1) and perform the following checks **1)** to **7)**.

(1) Combination Switch

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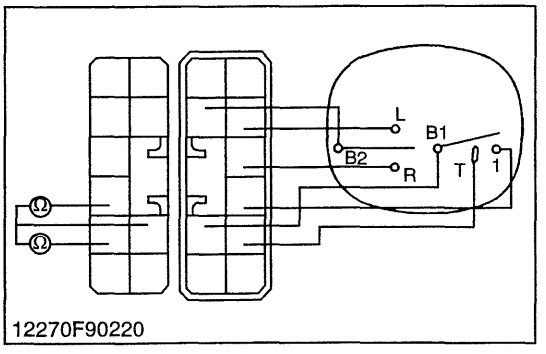
12270F90210

1) Connector Voltage

1. Measure the voltage with a voltmeter across the connector **B1** terminal and chassis when the main switch is **"ON"** position.
2. If the voltage differs from the battery voltage, the wiring harness and main switch is faulty.

Voltage	Main switch at **"ON"** position	**B1** terminal - Chassis	Battery voltage

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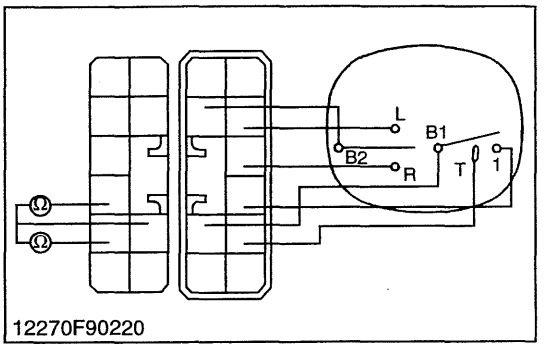
12270F90220

2) Head Light Switch Continuity when Setting Switch at OFF Position

1. Set the light switch to the **OFF** position.
2. Measure the resistance with an ohmmeter across the **B1** terminal to the **T** terminal, the **B1** terminal to the terminal **1**.
3. If infinity is not indicated, the head light switch is faulty.

Resistance (Switch at **OFF** position)	**B1** terminal - **T** terminal	Infinity
	B1 terminal - **1** terminal	

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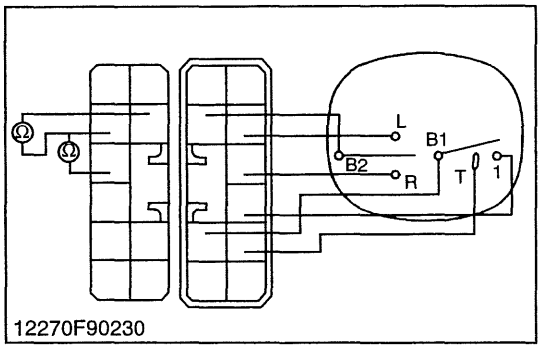
12270F90220

3) Head Light Switch Continuity when Setting Switch at ON Position

1. Set the light switch to the **ON** position.
2. Measure the resistance with an ohmmeter across the **B1** terminal to the **T** terminal and the **B1** terminal to the terminal **1**.
3. If 0 ohm is not indicated, the head light switch is faulty.

Resistance (Switch at **ON** position)	**B1** terminal - **T** terminal	0 ohm
	B1 terminal - **1** terminal	

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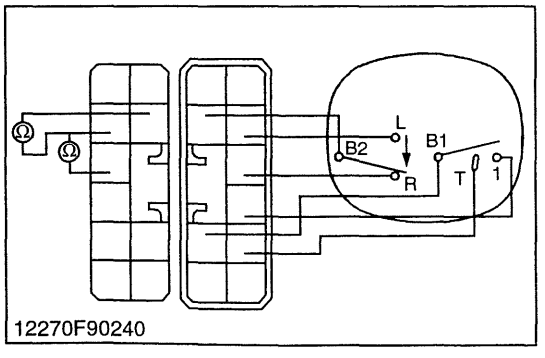
12270F90230

4) Turn Signal Light Switch Continuity When Setting Switch Knob at OFF Position

1. Set the hazard switch knob to the **OFF** position.
2. Measure the resistances with an ohmmeter across the **B2** terminal and **L** terminal, and across **B2** terminal and **R** terminal.
3. If infinity is not indicated, the combination switch is faulty.

Resistance (Switch knob at **OFF** position)	**B2** terminal - **L** terminal	Infinity
	B2 terminal - **R** terminal	

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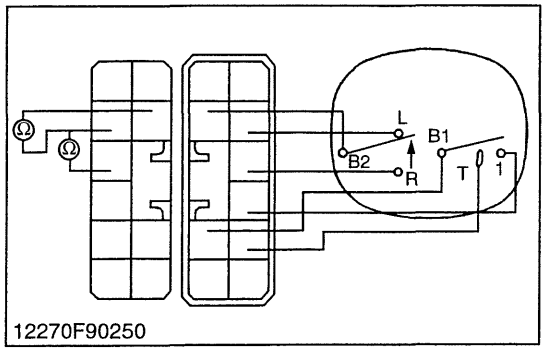
12270F90240

5) Turn Signal Light Switch Continuity When Setting Switch Knob at 1 Position

1. Set the hazard switch knob to the **1** position.
2. Measure the resistance with an ohmmeter across the **B2** terminal and **R** terminal.
3. If 0 ohm is not indicated, the combination switch is faulty.

Resistance (Switch knob at **1** position)	**B2** terminal - **R** terminal	0 ohm
	B2 terminal - **L** terminal	Infinity

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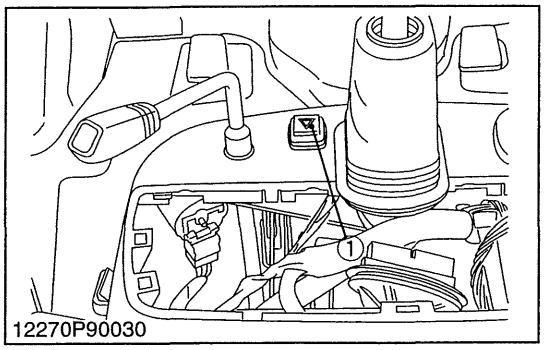
12270F90250

6) Turn Signal Light Switch Continuity When Setting Switch Knob at 2 Position

1. Set the hazard switch knob to the **2** position.
2. Measure the resistance with an ohmmeter across the **B2** terminal and **L** terminal.
3. If 0 ohm is not indicated, the combination switch is faulty.

Resistance (Switch knob at **2** position)	**B2** terminal – **L** terminal	0 ohm
	B2 terminal – **R** terminal	Infinity

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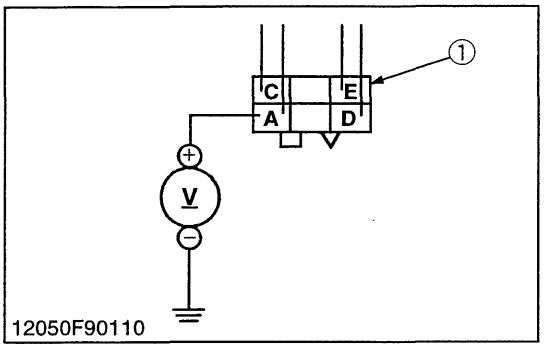
12270P90030

Hazard Switch

1. Remove the meter panel and disconnect the **4P** connector from hazard switch after disconnect the battery negative code.
2. Remove the hazard switch.
3. Perform the following checking.

(1) Hazard Switch

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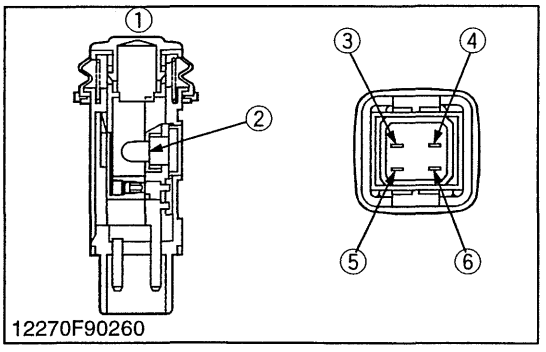
Connector Voltage

1. Connect the battery negative code, then measure the voltage with a voltmeter across the terminal **A** and chassis.
2. If the voltage differ from the battery voltage, the wiring harness is faulty.

Voltage	Terminal **A** – Chassis	Approx. battery voltage

(1) **6P** Connector

12270S90260



12270F90260

Hazard Switch Continuity

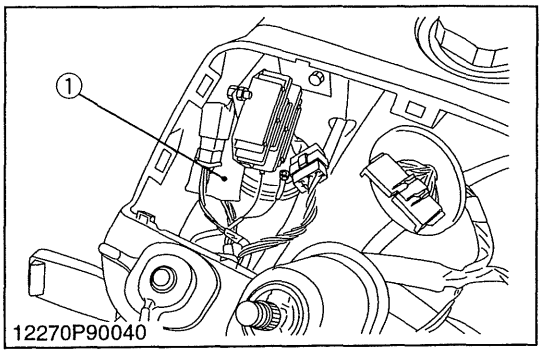
1. Measure the resistance with ohmmeter across the terminal **A** and terminal **C**, and across the terminal **D** and terminal **E**.
2. If the measurement is not following below, the hazard switch or the bulb are faulty.

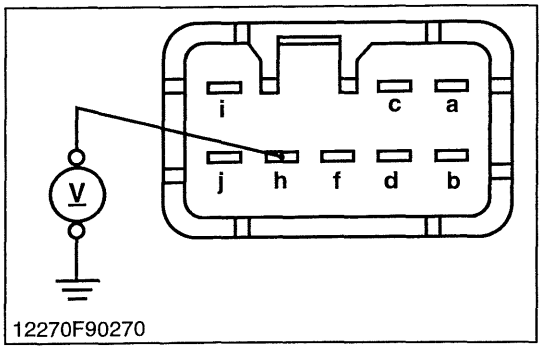
Resistance (Switch at **OFF**)	Terminal **A** – Terminal **C**	Infinity
Resistance (Switch at **ON**)	Terminal **A** – Terminal **C**	0 ohm
Resistance (Bulb)	Terminal **D** – Terminal **E**	Approx. 13 ohms

(1) Hazard Switch
(2) Bulb
(3) Terminal **A**
(4) Terminal **D**
(5) Terminal **C**
(6) Terminal **E**

12270S90270

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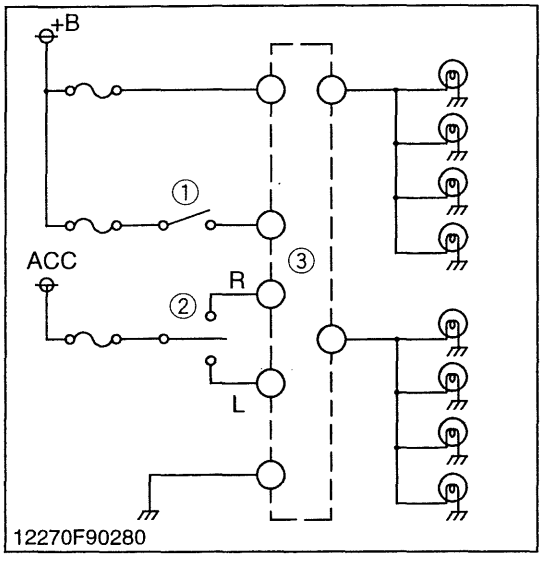
Flasher Unit

1. Remove the instrument pedal.
2. Measure the voltage with a voltmeter across the terminal **h** and chassis.
3. If the voltage differ from the battery voltage, the wiring harness is faulty.

Voltage	Terminal **h** – Chassis	Approx. battery voltage

(1) Flasher Unit (2) Battery (12 V)

12270S90280



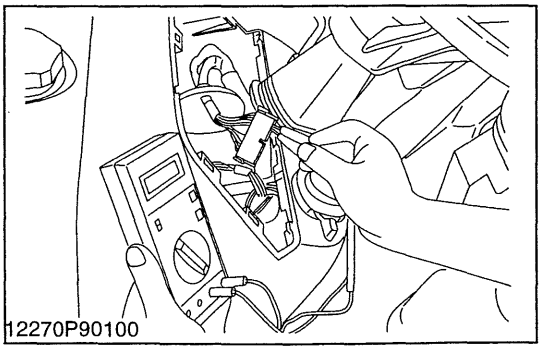
Flasher Unit Actuation Test

1. Set the hazard switch to the **ON** position, and make sure the hazard light gives 60 to 85 flashes for a minute.
2. With the main switch and the hazard switch at the **ACC** and **ON** positions, respectively, move the turn signal switch to the left. Make sure that the right-hand light stays on and the left-hand light gives flashes earlier (by about 20 flashes) than when the hazard lamp is activated. Then move the turn signal switch to the right and make sure the corresponding actions take place.
3. Now set the main switch to the **ACC** position and move the turn signal switch alone. Make sure the same actions as above result.
4. If both the hazard switch and the turn signal switch function but the above actions do not take place, replace the hazard unit with new one.

(1) Hazard Switch (3) Flasher Unit
(2) Turn Signal Switch

12270S90290

[6] EASY CHECKER CHECKING

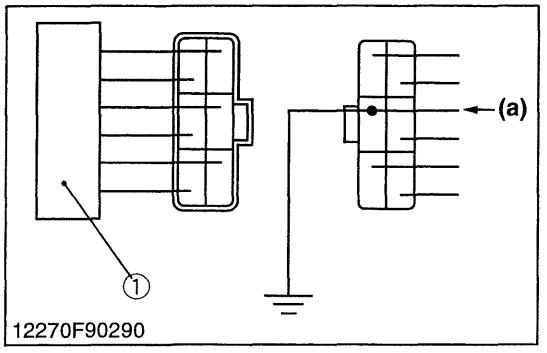


Easy Checker

1. Remove the panel board and disconnect the connector from it.
2. Turn the main switch on.
3. Measure the voltage with a voltmeter across the terminal (Red / Yellow) and the earth terminal (Black).
4. If the voltage differs from the battery voltage, the wiring harness, fuses and main switch should be checked.

12270S90300

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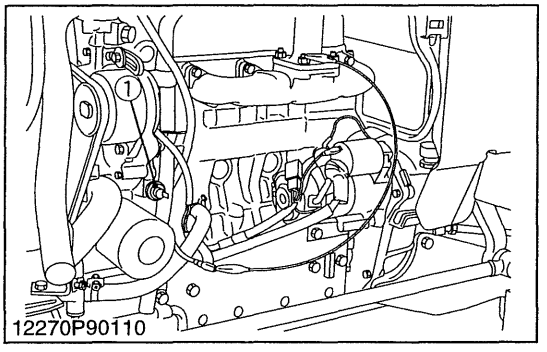
12270F90290

Charging Circuit (Panel Board and Wiring Harness)

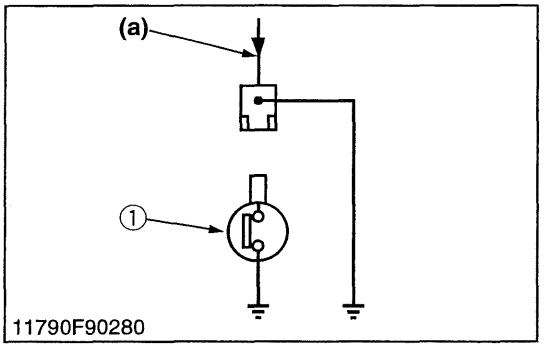
1. Remove the panel board from tractor.
2. Disconnect the **6P** connector from the regulator after turning the main switch off.
3. Turn the main switch on and connect a jumper lead from the wiring harness connector terminal (Black) to the chassis.
4. If the charge lamp does not light, the panel board circuit, regulator, wiring harness, or fuse is fault.

(1) Regulator **(a) From Charge Lamp**

12270S90310



12270P90110



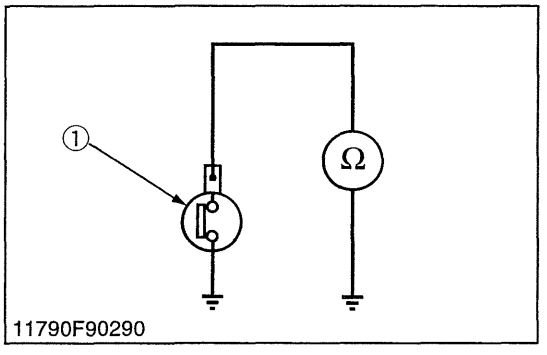
11790F90280

Engine Oil Pressure Switch Panel Board and Wiring Harness

1. Disconnect the lead from the engine oil pressure switch after turning the main switch **OFF**.
2. Turn the main switch **ON** and connect a jumper lead from the lead to the chassis.
3. If the engine oil pressure indicator lamp does not light, the panel board circuit or the wiring harness is faulty.

(1) Engine Oil Pressure Switch **(a) From Oil Pressure Lamp**

12270S90320



11790F90290

Engine Oil Pressure Switch Continuity

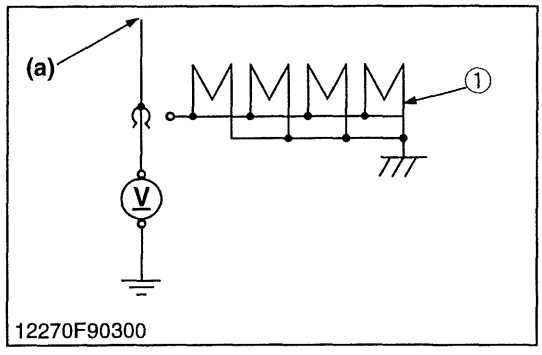
1. Measure the resistance with an ohmmeter across the switch terminal and the chassis.
2. If 0 ohm is not indicated in the normal state, the switch is faulty.
3. If infinity is not indicated at pressure over 4.9 kPa (0.5 kgf/cm^2, 7 psi), the switch is faulty.

Resistance (Switch terminal – Chassis)	In normal state	0 ohm
	At pressure over approx. 4.9 kPa (0.5 kgf/cm^2, 7 psi)	Infinity

(1) Engine Oil Pressure Switch

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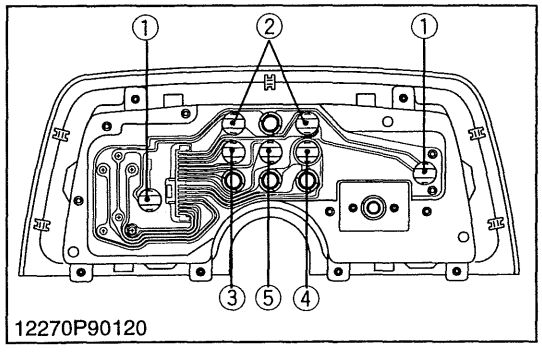
12270F90300

Glow Plug

1. Disconnect the lead from the glow plug.
2. Connect the tester positive cable to the glow plug lead and negative one to the chassis.
3. Measure its voltage with a voltmeter, after turning the main switch to the preheating or starting position.
4. If its voltage is not approximately the battery one, check the main switch or wiring harness.

(1) Glow Plugs
(a) From Main Switch 19 Terminal and Pre-heat Indicator Lamp

12270S90330



12270P90120

Monitor Lamp (for Charge, Engine Oil Pressure, Pre-heat, Illumination and Hazard)

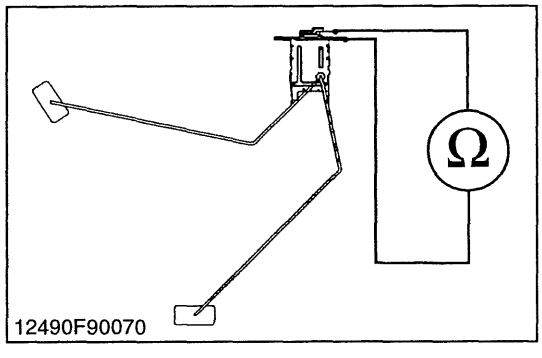
1. After removing the panel board from tractor, remove the plate behind the panel.
2. Remove the each lamp.
3. Measure the lamp resistance.
4. If it is infinity, replace the lamp with new.

Lamp spec.	All lamp	12 V, 1.7 W

(1) Illumination
(2) Hazard
(3) Engine Oil Pressure
(4) Pre-heat
(5) Charge

12270S90340

[7] GAUGE CHECKING



12490F90070

Fuel Level Sensor

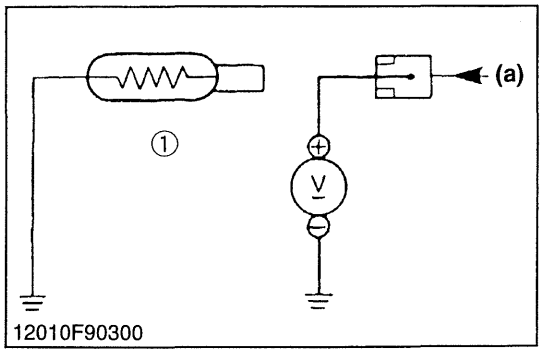
1) Sensor Continuity

1. Remove the fuel level sensor from the fuel tank.
2. Measure the resistance with an ohmmeter across the sensor terminal and its body.
3. If the reference values are not indicated, the sensor is faulty.

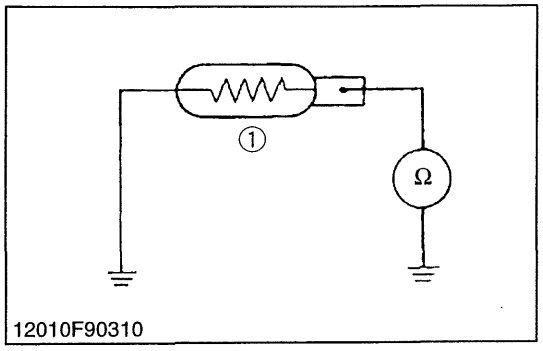
Resistance (Sensor terminal – its body)	Reference value	Float at upper-most position	1 to 5 ohms
		Float at lower-most position	103 to 117 ohms

12490S90060

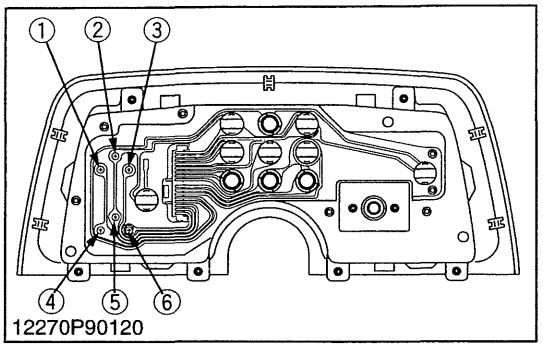
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12010F90300



12010F90310



12270P90120

Coolant Temperature Sensor

1) Lead Terminal Voltage

1. Disconnect the lead from the coolant temperature sensor after turning the main switch off.
2. Turn the main switch on and measure the voltage with a voltmeter across the lead terminal and the chassis.
   If the voltage differs from the battery voltage, the wiring harness, fuse or coolant temperature gauge is faulty.

Voltage	Lead terminal – Chassis	Approx. battery voltage

2) Sensor Continuity

1. Measure the resistances with an ohmmeter across the sensor terminal and the chassis.
2. If the reference value is not indicated, the sensor is faulty.

Resistance (Sensor terminal – Chassis)	Reference value	Approx. 12.2 ohms Approx. 23.6 ohms Approx. 51.9 ohms Approx. 153.9 ohms	at 130 °C (266 °F) at 105 °C (221 °F) at 80 °C (176 °F) at 50 °C (122 °F)

(1) Coolant Temperature Sensor **(a) From Temperature Gauge**

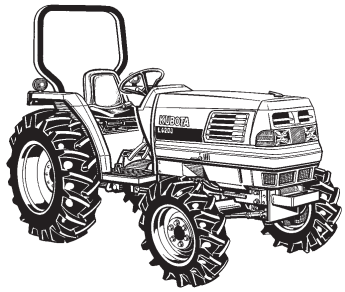
12010S90350

Fuel Gauge and Coolant Temperature Gauge Continuity

1. Remove the panel board from the tractor.
2. Check the continuity with an ohmmeter across the **U** terminal (2) and **IGN** terminal (3) and across the **U** terminal (2) and **GND** terminal (1).
3. If infinity is indicated, the coolant temperature is faulty.
4. Check the continuity with an ohmmeter across the **U** terminal (5) and **IGN** terminal (6) and across the **U** terminal (5) and **GND** terminal (4).
5. If infinity is indicated, the fuel gauge is faulty.

(1) **GND** Terminal (Temperature)
(2) **U** Terminal (Temperature)
(3) **IGN** Terminal (Temperature)
(4) **GND** Terminal (Fuel)
(5) **U** Terminal (Fuel)
(6) **IGN** Terminal (Fuel)

12270S90360



Kubota

Bulletin No : SFI-A-04-015
Date : Oct. 27, 2004
Replace :
Ref.PB No :

(Authorized by)

S. KASHIHARA

☐ QUALITY ASSURANCE DEPT.
☒ OVERSEAS SERVICE DEPT.

SUBJECT : INFORMATION OF OPC SYSTEM FOR WORKSHOP MANUAL

SERVICE BULLETIN

MODEL : B2410, B2710, B2910
COUNTRY AFFECTED : U.S.A., CANADA AND AUSTRALIA
REASON FOR ISSUE :

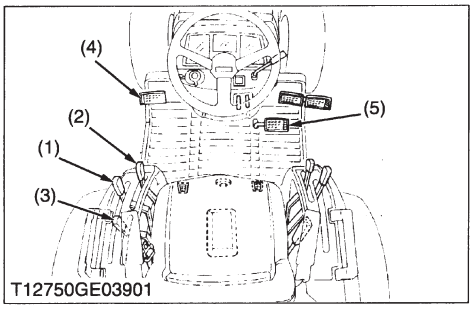
To inform the addition of OPC (Operator Presence Control) system information to Workshop Manual (97897-12271).

☒ **SERVICE INFORMATION**

1. Please keep this information with your Workshop Manual.
2. Revised Workshop Manual (97897-12272) will be available at the beginning of November.

* This bulletin is to be sent to the distributors directly from KUBOTA Corporation due to urgency of notification.

(1) CHECK POINTS OF EVERY 50 HOURS



Checking Engine Start System (OPC Specification)

⚠ CAUTION

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

■ **Preparation before testing**

1. Sit on operator's seat.
2. Set the parking brake and stop the engine.
3. Shift the range gear shift lever in "**NEUTRAL**" position.
4. Place the speed control pedal in "**NEUTRAL**" position.
5. Shift the rear-PTO gear shift lever and Mid-PTO gear shift lever to "**OFF**" (Disengaged) position.
6. Fully depress the clutch pedal.

■ **Test 1**

1. Release the clutch pedal.
2. Turn the key to "**START**" position.
3. The engine must not crank.

■ **Test 2**

1. Fully depress the clutch pedal.
2. Depress the speed control pedal.
3. Turn the key to "**START**" position.
4. The engine must not crank.

■ **Test 3**

1. Fully depress the clutch pedal.
2. Place the speed control pedal in "**NEUTRAL**" position.
3. Shift the rear-PTO gear shift lever to "**ON**" (Engaged) position.
4. Turn the key to "**START**" position.
5. The engine must not crank.

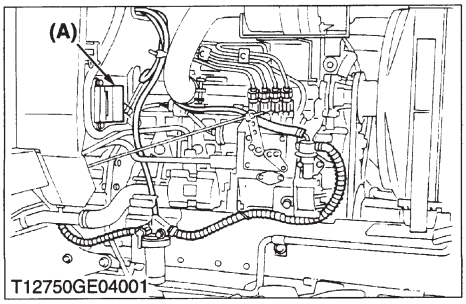
■ **Test 4**

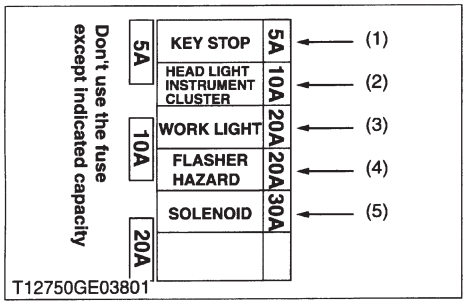
1. Shift the rear-PTO gear shift lever to "**OFF**" (Disengaged) position.
2. Shift the Mid-PTO gear shift lever to "**ON**" (Engaged) position.
3. Turn the key to "**START**" position.
4. The engine must not crank.

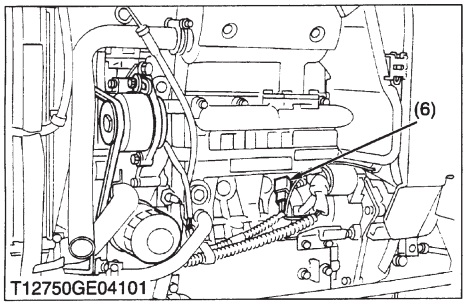
■ **Test 5 : Switch for the Operator's seat.**

1. Sit on operator's seat.
2. Start the engine.
3. Fully depress the clutch pedal.
4. Shift the rear-PTO gear shift lever to "**ON**" (Engaged) position.
5. Stand up. (Do not get off the machine.)
6. The engine must shut off after approximately 1 second.

(1) Runge Gear Shift Lever (Hi-Lo)
(2) Mid-PTO Gear Shift Lever
(3) Rear PTO Gear Shift Lever
(4) Clutch Pedal
(5) Speed Control Pedal







Replacing Fuse (OPC Specification)

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. Failure to follow this procedure may result in serious damage to the tractor electrical system. Refer to troubleshooting section of this manual or your local KUBOTA distributor for specific information dealing with electrical problems.**
  If any of them should blow, replace with a new one of the same capacity.

■ **Protected Circuit**

Fuse No.	Capacity (A)	Protected circuit
(1)	5	Key stop
(2)	10	Head light
(3)	20	Work light
(4)	20	Flasher / Hazard light
(5)	30	Engine Stop Solenoid
(6)	Slow blow fuse	Check circuit against wrong battery connection

(A) Fuse Box

Replacing Light Bulb

1. Head lights
   Take the bulb out of the light body and replace with a new one.
2. Other lights
   Detach the lens and replace the bulb.

Light	Capacity
Head lights	23 W
Tail light	8 W
Turn signal / Hazard light	27 W and 20 W
Illumination	1.7 W
Hazard light indicator	0.6 W

12270G00300

[8] OPC (OPERATOR PRESENCE CONTROL) SYSTEM

(1) Wiring Diagram

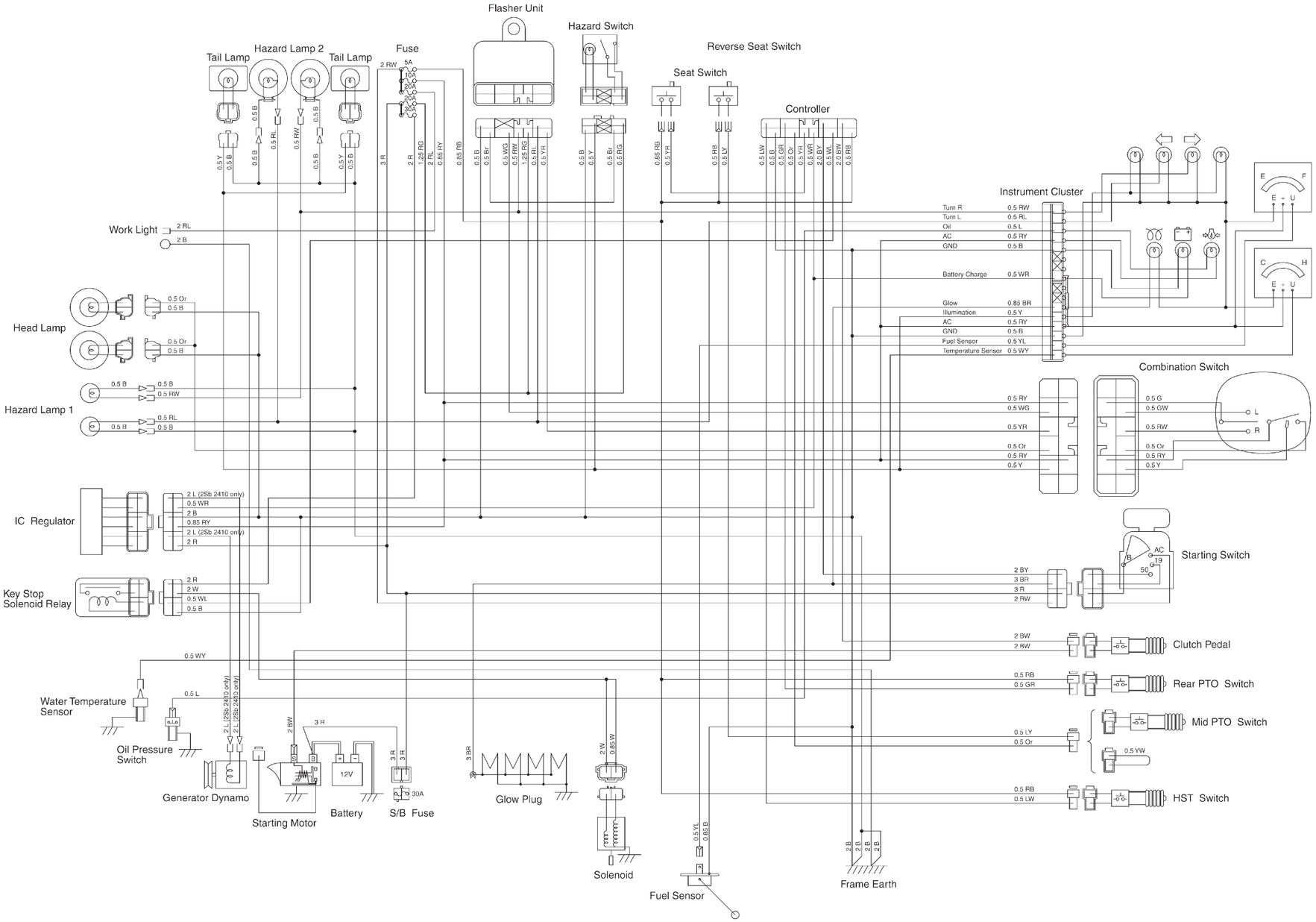
■ Color of wiring

W ..... White	RL ..... Red / Blue
R ..... Red	RY ..... Red / Yellow
L ..... Blue	RB ..... Red / Black
Y ..... Yellow	RG ..... Red / Green
B ..... Black	BW ..... Black / White
G ..... Green	BR ..... Black / Red
Br ..... Brown	BY ..... Black / Yellow
Or ..... Orange	LY ..... Blue / Yellow
Sb ..... Sky Blue	LW ..... Blue / White
WG ..... White / Green	YR ..... Yellow / Red
WR ..... White / Red	YL ..... Yellow / Blue
WY ..... White / Yellow	GR ..... Green / Red
WL ..... White / Blue	GW ..... Green / White
RW ..... Red / White	

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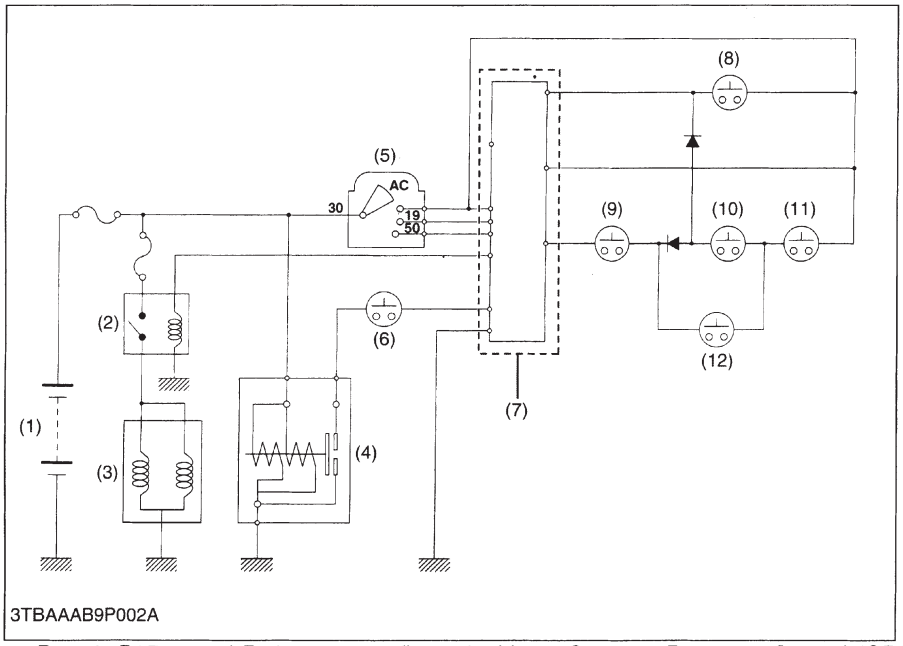
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■ OPC Type



T12750EL05301

(2) OPC system circuit



3TBAAAB9P002A

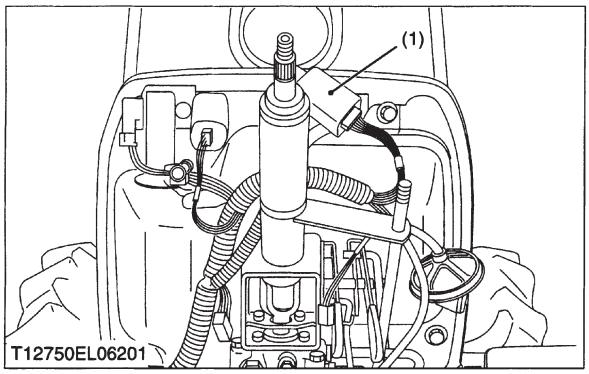
(1) Battery
(2) Key Stop Solenoid Relay
(3) Engine Stop Solenoid
(4) Starter
(5) Main Switch
(6) Clutch Pedal Switch
(7) Controller
(8) Seat Switch
(9) Mid-PTO Shift Lever Switch
(10) PTO Shift Lever Switch
(11) Speed Control Pedal Switch
(12) Seat Revers Switch

B2410, B2710 and B2910 are configured with an Operator Presence Control (OPC) to control engine starting, engine automatically stopping engine revolution automatically recovering, and rear-PTO shift lever changing. This OPC consists of controller and engine starting / stopping control switches such as clutch pedal switch, mid-PTO shift lever switch, rear-PTO shift lever switch, speed change pedal switch, seat (occupying) switch, and seat reverse switch

Main parts regarding OPC are laid out as shown in the electrical circuit.

The function of controller and each switch are mentioned as below.

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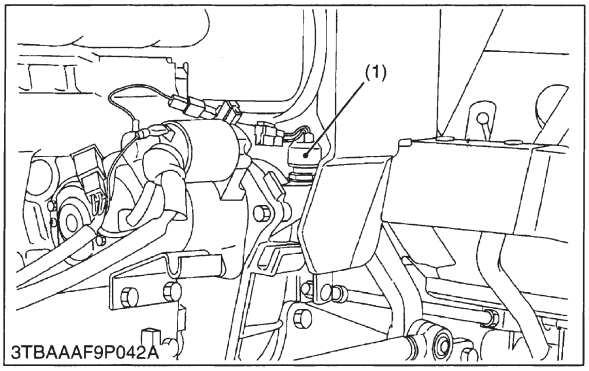
T12750EL06201

■ Controller

Controller is configured with a delay timer in the controller unit to hold fuel cut signal from the controller unit to fuel cut solenoid for about 1 second.

(1) Controller

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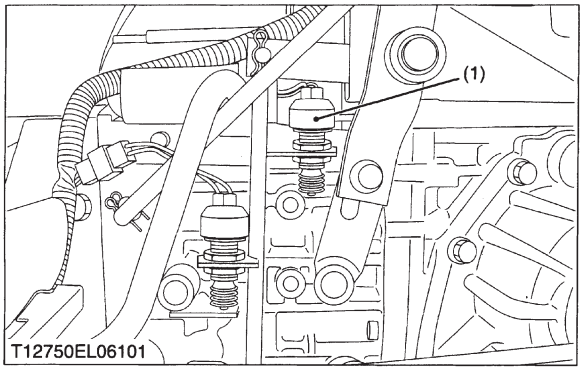


3TBAAAF9P042A

■ Clutch pedal switch

This clutch pedal switch detects the clutch pedal engaging or disengaging positions. When engaging the clutch pedal, the clutch pedal switch is pushed in and electrical circuit is closed.

(1) Clutch Pedal Switch

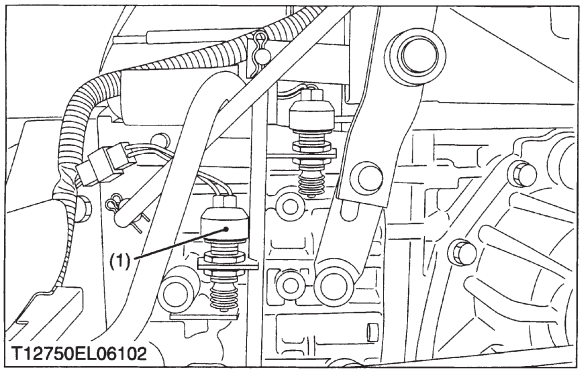


■ Mid-PTO shift lever switch

This mid-PTO lever switch detects the mid-PTO lever engaging or disengaging position. When engaging the mid-PTO shift lever, the mid-PTO shift lever switch is pushed in and electrical circuit is closed.

(1) Mid-PTO Lever Switch

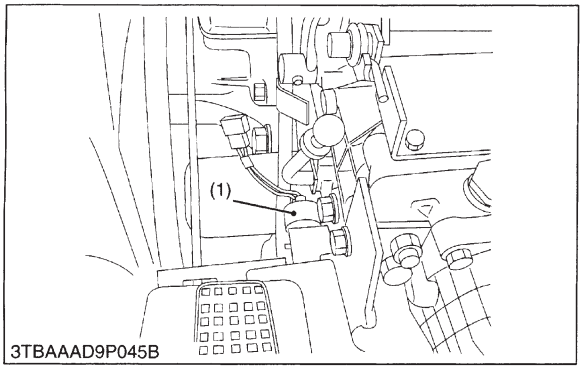
W1014367



■ PTO shift lever switch

This PTO shift lever switch detects both the rear-PTO shift lever and mid-PTO shift lever engaging or disengaging positions. When shifting both the rear-PTO shift lever and mid-PTO shift lever to **"NEUTRAL"**, the PTO shift lever switch is pushed in and electrical circuit is closed (**"ON"**).

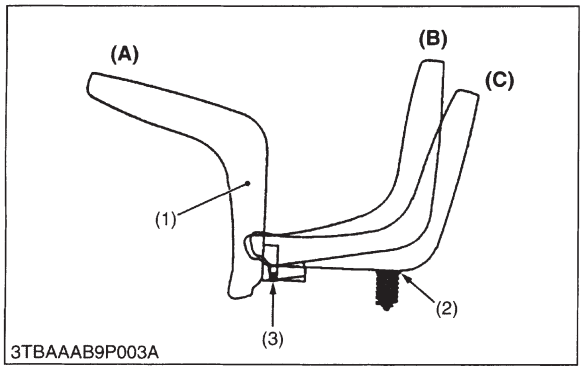
(1) PTO Shift Lever Switch



■ Speed-control pedal switch

This speed control pedal switch detects the speed control pedal forward or reverse positions. When engaging the speed change pedal, the speed change pedal switch is pushed in and electrical circuit is closed.

(1) Speed Control Pedal Switch



■ Seat switches

Seat switches consist of two switches. One is seat (occupying) switch to detect the position of the seat. This is located under the seat in the rear side of the seat support. When sitting on the seat, this switch is pushed in and electrical circuit is closed. When the seat is vacant, this switch is not pushed and electrical circuit is opened. Other is seat reverse switch to detect tilting the seat. This is located under the seat in the front side of the seat support. When tilting the seat forward, this switch is pushed in and electrical circuit is closed.

(1) Seat
(2) Seat Switch
(3) Seat Reverse Switch

A: Tilted
B: Vacant
C: Seated (Occupied)

[OPC switch and its electrical circuit]

Switch name	Switch movement	Electrical contacts
Clutch pedal switch	Pushed when depressing the clutch pedal	ON, closed
	Free when releasing the clutch pedal	OFF, opened
Mid-PTO shift lever switch	Pushed in disengaging position	ON, closed
	Free at engaging position	OFF, opened
PTO shift lever switch	Pushed when both rear-PTO and mid-PTO shift lever is "**NEUTRAL**"	ON, closed
	Free when both rear-PTO and mid-PTO shift lever is engaged	OFF, opened
Speed control pedal switch	Pushed in neutral position	ON, closed
	Free at forward or reverse position	OFF, opened
Seat (Occupying) switch	Pushed in when sitting on the seat	ON, closed
	Free when seat is vacant	OFF, opened
Seat reverse switch	Pushed when tilting the seat	ON, closed
	Free when returning back the seat to the original position	OFF, opened

W1014198

(3) Engine starting

The engine mounted on B2410, B2710, B2910 can be started when OPC switches such as clutch pedal switch, speed control pedal switch, mid-PTO shift lever switch, PTO shift lever switch are **"ON"** at any operator's seat positions as shown on the table below.

[Engine Starting Condition]

Clutch Pedal Switch	Speed Control Pedal Switch	PTO Shift Lever Switch
ON	ON	ON

W1014802

(4) Engine automatically stopping : Automatic engine stop

Engine can be shut-off under the following two conditions since these conditions cause delay timer in the control circuit of the controller to operate and it controls the fuel cut solenoid and fuel injection, and stops the engine. The delay timer holds the fuel cut signal for about 1 second.

[Condition 1]

- While keeping the operator's seat vacant, engaging speed control pedal, mid-PTO shift lever or rear-PTO shift lever as shown on the table below.

[Condition 2]

- While keeping the seat reverse switch to "ON", engaging speed control pedal or mid-PTO shift lever as shown on the table below.

[Engine Automatically Stopping Condition]

Seat (Occupying) Switch	Speed Control Pedal Switch	Mid-PTO Shift Lever Switch	PTO Shift Lever Switch	Seat Reverse Switch	Condition
OFF	ON	ON	OFF	OFF	Condition 1
OFF	ON	OFF	OFF	OFF	Condition 1
OFF	OFF	ON or OFF	ON or OFF	OFF	Condition 1
OFF	ON	OFF	OFF	ON	Condition 2
OFF	OFF	ON or OFF	ON or OFF	ON	Condition 2

W1014939

- Engine Revolution Automatically Recovering
  - While engine revolution decreasing under the engine automatically stopping condition, since sitting on the operator's seat does not operate the delay timer, and fuel are delivered to the engine, and engine revolution are automatically recovered.
- Rear-PTO Shift Lever
  - Shifting rear-PTO shift lever does not cause engine stopping at seat tilting position.

SERVICING SPECIFICATIONS

STARTER

Item		Factory Specification	Allowable Limit
Commutator	O.D.	28.0 mm 1.102 in.	27.0 mm 1.063 in.
	Difference of O.D.'s	Less than 0.02 mm 0.0008 in.	0.05 mm 0.0020 in.
Mica	Undercut	0.60 mm 0.0236 in.	0.20 mm 0.0079 in.
Brush	Length	14.0 mm 0.551 in.	9.0 mm 0.354 in.

GLOW PLUG

Glow Plug	Resistance	Approx. 0.9 ohms	–

12270S90040

SAFETY SWITCH

Item		Factory Specifications	Allowable Limit
• Clutch pedal switch	Resistance	0 Ω when depressing the clutch pedal.	–
• Speed control pedal switch	Resistance	0 Ω when placing the pedal to "**NEUTRAL**".	–
• Mid-PTO shift lever switch (Mid-PTO model) • PTO shift lever switch	Resistance	0 Ω when placing the levers to "OFF (Disengaged)" position.	–
• Seat switch	Resistance	0 Ω when sitting on the seat.	–
• Seat reverse switch	Resistance	0 Ω when tilting the seat forward.	–

W1010792

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-12.)

Item	N·m	kgf·m	ft-lbs
Starter			
• **M** terminal nut	8.8 to 11.8	0.9 to 1.2	6.5 to 8.7
• **C** terminal nut	7.9 to 11.8	0.8 to 1.2	5.8 to 8.7
• Magnetic switch mounting nut	5.9 to 10.8	0.6 to 1.1	4.4 to 7.9
• Through bolt	4.42 to 7.35	0.45 to 0.75	3.26 to 5.42

12270S90050

[8] OPC SYSTEM

(1) Troubleshooting

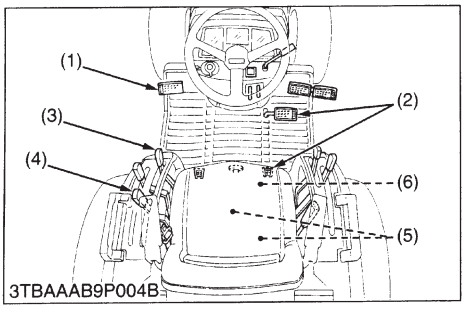
OPC (OPERATOR'S PRESENCE CONTROL)

Does Not Stop Engine	• Seat switch defective	Replace	9-S24
	• Key stop solenoid relay defective	Replace	9-S9
	• Key stop solenoid defective	Replace	9-S14
	• Controller defective	Replace	9-S25
	• Rear PTO lever switch malfunctioning	Adjust or Replace	9-S10
	• Mid PTO lever switch malfunctioning	Adjust or Replace	9-S10
	• Speed Control Pedal switch malfunctioning	Adjust or Replace	9-S10
Starter Motor Does Not Operate	• Seat switch defective	Replace	9-S24
	• Key stop solenoid relay defective	Replace	9-S9
	• Key stop solenoid defective	Replace	9-S14
	• Controller defective	Replace	9-S25
	• Rear PTO lever switch malfunctioning	Adjust or Replace	9-S10
	• Mid PTO lever switch malfunctioning	Adjust or Replace	9-S10
	• Speed control pedal switch malfunctioning	Adjust or Replace	9-S10
	• Clutch pedal safety switch malfunctioning	Adjust or Replace	9-S10

W10286310

(2) Checking and Servicing

(A) Safety Switches



Checking Safety Switches

A defective location can be adjusted by checking the function of the safety switches one by one in the table below.

(Reference)

Safety switch name	Switch type
Clutch pedal switch	Normal open
Speed control pedal switch	Normal open
Mid-PTO shift lever switch (Mid-PTO model)	Normal open
Rear-PTO shift lever switch	Normal open
Seat switch	Normal open
Seat reverse switch	Normal open

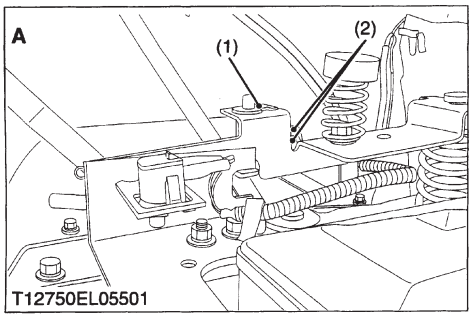
(1) Clutch Pedal
(2) Speed Control Pedal
(3) Mid-PTO Gear Shift Lever
(4) Rear-PTO Gear Shift Lever
(5) Seat Switch
(6) Seat Reverse Switch

W1011203

Clutch Pedal Switch, Speed Control Pedal Switch, Mid-PTO Shift Lever Switch and PTO Shift Lever Switch Continuity

1. Refer to page 9-S10.
2. If the safety switch is defective, replace it.

Safety switch (clutch pedal switch, speed control pedal switch, mid-PTO shift lever switch and PTO shift lever switch) resistance (across switch terminal)	When switch is pushed	0 Ω
	When switch is free	Infinity ohms

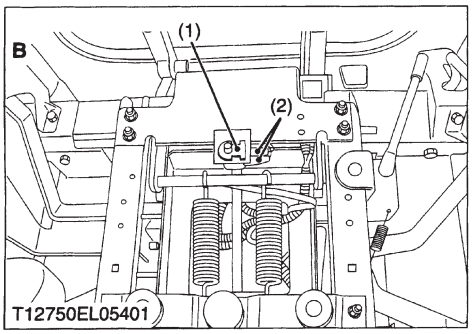


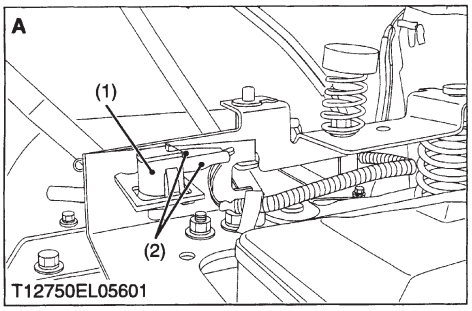
Seat Switch Continuity

1. Disconnect the leads from the seat switch (1).
2. Connect the circuit tester to the seat switch connectors (2).
3. Measure the resistance between the connectors (2) of the seat switch (1).
4. If the seat switch is defective, replace it.

(1) Seat Switch
(2) Connector

A : B2410, B2710
B : B2910



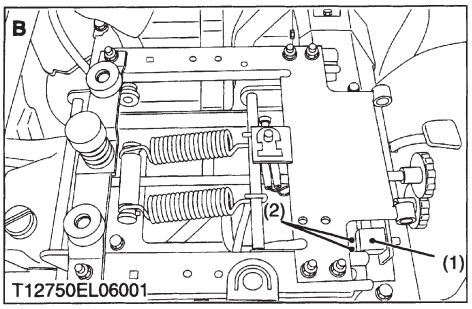


Seat Reverse Switch Continuity

1. Disconnect the leads from the seat reverse switch (1).
2. Connect the circuit tester to the seat reverse switch connectors (2).
3. Measure the resistance between the connectors (2) of the seat reverse switch (1).
4. If the seat reverse switch is defective, replace it.

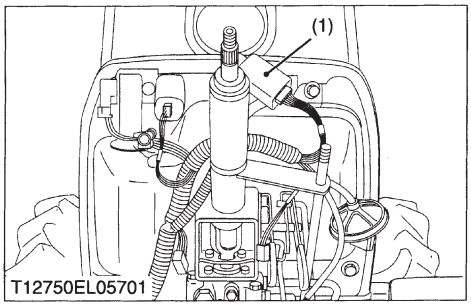
(1) Seat Reverse Switch
(2) Connector

A : B2410
B : B2710, B2910



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(B) Controller



Replacing Controller

1. If engine is not started, check all part regarding the starting system referring to "**TROUBLESHOOTING**".
2. If all part except the controller is not defective, replace the controller.

(1) Controller

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WSM

WORKSHOP MANUAL
TRACTOR

B7800 HSD (SUPPLEMENT)

Kubota

KiSC issued 09, 2007 A

https://truckmanualshub.com/

TO THE READER

Use this workshop manual together with workshop manual for B2410, B2710 and B2910.

B7800HSD tractor is simplified from B2910HSD. Front lights, seat, rear fender stay, hydraulic control valve, electrical system and lower link stabilizers are mainly changed.

Engine, clutch, transmission, brake, rear axle, front axle and steering are mainly same.

Pages of “TRAVELLING SPEED”, “LUBRICANT, FUEL AND COOLANT”, “MAINTENANCE” and “IMPLEMENT LIMITATIONS” are deleted because B7800’s data are same as B2910.

In this section, the main additional functions and altered points of B7800HSD tractor from B2910 tractor are explained separately in two items, “Mechanism” and “Servicing” for each section.

As for the items which are not explained in this section, refer to B2410, B2710, B2910 Workshop Manual.

■ **Mechanism**

Information on the construction and function are included for B7800HSD tractor. This part should be understood before proceeding with troubleshooting, disassembling and servicing.

■ **Servicing**

For B7800HSD tractor, 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 product information available at the time of publication.

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

October 2002

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SPECIFICATIONS

Model			**B7800HSD**
PTO power			16.4 kW (22.0 HP)
Engine	Maker		KUBOTA
	Model		V1505-E-D16
	Type		Indirect Injection. Vertical, water-cooled, 4-cycle diesel
	Number of cylinders		4
	Bore and stroke		78 × 78.4 mm (3.07 × 3.09 in.)
	Total displacement		1498 cm^3 (91.5 cu.in.)
	Engine net power (DIN)		22.3 kW (30.0 HP)
	Rated revolution (min^{-1})		43.3 r/s (2600 rpm)
	Maximum torque		89 N·m (66 ft-lbs)
	Battery		12 V, RC : 79 min, CCA : 433 A
	Starting system		Electric starting with cell starter 12 V, 1.4 kW
	Lubricating system		Forced lubrication by trochoidal pump
	Cooling system		Pressurized radiator, forced circulation with water pump
	Fuel		Diesel fuel No. 2-D [above –10 °C (14 °F)], Diesel fuel No. 1 [below –10 °C (14 °F)]
Capacities	Fuel tank		26 L (6.9 U.S.gals, 5.7 Imp.gals)
	Engine crankcase (with filter)		4.1 L (4.3 U.S.qts, 3.6 Imp.qts)
	Engine coolant		4.5 L (4.8 U.S.qts, 4.0 Imp.qts)
	Transmission case		14.5 L (3.83 U.S.gals, 3.19 Imp.gals)
	Front axle case		4.5 L (4.8 U.S.qts, 4.0 Imp.qts)
Dimensions	Overall length (without 3P)		2520 mm (99.2 in.)
	Overall width		1366 mm (53.8 in.)
	Overall height (with ROPS)		1995 mm (78.5 in.)
	Overall height (top of steering wheel)		1365 mm (53.7 in.)
	Wheel base		1666 mm (65.6 in.)
	Minimum ground clearance		370 mm (14.6 in.)
	Tread	Front	935 mm (36.8 in.)
		Rear	1050 mm (41.3 in.)
Weight (with ROPS)			790 kg (1740 lbs)
Clutch			Dry single plate
Travelling system	Tires	Front	7-12
		Rear	12.4-16
	Steering		Integral type power steering
	Transmission		Main-hydrostatic transmission, rage-gear shift (3 forward and 3 reverse)
	Brake		Wet disk type
	Min, turning radius (with brake)		2.1 m (6.9 feet)
	Differential		Bevel gear
Hydraulic system	Hydraulic control system		Quarter Inching Valve
	Pump capacity		3P: 24.4 L/min (6.4 U.S.GPM, 5.4 Imp.GPM), PS: 11.7 L/min (3.1 U.S.GPM, 2.6 Imp.GPM)
	Three point hitch		SAE Category I
	Max. lift force	At lift points	750 kg (1655 lbs)
		(24 in. behind lift points)	590 kg (1300 lbs)

NOTE: * Manufacture's estimate the company reserves the right to change the specifications without notice.

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Model			**B7800HSD**
PTO system	Rear	PTO shaft	SAE 1-3/8, 6 splines
		Revolution	1 speed (540 min^{-1} (rpm) at 2584 engine min^{-1} (rpm))
	Mid.	PTO shaft	USA No. 5 (KUBOTA 10-tooth) involute spline
		Revolution	1 speed (2537 min^{-1} (rpm) at 2600 engine min^{-1} (rpm))

NOTE: * Manufacture's estimate the company reserves the right to change the specifications without notice.

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G GENERAL

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GENERAL

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1. FEATURES G-1
2. TIRES G-2
   [1] TIRE PRESSURE G-2
   [2] FRONT TREAD G-2

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1. FEATURES



3TBAAAB0P001A

1. Quarter Inching Valve
2. E-TVCS (Three Vortex Combustion System) Diesel Engine
3. Hydrostatic Transmission (HST)
4. 3 Speed Ranges
5. Powerful Category I, 3-Point Hitch
6. Exceptional Hydraulics
7. Full Flat Deck
8. Illuminated Instrument Panel
9. Long Wheel Base / Tire Options

2. TIRES

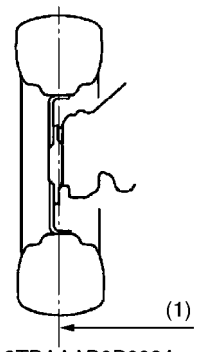
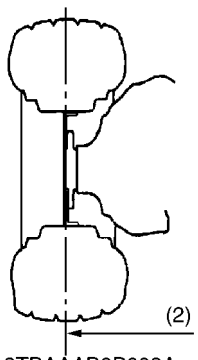
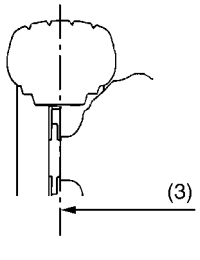
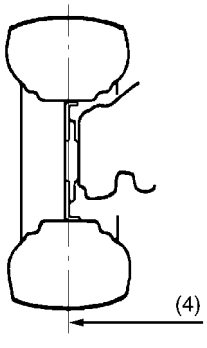
[1] TIRE PRESSURE

Type		Tire sizes	Inflation pressure
Farm	Front	7 – 12 4PR	170 kPa 1.7 kgf/cm^2 24 psi
	Rear	12.4 – 16 4PR	110 kPa 1.1 kgf/cm^2 16 psi
Turf	Front	23 × 8.50 – 12 4PR	150 kPa 1.5 kgf/cm^2 22 psi
		24 × 8.50 – 14	150 kPa 1.5 kgf/cm^2 22 psi
	Rear	13.6 – 16 4PR	96.5 kPa 1.0 kgf/cm^2 14 psi
Industry	Front	23 × 8.50 – 14 Ind. 4PR	241 kPa 2.5 kgf/cm^2 35 psi
	Rear	12.4 – 16 Ind. 4PR	138 kPa 1.4 kgf/cm^2 20 psi

[2] FRONT TREAD

CAUTION
- **Support tractor securely on stands before removing a wheel.**
- **Never operate tractor with a loose rim, wheel or axle.**

■ **IMPORTANT**
- **Always attach tires as shown in the figure.**
- **If not attached as the figure, transmission parts may be damaged.**
- **Do not use tires larger than specified.**

Model	B7800	B7800	B7800	B7800
Tires	7 – 12 Farm	23 × 8.50 – 12 Turf	24 × 8.50 – 14 Turf	23 × 8.50 – 14 Ind.
Tread	 3TBAAAB0P002A	 3TBAAAB0P003A	 3TBAAAB0P004A	 3TBAAAB0P005A

(1) 935 mm (36.8 in.) (2) 970 mm (38.2 in.) (3) 930 mm (36.6 in.) (4) 905 mm (35.6 in.)

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1 HYDRAULIC SYSTEM

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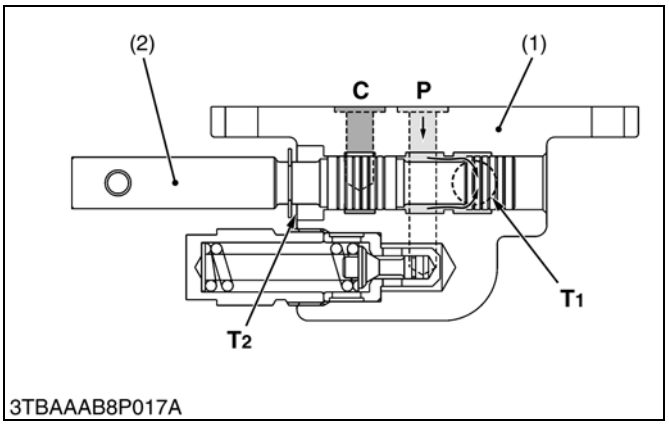
MECHANISM

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1. CONTROL VALVE (QUARTER INCHING VALVE) 1-M1
2. RELIEF VALVE 1-M3
3. FEEDBACK LINKAGE 1-M4
4. HYDRAULIC CYLINDER 1-M5

1. CONTROL VALVE (QUARTER INCHING VALVE)

This implement control valve (quarter inching valve) is located under the hydraulic cylinder block.



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■ Neutral

Oil forced into the control valve (1) through **P** port and returns to the transmission case through **T1** port.

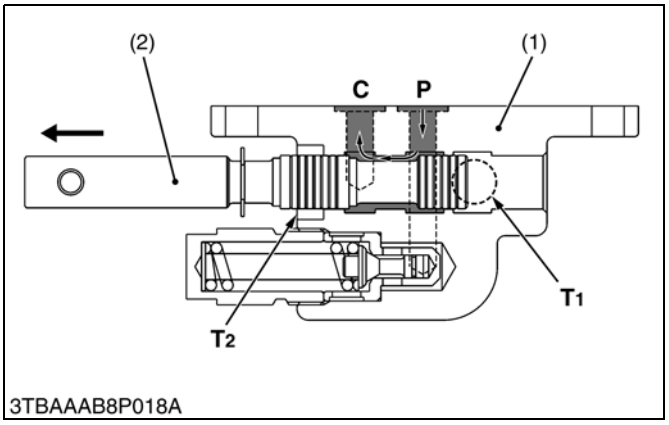
Also, **C** port is closed by spool (2), oil in the hydraulic cylinder does not flow to the transmission case.

Thus, the implement remains at its fixed position.

(1) Control Valve
(2) Spool

P: Pump Port
C: Cylinder Port
T1: Tank Port 1
T2: Tank Port 2

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■ Up

When the control lever is set to the "**Up**" position, the spool (2) is moved to the left.

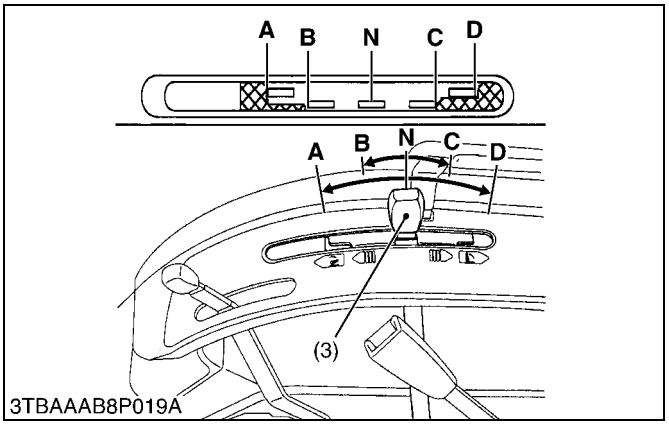
The oil forced into the control valve (1) through **P** port flows to **C** port.

The oil pushes and flows into the hydraulic cylinder through the **C** port to lift the implement.

(1) Control Valve
(2) Spool

P: Pump Port
C: Cylinder Port
T1: Tank Port 1
T2: Tank Port 2

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■ Slow Up (Quarter Inching Control)

When the hydraulic control lever (3) is set to "**SLOW UP**" position (**C**), the spool (2) is slightly moved to the left.

The oil forced into the control valve (1) from **P** port flows to **C** port in response to the movement of the hydraulic control lever (3).

Since the spool (2) is two stepped land spool, the oil forced in the oil passage (**IP**) between the spool (2) and the control valve body is throttled, and less quantity of hydraulic oil flows from **P** port, through this oil passage (**IP**), to **C** port.

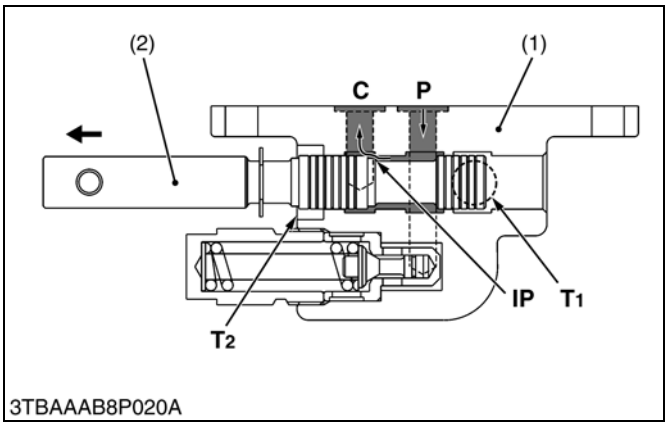
At this time, the hydraulic control lever (3) enables to control the valve easily in increments of approximately 1/4 inches "**SLOW UP**" at the lower link end.

(1) Control Valve
(2) Spool
(3) Hydraulic Control Lever

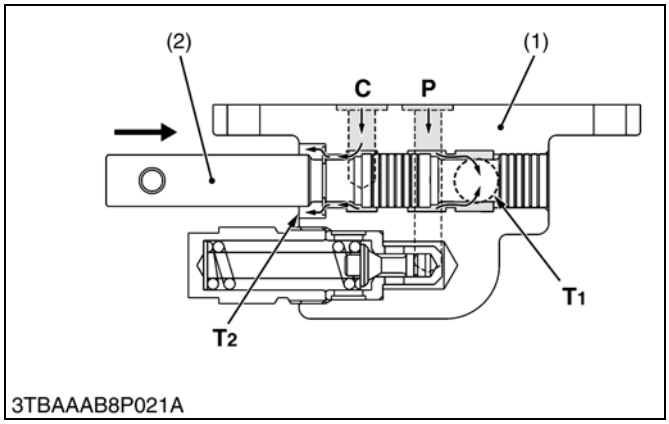
A: Down
B: SLOW DOWN
C: SLOW UP
D: UP
N: NEUTRAL
IP: Oil Passage (Pump Side)

P: Pump Port
C: Cylinder Port
T1: Tank Port 1
T2: Tank Port 2

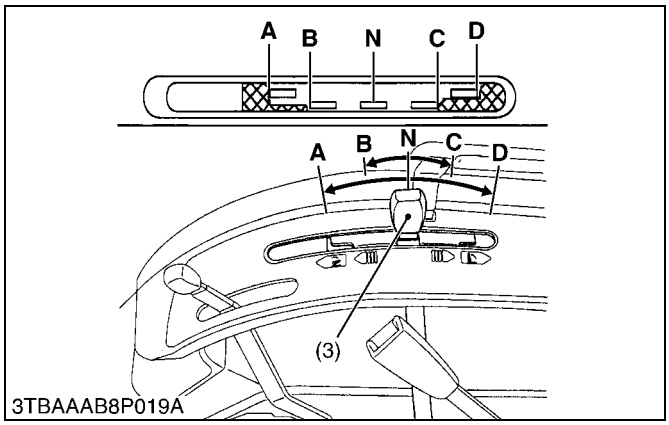
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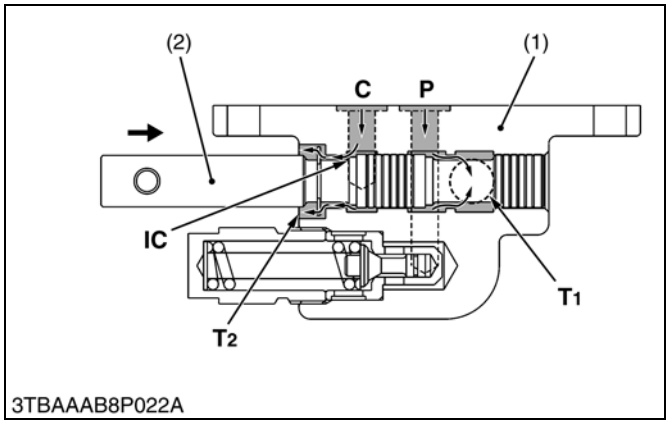
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3TBAAAB8P019A



3TBAAAB8P022A

■ Down

When the control lever is moved to "**DOWN**" position, the spool (2) is moved to the right.

Oil in the hydraulic cylinder is forced out to the transmission case through the **T2** port by the weight of the implement, causing the implement to lower.

Oil forced into the control valve (1) through the **P** port and returns to the transmission case through the **T1** port.

(1) Control Valve
(2) Spool

P: Pump Port
C: Cylinder Port
T_1: Tank Port 1
T_2: Tank Port 2

W1012863

■ Slow Down (Quarter Inching Control)

When the hydraulic control lever (3) is set to "**SLOW DOWN**" position (**B**), the spool (2) is slightly moved to the right.

The oil forced into the control valve (1) from **C** port flows to **T2** port in response to the movement of the hydraulic control lever (3).

Since the spool (2) is two stepped land spool, the oil forced in the oil passage (**IC**) between the spool (2) and the control valve body is throttled, and less quantity of hydraulic oil flows from **C** port, through this oil passage (**IC**), to **T2** port.

At this time, the hydraulic control lever (3) enables to control the valve easily in increments of approximately 1/4 inches "**SLOW DOWN**" at the lower link end.

(1) Control Valve
(2) Spool
(3) Hydraulic Control Lever

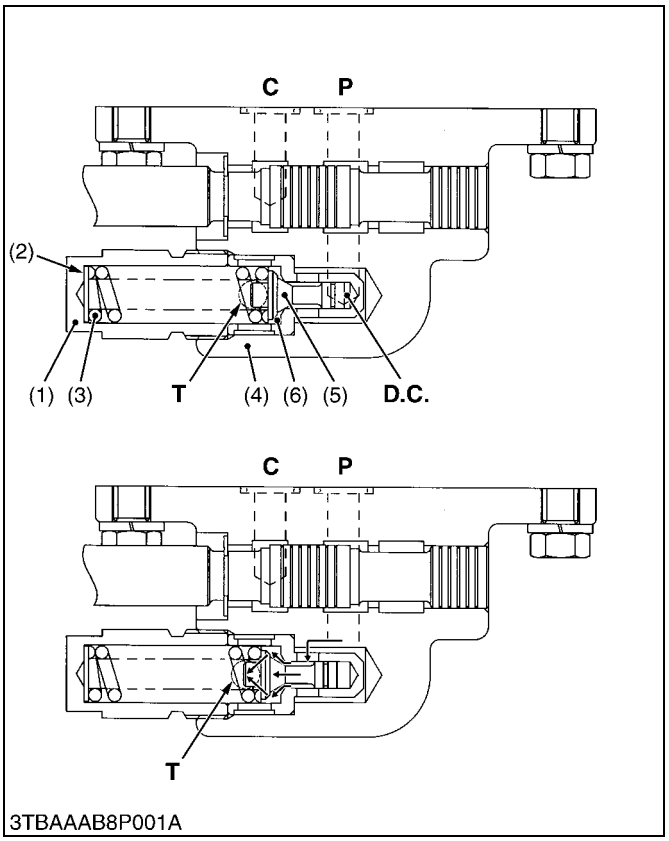
P: Pump Port
C: Cylinder Port
T_1: Tank Port 1
T_2: Tank Port 2

A: Down
B: SLOW DOWN
C: SLOW UP
D: UP
N: NEUTRAL
IC: Oil Passage (Cylinder Side)

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2. RELIEF VALVE



The implement control system circuit has a relief valve to restrict the maximum pressure in the circuit. The relief valve is located in the control valve body.

The relief valve is of the guide piston type with damping effect.

Among direct acting relief valves, this type is suited to higher pressure and has large capacity. Furthermore, this type is free from unstable operation, such as chattering, which occurs often in direct acting relief valves.

As shown in the figure, the guide is attached to the poppet (5) and a valve chamber **D.C.** (called the damping chamber) is formed at the right of the guide piston. The inlet of the valve leads to the chamber via a clearance between the sliding portion of the guide and the seat (6), minimizing valve vibration with the damping effect of the chamber.

When the oil pressure in the circuit is lower than the setting pressure of the relief valve, the relief valve is not operated and the oil fed to the relief valve from the hydraulic pump flows into the implement control valve.

As the oil pressure in the circuit increases, so does the pressure in the damping chamber **D.C.** When the pressure rises above the valve setting and overcomes the spring force, the valve opens. Oil then flows out to the transmission case through **T** port, preventing any further rise in pressure. The valve closes again when enough oil is released to drop pressure below the valve setting.

(Reference)

- Relief valve setting pressure: 13.2 to 14.2 MPa
  135 to 145 kgf/cm^2
  1920 to 2064 psi
- Engine speed: Maximum
- Oil temperature: 40 to 50 °C
  104 to 122 °F

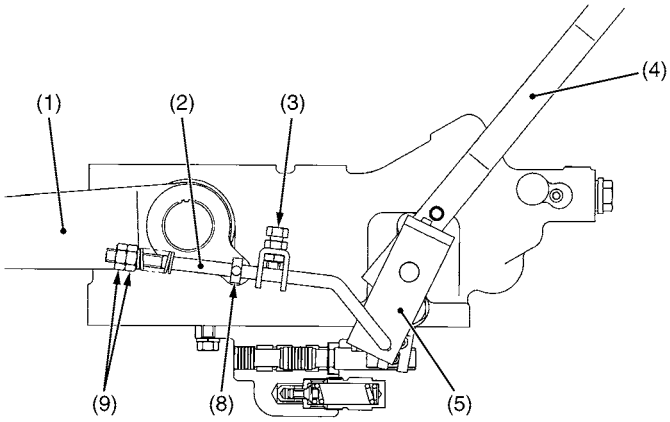
(1) Plug
(2) Washer
(3) Shim
(4) Hydraulic Cylinder Body
(5) Poppet
(6) Seat

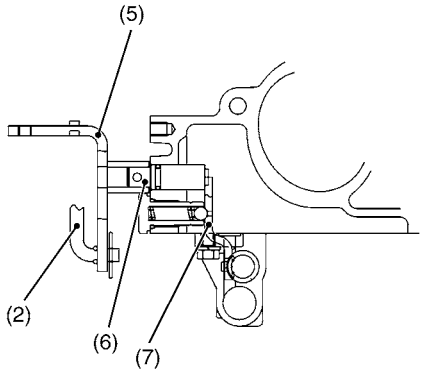
D.C.: Damping Chamber
P: Pump Port
C: Cylinder Port
T: Tank Port

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3. FEEDBACK LINKAGE





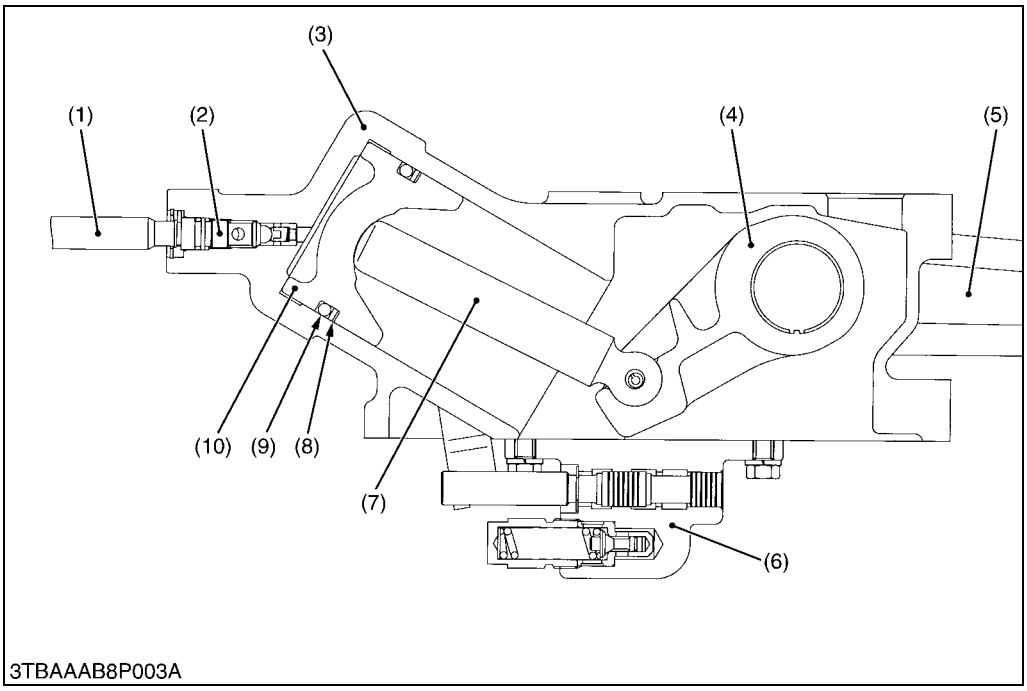
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(1) Lift Arm RH
(2) Feedback Rod
(3) Interlocker
(4) Hydraulic Control Lever
(5) Feedback Arm
(6) Control Lever Shaft
(7) Control Lever Arm
(8) Feedback Pin
(9) Lock Nut

When the hydraulic control lever (4) moved to rearward to lift the implement, the spool of the control valve is pulled out to form a raising circuit by the motions of feedback arm (5), control lever shaft (6) and control lever arm (7). And after the lift arm (1) moves upward, the spool is pushed in and returned to form a neutral circuit by the motions of interlocker (3), lock nut (9), feedback rod (2), feedback arm (5), control lever shaft (6) and control lever arm (7).

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4. HYDRAULIC CYLINDER



(1) Lowering Speed Adjusting Shaft
(2) Lowering Speed Adjusting Valve
(3) Hydraulic Cylinder
(4) Hydraulic Arm
(5) Lift Arm
(6) Hydraulic Control Valve
(7) Hydraulic Rod
(8) Back-up Ring
(9) O-ring
(10) Piston

W1014117

The main components of the hydraulic cylinder are shown in the figure above.

While the lift arm (5) is rising, oil from the hydraulic pump flows into the hydraulic cylinder through the hydraulic control valve (6). Then oil pushes out the piston (10).

While the lift arm (5) is lowering, oil in the hydraulic cylinder is discharged to the transmission case through the hydraulic control valve (6) by the weight of the implement. At this time, the lowering speed of the implement can be controlled by the lowering speed adjusting valve (2) attached to the hydraulic cylinder (3).

Turning the lowering speed adjusting knob clockwise decreases the lowering speed, and counterclockwise increases lowering speed. When the lowering speed adjusting valve (2) is completely closed, the lift arm (5) is held at its position since oil in the hydraulic cylinder is sealed between the piston (10) and lowering speed adjusting valve (2).

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SERVICING

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2. TIGHTENING TORQUES 1-S2
3. HYDRAULIC CYLINDER ASSEMBLY AND HYDRAULIC BLOCK 1-S3
   [1] CHECKING AND ADJUSTING 1-S3
   [2] DISASSEMBLING AND ASSEMBLING 1-S5
      (1) Separating Hydraulic Cylinder Assembly 1-S5
      (2) Disassembling Hydraulic Cylinder Assembly 1-S5
   [3] SERVICING 1-S7

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1. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
[Hydraulic Pump] Pump Delivery at Engine 2600 rpm, Oil Temperature 50 °C, 122 °F	at no pressure	24.4 L/min 6.4 U.S.gal/min 5.4 Imp.gal/min	–
	at 13.7 MPa 140 kgf/cm^2 1991 psi	23.0 L/min 6.1 U.S.gal/min 5.1 Imp.gal/min	–
Gear to Casing	Clearance	–	0.15 mm 0.0059 in.
Gear Shaft to Bushing	Clearance	0.020 to 0.091 mm 0.0008 to 0.0036 in.	0.12 mm 0.0047 in.
Gear Shaft	O.D.	14.970 to 14.980 mm 0.5894 to 0.5898 in.	–
Bushing	I.D.	15.000 to 15.061 mm 0.5906 to 0.5930 in.	–
Side Plate	Thickness	2.48 to 2.50 mm 0.0976 to 0.0984 in.	2.40 mm 0.0945 in.
Relief Valve	Setting Pressure	13.2 to 14.2 MPa 135 to 145 kgf/cm^2 1920 to 2064 psi	–
Lift Arm	Free Play	5 to 10 mm 0.20 to 0.40 in.	–
Hydraulic Cylinder	I.D.	70.05 to 70.10 mm 2.7579 to 2.7598 in.	70.15 mm 2.7618 in.
Hydraulic Arm Shaft to Bushing	Clearance	0.020 to 0.110 mm 0.0008 to 0.0043 in.	0.30 mm 0.0118 in.
Hydraulic Arm Shaft, Right	O.D.	37.925 to 37.950 mm 1.4931 to 1.4941 in.	–
Hydraulic Arm Shaft, Left	O.D.	33.925 to 33.950 mm 1.3356 to 1.3366 in.	–
Bushing, Right	I.D.	37.970 to 38.035 mm 1.4949 to 1.4974 in.	–
Bushing, Left	I.D.	33.970 to 34.035 mm 1.3374 to 1.3400 in.	–

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2. TIGHTENING TORQUES

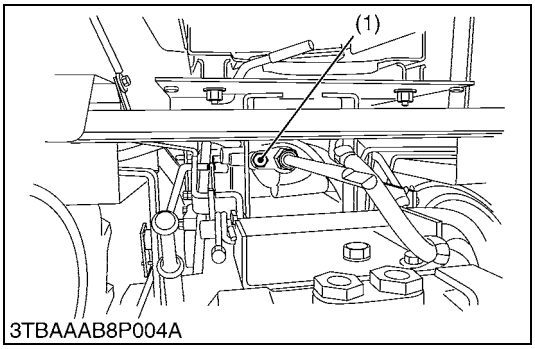
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: See page G-9.)

Item	N·m	kgf·m	ft-lbs
Delivery pipe nut for power steering	65 to 75	6.6 to 7.7	47.9 to 55.3
Hydraulic pump cover mounting screw	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Connecting plate mounting screws and nuts	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Joint bolt for delivery pipe to hydraulic cylinder	33.3 to 38.2	3.4 to 3.9	24.6 to 28.2
Relief valve plug	49.0 to 68.6	5.0 to 7.0	36.2 to 50.6
Hydraulic cylinder assembly mounting screws and nuts	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Control valve mounting screws	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2

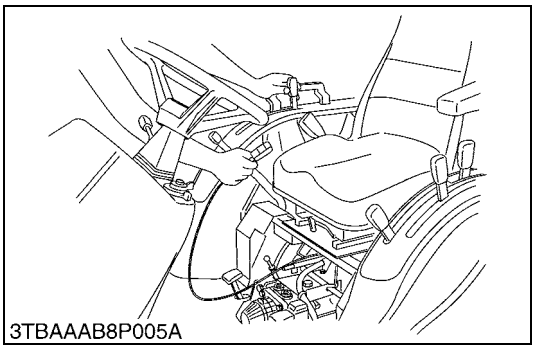
W1012736

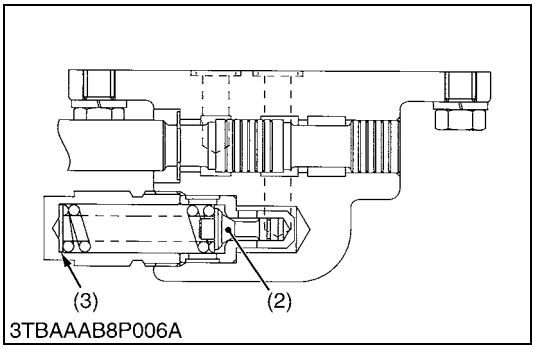
3. HYDRAULIC CYLINDER ASSEMBLY AND HYDRAULIC BLOCK

[1] CHECKING AND ADJUSTING



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3TBAAAB8P005A



3TBAAAB8P006A

Relief Valve Setting Pressure

1. Remove the seat under cover.
2. Remove the plug (1) from front of hydraulic cylinder body.
3. Install the adaptor **58**. Then connect the cable and pressure gauge to adaptor **58**.
4. Remove the feedback rod lock nut and spring.
5. Start the engine and set at maximum speed.
6. Move the hydraulic control lever all way up to operate the relief valve and read the gauge.
7. If the pressure is not factory specifications, remove the hydraulic cylinder assembly (refer to 1-S5 to 1-S7) and adjust relief valve (2) with the adjusting shims (3).
8. Reinstall the hydraulic cylinder assembly. After checking the pressure, reinstall the spring and feedback rod lock nut.

Relief valve setting pressure	Factory spec.	13.2 to 14.2 MPa 135 to 145 kgf/cm^2 1920 to 2064 psi

Condition

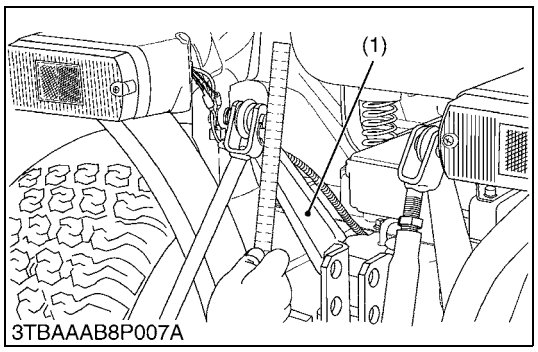
- Engine speed ..... Maximum
- Oil temperature ..... 45 to 55 °C
  113 to 131 °F

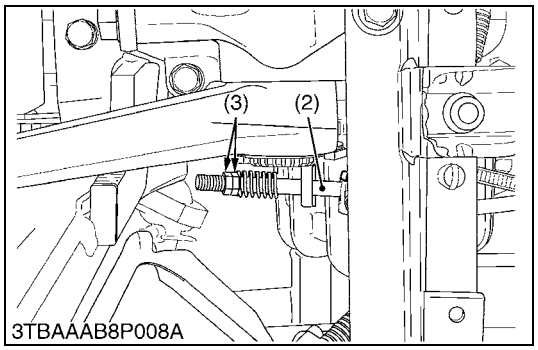
(Reference)

- Thickness of shims (3): 0.1 mm (0.0039 in.), 0.2 mm (0.0079 in.)

(1) Plug
(2) Relief Valve
(3) Shim

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Lift Arm Free Play

1. Set the hydraulic control lever to the lowest position.
2. Start the engine, and set at the idling speed.
3. Move the hydraulic control lever to lift position until the lift arm moves to the uppermost position.
4. Move the lift arm (1) to the upper end by hand and measure the free play.
5. If the measurement is not within the factory specifications, adjust the free play by changing the set position of feedback rod lock nut (3).

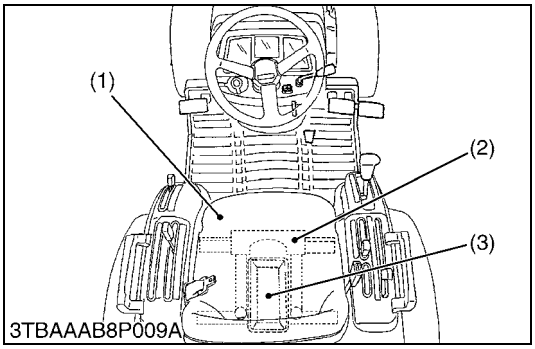
Lift arm free play	Factory spec.	5 to 15 mm 0.20 to 0.59 in.

(1) Lift Arm
(2) Feedback Rod
(3) Lock Nut

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[2] DISASSEMBLING AND ASSEMBLING

(1) Separating Hydraulic Cylinder Assembly

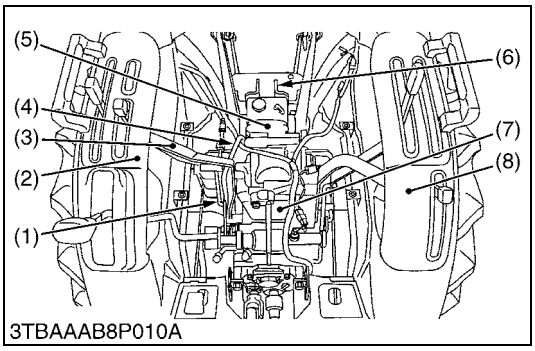


Seat and Seat Stay

1. Remove the seat.
2. Remove the lowering speed adjusting knob and dipstick, then remove the seat under cover.
3. Remove the tool box (3) and the seat stay assembly (2).
4. Disconnect the wiring harness.

(1) Seat
(2) Seat Stay Assembly
(3) Tool Box

W1014620



Hydraulic Cylinder Assembly

1. Remove the top link and disconnect the lift rods.
2. Remove the all lever grips and remove the both lever guides (2), (8).
3. Disconnect the differential lock rod (1) and remove the hydraulic control lever (3).
4. Disconnect the delivery pipe for 3-point hitch (4).
5. Remove the left hand side top link bracket (6) and connecting plate mounting screws.
6. Remove the hydraulic cylinder assembly (5) with connecting plate.

(When reassembling)

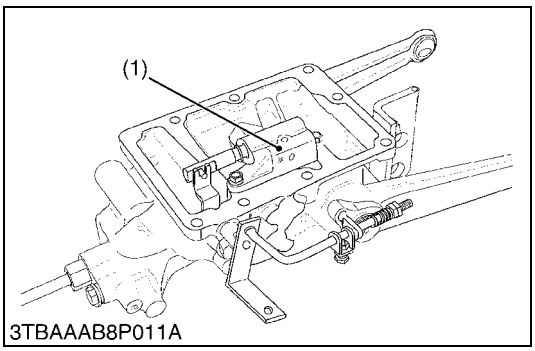
- Apply liquid gasket to joint face of the differential case and the hydraulic cylinder.

Tightening torque	Connecting plate mounting screw	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs
	Hydraulic cylinder mounting screw and nut	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs
	Delivery pipe joint bolt	33.3 to 38.2 N·m 3.4 to 3.9 kgf·m 24.6 to 28.2 ft-lbs

(1) Differential Lock Rod
(2) Lever Guide RH
(3) Hydraulic Control Lever
(4) Delivery Pipe
(5) Hydraulic Cylinder
(6) Top Link Bracket LH
(7) Connecting Plate
(8) Lever Guide LH

W1014733

(2) Disassembling Hydraulic Cylinder Assembly



Control Valve

1. Remove the control valve mounting screws, and remove the control valve (1).

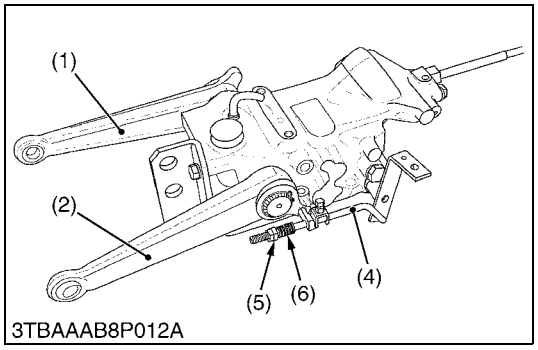
(When reassembling)

- Take care not to damage the O-rings.

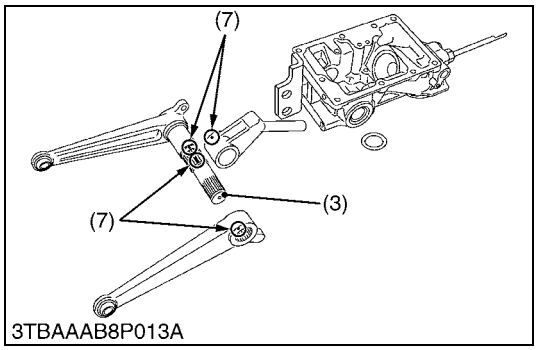
Tightening torque	Control valve mounting screws	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

(1) Control Valve

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3TBAAAB8P013A

Lift Arm, Hydraulic Arm Shaft and Hydraulic Arm

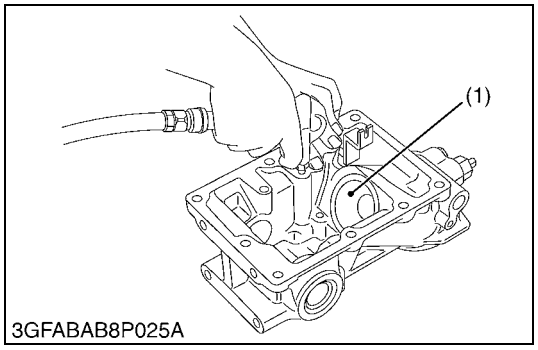
1. Remove the feedback rod lock nuts (5) and spring (6).
2. Remove the lift arm LH (1).
3. Remove the hydraulic arm shaft (3) and lift arm RH (2) as a unit.

(When reassembling)

- Align the alignment marks (7) of the hydraulic arm and hydraulic arm shaft.
- Align the alignment marks (7) of the lift arm LH and hydraulic arm shaft.
- Apply grease to the right and left bushings and O-rings.
- Take care not to damage the O-rings.

(1) Lift Arm LH
(2) Lift Arm RH
(3) Hydraulic Arm Shaft
(4) Feedback Rod
(5) Lock Nut
(6) Spring
(7) Alignment Mark

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Hydraulic Piston

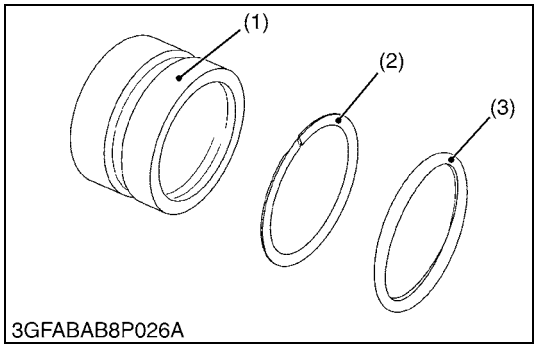
1. Inject the compressed air into the hydraulic cylinder, and take out the hydraulic piston (1).

(When reassembling)

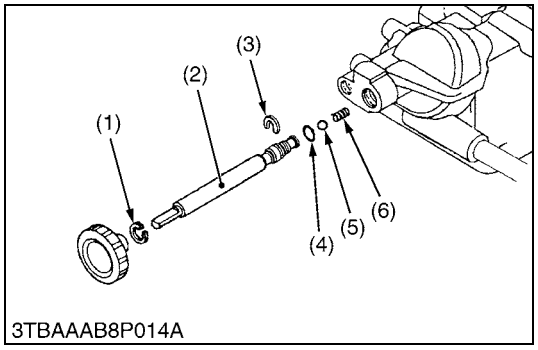
- Take care not to damage the O-ring (3) and backup ring (2).
- Apply transmission fluid to the O-ring.
- Replace the O-ring if it is defective, worn or scratched, which may cause oil leakage.

(1) Hydraulic Piston
(2) Backup Ring
(3) O-ring

W1015426



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3TBAAAB8P014A

Lowering Speed Adjusting Valve

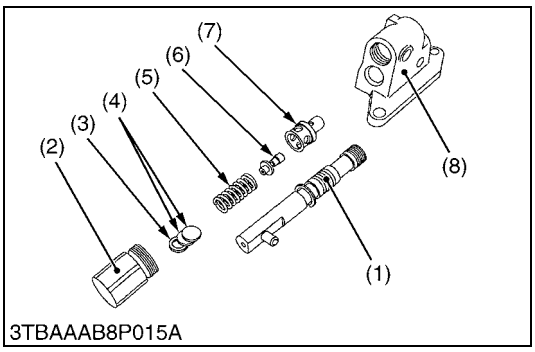
1. Remove the internal snap ring (1) and pull out the lowering speed adjusting valve with shaft (2).
2. Draw out the ball (5) and spring (6).

(When reassembling)

- Take care not to damage the O-rings.

(1) Internal Snap Ring
(2) Lowering Speed Adjusting Valve with Shaft
(3) Stopper
(4) O-ring
(5) Ball
(6) Spring

W1015576



3TBAAAB8P015A

Disassembling Control Valve

1. Remove the spool (1).
2. Remove the plug (2) and draw out the washer (3), shims (4), spring (5), poppet (6) and valve seat (7).

(When reassembling)

Tightening torque	Relief valve plug	49.0 to 68.6 N·m 5.0 to 7.0 kgf·m 36.2 to 50.6 ft-lbs

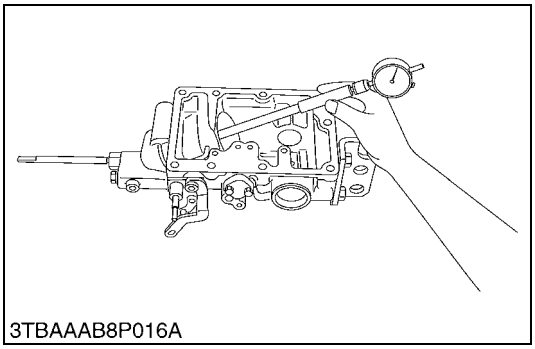
■ **IMPORTANT**

- **After disassembling and assembling the relief valve, be sure to adjust the relief valve setting pressure.**

(1) Spool
(2) Relief Valve Plug
(3) Washer
(4) Adjusting Shim
(5) Spring
(6) Poppet
(7) Valve Seat
(8) Control Valve Seat

W1015713

[3] SERVICING

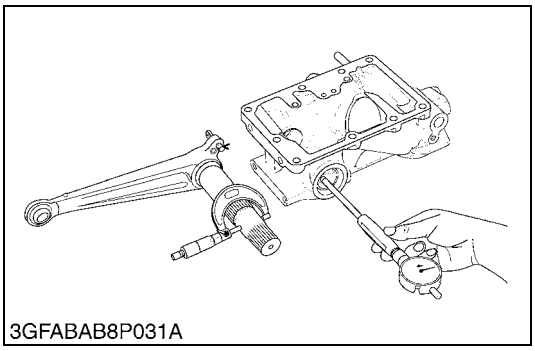

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Hydraulic Cylinder Bore

1. Check the cylinder internal surface for spring or damage.
2. Measure the cylinder I.D. with a cylinder gauge.
3. If the measurement exceeds the allowable limit, replace the hydraulic cylinder block.

Cylinder I.D.	Factory spec.	70.05 to 70.10 mm 2.7579 to 2.7598 in.
	Allowable limit	70.15 mm 2.7618 in.

W1016033


3GFABAB8P031A

Clearance between Hydraulic Arm Shaft and Bushing

1. Measure the hydraulic arm shaft O.D. with an outside micrometer.
2. Measure the bushing I.D. with a cylinder gauge, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the bushing.

Clearance between hydraulic arm shaft and bushing	Factory spec.	0.020 to 0.110 mm 0.0008 to 0.0043 in.
	Allowable limit	0.30 mm 0.0118 in.

Hydraulic arm shaft O.D.	Factory spec.	Right	37.925 to 37.950 mm 1.4931 to 1.4941 in.
		Left	33.925 to 33.950 mm 1.3356 to 1.3366 in.

Bushing I.D. (after press fitted)	Factory spec.	Right	37.970 to 38.035 mm 1.4949 to 1.4974 in.
		Left	33.970 to 34.035 mm 1.3374 to 1.3400 in.

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2 ELECTRICAL SYSTEM

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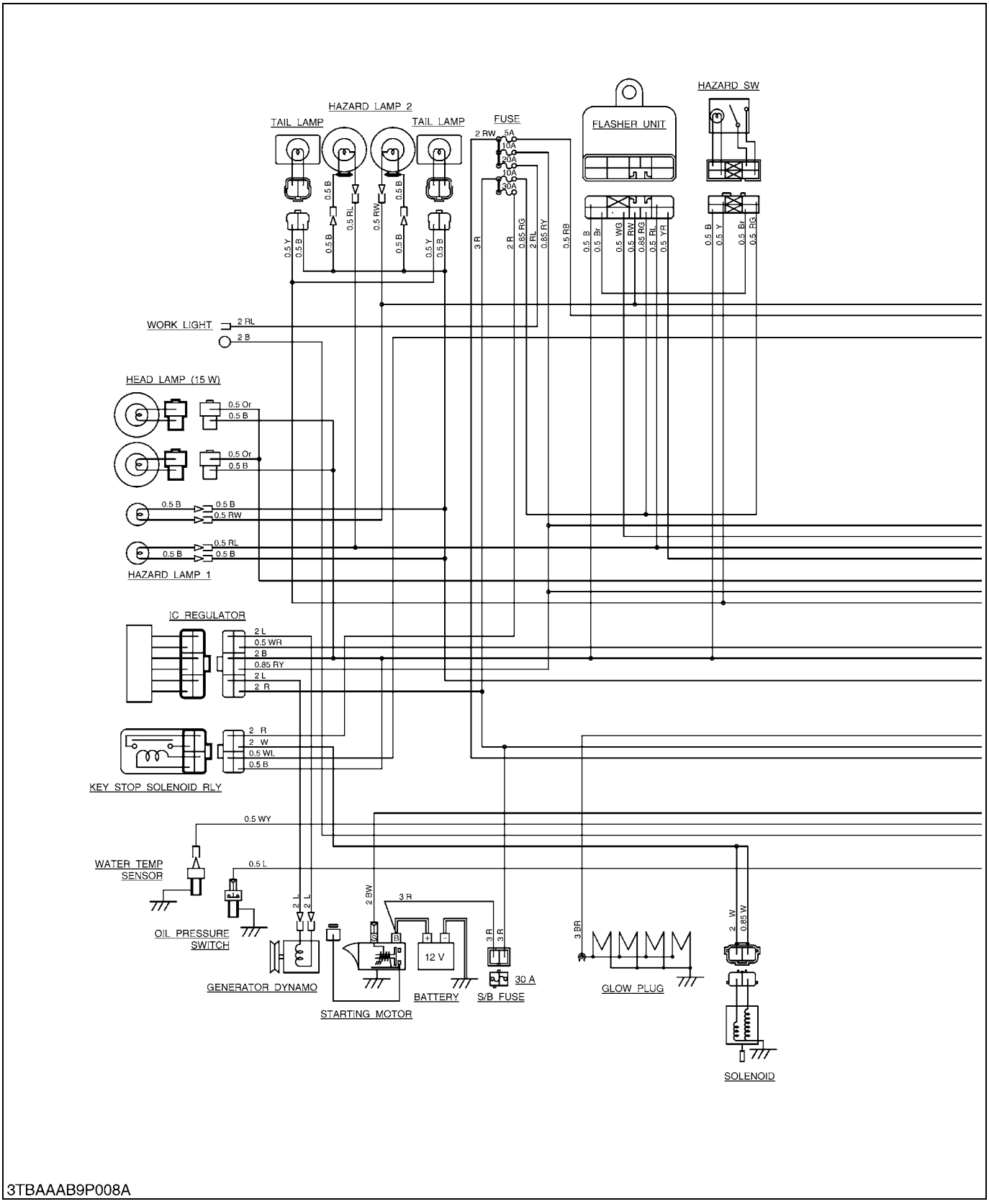
MECHANISM

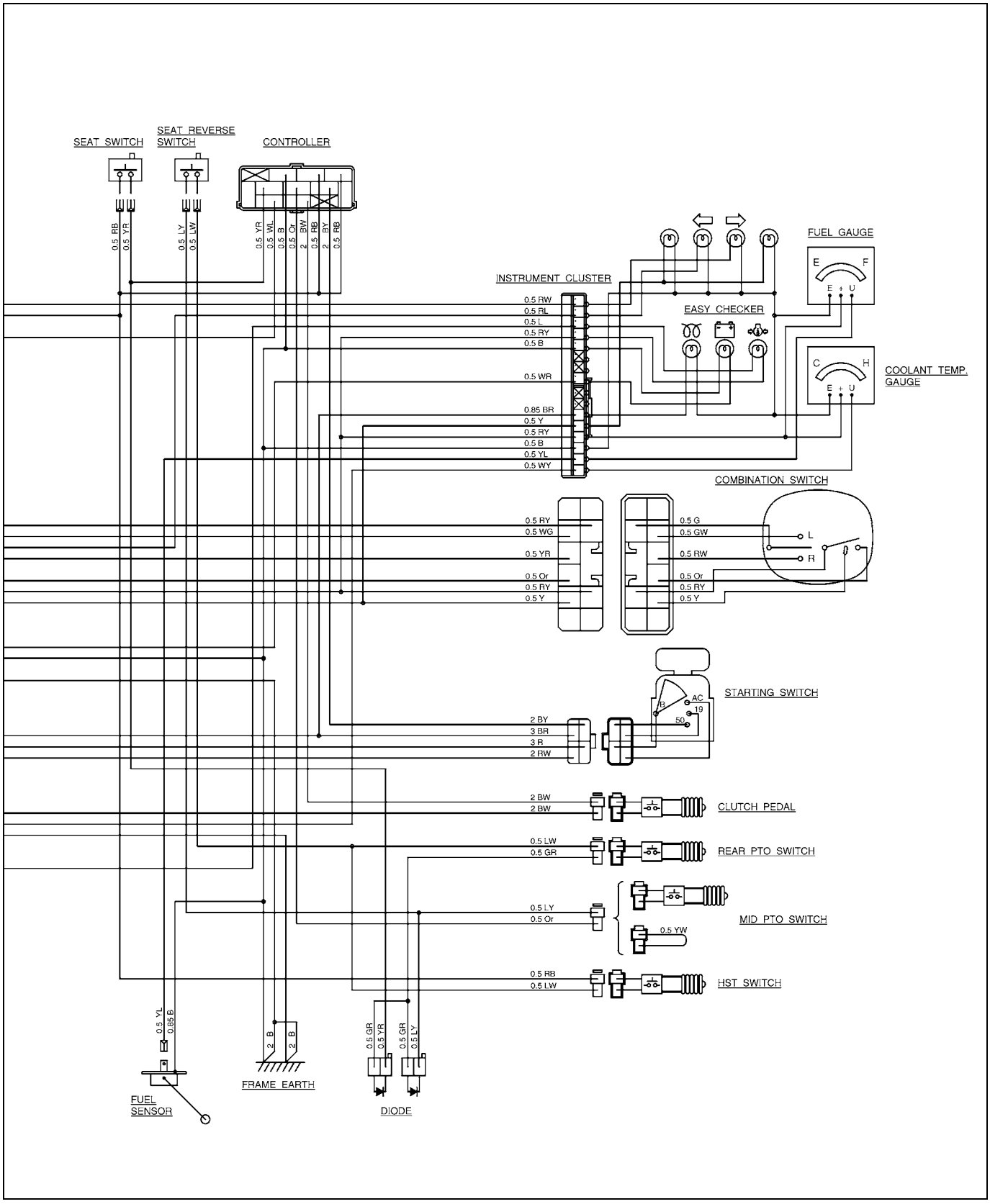
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2. OPERATORS PRESENCE CONTROL (OPC) 2-M3
   [1] ENGINE STARTING 2-M5
   [2] ENGINE AUTOMATICALLY STOPPING: AUTOMATIC ENGINE STOP 2-M5

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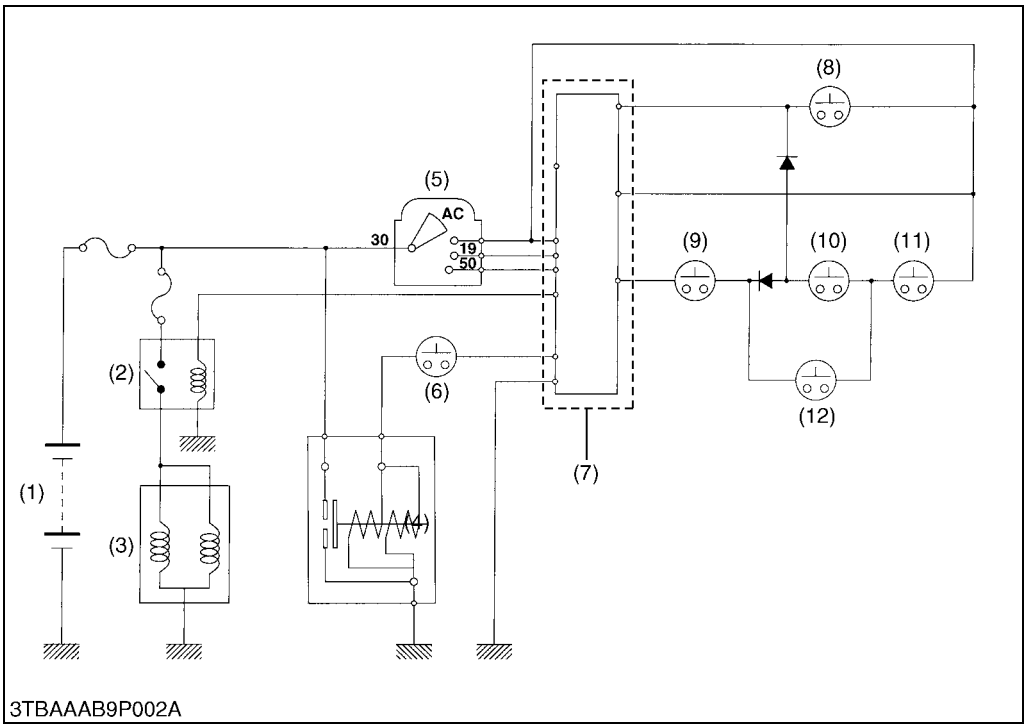
1. WIRING DIAGRAM




SEAT SWITCH
SEAT REVERSE SWITCH
CONTROLLER
INSTRUMENT CLUSTER
FUEL GAUGE
EASY CHECKER
COOLANT TEMP. GAUGE
COMBINATION SWITCH
STARTING SWITCH
CLUTCH PEDAL
REAR PTO SWITCH
MID PTO SWITCH
HST SWITCH
FUEL SENSOR
FRAME EARTH
DIODE

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2. OPERATORS PRESENCE CONTROL (OPC)



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(1) Battery
(2) Key Stop Solenoid Relay
(3) Engine Stop Solenoid
(4) Starter
(5) Main Switch
(6) Clutch Pedal Switch
(7) Controller
(8) Seat Switch
(9) Mid-PTO Shift Lever Switch (Mid-PTO Model)
(10) PTO Shift Lever Switch
(11) Speed Control Pedal Switch
(12) Seat Reverse Switch

W1012673

B7800 is configured with an Operators Presence Control (OPC) to control (1) Engine starting, (2) Engine automatically stopping, (3) Engine revolution automatically recovering, and (4) Rear-PTO shift lever changing. This OPC consists of controller and engine starting/stopping control switches such as clutch pedal switch, mid-PTO shift lever switch, rear-PTO shift lever switch, speed change pedal switch, seat (occupying) switch, and seat reverse switch.

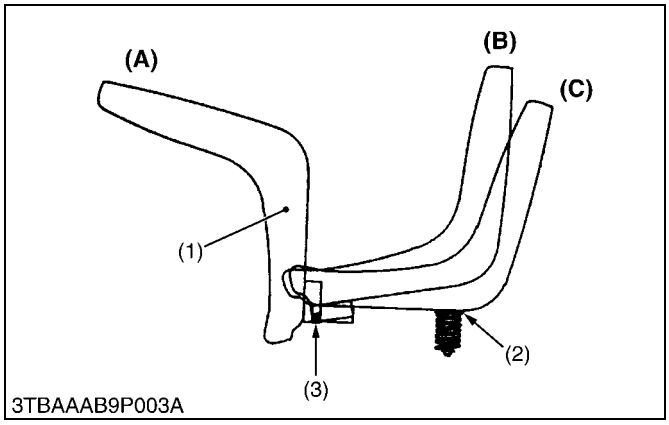
Main parts regarding OPC are laid out as shown in the electrical circuit.

The function of controller and each switch are mentioned as below.

1. Controller
   - Controller is configured with a delay timer in the controller unit to hold fuel cut signal from the controller unit to fuel cut solenoid for about 1 second.
2. Clutch pedal switch
   - This clutch pedal switch detects the clutch pedal engaging or disengaging positions. When engaging the clutch pedal, the clutch pedal switch is pushed in and electrical circuit is closed.
3. Mid-PTO shift lever switch (mid-PTO model only)
   - This mid-PTO lever switch detects the mid-PTO lever engaging or disengaging positions. When engaging the mid-PTO shift lever, the mid-PTO shift lever switch is pushed in and electrical circuit is closed.

4. PTO shift lever switch
   - This PTO shift lever switch detects both the rear-PTO shift lever and mid-PTO shift lever engaging or disengaging positions. When shifting both the rear-PTO shift lever and mid-PTO shift lever to "**NEUTRAL**", the PTO shift lever switch is pushed in and electrical circuit is closed ("ON").
5. Speed control pedal switch
   - This speed control pedal switch detects the speed control pedal forward or reverse positions.
   - When engaging the speed change pedal, the speed change pedal switch is pushed in and electrical circuit is closed.

W1013332



6. Seat switches
   - Seat switches consist of two switches. One is seat (occupying) switch to detect the position of the seat. This is located under the seat in the rear side of the seat support. When sitting on the seat, this switch is pushed in and electrical circuit is closed. When the seat is vacant, this switch is not pushed and electrical circuit is opened. Other is seat reverse switch to detect tilting the seat. This is located under the seat in the front side of the seat support. When tilting the seat forward, this switch is pushed in and electrical circuit is closed.

(1) Seat
(2) Seat Switch
(3) Seat Reverse Switch

A: Tilted
B: Vacant
C: Seated (Occupied)

W1013588

[OPC switch and its electrical circuit]

Switch name	Switch movement	Electrical contacts	Remarks
Clutch pedal switch	Pushed when depressing the clutch pedal	ON, closed	
	Free when releasing the clutch pedal	OFF, opened	
Mid-PTO shift lever switch	Pushed in disengaging position	ON, closed	Mid-PTO model only
	Free at engaging position	OFF, opened	
PTO shift lever switch	Pushed when both rear-PTO and mid-PTO shift lever is "**NEUTRAL**"	ON, closed	
	Free when both rear-PTO and mid-PTO shift lever is engaged	OFF, opened	
Speed control pedal switch	Pushed in neutral position	ON, closed	
	Free at forward or reverse position	OFF, opened	
Seat (Occupying) switch	Pushed in when sitting on the seat	ON, closed	
	Free when seat is vacant	OFF, opened	
Seat reverse switch	Pushed when tilting the seat	ON, closed	
	Free when returning back the seat to the original position	OFF, opened	

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[1] ENGINE STARTING

The engine mounted on B7800 can be started when OPC switches such as clutch pedal switch, speed control pedal switch, mid-PTO shift lever switch, PTO shift lever switch are “ON” at any operator’s seat positions as shown on the table below.

[Engine Starting Condition]

Clutch Pedal Switch	Speed Control Pedal Switch	PTO Shift Lever Switch
ON	ON	ON

W1014802

[2] ENGINE AUTOMATICALLY STOPPING: AUTOMATIC ENGINE STOP

Engine can be shut-off under the following two conditions since these conditions cause delay timer in the control circuit of the controller to operate and it controls the fuel cut solenoid and fuel injection, and stops the engine. The delay timer holds the fuel cut signal for about 1 second.

[Condition 1]

- While keeping the operator’s seat vacant, engaging speed control pedal, mid-PTO shift lever or rear-PTO shift lever as shown on the table below.

[Condition 2]

- While keeping the seat reverse switch to “ON”, engaging speed control pedal or mid-PTO shift lever as shown on the table below.

[Engine Automatically Stopping Condition]

Seat (Occupying) Switch	Speed Control Pedal Switch	Mid-PTO Shift Lever Switch	PTO Shift Lever Switch	Seat Reverse Switch	condition
OFF	ON	ON	OFF	OFF	Condition 1
OFF	ON	OFF	OFF	OFF	Condition 1
OFF	OFF	ON or OFF	ON or OFF	OFF	Condition 1
OFF	ON	OFF	OFF	ON	Condition 2
OFF	OFF	ON or OFF	ON or OFF	ON	Condition 2

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- Engine Revolution Automatically Recovering
  - While engine revolution decreasing under the engine automatically stopping condition, since sitting on the operator’s seat does not operate the delay timer, and fuel are delivered to the engine, and engine revolution are automatically recovered.
- Rear-PTO Shift Lever
  - Shifting rear-PTO shift lever does not cause engine stopping at seat tilting position.

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SERVICING

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1. SERVICING SPECIFICATIONS

SAFETY SWITCH

Item		Factory Specifications	Allowable Limit
• Clutch pedal switch	Resistance	0 Ω when depressing the clutch pedal.	–
• Speed control pedal switch	Resistance	0 Ω when placing the pedal to "**NEUTRAL**".	–
• Mid-PTO shift lever switch (Mid-PTO model) • PTO shift lever switch	Resistance	0 Ω when placing the levers to "OFF (Disengaged)" position.	–
• Seat switch	Resistance	0 Ω when sitting on the seat.	–
• Seat reverse switch	Resistance	0 Ω when tilting the seat forward.	–

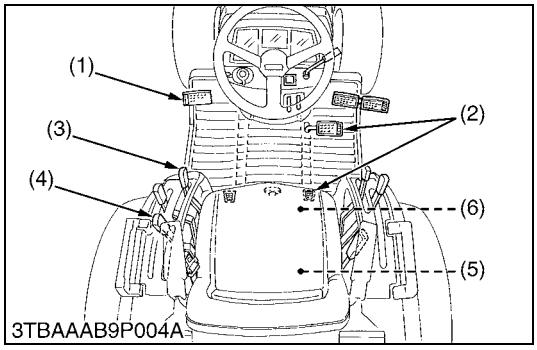
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2. CHECKING AND SERVICING

[1] STARTING SYSTEM

(1) Checking and Servicing

(A) Safety Switches



Checking Safety Switches

A defective location can be adjusted by checking the function of the safety switches one by one in the table below.

(Reference)

Safety switch name	Switch type
Clutch pedal switch	Normal open
Speed control pedal switch	Normal open
Mid-PTO shift lever switch (Mid-PTO model)	Normal open
Rear-PTO shift lever switch	Normal open
Seat switch	Normal open
Seat reverse switch	Normal open

(1) Clutch Pedal
(2) Speed Control Pedal
(3) Mid-PTO Gear Shift Lever
(4) Rear-PTO Gear Shift Lever
(5) Seat Switch
(6) Seat Reverse Switch

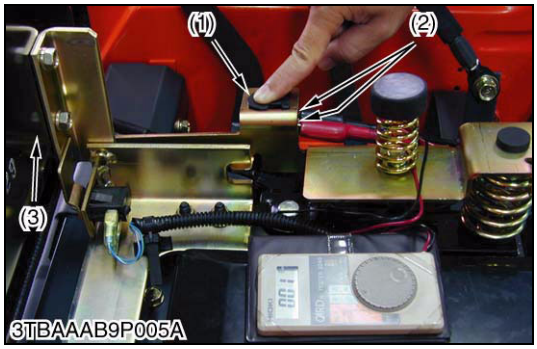
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Clutch Pedal Switch, Speed Control Pedal Switch, Mid-PTO Shift Lever Switch and PTO Shift Lever Switch Continuity

1. Refer to former B2410-B2910 WSM (97897-12271) page 9-S10.
2. If the safety switch is defective, replace it.

Safety switch (clutch pedal switch, speed control pedal switch, mid-PTO shift lever switch and PTO shift lever switch) resistance (across switch terminal)	When switch is pushed	0 Ω
	When switch is free	Infinity ohms

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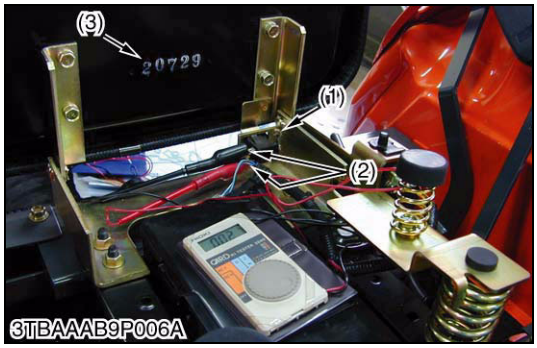


Seat Switch Continuity

1. Disconnect the leads from the seat switch (1).
2. Connect the circuit tester to the seat switch connectors (2).
3. Measure the resistance between the connectors (2) of the seat switch (1).
4. If the seat switch is defective, replace it.

(1) Seat Switch
(2) Connector
(3) Seat

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Seat Reverse Switch Continuity

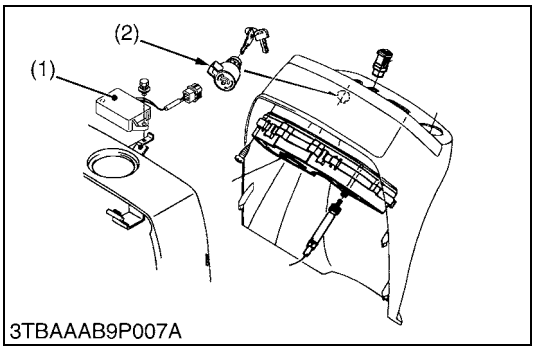
1. Disconnect the leads from the seat reverse switch (1).
2. Connect the circuit tester to the seat reverse switch connectors (2).
3. Measure the resistance between the connectors (2) of the seat reverse switch (1).
4. If the seat reverse switch is defective, replace it.

(1) Seat Reverse Switch
(2) Connector
(3) Seat

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(B) Controller



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Replacing Controller

1. If engine is not started, check all part regarding the starting system referring to "**TROUBLESHOOTING**" shown on B2410-B2910 WSM (97897-12271) page 9-S1.
2. If all part except the controller is not defective, replace the controller.

(1) Controller (2) Main Switch

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