WSM

WORKSHOP MANUAL
TRACTOR

M4900,M5700,M5700HD

Kubota

KiSC issued 03, 2020 A

TO THE READER

This Workshop Manual has been prepared to provide servicing personnel with information on the mechanism, service and maintenance of KUBOTA Tractors M4900 and M5700. 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.

March 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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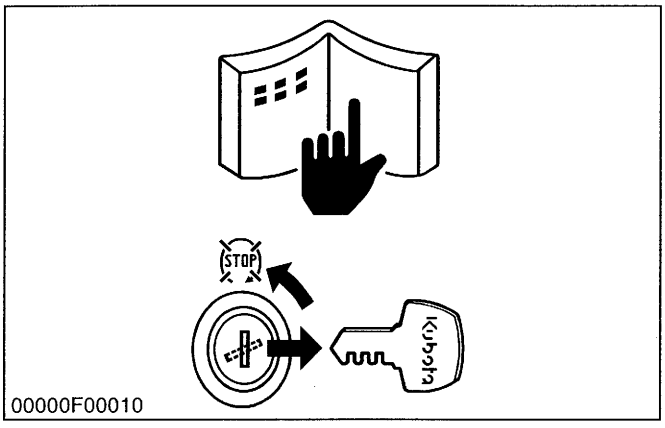

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BEFORE SERVICING AND REPAIRING

(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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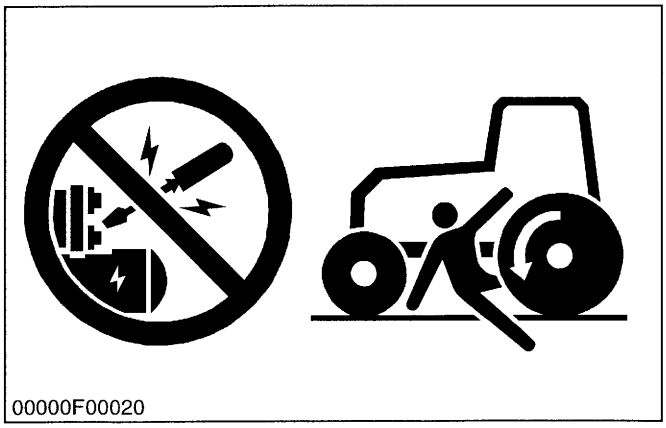
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SAFETY STARTING

(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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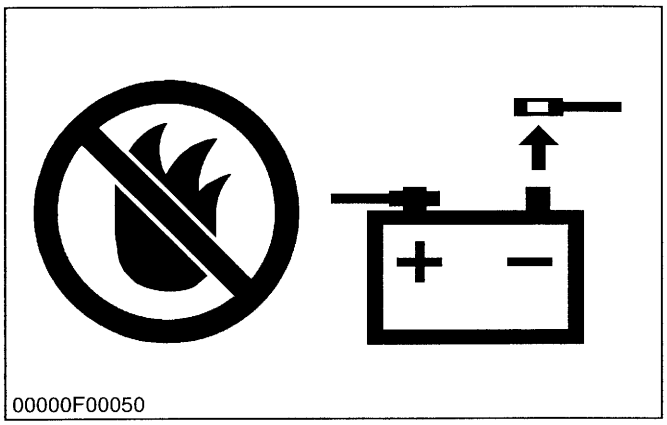
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AVOID FIRES

(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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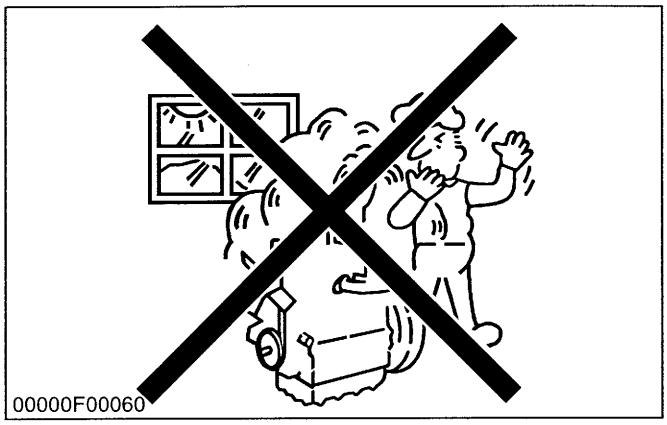
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VENTILATE WORK AREA

(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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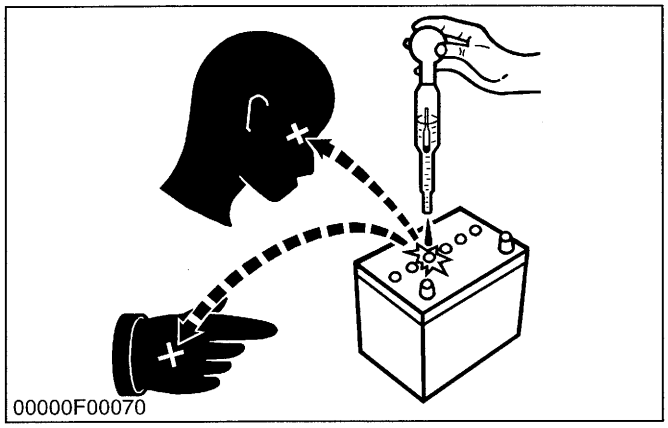
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PREVENT ACID BURNS

(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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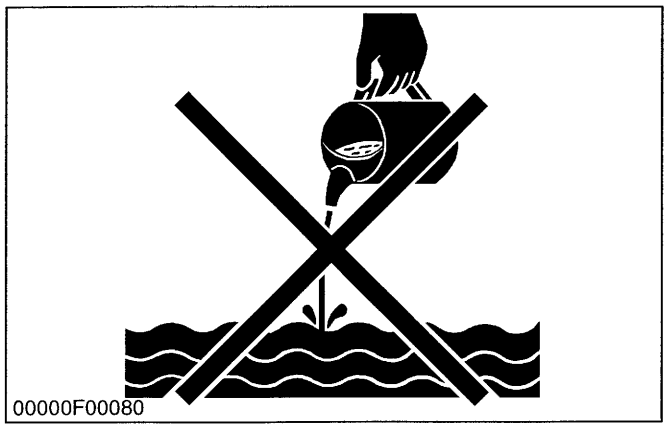
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DISPOSE OF FLUIDS PROPERLY

(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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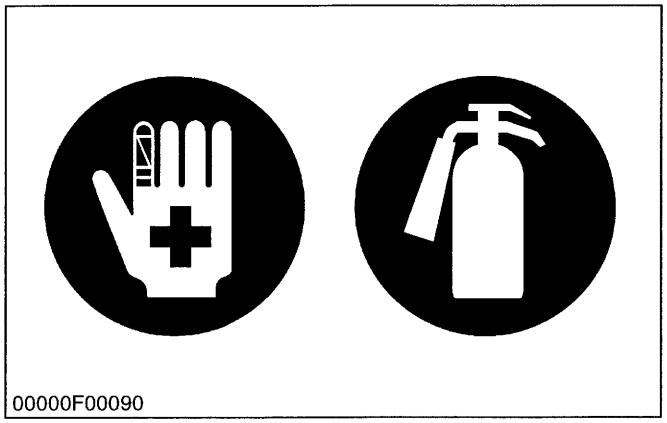
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PREPARE FOR EMERGENCIES

(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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SAFETY DECALS

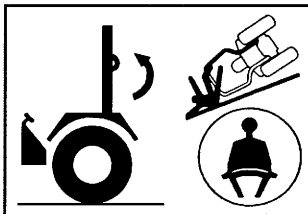
- **The following safety decals are installed on the machine.**
  If a decal becomes damaged, illegible or is not on the machine, replace it. The decal part number is listed in the parts list.

① Part No. TA040-4965-2

⚠ DANGER

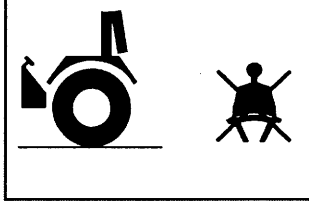
TO AVOID POSSIBLE INJURY OR DEATH FROM A MACHINE RUNAWAY.
1. Do not start engine by shorting across starter terminals or bypassing the safety start switch. Machine may start in gear and move if normal starting circuitry is bypassed.
2. Start engine only from operator's seat with transmission and PTO OFF. Never start engine while standing on the ground.

② Part No. 3A111-9848-2



⚠ WARNING

TO AVOID INJURY OR DEATH FROM ROLL-OVER:
- Keep Roll-Over Protective Structures (ROPS) in the upright and locked position.
- Fasten SEAT BELT before operating.



THERE IS NO OPERATOR PROTECTION WHEN THE ROPS IS IN THE FOLDED POSITION.
- Check the operating area and fold the ROPS only when absolutely necessary.
- Do not wear SEAT BELT if ROPS is folded.
- Raise and lock ROPS as soon as vertical clearance allows.
- Read ROPS related instructions and warnings.

⑤ Part No. 3A111-9554-1

⚠ WARNING

Never modify or repair a ROPS because welding, grinding, drilling or cutting any portion may weaken the structure.

⚠ CAUTION

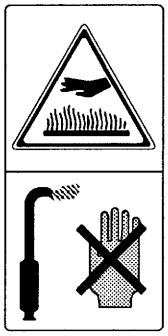
TO AVOID INJURY WHEN RAISING OR FOLDING ROPS:
- Set parking brake and stop engine.
- Remove any obstruction that may prevent raising or folding of the ROPS.
- Do not allow any bystanders.
- Always perform function from a stable position at the rear of the tractor.
- Hold the top of the ROPS securely when raising or folding.
- Make sure all pins are installed and locked.

③ Part No. TA040-4935-1

⚠ WARNING

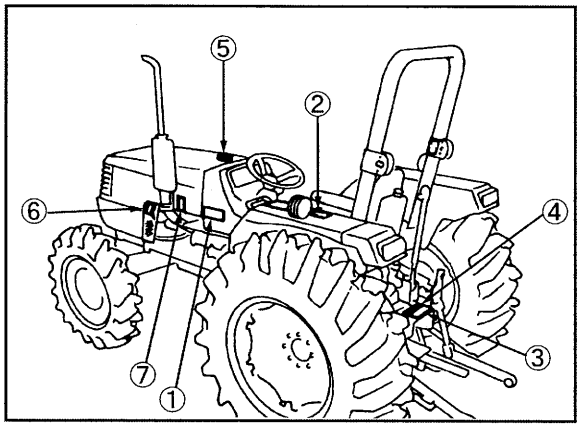
TO AVOID PERSONAL INJURY:
1. Attach pulled or towed loads to the drawbar only.
2. Use the 3-point hitch only with equipment designed for 3-point hitch usage.

④ Part No. 32310-4958-1



⑥ Part No. 6C040-4741-2

No fire



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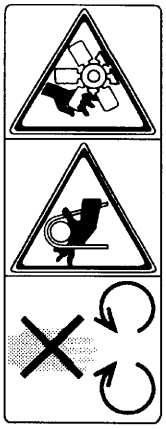
① Part No. 35260-3491-3

⚠ 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.

② Part No. 32751-4958-1
Stay clear of engine fan and fanbelt.

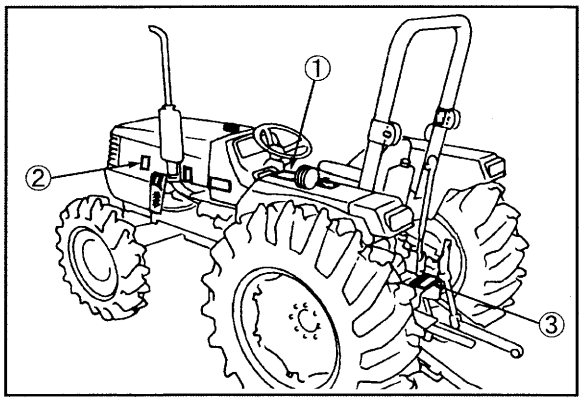


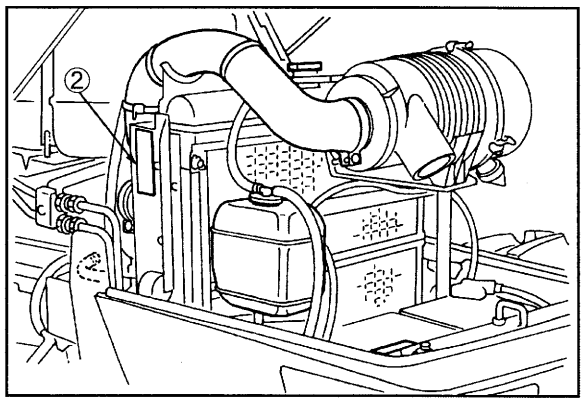
③ Part No. TA040-4959-3

⚠ 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)





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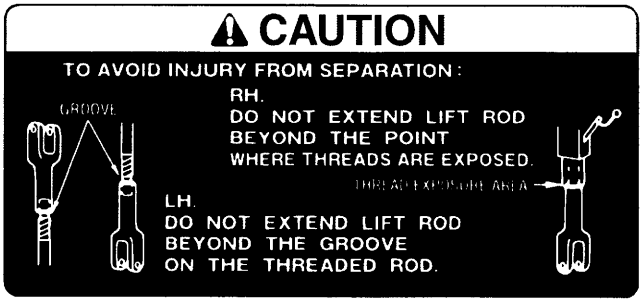
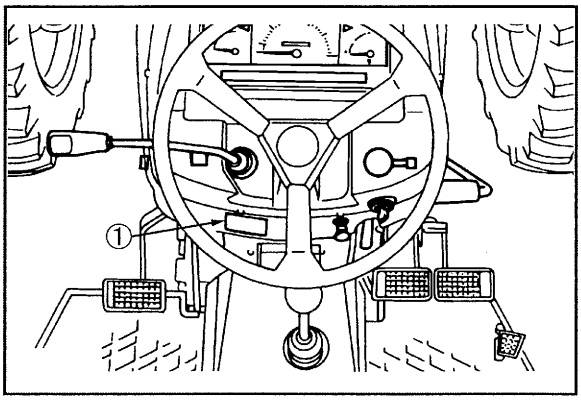
① Part No. 35080-6528-2

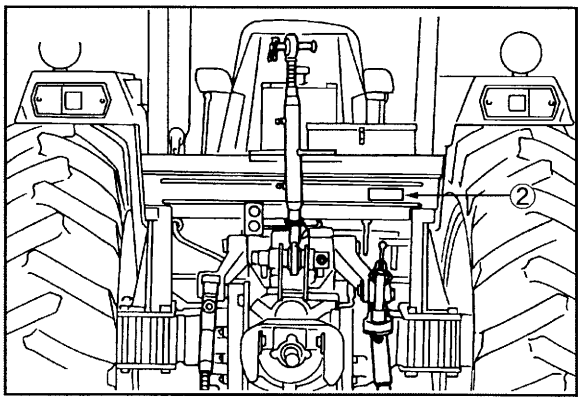
⚠ CAUTION

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

② Part No. 3A111-9856-3







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■ **NOTE**

- **Only labels applied to places other than where they are applied on tractors with no cabin are mentioned.**

① Part No. 3F240-9836-1

⚠ CAUTION

TO AVOID PERSONAL INJURY:

1. Read and understand the operator's manual before operation.
2. Before starting the engine, make sure that everyone is at a sate distance from tractor and the PTO is off.
3. Do not allow passengers on the tractor at any time.
4. Before allowing other people to use the tractor have them read the operator's manual.
5. Check the tightness of 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.

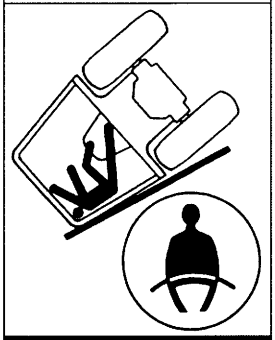
② Part No. 35080-6528-2

⚠ CAUTION

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

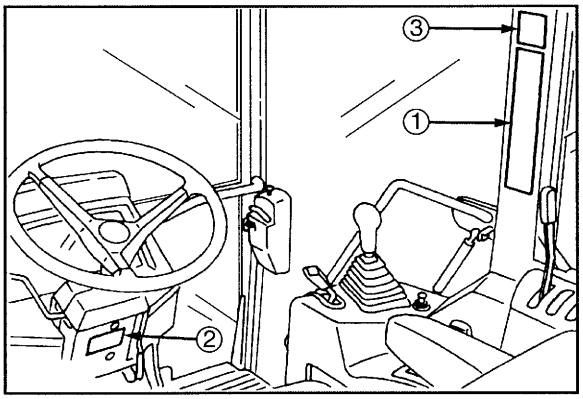
③ Part No. TA040-4902-1

⚠ WARNING



TO AVOID INJURY OR DEATH FROM ROLL-OVER:

Always use seat belt when driving.



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 and caution label (s) affixed is replaced 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

[ROPS TYPE]

Model			M4900		M5700	
			2WD	4WD	2WD	4WD
Engine	Model		F2803-ELA		F2803-EA	
	Type		Vertical, water-cooled, 4-cycle diesel engine			
	Number of cylinders		5			
	Total displacement		2746 cm^3 (167.6 cu.in.)			
	Bore and stroke		87 × 92.4 mm (3.4 × 3.6 in.)			
	Net power		37.7 kW (50.5 HP)*		42.5 kW (57 HP)*	
	PTO power (factory observed)		33.6 kw (45 HP)*/2600 min^{-1} (rpm)		38.8 kw (52 HP)*/2800 min^{-1} (rpm)	
	Maximum torque		171 N·m (17.4 kgf·m, 126.1 ft-lbs.)/ 1400 to 1600 min^{-1} (rpm)		183 N·m (18.7 kgf·m, 135 ft-lbs.)/ 1400 to 1600 min^{-1} (rpm)	
	Battery		12 V, CCA 700A			
	Fuel		Diesel fuel No.1 [below –10 °C (14 °F)] Diesel fuel No. 2 [above –10 °C (14 °F)]			
	Fuel tank capacity		65 L (17.2 U.S.gal., 14.4 Imp.gal)			
	Engine crankcase capacity		8.0 L (8.5 U.S.qts., 7.04 Imp.qts)			
	Engine coolant capacity		7.3 L (7.7 U.S.qts., 6.4 Imp.qts)			
Dimensions	Overall length		3495 mm (137.6 in.)	3405 mm (1341 in.)	3495 mm (137.6 in.)	3405 mm (134.1 in.)
	Overall width (Minimum tread)		1706 mm (67.2 in.)		1850 mm (72.8 in.)	
	Overall height (with ROPS)		2357 mm (93.0 in.)		2375 mm (93.5 in.)	
	Wheel base		2000 mm (78.7 in.)			
	Tread	Front	1420 to 1820 mm (55.9 to 71.7 in.)	1330 mm (52.4 in.) 1430 mm (56.3 in.)	1420 to 1820 mm (55.9 to 71.7 in.)	1330 mm (52.4 in.) 1430 mm (56.3 in.)
		Rear	1320 to 1720 mm (52.0 to 67.7 in.)		1420 to 1720 mm (55.9 to 67.7 in.)	
	Minimum ground clearance		430 mm (16.9 in.) (BRACKET DRAWBAR)		460 mm (18.1 in.) (BRACKET DRAWBAR)	
Weight (with ROPS)			1700 kg (3748 lbs.)	1800 kg (3968 lbs.)	1750 kg (3858 lbs.)	1850 kg (4078 lbs.)
Travelling system	Standard tire size	Front	6.5-16	9.5-22	7.5-16	9.5-22
		Rear	14.9-28		16.9-28	
	Clutch		Dry, Single plate			
	Steering		Full hydrostatic power steering			
	Transmission		Shuttle synchromesh, 8F/8R (with creep speed 12F/12R)			
	Brake	Travelling	Wet type, multiple discs (mechanical)			
		Parking	Connected with the travelling brake			
	Differential		Bevel gears (with differential lock)			
Hydraulic system	Hydraulic control system		Position, draft and mix control			
	Pump-up capacity		41.6 L (44.0 U.S.qts., 36.6 Imp.qts.)/min.			
	Three point hitch		Category I & II			
	Maximum lifting force		1900 kg (4200 lbs.) at lower link end 1500 kg (3307 lbs.) at 610 mm (24 in.) behind lifting point			
	System pressure		19.1 MPa (195 kgf/cm^2, 2773 psi)			
PTO	Independent clutch		Wet type, multiple discs			
	Live PTO	Direction of turning	Clockwise, viewed from tractor rear			
		PTO speed	540 min^{-1} (rpm) at 2295 engine min^{-1} (rpm)			
Traction system			Swinging drawbar, adjustabnle in direction			

NOTE : * Manufacturer's estimate The company reserves the right to change the specifications without notice.

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[CABIN TYPE]

Model			M4900		M5700	
			2WD	4WD	2WD	4WD
Engine	Model		F2803-ELA		F2803-EA	
	Type		Vertical, water-cooled, 4-cycle diesel engine			
	Number of cylinders		5			
	Total displacement		2746 cm^3 (167.6 cu.in.)			
	Bore and stroke		87 × 92.4 mm (3.4 × 3.6 in.)			
	Net power		37.7 kW (50.5 HP)*		42.5 kW (57 HP)*	
	PTO power (factory observed)		33.6 kW (45 HP)* / 2600 min^{-1} (rpm)		38.8 kW (52 HP)* / 2800 min^{-1} (rpm)	
	Maximum torque		171 N·m (17.4 kgf·m, 126.1 ft-lbs.)/ 1400 to 1600 min^{-1} (rpm)		183 N·m (18.7 kgf·m, 135.0 ft-lbs.)/ 1400 to 1600 min^{-1} (rpm)	
	Battery capacity		12 V, CCA 700A			
	Fuel		Diesel fuel No.1 [below –10 °C (14 °F)], Diesel fuel No. 2 [above –10 °C (14 °F)]			
	Fuel tank capacity		95 L (25.1 U.S.gal., 20.9 Imp.gal.)			
	Engine oil capacity		8.0 L (8.5 U.S.qts., 7.5 Imp.qts.)			
	Coolant capacity		7.3 L (7.7 U.S.qts., 6.4 Imp.qts.)			
Dimensions	Overall length		3570 mm (140.6 in.)	3480 mm (137.1 in.)	3570 mm (140.6 in.)	3480 mm (137.1 in.)
	Overall width (Minimum tread)		1706 mm (67.2 in.)		1850 mm (72.8 in.)	
	Overall height (with CAB)		2485 mm (98.1 in.)		2515 mm (99.0 in.)	
	Wheel base		2075 mm (81.7 in.)			
	Tread	Front	1420 to 1820 mm (55.9 to 71.7 in.)	1330 mm (52.4 in.) 1430 mm (56.3 in.)	1420 to 1820 mm (55.9 to 71.7 in.)	1330 mm (52.4 in.) 1430 mm (56.3 in.)
		Rear	1320 to 1720 mm (52.0 to 67.7 in.)		1420 to 1720 mm (55.9 to 67.7 in.)	
	Minimum ground clearance		400 mm (15.7 in.) (COVER TANK)		430 mm (16.9 in.) (COVER TANK)	
Weight (with CAB)			1940 kg (4277 lbs.)	2040 kg (4497 lbs.)	2020 kg (4453 lbs.)	2090 kg (4607 lbs.)
Travelling system	Standard tire size	Front	6.5-16	9.5-22	7.5-16	9.5-22
		Rear	14.9-28		16.9-28	
	Clutch		Dry, Single plate			
	Steering		Full hydrostatic power steering			
	Transmission		Shuttle synchromesh, 8F/8R (with creep speed 12F/12R)			
	Braking system		Wet type, multiple discs (mechanical)			
	Differential		Bevel gears (with differential lock)			
Hydraulic system	Hydraulic control system		Position, draft and mix control			
	Pump capacity		41.6 L (44.0 U.S.qts., 36.6 Imp.qts.)/min.			
	Three point hitch		Category I & II			
	Maximum lifting force	At lifting points	1900 kg (4200 lbs.) at lower link end with links horizontal			
		24 in. behind lifting point	1500 kg (3307 lbs.)			
	Remove hydraulic control		One remote valve with detent and self-canceling			
	System pressure		19.1 MPa (195 kgf/cm^2)			
	Traction system		Swinging drawbar, adjustabnle in direction			
PTO	Live PTO (Independent)	Direction of turning	Clockwise, viewed from tractor rear			
		Standard PTO / Engine speed	540 min^{-1} (rpm) at 2295 engine min^{-1} (rpm)			

NOTE : * Manufacturer's estimate The company reserves the right to change the specifications without notice.

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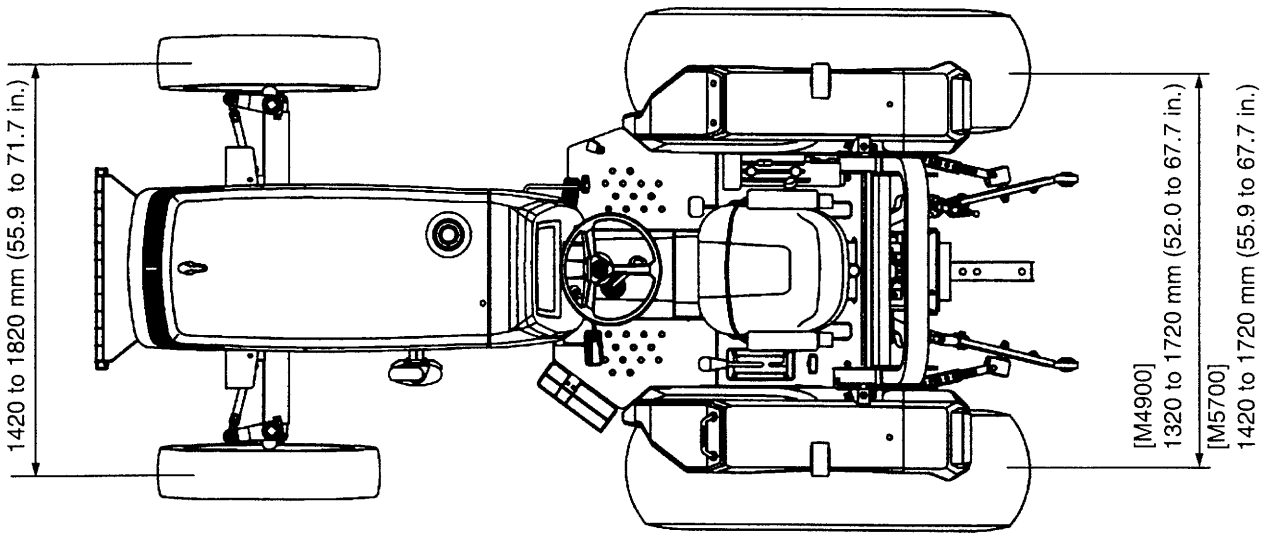
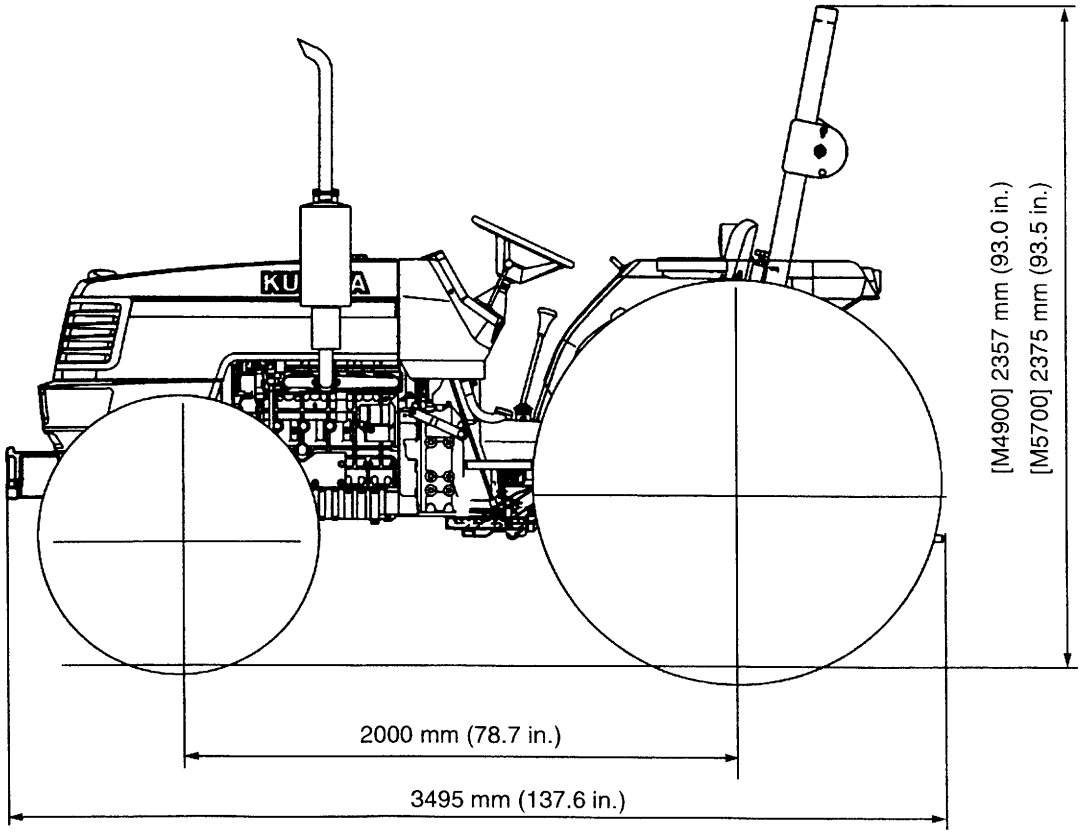
DIMENSIONS

M4900 · M5700 [2WD Type]





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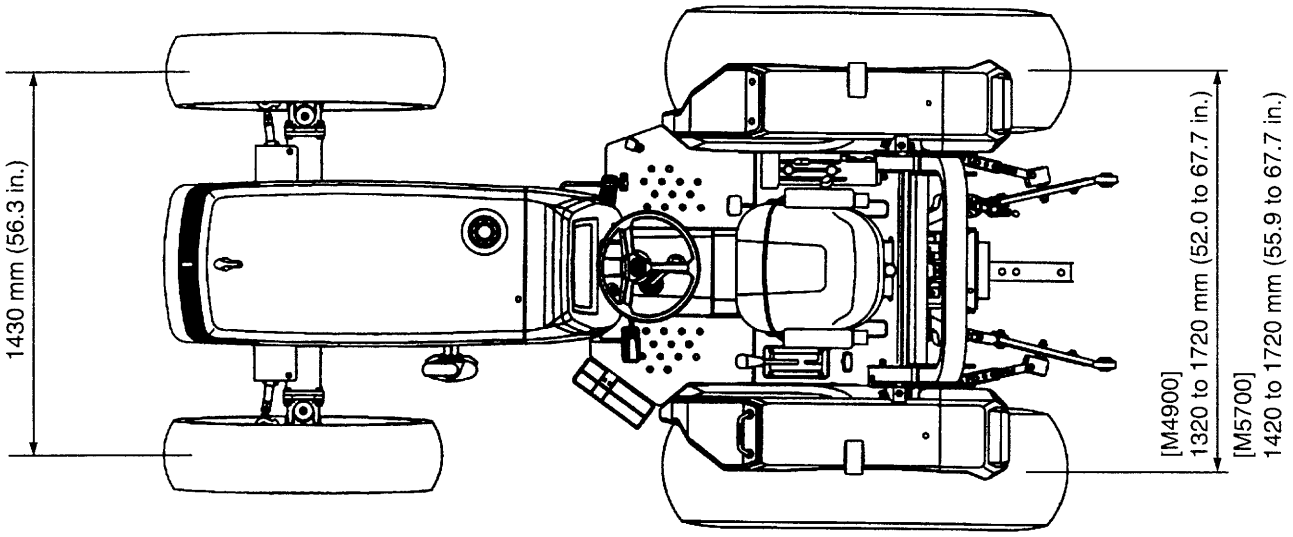
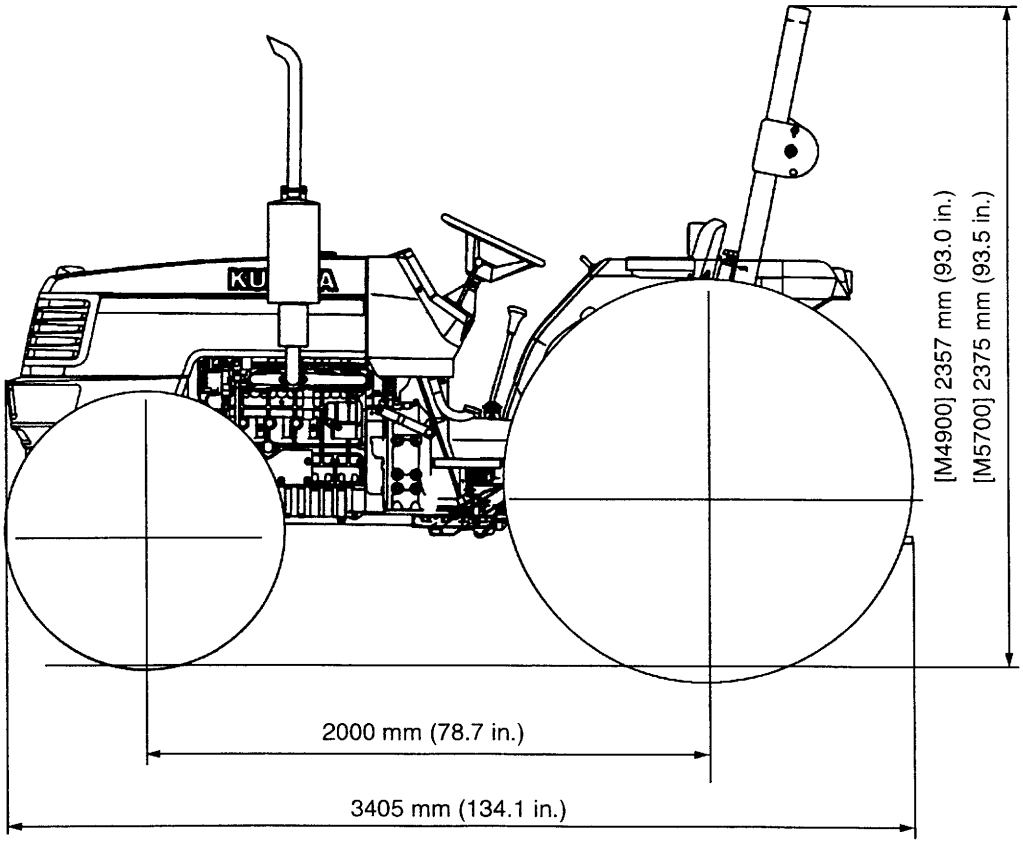
M4900 · M5700 [4WD Type]





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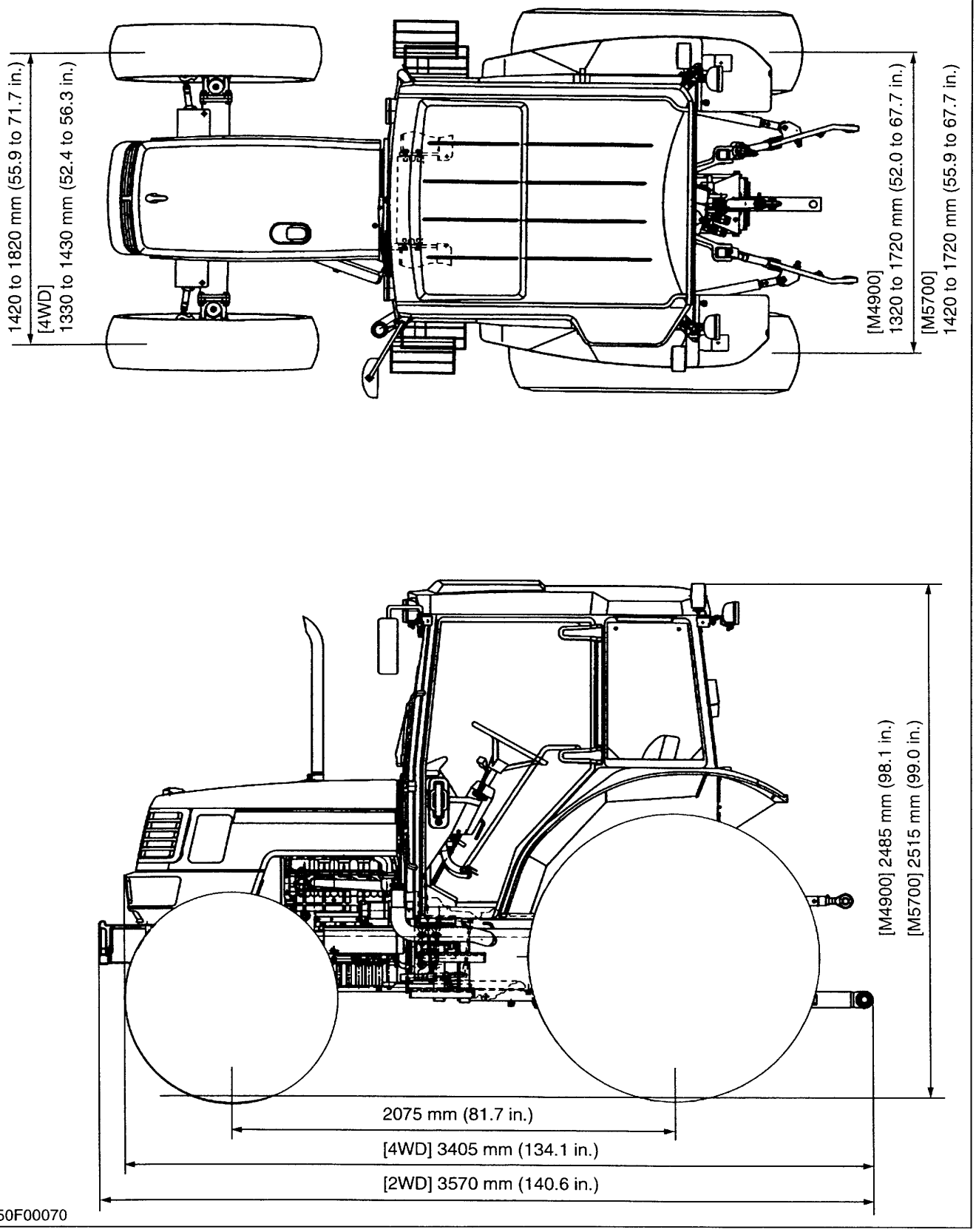
M4900 · M5700 [CABIN Type]



12550F00070

12550Z00100

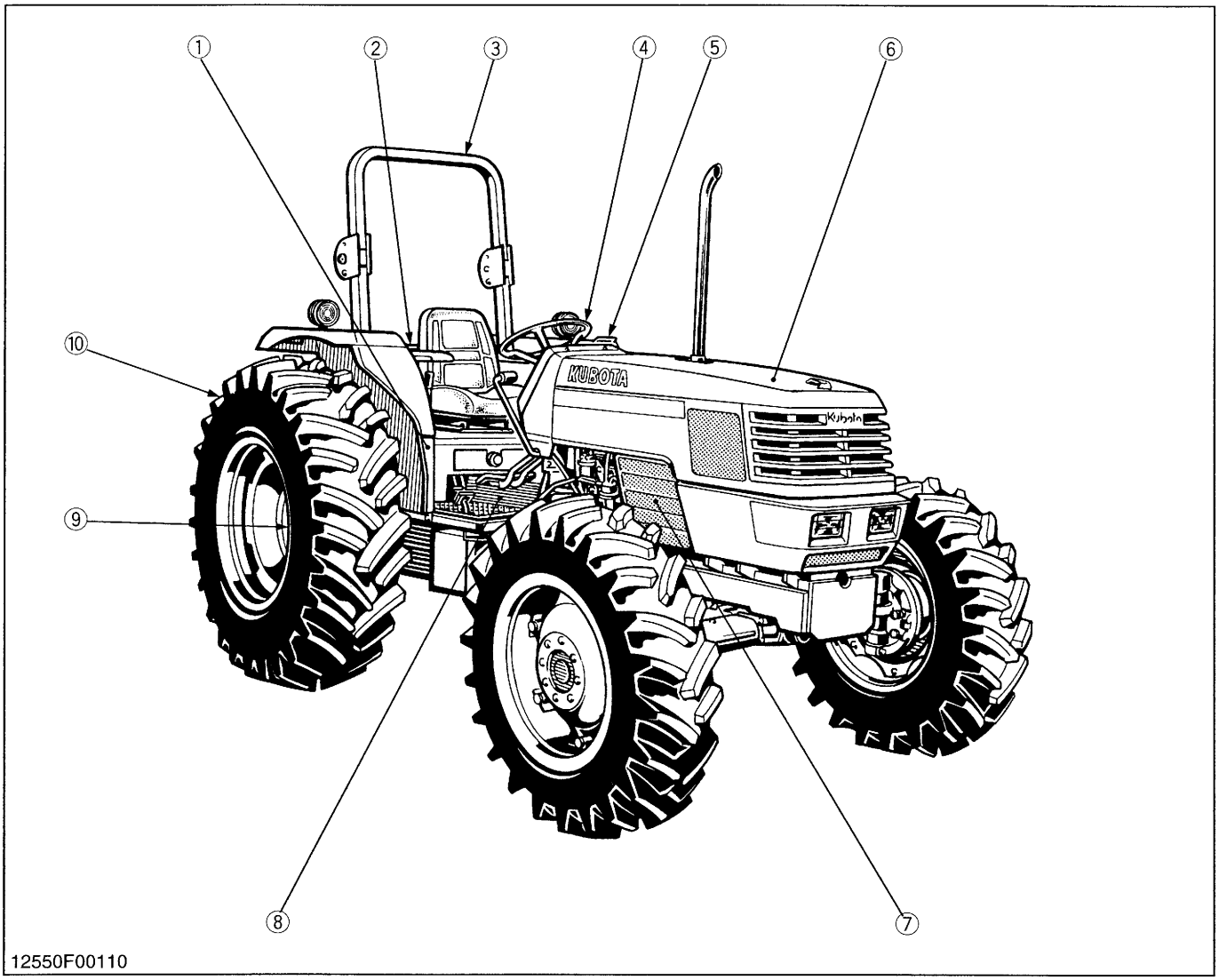
G GENERAL

G GENERAL

GENERAL

CONTENTS

[1] FEATURES

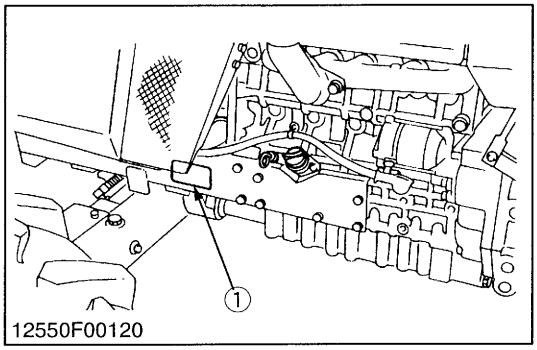


12550F00110

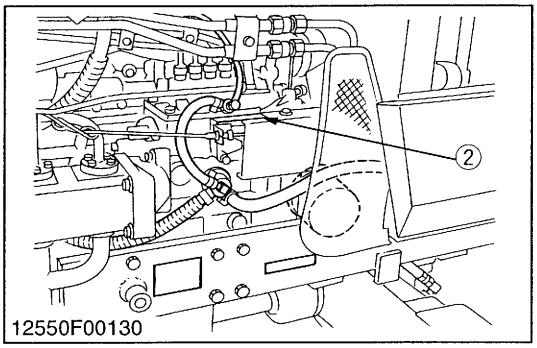
(1) Auxiliary Control Valve
(2) Independent PTO
Hydraulic PTO Clutch System
(3) Foldable ROPS
(4) Full Hydrostatic Power Steering
(5) Synchro-Shuttle (Forward-Reverse)
(6) New Design
(7) E-TVCS (Three Vortex Combustion System) Diesel Engine
(8) Transmission (Creep Option)
(9) Wet Disc Brake
(10) Three Point Hitch with Big Lift Power
Three Point Hitch Fully Equipped with position, Draft and Mixed Control
(11) Comfortable Integral Cab By KUBOTA
Shift Levers Integrally and Ergonomically Positioned Full-Floating Type Flat Deck Wider Piece of Curved Glass Side Glass Open

12550G00010

[2] TRACTOR IDENTIFICATION



12550F00120



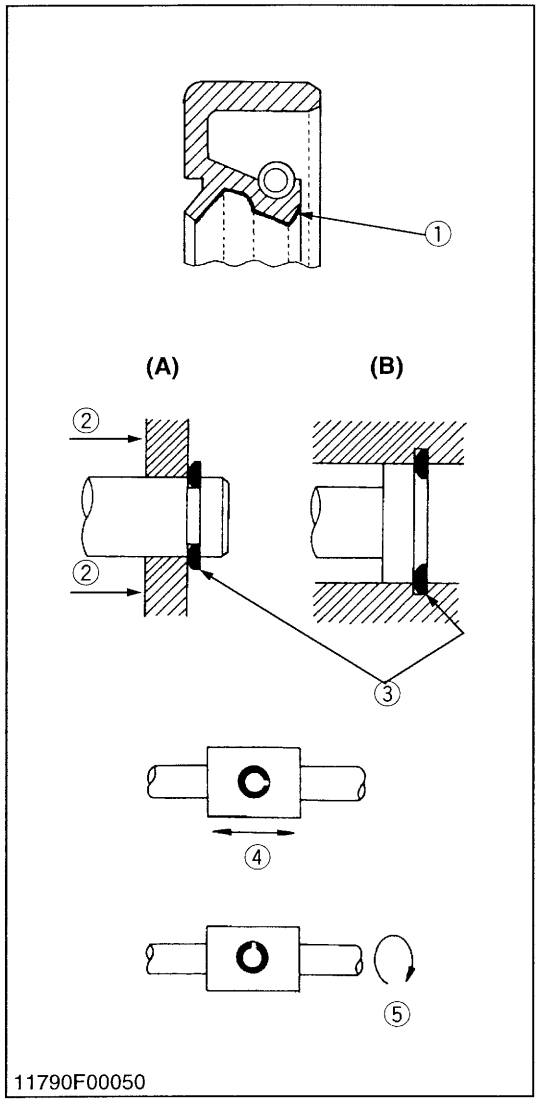
12550F00130

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

(1) Tractor Identification Plate (2) Engine Serial Number

12550G00020

[3] GENERAL PRECAUTIONS



11790F00050

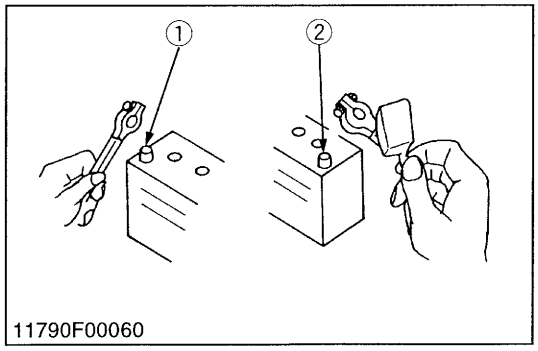
- During disassembly, carefully arrange removed parts in a clean area to prevent confusion later. Bolts and nuts should be installed in their original position to prevent reassembly errors.
- When special tools are required, use KUBOTA genuine special tools. Special tools which are not frequently used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

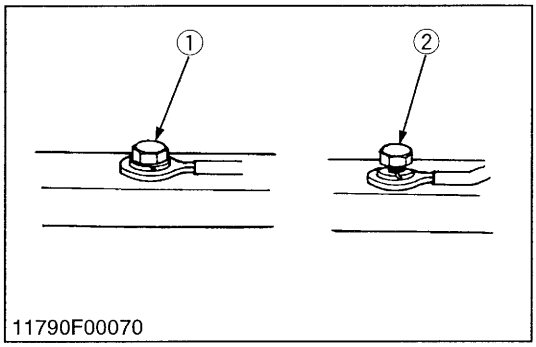
■ IMPORTANT

- **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 cord, disconnect the negative wire first. When installing the battery cord, connect the positive wire first.**

(1) Negative Terminal (2) Positive Terminal

11790G00040

(1) Wiring

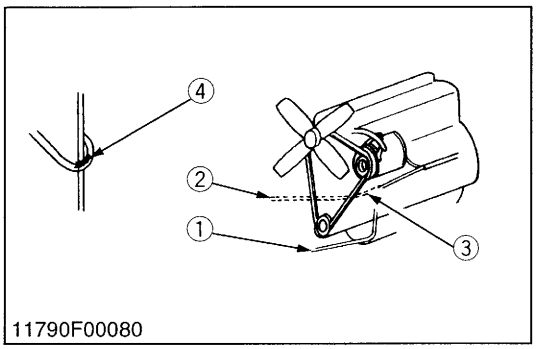


11790F00070

- Securely tighten wiring terminals.

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

11790G00050

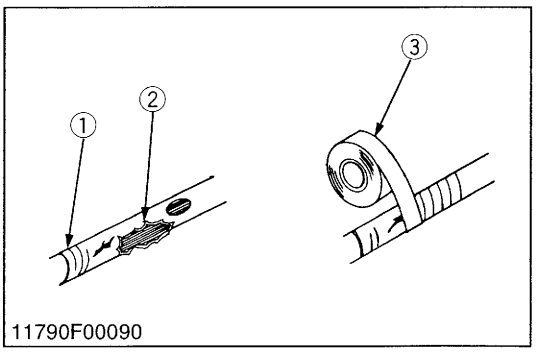


11790F00080

- Do not let wiring contact dangerous part.

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

11790G00060

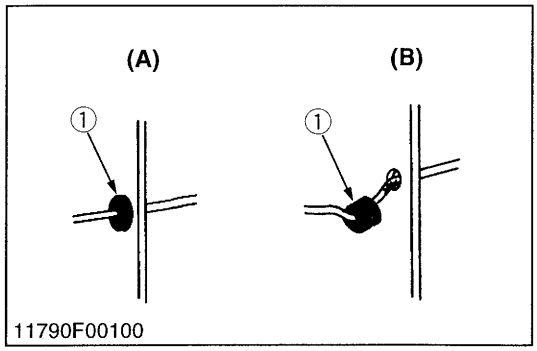


11790F00090

- Repair or change torn or aged wiring immediately.

(1) Damaged
(2) Torn
(3) Insulating Vinyl Tape

11790G00070

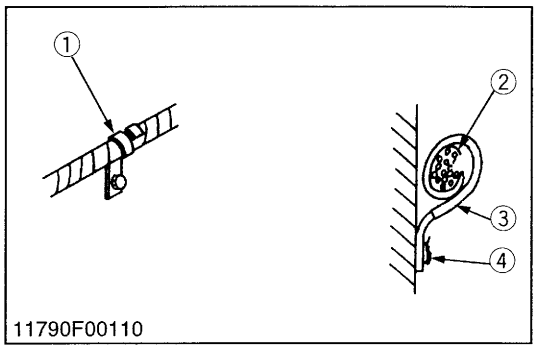


- Securely insert grommet.

(1) Grommet

(A) Correct
(B) Incorrect

11790G00080

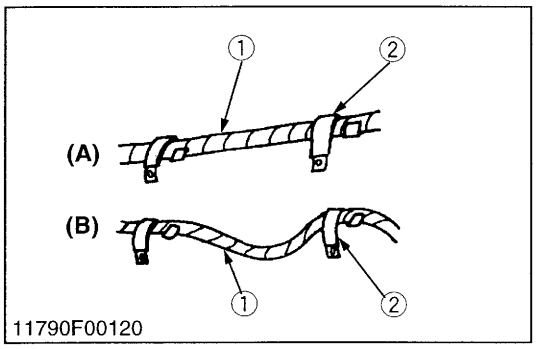


- Securely clamp, being careful not to damage wiring.

(1) Clamp
- Wind Clamp Spirally

(2) Wire Harness
(3) Clamp
(4) Welding Dent

11790G00090

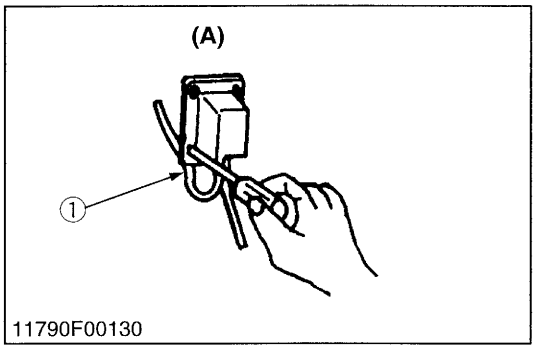


- Clamp wiring so that there is no twist, unnecessary sag, or excessive tension, except for movable part, where sag be required.

(1) Wiring
(2) Clamp

(A) Correct
(B) Incorrect

11790G00100

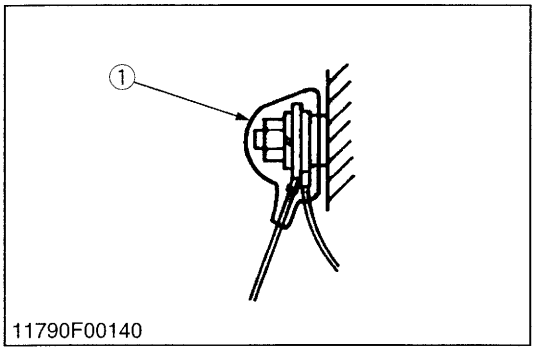


- In installing a part, take care not to get wiring caught by it.

(1) Wiring

(A) Incorrect

11790G00110

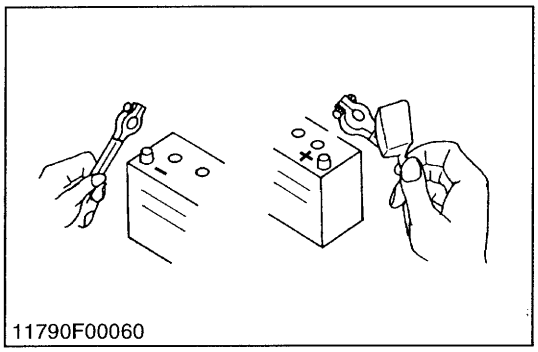


- After installing wiring, check protection of terminals and clamped condition of wiring, only connect battery.

(1) Cover
- Securely Install Cover

11790G00120

(2) Battery


11790F00060

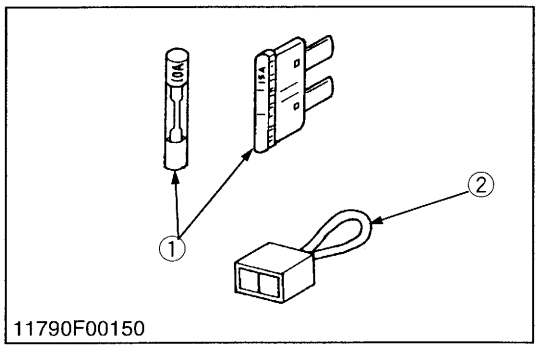
- Take care not to confuse positive and negative terminals.
- When removing battery cord, disconnect negative wire first. When installing battery cord, check for polarity and connect positive wire first.
- Do not install any battery with capacity other than is specified (Ah).
- After connecting cord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

⚠ CAUTION

- **Take care not to let battery liquid spill on your skin and clothes. If contaminated, wash it off with water immediately.**
- **Before recharging the battery, remove it from the machine.**
- **Before recharging, remove cell caps.**
- **Do recharging in a well-ventilated place where there is no open flame nearby, as hydrogen gas and oxygen are formed.**

11790G00130

(3) Fuse



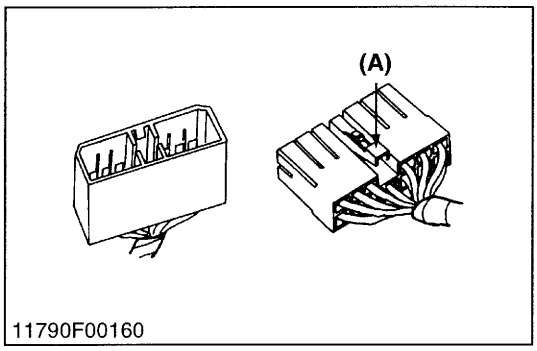
11790F00150

- 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

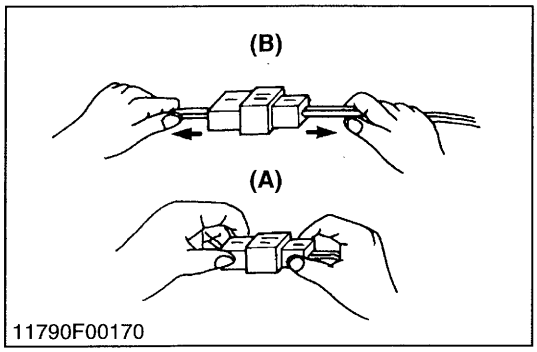


11790F00160

- For connector with lock, push lock to separate.

(A) Push

11790G00150

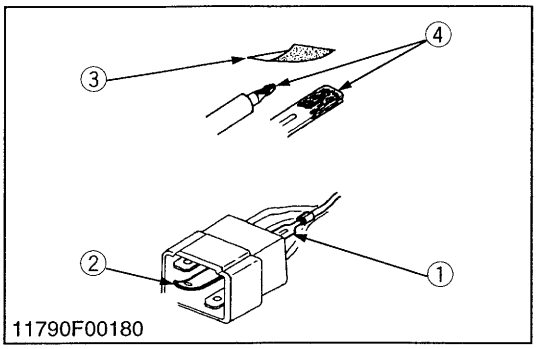


11790F00170

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

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

11790G00160

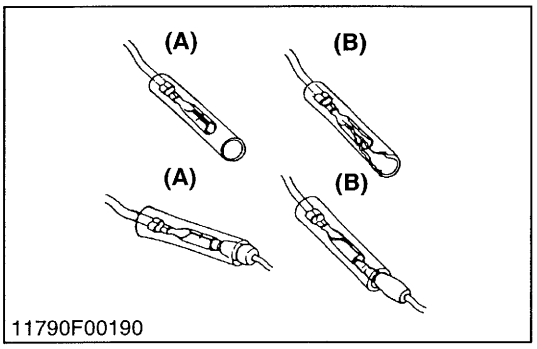


11790F00180

- 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

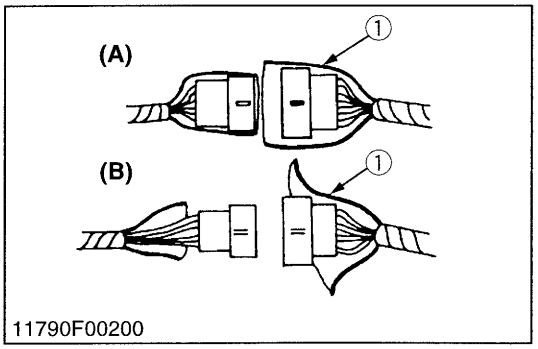


11790F00190

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

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

11790G00180



11790F00200

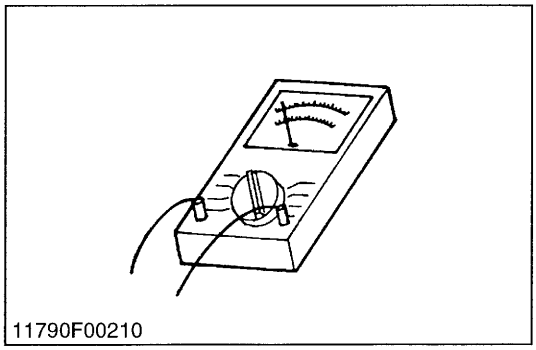
- Make certain plastic cover is large enough to cover whole connector.

(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
		M4900 M5700	M4900 (CAB) M5700 (CAB)	
1	Fuel	65 L 17.2 U.S.gals. 14.3 Imp.gals.	95 L 25.1 U.S.gals. 20.9 Imp.gals.	No. 2-D diesel fuel No. 1-D diesel fuel it temperature is below – 10 °C (14 °F)
2	Coolant (Radiator)	7.3 L 7.7 U.S.qts. 6.4 Imp.qts		Fresh clean water with anti-freeze
	Coolant (Recovery tank)	1.0 L 1.1 U.S.qts. 0.9 Imp.qts.		
3	Washer liquid	–	1.3 L 1.4 U.S.qts. 1.1 Imp.qts.	Automobile washer liquid
4	Engine crankcase	8.0 L 8.5 U.S.qts. 7.0 Imp.qts		Engine oil : API Service Classification 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
5	Transmission case	40.0 L 42.3 U.S.qts. 35.2 Imp.qts.	43.0 L 45.4 U.S.qts. 37.8 Imp.qts.	KUBOTA SUPER UDT fluid *
6	Front axle case [4WD]	8.0 L 8.5 U.S.qts. 7.0 Imp.qts		KUBOTA SUPER UDT fluid or SAE80, SAE90 gear oil

Greasing

	Place	No. of greasing point		Capacity	Type of grease
7	Front wheel hub [2WD]	2		Until grease overflows	Multipurpose type grease
	Knuckle shaft [2WD]	2			
	Front wheel case support [4WD]	2			
	Front axle support [4WD]	1			
	Top link	2			
	Top link bracket	2			
	Lift rod	1			
	Steering joint	–	1		
	Battery terminal	2		Moderate amount	

* KUBOTA original transmission hydraulic fluid.

12550G00030

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

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

Indication on top of bolt	⬡ 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		
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.)	7.84 to 9.31	0.80 to 0.95	5.79 to 6.87	7.84 to 8.83	0.80 to 0.90	5.79 to 6.51	9.80 to 11.2	1.00 to 1.15	7.24 to 8.32	7.84 to 8.83	0.80 to 0.90	5.79 to 6.51	12.3 to 14.2	1.25 to 1.45	9.05 to 10.5
M8 (8 mm, 0.31 in.)	17.7 to 20.5	1.8 to 2.1	13.0 to 15.2	16.7 to 19.6	1.7 to 2.0	12.3 to 14.5	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
M10 (10 mm, 0.39 in.)	39.2 to 45.0	4.0 to 4.6	29.0 to 33.2	31.4 to 34.3	3.2 to 3.5	23.1 to 25.3	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5	60.8 to 70.5	6.2 to 7.2	44.9 to 52.1
M12 (12 mm, 0.47 in.)	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5				77.5 to 90.1	7.9 to 9.2	57.2 to 66.5	62.8 to 72.5	6.4 to 7.4	46.3 to 53.5	103 to 117	10.5 to 12.0	76.0 to 86.8
M14 (14 mm, 0.55 in.)	108 to 125	11.0 to 12.8	79.6 to 92.5				124 to 147	12.6 to 15.0	91.2 to 108				167 to 196	17.0 to 20.0	123 to 144
M16 (16 mm, 0.63 in.)	167 to 191	17.0 to 19.5	123 to 141				196 to 225	20.0 to 23.0	145 to 166				260 to 303	26.5 to 31.0	192 to 224
M18 (18 mm, 0.71 in.)	245 to 284	25.0 to 29.0	181 to 210				275 to 318	28.0 to 32.5	203 to 235				343 to 401	35.0 to 41.0	254 to 297
M20 (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				490 to 568	50.0 to 58.0	362 to 420

11790G00760

[7] MAINTENANCE

No.	Item		Period	Service Interval										After purchase		Important		Reference page
				50	50	100	200	300	400	600	800	1500	3000	1 year	2 years			
1	Engine oil		Change	★		☆												G-13
2	Engine oil filter		Replace	★			☆											G-13
3	Hydraulic oil filter		Replace	★				☆										G-14
4	Transmission fluid		Change	★						☆								G-14
5	Front axle case oil		Change	★						☆								G-15
6	Clutch		Adjust	★		☆												G-15
7	Water separator (CAB)		Clean	★					☆									G-15
8	Engine start system		Check		☆													G-16
9	Wheel bolt torque		Check		☆													G-16
10	Greasing		–			☆												G-17
11	Battery condition		Check			☆												G-17
12	Air cleaner element [Double type]	Primary element	Clean			☆										*	@	G-18
			Replace											☆		**		G-18
		Secondary element	Replace											☆				G-18
13	Fuel filter element		Clean			☆												G-18
			Replace						☆								@	G-23
14	Fan belt		Adjust			☆												G-19
15	Brake		Adjust			☆												G-19
16	Radiator hose and clamp		Check				☆											G-20
			Replace												☆			G-20
17	Power steering oil line		Check				☆											G-20
			Replace												☆			G-20
18	Fuel line		Check				☆										@	G-20
			Replace												☆			G-20
19	Toe-in		Adjust				☆											G-21
20	Intake air line		Check				☆										@	G-21
			Replace												☆	***		G-21
21	Inner air filter		Clean				☆											G-22
22	Fresh air filter		Clean				☆											G-22
23	Air conditioner condenser		Clean				☆											G-22
24	Air conditioner drive belt		Adjust				☆											G-23
25	Greasing (2WD front wheel hub)		–						☆									G-23
26	Fuel filter (CAB)		Replace						☆								@	G-23
27	Front axle pivot		Adjust							☆								G-24
28	Engine valve clearance		Adjust								☆							1-S19
29	Fuel injection nozzle injection pressure		Check									☆					@	1-S56
30	Injection pump		Check										☆				@	1-S54
31	Air conditioner pipes and hoses		Check											☆				G-26
32	CAB isolation cushion		Check											☆				G-26
33	Cooling system		Flush												☆			G-28
34	Coolant		Change												☆			G-28

12550G00040

No.	Item \ Period		Service Interval										After purchase		Important		Reference page
			50	50	100	200	300	400	600	800	1500	3000	1 year	2 years			
35	Fuel system	Bleed											Service as required				G-29
36	Clutch housing water	Drain															G-29
37	Fuse	Replace															G-30, 31
38	Light bulb	Replace															G-32
39	Washer liquid	Add															G-32
40	Refrigerant (gas)	Check															10-S20

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.**

12550G00050

[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.**

11790G00210

(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 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 throttle pedal, brake pedals and clutch pedal.
2) Check the parking brake.
3) Check the steering wheel.

- Turning the key switch.

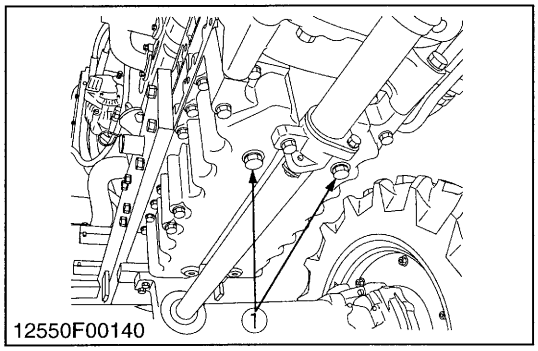
1) Check the performance of the Easy Checker lights.
2) Check head lights, tail lights and hazard lights. Clean if necessary.
3) Check the performance of the meters and gauges.

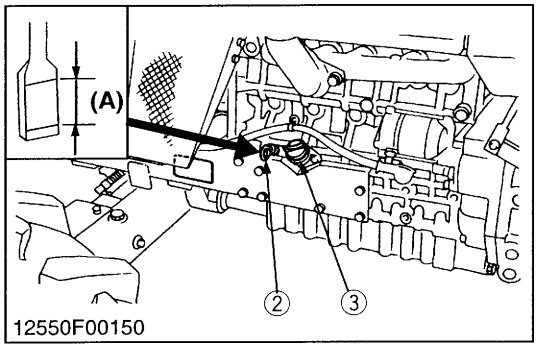
- Starting the engine.

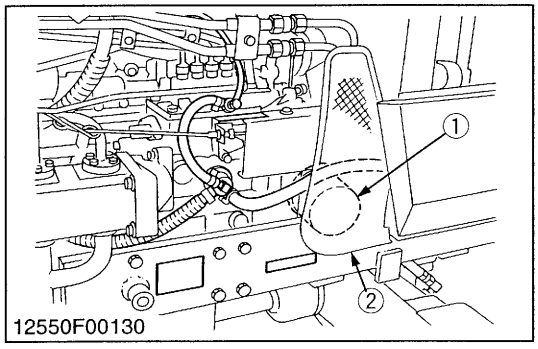
1) Check to see that the lights on the Easy Checker go off.
2) Check the color of the exhaust.
3) Check the brakes for proper operation.

11790G00220

(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-9.)**

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

12550G00060

Replacing Engine Oil Filter Cartridge

CAUTION

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

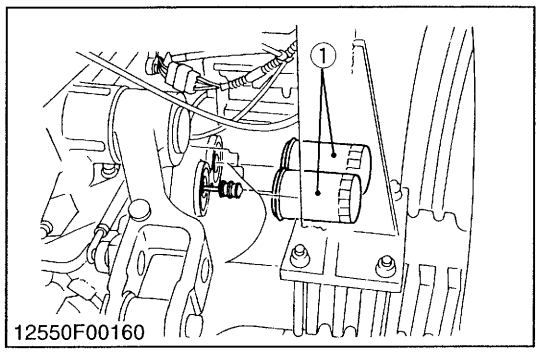
1. Remove the side cover R.H. (2)
2. Remove the engine oil filter cartridge (1) with the filter wrench.
3. Apply a slight coat of oil onto the cartridge gasket.
4. To install the new cartridge, screw it in by hand. Over tightening may cause deformation of rubber gasket.
5. After the new cartridge has been replaced, the 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 Cartridge (2) Side Cover (R.H.)

12550G00070



Replacing Hydraulic Oil Filter Cartridge

CAUTION

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

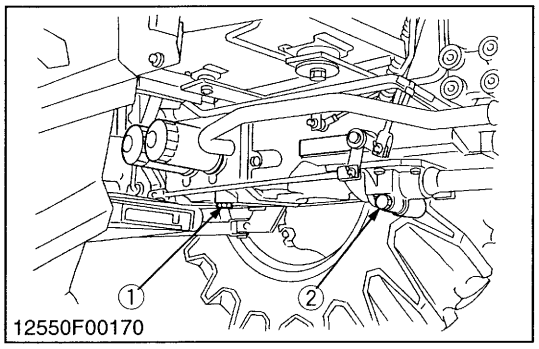
1. Remove the hydraulic oil filter cartridge (1).
2. When installing, apply the clean transmission oil slightly to the rubber gasket.
3. Tighten the hydraulic oil filter cartridge quickly until it contacts the mounting surface. Tighten hydraulic oil filter cartridge (1) by hand an additional 1/2 turn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

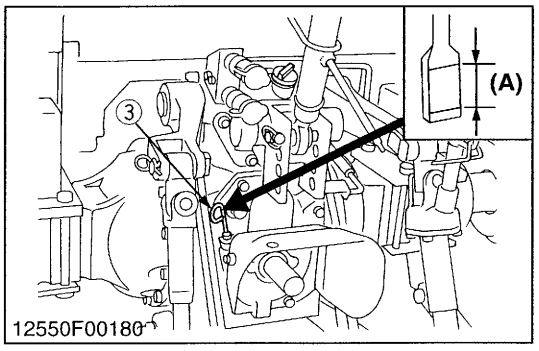
IMPORTANT

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

(1) Hydraulic Oil Filter Cartridge

12550G00080





Changing Transmission Fluid

CAUTION

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

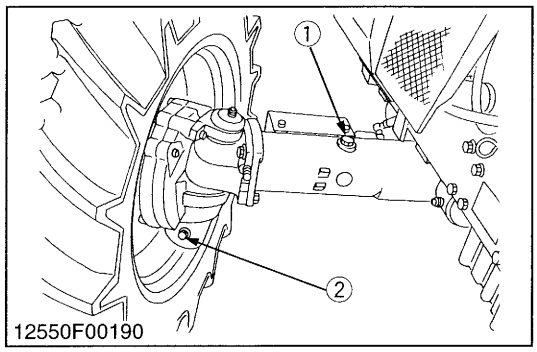
1. Place an oil pan underneath the transmission case.
2. Remove the drain plugs (1) and (2) at the bottom of the transmission case.
3. Drain the transmission fluid.
4. After draining, screw in the drain plugs (1).
5. Fill new oil from filling port after removing the filling plug up to the upper notch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

IMPORTANT

- **Use only multi-grade transmission fluid. Use of other fluides may damage the transmission or hydraulic system.**
- **Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)**
- **Never work the tractor immediately after changing the transmission fluid. Keeping the engine at medium speed for a few minutes to prevents damage to the transmission.**
- **Do not mix different brands oil together.**

(1) Drain Plug
(2) Drain Plug (4WD Only)
(3) Dipstick
(A) Oil level is acceptable within this range.

12550G00090



Changing Front Axle Case Oil (4WD)

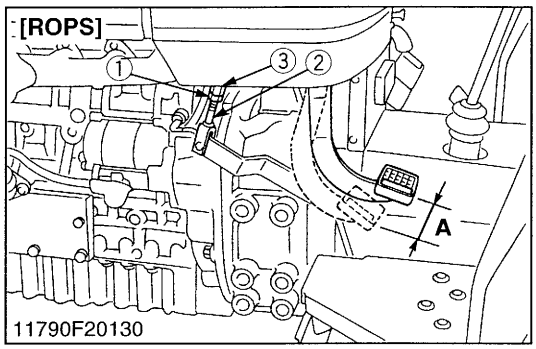
1. To drain the used oil, remove the right and left drain plugs (2) and filling plug (1) at the front axle case and drain the oil completely into the oil pan.
2. After draining, reinstall the drain plugs (2).
3. Fill with the new oil.
4. After filling, reinstall the filling plug (1).

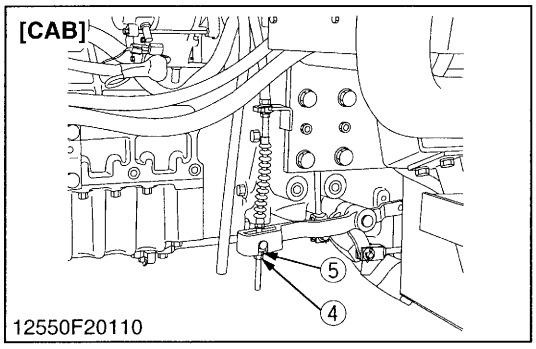
■ IMPORTANT

- **Use KUBOTA SUPER UDT fluid or SAE80, 90 gear oil. Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)**

(1) Filling Plug (2) Drain Plug

12550G00100





Clutch Pedal Free Play

[ROPS]

1. Stop the engine and remove the key.
2. Slightly depress the clutch pedal and measure free play **(A)** at top of pedal.
3. If adjustment is needed, loosen the lock nut (1), and turn the turnbuckle (3) to adjust the clutch rod (2) length.
4. Retighten the lock nut (1).

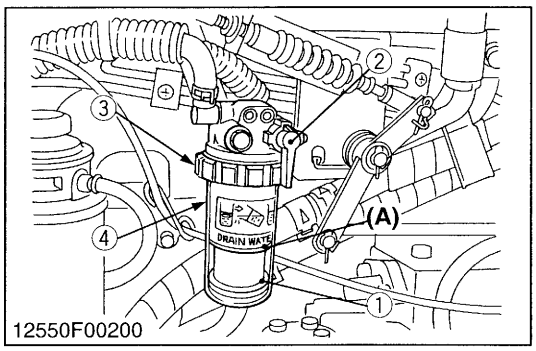
[CAB]

1. Stop the engine and remove the key.
2. Slightly depress the clutch pedal and measure free play (**A**) at the top of pedal stroke.
3. If adjustment is needed, loosen the lock nut (4) and turn the nut (5) to adjust the cable length within acceptable limits.
4. Retighten the lock nut (4).

Clutch pedal free play **(A)** on the pedal	Factory spec.	35 to 45 mm 1.4 to 1.8 in.

(1) Lock Nut
(2) Clutch Rod
(3) Turnbuckle
(4) Lock Nut
(5) Nut

12550S20060



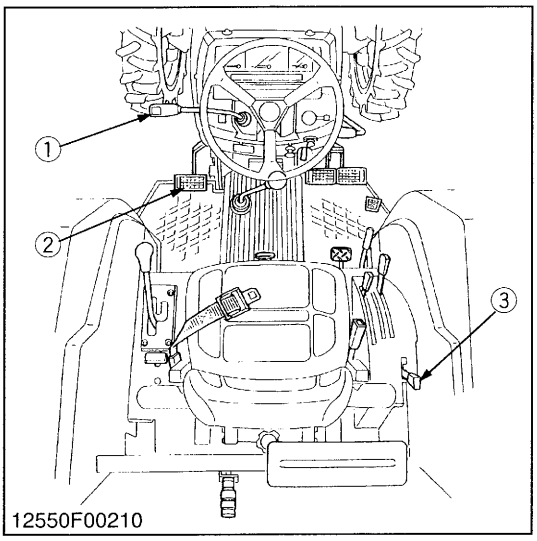
Checking Water Separator (CAB)

1. As water is collected in the water separator, the red float is raised.
2. When the red float has reached the white line, close the fuel cock, loosen the retainer ring, take out the cup, and clean the cup. Be careful not to break the element.
3. Place the cup back into position. Bleed the fuel system.

(1) Red Float
(2) Fuel Cock
(3) Retainer Ring
(4) Cup
(A) WHITE LINE

12550G00110

(3) Check Points of Every 50 Hours



12550F00210

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

■ Test 1 : Switch for the shuttle shift lever.

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

■ Test 2 : Switch for the PTO clutch control lever.

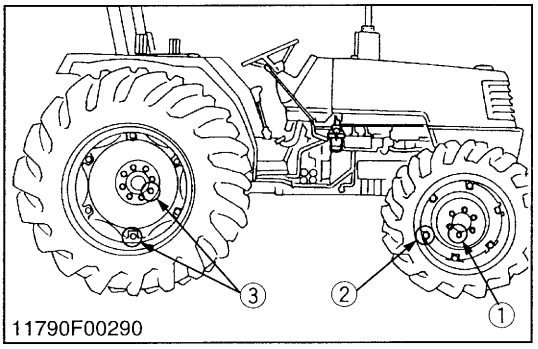
1. Sit on operator's seat.
2. Engage the PTO clutch control lever (3).
3. Depress the clutch pedal (2) fully.
4. Shift the shuttle shift lever (1) to the neutral position.
5. Pull out the engine emergency stop knob and turn the key to **"START"** position.
6. The engine must not crank.

■ After testing

If the engine cranks any test of above, adjust or replace the required safety switch.

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

12550G00120



11790F00290

Checking Wheel Mounting Nuts Tightening Torque

CAUTION

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

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

Tightening torque	Front wheel mounting nut	166.7 to 196.1 N·m 17.0 to 20.0 kgf·m 122.9 to 144.6 ft-lbs
	Front disc mounting nut	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs
	Rear wheel mounting nut and rear disc mounting nut	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs

(1) Front Wheel Mounting Nut
(2) Front Disc Mounting Nut
(3) Rear Wheel Mounting Nut and Rear Disc Mounting Nut

11790G00310

(4) Check Points of Every 100 Hours

Changing Engine Oil

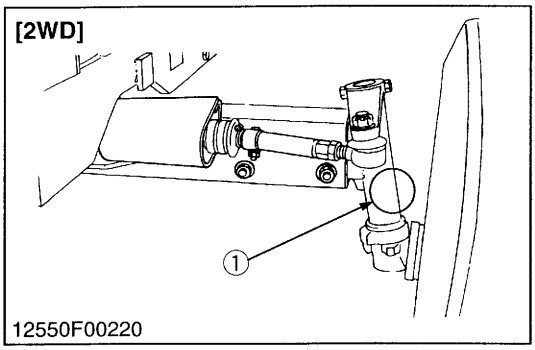
1. See page G-13.

12550G00430

Greasing

1. Apply grease to the following points every 100 hours.

[2WD]



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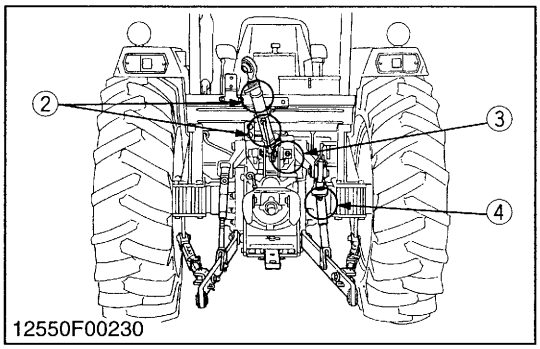

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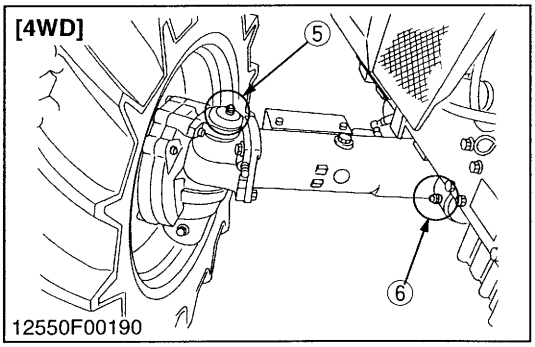
[4WD]



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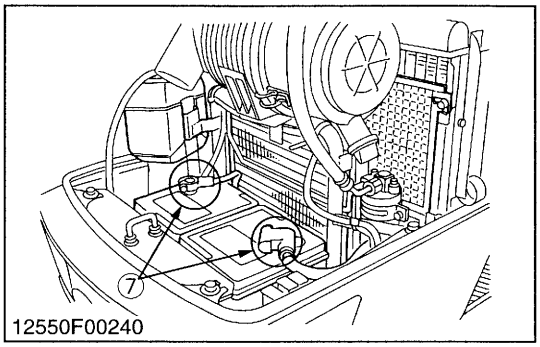
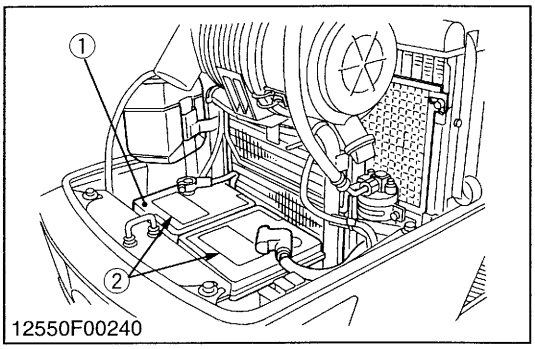


12550F00240

(1) Grease Fitting (Knuckle Shaft)
(2) Grease Fitting (Top Link)
(3) Grease Fitting (Top Link Bracket)
(4) Grease Fitting (Lifting Rod)
(5) Grease Fitting (Front Wheel Case Support)
(6) Grease Fitting (Front Axle Support)
(7) Battery Terminal

12550G00130



12550F00240

Checking Battery Condition

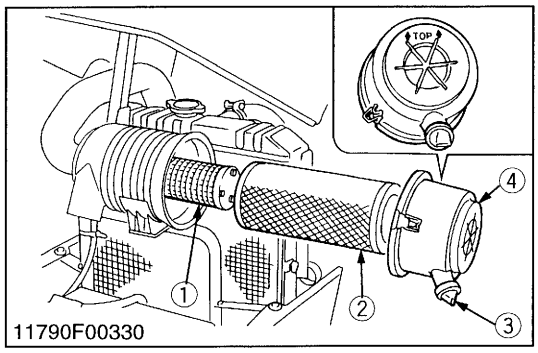
CAUTION

- **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) Gas Vent

12550G00140



11790F00330

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).
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 dure 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.

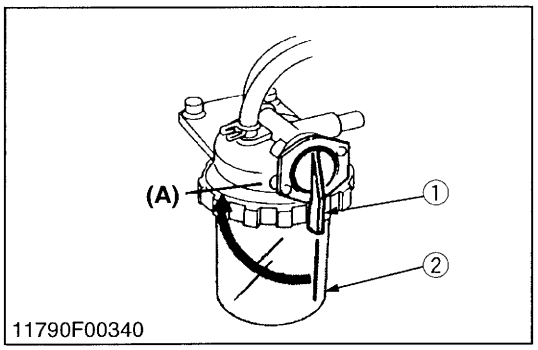
(1) Secondary (Safety) Element
(2) Primary Element
(3) Evacuator Valve
(4) Cover

11790G00360

Cleaning Fuel Filter (ROPS)

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-29.)



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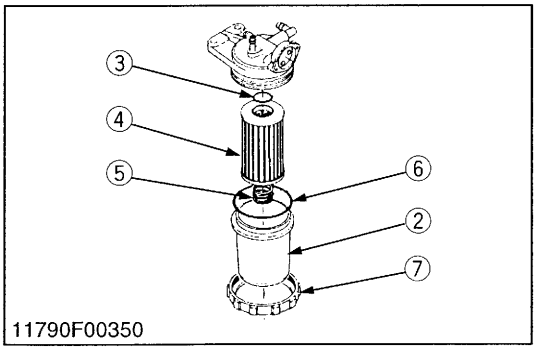

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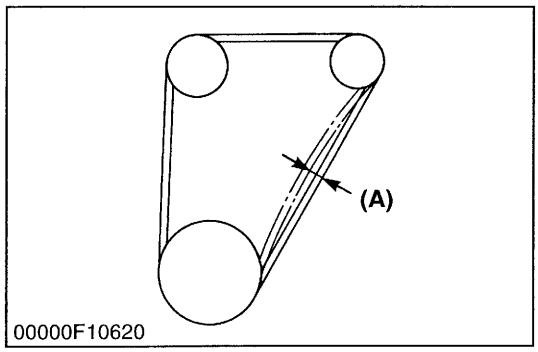
■ IMPORTANT

- **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) Spring
(6) O-ring
(7) Screw Ring
(A) Close

12550G00150



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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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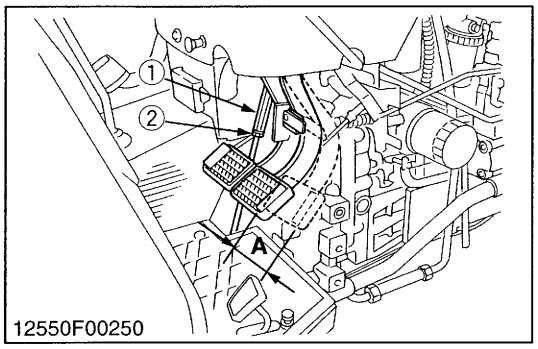
Adjusting Clutch Pedal Free Play

1. See page G-15.

11790G00380



12550F00250

Adjusting Brake Pedal Free Play

1. Release the parking brake.
2. Slightly depress the brake pedals and measure free play **(A)** at top of pedal stroke.
3. If the measurement is not within the factory specifications, loosen the lock nut (2) and turn the turnbuckle (1) to adjust the rod length within acceptable limits.
4. Retighten the lock nut (2).

Brake pedal free play **(A)**	Factory spec.	40 to 45 mm 1.6 to 1.8 in.

■ IMPORTANT

- **Keep the free play in the right and left brake pedals equal.**

(1) Turnbuckle (2) Lock Nut

12550G00160

(5) Check Points of Every 200 Hours

Replacing Engine Oil Filter Cartridge

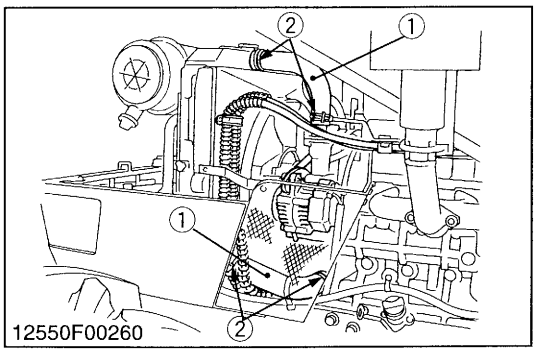
1. See page G-13.

11790G00400

Replacing Hydraulic Oil Filter Cartridge

1. See page G-14.

12550G00440



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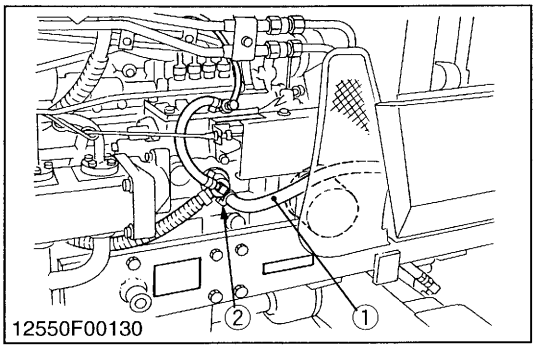


12550F00130

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 (2) are loose or water leaks, tighten bands (2) securely.
2. Replace hoses (1) and tighten hose clamps (2) securely, if radiator hoses (1) 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.

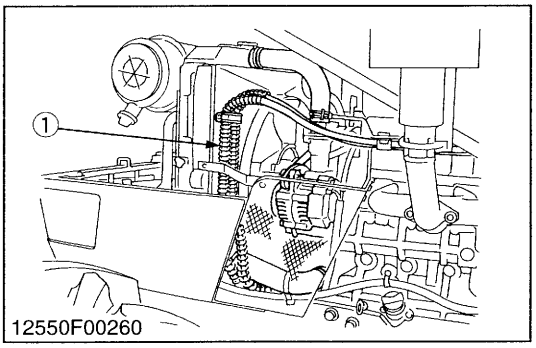
■ Precaution at Overheating

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 page 1-S3, and then start again the engine.

(1) Radiator Hose (2) Clamp

12550G00170



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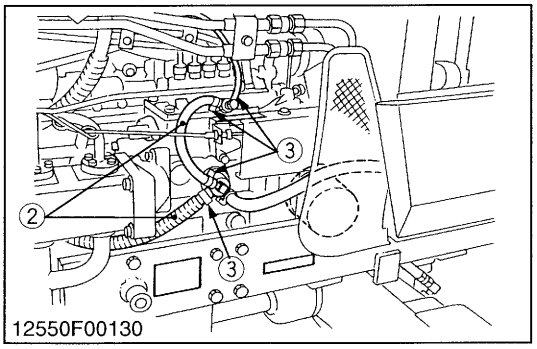


12550F00130

Checking Power Steering Line and Fuel Line

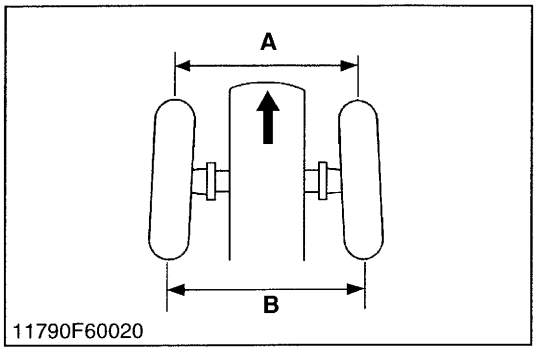
⚠ CAUTION

- **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 (2) and hose clamps (3) are tight and not damaged.
2. If hoses and clamps (3) are found worn or damaged, replace or repair them at once.

(1) Power Steering Hose (3) Clamp
(2) Fuel Line

12550G00180

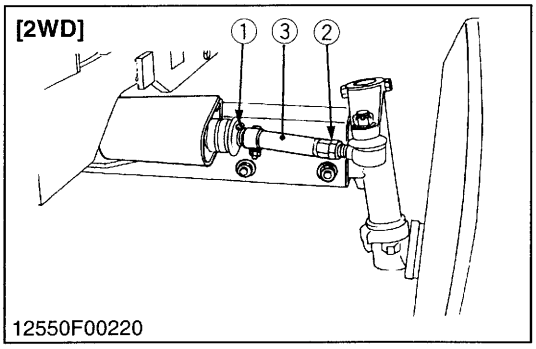


11790F60020

Adjusting 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.	2WD	1 to 5 mm 0.04 to 0.20 in.
		4WD	2 to 8 mm 0.08 to 0.32 in.



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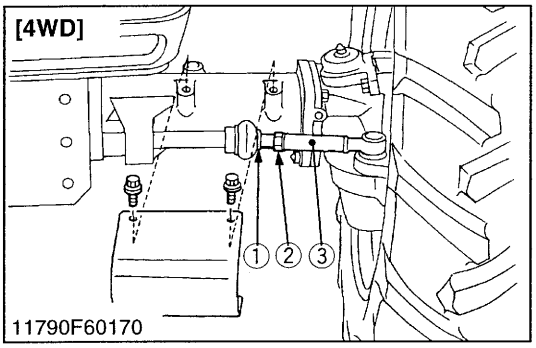
■ Toe-in Adjustment

1. Detach the snap ring (1).
2. Loosen the tie-rod nut (2).
3. Turn the tie-rod joint (3) to adjust the rod length until the proper toe-in measurement is obtained.
4. Retighten the tie-rod nut (2).
5. Attach the snap ring (1) of the tie-rod joint (3).

(1) Snap Ring
(2) Tie-rod Nut
(3) Tie-rod Joint



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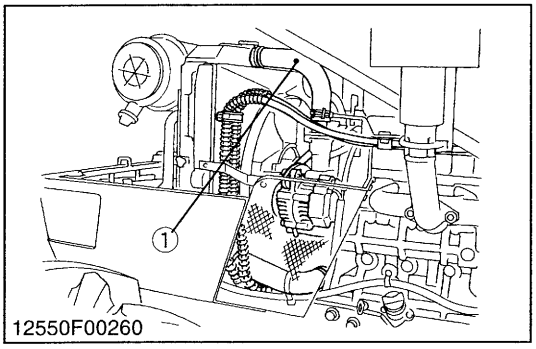


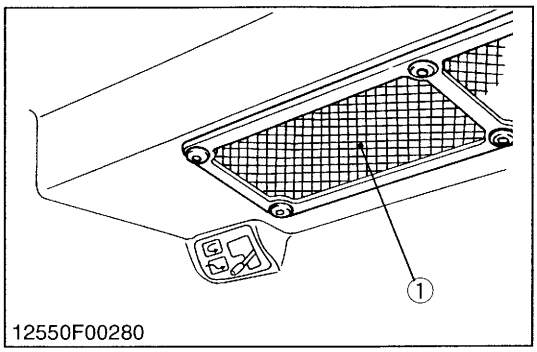
12550F00260

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) Intake Hose

12550G00200



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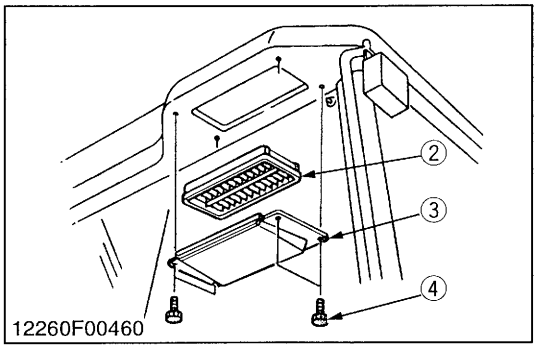

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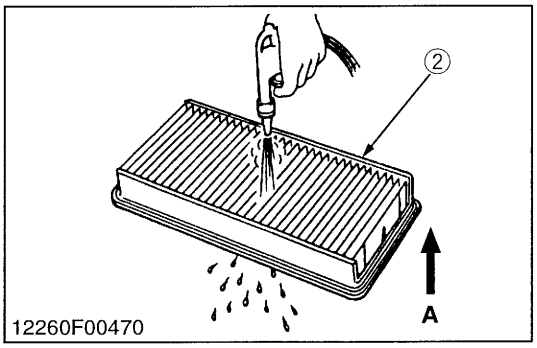


12260F00470

Cleaning Air Filter (CAB)

■ Inner Air Filter

1. Remove the inner filter (1), and blow air from the direction opposite to the filter's normal air flow.

■ Fresh Air Filter

1. Remove the knob bolts (4) and pull out the fresh air filter (2).
2. Blow air from the opposite direction to the filter's normal air flow.

■ NOTE

- **If the filter is very dirty :**
  Dip the filter in lukewarm water with mild dish washing detergent.
  Move it up and down as well as left and right to loosen dirt.
  Rinse the filter with clean water and let it air-dry.

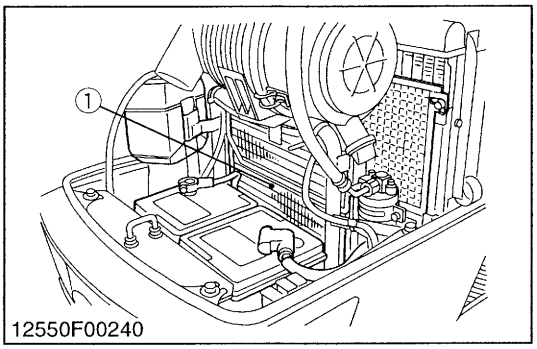
■ IMPORTANT

- **Do not use gasoline, thinner or similar chamicals to clean the filter as damage to the filter may occur.**
- **If may also cause an unpleasant odor in the CAB when the system is used next.**
- **Do not hit the filter. If the filter becomes defeomed, dust may enter into the air-conditioner, which may cause damage and malfunction.**

(1) Inner Filter
(2) Fresh Air Filter
(3) Cover
(4) Knob Bolt

(A) Air Conditioner Air Flow

12550G00210



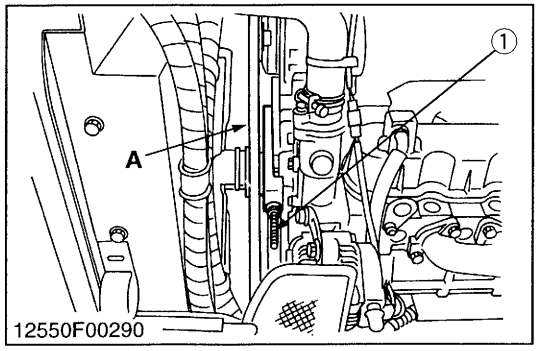
12550F00240

Checking Air Conditioner Condenser

1. Check the air conditioner condenser (1).
2. If dust and dirt, wash off all dirt and dust from the condenser (1) with a soft brush, use care not to damage or bend the fins.

(1) Air Conditioner Condenser

12550G00420



Adjusting Air Conditioner Belt Tension

CAUTION

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

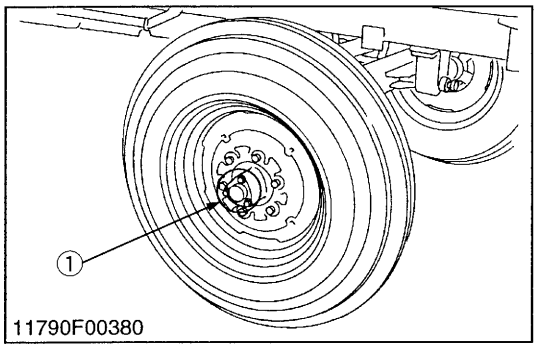
1. Stop the engine and remove the key.
2. Apply 98 N (10 kgf, 22 lbs.) pressure to the belt between the pulleys.
3. If tension is incorrect, adjust the belt tension.
4. If belt is damaged, replace it.

Air conditioner belt tension	Factory spec.	A deflection of between 10 to 12 mm (0.39 to 0.47 in.) when the belt is pressed in the middle of the span

(1) Adjusting Bolt **(A) Deflection**

12550G00220

(6) Check Points of Every 400 Hours

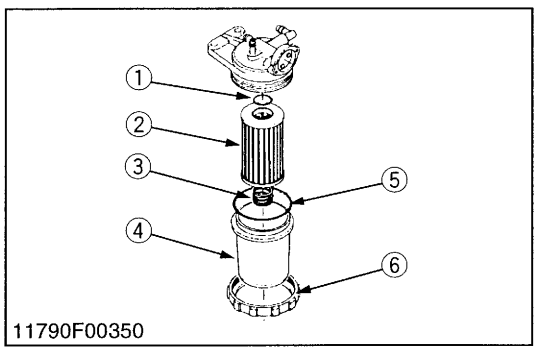


Lubricate Grease Fitting (2WD)

1. Detach the front wheel hub cover (1) and apply bearing grease.

(1) Front Wheel Hub Cover

11790G00450

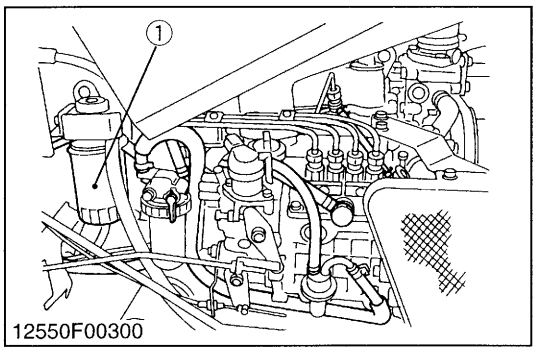


Replacing Fuel Filter Element (ROPS)

1. The fuel filter element (2) should be replaced every 400 hours.

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

12550G00230



Replacing Fuel Filter (CAB)

1. Remove the fuel filter (1).
2. Put a film of clean fuel on rubber seal of new filter.
3. Tighten the filter quickly until it contacts the mounting surface. Tighten filter by hand an additional 1/2 turn only.
4. Bleed the fuel system.
   (See page G-29 **"Bleeding Fuel System"**.)

(1) Fuel Filter

12550G00240

(7) Check Points of Every 600 Hours

Changing Transmission Fluid

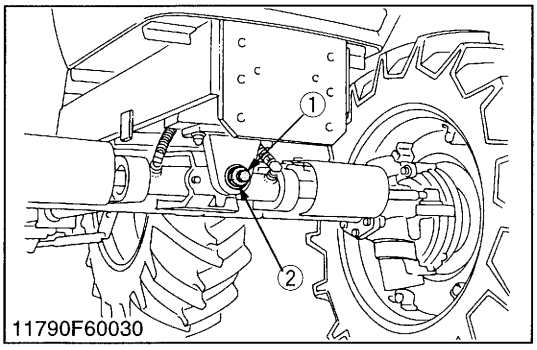
1. See page G-14.

11790G00470

Changing Front Axle Case Oil

1. See page G-15.

12550G00450



11790F60030

Adjusting Front Axle Pivot

1. Jack up the tractor body,then loosen the lock nut (2).
2. Measure the adjusting screw tightening torque.
3. If tightening torque is not within the factory specifications,adjust the adjusting screw (1).
4. After adjustment, tighten the lock nut firmly.

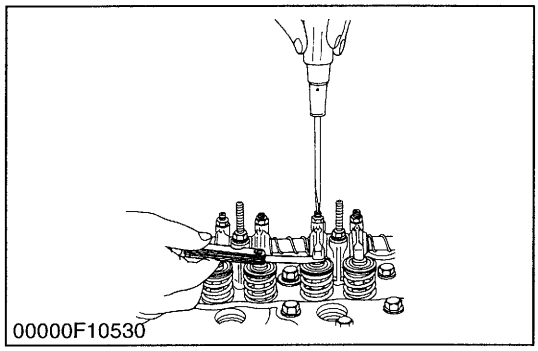
(When reassembling)

Tightening torque	Front axle adjusting screw	19.6 to 29.4 N·m 2.0 to 3.0 kgf·m 14.5 to 21.7 ft-lbs
	Lock nut	98.1 to 147.1 N·m 10.0 to 15.0 kgf·m 72.3 to 108.5 ft-lbs

(1) Adjusting Screw (2) Lock Nut

11790G00281

(8) Check Points of Every 800 Hours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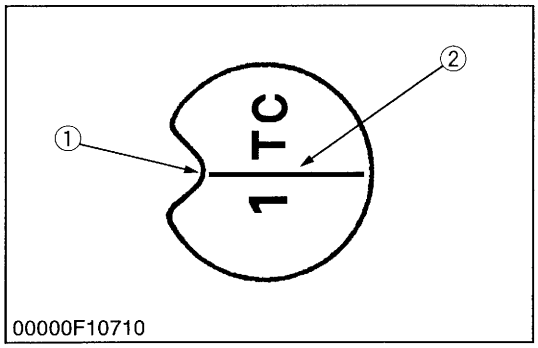

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Adjusting Valve Clearance

■ **IMPORTANT**

- **The valve clearance must be checked and adjusted when engine is cold.**

1. Remove the cylinder head cover.
2. Align the **"1TC"** mark (2) on the flywheel and projection (1) on the housing so that the No. 1 piston comes to the compression top dead center.
3. Check the following valve clearance marked with **"★"** using a feeler gauge.
   [When No. 1 piston is compression top dead center position]

Cylinder No.	1	2	3	4	5
Intake valve	★	★			
Exhaust valve	★		★		

4. If the clearance is not within the factory specifications, adjust with the adjusting screw.
5. Then turn the flywheel 6.28 rad. (360°), and align the **"1TC"** mark (2) on the flywheel and projection (1) on the housing so that the No. 1 piston comes to the overlap position.
6. the housing so that the No. 1 piston comes to the overlap position.
7. Check the following valve clearance marked with "☆" using a feeler gauge.
   [When No. 1 piston is overlap position]

Cylinder No.	1	2	3	4	5
Intake valve			☆	☆	☆
Exhaust valve		☆		☆	☆

8. If the clearance is not within the factory specifications, adjust with the adjusting screw.

Intake and exhaust valve clearance (Cold)	Factory spec.	0.18 to 0.22 mm 0.0071 to 0.0087 in.

■ **NOTE**

- **The sequence of cylinder numbers is given as No. 1, No. 2, No. 3, No. 4 and No. 5 starting from the gear case side.**
- **After adjusting the valve clearance, secure the adjusting screw with the lock nut.**

(1) Projection (2) **"1TC"** Mark

11790G00500

(9) Check Points of Every 1500 Hours

Checking Fuel Injection Nozzle Injection Pressure

1. See page 1-S56.

12550G00250

(10) Check Points of Every 3000 Hours

Checking Fuel Injection Pump

1. See page 1-S29.

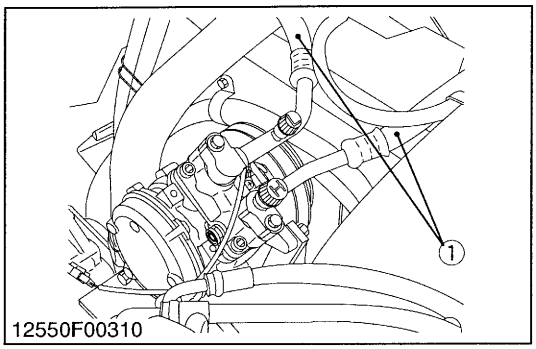
12550G00260

(11) Check Points of Every 1 Year

Replacing Air Cleaner Primary Element and Secondary Element

1. See page G-18.

12550G00460

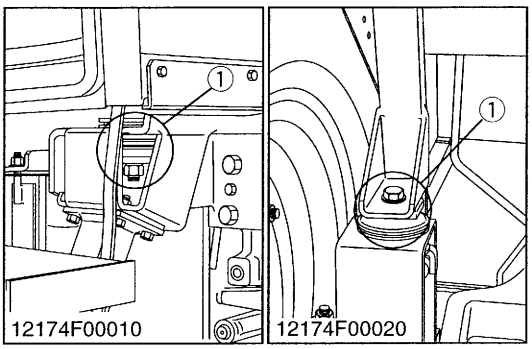


Checking Air Conditioner Pipe and Clamp

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

(1) Hose

12550G00270



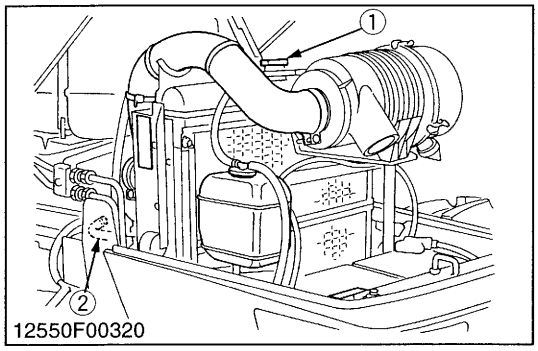
Checking Cabin Isolation Cushion

1. Check the isolation cushion (1) for any breakage or fatigue.
2. Replace them if they have deteriorated.

(1) Isolation Cushion

12550G00280

(12) Check Points of Every 2 Years



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, remove the radiator hose (2) and radiator cap (1). The radiator cap (1) must be removed to completely drain the coolant.
3. After all coolant is drained, install the hose (2) securely.
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. Fill with clean water and anti-freeze up to the upper line of recovery tank.
8. Install the radiator cap (1) securely.
9. Start and operate the engine for a few minutes.
10. Stop the engine. Check coolant level and add coolant if necessary.

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 (1). If the cap is loose or improperly fitted, water may lead out and the engine could overheat.**

Coolant capacity	Radiator	7.3 L 7.7 U.S.qts. 6.4 Imp.qts.
	Recovery tank	1.0 L 1.1 U.S.qts. 0.9 Imp.qts.

(1) Radiator Cap (2) Radiator Hose

12550G00290

Flush Cooling System and Changing Coolant (Continued)

■ Anti-Freeze

If it freezes, coolant 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 J19814c.
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.)**

11790G00530

Replacing Radiator Hose (Water Pipes)

1. Replace the hoses and clamps.
   Refer to **"Checking Radiator Hose and Hose Clamp"**.
   (See page G-20.)

12550G00470

Replacing Power Steering Hose

1. Replace the hoses and clamps, if necessary.
   Refer to **"Checking Power Steering Line and Fuel Line"**.
   (See page G-20.)

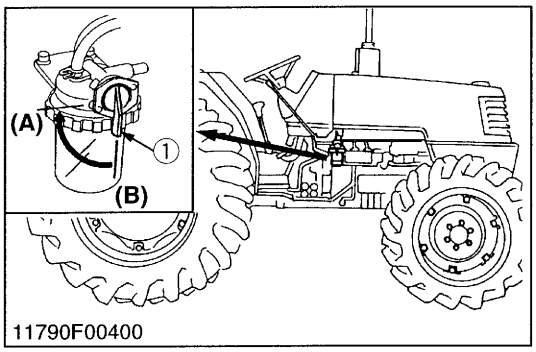
12550G00480

Replacing Fuel Hose

1. Replace the fuel hoses and clamps, if necessary.
   Refer to **"Checking Power Steering Line and Fuel Line"**.
   (See page G-20.)

12550G00490

(13) Others



11790F00400

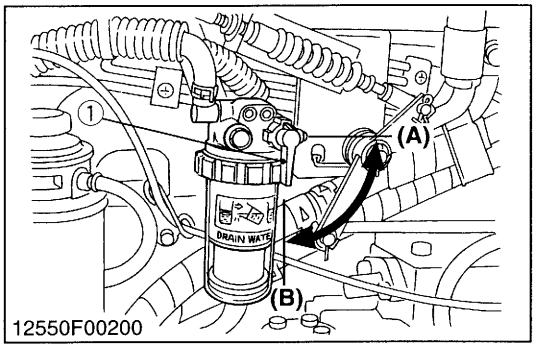
Bleeding Fuel System (ROPS)

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. When 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

12550G00300



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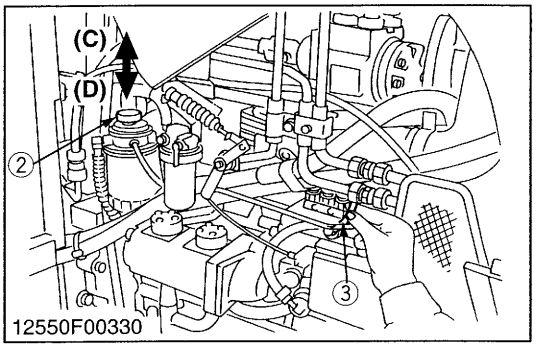


12550F00330

Bleeding Fuel System (CAB)

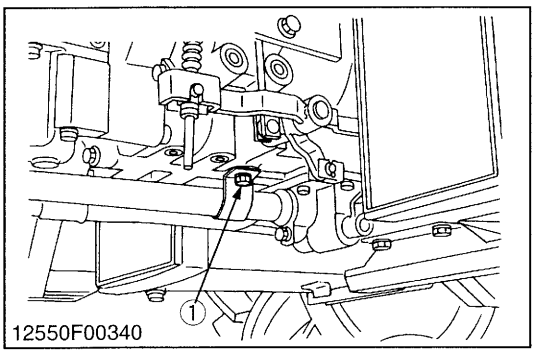
Air must be removed:
1. When the fuel filter or lines are removed.
2. When water is drained from water separator.
3. When tank is completely empty.
4. After the tractor has not been used for a long period of time.

■ Bleeding Procedure is as Follows:
1. Make sure the fuel cock is in the **"OPEN"** position.
2. Pump the fuel pump knob (2) located on the top of the fuel filter. The fuel pump knob (2) will pump easily at first and with added resistance as air is purged from the system. To make sure air is completely purged, pinch the fuel overflow hose with fingers, if a pulsation is felt when the knob is pumped, then, no air remains.
3. Set the hand throttle lever at the maximum speed position, turn on the key switch to the start the engine, and then reset the throttle lever at the mid speed (around 1500 min^{-1} (rpm)) position.
   If engine doesn't start, try it several times with 30 seconds intervals.
4. Accelerate the engine to remove the small portion of air left in the fuel system.
5. If air still remains and the engine stops, repeat the above steps.
6. Close the air vent cock.

■ IMPORTANT
- **Do not hold key witch at engine start position for more than 10 seconds continuously. If more engine cranking is needed, try again after 30 seconds.**

(1) Fuel Cock
(2) Fuel Pump Knob
(3) Fuel Overflow Hose
(A) Close
(B) Open
(C) Up
(D) Down

12550G00310



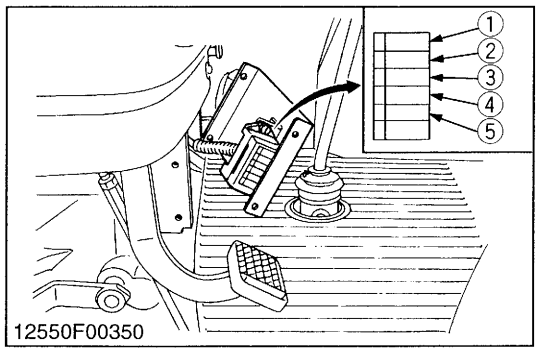
12550F00340

Draining Clutch Housing Water

1. The tractor is equipped with drain plug (1) under the clutch housing.
2. After operating in rain, snow or tractor has been washed, water may get into the clutch housing.
3. Remove the drain plug (1) and drain the water, then install the plug (1) again.

(1) Water Drain Plug

12550G00320



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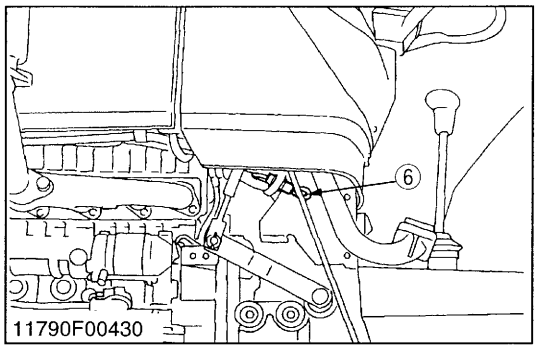


11790F00430

Replacing Fuse (ROPS)

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.

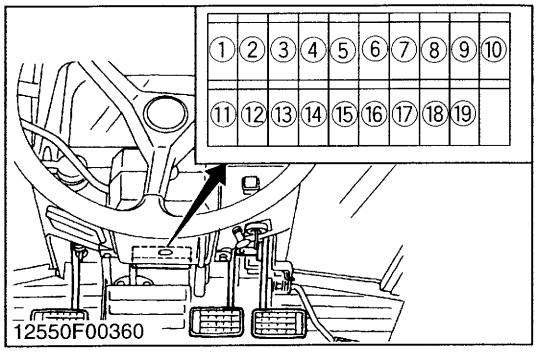
■ IMPORTANT

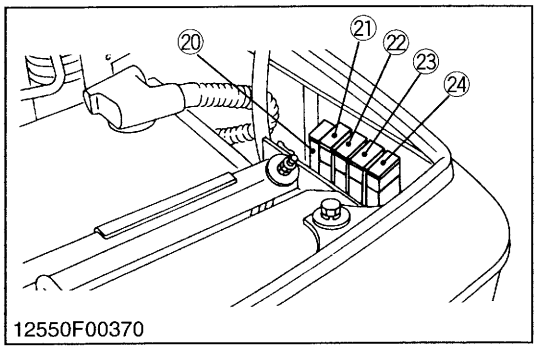
- **Before replacing a blown fuse, determine why the fuse blew and make any necessary repairs. Failure to follow this procedure may result in serious damage to the tractor electrical system. Refer to troubleshooting section of this manual or your local KUBOTA dealer for specific information dealing with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

■ Protected Circuit

Fuse No.	Capacity (A)	Protected circuit
①	15	Main key
②	15	Head light, Flasher
③	10	Parking, Hazard
④	10	Work light
⑤	15	Key stop
⑥	50 Slow blow fuse	Check circuit against wrong battery connection

12550G00330





Replacing Fuse (CAB)

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.**

Fuse No.	Capacity (A)	Protected circuit
①	15	Flasher (Hazard)
②	10	Dome light
③	10	Air con. (Compressor)
④	20	Air con. (Fan motor)
⑤	5	Air con. (Control)
⑥	15	Wiper
⑦	5	Radio
⑧	15	Key stop
⑨	15	Spare
⑩	20	Spare
⑪	10	Engine panel
⑫	15	Turn signal, Stop lamp
⑬	15	Auxiliary power
⑭	15	Head light, Tail lamp, Horn
⑮	20	(Rear) Deffogger (if equipped)
⑯	20	(Side) Deffogger (if equipped)
⑰	15	Work light (Front)
⑱	15	Work light (Rear)
⑲	15	Cigarette lighter
⑳	65 Slow blow fuse	Check circuit against wrong battery connection
	75 Slow blow fuse (if equipped)	
㉑	30	Battery
㉒	30	Accessory
㉓	30	Main key
㉔	30	Deffogger (if equipped)

12550G00340

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.

[ROPS]

Light	Capacity
Head lights	45 W
Tail light	8 W
Hazard light / turn signal	27 W
Instrument panel light	3.4 W
Work light	27 W

[CAB]

Light	Capacity
Head lights	45/45 W
Tail light	8 W
Turn signal light	15 W
Hazard light	27 W
Instrument panel light	3.4 W
Easy checker	1.4 W, 3 W
Work light	55 W
Dome light (Room lamp)	10 W

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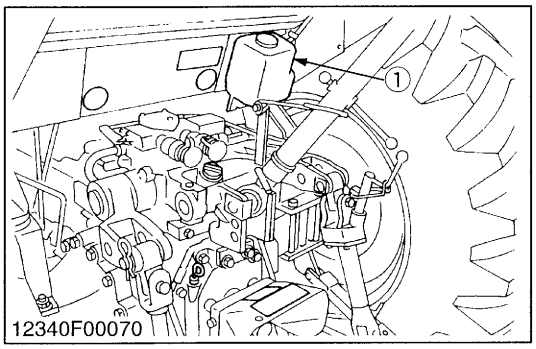


Adding Washer Liquid

1. Add a proper amount of automobile washer liquid when it is necessary.

Washer liquid tank	Capacity	1.3 L 1.4 U.S.qts. 1.1 Imp.qts.

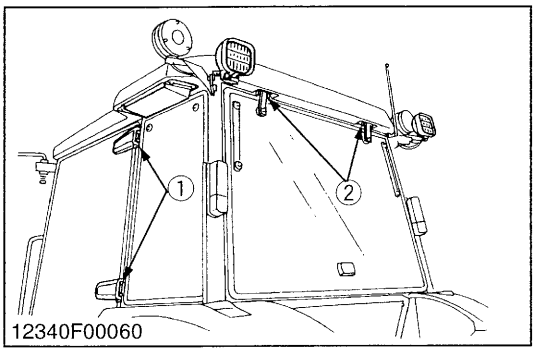
(1) Washer Liquid Tank

12340G00100

Checking Amount of Refrigerant (gas)

• See page 10-S21.

12550G00510



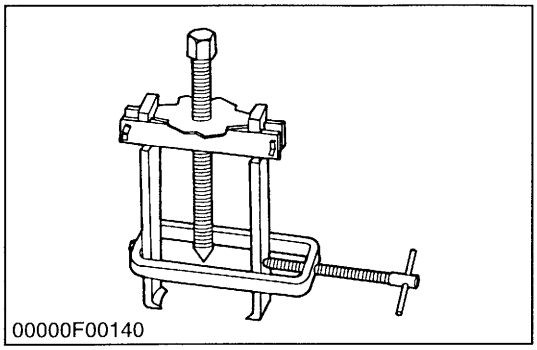
Lubricating Door and Rear Window Hinge

1. Apply a small amount of lubricating liquid to the following points when it is necessary.

(1) Door Hinge (2) Rear Window Hinge

12340G00090

[9] SPECIAL TOOLS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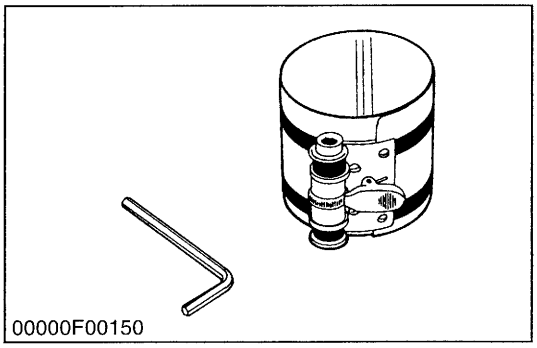
Special Use Puller Set

Code No : 07916-09032

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

00000G00010

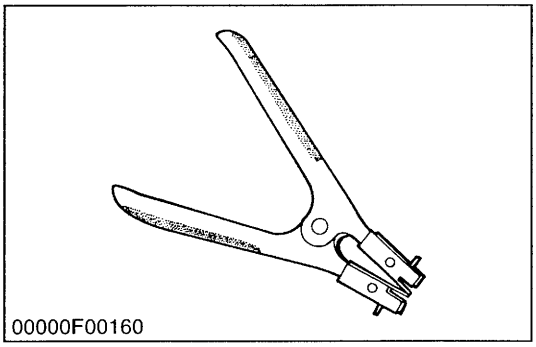

00000F00150

Piston Ring Compressor

Code No : 07909-32111

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

00000G00020

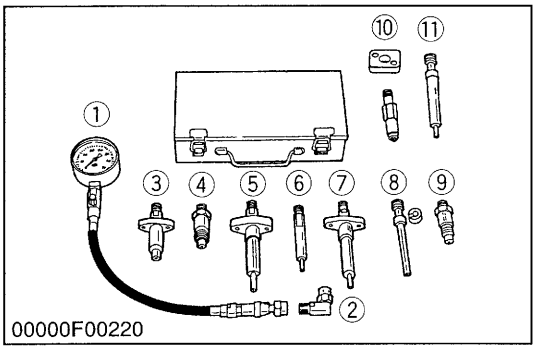

00000F00160

Piston Ring Tool

Code No : 07909-32121

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

00000G00030



00000F00220

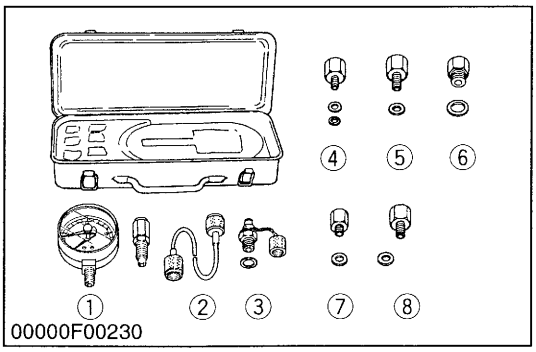
Diesel Engine Compression Tester

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



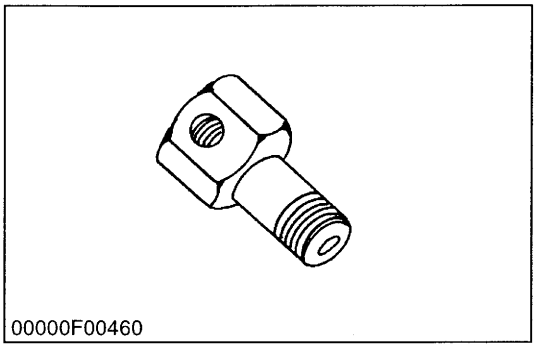
00000F00230

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**

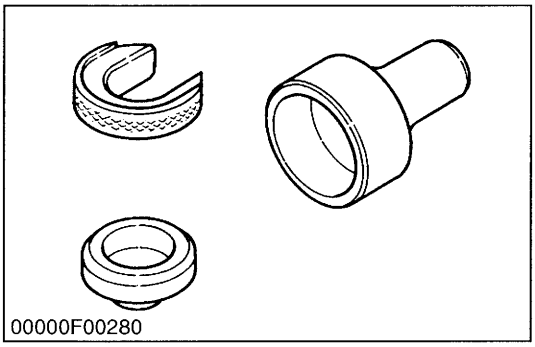
00000G00080


00000F00460

Adaptor 7

Code No : 07916-32591
Application : Use to measure lubricating oil pressure.

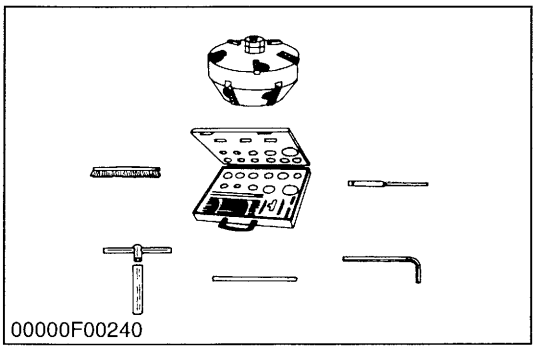
00000G00330


00000F00280

Auxiliary Socket for Fixing Crankshaft Sleeve

Code No : 07916-32091
Application : Use exclusively for fixing the crankshaft sleeve.

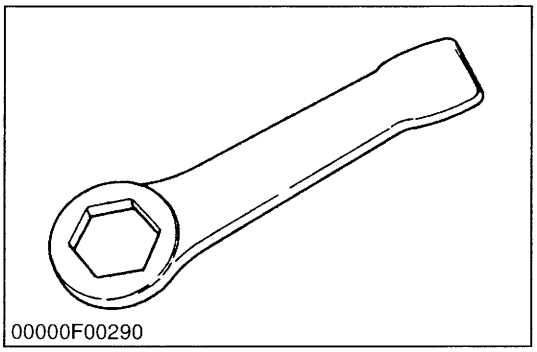
00000G00150


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.)

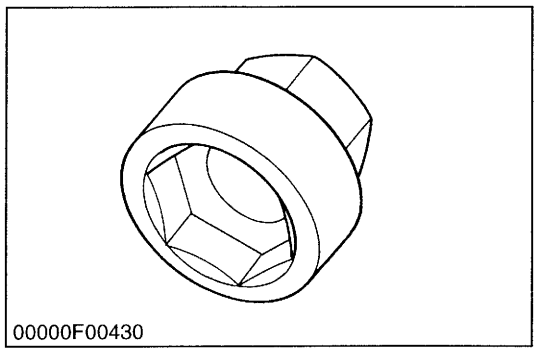
00000G00090


00000F00290

Socket Wrench 46

Code No : 07916-30901
Application : Use exclusively for removing or installing the crankshaft nut.

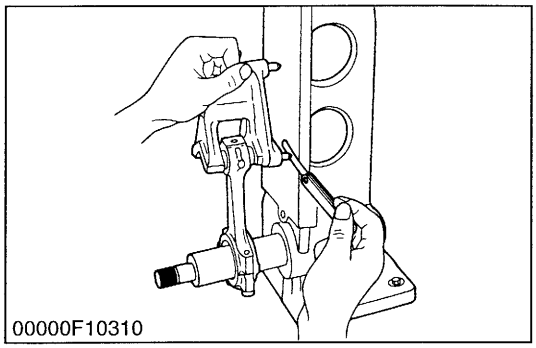
00000G00160


00000F00430

Crankshaft Nut Socket 46

Code No : 07916-30821
Application : Use exclusively for removing or installing the crankshaft nut.

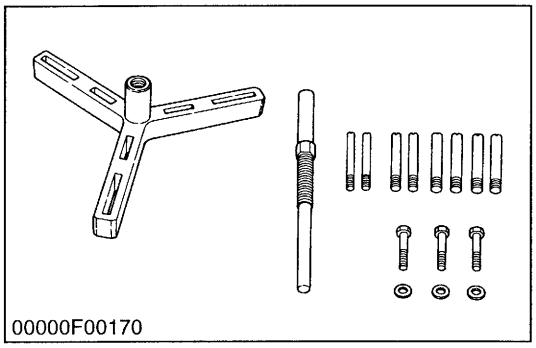
00000G00300


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.)

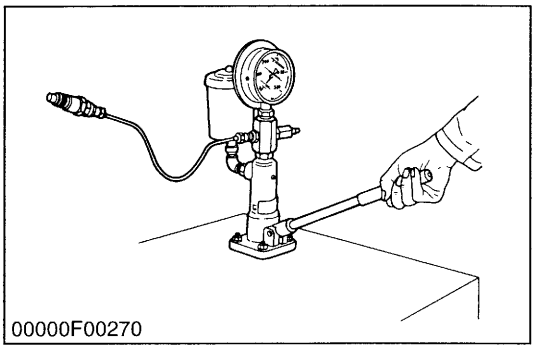
00000G00110


00000F00170

Flywheel Puller

Code No : 07916-32011
Application: Use exclusively for removing the flywheel with ease.

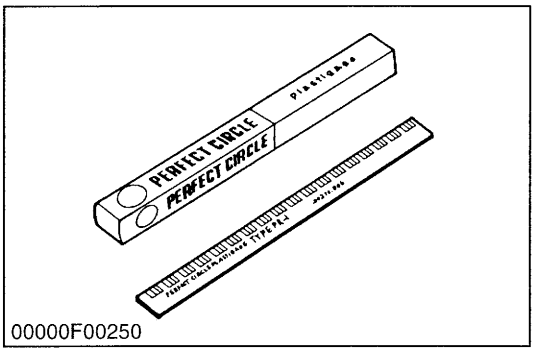
00000G00040


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)

00000G00140

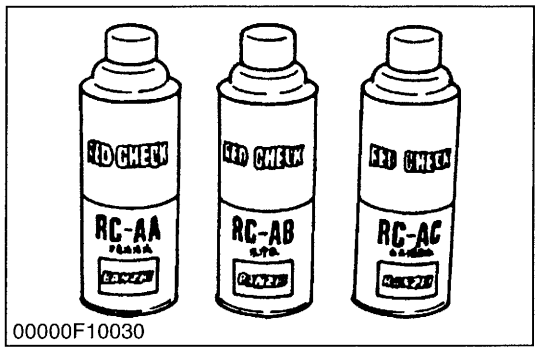


00000F00250

Plastigage

Code No : 07909-30241
Application : Use to check the oil clearance between crankshaft and bearing, etc.
Measuring : Green .....0.025 to 0.076 mm (0.001 to 0.003 in.)
range 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



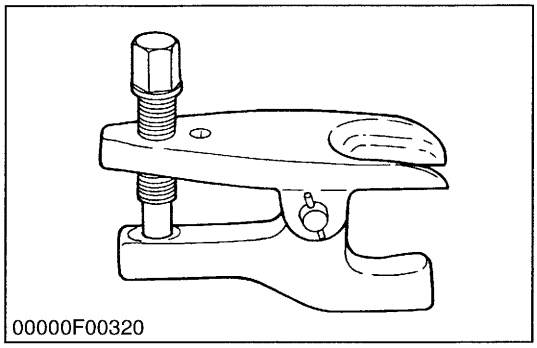
00000F10030

Red Check

Code No : 07909-31371

Application : Use to check cracks on cylinder head, cylinder block, etc.

00000G00120

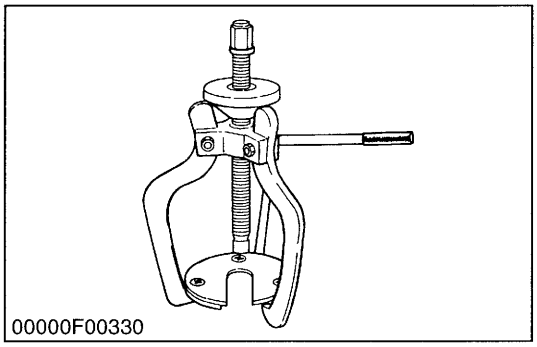

00000F00320

Tie-rod End Lifter

Code No : 07909-39051

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

00000G00190

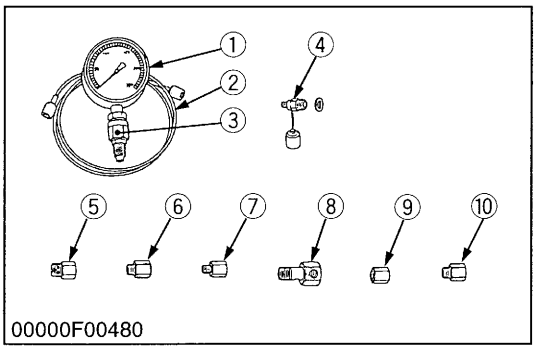

00000F00330

Steering Wheel Puller

Code No : 07916-51090

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

00000G00200



00000F00480

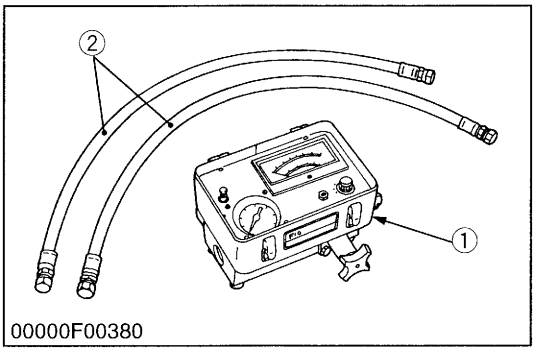
Relief Valve Pressure Tester

Code No : 07916-50045

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

(1) Gauge (07916-50321)
(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)

00000G00350



00000F00380

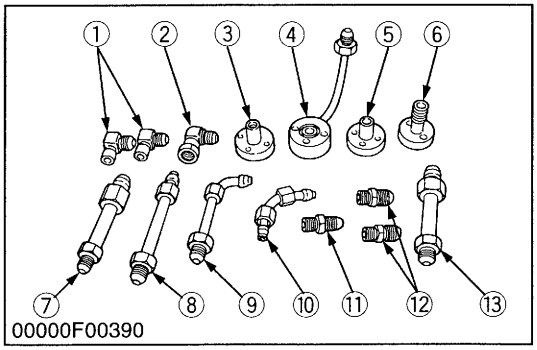
Flow Meter

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

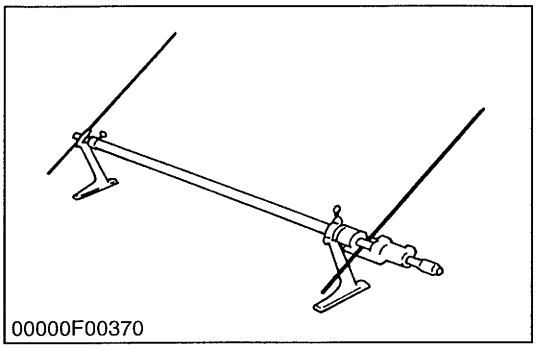
Adaptor Set for Flow Meter

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

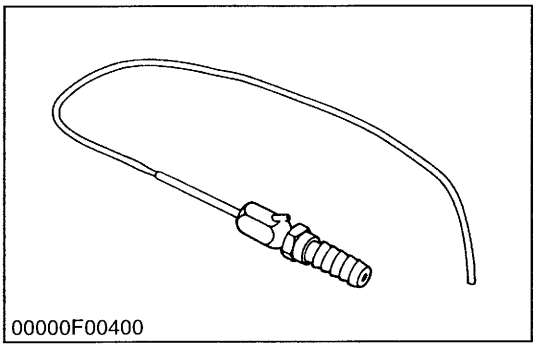

00000F00370

Toe-in Gauge

Code No : 07909-31681

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

00000G00240

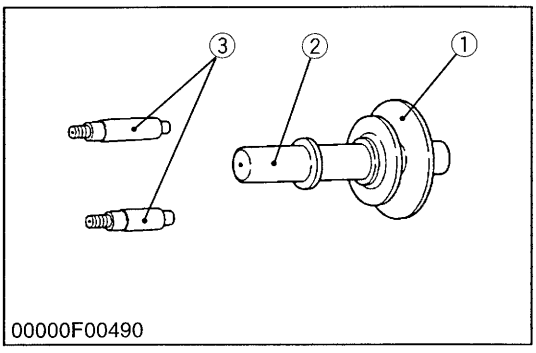

00000F00400

Injector CH3

Code No : 07916-52501

Application : Use for injecting calcium chloride solution into, and removing it from, rear and 4WD type front wheel tires.

00000G00270



00000F00490

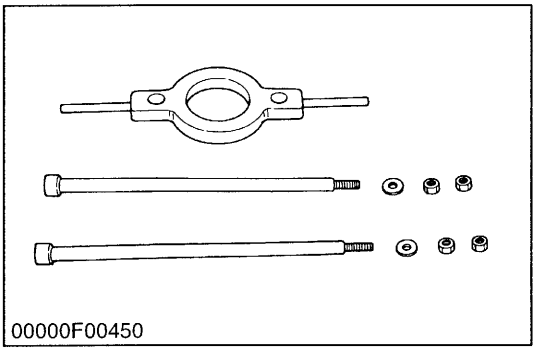
Clutch Tool B

Code No : 07916-53041

Application : Use for mounting the clutch to the flywheel.

(1) Gauge Ring
(2) Center Bar
(3) Centering Guide
— 07916-53041

00000G00360

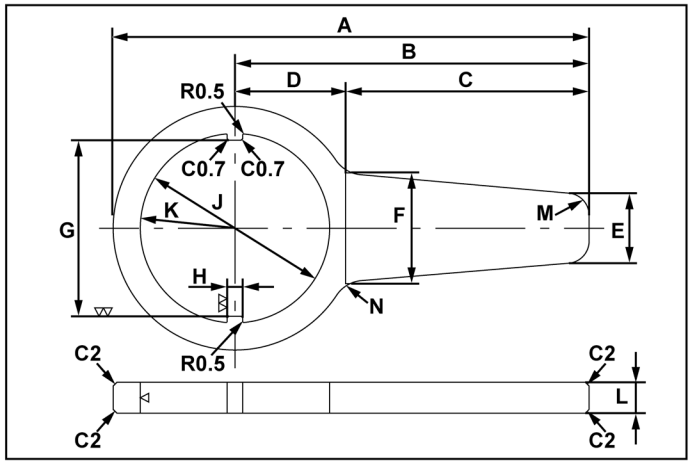

00000F00450

Rear Axle Cover Puller

Code No : 07916-51041

Application : Use for removing a rear axle cover from rear axle.

00000G00320



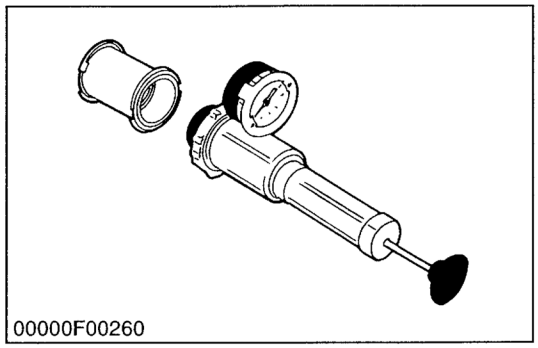
Rear Axle Nut Wrench 85

Application: Use for removing and installing a rear axle nut.

■NOTE

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

A	215 mm (8.46 in.)	J	Φ85.5 mm (Φ3.37 in.)
B	160 mm (6.30 in.)	K	R55 mm (R2.2 in.)
C	110 mm (4.33 in.)	L	14 mm (0.55 in.)
D	50 mm (2.0 in.)	M	R10 mm (R0.39 in.)
E	30 mm (1.2 in.)	N	R15 mm (R0.59 in.)
F	50 mm (2.0 in.)	C0.7	C0.7 mm (C0.03 in.)
G	79.5 mm (3.13 in.)	C2	C2 mm (C0.08 in.)
H	6.60 to 6.80 mm (0.260 to 0.267 in.)	R0.5	R0.5 mm (R0.02 in.)



Radiator Tester

Code No : 07909-31551

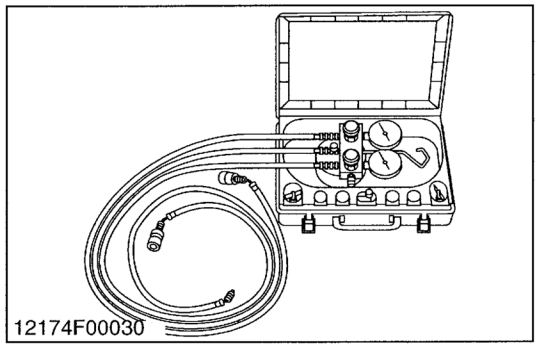
Application : Use to check of radiator cap pressure, and leaks from cooling system.

00000G00130

■ NOTE

- **Special tools for R134a refrigerant air conditioning system introduced below are available from NIPPONDENSO CO. LTD.**

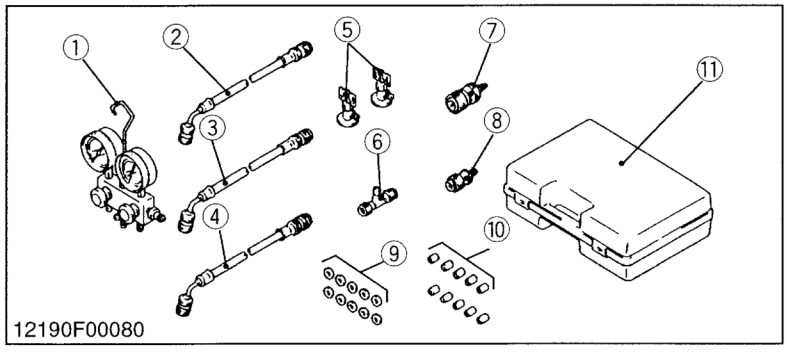
12550G00500



Air Conditioner Service Tool

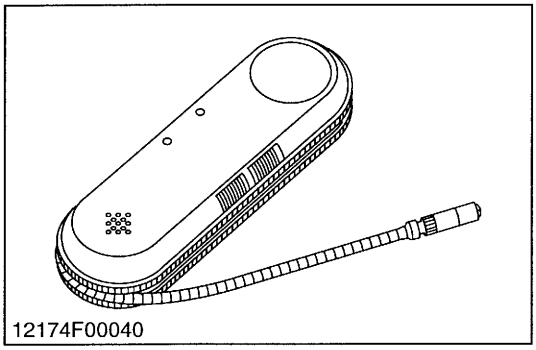
Code No: NIPPONDENSO 95048-00061

Application: Use for charging, testing or discharging the air conditioning system.



(1)	Manifold Gauge Assembly	95048-10090
(2)	Charging Hose (Red : HI)	95948-10270
(3)	Charging Hose (Blue : LO)	95948-10280
(4)	Charging Hose (Green)	95948-10260
(5)	Can Tap Valve	95048-10150
(6)	T Joint	95048-10160
(7)	Quick Coupler (HI)	95048-10130
(8)	Quick Coupler (LO)	95048-10140
(9)	Service Valve Packing	95906-10310
(10)	Charging Hose Packing	95906-10300
(11)	Tool Case	95949-10610

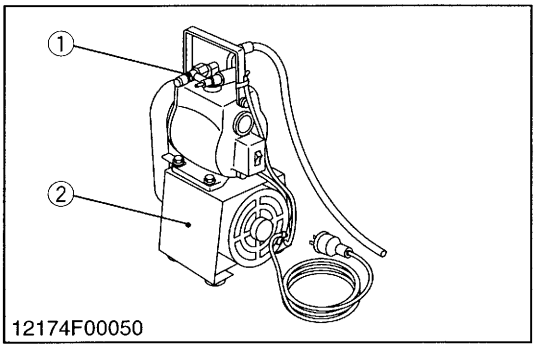
12340G00110


12174F00040

Electric Gas Leak Tester

Code No: NIPPONDENSO 95146-00060
Application: Use for gas leak testing the air conditioning system.

12340G00120



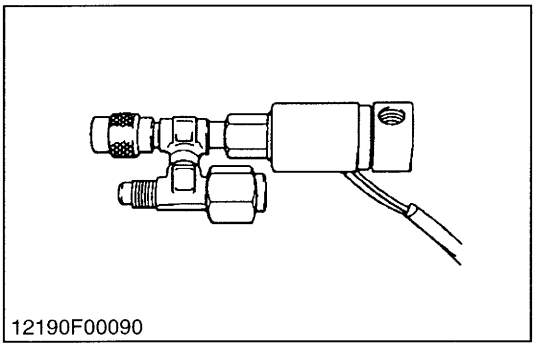
12174F00050

Vacuum Pump

Code No: NIPPONDENSO 95046-00040 (AC220V)
95046-00050 (AC240V)
Application: Use for evacuating the air conditioning system.

(1) Adaptor (For 134a) (2) Vacuum Pump

12340G00130

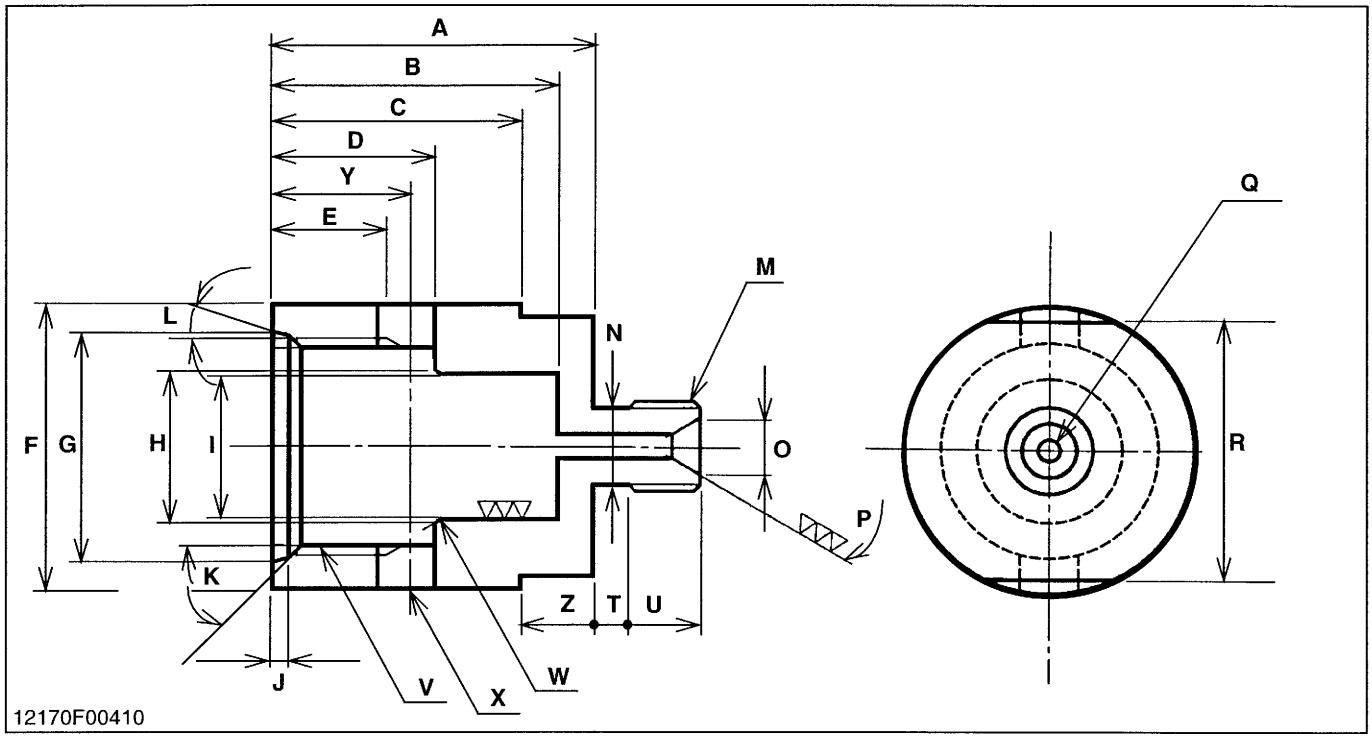

12190F00090

Adaptor (For R134a)

Code No: NIPPONDENSO 95048-10190 (AC220V)
95048-10200 (AC240V)
Application: Use for evacuating the air conditioning system.

12190G00180

Cylinder Safety Valve Setting Pressure Adaptor



Application: Use for setting the safety valve to the nozzle tester to measure cracking pressure and check oil tightness of the safety valves.

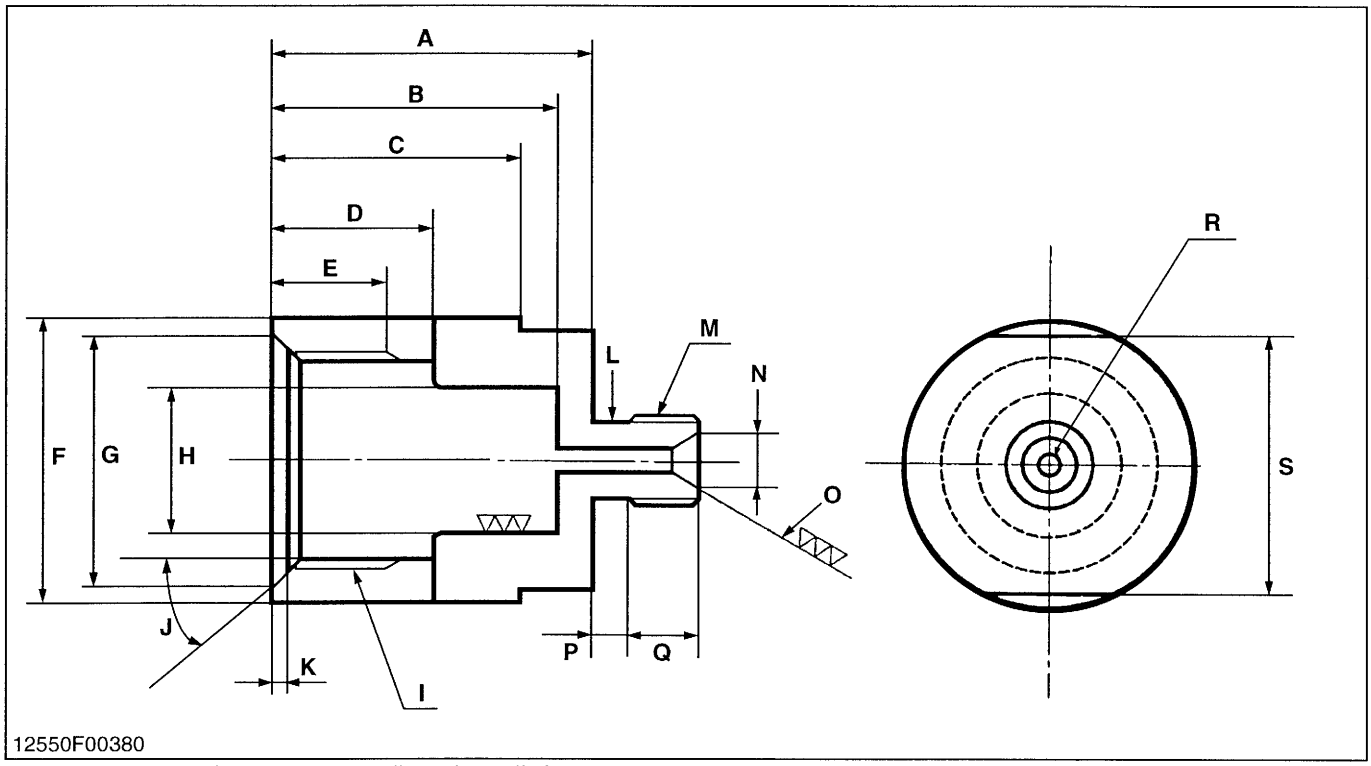
■ NOTE

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

A	45 mm (1.77 in.)	N	10 mm dia. (0.39 in. dia.)
B	40 mm (1.58 in.)	O	7.5 mm dia. (0.3 in.dia.)
C	35 mm (13.8 in.)	P	1.05 rad. (60°)
D	23 to 23.3 mm (0.9055 to 0.9713 in.)	Q	3 mm dia. (1.18 in. dia.)
E	16 mm (0.63 in.)	R	36 mm (1.18 in.)
F	40 mm (1.58 in.)	S	60 mm (2.36 in.)
G	32.4 to 32.7 mm (1.2756 to 1.2874 in.)	T	5 mm (0.20 in.)
H	21 mm dia. (0.83 in. dia.)	U	10 mm (0.39 in.)
I	20 to 20.05 mm (0.7874 to 0.7894 in.)	V	M30 × P1.5
J	2.5 to 2.59 mm (0.0984 to 0.1097 in.)	W	0.52 rad. (30°)
K	0.79 rad. (45°)	X	8 mm dia. (0.32 in. dia.)
L	0.26 rad. (15°)	Y	19 mm (0.75 in.)
M	M12 × P1.5	Z	10 mm (0.39 in.)

12550G00360

Oil Cooler Relief Valve Setting Pressure Adaptor (For M5700DT)



12550F00380

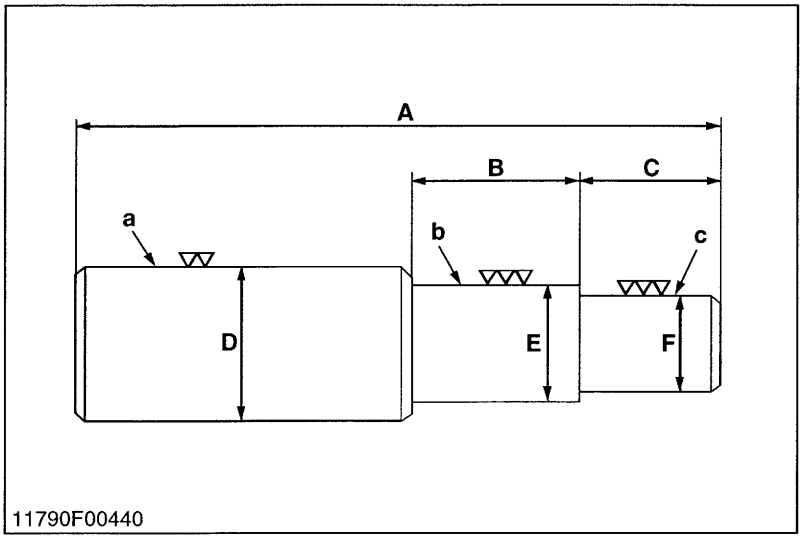
Application: Use for setting the oil cooler relief valve to the nozzle tester to measure cracking pressure and check oil tightness of the oil cooler relief valve.

■ NOTE

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

A	45 mm (1.77 in.)	K	2 mm (0.079 in.)
B	40 mm (1.58 in.)	L	10 mm dia. (0.39 in. dia.)
C	28 mm (1.1 in.)	M	M12 × P1.5
D	18 mm (0.71 in.)	N	7.5 mm dia. (0.3 in. dia.)
E	15 mm (0.59 in.)	O	1.05 rad. (60°)
F	24 mm (0.94 in.)	P	5 mm (0.20 in.)
G	20 mm (0.79 in.)	Q	10 mm (0.39 in.)
H	15 mm (0.59 in.)	R	3 mm dia. (0.118 in. dia.)
I	M18 × P1.5	S	21 mm (0.83 in.)
J	0.79 rad. (45°)		

12550G00370



11790F00440

Bushing Replacing Tool

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

■ NOTE

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

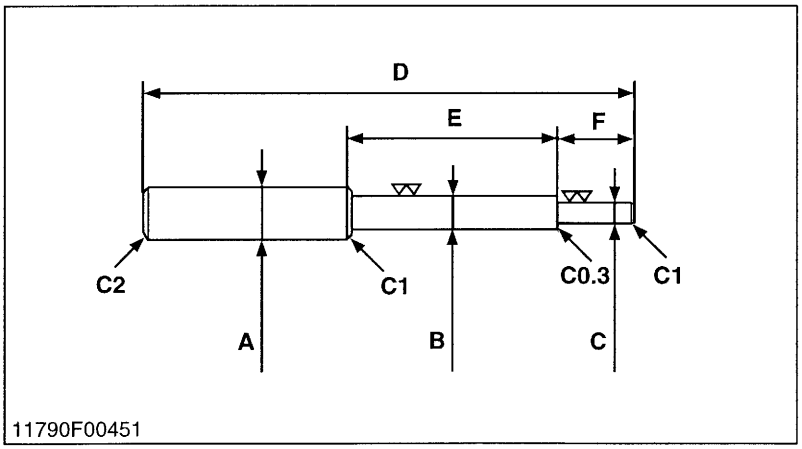
[1] For small end bushing

A	162 mm (6.378 in.)
B	35 mm (1.378 in.)
C	27 mm (1.063 in.)
D	35 mm DIA. (1.378 in. DIA.)
E	27.90 to 27.95 mm DIA. 1.0984 to 1.1004 in. DIA.
F	25.002 to 25.011 mm DIA. 0.9843 to 0.9847 in. DIA.
a	6.3 µm (250 µin.)
b	1.25 µm (50 µin.)
c	1.25 µm (50 µin.)

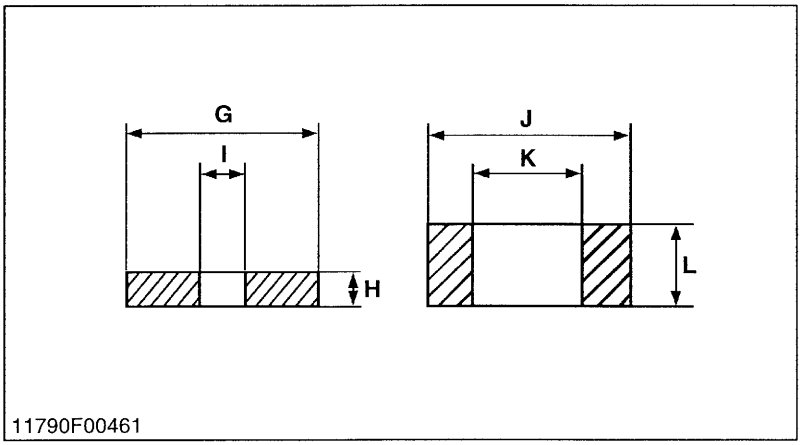
[2] For idle gear bushing

A	175 mm (6.890 in.)
B	40 mm (1.575 in.)
C	35 mm (1.378 in.)
D	40 mm DIA. (1.575 in. DIA.)
E	41.90 to 41.95 mm DIA. 1.6496 to 1.6516 in. DIA.
F	37.959 to 37.975 mm DIA. 1.4950 to 1.4951 in. DIA.
a	6.3 µm (250 µin.)
b	1.25 µm (50 µin.)
c	1.25 µm (50 µin.)

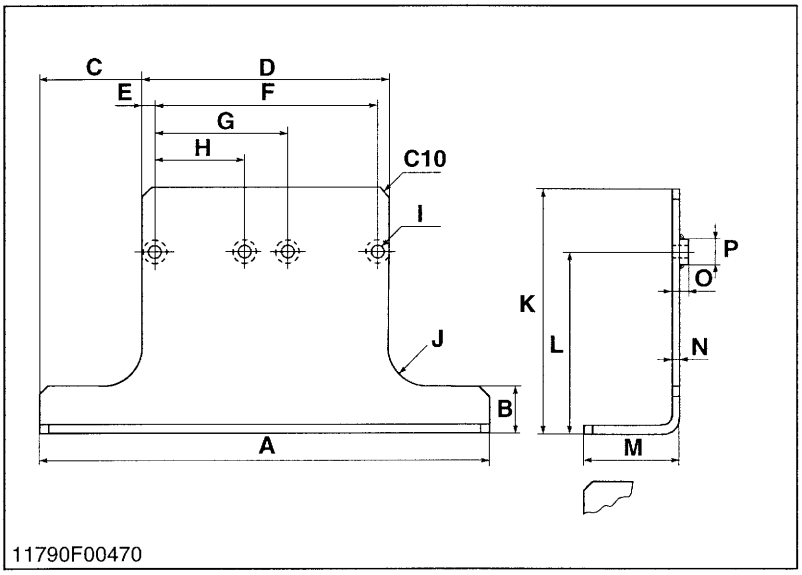
11790G00610



11790F00451



11790F00461



11790F00470

Valve Guide Replacing Tool

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

■ NOTE

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

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.)

11790G00621

Engine Stand

Application: Use to support engine.

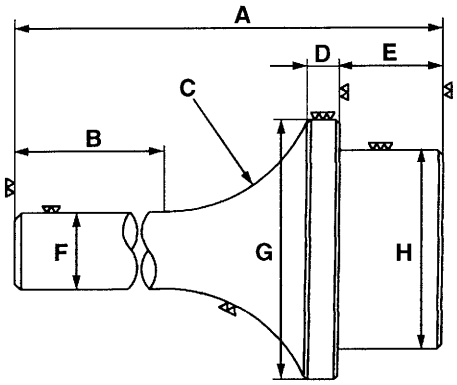
■ NOTE

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

A	480 mm (18.90 in.)
B	50 mm (1.97 in.)
C	108.5 mm (4.272 in.)
D	263 mm (10.35 in.)
E	12.5 mm (0.492 in.)
F	237.5 mm (9.350 in.)
G	142.5 mm (5.610 in.)
H	95 mm (3.74 in.)
I	4.14 mm DIA. (0.55 in. DIA.)
J	R4C (1.57)
K	210 mm (8.27 in.)
L	190 mm (7.48 in.)
M	100 mm (3.94 in.)
N	6 mm (0.24 in.)
O	6 mm (0.24 in.)
P	25 mm DIA. (0.98 in. DIA.)
C10	Chamfer 10 mm (0.394 in.)

11790G00780

[1]



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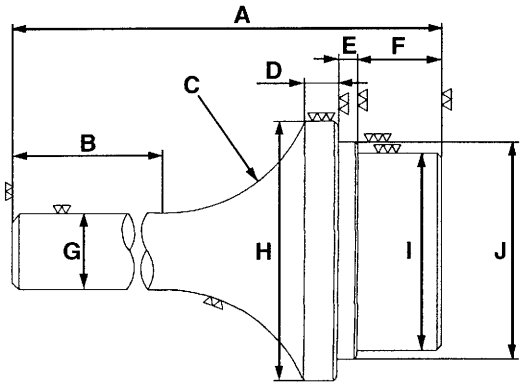

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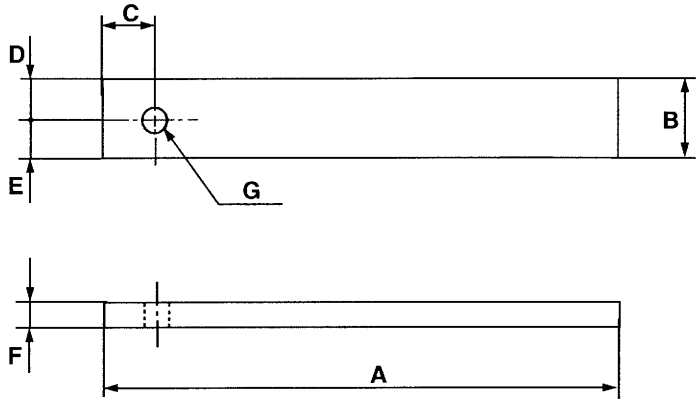


11790F00490

Crankshaft Bearing 1 Replacing Tool

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

■ NOTE

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

[1] Extracing Tool

A	135 mm (5.31 in.)
B	72 mm (2.83 in.)
C	40° (1.57 rad.)
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.

[2] Inserting Tool

A	130 mm (5.12 in.)
B	72 mm (2.83 in.)
C	40° (1.57 rad.)
D	9 mm (0.35 in.)
E	4 mm (0.16 in.)
F	20 mm (0.79 in.)
G	20 mm dia. (0.79 in. dia.)
H	68 mm dia. (2.68 in. dia.)
I	51.80 to 51.90 mm dia. 2.0393 to 2.0433 in. dia.
J	56.80 to 56.90 mm dia. 2.2362 to 2.2402 in. dia.

11790G00790

Flywheel Stopper

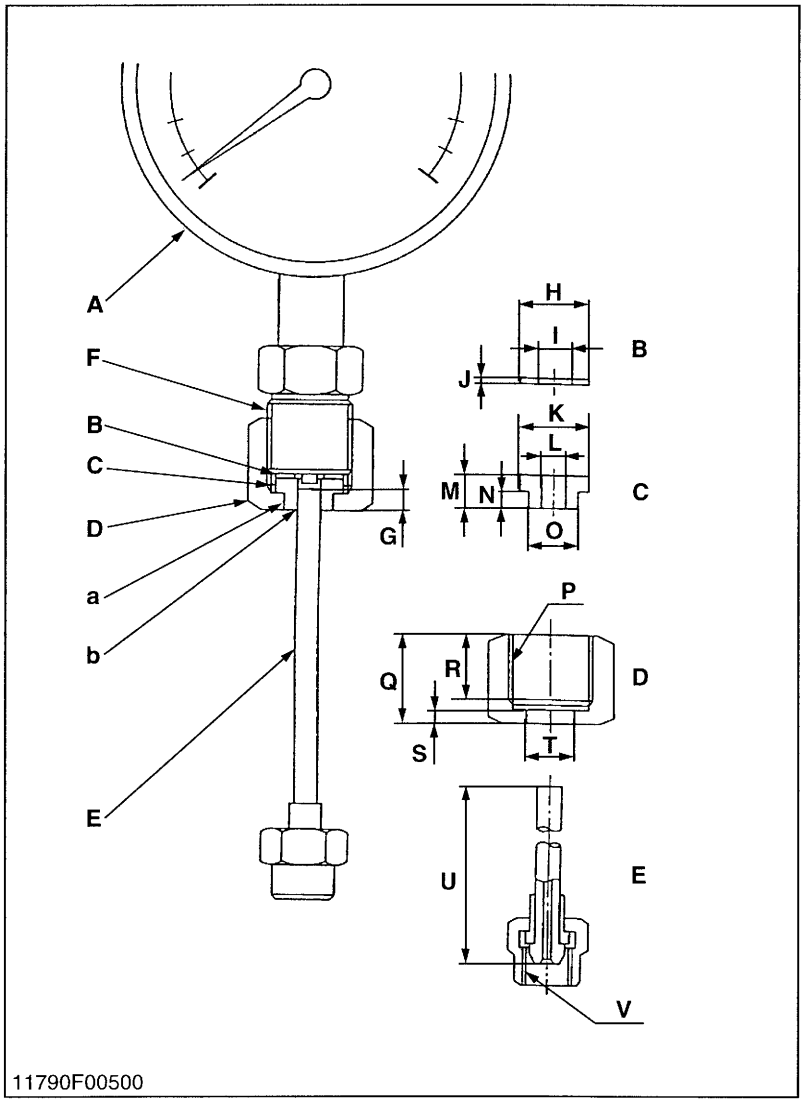
Application: Use to loosen and tighten the flywheel screw.

■ NOTE

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

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.)

11790G00800



11790F00500

Injection Pump Pressure Tester

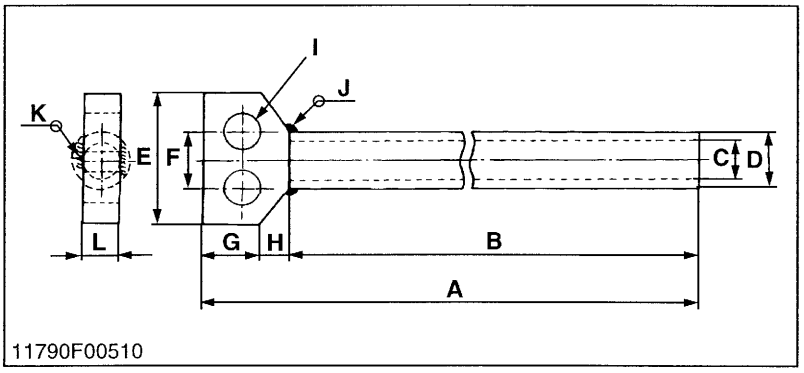
Application: Use to check fuel tightness of injection pumps.

■ 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

11790G00810



11790F00510

Draft Control Test Bar

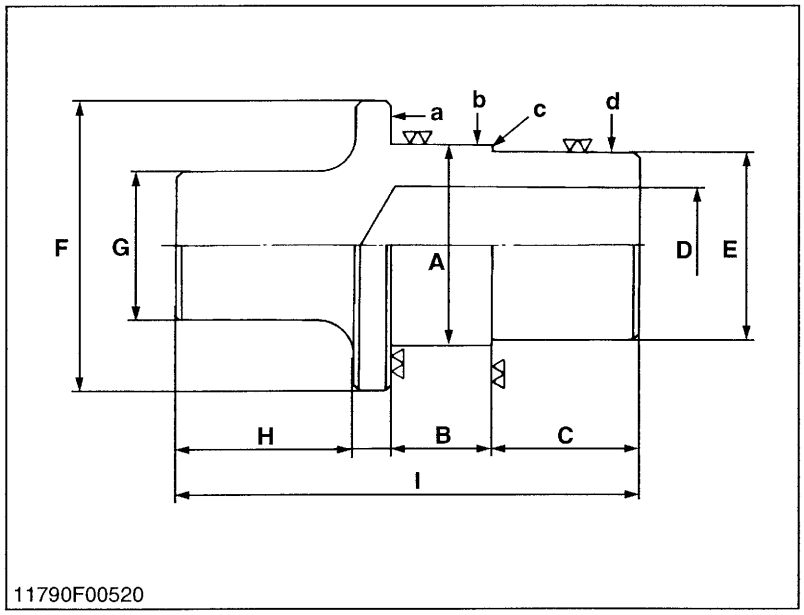
Application: Use for checking the lift range and floating range of hydraulic draft control.

■ NOTE

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

A	1045 mm (41.14 in.)
B	1000 mm (29.37 in.)
C	20 mm DIA. (0.79 in. DIA.)
D	30 mm DIA. (1.18 in. DIA.)
E	90 mm (3.54 in.)
F	30 mm (1.18 in.)
G	30 mm (1.18 in.)
H	15 mm (0.59 in.)
I	20 mm DIA. (0.79 in. DIA.)
J	Weld all around
K	Weld all around
L	20 mm (0.79 in.)

11790G00821



11790F00520

■ **NOTE**

- **Unless otherwise specified : All surface 12.5 μm (500 μin.)**

Hydraulic Arm Shaft Bushing Press-Fitting Tool

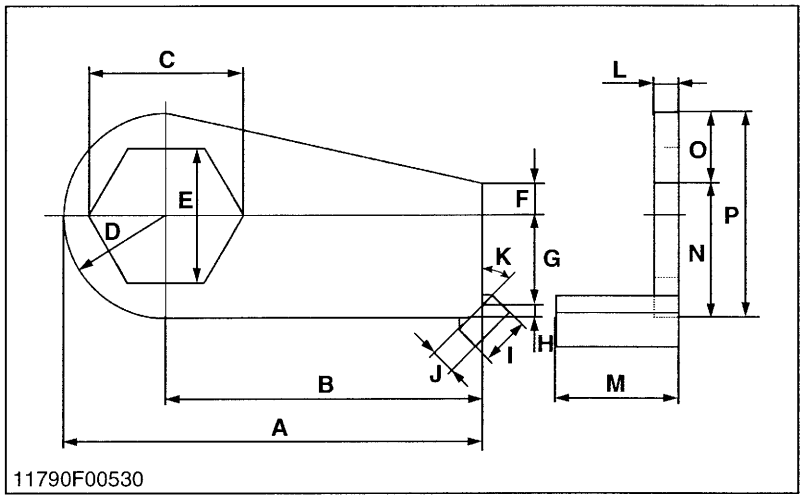
Application: Use for replacing the hydraulic arm shaft bushings in the hydraulic cylinder body.

■ **NOTE**

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

	Right	Left
A	54.7 to 54.9 mm 2.1535 to 2.1614 in.	49.7 to 49.9 mm 1.9567 to 1.9646 in.
B	22.5 to 23.5 mm 0.729 to 0.767 in.	18.5 to 19.0 mm 0.886 to 0.925 in.
C	55 mm (2.10 in.)	60 mm (2.36 in.)
D	32 mm (1.26 in.)	30 mm (1.18 in.)
E	49.7 to 49.9 mm 1.9567 to 1.9646 in.	44.7 to 44.9 mm 1.7598 to 1.7677 in.
F	70 mm dia. 2.76 in. dia.	70 mm dia. 2.76 in. dia.
G	40 mm dia. 1.57 in. dia.	40 mm dia. 1.57 in. dia.
H	50 mm (1.97 in.)	50 mm (1.97 in.)
I	130 mm (5.12 in.)	130 mm (5.12 in.)
a	6.3 μm (250 μin.)	6.3 μm (250 μin.)
b	6.3 μm (250 μin.)	6.3 μm (250 μin.)
c	6.3 μm (250 μin.)	6.3 μm (250 μin.)
d	6.3 μm (250 μin.)	6.3 μm (250 μin.)

11790G00830



11790F00530

Locking Wrench

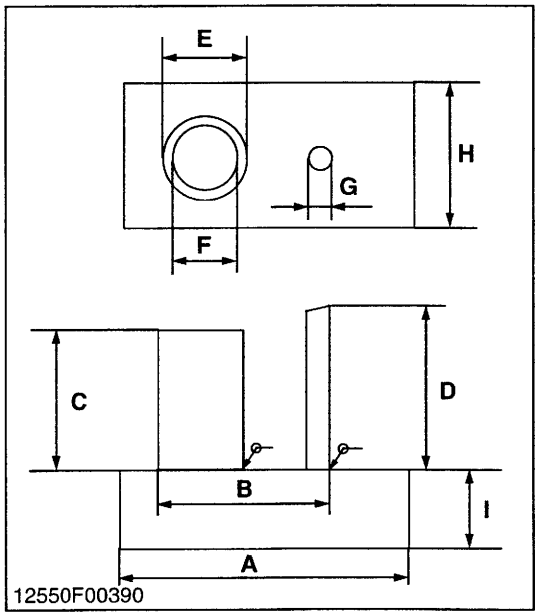
Application: Use for locking a pinion nut.

■ **NOTE**

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

A	170 mm (6.69 in.)
B	130 mm (5.12 in.)
C	63.5 mm (2.5 in.)
D	R40 (1.57)
E	55 mm (2.17 in.)
F	15 mm (0.59 in.)
G	35 mm (1.38 in.)
H	5 mm (0.2 in.)
I	20 mm (0.55 in.)
J	10 mm (0.39 in.)
K	45° (0.78 rad.)
L	10 mm (0.39 in.)
M	50 mm (1.97 in.)
N	55 mm (2.17 in.)
O	25 mm (0.97 in.)
P	80 mm (3.15 in.)

11790G00840



12550F00390

Shuttle Case Assembling Stand

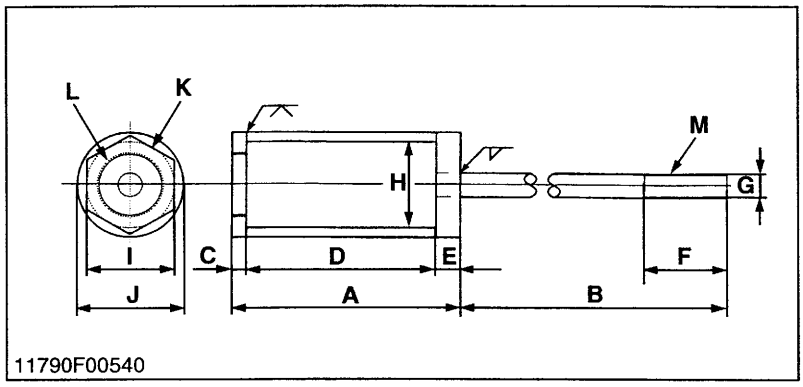
Application: Use for assembling the shuttle case.

■ NOTE

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

A	300 mm (11.81 in)
B	193 mm (7 60 in.)
C	175 mm (6.89 in.)
D	195 mm (7 68 in.)
E	85 mm dia (3.35 in. dia.)
F	75 mm dia. (2.95 in. dia.)
G	21 mm dia. (0.83 in. dia.)
H	150 mm (5 91 in)
I	75 mm (2.95 in.)

12550G00380



11790F00540

Pinion Shaft Remover

Application: Use for removing a pinion shaft.

■ NOTE

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

A	106 mm (4.17 in)
B	350 mm (13 78 in)
C	6 mm (0.24 in)
D	90 mm (3.54 in.)
E	10 mm (0.39 in)
F	40 mm (1.57 in)
G	10 mm (0 39 in.)
H	35.6 mm (1.40 in)
I	36 mm (1.42 in.)
J	41.6 mm (1.64 in.)
K	Part code No. 3A201-41301 nut
L	M27 × P1.5
M	M10 × P1 25

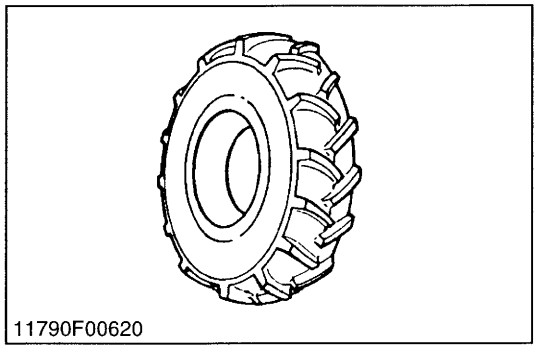
11790G00850

[10] TIRES

(1) Type of Tire

■ IMPORTANT

- **Do not use tires larger than specified.**


11790F00620

The following tires can be mounted on models M4900 and M5700.

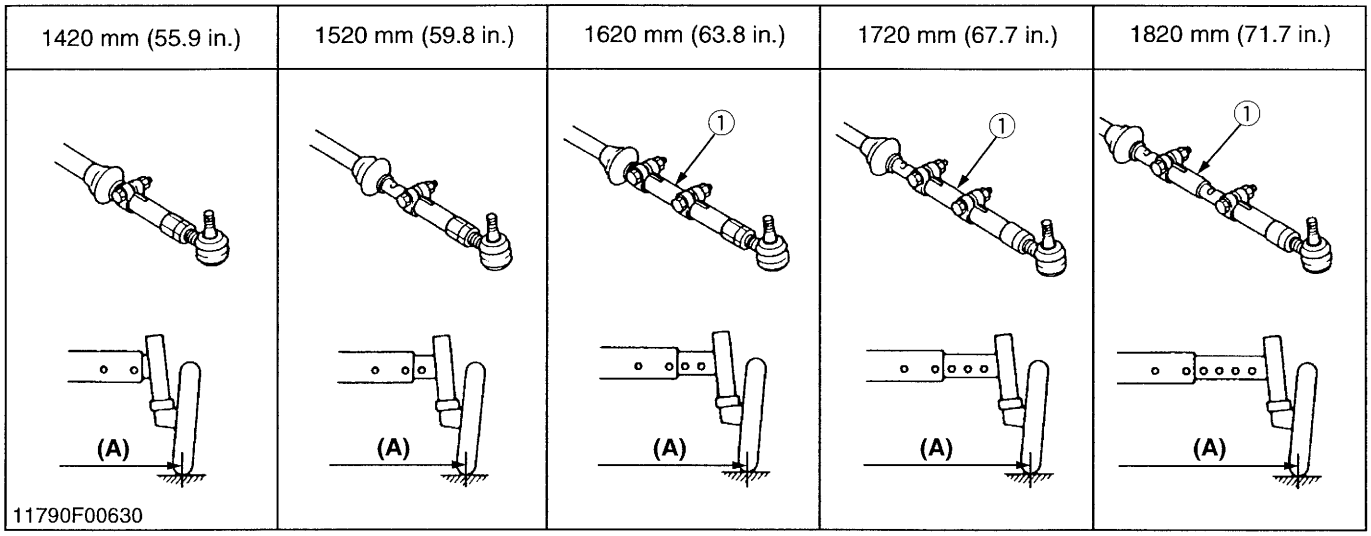
Model	Type of Tire	Front	Rear
M4900 [2WD]	Farm Tire	6.50 – 16, 6 PR	14.9 – 28, 6 PR
M4900 [4WD]		9.5 – 22, 6 PR	
M5700 [2WD]		7.50 – 16, 6 PR	16.9 – 28, 6 PR
M5700 [4WD]		9.5 – 22, 6 PR	

12550G00390

(2) Tread Adjustment

(2)-1 Front Wheels [2WD]

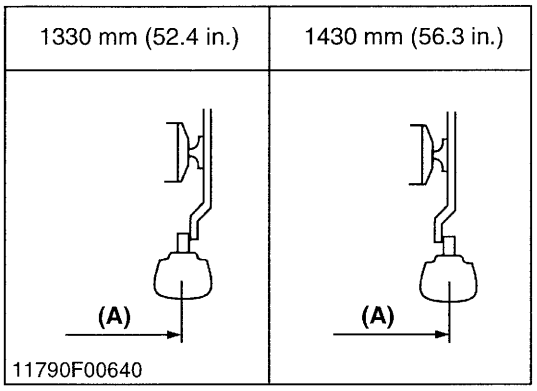
Front wheels can be adjusted.



(1) Extension **(A) Tread**

11790G00640

(2)-2 Front Wheels [4WD]



Front wheels can be adjusted.

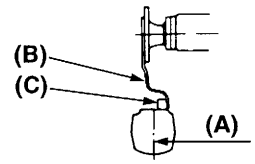
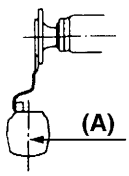
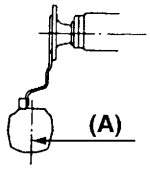
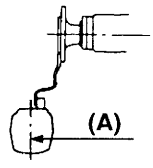
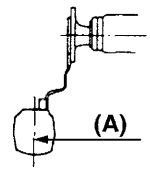
(A) Tread

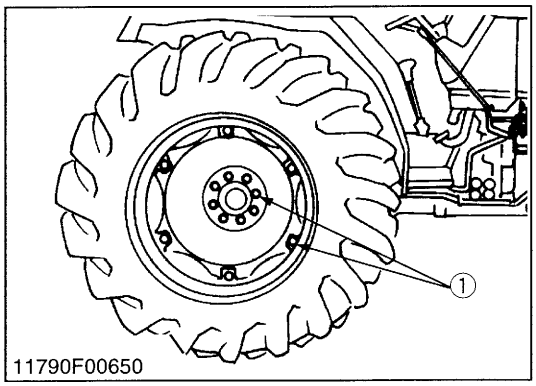
11790G00650

(2)-3 Rear Wheels

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

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

14.9-28	1320 mm (52.0 in.)	1420 mm (55.9 in.)	1520 mm (59.8 in.)	1620 mm (63.8 in.)	1720 mm (67.7 in.)
16.9-28	–	1420 mm (55.9 in.)	1520 mm (59.8 in.)	1620 mm (63.8 in.)	1720 mm (67.7 in.)
 11790F00660					



11790F00650

⚠ CAUTION

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

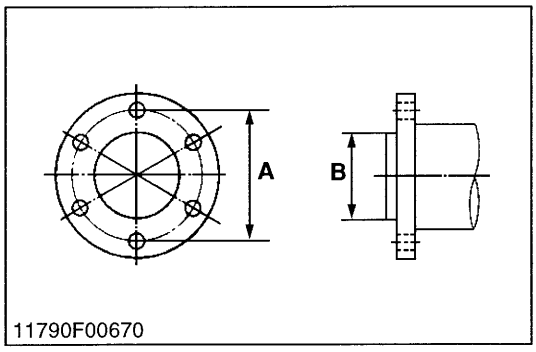
■ IMPORTANT

- **Always attach tires as shown in the drawings above.**
- **If not attached as illustrated, transmission parts may be damaged.**
- **Do not use tires larger than specified.**
- **When re-fitting or adjusting a wheel, tighten the nuts to the following torques then recheck after driving the tractor 200 m (200 yards) and thereafter daily check service.**

(1) Rear Wheel Mounting Nut and Rear Disc Mounting Nut [Refer to "**Checking Wheel Mounting Nuts Tightening Torque**". (See page G-16)]

(A) Tread
(B) Rear Wheel Disc
(C) Rear Wheel Rim

11790G00660



11790F00670

- Wheel Hub Dimension

	Front wheel hub	Rear wheel hub
Screw circle diameter **(A)**	152.4 mm (6 in.)	203.2 mm (8 in.)
Number of screw	6	8
Screw size	M14 × 1.5	M16 × 1.5
Hub pilot diameter **(B)** [4WD]	117.4 mm (4.625 in.)	152.4 mm (6 in.)
Hub pilot diameter **(B)** [2WD]	114.0 mm (4.488 in.)	

11790G00670

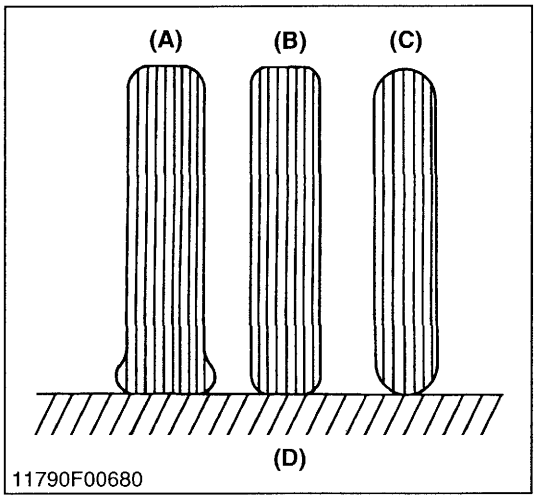
(4) Tire Pressure

CAUTION

- **Do not attempt mount a tire. This should be done by a qualified person with the proper equipment.**

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.**



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

Recommended Inflation Pressure

- Maintain the pressure shown below for normal use.

	Tire sizes	Inflation pressure
Front	6.50 – 16, 6PR	318 kPa (3.25 kgf/cm^2, 46 psi)
	7.50 – 16, 6PR	274 kPa (2.8 kgf/cm^2, 40 psi)
	9.50 – 22, 6PR	196 kPa (2.0 kgf/cm^2, 29 psi)
Rear	14.9 – 28, 6PR	138 kPa (1.4 kgf/cm^2, 20 psi)
	16.9 – 28, 6PR	147 kPa (1.5 kgf/cm^2, 22 psi)

NOTE

- **Maintain the maximum pressure in front tires, if using a front loader of when equipped with lots of front weight.**

(A) Insufficient
(B) Standard
(C) Excessive
(D) Ground

11790G00681

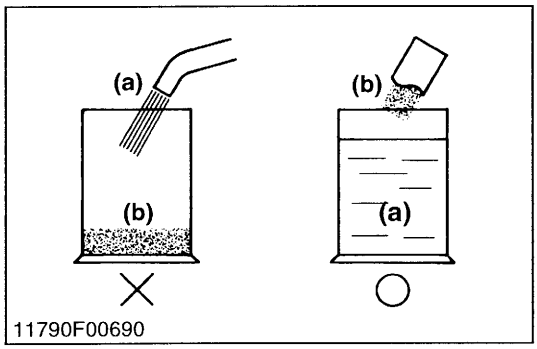
(5) Tire Liquid Injection

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

Another way is to inject water or another liquid, such as a calcium chloride solution in the tires. Water must not be used in winter since it freezes at 0 °C (32 °F). The calcium chloride solution will not freeze and moreover, affords higher effect than water since its specific gravity is higher than that of water by about 20 %. Below is an explanation of calcium chloride solution injection.

■ IMPORTANT

- **Do not fill the front tires with liquid.**



11790F00690

Preparation of Calcium Chloride Solution

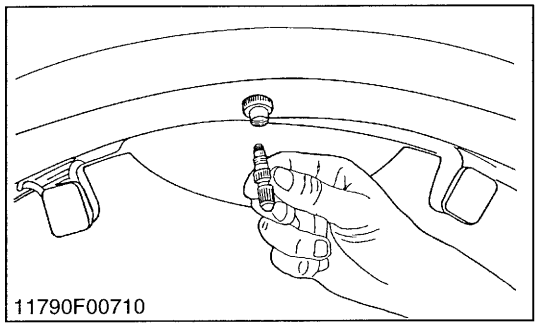
⚠ CAUTION

- **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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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. 07916-52501)

(1) Injector (2) Hose

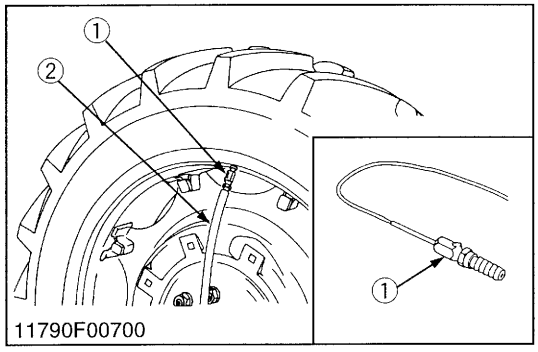

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Fig. 1

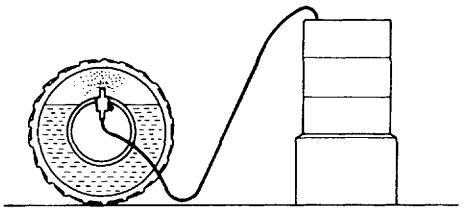


Fig. 2

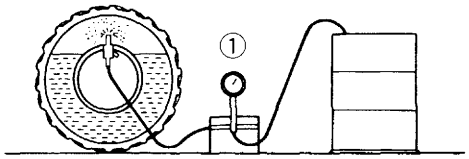
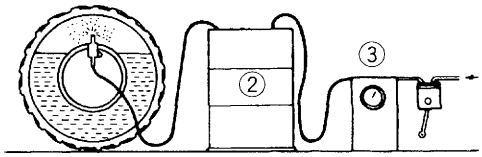


Fig. 3



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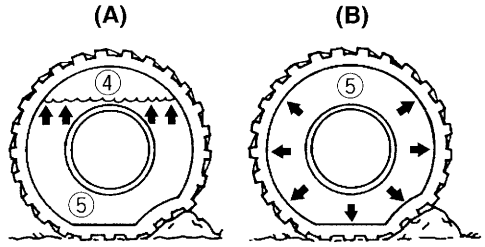

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Injection

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	14.9 - 28	16.9 - 28
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]	230 kg (507 lbs.)	295 kg (651 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]	247 kg (545 lbs.)	317 kg (699 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]	260 kg (574 lbs.)	339 kg (747 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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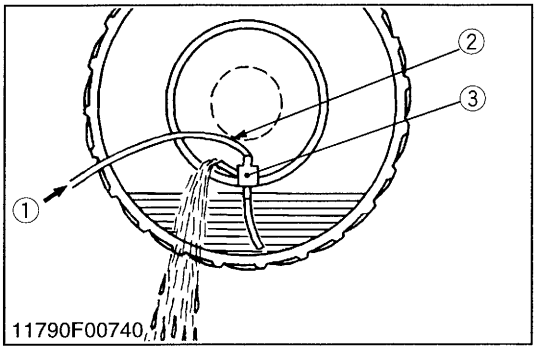

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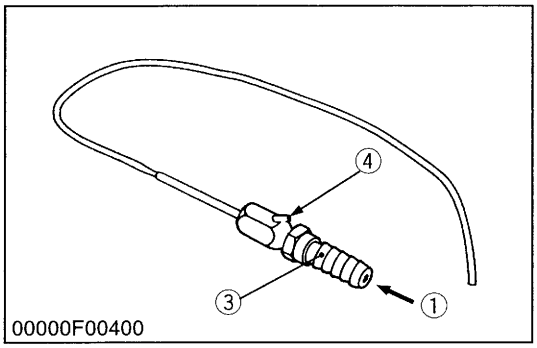

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Draining Water or Solution

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

(1) Compressed Air
(2) Hose
(3) Injector
(4) Vent

11790G00720

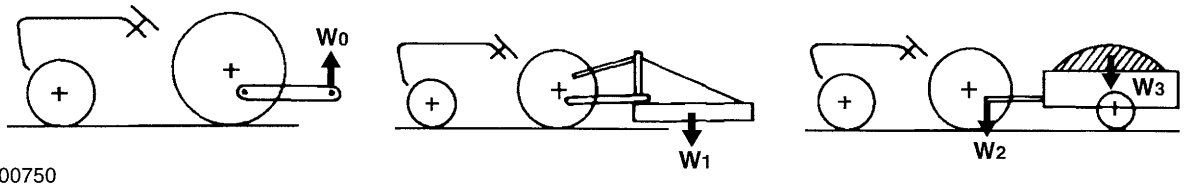
[11] IMPLEMENT LIMITATIONS

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. lifting capacity W_0
Front		Rear	
2WD	4WD		
1820 mm (71.7 in.)	1430 mm (56.3 in.)	1720 mm (67.7 in.)	1900 kg (4190 lbs.)

	Actual figures		
	Implement weight W_1 and / or size	Max. Drawbar Load W_2	Trailer loading weight W_3 Max. capacity
M4900	As in the following list (Shown on the next page)	1000 kg (2200 lbs.)	4000 kg (8800 lbs.)
M4900DT			4500 kg (9900 lbs.)
M5700			4000 kg (8800 lbs.)
M5700DT			4500 kg (9900 lbs.)

Lower link end max. hydraulic lifting capacity ..... W_0
Implement weight ..... The implement's weight which can be put on the lower link : W_1
Max. drawbar load ..... W_2
Trailer loading weight ..... The max. loading weight for trailer (without trailer's weight) : W_3



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NOTE :

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

12550G00400

No.	Implement		Remarks			M4900, M5700	
						2WD	4WD
1	Slurry Tank		Max. Tank Capacity		L (gals.)	3000 (790)	
			Max. Load Capacity		kg (lbs.)	4000 (8800)	
2	Trailer		Max. Load Capacity		kg (lbs.)	4000 (8800)	4500 (9900)
			Max. Draw bar Load		kg (lbs.)	1000 (2200)	
3	Mower	Rotary-Cutter-	Max. Cutting Width		mm (in.)	2130 (84)	
			Max. Weight		kg (lbs.)	540 (1200)	
		Flail Mower (Heavy)	Max. Cutting Width		mm (in.)	3050 (120)	
			Max. Weight		kg (lbs.)	800 (1760)	
		Sickle Bar	Max. Cutting Width		mm (in.)	2130 (84)	
4	Sprayer		Max. Tank-capacity	Mid	L (gals.)	680 (180)	
				Rear 3P	L (gals.)	680 (180)	
				Drawbar	L (gals.)	3000 (800)	3500 (920)
5	Rotary Tiller		Max. Tilling Width		mm (in.)	2130 (84)	
			Max. Weight		kg (lbs.)	800 (1760)	
6	Bottom Plow		Max. Size			16 in. × 2 18 in. × 1	14 in. × 3 16 in. × 2 18 in. × 1
			Max. Weight		kg (lbs.)	450 (1000)	
7	Disc-harrow	3P Type	Max. Size			18 in.× 24	
			Max. Harrowing Width		mm (in.)	2130 (84)	
			Max. Weight		kg (lbs.)	450 (1000)	
		Drawbar Type	Max. Harrowing Width		mm (in.)	2450 (96)	2750 (108)
8	Disc Plow		Max. Size			24 in. × 3 26 in. × 2	
			Max. Weight		kg (lbs.)	450 (1000)	
9	Sub Soiler		Numbers of Cultivating Tines			2	
			Cultivating Depth		mm (in.)	300 (12)	400 (16)
10	Cultivator		Max. Width		mm (in.)	3050 (120)	3660 (144)
			Number of Rows			4	
			Max. Weight		kg (lbs.)	450 (1000)	
11	Front Blade*		Max. Cutting Width		mm (in.)	1820 (72)	
			Max. Oil Pressure		MPa (kgf/cm^2)	19.1 (195)	
12	Rear Blade		Max. Cutting Width		mm (in.)	1820 (72)	
			Max. Oil Pressure		MPa (kgf/cm^2)	19.1 (195)	
13	Front Loader*		Max. Lifting Capacity		kgf (lbs.)	1000 (2200)	
			Max. Oil Pressure		MPa (kgf/cm^2)	18.6 (190)	
14	Box Blade		Max. Cutting Width		mm (in.)	1820 (72)	
			Max. Weight		kg (lbs.)	450 (1000)	
15	Back Hoe		Max. Digging Depth		mm (in.)	2530 (100)	
			Max. Weight		kg (lbs.)	900 (2000)	
16	Snow Blade		Max. Width		mm (in.)	1820 (72)	
			Max. Weight		kg (lbs.)	450 (1000)	

NOTE :

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

*** Must remove front weight with this implement.**

12550G00410

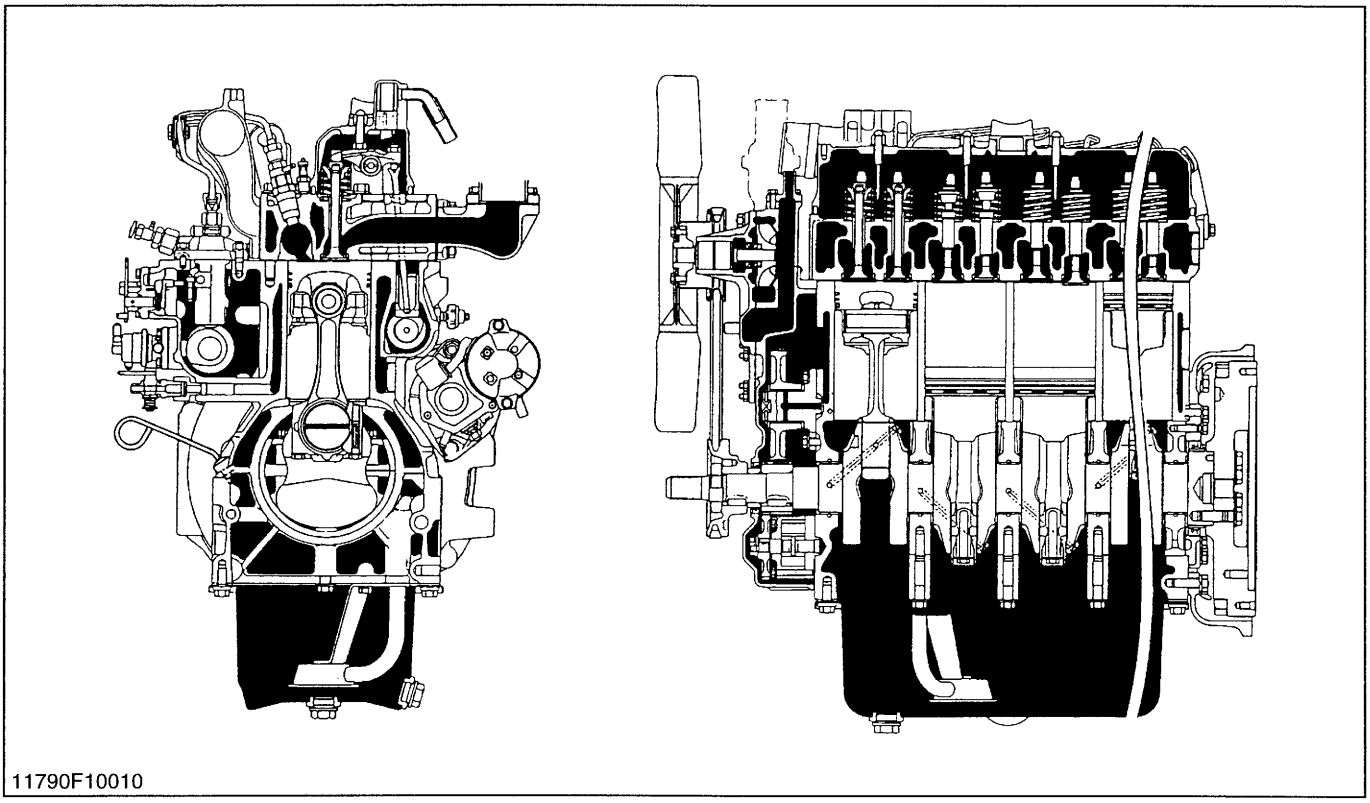
1 ENGINE

1 ENGINE

MECHANISM

CONTENTS

[1] FEATURES



11790F10010

The F2803-ELA and F2803-EA are vertical, water-cooled, 4 cycle diesel engines. They are incorporated KUBOTA's foremost technologies. With KUBOTA's E-TVCS (Three Vortex Combustion System), well-known Bosch type injection pump and the well-balanced designs, they give greater power, low fuel consumption, little vibration and quiet operation.

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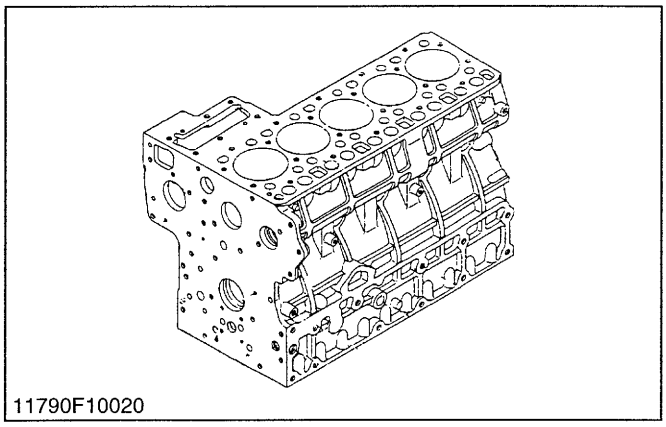
[2] ENGINE BODY

(1) Cylinder Block



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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 had its own chamber.

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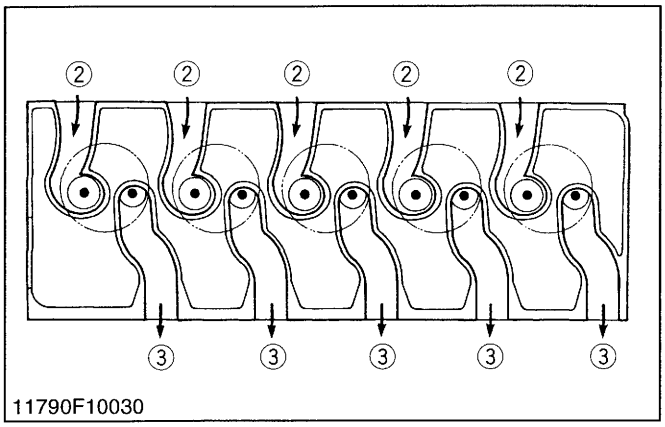
(2) Cylinder Head



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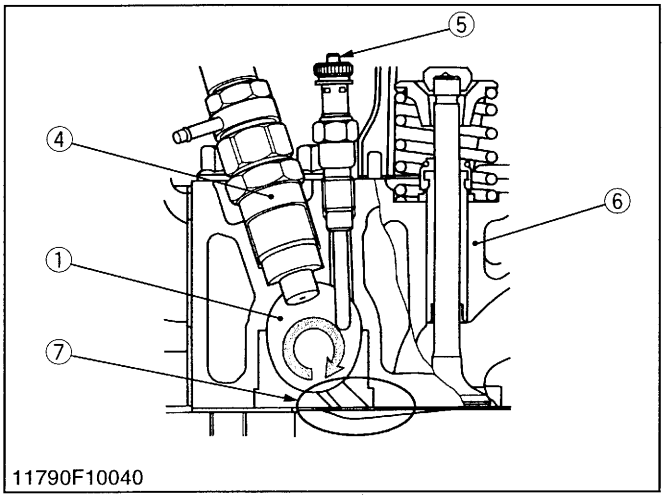

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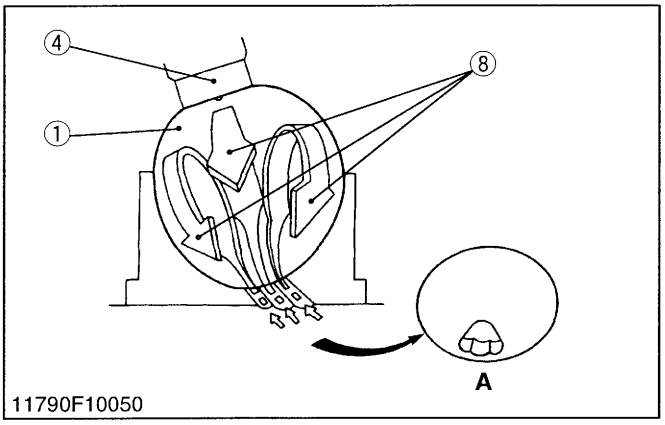


11790F10050

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.

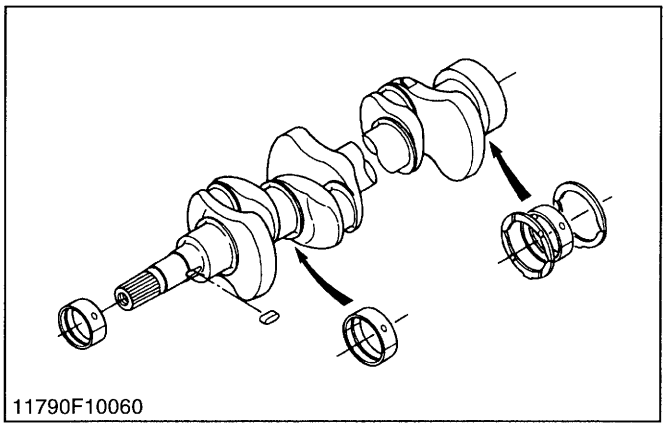
In the combustion chamber are installed throttle type injection nozzle and rapid heating sheathed type glow plug. This glow plug assures easier than ever engine starts even at –15 ˚C (5 ˚F).

(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

11790M10030

(3) Crankshaft


11790F10060

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

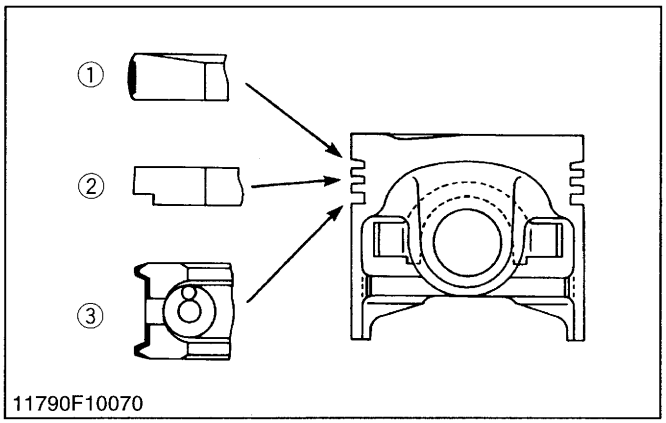
The crankshaft is made of tough special alloy steel, and the journals, pins and oil seal sliding portions are induction hardened to increase the hardness for higher wear resistance.

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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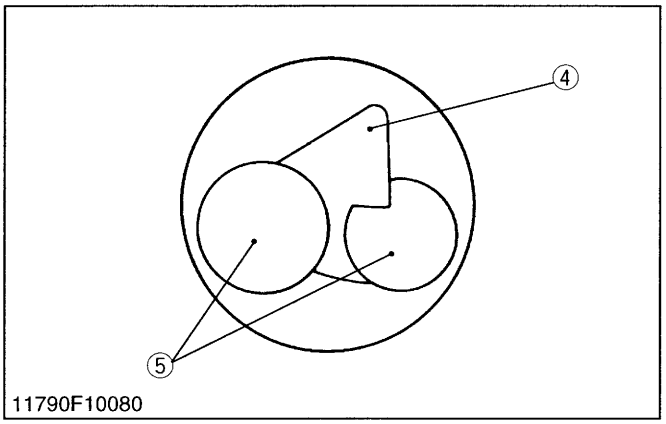


11790F10080

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.

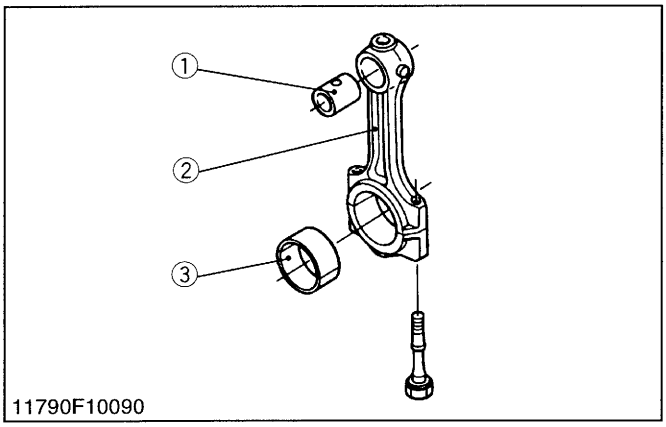
The oil ring (3) has chamfered contact faces and an expander ring, which increase the pressure of the oil ring against the cylinder wall.

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

11790M10050

(5) Connecting Rod



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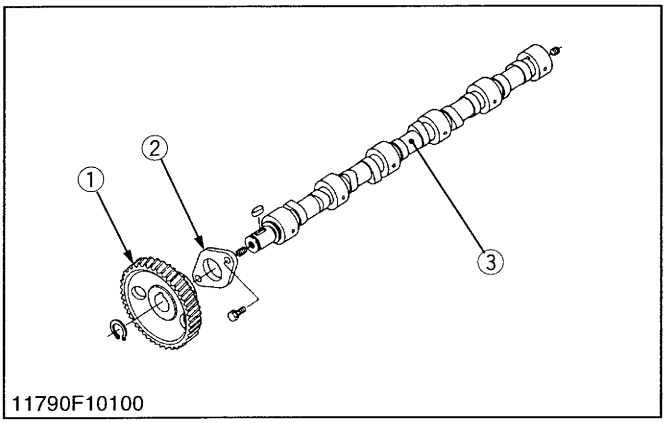
The connecting rod (2) is used to connect the piston with the crankshaft.

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

11790M10060

(6) Camshaft



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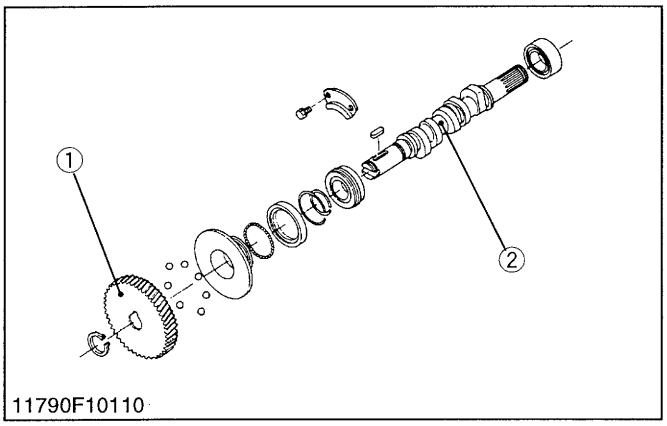
The camshaft (3) is made of special cast iron, and the journal and cam sections are quenched to resist wear.

The journal sections are force-lubricated.

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

11790M10070

(7) Fuel Camshaft



11790F10110

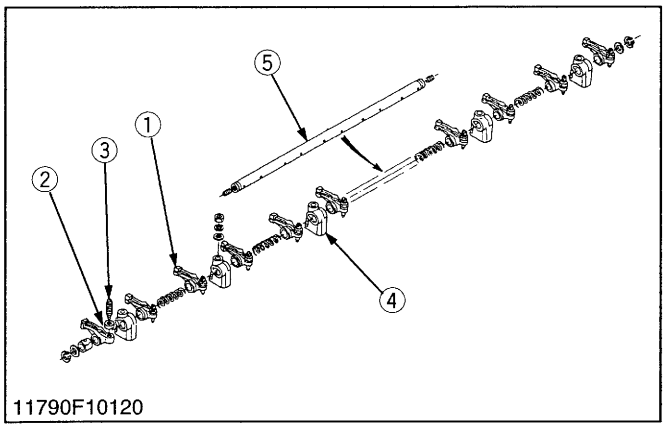
The fuel camshaft (2) controls the reciprocating movement of the injection pump.

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

11790M10080

(8) Rocker Arm



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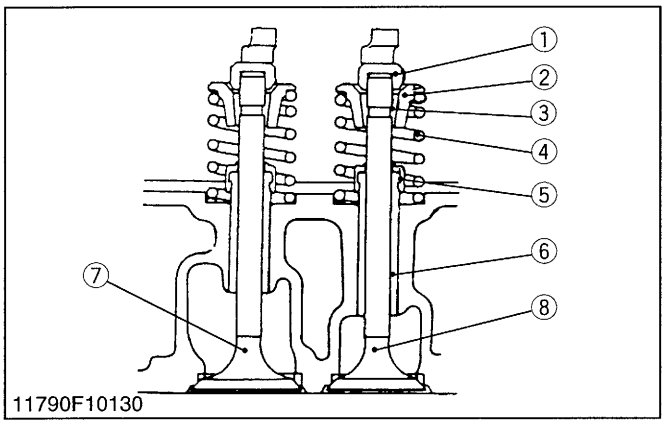
The rocker arm assembly includes the rocker arms (1), rocker arm brackets (4) and rocker arm shaft (5), and converts the reciprocating movement of the push rods to an open / close movement of the intake and exhaust valves.

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

11790M10090

(9) Intake and Exhaust Valve



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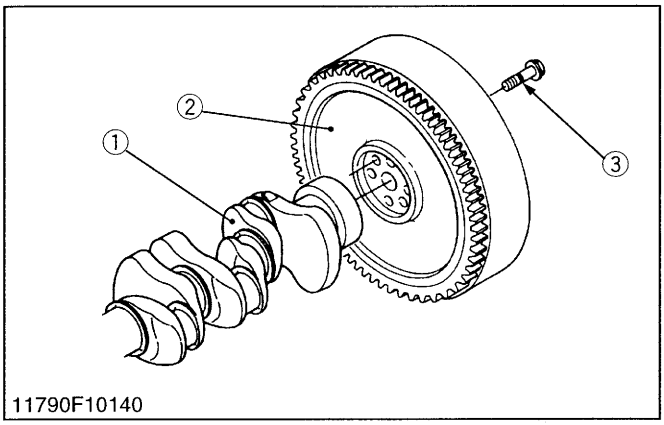
The intake and exhaust valves (7), (8) and their guides (6) are different from each other. Other parts, such as valve springs (4), valve spring retainers (2), valve spring collets (3), valve stem seals (5) and valve caps (1) are the same for both the inlet and exhaust valves. All contact or sliding parts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



11790F10140

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.

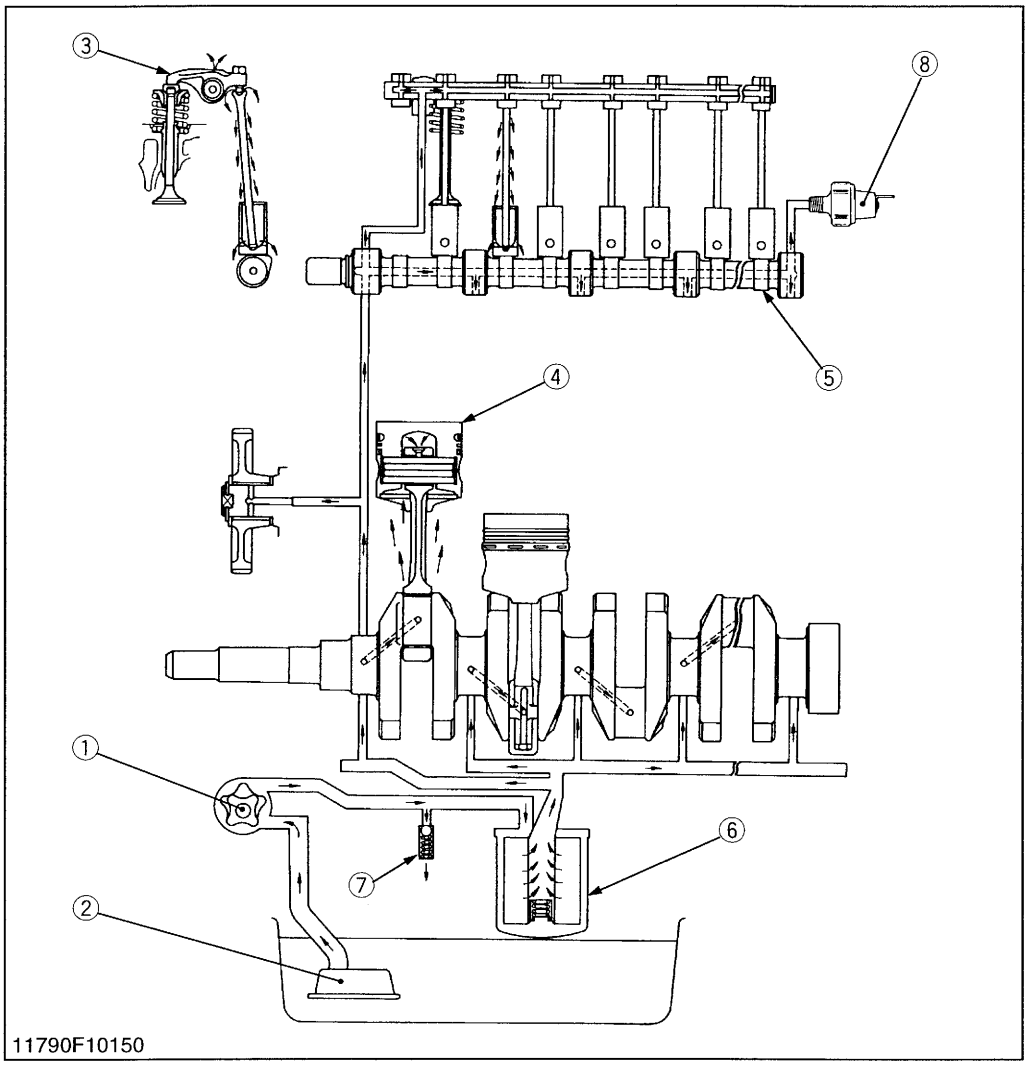
The flywheel has a ring gear, which mesh with the drive pinion of the starter.

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 mark of window on the clutch housing.

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

11790M10110

[3] LUBRICATING SYSTEM



11790F10150

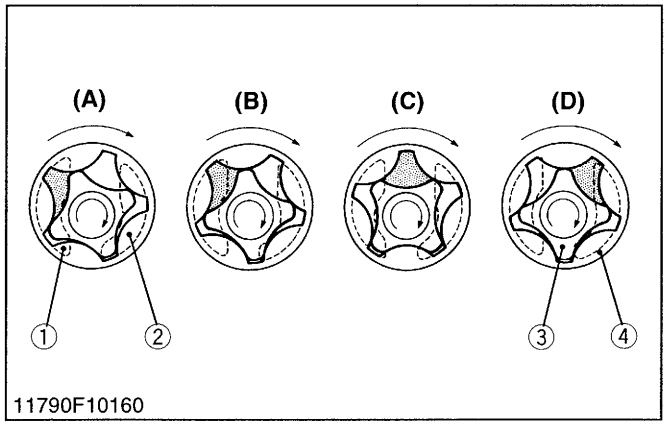
(1) Oil Pump
(2) Oil Strainer
(3) Rocker Arm and Rocker Arm Shaft
(4) Piston
(5) Camshaft
(6) Oil Filter Cartridge
(7) Relief Valve
(8) Oil Pressure Switch

This engine's lubricating system consists of oil strainer, oil pump, relief valve, oil filter cartridge and oil pressure switch. 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, connecting rods, idle gear, camshaft and rocker arm shaft 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, cylinders, small ends of connecting rods, tappets, pushrods, inlet and exhaust valves and timing gears.

11790M10120

(1) Oil Pump



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

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

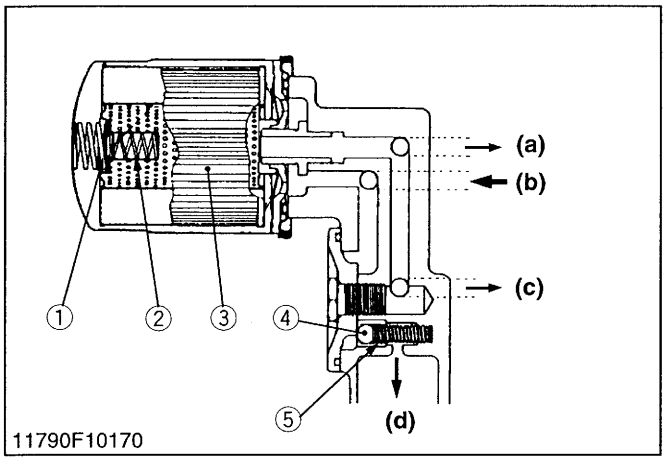
When the rotors rotate to **(C)**, the port to which the space leads is changed from inlet to outlet.

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

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

11790M10130

(2) Oil Filter and Relief Valve



The lubricating oil force-fed by the pump is filtered by the filter cartridge, passing through the filter element from the outside to the inside. When the filter element accumulates dirt and the pressure difference between the inside and outside rises more than 98 kPa (1.0 kgf/cm^2, 14 psi), the bypass valve (1) opens to allow the oil to flow from the inlet line to outlet line, bypassing the filter element.

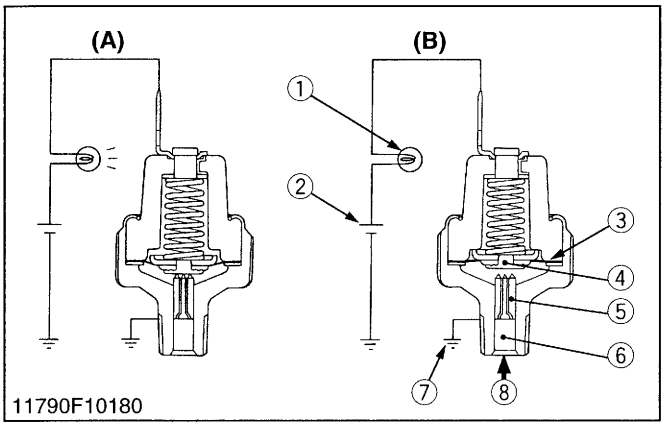
The relief valve (4) in the inlet line allows oil to prevent damage to the lubricating system, when the oil pressure rises more than 441 kPa (4.5 kgf/cm^2, 64 psi).

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

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

11790M10140

(3) Engine Oil Pressure Switch



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

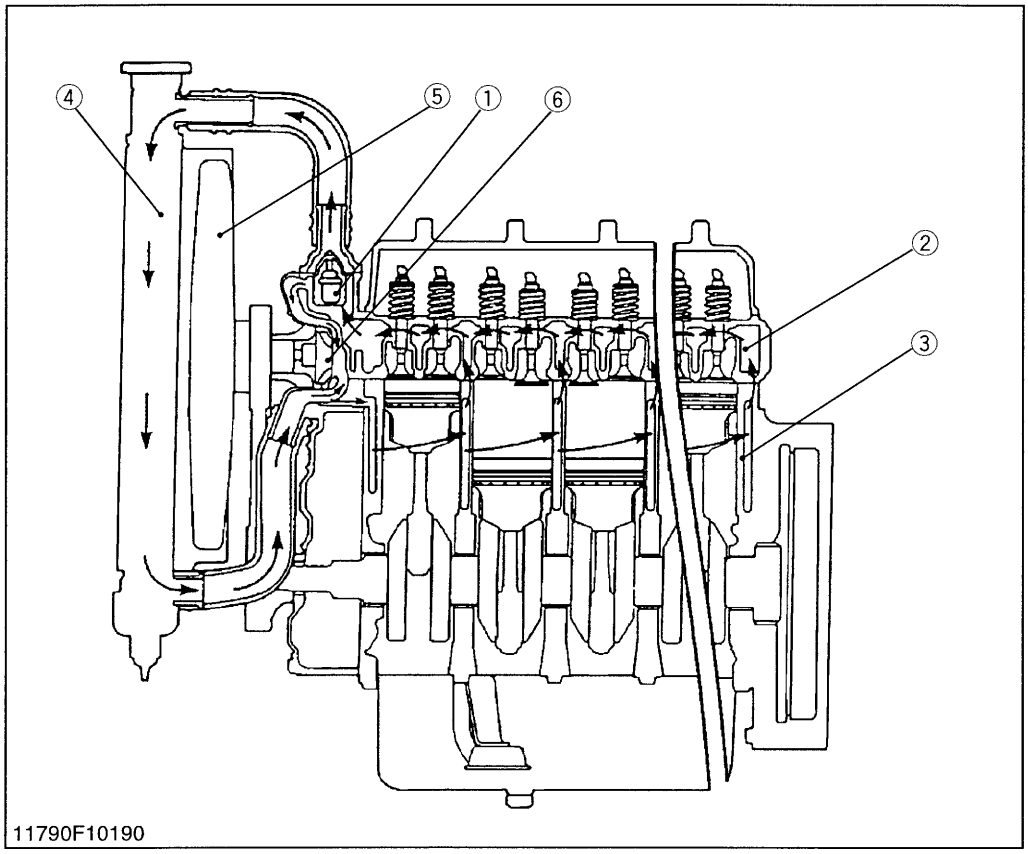
When the oil pressure falls below the specified value, the contacts of the oil pressure switch closes to turn on the warning lamp (1).

(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

11790M10150

[4] COOLING SYSTEM



11790F10190

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

The cooling system consists of a radiator (4), a centrifugal water pump (6), a cooling fan (5) and a thermostat (1).

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

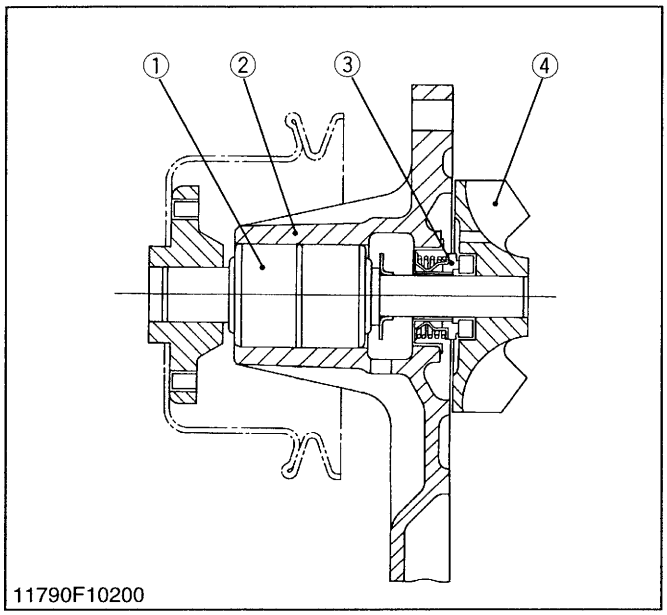
The water pump receives water from the radiator or from the cylinder head and force it into the cylinder block.

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. 71 °C (159.8 °F).

11790M10160

(1) Water Pump



11790F10200

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.

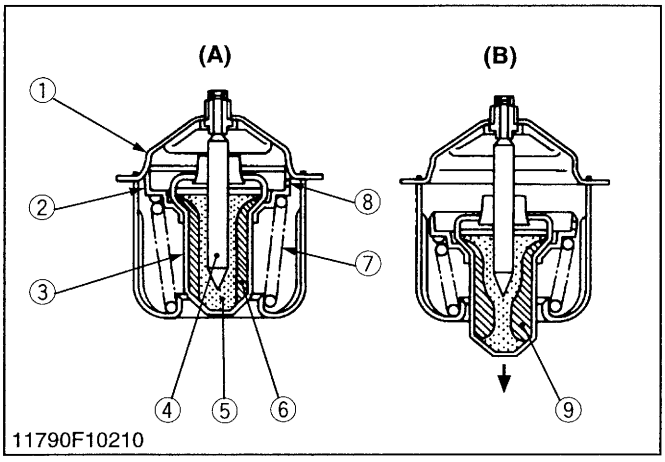
The rotating impeller (4) in the water pump receives cool water from the bottom of the radiator and the water jacket of cylinder head, and sends it into the water jacket in the cylinder block.

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

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

11790M10170

(2) Thermostat



11790F10210

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

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

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

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

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

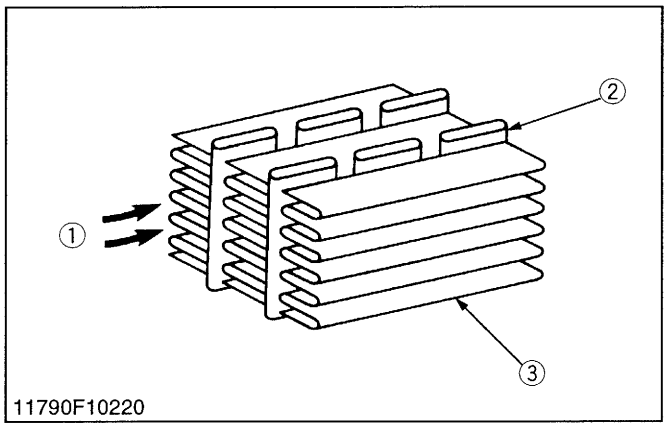
As the water temperature rises, the wax in the pellet (3) turns liquid and expands, repelling the spindle (4).

The pellet lowers and the valve (2) opens to send the cooling water to the radiator.

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

11790M10180

(3) Radiator



11790F10220

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

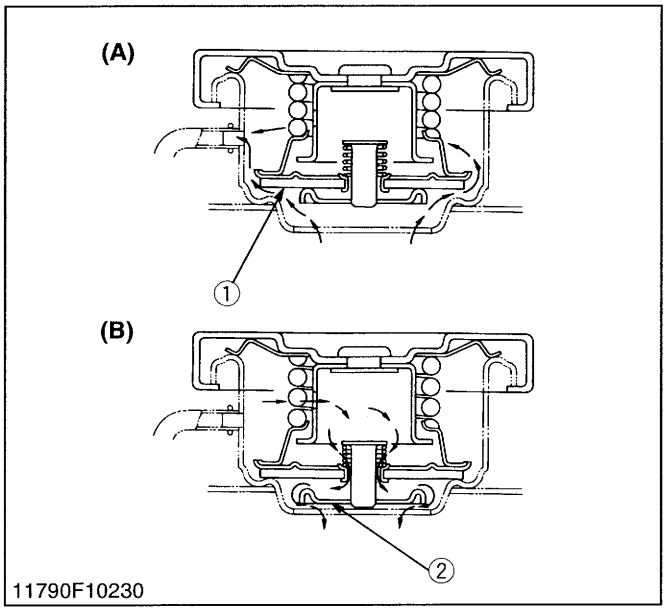
The water in the radiator is cooled by the air flowing through between the tube wall and the fin.

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

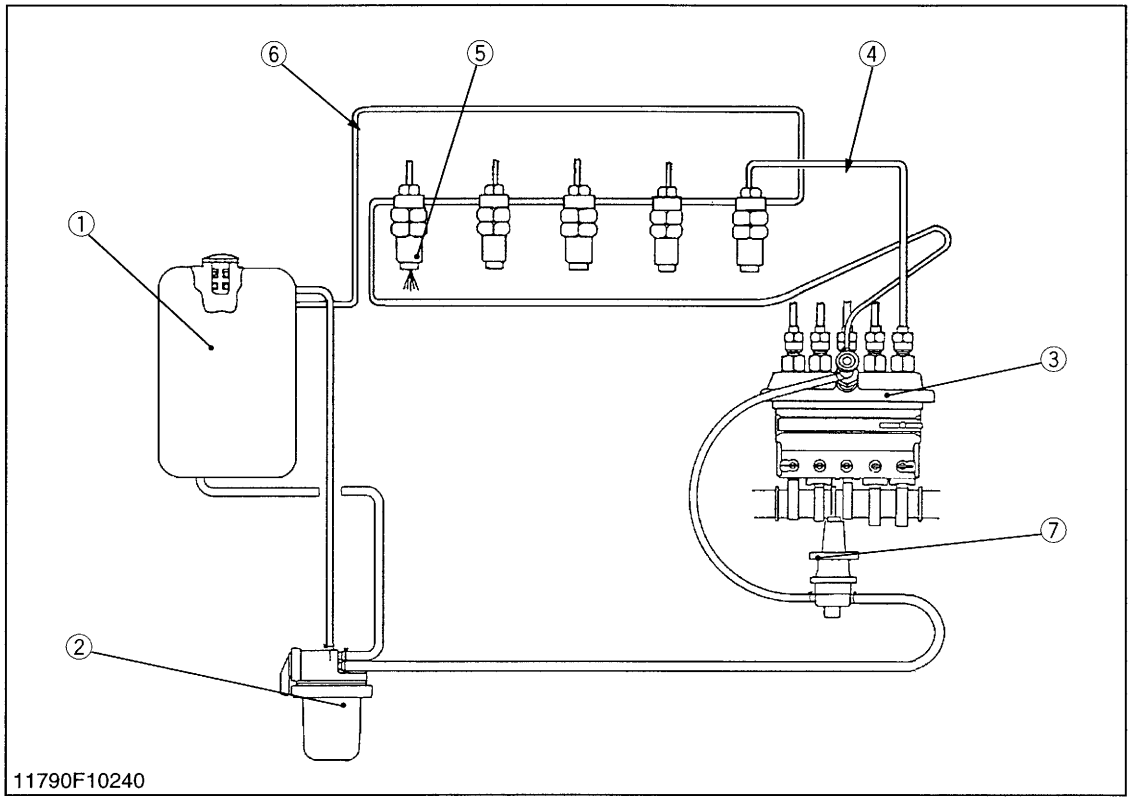
When the water temperature falls and a vacuum is formed in the radiator, the vacuum valve (2) opens to allow the air to enter the radiator.

(1) Pressure Valve
(2) Vacuum Valve

11790M10200

[5] FUEL SYSTEM

(1) Fuel Lines



11790F10240

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

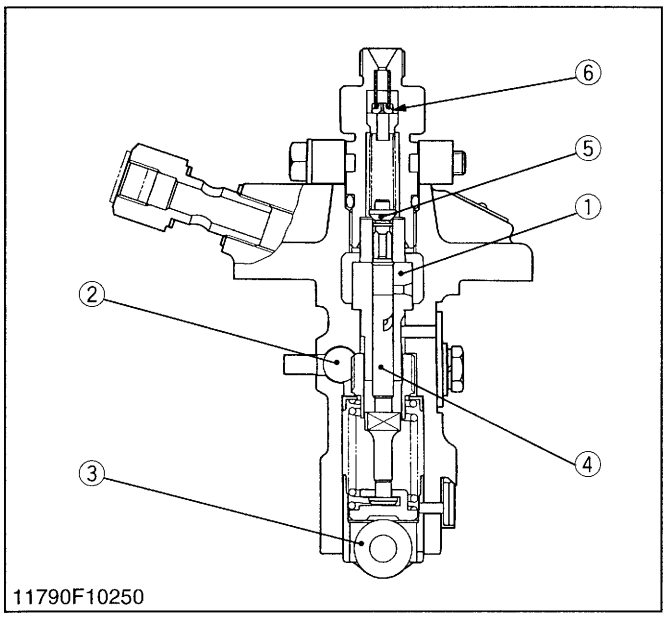
Fuel from the fuel tank (1) passes through the fuel filter (2), and then enters the injection pump (3) after impurities such as dirt, water, etc. are removed.

The fuel pressurized by the injection pump to the opening pressure (13.73 to 14.71 MPa, 140 to 150 kgf/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.

11790M10210

(2) Fuel Injection Pump



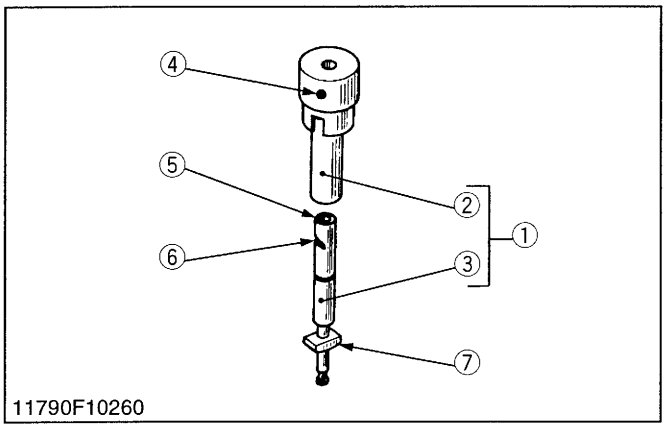
11790F10250

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

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

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

11790M10220



11790F10260

■ Pump Element

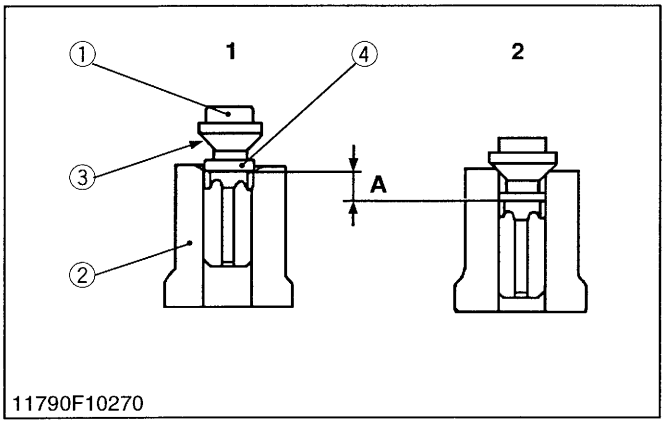
The pump element (1) is consist of the plunger (3) and cylinder (2).

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

11790M10230



11790F10270

■ 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

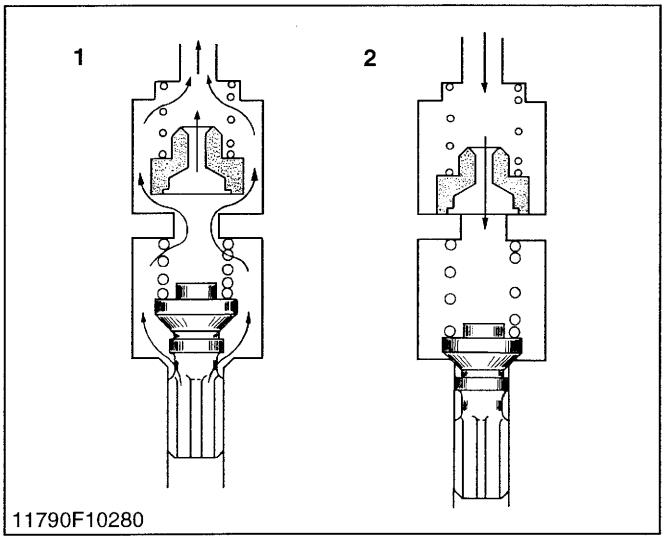
If the fuel flow reverse from the injection nozzle side when the plunger lowers, the time lag between the next delivery start and the nozzle injection start increases. To avoid this, the delivery chamber to injection pipe interruption by delivery valve (1) prevents this reverse flow, thus keeping fuel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

11790M10240



11790F10280

■ Dumping Valve

1. At fuel injection

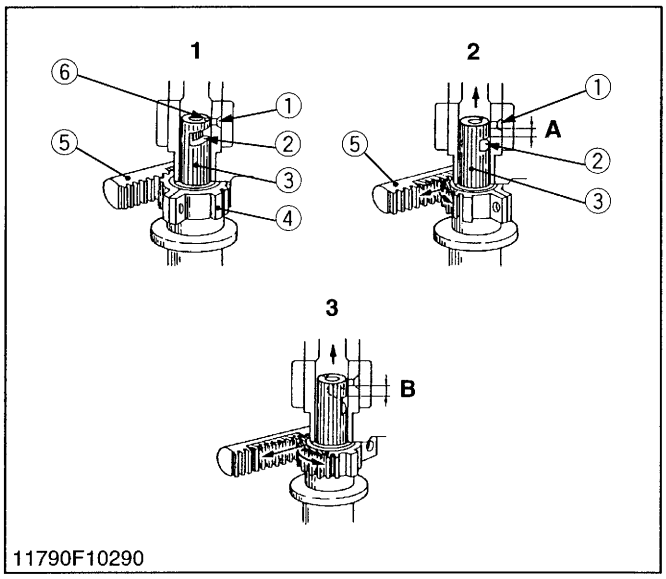
Since dumping valve is pushed up to press the spring, fuel is pressure-fed to injection nozzle the same as without dumping valve.

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.

11790M10250



■ Injection Control

1. No fuel delivery (Engine stop)

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

2. Partial fuel delivery

When the plunger (3) is rotated by the control rack (5) in the direction of arrow, the fuel is delivered to the injection nozzle.

The amount of fuel corresponds to the effective stroke **(A)** from closing the feed hole (1) by the plunger head to contact of the control groove (2) with the feed hole.

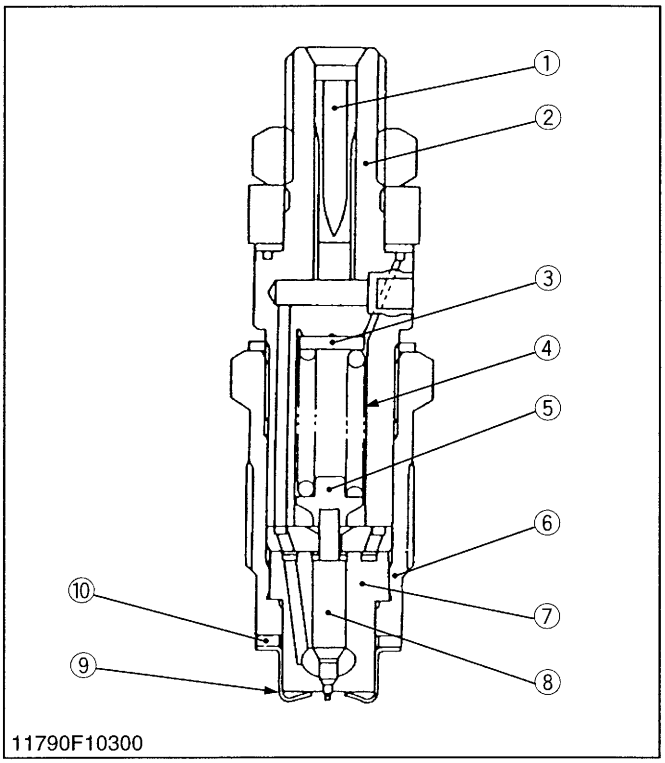
3. Maximum fuel delivery

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

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

11790M10260

(3) Fuel Injection Nozzle



Used as the injection nozzle, the small sized NIPPONDENSO made OPD mini nozzle is of a flat cut provided double throttle type.

This type of nozzle is designed to control the injection quantity when the lift rate is low at start of the injection, and to cut down on the knocking sound caused by excessive fuel injection by giving the needle valve section more taper than before to prevent the rapid increase in the injection quantity when the initial injection turns into the full-force injection.

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

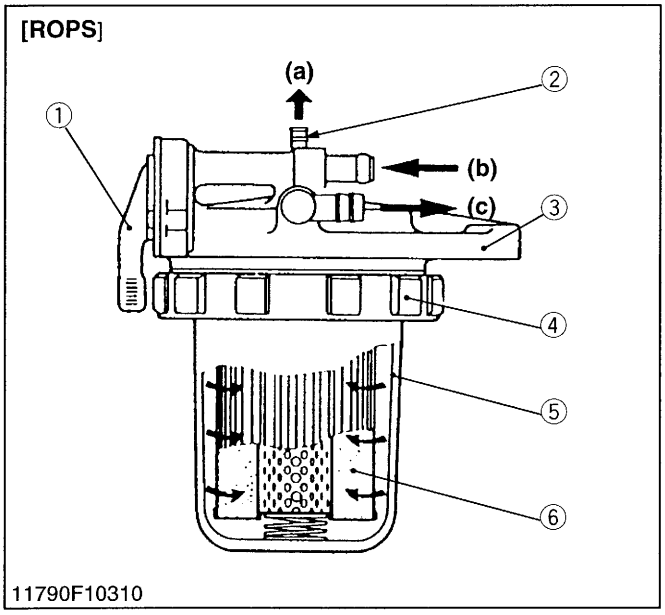
The heat seal is employed to improve the durability and reliability of the nozzle.

(1) Bar Filter
(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

11790M10270

(4) Fuel Filter

[ROPS]



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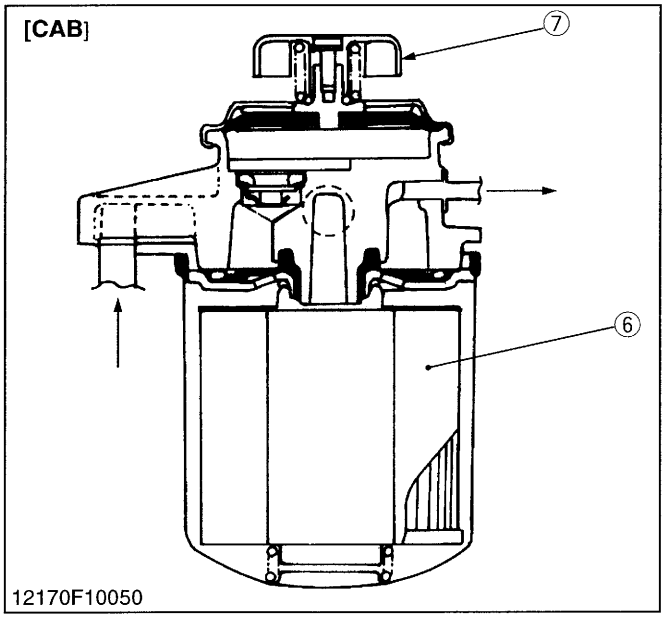
[CAB]



12170F10050

[ROPS]

The fuel filter removes dirt and water with its fine filter paper, which collects particles of 15 microns (0.00059 in.) at 20 kPa (0.2 kgf/cm^2, 3 psi).

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

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

[CAB]

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 (6) and passes through the filter element under its own pressure. As it passes through, the dirt and impurties in the fuel are filtered out, allowing only clean fuel to enter the interior of the filter element.

The feed pump (1) sends fuel from the fuel tank to the injection pump by applying pressure to fuel.

(1) Cock
(2) Air Vent
(3) Filter Bracket
(4) Retainer Ring
(5) Pot
(6) Filter Element
(7) Fuel Pump

(a) To Fuel Tank
(b) From Fuel Tank
(c) To Fuel Lift Pump

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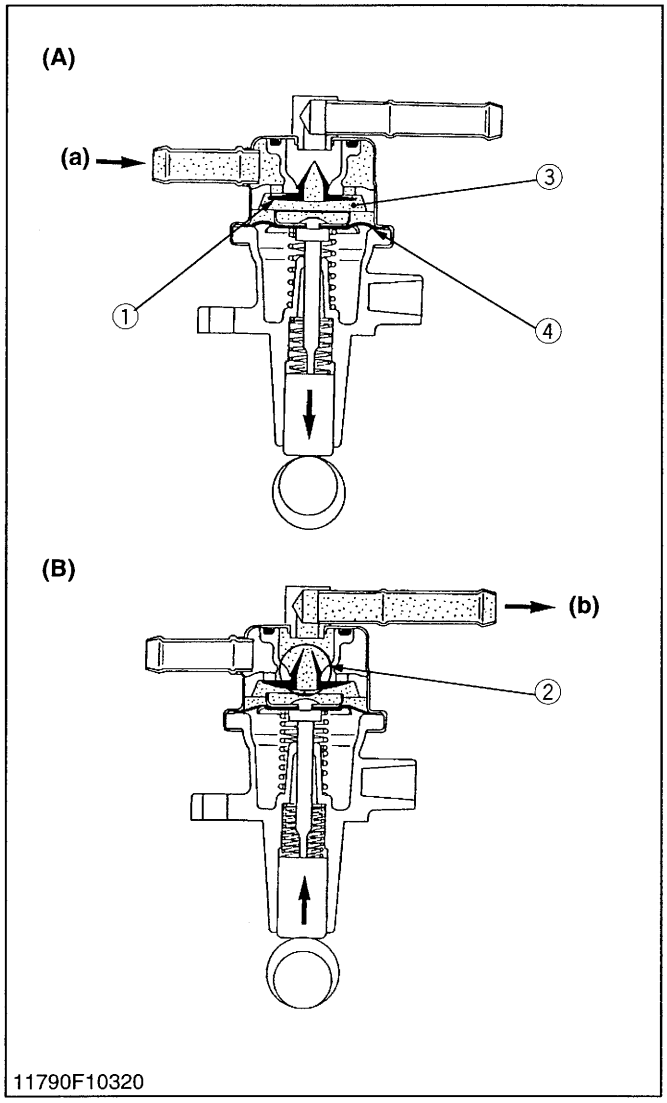
(5) Fuel Feed Pump



Filtered fuel is fed to the injection pump by the fuel feed pump. The fuel feed 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 feed 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.

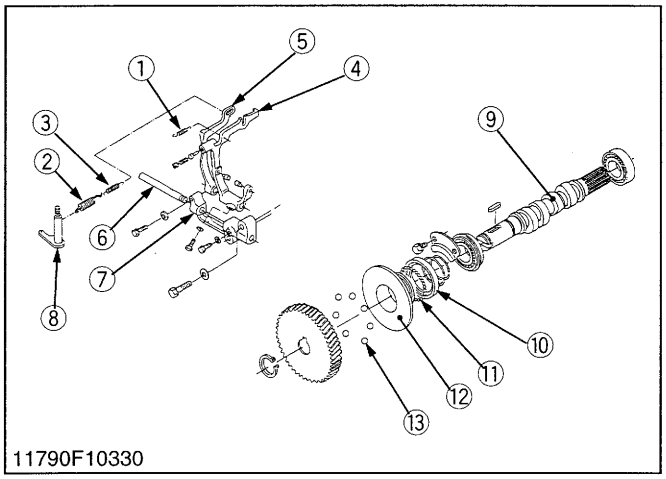
(1) Inlet Valve
(2) Outlet Valve
(3) Chamber
(4) Diaphragm

(A) Inlet Stroke
(B) Discharge Stroke

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

12550M10030

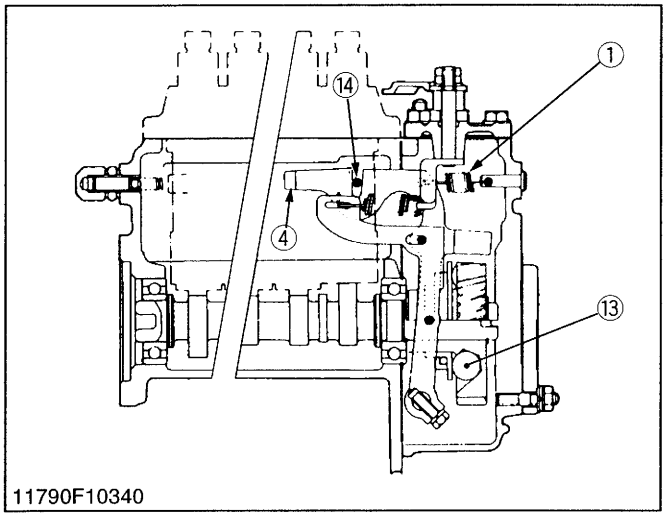
(6) Governor



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

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

11790M10300



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■ At Start

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

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

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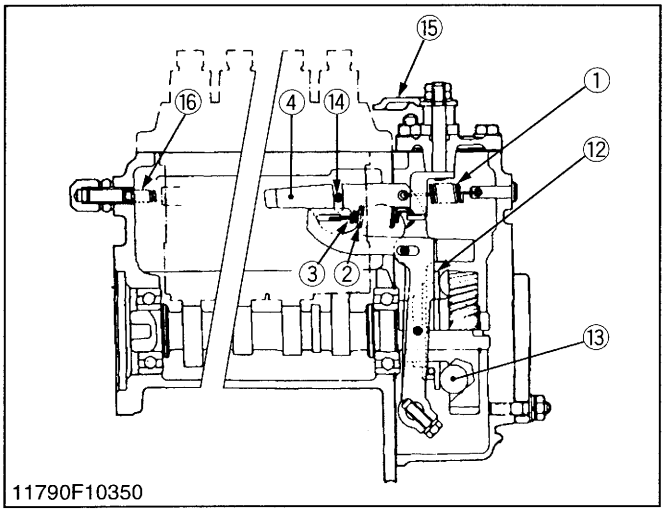

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■ At Idling

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

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

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

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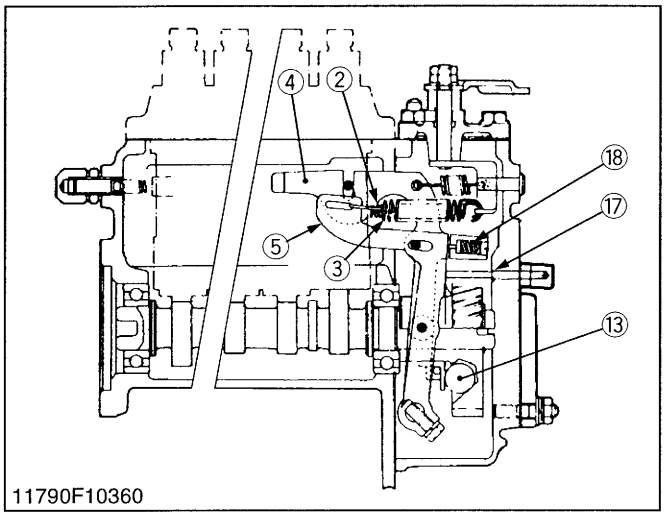

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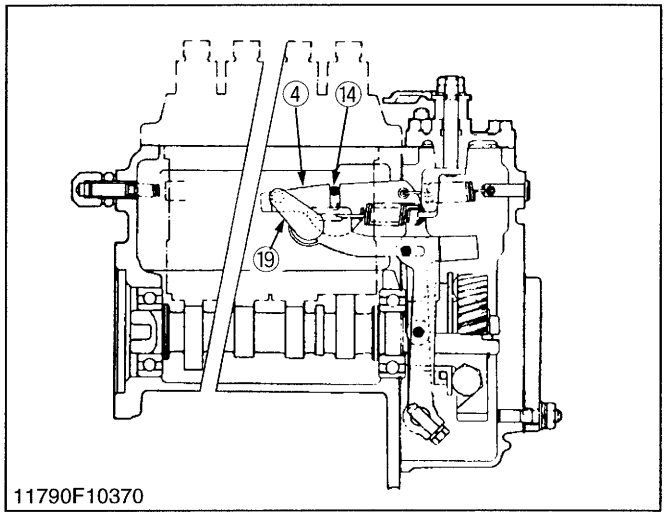
■ At High Speed Running with Overload

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

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

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

11790M10330



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■ To Stop Engine

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

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

11790M10340

SERVICING

CONTENTS

TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	• No fuel	Replenish fuel	–
	• Air in the fuel system	Bleed	G-29
	• Water in the fuel system	Change fuel and repair or replace fuel system	–
	• Fuel pipe clogged	Clean	–
	• Fuel filter clogged	Change	G-23
	• Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	G-9
	• Fuel with low cetane number	Use specified fuel	G-9
	• Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S20
	• Incorrect injection timing	Adjust	1-S54
	• Fuel camshaft worn	Replace	1-S33
	• Injection nozzle clogged	Clean	1-S56
	• Injection pump malfunctioning	Repair or replace	1-S29, S54
	• Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	–
	• Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S17
	• Improper valve timing	Correct or replace timing gear	1-S32
	• Piston ring and cylinder worn	Replace	1-S42, S49
	• Excessive valve clearance	Adjust	1-S19
(Starter Does Not Run)	• Battery discharged	Charge	–
	• Starter malfunctioning	Repair or replace	9-S11 to S14
	• Main switch malfunctioning	Repair or replace	9-S5 to S7
	• PTO safety switch improperly defective	Replace	–
	• Starter relay defective		
	• Wiring disconnected	Replace Connect	9-S7, S8 –
Engine Revolution Is Not Smooth	• Fuel filter clogged or dirty	Change	G-23
	• Air cleaner clogged	Clean or replace	G-18
	• Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S20
	• Injection pump malfunctioning	Repair or replace	1-S29, S54
	• Incorrect nozzle injection pressure	Adjust	1-S56
	• Injection nozzle stuck or clogged	Repair or replace	1-S20, S57
	• Governor malfunctioning	Repair	1-S30, S33
Either White or Blue Exhaust Gas Is Observed	• Excessive engine oil	Reduce to specified level	1-S11
	• Piston ring and cylinder worn or stuck	Repair or replace	1-S42, S49
	• Incorrect injection timing	Adjust	1-S54
	• Deficient compression	Adjust top clearance	1-S18

12550S10010

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-9
	• Fuel filter clogged	Replace	G-23
	• Air cleaner clogged	Clean or replace	G-18
	• Deficient nozzle injection	Repair or replace nozzle	1-S20, S57
Deficient Output	• Incorrect injection timing	Adjust	1-S54
	• Engine's moving parts seem to be seizing	Repair or replace	–
	• Uneven fuel injection	Repair or replace injection pump	1-S29, S54
	• Deficient nozzle injection	Repair or replace nozzle	1-S20, S55, S56
	• Compression leak	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S20, S22
Excessive Lubricant Oil Consumption	• Piston ring's gap facing the same direction	Shift ring gap direction	1-S37
	• Oil ring worn or stuck	Replace	1-S38
	• Piston ring groove worn	Replace piston	1-S38, S42
	• Valve stem and valve guide worn	Replace	1-S24
	• 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-S29, S54
	• Deficient nozzle injection	Repair or replace nozzle	1-S20, S56
	• Injection pump broken	Replace	1-S29
Water Mixed into Lubricant Oil	• Head gasket defective	Replace	1-S22
	• Cylinder block or cylinder head flawed	Replace	1-S23
Low Oil Pressure	• Engine oil insufficient	Replenish	1-S11
	• Oil strainer clogged	Clean	1-S36
	• Relief valve stuck with dirt	Clean	–
	• Relief valve spring weaken or broken	Replace	–
	• Excessive oil clearance of crankshaft bearing	Replace	1-S43, S44
	• Excessive oil clearance of crankpin bearing	Replace	1-S47
	• Excessive oil clearance of rocker arm	Replace	1-S27
	• Oil passage clogged	Clean	–
	• Different type of oil	Use specified type of oil	G-9
	• Oil pump defective	Repair or replace	1-S30, S50,S51
High Oil Pressure	• Different type of oil	Use specified type of oil	G-9
	• Relief valve defective	Replace	–

12550S10020

Symptom	Probable Cause	Solution	Reference Page
Engine Overheated	• Engine oil insufficient	Replenish	1-S11
	• Fan belt broken or elongated	Replace or adjust	1-S51
	• Cooling water insufficient	Replenish	G-28
	• Radiator net and radiator fin clogged with dust	Clean	–
	• Inside of radiator corroded	Clean or replace	–
	• Cooling water flow route corroded	Clean or replace	–
	• Radiator cap defective	Replace	1-S52
	• Overload running	Loosen load	–
	• Head gasket defective	Replace	1-S22
	• Incorrect injection timing	Adjust	1-S54
	• Unsuitable fuel used	Use specified fuel	G-9

12550S10030

SERVICING SPECIFICATIONS

ENGINE BODY

Item		Factory Specification	Allowable Limit
Compression Pressure (When Cranking with Starting Motor)		3.53 to 3.72 MPa 36 to 38 kgf/cm^2 512 to 540 psi	2.55 MPa 26 kgf/cm^2 370 psi
Difference among Cylinders		-	10 % or less
Top Clearance		0.55 to 0.70 mm 0.0217 to 0.0276 in.	–
Cylinder Head Gasket	Thickness (Free)	1.30 to 1.40 mm 0.0512 to 0.0551 in.	–
	Thickness (Tightened)	1.15 to 1.25 mm 0.0453 to 0.0492 in.	–
Valve Clearance (When Cold)		0.18 to 0.22 mm 0.0071 to 0.0087 in.	–
Valve Seat	Width (Intake)	2.12 mm 0.0835 in.	–
	Width (Exhaust)	2.12 mm 0.0835 in.	–
Valve Seat	Angle (Intake)	1.047 rad. 60°	–
	Angle (Exhaust)	0.785 rad. 45°	–
Valve Face	Angle (Intake)	1.047 rad. 60°	–
	Angle (Exhaust)	0.785 rad. 45°	–
Cylinder Head Surface	Flatness	–	0.05 mm 0.0020 in.
Valve Stem to Valve Guide	Clearance	0.040 to 0.070 mm 0.00157 to 0.00276 in.	0.10 mm 0.0039 in.
Valve Stem	O.D.	7.960 to 7.975 mm 0.31339 to 0.31398 in.	–
Valve Guide	I.D.	8.015 to 8.030 mm 0.31555 to 0.31614 in.	–
Valve Recessing	Protrusion	0.05 mm 0.0020 in.	–
	Recessing	0.15 mm 0.0059 in.	0.40 mm 0.0157 in.

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ENGINE BODY (Continued)

Item		Factory Specification	Allowable Limit
Valve Timing (Intake Valve)	Open	0.21 rad. 12° before T.D.C.	–
	Close	0.63 rad. 36° after B.D.C.	–
Valve Timing (Exhaust Valve)	Open	1.05 rad. 60° before T.D.C.	–
	Close	0.21 rad. 12° after B.D.C.	–
Valve Spring	Free Length	41.7 to 42.2 mm 1.6417 to 1.6614 in.	41.2 mm 1.6220 in.
	Setting Load	117.6 N 12.0 kgf 26.4 lbs	100.0 N 10.2 kgf 22.5 lbs
	Setting Length	35.0 mm 1.3780 in.	–
	Tilt	–	1.0 mm 0.039 in.
Rocker Arm Shaft to Rocker Arm	Clearance	0.016 to 0.045 mm 0.00063 to 0.00177 in.	0.15 mm 0.0059 in.
Rocker Arm Shaft	O.D.	13.973 to 13.984 mm 0.55012 to 0.55055 in.	–
Rocker Arm	I.D.	14.000 to 14.018 mm 0.55118 to 0.55189 in.	–
Push Rod	Alignment	–	0.25 mm 0.0098 in.
Tappet to Tappet Guide	Clearance	0.020 to 0.062 mm 0.00079 to 0.00244 in.	0.07 mm 0.0028 in.
Tappet	O.D.	23.959 to 23.980 mm 0.94327 to 0.94410 in.	–
Tappet Guide	I.D.	24.000 to 24.021 mm 0.94488 to 0.94571 in.	–
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.	39.934 to 39.950 mm 1.57221 to 1.57284 in.	–
Cylinder Block Bore	I.D.	40.000 to 40.025 mm 1.57480 to 1.57579 in.	–

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ENGINE BODY (Continued)

Item		Factory Specification	Allowable Limit
Camshaft	Alignment	–	0.01 mm 0.0039 in.
Camshaft	Side Clearance	0.07 to 0.22 mm 0.0028 to 0.0087 in.	0.30 mm 0.0118 in.
Cam (Intake / Exhaust)	Height	33.463 to 33.483 mm 1.31744 to 1.31823 in.	33.42 mm 1.3157 in.
Idle Gear Shaft to Idle Gear Bushing	Clearance	0.025 to 0.066 mm 0.00098 to 0.00260 in.	0.10 mm 0.0039 in.
Idle Gear Shaft	O.D.	37.959 to 37.975 mm 1.49445 to 1.49508 in.	–
Idle Gear Bushing	I.D.	38.000 to 38.025 mm 1.49606 to 1.49704 in.	–
Idle Gear	Side Clearance	0.20 to 0.51 mm 0.0079 to 0.0201 in.	0.90 mm 0.0354 in.
Timing Gear Crank Gear to Idle Gear	Backlash	0.0415 to 0.1122 mm 0.00163 to 0.00442 in.	0.15 mm 0.0059 in.
Idle Gear to Cam Gear	Backlash	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.	0.15 mm 0.0059 in.
Idle Gear to Injection Pump Gear	Backlash	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.	0.15 mm 0.0059 in.
Crank Gear to Oil Pump Gear	Backlash	0.0415 to 0.1090 mm 0.00163 to 0.00429 in.	0.15 mm 0.0059 in.
Piston Pin Bore	I.D.	25.000 to 25.013 mm 0.98425 to 0.98477 in.	25.05 mm 0.9862 in.
Piston Pin to Small End Bushing	Clearance	0.014 to 0.038 mm 0.00055 to 0.00150 in.	0.15 mm 0.0059 in.
Piston Pin	O.D.	25.002 to 25.011 mm 0.98433 to 0.98468 in.	–
Small End Bushing	I.D.	25.025 to 25.040 mm 0.98523 to 0.98582 in.	–
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.
Second Ring to Ring Groove	Clearance	0.093 to 0.120 mm 0.00366 to 0.00472 in.	0.20 mm 0.0079 in.
Oil Ring to Ring Groove	Clearance	0.020 to 0.052 mm 0.00079 to 0.00205 in.	0.15 mm 0.0059 in.
Connecting Rod	Alignment	–	0.05 mm 0.0020 in.

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ENGINE BODY (Continued)

Item		Factory Specification	Allowable Limit
Crankshaft Journal to Crankshaft Bearing 1	Oil Clearance	0.040 to 0.118 mm 0.00157 to 0.00465 in.	0.20 mm 0.0079 in.
Crankshaft Journal	O.D.	51.921 to 51.940 mm 2.04413 to 2.04488 in.	–
Crankshaft Bearing 1	I.D.	51.980 to 52.039 mm 2.04645 to 2.04878 in.	–
Crankshaft Journal to Crankshaft Bearing 2	Oil Clearance	0.040 to 0.104 mm 0.00157 to 0.00409 in.	0.20 mm 0.0079 in.
Crankshaft Journal	O.D.	51.921 to 51.940 mm 2.04413 to 2.04488 in.	–
Crankshaft Bearing 2	I.D.	51.980 to 52.025 mm 2.04645 to 2.04822 in.	–
Cylinder [Standard]	I.D.	87.000 to 87.022 mm 3.42519 to 3.42606 in.	+0.15 mm +0.0059 in.
Cylinder [Oversize : 0.5 mm (0.0197 in.)]	I.D.	87.500 to 87.522 mm 3.44488 to 3.44574 in.	+0.15 mm +0.0059 in.
Crankshaft	Alignment	–	0.02 mm 0.00079 in.
Flywheel	Sway	–	0.05 mm 0.0020 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	0.025 to 0.087 mm 0.00098 to 0.00343 in.	0.20 mm 0.0079 in.
Crankpin	O.D.	46.959 to 46.975 mm 1.84878 to 1.84941 in.	–
Crankpin Bearing	I.D.	47.000 to 47.046 mm 1.85039 to 1.85220 in.	–
Crankshaft Sleeve	Wear	–	0.10 mm 0.0039 in.

12550S10070

LUBRICATING SYSTEM

Item		Factory Specification	Allowable Limit
Engine Oil Pressure	At Idle Speed	98 kPa or more 1.0 kgf/cm^2 or more 14 psi or more	49 kPa 0.5 kgf/cm^2 7 psi
	At Rated Speed	294 to 441 kPa 3.0 to 4.5 kgf/cm^2 43 to 64 psi	245 kPa 2.5 kgf/cm^2 36 psi
Engine Oil Pressure Switch	Working Pressure	49 kPa 0.5 kgf/cm^2 7 psi	–
Inner Rotor to Outer Rotor	Clearance	0.03 to 0.14 mm 0.0012 to 0.0055 in.	0.20 mm 0.0079 in.
Outer Rotor to Pump Body	Clearance	0.11 to 0.19 mm 0.0043 to 0.0075 in.	0.25 mm 0.0098 in.
Rotor to Cover	Clearance	0.105 to 0.150 mm 0.0041 to 0.0059 in.	0.20 mm 0.0079 in.

COOLING SYSTEM

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

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FUEL SYSTEM

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

11790S10630

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-10.)

Item	N·m	kgf·m	ft-lbs
Power steering hose retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Front axle frame mounting screw M10	60.8 to 70.6	6.2 to 7.2	44.9 to 52.1
M12	103.0 to 117.7	10.5 to 12.0	75.9 to 86.8
Starter's terminal **B** mounting nut	8.8 to 11.8	0.9 to 1.2	6.5 to 8.7
Main delivery pipe and return pipe retaining nut	46.6 to 50.9	4.8 to 5.2	34.4 to 37.6
Turning delivery hose retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Engine and clutch housing mounting screw and nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Engine and clutch housing mounting stud bolt	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2
Clutch mounting screw and reamer 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	M8 × 1.25	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
Overflow pipe assembly retaining nut	–	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1
Glow plug	M10 × 1.25	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1
* Rocker arm bracket nut	M8 × 1.25	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
* Cylinder head screw	M11 × 1.25	93.1 to 98.0	9.5 to 10.0	68.7 to 72.3
* Crankshaft nut	M30 × 1.5	137.3 to 156.9	14.0 to 16.0	101.3 to 115.7
Oil pump drive gear 1 mounting nut	M12 × 1.25	78.4 to 88.2	8.0 to 9.0	57.8 to 65.1
Oil pan mounting screw	M10 × 1.25	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
* Connecting rod screw	M8 × 1.0	44.1 to 49.0	4.5 to 5.0	32.5 to 36.2
PTO propeller shaft spline hub screw	M8 × 1.25	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
* Flywheel screw	M12 × 1.25	98.0 to 107.8	10.0 to 11.0	72.3 to 79.5
Bearing case cover mounting screw	M8 × 1.25	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
* Main bearing case screw 2	M10 × 1.25	68.6 to 73.5	7.0 to 7.5	50.6 to 54.2
* Main bearing case screw 1	M9 × 1.25	46.1 to 50.9	4.7 to 5.2	34.0 to 37.6
Nozzle holder	–	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
* Idle gear shaft screw	M8 × 1.25	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3

■ NOTE

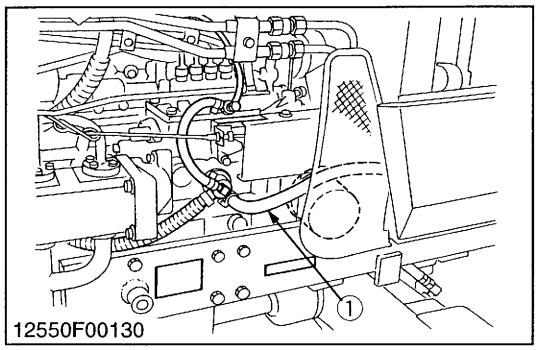
- **For * marked screws, bolts and nuts on the table, apply engine oil to their threads and seats before tightening.**
- **The letter "M" in Size × Pitch means that the screw, bolt or nut dimension stands for metric. The size is the nominal outside diameter in mm of the threads. The pitch is the nominal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

12550S10080

CHECKING, DISASSEMBLING AND SERVICING

[1] SEPARATING ENGINE FROM TRACTOR DISASSEMBLING AND ASSEMBLING

(1) Draining Coolant, Engine Oil and Transmission Fluid



Draining Coolant

CAUTION

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

1. Stop the engine and let cool down.
2. Remove the radiator hose (1) from the engine side to drain the coolant.
3. Remove the radiator cap to completely drain the coolant.
4. After all coolant is drained, reinstall the radiator hose.

Draining coolant	Capacity	7.3 L 7.7 U.S.qts. 6.4 Imp.qts.

(1) Radiator Hose

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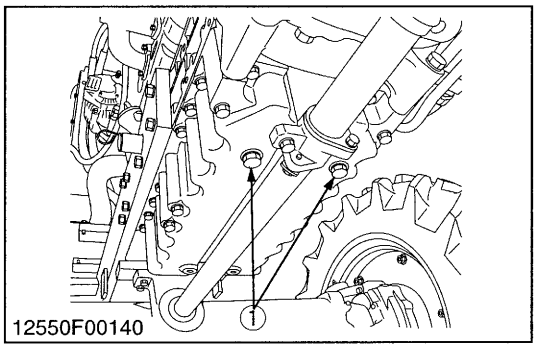


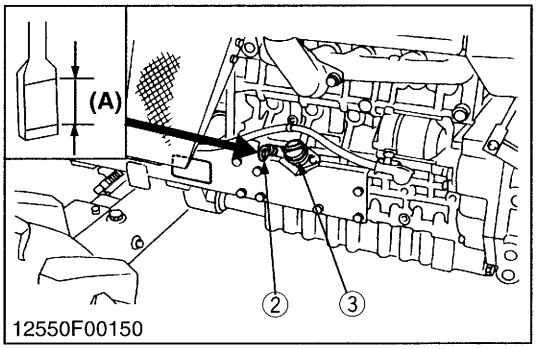
Changing Engine Oil

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. After draining, screw in the drain plugs (1).

(When refilling)

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

Engine oil	Capacity	8.0 L 8.5 U.S.qts. 7.0 Imp.qts.



IMPORTANT

- **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-9.)

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

(A) Oil level is acceptable within this range.

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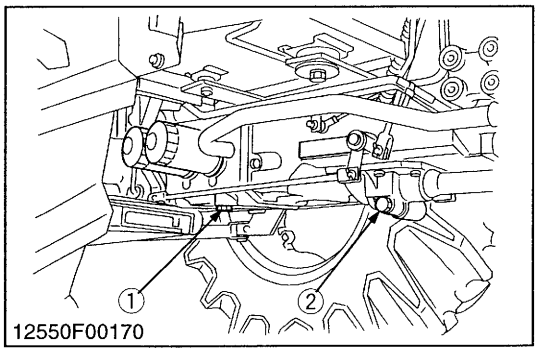

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Changing Transmission Fluid

1. Place an oil pan underneath the transmission case.
2. Remove the drain plugs (1) and (2).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1) and (2).

(When reassembling)

- Fill up from filling port after removing the filling plug until reaching the gauge.
- After running the engine for few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

Transmission fluid	Capacity	ROPS	40.0 L 42.3 U.S.qts. 35.2 Imp.qts.
		CAB	43.0 L 45.4 U.S.qts. 37.8 Imp.qts.

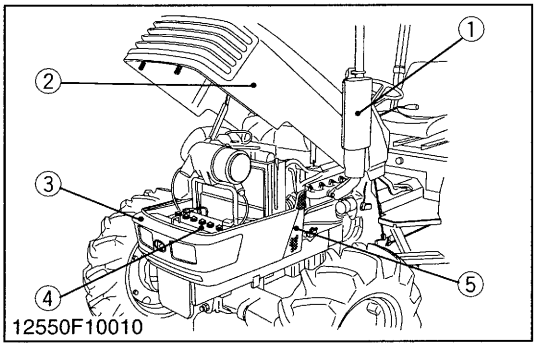
■ IMPORTANT

- **Use only KUBOTA SUPER UDT fluid. Use of other fluides may damage the transmission or hydraulic system.**
- **Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)**
- **Do not mix different brands oil together.**

(1) Drain Plug (2) Drain Plug (4WD Only)

12550S10110

(2) Separation Front Axle Frame As A Unit



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Muffler and Bonnet

1. Remove the muffler (1).
2. Remove the bonnet (2).
3. Disconnect the battery cables.
4. Remove the side cover (5).
5. Disconnect the head light **3P** connectors.
6. Remove the front lower cover (3).
7. Remove the battery (4).

(1) Muffler (4) Battery
(2) Bonnet (5) Side Cover
(3) Front Lower Cover

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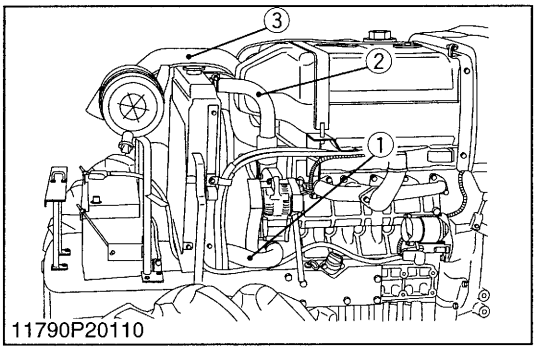

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Radiator Hoses and Hydraulic Hose

1. Remove the radiator hoses (1) and (2).
2. Disconnect the air cleaner hose (3) from the intake manifold.

(1) Radiator Hose (3) Air Cleaner Hose
(2) Radiator Hose

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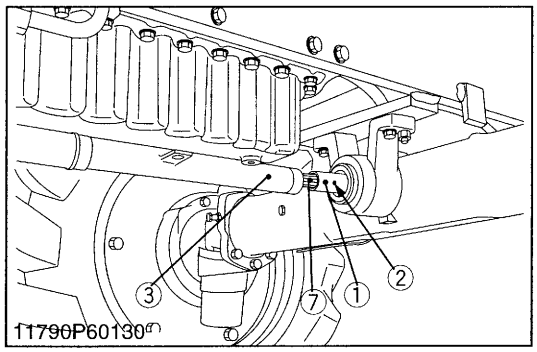

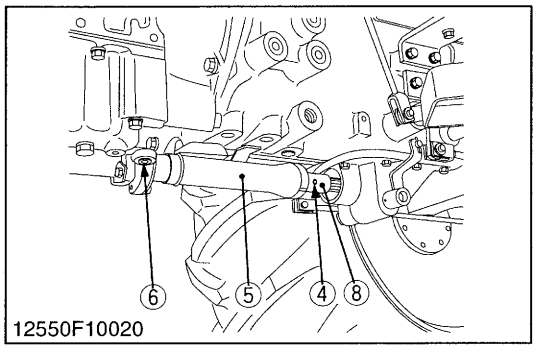

Propeller Shaft (4WD Only)

1. Slide the propeller shaft cover (3), (5) after removing the screws (6).
2. Tap out the spring pin (2), (4) and then slide the coupling (1), (8) to the front and rear.

(When reassembling)

- Apply grease to the splines of the propeller shaft (7).

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

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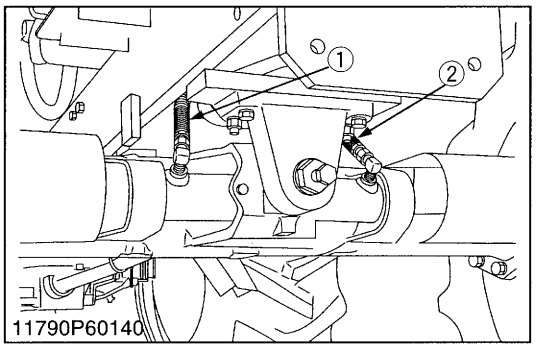

Power Steering Hoses

1. Disconnect the power steering hoses (1), (2) from steering cylinder.

(When reassembling)

Tightening torque	Power steering hose retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft-lbs

(1) Power Steering Hose 1
(2) Power Steering Hose 2

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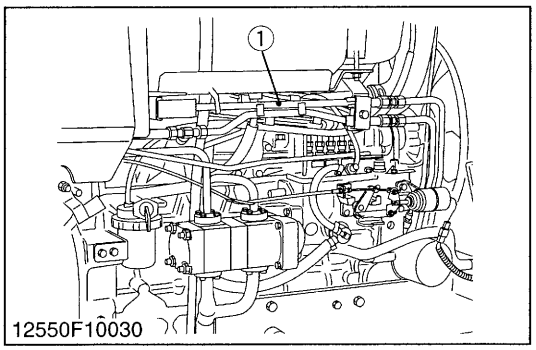

Oil Cooler Pipe and Return Pipe (M5700DT Only)

1. Remove the oil cooler pipes (1).

(1) Oil Cooler Pipe

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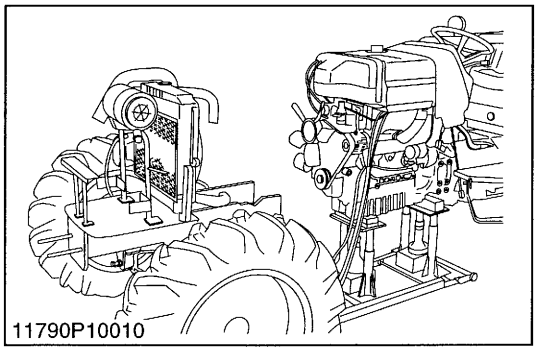
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Front Axle Frame as a Unit

1. Check the front axle and clutch housing case are securely mounted on the disassembling stands.
2. Separate the front axle frame as a unit after removing the front axle frame mounting screws.

(When reassembling)

Tightening torque	Front axle frame mounting screw (M10)	60.8 to 70.6 N·m 6.2 to 7.2 kgf·m 44.9 to 52.1 ft-lbs
	Front axle frame mounting screw (M12)	103.0 to 117.7 N·m 10.5 to 12.0 kgf·m 75.9 to 86.8 ft-lbs

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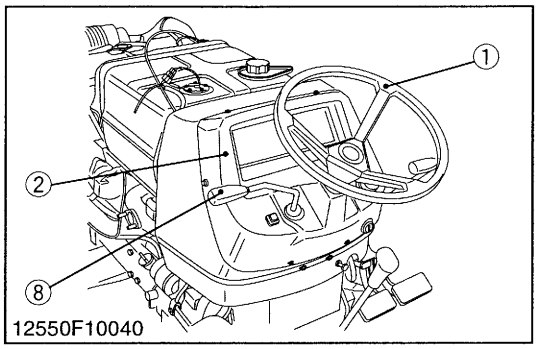

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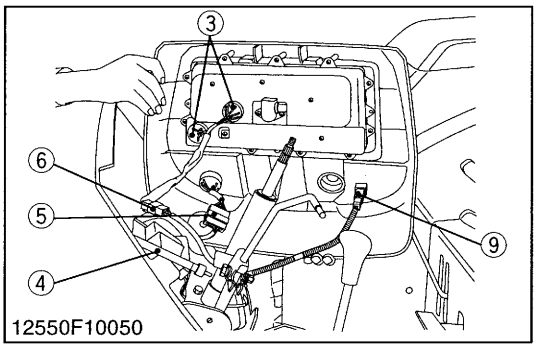

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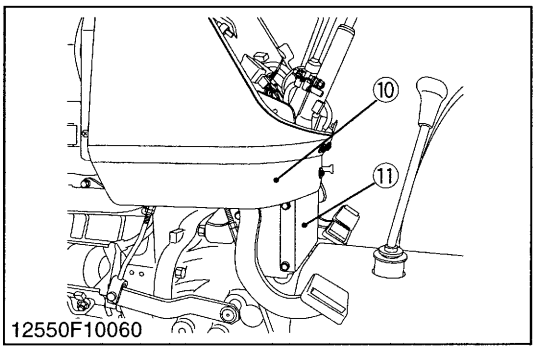

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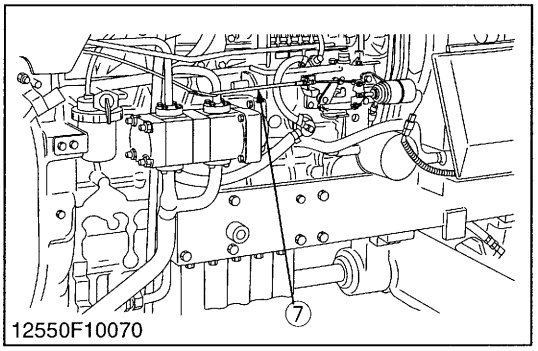

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Steering Wheel, Meter Panel and Rear Bonnet

1. Remove the steering wheel (1) with a steering wheel puller (Code No. 07916-51090).
2. Remove the shuttle lever grip (8).
3. Remove the meter panel mounting screws and open the meter panel (2).
4. Disconnect the two connectors (3) and meter cable (4).
5. Disconnect the main switch connector (5) and combination switch connector (6).
6. Disconnect the hazard switch connector (9).
7. Disconnect the engine stop cable (7) at the engine side.
8. Remove the rear bonnet (10) and lower cover (11).

(1) Steering Wheel
(2) Meter Panel
(3) Connector
(4) Meter Cable
(5) Main Switch Connector
(6) Combination Switch Connector
(7) Engine Stop Cable
(8) Shuttle Lever Grip
(9) Hazard Switch Connector
(10) Rear Bonnet
(11) Lower Cover

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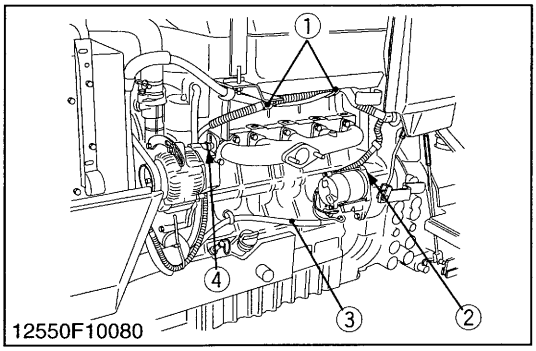

Wire Harness L.H.

1. Remove the power steering delivery pipe clamps (1).
2. Disconnect the alternator **2P** connector (4) and **B** terminal.
3. Disconnect the starter motor **C** terminal and **B** terminal.
4. Disconnect the engine oil pressure switch **1P** connector (2).

(When reassembling)

Tightening torque	Starter's terminal **B** mounting nut	8.8 to11.8 N·m 0.9 to 1.2 kgf·m 6.5 to 8.7 ft-lbs

(1) Clamp
(2) **1P** Connector for Engine Oil Pressure Switch
(3) Jumper Lead for Starter
(4) **2P** Connector for Alternator

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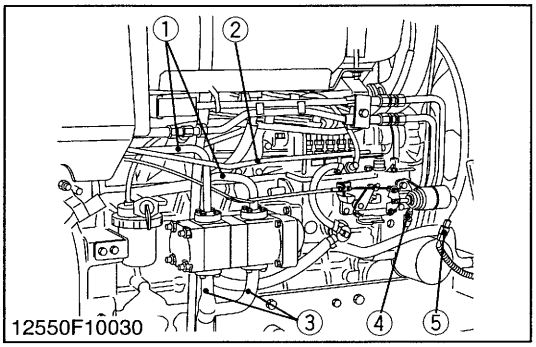
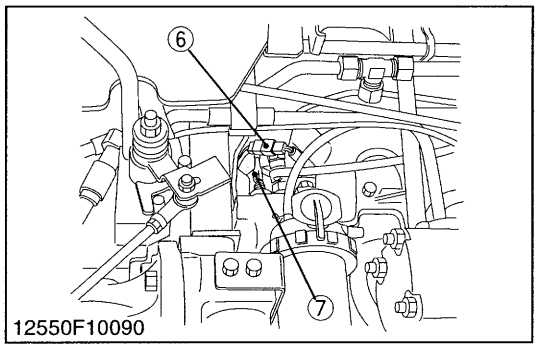


Wire Harness R.H. and Hydraulic Pipe

1. Remove the accelerator rod (2).
2. Remove the suction pipe (3) and delivery pipe (1).
3. Disconnect the glow plug **1P** connector (6) and coolant temperature sensor **1P** connector (7).
4. Remove the hourmeter cable (4) at engine side.
5. Disconnect the stop solenoid connector (5).

(1) Delivery Pipe
(2) Accelerator Rod
(3) Suction Pipe
(4) Hourmeter Cable
(5) Stop Solenoid Connector
(6) **1P** Connector for Glow Plug
(7) Coolant Tempurature Sensor **1P**



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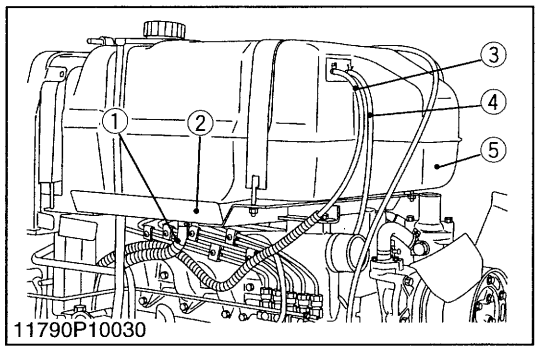

Fuel Tank (ROPS)

1. Disconnect the fuel delivery pipe (1) from the fuel filter, and then drain the fuel.
2. Disconnect the fuel return pipe (3) and (4).
3. Remove the fuel tank (5) with fuel tank support (2).

(1) Fuel Delivery Pipe
(2) Fuel Tank Support
(3) Fuel Return Pipe
(4) Fuel Return Pipe
(5) Fuel Tank

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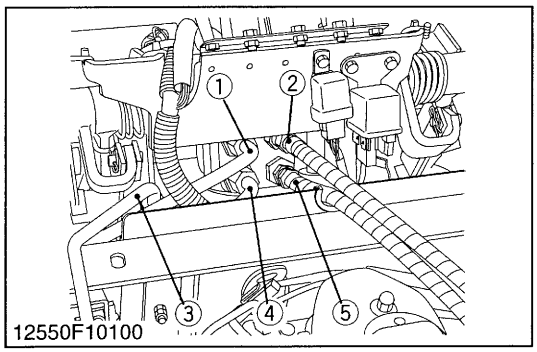

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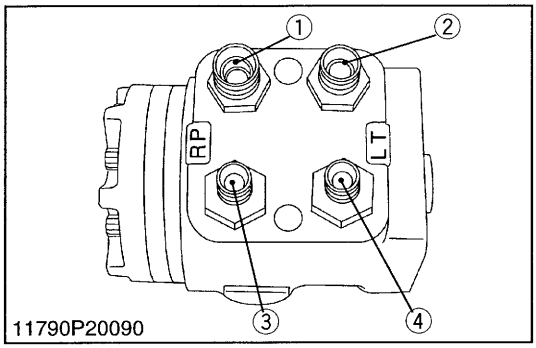

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Piping for Power Steering

1. Disconnect the main delivery pipe (4), return pipe 1 (1), right turning delivery hose (5), left turning delivery hose (2) and return pipe 2 (3).

(When reassembling)

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

(1) Return Pipe 1
(2) Left Turning Delivery Hose
(3) Return Pipe 2 (M5700: 4WD)
(4) Main Delivery Pipe
(5) Right Turning Delivery Hose

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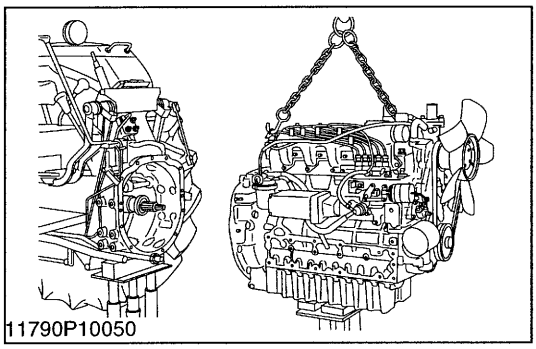
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Separating Engine from Clutch Housing

1. Hoist the engine by the hoist and chain.
2. Remove the engine mounting screws and nuts, and separate the engine from the clutch housing.

(When reassembling)

- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the splines of clutch disc boss.
- Apply liquid gasket (Three Bond 1141, 1211 or equivalent) to joint face of the engine and clutch housing.

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

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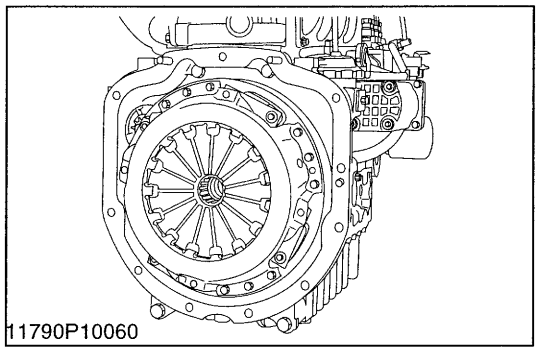
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Outer Parts

1. Remove the wire harness.
2. Remove the clutch assembly.

(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 tool set (Code No. 07916-50070).**

■ NOTE

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

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

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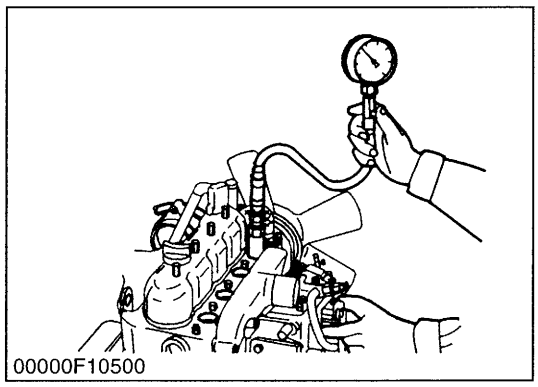
[2] CYLINDER HEAD CHECKING AND ADJUSTING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Compression Pressure

1. After warming up the engine, stop it and remove the air cleaner, the muffler and all injection nozzles.
2. Set a compression tester (Code No. 07909-30208) with the adaptor to the nozzle hole.
3. Keep the engine stop lever at "Stop Position".
4. While cranking the engine with the starter, measure the compression pressure.
5. Repeat steps 2 through 4 for each cylinder.
6. 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.
7. If the compression pressure is still less than the allowable limit, check the top clearance, valve and cylinder head.
8. 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.	3.53 to 3.72 MPa 36 to 38 kgf/cm^2 512 to 540 psi
	Allowable limit	2.55 MPa 26 kgf/cm^2 370 psi

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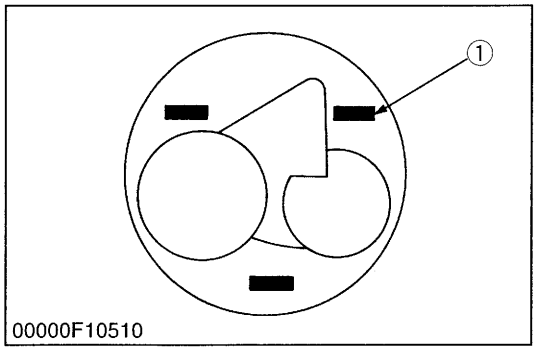

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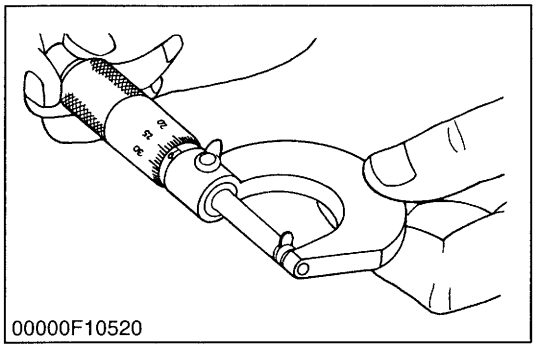
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Top Clearance

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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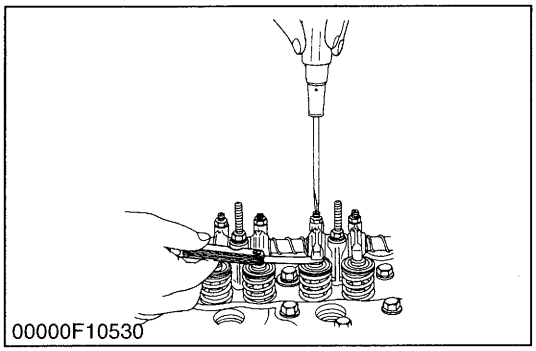
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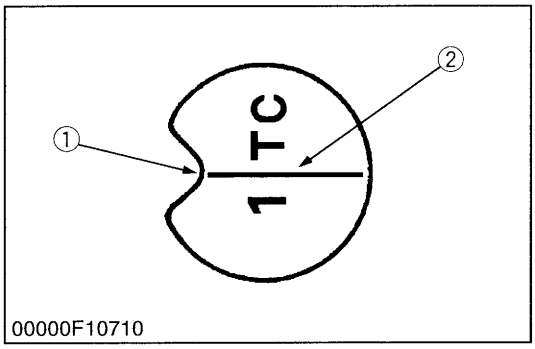

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Valve Clearance

■ IMPORTANT

- **The valve clearance must be checked and adjusted when engine is cold.**

1. Remove the cylinder head cover.
2. Align the **"1TC"** mark (2) on the flywheel and projection (1) on the housing so that the No. 1 piston comes to the compression top dead center.
3. Check the following valve clearance marked with "★" using a feeler gauge.

[When No. 1 piston is compression top dead center position]

Cylinder No.	1	2	3	4	5
Intake valve	★	★			
Exhaust valve	★		★		

4. If the clearance is not within the factory specifications, adjust with the adjusting screw.
5. Then turn the flywheel 6.28 rad. (360°), and align the **"1TC"** mark (2) on the flywheel and projection (1) on the housing so that the No. 1 piston comes to the overlap position.
6. Check the following valve clearance marked with "☆" using a feeler gauge.

[When No. 1 piston is overlap position]

Cylinder No.	1	2	3	4	5
Intake valve			☆	☆	☆
Exhaust valve		☆		☆	☆

7. If the clearance is not within the factory specifications, adjust with the adjusting screw.

Intake and exhaust valve clearance (Cold)	Factory spec.	0.18 to 0.22 mm 0.0071 to 0.0087 in.

■ NOTE

- **The sequence of cylinder numbers is given as No. 1, No. 2, No. 3, No. 4 and No. 5 starting from the gear case side.**
- **After adjusting the valve clearance, secure the adjusting screw with the lock nut.**

(1) Projection (2) **"1TC"** Mark

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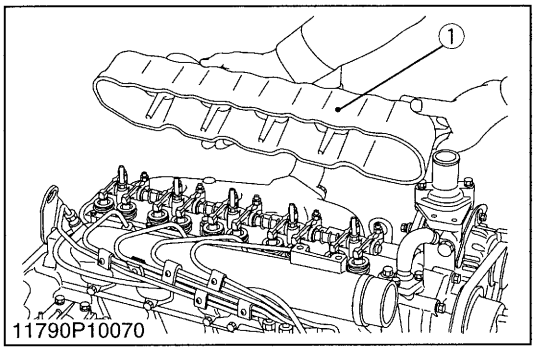
DISASSEMBLING AND ASSEMBLING



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Cylinder Head Cover

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

(When reassembling)

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

Tightening torque	Cylinder head cover cap nut	6.9 to 8.8 N·m 0.7 to 0.9 kgf·m 5.1 to 6.5 ft-lbs

(1) Head Cover

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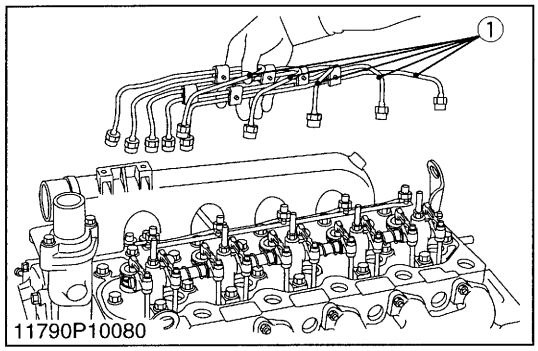

Injection Pipes

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

(When reassembling)

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

Tightening torque	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

(1) Injection Pipe

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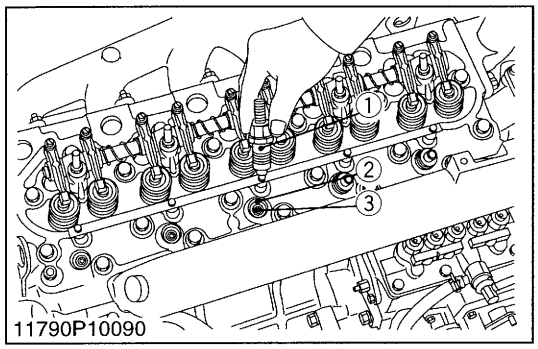

Nozzle Holder Assembly

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

(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

(1) Nozzle Holder
(2) Copper Gasket
(3) Heat Seal

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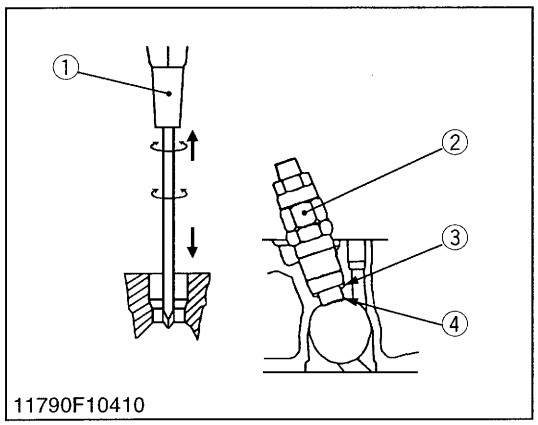

Nozzle Heat Seal Service Removal Procedure

■ 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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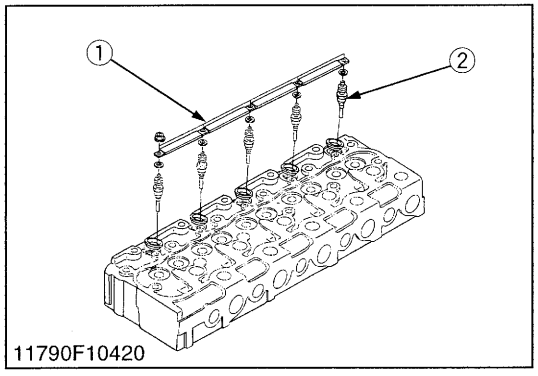

Glow Plugs

1. Remove the lead (1) from the glow plugs.
2. Remove the glow plugs(2).

(When reassembling)

Tightening torque	Glow plug	19.6 to 24.5 N·m 2.0 to 2.5 kgf·m 14.5 to 18.1 ft-lbs

(1) Lead
(2) Glow Plug

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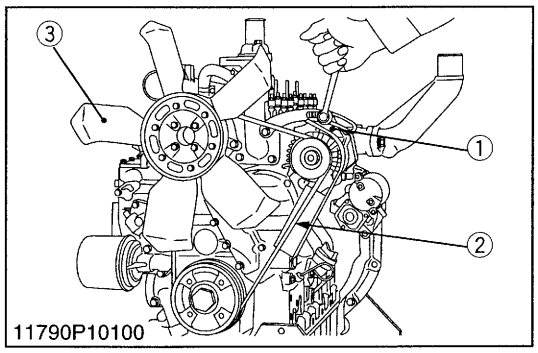

Fan, Fan Belts and Alternator

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

(When reassembling)

- Check to see if the fan belt is placed in a correct position (where letters on the belt can be read from your side), and there is no oil or grease on the belt.
- Adjust the fan belt tension. (See page G-19.)

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

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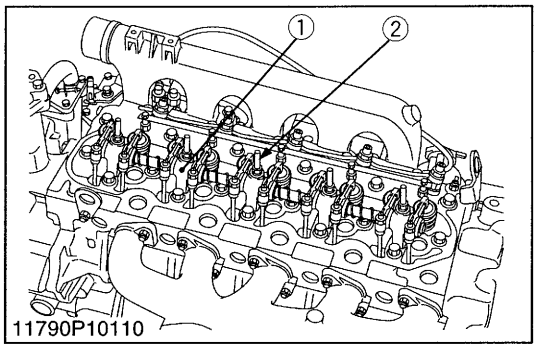

Rocker Arm

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

(When reassembling)

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

Tightening torque	Rocker arm bracket nut	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs

(1) Rocker Arm Assembly
(2) Rocker Arm Bracket Nut

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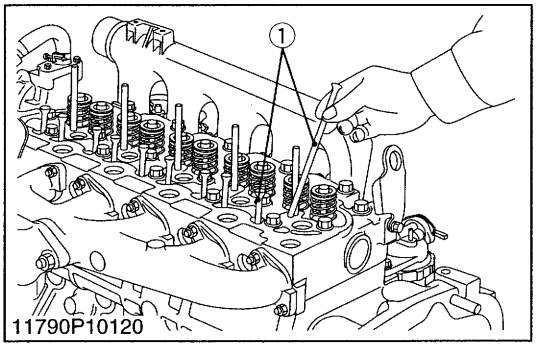

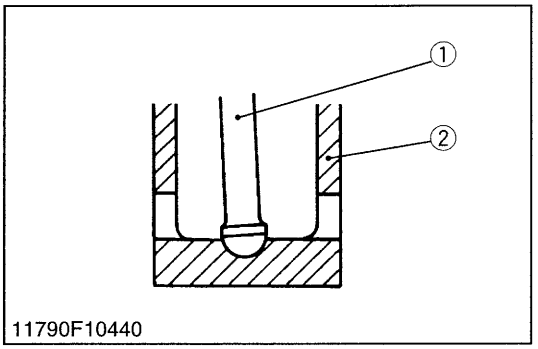

Push Rods

1. Remove the push rods (1).

(When reassembling)

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

(1) Push Rod
(2) Tappet

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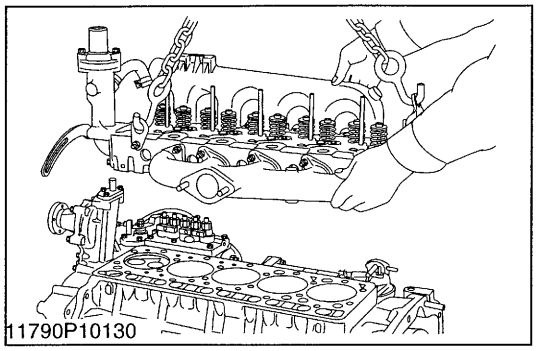
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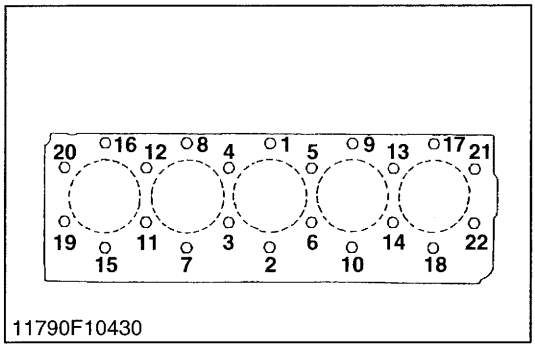

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Cylinder Head

1. Loosen the pipe clamp, and remove the water return pipe.
2. Remove the cylinder head screw in the order of (22) to (1).
3. Lift up the cylinder head to detach.

(When reassembling)

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

■ IMPORTANT

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

Tightening torque	Cylinder head screw	93.1 to 98.0 N·m 9.5 to 10.0 kgf·m 68.7 to 72.3 ft-lbs

(a) To Loosen 22 to 1 **(b) To Tighten 1 to 22**

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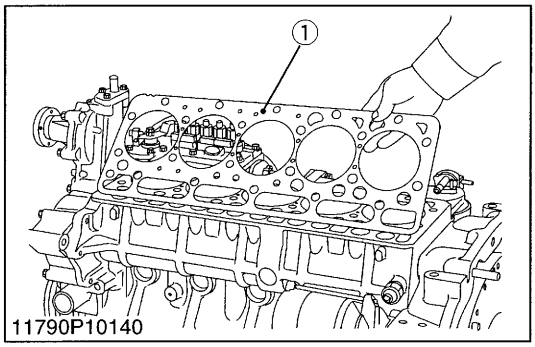

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Cylinder Head Gasket and Tappet

1. Remove the cylinder head gasket (1).
2. Remove the O-ring (2).
3. Remove the tappets (3) from the crankcase.

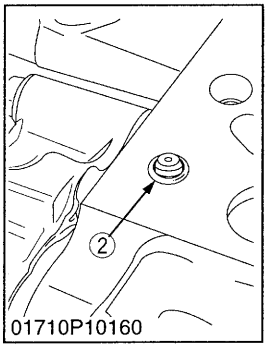
(When reassembling)

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

(1) Cylinder Head Gasket
(2) O-ring
(3) Tappet



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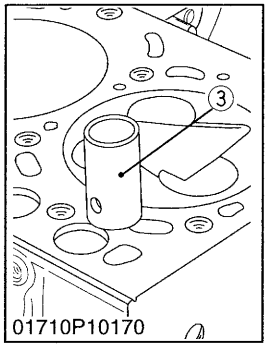

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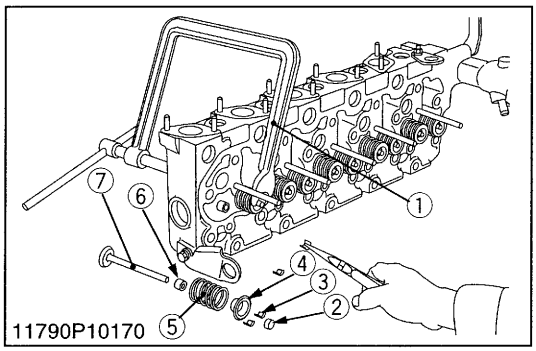

Valves

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

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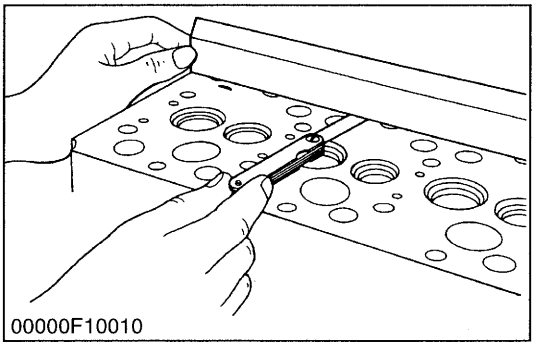
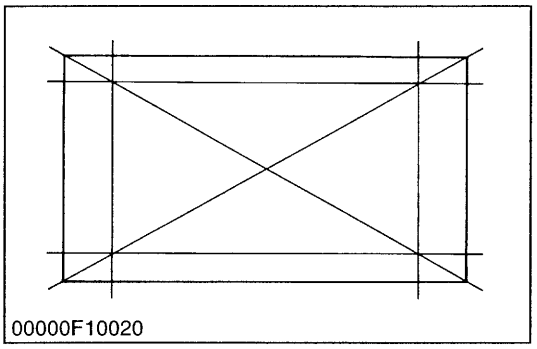
SERVICING





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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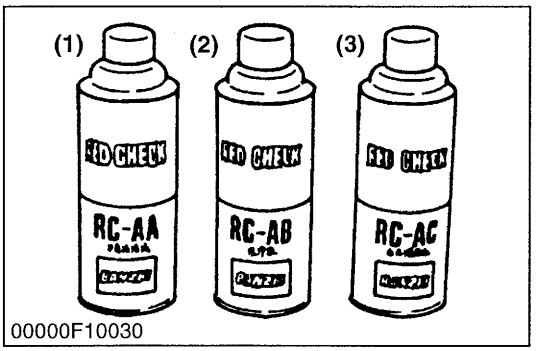

Cylinder Head Flaw

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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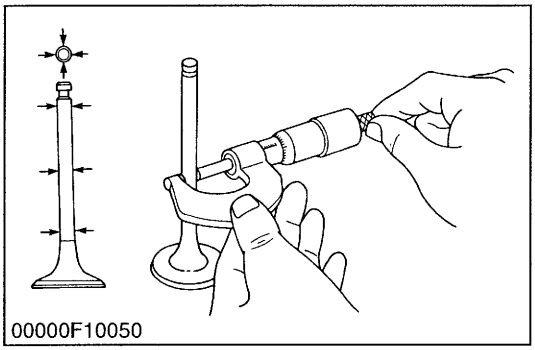
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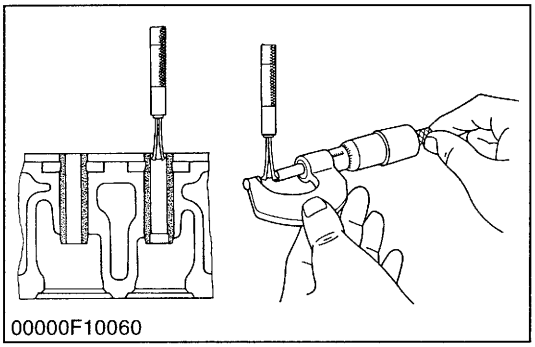
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Clearance between Valve Stem and Valve Guide

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.	0.040 to 0.070 mm 0.00157 to 0.00276 in.
	Allowable limit	0.10 mm 0.0039 in.

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

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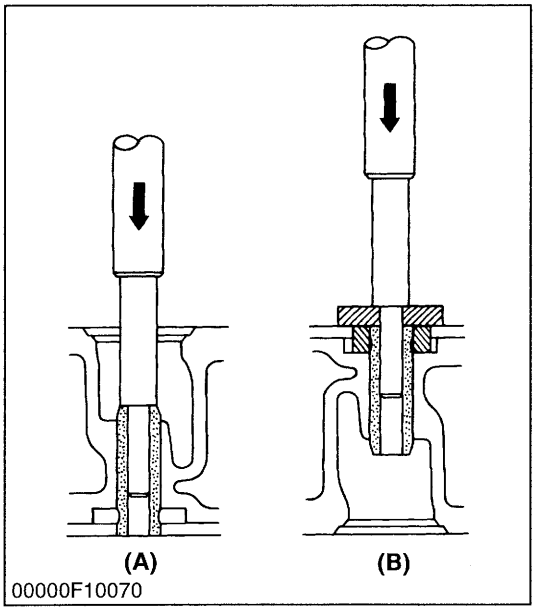
(A) (B)
00000F10070

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.	8.015 to 8.030 mm 0.31555 to 0.31614 in.

■ IMPORTANT

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

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

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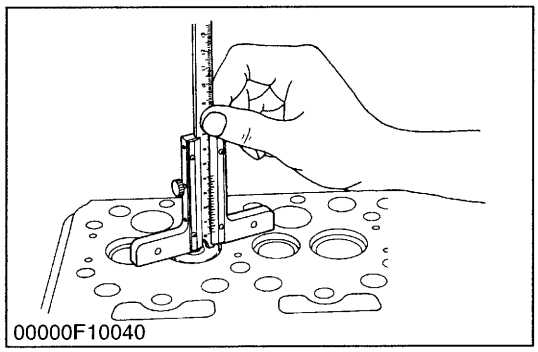
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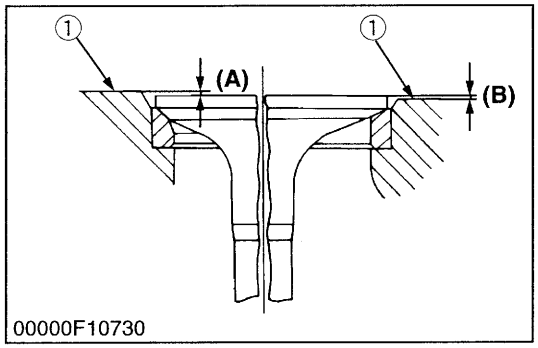

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Valve Recessing

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.

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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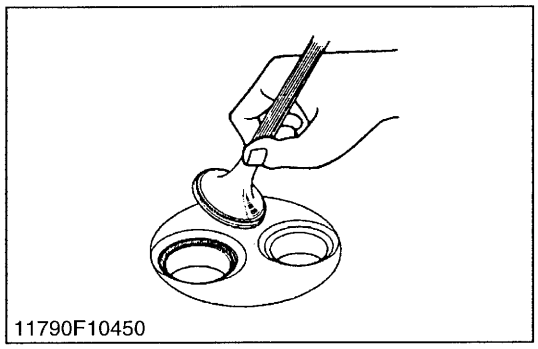
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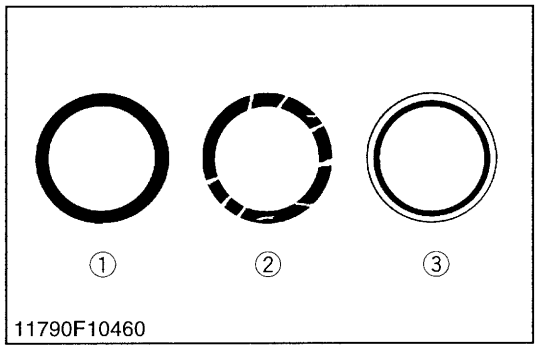
Valve Seating

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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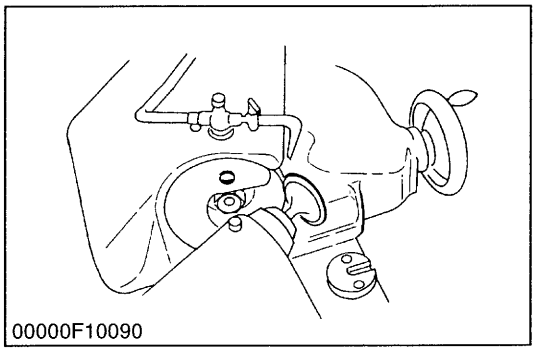
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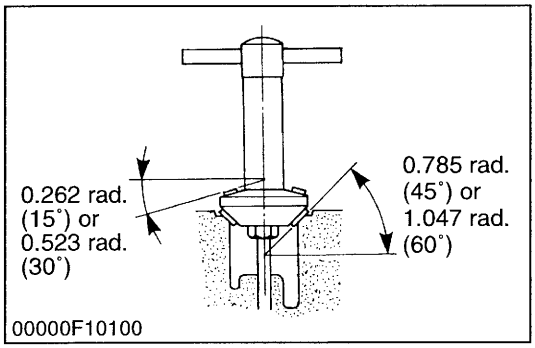

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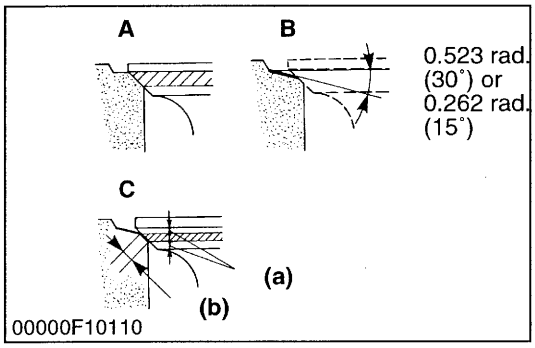

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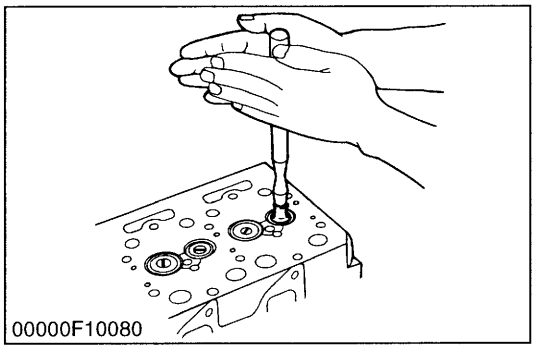
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Correcting Valve and Valve Seat

■ 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

00000S10070

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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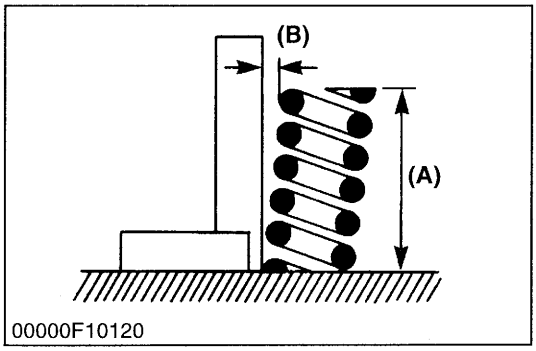

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Free Length and Tilt of Valve Spring

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.	41.7 to 42.2 mm 1.6417 to 1.6614 in.
	Allowable limit	41.2 mm 1.6220 in.
Tilt **(B)**	Allowable limit	1.0 mm 0.039 in.

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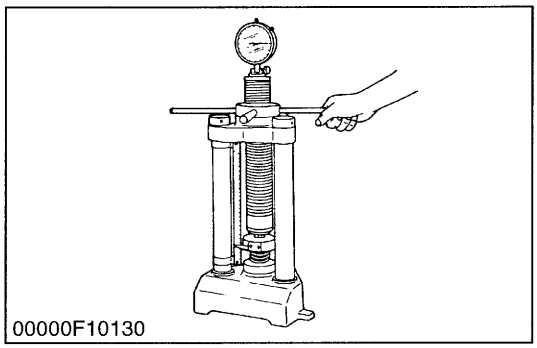
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Valve Spring Setting Load

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 / 35.0 mm 12.0 kgf / 35.0 mm 26.4 lbs / 1.3780 in.
	Allowable limit	100.0 N / 35.0 mm 10.2 kgf / 35.0 mm 22.5 lbs / 1.3780 in.

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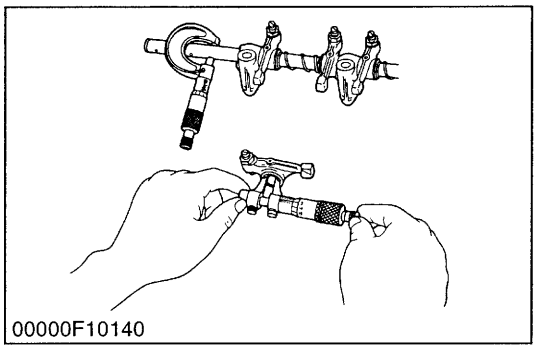
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Oil Clearance between Rocker Arm and Rocker Arm Shaft

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	0.15 mm 0.0059 in.
Rocker arm shaft O.D.	Factory spec.	13.973 to 13.984 mm 0.55012 to 0.55055 in.
Rocker arm I.D.	Factory spec.	14.000 to 14.018 mm 0.55118 to 0.55189 in.

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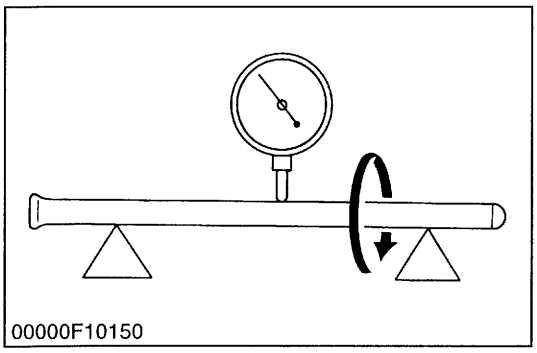
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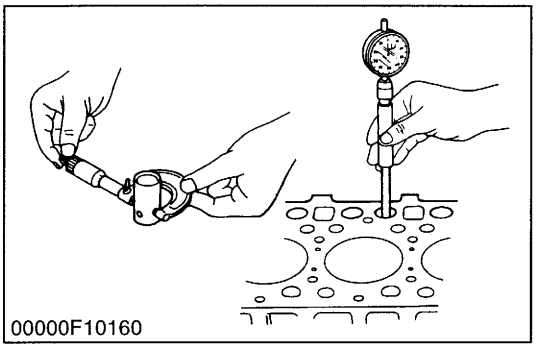
Push Rod Alignment

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.

12460S10470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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.	23.959 to 23.980 mm 0.94327 to 0.94410 in.
Tappet guide bore I.D.	Factory spec.	24.000 to 24.021 mm 0.94488 to 0.94571 in.

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[3] TIMING GEARS
DISASSEMBLING AND ASSEMBLING

Cylinder Head Assembly

1. Remove the cylinder head assembly.
(See page 1-S19 to 1-S23.)

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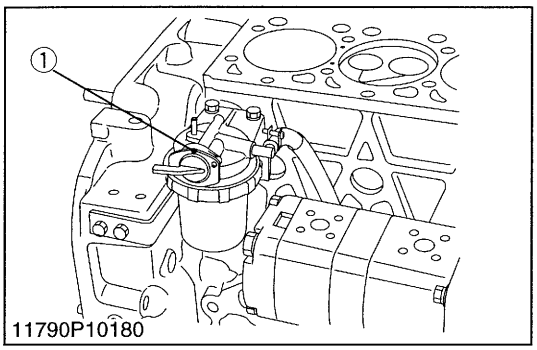

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Fuel Filter Assembly

1. Loosen the pipe clamp, and remove the fuel pipe from the fuel filter.
2. Remove the fuel filter assembly (1) with its support together.

(1) Fuel Filter Assembly

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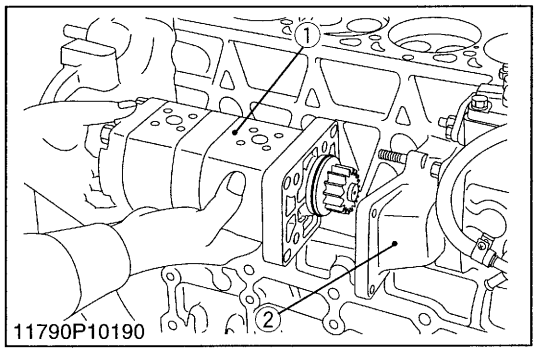

Hydraulic Pump

1. Remove the hydraulic pump (1).
2. Detach the pump base (2).

(1) Hydraulic Pump (2) Pump Base

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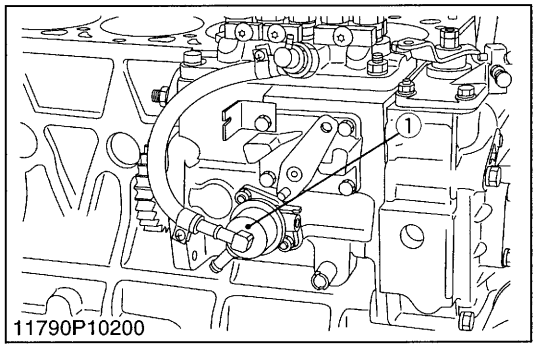


Fuel Lift Pump

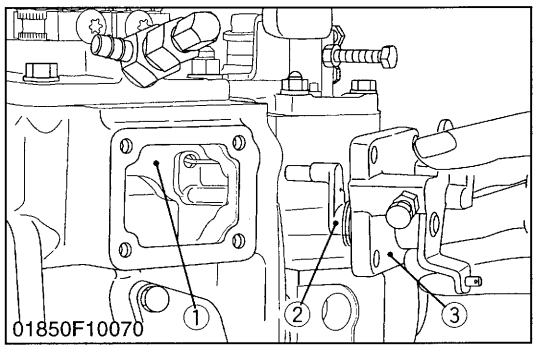
1. Loosen the pipe clamp, and remove the fuel pipe from the injection pump side.
2. Remove the fuel lift pump (1).

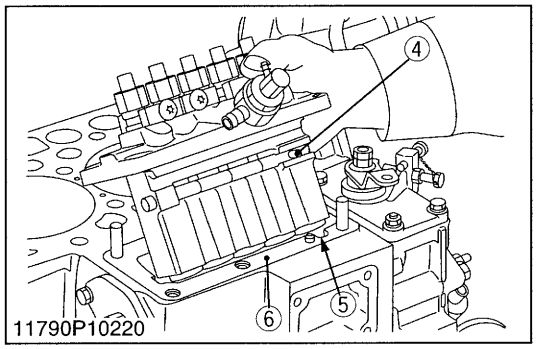
(When reassembling)

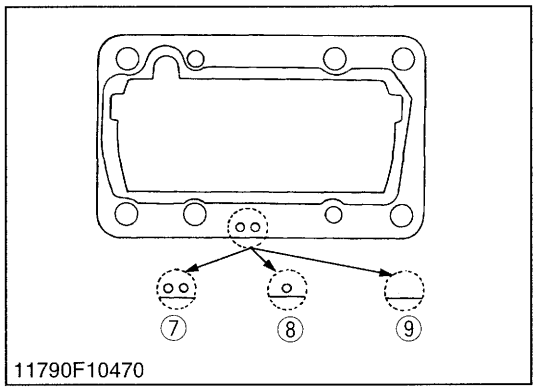
- Apply a liquid gasket (Three Bond 1215 or equivalent) to the both sides of fuel lift pump gasket.

(1) Fuel Lift Pump

11790S10270







Injection Pump

1. Remove the injection pump cover (3) with the engine stop lever (2).
2. Remove the injection pump mounting screws and nuts.
3. Align the control rack pin (4) with the groove (5) on the crankcase, then remove the injection pump.
4. Remove the injection pump timing shims.
5. In principle, the injection pump should not be disassemble.

(When reassembling)

- Install the injection pump so that its control rack pin (4) engages with the groove (5) of fork lever 1 (1).
- Install the injection pump cover with the arm of engine stop lever (2) at the right of the arm of fork lever 1 (1).
- The sealant is applied to both sides of the shim (soft metal gasket shim). The liquid gasket is not required for assembling.
- Addition or reduction of shims (0.05 mm, 0.0020 in.) delays or advances the injection timing by approx. 0.0087 rad. (0.5°).
- In disassembling and replacing, be sure to use the same number of new shims with the same thickness.
- Refer to figure left to check the thickness of the shims.

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

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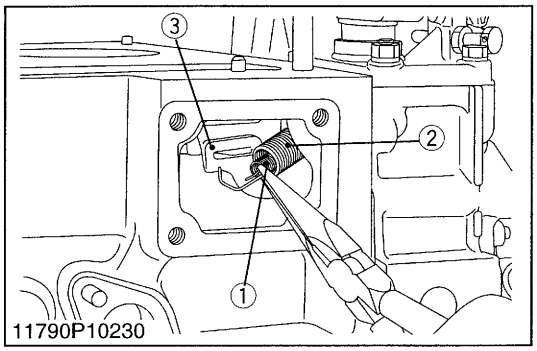

Governor Spring

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

(When reassembling)

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

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

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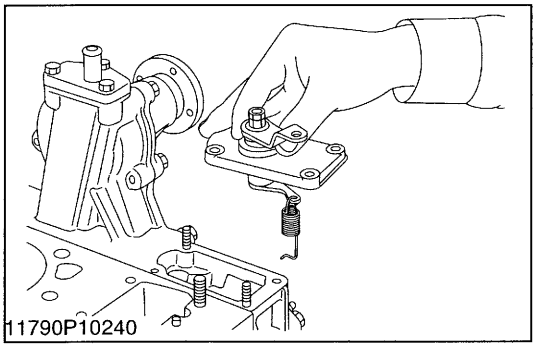

Speed Control Plate

1. Remove the speed control plate and governor spring.

(When reassembling)

- Be careful not to drop the governor spring in the gear case.
- Apply a liquid gasket (Three Bond 1102 or equivalent) to both sides of the speed control plate gasket.

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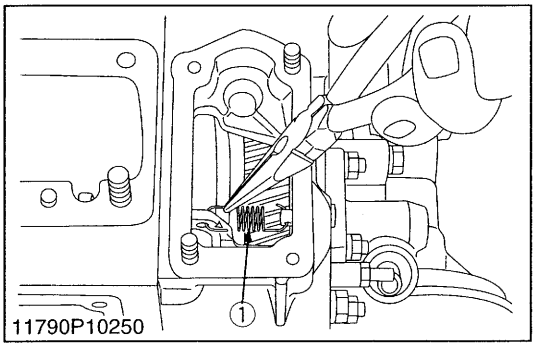


Start Spring

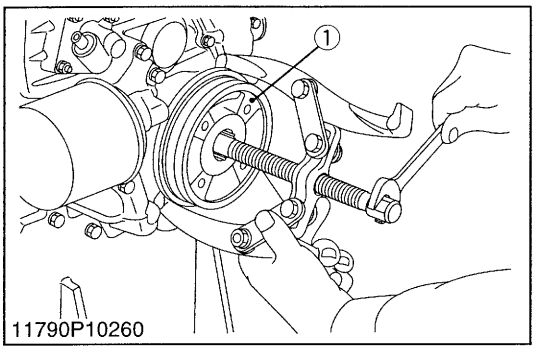
1. Remove the start spring (1) from the gear case.

(When reassembling)

- Be careful not to drop the start spring into the gear case.
- Hook the start spring so that the longer hook is on the fork lever side.

(1) Start Spring

11790S10310



Fan Drive Pulley

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

(When reassembling)

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

■ IMPORTANT

- **Install the fan drive pulley to the crankshaft, aligning the marks on them.**

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

(1) Fan Drive Pulley

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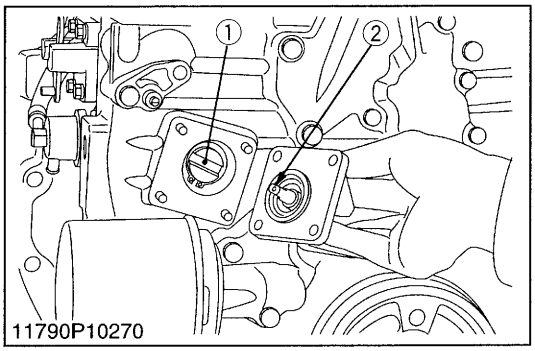

Hourmeter Unit

1. Remove the hourmeter unit.

(When reassembling)

- Apply a liquid gasket (Three Bond 1104 or equivalent) to both sides of the gasket.
- Ensure that the extremity convex section (2) of the hourmeter unit is inserted into groove (1) of the fuel camshaft.

(1) Groove
(2) Convex Section

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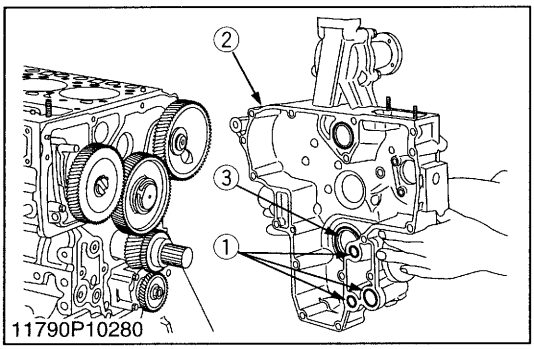

Gear Case

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

(When reassembling)

- Check to see if there are four O-rings (1) inside the gear case (2).
- Apply a thin film of engine oil to the oil seal (3), and install it, noting the lip come off.
- Apply a liquid gasket (Three Bond 1102 or equivalent) to gear case side of the gear case gasket.

(1) O-ring
(2) Gear Case
(3) Oil Seal

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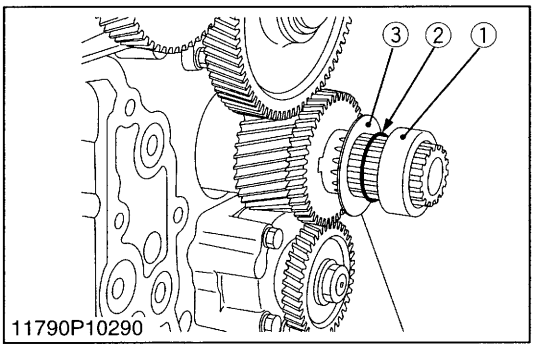

Crankshaft Oil Slinger

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

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

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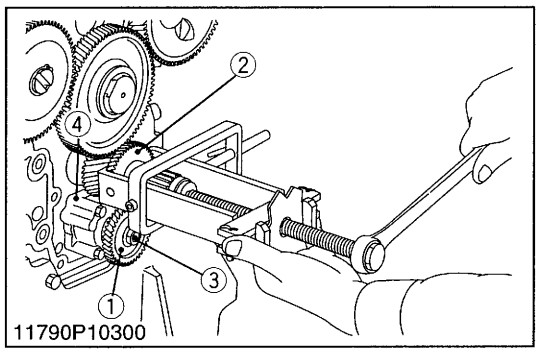

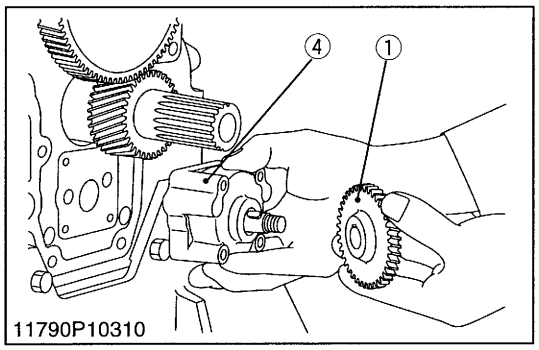

Oil Pump

1. Loosen the oil pump drive gear 1 mounting nut (3).
2. Draw out the oil pump drive gear 2 (2) with a special use puller set (Code No. 07916-09032).
3. Remove the oil pump drive gear 1 mounting nut, and draw out the oil pump drive gear 1(1) with a special use puller set.
4. Remove the oil pump (4).

(When reassembling)

Tightening torque	Oil pump drive gear 1 mounting nut	78.4 to 88.2 N·m 8.0 to 9.0 kgf·m 57.8 to 65.1 ft-lbs

(1) Oil Pump Drive Gear 1
(2) Oil Pump Drive Gear 2
(3) Oil Pump Drive Gear 1 Mounting Nut
(4) Oil Pump

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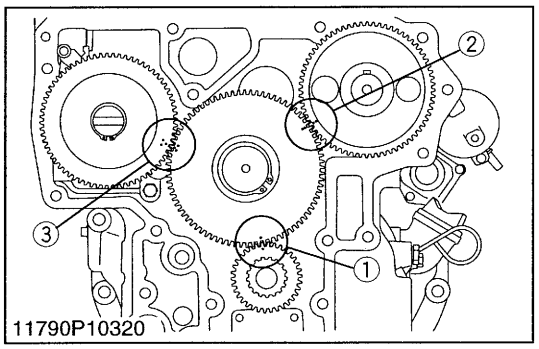

Idle Gear

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

(When reassembling)

- Check to see each gear is aligned with its aligning mark:

① Idle gear and crank gear
② Idle gear and camshaft gear
③ Idle gear and injection pump gear

- Apply a thin film of engine oil to the idle gear bushing before installation.

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Tappets

1. See page 1-S22.

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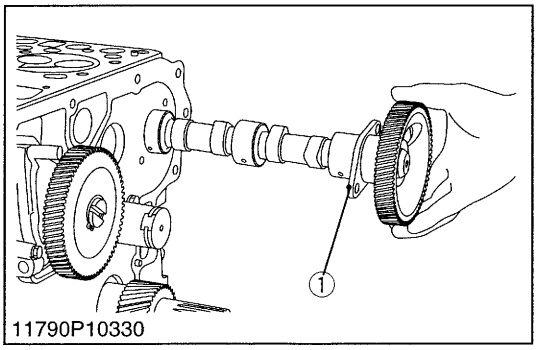

Gear and Camshaft

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

(When reassembling)

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

(1) Camshaft Stopper

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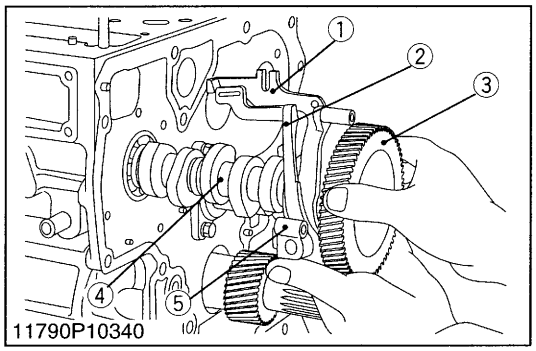

Fuel Camshaft and Fork Lever Assembly

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

(When reassembling)

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

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

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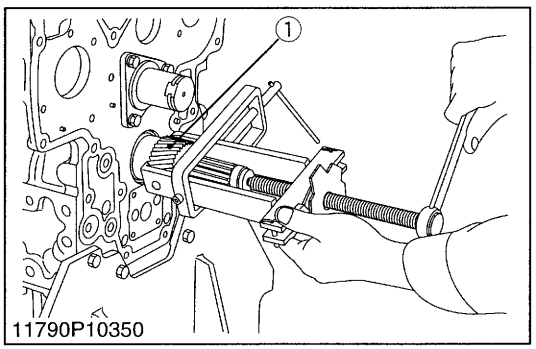

Crank Gear

1. Draw out the crank gear (1) with a special use puller set (Code No. 07916-09032).
2. Remove the feather key on the crankshaft.

(When reassembling)

- Check to see that the feather key on the crankshaft.
  Heat the crank gear to approx. 80 °C (176 °F), and fit on the crankshaft.

(1) Crank Gear

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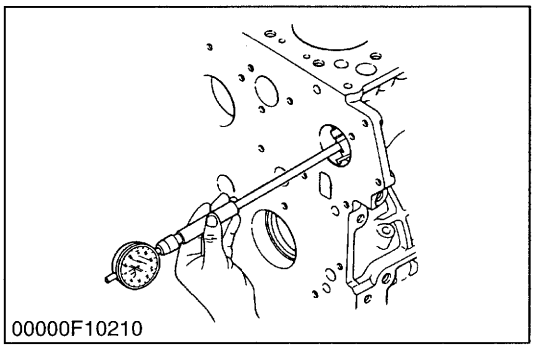
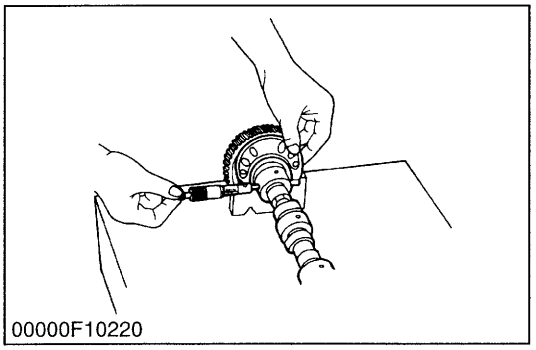
SERVICING





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.	39.934 to 39.950 mm 1.57221 to 1.57284 in.
Cylinder block bore I.D.	Factory spec.	40.000 to 40.025 mm 1.57480 to 1.57579 in.

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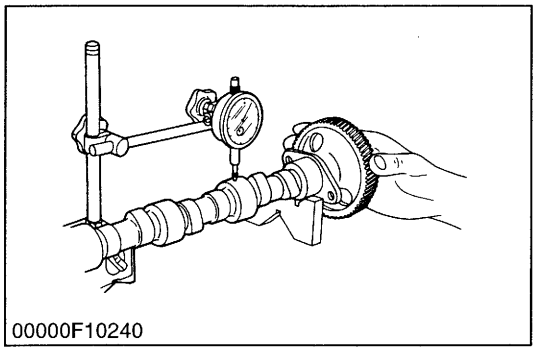
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Camshaft Alignment

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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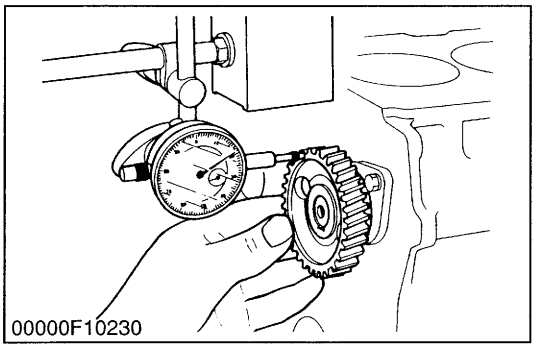
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Camshaft Side Clearance

1. Set a dial indicator with its tip on the cam gear.
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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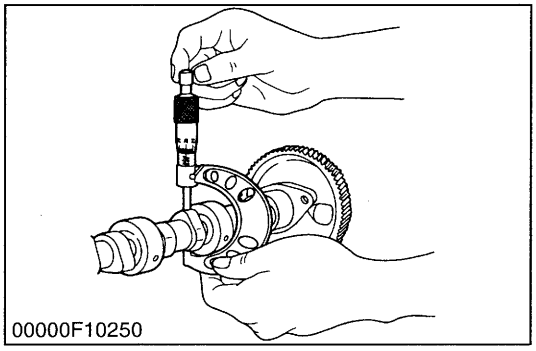
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Cam Height

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 heights (Intake and exhaust)	Factory spec.	33.463 to 33.483 mm 1.31744 to 1.31823in.
	Allowable limit	33.42 mm 1.3157 in.

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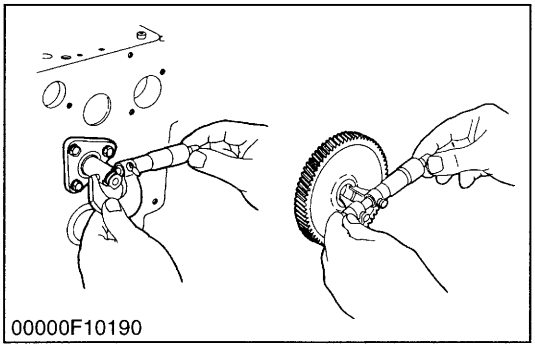
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Oil Clearance between Idle Gear Shaft and Idle Gear Bushing

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.	0.025 to 0.066 mm 0.00098 to 0.00260 in.
	Allowable limit	0.10 mm 0.0039 in.
Idle gear shaft O.D	Factory spec.	37.959 to 37.975 mm 1.49445 to 1.49508 in.
Idle gear bushing I.D	Factory spec.	38.000 to 38.025 mm 1.49606 to 1.49704 in.

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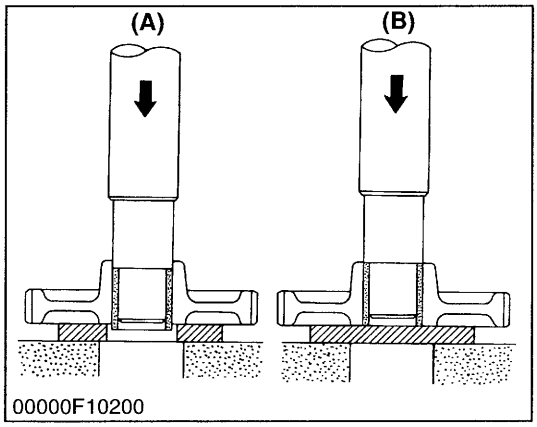

Replacing Idle Gear Bushing

(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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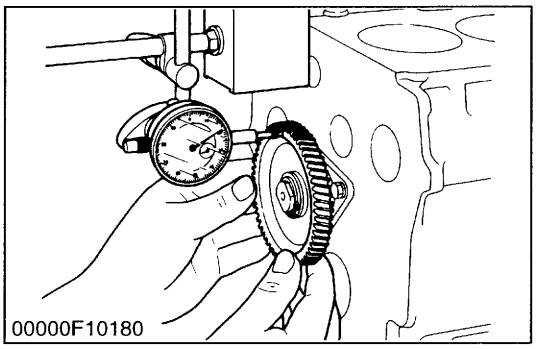

Idle Gear Side Clearance

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.	0.20 to 0.51 mm 0.0079 to 0.0201 in.
	Allowable limit	0.9 mm 0.0354 in.

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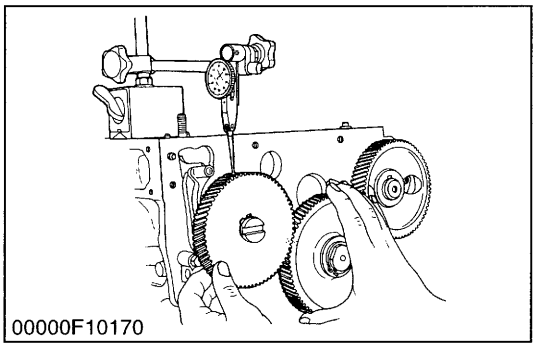

Timing Gear Backlash

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.

Backlash between idle gear and crank gear	Factory spec.	0.0415 to 0.1122 mm 0.00163 to 0.00442 in.
	Allowable limit	0.15 mm 0.0059 in.
Backlash between idle gear and cam gear	Factory spec.	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.
	Allowable limit	0.15 mm 0.0059 in.
Backlash between idle gear and injection pump gear	Factory spec.	0.0415 to 0.1154 mm 0.00163 to 0.00454 in.
	Allowable limit	0.15 mm 0.0059 in.
Backlash between crank gear and oil pump gear	Factory spec.	0.0415 to 0.1090 mm 0.00163 to 0.00429 in.
	Allowable limit	0.15 mm 0.0059 in.

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[4] CRANKCASE
DISASSEMBLING AND ASSEMBLING

Cylinder Head Assembly

1. Remove the cylinder head assembly. (See page 1-S19 to 1-S23.)

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Timing Gears

1. Remove the timing gears. (See page 1-S28 to 1-S33.)

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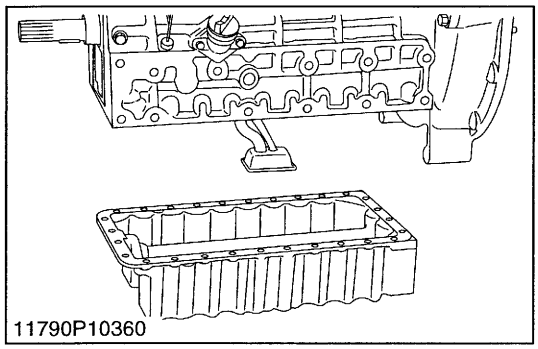
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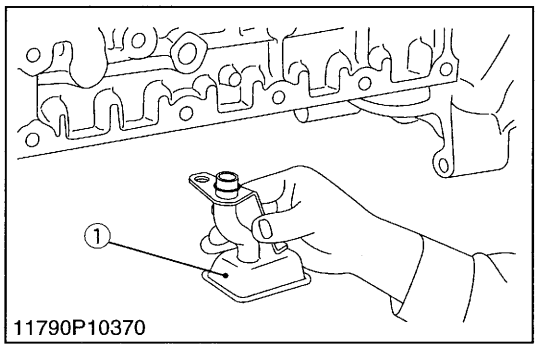
Oil Pan and Oil Strainer

1. Remove the oil pan mounting screws.
2. Screw hooks (M11 × Pitch 1.25) to lift up the cylinder block and detach the oil pan by lightly tapping the groove of the pan with a wooden hammer.
3. Remove the mounting screw of oil strainer 1.
4. Detach oil strainer 1(1), being careful of the O-ring.

(When reassembling)

- After cleaning the oil strainer 1 (1), check to see that the strainer mesh in clean, and install it.
- Visually check the O-ring, apply engine oil, and install it.
- After checking to see that the O-ring is securely installed, attach the oil strainer 1 (1).
- Apply a liquid gasket (Three Bond 1215 or equivalent) to both sides of the oil pan gasket.



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Tightening torque	Oil pan mounting screw	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs

(1) Oil Strainer 1

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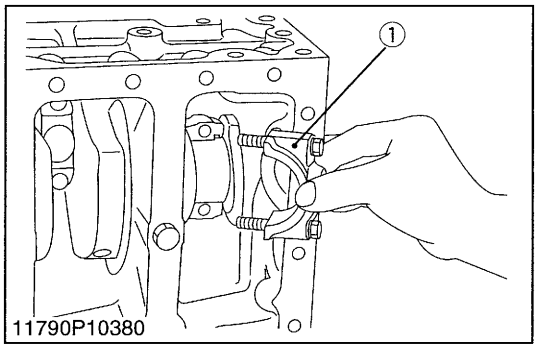

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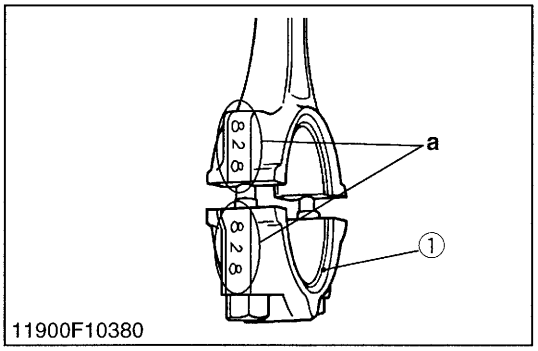
Connecting Rod Cap

1. Remove the connecting rod caps (1).

(When reassembling)

- Apply engine oil to the connecting rod screws.
- Align the marks (**a**) with each other. (Face the marks toward the injection pump.)



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Tightening torque	Connecting rod screw	44.1 to 49.0 N·m 4.5 to 5.0 kgf·m 32.5 to 36.2 ft-lbs

(1) Connecting Rod Cap **(a) Mark**

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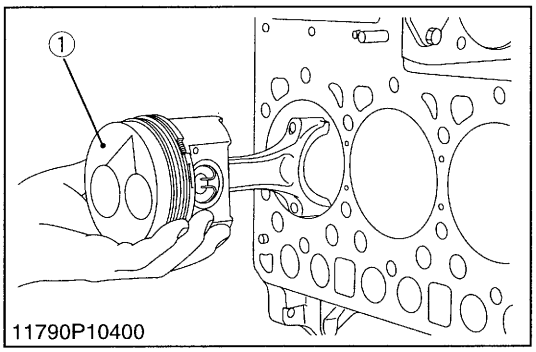

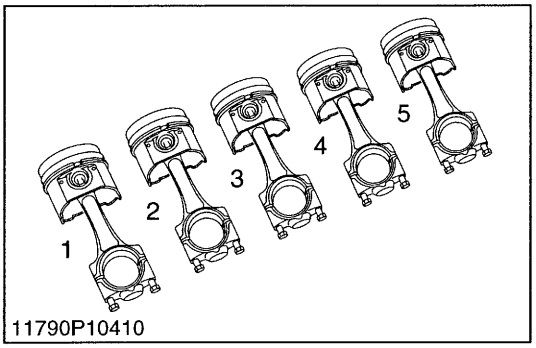

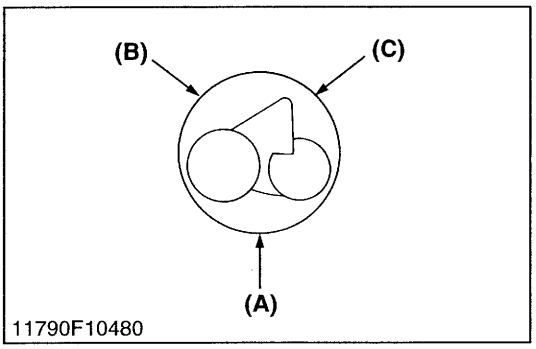

Pistons

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

(When reassembling)

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

■ IMPORTANT

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

(1) Piston

(A) Top Ring Gap
(B) Second Ring Gap
(C) Oil Ring Gap

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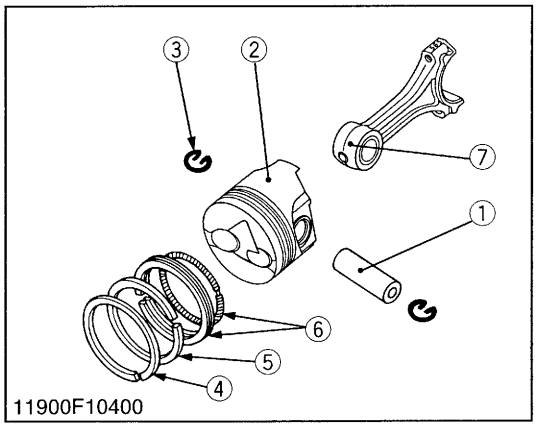

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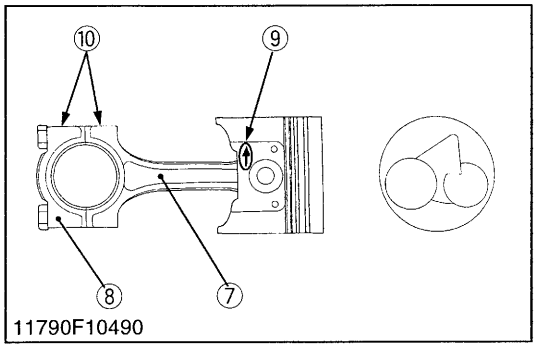

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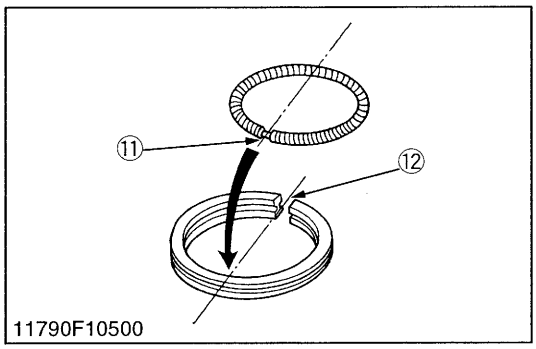

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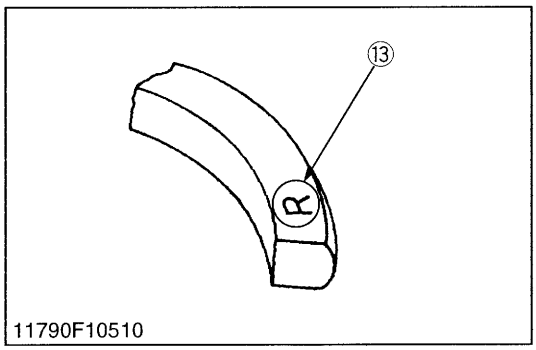

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Piston Ring and Connecting Rod

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

(When reassembling)

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

■ NOTE

- **When installing the connecting rod to the piston, align the mark (10) on the connecting rod to the arrow's direction of casting mark (9) on the piston.**
- **Mark the same number on the connecting rod and the piston so as not to change the combination.**

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

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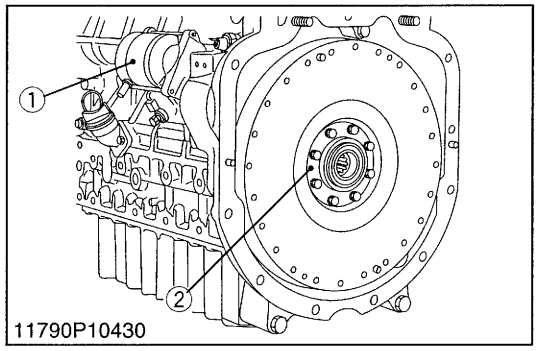

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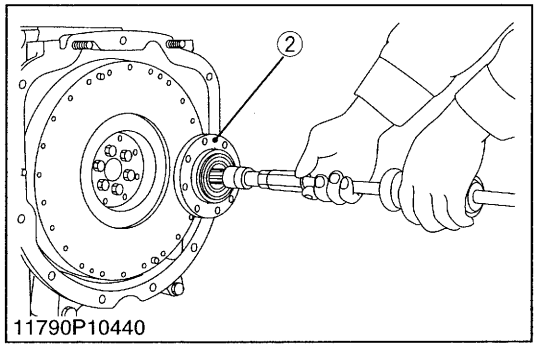

11790P10440

PTO Propeller Shaft Spline Hub and Flywheel

1. Remove the starter motor (1).
2. Lock the flywheel not to turn using the flywheel stopper.
3. Remove the PTO propeller shaft spline hub screws.
4. Draw out the PTO propeller shaft spline hub (2) with a knuckle spindle bushing replacement tool.
5. Remove the flywheel screws, except for two which must be loosened and left as they are.
6. Set a flywheel puller, and remove the flywheel.

(When reassembling)

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

Tightening torque	PTO propeller shaft spline hub screw	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
	Flywheel screw	98.0 to 107.8 N·m 10.0 to 11.0 kgf·m 72.3 to 79.5 ft-lbs

(1) Starter Motor (2) PTO Propeller Shaft Spline Hub

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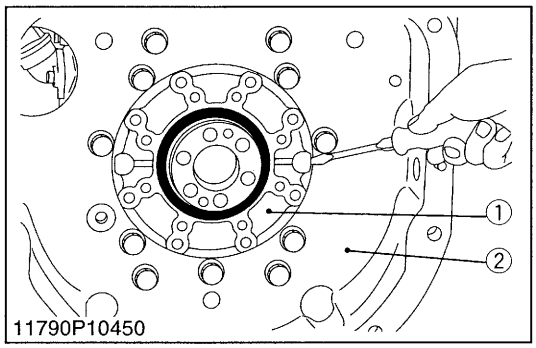

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Bearing Case Cover and Flywheel Housing Case

1. Remove the bearing case cover mounting screws first inside and next outside.
2. Remove the bearing case cover (1).
3. Remove the flywheel housing case (2).

(When reassembling)

- Apply grease 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	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs

(1) Bearing Case Cover (2) Flywheel Housing Case

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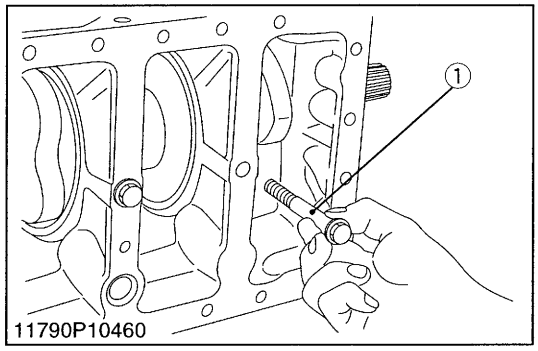

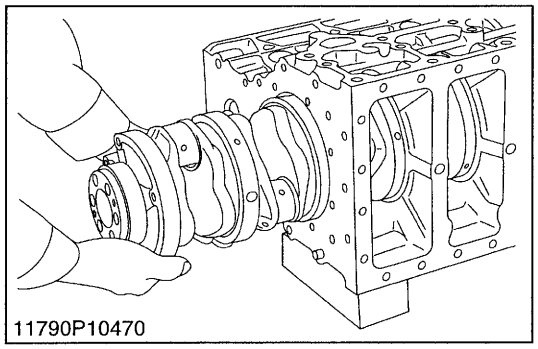

Crankshaft

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

(When reassembling)

- Apply oil to the main bearing case screw 2 (1).
- Clean the oil passage of the crankshaft with compressed air.

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

(1) Main Bearing Case Screw 2

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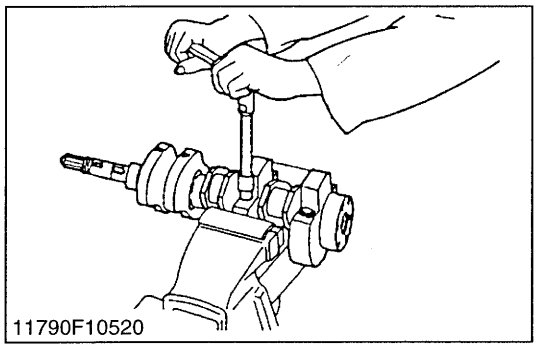
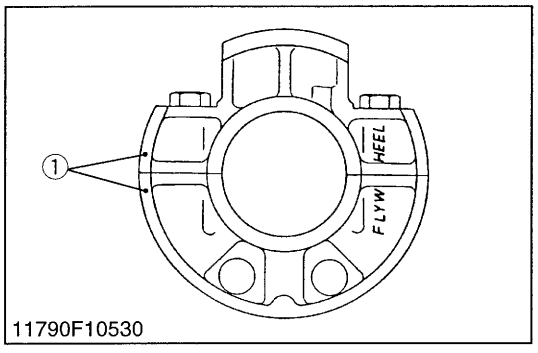


Main Bearing Case Assembly

1. Remove the two main bearing case screws 1, and remove the main bearing case assembly 1, being careful with the thrust bearing and crankshaft bearing 2.
2. Remove the main bearing case assembly 2, 3 and 4 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, D)** from the gear case side.
- Match the alignment numbers (1) on the main bearing case.
- When installing the main bearing case 1, 2, 3 and 4, 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	46.1 to 50.9 N·m 4.7 to 5.2 kgf·m 34.0 to 37.6 ft-lbs

(1) Alignment Number

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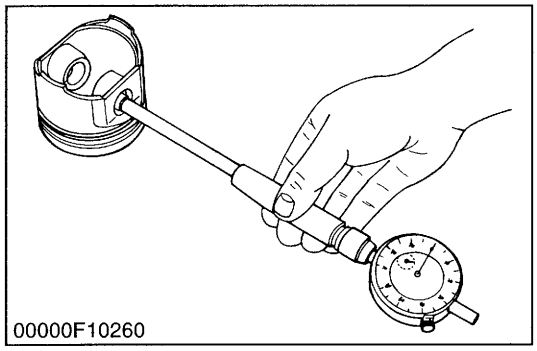
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Piston Pin Bore I.D.

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.	25.000 to 25.013 mm 0.98425 to 0.98477 in.
	Allowable limit	25.05 mm 0.9862 in.

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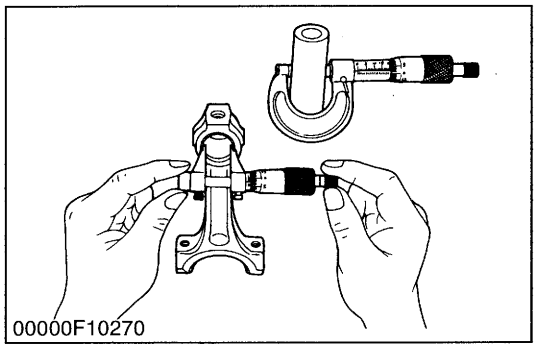
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Oil Clearance between Piston Pin and Small End Bushing

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

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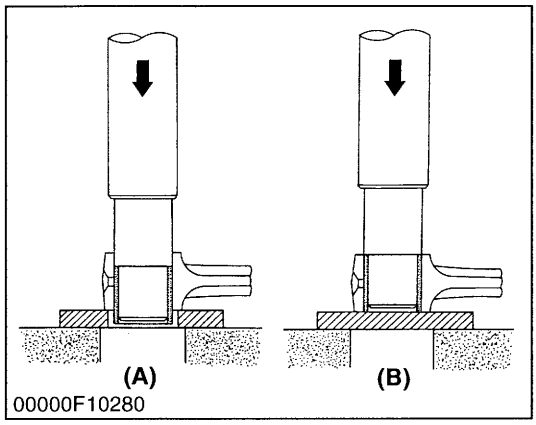

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Replacing Small End Bushing

(When removing)

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

(When installing)

1. Clean small end bore, and apply engine oil to them.
2. Press in a new bushing so that it is flush with the end of the connecting rod using a small end bushing replacing tool by aligning the oil holes of the connecting rod and the bushing.

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

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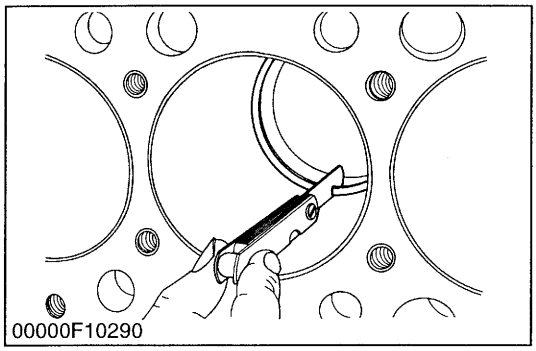
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Piston Ring Gap

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

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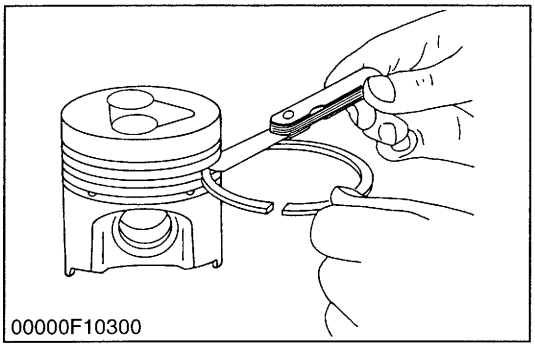
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Clearance between Piston Ring and Piston Ring Groove

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

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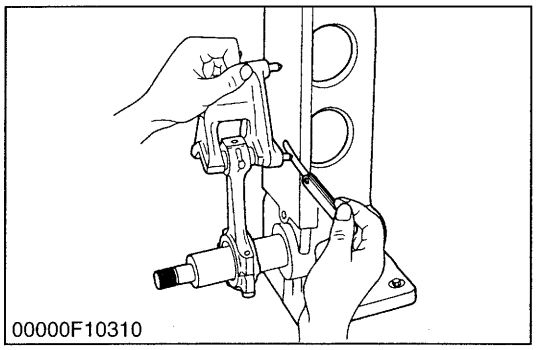
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Connecting Rod Alignment

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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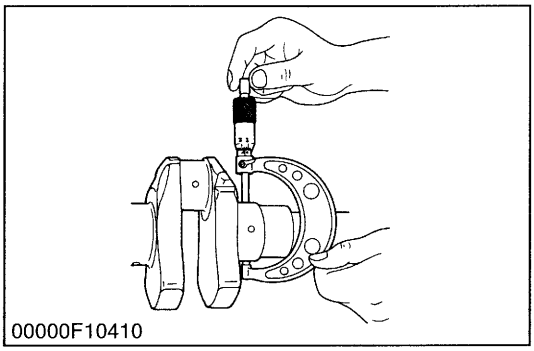
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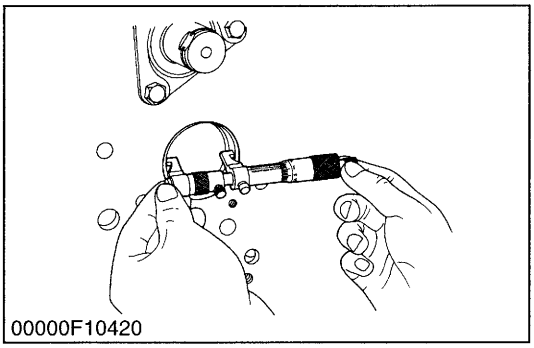
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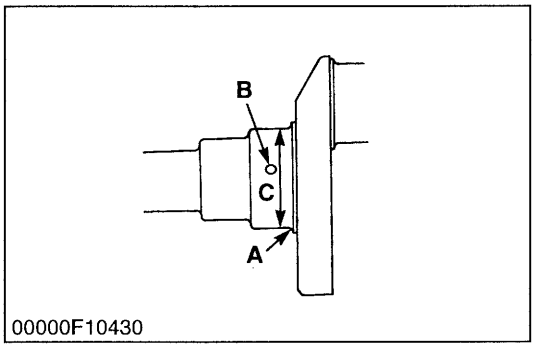

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Oil Clearance between Crankshaft Journal and Crankshaft Bearing 1

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.	0.040 to 0.118 mm 0.00157 to 0.00465 in.
	Allowable limit	0.20 mm 0.0079 in.
Crankshaft journal O.D.	Factory spec.	51.921 to 51.940 mm 2.04413 to 2.04488 in.
Crankshaft bearing 1 I.D.	Factory spec.	51.980 to 52.039 mm 2.04645 to 2.04878 in.

(Reference)

- Undersize crankshaft bearing 1

Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankshaft bearing 1 02	17331-23911	020 US
0.4 mm 0.016 in.	Crankshaft bearing 1 04	17331-23921	040 US

- Undersize dimensions of crankshaft journal

Undersize	0.2 mm 0.008 in.	0.4 mm 0.016 in.
Dimension 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
Dimension 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
Dimension C	51.721 to 51.740 mm 2.03626 to 2.03700 in.	51.521 to 51.540 mm 2.02838 to 2.02913 in.
The crankshaft journal must be fine-finished to higher than ∇∇∇∇ . (0.4S)		

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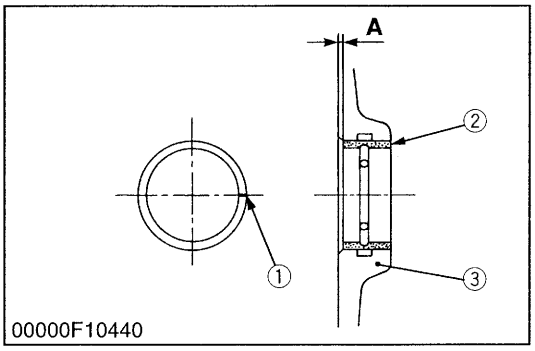

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Replacing Crankshaft Bearing 1

(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.

Dimension **(A)**	Factory spec.	4.2 to 4.5 mm 0.1654 to 0.1772 in.

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

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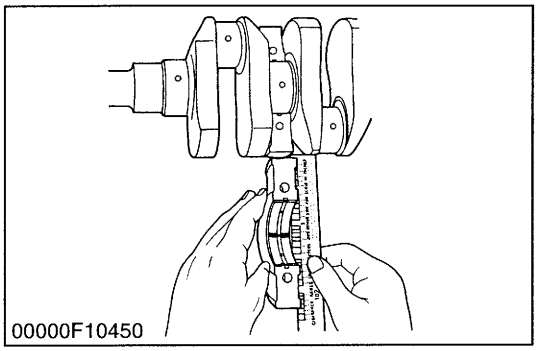
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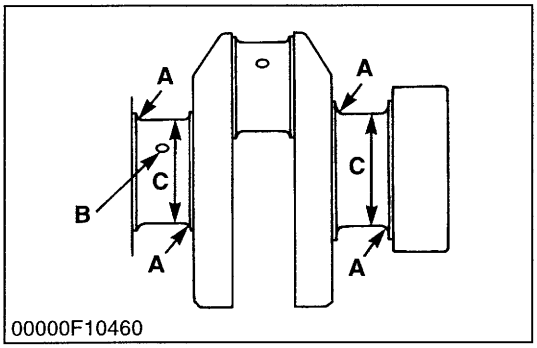

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Oil Clearance between Crankshaft Journal and Crankshaft Bearing 2

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.
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.	0.040 to 0.104 mm 0.00157 to 0.00409 in.
	Allowable limit	0.20 mm 0.0079 in.
Crankshaft journal O.D.	Factory spec.	51.921 to 51.940 mm 2.04413 to 2.04488 in.
Crankshaft bearing 2 I.D.	Factory spec.	51.980 to 52. 025 mm 2.04645 to 2.04822 in.

(Reference)

- Undersize crankshaft bearing 2

Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankshaft bearing 2 02	17331-23931	020 US
0.4 mm 0.016 in.	Crankshaft bearing 2 04	17331-23941	040 US

- Undersize dimensions of crankshaft journal

Undersize	0.2 mm 0.008 in.	0.4 mm 0.016 in.
Dimension 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
Dimension 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
Dimension C	51.721 to 51.740 mm 2.03626 to 2.03700 in.	51.521 to 51.540 mm 2.02838 to 2.02913 in.
The crankshaft journal must be fine-finished to higher than ∇∇∇ (0.4S).		

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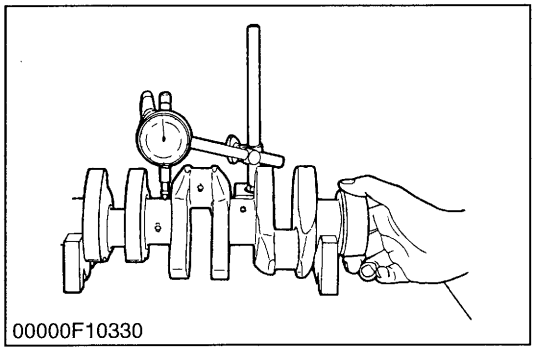
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Crankshaft Alignment

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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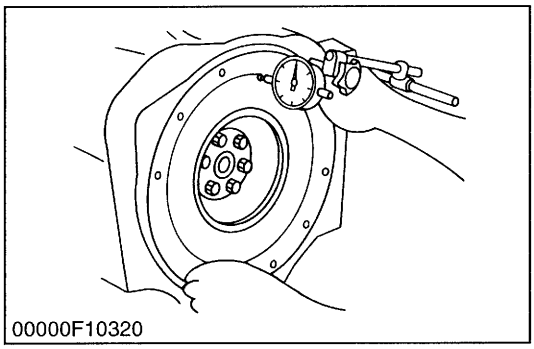
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Flywheel Sway

1. Set dial indicator with its tip on the rear friction face of the flywheel near the edge.
2. Turn the flywheel and measure the sway.
3. If the measurement exceeds the allowable limit, remove the flywheel and check the contact face of the crankshaft and flywheel.

Flywheel Deflection	Allowable limit	0.05 mm 0.002 in.

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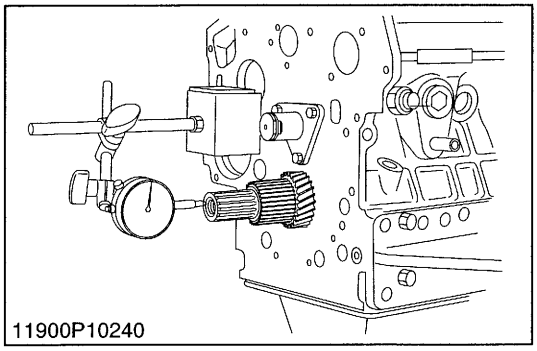
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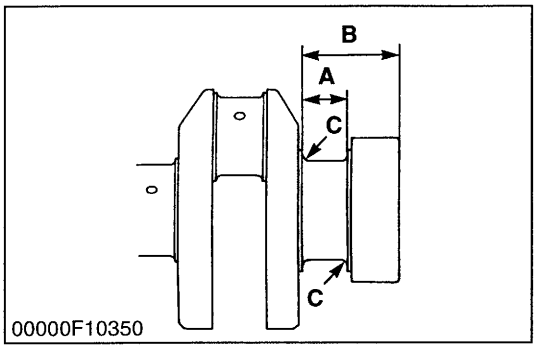

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Crankshaft Side Clearance

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	15221-23951	020 OS
	Thrust bearing 2 02	19202-23971	020 OS
0.4 mm 0.016 in.	Thrust bearing 1 04	15221-23961	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	26.20 to 26.25 mm 1.0315 to 1.0335 in.	26.40 to 26.45 mm 1.1181 to 1.1201 in.
B	54.5 to 54.7 mm 2.146 to 2.154 in.	54.6 to 54.8 mm 2.150 to 2.157 in.
C	2.8 to 3.2 mm radius 0.110 to 0.126 in. radius	2.8 to 3.2 mm radius 0.110 to 0.126 in. radius
The crankshaft journal must be fine-finished to higher than $\overset{(0.4S)}{\nabla\nabla\nabla\nabla}$.		

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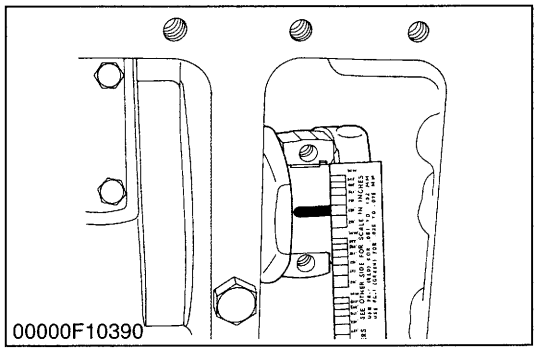
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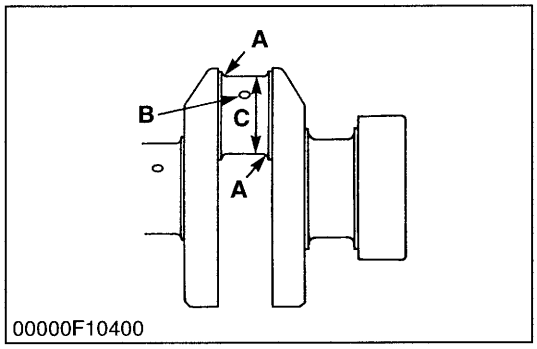

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Oil Clearance between Crankpin and Crankpin Bearing

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.	0.025 to 0.087 mm 0.00098 to 0.00343 in.
	Allowable limit	0.20 mm 0.0079 in.

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

(Reference)

- Undersize crankpin bearing

Undersize	Bearing	Code Number	Marking
0.2 mm 0.008 in.	Crankpin bearing 02	17331-22971	020 US
0.4 mm 0.016 in.	Crankpin bearing 04	17331-22981	040 US

- Undersize dimensions of crankpinl

Undersize	0.2 mm 0.008 in.	0.4 mm 0.016 in.
Dimension A	3.3 to 3.7 mm radius 0.1299 to 0.1457 in.radius	3.3 to 3.7 mm radius 0.1299 to 0.1457 in.radius
Dimension 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
Dimension C	46.759 to 46.775 mm 1.84090 to 1.84153 in.	46.559 to 46.575 mm 1.83303 to 1.83366 in.
The crankpin must be fine-finished to higher than ∇∇∇∇ . (0.4S)		

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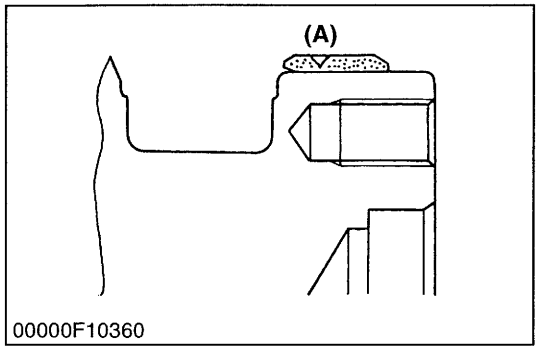

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Crankshaft Sleeve Wear

1. Measure the wear **(A)** of the crankshaft sleeve with a surface roughness tester.
2. If the wear exceeds the allowable limit or when the engine oil leaks, replace the crankshaft sleeve.

Wear **(A)** of crankshaft sleeve	Allowable limit	0.10 mm 0.0039 in.

(A) Wear

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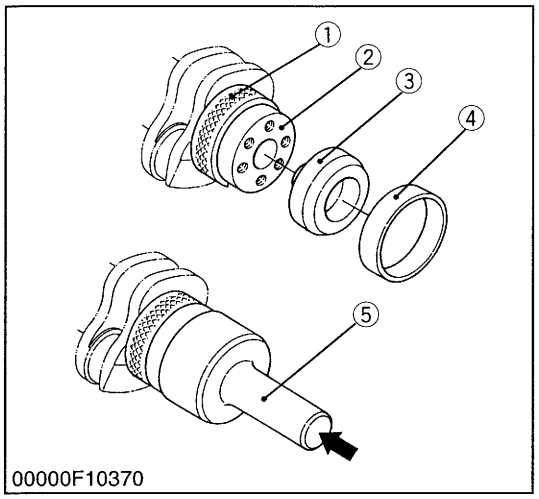

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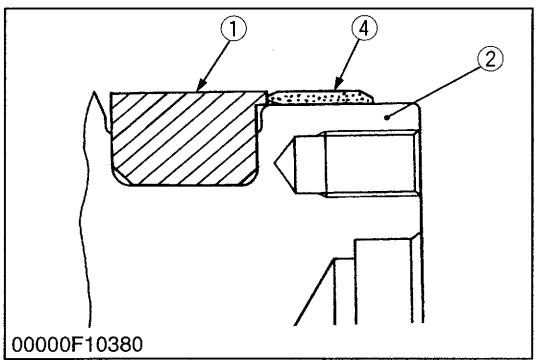
Replacing Crankshaft Sleeve

1. Remove the used crankshaft sleeve using a special use puller set (Code No. 07916-09032).
2. Prepare the auxiliary socket for fixing crankshaft sleeve (Code No. 07916-32091).
3. Set the sleeve guide (3) to the crankshaft (2).
4. Set the stopper (1) to the crankshaft as shown in figure.
5. Heat a new sleeve (4) to a temperature between 150 and 200 °C (302 and 392 °F), and fix the sleeve to the crankshaft as shown in figure.
6. Press fit the sleeve using the auxiliary socket for pushing (5).

■ NOTE

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



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

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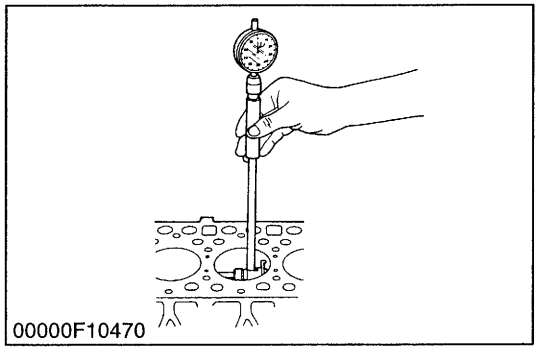
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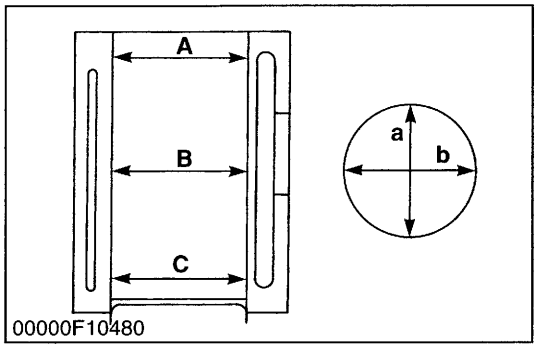

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Cylinder Wear

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"**)

Cylinder I.D.	Factory spec.	87.000 to 87.022 mm 3.42519 to 3.42606 in.
	Allowable limit	+0.15 mm +0.0059 in.

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

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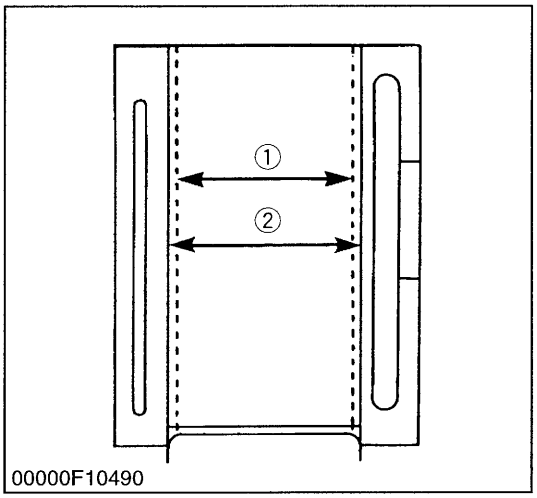

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Correcting Cylinder

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

Oversized cylinder I.D.	Factory spec.	87.500 to 87.522 mm 3.44488 to 3.44574 in.
	Allowable limit	+0.15 mm +0.0059 in.

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

Oversize	Part Name	Code Number	Marking
0.5 mm 0.0197 in.	Piston 05	19077-21911	05 OS
	Piston ring 05 assembly	17331-21091	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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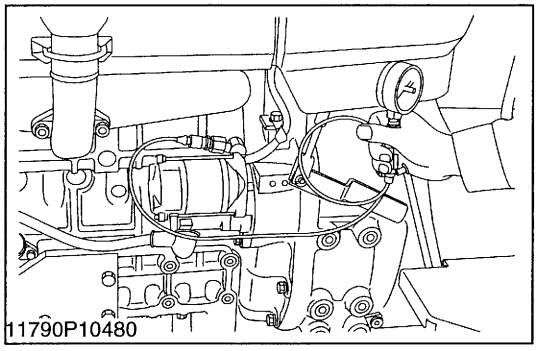
[5] LUBRICATING SYSTEM

CHECKING AND ADJUSTING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Engine Oil Pressure

1. Remove the engine oil pressure switch, and install the oil pressure tester (Code No. 07916-32032) with adaptor 7 (Code No. 07916-32591).
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 98 kPa 1.0 kgf/cm^2 14 psi
		Allowable limit	49 kPa 0.5 kgf/cm^2 7 psi
	At rated speed	Factory spec.	294 to 441 kPa 3.0 to 4.5 kgf/cm^2 43 to 64 psi
		Allowable limit	245 kPa 2.5 kgf/cm^2 36 psi

(When reassembling)

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

11790S10500

DISASSEMBLING AND ASSEMBLING

Oil Pump Assembly

1. Remove the oil pump assembly. (See page 1-S32.)

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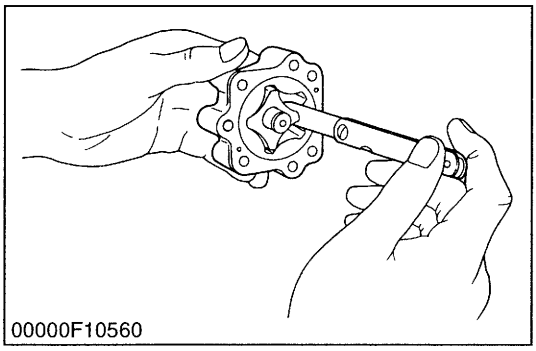
SERVICING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Rotor Lobe Clearance

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

Rotor lobe clearance	Factory spec.	0.03 to 0.14 mm 0.0012 to 0.0055 in.
	Allowable limit	0.20 mm 0.0079 in.

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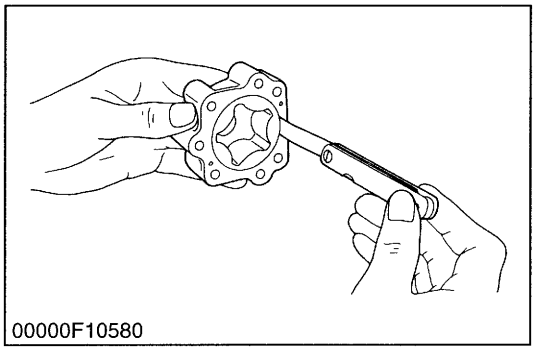
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Clearance between Outer Rotor and Pump Body

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

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

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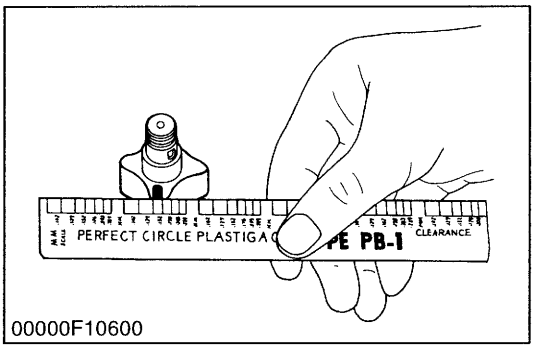

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Clearance between Rotor and Cover

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 allowable limit, replace oil pump rotor assembly.

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

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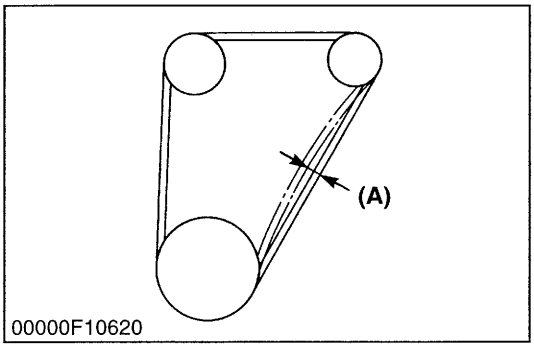
[6] COOLING SYSTEM CHECKING AND ADJUSTING



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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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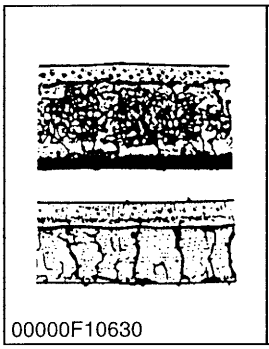
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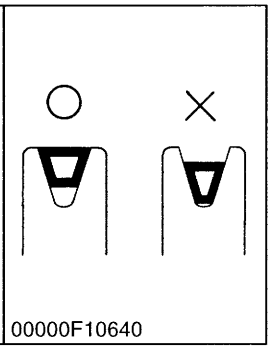
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Fan Belt Damage and Wear

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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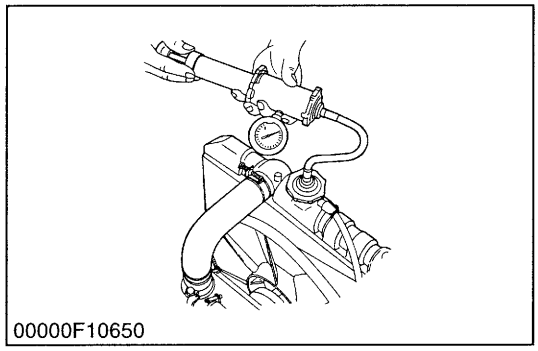
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Radiator Water Leakage

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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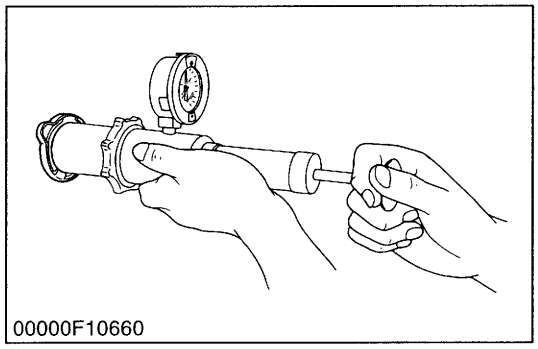
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Radiator Cap Air Leakage

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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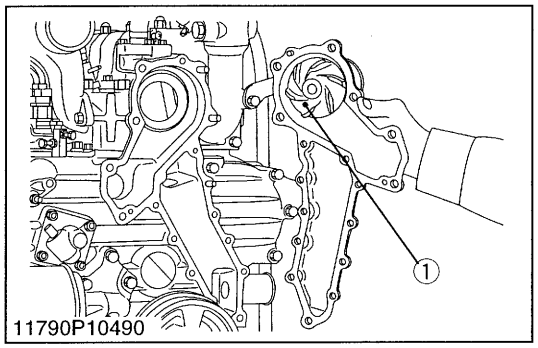
DISASSEMBLING AND ASSEMBLING



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Water Pump Assembly

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

(When reassembling)

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

(1) Water Pump Assembly

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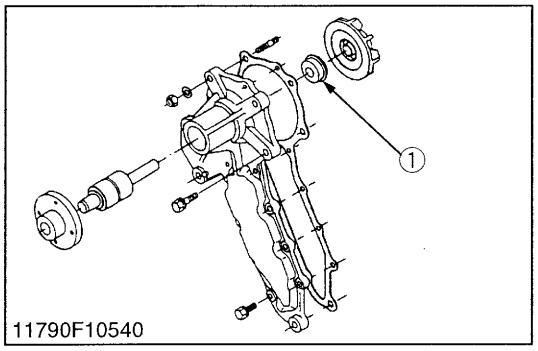

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Mechanical Seal Assembly

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

(When reassembling)

- Replace the mechanical seal with new one.

■ IMPORTANT

- **Do not disassembly the mechanical seal assembly.**

(1) Mechanical Seal Assembly

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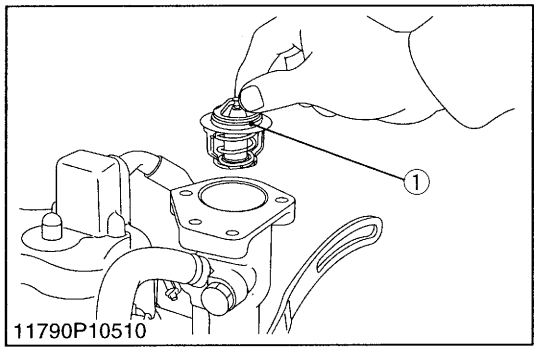

Thermostat Assembly

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

(When reassembling)

- Put the rib of the thermostat assembly in place in the recess of the water flange.
- Apply a liquid gasket (Three Bond 1104 or equivalent) only at the thermostat cover side of the gasket.

(1) Thermostat Assembly

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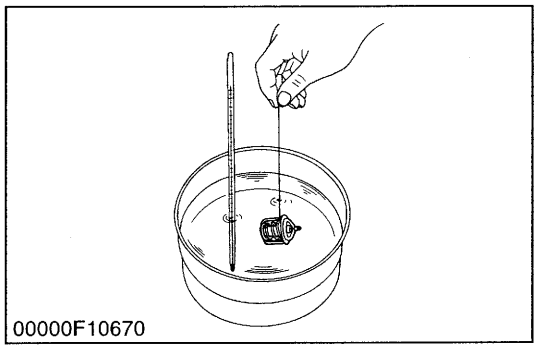
SERVICING



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. 8 mm (0.315 in.).
4. If the measurement is not within the factory specifications, replace the thermostat.

Thermostat's valve opening temperature	Factory spec.	69.5 to 72.5 °C 157.1 to 162.5 °F
Temperature at which thermostat completely opens	Factory spec.	85 °C 185.5 °F

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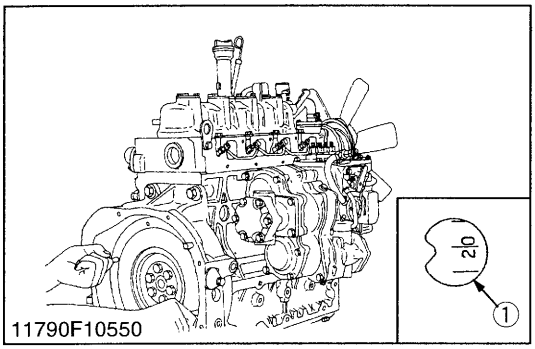
[7] FUEL SYSTEM
CHECKING AND ADJUSTING
(1) Injection Pump



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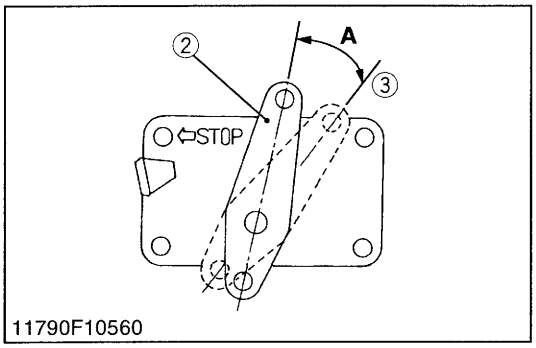

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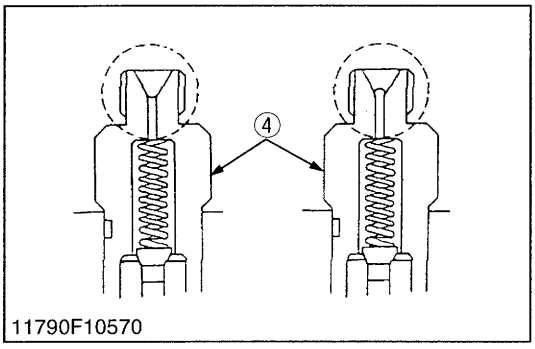

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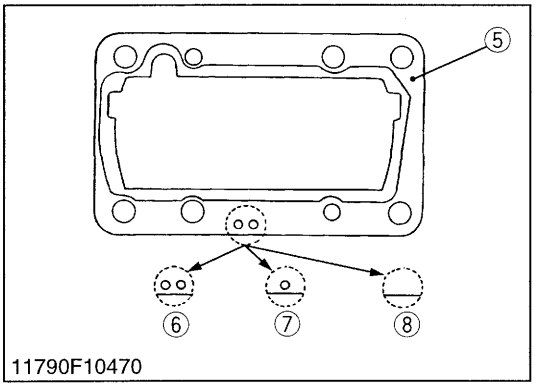

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Injection Timing

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

Injection timing	Factory spec.	0.314 to 0.349 rad. (18 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.**

(1) Timing Window
(2) Stop Lever
(3) Stop Lever in Free Position
(4) Delivery Valve Holder
(5) Shim (Soft Metal Gasket Shim)
(6) Two-holes : 0.20 mm (0.0079 in.)
(7) One-hole : 0.25 mm (0.0098 in.)
(8) Without hole : 0.30 mm (0.0118 in.)
(A) 0.401 to 0.471 rad. (23 to 27°)

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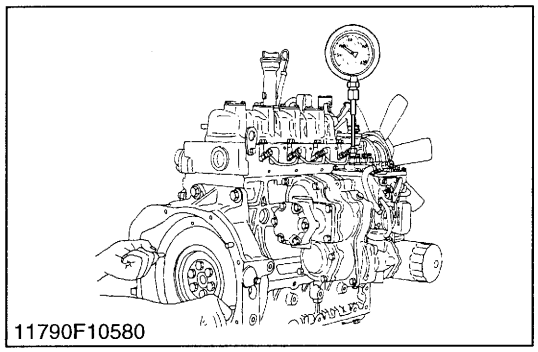
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Fuel Tightness of Pump Element

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

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

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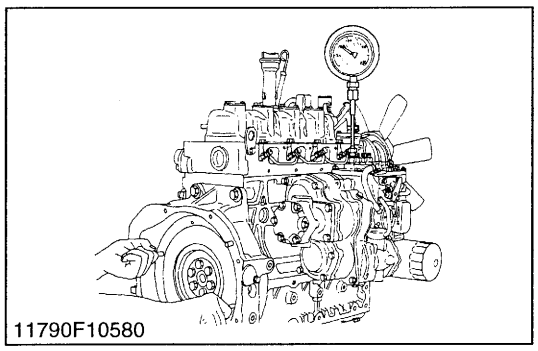
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Fuel Tightness of Delivery Valve

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

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

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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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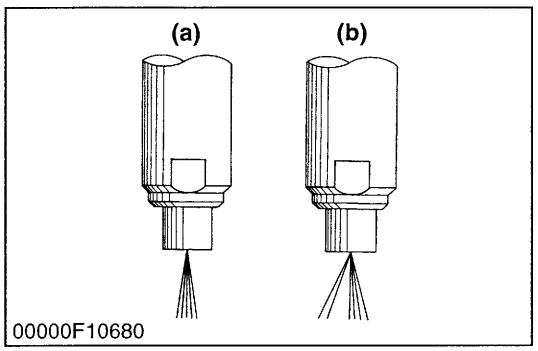

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Nozzle Spraying Condition

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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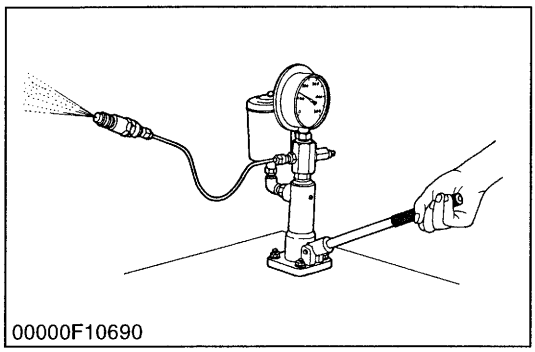
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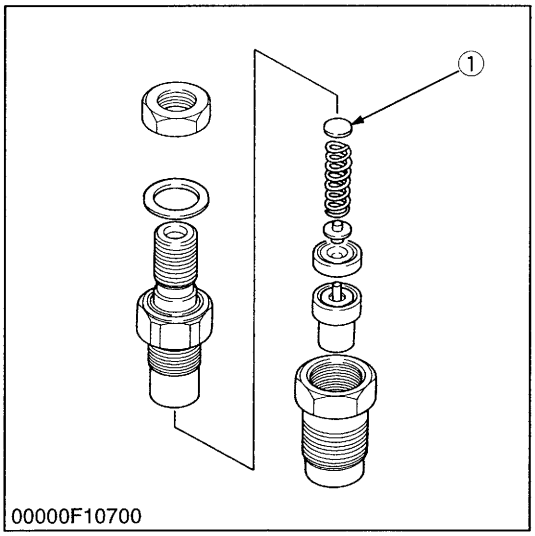
Fuel Injection Pressure

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 0.1 mm (0.0039 in.) difference of adjusting washer thickness.
  Approx. 981 kPa (10 kgf/cm^2, 142 psi)



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(1) Adjusting Washer

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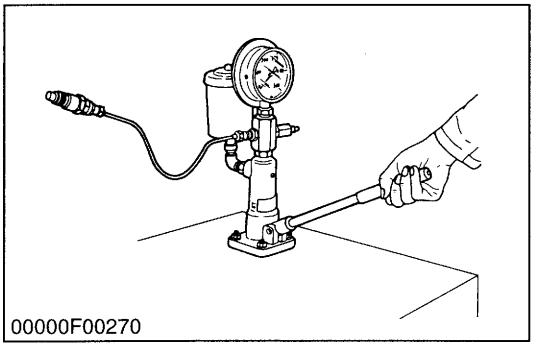
Valve Seat Tightness

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

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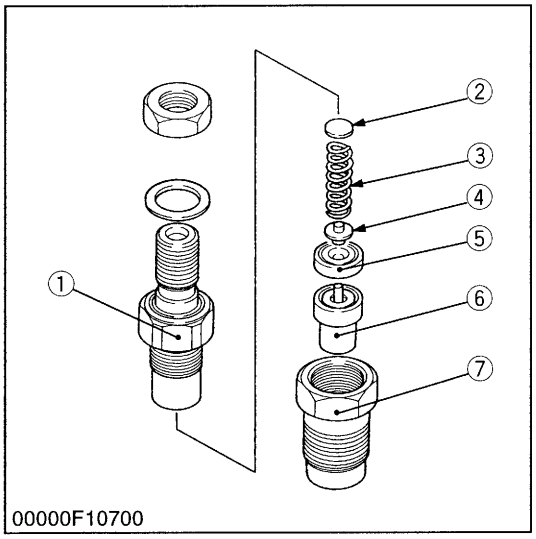
DISASSEMBLING AND ASSEMBLING

(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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2 CLUTCH

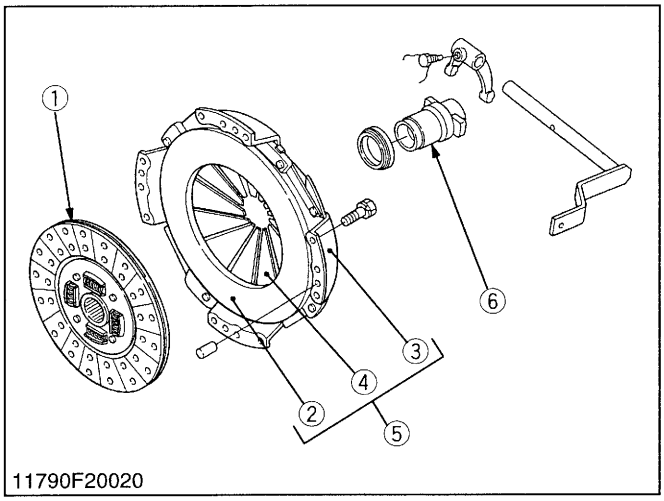
2 CLUTCH

MECHANISM

CONTENTS

[1] TRAVELLING CLUTCH

(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
(3) Clutch Cover
(4) Diaphragm Spring
(5) Pressure Plate Assembly
(6) Release Hub

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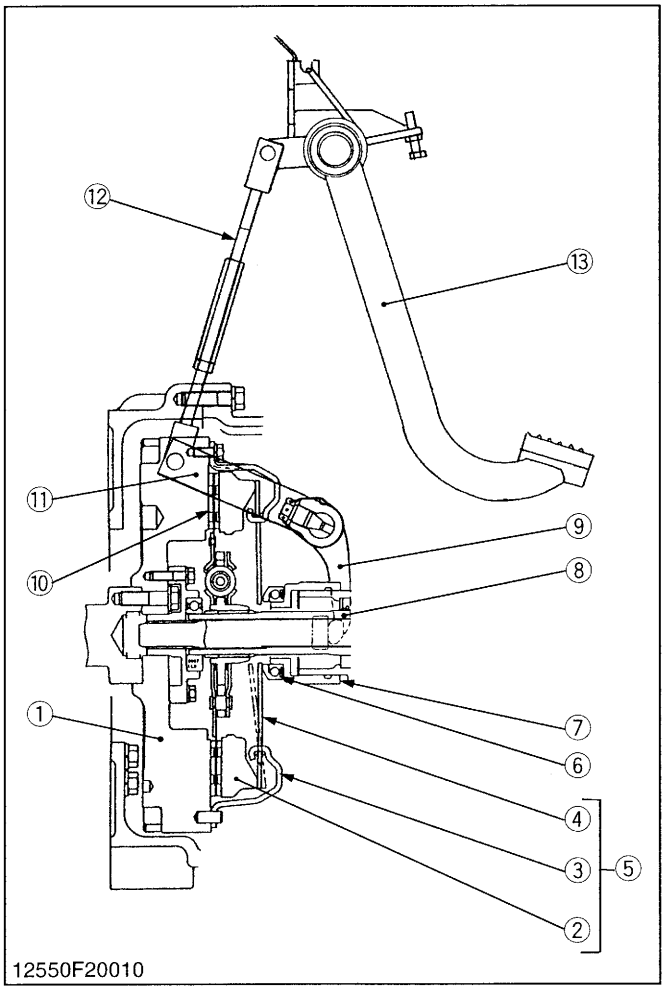
(2) Travelling Clutch Linkage



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

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

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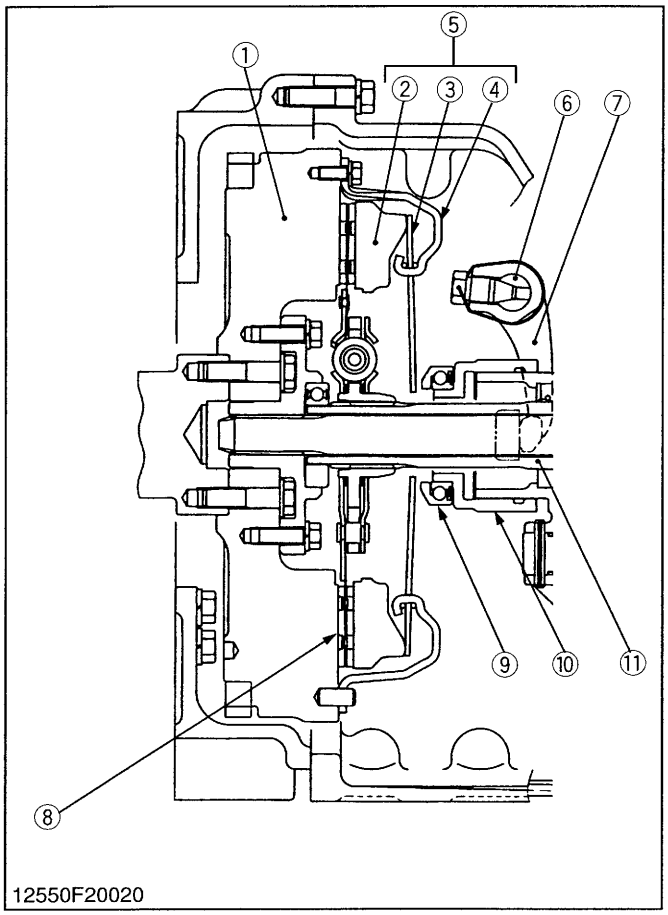
(3) Operation



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■ Clutch "Engaged"

When the clutch pedal is not depressed, the clutch release bearing (6) and the fingers of diaphragm spring (3) are not connected to each other.

Accordingly, the pressure plate (2) is tightly pressed against the flywheel (1) by the diaphragm spring (3).

As a result, rotation of the flywheel (1) is transmitted to the transmission through the gear shaft (8) due to the frictional force among the flywheel (1), clutch disc (8) and pressure plate (2).

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

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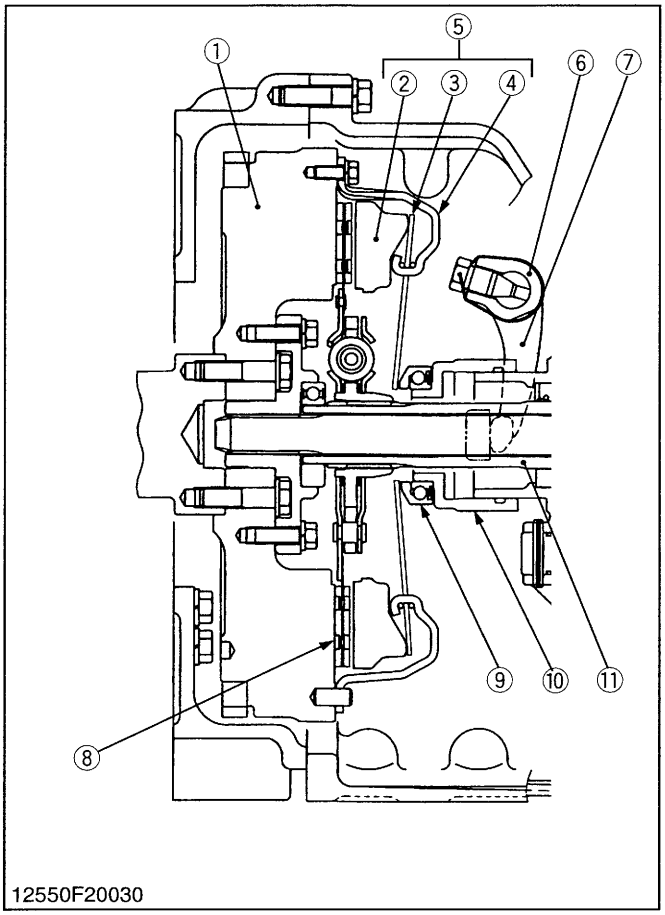

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■ Clutch "Disengaged"

When the clutch pedal is depressed, the clutch rod is pulled to move the clutch lever (11). Then, the release fork (9) pushes the release hub (7) and release bearing (6) toward the flywheel. Simultaneously, the release bearing (6) pushes the diaphragm spring (3).

As the pressure plate (2) is pulled by the diaphragm spring (3), the frictional force among the flywheel (1), clutch disc (10) and pressure plate (2) disappears.

Therefore, rotation of the flywheel (1) is not transmitted to the clutch disc (8), and then the rotation of the gear shaft (11) stops.

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

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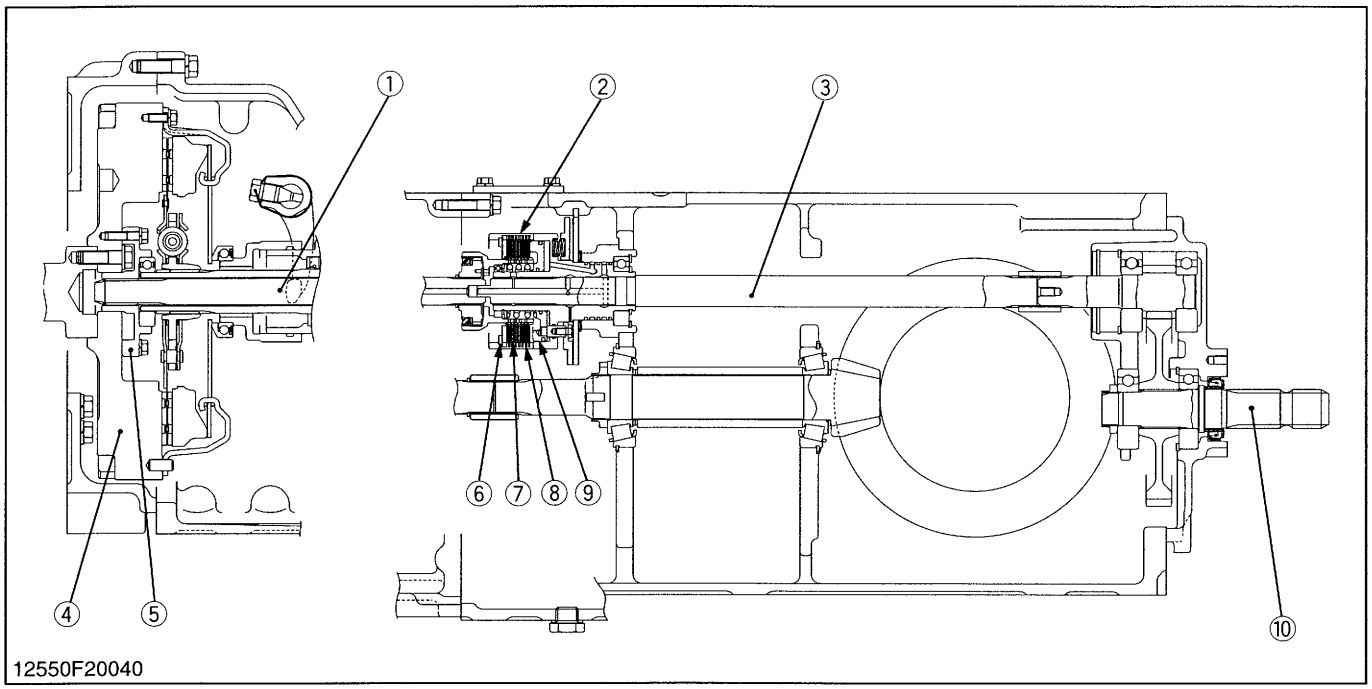
[2] PTO CLUTCH

(1) Structure



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(1) PTO Propeller Shaft
(2) PTO Clutch Pack
(3) Gear Shaft
(4) Flywheel
(5) PTO Spline Hub
(6) Pressure Plate
(7) Drive Plate
(8) Clutch Disc
(9) Clutch Piston
(10) PTO Shaft

As shown in the figure above, the PTO propeller shaft (1) is splined to the spline hub (5) and is always rotated while the engine runs.

The PTO clutch pack has seven clutch discs (8), seven drive plates (7) and one pressure plate (6). The clutch piston (9) actuated by hydraulic from PTO clutch valve, tightly presses the clutch discs (8) and drive plates (8) toward the pressure plate (6).

As a result, the rotation of the PTO propeller shaft is transmitted to the gear shaft (3) through the PTO clutch pack (2).

The PTO clutch valve can be in a semi-clutching state by means of the modulating valve. Thereby, the PTO clutch is engaged very smoothly.

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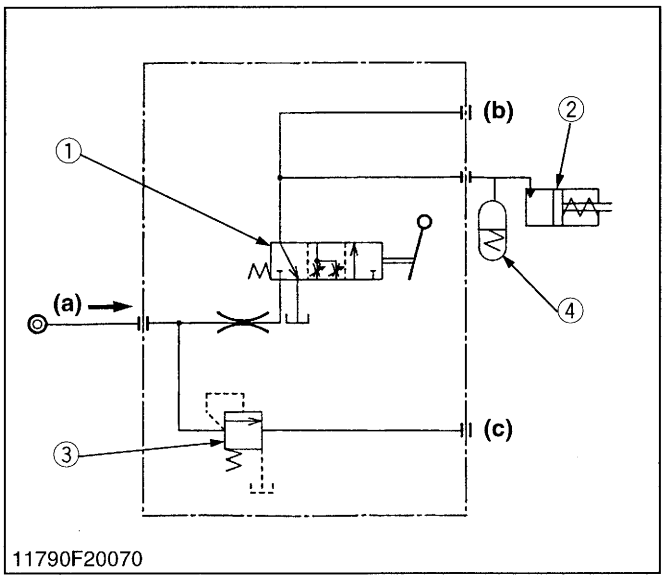
(2) Oil Flow



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The oil from the steering controller flows into the PTO clutch valve.

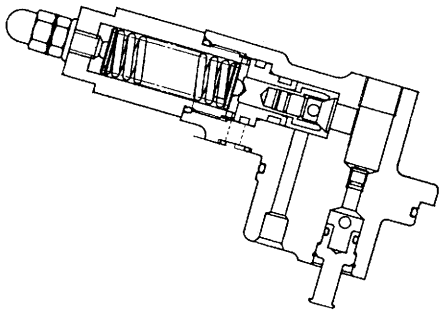
When the PTO is at the disengaged position, the oil flows is stopped by the PTO clutch valve (1). When the PTO is at the engaged position, the oil flows through the PTO clutch valve (1) to the modulating valve (4) and PTO clutch pack (2) to engage it.

(1) PTO Clutch Valve
(2) PTO Clutch Pack
(3) Relief Valve
(4) Modulating Valve
(a) From Steering Controller
(b) Pressure Check Port
(c) Lubricating Port

11790M20060

(3) PTO Clutch Valve

(1)



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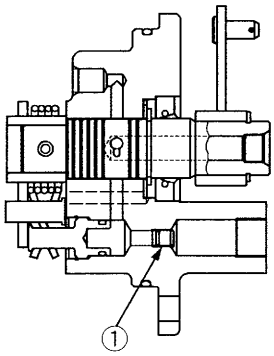
(2)



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PTO clutch valve is composed of the following parts.

(1) Main Relief Valve

PTO clutch inner pressure is kept in approx. 2.45 to 2.55 MPa (25 to 26 kgf/cm^2, 355 to 370 psi) by the main relief valve.

(2) Rotary Valve

This valve change the oil flow to PTO clutch. This is rotated by the PTO operation lever via to PTO clutch cable. The oil from steering controller passes through the orifice (1) and flow to the PTO clutch.

(1) Orifice

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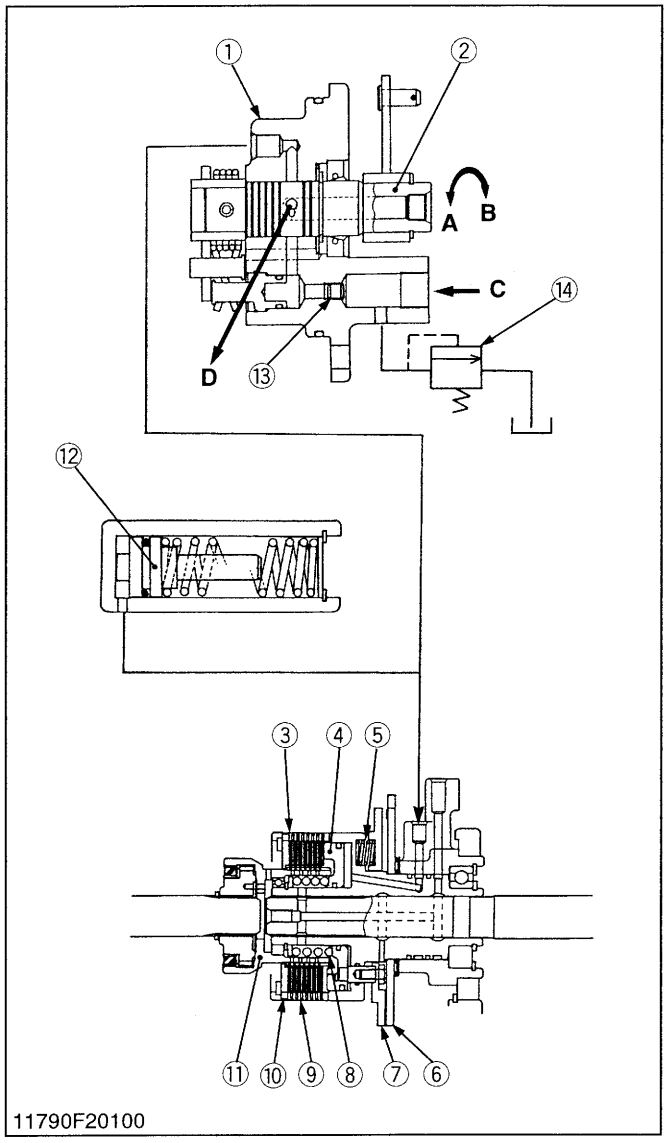

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■ PTO Clutch "Engaged"

The oil from power steering controller flows into the clutch valve (1). When the PTO shift lever is set at the **"Engaged"** position, the spool (2) is turned to **A** position, then oil flows through the spool (2) into the modulating valve and the clutch pack. Oil entering the clutch pack pushes the piston (4) to engage the clutch pack. The modulating valve absorbs the engaging shock of the clutch pack.

(1) PTO Clutch Valve
(2) Spool
(3) Plate
(4) Piston
(5) Brake Spring
(6) Brake Disc
(7) Brake Plate
(8) Return Spring
(9) Clutch Discs
(10) Pressure Plate
(11) Clutch Hub
(12) Modulating Valve
(13) Orifice
(14) Relief Valve

(A) Engaged Position
(B) Disengaged Position
(C) From Power Steering Controller
(D) Drain (To the Transmission Case)

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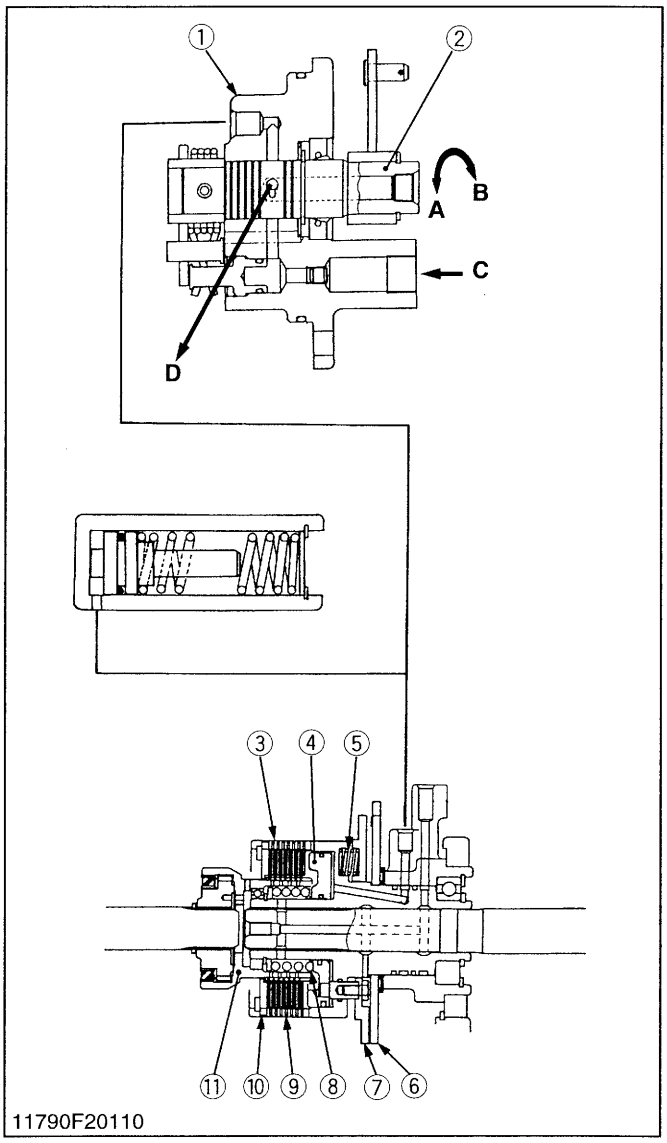

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■ PTO Clutch "Disengaged"

When the PTO shift lever is set at the **"Disengaged"** position, the spool (2) is turned to **B** position, then the oil from the power steering controller is stopped by the spool (2) and the oil in the PTO clutch pack drained into the tank. Thus the piston (4) is pushed back by the return spring (8).

When the piston (4) is pushed back, the brake plate (7) is also moved to contact the brake disc (6) so as to stop the rotation and the drag of the PTO shaft.

(1) PTO Clutch Valve
(2) Spool
(3) Plate
(4) Piston
(5) Brake Spring
(6) Brake Disc
(7) Brake Plate
(8) Return Spring
(9) Clutch Discs
(10) Pressure Plate
(11) Clutch Hub

(A) Disengaged Position
(B) Engaged Position
(C) From Power Steering Controller
(D) Drain (To the Transmission Case)

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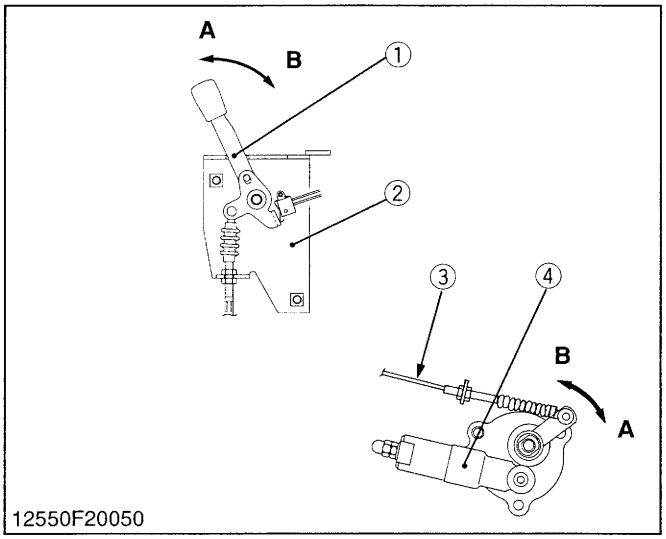
(4) Shift Linkage



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The shift lever (1) and the PTO clutch valve (4) are connected by the shift cable (3) as shown in the left figure.

When the shift lever is moved to the **B** side, the PTO clutch valve (4) is set at **"Engaged"** position. Then the oil flows to clutch pack through the PTO clutch valve (4), and the clutch pack is engaged and the PTO shaft rotates. When the shift lever is moved to the **A** side, the PTO clutch valve (4) is set at the **"Disengaged"** position.

(1) Shift Lever
(2) Lever Guide
(3) Shift Cable
(4) PTO Clutch Valve

(A) Disengaged Position
(B) Engaged Position

12550M20060

SERVICING

CONTENTS

TROUBLESHOOTING

TRAVELLING CLUTCH

Symptom	Probable Cause	Solution	Reference Page
Clutch Drags	• Clutch pedal free play excessive	Adjust	2-S5
	• Dust on clutch disc generated from clutch disc facing	Remove rust	–
	• Release fork broken	Replace	2S-11
	• Clutch disc or pressure plate warped	Replace	2-S12, S13
	• Wire ring of the pressure plate worn or broken	Replace (Pressure plate assembly)	2-S11
Clutch Slips	• Clutch pedal free play too small	Adjust	2-S5
	• Clutch disc excessively worn	Replace	2-S11, S12
	• Grease or oil on clutch disc facing	Replace	2-S11, S12
	• Clutch disc or pressure plate warped	Replace	2-S12, S13
	• Diaphragm spring weaken or broken	Replace	2-S11, S13
	• Wire ring of the pressure plate worn or broken	Replace (Pressure plate assembly)	2-S11
Chattering	• Grease or oil on clutch disc facing	Replace	–
	• Clutch disc or pressure plate warped	Replace	2-S12, S13
	• Clutch disc boss spline worn or rusted	Replace or remove rust	2-S11, S12
	• Gear shaft bent	Replace	3-S13
	• Pressure plate or flywheel face cracked or scored	Replace	2-S13 1-S39
	• Clutch disc boss spline and gear shaft spline worn	Replace	2-S11,S12 3-S13
	• Diaphragm spring strength uneven or diaphragm spring broken	Replace	2-S11, S13
Rattle During Running	• Clutch disc boss spline worn	Replace	2-S11,S12
	• Release bearing worn or sticking	Replace	2-S11,S12
Clutch Squeaks	• Release bearing sticking or dry	Replace or lubricate	2-S11
	• Clutch disc excessively worn	Replace	2-S11,S12
Vibration	• Gear shaft bent	Replace	3-S13
	• Clutch disc rivet worn or broken	Replace	2-S11
	• Clutch parts broken	Replace	2-S11

12550S20010

PTO CLUTCH

Symptom	Probable Cause	Solution	Reference Page
PTO Clutch Slip	• Operating pressure is low • PTO Clutch valve malfunctioning • Clutch disc or drive plate excessively worn • Deformation of piston or return plate	Adjust Repair or replace Replace Replace	2-S14 2-S15 2-S20 2-S20
PTO Shaft Does Not Rotate	• PTO clutch malfunctioning • PTO propeller shaft coupling disengaged	Repair or replace Engage	2-S20 –
PTO Clutch Operating Pressure Is Low	• Transmission oil improper or insufficient • Relief valve malfunctioning	Replenish or change Adjust or replace	G-14 2-S14
PTO Clutch Drags	• Brake plate excessively worn • Return spring weaken or broken • Modulating valve malfunctioning • Deformation or return plate or steal plate	Replace Replace Repair or replace Replace	2-S21 2-S21 2-S21 –

12550S20020

SERVICING SPECIFICATIONS

TRAVELLING CLUTCH

Item		Factory Specification	Allowable Limit
Clutch Pedal	Free play	35 to 45 mm 1.4 to 1.8 in.	–
Clutch Pedal ROPS	Total Stroke	165 to 170 mm 6.5 to 6.7 in.	–
CAB	Total Stroke	155 to 160 mm 5.9 to 6.3 in.	–
Clutch Pedal Shaft to Clutch Pedal Bushing	Clearance	0.025 to 0.185 mm 0.00098 to 0.00728 in.	1.00 mm 0.0394 in.
Clutch Pedal Shaft	O.D.	27.900 to 27.975 mm 1.09842 to 1.10138 in.	–
Clutch Pedal Bushing	I.D.	28.000 to 28.085 mm 1.10236 to 1.10571 in.	–
Clutch Disc Boss to Gear Shaft	Backlash (Displacement Around Disc Edge)	–	2.0 mm 0.079 in.
Clutch Disc	Disc Surface to Rivet Top (Depth)	–	0.3 mm 0.012 in.
Diaphragm Spring	Mutual Difference	–	0.5 mm 0.020 in.
Pressure Plate	Flatness	–	0.2 mm 0.008 in.

CONTROL LINKAGE

Shift Rod	Length	Approx. 209 mm 8.23 in.	–

12550S20030

PTO CLUTCH

Item		Factory Specification	Allowable Limit
PTO Clutch Valve Condition • Engine Speed Maximum • Oil temperature 45 to 55 °C 113 to 131 °F	Relief Valve Setting Pressure	2.45 to 2.55 MPa 25 to 26 kgf/cm^2 355 to 370 psi	–
PTO Clutch Disc	Thickness	1.70 to 1.90 mm 0.067 to 0.075 in.	1.55 mm 0.061 in.
PTO Steel Plate	Thickness	1.15 to 1.25 mm 0.045 to 0.049 in.	1.10 mm 0.043 in.
PTO Piston	Flatness	–	0.15 mm 0.006 in.
PTO Steel Plate	Flatness	–	0.30 mm 0.012 in.
PTO Return Spring	Free Length	40.5 mm 1.59 in.	37.5 mm 1.48 in.
PTO Brake Spring	Free Length	20.3 mm 0.80 in.	18.0 mm 0.71 in.
Seal Ring	Thickness	2.45 to 2.50 mm 0.096 to 0.098 in.	2.0 mm 0.079 in.

12550S20040

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-10.)

Item	N·m	kgf·m	ft-lbs
Main delivery pipe and return pipe retaining nut	46.6 to 50.9	4.8 to 5.2	34.4 to 37.6
Turning delivery hose retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Starter's terminal **B** mounting nut	8.8 to 11.8	0.9 to 1.2	6.5 to 8.7
Engine and clutch housing mounting screw, nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Engine and clutch housing mounting stud bolt	38.2 to 45.1	3.9 to 4.6	28.2 to 33.3
Clutch mounting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Release fork setting screw	166.7 to 191.2	17.0 to 19.5	123.0 to 141.0
PTO clutch control valve mounting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
PTO clutch case bearing holder mounting screw	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
Rear wheel mounting nut	260 to 304	26.5 to 31.0	192 to 224
Step mounting nut	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Step mounting screw (M16)	117.7 to 147.1	12.0 to 15.0	87.0 to 108.5
Foldable ROPS mounting screw M16 grade 9	259.9 to 304.0	26.5 to 31.0	192.0 to 224.0
Clutch housing and transmission case mounting screw, nut			
• M12, grade 11 nut	103.0 to 117.7	10.5 to 12.0	75.9 to 86.8
• M12, grade 7 screw, nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
• M10, grade 9 screw	60.8 to 70.6	6.2 to 7.2	44.8 to 52.1
Clutch housing and transmission case mounting stud bolt	38.2 to 45.1	3.9 to 4.6	28.2 to 33.3
Transmission upper cover mounting screw	23.5 to 27.4	2.4 to 2.8	17.4 to 20.3
Brake plate mounting screw	9.8 to 11.3	1.00 to 1.15	7.2 to 8.3

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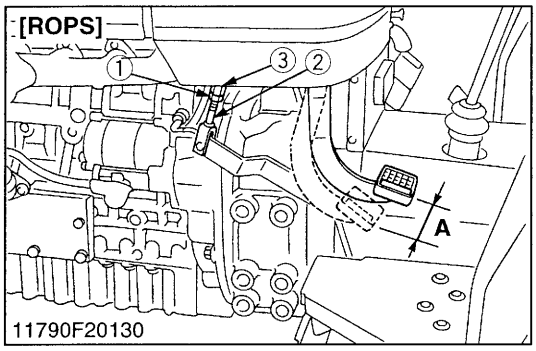
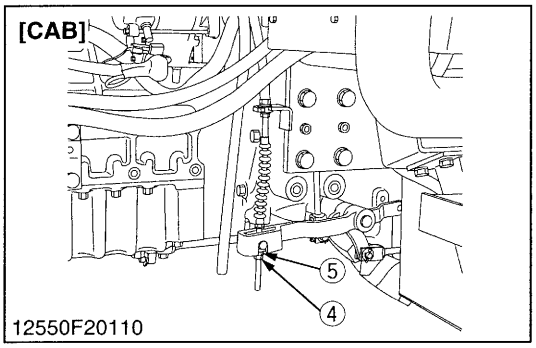
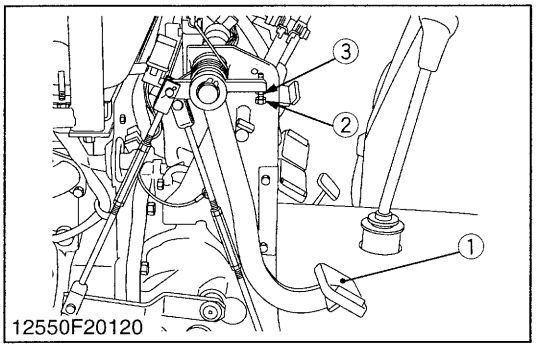
CHECKING, DISASSEMBLING AND SERVICING

[1] TRAVELLING CLUTCH

CHECKING AND ADJUSTING







Clutch Pedal Free Play

[ROPS]

1. Stop the engine and remove the key.
2. Slightly depress the clutch pedal and measure free play **(A)** at top of pedal.
3. If adjustment is needed, loosen the lock nut (1), and turn the turnbuckle (3) to adjust the clutch rod (2) length.
4. Retighten the lock nut (1).

[CAB]

1. Stop the engine and remove the key.
2. Slightly depress the clutch pedal and measure free play (**A**) at the top of pedal stroke.
3. If adjustment is needed, loosen the lock nut (4) and turn the nut (5) to adjust the cable length within acceptable limits.
4. Retighten the lock nut (4).

Clutch pedal free play **(A)** on the pedal	Factory spec.	35 to 45 mm 1.4 to 1.8 in.

(1) Lock Nut
(2) Clutch Rod
(3) Turnbuckle
(4) Lock Nut
(5) Nut

12550S20060

Clutch Pedal Stroke

1. Measure the clutch pedal (1).
2. If the measurement is not within the factory specifications, adjust it.
3. After adjustment, tighten the lock nut (3) firmly.
4. Measure the pedal stroke.

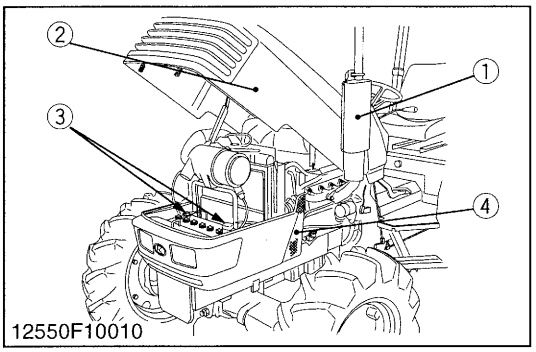
Total stroke	Factory spec.	ROPS	165 to 170 mm 6.5 to 6.7 in.
		CAB	155 to 160 mm 5.9 to 6.3 in.

(1) Clutch Pedal
(2) Adjusting Bolt
(3) Lock Nut

12550S20070

DISASSEMBLING AND ASSEMBLING

(1) Removing Clutch Pedal and Shaft



Muffler and Bonnet

1. Remove the muffler (1).
2. Remove the bonnet (2).
3. Disconnect the battery's cable (3).
4. Remove the side cover (4).

(1) Muffler
(2) Bonnet
(3) Battery's Cable
(4) Side Cover

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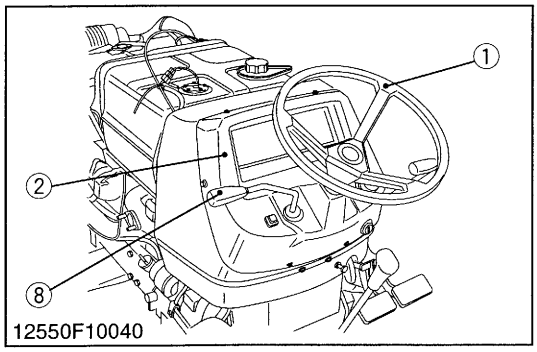

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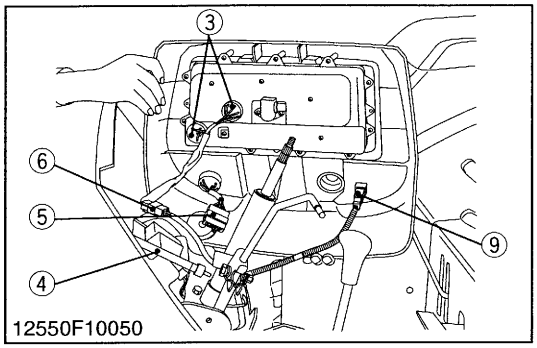

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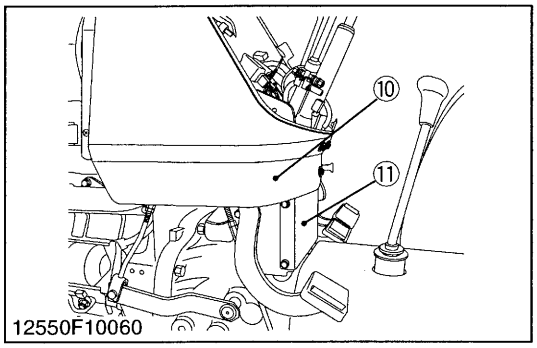

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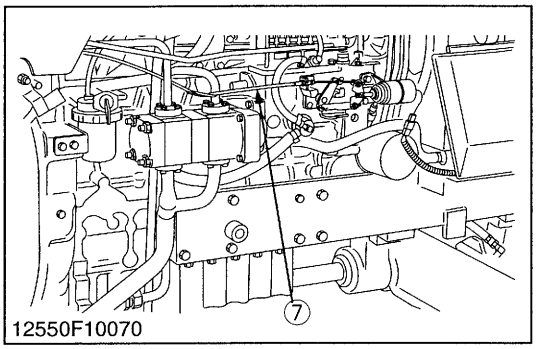

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Steering Wheel, Meter Panel and Rear Bonnet

1. Remove the steering wheel (1) with a steering wheel puller (Code No. 07916-51090).
2. Remove the shuttle lever grip (8).
3. Remove the meter panel mounting screws and open the meter panel (2).
4. Disconnect the two connectors (3) and meter cable (4).
5. Disconnect the main switch connector (5) and combination switch connector (6).
6. Disconnect the hazard switch connector (9).
7. Disconnect the engine stop cable (7) at the engine side.
8. Remove the rear bonnet (10) and lower cover (11).

(1) Steering Wheel
(2) Meter Panel
(3) Connector
(4) Meter Cable
(5) Main Switch Connector
(6) Combination Switch Connector
(7) Engine Stop Cable
(8) Shuttle Lever Grip
(9) Hazard Switch Connector
(10) Rear Bonnet
(11) Lower Cover

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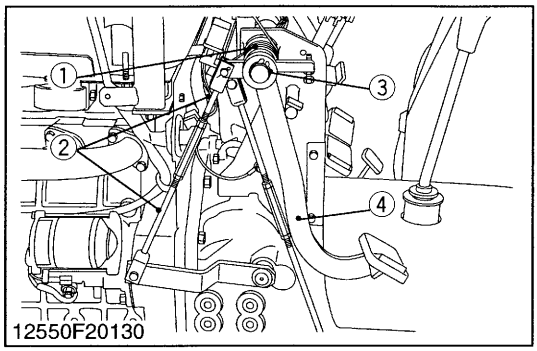

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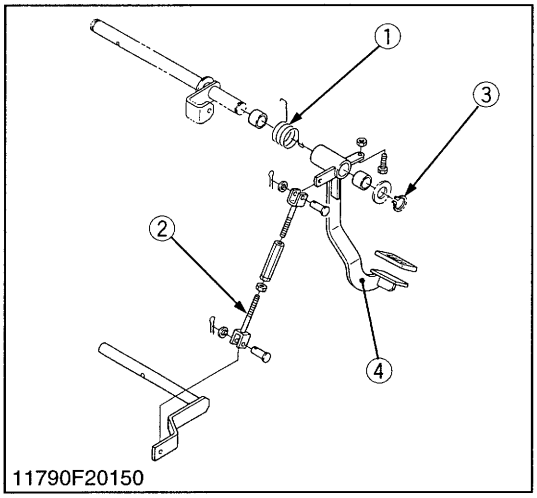

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Clutch Pedal and Shaft

1. Remove the clevis pin at the end of clutch rod (2).
2. Remove the external snap ring (3).
3. Remove the clutch pedal (4).

(When reassembling)

- Apply the grease to the clutch pedal bush and pedal shaft.

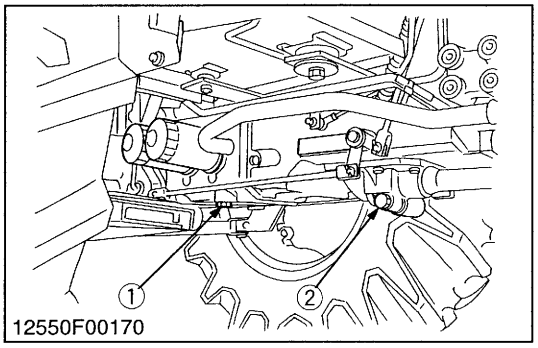
■ IMPORTANT

- **After reassembling the clutch pedal, be sure to adjust the clutch pedal free play. (See page 2-S5.)**

(1) Return Spring
(2) Clutch Rod
(3) External Snap Ring
(4) Clutch Pedal

12550S20090

(2) Draining Transmission Fluid



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Changing Transmission Fluid

1. Place an oil pan underneath the transmission case.
2. Remove the drain plugs (1) and (2).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1) and (2).

(When reassembling)

- Fill up from filling port after removing the filling plug until reaching the gauge.
- After running the engine for few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

Transmission fluid	Capacity	ROPS	40.0 L 42.3 U.S.qts. 35.2 Imp.qts.
		CAB	43.0 L 45.4 U.S.qts. 37.8 Imp.qts.

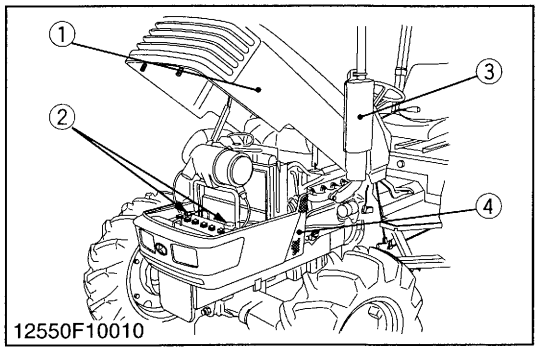
■ IMPORTANT

- **Use only KUBOTA SUPER UDT fluid. Use of other fluides may damage the transmission or hydraulic system.**
- **Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)**
- **Do not mix different brands oil together.**

(1) Drain Plug
(2) Drain Plug (4WD Only)

12550S10110

(3) Separating Engine and Clutch Housing Case



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Muffler and Bonnet

1. Remove the muffler (3).
2. Remove the bonnet (1).
3. Disconnect the battery's cable (2).
4. Remove the side cover (4).

(1) Bonnet
(2) Battery's Cable
(3) Muffler
(4) Side Cover

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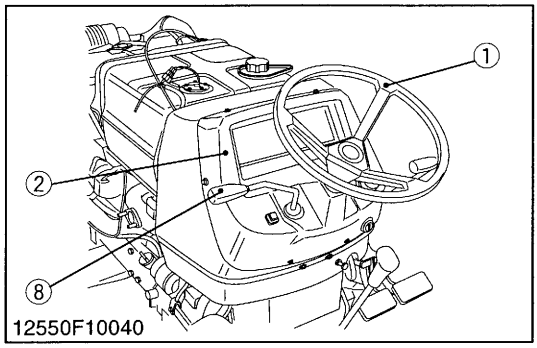

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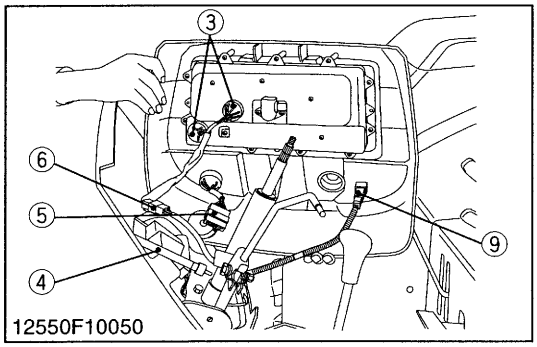
Steering Wheel, Meter Panel and Rear Bonnet

1. Remove the steering wheel (1) with a steering wheel puller (Code No. 07916-51090).
2. Remove the shuttle lever grip (8).
3. Remove the meter panel mounting screws and open the meter panel (2).
4. Disconnect the two connectors (3) and meter cable (4).
5. Disconnect the main switch connector (5) and combination switch connector (6).
6. Disconnect the hazard switch connector (9).
7. Disconnect the engine stop cable (7) at the engine side.
8. Remove the rear bonnet (10) and lower cover (11).



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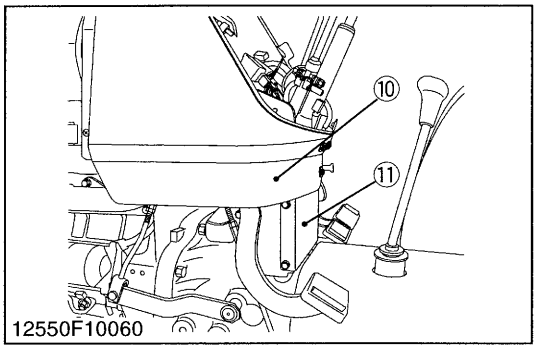
(1) Steering Wheel
(2) Meter Panel
(3) Connector
(4) Meter Cable
(5) Main Switch Connector
(6) Combination Switch Connector
(7) Engine Stop Cable
(8) Shuttle Lever Grip
(9) Hazard Switch Connector
(10) Rear Bonnet
(11) Lower Cover



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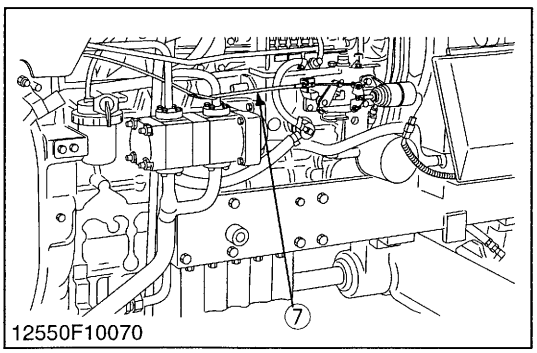

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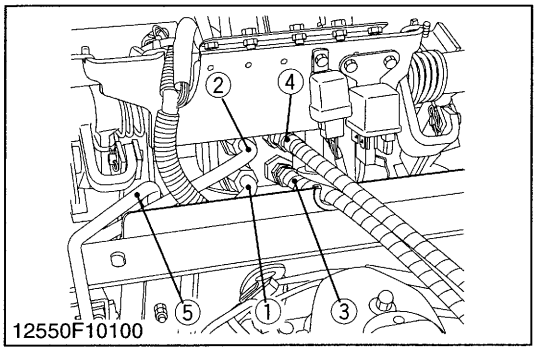

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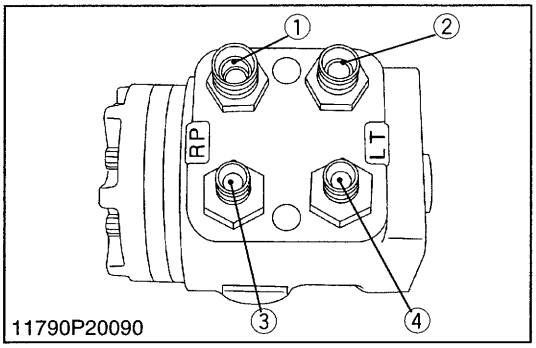

11790P20090

Piping for Power Steering

1. Disconnect the main delivery pipe (1), return pipe 1 (2), right turning delivery hose (3), left turning delivery hose (4) and return pipe 2 (5).

(When reassembling)

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

(1) Main Delivery Pipe
(2) Return Pipe 1
(3) Right Turning Delivery Hose
(4) Left Turning Delivery Hose
(5) Return Pipe 2 (M5700: 4WD)

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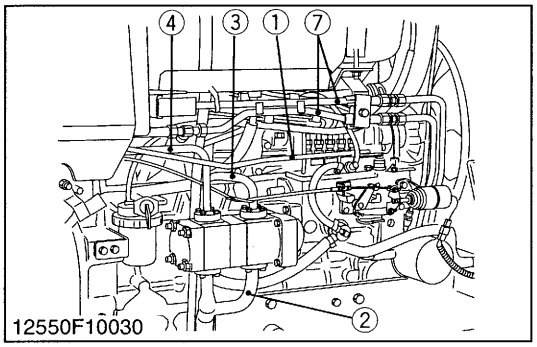
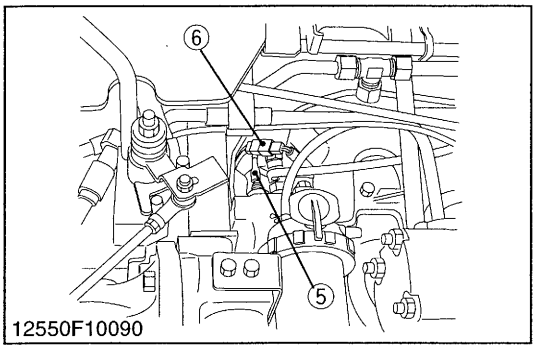


12550F10030

Pipings for 3-Point Hydraulic System

1. Remove the accelerator rod (1).
2. Remove the suction pipe (2).
3. Remove the delivery pipe (3) for 3-point hydraulic system.
4. Remove the delivery pipe (4) for power steering.
5. Disconnect the glow plug **1P** connector (6) and thermo unit **1P** connector (5).

(1) Accelerator Rod
(2) Suction Pipe
(3) Delivery Pipe for 3-Point Hitch
(4) Delivery Pipe for Power Steering
(5) Thermo Unit **1P** Connector
(6) Glow Plug **1P** Connector
(7) Oil Pipes



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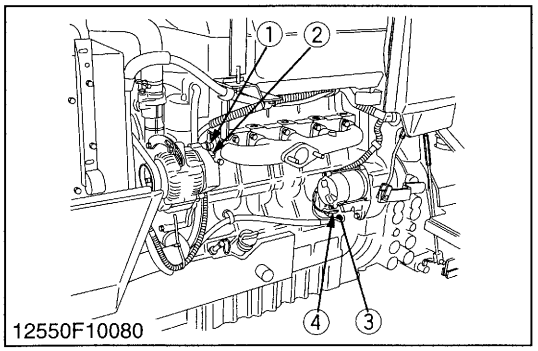

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Wire Harness for Alternator and Starter Motor

1. Disconnect the alternator **2P** connector (2) and **B** terminal (1).
2. Disconnect the starter motor **B** terminal (3) and **1P** connector (4).

(When reassembling)

Tightening torque	Starter's terminal **B** mounting nut	8.8 to11.8 N·m 0.9 to 1.2 kgf·m 6.5 to 8.7 ft-lbs

(1) Alternator **B** Terminal
(2) Alternator **2P** Connector
(3) Starter Motor **B** Terminal
(4) Starter Motor **1P** Connector

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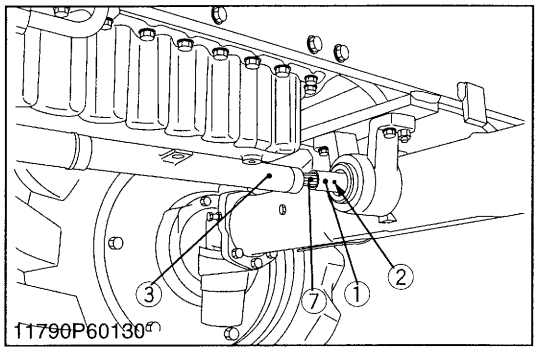

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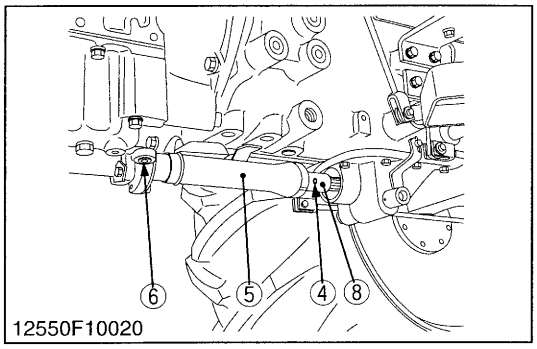

12550F10020

Propeller Shaft (4WD Only)

1. Slide the propeller shaft cover (3), (5) after removing the screws (6).
2. Tap out the spring pin (2), (4) and then slide the coupling (1), (8) to the front and rear.

(When reassembling)

- Apply grease to the splines of the propeller shaft (7).

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

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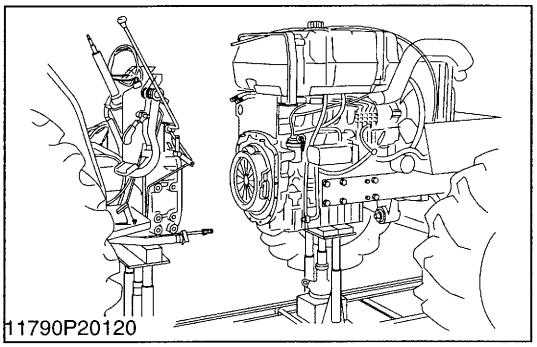

11790P20120

Separating Engine from Clutch Housing

1. Check the engine and clutch housing case are securely mounted on the disassembling stands.
2. Remove the engine mounting screws and nuts, and separate the engine from the clutch housing.

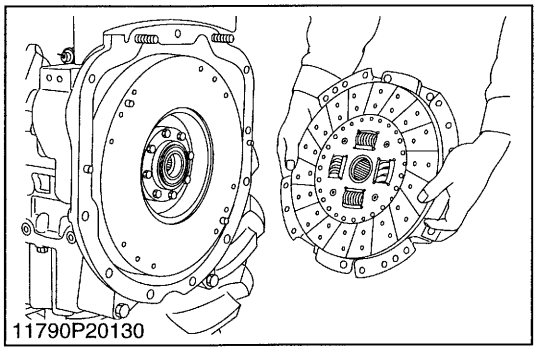
(When reassembling)

- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the splines of clutch disc boss.
- Apply liquid gasket (Three Bond 1141, 1211 or equivalent) to joint face of the engine and clutch housing.

Tightening torque	Engine and clutch housing mounting screw, nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Engine and clutch housing mounting stud bolt	38.2 to 45.1 N·m 3.9 to 4.6 kgf·m 28.2 to 33.3 ft-lbs

11790S20130

(2) Removing Clutch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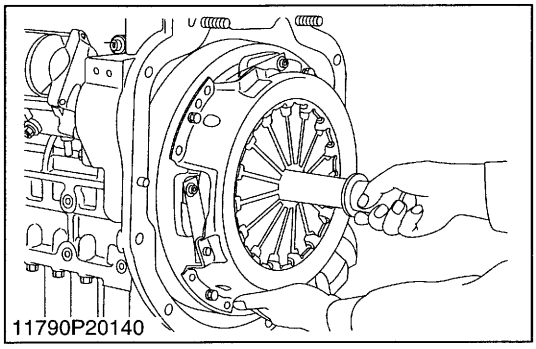
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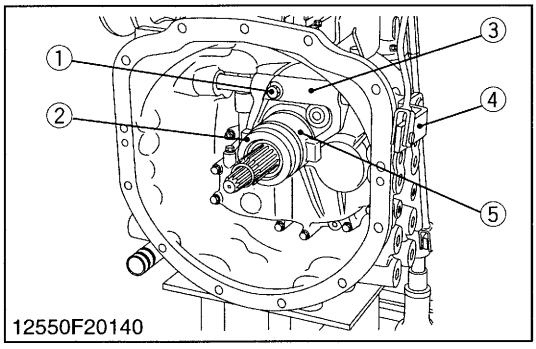

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Removing Clutch

1. Remove the clutch from the flywheel.

(When reassembling)

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

■ IMPORTANT

- **Align the center of disc and flywheel by inserting the clutch center tool. (See page G-37.)**

■ 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 20.3 ft-lbs

12550S20250

Release Holder and Clutch Lever

1. Draw out the clutch release holder (5) and the release bearing (2) as a unit.
2. Remove the release fork setting screws (1).
3. Draw out the clutch lever (4) to remove the release fork (3).

(When reassembling)

- Make sure the direction of the release fork (3) is correct.
- Inject grease to the release holder (5).
- Apply grease to the bushing and clutch lever.
- After tightening the release fork setting screw to the specified torque, insert a wire through the hole on the setting screw head and bind with release fork together.

Tightening torque	Release fork setting screw	166.7 to 191.2 N·m 17.0 to 19.5 kgf·m 123.0 to 141.0 ft-lbs

(1) Setting Screw
(2) Release Bearing
(3) Release Fork
(4) Clutch Lever
(5) Release Holder

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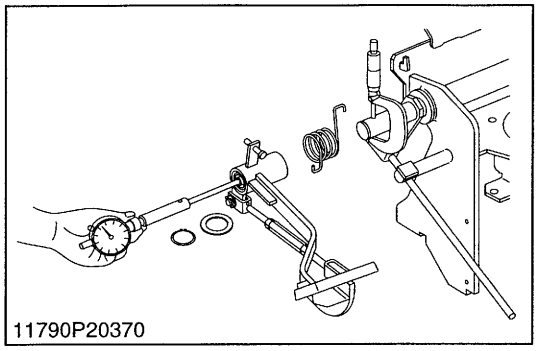
SERVICING


11790P20370

Clearance between Clutch Pedal Shaft and Pedal Bushing

1. Measure the clutch pedal shaft O.D. with an outside micrometer.
2. Measure the clutch pedal bushing I.D. with a cylinder gauge.
3. Calculate the clearance.
4. If the clearance exceeds the allowable limit, replace the bushing.

Clearance between clutch pedal shaft and pedal bushing	Factory spec.	0.025 to 0.185 mm 0.00098 to 0.00728 in.
	Allowable limit	1.00 mm 0.0394 in.

Clutch pedal shaft O.D.	Factory spec.	27.900 to 27.975 mm 1.09842 to 1.10138 in.
Clutch pedal bushing I.D.	Factory spec.	28.000 to 28.085 mm 1.10236 to 1.10571 in.

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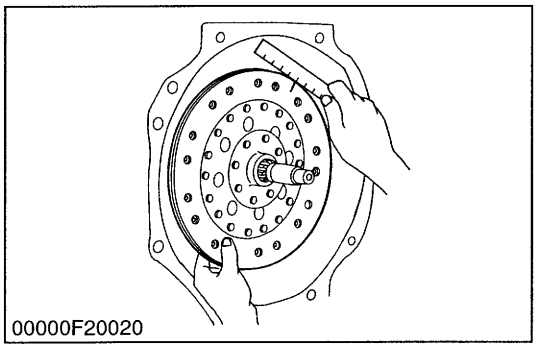
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Backlash between Clutch Disc Boss and Shaft

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

Displacement around disc edge	Allowable limit	2.0 mm 0.079 in.

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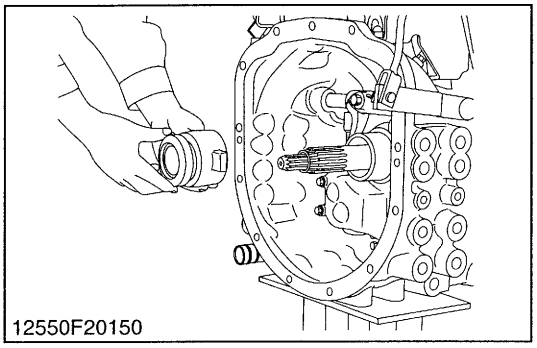
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Release Bearing

1. Check for abnormal wear on contact surface.
2. Rotate bearing outer race, while applying pressure to it.
3. If the bearing rotation is rough or noisy, replace the release bearing.

■ **NOTE**

- **Do not depress bearing outer race, when replacing release bearing.**
- **Do not wash the release bearing with a cleaning solvent.**

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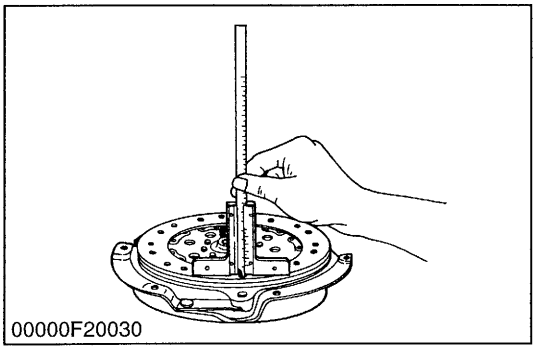
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Clutch Disc Wear

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

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

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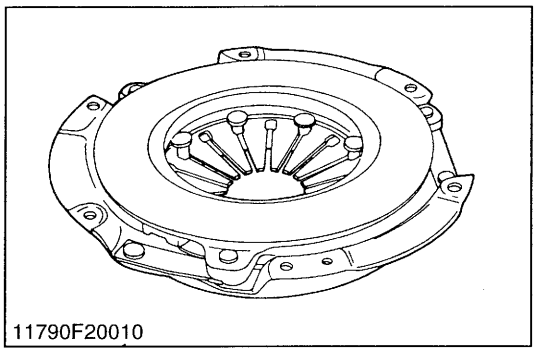
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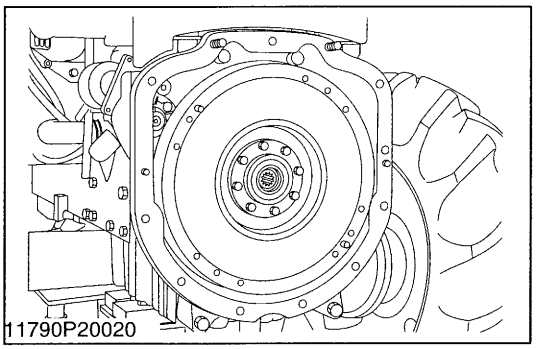
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Checking Pressure Plate Assembly and Flywheel

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

Diaphragm spring mutual difference	Allowable limit	0.5 mm 0.020 in.

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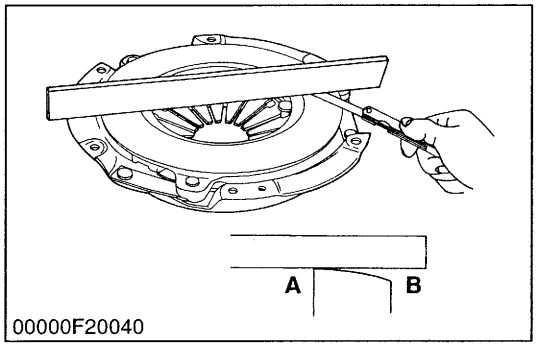

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Pressure Plate Flatness

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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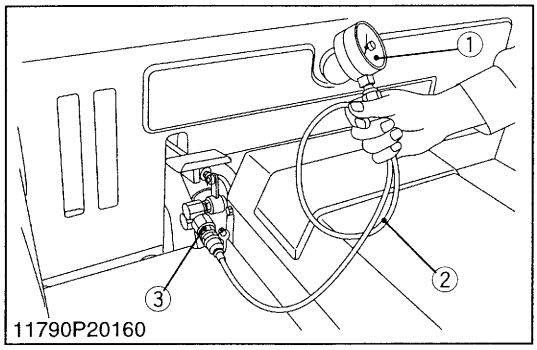
[2] HYDRAULIC PTO CLUTCH
[2]-1 PTO CLUTCH VALVE CHECKING AND ADJUSTING



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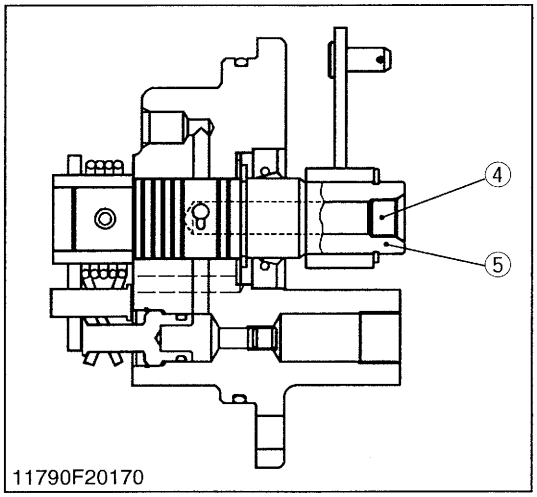

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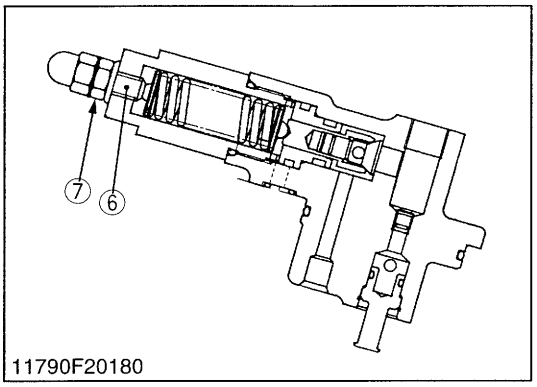

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Relief Valve Setting Pressure

1. Start the engine and warm up the transmission fluid, and then stop the engine.
2. Remove the plug (4) (PT 1/8) on the PTO valve spool (5).
3. Set the adaptor (PT 1/8) (Use the oil pressure tester for diesel engines, Code No. 07916-32032), threaded joint (3), cable (2) and pressure gauge (1).
4. Start the engine and set the engine speed maximum.
5. Move the PTO clutch lever to the **"ON"** position, and measure the pressure.
6. If only the pressure in the PTO clutch engaged position is low, check the hydraulic PTO clutch system.
7. If the measurement is not within the factory specifications, loosen the lock nut (7) and turn the screw (6) to adjust.

■ IMPORTANT

- **Do not connect the universal joint of the implement to the tractor PTO shaft while testing.**

PTO pressure (When PTO shift lever is **"Engaged"** position)	Factory spec.	2.45 to 2.55 MPa 25.0 to 26.0 kgf/cm^2 355 to 370 psi
PTO pressure (When PTO shift lever is **"Disengaged"** position)	Factory spec.	No pressure

Condition
- Engine speed .....Maximum
- Oil temperature ...45 to 55 °C
  113 to 131 °F

(Reference)
- Turn the screw (6) to clockwise direction → Pressure increase
- Turn the screw (6) to counterclockwise direction → Pressure decrease

(1) Pressure Gauge
(2) Cable
(3) Threaded Joint
(4) Plug (PT 1/8)
(5) Spool
(6) Screw
(7) Lock Nut

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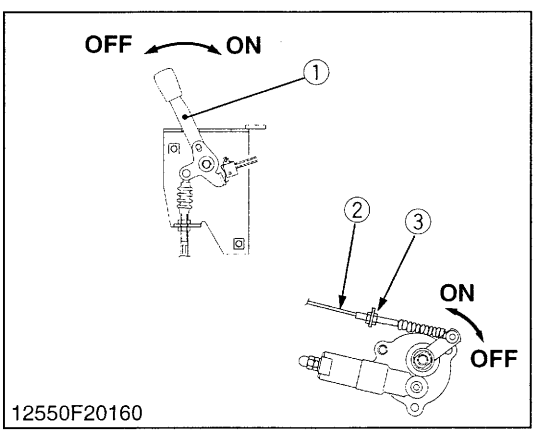

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PTO Clutch Lever Movement

1. Stop the engine and remove the key.
2. Check the PTO clutch lever (1) on the **"ON"** and **"OFF"** position of PTO clutch lever guide.
3. If adjustment is needed, loosen the lock nuts (3) and adjust the clutch control cable (2) length.
4. Retighten the lock nuts (3) firmly.

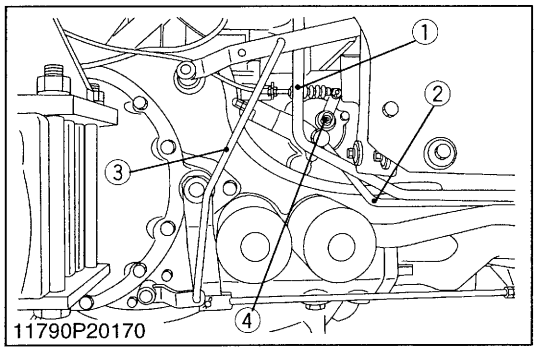
■ IMPORTANT

- **Do not connect the universal joint of the implement to the tractor PTO shaft while testing.**

(1) PTO Clutch Lever
(2) Clutch Control Cable
(3) Lock Nut

12550S20140

DISASSEMBLING AND ASSEMBLING



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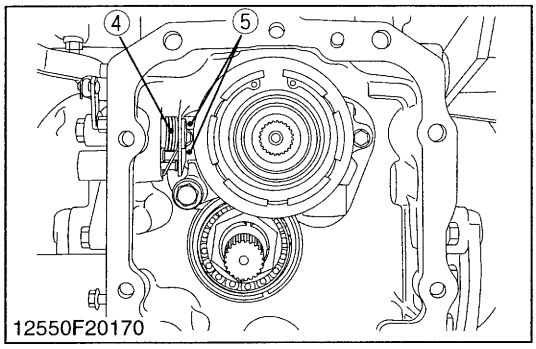

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Removing PTO Clutch Valve

1. Disconnect the suction pipe (1) and three point hydraulic system delivery pipe (2).
2. Remove the differential lock rod (3).
3. Disconnect the PTO clutch cable at PTO valve side.
4. Remove the PTO clutch valve (4).

(When reassembling)

- Apply grease to the O-ring.
- Take care not to damage the O-ring.
- Replace the oil pipes (5) with new ones.
- Apply transmission oil to oil pipes (5).

Tightening torque	PTO clutch control vavel mounting screw	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs

(1) Suction Pipe
(2) Delivery Pipe
(3) Differential Lock Rod
(4) PTO Clutch Valve
(5) Oil Pipe

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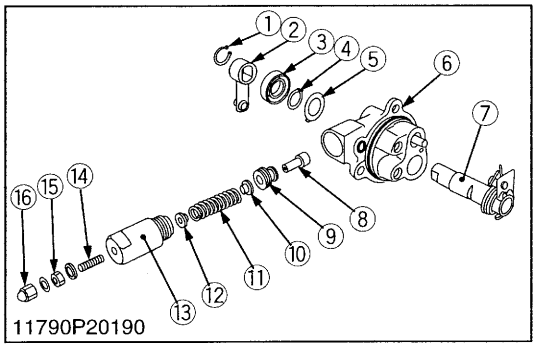

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Disassembling PTO Clutch Valve

1. Remove the external snap ring (1), lever (2) and oil seal (3).
2. Remove the external snap ring (4) and draw out the spool (7).
3. Remove the cap nut (16) and lock nut (15).
4. Remove the adjuster (14) and relief body (13).
5. Draw out the relief poppet (8) and relief bush (9).
6. Draw out the spring (11) and spring seat (10), (12).

(1) External Snap Ring
(2) Lever
(3) Oil Seal
(4) External Snap Ring
(5) Collar
(6) Control Valve Body
(7) Spool
(8) Relief Poppet
(9) Relief Bush
(10) Spring Seat
(11) Spring
(12) Spring Seat
(13) Relief Body
(14) Adjuster
(15) Lock Nut
(16) Cap Nut

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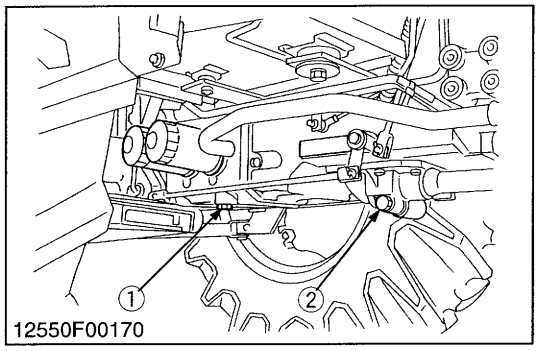
[2]-2 PTO CLUTCH
DISASSEMBLING AND ASSEMBLING
(1) Draining Transmission Fluid



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Changing Transmission Fluid

1. Place an oil pan underneath the transmission case.
2. Remove the drain plugs (1) and (2).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1) and (2).

(When reassembling)

- Fill up from filling port after removing the filling plug until reaching the gauge.
- After running the engine for few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

Transmission fluid	Capacity	ROPS	40.0 L 42.3 U.S.qts. 35.2 Imp.qts.
		CAB	43.0 L 45.4 U.S.qts. 37.8 Imp.qts.

■ IMPORTANT

- **Use only KUBOTA SUPER UDT fluid. Use of other fluides may damage the transmission or hydraulic system.**
- **Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)**
- **Do not mix different brands oil together.**

(1) Drain Plug (2) Drain Plug (4WD Only)

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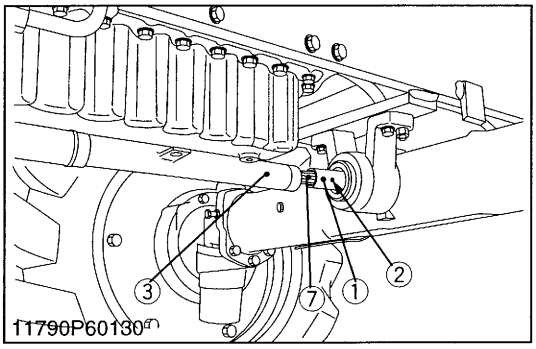
(2) Separating Transmission Case



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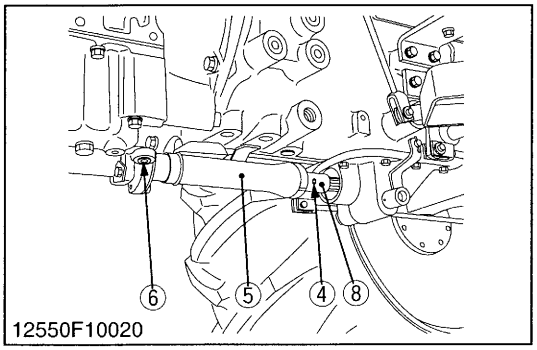

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Propeller Shaft (4WD Only)

1. Slide the propeller shaft cover (3), (5) after removing the screws (6).
2. Tap out the spring pin (2), (4) and then slide the coupling (1), (8) to the front and rear.

(When reassembling)

- Apply grease to the splines of the propeller shaft (7).

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

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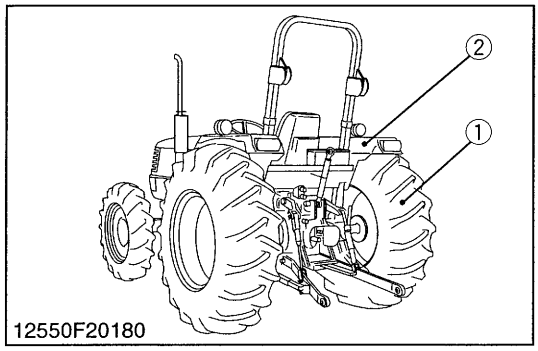


Rear Wheels and Fenders

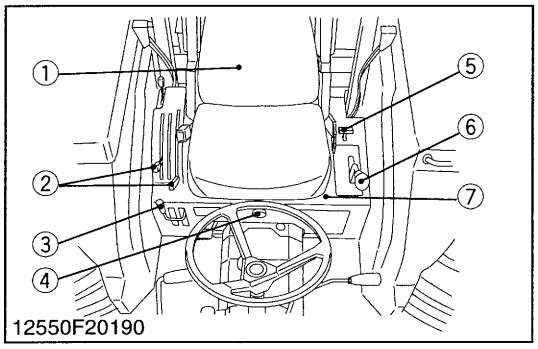
1. Check the clutch housing case and transmission case are securely mounted on the disassembling stands.
2. Remove the rear wheels (1).
3. Disconnect the jumper leads for hazard and tail light.
4. Disconnect the jumper leads for PTO safety switch.
5. Remove the fenders (2).

(When reassembling)

Tightening torque	Rear wheel mounting nut	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs

(1) Rear Wheel
(2) Fender

12550S20160

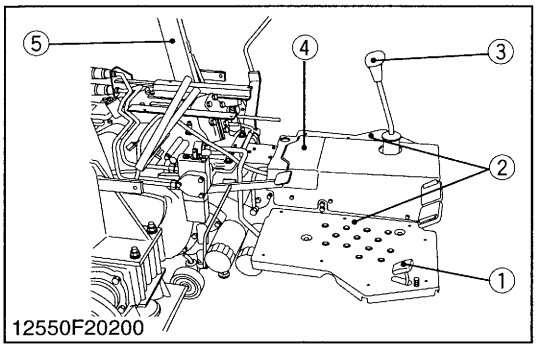


Seat and Center Frame

1. Remove the seat (1).
2. Remove the draft and position control lever grips (2).
3. Remove the auxiliary speed change lever grip (6), DT shift lever grip (5) and 3-point hitch lowering speed control grip (4).
4. Remove the auxiliary control valve lever assembly (3).
5. Remove the center frame (7).

(1) Seat
(2) Lever Grip
(3) Auxiliary Control Valve Lever Assembly
(4) 3-Point Hitch Lowering Speed Control Grip
(5) DT Shift Lever Grip
(6) Auxiliary Speed Change Lever Grip
(7) Center Frame

12550S20170



Steps and Clutch Housing Cover

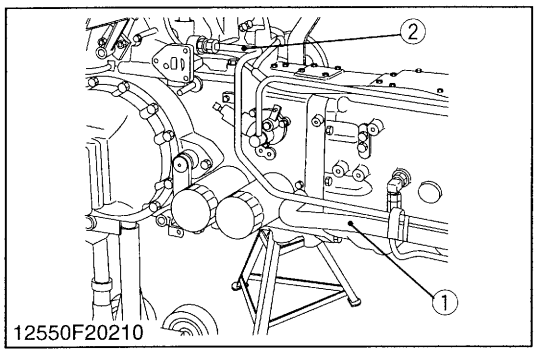
1. Disconnect the foot accelerator rod (1).
2. Remove the steps (2).
3. Remove the main speed change lever grip (3).
4. Remove the clutch housing cover (4).
5. Remove the foldable ROPS (5).

(When reassembling)

Tightening torque	Step mounting nut	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
	Step mounting screw (M16)	117.7 to 147.1 N·m 12.0 to 15.0 kgf·m 87.0 to 108.5 ft-lbs
	Foldable ROPS mounting screw (M16, Grade 9)	259.9 to 304.0 N·m 26.5 to 31.0 kgf·m 192.0 to 224.0 ft-lbs

(1) Foot Accelerator Rod
(2) Step
(3) Main Speed Change Lever Grip
(4) Clutch Housing Cover
(5) Foldable ROPS

12550S20180



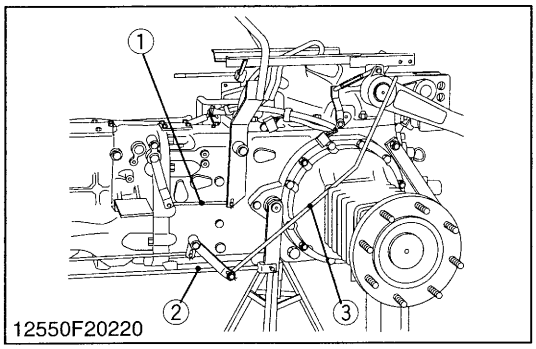
12550F20210

Hydraulic Pipes

1. Remove the suction pipe (1).
2. Remove the delivery pipe (2) for the three point hydraulic system.

(1) Suction Pipe (2) Delivery Pipe

12550S20190



12550F20220

Auxiliary Shift Lever and Brake Rod

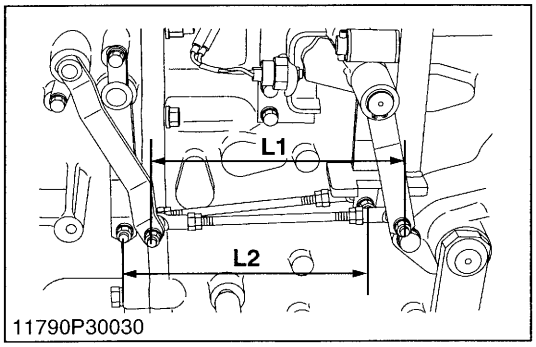
1. Disconnect the shift rods (1).
2. Remove the shift lever assembly.
3. Remove the brake rods (2).
4. Remove the DT rod (3).

(When reassembling)

- Be sure to adjusting the shift rod.

Shift rod length **L1** and **L2**	Factory spec.	Approx. 209 mm 8.23 in.

(1) Shift Rod (3) DT Rod
(2) Brake Rod



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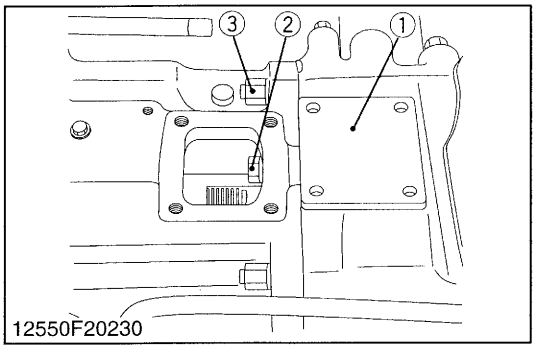
12550S20200



12550F20230

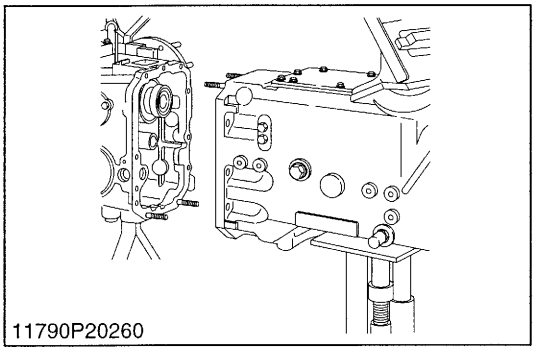
Separating Transmission Case

1. Remove the transmission upper cover (1).
2. Remove the transmission case mounting screws and nut, and separate the transmission case from the clutch housing.

(When reassembling)

- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the transmission case and clutch housing, transmission upper cover and transmission case.

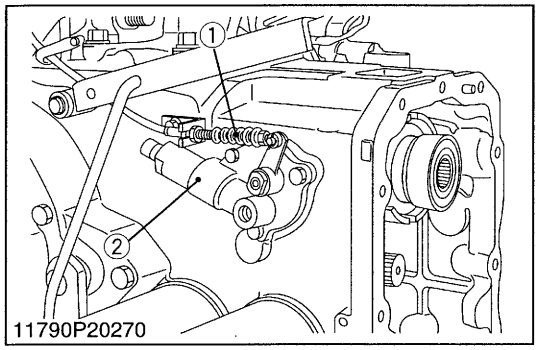
Tightening torque	Transmission case and clutch housing mounting screw, nut	M12, grade 11 nut (3)	103.0 to 117.7 N·m 10.5 to 12.0 kgf·m 75.9 to 86.8 ft-lbs
		M12, grade 7 screw, nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
		M10, grade 9 screw (2)	60.8 to 70.6 N·m 6.2 to 7.2 kgf·m 44.8 to 52.1 ft-lbs
	Transmission upper cover mounting screw		23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs

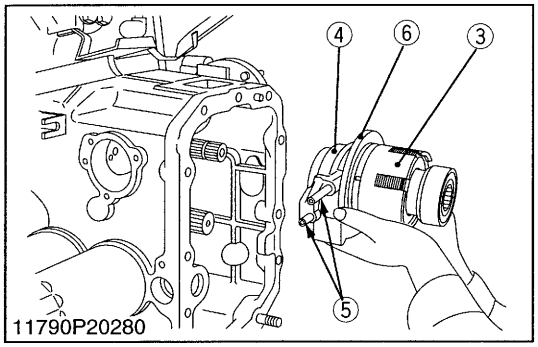

11790P20260

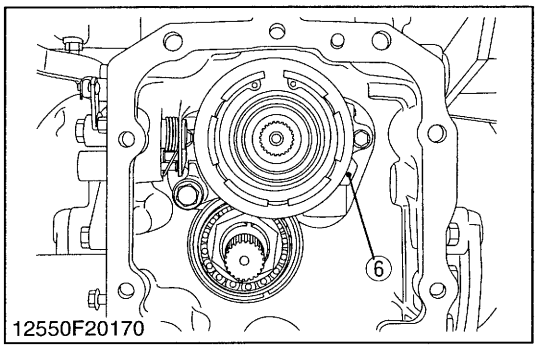
(1) Transmission Upper Cover (3) Transmission Case Mounting Nut
(2) Transmission Case Mounting Screw

12550S20210

(3) Removing PTO Clutch







PTO Clutch Valve, PTO Clutch and Holder

1. Disconnect the PTO clutch cable (1).
2. Remove the PTO clutch valve (2).
3. Remove the PTO clutch pack (3) with holder (4).

(When reassembling)

- Apply small amount of transmission fluid for the O-ring.
- Install the oil pipes (5) to the hole of the PTO clutch valve firmly.
- Apply the small amount of transmission fluid for O-ring.

Tightening torque	PTO clutch valve mounting screw	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs
	PTO clutch case bearing holder mounting screw	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

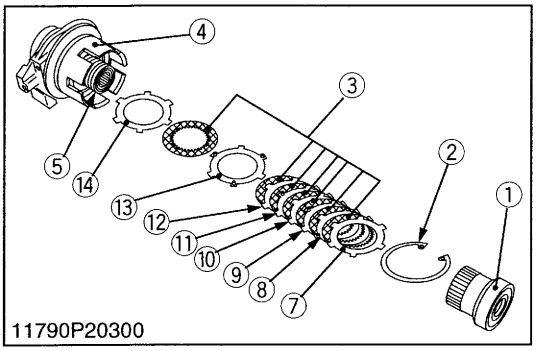
■ IMPORTANT

- **When reassembling the PTO clutch assemby, direct the projection part of brake plate (6) as a figure.**
- **After assembling the PTO clutch assembly, be sure to check the piston operation by air-blowing.**

(1) PTO Clutch Cable
(2) PTO Clutch Valve
(3) PTO Clutch Pack
(4) Holder
(5) Oil Pipe
(6) Brake Disc

12550S20220

(4) Disassembling PTO Clutch Pack



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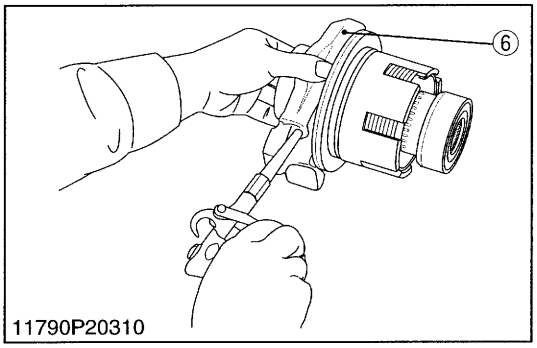

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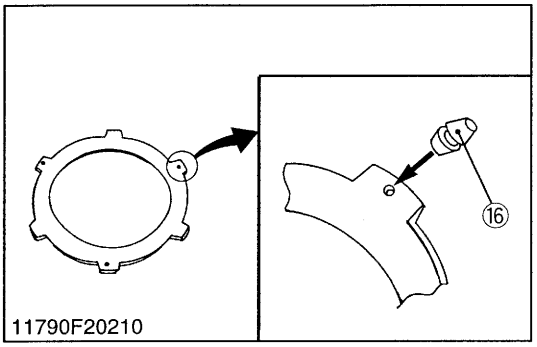

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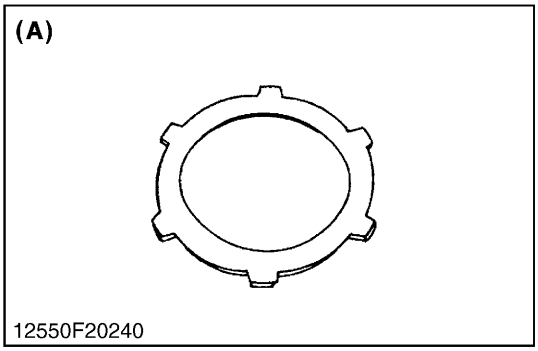
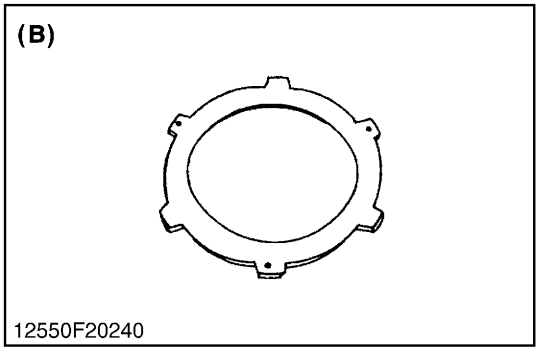
(A)


12550F20240

(B)

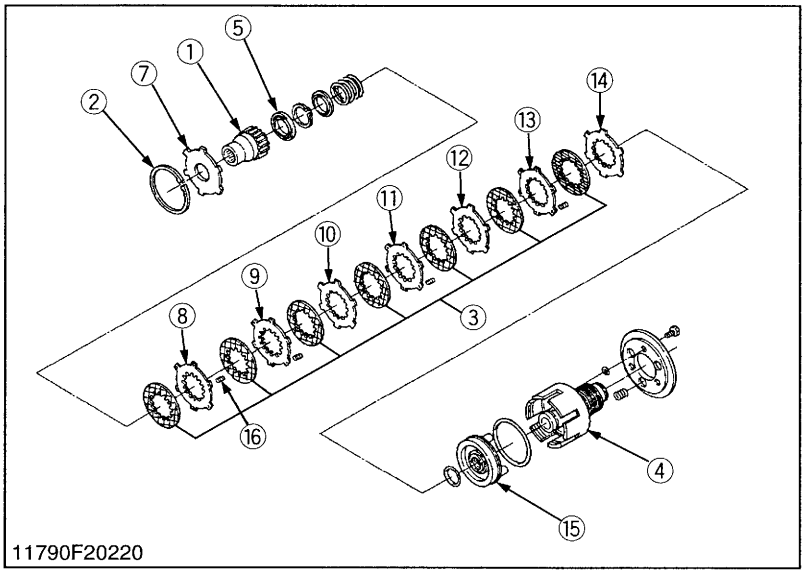

12550F20240

Clutch Hub and Clutch Discs

1. Remove the internal snap ring (2), and then take out the clutch discs (3), the back plate (7), the steel plates (8), (9), (10), (11), (12), (13), (14), the hub (1) and the bearings (5).

(When reassembling)

- Install the clutch discs (3) and steel plates (8), (9), (10), (11), (12), (13), (14) mutually. (Refer to figure below.)
- Do not confuse the two types steel plates. The steel plates with the plug rubbers (16) are (8), (9), (11), (13) and without plug rubbers (16) are (10), (12), (14).
- Do not confuse the back plate (7) and steel plates. The back plate (7) is thicker than the steel plates.
- Assemble the plug rubbers portion of the three steel plates (9), (11), (13) are same positions while assembling them, and do not pile up the plug rubbers portions of the another steel plate (8) with the steel plate (9). (Refer to figure below.)
- Apply enough transmission fluid to the discs (3).
- Confirm the moving of the piston (15) smoothly when pressure air at 0.29 to 0.39 MPa (3 to 4 kgf/cm^2, 42 to 57 psi) is sent to clutch pack. (Refer to the figure left.)
- Assemble the steel plates with rubber (9), (11), (13) and steel plates without rubber (10), (12), (14) alternately, and steel plates are built in so that the part of rubber is not corresponding to the part of the hole.



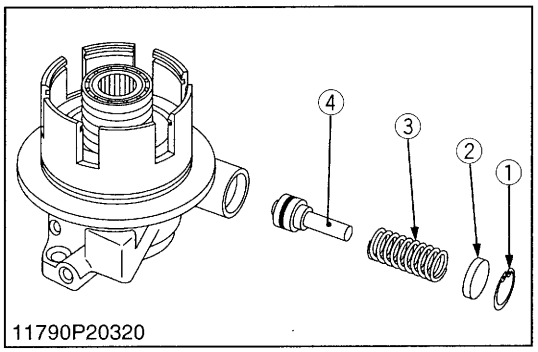
11790F20220

(1) Hub
(2) Internal Snap Ring
(3) Clutch Discs
(4) Clutch Case
(5) Bearing
(6) Mid Case Bearing Holder
(7) Back Plate
(8) Steel Plate (With Plug Rubbers)
(9) Steel Plate (With Plug Rubbers)
(10) Steel Plate (Without Plug Rubbers)
(11) Steel Plate (With Plug Rubbers)
(12) Steel Plate (Without Plug Rubbers)
(13) Steel Plate (With Plug Rubbers)
(14) Steel Plate (Without Plug Rubbers)
(15) Piston
(16) Plug Rubber

12550S20230

(A) Serial No. below M4900 [2WD] M490-11967
M4900 [4WD] M490-51828
M5700 [2WD] M570-10632
M5700 [4WD] M570-52192

(B) Serial No. above M4900 [2WD] M490-11968
M4900 [4WD] M490-51829
M5700 [2WD] M570-10633
M5700 [4WD] M570-52193



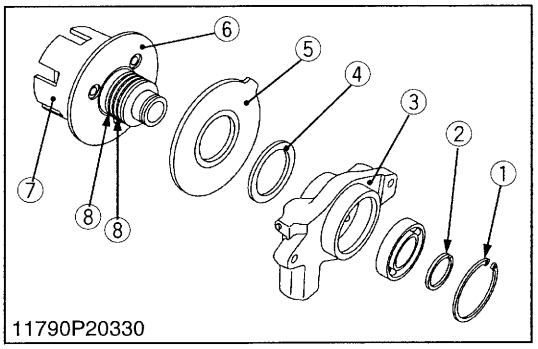
11790P20320

Modulating Valve

1. Remove the internal snap ring (1).
2. Remove the spring seat (2).
3. Draw out the spring (3) and piston (4).

(1) Internal Snap Ring
(2) Spring Seat
(3) Spring
(4) Piston

11790S20290



11790P20330

Clutch Case

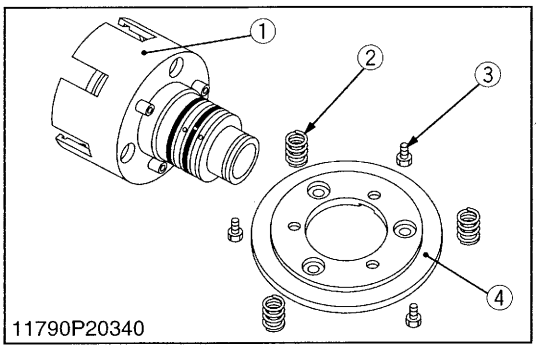
1. Remove the internal snap ring (1).
2. Remove the external snap ring (2).
3. Remove the clutch case (7) and brake disc (5).

(When reassembling)

- Direct the contact part of the brake disc (5) to the brake plate (6).
- Apply small amount of the grease to the seal rings (8).

(1) Internal Snap Ring
(2) External Snap Ring
(3) Clutch Holder
(4) Collar
(5) Brake Disc
(6) Brake Plate
(7) Clutch Case
(8) Seal Ring

11790S20300



11790P20340

Brake Plate

1. Remove the brake plate mounting screws (3) and then take out the brake plate (4) and the springs (2).

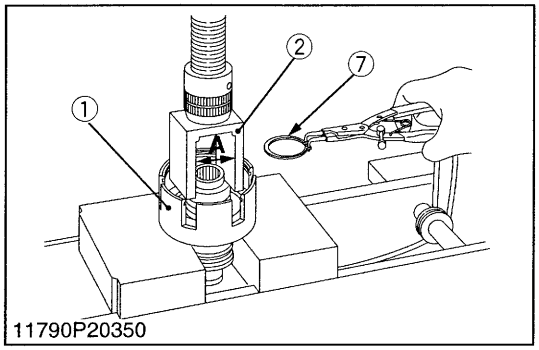
(When reassembling)

- Apply liquid lock (Three Bond 1372 or equivalent) to the brake plate mounting screws (3).

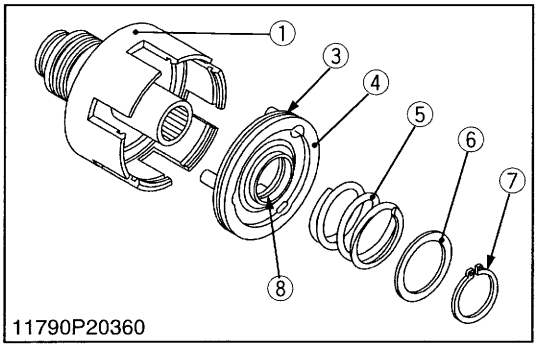
Tightening torque	Brake plate mounting screw	9.8 to 11.3 N·m 1.00 to 1.15 kgf·m 7.2 to 8.3 ft-lbs

(1) Clutch Case
(2) Spring
(3) Brake Plate Mounting Screw
(4) Brake Plate

11790S20310



11790P20350



11790P20360

Piston

1. Press the washer (6) lightly by the hand press, using the hand made jig. (Refer to the figure left.)
2. Draw out the piston (4).

(When reassembling)

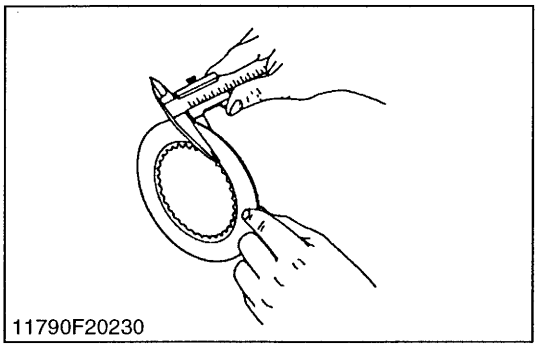
- Apply enough transmission fluid to seal rings (3) and (8).

(1) Clutch Case
(2) Jig
(3) Seal Ring
(4) Piston
(5) Spring
(6) Washer
(7) External Snap Ring
(8) Seal Ring
(9) O ring

(A) 41 mm (1.6 in.)

12550S20240

SERVICING

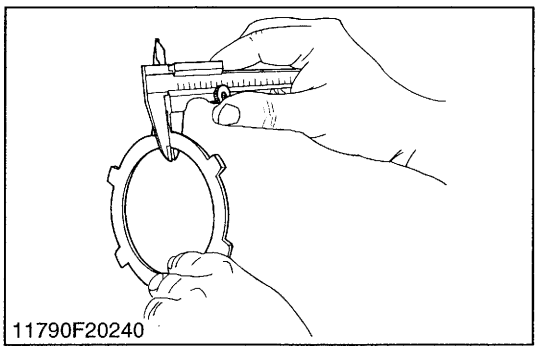

11790F20230

PTO Clutch Disc Wear

1. Measure the thickness of PTO clutch disc with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

Thickness of PTO clutch disc	Factory spec.	1.70 to 1.90 mm 0.067 to 0.075 in.
	Allowable limit	1.55 mm 0.061 in.

11790S20330

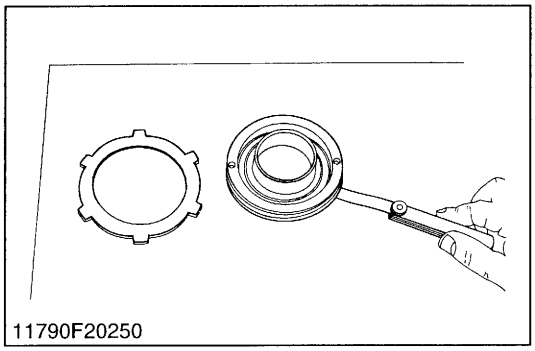

11790F20240

PTO Steel Plate Wear

1. Measure the thickness of PTO steel plate with vernier calipers.
2. If the thickness is less than the allowable limit, replace it.

Thickness of PTO steel plate	Factory spec.	1.15 to 1.25 mm 0.045 to 0.049 in.
	Allowable limit	1.10 mm 0.043 in.

11790S20340

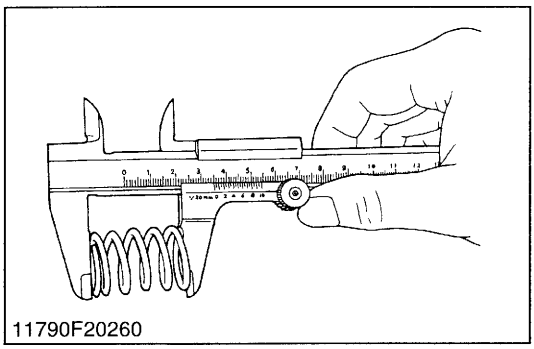

11790F20250

Flatness of PTO Piston and PTO Steel Plate

1. Place the part on a surface plate.
2. Check it unable to insert a feeler gauge (allowable limit size) underneath it at least four points.
3. If the gauge can be inserted, replace it.

Flatness of PTO piston	Allowable limit	0.15 mm 0.006 in.
Flatness of PTO steel plate	Allowable limit	0.30 mm 0.012 in.

11790S20350

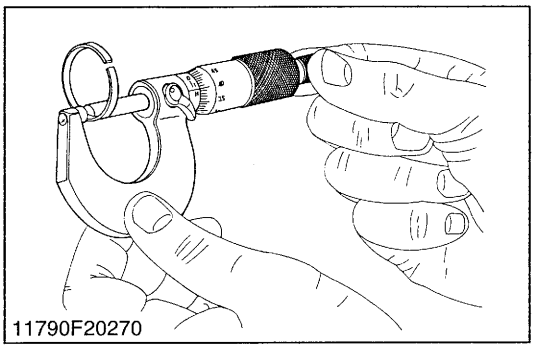

11790F20260

Piston Return Spring Free Length

1. Measure the free length of spring with vernier calipers.
2. If the measurement is less than the allowable limit, replace it.

PTO return spring free length	Factory spec.	40.5 mm 1.59 in.
	Allowable limit	37.5 mm 1.48 in.
PTO brake spring free length	Factory spec.	20.3 mm 0.80 in.
	Allowable limit	18.0 mm 0.71 in.

11790S20360

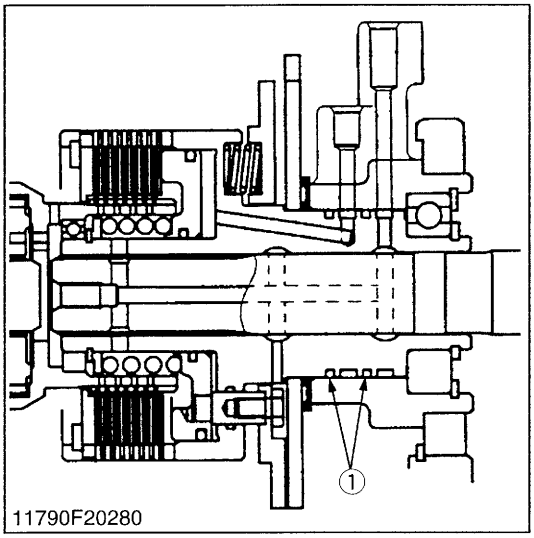

11790F20270

Thickness of Seal Ring

1. Measure the thickness of seal rings (1) with an outside micrometer.
2. If the measurement is less than the allowable limit, replace it.

Thickness of seal ring	Factory spec.	2.45 to 2.50 mm 0.096 to 0.098 in.
	Allowable limit	2.0 mm 0.079 in.

(1) Seal Ring



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11790S20370

3 TRANSMISSION

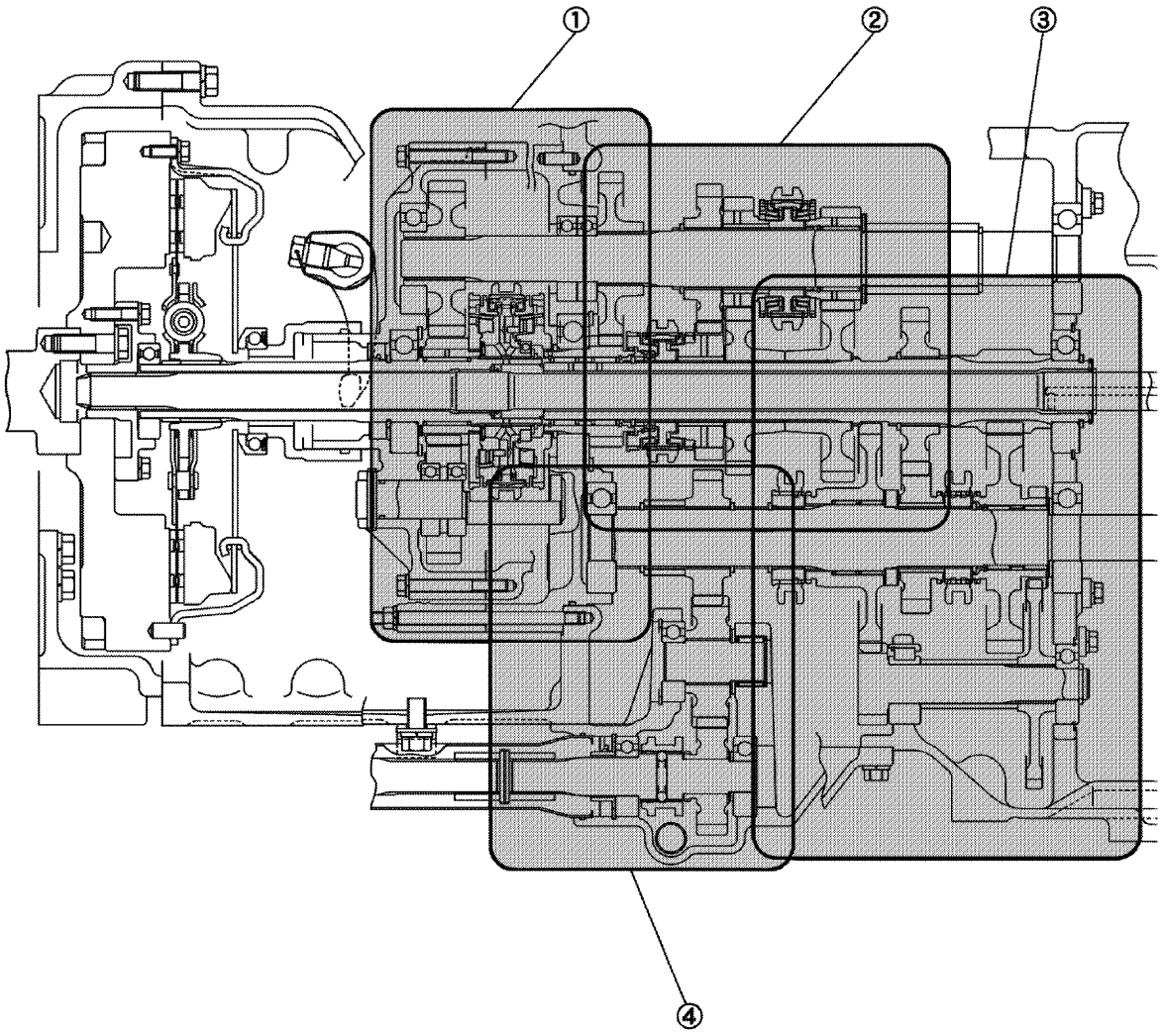
3 TRANSMISSION

MECHANISM

CONTENTS

MEMO

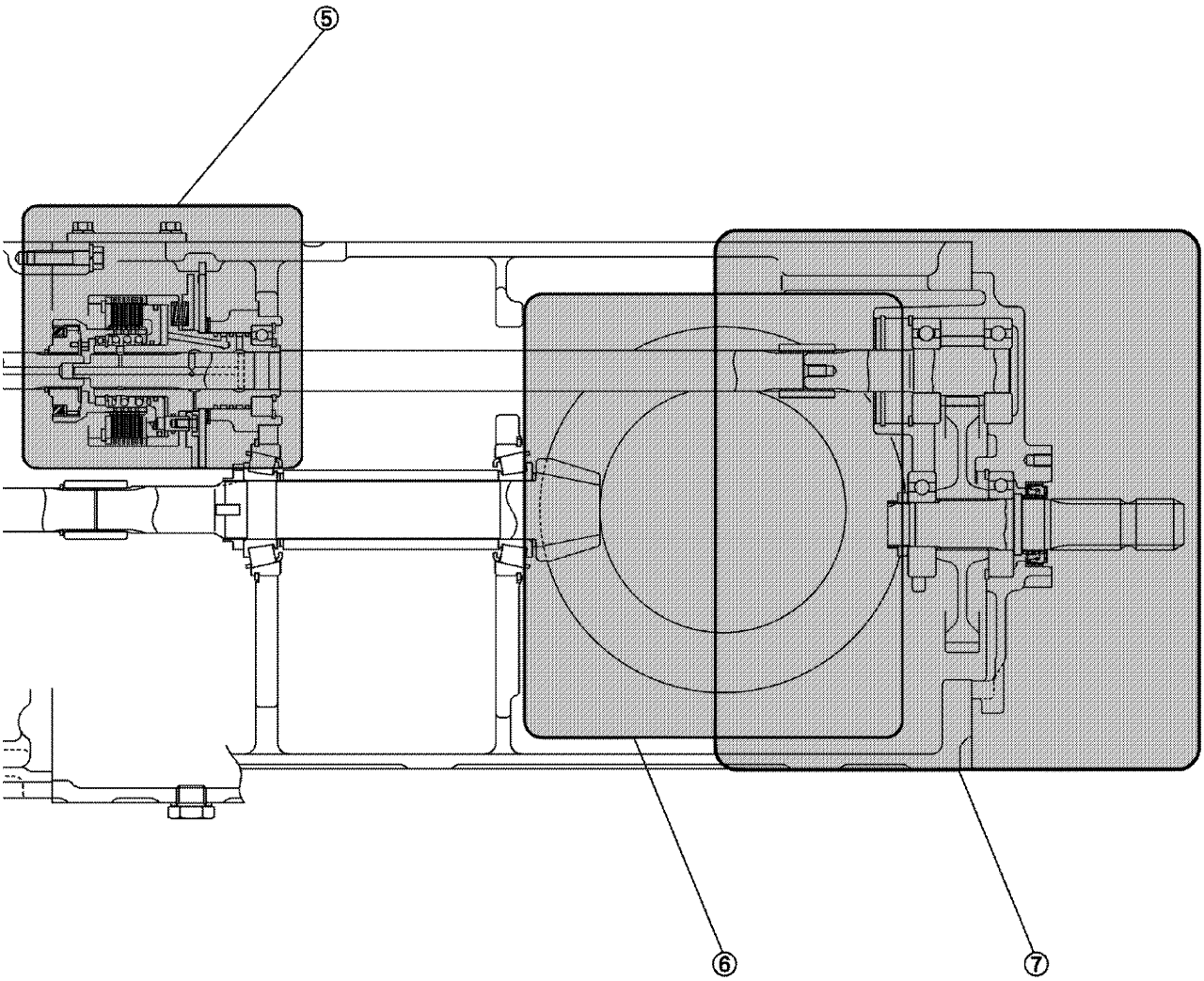
[1] STRUCTURE



12550F30010

(1) Shuttle Shift Section (Forward-Reverse)
(2) Main Gear Shift Section
(3) Hi-Lo, Creep (Option) Section
(4) Four Wheel Drive Section

12550M30010



(5) PTO Clutch Section (6) Differential Gear Section (7) PTO Gear Section

12550M30020

The transmission consist of a series of gears and shafts show previously. It offers the most suitable speed for travelling and operation by combination of these gears. It transmits power to the front axle (4WD Type), rear axle and PTO shaft, which are classified respectively as the travelling system and PTO system.

■ Travelling System

All models are equipped a transmission with 8 forward and 8 reverses. (12 forwards and 12 reverses, if the tractors are equipped creep speed gear.)

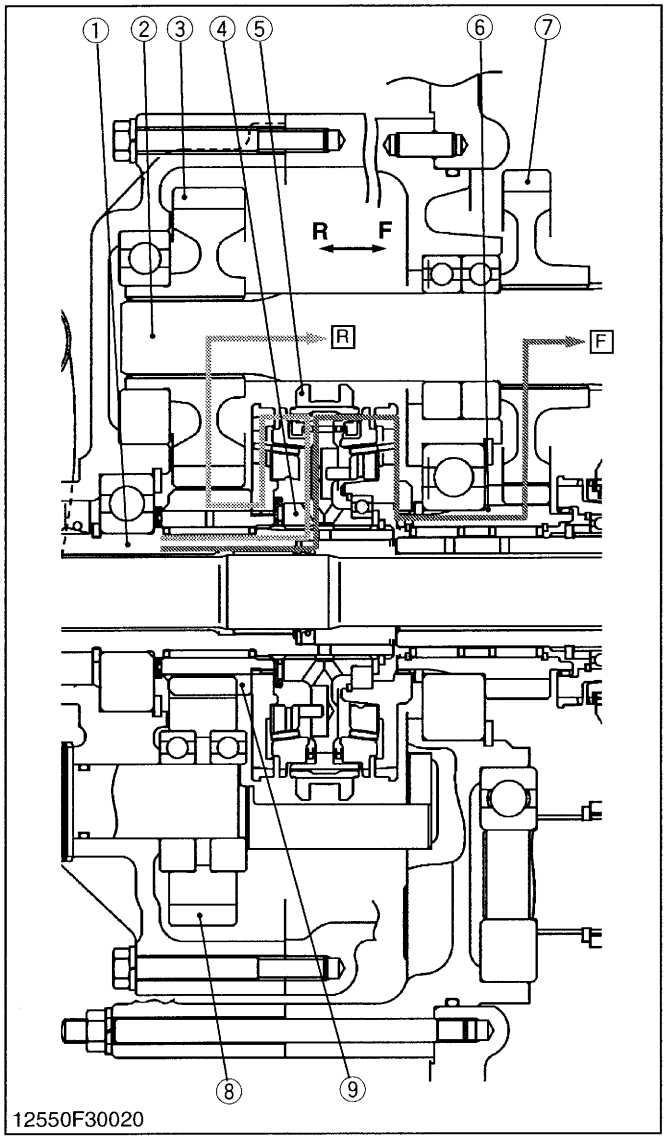
The travelling system consists of main gear shift section, shuttle shift section (Forward-Reverse), Hi-Low, Creep shift section (creep speed shift section is option.)

■ PTO System

All models have live PTO's (Independent PTO's) which have their own clutch controls completely separated from the travelling clutch and transmission. This means that the PTO operation is independent of the tractor travel. With this device have equipped with a hydraulic PTO clutch (wet multi-plates type clutch). (Refer to **"2 CLUTCH"** section.)

12550M30030

(1) Shuttle Shift Section (Forward-Reverse)



12550F30020

The shuttle shift section allows the operators to change forward and reverse with a shuttle lever. It is used synchromesh type gear shift.

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

When the shuttle lever is move to the F or R position, the shifter (5) is slid to the rear or front by the mechanical linkage to be engaged with the 21T gear shaft (6) or 20T gear (9).

Then, the power is transmitted to the 1 st shaft (2).

The power is transmitted as follows.

■ Forward

Gear Shift (1) → Hub (4) → Shifter (5) → 21T Gear Shaft (6) → 34T Gear (7) → 1st Shaft (2).

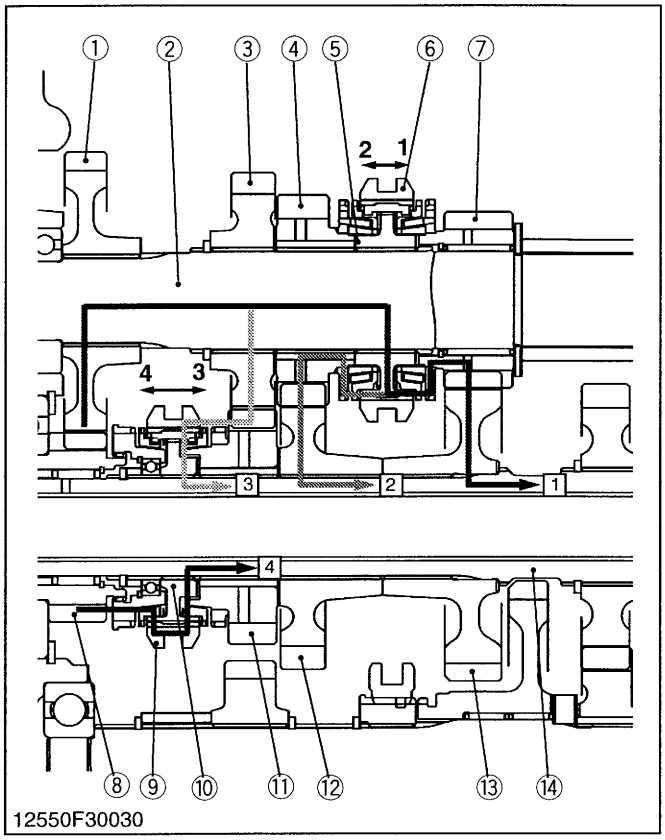
■ Reverse

Gear Shaft (1) → Hub (4) → Shifter (5) → 20T Gear (9) → 25T Gear (8) → 31T Gear (3) → 1st Shaft (2)

(1) Gear Shaft
(2) 1st Shaft
(3) 31T Gear
(4) Hub
(5) Shifter
(6) 21T Gear Shaft
(7) 34T Gear
(8) 25T Gear
(9) 20T Gear

12550M30040

(2) Main Gear Shift Section



12550F30030

The main shift section uses a synchromesh type transmission.

■ 1st Speed

21T Gear Shaft (8) → 34T Gear (1) → 1st Shaft (2) → Hub (5) → Shifter (6) → 19T Gear (7) → 36T Gear (13) → 2nd Shaft (14)

■ 2nd Speed

21T Gear Shaft (8) → 34T Gear (1) → 1st Shaft (2) → Hub (5) → Shifter (6) → 17T Gear (4) → 24T Gear (12) → 2nd Shaft (14)

■ 3rd Speed

21T Gear Shaft (8) → 34T Gear (1) → 1st Shaft (2) → 25T Gear (3) → 23T Gear (11) → Shifter (9) → Hub (10) → 2nd Shaft (14)

■ 4th Speed

21T Gear Shaft (8) → Shifter (9) → Hub (10) → 2nd Shaft (14)

(1) 34T Gear
(2) 1st Shaft
(3) 25T Gear
(4) 17T Gear
(5) Hub
(6) Shifter
(7) 19T Gear
(8) 21T Gear Shaft
(9) Shifter
(10) Hub
(11) 23T Gear
(12) 24T Gear
(13) 36T Gear
(14) 2nd Shaft

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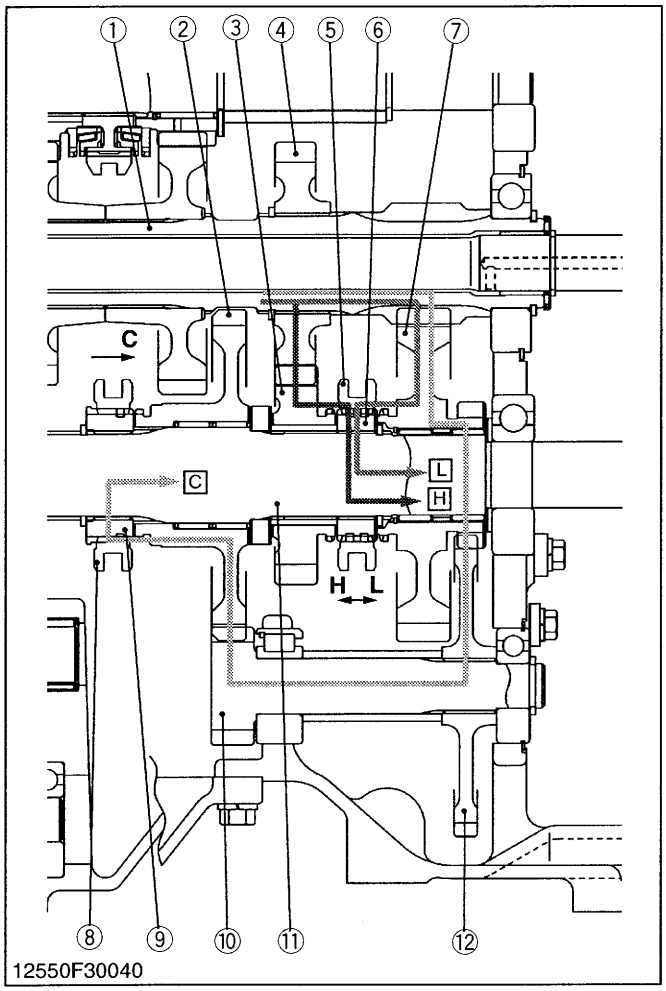
(3) Hi-Lo, Creep Shift Section



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The Hi-Lo, creep shift section allows the operator to change Hi-Low and creep with an auxiliary speed change lever is move to the Hi-Low or creep position. The Hi-Low shifter (5) is slide to the front or rear by mechanical linkage to be engaged with the 21T gear (3) or 41T-19T gear (7).

The creep shifter (8) is slide the rear 47T gear (2).

Then, power is transmitted as follows.

■ Hi Range

2nd Shaft (1) → 24T Gear (4) → 21T Gear (3) → Shifter (5) → Hub (6) → 3rd Shaft (11)

■ Low Range

2nd Shaft (1) → 41T-19T Gear (7) → Shifter (5) → Hub (6) → 3rd Shaft (11)

■ Creep Range (Option)

2nd Shaft (1) → 41T-19T Gear (7) → 43T Gear (12) →15T Gear Shaft (10) → 47T Gear (2) → Shifter (8) → Hub (9) → 3rd Shaft (11).

(1) 2nd Shaft
(2) 47T Gear
(3) 21T Gear
(4) 24T Gear
(5) Shifter
(6) Hub
(7) 41T-19T Gear
(8) Shifter
(9) Hub
(10) 15T Gear Shaft
(11) 3rd Shaft
(12) 43T Gear

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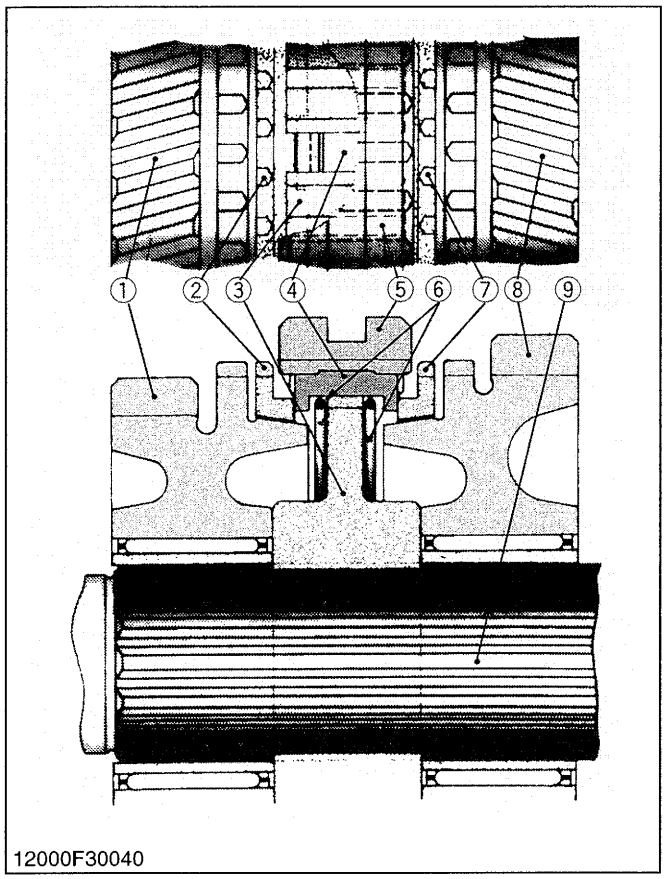

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■ Operation of Block-type Synchronizer

(Main speed change 3rd-4th speed)

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

(1) Gear
(2) Synchronizer Ring
(3) Coupling
(4) Synchronizer Key
(5) Shifter
(6) Synchronizer Springs
(7) Synchronizer Ring
(8) Gear
(9) Counter Shaft

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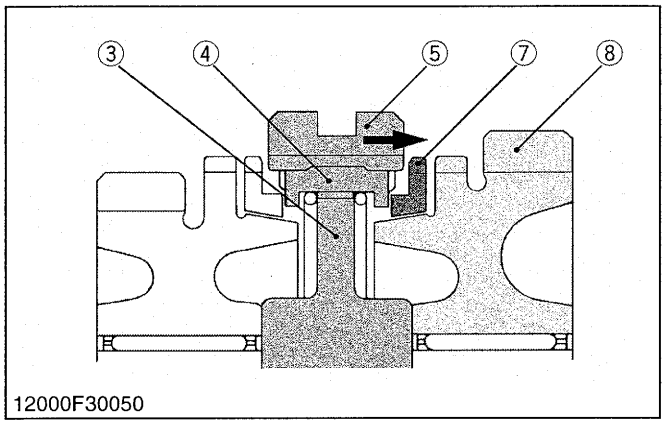

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- **First Stage**

An effort to place the main gear shift lever to the 2nd or 3rd speed causes the shifter (5) and synchronizer keys (4) to move slightly. Then, the end surface of the synchronizer key (4) presses the synchronizer ring (7) against the cone-shaped portion of the gear (8). The frictional force generated at the cone-shaped portion rotates the synchronizer ring (7), synchronizer keys (4) and coupling (3) which is splined to the counter shaft.

(3) Coupling
(4) Synchronizer Key
(5) Shifter
(7) Synchronizer Ring
(8) Gear

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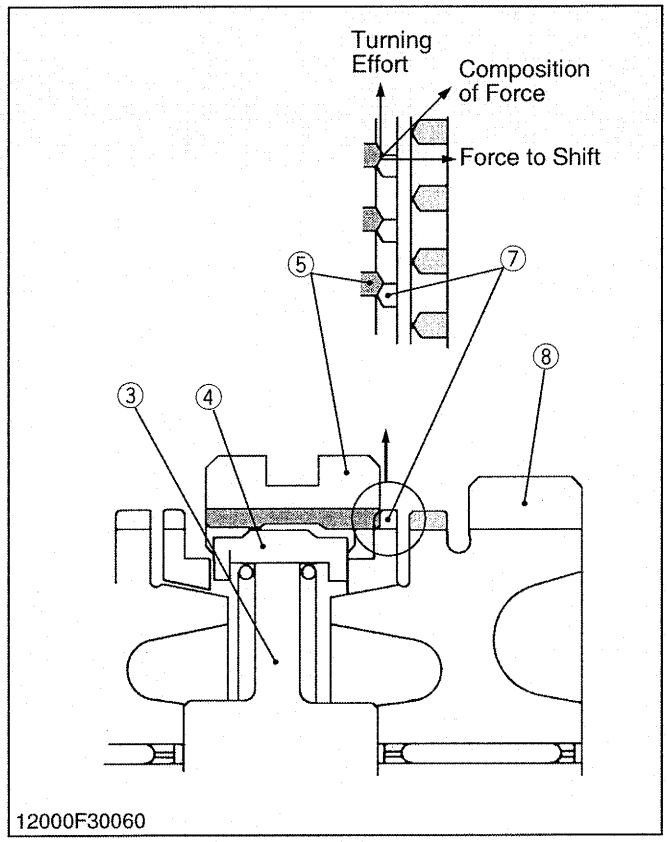

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- **Second Stage**

When synchronizer keys (4) are prevented by the synchronizer ring (7) from sliding, the synchronizer keys (4) are disengaged from the shifter (5). The synchronizer keys (4) go into the grooves provided on the synchronizer ring (7), however, since the width of the grooves is wider than that of the keys, the synchronizer keys begin rotating at the same speed with the shifter (5) and coupling (3) with a time lag. In the meantime, the shifter (5) in its sliding direction and the synchronizer ring (7) in its rotating direction press each other at their chamfered portions to synchronize the synchronizer ring (7) speed with the gear (8) speed.

(3) Coupling
(4) Synchronizer Key
(5) Shifter
(7) Synchronizer Ring
(8) Gear

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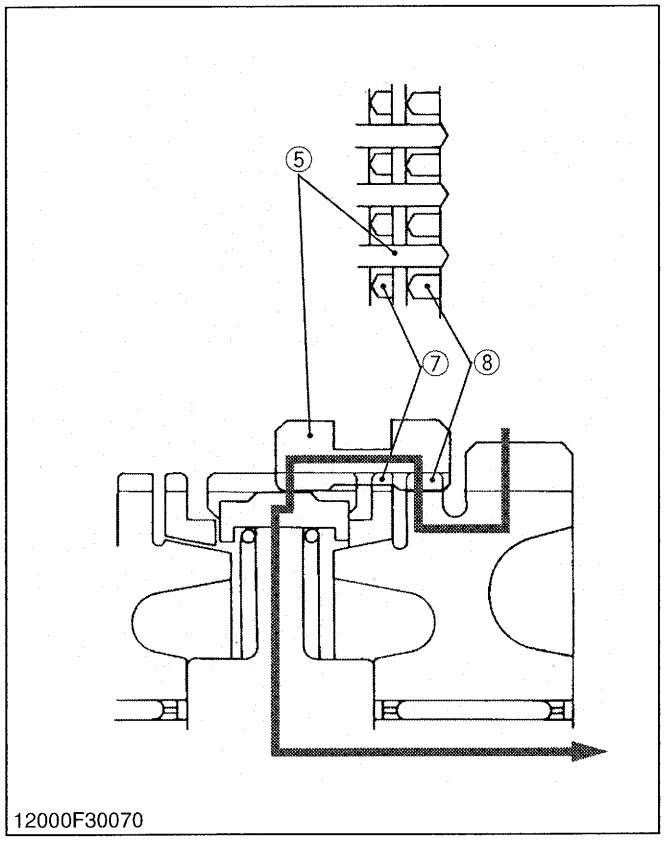

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- **Final Stage**

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

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

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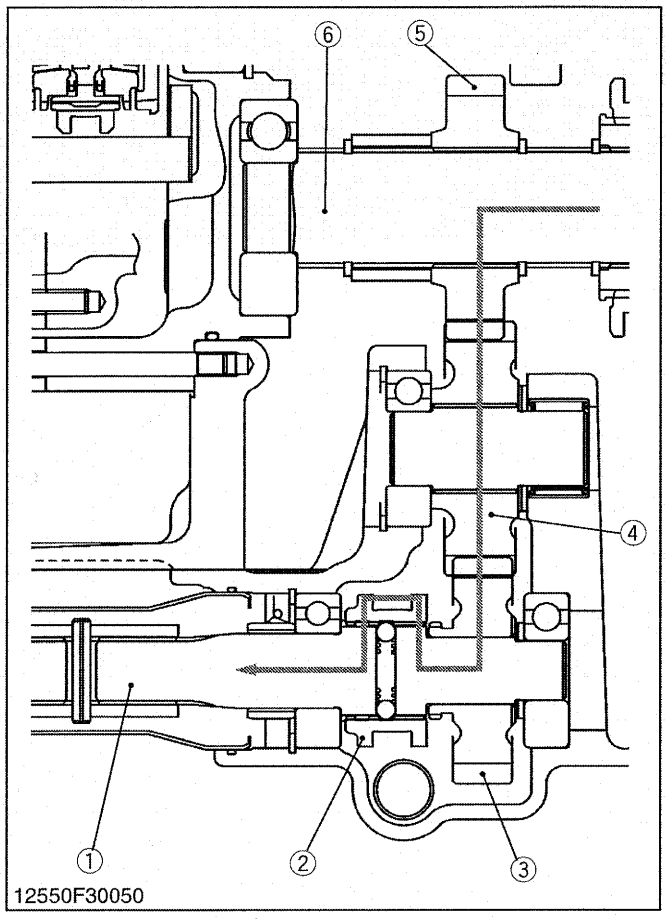
(4) Four Wheel Drive Section (4WD Only)



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2 wheel drive or 4 wheel drive is selected by changing the position of shifter (2) on the propeller shaft 1 (1) using the front wheel drive lever.

When the front wheel drive lever is set to **"Disengage"**, the shifter is in neutral and power is not transmitted to the propeller shaft 1 (1).

Power is transmitted as follows.

■ 4 Wheel Drive Engaged

3rd Shaft (6) → 26T Gear (5) → 25T Gear (4) → 22T Gear (3) → Shifter (2) → Propeller Shaft (1).

(1) Propeller Shaft 1
(2) Shifter
(3) 22T Gear
(4) 25T Gear
(5) 26T Gear
(6) 3rd Shaft

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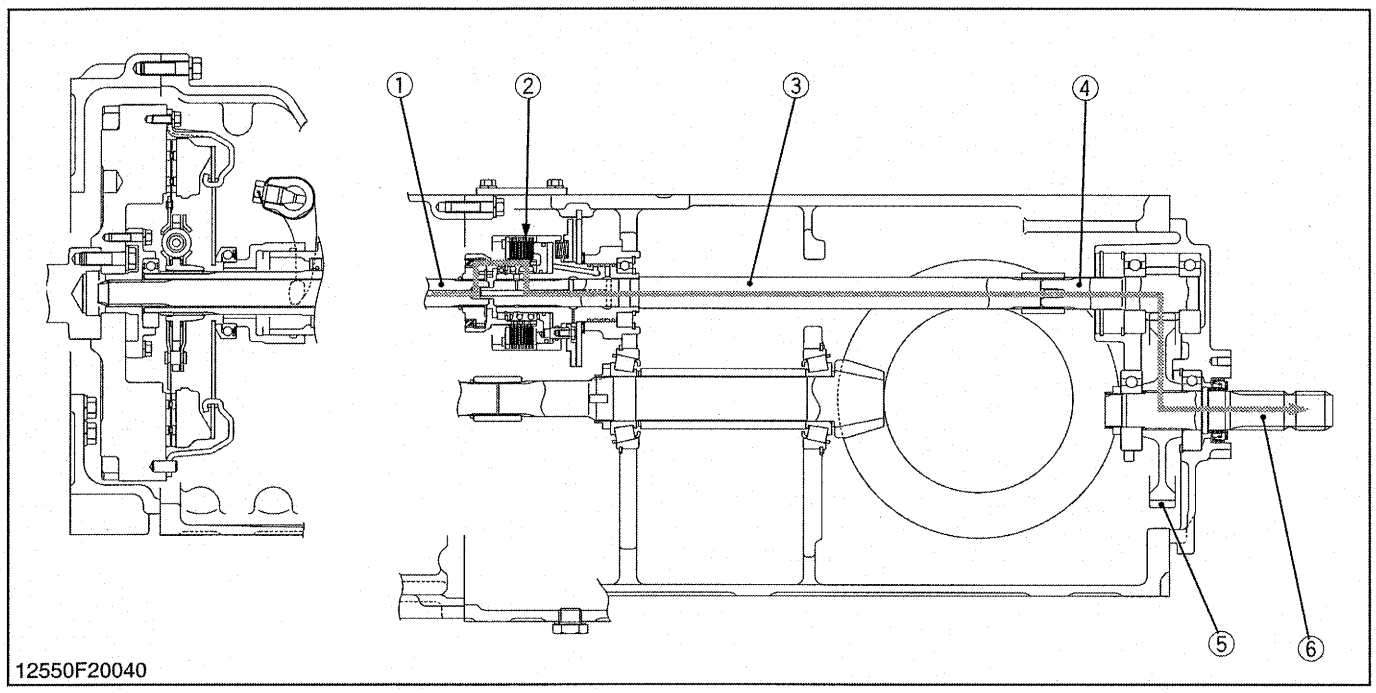
[2] PTO SYSTEM

All models have Live PTO's (Independent PTO's) which have their own clutch controls completely separate from the travelling clutch and transmission.

Therefore, the PTO can operate while the tractor is stopped and also the PTO can be disengaged and engaged while the tractor is in motion.

The PTO system offers 540 min^{-1} (rpm) on the rear PTO speed.



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(1) PTO Propeller Shaft 1
(2) PTO Clutch
(3) PTO Propeller Shaft 2
(4) 12T Gear Shaft
(5) 51T Gear
(6) PTO Shaft

By operating the PTO clutch lever from **"OFF"** to **"ON"** position to engage the PTO clutch (2), the PTO propeller shaft 1 (1) is connected to the 12T gear shaft (4).

So the rotation of PTO propeller shaft 1 (1) is transmitted to the 12T gear shaft (4), the power is transmitted as follows.

PTO Propeller Shaft 1 (1) → PTO Clutch (2) → PTO Propeller Shaft 2 (3) → 12T Gear Shaft (4) → 51T Gear (5) → PTO Shaft (6).

Relationship between engine speed and PTO shaft speed is as shown below.

PTO speed / Engine speed	540 / 2295 min^{-1} (rpm)

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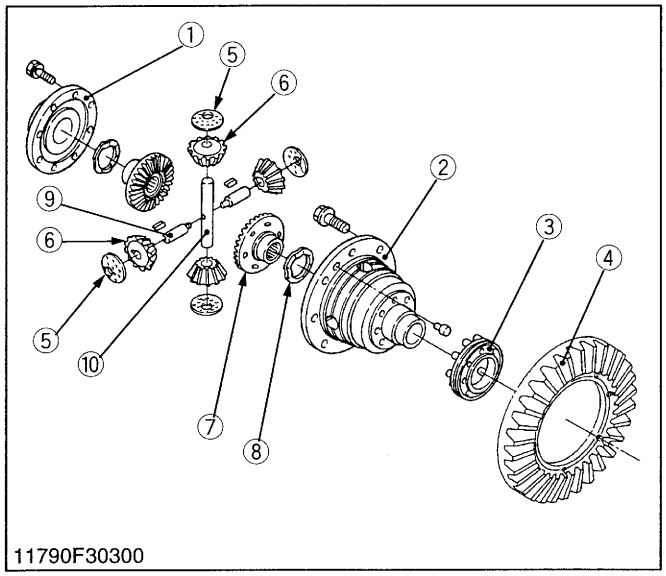
[3] DIFFERENTIAL GEAR

(1) Structure



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The differential gear assembly is a mechanism to provide smooth steering. It automatically provides different optimum torques to the right and left wheels according to road resistance and braking friction at the wheels.

The differential gear assembly is composed of the differential case, differential pinions, differential side gears, differential pinion shaft, ring gear, etc.

(1) Differential Case Cover
(2) Differential Case
(3) Differential Lock Shifter
(4) Ring Gear
(5) Differential Pinion Washer
(6) Differential Pinion
(7) Differential Side Gear
(8) Differential Side Gear Washer
(9) Differential Pinion Shaft 2
(10) Differential Pinion Shaft

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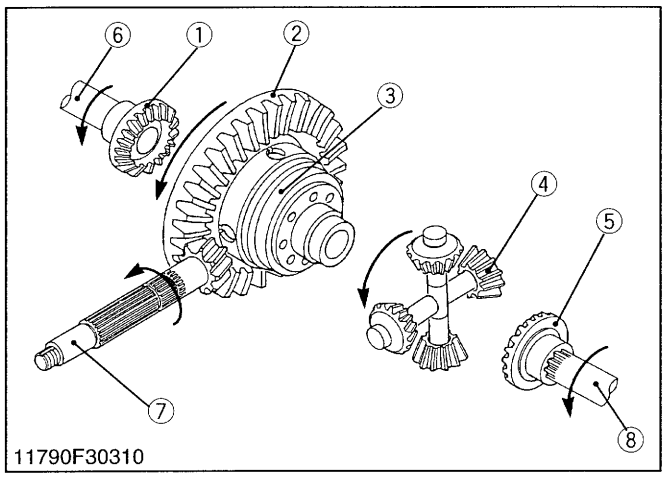
(2) Operation



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■ Traveling Straight Ahead

Rotation of the spiral bevel pinion (7) is transmitted to the ring gear (2) bolted to the differential case (3). When road resistance to the right and left wheels are equal, the differential pinions (4), and differential side gears (1), (5) are carried around by the ring gear (2), and differential case (3) rotate as a unit. Differential gear shaft (6), (8) receive the same rotation and both wheels travel at the same speed.

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

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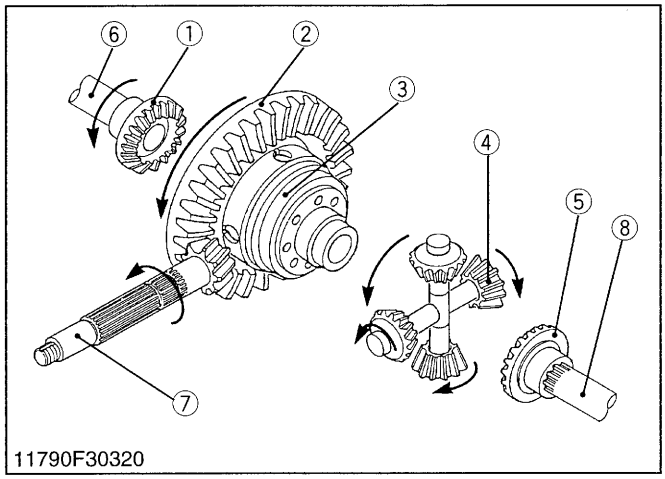

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■ Turning a Corner

The power from the engine on spiral bevel pinion (7) rotates ring gear (2). When turning a corner, the outer wheel must travel farther than the inner one. While differential pinions (4) rotate with the differential case (3), they spin on differential pinion shaft to transmit more rotation to one differential side gear than to the other. As one differential gear shaft rotates faster, the other rotates slower by the same amount.

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

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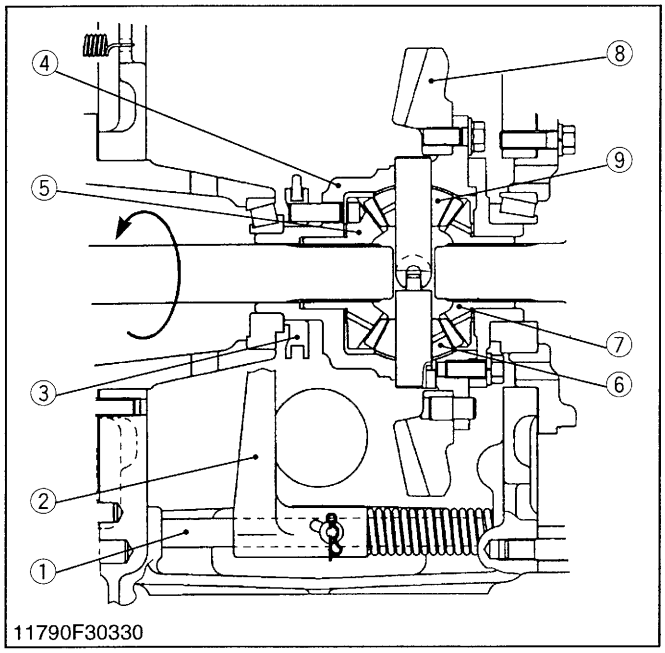

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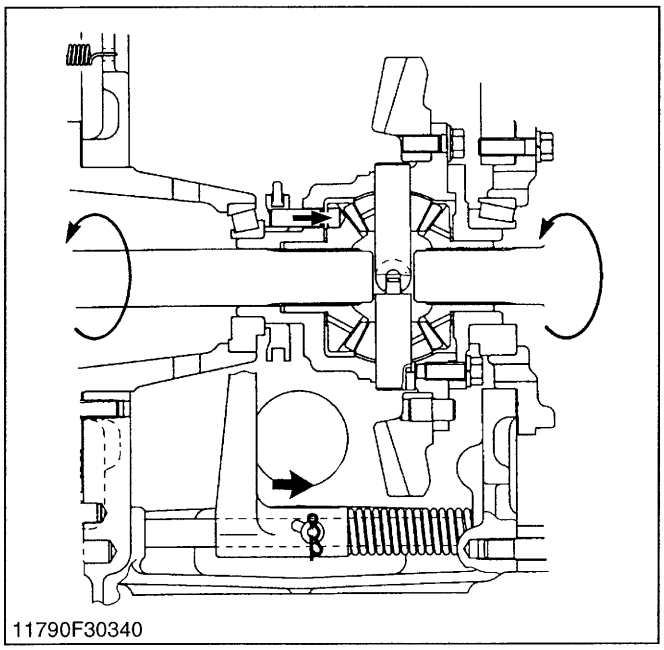
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■ Differential Lock

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

When the differential lock pedal is stepped on, it causes the differential lock cam shaft (1), differential lock shift fork (2) and differential lock shifter (3) are moved forward the ring gear (8).

The pins on the differential lock shifter (3) go into the holes in the differential side gear (5) through the holes in the differential case (4) to cause the differential case, differential lock shifter and differential side gear to rotate as a unit. Therefore the differential pinions (6), (9), can not rotate on their axles, and the rotation of the spiral bevel pinion is transmitted to the both rear axles evenly. It means the tractor going straight ahead.

When the drive wheels regain equal traction, the lock will disengage automatically by the force of differential lock pedal return spring, while released differential lock pedal.

(1) Differential Lock Cam Shaft
(2) Differential Lock Shift Fork
(3) Differential Lock Shifter
(4) Differential Case
(5) Differential Side Gear
(6) Differential Pinion
(7) Differential Side Gear
(8) Ring Gear
(9) Differential Pinion

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SERVICING

CONTENTS

TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Excessive Transmission Noise	• Transmission fluid insufficient	Replenish	G-14
	• Improper backlash between bevel pinion shaft and bevel gear	Replace	3-S31
	• Improper backlash between differential pinion and side gear	Adjust	3-S33
	• Collars or shims have not been installed	Repair	–
	• Bearings worn	Replace	3-S18, S29
Gears Slip Out of Mesh	• Shifter or shift form worn or damaged	Replace	3-S18, S19
	• Shift fork spring weaken or damaged	Replace	–
	• Interlock ball fallen	Reassemble	–
	• Synchronizer unit damaged	Repair or replace	3-S18, S19
Hard Shifting	• Shifter or shift fork worn or damaged	Replace	3-S18, S19
	• Sift fork bent	Replace	–
	• Synchronizer unit damaged	Repair or replace	3-S18, S19
Gears Clash When Shifting	• Synchronizer unit defective	Repair or replace	3-S18, S19
	• Clutch does not release	Adjust	2-S5
Differential Lock Can Not Be Set	• Differential lock shift fork damaged	Replace	3-S26
	• Differential lock shift fork mounting spring pin damaged	Replace	3-S25
	• Movement of differential lock shifter improperly adjusted	Adjust	3-S33
Differential Lock Pedal Does Not Return	• Differential lock cam spring weaken or damaged	Replace	3-S25
	• Differential shifter pin damaged	Repair or replace	–

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SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Shuttle Shift Rod	Length	Approx.160 mm 6.3 in.	–
Shift Fork to Shifter Groove Shuttle	Clearance	0.20 to 0.45 mm 0.0079 to 0.0177 in.	0.80 mm 0.031 in.
Other	Clearance	0.15 to 0.40 mm 0.0059 to 0.0157 in.	0.80 mm 0.031 in.
Shift Rod	Length	209 mm 8.23 in.	–
Spiral Bevel Pinion Shaft	Turning Torque	0.69 to 1.96 N·m 0.07 to 0.20 kgf· m 0.51 to 1.45 ft-lbs	–
Spiral Bevel Pinion Shaft and Differential Assembly	Turning Torque	1.28 to 2.45 N·m 0.13 to 0.25 kgf·m 0.94 to 1.81 ft-lbs	–
Spiral Bevel Gear to Spiral Bevel Pinion Shaft	Backlash	0.20 to 0.30 mm 0.0079 to 0.0118 in.	0.4 mm 0.016 in.
Differential Case Bore (Differential Case Cover Bore) to Differential Side Gear Boss	Clearance	0.050 to 0.151 mm 0.00197 to 0.00594 in.	0.35 mm 0.0138 in.
Differential Case Bore	I.D.	40.500 to 40.550 mm 1.59449 to 1.59646 in.	–
Differential Case Cover Bore	I.D.	40.500 to 40.550 mm 1.59449 to 1.59646 in.	–
Differential Side Gear Boss	O.D.	40.388 to 40.450 mm 1.59008 to 1.59252 in.	–
Differential Pinion Shaft to Differential Pinion	Clearance	0.060 to 0.102 mm 0.00236 to 0.00402 in.	0.25 mm 0.0098 in.
Differential Pinion Shaft	O.D.	19.959 to 19.980 mm 0.78579 to 0.78661 in.	–
Differential Pinion	I.D.	20.040 to 20.061 mm 0.78898 to 0.78980 in.	–
Differential Pinion to Differential Side Gear	Backlash	0.15 to 0.30 mm 0.0059 to 0.0118 in.	0.4 mm 0.016 in.
Differential Lock Shifter	Displacement	6.0 to 8.0 mm 0.236 to 0.315 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-10.)

Item	N·m	kgf·m	ft-lbs
Starter's terminal B mounting nut	8.8 to 11.8	0.9 to 1.2	6.5 to 8.7
Main delivery pipe and return pipe retaining nut	49.0 to 68.6	5.0 to 7.0	36.2 to 50.6
Turning delivery hose retaining nut	24.5 to 29.4	2.5 to 3.0	21.7 to 37.6
DT gear case munting screw (4WD only)	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
Rear wheel mounting nut	260 to 304	26.5 to 31.0	192 to 224
Step mounting nut	48.1 to 55.9	4.9 to 5.7	35.4 to 41.2
screw M16	117.7 to 147.1	12.0 to 15.0	87.0 to 108.5
Foldable ROPS mounting screw M16 grade 9	259.9 to 3040	26.5 to 31.0	192.0 to 224.0
Engine and clutch housing mounting screw, nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Engine and clutch housing mounting stud bolt	38.2 to 45.1	3.9 to 4.6	28.2 to 33.3
Transmission case and clutch housing mounting screw, nut			
M12, grade 11 nut	103.0 to 117.7	10.5 to 12.0	75.9 to 86.8
M12, grade 7 screw, nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
M10, grade 9 screw	60.8 to 70.6	6.2 to 7.2	44.8 to 52.1
Speed change cover mounting screw	23.5 to 27.4	2.4 to 2.8	17.4 to 20.3
Release fork setting screw	166.7 to 186.3	17.0 to 19.5	122.9 to 137.4
Bearing holder mounting screw and nut	23.5 to 27.4	2.4 to 2.8	17.4 to 20.3
Shuttle case assembly screw nut	23.5 to 27.4	2.4 to 2.8	17.4 to 20.3
Shuttle case mounting screw	29.4 to 34.3	3.0 to 3.5	217 to 25.3
M8, grade 7	23.5 to 27.4	2.4 to 2.8	17.4 to 20.3
M8, grade 9	29.4 to 34.3	3.0 to 3.5	217 to 25.3
Foldable ROPS mounting screw			
9/16-18 UNF, grade 8 screw	149.1 to 179.5	15.2 to 18.3	110 to 132
Rear axle case mounting screw and nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Rear axle case mounting stud bolt	38.2 to 45.1	3.9 to 4.6	28.2 to 33.3
Hydraulic cylinder assembly mounting stud bolt	38.2 to 45.1	3.9 to 4.6	28.2 to 33.3
Hydraulic cylinder assembly mounting screw and nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
PTO gear case mounting screw	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
PTO shaft staking nut	225.5 to 264.8	23.0 to 27.0	166.4 to 195.3
Differential bearing support mounting screw	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Differential case cover mounting screw	48.1 to 55.9	4.9 to 5.7	35.5 to 41.2
Spiral bevel gear UBS screw	70.6 to 90.2	7.2 to 9.2	52.1 to 66.5
PTO clutch valve mounting screw	23.5 to 27.4	2.4 to 2.8	17.4 to 20.3
PTO clutch holder mounting screw	23.5 to 27.4	2.4 to 2.8	17.4 to 20.3
Spiral bevel pinion shaft staking nut	274.6 to 343.2	28.0 to 35.0	202.5 to 253.2

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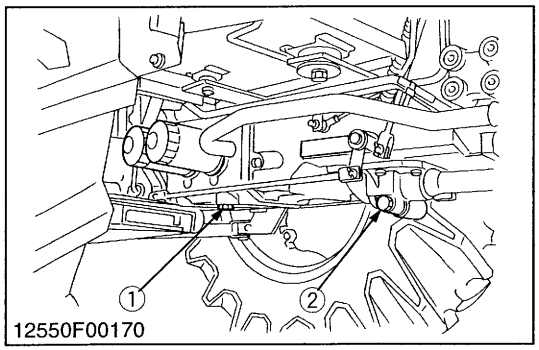
CHECKING, DISASSEMBLING AND SERVICING

[1] CLUTCH HOUSING

DISASSEMBLING AND ASSEMBLING

(1) Draining the Transmission Fluid



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Changing Transmission Fluid

1. Place an oil pan underneath the transmission case.
2. Remove the drain plugs (1) and (2).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1) and (2).

(When reassembling)

- Fill up from filling port after removing the filling plug until reaching the gauge.
- After running the engine for few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

Transmission fluid	Capacity	ROPS	40.0 L 42.3 U.S.qts. 35.2 Imp.qts.
		CAB	43.0 L 45.4 U.S.qts. 37.8 Imp.qts.

■ IMPORTANT

- **Use only KUBOTA SUPER UDT fluid. Use of other fluides may damage the transmission or hydraulic system.**
- **Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)**
- **Do not mix different brands oil together.**

(1) Drain Plug (2) Drain Plug (4WD Only)

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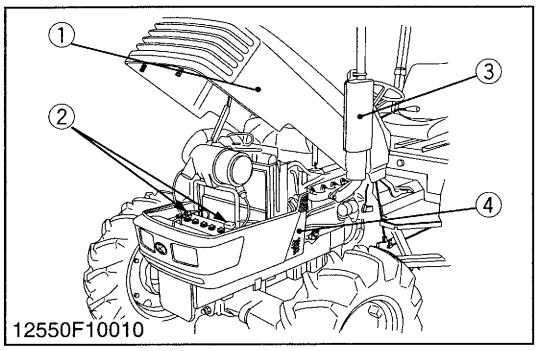
(2) Separating Engine and Clutch Housing Case



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Muffler and Bonnet

1. Remove the muffler (3).
2. Remove the bonnet (1).
3. Disconnect the battery's cable (2).
4. Remove the side cover (4).

(1) Bonnet (3) Muffler
(2) Battery's Cable (4) Side Cover

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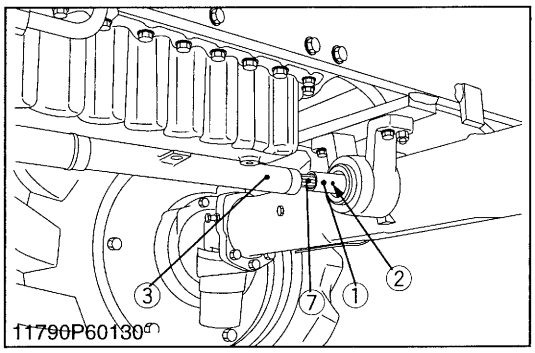

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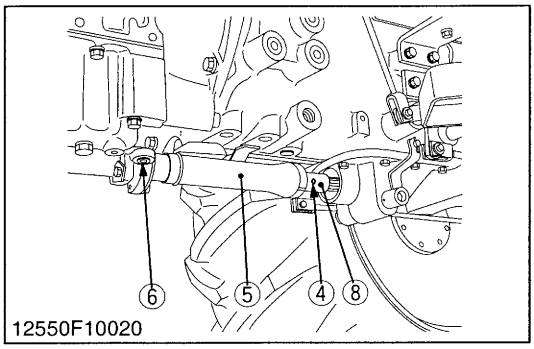

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Propeller Shaft (4WD Only)

1. Slide the propeller shaft cover (3), (5) after removing the screws (6).
2. Tap out the spring pin (2), (4) and then slide the coupling (1), (8) to the front and rear.

(When reassembling)

- Apply grease to the splines of the propeller shaft (7).

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

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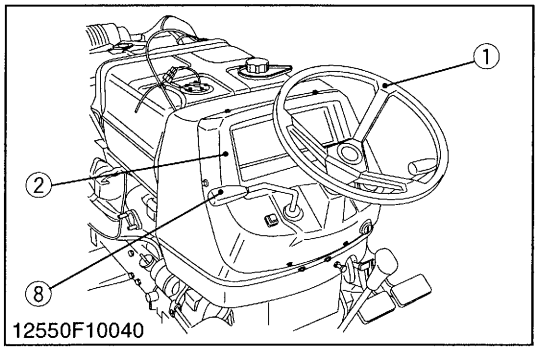

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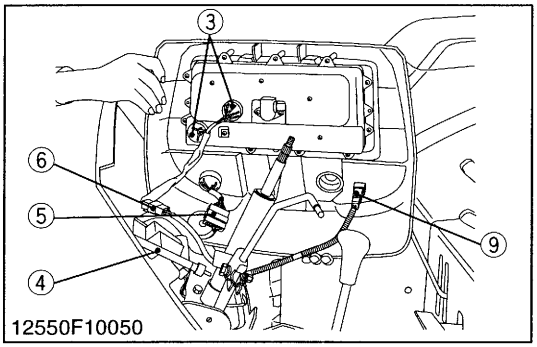

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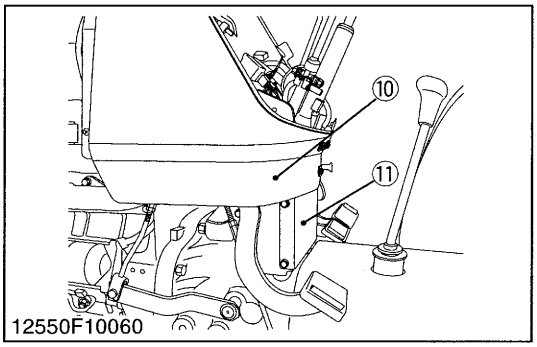

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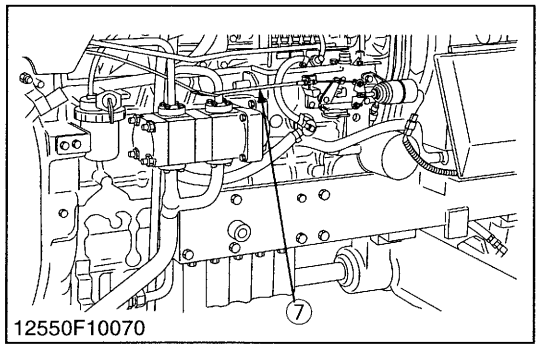

12550F10070

Steering Wheel, Meter Panel and Rear Bonnet

1. Remove the steering wheel (1) with a steering wheel puller (Code No. 07916-51090).
2. Remove the shuttle lever grip (8).
3. Remove the meter panel mounting screws and open the meter panel (2).
4. Disconnect the two connectors (3) and meter cable (4).
5. Disconnect the main switch connector (5) and combination switch connector (6).
6. Disconnect the hazard switch connector (9).
7. Disconnect the engine stop cable (7) at the engine side.
8. Remove the rear bonnet (10) and lower cover (11).

(1) Steering Wheel
(2) Meter Panel
(3) Connector
(4) Meter Cable
(5) Main Switch Connector
(6) Combination Switch Connector
(7) Engine Stop Cable
(8) Shuttle Lever Grip
(9) Hazard Switch Connector
(10) Rear Bonnet
(11) Lower Cover

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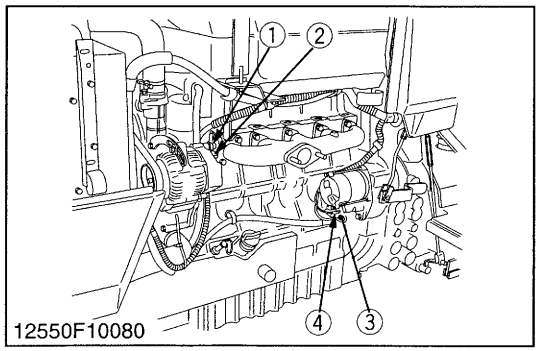


12550F10080

Wire Harness for Alternator and Starter Motor

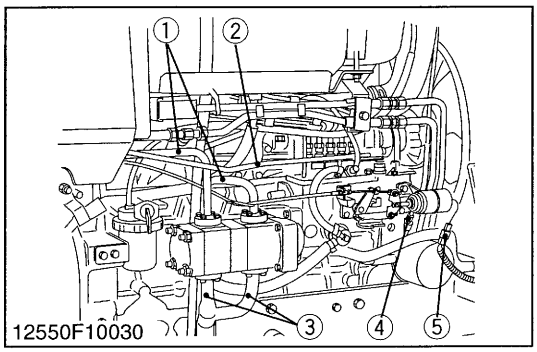
1. Disconnect the alternator **2P** connector (2) and **B** terminal (1).
2. Disconnect the starter motor **B** terminal (3) and **1P** connector (4).

(When reassembling)

Tightening torque	Starter's terminal **B** mounting nut	8.8 to11.8 N·m 0.9 to 1.2 kgf·m 6.5 to 8.7 ft-lbs

(1) Alternator **B** Terminal
(2) Alternator **2P** Connector
(3) Starter Motor **B** Terminal
(4) Starter Motor **1P** Connector

12550S20110



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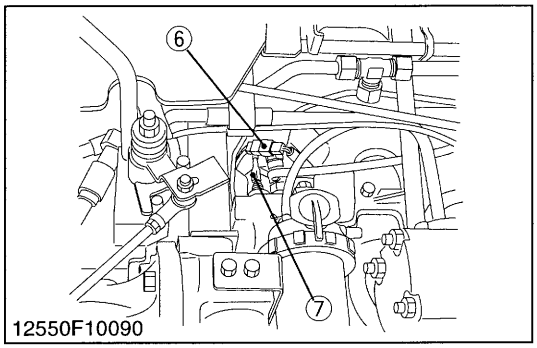

12550F10090

Wire Harness R.H. and Hydraulic Pipe

1. Remove the accelerator rod (2).
2. Remove the suction pipe (3) and delivery pipe (1).
3. Disconnect the glow plug **1P** connector (6) and coolant temperature sensor **1P** connector (7).
4. Remove the hourmeter cable (4) at engine side.
5. Disconnect the stop solenoid connector (5).

(1) Delivery Pipe
(2) Accelerator Rod
(3) Suction Pipe
(4) Hourmeter Cable
(5) Stop Solenoid Connector
(6) **1P** Connector for Glow Plug
(7) Coolant Tempurature Sensor **1P**

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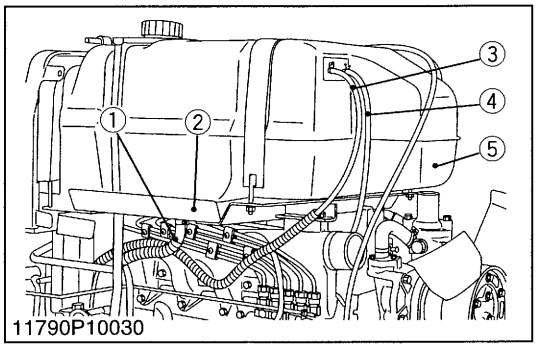


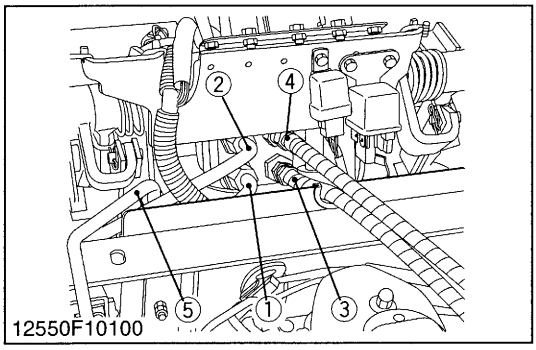
11790P10030

Fuel Tank (ROPS)

1. Disconnect the fuel delivery pipe (1) from the fuel filter, and then drain the fuel.
2. Disconnect the fuel return pipe (3) and (4).
3. Remove the fuel tank (5) with fuel tank support (2).

(1) Fuel Delivery Pipe
(2) Fuel Tank Support
(3) Fuel Return Pipe
(4) Fuel Return Pipe
(5) Fuel Tank

12550S10200



12550F10100

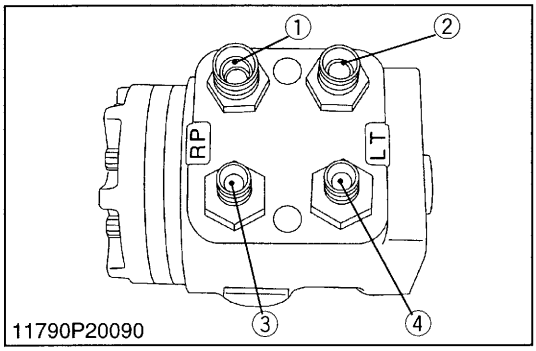
Piping for Power Steering

1. Disconnect the main delivery pipe (1), return pipe 1 (2), right turning delivery hose (3), left turning delivery hose (4) and return pipe 2 (5).

(When reassembling)

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

(1) Main Delivery Pipe
(2) Return Pipe 1
(3) Right Turning Delivery Hose
(4) Left Turning Delivery Hose
(5) Return Pipe 2 (M5700: 4WD)



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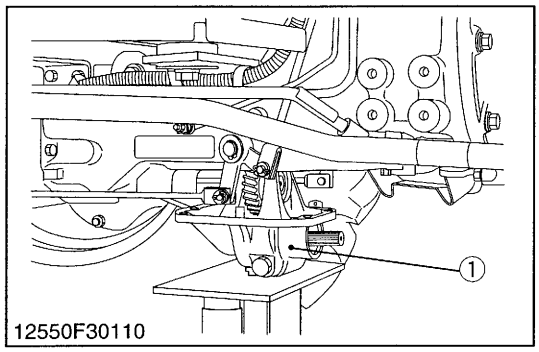

DT Gear Case (4WD Only)

1. Remove the DT shift rod.
2. Remove the DT gear case (1).

(When reassembling)

- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the clutch housing and DT gear case.

Tightening torque	DT gear case mounting screw	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs

(1) DT Gear Case

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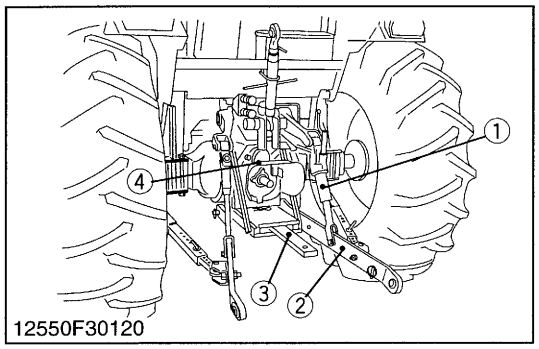

Lift Rods and Lower Links

1. Remove the lift rods (1).
2. Remove the lower links (2) with stabilizer.
3. Remove the draw bar (3).
4. Remove the PTO shaft cover (4).

(1) Lift Rod
(2) Lower Link
(3) Draw Bar
(4) PTO Shaft Cover

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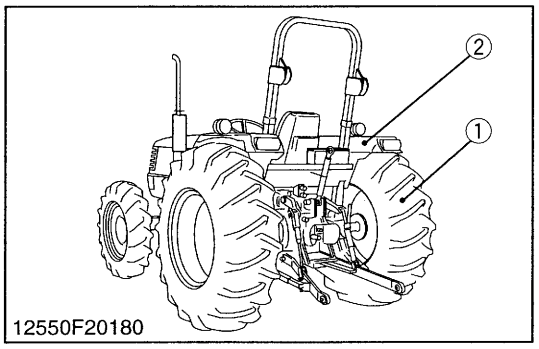

Rear Wheels and Fenders

1. Check the clutch housing case and transmission case are securely mounted on the disassembling stands.
2. Remove the rear wheels (1).
3. Disconnect the jumper leads for hazard and tail light.
4. Disconnect the jumper leads for PTO safety switch.
5. Remove the fenders (2).

(When reassembling)

Tightening torque	Rear wheel mounting nut	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs

(1) Rear Wheel
(2) Fender

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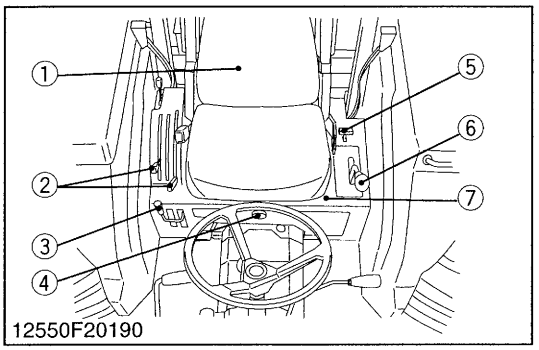

Seat and Center Frame

1. Remove the seat (1).
2. Remove the draft and position control lever grips (2).
3. Remove the auxiliary speed change lever grip (6), DT shift lever grip (5) and 3-point hitch lowering speed control grip (4).
4. Remove the auxiliary control valve lever assembly (3).
5. Remove the center frame (7).

(1) Seat
(2) Lever Grip
(3) Auxiliary Control Valve Lever Assembly
(4) 3-Point Hitch Lowering Speed Control Grip
(5) DT Shift Lever Grip
(6) Auxiliary Speed Change Lever Grip
(7) Center Frame

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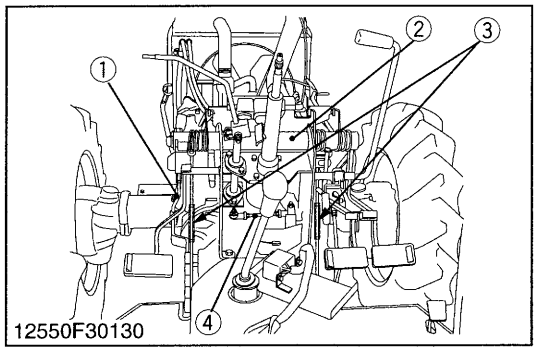

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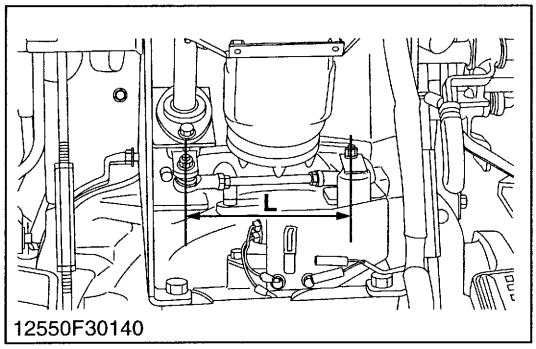

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Pedal Frame

1. Disconnect the brake rods (3).
2. Disconnect the clutch rod (1).
3. Remove the shuttle rod (4).
4. Remove the pedal frame (2) and steering controller assembly as a unit.

(When reassembling)

- Be sure to adjusting the shuttle shift rod.

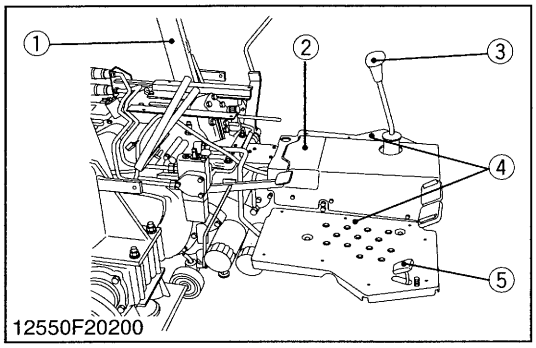
Shuttle shift rod length **L**	Factory spec.	Approx. 160 mm 6.3 in.

■ IMPORTANT

- **After reassembling the pedal frame, be sure to adjust the brake pedal play and clutch pedal free play.**

(1) Clutch Rod
(2) Pedal Frame
(3) Brake Rod
(4) Shuttle Rod

12550S30060



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Steps and Clutch Housing Cover

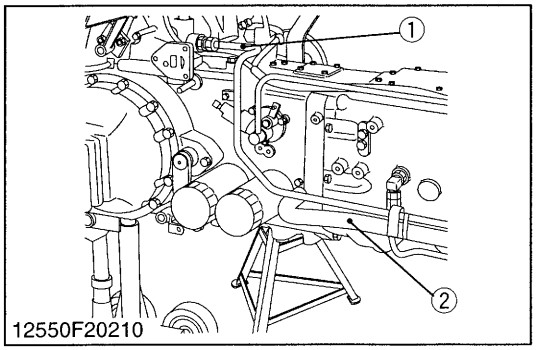
1. Disconnect the foot accelerator rod (5).
2. Remove the steps (4).
3. Remove the main speed change lever grip (3).
4. Remove the clutch housing cover (2).
5. Remove the foldable ROPS (1).

(When reassembling)

Tightening torque	Step mounting nut	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs
	Step mounting screw (M16)	117.7 to 147.1 N·m 12.0 to 15.0 kgf·m 87.0 to 108.5 ft-lbs
	Foldable ROPS mounting screw (M16, Grade 9)	259.9 to 304.0 N·m 26.5 to 31.0 kgf·m 192.0 to 224.0 ft-lbs

(1) Foldable ROPS
(2) Clutch Housing Cover
(3) Main Speed Change Lever Grip
(4) Step
(5) Foot Accelerator Rod

12550S20180



12550F20210

Hydraulic Pipes

1. Remove the suction pipe (2).
2. Remove the delivery pipe (1) for the three point hydraulic system.

(1) Delivery Pipe
(2) Suction Pipe

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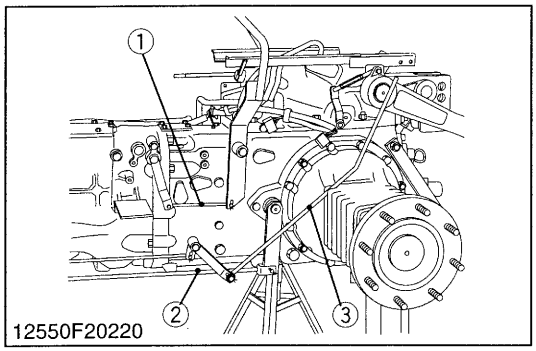

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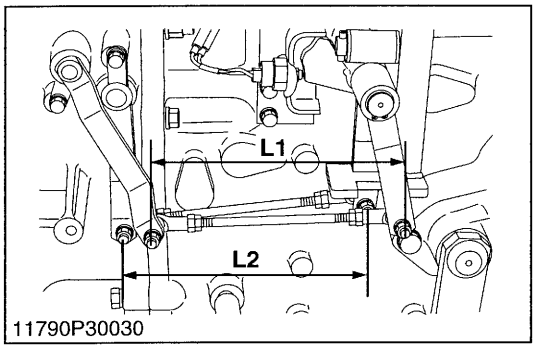


11790P30030

Auxiliary Shift Lever and Brake Rod

1. Disconnect the shift rods (1).
2. Remove the shift lever assembly.
3. Remove the brake rods (2).
4. Remove the DT rod (3).

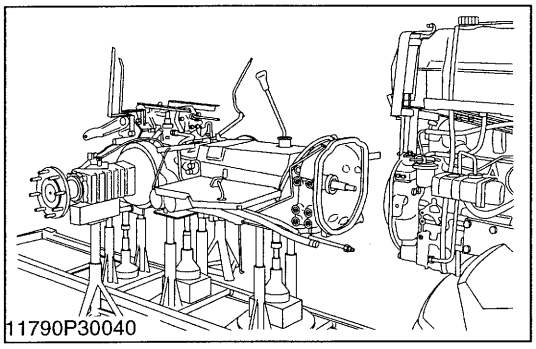
(When reassembling)

- Be sure to adjusting the shift rod.

Shift rod length **L1** and **L2**	Factory spec.	Approx. 209 mm 8.23 in.

(1) Shift Rod
(2) Brake Rod
(3) DT Rod

12550S20200


11790P30040

Separating Engine from Clutch Housing

1. Remove the engine mounting screws and nuts, and separate the engine from the clutch housing.

(When reassembling)

- Apply grease to the splines.
- Apply liquid gasket (Three Bond 1211,1141 or equivalent) to the seam of engine and clutch housing.
- When connecting the engine to the clutch housing, be sure to align the input shaft spline to the clutch hub center.

Tightening torque	Engine and clutch housing mounting screw, nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
	Engine and clutch housing mounting stud bolt	38.2 to 45.1 N·m 3.9 to 4.6 kgf·m 28.2 to 33.3 ft-lbs

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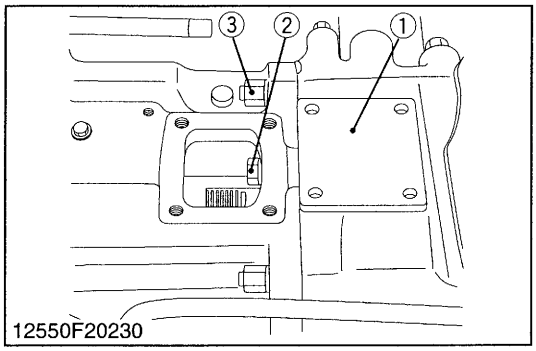

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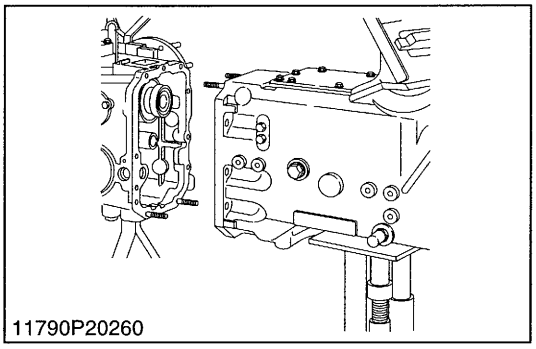

11790P20260

Separating Transmission Case

1. Remove the transmission upper cover (1).
2. Remove the transmission case mounting screws and nut, and separate the transmission case from the clutch housing.

(When reassembling)

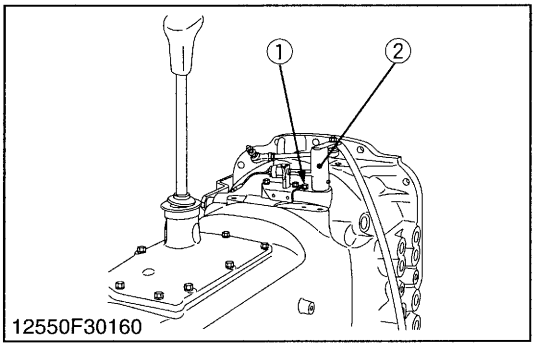
- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the transmission case and clutch housing, transmission upper cover and transmission case.

Tightening torque	Transmission case and clutch housing mounting screw, nut	M12, grade 11 nut (3)	103.0 to 117.7 N·m 10.5 to 12.0 kgf·m 75.9 to 86.8 ft-lbs
		M12, grade 7 screw, nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
		M10, grade 9 screw (2)	60.8 to 70.6 N·m 6.2 to 7.2 kgf·m 44.8 to 52.1 ft-lbs
	Transmission upper cover mounting screw		23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs

(1) Transmission Upper Cover
(2) Transmission Case Mounting Screw
(3) Transmission Case Mounting Nut

12550S20210

(3) Disassembling Clutch Housing



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Shift Lever

1. Remove the screw (1).
2. Remove the shift lever (2).

(1) Screw
(2) Shift Lever

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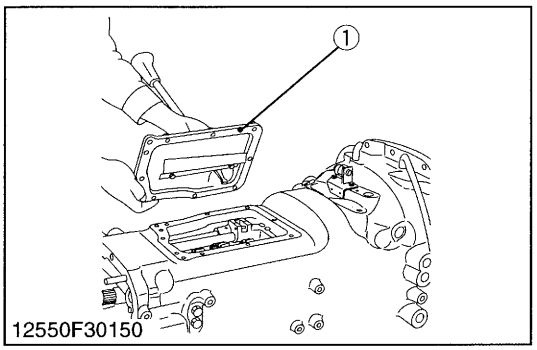

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Speed Change Cover

1. Remove the speed change cover (1).

(When reassembling)

- When reassembling the speed change cover (1), set the shifter and fork in neutral position.
- Apply liquid gasket (Three Bond 1216 or equivalent) to seam of speed change cover and clutch housing.

Tightening torque	Speed change cover mounting screw	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs

(1) Speed Change Cover

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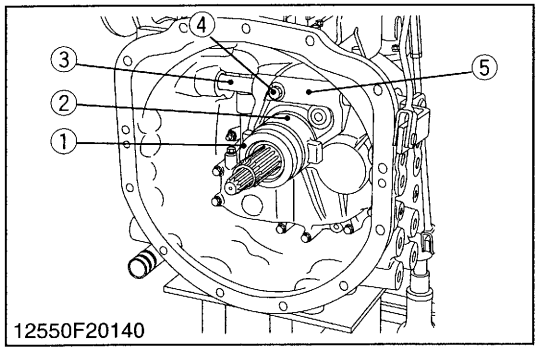

Clutch Release Bearing

1. Draw out the release bearing (1) and the release hub (2) together.
2. Remove the release fork setting screw (4).
3. Draw out the control shaft (3) to take out the release fork (5).

(When reassembling)

- After tightening the release fork setting screw to the specified torque, insert a wire through the holes of the setting screw head and release fork.
- Apply grease to the sliding surface of the clutch release hub.
- Apply grease to the bushing of control shaft.

Tightening torque	Release fork setting screw	166.7 to 186.3 N·m 17.0 to 19.5 kgf·m 122.9 to 137.4 ft-lbs

(1) Release Bearing
(2) Release Hub
(3) Control Shaft
(4) Release Fork Setting Screw
(5) Release Fork

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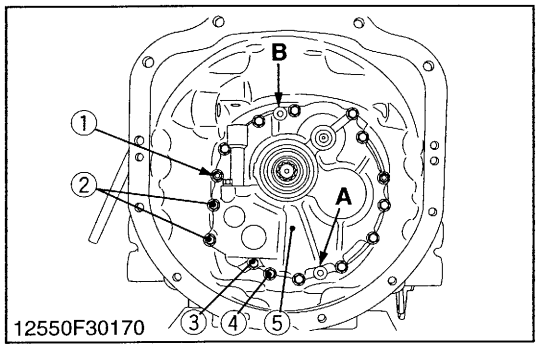

Shuttle Case Assembly

1. Loosen only two nuts (1) and five screws (grade 9 is marked) (4) and remove the shuttle case assembly (5) by screwing M8 × Pitch 1.25 screws into holes **A** and **B**. Two grade 9 screws (2) and six grade 7 screws (3) are not necessary to remove.

Tightening torque	Shuttle case assembly screw, nut	M8, grade 7 nut	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
		M8, grade 9 screw	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs

(1) Nut
(2) Grade 7 Screw
(3) Grade 9 Screw
(4) Grade 9 Screw
(5) Shuttle Case Assembly

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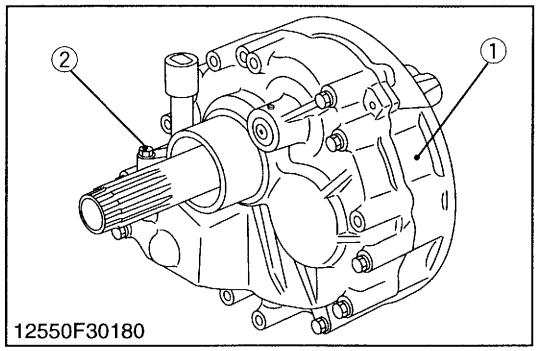

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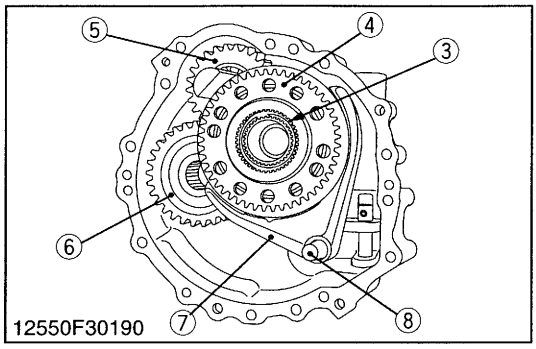

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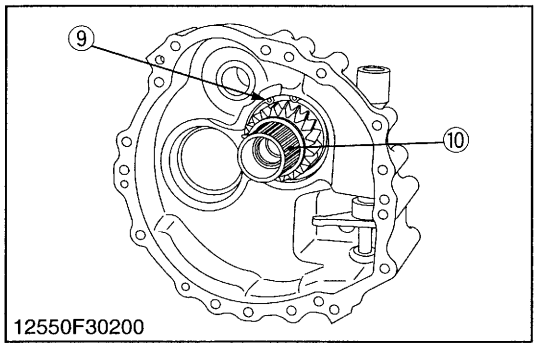

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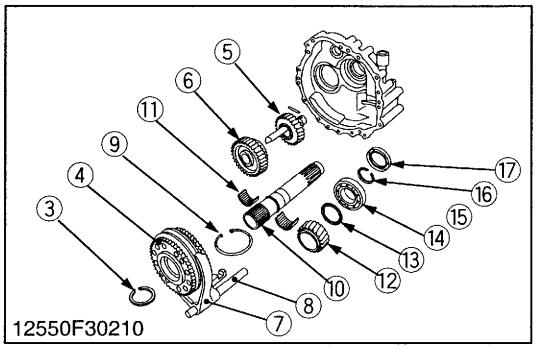

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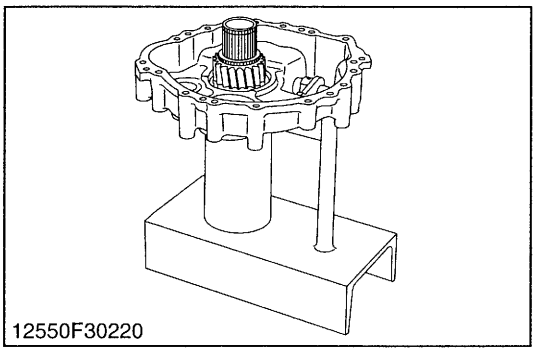
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Disassembling Shuttle Case Assembly

1. Remove the grade 7 and grade 9 screws.
2. Remove the shuttle case 2 (1).
3. Remove the screw (2).
4. Remove the external snap ring (3).
5. Remove the synchronizer assembly (4) with shifter (7) and shift rod (8).
6. Remove the 25T gear (5) and 31T gear (6).
7. Remove the internal snap ring (9).
8. Tap out the input shaft (10) with bearing.

(When reassembling)

- Take care of direction of the oil seal.
- Apply grease to the oil seal and bushing.
- Take care of the position of needle bearing.
- Apply transmission fluid to the bearing.
- Use to shuttle case assembling stand (See page G-47).

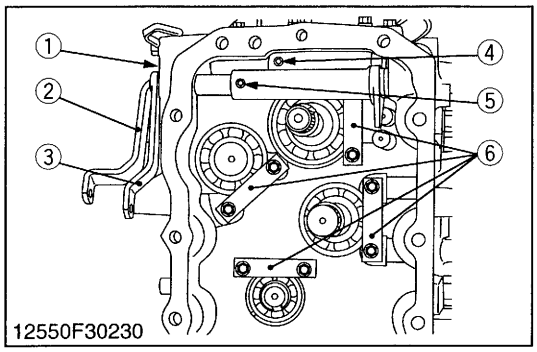
Tightening torque	Shuttle case mounting screw	M8 grade 7 screw	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs
		M8 grade 9 screw	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs

■ NOTE

- **After check the reassembly, please check the operation.**

(1) Shuttle Case 2
(2) Screw
(3) External Snap Ring
(4) Synchronizer Assembly
(5) 25T Gear
(6) 31T Gear
(7) Shifter
(8) Shift Rod
(9) Internal Snap Ring
(10) Input Shaft
(11) Needle Bearing
(12) 20T Gear
(13) Thrust Collar
(14) Bearing
(15) External Snap Ring
(16) Oil Seal
(17) Shuttle Case 1

12550S30110



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Shift Levers and Bearing Retainer

1. Remove the shift lever stopper (1).
2. Tap out the spring pin (4) from Creep shift lever (2).
3. Draw out the Creep shift lever (2).
4. Tap out the spring pin (5) from Hi-Low shift lever (3).
5. Draw out the Hi-Low shift lever (3).
6. Remove the bearing retainers (6).

(When reassembling)

- Apply grease to the O-ring.

(1) Stopper
(2) Shift Lever (Creep)
(3) Shift Lever (Hi-Low)
(4) Spring Pin
(5) Spring Pin
(6) Bearing Retainer

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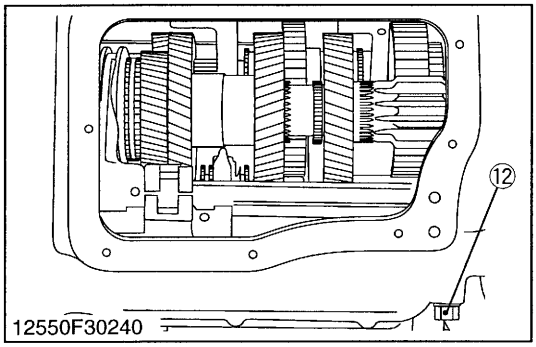

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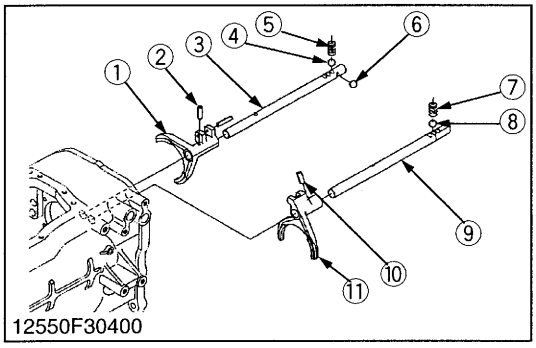
Shift Rods and Forks (1-2), (3-4)

1. Remove the lock screw (12), and take out the springs (5), (7) and balls (4), (8).
2. Tap out the spring pins (2), (10) from shift forks (1) and (11).
3. Draw out the shift rod (3) and (9).
4. Take out the shift forks (1) and (11).

(When reassembling)

- Apply grease to the ball and spring.
- Take care of installing the inter-locking ball (6).
- Apply liquid lock (Three Bond 1372 or equivalent) to the lock screws (12).

(1) Shift Fork (1-2)
(2) Spring Pin
(3) Shift Fork Rod (1-2)
(4) Ball
(5) Spring
(6) Inter-locking Ball
(7) Spring
(8) Ball
(9) Shift Fork Rod (3-4)
(10) Spring Pin
(11) Shift Fork (3-4)
(12) Lock Screw



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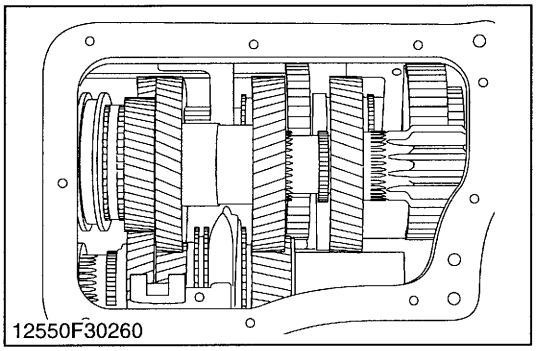
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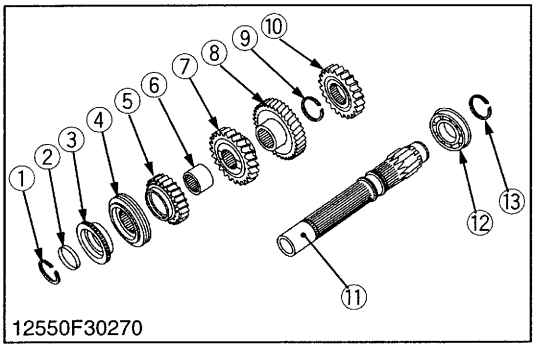

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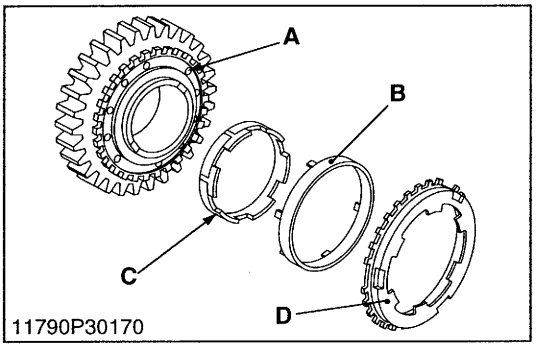

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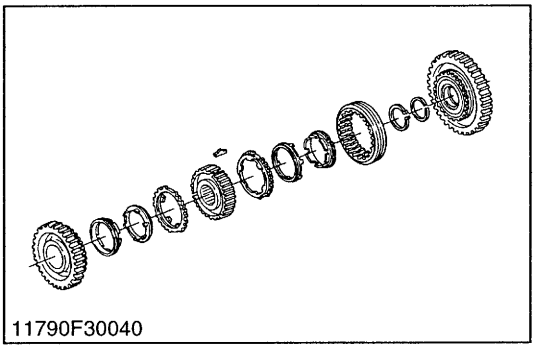
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2nd Shaft

1. Remove the external snap ring (1).
2. Tap the 2nd shaft (11) to the rear.
3. Remove the external snap ring (9) with tap out the 2nd shaft (11) to the rear.

(When reassembling)

- Install the protrusion portions (**B**) of the center rings to the holes (**A**) of the gear firmly. (Refer to the figure left.)
- Install the protrusion portion (**D**) of the outer synchronizer rings to the grooves (**C**) of the inner synchronizer rings. (Refer to the figure left.)
- Install the synchronizer keys in the key grooves of the outer synchronizer rings firmly.

(1) External Snap Ring
(2) Collar
(3) Holder
(4) Synchronizer
(5) 23T Gear
(6) Inner Ring
(7) 24T Gear
(8) 36T Gear
(9) External Snap Ring
(10) 24T Gear
(11) 2nd Shaft
(12) Bearing
(13) External Snap Ring

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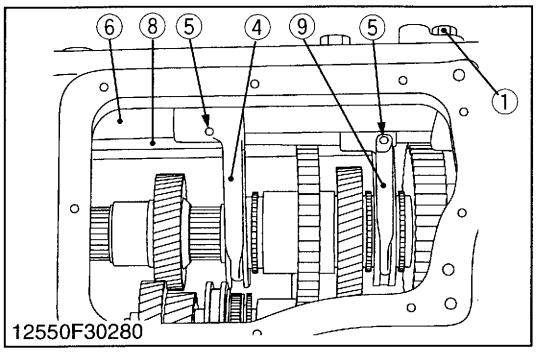

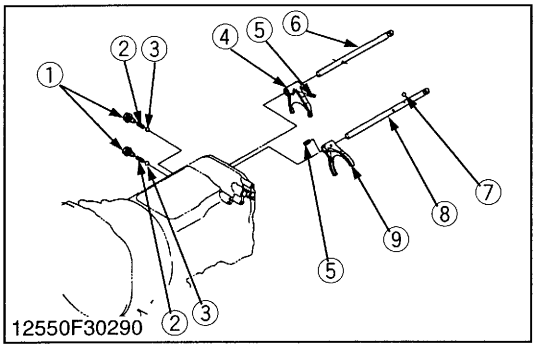

Shift Fork L-H, C and Shift Fork Rod L-H, C

1. Remove the lock screws (1) and take out the springs (2) and balls (3).
2. Tap out the spring pin (5).
3. Draw out the shift rod (6) and (8).
4. Take out the shift fork (4), and shift fork (9).

(When reassembling)

- Apply grease to the ball and spring.
- Take care of installing the inter-locking ball (7).
- Apply liquid lock (Three Bond 1372 or equivalent) to the lock screws (1).

(1) Lock Screw
(2) Spring
(3) Ball
(4) Shift Fork (Creep)
(5) Spring Pin
(6) Shift Rod (Creep)
(7) Inter-locking Ball
(8) Shift Rod (Hi-Low)
(9) Shift Fork (Hi-Low)

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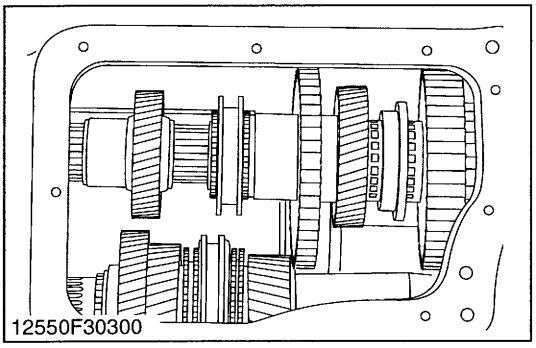
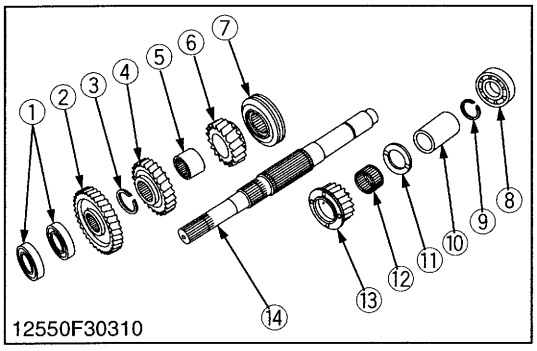


1st Shaft

1. Tap out the 1st shaft to the front with gears.

(1) Ball Bearing
(2) 34T Gear
(3) External Snap Ring
(4) 25T Gear
(5) Inner Ring
(6) 17T Gear
(7) Synchronizer
(8) Ball Bearing
(9) External Snap Ring
(10) Collar
(11) Thrust Collar
(12) Needle Bearing
(13) 19T Gear
(14) 1st Shaft



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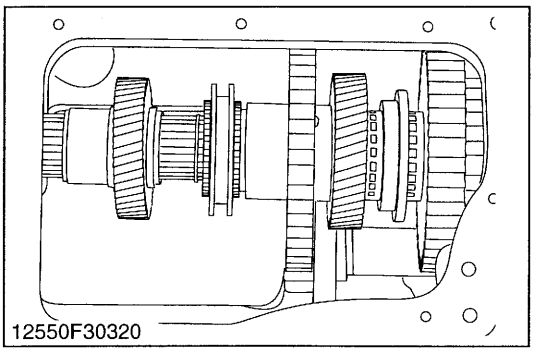
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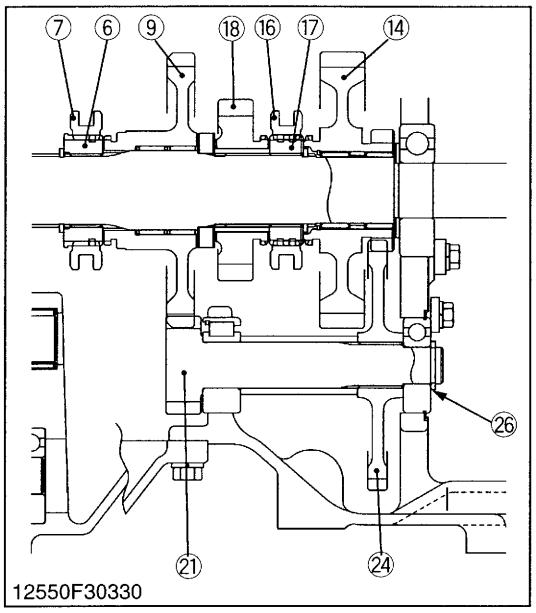

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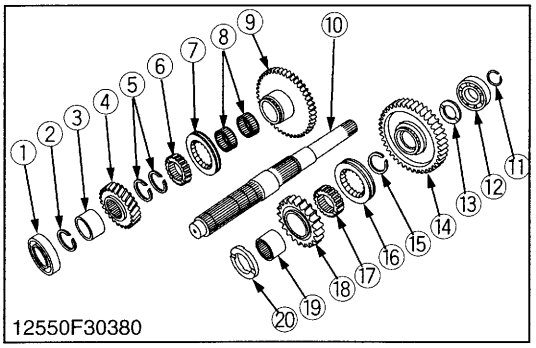

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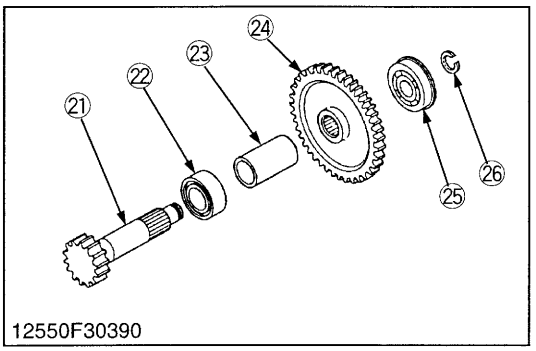

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Creep Gear and 3rd Shaft

1. Tap out the 3rd shaft (10) with gears to the front.
2. Remove the external snap ring (26).
3. Tap out the 15T gear shaft (21).
4. Take out the 43T gear and collar (24).

(1) Ball Bearing
(2) External Snap Ring
(3) Collar
(4) 26T Gear
(5) External Snap Ring
(6) Hub
(7) Shifter
(8) Needle Bearing
(9) 47T Gear
(10) 3rd Shaft
(11) External Snap Ring
(12) Ball Bearing
(13) Thrust Collar
(14) 41T-19T Gear
(15) External Snap Ring
(16) shifter
(17) Hub
(18) 21T Gear
(19) Inner Ring
(20) Spacer
(21) 15T Gear Shaft
(22) Ball Bearing
(23) Collar
(24) 43T Gear
(25) Ball Bearing
(26) External Snap Ring

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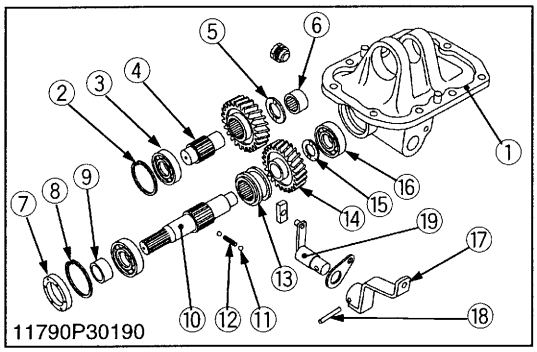

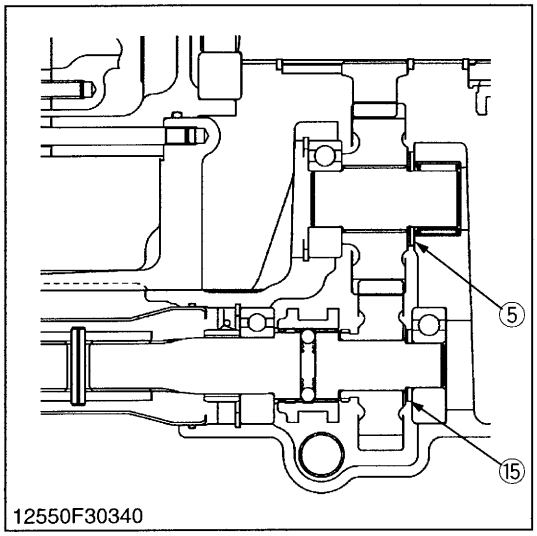

Front Drive Shaft

1. Remove the gear case (1) from the clutch housing.
2. Remove the internal snap ring (2), and tap out the idle shaft (4).
3. Remove the oil seal (7) and internal snap ring (8).
4. Draw out the front drive shaft (10).
5. Remove the spring pin (18) and draw out the lever (17).
6. Draw out the shift lever (19).

■ NOTE

- **Take care not to fly out the balls (11) and spring (12) when take out the shifter (13).**

(When reassembling)

- Direct the grooved side of the thrust collars (5) and (15) to the gear side.

(1) Gear Case
(2) Internal Snap Ring
(3) Bearing
(4) Idle Shaft
(5) Thrust Collar
(6) Sleeve
(7) Oil Seal
(8) Internal Snap Ring
(9) Sleeve
(10) Front Drive Shaft
(11) Ball
(12) Spring
(13) Shifter
(14) 22T Gear
(15) Thrust Collar
(16) Bearing
(17) Lever
(18) Spring Pin
(19) Shift Lever

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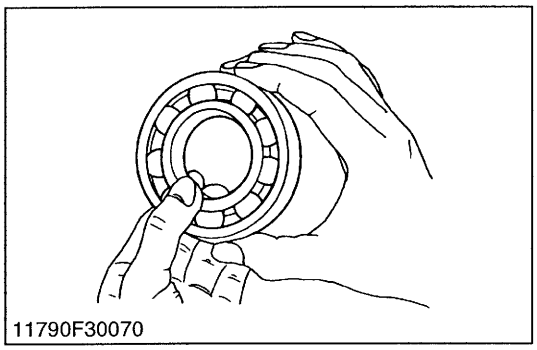
SERVICING



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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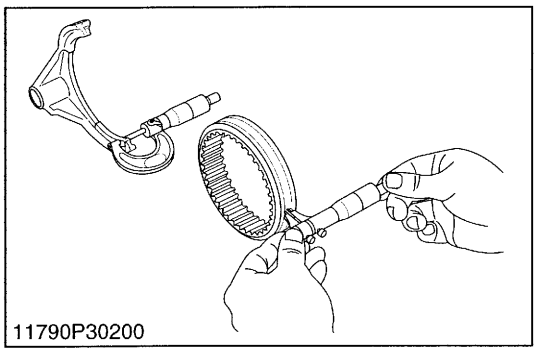

Clearance between Shift Fork and Shifter Groove

1. Measure the width of shift fork.
2. Measure the shifter groove width, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

Clearance between shift fork and shifter groove	Factory spec.	Shuttle F-R	0.20 to 0.45 mm 0.0079 to 0.0177 in.
		Other	0.15 to 0.40 mm 0.0059 to 0.0157 in.
	Allowable limit	Shuttle F-R	0.80 mm 0.031 in.
		Other	0.80 mm 0.031 in.

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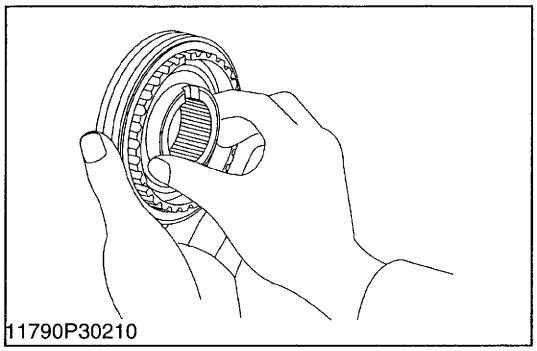
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Checking Contact between Coupling and Shifter

1. Check to see if there is flaw or wear on the spline of the coupling and shifter, and the key groove on the coupling.
2. Engage the shifter with the coupling, and check that they slide smoothly.
3. Similarly, check that there is any flaw or wear on the gear splines.
4. If there is any defect, replace them.

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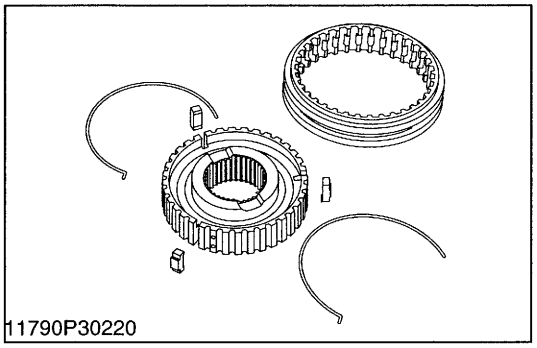
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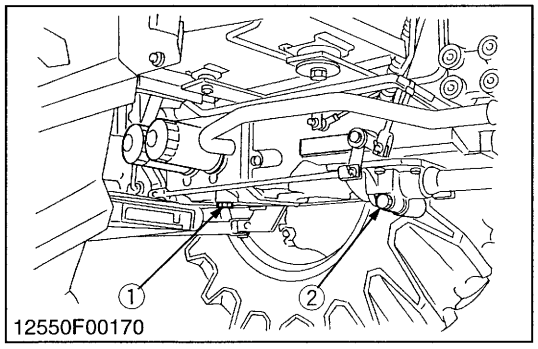
Flaw on Synchronizer Key and Spring

1. Check the projection in the center of the synchronizer key for wear.
2. Check the sprig for fatigue or wear on the area where the spring contacts with the keys.
3. If there is any defect, replace them.

11790S30210

[2] TRANSMISSION CASE DISASSEMBLING AND ASSEMBLING

(1) Draining Transmission Fluid



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Changing Transmission Fluid

1. Place an oil pan underneath the transmission case.
2. Remove the drain plugs (1) and (2).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1) and (2).

(When reassembling)

- Fill up from filling port after removing the filling plug until reaching the gauge.
- After running the engine for few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

Transmission fluid	Capacity	ROPS	40.0 L 42.3 U.S.qts. 35.2 Imp.qts.
		CAB	43.0 L 45.4 U.S.qts. 37.8 Imp.qts.

■ IMPORTANT

- **Use only KUBOTA SUPER UDT fluid. Use of other fluides may damage the transmission or hydraulic system.**
- **Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)**
- **Do not mix different brands oil together.**

(1) Drain Plug (2) Drain Plug (4WD Only)

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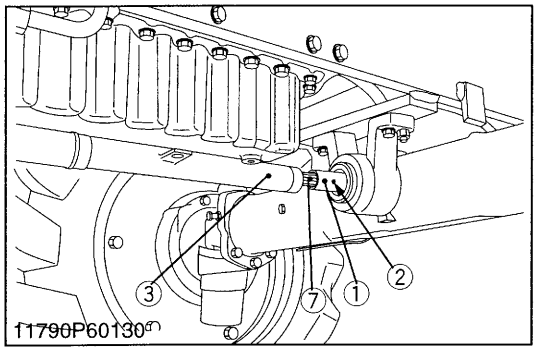
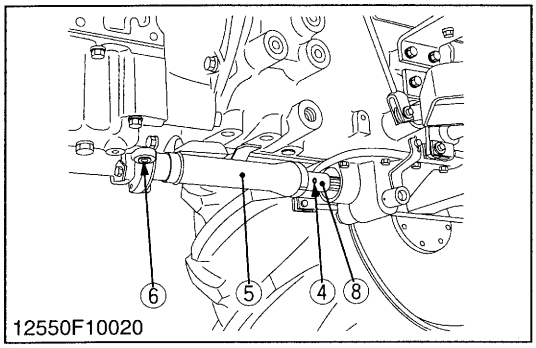
(2) Separating Transmisison Case





Propeller Shaft (4WD Only)

1. Slide the propeller shaft cover (3), (5) after removing the screws (6).
2. Tap out the spring pin (2), (4) and then slide the coupling (1), (8) to the front and rear.

(When reassembling)

- Apply grease to the splines of the propeller shaft (7).

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

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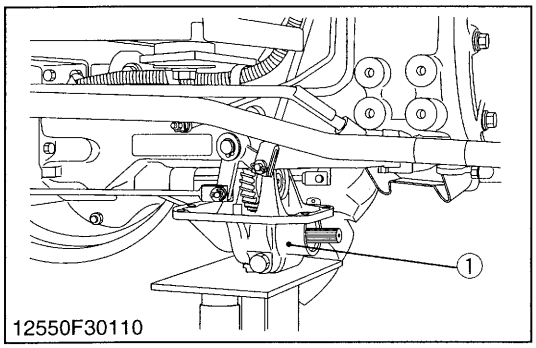

DT Gear Case (4WD Only)

1. Remove the DT shift rod.
2. Remove the DT gear case (1).

(When reassembling)

- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the clutch housing and DT gear case.

Tightening torque	DT gear case mounting screw	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs

(1) DT Gear Case

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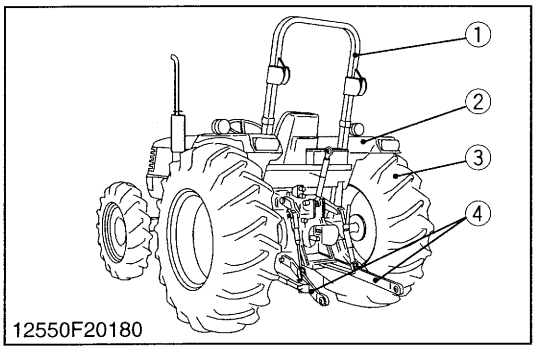

Rear Wheel, Fender and Foldable ROPS

1. Check the clutch housing case and transmission case are securely mounted on the disassembly stands.
2. Remove the rear wheels (3).
3. Disconnect the jumper leads for hazard and tail light.
4. Disconnect the jumper leads for PTO safety switch.
5. Remove the 3-point hitch link (4).
6. Remove the fenders (2).
7. Remove the foldable ROPS (1).

(When reassembling)

Tightening torque	Foldable ROPS mounting screw	M16, grade 9 screw	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs
		9/16-18 UNF, grade 8 screw	149.1 to 179.5 N·m 15.2 to 18.3 kgf·m 110 to 132 ft-lbs
	Rear wheel mounting nut		260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs

(1) Foldable ROPS
(2) Fender
(3) Rear Wheel
(4) 3-point Hitch Link

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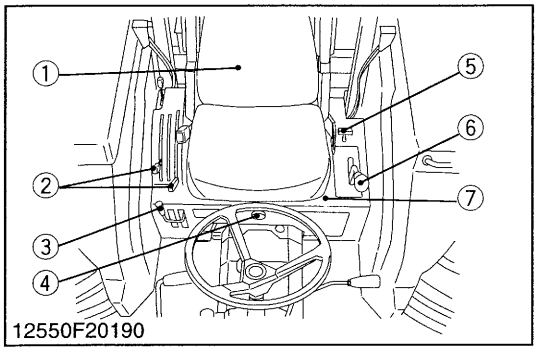

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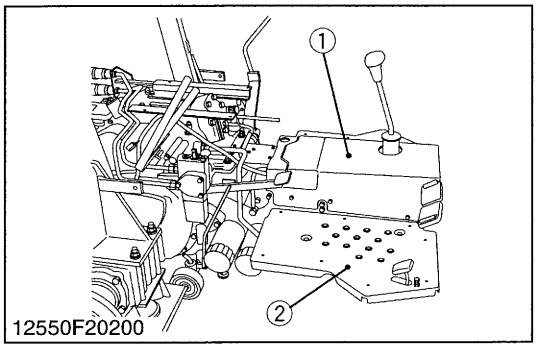
Seat and Center Frame

1. Remove the seat (1).
2. Remove the draft and position control lever grips (2).
3. Remove the auxiliary speed change lever grip (6), DT shift lever grip (5) and 3-point hitch lowering speed control grip (4).
4. Remove the auxiliary control valve lever assembly (3).
5. Remove the center frame (7).

(1) Seat
(2) Lever Grip
(3) Auxiliary Control Valve Lever Assembly
(4) 3-Point Hitch Lowering Speed Control Grip
(5) DT Shift Lever Grip
(6) Auxiliary Speed Change Lever Grip
(7) Center Frame

12550S20170



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Step and Clutch Housing Cover

1. Disconnect the foot accelerator rod.
2. Remove the steps (2).
3. Remove the clutch housing cover (1).

(1) Clutch Housing Cover
(2) Step

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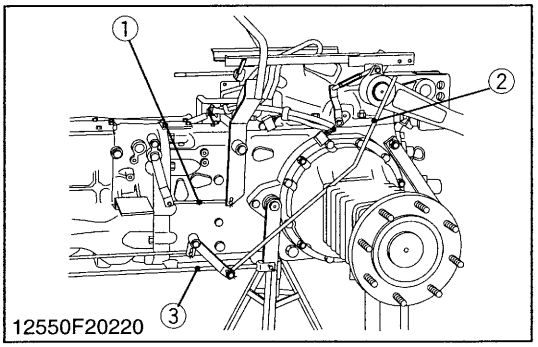

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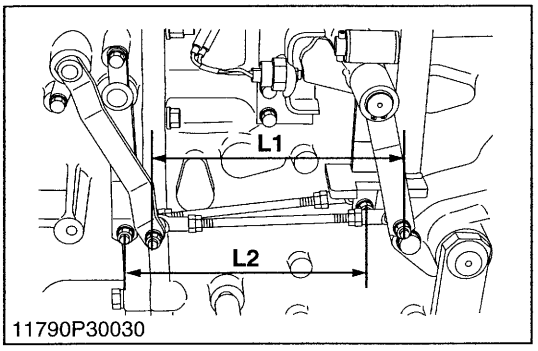

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Rear Axle L.H.

1. Disconnect the shift rod (1).
2. Remove the auxiliary speed change lever.
3. Remove the DT shift rod (2).
4. Remove the brake rod (3).
5. Remove the rear axle case mounting screws and nuts.
6. Support the rear axle case with nylon lift strap and hoist.
7. Separate the rear axle case from transmission case.

(When reassembling)

- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the rear axle case and transmission case, after eliminate the water, oil and stuck liquid gasket.
- Be sure to adjusting the shift rod.

Shift rod length **L1** and **L2** (Option)	Factory spec.	Approx. 209 mm 8.23 in.

Tightening torque	Rear axle case mounting screw and nut	M12 screw and nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
		Stud bolt	38.2 to 45.1 N·m 3.9 to 4.6 kgf·m 28.2 to 33.3 ft-lbs

(1) Shift Rod
(2) DT Shift Rod
(3) Brake Rod

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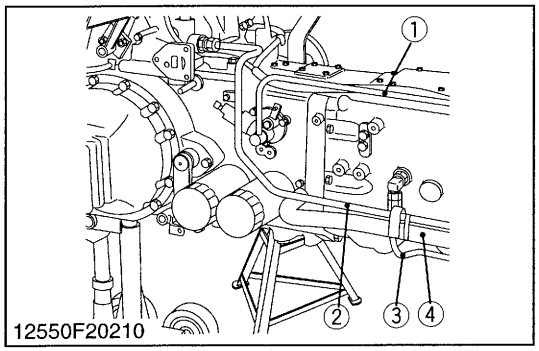

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Hydraulic Pipes, Brake Rod and Rear Axle R.H.

1. Remove the suction pipe (4).
2. Remove the oil cooler pipe (3).
3. Remove the delivery pipe (2) for the three point hydraulic system.
4. Remove the delivery pipe (1) for the PTO clutch.
5. Remove the rear axle mounting screws and nuts.
6. Support the rear axle case with nylon lift strap and hoist.
7. Separate the rear axle case from transmission case.

(1) Delivery Pipe for PTO Clutch
(2) Delivery Pipe for 3-point Hydraulic System
(3) Oil Cooler Pipe
(4) Suction Pipe

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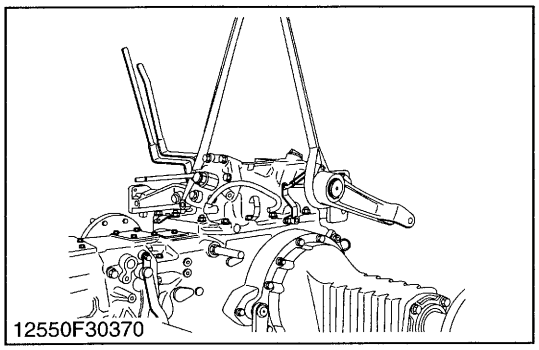
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Hydraulic Cylinder Assembly

1. Remove the delivery pipe.
2. Remove the hydraulic cylinder assembly mounting screws and nuts.
3. Support the hydraulic cylinder assembly with nylon lift strap and hoist, and take out it.

(When reassembling)

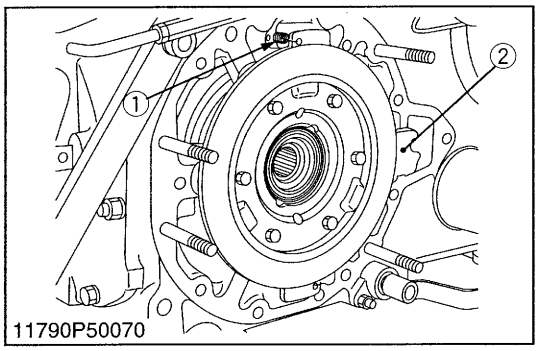
- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the hydraulic cylinder assembly and transmission case after eliminate the water, oil and stuck liquid gasket.

Tightening torque	Hydraulic cylinder assembly mounting stud bolt	38.2 to 45.1 N·m 3.9 to 4.6 kgf·m 28.2 to 33.3 ft-lbs
	Hydraulic cylinder assembly mounting screw and nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

■ NOTE

- **Reassemble the hydraulic cylinder assembly to the tractor, be suer to adjust the position control feedback rod and draft control rod.**

12550S30220



11790P50070

Brake Cam Plate

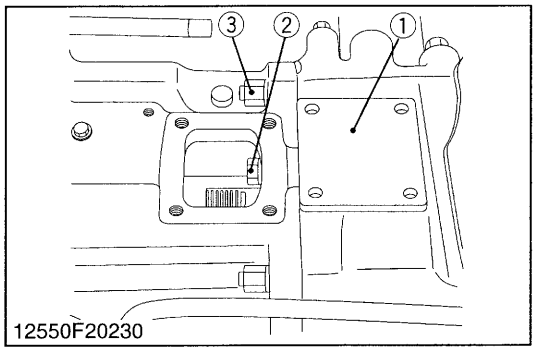
1. Remove the return spring (1).
2. Remove the brake cam plate (2).

(When reassembling)

- Apply grease to the brake ball seats. (Do not grease excessively.)

(1) Return Spring
(2) Brake Cam Plate

11790S50140



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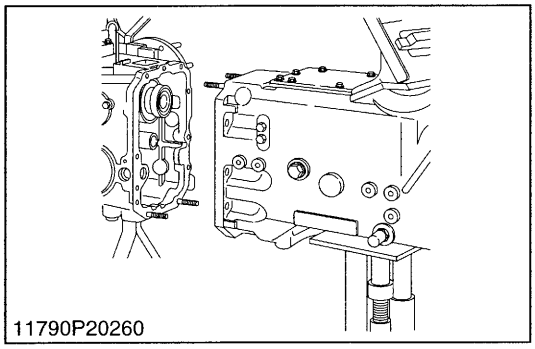
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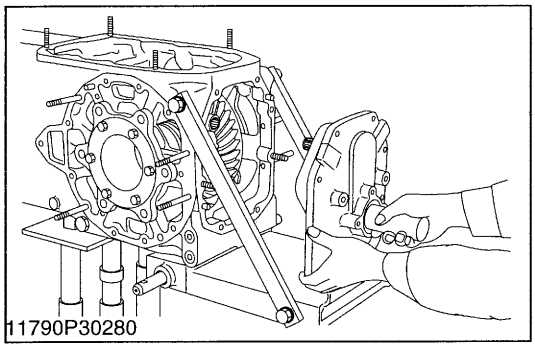

11790P30280

Separating Transmission Case

1. Remove the transmission upper cover (1).
2. Remove the transmission case mounting screws and nut, and separate the transmission case from the clutch housing.

(When reassembling)

- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the transmission case and clutch housing, transmission upper cover and transmission case.

Tightening torque	Transmission case and clutch housing mounting screw, nut	M12, grade 11 nut (3)	103.0 to 117.7 N·m 10.5 to 12.0 kgf·m 75.9 to 86.8 ft-lbs
		M12, grade 7 screw, nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs
		M10, grade 9 screw (2)	60.8 to 70.6 N·m 6.2 to 7.2 kgf·m 44.8 to 52.1 ft-lbs
	Transmission upper cover mounting screw		23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs

(1) Transmission Upper Cover
(2) Transmission Case Mounting Screw
(3) Transmission Case Mounting Nut

12550S20210

PTO Gear Case Assembly

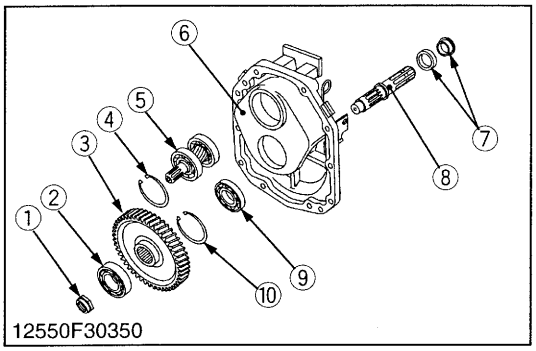
1. Remove the PTO gear case and PTO drive shaft as a unit.

(When reassembling)

- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the PTO gear case and transmission case.

Tightening torque	PTO gear case mounting screw	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

11790S30291



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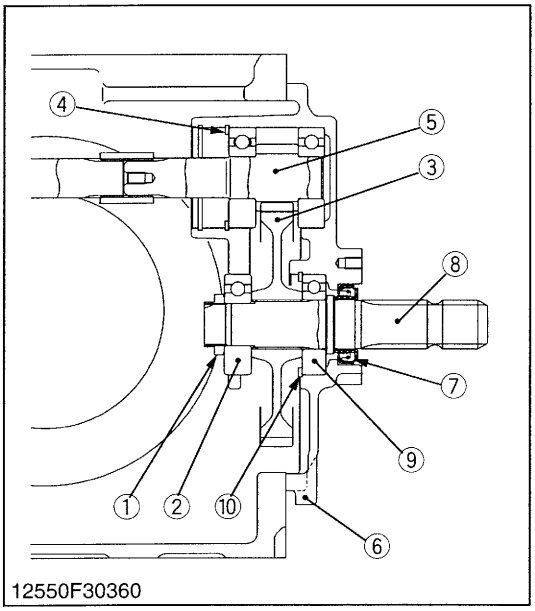


12550F30360

Disassembling PTO Gear Case Assembly

1. Remove the stake of the staking nut and remove the staking nut (1).
2. Tap out the PTO shaft (8).
3. Remove the internal snap ring (4).
4. Draw out the 12T gear shaft (5).

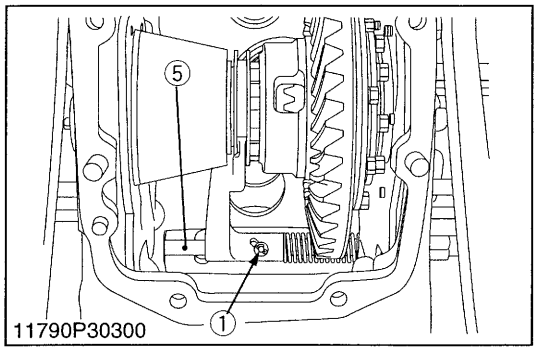
(When reassembling)

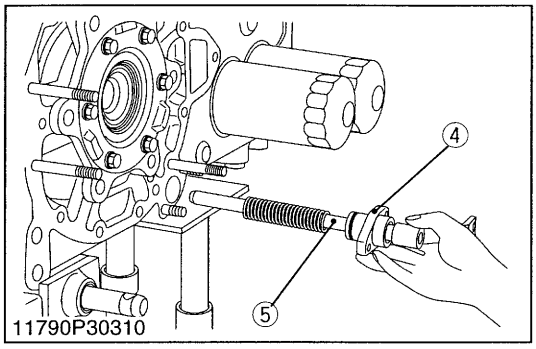
- Assembling the oil seal (7) with correct direction.
- Apply grease to the oil seal (7).
- Replace the staking nut with a new one, and after tightening it to specified torque, stake it firmly.

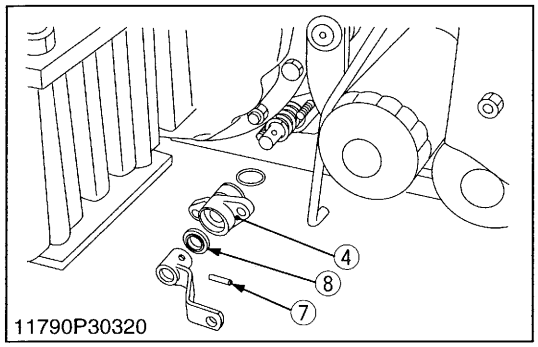
Tightening torque	PTO shaft staking nut	225.5 to 264.8 N·m 23 to 27 kgf·m 166.4 to 195.3 ft-lbs

(1) Staking Nut
(2) Ball Bearing
(3) 51T Gear
(4) Internal Snap Ring
(5) 12T Gear Shaft
(6) Gear Case
(7) Oil Seal
(8) PTO Shaft
(9) Ball Bearing
(10) Internal Snap Ring

12550S30250







Differential Lock Fork

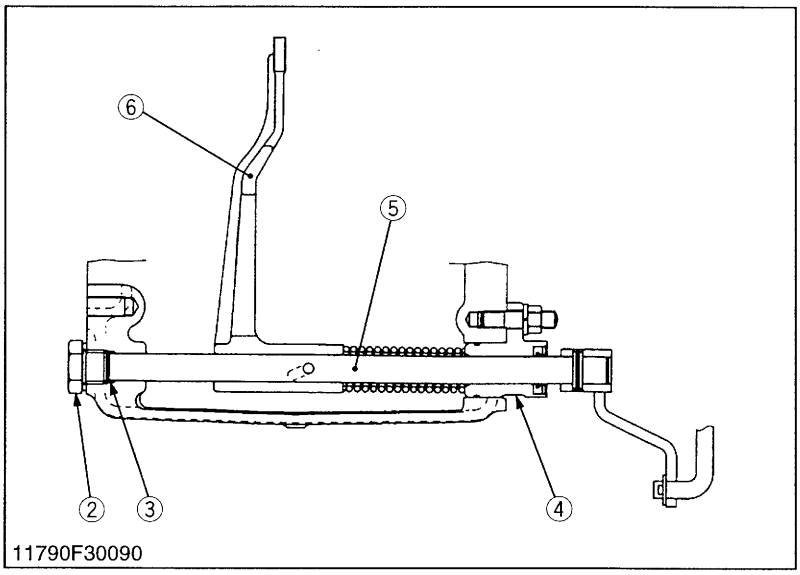
1. Remove the clevis pin (1).
2. Remove the plug (2) and take out the adjusting shims (3).
3. Remove the spring holder mounting nuts.
4. Tap out the differential lock shaft (5) with the spring holder (4).

■ NOTE

- **Taking out the differential lock fork (6), after remove the differential assembly.**
- **When replacing the oil seal only, tap out the differential lock lever spring pin (7), then remove the spring holder (4) and replace the oil seal (8).**

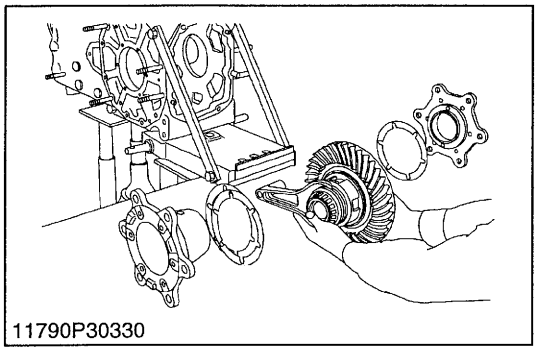
(When reassembling)

- Apply grease to the oil seal.



(1) Clvis Pin
(2) Plug
(3) Adjusting Shim
(4) Spring Holder
(5) Differential Lock Shaft
(6) Differential Lock Fork
(7) Spring Pin
(8) Oil Seal

11790S30310


11790P30330

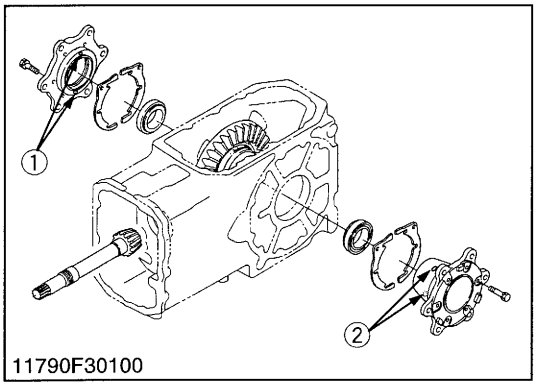
Differential Gear Assembly

1. Remove the differential support, noting the number of left and right shims.
2. Take out the differential gear assembly from transmission case.

(When reassembling)

- Be sure to adjust the turning torque of spiral bevel pinion shaft and differential assembly combined. (See page 3-S30.)
- Be sure to adjust the backlash and tooth contact between the spiral bevel gear and spiral bevel pinion shaft. (See page 3-S27.)
- When installing the differential support to the transmission, be sure to reassemble it as shown in the figure.

Tightening torque	Differential bearing support mounting screw	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs



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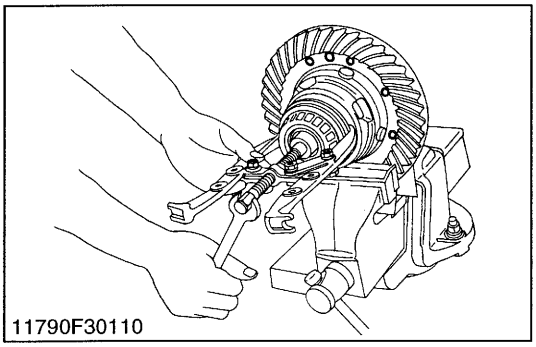
(1) Oil Hole (2) Oil Hole

11790S30320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Bearing and Differential Lock Shifter

1. Secure the differential gear in a vise.
2. Remove the differential lock shifter and taper roller bearing as a unit with a puller.

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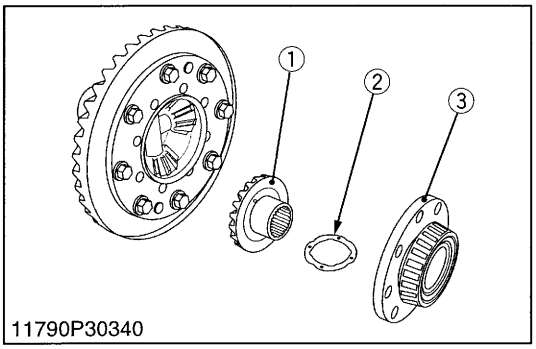


11790P30340

Differential Case Cover and Differential Side Gear

1. Remove the differential case cover (3).
2. Remove the differential side gear (1) and differential side gear washer (2).

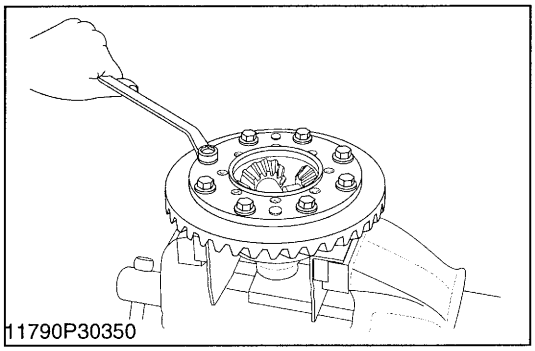
(When reassembling)

- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential side gear boss.

Tightening torque	Differential case cover mounting screw	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs

(1) Differential Side Gear (3) Differential Case Cover
(2) Differential Side Gear Washer

11790S30341


11790P30350

Spiral Bevel Gear

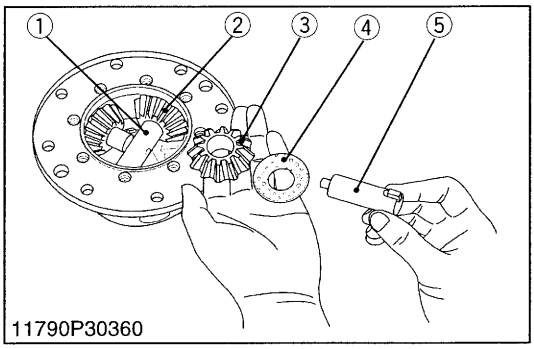
1. Remove the spiral bevel gear.

(When reassembling)

- Check the spiral bevel gear for wear or damage. If it is no longer serviceable, replace it. Then, also replace the spiral bevel pinion shaft.
- Apply liquid lock (Three Bond 1372 or equivalent) to the spiral bevel gear UBS screws.

Tightening torque	Spiral bevel gear UBS screw	70.6 to 90.2 N·m 7.2 to 9.2 kgf·m 52.1 to 66.5 ft-lbs

11790S30350



11790P30360

Differential Pinion Shaft and Differential Pinion

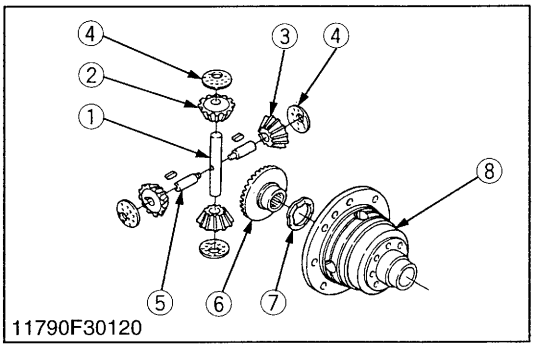
1. Draw out the differential pinion shaft 2 (5), and take out the differential pinion (3) and differential pinion washer (4).
2. Draw out the differential pinion shaft (1), and take out the differential pinion (2) and differential pinion washer.

■ NOTE

- **Arrange the parts to know their original position.**

(When reassembling)

- Check the differential pinions (2) and (3), and pinion shaft (1) and (5) for excessive wear. If these parts are damaged or excessively worn, replace their parts they are in mesh with, or they sliding on.
- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential pinions.
- Install the parts to their original position.
- Install the differential pinion washer (4), noting its groove position.



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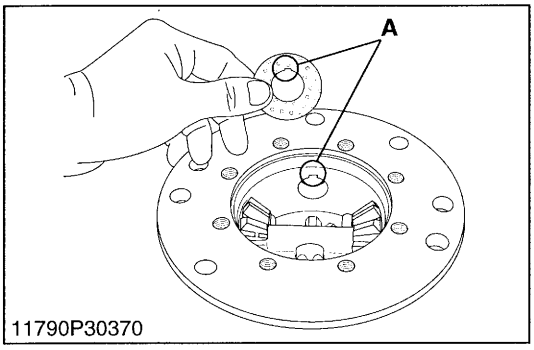
(1) Differential Pinion Shaft
(2) Differential Pinion
(3) Differential Pinion
(4) Differential Pinion Washer
(5) Differential Pinion Shaft 2
(6) Differential Side Gear
(7) Differential Side Gear Washer
(8) Differential Case

(A) Fit Groove



11790P30370

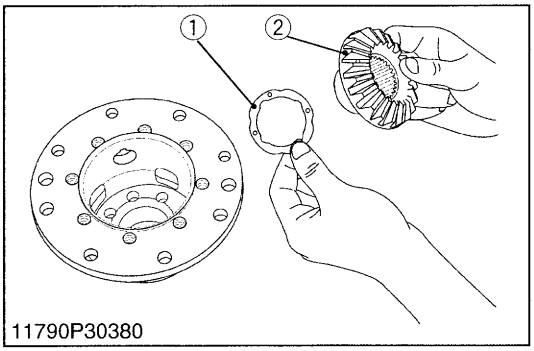
11790S30360

Differential Side Gear

1. Take out the differential side gear (2) and differential side gear washer (1).

(When reassembling)

- Check the thrust and bearing surface of both differential side gears (2). If they are worn or damaged, bores in the differential case may also be damaged. Be sure to replace their parts.



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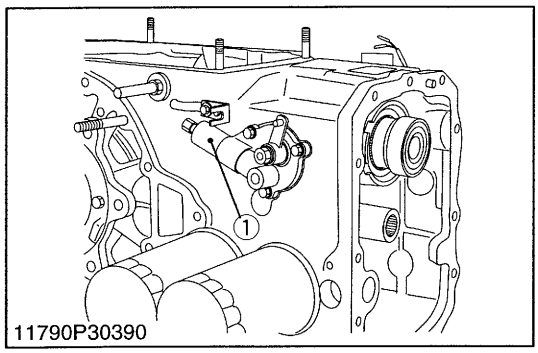
(1) Differential Side Gear Washer
(2) Differential Side Gear

11790S30370



PTO Clutch Valve

1. Disconnect the PTO clutch valve cable.
2. Remove the PTO clutch valve (1).

(When reassembling)

- Apply transmission fluid to O-ring.
- Install the pipes to the hole of the PTO clutch valve firmly.

Tightening torque	PTO clutch valve mounting screw	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs

(1) PTO Clutch Valve

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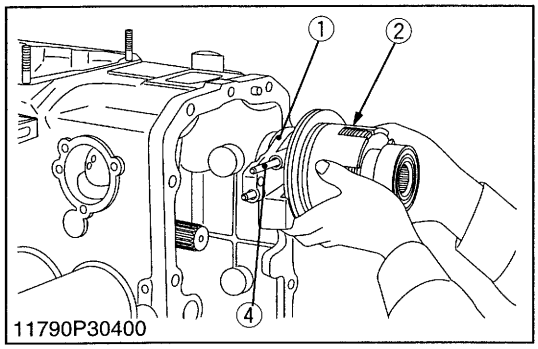


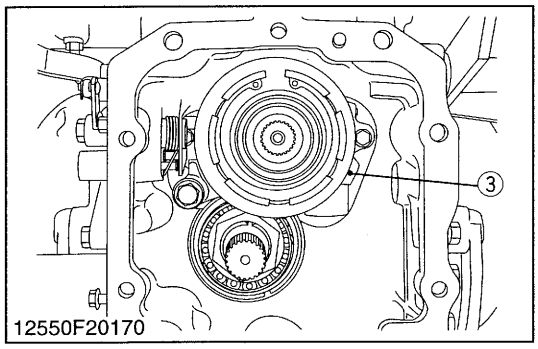
PTO Clutch and Holder

1. Remove the PTO clutch holder mounting screws.
2. Remove the PTO clutch (2) with PTO clutch holder (1).

(When reassembling)

- Apply transmission fluid to O-ring.
- Take care not to damage the oil pipes (4).

Tightening torque	PTO clutch holder mounting screw	23.5 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.3 ft-lbs



■ IMPORTANT

- **When reassembling the PTO clutch assembly, direct the projection part of brake plate (3) as a figure.**
- **After assembling the PTO clutch assembly, be sure to check the piston operation by air-blowing.**

(1) PTO Clutch Holder
(2) PTO Clutch
(3) Brake Plate
(4) Oil Pipe

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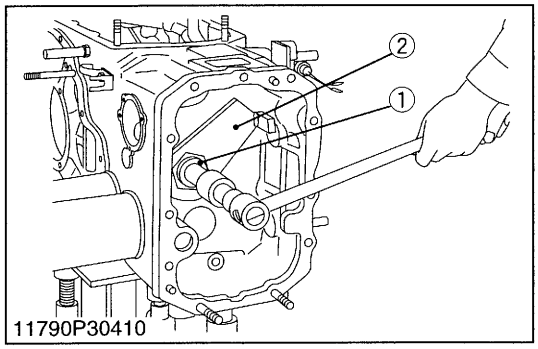

Spiral Bevel Pinion Shaft

1. Remove the stake of staking nut (1).
2. Set the staking nut locking wrench (2).
3. Set the spiral bevel pinion shaft turning wrench.
4. Turn the spiral bevel pinion shaft turning wrench to the counterclockwise, then remove it.
5. Tap out the shaft to the rear.

(When reassembling)

- Replace the staking nut with a new one, and be sure to adjust the turning torque of spiral bevel pinion shaft only. (See page 3-S29.)
- Stake the staking nut after installing the differential assembly.

Tightening torque	Spiral bevel pinion shaft staking nut	274.6 to 343.2 N·m 28.0 to 35.0 kgf·m 202.5 to 253.2 ft-lbs

(1) Staking Nut
(2) Locking Wrench

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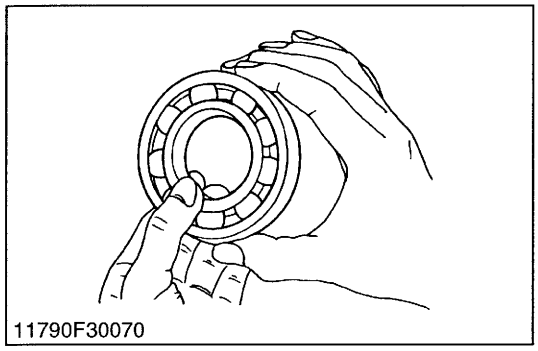

11790F30070

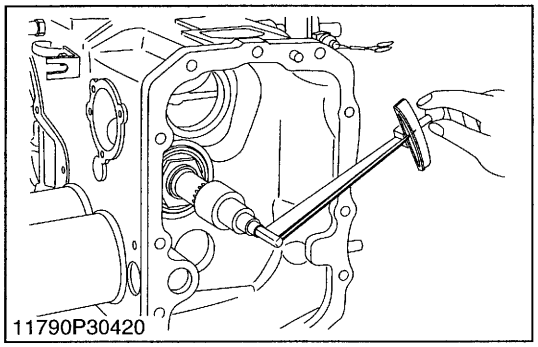
Checking Bearing

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

■ IMPORTANT

- **When reassembling spiral bevel pinion shaft and differential assembly, be sure to adjust the following.**
  1. Turning torque of spiral bevel pinion shaft only.
  2. Turning torque of spiral bevel pinion shaft and differential assembly combined.
  3. Backlash and tooth contact between spiral bevel pinion shaft and spiral bevel gear.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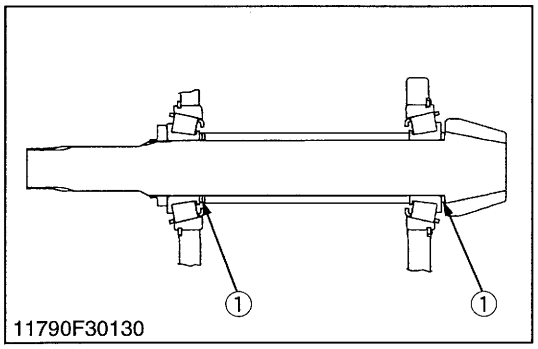


11790F30130

Turning Torque of Spiral Bevel Pinion Shaft Only

1. Reassemble the spiral bevel pinion shaft and tighten the staking nut with locking wrench and turning wrench.
2. After striking the bevel pinion shaft to the front and rear, retighten the staking nut to specified torque (274.6 to 343.2 N·m, 28.0 to 35.0 kgf·m, 202.5 to 253.2 ft-lbs).
3. Measure the turning torque of spiral bevel pinion shaft.
4. If the measurement is not within the factory specifications, adjust with the adjusting collar 1 (1).

Turning torque	Factory spec.	0.69 to 1.96 N·m 0.07 to 0.20 kgf·m 0.51 to 1.45 ft-lbs

(Reference)

- Thickness of adjusting collar (1) :

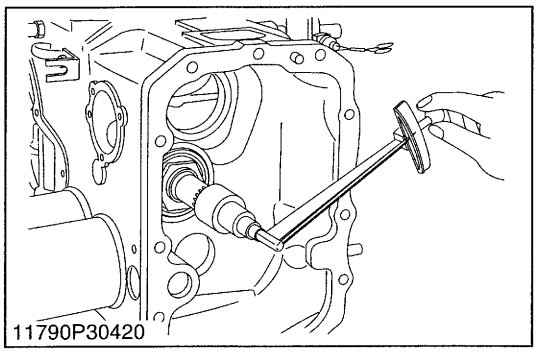
1.00 mm (0.039 in.)	2.00 mm (0.079 in.)
1.50 mm (0.059 in.)	2.10 mm (0.083 in.)
1.70 mm (0.067 in.)	2.20 mm (0.087 in.)
1.75 mm (0.069 in.)	2.25 mm (0.089 in.)
1.80 mm (0.071 in.)	2.30 mm (0.091 in.)
1.90 mm (0.075 in.)	

■ NOTE

- **Stake the staking nut after performing adjustments described in the following pages.**

(1) Collar 1

11790S30410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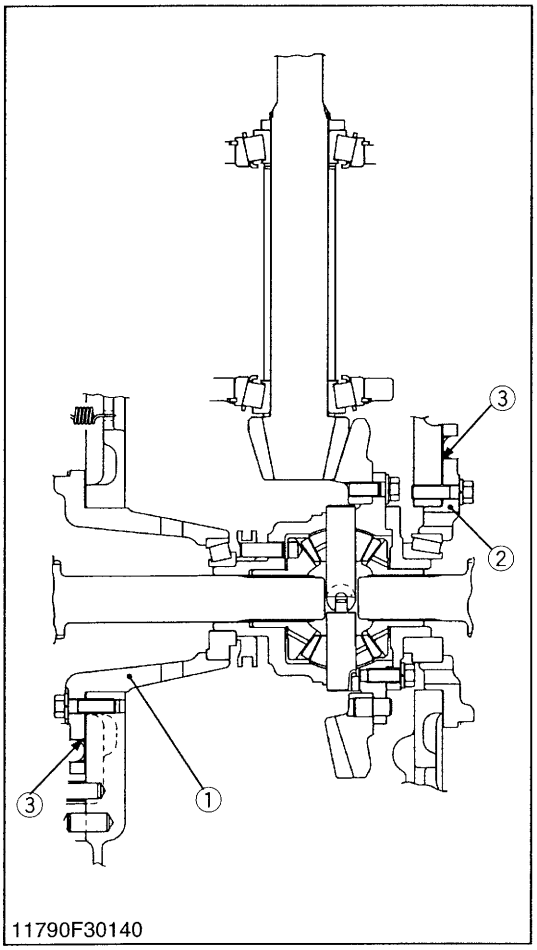

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Turning Torque of Spiral Bevel Pinion Shaft and Differential Assembly Combined

1. Reassemble the differential assembly with left and right shims (3) same as before disassembling.
2. Check that there is a backlash. If there is no backlash, move a left shim to the right.

(Reference)

- If the thickness of shims is not known, refer to the following.
- Reassemble the differential assembly with no shim at bearing support **L** (1) side and with an adequate number of shims at bearing support **R** (2) side. And proceed to the next step.

3. Measure the turning torque by turning the spiral bevel pinion shaft, and then add a shim to the bearing support **R** (2) if the turning torque exceeds the factory specifications, or remove a shim from there if the turning torque is less than the factory specifications.
4. And repeat the above procedure until the turning torque becomes the factory specifications.

Turning torque	Factory spec.	1.28 to 2.45 N·m 0.13 to 0.25 kgf·m 0.94 to 1.81 ft-lbs

(Reference)

- Thickness of adjusting shims :
  0.1 mm (0.004 in.) 0.5 mm (0.020 in.)
  0.3 mm (0.012 in.)

(1) Bearing Support **L**
(2) Bearing Support **R**
(3) Shim

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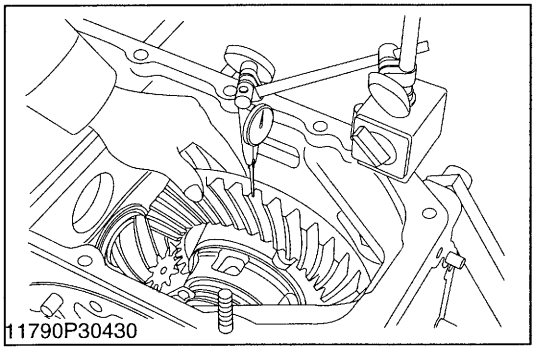
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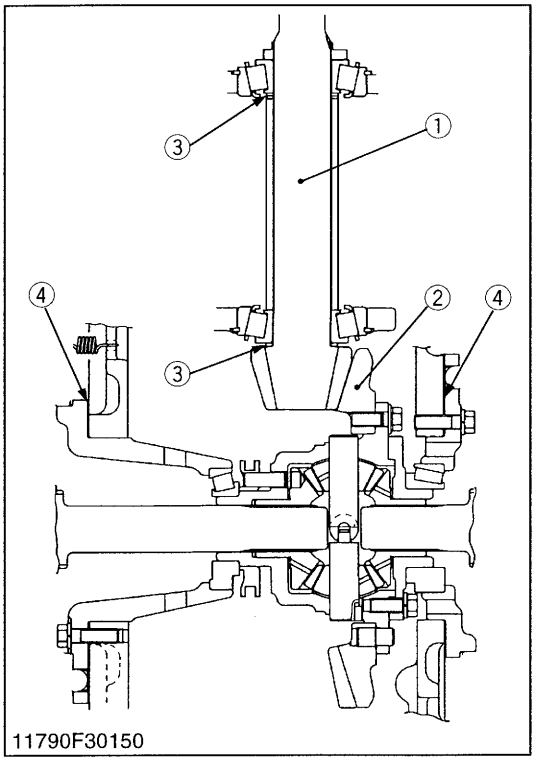

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Backlash and Tooth Contact between Spiral Bevel Gear and Spiral Bevel Pinion Shaft

1. Set the dial indicator (lever type) with its finger on the tooth surface.
2. Measure the backlash by fixing the spiral bevel pinion shaft (1) and moving the spiral bevel gear (2) by hand.
3. When the backlash is too large, decrease the number of shims in the side of the spiral bevel gear, and insert the removed shims in the opposite side. When the backlash is too small, decrease the number of shims in the side of the differential case, and insert the removed shims in the opposite side.
4. Adjust the backlash properly by repeating the above procedure.
5. Apply red lead lightly over several teeth at three positions equally spaced on the spiral bevel gear.
6. Turn the spiral bevel pinion shaft, while pressing a wooden piece against the periphery of the spiral bevel gear.
7. Check the tooth contact. If not proper, adjust according to the instructions below.

Backlash between spiral bevel gear and spiral bevel pinion shaft	Factory spec.	0.20 to 0.30 mm 0.0079 to 0.0118 in.
	Allowable limit	0.4 mm 0.016 in.

(Reference)

- Thickness of shim (4) :
  0.1 mm (0.004 in.) 0.5 mm (0.020 in.)
  0.3 mm (0.012 in.)
- Thickness of collar (3) :
  1.00 mm (0.039 in.) 2.00 mm (0.079 in.)
  1.50 mm (0.059 in.) 2.10 mm (0.083 in.)
  1.70 mm (0.067 in.) 2.20 mm (0.087 in.)
  1.75 mm (0.069 in.) 2.25 mm (0.089 in.)
  1.80 mm (0.071 in.) 2.30 mm (0.091 in.)
  1.90 mm (0.075 in.)

(1) Spiral Bevel Pinion Shaft
(2) Spiral Bevel Gear
(3) Adjusting Collar 1
(4) Shim

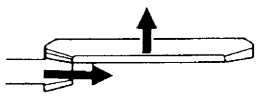
[Proper Contact]


11790F30160

More than 35 % red lead contact area on the gear tooth surface.
The center oftooth contact at 1/3 of the entire width from the small end.

[Shallow Contact]

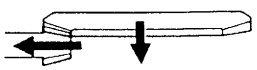

[Heel Contact]



11790F30170

Replace adjusting collar 1 with thicker one to move the spiral bevel pinion shaft backward.
And place the left side shim to the right to move the spiral bevel gear rightward.
Repeat above until the proper tooth contact and backlash are achieved.

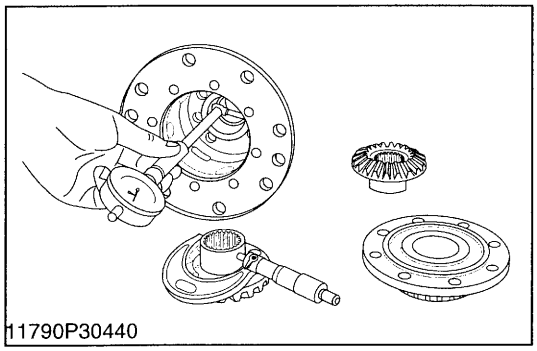
[Deep Contact]


[Toe Contact]



11790F30180

Replace adjusting collar 1 with thinner one to move the spiral bevel pinion shaft forward.
And place the right wide shim to the left to move the spiral bevel gear leftward.
Repeat above until the proper tooth contact and backlash are achieved.

11790S30430


11790P30440

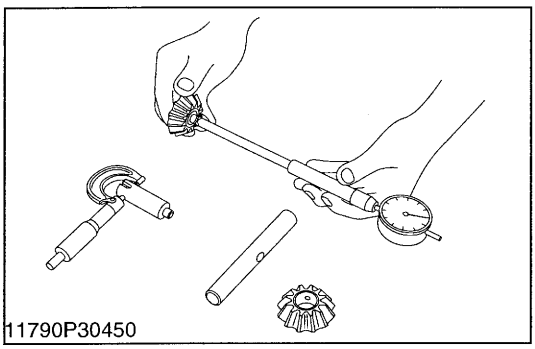
Clearance between Differential Case Bore (Differential Case Cover Bore) and Differential Side Gear Boss

1. Measure the bore I.D. of the differential case and differential case cover.
2. Measure the differential side gear boss O.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

Clearance between differential case bore and differential side gear boss	Factory spec.	0.050 to 0.151 mm 0.00197 to 0.00594 in.
	Allowable limit	0.35 mm 0.0138 in.
Differential case bore I.D.	Factory spec.	40.500 to 40.550 mm 1.59449 to 1.59646 in.
Differential side gear boss O.D.	Factory spec.	40.388 to 40.450 mm 1.59008 to 1.59252 in.

Clearance between differential case cover bore and differential side gear boss	Factory spec.	0.050 to 0.151 mm 0.00197 to 0.00594 in.
	Allowable limit	0.35 mm 0.0138 in.
Differential case cover bore I.D.	Factory spec.	40.500 to 40.550 mm 1.59449 to 1.59646 in.
Differential side gear boss O.D.	Factory spec.	40.388 to 40.450 mm 1.59008 to 1.59252 in.

11790S30440

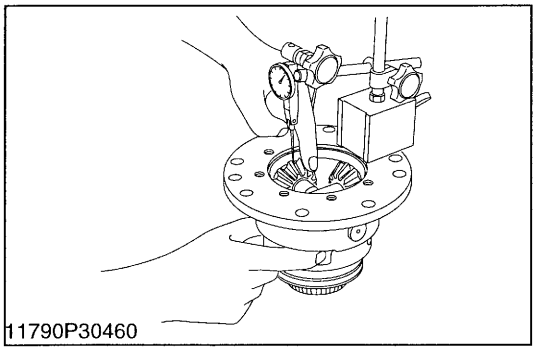

11790P30450

Clearance between Differential Pinion Shaft and Differential Pinion

1. Measure the differential pinion shaft O.D.
2. Measure the differential pinion I.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

Clearance between differential pinion shaft and differential pinion	Factory spec.	0.060 to 0.102 mm 0.00236 to 0.00402 in.
	Allowable limit	0.25 mm 0.0098 in.
Differential pinion shaft O.D.	Factory spec.	19.959 to 19.980 mm 0.78579 to 0.78661 in.
Differential pinion I.D.	Factory spec.	20.040 to 20.061 mm 0.78898 to 0.78980 in.

11790S30450


11790P30460

Backlash between Differential Pinion and Differential Side Gear

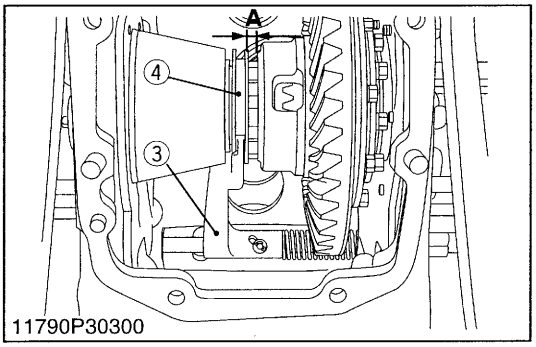
1. Set a dial indicator (lever type) on the tooth of the differential pinion.
2. Hold the differential side gear and move the differential pinion to measure the backlash.
3. If the measurement is not within the factory specifications, adjust with the differential side gear washer.

Backlash between differential pinion and differential side gear	Factory spec.	0.15 to 0.30 mm 0.0059 to 0.0118 in.
	Allowable limit	0.4 mm 0.016 in.

(Reference)

- Thickness of differential side gear washer :
  1.5 mm (0.059 in.) 1.7 mm (0.067 in.)
  1.6 mm (0.063 in.) 1.8 mm (0.071 in.)
  2.0 mm (0.079 in.)

11790S30461

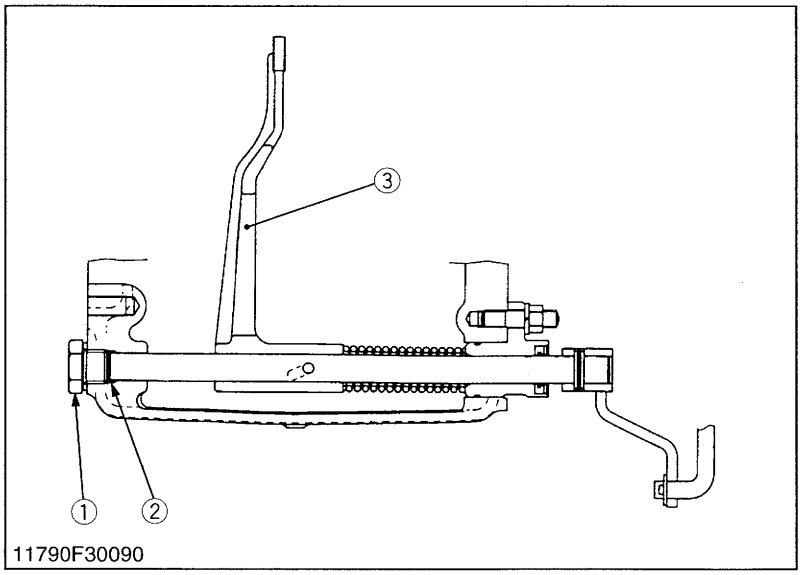


11790P30300

Displacement of Differential Lock Shifter

1. Measure the displacement **(A)** of the shift fork (3) by pushing down the differential lock pedal as far as not to bend the shift fork to get the displacement of the differential lock shifter (4).
2. If the measurement is not between the factory specifications, adjust with the differential lock adjusting shim (2).

Displacement **(A)** of differential lock shifter	Factory spec.	6.0 to 8.0 mm 0.236 to 0.315 in.



11790F30090

(1) Plug
(2) Adjusting Shim
(3) Shift Fork
(4) Differential Lock Shifter

12550S30280

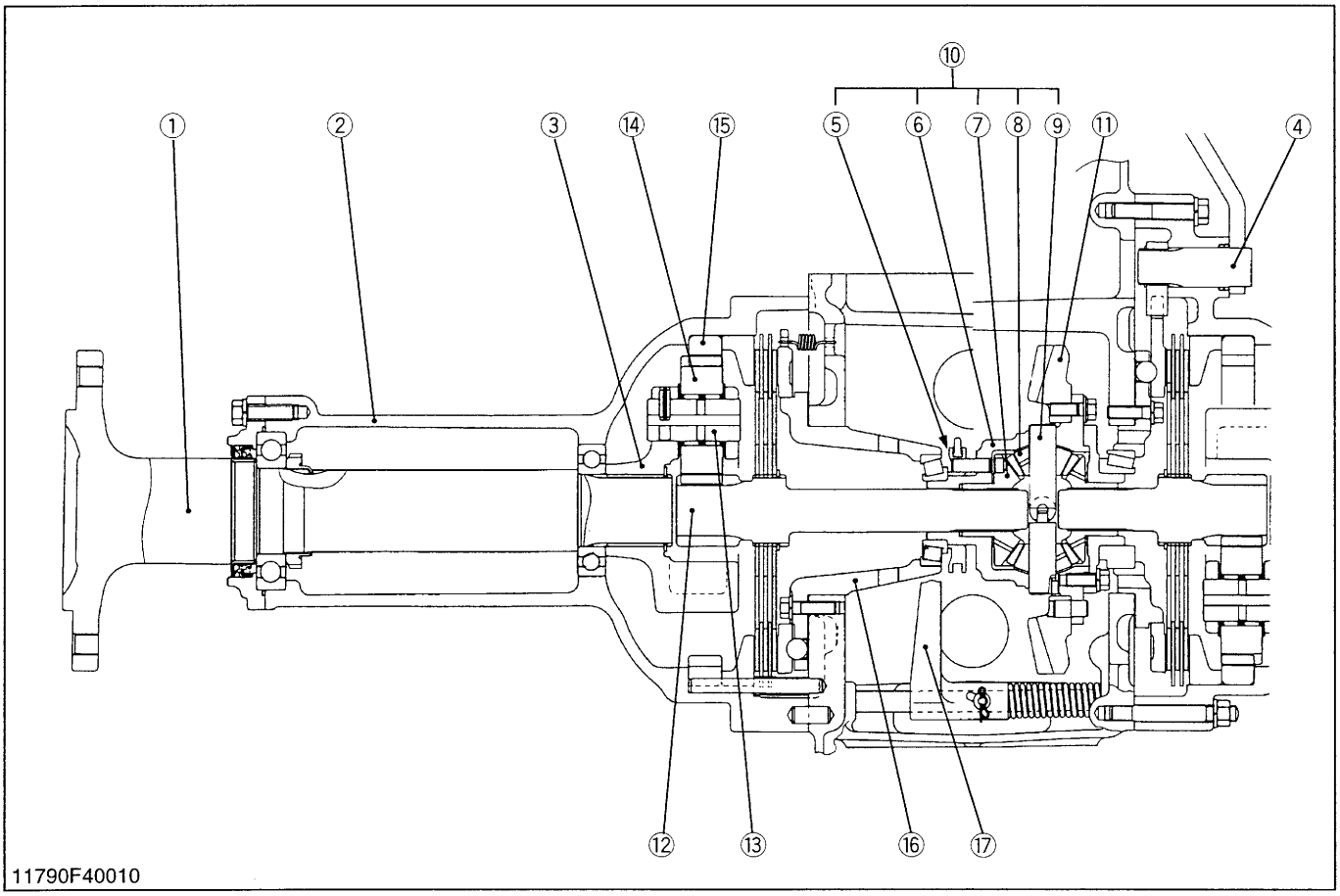
4 REAR AXLE

4 REAR AXLE

MECHANISM

CONTENTS

[1] FEATURES



11790F40010

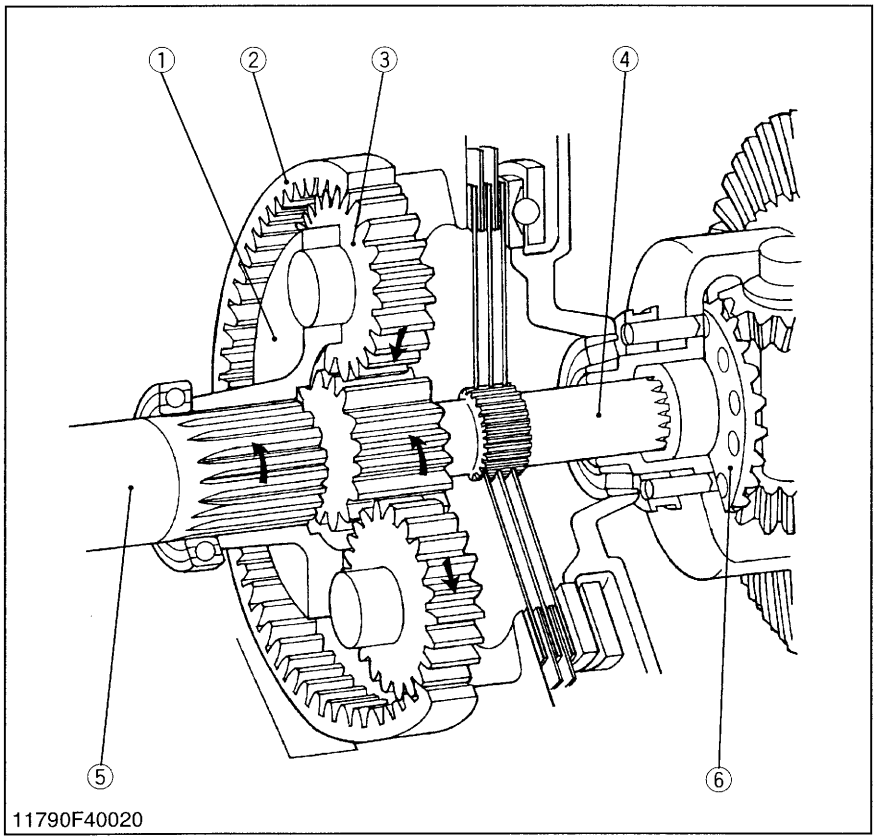
(1) Rear Axle
(2) Rear Axle Case
(3) Planetary Gear Support
(4) Brake Cam Shaft
(5) Differential Lock Shifter
(6) Differential Case
(7) Differential Side Gear
(8) Differential Pinion Gear
(9) Differential Pinion Shaft
(10) Differential Gear
(11) 39T Bevel Gear
(12) Brake Shaft (13T Gear)
(13) Planetary Gear Pin
(14) 25T Planetary Gear
(15) 65T Internal Gear
(16) Differential Bearing Support
(17) Differential Lock Shift Fork

The rear axles are the final mechanism which transmit power from the transmission to the rear wheels. Direction of power transmitted is changed at a right angle by the differential gear (10) and, at the same time, speed is reduced. It is further reduced by the planetary gear to drive the rear axles.

The rear axles (1) are semi-floating type with the ball bearing between the rear axle (1) and rear axle case (2), which support the rear wheel load as well as transmitting power to the rear wheel. They withstand all the forces caused by tire rotation and side skidding.

12550M40010

[2] FINAL REDUCTION SYSTEM



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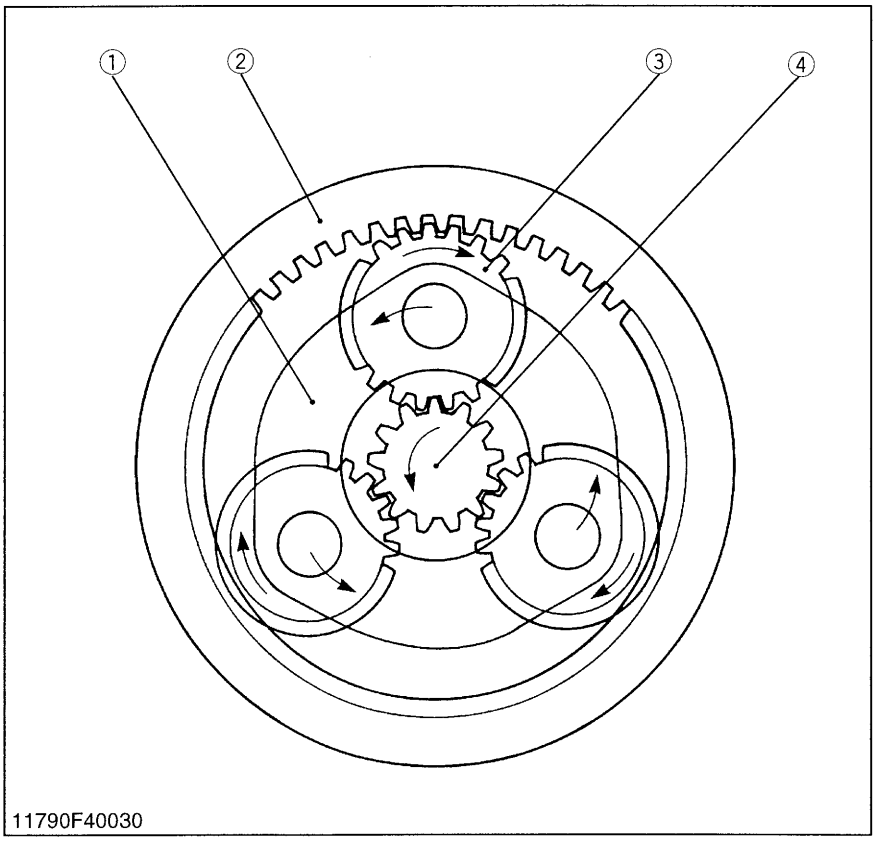


11790F40030

The final reduction system has a planetary gear system. It is compact, and is durable under heavy loads since torque loads are spread over three gears, decreasing the load on each tooth. And this system also spreads the load evenly around the circumference of the system, eliminating the sideways stress on the shafts.

Power, transmitted from the differential side gear (6) to the brake shaft (13T gear) (4), drives the three 25T planetary gears (3). Since the 65T internal gear (2) is fixed to the rear axle case, the planetary gears move around the teeth of the 65T internal gear while rotating on their axes. The movement of the planetary gears around the internal gear is transmitted to the rear axle (5) through the planetary gear support (1). As a result, the planetary gear support (1) and rear axle (5) rotate in the same direction as the brake shaft (4), but at a reduced speed and increased torque.

(1) Planetary Gear Support
(2) 65T Internal Gear
(3) 25T Planetary Gear
(4) Brake Shaft (13T Gear)
(5) Rear Axle
(6) Differential Side Gear

12550M40020

SERVICING

CONTENTS

TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Excessive or Unusual Noise at All Time	• Improper backlash between brake shaft's 13T gear and planetary gear	Replace	4-S4
	• Improper backlash between planetary gear and internal gear	Replace	4-S4
	• Bearings worn	Replace	4-S4, S5
	• Insufficient or improper type of transmission fluid used	Replenish or change	G-14
Noise while Turning	• Brake shaft's 13T gear, planetary gears and internal gear worn or damaged	Replace	4-S4
	• Needle bearings or planetary gear shafts worn or broken	Replace	4-S4

11790S40010

SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Internal Gear to Planetary Gear	Backlash	0.08 to 0.30 mm 0.0031 to 0.0118 in.	0.5 mm 0.020 in.
Planetary Gear Thrust Collar	Thickness	1.55 to 1.65 mm 0.0610 to 0.0650 in.	1.2 mm 0.047 in.
Planetary Gear to Planetary Gear Shaft	Clearance	0.009 to 0.048 mm 0.00035 to 0.00189 in.	0.30 mm 0.0118 in.
Planetary Gear Shaft	O.D.	31.989 to 32.000 mm 1.25941 to 1.25984 in.	–
Planetary Gear	I.D.	39.000 to 39.025 mm 1.53543 to 1.53641 in.	–
Needle	O.D.	3.494 to 3.500 mm 0.13756 to 0.13780 in.	–

12550S40020

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-10.)

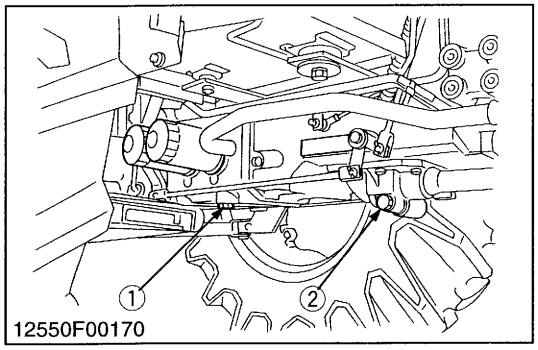
Item	N·m	kgf·m	ft-lbs
Foldable ROPS mounting screw			
M16, grade 9 screw	260 to 304	26.5 to 31.0	192 to 224
Rear wheel mounting nut	260 to 304	26.5 to 31.0	192 to 224
Rear axle case mounting screw and nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Rear axle cover mounting screw	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Rear axle nut	539 to 637	55.0 to 65.0	398 to 470

12550S40030

CHECKING, DISASSEMBLING AND SERVICING

DISASSEMBLING AND ASSEMBLING

(1) Separating Rear Axle Case from Transmission Case



12550F00170

Changing Transmission Fluid

1. Place an oil pan underneath the transmission case.
2. Remove the drain plugs (1) and (2).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1) and (2).

(When reassembling)

- Fill up from filling port after removing the filling plug until reaching the gauge.
- After running the engine for few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

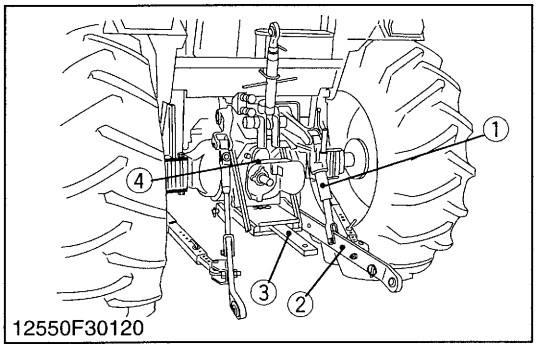
Transmission fluid	Capacity	ROPS	40.0 L 42.3 U.S.qts. 35.2 Imp.qts.
		CAB	43.0 L 45.4 U.S.qts. 37.8 Imp.qts.

■ IMPORTANT

- **Use only KUBOTA SUPER UDT fluid. Use of other fluides may damage the transmission or hydraulic system.**
- **Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)**
- **Do not mix different brands oil together.**

(1) Drain Plug (2) Drain Plug (4WD Only)

12550S10110



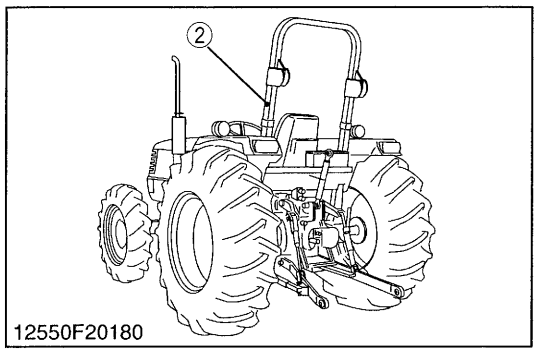
12550F30120

Lift Rods and Lower Links

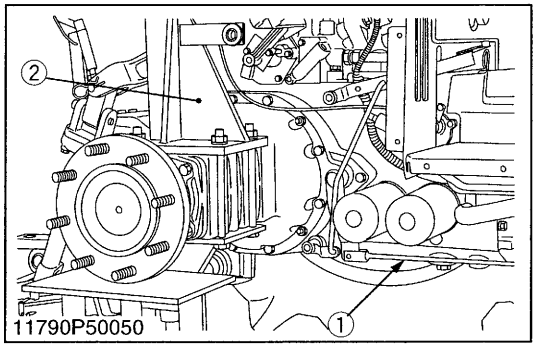
1. Remove the lift rods (1).
2. Remove the lower links (2) with stabilizer.
3. Remove the draw bar (3).
4. Remove the PTO shaft cover (4).

(1) Lift Rod (3) Draw Bar
(2) Lower Link (4) PTO Shaft Cover

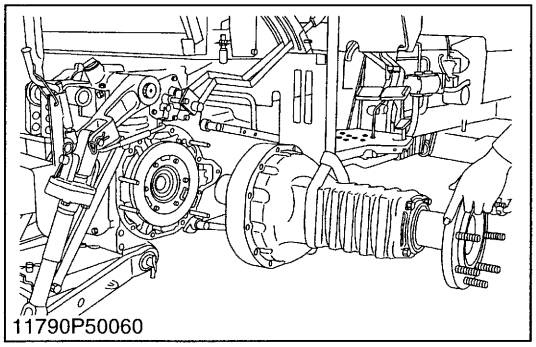
12550S30050



12550F20180



11790P50050


11790P50060

Rear Wheel, Fender and Foldable ROPS

1. Check the rear axle and transmission case are securely mounted on the disassembly stands.
2. Loosen the rear wheel mounting nuts.
3. Take out the rear wheel.
4. Remove the brake rod (1).
5. Disconnect the jumper leads for hazard and tail lights.
6. Disconnect the jumper leads for PTO safety switch. (If removing the right side fender.)
7. Remove the auxiliary control valve lever assembly.
8. Remove the fender mounting screws and nuts.
9. Remove the fender.
10. Remove the foldable ROPS (2).

(When reassembling)

Tightening torque	Foldable ROPS mounting screw	M16, grade 9 screw	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs
	Rear wheel mounting nut		260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs

(1) Brake Rod (2) Foldable ROPS

12550S40040

Rear Axle Case

1. Remove the DT shift rod. (If separating left side.)
2. Remove the differential lock rod. (If separating right side.)
3. Remove the auxiliary control valve. (If separating right side.)
4. Remove the rear axle case mounting screws and nuts.
5. Support the rear axle case with nylon lift strap and hoist.
6. Separate the rear axle case from transmission case.

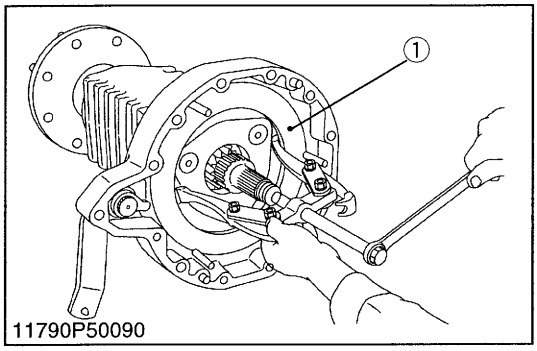
(When reassembling)

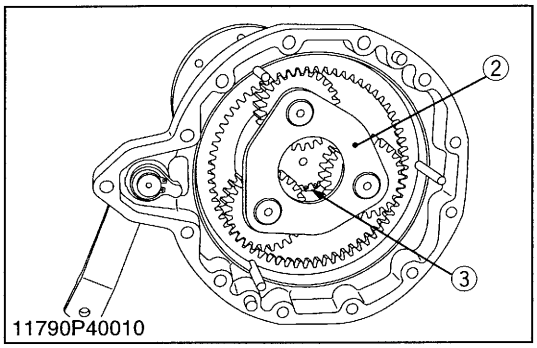
- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the rear axle case and transmission case, after eliminate the water, oil and stuck liquid gasket.

Tightening torque	Rear axle case mounting screw and nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

12550S40050

(2) Disassembling Planetary Gear



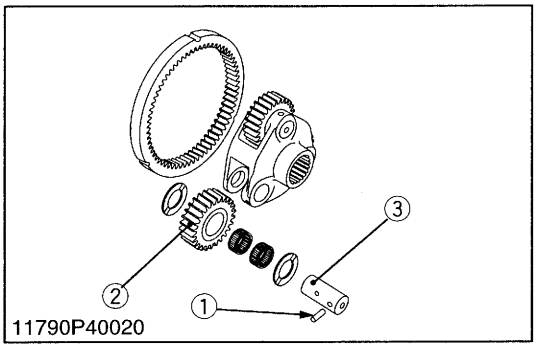


Planetary Gear Support

1. Remove the brake plate (1).
2. Remove the external snap ring (3).
3. Carefully remove the planetary gear support (2).

(1) Brake Plate
(2) Planetary Gear Support
(3) External Snap Ring

11790S40040



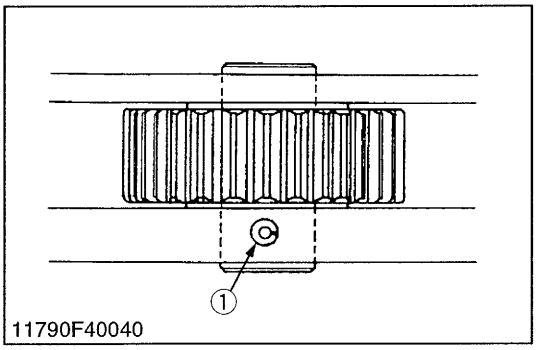
Planetary Gear

1. Tap the spring pin (1) into the planetary gear shaft (3).
2. Draw out the planetary gear shaft (3), and remove the planetary gear (2).
3. Tap out the spring pin from the planetary gear shaft.

(When reassembling)

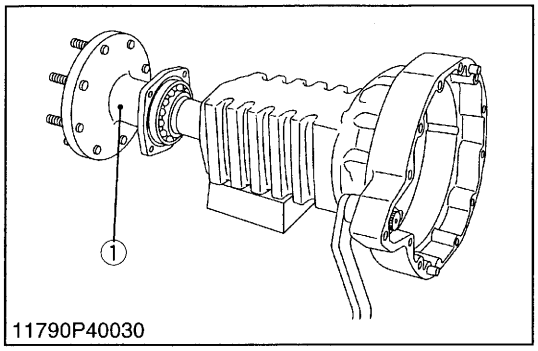
- Apply transmission fluid to the inner surface of planetary gear (2).
- Tap in the spring pin (1) as shown in the figure.

(1) Spring Pin
(2) Planetary Gear
(3) Planetary Gear Shaft



11790S40050

(3) Disassembling Rear Axle



Rear Axle

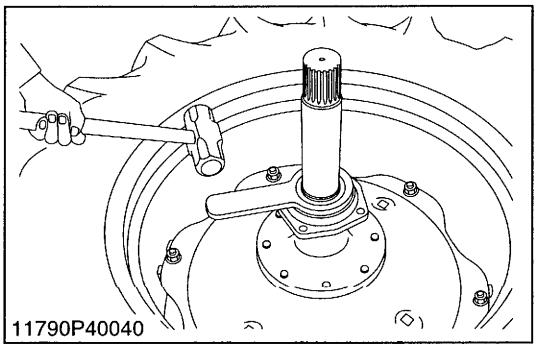
1. Unscrew the rear axle cover mounting screws, and remove the rear axle (1).

(When reassembling)

Tightening torque	Rear axle cover mounting screw	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

(1) Rear Axle

11790S40060



Rear Axle Nut

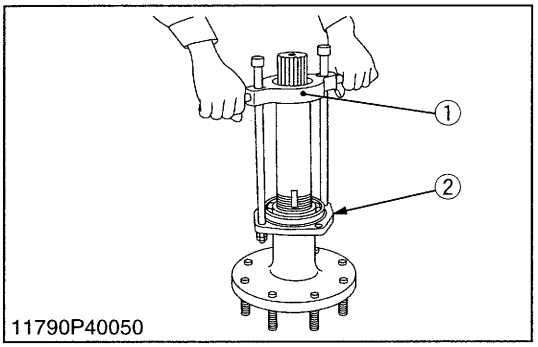
1. Fix the rear axle on the repair table or set to the rear wheel.
2. Remove the stake on the rear axle nut.
3. Remove the rear axle nut with a rear axle nut wrench 85 (Code No. 07916-52541).

(When reassembling)

- Replace the rear axle nut with a new one, and stake if firmly after tightening.

Tightening torque	Rear axle nut	539 to 637 N·m 55.0 to 65.0 kgf·m 398 to 470 ft-lbs

12550S40060



Rear Axle Cover

1. Remove the rear axle cover (2) with a rear axle cover puller (1) (Code No. 07916-51041).

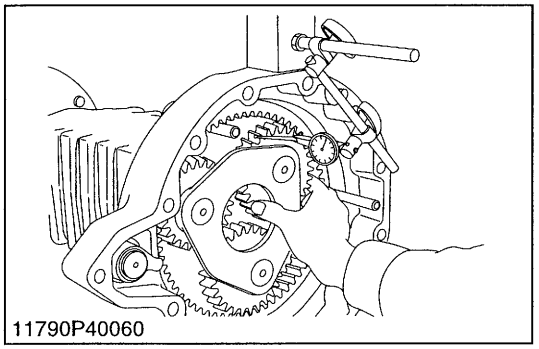
(When reassembling)

- Apply grease to the oil seal lips.

(1) Rear Axle Cover Puller (2) Rear Axle Cover

11790S40080

SERVICING

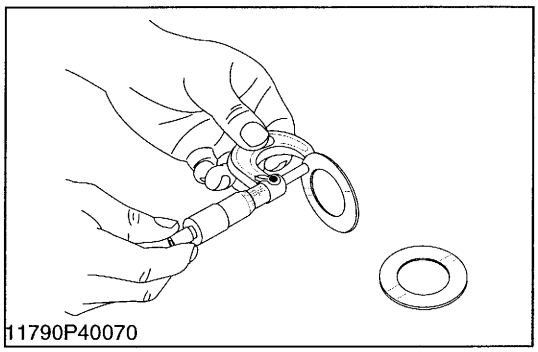


Backlash between Internal Gear and Planetary Gear

1. Set a dial indicator (lever type) on the tooth of the planetary gear.
2. Hold the planetary gear support and move only the planetary gear to measure the backlash.
3. If the measurement exceeds the allowable limit, check the planetary gear and planetary shaft.

Backlash between internal gear and planetary gear	Factory spec.	0.08 to 0.30 mm 0.0031 to 0.0118 in.
	Allowable limit	0.5 mm 0.020 in.

12550S40070

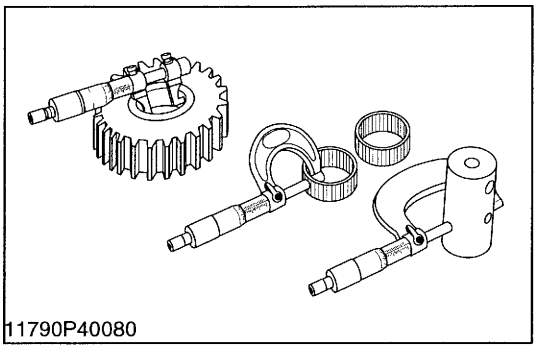

11790P40070

Thrust Collar Thickness

1. Measure the thickness of the thrust collar.
2. If the measurement is less than the allowable limit, replace it.

Thrust collar thickness	Factory spec.	1.55 to 1.65 mm 0.0610 to 0.0650 in.
	Allowable limit	1.2 mm 0.047 in.

11790S40100


11790P40080

Clearance between Planetary Gear and Planetary Gear Shaft

1. Measure the planetary gear shaft O.D. (rubbing surface).
2. Measure the planetary gear I.D. (rubbing surface).
3. Measure the O.D. of the two needles installed diagonally in the needle bearing.
4. Calculate the clearance.
5. (Clearance = Planetary gear I.D. – {(2 × Needle O.D.) + Planetary gear shaft O.D.})
6. If the clearance exceeds the allowable limit, replace them.

Clearance between planetary gear and planetary gear shaft	Factory spec.	0.009 to 0.048 mm 0.00035 to 0.00189 in.
	Allowable limit	0.30 mm 0.0118 in.
Planetary gear shaft O.D.	Factory spec.	31.989 to 32.000 mm 1.25941 to 1.25984 in.
Planetary gear I.D.	Factory spec.	39.000 to 39.025 mm 1.53543 to 1.53641 in.
Needle O.D.	Factory spec.	3.494 to 3.500 mm 0.13756 to 0.13780 in.

11790S40110

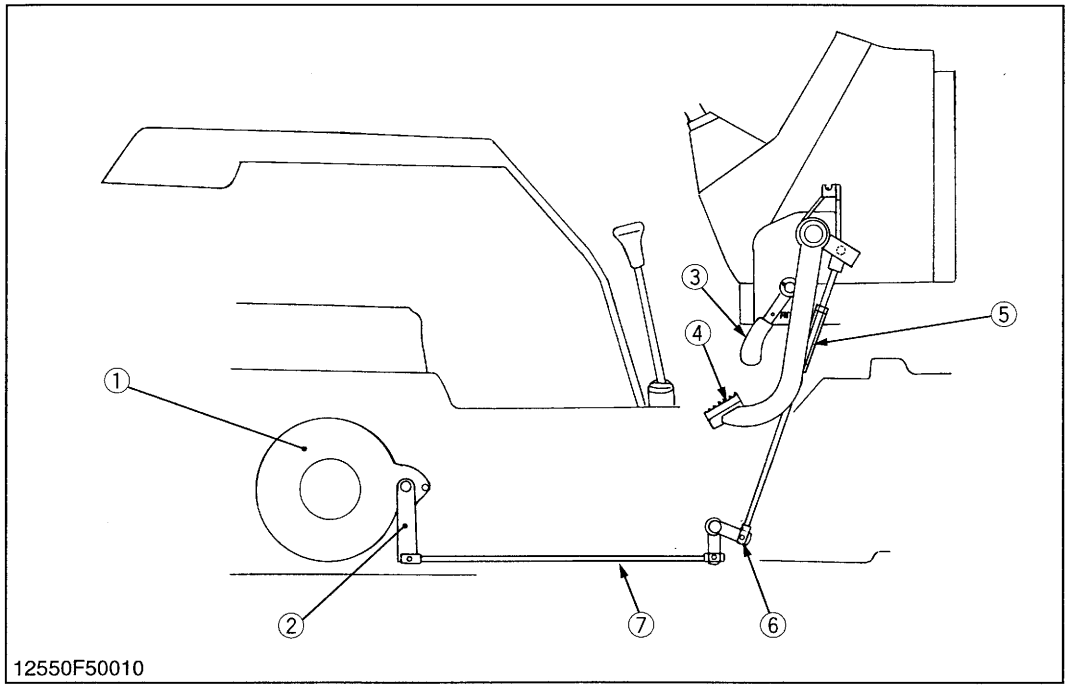
5 BRAKES

5 BRAKES

MECHANISM

CONTENTS

[1] FEATURES



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(1) Brake Case
(2) Brake Cam Lever
(3) Parking Brake Lever
(4) Brake Pedal
(5) Turnbuckle
(6) Brake Rod
(7) Brake Lever

These tractors are used hanging type brake pedals (4) to have wider space of the platform.

Independent mechanical wet disc brakes (1) are used for the right and left traveling brakes. They are operated by the brake pedals (4) through the mechanical linkages.

The parking brake (3) is a mechanical type which is designed to actuate the traveling brakes. Pulling the parking brake lever (3) results in the same state as that obtained when the brake pedals (4) are pressed.

■ 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 100 hours or so, almost no wear occurs afterwards. This means that very little brake adjustments are required.

2. Stable braking

Since the brake discs are immersed in transmission fluid, **Fade*** is rarely caused even after repeated braking and stable braking force is obtained.

3. Pedal stroke does not change under influence of heat.

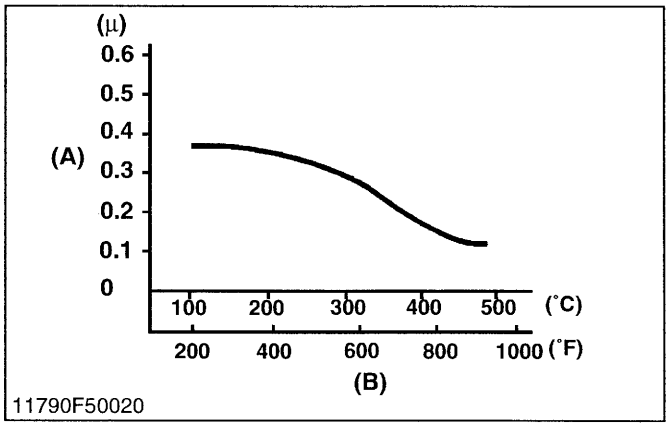
Unlike internal expanding type brakes, the drum-to-shoe clearance of the wet disc brake does not increase due to thermal expansion and the increased pedal stroke does not result. Thus, the wet disc brake provides a constant pedal stroke.

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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(A) Friction Coefficient (B) Temperature

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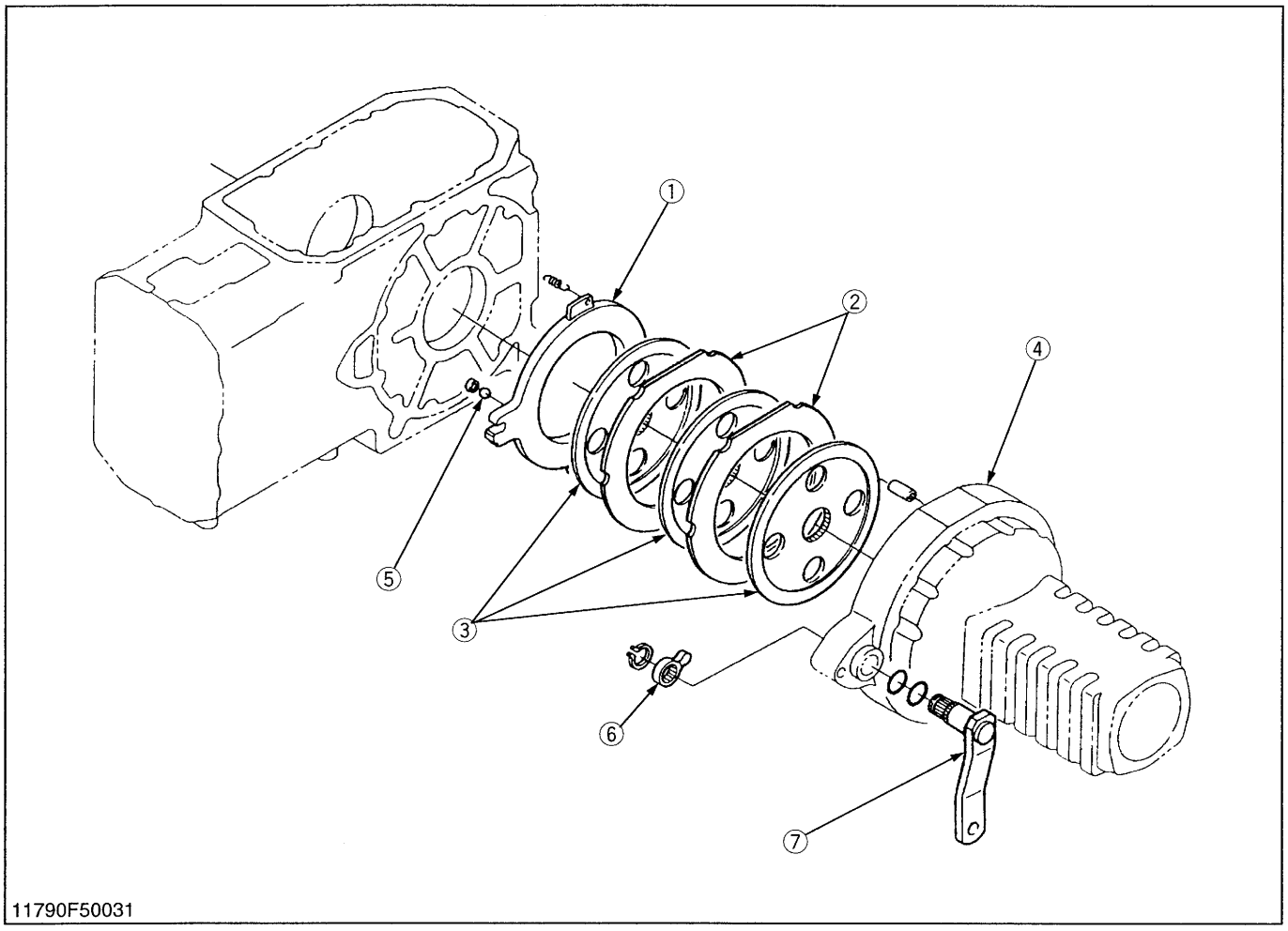
[2] OPERATION



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(1) Cam Plate
(2) Steel Plate
(3) Brake Disc
(4) Brake Case
(5) Steel Ball
(6) Brake Cam
(7) Brake Cam Lever

The brake body is incorporated in the brake case (4) filled with transmission fluid and is designed to brake when the brake disc (3) splined with the brake shaft is pressed against the cam plate (1) by means of the cam mechanism incorporating steel balls (5).

For greater braking force, two brake discs are provided at the right and left sides respectively, and the steel plate (2) fixed to the brake case is arranged between the brake discs.

■ During braking

When the brake pedal is pressed, the linkage causes the brake cam lever (7) and brake cam (6) to turn into the direction of arrow shown in the above figure.

Therefore, the cam plate (1) also moves the direction of arrow. At this time, since the cam plate (1) rides on the steel balls (5) set in the grooves of the transmission case to press the brake disc (3), the brake shaft is braked by the frictional force generated by the cam plate (1) and brake disc (3).

11790M50021

SERVICING

CONTENTS

TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Uneven Braking Force	• Brake pedal free play unevenly adjusted • Brake disc worn • Cam plate warped	Adjust Replace Replace	5-S2 5-S7, 8 5-S6, 8
Brake Drags	• Brake pedal free play too small • Ball holes of cam plate for uneven wear • Brake pedal return spring weaken or broken • Brake cam rusted	Adjust Replace Replace Repair	5-S2 5-S6, 8 5-S4 5-S7, 8
Poor Braking Force	• Brake pedal free play excessive • Brake disc worn • Cam plate warped • Brake cam or lever damaged • Transmission fluid improper	Adjust Replace Replace Replace Change	5-S2 5-S7, 8 5-S6, 8 5-S7 5-S5

12550S50060

SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Brake Pedal	Free Play	40 to 45 mm 1.6 to 1.8 in.	–
Brake Pedal Shaft to Brake Pedal Bushing	Clearance	0.025 to 0.185 mm 0.00098 to 0.00728 in.	1.00 mm 0.0394 in.
Brake Pedal Shaft	O.D.	27.900 to 27.975 mm 1.09842 to 1.10138 in.	–
Brake Pedal Bushing	I.D.	28.000 to 28.085 mm 1.10236 to 1.10571 in.	–
Brake Lever Link Shaft to Brake Lever Link Bushing	Clearance	0.02 to 0.25 mm 0.0008 to 0.0098 in.	1.00 mm 0.0394 in.
Brake Lever Link Shaft	O.D.	19.90 to 19.98 mm 0.7835 to 0.7866 in.	–
Brake Lever Link Bushing	I.D.	20.00 to 20.15 mm 0.7874 to 0.7933 in.	–
Cam Plate	Flatness	–	0.3 mm 0.012 in.
Cam Plate and Ball	Height	22.45 to 22.55 mm 0.8839 to 0.8879 in.	22.00 mm 0.8661 in.
Brake Disc	Thickness	4.15 to 4.35 mm 0.1634 to 0.1713 in.	3.3 mm 0.130 in.
Plate	Thickness	2.25 to 2.35 mm 0.0889 to 0.0925 in.	1.5 mm 0.059 in.
Brake Stopper Plate	Flatness	–	0.3 mm 0.012 in.

12550S50020

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-10.)

Item	N·m	kgf·m	ft-lbs
Foldable ROPS mounting screw			
M16, grade 9 screw	260 to 304	26.5 to 31.0	192 to 224
Rear wheel mounting nut	260 to 304	26.5 to 31.0	192 to 224
Rear axle case mounting screw and nut			
M12 screw and nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5

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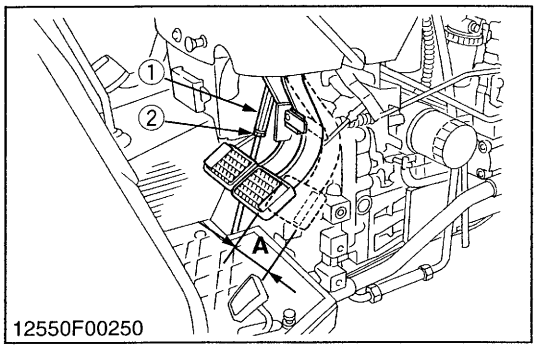
CHECKING, DISASSEMBLING AND SERVICING

CHECKING AND ADJUSTING



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Brake Pedal Free Play

⚠ CAUTION

- **Stop the engine and remove the key, then choke the wheel before chekcing brake pedal.**

1. Release the parking brake.
2. Slightly depress the brake pedals and measure free play **(A)** at top of pedal stroke.
3. If the measurement is not within the factory specifications, loosen the lock nut (2) and turn the turnbuckle (1) to adjust the rod length within acceptable limits.

Brake pedal free play **(A)**	Factory spec.	40 to 45 mm 1.6 to 1.8 in.

■ IMPORTANT

- **Keep the free play in the right and left brake pedals equal.**

(1) Turnbuckle (2) Lock Nut

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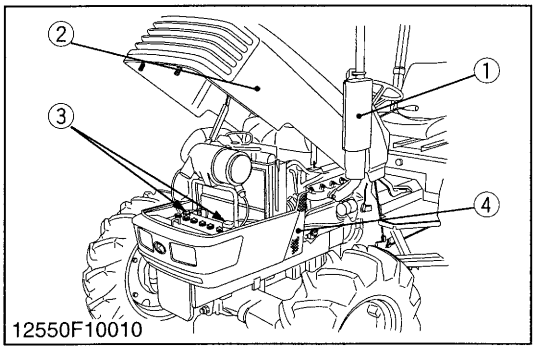
[1] BRAKE PEDAL
DISASSEMBLING AND ASSEMBLING



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Muffler and Bonnet

1. Remove the muffler (1).
2. Remove the bonnet (2).
3. Disconnect the battery's cable (3).
4. Remove the side cover (4).

(1) Muffler (3) Battery's Cable
(2) Bonnet (4) Side Cover

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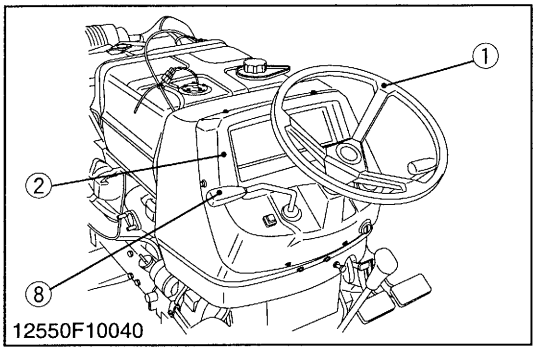

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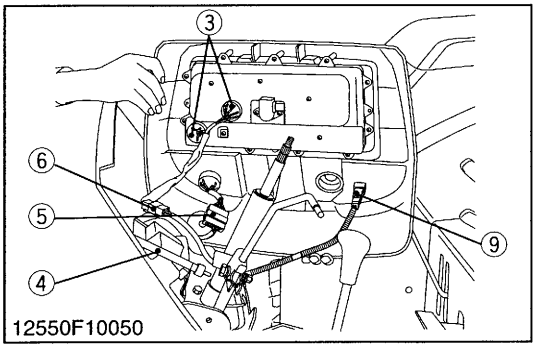

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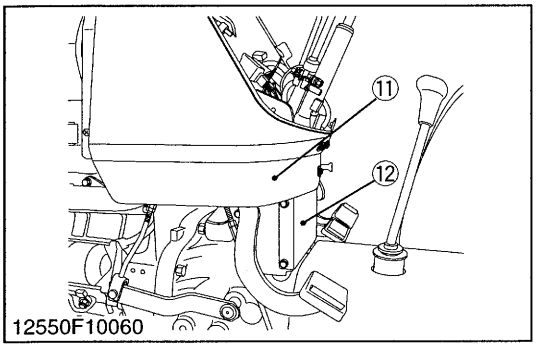

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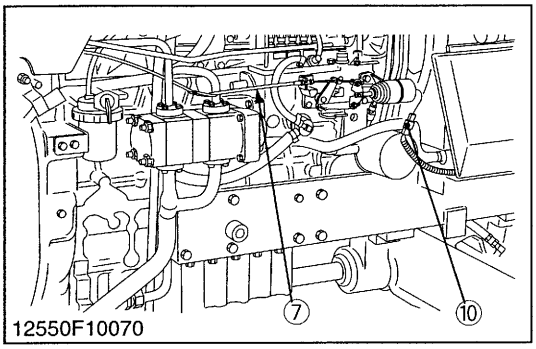

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Steering Wheel, Meter Panel and Rear Bonnet

1. Remove the steering wheel (1) with a steering wheel puller (Code No. 07916-51090).
2. Remove the shuttle lever grip (8).
3. Remove the meter panel mounting screws and open the meter panel (2).
4. Disconnect the two connectors (3) and meter cable (4).
5. Disconnect the main switch connector (5) and combination switch connector (6).
6. Disconnect the hazard switch connector (9) and engine stop solenoid connector (10).
7. Disconnect the engine stop cable (7) at the engine side.
8. Remove the rear bonnet (11) and lower cover (12).

(1) Steering Wheel
(2) Meter Panel
(3) Connector
(4) Meter Cable
(5) Main Switch Connector
(6) Combination Switch Connector
(7) Engine Stop Cable
(8) Shuttle Lever Grip
(9) Hazard Switch Connector
(10) Engine Stop Solenoid Connector

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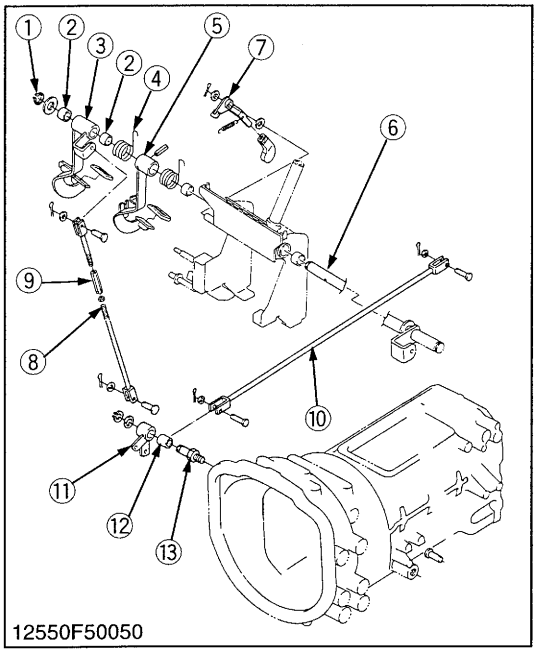

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Brake Pedal and Brake Pedal Shaft

1. Remove the clevis pin at the end of brake rod 1 (8).
2. Remove the return spring (4) and external snap ring (1).
3. Draw out the brake pedal shaft (6).

(When reassembling)

- Apply the grease to the brake pedal bush and pedal shaft.

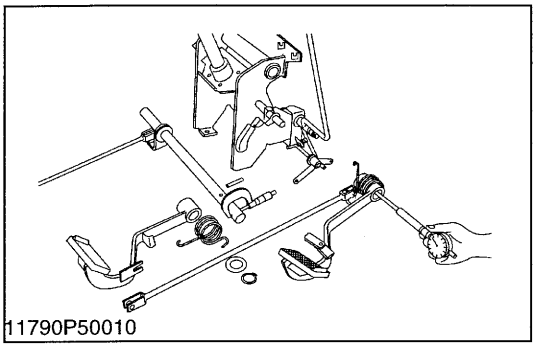
■ IMPORTANT

- **After reassembling the brake pedal, be sure to adjust the brake pedal free play.**

(1) External Snap Ring
(2) Bushing
(3) Brake Pedal RH
(4) Return Spring
(5) Brake Pedal LH
(6) Brake Pedal Shaft
(7) Parking Brake Lock
(8) Brake Rod 1
(9) Turnbuckle
(10) Brake Rod 2
(11) Brake Lever
(12) Bushing
(13) Brake Level Link Shaft

12550S50050

SERVICING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Clearance between Brake Pedal Shaft and Pedal Bushing

1. Measure the brake pedal shaft O.D. with an outside micrometer.
2. Measure the brake pedal bushing I.D. with a cylinder gauge.
3. Calculate the clearance.
4. If the clearance exceeds the allowable limit, replace the bushing.

Clearance between brake pedal shaft and pedal bushing	Factory spec.	0.025 to 0.185 mm 0.00098 to 0.00728 in.
	Allowable limit	1.00 mm 0.0394 in.
Brake pedal shaft O.D.	Factory spec.	27.900 to 27.975 mm 1.09842 to 1.10138 in.
Brake pedal bushing I.D.	Factory spec.	28.000 to 28.085 mm 1.10236 to 1.10571 in.

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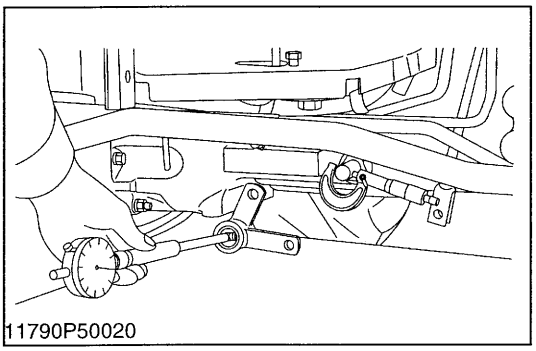
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Clearance between Brake Lever Link Shaft and Bushing

1. Measure the brake lever link shaft O.D. with an outside micrometer.
2. Measure the brake lever link bushing I.D. with a cylinder gauge.
3. Calculate the clearance.
4. If the clearance exceeds the allowable limit, replace the bushing.

Clearance between brake lever link shaft and brake lever link bushing	Factory spec.	0.02 to 0.25 mm 0.0008 to 0.0098 in.
	Allowable limit	1.00 mm 0.0394 in.
Brake lever link shaft O.D.	Factory spec.	19.90 to 19.98 mm 0.7835 to 0.7866 in.
Brake lever link bushing I.D.	Factory spec.	20.00 to 20.15 mm 0.7874 to 0.7933 in.

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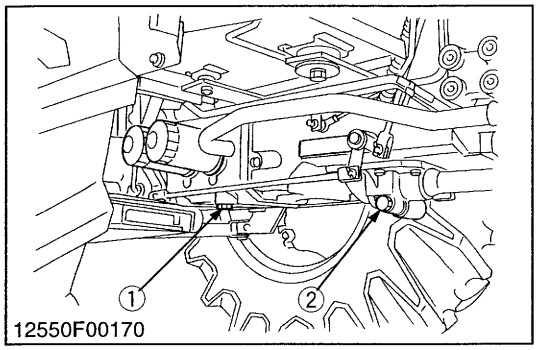
[2] BRAKE CASE
DISASSEMBLING AND ASSEMBLING
(1) Separating Rear Axle Case from Transmission Case



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Changing Transmission Fluid

1. Place an oil pan underneath the transmission case.
2. Remove the drain plugs (1) and (2).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1) and (2).

(When reassembling)

- Fill up from filling port after removing the filling plug until reaching the gauge.
- After running the engine for few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

Transmission fluid	Capacity	ROPS	40.0 L 42.3 U.S.qts. 35.2 Imp.qts.
		CAB	43.0 L 45.4 U.S.qts. 37.8 Imp.qts.

■ IMPORTANT

- **Use only KUBOTA SUPER UDT fluid. Use of other fluides may damage the transmission or hydraulic system.**
- **Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)**
- **Do not mix different brands oil together.**

(1) Drain Plug (2) Drain Plug (4WD Only)

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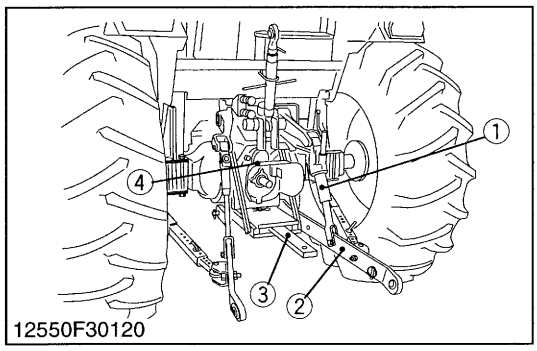

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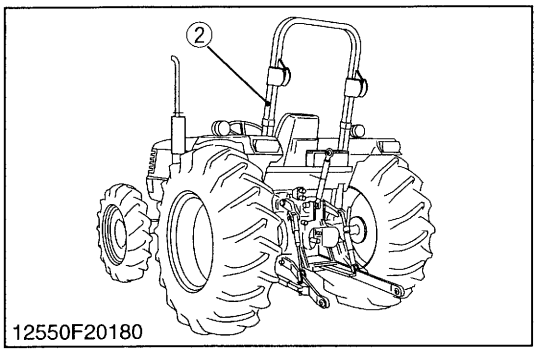
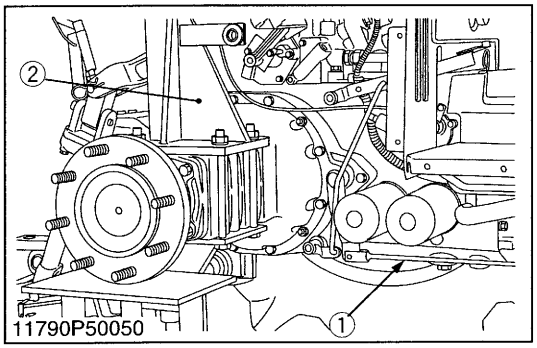
Lift Rods and Lower Links

1. Remove the lift rods (1).
2. Remove the lower links (2) with stabilizer.
3. Remove the draw bar (3).
4. Remove the PTO shaft cover (4).

(1) Lift Rod (3) Draw Bar
(2) Lower Link (4) PTO Shaft Cover

12550S30050





Rear Wheel, Fender and Foldable ROPS

1. Check the rear axle and transmission case are securely mounted on the disassembly stands.
2. Loosen the rear wheel mounting nuts.
3. Take out the rear wheel.
4. Remove the brake rod (1).
5. Disconnect the jumper leads for hazard and tail lights.
6. Disconnect the jumper leads for PTO safety switch. (If removing the right side fender.)
7. Remove the auxiliary control valve lever assembly.
8. Remove the fender mounting screws and nuts.
9. Remove the fender.
10. Remove the foldable ROPS (2).

(When reassembling)

Tightening torque	Foldable ROPS mounting screw	M16, grade 9 screw	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs
	Rear wheel mounting nut		260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs

(1) Brake Rod (2) Foldable ROPS

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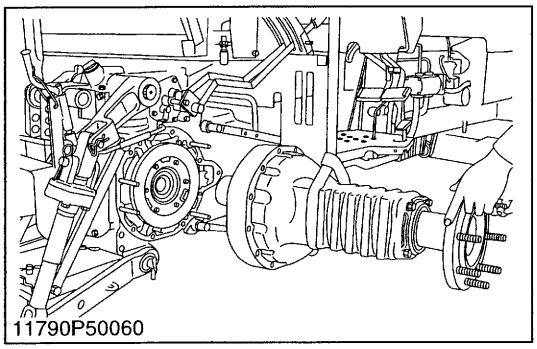

Rear Axle Case

1. Remove the DT shift rod. (If separating left side.)
2. Remove the differential lock rod. (If separating right side.)
3. Remove the auxiliary control valve. (If separating right side.)
4. Remove the rear axle case mounting screws and nuts.
5. Support the rear axle case with nylon lift strap and hoist.
6. Separate the rear axle case from transmission case.

(When reassembling)

- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the rear axle case and transmission case, after eliminate the water, oil and stuck liquid gasket.

Tightening torque	Rear axle case mounting screw and nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

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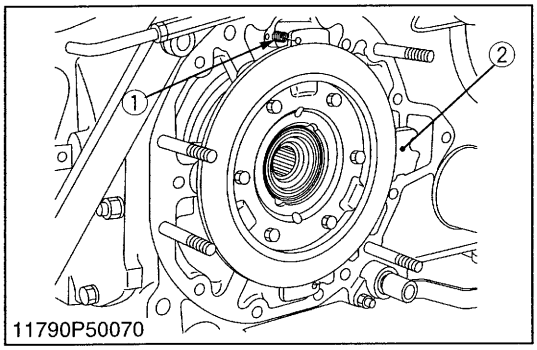

Brake Cam Plate

1. Remove the return spring (1).
2. Remove the brake cam plate (2).

(When reassembling)

- Apply grease to the brake ball seats. (Do not grease excessively.)

(1) Return Spring (2) Brake Cam Plate

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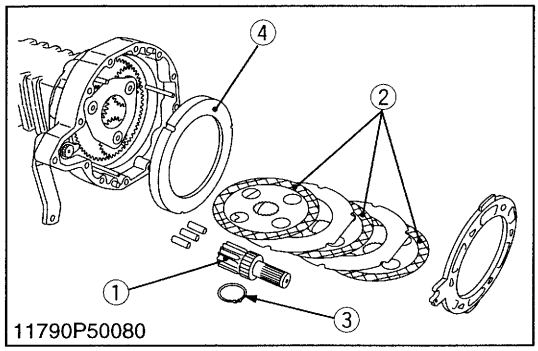

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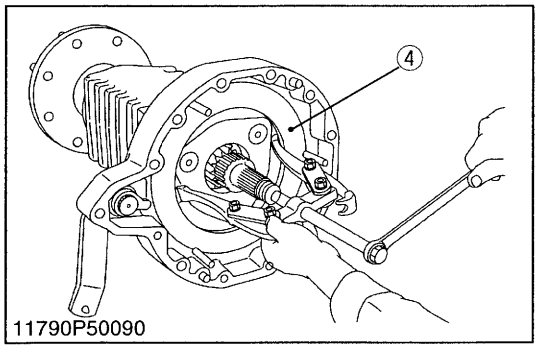

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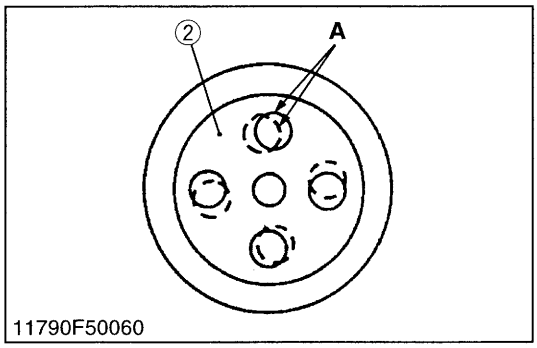

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Brake Shaft, Brake Disc and Brake Plate

1. Draw out the brake shaft (1) with brake disc (2).
2. Remove the external snap ring (3).
3. Remove the brake plate (4) with a puller.

(When reassembling)

- Place the brake discs (2) so that the hole **"A"** of the second disc should be overlapped 50 % or more.

(1) Brake Shaft
(2) Brake Disc
(3) External Snap Ring
(4) Brake Plate

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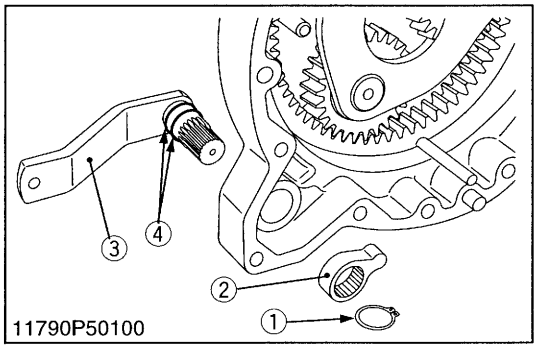

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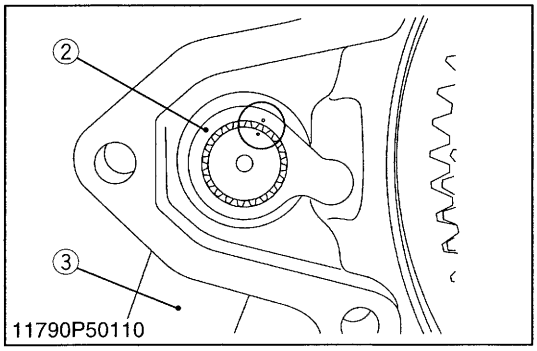

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Brake Cam and Brake Cam Lever

1. Remove the external snap ring (1).
2. Remove the brake cam (2) and brake cam lever (3).

(When reassembling)

- Apply grease to the O-ring (4) and take care not to damage the O-ring.

■ IMPORTANT

- **Install the brake cam (2) to brake cam lever, aligning the marks on them.**

(1) External Snap Ring
(2) Brake Cam
(3) Brake Cam Lever
(4) O-ring

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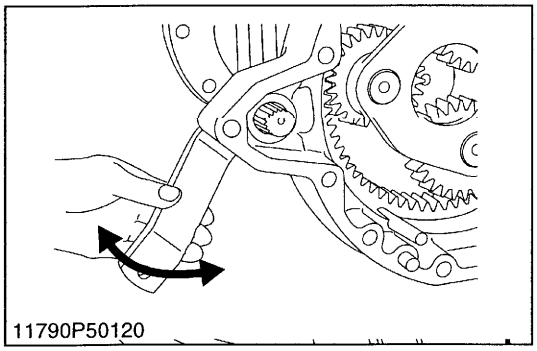
SERVICING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Brake Cam Lever Movement

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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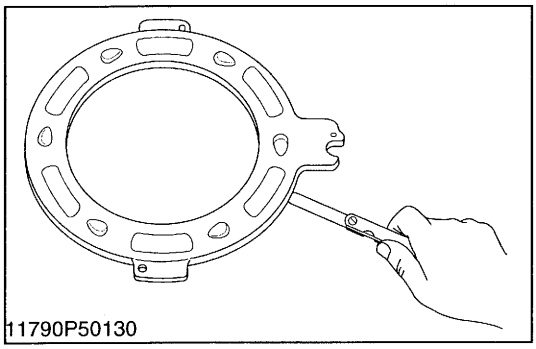
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Cam Plate Flatness

1. Place the cam plate on the surface plate.
2. Measure the flatness of cam plate with a feeler gauge at four points on a diagonal line.
3. If the measurement exceeds the allowable limit, replace it.

Cam Plate Flatness	Allowable limit	0.3 mm 0.012 in.

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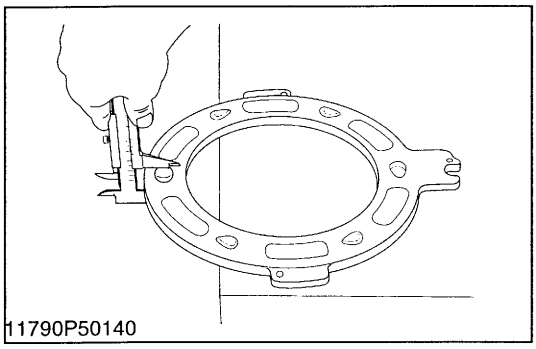
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Height of Cam Plate and Ball

1. Measure the dimensions of the cam plate with the ball installed.
2. If the measurement is less than the allowable limit, replace the cam plate and balls.
3. Inspect the ball holes of cam plate for uneven wear. If the uneven wear is found, replace it.

Height of cam plate and ball	Factory spec.	22.45 to 22.55 mm 0.8839 to 0.8879 in.
	Allowable limit	22.00 mm 0.8661 in.

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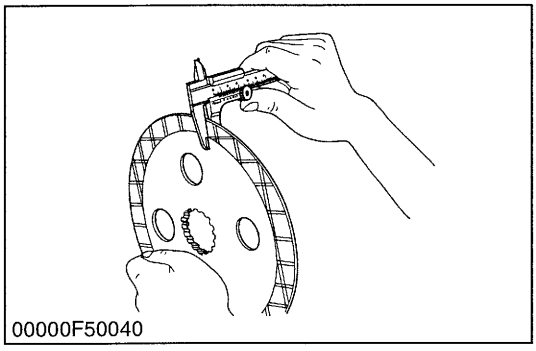
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Brake Disc Wear

1. Measure the brake disc thickness with vernier calipers.
2. If the measurement is less than the allowable limit, replace it.

Brake disc thickness	Factory spec.	4.15 to 4.35 mm 0.1634 to 0.1713 in.
	Allowable limit	3.3 mm 0.130 in.

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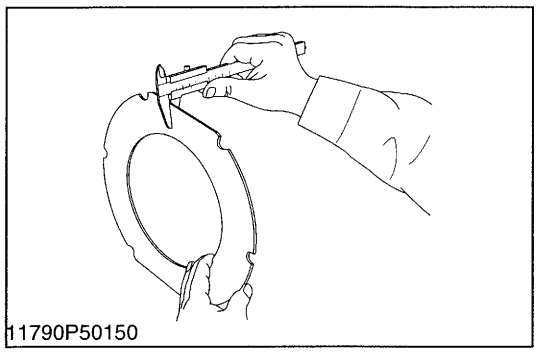
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Plate Wear

1. Measure the plate thickness with vernier calipers.
2. If the measurement is less than the allowable limit, replace it.

Plate thickness	Factory spec.	2.25 to 2.35 mm 0.0886 to 0.0925 in.
	Allowable limit	1.5 mm 0.059 in.

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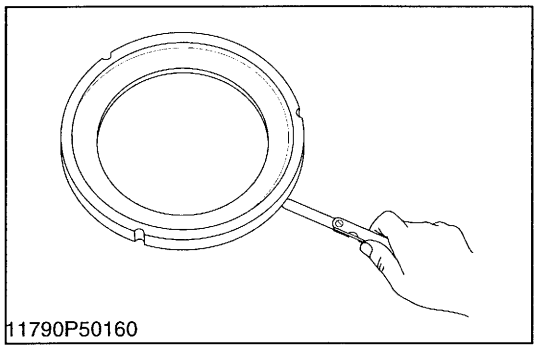
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Brake Plate Flatness

1. Place the brake plate on the surface plate.
2. Measure the flatness of brake plate with a feeler gauge at four points on a diagonal line.
3. If the measurement exceeds the allowable limit, replace it.

Brake Plate Flatness	Allowable limit	0.3 mm 0.012 in.

11790S50210

6 FRONT AXLE

6 FRONT AXLE

MECHANISM

CONTENTS

[1] STRUCTURE

The front axle supports the front of tractor and facilitates steering.

There are two kinds of front axles.

The two-wheel drive axle has free-running front wheels and the four-wheel drive axle has powered front wheels.

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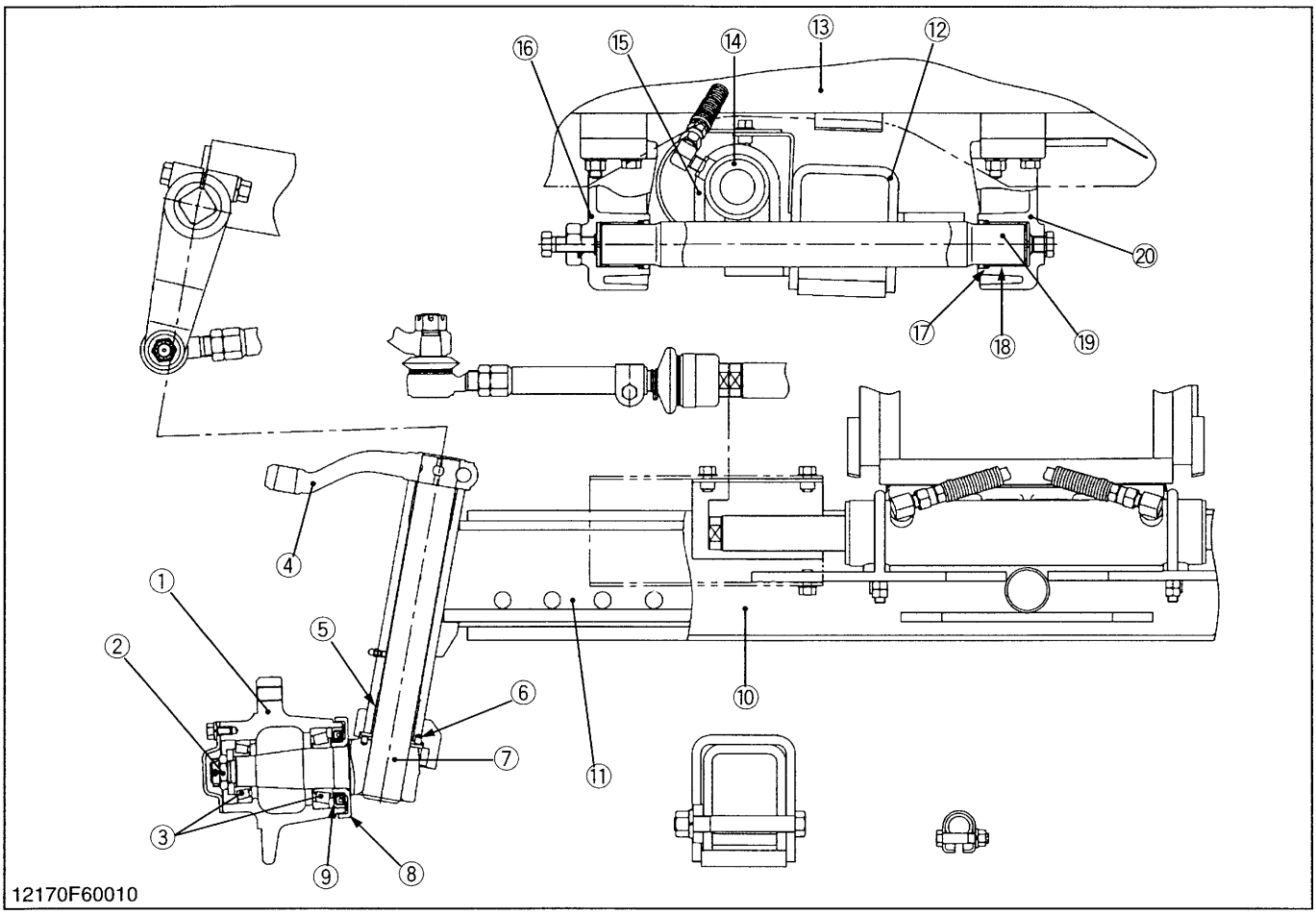
(1) 2 Wheel Drive Type



(1) Front Wheel Hub
(2) Slotted Nut
(3) Taper Roller Bearing
(4) Knuckle Arm
(5) Knuckle Shaft Bushing
(6) Knuckle Shaft Dowel Pin
(7) Knuckle Shaft
(8) Knuckle Dust Proof Cover
(9) Knuckle Stub Gasket
(10) Front Axle Middle
(11) Front Axle
(12) Front Axle Support
(13) Front Axle Bracket
(14) Power Steering Cylinder
(15) Power Steering Cylinder Bracket
(16) Bracket (Front)
(17) Oil Seal
(18) Bushing
(19) Center Pin
(20) Bracket (Rear)

The front axle of the 2WD type is constructed as shown above.

The knuckle shaft (7) is installed to the front axle (11) by the **"RUMOAN"** method.

With this method, the shape of the front axle is relatively simple, and front axle is supported at its center with the front axle support (12) on the front axle bracket (13), so that steering operation is stable even on an uneven ground encountered in a farm field.

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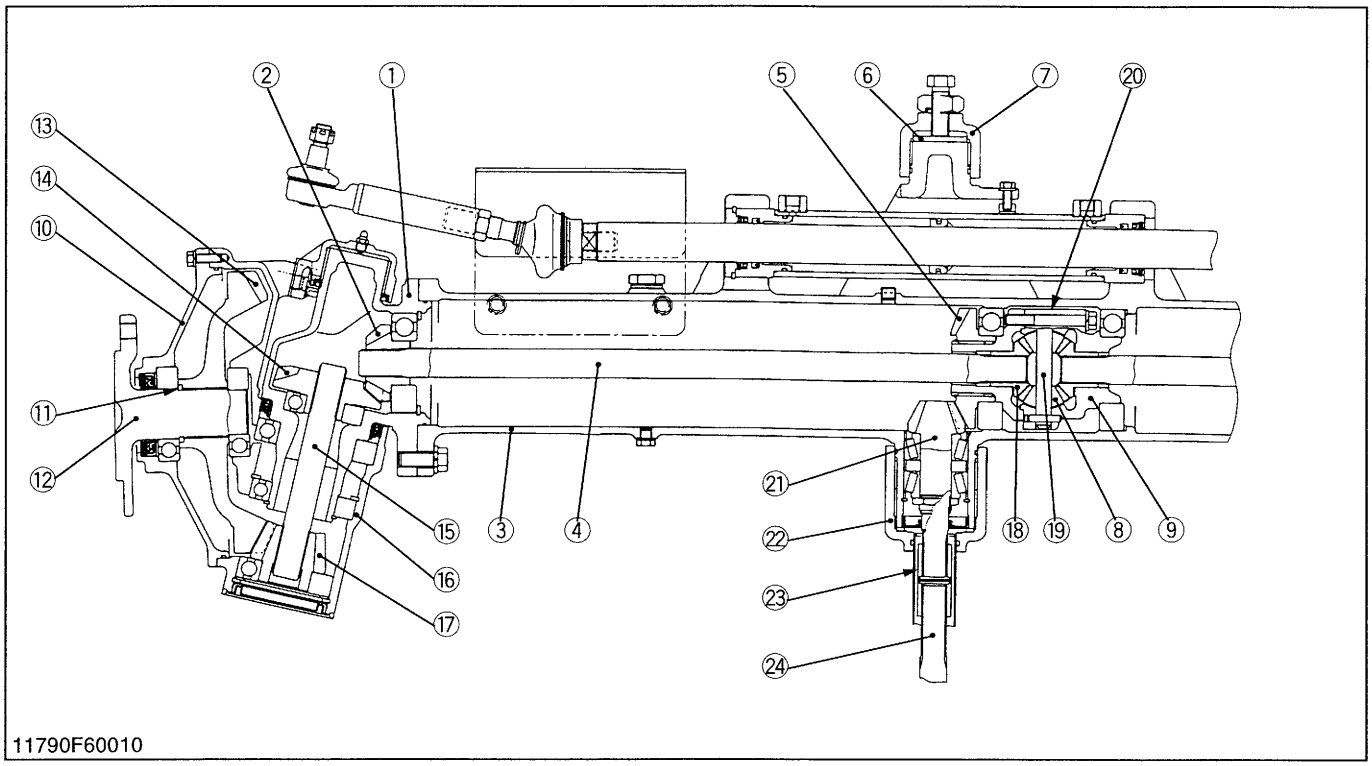
(2) 4 Wheel Drive Type



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(1) Bevel Gear Case
(2) Bevel Gear
(3) Front Axle Case
(4) Differential Yoke Shaft
(5) Spiral Bevel Gear
(6) Collar
(7) Front Axle Bracket, Front
(8) Differential Pinion
(9) Differential Case
(10) Axle Flange
(11) Collar
(12) Axle
(13) Bevel Gear
(14) Bevel Gear
(15) Bevel Gear Shaft
(16) Front Gear Case
(17) Bevel Gear
(18) Differential Side Gear
(19) Pinion Shaft
(20) Differential Assembly
(21) Spiral Bevel Pinion Shaft
(22) Front Axle Bracket, Rear
(23) Coupling
(24) Propeller Shaft

The front axle of the 4WD is constructed as shown above. Power is transmitted from the transmission through the propeller shaft (24) and to the spiral bevel pinion shaft (21), then to the spiral bevel gear (5) after that to the differential gear.

The power through the differential is transmitted to the differential yoke shaft (4), and to the bevel gear shaft (15) in the bevel gear case (1).

The revolution is greatly reduced by the bevel gears (17), (13), then the power is transmitted to the axle (12).

The differential system allows each wheel to rotate at a different speed to make turning easier.

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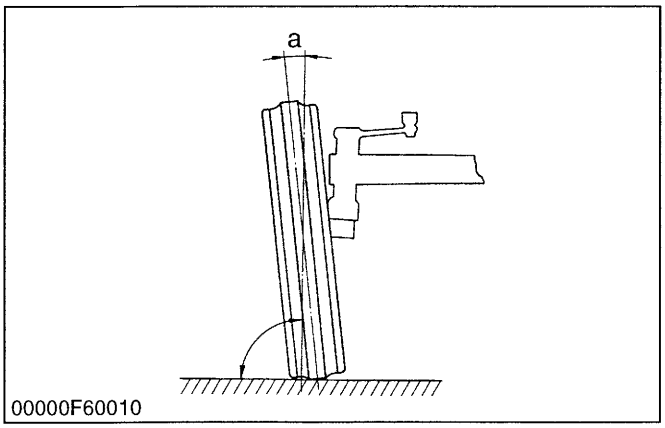
[2] FRONT WHEEL ALIGNMENT

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.



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■ 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	2WD	0.035 rad. 2°
	4WD	0.035 rad. 2°

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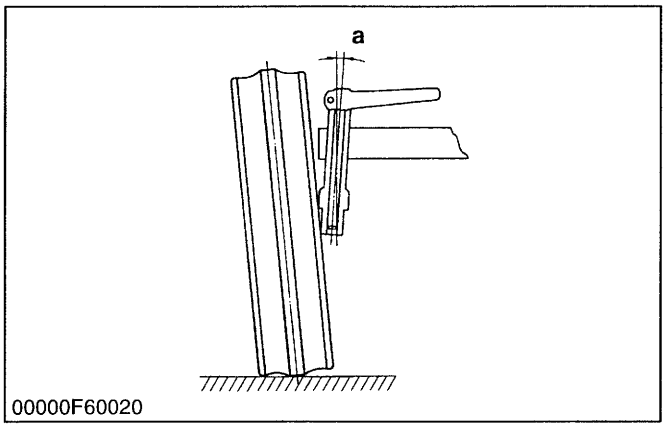

■ Kingpin Angle

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	0.175 rad. 10 °
	4WD	0.218 rad. 12.5 °

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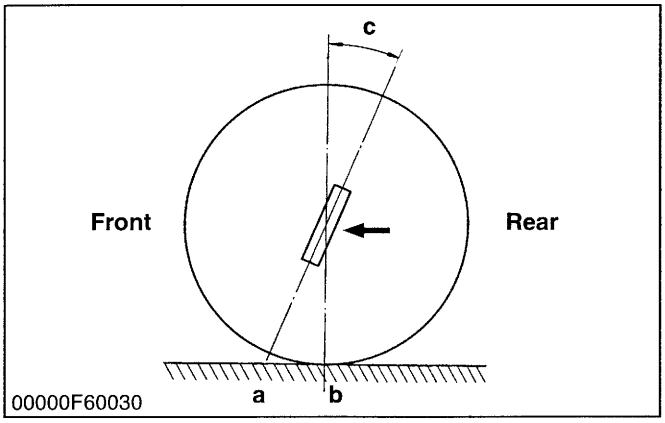

■ Caster

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	2WD	0.035 rad. 2 °
	4WD	0.026 rad. 1.5 °

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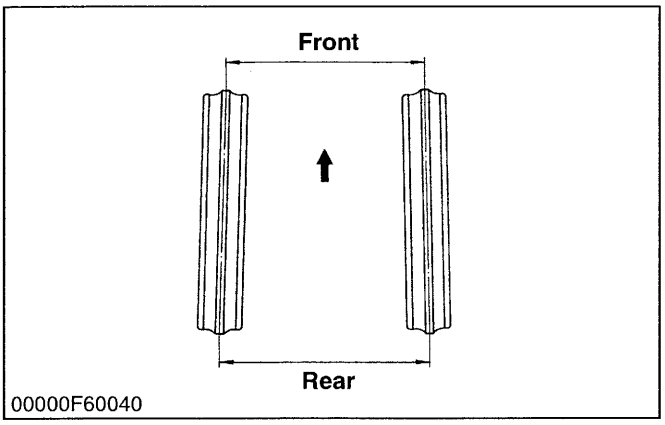

■ Toe-in

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	2WD	1 to 5 mm 0.04 to 0.20 in.
	4WD	2 to 8 mm 0.08 to 0.32 in.

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SERVICING

CONTENTS

TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Front Wheels Wander to Right or Left	• Tire pressure uneven	Adjust	G-50
	• Improper toe-in adjustment (improper alignment	Adjust	6-S5
	• Clearance between front axle case boss and front axle bracket (front, rear) bushing excessive [4WD Type]	Replace	6-S19
	• Front axle rocking force too small	Adjust	6-S6
	• Front wheel sway excessive	Replace	6-S5
	• Tie-rod end loose	Tighten	6-S9, S10
	• Air sucked in power steering circuit	Bleed	7-S7
	• Knuckle shaft bushings worn [2WD Type]	Replace	6-S16
Front Wheels Can Not Be Driven [4WD Type]	• Propeller shaft broken	Replace	6-S8
	• Front wheel drive gears in transmission broken	Replace	–
	• Front differential gear broken	Replace	6-S11 to S16
	• Shift fork broken	Replace	–
	• Coupling displaced	Reassemble	6-S8
Noise [4WD Type]	• Gear backlash excessive	Adjust or replace	6-S17, S18
	• Oil insufficient	Replenish	G-15
	• Bearings damaged or broken	Replace	–
	• Gears damaged or broken	Replace	–
	• Spiral bevel pinion shaft turning force improper	Adjust	6-S14

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SERVICING SPECIFICATIONS

2WD TYPE

Item		Factory Specification	Allowable Limit
Front Wheel Alignment	Toe-in	1 to 5 mm 0.04 to 0.20 in.	–
Front Wheel	Steering Angle	0.925 to 0.960 rad. 53 to 55°	–
	Axial Sway	5.0 mm 0.196 in.	–
	Radial Sway	5.0 mm 0.197 in.	–
Front Axle Middle Boss to Bushing	Clearance	0.050 to 0.15 mm 0.00197 to 0.00590 in.	0.35 mm 0.0138 in.
Front Axle Middle Boss	O.D.	39.998 to 40.000 mm 1.57236 to 1.57480 in.	–
Bushing	I.D.	40.050 to 40.088 mm 1.57677 to 1.57827 in.	–

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2WD TYPE (Continued)

Item		Factory Specification	Allowable Limit
Knuckle Shaft to Bushing	Clearance	0.020 to 0.125 mm 0.00079 to 0.00492 in.	0.35 mm 0.0138 in.
Knuckle Shaft	O.D.	37.975 to 38.000 mm 1.49508 to 1.49606 in.	–
Bushing	I.D.	38.020 to 38.100 mm 1.49685 to 1.50000 in.	–
Front Wheel Hub	Turning Torque	2.94 to 4.90 N·m 0.3 to 0.5 kgf·m 2.17 to 3.62 ft-lbs	–

4WD TYPE

Item		Factory Specification	Allowable Limit
Front Wheel Alignment	Toe-in	2 to 8 mm 0.08 to 0.32 in.	–
Front Wheel	Steering Angle	0.925 to 0.960 rad. 53 to 55°	–
	Axial Sway	5.0 mm 0.196 in.	–
	Radial Sway	5.0 mm 0.196 in.	–
Differential Case, Differential Case Cover to Differential Side Gear	Clearance	0.04 to 0.123 mm 0.00157 to 0.00484 in.	0.20 mm 0.0079 in.
Differential Case	I.D.	32.000 to 32.062 mm 1.25984 to 1.26228 in.	–
Differential Case Cover	I.D.	32.000 to 32.062 mm 1.25984 to 1.26228 in.	–
Differential Side Gear	O.D.	31.939 to 31.960 mm 1.25744 to 1.25827 in.	–
Pinion Shaft to Differential Pinion	Clearance	0.064 to 0.100 mm 0.00252 to 0.00394 in.	0.25 mm 0.0096 in.
Pinion Shaft	O.D.	13.950 to 13.968 mm 0.54921 to 0.54992 in.	–
Differential Pinion	I.D.	14.032 to 14.050 mm 0.55244 to 0.55315 in.	–

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4WD TYPE (Continued)

Item		Factory Specification	Allowable Limit
Differential Pinion to Differential Side Gear	Backlash	0.2 to 0.3 mm 0.008 to 0.012 in.	0.4 mm 0.016 in.
Spiral Bevel Pinion Shaft	Turning Torque	0.98 to 1.18 N·m 0.10 to 0.12 kgf·m 0.72 to 0.87 ft-lbs	–
Spiral Bevel Pinion Shaft to Spiral Bevel Gear	Backlash	0.2 to 0.3 mm 0.008 to 0.012 in.	0.4 mm 0.016 in.
10T Bevel Gear to 17T Bevel Gear	Backlash	0.15 to 0.35 mm 0.00559 to 0.0138 in.	0.6 mm 0.025 in.
9T Bevel Gear to 43T Bevel Gear	Backlash	0.25 to 0.35 mm 0.0098 to 0.0138 in.	0.6 mm 0.025 in.
Front Axle Case Boss (Front) to Bracket Bushing	Clearance	0.025 to 0.160 mm 0.00098 to 0.00630 in.	0.35 mm 0.0138 in.
Front Axle Case Boss (Front)	O.D.	49.950 to 49.975 mm 1.96653 to 1.96752 in.	–
Bushing	I.D.	50 000 to 50.110 mm 1.96850 to 1.97283 in.	–
Front Axle Case Boss (Rear) to Bracket Bushing	Clearance	0.025 to 0.190 mm 0.00098 to 0.00748 in.	0.35 mm 0.0138 in.
Front Axle Case Boss (Rear)	O.D.	70.000 to 70.035 mm 2.75590 to 2.75728 in.	–
Bushing	I.D.	70.060 to 70.190 mm 2.75826 to 2.76338 in.	–
Press-fitting	Depth of bushing	12.0 to 13.0 mm 0.47 to 0.51 in.	–
Bevel Gear Case Boss to Front Axle Support Bushing	Clearance	0.060 to 0.220 mm 0.00236 to 0.00866 in.	0.50 mm 0.0197 in.
Bevel Gear Case Boss	O.D.	54.970 to 55.000 mm 2.16417 to 2.16535 in.	–
Front Axle Support Bushing	I.D.	55.060 to 55.190 mm 2.16772 to 2.17283 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-10.)

2WD TYPE

Item	N·m	kgf·m	ft-lbs
Front axle rocking force adjusting screw	19.6 to 29.4	2.0 to 3.0	14.5 to 21.7
Front axle rocking force adjusting lock nut	98.1 to 147.1	10.0 to 15.0	72.3 to 108.5
Power steering hose retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Front wheel mounting nut	166.7 to 196.1	17.0 to 20.0	122.9 to 144.6
Front axle bracket mounting nut	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Front axle bracket mounting screw	103.0 to 117.7	10.5 to 12.0	75.9 to 86.8
Front wheel hub slotted nut	29.4 to 39.2	3.0 to 4.0	21.7 to 28.9
Tie-rod end nut	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Knuckle arm mounting screw and nut	123.5 to 147.0	12.6 to 15.0	91.1 to 108.5
Steering cylinder mounting nut	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Steering cylinder mounting lock nut	39.2 to 45.1	4.0 to 4.6	28.9 to 33.3
Cylinder cover mounting screw	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2

4WD TYPE

Item	N·m	kgf·m	ft-lbs
Front axle rocking force adjusting screw	19.6 to 29.4	2.0 to 3.0	14.5 to 21.7
Front axle rocking force adjusting lock nut	98.1 to 147.1	10.0 to 15.0	72.3 to 108.5
Power steering hose retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Cylinder cover	48.1 to 55.8	4.9 to 5.7	33.5 to 41.2
Front wheel mounting nut	166.7 to 196.1	17.0 to 20.0	122.9 to 144.6
Front bracket mounting screw	103.0 to 1177	10.5 to 12.0	75.9 to 86.8
Front bracket mounting nut	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Tie-rod end nut	156.9 to 176.5	16.0 to 18.0	115.7 to 130.2
Bevel gear case mounting screw	166.7 to 196.1	17.0 to 20.0	122.9 to 144.6
Axle flange mounting screw	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
Tie-rod joint and steering cylinder mounting screw	166.7 to 196.1	17.0 to 20.0	122.9 to 144.6
Differential case cover mounting screw	60.8 to 70.6	6.2 to 7.2	44.8 to 52.1

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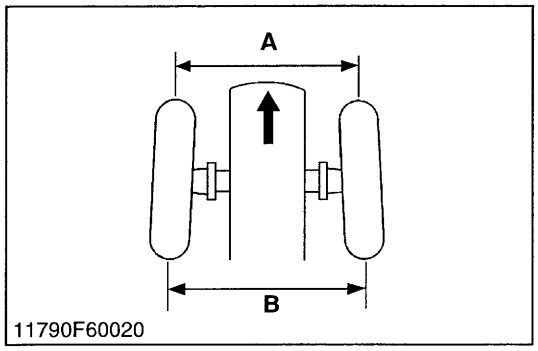
KiSC issued 03, 2020 A

CHECKING, DISASSEMBLING AND SERVICING

CHECKING AND ADJUSTING



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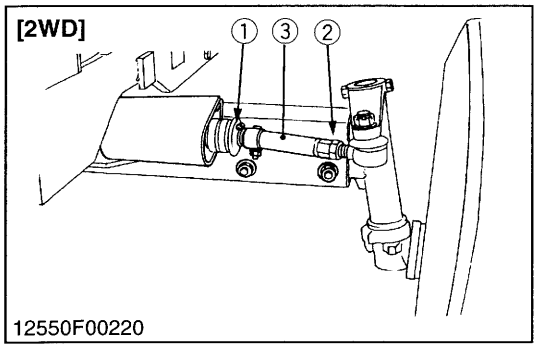
Toe-in

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.	2WD	1 to 5 mm 0.04 to 0.20 in.
		4WD	2 to 8 mm 0.08 to 0.32 in.



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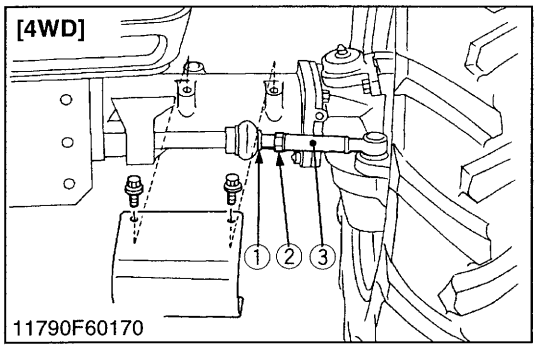
■ Toe-in Adjustment

1. Detach the snap ring (1).
2. Loosen the tie-rod nut (2).
3. Turn the tie-rod joint (3) to adjust the rod length until the proper toe-in measurement is obtained.
4. Retighten the tie-rod nut (2).
5. Attach the snap ring (1) of the tie-rod joint (3).

(1) Snap Ring
(2) Tie-rod Nut
(3) Tie-rod Joint



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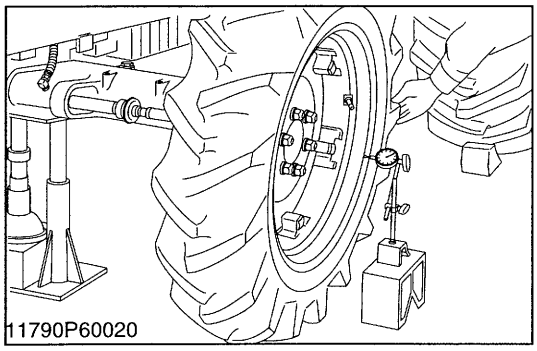
Axial Sway of Front Wheel

1. Jack up the front side of tractor.
2. Set a dial gauge on the outside of rim.
3. Turn the wheel slowly and read the runout of rim.
4. If the measurment exceeds the factory specifications, check the bearing, rim and front wheel hub.

Axial sway of front wheel	Factory spec.	Less than 5.0 mm 0.197 in.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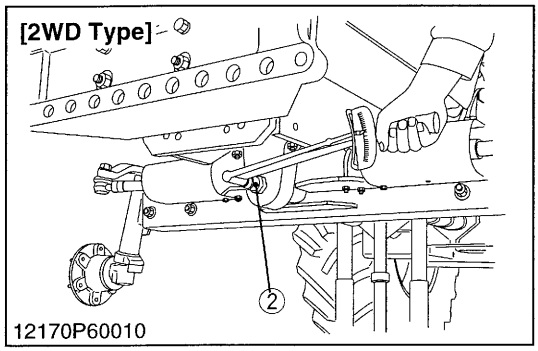

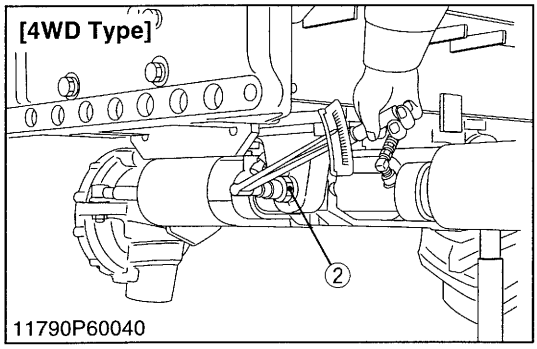

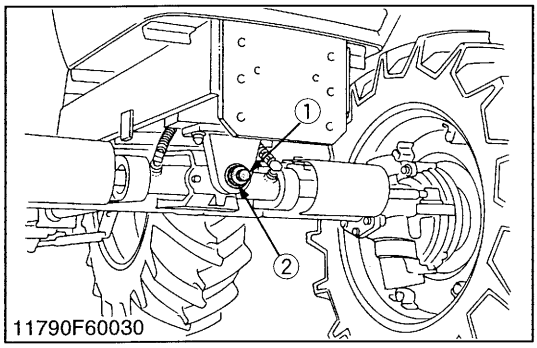

Adjusting Front Axle Pivot

1. Jack up the tractor body, then loosen the lock nut (2).
2. Measure the adjusting screw tightening torque.
3. If tightening torque is not within the factory specifications, adjust the adjusting screw (1).
4. After adjustment, tighten the lock nut firmly.

Tightening torque	Front axle adjusting screw	19.6 to 29.4 N·m 2.0 to 3.0 kgf·m 14.5 to 21.7 ft-lbs
	Lock nut	98.1 to 147.1 N·m 10.0 to 15.0 kgf·m 72.3 to 108.5 ft-lbs

(1) Adjusting Screw
(2) Lock Nut

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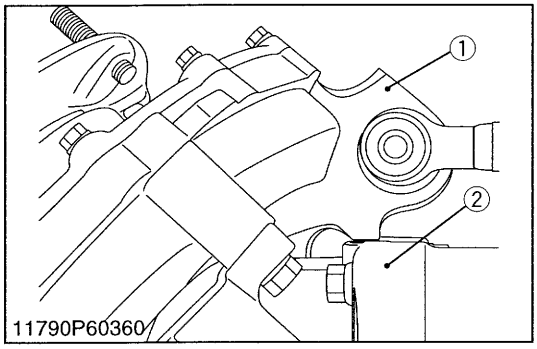

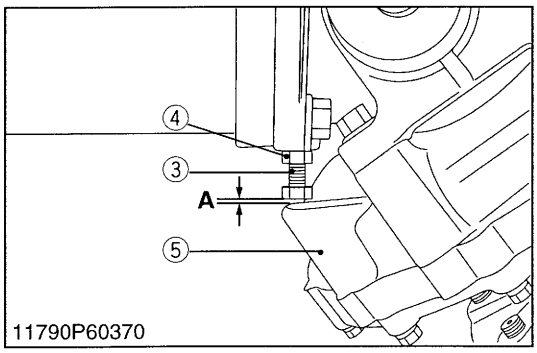

Front Wheel Steering Angle (4WD Only)

1. Inflate the tires to the specified pressure.
2. Steer the wheels to the extreme right until the front gear case (1) contacts with the bevel gear case (2) at right hand side of the front axle.
3. If the front gear case (1) can not be contacted with the bevel gear case (2), shorten the length of stopper (3).
4. Keeping the front gear case (1) contact with the bevel gear case (2), make a specified clearance **(A)** as shown in the lower table.
5. After adjustment, secure the stopper with the lock nut (4).
6. For adjusting the left steering angle, perform the same procedure as mentioned in right steering angle.

Clearance **(A)** between bevel gear case and stopper	Factory spec.	1.0 to 3.0 mm 0.04 to 0.12 in.

(1) Front Gear Case
(2) Bevel Gear Case
(3) Stopper
(4) Lock Nut
(5) Front Gear Case
(A) Clearance

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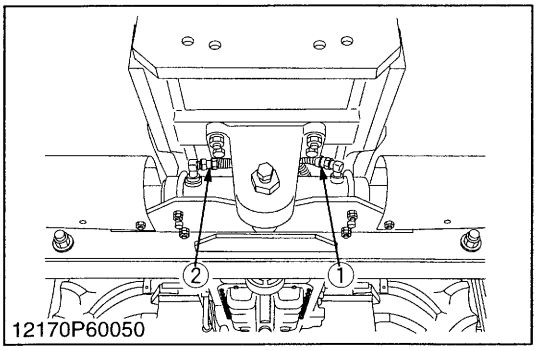
DISASSEMBLING AND ASSEMBLING

(1)-1 Separating Front Axle (2WD Type)



Front Wheel and Power Steering Hoses

1. Check the front axle and engine are securely mounted on the disassembly stand.
2. Loosen the front wheel mounting nuts.
3. Lift the front axle and remove the front wheels.
4. Disconnect the delivery hoses.

(When reassembling)

Tightening torque	Power steering hose retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft-lbs
	Front wheel mounting nut	166.7 to 196.1 N·m 17.0 to 20.0 kgf·m 122.9 to 144.6 ft-lbs

(1) Power Steering Hose 1 (2) Power Steering Hose 2

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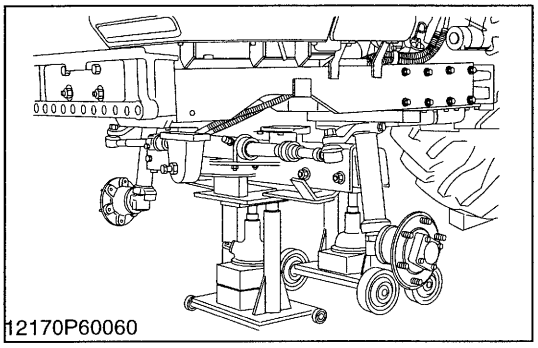

Front Axle

1. Place a disassembly stand under the front axle case and support it with a jack.
2. Remove the bracket (front) mounting screws and nuts.
3. Remove the bracket (rear) mounting screws and nuts.
4. Separating the front axle from front axle bracket.

(When reassembling)

Tightening torque	Bracket mounting nut	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Bracket mounting screw	103 to 117 N·m 10.5 to 12.0 kgf·m 75.9 to 86.8 ft-lbs

■ IMPORTANT

- **Be sure to adjust the front axle rocking force.**

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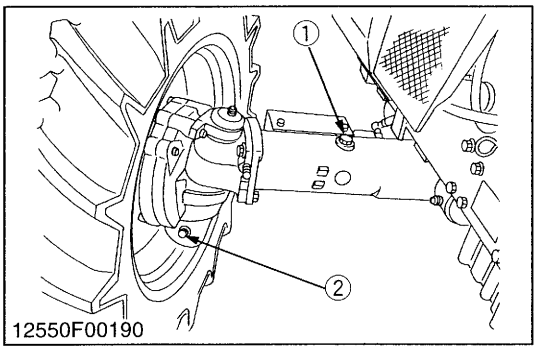
(1)-2 Separating Front Axle (4WD Type)



Draining Front Axle Case Oil

1. Place oil pans underneath the front axle case.
2. Remove the drain plug (1) both sides and filling port plug (2) to drain the oil.
3. After filling, reinstall the filling plugs (1) and filling port plug (2).

(When reassembling)

- Remove the filling port plug (2).
- Fill with the new oil.
- After filling, reinstall the filling port plug (2).

Capacity	Front axle case oil	8.0 L 8.5 U.S.qts. 7.0 Imp.qts.

■ IMPORTANT

- **Use KUBOTA SUPER UDT fluid or SAE80, 90 gear oil. Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9.)**

(1) Filling Plug (2) Drain Plug

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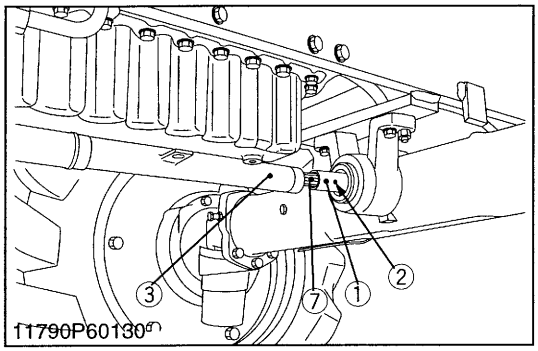
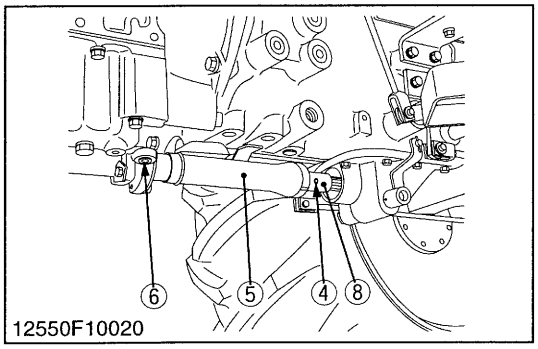




Propeller Shaft (4WD Only)

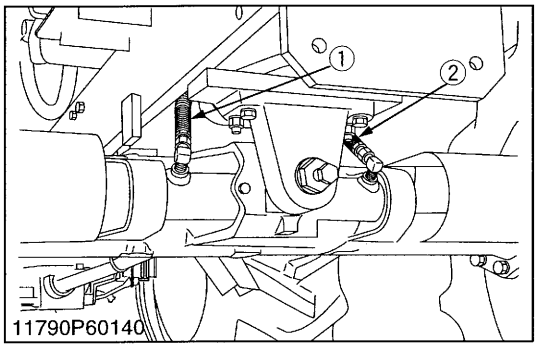
1. Slide the propeller shaft cover (3), (5) after removing the screws (6).
2. Tap out the spring pin (2), (4) and then slide the coupling (1), (8) to the front and rear.

(When reassembling)

- Apply grease to the spline of the propeller shaft (7).

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

12550S10130



Power Steering Hoses

1. Disconnect the power steering hoses (1), (2) from steering cylinder.
2. Remove the cylinder cover.

(When reassembling)

Tightening torque	Power steering hose retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft-lbs
	Cylinder cover	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs

(1) Power Steering Hose 1
(2) Power Steering Hose 2

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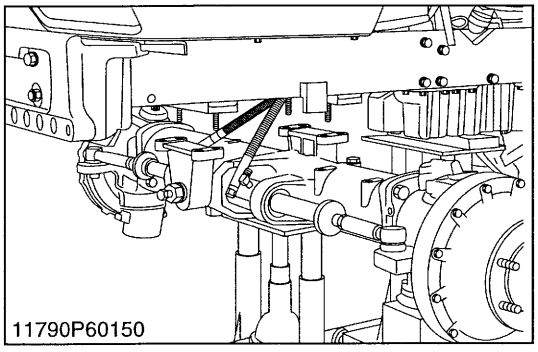

Front Wheel and Front Axle

1. Check the front axle and engine are securely mounted on the disassembly stand.
2. Loosen the front wheel mounting nuts.
3. Lift the front axle and remove the front wheels.
4. Remove the bracket (front) mounting screws and nuts.
5. Remove the bracket (rear) mounting screws and nuts.
6. Separate the front axle from front axle bracket.

(When reassembling)

Tightening torque	Front wheel mounting nut	166.7 to 196.1 N·m 17.0 to 20.0 kgf·m 122.9 to 144.6 ft-lbs
	Bracket mounting screw	103.0 to 117.7 N·m 10.5 to 12.0 kgf·m 75.9 to 86.8 ft-lbs
	Bracket mounting nut	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs

■ IMPORTANT

- **Be sure to adjust the front axle rocking force.**

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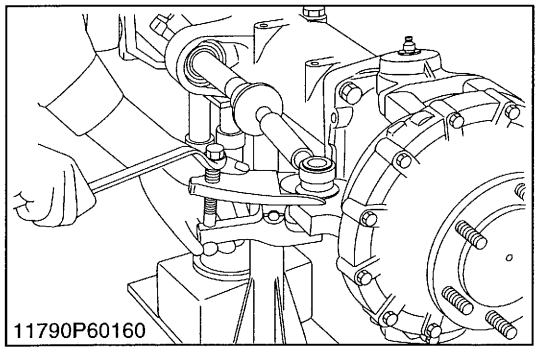
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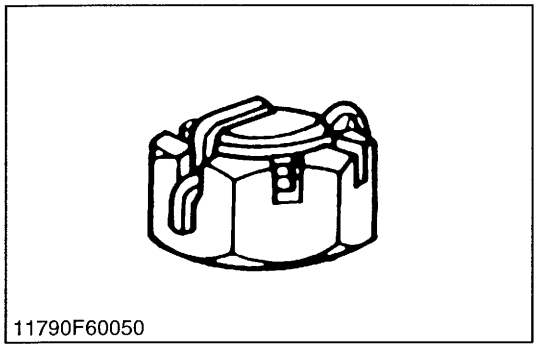
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Tie-rods

1. Pull out the cotter pin and remove the tie-rod end slotted nuts.
2. Remove the tie-rod with a tie-rod end lifter (Code No. 07909-39051).

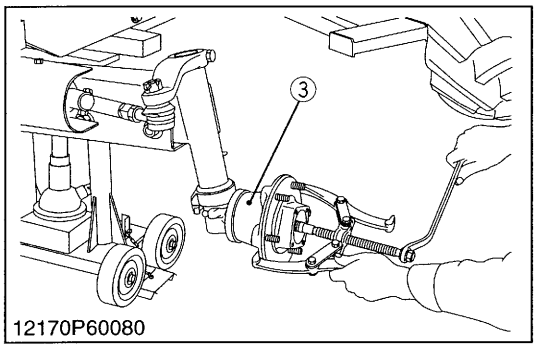
(When reassembling)

- After tightening the tie-rod end nut to the specified torques, install a cotter pin as shown in the figure left.

Tightening torque	Tie-rod end nut	156.9 to 176.5 N·m 16.0 to 18.0 kgf·m 115.7 to 130.2 ft-lbs

11790S60170

(2)-1 Disassembling Front Axle (2WD Type)



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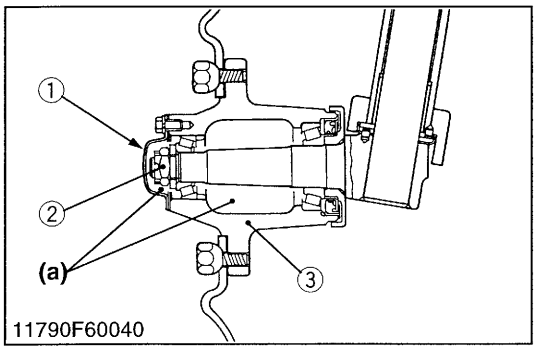

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Front Wheel Hub

1. Remove the front wheel cap (1).
2. Draw out the cutter pin.
3. Remove the slotted nut (2).
4. Remove the collar.
5. Remove the front wheel hub (3) with puller.

(When reassembling)

- Replace cotter pin with a new one.
- Apply grease to the oil seal and bearing in the front wheel hub.

Tightening torque	Front wheel hub slotted nut	29.4 to 39.2 N·m 3.0 to 4.0 kgf·m 21.7 to 28.9 ft-lbs

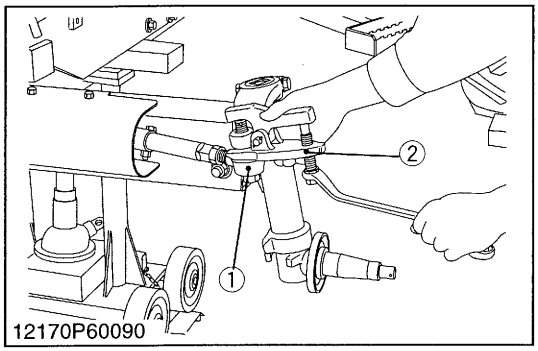
■ IMPORTANT

- **After tightening the slotted nut to the specified torque, measure the front wheel hub turning torque.**
- **If the measurement is not within the factory specifications, adjust with the slotted nut.**

Front wheel hub turning torque	Factory spec.	2.94 to 4.90 N·m 0.3 to 0.5 kgf·m 2.17 to 3.62 ft-lbs

(1) Front Wheel Cap
(2) Slotted Nut
(3) Front Wheel Hub
(a) Grease

12170S60250



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Tie-rod

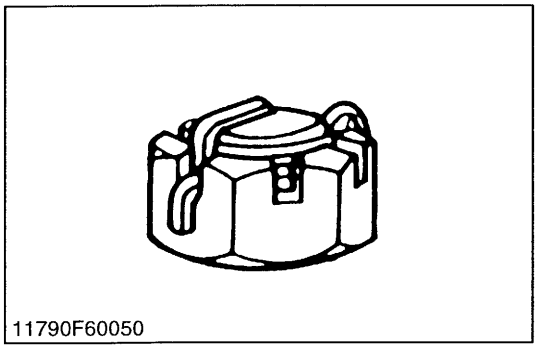
1. Pull out the cotter pin and loosen the tie-rod end nut.
2. Disconnect the tie-rod (1) with a tie-rod end lifter (2) (Code No. 07909-39051).
3. Remove the tie-rod end nut and tie-rod end.

(When reassembling)

- After tightening the tie-rod end nut to the specified torques, install a cotter pin as shown in the figure.

Tightening torque	Tie-rod end nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs

(1) Tie-rod
(2) Tie-rod End Lifter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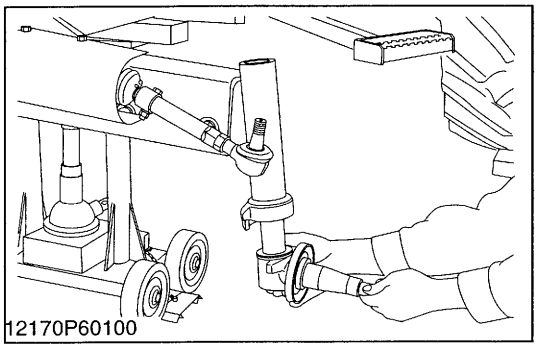

12170P60100

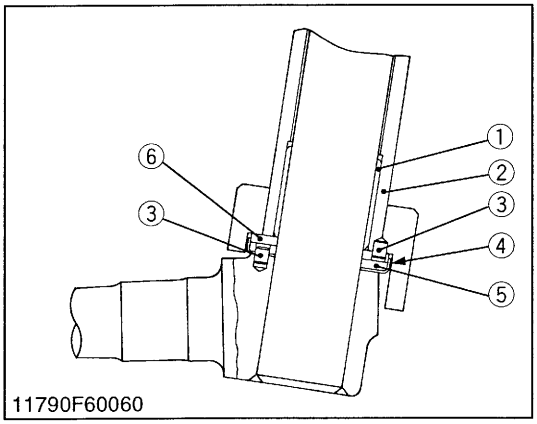
Knuckle Shaft

1. Remove the knuckle arm and draw out the knuckle shaft from the front axle.

(When reassembling)

- Assemble the knuckle shaft, making sure that the hole of the thrust collars (5), (6) at properly fitted to the knuckle shaft dowel pins (3).
- When lift the knuckle shaft, the knuckle arms must be mounted so that the clearance between the knuckle arms and front axle is 0.3 to 1.0 mm (0.012 to 0.039 in.).

Tightening torque	Knuckle arm mounting screw and nut	123.5 to 147.0 N·m 12.6 to 15.0 kgf·m 91.1 to 108.5 ft-lbs



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(1) Knuckle Shaft Bushing
(2) Front Axle
(3) Dowel Pin
(4) Thrust Collar Cap
(5) Thrust Collar 1
(6) Thrust Collar 2

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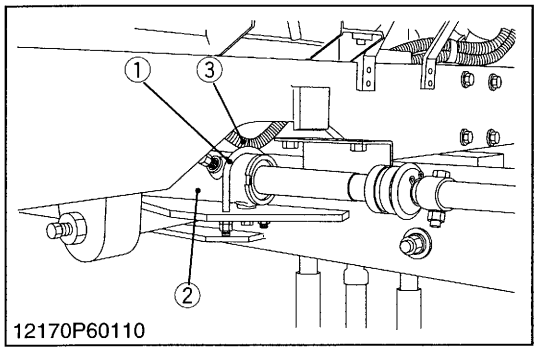


Steering Cylinder

1. Remove the cylinder cover.
2. Disconnect the power steering hoses (3).
3. Remove the cylinder clamps (1).
4. Take out the steering cylinder (2).

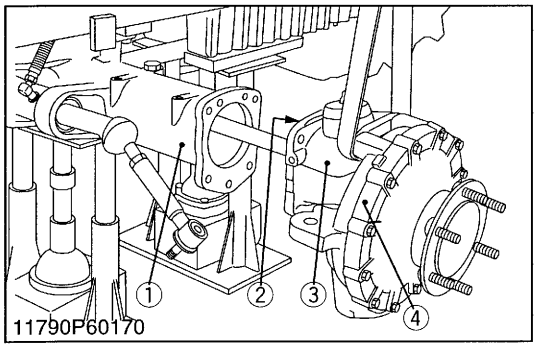
(When reassembling)

Tightening torque	Steering cylinder mounting nut	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs
	Steering cylinder mouknting lock nut	39.2 to 45.1 N·m 4.0 to 4.6 kgf·m 28.9 to 33.3 ft-lbs
	Cylinder cover mounting screw	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs

(1) Cylinder Clamp
(2) Steering Cylinder
(3) Power Steering Hose

12170S60280

(2)-2 Disassembling Front Axle (4WD Type)



Bevel Gear Case and Front Gear Case

1. Remove the bevel gear case mounting screws.
2. Remove the bevel gear case (3) and front gear case (4) as a unit from the front axle case (1).

(When reassembling)

- Apply grease to the O-ring (2) and take care not to damage it.
- Do not interchange right and left bevel gear case assemblies.

Tightening torque	Bevel gear case mounting screw	166.7 to 196.1 N·m 17.0 to 20.0 kgf·m 122.9 to 144.6 ft-lbs

(1) Front Axle Case
(2) O-ring
(3) Bevel Gear Case
(4) Front Gear Case

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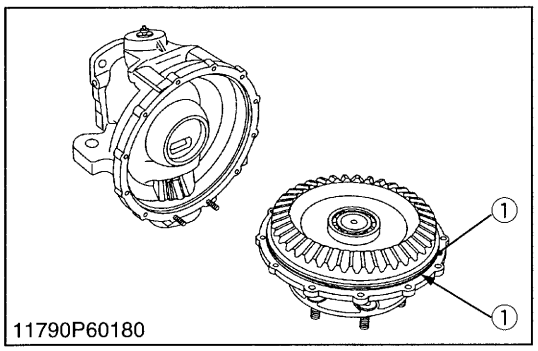

Axle Flange and Front Gear Case

1. Remove the axle flange mounting screws.
2. Remove the axle flange (1).

(When reassembling)

- Apply grease to the O-ring (2) of axle flange.
- Tighten the axle flange mounting screws and nuts diagonally in several steps.

Tightening torque	Axle flange mounting screw	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs

(1) Axle Flange
(2) O-ring

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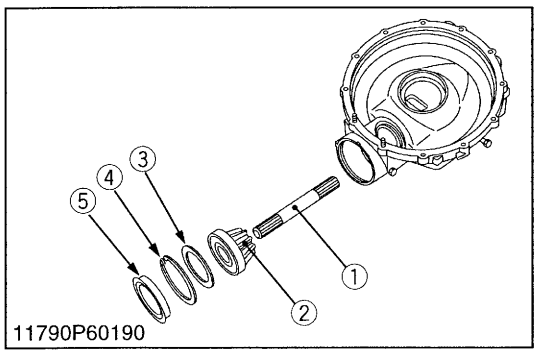

Bevel Gear and Bevel Gear Shaft

1. Remove the plug (5).
2. Remove the internal snap ring (4) and shim (3).
3. Tap out the bevel gear (2) with ball bearing.
4. Draw out the bevel gear shaft (1).

(1) Bevel Gear Shaft
(2) Bevel Gear
(3) Shim
(4) Internal Snap Ring
(5) Plug

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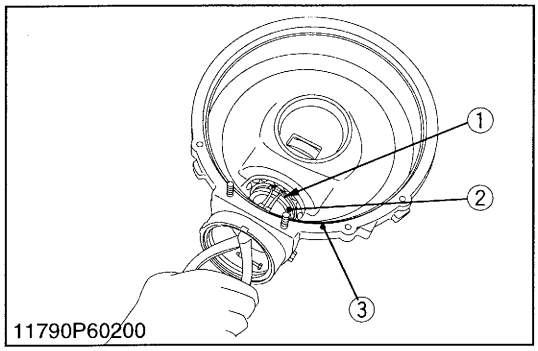

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Bevel Gear Case

1. Remove the external snap ring (1).
2. Tap the bevel gear case (2) and separate it from the front gear case (3).

(1) External Snap Ring
(2) Bevel Gear Case
(3) Front Gear Case

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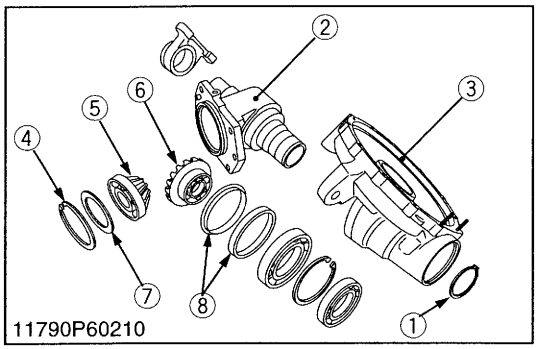

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Bevel Gear Case Gears

1. Remove the internal snap ring (4).
2. Take out the bevel gears (5), (6) with ball bearings, and shims (7).

(When reassembling)

- Install the shims (7) to their original position.
- Install the oil seal (8) of bevel gear case, noting its direction.

(1) External Snap Ring
(2) Bevel Gear Case
(3) Front Gear Case
(4) Internal Snap Ring
(5) Bevel Gear
(6) Bevel Gear
(7) Shim
(8) Oil Seal

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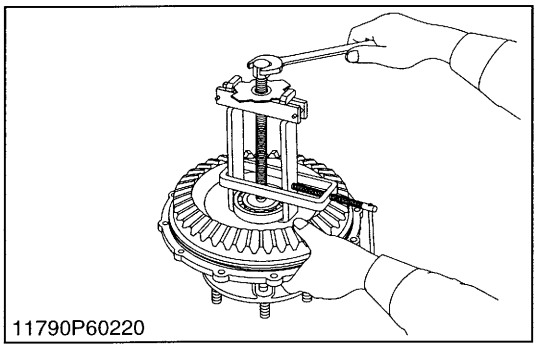
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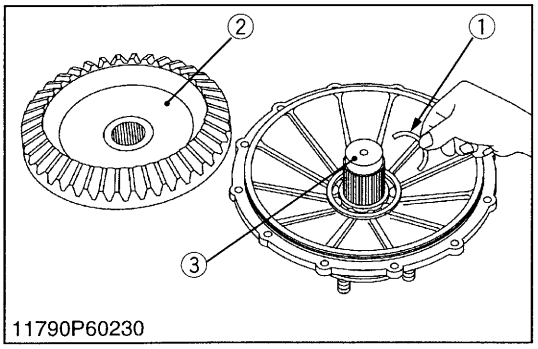
Axle

1. Remove the bearing with a special use puller set (Code No. 07916-09032).
2. Take out the bevel gear (2).
3. Take out the collar (1).
4. Tap out the axle (3).

(When reassembling)

- Install the oil seal (5) of axle flange (4), noting its direction as shown in the figure below.

(1) Collar
(2) Bevel Gear
(3) Axle
(4) Axle Flange
(5) Oil Seal



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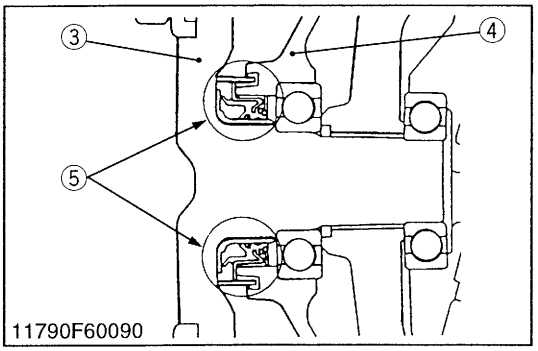

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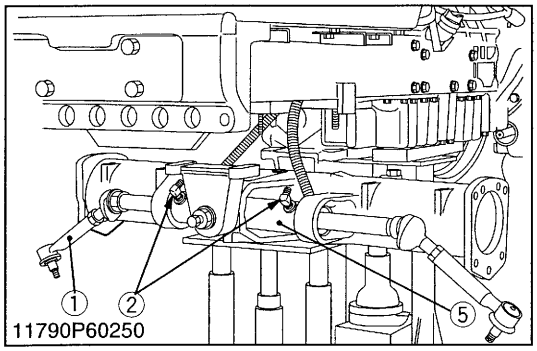

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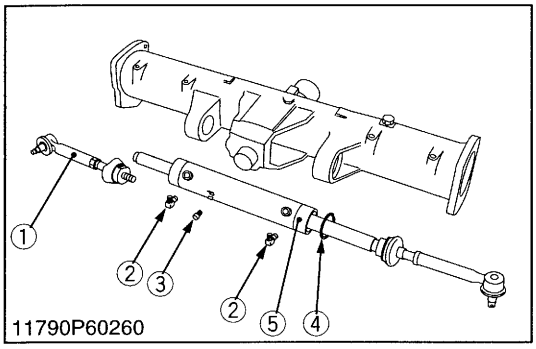

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Steering Cylinder

1. Remove the tie-rod joint (1) (right side).
2. Remove the cylinder set screw (3).
3. Remove the nipples (2) from steering cylinder.
4. Remove the internal snap ring (4).
5. Draw out the steering cylinder (5).

(When reassembling)

- Apply liquid lock (Three Bond 1372 or equivalent) to the tie-rod joint.

Tightening torque	Tie-rod joint and steering cylinder mounting screw	166.7 to 196.1 N·m 17.0 to 20.0 kgf·m 122.9 to 144.6 ft-lbs

(1) Tie-rod Joint
(2) Nipple
(3) Cylinder Set Screw
(4) Internal Snap Ring
(5) Steering Cylinder

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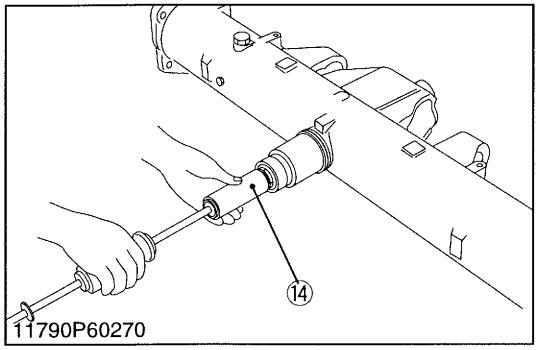

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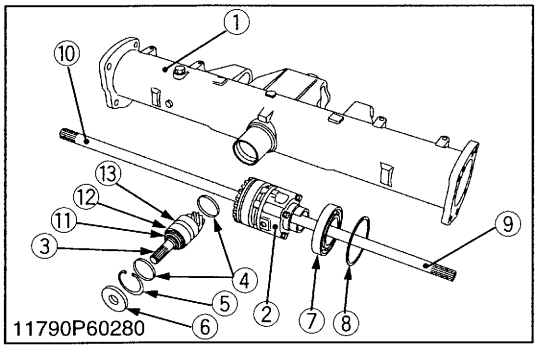

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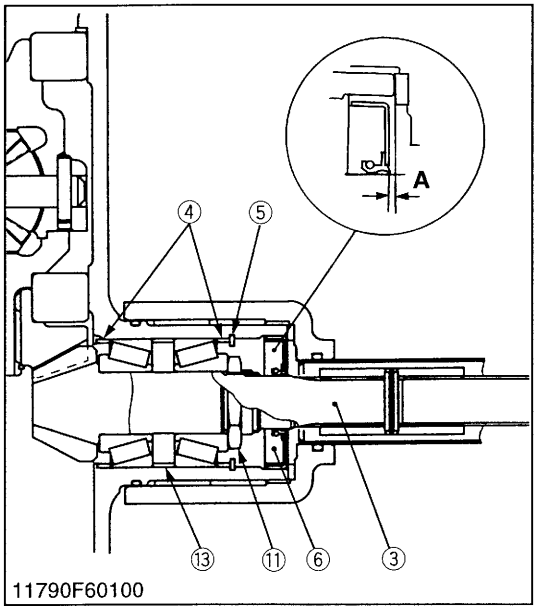

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Spiral Bevel Pinion Shaft and Differential Gear Assembly

1. Take out the differential yoke shaft (9), (10) both sides.
2. Remove the oil seal (6) and internal snap ring (5).
3. Remove the collar (4).
4. Remove the spiral bevel pinion shaft (3) by the pinion shaft remover (14).
5. Take out the differential gear assembly (2), ball bearing (7) and shim (8) from left side of front axle case (1).
6. Remove the stake of lock nut (11), and then remove the lock nut (11).
7. Remove the taper roller bearings (12).

(When reassembling)

- Replace the lock nut (11) and oil seal (6) with new ones.
- Apply grease to the oil seal (6).
- Install the shims and collars to their original position.
- Install the taper roller bearings correctly, noting their direction and apply gear oil to them.
- When press-fitting a oil seal (6), observe the dimension **"A"** described in the figure.

■ IMPORTANT

- **After adjusting the turning torque, stake the lock nut (11) firmly.**

Turning torque of spiral bevel pinion shaft	Factory spec.	0.98 to 1.18 N·m 0.10 to 0.12 kgf·m 0.72 to 0.87 ft-lbs

(1) Front Axle Case
(2) Differential Gear Assembly
(3) Spiral Bevel Pinion Shaft
(4) Adjusting Collar
(5) Internal Snap Ring
(6) Oil Seal
(7) Ball Bearing
(8) Shim
(9) Differential Yoke Shaft R.H.
(10) Differential Yoke Shaft L.H.
(11) Lock Nut
(12) Taper Roller Bearing
(13) Collar
(14) Pinion Shaft Remover

(A) Dimension A : 0.5 to 1 mm (0.020 to 0.039 in.)

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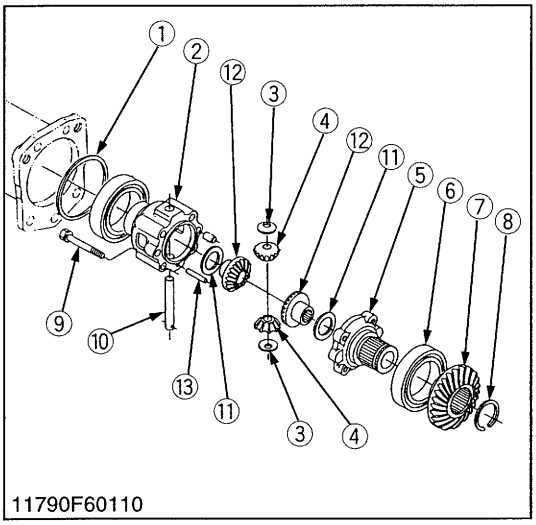

Differential Gear

1. Remove the differential case cover mounting screws (9) and then take out the differential case cover (5), ball bearing (6) and spiral bevel gear (7) as a unit.
2. Remove the external snap ring (8), and then remove the ball bearing (6) and spiral bevel gear (7) as a unit with a puller.
3. Remove the straight pin (13).
4. Pull out the pinion shaft (10) and take out the differential pinions (4) and differential side gears (12).

(When reassembling)

- Apply molybdenum disulfide (Three Bond 1901 or equivalent) to the inner circumferential surface of the differential side gears (12) and differential pinions (4).

Tightening torque	Differential case cover mounting screw	60.8 to 70.6 N·m 6.2 to 7.2 kgf·m 44.8 to 52.1 ft-lbs

(1) Shim
(2) Differential Case
(3) Thrust Collar
(4) Differential Pinion
(5) Differential Case Cover
(6) Ball Bearing
(7) Spiral Bevel Gear
(8) External Snap Ring
(9) Differential Case Cover Mounting Screw
(10) Pinion Shaft
(11) Shim
(12) Differential Side Gear
(13) Straight Pin

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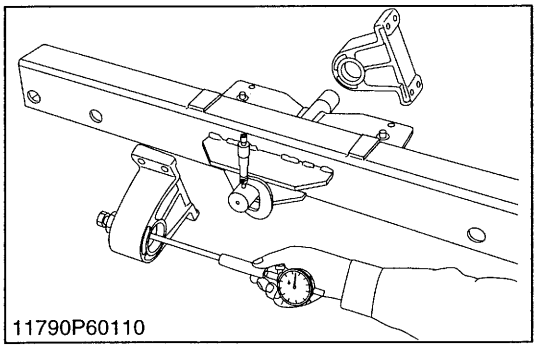
SERVICING

(1) 2WD Type



Clearance between Front Axle Middle Boss and Bracket Bushing

1. Measure the front axle middle boss O.D. at several points where it contacts with the bushings.
2. Measure the front axle bracket (front) bushing I.D. and bracket (rear) bushing I.D. in the same method, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace them.

Clearance between front axle middle boss and bracket bushing	Factory spec.	0.050 to 0.150 mm 0.00197 to 0.00590 in.
	Allowable limit	0.35 mm 0.0138 in.
Front axle middle boss O.D.	Factory spec.	39.938 to 40.000 mm 1.57236 to 1.57480 in.
Bracket bushing I.D.	Factory spec.	40.050 to 40.088 mm 1.57677 to 1.57827 in.

(When replacing bushing)

- Before press-fitting the bushing, install the new thrust collar.
- Install the oil seals, noting their direction.

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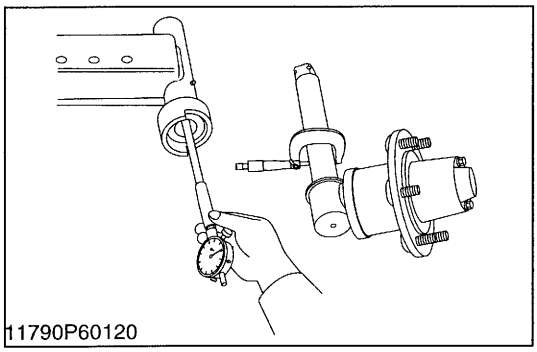
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Clearance between Knuckle Shaft (Kingpin) and Bushing

1. Measure the shaft O.D. at several point where it contacts with the bushings.
2. Measure the bushing I.D. in the same method, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the bushing.

Clearance between knuckle shaft (kingpin) and bushing	Factory spec.	0.020 to 0.125 mm 0.00079 to 0.00492 in.
	Allowable limit	0.35 mm 0.0138 in.
Knuckle shaft O.D.	Factory spec.	37.975 to 38.000 mm 1.49508 to 1.49606 in.
Bushing I.D.	Factory spec.	38.020 to 38.100 mm 1.49685 to 1.50000 in.

(When replacing bushing)

- Remove the bushing with a bushing puller set (Code No. 07916-51011).

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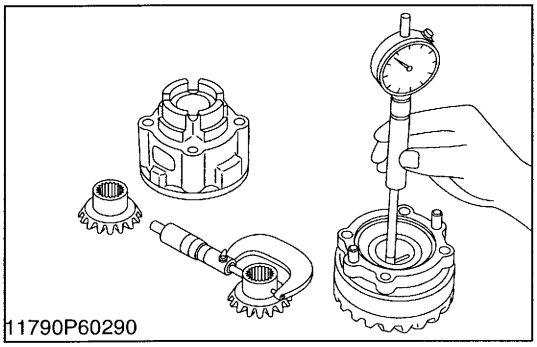
(2) 4WD Type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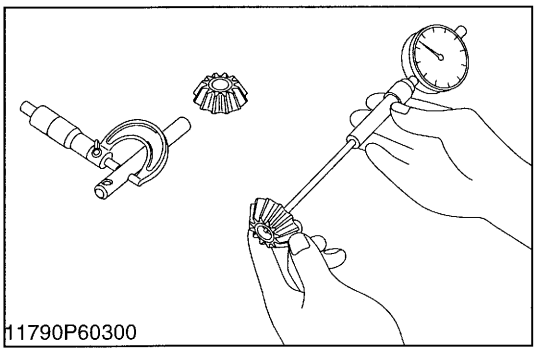
Clearance between Differential Case (Differential Case Cover) and Differential Side Gear

1. Measure the differential side gear O.D.
2. Measure the differential case bore I.D. and calculate the clearance.
3. Measure the differential case cover bore I.D. and calculate the clearance.
4. If the clearance exceeds the allowable limit, replace faulty parts.

Clearance between differential case (differential case cover) and differential side gear	Factory spec.	0.040 to 0.123mm 0.00157 to 0.00484 in.
	Allowable limit	0.20 mm 0.0079 in.
Differential case bore I.D.	Factory spec.	32.000 to 32.062 mm 1.25984 to 1.26228 in.
Differential case cover bore I.D.	Factory spec.	32.000 to 32.062 mm 1.25984 to 1.26228 in.
Differential side gear O.D.	Factory spec.	31.939 to 31.960 mm 1.25744 to 1.25827 in.

11790S60270

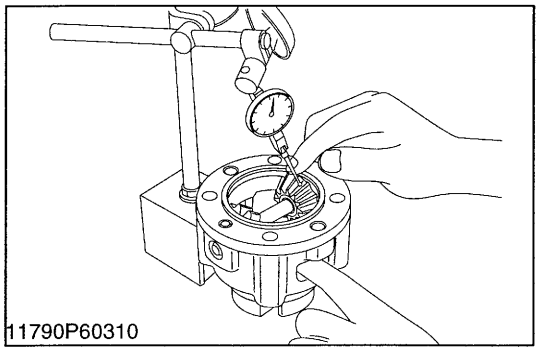

11790P60300

Clearance between Pinion Shaft and Differential Pinion

1. Measure the pinion shaft O.D.
2. Measure the differential pinion I.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace faulty parts.

Clearance between pinion shaft and differential pinion	Factory spec.	0.064 to 0.100 mm 0.00252 to 0.00394 in.
	Allowable limit	0.25 mm 0.0096 in.
Pinion shaft O.D.	Factory spec.	13.950 to 13.968 mm 0.54921 to 0.54992 in.
Differential pinion I.D.	Factory spec.	14.032 to 14.050 mm 0.55244 to 0.55315 in.

11790S60280


11790P60310

Backlash between Differential Pinion and Differential Side Gear

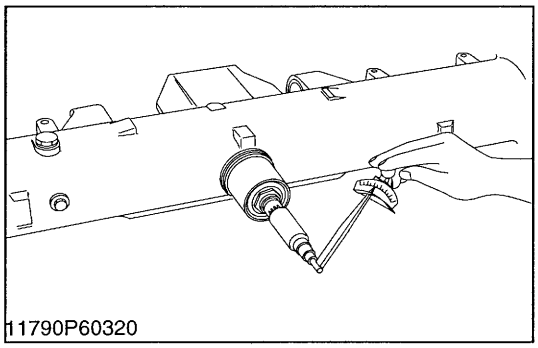
1. Set a dial gauge (lever type) on a tooth of the differential pinion.
2. Fix the differential side gear and move the differential pinion to measure the backlash.
3. If the measurement exceeds the factory specifications, adjust with the differential side gears shims.

Backlash between differential pinion and differential side gear	Factory spec.	0.2 to 0.3 mm 0.008 to 0.012 in.
	Allowable limit	0.4 mm 0.016 in.

(Reference)

- Thickness of adjusting shims
  0.4 mm (0.016 in.) 1.0 mm (0.039 in.)
  0.6 mm (0.024 in.) 1.2 mm (0.047 in.)
  0.8 mm (0.031 in.)
- Tooth contact : More than 35 %

11790S60290


11790P60320

Turning Torque of Spiral Bevel Pinion Shaft (Pinion Shaft Only)

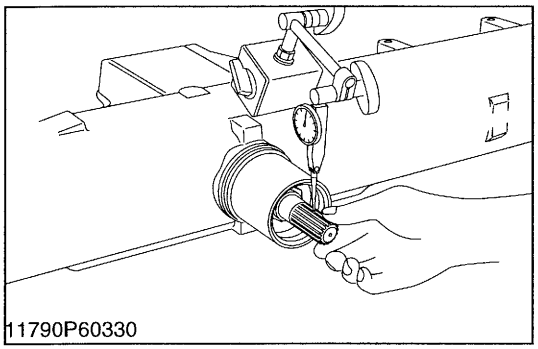
1. Install the spiral bevel pinion shaft assembly only to the front axle case.
2. Measure the turning torque of spiral bevel pinion shaft.
3. If the turning torque is not within the factory specifications, adjust with the lock nut.

Turning torque of spiral bevel pinion shaft	Factory spec.	0.98 to 1.18 N·m 0.10 to 0.12 kgf·m 0.72 to 0.87 ft-lbs

■ NOTE

- **After turning torque adjustment, be sure to stake the lock nut.**

11790S60300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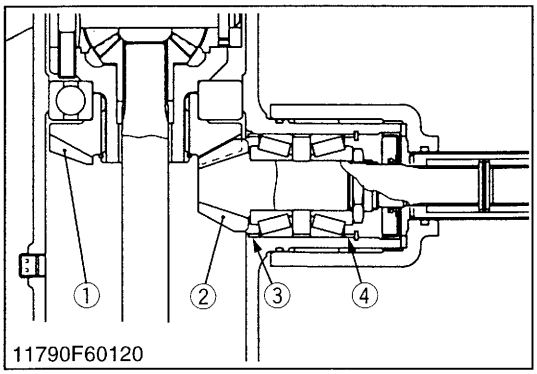


11790F60120

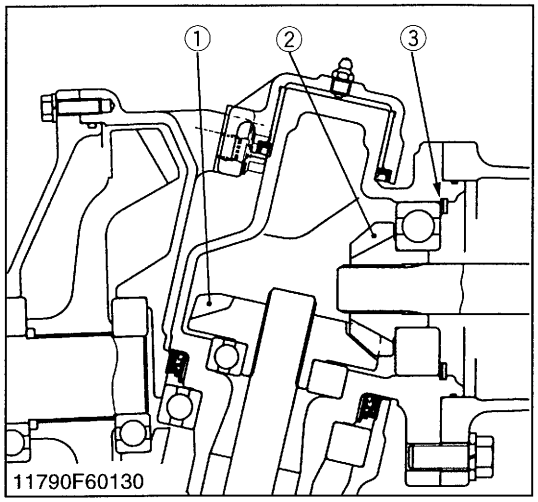
Backlash between Spiral Bevel Pinion Shaft and Spiral Bevel Gear

1. Set a dial gauge (lever type) with its finger on the spline of spiral bevel pinion shaft.
2. Measure the backlash by moving the spiral bevel pinion shaft by hand lightly.
3. If the backlash is not within the factory specifications, change the adjusting collar (3), (4).
4. Adjust the backlash properly by repeating the above procedures.

Backlash between spiral bevel pinion shaft and spiral bevel gear	Factory spec.	0.2 to 0.3 mm 0.008 to 0.012 in.
	Allowable limit	0.4 mm 0.016 in.

(1) Spiral Bevel Gear
(2) Spiral Bevel Pinion Shaft
(3) Adjusting Collar
(4) Adjusting Collar

11790S60310



Backlash between 10T Bevel Gear and 17T Bevel Gear

1. Stick a strip of fuse spots on the 17T 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 10T bevel gear and 17T bevel gear	Factory spec.	0.2 to 0.3 mm 0.0079 to 0.0118 in.
	Allowable limit	0.6 mm 0.024 in.

(Reference)

- Thickness of adjusting shims (3)
  0.4 mm (0.016 in.) 1.0 mm (0.039 in.)
  0.6 mm (0.024 in.) 1.2 mm (0.047 in.)
  0.8 mm (0.031 in.)
- Tooth contact : More than 35 %

(1) 17T Bevel Gear
(2) 10T Bevel Gear
(3) Shim

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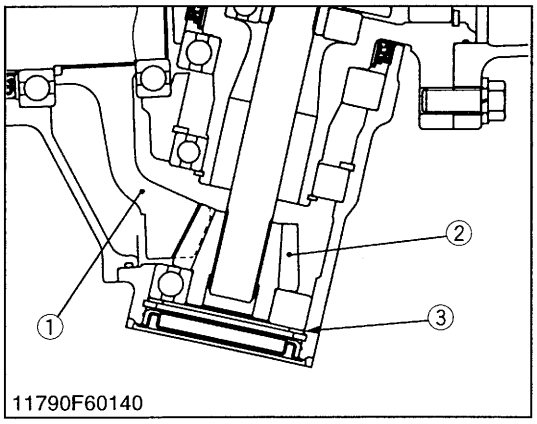

Backlash between 9T Bevel Gear and 43T Bevel Gear

1. Stick a strip of fuse to three spots on the 43T bevel gear (1) with grease.
2. Fix the axle flange and front gear case.
3. Turn the axle.
4. Remove the axle flange from front gear case and measure the thickness of the fuse with an outside micrometer.
5. If the backlash is not within the factory specifications, adjust with shim (3).

Backlash between 9T bevel gear and 43T bevel gear	Factory spec.	0.25 to 0.35 mm 0.0098 to 0.0138 in.
	Allowable limit	0.6 mm 0.024 in.

(Reference)

- Thickness of adjusting shims (3)
  0.4 mm (0.016 in.) 1.0 mm (0.039 in.)
  0.6 mm (0.024 in.) 1.2 mm (0.047 in.)
  0.8 mm (0.031 in.)
- Tooth contact : More than 35 %

(1) 43T Bevel Gear
(2) 9T Bevel Gear
(3) Shim

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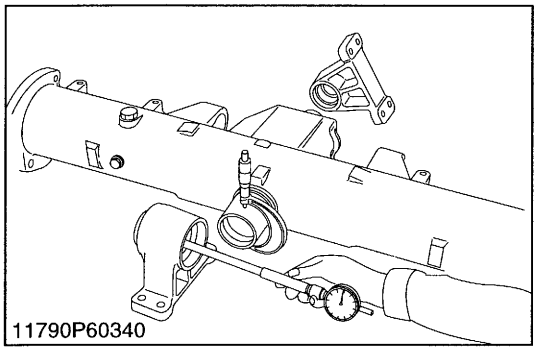
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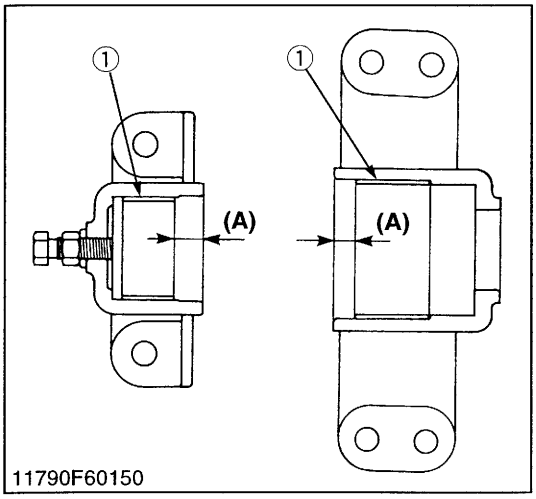


11790F60150

Clearance between Front Axle Case Bosses and Bracket Bushings

1. Measure the front axle case bosses O.D. with an outside micrometer.
2. Measure the bracket bushing I.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace the bracket bushing.

Clearance between front axle case boss (front) and bracket bushing (front)	Factory spec.	0.025 to 0.160 mm 0.00098 to 0.00630 in.
	Allowable limit	0.35 mm 0.0138 in.
Front axle case boss (front) O.D.	Factory spec.	49.950 to 49.975 mm 1.96653 to 1.96752 in.
Bracket bushing (front) I.D.	Factory spec.	50.000 to 50.110 mm 1.96850 to 1.97283 in.
Clearance between front axle case boss (rear) and bracket bushing (rear)	Factory spec.	0.025 to 0.190 mm 0.00098 to 0.00748 in.
	Allowable limit	0.35 mm 0.0138 in.
Front axle case boss (rear) O.D.	Factory spec.	70.000 to 70.035 mm 2.75590 to 2.75728 in.
Bracket bushing (rear) I.D.	Factory spec.	70.060 to 70.190 mm 2.75826 to 2.76338 in.

■ Press-fitting Bushing

- When press-fitting a new bushing, observe the dimension described in the figure.

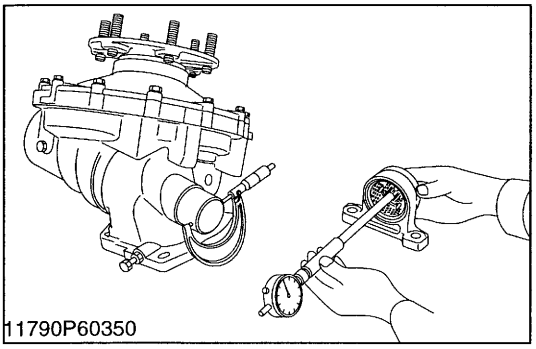
Press-fit depth of bushing (**A**)	Factory spec.	12.0 to 13.0 mm 0.47 to 0.51 in.

■ NOTE

- **After replacing the bushing, be sure to adjust the front axle rocking force. (See page 6-S6.)**

(1) Bushing

12550S60130


11790P60350

Clearance between Bevel Gear Case Boss and Front Axle Support Bushing

1. Measure the bevel gear case boss O.D. with an outside micrometer.
2. Measure the support bushing I.D. and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace it.

Clearance between bevel gear case boss and front axle support bushing	Factory spec.	0.060 to 0.220 mm 0.00236 to 0.00866 in.
	Allowable limit	0.50 mm 0.0197 in.
Bevel gear case boss O.D.	Factory spec.	54.970 to 55.000 mm 2.16417 to 2.16535 in.
Front axle support bushing I.D.	Factory spec.	55.060 to 55.190 mm 2.16772 to 2.17283 in.

11790S60350

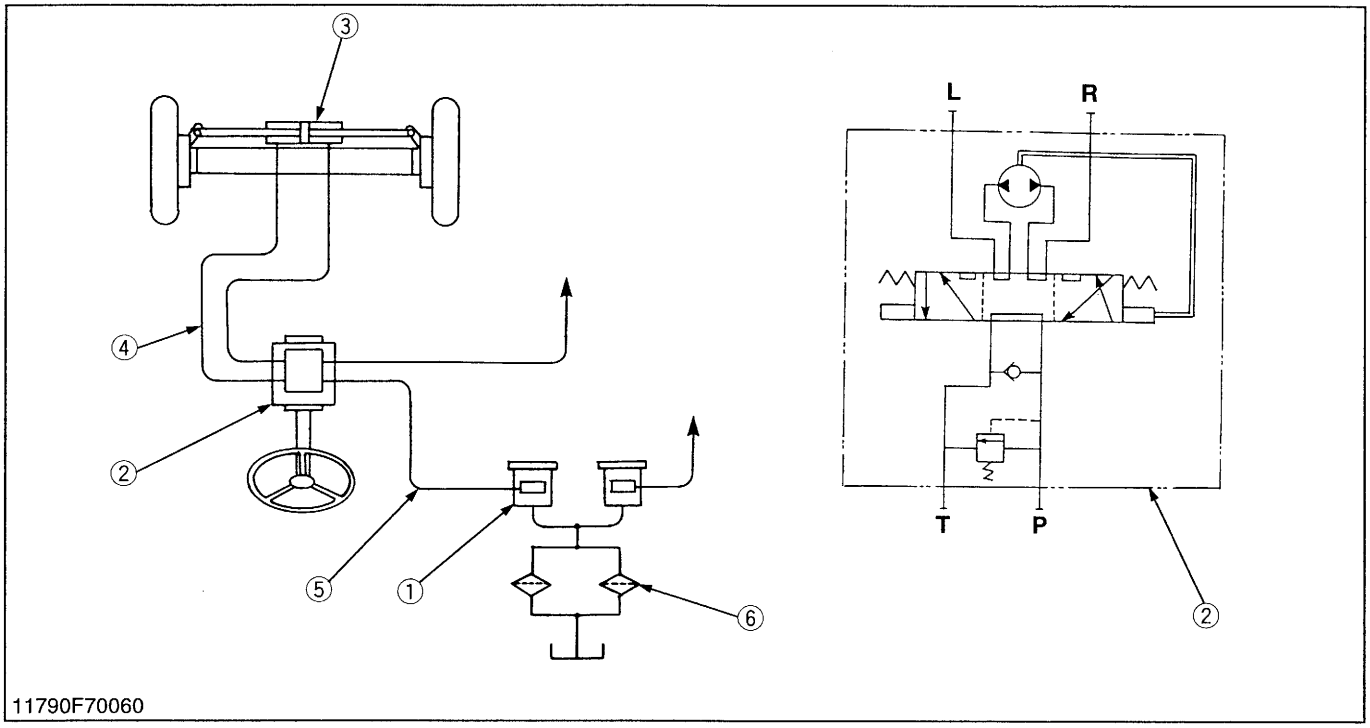
7 STEERING

7 STEERING

MECHANISM

CONTENTS

[1] STEERING LINKAGE



11790F70060

(1) Hydraulic Pump
(2) Steering Controller
(3) Steering Cylinder
(4) Power Steering Hose
(5) Power Steering Pipe
(6) Magnet Filter

All models are provided with a full hydrostatic power steering. Generally power steerings are divided into 4 types: booster type, integral type, semi-integral type and full hydrostatic type.

In the full hydrostatic power steering, the steering controller is connected to the steering cylinder with only the hydraulic piping. This steering is actuated by oil pressure. Accordingly, it does not have mechanical transmitting parts such as steering gear, pitman arm, drag link, etc. Therefore, it is simple in construction.

This steering system consists of the hydraulic pump (1), steering controller (2), steering cylinder (3), magnet filter (6), etc.

The full hydrostatic power steering systems are divided into two types : non-load reaction type and load reaction type.

They are distinguished by wether the cylinder port is blocked or not with the controller in neutral. In these models, load reaction type is used.

With the load reaction type power steering, the steering wheel returns almost to the straight forward position as with an automobile when the operator releases his hands from the steering wheel.

(Reference)

With the non-load reaction type power steering, the steering wheel maintain their position when the operator releases his hands from the steering wheel.

Vibration at the wheels is not transmitted to the steering wheel.

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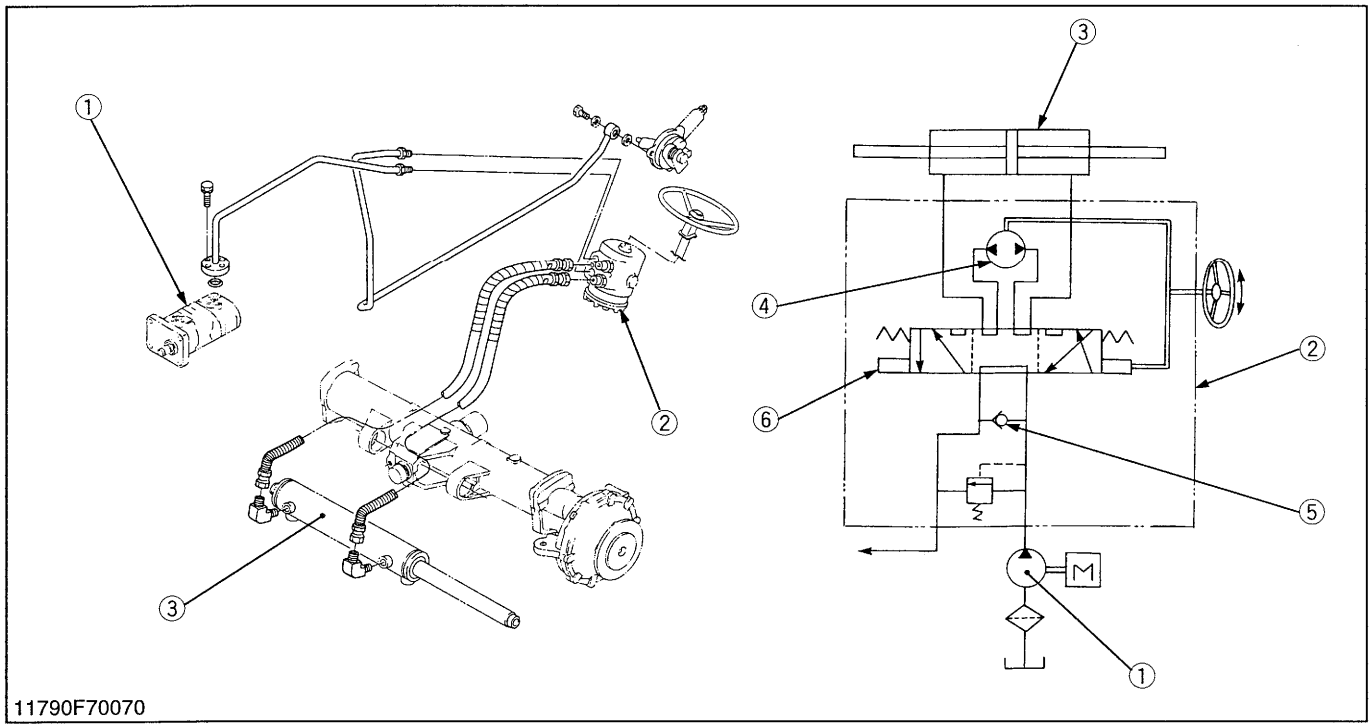
[2] POWER STEERING HYDRAULIC CIRCUIT



11790F70070

(1) Hydraulic Pump
(2) Steering Controller
(3) Steering Cylinder
(4) Gerotor
(5) Check Valve
(6) Control Valve

■ Hydraulic Oil Flow

When the engine starts, the hydraulic pump (1) of the power steering system pressure-feeds the oil drawn from the transmission case through the suction pipe.

The oil which has entered steering controller (2) is directed to control valve (6).

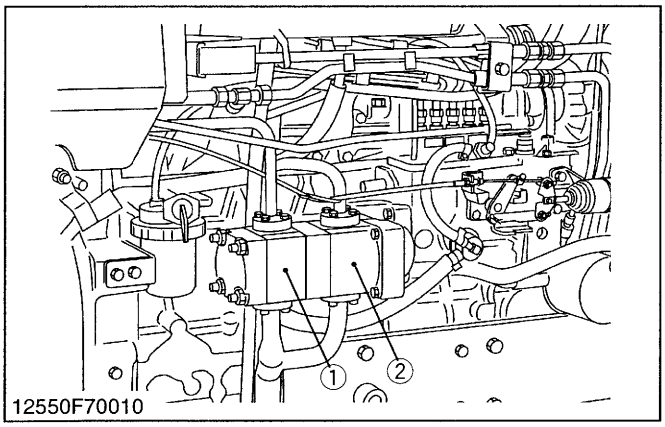
As the steering wheel is turned, control valve (6) operates and the oil passes through gerotor (4) and into steering cylinder (3). The cylinder rod then moves to control the directional movement of the front wheels.

Return oil from steering cylinder (3) passes through control valve (6) is sent to the PTO clutch valve.

When the engine is not operating, and the steering wheel is turned, gerotor (4) rotates to supply oil to steering cylinder (3). Thus the machine can be steered manually.

11790M70020

[3] POWER STEERING SYSTEM HYDRAULIC PUMP

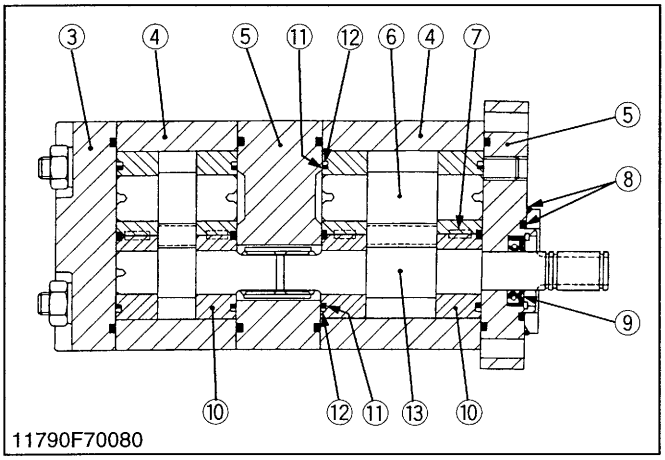


12550F70010

The power steering system hydraulic pump pressure-feeds the oil sucked from the transmission case to the steering cylinder through the steering controller.

On M4900 and M5700, the hydraulic pump is driven by the fuel camshaft.

(1) Power Steering System Hydraulic Pump
(2) Three Point Hydraulic System Hydraulic Pump
(3) Cover
(4) Housing
(5) Flange
(6) Driven Gear
(7) Key
(8) O-ring
(9) Oil Seal
(10) Bushing
(11) Seal Element
(12) Backup Element
(13) Drive Gear



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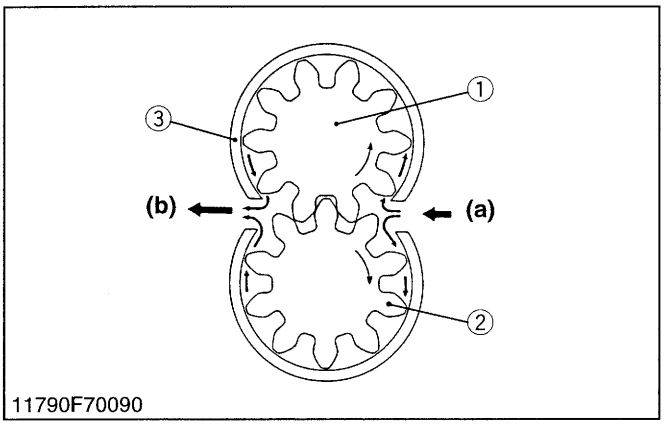
■ Operation of Hydraulic Pump

The hydraulic pump has two meshing gears (1), (2) whose teeth run close to the casing (3). One gear is a drive gear (1) which drives the driven gear (2).

When the drive gear is driven in the direction of the arrow by the crankshaft, the gears trap oil between the gear teeth and the casing. The trapped oil is carried around to the outlet. The higher the engine speed, the more the pump discharge.



11790F70090

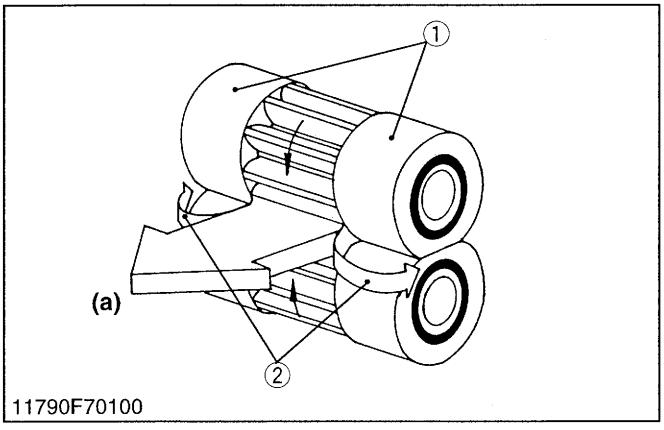
(1) Drive Gear
(2) Driven Gear
(3) Casing
(a) Inlet
(b) Outlet

11790M70040

■ Pressure Loading System

The pressure loading system automatically decreases the clearance between the gear and the bushing (1). A small amount of pressure oil is fed behind the bushings, pressing them against the gears and forming a tighter seal against leakage.

Therefore, leakage from the delivery side (high pressure) to the inlet side (low pressure) does not increase even if the pressure on the delivery side increases.



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(1) Bushing
(2) Loading Pressure
(a) Outlet

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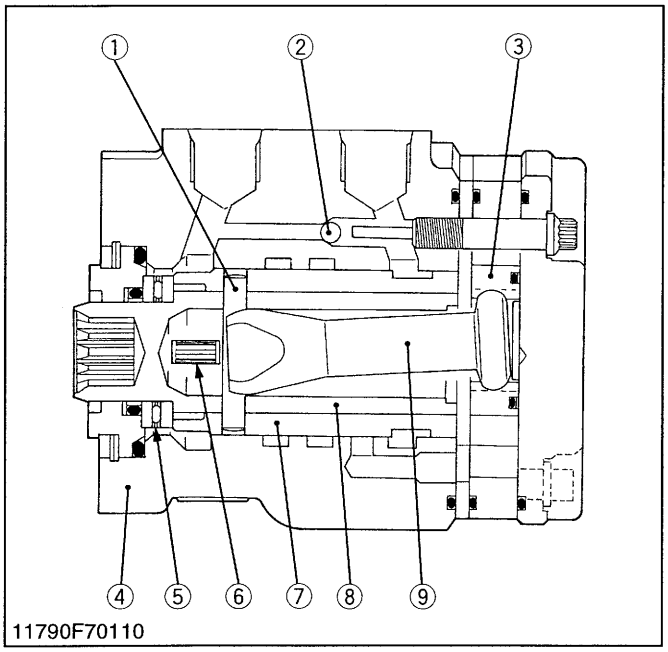
[4] STEERING CONTROLLER



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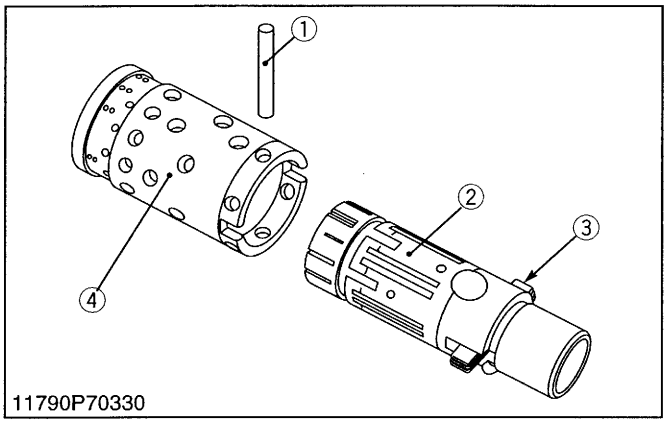
The steering controller mainly consists of a control valve, a metering device and a relief valve.

The metering device comprises a set of special gear called **"Gerotor"**.

(1) Dowel Pin
(2) Check Valve
(3) Gerotor
(4) Housing
(5) Bearing Assembly
(6) Centering Spring
(7) Sleeve
(8) Spool
(9) Drive Shaft

12550M70030

(1) Control Valve



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The control valve is a rotating spool type. When the steering wheel is not turned, the valve is kept in the neutral position by the centering spring (3).

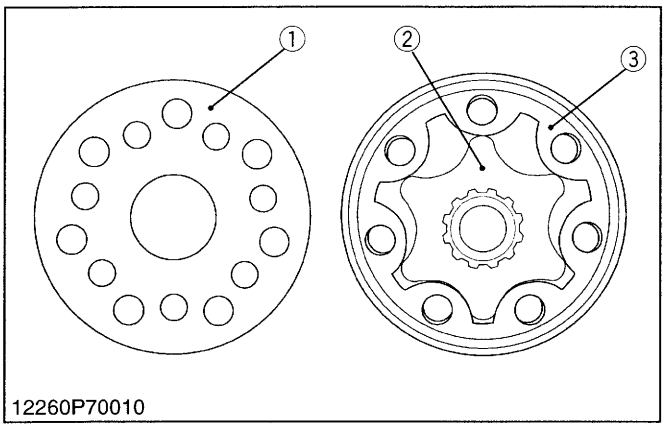
Then, the oil flow from the hydraulic pump to the steering cylinder and from the steering cylinder to the transmission case is shut off. Oil from the hydraulic pump is sent to the transmission case through the control valve.

When the steering wheel is turned clockwise or counterclockwise, the control valve, together with the gerotor, changes the direction of oil flow to the steering cylinder according to the direction, the steering wheel was turned.

(1) Dowel Pin
(2) Spool
(3) Centering Spring
(4) Sleeve

11790M70070

(2) Metering Device (Gerotor)



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All oil sent from the hydraulic pump to the steering cylinder, passes through the metering device (Gerotor).

Namely, when the rotor is drive, three chambers suck in oil due to volumetric change in the pump chambers formed between the rotor (2) and the stator (3), while oil is discharged from other three chambers. On the other hand, rotation of the steering wheel is directly transmitted to the rotor through the steering shaft, spool, drive shaft, etc.

Accordingly, the gerotor serves to supply the steering cylinder with oil, amount of which corresponds to the rotation of the steering wheel. The wheels are thus turned by the angle corresponding to the rotation of the steering wheel.

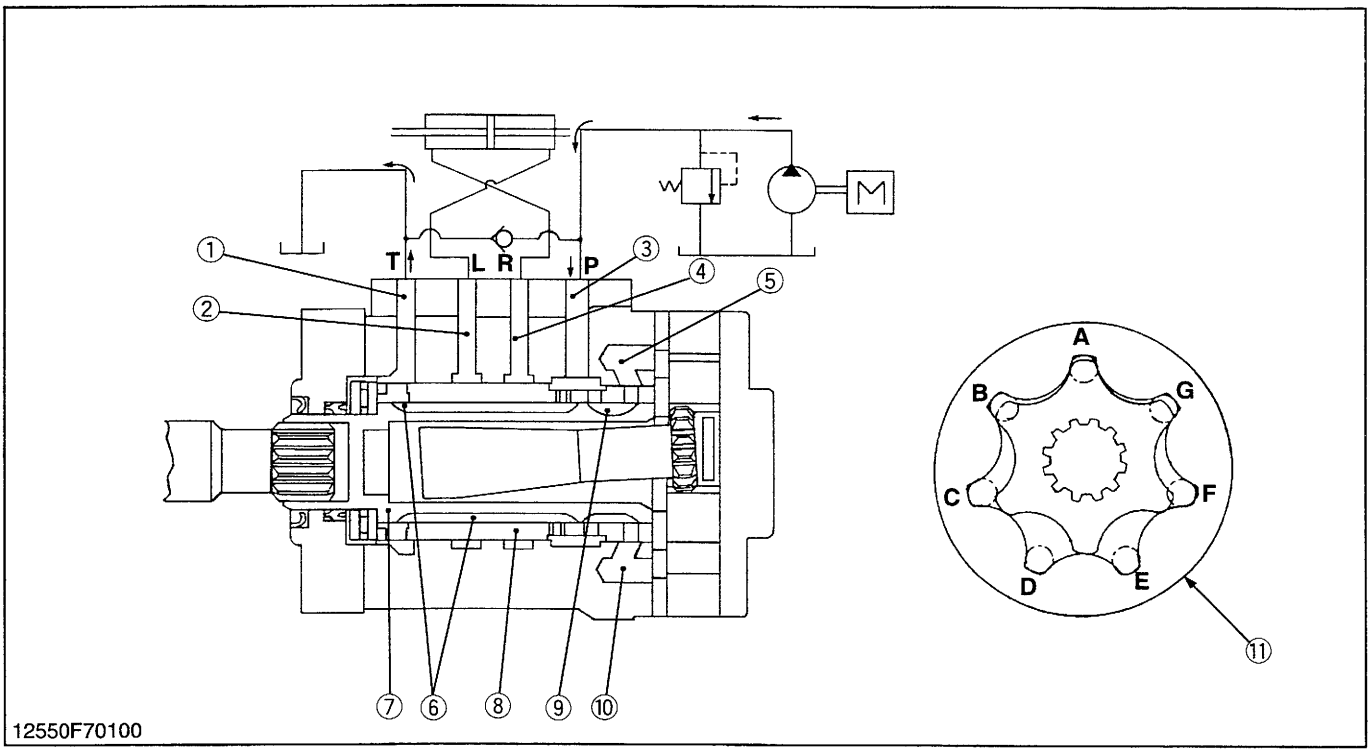
When the engine stops or the hydraulic pump malfunctions, the gerotor functions as a manual trochoid pump, which makes manual steering possible. Oil discharge per rotor revolution is approx. 80 cc/rev. (4.88 cu.in./rev.).

(1) Distributor Plate
(2) Rotor
(3) Stator

12550M70020

(3) Oil Flow

■ Neutral Position



(1) Passage
(2) Passage
(3) Passage
(4) Passage
(5) Passage
(6) Spool Groove
(7) Spool
(8) Sleeve
(9) Spool Groove
(10) Passage
(11) Gerotor

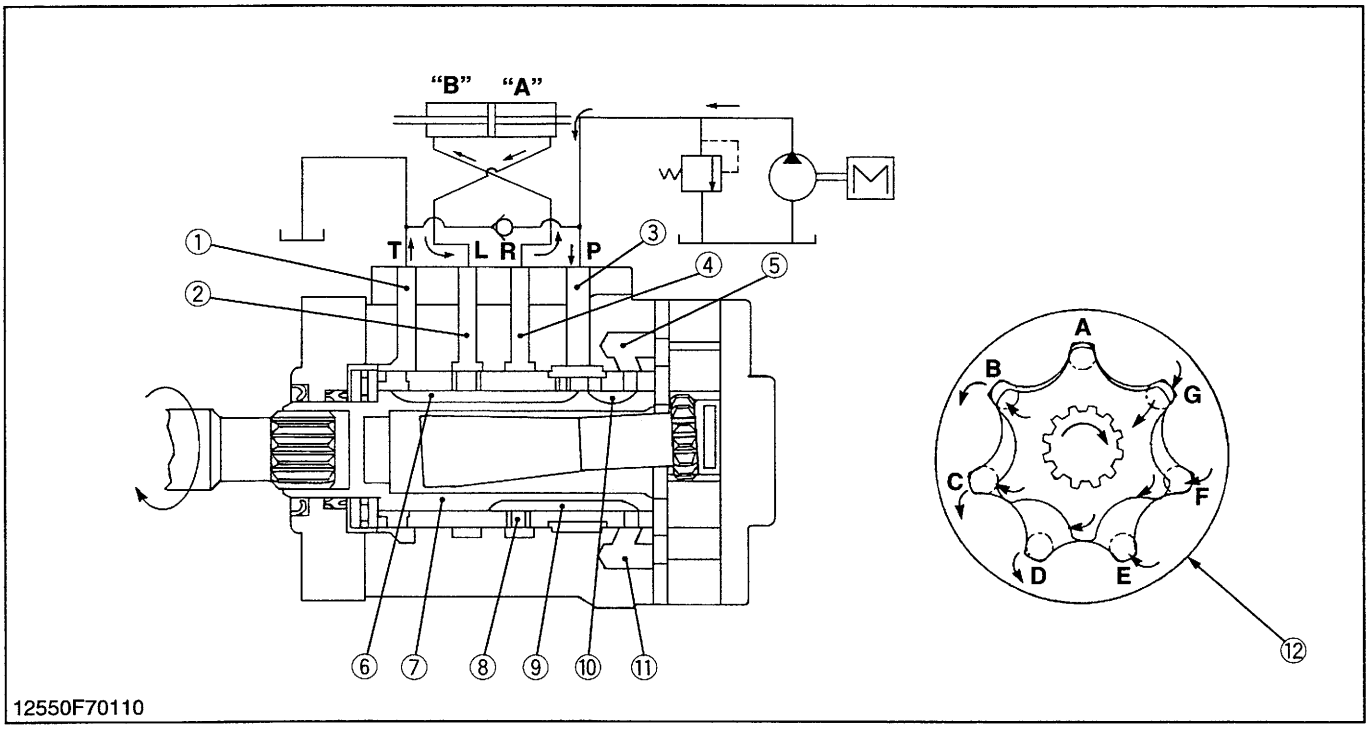
When the steering wheel is not turned, the control valve is kept in neutral position by the centering spring.

Oil, sent from the hydraulic pump to pump port **P**, returns to the transmission case from tank port **T**, passing through the passage (3), spool groove (6), and passage (1).

The cylinder ports **L** and **R** are blocked by the sleeve. So the piston does not act, when affected by and external force, due to which the wheels are held running straight forward or turning at a given angle.

12550M70040

■ Right Turning



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(1) Passage
(2) Passage
(3) Passage
(4) Passage
(5) Passage
(6) Spool Groove
(7) Spool
(8) Sleeve
(9) Passage
(10) Spool Groove
(11) Passage
(12) Gerotor

1. When the operator attempts to turn the steering wheel clockwise, only the spool (7) is rotated a small amount overcoming the force of the centering spring, thereby causing a relative displacement between the spool (7) and the sleeve (8). As a result, while the passage from the passage (3) to the spool groove (6) is throttled, the passage from (3) to (1) and (5) is opened, forming a passage to the three pump chambers **E**, **F** and **G** (in sucking-in state) of the gerotor. At the same time, a passage is formed from the three chambers **B**, **C** and **D** (in oil discharging state) of the gerotor to the cylinder port **R** through the passages (11), (9) and (4).
2. Oil pressure generated at this time in the three chambers **E**, **F** and **G** of the gerotor, that is oil pressure generated in the spool groove (10), is set depending on the extent of throttling from (3) to (6). The extent of throttling increases as the relative displacement between the spool (7) and the sleeve (8) increases. Accordingly, at small relative displacements, oil pressure generated in the three chambers **E**, **F** and **G** of the gerotor is too low to move the piston overcoming road resistance. When the relative displacement increases to such an extent that oil pressure generated in the three chambers **E**, **F** and **G** rises up to the operating pressure, the rotor rotates and oil in the three chambers **B**, **C** and **D** of the gerotor which are in the discharging state is pressure-fed to the cylinder chamber **"A"** to steer. On the other hand, oil discharged from the cylinder chamber **"B"** returns to the oil tank from tank port **T**, after following through the passages (2), (6) and (1) from the cylinder port **L**.
3. When the steering wheel is turned, a relative displacement develops and generates operating pressure corresponding to the road resistance, and the spool (7) and sleeve (8) rotate as the steering wheel is turned. As already described, the gerotor serves as a metering device so that the wheels are turned to the angle corresponding to the turn of the steering wheel.
4. When the steering wheel is stopped, a relative displacement between the spool (7) and the sleeve (8) becomes zero due to the function of the centering spring, and the neutral state is restored.

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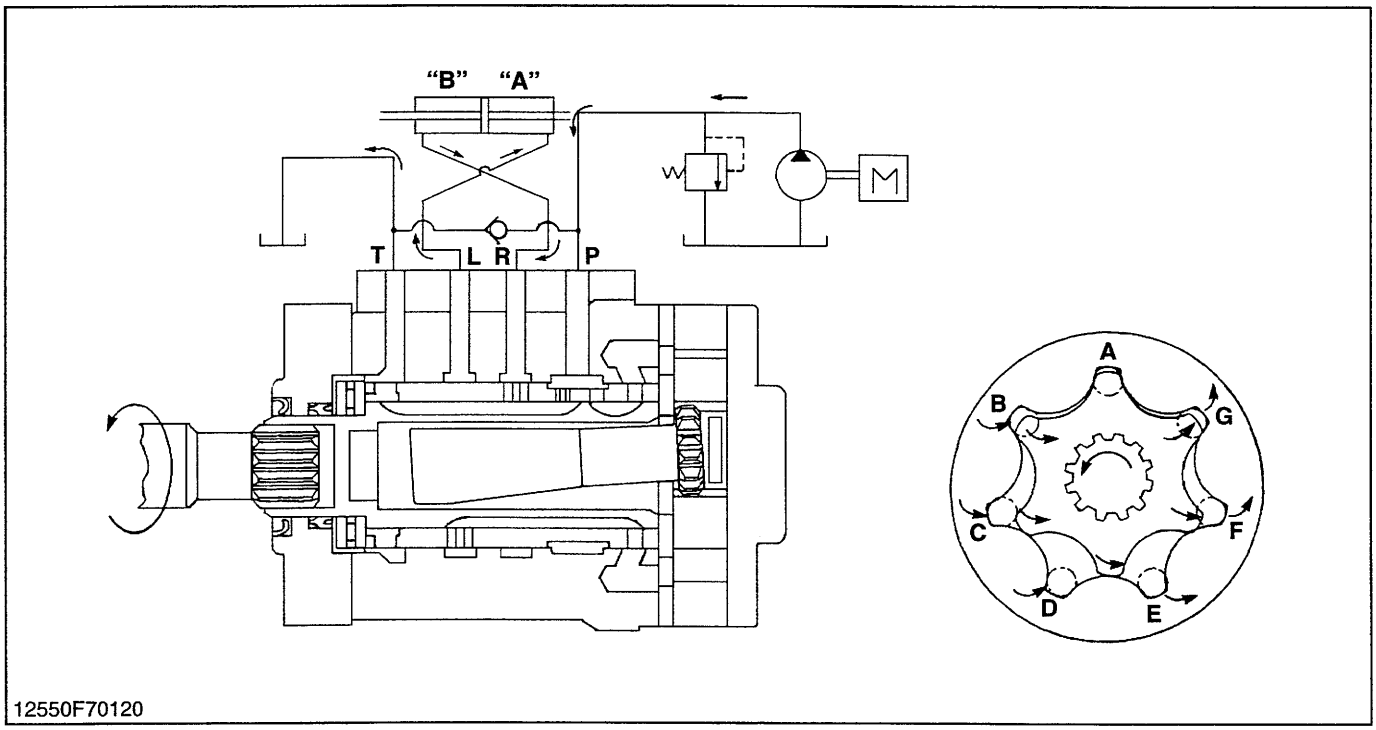
■ Left Turning



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Operation mechanism for left turning is the same as that for right turning, except for directions of oil flow from and to the steering cylinder.

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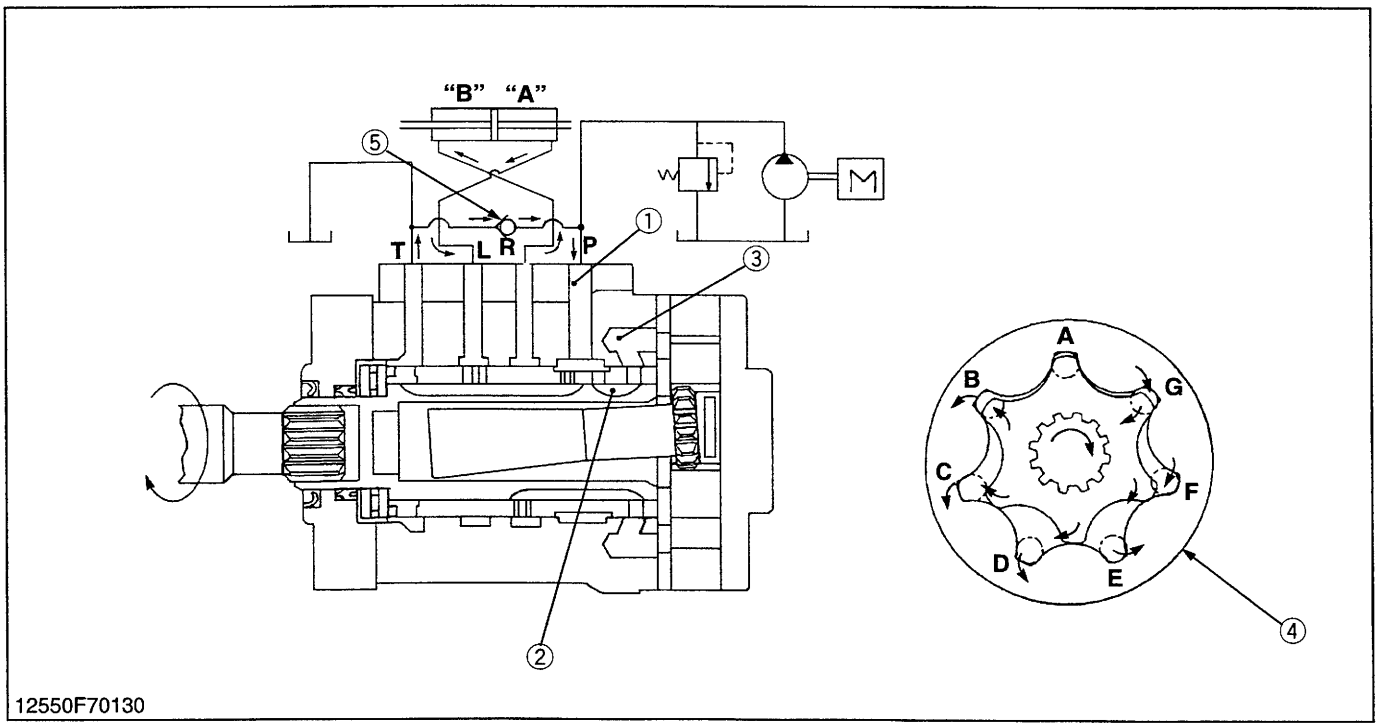
■ Manual Operation



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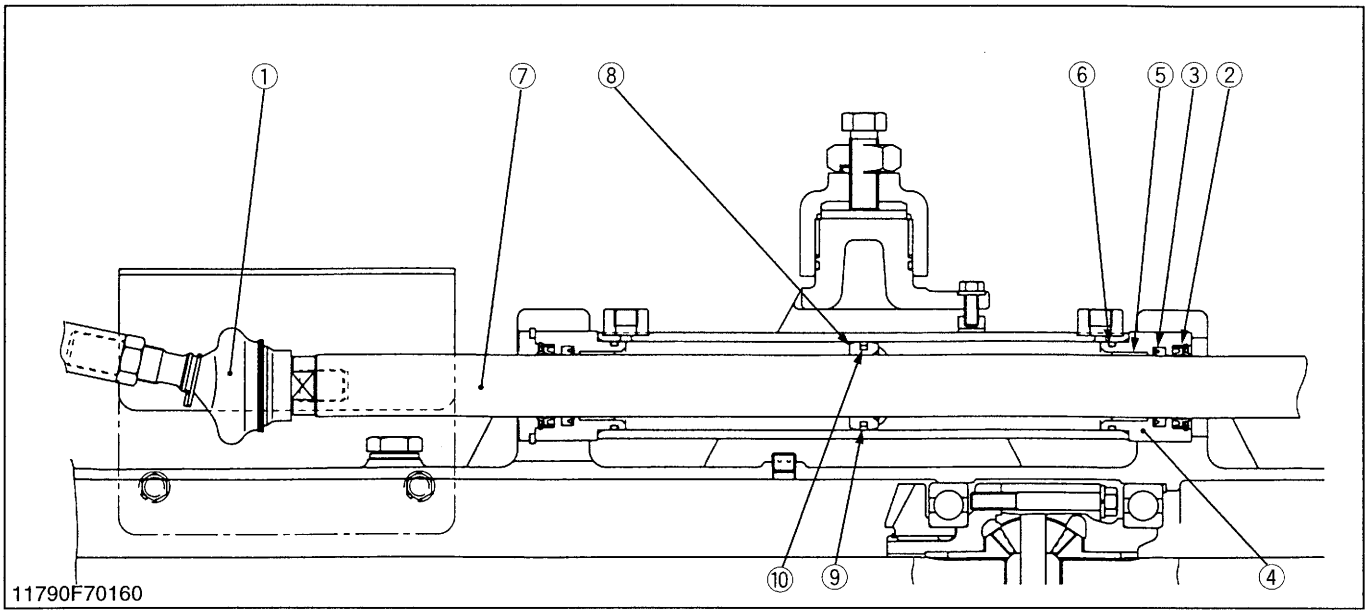
(1) Passage (2) Spool Groove (3) Passage (4) Gerotor (5) Check Valve

As already described, in the case of manual operation the gerotor functions as a hand-perated trochoid pump. Accordingly, when the rotor is the gerotor is driven by steering force, oil is sucked from the oil tank through the check valve provided in the housing, passage (1), spool groove (2) and passage (3). And oil is pressure-fed to the cylinder, and flows through the same route as in power steering operation. (The illustration shows right turning.)

12550M70070

[5] STEERING CYLINDER



(1) Rubber Boots
(2) Scraper Seal
(3) Oil Seal
(4) Guide
(5) Bushing
(6) O-ring
(7) Rod
(8) Piston
(9) Slipper Seal
(10) O-ring

The steering cylinder is single piston both rod double-acting type. This steering cylinder is installed parallel to the front axle and connected to tie-rods.

The tie-rods connected to both knuckle arm guarantees equal steering movement to both front wheels.

The steering cylinder provide force in both directions. Depending upon direction the steering wheel is turned pressure oil enters at one end of the cylinder to extend, or the other end to retract it, thereby turning front wheel of the tractor.

11790M70130

SERVICING

CONTENTS

TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Tractor Cannot Be Steered	• Drive shaft in the power steering body improper assembled • Pipe broken	Reassemble Replace	7-S11, S12 –
Hard Steering	• Oil improper • Hydraulic pump malfunctioning • Relief valve malfunctioning • Control valve (spool and sleeve) malfunctioning • Oil leak due to seal damaged	Change with specified oil Replace Replace Repair or replace Replace	G-9 7-S5, S6, S7 7-S10 7-S12, S13 –
Steering Force Fluctuates	• Control valve malfunctioning • Air sucked in pump due to leaking or missing of oil • Air sucked in pump from suction circuit	Replace Replenish Repair	7-S12, S13 G-9 –
Heavy Steering Especially in the Beginning of Steering	• Control valve malfunctioning	Repair or replace	7-S12, S13
Steering Wheel Turns Spontaneously When Released	• Control valve malfunctioning	Repair or replace	7-S12, S13
Front Wheels Wander to Right and Left	• Control valve malfunctioning • Air sucked in pump due to lack of oil • Air sucked in pump from suction circuit • Insufficient bleeding • Cylinder malfunctioning	Repair or replace Replenish Repair Bleed Repair or replace	7-S12, S13 G-9 – 7-S9 7-S13, S14, S15
Wheels Are Turned to a Direction Opposite to Steering Direction	• Cylinder piping connected in reverse	Repair	–
Steering Wheel Turns Idle in Manual Steering	• Insufficient bleeding • Air sucked in due to lack of oil	Bleed Replenish	7-S9 G-9
Noise	• Air sucked in pump due to lack of oil • Air sucked in pump from suction circuit • Pipe deformed	Replenish Repair Replace	G-9 – –
Oil Temperature Increases Rapidly	• Relief valve malfunctioning	Replace	7-S10
Front Wheels Vibrate	• Mechanical connections or wheel bearings worn	Replace defective parts	–

12550S70010

SERVICING SPECIFICATIONS

HYDRAULIC PUMP [M4900]

Item		Factory Specification	Allowable Limit
Hydraulic Pump Condition • Engine Speed 2600 min^{-1} (rpm) • Rated Pressure 16.8 MPa 170 kgf/cm^2 2418 psi • Oil Temperature 45 to 55 °C 113 to 131 °F	Delivery	Above 21.8 L/min. Above 5.76 U.S.gal./min. Above 4.80 Imp.gal./min.	17.8 L/min. 4.70 U.S.gal/min. 3.92 Imp.gal./min.
Housing Bore	Depth of Scratch	–	0.09 mm 0.0035 in.
Bushing to Gear Shaft	Clearance	–	0.15 mm 0.0059 in.
Gear Shaft	O.D.	–	17.968 mm 0.7074 in.
Bushing	Length	–	18.965 mm 0.7466 in.

HYDRAULIC PUMP [M5700]

Hydraulic Pump Condition • Engine Speed 2800 min^{-1} (rpm) • Rated Pressure 16.8 MPa 170 kgf/cm^2 2418 psi • Oil Temperature 45 to 55 °C 113 to 131 °F	Delivery	Above 21.1 L/min. Above 5.57 U.S.gal./min. Above 4.64 Imp.gal./min.	17.2 L/min. 4.54 U.S.gal/min. 3.78 Imp.gal./min.
Housing Bore	Depth of Scratch	–	0.09 mm 0.0035 in.
Bushing to Gear Shaft	Clearance	–	0.15 mm 0.0059 in.
Gear Shaft	O.D.	–	17.968 mm 0.7074 in.
Bushing	Length	–	18.965 mm 0.7466 in.

12550S70020

STEERING CYLINDER

Item		Factory Specification	Allowable Limit
Steering Cylinder	I.D.	50.000 to 50.062 mm 1.96850 to 1.97094 in.	50.100 mm 1.97244 in.
Rod to Bushing	Clearance	0.009 to 0.127 mm 0.00035 to 0.00500 in.	0.135 mm 0.00531 in.

11790S70330

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-10.)

Item	N·m	kgf·m	ft-lbs
Hydraulic pipe mounting screw	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Hydraulic pump assembly mounting screw and nut	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Housing cover mounting nut	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Steering wheel mounting nut	48.0 to 55.8	4.9 to 5.7	35.5 to 41.2
Delivery pipe and return pipe retaining nut	46.6 to 50.9	4.8 to 5.2	34.4 to 37.6
Turning delivery hose retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Steering controller mounting screw	77.5 to 90.2	7.9 to 9.2	57.2 to 66.5
Gerotor assembly mounting screw	25.5 to 28.4	2.6 to 2.9	18.8 to 20.9
Tie-rod end nut [2WD]	77.5 to 90.2	7.9 to 9.2	57.2 to 66.5
Steering cylinder mounting nut	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Steering cylinder mounting lock nut	39.2 to 45.1	4.0 to 4.6	28.9 to 33.3
Cylinder cover mounting screw	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2
Guide assembly	142.2 to 152.0	14.5 to 15.5	104.9 to 112.1
Tie-rod end nut [4WD]	156.9 to 176.5	16.0 to 18.0	115.7 to 130.2
Tie-rod joint and steering cylinder	166.6 to 196.0	17.0 to 20.0	122.9 to 144.6

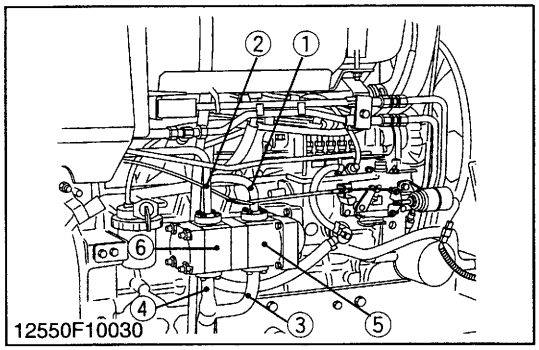
12550S70030

CHECKING, DISASSEMBLING AND SERVICING

[1] POWER STEERING HYDRAULIC PUMP

CHECKING

(1) Pump Test Using Flowmeter



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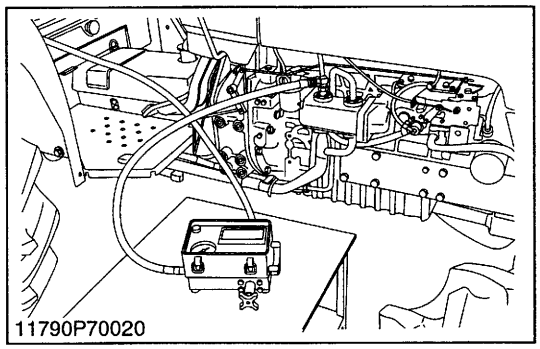
11790P70020

Condition

- Engine speed
  M4900 : Approx. 2600 min^{-1} (rpm)
  M5700 : Approx. 2800 min^{-1} (rpm)
- Rated pressure : 16.8 MPa
  170 kgf/cm^2
  2418 psi
- Oil temperature : 45 to 55 °C
  13 to 131 °F

Hydraulic Flow Test

■ **IMPORTANT**

- **When using a flowmeter other than KUBOTA specified flowmeter (Code No. 07916-52792), be sure to use the instructions with the flowmeter.**
- **Do not close the flowmeter loading valve completely, before testing, because it has no relief valve.**

1. Disconnect the delivery pipe which is connected from hydraulic pump to steering controller.
2. Install the adaptor **53** and **54** to the pump discharge port. [Adaptor **53** and **54** are included in adaptor set (Code No. 07916-54301).]
3. Connect the hydraulic test hose to the adaptor **53** and flowmeter inlet port.
4. Connect the other hydraulic test hose to the flowmeter outlet and put the end of the hose into the transmission oil port.
5. Open the flowmeter loading valve completely. (Turn counterclockwises.)
6. Start the engine and set the engine speed at 2000 to 2200 rpm.
7. Slowly close the loading valve to generate pressure approx. 9.8 MPa (100 kgf/cm^2, 1422 psi). Hold in this condition until oil temperature reaches approx. 50 °C (122 °F).
8. Open the loading valve completely.
9. Set the engine speed. (Refer to condition.)
10. Read and note the pump delivery at no pressure.
11. Slowly close the loading valve to increase rated pressure. (Refer to condition.) As the load is increased, engine speed drops, therefore, reset the engine speed.
12. Read and note the pump delivery at rated pressure.
13. Open the loading valve completely and stop the engine.
14. If the pump delivery does not reach the allowable limit, check the pump suction line, oil filter or hydraulic pump.

Hydraulic pump delivery at no pressure	Factory spec.	M4900	23.2 L/min. 6.13 U.S gal/min. 5 10 U.S Imp gal/min.
		M5700	22.4 L/min 5 92 U S gal/min. 4.93 Imp.gal/min
Hydraulic pump delivery at rated pressure	Factory spec	M4900	21.8 L/min. 5.76 U S.gal/min 4.80 Imp.gal/min
		M5700	21.1 L/min 5 57 U S gal/min. 4 64 Imp gal/min.
	Allowable limit	M4900	17.8 L/min 4 70 U S gal/min. 3.92 Imp gal/min
		M5700	17 2 L/min. 4 54 U.S gal/min. 3.78 Imp gal/min.

12550S70040

DISASSEMBLING AND ASSEMBLING

■ IMPORTANT

- **The hydraulic pump is precision machined and assembled : if disassembled once, it may be unable to maintain its original performance. Therefore, when the hydraulic pump fails, replacement should be carried out with the hydraulic pump assembled except when emergency repair is unavoidable.**
- **When repair is required, follow the disassembly and servicing procedures shown below with utmost care.**
- **Be sure to test the hydraulic pump with a flowmeter before disassembling.**
- **After reassembly, be sure to perform break-in operation and ensure that there is nothing abnormal with the hydraulic pump.**

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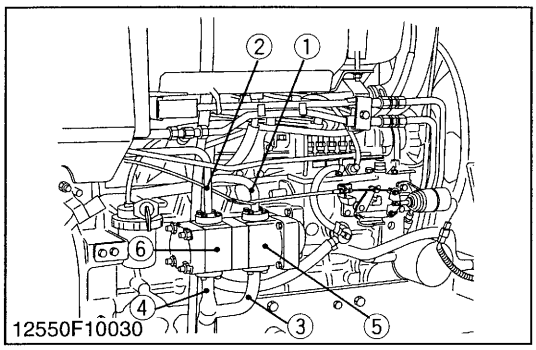

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Removing Three Point System Hydraulic Pump and Power Steering Hydraulic Pump

1. Disconnect the delivery pipe (1), (2) from the hydraulic pump.
2. Disconnect the suction pipe (3), (4) from the hydraulic pump.
3. Remove the hydraulic pump assembly mounting screws and nuts.
4. Take out the hydraulic pump assembly.

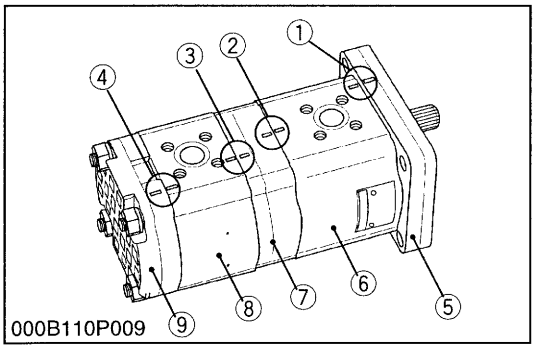
(When reassembling)

- Apply grease to the O-ring and take care not to damage it.

Tightening torque	Hydraulic pipe mounting screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs
	Hydraulic pump assembly mounting screw and nut	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

(1) Delivery Pipe (Three Point Hydraulic Pump)
(2) Delivery Pipe (Power Steering Pump)
(3) Suction Pipe (Three Point Hydraulic Pump)
(4) Suction Pipe (Power Steering Pump)
(5) Three Point Hydraulic Pump
(6) Power Steering Pump

12550S70050



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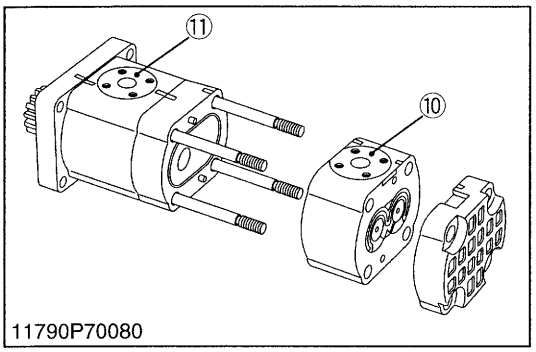
Separating Power Steering Hydraulic Pump

1. Put the parting marks (1), (2), (3), (4) on the flange (5), front housing (6), center plate (7), housing (8) and housing cover (9).
2. Unscrew the housing cover mounting nuts and separate the power steering pump (10) from the three point system hydraulic pump (11).

(When reassembling)

Tightening torque	Housing cover mounting nut	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs

(1) Parting Mark
(2) Parting Mark
(3) Parting Mark
(4) Parting Mark
(5) Flange
(6) Front Housing (Three Point System Hydraulic Pump)
(7) Center Plate
(8) Housing (Power Steering Pump)
(9) Housing Cover
(10) Power Steering Pump
(11) Three Point System Hydraulic Pump



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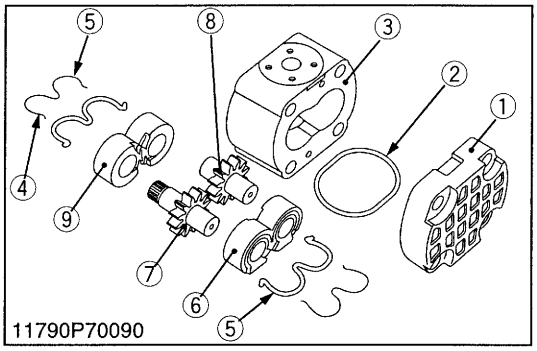

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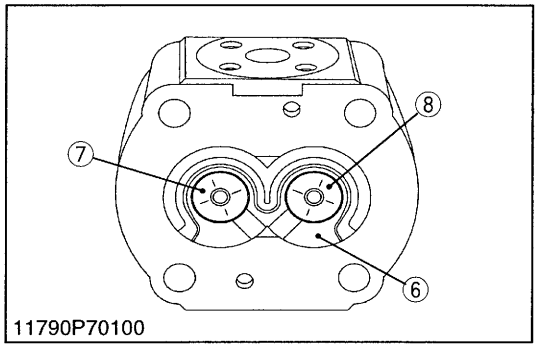

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Disassembling Power Steering Hydraulic Pump

1. Remove the housing cover (1).
2. Remove the backup elements (4) and seal elements (5).
3. Take out bushings (6), (9) and gears (7), (8).

(When reassembling)

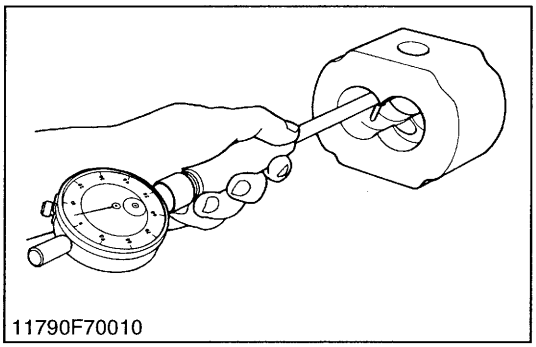
- Install the driven gear (8), noting its direction as shown in the photograph.
- When installing the bushings (6) and (9), be sure to reassemble them to the each original position.
- Take care not to damage the seal elements and O-rings.
- After reassembly, check the smooth rotation of the hydraulic pump (for example, mount arm an approx. 100 m (3.94 in.) long to the drive gear and rotate its arm slowly for smooth rotation).

(1) Housing Cover
(2) O-ring
(3) Housing
(4) Backup Element
(5) Seal Element
(6) Bushing
(7) Drive Gear
(8) Driven Gear
(9) Bushing

(a) Outlet
(b) Inlet

11790S70080

SERVICING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Housing Bore

1. Measure the housing I.D. where the interior surface is not scratched, and measure the housing I.D. where the interior surface is scratched.
2. If the values obtained in the two determinations differ by more than the allowable limit, replace the hydraulic pump as a unit.

Depth of scratch	Allowable limit	0.09 mm 0.0035 in.

(Reference)

- Use a cylinder gauge to measure the housing I.D.

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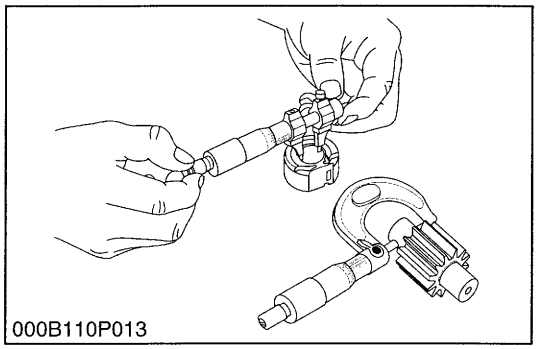
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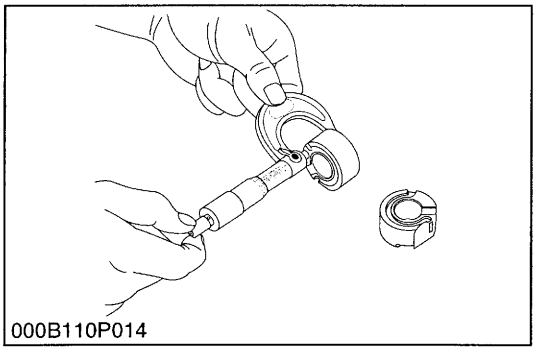
Clearance between Bushing and Gear Shaft

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

Clearance between bushing and gear shaft	Allowable limit	0.15 mm 0.0059 in.
Gear shaft O.D.	Allowable limit	17.968 mm 0.7074 in.

11790S70120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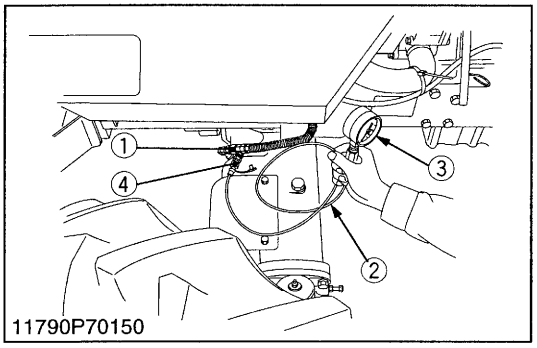
Bushing Length

1. Measure the bushing length with an outside micrometer.
2. If the length is less than the allowable limit, replace it.

Bushing length	Allowable limit	18.965 mm 0.74665 in.

11790S70130

[2] RELIEF VALVE CHECKING AND ADJUSTING



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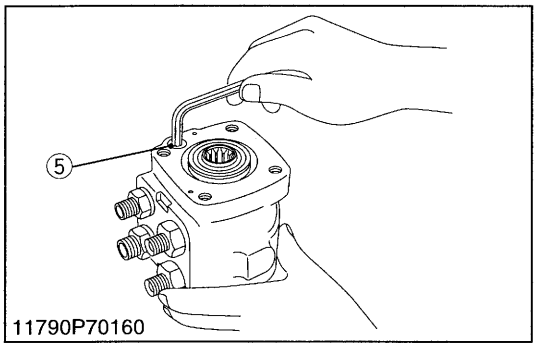


11790P70160

Condition

- Engine speed .....Maximum
- Oil temperature .....45 to 55 °C
  113 to 131 °F

Relief Valve Setting Pressure

1. Disconnect the delivery hose 1 (or 2) from steering cylinder and set a pressure gauge (3) (Code No. 07916-50321) between them using power steering adaptor (1) (Code No. 07916-54021), joint (Code No. 07916-50401) and cable (Code No. 07916-50331).
2. Start the engine and set the engine speed at maximum speed.
3. Fully turn the steering wheel to the left or right and read the pressure when the relief valve operates.
4. Return the steering wheel to the front position and read the pressure gauge when the steering control valve is in neutral.
5. If the difference between the relief pressure and the pressure in neutral is not within the factory specifications, adjust the relief pressure by the adjust plug (5).

■ IMPORTANT

6. (Air Bleeding)

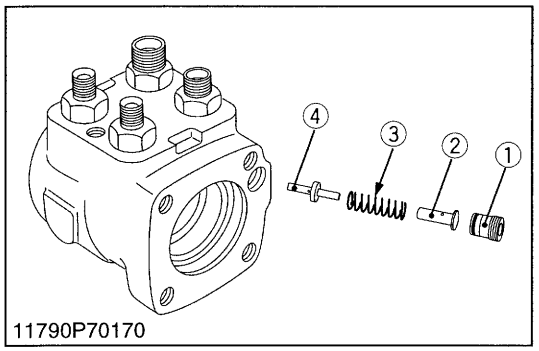
- **Start the engine, then turn the steering wheel slowly in both directions all the way alternately a few times, and stop the engine.**

Relief valve setting pressure	Factory spec.	18.1 MPa 185 kgf/cm^2 2631 psi

(1) Power Steering Adaptor
(2) Cable
(3) Pressure Gauge
(4) Joint
(5) Adjust Plug for Relief Valve

12550S70060

DISASSEMBLING AND ASSEMBLING



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Relief Valve Assembly

1. Remove the adjust plug (1) and draw out the collar (2), spring (3) and poppet (4).

(When reassembling)

- Take care not to damage the O-ring.

■ IMPORTANT

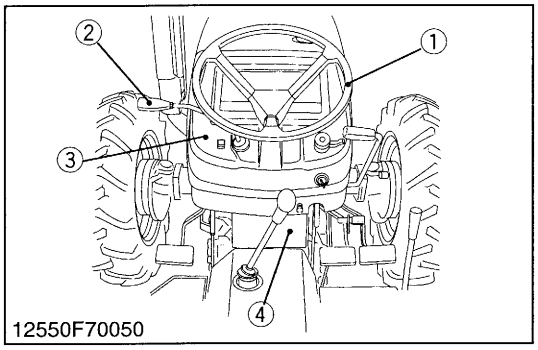
- **After disassembling and assembling the relief valve, be sure to adjust the relief valve setting pressure.**

(1) Adjust Plug
(2) Collar
(3) Spring
(4) Poppet

11790S70150

[3] STEERING CNTROLLER DISASSEMBLING AND ASSEMBLING

(1) Removing Steering Controller



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Steering Wheel and Meter Panel

1. Remove the ground cable from battery.
2. Remove the steering wheel (1).
3. Remove the grip (2).
4. Remove the meter panel (3).
5. Remove the under cover (4).

(When reassembling)

Tightening torque	Steering wheel mounting nut	48.0 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs

(1) Steering Wheel
(2) Shuttle grip
(3) Meter Panel
(4) Under Cover

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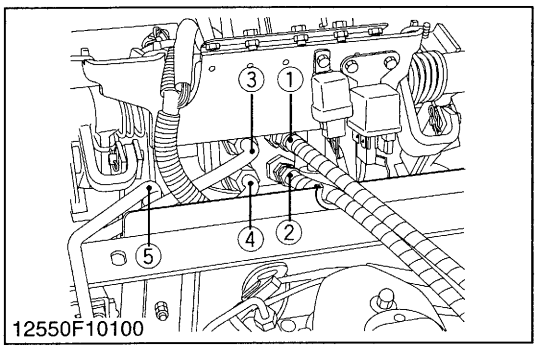

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Hydraulic Hoses and Pipes

1. Disconnect the delivery pipe (4).
2. Disconnect the return pipe 1 (3), and return pipe 2 (5).
3. Disconnect the delivery hoses (1) and (2).

(When reassembling)

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

(1) Delivery hose L
(2) Delivery hose R
(3) Return Pipe
(4) Delivery Pipe

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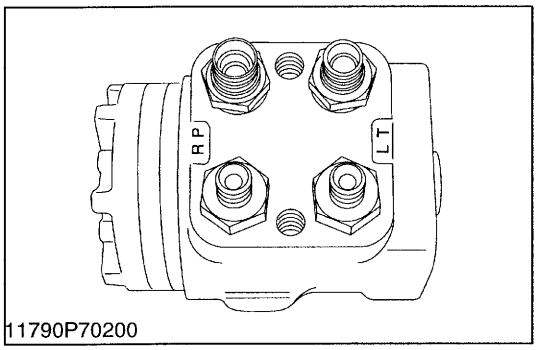

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Steering Controller

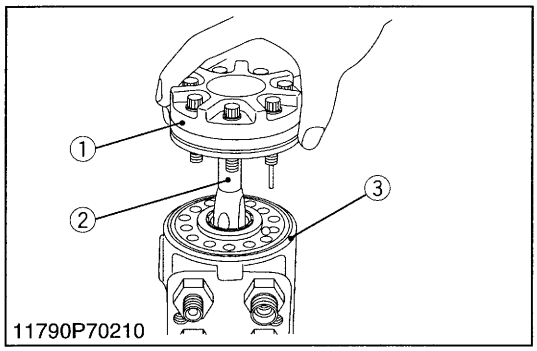
1. Remove the steering controller mounting screws.
2. Take out the steering controller.

(When reassembling)

Tightening torque	Steering controller mounting screw	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs

11790S70180

(2) Disassembling Steering Controller



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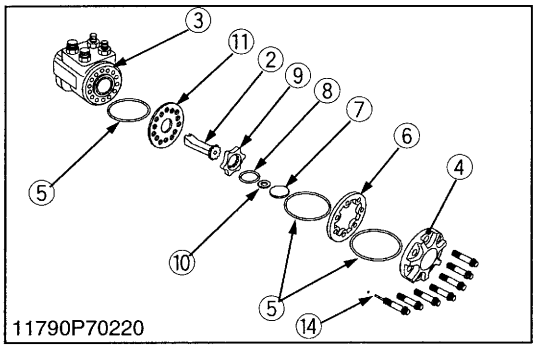

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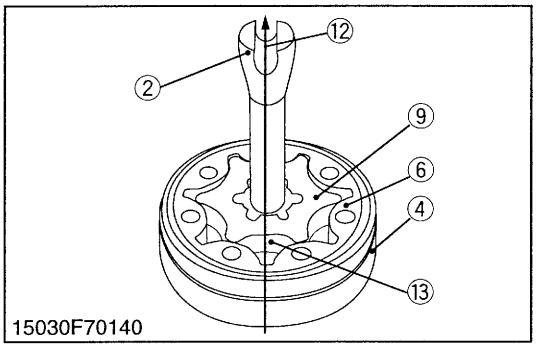

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Removing Gerotor

1. Secure the housing (3) in a vise and remove seven gerotor mounting screws and gerotor assembly (1).
2. Remove the distributor plate (11) and drive shaft (2).
3. Remove the rotor (9), O-ring (5) between the distributor plate and stator (6).
4. Take out the spacer ring (10) and spacer (7).
5. Remove the O-ring (8) from the rotor.

(When reassembling)

1. Fit an O-ring into the groove of the end cap (4), and insert 2 or 3 bolts.
2. Fit an O-ring into the groove of the stator (6), and put it on the end cap, with the O-ring upward.
3. Apply clean transmission fluid (specified fluid) to the rotor (9), fit an O-ring (8) into the groove of the rotor and put the spacer on it. Keeping the spacer on the rotor, fit it into the stator (6) with the spline bevelled side upward.
4. After putting the spacer into the rotor (9), insert the splines of drive shaft (2) into the rotor (9), aligning the direction of drive shaft pin groove (12) with the rotor tooth bottom (13).
5. Fit an O-ring into the groove of the housing.
   Fit the pin groove of the drive shaft (2) to the dowel pin inside the housing.

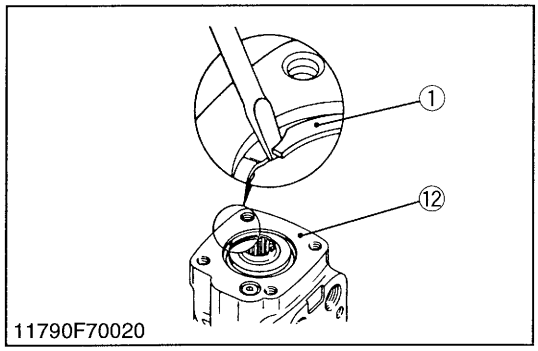
■ IMPORTANT

- **Be sure to align the direction of the drive shaft pin groove (12) with the rotor tooth bottom (13).**

Tightening torque	Gerotor assembly mounting screw (5/16')	25.5 to 28.4 N·m 2.6 to 2.9 kgf·m 18.8 to 20.9 ft-lbs

(1) Gerotor Assembly
(2) Drive Shaft
(3) Housing
(4) End Cap
(5) O-ring
(6) Stator
(7) Spacer
(8) O-ring
(9) Rotor
(10) Spacer Ring
(11) Distributor Plate
(12) Direction of Pin Groove
(13) Rotor Tooth Bottom
(14) Ball

11790S70190



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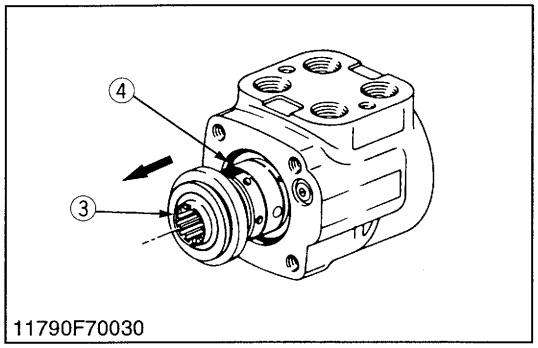

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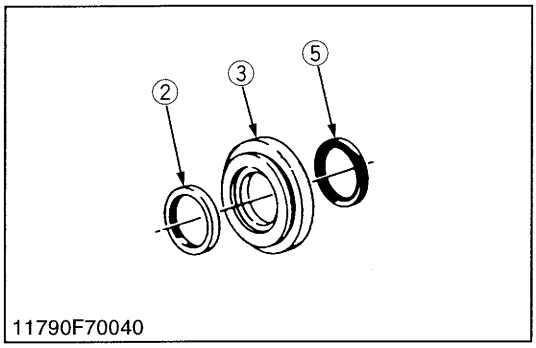

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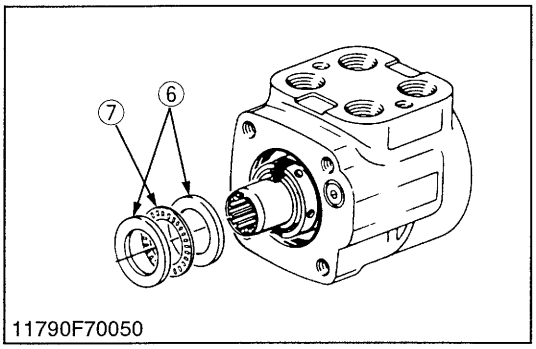

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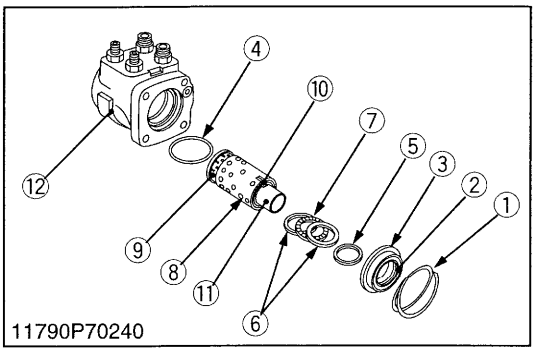

11790P70240

Grand Seal, Needle Bearing, Sleeve and Spool

1. Remove the retaining ring (1) with a screw driver.
2. Hold the control valve unit vertically and spool and sleeve align the cross pin paralles to flat side of housing (flow priority valve mounting side), the cross pin is visible through open end of spool.
3. At this time, take care so as not to allow the cross pin to be caught in the groove of the housing. If the cross pin is caught, adjust its position with a fingertip.
4. Push the spool and sleeve to the allow direction and remove the seal grand bushing (3) with dust seal (2) and quad ring seal (5).
5. Remove the O-ring (4) from the housing (12).
6. Remove the dust seal from the seal grand bushing (3).
7. Remove the O-ring (4).

(When reassembling)

- Replace O-ring with new one.
  Apply transmission oil to the dust seal, quad ring seal and O-ring.

8. Remove the quad ring seal (5) from the sleeve (9).
9. Remove the bearing races and needle bearing from valve assembly.

(When reassembling)

- Apply transmission oil to the bearing races and needle bearing.

10. Draw out the sleeve (9) and spool (11) assembly from the gerotor side, with the port surface of the housing downward. At this time, take care so as not to allow the dowel pin to be caught in the groove of the housing (12). If the dowel pin is caught, adjust its position with a fingertip and draw out the sleeve and spool assmebly slowly.

■ IMPORTANT

- **As the clearance between the housing and sleeve is very narrow, do not forcibly draw out the sleeve.**

(When reassembling)

- When fitting the sleeve (9) and spool (11) assembly into the housing (12), apply clean transmission oil to the assembly and then insert it while turning it slowly, taking care so that the parts are not inclined. Also, pay attention to the dowel pin so that it is not caught in the housing grooves. If the pin is caught, adjust its position with a fingertip.

(1) Retaining Ring
(2) Dust Seal
(3) Seal Grand Bushing
(4) O-ring
(5) Quad Ring Seal
(6) Bearing Race
(7) Needle Bearing
(8) Pin
(9) Sleeve
(10) Centering Spring
(11) Spool
(12) Housing

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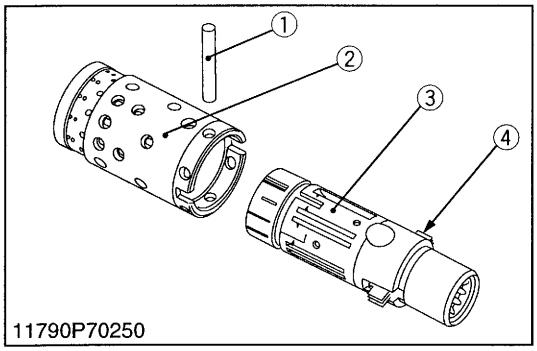


11790P70250

Sleeve and Spool

1. Draw out the dowel pin (1).
2. Draw out the spool (3) from the sleeve (2).
3. Push out the centering spring (4).

■ IMPORTANT

- **As the clearance between the sleeve (4) and spool (2) is very narrow, draw out the spool by turning it slowly with due care.**

(When reassembling)

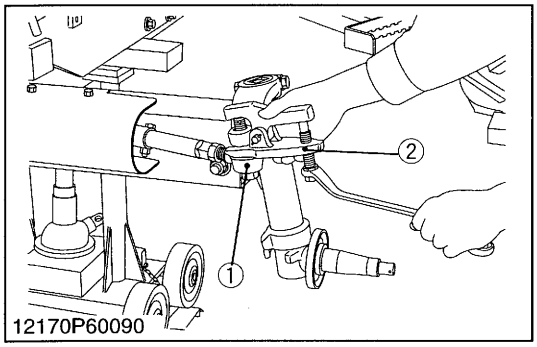
- For easier assembly, first insert a couple of centering springs assembled back to back and then fit springs in one after another.
- Align the centering spring notch with the sleeve notch.

(1) Dowel Pin
(2) Sleeve
(3) Spool
(4) Centering Spring

12550S70100

[4] STEERING CYLINDER DISASSEMBLING AND ASSEMBLING

(1) 2WD TYPE



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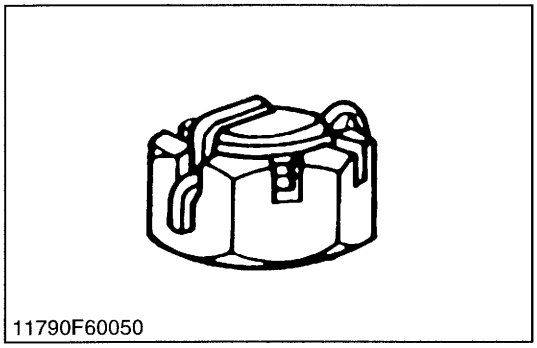
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Tie-rod

1. Pull out the cotter pin and loosen the tie-rod end nut.
2. Disconnect the tie-rod (1) with a tie-rod end lifter (2) (Code No. 07909-39051).
3. Remove the tie-rod end nut and tie-rod end.

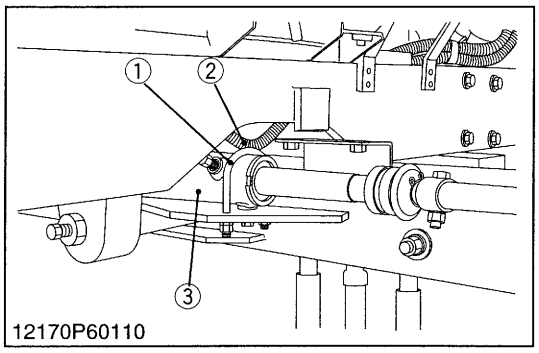
(When reassembling)

- After tightening the tie-rod end nut to the specified torques, install a cotter pin as shown in the figure.

Tightening torque	Tie-rod end nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs

(1) Tie-rod
(2) Tie-rod End Lifter

12170S60260



12170P60110

Steering Cylinder

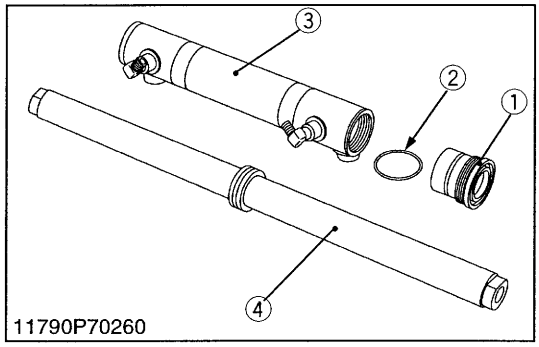
1. Remove the cylinder cover.
2. Disconnect the power steering hoses (2).
3. Remove the cylinder clamps (1).
4. Take out the steering cylinder (3).

(When reassembling)

Tightening torque	Steering cylinder mounting nut	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs
	Steering cylinder mounting lock nut	39.2 to 45.1 N·m 4.0 to 4.6 kgf·m 28.9 to 33.3 ft-lbs
	Cylinder cover mounting screw	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs

(1) Cylinder Clamp
(2) Power Steering Hose
(3) Steering Cylinder

12550S60140



11790P70260

Disassembling Steering Cylinder

1. Carefully clamp the cylinder in a vise.
2. Remove the guide assembly (1) and draw out the piston rod (4).

(When reassembling)

- Apply transmission fluid to the oil seal and O-ring.
- Apply molybdenum disulfide (Three Bond 1901 or equivalent) on the screw of guide when tighten it.
- After tightening the guide assembly to the specified torque, stake the cylinder firmly.

Tightening torque	Guide assembly	142.2 to 152.0 N·m 14.5 to 15.5 kgf·m 104.9 to 112.1 ft-lbs

(1) Guide Assembly
(2) O-ring
(3) Cylinder
(4) Piston Rod

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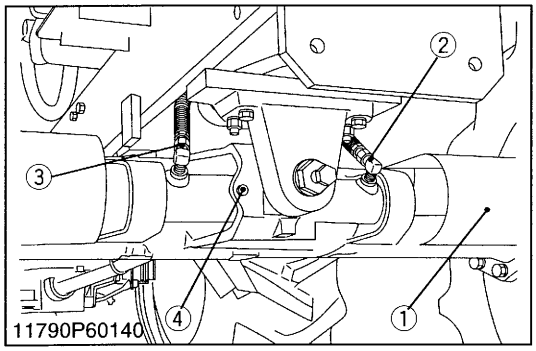
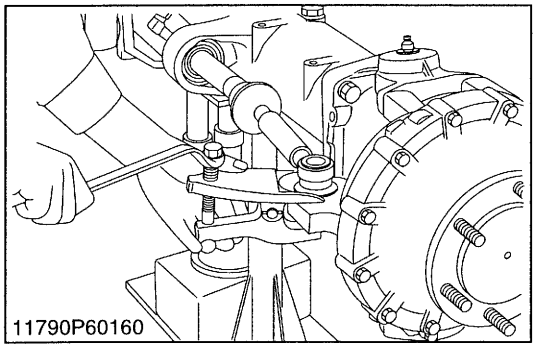
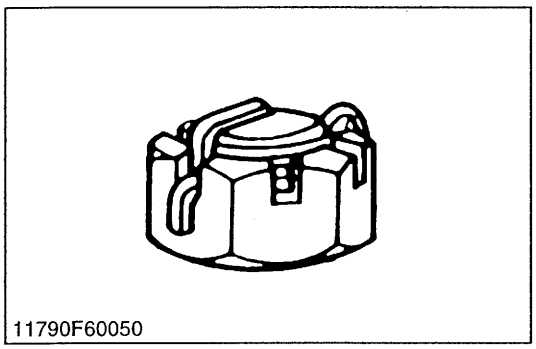
(2) 4WD TYPE







Tie-rod

1. Remove the cylinder cover (1).
2. Disconnect the power steering hoses (2), (3) from cylinder.
3. Remove the set screw (4).
4. Place a disassembly stand under the engine and support it with a jack.
5. Pull out the cotter pin and remove the tie-rod end nuts.
6. Remove the tie-rod with a tie-rod end lifter (Code No. 07909-39051).

(When reassembling)

- After tightening the tie-rod end nut to the specified torque, install a cotter pin as shown in the figure left.

Tightening torque	Tie-rod end nut	156.9 to 176.5 N·m 16.0 to 18.0 kgf·m 115.7 to 130.2 ft-lbs

(1) Cylinder Cover
(2) Power Steering Hose
(3) Power Steering Hose
(4) Set Screw

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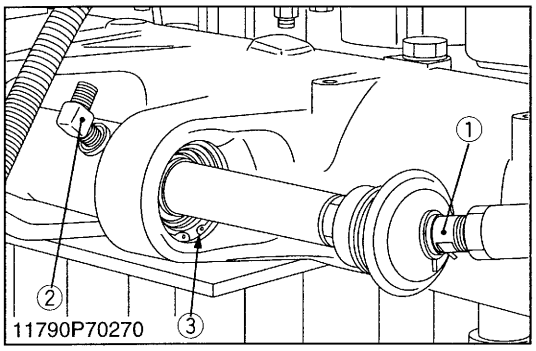

Steering Cylinder

1. Remove the tie-rod joint (1) (right and left).
2. Remove the nipples (2) from steering cylinder.
3. Remove the internal snap ring (3).
4. Draw out the steering cylinder to the left.

(When reassembling)

- Apply liquid lock (Three Bond 1372 or equivalent) to the tie-rod joint.

Tightening torque	Tie-rod joint and steering cylinder	166.6 to 196.0 N·m 17.0 to 20.0 kgf·m 122.9 to 144.6 ft-lbs

(1) Tie-rod Joint
(2) Nipple
(3) Internal Snap Ring

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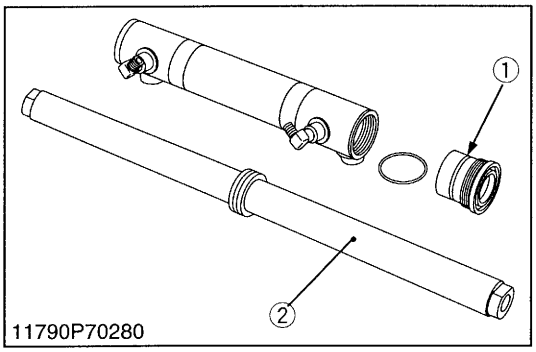


Disassembling Steering Cylinder

1. Remove the guide assembly (1) and draw out the piston rod (2).

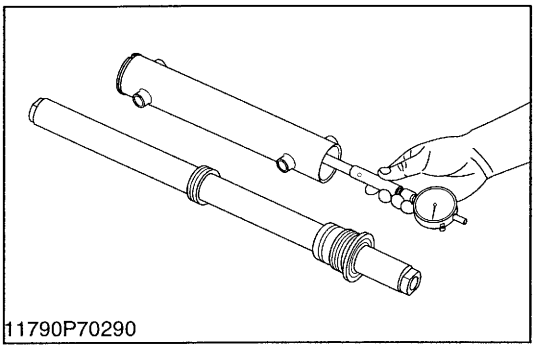
(When reassembling)

- Apply transmission fluid to the oil seal and O-ring.

(1) Guide Assembly (2) Piston Rod

11790S70270

SERVICING

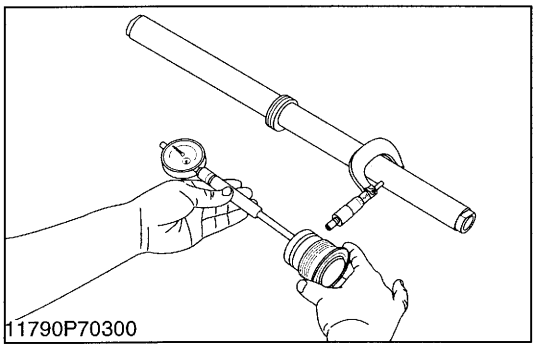


Steering Cylinder I.D.

1. Measure the steering cylinder I.D. with a cylinder gauge.
2. If the cylinder I.D. exceed the allowable limit, replace the cylinder barrel.

Steering cylinder I.D.	Factory spec.	50.000 to 50.062 mm 1.96850 to 1.97094 in.
	Allowable limit	50.100 mm 1.97244 in.

11790S70280



Clearance between Rod and Bushing

1. Measure the bushing I.D. with a cylinder gauge.
2. Measure the rod O.D. with a outside micrometer, and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace as a unit.

Clearance between rod and bushing	Factory spec.	0.009 to 0.127 mm 0.00035 to 0.00500 in.
	Allowable limit	0.135 mm 0.00531 in.

11790S70290

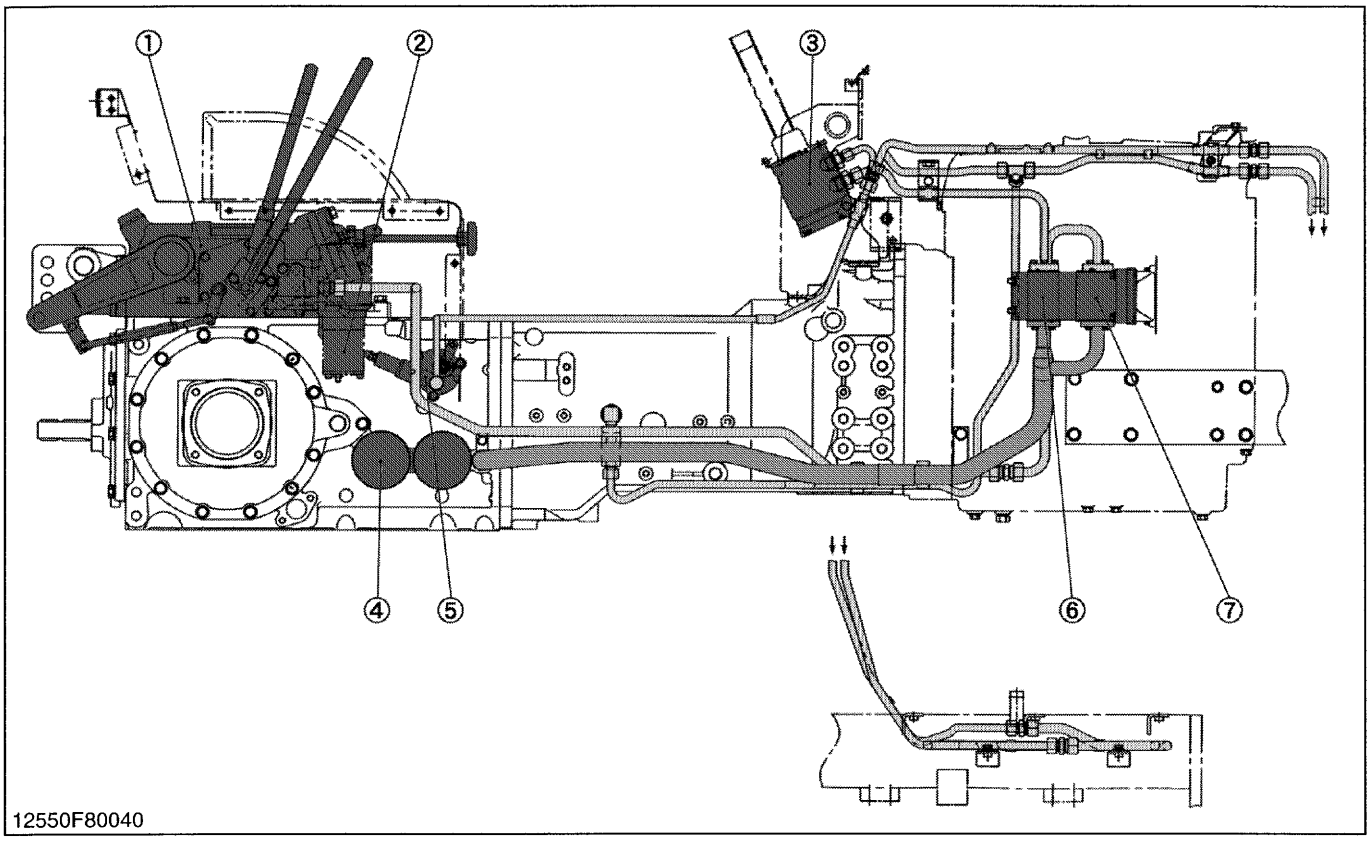
8 HYDRAULIC SYSTEM

8 HYDRAULIC SYSTEM

MECHANISM

CONTENTS

[1] THREE POINT HYDRAULIC SYSTEM



(1) Hydraulic Cylinder Body
(2) Auxiliary Control Valve
(3) Power Steering Controller
(4) Oil Filter Cartridge
(5) PTO Control Valve
(6) Hydraulic Pump for Power Steering
(7) Hydraulic Pump for Three Point Hydraulic System

The hydraulic system of these tractors are composed of the main components as shown in the figure.

- To raise and lower the implement connected to the three point hitch. For this motion, the position control valve and the linkage installed on the hydraulic cylinder body provide three different applications : position control, draft control and mix control.
- Take out hydraulic power from the hydraulic cylinder body to operate an implement's hydraulic actuator.
- Takes out hydraulic power from the quick couplers for the implements with either single acting or double acting actuators. In this case, the implement's cylinders can be actuated by operating the auxiliary control valves.

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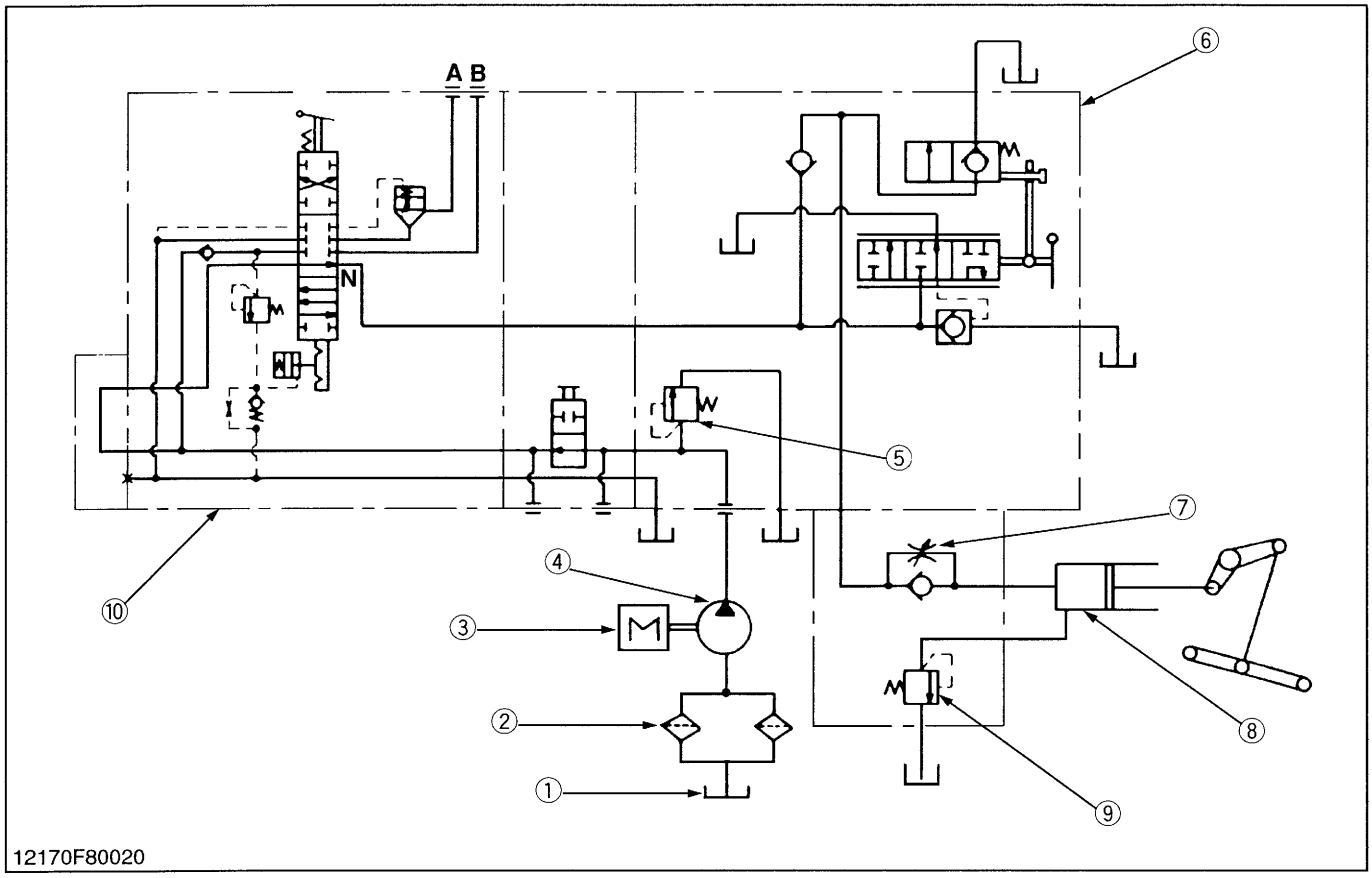
[2] HYDRAULIC CIRCUIT FOR THREE POINT HYDRAULIC SYSTEM



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(1) Oil Tank (Transmission Case)
(2) Hydraulic Oil Filter Cartridge
(3) Engine
(4) Hydraulic Pump
(5) Relief Valve
(6) Control Valve
(7) Lowering Speed Adjusting Valve
(8) Hydraulic Cylinder
(9) Cylinder Safety Valve
(10) Auxiliary Control Valve

A : To Implement Cylinder
B : To Implement Cylinder

1. When the engine is started, the hydraulic pump (4) is rotated to suck oil from transmission case (1) through the suction pipe.
   Supplied oil is filtered by the hydraulic oil filter cartridge (2).
2. Filtered oil is forced out by the hydraulic pump to the auxiliary control valve (10) through the delivery pipe.
3. With the auxiliary control valve (10) in neutral position, oil is channelled from **"N"** port to the control valve (6).
4. The hydraulic system has a relief valve (5) which restricts the maximum pressure in the circuit.
   The hydraulic cylinder (8) has a cylinder safety valve (9) to relieve shock pressure due to heavy implement bounce.
5. The control valve is actuated by the mechanical linkage for **"Position control"** or **"Draft control"** or both (**"Mix control"**).
6. These tractors have one single / double acting auxiliary control valve as standard equipment.

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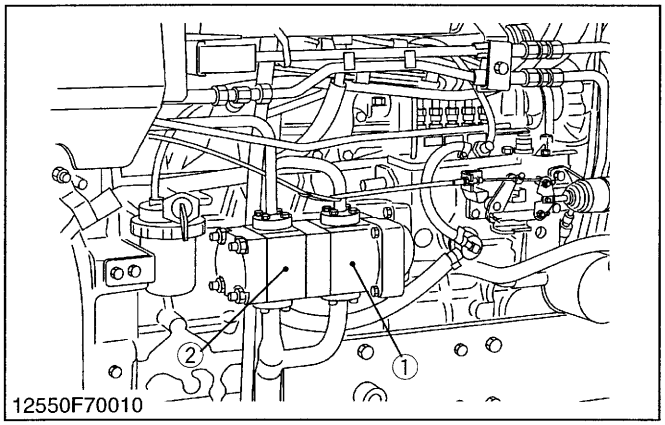
[3] HYDRAULIC PUMP



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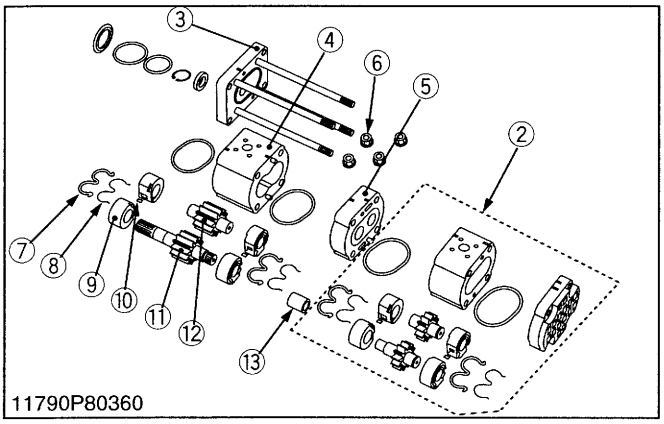

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The three point system hydraulic pump pressure feds the oil drawn from the transmission case through the oil filter to the control valve.

The three point system hydraulic pump is driven by the engine fuel camshaft.

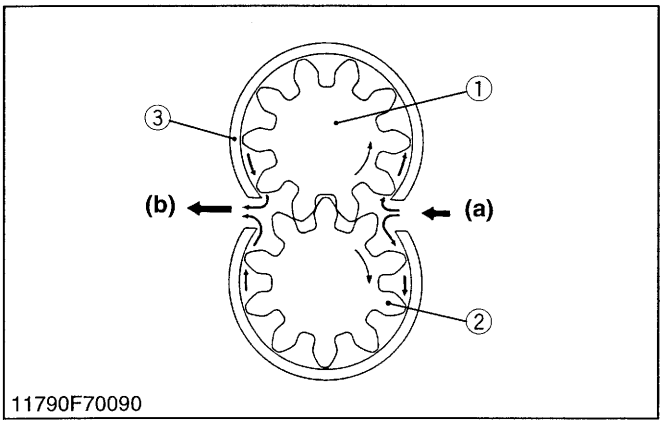
(Reference)

- Pump discharge per revolution.

Factory spec.	16.3 cc/rev. 0.99 cu.in./rev.

(1) Three Point System Hydraulic Pump
(2) Power Steering Pump
(3) Flange
(4) Front Housing
(5) Center Plate
(6) Nut
(7) Seal Element
(8) Backup Element
(9) Bushing
(10) Key
(11) Drive Gear
(12) Driven Gear
(13) Coupling

12550M80010



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■ Operation of Hydraulic Pump

The hydraulic pump has two meshing gears (1), (2) whose teeth run close to the casing (3). One gear is a drive gear (1) which drives the driven gear (2).

When the drive gear is driven in the direction of the arrow by the crankshaft, the gears trap oil between the gear teeth and the casing. The trapped oil is carried around to the outlet. The higher the engine speed, the more the pump discharge.

(1) Drive Gear
(2) Driven Gear
(3) Casing
(a) Inlet
(b) Outlet

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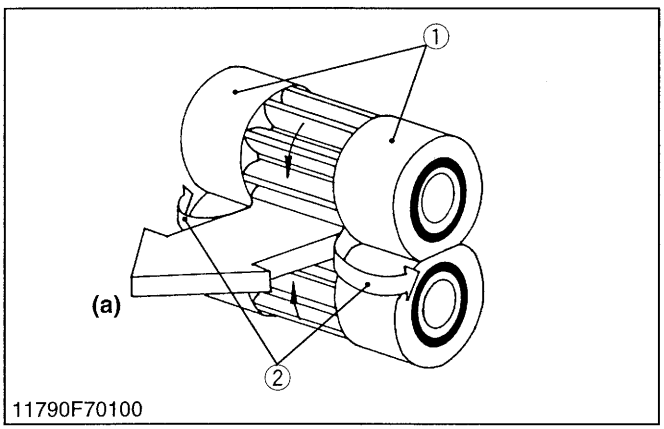

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■ Pressure Loading System

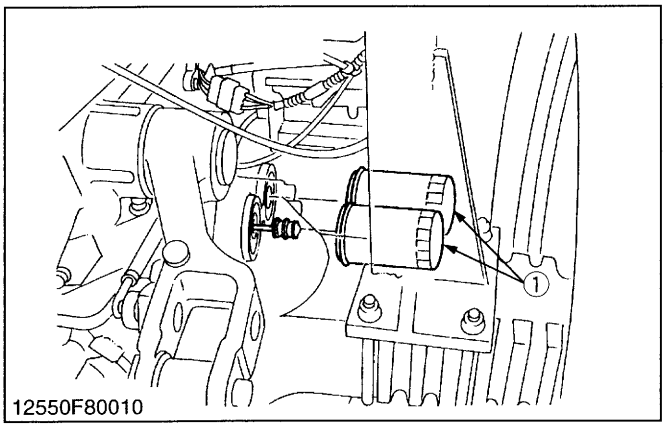
The pressure loading system automatically decreases the clearance between the gear and the bushing (1). A small amount of pressure oil is fed behind the bushings, pressing them against the gears and forming a tighter seal against leakage.

Therefore, leakage from the delivery side (high pressure) to the inlet side (low pressure) does not increase even if the pressure on the delivery side increases.

(1) Bushing
(2) Loading Pressure
(a) Outlet

11790M70050

[4] OIL FILTER



Two oil filter are located in parallel at the pump suction line. A permanent magnet, serving as a magnet filter, is inserted in the paper type element of each cartridge, which ensures a filtration degree of β60 or BETA60=2.5 (MIN)*

* This is authorized by ISO / 4572 Filter Element Multi Pass Test.
βa=(The number of particles which are more than μm diameter before passing filter) / (The number of the same size of particles after passing filter)

(1) Hydraulic Oil Filter Cartridge

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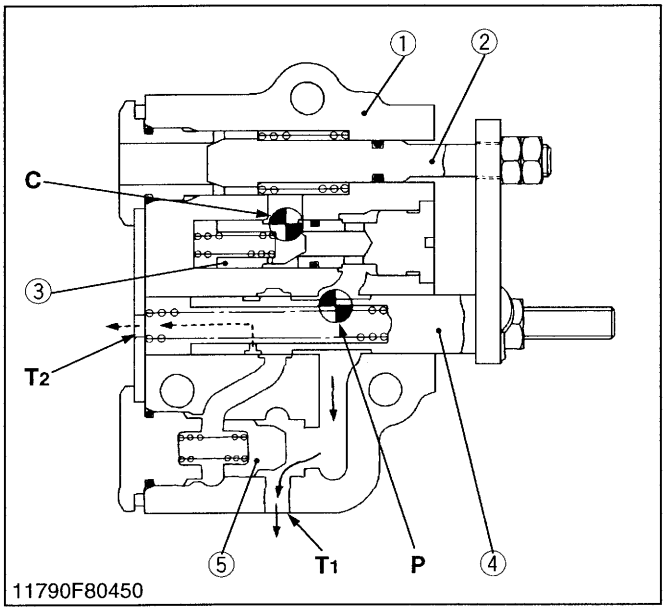
[5] POSITION CONTROL VALVE



■ Neutral

Oil forced into the control valve through the **P** port pushes open the unload valve (5) and then returns to the transmission case through the **T1** port.

Oil behind the unload valve (5) returns to the transmission case through the spool (4) and the **T2** port.

Since the check valve (3) and poppet valve (2) are closed, oil in the hydraulic cylinder does not flow to the transmission case. Thus, the implement remains at its fixed position.

(1) Valve Body
(2) Poppet Valve
(3) Check Valve
(4) Spool
(5) Unload Valve

C : C (Cylinder) port
P : P (Pump) Port
T1 : T1 Port (To Transmission Case)
T2 : T2 Port (To Transmission Case)

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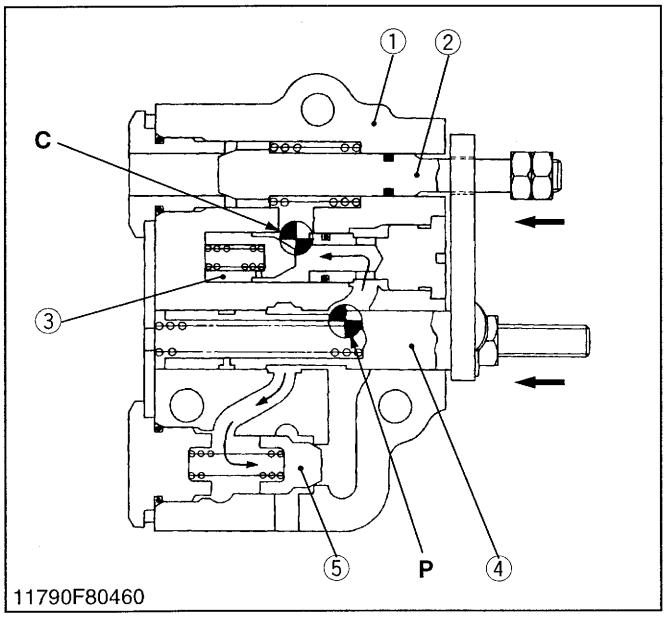


■ Lift

When the control lever is set to the **"LIFT"** position, the spool (4) is pushed to the left.

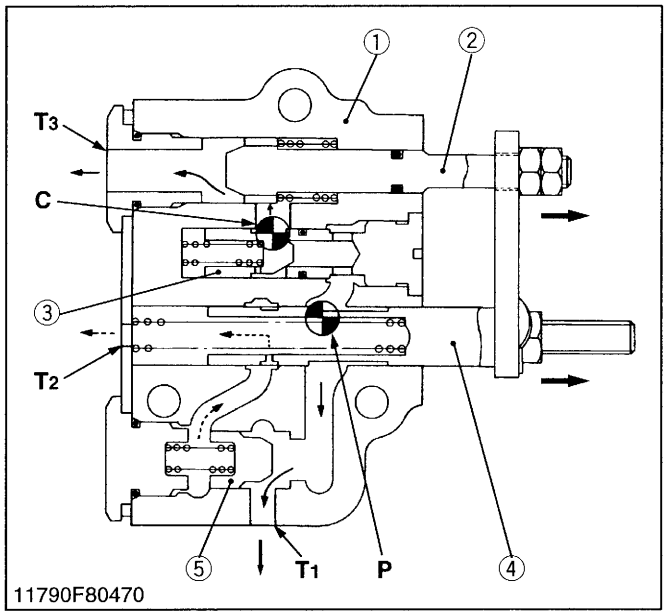
The oil forced into the control valve through the **P** port is directed to the back of the unload valve (5) to close it.

The oil pushes open the check valve (3), and flows into the hydraulic cylinder through the **C** port to lift the implement.

(1) Valve Body
(2) Poppet Valve
(3) Check Valve
(4) Spool
(5) Unload Valve

C : C (Cylinder) Port
P : P (Pump) Port

11790M80300



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■ Down

When the control lever is moved to the **"DOWN"** position, the spool (4) is pulled out to the right, and the poppet valve (2) is allso pulled out.

Oil in the hydraulic cylinder is forced out to the transmission case through the **T3** 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 valve (5) as in neutral and returns to the transmission case through the **T1** port.

(1) Valve Body
(2) Poppet Valve
(3) Check Valve
(4) Spool
(5) Unload Valve

C : C (Cylinder) Port
P : P (Pump) Port
T1 : T1 Port (To Transmission Case)
T2 : T2 Port (To Transmission Case)
T3 : T3 Port (To Transmission Case)

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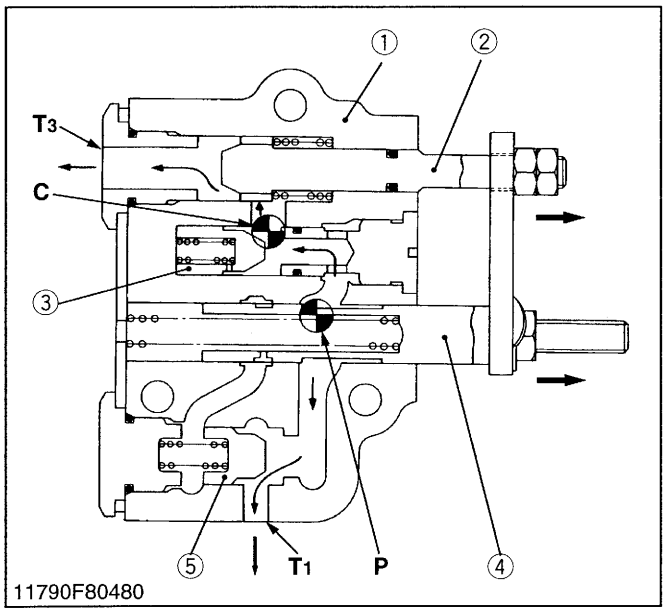

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■ Floating

When the position control lever is moved to its lowest position, the spool (4) is maintained at the **"DOWN"** position. When the implement is at its lowest position, the hydraulic cylinder is in no-load condition, and oil forced out by the hydraulic pump pushes open both the unload valve (5) and check valve (3). Thus, oil flows freely in the valves.

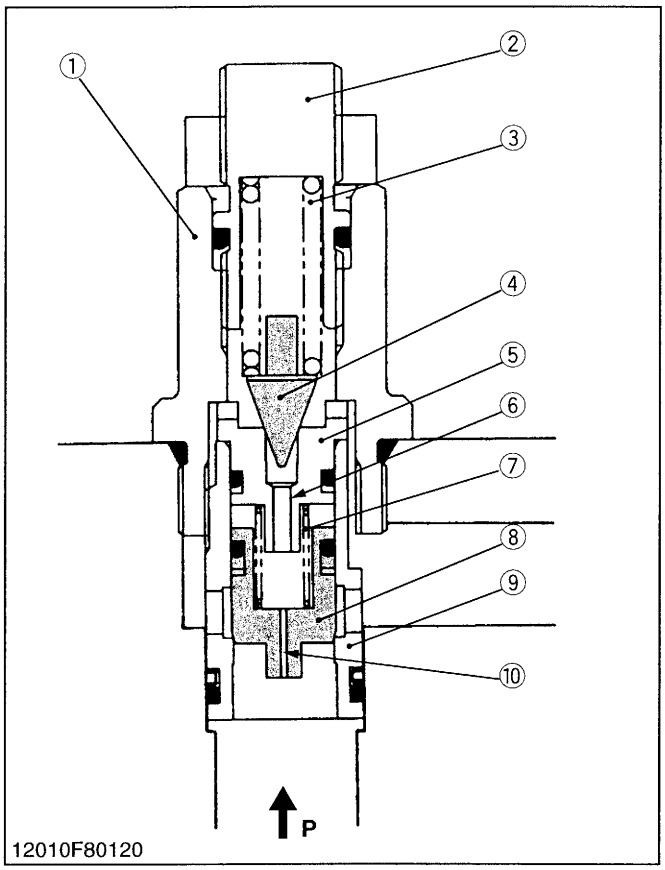
(1) Valve Body
(2) Poppet Valve
(3) Check Valve
(4) Spool
(5) Unload Valve

C : C (Cylinder) Port
P : P (Pump) Port
T1 : T1 Port (To Transmission Case)
T3 : T3 Port (To Transmission Case)

11790M80320

[6] RELIEF VALVE

■ Relief Valve



12010F80120

M4900 and M5700 use a pilot-operated relief valve. This relief valve is suitable for a high pressure and large volumetric flow, and has better pressure override performance than direct acting relief valves.

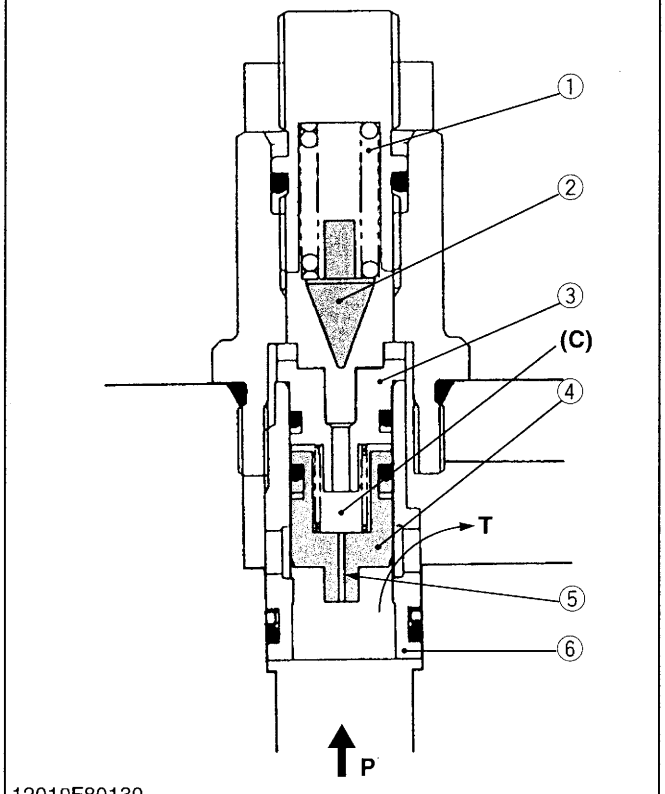
This relief valve consists of a pilot valve (4) and main valve (8). The pilot valve (4) is trigger which controls the main valve (8).

When the oil pressure in the circuit is lower than the setting pressure, the pilot valve (4) and main vlave (8) are closed by the spring (3), (7).

(1) Relief Valve Body
(2) Adjuster
(3) Spring
(4) Pilot Valve
(5) Valve Seat
(6) Sensing Passage
(7) Spring
(8) Main Valve
(9) Valve Seat
(10) Choke

12550M80030

Relief Valve Operation



12010F80130

As the oil pressure in the circuit rises, so does the pressure in the chamber **"C"**. When it reaches the pilot valve (2) setting pressure, the pilot valve (2) opens. This releases oil in the chamber **"C"** to the transmission case. Accordingly the oil in the circuit flows to the chamber **"C"** through the choke (5).

The resulting pressure drop in the chamber **"C"** causes the main valve (4) open. The oil in the circuit then flows out to the transmission case, preventing any further rise in pressure. The relief valve close again when the oil pressure in the circuit drops below the setting pressure.

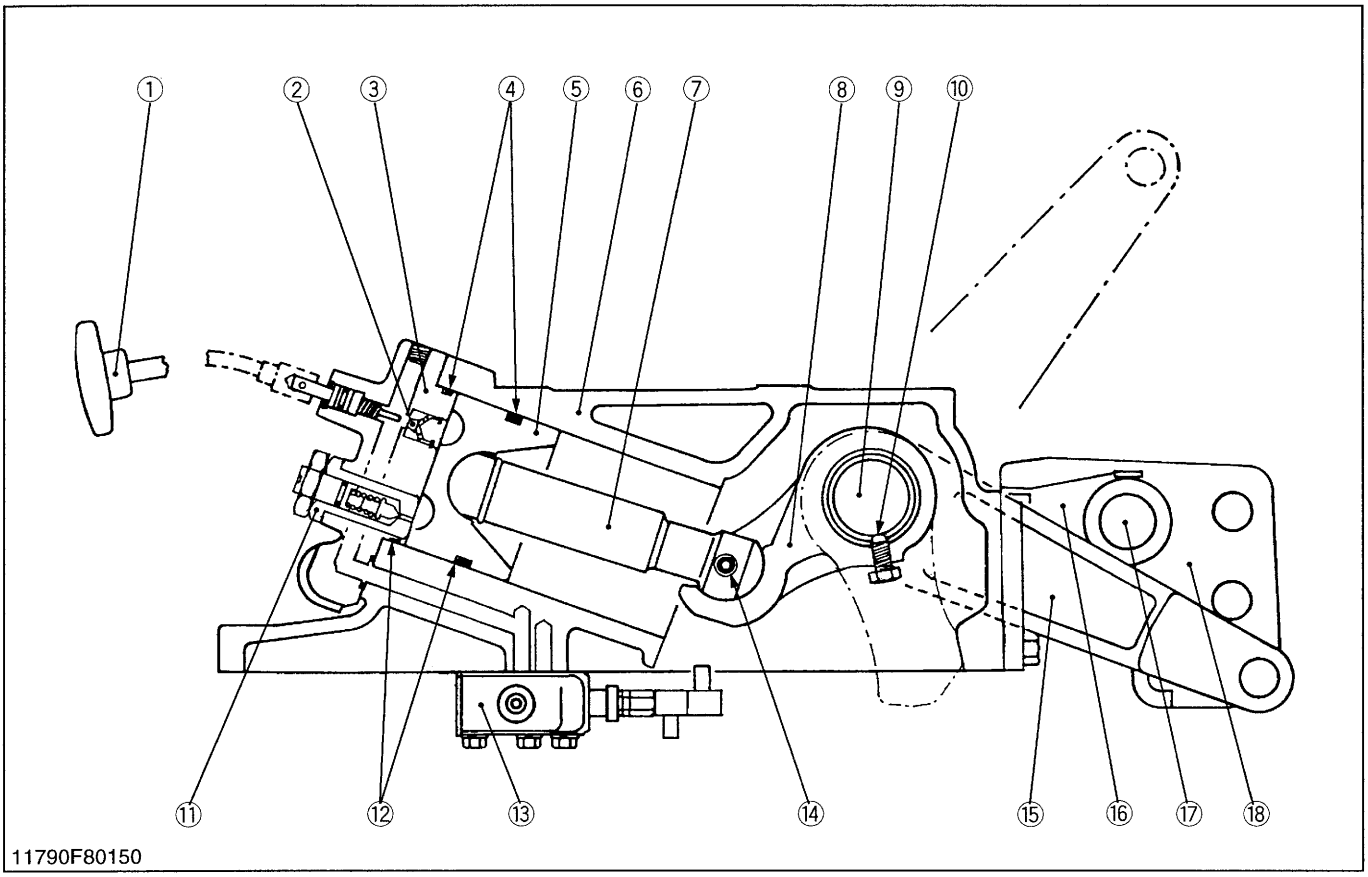
(Reference)

- Relief valve setting pressure :
  18.6 to 19.1 MPa
  190 to 195 kgf/cm^2
  2702 to 2773 psi
  Engine speed : Maximum rpm
  Oil temperature : 45 to 65 °C
  113 to 131 °F

(1) Spring
(2) Pilot Valve
(3) Valve Seat
(4) Main Valve
(5) Choke
(6) Valve Seat
C : Chamber "C"

12550M80040

[7] HYDRAULIC CYLINDER



11790F80150

(1) Lowering Speed Adjusting Knob
(2) Lowering Speed Adjusting Valve
(3) Hydraulic Cylinder Cover
(4) O-ring
(5) Hydraulic Piston
(6) Hydraulic Cylinder
(7) Hydraulic Rod
(8) Hydraulic Arm
(9) Hydraulic Arm Shaft
(10) Setting Screw
(11) Cylinder Safety Valve
(12) Backup Ring
(13) Position Control Valve
(14) Spring Pin
(15) Lift Arm
(16) Top Link Bracket
(17) Torsion Bar
(18) Top Link Holder

The main components of the hydraulic cylinder are shown in the figure above.

While the lift arm (15) is rising, oil from the hydraulic pump flows into the hydraulic cylinder (6) through the control valve (13). Then oil pushes the hydraulic piston (5) out.

While the lift arm is lowering, oil in the hydraulic cylinder is discharged to the transmission case through the control valve (13) 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) on the hydraulic cylinder cover (3). Turning the lowering speed adjusting knob (1) clockwise decreases the lowering speed, and counterclockwise increases it.

When the lowering speed adjusting valve (2) is completely closed, the lift arm is held at its position since oil in the hydraulic cylinder is sealed between the piston and the valve.

11790M80110

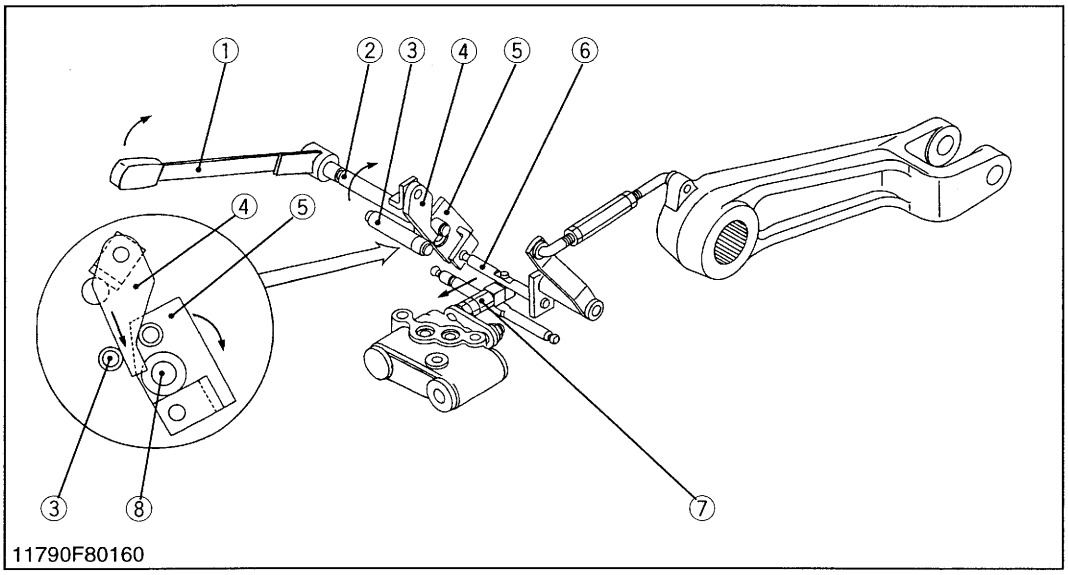
[8] LINKAGE MECHANISM

(1) Position Control

Position control is a linkage mechanism to raise or lower the implement attached to the tractor in proportion to the movement of the position control lever.

The implement can be positioned at any height by moving the position control lever. Fine position adjustment is also easy.

■ Lift

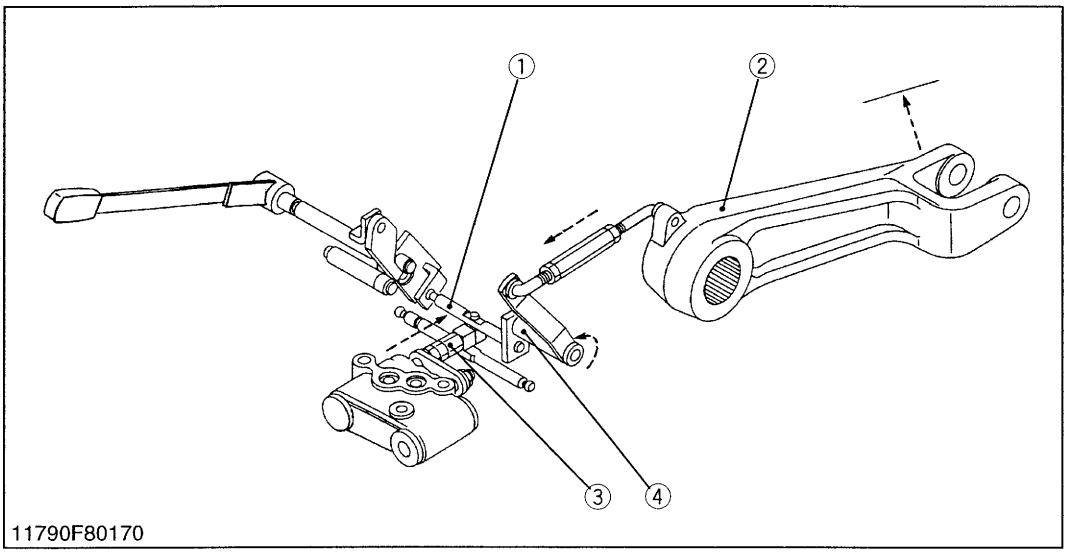


11790F80160

(1) Position Control Lever
(2) Lever Shaft
(3) Fulcrum 1
(4) Cam Link
(5) Link
(6) Spool Drive Lever
(7) Spool
(8) Fulcrum 2

1. When the position control lever (1) is moved to the **"LIFT"** position, the lever shaft (2) rotates and press down the cam link (4) between the fulcrum 1 (3) and link (5).

   The link (5) rotates around the fulcrum 2 (8) and pushes the spool (7) by the spool drive lever (6), opening the **"LIFT"** circuit.



11790F80170

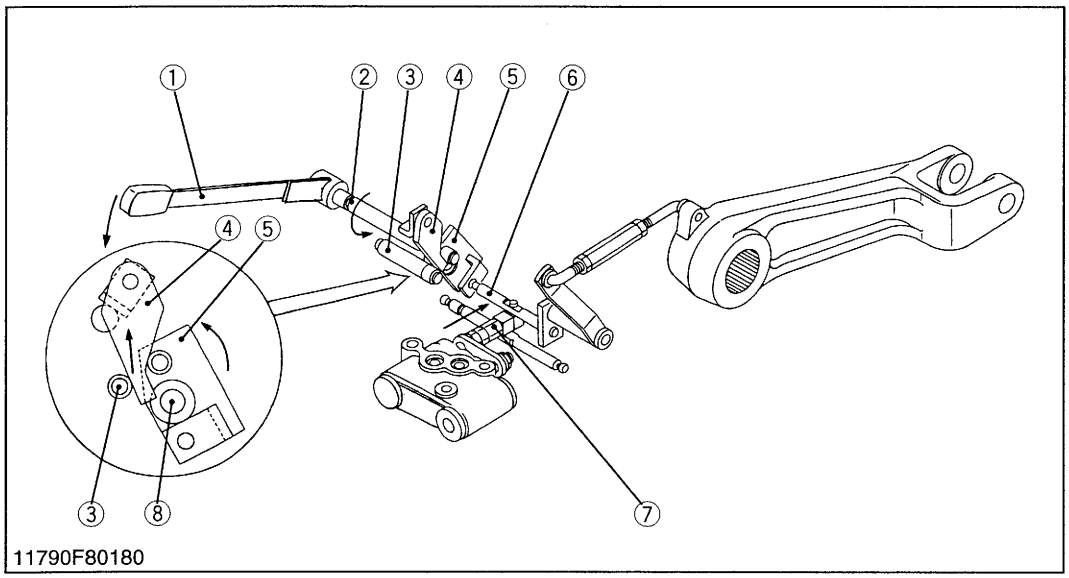
(1) Spool Drive Lever
(2) Lift Arm
(3) Spool
(4) Feedback Shaft

2. When the lift arm (2) moves upward, feedback shaft (4) rotates and pulls the spool (3) by the spool drive lever (1).

   The lift arm stops when the spool returns to the neutral position.

11790M80120

■ Down

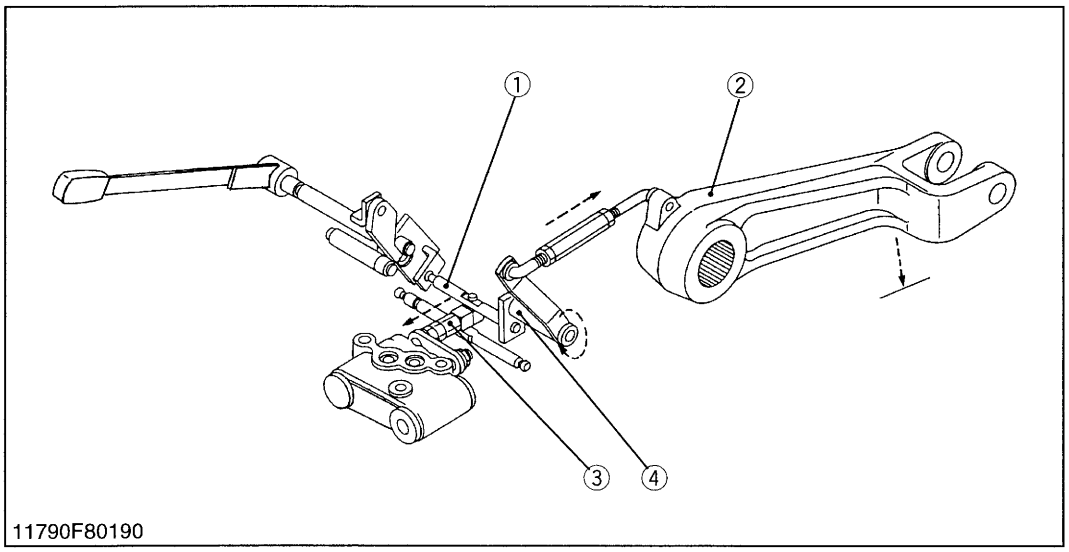


11790F80180

(1) Position Control Lever
(2) Lever Shaft
(3) Fulcrum 1
(4) Cam Link
(5) Link
(6) Spool Drive Lever
(7) Spool
(8) Fulcrum 2

1. When the position control lever (1) is moved to the **"DOWN"** position, the lever shaft (2) rotates and pull up the cam link (4) between the fulcrum 1 (3) and link (5).

The link rotates around the fulcrum 2 (8) and pull the spool (7) out by the spool drive lever (6), opening the **"DOWN"** circuit.



11790F80190

(1) Spool Drive Lever
(2) Lift Arm
(3) Spool
(4) Feedback Shaft

2. When the lift arm (2) moves downward, feedback shaft (4) rotates and push the spool (3) in by the spool drive lever (1).

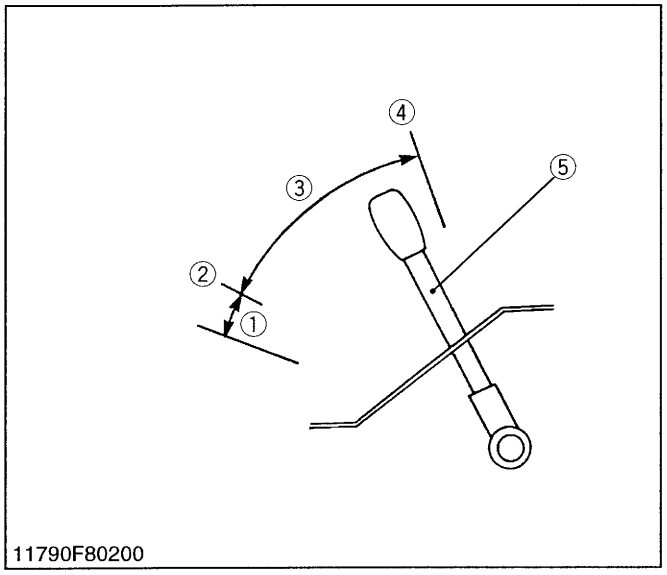
The lift arm stops when the spool returns to the neutral position.

11790M80130

(2) Draft Control

Draft control is a system which maintain a constant traction load, and is suited for the work which needs heavy traction load such as plowing.

The implement is automatically raised when its traction load is increased, and lowers when the traction load is decreased. By maintaining a constant load level, it prevents the tractor from slipping and being loaded excessively.



11790F80200

The setting traction load can be adjusted by changing the position of the draft control lever (5).

The draft control system uses the same control valve as the position control system. The traction load applied to the tractor is sensed and is fed back to the control valve by means of the other linkage mechanism.

With this type of draft control, operation is as described below according to the position of the draft control lever.

1. When the draft control lever is positioned in the floating range, the implement lowers to the ground.
2. When the draft control lever is positioned in the draft control range, work is performed as follows.
   - As the traction load applied to the tractor from the implement increases, the implement is raised.
   - As the traction load decreases, the implement lowers to the position at which it matches the setting traction load.
3. When the implement is raised as described in 2 above, the force to raise the implement is applied to the rear wheels so that the ground pressure of the wheels is momentarily increased to prevent slippage.

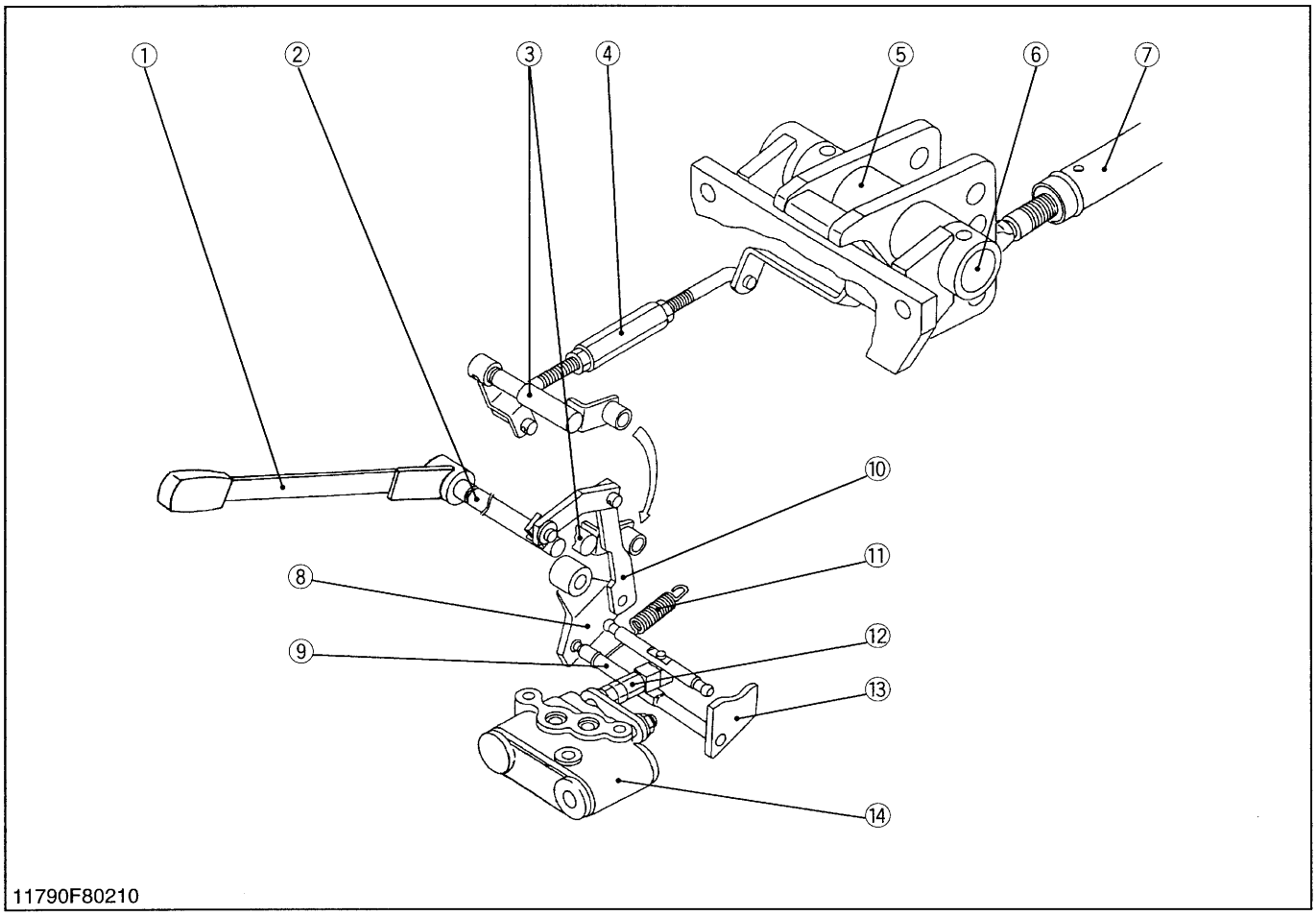
(Reference)

- When the draft control is used, the position control lever should be set at **"FLOATING"** range.
- If the position control lever is set at working range, both control systems operate performing mix control system. (See **"(3) Mixed Control"**.)

(1) Floating Range
(2) Deep
(3) Draft Range
(4) Shallow
(5) Draft Control Lever

11790M80140

■ Draft Control Operation

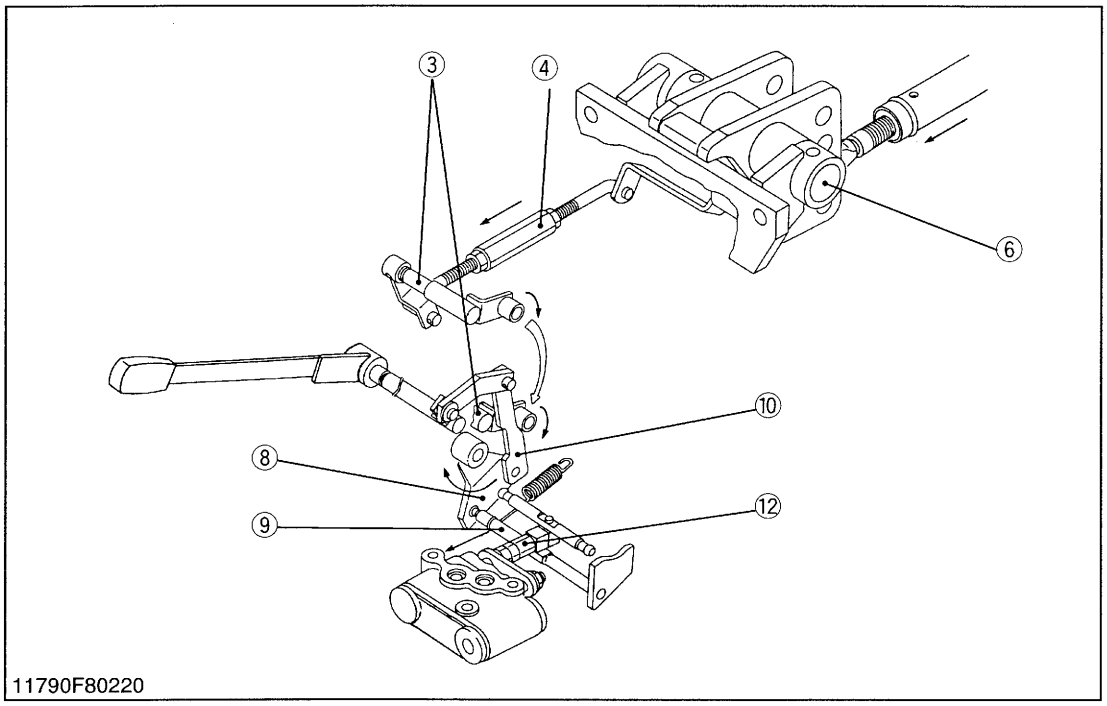


11790F80210

(1) Draft Control Lever
(2) Lever Shaft
(3) Feedback Shaft
(4) Feedback Rod
(5) Top Link Holder
(6) Torsion Bar
(7) Top Link
(8) Link 2
(9) Spool Drive Lever
(10) Link 1
(11) Spring
(12) Spool
(13) Fixed Arm
(14) Control Valve

1. The traction load applied to the tractor from the implement act as a torsional force to the torsion bar (6) via the top link (7) and the top link holder (5). When the torsion bar (6) is twisted, its displacement is transmitted to the feedback shaft (3) to rotate via the feedback rod (4). The feedback shaft rotates and push the link 1 (10) to rotate the link 2 (8). The end of the spool drive lever (9) is connected to the link 2 (8) and the other end is hold by the fixed arm (13), pulling out or pushing in the spool (12) by the rotation of the link 2 (8).
   The spring (11) is pulling the spool drive lever (9) to keep the link 1 (10) coming in contact with the feedback shaft (3).
   The angle of the link 1 (10) is controlled by the draft control lever (1) via the lever shaft (2).

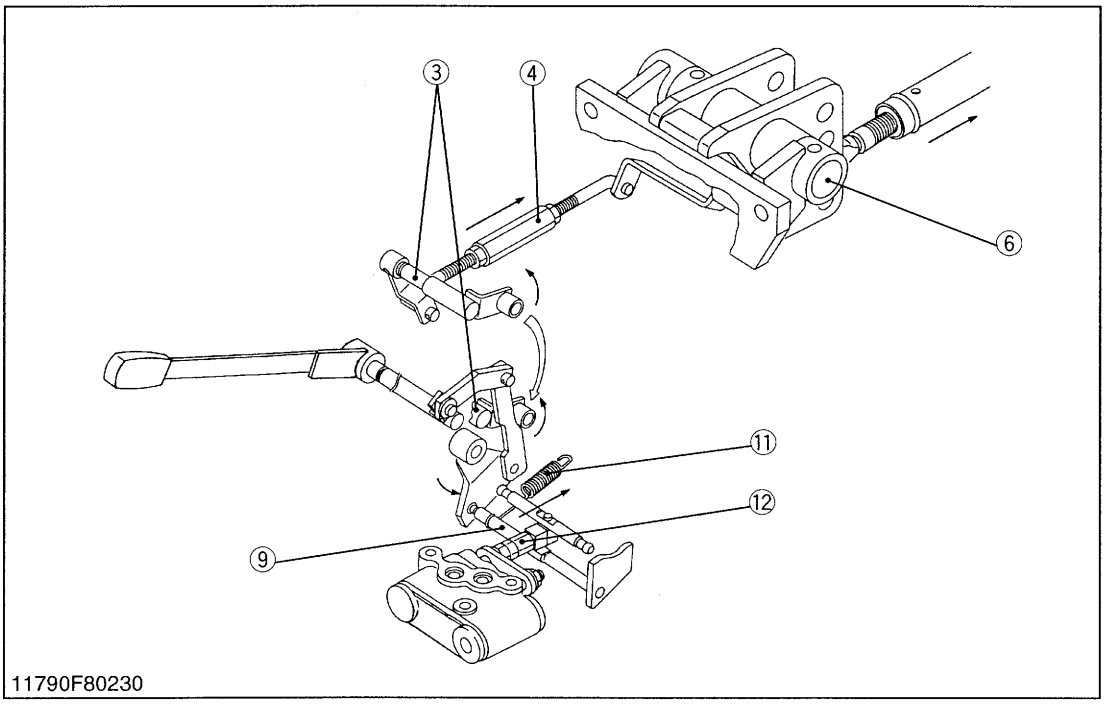
11790M80150



11790F80220

(3) Feedback Shaft
(4) Feedback Rod
(6) Torsion Bar
(8) Link 2
(9) Spool Drive Lever
(10) Link 1
(12) Spool

2. When the traction load increases, the torsion bar (6) is twisted, and its displacement is transmitted to the feedback shaft (3) via the feedback rod (4). The feedback shaft (3) rotates clockwise and push the link 1 (10) to rotate the link 2 (8) clockwise. The link 2 (8) pushes the spool (12) in via the spool drive lever (9) and the **"LIFT"** circuit is formed.
As the implement is raised and the traction load decreases, the torsion bar (6) is restored to return the spool (12) to neutral.



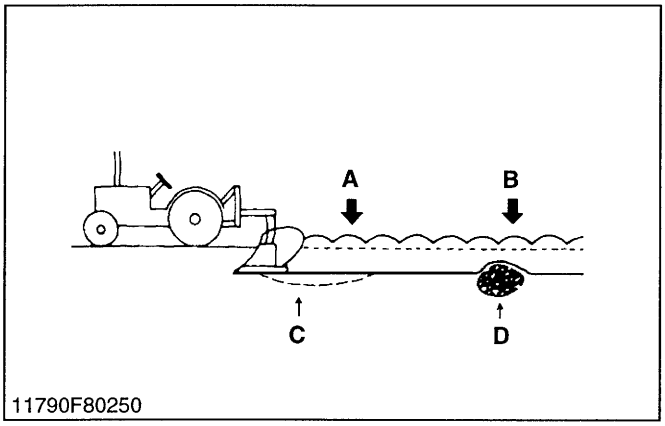
11790F80230

(3) Feedback Shaft
(4) Feedback Rod
(6) Torsion Bar
(9) Spool Drive Lever
(11) Spring
(12) Spool

3. When the traction load decreases, the torsion bar (6) is restored and its displacement is transmitted to the feedback shaft (3) via the feedback rod (4). As the feedback shaft (3) rotates counterclockwise, the spool drive lever (9) pulls the spool (12) out by the spring (11) to form the **"DOWN"** circuit.
As the implement lowers and the traction load increases, the torsion bar (6) is twisted to return the spool (12) to neutral.

11790M80160

(3) Mixed Control



11790F80250

Mixed control is a system combining position control with draft control.

When traction load increases, the draft control functions to raise the lift arms (implement). When traction load reduces, the lift arms (implement) lower to the height set by the position control only, when traction load increases, slippage or engine stop may occur unless the implement is raised.

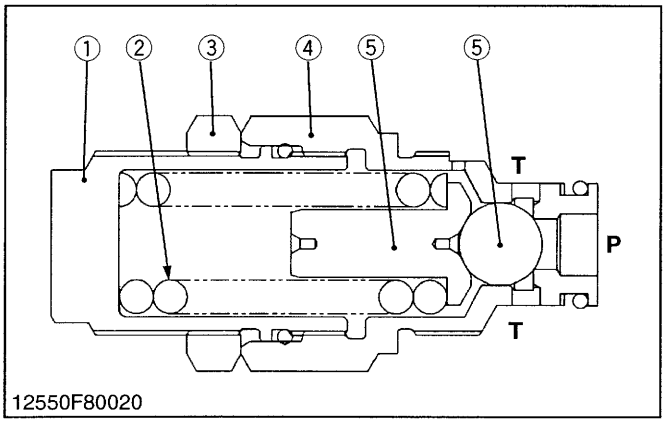
With the draft control only, plowing depth cannot be kept constant if soil hardness changes greatly.

The mixed control serves to eliminate such disadvantages.

(A) Position Controlled
(B) Draft Controlled
(C) Not Deep Even in Soft Soil
(D) Shallow where Resistance Occurs

11790M80180

(4) Cylinder Safety Valve (Surge Relief Valve)



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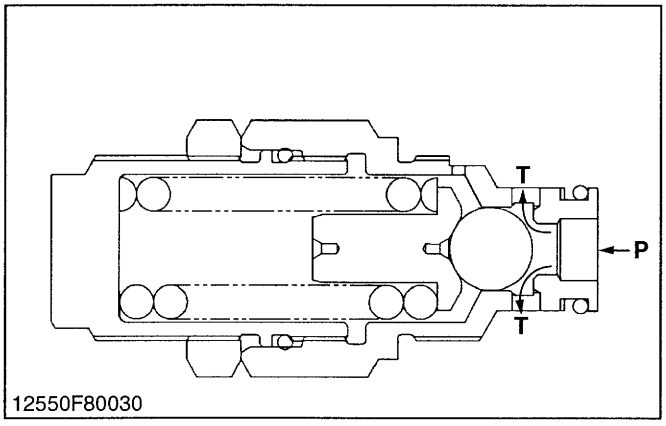

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The cylinder safety valve is located on the cylinder cover of the three point hydraulic system. These tractors use a direct acting relief valve, which is suitable for low volume and less frequent operations.

This valve has a fast response, makes it ideal for relieving shock pressure caused by heavy implement bounce and thereby reducing the possibility of damage to three point hydraulic system components.

If pressure in the cylinder becomes too great, oil pressure forces the valve (5) off the seat of valve body (4), compressing the coil springs (2) and allows oil to flow to the transmission case through the **T** port.

(Reference)

- Cylinder safety valve setting pressure :
  21.1 to 22.6 MPa
  215 to 230 kgf/cm^2
  3060 to 3277 psi

(1) Adjusting Plug
(2) Spring
(3) Lock Nut
(4) Valve Body
(5) Valve

T : T Port (To Transmission Case)
P : P Port (From Pump)

12550M80050

[10] AUXILIARY CONTROL VALVE

If necessary, hydraulic power for implements can be taken out using auxiliary control valves and quick couplers.

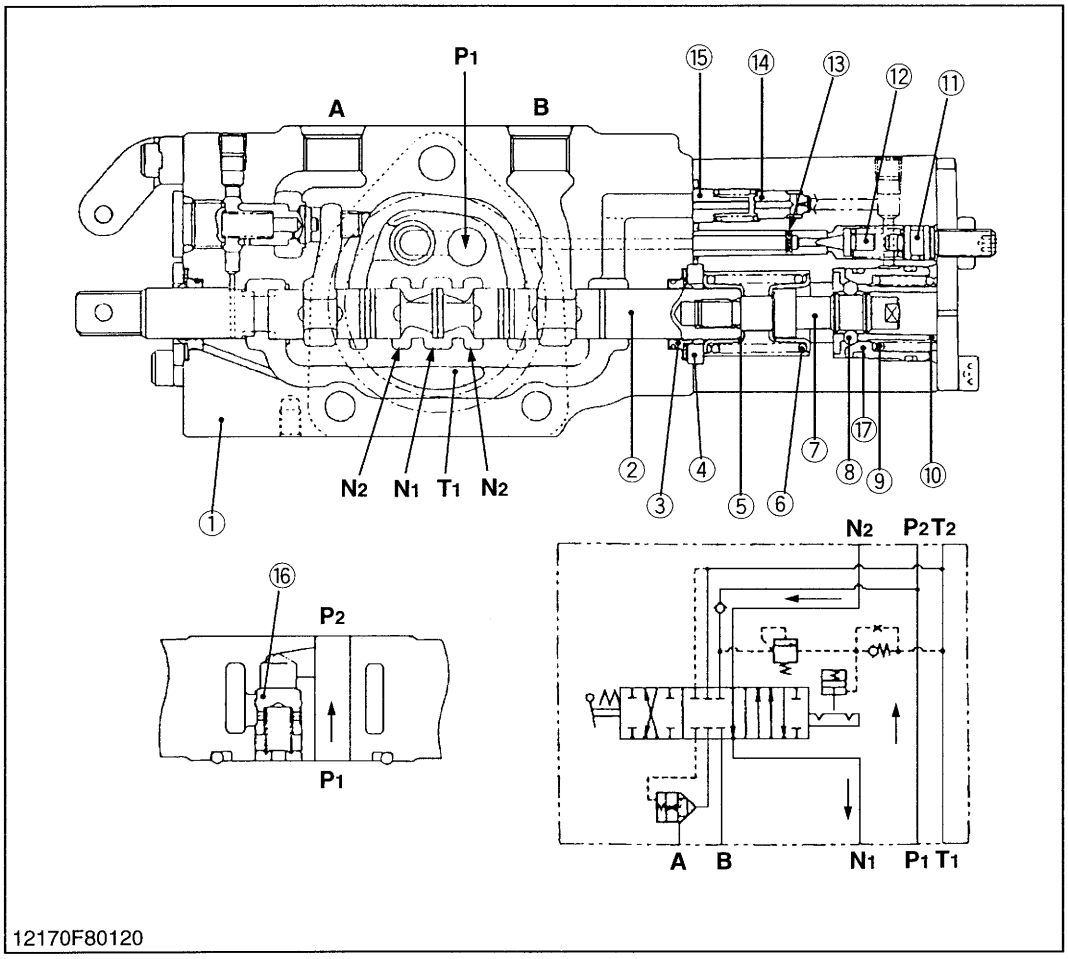
■ **IMPORTANT**

- **When taking out hydrualic power, replenish transmission oil in the quantity equal to the flow rate required for the implement cylinder.**

12170M80150

(1) Self Cancelling with Detent (Standard)

■ **Neutral**



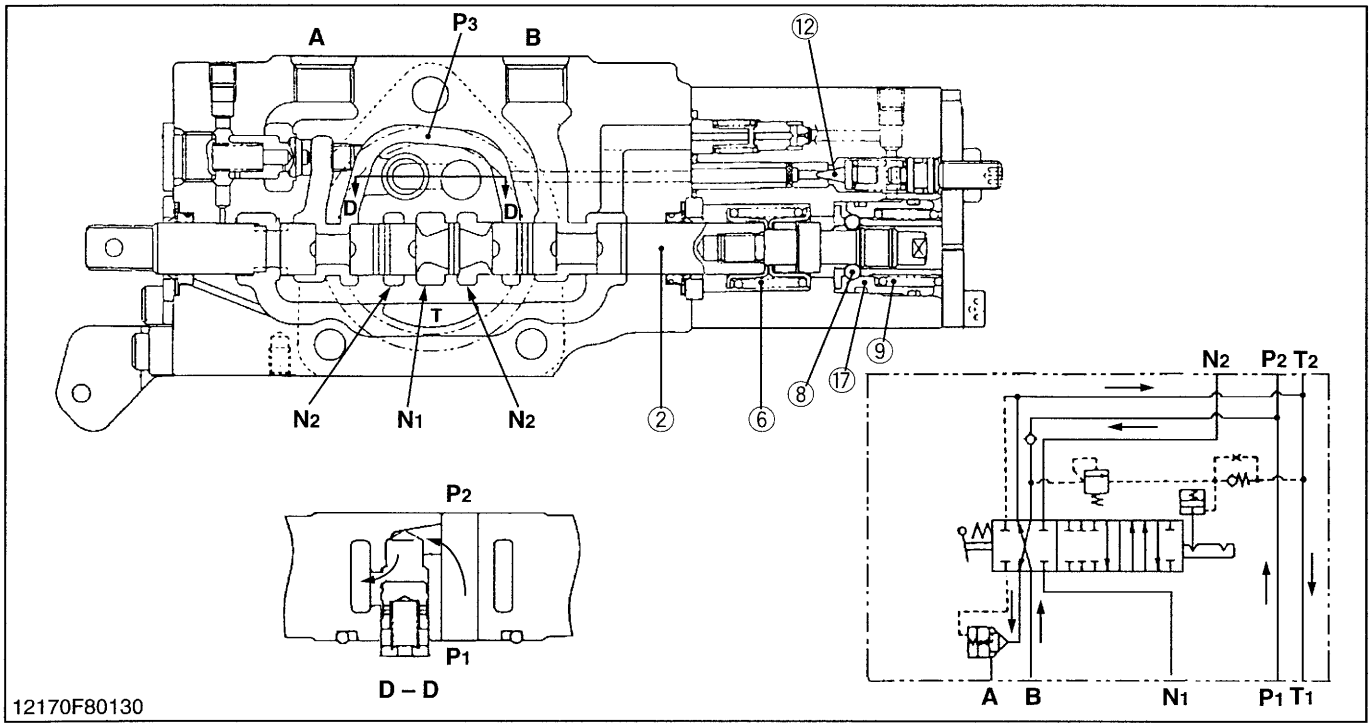
12170F80120

(1) Valve Body
(2) Spool
(3) Gasket
(4) Washer
(5) Spring Seat
(6) Spring
(7) Spacer Bolt
(8) Detent Ball
(9) Spring
(10) Bushing
(11) Spring Seat
(12) Poppet
(13) Filter
(14) Planger
(15) Spring Seat
(16) Check Valve
(17) Bushing
P1 : From Hydraulic Pump
P2 : To "P1" Port of Double Acting Auxiliary Control Valve
T1 : To Transmission Case
T2 : From "T1" Port of Double Acting Auxiliary Control Valve
N1 : To Transmission Case
N2 : From "N1" Port of Auxiliary Control Valve
A : To Implement Cylinder
B : To Implement Cylinder

1. Pressure-fed oil from the hydraulic pump is delivered into the **P1** port.
2. As the passage from the **P1** port to the **A** port or **B** port is blocked by the spool (2), the oil in the **P1** port flows across the valve body to **P2** port.
3. When the double acting auxiliary control valve is in neutral mode, the oil flows from **P2** port to **N2** port via the auxiliary control valve and its cover to **N2** port.
4. Then, the oil in the **N2** port flows along the notched section of the spool (2) to the **N1** port to the transmission case.

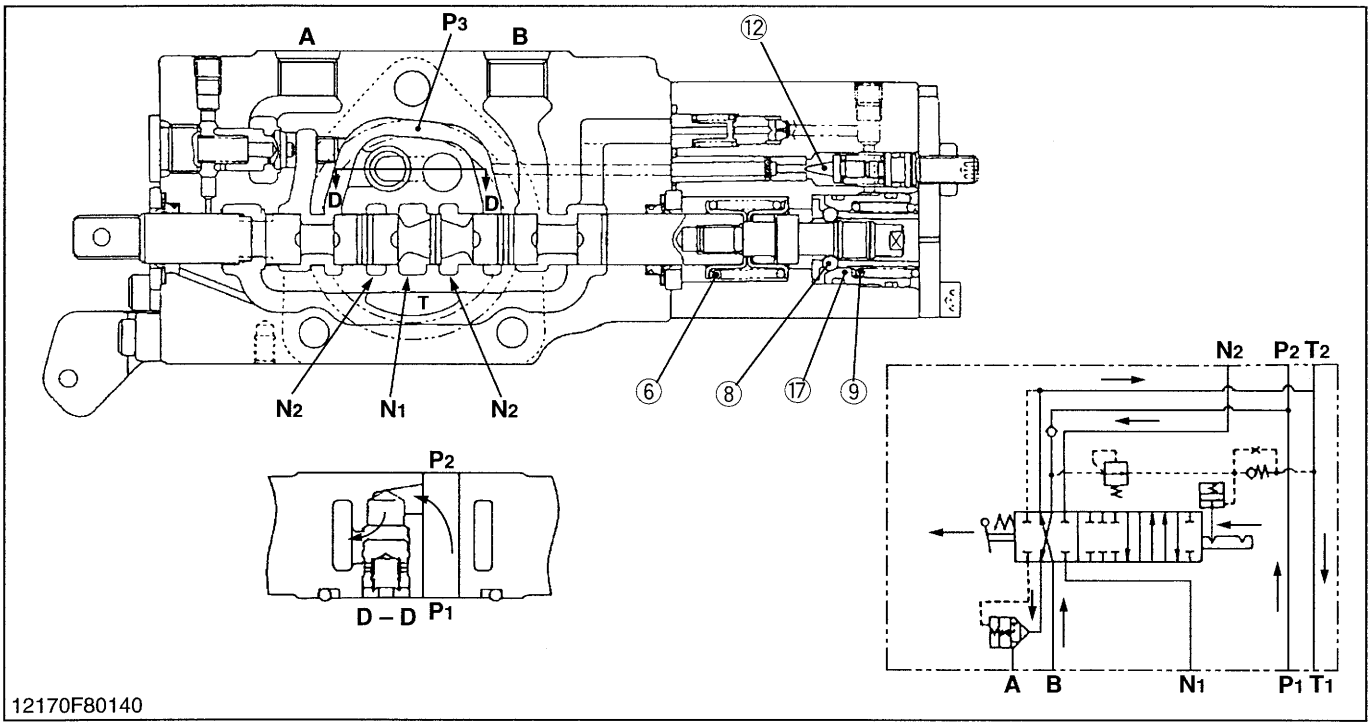
12170M80170

■ Up (When Spool is Held at "UP" Position by Detent)



12170M80180

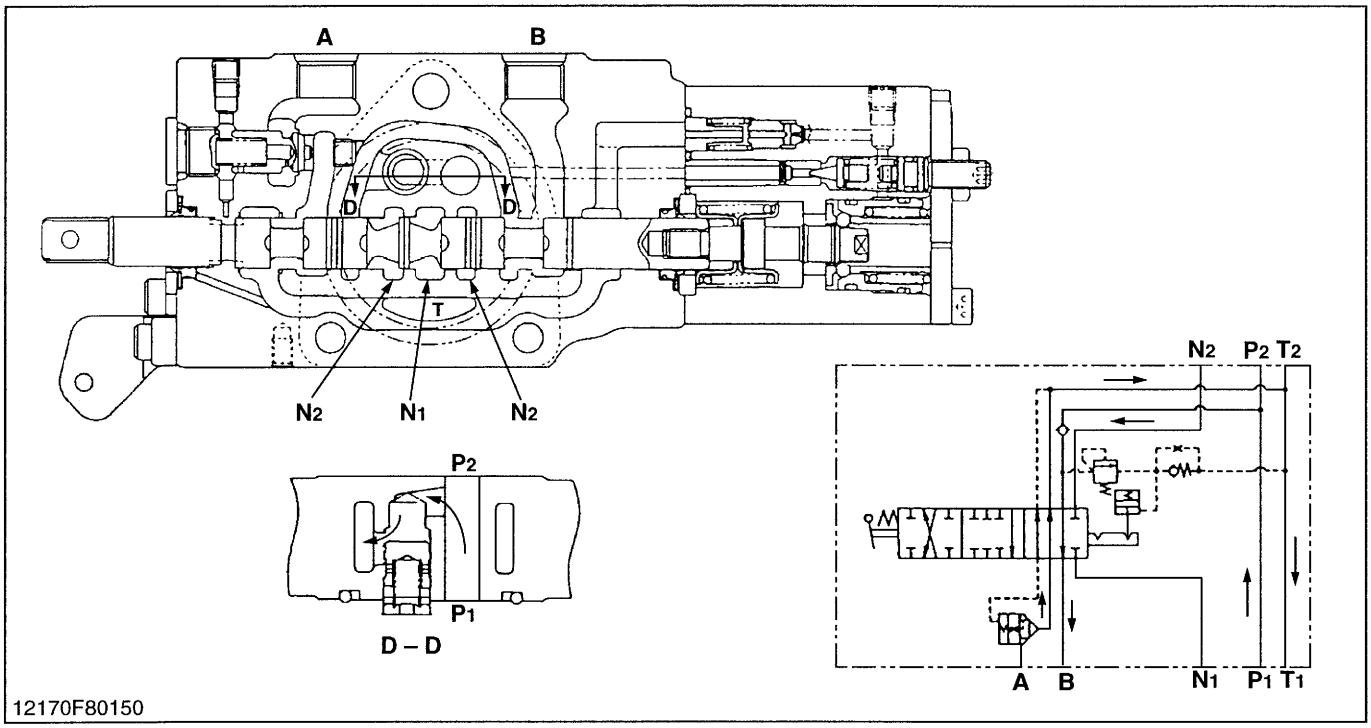
■ Up (When "Up" Position is Self-Cancelled)



1. As the implement cylinder rises to its uppermost position, pressure at **P3** passage increases.
2. When this pressure exceeds 14.2 to 15.2 MPa (145 to 155 kgf/cm^2, 2062 to 2205 psi), the relief valve (12) is opened and pressure compresses the spring (9) and the bushing (17) is moved to the right.
3. The spool (2) is returned to **Neutral** position by the tension of the spring (6) while the detent balls (8) are moved outside.

12170M80190

■ Down (When Spool is Held at "Down" Position by Detent)



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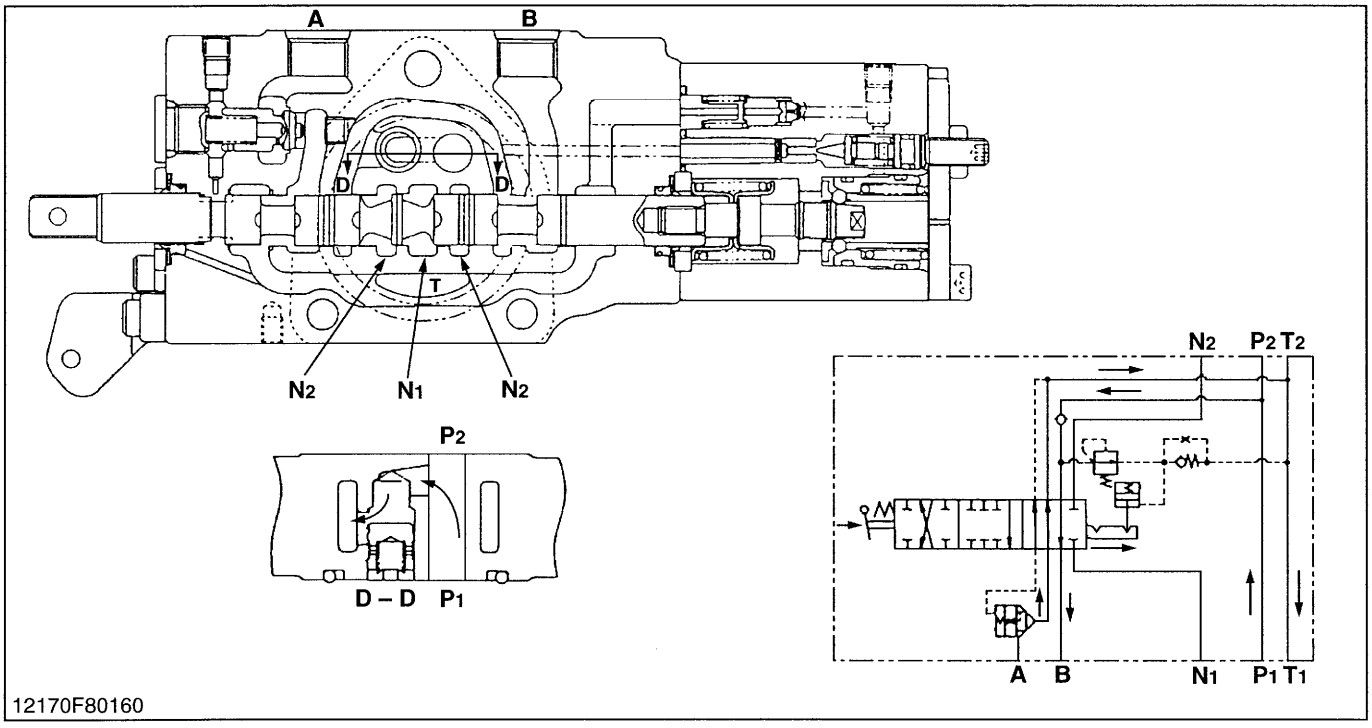
12170M80200

■ Down (When "Down" Position is Self-Cancelled)



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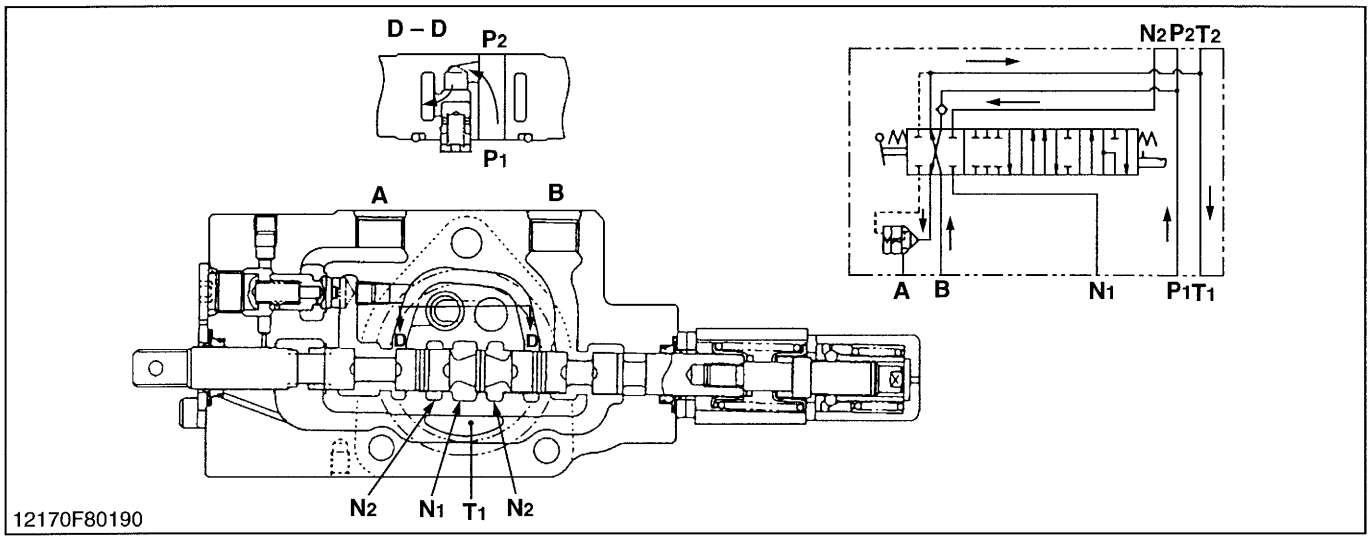
12170M80210

(2) Floating Valve with Detent (If Equipped)

■ Up



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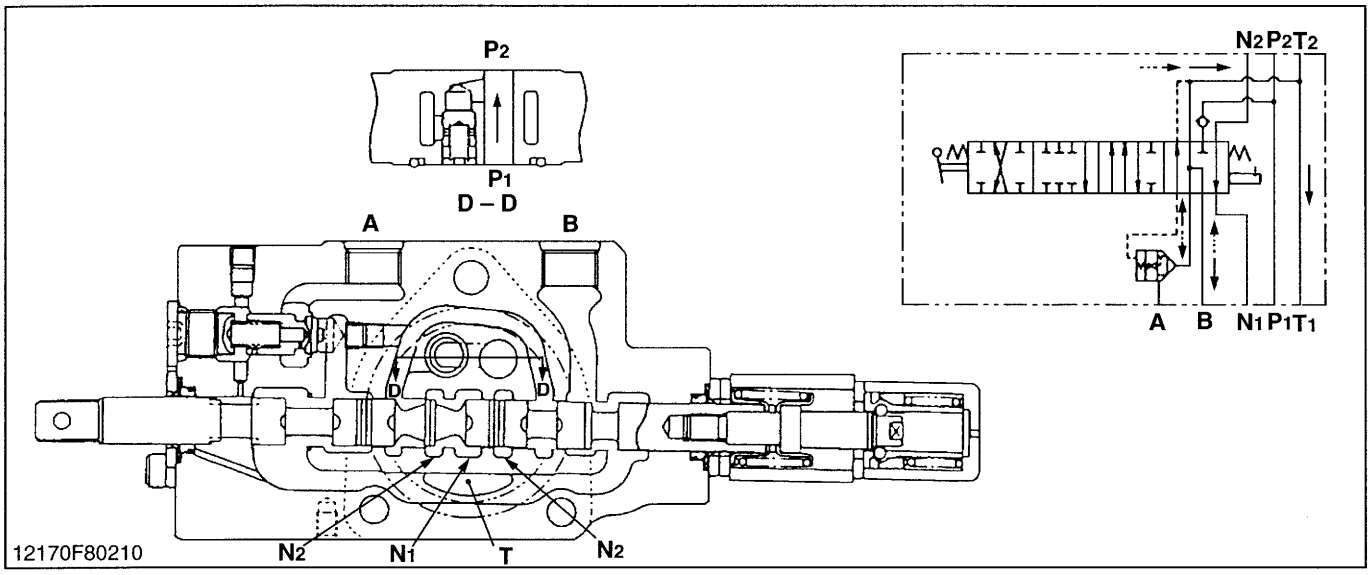
■ Floating



12170M80260

SERVICING

CONTENTS

TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Implement Does Not Rises (Not Noise)	• Control linkage improperly assembled or damaged	Repair or replace	8-S9, S10 S11
	• Control valve malfunctioning (unload valve, spool, check valve, poppet valve)	Repair or replace	8-S13,S14 S15
	• Control valve broken	Replace	8-S13, S14 S15
	• Control valve improperly adjusted	Adjust	8-S13
	• Relief valve spring damaged	Replace	8-S12
	• Hydraulic piston O-ring, cylinder damaged	Replace	8-S16
	• Safety valve damaged	Replace	8-S16
(Noise)	• Transmission fluid improper or insufficient	Change or replenish	G-14
	• Oil filter clogged	Replace	G-14
	• Relief valve setting pressure too low	Adjust	8-S12
	• Relief valve spring weak or damaged	Replace	8-S12
	• Hydraulic pump malfunctioning	Repair or replace	8-S5, S6 S7
Implement Does Not Reach Maximum Height	• Position rod and feedback rod improperly adjusted	Adjust	8-S9,S10
	• Draft rod and feedback rod improperly adjusted	Adjust	8-S10,S11
	• Lever stopper position improper	Adjust	–
Implement Does Not Lower	• Control valve malfunctioning	Repair or replace	8-S13, S14 S15
	• Spool damaged	Replace	8-S14
	• Poppet valve improperly adjusted (Adjusting screw of poppet valve)	Adjust	8-S14
	• Lowering speed adjusting valve closed	Open	–
Implement Drops by Weight	• Hydraulic cylinder worn or damaged	Replace	8-S12, S13
	• Hydraulic piston O-ring worn or damaged	Replace	8-S16
	• Safety valve damaged	Replace	8-S16
	• Lowering speed adjusting valve damaged	Replace	8-S17
	(Control valve malfunctioning)		
	• Check valve seat surface damaged	Replace	8-S15
	• Check valve O-ring damaged	Replace	8-S15
	• Poppet valve seat surface damaged	Replace	8-S14
	• Poppet valve O-ring damaged	Replace	8-S14
Implement Hunts (Moves Up and Down)	• Poppet valve, poppet seat surface damaged	Replace	8-S14
	• Check valve, check valve seat surface damaged	Replace	8-S15
	• Control valve O-ring worn or damaged	Replace	8-S14
Draft Control Malfunctioning	• Draft control linkage improperly adjusted	Adjust	8-S10, S11
	• Torsion bar weak or broken	Replace	–

12550S80010

SERVICING SPECIFICATIONS

HYDRAULIC PUMP [M4900]

Item		Factory Specification	Allowable Limit
Hydraulic Pump Condition • Engine Speed Approx. 2600 rpm • Rated Pressure 19.1 MPa 195 kgkf/cm^2 2773 psi • Oil Temperature 45 to 55 °C 113 to 131 °F	Delivery	Above 39.0 L/min. Above 10.30 U.S.gal./min. Above8.58 Imp.gal./min.	31.8 L/min. 8.40 U.S.gal/min. 7.00 Imp.gal./min.
Housing Bore	Depth of Scratch	–	0.09 mm 0.0035 in.
Bushing to Gear Shaft	Clearance	–	0.12 mm 0.0047 in.
Gear Shaft	O.D.	–	13.92 mm 0.5480 in.
Side Plate A	Thickness	2.0 mm 0.0787 in.	1.9 mm 0.0748 in.
Side Plate B	Thickness	1.2 mm 0.0472 in.	1.1 mm 0.0433 in.

HYDRAULIC PUMP [M5700]

Hydraulic Pump Condition • Engine Speed Approx. 2800 rpm • Rated Pressure 19.1 MPa 195 kgkf/cm2 2773 psi • Oil Temperature 45 to 55 °C 113 to 131 °F	Delivery	Above 37.8 L/min. Above 9.9 U.S.gal./min. Above 8.32 Imp.gal./min.	31.2 L/min. 8.24 U.S.gal/min. 6.86 Imp.gal./min.
Housing Bore	Depth of Scratch	–	0.09 mm 0.0035 in.
Bushing to Gear Shaft	Clearance	–	0.15 mm 0.0059 in.
Gear Shaft	O.D.	–	17.968 mm 0.7074 in.
Bushing	Length	–	18.965 mm 0.7466 in.

12550S80020

RELIEF VALVE

Item		Factory Specification	Allowable Limit
Relief Valve Condition • Engine Speed Maximum • Oil Temperature 45 to 55 °C 113 to 131 °F	Setting Pressure	18.6 to 19.1 MPa 190 to 195 kgf/cm^2 2702 to 2773 psi	–

CYLINDER SAFETY VALVE

Cylinder Safety Valve	Operating Pressure	21.1 to 22.6 MPa 215 to 230 kgf/cm^2 3060 to 3277 psi	–

HYDRAULIC CYLINDER

Cylinder Liner Bore	I.D.	90.000 to 90.050 mm 3.54330 to 3.54527 in.	90.15 mm 3.549 in.
Hydraulic Arm Shaft to Bushing	Clearance (Right)	0.049 to 0.154 mm 0.00193 to 0.00606 in.	0.50 mm 0.0197 in.
	Clearance (Left)	0.049 to 0.149 mm 0.00193 to 0.00587 in.	0.50 mm 0.0197 in.
Hydraulic Arm Shaft	O.D. (Right)	49.950 to 49.975 mm 1.96653 to 1.96752 in.	–
	O.D. (Left)	44.950 to 44.975 mm 1.76968 to 1.77067 in.	–
Bushing	I.D. (Right)	50.024 to 50.104 mm 1.96944 to 1.97259 in.	–
	I.D. (Left)	45.024 to 45.099 mm 1.77259 to 1.77555 in.	–

CONTROL LINKAGE

Stopper to Top Link Holder	Clearance	7.0 to 8.0 mm 0.280 to 0.315 in.	–
Position Control Feedback Rod	Length	125 mm 4.92 in.	–
Draft Control Rod	Length	215 mm 8.46 in.	–

12550S80030

OIL COOLER RELIEF VALVE

Item		Factory Specification	Allowable Limit
Relief Valve	Setting Pressure	4.4 to 4.9 MPa 45.0 to 50.0 kgf/cm^2 640 to 711 psi	–

12550S80040

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-10.)

Item	N·m	kgf·m	ft-lbs
Hydraulic pipe mounting screw	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Hydraulic pump assembly mounting screw and nut	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Housing cover mounting nut	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
Rear wheel mounting nut	260 to 304	26.5 to 31.0	192 to 224
Delivery pipe retaining nut	39.2 to 49.0	4.0 to 5.0	28.9 to 36.2
Hydraulic cylinder assembly mounting screw and nut	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
Control valve mounting screw	19.6 to 23.5	2.0 to 2.4	14.5 to 17.4
Control valve lock nut	17.7 to 21.6	1.8 to 2.2	13.0 to 15.9
Control valve plug (for poppet valve and unload valve)	68.6 to 88.2	7.0 to 9.0	50.6 to 65.1
Control valve seat plug (for check valve)	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4
Bracket guide mounting screw	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Cylinder safety valve	98.0 to 117.6	10.0 to 12.0	72.3 to 86.7
Cylinder safety valve lock nut	49.0 to 68.6	5.0 to 7.0	36.2 to 50.6
Relief valve	34.3 to 39.2	3.5 to 4.0	25.3 to 28.9
Hydraulic arm setting screw	39.2 to 45.1	4.0 to 4.6	28.9 to 33.2

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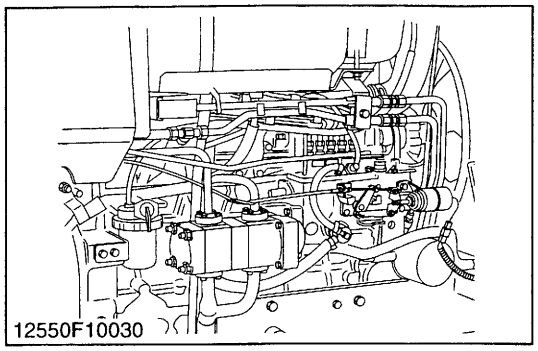
CHECKING, DISASSEMBLING AND SERVICING

[1] HYDRAULIC PUMP

CHECKING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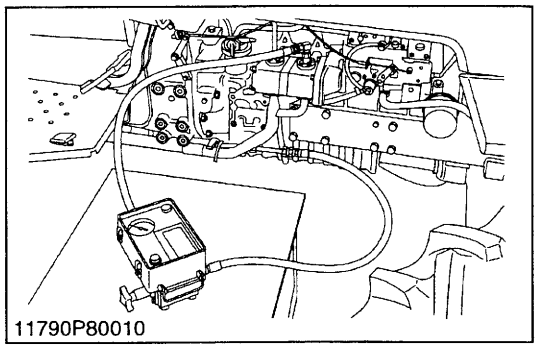
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Condition

- Engine speed
  [M4900] ..... Approx. 2600 rpm
  [M5700] ..... Approx. 2800 rpm
- Rated pressure ..... 19.1 MPa
  195 kgf/cm^2
  2773 psi
- Oil temperature ..... 45 to 55 °C
  113 to 131 °F

Hydraulic Flow Test

■ **IMPORTANT**

- **When using a flowmeter other than KUBOTA specified flowmeter (Code No. 07916-52792), be sure to use the instructions with that flowmeter.**
- **Do not close the flowmeter loading valve completely, before testing, because it has no relief valve.**

1. Disconnect the delivery pipe which is connected from hydraulic pump to hydraulic cylinder.
2. Install the adaptor **53** and **54** to the pump discharge port. [Adaptor **53** and **54** are include in adaptor set (Code No. 07916-54301.)]
3. Install the adaptor **64** to the delivery pipe joint. [Hydraulic adaptor **64** is included in adaptor set (Code No. 07916-54031.)]
4. Connect the hydraulic test hose to the adaptor **53** and flowmeter inlet port.
5. Connect the other hydraulic test hose to flowmeter outlet port and to hydraulic adaptor 64.
6. Open the flowmeter loading valve completely. (Turn counterclockwises.)
7. Start the engine and set the engine speed at 2000 to 2200 rpm.
8. Slowly alone the loading valve to generate pressure approx. 9.8 MPa (100 kgf/cm^2, 1422 psi). Hold in this condition until oil temperature reaches approx. 50 °C (122 °F).
9. Open the loading valve completely.
10. Set the engine speed. (Refer to Condition.)
11. Read and note the pump delivery at rated pressure.
12. Slowly close the loading valve to increase rated pressure. (Refer to Condition.) As the load is increase, engine speed drops, therefore, reset the engine speed.
13. Read and note the pump delivery at rated pressure.
14. Open the loading valve completely and stop the engine.
15. If the pump delivery does not reach the allowable limit, check the pump suction line, oil filter or hydraulic pump.

Hydraulic pump delivery at no pressure	Factory spec.	M4900	Above 41.6 L/min. 10.99 U.S.gal./min. 9.15 Imp.gal./min.
		M5700	Above 40.3 L/min. 10.65 U.S gal./min. 8.87 Imp.gal./min.
Hydraulic pump delivery at rated pressure	Factory spec.	M4900	39 0 L/min. 10.30 U.S.gal./min. 8 58 Imp.gal./min.
		M5700	37.8 L/min 9.90 U.S.gal /min. 8.32 Imp gal /min.
	Allowable limit	M4900	31 8 L/min. 8 40 U S gal./min 7 00 Imp gal./min
		M5700	31 2 L/min. 8.24 U S gal /min 6.86 Imp gal /min

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DISASSEMBLING AND ASSEMBLING

■ IMPORTANT

- **The hydraulic pump is precision machined and assembled : if disassembled once, it may be unable to maintain its original performance. Therefore, when the hydraulic pump fails, replacement should be carried out with the hydraulic pump assembled except when emergency repair is unavoidable.**
- **When repair is required, follow the disassembly and servicing procedures shown below with utmost care.**
- **Be sure to test the hydraulic pump with a flowmeter before disassembling.**
- **After reassembly, be sure to perform break-in operation and ensure that there is nothing abnormal with the hydraulic pump.**

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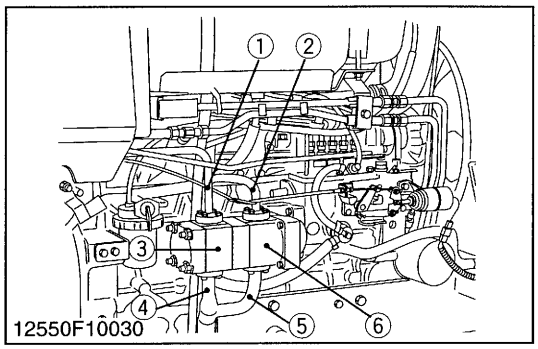

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Removing Three Point System Hydraulic Pump and Power Steering Hydraulic Pump

1. Disconnect the delivery pipe (1), (2) from the hydraulic pump.
2. Disconnect the suction pipe (4), (5) from the hydraulic pump.
3. Remove the hydraulic pump assembly mounting screws and nuts.
4. Take out the hydraulic pump assembly.

(When reassembling)

- Apply grease to the O-ring and take care not to damage it.

Tightening torque	Hydraulic pipe mounting screw	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.0 to 15.2 ft-lbs
	Hydraulic pump assembly mounting screw and nut	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

(1) Delivery Pipe (Power Steering Pump)
(2) Delivery Pipe (Three Point Hydraulic Pump)
(3) Power Steering Pump
(4) Suction Pipe (Three Point Hydraulic Pump)
(5) Suction Pipe (Power Steering Pump)
(6) Three Point Hydraulic Pump

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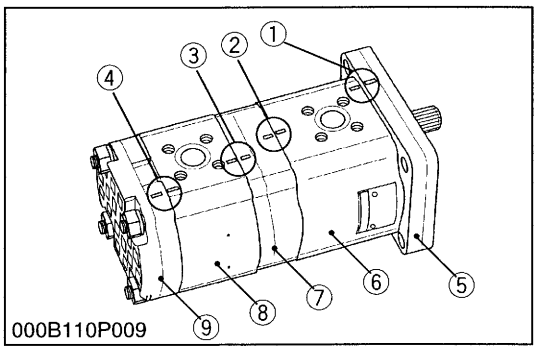

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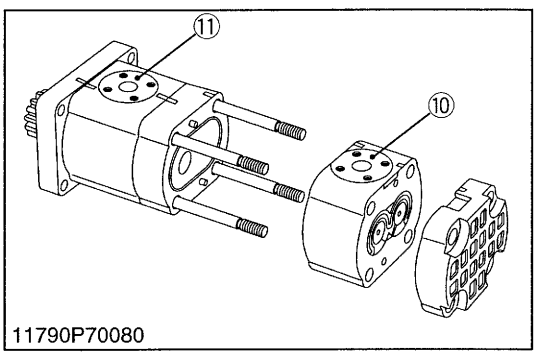

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Separating Three Point System Hydraulic Pump

1. Put the parting marks (1), (2), (3), (4) on the flange (5), front housing (6), center plate (7), housing (8) and housing cover (9).
2. Unscrew the housing cover mounting nuts and separate the three point system hydraulic pump (11) from the power steering pump (10).

(When reassembling)

- Take care not to damage the O-rings.

Tightening torque	Housing cover mounting nut	39.2 to 44.1 N·m 4.0 to 4.5 kgf·m 28.9 to 32.5 ft-lbs

(1) Parting Mark
(2) Parting Mark
(3) Parting Mark
(4) Parting Mark
(5) Flange
(6) Front Housing (Three Point System Hydraulic Pump)
(7) Center Plate
(8) Housing (Power Steering Pump)
(9) Housing Cover
(10) Power Steering Pump
(11) Three Point System Hydraulic Pump

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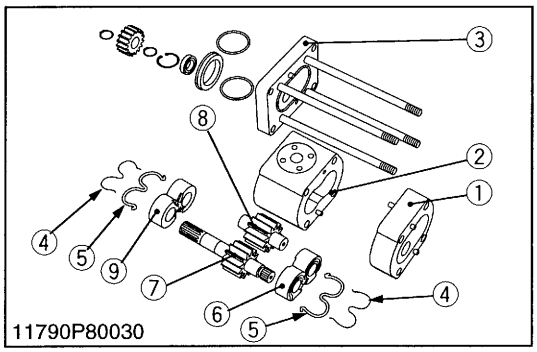

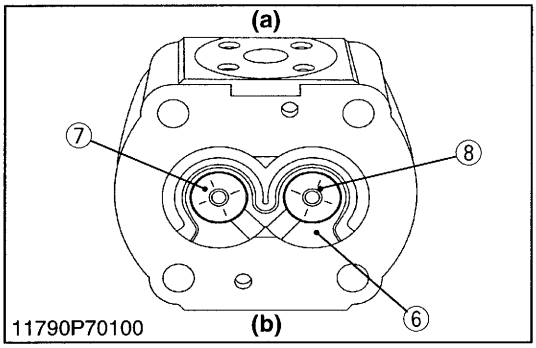

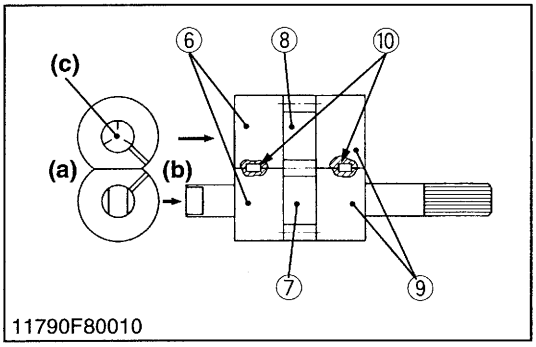

Disassembling Three Point System Hydraulic Pump

1. Remove the flange (3) and center plate (1).
2. Remove the backup element (4) and seal element (5).
3. Remove the bushings (6) and (9).
4. Remove the drive gear (7) and driven gear (8).

(When reassembling)

- When installing the bushing (6) and (9), be sure to reassemble them to the each original position and direct bushing grooves to inlet side as shown in the photograph.
- Install the driven gear (8) in the correct direction as shown in the photograph.
- Take care not to damage the seal element (5), backup element (4) and O-ring.
- Take care not to lose or damage the keys (10) joining the two bushings.

(1) Center Plate
(2) Housing
(3) Flange
(4) Backup Element
(5) Seal Element
(6) Bushing
(7) Drive Gear
(8) Driven Gear
(9) Bushing
(10) Key

(a) Outlet
(b) Inlet
(c) Mark Side

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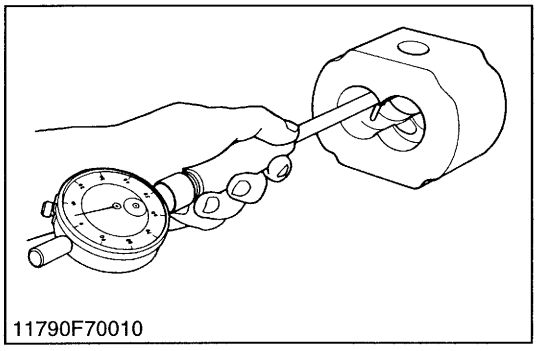
SERVICING



Housing Bore

1. Measure the housing I.D. where the interior surface is not scratched, and measure the housing I.D. where the interior surface is scratched.
2. If the values obtained in the two determinations differ by more than the allowable limit, replace the hydraulic pump as a unit.

Depth of scratch	Allowable limit	0.09 mm 0.0035 in.

(Reference)

- Use a cylinder gauge to measure the housing I.D.

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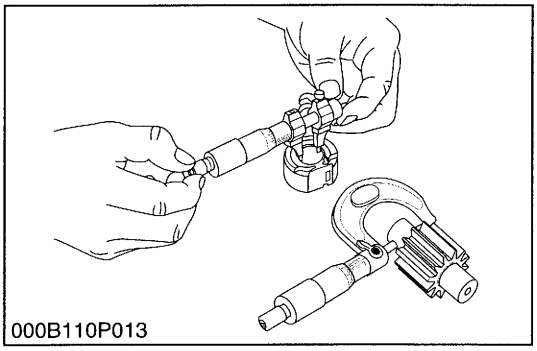
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Clearance between Bushing and Gear Shaft

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

Clearance between bushing and gear shaft	Allowable limit	0.15 mm 0.0059 in.
Gear shaft O.D.	Allowable limit	17.968 mm 0.7074 in.

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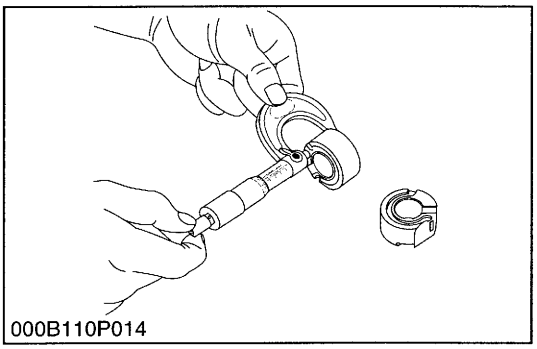
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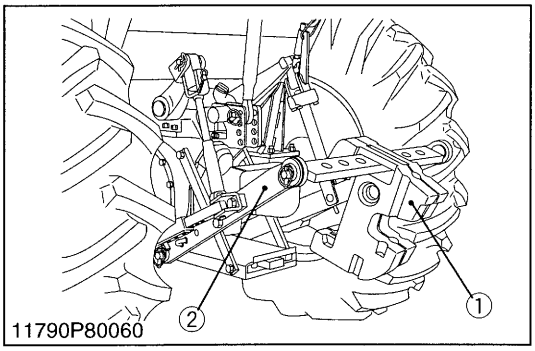
Bushing Length

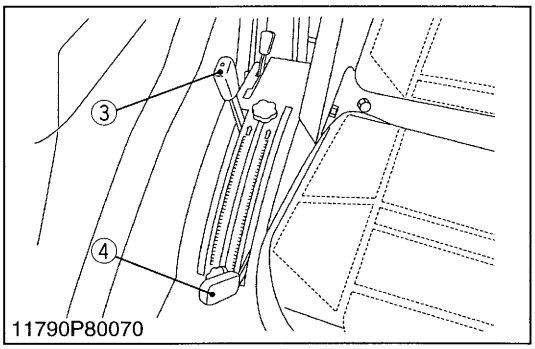
1. Measure the bushing length with an outside micrometer.
2. If the length is less than the allowable limit, replace it.

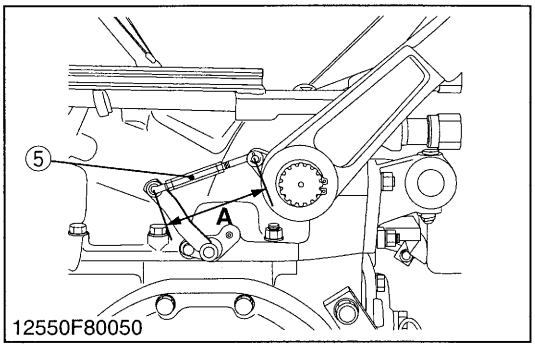
Bushing length	Allowable limit	18.965 mm 0.74665 in.

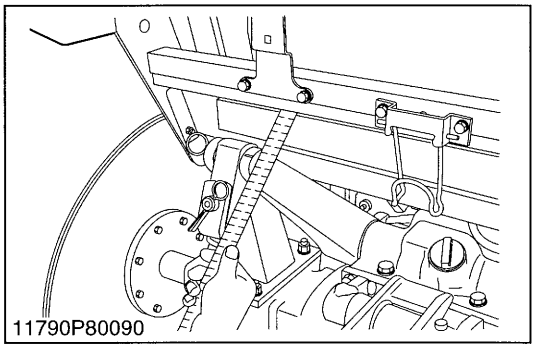
11790S70130

[2] POSITION CONTROL AND DRAFT CONTROL LINKAGE CHECKING AND ADJUSTING









Adjusting Uppermost Position

1. Attach the weight (1) of 490 N (50 kgf, 110 lbs) to the end of lower link (2).
2. Set the position control lever (3) and draft control lever (4) to the lowest position.
3. Start the engine, and set the engine speed at the 1000 rpm.
4. Set the position control lever (3) to the uppermost position.
5. Shorten the feedback rod by turning the turnbuckle (5) until the relief valve begins to be operated.
6. From the feedback rod position obtained above 5, turn the turnbuckle by 1.5 turn to lengthen the feedback rod, then tighten the lock nut.
7. Move the position control lever down then all the way up. Stop the engine and check that the lift arm has 5 to 20 mm (0.20 to 0.79 in.) play upward on its edge.
8. If the specified play is not obtained, repeat from 4 again.

Position control feedback rod **A**	Factory spec.	Approx.125 mm 4.92 in.

(1) Weight
(2) Lower Link
(3) Position Control Lever
(4) Draft Control Lever
(5) Turnbuckle

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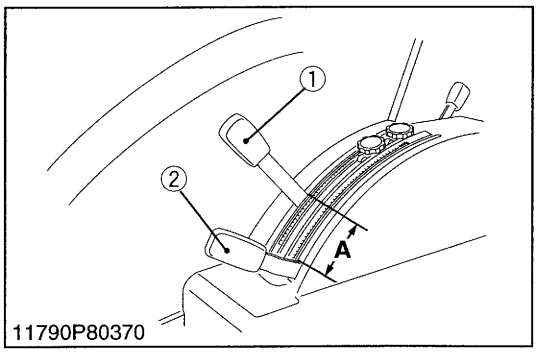

Checking Floating Position

1. Attach the weight of 490 N (50 kgf, 110 lbs) to the end of lower link.
2. Set the position control lever (1) and draft control lever (2) to the lowest position, and set the engine speed at the maximum.
3. Gradually move the position control lever (1) until the lower link begins to rise.
4. Check the distance A.
5. If the specified play is not obtained, readjust the feedback rod. (Refer to Adjusting of uppermost position section.)

Distance "**A**"	Factory spec.	10 to 50 mm 0.39 to 1.97 in.

(1) Position Control Lever (2) Draft Control Lever

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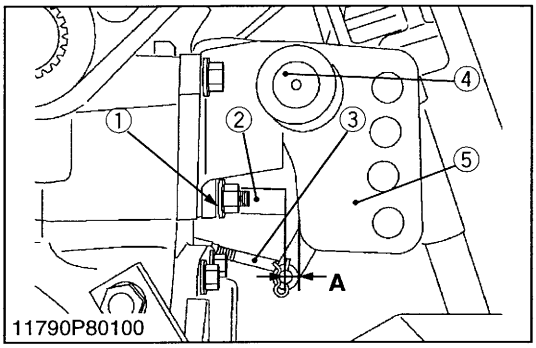

Adjusting Top Link Bracket

1. Measure the clearance **(A)** between the stopper (2) and top link bracket (5).
   If the clearance is not within the factory specifications, adjust with the shims (1) between the stopper (2) and top link bracket (5).

Clearance **(A)**	Factory spec.	7.0 to 8.0 mm 0.276 to 0.315 in.

(Reference)

- Thickness of shim (5) : 0.5 mm (0.020 in.)

(1) Shim
(2) Stopper
(3) Draft Control Rod
(4) Torsion Bar
(5) Top Link Bracket

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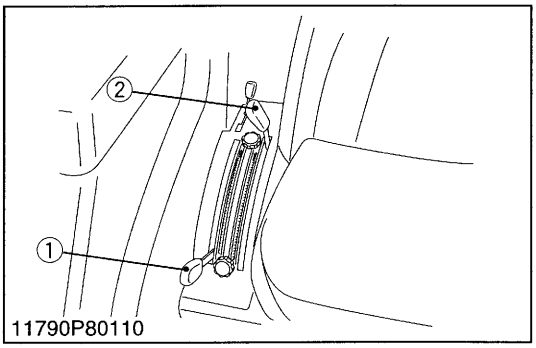

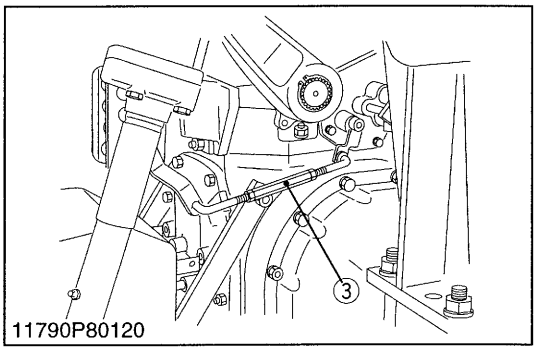

Adjusting Draft Control Rod

1. Attach the weight of 490 N (50 kgf, 110 lbs) to the end of lower link.
2. Set the position control lever (1) to the lowest position.
3. Start the engine, and set the engine speed at 1000 rpm.
4. Set the draft control lever (2) to the uppermost position.
5. Lengthen the draft control rod (3) by turning the turnbuckle until the relief valve begins to be operated.
6. From the draft control rod position obtained above 5, turn the turnbuckle by 1/2 turn to shorten the draft control rod, then tighten the lock nut.

Draft control rod length	Factory spec.	Approx. 215 mm 8.46 in.

(1) Position Control Lever
(2) Draft Control Lever
(3) Draft Control Rod

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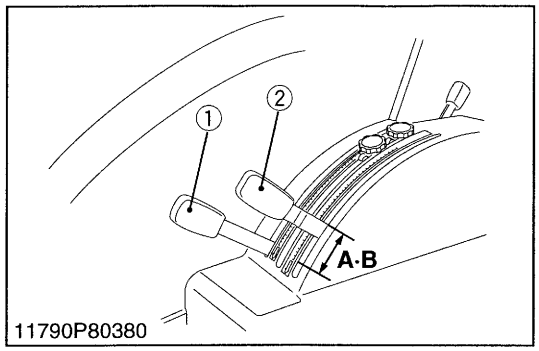

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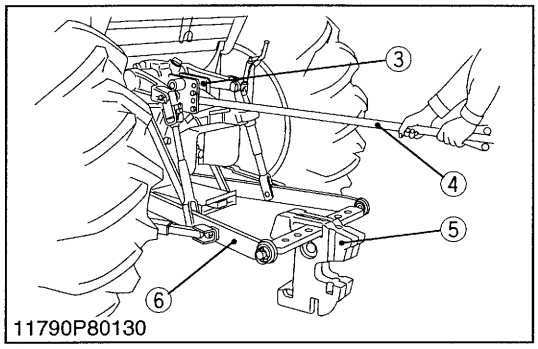

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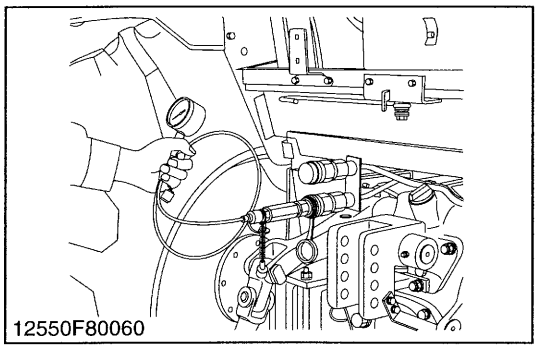
Checking Floating Position

1. Attach the weight (5) of 490 N (50 kgf, 110 lbs) to the end of lower link (6).
2. Set the position control lever (1) and draft control lever (2) to the lowest position.
3. Attach the test bar (4) to the top link bracket (3).
4. Start the engine, and set the engine speed at the maximum.
5. Set the draft control lever upward by approx. 10 mm **A** (0.39 in.) from the lowest position.
6. Press the test bar (4) downward until the top link bracket (3) comes in contact with the stopper.
7. Confirm that the lower link (draft control) will not operate.
8. Set the draft control lever upward by approx. 50 mm **B** (1.97 in.) from the lowest position.
9. Press the test bar (4) downward until the top link bracket (3) comes in contact with the stopper.
10. Confirm that the lower link begin to rise.
11. If the specified play is not obtained, readjust the feedback rod. (Refer Adjusting Draft Control Rod Section.)

(1) Positioin Control Lever
(2) Draft Control Lever
(3) Top Link Bracket
(4) Test Bar
(5) Weight
(6) Lower Link

12550S80160

[3] RELIEF VALVE CHECKING AND ADJUSTING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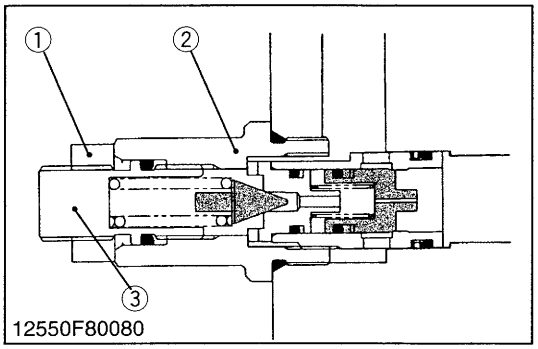

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Relief Valve Setting Pressure Test Using Pressure Tester (Coupler)

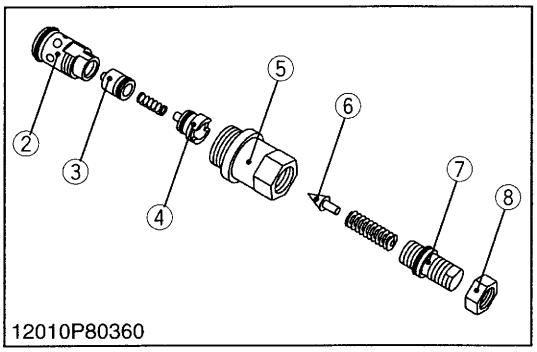
1. Set the Relief Valve Set Pressure Adaptor **G** (Code No: 07916-52751) to the half male of the quick coupler and then set a pressure gauge (Code No: 07916-50321), Cable (Code No: 07916-50331).
2. Start the engine, set at maximum speed.
3. Set the auxiliary control valve operation lever to the **UP** position and read the pressure gauge when the relief valve is actuated.
4. If the pressure is not within the factory specification, adjust the relief valve adjuster (3).

Relief valve setting pressure	Factory spec.	18.6 to 19.1 MPa 190 to 195 kgf/cm^2 2702 to 2773 psi

(1) Lock Nut
(2) Relief Valve
(3) Adjuster

12550S80070

DISASSEMBLING AND ASSEMBLING



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Relief Valve

1. Remove the relief valve assembly from the hydraulic block.
2. Remove the lock nut (7).
3. Remove the adjuster (6) and draw out the spring and the pilot valve (5).
4. Remove the valve seat (1), and draw out the valve seat (3), the spring and the main valve (2).

(When reassembling)

- Take care not to damage the O-rings.

Tightening torque	Relief valve assembly	34.3 to 39.2 N·m 3.5 to 4.0 kgf·m 25.3 to 28.9 ft-lbs

■ IMPORTANT

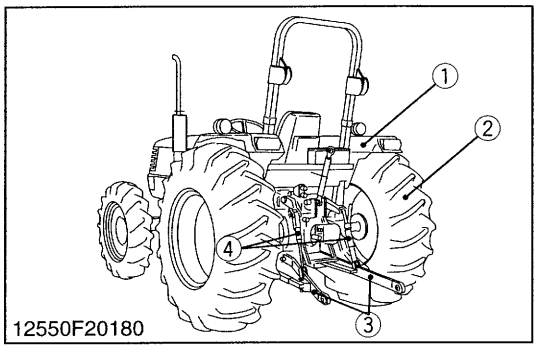
- **After disassembling and assembling the relief valve, be sure to adjust the relief valve setting pressure.**

(1) Valve Seat
(2) Main Valve
(3) Valve Seat
(4) Valve Body
(5) Pilot Valve
(6) Adjuster
(7) Lock Nut

12550S80080

[4] HYDRAULIC CYLINDER AND POSITION CONTROL VALVE DISASSEMBLING AND ASSEMBLING

(1) Removing Hydraulic Cylinder Assembly



12550F20180

Rear Wheel and Fenders

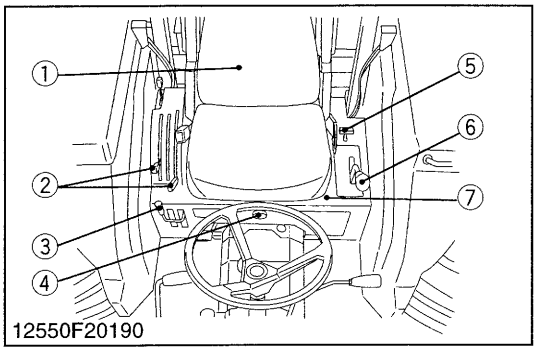
1. Remove the three point linkage, lift rods (4), lower link (3), and drawber.
2. Place disassembly stand under the transmission case.
3. Remove the rear wheels (2).
4. Disconnect the jumper leads for hazard and tail light.
5. Disconnect the jumper leads for PTO safety switch.
6. Remove the fender (1).

(When reassembling)

Tightening torque	Rear wheel mounting nut	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs

(1) Fender
(2) Rear Wheel
(3) Lower Link
(4) Lift Rod

12550S80090



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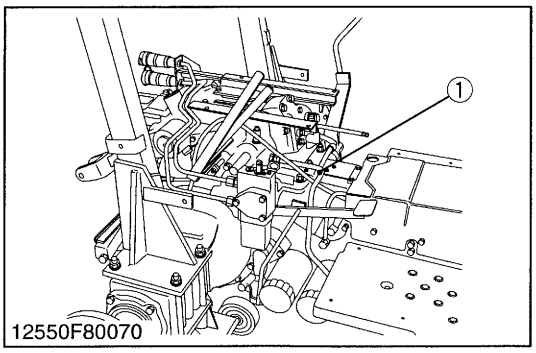
Seat and Center Frame

1. Remove the seat (1).
2. Remove the draft and position control lever grips (2).
3. Remove the auxiliary speed change lever grip (6), DT shift lever grip (5) and 3-point hitch lowering speed control grip (4).
4. Remove the auxiliary control valve lever assembly (3).
5. Remove the center frame (7).

(1) Seat
(2) Lever Grip
(3) Auxiliary Control Valve Lever Assembly
(4) 3-Point Hitch Lowering Speed Control Grip
(5) DT Shift Lever Grip
(6) Auxiliary Speed Change Lever Grip
(7) Center Frame

12550S20170



Hydraulic Cylinder Assembly

1. Remove the Delivery Pipe (1).
2. Disconnect the draft control rod from the top link bracket.
3. Remove the lift rods from lift arms
4. Remove the hydraulic cylinder assembly mounting screws and nuts.
5. Support the hydraulic cylinder assembly with nylon lift strap and hoist, and then remove it.

(When reassembling)

- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the hydraulic cylinder assembly and transmission case after eliminate the water, oil and stuck liquid gasket.

Tightening torque	Delivery pipe retaining nut	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft-lbs
	Hydraulic cylinder assembly mounting screw and nut	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 ft-lbs

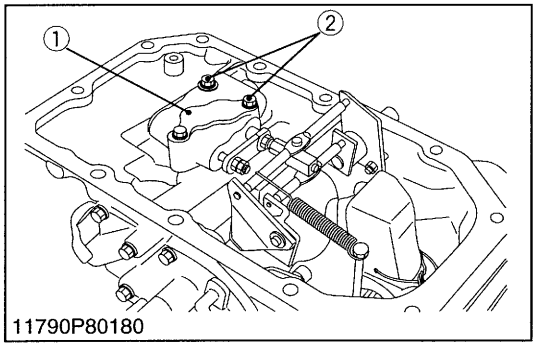
■ NOTE

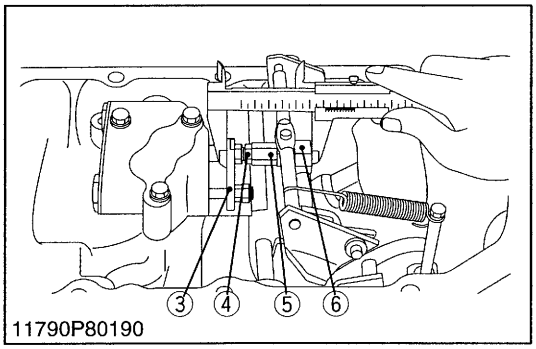
- **Reassemble the hydraulic cylinder assembly to the tractor, be suer to adjust the position control feedback rod and draft control rod.**

(1) Delivery Pipe

12550S80100

(2)Disassembling Position Control Valve





Removing Control Valve

1. Remove the return pipe.
2. Remove the control valve mounting screws (2).
3. Remove the control valve (1).

■ NOTE

- **Do not loosen adjusting section at the end of the spool unless necessary.**

(When reassembling)

- If the spool joint (6) is removed, be sure to adjust its position according to the following procedure.

Tightening torque	Control valve mounting screw	19.6 to 23.5 N·m 2.0 to 2.4 kgf·m 14.5 to 17.4 ft-lbs

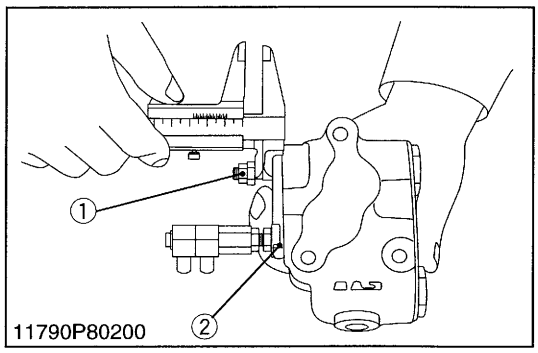
■ Adjusting Spool Joint

1. Measure the distance between plate (3) and spool joint (6).
2. If the measurement is not within the factory specifications, loosen the lock nut (4) and adjust by the turnbuckle (5).

Distance between plate and spool joint	Factory spec.	62.0 to 63.0 mm 2.44 to 2.48 in.

(1) Control Valve
(2) Control Valve Mounting Screw
(3) Plate
(4) Lock Nut
(5) Turnbuckle
(6) Spool Joint

12550S80110



Recording Distance between Plate and Lock Nut

■ NOTE

- **Before disassembling spool, be sure to record the lock nut position.**

1. Press the plate (2) on to the valve body, and measure the distance between the plate (2) and lock nut (1) for poppet valve.

(When reassembling)

- After assembling the control valve, be sure to check the function of it by air-blowing.
  If neutral, lift and down circuit can not be obtained properly, adjust the position of lock nut following the instructions given below.
  If the function is proper, stake the lock nut with a punch.

■ Adjusting Lock Nut

1. Turn the adjusting nuts all the way in, apply compressed air to the pump port while covering the cylinder port.
2. Move the adjusting nuts slowly out until you hear a loud hiss of air (unload valve opens).
3. Turn the nuts another 1/4 turn and lock.

Tightening torque	Lock nut	17.7 to 21.6 N·m 1.8 to 2.2 kgf·m 13.0 to 15.9 ft-lbs

(1) Lock Nut (2) Plate

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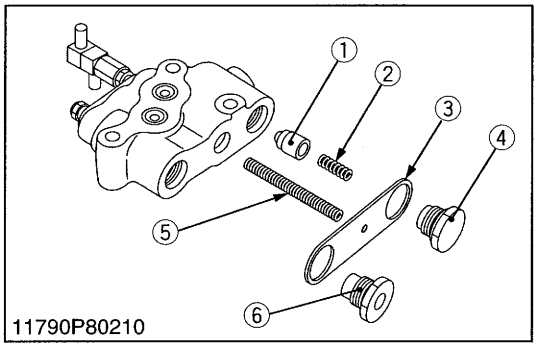


Plug and Unload Valve

1. Secure the control valve with a vise.
2. Remove the seat plug (6) for poppet valve.
3. Remove the plug (4) for unload valve (1).
4. Remove the plate (3) and return spring (5).
5. Draw out the spring (2) and unload valve (1).

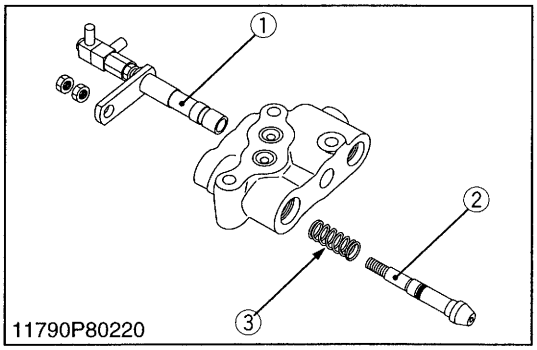
(When reassembling)

- Install the plug, noting O-ring.

Tightening torque	Plug	68.6 to 88.2 N·m 7.0 to 9.0 kgf·m 50.6 to 65.1 ft-lbs

(1) Unload Valve
(2) Spring
(3) Plate
(4) Plug
(5) Return Spring
(6) Plug

12550S80170



Spool and Poppet Valve

1. Remove the lock nut for poppet valve (2).
2. Draw out the spool (1).
3. Push the poppet valve toward the seat plug to remove.

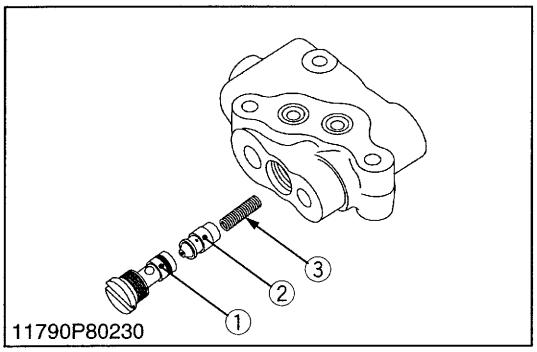
(When reassembling)

- Install the poppet valve, noting O-ring and backup ring.
- Install the lock nut so that the distance between the plate and lock nut is same as the recorded valve before disassembling the spool.

Tightening torque	Lock nut	17.7 to 21.6 N·m 1.8 to 2.2 kgf·m 13.0 to 15.9 ft-lbs

(1) Spool
(2) Poppet Valve
(3) Spring

11790S80210



11790P80230

Check Valve

1. Remove the seat plug (1).
2. Draw out the check valve (2) and spring (3).

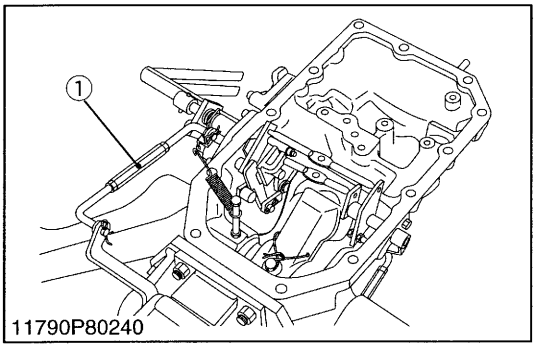
(When reassembling)

- Install the seat, noting O-ring.
- After tightening the seat plug, stake it with a punch.

Tightening torque	Seat plug	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 ft-lbs

(1) Seat Plug
(2) Check Valve
(3) Spring

11790S80220



11790P80240

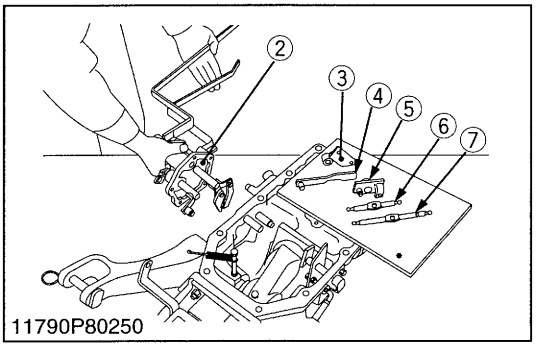
Position and Draft Linkage

1. Remove the draft feedback rod (1).
2. Remove the spool drive levers (6), (7) and links (3), (4), (5).
3. Remove the bracket guide mounting screws.
4. Remove the bracket guide assembly (2).

(When reassembling)

Tightening torque	Bracket guide mounting screw	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

(1) Draft Feedback Rod
(2) Bracket Guide Assembly
(3) Link
(4) Link
(5) Link
(6) Spool Drive Lever
(7) Spool Drive Lever



11790P80250

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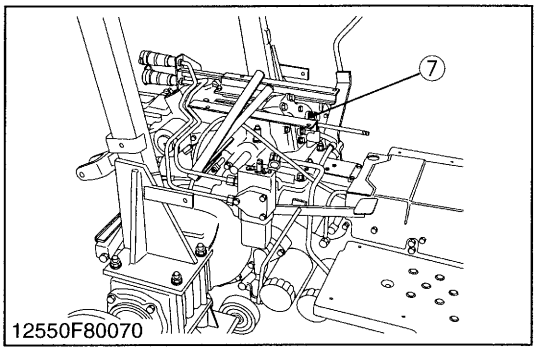
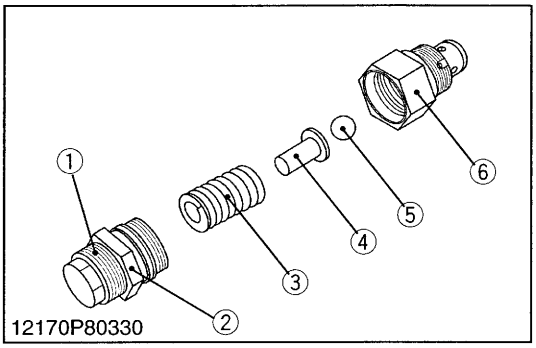
(3) Disassembling Cylinder Safety Valve





Cylinder Safety Valve

1. Remove the cylinder safety valve assembly (7).
2. Secure the cylinder safety valve assembly in a vise.
3. Loosen the lock nut (2), and remove the adjust screw (1).
4. Draw out the spring (3), seat (4), and ball (5).

(When reassembling)

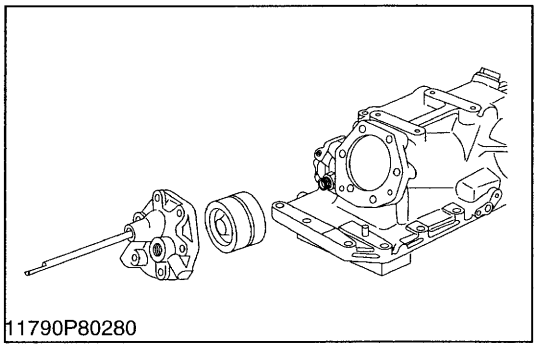
- Install the cylinder safety valve to the hydraulic cylinder block, taking care not to damage the O-rings.

Tightening torque	Cylinder safety valve body	39.2 to 49.0 N·m 4.0 to 5.0 kgf·m 28.9 to 36.2 ft-lbs
	Cylinder safety valve lock nut	58.8 to 78.5 N·m 6.0 to 8.0 kgf·m 43.4 to 57.9 ft-lbs

(1) Adjust Screw
(2) Lock Nut
(3) Spring
(4) Seat
(5) Ball
(6) Housing
(7) Safety Valve Assembly

12550S80120

(4) Disassembling Hydraulic Cylinder Assembly



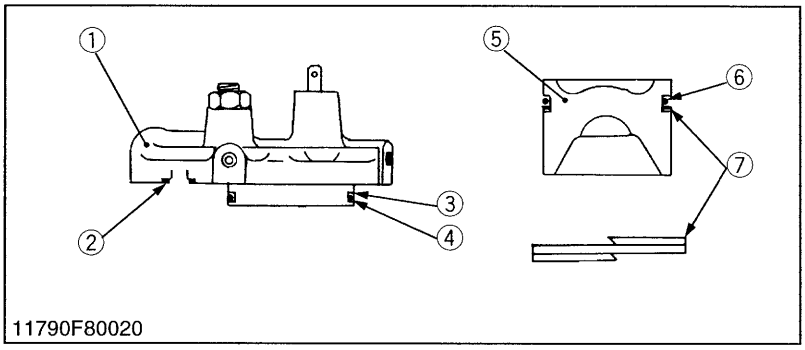
(1) Hydraulic Cylinder Cover
(2) O-ring
(3) Backup Ring
(4) O-ring
(5) Hydraulic Piston
(6) O-ring
(7) Backup Ring

Hydraulic Cylinder Cover and Hydraulic Piston

1. Remove the hydraulic cylinder cover (1).
2. Push out the hydraulic piston (5) from the hydraulic cylinder.

(When reassembling)

- Install the hydraulic piston, noting O-ring (6) and backup ring (7).
- Install the hydraulic cylinder cover, noting O-ring (2), (4) and backup ring (3).
- Apply grease to the hydraulic piston bottom contacts with hydraulic rod.



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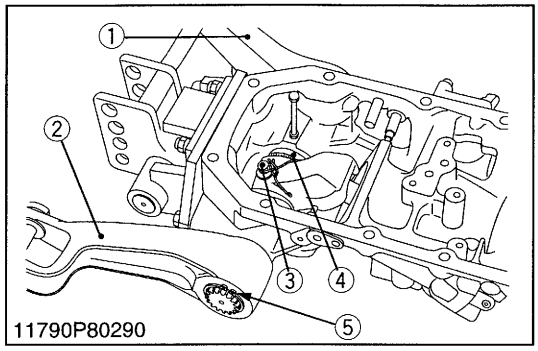

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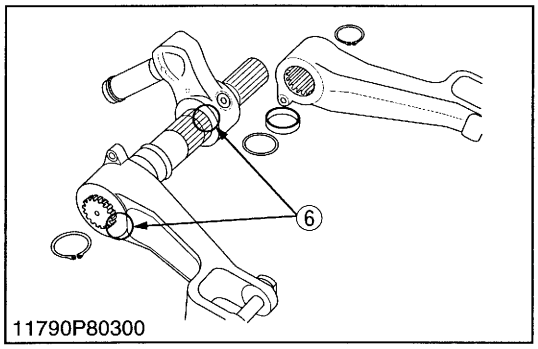

11790P80300

Lift Arm and Hydraulic Arm Shaft

1. Disconnect the feedback rod from the lift arm L.H. (2).
2. Remove the wire and unscrew the setting screw (3).
3. Remove the external snap ring (5).
4. Draw out the hydraulic arm shaft (4) and lift arm R.H. (1) as a unit.
5. Remove the collar and O-ring.

(When reassembling)

- Align the alignment marks of the hydraulic arm and hydraulic arm shaft.
- Align the alignment marks of the lift arm and hydraulic arm shaft.
- Apply grease to the right and left bushings of hydraulic cylinder body and O-ring.
- Take care not to damage the O-ring.
- After tightening the hydraulic arm setting screw to the specified torque, insert a wire through the holes of the screw head and hydraulic arm.

Tightening torque	Hydraulic arm setting screw	39.2 to 45.1 N·m 4.0 to 4.6 kgf·m 28.9 to 33.2 ft-lbs

(1) Lift Arm R.H.
(2) Lift Arm L.H.
(3) Setting Screw
(4) Hydraulic Arm Shaft
(5) External Snap Ring
(6) Alignment Mark

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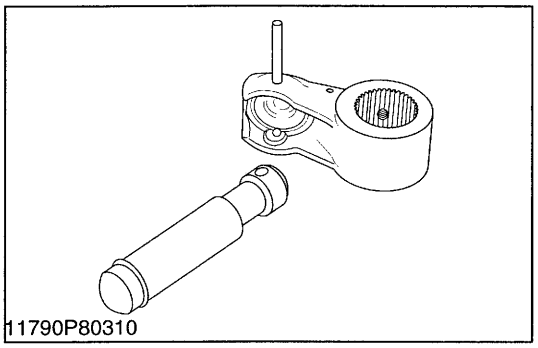

11790P80310

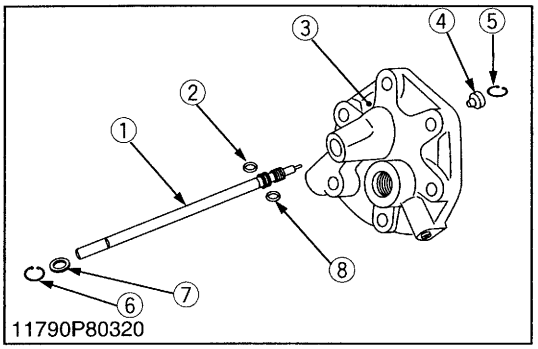
Hydraulic Arm and Hydraulic Rod

1. Remove the spring pin, and separate the hydraulic arm and the hydraulic rod.

(When reassembling)

- Apply grease to the joints of the hydraulic arm, hydraulic rod, set pin and piston.

11790S80280



11790P80320

Lowering Speed Adjusting Valve

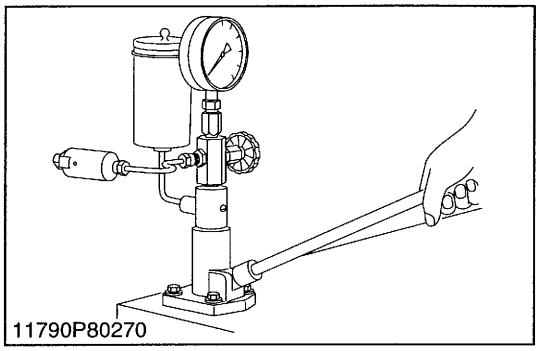
1. Remove the internal snap ring (6) and adjusting screw (1).
2. Remove the internal snap ring (5), and draw out the poppet valve (4).

(1) Adjusting Screw
(2) O-ring
(3) Hydraulic Cylinder Cover
(4) Poppet Valve
(5) Internal Snap Ring
(6) Internal Snap Ring
(7) Plain Washer
(8) O-ring

12550S80200

SERVICING

(1) Cylinder Safety Valve



Operating Pressure of Cylinder Safety Valve

1. Attach the cylinder safety valve to a injection nozzle tester with a safety valve setting adaptor.
2. Measure the operating pressure of the cylinder safety valve.
3. If the operating pressure is not within the factory specifications, adjust by turning the adjust screw. (See page 8-S16.)
4. After adjustment, tighten the lock nut firmly.

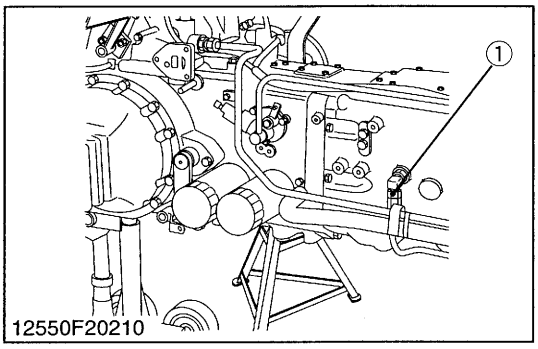
Cylinder safety valve operating pressure	Factory spec.	21.1 to 22.6 MPa 215 to 230 kgf/cm^2 3060 to 3277 psi

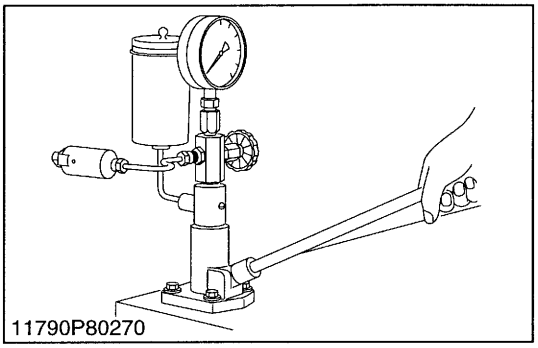
■ NOTE

- **Use specified transmission fluid (see page G-9) to test the operating pressure of the cylinder safety valve.**

12550S80130

(2) Oil Cooler Relief Valve





Operating Pressure of Oil Relief Valve

1. Attach the oil cooler relief valve to a injection nozzle tester with a safety valve setting adaptor.
2. Measure the operating pressure of the cylinder safety valve.

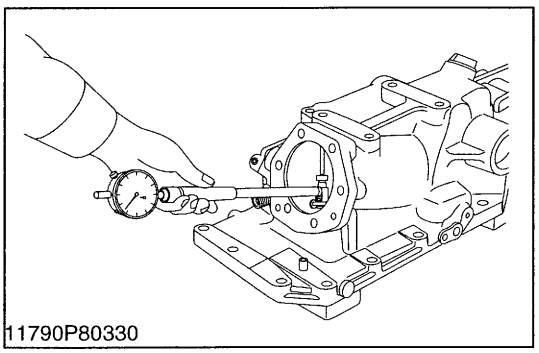
Oil cooler relief valve operating pressure	Factory spec.	4.4 to 4.9 MPa 45.0 to 50.0 kgf/cm^2 640 to 711 psi

■ NOTE

- **Use specified transmission fluid (see page G-9) to test the operating pressure of the oil cooler relief.**

12550S80140

(3) Hydraulic Cylinder Assembly



Hydraulic Cylinder Bore

1. Check the cylinder internal surface for scoring or damage.
2. Measure the cylinder I.D. with a cylinder gauge.
3. If the measurement exceeds the allowable limit, replace it.

Cylinder I.D.	Factory spec.	90.000 to 90.050 mm 3.54330 to 3.54527 in.
	Allowable limit	90.15 mm 3.5492 in.

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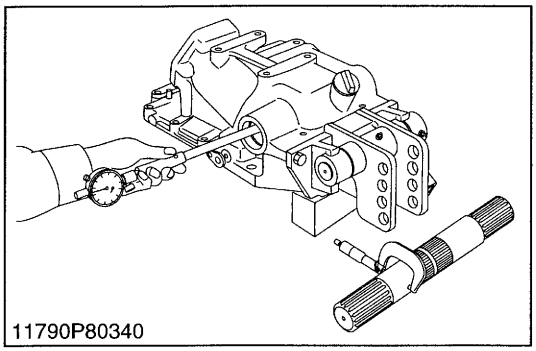
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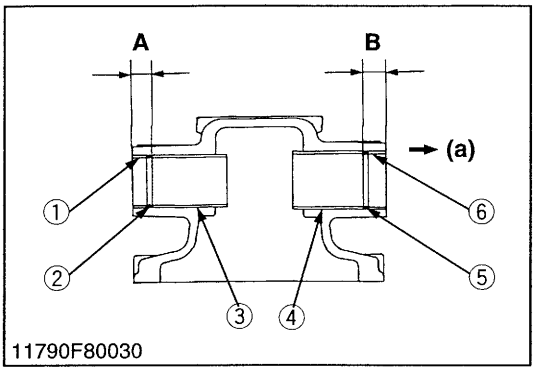


11790F80030

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 hydrualic arm shaft and bushing (Right side)	Factory spec.	0.049 to 0.154 mm 0.00193 to 0.00606 in.
	Allowable limit	0.50 mm 0.0197 in.
Hydraulic arm shaft O.D. (Right side)	Factory spec.	49.950 to 49.975 mm 1.96653 to 1.96752 in.
Busing I.D. (After press-fitted) (Right side)	Factory spec.	50.024 to 50.104 mm 1.96944 to 1.97259 in.

Clearance between hydrualic arm shaft and bushing (Left side)	Factory spec.	0.049 to 0.149 mm 0.00193 to 0.00587 in.
	Allowable limit	0.50 mm 0.0197 in.
Hydraulic arm shaft O.D. (Left side)	Factory spec.	44.950 to 44.975 mm 1.76968 to 1.77067 in.
Busing I.D. (After press-fitted) (Left side)	Factory spec.	45.024 to 45.099 mm 1.77259 to 1.77555 in.

(When reassembling)

- When press-fitting a new bushing with a press-fitting tool (see page G-46), observe the dimensions described in the figure.
- When press-fitting a new bushing, apply transmission fluid to the hydraulic cylinder liner boss and bushing.
- When press-fitting a new bushing, press-fit it so that each seam faces up.

Press-fit location of bushing	Factory spec.	A	14.5 to 15.5 mm 0.5708 to 0.6102 in.
		B	22.5 to 23.5 mm 0.8858 to 0.9252 in.

(1) Collar (Left)
(2) O-ring
(3) Bushing (Left)
(4) Bushing (Right)
(5) O-ring
(6) Collar (Right)

(a) Right Side
*** Flush the end of collar with the end of hydrualic cylinder body.**

12550S80210

9 ELECTRICAL SYSTEM

9 ELECTRICAL SYSTEM

MECHANISM

CONTENTS

- Color of Wiring

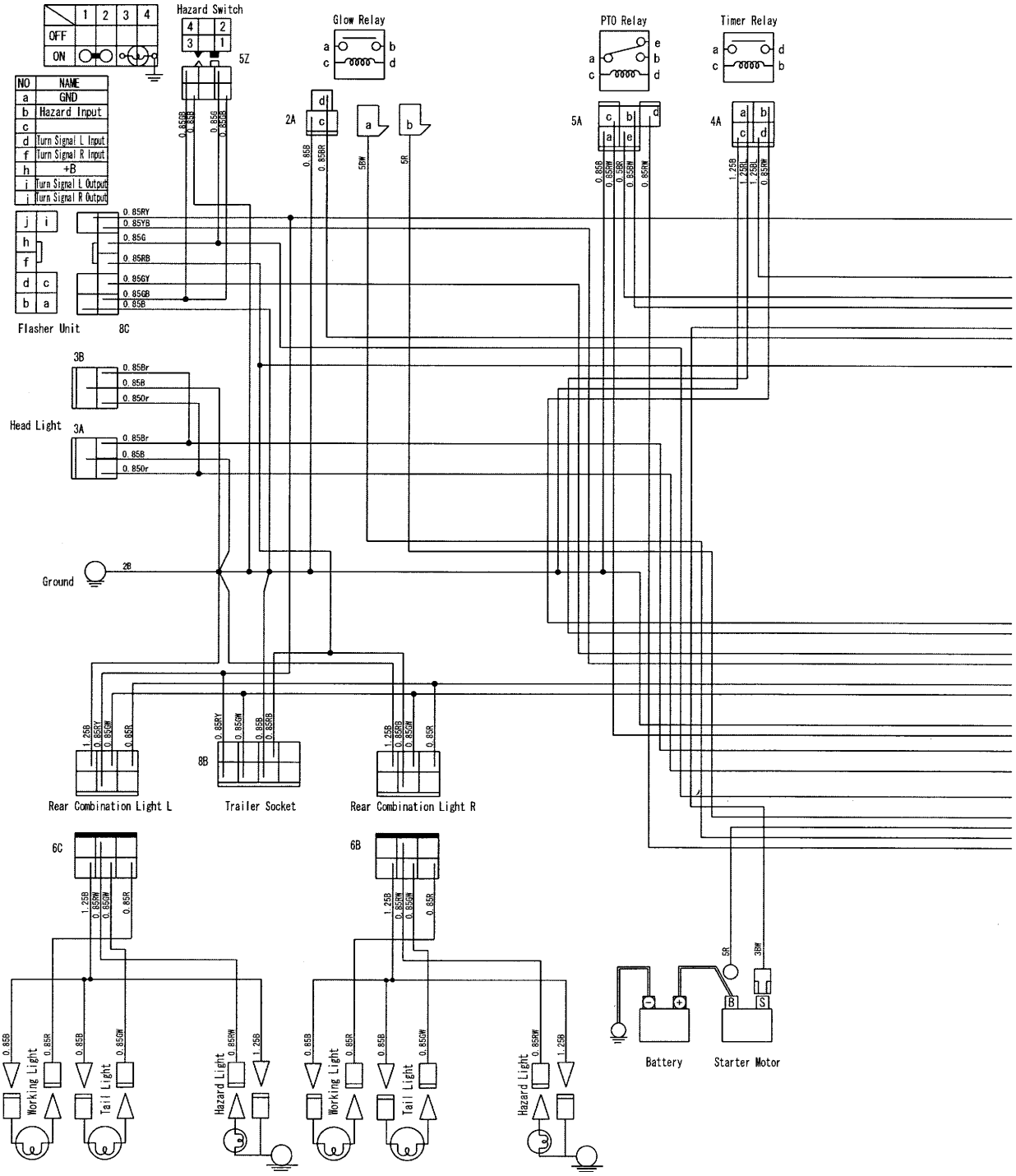
B ..... Black	RW ..... Red / White
W ..... White	RY ..... Red / Yellow
R ..... Red	RG ..... Red / Green
G ..... Green	RL ..... Red / Blue
Or ..... Orange	GB ..... Green / Black
Y ..... Yellow	GW ..... Green / White
Br ..... Brown	GR ..... Green / Red
L ..... Blue	GY ..... Green / Yellow
Lg ..... Light Green	GL ..... Green / Blue
WB ..... White / Black	YR ..... Yellow / Red
WR ..... White / Red	YB ..... Yellow / Black
BL ..... Black / Blue	LB ..... Blue / Black
BR ..... Black / Red	YL ..... Yellow / Blue
BW ..... Black / White	LW ..... Blue / White
BY ..... Black / Yellow	LR ..... Blue / Red
BPu ..... Black / Purple	LY ..... Blue / Yellow
BP ..... Black / Pink	LgW ..... Light Green / White
BrY ..... Brown / Yellow	LgB ..... Light Green / Black
RB ..... Red / Black	LgY ..... Light Green / Yellow

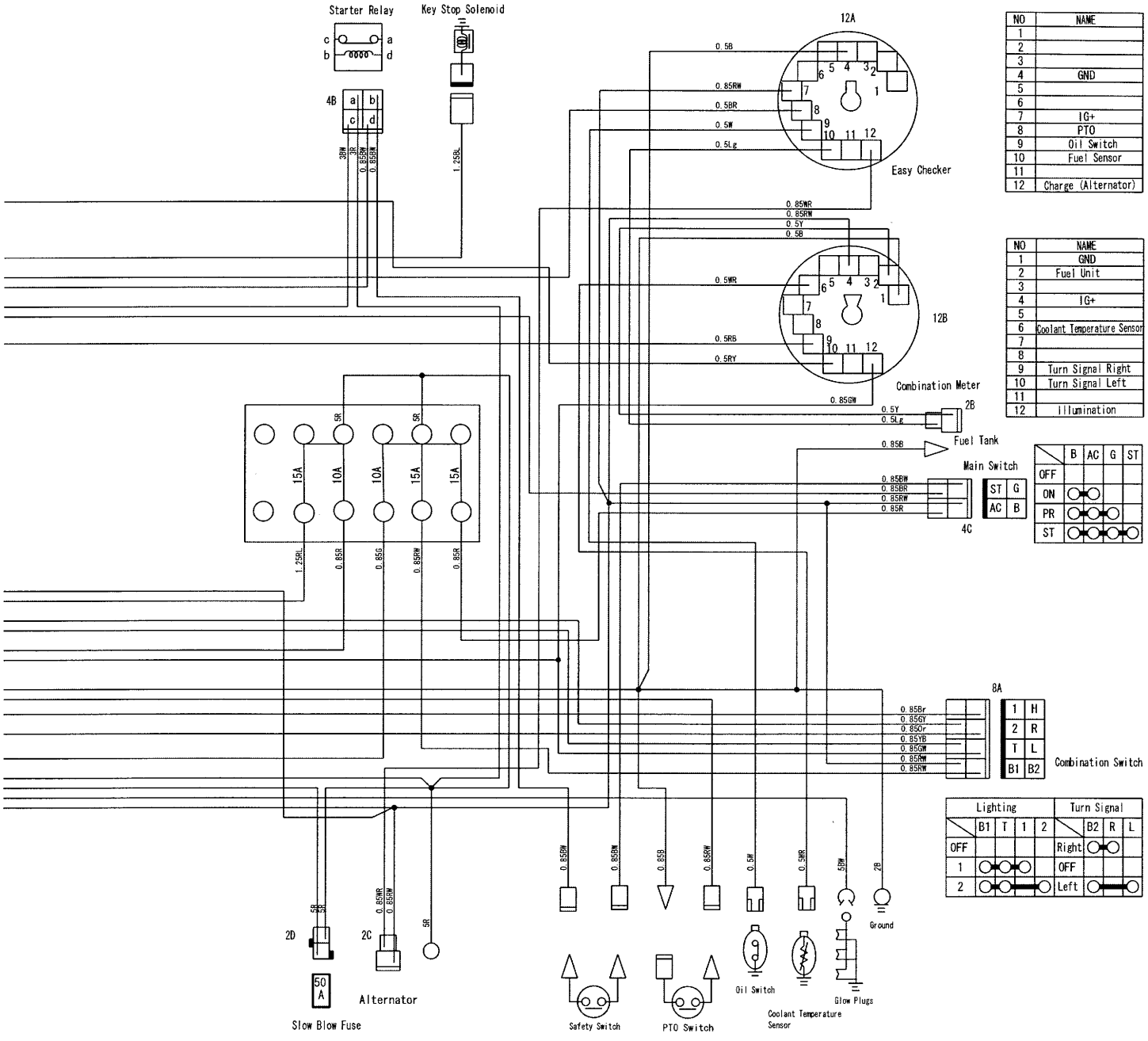
■ **Color of wiring that are shown Fig [1] and Fig [2] is same as above.**

12550M90010

[1] WIRING DIAGRAM

(1) ROPS Type





NO	NAME
1	
2	
3	
4	GND
5	
6	
7	IG+
8	PTO
9	Oil Switch
10	Fuel Sensor
11	
12	Charge (Alternator)

NO	NAME
1	GND
2	Fuel Unit
3	
4	IG+
5	
6	Coolant Temperature Sensor
7	
8	
9	Turn Signal Right
10	Turn Signal Left
11	
12	Illumination

	B	AC	G	ST
OFF				
ON	○			
PR	○			○
ST	○		○	○

ST	G		
AC	B		

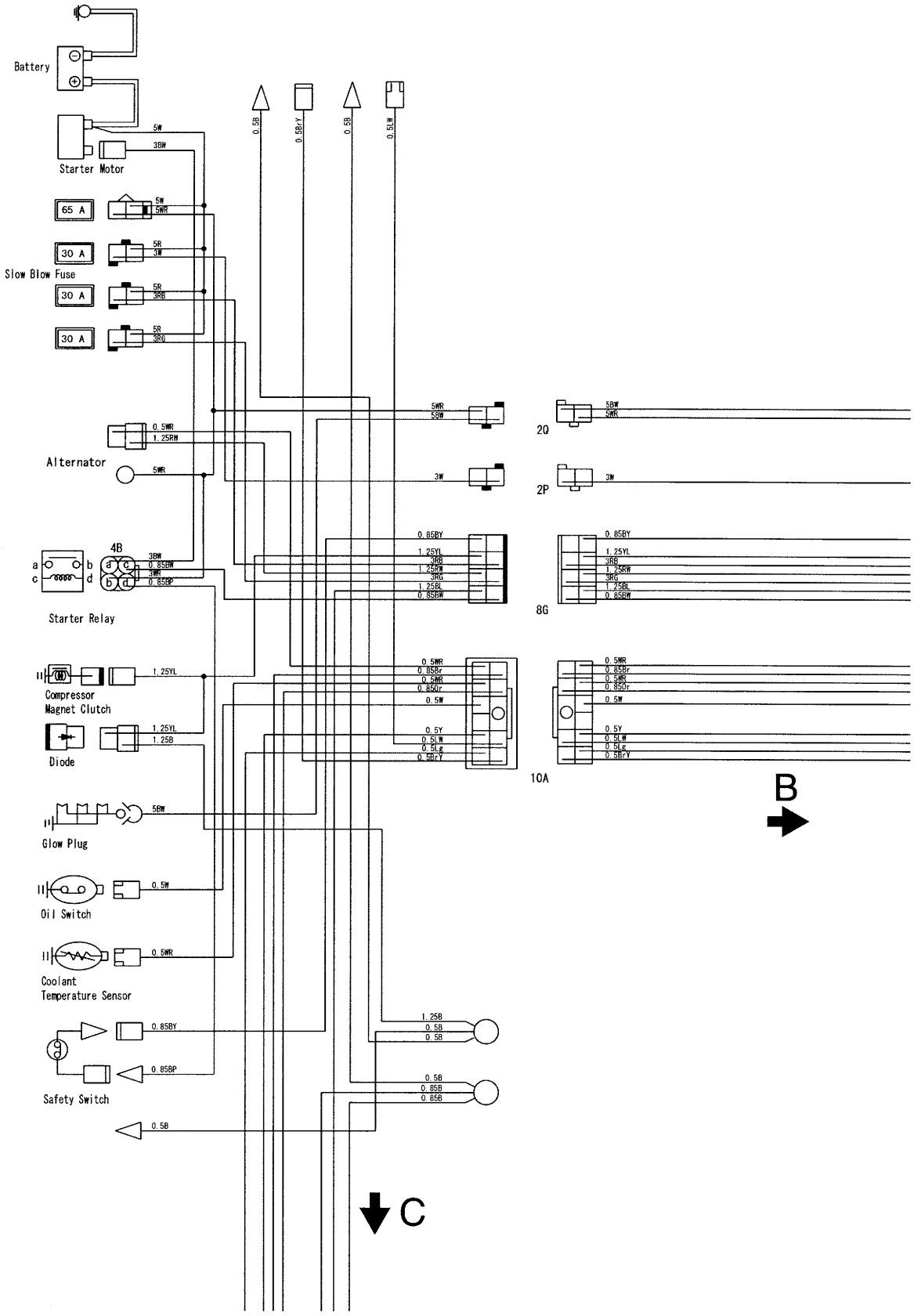
1	H		
2	R		
T	L		
B1	B2		

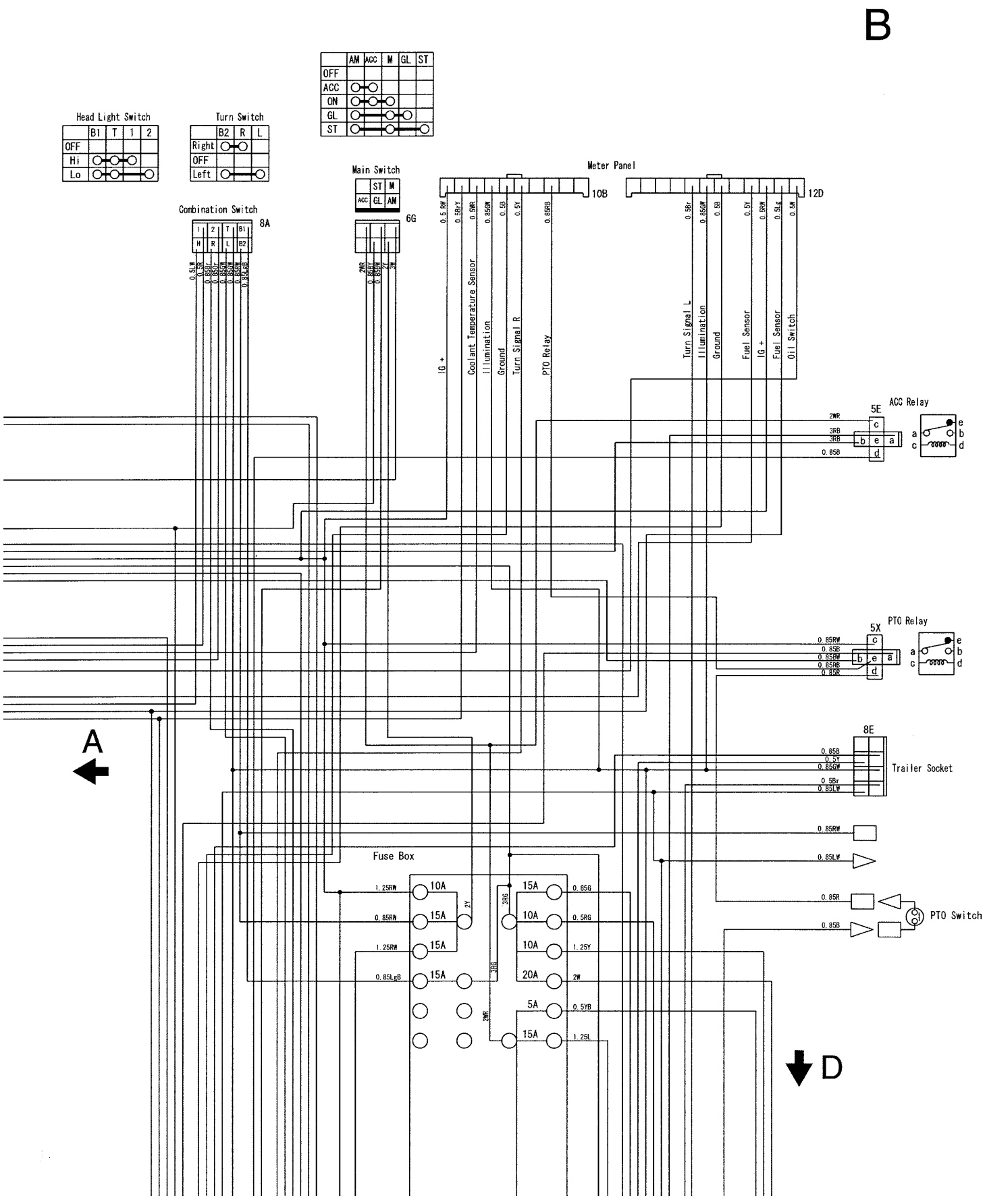
Lighting					Turn Signal			
	B1	T	1	2		B2	R	L
OFF					Right	○	○	
1	○	○	○		OFF			
2	○	○	●	●	Left	○	●	

(2) CABIN Type (for USA)

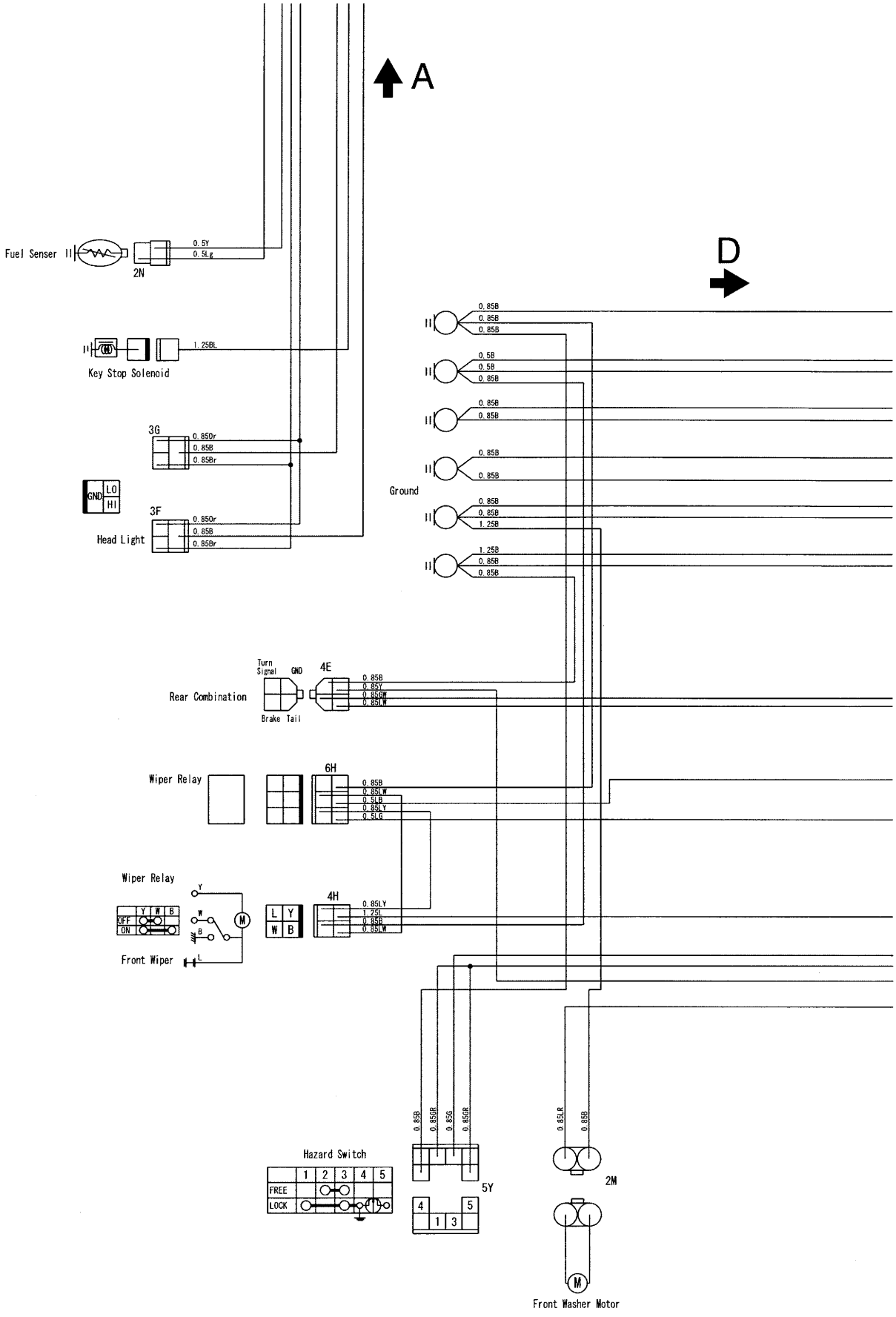
(2)-1 Body Harness

A

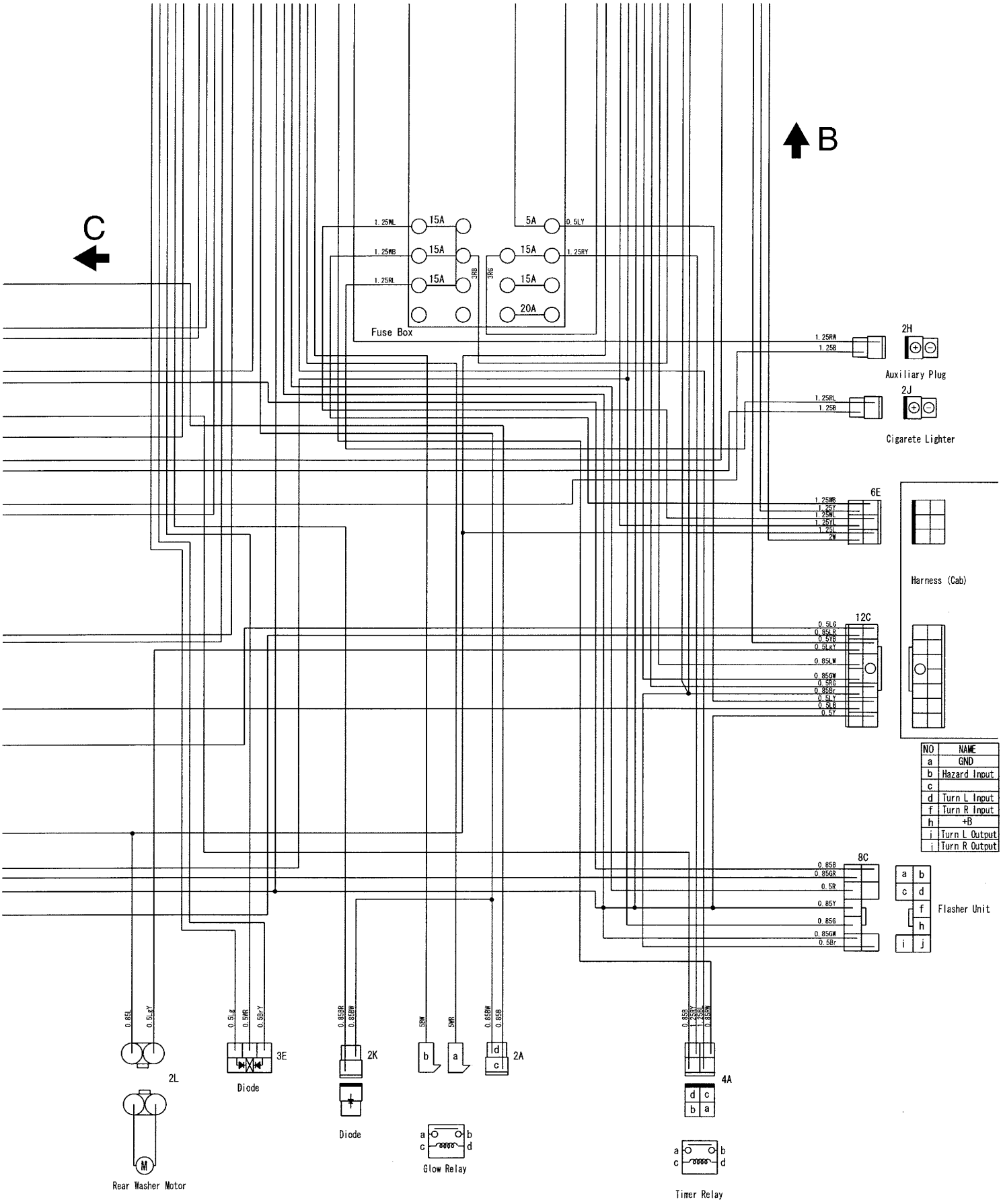



B
Head Light Switch
B1 T 1 2
OFF
Hi
Lo
Turn Switch
B2 R L
Right
OFF
Left
AM ACC M GL ST
OFF
ACC
ON
GL
ST
Main Switch
ST M
ACC GL AM
6G
Combination Switch
8A
Meter Panel
10B
12D
IG +
Coolant Temperature Sensor
Illumination
Ground
Turn Signal R
PTO Relay
Turn Signal L
Illumination
Ground
Fuel Sensor
IG +
Fuel Sensor
Oil Switch
ACC Relay
5E
PTO Relay
5X
8E
Trailer Socket
Fuse Box
10A
15A
15A
15A
15A
10A
10A
20A
5A
15A
PTO Switch
A
D

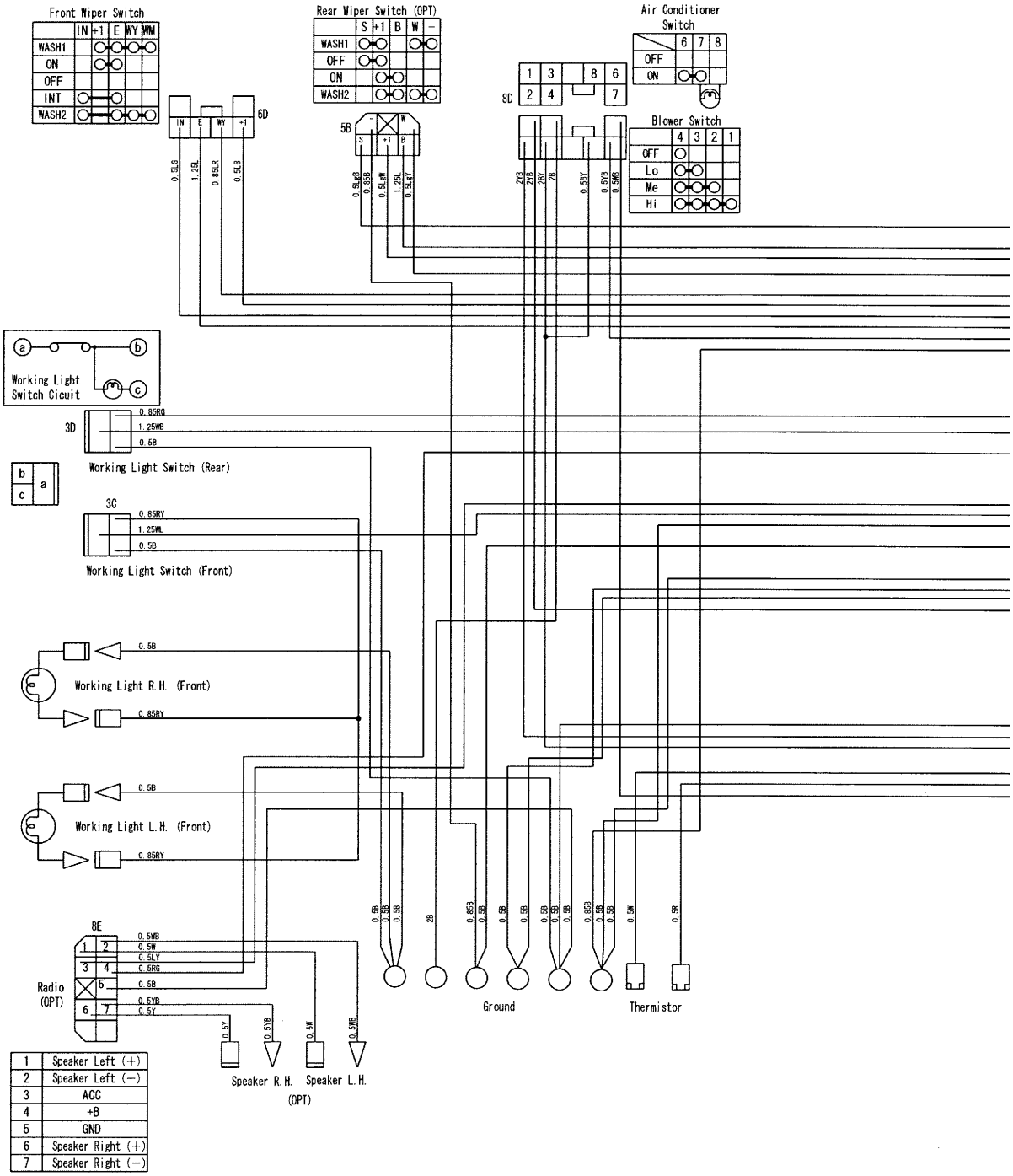
MEMO

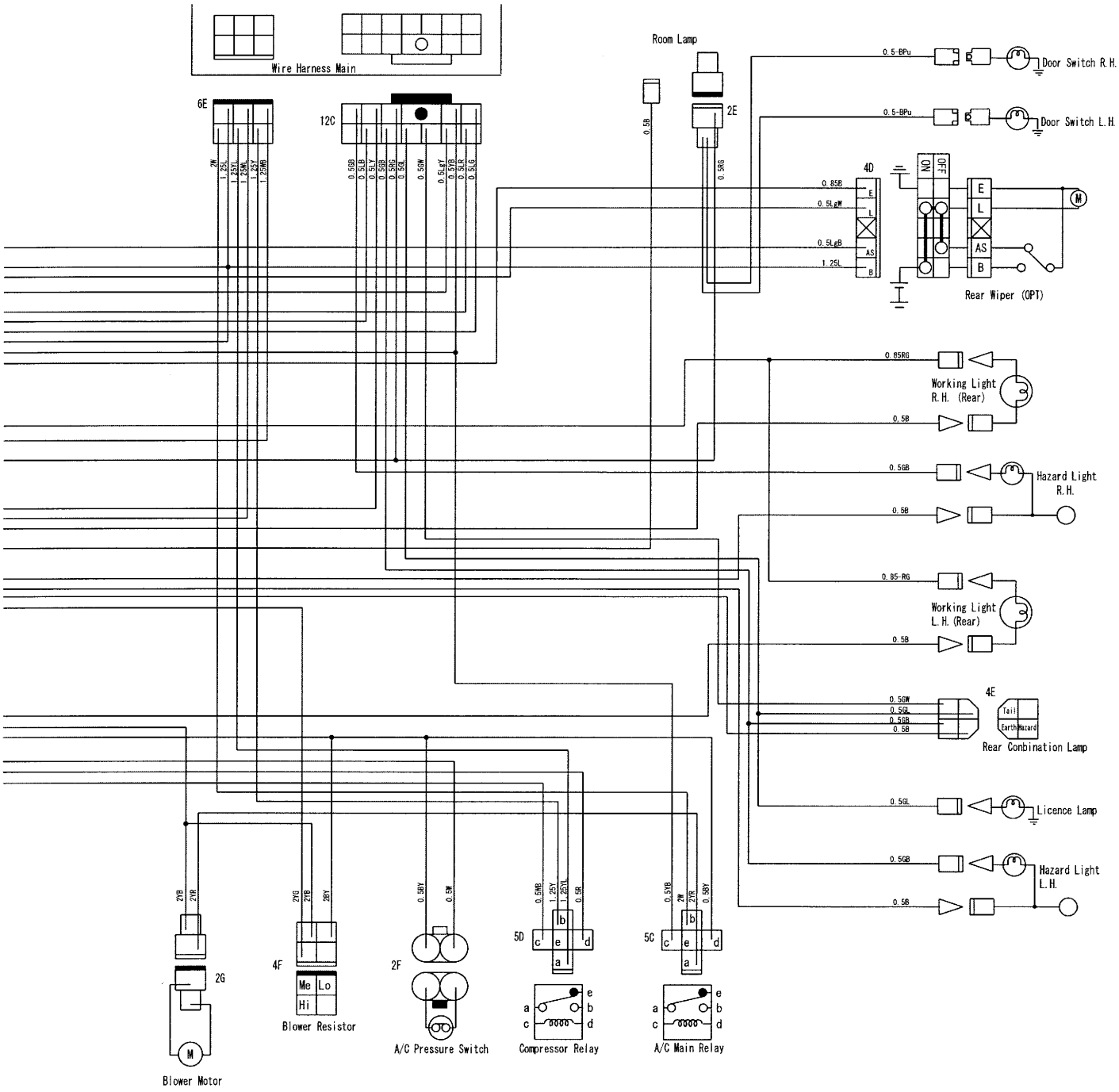

A
D
Fuel Senser
2N
0.5Y
0.5Lg
Key Stop Solenoid
1.25BL
3G
3F
GND
LO
HI
Head Light
0.85Or
0.85B
0.85Br
Ground
0.85B
0.5B
1.25B
Rear Combination
Turn Signal
GND
Brake Tail
4E
0.85Y
0.85GW
0.85LW
Wiper Relay
6H
0.85LB
0.85LY
0.5LG
4H
1.25L
0.85G
Front Wiper
OFF
ON
Hazard Switch
FREE
LOCK
5Y
2M
0.85LR
0.85GR
Front Washer Motor
M
C

MEMO


C
B
D
Fuse Box
15A
15A
15A
5A
15A
15A
20A
2H
Auxiliary Plug
2J
Cigarete Lighter
6E
Harness (Cab)
12C
NO NAME
a GND
b Hazard Input
c
d Turn L Input
f Turn R Input
h +B
i Turn L Output
j Turn R Output
8C
Flasher Unit
2L
Rear Washer Motor
3E
Diode
2K
Diode
2A
Glow Relay
4A
Timer Relay

(2)-2 CABIN Harness

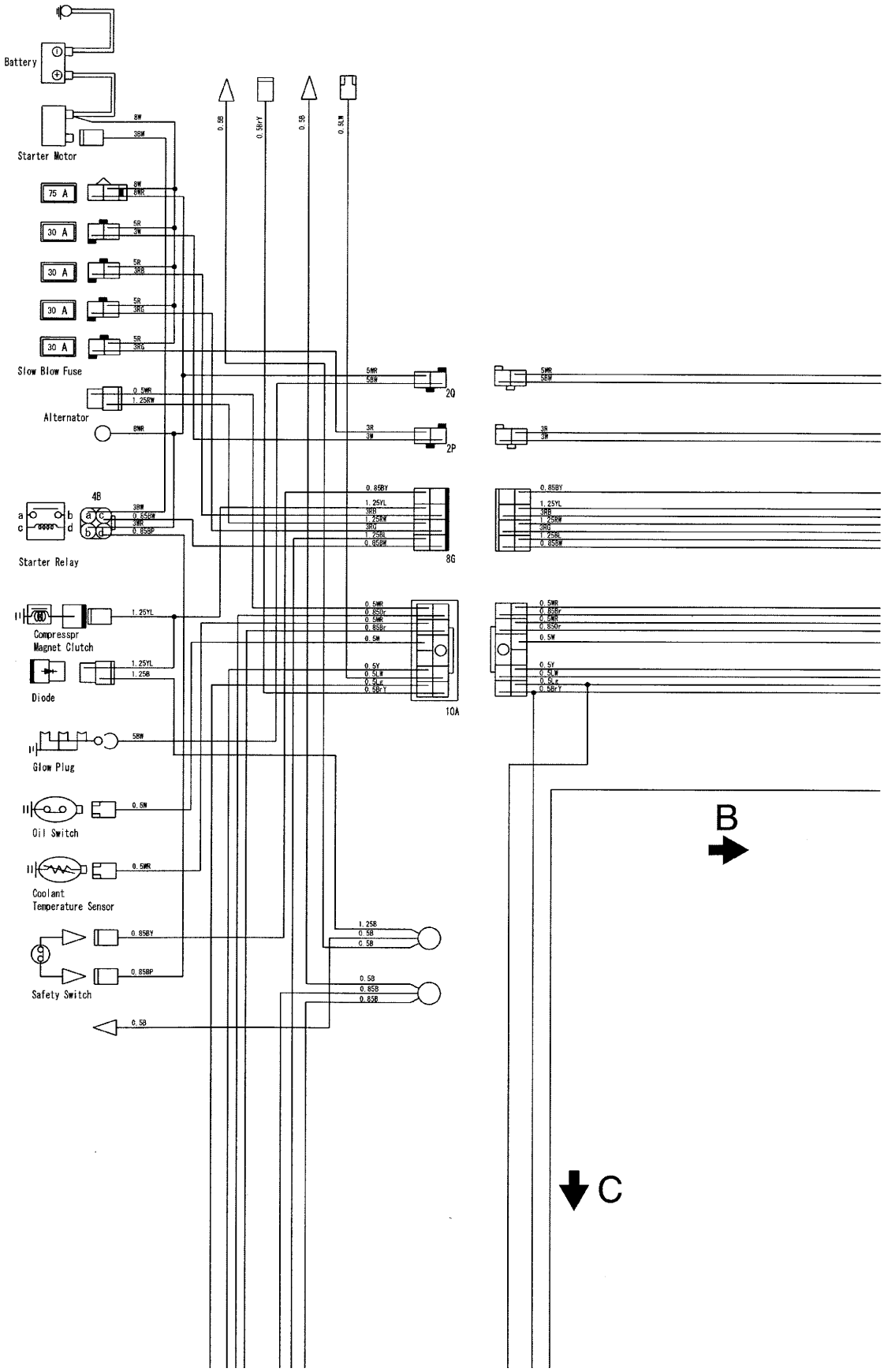


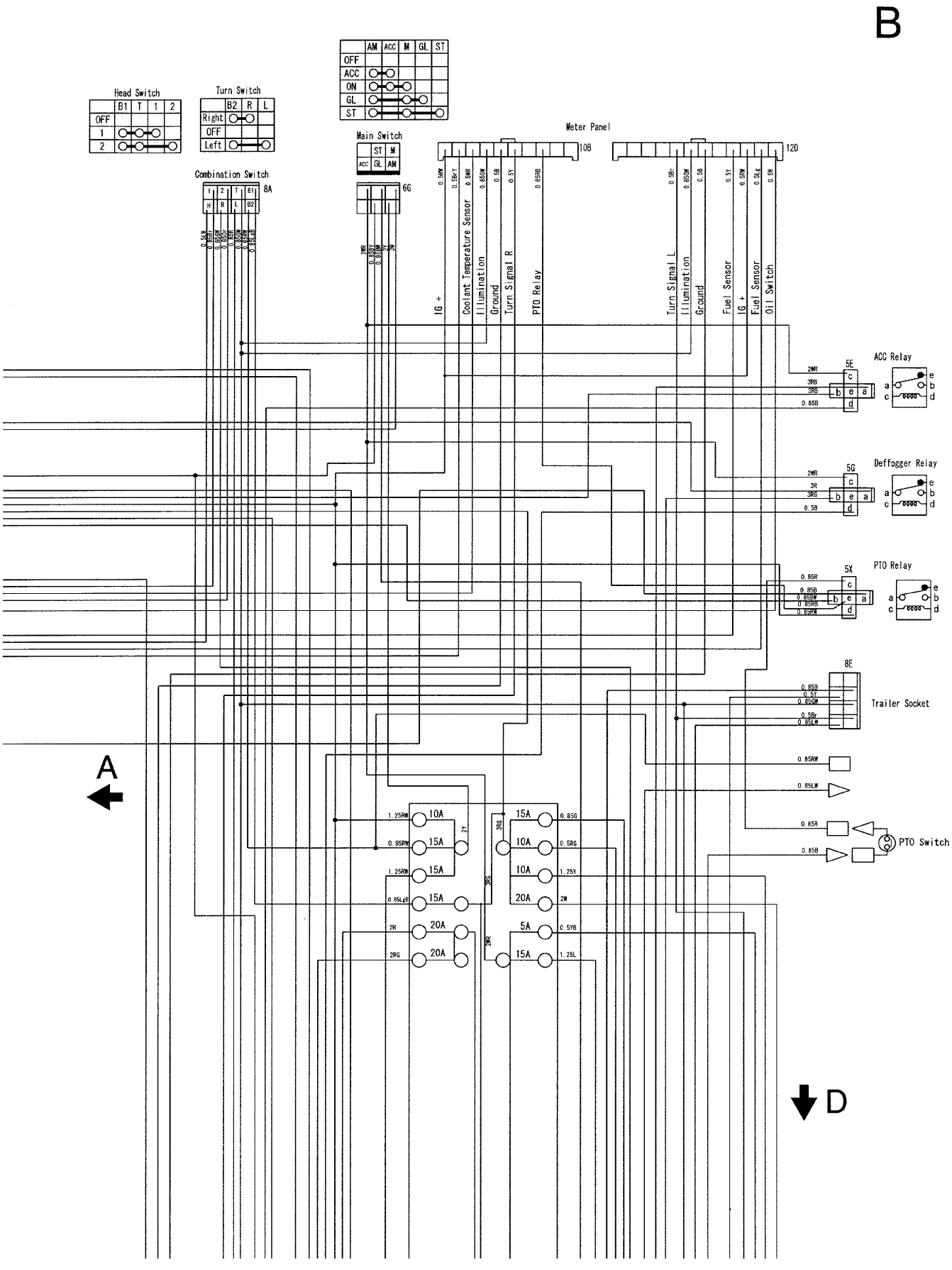

Wire Harness Main
6E
12C
Room Lamp
2E
0.5B
0.5RG
0.5-BPu
Door Switch R.H.
0.5-BPu
Door Switch L.H.
4D
0.85B
0.5LgW
0.5LgB
1.25L
ON
OFF
E
L
AS
B
M
Rear Wiper (OPT)
0.85RG
Working Light R.H. (Rear)
0.5B
0.5GB
Hazard Light R.H.
0.5B
0.85-RG
Working Light L.H. (Rear)
0.5B
4E
0.5GW
0.5GL
0.5GB
0.5B
Tail
Earth
Hazard
Rear Conbination Lamp
0.5GL
Licence Lamp
0.5GB
Hazard Light L.H.
0.5B
2G
M
Blower Motor
4F
Me
Lo
Hi
Blower Resistor
2F
A/C Pressure Switch
5D
Compressor Relay
5C
A/C Main Relay

(3) CABIN Type (for CANADA)

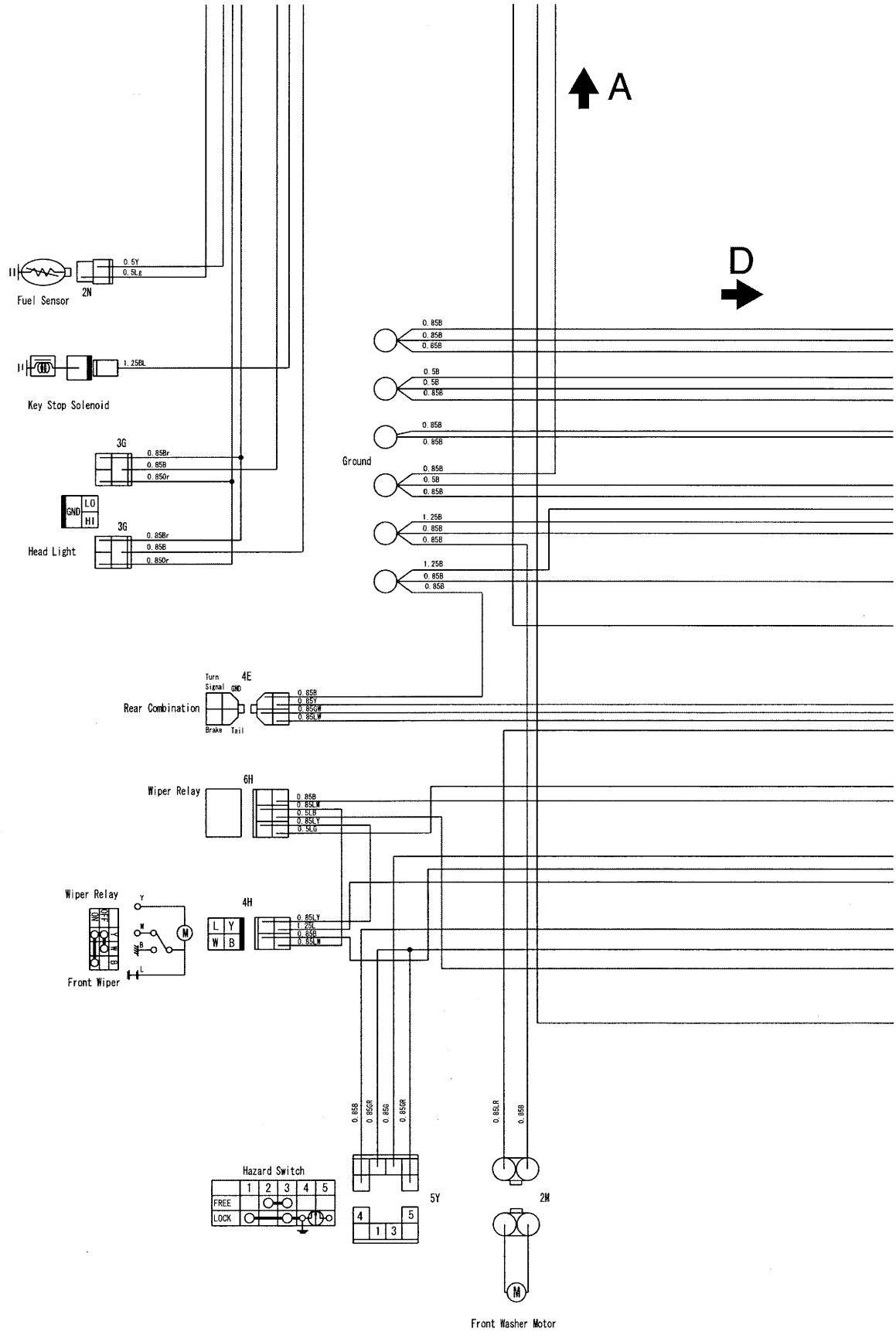
(3)-1 Body Harness

A

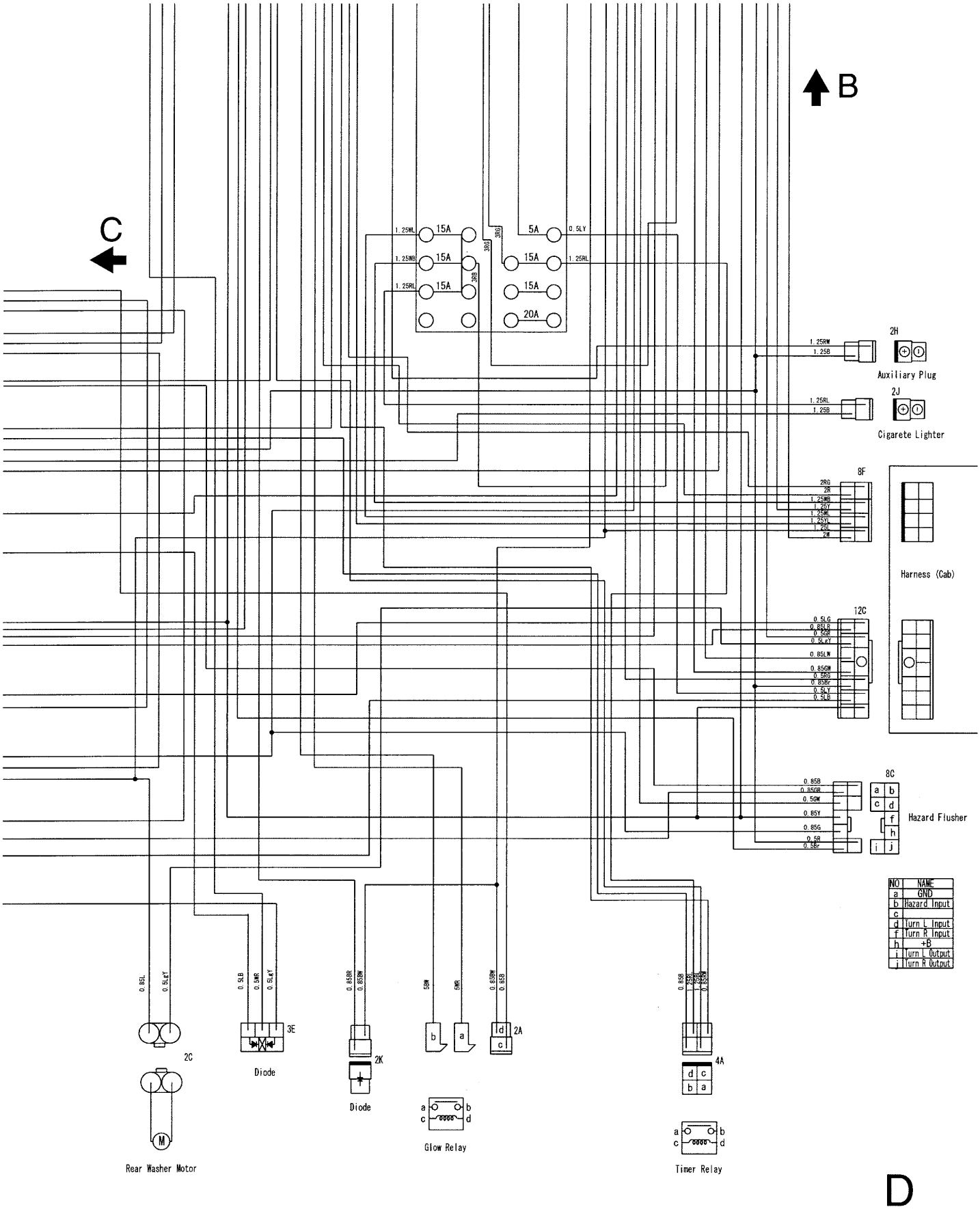



B
Head Switch
Turn Switch
Main Switch
Combination Switch
8A
6G
Meter Panel
10B
12D
IG +
Coolant Temperature Sensor
Illumination
Ground
Turn Signal R
PTO Relay
Turn Signal L
Illumination
Ground
Fuel Sensor
IG +
Fuel Sensor
Oil Switch
ACC Relay
5E
Deffogger Relay
5G
PTO Relay
5X
8E
Trailer Socket
PTO Switch
A
D
10A
15A
15A
15A
20A
20A
15A
10A
10A
20A
5A
15A

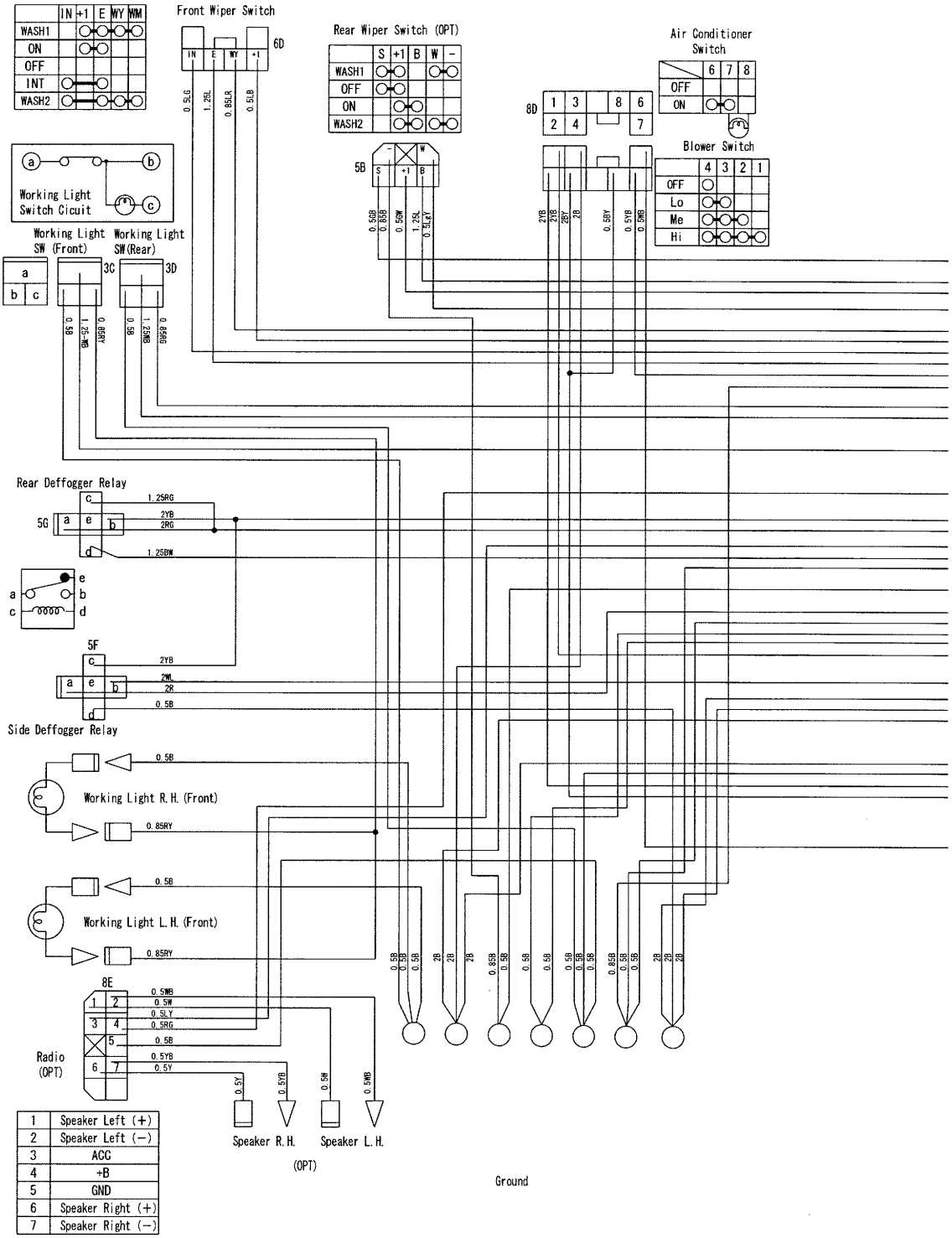
MEMO

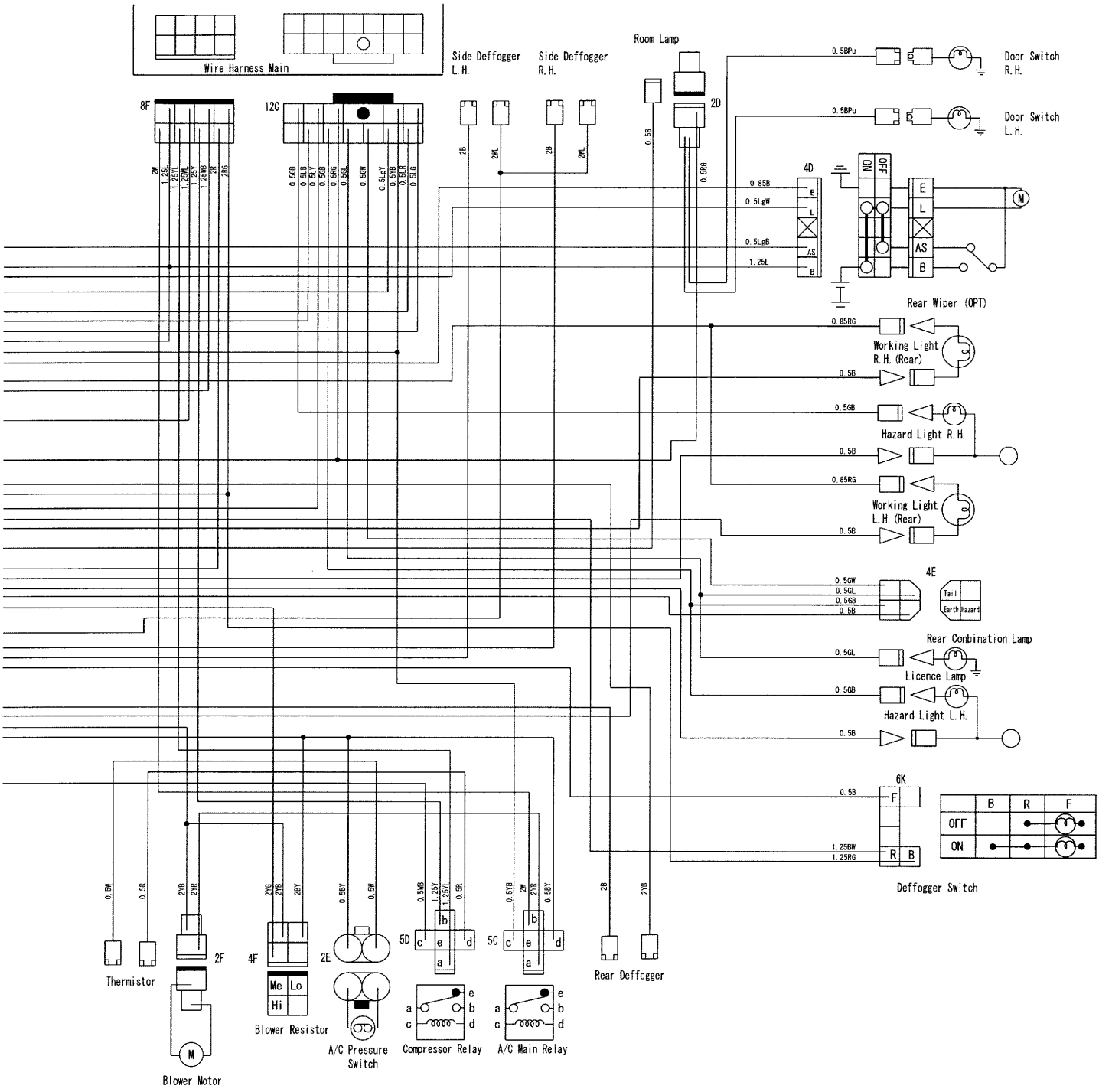

A
D
Fuel Sensor
2N
0.5Y
0.5Lg
Key Stop Solenoid
1.25BL
3G
0.85Br
0.85B
0.85Or
GND
LO
HI
Head Light
Ground
0.85B
0.5B
1.25B
Rear Combination
4E
Turn Signal
GND
Brake
Tail
0.85Y
0.85GW
0.85LW
Wiper Relay
6H
0.85LW
0.5LB
0.85LY
0.5LG
Wiper Relay
4H
Front Wiper
OFF
ON
L Y
W B
1.25L
0.85G
0.85GR
0.85LR
Hazard Switch
FREE
LOCK
5Y
2M
Front Washer Motor

C


B
C
D
15A
15A
15A
5A
15A
15A
20A
2H
Auxiliary Plug
2J
Cigarete Lighter
8F
Harness (Cab)
12C
8C
Hazard Flusher
NO NAME
a GND
b Hazard Input
c
d Turn L Input
f Turn R Input
h +B
i Turn L Output
j Turn R Output
2C
3E
Diode
2K
Diode
2A
4A
Glow Relay
Timer Relay
Rear Washer Motor

(3) CABIN Harness

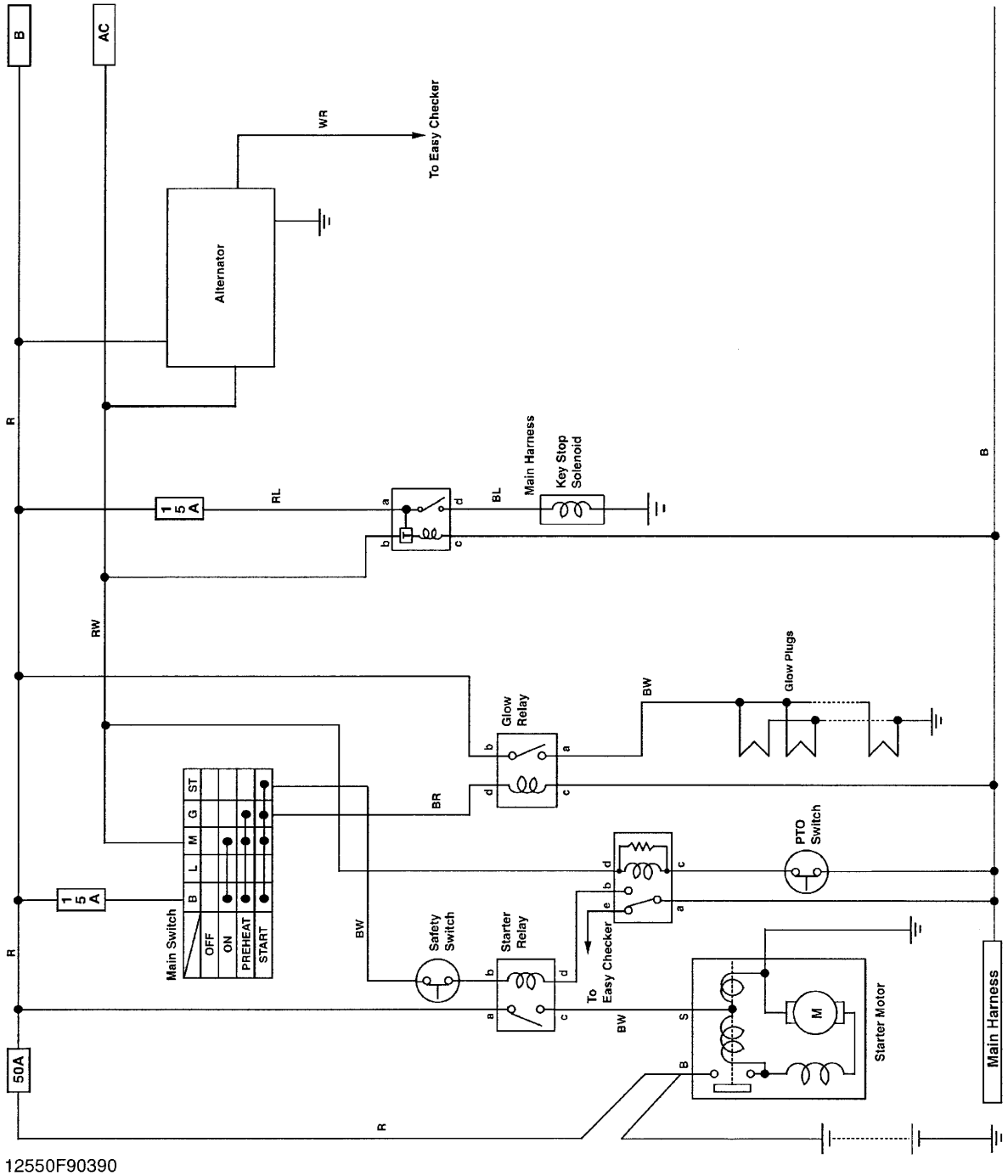



Wire Harness Main
Side Deffogger L.H.
Side Deffogger R.H.
Room Lamp
Door Switch R.H.
Door Switch L.H.
Rear Wiper (OPT)
Working Light R.H. (Rear)
Hazard Light R.H.
Working Light L.H. (Rear)
Rear Combination Lamp
Licence Lamp
Hazard Light L.H.
Deffogger Switch
Rear Deffogger
Thermistor
Blower Resistor
A/C Pressure Switch
Compressor Relay
A/C Main Relay
Blower Motor
OFF
ON
Me
Lo
Hi
Tail
Earth
Hazard

[2] ELECTRICAL CIRCUIT

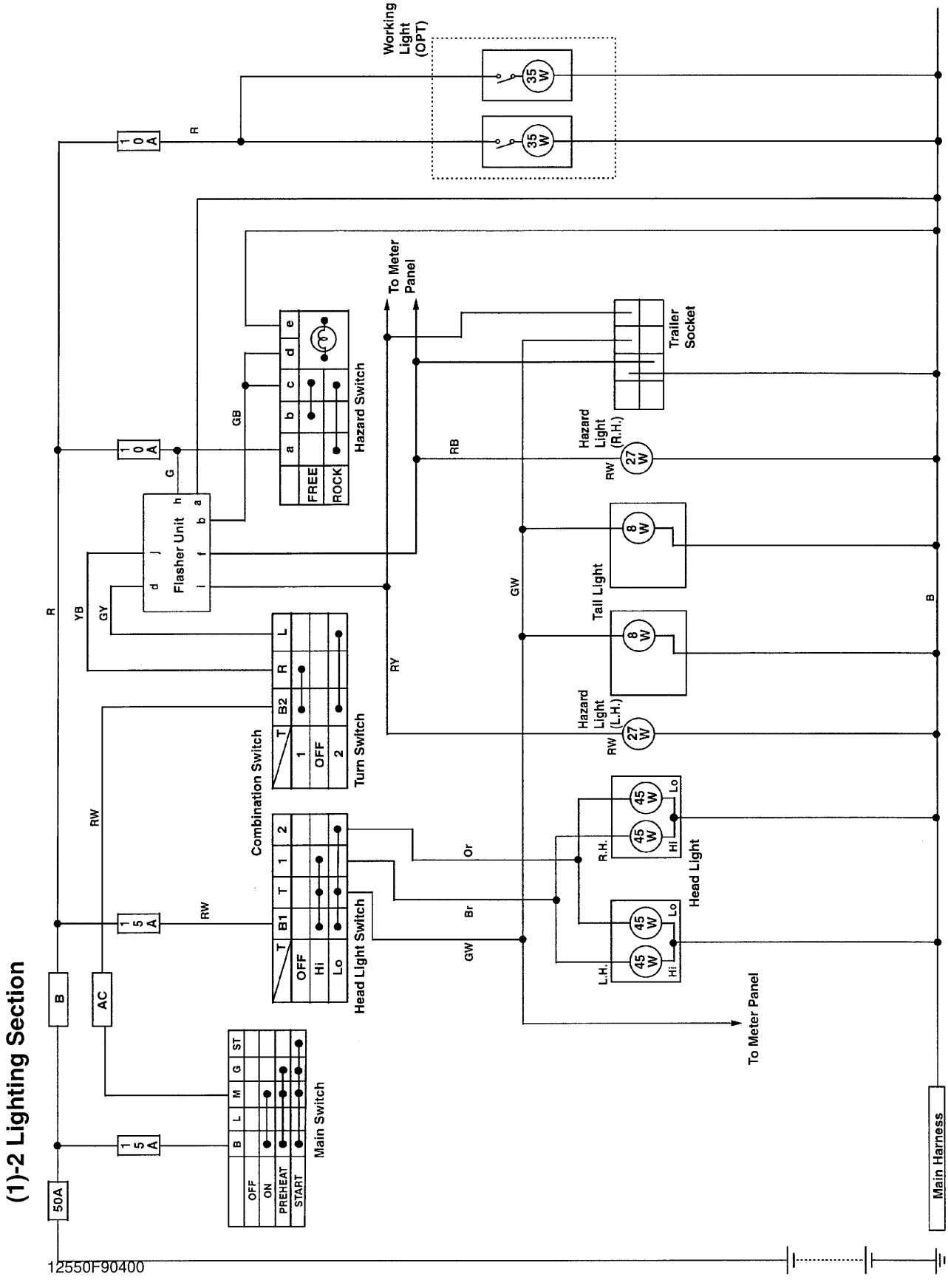
(1) ROPS Type

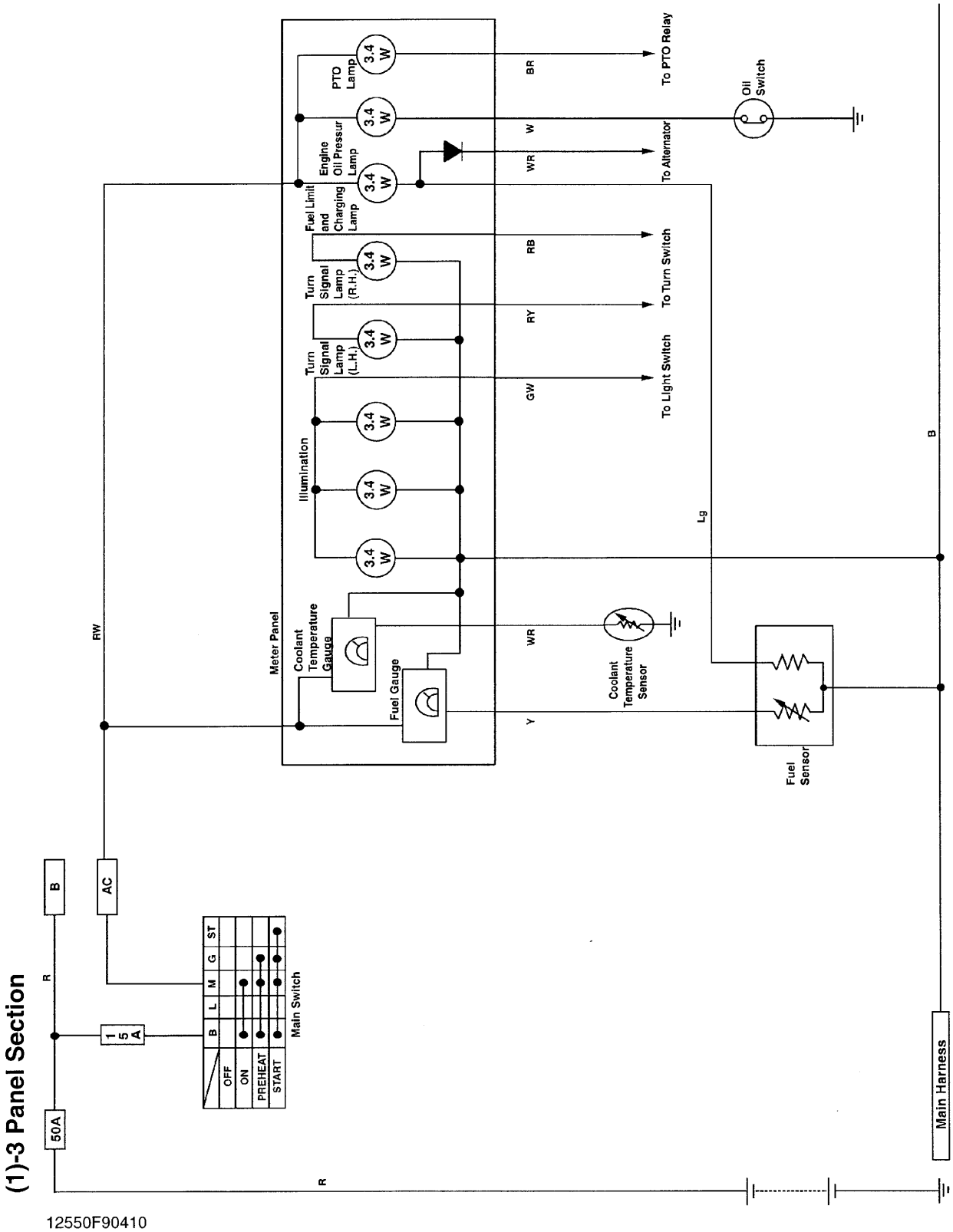
(1)-1 Starting Section



12550F90390

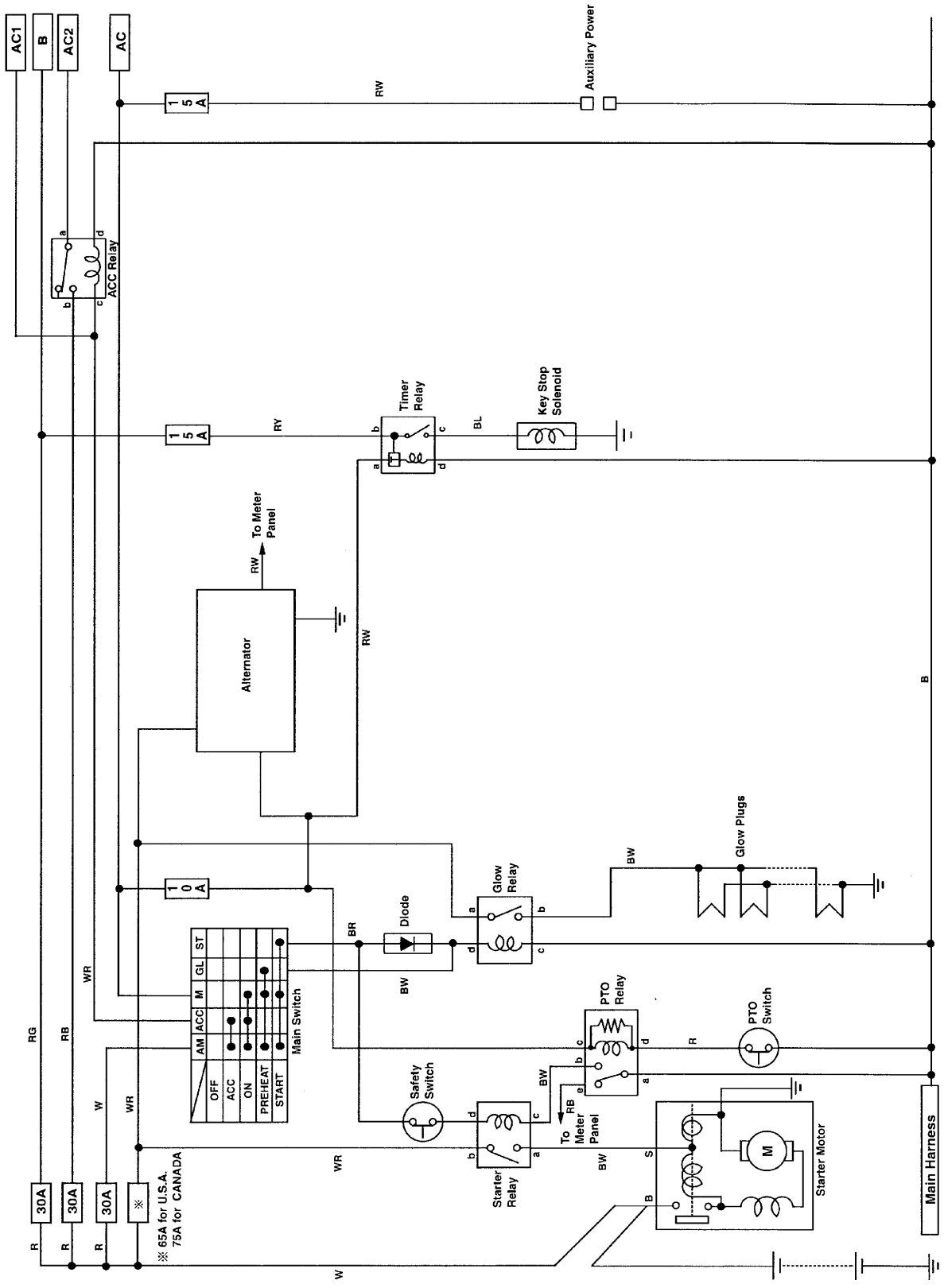
12550M90160


(1)-2 Lighting Section
Working Light (OPT)
35 W
10 A
15 A
50A
B
AC
R
RW
GY
YB
GB
G
RB
RY
GW
Or
Br
B
Flasher Unit
Hazard Switch
FREE
ROCK
Combination Switch
Turn Switch
Head Light Switch
OFF
Hi
Lo
Main Switch
OFF
ON
PREHEAT
START
To Meter Panel
Trailer Socket
Hazard Light (R.H.)
27 W
Tail Light
8 W
Hazard Light (L.H.)
Head Light
45 W
R.H.
L.H.
Main Harness
12550F90400
12550M90170



12550M90180

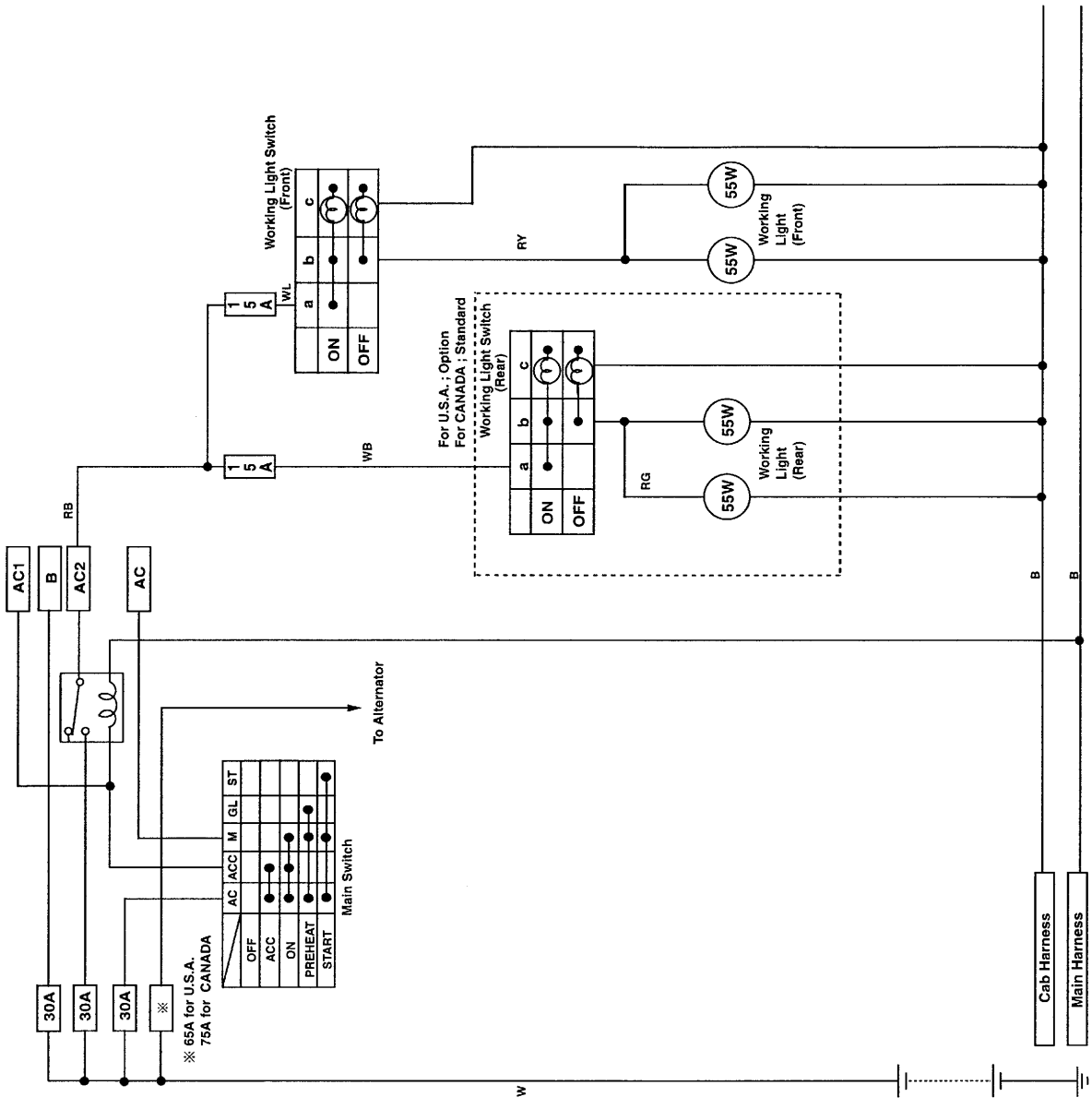
(2) CABIN Type
(2)-1 Starting Section



12550F90420

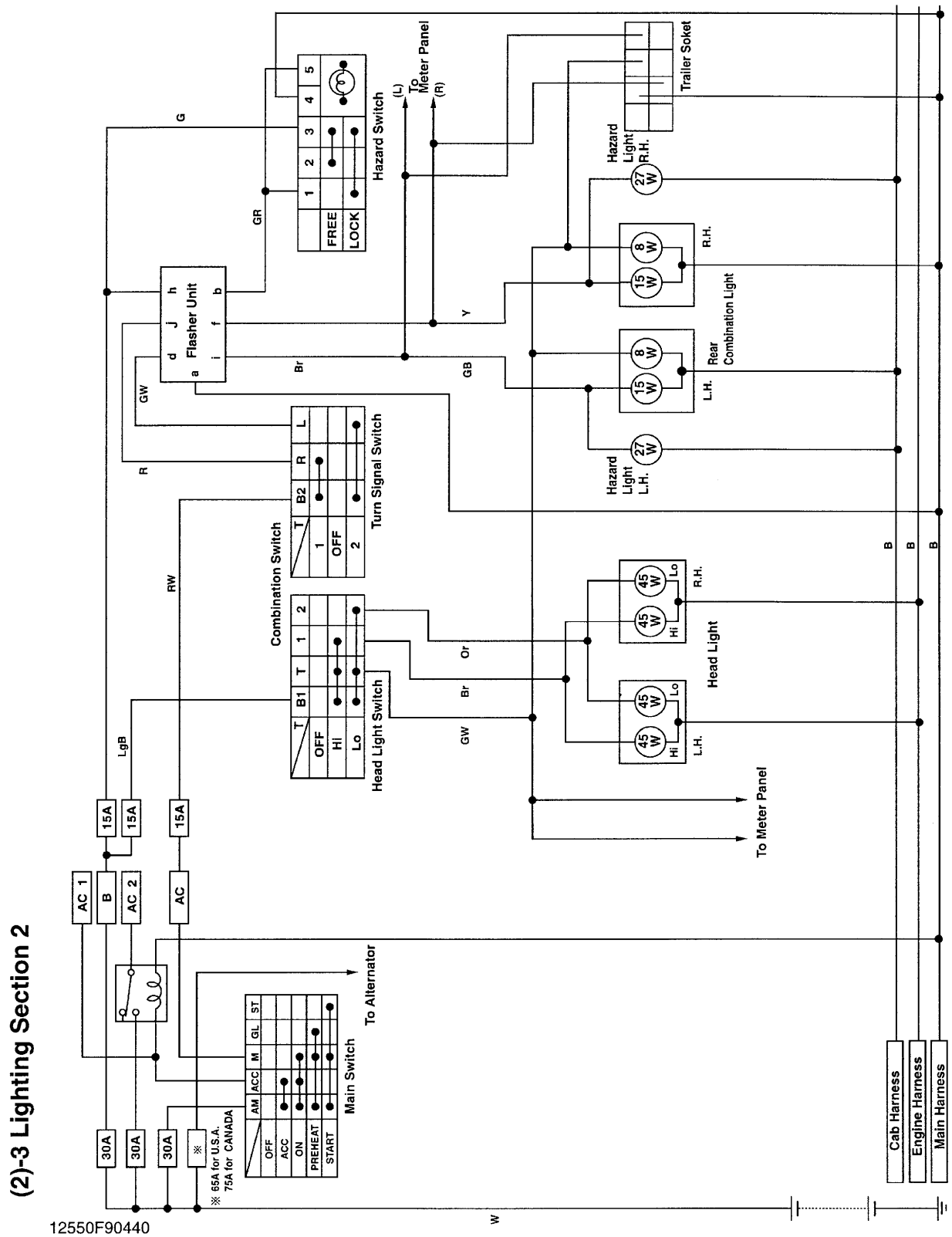
12550M90190

(2)-2 Lighting Section 1

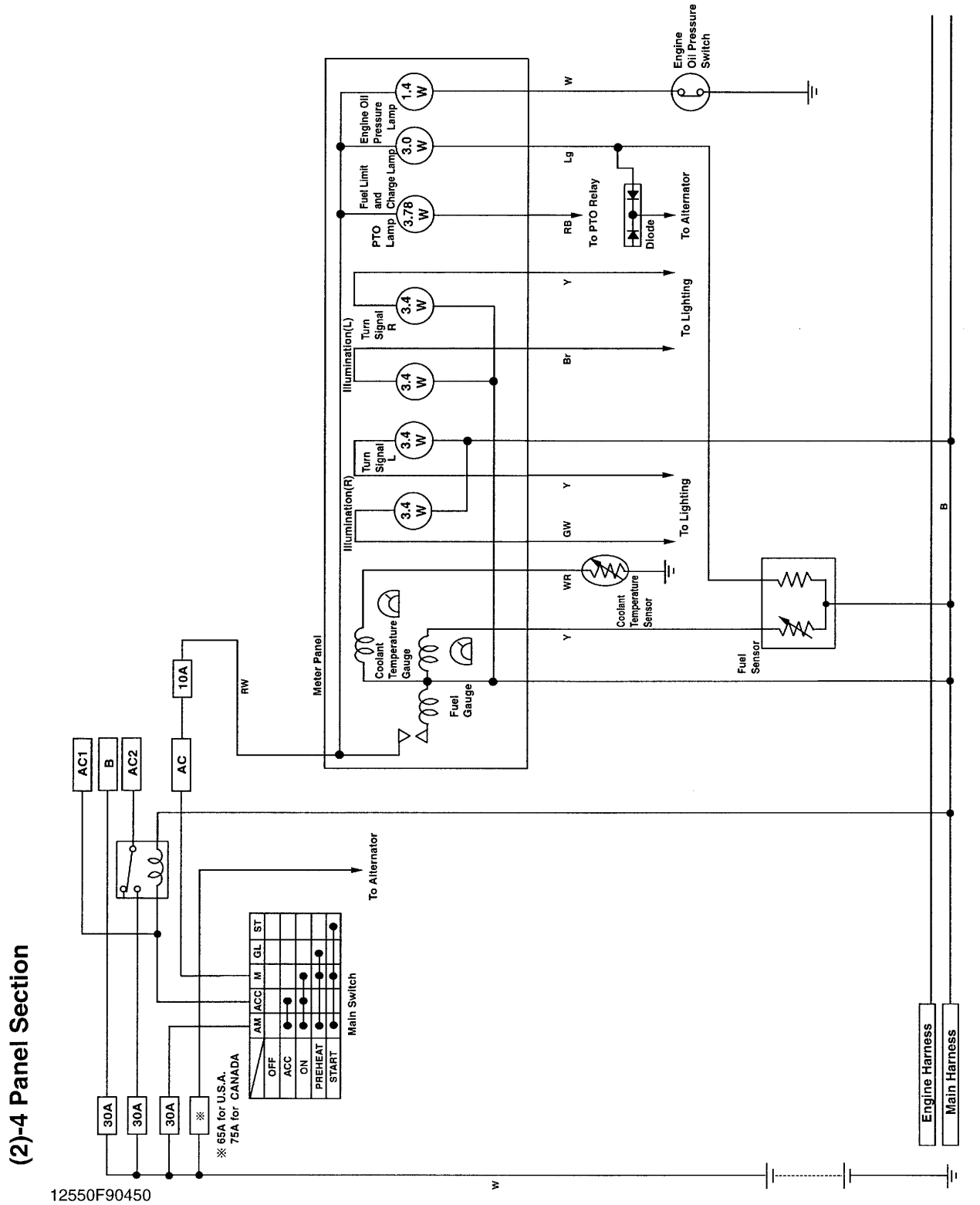


12550F90430

12550M90200

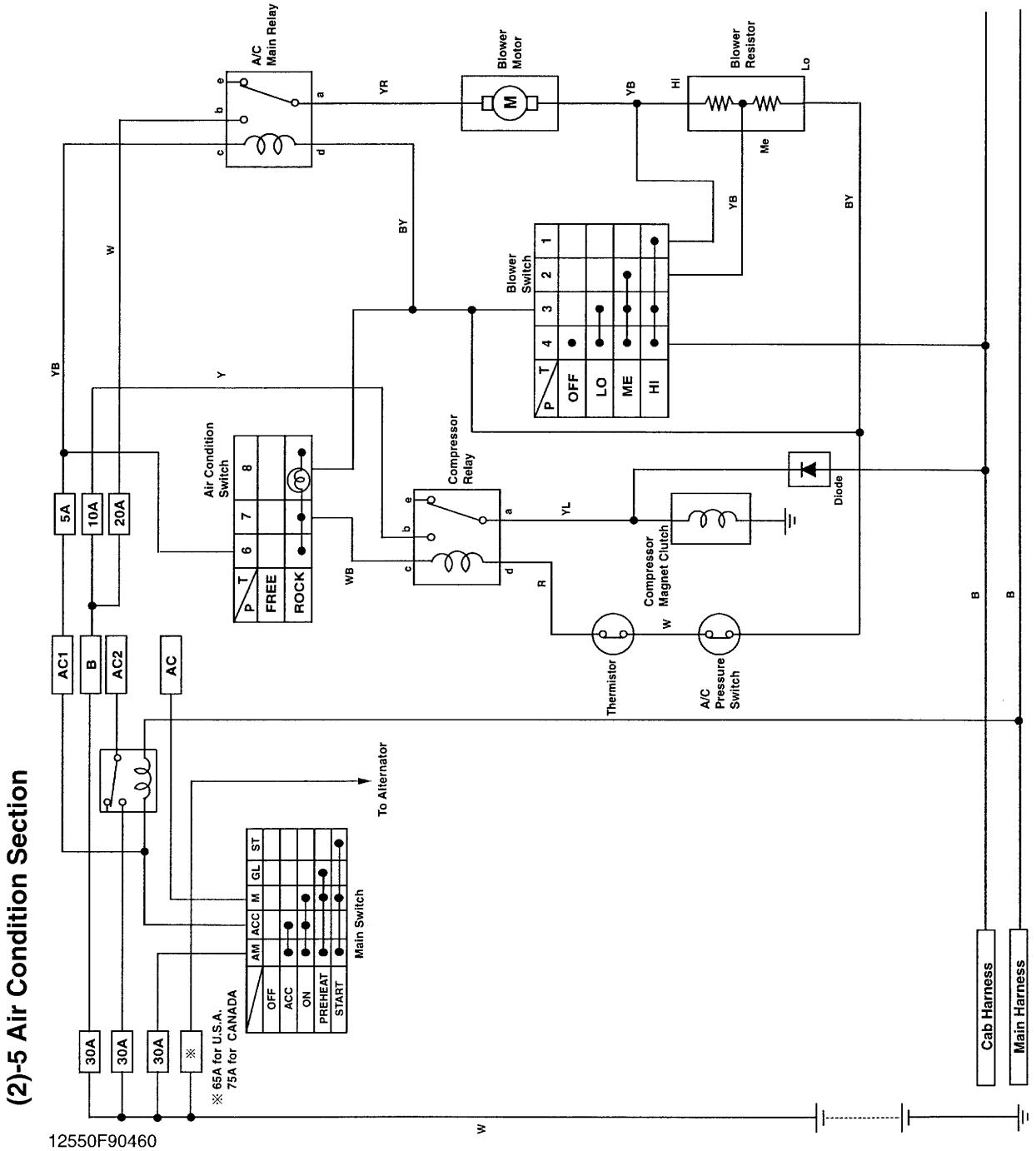


12550M90210

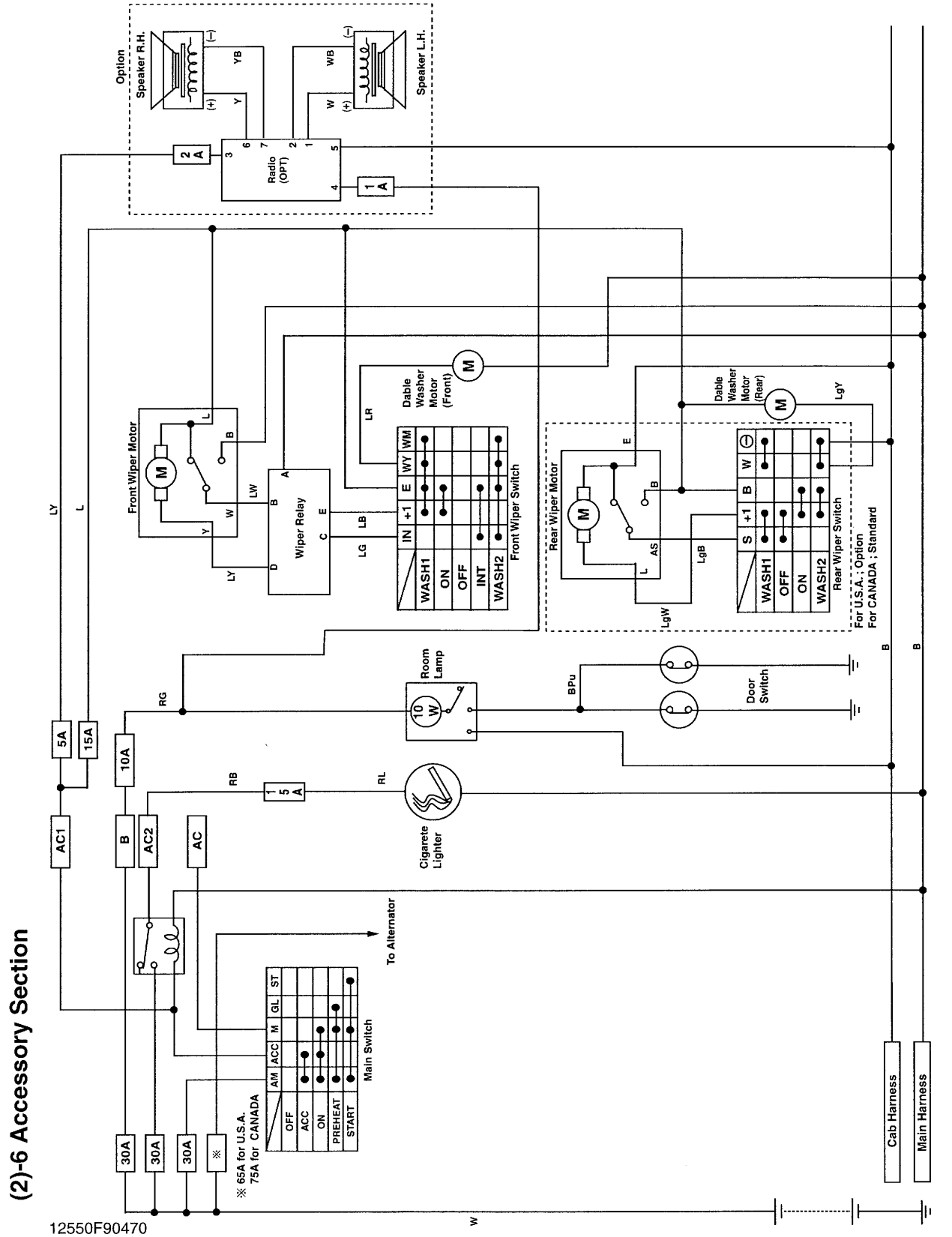


12550M90220

(2)-5 Air Condition Section

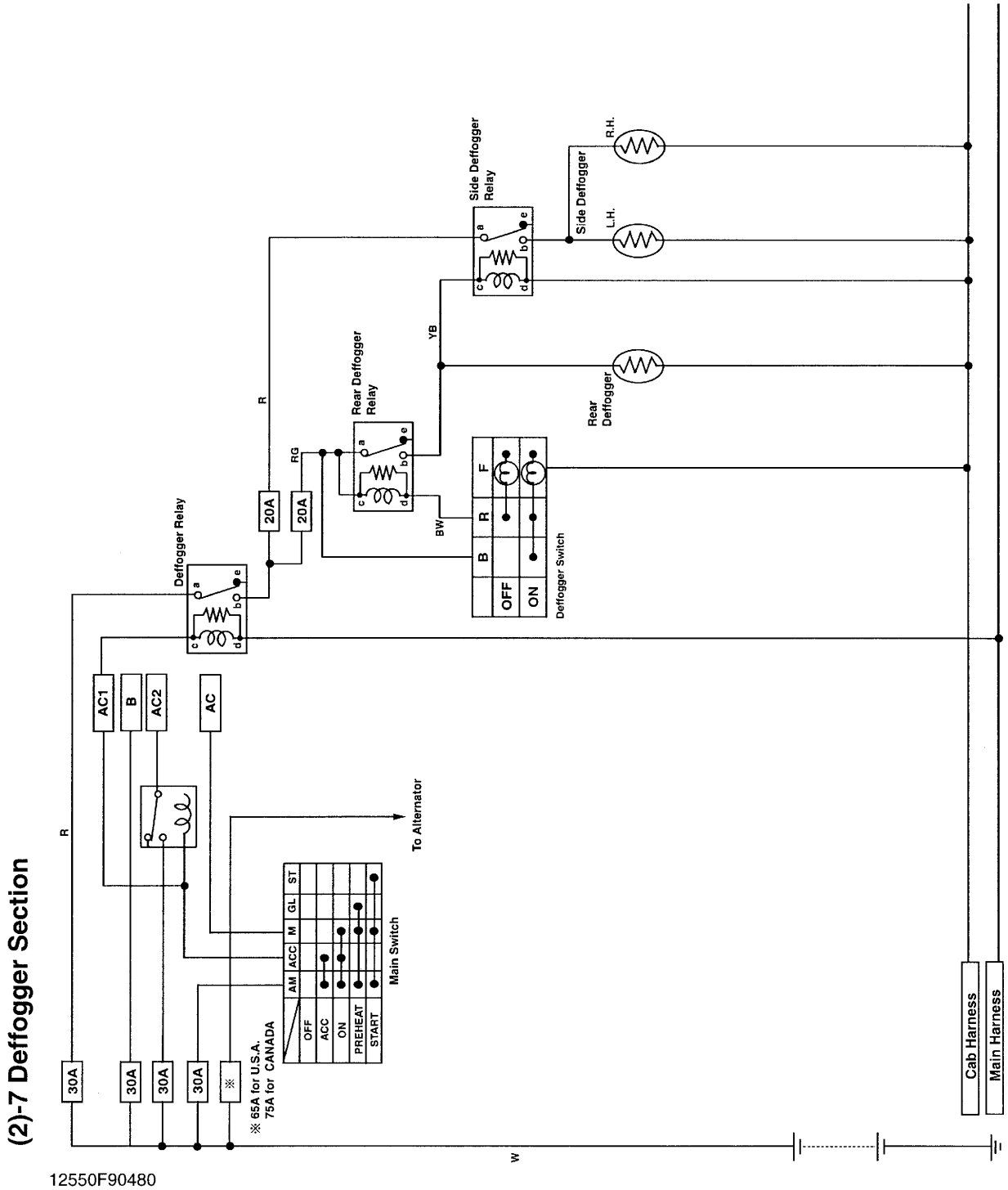


12550M90230



12550M90240

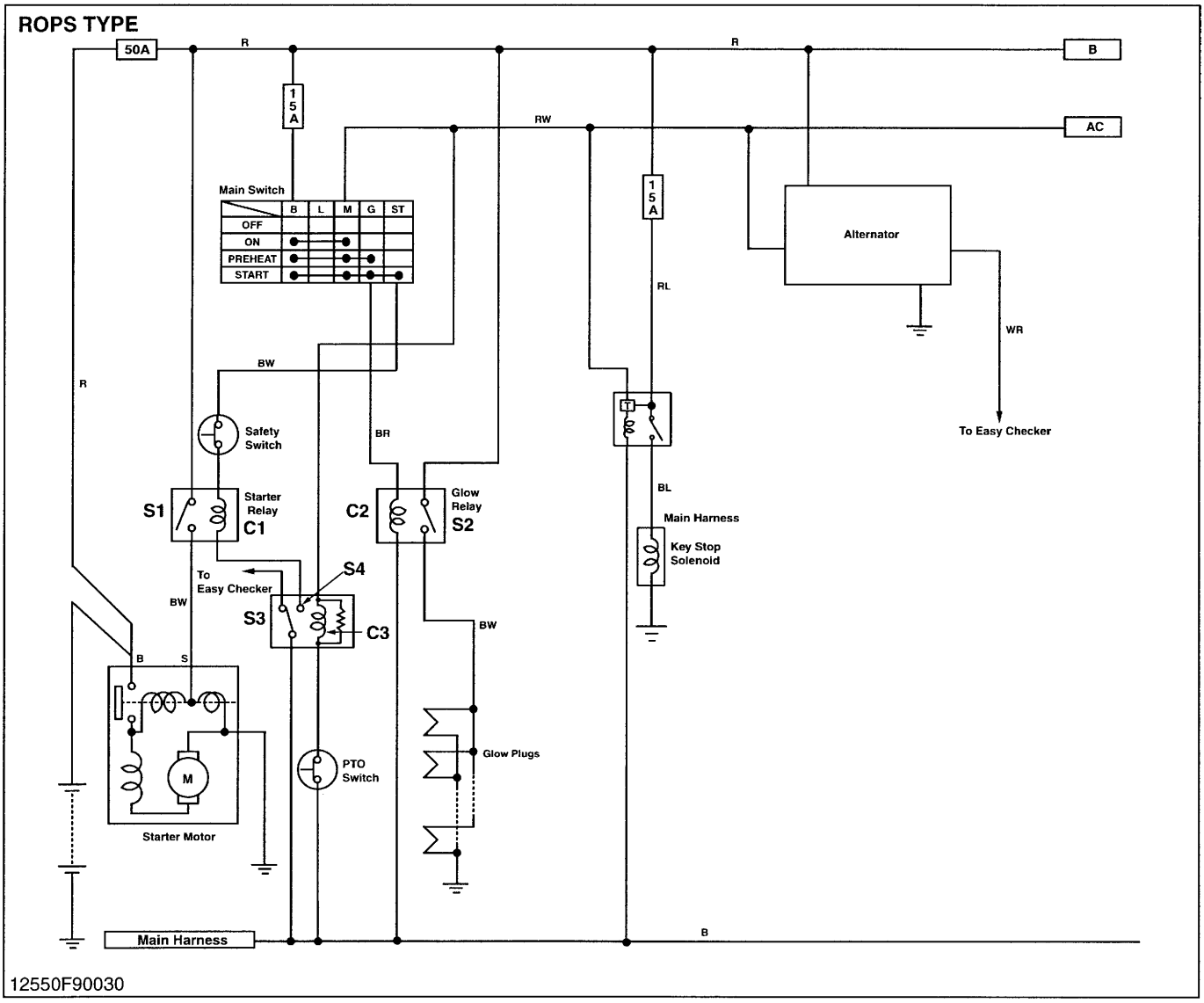
(2)-7 Deffogger Section



12550F90480

12550M90250

[3] STARTING SYSTEM



There are four key positions, **OFF**, **ON**, **PREHEAT** and **START** on the main : switch as shown above.

When the main switch is set to **PREHEAT**, **B** terminal of the main switch is connected to **M** and **G** terminals.Consequently, battery current flows to **C2** of the glow relay, and the relay contact point **S2** is turned on.

This makes the glow plugs red-hot.

When the main switch is set to **START**, **B** terminal of the main switch is connected to **M**, **G** and **ST** terminals.

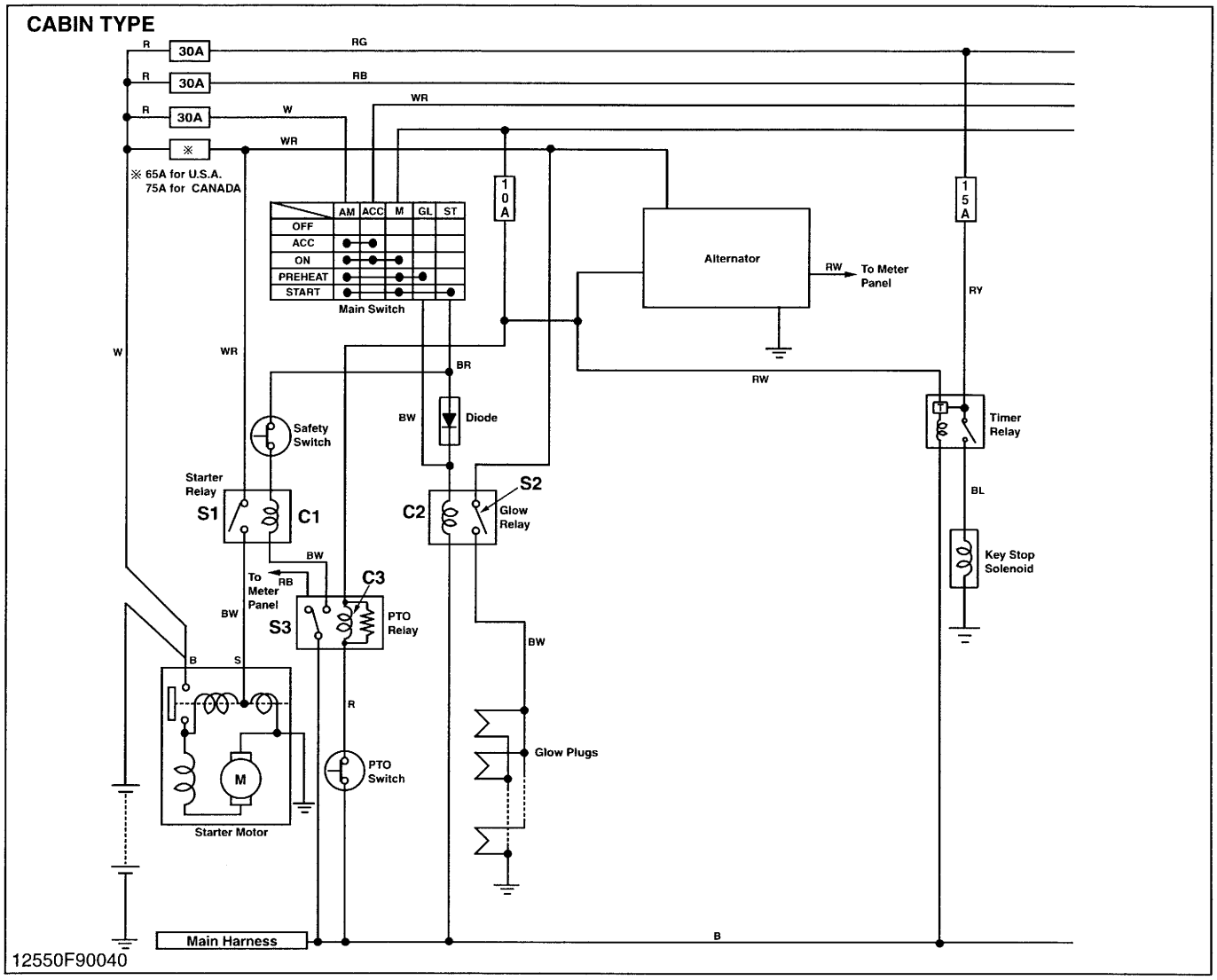
At this time the starter motor can be actuated under condition that shuttle lever is in neutral position and PTO clutch lever is in **OFF** position.

Consequently, battery current flows to coil **C1** of the starter relay, coil **C3** of the PTO relay and coil **C2** of the glow relay at the same time. As a result, the starter motor is actuated and glow plug is kept red-hot.

When the main switch is released after starting the engine, the main switch returns to **ON** automatically.

This stops the starter motor.

12550M90020



There are five key positions, **OFF**, **ACC**, **ON**, **PREHEAT** and **START** on the main switch as shown above.

When the main switch is set to **ACC** (Accessory), in case of INTEGRAL CABIN, the front windshield wiper (rear option), working light, cigar lighter and blower fan can be used.

When the main switch is set to **PREHEAT**, **AM** terminal of the main switch is connected to **M** and **GL** terminals. Consequently, battery current flows to coil **C2** of the glow relay, and the relay contact points **S2** is turned on.

When the main switch is set **START**, **AM** terminal of the main switch is connected to **M** and **ST** terminals.

At this time the starter motor can be actuated under condition that shuttle lever is in neutral position and PTO clutch lever is in **OFF** position.

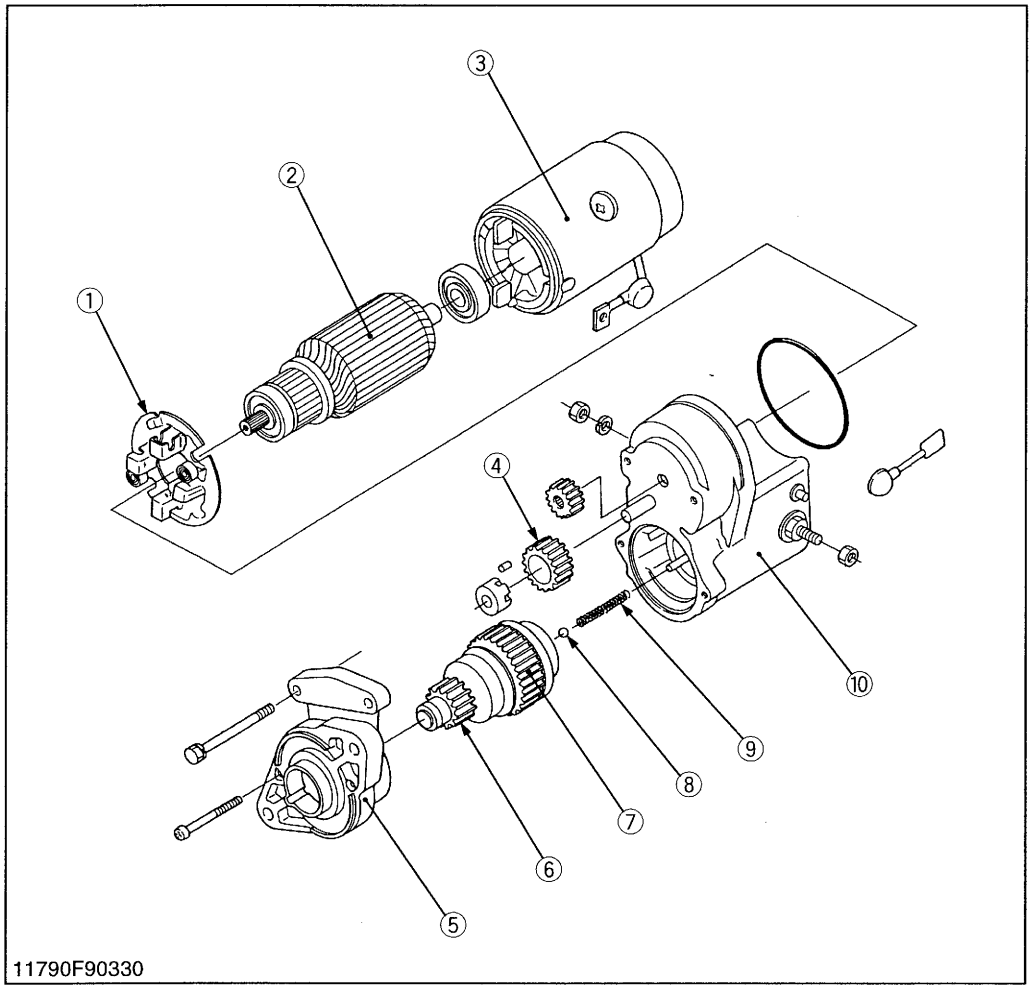
Consequently, battery current flows to coil **C1** of the starter relay, coil **C3** of the PTO relay. As a result the starter motor is actuated.

When the main switch is released after starting the engine, the main switch returns to **ON** automatically.

This stops the starter motor.

12550M90030

(1) Starter Motor

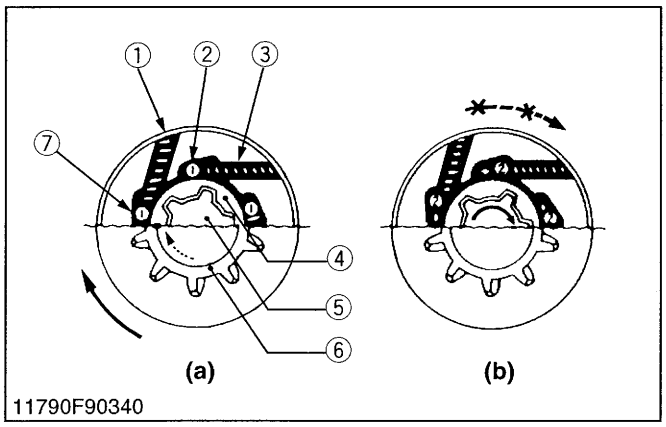


(1) Brush Holder
(2) Armature
(3) Yoke
(4) Gear
(5) Drive End Frame
(6) Pinion
(7) Roller Clutch
(8) Ball
(9) Spring
(10) Magnet Switch

The starter motor is a reduction type. The speed of the pinion gear is reduced to approx. one third of motor one.

11790M90020

(1)-1 Roller Clutch



The roller clutch prevents the armature from being driven by the rotational force of the engine when the pinion and the engine flywheel ring gear are in mesh.

(a) When power is transmitted, the rotational force of the outer clutch gear (1) drives the pinion gear (6) through the roller (2).

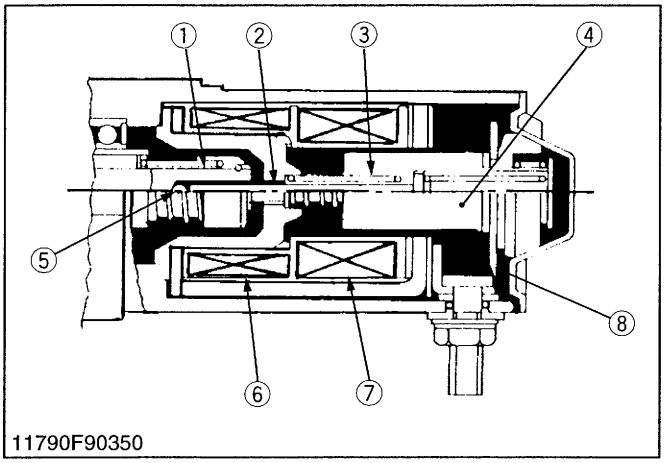
(b) Even when the pinion gear is driven by the engine flywheel ring gear and its speed exceeds that of the outer clutch gear (1), the rotation force of the ring gear is not transmitted to the outer clutch gear (1).

(1) Outer Clutch Gear
(2) Roller
(3) Roller Spring
(4) Inner Spline Tube
(5) Pinion Shaft, Solid with Pinion Gear
(6) Pinion Gear
(7) Locked Position

(a) When power is transmitted
(b) Idling rotation with pinion shaft speed exceeding that of outer clutch gear

11790M90030

(1)-2 Magnet Switch



11790F90350

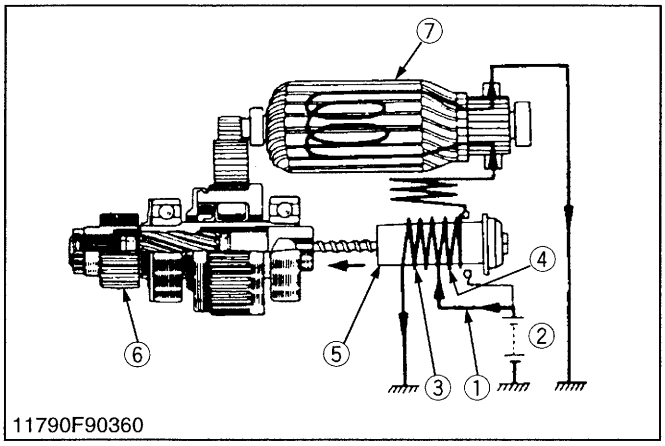
The magnet switch series as a relay to drive the armature. It consists of a pull-in coil, a holding coil and a plunger. It works as follows.

1. When the main switch is at the **START** position, the armature is rotated at a small amperage as the pull-in coil (7) and the holding coil (6) attract the plunger (4) to the left.
2. When the main circuit from the contact plate (8) to armature is closed by the plunger (4), the armature starts rotating at a strong torque.
3. At the same time, a current stops flowing into the pull-in coil and the plunger is kept attracted by the holding coil alone.
4. When the main switch is released from the **START** position after starting the engine, it returns to the **ON** position so that the flow of a current to the holding coil also stops. Thus, the armature stops rotating.

(1) Clutch Pinion Shaft
(2) Plunger Shaft
(3) Return Spring
(4) Plunger
(5) Steel Ball
(6) Holding Coil
(7) Pull-in Coil
(8) Contact Plate

11790M90040

(1)-3 Opetation of Starter Motor



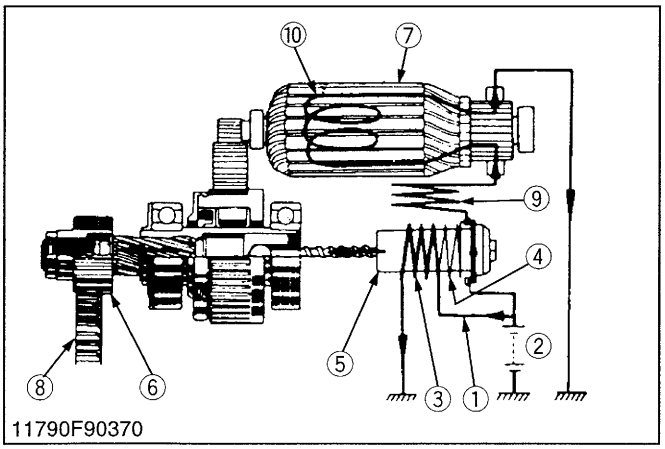
11790F90360

■ When Main Switch is Turned to "START" Position

With the main switch (1) is at the **START** position, current flows, from the battery (2) to the holding coil (3) and pull-in coil (4). This moves the plunger (5) electromagnetically and pushes out the pinion gear (6). At the same time, current flowing through the pull-in coil (4) rotates the armature (7) at low speeds.

(1) Main Switch
(2) Battery
(3) Holding Coil
(4) Pull-in Coil
(5) Plunger
(6) Pinion Gear
(7) Armature

11790M90050



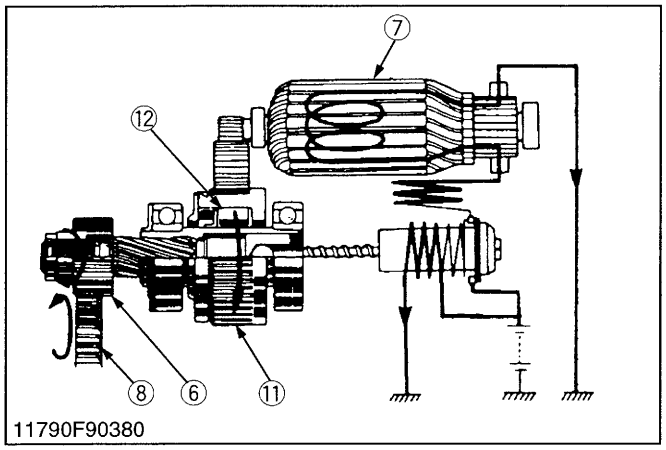
11790F90370

■ When Pinion Gear Meshes with Ring Gear

When the pinion gear (6) comes into mesh with the ring gear (8) on the flywheel, a large current flows from the battery directly into the field coil (9) and armature coil (10), but not through the pull-in coil (4). This rotates the armature (7) at a high speed, which in turn drives the ring gear through the pinion gear at 200 to 300 rpm.

(1) Main Switch
(2) Battery
(3) Holding Coil
(4) Pull-in Coil
(5) Plunger
(6) Pinion Gear
(7) Armature
(8) Ring Gear
(9) Field Coil
(10) Armature Coil

11790M90060



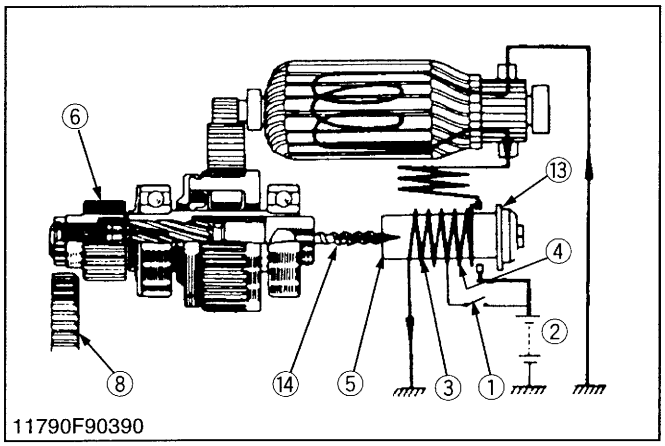
11790F90380

■ When Engine is Running

When the engine runs so fast that the ring gear (8) starts to turn the pinion gear (6), the roller clutch (11), (12) are actuated to prevent excessive high-speed revolutions of the armature (7).

(6) Pinion Gear
(7) Armature
(8) Ring Gear
(11) Clutch Gear
(12) Roller

11790M90070



11790F90390

■ When Main Switch is Released

When the main switch (1) released, the main switch returns from the **START** to the **ON** position and opens the starter circuit. Then, current flows from the battery (2) to the pull-in coil (4) and holding coil (3) through the contact plate (13). Since the magnetic forces of the pull-in coil and holding coil become partially opposed and cancel one another, the plunger (5) is restored by the tension of the return spring (14).

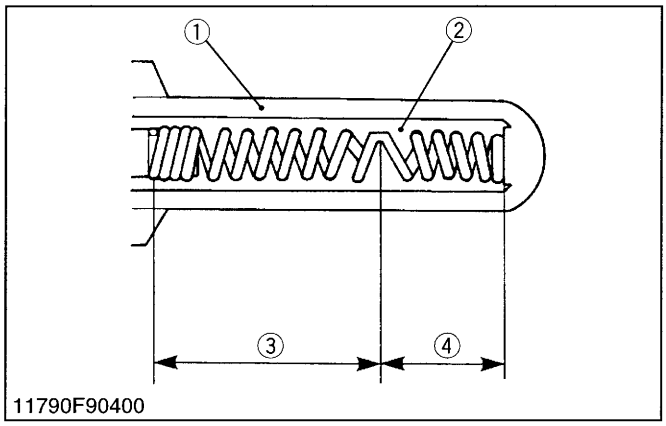
This opens the contacts on the contact plate and separated the pinion gear (6) from the ring gear (8), so that the pinion gear stops rotating.

(1) Main Switch
(2) Battery
(3) Holding Coil
(4) Pull-in Coil
(5) Plunger
(6) Pinion Gear
(8) Ring Gear
(13) Contact Plate
(14) Return Spring

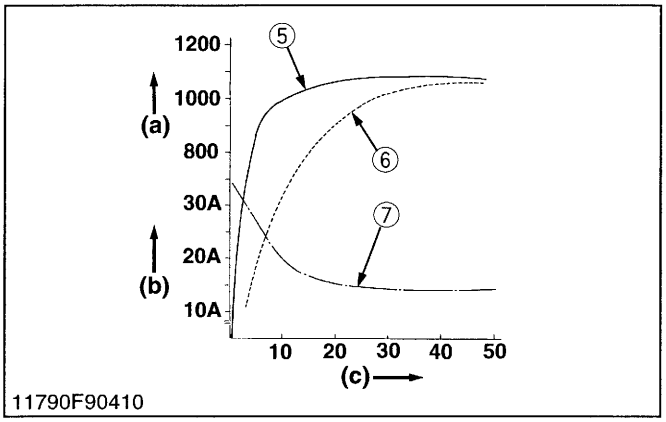
11790M90080

(2) Glow Control System

(2)-1 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.

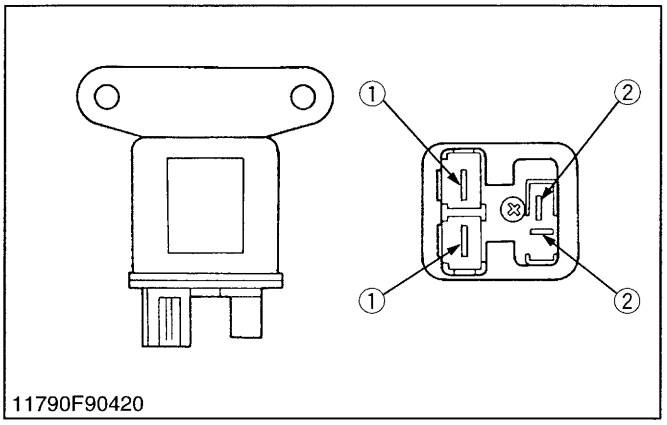
Therefore, because sufficient current is flown to the heater (4) during the initial period of energization, the temperature rises quickly and the resistance grows with the rise in the temperature of the resistor, the flowing current is reduces to prevent the heater (4) from being heated.

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.)

12550M90040

(2)-2 Glow Relay



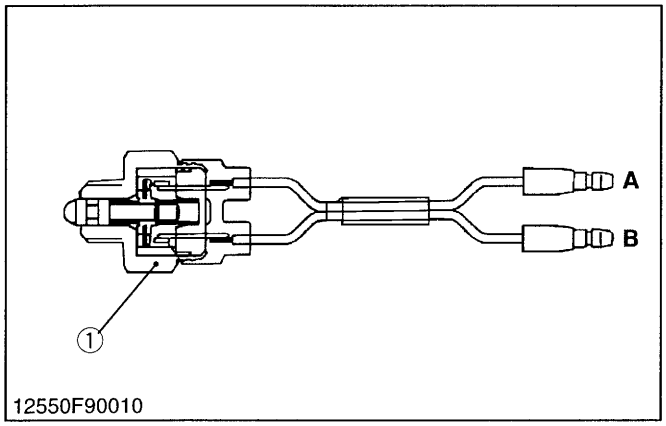
11790F90420

The glow relay is actuated by the signal from the glow controller and supplies the battery power to the glow plug directly.

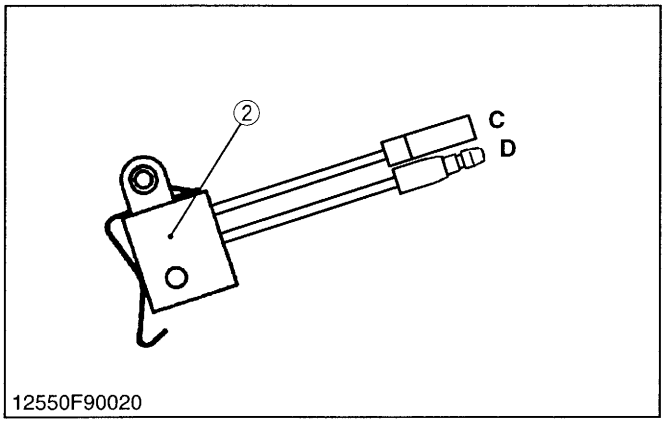
(1) Contact Point
(2) Coil

12550M90050

(3) Safety Switch (shuttle lever neutral switch and PTO lever switch)



12550F90010



12550F90020

Two switches (1), (2) are used for safety operation.
One is mounted on the shuttle lever and the other is mounted on the PTO lever.

■ **When the PTO clutch is in OFF position**
Current flows to the PTO safety switch through the PTO safety relay.

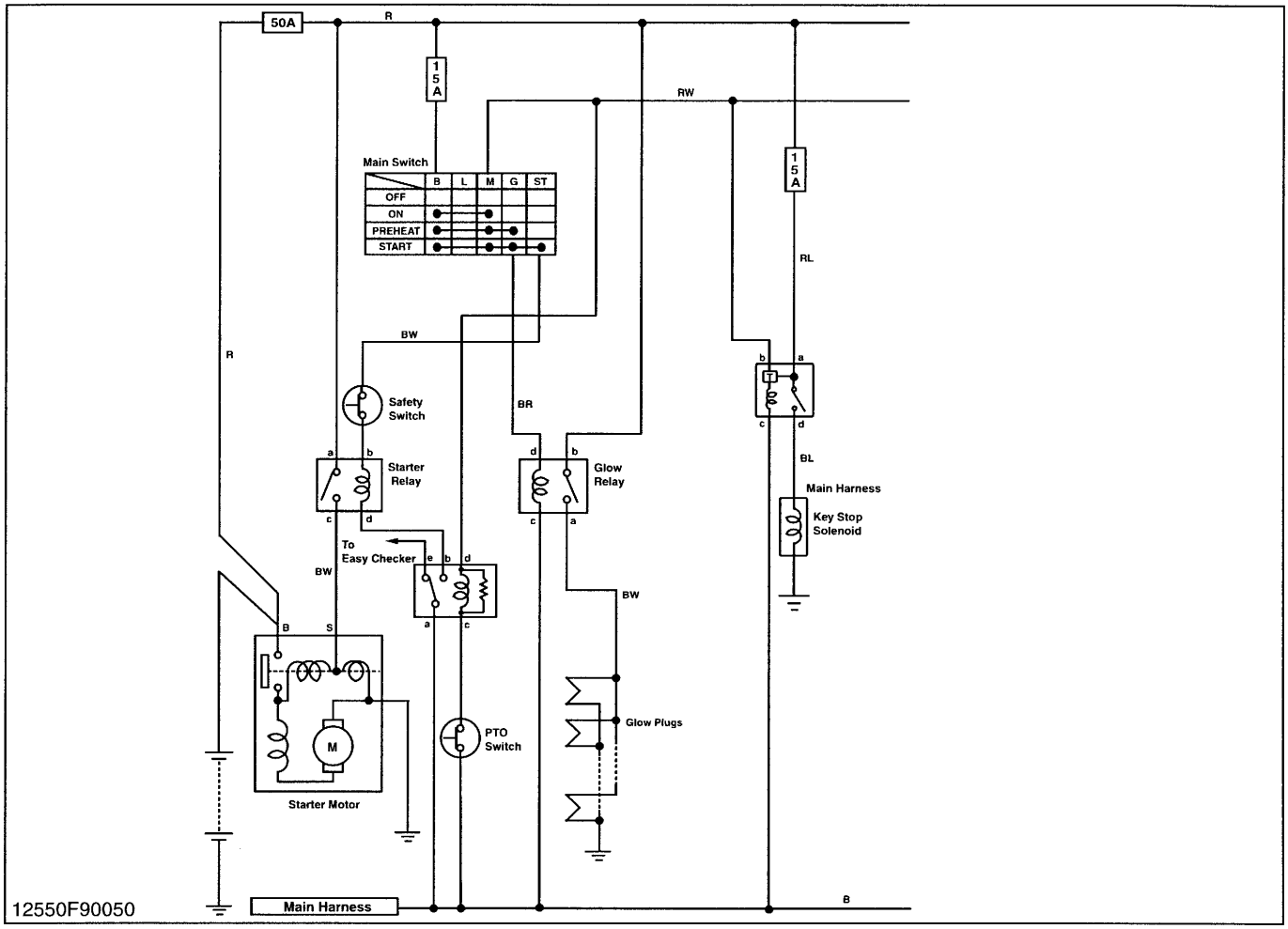
■ **When the shuttle shift lever is in neutral**
Current flows from the main switch to PTO safety switch through the shuttle lever switch, starter relay and PTO relay.

(1) Shuttle Lever Neutral Switch
(2) PTO Lever Switch

(A) From Main Switch
(B) To Starter Relay
(C) From Battery
(D) To Earth

12550M90060

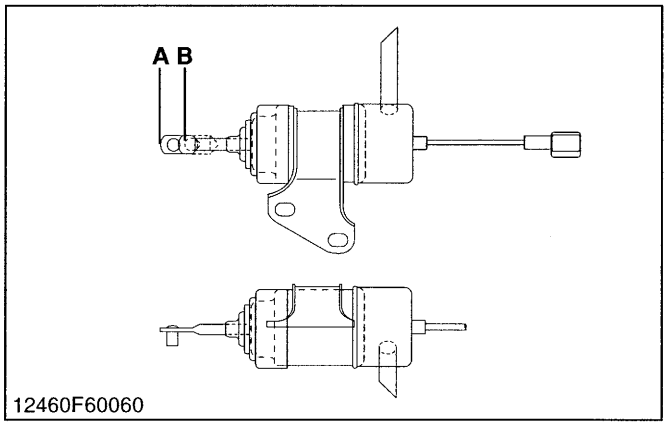
[4] ENGINE KEY SWTCH SHUT-OFF SYSTEM



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.

12550M90070

(1) Engine Stop Solenoid



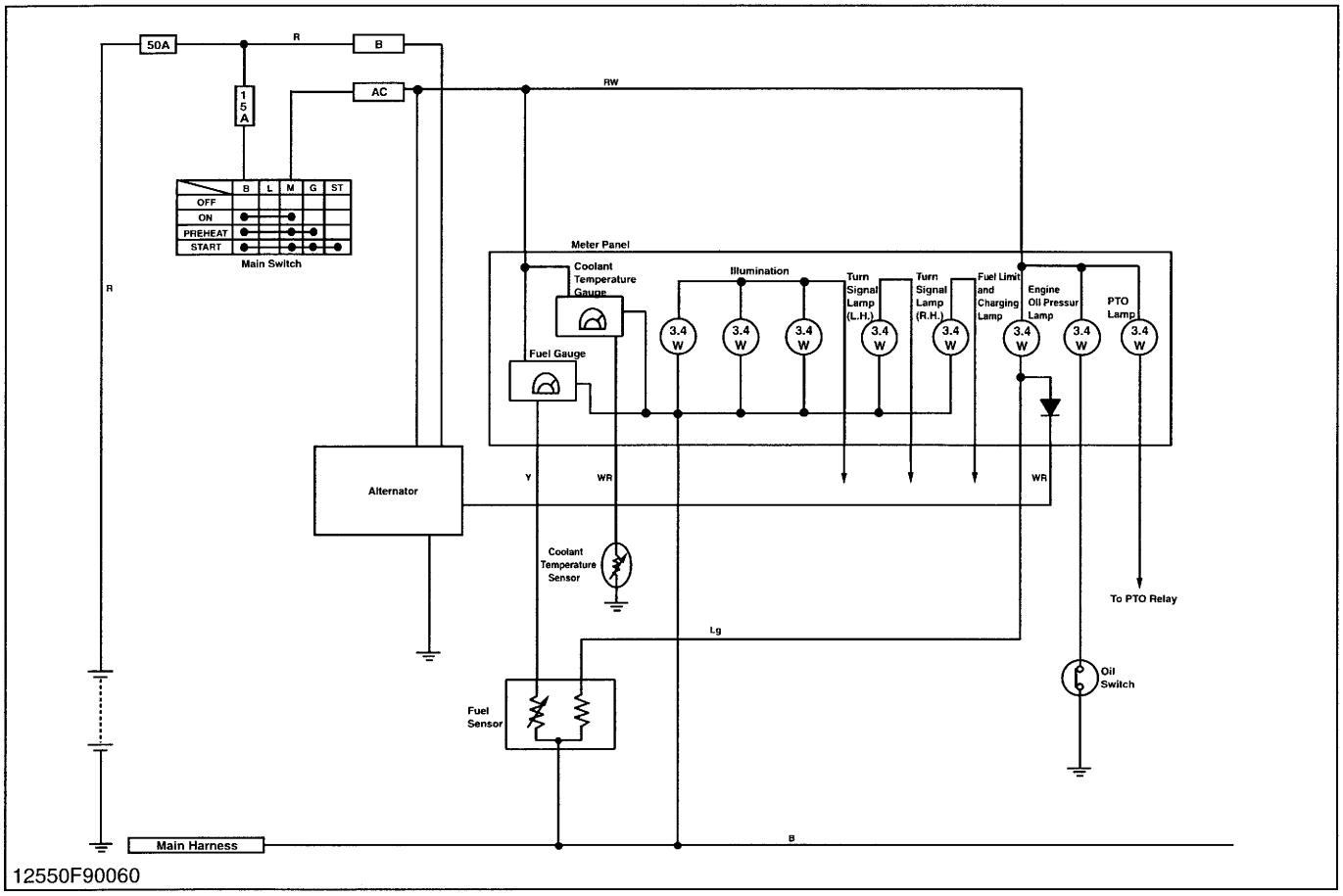
The timer relay is provided to actuate the engine stop solenoid approx. 10 seconds to stop after the main switch is turned from **ON** position to **OFF** position.

Flowing of the battery current into the coil while the timer relay contact point is closed attracts the plunger to actuate the stop lever of the injection pump. When the battery current stops, the plunger is returned to the original position by the spring.

(A) ON **(B) OFF**

12550M90080

[5] CHARGING SYSTEM



12550F90060

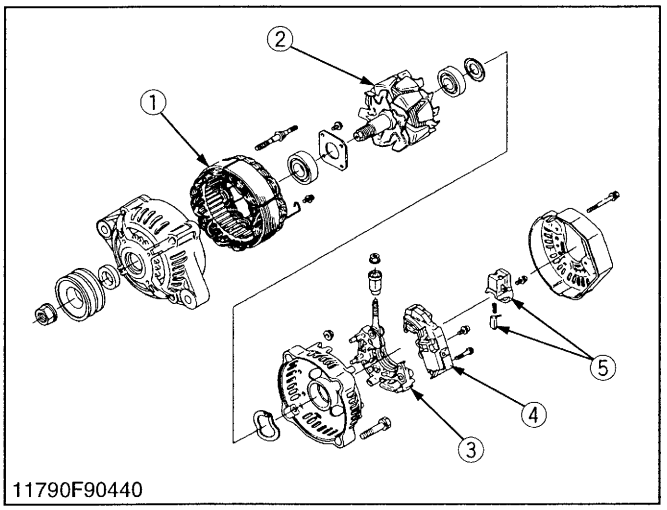
The charging system supplies electric power for various electrical devices and also charges the battery while the engine runs.

This alternator has IC regulator.

If the alternator is not charging the battery, fuel limit and charging lamp in the panel board will come on.

12550M90090

(1) Alternator



11790F90440

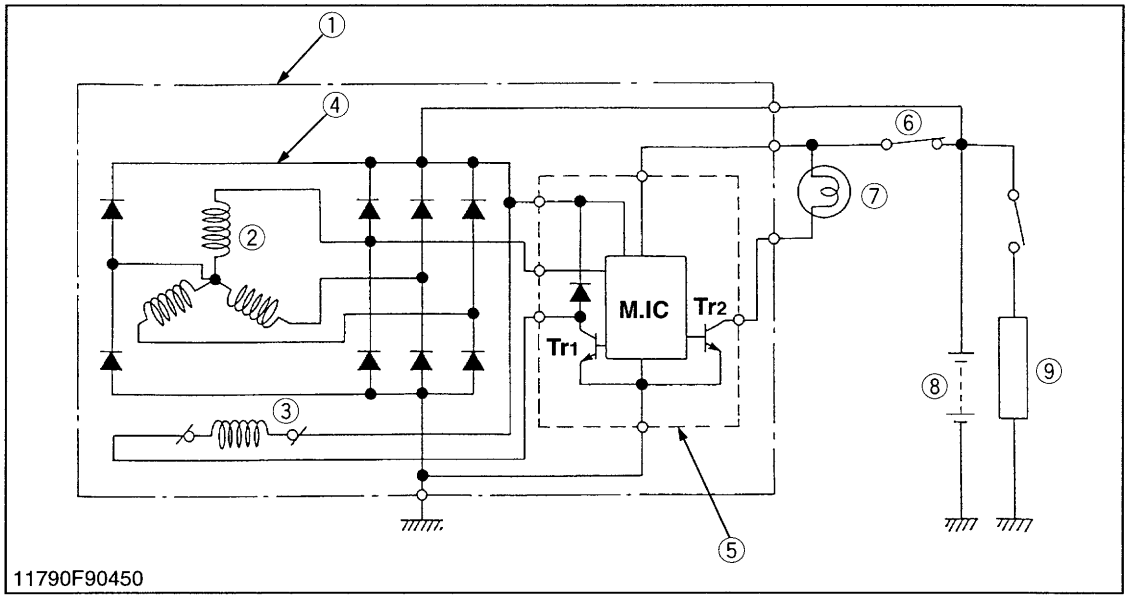
A compact alternator with an IC regulator is used, having the following characteristics :

- Approximately 26 % lighter and 17 % smaller than a standard alternator.
- Cooling performance and safety have been improved by combining the cooling fan with the rotor and incorporating the fan / rotor unit inside the alternator.
- IC regulator is fitted inside the alternator.
- The rectifier, IC regulator and similar components are easy to remove, making it easier to service the alternator.

(1) Stator
(2) Rotor
(3) Rectifier
(4) IC Regulator
(5) Brush Holder

11790M90120

(2) IC Regulator



11790F90450

(1) Alternator
(2) Stator Coil
(3) Rotor Coil
(4) Rectifier
(5) IC Regulator
(6) Main Switch
(7) Charge Lamp
(8) Battery
(9) Load

An IC regulator uses solid state transistors, chips or other semiconductor elements instead of the relays in a conventional regulator. Stable characteristics are achieved by cutting off the field current.

IC regulators have the following characteristics :

- The control voltage does not change over time, so the need for readjustment is eliminated. Since there are no moving parts, IC regulators are extremely durable and resistant to vibration.
- The overheat compensation characteristics ensure that the control voltage is reduced as the temperature rises, so the battery is charged at just the right level.

The internal circuitry of the IC regulator is shown in the diagram. It consists of a hybrid IC incorporating a monolithic IC. (The internal circuitry of the monolithic IC is extremely complex, so it is shown as simply **"M.IC circuit"**)

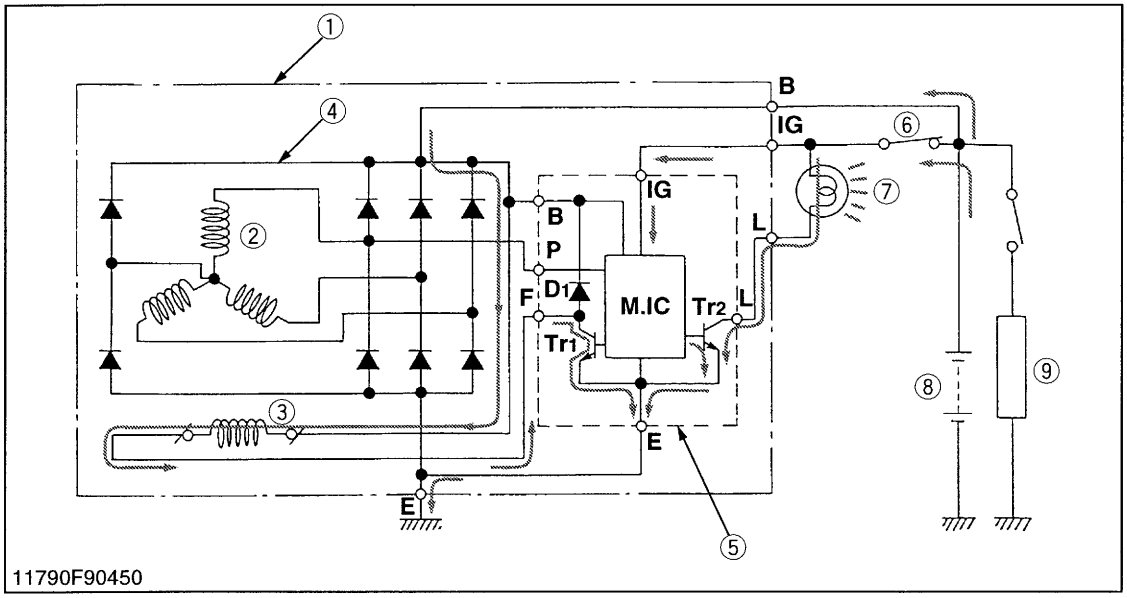
Tr1 acts as the contacts controlling the field current, and **Tr2** acts as the charge lamp relay controlling the flashing of the charge lamp.

The **M.IC** circuit controls **Tr1** and **Tr2**, and monitors the alternator output voltage, and detects any drop in **L** terminal voltage or breaks in the rotor coil.

11790M90130

(3) Operation of Charging System

■ In an Engine Stop (Main Switch "ON")



11790F90450

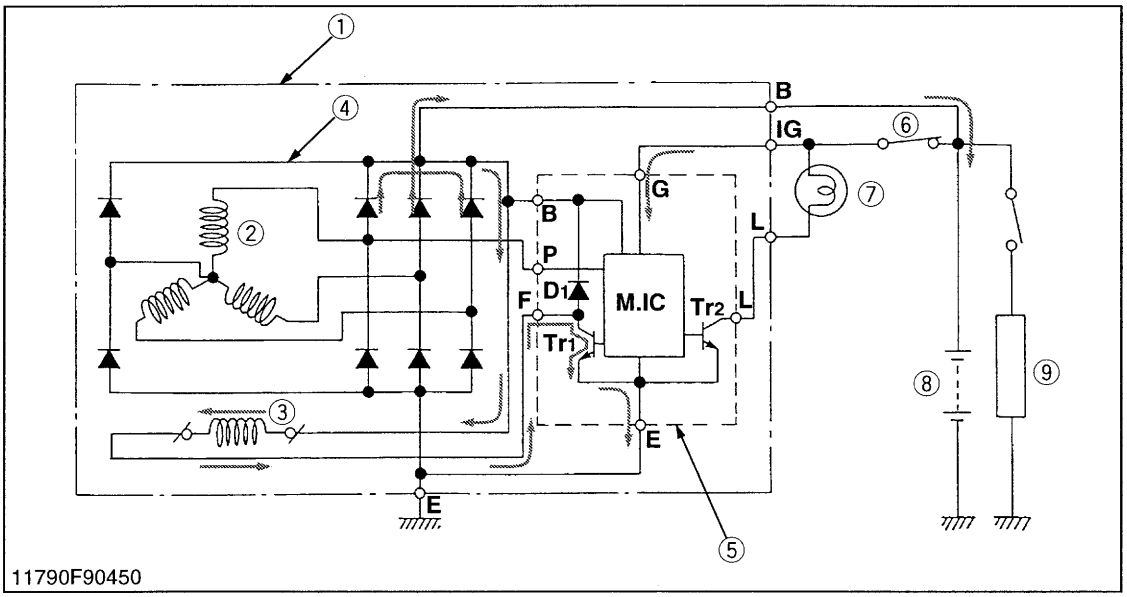
(1) Alternator
(2) Stator Coil
(3) Rotor Coil
(4) Rectifier
(5) IC Regulator
(6) Main Switch
(7) Charge Lamp
(8) Battery
(9) Load

Since the battery voltage is applies to terminal **IG**, the **M.IC** (circuit) detects this voltage and turns **Tr1 ON**. By this, the initial exciting current flows to the rotor coil.

Since the alternator is not yet rotating at this time, power generation is not being done, and the voltage of terminal **P** is 0 V. The **M.IC** (circuit) detects this voltage and issues an **ON** signal to **Tr2**. This causes the charge lamp to light up.

11790M90140

■ In Charging (When the Battery Voltage is below the Regulating Voltage)



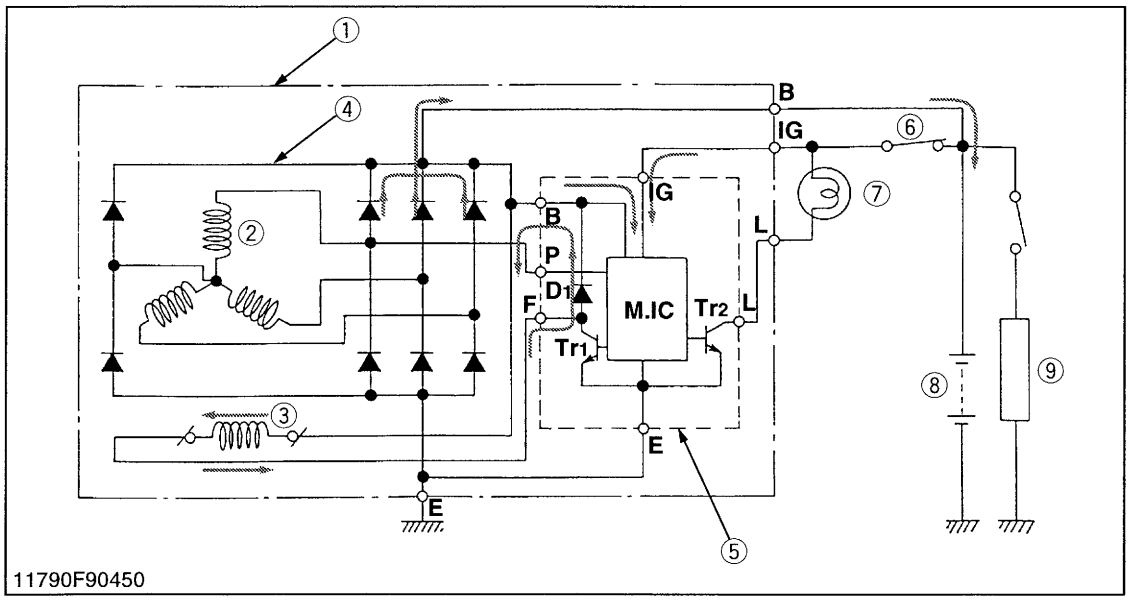
11790F90450

(1) Alternator
(2) Stator Coil
(3) Rotor Coil
(4) Rectifier
(5) IC Regulator
(6) Main Switch
(7) Charge Lamp
(8) Battery
(9) Load

As the engine is started and the alternator RPM rises. **Tr2** is turned **OFF**. By this, the charge lamp goes out. As the voltage of terminal **B** exceeds the battery voltage, the charge current flows to the battery.

11790M90150

■ In Charging (When Exceeding the Regulating Voltage)



11790F90450

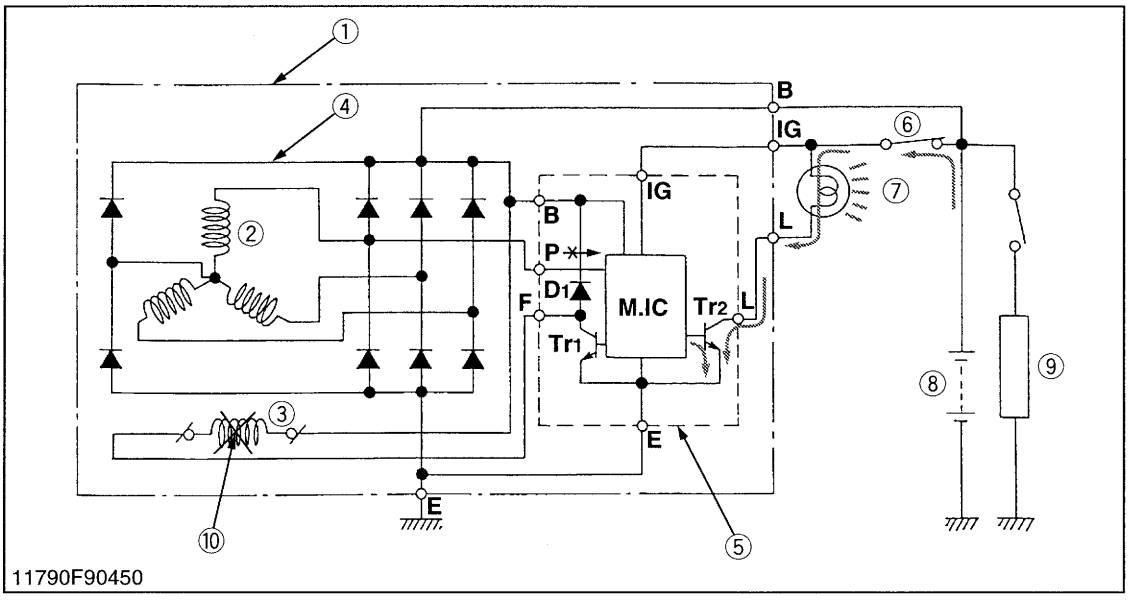
(1) Alternator
(2) Stator Coil
(3) Rotor Coil
(4) Rectifier
(5) IC Regulator
(6) Main Switch
(7) Charge Lamp
(8) Battery
(9) Load

As the **ON** state of **Tr1** continues, the voltage of terminal **B** goes up. And as the voltage of terminal **B** exceeds the regulating voltage of 14.5 V at 25 °C (77 °F), the **M.IC** (circuit) detects this voltage and turns **Tr1 OFF**. By absorption, and the terminal **B** voltage also drops.

And then, as terminal **B** voltage drops below the regulating voltage, the **M.IC** (circuit) detects this voltage and turns **Tr1 ON** again. By this, the exciting current of the rotor coil increases, and terminal **B** voltage also rises. After that terminal **B** voltage (battery voltage) is controlled to a constant value (of regulating voltage) by repeating actuations illustrated in figure of the foregoing par. and the following figure.

11790M90160

■ In Burnout of Rotor Coil



11790F90450

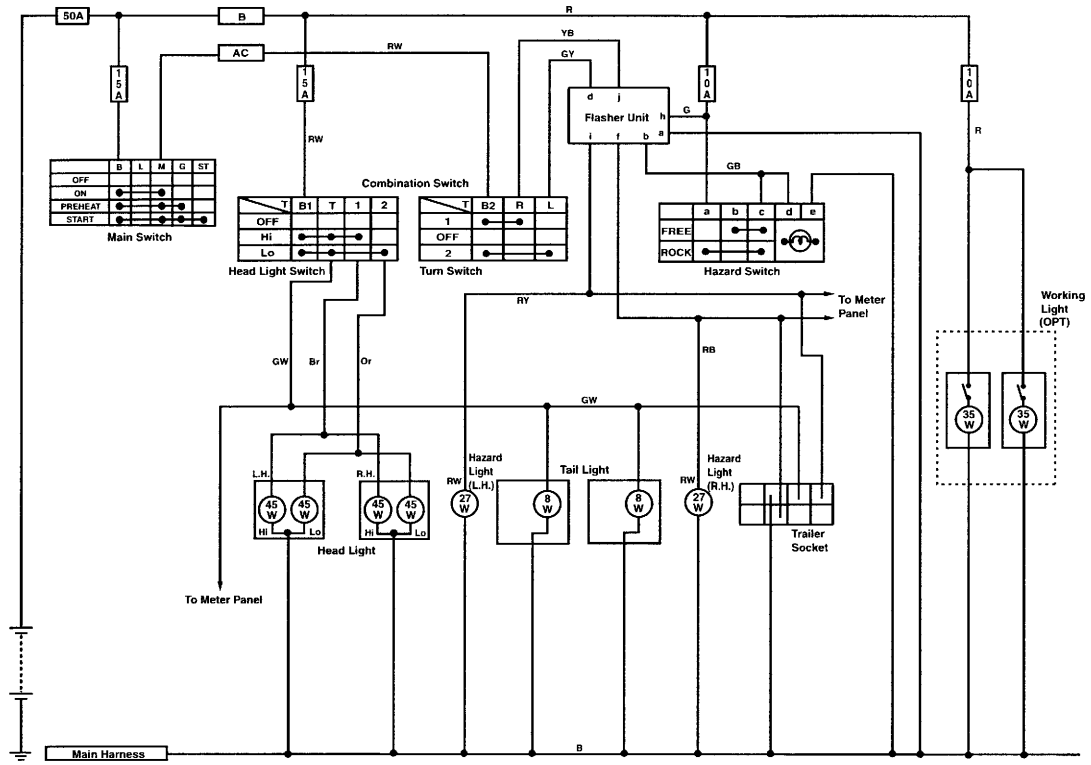
(1) Alternator
(2) Stator Coil
(3) Rotor Coil
(4) Rectifier
(5) IC Regulator
(6) Main Switch
(7) Charge Lamp
(8) Battery
(9) Load
(10) Burnout of Rotor Coil

In case the rotor coil burns out during rotation of the alternator, it no longer generates the power, and the output voltage of terminal **P** vanishes. This is detected by the **M.IC** (circuit) which turns **Tr2 ON**. By this, the charge lamp lights up to indicate an abnormality.

11790M90170

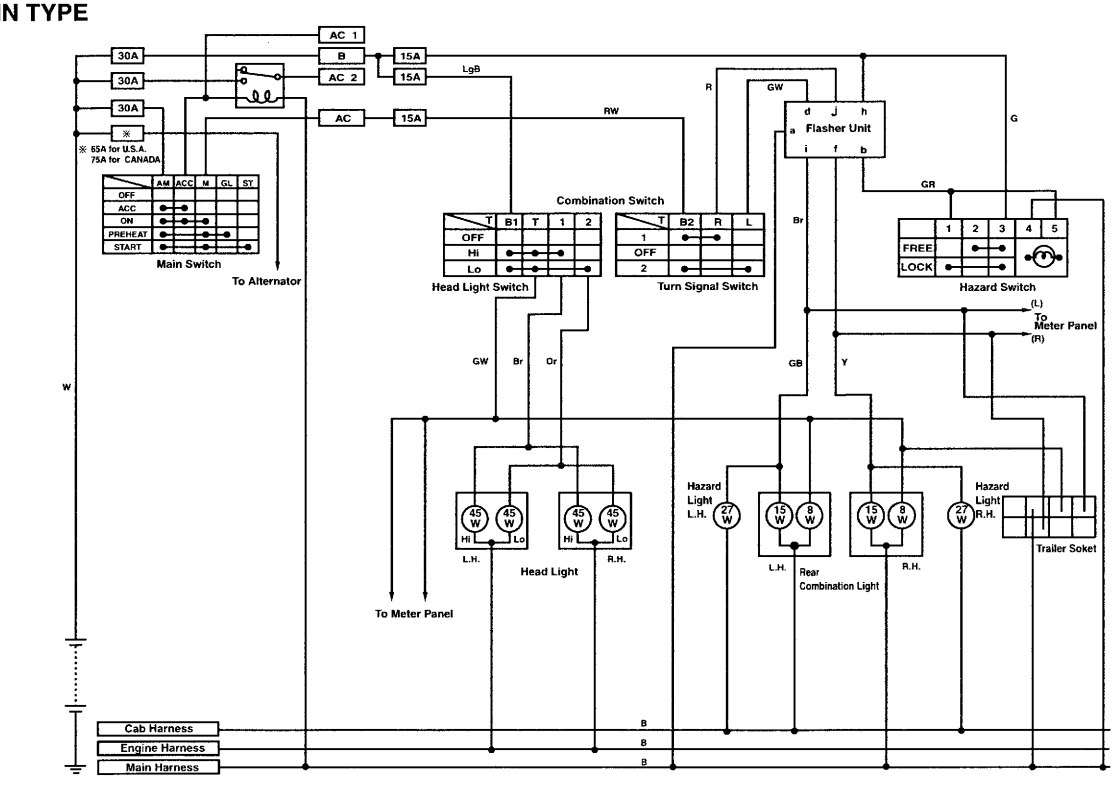
[6] LIGHTING SYSTEM

ROPS TYPE



12550F90070

CABIN TYPE

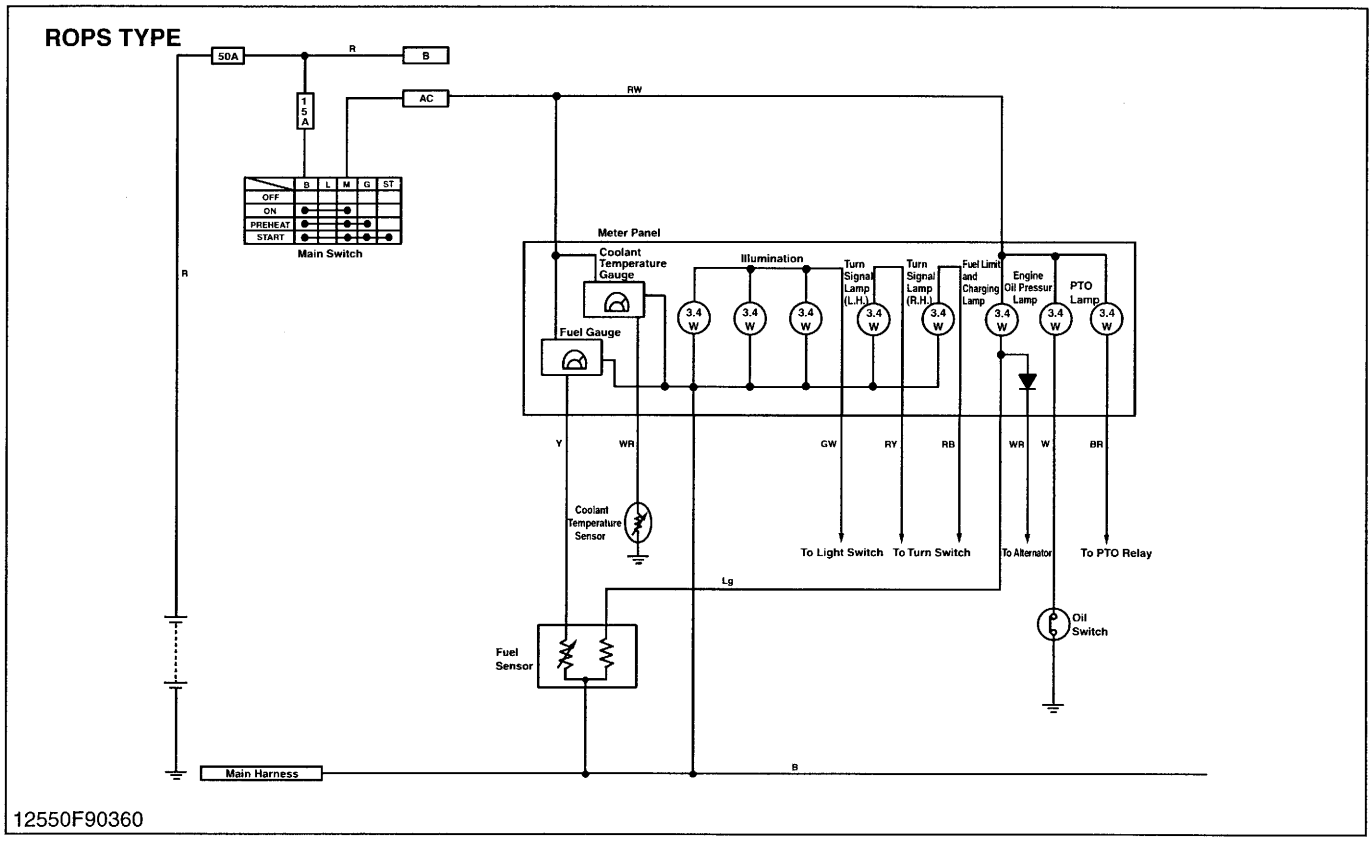


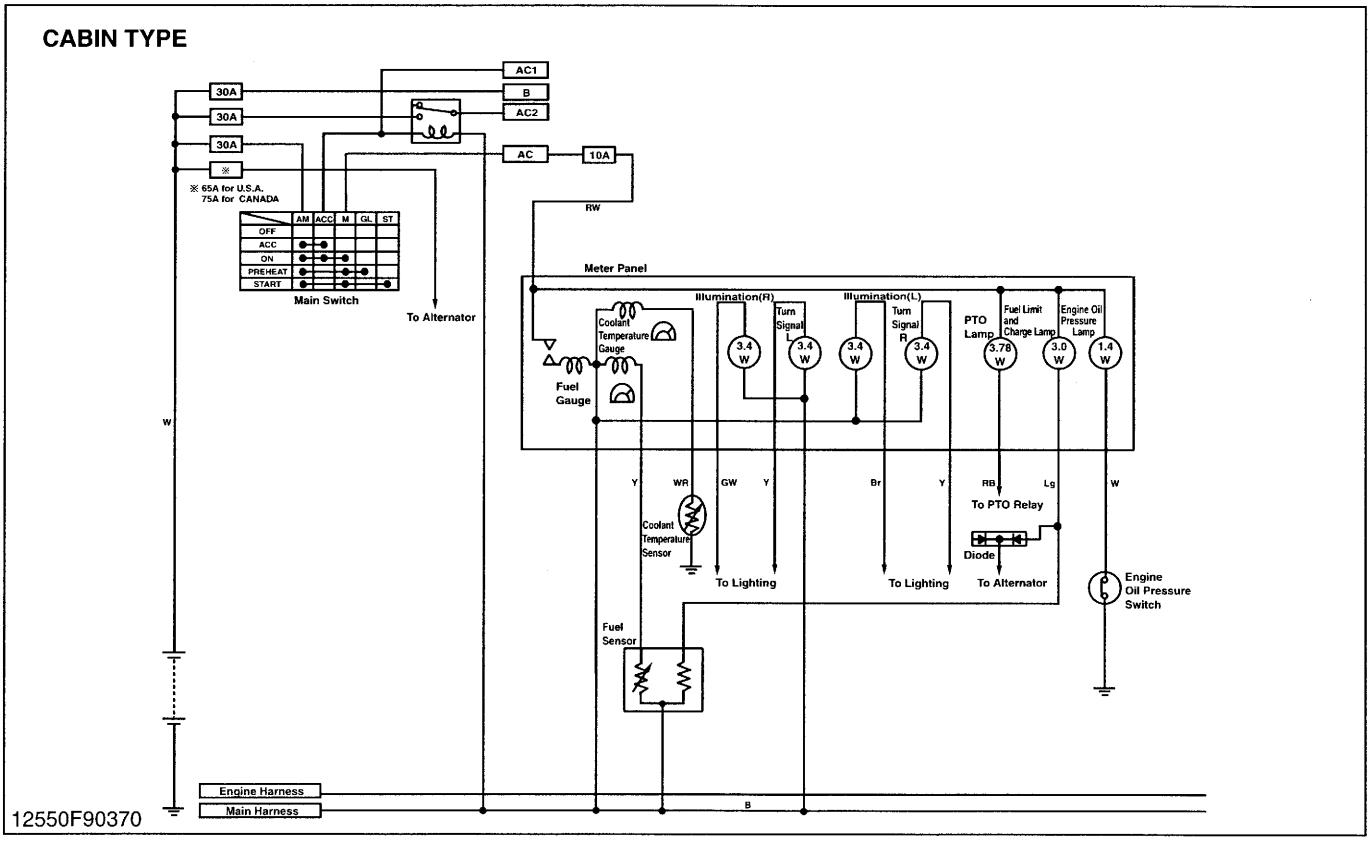
12550F90080

The lighting system consists as shown above.

12550M90100

[7] EASY CHECKER



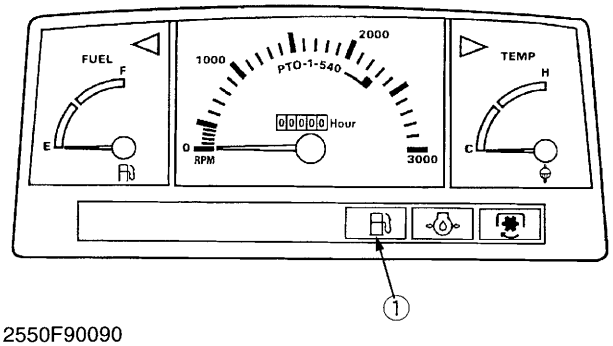


The operator must check the conditions of the tractor before and during operation. To facilitate checking, the Easy Checker-combination of lamps on the panel board is provided.

12550M90110

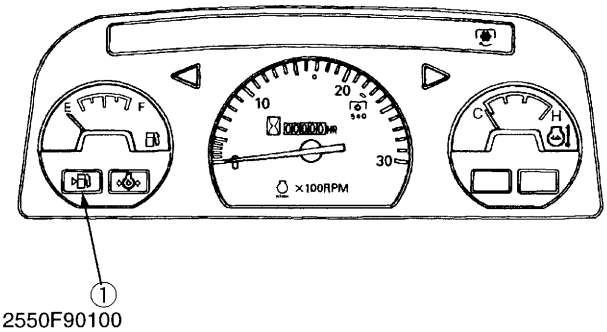
(1) Indication Items

[ROPS TYPE]



12550F90090

[CABIN TYPE]



12550F90100

1) Fuel level
Alarm against fuel level drop.
Light up when remaining fuel quantity is less than approx. 10 L (2.6 U.S.gal., 2.2 Imp.gal.)

2) Engine oil pressure
Alarm against the low engine oil pressure.

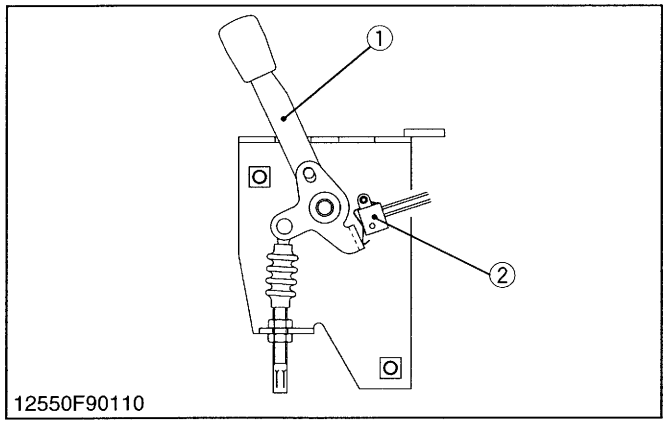
3) Power take off operation
Light up when the PTO clutch is engaged.

4) Charging circuit mulfunction
There is no special lamp to warn of chating circuit malfunction, but the lamps (1) light simultaneously to indicate the operator that charging is improper.

(1) Fuel Level Lamp

12550M90120

(2) PTO Clutch Lever Operation



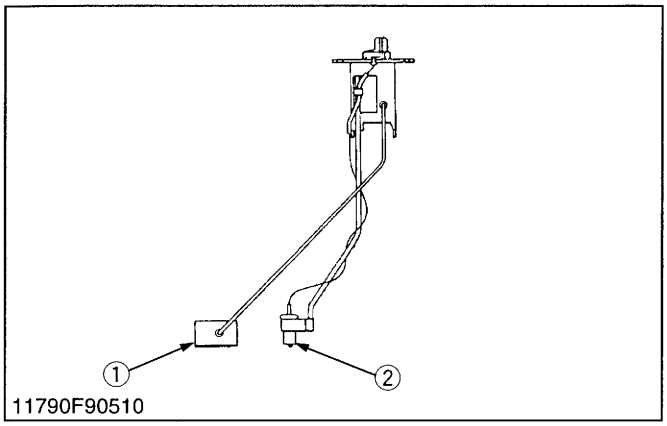
12550F90110

PTO clutch lamp inform an operator that PTO clutch lever is engaged. This system consists of a PTO clutch lamp on the panel board and a switch is operated by a PTO clutch lever.

(1) PTO Clutch Lever (2) PTO Switch

12550M90130

(3) Fuel Lacking



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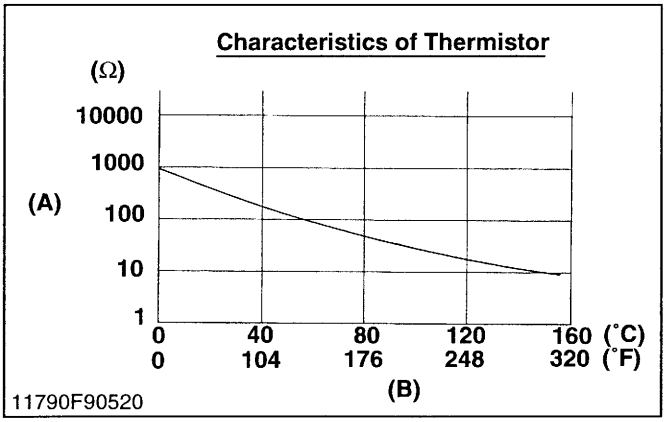


11790F90520

■ Fuel Limit Sensor (Thermistor)

Thermistor is a kind of resistor whose resistance varies with the temperature.

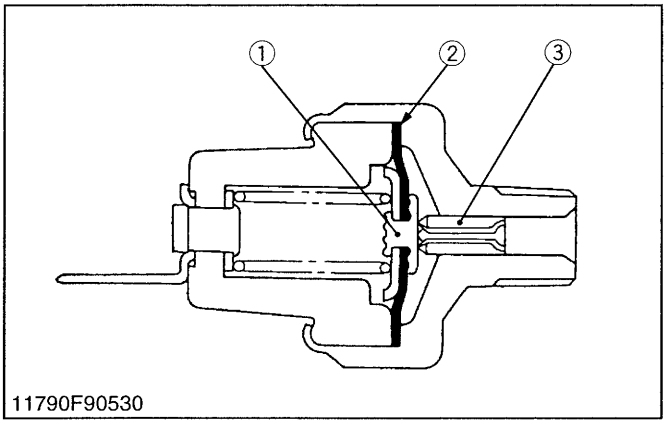
It has a large resistance in fuel as it is cooled. But in the air, it is heated by flowing current, and as the temperature rises, the resistance decreases, which in turn further increases the current and decreases the resistance. After a certain period of time, calorific values (temperature) of heat radiation and heat generation are balanced. (Testing must be done under this equilibrium.)

(1) Float
(2) Thermistor
(A) Resistance
(B) Temperature

11790M90260

(4) Engine Oil Pressure Alarm

When the engine oil pressure has drpooed, the engine oil pressure switch is activated to let the current flow from the main switch and to light up the lamp.



11790F90530

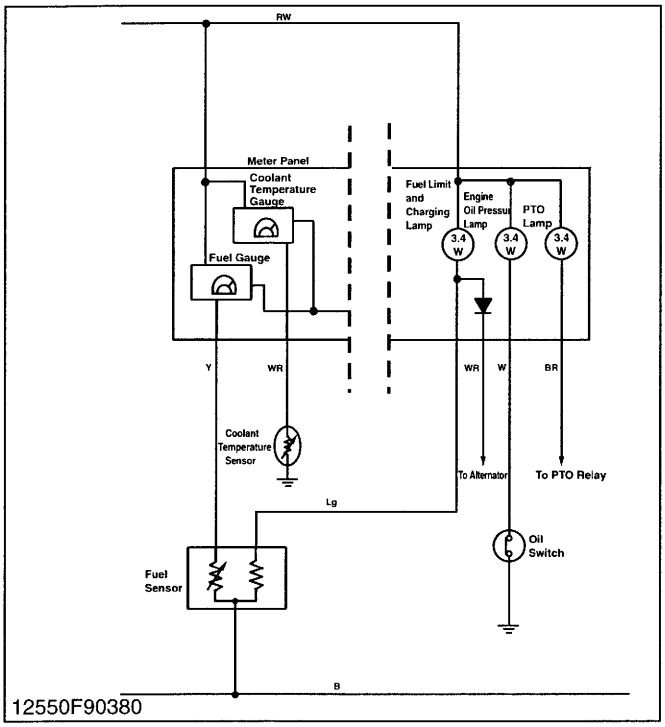
■ Engine Oil Pressure Switch

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

11790M90270

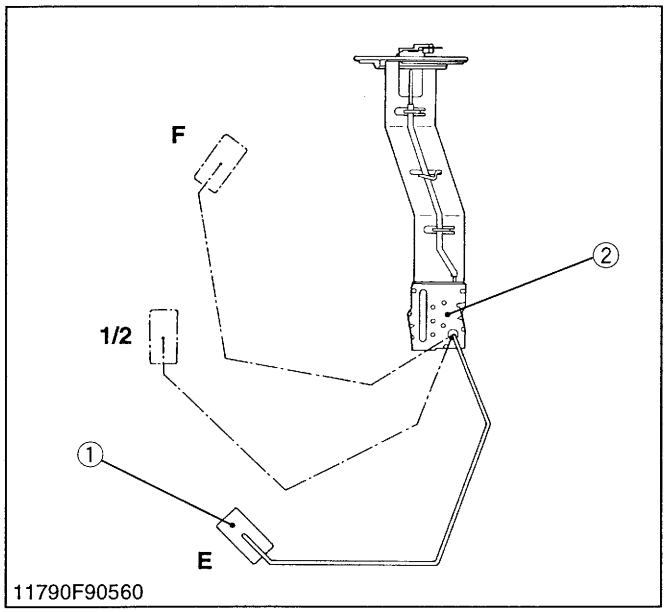
[8] GAUGES



The fuel quantity and coolant temperature are indicated by the ammeters. The ammeters indicate each amperate flowing through the fuel sensor for the fuel quantity detection and through the coolant temperature sensor for the coolant temperature detection.

12550M90140

(1) Sensor



■ Fuel Level Sensor

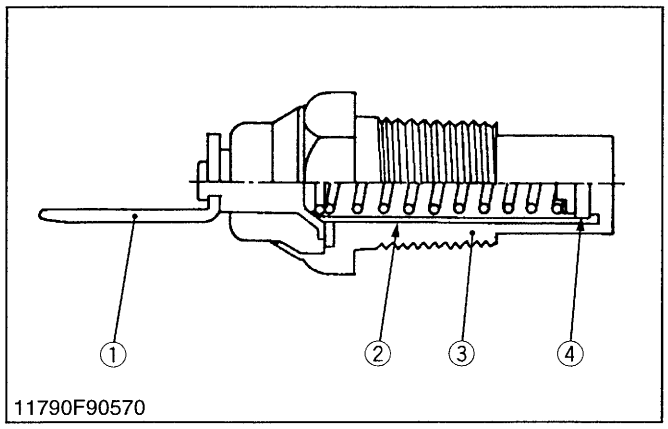
The remaining fuel quantity is detected by the fuel level sensor installed in the fuel tank and indicated on the fuel gaug. For detection, a float and a resistor are used.

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	28 to 36 Ω	103 to 117 Ω

(1) Float (2) Variable Resistor

11790M90300



11790F90570

■ 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.

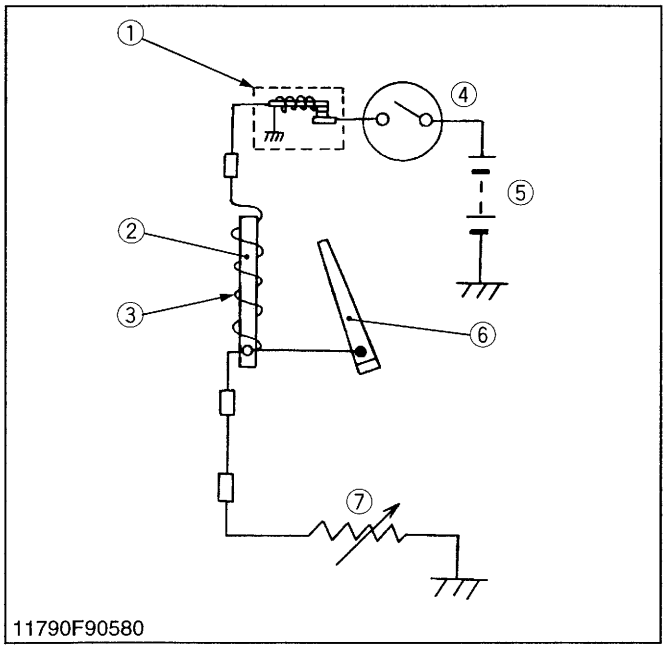
Current varies with changes in the coolant temperature, and the increases or decreases in the current move the pointer of gauge.

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

11790M90310

(2) Gauge



11790F90580

Both the fuel gauge and coolant temperature gauge use bimetal types.

When the main switch (4) is turned **ON**, the current controlled by the resistance of the sensor (7) flows through the circuit and is grounded.

This current heats the heat wire (3), causing the bimetal (2) to deflect in proportion to the current, thereby swinging the indicating needle (6) connected to the bimetal (4).

When the main switch (4) is turned **OFF**, the indicating needle (6) returns to its original position.

The voltage regulator (1) is installed so as to prevent errors due to voltage fluctuation.

(1) Voltage Regulator
(2) Bimetal
(3) Heat Wire
(4) Main Switch
(5) Battery
(6) Indicating Needle
(7) Sensor

12550M90150

SERVICING

CONTENTS

TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
All Electrical Equipments Do Not Operate	• Battery discharged or defective	Recharge or replace	9-S4, S5
	• Battery positive cable disconnected or improperly connected	Repair or replace	9-S4
	• Battery negative cable disconnected or improperly connected	Repair or replace	9-S4
	• Fusible link	Replace	–
Fuse Blown Frequently	• Short-circuited	Repair or replace	–

BATTERY

Battery Discharges Too Quickly	• Battery defective	Recharge or replace	9-S4, S5
	• Alternator defective	Repair or replace	9-S15 to S19
	• Wiring harness disconnected or improperly connected (between battery positive terminal and alternator **B** terminal)	Repair or replace	9-M1 to M25
	• Cooling fan belt slipping	Adjust tension	–

STARTING SYSTEM

Starter Motor Does Not Operate	• Battery discharged or defective	Recharge or replace	9-S4, S5
	• Slow blow fuse blown	Replace	–
	• Starter relay defective	Replace	9-S7, S8
	• Safety switch defective	Replace	9-S10
	• PTO switch improperly adjusted or defective	Repair or replace	9-S10
	• Wiring harness disconnected or improperly connected (between main switch **ST** terminal and PTO switch, between PTO switch and safety switch, between safety switch and starter relay, between starter relay and ground, between main switch **B** terminal and starter relay, between starter relay and starter motor **S** terminal, between battery positive terminal and starter motor **B** terminal)	Repair or replace	9-M1 to M25
	• Starter motor defective	Repair or replace	9-S10 to S14
	• Main switch defective	Replace	9-S5, S8

CHARGING SYSTEM

Fuel Limit and Charging Lamp Does Not Light When Main Switch Is Turned ON	• Fuse blown (10 A)	Replace	–
	• Wiring harness disconnected or improperly connected (between main switch **AC** terminal and panel board, between panel board and alternator **L** terminal)	Repair or replace	9-M1 to M25
Fuel Limit and Charging Lamp Does Not Go OFF When Engine Is Running	• Short circuit between alternator **L** terminal lead and chassis	Repair or replace	9-M1 to M25
	• Alternator defective	Repair or replace	9-S15 to S20

12550S90010

LIGHTING SYSTEM

Symptom	Probable Cause	Solution	Reference Page
Head Light Does Not Light	• Fuse blown (15 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 head light, between combination switch **2** terminal and head light)	Replace Replace Repair or replace	– – 9-M1 to M25
Illumination Light Does Not Light	• Fuse blown (15 A) • Bulb blown • Wiring harness disconnected or improperly connected (between combination switch **T** terminal and panel board)	Replace Replace Repair or replace	– – 9-M1 to M25
Tail Light Does Not Light	• Fuse blown • Wiring harness disconnected or improperly connected (between combination switch **T** terminal and tail light)	Replace Repair or replace	– 9-M1 to M25
Hazard Light Does Not Light	• Fuse blown (10 A) • Bulb blown • Wiring harness disconnected or improperly connected (between main switch **B** terminal and hazard unit, between hazard unit and combination switch **B2** terminal, between combination switch **R** terminal and hazard lights) • Flasher unit defective • Combination switch defective	Replace Replace Repair or replace Replace Replace	– – 9-M1 to M25 9-S23 9-S20
Hazard Indicator Lamp Does Not Light	• Bulb blown • Wiring harness disconnected or improperly connected (between combination switch **R** terminal and panel board)	Replace Repair or replace	– 9-M1 to M25
Hazard Light Does Not Go ON and OFF	• Flasher unit defective	Replace	9-S22

EASY CHECKER

Engine Oil Pressure Lamp Lights Up When Engine Is Running	• Engine oil pressure too low • Engine oil insufficient • Engine oil pressure switch defective • Short circuit between engine oil pressure switch lead and chassis • Circuit in panel board defective	Repair engine Replenish Replace Repair Replace	– G-9 9-S25 9-M1 to M25 –
Engine Oil Pressure Lamp Does Not Light When Main Switch Is Turned ON and Engine Is Not Running	• Bulb blown • Engine oil pressure switch defective • Wiring harness disconnected or improperly connected (between panel board and engine oil pressure switch) • Circuit in panel board defective	Replace Replace Repair or replace Replace	– 9-S25 9-M1 to M25 –

12550S90020

GAUGES

Symptom	Probable Cause	Solution	Reference Page
Fuel Gauge Does Not Function	• Fuel gauge defective • Fuel level sensor (tank unit) 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-S26 9-S26 9-M1 to M25 –
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-S26 9-S26 9-M1 to M25 –

12550S90030

SERVICING SPECIFICATIONS

STARTER MOTOR

Item		Factory Specification	Allowable Limit
Commutator	O.D.	30.0 mm 1.181 in.	29.0 mm 1.142 in.
Mica	Undercut	0.50 to 0.80 mm 0.019 to 0.031 in.	0.2 mm 0.008 in.
Brush	Length	14.0 mm 0.551 in.	9.0 mm 0.354 in.

ALTERNATOR

Brush	Length	10.5 mm 0.413 in.	8.4 mm 0.331 in.
Slip Ring	O.D.	14.4 mm 0.567 in.	12.8 mm 0.504 in.

GLOW PLUG

Glow Plug	Resistance	Approx. 0.5 ohms	–

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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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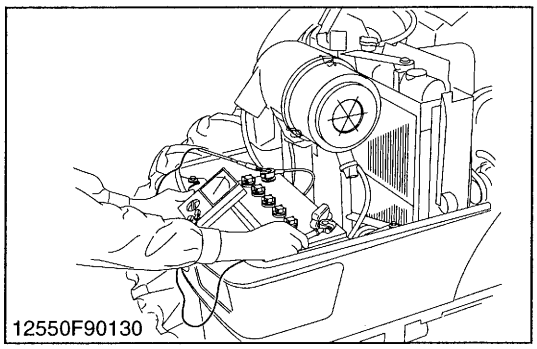
[1] BATTERY

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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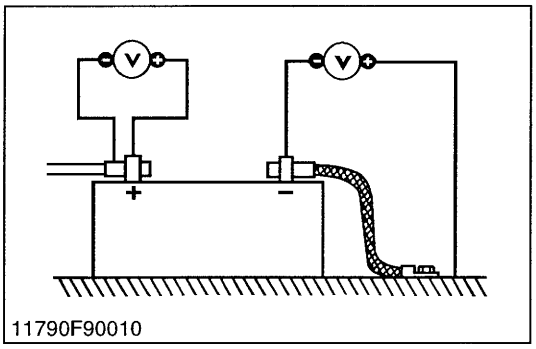

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Battery Terminal Connection

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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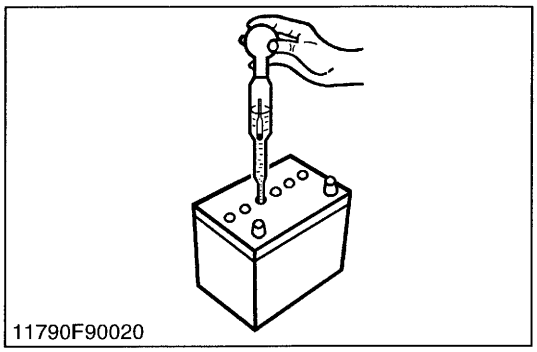
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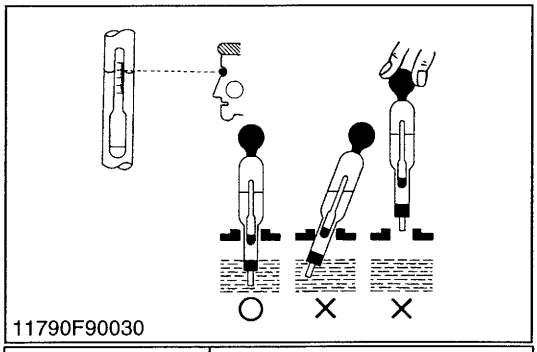
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Specific Gravity	State of Charge
1.260 Sp. Gr.	100 % Charged
1.230 Sp. Gr.	75 % Charged
1.200 Sp. Gr.	50 % Charged
1.170 Sp. Gr.	25 % Charged
1.140 Sp. Gr.	Very Little Useful Capacity
1.110 Sp. Gr.	Discharged

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)

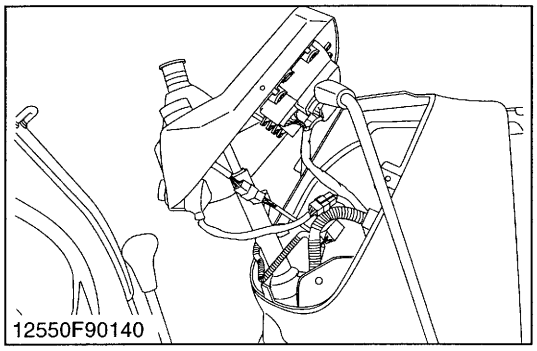
11790S90040

[2] STARTING SYSTEM

CHECKING

(1) Main Switch

(1)-1 ROPS Type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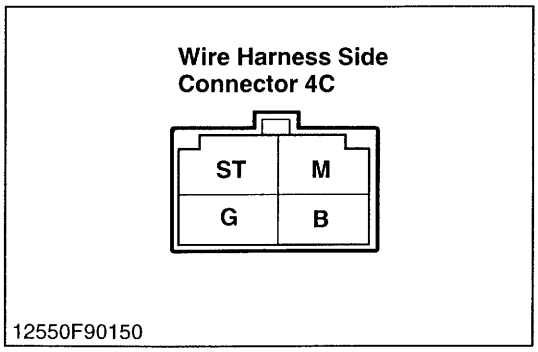
Remove the Main Switch

1. Remove the steering wheel.
2. Remove the shuttle grip.
3. Remove the meter panel, and disconnect the hourmeter cable, hazard switch connector and the main switch connectors after turning the main switch off.
4. Perform the following checking.

(1) Main Switch

12550S90050

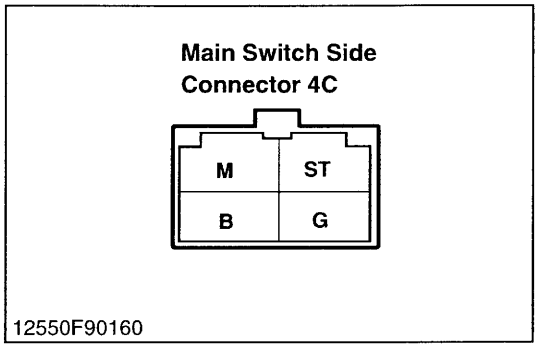


Connector Voltage

1. Measure the voltage with a voltmeter across the connector **B** terminal and chassis.
2. If the voltage differs from the battery voltage (11 to 14 V), check the wiring harness.

Voltage	Connector **B** terminal – Chassis	Approx. battery voltage

12550S90060

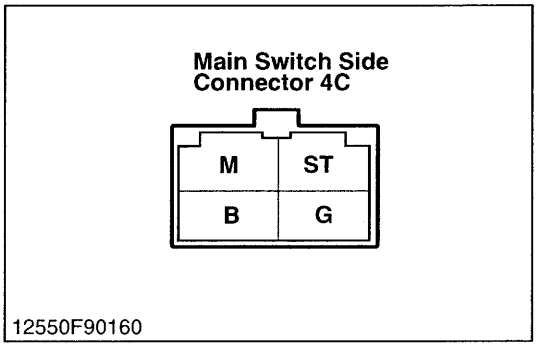


Main Switch at ON Position

1. Turn the main switch **ON** position.
2. Measure the resistance with an ohmmeter across the **B** terminal and the **M** terminal.
3. If 0 ohm is not indicated, renew the main switch.

Resistance	**B** terminal – **M** terminal	0 ohm

12550S90070



Main Switch at START Position

1. Turn and hold the main switch at the **START** position.
2. Measure the resistances with an ohmmeter across the **B** terminal and the **M** terminal, across the **B** terminal the **G** terminal, and across the **B** terminal, and the **ST** terminal.
3. If 0 ohm is not indicated, renew the main switch.

Resistance	**B** terminal – **M** terminal	0 ohm
	B terminal – **G** terminal	0 ohm
	B terminal – **ST** terminal	0 ohm

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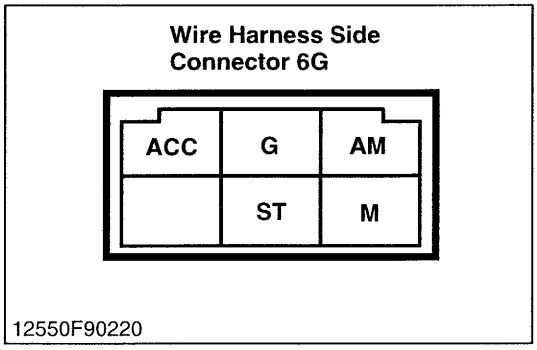
(1)-2 CABIN Type

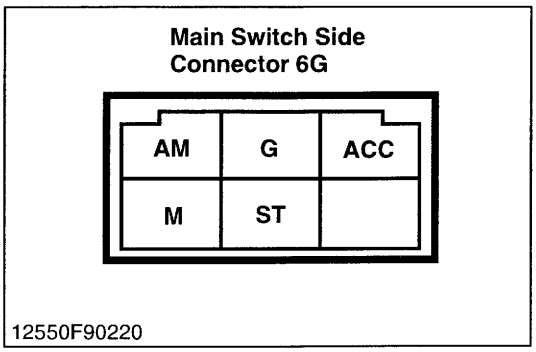


Connector Voltage

1. Measure the voltage with a voltmeter across the connector **6G AM** terminal and chassis.
2. If the voltage differs from the battery voltage (11 to 14 V), check the wiring harness.

Voltage	Connector **AM** terminal – Chassis	Approx. battery voltage

12550S90090



Main Switch at ON Position

1. Turn the main switch **ON** position.
2. Measure the resistance with an ohmmeter across the **AM** terminal and the **ACC** terminal and **AM** terminal and **M** terminal.
3. If 0 ohm is not indicated, renew the main switch.

Resistance	**AM** terminal - **ACC** terminal	0 ohm

(1) Main Switch Connector

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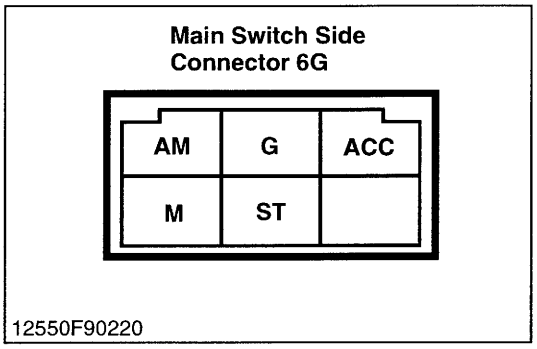

Main Switch Key PREHEAT Position

1. Turn and hold the main switch at the **PREHEAT** position.
2. Measure the resistances with an ohmmeter across the **AM** terminal and the **M** terminal, and across the **AM** terminal and the **GL** terminal.
3. If 0 ohm is not indicated, renew the main switch.

Resistance	**AM** terminal - **M** terminal	0 ohm
	AM terminal - **GL** terminal	

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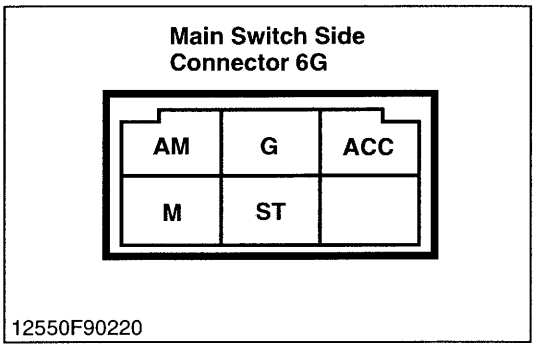

Main Switch at START Position

1. Turn and hold the main switch at the **START** position.
2. Measure the resistances with an ohmmeter across the **3** terminal and the **B** terminal, and across the **AM** terminal and the **ST** terminal.
3. If 0 ohm is not indicated, renew the main switch.

Resistance	**AM** terminal - **M** terminal	0 ohm
	AM terminal - **ST** terminal	

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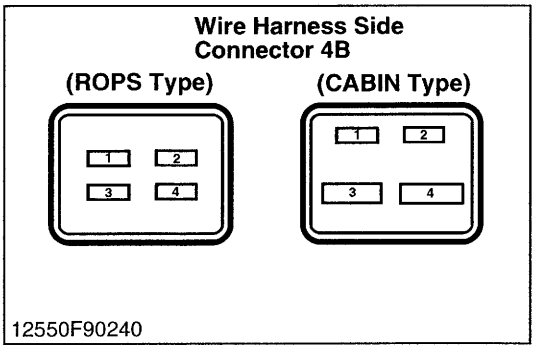
(2) Starter Relay



Connector Voltage

1. Disconnect the starter relay (1) connector **4B**.
2. Shift the shuttle lever in neutral position.

(ROPS type)

3. Measure the voltage across **3** terminal and **4** terminal (wire harness side).

(CABIN type)

3. Measure the voltage across **1** terminal and **2** terminal (wire harness side).
4. If the voltage differs from the battery voltage, check the wiring harness.

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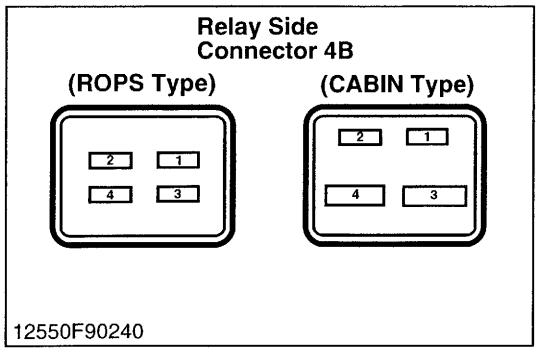

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Starter Relay Test

(ROPS type)

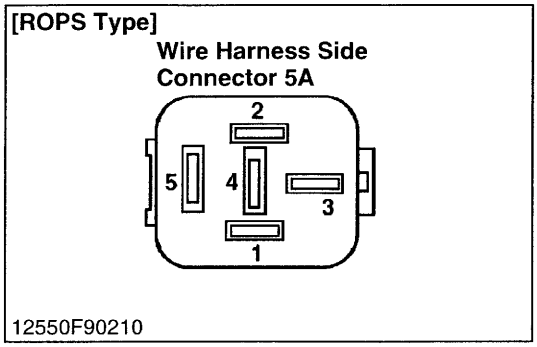
1. Apply battery voltage across **3** and **4** terminals, and check for continuity across **1** and **2** terminals.

(CABIN type)

1. Apply battery voltage across terminals **1** and **2**, and check for continuity across terminals **3** and **4**.
2. If 0 ohm is not indicated, renew the starter relay.

12550S90140

(3) PTO Relay



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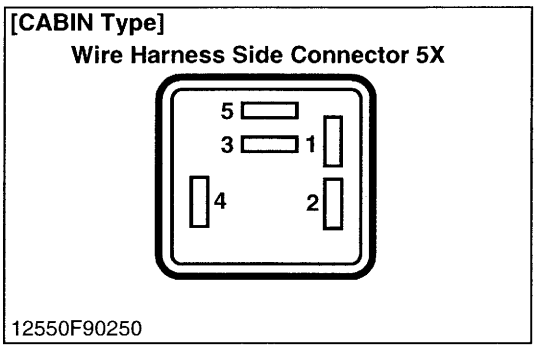

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Connector Voltage

1. Disconnect the PTO relay connector **5A** (ROPS Type), **5X** (CABIN Type).
2. Shift the PTO clutch lever to **OFF** position and turn the main switch to **ON** position.

(ROPS Type)

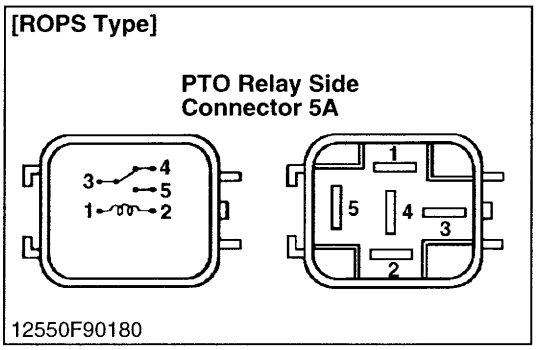
3. Measure the voltage across **1** terminal and **2** terminal (wire harness side).

(CABIN Type)

3. Measure the voltage across **2** terminal and **4** terminal.
4. If the voltage differs from the battery voltage, check the wiring harness.

Voltage	Connector **1** terminal and **2** terminal	Battery voltage (11 to 14 V)

12550S90150



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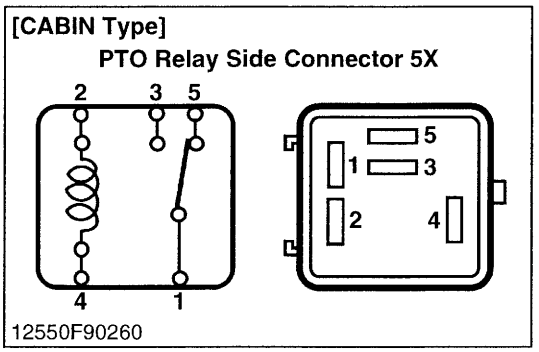

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PTO Relay Test

(ROPS Type)

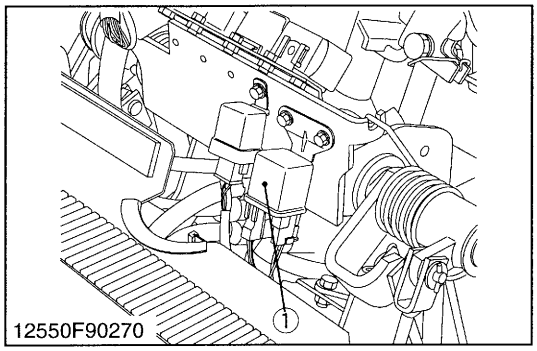
1. Apply battery voltage across **1** and **2** terminals, and check for continuity across **3** and **5** terminals.

(CABIN Type)

1. Apply battery voltage across **2** and **4** terminal, and check for continuity across **1** and **3** terminals.
2. If 0 ohm is not indicated, renew the PTO relay.

12550S90160

(4) Glow Relay



Connector Voltage

1. Turn the main switch **OFF** position.
2. Disconnect the **1P** connectors and connector **2A** from glow relay (1).
3. Measure the voltage with a voltmeter across the **1P** connector **R** terminal (Positive) and chassis (Negative).
4. If the voltage differs from the battery voltage, check the wiring harness.
5. Turn the main switch **ON** position.
6. Measure the voltage with a voltmeter across the connector **2A BW** terminal (Positive) and chassis (Negative).
7. If the voltage differs from the battery voltage, check the wiring harness.

(1) Glow Relay

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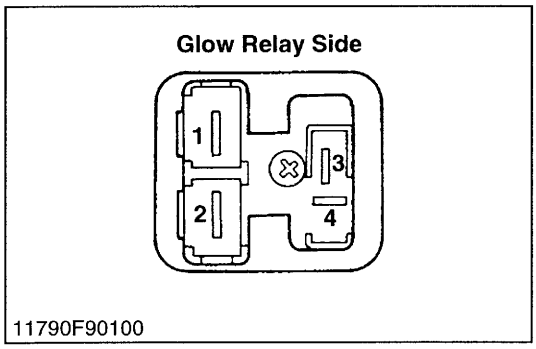

Glow Relay Test

1. Remove the glow relay.
2. Apply battery voltage across **3** and **4** terminals, and check for continuity across **1** and **2** terminals.
3. If continuity is not established across **1** and **2** terminals, renew the glow relay.

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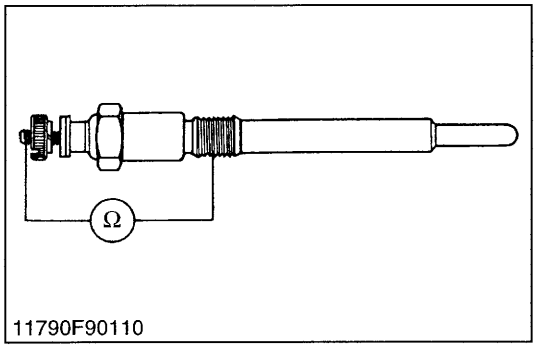
(5) Glow Plug



Check the Glow Plug

1. Disconnect the leads from the glow plugs.
2. Measure the resistance with an ohmmeter across the glow plug terminal and 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, renew the glow plug.

Glow plug resistance	Factory spec.	Approx. 0.5 ohms

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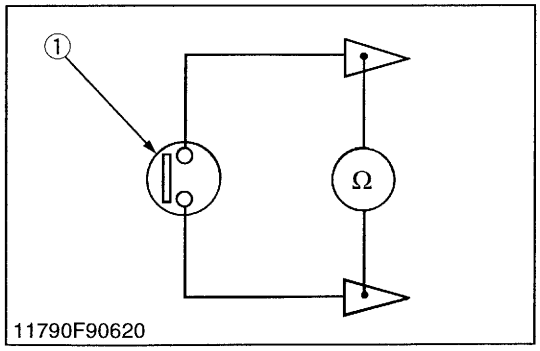
(6) Safety Switch and PTO Clutch Safety Switch



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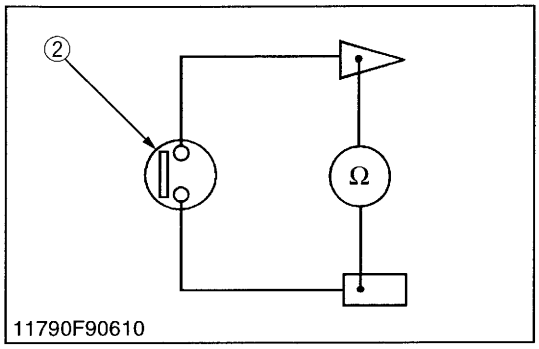

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Check the Safety Switch and PTO Clutch Safety Switch

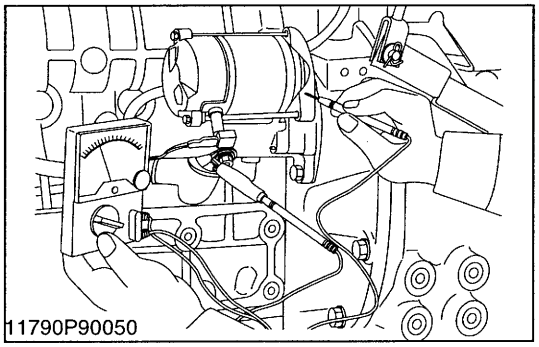
1. Remove the safety switch (PTO clutch safety switch) leads.
2. Connect the circuit tester to the safety switch (PTO clutch safety switch) leads.
3. Measure the resistance between leads.
4. If the safety switch (PTO clutch safety switch) is defective, replace it.

Resistance (Across switch terminal)	When switch push is pushed	0 ohm
	When switch push is released	Infinity

(1) Safety Switch (2) PTO Clutch Safety Switch

12550S90200

(7) Starter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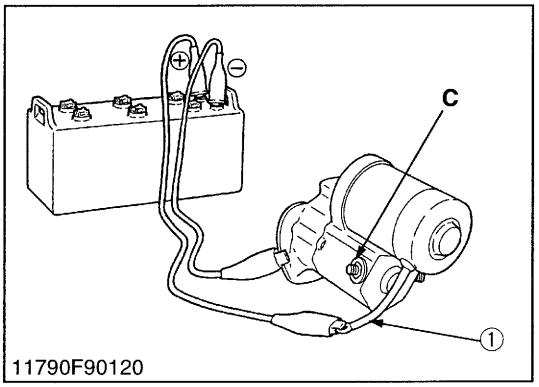
Starter Motor B Terminal Voltage

1. Measure the voltage with a voltmeter across the **B** terminal and chassis.
2. If the voltage differs from the battery voltage, check the battery's cable.

Voltage	Factory spec.	Approx. battery voltage

12550S90210



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Motor Test

CAUTION

- **Secure the starter in a vise to prevent it from jumping up and down while testing the motor.**

1. Disconnect the ground cable clamp from the battery negative terminal post.
2. Disconnect the battery positive cable and the leads from the starter.
3. Remove the starter motor from the engine.
4. Disconnect the connecting lead (1) from the starter **C** terminal.
5. Connect a jumper lead from the connecting lead (1) 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.

(1) Connecting Lead

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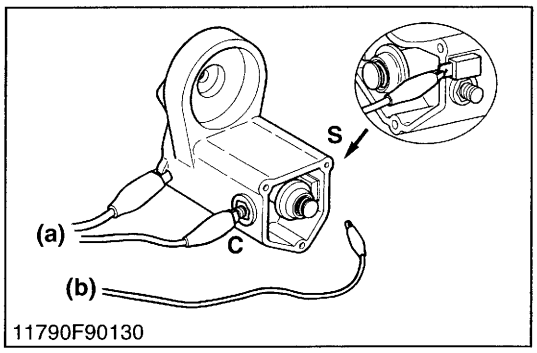

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Magnet Switch Test (Pull-in, Holding Coils)

1. Remove the motor from the starter housing.
2. Prepare a 6 V battery for the test.
3. Connect jumper leads from the battery negative terminal to the housing and the starter **C** terminal.
4. The plunger should be attached and the pinion gear should pop out when a jumper lead is connected from the battery positive terminal to the **S** terminal. It's a correct.
5. Disconnect the jumper lead to the starter **C** terminal. Then the pinion gear should remain popped out. It's a correct.

■ **IMPORTANT**

- **Testing time must be 3 to 5 sec.**

(a) To Negative Terminal **(b) To Positive Terminal**

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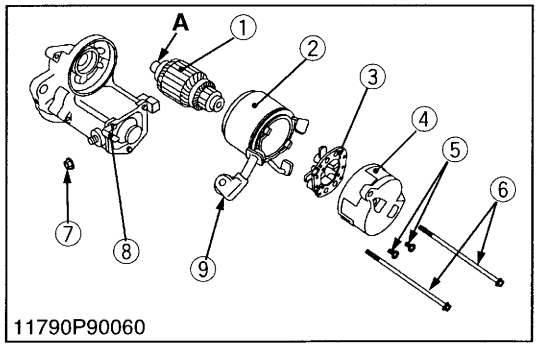
DISASSEMBLING AND ASSEMBLING

(1) Starter



11790P90060

Disassembling Motor

1. Disconnect the connecting lead (9) from the magnet switch (8).
2. Remove the through screws (6), and then separate the end frame (4), yoke (2) and armature (1).
3. Remove the two screws (5), and then take out the brush holder (3) from the end frame (4).

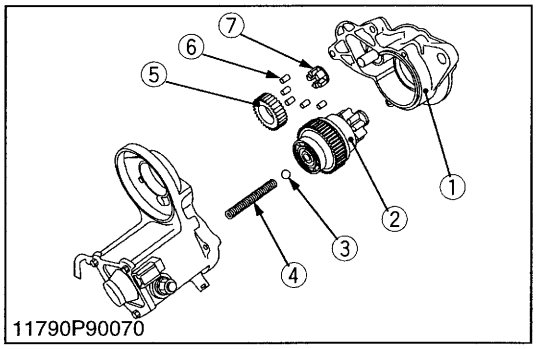
(When reassembling)

- Apply grease to the spline teeth **(A)** of the armature (1).

(1) Armature
(2) Yoke
(3) Brush Holder
(4) End Frame
(5) Screw
(6) Screw
(7) Nut
(8) Magnet Switch
(9) Connecting Lead

(A) Spline Teeth

11790S90200



11790P90070

Disassembling Magnet Switch

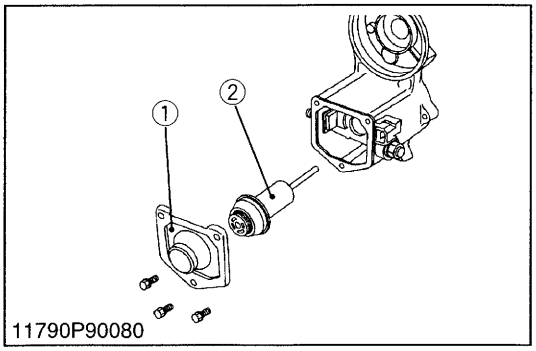
1. Remove the drive end frame (1) mounting screws.
2. Take out the overrunning clutch (2), ball (3), spring (4), gear (5), rollers (6) and retainer (7).

(When reassembling)

- Apply grease to the gear teeth of the gear (5) and overrunning clutch (2), and ball (3).

(1) Drive End Frame
(2) Overrunning Clutch
(3) Ball
(4) Spring
(5) Gear
(6) Roller
(7) Retainer

11790S90210



11790P90080

Plunger

1. Remove the end cover (1).
2. Take out the plunger (2).

(1) End Cover
(2) Plunger

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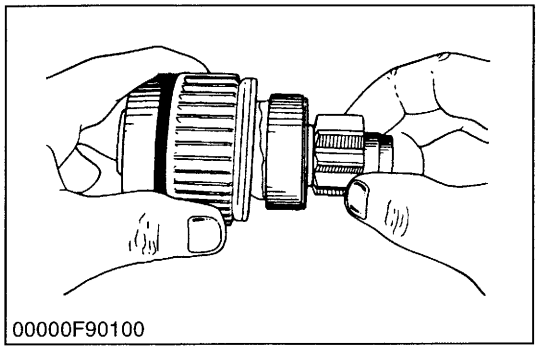
SERVICING

(1) Starter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Overrunning Clutch

1. Inspect the pinion for wear or damage.
2. If there is any defect, replace the overrunning clutch assembly.
3. Check that the pinion turns freely and smoothly in the overrunning direction and does not slip in the cranking direction.
4. If the pinion slips or does not rotate in the both directions, replace the overrunning clutch assembly.

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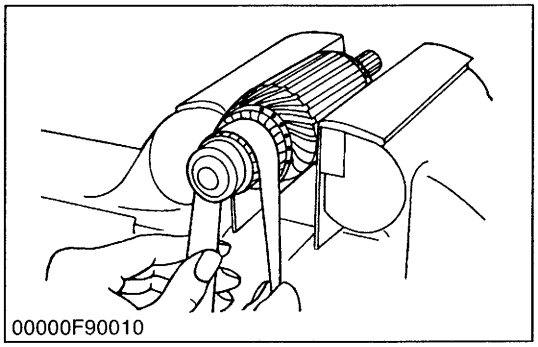
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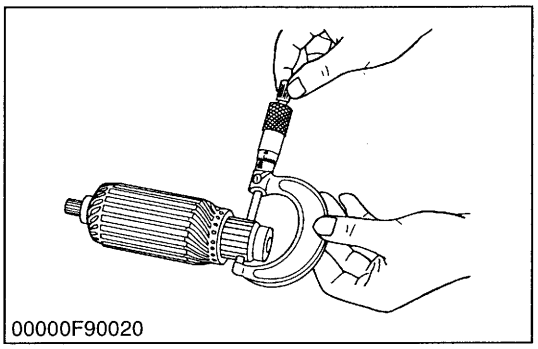
Commutator and Mica

1. Check the contact face of the commutator for wear, and grind the commutator with emery paper if it is slightly worn.
2. Measure the commutator O.D. with an outside micrometer at several points.
3. If the minimum O.D. is less than the allowable limit, replace the armature.
4. If the difference of the O.D.'s exceeds the allowable limit, correct the commutator on a lathe to the factory specification.
5. Measure the mica undercut.
6. If the undercut is less than the allowable limit, correct it with a saw blade and chamfer the segment edges.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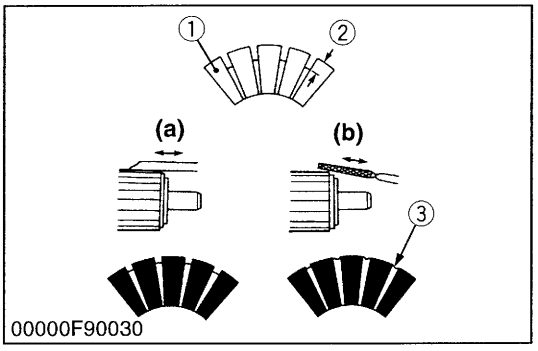
Commutator O.D.	Factory spec.	30.0 mm 1.181 in.
	Allowable limit	29.0 mm 1.142 in.
Difference of O.D.'s	Factory spec.	Less than 0.02 mm 0.0008 in.
	Allowable limit	0.05 mm 0.0020 in.
Mica undercut	Factory spec.	0.50 to 0.80 mm 0.0197 to 0.0315 in.
	Allowable limit	0.20 mm 0.0079 in.



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(1) Segment
(2) Undercut
(3) Mica

(a) Correct
(b) Incorrect

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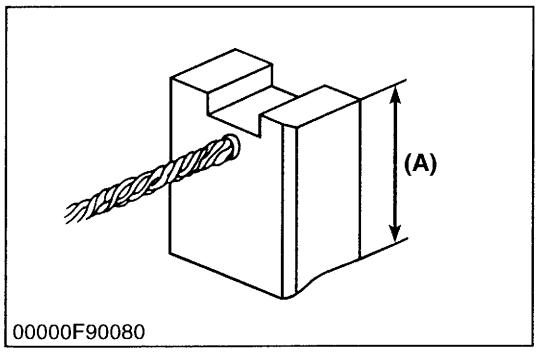

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Brush Wear

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.

Brush length **(A)**	Factory spec.	14.0 mm 0.551 in.
	Allowable limit	9.0 mm 0.354 in.

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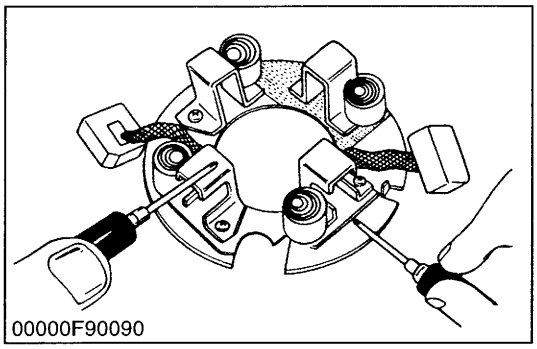
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Brush Holder

1. Check the continuity across the brush holder and the holder support with an ohmmeter.
2. If it conducts, replace the brush holder.

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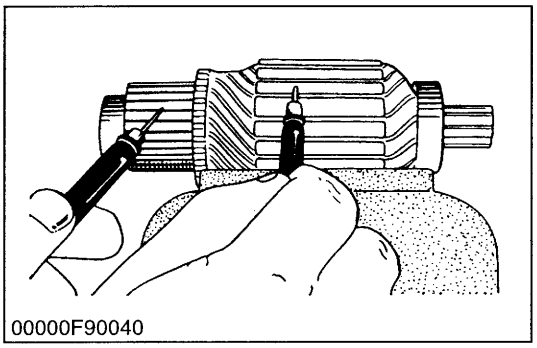
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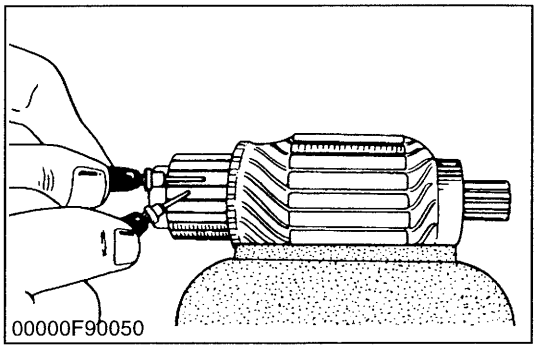
Armature Coil

1. Check the continuity across the commutator and armature coil core with an ohmmeter.
2. If it conducts, replace the armature.
3. Check the continuity across the segments of the commutator with an ohmmeter.
4. If it does not conduct, replace the armature.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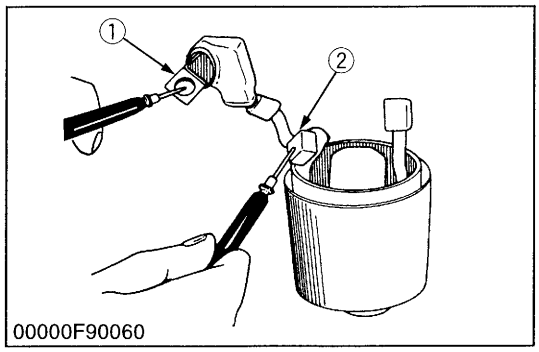

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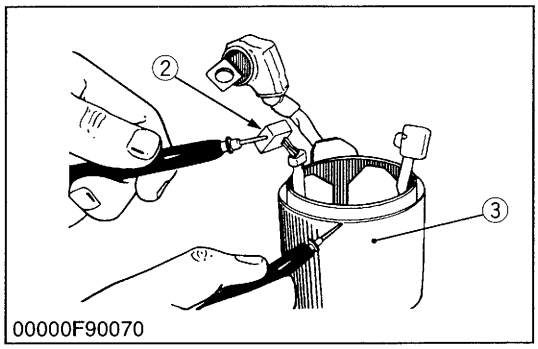

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Field Coil

1. Check the continuity across the lead (1) and brush (2) with an ohmmeter.
2. If it does not conduct, replace the yoke assembly.
3. Check the continuity across the brush (2) and yoke (3) with an ohmmeter.
4. If it conducts, replace the yoke assembly.

(1) Lead
(2) Brush
(3) Yoke

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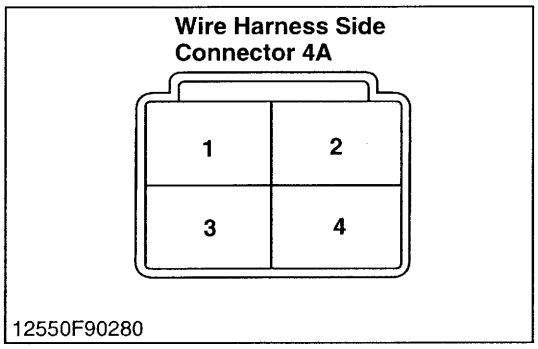
[3] ENGINE KEY SWITCH SHUT OFF SYSTEM

(1) Timer Relay



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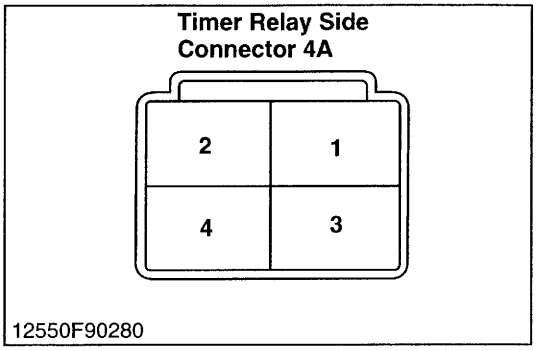
Connector Voltage

1. Disconnect the connector **4A** from the timer relay after turning the main switch **OFF** position.
2. Measure the voltage with a voltmeter across the connector **3** terminal and chassis
3. Turn the main switch **ON** position, and measure the voltage across the connector **4** terminal and chassis.
4. If these voltages differ from the battery voltage, check the wiring harness.

Voltage	Connector **3** terminal-chassis (Main Switch **OFF**)	Approx. battery voltage
	Connector **4** terminal-chassis (Main Switch **ON**)	Approx. battery voltage

12550S90220



12550F90280

Test of Timer Relay

1. Remove the timer relay.
2. Connect jumper leads across the battery positive terminal and the timer relay **3** terminal, and across the battery positive terminal and the timer relay **4** terminal.
3. Connect jumper leads across the battery negative terminal and the timer relay **2** terminal, and across the battery negative terminal and the bulb terminal.
4. Connect jumper lead across the timer relay **1** terminal and the bulb terminal.
5. The bulb lights up when disconnecting a jumper lead from the **3** terminal and goes off 6 to 13 seconds late, the timer relay is proper.

(1) Timer Relay
(2) Load (Lamp)
(3) Battery (12V)

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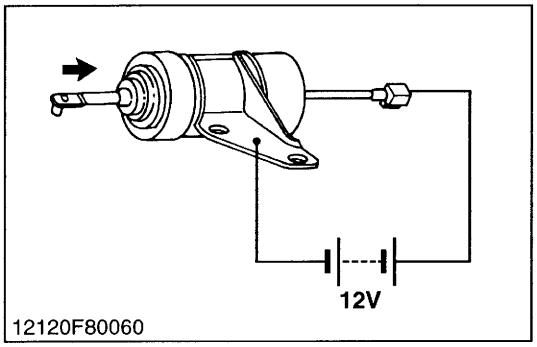
(2) Engine Stop Solenoid



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Engine Stop Solenoid Test

1. Disconnect the **1P** connector from the engine stop solenoid.
2. Remove the engine stop solenoid from the engine.
3. Connect the jumper leads from the battery positive terminal to the **1P** connector, and from the battery negative terminal to the engine stop solenoid body.
4. If the solenoid plunger is not attracted, check the engine stop solenoid.

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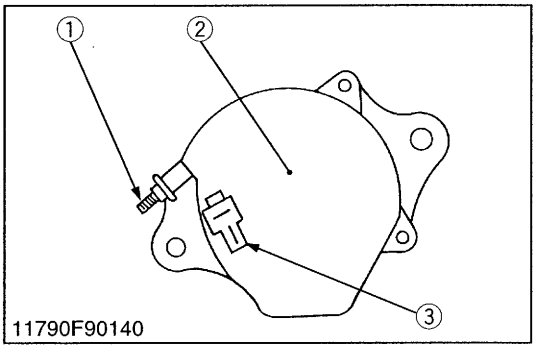
[4] CHARGING SYSTEM

CHECKING

(1) Alternator



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Remove the Alternator

1. Disconnect the **2P** connector (3) from alternator after turning the main switch **OFF**.
2. Perform the following checkings.

(1) **B** Terminal
(2) Alternator
(3) **2P** Connector

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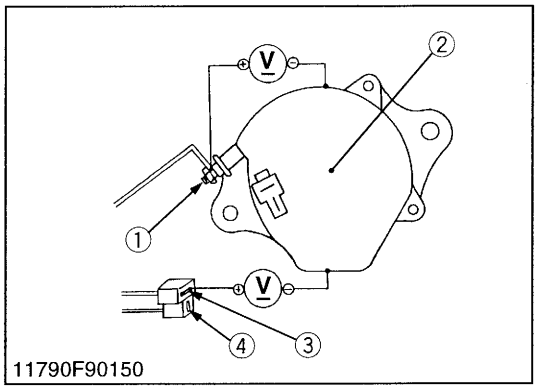

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Connector Voltage

1. Turn the main switch **OFF**. Measure the voltage between the **B** terminal (1) and the chassis.
2. Turn the main switch **ON**. Measure the voltage between the **IG** terminal (3) and the chassis.

Voltage (Main switch at **OFF**)	**B** terminal - Chassis	Approx. battery voltage
Voltage (Main switch at **ON**)	**IG** terminal - Chassis	Approx. battery voltage

(1) **B** Terminal
(2) Alternator
(3) **IG** Terminal
(4) **L** Terminal

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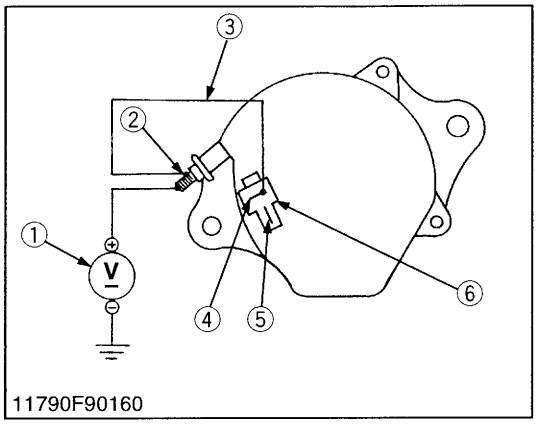

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No-Load Test

1. Connect the **2P** connector (6) to previous positions of the alternator after turning the main switch **OFF**.
2. Connect the jumper lead (3) between the **IG** terminal (4) and the **B** terminal (2).
3. Start the engine and then set at idling speed.
4. Disconnect the negative cable from the battery.
5. Measure the voltage between the **B** terminal (2) and the chassis.
6. If the measurement is less than the factory specification, disassemble the alternator and check the IC regulator.

Voltage	Factory spec.	More than 14 V

(Reference)

- Once the engine has started, the alternator temperature rises quickly up to an ambient temperature of 70 to 90 °C (158 to 194 °F). As the temperature goes higher than 50 °C (122 °F), the alternator voltage slowly drops ; at higher than 100 °C (212 °F), it drops by about 1 V.

(1) Voltmeter
(2) **B** Terminal
(3) Jumper Lead
(4) **IG** Terminal
(5) **L** Terminal
(6) **2P** Connector

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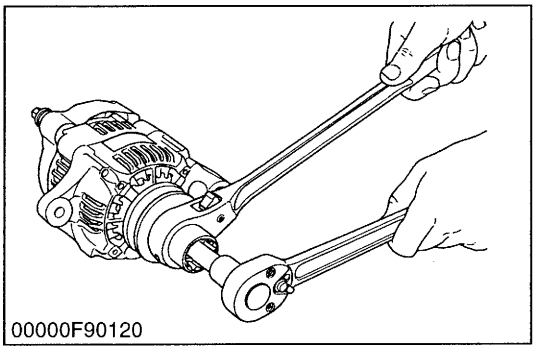
DISASSEMBLING AND ASSEMBLING

(1) Alternator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Pulley

1. Secure the hexagonal end of the pulley shaft with a double-ended ratchet wrench as shown in the figure, loosen the pulley nut with a socket wrench and remove it.

(When reassembling)

Tightening torque	Pulley nut	58.3 to 78.9 N·m 5.95 to 8.05 kgf·m 43.0 to 58.2 ft-lbs

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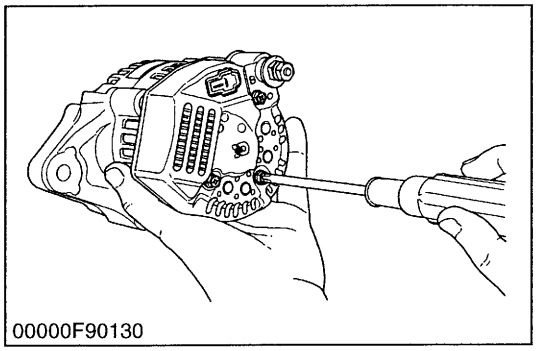
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Rear End Cover

1. Unscrew the three rear end cover screws and the **B** terminal nut, and remove the rear end cover.

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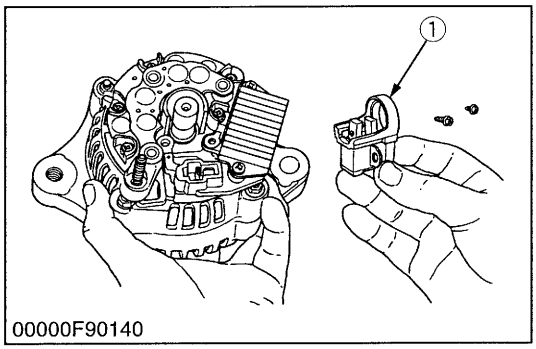

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Brush Holder

1. Unscrew the two screws holding the brush holder, and remove the brush holder (1).

(1) Brush Holder

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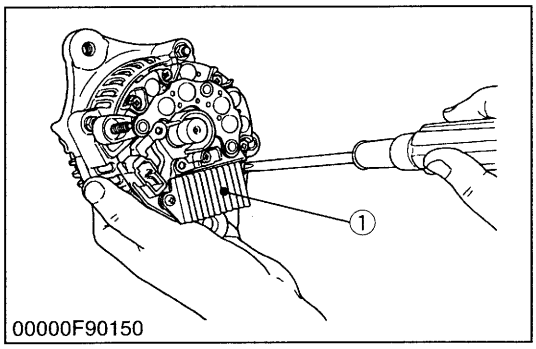

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IC Regulator

1. Unscrew the three screws holding the IC regulator, and remove the IC regulator (1).

(1) IC Regulator

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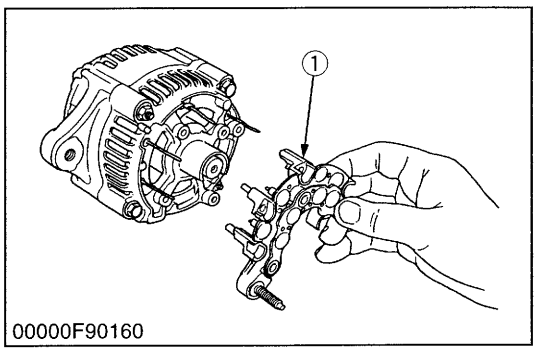

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Rectifier

1. Remove the four screws holding the rectifier and the stator lead wires.
2. Remove the rectifier (1).

(1) Rectifier

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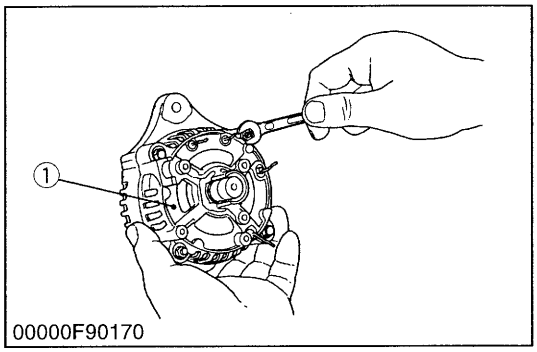

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Rear End Frame

1. Unscrew the two nuts and two screws holding the drive end frame and the rear end frame.
2. Remove the rear end frame (1).

(1) Rear End Frame

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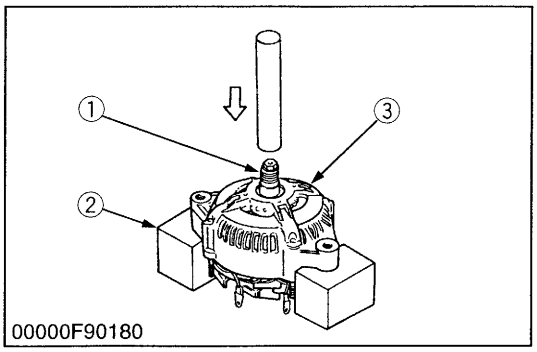

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Rotor

1. Press out the rotor (1) from drive end frame (3).

■ IMPORTANT

- **Take special care not to drop the rotor and damage the slip ring or fan, etc.**

(1) Rotor
(2) Block
(3) Drive End Frame

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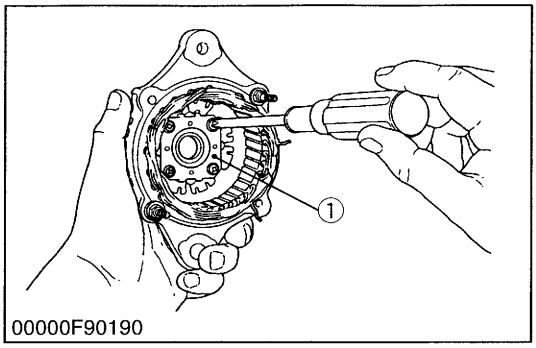

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Retainer Plate

1. Unscrew the four screws holding the retainer plate, and remove the retainer plate (1).

(1) Retainer Plate

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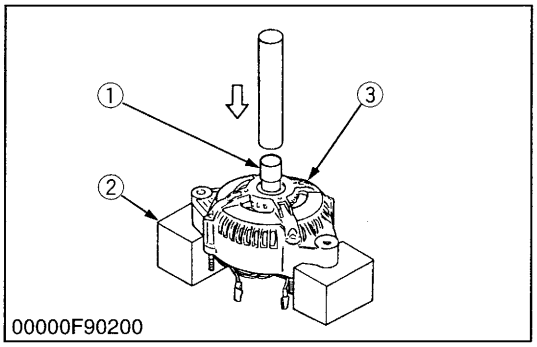

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Bearing on Drive End Side

1. Press out the bearing from drive end frame (3) with a press and jig (1).

(1) Jig
(2) Block
(3) Drive End Frame

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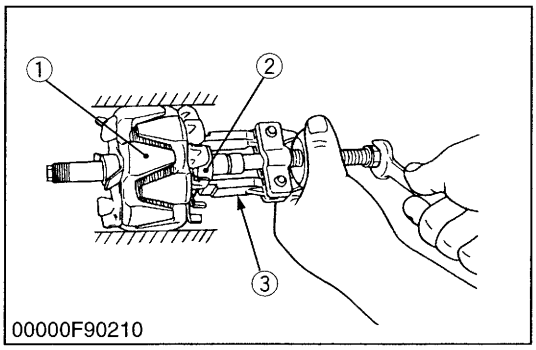

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Bearing at Slip Ring Side

1. Lightly secure the rotor (1) with a vise to prevent damage, and remove the bearing (2) with a puller (3).

(1) Rotor
(2) Bearing
(3) Puller

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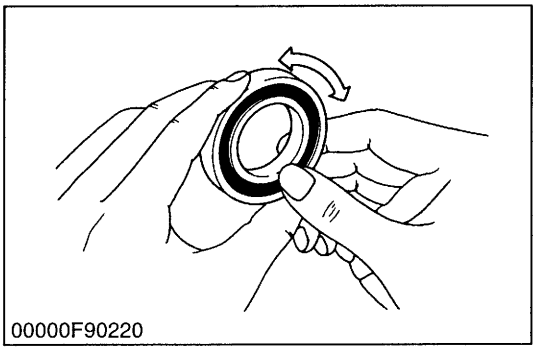
SERVICING

(1) Alternator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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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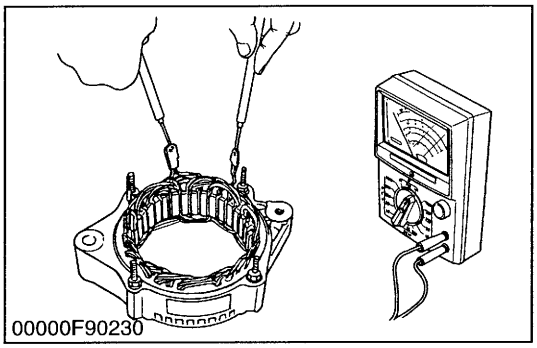
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Stator

1. Measure the resistance across each lead of the stator coil with an ohmmeter.
2. If the measurement is not within factory specification, replace it.
3. Check the continuity across each stator coil lead and core with an ohmmeter.
4. If infinity is not indicated, replace it.

Resistance	Factory spec.	Less than 1.0 ohms

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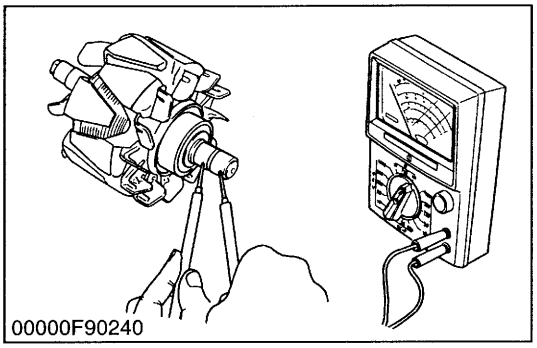
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Rotor

1. Measure the resistance across the slip rings with an ohmmeter.
2. If the resistance is not the factory specification, replace it.
3. Check the continuity across the slip ring and core with an ohmmeter.
4. If infinity is not indicated, replace it.

Resistance	Factory spec.	2.9 ohms

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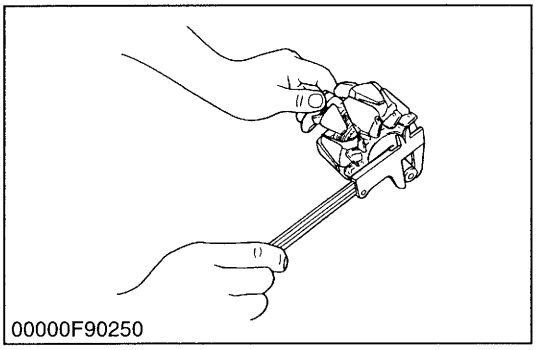
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Slip Ring

1. Check the slip ring for score.
2. If scored, correct with an emery paper or on a lathe.
3. Measure the O.D. of slip ring with vernier calipers.
4. If the measurement is less than the allowable limit, replace it.

Slip ring O.D.	Factory spec.	14.4 mm 0.567 in.
	Allowable limit	12.8 mm 0.504 in.

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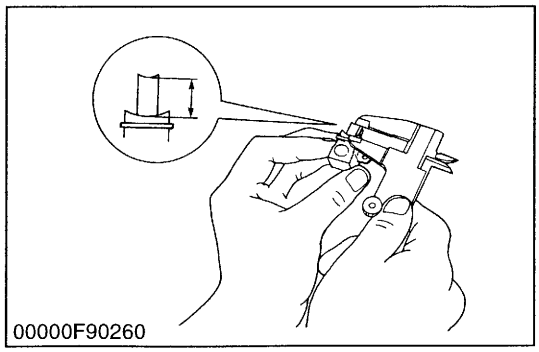
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Brush Wear

1. Measure the brush length with vernier calipers.
2. If the measurement is less than allowable limit, replace it.
3. Make sure that the brush moves smoothly.
4. If the brush is defective, replace it.

Brush length	Factory spec.	10.5 mm 0.4134 in.
	Allowable limit	8.4 mm 0.3307 in.

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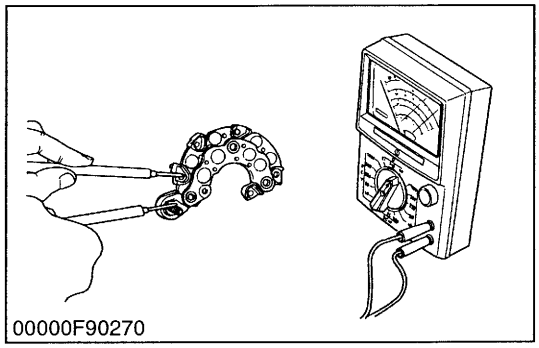
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Rectifier

1. Check the continuity across each diode of rectifier with an analog ohmmeter. Conduct the test in the (R × 1) setting.
2. The rectifier is normal if the diode in the rectifier conducts in one direction and does not conduct in the reverse direction.

■ **IMPORTANT**

- **Do not use a 500 V megger for measuring because it will destroy the rectifier.**

■ **NOTE**

- **Do not use an auto digital multimeter. Because it's very hard to check the continuity of rectifier by using it.**

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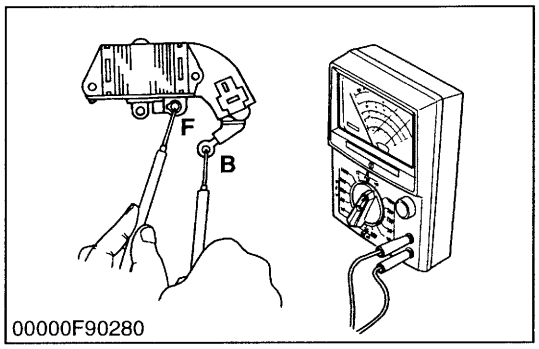
(2) IC Regulator



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IC Regulator

1. Check the continuity across the **B** terminal and the **F** terminal of IC regulator with an analog ohmmeter. Conduct the test in the (R × 1) setting.
2. The IC regulator is normal if the IC regulator conducts in one direction and does not conduct in the reverse direction.

■ **IMPORTANT**

- **Do not use a 500 V megger for measuring because it will destroy the IC regulator.**

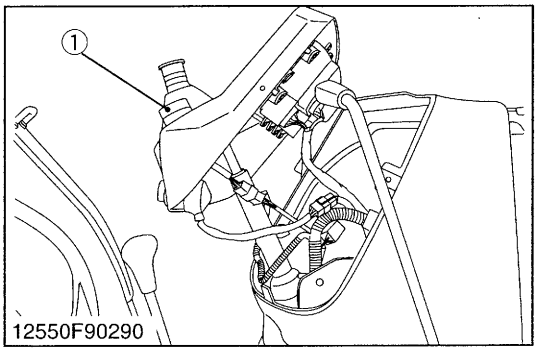
■ **NOTE**

- **Do not use an auto digital multimeter. Because it's very hard to check the continuity of IC regulator by using it.**

00000S90240

[5] LIGHTING SYSTEM CHECKING

(1) Combination Switch



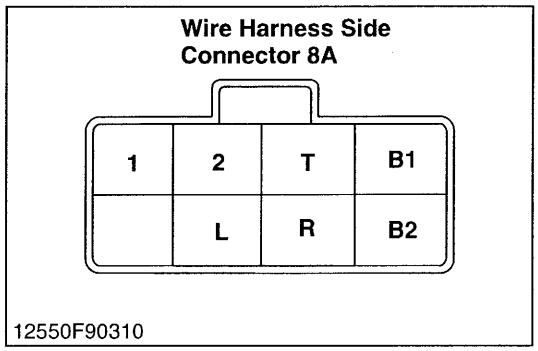
12550F90290

Remove the Combination Switch

1. Remove the meter panel, and disconnect the combination switch connector **8A** after turning the main switch **OFF** position.
2. Perform the following checkings.

(1) Combination Switch

12550S90260



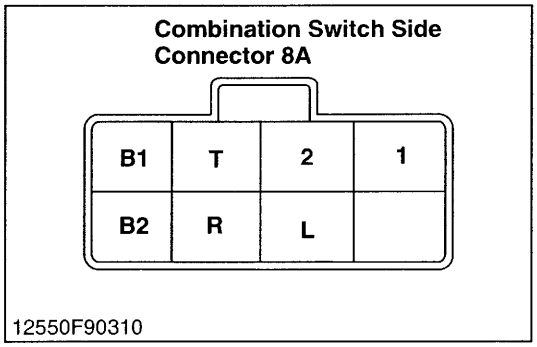
Connector Voltage

1. Disconnect the connector **8A** from the combination switch.
2. Measure the voltage with a voltmeter across the connector **B1** terminal and chassis when the main switch is **OFF** position.
3. If the voltage differs from the battery voltage, the wiring harness is faulty.
4. Measure the voltage with a voltmeter across the connector **B2** terminal and chassis when the main switch is **ON** position.
5. If the voltage differs from the battery voltage, check the wiring harness and main switch.

Voltage	Main switch at **OFF** position	**B1** terminal – Chassis	Battery voltage
	Main switch at **ON** position	**B2** terminal – Chassis	

12550S90270

(1)-1 Lighting Switch

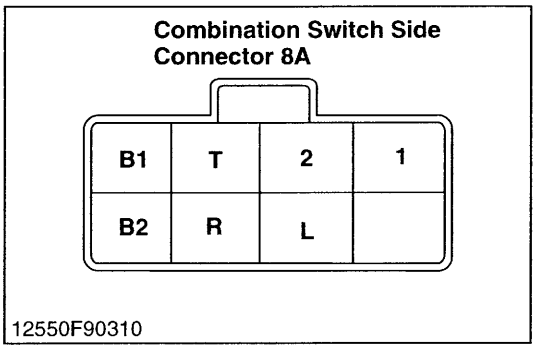


Head Light Switch Continuity when Setting Switch at OFF Position

1. Disconnect the connector **8A** from the combination switch.
2. Set the light switch to the **OFF** position.
3. Measure the resistance with an ohmmeter across the **B1** terminal to the **T** terminal, the **B1** terminal to the **1** terminal and the **B1** terminal to the **2** terminal.
4. If infinity is not indicated, renew the switch.

Resistance (Switch at **OFF** position)	**B1** terminal – **T** terminal	Infinity
	B1 terminal – **1** terminal	
	B1 terminal – **2** terminal	

12550S90280

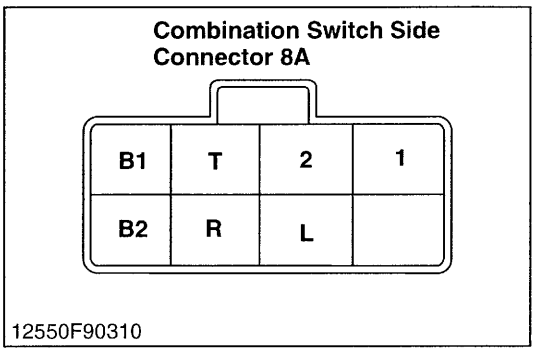


Head Light Switch Continuity when Setting Switch at HI-BEAM Position

1. Measure the resistance with an ohmmeter across the **B1** terminal to the **T** terminal and the **B1** terminal to the **1** terminal.
2. If 0 ohm is not indicated, renew the head light switch.

Resistance (Switch at **HI-BEAM** position)	**B1** terminal – **T** terminal	0 ohm
	B1 terminal – **1** terminal	

12550S90290



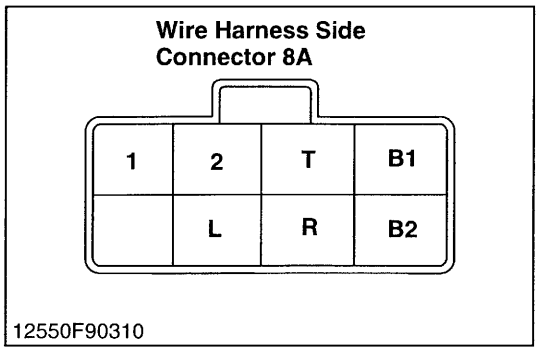
Head Light Switch Continuity when Setting Switch at LO-BEAM Position

1. Measure the resistance with an ohmmeter across the **B1** terminal to the **T** terminal and the **B1** terminal to the **2** terminal.
2. If 0 ohm is not indicated, renew the head light switch.

Resistance (Switch at **LO-BEAM** position)	**B1** terminal – **T** terminal	0 ohm
	B1 terminal – **2** terminal	

12550S90300

(1)-2 Turn Signal Switch

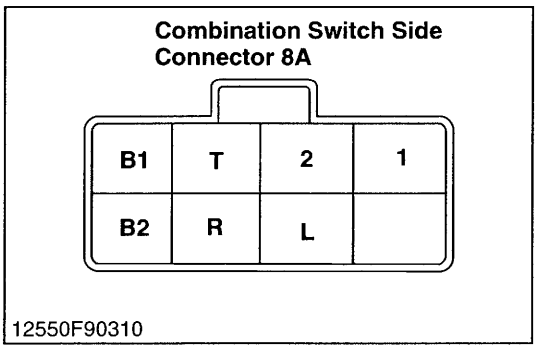


Connector Voltage

1. Disconnect the connector **8A** from combination switch.
2. Measure the voltage with a voltmeter across the connector **B2** terminal and chassis when the main switch is **ON** position.
3. If the voltage differs from the battery voltage, check the wiring harness.

Voltage	Main switch at **ON** position	**B2** terminal – Chassis	Battery voltage

12550S90310

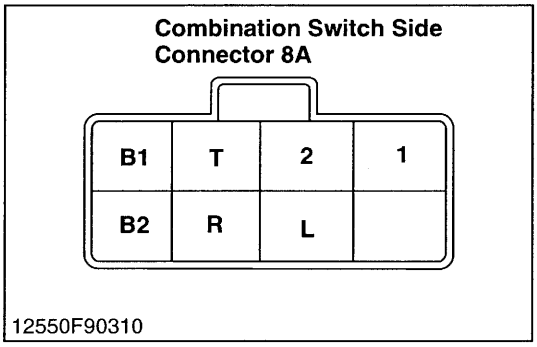


Turn Signal Switch OFF Position

1. Set the hazard switch to the **OFF** position.
2. Measure the resistance with an ohmmeter across the **B2** terminal to the **R** terminal and the **B2** terminal to the **L** terminal.
3. If infinity ohm is not indicated, renew the combination switch.

Resistance (Switch at **OFF** position)	**B2** terminal – **R** terminal	Infinity
	B2 terminal – **L** terminal	

12550S90320

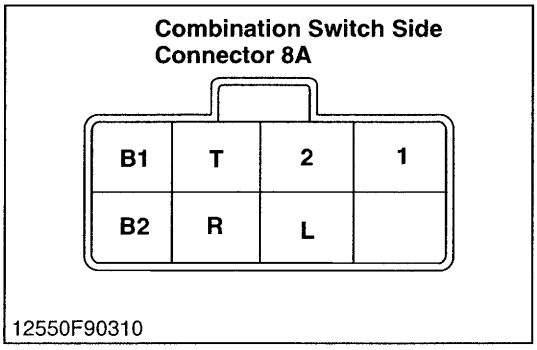


Turn Signal Switch at R Position

1. Set the hazard switch to the **R** position.
2. Measure the resistance with an ohmmeter across the **B2** terminal to the **R** terminal.
3. If 0 ohm is not indicated, renew the combination switch.

Resistance (Switch at **R** position)	**B2** terminal – **R** terminal	0 ohm

12550S90330



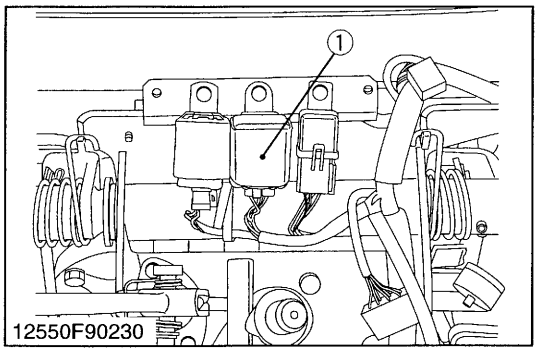
Turn Signal Switch at L Position

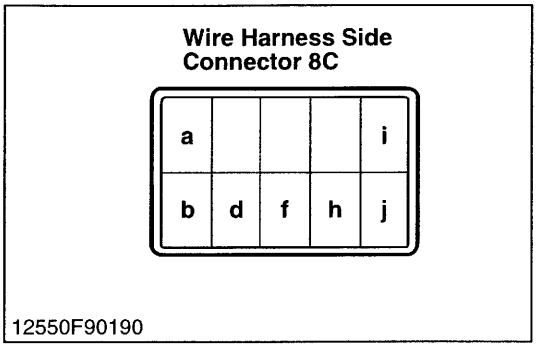
1. Set the hazard switch to the **L** position.
2. Measure the resistance with an ohmmeter across the **B2** terminal to the **L** terminal.
3. If 0 ohm is not indicated, the combination switch is faulty.

Resistance (Switch at **L** position)	**B2** terminal – **L** terminal	0 ohm

12550S90340

(2) Flasher Unit





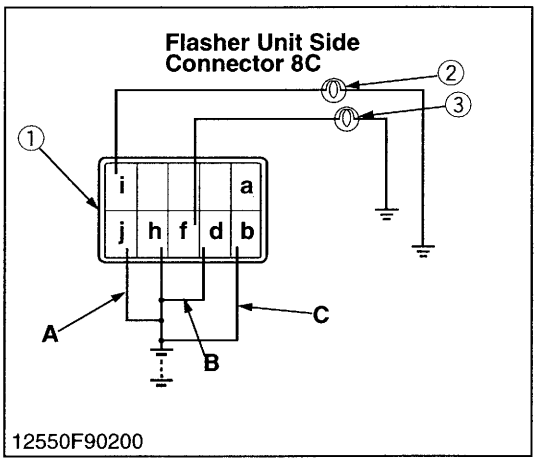
Connector Voltage

1. Disconnect the connector **8C** from hazard unit (1) after turning the main switch **ON** position.
1. Measure the voltage with a voltmeter across the connector **a** terminal and chassis, across **b** terminal and chassis, across **d** terminal and chassis.
2. If the voltage differs from the battery voltage (11 to 14 V) the wiring harness, fuses or main switch is faulty.

Voltage	Turn switch **R** position	**a** – Chassis	Battery voltage
	Turn switch **L** position	**b** – Chassis	
	Hazard switch **ON** position	**d** – Chassis	

(1) Hazard Unit

12550S90350



Flasher Unit Test

1. Remove the flasher unit (1).
2. Connect jumper leads across the hazard unit, bulbs (2), (3) and 12 V battery as shown in the following figure.
3. When the jumper lead **A**, **B** or **C** are connected, the bulb, should flicker by each switch position. When it is disconnected, the bulb, should not flicker
1. If the bulbs does not flicker or off correctly, renew the unit.

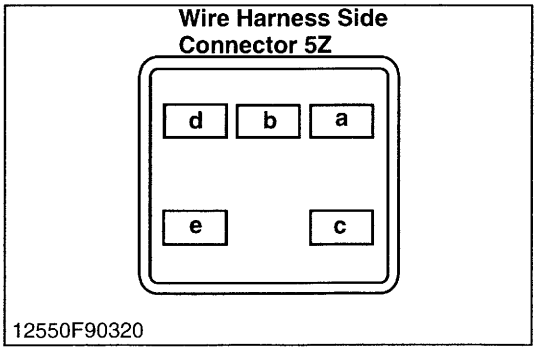
Ampere	Bulb	When jumper lead **A** is connected	Bulb (3) is flicker
		When jumper lead **B** is connected	Bulb (2) is flicker
		When jumper lead **C** is connected	Bulb (2), (3) are flicker

(1) Flasher Unit
(2) Bulb
(3) Bulb

12550S90360

(3) Hazard Switch

(3)-1 ROPS Type

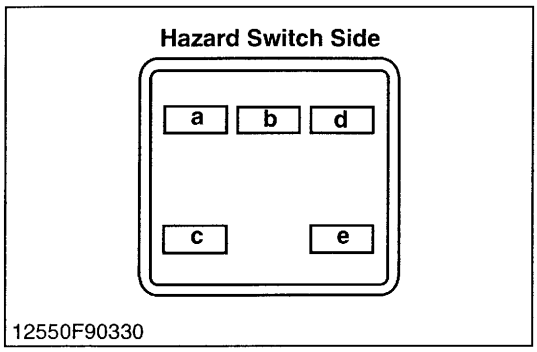


Connector Voltage

1. Connect the battery negative code, then measure the voltage with a voltmeter across the **a** terminal and chassis.
2. If the voltage differ from the battery voltage, the wiring harness is faulty.

Voltage	**a** terminal – Chassis	Approx. battery voltage

12550S90370



12550F90330

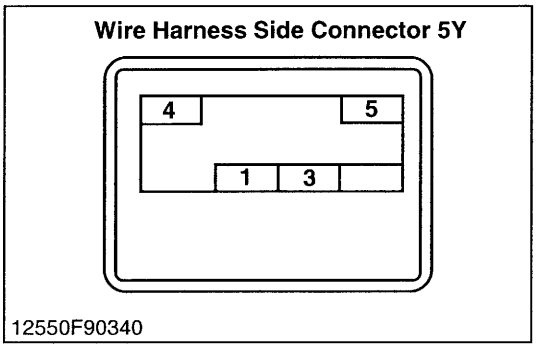
Hazard Switch Continuity

1. Measure the resistance with ohmmeter across the **a** terminal and **c** terminal, and across the **d** terminal and **e** terminal.
2. If the measurement is not following below, the hazard switch or the bulb are faulty.

Resistance (Switch at **OFF**)	**a** terminal – **c** terminal	Infinity
Resistance (Switch at **ON**)	**a** terminal – **c** terminal	0 ohm
Resistance (Bulb)	**d** terminal – **e** terminal	Approx. 13 ohms

12550S90380

(3)-2 CABIN Type



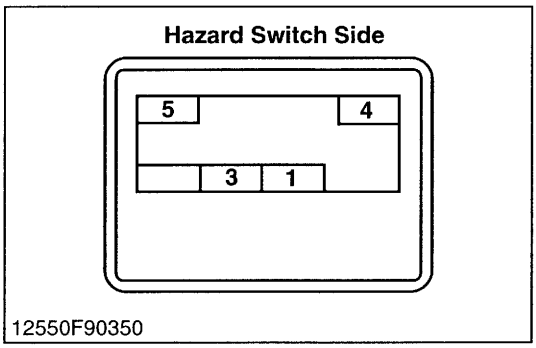
12550F90340

Connector Voltage

1. Disconnect the connector **5Y** from hazard switch.
2. Measure the voltage with a voltmeter across the connector **3** terminal and chassis when the main switch is **OFF** position.
3. If the voltage differs from the battery voltage, check the wiring harness.

Voltage	**3** terminal – Chassis	Approx. battery voltage

12550S90390



12550F90350

Hazard Switch Continuity

1. Measure the resistance with ohmmeter across the **1** terminal and **3** terminal, and across the **4** terminal and **5** terminal.
2. If the measurement is not following below, check the hazard switch or bulb.

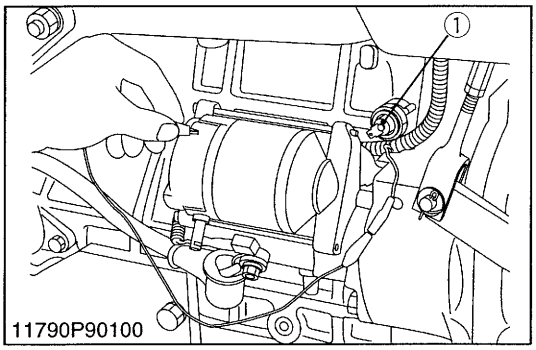
Resistance (Switch **OFF**)	**1** terminal - **3** terminal	Infinity
Resistance (Switch **ON**)	**1** terminal - **3** terminal	0 ohm
Resistance (Bulb)	**4** terminal - **5** terminal	Approx. 13 ohms

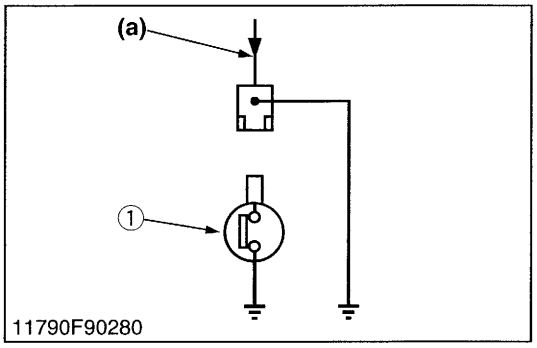
12550S90400

[6] WARNING LAMPS

CHECKING

(1) Engine Oil Pressure



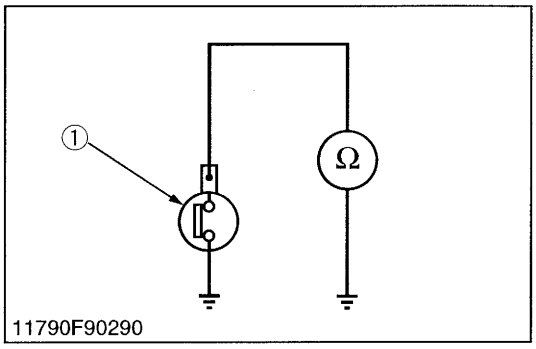


Engine Oil Pressure Switch Panel Board and Wiring Harness

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**

11790S90370



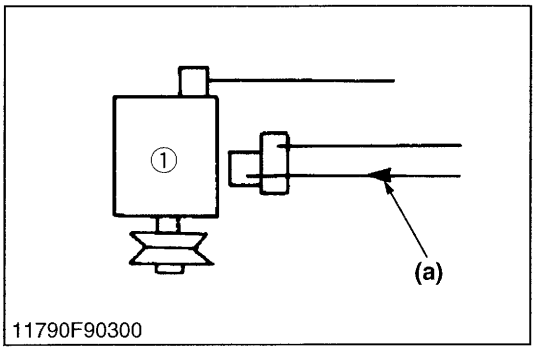
Engine Oil Pressure Switch Continuity

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

11790S90380



Charging Circuit (Panel Board and Wiring Harness)

1. Disconnect the **2P** connector from the alternator after turning the main switch **OFF**.
2. Turn the main switch **ON** and connect a jumper lead from the wiring harness connector terminal (**WR**) to the chassis.
3. If the charge lamp does not light, the panel board circuit, alternator, wiring harness, or fuse is fault.

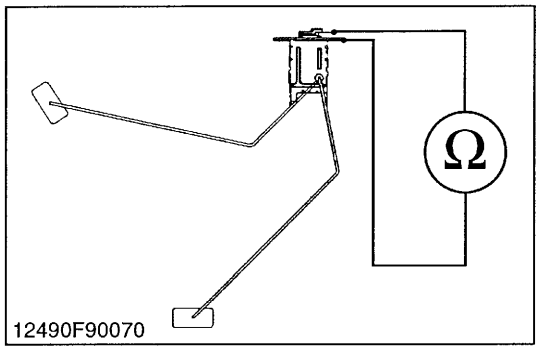
(1) Alternator **(a) From Charge Lamp**

11790S90390

[7] GAUGES

CHECKING

(1) Fuel Level Sensor



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

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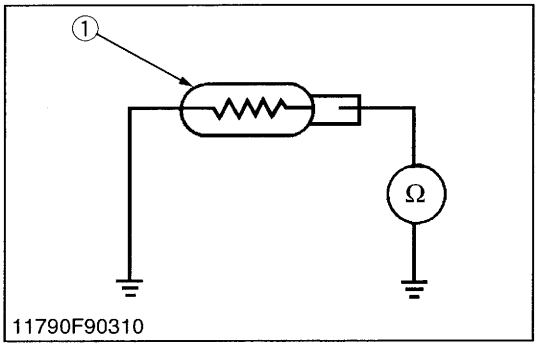
(2) Coolant Temperature Sensor



Coolant Temperature Sensor Continuity

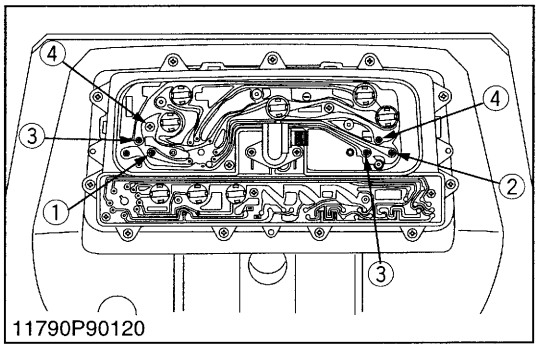
1. Measure the resistance with an ohmmeter across the sensor terminal and the chassis.
2. If the measurement is not indicated, the sensor is faulty.

Resistance (Sensor terminal – Chassis)	Factory spec.	Approx. 16 ohms at 120 °C (248 °F) Approx. 50 ohms at 80 °C (176 °F) Approx. 149 ohms at 50 °C (122 °F)

(1) Coolant Temperature Sensor

11790S90410

(3) Fuel Gauge and Coolant Temperature Gauge



Fuel Gauge and Coolant Temperature Gauge Continuity

1. Remove the panel board from the tractor.
2. Check the continuity with an ohmmeter across the **FU** terminal (2) and **IG** terminal (3) and across the **FU** terminal (2) and **GND** terminal (4).
3. If infinity is indicated, the fuel gauge is faulty.
4. Check the continuity with an ohmmeter across the **TU** terminal (1) and **IG** terminal (3) and across the **TU** terminal (1) and **GND** terminal (4).
5. If infinity is indicated, the coolant temperature gauge is faulty.

(1) **TU** Terminal
(2) **FU** Terminal
(3) **IG** Terminal
(4) **GND** Terminal

11790S90420

10 CABIN

10 CABIN

MECHANISM

CONTENTS

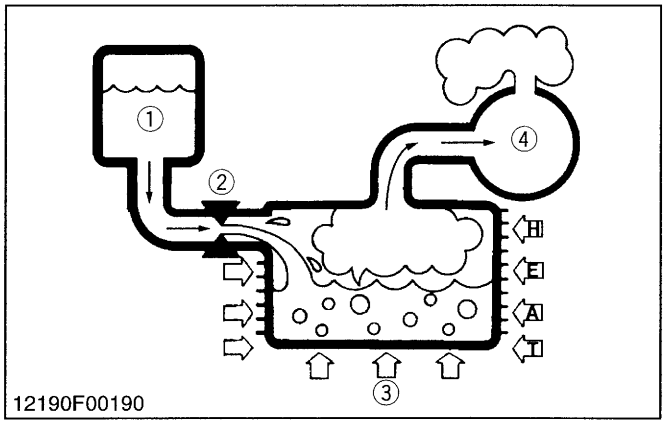
[1] AIR CONDITIONER SYSTEM

The air conditioner system operates using R134a refrigerant.

12190M00060

(1) Principles of Air Conditioner

(1)-1 Expansion and Evaporation



12190F00190

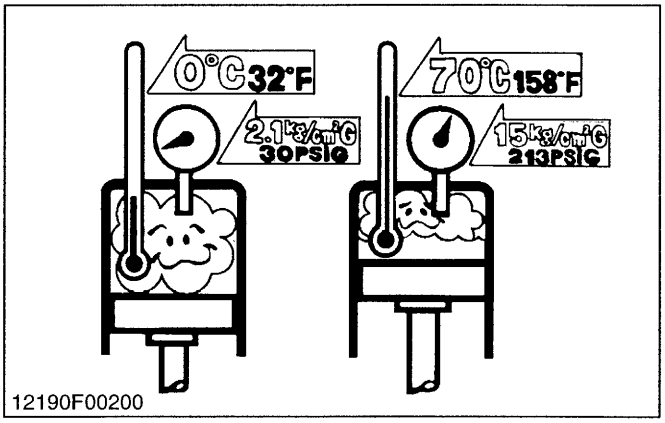
In the mechanical refrigeration system, the cool air is made by the following methods.

1. The high temperature and high pressure liquid refrigerant is stored in the container which is called receiver (1).
2. Then, the liquid refrigerant is released to evaporator (3) through a small hole, called expansion valve (2). At this time, temperature and pressure of the liquid refrigerant are lowered too, and some of the liquid refrigerant is changed to vapor.
3. The low temperature and low pressure refrigerant flows into the container, called evaporator. In the evaporator, the liquid refrigerant evaporates and removes heat from the surrounding air.

(1) Receiver
(2) Expansion Valve
(3) Evaporator
(4) Pump

12190M00070

(1)-2 How to condense Gaseous Refrigerant into Liquid



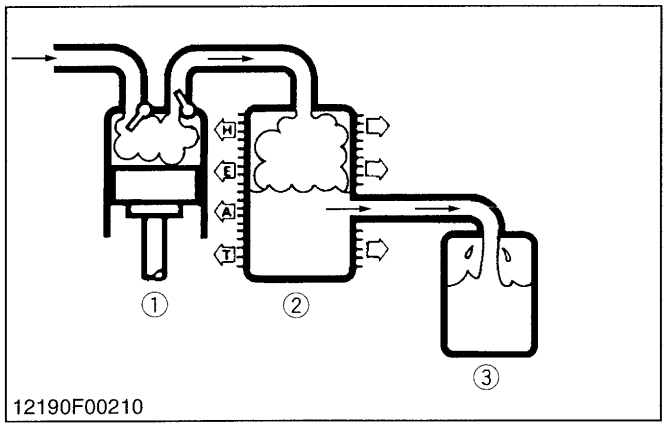
12190F00200

The mechanical refrigerant system changes the refrigerant from the gaseous state to the liquid state while it is passing through the evaporator.

When gas is compressed, both temperature and pressure increase. For example, when gaseous refrigerant is compressed from 0.21 MPa (2.1 kgf/cm^2, 30 psi) to 1.47 MPa (15 kgf/cm^2, 213 psi), temperature of the gaseous refrigerant rises from 0 °C (32 °F) to 70 °C (158 °F). The boiling point of refrigerant at 1.47 MPa (15 kgf/cm^2, 213 psi) is 62 °C (144 °F). So the temperature (70 °C, 158 °F) of compressed gaseous refrigerant is higher than the boiling point (62 °C, 144 °F) and also higher than the surrounding air. Therefore, the gaseous refrigerant can be converted into liquid state, releasing heat until its temperature drops to the boiling point. For example, 1.47 MPa (15 kgf/cm^2, 213 psi), 70 °C (158 °F) gaseous refrigerant can be liquefied by lowering the temperature by approx. 8 °C (46 °F).

12190M00080

(1)-3 Condensing Gaseous



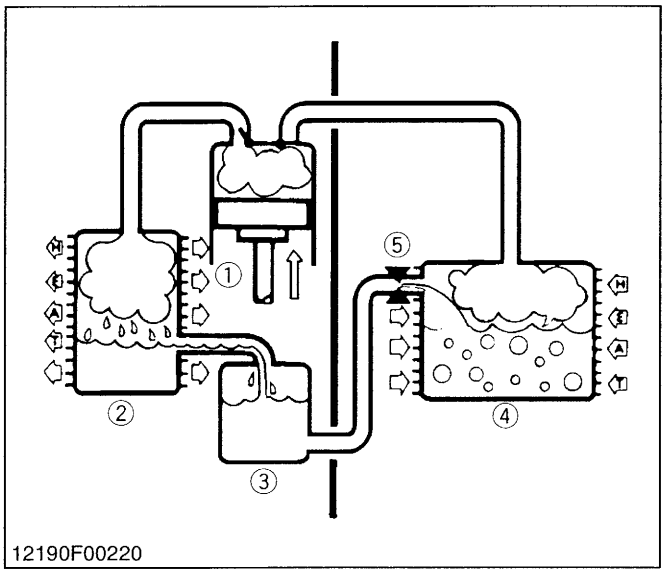
12190F00210

In the mechanical refrigeration system, the liquefaction of refrigerant is achieved by raising the pressure and then by lowering the temperature. The gaseous refrigerant which leaves the evaporator is compressed by the compressor (1). In the condenser (2) the compressed gaseous refrigerant releases heat to the surrounding air and it condenses back into liquid. And then the liquid refrigerant returns to the receiver (3).

(1) Compressor
(2) Condenser
(3) Receiver

12190M00090

(1)-4 Refrigeration Cycle



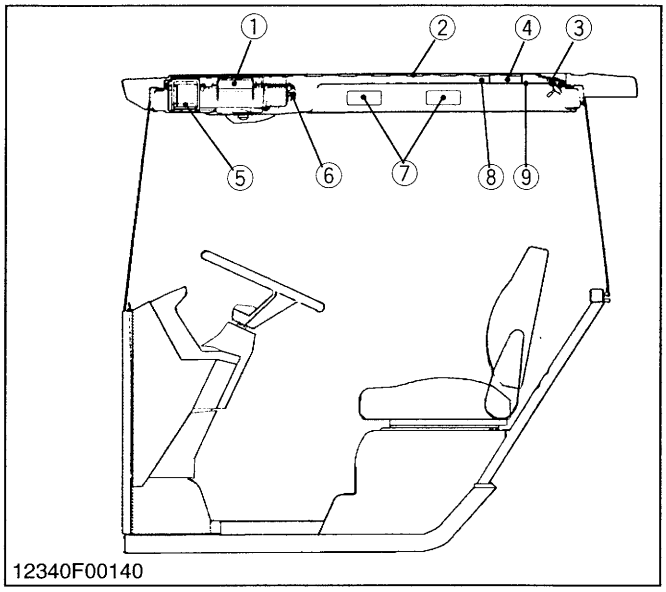
12190F00220

1. The compressor (1) discharges high temperature and high pressure refrigerant that contains the heat absorbed from the evaporator (4) plus the heat created by the compressor in a discharge stroke.
2. This gaseous refrigerant flows into the condenser (2). In the condenser, the gaseous refrigerant condenses into liquid refrigerant.
3. This liquid refrigerant flows into the receiver (3) which stores and filters the liquid refrigerant till the evaporator requires the refrigerant.
4. By the expansion valve (5), the liquid refrigerant changes into low temperature, low pressure liquid and gaseous mixture.
5. This cold and foggy refrigerant flows to evaporator. Vaporizing the liquid in the evaporator, the heat from the warm air steam passing through the evaporator core is transferred to the refrigerant.
   All the liquid will change into gaseous refrigerant in the evaporator and only heat-laden gaseous refrigerant is drawn into the compressor. Then the process is repeated again.

(1) Compressor
(2) Condenser
(3) Receiver
(4) Evaporator
(5) Expansion Valve

12190M00100

(2) Outline of Aie Conditioning System



12340F00140

The machine is equipped with a thin large-capacity air conditioner with outside air intake. Through the inside air filter (9) as well as the outside air filter (4), the air flows along between the outer roof (2) and the inner roof (8) and reaches the air conditioner unit (1). The air is then cooled and dehumidified by this unit.

The resulting air is heated to a comfortable level. In this way, the air being blown via the blow port can be kept at comfortable temperature and humidity.

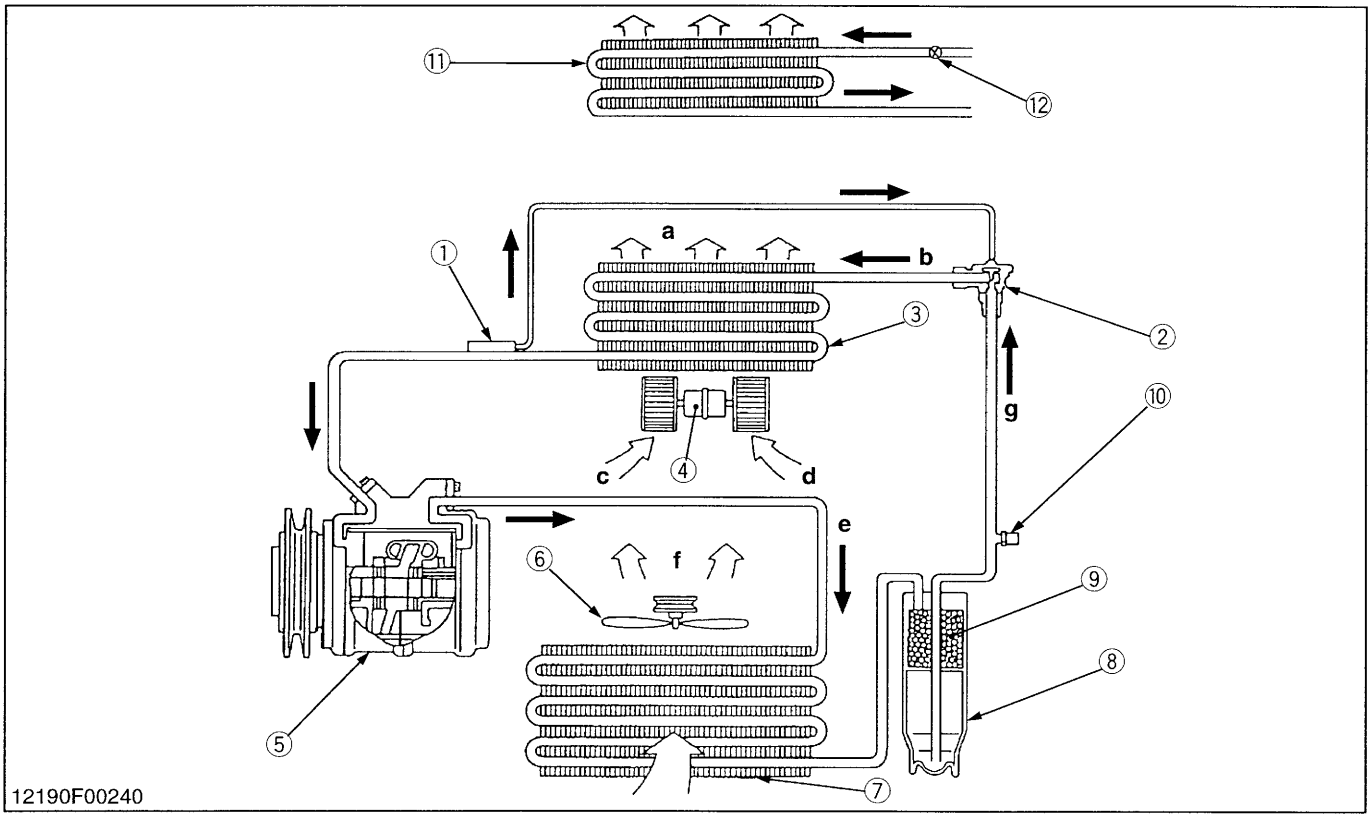
The 3 front blow ports (5) can be opened and closed using the center knob of each port. The 4 side blow ports (7) are opened and closed using the mode lever on the control panel (6). With these ports open or closed, you can feel your head cool and your feet warm.

Capcaity (Cooling)	Factory spec.	2.44 kw
Capacity (Warming)	Factory spec.	3.84 kw
Kinds of refrigerant (Charge amount)	Factory spec.	R134a 0.9 to 1.0 kg 1.98 to 2.21 lbs.
Pressure sensor (Low)	Factory spec.	0.196 MPa 2.0 kgf/cm^2 28.4 psi
Pressure sensor (High)	Factory spec.	3.14 MPa 32.0 kgf/cm^2 455 psi

(1) Air Conditioner Unit
(2) Outer Roof
(3) Inside/Outside Air Selection Damper
(4) Outside Air Filter
(5) Front Blow Port
(6) Control Panel
(7) Side Blow Port
(8) Inner Roof
(9) Inside Air Filter

12340M00060

(3) Refrigeration System



(1) Heat Sensitizing Tube
(2) Expansion valve
(3) Evaporator
(4) Blower Motor
(5) Compressor
(6) Engine Cooling Fan
(7) Condenser
(8) Receiver
(9) Desiccant
(10) Pressure Switch
(11) Heater Core
(12) Water Valve
(a) Cold Air
(b) Low Pressure, Low Temperature Mist
(c) Cabin Interior Air
(d) Cabin Interior Air
(e) High Pressure, High Temperature Gas
(f) Hot Air
(g) Liquid

The refrigerant cycle of air conditioning system is as follows.

1. The gaseous refrigerant evaporated through the evaporator (3) is compressed in the compressor (5) to approx. 1.47 MPa (15 kgf/cm^2, 213 psi) and is also raised in temperature to approx. 70 °C (158 °F) and delivered to the condenser (7).
2. The gaseous refrigerant is cooled down through the condenser (7) to approx. 50 °C (122 °F) and delivered to the receiver (8) in the liquid state.
   At this time, heat removed from the cabin interior is extracted by means of the condenser (7).
3. The liquid refrigerant is collected in the receiver (8) for a certain period. At this time moisture are removed from the refrigerant by desiccant (9).
4. The liquid refrigerant after removing moisture and dust is jetted out of the small hole of the expansion valve (2) into the evaporator (3) as if it were distributed by an atomizer. Thus, the refrigerant is reduced in both pressure and temperature, and becomes easy to evaporate.
5. The refrigerant evaporates at 0 °C (32 °F) vigorously, taking heat from the surface of the pipes in the evaporator (3).
6. At this time, warm air in a cabin is drawn into the evaporator (3) by the blower motor and is passed over those pipes, transferring its heat to the refrigerant for evaporation. The air thus cooled is distributed to the cabin. (That is heat in a cabin is taken by the evaporator.)

(Reference)

- Since warm air in a cabin is cooled suddenly, water in the air is liquefied and removed, which means dehumidification is also performed.

7. The gaseous refrigerant from the evaporator (3) after having performed the cooling action is returned to the compressor (5), and is compressed to liquefy it (high pressure and high temperature). This cycle is repeated.
8. The air coming from the evaporator is fed to the air mixing doors, by which part of the air is introduced into the heater core (11). In doing so, the air temperature can be adjusted to a comfortable level. The air mixing doors are controlled through the cable connected with the control panel.

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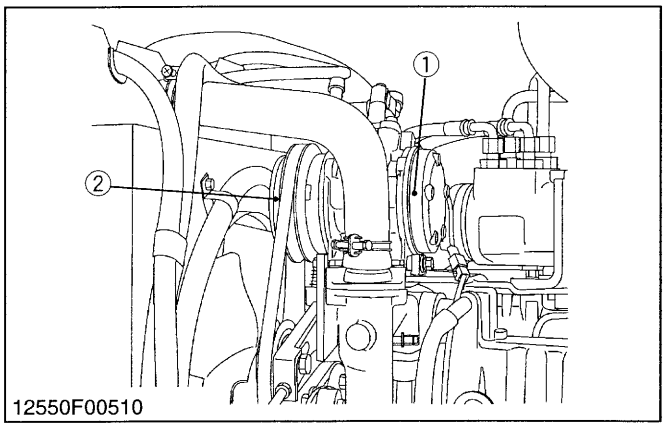
(3)-1 Compressor



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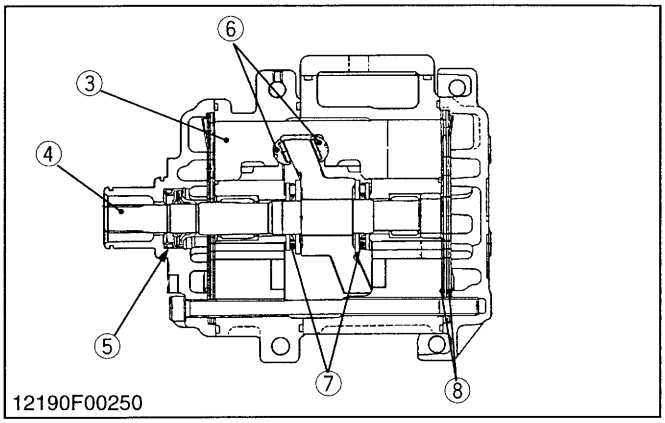

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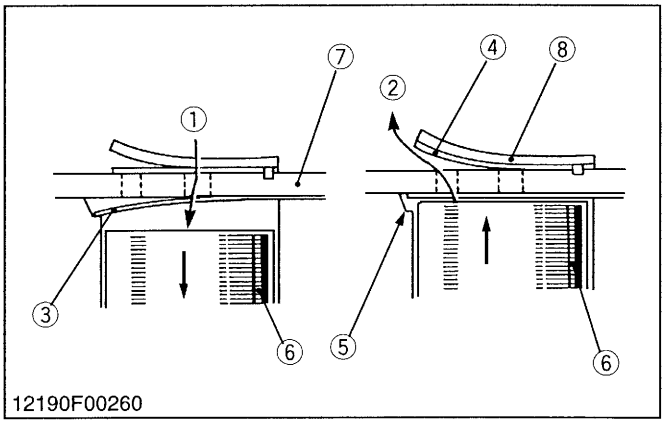

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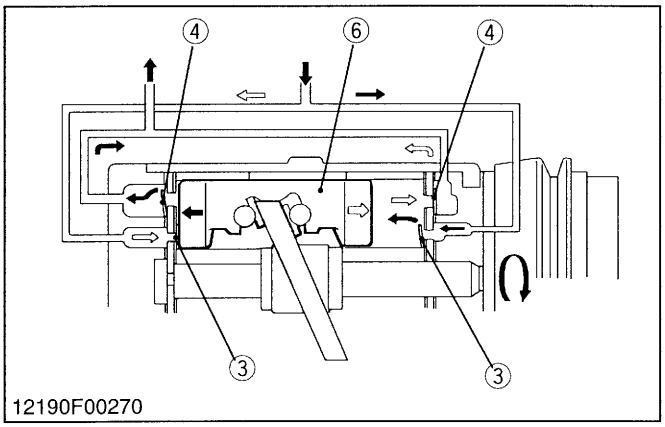

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The compressor (1) is installed to on the engine and is driven by crank pulley through a belt.

The compressor is a pump designed to raise the pressure of refrigerant. Raising the pressure means raising the temperature. High temperature refrigerant vapor will condense rapidly in the condenser by releasing heat to the surrounding.

Compressors are roughly classified into two types; reciprocating type and swash plate type. This air conditioner system adopts swash plate type compressor.

■ Swash Plate Type Compressor

A number of paired piston at set on the swash plate in an interval of 72 degrees for 10 cylinders compressor. When one side of a piston is in a compression stroke, the other is in a suction stroke.

(1) Compressor
(2) Magnetic Clutch
(3) Piston
(4) Shaft
(5) Shaft Seal
(6) Ceramic Shoe
(7) Thrust Bearing
(8) Suction and Discharge Valve

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When the pressure inside piston becomes negative as the piston is lowered, the low pressure gas flows through the suction hole of the valve plate (7) to force down the suction valve (3), thereby sending refrigerant into each cylinder. The deflecting width of the suction valve (3) is determined by the notch in the cylinder (suction valve stopper) (5). When the piston goes into the compression stroke and the pressure exceeds that of high pressure side, the discharge valve (4) is pushed up to send out the high pressure gas from the compressor.

After the compression stroke is completed and the piston goes into the suction stroke, the high pressure gas on the discharge side holds the discharge valve to prevent the back flow of the gas from the high pressure side. In this way, the difference of high and low pressure can be maintained inside of the compressor.

The **R** type compressor has 5 pairs (10 cylinders) of pistons secured to the swash plate which is secured diagonally on the shaft. As the shaft rotates, the piston (6) reciprocates in the same direction as the shaft. Cylinders are arranged respectively on both sides of a pair of pistons and when the cylinder on one side is in compression stroke, the cylinder on the other side goes into suction stroke.

(1) Suction
(2) Discharge
(3) SuctionValve
(4) Discharge Valve
(5) Notch
(6) Piston
(7) Valve Plate
(8) Retainer

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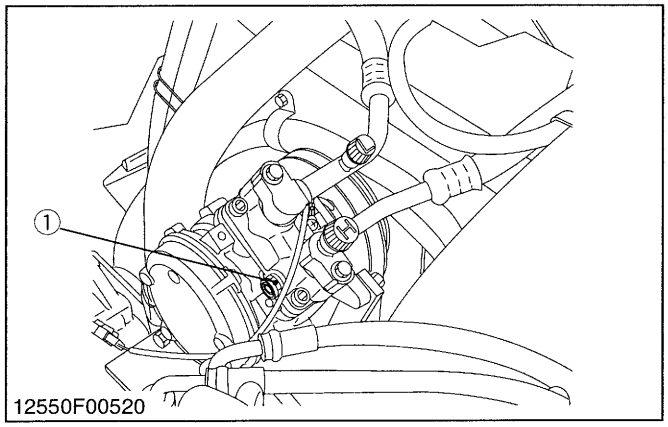

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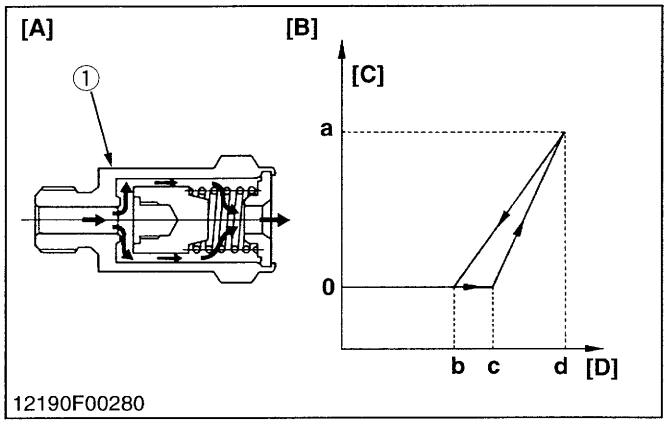

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If the high pressure is abnormally high, the pressure relief valve open, and the refrigerant is released into the atmosphere, and the system is maintained. At the time, all of the refrigerant in the system is released into the atmosphere.

Even in the worst case, the outflow of refrigerant is stopped at the minimum limit.

(Reference)

- In normal operation, the high pressure switch is triggered first and the compressor stops, so the pressure relief valve is not triggered so easily.

(1) Pressure Relief Valve
(A) Gas Ejection Route When Operating
(a) 113 (L/min.)
(B) Operaton Characteristic
(b) 2.76 MPa, 28.1 kgf/cm^2, 399.7 psi
(c) 3.43 MPa, 35.0 kgf/cm^2, 497.8 psi
(C) Leakage Quantity
(d) 4.14 MPa, 42.4 kgf/cm^2, 603.1 psi
(D) Pressure

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■ Compressor Oil

The compressor oil dissolves in the refrigerant, circulates through the air-conditioning cycle, and functions to lubricate the compressor. But the conventional compressor oil for R12 doesn't dissolve in R134a, so it doesn't circulate through the cycle, and the lifespan of the compressor is considerably shortened.

It is still essential to ensure that the correct refrigerant oil is used. R12 systems were lubricated with mineral oil, which is totally unsuitable for R134a systems. The letter require PAG oil, which mixes very well with the refrigerant and provides ideal lubrication throughout the system.

Quality (Total)	Brand Name
200 cm^3 12.2 cu.in.	ND-OIL 8 <PAG* oil>

*PAG : Polyalkyleneglycol (Synthetic oil)

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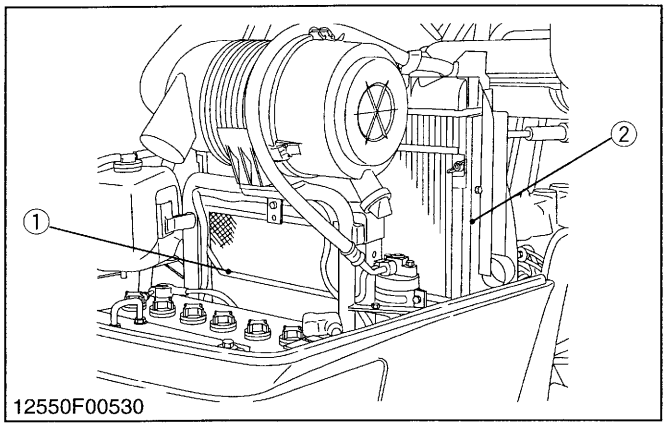
(3)-2 Condenser



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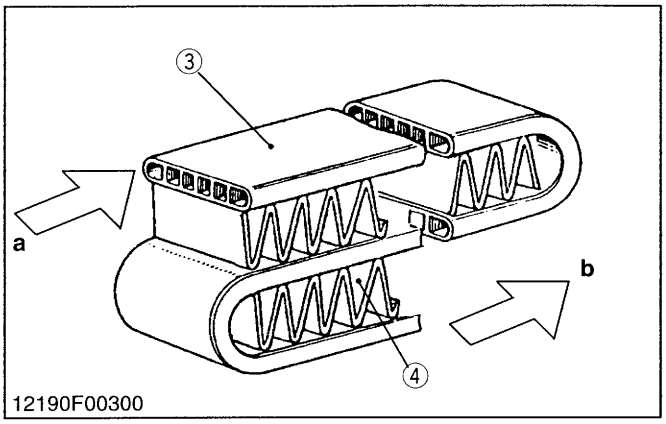

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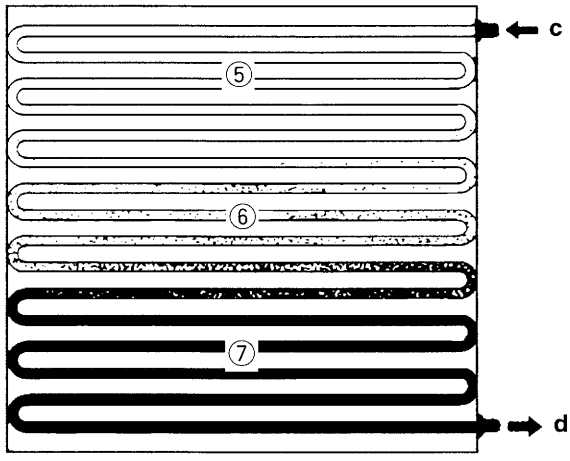
The condenser (1) is installed to the front of radiator (2) to enable forcible cooling by the air drawn in by the engine radiator fan.

The condenser is used for the purpose of cooling and robbing the heat from the refrigerant gas, which has been compressed by the compressor into high temperature, high pressure gas, so as to change this gas into liquid refrigerant.

The heat given off by the gaseous refrigerant in the condenser is the sum of the heat absorbed at the evaporator and the heat of work required by the compressor to compress the refrigerant. The greater the amount of heat give off in the condenser, the greater will be the cooling effect attainable by the evaporator.

(1) Condenser
(2) Radiator
(3) Tube
(4) Fin
(5) Vapor
(6) Liquefying
(7) Liquefied

(a) Gaseous Refrigerant
(b) Liquid Refrigerant
(c) Heated Vapor from Compressor (70 °C, 158 °F)
(d) Cooled Liquid to Receiver



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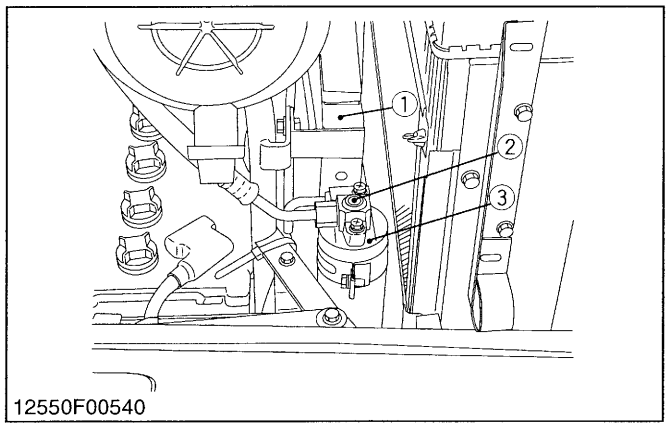
(3)-3 Receiver



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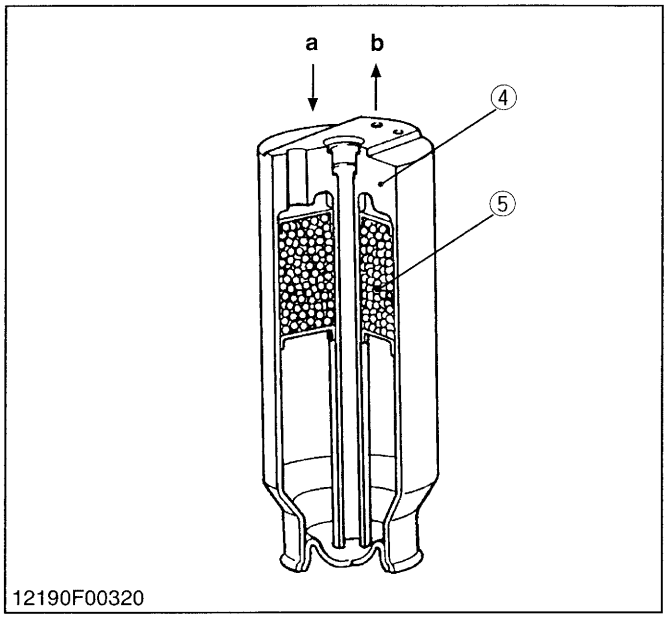

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The receiver (3) serves the purpose of storing the liquid refrigerant. The amount of the liquid refrigerant flowing through the system varies with the operating condition of the air conditioner. To be accurate, the receiver stores excess amount of refrigerant when the heat load is lowered. It also releases stored refrigerant when additional cooling is needed, thus, maintaining the optimum flow of refrigerant within the system.

The receiver includes a desiccant (5). It has the job of removing moisture as the refrigerant circulates within the system.

The sight glass (2) is installed on the top of receiver. Amount of refrigerant to be charged is very important for the efficiency of air conditioner. The sight glass is used to check the amount of refrigerant. If large flow of bubbles can be seen in the sight glass, there is insufficient refrigerant charged. If so, replenish the refrigerant to the proper level.

(1) Condenser
(2) Sight Glass
(3) Receiver
(4) Receiver Body
(5) Desiccant

(a) IN
(b) OUT

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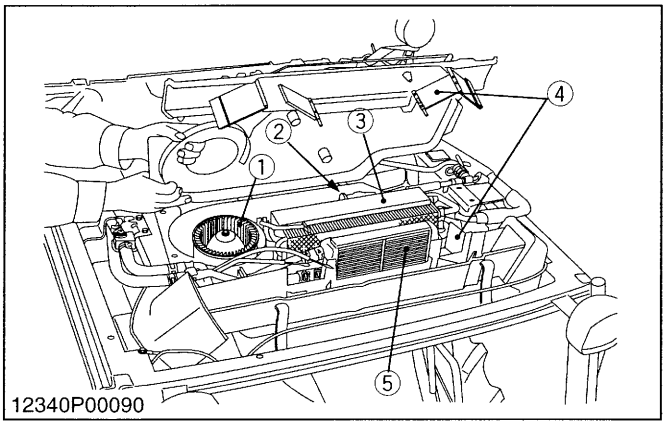
(3)-4 Air Conditioner Unit



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Air conditioner unit (5) consists of evaporator (3), expansion valve (2), heater core (5), blower (1), etc.

(1) Blower
(2) Expansion Valve
(3) Evaporator
(4) Air Conditioner Unit
(5) Heater Core

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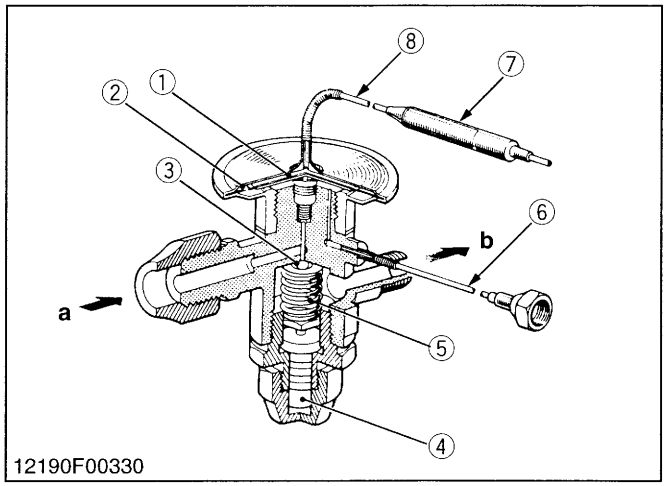

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■ Expansion Valve

The expansion valve restricts the flow of liquid refrigerant as it passes through the expansion valve and delivers sprayed refrigerant to the evaporator for facilitating refrigerant evaporation.

The cabin interior will not be cooled sufficiently if the expansion valve outlet is too small. If it is too wide, frost will be produced on the evaporator, decreasing cooling efficiency. Thus the size of this small spray hole has to be controlled according to various conditions.

(1) Diaphragm Chamber
(2) Diaphragm
(3) Needle Valve
(4) Adjusting Screw
(5) Pressure spring
(6) Tube
(7) Heat Sensitizing Tube
(8) Capillary Tube

(a) From Receiver
(b) To Evaporator
(c) From Evaporator
(d) To Compressor

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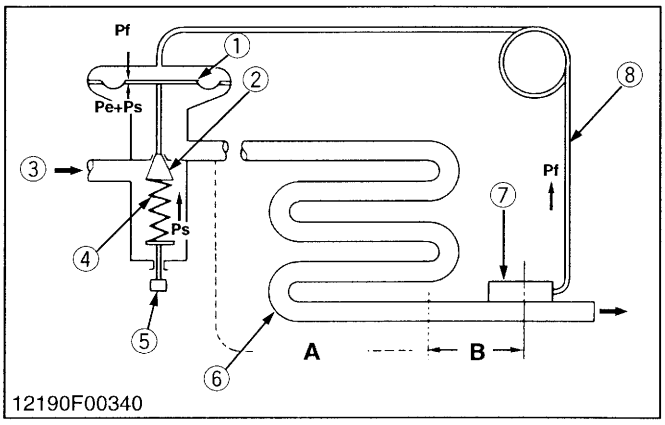

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When the vapor pressure of the operating system is stable, **Pf = Pe + Ps** condition will prevail. The needle valve opening at this time will be stationary and constant refrigerant flow will be maintained.

In the evaporator installing expansion valve, the refrigerant in the outlet is always in superheated vapor form for a certain length (part **B** in the figure). If the cooling load increases (inlet air temperature of evaporator becomes high), the refrigerant will vaporize faster and cause the length of the superheated vapor part L to become longer. Thus, the pressure in the heat sensitizing tube (7) rises and increases the needle valve opening, resulting in larger flow of the refrigerant into evaporator. Conversely, if the amount of refrigerant in the evaporator becomes greater, the length of the superheated vapor part **L** will become shorter. The pressure in the heat sensitizing tube will drop and decrease the needle valve (2) opening.

(1) Diaphragm
(2) Needle Valve
(3) Refrigerant Inlet
(4) Spring
(5) Adjusting Screw
(6) Evaporator Tube
(7) Heat Sensitizing Tube
(8) Capillary Tube

(A) Saturated Vapor Part
(B) Superheated Vapor Part L
Pf : Gas pressure in sensitizing tube
Ps : Spring pressure
Pe : Vapor pressure in evaporator

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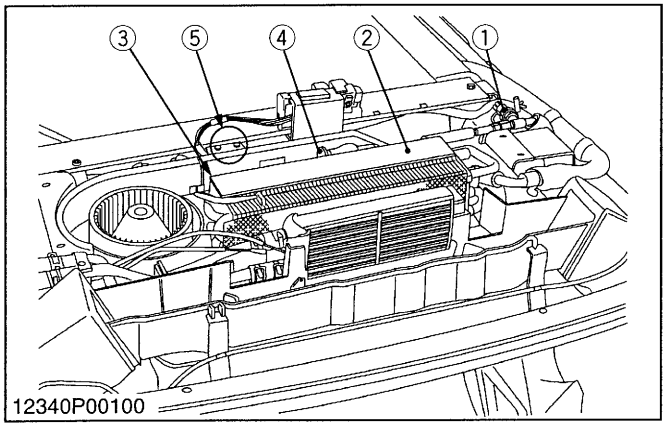

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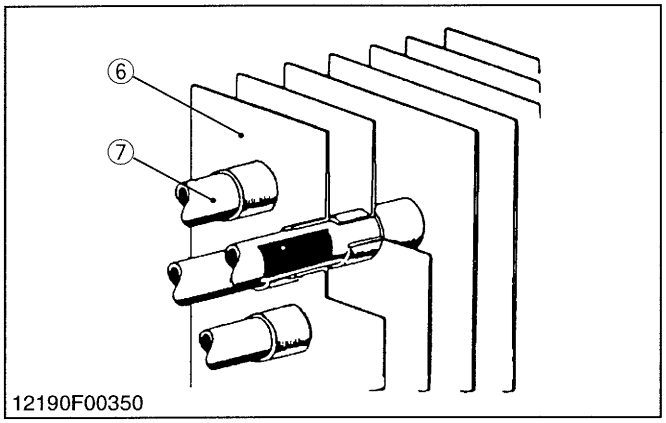

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■ Evaporator

The purpose of evaporator (2) is just opposite to that of the condenser. The state of refrigerant immediately after the expansion valve (3) is 100 % liquid. As soon as the liquid pressure drips, it starts to boil, and in doing so, absorbs heat. This heat is removed from the air passing over the cooling fins of the evaporator and causes the air to cool.

If too much refrigerant is sent into the evaporator, it will not boil away so easily. Also, the evaporator filled with liquid refrigerant eliminates a place for the refrigerant to properly vaporize, which is necessary in order to take on heat. A flooding condition of the evaporator will allow an excess of liquid refrigerant to leave the evaporator and may cause serious damage to the compressor.

If too little refrigerant is sent into the evaporator, again the evaporator will not cool because the refrigerant will vaporize, or boil off, long before it passes through the evaporator.

Refrigerant properly metered into the evaporator should allow for 100 % liquid just after the expansion valve, and 100 % gas at the outlet.

(1) Pressure Switch
(2) Evaporator
(3) Capillary Tube
(4) Expansion Valve
(5) Thremostat
(6) Fin
(7) Tube

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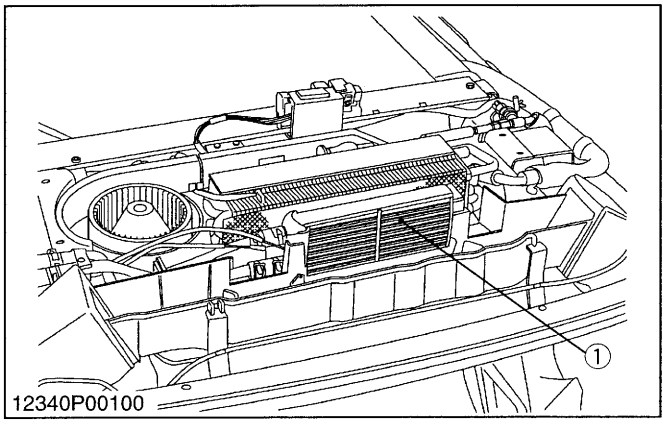


12340P00100

■ Heater Core

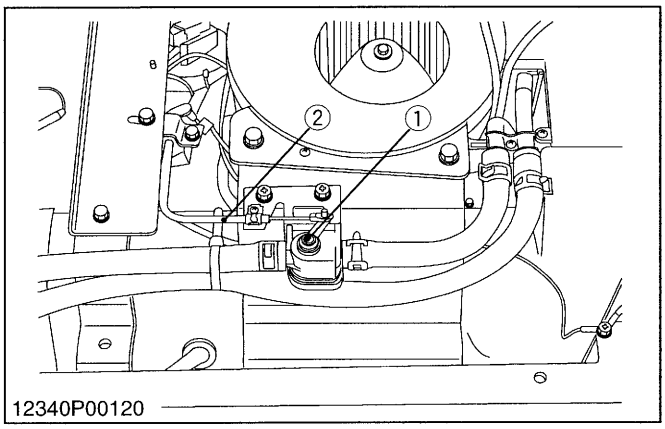
The heater-sauce of heater utilizes cooling water which becomes high temperature by heat of engine.

The inlet port of heater core is connected to the delivery side of engine water pump by a rubber hose, and the water valve is installed on the inlet port of heater core. Also, the outlet port of heater core is connected to the engine cylinder block.

The heater core is one of the heat exchangers like evaporator or condenser, and heat is exchanged between heated cooling water passing through the core and air in the cabin or fresh outdoor air. Thus, air is heated.

(1) Heater Core

12340M00100



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■ Water Valve

The hot water valve (1) is connected with the hot water valve cable (2) and controlled with the temperature control lever on the control panel. This lever is used to adjust the flow rate of hot water going into the heater.

Set the temperature control lever to the **COOL** position and the hot water valve gets closed, allowing no hot water flow. The hot water valve is built in at the right-hand top of the center pillar.

(1) Hot Water Valve
(2) Hot Water Valve Cable

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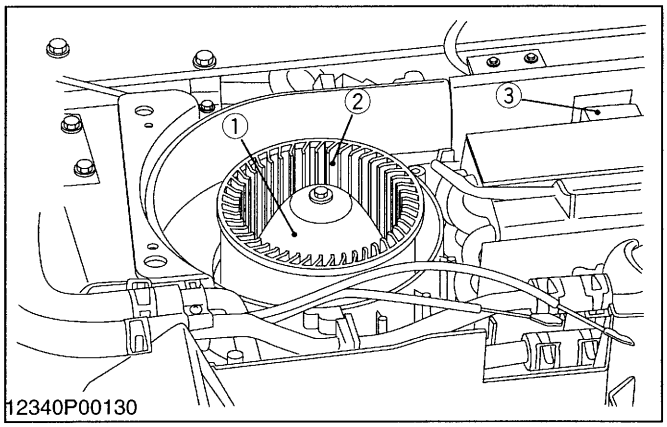

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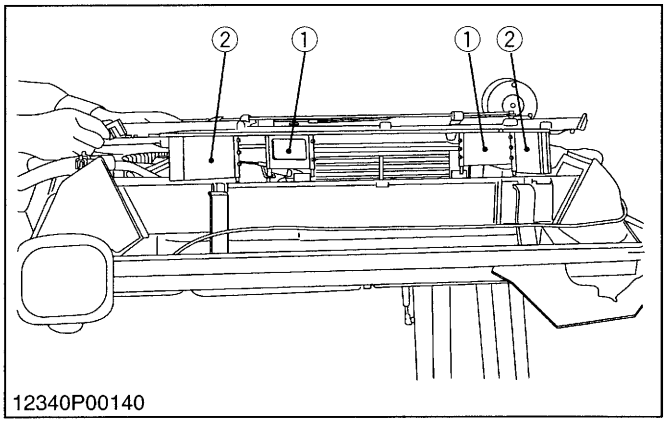

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■ Refrigerant R134a

■ A/C Blower

The blower is incorporated in the right-hand space of the air conditioner unit. It blows cool, warm or fresh air via the front and side blow ports into the cabin.

The speed of the blower motor (1) can be adjusted in 3 steps by the resistor (3).

The blower fan (2) is centrifugal type. The air being sucked in parallel with the rotary shaft is blown in the centrifugal direction; in other words, perpendicular to the rotary shaft.

(1) Blower Motor
(2) Blower Fan
(3) Resistor

12550M00070

■ A/C Blower

The blower is incorporated in the right-hand space of the air conditioner unit. It blows cool, warm or fresh air via the front and side blow ports into the cabin.

The speed of the blower motor (1) can be adjusted in 3 steps by the resistor (2).

The blower fan (3) is centrifugal type. The air being sucked in parallel with the rotary shaft is blown in the centrifugal direction; in other words, perpendicular to the rotary shaft.

(1) Blower Motor
(2) Resistor
(3) Blower Fan

12340M00240

■ IMPORTANT

- **The air conditioning system operates using R134a refrigerant. This substance does not contain any chlorine atoms, so it does not have a detrimental effect on the ozone in the Earth's atmosphere.**
- **Even so, the refrigerant must never be discharged straight into the air. It must be trapped in a recycling machine.**
  Refrigerant stored in a recycling unit may be re-used at any time.
- **The recycling machine used to do this must be of a type suitable for handling R134a refrigerant.**
- **R134a has a corrosive effect on copper as well as various seals and components used in the R12 system. For this reasen, never use R134a refrigerant in a system that has previously used R12. Before replacing any component, it is vital to check whether it is compatible with the type of refrigerant used.**

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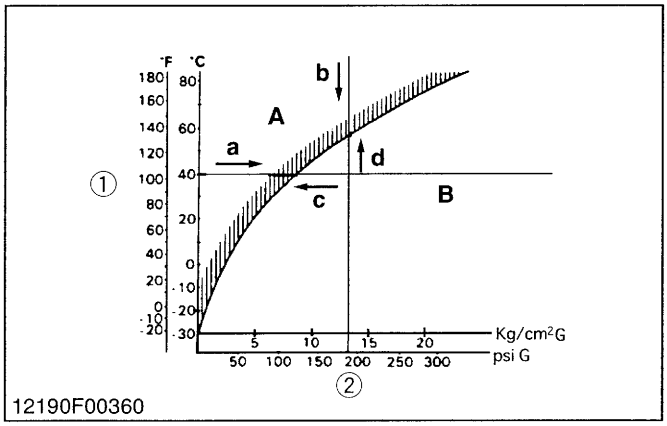

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■ Refrigerant Properties

Water boils at 100 °C (212 °F) under atmospheric pressure, but R134a boils at – 26.5 °C (– 15.7 °F) and its freezing point is – 101 °C (–149.8 °F) below zero under atmospheric pressure.

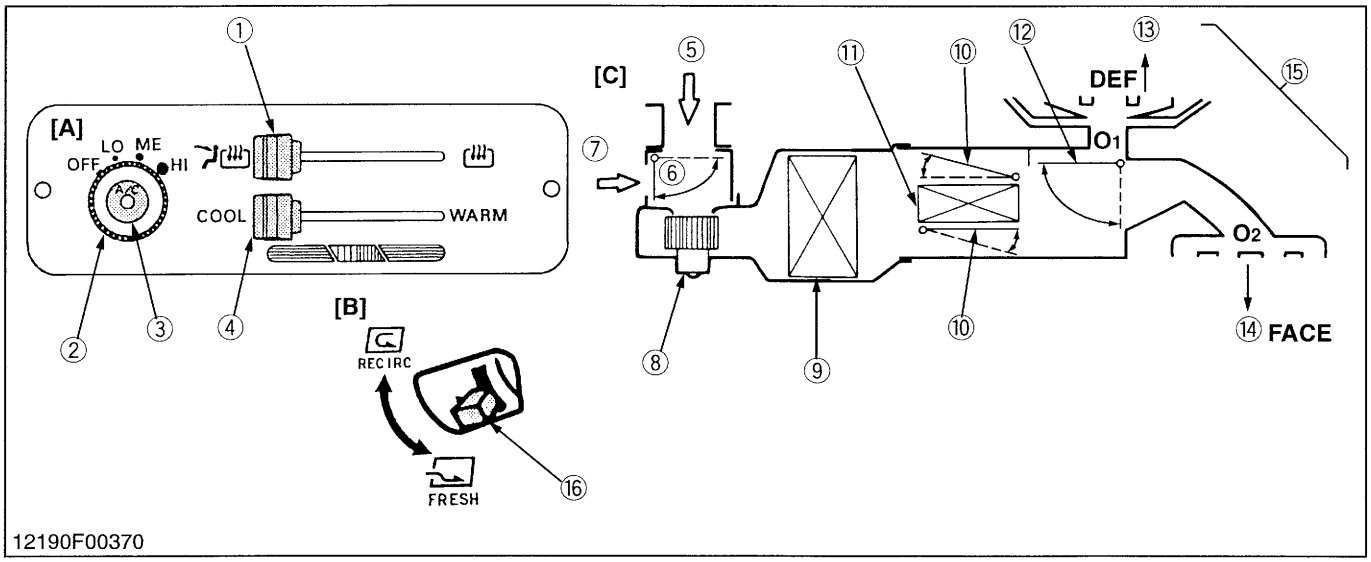
If R134a were exposed and released to the air under normal room temperature and atmospheric pressure, it would absorb the heat from the surrounding air and boil immediately changing into gas. Also R134a is easily condensed back into liquid under the pressurized condition by removing heat from it.

The characteristic curve of R134a which expresses the relation between the temperature and pressure is shown in the figure left. The graph itself indicates the boiling point of R134a under each temperature and pressure. On the graph, the upper portion above the curve is gaseous state of R134a and the lower portion below the curve is liquid state of R134a. The gaseous refrigerant can be converted into the liquid refrigerant by raising the pressure without changing the temperature or decreasing the temperature without changing the pressure. (See (a) and (b) in the figure.) Conversely, the liquid refrigerant can be converted in to the gaseous refrigerant by lowering the pressure without changing the temperature, or by raising the temperature without changing the pressure. (See **(c)** and **(d)**.)

(1) Temperature
(2) Gauge Pressure
(A) GAS
(B) LIQUID

12190M00290

(4) System Control



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(1) Air Mode Lever
(2) Blower Switch
(3) Air Conditioner Switch
(4) Temperature Control Lever
(5) Fresh Air
(6) Air Intake Door **D1**
(7) Recirculated Air
(8) Blower
(9) Evaporator
(10) Temperature Door **D2** (Air Mixed Door)
(11) Heater
(12) Air Outlet Door **D3** (Mode Door)
(13) DEF
(14) FACE
(15) **DEF** and **FACE**
(16) Air Selection Lever

(A) Control Plate
(B) Air Selection Lever
(C) Block Diagram of Air Flow Passage

1) Selection of recirculated air (7) or fresh air (5) is done with door D1 (6).

■ **RECIRC**
By setting the air selection lever (16) in rear control panel to **RECIRC** position, door **D1** (6) shuts the flesh air inlet port (5). Air inside the cabin is recirculated.

■ **FRESH**
By moving the air selection lever (16) to **FRESH** position, door **D1** (6) opens the flesh air inlet port (5). Outside air comes into cabin.

2) Temperature control of outlet air is done with door D2.

■ **COOL**
By setting the temperature control lever (4) in control panel to **COOL** position, door **D2** (10) is moved to close water valve. The air flows to door **D3** (12) side without passing the heater core.

■ **WARM**
By moving the temperature lever to **WARM** position door **D2** (10) is moved to open water valve. The air flows to door **D3** (12) side passing through the heater core.

3) Outlet fir flow is controlled by door D3 (12).
Moving the air mode lever (1) opens and shuts door **D3** (12) and establishes the air passage according to the lever position.

■ **DEF + FACE**
By moving the mode lever to **DEF + FACE** position, the door **D3** (12) is moved to establish the air passages to outlets **O1** and **O2**. Air comes out from both outlets.

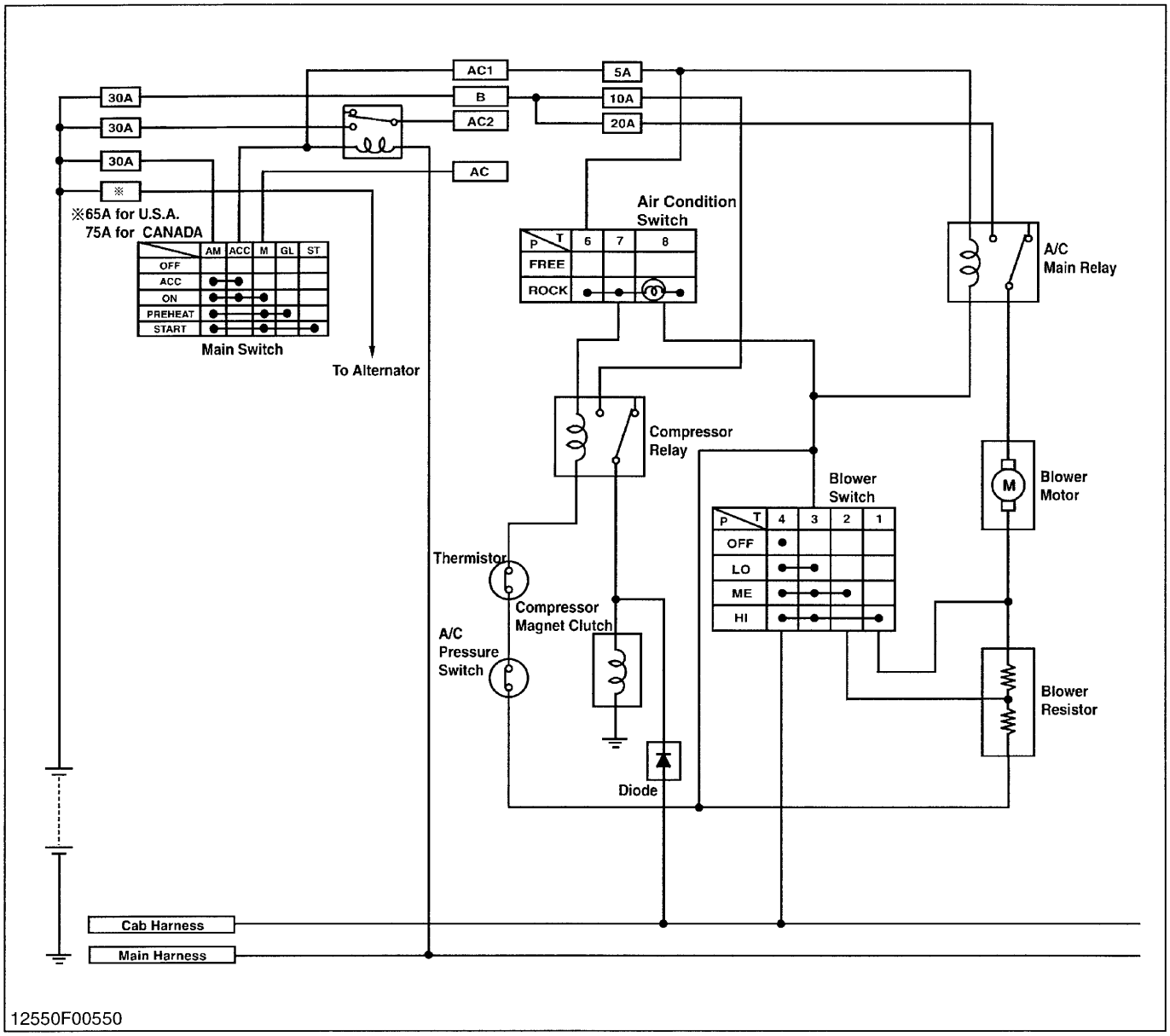
■ **DEF**
Moving the mode lever to **DEF** position, door **D3** (12) is moved to set up the air passage to outlet **O1**. Air comes out from outlet **O1**.

O1 : Front air outlet
O2 : Side air outlet

12550M00050

(5) Electrical System

(5)-1 Electrical Circuit



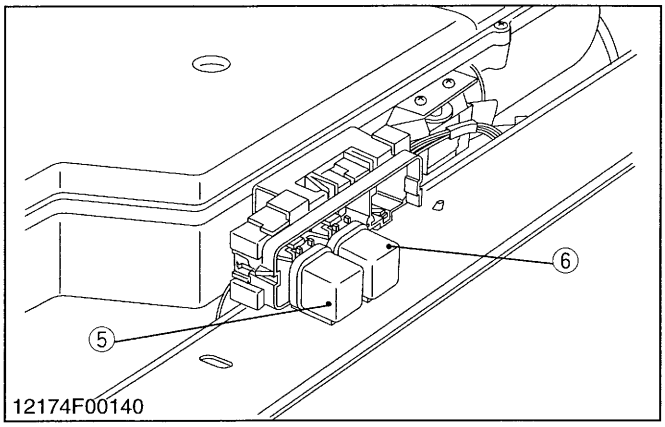
12550F00550

The process of magnet clutch being engaged is shown below.

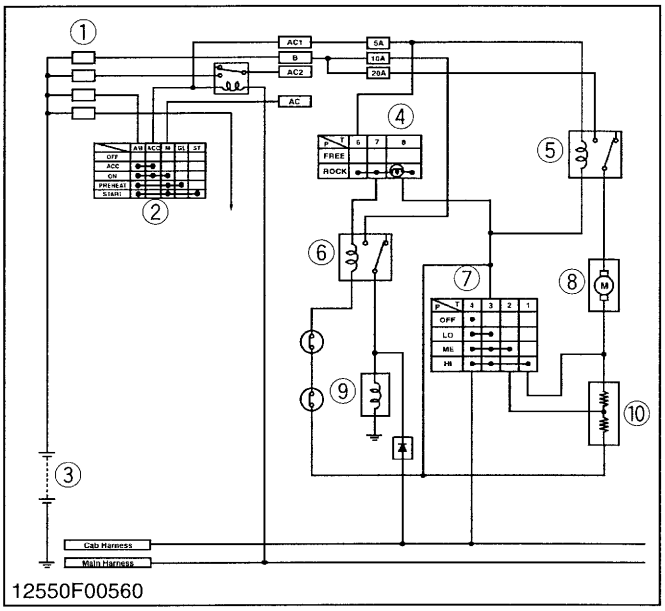
Main Switch **ON** → A/C Switch **ON** → Blower Switch **ON** (Low, Medium or High) → Compressor Relay **ON** → Thermostat **ON** (the thermostat temperature is more than 4 ˚C (39.2 ˚F)) → Pressure Switch **ON** (if refrigerant pressure is between 0.21 MPa (2.1 kgf/cm^2, 30 psi) and 265 MPa (27 kgf/cm^2, 384 psi) → Magnet Clutch of Compressor Engaged.

12550M00080

(5)-2 Air Conditioner Main Relay and Compressor Relay



12174F00140



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Remove the outer roof and the relays are visible at the ceiling center of the cabin : A/C main relay (5) and compressor relay (6). The blower fan is adjusted for the air flow rate by a signal from the fan switch on the control panel.

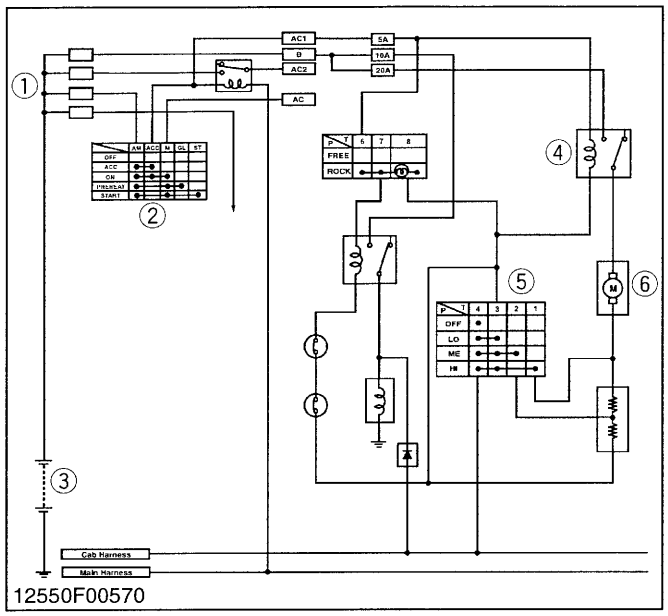
Among the air conditioner components, current flows to the blower motor (8) and magnetic clutch. If all of these current were to be passed through the main switch (2) and supplied, the current would be too large for the main switch (2) so that there will be danger or burning out the main switch contact. If the current were to be passed directly from the battery (3) forgetting to turn off the blower motor could result in a discharged battery.

To protect against such trouble, A/C main relay (5) has been provided. A/C main relay (5) has been made so that when current flows through its coil, the contact close to supply the power from the battery (3). By employing A/C main relay (5), the current flowing through the main switch (2) has been decreased as only a small current is required to actuate the relay. Thus there will be no danger of burning out the switch contact, and when the main switch (2) is opened, the relay contact will open at the same time. This action stops the current flow in the air conditioner circuit so that there will also be no chance of the battery discharging.

(1) Slow Blow Fuse
(2) Main Switch
(3) Battery
(4) A/C Switch
(5) A/C Main Relay
(6) Compressor Relay
(7) Blower Switch
(8) Blower Motor
(9) Compressor Magnet Clutch
(10) Blower Resistor

12550M00090

(5)-3 Air Conditioner Blower Switch



12550F00570

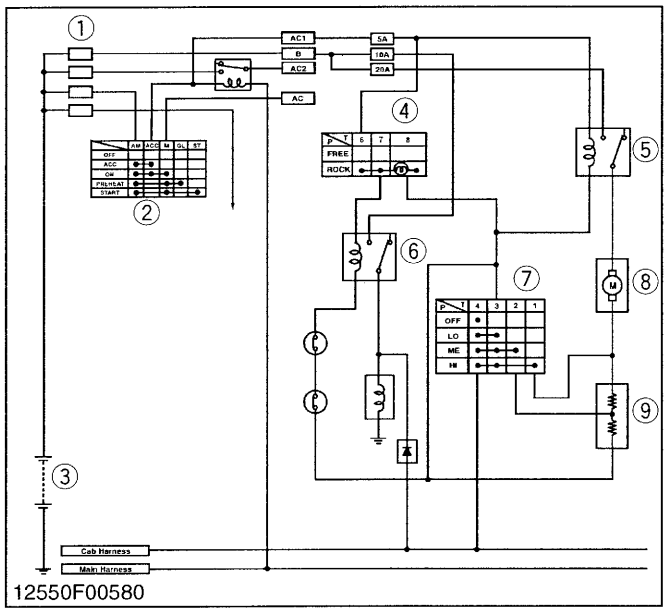
The wind of blower can be changed in 3 position (Low, Medium, High) by changing the air conditioner blower switch position.

■ Air Conditioner Blower Switch is "OFF" Position

When the air conditioner blower switch is in **OFF** position, even if the main switch is turned to **ON** position, air conditioner relay does not operate.

(1) Slow Blow Fuse
(2) Main Switch
(3) Battery
(4) **A/C** Main Relay
(5) Blower Switch
(6) Blower Motor

12550M00100



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■ When Air Conditioner Blower Switch is in · (Low), • (Medium) or ● (High) Position

When the main switch and blower switch is turned **ON**, the current flows from battery to A/C main relay's coil and A/C relay is turned **ON**. As the A/C main relay is turned **ON**, the current from battery flows to A/C blower switch through the A/C blower motors as follows.

"·" (Low) Position

Battery (3) → Slow Blow Fuse (1) → A/C Main Relay (5) → Blower Motor (8) → Blower Resistor (9) → Blower Switch (7) → Ground.

"•" (Medium) Position

Battery (3) → Slow Blow Fuse (1) → A/C Main Relay (5) → Blower Motor (8) → Blower Resistor (9) → Blower Switch (7) → Ground.

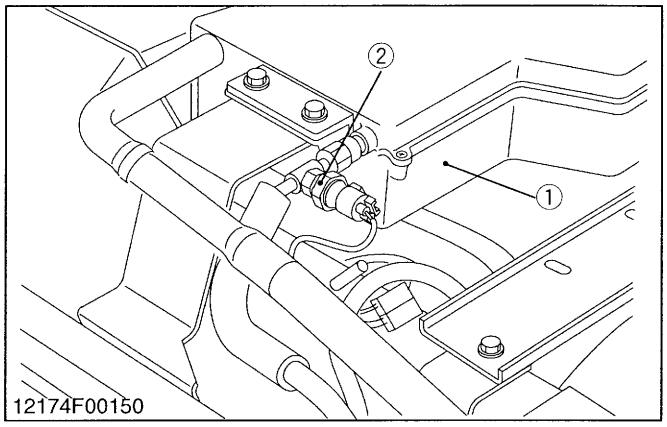
"●" (High) Position

Battery (3) → Slow Blow Fuse (1) → A/C Main Relay (5) → Blower Motor (8) → Blower Switch (7) → Ground.

(1) Slow Blow Fuse
(2) Main Switch
(3) Battery
(4) A/C Switch
(5) A/C Main Relay
(6) Compressor Relay
(7) Blower Switch
(8) Blower Motor
(9) Blower Resistor

12550M00110

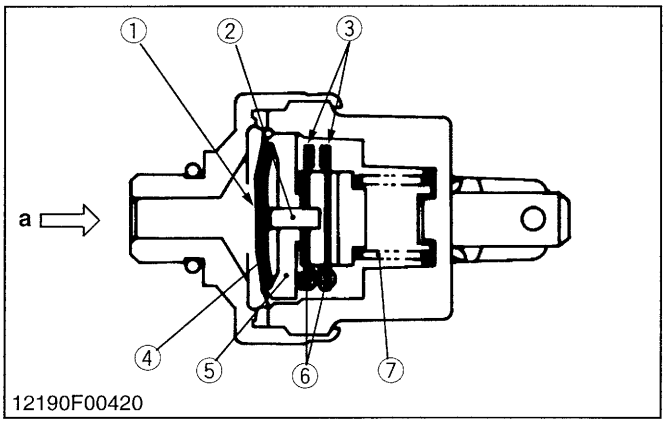
(5)-4 Pressure Switch



The pressure switch detects the pressure in the refrigerant cycle, and when something is wrong, turns off the magnetic clutch to prevent the component from troubling. This system has dual type pressure switch (2), and this switch controls low pressure cut and high pressure cut.

(1) A/C Unit
(2) Pressure Switch

12340M00150



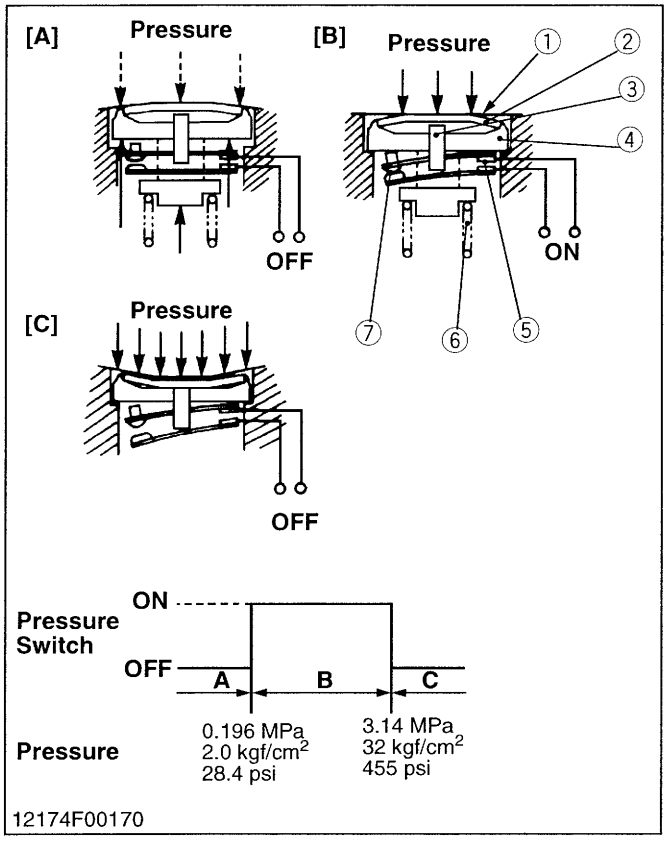
1) Pressure Switch (Dual Type)

The pressure switch is installed in inlet line (liquid line) between receiver and expansion valve.

The contact of pressure switch is normally open type.

(1) Diaphragm
(2) Pin
(3) Terminal
(4) Belleville Spring
(5) Plate
(6) Movable Contact
(7) Spring
(a) Pressure

12190M00360



■ OFF Position : A (When the Refrigerant Pressure is Low)

The pressure switch detects the pressure drop when the refrigerant leaks from the system causing compressor seizure. When pressure of refrigerant is less than specified pressure, the switch is turned **OFF** and disengages magnetic clutch.

■ ON Position : B (When the Refrigerant Pressure is Normal)

When the pressure in the inlet line is between 0.196 MPa (2.0 kgf/cm^2, 28.4 psi) and 3.14 MPa (32 kgf/cm^2, 455 psi), the switch is turned **ON** (the pressure is normal condition), and engages magnetic clutch.

■ OFF Position : C (When the Refrigeran Pressure is High)

When the pressure in the inlet line is higher than specified pressure, the switch is turned **OFF**, and disengages magnetic clutch.

(Reference)

- Setting pressure

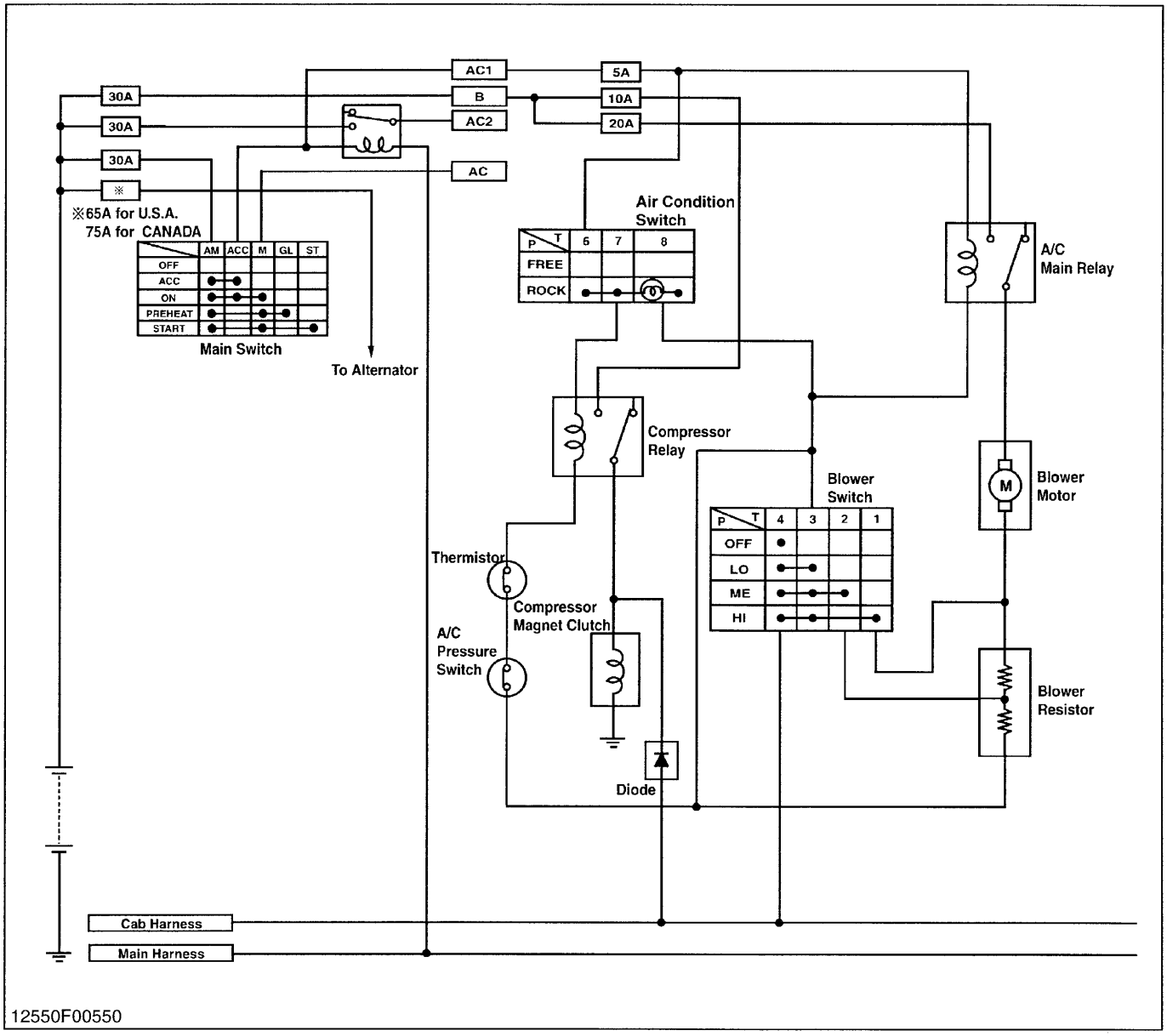
  OFF (Low pressure side) :
  Less than approx. 0.196 MPa (2.0 kgf/cm^2, 28.4 psi)

  ON (Normal pressure) :
  Between approx. 0.196 MPa (2.0 kgf/cm^2, 28.4 psi), to 3.14 MPa (32 kgf/cm^2, 455 psi)

  OFF (High pressure side) :
  More than approx. 3.14 MPa (32 kgf/cm^2, 445 psi)

(1) Diaphragm
(2) Belleville Spring
(3) Pin
(4) Plate
(5) Terminal
(6) Spring
(7) Contact

12174M00130



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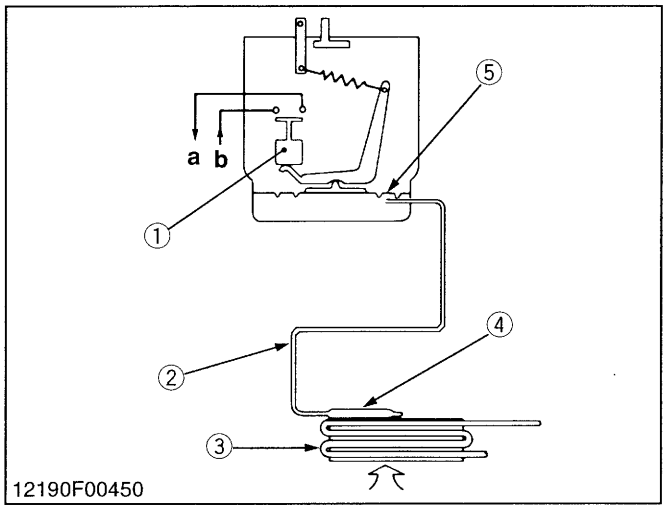
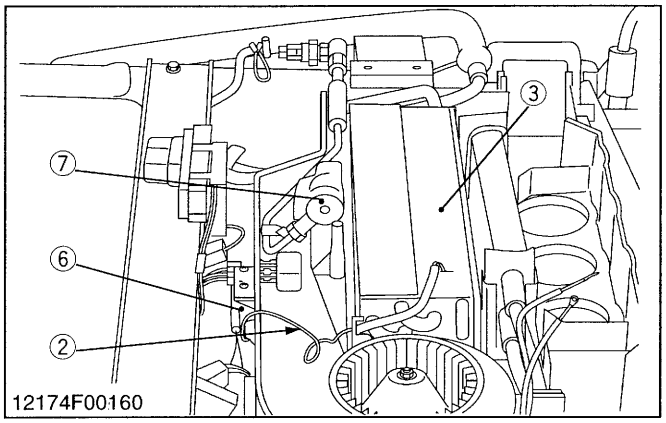
The circuit of magnetic clutch including the pressure switches is as shown in the figure. All switches are connected in series. The magnetic clutch can be turned **ENGAGED** when the blower switch and A/C switch are turned **ON** under the condition that both pressure switch and thermmo switch, are turned **ON**.

12550M00120

(5)-5 Thermostat



12190F00450



12174F00160

If the evaporator fin temperature, that is, refrigerant vaporizing temperature, drops below 0 °C (32 °F), frost or ice will form on the fins, causing a decrease in air flow and lowering cooling capacity. To prevent such frosting, and also to allow setting cabin interior to desired temperature, a thermostat has been installed.

In this system, gas type thermostat is used.

The gas type thermostat has a capillary tube which is filled with special gas. The capillary tube is connected to the diaphragm chamber. The tip of the capillary tube is positioned on the evaporator fins.

When the evaporator fins temperature is higher than setting temperature of the thermostat, the micro switch in the thermostat is turned **ON** by increasing the pressure in the diaphragm chamber. When the evaporator fins temperature is low, such as in winter season, the micro switch is turned **OFF** because of the pressure in the diaphragm chamber and spring tension drops, thus turning **OFF** the magnetic clutch to prevent the evaporator from frosting.

(Reference)

- Thermostat setting temperature
  OFF ..... Approx. 1 °C (34 °F)
  ON ..... Approx. 4.5 °C (40.1 °F)

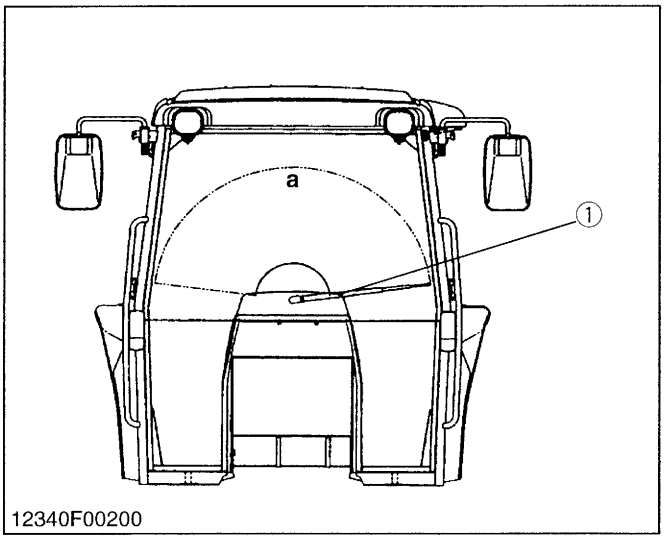
(1) Micro Switch
(2) Capillary Tube
(3) Evaporator
(4) Heat Sentizing Tube
(5) Diaphragm
(6) Thermo Switch
(7) Expansion Valve

(a) To Magnetic Clutch
(b) From A/C Switch

12340M00170

[2] WINDSHIELD WIPER

(1) Front Windshield Wiper



12340F00200

Front wiper motor is of the ferrite magnet type and possesses the function to stop the wiper arm at a designed position.

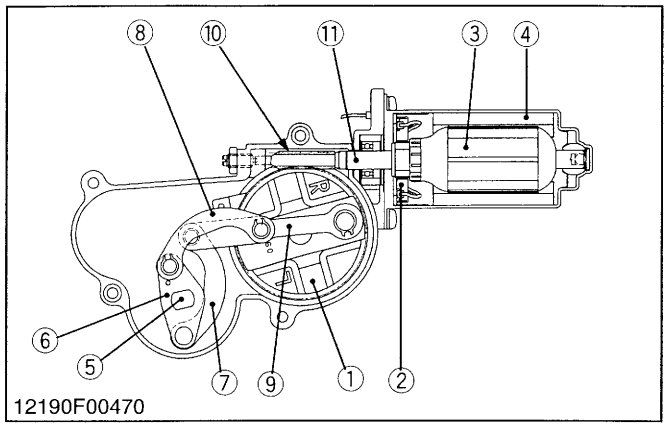
The wiper linkage changes rotating motion of the output shaft of the motor into reciprocating movement, which moves the wiper arm. The wiper arm uses a pantograph system, so the wiper blade keeps a certain angle (perpendicular) continuously although the wiper arm moves.

Wiping angle of the wiper arm is 2.90 rad. (166°). The wiper blade is for flat glass, and length of blade rubber is 400 mm (15.6 in.)

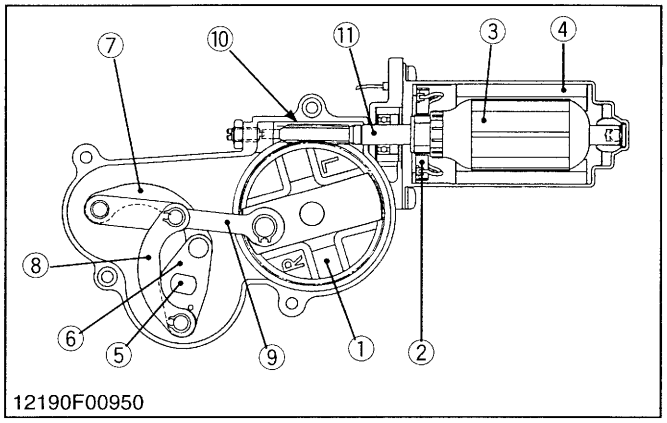
(1) Wiper Arm

(a) 2.90 rad. (166°)

12340M00180



12190F00470



12190F00950

■ Front Wiper Motor

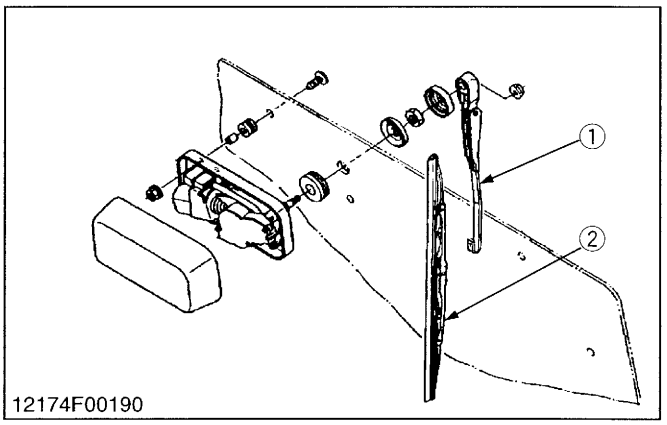
The front wiper motor is so designed as a field that cylindrical barium ferrite magnet (4) is fixed in the motor housing, in which armature (3) is mounted. Worm gear (10) is machined around armature shaft (11), and rotating speed of the armature is reduced by means of helical gear (1) and is transferred to motor shaft.

As the helical gear is turning, lever (6) which is attached to arm shaft (5) is oscillated by the function of rod (9), crank **A** (7) and crank **B** (8).

(1) Helical Gear
(2) Brush
(3) Armature
(4) Magnet
(5) Arm Shaft
(6) Lever
(7) Crank **A**
(8) Crank **B**
(9) Rod
(10) Worm Gear
(11) Armature Shaft

12190M00410

(2) Rear Windshield Wiper

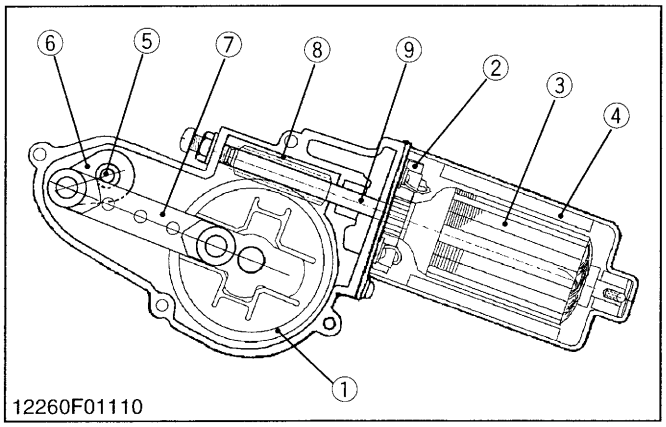


12174F00190

Rear wiper motor is of the ferrite magnet type and possesses the function to stop the wiper arm (2) at a desired position as same as the front wiper motor. Rotating speed is constant. The linkage mechanism which changes rotating movement of the crankshaft to oscillating movement of the wiper arm is provided in the motor, and the wiper arm is directly connected to the motor-output shaft. Wiping angle of the wipre arm is 1.92 rad. (110°). The wiper blade (1) is for flat glass, and the length of blade rubber is 425 mm (16.7 in.).

(1) Wiper Blade
(2) Wiper Arm

12174M00150



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■ Rear Wiper Motor

The rear wiper motor has basically the same structure with that of the front wiper motor, but it has two brushes only, so there is no such mechanism to change the roataing speed.

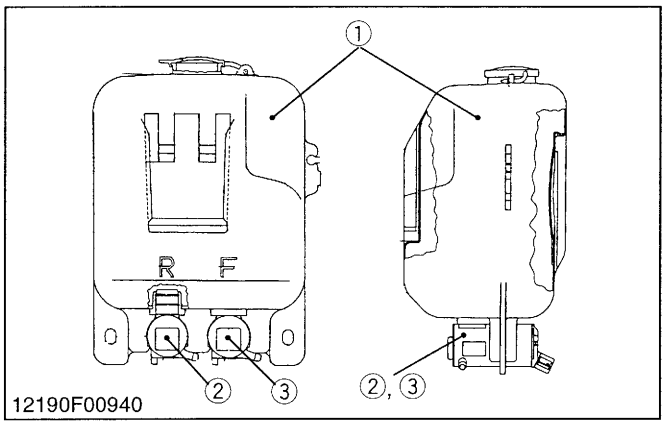
As the helical gear is turning, segment arm (6) which is attached to the arm shaft (5) is oscillated by the function of rod (7).

Rear Wiper Motor Specifications	
Motor type	Ferrite magnet type
Wiper angle	1.57 rad. (90°)
Rating voltage	12 V
Rating load current	Less than 3 A
No load current	Less than 2 A
Rotating speed (No load period)	36 to 50 rpm
(Load period)	32 to 44 rpm Load 0.59 N·m 0.06 kgf·m 0.434 ft-lbs

(1) Helical Gear
(2) Brush
(3) Armature
(4) Barium Ferrite Magnet
(5) Arm Shaft
(6) Segment Arm
(7) Rod
(8) Worm Gear
(9) Armature Shaft

12260M00080

(3) Window Washer



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The window washer is of the electric washer using a small size high speed motor and consists of tank, pump, nozzle and etc.

The washer tank is installed in rear side of cabine and its capacity is 1.3 L (1.4 U.S.qts., 1.6 Imp.qts.).

Washer pump is mounted under the tank, and is driven by a motor. When the motor starts running, washer is drawn through the suction inlet and discharged through the discharge outlet to the washer nozzle.

(1) Tank
(2) Pump (Rear) (OPT.)
(3) Pump (Front)

12174M00160

SERVICING

CONTENTS

TROUBLESHOOTING-1

COMPRESSOR

Symptom	Probable Cause	Solution	Reference Page
Noisy (Compressor ON)	• Bearing of compressor worn or damaged	Replace	10-S27
	• Valves in compressor damaged	Replace	10-S27
	• Belt slipping	Adjust or replace	G-23
	• Compressor bracket mounting screws loosen	Tighten	–
	• Piping resonant	Tighten or add clamp	–
(Compressor OFF)	• Blower defective		10-S29
	• Bearings of magnetic clutch, idle pulley or crank pulley worn or damaged	Repair or replace Replace	10-S26

AIR CONDITIONING SYSTEM

Does Not Cool (No Air Flow)	• Fuse blown	Replace	–
	• A/C main relay defective	Repair or replace	10-S28
	• blower motor defective	Replace	10-S29
	• blower switch defective	Replace	10-S28
	• Wiring harness disconnected or improperly connected	Repair	–
(Compressor Does Not Rotate)	• Fuse blown	Replace	–
	• Magnetic clutch defective	Repair or replace	10-S26
	• A/C switch defective	Replace	10-S30
	• Pressure switch defective	Replace	10-S31
	• Belt slipping	Adjust or replacae	G-23
(Others)	• Insufficient refrigerant	Check with manifor gauge	10-S12
	• Expansion valve defective	Replace	–
	• Compressor defective	Replace	10-S27
Insufficient Cooling (Insufficient Air Flow)	• Air filter clogged	Clean or replace	G-23
	• Evaporator frosted	Clean or replace thermo switch	10-S39
	• blower motor defective	Replace	10-S29
	• blower resistor defective	Replace	10-S30
(Many Bubbles in Sight Glass)	• Insifficient refrigerant	Check with manifold gauge	10-S12
	• Gas leaking from some place in refrigerating cycle	Repair and charge refrigerant	10-S10
	• Air mixed in	Check with manifold gauge	10-S13
(No Bubbles in Sight Glass)	• Too much refrigerant	Check with manifold gauge	10-S13

12550S00010

AIR CONDITIONING SYSTEM (Continued)

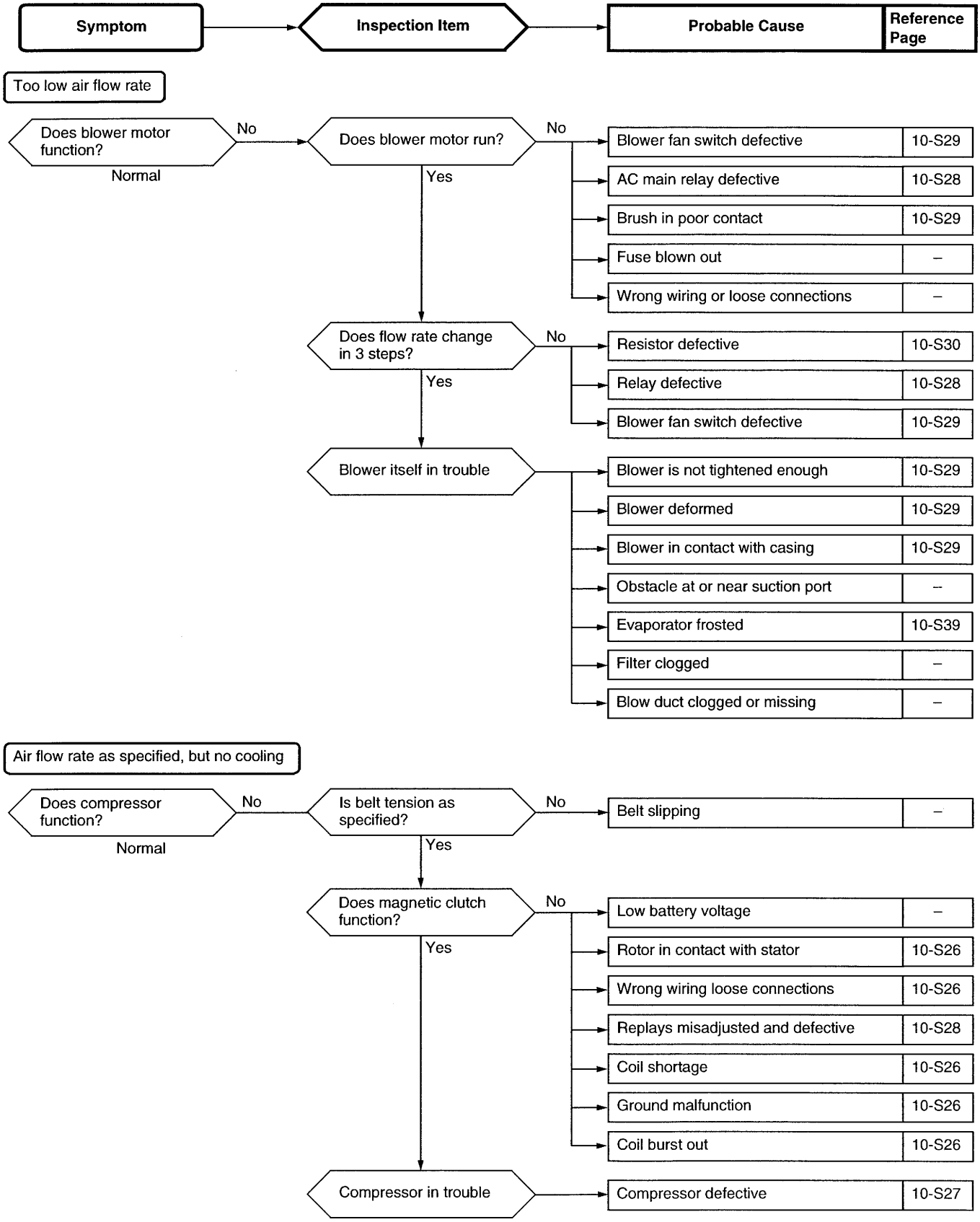
Symptom	Probable Cause	Solution	Reference Page
Insufficient Cooling (Compressor Does Not Rotate Properly)	• Belt slipping	Adjust or replace	G-23
	• Magnetic clutch defective	Repair or replace	10-S28
	• Compressor defective	Replace	10-S27
(Others)	• Thermostat defective	Replace	–
	• Water valve defective	Replace	–
	• Condenser fin clogged with dust	Clean	G-23
	• Expansion valve defective	Replace	–
Insufficient Heating	• Water valve defective	Replace	–
	• Air mix door malfunctioning	Adjust control cable	10-S33
	• Insufficient cooling water	Replenish	G-9
Insufficient Cooling (Compressor Does Not Rotate Properly)	• Belt slipping	Adjust or replace	G-23
	• Magnetic clutch defective	Repair or replace	10-S26
	• Compressor defective	Replace	10-S27
(Others)	• Condenser fin clogged with dust	Clean	G-23
	• Expansion valve defective	Replace	–

WINDSHIELD WIPER

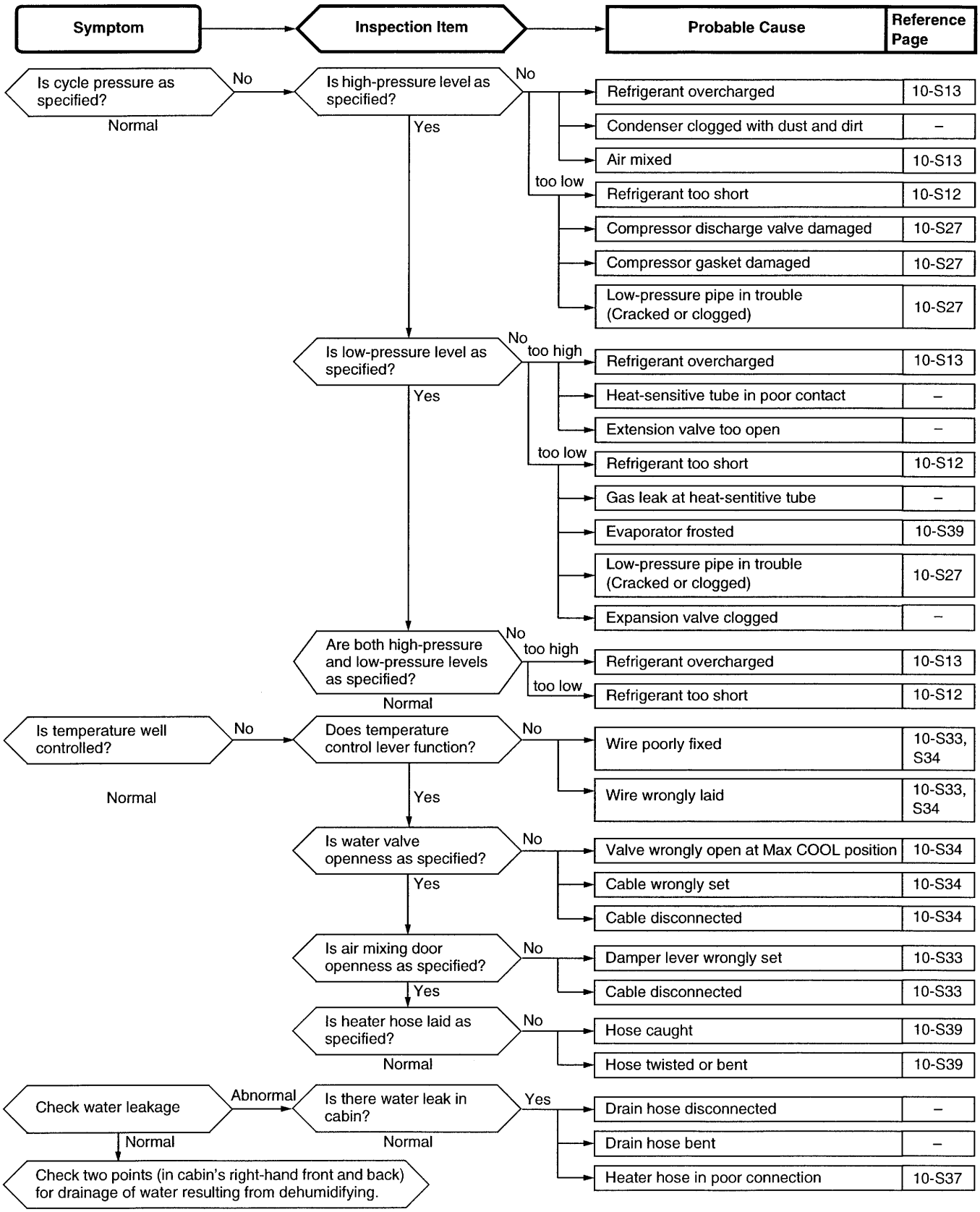
Windshield Wiper Does Not Operate	• Wiring defective	Check and repair	10-S32, S40
	• Fuse blown (Short-circuit, burnt component inside motor or other part for operation)	Correct cause and replace	–
	• Wiper motor defective (Broken armature, worn motor brush or seized motor shaft)	Replace	10-S32, S40
	• Wiper switch defective	Replace	10-S32, S40
	• Foreign material interrupts movement of link mechanism	Repair	–
	• Wiper arm seized or rusted	Lubricate or replace	10-S36, S43
Windshield Wiper Operating Speed Is Too Low	• Wiper motor defective (Short-circuit of motor armature, worn motor brush or seized motor shaft)	Replace	10-S35, S43
	• Low battery voltage	Recharge or replace	–
	• Humming occurs on motor in arm operating cycle due to seized arm shaft	Lubricate or replace	–
	• Wiper switch contact improper	Replace	10-S32, S40
Windshield Wiper Does Not Stop Correctly	• Wiper motor defective (Contaminated auto-return contacts or improper contact due to foreign matter)	Replace	10-S36, S43

12550S00020

TROUBLESHOOTING-2



12550S00030



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WASHER MOTOR

Symptom	Probable Cause	Solution	Reference Page
Washer Motor Does Not Operate	• Fuse blown	Correct cause and replace	–
	• Washer switch defective	Replace	10-S32
	• Washer motor defective	Replace	–
	• Wiring defective	Repair	10-S32
Washer Motor Operates but Washer Fluid Is Not Ejected	• No washer fluid	Replenish	–
	• Clogged washer nozzle	Clean or replace	–

12550S00050

SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Refrigerating Cycle (Refrigerating Cycle is Notmal Operating) Condition • Engine Speed : Approx. 1500 rpm • Embient Temperature : 30 to 35 °C 86 to 95 °F • Blower Switch : PURGE Position	Pressure (**LO** Pressure Side)	0.15 to 0.20 MPa 1.5 to 2.0 kgf/cm^2 21 to 28 psi	–
	Pressure (**HI** Pressure Side)	1.27 to 1.66 MPa 13 to 17 kgf/cm^2 185 to 242 psi	–
Pressure Switch (Dual Type) (When pressure switch is turned **OFF**)	Setting Pressure (**LO** Pressure Side)	Less than approx. 0.196 MPa 2.0 kgf/cm^2 28.4 psi	–
	Setting Pressure (**HI** Pressure Side)	More than approx. 3.4 MPa 32 kgf/cm^2 455 psi	–
Air Conditioner Drive Belt	Tension	10 to 12 mm (0.39 to 0.47 in.) deflection at 98 N (10 kgf, 22 lbs) of force	–

12190S00060

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-10.)

Item	N·m	kgf·m	ft-lbs
Cabin mounting screws and nuts	123.6 to 147.0	12.6 to 15.0	91.2 to 108.4
Cabin bracket mounting screws			
M12 screw	77.5 to 90.2	7.9 to 9.2	57.2 to 66.5
M14 screw	123.6 to 147.0	12.6 to 15.0	91.2 to 108.4
Compressor mounting screws	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
Compressor bracket mounting screws			
Screws to inlet manifold	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Screws to water flange	17.7 to 20.5	1.8 to 2.1	13.1 to 15.1
High pressure pipe screw and retainer nut			
between compressor and condenser (High pressure pipe 1)			
screw	7.9 to 11.8	0.8 to 1.2	5.8 to 8.7
retaining nut	19.7 to 24.5	2.0 to 2.5	14.5 to 18.0
between condenser and receiver			
screw	3.9 to 6.9	0.4 to 0.7	2.9 to 5.1
retaining nut	11.8 to 14.7	1.2 to 1.5	8.7 to 10.8
between receiver and A/C unit (High pressure pipe 2)			
retaining nut	11.8 to 14.7	1.2 to 1.5	8.7 to 10.8
Low pressure pipe			
between A/C unit and compressor			
screw	7.9 to 11.8	0.8 to 1.2	5.8 to 8.7
retaining nut	29.5 to 34.3	3.0 to 3.5	21.7 to 25.3
Wiper arm mounting nut	6.37 to 9.32	0.65 to 0.95	4.7 to 6.9
Main delivery hose retaining nut	46.6 to 50.9	4.8 to 5.2	34.4 to 37.6
Turning delivery hose retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
A/C unit mounting screws (M6)	3.9 to 6.9	0.4 to 0.7	2.9 to 5.1
(M8)	9.8 to 11.7	1.0 to 1.2	7.2 to 8.6

12550S00570

PRECAUTIONS AT REPAIRING REFRIGERANT CYCLE

When checking or repairing the air conditioning system, the following precautions and rules must be observed. And it is of first importance that no other personnel than a well-trained serviceman should be allow to handle the refrigerant.

⚠ CAUTION

- **Since direct contact of the liquid refrigerant with your skin will cause frostbite, always be careful when handling the refrigerant. Always wear goggles to protect your eyes when working around the system.**
- **The refrigerant service container has a safe strength. However, if handled incorrectly, it will explode. Therefore, always follow the instructions on the label. In particular, never heat the refrigerant container above 40 °C (104 °F) or drop it from a high height.**
- **Do not steam clean on the system, especially condenser since excessively high pressure will build up in the system, resulting in explosion of the system.**
- **If you improperly connect the hose between the service valve of compressor and gauge manifold, or incorrectly handle the valves, the refrigerant service container or charging hose will explode. When connecting the hose or handling the valve, be sure to check the high pressure side or low pressure side.**
- **In case the refrigerant is charged while the compressor is operated, do not open the high pressure valve of the gauge manifold.**
- **Beware of the toxicity of the gas. The gas is harmless and nontoxic in its original state, however it produces a toxic substance when it comes in contact with high temperature parts and decomposes.**
- **Do not heat the service can unless necessary. When it has to be heated, use warm water of 40 °C (104 °F) or lower. Do not heat using boiling water.**

■ IMPORTANT

- **If the refrigerant, O-rings, etc. for R12 are used in the R134a air conditioner system, problems such as refrigerant leakage or cloudiness in the sight glass may occur. Therefore, in order to prevent charging of refrigerant or erroneous connections, the shapes of the piping joint as well as the shapes of the service valve and the service tools have been changed.**

■ IMPORTANT (Continued)

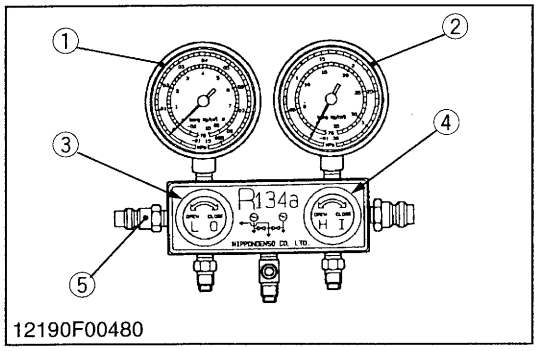
- **Always keep the working place clean and dry and free from dirt and dust. Wipe off water from the line fittings with a clean cloth before disconnecting.**
- **Use only for R134a refrigerant service tool.**
- **Use for R134a refrigerant recovery and recycling machine when discharging the refrigerant.**
- **Before attaching the charging hose to the can tap valve of the refrigerant container, check each packing for clogging.**
- **When disconnecting the charging hose from the charging valve of compressor and receiver, remove it as quick as possible so that gas leakage can be minimized.**
- **Be sure to charge the specified amount of refrigerant, but not excessively. Over-charging of the refrigerant in particular may cause insufficient cooling, etc.**
- **Since the charging hose can be connected to can tap valve by hand, do not use a pliers for tightening it.**
- **Keep refrigerant containers in a cool and dark place avoiding such place which are subject to strong sunlight or high temperature.**
- **R134a compressor oil absorbs moisture easily, so that be sure to seal after disconnecting the each parts.**
- **Do not use old-type refrigerant R12a or compressor oil for old-type refrigerant.**
- **When replacing the condenser, evaporator and receiver, etc., replenish the compressor oil to compressor according to the table below.**

Replacing Parts	Replenish Quantity	Brand Name
Condenser	40 cc 2.44 cu.in.	ND-OIL8
Evaporator	40 cc 2.44 cu.in.	
Circulation system (Total)	120 cm^3 7.32 cu.in.	

12174S00050

HANDLING OF SERVICE TOOLS

(1) Manifold Gauge Set

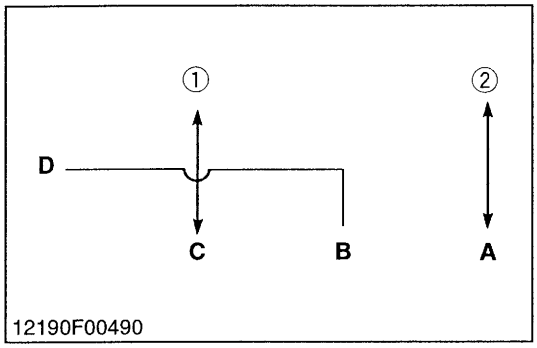


12190F00480

The hand valves on the manifold gauge set are used to open and close the valve. The hand valve inscribed **LO** is for the low pressure side valve (3) and **HI** is for the high pressure side valve (4). By opening or closing the high and low pressure hand valves, the following circuits are established.

(1) **LO** Pressure Gauge
(2) **HI** Pressure Gauge
(3) **LO** Pressure Side Valve
(4) **HI** Pressure Side Valve
(5) Schrader Valve

12190S00090



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■ **When LO Pressure Side Valve and HI Pressure Side Valve are Closed**

Two circuits are established.
Port (C) → **LO** pressure gauge (1)
Port (A) → **HI** pressure gauge (2)

■ **NOTE**

- **Schrader valve must be opened.**

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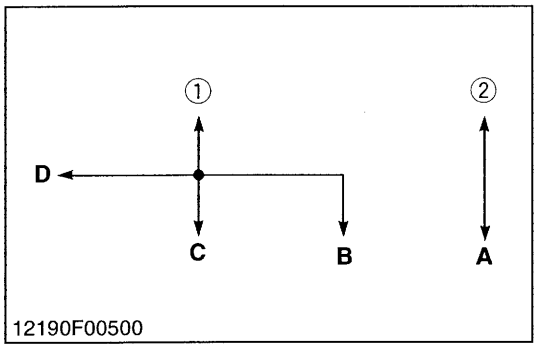


12190F00500

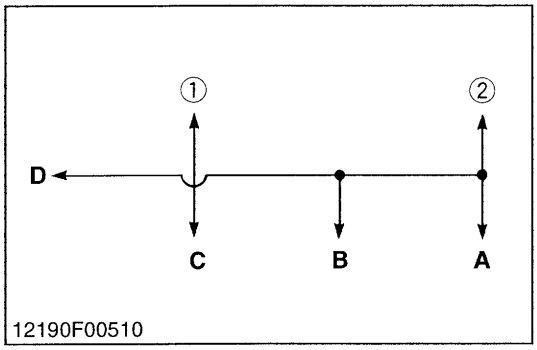
■ **When LO Valve is Opened and HI Valve is Closed**

Two circuits are established.
Port (C) → **LO** pressure gauge (1)
→ Port (B)
→ Port (D)
Port (A) → **HI** pressure gauge (2)

■ **NOTE**

- **Schrader valve must be opened.**

12190S00110



12190F00510

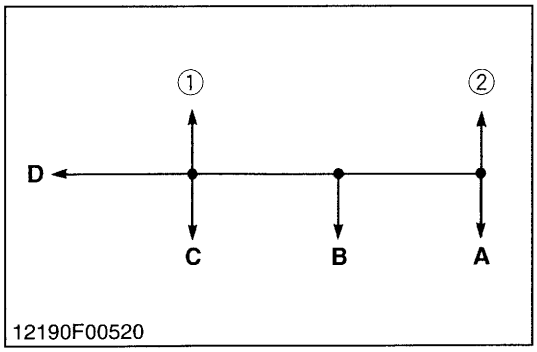
■ **When LO Valve is Closed and HI Valve is Opened**

Two circuits are established.
Port (A) → **HI** pressure gauge (2)
→ Port (B)
→ Port (D) (Schrader valve must be opened)
Port (C) → **LO** pressure gauge (1)

■ **NOTE**

- **Schrader valve must be opened.**

12190S00120



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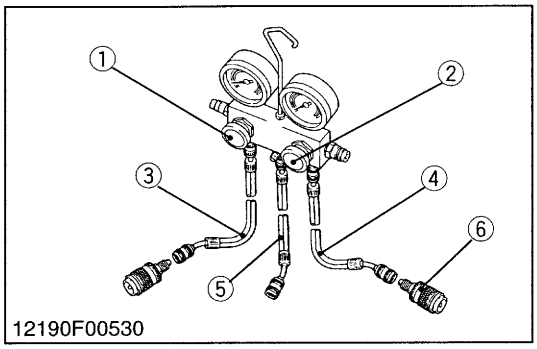

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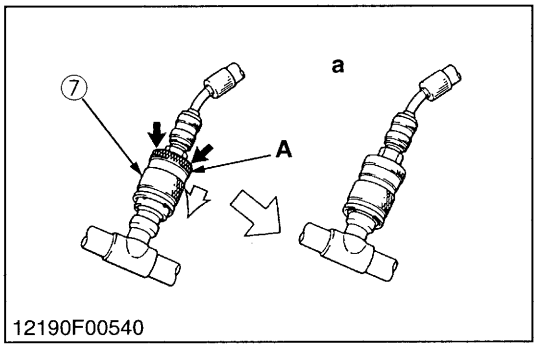

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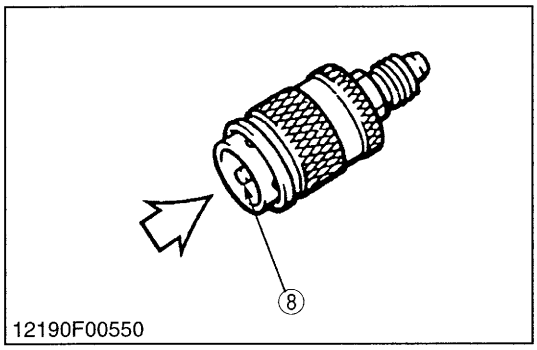

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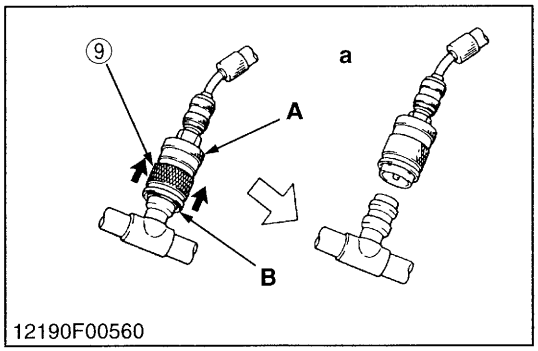


12190F00560

■ When LO and HI Valves are Opened

Circuits are established.

Port (A) → **LO** pressure gauge (1)
→ **HI** pressure gauge (2)
→ Port (B)
→ Port (C)
→ Port (D) (Schrader valve must be opened)

■ NOTE

- **Schrader valve must be opened.**

12190S00130

The charging hoses are classified into three colors. Each charging hose must be handled as follows :

- The air conditioner manufacture recommends that the blue hose (3) is used for the **LO** pressure side (suction side), the green hose (5) for refrigeration side (center connecting port) and the red hose (4) for **HI** pressure side (discharged side).

(When connecting)

- Push the quick disconnect adaptor (6) into the charging valve, and push on part **A** until a click is heard.

■ NOTE

- **When connecting, push carefully so the pipe doesn't bend.**
- **When connecting the quick disconnect connector, should the sleeve (7) move before the quick link connector can be connected to the charging valve, move the quick sleeve to its original position and try again.**
- **When some refrigerant remains in the charging hose at the time of connections, it may be difficult to connect the quick link connector. In this case, perform the operation after removing any residual pressure in the hose. (Remove the residual pressure by pushing the pusher (8).)**

(When reassembling)

- While holding on to part **A** of the quick disconnect adaptor, slide part **B** up.

■ NOTE

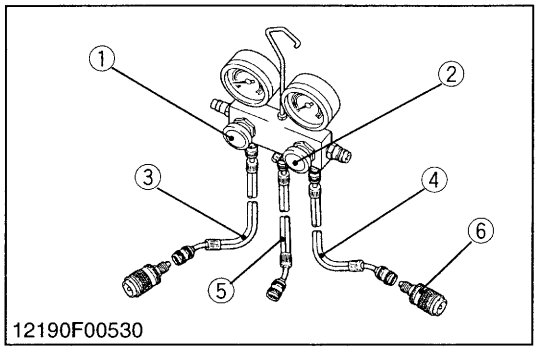
- **After removing the adaptor, ensure to cap the quick disconnect adaptor service valve.**

(1) **LO** Pressure Side Valve
(2) **HI** Pressure Side Valve
(3) Blue Hose
(4) Red Hose
(5) Green Hose
(6) Quick Disconnect Adaptor
(7) Sleeve
(8) Pusher
(9) Sleeve

(a) CLICK

12190S00140

(2) Refrigerant Charging Hose



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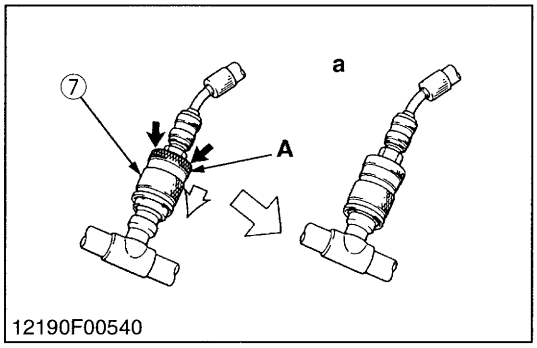

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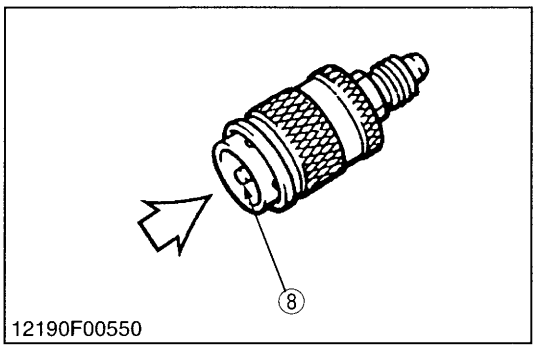

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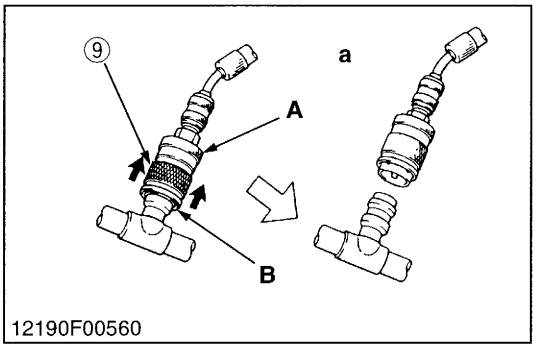


12190F00560

The charging hoses are classified into three colors. Each charging hose must be handled as follows :

- The air conditioner manufacture recommends that the blue hose (3) is used for the **LO** pressure side (suction side), the green hose (5) for refrigeration side (center connecting port) and the red hose (4) for **HI** pressure side (discharged side).

(When connecting)

- Push the quick disconnect adaptor (6) into the charging valve, and push on part **A** until a click is heard.

■ NOTE

- **When connecting, push carefully so the pipe doesn't bend.**
- **When connecting the quick disconnect connector, should the sleeve (7) move before the quick link connector can be connected to the charging valve, move the quick sleeve to its original position and try again.**
- **When some refrigerant remains in the charging hose at the time of connections, it may be difficult to connect the quick link connector. In this case, perform the operation after removing any residual pressure in the hose. (Remove the residual pressure by pushing the pusher (8).)**

(When reassembling)

- While holding on to part **A** of the quick disconnect adaptor, slide part **B** up.

■ NOTE

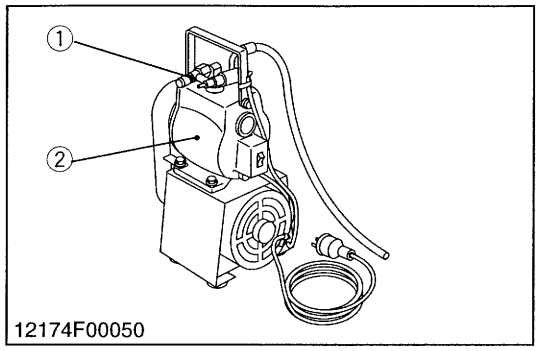
- **After removing the adaptor, ensure to cap the quick disconnect adaptor service valve.**

(1) **LO** Pressure Side Valve
(2) **HI** Pressure Side Valve
(3) Blue Hose
(4) Red Hose
(5) Green Hose
(6) Quick Disconnect Adaptor
(7) Sleeve
(8) Pusher
(9) Sleeve

(a) CLICK

12190S00140

(3) Vacuum Pump Adaptor



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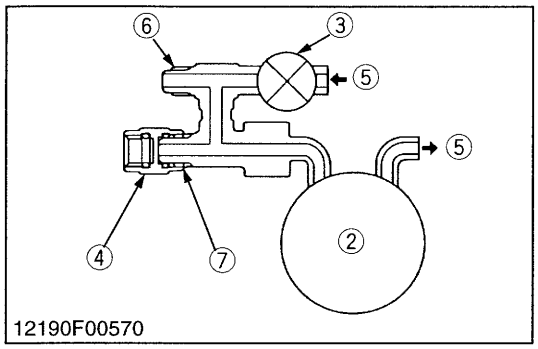


12190F00570

Objective of the Vacuum Pump Adaptor

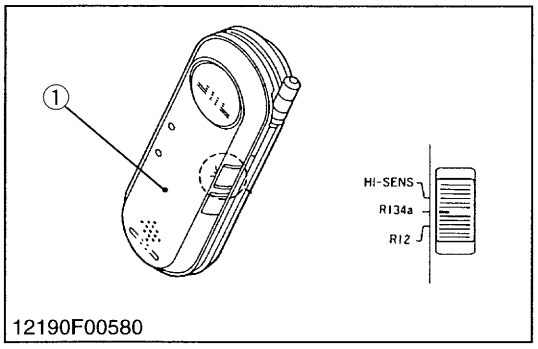
1. After vacuum has been created in the air conditioning cycle, when the vacuum pump is stopped, since there is vacuum in hoses within the gauge manifold, the vacuum pump oil flows back into the charging hose. If the refrigerant is refilled with the system still in this state, the vacuum pump oil left in the charging hose enters the air conditioner cycle together with the refrigerant. Vacuum pump adaptor with a solenoid valve is used to prevent this back-flow of oil from the vacuum pump. The role of the solenoid valve is that when the current passes through the solenoid valve, the valve closes to keep out the outside air and allow the vacuum to build up, but when the current stops, the valve opens to allow in air and end the vacuum.
2. Attaching this adaptor to the R12 vacuum pump currently being used allows the pump to be used with both R134a and R12.

(1) Vacuum Pump Adaptor
(2) Vacuum Pump
(3) Magnetic Valve
(4) Blind Cap
(5) Air
(6) For R134a
(7) For R12

(A) IN
(B) OUT

12340S00260

(4) Electric Gas Leak Tester



12190F00580

The current R12 gas leak tester has poor sensitivity for R134a and cannot be used. Therefore, a new electric gas leak tester with greater sensitivity has been designed and can be used with both R134a and R12.

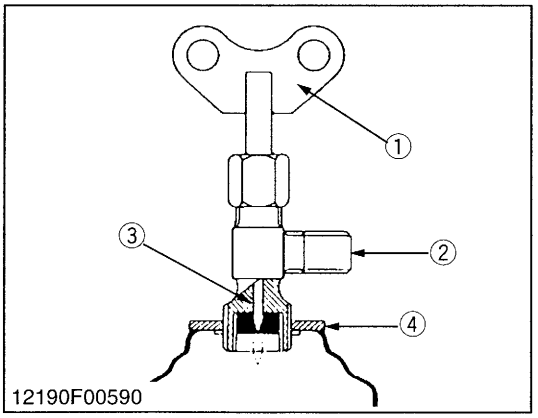
(Reference)
Leak tester with halide torch

- Since the reaction with chlorine within the refrigerant is used to detect gas leaks, R134a, which contains no chlorine, cannot be detected.

(1) Electric Gas Leak Tester

12190S00160

(5) Can Tap Valve



12190F00590

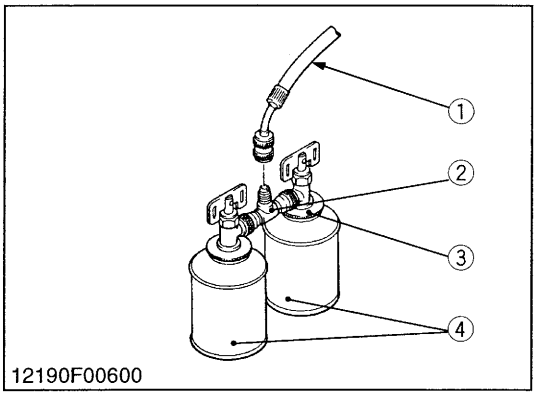
The can tap valve that is used to charge the refrigerant into the air conditioning system, should be used as follows :

1. Before putting the can tap valve on the refrigerant container, turn the handle (1) counterclockwise till the valve needle is fully retracted.
2. Turn the plate nut (disc) (4) counterclockwise till it reaches its highest position, then screw down the can tap valve into the sealed tap.
3. Turn the plate nut clockwise fully, and fix the center charging hose to the valve.
4. Tighten the plate nut firmly by hand.
5. Turn the handle (1) clockwise, thus making a hole in the sealed tap.
6. To charge the refrigerant into the system, turn the handle (1) counterclockwise. To stop charging, turn it clockwise.

(1) Butterfly Handle
(2) Connection
(3) Needle
(4) Disc

12190S00170

(6) T-joint



12190F00600

T-joint (2) is used to increase efficiency of gas charging using two refrigerant containers (4) at a time.

1. Install two refrigerant container service valves to T-joint (2) sides and connect the charging hose (1) to it.

(1) Charging Hose (Green)
(2) T-joint
(3) Can Tap Valve
(4) Refrigerant Container

12190S00180

(7) R134a Refrigerant Recovery and Recycling Machine

When there is necessity of discharging the refrigerant on repairing the tractor, it should use recovery and recycling machine. (Don't release the refrigerant into the atmosphere.)

■ IMPORTANT

- **Use only R134a refrigerant recovery and recycling machine, eliminate mixing R134a equipment, refrigerant and refrigerant oils with R12 systems to prevent compressor damage.**

12190S00190

CHECKING AND CHARGING REFRIGERANT CYCLE

[1] CHECKING WITH MANIFOLD GAUGE

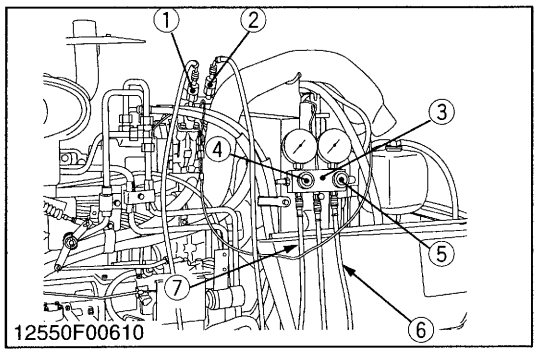
■ IMPORTANT

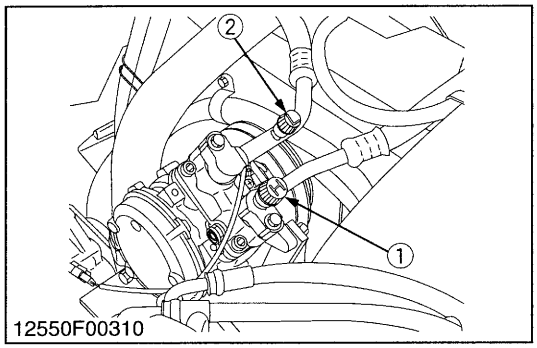
- **The gauge indications described in the following testing are those taken under the same condition, so it should be noted that the gauge readings will differs somewhat with the ambient conditions.**

Condition

- Ambient temperature : **30 to 35 °C (86 to 95 °F)**
- Engine speed : Approx. **1500 rpm**
- Temperature control lever : **Maximum cooling position**
- Air-Conditioner swicth : **ON**
- Blower switch : **HI** position

12190S00200





Manifold Gauge Connecting and Test Preparation

1. Close the manifold gauge HI and LO pressure side valve (5), (4) tightly.
2. Connect the charging hose (6) (red) to the HI pressure side charging valve (1) and connect the charging hose (7) (blue) to the LO pressure side charging valve (2).

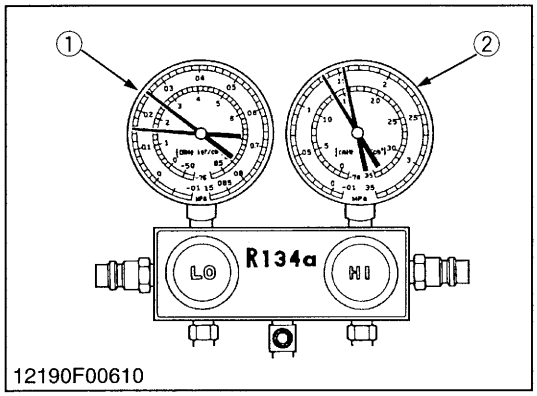
■ **NOTE**

- **Be sure to drive out the air in the charging hoses at the manifold gauge connection end by utilizing the refrigerant pressure in the refrigerating cycle.**

3. Start the engine and set at approx. **1500 rpm**.
4. Turn on the A/C switch and set the temperature control lever to **maximum cooling** position.
5. Set the blower switch to **HI** position.

(1) **HI** Pressure Side Charging Valve
(2) **LO** Pressure Side Charging Valve
(3) Manifold Gauge
(4) **LO** Pressure Side Valve
(5) **HI** Pressure Side Valve
(6) Charging Hose (Red)
(7) Charging Hose (Blue)

12550S00060



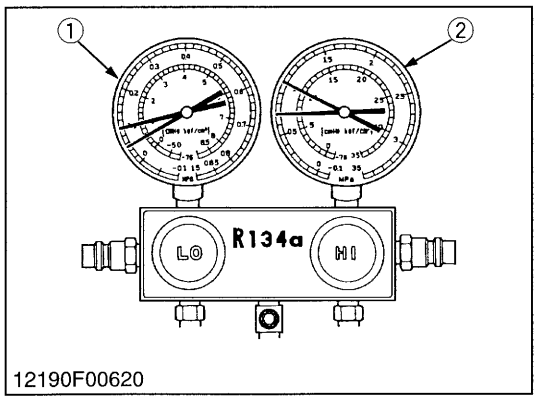
Normal Operating

If the refrigerating cycle is operating normally, the reading at the **LO** pressure side (1) should be generally by around 0.15 to 0.2 MPa (1.5 to 2.0 kgf/cm^2, 21 to 28 psi) and that at the **HI** pressure side (2) around 1.27 to 1.66 MPa (13 to 17 kgf/cm^2, 185 to 242 psi).

Gas pressure	Factory spec.	Low pressure side	0.15 to 0.20 MPa 1.5 to 2.0 kgf/cm^2 21 to 28 psi
		High pressure side	1.27 to 1.66 MPa 13 to 17 kgf/cm^2 185 to 242 psi

(1) **LO** Pressure Side
(2) **HI** Pressure Side

12190S00220



Insufficient Refrigerant

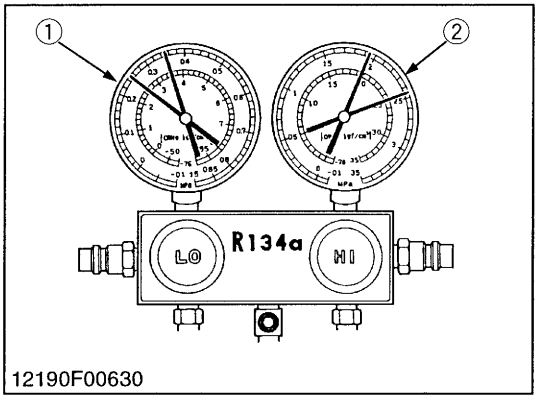
a) Symptomps seen in refrigerating cycle
- Both **LO** and **HI** pressure side (1), (2) pressures too low.
  LO pressure side (1) : 0.05 to 0.1 MPa (0.5 to 1.0 kgf/cm^2, 7.1 to 14.2 psi)
  HI pressure side (2) : 0.69 to 0.98 kPa (7 to 10 kgf/cm^2, 99.6 to 142.2 psi)
- Bubbles seen in sight glass.
- Air discharged from air conditioner slightly cold.

b) Probable cause
- Gas leaking from some place in refrigerant cycle.

c) Solution
- Check for leakage with electric gas leak tester (see page 10-S10) and repair.
- Recharge refrigerant to the proper level. (See page 10-S18)

(1) **LO** Pressure Side
(2) **HI** Pressure Side

12190S00230



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Excessive Refrigerant or Insufficient Condenser Cooling

a) Symptoms seen in refrigerating cycle
- Both **LO** and **HI** pressure side (1), (2) pressures too high.
  LO pressure side (1) : 0.2 to 0.35 MPa (2.0 to 3.5 kgf/cm^2, 28 to 49.8 psi)
  HI pressure side (2) : 1.96 to 2.45 MPa (20 to 25 kgf/cm^2, 284.5 to 355.6 psi)

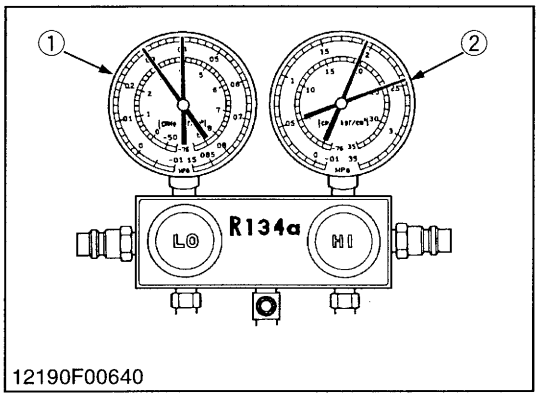
b) Probable cause
- Overcharging refrigerant into cycle.
- Condenser cooling faulty.

c) Solution
- Clean condenser. (See page G-22.)
- Adjust fan belt to proper tension. (See page G23.)
- If the above two items are in normal condition, check refrigerant quantity. (See page 10-S20.)

■ NOTE
- **If excessive refrigerant is to be discharged, loosen manifold gauge LO pressure side valve and vent out slowly.**

(1) **LO** Pressure Side (2) **HI** Pressure Side

12550S00070



12190F00640

Air Entered in the Cycle

a) Symptoms seen in refrigerating cycle
- Both **LO** and **HI** pressure side (1), (2) pressures too high.
  LO pressure side (1) : 0.2 to 0.35 MPa (2.0 to 3.5 kgf/cm^2, 28 to 49.8 psi)
  HI pressure side (2) : 1.96 to 2.45 MPa (20 to 25 kgf/cm^2, 284.5 to 355.6 psi)
- **LO** pressure side (1) piping not cold when touched.

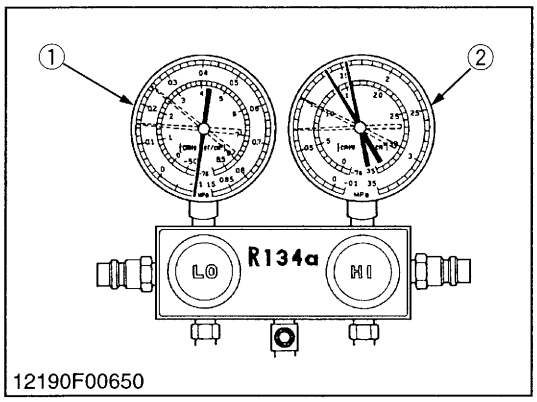
b) Probable cause
- Air entered in refrigerating cycle.

c) Solution
- Replace receiver.
- Check compressor oil contamination and quantity.
- Evacuate and recharge new refrigerant. (See page 10-S17, 18.)

■ NOTE
- **The above cycle can be seen when the cycle is charged without evacuation.**

(1) **LO** Pressure Side (2) **HI** Pressure Side

12190S00250



12190F00650

Moisture Entered in the Cycle

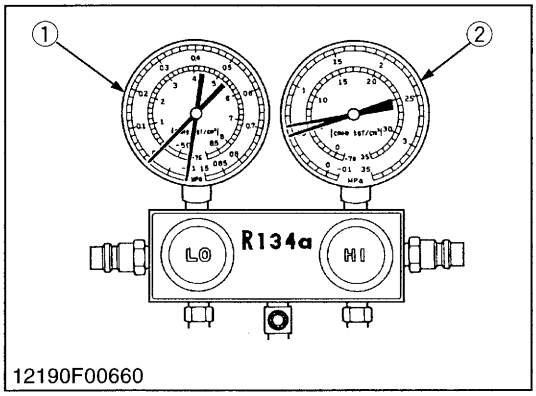
a) Symptoms seen in refrigerating cycle
- The air conditioner operates normally at the beginning, but over time, **LO** pressure side (1) pressure is **vacuum** and **HI** pressure side (2) is **low** pressure.
  LO pressure side (1) : Vacuum
  HI pressure side (2) : 0.69 to 0.98 MPa
  (7 to 10 kgf/cm^2, 99.6 to 142.2 psi)

b) Probable cause
- The moisture in the refrigerating cycle freezes in the expansion valve orifice and causes temporary blocking. After a time, the ice melts and condition returns to normal.

c) Solution
- Replace receiver.
- Remove moisture in cycle by means of repeated evacuation. (See page 10-S17.)
- Recharge new refrigerant to the proper level. (See page 10-S18.)

(1) **LO** Pressure Side (2) **HI** Pressure Side

12190S00260



12190F00660

Refrigerant Fails to Circulate

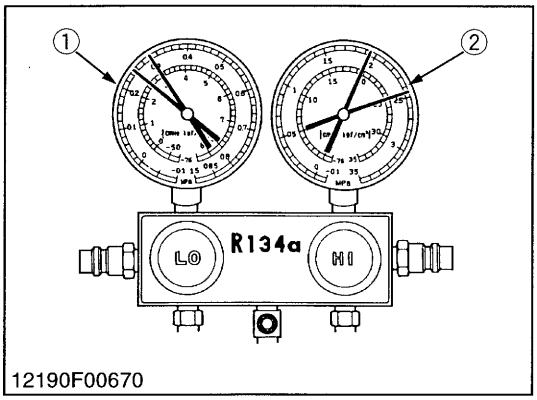
a) Symptoms seen in refrigerating cycle
- **LO** pressure side (1) pressure is **vacuum** and, **HI** pressure side (2) is **low** pressure.
  LO pressure side (1) : Vacuum
  HI pressure side (2) : 0.49 to 0.59 MPa
  (5 to 6 kgf/cm^2, 21.1 to 85.3 psi)
- Frost or dew formed on piping at front and rear sides of expansion valve or receiver.

b) Probable cause
- Refrigerant flow obstructed by moisture or dirt in the refrigerating cycle freezing or sticking on the expansion vlave orifice.

c) Solution
  Allow to stand for some time and then resume operation to decide whether the plugging is due to moisture or dirt.
- If caused by moisture, correct by referring to instructions in previous.
- If caused by dirt, remove the expansion valve and blow out the dirt with compressed air.
- If unable to remove the dirt, replace the expansion valve. Replace the receiver. Evacuate and charge in proper amount of new refrigerant. (See page 10-S17, 18, 19.)
- If caused by gas leakage in heat sensitizing tube, replace the expansion valve.

(1) **LO** Pressure Side (2) **HI** Pressure Side

12190S00270



12190F00670

Expansion Valve Opens Too Far or Improper Installation of Heat Sensitizing Tube

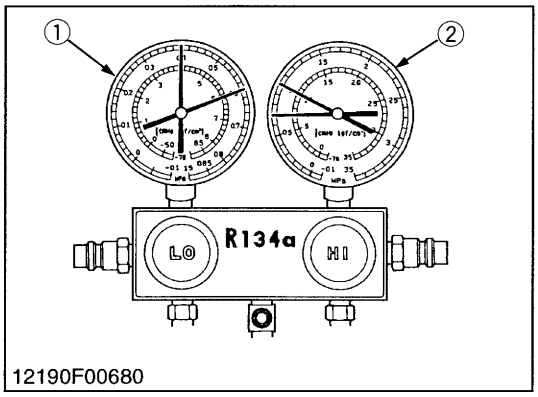
a) Symptoms seen in refrigerating cycle
- Both **LO** and HI pressure side (1), (2) pressures too high.
  LO pressure side (1) : 0.29 to 0.39 MPa (3.0 to 4.0 kgf/cm^2, 42.7 to 56.9 psi)
  HI pressure side (2) : 1.96 to 2.45 MPa (20 to 25 kgf/cm^2, 284.5 to 355.6 psi)
- Frost or heavy dew on low pressure side piping.

b) Probable cause
- Expansion valve trouble or heat sensitizing tube improperly installed.
- Flow adjustment not properly done.

c) Solution
- Check installed condition of heat sensitizing tube.
- If installation of heat sensitizing tube is correct, replace the expansion valve.

(1) **LO** Pressure Side (2) **HI** Pressure Side

12190S00280



12190F00680

Faulty Compression of Compressor

a) Symptoms seen in refrigerating cycle
- **LO** pressure side (1) pressure too high :0.39 to 0.59 MPa (4 to 6 kgf/cm^2, 56.9 to 85.3 psi) .
- **HI** pressure side (2) pressure too low :0.69 to 0.98 MPa (7 to 10 kgf/cm^2, 99.6 to 142.2 psi) .

b) Probable cause
- Leak in compressor

c) Solution
- Replace compressor. (See page 10-S27.)

■ NOTE
- **Manifold gauge indications (left side figure) at faulty compressing by compressor.**

(1) **LO** Pressure Side (2) **HI** Pressure Side

12174S00170

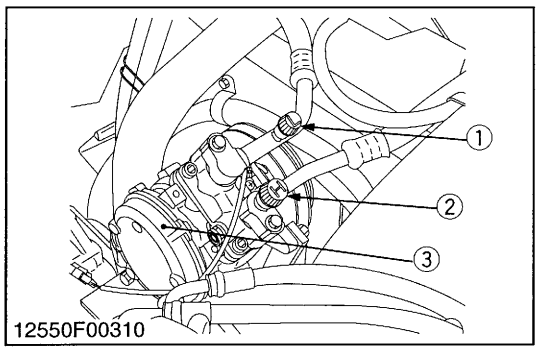
[2] DISCHARGING EVECUATING AND CHARGING

■ IMPORTANT

- **When discharging, evacuating or charging the refrigerating system, be sure to observe the "PRECAUTION AT REPAIRING REFRIGERANT CYCLE". (See page 10-S7.)**

12550S00090

(1) Discharging the System



Prepare for the R134a refrigerant recovery and recycling machine.

1. Connect low pressure side hose (blue) from the recovery and recycling machine to **LO** pressure side charging valve (1) on the compressor (3). Connect high pressure side hose (red) to **HI** pressure side charging valve (2) on the compressor (3).
2. Follow the manufacturers instructions and discharge the system.

■ IMPORTANT

- **Use only R134a refrigerant recovery and recycling machine. Eliminate mixing R134a equipment, refrigerant, and refrigerant oils with R12 systems to prevent compressor damage.**

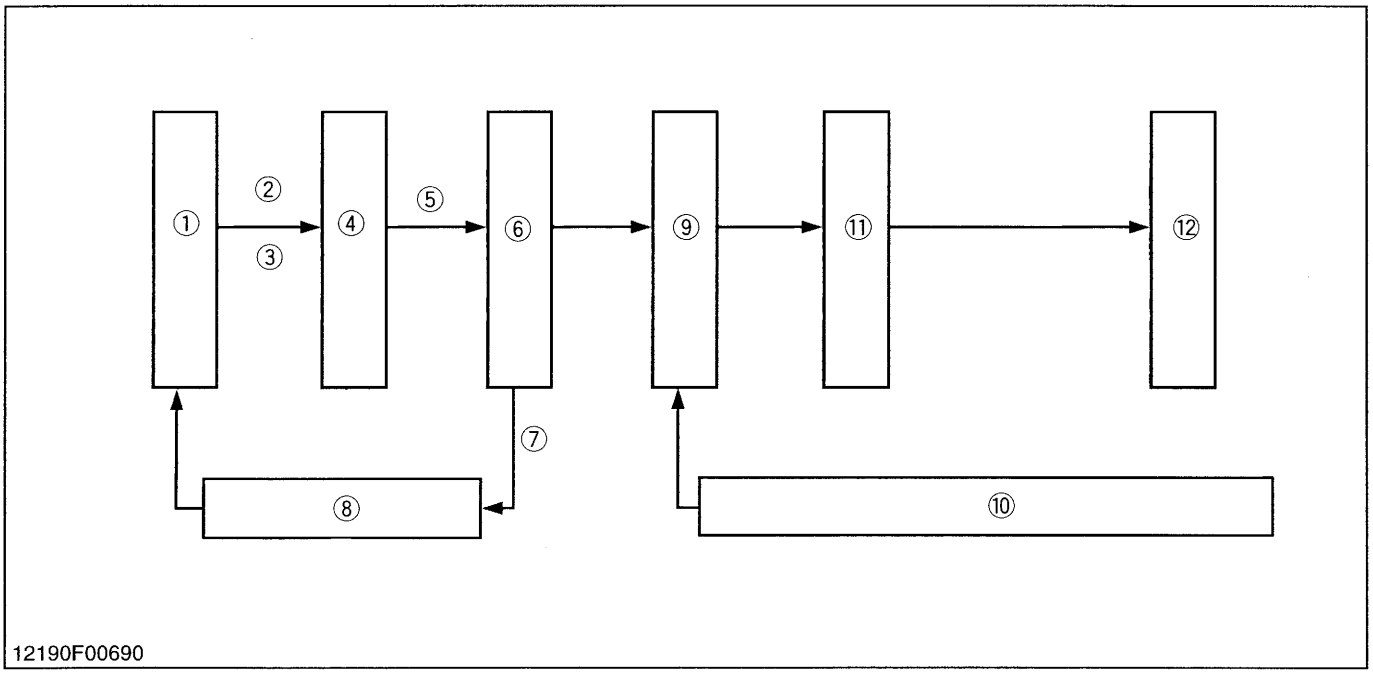
⚠ CAUTION

- **Protect fingers with cloth against frostbite by refrigerant when disconnecting the hose to the charging valve.**

(1) **LO** Pressure Side Charging Valve
(2) **HI** Pressure Side Charging Valve
(3) Compressor

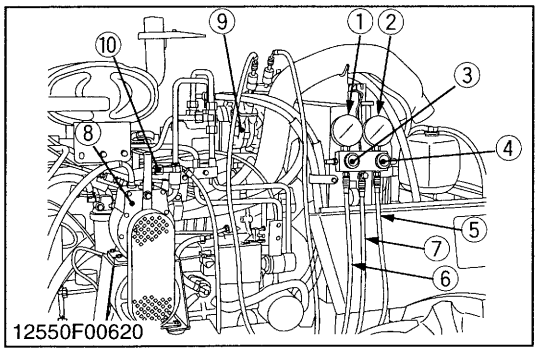
12550S00080

(2) Evacuating the System



(1) Begin Creating Vacuum
(2) Approx. 15 minutes
(3) 2.2 MPa (750 mm Hg, 319 psi)
(4) Stop Creating Vacuum
(5) Leave for 5 minutes
(6) Checking Airtightness
(7) Gauge Indication Abnormal
(8) Checking Connecting Parts, and Correction
(9) Charging Refrigerant
(10) Filling Refrigerant (98 kPa, 1 kgf/cm^2, 14 psi)
(11) Gas Leak Testing
(12) Charging Refrigerant

12190S00320



12550F00620

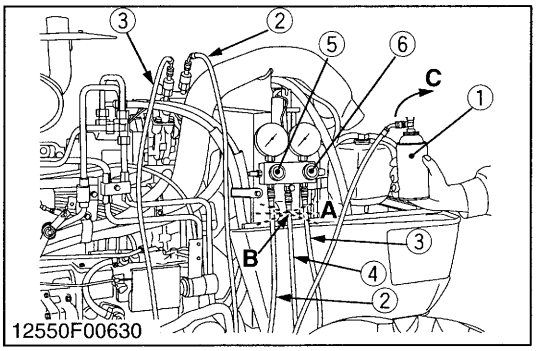
Evacuating the System

1. Discharge refrigerant from the system by R134a refrigerant recovery and recycling machine. (Refer to **"Discharging the system"**.)
2. Connect the charging hose (5) (red) to the **HI** pressure side charging valve and connect the charging hose (6) (blue) to the **LO** pressure side charging valve.
3. Connect the center charging hose (7) (green) to a vacuum pump inlet.
4. Open both valves (3), (4) of manifold gauge fully. Then run the vacuum pump (8) to evacuate the refrigerant cycle. (For approx. **15 minutes**.)
5. When **LO** pressure gauge (1) reading is more than **2.20 MPa (750 mmHg, 319 psi)**, stop the vacuum pump (8) and close both valves (3), (4) of manifold gauge fully.
6. Wait for over **5 minutes** with the **HI** and **LO** pressure side valves (4), (3) of gauge manifold closed, and then check that gauge indicator does not return to **0**.
7. If the gauge indicator is going to approach to **0**, check whether there is a leaking point and repair if it is, and then evacuate it again.

(1) **LO** Pressure Gauge
(2) **HI** Pressure Gauge
(3) **LO** Pressure Side Valve (Close)
(4) **HI** Pressure Side Valve (Open)
(5) Red Hose
(6) Blue Hose
(7) Green Hose
(8) Vacuum Pump (Running)
(9) Compressor
(10) Vacuum Pump Adaptor

12550S00100

(3) Charging the System



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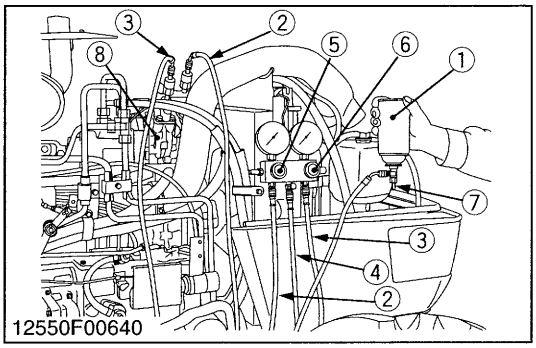


12550F00640

Charging an Empty System (Liquid)

This procedure is for charging an empty system through the **HI** pressure side with the refrigerant in the liquid state.

⚠ CAUTION

- **Never run the engine when charging the system through the HI pressure side.**
- **Do not open the LO pressure valve when refrigerant R134a is being charged in the liquid state (refrigerant container is placed upside-down).**

■ IMPORTANT

- **After charging the refrigerant in the liquid state with approx. 500 g (1.1 lbs) through the HI pressure side, be sure to recharge the refrigerant in the vapor state to specified amount through the LO pressure side.**

1. Close the **HI** and **LO** pressure side valves (6), (5) of manifold gauge after the system is evacuated completely.
2. Connect the center charging hose (4) to the can tap valve (7) fitting, and then loosen the center charging hose at the center fitting of manifold gauge until hiss can be heard.
   Allow the air to escape for few seconds and tighten the nut.
3. Open the **HI** pressure side valve (6) fully, and keep the container upside-down to charge the refrigerant in the liquid state from the **HI** pressure side.
4. Charge the refrigerant in the liquid state with approx. 500 g (1.1 lbs) from the **HI** pressure side.

■ NOTE

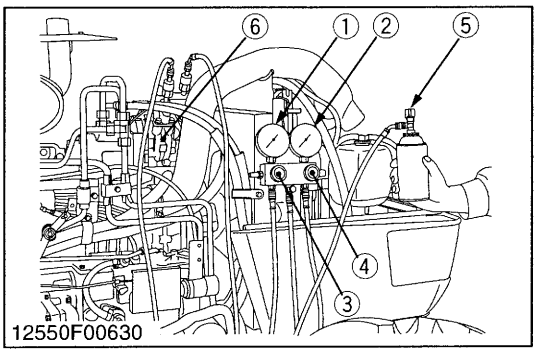
- **If LO pressure gauge does not show a reading, the system is clogged and must be repaired.**

5. Close the **HI** pressure side valve (6) of manifold gauge and can tap valve of refrigerant container.

(1) Refrigerant Container (R134a)
(2) Blue Hose
(3) Red Hose
(4) Green Hose
(5) **LO** Pressure Side Valve (Close)
(6) **HI** Pressure Side Valve (Open)
(7) Can Tap Valve (Open)
(8) Compressor

(A) Air Purge
(B) Loosen the Nut
(C) Open the Can Tap Valve

12550S00110



Charging an Empty or Partially Charged System (Vapor)

This procedure is to charge the system through the **LO** pressure side with refrigerant in the vapor state. When the refrigerant container is placed right side up, refrigerant will enter the system as a vapor.

⚠ CAUTION

- **Never open the HI pressure valve of manifold gauge while the engine is running.**

■ NOTE

- **Do not turn the refrigerant container upside-down when charging the system by running the engine.**
- **Put refrigerant conatiner into a pan of warm water (maximum temperature 40 °C (104 °F)) to keep the vapor pressure in the container slightly higher than vapor pressure in the system.**

1. Check that the **HI** pressure valve (4) is closed.
2. Start the engine and set an approx. 1500 min^{-1} (rpm).
3. Turn on the A/C switch.
   Set the temperature control lever to maximum cooling position and the blower switch to **HI** position.
4. Open the **LO** pressure valve (3) of manifold gauge and the can tap valve (5) on refrigerant container and charge the refrigerant until air bubbles in the sight glass of the receiver vanish.
5. After charging the specified amount of refrigerant into the system, close the **LO** pressure valve (3) of manifold gauge and can tap valve (5), then stop the engine.
6. Check for gas leak with a electric gas leak tester (see page 10-S10).

(Reference)

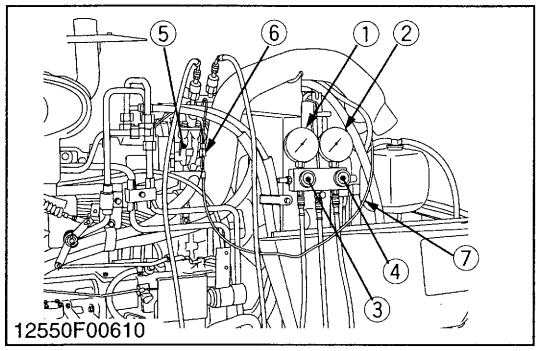
- Specified amount of refrigerant (total) :
- 900 to 1000 g (2.0 to 2.2 lbs) [Refrigerant R134a]
- Manifold gauge indication at fully charged system (at ambient temperature : 30 °C (86 °F))

HI pressure side :	1.27 to 1.66 MPa
	13 to 17 kgf/cm^2
	185 to 242 psi
LO pressure side :	0.15 to 0.20 MPa
	1.5 to 2.0 kgf/cm^2
	21 to 28 psi

(1) **LO** Pressure Gauge
(2) **HI** Pressure Gauge
(3) **LO** Pressure Valve (Open)
(4) **HI** Pressure Valve (Close)
(5) Can Tap Valve
(6) Compressor (Running)

12550S00120

(4) Checking Charge Refrigerant Amount



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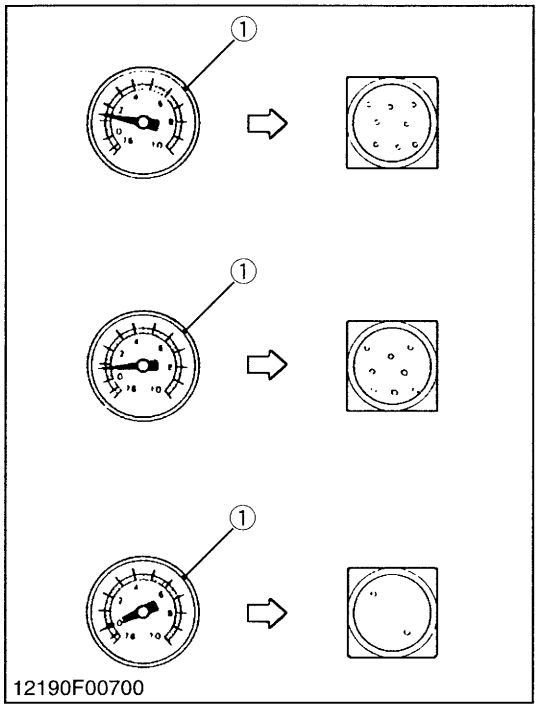


12190F00700

After charging the refrigerant, check for amount of charging refrigerant as follows.

■ NOTE

- **The pressure on the following checking are the gauge indications at ambient temperature 30 ˚C (86 ˚F), so it should be noted that the pressure will differ some what with the ambient temperature.**

1. Disconnect the **1P** connector (6) of magnetic clutch.
2. Start the engine and set at approx. **1500 rpm**.
3. Connect the **1P** connector (6) of magnetic clutch to battery directly, and then set the blower switch to **HI** position.
4. Leave the system for approx. **5 minutes** until the refrigerant cycle becomes stable, keeping pressure on the **HI** pressure side from 1.27 to 1.66 MPa (13 to 17 kgf/cm^2, 185 to 242 psi).
5. When the refrigerant cycle is stabilizer, turn off the blower switch and let the compressor alone to run. Then pressure on the **LO** pressure side gradually drops. At this time, if pressure on the **HI** pressure side is maintained from 1.27 to 1.66 MPa (13 to 17 kgf/cm^2, 185 to 242 psi), air bubbles which pass through the sight glass become as stated below depending on refrigerant charged amount.

A: Insufficient refrigerant charge

Air bubbles pass continuously the sight glass when pressure on the **LO** pressure side is over 99.0 kPa (1.01 kgf/cm^2, 14.4 psi).
In this case, charge the refrigerant from the **LO** pressure side.

B: Properly refrigerant charge

Air bubbles pass through the sight glass continuously when pressure on the **LO** pressure side is within 59 to 98 kPa (0.6 to 1.0 kgf/cm^2, 9 to 14 psi).
If the charge refrigerant amount is proper, no air bubble is observed on the sight glass at pressure on the **LO** pressure side over 99.0 kPa (1.01 kgf/cm^2, 14.4 psi) when the blower switch is turned on. When the blower switch is turned off, bubbles pass through the sight glass in case pressure on the **LO** pressure side is within 59 to 98 kPa (0.6 to 1.0 kgf/cm^2, 9 to 14 psi).

C: Excessive refrigerant charge

Air bubbles pass through the sight glass time to time or no air bubble is observed when pressure on the **LO** pressure side is under 59 kPa (0.6 kgf/cm^2, 9 psi).
In this case, discharge excessive refrigerant gradually from the **LO** pressure side.

(1) **LO** Pressure Gauge
(2) **HI** Pressure Gauge
(3) **LO** Pressure Valve (Close)
(4) **HI** Pressure Valve (Close)
(5) Compressor (Running)
(6) **1P** Connector
(7) To Battery

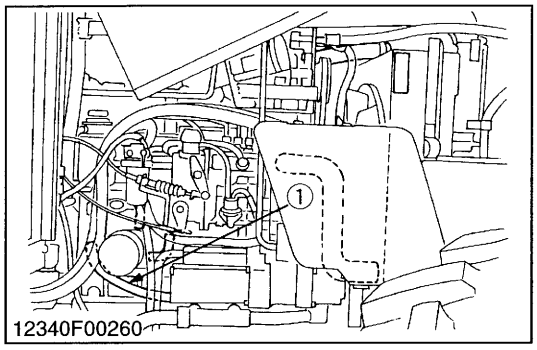
12550S00130

CHECKING AND CHARGING REFRIGERANT CYCLE

[1] SEPARATING CABIN FROM TRACTOR BODY DISASSEMBLING AND ASSEMBLING

The disassembling method described here is a procedure for disassembly that doesn't require discharging air conditioner refrigerant from the air conditioner system.

12190S00370



Draining Coolant

CAUTION

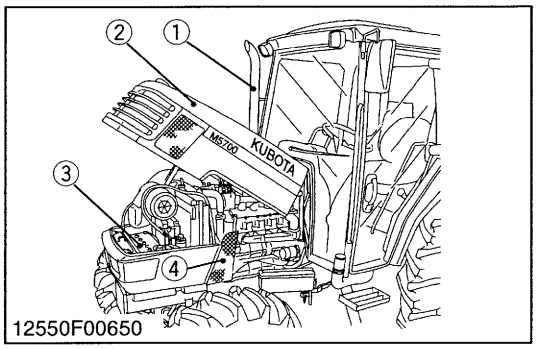
- **Never remove the radiator cap until coolant temperature is well below its boiling point. Then loosen cap slightly to the stop to relieve any excess pressure before removing cap completely.**

1. Stop the engine and let cool down.
2. Remove the radiator hose (1) from the engine side to drain the coolant.
3. Remove the radiator cap to completely drain the coolant.
4. After all coolant is drained, reinstall the radiator hose.

Coolant	Capacity	7.3 L 7.7 U.S.qts. 64 Imp.qts.

(1) Radiator Hose

12550S00140



Preparation 1

1. Remove the muffler (1).
2. Remove the bonnet (2).
3. Disconnect the battery's cable.
4. Remove the side cover (4).

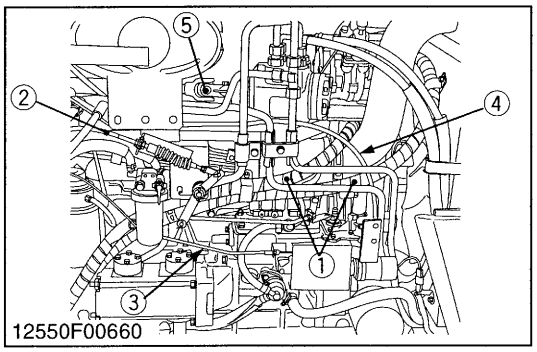
(1) Muffler
(2) Bonnet
(3) Battery
(4) Side Cover

12550S00150

Discharging Refrigerant

1. Refer to **"Discharging the System"**. (See page 10-S17.)

12550S00160

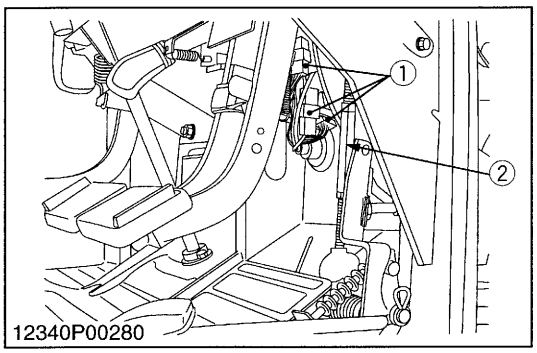


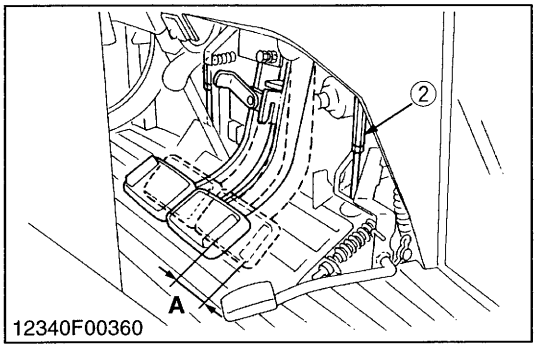
Preparation 2

1. Disconnect the heater hoses (1).
2. Disconnect the accelerator wire (2) and engine stop wire (3).
3. Disconnect the hour meter cable (4).
4. Pull out the steering joint (5).

(1) Heater Hoses
(2) Accelerator Wire
(3) Engine Stop Wire
(4) Hour Meter Cable
(5) Steering Joint

12550S00170





Preparation 3

1. Disconnect the connectors (1) and pull out it from cabin.
2. Disconnect the brake rod **R.H.** (2) from turnbuckle and remove it.

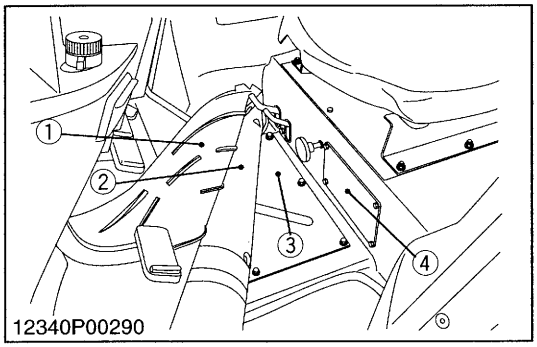
(When reassembling)

- Be sure to adjust the brake pedal free travel.

Proper brake pedal free travel **(A)**	40 to 45 mm (1.6 to 1.8 in.) in the pedal
	Keep the free travel in the right and left brake pedals equal.

(1) Connectors
(2) Brake Rod **R.H.**

12340S00370



Preparation 4

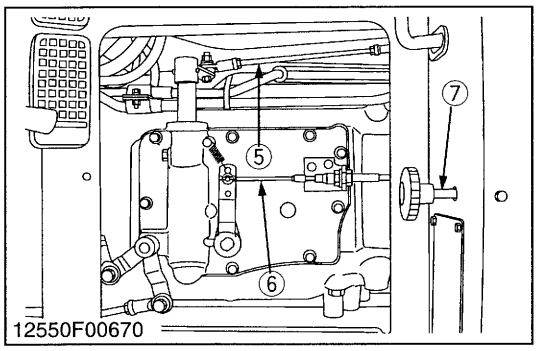
1. Remove the floor mat 1 (1), floor mat 2 (2) and cover 1 (3), cover 2 (4).
2. Disconnect the main shift rod (5).
3. Disconnect the wire (6).
4. Disconnect the lowering speed adjusting rod (7).

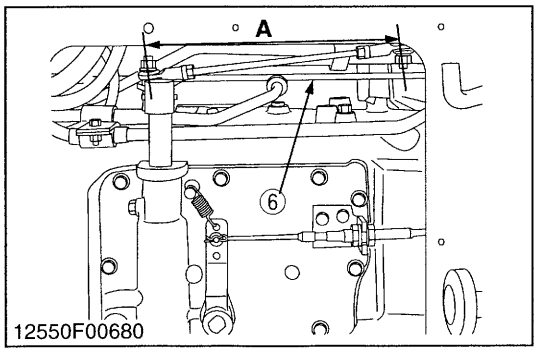
(When reassembling)

- Be sure to adjust the main shift rod length **(A)**, if necessary.

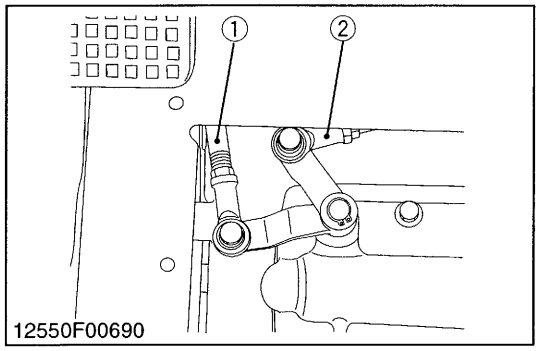
Shift rod length **(A)**	Factory spec.	Approx. 275 mm 10.8 in.

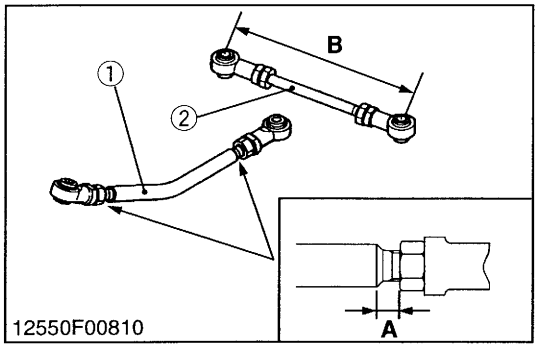
(1) Floor Mat **1**
(2) Floor Mat **2**
(3) Cover **1**
(4) Cover **2**
(5) Main Shift Rod
(6) Wire
(7) Lowering Speed Adjusting Rod

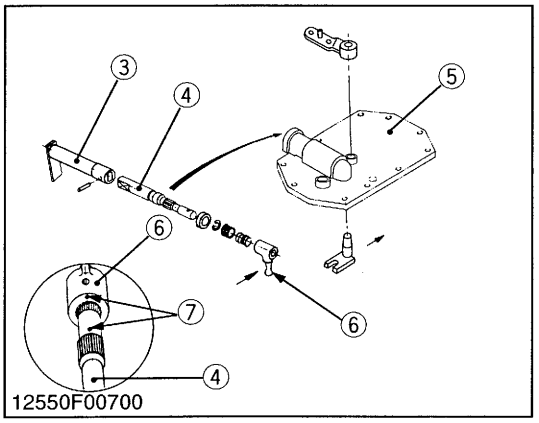




12550S00180







Preparation 5

1. Disconnect the shuttle shift rod 1 (1).
2. Disconnect the shuttle shift rod 2 (2).

- Be sure to adjust the length **(A)** (both sides) of shuttle shift rod (1) and (2).

Shuttle rod length **(A)**	Factory spec.	Approx. 10 mm 0.39 in.
Shuttle rod length **(B)**		Approx. 176 mm 6.9 in.

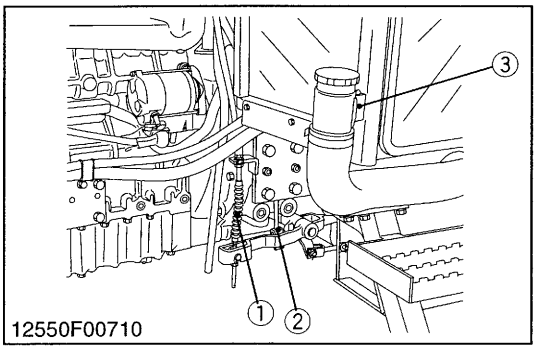
■ NOTE

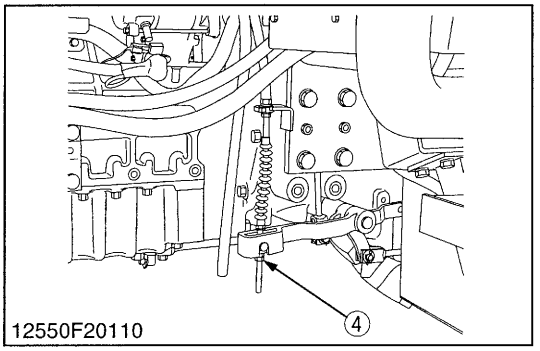
(When reassembling)

- When install the shaft (4) to the cam (6), be sure to align the alignment mark (7) in the figure left.

(1) Shuttle Shift Rod **1**
(2) Shuttle Shift Rod **1**
(3) Lever
(4) Shaft
(5) Speed Charge Cover
(6) Cam
(7) Alignment Mark

12550S00190





Preparation 6

1. Disconnect the brake rod **L.H.** (2) from turnbuckle and remove it.
2. Disconnect the clutch cable (1).
3. Remove the cap stay (3).

(When reassembling)

- Be sure to adjust the clutch pedal free travel.

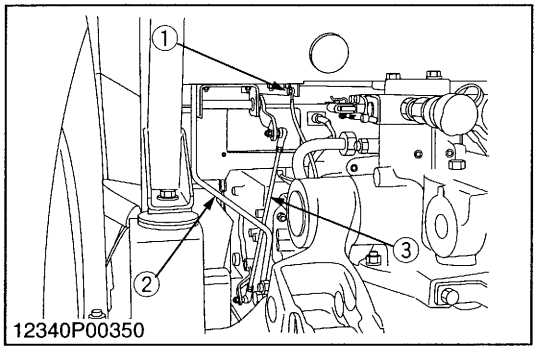
Proper clutch pedal free travel	35 to 45 mm (1.4 to 1.8 in.) on the pedal

(Adjusting Procedure)

1. Stop the engine and remove the key.
2. Slightly depress the clutch pedal and measure free travel at the top of pedal stroke.
3. If adjustment is needed, loosen the lock nut (4) and adjust the cable length within acceptable limits.
4. Retighten the lock nut (4).

(1) Brake Rod **L.H.**
(2) Clutch Cable
(3) Cap Stay
(4) Lock Nut

12550S00200

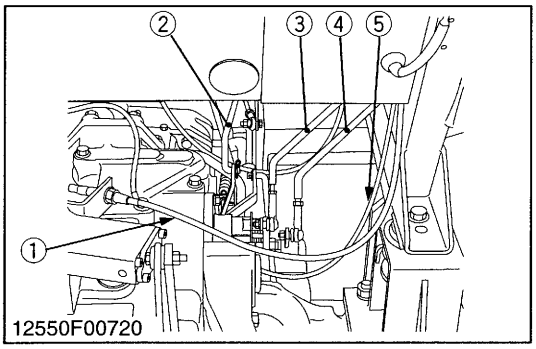


Preparation 7

1. Disconnect the auxiliary speed change rod (3).
2. Disconnect the DT shift rod (2).
3. Disconnect the earth harness (1).

(1) Earth Harness
(2) DT Shift Rod
(3) Auxiliary Speed Change Rod

12550S00210



Preparation 8

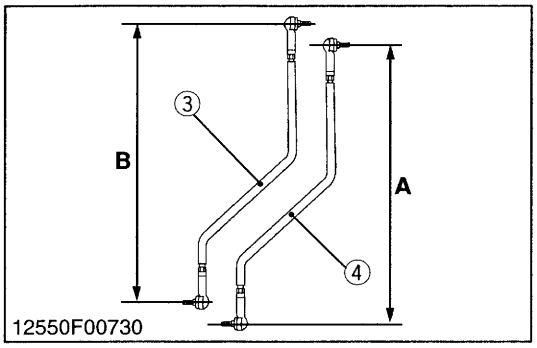
1. Disconnect the differential lock rods (2).
2. Disconnect the position control rod (4) and draft control rod (3).
3. Disconnect the auxiliary control valve wire (1).
4. Disconnect the PTO wire (5).

(When reassembling)

- Be sure to adjust the position rod length **A** and draft rod length **B**.

Position rod length **A**	Factory spec.	Approx. 362 mm 14.3 in.
Draft rod length **B**	Factory spec.	Approx. 362 mm 14.3 in.

(1) Auziliary Control Valve Wire
(2) Differential Lock Rod
(3) Draft Control Rod
(4) Position Control Rod
(5) PTO Wire



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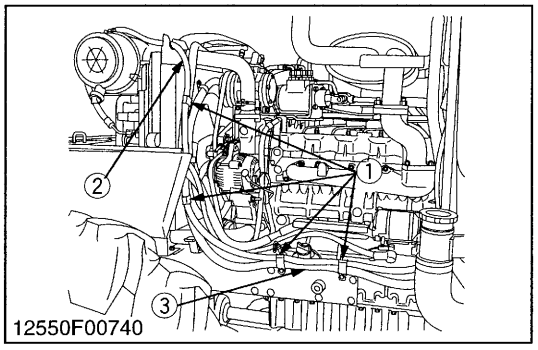


Preparation 9

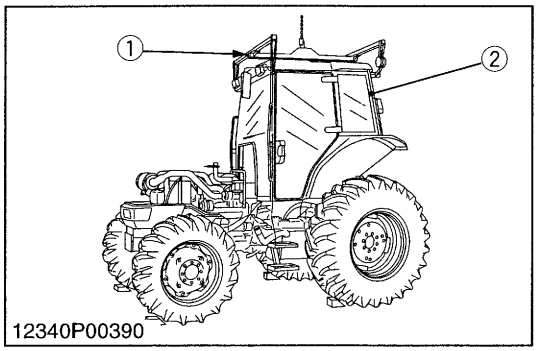
1. Remove the hose clamps (1).
2. Disconnect the low pressure pipe (2) from receiver.
3. Disconnect the high pressure pipe (3) from compressor.

(When reassembling)

Tightening torque	High Pressure Pipe 2 retaining nut	11.8 to 14.7 N·m 1.2 to 1.5 kgf·m 8.7 to 10.8 ft-lbs
	Low pressure pipe mounting bolts	7.9 to 11.8 N·m 0.8 to 1.2 kgf·m 5.8 to 8.7 ft-lbs

(1) Hose Clamp
(2) High Pressure Pipe 2
(3) Low Pressure Pipe

12550S00230



Dismounting Cabin

1. Set the cabin dismounting tool (1).
2. Remove the cabin mounting bolts and nuts.
3. Dismounting the cabin from tractor body (2).

(When reassembling)

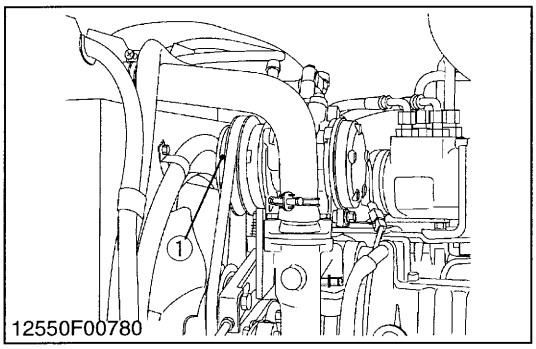
Tightening torque	Cabin mounting screws and nuts	123.6 to 147.0 N·m 12.6 to 15.0 kgf·m 91.2 to 108.4 ft-lbs

(1) Dismounting Tool (2) Cabin Body

12340S00430

[2] COMPRESSOR

CHECKING

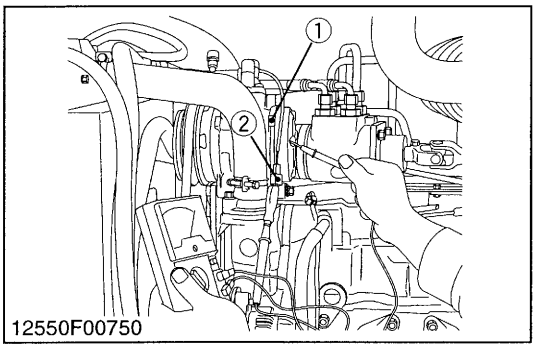


Operation of Magnetic Clutch

1. Start the engine.
2. Check whether abrasion or abnormal noise is heard when only the magnetic clutch pulley is running while the A/C switch is turned **OFF**.
3. Check that the magnetic clutch (1) does not slip when the A/C switch and blower switch are turned **ON** (when the air conditioner is in operation).
4. If anything abnormal is found, repair or replace.

(1) Magnetic Clutch

12550S00250



Stator Coil

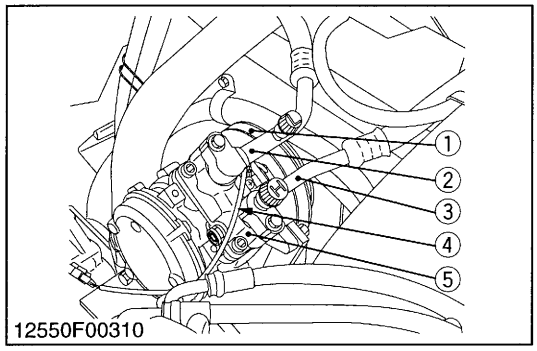
1. Measure the resistance of the stator coil with an ohmmeter across the **1P** connector of magnetic clutch and stator body.
2. If the measurement is not within the factory specifications, replace the stator coil.

Stator coil resistance	Factory spec.	3.0 to 3.4 Ω

(1) Stator Body (2) 1P Connector

12550S00260

DISASSEMBLING AND ASSEMBLING



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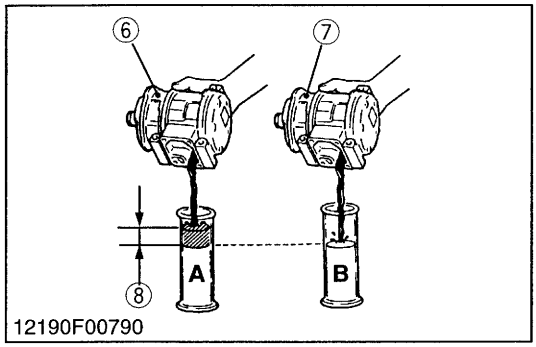


12190F00790

Compressor

1. Discharge the refrigerant from the system. (Refer to **"Discharging the System"** : See page 10-S17.)
2. Disconnect the low pressure pipe (suction) (2) and high pressure pipe (discharge) (3) from the compressor, then cap the open fittings immediately to keep moisture out of the system.
3. Disconnect the **1P** connector of magnetic clutch.
4. Remove the air conditioner belt (1) and remove the compressor (5).

(When reassembling)

- After reassembling the compressor, be sure to adjust the air conditioner belt tension (see page G-23) and recharge the refrigerant to the system. (Refer to **"Charging the System"** : See page 10-S17.)
- Apply compressor oil (**NIPPONDENSO ND-OIL8** or equivalent) to the O-rings and take care not to damage them.
- **"S"** letter is marked on the compressor for connecting the low pressure pipe (suction side).
- **"D"** letter is marked on the compressor for connecting the high pressure pipe (discharge side).

(When replacing compressor)

- When replaceing the compressor with a new one, meet the oil amount with old one.

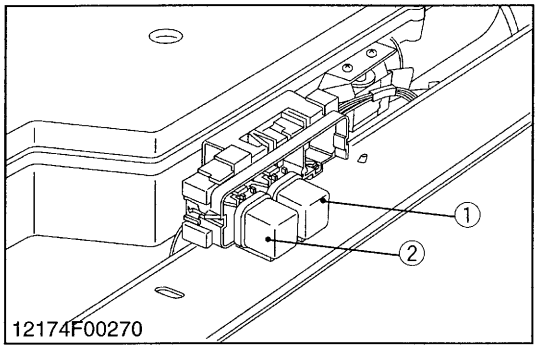
Tightening torque	High pressure pipe and low pressure pipe mounting screw	7.9 to 11.8 N·m 0.8 to 1.2 kgf·m 5.8 to 8.7 ft-lbs
	Compressor mounting screws	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft-lbs

(1) Air-conditioner Belt
(2) Low Pressure Pipe
(3) High Pressure Pipe
(4) **1P** Connector Harness
(5) Compressor
(6) New Compressor
(7) Old Compressor
(8) Remove the Excess Oil (**A-B**)

12550S00270

[3] AIR CONDITIONING SYSTE AND FRONT WINDSHIELD WIPER CHECKING

(1) A/C Main Relay and Compressor Relay



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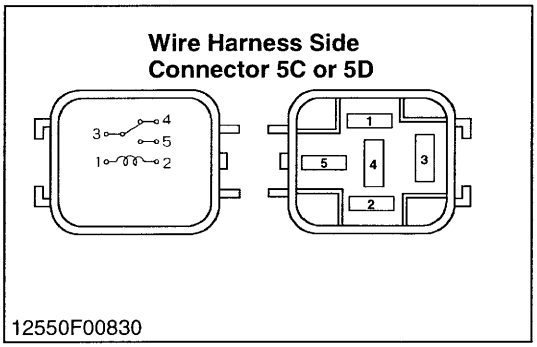


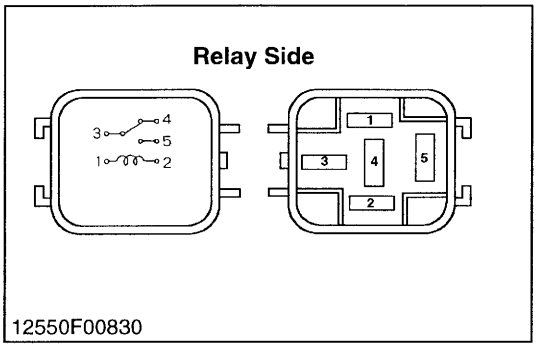
12550F00830

Connector Voltage

1. Turn the main switch **ON** position.
2. Measure the voltage across the connector **5C** (A/C main relay), connector **5D** (compressor relay) terminal **1** and chassis.
3. If the voltage differs from the battery voltage (11 to 14 V), check the wiring harness.

(1) Compressor Relay (2) A/C Main Relay

12550S00430



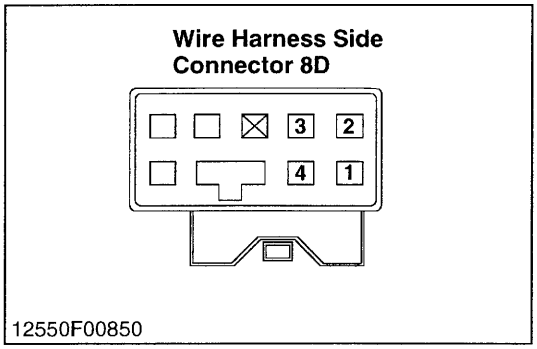
12550F00830

Relay Test

1. Apply battery voltage across terminal **1** and **2** and check for continuity across terminals **3** and **5**.
2. If 0 ohm is not indicated, renew the relay.

12550S00440

(2) Blower Switch



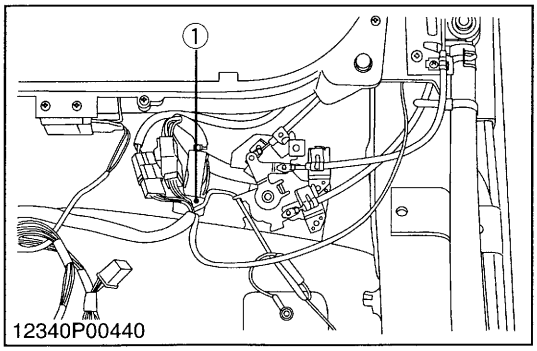
12550F00850

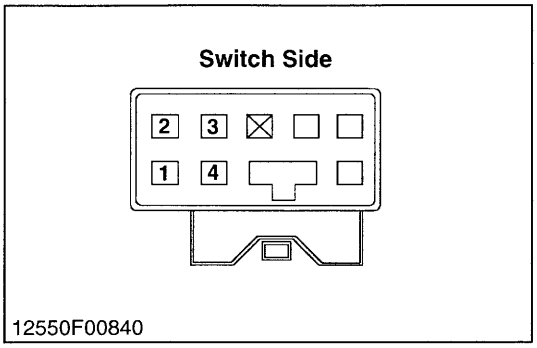
Connector Voltage

1. Disconnect the blower switch connector **8D**
2. Turn the main switch **ON** position.
3. Measure the voltage with a voltmeter across the connector **3** terminal and **4** terminal.
4. If the voltage differs from the battery voltage, the wiring harness, A/C relay, fuse or main switch is faulty.

Voltage	**3** terminal – **4** terminal	Approx. battery voltage

12550S00450





Blower Switch Test

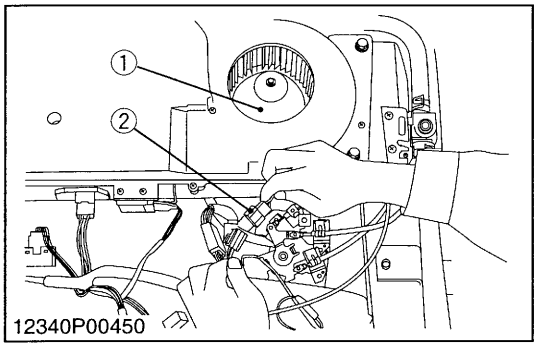
1. Check the continuity through the switch with an ohmmeter.
2. If the continuity specified below are not indicated, the switch is faulty.

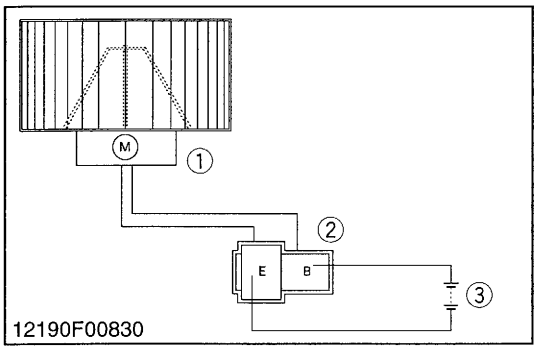
Position \ Terminal		4	3	2	1
blower switch	OFF	●			
	● (Low)	●	●		
	● (Medium)	●	●	●	
	● (High)	●	●		●

(1) Blower Switch

12550S00460

(3) Blower Motor





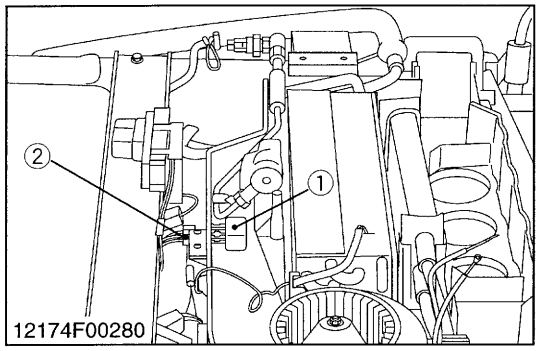
Blower Motor Test

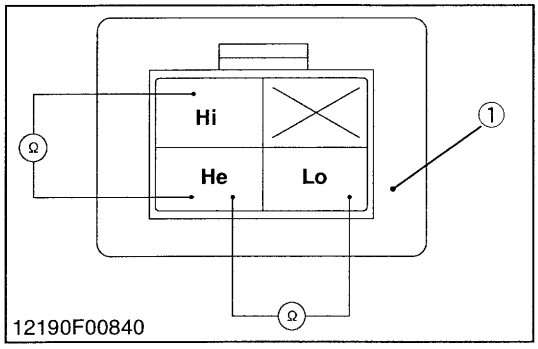
1. Remove the outer roof.
2. Turn the blower motor (1) by hand and check whether it turns smoothly.
3. Disconnect the connector (2) of blower motor (1).
4. Connect a jumper lead from battery (3) positive terminal to connector **B** terminal.
5. Connect a jumper lead from battery negative terminal to connector **E** terminal momentarily.
6. If the blower motor does not run, check the motor.

(1) Blower Motor
(2) Blower Motor Connector
(3) Battery (12 V)

12174S00080

(4) Blower Resistor





Blower Resistor Check

1. Disconnect the connector **4F** (2) for blower resistor (1).
2. Measure the resistance with an ohmmeter across the **Hi** terminal and **Me** terminal, and across the **Lo** terminal and **Me** terminal.
3. If the factory specifications are not indicated, renew blower resistor.

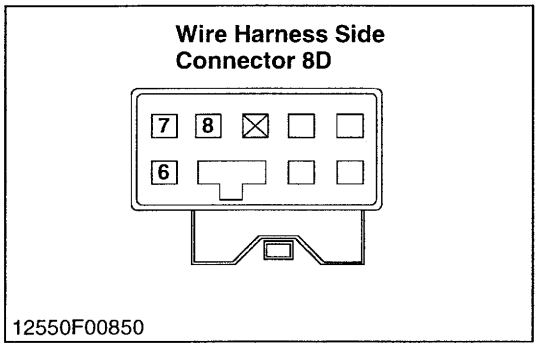
Resistance	Factory spec.	**Hi** terminal – **Me** terminal	Approx. 0.9 ohm
		Lo terminal – **Me** terminal	Approx. 1.8 ohm

(1) Blower Resistor

(2) Blower Resistor Connector

12550S00470

(5) A/C Switch

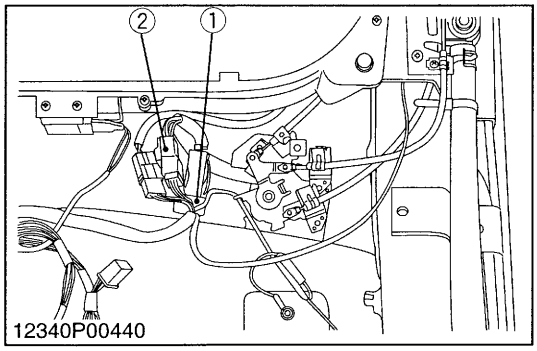


Connector Voltage

1. Disconnect the A/C switch connector **8D**.
2. Turn the main switch **ON** position.
3. Measure the voltage with a voltmeter across the connector **6** terminal and **7** terminal.
4. If the voltage differs from the battery voltage, the wiring harness, A/C relay or fuse is faulty.

Voltage	**6** terminal – **7** terminal	Approx. battery voltage

12550S00480



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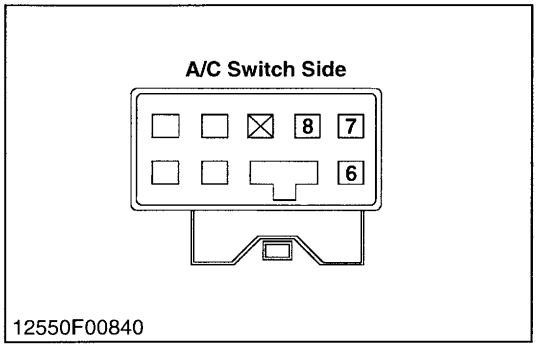

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A/C Switch Check

1. Check the continuity through the switch with an ohmmerter.
2. If the continuity specified below is not indicated, check the switch.

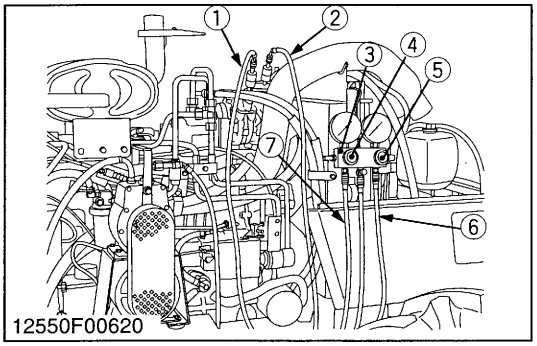
Position \ Terminal		6	7	8
A/C switch	OFF *2			
	ON *1	●	● ⌒	●

*1 : Push the A/C switch button to **ON** position.
*2 : Push again the A/C switch button to **OFF** position.

(1) A/C Switch

12550S00490

(6) A/C Pressure Switch



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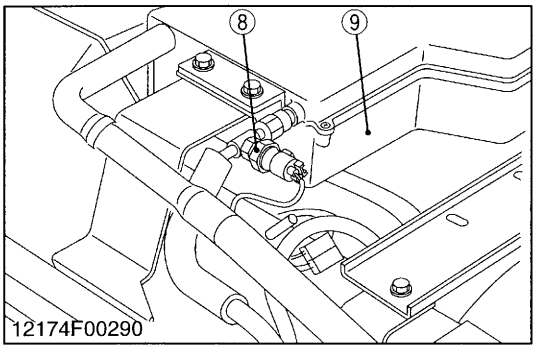

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HI Pressure Side

1. Connect the manifold gauge (3) to compressor as following procedure.
   Close the **HI** and **LO** pressure valves (5), (4) of manifold gauge tightly, and connect the charging hoses (red and blue) (6), (7) to the respective compressor service valves. (Refer to **HANDLING OF SERVICE TOOLS** : See page 10-S8.)

■ **NOTE**

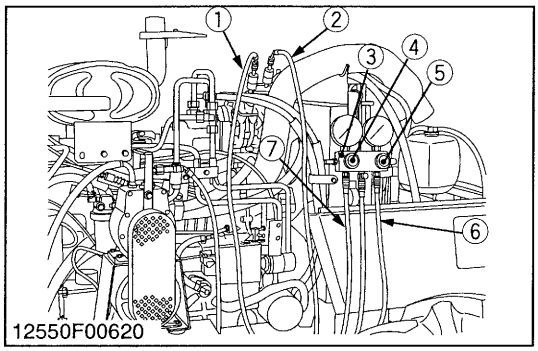
- **Be sure to blow out the air in the charging hoses at the manifold gauge connection end by utilizing the refrigerant pressure in the refrigerant cycle.**

2. Start the engine and set at approx. 1500 rpm. Turn on the A/C switch, then set the blower switch to **HI** position.
3. Raise pressure on the **HI** pressure side of the refrigerant cycle by covering the condenser front with a corrugated carboard, and the dual switch (8) is activated and the compressor magnetic clutch is turned off. At this time, read the **HI** pressure gauge of the manifold gauge. If this pressure reading differs largely with the setting pressure, replace the pressure switch with a new one.

Setting pressure	Factory spec.	Dual switch **OFF**	More than approx. 3.14 MPa 32 kgf/cm^2 455 psi

(1) **HI** (High Pressure Side) Charging Valve
(2) **LO** (Low Pressure Side) Charging Valve
(3) Manifold Gauge
(4) **LO** Pressure Valve
(5) **HI** Pressure Valve
(6) Charging Hose (Red)
(7) Charging Hose (Blue)
(8) Pressure Switch
(9) Air Conditioner Unit

12550S00500



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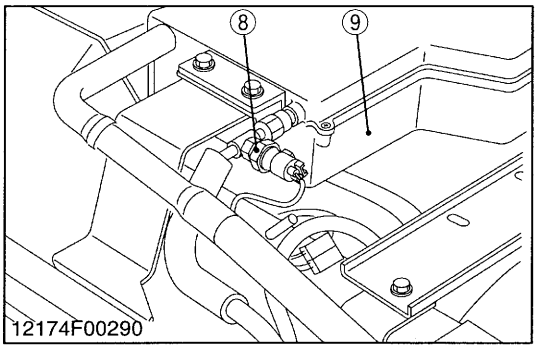

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LO Pressure Side

1. Disconnect connector **2F** of A/C pressure switch.
2. Measure the resistance with an ohmmeter across the connector terminals.
3. If 0 Ω is not indicated at normal condition, there is no refrigerant in the refrigerating cycle because gas leaks or pressure switch is defective.

(Reference)

Setting pressure	Factory spec.	Dual switch **OFF**	Less than approx. 0.196 MPa 2.0 kgf/cm^2 28.4 psi

- The resistance of dual switch is 0 Ω in normal running, but is becomes infinity if the pressure is abnormal (out of factory spec.). Because the dual switch starts to work.

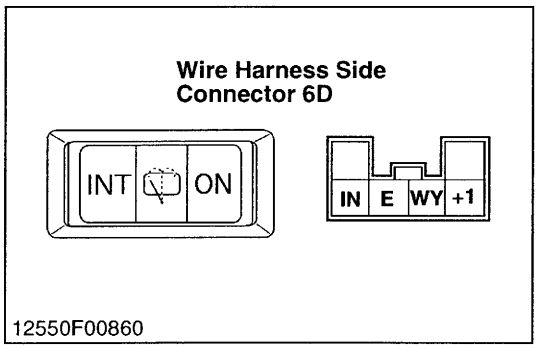
(1) **HI** (High Pressure Side) Charging Valve
(2) **LO** (Low Pressure Side) Charging Valve
(3) Manifold Gauge
(4) **LO** Pressure Valve
(5) **HI** Pressure Valve
(6) Charging Hose (Red)
(7) Charging Hose (Blue)
(8) Pressure Switch
(9) Air Conditioner Unit

12550S00280

[4] FRONT WINDSHIELD WIPER

CHECKING

(1) Front Wiper Switch



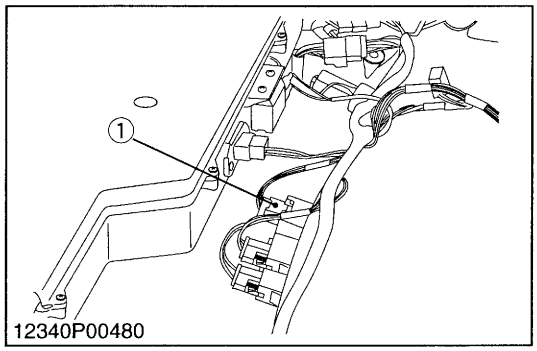
12550F00860

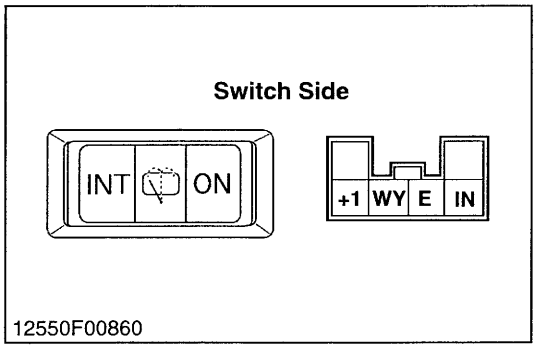
Connector Voltage

1. Turn the main switch **ON** position.
2. Measure the voltage with a voltmeter across the connector **E** terminal and chassis.
3. If the voltage differs from the battery voltage (11 to 14 V), the wiring harness, fuse or main switch is faulty.

Voltage	**E** terminal – Chassis	Approx. battery voltage

12550S00510





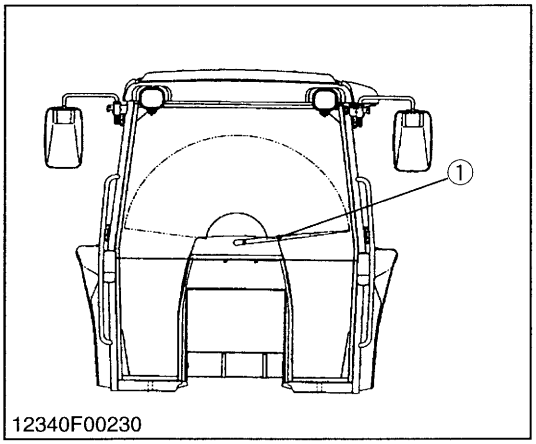
Front Wiper Switch

1. Check the continuity through the switch with an ohmmeter.
2. If the continuity specified below are not indicated, the switch is faulty.

	IN	+1	E	WY	WM
WASH 1		●	●	●	●
ON		●	●		
OFF					
INT	●		●		
WASH 2	●		●	●	●

(1) Front Wiper Switch Connector

12550S00290



Front Wiper Motor

1. Raise up the front wiper arm (1).
2. Turn the main switch **ON**.
3. Push the front wiper switch to **ON** position.
4. Count the number of wiper arm rocking per minutes.
5. If the number differs from the factory specifications, replace the wiper motor assembly.

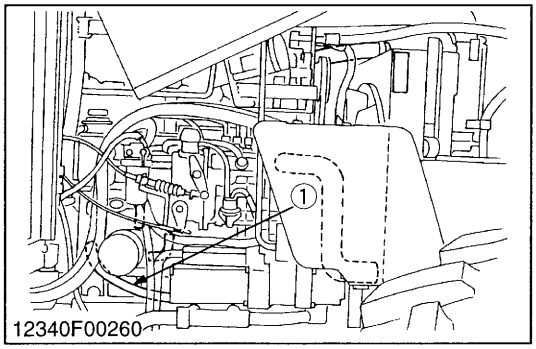
No load rotating speed	Factory spec.	33 to 43 times/min

(1) Wiper Arm

12340S00080

DISASSEMBLING AND ASSEMBLING

(1) Removing Air Conditioner Unit and Front Wiper Motor



Draining Coolant

CAURION

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

1. Stop the engine and let it cool down.
2. Disconnect the hose (1) to drain the coolant. When removing the drain plug, set the hose to drain port.
3. Remove the radiator cap to completely drain the coolant.
4. After all coolant is drained, reinstall the drain plug (1).

Coolant	Capacity	7.3 L 7.7 U.S.qts. 6.4 Imp.qts.

(1) Hose

12550S00410

Discharging Refrigerant

- Refer to **"Discharging the System"**. (See page 10-S16.)

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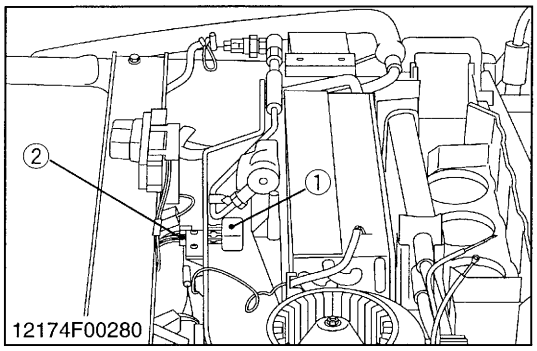
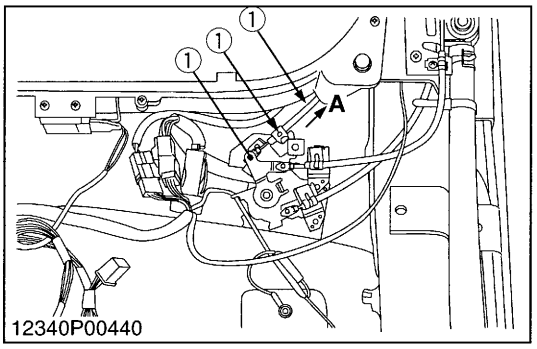


Preparation 1

1. Remove the outer roof.
2. Disconnect the battery negative cable.
3. Disconnect the A/C blower motor connector (1).
4. Disconnect the **4P** connector for A/C blower resistor (2).

(1) A/C Blower Motor Connector
(2) A/C Blower Resistor
(3) A/C Blower Resistor Connector

12550S00300



Air Mixing Door Control Cable (Blue Cable)

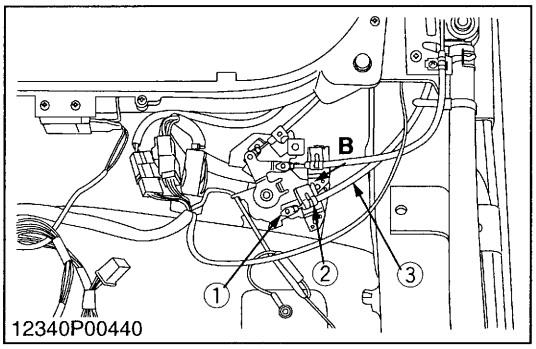
1. Disconnect the air mixing door control cable (3) from the damper lever (1) of air conditioner control panel side.

(When reassembling)

- Set the damper lever (1) of the air ocnditioner unit at **MAX HOT** position. Recnnect the cable.
- Move the control to **MAX HOT** position. Fit the inner cable in position, and press and fix the outer cable by the cable clip (2) in the direction of arrow **(A)** as shown at left.
- Move the temperature control lever several times and finally set it to **MAX HOT** position to make sure the damper lever is at **HOT** position too.

(1) Damper Lever
(2) Cable Clip
(3) Aix Mixing Door Control Cable
(A) Direction of Pulling Outer Cable

12550S00310



A/C Mode Door Control Cable (Yellow Cable)

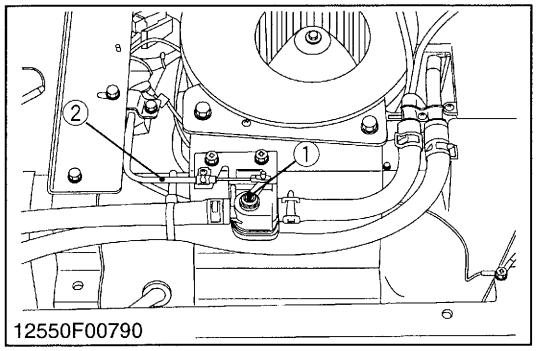
1. Disconnect the air conditioner mode door control cable (3) from the def. control lever (1) of A/C control panel side.

(When reassembling)

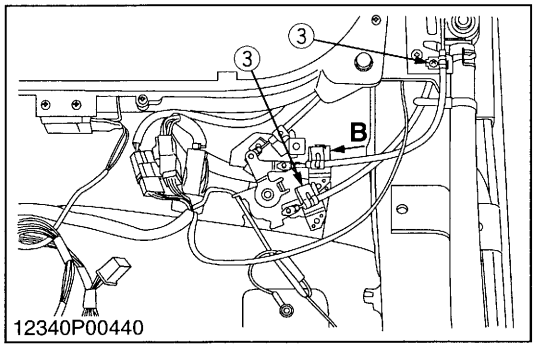
- Set the air conditioner unit to **DEF** mode position and reconnect the cable (3).
- Set the control at **DEF** position. Fit the inner cable in position, and press and fix the outer cable by the cable clip (2) in the direction of arrow **(B)** as shown at left.
- Move the mode lever several times and finally set it to **DEF** position to make sure the air conditioner unit is at **DEF** mode position.
- Lay and fix the mode door control cable over the water valve cable.

(1) **DEF.** Control Lever
(2) Cable Clip
(3) Mode Door Control Cable
(B) Direction of Pushing Outer Cable

12550S00320



12550F00790



12340P00440

Water Valve Control Cable (White Cable)

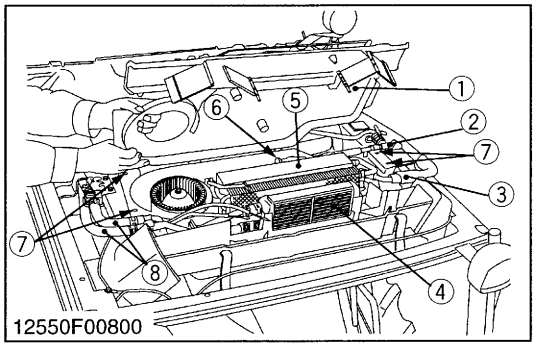
1. When disconnecting the water valve cable (2), follow the next reassembly procedure.

(When reassembling)

- Fully close the water valve (1) and reconnect the cable (2).
- Set the control at **MAX COOL** position. Fit the inner cable in position, and press and fix the outer cable by the cable clip (3) in the direction of arrow **(B)** as shown at left.
- Move the temperature control lever several times to make sure the water valve is fully closed at **MAX COOL** position.
- Do not allow the water valve cable to bend just away from the control, nor to get caught by the outer roof.

(1) Water Valve
(2) Water Valve Control Cable
(3) Cable Clip
(B) Direction of PushingOuter Cable

12550S00330



12550F00800

Air Conditioning Unit

1. Remove the unit cover (1).
2. Disconnect the heater hoses (8).
3. Disconnect the cooler pipe (liquid) (2) and coolerpipe (suction side) (3).
4. Remove the five screws (7) and take off the unit.
5. Remove the duct hoses.

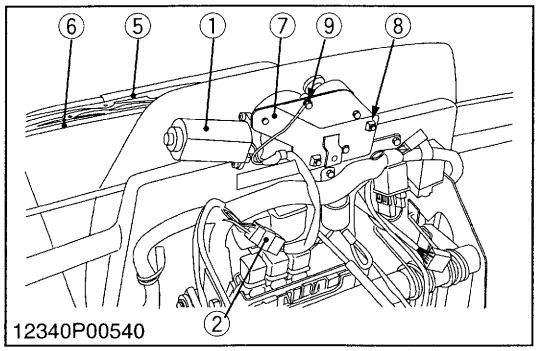
(When reassembling)

- When reconnecting the cooler pipes with the unit, apply compressor oil (NIPPONDENSO ND-OIL8) to O-rings.
- When remounting the unit, tighten five screw by hand and finally retighten them after aligning the inner roof duct with the unit duct.

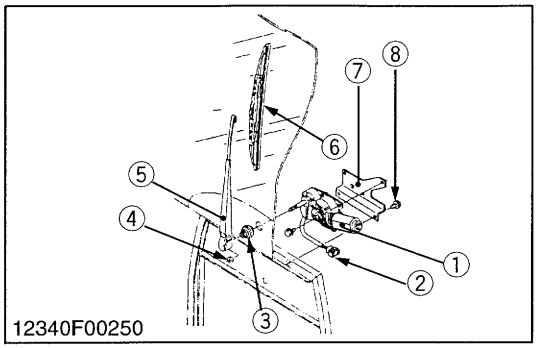
Tightening torque	A/C unit mounting screw (M6)	3.92 to 6.86 N·m 0.40 to 0.70 kgf·m 2.89 to 5.06 ft-lbs
	A/C unit mounting screw (M8)	9.8 to 15.7 N·m 1.00 to 1.6.0 kgf·m 7.23 to 11.6 ft-lbs
	Low pressure pipe (Cooler pipe (suction)) retaining nut	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs
	High pressure pipe 1 (Cooler pipe (liquid)) retaining nut	11.8 to 14.7 N·m 1.2 to 1.5 kgf·m 8.7 to 10.8 ft-lbs

(1) Unit Cover
(2) High Pressure Pipe 2 (Cooler Pipe (Liquid)) (High Pressure)
(3) Low Pressure Pipe (Cooler Pipe (Suction Side))
(4) Heater Core
(5) Evaporator
(6) Expansion Valve
(7) Screws
(8) Heater Hoses

12174S00100



12340P00540



12340F00250

Front Wiper Motor

1. Remove the steering wheels and steering post under covers.
2. Remove the meter panel.
3. Remove the panel under cover.
4. Disconnect the front wiper motor **4P** connector (2).
5. Remove the wiper arm mounting nut (4) and wiper arm (5).
6. Remove the wiper link cap (3).
7. Disconnect the earth lead setting screw.
8. Remove the front wiper motor bracket (7) mounting screw (8), then take out the front wiper motor (1).

(When reassembling)

Tightening torque	Wiper arm mounting nut (4)	6.37 to 9.32 N·m 0.65 to 0.95 kgf·m 4.7 to 6.9 ft-lbs

(1) Front Wiper Motor
(2) Front Wiper Motor Connector (**4P**)
(3) Wiper Link Cap
(4) Nut
(5) Wiper Arm
(6) Wiper Blade
(7) Wiper Motor Mounting Bracket
(8) Wiper Motor Bracket Mounting Screw

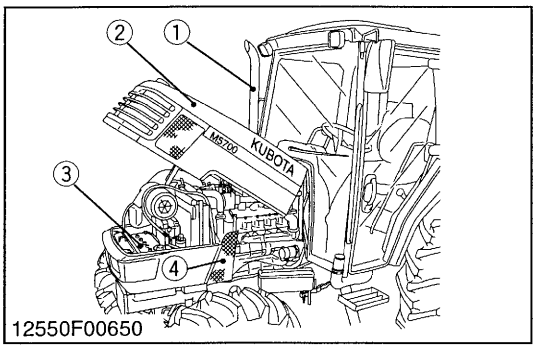
12340S00150

(2) Removing Air Conditioner Pipes

Discharging Refrigerant

1. Refer to "Discharging the System. (See page 10-S16.)

12340S00160



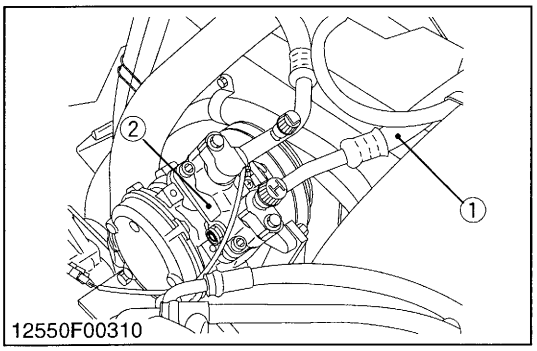
12550F00650

Muffler and Bonnet

1. Remove the muffler (1).
2. Remove the bonnet (2).
3. Disconnect the battery's cable.
4. Remove the side cover (4).

(1) Muffler
(2) Bonnet
(3) Battery
(4) Side Cover

12550S00340



12550F00310

High Pressure Pipe 1

1. Disconnect the high pressure pipe 1 (1) from the compressor (2) and cap the open fittings immediately to keep moisture out of the system.

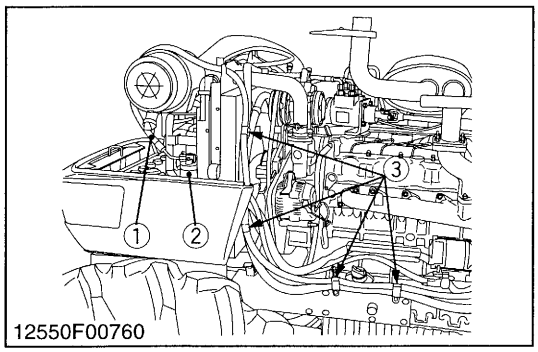
(When reassembling)

- Apply compressor oil (NIPPONDENSO ND-OIL8 or equivalent) to the O-rings and take care not to damage them.

Tightening torque	High pressure pipe 1 mounting screw (Compressor side)	7.9 to 11.8 N·m 0.8 to 1.2 kgf·m 5.8 to 8.7 ft-lbs

(1) High Pressure Pipe 1
(2) Compressor

12550S00350



Low Pressure Pipe 2

1. Remove the pipe clamps (3).
2. Disconnect the low pressure hose 2 (1) from the receiver (2) and cap the open fittings immediately to keep moisture out of the system.

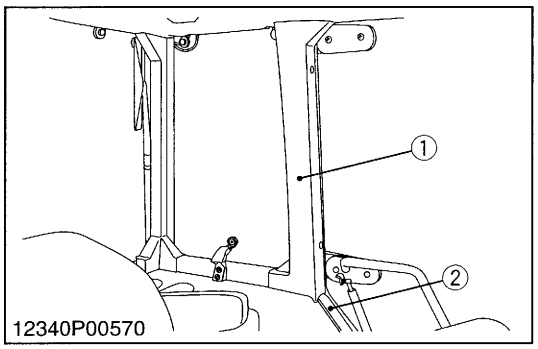
(When reassembling)

- Apply compressor oil (NIPPONDENSO ND-OIL8 or equivalent) to the O-rings and take care not to damage them.

Tightening torque	Low pressure pipe 2 mounting screw (Receiver side)	11.7 to 14.7 N·m 1.2 to 1.5 kgf·m 8.7 to 10.8 ft-lbs

(1) Low Pressure Pipe 2
(2) Receiver
(3) Clamp

12550S00360

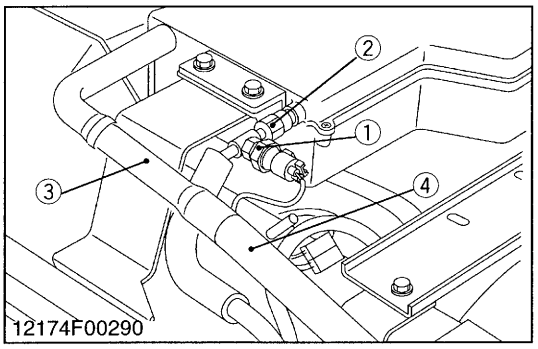


Inner Covers

1. Remove the inner covers (1) and (2).

(1) Inner Cover (Upper)
(2) Inner Cover (Lower)

12340S00200



Removing High Pressure and Low Pressure Pipes

1. Remove the outer roof.
2. Disconnect the pressure switch (1) connector.
3. Disconnect the high pressure pipe 2 (2), then cap the open fitting immediately to keep moisture out of the system.
4. Remove the rubber (3) and disconnect the low pressure pipe (4), then cap the open fittings immediately to keep moisture out of the system.
5. Pull out the pressure pipes (2) and (4) from the bottom of the cabin.
6. Take out the pressure pipes (2) and (4).

(When reassembling)

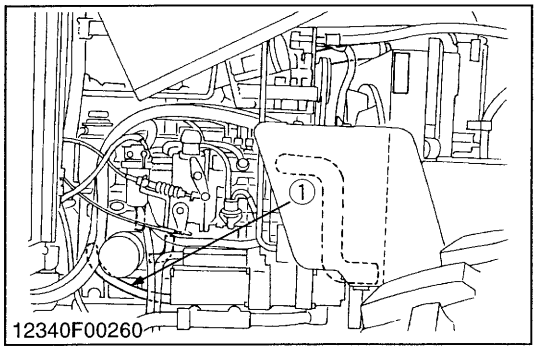
- Replace the rubber (3) with a new one.
- Apply compressor oil (**NIPPONDENSO ND-OIL8**) to the O-rings and take care not to damage them.

Tightening torque	High pressure pipe 2 retaining nut	11.8 to 14.7 N·m 1.2 to 1.5 kgf·m 8.7 to 10.8 ft-lbs
	Low pressure pipe retaining nut	29.5 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs

(1) Pressure Switch
(2) High Pressure Pipe 2
(3) Rubber
(4) Low Pressure Pipe

12174S00130

(3) Removing Heater Hoses



Draining Coolant

CAUTION

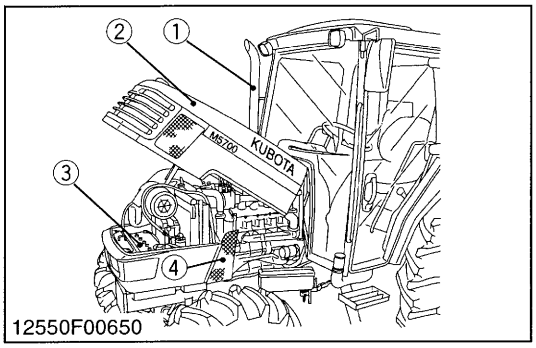
- **Never remove the radiator cap until coolant temperature is well below its boiling point. Then loosen cap slightly to relieve any excess pressure before removing cap completely.**

1. Stop the engine and let it cool down.
2. Disconnect the hose (1) to drain the coolant.
3. Remove the radiator cap to completely drain the coolant.
4. After all coolant is drained, reinstall the hose (1).

Coolant	Capacity	7.3 L 7.7 U.S.qts. 6.4 Imp.qts.

(1) Hose

12550S00420

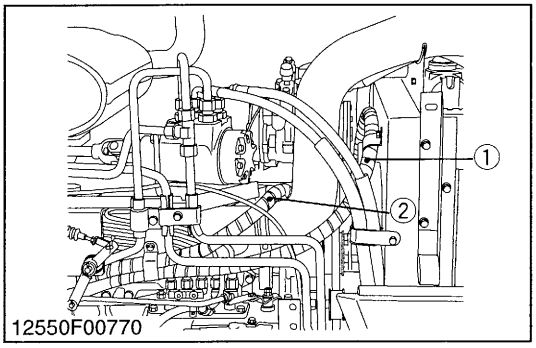


Muffler and Bonnet

1. Remove the muffler (1).
2. Remove the bonnet (2).
3. Disconnect the battery's cable.
4. Remove the side cover (4).

(1) Muffler
(2) Bonnet
(3) Battery
(4) Side Cover

12550S00340

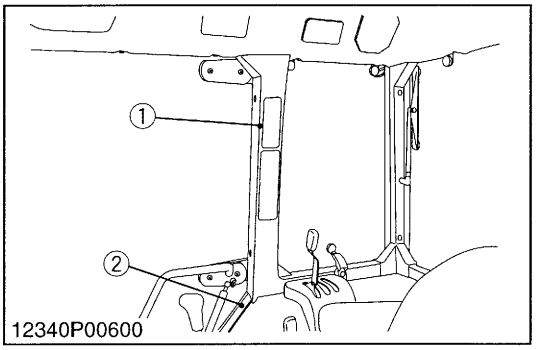


Heater Hoses

1. Disconnect the heater hoses (1), (2), and take out them under the cabin.

(1) Heater Hose 1
(2) Heater Hose 2

12550S00370

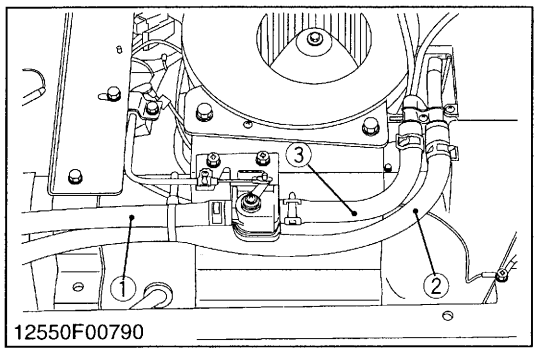


Inner Covers

1. Remove the inner covers (1) and (2).

(1) Inner Cover (Upper)
(2) Inner Cover (Lower)

12340S00480



12550F00790

Removing Heater Hoses

1. Remove the outer roof.
2. Disconnect the heater hoses (1), (2), (3).
3. Pull out the heater hoses (1), (2) from the bottom of the cabin.
4. Take out the heater hoses (1), (2).

(When reassembling)

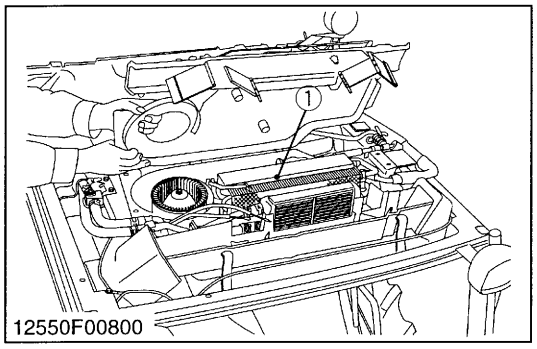
- When connecting the heater hose with A/C unit, hose should be put into the A/C unit pipe more than 30 mm (1.2 in.).

(1) Heater Hose 1 (2) Heater Hose 2

12550S00380

SERVICING

(1) Air Conditioner Unit



12550F00800

Evaporator

1. Check whether white powder or dust is attached to the evaporator (1). If they are attached, wash them off with warm water and blow them off with compressed air.

■ NOTE

- **In case the evaporator is cleaned with warm water, cap the evaporator pipe ends so that water does not enter it.**

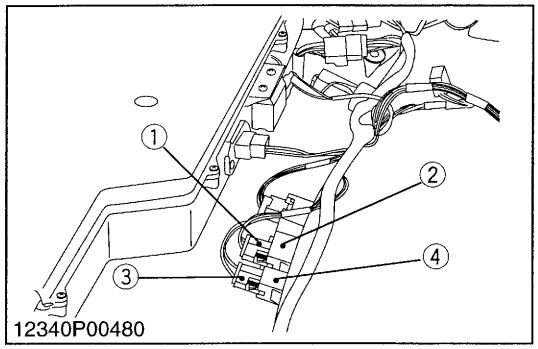
(1) Evaporator

12550S00390

[4] LIGHTING SYSTEM

CHECKING

(1) Working Light Switch

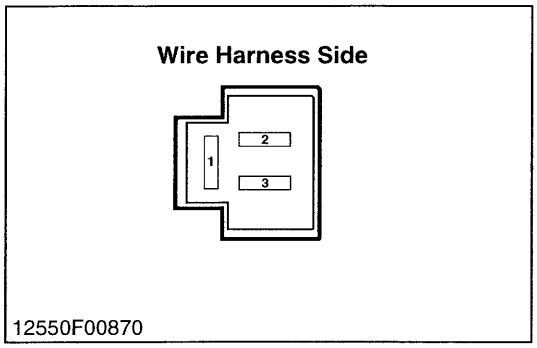


12340P00480

1. Remove the outer roof, and disconnect the working light switch connector (1) from the switch (2) connector.
2. Perform the following checkings connector and voltage.

(1) Working Light Switch Connector (Front)
(2) Working Light Switch (Front)
(3) Working Light Switch Connector (Rear)
(4) Working Light Switch (Rear)

12550S00400



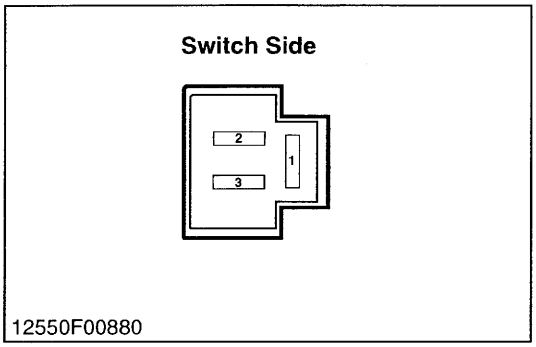
12550F00870

Connector Voltage

1. Turn the main switch **ON**.
1. Measure the voltage with a voltmeter across the connector **1** terminal and chassis.
2. If the voltage differs from the battery voltage, the wiring harness, fuse or main switch is faulty.

Voltage	**1** terminal – Chassis	Approx. battery voltage

12550S00520



12550F00880

Working Light Switch Checking

1. Check the continuity through the switch with an ohmmeter.
2. If continuity specified below is not indicated.

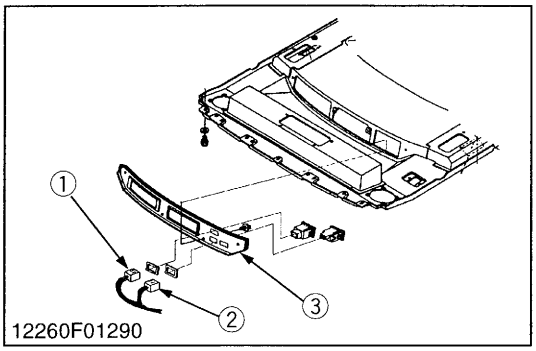
Position \ Terminal		1	2	3
Working light switch	**OFF**		●	●
	ON	●	●	●

12550S00530

[5] OTHERS

CHECKING

(1) Rear Windshield Wiper Switch

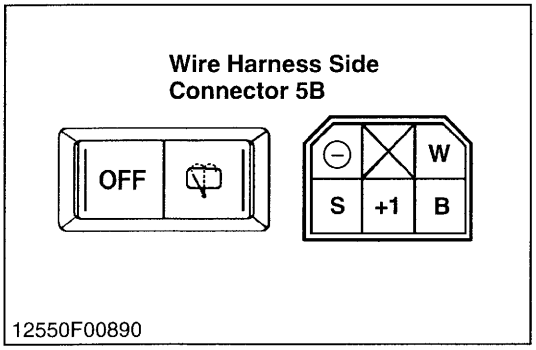


12260F01290

1. Remove the inner panel (3), and disconnect the rear wiper switch connector (2).
2. Perform the following checkings connector and rear wioer switch.

(1) Front Wiper Switch Connector
(2) Rear Wiper Switch Connector
(3) Inner Panel

12550S00540

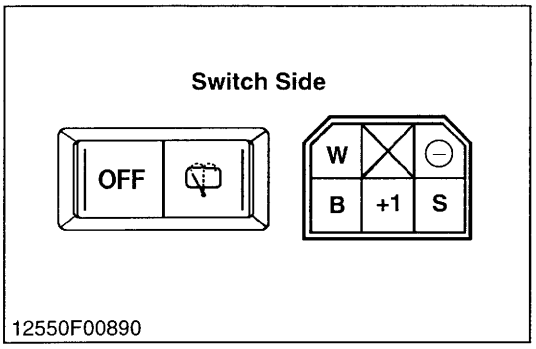


Connector Voltage

1. Turn the main switch **ON** position.
1. Measure the voltage with a voltmeter across the connector terminal **B** and chassis.
2. If the voltage differs from the battery voltage, the wiring harness, fuse or main switch is faulty.

Voltage	**B** terminal – Chassis	Approx. battery voltage

12550S00550

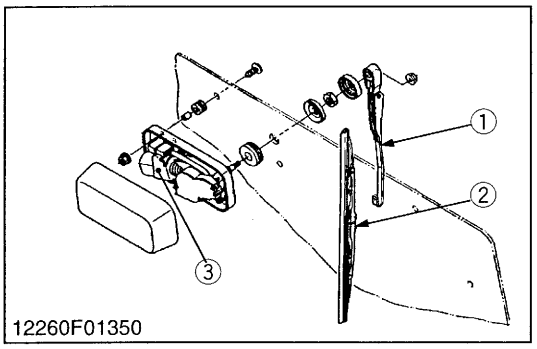


Rear Wiper Switch Checking

1. Check the continuity through the switch with an ohmmeter.
2. If continuity specified below is not indicated, the switch is faulty.

Position \ Terminal		S	+1	B	W	⊖
Front wiper switch	**WASH I**	●	●		●	●
	OFF	●	●			
	ON		●	●		
	WASH II		●	●	●	●

12550S00560



Rear Wiper Motor

1. Raise up the rear wiper arm (1).
2. Turn the main switch **ON**.
3. Push the rear wiper switch to **ON** position.
4. Count the number of wiper arm rocking per minutes.
5. If the number differs from the factory specifications, replace the wiper motor (3) assembly.

No. of wiper arm swing frequency at no load	Factory spec.	36 to 50 times/min

(1) Wiper Arm
(2) Wiper Blade
(3) Wiper Motor

12260S00150

DISASSEMBLING AND ASSEMBLING

(1) Cab Windshield

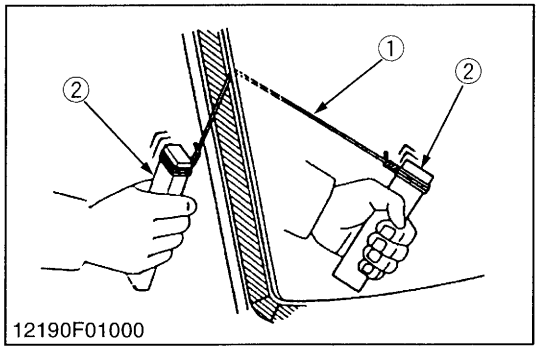
Preparation

1. Prepare the followings.
- Clutch knife 1 pcs
- Scraper 1 pcs
- Gun for coating 1 pcs
- Sika Tack-Ultrafast or equivalent
- Sika-cleaner No. 1

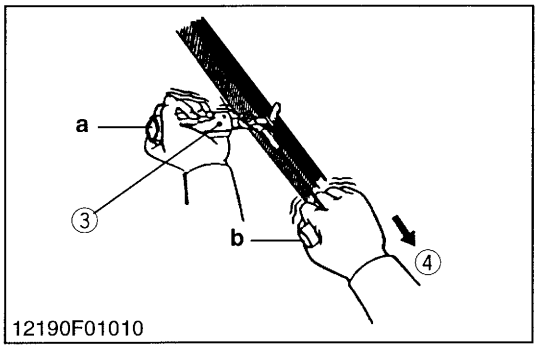
■ NOTE

- **Sika Tack-Ultrafast and cleaner No. 1 are made by Sika Corporation.**
- **These materials can't be provided by Kubota Corporation.**
- **Therefore, please find the local made equivalent materials in your country and use them when you need.**

12340S00540



12190F01000



12190F01010

Before Replacing Windshields (1)

[In case of using piano wire (When glass is clacked)]

1. Thread the piano wire from the inside of cabin. Tie its both ends to a wooden blocks or the like. (See the left figure.)
2. Pull the piano wire inward/outward alternately to cut the adhered part.

■ NOTE

- **Do not let the piano wire make sliding contact with the edge of glass plate forcibly.**

[In case of using cutter knife (When glass is totally crushed finely)]

1. Insert the knife (3) into the adhered part.
2. Keep the edge of knife blade square to the glass edge at the part (a). Slide the knife blade along the glass surface and the edge. Pull the part (b) in the direction parallel to the glass edge to cut them off.

■ NOTE

- **Find a wider gap between the glass and body.**
- **Take care of handling the cutter knife not to damage your hand.**

(1) Piano Wire
(2) Wood Peace
(3) Cutter Knife
(4) Pulling

12190S01040

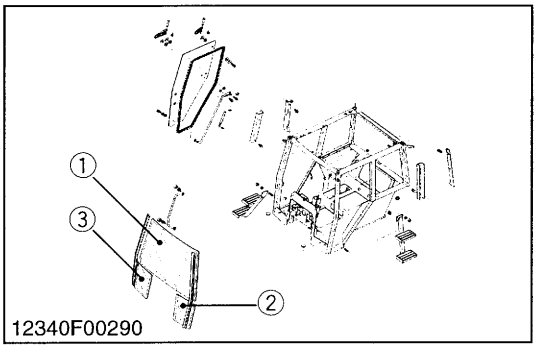
Before Replacing Windshields (2)

1. When the Sika Tack-Ultrafast or equivalent attached to the cabin frame and the glass are reused, remove the bond clearly.
2. Clean the frame surface with Sika-cleaner No. 1.

■ NOTE

- **Remove the bond completely.**

12340S00550



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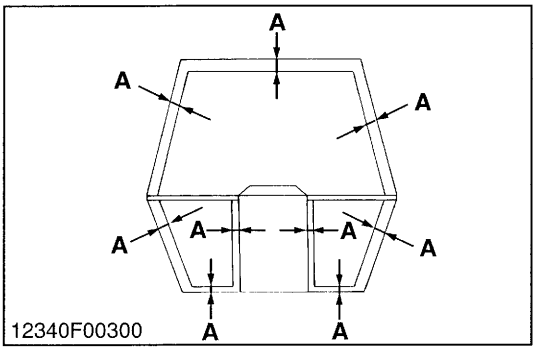


12340F00300

Before Replacing Windshields (3)

1. Check that the glasses are not damaged and crocked.
2. Turn over the glass and clean this surface of the glass by Sika-cleaner No. 1.
3. This cleaning area of the rear surface is indicated **"A"** in the figure left.

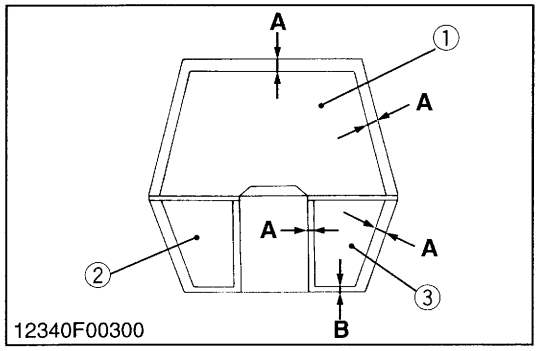
■ NOTE

- **If not cleaning the glass, it may result in adhesive failure.**

(1) Upper Windshield
(2) Lower Windshield (Left)
(3) Lower Windshield (Right)

A : 25 mm (1.0 in.)

12340S00560



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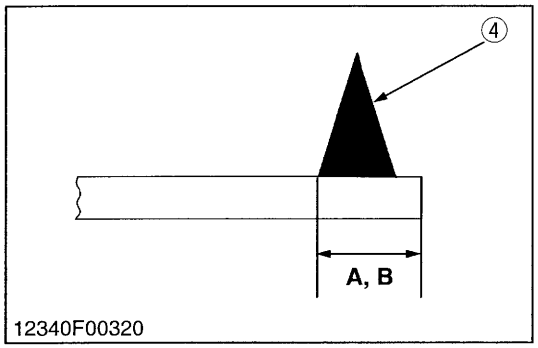
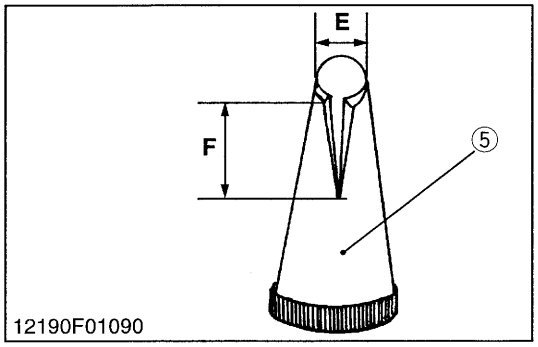


12340F00320



12190F01090

Applying Sika Tack-Ultrafast

1. Apply a Sika Tack-Ultrafast (or equivalent) on the glasses as shown in the figure left.

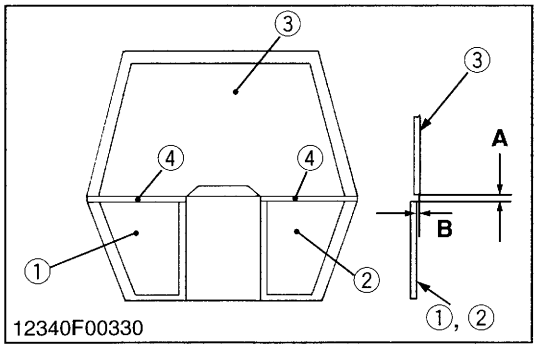
■ NOTE

- **Apply the Sika Tack-Ultrafast (or equivalent) with the jig having the specified tip shape as shown in the figure left.**
- **Apply it with a uniform speed to minimize unevenness.**
- **Follow the instruction manual of Sika Tack-Ultrafast.**

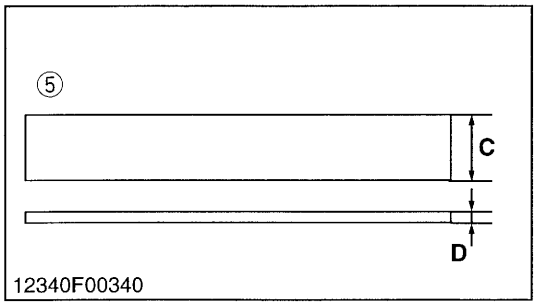
(1) Upper Windshield
(2) Lower Windshield (Left)
(3) Lower Windshield (Right)
(4) Sika Tack-Ultrafast
(5) Jig

A : 10 mm (0.39 in.)
B : 12 mm (0.47 in.)
E : Dia. 8 mm (0.31 in.)
F : 12 mm (0.47 in.)

12340S00570



12340F00330



12340F00340

Installing Windshield

1. Install the lower (left or right) windshield (1), (2) to the cabin and fix it with a gummed taped.
   Leave it for one hour.
2. Set the upper windshield (3) to the cabin and fix it with a gummed tape.
   Leave it for one hour.
3. Install the **H** rubber (4) between the lower and upper windshield.

■ NOTE

- **Use a jig A (5) shown in the figure to create even clearance (5 mm (0.2 in.) approx.) between the lower and upper windshield.**
- **The level unevenness between the upper and lower windshields should be – 1 to + 1 mm (– 0.04 to + 0.04 in.) or less at the glass surface.**
- **When the gummed tape is removed, the glass may be displaced. In this case fix it again.**
- **Remove the gummed tape little by little to confirm the bonding condition.**

(1) Lower Windshield Right
(2) Lower Windshield Left
(3) Upper Windshield
(4) H Rubber
(5) Jig **A**

A : 5 mm (0.2 in.)
B : – 1 0 to + 1.0 mm (– 0.04 to + 0.04 in.)
C : 5 mm (0.2 in.)
D : 300 mm (11.8 in.)

12340S00580

H M5700HD

Insert this supplement to the end of Workshop Manual for M4900, M5700 issued already.

Printed in Japan 2001. 05, S, EI, EI, e Code No. 97897-12553
2000. 03, S, EI, EI, e

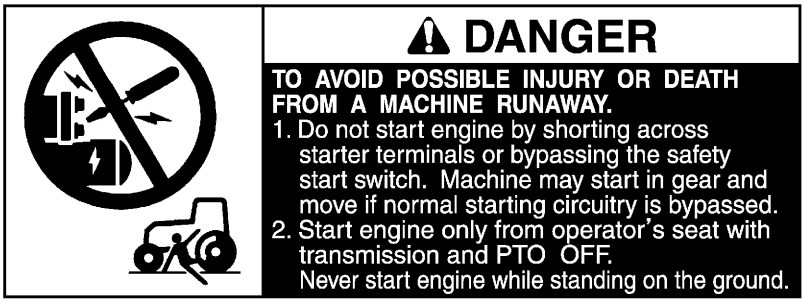
KiSC issued 03, 2020 A

CONTENTS

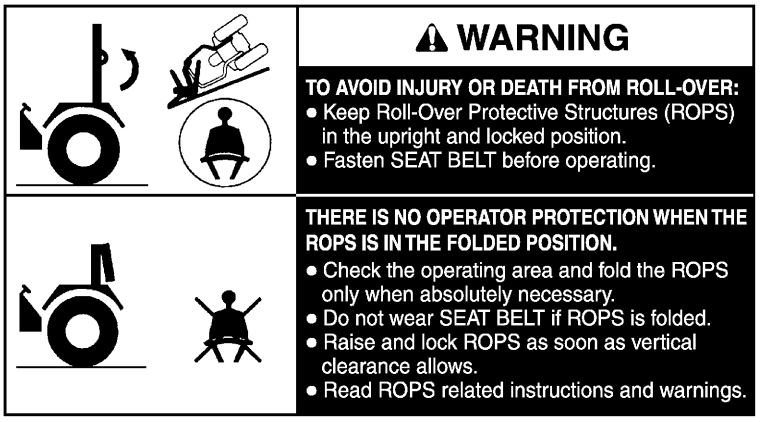
SAFETY DECALS

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.

(1) Part No. TA040-4965-2

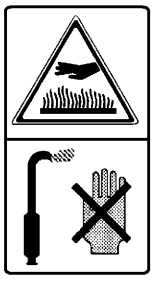


(2) Part No. 3A111-9848-2



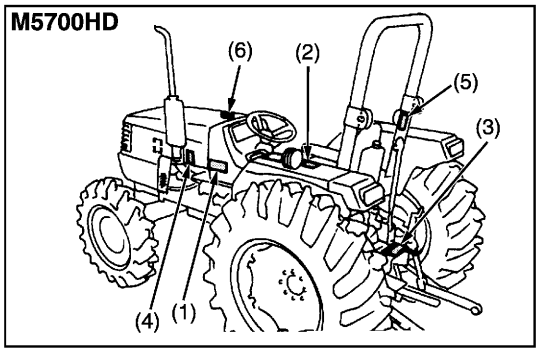
(3) Part No. TA040-4935-1

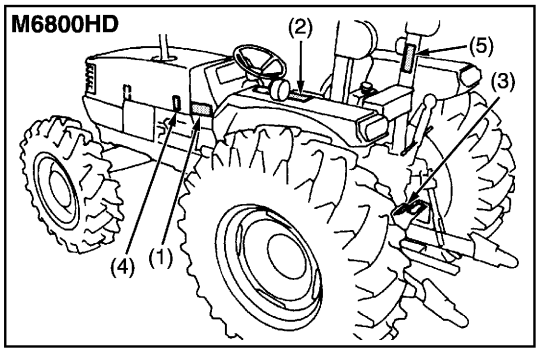
(4) Part No. 32310-4958-1
Do not touch hot surface like muffler, etc.



(5) Part No. 3A111-9554-1

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





T12553ZZ00101

(1) Part No. 35260-3491-3

⚠ C A U T I O N

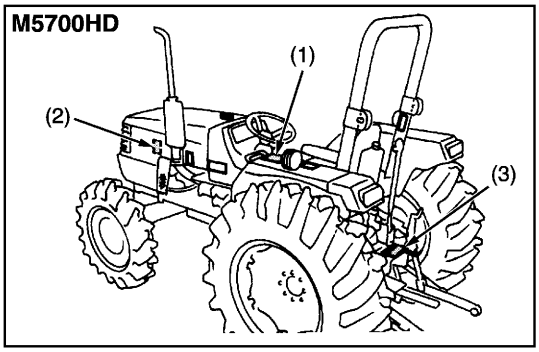
TO AVOID PERSONAL INJURY:
1. Read and understand the operator's manual before operation.
2. Before starting the engine, make sure that everyone is at a safe distance from the tractor and that the PTO is OFF.
3. Do not allow passengers on the tractor at any time.
4. Before allowing other people to use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

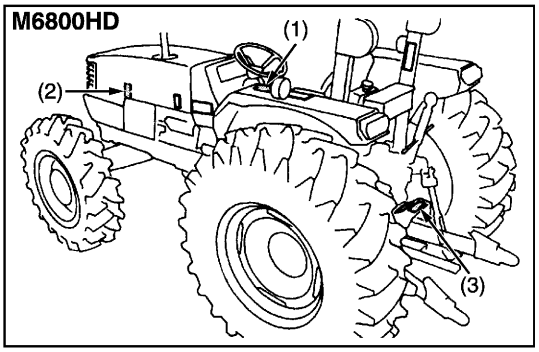
(2) Part No. 32751-4958-1
Stay clear of engine fan and fanbelt.

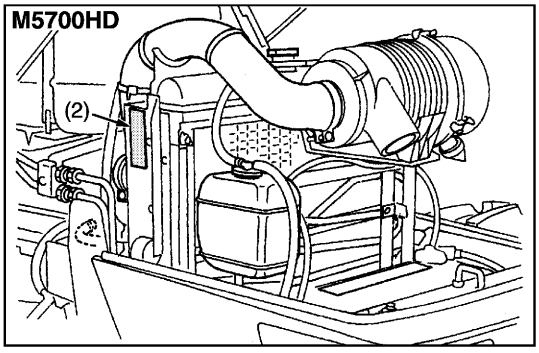
(3) Part No. TA040-4959-3

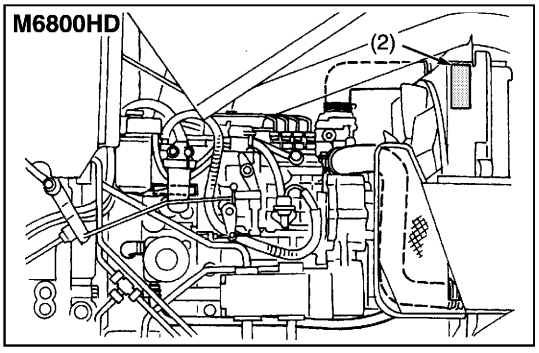
⚠ WARNING

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)









T12553ZZ00201

(1) Part No. 3F240-9857-1

⚠ WARNING

To avoid free wheeling when shifting the shuttle lever while on a slop : Stop completely by using the brake and by depresssing the clutch padal. Start off after selecting shuttle direction by releasing the clutch pedal.

(2) Part No. 35080-6528-2

⚠ CAUTION

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

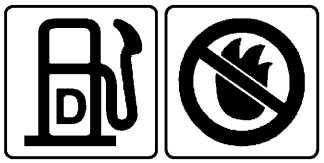
(3) Part No. 6C150-4743-1

⚠ WARNING

BEFORE DISMOUNTING TRACTOR:
1. ALWAYS SET PARKING BRAKE.
Leaving transmission in gear with the engine stopped will not prevent tractor from rolling.
2. PARK ON LEVEL GROUND WHENEVER POSSIBLE.
If parking on a slope, position tractor across the slope.
3. LOWER ALL IMPLEMENTS TO THE GROUND.
4. STOP THE ENGINE.

(4) Part No. TA040-4956-2

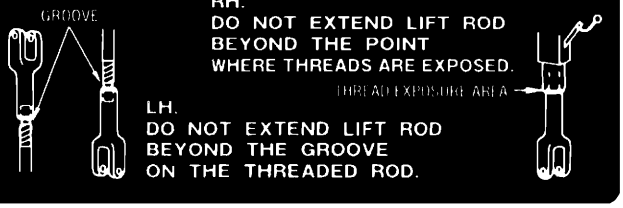
Diesel fuel only | No fire

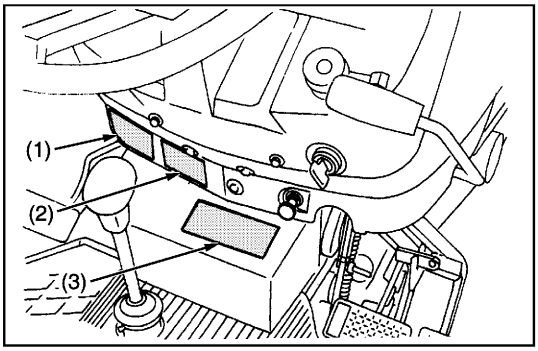


(5) Part No. 3A111-9856-3

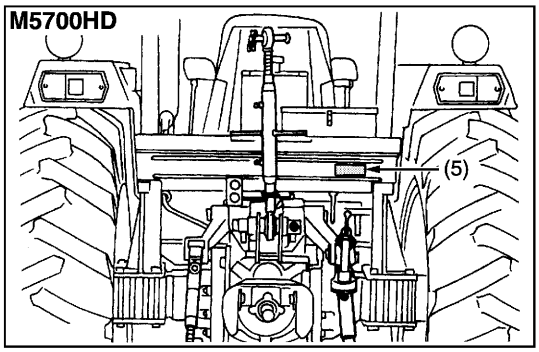
⚠ CAUTION

TO AVOID INJURY FROM SEPARATION :

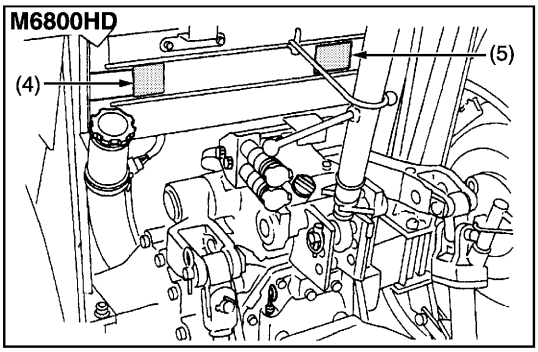




M5700HD



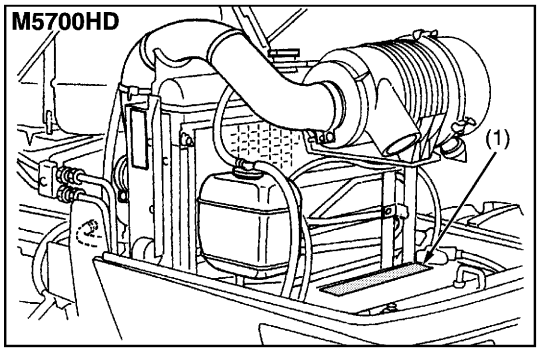
M6800HD

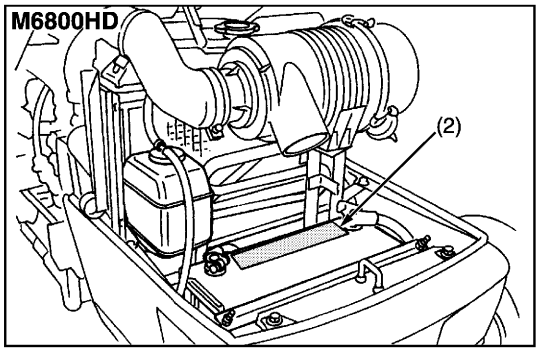


T12553ZZ00301

(1) Part No. 3A999-1274-1[M5700HD]

(2) Part No. 3A999-1275-1[M6800HD]





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 from your local KUBOTA distributor.
4. If a component with danger, warning and caution label(s) affixed is replaced with new part, make sure new label(s) is (are) attached in the same location (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.

T12553ZZ00401

SPECIFICATIONS

Model			M5700HD	M6800HD
Engine	Model		F2803-EA	V3300-E
	Type		Vertical, water-cooled, 4-cycle diesel engine	
	No. of cylinders		5	4
	Total displacement		2746 cm^3 (167.6 cu.in.)	3318 cm^3 (202.5 cu.in.)
	Bore and stroke		87 × 92.4 mm (3.4 × 3.6 in.)	98 × 110 mm (3.9 × 4.3 in.)
	Net power		42.5 kw (57 HP)*	50.7 kw (68 HP)*
	PTO power (factory observed)		38.8 kw (52 HP)*/ 2800 min^{-1} (rpm)	46.3 kw (62 HP)*/ 2600 min^{-1} (rpm)
	Maximum torque		183 N·m (18.7 kgf·m, 135 ft-lbs.)/ 1400 to 1600 min^{-1} (rpm)	235 N·m (24.0 kgf·m, 173.3 ft-lbs.)/ 1300 to 1500 min^{-1} (rpm)
	Battery		12 V, CCA 700A	12 V, CCA 1000A
	Fuel		Diesel fuel No. 1-D [below –10 °C (14 °F)], Diesel fuel No. 2-D [above –10 °C (14 °F)]	
	Fuel tank capacity		65 L (17.2 U.S.gal., 14.4 Imp.gal.)	
	Engine crankcase capacity		8.0 L (8.5 U.S.qts., 7.04 Imp.qts.)	10.7 L (11.3 U.S.qts., 9.4 Imp.qts.)
	Engine coolant capacity		7.3 L (7.7 U.S.qts., 6.4 Imp.qts.)	8.5 L (9.0 U.S.qts., 7.5 Imp.qts.)
Dimensions	Overall length		3405 mm (134.1 in.)	3525 mm (138.8 in.)
	Overall width (Minimum tread)		1850 mm (72.8 in.)	1860 mm (73.2 in.)
	Overall height (with ROPS)		2375 mm (93.5 in.)	2450 mm (96.5 in.)
	Wheel base		2000 mm (78.7 in.)	2050 mm (80.7 in.)
	Tread	Front	1330 mm (52.4 in.) 1430 mm (56.3 in.)	1420 to 1520 mm (55.9 to 59.8 in.)
		Rear	1420 to 1720 mm (55.9 to 67.7 in.)	
	Minimum ground clearance		460 mm (18.1 in.) (BRACKET DRAEBAR)	430 mm (16.9 in.) (COVER TANK)
Weight (with ROPS)			1850 kg (4079 lbs)	2090 kg (4608 lbs)
Travelling system	Standard tire size	Front	9.5 - 22	9.5 - 24
		Rear	16.9 - 28	16.9 - 30
	Clutch		Multiple wet disc hydraulic	
	Steering		Full hydraulic power steering	
	Transmission		Shuttle synchromesh, 8F/8R	
	Brake	Travelling	Wet type multiple discs (mechanical)	
		Parking	Connected with the travelling brake	
	Differential		Bevel gears (Rear)	Bevel gears (Front, Rear)
Hydraulic system	Hydraulic control system		Position, draft and mix control	
	Pump capacity		41.6 L (44.0 U.S.qts., 36.6 Imp.qts.)/min.	
	Three point hitch		Category I and II	
	Maximum lifting force	At lifting point	1900 kg (4200 lbs) at lower link end	2050 kg (4550 lbs) at lower link end with link horizontal
		24 in. behind lifting point	1500 kg (3307 lbs) at 610 mm (24 in.) behind lifting point	
	Remote hydraulic control		One remote valve with detente and self-canceling	One remote valve
	System pressure		19.1 MPa (195 kgf/cm^2, 2773 psi)	
PTO	Independence clutch		Wet type, multiple discs	
	Live PTO	Direction of turning	Clock wise, viewed from tractor rear	
		PTO speed	540 min^{-1}(rpm) at 2295 engine min^{-1}(rpm)	
Traction system			Swing drawbar, adjustable in direction	

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

W1028103

G. GENERAL

[1] FEATURES

T12553GE00100

1. Auxiliary Control Valve
2. Independent PTO
   Hydraulic PTO clutch System
3. Foldable ROPS
4. Full Hydraulic Power Steering
5. Hydraulic-Shuttle (Forward- Reverse)
6. E-TVCS (Three Vortex Combustion System) Diesel Engine
7. New Transmission
8. Wet Disc Brake
9. Three Point Hitch with Big Lift Power
   Three Point Hitch Fully Equipped with Position, Draft and Mixed Control

[2] MAINTENANCE

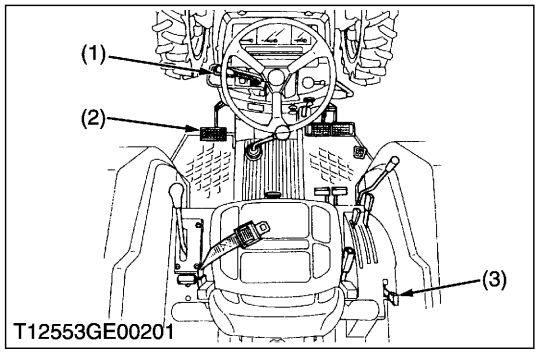
No.	Item		Period	Service Interval									After purchase		Important		Reference page
				50	100	200	300	400	600	800	1500	3000	1 year	2 years			
M5700HD																	
1	Engine oil		Change	★	☆												G-13
2	Engine oil Filter		Replace	★		☆											G-13
3	Front axle case oil		Change	★					☆								G-15
4	Fuel filter element		Clean		☆												G-18
			Replace					☆								@	G-23
M6800HD																	
1	Engine oil		Change	★		☆											G-13
2	Engine oil Filter		Replace	★				☆									G-14
3	Fuel filter		Replace	★				☆								@	G-23
4	Front differential case oil		Change	★					☆								G-25
5	Front axle gear case oil		Change	★					☆								G-25
6	Water separator		Clean					☆									G-23
COMMON ITEMS																	
1	Engine start system		Check	☆													HG-3
2	Wheel bolt torque		Check	☆													G-16
3	Greasing		–		☆												G-17
4	Battery condition		Check		☆												G-17
5	Air cleaner element [Double type]	Primary element	Clean		☆										*	@	G-18
			Replace										☆		**		G-18
		Secondary element	Replace										☆				G-18
6	Fan belt		Adjust		☆												G-19
7	Brake		Adjust		☆												G-19
8	Radiator hose and clamp		Check			☆											G-20
			Replace											☆			G-20
9	Power steering oil line		Check			☆											G-20
			Replace											☆			G-20
10	Fuel line		Check			☆										@	G-20
			Replace											☆			G-20
11	Toe-in		Adjust			☆											G-21
12	Intake air line		Check			☆										@	G-21
			Replace											☆	***		G-21
13	Front axle pivot		Adjust						☆								G-24
14	Engine valve clearance		Adjust							☆							1S-19
15	Fuel injection nozzle injection pressure		Check								☆					@	1S-56
16	Injection pump		Check									☆				@	1S-54
17	Cooling system		Flush											☆			G-28
18	Coolant		Change											☆			G-28
19	Fuel system		Bleed										Service as required				G-29
20	Clutch housing water		Drain														G-29
21	Fuse		Replace														HG-4
22	Light bulb		Replace														G-32

■ 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.

W1035769

[3] CHECK AND MAINTENANCE



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. Place all shift lever and hydraulic levers in the “NEUTRAL”.
2. Set the parking brake and stop the engine.

■ **Test 1 : Switch for the shuttle shift lever.**

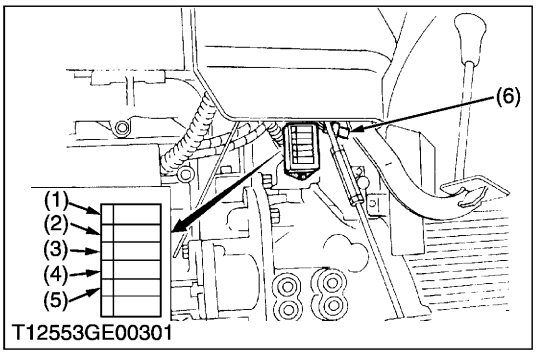
1. Sit on operator’s seat.
2. Shift the shuttle shift lever to the forward or reverse position.
3. Depress the clutch pedal fully.
4. Disengage the PTO clutch control lever.
5. Pull out the engine emergency stop knob and turn the key to “START” position.
6. The engine must not crank.
7. If it cranks, consult your local KUBOTA Dealer for this service.

■ **Test 2 : Switch for the PTO clutch control lever.**

1. Sit on operator’s seat.
2. Engage the PTO clutch control lever.
3. Depress the clutch pedal fully.
4. Shift the shuttle shift lever to the neutral position.
5. Pull out the engine emergency stop knob and turn the key to “START” position.
6. The engine must not crank.
7. If it cranks, consult your local KUBOTA Dealer for this service.

(1) Hydraulic-shuttle shift lever
(2) Clutch Pedal
(3) PTO Clutch Lever

W1019372



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 electrical problems.**

M5700HD

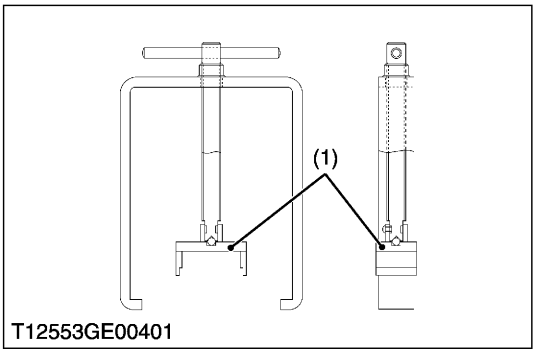
FUSE No.	CAPACITY (A)	Protected circuit
(1)	15	Main key
(2)	15	Head light. Flasher
(3)	10	Parking. Hazard
(4)	10	Work Light
(5)	15	Key stop
(6)	50 Slow blow fuse	Check circuit against wrong battery connection

M6800HD

FUSE No.	CAPACITY (A)	Protected circuit
(1)	20	Main key
(2)	15	Head light
(3)	10	Parking · Flasher (Hazard)
(4)	10	Work Light
(6)	50 Slow blow fuse	Check circuit against wrong battery connection

W1019843

[4] SPECIAL TOOL



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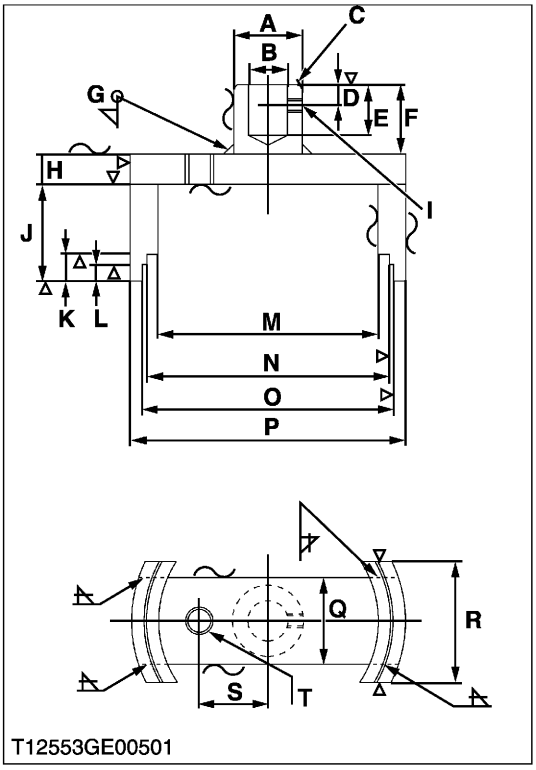

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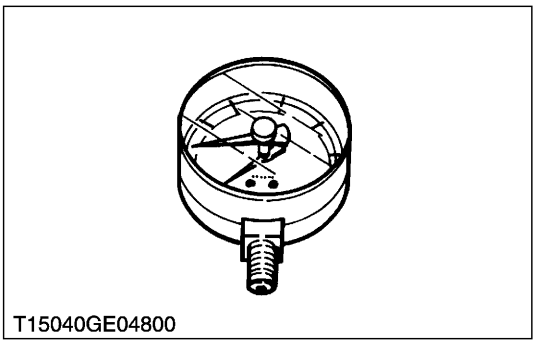


T15040GE04800

Shuttle Clutch Compression Tool

Code No : 07916 - 55031

Application : Use exclusively for pushing the thrust cooler, remove the external snap ring.

■ **NOTE**

- **Replace the center guide (1) for shown the figure.**

A	20 mm DIA (0.79 in DIA)
B	11.5 mm DIA (0.45 in DIA)
C	Chamfer 1 mm (0.04 in.)
D	6 mm (0.24 in.)
E	15 mm (0.59 in.)
F	20 mm (0.79 in.)
G	Weld all around
H	6 mm (0.24 in.)
I	M4 × P0.7
J	28 mm (1.1 in.)
K	8 mm (0.31 in.)
L	5 mm (0.2 in.)
M	64 mm DIA (2.52 in DIA)
N	70.5 mm DIA (2.78 in DIA)
O	73 mm DIA (2.87 in DIA)
P	80 mm DIA (3.15 in DIA)
Q	25 mm (0.98 in.)
R	35 mm (1.38 in.)
S	20 mm (0.79 in.)
T	M8 × 1.25

(1) Center Guide

W1020107

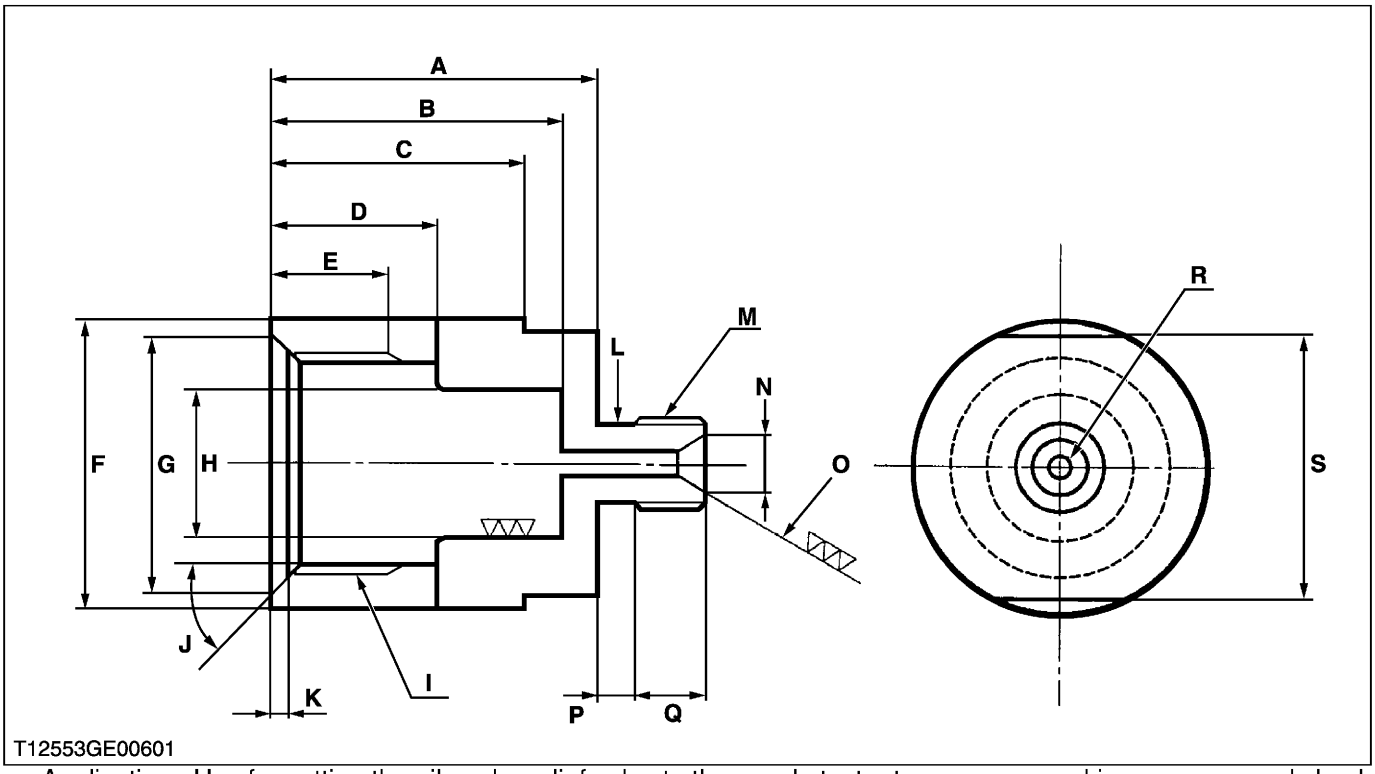
Pressure Gauge 50

Code No : 07916 - 52961

Application : This pressure gauge is used to measure the low oil Pressure.

W1020614

Oil Cooler relief Valve Setting Pressure Adaptor



T12553GE00601

Application : Use for setting the oil cooler relief valve to the nozzle tester to measure cracking pressure and check oil tightness of the oil cooler relief valve.

■ **NOTE**

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

A	45 mm (1.77 in.)	K	2 mm (0.079 in.)
B	40 mm (1.58 in.)	L	10 mm dia. (0.39 in. dia.)
C	28 mm (1.1 in.)	M	M12 × P1.5
D	18 mm (0.71 in.)	N	7.5 mm dia. (0.3 in. dia.)
E	15 mm (0.59 in.)	O	1.05 rad. (60 °)
F	24 mm (0.94 in.)	P	5 mm (0.20 in.)
G	20 mm (0.79 in.)	Q	10 mm (0.39 in.)
H	15 mm (0.59 in.)	R	3 mm dia. (0.118 in. dia.)
I	M18 × P1.5	S	21 mm (0.83 in.)
J	0.79 rad. (45 °)		

1. ENGINE

[2] SERVICING

(1) Tightening Torques

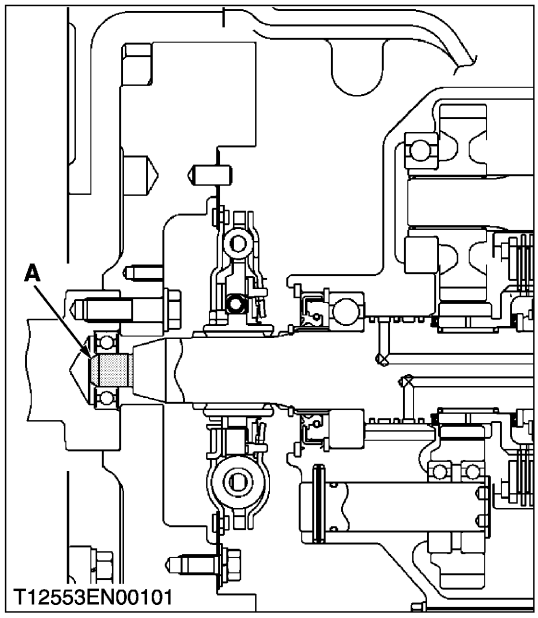
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts : See page G-10.)

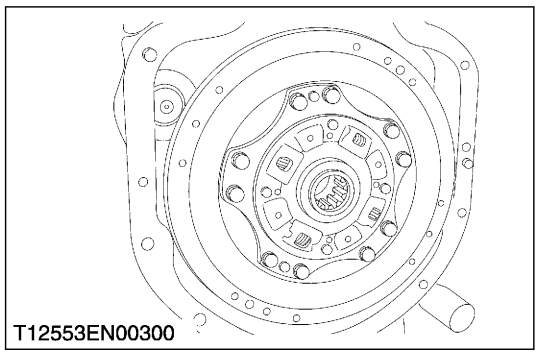
Item	N·m	kgf·m	ft-lbs
Dumper disc mounting screw	48.1 to 55.8	4.9 to 5.7	35.5 to 41.2

W1012736

(2) Disassembling and Assembling

(A) Separation Front Axle Frame as a Unit





Outer Parts

1. Remove the wire harness.
2. Remove the dumper disc.

(When reassembling)

- Confirm that the bearing is surely assembled to the flywheel.
- Direct the shorter end of the dumper disc boss toward the flywheel.
- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the shaft **A**.

Tightening torque	Dumper disc mounting screw	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 ft-lbs

W1010732

2. CLUTCH

[1] SERVICING

(1) Servicing Specifications

TRAVELLING CLUTCH

Item		Factory Specification	Allowable Limit
Clutch Pedal	Total stroke	170 to 175 mm 6.7 to 6.9 in.	–

W1010716

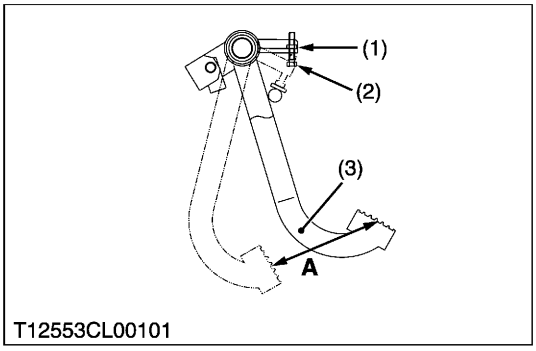
DUMPER DISC

Item		Factory Specification	Allowable Limit
Dumper Disc Boss to Gear Shaft	Backlash (Displacement around disc edge)	–	2.0 mm 0.079 in.

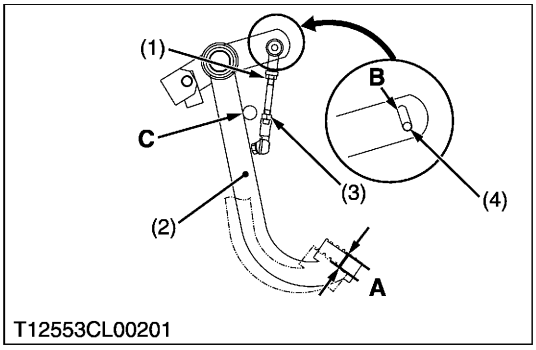
W1013874

(2) Travelling Clutch

(A) Checking and Adjusting



T12553CL00101



T12553CL00201

Clutch Pedal Stroke

1. Stop the engine and remove the key.
2. Measure the clutch pedal stroke **A**.
3. If the measurement is not within the factory specifications, adjust with stopper bolt (2).

Total stroke **A**	Factory spec.	170 to 175 mm 6.7 to 6.9 in.

(1) Lock Nut 1
(2) Stopper Bolt
(3) Clutch Pedal
A : Pedal Stroke

W1011357

Clutch Pedal Free Play

■ **NOTE**

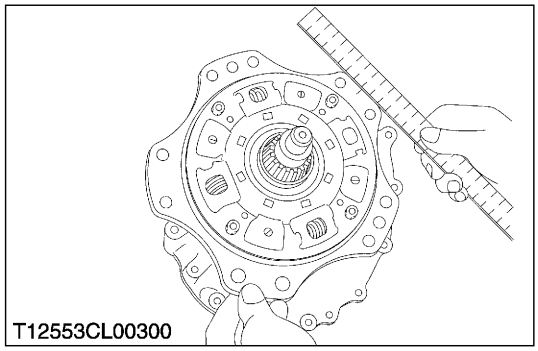
- **Before checking the clutch pedal free play, be sure to adjust the pedal stroke.**

1. Make sure that clutch pedal is contact with frame **C** and upper rod end of turnbuckle (4) is located on the bottom of hole **B** when the pedal is released.
2. If the clutch pedal or turnbuckle is out of above condition, adjust with turnbuckle.
3. Measure the clutch pedal free play **A**.
4. If adjustment is needed, change the length of turnbuckle so that the free play becomes 24 to 30 mm (0.9 to 1.2 in.).
5. After adjustment is completed secure the lock nut of turnbuckle.

(1) Lock Nut 1
(2) Clutch Pedal
(3) Lock Nut 2
(4) Turnbuckle
A : Free Play
B : Hole
C : Frame

W1010832

(B) Servicing


T12553CL00300

Backlash between Dumper Disc Boss and Shaft

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

Displacement around disc edge	Allowable limit	2.0 mm 0.079 in.

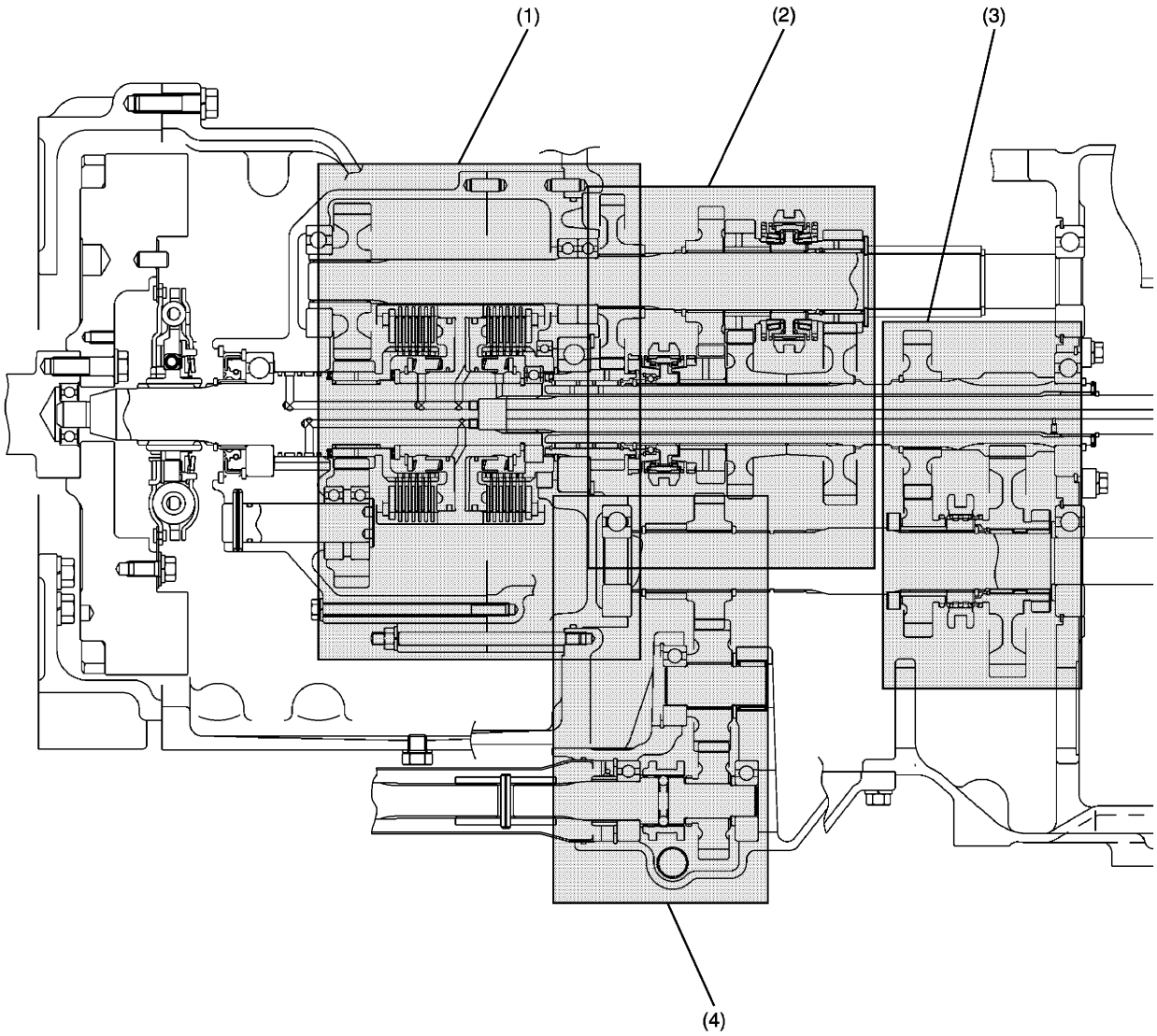
W1011103

MEMO

3. TRANSMISSION

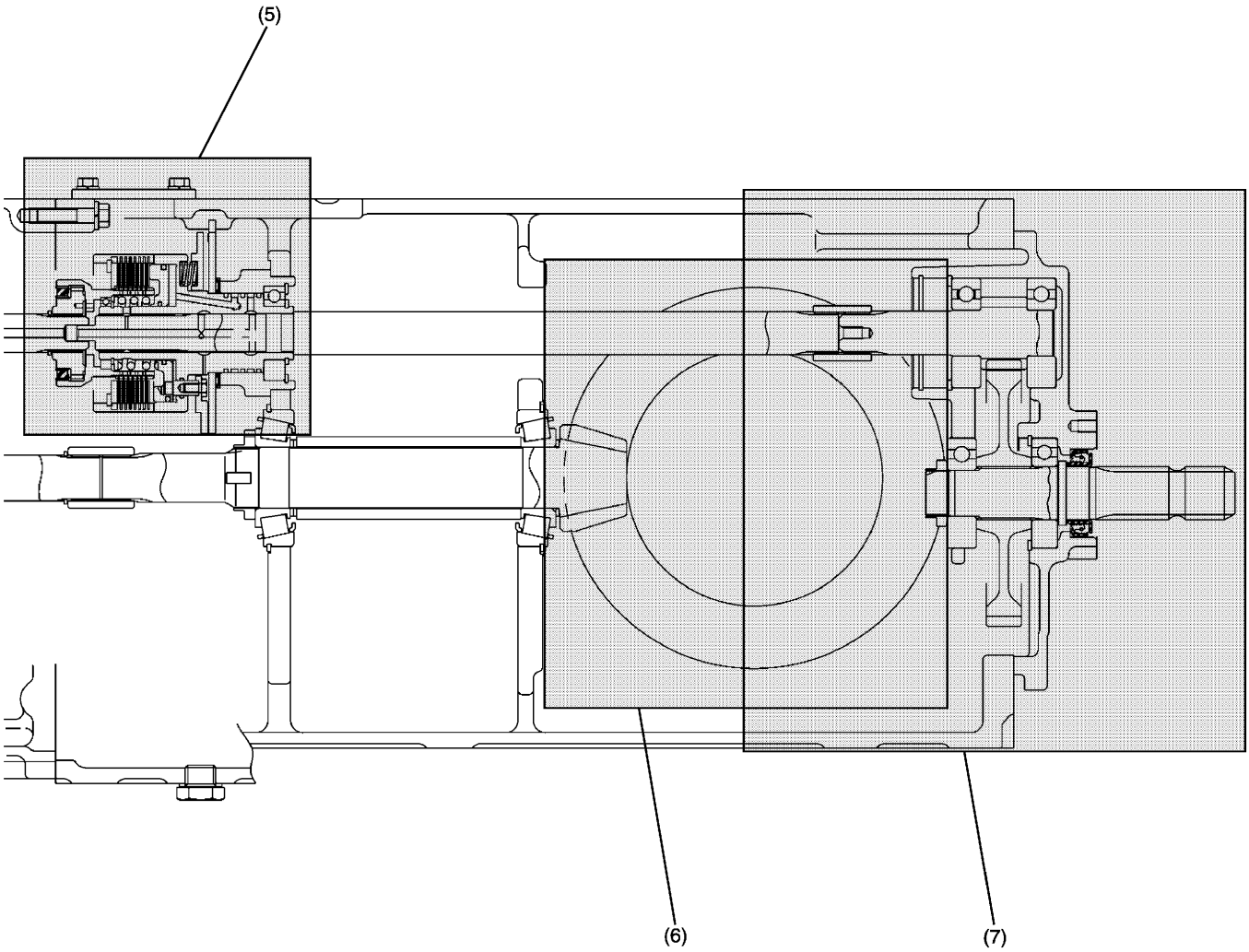
[1] MECHANISM

(1) Structure



T12553TR00101

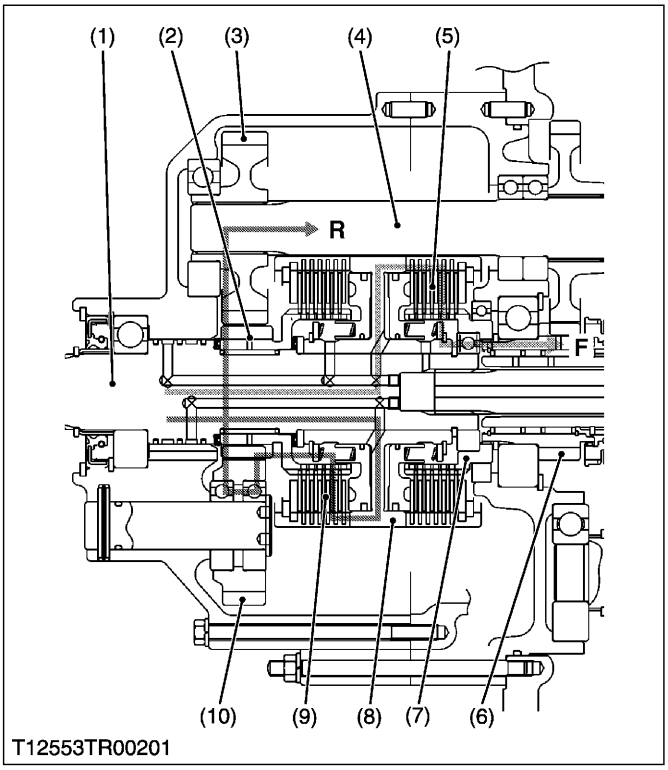
(1) Shuttle Shift Section (Forward-Reverse)
(2) Main Gear Shift Section
(3) Hi-Low Section
(4) Front Wheel Drive Section



(5) PTO Clutch Section (6) Difference Gear Section (7) PTO Gear Section

(2) Travelling System

(A) Shuttle Shift Section (Forward-Reverse)



T12553TR00201

The shuttle shift section allows the operators to change forward and reverse with a shuttle lever. It is used hydraulic clutch shifting.

It also operators as a reduction until when shifting from forward to reverse.

When the shuttle lever is move to the **F** or **R** position, clutch is engaged to the front or rear by the hydraulic linkage to be engaged with the 21T gear (6) or 20T gear (2). Then the power is transmitted as follows.

■ **Forward**

Input Shaft (1) → Shuttle Clutch Body (8) → Clutch Disc and Plate (5) → Coupling (7) → 21T Gear (6)

■ **Reverse**

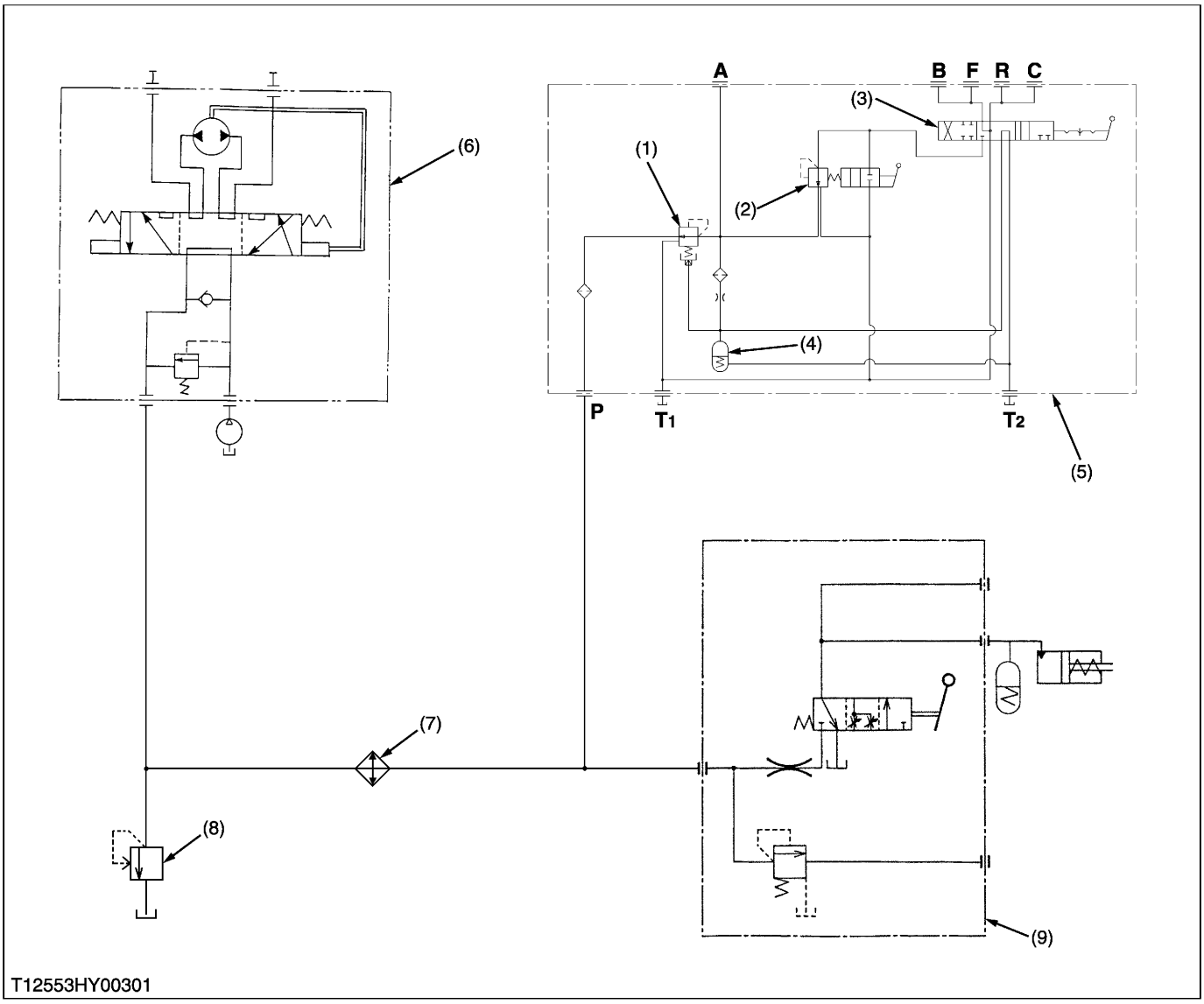
Input Shaft (1) → Shuttle Clutch Body (8) → Clutch Disc and Plate (9) → 20T Gear (2) → 25T Idle Gear (10) → 31T Gear (3) → 1st Shaft (4)

(1) Input Shaft
(2) 20T Gear
(3) 31T Gear
(4) 1st Shaft
(5) Clutch Disc and Plate
(6) 21T Gear
(7) Coupling
(8) Shuttle Clutch Body
(9) Clutch Disc and Plate
(10) 25T Idle Gear

W1012816

(3) Hydraulic Shuttle Valve

(A) Hydraulic Circuit



T12553HY00301

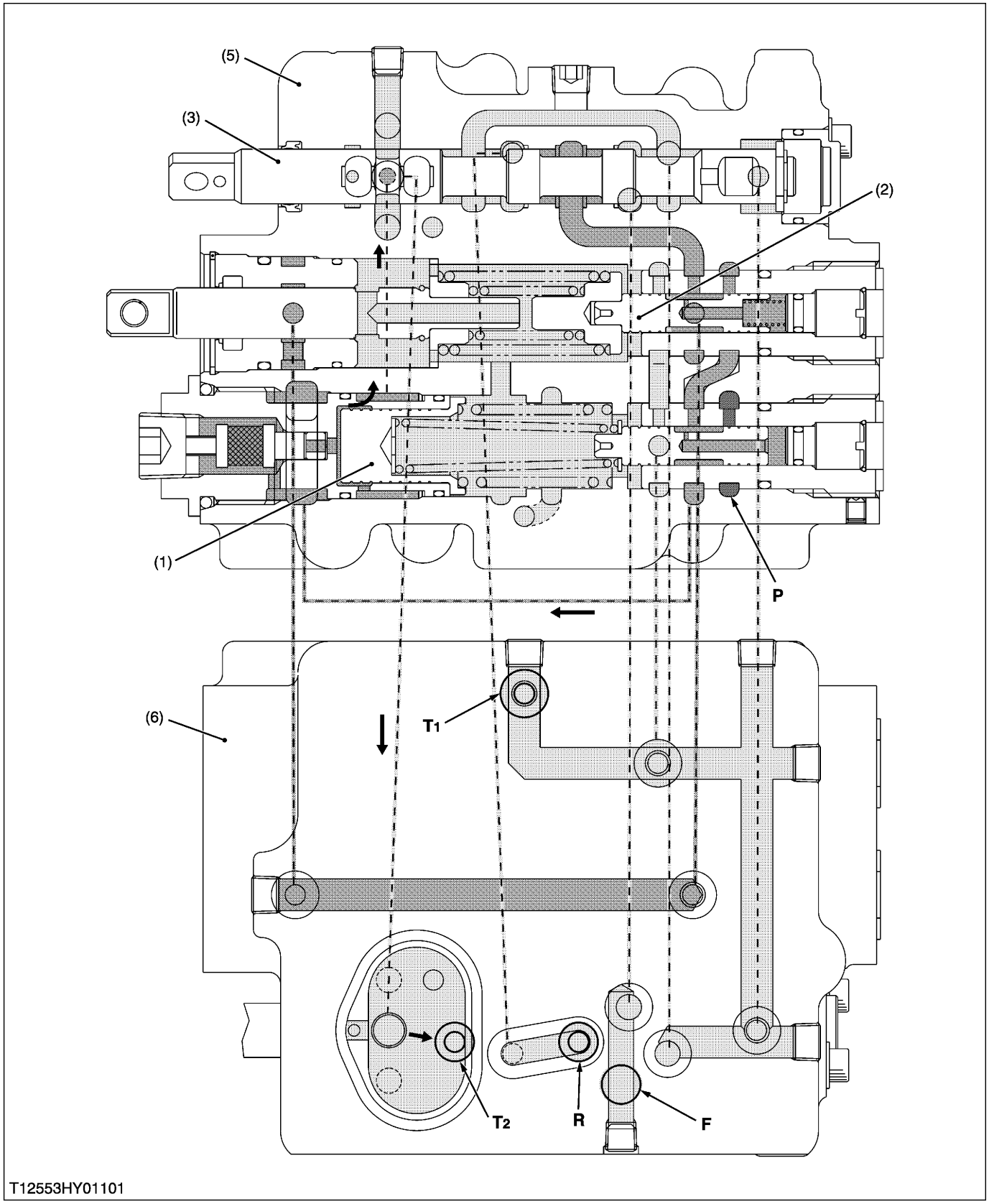
(1) Modulating Valve
(2) Proportionally Reducing Valve
(3) Shuttle Shift Valve (Forward, Reverse)
(4) Accumulate Valve
(5) Shuttle Valve
(6) Power Steering Controller
(7) Oil Cooler
(8) Oil Cooler Relief Valve
(9) PTO Control Valve

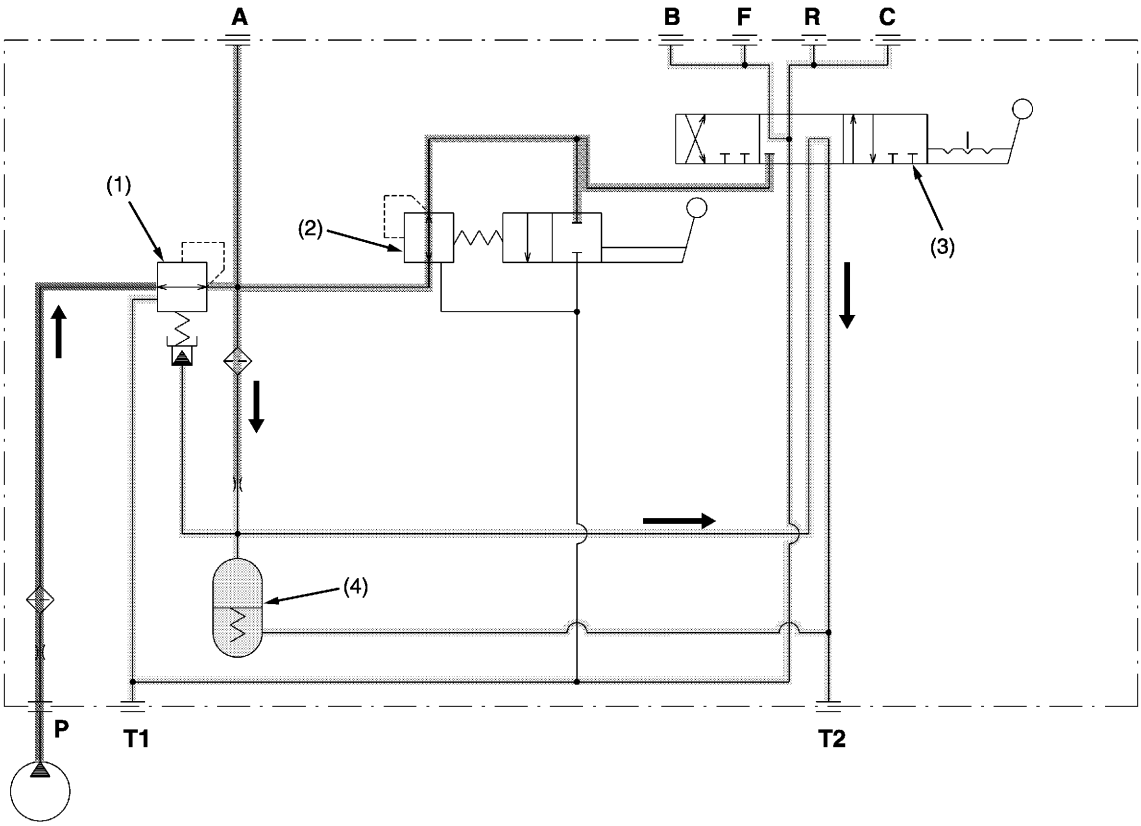
P : From Power Steering Controller
A : Pressure Check Port (Modulation)
B : Pressure Check Port (Forward)
F : To Clutch Pack (Forward)
R : To Clutch Pack (Reverse)
C : Pressure Check Port (Reverse)
T1, T2 : Tank Port

Hydraulic shuttle valve is composed of modulating valve (1), proportionally reducing valve (2), spool (3), accumulate valve (4) and other component parts.

(B) Operation

■ Shuttle Lever at Neutral Position





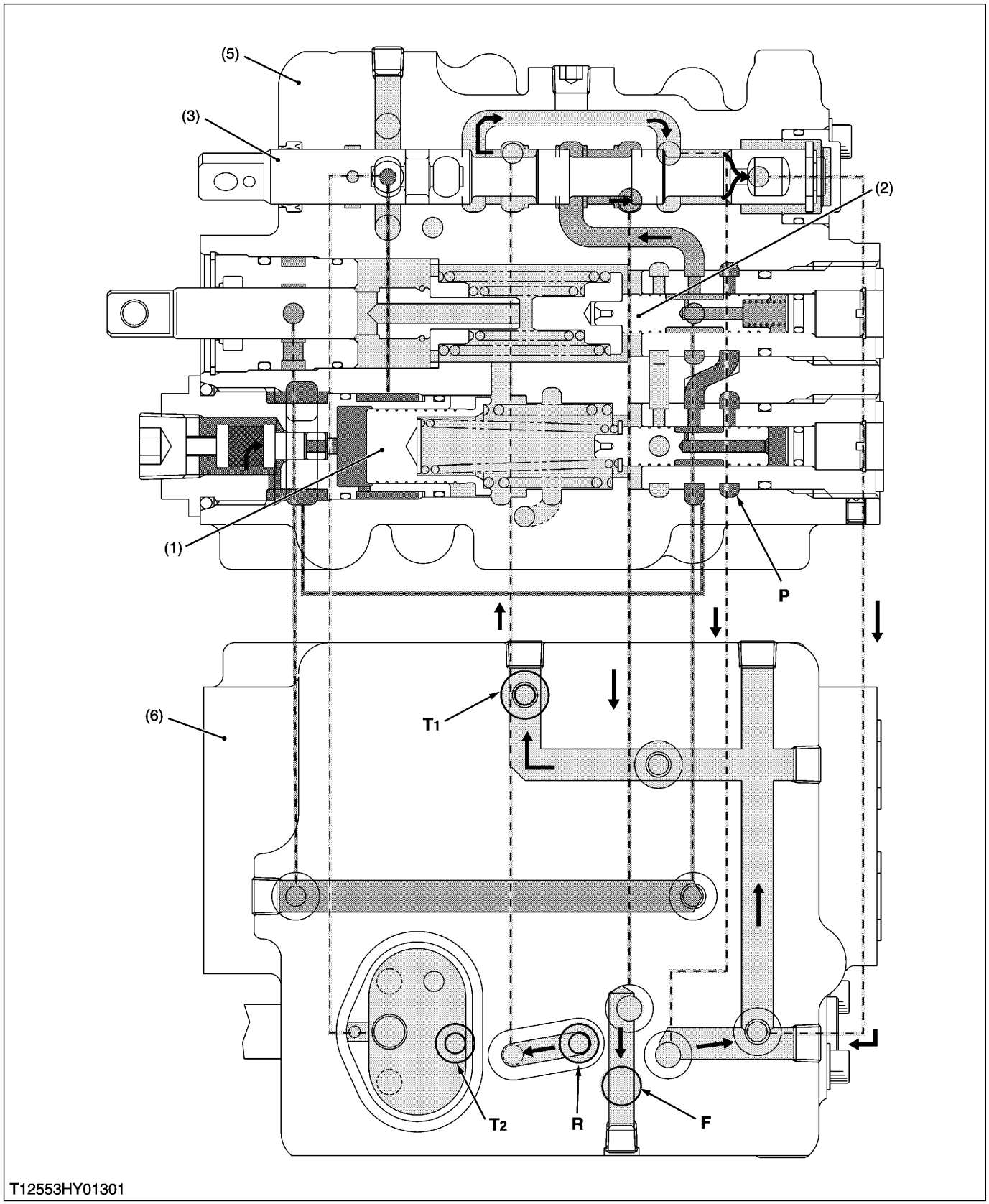
T12553HY01201

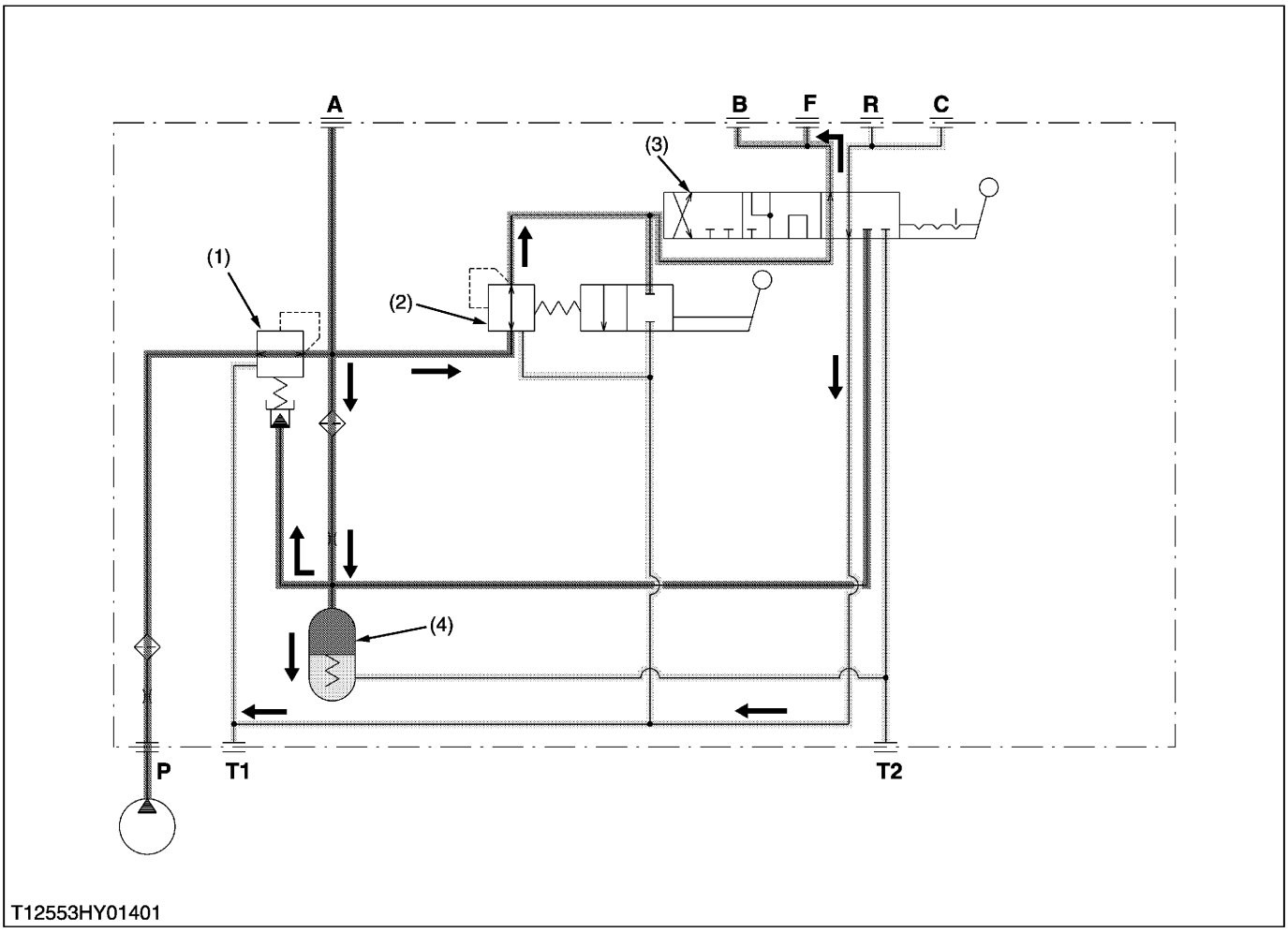
(1) Modulating Valve
(2) Proportionally Reducing Valve
(3) Spool (Forward, Reverse)
(4) Accumulate Valve
(5) Shuttle Valve Case 1
(6) Shuttle Valve Case 2

A : Check Port (Modulation)
B : Check Port (Forward)
C : Check Port (Reverse)
P : From Pump
F : To Clutch Body (Forward)
R : To Clutch Body (Reverse)
T1 : To Transmission Case
T2 : To Transmission Case

When the shuttle lever at **Neutral** position, as the oil passage between **P** port to **F** or **R** port is closed by spool (3), pressure-fed oil from **P** port flows to the **T2** port. Thus the shuttle clutch is not engage.

■ **When shuttle lever is shifting Neutral to Forward or Reverse Position (Clutch Pedal is Released).**





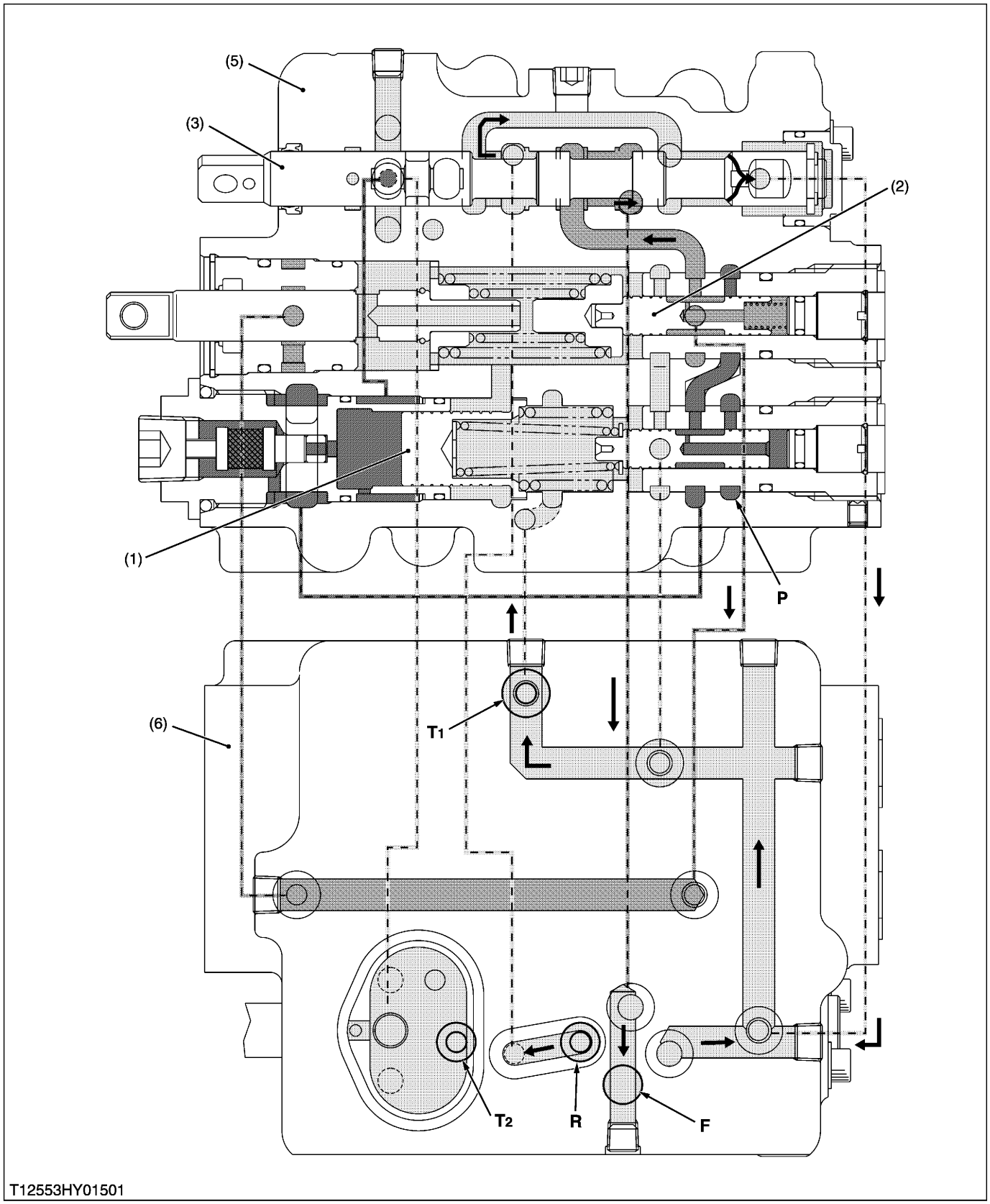
(1) Modulating Valve
(2) Proportionally Reducing Valve
(3) Spool (Forward, Reverse)
(4) Accumulate Valve
(5) Shuttle Valve Case 1
(6) Shuttle Valve Case 2

A : Check Port (Modulation)
B : Check Port (Forward)
C : Check Port (Reverse)
P : From Pump
F : To Clutch Body (Forward)
R : To Clutch Body (Reverse)
T1 : To Transmission Case
T2 : To Transmission Case

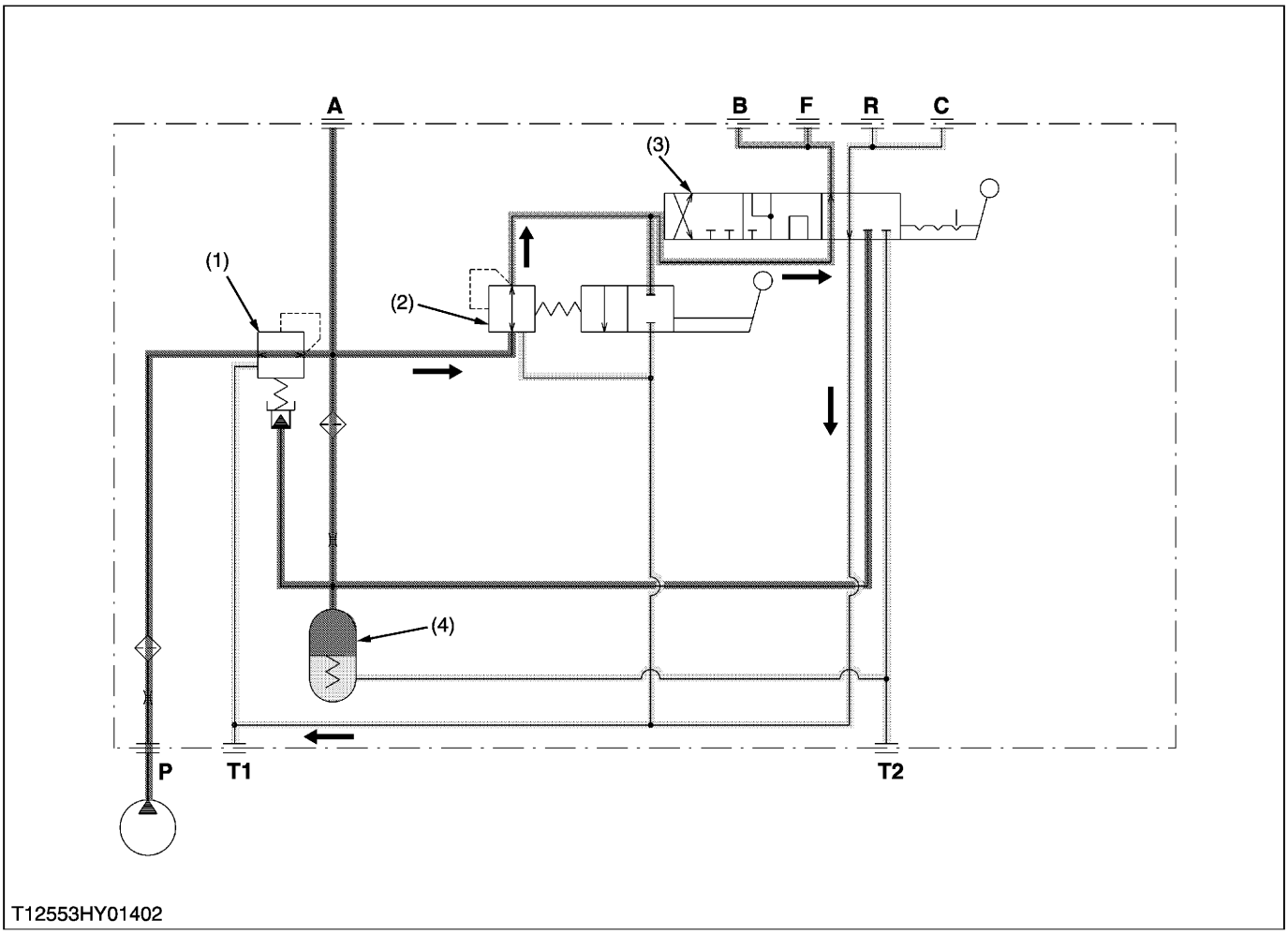
When the shuttle lever is moved to "**FORWARD**" or "**REVERSE**", pressure-fed oil from **P** port flows into shuttle clutch via **F** or **R** port. At this time, the pressure of **F** or **R** port is increased gradually by modulating valve (1).

When the shuttle clutch is engaging, the accumulate valve (4) assists the operation of modulating valve (1) to reduce a shock.

■ Shuttle Lever at Forward Position (Clutch Pedal is Released)



T12553HY01501



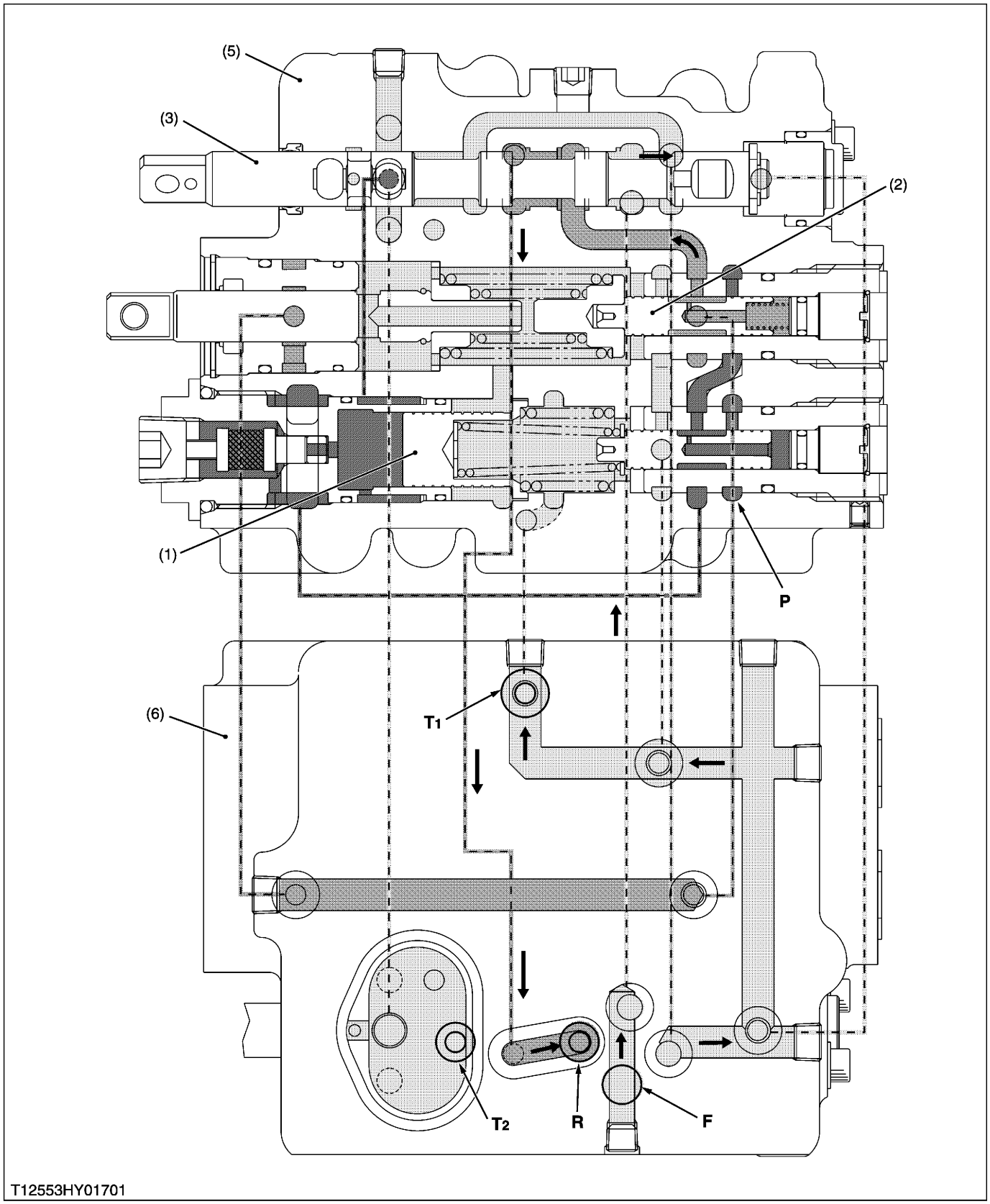
(1) Modulating Valve
(2) Proportionally Reducing Valve
(3) Spool (Forward, Reverse)
(4) Accumulate Valve
(5) Shuttle Valve Case 1
(6) Shuttle Valve Case 2

A : Check Port (Modulation)
B : Check Port (Forward)
C : Check Port (Reverse)
P : From Pump
F : To Clutch Body (Forward)
R : To Clutch Body (Reverse)
T1 : To Transmission Case
T2 : To Transmission Case

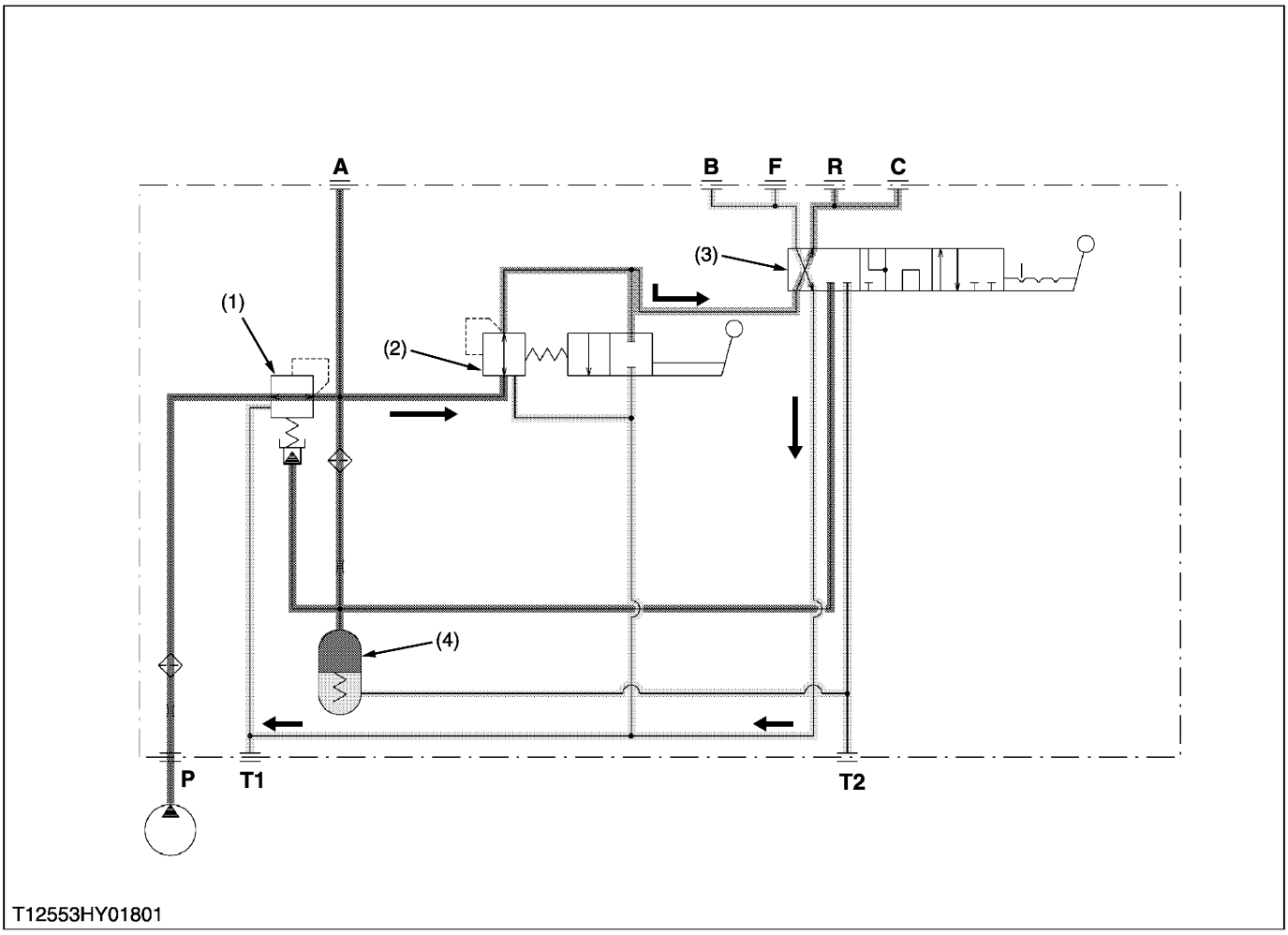
When the shuttle lever have been setting on the **F** side, the oil pressure on **F** port is constantly controlled by proportionally reducing valve (2).

On the other hand, the oil in the **R** side of shuttle clutch returns to **T1** port through **R** port and spool (3).

■ Shuttle Lever at Reverse Position (Clutch Pedal is Released)



T12553HY01701



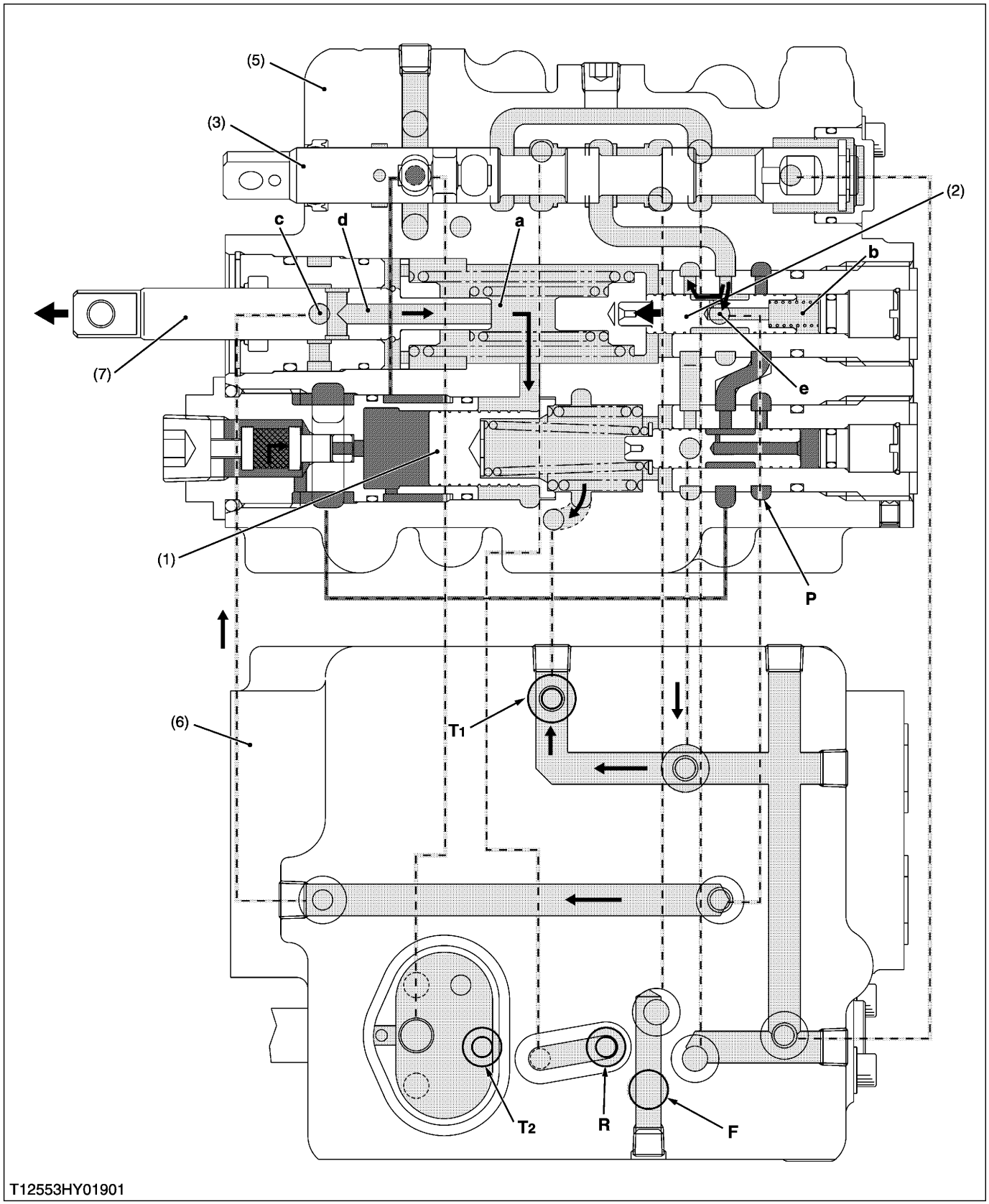
(1) Modulating Valve
(2) Proportionally Reducing Valve
(3) Spool (Forward, Reverse)
(4) Accumulate Valve
(5) Shuttle Valve Case 1
(6) Shuttle Valve Case 2

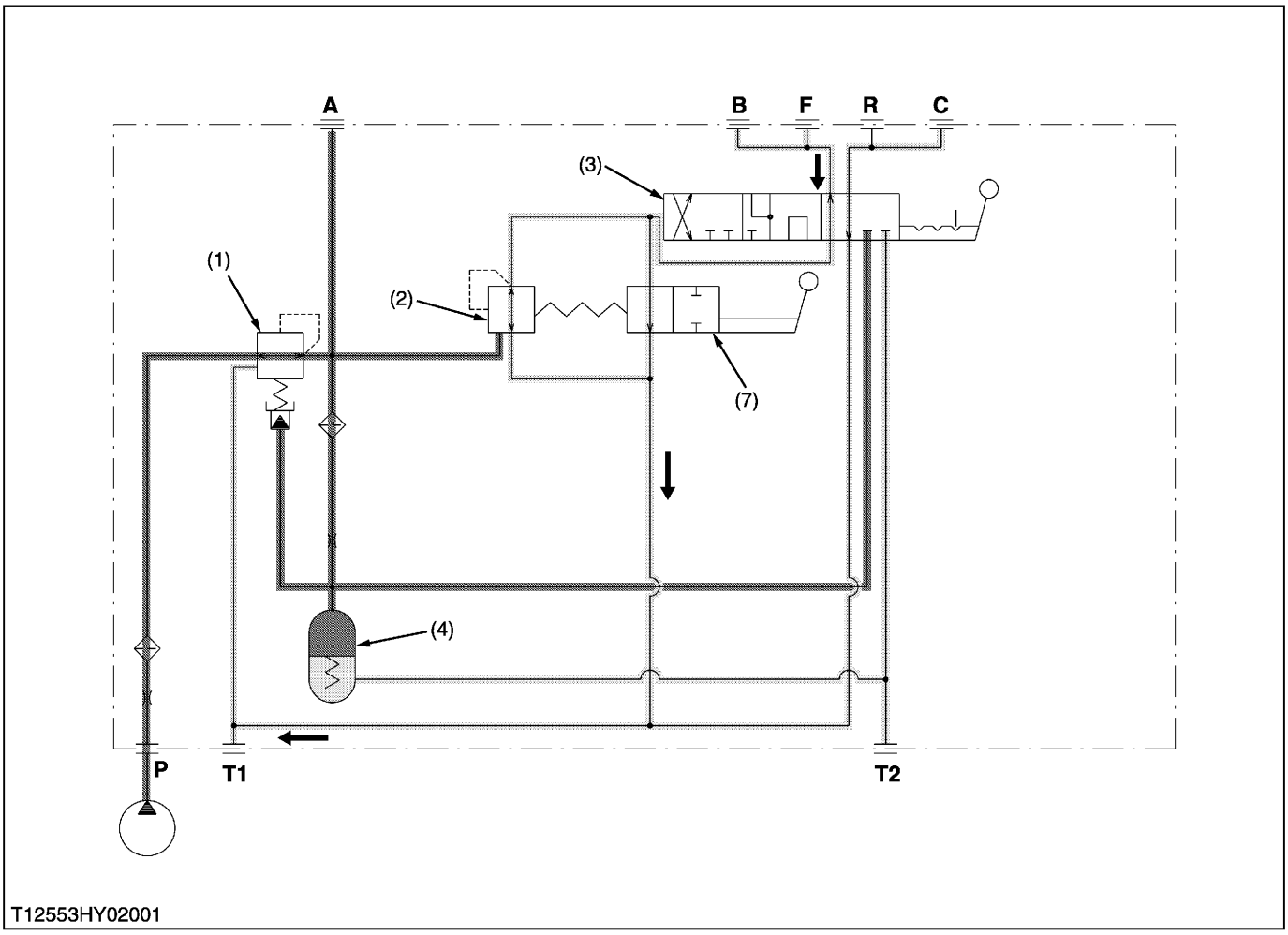
A : Check Port (Modulation)
B : Check Port (Forward)
C : Check Port (Reverse)
P : From Pump
F : To Clutch Body (Forward)
R : To Clutch Body (Reverse)
T1 : To Transmission Case
T2 : To Transmission Case

When the shuttle lever have been setting on the **R** side, the oil pressure on **R** port is constantly controlled by proportionally reducing valve (2).

On the other hand, the oil in the **F** side of shuttle clutch returns to **T1** port through **F** port and spool (3).

■ **When Clutch Pedal is Depressed (with Shuttle Lever at Forward or Reverse Position)**





(1) Modulating Valve
(2) Spool 1
(3) Spool (Forward, Reverse)
(4) Accumulate Valve
(5) Shuttle Valve Case 1
(6) Shuttle Valve Case 2
(7) Spool 2

A : Check Port (Modulation)
B : Check Port (Forward)
C : Check Port (Reverse)
P : From Pump

F : To Clutch Body (Forward)
R : To Clutch Body (Reverse)
T1 : To Transmission Case
T2 : To Transmission Case

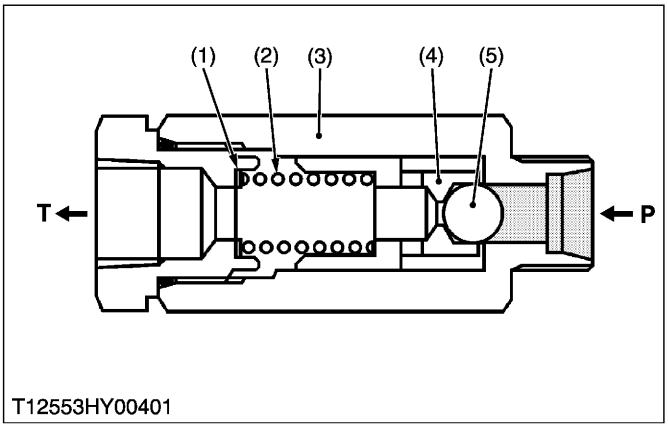
a : Part a
b : Part b
c : Hole c
d : Passage d
e :Hole e

With the shuttle lever at **F** or **R** position, when the clutch pedal is depressed, the spool 2 (7) is moved to the left. And pressure difference between **a** part and **b** part is generated. As the spool 1 (2) is moved to the left by pressure difference, **F** port (or **R** port) and **T1** port are connected.

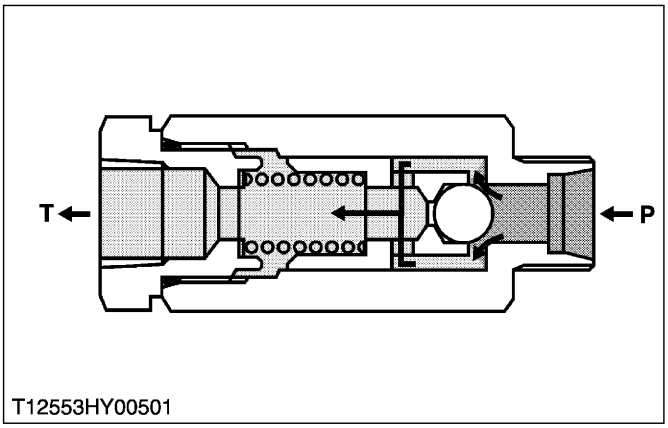
The oil in the shuttle clutch returns into the transmission case via **F** port (or **R** port), notched portion of spool 1 (2) and **T1** port. This cause the shuttle clutch to be set to off.

At the same time, as the hole **c** and passage **d** are connected, oil passage among the hole **e**, hole **c** and **T1** port are connected. As a result, even when the spool 1 (2) does not move, the oil passage from **F** port (or **R** side) to **T1** port is secured.

(4) Oil Cooler Relief Valve



T12553HY00401



T12553HY00501

The oil cooler relief valve is located on the right hand side of the clutch housing case.

This valve uses a direct acting relief valve, which is suitable for low volume and less frequent operations

This valve has a fast response, makes it ideal for relieving shock pressure caused by engine starting.

If pressure in the oil cooler line becomes to great, oil pressure forces the ball (5) off the seat of valve body (3), compressing the coil spring (2) and allows oil to flow to the transmission case through the **T** port.

■ **NOTE**

- **This oil cooler relief valve is not only adapted to M5700HD and M6800HD but also M5700DT.**

(Reference)

- Oil cooler relief valve setting pressure.
  4.5 to 4.9 MPa
  45 to 49 kgf/cm^2
  653 to 711 psi

(1) Shim
(2) Spring
(3) Valve Body
(4) Poppet
(5) Ball

P : P Port (From Power Steering Controller)
T : Tank Port (To Transmission Case)

W1012964

[2] SERVICING

(1) Servicing Specification

Item		Factory Specification	Allowable Limit
Shift Rod	Length	209 mm 8.23 in.	–
Internal snap ring to pressure plate	Clearance (R side)	1.8 to 2.0 mm 0.071 to 0.079 in.	3.6 mm 0.142 in.
	Clearance (F side)	R side + 0.1 to 0.3 mm 0.004 to 0.012 in.	

W1013874

Oil Cooler Relief Valve

Item		Factory Specification	Allowable Limit
Relief Valve	Setting Pressure	4.4 to 4.9 MPa 45.0 to 50.0 kgf/cm^2 640 to 711 psi	–

W1027835

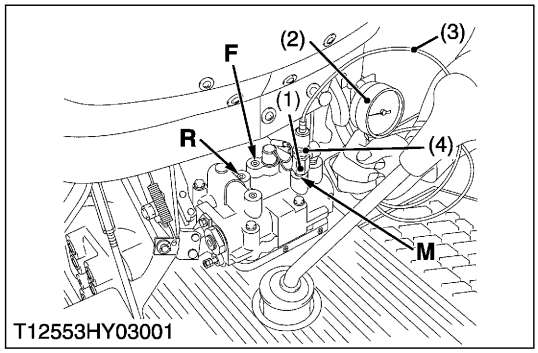
(2) Tightening Torques

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts : See page G-10.)

Item	N·m	kgf·m	ft-lbs
Starter terminal **B** mounting nut	8.8 to 11.8	0.9 to 1.2	6.5 to 8.7
Main delivery pipe and return pipe retaining nut	49.0 to68.6	5.0 to 7.0	36.2 to 50.6
Turning delivery hose retaining nut	24.5 to 29.4	2.5 to 3.0	18.1 to 21.7
DT gear case mounting screw	48.1 to 55.8	4.9 to 5.7	35.4 to 41.2
Rear wheel mounting nut	260 to 304	26.5 to 31.0	192 to 224
Shuttle valve mounting screw M8 grade 7	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Step mounting screw M16	117.7 to 147.1	12.0 to 15.0	87.0 to 108.5
ROPS mounting screw M16 grade 9	260 to 304	26.5 to 31.0	192 to 224
Engine and clutch housing mounting screw, nut	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
Engine and clutch housing mounting stud bolt	38.2 to 45.1	3.9 to 4.6	28.2 to 33.3
Transmission case and clutch housing mounting screw, nut			
M12, grade 11 nut	103 to 117	10.5 to 12.0	76.0 to 86.8
M12, grade 7 screw	77.5 to 90.1	7.9 to 9.2	57.2 to 66.5
M10, grade 9 screw	60.8 to 70.5	6.2 to 7.2	44.9 to 52.1
Transmission upper cover mounting screw	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Speed change cover mounting screw	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2
Shuttle case mounting screw M8 grade 9	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
Shuttle case mounting nut	23.6 to 27.4	2.4 to 2.8	17.4 to 20.2

W1010651

(3) Checking



Checking of Shuttle Valve System Pressure

1. Remove the lower cover.
2. Remove the each plugs of **F**, **R**, **M** and set the adaptor D (1), threaded joint (4), cable (3), and pressure gauge (Code No. : 07916-52961) (2).
3. Start the engine and measure the pressure of each port and each shuttle lever position as the pressure table.

Condition

- Engine speed.....M5700HD : Approx. 2800 rpm
  M6800HD : Approx. 2600rpm
- Oil temperature...45 to 55 °C (113 to 131 °F)

Shuttle Lever	Clutch Pedal	F port pressure	R port Pressure	M port pressure
Forward	Fully pressed	0	0	2.45 to 3.43 MPa 25.0 to 35.0 kgf/cm^2 356 to 498 psi
	Free	1.6 to 1.9 MPa 16.3 to 19.4 kgf/cm^2 232 to 276 psi	0	
Reverse	Fully pressed	0	0	
	Free	0	1.6 to 1.9 MPa 16.3 to 19.4 kgf/cm^2 232 to 276 psi	
Neutral	–	0	0	0.27 MPa 2.75 kgf/cm^2 39 psi

■ **NOTE**

- **Pressure gauge is 5 MPa (50 kgf/cm^2, 700 psi) full scale.**
- **Apply Three Bond 2401 or equivalent to the plugs F, R and M, when install them.**

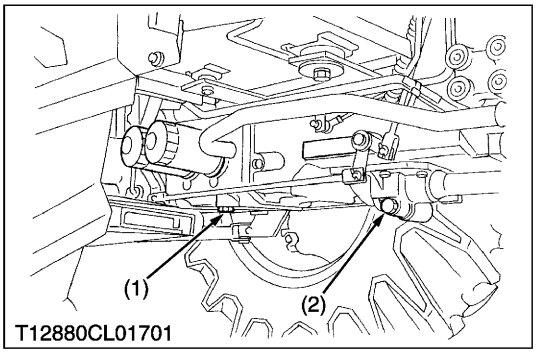
(1) Adaptor D
(2) Pressure Gauge
(3) Cable
(4) Threaded Joint

Plug F : Operation Oil Pressure (For Forward)
Plug R : Operation Oil Pressure (For Reverse)
Plug M : Operation Oil Pressure (For Modulation Valve)

W1010646

(4) Disassembling and Assembling

(A) Draining the Transmission Fluid and Fuel



Draining Transmission Fluid

1. Place an oil pan underneath the transmission case.
2. Remove the drain plugs (1) and (2).
3. Drain the transmission fluid.
4. Reinstall the drain plugs (1) and (2).

(When reassembling)

- Fill up from filling port after removing the filling plug until reaching the gauge.
- After running the engine for few minutes, stop it and check the fluid level again, add the fluid to prescribed level if it is not correct level.

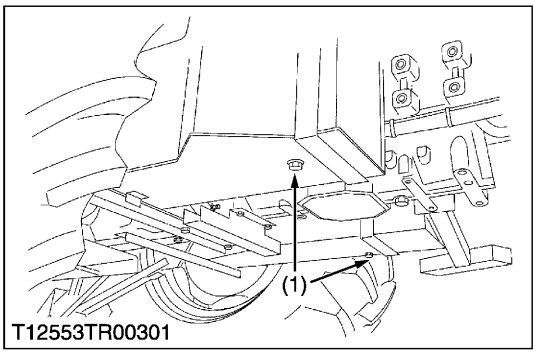
Transmission fluid	Capacity	40.0 L 42.3 U.S.qts. 35.2 Imp.qts.

■ **IMPORTANT**

- **Use only KUBOTA SUPER UDT fluid. Use of other fluids may damage the transmission or hydraulic system.**
- **Refer to "LUBRICANTS, FUEL AND COOLANT". (See page G-9)**
- **Do not mix difference brands oil together.**

(1) Drain Plug (2) Drain Plug

W1010824



Draining Fuel (M6800HD)

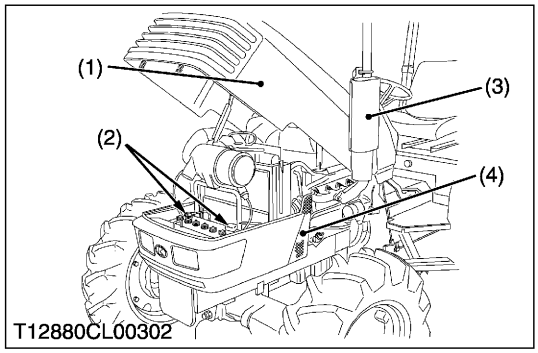
1. Place oil pans under the fuel tank.
2. Remove the drain plug (1).
3. Drain the fuel.
4. Reinstall the drain plug (1).

Fuel	Capacity	65 L 17.2 U.S.gals. 14.3 Imp.gals.

(1) Drain Plug

W1011070

(B) Separating Engine and Clutch Housing Case (for M5700HD)

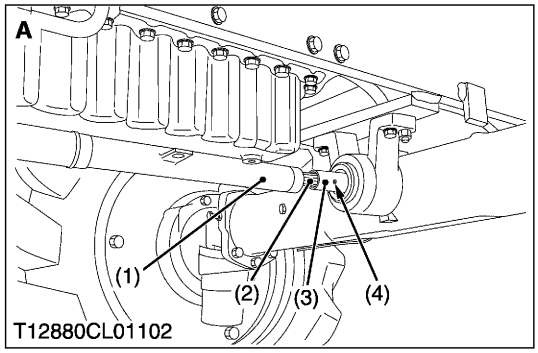


Muffler and Bonnet

1. Remove the muffler (3).
2. Remove the bonnet (1).
3. Disconnect the battery's cable (2).
4. Remove the side cover (4).

(1) Bonnet
(2) Battery's Cable
(3) Muffler
(4) Side Cover

W1011218



Propeller Shaft

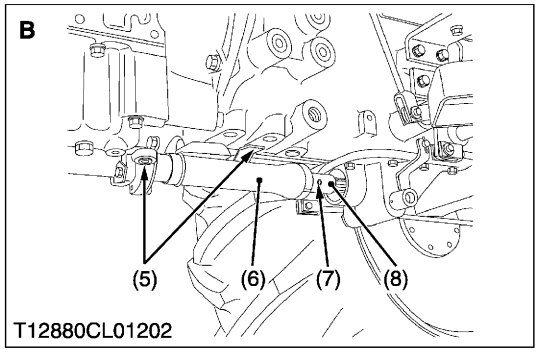
1. Slide the propeller shaft covers (1), (6) after removing the screws (5).
2. Tap out the spring pins (4), (7) and then slide the couplings (3), (8) to the front and rear.

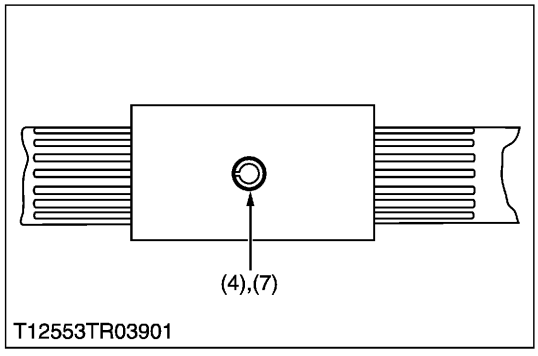
(When reassembling)

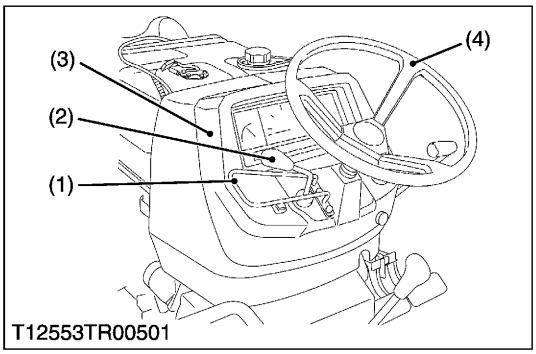
- Apply grease to the splines of the propeller shaft (2).
- Tap in the spring pins (4), (7) as shown in figure.

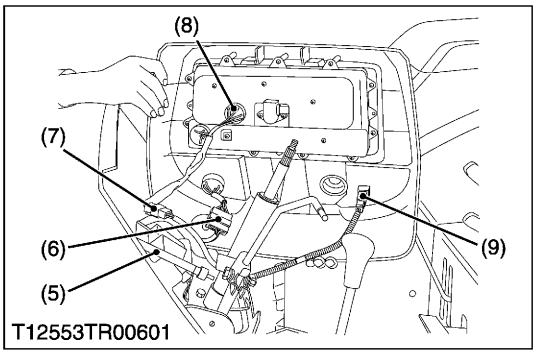
(1) Propeller Shaft Cover
(2) Propeller Shaft
(3) Coupling
(4) Spring Pin
(5) Screw
(6) Propeller Shaft Cover
(7) Spring Pin
(8) Coupling
A : Front Side
B : Rear Side

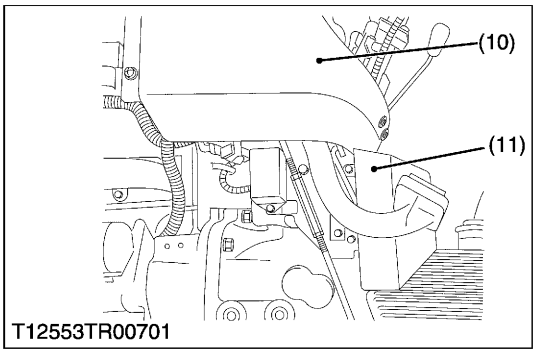
W1011487

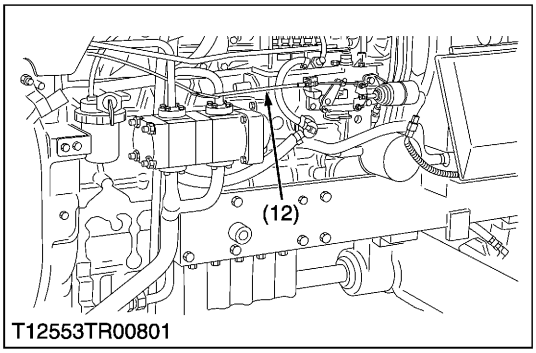


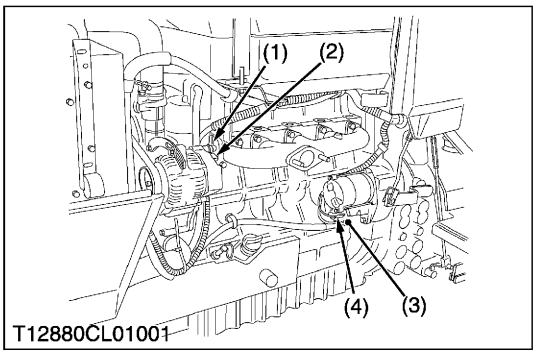












Steering Wheel, Meter panel and Rear Bonnet

1. Remove the steering wheel (4) with a steering wheel puller (Code No. 07916-51090).
2. Remove the shuttle lever grip (2) and shuttle lever guide (1).
3. Remove the meter panel mounting screws and open the meter panel (3).
4. Disconnect the two connectors (8) and meter cable (5).
5. Disconnect the main switch connector (6) and combination switch connector (7).
6. Disconnector the hazard switch connector (9).
7. Remove the meter panel (3).
8. Disconnect the engine stop cable (12) at the engine side.
9. Remove the rear bonnet (10) and lower cover (11).

(1) Shuttle Lever Guide
(2) Shuttle Lever Grip
(3) Meter Panel
(4) Steering Wheel
(5) Meter Cable
(6) Main Switch Connector
(7) Combination Switch Connector
(8) Connector
(9) Hazard Switch Connector
(10) Rear Bonnet
(11) Lower Cover
(12) Engine Stop Cable

W1011668

Wire Harness for Alternator and Starter Motor

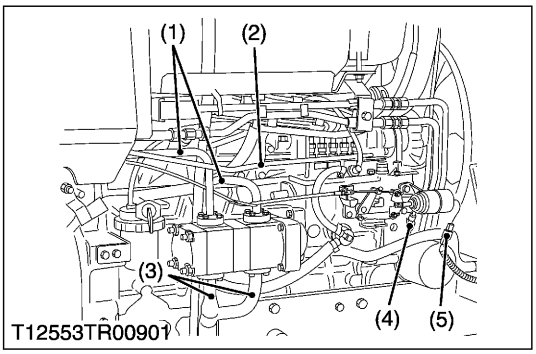
1. Disconnect the alternator **2P** connector (2) and **B** terminal (1).
2. Disconnect the starter motor **B** terminal (3) and **1P** connector (4).

(When reassembling)

Tightening torque	Starter's terminal **B** mounting nut	8.8 to 11.8 N·m 0.9 to 1.2 kgf·m 6.5 to 8.7 ft-lbs

(1) Alternator **B** Terminal
(2) Alternator **2P** Connector
(3) Starter Motor **B** Terminal
(4) Starter Motor **1P** Connector

W1011967

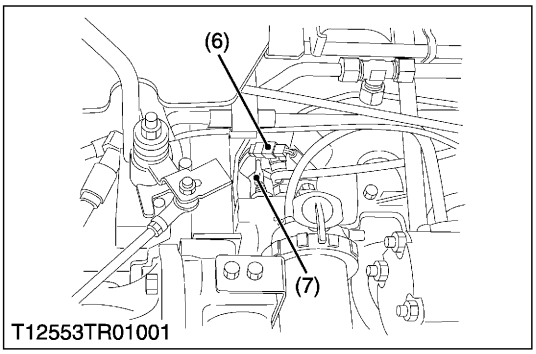


Wire Harness R.H. and Hydraulic Pipe

1. Remove the accelerator rod (2).
2. Remove the suction pipe (3) and delivery pipe (1).
3. Disconnect the glow plug **1P** connector (6) and coolant temperature sensor **1P** connector (7).
4. Remove the hourmeter cable (4) at engine side.
5. Disconnect the stop solenoid connector (5).

(1) Delivery Pipe
(2) Accelerator Rod
(3) Suction Pipe
(4) Hourmeter Cable
(5) Stop Solenoid Connector
(6) **1P** Connector for Glow Plug
(7) **1P** Connector for Coolant Temperature Sensor

W1012142

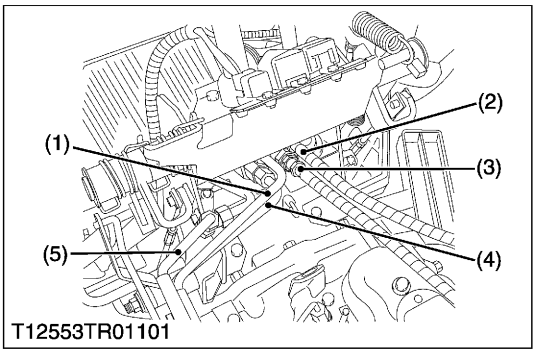


Piping for Power Steering

1. Disconnect the main delivery pipe (4), return pipe 1 (1), right turning delivery hose (3), left turning delivery hose (2) and return pipe 2 (5).

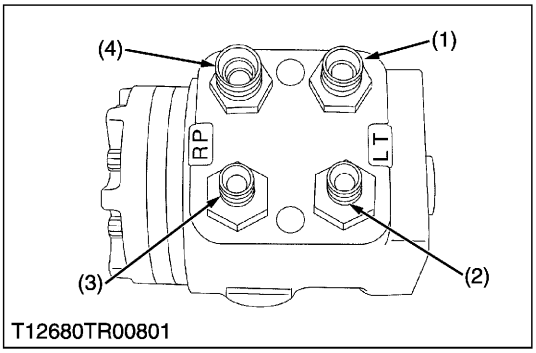
(When reassembling)

Tightening torque	Main delivery pipe and return pipe retaining nut	49.0 to 68.6 N·m 5.0 to 7.0 kgf·m 36.2 to 50.6 ft-lbs
	Turning delivery hose retaining nut	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 ft-lbs



(1) Return Pipe 1
(2) Left Turning Delivery hose
(3) Right Turning Delivery Hose
(4) Main Delivery Pipe
(5) Return Pipe 2

W1012425



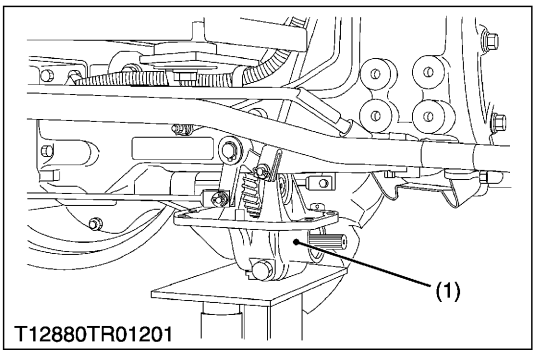
DT Gear Case

1. Remove the DT shift rod.
2. Remove the DT gear case (1).

(When reassembling)

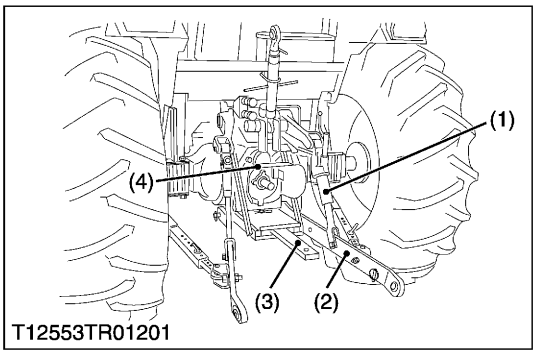
- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the clutch housing and DT gear case.

Tightening torque	DT gear case mounting screw	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs



(1) DT Gear Case

W1012609

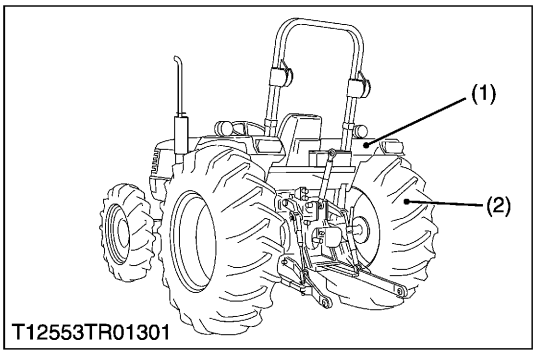


Lift Rods and Lower Links

1. Remove the lift rods (1).
2. Remove the lower links (2) with stabilizer.
3. Remove the drawbar (3).
4. Remove the PTO shaft cover (4).

(1) Lift Rod
(2) Lower Link
(3) Drawbar
(4) PTO Shaft Cover

W1012737



Rear Wheels and Fenders

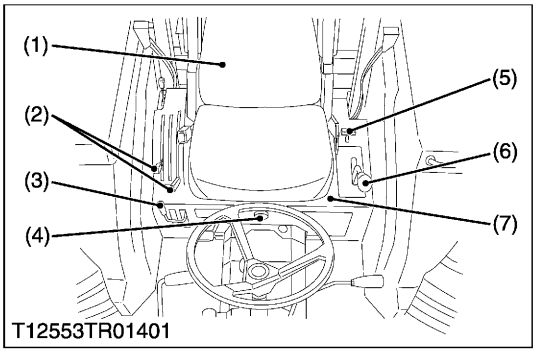
1. Check the clutch housing case and transmission case are securely mounted on the disassembling stands.
2. Remove the rear wheels (2).
3. Disconnect the jumper leads for hazard and tail light.
4. Disconnect the jumper leads for PTO safety switch.
5. Remove the fenders (1).

(When reassembling)

Tightening torque	Rear wheel mounting nut	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs

(1) Fender
(2) Rear Wheel

W1012933

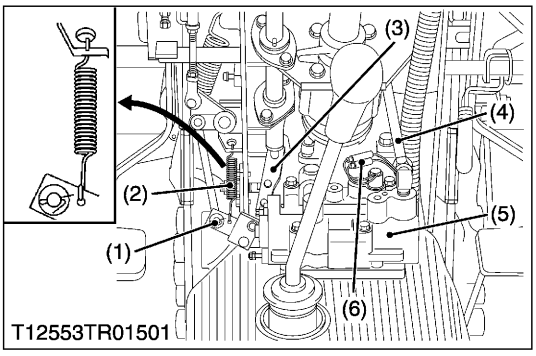


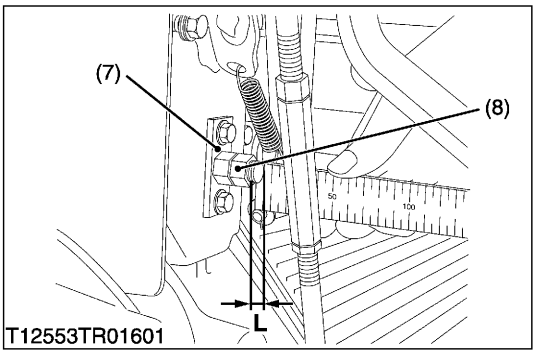
Seat and Center Frame

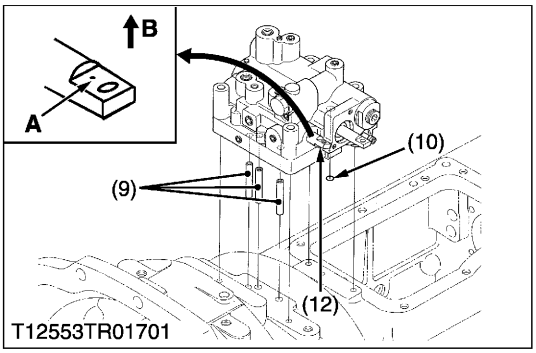
1. Remove the seat (1).
2. Remove the draft and position control lever grips (2).
3. Remove the auxiliary speed change lever grip (6), DT shift lever grip (5) and 3-point hitch lowering speed control grip (4).
4. remove the auxiliary control valve lever assembly (3).
5. Remove the center frame (7).

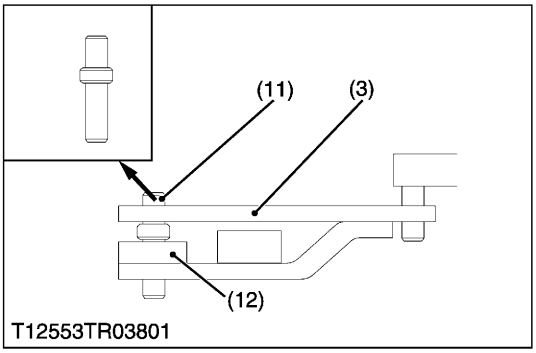
(1) Seat
(2) Lever Grip
(3) Auxiliary Control Valve Lever Assembly
(4) 3-Point Hitch Lowering Speed Control Grip
(5) DT Shift Grip
(6) Auxiliary Speed Change Lever Grip
(7) Center Frame

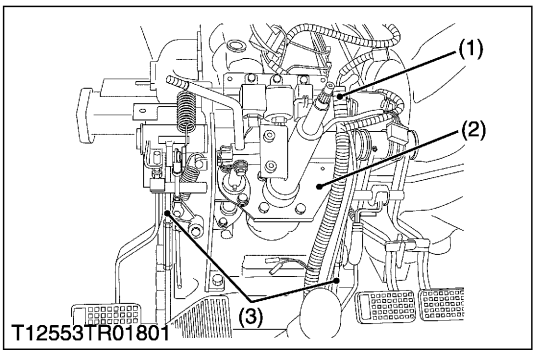
W1013130











Shuttle Valve Assembly

1. Disconnect the rod (1) and connector (6).
2. Remove the spring (2).
3. Remove the hydraulic pipe (4) for shuttle valve.

■ **NOTE**

- **Measure and note the length L, before removing lock nut of adjusting plate (7).**

4. Remove the lock nut (8) and adjusting plate (7).
5. Remove the neutral position adjusting assembly (3).
6. Remove the shuttle valve assembly (5).
7. Remove the pin (11) and oil pipes (9).

(When reassembling)

- When installing the shuttle valve, make sure that the punched mark **A** of shuttle rod is upward.
- Replace the oil pipe (9) with a new one.
- Apply transmission fluid to the oil pipes (9).
- To avoid uneven tightening, tighten the shuttle valve mounting screws uniformly.
- Be sure to hook the spring (2) from bottom side as shown in figure.
- Be sure to install the pin (11) as shown in figure.
- After assembled, confirm the shuttle lever can be shifted on each position securely. If not adjust the length **L**.
- Be sure to install the O-ring (10).

Tightening torque	Shuttle valve mounting screw M8 grade 7	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

(1) Rod
(2) Spring
(3) Neutral Position Adjusting Assembly
(4) Hydraulic Pipe
(5) Shuttle Valve Assembly
(6) Connector
(7) Adjusting plate
(8) Lock Nut
(9) Oil Pipe
(10) O-ring
(11) Pin
(12) Shuttle Spool
L : Shuttle Neutral Position Length
A : Punched Mark
B : Up

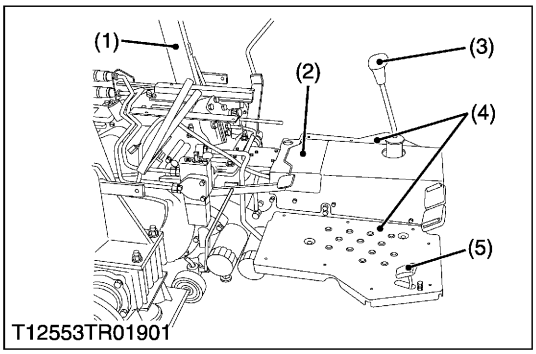
W1013324

Pedal Frame

1. Remove the brake rods (3).
2. Disconnect relay and wireharness assembly (1) to the rear side.
3. Remove the pedal frame (2) and steering controller assembly as a unit.

(1) Wireharness Assembly
(2) Pedal Frame
(3) Brake Rod

W1013726



Steps and Clutch Housing Cover

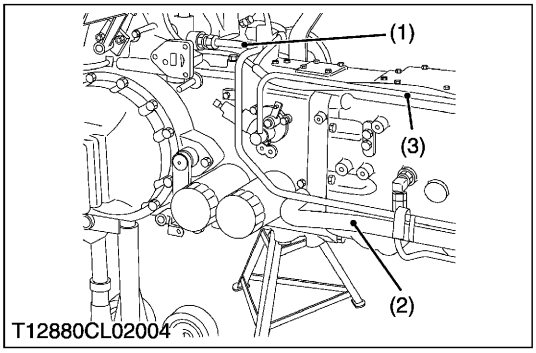
1. Disconnect the foot accelerator rod (5).
2. Remove the steps (4).
3. Remove the main speed change lever grip (3).
4. Remove the clutch housing cover (2).
5. Remove the ROPS (1).

(When reassembling)

Tightening torque	Step mounting screw M16	117.7 to 147.1 N·m 12.0 to 15.0 kgf·m 87.0 to 108.5 ft-lbs
	ROPS mounting screw M16, Grade 9	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs

(1) ROPS
(2) Clutch Housing Cover
(3) Main Speed Change Lever Grip
(4) Step
(5) Foot Accelerator Rod

W1013869

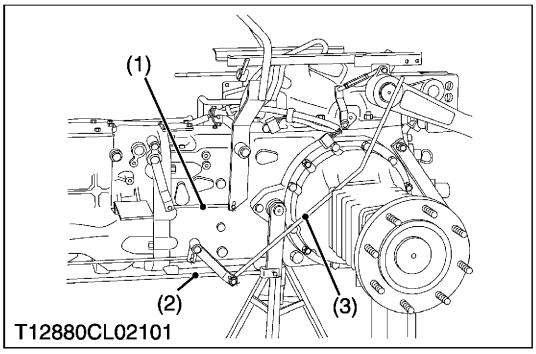


Hydraulic Pipes

1. Remove the suction pipe (2).
2. Remove the delivery pipe (1) for the three point hydraulic system.
3. Remove the PTO pipe (3).

(1) Delivery Pipe
(2) Suction Pipe
(3) PTO Pipe

W1014142



Auxiliary Shift Lever and Brake Rod

1. Disconnect the shift rods (1).
2. Remove the shift lever assembly.
3. Remove the brake rods (2).
4. Remove the DT rod (3).

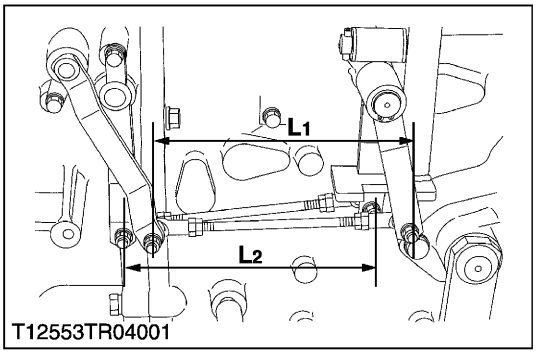
(When reassembling)

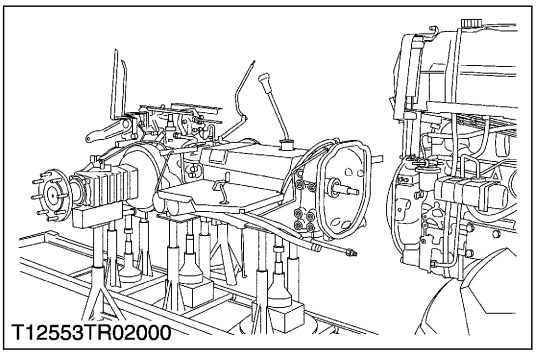
Shift rod length **L1** and **L2**	Factory spec.	Approx. 209 mm 8.23 in.

(1) Shift Rod
(2) Brake Rod
(3) DT Rod

L1 : Creep Length
L2 : Hi-Low Length

W1014265

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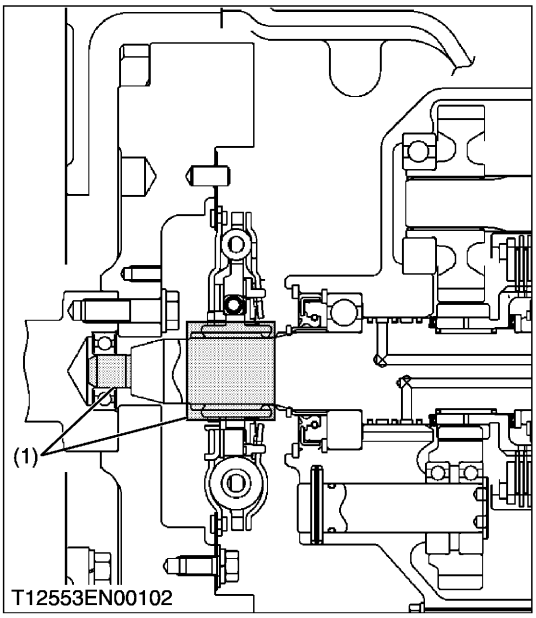
Separating Engine from Clutch Housing

1. Remove the engine mounting screws and nuts, and separate the engine from the clutch housing.

(When reassembling)

- Apply molydenum disulphide (Three Bond 1901 or equivalent) to the splines of clutch disc boss.
- Apply liquid gasket (Three Bond 1211, 1141 or equivalent) to the seam of engine and clutch housing.
- When connecting the engine to the clutch housing, be sure to align the input shaft spline to the clutch hub center.

Tightening torque	Engine and clutch housing mounting screw, nut	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Engine and clutch housing mounting stud bolt	38.2 to 45.1 N·m 3.9 to 4.6 kgf·m 28.2 to 33.3 ft-lbs



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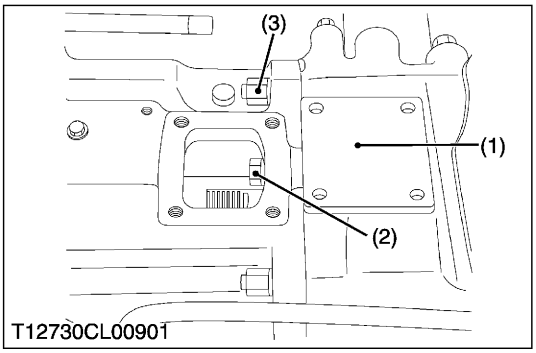
(1) Greasing Point

W1014453



T12730CL00901

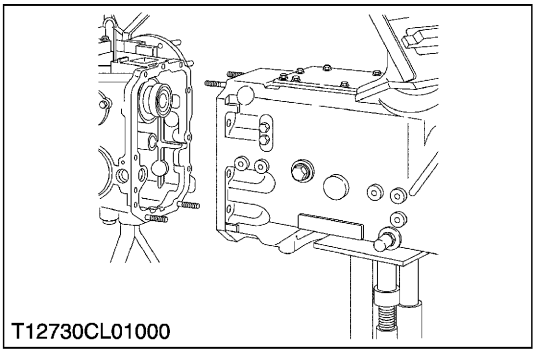
Separating Transmission Case

1. Remove the transmission upper cover (1).
2. Remove the transmission case mounting screws (2) and nut (3), and separate the transmission case from the clutch housing.

(When reassembling)

- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the transmission case and clutch housing, transmission upper cover and transmission case.

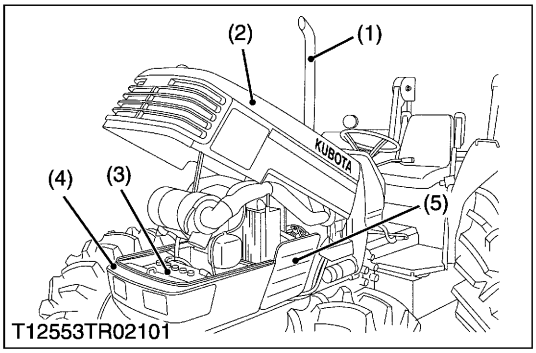
Tightening torque	Transmission case and clutch housing mounting screws, nut	M12, grade 11 nut	103. to 107 N·m 10.5 to 12.0 kgf·m 76.0 to 86.8 ft-lbs
		M12, grade 7 screws	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
		M10, grade 9 screws (2)	60.8 to 70.5 N·m 6.2 to 7.2 kgf·m 44.9 to 52.1 ft-lbs
	Transmission upper cover mounting screw		23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs


T12730CL01000

(1) Transmission Upper Cover
(2) Transmission Case Mounting Screw
(3) Transmission Case Mounting Nut

W1014648

(C) Separating Engine and Clutch Housing Case (for M6800HD)

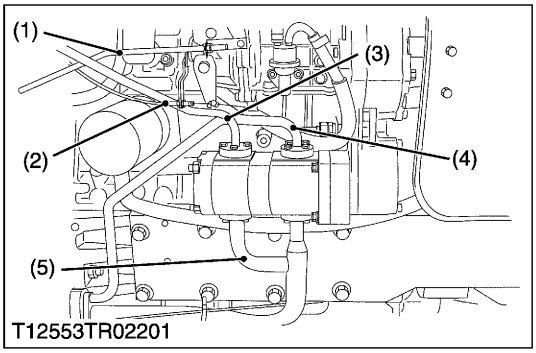


Muffler and Bonnet

1. Remove the muffler (1).
2. Remove the bonnet (2).
3. Disconnect the battery's cable.
4. Disconnect the head light **3P** connectors.
5. Remove the front lower cover (4) and side cover (5).

(1) Muffler (Upper)
(2) Bonnet
(3) Battery
(4) Front Lower Cover
(5) Side Cover

W1014877

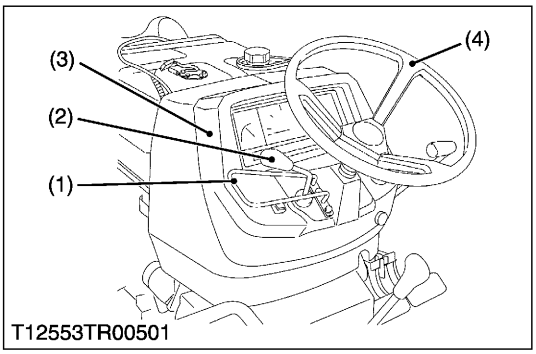


Piping for 3-Point Hydraulic System

1. Remove the accelerator rod (1).
2. Disconnect the engine stop cable (2).
3. Remove the suction pipe (5).
4. Remove the delivery pipe (4) for 3-point hydraulic system.
5. Remove the delivery pipe (3) for power steering.

(1) Accelerator Rod
(2) Engine Stop Cable
(3) Delivery Pipe
(4) Delivery Pipe
(5) Suction Pipe

W1015071



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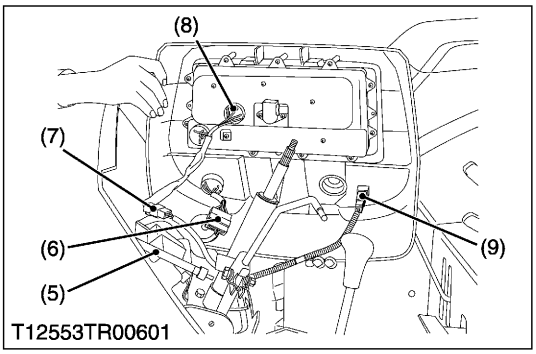

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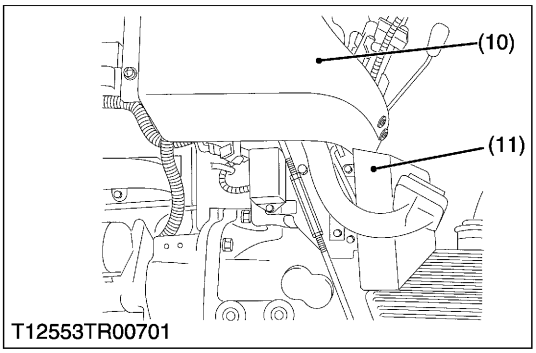

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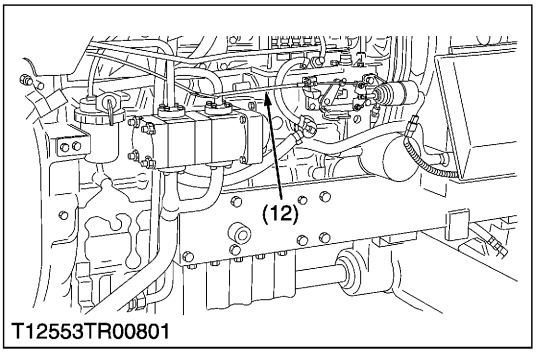

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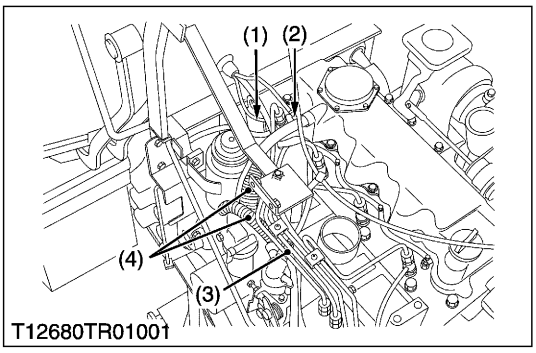


T12680TR01001

Steering Wheel, Meter panel and Rear Bonnet

1. Remove the steering wheel (4) with a steering wheel puller (Code No. 07916-51090).
2. Remove the shuttle lever grip (2) and shuttle lever guide (1).
3. Remove the meter panel mounting screws and open the meter panel (3).
4. Disconnect the two connectors (8) and meter cable (5).
5. Disconnect the main switch connector (6) and combination switch connector (7).
6. Disconnect the hazard switch connector (9).
7. Remove the meter panel (3).
8. Disconnect the engine stop cable (12) at the engine side.
9. Remove the rear bonnet (10) and lower cover (11).

(1) Shuttle Lever Guide
(2) Shuttle Lever Grip
(3) Meter Panel
(4) Steering Wheel
(5) Meter Cable
(6) Main Switch Connector
(7) Combination Switch Connector
(8) Connector
(9) Hazard Switch Connector
(10) Rear Bonnet
(11) Lower Cover
(12) Engine Stop Cable

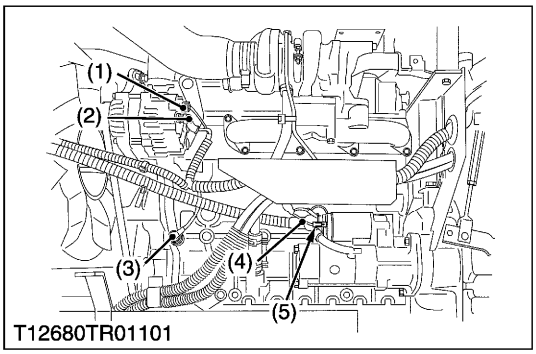
W1015311

Wire Harness R.H. and Fuel Pipes

1. Disconnect the **3P** connector for solenoid valve (3).
2. Disconnect the wiring lead (2) from the glow plug.
3. Disconnect the **1P** connector for coolant thermo sensor **1P** connector (1).
4. Remove the fuel pipes (4).

(1) **1P** Connector for Coolant Thermo Sensor
(2) Wiring Lead for Glow Plug
(3) **3P** Connector for Solenoid Valve
(4) Fuel Pipes

W1015545



Wire Harness L.H.

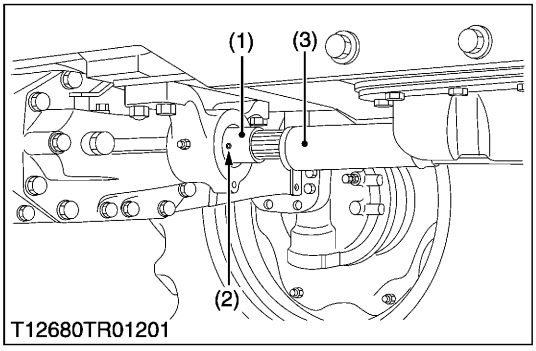
1. Disconnect the alternator **2P** connector (1) and **B** terminal (2).
2. Disconnect the starter motor **C** terminal (5) and **B** terminal (4).
3. Disconnect the engine oil pressure switch terminal (3).

(When reassembling)

Tightening torque	Starter's terminal **B** mounting nut	8.8 to 11.8 N·m 0.9 to 1.2 kgf·m 6.5 to 8.7 ft-lbs

(1) Alternator **2P** Connector
(2) Alternator **B** terminal
(3) Engine Oil Pressure Switch Terminal
(4) Starter Motor **B** Terminal
(5) Starter Motor **C** Terminal

W1012136



Propeller Shaft

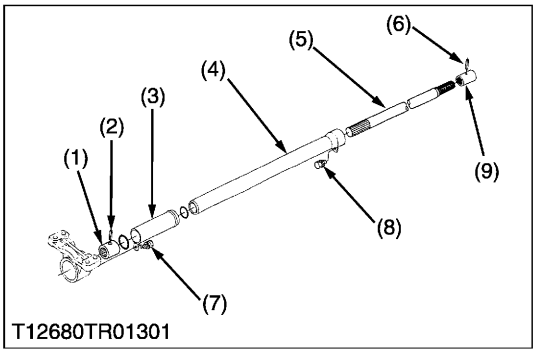
1. Slide the propeller shaft covers (3), (4) after removing the screws (7), (8).
2. Tap out the spring pins (2), (6) and then slide the couplings (1), (9) to the front and rear.

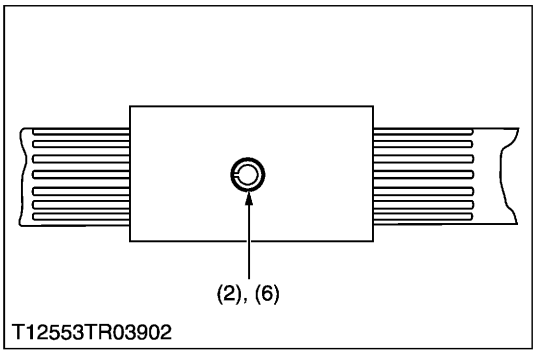
(When reassembling)

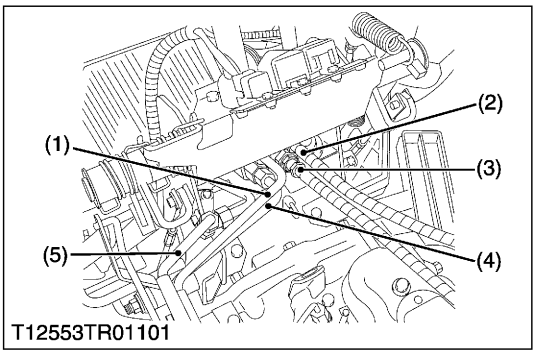
- Apply grease to the splines of the propeller shaft (5) and pinion shaft.
- Tap in the spring pins (2), (6) as shown in figure.

(1) Coupling
(2) Spring Pin
(3) Propeller Shaft Cover
(4) Propeller Shaft Cover
(5) Propeller Shaft
(6) Spring Pin
(7) Screw
(8) Screw
(9) Coupling

W1012314







T12553TR01101

Piping for Power Steering

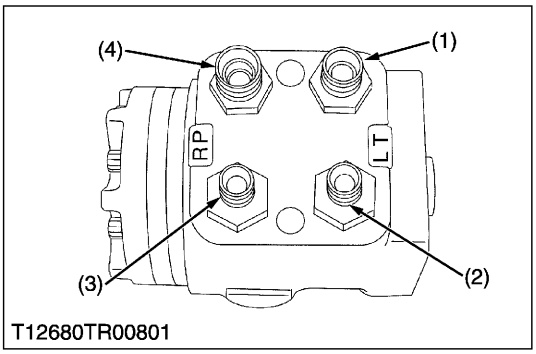
1. Disconnect the main delivery pipe (4), return pipe 1 (1), right turning delivery hose (3), left turning delivery hose (2) and return pipe 2 (5).

(When reassembling)

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

(1) Return Pipe 1
(2) Left Turning Delivery hose
(3) Right Turning Delivery Hose
(4) Main Delivery Pipe
(5) Return Pipe 2

W1016073



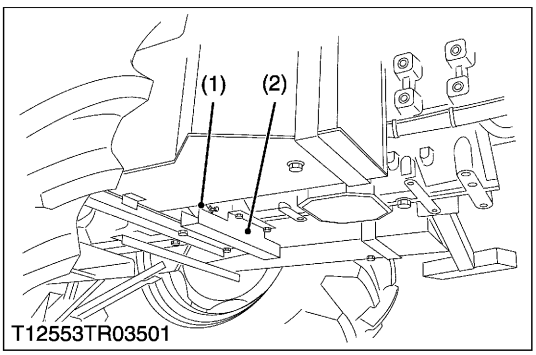
T12680TR00801

Fuel Tank Connection Hose

1. Remove the cover (2).
2. Remove the connection hose (1).

(1) Connection Hose
(2) Cover

W1016206



T12553TR03501

DT Gear Case

1. Remove the DT shift rod.
2. Remove the DT gear case (1).

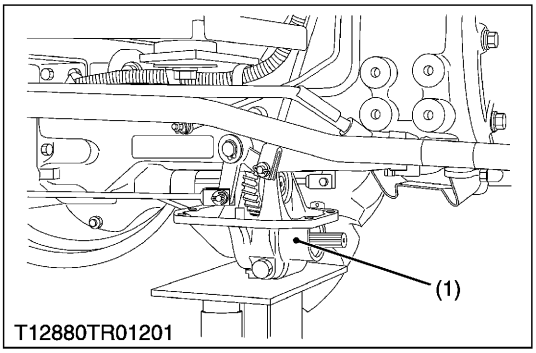
(When reassembling)

- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the clutch housing and DT gear case.

Tightening torque	DT gear case mounting screw	48.1 to 55.8 N·m 4.9 to 5.7 kgf·m 35.4 to 41.2 ft-lbs

(1) DT Gear Case

W1016349



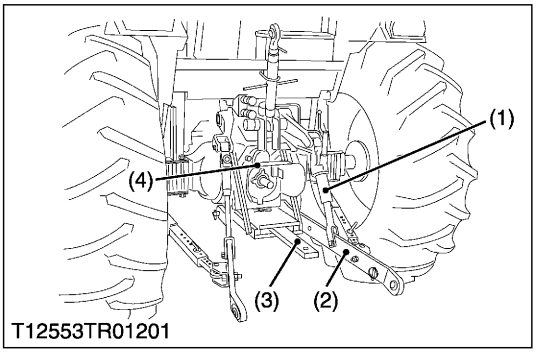
T12880TR01201

Lift Rods and Lower Links

1. Remove the lift rods (1).
2. Remove the lower links (2) with stabilizer.
3. Remove the drawbar (3).
4. Remove the PTO shaft cover (4).

(1) Lift Rod
(2) Lower Link
(3) Drawbar
(4) PTO Shaft Cover

W1016475



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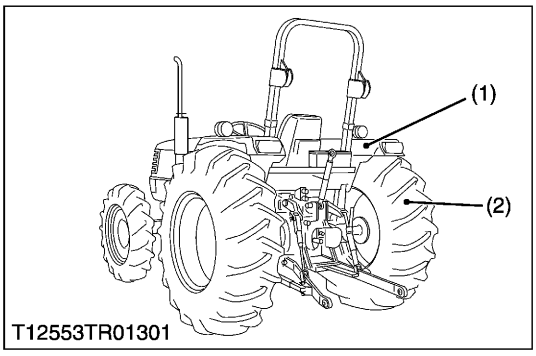


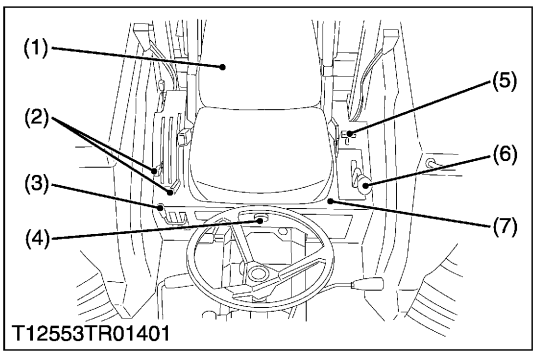
Rear Wheels and Fenders

1. Check the clutch housing case and transmission case are securely mounted on the disassembling stands.
2. Remove the rear wheels (2).
3. Disconnect the jumper leads for hazard and tail light.
4. Disconnect the jumper leads for PTO safety switch.
5. Remove the fenders (1).

(When reassembling)

Tightening torque	Rear wheel mounting nut	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs

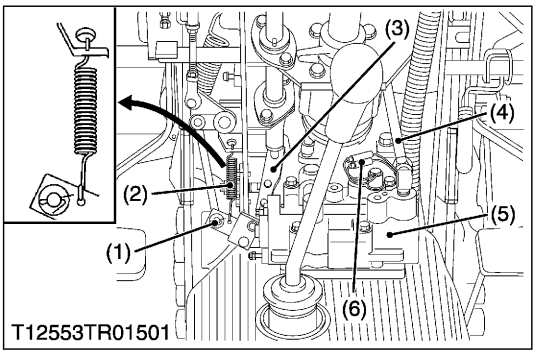
(1) Fender
(2) Rear Wheel

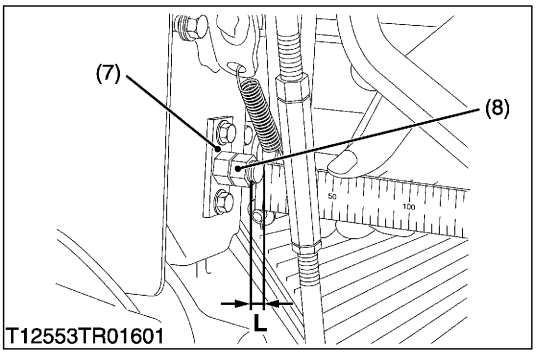


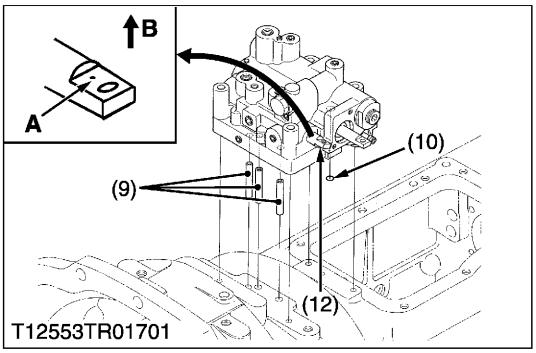
Seat and Center Frame

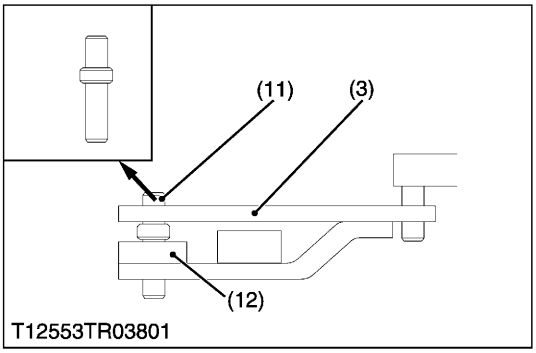
1. Remove the seat (1).
2. Remove the draft and position control lever grips (2).
3. Remove the auxiliary speed change lever grip (6), DT shift lever grip (5) and 3-point hitch lowering speed control grip (4).
4. Remove the auxiliary control valve lever assembly (3).
5. Remove the center frame (7).

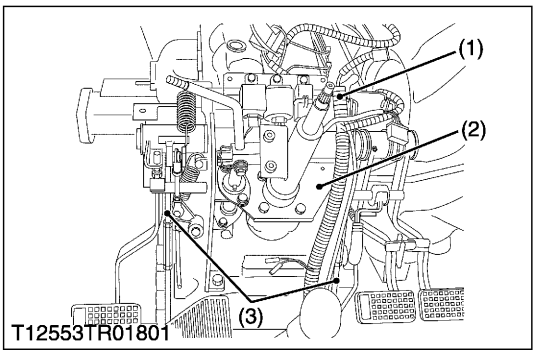
(1) Seat
(2) Lever Grip
(3) Auxiliary Control Valve Lever Assembly
(4) 3-Point Hitch Lowering Speed Control Grip
(5) DT Shift Grip
(6) Auxiliary Speed Change Lever Grip
(7) Center Frame











Shuttle Valve Assembly

1. Disconnect the rod (1) and connector (6).
2. Remove the spring (2).
3. Remove the hydraulic pipe (4) for shuttle valve.

■ **NOTE**

- **Measure and note the length L, before removing lock nut of adjusting plate (7).**

4. Remove the lock nut (8) and adjusting plate (7).
5. Remove the neutral position adjusting assembly (3).
6. Remove the shuttle valve assembly (5).
7. Remove the pin (11) and oil pipes (9).

(When reassembling)

- When installing the shuttle valve, make sure that the punched mark **A** of shuttle rod is upward.
- Replace the oil pipe (9) with a new one.
- Apply transmission fluid to the oil pipes (9).
- To avoid uneven tightening, tighten the shuttle valve mounting screws uniformly.
- Be sure to hook the spring (2) from bottom side as shown in figure.
- Be sure to install the pin (11) as shown in figure.
- After assembled, confirm the shuttle lever can be shifted on each position securely. If not adjust the length **L**.
- Be sure to install the O-ring (10).

Tightening torque	Shuttle valve mounting screw M8 grade 7	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

(1) Rod
(2) Spring
(3) Neutral Position Adjusting Assembly
(4) Hydraulic Pipe
(5) Shuttle Valve Assembly
(6) Connector
(7) Adjusting plate
(8) Lock Nut
(9) Oil Pipe
(10) O-ring
(11) Pin
(12) Shuttle Spool
L : Shuttle Neutral Position Length
A : Punched Mark
B : Up

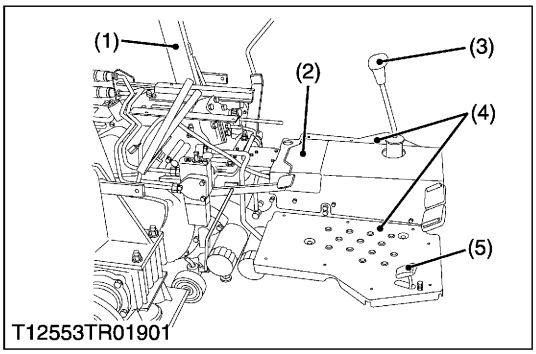
W1032539

Pedal Frame

1. Remove the brake rods (3).
2. Disconnect and relay the wireharness assembly (1) to the rear side.
3. Remove the pedal frame (2) and steering controller assembly as a unit.

(1) Wireharness Assembly
(2) Pedal Frame
(3) Brake Rod

W1017072



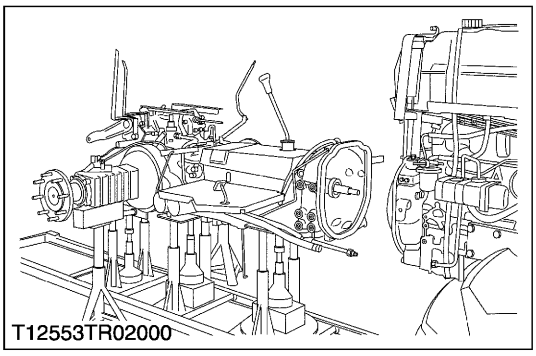
Steps and Clutch Housing Cover

1. Disconnect the foot accelerator rod (5).
2. Remove the steps (4).
3. Remove the main speed change lever grip (3).
4. Remove the clutch housing cover (2).
5. Remove the ROPS (1).

Tightening torque	Step mounting screw M16	117.7 to 147.1 N·m 12.0 to 15.0 kgf·m 87.0 to 108.5 ft-lbs
	ROPS mounting screw M16, Grade 9	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 ft-lbs

(1) ROPS
(2) Clutch Housing Cover
(3) Main Speed Change Lever Grip
(4) Step
(5) Foot Accelerator Rod

W1017337



Separating Engine from Clutch Housing

1. Remove the engine mounting screws and nuts, and separate the engine from the clutch housing.

(When reassembling)

- Apply grease to the splines.
- Apply liquid gasket (Three Bond 1211, 1141 or equivalent) to the seam of engine and clutch housing.
- When connecting the engine to the clutch housing, be sure to align the input shaft spline to the clutch hub center.

Tightening torque	Engine and clutch housing mounting screw, nut	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
	Engine and clutch housing mounting stud bolt	38.2 to 45.1 N·m 3.9 to 4.6 kgf·m 28.2 to 33.3 ft-lbs

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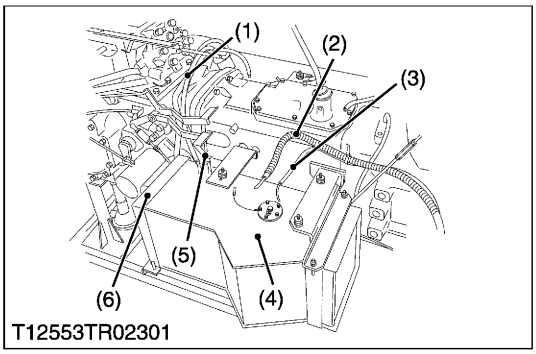
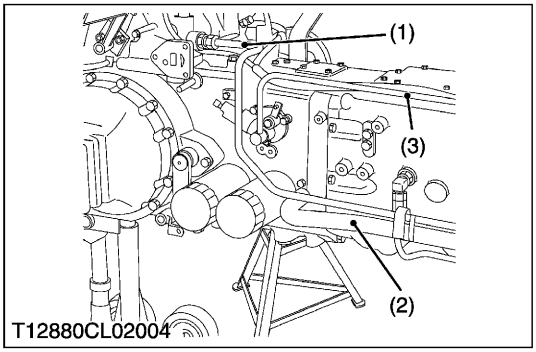


Fuel Tank

1. Remove the fuel hoses (1), (2), (3), (5).
2. Remove the tank bands (6).
3. Remove the fuel tanks (4).

(1) Fuel Hose 1
(2) Fuel Hose 3
(3) Fuel Hose 4
(4) Fuel Tank
(5) Fuel Hose 2
(6) Tank Band

W1017539



Hydraulic Pipes

1. Remove the suction pipe (2).
2. Remove the delivery pipe (1) for the three point hydraulic system.
3. Remove the PTO pipe (3).

(1) Delivery Pipe
(2) Suction Pipe
(3) PTO Pipe

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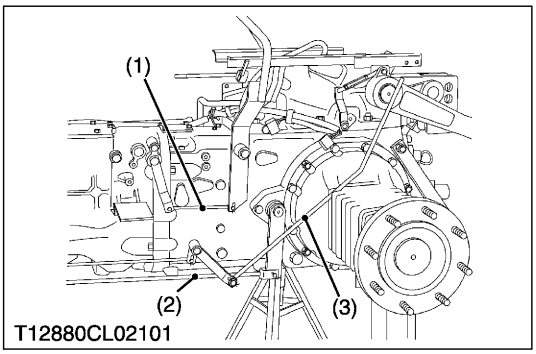
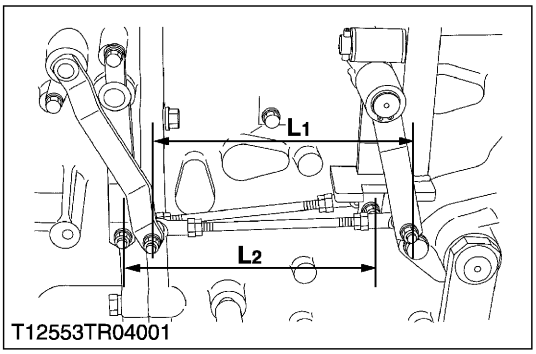
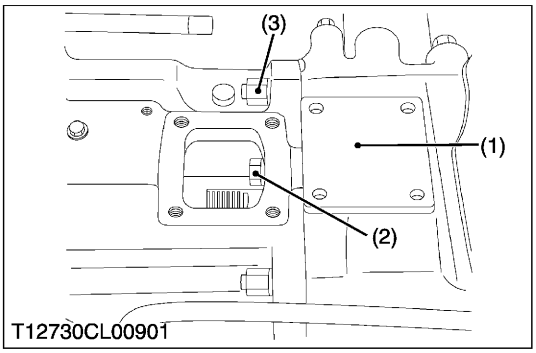
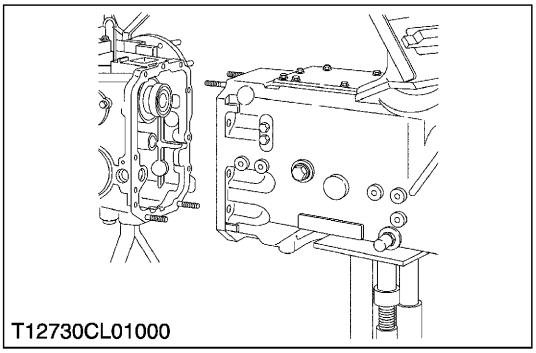








Auxiliary Shift Lever and Brake Rod

1. Disconnect the shift rods (1).
2. Remove the shift lever assembly.
3. Remove the brake rods (2).
4. Remove the DT rod (3).

(When reassembling)

Shift rod length **L1** and **L2**	Factory spec.	Approx. 209 mm 8.23 in.

(1) Shift Rod
(2) Brake Rod
(3) DT Rod

L1 : Creep Length
L2 : Hi-Low Length

Separating Transmission Case

1. Remove the transmission upper cover (1).
2. Remove the transmission case mounting screws (2) and nut (3), and separate the transmission case from the clutch housing.

(When reassembling)

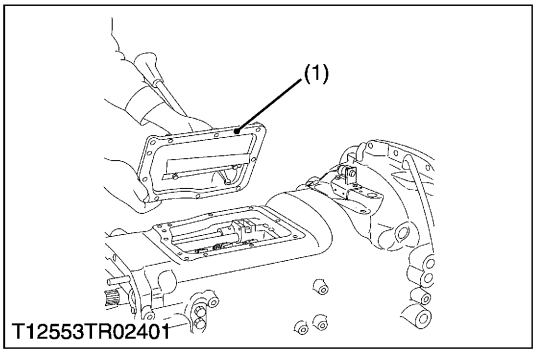
- Apply liquid gasket (Three Bond 1216 or equivalent) to joint face of the transmission case and clutch housing, transmission upper cover and transmission case.

Tightening torque	Transmission case and clutch housing mounting screws, nut	M12, grade 11 nut	103. to 107 N·m 10.5 to 12.0 kgf·m 76.0 to 86.8 ft-lbs
		M12, grade 7 screws	77.5 to 90.1 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 ft-lbs
		M10, grade 9 screws (2)	60.8 to 70.5 N·m 6.2 to 7.2 kgf·m 44.9 to 52.1 ft-lbs
	Transmission upper cover mounting screw		23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

(1) Transmission Upper Cover
(2) Transmission Case Mounting Screw
(3) Transmission Case Mounting Nut

W1018178
W1018380

(D) Disassembling Clutch Housing



Speed Change Cover

1. Remove the speed change cover (1).

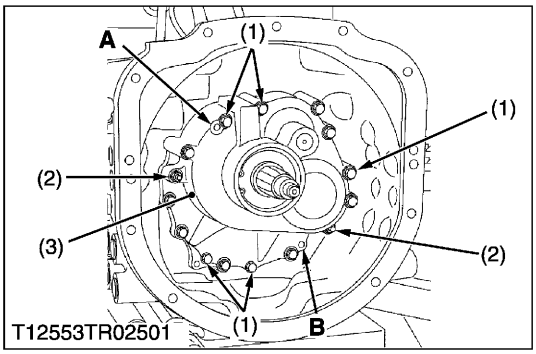
(When reassembling)

- When reassembling the speed change cover (1), set the shifter and fork in neutral position.
- Apply liquid gasket (Three Bond 1216 or equivalent) to seam of speed change cover and clutch housing.

Tightening torque	Speed change cover mounting screw	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

(1) Speed Change Cover

W1018414



Shuttle Case Assembly

1. Remove the screws (1) and nut (2).
2. Remove the shuttle case assembly (3) by screwing M8 × Pitch 1.25 screws into holes **A** and **B**.

(When reassembling)

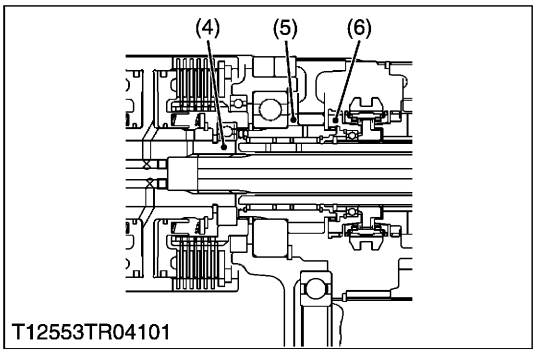
■ **IMPORTANT**

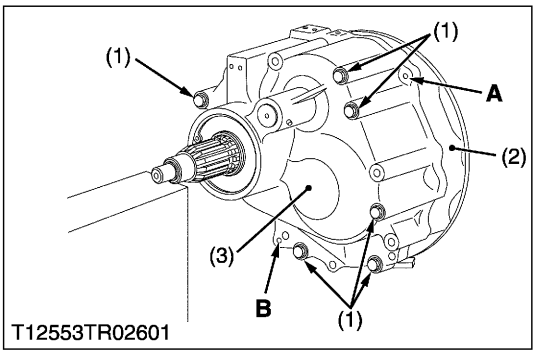
- **When assemble the shuttle case to the clutch housing case, be sure to align the 21T gear (5) to coupling (6) securely by turning the input shaft (4).**

Tightening torque	Shuttle case mounting screw M8 Grade 9	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs
	Shuttle case mounting nut	23.6 to 27.4 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 ft-lbs

(1) Screw
(2) Nut
(3) Shuttle Case Assembly
(4) Input Shaft
(5) **21T** Gear
(6) Coupling

W1018538





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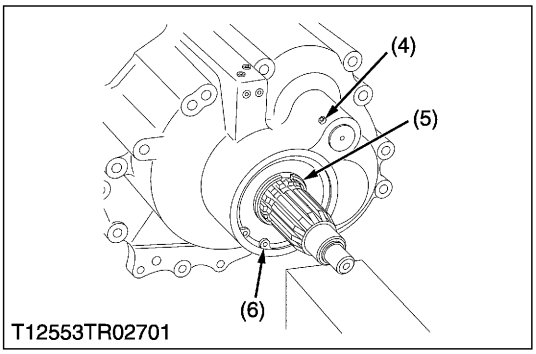

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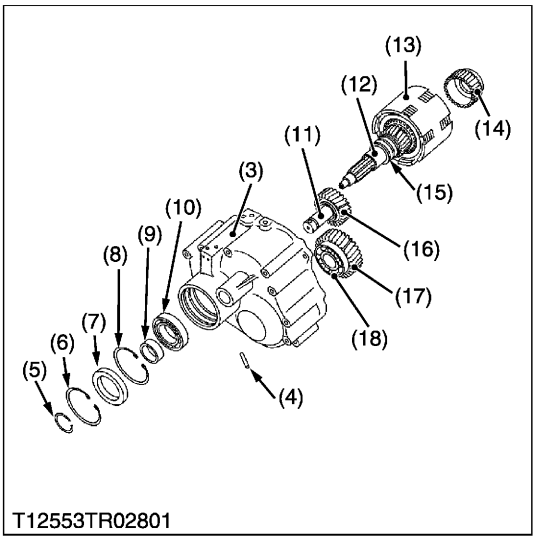

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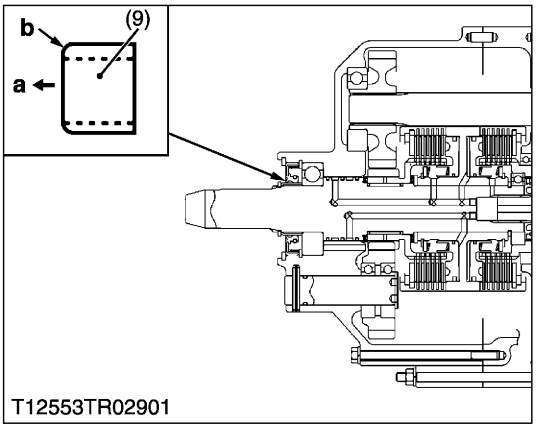


T12553TR02901

Disassembling Shuttle Case Assembly

1. Remove the screw (1).
2. Separating the shuttle case 1 (3) and shuttle case 2 (2) by screwing M8 × Pitch 1.25 screws into holes **A** and **B**.
3. Remove the external snap ring (5) and internal snap ring (6).
4. Remove the oil seal (7) and internal snap ring (8).
5. Tap out the input shaft (12) with shuttle clutch pack (13).
6. Remove the spring pin (4).
7. Tap out the idle shaft (11) with 25T gear (16).
8. Remove the 31T gear (17) with bearing (18).

(When reassembling)

- Apply grease to the sleeve (9).
- Replace the oil seal (7) with a new one.
- Take care of direction of the oil seal (7).
- Apply grease to the oil seal (7) and seal ring (15).
- Apply transmission fluid to the bearing.
- Replace the sleeve (9) with a new one and be sure to install sleeve as shown figure.
- Apply liquid gaskets (Three Bond 1216 or equivalent) to joint face of the shuttle case 1 (3) and shuttle case 2 (2).

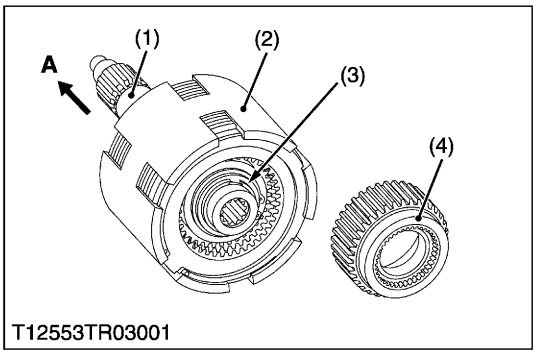
■ **NOTE**

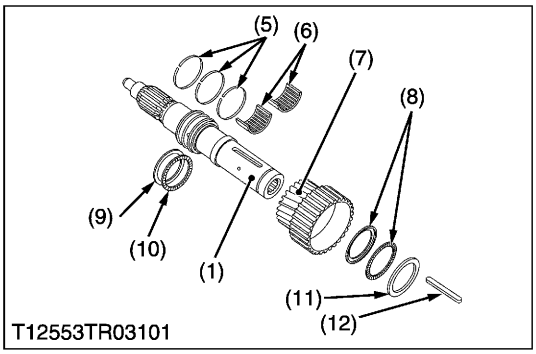
- **Do not get in the seal ring (15) between input shaft (12) and shuttle case 1 (3).**

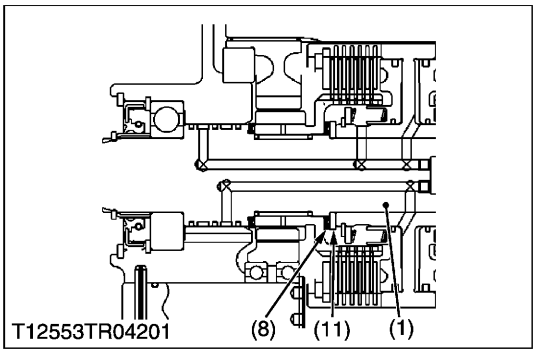
Tightening torque	Shuttle case mounting screw M8 Grade 9	29.4 to 34.3 N·m 3.0 to 3.5 kgf·m 21.7 to 25.3 ft-lbs

(1) Screw
(2) Shuttle Case 2
(3) Shuttle Case 1
(4) Spring Pin
(5) External Snap Ring
(6) Internal Snap Ring
(7) Oil Seal
(8) Internal Snap Ring
(9) Sleeve
(10) Bearing
(11) Idle Shaft
(12) Input Shaft
(13) Shuttle Clutch Pack
(14) Coupling
(15) Seal Ring
(16) 25T Gear
(17) 31T Gear
(18) Bearing
a : Front Side
b : Rounded Edge

W1018710







Shuttle Clutch Assembly

1. Remove the coupling (4) with bearing.
2. Remove the external snap ring (3).
3. Tap out the input shaft (1) to the front side **A**.
4. Remove the key (12) and other part (see figure.).

(When reassembling)

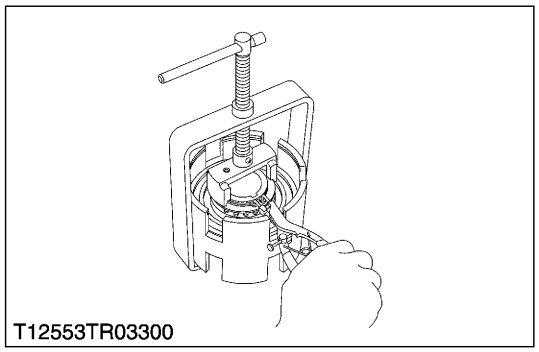
- Apply transmission fluid to the needle bearing (6) and thrust needle bearing (8), (10).
- Do not interchange the thrust collar and thrust needle bearing.
- Do not get in the thrust needle bearing (8) between thrust collar (9) and input shaft (1).

■ **IMPORTANT**

- **Do not interchange the clutch assembly between F and R side. Therefore, put a mark on the clutch disc and plate before disassembling.**

(1) Input Shaft
(2) Shuttle Clutch Pack
(3) External Snap Ring
(4) Coupling
(5) Seal Ring
(6) Needle Bearing
(7) 20T Gear
(8) Thrust Needle Bearing
(9) Thrust Collar
(10) Thrust Needle Bearing
(11) Thrust Collar
(12) Key
A : Front Side

W1019491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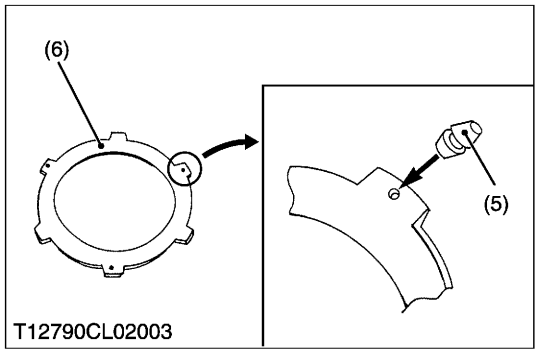

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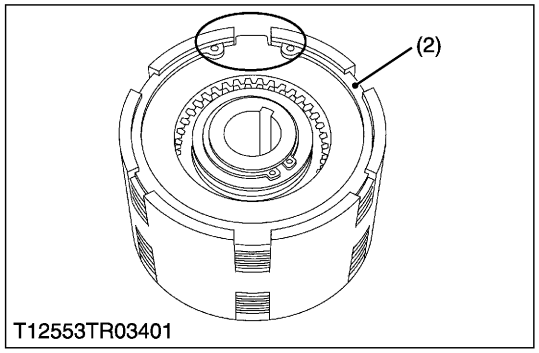

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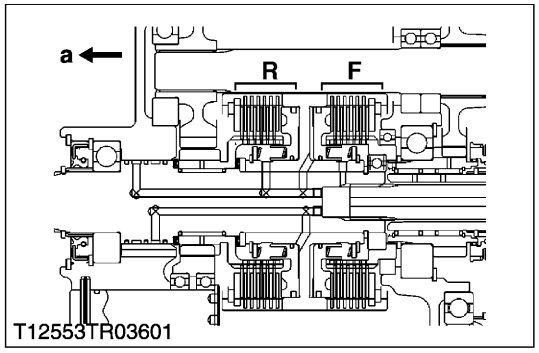

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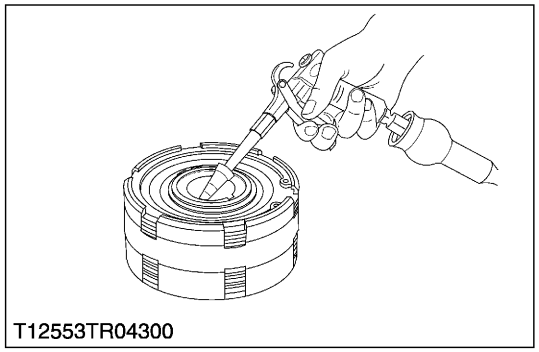
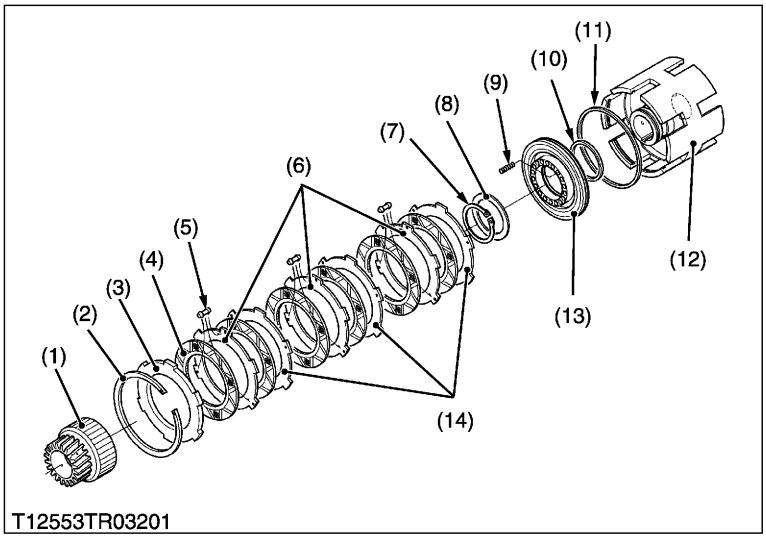

T12553TR04300

Shuttle Clutch Pack

1. Remove the internal snap ring (2), and then take out the pressure plate (3), the clutch discs (4) and steel plates (6) and (14).
2. Remove the external snap ring (7) using a shuttle clutch compression tool (see page HG-5), and take out the springs (9) and piston (13).

(When reassembling)

- When installing the internal snap ring (2) to the clutch body, align its split portion to the notched portion of clutch body.
- Replace the D-ring (11) with new one.
- Apply transmission fluid to the D-ring (11), and take care not to damage it.
- Install 2 pieces of thin steel plate to the piston side.
  If there is the 3 pieces thin steel plate, the 3rd thin steel plate is put in to the internal snap ring (2) side.
- Assemble the steel plates with rubber (6) and steel plates without rubber (14) alternately, and steel plates are built in so that the part of rubber is not corresponding to the part of the hole.
- Confirm the moving of the piston (13) smoothly when pressure air is sent to clutch pack.

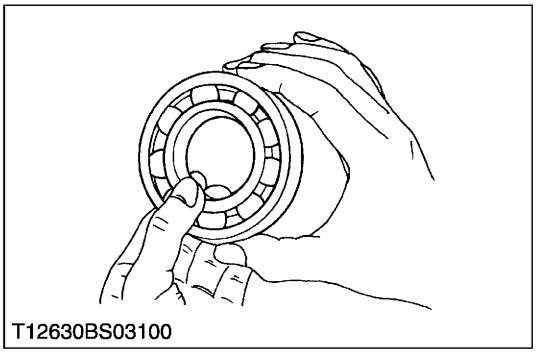


T12553TR03201

(1) Coupling
(2) Internal Snap Ring
(3) Pressure Plate
(4) Clutch Disc
(5) Rubber
(6) Steel Plate (with rubber)
(7) External Snap Ring
(8) Thrust Collar
(9) Spring
(10) O-ring
(11) D-ring
(12) Clutch Body
(13) Piston
(14) Steel Plate (without rubber)
a : Front Side
R : R Side
F : F Side

W1019788

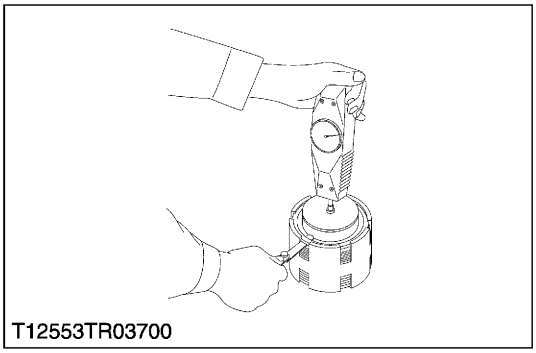
(5) Servicing


T12630BS03100

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.

W1024036


T12553TR03700

Clearance between Internal Snap Ring and Pressure Plate

1. Measure the clearance between internal snap ring and pressure plate with a feeler gauge while applying the specified force. Specified force : 196 to 245 N (20 to 25 kgf, 44.1 to 55.1 lbs).

■ **NOTE**

- **Measure the R side first to decide the value of F side by R side.**

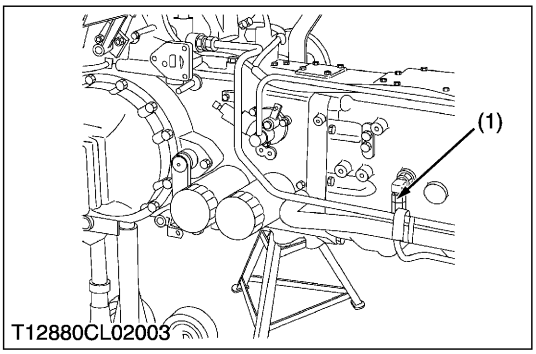
2. Measure the clearance at several points.
3. If the clearance exceeds the allowable limit, check the clutch disc and drive plate, and replace them if necessary.

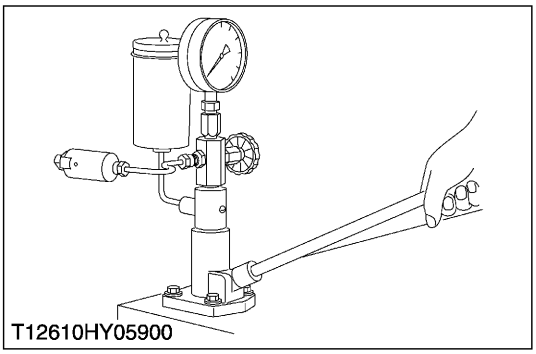
Clearance between internal snap ring and pressure plate	Factory spec.	R side	1.8 to 2.0 mm 0.071 to 0.079 in.
		F side	R side + 0.1 to 0.3 mm 0.004 to 0.012 in.
	Allowable limit		3.6 mm 0.142 in.

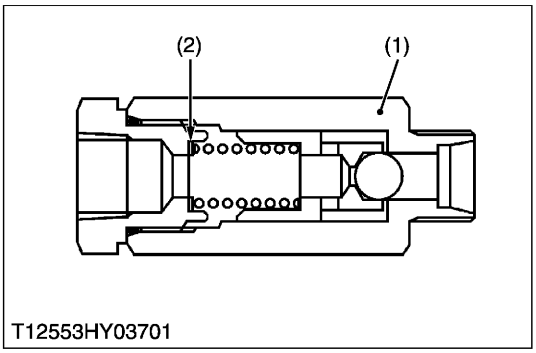
(Reference)

Part Name	Factory spec.
Steel plate	1.55 to 1.65 mm 0.061 to 0.065 in.
	1.75 to 1.85 mm 0.069 to 0.072 in.
pressure plate	3.92 to 4.08 mm 0.154 to 0.161 in.
Clutch disc	2.35 to 2.45 mm 0.093 to 0.096 in.

W1020739







Operating Pressure of Oil Cooler Relief Valve

1. Attach the oil cooler relief valve to a injection nozzle tester with a relief valve adaptor (See page HG-6.).
2. Measure the operating pressure of the oil cooler relief valve (1).
3. If the pressure is not within the factory specifications, adjust relief valve with the adjusting shims (2).
4. After checking the pressure, of the oil cooler relief valve (1).

Oil cooler relief valve operating pressure	Factory spec.	4.4 to 4.9 MPa 45.0 to 50.0 kgf/cm^2 640 to 711 psi

■ **NOTE**

- **Use specified transsmission fluid (see page G-9) to test the operating pressure of the oil cooler relief valve (1).**

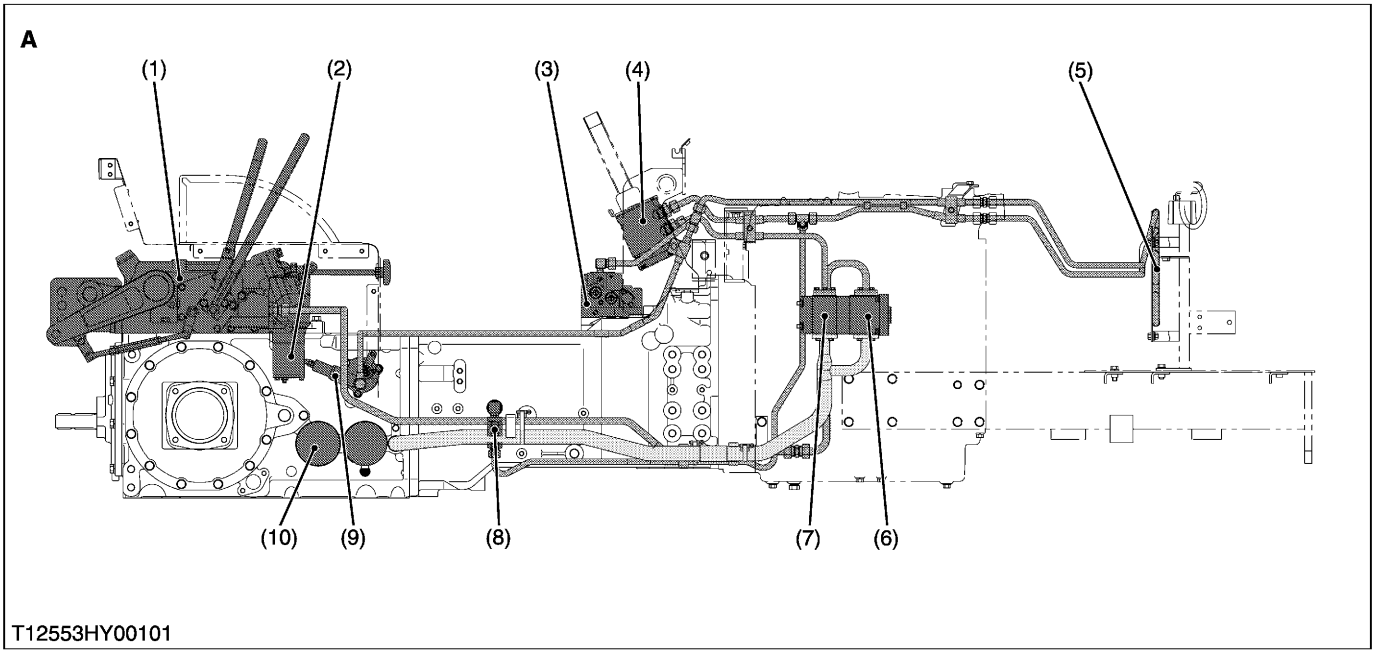
(1) Oil Cooler Relief Valve (2) Shim

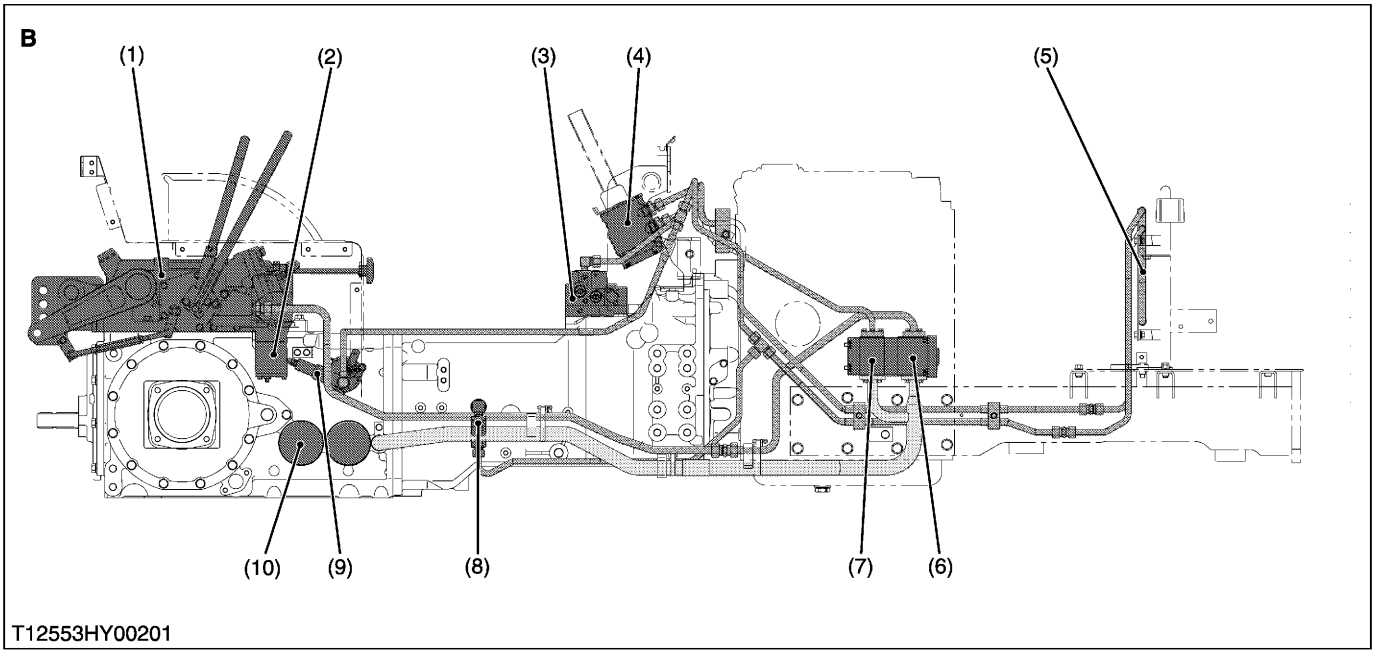
W1031580

8. HYDRAULIC SYSTEM

[1] MECHANISM

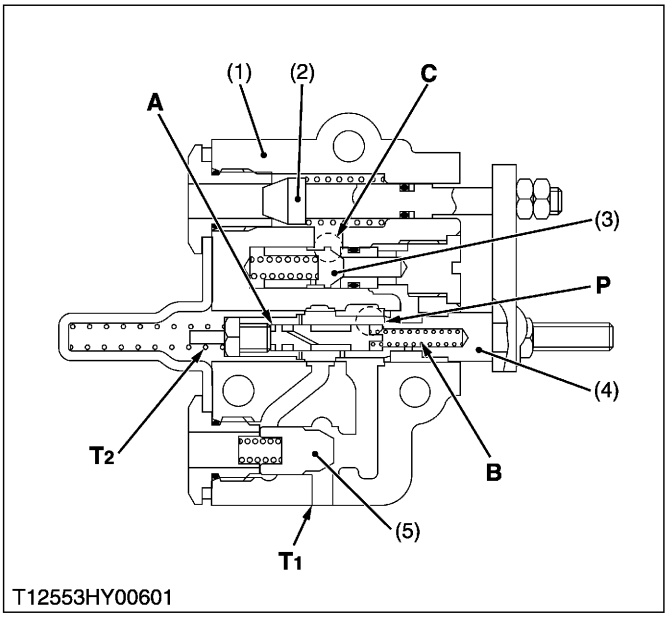
(1) Structure





(1) Hydraulic Cylinder Body
(2) Auxiliary Control Valve
(3) Shuttle Valve (Forward, Reverse)
(4) Power Steering Controller
(5) Oil Cooler
(6) Hydraulic Pump for Three point Hydraulic System
(7) Hydraulic Pump for Power Steering and Shuttle Valve
(8) Oil Cooler Relief Valve
(9) PTO Control Valve
(10) Oil Filter Cartridge
A : M5700HD
B : M6800HD

(2) Position Control Valve



T12553HY00601

The control valve is constructed as shown in the figure. When the control lever is operated, the valve spool (4) moves to control the direction of oil flow to the hydraulic cylinder or the transmission case.

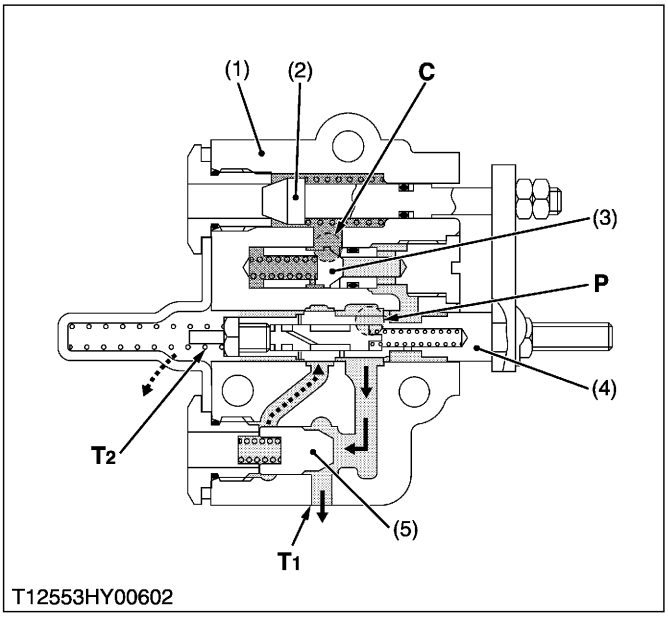
As illustrated left, a bypass valve (6) is provided inside the spool (4) to absorb shocks when the implement goes up.

The pump-side pressure is led to chamber **A** inside the spool (4) and the hydraulic cylinder side pressure to chamber **B**.

(1) Valve Body
(2) Poppet valve
(3) Check valve
(4) Spool
(5) Unload Valve
(6) Bypass Valve

A : Chamber A
B : Chamber B
C : C (Cylinder) Port
P : P (Pump) Port
T1, T2 : T1, T2 Port
(To Transmission Case)

W1013419



T12553HY00602

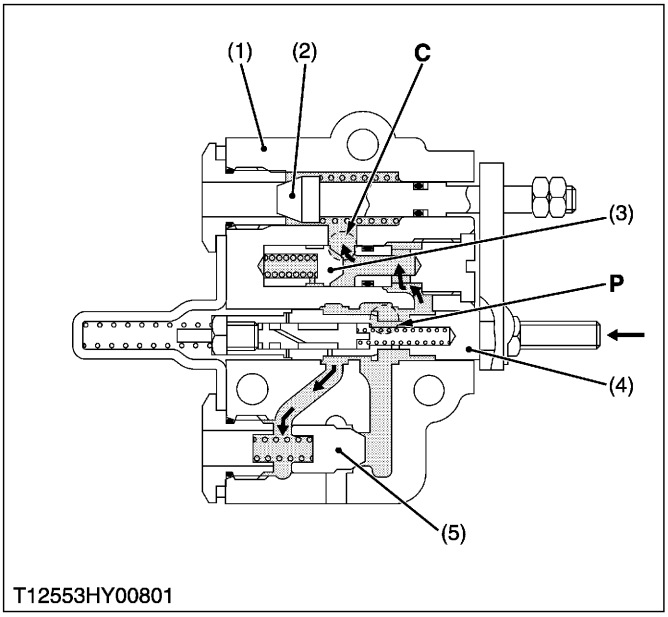
■ Neutral

1. Oil forced into the control valve through the **P** port pushes open the unload valve (5) and then returns to the transmission case through the **T1** port.
2. Oil behind the unload valve (5) returns to the transmission case through the spool (4) and the **T2** port.
3. Since the check valve (3) and poppet valve (2) are closed, oil in the hydraulic cylinder does not flow to the transmission case. Thus, the implement remains at its fixed position.

(1) Valve Body
(2) Poppet valve
(3) Check valve
(4) Spool
(5) Unload Valve

C : C (Cylinder) Port
P : P (Pump) Port
T_1, T_2 : T_1, T_2 Port
(To Transmission Case)

W1013549



T12553HY00801

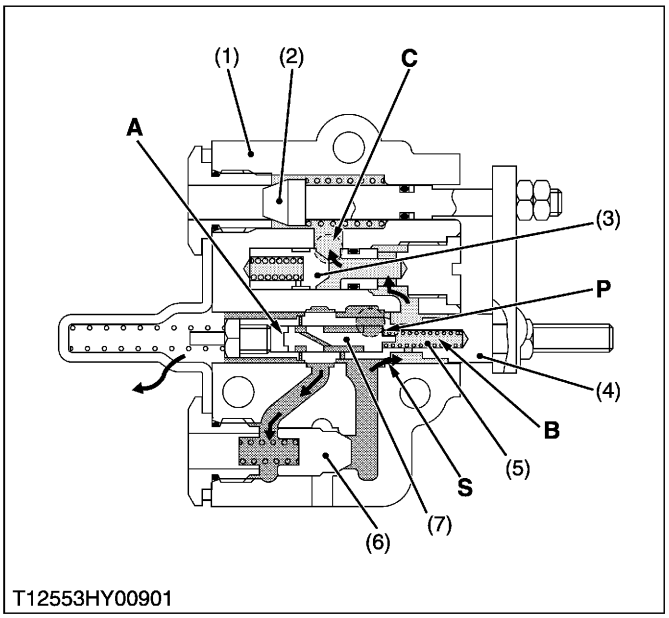
■ Lift

1. When the control lever is moved to the **LIFT** position, the spool (4) is pulled to the left.
2. The oil forced into the control valve through the **P** port is directed to the back of the unload valve (5) to close it.
3. The oil pushed open the check valve (3), and flows into the hydraulic cylinder through the **C** port to lift the implement.

(1) Valve Body
(2) Poppet valve
(3) Check valve
(4) Spool
(5) Unload Valve

C : C (Cylinder) Port
P : P (Pump) Port

W1013775



T12553HY00901

■ Bypass Valve Operation

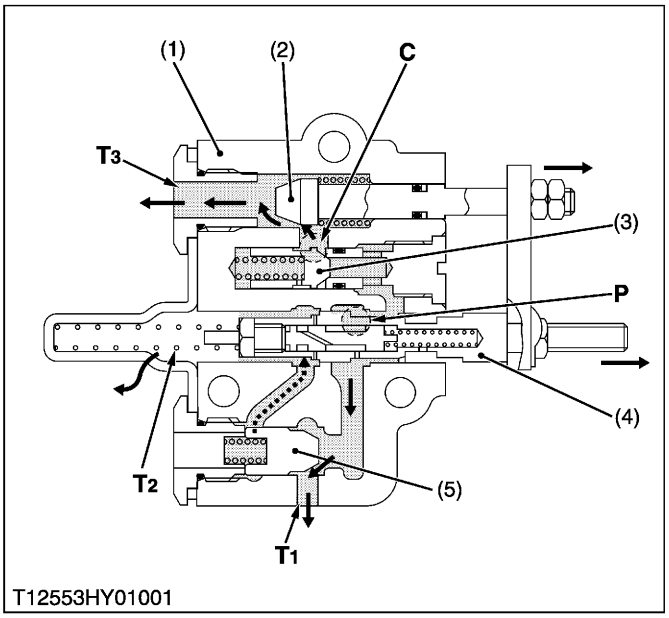
This control valve has a bypass valve (7) inside the spool (4) to prevent the tractor from getting a shock when the implement begins to going up or stop going up.

1. When the implement begins to going up or stop going up, the spool (4) is locked at the position slightly slided from the neutral position. Then, the pressure difference is generated between both ends of the slit **S** of the spool.
2. The **P** port side pressure is led to the chamber **A** through the passage of bypass valve (7), while the **C** port side pressure is led to the chamber **B**.
3. When the pressure difference at the left and right sides of the bypass valve (7) overcomes the force of spring (5), the bypass valve (7) is moved to the right to release part of oil pressure-fed from pump to the transmission case through the passages of bypass valve (7) and spool (4).
4. As the amount of oil pressure-fed to the hydraulic cylinder is reduced, the implement goes up slowly preventing the tractor from getting a shock.

(1) Valve Body
(2) Poppet valve
(3) Check valve
(4) Spool
(5) Unload Valve
(6) Bypass Valve

A : Chamber A
B : Chamber B
C : C (Cylinder) Port
P : P (Pump) Port
S : Slit

W1013962



T12553HY01001

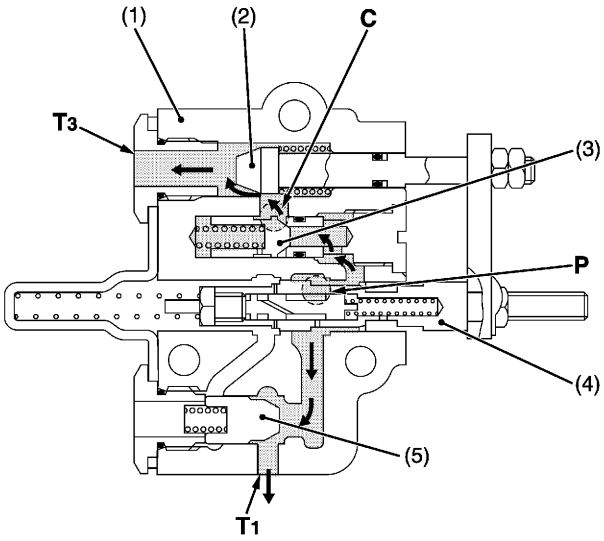
■ Down

1. When the control lever is moved to the **DOWN** position, the spool (4) is pushed out to the right, and the poppet valve (2) is also pulled out.
2. Oil in the hydraulic cylinder is forced out to the transmission case through the **T3** port by the weight of the implement, causing the implement to lower.
3. Oil forced into the control valve through the **P** port pushes to open the unload valve (5) as in neutral and returns to the transmission case through the **T1** port.

(1) Valve Body
(2) Poppet valve
(3) Check valve
(4) Spool
(5) Unload Valve

C : C (Cylinder) Port
P : P (Pump) Port
T_1, T_2, T_3 : T_1, T_2, T_3 Port
(To Transmission Case)

W1014133



T12553HY01002

■ Floating

When the position control lever is moved to its lowest position, the spool (4) is maintained at the **DOWN** position. When the implement is at its lowest position, the hydraulic cylinder is in no-load condition, and oil forced out by the hydraulic pump pushes to open both the unload valve (5) and check valve (3). Thus, oil flows freely in the position control valve.

(1) Valve Body
(2) Poppet valve
(3) Check valve
(4) Spool
(5) Unload Valve

C : C (Cylinder) Port
P : P (Pump) Port
T_1, T_3 : T_1, T_3 Port
(To Transmission Case)

W1014288

[2] SERVICING

(1) Servicing Specification

Item		Factory Specification	Allowable Limit
Plate to spool joint	Distance	62.0 to 63.0 mm 244 to 248 in.	–

W1014295

(2) Tightening Torques

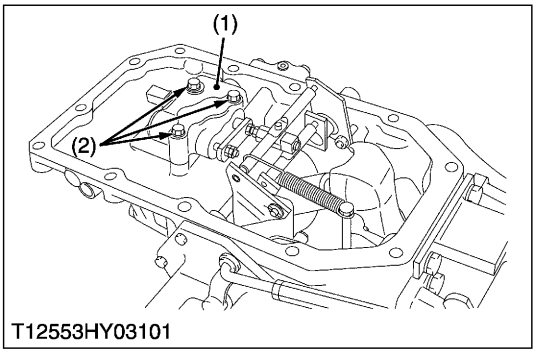
Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts : See page G-10.)

Item	N·m	kgf·m	ft-lbs
Control valve mounting screw	9.6 to 23.5	2.0 to 2.4	14.5 to 17.4
Lock nut	17.7 to 21.6	1.8 to 2.2	13.0 to 15.9
Plug	68.6 to 88.2	7.0 to 9.0	50.6 to 65.1
Seat plug	49.0 to 58.8	5.0 to 6.0	36.2 to 43.4

W1010651

(3) Disassembling and Assembling

(A) Position Control Valve



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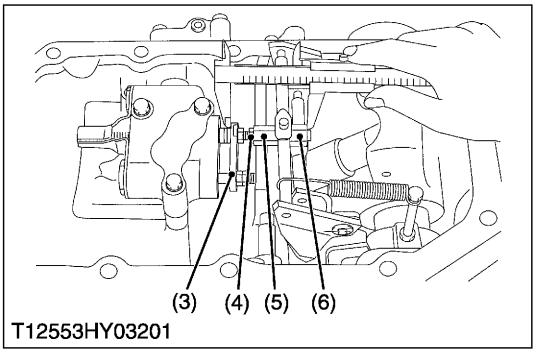

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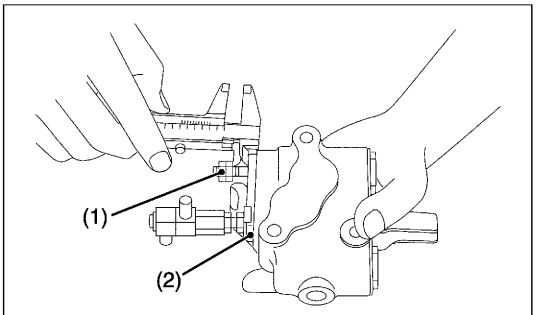


T12553HY03301

Removing Control Valve

1. Remove the return pipe.
2. Remove the control valve mounting screws (2).
3. Remove the control valve (1).

■ **NOTE**

- **Do not loosen adjusting section at the end of the spool unless necessary.**

(When reassembling)

- If the spool joint (6) is removed, be sure to adjust its position according to the following procedure.

Tightening torque	Control valve mounting screw	19.6 to 23.5 N·m 2.0 to 2.4 kgf·m 14.5 to 17.4 ft-lbs

■ **Adjusting Spool Joint**

1. Measure the distance between plate (3) and spool joint (6).
2. If the measurement is not within the factory specifications, loosen the lock nut (4) and adjust by the turnbuckle (5).

Distance between plate and spool joint	Factory spec.	62.0 to 63.0 mm 2.44 to 2.48 in.

(1) Control Valve
(2) Control Valve Mounting Screw
(3) Plate
(4) Lock Nut
(5) Turnbuckle
(6) Spool Joint

W1011738

Recording Distance between Plate Lock Nut

■ **NOTE**

- **Before disassembling spool, be sure to record the lock nut position.**

1. Press the plate (2) on to the valve body, and measure the distance between the plate (2) and lock nut (1) for poppet valve.

(When reassembling)

- After assembling the control valve, be sure to check the function of it by air-blowing.
  If neutral, lift and down circuit can not be obtained properly, adjust the position of lock nut following the instructions given below.
  If the function is proper, stake the lock nut with a punch.

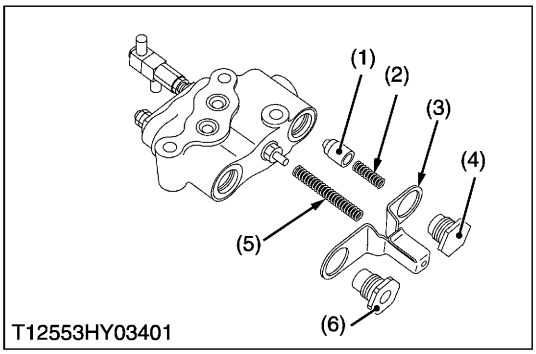
■ **Adjusting Lock Nut**

1. Turn the adjusting nuts all the way in, apply compressed air to the pump port while covering the cylinder port.
2. Move the adjusting nuts slowly out until you hear a loud hiss of air (unload valve opens).
3. Turn the nuts another 1/4 turn and lock.

Tightening torque	Lock nut	17.7 to 21.6 N·m 1.8 to 2.2 kgf·m 13.0 to 15.9 ft-lbs

(1) Lock Nut
(2) Plate

W1012259



Plug and Unload Valve

1. Secure the control valve with a vise.
2. Remove the seat plug (6) for poppet valve.
3. Remove the plug (4) for unload valve (1).
4. Remove the plate (3) and return spring (5).
5. Draw out the spring (2) and unload valve (1).

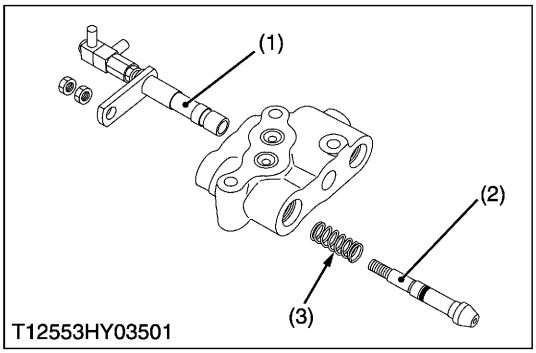
(When reassembling)

- Install the plug, nothing O-ring.

Tightening torque	Plug	68.6 to 88.2 N·m 7.0 to 9.0 kgf·m 50.6 to 65.1 ft-lbs

(1) Unload Valve
(2) Spring
(3) Plate
(4) Plug
(5) Return Spring
(6) Plug

W1012472



Spool and Poppet Valve

1. Remove the lock nut for poppet valve (2).
2. Draw out the spool (1).
3. Push the poppet valve toward the seat plug to remove.

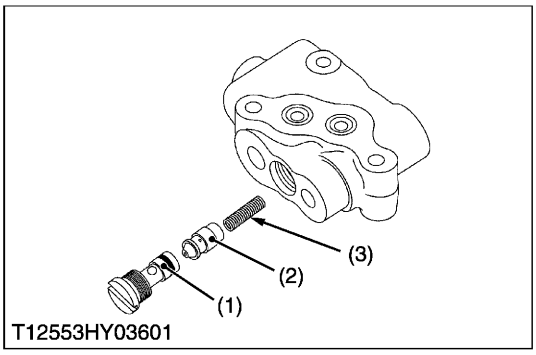
(When reassembling)

- Install the poppet valve, noting O-ring and backup ring.
- Install the lock nut so that the distance between the plate and lock nut is same as the recorded valve before disassembling the spool.

Tightening torque	Lock nut	17.7 to 21.6 N·m 1.8 to 2.2 kgf·m 13.0 to 15.9 ft-lbs

(1) Spool
(2) Poppet Valve
(3) Spring

W1012844



Check Valve

1. Remove the seat plug (1).
2. Draw out the check valve (2) and spring (3).

(When reassembling)

- Install the seat, noting O-ring.
- After tightening the seat plug, stake it with a punch.

Tightening torque	Seat plug	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to43.4 ft-lbs

(1) Seat Plug
(2) Check Valve
(3) Spring

W1013067

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