

WSM

WORKSHOP MANUAL
TRACTOR

M8560, M9960

Kubota

TO THE READER

This Workshop Manual tells the servicing personnel about the mechanism, servicing and maintenance of the M8560 and M9960. It contains 4 parts: **"Information"**, **"General"**, **"Mechanism"** and **"Servicing"**.

■ Information

This section primarily contains information below.

- Safety First
- Safety Decal
- Specification
- Dimension

■ General

This section primarily contains information below.

- Engine Identification
- Model Identification
- General Precautions
- Maintenance Check List
- Check and Maintenance
- Special Tools

■ Mechanism

This section contains information on the structure and the function of the unit. Before you continue with the subsequent sections, make sure that you read this section.

Refer to the latest version of Workshop Manual (Code No. 9Y021-01870 / 9Y021-18200) for the diesel engine / tractor mechanism that this workshop manual does not include.

■ Servicing

This section primarily contains information below.

- Troubleshooting
- Servicing Specifications
- Tightening Torques
- Checking, Disassembling and Servicing

Regarding the servicing of Common Rail System (CRS), refer to "DIAGNOSIS MANUAL" (9Y111-01920).

Regarding the servicing of Diesel Particulate Filter (DPF), refer to "DIESEL PARTICULATE FILTER HANDLING MANUAL" (9Y111-08130).

All illustrations, photographs and specifications contained in this manual are of the newest information available at the time of publication.

KUBOTA reserves the right to change all information at any time without notice.

Since this manual includes many models, information or illustrations and photographs can show more than one model.

I INFORMATION

INFORMATION

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1. SAFETY FIRST

SAFETY FIRST

- This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels 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.

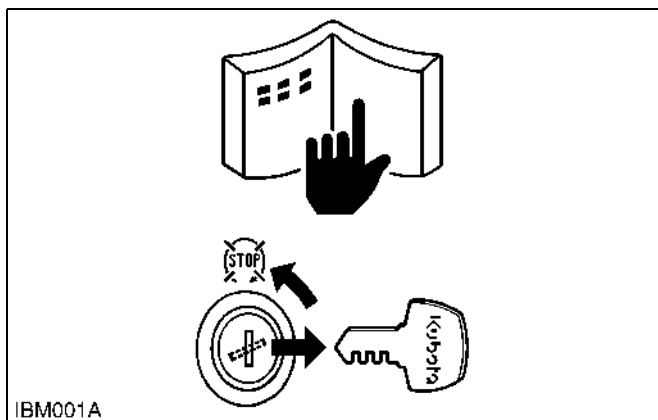
■ IMPORTANT

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

■ NOTE

- Gives helpful information.

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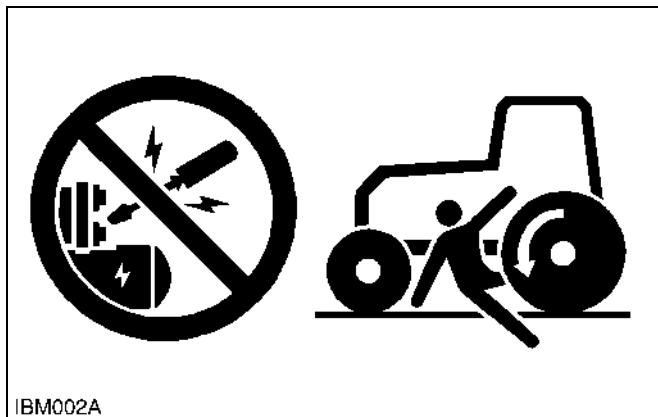


IBM001A

BEFORE YOU START SERVICE

- Read all instructions and safety instructions in this manual and on your machine safety decals.
- Clean the work area and machine.
- Park the machine on a stable and level ground, and set the parking brake.
- Lower the implement to the ground.
- Stop the engine, then remove the key.
- Disconnect the battery negative cable.
- Hang a **"DO NOT OPERATE"** tag in the operator station.

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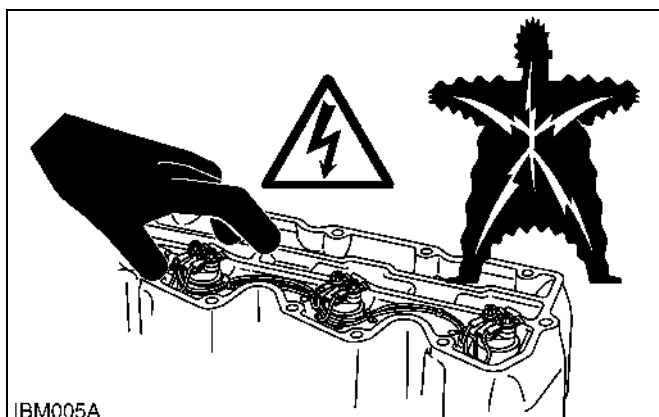
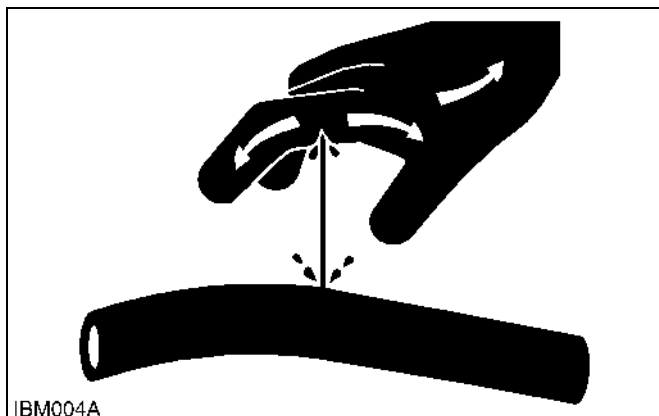
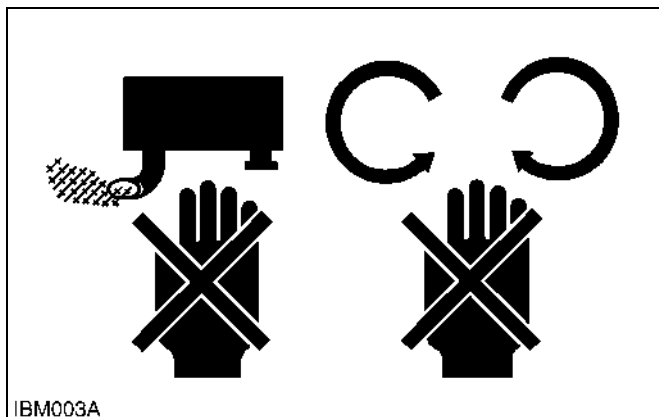


IBM002A

START SAFELY

- Do not do the procedures below when you start the engine.
 - short across starter terminals
 - bypass the safety start switch
- Do not alter or remove any part of machine safety system.
- Before you start the engine, make sure that all shift levers are in neutral positions or in disengaged positions.
- Do not start the engine when you stay on the ground. Start the engine only from operator's seat.

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OPERATE SAFELY

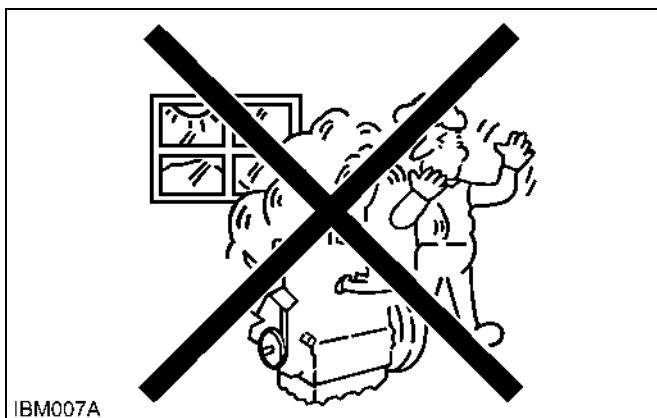
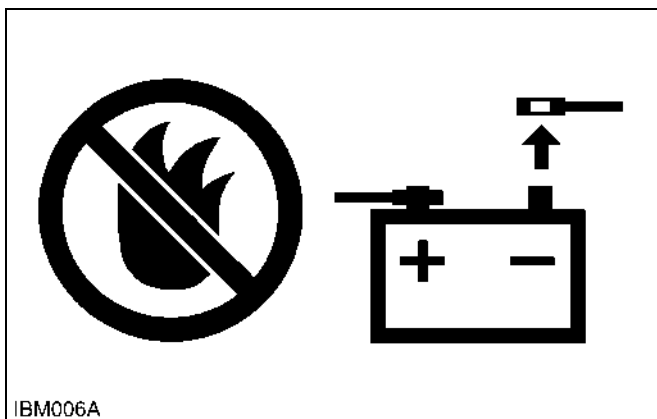
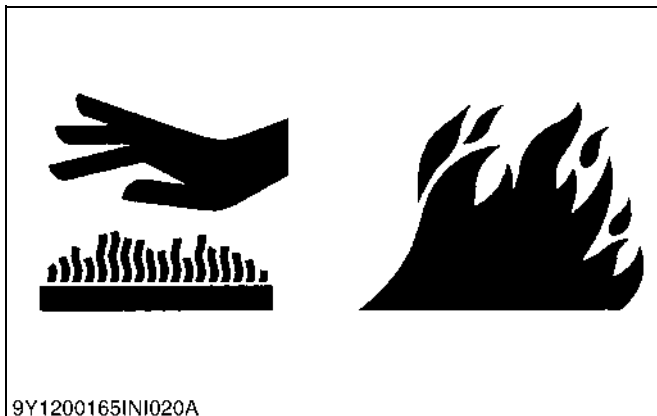
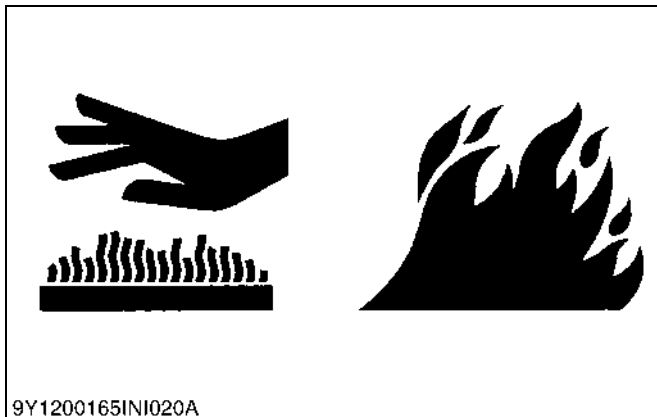
- Do not use the machine after you consume alcohol or medication or when you are tired.
- Put on applicable clothing and safety equipment.
- Use applicable tools only. Do not use alternative tools or parts.
- When 2 or more persons do servicing, make sure that you do it safely.
- Do not operate below the machine that only a jack holds. Always use a safety stand to hold the machine.
- Do not touch the hot parts or parts that turn when the engine operates.
- Do not remove the radiator cap when the engine operates, or immediately after it stops. If not, hot water can spout out from the radiator. Only remove the radiator cap when it is at a sufficiently low temperature to touch with bare hands. Slowly loosen the cap to release the pressure before you remove it fully.
- Released fluid (fuel or hydraulic oil) under pressure can cause damage to the skin and cause serious injury. Release the pressure before you disconnect hydraulic or fuel lines. Tighten all connections before you apply the pressure.
- Do not open a fuel system under high pressure. The fluid under high pressure that stays in fuel lines can cause serious injury. Do not disconnect or repair the fuel lines, sensors, or any other components between the fuel pump and injectors on engines with a common rail fuel system under high pressure.
- Put on an applicable ear protective device (earmuffs or earplugs) to prevent injury against loud noises.
- Be careful about electric shock. The engine generates a high voltage of more than DC100 V in the ECU and is applied to the injector.

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PROTECT AGAINST HIGH PRESSURE SPRAY

- Spray from high pressure nozzles can penetrate the skin and cause serious injury. Keep spray from contacting hands or body.
- If an accident occurs, see a doctor immediately. Any high pressure spray injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source.

9Y1210651INI0014US0



AVOID HOT EXHAUST

- Servicing machine or attachments with engine running can result in serious personal injury. Avoid exposure and skin contact with hot exhaust gases and components.
- Exhaust parts and streams become very hot during operation. Exhaust gases and components reach temperatures hot enough to burn people, ignite, or melt common materials.

9Y1210651INI0015US0

EXHAUST FILTER CLEANING

- Servicing machine or attachments during exhaust filter cleaning can result in serious personal injury. Avoid exposure and skin contact with hot exhaust gases and components.
- During auto or manual/stationary exhaust filter cleaning operations, the engine will run at elevated idle and hot temperatures for an extended period of time. Exhaust gases and exhaust filter components reach temperatures hot enough to burn people, or ignite, or melt common materials.

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PREVENT A FIRE

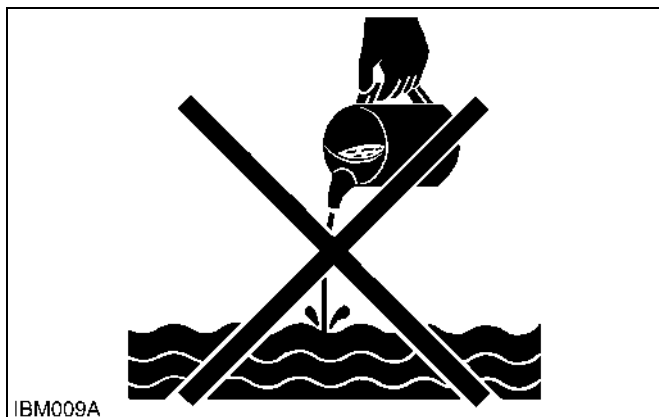
- Fuel is very flammable and explosive under some conditions. Do not smoke or let flames or sparks in your work area.
- To prevent sparks from an accidental short circuit, always disconnect the battery negative cable first and connect it last.
- The battery gas can cause an explosion. Keep the sparks and open flame away from the top of battery, especially when you charge the battery.
- Make sure that you do not spill fuel on the engine.

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KEEP A GOOD AIRFLOW IN THE WORK AREA

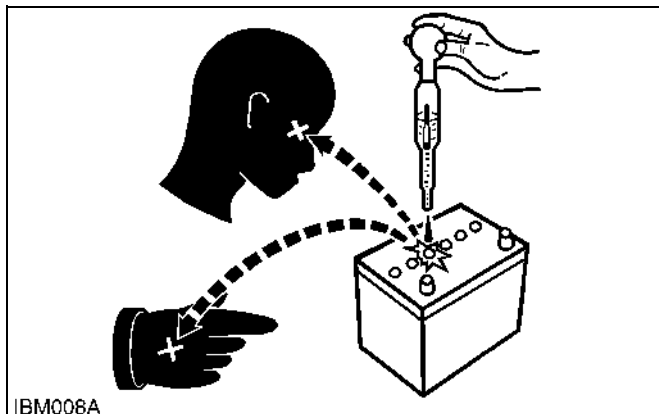
- If the engine is in operation, make sure that the area has good airflow. Do not operate the engine in a closed area. The exhaust gas contains poisonous carbon monoxide.

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**DISCARD FLUIDS CORRECTLY**

- Do not discard fluids on the ground, down the drain, into a stream, pond, or lake. Obey related environmental protection regulations when you discard oil, fuel, coolant, electrolyte and other dangerous waste.

WSM000001INI0007US1

**PREVENT ACID BURNS**

- Keep electrolyte away from your eyes, hands and clothing. Sulfuric acid in battery electrolyte is poisonous and it can burn your skin and clothing and cause blindness. If you spill electrolyte on yourself, clean yourself with water, and get medical aid immediately.

WSM000001INI0008US1

**PREPARE FOR EMERGENCIES**

- Keep a first aid kit and fire extinguisher ready at all times.
- Keep the emergency contact telephone numbers near your telephone at all times.

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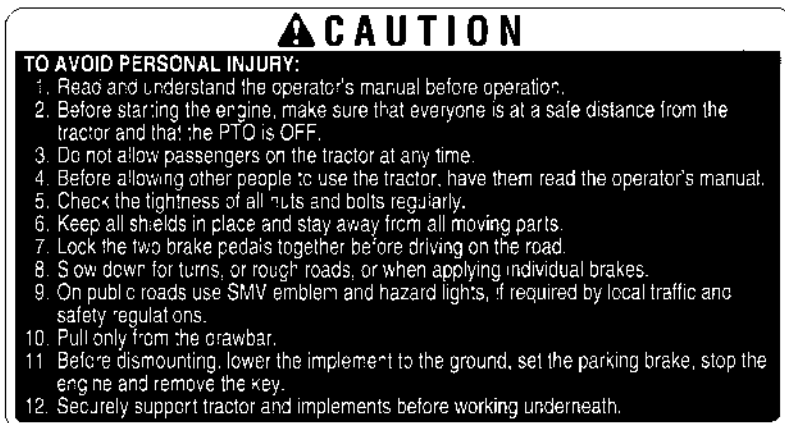
2. SAFETY DECALS

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.

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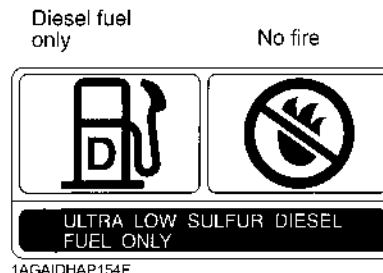
ROPS Model

(1) Part No. 6C040-4742-2



1AGAIAZAP109A

(4) Part No. TC420-4956-1

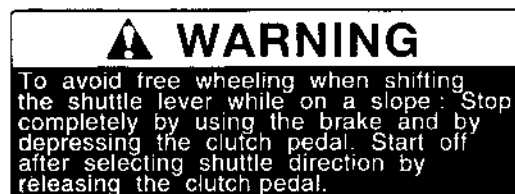


(2) Part No. 3A111-9848-2

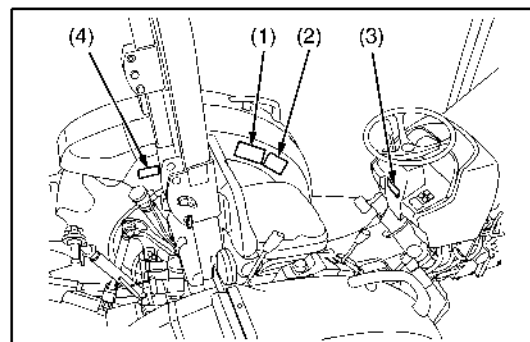


1AGAIDCAP066E

(3) Part No. 3F240-9857-1



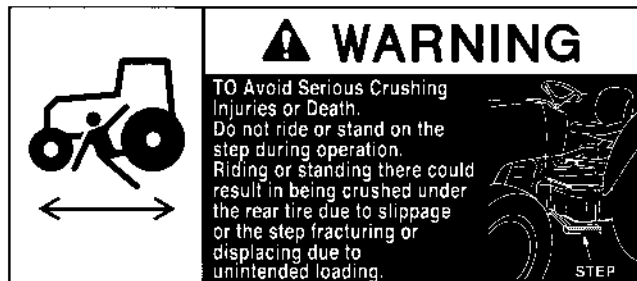
1AGAIBDAP039A



9Y1210686ICI001US

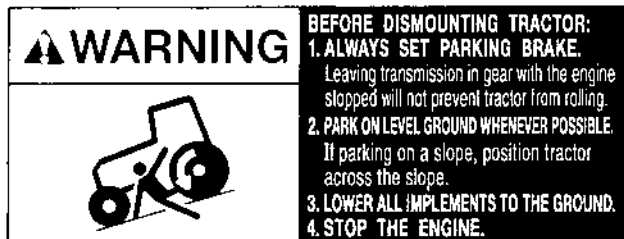
9Y1210686INI0001US0

(1) Part No. 3A111-9801-1



1AGAIDHAP009A

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

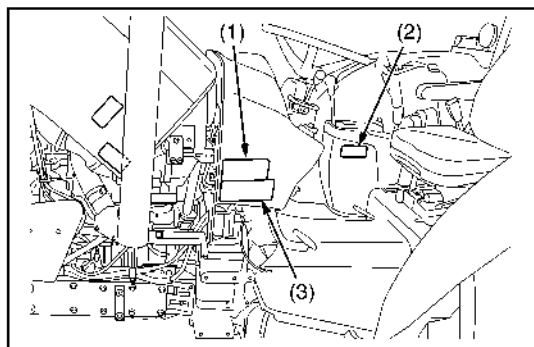


1AGAIBDAP040E

(3) Part No. TA040-4965-2



1AGIAZAPD09A



9Y1210686ICI002US

9Y1210686INI0002US0

(1) 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.

1AGAIAZAP076A

(2) Part No. 3P305-9856-1

⚠ CAUTION

TO AVOID INJURY FROM SEPARATION:

DO NOT EXTEND LIFT ROD BEYOND THE GROOVE ON THE THREADED ROD.

GROOVE
LH

GROOVE
RH

1AGAICVAP046E

(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-driver implements, set drawbar at towing position. (see operator's manual)

1AGAIAZAP116A

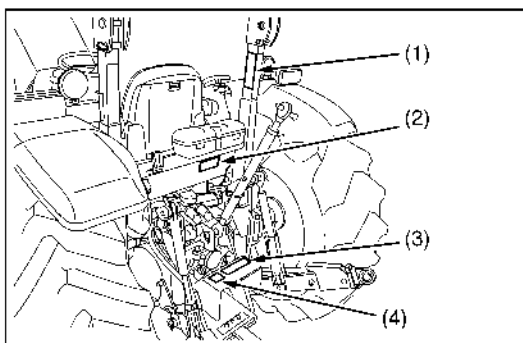
(4) Part No. TA040-4935-1

⚠ 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.

1AGAIAZAP056A



9Y1210686ICI003US

9Y1210686INI0003US0

- (1) Part No. 6C090-4958-2
Do not get your hands close to engine fan and fan belt.



1AGAIAZAP110A

- (4) Part No. 3Y205-9892-1

! DANGER/POISON

SHIELD EYES.
 EXPLOSIVE
 GASES CAN
 CAUSE BLINDNESS
 OR INJURY.

NO
 *SPARKS
 *FLAMES
 *SMOKING
 CAN CAUSE
 BLINDNESS OR
 SEVERE BURNS.

SULFURIC ACID
 CAN CAUSE
 BLINDNESS OR
 SEVERE BURNS.

**KEEP OUT OF REACH OF CHILDREN.
DO NOT TIP. DO NOT OPEN BATTERY.**

**FLUSH EYES
IMMEDIATELY
WITH WATER.**

**GET
MEDICAL
HELP FAST.**

PROPOSITION 65 WARNING
 BATTERY PCSTS, TERMINALS,
 AND RELATED ACCESSORIES
 CONTAIN LEAD AND LEAD COMPOUNDS,
 CHEMICALS KNOWN
 TO THE STATE OF CALIFORNIA
 TO CAUSE CANCER AND
 REPRODUCTIVE HARM.
 WASH HANDS AFTER HANDLING.

105E41R 12V

AMP. HR (5HR)	80
AMP. HR (20HR)	100
RESERVE CAPACITY(MIN)	160
BCI CCA	900
EN CCA	800

S.O.C.
INDICATOR

ON

OFF

DO NOT REPAIR
BATTERY BATTERY

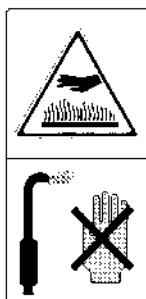
RECYCLE

Pb

DK 89330

1AGAIJHAP083A

- (2) Part No. 32310-4958-1
Do not touch hot surface
like muffler, etc.



1AGAIAZAP071A

- (3) Part No. K3512-4719-1
Do not touch hot surface
like muffler, etc.



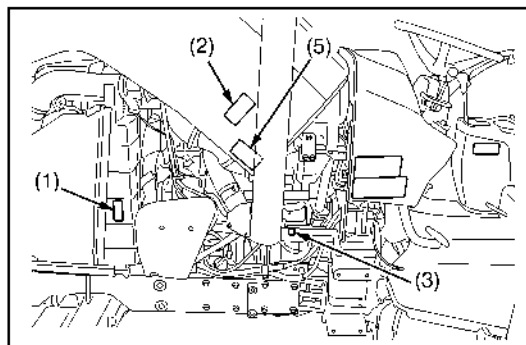
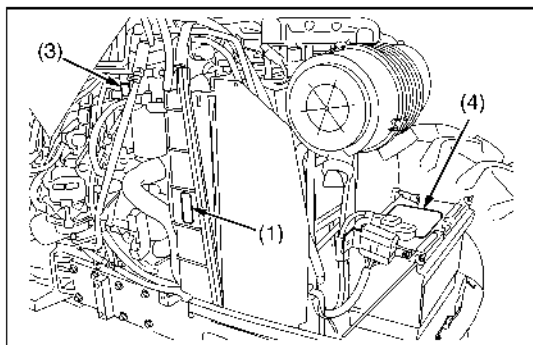
1BDABANAP080A

- (5) Part No. 3C151-9861-1

! CAUTION

TO AVOID PERSONAL INJURY:
 When the Diesel Particulate Filter (DPF) is in the regenerating mode, the exhaust gas and the DPF muffler become hot. During regeneration, take into account that the muffler will be very hot and keep the machine away from other people, animals, plants, and flammable material. Also keep the area near the DPF muffler clean and away from flammable material.

1AGAIJHAP084A



9Y1210686IC1004US

9Y1210686INI0004US0

ROPS (Low Profile) Model

- (1) Part No. 6C090-4958-2
Do not get your hands close to engine fan and fan belt.



1AGAIAZAP110A

- (2) Part No. K3512-4719-1
Do not touch hot surface like muffler, etc.



1BDABANAP080A

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



- (4) Part No. TA040-4965-2



1AGAIAZAP009A

⚠ 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.

- (5) Part No. 3A111-9801-1



1AGAIDHAP009A

⚠ WARNING

TO Avoid Serious Crushing Injuries or Death. Do not ride or stand on the step during operation. Riding or standing there could result in being crushed under the rear tire due to slippage or the step fracturing or displacing due to unintended loading.



- (6) Part No. 3F240-9857-1

⚠ WARNING

To avoid free wheeling when shifting the shuttle lever while on a slope: Stop completely by using the brake and by depressing the clutch pedal. Start off after selecting shuttle direction by releasing the clutch pedal.

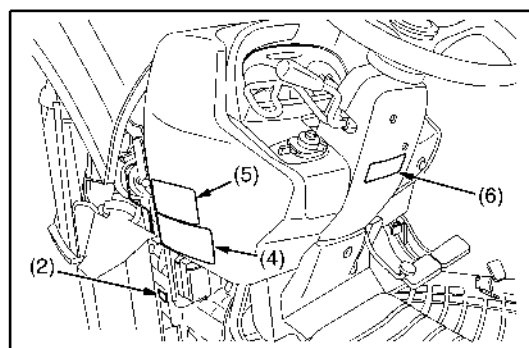
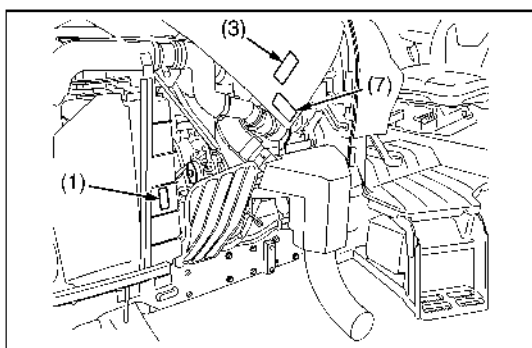
1AGAIBDAP039A

- (7) Part No. 3C151-9861-1

⚠ CAUTION**TO AVOID PERSONAL INJURY:**

When the Diesel Particulate Filter (DPF) is in the regenerating mode, the exhaust gas and the DPF muffler become hot. During regeneration, take into account that the muffler will be very hot and keep the machine away from other people, animals, plants, and flammable material. Also keep the area near the DPF muffler clean and away from flammable material.

1AGAUIHAP004A



9Y1210686ICI010US

9Y1210686INI0010US0

(1) Part No. 6C040-4742-2

⚠ CAUTION**TO AVOID PERSONAL INJURY:**

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

1AGAIAZAP108A

(2) Part No. 3A293-9848-1

	⚠ WARNING TO AVOID INJURY OR DEATH FROM ROLL-OVER: • Keep Roll-Over Protective Structures (ROPS) in the extended and locked position. • Fasten SEAT BELT before operating.
	THERE IS NO OPERATOR PROTECTION WHEN THE ROPS IS IN THE RETRACTED POSITION. • Check the operating area and retract the ROPS only when absolutely necessary. • Do not wear SEAT BELT if ROPS is retracted. • Extend and lock ROPS as soon as vertical clearance allows. • Read ROPS related instructions and warnings.

1AGAOAPAP004A

(3) Part No. TC420-4956-1

Diesel fuel
only

No fire

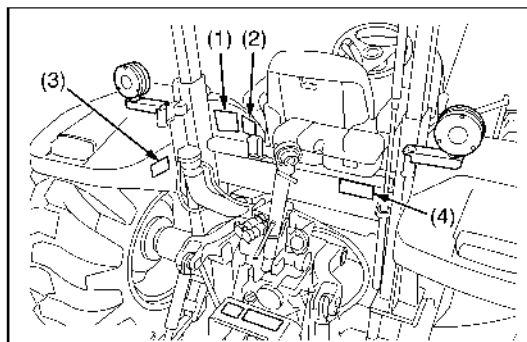


1AGAIIDHAP154E

(4) Part No. 3P305-9856-1

⚠ CAUTION	
TO AVOID INJURY FROM SEPARATION:	
DO NOT EXTEND LIFT ROD BEYOND THE GROOVE ON THE THREADED ROD.	

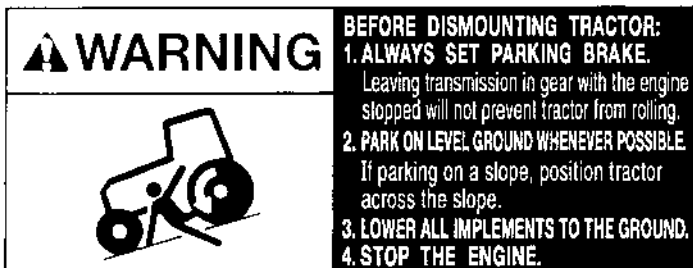
1AGAIICVAP048E



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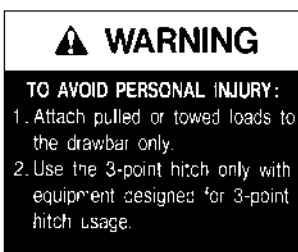
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(1) Part No. 6C150-4743-1



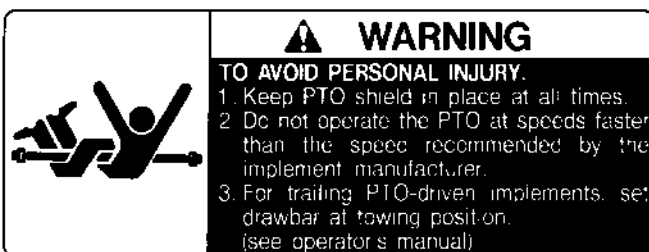
1AGAIBDAP040E

(2) Part No. TA040-4935-1



1AGAIAP056A

(3) Part No. TA040-4959-3

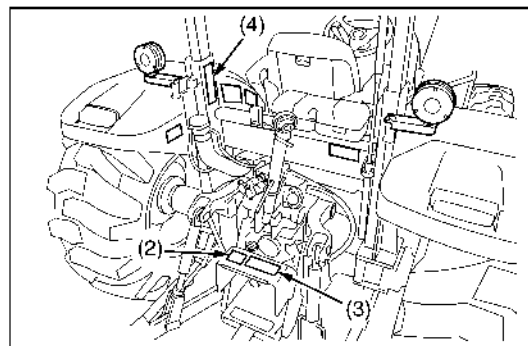
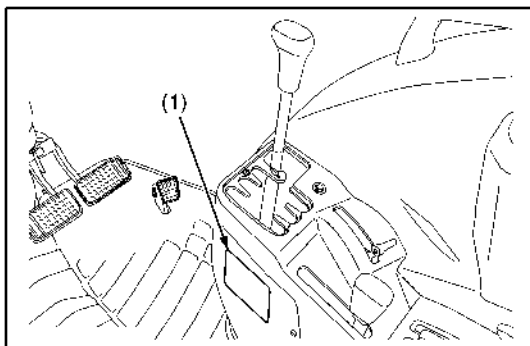


1AGAIAP116A

(4) Part No. 3A294-9554-1



1AGAOAAP077A



9Y1210686ICI012US

9Y1210686INI0012US0

- (1) Part No. K3512-4719-1
Do not touch hot surface
like muffler, etc.



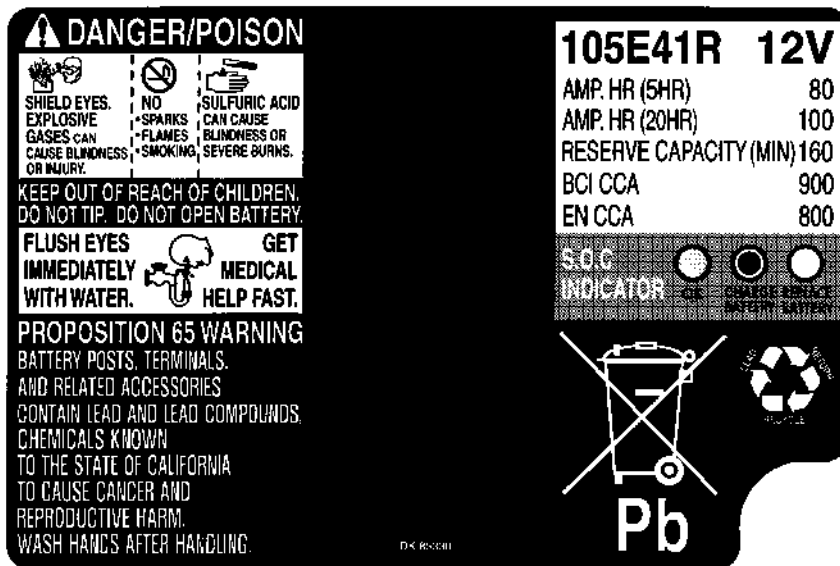
1BDABANAP080A

- (2) Part No. 6C090-4958-1
Do not get your hands close
to engine fan and fan belt.

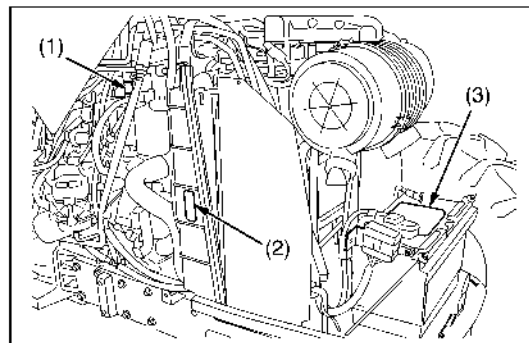


1AGAIAZAP110A

- (3) Part No. 3Y205-9892-1



1AGAIJHAP083A



9Y1210686ICI013US

9Y1210686INI0013US0

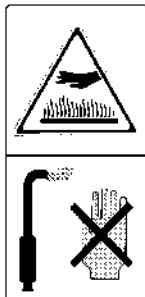
CABIN Model

- (1) Part No. 6C090-4958-2
Do not get your hands close
to engine fan and fan belt.



1AGAIAP110A

- (2) Part No. 32310-4958-1
Do not touch hot surface
like muffler, etc.



1AGAIAP071A

- (3) Part No. K3512-4719-1
Do not touch hot surface
like muffler, etc.

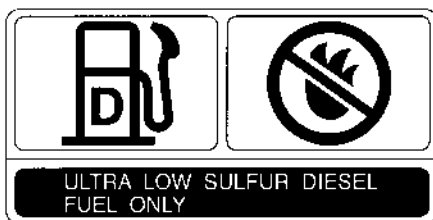


1BDABANAP080A

- (4) Part No. TC420-4956-1

Diesel fuel only

No fire

ULTRA LOW SULFUR DIESEL
FUEL ONLY

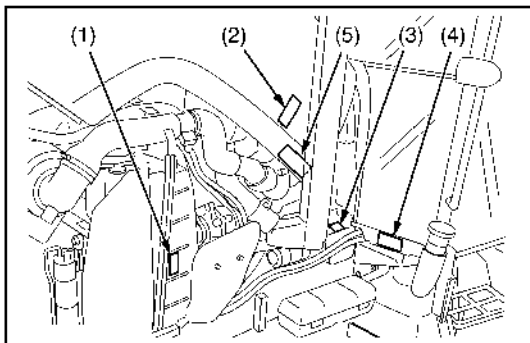
1AGAIHAP154E

- (5) Part No. 3C151-9861-1

CAUTION**TO AVOID PERSONAL INJURY:**

When the Diesel Particulate Filter (DPF) is in the regenerating mode, the exhaust gas and the DPF muffler become hot. During regeneration, take into account that the muffler will be very hot and keep the machine away from other people, animals, plants, and flammable material. Also keep the area near the DPF muffler clean and away from flammable material.

1AGAIHAP084A



9Y1210686ICI005US

9Y1210686INI0005US0

- (1) Part No. K3512-4719-1
Do not touch hot surface
like muffler, etc.



1BDABANAP080A

- (3) Part No. 3A851-7295-1

CAUTION REFRIGERANT UNDER HIGH PRESSURE Improper service methods may cause injury. Air conditioning system should be serviced by qualified personnel. See Repair Manual.		ATTENTION REFRIGERANT SOUS HAUTE PRESSION Un entretien incorrect peut provoquer des blessures. Le système de climatisation doit être entretenu par une personne qualifiée. Voir le manuel de réparation.	
Refrigerant HFC134a Max. 0.95kg (2.09lbs.) USE ONLY Min. 0.65kg (1.47lbs.)	ND-OIL 8 SAE OR EQUIVALENT J-639	Refrigerant HFC134a Max. 0.95kg (2.09lbs.) UNDOUMENT Min. 0.65kg (1.47lbs.)	ND-OIL 8 SAE OR EQUIVALENT J-639
MFD. BY DENSO CORPORATION JAPAN.		FABRIQUE PAR DENSO CORPORATION JAPON.	

1AGAIDGAP074A

- (2) Part No. 6C090-4958-2
Do not get your hands close
to engine fan and fan belt.

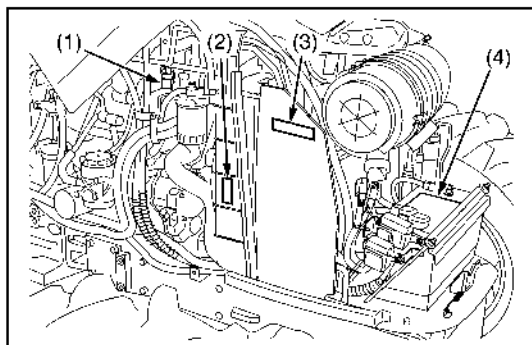


1AGAIAZAP110A

- (4) Part No. 3Y205-9892-1

DANGER/POISON SHIELD EYES. EXPLOSIVE GASES CAN CAUSE BLINDNESS OR INJURY. NO SPARKS, FLAMES OR SMOKING. SULFURIC ACID CAN CAUSE BLINDNESS OR SEVERE BURNS. KEEP OUT OF REACH OF CHILDREN. DO NOT TIP. DO NOT OPEN BATTERY. FLUSH EYES IMMEDIATELY WITH WATER. GET MEDICAL HELP FAST. PROPOSITION 65 WARNING BATTERY POSTS, TERMINALS AND RELATED ACCESSORIES CONTAIN LEAD AND LEAD COMPOUNDS, CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND REPRODUCTIVE HARM. WASH HANDS AFTER HANDLING.		105E41R 12V AMP. HR (5HR) 80 AMP. HR (20HR) 100 RESERVE CAPACITY (MIN) 160 BCI CCA 900 EN CCA 800 S.O.C INDICATOR

1AGAIJHAP083A



9Y1210686IC1006US

9Y1210686INI0006US0

(1) Part No. 3F240-9857-1

⚠ WARNING

To avoid free wheeling when shifting the shuttle lever while on a slope: Stop completely by using the brake and by depressing the clutch pedal. Start off after selecting shuttle direction by releasing the clutch pedal.

1AGAIBDAP039A

(2) Part No. 3C581-9858-1

⚠ DANGER

TO AVOID POSSIBLE INJURY OR DEATH FROM A MACHINE RUNAWAY.

1. Do not start engine by shorting across starter terminals or bypassing the safety start switch. Machine may start in gear and move if normal starting circuitry is bypassed.
2. Start engine only from operator's seat with transmission and PTO OFF.

Never start engine while standing on the ground.

1AGAIAP009A

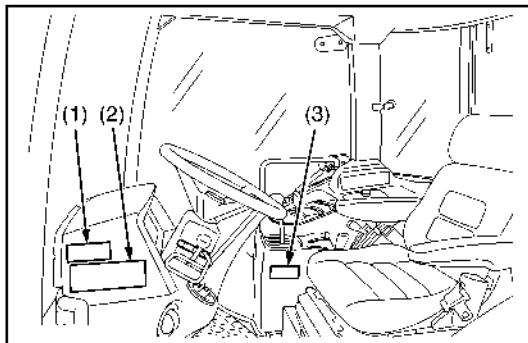
(3) Part No. 6C150-4743-1

⚠ 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.

1AGAIBDAP040A



9Y1210686ICI007US

9Y1210686INI0007US0

(1) Part No. 3F240-9836-2

CAUTION

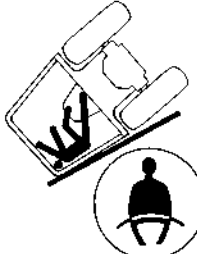
TO AVOID PERSONAL INJURY:

1. Read and understand the operator's manual before operation.
2. Before starting the engine, make sure that everyone is at a safe distance from 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 to the ground, set the parking brake, stop the engine and remove the key.
12. Securely support tractor and implements before working underneath.

1AGAICHAP113A

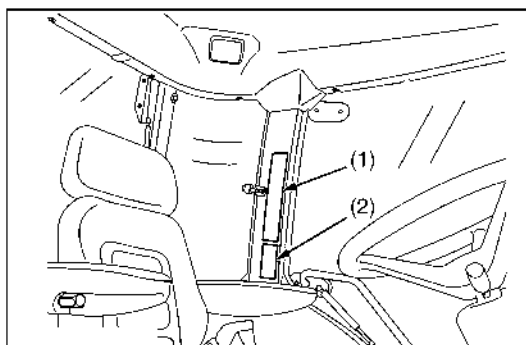
(2) Part No. TA040-4902-1

WARNING



TO AVOID INJURY OR DEATH FROM ROLL-OVER:
Always use seat belt when driving.

1AGAMAOAP078A



9Y1210686ICI008US

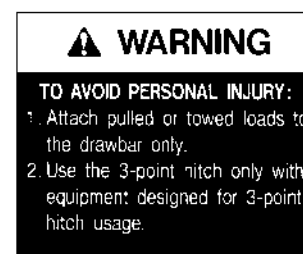
9Y1210686INI0008US0

(1) Part No. 3P305-9856-1



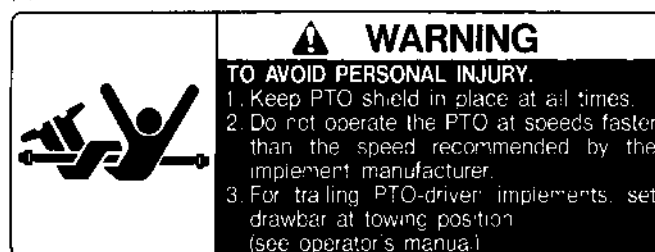
1AGAICVAP048E

(2) Part No. TA040-4935-1

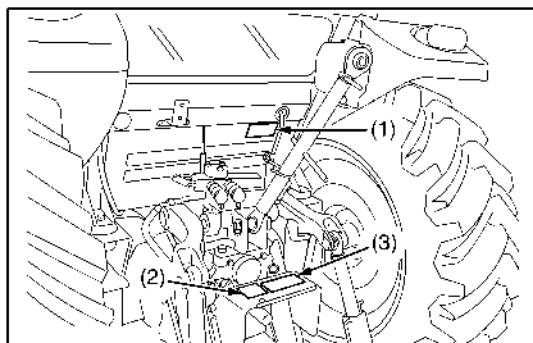


1AGAIAZAP056A

(3) Part No. TA040-4959-3



1AGAIAZAP116A



9Y1210686ICI009US

9Y1210686INI0009US0

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 location(s) as the replace component.
5. Mount new danger, warning and caution labels by applying on a clean dry surface and pressing any bubbles to outside edge.

9Y1210686INI0014US0

3. SPECIFICATIONS

Model			M8560		M9960	
			2WD	4WD	2WD	4WD
Engine	Model		V3800-CR-TE4		V3800-CR-TIE4	
	Type		4 cylinder in-line, Common Rail System, direct injection		4 cylinder in-line, Common Rail System, direct injection with inter cooler	
	Number of cylinders		4			
	Total displacement		3769 cm ³ (230 cu.in.)			
	Bore and stroke		100 × 120 mm (3.9 × 4.7 in.)			
	Rated revolution	ROPS	2400 min ⁻¹ (rpm)			
		CABIN	2600 min ⁻¹ (rpm)			
	Low idling revolution		800 to 850 min ⁻¹ (rpm)			
	Net power *1		63.8 kW (85.5 HP)		74.6 kW (100 HP)	
	PTO power *1 (factory observed)		56.7 kW (76 HP)		66.4 kW (89 HP)	
	Maximum torque		293 N·m (29.9 kgf·m, 216 lbf·ft) / 1400 to 1600 min ⁻¹ (rpm)		342 N·m (34.9 kgf·m, 252 lbf·ft) / 1400 to 1600 min ⁻¹ (rpm)	
	Battery capacity		12V, RC: 160 min, CCA 900A			
	Fuel tank capacity	ROPS	90.0 L (23.8 U.S.gals, 19.8 Imp.gals)			
		CABIN	110 L (29.1 U.S.gals, 24.2 Imp.gals)			
Engine oil capacity		10.7 L (11.3 U.S.qts, 9.41 Imp.qts)				
Coolant capacity		9.0 L (9.5 U.S.qts, 7.9 Imp.qts)				
Dimensions	Overall length		3885 mm (153 in.)	3760 mm (148 in.)	3885 mm (153 in.)	3760 mm (148 in.)
	Overall width (minimum tread)	ROPS	1960 mm (77 in.)	1990 mm (78 in.)	1990 mm (78 in.)	2010 mm (79 in.)
		ROPS (Low Profile)	—	—	—	1970 mm (77.6 in.)
		CABIN	1960 mm (77 in.)	1990 mm (78 in.)	1990 mm (78 in.)	2010 mm (79 in.)
	Overall height	ROPS	2510 mm (99 in.)		2535 mm (100 in.)	
		ROPS (Low Profile)	—	—	—	2300 mm (90.6 in.)
		CABIN	2545 mm (100 in.)		2570 mm (101 in.)	
	Wheel base		2250 mm (88.6 in.)			
	Tread (Front)		1440 to 2040 mm (56.7 to 80.3 in.)	1520, 1620 mm (59.8, 63.8 in.)	1440 to 2040 mm(56.7 to 80.3 in.)	1520, 1620 mm (59.8, 63.8 in.)
	Tread (Rear)	ROPS	1520 to 1920 mm (59.8 to 75.6 in.)			
		ROPS (Low Profile)	—	—	—	1500 to 1900 mm (59.2 to 74.8 in.)
		CABIN	1520 to 1920 mm (59.8 to 75.6 in.)			
	Minimum ground clearance	ROPS	425 mm (16.7 in.) (Drawbar bracket)		450 mm (17.7 in.) (Drawbar bracket)	
		ROPS (Low Profile)	—	—	—	330 mm (13.0 in.) (Drawbar bracket)
CABIN		425 mm (16.7 in.) (Drawbar bracket)		450 mm (17.7 in.) (Drawbar bracket)		
Weight	ROPS		2450 kg (5400 lbs)	2640 kg (5820 lbs)	2510 kg (5535 lbs)	2700 kg(5950 lbs)
	ROPS (Low Profile)		—	—	—	2610 kg (5750 lbs)
	CABIN		2840 kg (6260 lbs)	3030 kg (6680 lbs)	2900 kg (6395 lbs)	3090 kg (6810 lbs)
Traveling system	Standard tire size (Front)	ROPS	7.5-18	11.2-24	7.5-18	12.4-24
		ROPS (Low Profile)	—	—	—	9.5-20
		CABIN	7.5-18	11.2-24	7.5-18	12.4-24
	Standard tire size (Rear)	ROPS	16.9-30	16.9-30	18.4-30	18.4-30
		ROPS (Low Profile)	—	—	—	16.9-24
		CABIN	16.9-30	16.9-30	18.4-30	18.4-30
	Clutch		Multiple wet disk			
	Steering		Hydraulic Power Steering			
	Braking system		Hydraulic wet disk			
	Differential		Bevel gears with differential lock (Rear)			

Model			M8560		M9960	
			2WD	4WD	2WD	4WD
Hydraulic unit	Hydraulic control system		Position, draft (top link sensing) and mix control			
	Pump capacity	ROPS	60.0 L/min.(15.9 U.S.gals/min, 13.2 Imp.gals/min)			
		CABIN	64.3 L/min.(17.0 U.S.gals/min, 14.1 Imp.gals/min)			
	Three point hitch		Category 2			
	Max. lifting force	At lifting points *3	3200 kg (7055 lbs), 3900 kg (8600 lbs) with Hydraulic High Capacity Lift Cylinders (F12 / R12 model: standard, F8 / R8 model: option)			
		24 in. behind lifting point *3	2100 kg (4630 lbs), 3300 kg (7275 lbs) with Hydraulic High Capacity Lift Cylinders (F12 / R12 model: standard, F8 / R8 model: option)			
	Remote hydraulic control		1 standard (2nd, 3rd and flow control valve optional)			
	System pressure		19.6 MPa (200 kgf/cm ² , 2840 psi)			
PTO	Traction system		Swinging drawbar, adjustable in direction			
	Live PTO (Independent)	Direction of turning	Clockwise, viewed from tractor rear			
		PTO/Engine speed	6 spline: 540 min ⁻¹ (rpm) / 2205 min ⁻¹ (rpm)			

■ **NOTE**

- The company reserves the right to change the specifications without notice.

*1 : Manufacturer's estimate

*2 : Cast iron disks available for wheels. (Except Low Profile Model)

*3 : At lower link end with links horizontal.

9Y1210686INI0015US0

4. TRAVELING SPEEDS

ROPS Model (without Low Profile Model)

(At rated engine rpm)

Model			M8560 / M9960			
			F8/R8 Model		F12/R12 Model	
Tire size (Rear)			18.4-30			
Shuttle shift lever	Range gear shift lever	Main gear shift lever	km/h	mph	km/h	mph
Forward	CREEP (option)	1	0.35	0.22	0.36	0.23
		2	0.54	0.34	0.49	0.31
		3	0.78	0.49	0.64	0.40
		4	1.11	0.69	0.82	0.51
		5	—	—	1.01	0.63
		6	—	—	1.45	0.91
	L	1	2.5	1.5	2.5	1.5
		2	3.7	2.3	3.4	2.1
		3	5.4	3.4	4.3	2.7
		4	7.7	4.8	5.6	3.5
		5	—	—	6.9	4.3
		6	—	—	9.9	9.9
	H	1	9.5	5.9	10.8	6.8
		2	14.4	9.0	14.8	9.3
		3	20.7	13.0	19.1	11.9
		4	29.7	18.6	24.7	15.4
		5	—	—	30.5	19.0
		6	—	—	37.8	23.6

The company reserves the right to change the specifications without notice

(At rated engine rpm)

Model			M8560 / M9960			
			F8/R8 Model		F12/R12 Model	
Tire size (Rear)			18.4-30			
Shuttle shift lever	Range gear shift lever	Main gear shift lever	km/h	mph	km/h	mph
Reverse	CREEP (option)	1	0.35	0.22	0.36	0.22
		2	0.53	0.33	0.49	0.31
		3	0.77	0.48	0.63	0.40
		4	1.10	0.69	0.82	0.51
		5	—	—	1.01	0.63
		6	—	—	1.44	0.90
	L	1	2.4	1.5	2.4	1.5
		2	3.7	2.3	3.3	2.1
		3	5.3	3.3	4.3	2.7
		4	7.7	4.8	5.6	3.5
		5	—	—	6.9	4.3
		6	—	—	9.8	6.1
	H	1	9.4	5.9	10.8	6.7
		2	14.3	8.9	14.7	9.2
		3	20.6	12.9	19.0	11.9
		4	29.5	18.4	24.5	15.3
		5	—	—	30.3	18.9
		6	—	—	37.6	23.5

The company reserves the right to change the specifications without notice

9Y1210686INI0016US0

ROPS Model (with Low Profile Model)

(At rated engine rpm)

Model			M9960	
			F12/R12 Model	
Tire size (Rear)			16.9-24	
Shuttle shift lever	Range gear shift lever	Main gear shift lever	km/h	mph
Forward	CREEP (option)	1	0.31	0.19
		2	0.42	0.26
		3	0.54	0.34
		4	0.70	0.44
		5	0.86	0.54
		6	1.23	0.77
	L	1	2.1	1.3
		2	2.8	1.8
		3	3.7	2.3
		4	4.7	3.0
		5	5.9	3.7
		6	8.4	5.2
	H	1	9.2	5.8
		2	12.6	7.9
		3	16.2	10.1
		4	21.0	13.1
		5	25.9	16.2
		6	32.1	20.1

The company reserves the right to change the specifications without notice

(At rated engine rpm)

Model			M9960	
			F12/R12 Model	
Tire size (Rear)			16.9-24	
Shuttle shift lever	Range gear shift lever	Main gear shift lever	km/h	mph
Reverse	CREEP (option)	1	0.30	0.19
		2	0.42	0.26
		3	0.54	0.34
		4	0.69	0.43
		5	0.86	0.54
		6	1.23	0.77
	L	1	2.1	1.3
		2	2.8	1.8
		3	3.7	2.3
		4	4.7	2.9
		5	5.8	3.6
		6	8.3	5.2
	H	1	9.2	5.7
		2	12.5	7.8
		3	16.1	10.1
		4	20.8	13.0
		5	25.7	16.1
		6	31.9	20.0

The company reserves the right to change the specifications without notice

9Y1210686INI0017US0

CABIN Model (without Dual Speed Type)

(At rated engine rpm)

Model			M8560 / M9960			
			F8/R8 Model		F12/R12 Model	
Tire size (Rear)			18.4-30			
Shuttle shift lever	Range gear shift lever	Main gear shift lever	km/h	mph	km/h	mph
Forward	CREEP (option)	1	0.38	0.24	0.39	0.24
		2	0.58	0.36	0.53	0.33
		3	0.84	0.53	0.69	0.43
		4	1.2	0.75	0.89	0.56
		5	—	—	1.10	0.69
		6	—	—	1.57	0.98
	L	1	2.7	1.7	2.7	1.7
		2	4.0	2.5	3.6	2.3
		3	5.8	3.6	4.7	2.9
		4	8.3	5.2	6.1	3.8
		5	—	—	7.5	4.7
		6	—	—	10.7	6.7
	H	1	10.3	6.4	11.7	7.3
		2	15.6	9.7	16.1	10.0
		3	22.5	14.0	20.7	12.9
		4	32.2	20.1	26.7	16.7
		5	—	—	33.0	20.6
		6	—	—	37.8	23.6

The company reserves the right to change the specifications without notice

(At rated engine rpm)

Model			M8560 / M9960			
			F8/R8 Model		F12/R12 Model	
Tire size (Rear)			18.4-30			
Shuttle shift lever	Range gear shift lever	Main gear shift lever	km/h	mph	km/h	mph
Reverse	CREEP (option)	1	0.38	0.24	0.39	0.24
		2	0.58	0.36	0.53	0.33
		3	0.84	0.52	0.68	0.43
		4	1.2	0.75	0.88	0.55
		5	—	—	1.09	0.68
		6	—	—	1.56	0.98
	L	1	2.6	1.7	2.6	1.7
		2	4.0	2.5	3.6	2.3
		3	5.8	3.6	4.7	2.9
		4	8.3	5.2	6.0	3.8
		5	—	—	7.4	4.6
		6	—	—	10.6	6.6
	H	1	10.2	6.4	11.7	7.3
		2	15.5	9.7	16.0	10.0
		3	22.3	14.0	20.6	12.9
		4	32.0	20.0	26.6	16.6
		5	—	—	32.8	20.5
		6	—	—	37.6	23.5

The company reserves the right to change the specifications without notice

9Y1210686INI0018US0

CABIN Model (with Dual Speed Model)

(At rated engine rpm)

Model			M9960			
			F24/R24 Model			
Tire size (Rear)			18.4-30			
Shuttle shift lever	Range gear shift lever	Main gear shift lever	Dual speed : H		Dual speed : L	
			km/h	mph	km/h	mph
Forward	CREEP (option)	1	0.39	0.24	0.33	0.20
		2	0.53	0.33	0.45	0.28
		3	0.68	0.43	0.57	0.36
		4	0.88	0.55	0.74	0.46
		5	1.09	0.68	0.92	0.57
		6	1.56	0.97	1.31	0.82
	L	1	2.6	1.6	2.2	1.4
		2	3.6	2.2	3.0	1.9
		3	4.6	2.9	3.9	2.4
		4	6.0	3.7	5.0	3.2
		5	7.4	4.6	6.2	3.9
		6	10.6	6.6	8.9	5.6
	H	1	11.6	7.3	9.8	6.1
		2	15.9	9.9	13.4	8.4
		3	20.5	12.8	17.3	10.8
		4	26.5	16.6	22.3	13.9
		5	32.7	20.4	27.5	17.2
		6	37.5	23.4	31.5	19.7

The company reserves the right to change the specifications without notice

(At rated engine rpm)

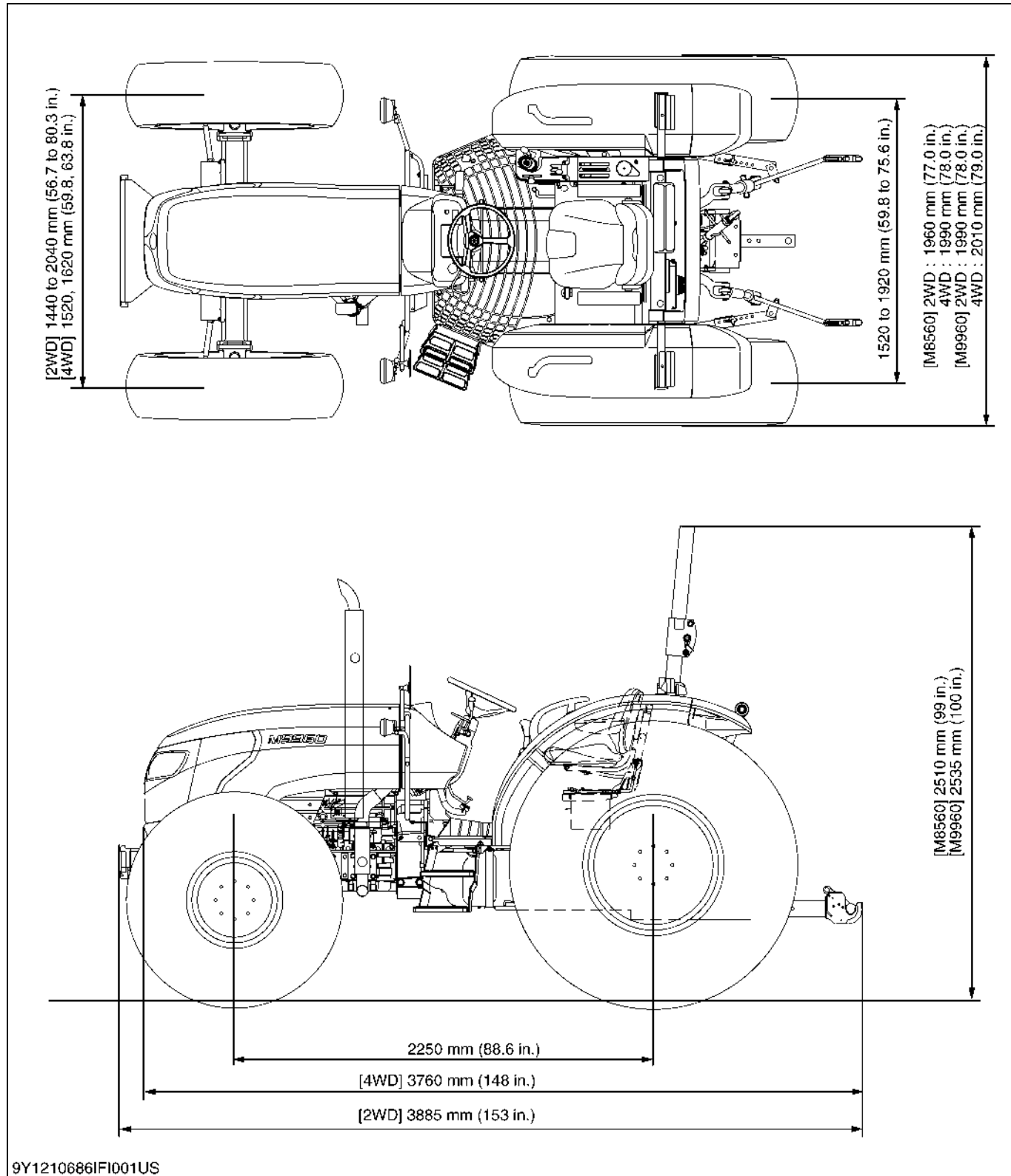
Model			M9960			
			F24/R24 Model			
Tire size (Rear)			18.4-30			
Shuttle shift lever	Range gear shift lever	Main gear shift lever	Dual speed : H		Dual speed : L	
			km/h	mph	km/h	mph
Reverse	CREEP (option)	1	0.39	0.24	0.33	0.21
		2	0.54	0.33	0.45	0.28
		3	0.69	0.43	0.58	0.36
		4	0.89	0.56	0.75	0.47
		5	1.10	0.69	0.93	0.58
		6	1.58	0.99	1.33	0.83
	L	1	2.7	1.7	2.2	1.4
		2	3.6	2.3	3.1	1.9
		3	4.7	2.9	4.0	2.5
		4	6.1	3.8	5.1	3.2
		5	7.5	4.7	6.3	3.9
		6	10.7	6.7	9.0	5.6
	H	1	11.8	7.4	9.9	6.2
		2	16.1	10.1	13.6	8.5
		3	20.8	13.0	17.5	10.9
		4	26.8	16.8	22.6	14.1
		5	33.1	20.7	27.9	17.4
		6	37.9	23.7	31.9	19.9

The company reserves the right to change the specifications without notice

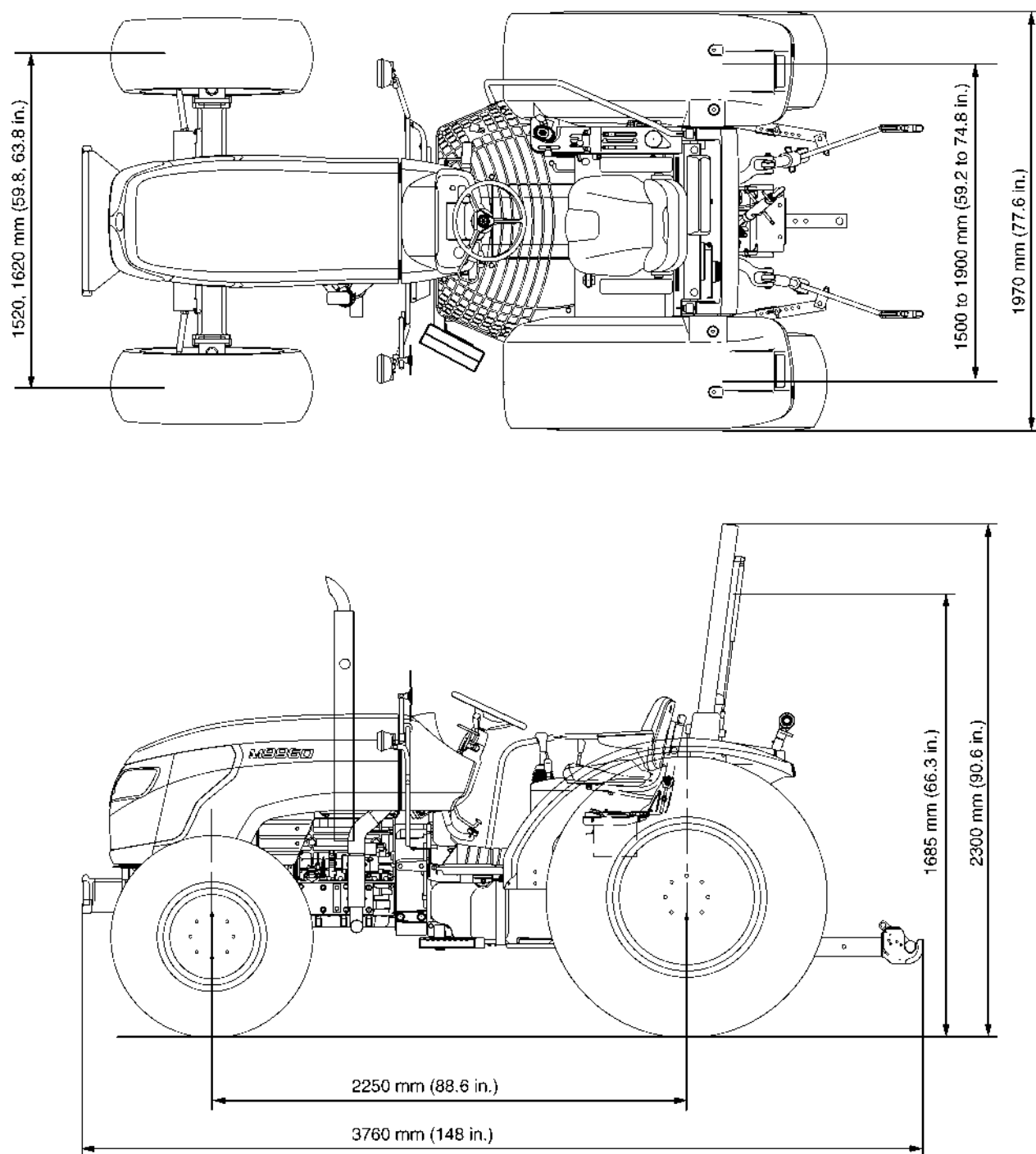
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5. DIMENSIONS

ROPS Model

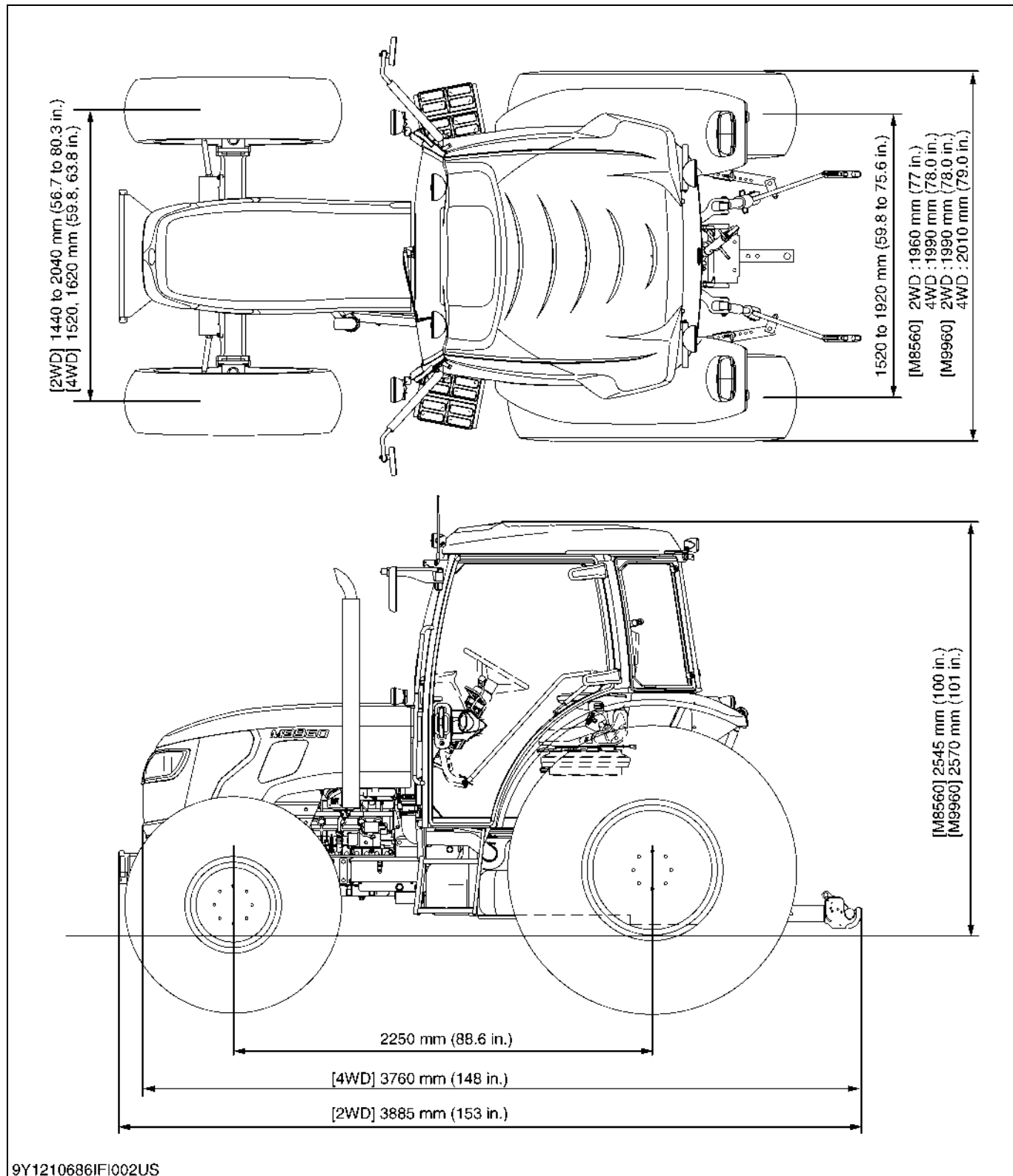


9Y1210686INI0020US0

ROPS (Low Profile) Model

9Y1210686IFI004US

9Y1210686INI0022US0

CABIN Model

9Y1210686IF002US

9Y1210686INI0021US0

G GENERAL

GENERAL

CONTENTS

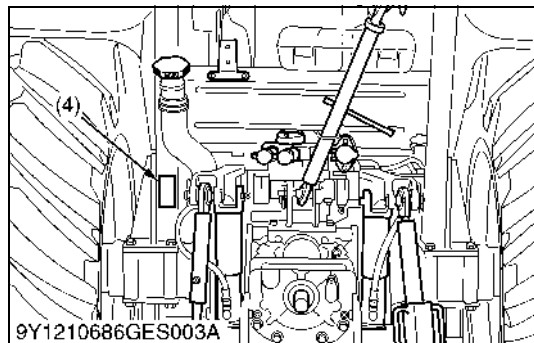
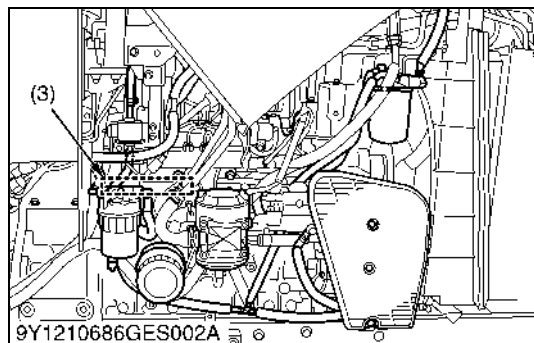
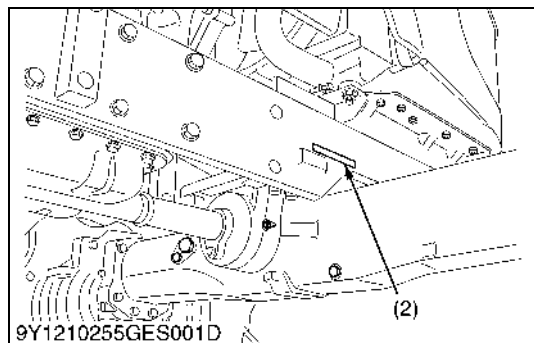
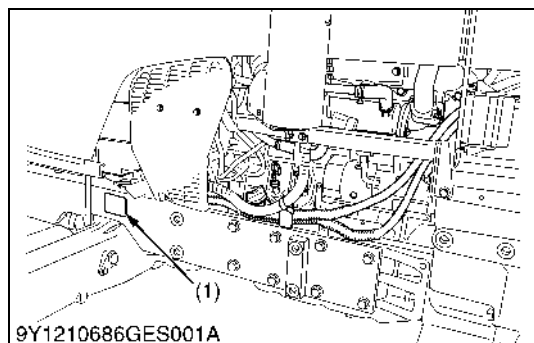
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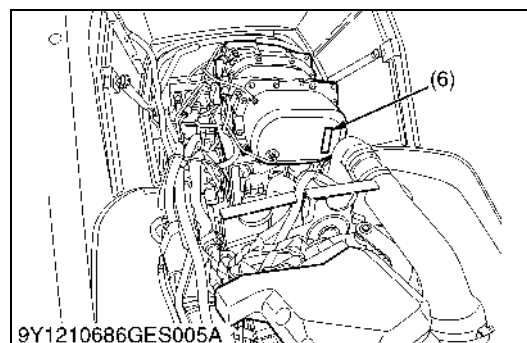
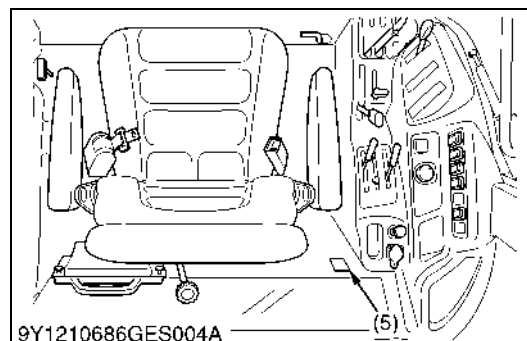
1. TRACTOR IDENTIFICATION

[1] MODEL NAME AND SERIAL NUMBERS

(1) Tractor Number



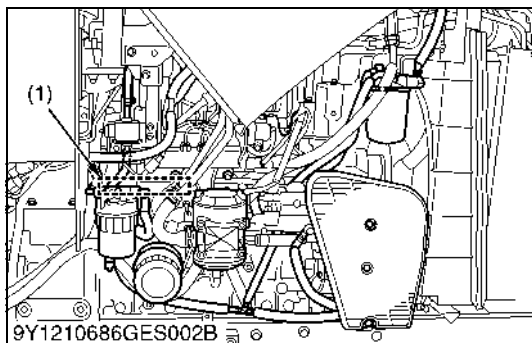
When contacting your local KUBOTA distributor, always specify engine serial number, tractor serial number and hourmeter reading.



- | | |
|---|---|
| (1) Tractor Identification Plate | (5) CABIN Identification Plate
(CABIN Serial Number) |
| (2) Tractor Serial Number | (6) Diesel Particulate Filter (DPF) Serial
Number |
| (3) Engine Serial Number | |
| (4) ROPS Identification Plate
(ROPS Serial Number) | |

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(2) Engine Number



Engine Serial Number

The engine serial number is an identified number for the engine. It is marked after the engine model number.

It indicates month and year of manufacture as follows.

Year of manufacture

Alphabet or Number	Year	Alphabet or Number	Year
1	2001	F	2015
2	2002	G	2016
3	2003	H	2017
4	2004	J	2018
5	2005	K	2019
6	2006	L	2020
7	2007	M	2021
8	2008	N	2022
9	2009	P	2023
A	2010	R	2024
B	2011	S	2025
C	2012	T	2026
D	2013	V	2027
E	2014		

Month of manufacture

Month	Engine Serial Number	
	0001 ~ 9999	10000 ~
January	A0001 ~ A9999	B0001 ~
February	C0001 ~ C9999	D0001 ~
March	E0001 ~ E9999	F0001 ~
April	G0001 ~ G9999	H0001 ~
May	J0001 ~ J9999	K0001 ~
June	L0001 ~ L9999	M0001 ~
July	N0001 ~ N9999	P0001 ~
August	Q0001 ~ Q9999	R0001 ~
September	S0001 ~ S9999	T0001 ~
October	U0001 ~ U9999	V0001 ~
November	W0001 ~ W9999	X0001 ~
December	Y0001 ~ Y9999	Z0001 ~

e.g. V3800-6A0001

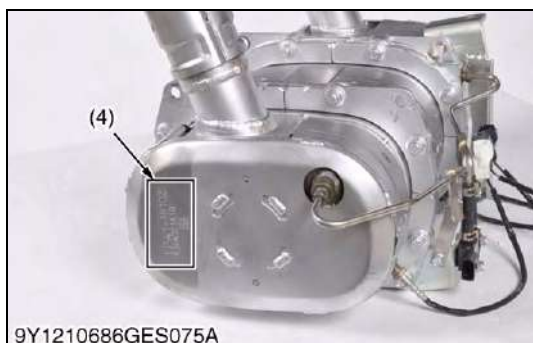
"6" indicates 2006 and "A" indicates January.

So, 6A indicates that the engine was manufactured on January, 2006.

(1) Engine Model and Serial Number

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(3) DPF Muffler Number



The DPF muffler full assembly serial number is an identified number for the DPF muffler full assembly.

It shows the month and year of manufacture as below.

- | | |
|---|---|
| (1) DPF Muffler Full Assembly Part Number and Serial Number | (3) Filter Comp (DPF) Part Number and Serial Number |
| (2) Body (DPF Outlet) Part Number and Serial Number | (4) Catalyst (DOC) Part Number and Serial Number |

(To be continued)

(Continued)

Year of manufacture

Alphabet or Number	Year	Alphabet or Number	Year
1	2001	F	2015
2	2002	G	2016
3	2003	H	2017
4	2004	J	2018
5	2005	K	2019
6	2006	L	2020
7	2007	M	2021
8	2008	N	2022
9	2009	P	2023
A	2010	R	2024
B	2011	S	2025
C	2012	T	2026
D	2013	V	2027
E	2014		

Month of manufacture

Month	DPF Muffler Full Assembly Lot Number	
January	A0001 ~ A9999	B0001 ~ BZ999
February	C0001 ~ C9999	D0001 ~ DZ999
March	E0001 ~ E9999	F0001 ~ FZ999
April	G0001 ~ G9999	H0001 ~ HZ999
May	J0001 ~ J9999	K0001 ~ KZ999
June	L0001 ~ L9999	M0001 ~ MZ999
July	N0001 ~ N9999	P0001 ~ PZ999
August	Q0001 ~ Q9999	R0001 ~ RZ999
September	S0001 ~ S9999	T0001 ~ TZ999
October	U0001 ~ U9999	V0001 ~ VZ999
November	W0001 ~ W9999	X0001 ~ XZ999
December	Y0001 ~ Y9999	Z0001 ~ ZZ999

* Alphabetical letters "I" and "O" are not used.

(a)(b) (c)
e.g. B L 0019

- (a) Year: B indicates 2011
- (b) Month: L or M indicates June
- (c) Lot Number: (**0001 ~ 9999** or **A001 ~ Z999**)

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[2] E4B ENGINE

[Example: Engine Model Name V3800-CR-**TE4(C)B**-XXXX or V3800-CR-**TIE4(C)B**-XXXX]

The emission controls previously implemented in various countries to prevent air pollution will be stepped up as Nonroad Emission Standards continue to change. The timing or applicable date of the specific Nonroad Emission regulations depends on the engine output classification.

Over the past several years, KUBOTA has been supplying diesel engines that comply with regulations in the respective countries affected by Nonroad Emission regulations. For KUBOTA Engines, E4B will be the designation that identifies engine models affected by the next emission phase (See the table below).

When servicing or repairing **###-E4B** series engines, use only replacement parts for that specific E4B engine, designated by the appropriate E4B KUBOTA Parts List and perform all maintenance services listed in the appropriate KUBOTA Operator's Manual or in the appropriate E4B KUBOTA Workshop Manual. Use of incorrect replacement parts or replacement parts from other emission level engines (for example: E3B engines), may result in emission levels out of compliance with the original E4B design and EPA or other applicable regulations. Please refer to the emission label located on the engine head cover to identify Output classification and Emission Control Information. E4B engines are identified with "EF" at the end of the Model designation, on the US EPA label. Please note: E4B is not marked on the engine.

TYPE : #####
 FAMILY : #####
 APPROVAL NUMBER: #####(EPA)#####
Kubota KUBOTA Corporation
 #####

(1) (2)

EMISSION CONTROL INFORMATION

THIS ENGINE MEETS 2012 EMISSION REGULATIONS
 FOR U.S. EPA AND CALIFORNIA NONROAD DIESEL ENGINES.

Kubota KUBOTA Corporation

MODEL : ###-EF ENGINE DISP. : ####
 FAMILY : C ###
 POWER : ## kW / ## rpm CATEGORY : ## - ## kW
 VALVE CLEARANCE (COLD) : IN ## mm EX ## mm
 ECS : ### ###
 ULTRA LOW SULFUR DIESEL FUEL ONLY
 DEL. ASSY. : #####

9Y1200165GES001A

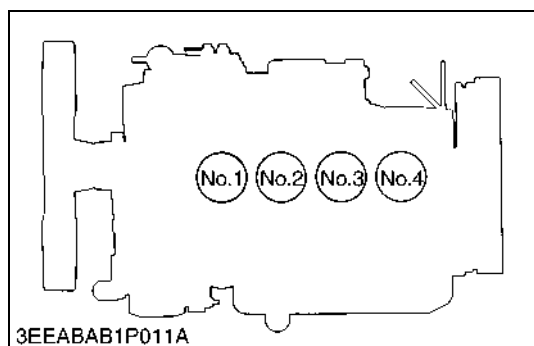
Category (1)	Engine output classification	EU regulation
P	From 37 to less than 56 kW	STAGE IIIB
N	From 56 to less than 75 kW	STAGE IIIB
M	From 75 to less than 130 kW	STAGE IIIB

Category (2)	Engine output classification	EPA regulation
EF	Less than 19 kW	Tier 4
	From 19 to less than 56 kW	Interim Tier 4
	From 56 to less than 75 kW	Interim Tier 4
	From 75 to less than 130 kW	Interim Tier 4

- (1) EU regulation engine output classification category
 (2) "E4B" engines are identified with "EF" at the end of the Model designation, on the US EPA label.
 "E4B" designates some Interim Tier 4 / Tier 4 models, depending on engine output classification.

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[3] CYLINDER NUMBER

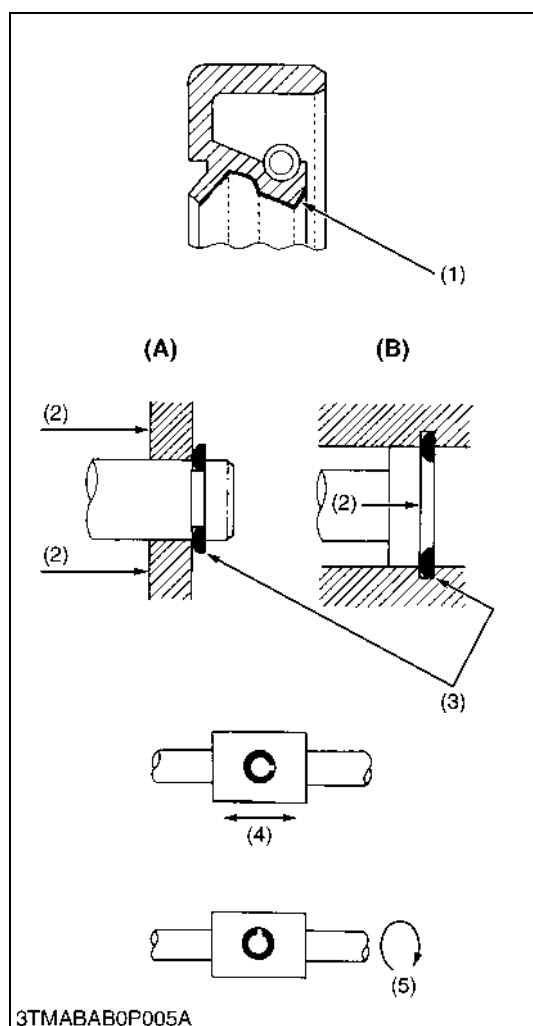


You can see the cylinder numbers of KUBOTA diesel engine in the figure.

The sequence of cylinder numbers is No.1, No.2, No.3 and No.4 and it starts from the gear case side.

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2. GENERAL PRECAUTIONS



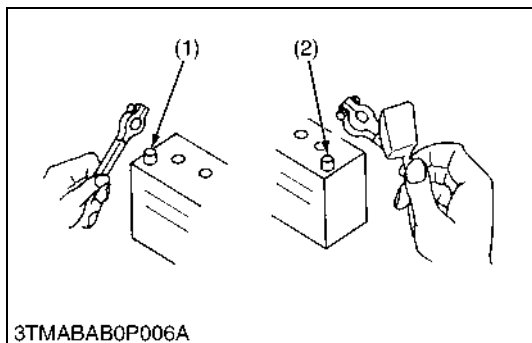
- When you disassemble, carefully put the parts in a clean area to make it easy to find the parts. You must install the screws, bolts and nuts in their initial position to prevent the reassembly errors.
- When it is necessary to use special tools, use KUBOTA special tools. Refer to the drawings when you make special tools that you do not use frequently.
- Before you disassemble or repair machine, make sure that you always disconnect the ground cable from the battery first.
- Remove oil and dirt from parts before you measure.
- Use only KUBOTA genuine parts for replacement to keep the machine performance and to make sure of safety.
- You must replace the gaskets and O-rings when you assemble again. Apply grease (1) to new O-rings or oil seals before you assemble.
- When you assemble the external or internal snap rings, make sure that the sharp edge (3) faces against the direction from which force (2) is applied.
- 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.
- Clean the parts before you measure them.
- Tighten the fittings to the specified torque. Too much torque can cause damage to the hydraulic units or the fittings. Not sufficient torque can cause oil leakage.
- When you use a new hose or pipe, tighten the nuts to the specified torque. Then loosen (approx. by 45 °) and let them be stable before you tighten to the specified torque (This is not applied to the parts with seal tape).
- When you remove the two ends of a pipe, remove the lower end first.
- Use two pliers in removal and installation. One to hold the stable side, and the other to turn the side you remove to prevent twists.
- Make sure that the sleeves of flared connectors and tapers of hoses are free of dust and scratches.
- After you tighten the fittings, clean the joint and apply the maximum operation pressure 2 to 3 times to examine oil leakage.

- (1) Grease
- (2) Force
- (3) Sharp Edge
- (4) Axial Force
- (5) Rotating Movement

- (A) External Circlip
- (B) Internal Circlip

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3. HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING



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

■ IMPORTANT

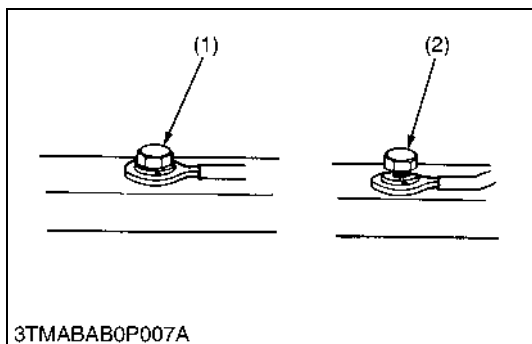
- Check electrical wiring for damage and loosened connection every year. To this end, educate the customer to do his or her own check and at the same time recommend the dealer to perform periodic check for a fee.
- Do not try to modify or remodel any electrical parts and wiring.
- When removing the battery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

(1) Negative Terminal

(2) Positive Terminal

WSM000001GEG0062US1

[1] WIRING

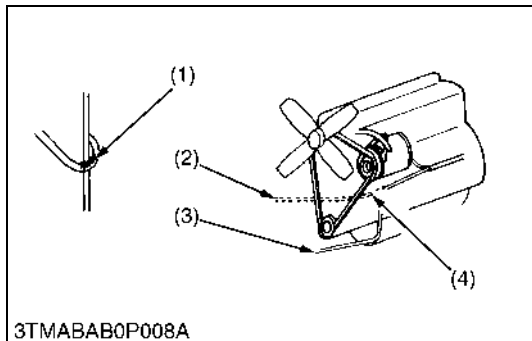


- Securely tighten wiring terminals.

(1) Correct
(Securely Tighten)

(2) Incorrect
(Loosening Leads to Faulty Contact)

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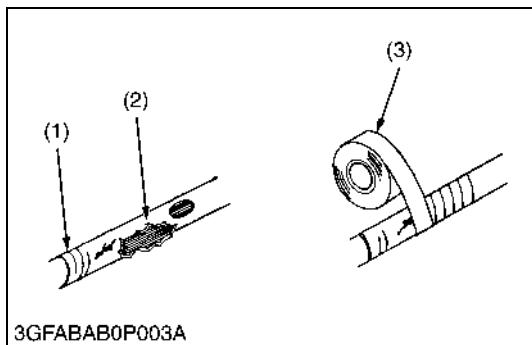


- Do not let wiring contact dangerous part.

(1) Dangerous Part (Sharp Edge)
(2) Wiring (Incorrect)

(3) Wiring (Correct)
(4) Dangerous Part

WSM000001GEG0064US1

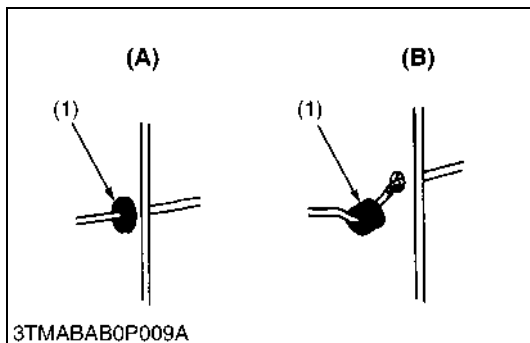


- Repair or change torn or aged wiring immediately.

(1) Aged
(2) Torn

(3) Insulating Vinyl Tape

WSM000001GEG0065US1

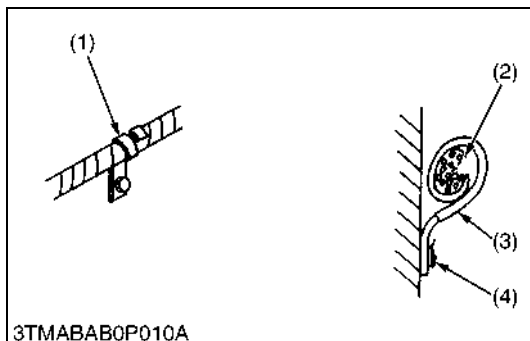


- Securely insert grommet.

(1) Grommet

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

WSM000001GEG0066US1

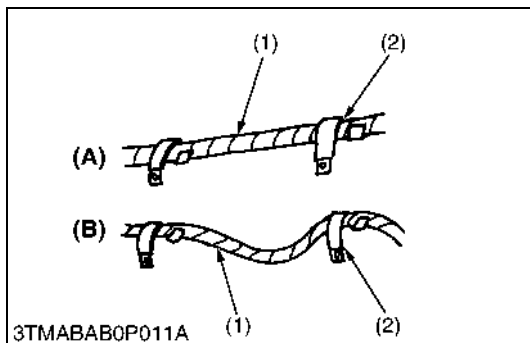


- Securely clamp, being careful not to damage wiring.

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

(3) **Correct**
(4) **Incorrect**

WSM000001GEG0067US1

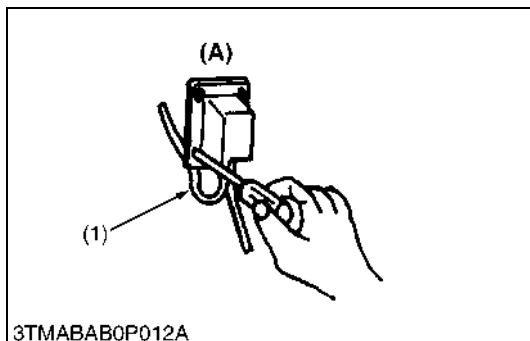


- Clamp wiring so that there is no twist, unnecessary sag, or excessive tension, except for movable part, where sag be required.

(1) Wiring
(2) Clamp

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

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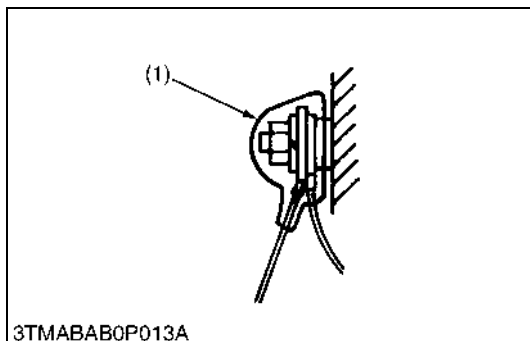


- In installing a part, be careful not to get wiring caught by it.

(1) Wiring

(A) **Incorrect**

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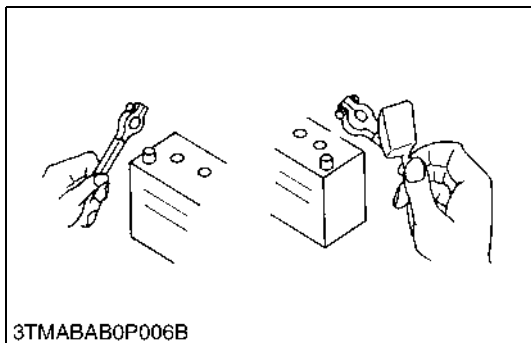


- After installing wiring, check protection of terminals and clamped condition of wiring.

(1) Cover
(Securely Install Cover)

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[2] BATTERY



- Be careful not to confuse positive and negative terminal posts.
- When you remove battery cables, disconnect negative cable first. When you install battery cables, check for polarity and connect positive cable first.
- Do not install any battery with capacity other than is specified (Ah).
- After you connect cables to battery terminal posts, apply high temperature grease to them and securely install terminal covers on them.
- Do not allow dirt and dust to collect on battery.

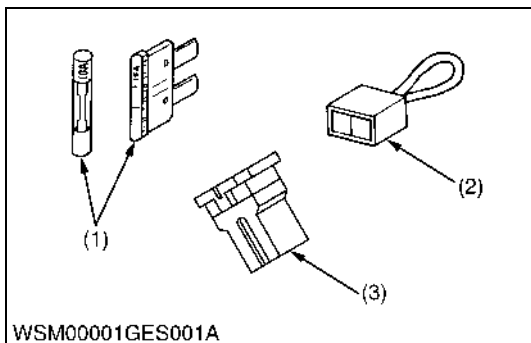


CAUTION

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

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[3] FUSE



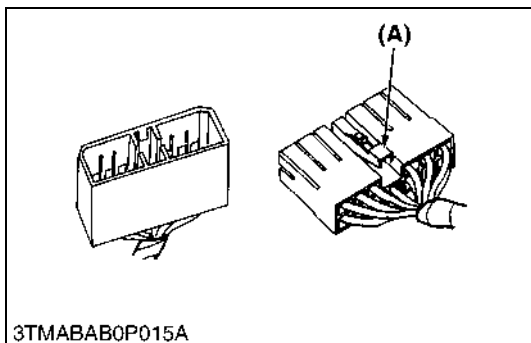
- Use fuses with specified capacity. Neither too large nor small capacity fuse is acceptable.
- Never use steel nor copper wire in place of fuse.
- Do not install working light, radio set, etc. on machine which is not provided with reserve power supply.
- Do not install accessories if fuse capacity of reserve power supply is exceeded.

(1) Fuse
(2) Fusible Link

(3) Slow Blow Fuse

WSM000001GEG0072US1

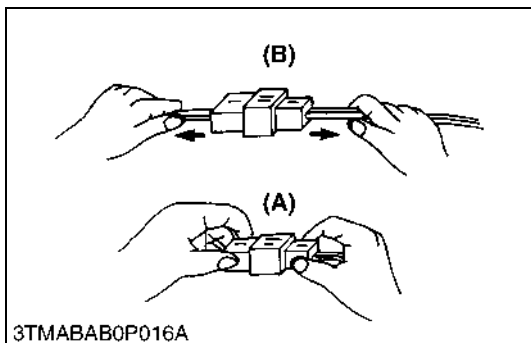
[4] CONNECTOR



- For connector with lock, push lock to separate.

(A) Push

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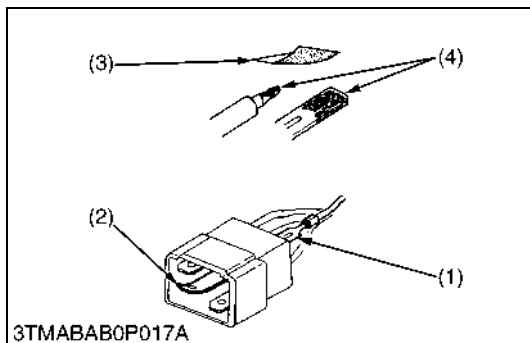


- In separating connectors, do not pull wire harnesses.
- Hold connector bodies to separate.

(A) Correct

(B) Incorrect

WSM000001GEG0074US1

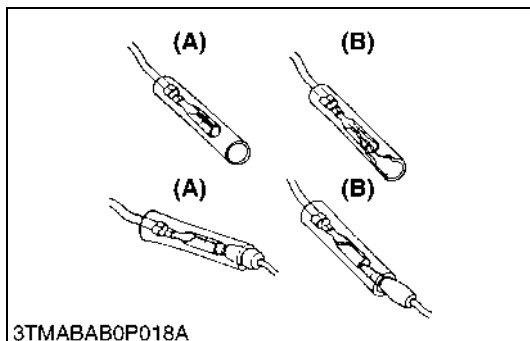


- Use sandpaper to remove rust from terminals.
- Repair deformed terminal. Make sure that there is no terminal being exposed or displaced.

(1) Exposed Terminal
(2) Deformed Terminal

(3) Sandpaper
(4) Rust

WSM000001GEG0075US1

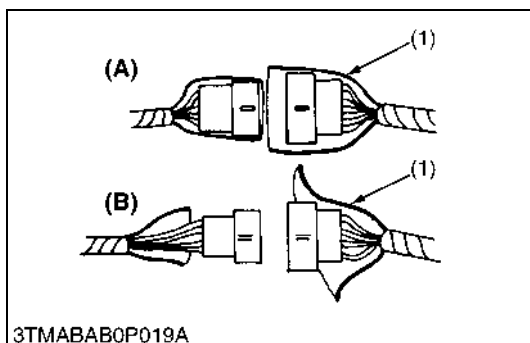


- Make sure that there is no female connector being too open.

(A) Correct

(B) Incorrect

WSM000001GEG0076US1



- Make sure that plastic cover is large enough to cover whole connector.

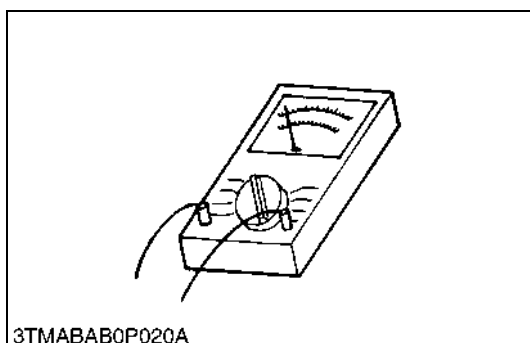
(1) Cover

(A) Correct

(B) Incorrect

WSM000001GEG0077US1

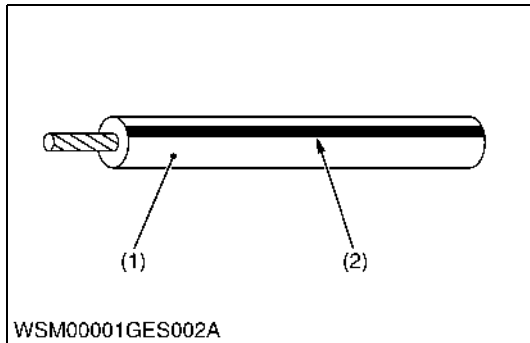
[5] HANDLING OF CIRCUIT TESTER



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

WSM000001GEG0078US1

[6] COLOR OF WIRING



- Colors of wire are specified to the color codes.
- This symbol of "/" shows color with stripe(s).

(An example)

Red stripe on white color: W/R

Color of wiring	Color code
Black	B
Brown	Br
Green	G
Gray	Gy or Gr
Blue	L
Light Green	Lg
Orange	Or
Pink	P
Purple	Pu or V
Red	R
Sky Blue	Sb
White	W
Yellow	Y

(1) Wire Color

(2) Stripe

WSM000001GEG0079US0

4. LUBRICANT, FUEL AND COOLANT

No.	Place	Capacity		Lubricants, fuel and coolant
		M8560 / M9960		
		ROPS	CABIN	
1	Fuel tank	90.0 L 23.8 U.S.gals 19.8 Imp.gals	110 L 29.1 U.S.gals 24.2 Imp.gals	• No. 2-D S15 diesel fuel • No. 1-D S15 diesel fuel if temperature is below –10 °C (14 °F)
2	Coolant	9.0 L 9.5 U.S.qts 7.9 Imp.qts		Fresh clean water with anti-freeze
	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 (with filter)	10.7 L 11.3 U.S.qts 9.41 Imp.qts		API Service Classification CJ-4 (DPF type engine) • Below 0 °C (32 °F) SAE10W, 10W-30 or 15W-40 • 0 to 25 °C (32 to 77 °F) SAE20, 10W-30 or 15W-40 • Above 25 °C (77 °F) SAE30, 10W-30 or 15W-40
5	Transmission case	60.0 L 63.4 U.S.qts 52.8 Imp.qts		KUBOTA SUPER UDT 2 fluid*
6	Front differential case oil (4WD)	6.0 L 6.3 U.S.qts 5.3 Imp.qts		KUBOTA SUPER UDT 2 fluid* or SAE80-SAE90 gear oil
7	Front axle gear case oil (4WD)	3.5 L 3.7 U.S.qts 3.1 Imp.qts		

* KUBOTA original transmission hydraulic fluid.

(To be continued)

(Continued)

Greasing				
No.	Place	No. of greasing point	Capacity	Type of grease
8	Top link	2	Until grease overflows	Multipurpose grease NLGI-2 or NLGI-1 (GC-LB)
	Top link bracket	2		
	Lift rod	2		
	Hydraulic lift cylinder pin	4		
	Front axle gear case support (4WD)	2		
	Front axle support	2		
	Front wheel hub (2WD)	2		
	Knuckle shaft (2WD)	2		
	Steering joint shaft [CABIN model]	1		
	Battery terminal	2	A small amount	

9Y1210686GEG0152US0

■ NOTE

Engine Oil:

- Oil used in the engine should have an American Petroleum Institute (API) service classification and Proper SAE Engine Oil according to the ambient temperatures as shown above.
- Refer to the following table for the suitable API classification engine oil according to the engine type (with DPF (Diesel Particulate Filter) type engines) and the fuel.

Fuel used	Engine oil classification (API classification)
	Oil class of engines with DPF
Ultra Low Sulfur Fuel [< 0.0015 % (15 ppm)]	CJ-4

Fuel :

- Use the ultra low sulfur diesel fuel only [below 0.0015 % (15 ppm)] for these engines.
- Cetane number of 45 minimum. Cetane number greater than 50 is preferred, especially for temperatures below -20 °C (-4 °F) or elevations above 1500 m (5000 ft).
- Diesel fuels specified to EN 590 or ASTM D975 are recommended.
- No.2-D is a distillate fuel of lower volatility for engines in industrial and heavy mobile service. (SAE J313 JUN87).

Transmission Oil:

*KUBOTA Super UDT-2 : For an enhanced ownership experience, we highly recommend Super UDT-2 to be used instead of standard hydraulic/transmission fluid.

Super UDT-2 is a proprietary KUBOTA formulation that delivers superior performance and protection in all operating conditions.

Regular UDT is also permitted for use in this machine.

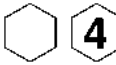
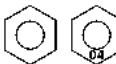
- Indicated capacities of water and oil are manufacturer's estimate.

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5. TIGHTENING TORQUES

[1] GENERAL USE SCREWS, BOLTS AND NUTS

Tighten screws, bolts and nuts whose tightening torques are not specified in this Workshop Manual according to the table below.

Indication on top of bolt	 4 No-grade or 4T						 7T						 9T		
Indication on top of nut	  No-grade or 4T												   6T		
Material of opponent part	Ordinariness			Aluminum			Ordinariness			Aluminum			Ordinariness		
Unit	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M6	7.9 to 9.3	0.80 to 0.95	5.8 to 6.8	7.9 to 8.8	0.80 to 0.90	5.8 to 6.5	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31	7.9 to 8.8	0.80 to 0.90	5.8 to 6.5	12.3 to 14.2	1.25 to 1.45	9.05 to 10.4
M8	18 to 20	1.8 to 2.1	13 to 15	17 to 19	1.7 to 2.0	13 to 14	24 to 27	2.4 to 2.8	18 to 20	18 to 20	1.8 to 2.1	13 to 15	30 to 34	3.0 to 3.5	22 to 25
M10	40 to 45	4.0 to 4.6	29 to 33	32 to 34	3.2 to 3.5	24 to 25	48 to 55	4.9 to 5.7	36 to 41	40 to 44	4.0 to 4.5	29 to 32	61 to 70	6.2 to 7.2	45 to 52
M12	63 to 72	6.4 to 7.4	47 to 53	—	—	—	78 to 90	7.9 to 9.2	58 to 66	63 to 72	6.4 to 7.4	47 to 53	103 to 117	10.5 to 12.0	76.0 to 86.7
M14	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	167 to 191	17.0 to 19.5	123 to 141	—	—	—	197 to 225	20.0 to 23.0	145 to 166	—	—	—	260 to 304	26.5 to 31.0	192 to 224
M18	246 to 284	25.0 to 29.0	181 to 209	—	—	—	275 to 318	28.0 to 32.5	203 to 235	—	—	—	344 to 402	35.0 to 41.0	254 to 296
M20	334 to 392	34.0 to 40.0	246 to 289	—	—	—	368 to 431	37.5 to 44.0	272 to 318	—	—	—	491 to 568	50.0 to 58.0	362 to 419

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[2] STUD BOLTS

Material of opponent part	Ordinariness			Aluminum		
Unit	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M8	12 to 15	1.2 to 1.6	8.7 to 11	8.9 to 11	0.90 to 1.2	6.5 to 8.6
M10	25 to 31	2.5 to 3.2	18 to 23	20 to 25	2.0 to 2.6	15 to 18
M12	30 to 49	3.0 to 5.0	22 to 36	31	3.2	23
M14	62 to 73	6.3 to 7.5	46 to 54	—	—	—
M16	98.1 to 112	10.0 to 11.5	72.4 to 83.1	—	—	—
M18	172 to 201	17.5 to 20.5	127 to 148	—	—	—

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[3] HYDRAULIC FITTINGS

(1) Hydraulic Hose Fittings

Hose size	Thread side	Tightening torque		
		N·m	kgf·m	lbf·ft
02	1/8	13.8 to 15.6	1.40 to 1.60	10.2 to 11.5
03	1/4	22.6 to 27.4	2.30 to 2.80	16.7 to 20.2
04				
05	3/8	45.2 to 52.9	4.60 to 5.40	33.3 to 39.0
06				

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(2) Hydraulic Pipe Cap Nuts

Pipe size	Tightening torque		
	N·m	kgf·m	lbf·ft
φ4 × t1.0	19.7 to 29.4	2.00 to 3.00	14.5 to 21.6
φ6 × t1.0	24.6 to 34.3	2.50 to 3.50	18.1 to 25.3
φ8 × t1.0	29.5 to 39.2	3.00 to 4.00	21.7 to 28.9
φ10 × t1.0	39.3 to 49.0	4.00 to 5.00	29.0 to 36.1
φ12 × t1.5	49.1 to 68.6	5.00 to 7.00	36.2 to 50.6
φ15 × t1.6	108 to 117	11.0 to 12.0	79.6 to 86.7
φ18 × t1.6	108 to 117	11.0 to 12.0	79.6 to 86.7

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(3) Adaptors, Elbows and Others

Item	Thread side	Tightening torque		
		N·m	kgf·m	lbf·ft
Fitting with O-ring	G 1/8	45 to 53	4.5 to 5.5	33 to 39
	G 1/4	74 to 83	7.5 to 8.5	55 to 61
	G 3/8	93.2 to 102	9.50 to 10.5	68.8 to 75.9
	G 1/2	113 to 122	11.5 to 12.5	83.2 to 90.4
Elbow with O-ring	G 1/8	23 to 26	2.3 to 2.7	17 to 19
	G 1/4	36 to 43	3.6 to 4.4	26 to 31
	G 3/8	54 to 63	5.5 to 6.5	40 to 47
	G 1/2	73 to 83	7.4 to 8.5	54 to 61
Adapter	G 1/8	9.8 to 14	1.0 to 1.5	7.3 to 10
	G 1/4	30 to 34	3.0 to 3.5	22 to 25
	G 3/8	49 to 68	5.0 to 7.0	37 to 50
	G 1/2	69 to 88	7.0 to 9.0	51 to 65

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[4] METRIC SCREWS, BOLTS AND NUTS

Grade	 Property class 8.8			 Property class 10.9		
Unit	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M8	24 to 27	2.4 to 2.8	18 to 20	30 to 34	3.0 to 3.5	22 to 25
M10	48 to 55	4.9 to 5.7	36 to 41	61 to 70	6.2 to 7.2	45 to 52
M12	78 to 90	7.9 to 9.2	58 to 66	103 to 117	10.5 to 12.0	76.0 to 86.7
M14	124 to 147	12.6 to 15.0	91.2 to 108	167 to 196	17.0 to 20.0	123 to 144
M16	197 to 225	20.0 to 23.0	145 to 166	260 to 304	26.5 to 31.0	192 to 224

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[5] AMERICAN STANDARD SCREWS, BOLTS AND NUTS WITH UNC OR UNF THREADS

Grade	 SAE GR.5			 SAE GR.8		
Unit	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
1/4	11.7 to 15.7	1.20 to 1.60	8.63 to 11.5	16.3 to 19.7	1.67 to 2.00	12.0 to 14.6
5/16	23.1 to 27.7	2.36 to 2.82	17.0 to 20.5	33 to 39	3.4 to 3.9	25 to 28
3/8	48 to 56	4.9 to 5.7	36 to 41	61 to 73	6.3 to 7.4	45 to 53
1/2	110 to 130	11.3 to 13.2	81.2 to 95.8	150 to 178	15.3 to 18.1	111 to 131
9/16	150 to 178	15.3 to 18.1	111 to 131	217 to 260	22.2 to 26.5	160 to 191
5/8	204 to 244	20.8 to 24.8	151 to 179	299 to 357	30.5 to 36.4	221 to 263

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[6] PLUGS

Shape	Size	Material of opponent part					
		Ordinariness			Aluminum		
		N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
Tapered screw 	R1/8	13 to 21	1.3 to 2.2	9.4 to 15	13 to 19	1.3 to 2.0	9.4 to 14
	R1/4	25 to 44	2.5 to 4.5	18 to 32	25 to 34	2.5 to 3.5	18 to 25
	R3/8	49 to 88	5.0 to 9.0	37 to 65	49 to 58	5.0 to 6.0	37 to 43
	R1/2	58.9 to 107	6.00 to 11.0	43.4 to 79.5	59 to 78	6.0 to 8.0	44 to 57
Straight screw 	G1/4	25 to 34	2.5 to 3.5	18 to 25	—	—	—
	G3/8	62 to 82	6.3 to 8.4	46 to 60	—	—	—
	G1/2	49 to 88	5.0 to 9.0	37 to 65	—	—	—

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6. MAINTENANCE

No.	Item		Service Interval														After since	Refer- ence page		
			50	100	150	200	250	300	350	400	450	500	550	600	650	700				
1	Engine start system	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-23		
2	Wheel bolt torque	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-24		
3	Tie-rod dust cover	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 Hr	G-24		
4	Battery condition	Check		☆		☆		☆		☆		☆		☆		☆	every 100 Hr	G-25	*4	
5	Greasing	—		☆		☆		☆		☆		☆		☆		☆	every 100 Hr	G-27		
6	Fan belt	Adjust		☆		☆		☆		☆		☆		☆		☆	every 100 Hr	G-29		
7	Alternator belt	Adjust		☆		☆		☆		☆		☆		☆		☆	every 100 Hr	G-29		
8	Brake pedal	Adjust		☆		☆		☆		☆		☆		☆		☆	every 100 Hr	G-30		
9	Air cleaner element	Primary element	Clean	☆		☆		☆		☆		☆		☆		☆	every 100 Hr	G-31	*1	
		Replace															every 1 year	G-40	*2	
		Secondary element	Replace														every 1 year	G-40		
10	Fuel line	Check		☆		☆		☆		☆		☆		☆		☆	every 100 Hr	G-31		
		Replace															every 2 years	G-41		
11	Parking brake	Check		☆		☆		☆		☆		☆		☆		☆	every 100 Hr	G-32		
12	Toe-in	Adjust				☆				☆				☆			every 200 Hr	G-32		
13	Fuel tank water	Drain				☆				☆				☆			every 200 Hr	G-33		
14	Power steering line	Check				☆				☆				☆			every 200 Hr	G-33		
		Replace															every 2 years	G-41		
15	Radiator hose and clamp	Check				☆				☆				☆			every 200 Hr	G-34		
		Replace															every 2 years	G-41		
16	Intake air line	Check				☆				☆				☆			every 200 Hr	G-34		
		Replace															every 2 years	G-41	*3	
17	Hydraulic oil filter	Replace	★					☆						☆			every 300 Hr	G-21		
18	Engine oil	Change	★							☆							every 400 Hr	G-21		
19	Engine oil filter	Replace	★							☆							every 400 Hr	G-22		
20	Fuel filter	Replace								☆							every 400 Hr	G-36		
21	Greasing (2WD front wheel hub)	—								☆							every 400 Hr	G-36		
22	Water separator	Clean								☆							every 400 Hr	G-37		
23	Transmission fluid	Change	★											☆			every 600 Hr	G-22		
24	Front differential case oil	Change												☆			every 600 Hr	G-37		

No.	Item		Service Interval														After since	Refer- ence page		
			50	100	150	200	250	300	350	400	450	500	550	600	650	700				
25	Front axle gear case oil	Change												☆			every 600 Hr	G-38		
26	Front axle pivot	Adjust												☆			every 600 Hr	G-38		
27	Engine valve clearance	Adjust															every 800 Hr	G-38		
28	Fuel injector nozzle tip	Check															every 1500 Hr	G-38		
29	Oil separator element	Replace															every 1500 Hr	G-39		
30	PCV (Positive Crankcase Ventilation) valve (Oil separator)	Check															every 1500 Hr	G-39		
31	EGR cooler	Check Clean															every 1500 Hr	G-39		
32	EGR system	Check Clean															every 3000 Hr	G-39		
33	Turbocharger	Check															every 3000 Hr	G-39		
34	Supply pump	Check															every 3000 Hr	G-39		
35	Intake air heater	Check															every 3000 Hr	G-40		
36	DPF muffler	Clean															every 3000 Hr	G-40		
37	Exhaust manifold	Check															every 1 year	G-40		
38	DPF differential pressure sensor pipe	Check															every 1 year	G-40		
39	EGR pipe	Check															every 1 year	G-40		
40	Cooling system	Flush															every 2 years	G-41		
41	Coolant	Change															every 2 years	G-41		
42	PCV (Positive Crankcase Ventilation) valve hose	Replace															every 2 years	G-44		
43	DPF differential pressure sensor hose	Replace															every 2 years	G-44		
44	Boost sensor hose	Replace															every 2 years	G-44		
45	Master cylinder filter	Clean															every 2 years	G-44		
46	Master cylinder kit	Replace															every 2 years	G-44		
47	Equalizer kit	Replace															every 2 years	G-44		
48	Brake seal 1 and 2	Replace															every 2 years	G-44		
49	Lift cylinder hose	Replace															every 2 years	G-44		
50	Fuel system	Bleed															Service as re- quired	G-45		
51	Brake system	Bleed																G-45		
52	Clutch housing water	Replace																G-45		
53	Fuse	Replace																G-46		
54	Light bulb	Replace																G-49		

No.	Item		Service Interval														After since	Refer- ence page		
			50	100	150	200	250	300	350	400	450	500	550	600	650	700				
1	Inner air filter	Clean				☆				☆				☆			every 200 Hr	G-35		
2	Fresh air filter	Clean				☆				☆				☆			every 200 Hr	G-35		
3	Air conditioner condenser	Clean				☆				☆				☆			every 200 Hr	G-36		
4	Air conditioner pipes and hoses	Check															every 1 year	G-40		
		Replace															every 2 years	G-44		
5	CABIN isolation cushion	Check															every 1 year	G-40		
6	Washer liquid	Add															Service as re- quired	G-50		
7	Refrigerant (gas)	Check																G-50		

■ **IMPORTANT**

- The jobs indicated by ★ must be done after the first 50 hours of operation.
- *1: Air cleaner should be cleaned more often in dusty conditions than in normal conditions.
- *2: Every year or every 6 times of cleaning.
- *3: Replace only if necessary.
- *4: When the battery is used for less than 100 hours per year, check the battery condition by reading the indicator annually.

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7. CHECK AND MAINTENANCE



CAUTION

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

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[1] DAILY CHECK

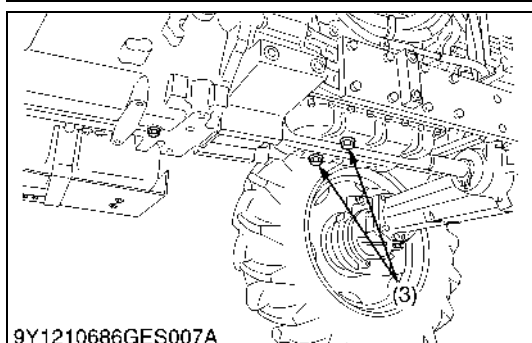
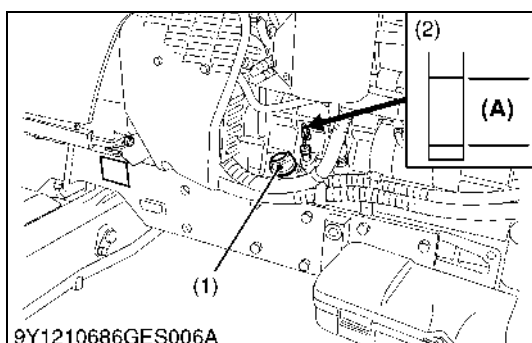
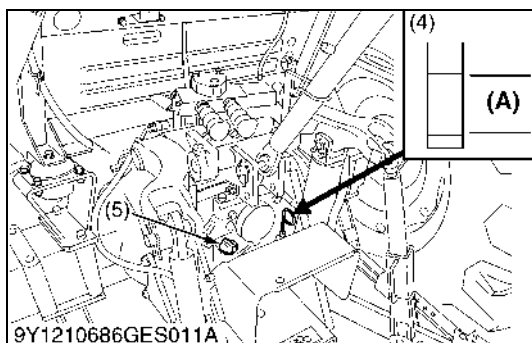
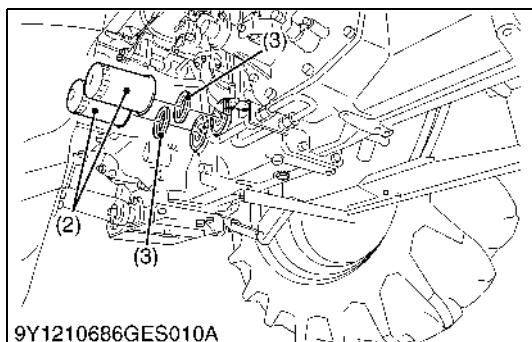
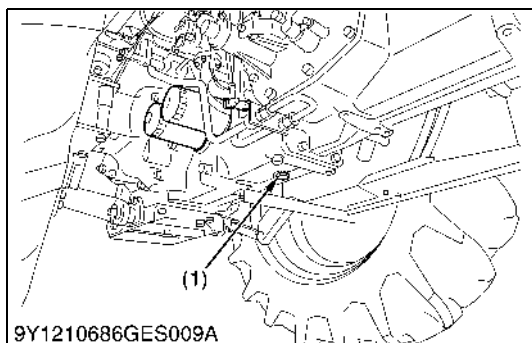
To prevent trouble from occurring, it is important to know the condition of the tractor. Check the following items before starting.

Checking

- Check areas where previous trouble was experienced.
 - Walk around the tractor.
1. Check the tire pressure, and check for wear and damage.
 2. Check and refueling.
 3. Check for oil and water leak.
 4. Check the engine oil level.
 5. Check the transmission fluid level.
 6. Check the coolant level.
 7. Check the condition of ROPS attaching hardware. (ROPS model).
 8. Check the washer liquid level. (CABIN model)
 9. Check the water separator.
 10. Clean the air cleaner evacuator valve.
 11. Check and clean the radiator screen, grill, oil cooler, and battery mount.
 12. Check and clean the air conditioner condenser screen. (CABIN model)
 13. Check the DPF muffler.
 14. Check the nuts of tires are tight.
 15. Check the number plate for damage and replace as necessary if equipped.
 16. Care of danger, warning and caution labels (pictorial safety labels).
 17. Clean around the exhaust manifold and the muffler of the engine.
- While sitting in the operator's seat.
1. Check the throttle pedal, brake pedal and clutch pedal.
 2. Check the throttle lever and shuttle lever.
 3. Check the parking brake.
 4. Check the steering wheel.
 5. Check the seat belt.
- Turning the key switch.
1. Check the performance of the Easy Checker™ lights.
 2. Check the head lights, turn signal lights, hazard lights and other light equipment. Clean if necessary.
 3. Check the performance of the meters and gauges.
- Starting the engine.
1. Check to see that the lights on the Easy Checker™ go off.
 2. Check the color of the exhaust gas.
 3. Check the brakes for proper operation.

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[2] CHECK POINTS OF INITIAL 50 HOURS



Replacing Hydraulic Oil Filter

⚠ CAUTION

- Allow engine to cool down sufficiently, oil can be hot and can burn.

1. Remove the drain plug (1) at the bottom of the transmission case and drain the oil completely into the oil pan.
2. After draining reinstall the drain plug (1).
3. Remove the two oil filters (2).
4. Wipe off metal fillings from the magnetic filters (3) with a clean rag.
5. Put a film of clean transmission fluid on rubber seal of new filters.
6. Tighten the filter quickly until it contacts the mounting surface. Tighten filter by hand and additional 1/2 turn only.
7. After the new filter has been replaced, fill with the oil up to the upper notch on the dipstick (4).
8. After running the engine for a few minutes, stop it and check the oil level again, add oil to the prescribed level.
9. Make sure that the transmission fluid doesn't leak through the seal.

■ IMPORTANT

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

- (1) Drain Plug
(2) Hydraulic Oil Filter
(3) Magnetic Filter (Wipe off Metal Fillings)
(4) Dipstick
(5) Oil Filling Plug

(A) Oil level is acceptable within this range.

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Changing Engine Oil

⚠ CAUTION

- Before changing oil, be sure to stop the engine.
- Allow engine to cool down sufficiently, oil can be hot and can burn.

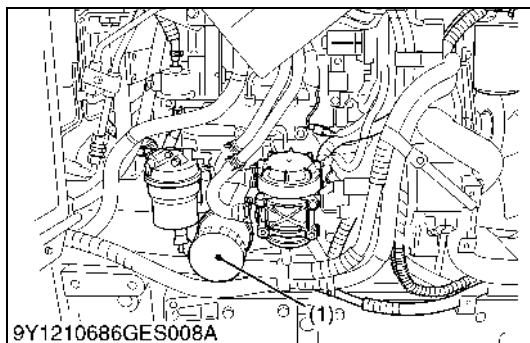
1. To drain the used oil, remove the drain plugs (3) at the bottom of the engine and drain the oil completely into the oil pan. All the used oil can be drained out easily when the engine is still warm.
2. After draining reinstall the drain plugs (3).
3. Fill with the new oil up to the upper notch on the dipstick (2). (See page G-12.)

Engine oil (with filter)	Capacity	10.7 L 11.3 U.S.qts 9.41 Imp.qts
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- (1) Oil Inlet
(2) Dipstick
(3) Drain Plugs

(A) Oil level is acceptable within this range.

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Replacing Engine Oil Filter

⚠ CAUTION

- Be sure to stop the engine before changing oil filter cartridge.
- Allow engine to cool down sufficiently, oil can be hot and can burn.

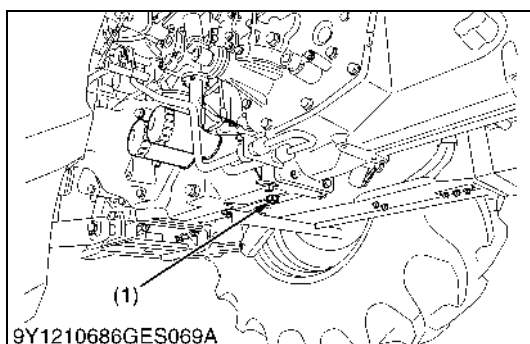
1. Remove the oil filter (1).
2. Put a film of clean engine oil on rubber seal of new filter.
3. Tighten the filter quickly until it contacts the mounting surface. Tighten filter by hand an additional 1/2 turn only.
4. After the new filter has been replaced, the engine oil normally decreases a little. Make sure that the engine oil does not leak through the seal and be sure to check the oil level on the dipstick. Then, replenish the engine oil up to the prescribed level.

■ IMPORTANT

- To prevent serious damage to the engine, use only a KUBOTA genuine filter.

(1) Engine Oil Filter

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Changing Transmission Fluid

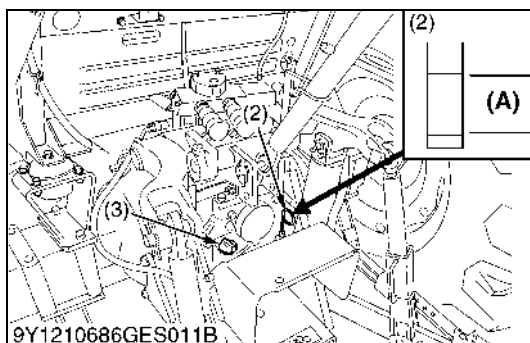
⚠ CAUTION

- Allow engine to cool down sufficiently, oil can be hot and can burn.

1. To drain the used oil, remove the drain plug (1) at the bottom of the transmission case and drain the oil completely into the oil pan.
2. After draining reinstall the drain plug.
3. Fill with the new KUBOTA SUPER UDT fluid up to the upper notch on the dipstick (2). (See page G-12.)
4. After running the engine for a few minutes, stop it and check the oil level again; add oil to prescribed level.

■ IMPORTANT

- Do not operate the tractor immediately after changing the transmission fluid. Run the engine at medium speed for a few minutes to prevent damage to the transmission.



Transmission fluid	Capacity	60.0 L 63.4 U.S.qts 52.8 Imp.qts
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(1) Drain Plug

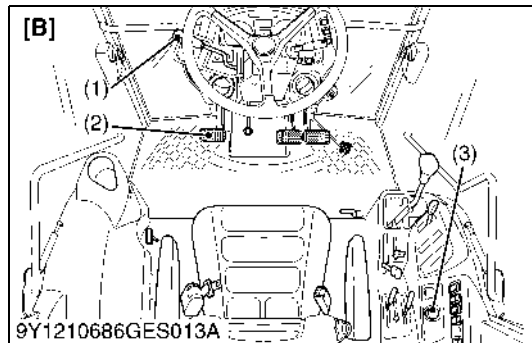
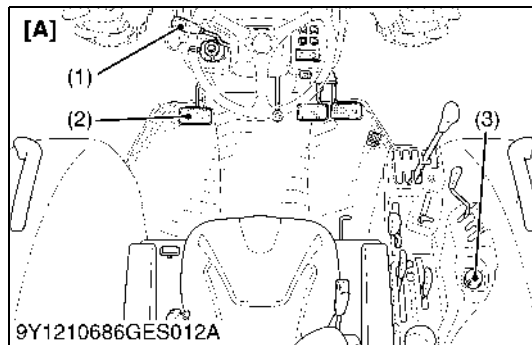
(2) Dipstick

(3) Oil Inlet

(A) Oil level is acceptable within the range.

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[3] CHECK POINTS OF EVERY 50 HOURS



Checking Engine Start System



To avoid personal injury:

- 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. Set the PTO clutch control switch (3).
5. Turn the key to "START" position.
6. The engine must not crank.
7. If it cranks, inspect the safety switch.

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

1. Sit on operator's seat.
2. Set the PTO clutch control switch (3).
3. Depress the clutch pedal (2) fully.
4. Shift the shuttle shift lever (1) to the neutral position.
5. Turn the key to "START" position.
6. The engine must not crank.
7. If it cranks, inspect the safety switch.

■ Test 3: Checking Operator Presence Control (OPC) System.

1. Sit on the operator's seat.
2. Make sure the PTO drive shaft is disconnected from any attached implement.
3. Start the engine.
4. Engage the PTO clutch control switch. The PTO should begin to rotate. Disengage the PTO clutch control switch.
5. While lifting yourself from the seat, engage the PTO clutch control switch.
 - a) The PTO should begin to rotate and a buzzer should sound.
 - b) Disengage the PTO clutch control switch.
 - c) If the buzzer does not sound, shut off the engine.
6. If the PTO or OPC is operating properly, shut off the engine, and reconnect the implement drive shaft to the PTO. Restart the engine per the available instructions.



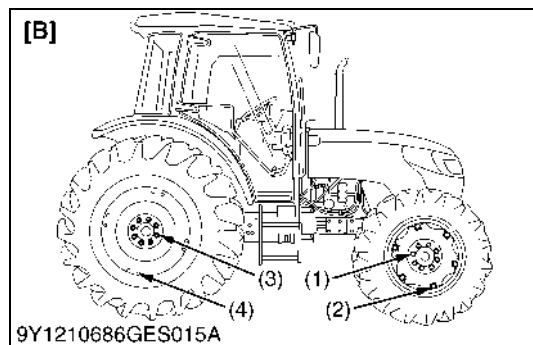
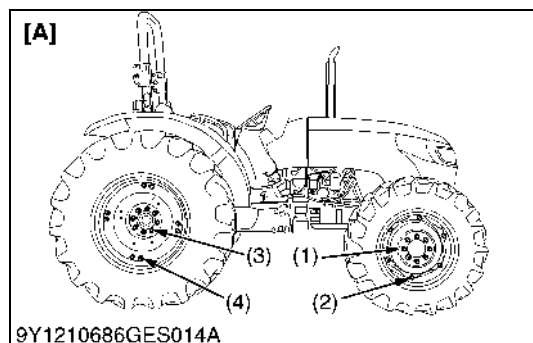
To avoid serious injury or death:

- Before checking the PTO or OPC, make sure that the PTO drive shaft should be disconnected from the tractor.
- The unit should not be operated until servicing is completed.

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

[A] ROPS Model
 [B] CABIN Model

9Y1210686GEG0059US0



Checking Wheel Mounting Nuts Tightening Torque

⚠ CAUTION

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

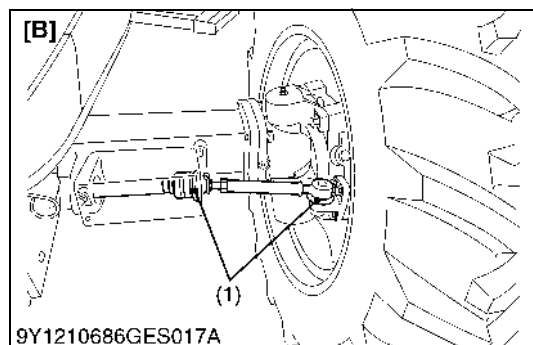
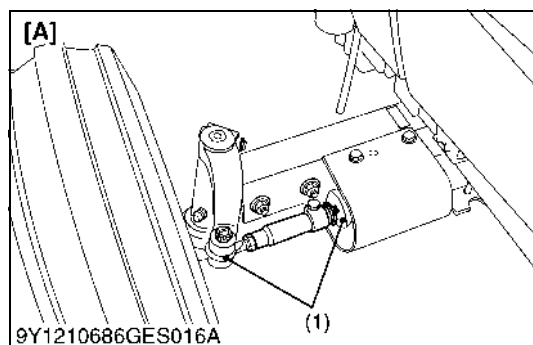
1. Check the wheel mounting nuts regularly especially when new. If there are loosened, tighten as follows.

Tightening torque	Front wheel mounting nut	M16	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 lbf·ft
	Rear wheel mounting nut	M18	343 to 401 N·m 35.0 to 41.0 kgf·m 254 to 297 lbf·ft
	Front and rear disk mounting nut (Both steel disk and cast iron disk)	M16	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 lbf·ft

- (1) Front Wheel Mounting Nut
- (2) Front Disk Mounting Nut
- (3) Rear Wheel Mounting Nut
- (4) Rear Disk Mounting Nut

[A] ROPS Model
[B] CABIN Model

9Y1210686GEG0060US0



Checking Tie-rod Dust Cover

1. Check to see the dust covers (1) are not damaged.
2. If the dust covers (1) are damaged, exchange them.

■ IMPORTANT

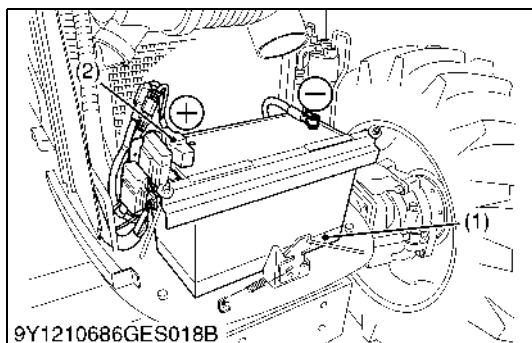
- If the dust cover is cracked, water and duct invade into tie-rod and it will be early wear.

- (1) Dust Cover

[A] 2WD Model
[B] 4WD Model

9Y1210686GEG0061US0

[4] CHECK POINTS OF EVERY 100 HOURS



Checking Battery Condition

⚠ DANGER

To avoid the possibility of battery explosion:

For the refillable type battery, follow the instructions below.

- Do not use or charge the refillable type battery if the fluid level is below the LOWER (lower limit level) mark. Otherwise, the battery component parts may prematurely deteriorate, which may shorten the battery's service life or cause an explosion. Check the fluid level regularly and add distilled water as required so that the fluid level is between the UPPER and LOWER level.

⚠ CAUTION

To avoid personal injury:

- Never remove the battery cap while the engine is running.
- Keep electrolyte away from eyes, hands and clothes. If you are splattered with it, wash it away completely with water immediately and get medical attention.
- Keep open sparks and flames away from the battery at all times. Hydrogen gas mixed with oxygen becomes very explosive.
- Wear eye protection and rubber gloves when working around battery.

■ NOTE

- The factory-installed battery is of non-refillable type. If the indicator turns white, do not charge the battery but replace it with new one.
1. Mishandling the battery shortens the service life and adds to maintenance costs.
 2. The original battery is maintenance free, but needs some servicing.
 3. If the battery is weak, the engine will be difficult to start and the lights will be dim. It is important to check the battery periodically.

■ How to read the indicator

1. Check the battery condition by reading the indicator.

State of indicator display	
Green	Specific gravity of electrolyte and quality of electrolyte are both in good condition.
Black	Needs charging battery.
White	Needs replacing battery.

(1) Battery

(2) Indicator

(To be continued)

(Continued)

■ Battery Charging



CAUTION

To avoid personal injury:

- When the battery is being activated, hydrogen and oxygen gases in the battery are extremely explosive. Keep open sparks and flames away from the battery at all times, especially when charging the battery.
- When charging the battery, ensure the vent caps are securely in place. (If equipped.)
- When disconnecting the cable from the battery, start with the negative terminal first.

When connecting the cable to the battery, start with the positive terminal first.

- Never check battery charge by placing a metal object across the posts.

Use a voltmeter or hydrometer.

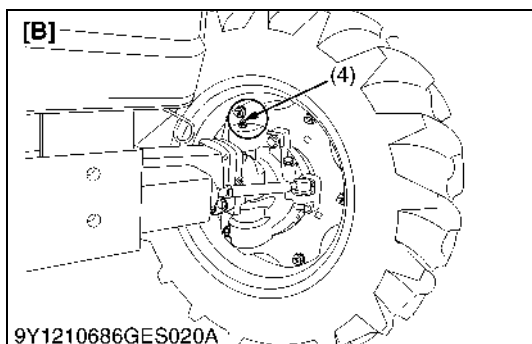
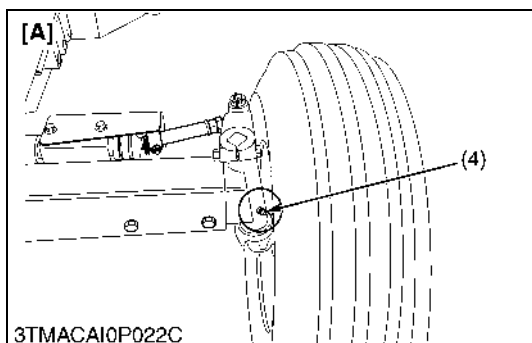
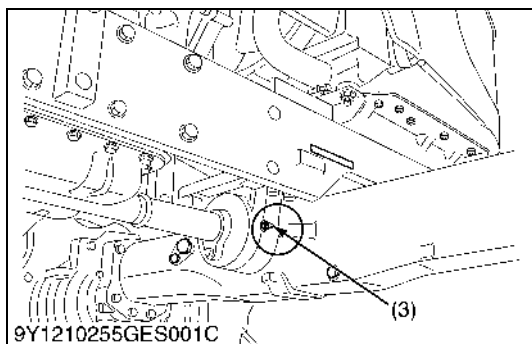
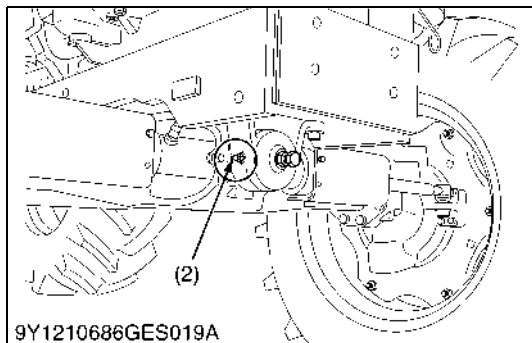
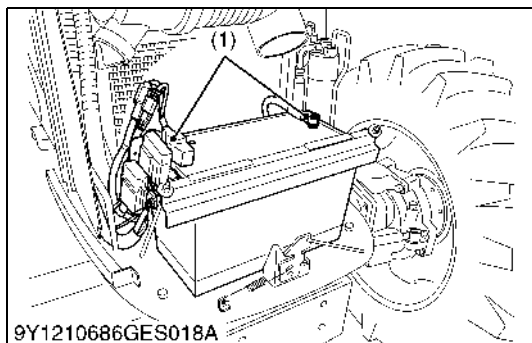
1. To slow charge the battery, connect the battery positive terminal to the charger positive terminal and the negative to the negative, then recharge in the standard fashion.
2. A boost charge is only for emergencies. It will partially charge the battery at a high rate and in a short time.
When using a boost-charged battery, it is necessary to recharge the battery as early as possible.
3. The battery is charged if the indicator display turns green from black.
4. When exchanging an old battery for a new one, use battery of equal specification below.

Battery type	Volts (V)	Capacity (at 5HR (A.H))	Reserve capacity (min.)	Cold Cranking Amps (SAE)	Normal Charging Rate (A)
GP31 (105E41R)	12	80	160	900	11

■ Directions for Storage

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

9Y1210686GEG0062US0

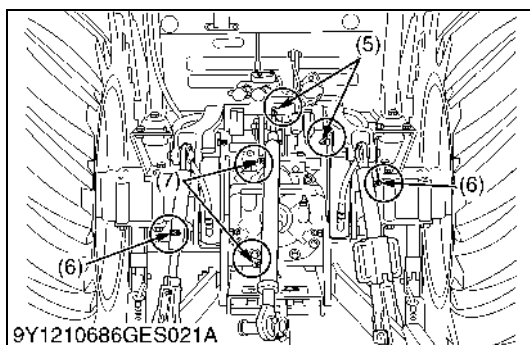


Lubricating Grease Fittings

1. Apply a small amount of multipurpose grease to following points every 100 hours.
2. If you operated the machine in extremely wet and muddy condition, lubricate grease fittings more often.

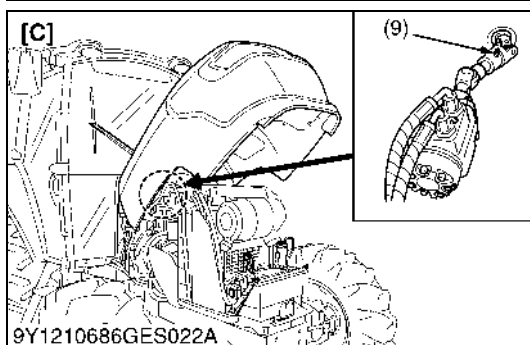
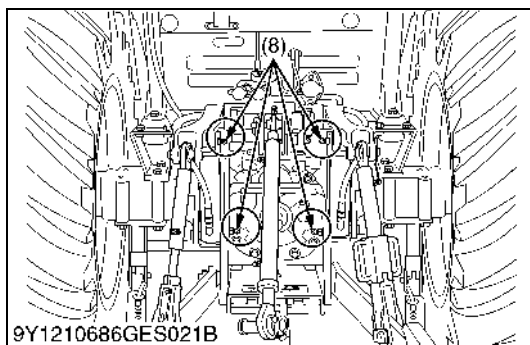
- | | |
|--|---------------|
| (1) Battery Terminals | [A] 2WD Model |
| (2) Grease Fitting (Front Axle Support) | [B] 4WD Model |
| (3) Grease Fitting (Front Axle Support) | |
| (4) Grease Fitting (Front Axle Gear Case Support) [R.H., L.H.] | |

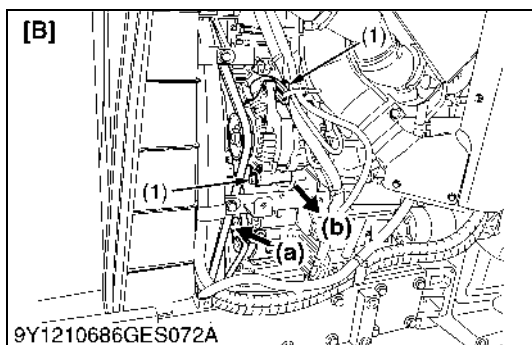
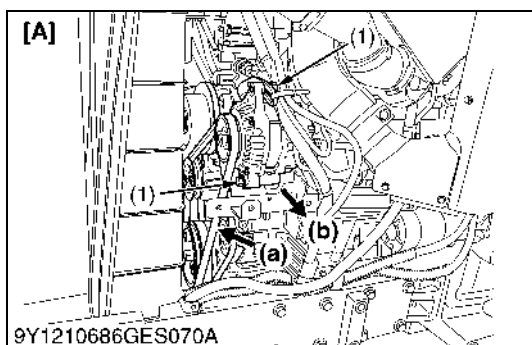
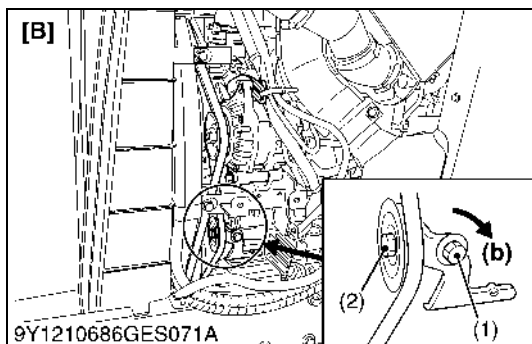
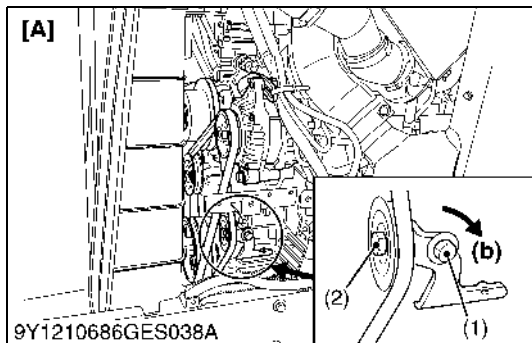
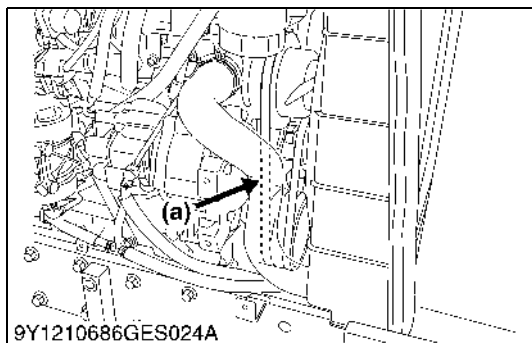
(To be continued)

(Continued)

- (5) Grease Fitting (Top Link Bracket) **[C] CABIN Model**
- (6) Grease Fitting (Lifting Rod)
- (7) Grease Fitting (Top Link)
- (8) Grease Fitting (Hydraulic Lift Cylinders Pin)
- (9) Steering Joint Shaft

9Y1210686GEG0064US0





Adjusting Fan Belt Tension



CAUTION

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

Belt tension	Factory specification	10 to 12 mm 0.39 to 0.47 in.
--------------	-----------------------	---------------------------------

1. Stop the engine and remove the key.
2. Apply moderate thumb pressure to belt between pulleys.
3. If tension is incorrect, loosen the tension pulley mounting nut (2) and turn the adjusting bolt (1) to adjust the belt tension within acceptable limits.
4. Replace fan belt if it is damaged.

- (1) Adjusting Bolt
(2) Tension Pulley Mounting Nut

- (a) Check the belt tension
(b) To tighten
[A] ROPS Model
[B] CABIN Model

9Y1210686GEG0065US0

Alternator Belt



CAUTION

To avoid personal injury :

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

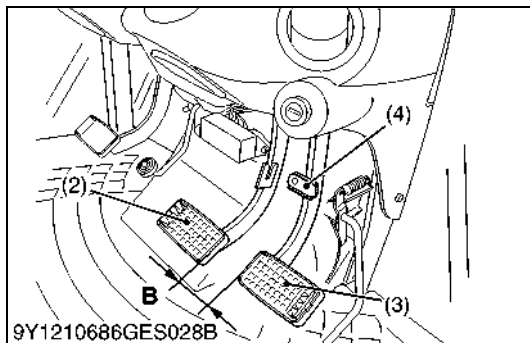
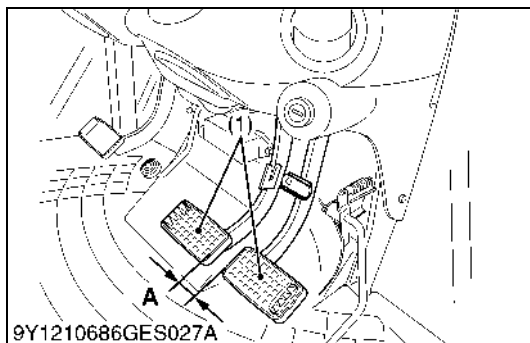
1. Stop the engine and remove the key.
2. Apply moderate thumb pressure to belt between pulleys.
3. If tension is incorrect, loosen the alternator mounting bolts and, using a lever placed between the alternator and the engine block, pull the alternator out until the deflection of the belt falls within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

Proper alternator belt tension	Factory specification	10 to 12 mm 0.39 to 0.47 in.
--------------------------------	-----------------------	---------------------------------

- (1) Bolt

- (a) Check the belt tension
(b) To tighten
[A] ROPS Model
[B] CABIN Model

9Y1210686GEG0066US0



Adjusting Brake Pedal



CAUTION

To avoid personal injury :

- Stop the engine and chock the wheels before checking brake pedal.
- To prevent uneven braking, the specification must be within the recommended limit.

■ Checking the brake pedal free travel

1. Set the parking brake.
2. Slightly depress the brake pedals and measure free travel at the top of pedal stroke.

■ NOTE

- Brake pedals should be equal when depressed.

Proper brake pedal free travel "A"	Factory specification	7 to 14 mm 0.3 to 0.6 in.
------------------------------------	-----------------------	------------------------------

■ Checking the brake pedal stroke

1. Disengage the brake pedal lock.
2. Depress the brake pedal several times.
3. Step on the right-hand pedal and measure the level difference (pedal stroke) between this pedal and the left-hand pedal.
4. Do the same for the left-hand pedal.

Pedal stroke "B"	Factory specification	Less than 100 mm 3.9 in.
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■ Checking the equalizer working level (anti-imbalance device)

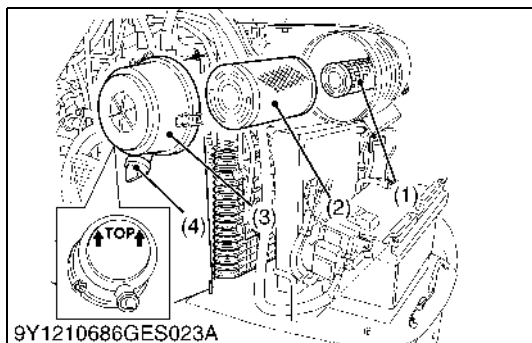
1. Gently step on both brake pedals at once.
2. Further step on the right-hand pedal (the left-hand pedal slightly raises itself) and measure the level difference between the pedals.
3. Do the same for the left-hand pedal.

Equalizer working level	Factory specification	Level difference of over 5 mm (0.2 in.) between both pedals.
-------------------------	-----------------------	--

- (1) Brake Pedal
- (2) Brake Pedal (L.H.)
- (3) Brake Pedal (R.H.)
- (4) Brake Pedal Lock

A: Free Travel
B: Pedal Stroke

9Y1210686GEG0067US0



Cleaning Air Cleaner Element

1. Remove the air cleaner cover (3) 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 205 kPa (2.1 kgf/cm², 30 psi).
 - When carbon or oil adheres to the element, soak the element in detergent for 15 minutes then wash it several times in water, rinse with clean water and dry it naturally. After element is fully dried, inspect inside of the element with a light and check if it is damaged or not.
3. Replace the primary element (2):
Once a year or after every six times of cleaning, whichever comes first.

■ NOTE

- Check to see if the evacuator valve is blocked with dust.

■ IMPORTANT

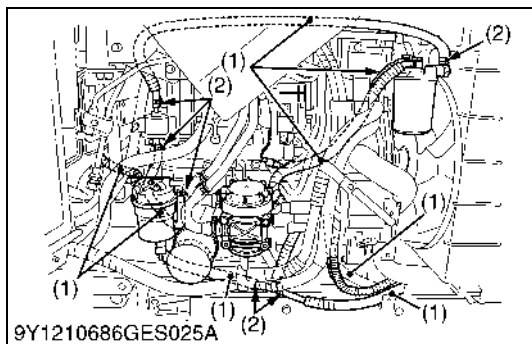
- The air cleaner uses a dry element, never apply oil.
- Do not run the engine with filter element removed.
- Be sure to refit the dust cup with the arrow ↑ (on the rear of cup) upright. If the dust cup is improperly fitted, evacuator valve will not function and dust will adhere to the element.
- Do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

■ Evacuator Valve

Open 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 | (3) Cover |
| (2) Primary Element | (4) Evacuator Valve |

9Y1210686GEG0068US0



Checking Fuel Line

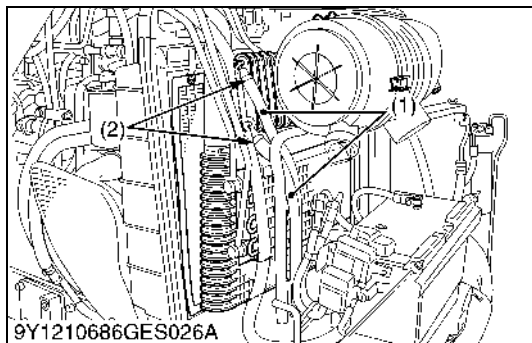
1. Check to see that all lines and hose clamps are tight and not damaged.
2. If hoses and clamps are found worn or damaged, replace or repair them at once.

■ NOTE

- If the fuel line is removed, be sure to properly bleed the fuel system. (See page G-45.)

- | | |
|---------------|----------------|
| (1) Fuel Line | (2) Clamp Band |
|---------------|----------------|

9Y1210686GEG0069US0



Checking Parking Brake**CAUTION**

- Do not dismount the tractor while checking the parking brake.

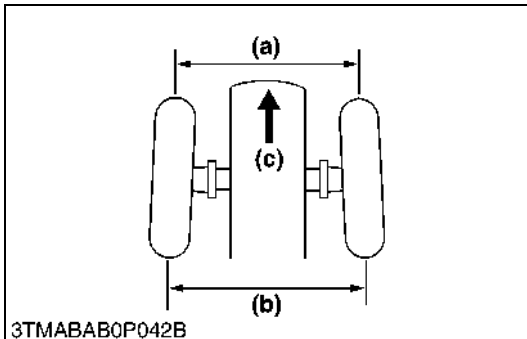
1. Confirm the tractor (tractor unit only) can surely be parked on the slope of about 15 degrees (Slope that rises by 2.7 meters every 10 meters).

Always engage the parking brake before dismounting the tractor.

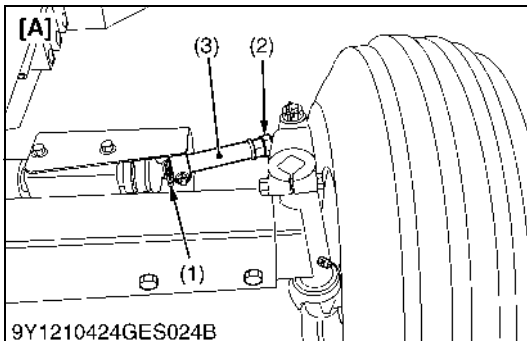
■ **NOTE**

- To check and adjusting for parking brake lever (refer to 4-S7).

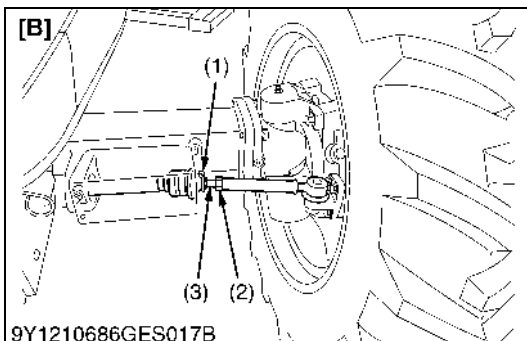
9Y1210686GEG0071US0

[5] CHECK POINTS OF EVERY 200 HOURS

3TMABAB0P042B



9Y1210424GES024B



9Y1210686GES017B

Adjusting Toe-in

1. Park tractor on a flat place.
2. Turn steering wheel so front wheels are in the straight ahead position.
3. Lower the implement, lock the park brake and stop the engine.
4. Measure distance between tire beads at front of tire, hub height.
5. Measure distance between tire beads at rear of tire, hub height.
6. Front distance should be shorter than rear distance.
7. If not, adjust tie-rod length.

Toe-in (b-a)	Factory specification	2WD	1.0 to 5.0 mm 0.040 to 0.19 in.
		4WD	2.0 to 8.0 mm 0.08 to 0.31 in.

Tightening torque	Tie-rod nut	167 to 196 N·m 17.0 to 20.0 kgf·m 123 to 144 lbf·ft
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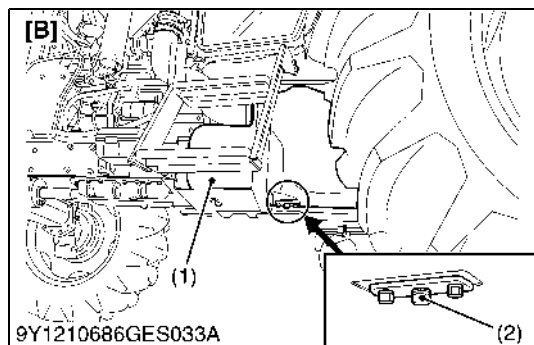
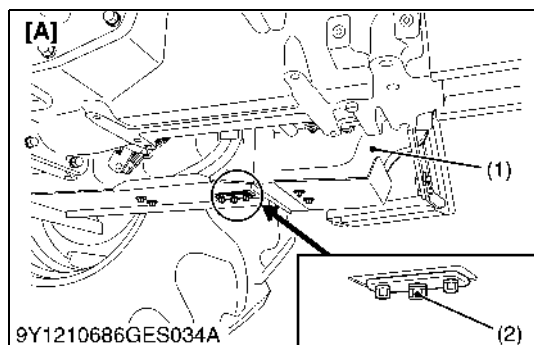
■ **Toe-in Adjustment**

1. Detach the snap ring (1).
2. Loosen the tie-rod nut (2).
3. Turn the tie-rod joint (3) to adjust 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.

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

- (a) Wheel-to-wheel distance at front
(b) Wheel-to-wheel distance at rear
(c) "FRONT"
[A] 2WD Model
[B] 4WD Model

9Y1210686GEG0072US0



Draining Fuel Tank Water

1. Loosen the drain plug (2) at the bottom of the fuel tank (1) to let sediments, impurities and water out of the tank. Finally tighten up the plug.

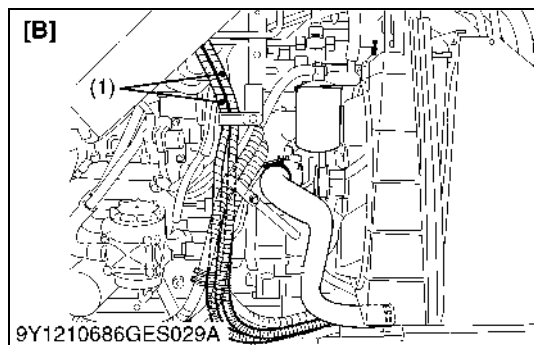
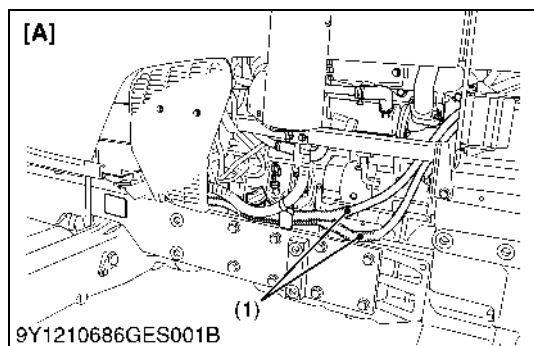
■ IMPORTANT

- If the fuel contains poor qualities with much water in it, drain the fuel tank at shorter intervals.
- Drain the fuel tank before operating the tractor after a long period of storage.
- The fuel tank is made of plastic. Be careful not to overtighten the bolts.

- (1) Fuel Tank
(2) Drain Plug

- [A] ROPS Model
[B] CABIN Model

9Y1210686GEG0073US0



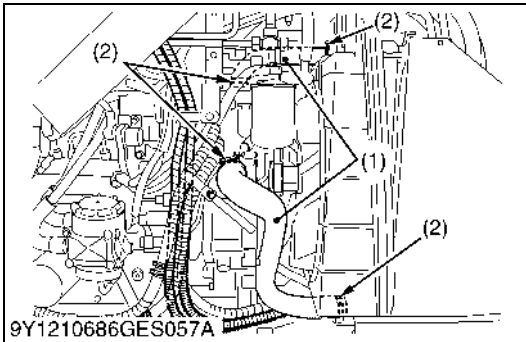
Checking Power Steering Line

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

- (1) Power Steering Hose
(2) Clamp

- [A] ROPS Model
[B] CABIN Model

9Y1210686GEG0075US0



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 hose clamp (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

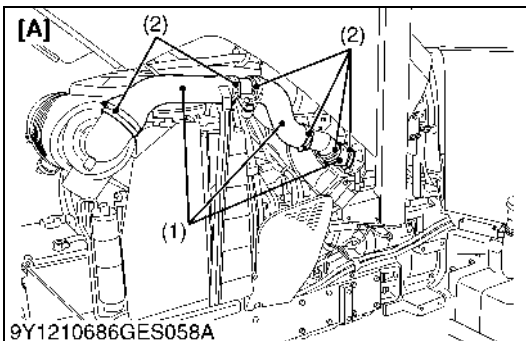
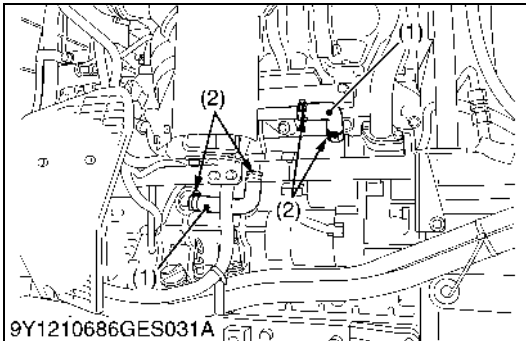
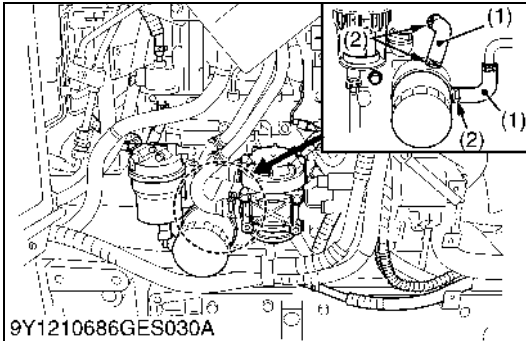
Take the following actions in the event the coolant temperature be nearly or more than the boiling point, what is called "Overheating".

1. Stop the machine operation in a safe place and keep the engine unloaded idling.
2. Do not 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 (refer to "1. TROUBLESHOOTING" on page 1-S1) and then start again the engine.

(1) Radiator Hose

(2) Clamp

9Y1210686GEG0076US0



Checking Intake Air Line

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

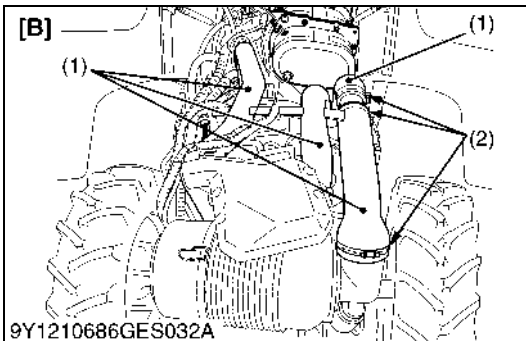
(1) Hose

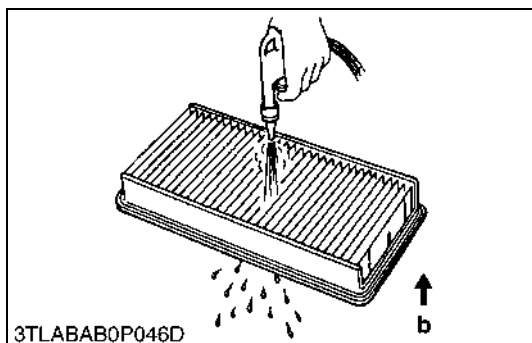
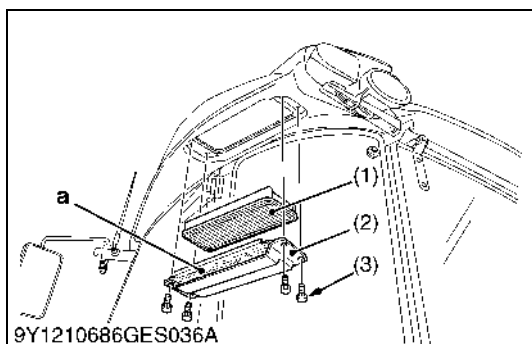
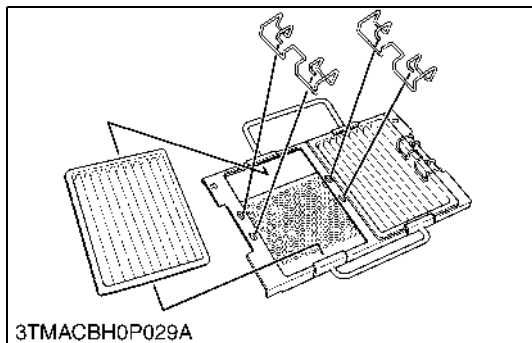
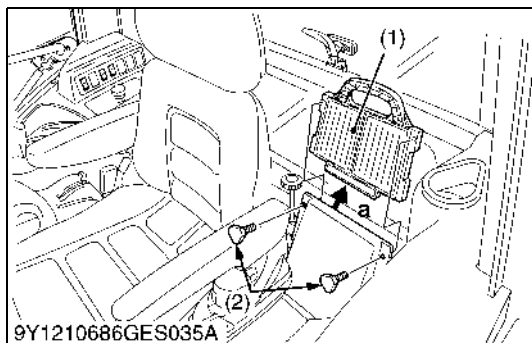
(2) Clamp

[A] M8560 Model

[B] M9960 Model

9Y1210686GEG0074US0





Cleaning Inner Air Filter (CABIN Model)

1. Remove the knob bolt (2) and pull out the filter (1).
2. Blow air from the direction opposite to the filter's normal air flow. Pressure of compressed air must be under 210 kPa (2.1 kgf/cm², 30 psi).

■ **NOTE**

- **Attach the filter as the illustration.**

- (1) Inner Air Filter
(2) Knob Bolt

a: Pull Out

9Y1210686GEG0077US0

Cleaning Air Filter (CABIN Model)

■ **Fresh Air Filter**

1. Remove the knob bolts (3) and pull out the fresh air filter (1).
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**

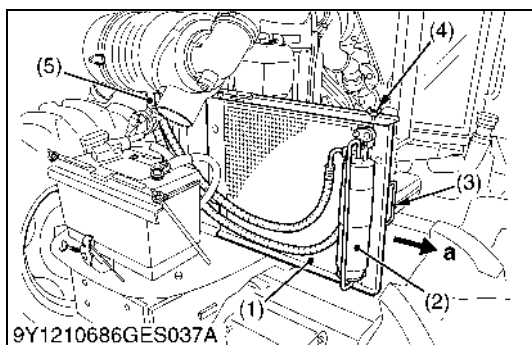
- Do not use gasoline, thinner or similar chemicals to clean the filter as damage to the filter may occur.
- If may also cause an unpleasant odor in the cabin when the system is used next.
- Do not hit the filter. If the filter becomes deformed, dust may enter into the air-conditioner, which may cause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

- (1) Fresh Air Filter
(2) Cover
(3) Knob Bolt

a: Air Inlet Port

b: Air Conditioner Air Flow

9Y1210686GEG0078US0



Checking Air Conditioner Condenser (CABIN Model)

1. Loosen the wing nut (4).
2. Hold the handle (3), slide out the air conditioner condenser (1) assembly toward yourself.



CAUTION

To avoid personal injury :

- Be sure to stop the engine before removing the screen.
- The condenser and receiver become hot while the air conditioner is running. Before checking or cleaning them, wait long enough until they cool down.

■ IMPORTANT

- Do not hold the air conditioner receiver or the air conditioner pipes when sliding out the condenser for cleaning.

- (1) Air Conditioner Condenser
(2) Receiver
(3) Handle

- (4) Wing Nut
(5) Air Condenser Hose
(6) Air Conditioner Condenser Screen

9Y1210686GEG0079US0

[6] CHECK POINTS OF EVERY 300 HOURS

Replacing Hydraulic Oil Filter

1. See page G-21.

9Y1210686GEG0081US0

[7] CHECK POINTS OF EVERY 400 HOURS

Changing Engine Oil

1. See page G-21.

9Y1210686GEG0082US0

Replacing Engine Oil Filter

1. See page G-22.

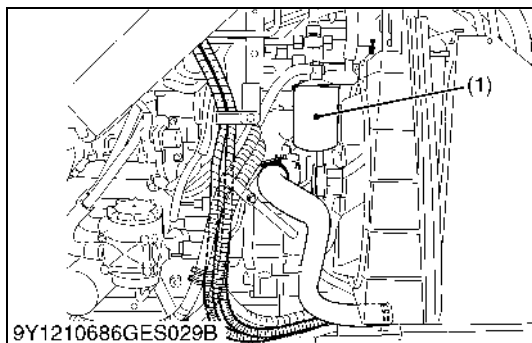
9Y1210686GEG0149US0

Replacing Fuel Filter

1. Remove the fuel filter (1).
2. Put a film of clean fuel on rubber seal of new filter.
3. Tighten the filter until it contacts the mounting surface. Tighten filter by hand an additional 1/2 turn only.
4. Bleed the fuel system. (See page G-45.)

- (1) Fuel Filter

9Y1210686GEG0084US0

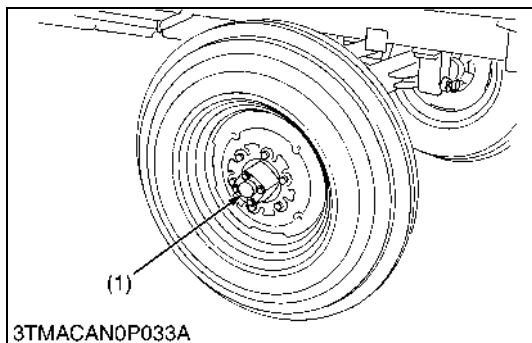


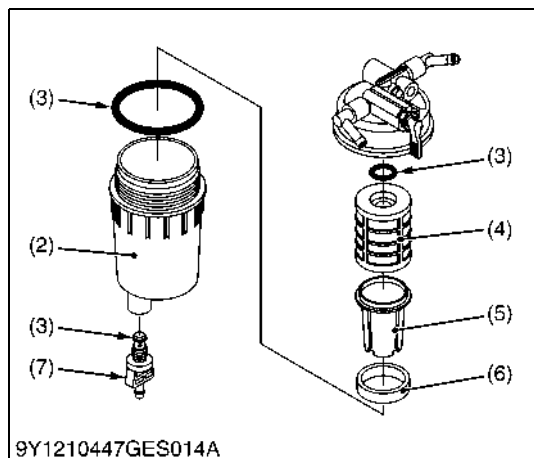
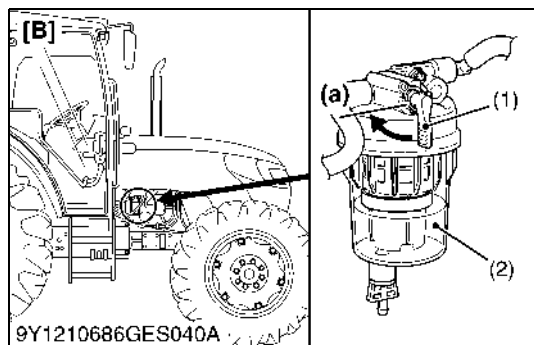
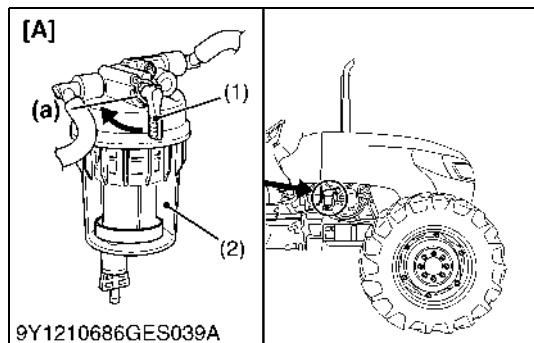
Lubricating Grease Fitting (2WD Model)

1. Detach the cover, and apply bearing grease.

- (1) Front Wheel Hub Cover

9Y1210686GEG0083US0





Cleaning Water Separator

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

1. Close the fuel cock (1).
2. Remove the cup (2), and rinse the inside with kerosene.
3. Take out the element (4) and dip it in the kerosene to rinse.
4. After cleaning, reassemble the water separator, keeping out dust and dirt.
5. Bleed the fuel system. (See page G-45.)

■ IMPORTANT

- If the water separator and/or fuel filter is not well maintained, the supply pump and injector may be damaged earlier than expected.

- (1) Fuel Cock
- (2) Cup
- (3) O-ring
- (4) Element
- (5) Element Cup
- (6) Red Float
- (7) Drain Plug

- (a) Close
- [A] ROPS Model
- [B] CABIN Model

9Y1210686GEG0085US0

[8] CHECK POINTS OF EVERY 600 HOURS

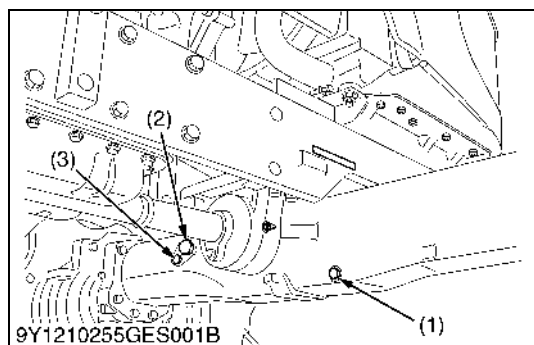
Changing Transmission Fluid

1. See page G-22.

9Y1210686GEG0086US0

Changing Front Differential Case Oil

1. To drain the used oil, remove the drain and filling plug at the front differential case and drain the oil completely into the oil pan.
2. After draining reinstall the drain plug (1).
3. Remove the oil level check plug (3).
4. Fill with the new oil up to the lower rim of check plug port (3). (See page G-12.)
5. After filling reinstall the filling plug and check plugs.

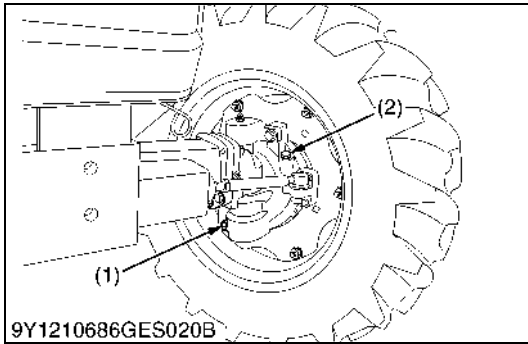


Front differential case oil	Capacity	6.0 L 6.3 U.S.qts 5.3 Imp.qts
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- (1) Drain Plug
- (2) Filling Port

- (3) Check Plug

9Y1210686GEG0087US0



Changing Front Axle Gear Case Oil

1. To drain the used oil, remove the right and left drain plugs (1) and filling plugs (2) at the front axle gear case and drain the oil completely into the oil pan.
2. After draining reinstall the drain plugs.
3. Fill with the new oil up to the filling plug port. (See page G-12.)
4. After filling reinstall the filling plugs (2).

■ NOTE

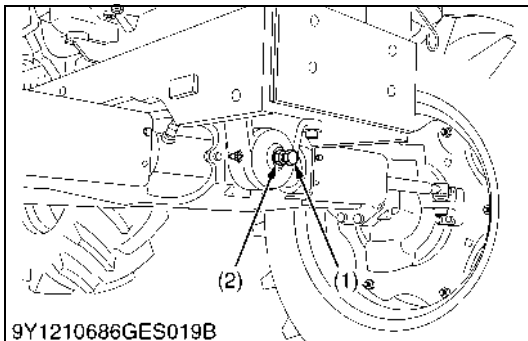
- Check plug is not available for front axle gear case, fill the specified amount of lubricant to the front axle gear case.

Front axle gear case oil	Capacity	3.5 L 3.7 U.S.qts 3.1 Imp.qts
--------------------------	----------	-------------------------------------

(1) Drain Plug

(2) Filling Plug

9Y1210686GEG0088US0



Adjusting Front Axle Pivot

1. If the front axle pivot pin adjustment is not correct, front wheel vibration can occur causing vibration in the steering wheel.

■ Adjusting Procedure

1. Loosen the lock nut (2), screw in the adjusting screw (1) until seated, then tighten the screw (1) with an additional 1/6 turn. Retighten the lock nut (2).

Tightening torque	Lock nut	98.1 to 147.1 N·m 10.0 to 15.0 kgf·m 72.3 to 108.5 lbf·ft
-------------------	----------	---

(1) Adjusting Screw

(2) Lock Nut

9Y1210686GEG0089US0

[9] CHECK POINT OF EVERY 800 HOURS

Adjusting Engine Valve Clearance

1. See page 1-S12.

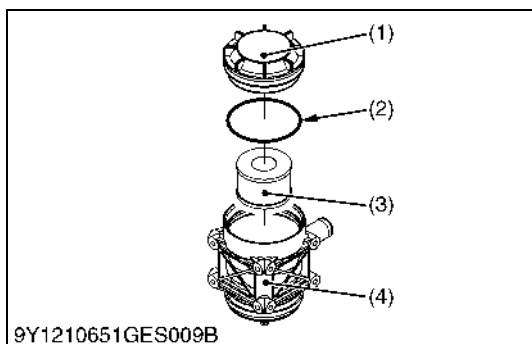
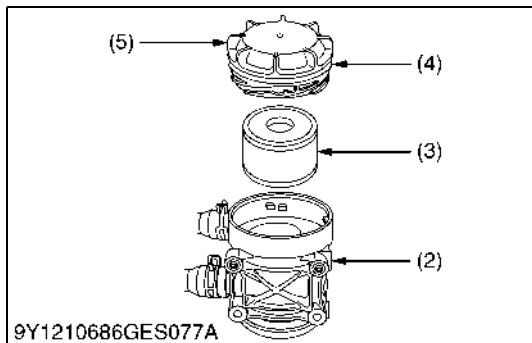
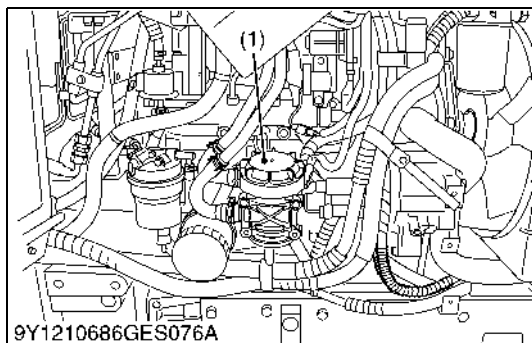
9Y1210686GEG0090US0

[10] CHECK POINT OF EVERY 1500 HOURS

Checking Fuel Injection Nozzle Tip (Injection Pressure)

1. Refer to the Diagmaster Manual (9Y111-01920).
2. Use the Diagmaster Software.
3. Do the "Injection Stop" of active test on the Diagmaster Software.
4. If the each injector is normal condition, the engine noise level changes.

9Y1210686GEG0091US0



Replacing Oil Separator Element



CAUTION

To avoid personal injury:

- Be sure to stop the engine before replacing the oil separator element.
1. Remove the cover and take out the element. Wipe off oil and the carbon in the case with a clean rag.
 2. Fit a new oil separator element.
 3. Tighten the cover.

- | | |
|---------------------------|------------|
| (1) Oil separator | (4) Gasket |
| (2) Body | (5) Cover |
| (3) Oil separator element | |

9Y1210686GEG0092US0

Checking PCV (Position Crankcase Ventilation) Valve (Oil Separator)

1. Remove the cover (1) and element (3).
2. Press on the PCV valve (5) and check that it moves smoothly.
3. If it does not move smoothly, replace the oil separator.

- | | |
|-------------|---------------|
| (1) Cover | (4) Body |
| (2) O-ring | (5) PCV Valve |
| (3) Element | |

9Y1210686GEG0093US0

Checking and Cleaning EGR Cooler

1. See page 1-S16.

9Y1210686GEG0094US0

[11] CHECK POINTS OF EVERY 3000 HOURS

Checking EGR System

1. See page 1-S16.

9Y1210686GEG0095US0

Checking Turbocharger

1. See page 1-S15.

9Y1210686GEG0096US0

Checking Supply Pump

1. See page 1-S47.

9Y1210686GEG0097US0

Checking Intake Air Heater

1. See page 8-S18.

9Y1210686GEG0098US0

Cleaning DPF Muffler

1. Refer to the DPF handling manual (9Y111-08130).

9Y1210686GEG0099US0

[12] CHECK POINTS OF EVERY 1 YEAR**Replacing Air Cleaner Primary Element and Secondary Element**

1. See page G-31.

9Y1210686GEG0100US0

Checking Exhaust Manifold

1. See page 1-S35.

9Y1210686GEG0150US0

Checking DPF Differential Pressure Sensor Pipe

1. See page 1-S60.

9Y1210686GEG0101US0

Checking EGR Pipe

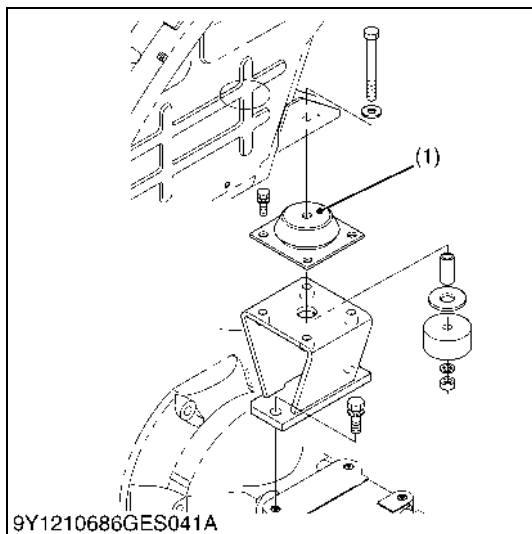
1. See page 1-S16.

9Y1210686GEG0102US0

Checking Air Conditioner Pipe and Hose (CABIN Model)

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

9Y1210686GEG0103US0

**Checking Cabin Isolation Cushion (CABIN Model)**

1. Check the cushion (1) for any breakage or fatigue. Replace them if they are deteriorated. (See page 3-S12.)

- (1) Isolation Cushion

9Y1210686GEG0104US0

[13] CHECK POINTS OF EVERY 2 YEARS

Replacing Fuel Line

1. Replace the fuel hose and clamps.
See page G-31.

9Y1210686GEG0108US0

Replacing Power Steering Line

1. Replace the hoses and clamps.
See page 5-S9.

9Y1210686GEG0109US0

Replacing Radiator Hose (Water Pipes)

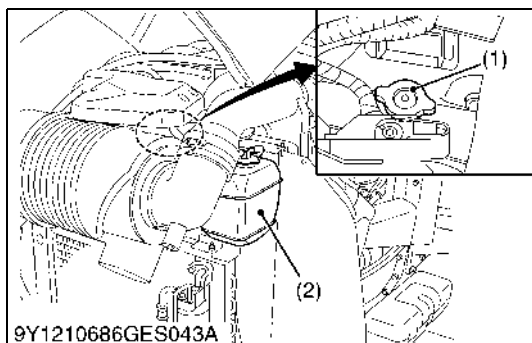
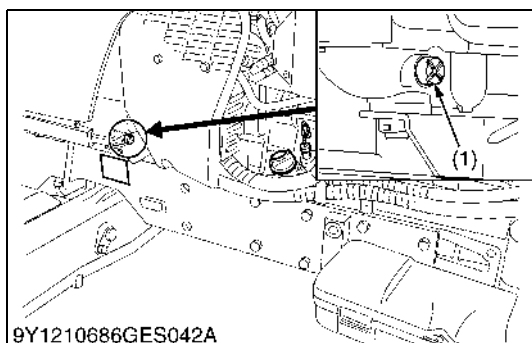
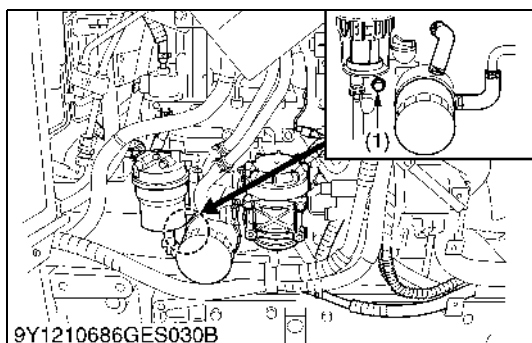
1. Replace the hoses and clamps.
See page G-34.

9Y1210686GEG0106US0

Replacing Intake Air Line

1. Replace the hoses and clamps.
See page G-34.

9Y1210686GEG0107US0



Flush Cooling System and Changing Coolant



CAUTION

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

1. Stop the engine and let cool down.
2. To drain the coolant, open the radiator drain plug (1) and remove the drain plug (2) and radiator cap (3). The radiator cap (3) must be removed to completely drain the coolant.
3. After all coolant is drained, install the drain plug (1) and (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 radiator cap. Install the radiator cap (3) securely.
7. Fill with clean water and anti-freeze up to the upper line of recovery tank (4).
8. Start and operate the engine for few minutes.
9. Stop the engine. Check coolant level and add coolant if necessary.
10. Properly dispose of used coolant.

Coolant capacity	Engine block and radiator	9.0 L 9.5 U.S.qts 7.9 Imp.qts
	Recovery tank	1.0 L 1.1 U.S.qts 0.9 Imp.qts

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

- (1) Drain Plug (Radiator)
(2) Drain Plug (Crankcase)

- (3) Radiator Cap
(4) Recovery Tank

(To be continued)

(Continued)

■ Anti-Freeze



CAUTION

- When using antifreeze, put on some protection such as rubber gloves (Antifreeze contains position).
- If should drink antifreeze, throw up at once and take medical attention.
- When antifreeze comes in contact with the skin or clothing, wash it off immediately.
- Do not mix different types of Antifreeze.
The mixture can produce chemical reaction causing harmful substances.
- Antifreeze is extremely flammable and explosive under certain conditions. Keep fire and children away from antifreeze.
- When draining fluids from the engine, place some container underneath the engine body.
- Do not pour waste onto the grounds, down a drain, or into any water source.
- Also, observe the relevant environmental protection regulations when disposing of antifreeze.

If it freezes, coolant can damage the cylinders and radiator. If the ambient temperature falls below 0 °C or before a long-term storage, let out coolant completely, or mix fresh water with long-life coolant and fill the radiator and reserve tank with the mixture.

1. Long-life coolant (hereafter LLC) comes in several types. Use ethylene glycol (EG) type for this engine.
2. Before employing LLC-mixed coolant, fill the radiator with fresh water and empty it again.
Repeat this procedure 2 or 3 times to clean up the inside.
3. Mixing the LLC
Put the LLC in coolant in the percentage (%) for a target temperature. When mixing, stir it up well, and then fill into the radiator.
4. The procedure for the mixing of water and antifreeze differs according to the make of the antifreeze and the ambient temperature. Refer to SAE J1034 standard, more specifically also to SAE J814c.

■ IMPORTANT

- When the antifreeze is mixed with water, the antifreeze mixing ratio must be less than 50 %.

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

*At 1.013 x 1000000 Pa (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.

(To be continued)

(Continued)

5. Adding the LLC
 - (1) Add only water if the mixture reduces in amount by evaporation.
 - (2) If there is a mixture leak, add the LLC of the same manufacture and type in the same mixture percentage.
*Never add any long-life coolant of different manufacture. (Different brands may have different additive components, and the engine may fail to perform as specified.)
6. When the LLC is mixed, do not employ any radiator cleaning agent. The LLC contains anticorrosive agent. If mixed with the cleaning agent, sludge may build up, adversely affecting the engine parts.
7. Kubota's genuine long-life coolant has a service life of 2 years. Be sure to change the coolant every 2 years.

■ NOTE

- **The above data represents industry standards that necessitate a minimum glycol content in the concentrated anti-freeze.**
- **When the coolant level drops due to evaporation, add water only to keep the antifreeze mixing ratio less than 50 %. In case of leakage, add antifreeze and water in the specified mixing ratio before filling in to the radiator.**

9Y1210686GEG0105US0

Replacing PCV (Position Crankcase Ventilation) Valve Hose

1. See page G-39.

9Y1210686GEG0111US0

Replacing DPF Differential Pressure Sensor Hose

1. See page 1-S61.

9Y1210686GEG0112US0

Replacing Boost Sensor Hose

1. See page 8-S41.

9Y1210686GEG0113US0

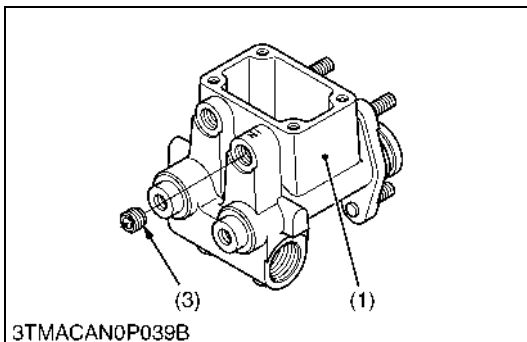
Cleaning Master Cylinder Filter

1. Remove the master cylinder hose (2) from the master cylinder assembly (1).
2. Remove the filter (3) using the screwdriver.
3. Clean the filter (3) with kerosene and blow with air.

Tightening torque	Master cylinder 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 lbf·ft
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- (1) Master Cylinder Assembly (3) Filter
(2) Master Cylinder Hose

9Y1210686GEG0114US0

**Replacing Master Cylinder Kit**

1. To check and adjusting for brake pedal (see page 4-S4).

9Y1210686GEG0115US0

Replacing Equalizer Kit

1. To check and adjusting for brake pedal (see page 4-S15).

9Y1210686GEG0116US0

Replacing Brake Seal 1 and 2

1. To check and adjusting for brake pedal (see page 4-S16).

9Y1210686GEG0117US0

Replacing Lift Cylinder Hose

1. Replace the lift cylinder hoses.

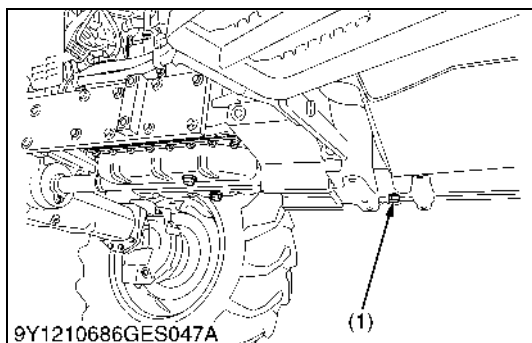
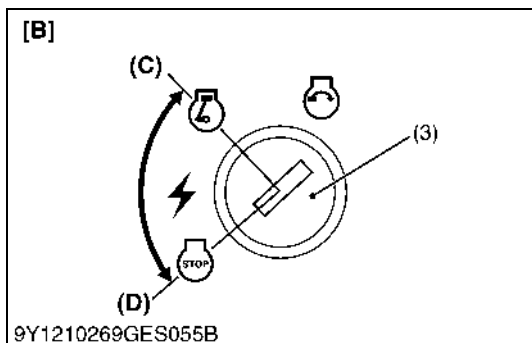
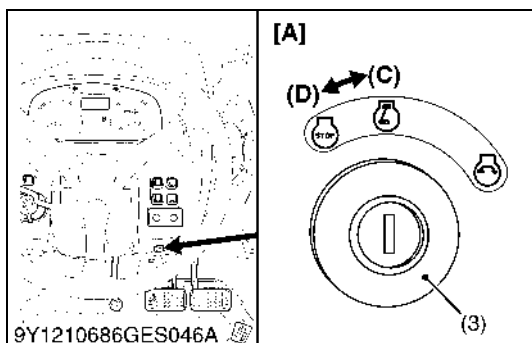
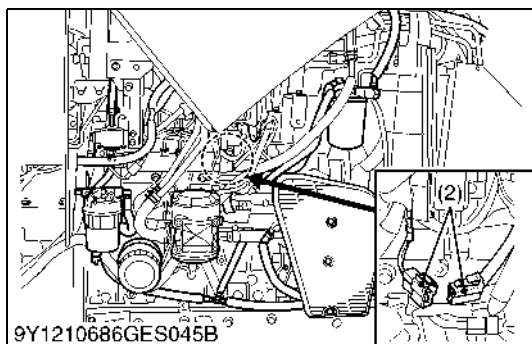
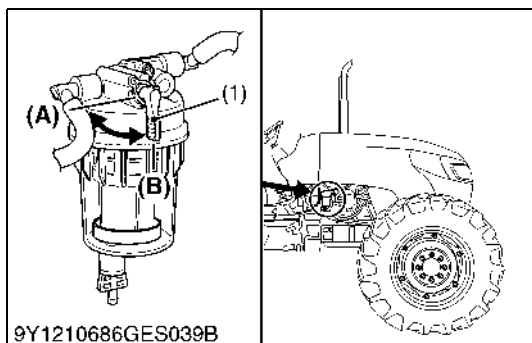
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Replacing Air Conditioner Pipes and Hoses (CABIN Model)

1. Replace the air conditioner pipes and hoses (see page 9-S50).

9Y1210686GEG0151US0

[14] OTHERS



Bleeding Fuel System

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. Fill the fuel tank with fuel, and open the fuel cock (1).
2. Disconnect the connector (2).
3. Turn **ON** and **OFF** the key switch (3) repeatedly 10 times or so at the following intervals. This lets the air out of the fuel line.
 - Key switch **ON** time : 30 seconds.
 - Key switch **OFF** time : 15 seconds.
4. Connect the connector (2).
5. Set the hand throttle lever at the maximum speed position, turn the key switch to start the engine and then reset the throttle lever at the mid speed (around 1500 min⁻¹ (rpm)) position. If engine does not start, try it several times at 30 second intervals.
6. Accelerate the engine to remove the small portion of air left in the fuel system.
7. If air still remains and the engine stops, repeat the above steps.

■ IMPORTANT

- Do not try ai-bleeding with the heater in operation. Otherwise the battery may get damaged.
- Do not hold key switch 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) Connector
(3) Key Switch

- (A) CLOSE
(B) OPEN
(C) ON
(D) OFF
[A] ROPS Model
[B] CABIN Model

9Y1210686GEG0118US0

Bleeding Brake System

1. See page 4-S6.

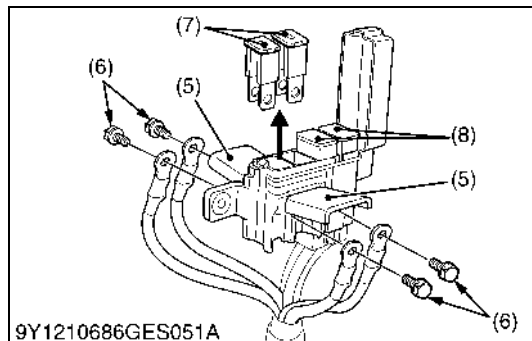
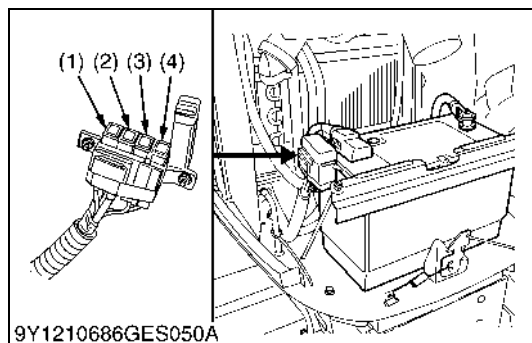
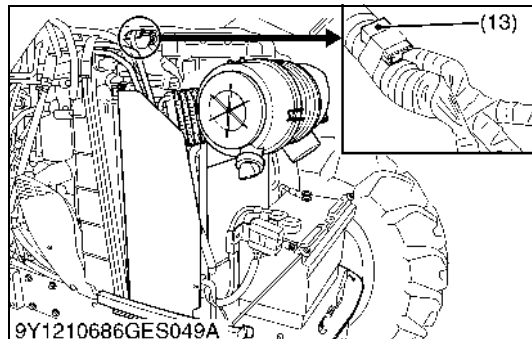
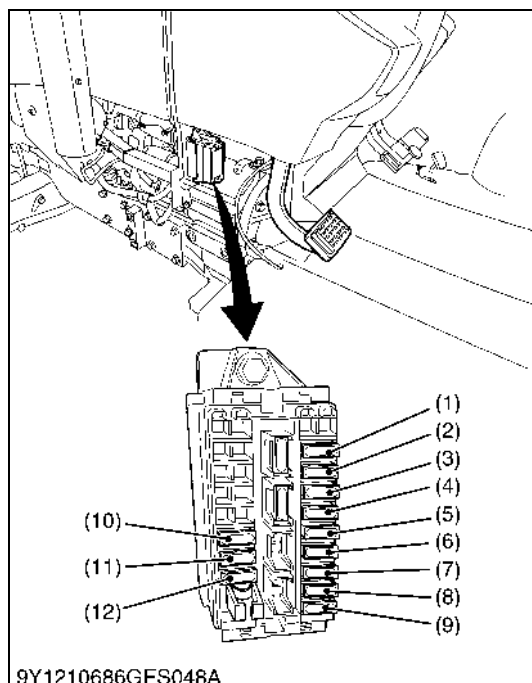
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Draining Clutch Housing Water

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) Drain Plug (Water)

9Y1210686GEG0120US0



Replacing Fuse (ROPS Model)

1. The tractor electrical system is protected from potential damage by fuses.
2. A blown fuse indicates that there is an overload or short somewhere in the electrical system.
3. 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.

■ Protected Circuit

Fuse I.D.	Capacity (A)	Protected circuit
(1)	15	Work light
(2)	5	Meter (Backup)
(3)	5	ECU (Backup)
(4)	10	Turn signal
(5)	15	Loader plug
(6)	5	Meter panel
(7)	15	Head light
(8)	15	Flasher (Hazard)
(9)	5	Starter relay
(10)	5	Engine, PTO
(11)	10	Transmission control
(12)	15	ECU
(13)	20	CRS relay

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Replacing Slow Blow Fuse (ROPS Model)

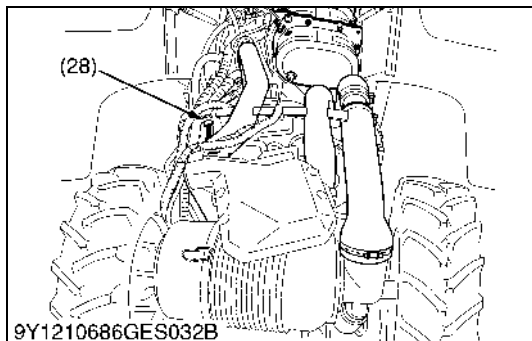
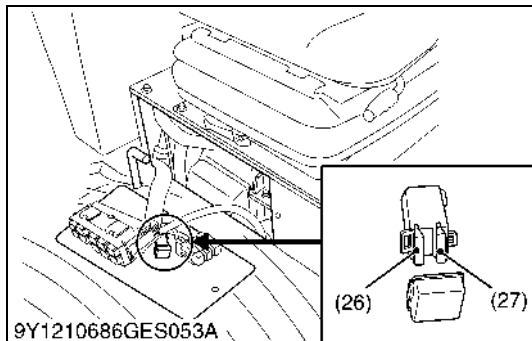
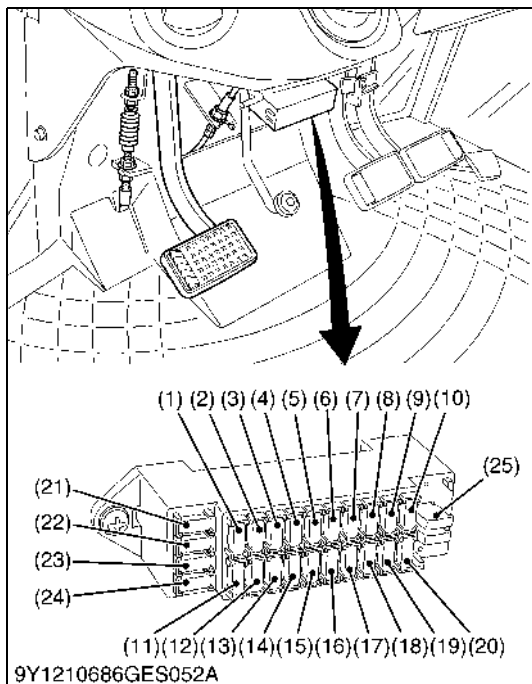
1. The slow blow fuse are intended to protect the electrical cabling. If any of them has blown out, be sure to pinpoint the cause. Never use any substitute, use only a KUBOTA genuine part.
2. Unscrew the bolt (6) from fuse box (5). (Bolt fixed slow blow fuse)

Fuse I.D.	Capacity (A)	Protected circuit	Type
(1)	50	Charge	Bolt fixed
(2)	120	Engine preheat	
(3)	40	Head lamp, starter	Non bolt fixed
(4)	30	Key switch, Work light	

- (5) Fuse Box
(6) Bolt

- (7) Bolt Fixed Slow Blow Fuse
(8) Non Bolt Fixed Slow Blow Fuse

9Y1210686GEG0122US0



Replacing Fuse (CABIN Model)

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

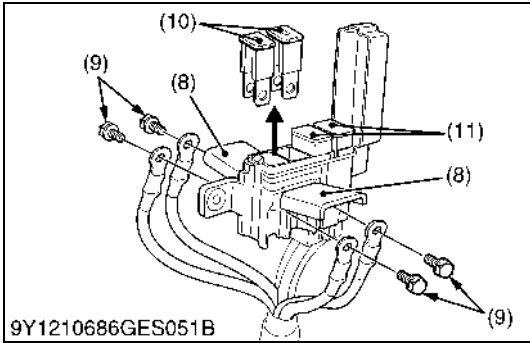
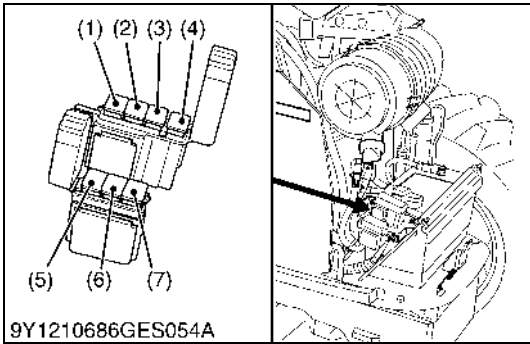
■ IMPORTANT

- 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.

■ Protected Circuit

Fuse I.D.	Capacity (A)	Protected circuit
(1)	5	Radio
(2)	5	Air conditioner (Control)
(3)	15	Wiper
(4)	10	Alternator, PTO, Engine
(5)	5	Meter
(6)	10	Turn signal, Stop lamp
(7)	10	Back up (Meter)
(8)	20	Head light
(9)	20	Flasher (Hazard)
(10)	5	Back up (ECU)
(11)	15	Work light (Rear)
(12)	15	Work light (Front)
(13)	15	Cigarette lighter
(14)	30	Air conditioner (Fan motor)
(15)	10	Air conditioner (Compressor)
(16)	20	Work light (Front side)
(17)	5	Transmission control
(18)	15	Loader plug
(19)	15	ECU
(20)	5	Starter relay
(21)	5	Spare fuse
(22)	10	Spare fuse
(23)	15	Spare fuse
(24)	20	Spare fuse
(25)	Fuse puller	
(26)	20	Rear window defogger
(27)	20	Side window defogger
(28)	10	CRS power

9Y1210686GEG0123US0



Replacing Slow Blow Fuse (CABIN Model)

- 1. The slow blow fuse are intended to protect the electrical cabling. If any of them has blown out, be sure to pinpoint the cause. Never use any substitute, use only a KUBOTA genuine part.

■ Replacement procedure

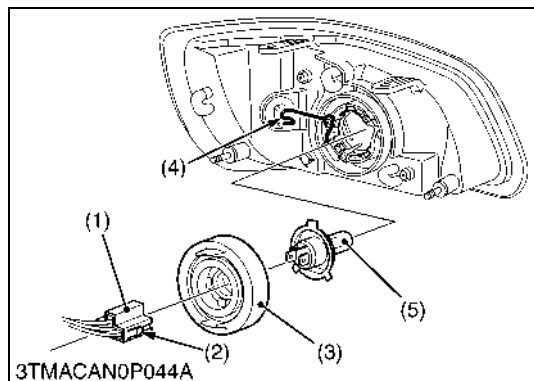
Non bolt fixed slow blow fuse:

- 1. Disconnect the negative cord of the battery.
- 2. Unscrew the bolt for fuse box (8).
- 3. Pull out the fuse from the fuse box (8).

Fuse I.D.	Capacity (A)	Protected circuit	Type
(1)	120	Engine preheat	Bolt fixed
(2)	30	Work light	
(3)	30	Electrical outlet	Non bolt fixed
(4)	50	Starter. Air conditioner	
(5)	100	Charge	Bolt fixed
(6)	50	Head lamp. Hazard	
(7)	30	Main key switch	

- (8) Fuse Box
- (9) Bolt
- (10) Bolt Fixed Slow Blow Fuse
- (11) Non Bolt Fixed Slow Blow Fuse

9Y1210686GEG0124US0



Replacing Light Bulb

⚠ CAUTION

- Be careful not to drop the bulb, hit anything against the lamp, apply excess force, and get the lamp scratched. If broken, glass may cause injury. Pay more attention to halogen lamps in particular, which have high pressure inside.
- Before replacing the lamp, be sure to turn off the light and wait until the bulb cools down, otherwise, you may get burned.

■ Head lights

1. While pushing the right and left lock buttons (2), pull and remove the electrical connector (1).
2. Remove the rubber boot (3).
3. Remove the clamping fixture (4) and take out the bulb (5).
4. Replace with a new bulb and reinstall the head lamp assembly in the reverse order.

■ Other lights

1. Detach the lens and replace the bulb.

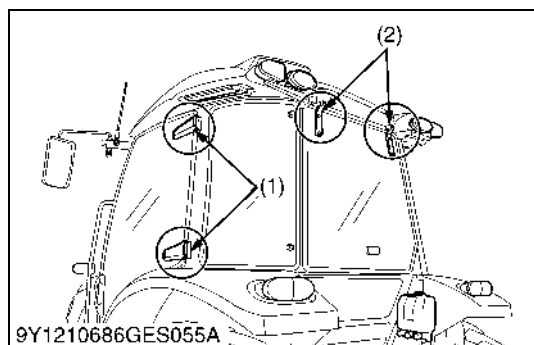
■ IMPORTANT

- Be sure to use a new bulb of the specified wattage.
- Never touch the bulb surface (glass) with bare hands. Fingerprints, for example, may break the bulb.

Light	Capacity	Remark
Head lights	12 V, 55 / 60 W (H4)	
Turn signal / Hazard lights (Front)	12 V, 21 W	
Turn signal / Hazard lights (Rear)	12 V, 21 W	
Front work light	12 V, 21 W	
Work light (if equipped)	12 V, 35 W	
Work light (for outer roof)	12 V, 55 W	CABIN Model
Dome light (Room lamp)	12 V, 5 W	CABIN Model
Tail light	12 V, 5 W	

- | | |
|--------------------------|----------------------|
| (1) Electrical Connector | (4) Clamping Fixture |
| (2) Lock Button | (5) Bulb |
| (3) Rubber Boot | |

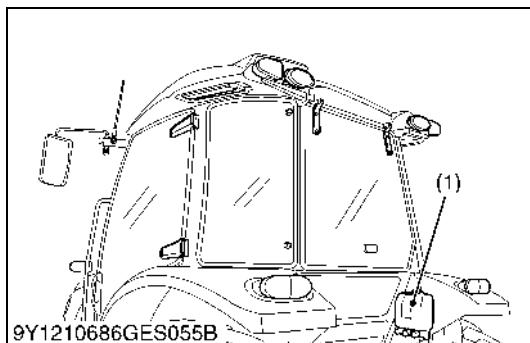
9Y1210686GEG0125US0



Lubricating Points (CABIN Model)

- | | |
|----------------|-----------------------|
| (1) Door Hinge | (2) Rear Window Hinge |
|----------------|-----------------------|

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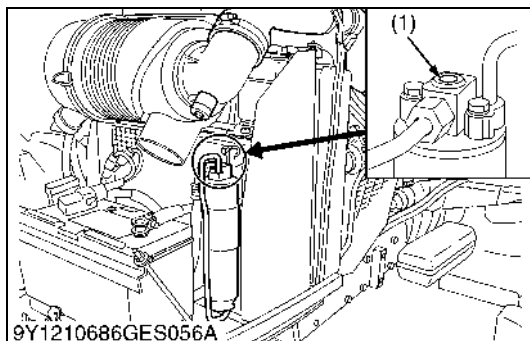
Adding Washer Liquid (CABIN Model)

1. Add a proper amount of automobile washer liquid.

Tank capacity	1.3 L
	1.4 U.S.gals
	1.1 Imp.gals

(1) Washer Liquid Tank

9Y1210686GEG0127US0



Checking Refrigerant (Gas) (CABIN Model)

⚠ CAUTION

- Liquid contact with eyes or skin may cause frostbite.
- In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes.
- In contact with a flame, R134a refrigerant gives a toxic gas.
- Do not disconnect any part of the refrigeration circuit of the air conditioning system.

A shortage of refrigerant impairs the air-conditioner performance. Check the following points. If it is indicated that the amount of refrigerant is extremely low, inspect and charge. (See page 9-S22.)

■ Checking Procedure

1. Run the air-conditioner in the following conditions.
 - Engine speed: About 1500 min⁻¹ (rpm)
 - Temperature control lever: Maximum cooling position
 - Fan switch: Highest blow (HI)
 - Air-conditioner switch: **ON**
2. Look into the sight glass (1) to see if the refrigerant is flowing through its circuit.

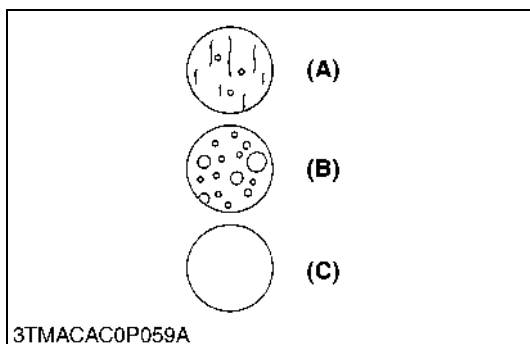
■ IMPORTANT

- Charge only with R134a not R12 refrigerant (gas).

(1) Sight Glass

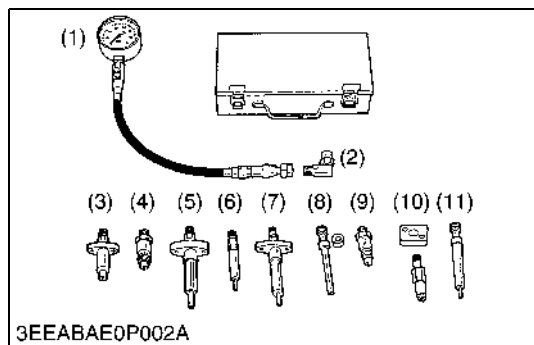
- (A) Proper: Little or no air bubbles in the refrigerant flow.
- (B) Low: Lots of air bubbles in the refrigerant flow (air bubbles or foam passing continuously).
- (C) Overfull or no refrigerant: Colorless and transparent.

9Y1210686GEG0128US0



8. SPECIAL TOOLS

[1] SPECIAL TOOLS FOR ENGINE



Diesel Engine Compression Tester (for Injection Nozzle)

Code No.

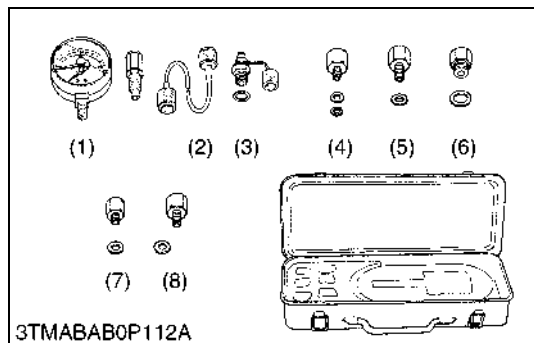
- 07909-30208 (Assembly)
- 07909-30934 (A to F)
- 07909-31211 (E and F)
- 07909-31231 (H)
- 07909-31251 (G)
- 07909-31271 (I)
- 07909-31281 (J)

Application

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

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

WSM000001GEG0014US0



Oil Pressure Tester

Code No.

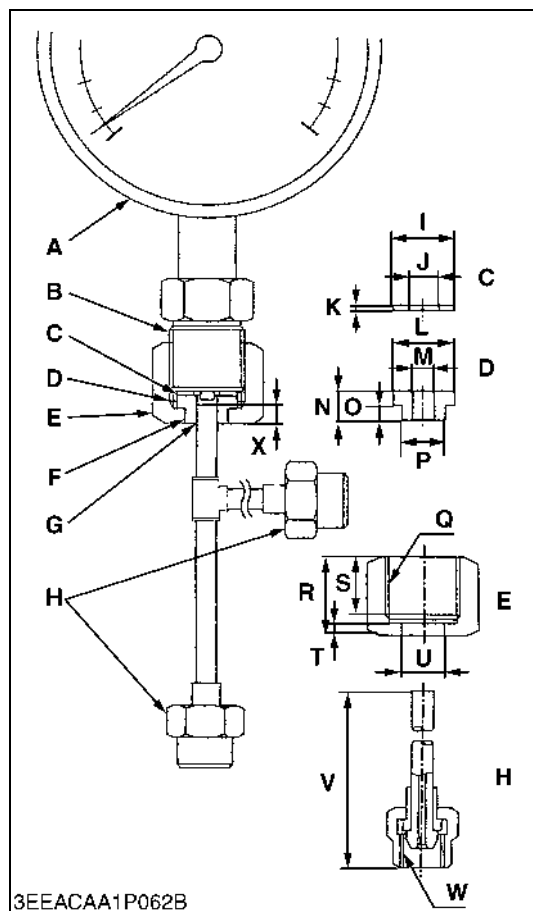
- 07916-32032

Application

- Use to measure lubricating oil pressure.

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

WSM000001GEG0015US0



Injection Pump Pressure Tester

Application

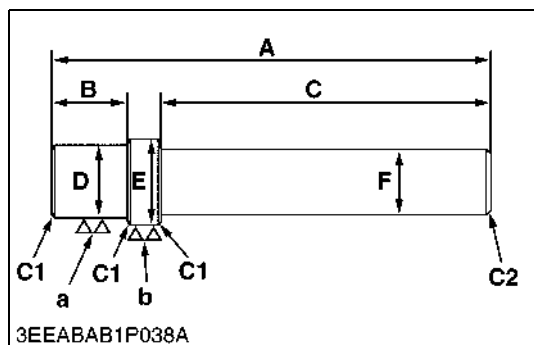
- Use to check fuel tightness of injection pumps.

■ NOTE

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

A	Pressure gauge full scale: More than 29.4 MPa (300 kgf/cm ² , 4267 psi)
B	PF 1/2
C	Copper gasket
D	Flange (Material: Steel)
E	Hex. nut 27 mm (1.06 in.) across the plat
F	Adhesive application
G	Fillet welding on the enter circumference
H	Retaining nut
I	17 mm dia. (0.67 in. dia.)
J	8 mm dia. (0.31 in. dia.)
K	1.0 mm (0.039 in.)
L	17 mm dia. (0.67 in. dia.)
M	6.10 to 6.20 mm dia. (0.2402 to 0.2441 in. dia.)
N	8 mm (0.31 in.)
O	4 mm (0.16 in.)
P	11.97 to 11.99 mm dia. (0.4713 to 0.4720 in. dia.)
Q	PF 1/2
R	23 mm (0.91 in.)
S	17 mm (0.67 in.)
T	4 mm (0.16 in.)
U	12.00 to 12.02 mm dia. (0.4724 to 0.4732 in. dia.)
V	100 mm (3.94 in.)
W	M12 × P1.5
X	5 mm (0.20 in.)

9Y1210686GEG0001US0



Small End Bushing Replacing Tool

Application

- Use to press out and to press fit the small end.

NOTE

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

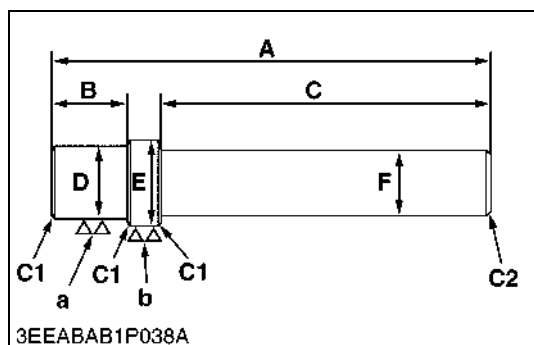
[Press out]

A	157 mm (6.1811 in.)
B	14.5 mm (0.571 in.)
C	120 mm (4.7244 in.)
D	30.0 mm dia. (1.1811 in. dia.)
E	32.95 mm dia. (1.2972 in. dia.)
F	20 mm dia. (0.7874 in. dia.)
a	6.3 µm (0.00025 in.)
b	6.3 µm (0.00025 in.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)

[Press fit]

A	157 mm (6.1811 in.)
B	14.5 mm (0.571 in.)
C	120 mm (4.7244 in.)
D	30.0 mm dia. (1.1811 in. dia.)
E	42.000 mm dia. (1.6535 in. dia.)
F	20 mm dia. (0.7874 in. dia.)
a	6.3 µm (0.00025 in.)
b	6.3 µm (0.00025 in.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)

9Y1210686GEG0002US0



Idle Gear Bushing Replacing Tool

Application

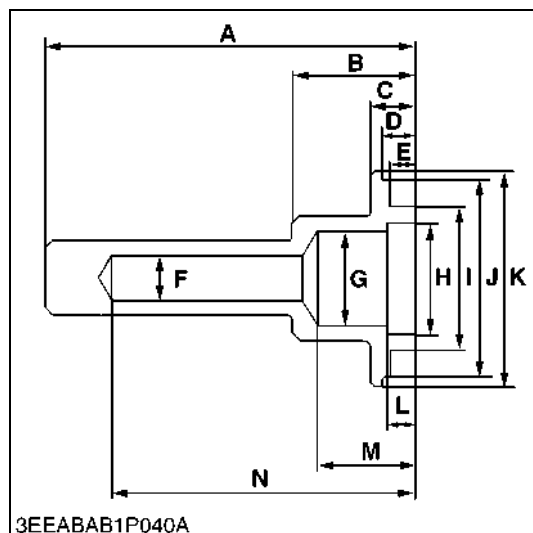
- Use to press out and to press fit the bushing.

NOTE

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

A	196 mm (7.7165 in.)
B	37.5 mm (1.476 in.)
C	150 mm (5.9055 in.)
D	44.95 mm dia. (1.7697 in. dia.)
E	48.075 to 48.100 mm dia. (1.8927 to 1.8937 in. dia.)
F	20 mm dia. (0.7874 in. dia.)
a	6.3 µm (0.00025 in.)
b	6.3 µm (0.00025 in.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)

9Y1210686GEG0003US0



Gear Case Oil Seal Replacing Tool

Application

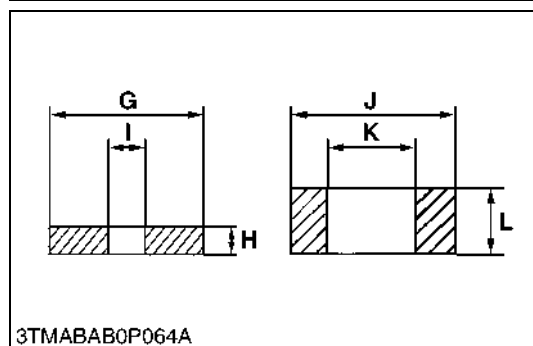
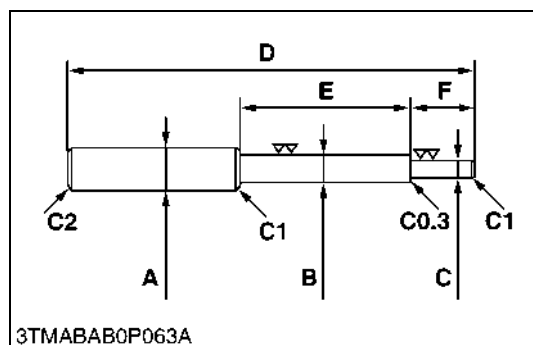
- Use to press fit the oil seal.

NOTE

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

A	148.8 mm (5.8582 in.)
B	50 mm (1.9685 in.)
C	18.8 mm (0.7401 in.)
D	13.7 to 13.9 mm (0.5394 to 0.5472 in.)
E	11 mm (0.433 in.)
F	18 mm dia. (0.7087 in. dia.)
G	38 mm dia. (1.4961 in. dia.)
H	45 mm dia. (1.7716 in. dia.)
I	57.9 to 58.1 mm dia. (2.2795 to 2.2874 in. dia.)
J	79.5 mm dia. (3.1299 in. dia.)
K	87 mm dia. (3.452 in. dia.)
L	12 mm (0.4724 in.)
M	40 mm (1.5748 in.)
N	120 mm (4.7244 in.)

9Y1210686GEG0004US0



Valve Guide Replacing Tool

Application

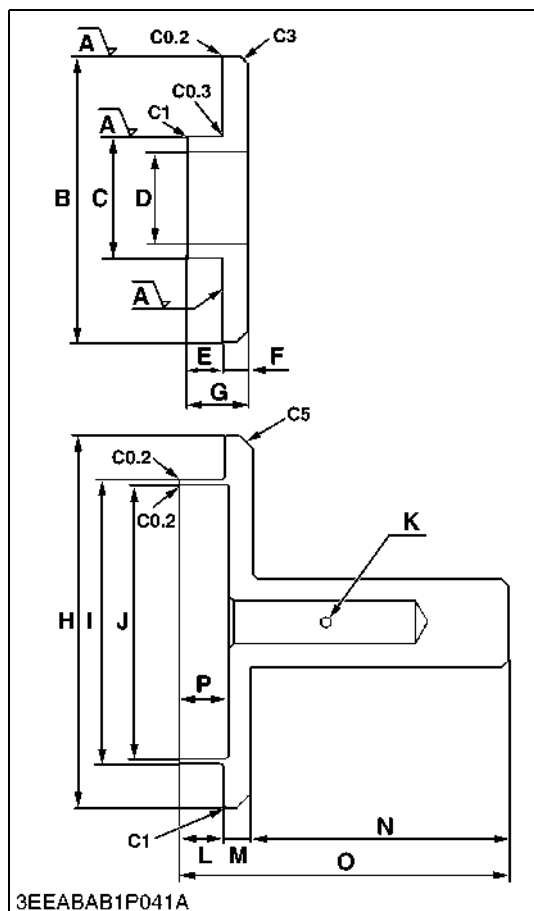
- Use to press out and press fit the valve guide.

NOTE

- The following special tools are not provided, so make them 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 dia. (0.98 in. dia.)
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.)

9Y1210686GEG0005US0



Auxiliary Socket for Fixing Crankshaft Sleeve

Application

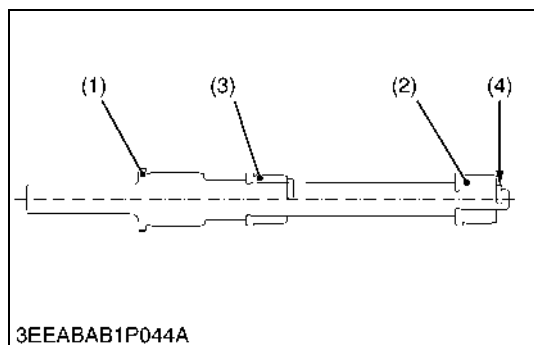
- Use to fix the crankshaft sleeve of the diesel engine.

NOTE

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

A	Rmax = 12.5 S
B	94.5 to 95.0 mm dia. (3.7205 to 3.7402 in. dia.)
C	40 mm dia. (1.5748 in. dia.)
D	30 mm dia. (1.1811 in. dia.)
E	12 mm (0.4724 in.)
F	7.9 to 8.1 mm (0.3110 to 0.3189 in.)
G	20 mm (0.787 in.)
H	130 mm dia. (5.1181 in. dia.)
I	99.4 to 99.6 mm dia. (3.9134 to 3.9213 in. dia.)
J	95.05 to 95.20 mm dia. (3.7421 to 3.7480 in. dia.)
K	3 mm dia. (0.1181 in. dia.)
L	15 mm (0.5905 in.)
M	10 mm (0.3937 in.)
N	90 mm (3.5433 in.)
O	115 mm (4.5275 in.)
P	16.9 to 17.1 mm (0.6654 to 0.6732 in.)
C1	Chamfer 1.0 mm (0.039 in.)
C3	Chamfer 3.0 mm (0.1181 in.)
C5	Chamfer 5.0 mm (0.1969 in.)
C0.2	Chamfer 0.2 mm (0.0079 in.)
C0.3	Chamfer 0.3 mm (0.0118 in.)

9Y1210686GEG0006US0



Balancer Bushing Replacing Tool 1 Assembly

Application

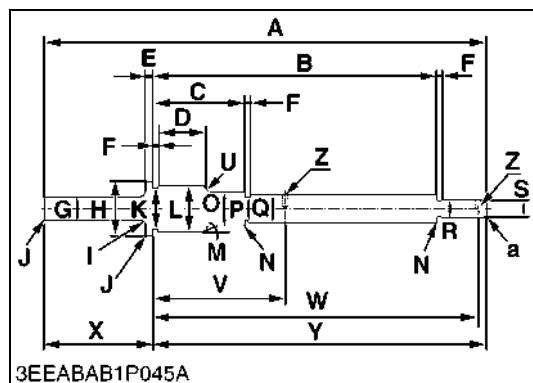
- Use to press fit the bushing.

NOTE

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

No.	Name of Part	Q'ty	Remarks
1	Shaft	1	—
2	Piece 1	1	—
3	Piece 2	1	—
4	Bolt	2	M6 × P1.0

9Y1210686GEG0007US0



Balancer Bushing Replacing Tool 1 Components Parts

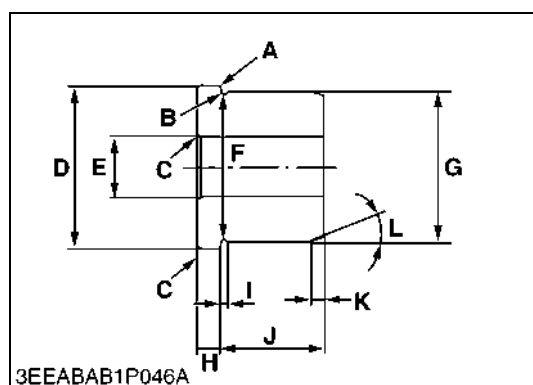
NOTE

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

1) Shaft

A	498 mm (19.61 in.)
B	318.8 to 319.2 mm (12.5726 to 12.5669 in.)
C	102.8 to 103.2 mm (4.0472 to 4.0630 in.)
D	60 mm (2.36 in.)
E	8 mm (0.31 in.)
F	5 mm (0.20 in.)
G	30 mm dia. (1.18 in. dia.)
H	65 mm dia. (2.56 in. dia.)
I	6 mm (0.24 in.)
J	Chamfer 1 mm (0.04 in.)
K	53 mm dia. (2.09 in. dia.)
L	54.7 to 54.9 mm dia. (2.1535 to 2.1614 in. dia.)
M	0.26 rad (15 °)
N	Chamfer 0.5 mm (0.02 in.)
O	41 mm dia. (1.61 in. dia.)
P	32 mm dia. (1.26 in. dia.)
Q	33.961 to 34.0 mm dia. (1.3370 to 1.3386 in. dia.)
R	18 mm dia. (0.71 in. dia.)
S	19.967 to 20.0 mm dia. (0.7861 to 0.7874 in. dia.)
U	3 mm (0.12 in.)
V	149.1 to 149.4 mm (5.8701 to 5.8819 in.)
W	365.1 to 365.4 mm (14.3740 to 14.3858 in.)
X	123 mm (4.84 in.)
Y	375 mm (14.76 in.)
Z	M6 × P1.0 depth 7 mm (0.28 in.)
a	Chamfer 2 mm (0.08 in.)

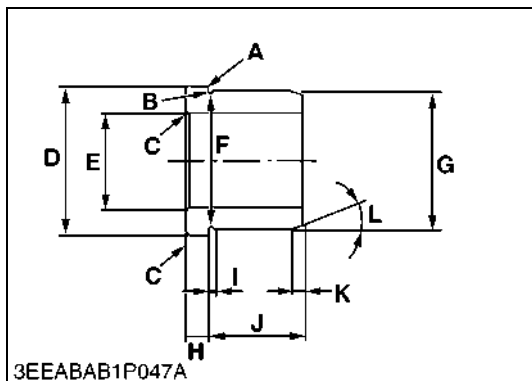
9Y1210686GEG0008US0



2) Piece 1

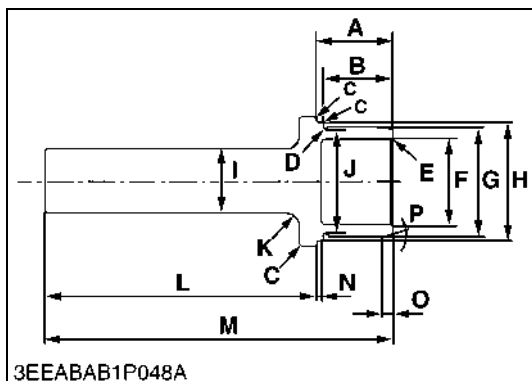
A	Chamfer 0.1 mm (0.004 in.)
B	1 mm (0.04 in.)
C	Chamfer 1 mm (0.04 in.)
D	53.8 to 53.9 mm dia. (2.1181 to 2.1220 in. dia.)
E	20.02 to 20.041 mm dia. (0.7882 to 0.7890 in. dia.)
F	48 mm dia. (1.89 in. dia.)
G	49.934 to 49.94 mm dia. (1.9659 to 1.9661 in. dia.)
H	8 mm (0.31 in.)
I	2 mm (0.08 in.)
J	35 mm (1.38 in.)
K	5 mm (0.20 in.)
L	0.26 rad (15 °)

9Y1210686GEG0009US0

**3) Piece 2**

A	Chamfer 0.1 mm (0.004 in.)
B	1 mm (0.04 in.)
C	Chamfer 1 mm (0.04 in.)
D	54.3 to 54.4 mm dia. (2.1378 to 2.1417 in. dia.)
E	34.025 to 34.05 mm dia. (1.3396 to 1.3406 in. dia.)
F	48.5 mm dia. (1.9094 in. dia.)
G	50.421 to 50.44 mm dia. (1.9851 to 1.9858 in. dia.)
H	8 mm (0.31 in.)
I	2 mm (0.08 in.)
J	35 mm (1.38 in.)
K	5 mm (0.20 in.)
L	0.26 rad (15 °)

9Y1210686GEG0010US0

**Balancer Bushing Replacing Tool 2****Application**

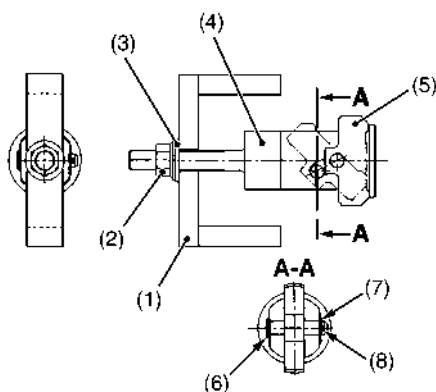
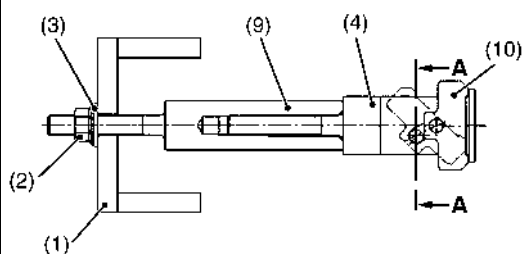
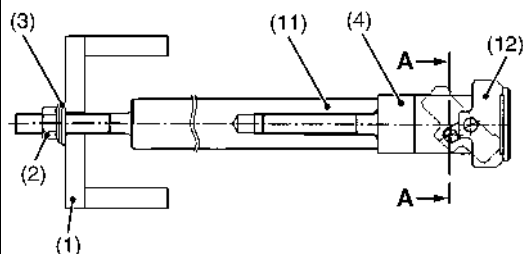
- Use to press fit the bushing.

NOTE

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

A	35 mm (1.38 in.)
B	33 mm (1.30 in.)
C	Chamfer 0.5 mm (0.02 in.)
D	1 mm (0.04 in.)
E	Chamfer 1 mm (0.04 in.)
F	40 mm dia. (1.57 in. dia.)
G	50.921 to 50.94 mm dia. (2.0048 to 2.0055 in. dia.)
H	54.8 to 54.9 mm dia. (2.1575 to 2.1614 in. dia.)
I	30 mm dia. (1.18 in. dia.)
J	49 mm dia. (1.93 in. dia.)
K	6 mm (0.24 in.)
L	125 mm (4.92 in.)
M	160 mm (6.30 in.)
N	3 mm (0.12 in.)
O	5 mm (0.20 in.)
P	0.26 rad (15 °)

9Y1210686GEG0011US0

[a]**[b]****[c]**

3EEABAB1P049A

Balancer Replacing Tools 3, 4, 5**Application**

- Use to press fit the bushing.

NOTE

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

No.	Name of Part	Q'ty
1	Bracket	1
2	Flange Nut	1
3	Washer	1
4	Shaft	1
5	Piece 1	1
6	Clevis	1
7	Washer	1
8	Cotter Pin	1
9	Joint 1	1
10	Piece 2	1
11	Joint 2	1
12	Piece 3	1

[a] Tool 3**[c] Tool 5****[b] Tool 4**

9Y1210686GEG0012US0

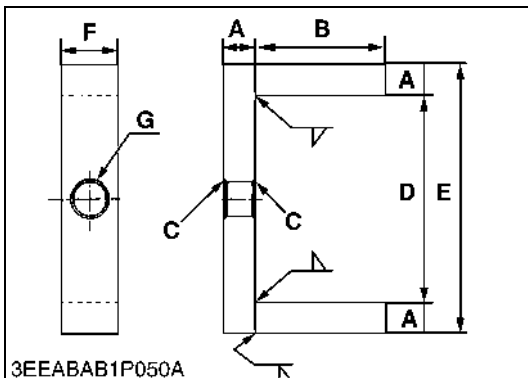
Balancer Bushing Tool Components Parts**NOTE**

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

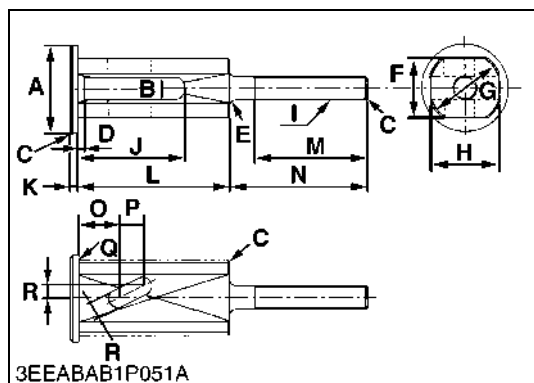
1) Bracket

A	12 mm (0.47 in.)
B	50 mm (1.97 in.)
C	Chamfer 1 mm (0.04 in.)
D	80 mm (3.15 in.)
E	104 mm (4.09 in.)
F	22 mm (0.87 in.)
G	13 mm dia. (0.51 in. dia.)

9Y1210686GEG0013US0



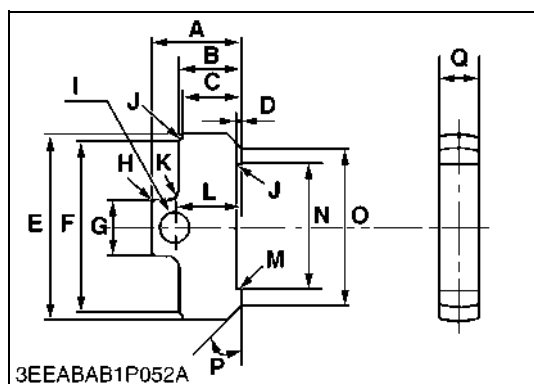
3EEABAB1P050A



2) Shaft

A	44 mm dia. (1.73 in. dia.)
B	12 mm (0.47 in.)
C	Chamfer 1 mm (0.04 in.)
D	3 mm (0.12 in.)
E	3 mm (0.12 in.)
F	30 mm (1.18 in.)
G	38 mm (1.38 in.)
H	35 mm (1.38 in.)
I	M12 × P1.25
J	53 mm (2.09 in.)
K	4 mm (0.16 in.)
L	75 mm (2.95 in.)
M	57 mm (2.24 in.)
N	70 mm (2.76 in.)
O	19.5 mm (0.77 in.)
P	12 mm (0.47 in.)
Q	0.8 mm (0.03 in.)
R	6 mm (0.24 in.)

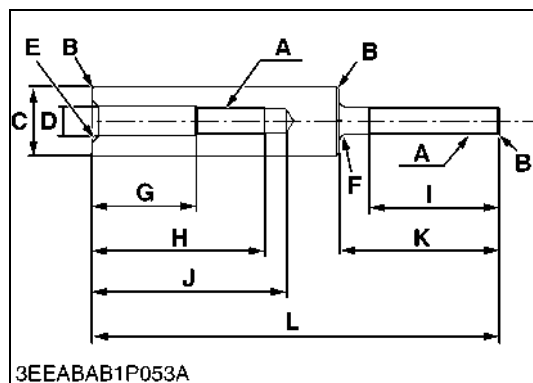
9Y1210686GEG0014US0



3) Piece 1

A	26 mm (1.02 in.)
B	18 mm (0.71 in.)
C	16.5 to 17.0 mm (0.6496 to 0.6693 in.)
D	1.5 mm (0.06 in.)
E	54.0 to 54.2 mm dia. (2.1260 to 2.1339 in. dia.)
F	50.55 to 50.75 mm dia. (1.9902 to 1.9980 in. dia.)
G	16 mm (0.63 in.)
H	Chamfer 1 mm (0.04 in.)
I	8.5 mm dia. (0.33 in. dia.)
J	0.4 mm (0.0157 in.)
K	3 mm (0.12 in.)
L	19 mm (0.75 in.)
M	Chamfer 0.5 mm (0.02 in.)
N	36 mm (1.42 in.)
O	45 mm dia. (1.77 in. dia.)
P	0.78 rad (45 °)
Q	11.5 mm (0.45 in.)

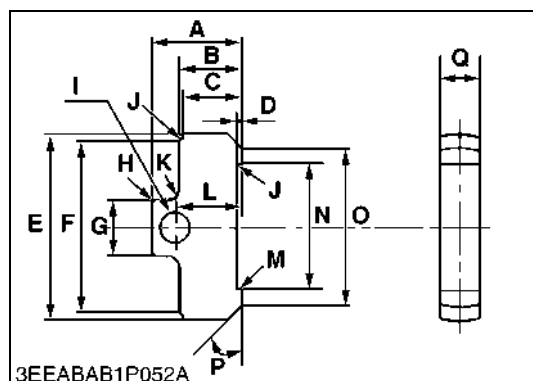
9Y1210686GEG0015US0



4) Joint 1

A	M12 × P1.25
B	Chamfer 1 mm (0.04 in.)
C	30 mm dia. (1.18 in. dia.)
D	13 mm dia. (0.51 in. dia.)
E	Chamfer 3 mm (0.12 in.)
F	R3 mm (0.12 in. radius)
G	45 mm (1.77 in.)
H	75 mm (2.95 in.)
I	57 mm (2.24 in.)
J	85 mm (3.35 in.)
K	70 mm (2.76 in.)
L	178 mm (7.01 in.)

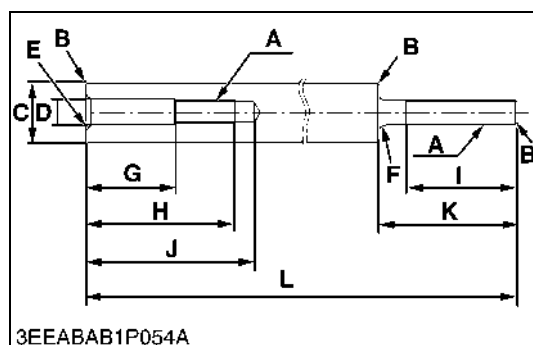
9Y1210686GEG0016US0



5) Piece 2

A	26 mm (1.02 in.)
B	18 mm (0.71 in.)
C	16.5 to 17.0 mm (0.6496 to 0.6693 in.)
D	1.5 mm (0.06 in.)
E	53.5 to 53.7 mm dia. (2.1063 to 2.1142 in. dia.)
F	50.05 to 50.25 mm dia. (1.9705 to 1.9783 in. dia.)
G	16 mm (0.63 in.)
H	Chamfer 1 mm (0.04 in.)
I	8.5 mm dia. (0.33 in. dia.)
J	0.4 mm (0.0157 in.)
K	3 mm (0.12 in.)
L	19 mm (0.75 in.)
M	Chamfer 0.5 mm (0.02 in.)
N	36 mm (1.42 in.)
O	45 mm dia. (1.77 in. dia.)
P	0.78 rad (45 °)
Q	11.5 mm (0.45 in.)

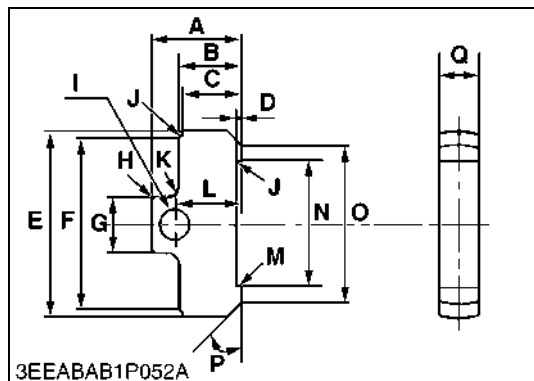
9Y1210686GEG0017US0



6) Joint 2

A	M12 × P1.25
B	Chamfer 1 mm (0.04 in.)
C	30 mm dia. (1.18 in. dia.)
D	13 mm dia. (0.51 in. dia.)
E	Chamfer 3 mm (0.12 in.)
F	R3 mm (0.12 in. radius)
G	45 mm (1.77 in.)
H	75 mm (2.95 in.)
I	57 mm (2.24 in.)
J	85 mm (3.35 in.)
K	70 mm (2.76 in.)
L	394 mm (15.51 in.)

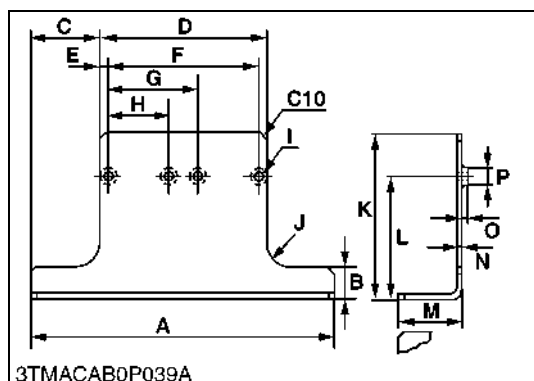
9Y1210686GEG0018US0



7) Piece 3

A	26 mm (1.02 in.)
B	18 mm (0.71 in.)
C	16.5 to 17.0 mm (0.6496 to 0.6693 in.)
D	1.5 mm (0.06 in.)
E	53.0 to 53.2 mm dia. (2.0866 to 2.0945 in. dia.)
F	49.55 to 49.75 mm dia. (1.9508 to 1.9587 in. dia.)
G	16 mm (0.63 in.)
H	Chamfer 1 mm (0.04 in.)
I	8.5 mm dia. (0.33 in. dia.)
J	0.4 mm (0.0157 in.)
K	3 mm (0.12 in.)
L	19 mm (0.75 in.)
M	Chamfer 0.5 mm (0.02 in.)
N	36 mm (1.42 in.)
O	45 mm dia. (1.77 in. dia.)
P	0.78 rad (45 °)
Q	11.5 mm (0.45 in.)

9Y1210686GEG0019US0



Engine Stand

Application

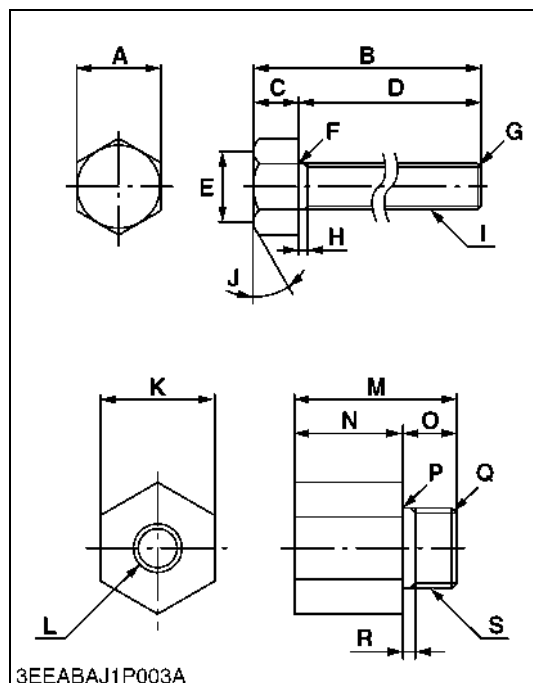
- Use to support engine.

■ NOTE

- The following 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	40 mm (1.57 in.)
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.)

9Y1210686GEG0020US0



Timer Gear Puller

Application

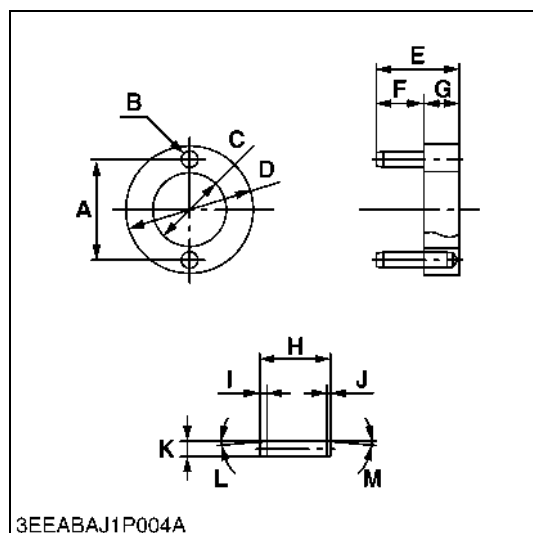
- Use for removing the timer gear from governor shaft.

NOTE

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

A	27 mm (1.1 in.)
B	130 mm (5.12 in.)
C	15 mm (0.59 in.)
D	115 mm (4.53 in.)
E	26 mm dia. (1.0 in. dia.)
F	0.8 mm radius (0.03 in. radius)
G	Chamfer 1 mm (0.04 in.)
H	Less than 3 mm (Less than 0.1 in.)
I	M14 × Pitch 1.5
J	0.52 rad (30 °)
K	32 mm (1.3 in.)
L	M14 × Pitch 1.5
M	45 mm (1.8 in.)
N	30 mm (1.2 in.)
O	15 mm (0.59 in.)
P	0.8 mm radius (0.03 in. radius)
Q	Chamfer 1 mm (0.04 in.)
R	Less than 3 mm (Less than 0.1 in.)
S	M24 × Pitch 1.5

9Y1210686GEG0021US0



Timer 0° Restoring Jig

Application

- Use for restoring 0° in the timer gear.

NOTE

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

A	50.98 to 51.02 mm (2.007 to 2.008 in.)
B	8 mm dia. depth 12 mm (0.31 in. dia. depth 0.472 in.)
C	37 mm dia. (1.5 in. dia)
D	65 mm dia. (2.6 in. dia)
E	42 mm (1.7 in.)
F	24 mm (0.94 in.)
G	18 mm (0.71 in.)
H	36 mm (1.4 in.)
I	3.5 mm (0.14 in.)
J	1.5 mm (0.059 in.)
K	8 mm dia. (0.31 in. dia.)
L	0.09 rad (5 °)
M	0.09 rad (5 °)

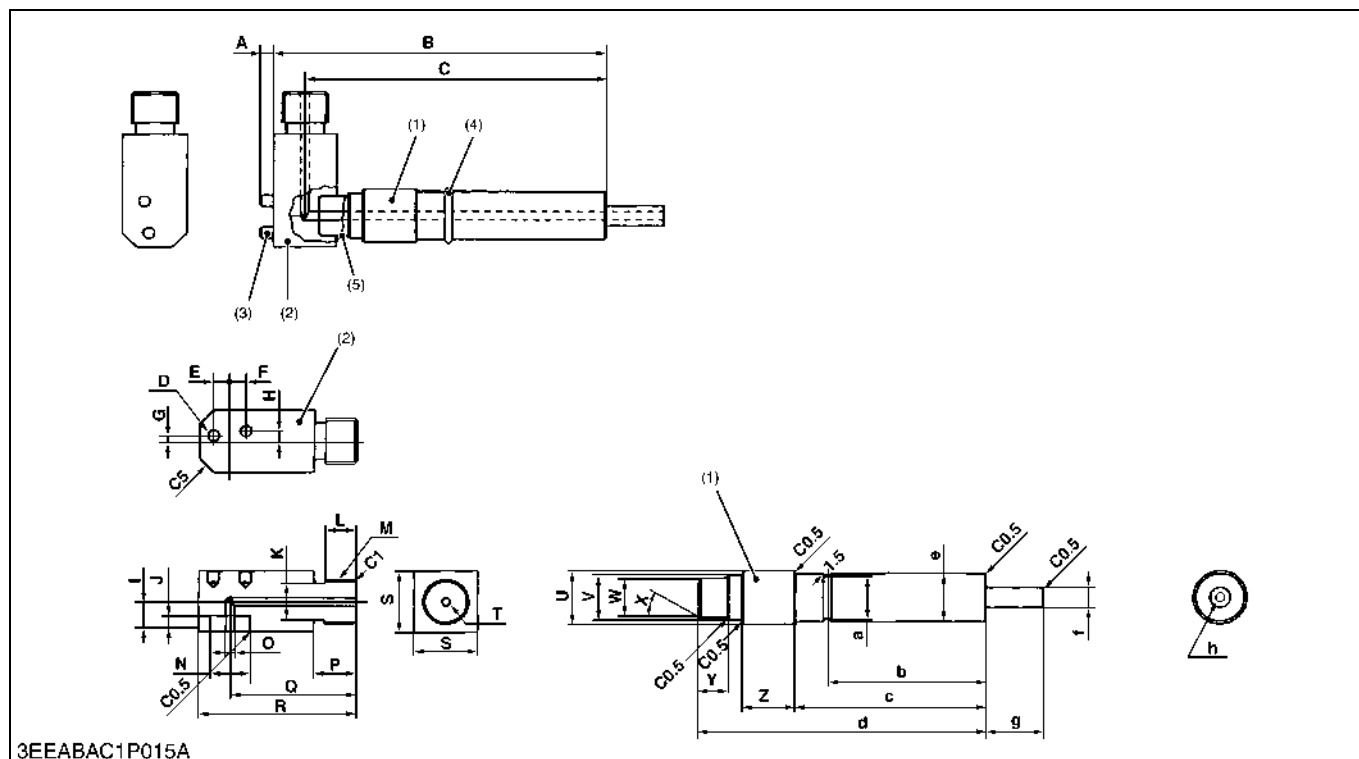
9Y1210686GEG0022US0

Nozzle Adaptor for Measuring Cylinder Compression Pressure**Application**

- Use for measuring diesel engine compression pressure.

NOTE

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



A	5 mm (0.1969 in.)	T	3 mm dia., 44.5 to 45 mm depth (0.1181 in. dia., 1.7520 to 1.7717 in. depth)
B	115.9 to 116.1 mm (4.5630 to 4.5709 in.)	U	19 mm dia. (0.7480 in. dia.)
C	105 mm (4.1339 in.)	V	16 mm dia. (0.6299 in. dia.)
D	4 mm dia., 4 mm depth (0.1575 in. dia., 0.1575 in. depth)	W	14 mm dia. (0.5512 in. dia.)
E	6 mm (0.2362 in.)	X	0.524 rad. (30 °)
F	5.3 mm (0.2087 in.)	Y	10 mm (0.3937 in.)
G	1.9 mm (0.0748 in.)	Z	19 mm (0.7480 in.)
H	3.5 mm (0.1378 in.)	a	14.94 to 15 mm dia. (0.5882 to 0.5906 in. dia.)
I	11.6 to 12.1 mm (0.4567 to 0.4764 in.)	b	55 mm (2.1654 in.)
J	6 to 6.1 mm (0.2362 to 0.2402 in.)	c	66 mm (2.5984 in.)
K	13 mm dia. (0.5118 in. dia.)	d	100 to 100.1 mm (3.9370 to 3.9409 in.)
L	11 mm (0.4331 in.)	e	16.89 to 17 mm dia. (0.6650 to 0.6693 in. dia.)
M	5/8-18UNF-2B	f	7.1 to 7.2 mm dia. (0.2795 to 0.2835 in. dia.)
N	14.0 to 14.011 mm dia. (0.5512 to 0.5516 in. dia.)	g	20.3 to 20.5 mm (0.7992 to 0.8071 in.)
O	3 mm dia. (0.1181 in. dia.)	h	3 mm dia. (0.1181 in. dia.)
P	15 mm (0.5906 in.)	C0.5	Chamfer 0.5 mm (Chamfer 0.0197 in.)
Q	44 mm (1.7323 in.)	C1	Chamfer 1 mm (Chamfer 0.0394 in.)
R	55 mm (2.1654 in.)	C5	Chamfer 5 mm (Chamfer 0.1969 in.)
S	22 mm (0.8661 in.)		

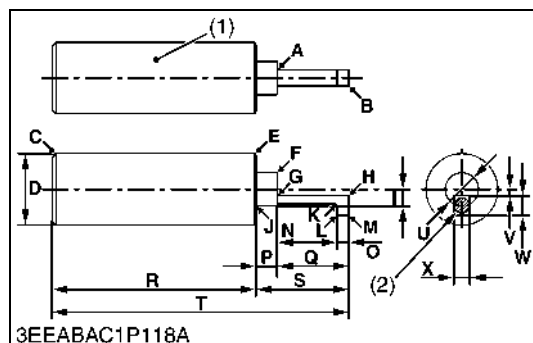
(1) Material SS400
(2) Material S43C-D

(3) Pin 05012-00408

(4) O-ring 04811-00150

(5) Arc welding

9Y1210686GEG0023US0



Jig for Governor Connecting Rod

Application

- Use for connecting the governor connecting rod to the rack pin of the fuel injection pump assembly.

NOTE

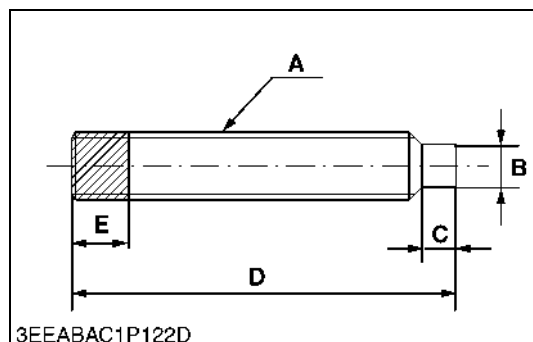
- The following special tool is not provided, so make it referring to the figure.

A	1 mm (0.0394 in.)
B	C0.2 mm (0.0079 in.)
C	C2 mm (0.0787 in.)
D	35 mm dia. (1.3780 in. dia.)
E	C1 mm (0.0394 in.)
F	C0.1 mm (0.0039 in.)
G	1 mm (0.0394 in.)
H	C0.2 mm (0.0079 in.)
I	R8 mm (0.3150 in.)
J	1 mm (0.0394 in.)
K	1 mm (0.0394 in.)
L	C0.2 mm (0.0079 in.)
M	C0.2 mm (0.0079 in.)
N	29 mm (1.1417 in.)
O	6 mm (0.2362 in.)
P	10.7 mm (0.4213 in.)
Q	35 mm (1.3780 in.)
R	99.3 mm (3.9095 in.)
S	45.65 to 45.75 mm (1.7972 to 1.8012 in.)
T	145 mm (5.7087 in.)
U	16.15 to 16.35 mm (0.6358 to 0.6437 in.)
V	3 mm (0.1181 in.)
W	10 mm (0.3937 in.)
X	8 mm (0.3150 in.)

(1) Material: S45C-D

(2) Permanent Magnet: 8 mm dia.
(0.3150 in. dia.)
Thickness: 3 mm (0.1181 in.)

9Y1210686GEG0024US0



Fuel Camshaft Lock Screw

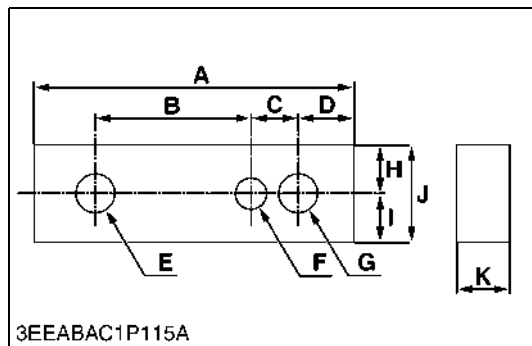
For locking fuel camshaft.

NOTE

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

A	M8 × Pitch 1.25
B	5 mm dia. (0.197 in. dia.)
C	4 mm (0.157 in.)
D	45 mm (1.772 in.)
E	10 mm (0.39 in.): Conspicuously Painted

9Y1210686GEG0025US0



Tool for Aligning the Crankcase 1 and 2

Application

- Use for aligning the crankcase 1 and 2.

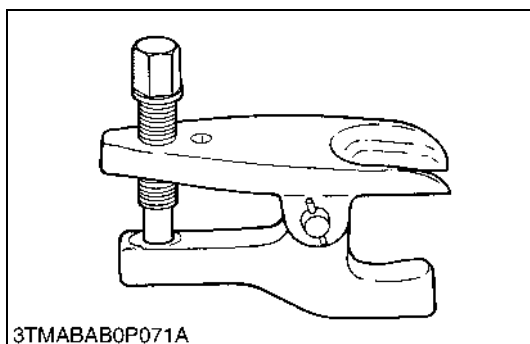
NOTE

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

A	115 mm (4.53 in.)
B	56 mm (2.2 in.)
C	17 mm (0.67 in.)
D	20 mm (0.79 in.)
E	14 mm dia. (0.55 in. dia.)
F	11 mm dia. (0.43 in. dia.)
G	14 mm dia. (0.55 in. dia.)
H	17.5 mm (0.689 in.)
I	17.5 mm (0.689 in.)
J	35 mm (1.4 in.)
K	19 mm (0.75 in.)

9Y1210686GEG0026US0

[2] SPECIAL TOOLS FOR TRACTOR



Tie-rod End Lifter

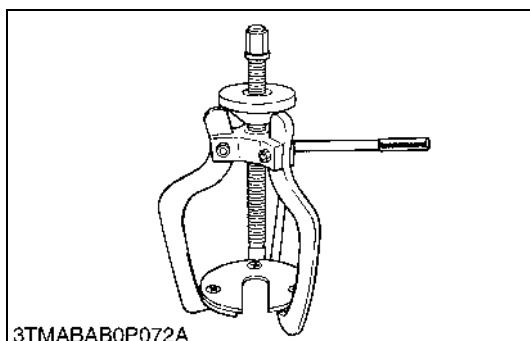
Code No.

- 07909-39051

Application

- Use to remove the tie-rod end with ease.

WSM000001GEG0029US0



Steering Wheel Puller

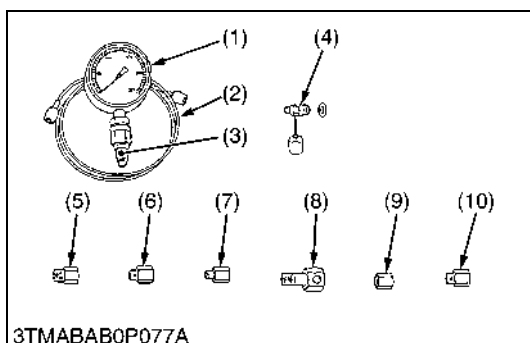
Code No.

- 07916-51090

Application

- Use to remove the steering wheel without damage to the steering shaft.

WSM000001GEG0030US0



Relief Valve Pressure Tester

Code No.

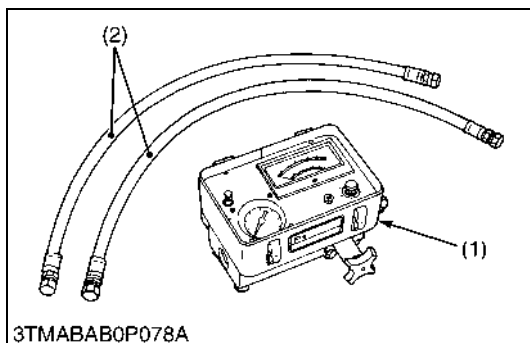
- 07916-50045

Application

- This allows easy measurement of relief set pressure.

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

WSM000001GEG0027US0



Flow Meter

Code No.

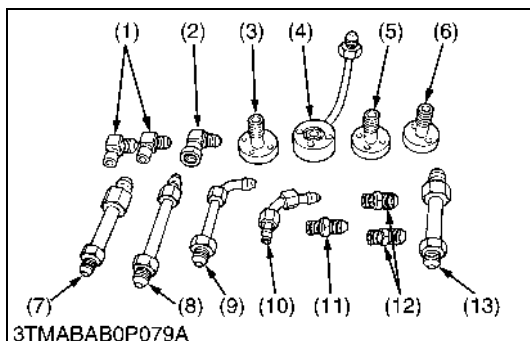
- 07916-52791 (Flow Meter)
- 07916-52651 (Hydraulic Test Hose)

Application

- This allows easy testing of hydraulic system.

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

WSM000001GEG0036US0



Adaptor Set for Flow Meter

Code No.

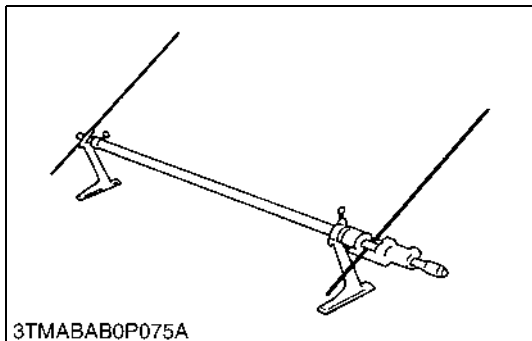
- 07916-54031

Application

- Use for test of the hydraulic system.

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

WSM000001GEG0037US0

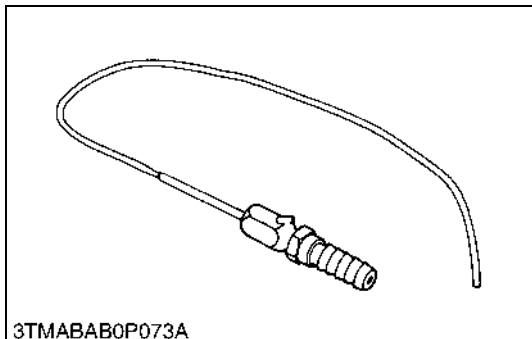
**Toe-in Gauge****Code No.**

- 07909-31681

Application

- This allows easy measurement of toe-in for all machine models.

WSM000001GEG0034US0

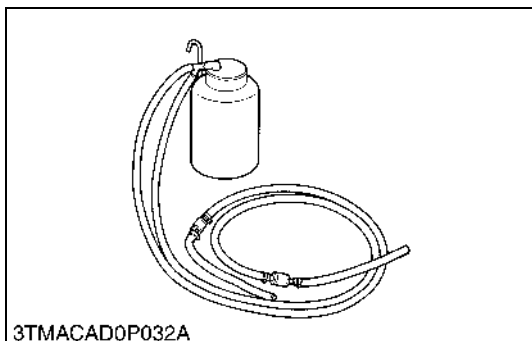
**Injector CH3****Code No.**

- 07916-52501

Application

- Use to put calcium chloride solution into a rear wheel and to remove it.

WSM000001GEG0031US0

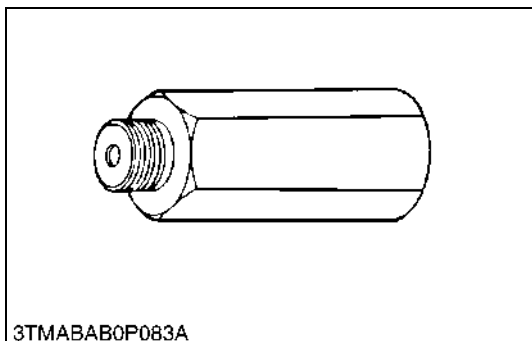
**Brake Air Bleeder****Code No.**

- 07916-54001

Application

- This allows easy air bleed of the hydraulic brake.

WSM000001GEG0046US0

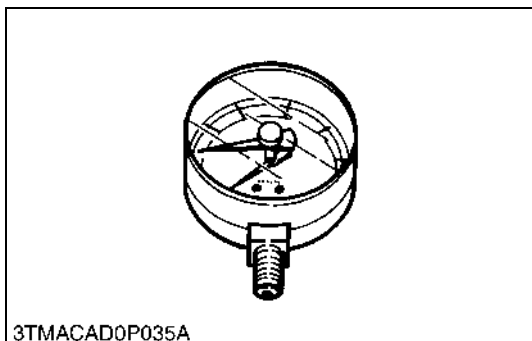
**Relief Valve Setting Pressure Adaptor G****Code No.**

- 07916-52751

Application

- This allows easy measurement of relief valve setting pressure from the hydraulic coupler. This is available with the relief valve setting pressure tester.

WSM000001GEG0041US0

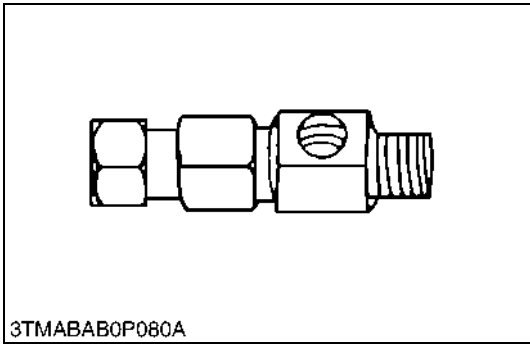
**Pressure Gauge 50****Code No.**

- 07916-52961

Application

- This pressure gauge is to measure the low oil pressure.

WSM000001GEG0047US0



Power Steering Adaptor

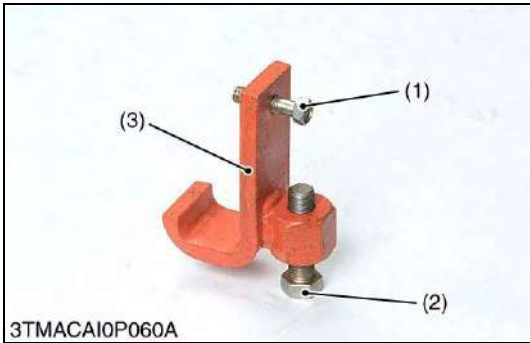
Code No.

- 07916-54021

Application

- Use to measure the relief valve setting pressure for power steering.

WSM000001GEG0038US0

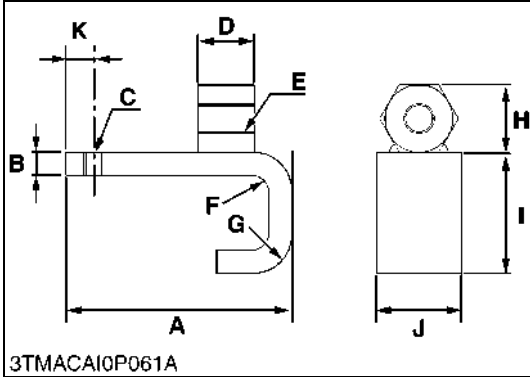


Front Axle Rocking Restrictor

■ **NOTE**

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

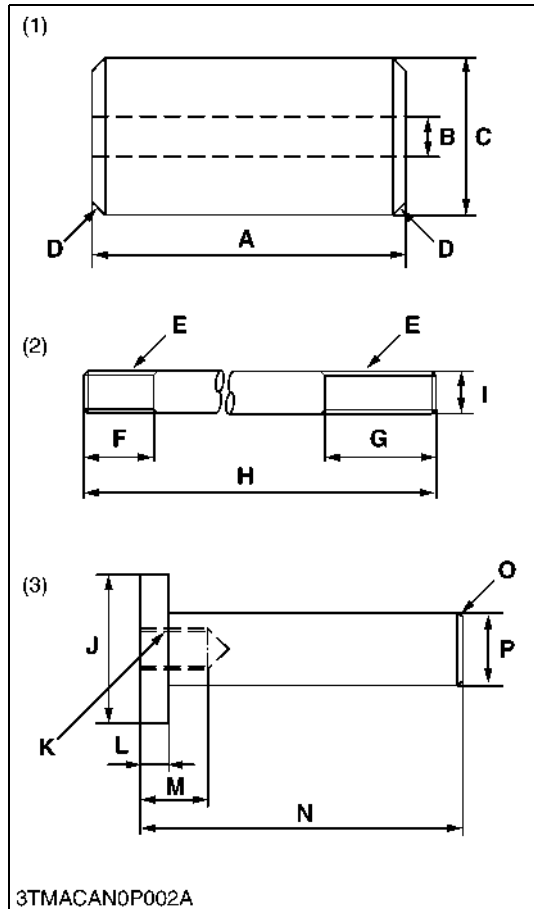
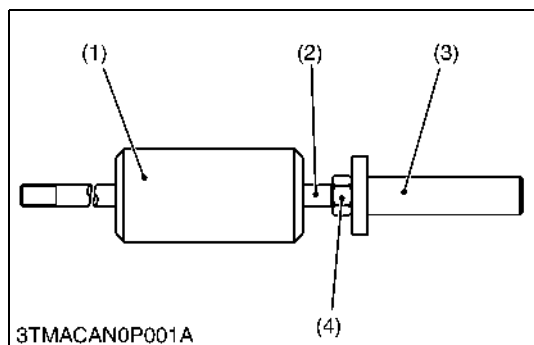
A	120 mm (4.72 in.)
B	12 mm (0.72 in.)
C	M10 × P1.25
D	30 mm (1.18 in.)
E	M16 × P1.5
F	10 mm (0.39 in.)
G	20 mm (0.79 in.)
H	36 mm (1.42 in.)
I	64 mm (2.52 in.)
J	45 mm (1.77 in.)
K	20 mm (0.79 in.)



- (1) Screw
M10 × P1.25 × L50 mm (2 in.)
- (2) Screw
M16 × P1.5 × L50 mm (2 in.)

(3) Rocking Restrictor

9Y1210686GEG0027US0



Sliding Hammer

Application

- Use to removing the bevel pinion shaft with adaptor for front axle.

NOTE

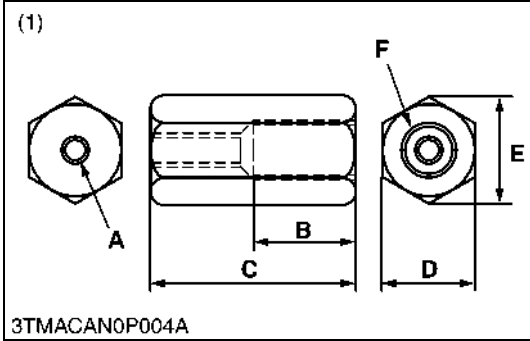
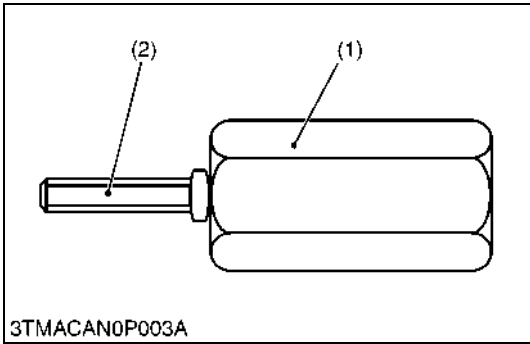
- The following special tool is not provided, so make it referring to the figure.

A	120 mm (4.72 in.)
B	14.5 mm dia. (0.57 in. dia.)
C	60 mm dia. (2.36 in. dia.)
D	Chamfer 5 mm (0.20 in.)
E	M14 × P1.5
F	25 mm (0.98 in.)
G	40 mm (1.57 in.)
H	450 mm (17.72 in.)
I	14 mm dia. (0.55 in. dia.)
J	50 mm dia. (1.97 in. dia.)
K	M14 × P1.5
L	10 mm (0.39 in.)
M	30 mm (1.18 in.)
N	110 mm (4.3 in.)
O	Chamfer 2 mm (0.08 in.)
P	25 mm dia. (0.98 in. dia.)

- (1) Hammer
(2) Sliding Shaft

- (3) Handle
(4) Nut (M14 × P1.5)

9Y1210686GEG0028US0



Adaptor (M6) for Sliding Hammer

Application

- Use to removing the front axle bevel pinion shaft with sliding hammer.

NOTE

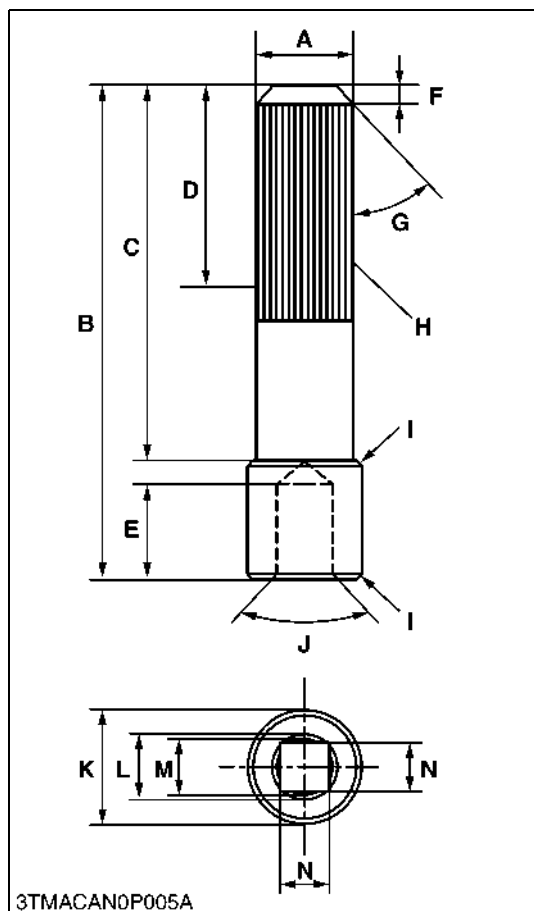
- The following special tool is not provided, so make it referring to the figure.

A	M6 × P1.0
B	25 mm (0.98 in.)
C	50 mm (1.97 in.)
D	23 mm (0.91 in.)
E	27 mm (1.06 in.)
F	M14 × P1.5

(1) Adaptor (M6)

(2) Stud Bolt (M6 × P1.0)

9Y1210686GEG0029US0



LSD Adaptor

Application

- Use for measuring the turning torque of LSD.

NOTE

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

A	24.65 to 24.80 mm dia. (0.970 to 0.976 in. dia.)
B	131.85 to 132.15 mm (5.19 to 5.20 in.)
C	99.25 to 100.75 mm (3.91 to 3.97 in.)
D	54 to 60 mm full spline (2.12 to 2.36 in. full spline)
E	22.4 to 28.4 mm (0.88 to 1.11 in.)
F	4 to 6 mm (0.16 to 0.23 in.)
G	0.52 rad (30 °)
H	Involute spline (refer to below)
I	Chamfer 3.0 mm (0.12 in.)
J	1.05 rad (60 °)
K	29.5 to 30.5 mm dia. (1.16 to 1.20 in. dia.)
L	17.87 mm dia. (0.7 in. dia.)
M	13.95 to 14.25 mm dia. (0.55 to 0.56 in. dia.)
N	12.75 to 12.90 mm square (0.50 to 0.51 in. square)

(Involute Spline)

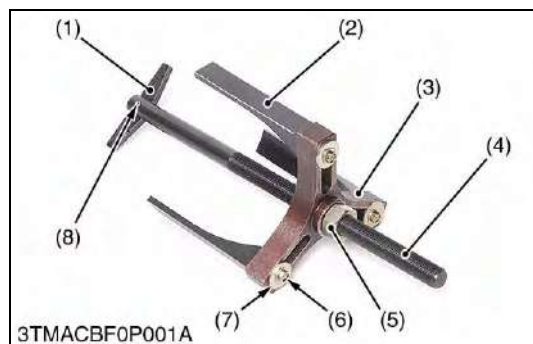
- EXTERNAL 25 × 24Z × 1.0 m × 30

Coefficient of profile shifting		0.000
Tool	Tooth form	Stub tooth
	Module	1.00
	Pressure angle	0.52 rad (30 °)
Number of teeth		24
Diameter of basic pitch circle		24 mm
Tooth thickness	Grade	Class a
	Over pitch diameter	26.534 to 26.645 mm (Pin diameter = 1.8 mm)

(Reference)

- This tool can be made by welding the yoke shaft R.H. (3C091-43210) and socket wrench.

9Y1210686GEG0030US0



Hydraulic Clutch Spring Compressor

Application

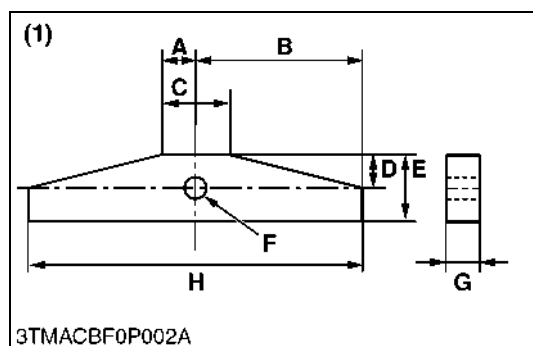
- Use exclusively for pushing the spring, to remove the circlip for hydraulic clutch.

NOTE

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

- | | |
|-------------------------|---------------------------------------|
| (1) Tool 4 (Plate) | (5) Nut (M × P1.5) |
| (2) Tool 3 (Clow) | (6) Screw (M5 × P1.0 - L10mm) |
| (3) Tool 1 (Body) | (7) Washer (M5) |
| (4) Tool 2 (Center Bar) | (8) Spring Pin (5.0 mm Dia. - L16 mm) |

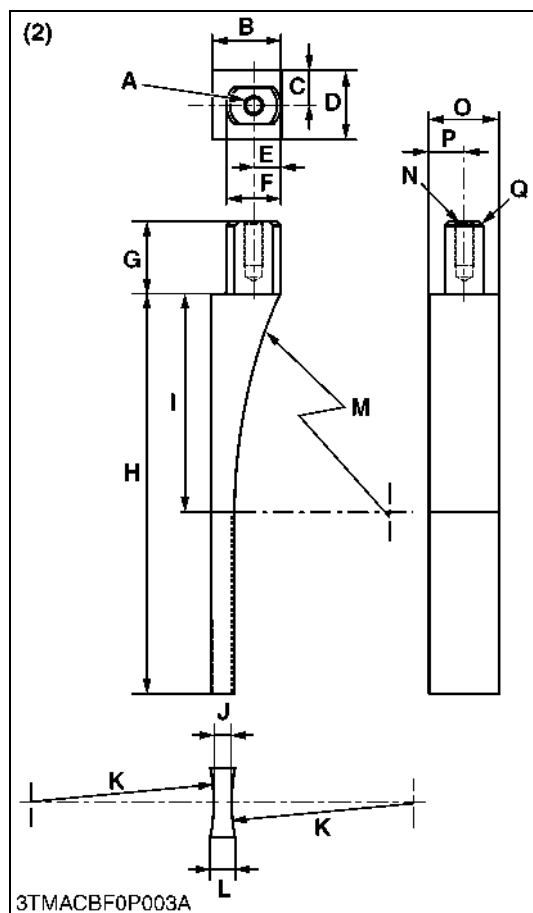
9Y1210686GEG0031US0



(1) Tool 4 (Plate)

A	8 mm (0.3 in.)
B	40 mm (1.6 in.)
C	16 mm (0.63 in.)
D	8 mm (0.3 in.)
E	16 mm (0.63 in.)
F	5.2 mm dia. (0.20 in. dia.)
G	5.70 to 5.90 mm (0.225 to 0.232 in.)
H	80 mm (3.1 in.)

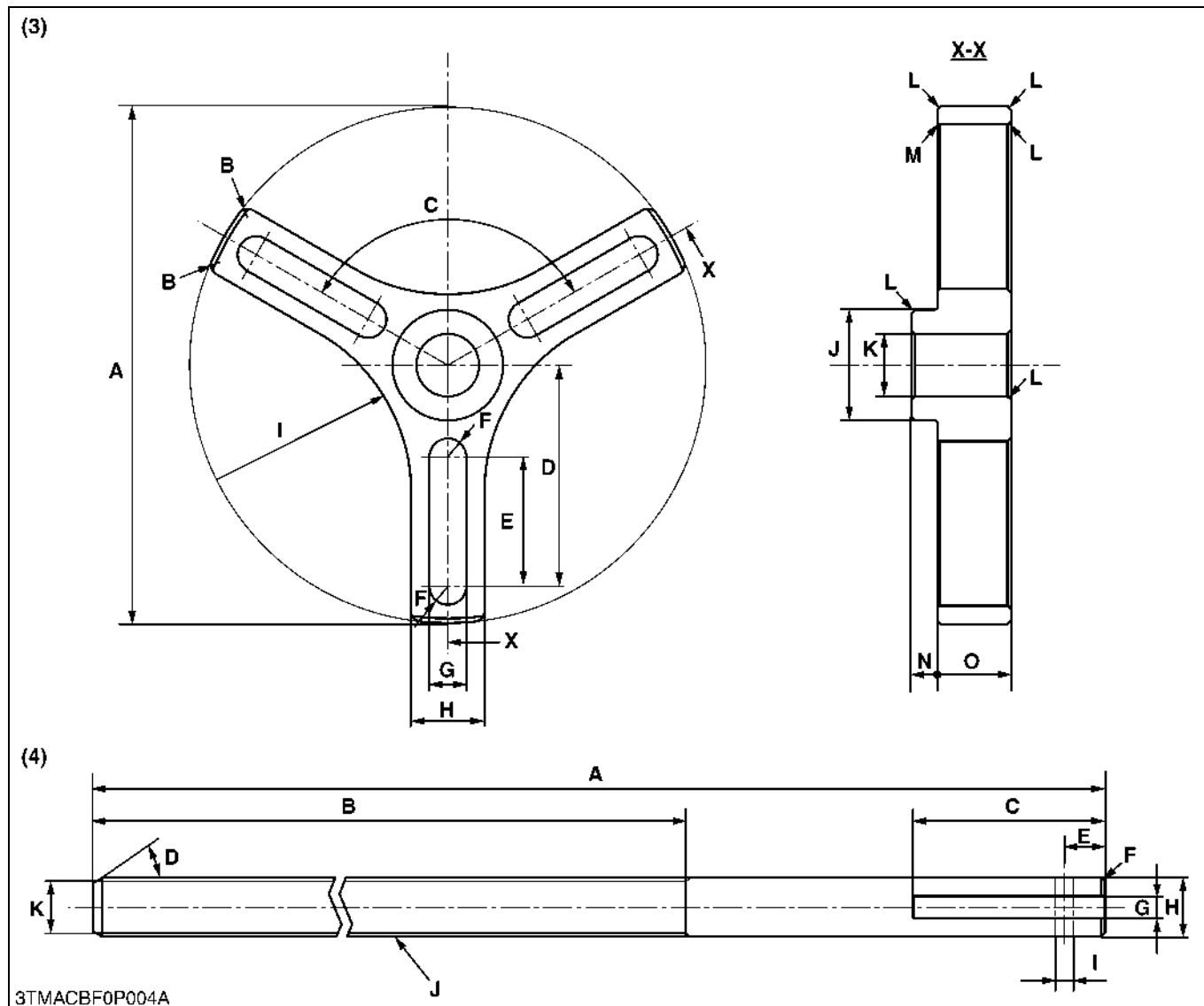
9Y1210686GEG0032US0



(2) Tool 3 (Clow): 3 pcs.

A	M5 × P1.0 × 12 mm depth (0.47 in. depth)
B	19 mm (0.75 in.)
C	5 mm (0.2 in.)
D	9.73 to 10.0 mm (0.383 to 0.393 in.)
E	7.5 mm (0.30 in.)
F	15 mm dia. (0.59 in. dia.)
G	20.05 to 20.10 mm (0.7894 to 0.7913 in.)
H	110 mm (4.33 in.)
I	60 mm (2.4 in.)
J	5 mm (0.2 in.)
K	50 mm (2.0 in.)
L	6.8 mm (0.27 in.)
M	Radius 150 to 160 mm (5.91 to 6.29 in.)
N	4.2 mm dia. × 15 mm depth (0.17 in. dia. × 0.59 in. depth)
O	19 mm (0.75 in.)
P	9.5 mm (0.37 in.)
Q	Chamfer 1.0 mm (0.039 in.)

9Y1210686GEG0033US0

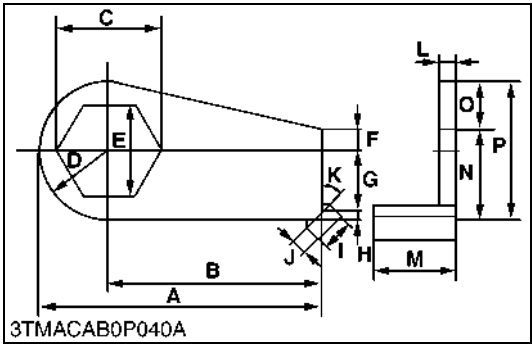
**(3) Tool 1 (Body)**

A	140 mm dia. (5.51 in. dia.)	I	Radius 50 mm (2.0 in.)
B	Radius 3 mm (0.1 in.)	J	30 mm dia. (1.2 in. dia.)
C	2.09 rad (120 °)	K	17 mm dia. (0.67 in. dia.)
D	60 mm (2.4 in.)	L	Chamfer 1.0 mm (0.039 in.)
E	35 mm (1.4 in.)	M	Chamfer 0.5 mm (0.02 in.)
F	Radius 5 mm (0.2 in.)	N	7 mm (0.3 in.)
G	10.00 to 10.27 mm (0.3937 to 0.4043 in.)	O	20 mm (0.79 in.)
H	20 mm (0.79 in.)	X (X-X)	View direction

(4) Tool 2 (Center Bar)

A	330 mm (13.0 in.)	G	6.00 to 6.58 mm (0.237 to 0.259 in.)
B	210 mm (8.27 in.)	H	16 mm dia. (0.63 in. dia.)
C	52 mm (2.0 in.)	I	5.00 to 5.18 mm dia. (0.197 to 0.203 in. dia.)
D	0.52 rad (30 °)	J	M16 × P1.5 mm
E	11 mm (0.43 in.)	K	13 mm dia. (0.51 in. dia.)
F	Chamfer 1.0 mm (0.039 in.)		

9Y1210686GEG0034US0



Locking Wrench

Application

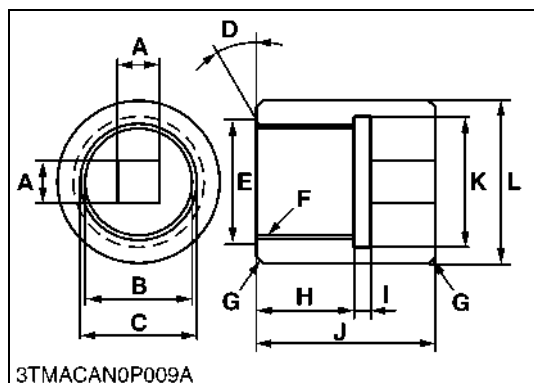
- Use for locking pinion nut.

NOTE

- The following 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	40 mm radius (1.57 in. radius)
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	0.78 rad (45 °)
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.)

9Y1210686GEG0035US0



Bevel Gear Shaft (8T) Tool

Application

- Use for measuring and tightening the bevel gear shaft.

NOTE

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

A	12.75 to 12.90 mm square (0.50 to 0.51 in. square)
B	32.500 to 32.525 mm dia. (1.2795 to 1.2805 in. dia.)
C	35 mm dia. (1.378 in. dia.)
D	0.52 rad (30 °)
E	35.1 to 35.5 mm dia. (1.38 to 1.39 in. dia.)
F	Involute spline (refer to below)
G	Chamfer 1.0 mm (0.039 in.)
H	30 mm (1.18 in.)
I	5 mm (0.19 in.)
J	55 mm (2.17 in.)
K	40 mm dia. (1.57 in. dia.)
L	50 mm dia. (1.97 in. dia.)

(Involute Spline)

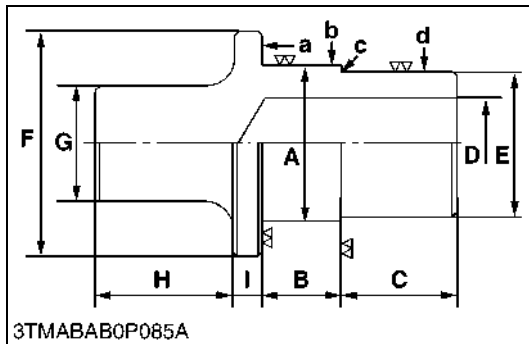
- INTERNAL 35 × 26Z × 1.25 m × 20

Coefficient of profile shifting		+0.800
Tool	Tooth form	Stub tooth
	Module	1.250
	Pressure angle	0.35 rad (20 °)
Number of teeth		26
Diameter of basic pitch circle		32.50 mm
Tooth thickness	Grade	Class a
	Between pin diameter	30.084 to 30.156 mm (Pin diameter = 2.50 mm)

(Reference)

- This tool can be made by welding the coupling (3C081-28910) and socket wrench.

9Y1210686GEG0036US0



Hydraulic Arm Shaft Bushing Press-Fitting Tool

Application

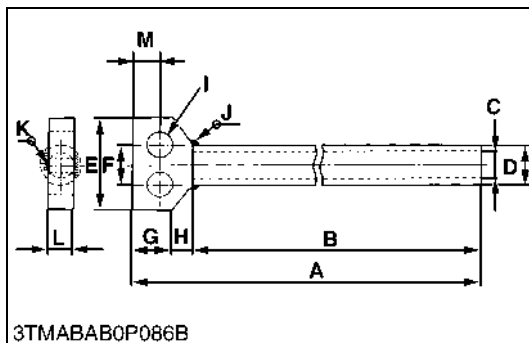
- Use for replacing the hydraulic arm shaft bushings in the hydraulic cylinder body.

NOTE

- The following special tool is not provided, so make it referring to the figure.
- Unless otherwise specified: All surface 12.5 μm (0.0005 in.)

A	54.85 to 54.95 mm (2.159 to 2.163 in.)
B	11 mm (0.43 in.)
C	60 mm (2.36 in.)
D	30 mm (1.18 in.)
E	48.85 to 48.95 mm (1.923 to 1.927 in.)
F	78 mm dia. (3.07 in. dia.)
G	40 mm dia. (1.57 in. dia.)
H	50 mm (1.97 in.)
I	20 mm (0.79 in.)
a	6.3 μm (0.00025 in.)
b	6.3 μm (0.00025 in.)
c	6.3 μm (0.00025 in.)
d	6.3 μm (0.00025 in.)

9Y1210686GEG0037US0



Draft Control Test Bar

Application

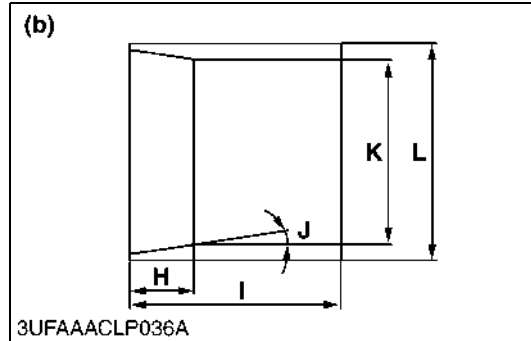
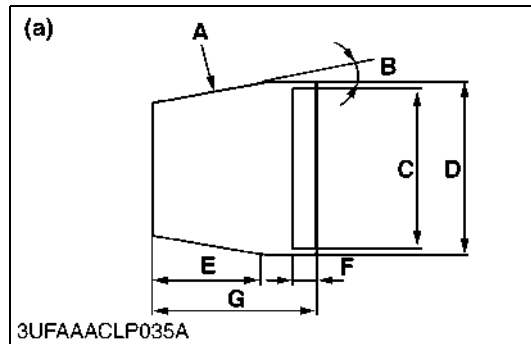
- Use for checking the lift range and floating range of hydraulic draft control.

NOTE

- The following 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	100 mm (3.94 in.)
F	35.5 mm (1.4 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.)
M	26 mm (1.02 in.)

9Y1210686GEG0038US0



Hydraulic Cylinder Piston Sealing Tool

Application

- Tool (a): Use for installing the piston seals to the piston.
- Tool (b): Use for installing the piston to the cylinder.

NOTE

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

Cylinder Size	60 mm (2.36 in.)	65 mm (2.56 in.)	75 mm (2.95 in.)
A	80 °	80 °	80 °
B	0.16 rad (9.0 °)	0.16 rad (9.0 °)	0.16 rad (9.0 °)
C	60.18 mm (2.369 in.)	65.18 mm (2.566 in.)	75.18 mm (2.960 in.)
D	61.18 mm (2.409 in.)	66.18 mm (2.606 in.)	76.18 mm (2.999 in.)
E	42 mm (1.7 in.)	42 mm (1.7 in.)	42 mm (1.7 in.)
F	10 mm (0.39 in.)	10 mm (0.39 in.)	10 mm (0.39 in.)
G	58.5 mm (2.30 in.)	58.5 mm (2.30 in.)	58.5 mm (2.30 in.)
H	14 mm (0.55 in.)	14 mm (0.55 in.)	14 mm (0.55 in.)
I	35 mm (1.4 in.)	35 mm (1.4 in.)	35 mm (1.4 in.)
J	0.12 rad (7.0 °)	0.12 rad (7.0 °)	0.12 rad (7.0 °)
K	60.0 mm (2.36 in.)	65.0 mm (2.56 in.)	75.0 mm (2.95 in.)
L	68.9 mm (2.71 in.)	73.9 mm (2.91 in.)	83.9 mm (3.30 in.)

9Y1210686GEG0039US0

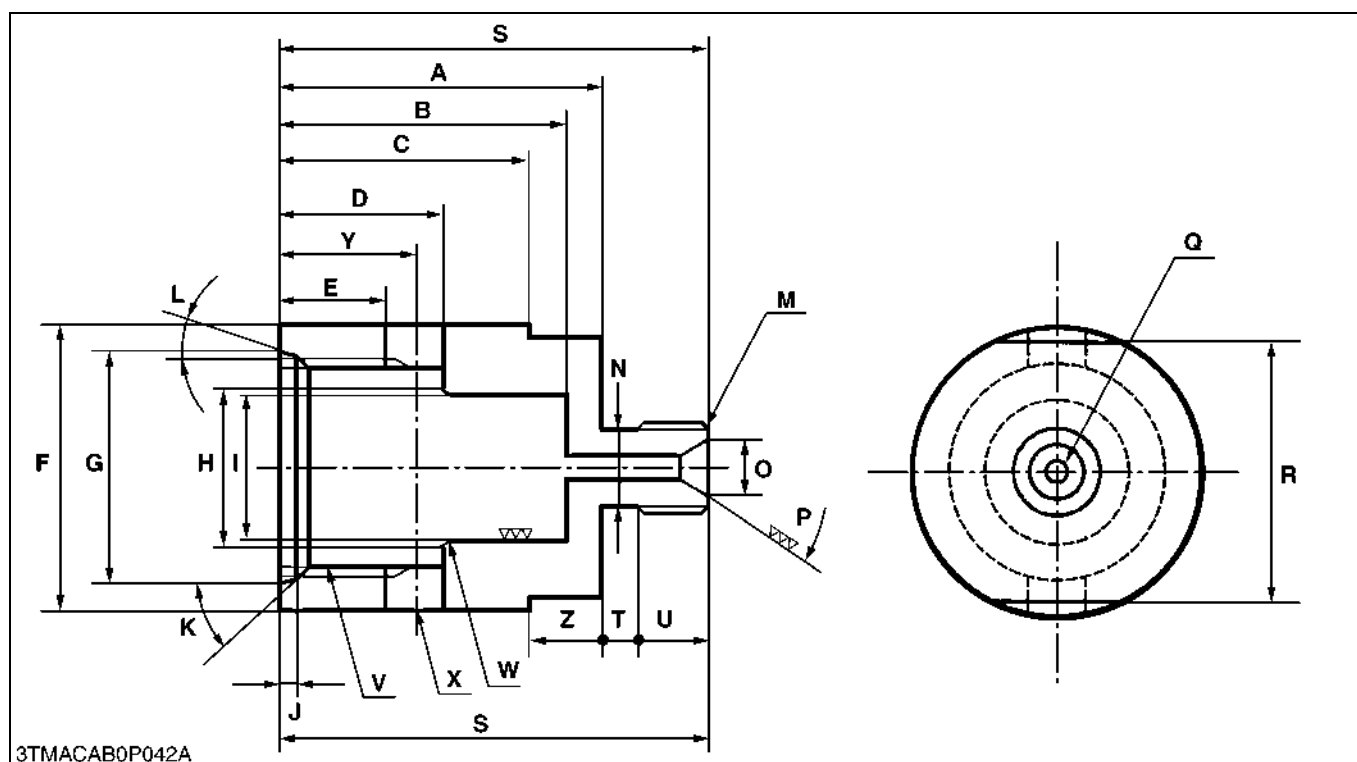
Cylinder Safety Valve Setting Pressure Adaptor

Application

- Use to adapt the safety valve to the nozzle tester to measure cracking pressure and test the check valve on the safety valves.

NOTE

- The following 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 (1.38 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 dia. (1.58 in. dia.)	S	60 mm (2.36 in.)
G	32.4 to 32.7 mm dia. (1.2756 to 1.2874 in. dia.)	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 dia. (0.7874 to 0.7894 in. dia.)	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.)

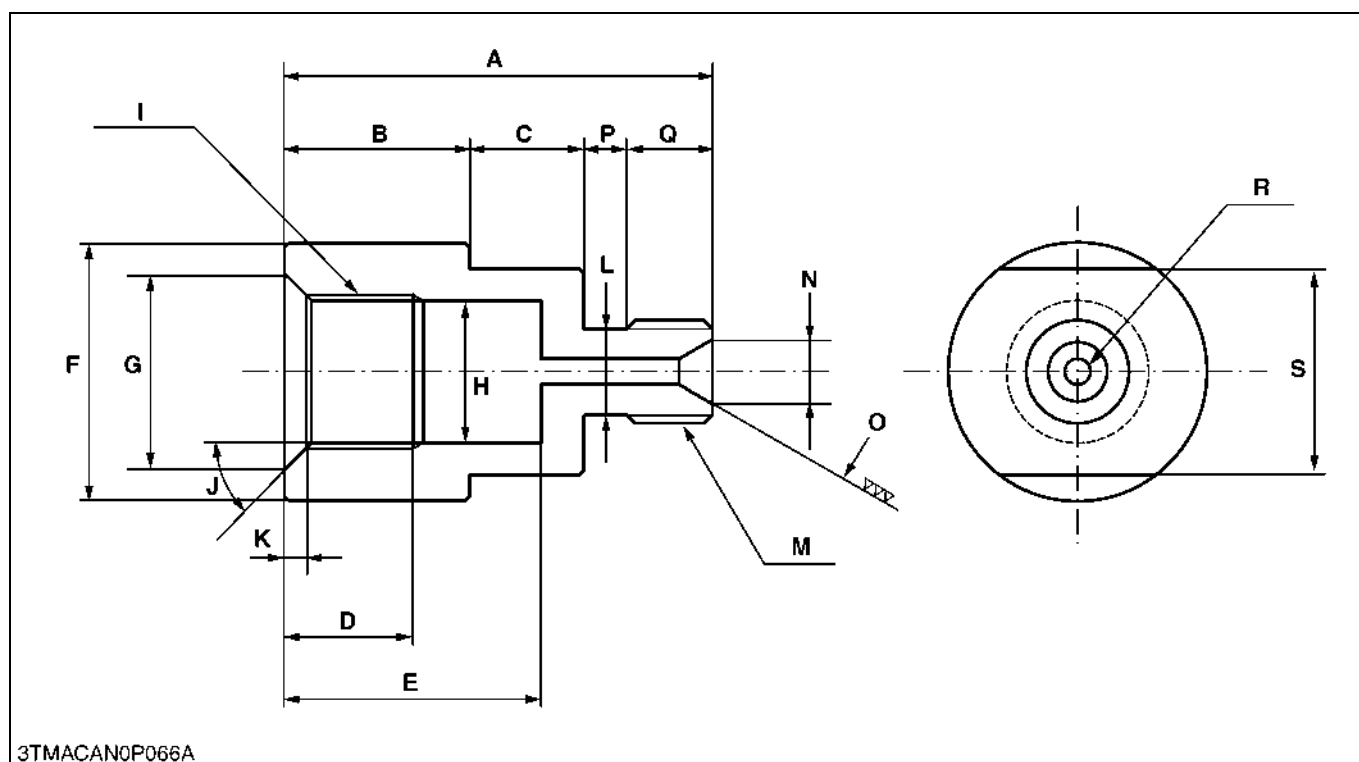
9Y1210686GEG0040US0

Oil Cooler Relief Valve Setting Pressure Adaptor**Application**

- Use to adapt the oil cooler relief valve to the nozzle tester to measure cracking pressure and test check on the oil cooler relief valve.

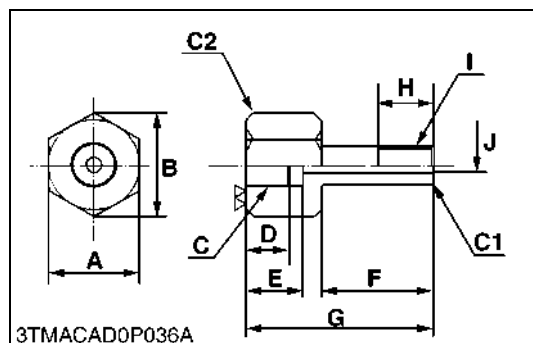
NOTE

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



A	50 mm (2.0 in.)	H	16.5 mm (0.650 in.)	N	7.5 mm dia. (0.30 in. dia.)
B	22 mm (0.87 in.)	I	M18 × P1.5	O	1.0 rad (60 °)
C	13 mm (0.51 in.)	J	0.79 rad (45 °)	P	5 mm (0.2 in.)
D	15 mm (0.59 in.)	K	2.5 mm (0.039 in.)	Q	10 mm (0.39 in.)
E	30 mm (1.2 in.)	L	10 mm dia. (0.39 in. dia.)	R	3 mm dia. (0.1 in. dia.)
F	30 mm (1.2 in.)	M	M12 × P1.5	S	24 mm (0.94 in.)
G	23 mm (0.91 in.)				

9Y1210686GEG0041US0



Valve Adaptor

Application

- Use for measuring the system pressure of shuttle valve, system pressure relief pressure, 4WD valve, PTO valve and dual hi-lo valve.

NOTE

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

A	24 mm (0.94 in.)
B	27.7 mm (1.09 in.)
C	PS1/4
D	11 mm (0.43 in.)
E	15 mm (0.59 in.)
F	40 mm (1.57 in.)
G	60 mm (2.36 in.)
H	15 mm (0.59 in.)
I	PT1/8
J	4 mm dia. (0.15 in. dia.)
C1	Chamfer 1 mm (0.039 in.)
C2	Chamfer 2 mm (0.079 in.)

9Y1210686GEG0042US0

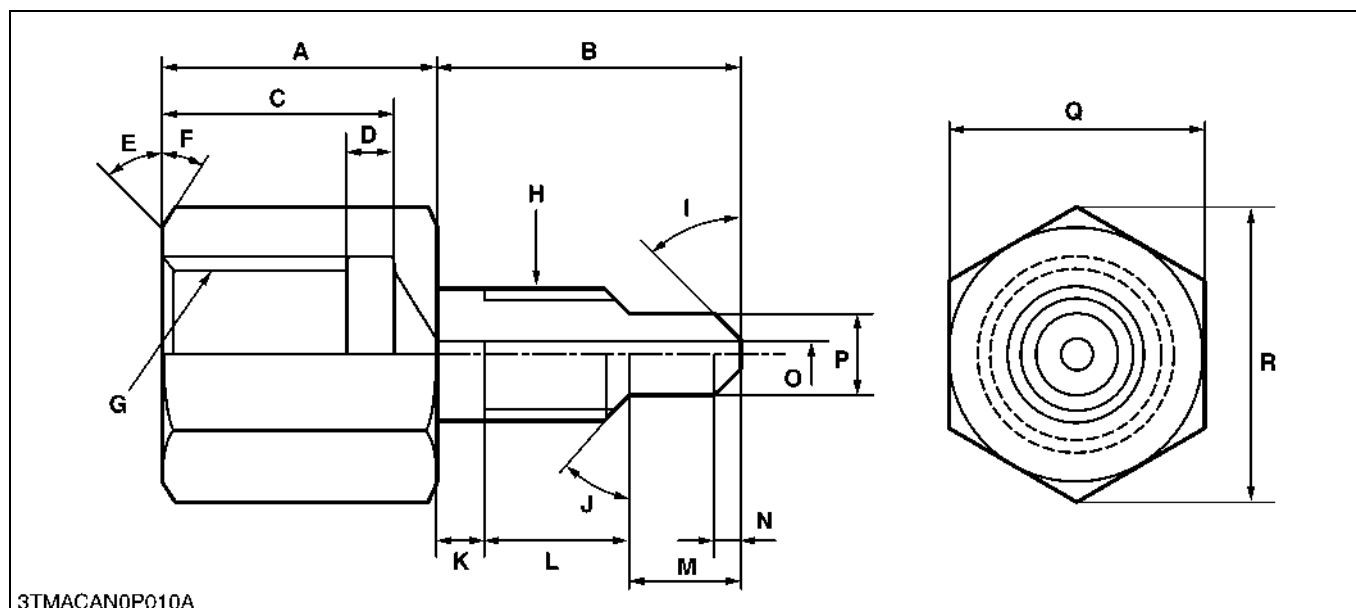
Hydraulic Brake Adaptor

Application

- Use for testing the hydraulic brake oil linkage.

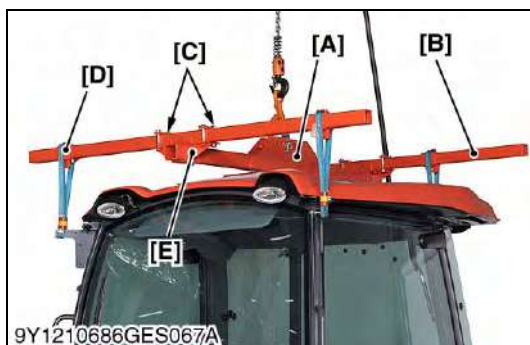
NOTE

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



A	18 mm (0.71 in.)	G	PS 1/4	M	4 mm (0.16 in.)
B	15 mm (0.59 in.)	H	M7 × P1.0	N	2 mm (0.079 in.)
C	15 mm (0.59 in.)	I	0.79 rad (45 °)	O	2 mm dia. (0.079 in. dia.)
D	3 mm (0.12 in.)	J	0.79 rad (45 °)	P	5 mm dia. (0.20 in. dia.)
E	0.79 rad (45 °)	K	6 mm (0.24 in.)	Q	17 mm (0.67 in.)
F	0.52 rad (30 °)	L	5 mm (0.20 in.)	R	19.6 mm (0.77 in.)

9Y1210686GEG0043US0



Tools for Dismounting Cabin

Application

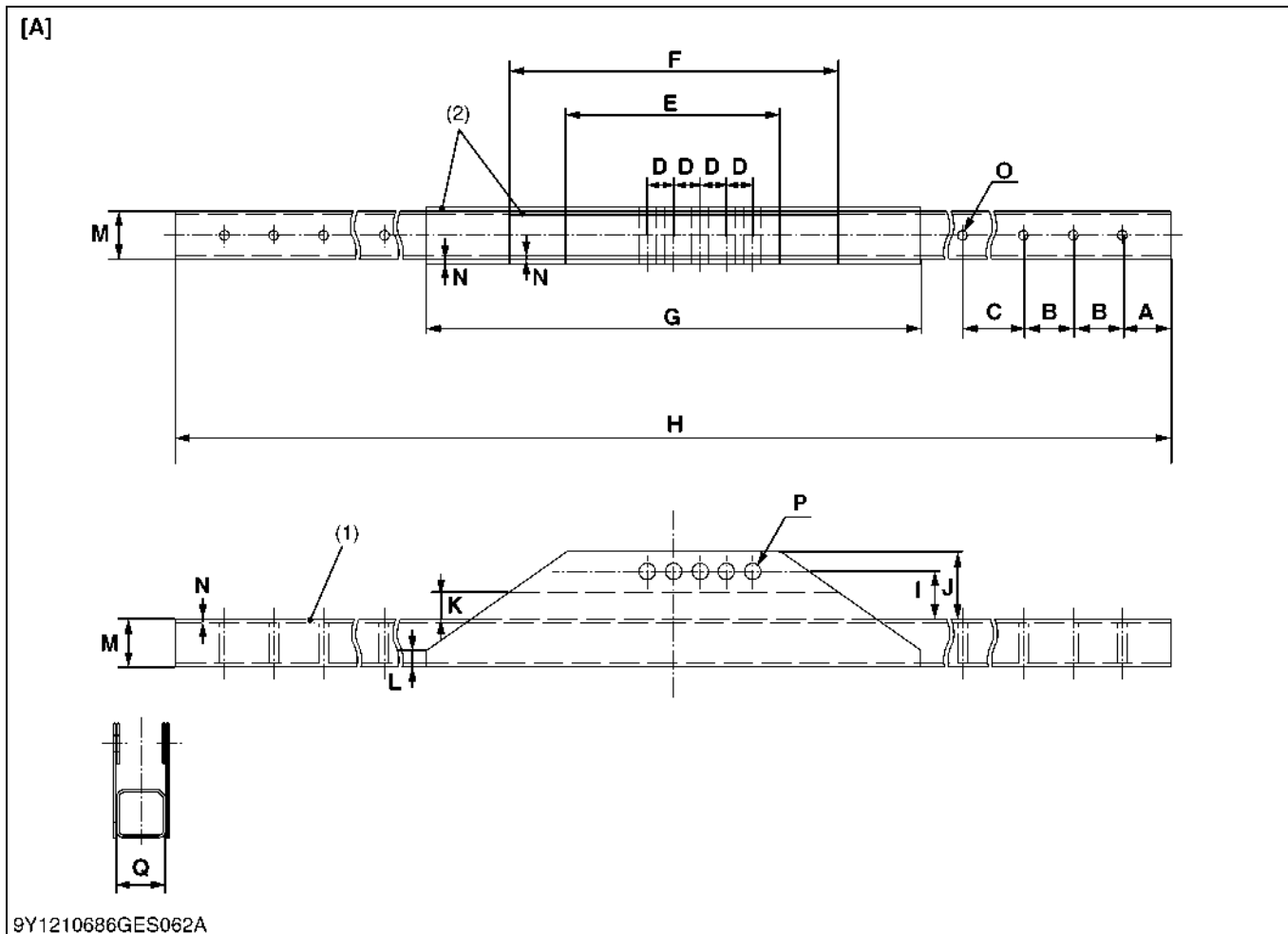
- Use to dismounting the cabin from tractor body.

NOTE

- This special tools are not provided, so make them referring to the figure.

	Q'ty
Piece [A]	1
Piece [B]	2
Piece [C]	4
Piece [D]	4
Piece [E]	2

9Y1210686GEG0129US0

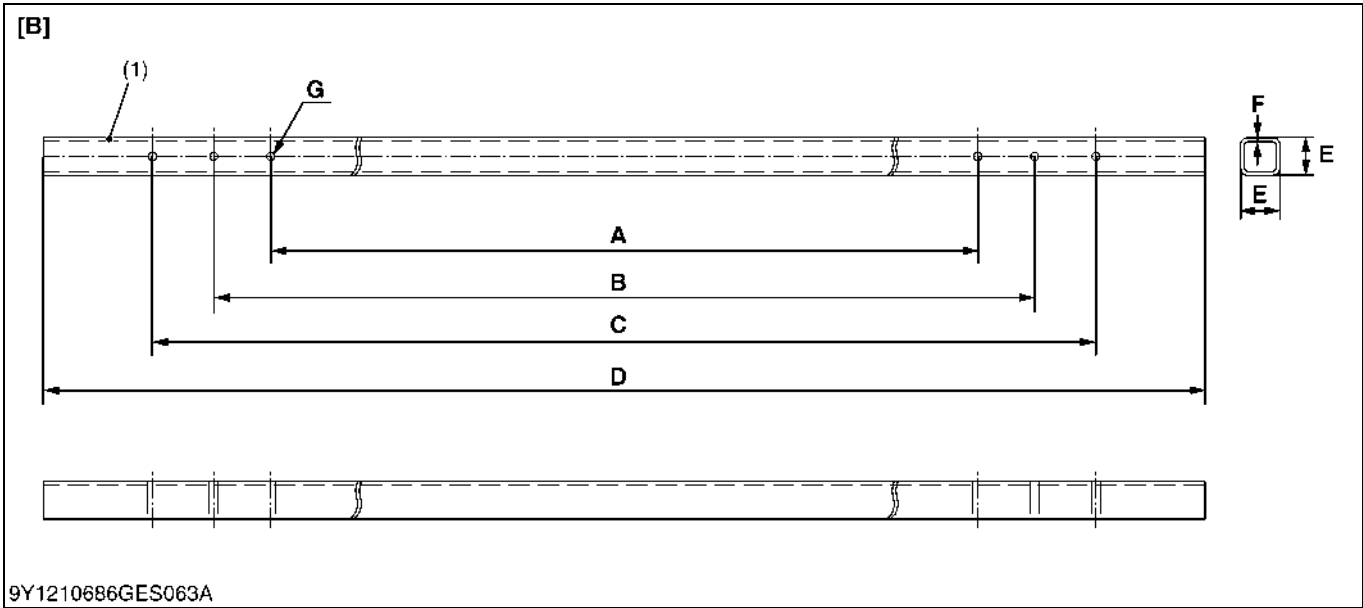


A	77.0 mm (3.03 in.)	G	600 mm (23.6 in.)	M	60.0 mm (2.36 in.)
B	50.0 mm (2.17 in.)	H	1562 mm (61.50 in.)	N	4.5 mm (0.18 in.)
C	200 mm (7.87 in.)	I	65.0 mm (2.56 in.)	O	8-11.0 mm dia. (0.433 in. dia.)
D	32.0 mm (1.26 in.)	J	15.0 mm (0.984 in.)	P	5-20.0 mm dia. (0.787 in. dia.)
E	260 mm (10.2 in.)	K	40.0 mm (2.17 in.)	Q	60.0 mm (2.36 in.)
F	400 mm (15.7 in.)	L	20.0 mm (0.787 in.)		

(1) Material : STKR400
(60 × 60 × t45)

(2) Material : SPHC-P

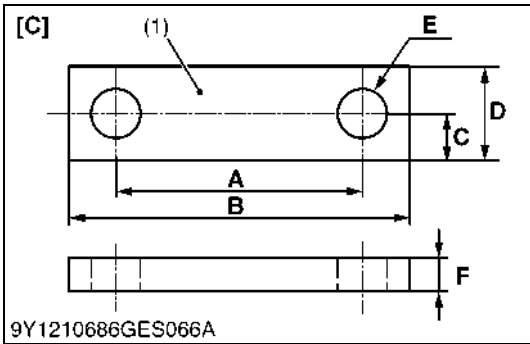
9Y1210686GEG0130US0



A	1050 mm (41.34 in.)	D	1650 mm (64.96 in.)	F	4.5 mm (0.18 in.)
B	1200 mm (47.24 in.)	E	50.0 mm (1.97 in.)	G	6-11.0 mm dia. (0.433 in. dia.)
C	1362 mm (53.62 in.)				

(1) Material : STKR400
(50 × 50 × t45)

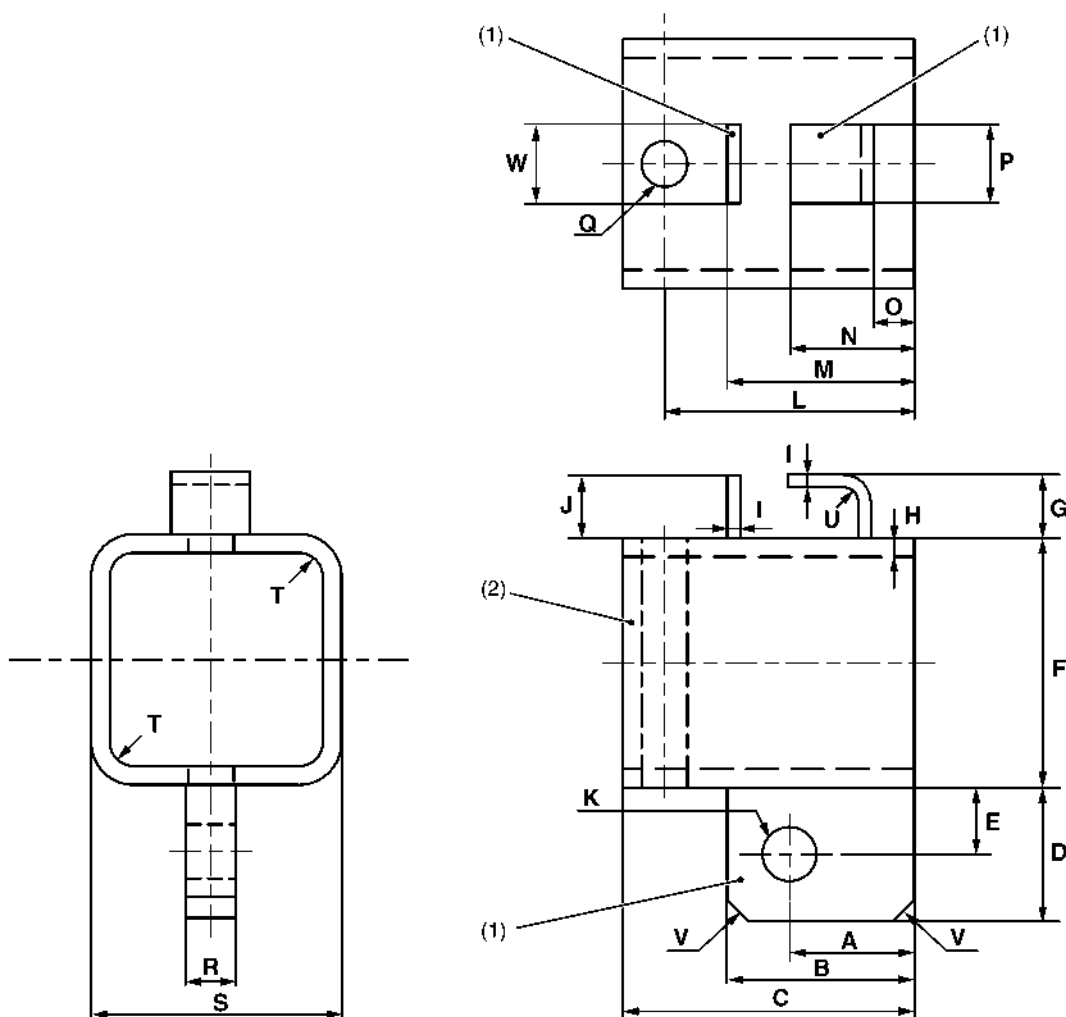
9Y1210686GEG0131US0



A	62.0 mm (2.44 in.)
B	90.0 mm (3.54 in.)
C	12.5 mm (0.492 in.)
D	25.0 mm (0.984 in.)
E	2-13 mm dia. (2-0.512 in. dia.)
F	9.0 mm (0.35 in.)

(1) Material : SS400

9Y1210686GEG0134US0

[D]

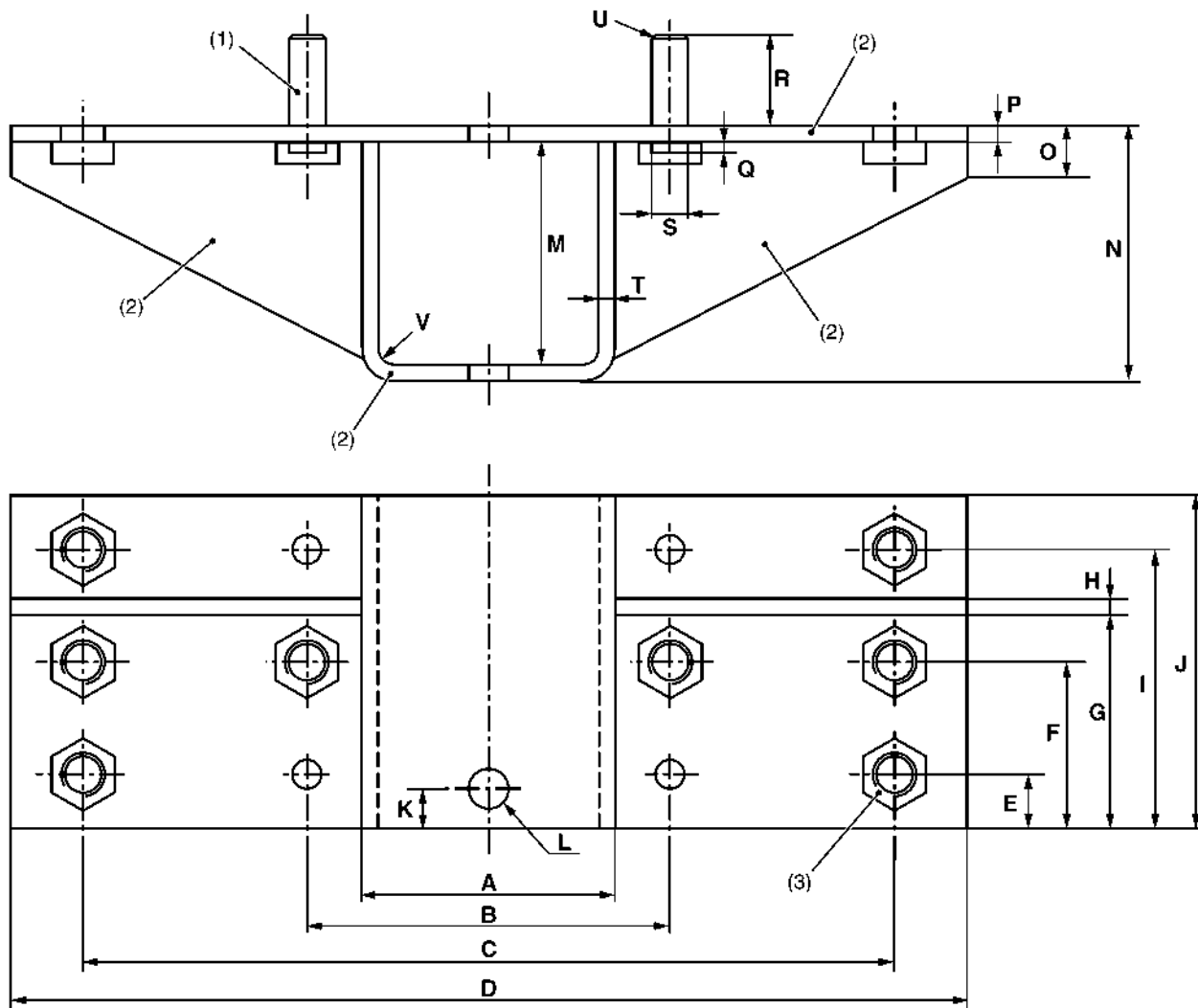
9Y1210686GES064A

A	30.0 mm (1.18 in.)	I	3.2 mm (0.13 in.)	Q	11.0 mm dia. (0.433 in. dia.)
B	45.0 mm (1.77 in.)	J	15.0 mm (0.591 in.)	R	12.0 mm (0.472 in.)
C	70.0 mm (2.76 in.)	K	13.0 mm dia. (0.512 in. dia.)	S	60.0 mm (2.36 in.)
D	32.0 mm (1.26 in.)	L	60.0 mm (2.36 in.)	T	4.5 mm radius (0.18 in. radius)
E	16.0 mm (0.630 in.)	M	45.0 mm (1.77 in.)	U	3.5 mm radius (0.14 in. radius)
F	60.0 mm (2.36 in.)	N	30.0 mm (1.18 in.)	V	Chamfer 5.0 mm (0.20 in.)
G	15.0 mm (0.591 in.)	O	10.0 mm (0.394 in.)	W	19.0 mm (0.748 in.)
H	4.5 mm (0.18 in.)	P	19.0 mm (0.748 in.)		

(1) Material : SS400

(2) Material : STKR400
(60 × 60 × t45)

9Y1210686GEG0132US0

[E]

9Y1210686GES065A

A	70.0 mm (2.76 in.)	I	77.0 mm (3.03 in.)	P	4.5 mm (0.18 in.)
B	100 mm (3.94 in.)	J	92.0 mm (3.62 in.)	Q	3.0 mm (0.12 in.)
C	224 mm (8.82 in.)	K	11.0 mm (0.433 in.)	R	25.0 mm (0.984 in.)
D	264 mm (10.4 in.)	M	61.0 mm (2.40 in.)	S	10.0 mm dia. (0.394 in. dia.)
E	15.0 mm (0.591 in.)	N	64.5 mm (2.54 in.)	T	4.5 mm (0.18 in.)
F	46.0 mm (1.81 in.)	L	11.0 mm dia. (0.433 in. dia.)	U	Chamfer 5.0 mm (0.039 in.)
G	59.0 mm (2.32 in.)	O	14.5 mm (0.571 in.)	V	5.0 mm radius (0.18 in. radius)
H	4.5 mm (0.18 in.)				

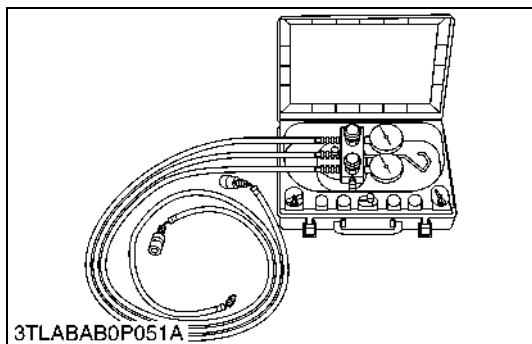
(1) Material : SGD400

(2) Material : SS400

(3) 8-M12 × 1.25 Nut

9Y1210686GEG0133US0

[3] SPECIAL TOOLS FOR AIR CONDITIONER UNIT



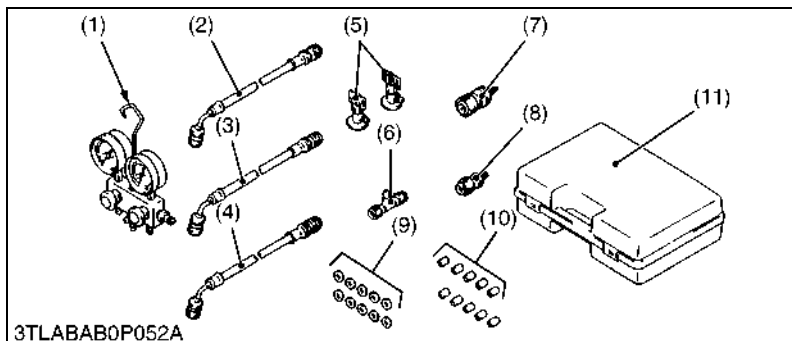
Air Conditioner Service Tool

Code No.

- DENSO 95048-00063

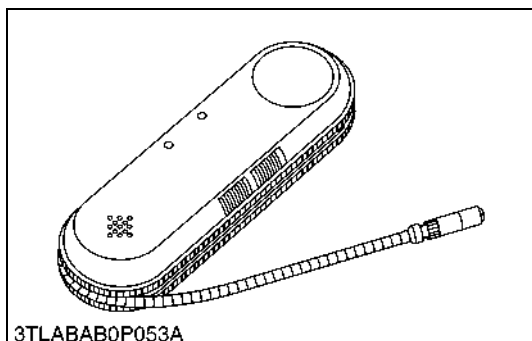
Application

- Use for charge, test or discharge of 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)

WSM000001GEG0042US0



Electric Gas Leak Tester

Code No.

- DENSO 95146-00060

Application

- Use for gas leak test of the air conditioning system.

WSM000001GEG0043US0



Vacuum Pump

Code No.

- DENSO 95046-00130 (AC220V)
- DENSO 95046-00140 (AC240V)

Application

- Use to evacuate the air conditioning system.

(1) Adaptor (For 134a)

(2) Vacuum Pump

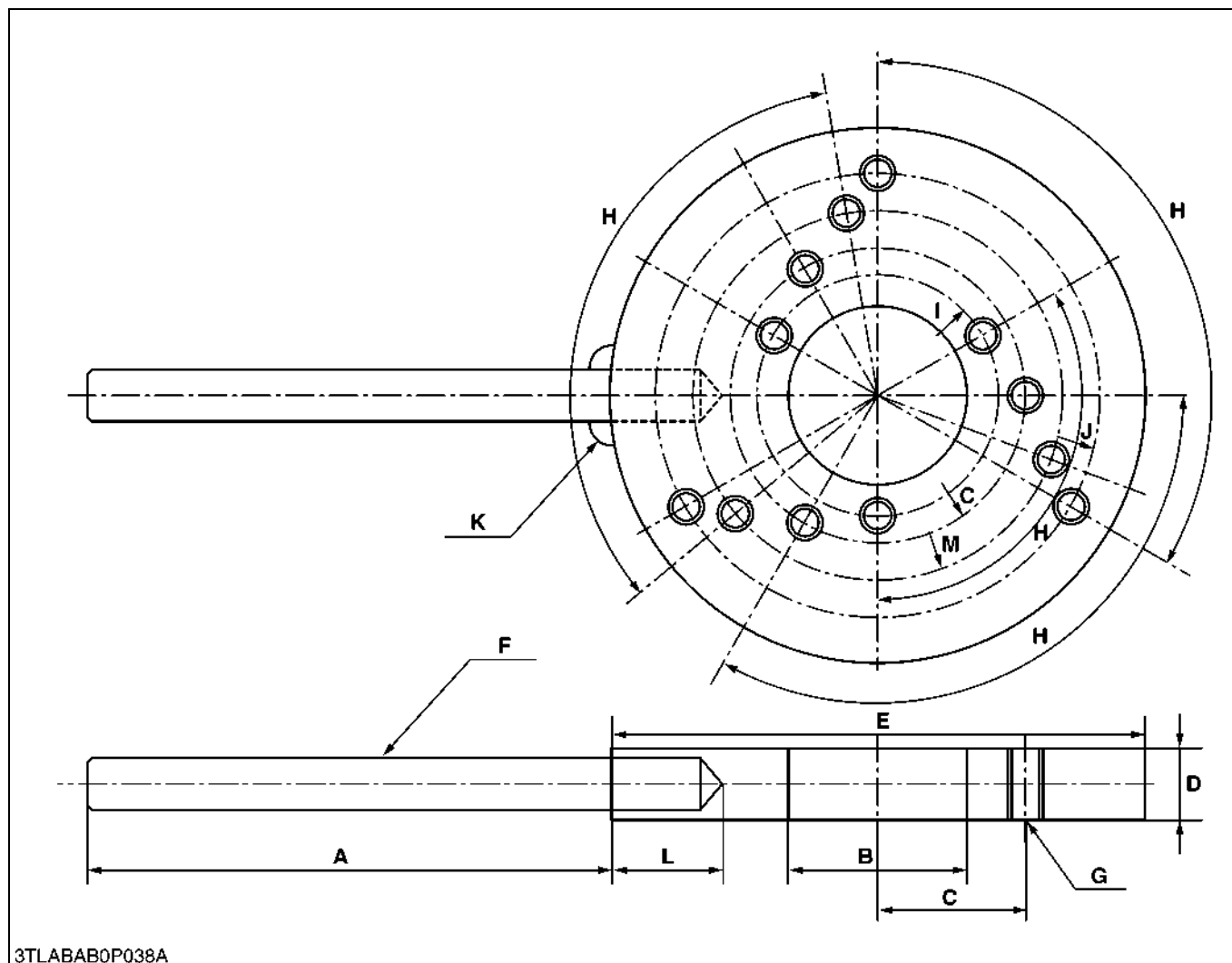
WSM000001GEG0044US0

Stopper Magnet Clutch (For A/C Compressor)**Application**

- Use to loosen and tighten the magnet clutch mounting nut. (Use radius **M**)

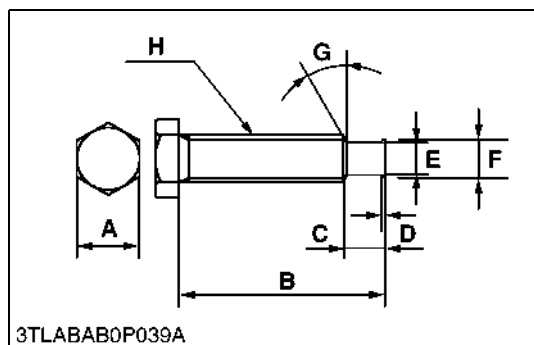
NOTE

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



A	125 mm (4.92 in.)	H	4.52 rad (120 °)
B	40 mm dia. (1.57 in. dia.)	I	Radius 27 mm (Radius 1.06 in.)
C	Radius 33 mm (Radius 1.30 in.)	J	Radius 50 mm (Radius 1.97 in.)
D	16 mm (0.63 in.)	K	Weld all around
E	120 mm dia. (4.72 in. dia.)	L	20 mm (0.78 in.)
F	12 mm dia. (0.47 in. dia.)	M	Radius 41 mm (Radius 1.61 in.)
G	3 × M8 × 1.25 All screws		

9Y1210686GEG0044US0



Stopper Bolt (for A/C Compressor)

Application

- Use with the stopper magnet clutch.

NOTE

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

A	12 mm (0.47 in.)	E	5.5 mm dia. (0.22 in. dia.)
B	35 mm (1.38 in.)	F	6.5 mm dia. (0.26 in. dia.)
C	7 mm (0.28 in.)	G	0.52 rad (30 °)
D	0.4 mm (0.016 in.)	H	M8 × P1.25

9Y1210686GEG0045US0

9. TIRES



WARNING

To avoid personal injury:

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

IMPORTANT

- Do not use tires other than those approved by KUBOTA.
- Dual tires are not approved.

NOTE

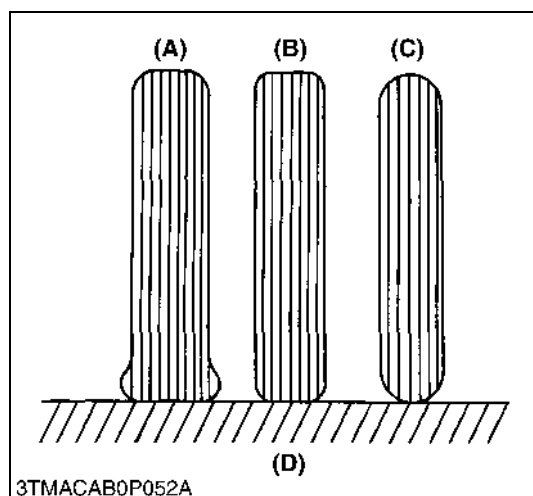
- When optional different-diameter tires are fitted on the machine, the travel speed display mode must be changed. Otherwise the travel speed will not get correctly displayed. Such mode switching is also needed when the original tires are back on the machine. (See page 8-S31.)

9Y1210686GEG0135US0

[1] TIRE SIZE AND INFLATION PRESSURE

IMPORTANT

- Excessive wear of tires may occur due to improper gear ratio.



Through the tire pressure is factory-set to the prescribed level, it naturally drops slowly in the course of time. Thus, check it every day and inflate as necessary.

Recommended Inflation Pressure

- Maintain the pressure shown below for normal use.

	Tire sizes	Inflation pressure
Front	7.50-18	280 kPa (2.8 kgf/cm ² , 40 psi)
	9.5L-15	220 kPa (2.2 kgf/cm ² , 32 psi)
	9.5-22	200 kPa (2.0 kgf/cm ² , 29 psi)
	10.00-16	200 kPa (2.0 kgf/cm ² , 29 psi)
	11.2-24	160 kPa (1.6 kgf/cm ² , 23 psi)
	12.4-24	140 kPa (1.4 kgf/cm ² , 20 psi)
Front (Low Profile)	9.5-20	200 kPa (2.0 kgf/cm ² , 29 psi)
	9.5-24	180 kPa (1.8 kgf/cm ² , 26 psi)
Rear	16.9-30	110 kPa (1.1 kgf/cm ² , 16 psi)
	16.9-34	120 kPa (1.2 kgf/cm ² , 18 psi)
	18.4-28	110 kPa (1.1 kgf/cm ² , 16 psi)
	18.4-30	110 kPa (1.1 kgf/cm ² , 16 psi)
Rear (Low Profile)	16.9-24	120 kPa (1.2 kgf/cm ² , 18 psi)
	18.4-26	110 kPa (1.1 kgf/cm ² , 16 psi)

NOTE

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

(A) Insufficient
(B) Standard

(C) Excessive
(D) Ground

9Y1210686GEG0136US0

[2] TREAD ADJUSTMENT

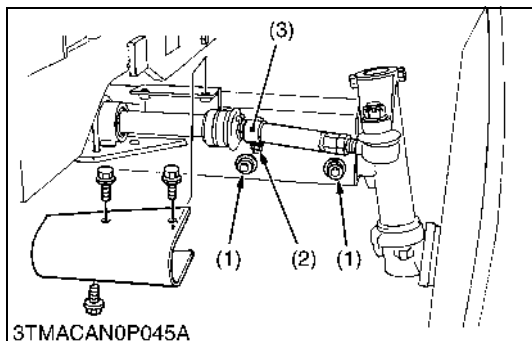


CAUTION

- When working on slopes or when working with trailer, set the wheel tread as wide as practical for maximum stability.
- Support tractor securely on stands before removing a wheel.
- Do not work under any hydraulically supported devices. They can settle, suddenly leak down, or be accidentally lowered. If necessary to work under tractor or any machine elements for servicing or adjustment, securely support them with stands or suitable blocking beforehand.
- Never operate tractor with a loose rim, wheel, or axle.
- Before jacking up the tractor, park it on a firm and level ground and chock the rear wheels.
- Fix the front axle to keep it from swinging.
- Select jacks that withstand the machine weight and set them up.

9Y1210686GEG0137US0

(1) Front Wheels (2WD Model)



Front tread width can be adjusted as shown with the standard equipped tires.

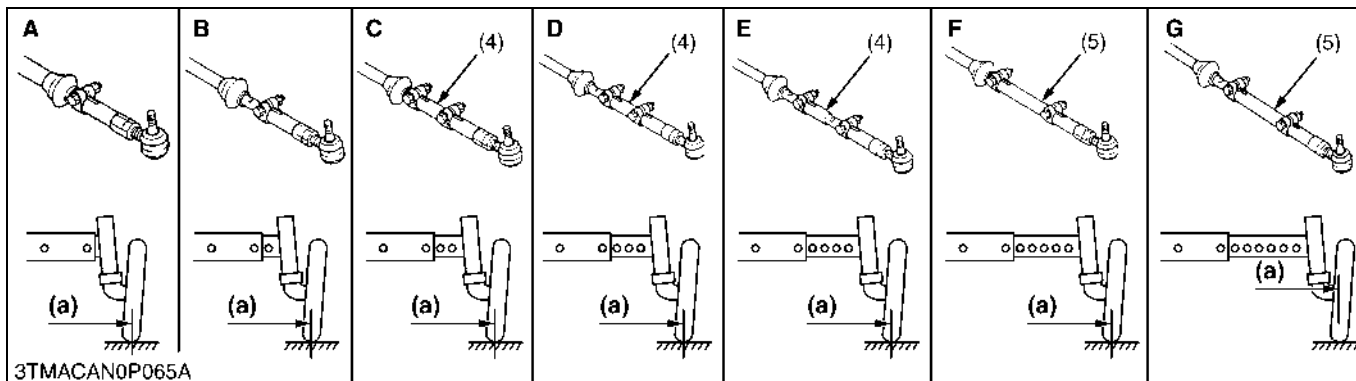
To change the tread width

1. Remove the front axle mounting bolts (1) and the tie-rod mounting bolt (2).
2. Move the front axles (right and left) to the desired position, and tighten the bolts.
3. Adjust the toe-in. (See page G-32.)

NOTE

- The front tread width for the front loader application on 2WD models should not be greater than 1540 mm (60.6 in.).

Toe-in	Factory specification	1.0 to 5.0 mm 0.040 to 0.19 in.
Tightening torque	Front axle mounting bolt	124 to 147 N·m 12.6 to 15.0 kgf·m 91.5 to 108.9 lbf·ft
	Tie-rod mounting bolt	61 to 71 N·m 6.2 to 7.2 kgf·m 44.8 to 52.1 lbf·ft



	A	B	C	D	E	F	G
Tread (a)	1440 mm 56.7 in.	1540 mm 60.6 in.	1640 mm 64.6 in.	1740 mm 68.5 in.	1840 mm 72.4 in.	1940 mm 76.4 in.	2040 mm 80.3 in.

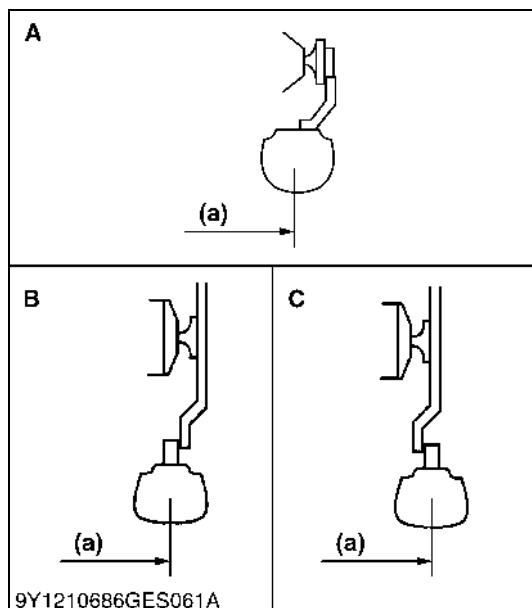
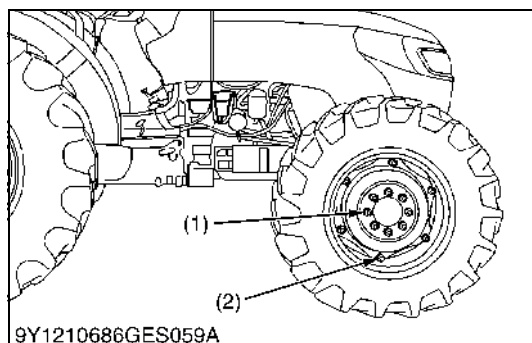
- (1) Front Axle Mounting Bolt
(2) Tie-rod Mounting Bolt

- (3) Tie-rod Clamp
(4) Extension 1 (a short spacer)

- (5) Extension 2 (a long spacer) (a) "TREAD"

9Y1210686GEG0138US0

(2) Front Wheels (4WD Model)



Front tread width can be adjusted as shown with the standard equipped tires.

To change the tread width

1. Remove the wheel rim and disk mounting bolts.
2. Change the position of the rim and disk (right and left) to the desired position, and tighten the bolts.
3. Adjust the toe-in. (See page G-32.)

■ IMPORTANT

- Always attach wheels as shown in the figure.
- If not attached as illustrated, transmission parts may be damaged.
- When re-fitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m (200 yards) and thereafter according to service interval. (See page G-24.)

■ NOTE

- Wheels with beveled or tapered holes: use the tapered side of lug nut.

Toe-in	Factory specification	2.0 to 8.0 mm 0.08 to 0.31 in.
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Tightening torque	Front wheel mounting nut	M16	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 lbf·ft
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Disk : Manufactured by TITAN INTERNATIONAL INC.

Tightening torque	Front disk mounting nut (waffle wheel))	M16	298 to 366 N·m 30.4 to 37.3 kgf·m 220 to 270 lbf·ft
	Front disk mounting nut (Except waffle wheel)	M16	244 N·m 24.9 kgf·m 180 lbf·ft

Disk : Other manufactured

Tightening torque	Front disk mounting nut (Both steel disk and cast iron disk)	M16	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 lbf·ft
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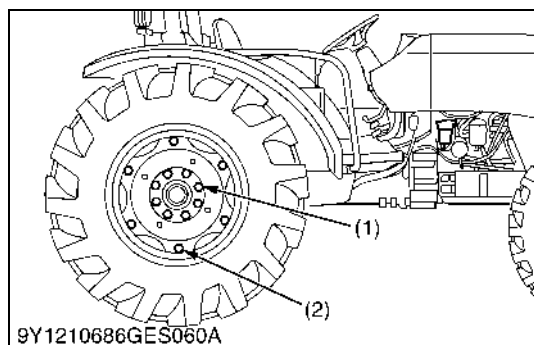
	Tire sizes	A	B	C
Tread (a)	7.50-18, 9.5L-15, 9.5-22, 10.00-16, 11.2-24, 12.4-24	—	1520 mm 59.84 in.	1620 mm 63.78 in.
	9.5-20	1510 mm 59.45 in.	—	—

- (1) Front Wheel Mounting Nut
(2) Front Disk Mounting Nut

(a) Tread

9Y1210686GEG0139US0

(3) Rear Wheels



Rear tread width can be adjusted as shown with the standard equipped tires.

To change the tread width

1. Remove the wheel rim and / or disk mounting bolts.
2. Change the position of the rim and disk (right and left) to the desired position, and tighten the bolts.

■ IMPORTANT

- Always attach wheels as shown in the figure.
- If not attached as illustrated, transmission parts may be damaged.
- When re-fitting or adjusting a wheel, tighten the bolts to the following torques then recheck after driving the tractor 200 m (200 yards) and thereafter according to service interval. (See page G-24.)

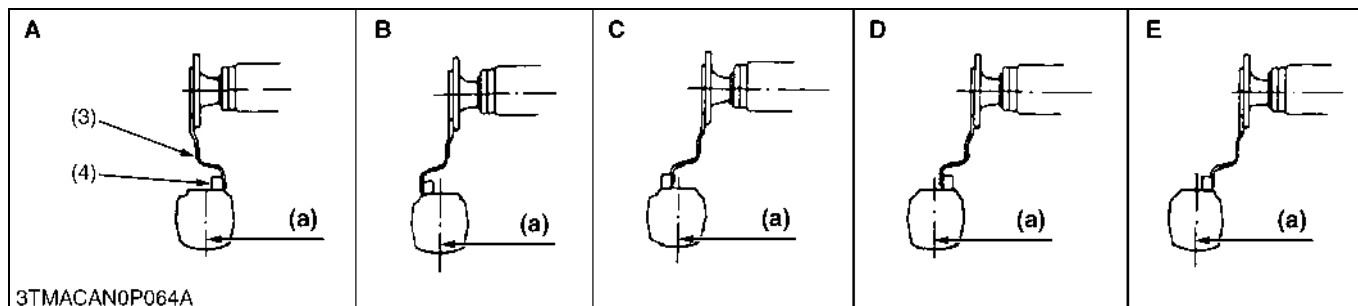
Tightening torque	Rear wheel mounting nut	M18	343 to 401 N·m 35.0 to 41.0 kgf·m 254 to 297 lbf·ft
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Disk : Manufactured by TITAN INTERNATIONAL INC.

Tightening torque	Rear disk mounting nut (steel disk) (4WD)	M16	244 N·m 24.9 kgf·m 180 lbf·ft
	Rear disk mounting nut (cast iron disk) (4WD)	M16	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 lbf·ft

Disk : Other manufactured

Tightening torque	Rear disk mounting nut (Both steel disk and cast iron disk)	M16	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 lbf·ft
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Tread (a)	A	B	C	D	E
16.9-30 (M8560)	1520 mm	1620 mm	1720 mm	1820 mm	1920 mm
18.4-30 (M9560)	59.84 in.	63.78 in.	67.72 in.	71.65 in.	75.59 in.
16.9-24 (M8560-LP)	1500 mm	1590 mm	1700 mm	1790 mm	1900 mm
	59.06 in.	62.60 in.	66.93 in.	71.47 in.	74.80 in.
18.4-26 (M9560-LP)	1520 mm	1600 mm	1700 mm	1800 mm	1900 mm
	59.84 in.	62.99 in.	66.93 in.	70.87 in.	74.80 in.

(1) Rear Wheel Mounting Nut
(2) Rear Disk Mounting Nut

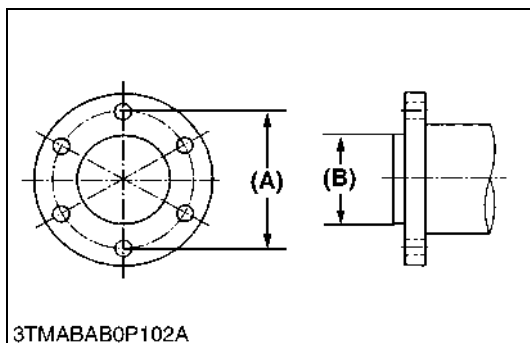
(3) Rear Wheel Disk

(4) Rear Wheel Rim

(a) Tread

9Y1210686GEG0140US0

[3] WHEEL HUB



	Front wheel hub		Rear wheel hub
	2WD	4WD	—
Screw circle diameter (A)	152.4 mm (6.000 in.)	203.2 mm (8.000 in.)	203.2 mm (8.000 in.)
Number of screws	6	8	8
Screws	M14 × P1.5	M16 × P1.5	M18 × P1.5
Hub pilot diameter (B)	114.0 mm (4.488 in.)	152.4 mm (6.000 in.)	152.4 mm (6.000 in.)

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[4] TIRE LIQUID INJECTION

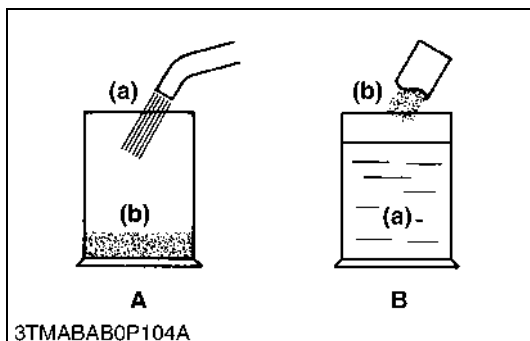
Auxiliary weights can be used to increase traction force for plowing in fields or clayey ground.

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.

9Y1210686GEG0142US0



Preparation of Calcium Chloride Solution

⚠ CAUTION

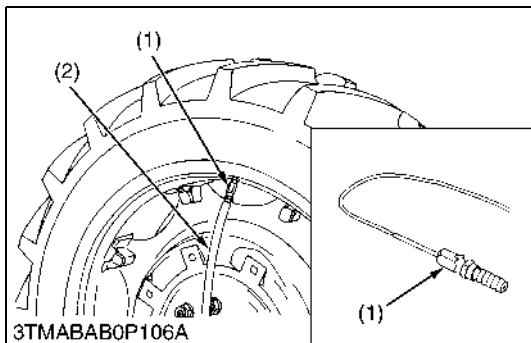
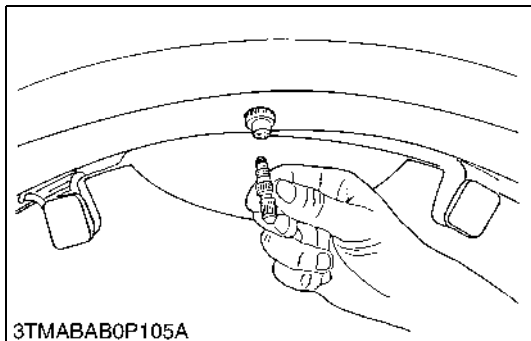
- When making a calcium chloride solution, do not pour water over calcium chloride since this results in chemical reaction which will cause high temperature. Instead add a small amount of calcium chloride to the water at a time until the desired solution is achieved.

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) CaCl₂ (Calcium Chloride)

9Y1210686GEG0143US0



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

9Y1210686GEG0144US0

Fig. 1

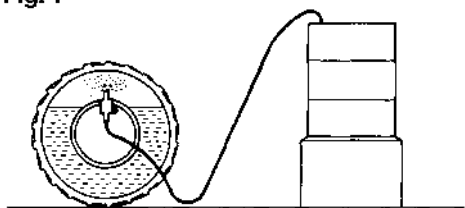


Fig. 2

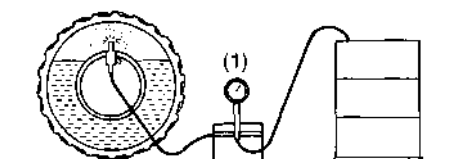
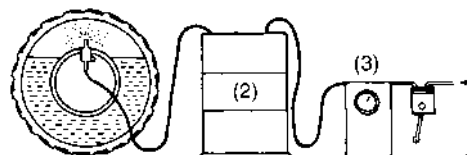
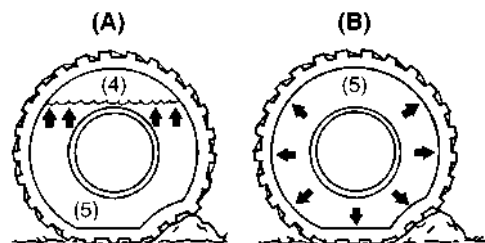


Fig. 3



3TMABAB0P111A



3TMABAB0P107A

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.

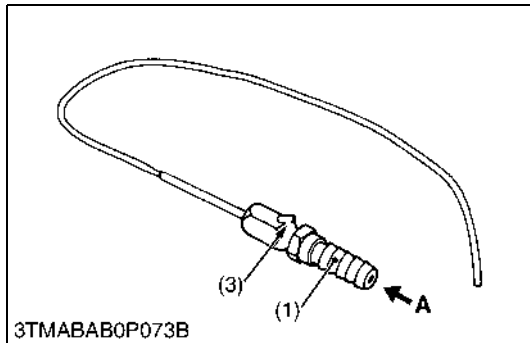
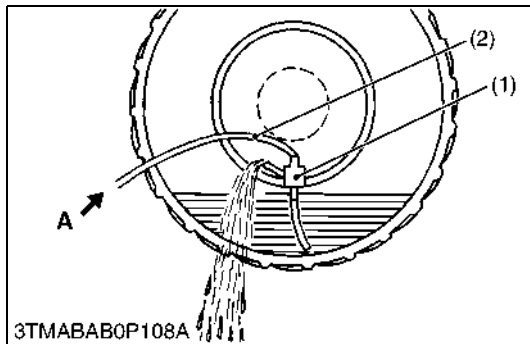
Tire sizes	16.9-30	16.9-34	18.4-28	18.4-30
Slush free at -10 °C (14 °F) Solid at -30 °C (-22 °F) [Approx. 1 kg (2 lbs.) CaCl ₂ per 4 L (1 gal.) of water]	314 kg (693 lbs)	342 kg (755 lbs)	357 kg (787 lbs)	385 kg (848 lbs)
Slush free at -24 °C (-11 °F) Solid at -47 °C (-53 °F) [Approx. 1.5 kg (3.5 lbs.) CaCl ₂ per 4 L (1 gal.) of water]	338 kg (746 lbs)	376 kg (829 lbs)	387 kg (853 lbs)	414 kg (912 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]	357 kg (787 lbs)	399 kg (880 lbs)	411 kg (906 lbs)	436 kg (960 lbs)

Tire sizes	16.4-24	18.4-26
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]	231 kg (509 lbs)	299 kg (659 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]	279 kg (616 lbs)	365 kg (805 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]	297 kg (654 lbs)	387 kg (854 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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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 (1), and direct compressed air into the tire to force out the liquid through the injector's vent (3).

- (1) Injector
- (2) Hose
- (3) Vent

A : Compressed Air

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10. 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.]

9Y1210686GEG0046US0

	Tread (max. width) with farm tires			Lower link end max. loading weight W0
	Front		Rear	
	2WD	4WD		
M8560 M9960	2040 mm (80.3 in.)	1620 mm (63.8 in.)	1920 mm (75.6 in.)	Hydraulic high capacity lift cylinder equipped : 3000 kg (8600 lbs) non-equipped : 3200 kg (7055 lbs)

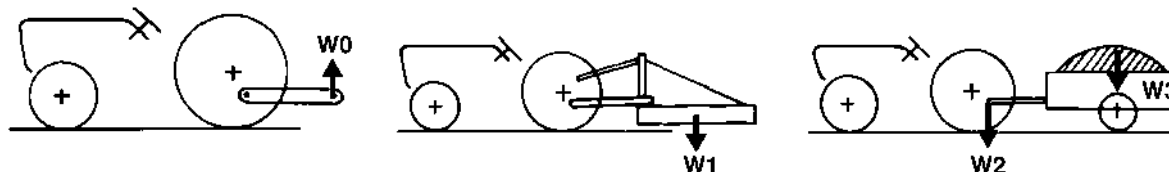
	Actual figures			
	Implement Weight W1 and / or size	Max. Drawbar Load W2	Trailer loading weight W3 Max. capacity	
			2WD	4WD
M8560 M9960	As in the following list (shown on the next page)	1500 kg (3300 lbs)	6000 kg (13200 lbs)	7000 kg (15400 lbs)

Lower link end max. hydraulic lifting capacity : **W0**

Implement weight : The implement's weight which can be put on the lower link : **W1**

Max. drawbar load : **W2**

Trailer loading weight : The max. loading weight for trailer (without trailer's weight) : **W3**



3TMABAB0P109A

■ NOTE

- Implement size may vary depending on soil operating conditions.
- Strictly follow the instructions outlined in the operator's manual of the mounted or trailed machinery or trailer, and do not operate the combination tractor - machine or tractor - trailer unless all instructions have been followed.
- Forestry Application
Following hazards exist;
 - a) topping trees, primarily in case a rear-mounted tree grab-crane is mounted at the rear of the tractor.
 - b) penetrating objects in the operator's enclosure, primarily in case a winch is mounted at the rear of the tractor.

Optional equipments such as OPS (Operator Protective Structure), FOPS (Falling Object Protective Structure), etc. to deal with these hazards and other related hazards are not available for this tractor. Without such optional equipment use is limited to tractor specific applications like transport and stationary work.

9Y1210686GEG0147US0

No.	Implement		Remarks		M8560		M9960	
					2WD	4WD	2WD	4WD
1	Slurry Tank		Max. Tank Capacity		4000 L (1060 U.S.gals, 880 Imp.gals)			
			Max. Load Capacity		5000 kg (11000 lbs)			
2	Trailer		Max. Load Capacity		5000 kg (11000 lbs)	6000 kg (13200 lbs)	5000 kg (11000 lbs)	6000 kg (13200 lbs)
			Max. Drawbar Load		1500 kg (3300 lbs)			
3	Mower	Rotary-Cutter	Max. Cutting Width		2300 mm (90 in.)			
			Max. Weight		600 kg (1320 lbs)			
		Flail Mower (Heavy)	Max. Cutting Width		3660 mm (144 in.)			
			Max. Weight		1000 kg (2200 lbs)			
		Sickle Bar	Max. Cutting Width		2743 mm (108 in.)			
4	Sprayer		Max. Tank-capacity	Mid	800 L (200 U.S.gals 170 Imp.gals)		1000 L (260 U.S.gals 220 Imp.gals)	
				Rear 3-point Hitch	800 L (200 U.S.gals 170 Imp.gals)		1000 L (260 U.S.gals 220 Imp.gals)	
				Draw-bar	4000 L (1300 U.S. gals 880 Imp.gals)	4500 L (1200 U.S. gals 990 Imp.gals)		5000 L (1320 U.S. gals 1100 Imp.gals)
5	Rotary Tiller		Max. Tilling Width		2400 mm (96 in.)			
			Max. Weight		1000 kg (2200 lbs)			
6	Bottom Plow		Max. Size		16 in. × 3 18 in. × 2	16 in. × 4 18 in. × 3 24 in. × 2	16 in. × 4 18 in. × 3	14 in. × 5 16 in. × 4 20 in. × 3 24 in. × 1
			Max. Weight		650 kg (1400 lbs)	750 kg (1650 lbs)	900 kg (2000 lbs)	
7	Disk-harrow	3-point Hitch Type	Max. Size		20 in. × 24	24 in. × 24		24 in. × 28
			Max. Harrowing Width		2450 mm (96 in.)	2850 mm (112 in.)		3300 mm (130 in.)
			Max. Weight		650 kg (1400 lbs)	750 kg (1650 lbs)	900 kg (2000 lbs)	
		Drawbar Type	Max. Harrowing Width		3050 mm (120 in.)	3660 mm (144 in.)		4300 mm (168 in.)
8	Disk Plow		Max. Size		26 in. × 3 28 in. × 3	26 in. × 4 28 in. × 4		
			Max. Weight		650 kg (1400 lbs)	750 kg (1650 lbs)	900 kg (2000 lbs)	
9	Sub Soiler		Numbers of Cultivating Tines		2			
			Cultivating Depth		450 mm (18 in.)	500 mm (20 in.)		550 mm (22 in.)

No.	Implement	Remarks	M8560		M9960	
			2WD	4WD	2WD	4WD
10	Cultivator	Max. Width	4270 mm (168 in.)	4880 mm (192 in.)		5490 mm (216 in.)
		Number of Rows	6			
		Max. Weight	650 kg (1400 lbs)	750 kg (1650 lbs)	900 kg (2000 lbs)	
11	Front Blade ^{*1, *2}	Max. Cutting Width	2130 mm (84 in.)	2430 mm (96 in.)		2600 mm (102 in.)
		Max. Oil Pressure	19.6 MPa (200 kgf/cm ² , 2844 psi)			
12	Rear Blade	Max. Cutting Width	2130 mm (84 in.)	2430 mm (96 in.)		2600 mm (102 in.)
		Max. Oil Pressure	19.6 MPa (200 kgf/cm ² , 2844 psi)			
13	Front Loader ^{*1, *2}	Max. Lifting Capacity	1880 kg (4145 lbs) ^{*3}			
		Max. Oil Pressure	20.5 MPa (209 kgf/cm ² , 2973 psi)			
14	Box Blade	Max. Cutting Width	2130 mm (84 in.)	2430 mm (96 in.)	2130 mm (84 in.)	2430 mm (96 in.)
		Max. Weight	650 kg (1400 lbs)	750 kg (1650 lbs)	800 kg (1760 lbs)	
15	Back Hoe ^{*2}	Max. Digging Depth	3050 mm (120 in.)			
		Max. Weight	1200 kg (2650 lbs)			
16	Snow Blade	Max. Width	2130 mm (84 in.)	2430 mm (96 in.)		2600 mm (102 in.)
		Max. Weight	650 kg (1400 lbs)	750 kg (1650 lbs)	800 kg (1760 lbs)	

■ **NOTE**

- Implement size may vary depending on soil operating conditions.

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

***2 : Need subframe.**

***3 : The valve contains the weight of KUBOTA standard bucket.**

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1 ENGINE

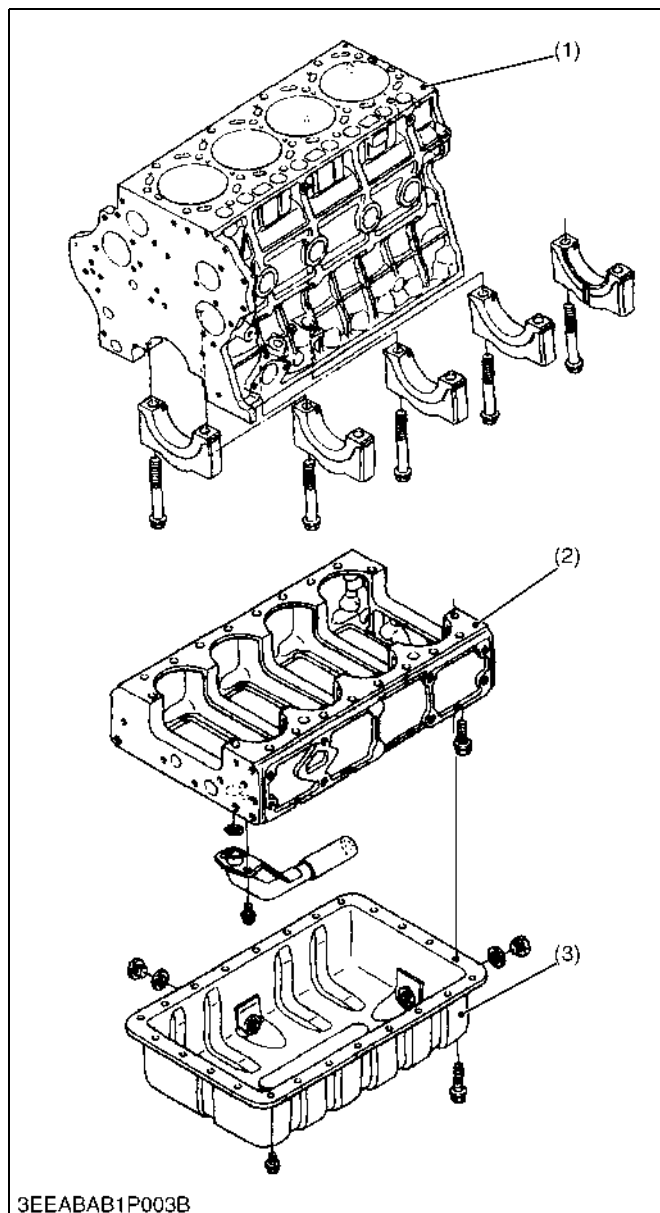
MECHANISM

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1. ENGINE

[1] CYLINDER BLOCK



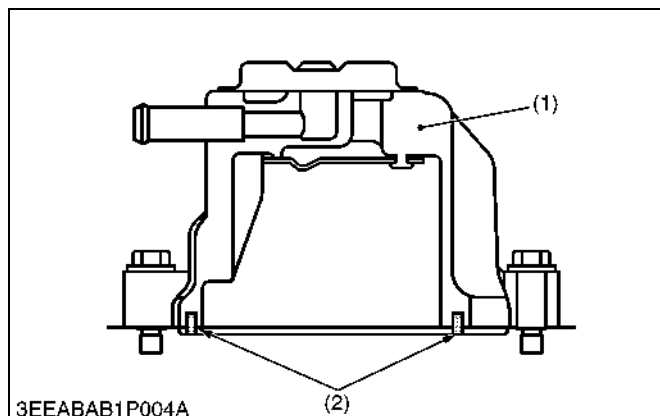
The engine utilizes a split crankcase to produce greater durability and operate more quietly; the crankcase is split into two parts, crankcase 1 (1), which houses the parts for combustion and crankcase 2 (2), which completes crankcase 1 and produces low-noise.

It uses a hanger type of crankshaft support which allows for easy dis/assembly and the lining of the cylinder is a linerless type, which offers good cooling performance and excellent resistance to wear as it is little affected by distortion.

- (1) Crankcase 1
- (2) Crankcase 2
- (3) Oil Pan

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[2] HALF-FLOATING HEAD COVER

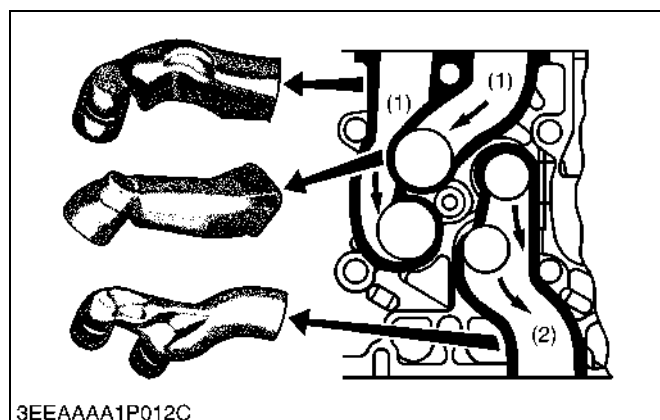


The rubber packing is fitted in to maintain the head cover 0.5 mm (0.02 in.) or so off the cylinder head. This arrangement helps to reduce noise coming from the top of cylinder head.

- (1) Cylinder Head Cover
- (2) Rubber Packing

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[3] CYLINDER HEAD



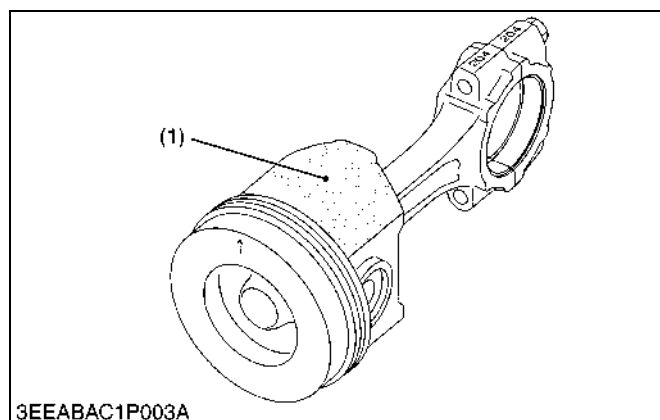
We have improved the helical shaped 2-valve, 2-stage ports in order to generate an ideal swirl and intake air inertia at the intake port and to gain a greater amount of intake air for the air/fuel mixture.

(1) Intake Port

(2) Exhaust Port

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[4] PISTON

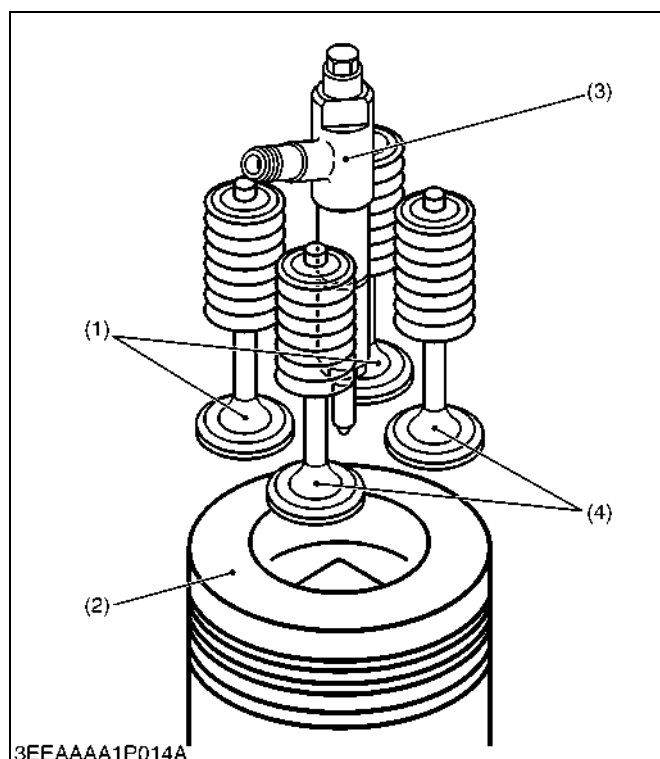


The piston skirt has a disulfide molybdenum coating (1), to improve the fit of the piston with the cylinder and to prevent scorching.

(1) Molybdenum

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[5] CENTER DIRECT INJECTION SYSTEM (E-CDIS)



V3 series DI engine adopts the Center Direct Injection System (E-CDIS), in which the injection nozzle is positioned upright at the center of the cylinder.

This system serves to inject fuel directly at the center of the cylinder. By so doing, injected fuel and suction air can be mixed more uniformly, leading to more stable, higher combustion performance. In other words, cleaner emission, higher power output, lower fuel consumption, lower operating noise and higher start-up performance.

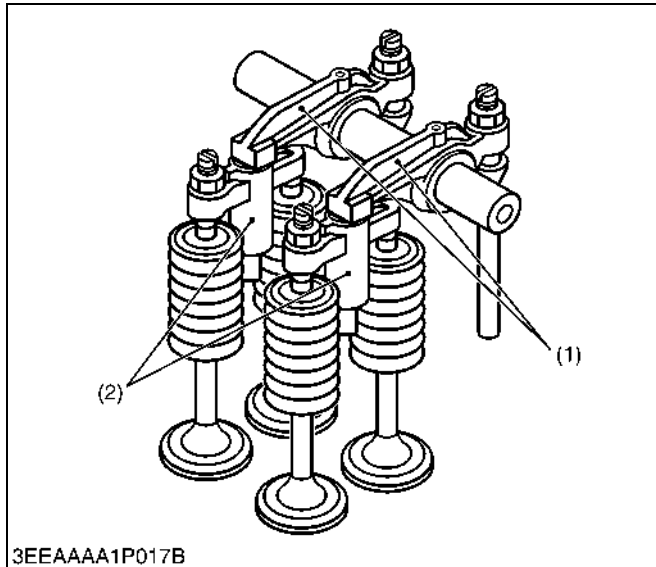
(1) Exhaust Valves

(3) Injection Nozzle

(2) Piston

(4) Intake Valves

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V3 series DI engine has two intake valves and two exhaust valves per each cylinder.

The rocker arm (1) contacts a bridge arm (2) instead of the valves stem tip.

The bridge arm then contacts both intake valves or both exhaust valves and causes two valves to open simultaneously.

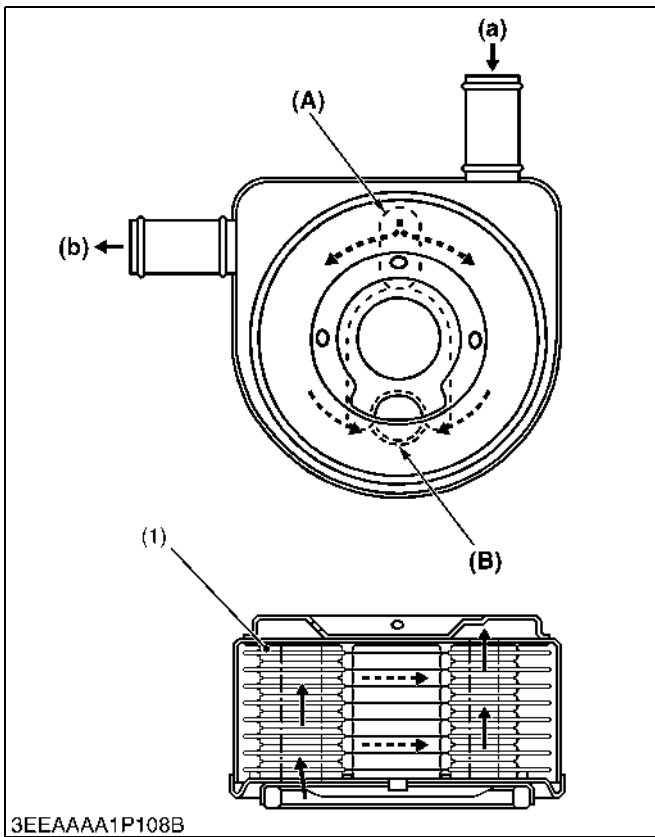
(1) Rocker Arm

(2) Bridge Arm

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2. LUBRICATING SYSTEM

[1] OIL COOLER



V3 series engine has a water-cooled oil cooler that not only cools hot oil, but also warms the cool engine oil shortly after start up.

As shown in the figure, the oil flows inside the connected cooler plate, whereas coolant is kept circulating outside the cooler plate, thereby cooling down or warming the oil.

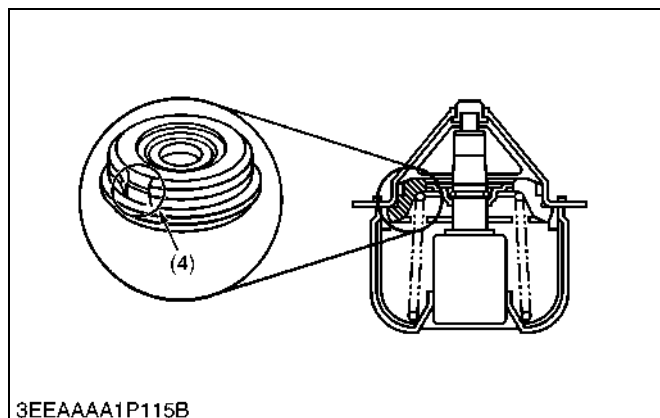
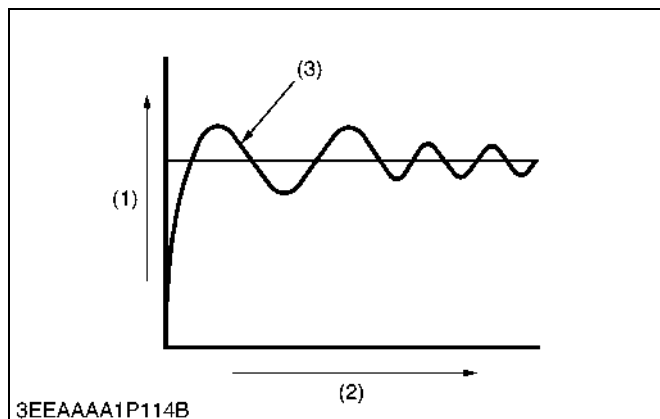
(1) Oil Cooler

- (A) Oil Inlet
- (B) Oil Outlet
- (a) Coolant Inlet
- (b) Coolant Outlet

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3. COOLING SYSTEM

[1] THERMOSTAT



Conventional thermostatically-controlled valves (outlet water temperature control type) open against the flow of coolant. In this design, the pressure (steam pressure + water pump's discharge pressure) affects the open/close performance of such valve. In other words, the valve may be delayed in opening at a preset opening temperature opening suddenly, above the preset temperature. This is called the overshoot phenomenon.

The overshoot problem invites the undershoot phenomenon too. Too much water cooled by the radiator flows through the water passage, which suddenly closes the valve below the thermostat's preset valve closing temperature.

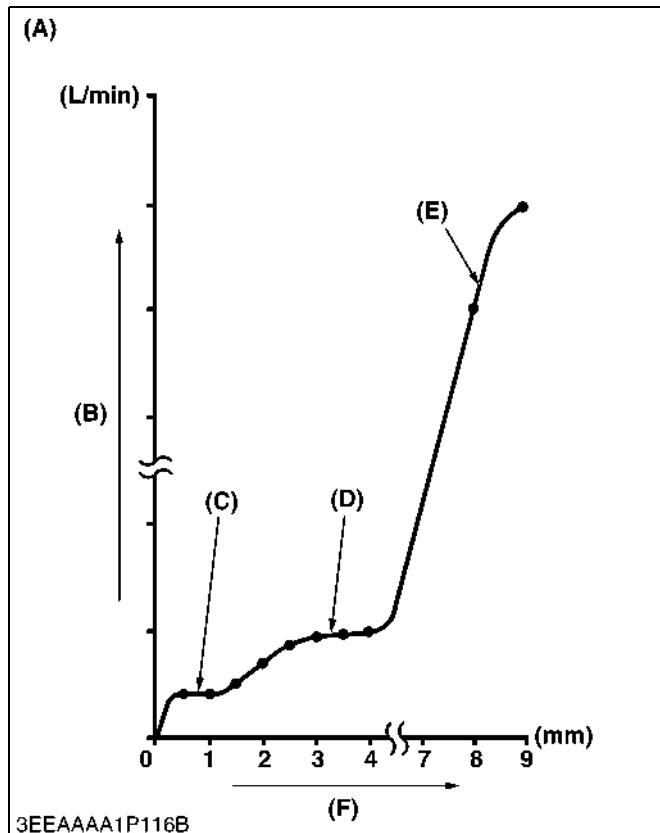
A repeated cycle of such overshoot and undershoot phenomena is called the water temperature hunting. This hunting problem may adversely affect the cooling system parts, and also the engine and its related components.

To cope with this trouble, the V3 series engine is equipped with the flow control thermostat. The valve has a notch to control the coolant flow rate smoothly in small steps.

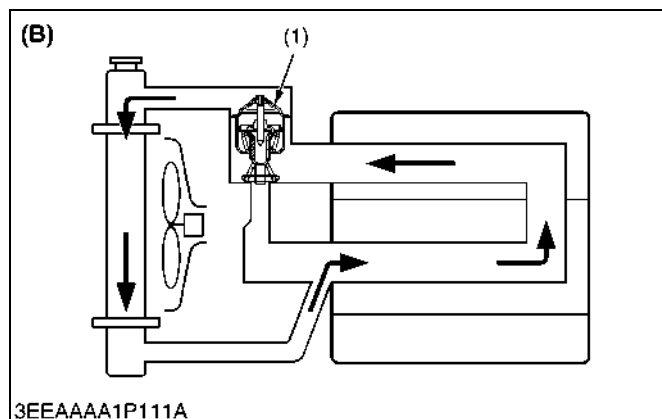
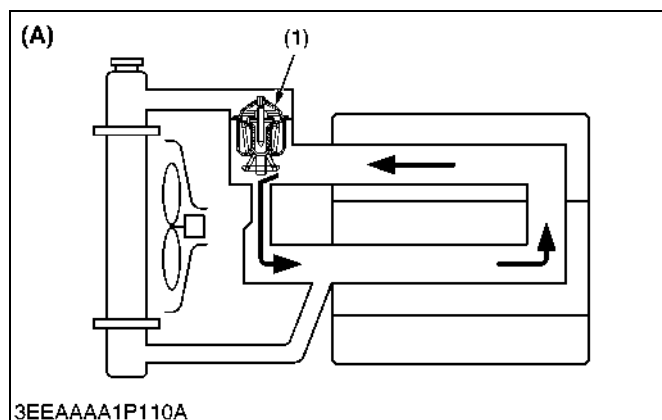
- (1) Coolant Temperature
- (2) Time
- (3) Overshoot
- (4) Notch

- (A) Valve Lift Flow Rate
- (B) Flow Rate
- (C) At Short Valve Lift
- (D) At Medium Valve Lift
- (E) At High Valve Lift
- (F) Valve Lift

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[2] BOTTOM BYPASS SYSTEM



In addition, to improving the cooling performance of the radiator by utilizing a bottom bypass system, the mechanism utilizes a 3-stage thermostat valve that reduces thermal shock considerably compared to previous radiators.

When the coolant inside the engine is cool, the thermostat (1) stays closed and coolant circulates inside the engine via the bypass pipe.

When the temperature of the coolant exceeds the opening temperature of the thermostat (1), the thermostat opens in three stages, sending the now hot coolant to the radiator. Further, when the thermostat is fully open, it is structured so the hot coolant does not flow into the engine via the bypass circuit, thus increasing the cooling performance of the system.

(1) Thermostat

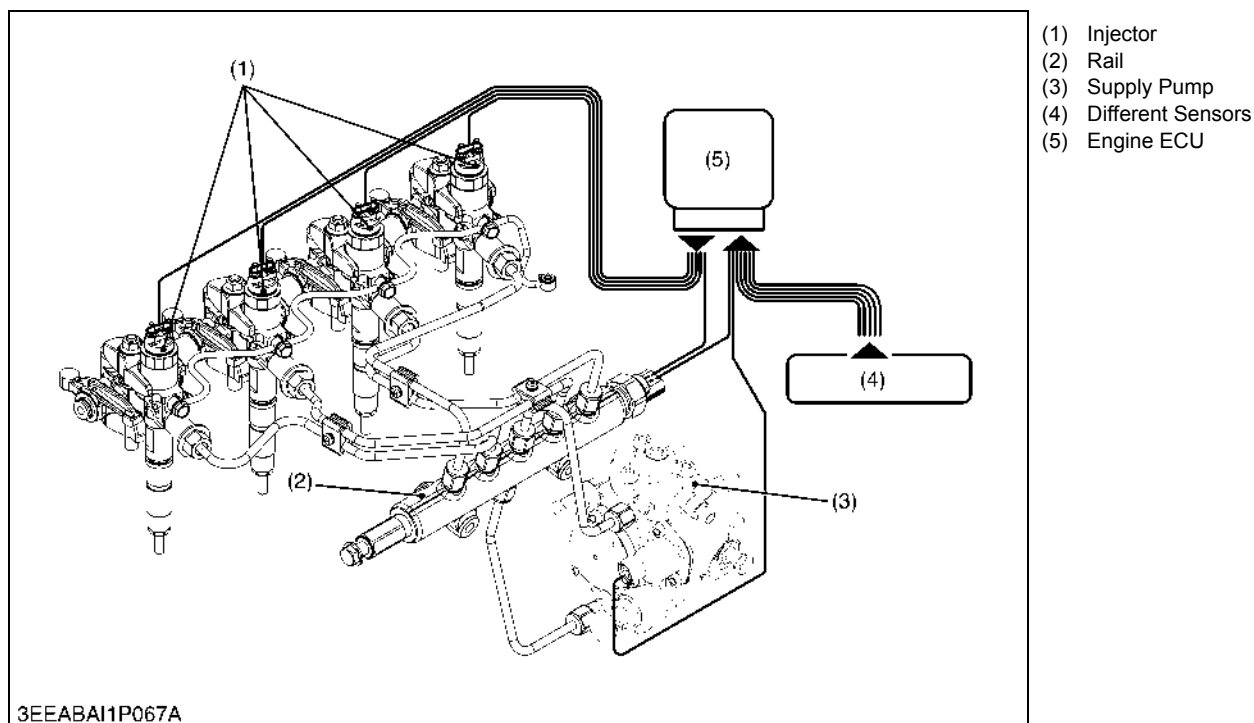
(A) Bypass Opened

(B) Bypass Closed

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4. COMMON RAIL SYSTEM (CRS)

[1] OVERVIEW



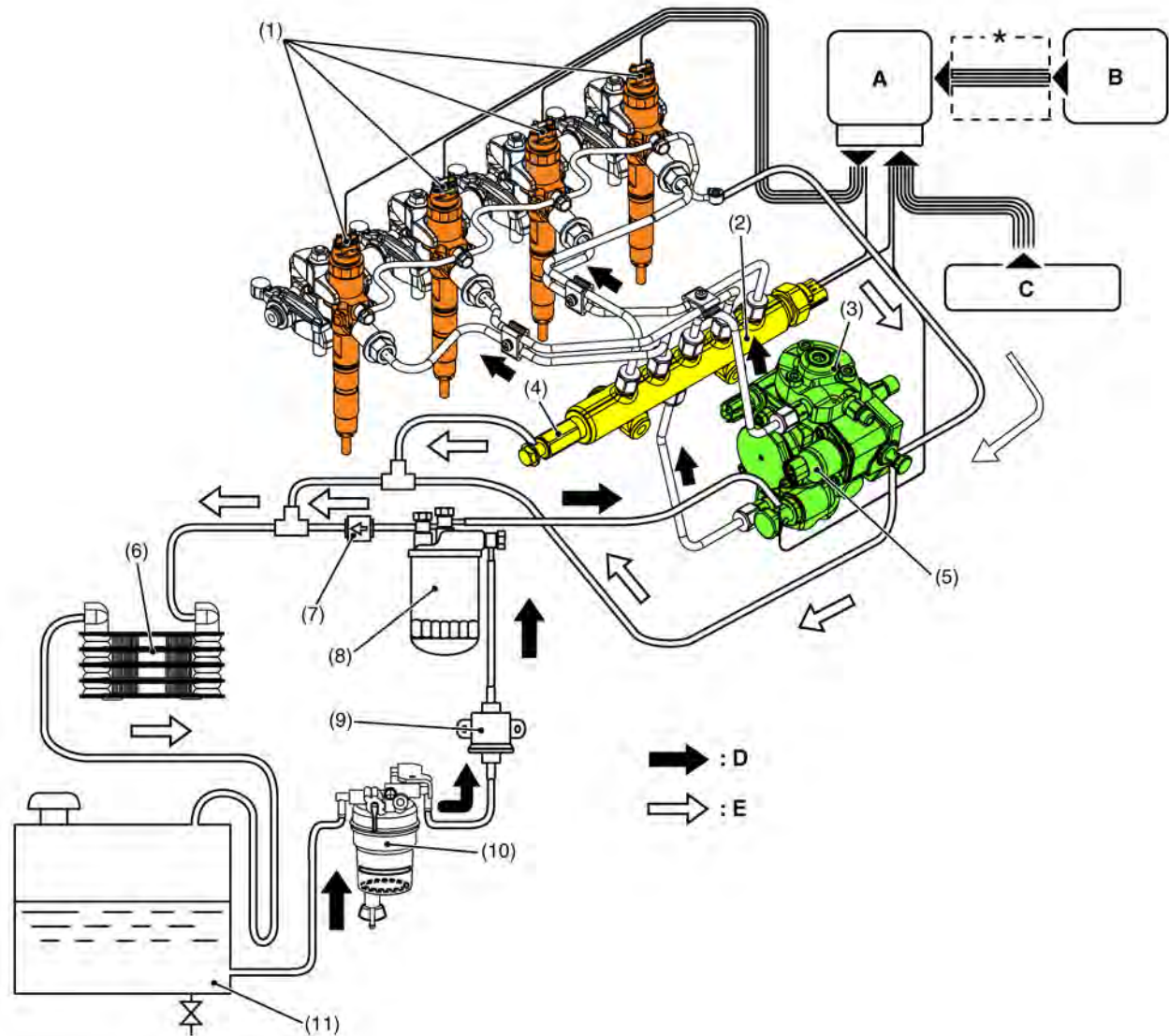
Common rail system not only complies with strict emission regulations, it enables multiple, precise high-pressure injections that do not vary with engine RPM.

This system is an electronically controlled fuel injection device, with a supply pump (3) that pressurizes the fuel, a rail (2) that stores the high-pressure fuel, injectors (1) that inject the fuel under high-pressure via solenoids into each cylinder and an engine ECU that controls them all.

Various parameters are controlled by the engine ECU, such as the amount of fuel from the injectors and their timing, the pressure of fuel in the rail, etc., as sensed via signals from each sensor and CAN communications from the engine ECU.

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[2] FUEL SYSTEM



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- | | | |
|----------------------|---------------------------------|----------------------|
| (1) Injector | (5) SCV (Suction Control Valve) | (9) Fuel Feed Pump |
| (2) Rail | (6) Fuel Cooler | (10) Water Separator |
| (3) Supply Pump | (7) Check Valve | (11) Fuel Tank |
| (4) Pressure Limiter | (8) Fuel Filter | |

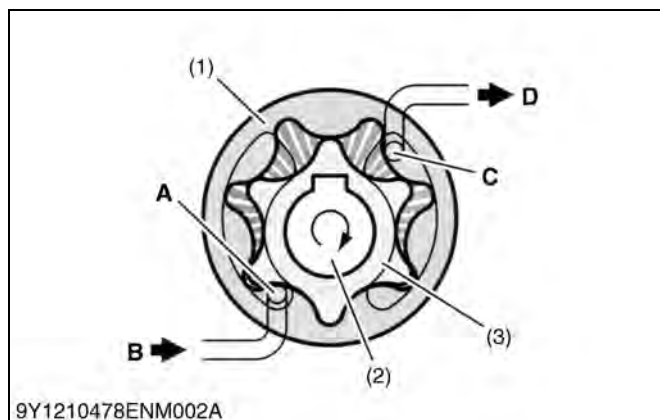
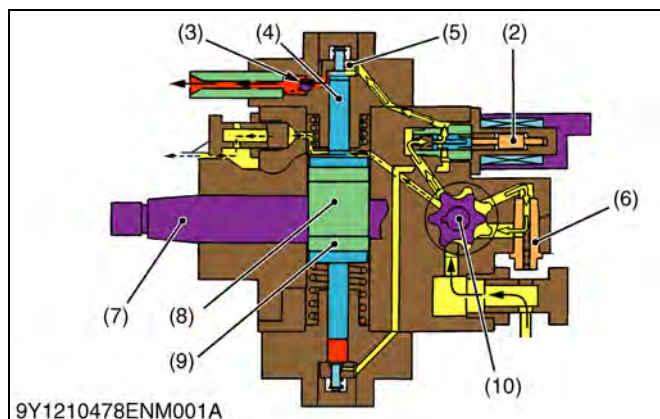
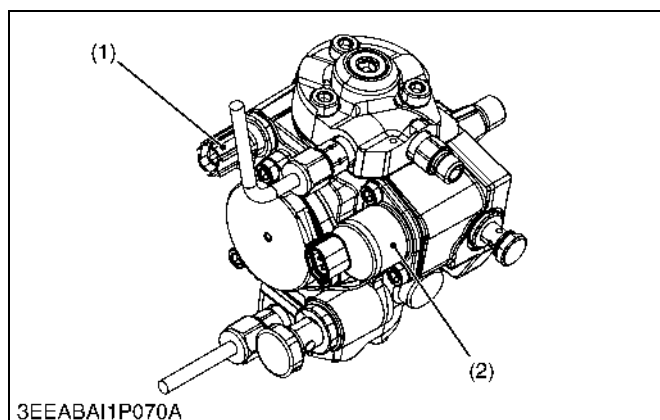
- A: Engine ECU**
B: Tractor ECU
C: Sensor
D: Injected Fuel Flow
E: Returned Fuel Flow

■ NOTE

- The signals marked with * are CAN communication.

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[3] SUPPLY PUMP



The supply pump is equivalent to previously used injection pumps and it delivers fuel to the rail at a pressure more than double that of previous pumps.

It consists of feed pump (10), regulating valve (6), SCV (suction control valve) (2), pump unit, delivery valve (3) and fuel temperature sensor (1).

- | | |
|---------------------------------|----------------------|
| (1) Fuel Temperature Sensor | (6) Regulating Valve |
| (2) SCV (Suction Control Valve) | (7) Drive Shaft |
| (3) Delivery Valve | (8) Eccentric Cam |
| (4) Plunger | (9) Ring Cam |
| (5) Suction Valve | (10) Feed Pump |

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Feed Pump

The feed pump sucks up fuel filtered by the fuel filter and supplies it to the pump unit.

The feed pump is a trochoid pump with an inner rotor and outer rotor (1) geared elliptically; the inner rotor (3) is driven by the drive shaft (2) and drives the outer rotor in turn in the same direction. In the process, the volume of the part enclosed by the teeth of the rotor changes and thus pumps the fuel.

- | | |
|-----------------|------------------------------|
| (1) Outer Rotor | A: Suction Port |
| (2) Drive Shaft | B: From The Fuel Tank |
| (3) Inner Rotor | C: Discharge Port |
| | D: To Pump Chamber |

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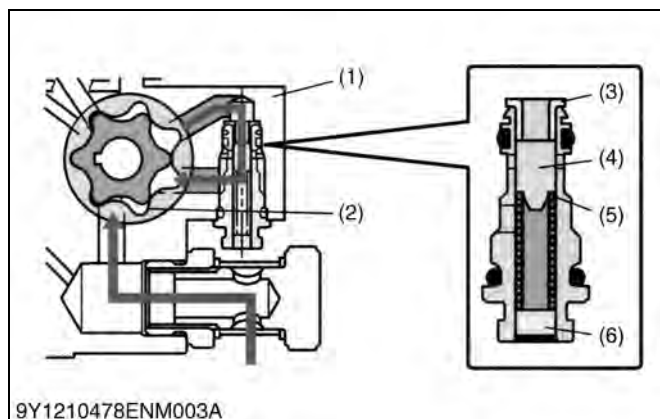
Regulating Valve

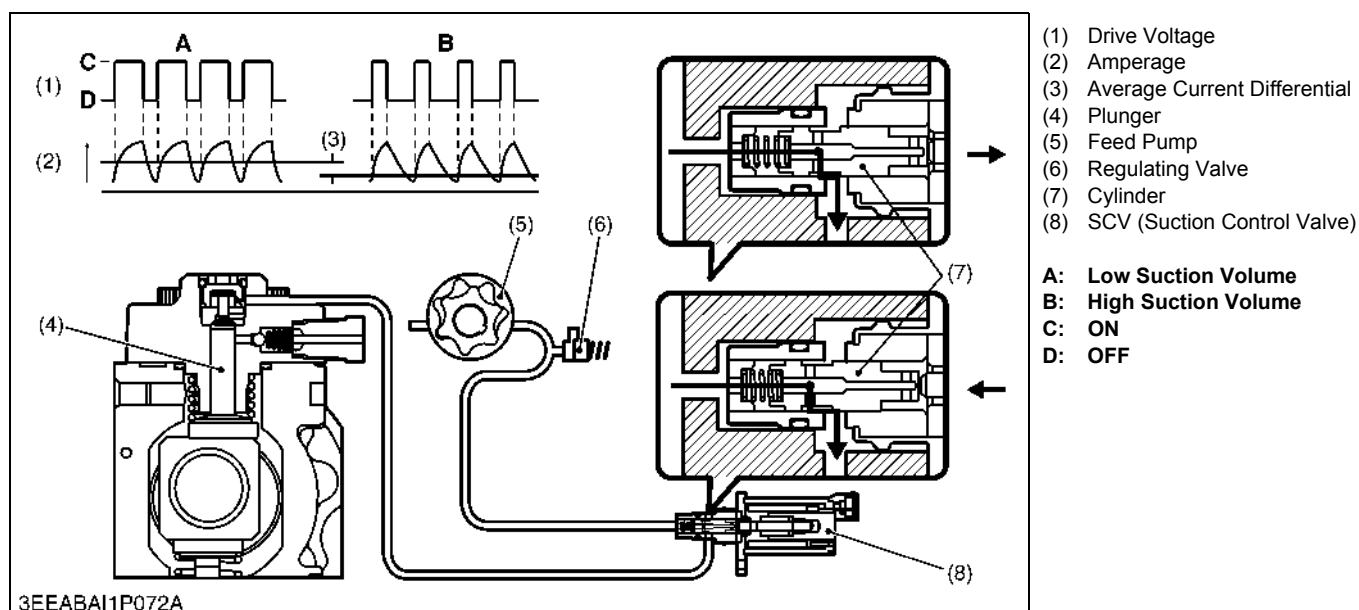
The regulating valve controls the fuel feed pressure (feed pump discharge pressure) so it always stays at the set pressure.

When the feed pressure exceeds the set pressure due to changes in the pump's RPM, the piston (4) overcomes the pressure of the spring (5), opening the valve and returning fuel to the suction side of the feed pump (2).

- | | |
|------------------|------------|
| (1) Pump Housing | (4) Piston |
| (2) Feed Pump | (5) Spring |
| (3) Bushing | (6) Plug |

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SCV (suction control valve)

By regulating the amount of fuel supplied to the plunger (4), the SCV (8) controls the pressure of fuel in the rail. The SCV uses a linear solenoid valve and the fuel flow is controlled by controlling how long the SCV is energized by the engine ECU.

There are two types of SCV valve, the fail-opened type (max flow with no power) and the fail-closed type (min flow with no power) and the engine uses a fail-opened SCV.

When power flows to the SCV (8), the actuator inside moves according to the duty ratio, pressing on the cylinder (7) and altering the flow of fuel corresponding to the size of the cylinder opening and establishing the appropriate amount of fuel.

1) Fail-opened type

When the power to the solenoid is not enough, the cylinder is returned via spring force and the valve opens wide, supplying a large quantity of fuel to the plunger.

When the solenoid is energized, the armature presses the solenoid on the cylinder, compressing the spring and reducing the quantity of fuel supplied. The solenoid turns ON & OFF according to the duty ratio. The quantity of fuel supplied to the plunger is in proportion to the size of the cylinder opening.

2) Duty ratio control

The engine ECU outputs a waveform signal for a set interval. The current amperage is the average amperage of the average current differential. When this average value rises, the size of the valve opening is reduced, and conversely, when it drops, the valve opens wider.

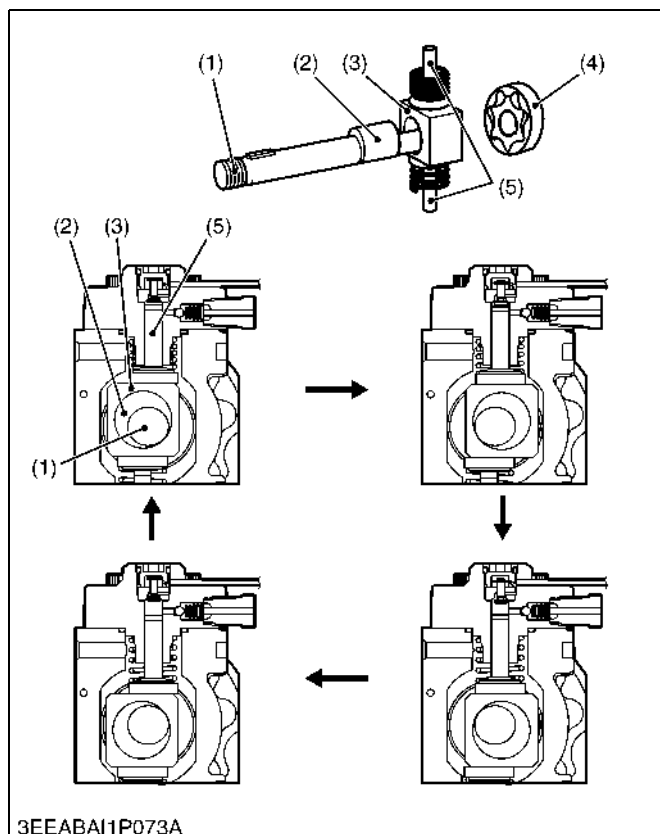
3) When the SCV operates for a short time

The average current to the solenoid is low, so the cylinder is returned via spring force and the valve opens wide, supplying a large quantity of fuel to the plunger.

4) When the SCV operates for a long time

The average current to the solenoid is high, so the armature presses on the cylinder, compressing the spring, closing the valve opening and supplying a smaller quantity of fuel to the plunger.

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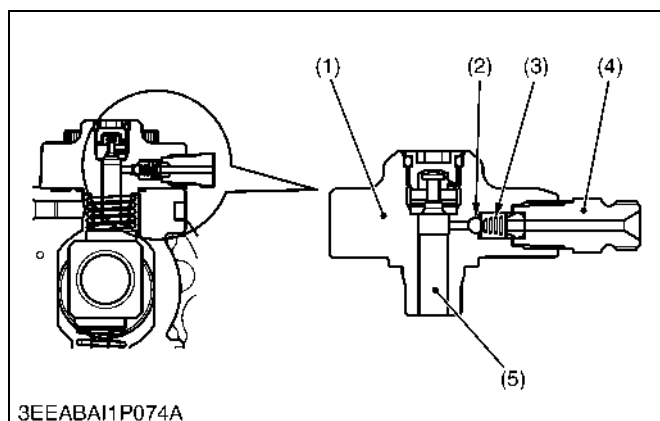
Pump Unit

The pump unit works to increase the pressure of fuel received from the SCV and is composed of a drive shaft (1), ring cam (3) and two plungers (5). A ring cam (3) is mounted on the outside of the eccentric cam (2), which is on the same axle as the drive shaft; the plungers are arranged symmetrically vertically on the ring cam (3).

When the drive shaft (1) rotates, the eccentric cam (2) rotates eccentrically and the ring cam (3) is driven up and down by it, which operates the two plungers (5) through their cycles.

- | | |
|-------------------|---------------|
| (1) Drive Shaft | (4) Feed Pump |
| (2) Eccentric Cam | (5) Plunger |
| (3) Ring Cam | |

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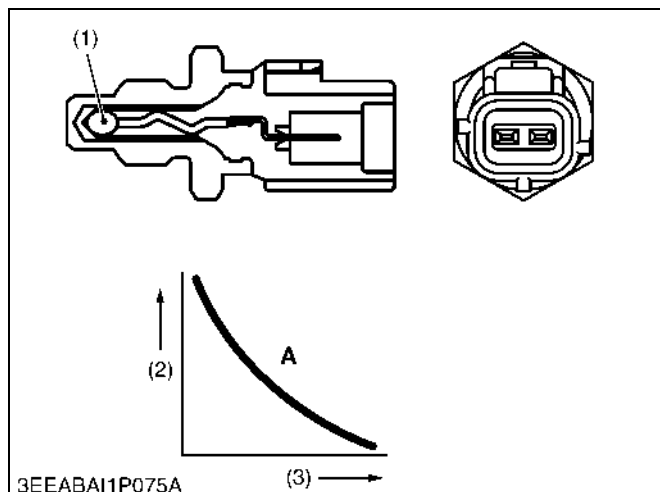
Delivery Valve

The delivery valve is integrated with the element (1) and is composed of a check ball (2), spring (3) and holder (4).

When the pressure on the plunger side equals/exceeds the pressure on the rail side, the check ball (2) opens and discharges fuel. As soon as the fuel pressure feed is completed, the check ball is pressed back by the spring (3) and when that touches the seat of the element (1), that cuts off the rail side from the plunger side, thus preventing any backflow of fuel.

- | | |
|----------------|-------------|
| (1) Element | (4) Holder |
| (2) Check Ball | (5) Plunger |
| (3) Spring | |

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Fuel Temperature Sensor

NOTE

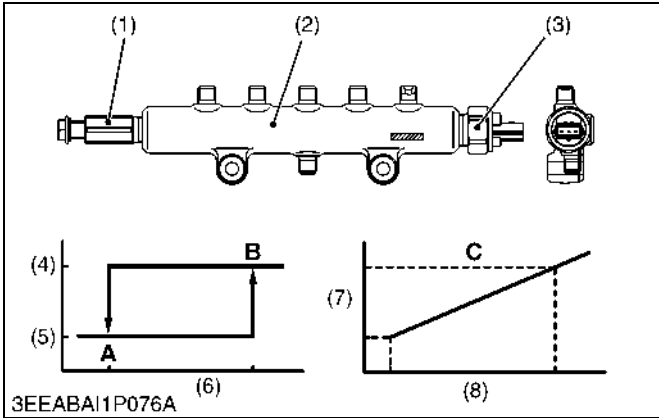
- The fuel temperatures sensor is not treated as a part. When replacing the fuel temperature sensor, replace the supply pump assembly.

The fuel temperature sensor is mounted on the fuel intake side and detects the temperature of the fuel using the characteristic of the thermistor (1), whose electrical conductivity varies with temperature.

- | | |
|-----------------|--|
| (1) Thermistor | A: Thermistor Resistance Temperature Change Curve |
| (2) Resistance | |
| (3) Temperature | |

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[4] RAIL



The common rail (2) stores fuel at the high pressure applied by the supply pump and supplies the shared pressure to the injectors of each cylinder. The rail incorporates control parts a rail pressure sensor (3) and a pressure limiter (1).

The pressure of the fuel in the rail is detected by the rail pressure sensor, and optimal feedback control is provided for the engine RPM and load. This greatly improves the ability to raise the pressure at low RPM and enables high-pressure injection from low speed ranges.

Pressure Limiter

The pressure limiter (1) operates when the pressure inside the common rail (2) becomes excessively high (valve opens), and then once the pressure drops to a certain pressure, it acts to maintain the pressure (valve closes).

Fuel discharged by the pressure limiter returns to the fuel tank.

Valve opening pressure	Reference value	Approx. 220 MPa (2240 kgf/cm ² , 31900 psi)
Valve closing pressure		Approx. 50 MPa (510 kgf/cm ² , 7300 psi)

Rail Pressure Sensor

The rail pressure sensor (3) is mounted on the common rail (2), detects the pressure inside the common rail (2) and sends a signal to the engine ECU.

This rail pressure sensor (3) is a semiconductor type of pressure sensor, which uses the piezo resistance effect, in which increasing the pressure on its silicon element changes its electrical resistance. Please note that the rail pressure sensor (3) is not treated as a part, so replacement requires replacing the rail assembly.

- (1) Pressure Limiter

(2) Rail

(3) Rail Pressure Sensor

(4) Valve (Open)

(5) Valve (Close)

(6) Rail Pressure

(7) Output Voltage

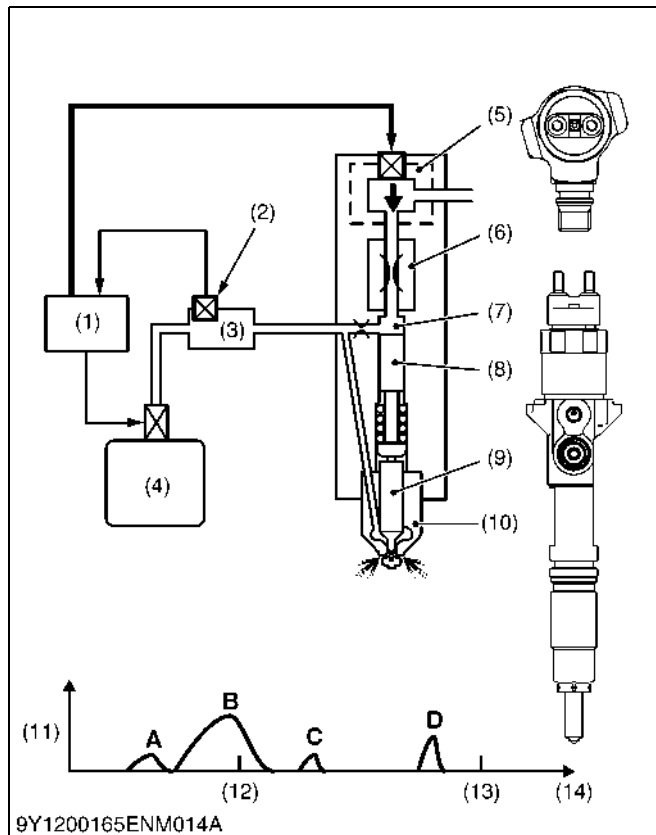
(8) Rail Pressure
- A: Return

B: Abnormally High Pressure

C: Rail Pressure Characteristics

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[5] INJECTOR



The injectors inject high-pressure fuel from the rail into the combustion chamber of the engine, using signals from the engine ECU (1) to produce the ideal timing, amount of fuel, mixture and spray.

The injector injects a finely tuned spray in three pulses during the combustion stage.

A: Pre-injection

First a small amount is injected, mitigating the effect of the initial burn and reducing NOx (oxides of nitrogen) and noise.

B: Main injection

The main injection follows with the real burn, and in the last stage.

C: After injection

Diffuse combustion is induced, thus reducing particulate matter (PM) generated by the main injection.

D: Post injection

Post injection function is to send fuel to Diesel Oxidation Catalyst (DOC) including with Diesel Particulate Filter (DPF) assembly. This injection increases the exhaust temperature.

Injector Architecture

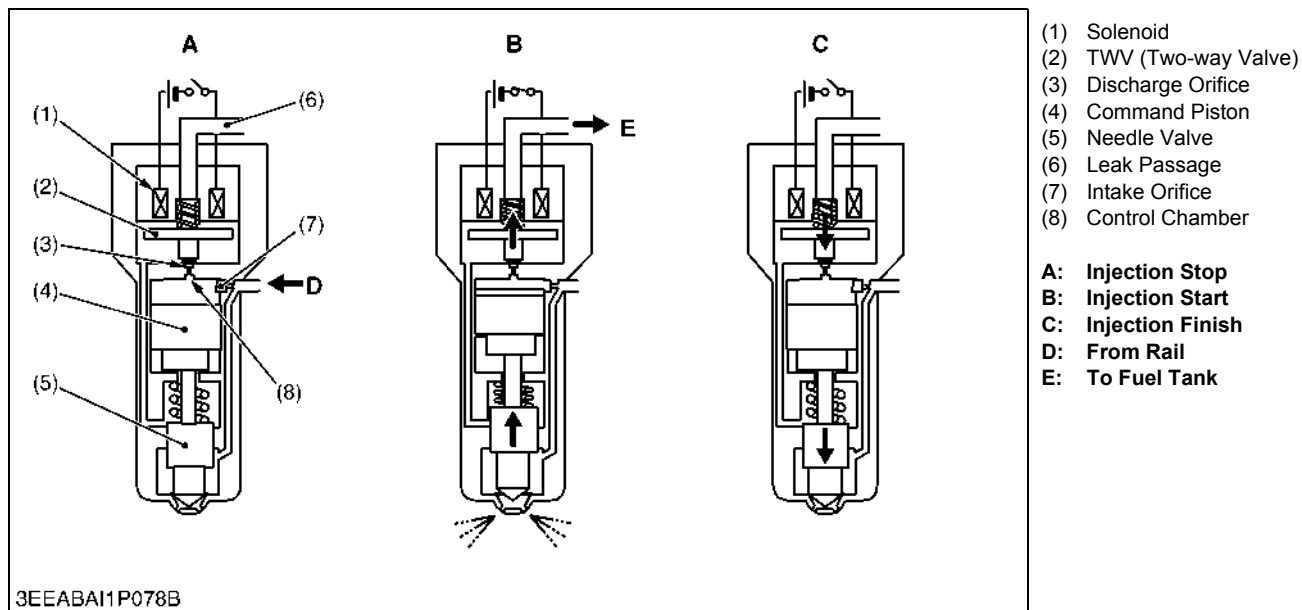
Injectors consist of nozzle components (nozzle (10) and needle valve (9)), a TWV (two-way valve) (5), which controls the volume and mixture of fuel, a control chamber (7) with an intake orifice and discharge orifice (6), a command piston (8) and a nozzle spring.

- (1) Engine ECU
- (2) Rail Pressure Sensor
- (3) Rail
- (4) Supply Pump
- (5) TWV (Two-way Valve)
- (6) Discharge Orifice
- (7) Control Chamber
- (8) Command Piston
- (9) Needle Valve
- (10) Nozzle
- (11) Injection Amount
- (12) T.D.C (Top Dead Center)
- (13) B.D.C (Bottom Dead Center)
- (14) Crank Angle

- A: Pre-injection
- B: Main Injection
- C: After Injection
- D: Post Injection

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Injector Operation



The injector uses the signal output from the engine ECU to control the injection with the fuel pressure in the control chamber.

The system for controlling the pressure of the control chamber works by energizing the solenoid, which opens the passage of the chamber's discharge orifice and the fuel is injected due to the drop in pressure. When the current stops, the pressure in the control chamber returns to what it was and injection ceases.

1) Injection Stop

With no current to the solenoid (1), the TWV (2) cuts off the discharge orifice (3) passage, so rail pressure is applied to the control chamber (8) and the bottom of the needle valve (5). As the diameter of the command piston (4) on the control chamber side is larger than the diameter of the bottom of the needle valve, it works to push the needle valve down, which is compounded by the nozzle spring pushing it down, and the needle valve is closed.

2) Injection Start

When the solenoid (1) is energized, it draws the TWV (2) up, opening the passage of the discharge orifice (3), returning fuel in the control chamber (8) to the fuel tank via the leak passage (6) and dropping the pressure.

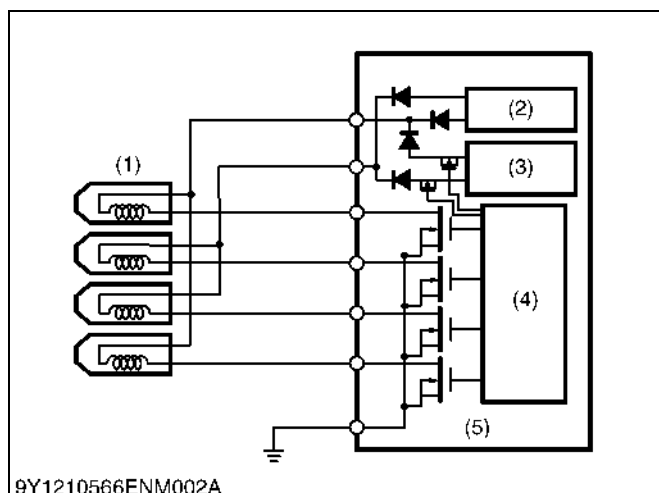
The drop in the pressure of the control chamber causes the pressure applied to the bottom of the needle valve (5) to become greater than the pressure on the control chamber side, and the needle valve compresses the nozzle spring and starts injecting fuel.

3) Injection Finish

When current to the solenoid (1) stops, the TWV (2) lowers and the discharge orifice (3) passage is closed.

When the passage of the discharge orifice closes, the fuel pressure in the control chamber (8) recovers to the rail pressure, so the needle valve (5) is pressed back via the command piston (4), stopping the injection.

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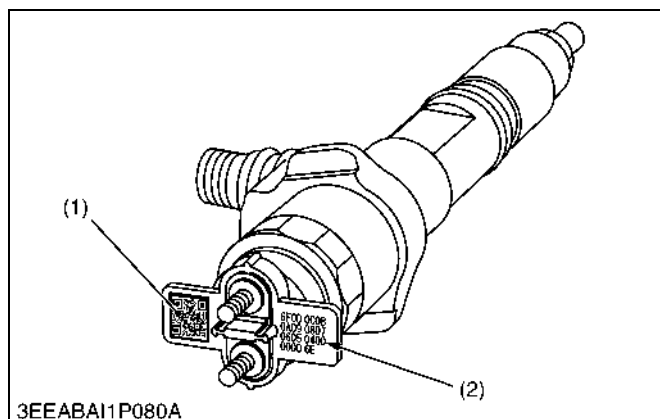
Injector Drive Circuit

To increase the responsiveness of the injector, the voltage that drives the injector is raised to a high voltage, accelerating the magnetization of the solenoid and increasing the responsiveness of the TWV.

The battery voltage is raised to about 110 V by a high voltage generating circuit (3) inside the engine ECU (5) and that voltage is supplied to the injector to actuate it.

- (1) Injector
- (2) Rated Amperage Circuit
- (3) High Voltage Generating Circuit
- (4) Control Circuit
- (5) Engine ECU

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Injector QR/ID Codes

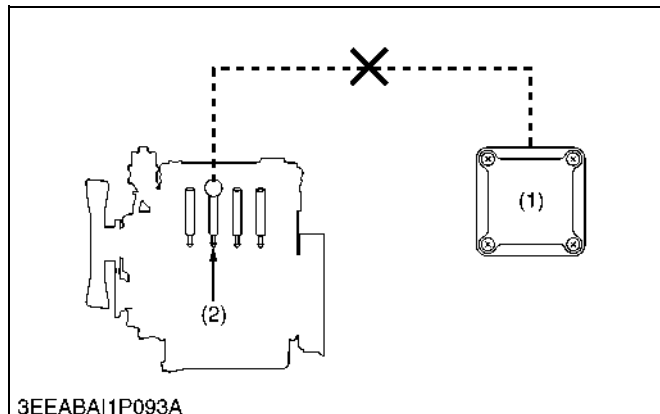
Injectors are processed to exacting tolerances, but there are minute variations in the amount they inject, so to correct for these variations, a correction volume is recorded on the QR code (1) and ID codes (2) of the injectors.

During manufacture, the QR code (1) is read by a scanner and the correction value is registered in the engine ECU.

(1) QR Code

(2) ID Code

9Y1210686ENM0022US0



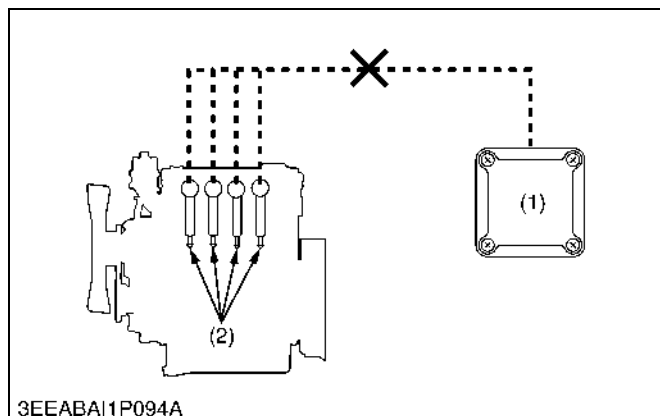
When Replacing an Injector

The ID code of the replacement injector (2) registers into the engine ECU (1).

(1) Engine ECU

(2) Replacement Injector

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When Replacing the Engine ECU

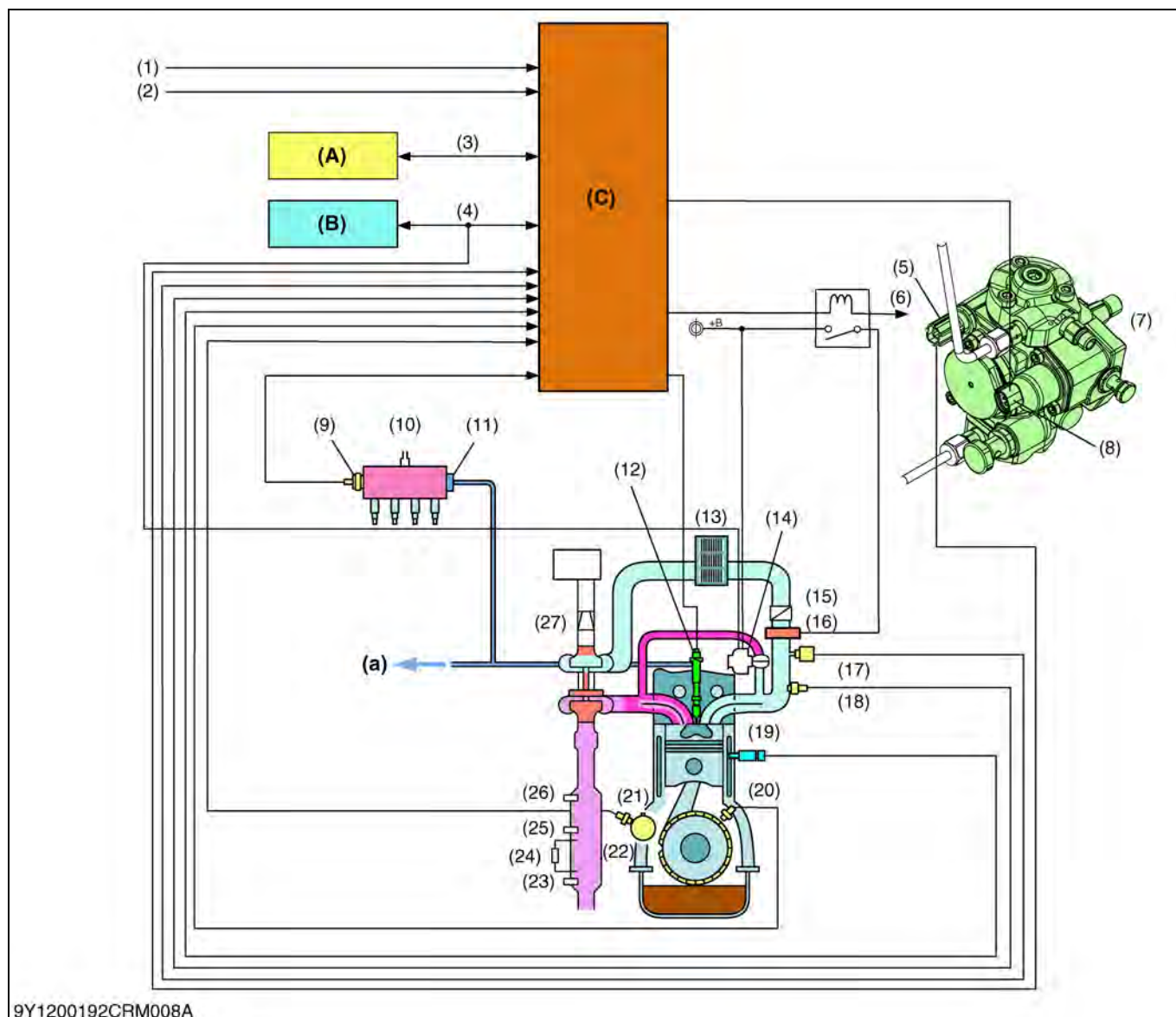
The ID code of all of the injectors (2) registers into the replacement engine ECU (1).

When replacing an engine ECU, as it is necessary to write all of the data, including the injector (2) corrections, only KUBOTA can write the data to the engine ECU.

(1) Replacement Engine ECU (2) Injector

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[6] ENGINE CONTROL SYSTEM



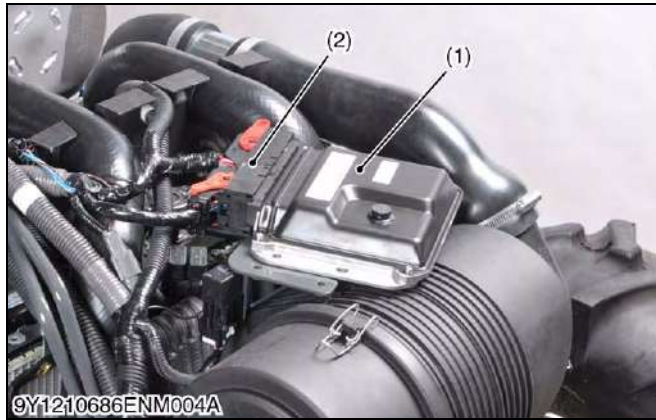
- | | | | |
|---|------------------------------------|--|---|
| (1) Key Switch ON Signal | (9) Rail Pressure Sensor | (21) Camshaft Position Sensor | (26) Exhaust Gas Temperature Sensor0 (T0) (DOC Inlet Exhaust Gas Temperature) |
| (2) Starter Switch Signal | (10) Rail | (22) Diesel Particulate Filter (Hereinafter Referred To As The "DPF") Muffler | (27) Mass Air Flow Sensor |
| (3) CAN Communication for tractor (Accelerator Position Signal*, Neutral Switch*, Machine Travel Speed Signal*) | (11) Pressure Limiter | (23) Exhaust Gas Temperature Sensor2 (T2) (DPF Outlet Exhaust Gas Temperature) | |
| (4) CAN Communication for Service | (12) Injector | (24) Differential Pressure Sensor (DPF Differential Pressure) (ΔP) | |
| (5) Fuel Temperature Sensor | (13) Inter Cooler | (25) Exhaust Gas Temperature Sensor1 (T1) (DPF Inlet Exhaust Gas Temperature) | |
| (6) Air Heater Relay | (14) EGR DC Motor | | |
| (7) Supply Pump | (15) Intake Throttle Valve | | |
| (8) SCV (Suction Control Valve) | (16) Intake Air Heater | | |
| | (17) Boost Pressure Sensor | | |
| | (18) Intake Air Temperature Sensor | | |
| | (19) Coolant Temperature Sensor | | |
| | (20) Crankshaft Position Sensor | | |
- (A) CAN2 Connector (For Tractor)**
(B) CAN1 Connector (For Service)
(C) Engine ECU
(a) To Fuel Tank

■ NOTE

- The signals marked with * are CAN communication.

9Y1210686ENM0047US0

(1) Engine ECU



The engine ECU (1) controls the amount, timing, mixture and pressure of fuel that is injected. The engine ECU (1) operates each kind of control based on the signals from each type of sensor.

The actuator for controlling the amount, timing and mixture of fuel injection is the injector, while the actuator for controlling fuel pressure is the supply pump.

■ Fuel Quantity Control

The amount of fuel to be injected is determined using a basic injection amount, which is calculated based on the state of the engine and driving conditions, with corrections added for parameters such as water temperature, fuel temperature, intake air temperature, intake pressure, etc.

■ Injection Timing Control

The ECU controls the timing for starting to energize the injectors, first determining the timing for the main injection and then setting the timing of other injections, such as pilot injections.

■ Fuel Mixture Control

By conducting a pilot injection, the initial fuel mixture is kept to a minimum, mitigating the explosive initial combustion and reducing NOx and noise.

■ Fuel Pressure Control

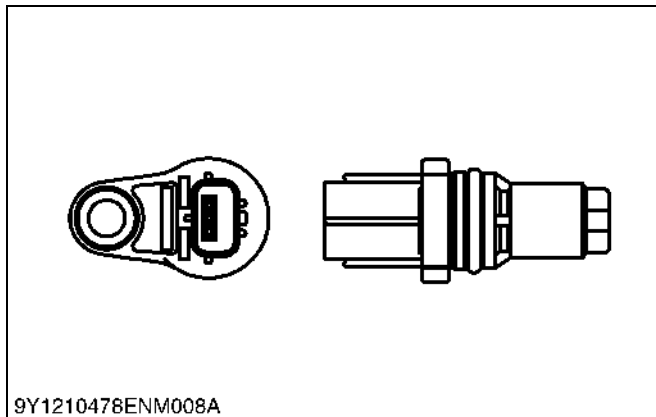
The ECU calculates the set fuel injection pressure based on the engine load (last injection amount and engine RPM) and controls the amount the supply pump supplies and the fuel pressure inside the rail.

(1) Engine ECU

(2) Engine ECU Connector

9Y1210686ENM0026US0

(2) Sensor



9Y1210478ENM008A

Crankshaft Position Sensor

The crankshaft position sensor (2) is mounted near the crankshaft gear of the gear case (1) and the sensor utilizes an MRE (magnetic resistance element) type of sensor.

When the crankshaft pulsar gear passes by the sensor, it alters the magnetic field inside the sensor, generating an AC voltage, which is output to the engine ECU.

Further, the gear has a wide part between teeth, which alters the waveform of the AC voltage and the sensor detects the crankshaft position with every revolution; this change in the voltage is amplified by the IC circuit inside the sensor and outputs it to the engine ECU.

The engine ECU uses the signals to calculate the piston position and engine RPM.

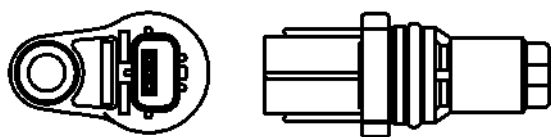
(1) Gear Case

(2) Crankshaft Position Sensor

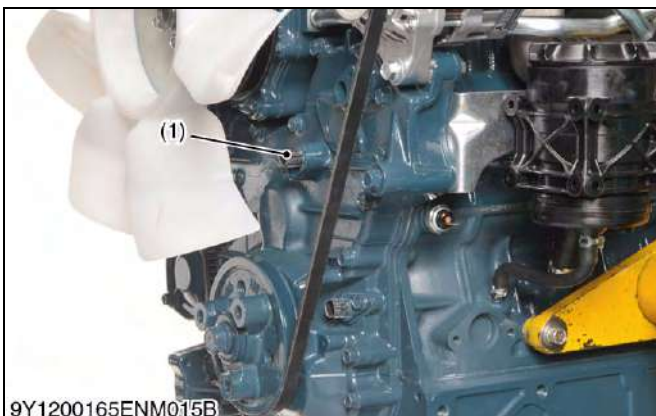
9Y1210686ENM0027US0



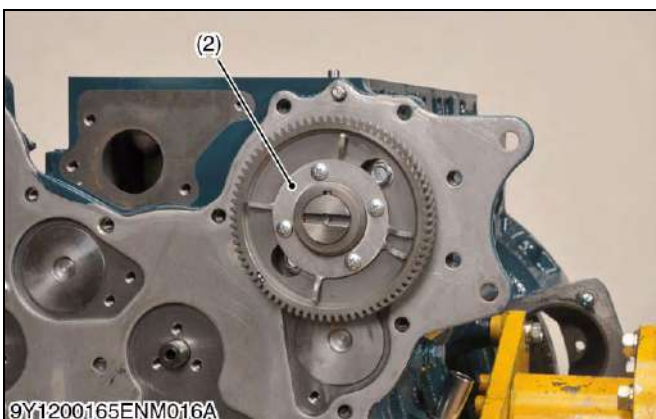
9Y1200165ENM015A



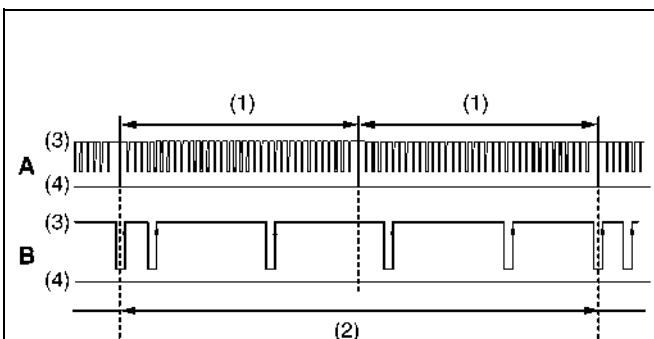
9Y1210478ENM008A



9Y1200165ENM015B



9Y1200165ENM016A



3EEABAI1P085A

Camshaft Position Sensor

The camshaft position sensor (1) is mounted near the camshaft gear and the sensor functions in the same way as the crankshaft position sensor.

This sensor detects the extra teeth (two teeth) of the camshaft pulsar gear (2) and the engine ECU uses the signal to calculate the piston position.

- (1) Camshaft Position Sensor (2) Camshaft Pulsar Gear

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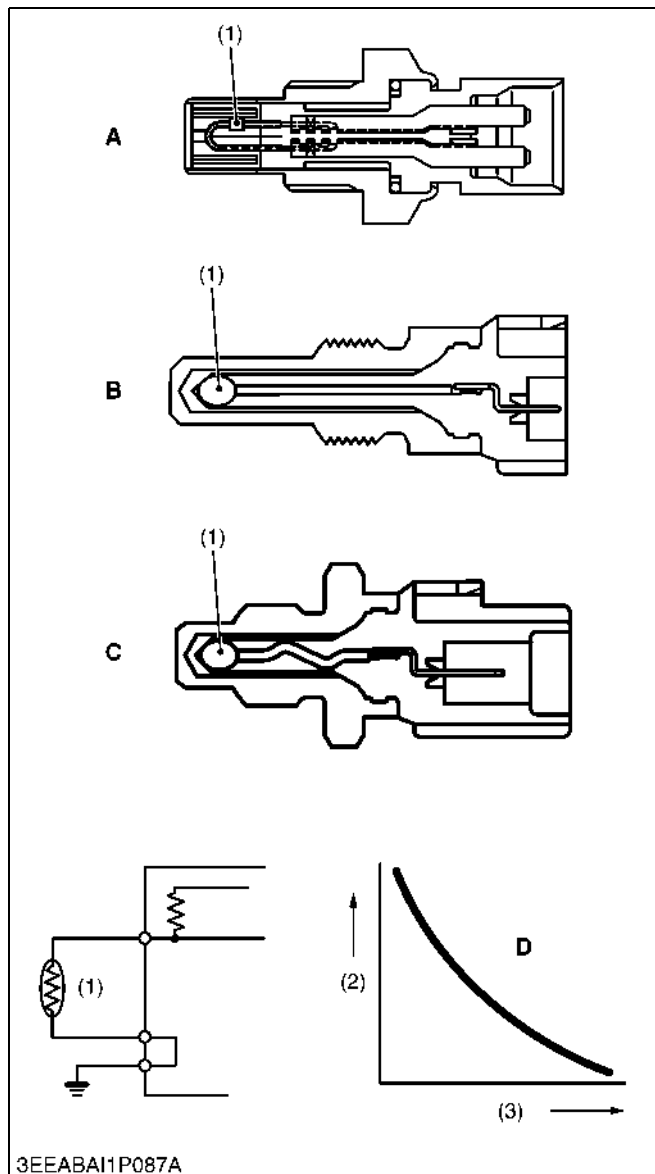
This figure shows the pulse chart of the crankshaft position sensor output signal and camshaft position sensor output signal.

The camshaft pulsar gear rotates once when the crankshaft pulsar gear rotates twice (12.6 rad (720 °) crank angle).

there is a gearless section in the crankshaft pulsar gear. The ECU determines whether it is TDC if the camshaft position sensor signal is detected while the crankshaft position sensor is passing this gearless section.

- (1) 56 pulses (6.28 rad (360 °) crank angle) **A: Crankshaft Position Sensor Output Voltage**
 (2) 5 pulses (12.6 rad (720 °) crank angle) **B: Camshaft Position Sensor Output Voltage**
 (3) 5 V
 (4) 0 V

9Y1210686ENM0029US0



These sensors utilize thermistors to detect temperature.

A characteristic of thermistors is that their electrical resistance varies with temperature, and this characteristic is used by the different sensors to detect temperature via voltage.

Intake Air Temperature Sensor

The intake air temperature sensor "A" measures the intake temperature after it passes through the turbocharger.

Coolant Temperature Sensor

The coolant temperature sensor "B" is mounted on the cylinder head and detects the temperature of the coolant.

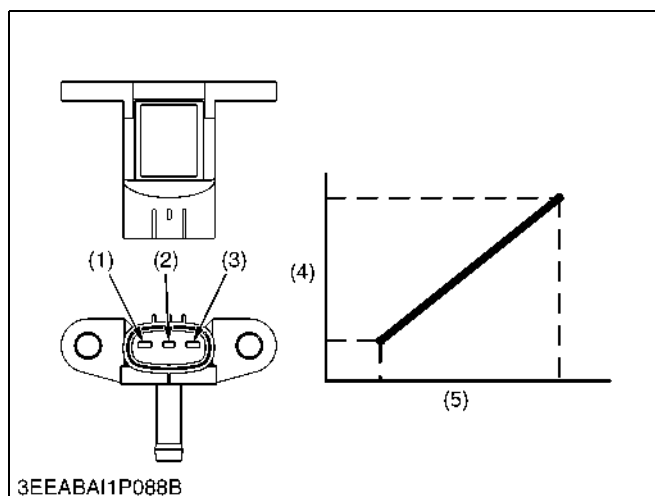
Fuel Temperature Sensor

The fuel temperature sensor "C" is mounted on the fuel intake side of the supply pump and detects the temperature of the fuel.

- (1) Thermistor
- (2) Resistance
- (3) Temperature

- A: Intake Air Temperature Sensor
- B: Coolant Temperature Sensor
- C: Fuel Temperature Sensor
- D: Thermistor Temperature Curve

9Y1210686ENM0030US0



Boost Sensor

The boost sensor is a semiconductor pressure sensor and when there are changes in the pressure on the silicon element inside the sensor, its electrical resistance changes and this piezo resistance effect is used to detect pressure using voltage.

The boost sensor measures the intake air pressure after it passes through the turbocharger.

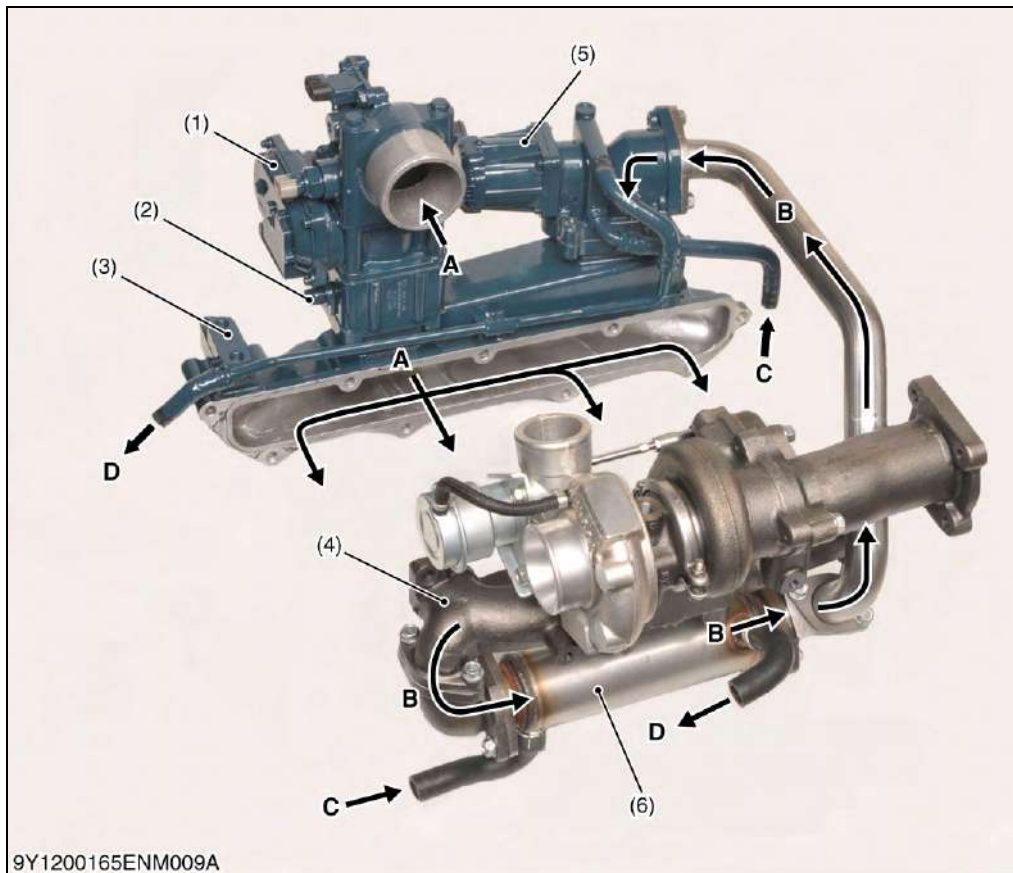
- (1) Supply Terminal
- (2) Output Terminal
- (3) Ground Terminal

- (4) Output Voltage
- (5) Intake Air Pressure

9Y1210686ENM0031US0

5. EGR SYSTEM

[1] OVERVIEW



- (1) Intake Throttle Valve
- (2) Intake Air Heater
- (3) Intake Manifold
- (4) Exhaust Manifold
- (5) EGR Valve
- (6) EGR Cooler

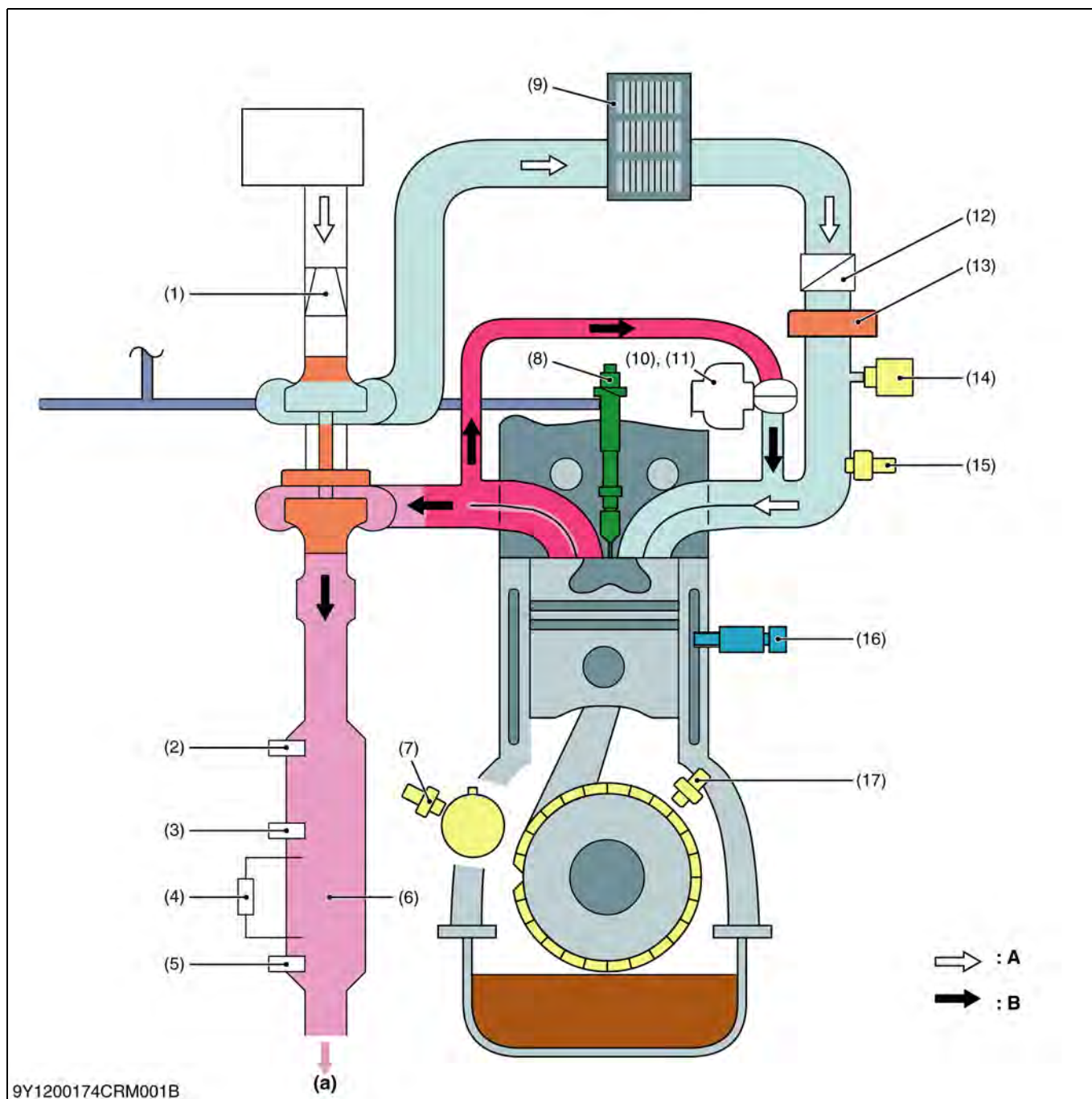
- A: Intake Air**
- B: Exhaust Gas**
- C: Coolant Inlet**
- D: Coolant Outlet**

9Y1200165ENM009A

An EGR (exhaust gas recirculation) system takes out a portion of the exhaust gas and recirculates it to the intake side, thus reducing the amount of available oxygen and lowering the temperature of combustion, which suppresses the generation of nitrogen oxide (NO_x).

9Y1210686ENM0032US0

[2] INTAKE AND EXHAUST SYSTEM



- (1) Mass Air Flow Sensor
- (2) Exhaust Gas Temperature Sensor0 (T0) (DOC Inlet Exhaust Gas Temperature)
- (3) Exhaust Gas Temperature Sensor1 (T1) (DPF Inlet Exhaust Gas Temperature)
- (4) Differential Pressure Sensor (DPF Differential Pressure) (ΔP)

- (5) Exhaust Gas Temperature Sensor2 (T2) (DPF Outlet Exhaust Gas Temperature)
- (6) Diesel Particulate Filter (Hereinafter Referred To As The "DPF") Muffler
- (7) Camshaft Position Sensor
- (8) Injector
- (9) Inter Cooler

- (10) EGR DC Motor
- (11) EGR Lift Sensor
- (12) Intake Throttle Valve
- (13) Intake Air Heater
- (14) Boost Pressure Sensor
- (15) Intake Air Temperature Sensor
- (16) Coolant Temperature Sensor
- (17) Crankshaft Position Sensor

A: Intake Air Flow
B: Exhaust Gas Flow
(a) To Muffler

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[3] EGR VALVE

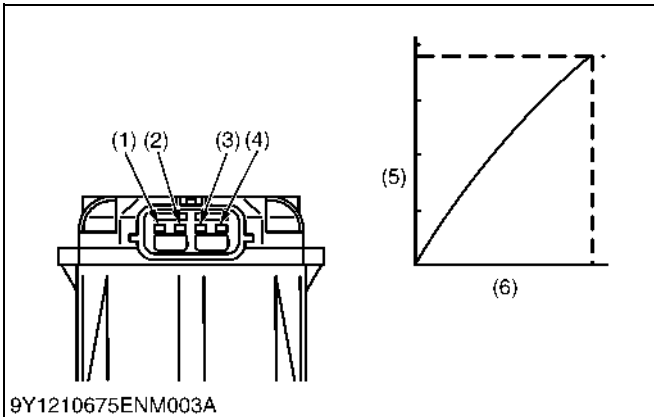


Water Cooled EGR Valve

This is a device that regulates EGR gas flow. The degree the valve is open is detected using a lift sensor and a motor is used to set this to the degree of open calculated using signals including the engine speed.

Also, passing engine coolant through the housing enables controlling temperature rise of the EGR valve.

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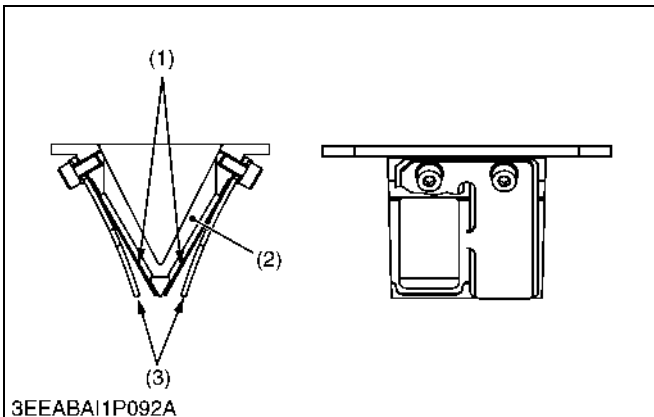
EGR Valve Lift Sensor

How far the EGR valve is open is detected by a contact type of position sensor that detects the movement of the motor's shaft. The motor's shaft opens and closes the valve by changing the rotation of the motor into linear motion via a screw deceleration mechanism.

- | | |
|-------------|----------------------------|
| (1) CAN H | (4) Power (+) |
| (2) CAN L | (5) Exhaust Gas Flow |
| (3) GND (-) | (6) CAN Communication Data |

9Y1210686ENM0034US0

[4] REED VALVE



The reed valves are positioned at the point where exhaust gases that have passed through the EGR valve mix with intake air and they prevent air on the air cleaner side from flowing to the EGR cooler side.

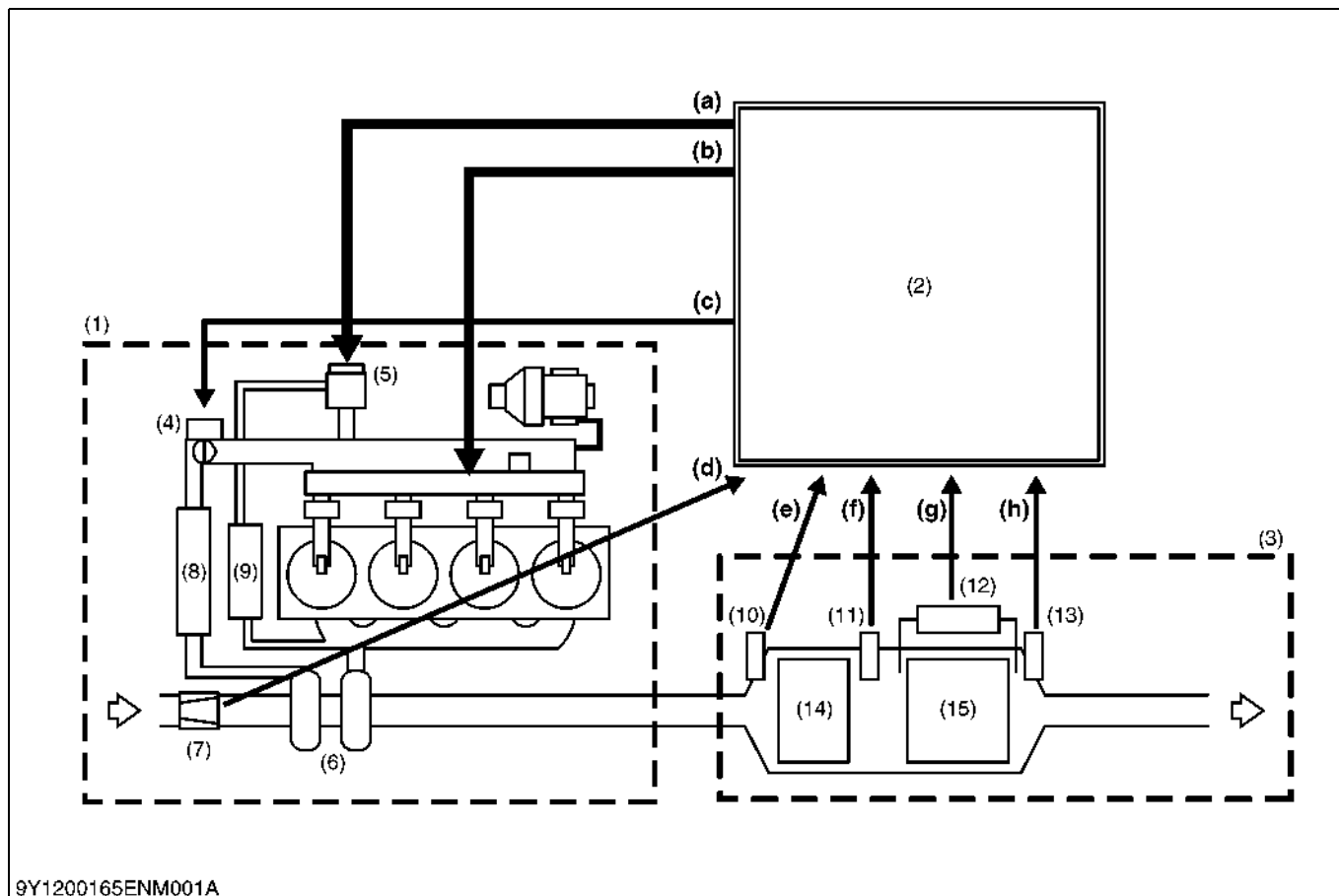
These thin plate springs (reed valves) mounted at the bottom of the EGR valve motor open and close the EGR gas passage (during intake: reed valve is closed; during exhaust: open) and prevent the intake air from backflowing to the exhaust side.

- | | |
|-----------|-------------|
| (1) Valve | (3) Stopper |
| (2) Case | |

9Y1210686ENM0035US0

6. AFTER TREATMENT SYSTEM

[1] AFTER TREATMENT DEVICES



- (1) Common Rail System
- (2) Engine ECU
- (3) After Treatment Devices
- (4) Intake Throttle Valve
- (5) EGR Valve
- (6) Turbo Charger
- (7) Air Flow Sensor
- (8) Inter Cooler
- (9) EGR Cooler

- (10) Temperature Sensor (DOC Inlet Exhaust Temperature) (T_0)
- (11) Temperature Sensor (DPF Inlet Exhaust Temperature) (T_1)
- (12) Differential Pressure Sensor (DPF Differential Pressure) (ΔP)

- (13) Temperature Sensor (DPF Outlet Exhaust Temperature) (T_2)
- (14) Diesel Oxidation Catalyst (DOC)
- (15) Diesel Particulate Filter (DPF)

- (a) EGR Valve Opening
- (b) Injection Pattern
- (c) Inlet Throttle Valve Angle
- (d) Air Flow Sensor
- (e) T_0 (DOC Inlet Exhaust Temperature)
- (f) T_1 (DPF Inlet Exhaust Temperature)
- (g) ΔP (DPF Differential Pressure)
- (h) T_2 (DPF Outlet Exhaust Temperature)

9Y1210686ENM0036US0

[2] DPF REGENERATION PROCESS

(1) Auto Mode

Auto Mode								
					Engine Output	Buzzer	PM Accumulates	Required procedure
PM Warning Level: 0 (No Need Regeneration)					100 %	Not Sounding		Normal Condition
PM Warning Level: 1 (Auto Regeneration)	★	★			100 %	Not Sounding		- A specific amount of PM has accumulated in the DPF muffler. - Continue to work the tractor to raise the DPF temperature. - The regeneration cycle begins until cycle is complete then the indicator will turn "OFF".
PM Warning Level: 2-1 (Request parked Regeneration)	★	★	★		100 %	Sounding Every 5 seconds		- Start the regeneration, referring to "PM warning level: 1" above. - Now the parked regeneration indicator starts flashing, and the parked regeneration can also be started.
PM Warning Level: 2-2 (Request parked Regeneration)	★	★	★		100 %	Sounding Every 3 seconds		If the regeneration conditions are not met, perform the parked regeneration.
PM Warning Level: 3 (Parked Regeneration)			★	★	50 %	Constantly Sounds	26g and more	- Immediately discontinue working the tractor and begin the parked regeneration cycle process. - At this PM warning level, the Auto Regeneration Mode does not function. - If the tractor is operated further, the regeneration cycle will be disabled.

●: Lighting, ★: Blinking

■ IMPORTANT

- If the tractor becomes PM warning level 4, do the manual DPF regeneration on the Diagmaster Software.
- If the tractor becomes PM warning level 5, Clean and replace the DPF assembly. It is impossible to do manual DPF regeneration on the Diagmaster Software.
- This above PM accumulates are the theoretical values. There is a possibility that the actual values are different.

Auto Mode								
		 r/min	 P		Engine Output	Buzzer	PM Accumulates	Required procedure
PM Warning Level: 4 (Regeneration with Diagmaster Software)				●	50 %	Constantly Sounds	31g and more	- Immediately move the tractor to a safe place and park it there and turn the engine "OFF". - At this level, never continue to operate the tractor otherwise damage will result to the DPF and engine.
PM Warning Level: 5 (DPF Cleaning or Replacement)				●	50 %	Constantly Sounds	36g and more	- At this level, never continue to operate the tractor otherwise damage will result to the DPF and engine. - Remove DPF assembly, and do the DPF cleaning or replace new DPF.

●: Lighting, ★: Blinking

■ IMPORTANT

- If the tractor becomes PM warning level 4, do the manual DPF regeneration on the Diagmaster Software.
- If the tractor becomes PM warning level 5, Clean and replace the DPF assembly. It is impossible to do manual DPF regeneration on the Diagmaster Software.
- This above PM accumulates are the theoretical values. There is a possibility that the actual values are different.

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(2) Inhibit Mode

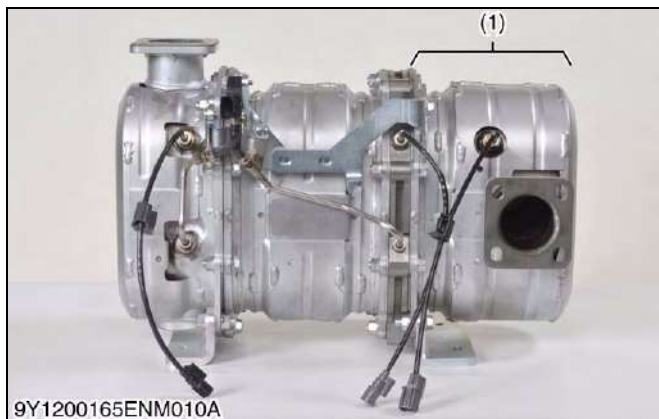
Inhibit Mode								
					Engine Output	Buzzer	PM Accumulates	Required procedure
PM Warning Level: 0 (No Need Regeneration)					100 %	Not Sounding		Normal Condition
PM Warning Level: 1 (Auto Regeneration)	★	★			100 %	Not Sounding		A specific level of PM has built up in the DPF muffler.
PM Warning Level: 2-1 (Request parked Regeneration)	★	★	★		100 %	Sounding Every 5 seconds		Move the tractor to a safe area, then follow the "Operating Procedure for Parked Regeneration".
PM Warning Level: 2-2 (Request parked Regeneration)	★	★	★		100 %	Sounding Every 3 seconds		
PM Warning Level: 3 (Parked Regeneration)			★	★	50 %	Constantly Sounds	26g and more	- Immediately discontinue working the tractor and begin the parked regeneration cycle process. - At this PM warning level, the Auto Regeneration Mode does not function. - If the tractor is operated further, the regeneration cycle will be disabled.
PM Warning Level: 4 (Regeneration with Diagmaster Software)				●	50 %	Constantly Sounds	31g and more	- Immediately stop working the tractor, move the tractor to a safe area, then follow the "Operating Procedure for Parked Regeneration". - If the tractor is operated further and the operator ignores the warning signs, then regeneration will be disabled.
PM Warning Level: 5 (DPF Cleaning or Replacement)				●	50 %	Constantly Sounds	36g and more	- At this level, never continue to operate the tractor otherwise damage will result to the DPF and engine. - Remove DPF assembly, and do the DPF cleaning or replace new DPF.

●: Lighting, ★: Blinking

■ IMPORTANT

- If the tractor becomes PM warning level 4, do the manual DPF regeneration on the Diagmaster Software. (Refer to the Diagmaster Manual.)
- If the tractor becomes PM warning level 5, Clean and replace the DPF assembly. It is impossible to do manual DPF regeneration on the Diagmaster Software. (Refer to the DPF handling manual.)
- This above PM accumulates are the theoretical values. There is a possibility that the actual values are different.

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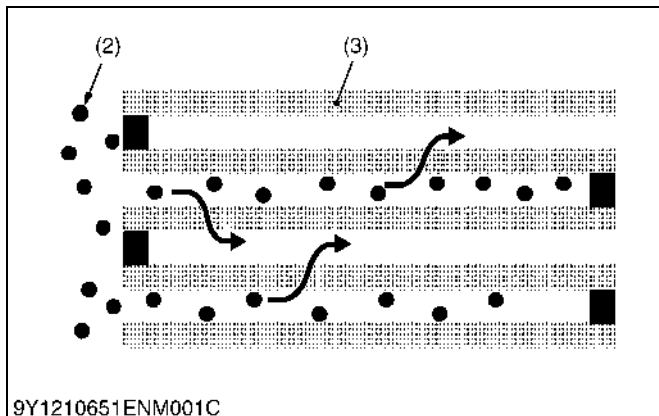
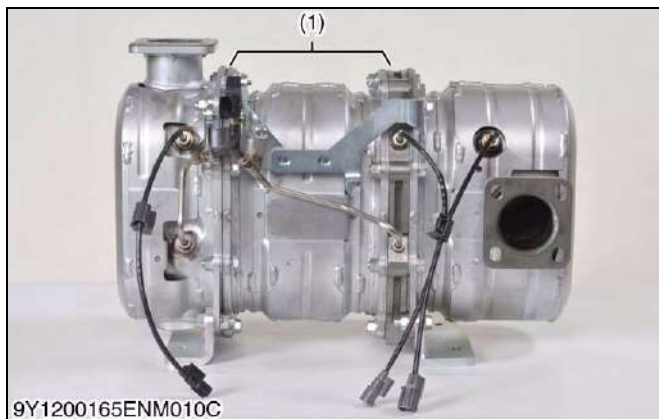
Diesel Oxidation Catalyst (DOC)

An oxidizing catalyst positioned in front of the Diesel Particulate Filter (DPF) step that uses post injection unburned fuel to actively regenerate the DPF.

- (1) Diesel Oxidation Catalyst (DOC)

9Y1210686ENM0039US0





Diesel Particulate Filter (DPF)

The Diesel Particulate Filter (DPF) is a device that captures and combusts PM in the exhaust gas.

Physically captures the PM using a filter which spontaneously combusts when exhaust gas temperature is high.

However, while exhaust gas temperature is low PM does not spontaneously combust the pressure differential between the inlet and outlet of the DPF is detected and the PM is combusted using a heat source generated using DOC to regenerate the filter.

- (1) Diesel Particulate Filter (DPF)
- (2) PM (Particular Matter)
- (3) Filter

9Y1210686ENM0040US0

Intake Throttle Valve

The amount of air intake is regulated by the angle of the throttle valve and the exhaust gas temperature is controlled when regenerating the DPF muffler.

This valve works for charging load to engine. When this valve closes temporally, the exhaust gas temperature becomes high.

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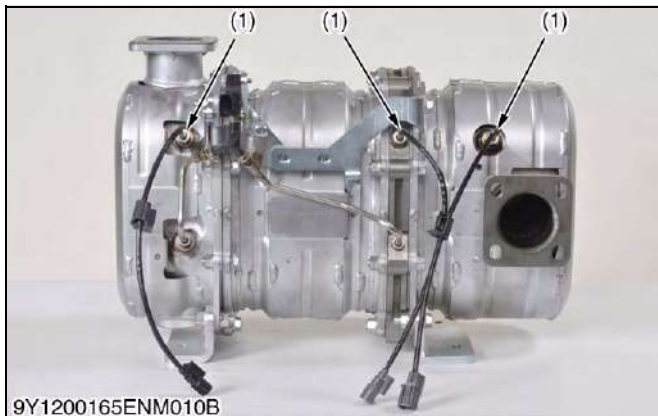


Mass Air Flow Sensor

The amount of air intake required for control of the EGR valve used to reduce NOx is measured.

This sensor calculates temperature of intake air and intake mass air flow. This sensor communicates to engine ECU.

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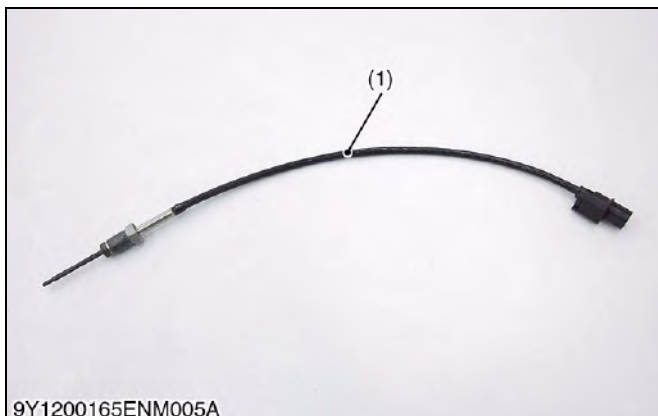


Exhaust Gas Temperature Sensor

This is mounted on the DPF muffler and the DPF muffler DOC intake, DPF intake, and DPF discharge exhaust temperature, needed for the post processing system, are measured.

- (1) Exhaust Gas Temperature Sensor

9Y1210686ENM0043US0



Differential Pressure Sensor

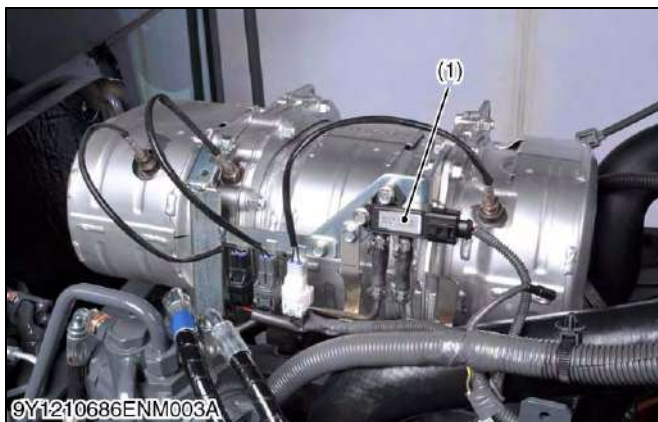
The differential pressure sensor is a sensor that detects the pressure differential between the inlet and the outlet of the DPF.

The engine ECU calculates the amount of accumulated PM in the DPF using this signal.

If DPF accumulates PM, the engine ECU judges from this sensor whether there is to need DPF regeneration or DPF cleaning.

- (1) Differential Pressure Sensor

9Y1210686ENM0044US0





Oil Separator

Removes oil in the blowby gases that pass through the element (1) and the oil is returned to the oil pan.

Blowby gases that pass through the element (1) are mixed into the intake upstream from the turbo charger.

(1) Element

9Y1210686ENM0045US0

SERVICING

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1. TROUBLESHOOTING

This troubleshooting shows only mechanical failures. The failures related to the common rail system (CRS), and DPF, refer to the diagnosis manual (DM) for common rail system engine (9Y120-01740).

Symptom	Probable Cause	Solution	Reference Page
The engine does not start	No fuel	Fill up the fuel	—
	Air in the fuel system	Bleed the air	—
	Water in the fuel system	Change the fuel and repair or replace the fuel system	G-31
	The fuel pump is defective	Replace	—
	The fuel hose is clogged	Clean or replace	G-31
	The fuel filter is clogged	Replace	G-36
	The viscosity of fuel at low temperature is too high	Replace the specified fuel	G-13
	The cetane number of fuel is low	Replace the specified fuel	G-13
	Fuel leakage because of loose injection pipe retaining nut	Tighten the retaining nut	1-S36
	The injector is clogged	Replace	1-S36
	The supply pump is defective	Replace	1-S47
	Seizure of the crankshaft, camshaft, piston or bearing	Repair or replace	—
	Compression leakage from the cylinder	Replace the head gasket Tighten the cylinder head screw	1-S44
	Incorrect valve timing	Examine the timing gear	1-S51
	Piston ring and cylinder are worn out	Replace	1-S54
	Incorrect valve clearance	Adjust valve clearance	1-S12
The starter does not operate	Discharged battery	Charge or replace	—
	Starter is defective	Repair or replace	—
	The key switch is defective	Replace	—
	The connection of the wires is incorrect	Examine or correct	—

Symptom	Probable Cause	Solution	Reference Page
The engine revolution is not smooth	The fuel filter is clogged	Replace	G-31
	The air cleaner is clogged	Clean or replace the air cleaner element	G-31
	Fuel leakage because of loose injection pipe retaining nut	Tighten the retaining nut	1-S36
	The supply pump is defective	Replace	1-S47
	The injector is defective	Replace	1-S36
	The turbocharger bearing is worn out	Replace the turbocharger assembly	1-S35
	The turbocharger shaft is bent	Replace the turbocharger assembly	1-S35
	The turbocharger fin or other part has a damage because of unwanted materials	Replace the turbocharger assembly	1-S35
The exhaust gas is white or blue	Too much engine oil	Reduce it to the specified level	G-20
	The piston ring, piston and cylinder is worn out	Replace the piston ring or piston, or repair the cylinder	1-S54
There is oil leakage into the exhaust pipe or suction pipe	The oil pipe is clogged or has a damage	Examine, replace or clean the oil pipe	–
	The piston ring seal of the turbocharger is defective	Replace the turbocharger assembly	1-S35
The exhaust gas is black or dark gray	Overload	Decrease the load	–
	The grade of the fuel is low	Replace the specified fuel	G-13
	The fuel filter is clogged	Replace	G-31
	The air cleaner is clogged	Clean or replace the element	G-31
	The injector is defective	Replace	1-S36
The output is deficient	The moving parts of engine have a seizure	Repair or replace	–
	The supply pump is defective	Replace	1-S47
	The injector is defective	Replace	1-S41
	There is compression leakage	Examine the compression pressure and repair	1-S11
	There is a gas leakage from the exhaust system	Repair or replace	1-S35
	The air cleaner is clogged	Clean or replace the element	G-31
	There is an air leakage from the compressor discharge side	Replace the turbocharger assembly	1-S35

Symptom	Probable Cause	Solution	Reference Page
The lubricant oil consumption is too much	The gap of the piston ring points to the same direction	Move the ring gap direction	1-S54
	The oil ring is worn out or cannot move	Replace	1-S54
	The piston ring groove is worn out	Replace the piston and piston ring	1-S73
	The valve stem and valve guide are worn out	Replace	1-S73
	The crankshaft bearing and the crank pin bearing is worn out	Replace	1-S75
The fuel is mixed into the lubricant oil	The injector is defective	Replace	1-S36
	Fuel leak from the overflow pipe of the inner cylinder head cover	Replace the gasket	–
	Oil dilution due to regeneration	Change the engine oil	G-20
Water is mixed into the lubricant oil	The head gasket is defective	Replace	1-S44
	The cylinder block or cylinder head is defective	Replace	1-S44
The oil pressure is low	The engine oil is not sufficient	Replenish oil to the specified amount	G-21
	The oil strainer is clogged	Clean	1-S52
	The relief valve does not operate with dirt	Repair or replace	1-S50
	The oil clearance of the bearings are too much	Replace the metal, bushing or shaft	1-S53
	The oil passage is clogged	Clean	–
	The type of oil used is incorrect	Use the specified type of oil	G-12
	The oil pump is defective	Replace	1-S77
The oil pressure is high	The type of oil used is incorrect	Use the specified type of oil	G-12
	The relief valve is defective	Repair or replace	1-S50
The engine is overheated	The engine oil is not sufficient	Replenish oil to the specified amount	G-21
	The fan belt is broken or the fan belt tension is too loose	Replace or adjust	1-S13
	The coolant is not sufficient	Replenish to the specified amount	G-20
	The radiator net and the radiator fin are clogged with dust	Clean	–
	There is corrosion in the inner side of the radiator	Clean or replace	G-34
	There is clogged in the coolant flow route	Clean or replace	G-34
	The radiator or radiator cap is defective	Replace	1-S14
	The load is too much	Reduce the load	–
	The head gasket is defective	Replace	1-S44
	The fuel used is incorrect	Replace the specified fuel	G-13

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2. SERVICING SPECIFICATIONS

ENGINE BODY

Item		Factory Specification	Allowable Limit
Cylinder Head Surface	Flatness	—	0.005 mm 0.002 in.
Top Clearance		0.70 to 0.90 mm 0.028 to 0.035 in.	—
Compression Pressure		3.09 to 3.28 MPa / 200 min ⁻¹ (rpm) 31.5 to 33.5 kgf/cm ² / 200 min ⁻¹ (rpm) 448 to 476 psi / 200 min ⁻¹ (rpm)	2.41 MPa / 200 min ⁻¹ (rpm) 24.6 kgf/cm ² / 200 min ⁻¹ (rpm) 350 psi / 200 min ⁻¹ (rpm)
Variance Among Cylinders		—	10 % or less
Valve Seat	Angle (Intake)	1.0 rad 60 °	—
	Angle (Exhaust)	0.79 rad 45 °	—
	Width (Intake)	1.5 to 1.9 mm 0.059 to 0.074 in.	—
	Width (Exhaust)	2.0 to 2.3 mm 0.079 to 0.091 in.	—
Valve Face	Angle (Intake)	1.0 rad 60 °	—
	Angle (Exhaust)	0.79 rad 45 °	—
Valve Recessing	Intake	0.60 to 0.80 mm 0.024 to 0.031 in.	1.2 mm 0.047 in.
	Exhaust	0.85 to 1.05 mm 0.0335 to 0.0413 in.	1.2 mm 0.047 in.
Valve Stem to Valve Guide	Clearance (Intake)	0.035 to 0.065 mm 0.0014 to 0.0025 in.	0.1 mm 0.004 in.
	• Valve Stem O.D. (Intake)	6.960 to 6.975 mm 0.2741 to 0.2746 in.	—
	• Valve Guide I.D. (Intake)	7.010 to 7.025 mm 0.2760 to 0.2765 in.	—
Valve Stem to Valve Guide	Clearance (Exhaust)	0.035 to 0.065 mm 0.0014 to 0.0025 in.	0.1 mm 0.004 in.
	• Valve Stem O.D. (Exhaust)	6.960 to 6.975 mm 0.2741 to 0.2746 in.	—
	• Valve Guide I.D. (Exhaust)	7.010 to 7.025 mm 0.2760 to 0.2765 in.	—
Valve Clearance (Cold)		0.23 to 0.27 mm 0.0091 to 0.010 in	—

Item		Factory Specification	Allowable Limit
Intake Valve Timing	Open	0.24 rad (14 °) before T.D.C.	–
	Close	0.63 rad (36 °) after B.D.C.	–
Exhaust Valve Timing	Open	0.79 rad (45 °) before B.D.C.	–
	Close	0.30 rad (17 °) after T.D.C.	–
Valve Spring	Free Length (Intake)	35.1 to 35.6 mm 1.39 to 1.40 in.	34.6 mm 1.36 in.
	Free Length (Exhaust)	35.1 to 35.6 mm 1.39 to 1.40 in.	34.6 mm 1.36 in.
	Tilt	–	1.0 mm 0.039 in.
Valve Spring	Setting Load / Setting Length (Intake)	63.5 N / 31.5 mm 6.48 kgf / 31.5 mm 14.3 lbf / 1.24 in.	45.9 N / 31.5 mm 4.68 kgf / 31.5 mm 10.3 lbf / 1.24 in.
	Setting Load / Setting Length (Exhaust)	63.5 N / 31.5 mm 6.48 kgf / 31.5 mm 14.3 lbf / 1.24 in.	45.9 N / 31.5 mm 4.68 kgf / 31.5 mm 10.3 lbf / 1.24 in.
Rocker Arm Shaft to Rocker Arm	Clearance	0.016 to 0.045 mm 0.00063 to 0.0017 in.	0.15 mm 0.0059 in.
	• Rocker Arm Shaft O.D.	15.973 to 15.984 mm 0.62886 to 0.62929 in.	–
	• Rocker Arm I.D.	16.000 to 16.018 mm 0.62993 to 0.63062 in.	–
Valve Bridge Arm and Valve Bridge Arm Shaft	Clearance	0.018 to 0.042 mm 0.00071 to 0.0016 in.	0.15 mm 0.0059 in.
	• Valve Bridge Arm I.D.	9.050 to 9.065 mm 0.3563 to 0.3568 in.	–
	• Valve Bridge Arm Shaft O.D.	9.023 to 9.032 mm 0.3552 to 0.3555 in.	–
Push Rod	Alignment	–	0.25 mm 0.0098 in.
Tappet to Tappet Guide	Clearance	0.020 to 0.062 mm 0.00079 to 0.0024 in.	0.07 mm 0.003 in.
	• Tappet Guide Bore I.D.	24.000 to 24.021 mm 0.94489 to 0.94570 in.	–
	• Tappet O.D.	23.959 to 23.980 mm 0.94327 to 0.94409 in.	–

Item		Factory Specification	Allowable Limit
Camshaft	Side Clearance	0.070 to 0.22 mm 0.0028 to 0.0086 in.	0.30 mm 0.012 in.
	Alignment	–	0.01 mm 0.0004 in.
Cam Height	Intake	37.64 mm 1.482 in.	37.14 mm 1.462 in.
	Exhaust	38.96 mm 1.534 in.	38.46 mm 1.514 in.
Camshaft	Oil Clearance	0.050 to 0.091 mm 0.0020 to 0.0035 in.	0.15 mm 0.0059 in.
• Camshaft Journal	O.D.	45.934 to 45.950 mm 1.8085 to 1.8090 in.	–
• Camshaft Bearing	I.D.	46.000 to 46.025 mm 1.8111 to 1.8120 in.	–
Timing Gear Idle Gear 1 to Crank Gear	Backlash	0.0490 to 0.193 mm 0.00193 to 0.00759 in.	0.22 mm 0.0087 in.
Idle Gear 1 to Cam Gear	Backlash	0.0490 to 0.189 mm 0.00193 to 0.00744 in.	0.22 mm 0.0087 in.
Idle Gear 1 to Idle Gear 2	Backlash	0.0440 to 0.185 mm 0.00174 to 0.00728 in.	0.22 mm 0.0087 in.
Idle Gear 2 to Supply Pump Gear	Backlash	0.0440 to 0.177 mm 0.00174 to 0.00696 in.	0.22 mm 0.0087 in.
Idle Gear Shaft 1, 2 to Idle Gear 1, 2 Bushing	Oil Clearance	0.050 to 0.091 mm 0.0020 to 0.0035 in.	0.10 mm 0.0039 in.
• Idle Gear 1, 2 Bushing	I.D.	45.025 to 45.050 mm 1.7727 to 1.7736 in.	–
• Idle Gear Shaft 1, 2	O.D.	44.959 to 44.975 mm 1.7701 to 1.7706 in.	–
Idle Gear	Side Clearance	0.15 to 0.30 mm 0.0059 to 0.011 in.	0.90 mm 0.035 in.
Piston Pin Bore	I.D.	30.006 to 30.013 mm 1.1814 to 1.1816 in.	30.05 mm 1.183 in.
Top Ring to Ring Groove	Clearance	0.05 to 0.09 mm 0.002 to 0.003 in.	0.15 mm 0.0059 in.
Second Ring to Ring Groove	Clearance	0.0930 to 0.120 mm 0.00367 to 0.00472 in.	0.20 mm 0.0079 in.
Oil Ring to Ring Groove	Clearance	0.020 to 0.060 mm 0.00079 to 0.0023 in.	0.15 mm 0.0059 in.

Item		Factory Specification	Allowable Limit
Piston Ring Gap	Top Ring	0.30 to 0.45 mm 0.012 to 0.017 in.	1.25 mm 0.0492 in.
	Second Ring	0.30 to 0.45 mm 0.012 to 0.017 in.	1.25 mm 0.0492 in.
	Oil Ring	0.025 to 0.045 mm 0.0099 to 0.017 in.	1.25 mm 0.0492 in.
Connecting Rod	Alignment	–	0.05 mm 0.002 in.
Piston Pin to Small End Bushing	Clearance	0.020 to 0.040 mm 0.00079 to 0.0015 in.	1.25 mm 0.0059 in.
	• Piston Pin O.D.	30.006 to 30.011 mm 1.1814 to 1.1815 in.	–
	• Small End Bushing I.D.	30.031 to 30.046 mm 1.1824 to 1.1829 in.	–
Crankshaft	Side Clearance	0.15 to 0.31 mm 0.0059 to 0.012 in.	0.50 mm 0.020 in.
	Alignment	–	0.02 mm 0.0008 in.
Crankshaft Journal to Crankshaft Bearing	Oil Clearance	0.018 to 0.062 mm 0.00071 to 0.0024 in.	0.20 mm 0.0079 in.
	• Crankshaft Journal O.D.	74.977 to 74.990 mm 2.9519 to 2.9523 in.	–
Crank Pin to Pin Bearing	Oil Clearance	0.018 to 0.051 mm 0.00071 to 0.0020 in.	0.20 mm 0.0079 in.
	• Crank Pin O.D.	52.977 to 52.990 mm 2.0857 to 2.0862 in.	–
Cylinder Bore	I.D.	100.000 to 100.022 mm 3.93701 to 3.93787 in.	100.150 mm 3.9429 in.
Cylinder Bore (Oversize)	I.D.	100.500 to 100.522 mm 3.95670 to 3.95755 in.	100.650 mm 3.96260 in.

LUBRICATING SYSTEM

Item		Factory Specification	Allowable Limit
Engine Oil Pressure	At Idle Speed	—	50 kPa 0.5 kgf/cm ² 7 psi
	At Rated Speed	200 to 390 kPa 2.0 to 4.0 kgf/cm ² 29 to 56 psi	150 kPa 1.5 kgf/cm ² 21 psi
Engine Oil Pressure Switch	Working Pressure	40 to 50 kPa 0.4 to 0.6 kgf/cm ² 6 to 8 psi	—
Inner Rotor to Outer Rotor	Clearance	0.040 to 0.16 mm 0.0016 to 0.0062 in.	0.3 mm 0.01 in.
Outer Rotor to Pump Body	Clearance	0.100 to 0.184 mm 0.00394 to 0.00724 in.	0.3 mm 0.01 in.
Inner Rotor to Cover	Clearance	0.025 to 0.075 mm 0.00099 to 0.0029 in.	0.225 mm 0.00886 in.

COOLING SYSTEM

Item		Factory Specification	Allowable Limit
Thermostat	Valve Opening Temperature	74.5 to 78.5 °C 166.1 to 173.3 °F	—
	Valve Full Opening Temperature (Opened Completely)	90 °C 194 °F	—
Radiator	Water Tightness	No leak at specified pressure	—
Radiator Cap	Air Leakage	10 seconds or more 90 → 60 kPa 0.9 → 0.6 kgf/cm ² 10 → 9 psi	
Fan Belt	Tension	10 to 12 mm / 98 N 0.40 to 0.47 in. / 98 N (10 kgf, 22 lbf)	—

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3. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to G-14.)

■ NOTE

- For the screws, bolts and nuts with the mark "*", apply engine oil to their threads and seats before you tighten.
- The alphabet "M" in Dimension × Pitch shows that the screw, bolt or nut dimensions are in the metric system. The dimension is the nominal external diameter in mm of the threads. The pitch is the nominal distance in mm between 2 threads.

Item	Dimension × Pitch	N·m	kgf·m	lbf·ft
Injector clamp nut	M8 × 1.25	24 to 27	2.4 to 2.8	18 to 20
Overflow pipe joint screw	M6 × 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
Cylinder head cover 1 screw	M6 × 1.0	6.87 to 11.2	0.700 to 1.15	5.07 to 8.31
Cylinder head cover 2 screw	M6 × 1.0	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
Injection pipe retaining nut	M12 × 1.5	23 to 36	2.3 to 3.7	17 to 26
Oil pressure switch taper screw	R 1/8	15 to 19	1.5 to 2.0	11 to 14
Supply pump mounting nut	M8 × 1.25	24 to 27	2.4 to 2.8	18 to 20
Supply pump gear mounting nut	M14 × 1.5	59 to 68	6.0 to 7.0	44 to 50
Overflow pipe joint screw	M8	7.9 to 12	0.80 to 1.3	5.8 to 9.4
Overflow pipe joint screw	M10	16 to 19	1.6 to 2.0	12 to 14
Supply pump gear cover mounting screw	M8 × 1.25	24 to 27	2.4 to 2.8	18 to 20
Common rail mounting screw	M8 × 1.25	24 to 27	2.4 to 2.8	18 to 20
Coolant temperature sensor taper screw	—	16 to 23	1.6 to 2.4	12 to 17
Camshaft position sensor mounting screw	—	4 to 5	0.4 to 0.6	3 to 4
Crankshaft position sensor mounting screw	—	4 to 5	0.4 to 0.6	3 to 4
Intake air temperature sensor mounting screw	—	30 to 39	3.0 to 4.0	22 to 28
Injector terminal nut	—	1.6 to 2.2	0.16 to 0.23	1.2 to 1.6
Rocker arm bracket nut	M10 × 1.25	49 to 55	5.0 to 5.7	37 to 41
*Cylinder head mounting screw	M12 × 1.25	98.1 to 107	10.0 to 11.0	72.4 to 79.5
Oil cooler joint screw	M20 × 1.5	40 to 44	4.0 to 4.5	29 to 32
*Crankshaft screw	M16 × 1.5	255 to 274	26.0 to 28.0	188 to 202
Gear case cover mounting screw	M8 × 1.25	24 to 27	2.4 to 2.8	18 to 20
Relief valve retaining screw	M22 × 1.5	69 to 78	7.0 to 8.0	51 to 57
Idle gear mounting screw	M8 × 1.25	24 to 27	2.4 to 2.8	18 to 20
Camshaft set screw	M8 × 1.25	24 to 27	2.4 to 2.8	18 to 20
Camshaft position pulsar gear mounting screw	M5	4.7 to 5.6	0.48 to 0.58	3.5 to 4.1
Plate mounting screw	M8 × 1.25	24 to 27	2.4 to 2.8	18 to 20
*Connecting rod screw	M10 × 1.25	79 to 83	8.0 to 8.5	58 to 61
*Flywheel screw	M12 × 1.25	98.1 to 107	10.0 to 11.0	72.4 to 79.5
Flywheel housing mounting screw	M12 × 1.25	78 to 90	7.9 to 9.2	58 to 66

Item	Dimension × Pitch	N·m	kgf·m	lbf·ft
Crankcase 2 mounting screw	M10 × 1.25	49 to 55	5.0 to 5.7	37 to 41
*Main bearing case screw	M14 × 1.5	138 to 147	14.0 to 15.0	102 to 108
Bearing case cover mounting screw	M8 × 1.25	24 to 27	2.4 to 2.8	18 to 20
Intake air heater terminal nut	M6 × 1.0	3.5 to 5.3	0.35 to 0.55	2.6 to 3.9
B terminal nut of starter	M8 × 1.25	9.8 to 11	1.0 to 1.2	7.3 to 8.6
Pulley nut of alternator	—	58.4 to 78.9	5.95 to 8.05	43.1 to 58.2
Oil pump cover screw	M6	7.9 to 9.3	0.80 to 0.95	5.8 to 6.8
Diesel Particulate Filter (hereinafter referred to as the "DPF") stay 1	M8 × 1.25	24 to 27	2.4 to 2.8	18 to 20
	M10 × 1.25	49 to 55	5.0 to 5.7	37 to 41
DPF stay 2	M10 × 1.25	49 to 55	5.0 to 5.7	37 to 41
Muffler flange	M10 × 1.25	49 to 55	5.0 to 5.7	37 to 41
Muffler full assembly (DPF) mounting screw	M10 × 1.25	49 to 55	5.0 to 5.7	37 to 41
DPF bracket	M12 × 1.25	78 to 90	7.9 to 9.2	58 to 66
Filter comp (DPF) mounting screw	M10 × 1.25	49 to 55	5.0 to 5.7	37 to 41
Temperature sensor	M12 × 1.25	25 to 34	2.5 to 3.5	18 to 25
Differential pressure pipe	M12 × 1.0	16 to 22	1.6 to 2.3	12 to 16

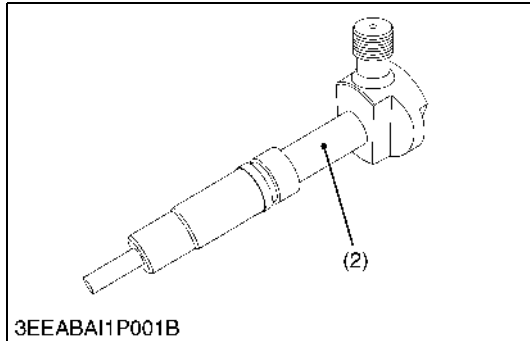
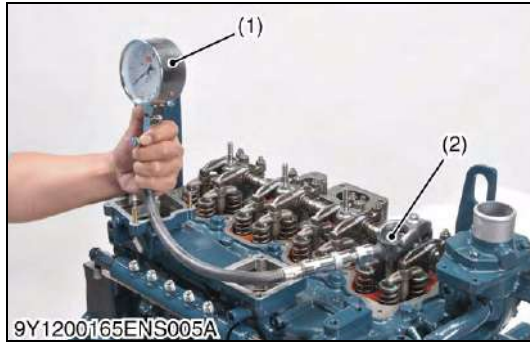
Item	N·m	kgf·m	lbf·ft
Power steering hose retaining nut	23 to 27	2.3 to 2.8	17 to 20
Starter's B terminal mounting nut	9.8 to 11	1.0 to 1.2	7.3 to 8.6
Oil cooler pipe nut	49 to 68	5.0 to 7.0	37 to 50
Intake air heater terminal mounting nut	3.5 to 5.3	0.35 to 0.55	2.6 to 3.9
Front frame mounting screw (M14, 9T, UBS)	167 to 196	17.0 to 20.0	123 to 144
Engine and clutch housing mounting screw and nut (M14, 7T)	124 to 147	12.6 to 15.0	91.2 to 108
Engine and clutch housing mounting stud bolt	62 to 73	6.3 to 7.5	46 to 54
Compressor bracket mounting screw (M8) to aluminum parts	18 to 20	1.8 to 2.1	13 to 15
Compressor bracket mounting screw (M8) to ordinariness parts	24 to 27	2.4 to 2.8	18 to 20
Compressor bracket mounting screw (M10) to ordinariness parts	48 to 55	4.9 to 5.7	36 to 41
High pressure hose mounting screw	7.9 to 11	0.80 to 1.2	5.8 to 8.6
Low pressure hose mounting screw	7.9 to 11	0.80 to 1.2	5.8 to 8.6
Master cylinder hose retaining nut	24 to 27	2.4 to 2.8	18 to 20
Power steering joint shaft mounting screw	24 to 27	2.4 to 2.8	18 to 20
Power steering pipe nut	49 to 68	5.0 to 7.0	37 to 50
Front frame mounting screw (M14, 9T, UBS)	167 to 196	17.0 to 20.0	123 to 144
Engine and clutch housing mounting screw and nut (M14, 7T)	124 to 147	12.6 to 15.0	91.2 to 108
Damper disk mounting screw	48 to 55	4.9 to 5.7	36 to 41

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4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING

(1) Engine Body



Compression Pressure

1. After warming up the engine, stop it and remove the air cleaner, the DPF assembly, the muffler, high pressure pipes, cylinder head cover, overflow pipe, all nozzle holders and all nozzle gaskets.
2. Install a compression tester (Code No: 07909-30208) and nozzle adaptor for diesel engines to nozzle holder hole.
3. After making sure that the speed lever is set at the stop position (Non-injection), run the engine at 200 to 300 min⁻¹ (rpm) with the starter.
4. Check the maximum pressure. Measure the pressure more than twice.

■ 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 %.

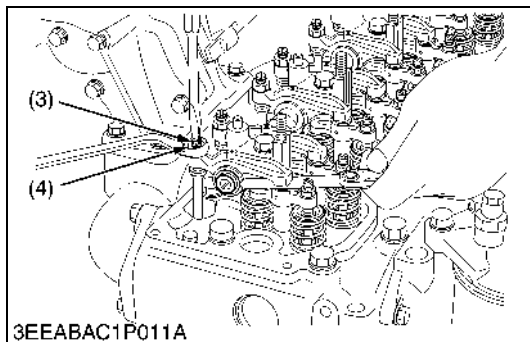
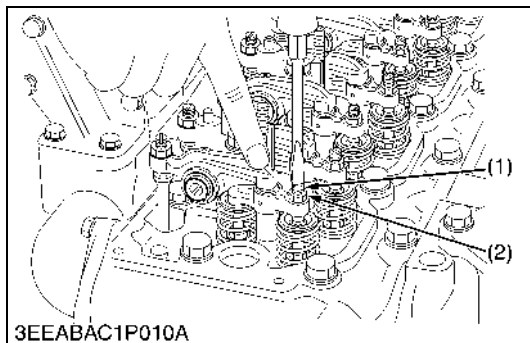
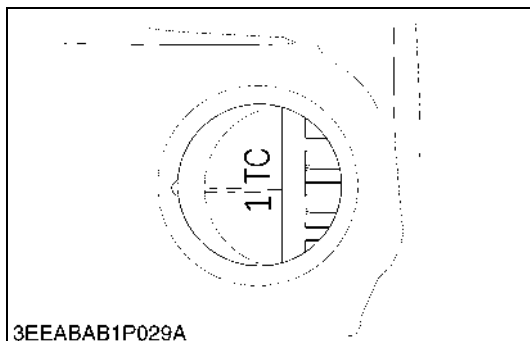
Compression pressure	Factory specification	3.09 to 3.28 MPa / 200 min ⁻¹ (rpm) 31.5 to 33.5 kgf/cm ² / 200 min ⁻¹ (rpm) 448 to 476 psi / 200 min ⁻¹ (rpm)
	Allowable limit	2.41 MPa / 200 min ⁻¹ (rpm) 24.6 kgf/cm ² / 200 min ⁻¹ (rpm) 350 psi / 200 min ⁻¹ (rpm)

Tightening torque	Injector clamp nut	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Overflow pipe joint screw (M6 × 1.0)	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft
	Cylinder head cover 1 screw	6.87 to 11.2 N·m 0.700 to 1.15 kgf·m 5.07 to 8.31 lbf·ft
	Cylinder head cover 2 screw	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft
	Injection pipe retaining nut	23 to 36 N·m 2.3 to 3.7 kgf·m 17 to 26 lbf·ft

(1) Compression Tester

(2) Injector Adaptor

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Valve Clearance

■ IMPORTANT

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

- Remove the high pressure pipes and the head cover.
- Align the 1TC mark of flywheel and the convex of flywheel housing timing windows so that the first piston (gear case side) comes to the compression top dead center.
- Before adjusting the valve clearance, adjust the bridge evenly to the valve stem.
- Loosen the lock nut (2) and adjust with screw (1).
- Slightly push the rocker arm by your fingers and screw in the adjusting screw slowly until you feel the screw touch the top of valve stem, then tighten the lock nut.
- Loosen the lock nut (4) of adjusting screw (3) (push rod side) and insert the thickness gauge between the rocker arm and the bridge head. Set the adjusting screw to the specified value, then tighten the lock nut.

Valve clearance (cold)	Factory specification	0.23 to 0.27 mm 0.0091 to 0.010 in.
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■ NOTE

- After you adjust the valve clearance, tighten the lock nut (2) of the adjusting screw.

Adjustable Cylinder Location of Piston		IN.	EX.
When No. 1 piston is at compression top dead center	1	☆	☆
	2	☆	
	3		☆
	4		
When No. 1 piston is at overlap position	1		
	2		☆
	3	☆	
	4	☆	☆

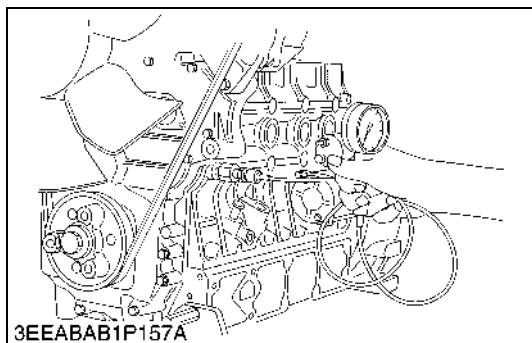
Tightening torque	Injector clamp nut	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Overflow pipe joint screw (M6 × 1.0)	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft
	Cylinder head cover 1 screw	6.87 to 11.2 N·m 0.700 to 1.15 kgf·m 5.07 to 8.31 lbf·ft
	Cylinder head cover 2 screw	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft
	Injection pipe retaining nut	23 to 36 N·m 2.3 to 3.7 kgf·m 17 to 26 lbf·ft

- (1) Adjusting Screw
(2) Lock Nut

- (3) Adjusting Screw
(4) Lock Nut

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(2) Lubricating System



Engine Oil Pressure

1. Remove the oil switch and set a pressure tester (Code No. 07916-32032).
2. Start the engine. After warming up, measure the oil pressure of both idling and rated speeds.
3. If the oil pressure is less than the allowable limit, check the following.
 - Engine oil insufficient
 - Oil pump defective
 - Oil strainer clogged
 - Oil filter cartridge clogged
 - Oil gallery clogged
 - Excessive oil clearance
 - Foreign matter in the relief valve

(When reassembling)

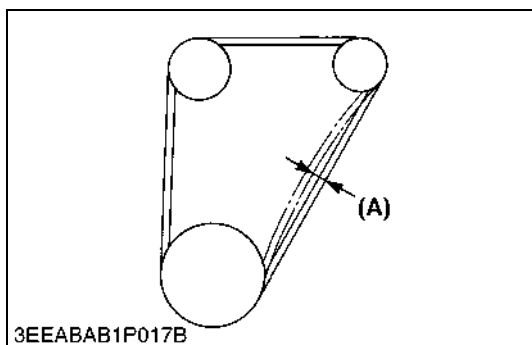
- After checking the engine oil pressure, tighten the engine oil pressure switch to the specified torque.

Engine oil pressure	At idle speed	Allowable limit	50 kPa 0.5 kgf/cm ² 7 psi
	At rated speed	Factory specification	200 to 390 kPa 2.0 to 4.0 kgf/cm ² 29 to 56 psi
		Allowable limit	150 kPa 1.5 kgf/cm ² 21 psi

Tightening torque	Oil pressure switch taper screw	15 to 19 N·m 1.5 to 2.0 kgf·m 11 to 14 lbf·ft
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(3) Cooling System



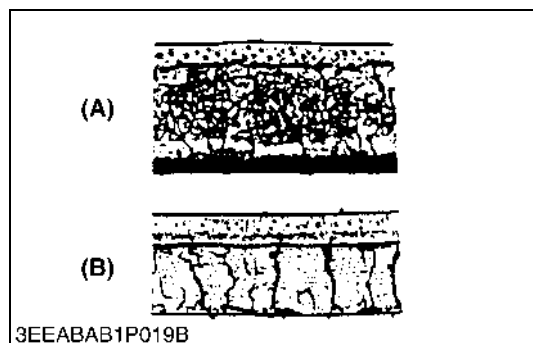
Fan Belt Tension

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 lbf).
2. If the measurement is not within the factory specifications, loosen the alternator mounting screws and relocate the alternator to adjust.

Deflection (A)	Factory specification	10 to 12 mm 0.40 to 0.47 in.
----------------	-----------------------	---------------------------------

(A) Deflection

9Y1210686ENS0009US0



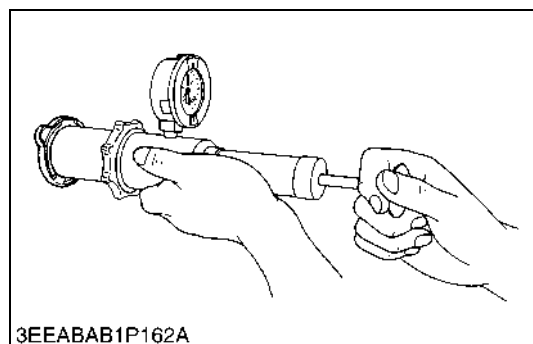
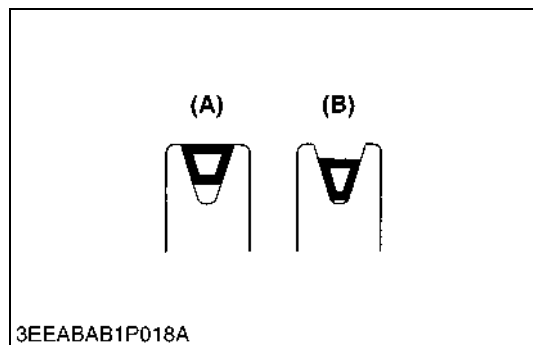
Fan Belt Damage and Wear

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.

(A) Good

(B) Bad

9Y1210686ENS0010US0



Radiator Cap Air Leakage

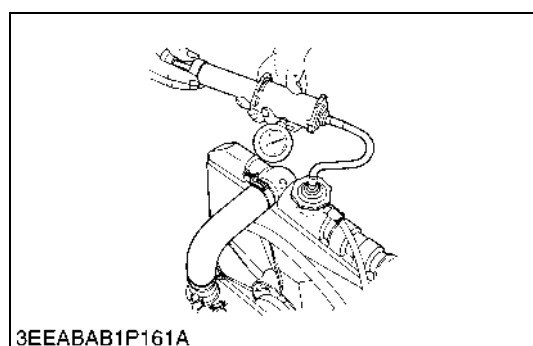


CAUTION

- When removing the radiator cap, wait at least ten minutes after the engine has stopped and cooled down. Otherwise, hot water may gush out, scalding nearby people.

1. Set a radiator tester on the radiator cap.
2. Set a radiator tester.
Apply the specified pressure of 88 kPa (0.90 kgf/cm², 13 psi).
3. Check if the pressure drop to less than 59 kPa (0.60 kgf/cm², 8.6 psi) in 10 seconds.
4. If the pressure is less than the factory specification, replace it.

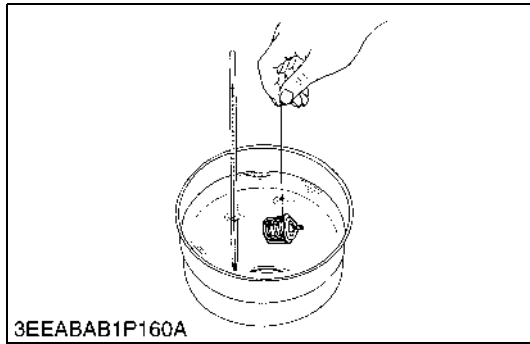
9Y1210686ENS0011US0



Radiator Water Leakage

1. Pour a specified amount of water into the radiator.
2. Set a radiator tester.
Increase water pressure to the specified pressure of 140 kPa (1.4 kgf/cm², 20 psi).
3. Check the radiator for water leaks.
4. When water leakage is excessive, replace the radiator. If water leakage is caused by a small pinhole, correct the radiator with radiator cement.

9Y1210686ENS0012US0



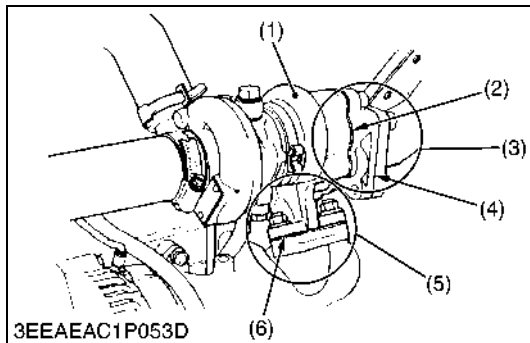
Opening-temperature of Thermostat Valve

1. Push down the thermostat valve and insert a string between the valve and the valve seat.
2. Place the thermostat and a thermometer in a container with water and gradually heat the water.
3. Hold the string to suspend the thermostat in the water. When the water temperature rises, the thermostat valve will open, allowing it to fall down from the string. Read the temperature at this moment on the thermometer.
4. Continue heating the water and read the temperature when the valve has risen by about 8 mm (0.3 in.).
5. If the measurement is not acceptable, replace the thermostat.

Thermostat valve opening temperature	Factory specification	74.5 to 78.5 °C 166.1 to 173.3 °F
Full opening temperature	Factory specification	90 °C 194 °F

9Y1210686ENS0013US0

(4) Turbocharger

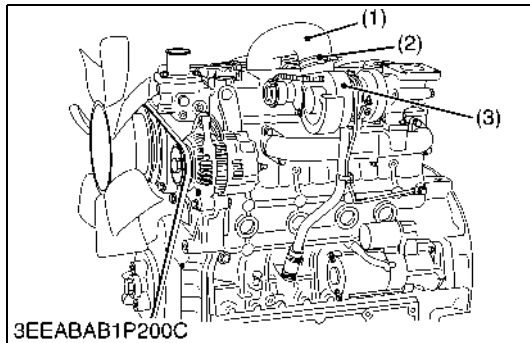


Exhaust Gas Leakage of Turbine Side

1. Check the exhaust port (3) and inlet port (5) side of turbine housing (1) to see if there is no exhaust gas leak.
2. If any gas leak is found, retighten the bolts and nuts or replace the gasket (2) / (4) / (6) with new one.

- | | |
|---------------------|----------------|
| (1) Turbine Housing | (4) Gasket |
| (2) Gasket | (5) Inlet Port |
| (3) Exhaust Port | (6) Gasket |

9Y1210686ENS0034US0

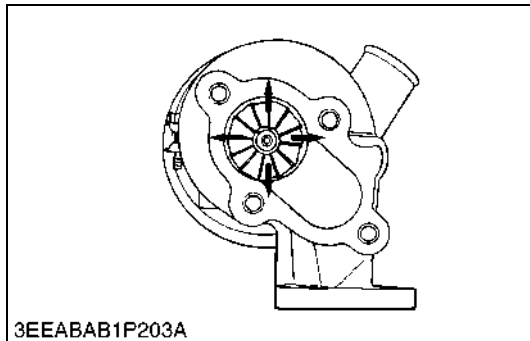


Compressor Side

1. Check the inlet hose (1) of the compressor cover (3) to see if there is no air leak.
2. Check for loose connections or cracks in the suction side of the intake hose.
3. If any air leak is found, change the clamp (2) and or inlet hoses.

- | | |
|----------------|----------------------|
| (1) Inlet Hose | (3) Compressor Cover |
| (2) Clamp | |

9Y1210686ENS0035US0

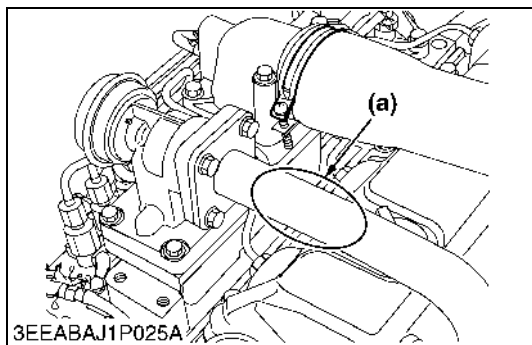


Radial Clearance

1. If the wheel contact to the housing, replace the turbocharger assembly with new one.

9Y1210686ENS0036US0

(5) EGR System



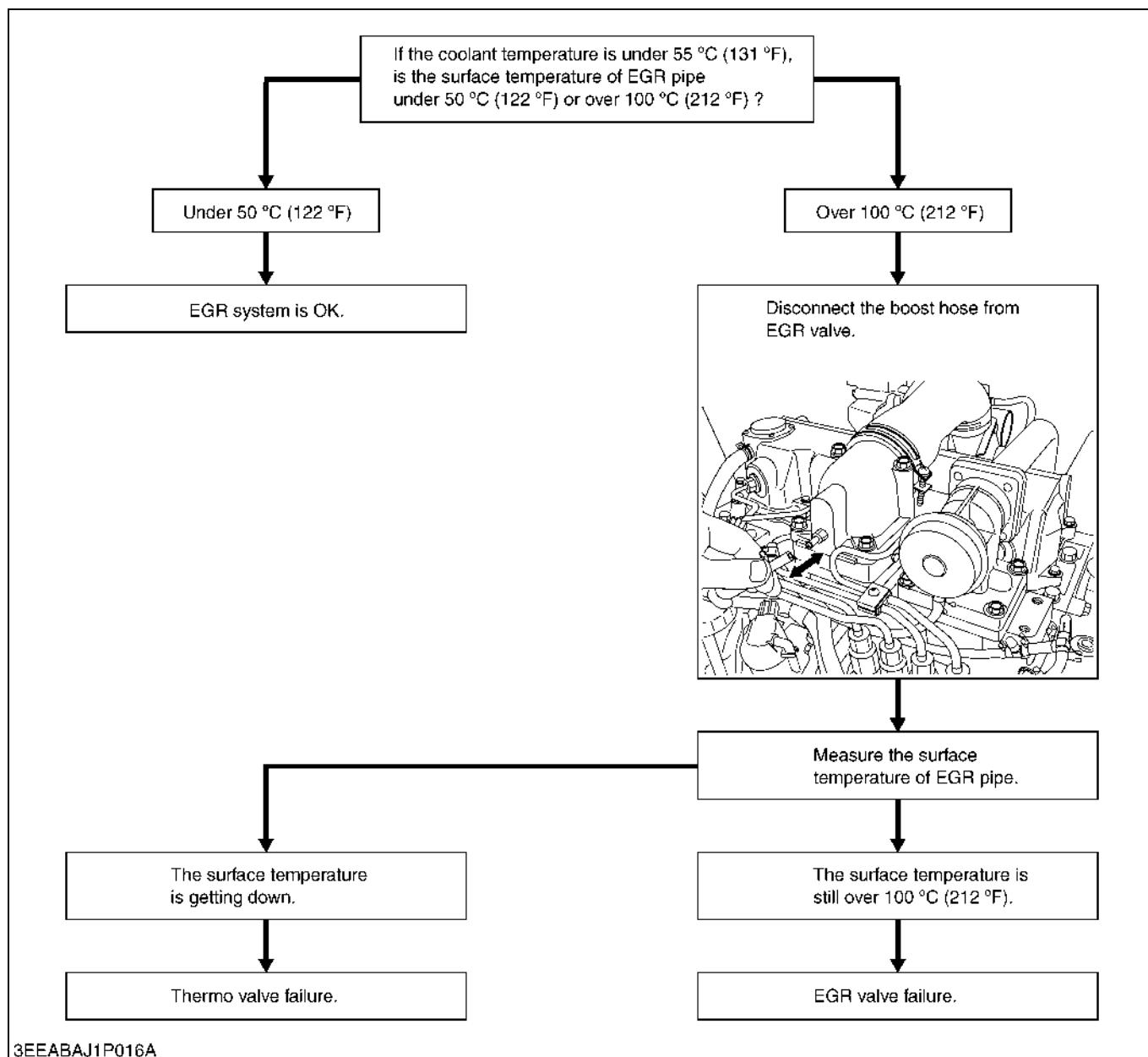
EGR System

1. Check the coolant temperature and monitor the coolant temperature while checking 1) and 2).
2. If the coolant temperature is already 55 °C (131 °F), cool down the engine.
3. Start the engine and go to check 1) immediately.
4. After completing checking 1), arrange the coolant temperature is getting over 70 °C (158 °F).
5. If the coolant temperature is over 70 °C (158 °F), go to check 2).

(a) Measuring Place of EGR Pipe
Surface Temperature

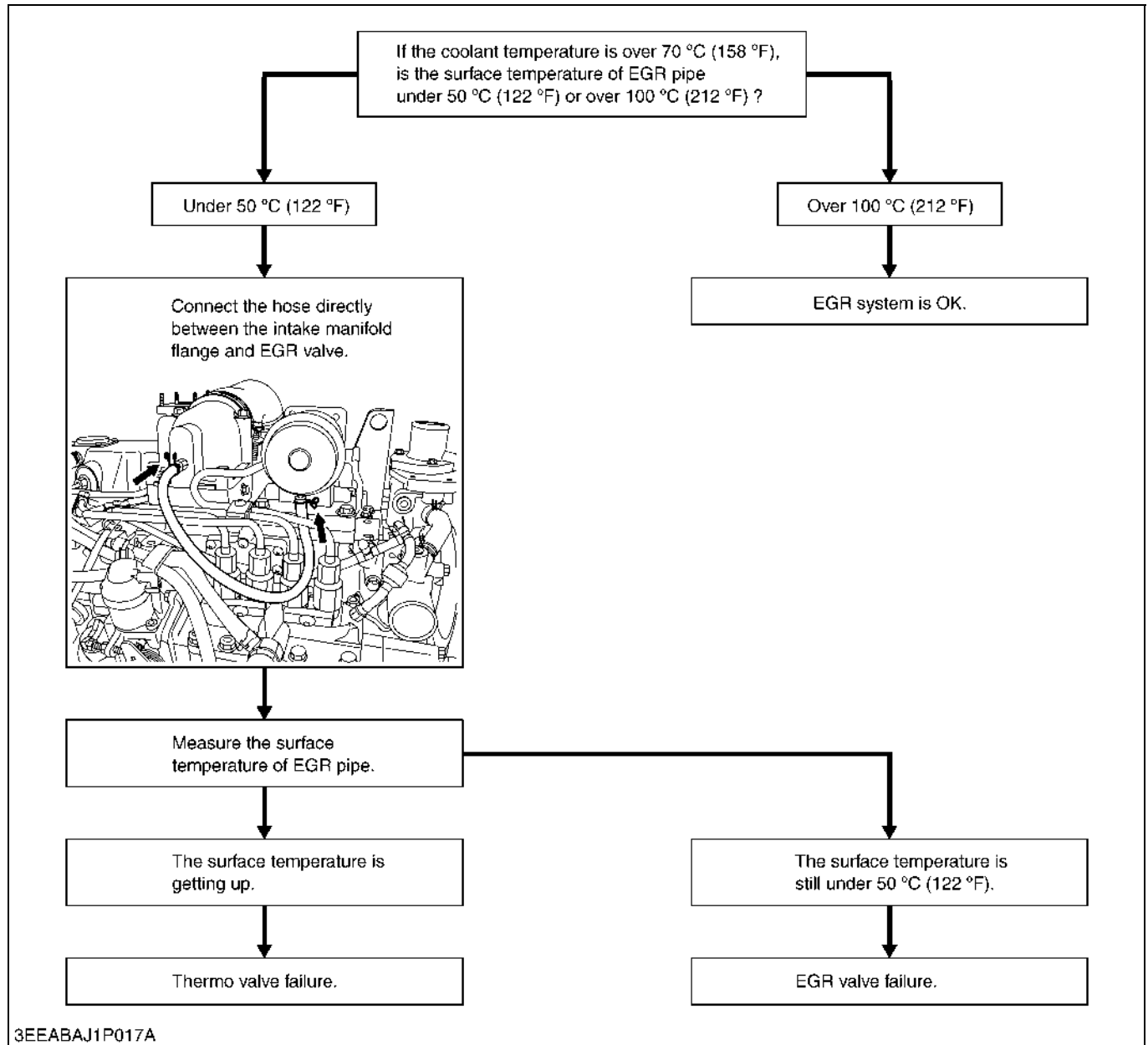
9Y1210686ENS0037US0

1) If the coolant temperature is under 55 °C (131 °F), the surface temperature of EGR pipe must be under 50 °C (122 °F).



9Y1210686ENS0038US0

2) If the coolant temperature is over 70 °C (158 °F), the surface temperature of EGR pipe must be over 100 °C (212 °F).



9Y1210686ENS0039US0

(6) DPF System

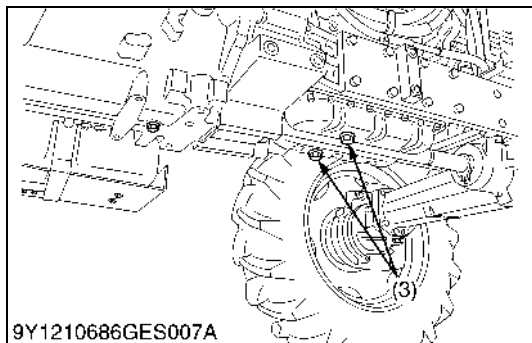
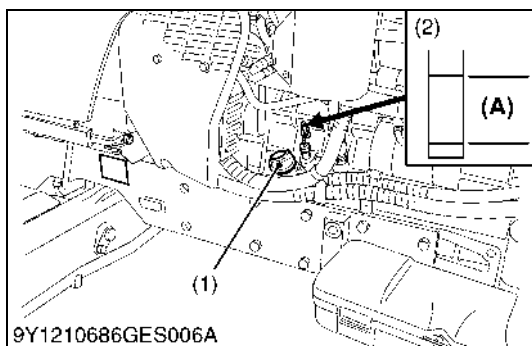
Check the DPF Accumulate Level

1. Refer to the electrical section (see page 8-S27).

9Y1210686ENS0116US0

[2] PREPARATION FOR SEPARATING ENGINE

(1) Lubricant and Coolant



Draining Engine Oil

CAUTION

- Before draining oil, be sure to stop the engine.
- Allow engine to cool down sufficiently, oil can be hot and can burn.

1. To drain the used oil, remove the drain plugs (3) at the bottom of the engine and drain the oil completely into the oil pan. All the used oil can be drained out easily when the engine is still warm.
2. After draining reinstall the drain plugs (3).
3. Fill with the new oil up to the upper notch on the dipstick (2). (See page G-12.)

Engine oil (with filter)	Capacity	10.7 L 11.3 U.S.qts 9.41 Imp.qts
--------------------------	----------	--

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

(A) Oil level is acceptable within this range.

9Y1210686ENS0014US0

Draining Coolant

CAUTION

- Do not remove radiator cap while coolant is hot. When cool, slowly rotate cap to the first stop and allow sufficient time for excess pressure to escape before removing the cap completely.

1. Stop the engine and let the engine cool down.
2. To drain the coolant, open the radiator drain plug (1). When opening 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 radiator drain plug.

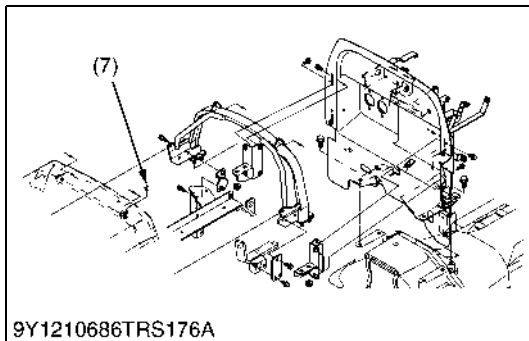
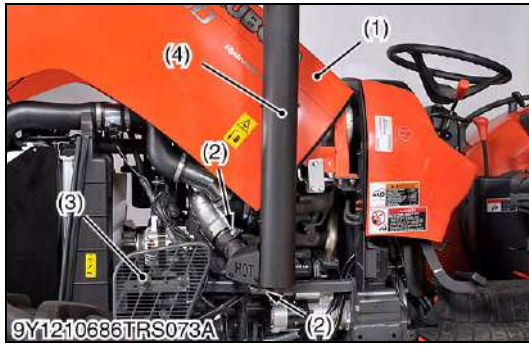
Coolant	Capacity	9.0 L 9.5 U.S.qts 7.9 Imp.qts
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- (1) Drain Plug

9Y1210686CAS0096US0



(2) Bonnet and Cover



Bonnet and Cover (ROPS Model)

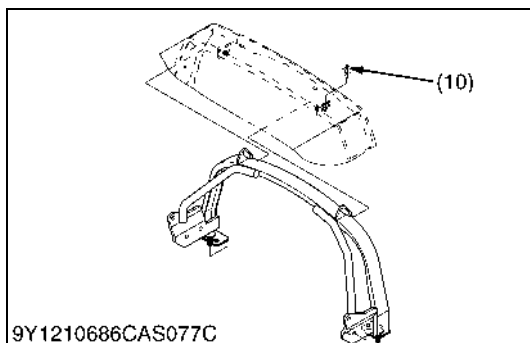
1. Open the bonnet (1) and disconnect the battery negative terminal.
2. Disconnect the **3P** connector (5) for head lights.
3. Remove the muffler pipe mounting screws (2) and then muffler pipe (4).
4. Remove the bonnet damper (6) on both sides.
5. Close the bonnet (1) and remove the plug.
6. Pull out the snap pin (7) and then remove the bonnet (1).
7. Remove the bonnet support mounting screws (8) and nuts (9) on both sides and then remove the bonnet support (10).
8. Remove the side cover (3) on both sides.
9. Remove the rubber sheet and steering (11).
10. Remove the steering support under cover (12) and steering post cover (13).
11. Remove the rear bonnet mounting screws and then remove rear bonnet (14).

■ IMPORTANT

- When disconnecting the battery cables, disconnect the negative cable first. When connecting, connect the positive cable first.
- When assembling the bonnet damper (6), make sure that the rod part of bonnet damper (6) is on the backside.

- | | |
|--------------------------------------|-----------------------------------|
| (1) Bonnet | (8) Bonnet Support Mounting Screw |
| (2) Muffler Pipe Mounting Screw | (9) Bonnet Support Mounting Nut |
| (3) Side Cover | (10) Bonnet Support |
| (4) Muffler Pipe | (11) Steering |
| (5) 3P Connector (Head Light) | (12) Steering Support Under Cover |
| (6) Bonnet Damper | (13) Steering Post Cover |
| (7) Snap Pin | (14) Rear Bonnet |

9Y1210686TRS0029US0



Bonnet and Cover (CABIN Model)

1. Open the bonnet (1) and disconnect the battery (2) negative terminal.
2. Remove the muffler pipe mounting screws 1 (7) and the muffler pipe (6).
3. Remove the cover (3), the side panel (4) and the side cover guide (5) on both sides.
4. Disconnect the **3P** connector (8) for head light and remove the bonnet damper (9).
5. Close the bonnet (1) and remove the plug.
6. Pull out the snap pin (10), and then remove the bonnet (1).
7. Remove the bonnet support mounting screw 2 (11), the bonnet mounting nut (12) on both side, and the bonnet support (13).

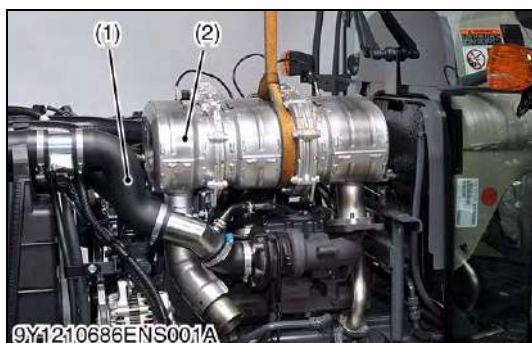
■ IMPORTANT

- When disconnecting the battery cables, disconnect the negative cable first. When connecting, connect the positive cable first.
- When assembling the bonnet damper (9), make sure that the rod part of bonnet damper (9) is on the backside.

- | | |
|-----------------------------------|--------------------------------------|
| (1) Bonnet | (8) 3P Connector (Head Light) |
| (2) Battery | (9) Bonnet Damper |
| (3) Side Cover | (10) Snap Pin |
| (4) Side Panel | (11) Bonnet Support Mounting Screw 2 |
| (5) Side Cover Guide | (12) Bonnet Support Mounting Nut |
| (6) Muffler Pipe | (13) Bonnet Support |
| (7) Muffler Pipe Mounting Screw 1 | |

9Y1210686TRS0172US0

(3) DPF Muffler



DPF Muffler 1



CAUTION

- After running the engine, DPF muffler is very hot. When disconnecting the connectors, wait the cooling down.
- Disconnect the connector 1 (1) and connector 2 (2).
 - Remove the screws (3) of between the DPF muffler and the mount stay.
 - Remove the nuts (4).

(When reassembling)

- Each exhaust gas temperature sensor is different. Be attention for the color of connectors. (Steering Side) Black → Gray → White (Front Side)

Tightening torque	M10 nut	48 to 55 N·m 4.9 to 5.7 kgf·m 36 to 41 lbf·ft
	M12 bolt	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 lbf·ft

- Connector 1 (Exhaust Gas Temperature Sensor)
- Connector 2 (Differential Pressure Sensor)
- Screw
- Nut

9Y1210686ENS0015US0

DPF Muffler 2

■ IMPORTANT

- This DPF muffler assembly is about 20 kg (44 lbs). So use the hoist for safety. Be attention for each sensor when assembling and removing. Each sensor is easy to corrupt by shock.

- Ready for using the hoist for removing.
- Disconnect the intake air hose (1) from the intake air pipe.
- Remove the DPF muffler with the hoist.

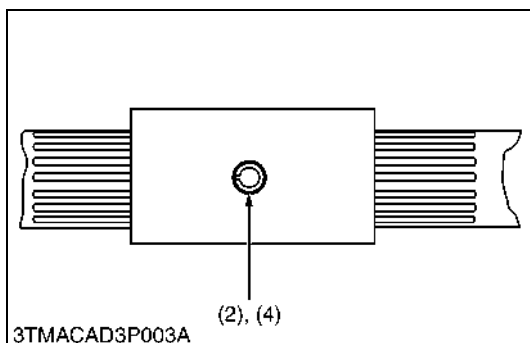
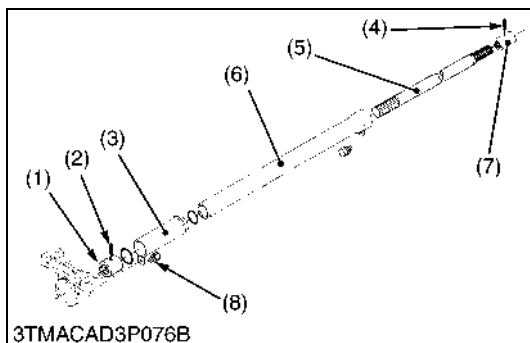
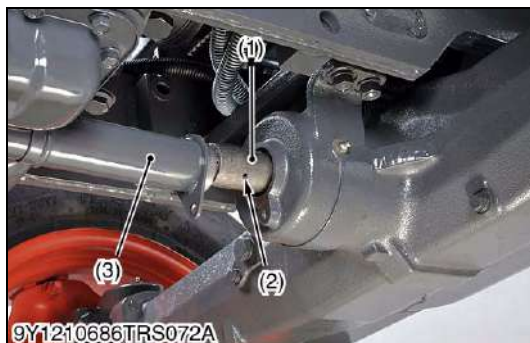
(When reassembling)

- Firstly, pre-tighten all bolts and nuts around DPF muffler assembly. After that, tighten the all bolts and nuts.

- Intake Air Hose
- DPF Muffler

9Y1210686ENS0016US0

(4) Propeller Shaft and Power Steering Hose



Propeller Shaft

1. Slide the propeller shaft cover (3) after removing the screw (8).
2. Tap out the roll pins (2) and then slide the coupling (1) to the rear.

(When reassembling)

- Apply grease to the splines of the propeller shaft (5) and pinion shaft.
- Tap in the roll pins (2) as shown in figure.

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

9Y1210686TRS0027US0

Power Steering Hose

1. Disconnect both power steering hoses (2) from power steering cylinder (1).

(When reassembling)

- Connect the power steering hose with blue tape to the R.H..

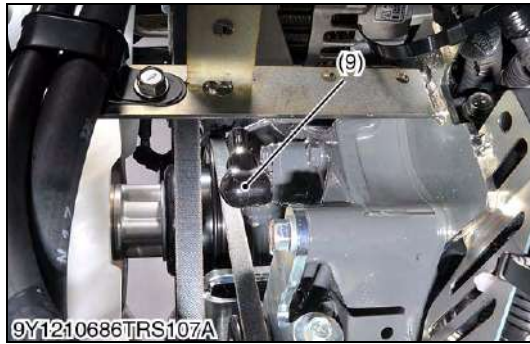
Tightening torque	Power steering hose retaining nut	23 to 27 N·m 2.3 to 2.8 kgf·m 17 to 20 lbf·ft
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- | | |
|-----------------------------|-------------------------|
| (1) Power Steering Cylinder | (2) Power Steering Hose |
|-----------------------------|-------------------------|

9Y1210686TRS0028US0

[3] SEPARATING ENGINE

(1) ROPS Model



Power Steering Hose and Wire Harness for L.H. Side

1. Remove the power steering hose bands (1) with the power steering hose (2).
2. Disconnect the wire harness (3) from the alternator (4), the starter (5), the coolant temperature sensor (6), the engine oil pressure switch (7) and the intake air flow sensor (8).
3. Disconnect the wire harness (3) from the camshaft position sensor (9) and the crankshaft position sensor (10).

(When reassembling)

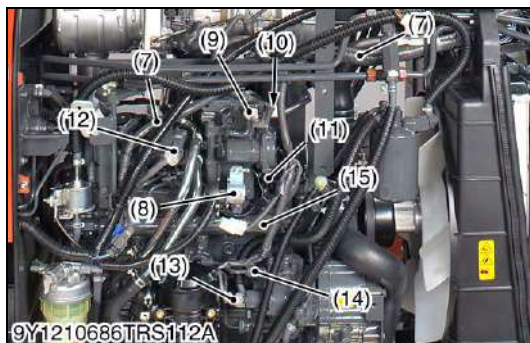
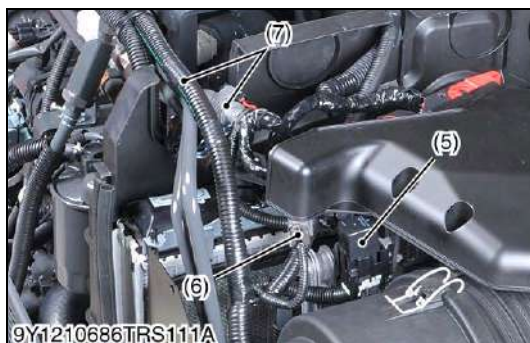
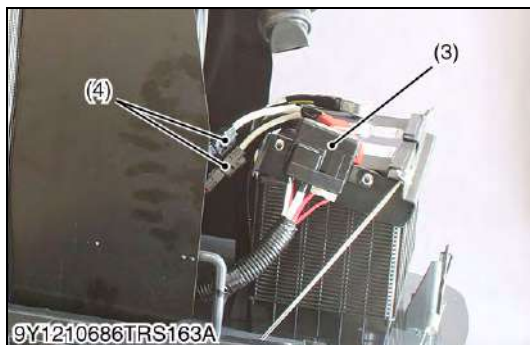
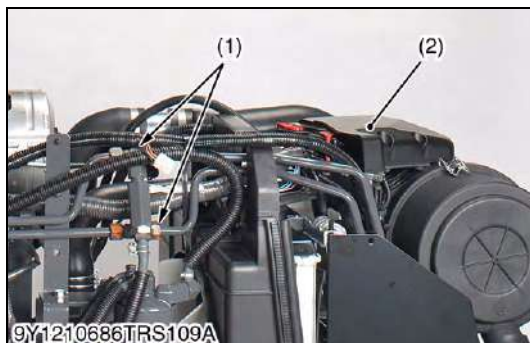
Tightening torque	Starter's B terminal mounting nut	9.8 to 11 N·m 1.0 to 1.2 kgf·m 7.3 to 8.6 lbf·ft
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■ NOTE

- There are three bands for power steering hose. Hose band under the radiator is not in photo.
- There is the crankshaft position sensor (10) that is wrapped a white tape.
There is the camshaft position sensor (9) that is wrapped no tape.

- | | |
|-------------------------------------|---------------------------------|
| (1) Hose Band (Power Steering Hose) | (6) Coolant Temperature Sensor |
| (2) Power Steering Hose | (7) Engine Oil Pressure Switch |
| (3) Wire Harness | (8) Intake Air Flow Sensor |
| (4) Alternator | (9) Camshaft Position Sensor |
| (5) Starter | (10) Crankshaft Position Sensor |

9Y1210686TRS0033US0



Oil Cooler Pipe, Fuel Hoses and Wire Harness for R.H. Side

1. Disconnect the oil cooler pipe retaining nuts (1).
2. Remove the slow blow fuse box (3) from the battery support and disconnect the connectors 1 (4) for the battery.
3. Remove the engine ECU cover (2).
4. Let the red handles of engine ECU be rotated 0.79 rad (45 °) and disconnect the **96P** connector and the **58P** connector.
5. Remove the relay (5), the relays (6) and the ground cables from the engine ECU stay.
6. Disconnect the wire harness (7) from the heater relay (8), the intake air temperature sensor (9), the intake air pressure sensor (10), the intake air heater (11), the EGR DC motor (12), the fuel temperature sensor (13), the SCV (14), the rail pressure sensor (15) and the connector 2 (16).
7. Disconnect the fuel hose (17) and the fuel return hose (18).
8. Remove the DPF muffler.

NOTE

- Do not be rotated over 0.79 rad (45 °). The red handle may be damaged.

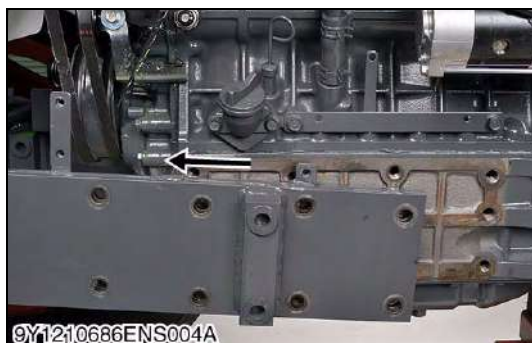
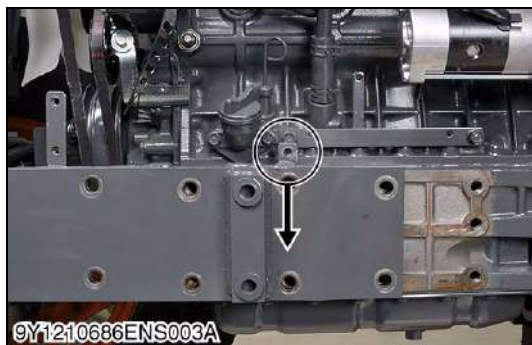
(When reassembling)

Tightening torque	Oil cooler pipe nut	49 to 68 N·m 5.0 to 7.0 kgf·m 37 to 50 lbf·ft
	Intake air heater terminal mounting nut	3.5 to 5.3 N·m 0.35 to 0.55 kgf·m 2.6 to 3.9 lbf·ft



- | | |
|-----------------------------------|---------------------------------|
| (1) Oil Cooler Pipe Mounting Nut | (10) Intake Air Pressure Sensor |
| (2) Engine ECU Cover | (11) Intake Air Heater |
| (3) Slow Blow Fuse Box | (12) EGR DC Motor |
| (4) Connector 1 (Battery) | (13) Fuel Temperature Sensor |
| (5) Relay (Starter) | (14) SCV |
| (6) Relay (CRS) | (15) Rail Pressure Sensor |
| (7) Wire Harness | (16) Connector 2 (Injector) |
| (8) Heater Relay | (17) Fuel Hose |
| (9) Intake Air Temperature Sensor | (18) Fuel Return Hose |

9Y1210686ENS0017US0



Axle Support as a Unit

1. Make sure the clutch housing case and front frame are securely mounted on the disassembling stands.
2. Install the front axle rocking restrictor (1) (see page G-68) to the front axle bracket.
3. Remove the front frame mounting screws.
4. Drop down front axle support not to damage engine oil cap.
5. Move the front axle support to the front side.

(When reassembling)

Tightening torque	Front frame mounting screw (M14, 9T, UBS)	167 to 196 N·m 17.0 to 20.0 kgf·m 123 to 144 lbf·ft
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NOTE

- When reassembling, pre-install the all front frame mounting screws. After that, tighten the front frame mounting screws to the specified tightening torque.

(1) Front Axle Rocking Restrictor

9Y1210686ENS0018US0



Separating Engine from Clutch Housing

WARNING

- For safety, when separating the engine, use the hoist. Ensure that the hoist is fixed to the engine securely before separating the engine. You may be injured by dropping down the engine.

- Make sure the engine and clutch housing case are securely mounted on the disassembling stands.
- Remove the steering support mounting screw (1) for front side.
- Remove the engine mounting screws and nut, and separate the engine from the clutch housing.

■ NOTE

- When you replace the engine with a new one, please record the serial number of new engine and the parts number and serial number of "DPF Full Assembly" which is incorporate with its new engine.

(When reassembling)

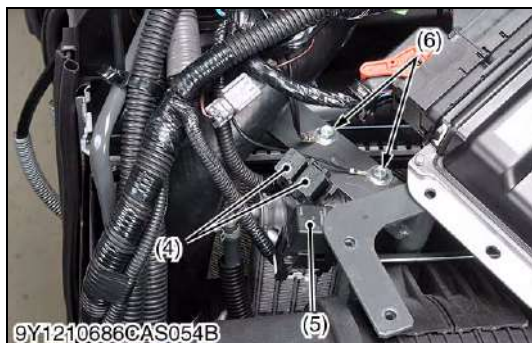
- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the splines of damper disk boss.
- Apply liquid gasket (Three Bond 1141, 1211 or equivalent) to joint face of the engine and clutch housing.

Tightening torque	Engine and clutch housing mounting screw and nut (M14, 7T)	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 lbf·ft
	Engine and clutch housing mounting stud bolt	62 to 73 N·m 6.3 to 7.5 kgf·m 46 to 54 lbf·ft

(1) Steering Support Mounting Screw

9Y1210686ENS0020US0

(2) CABIN Model



Wire Harness for Tractor Front Side

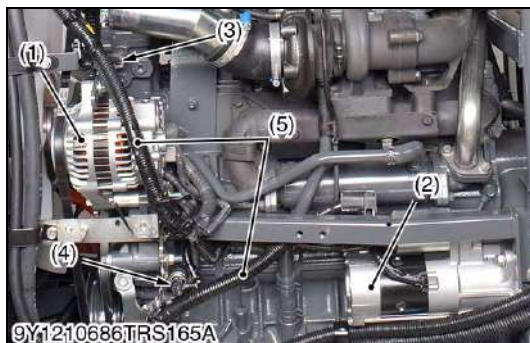
1. Remove the engine ECU cover (1).
2. Let the red handles of engine ECU be rotated 0.79 rad (45 °) and disconnect the **96P** connector (2) and **58P** connector (3).
3. Remove the relays (4).
4. Remove the relay (5).
5. Disconnect the ground wires (6).
6. Remove the slow blow fuse boxes (7) from the battery support and disconnect the connector (8) from the battery.

■ NOTE

- Do not be rotated over 0.79 rad (45 °). The red handle may be damaged.

- | | |
|---------------------------------------|-------------------------|
| (1) Engine ECU Cover | (5) Relay (Starter) |
| (2) 96P Connector (Engine ECU) | (6) Ground Wire |
| (3) 58P Connector (Engine ECU) | (7) Slow Blow Fuse Box |
| (4) Relay (CRS) | (8) Connector (Battery) |

9Y1210686ENS0111US0



Wire Harness for L.H. Side

1. Disconnect the wire harness (5) from the alternator (1), the starter (2), the coolant temperature sensor (3), the engine oil pressure switch (4).
2. Disconnect the wire harness (6) from the camshaft position sensor (6) and the crankshaft position sensor (7).

(When reassembling)

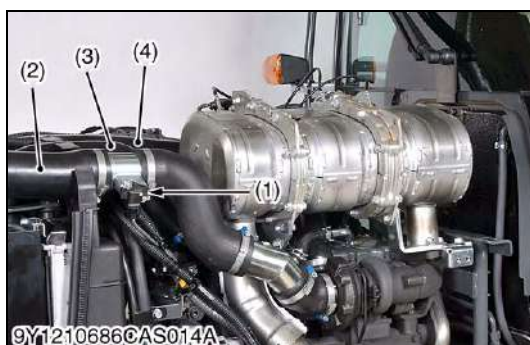
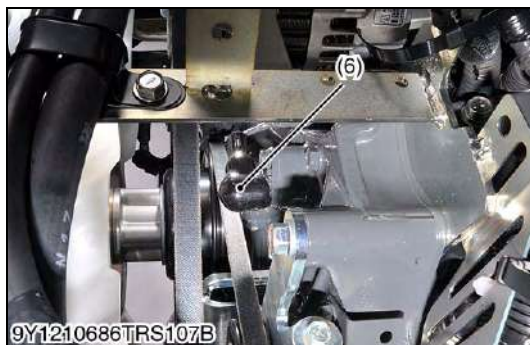
Tightening torque	Starter's B terminal mounting nut	9.8 to 11 N·m 1.0 to 1.2 kgf·m 7.3 to 8.6 lbf·ft
-------------------	-----------------------------------	--

NOTE

- There are three bands for power steering hose. Hose band under the radiator is not in photo.
- There is the crankshaft position sensor (7) that is wrapped a white tape.
There is the camshaft position sensor (6) that is wrapped no tape.

- | | |
|--------------------------------|--------------------------------|
| (1) Alternator | (5) Wire Harness |
| (2) Starter | (6) Camshaft Position Sensor |
| (3) Coolant Temperature Sensor | (7) Crankshaft Position Sensor |
| (4) Engine Oil Pressure Switch | |

9Y1210686TRS0130US0

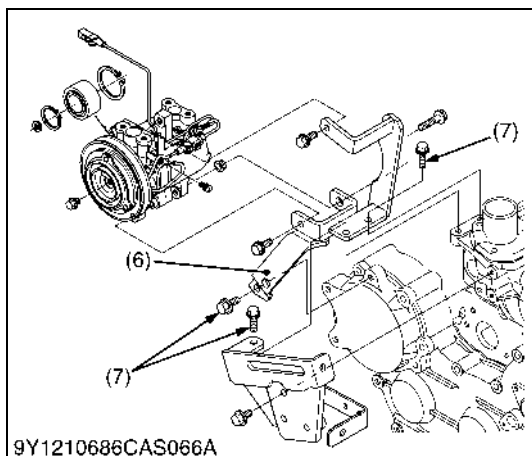


Hose

1. Disconnect the **5P** connector for mass air flow sensor (1) and the air cleaner hose (2).
2. Disconnect the intercooler hose 1 (3) and the intercooler hose 2 (4). (for M9960 Model)

- | | |
|--------------------------|------------------------|
| (1) Mass Air Flow Sensor | (3) Intercooler Hose 1 |
| (2) Air Cleaner Hose | (4) Intercooler Hose 2 |

9Y1210686CAS0058US0



Condenser and Compressor

■ Without discharging the refrigerant from system

1. Remove the screw 1 (1) from the condenser (2) and slide out the condenser (2).
2. Remove the hose clamps (3).
3. Disconnect **1P** connector (4) of magnetic clutch.
4. Remove the compressor stay (6) mounting screw 2 (7) from engine.
5. Remove the compressor (5) with hoses and compressor stay (6).

(When reassembling)

- Take care not to damage the air condenser fin.
- After reassembling the compressor, be sure to adjust the air conditioner belt tension. (See page G-29.)

Tightening torque	Compressor bracket mounting screw (M8) to aluminum parts	18 to 20 N·m 1.8 to 2.1 kgf·m 13 to 15 lbf·ft
	Compressor bracket mounting screw (M8) to ordinariness parts	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Compressor bracket mounting screw (M10) to ordinariness parts	48 to 55 N·m 4.9 to 5.7 kgf·m 36 to 41 lbf·ft

- | | |
|---|---|
| (1) Screw 1 | (6) Compressor Stay |
| (2) Condenser | (7) Compressor Support Mounting Screw 2 |
| (3) Hose Clamp | (8) Low Pressure Hose |
| (4) 1P Connector (Magnetic Clutch) | (9) High Pressure Hose |
| (5) Compressor | |

(To be continued)

(Continued)

■ **With discharge the refrigerant from system**

1. See page 9-S18.
2. Disconnect the low pressure hose (8) and high pressure hose (9) from compressor (5).

(When reassembling)

- Charge the refrigerator to the air conditioner system. (See page 9-S20.)
- Apply compressor oil (DENSO CO. ND-OIL8) to the O-rings and take care not to damage them.

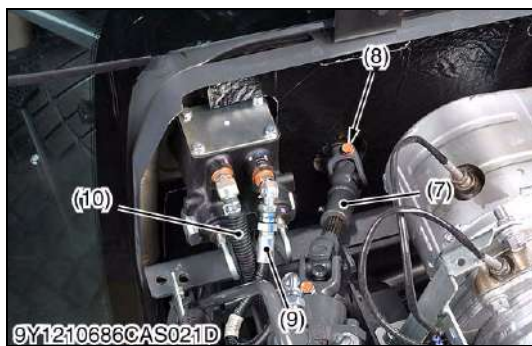
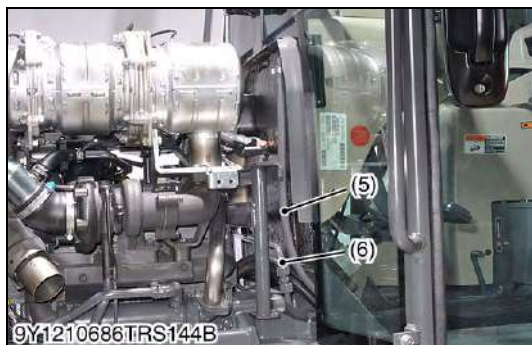
■ **IMPORTANT**

- **After removing the condenser, return the front wheel to straight.**

Tightening torque	High pressure hose mounting screw	7.9 to 11 N·m 0.80 to 1.2 kgf·m 5.8 to 8.6 lbf·ft
	Low pressure hose mounting screw	7.9 to 11 N·m 0.80 to 1.2 kgf·m 5.8 to 8.6 lbf·ft

- | | |
|---|---|
| (1) Screw 1 | (6) Compressor Stay |
| (2) Condenser | (7) Compressor Support Mounting Screw 2 |
| (3) Hose Clamp | (8) Low Pressure Hose |
| (4) 1P Connector (Magnetic Clutch) | (9) High Pressure Hose |
| (5) Compressor | |

9Y1210686CAS0059US0



Heater Hose, Steering Hose, Steering Pipe and Steering Joint Shaft

1. Remove the hose clamps (1).
2. Slide the hose clamp 2 (3) and disconnect the heater hoses (2) from the heater hose couples.
3. Remove the steering hose (4).
4. Disconnect the breather hose (5) and steering pipe 1 (6).
5. Remove the steering joint shaft mounting screw (8) then disconnect the steering joint shaft (7) from steering joint.
6. Disconnect the master cylinder hose (9), master cylinder return hose (10) and the steering pipe 2 (11).

(When reassembling)

- Be sure to fix the heater hose to the original position. Note the inlet hose and outlet hoses.

Tightening torque	Master cylinder hose retaining nut	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Power steering joint shaft mounting screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Power steering pipe nut	49 to 68 N·m 5.0 to 7.0 kgf·m 37 to 50 lbf·ft

- (1) Hose Clamp
(2) Heater Hose
(3) Hose Clamp 2
(4) Steering Hose
(5) Breather Hose
(6) Steering Pipe 1

- (7) Steering Joint Shaft
(8) Screw
(9) Master Cylinder Hose
(10) Master Cylinder Return Hose
(11) Steering Pipe 2

9Y1210686ENS0112US0



Fuel Hose and Wire Harness for R.H. Side

1. Disconnect the wire harness (9) from the heater relay (1), the intake air temperature sensor (2), the intake air pressure sensor (3), the intake air heater (4), the EGR DC motor (5), the fuel temperature sensor (6), the SCV (7), the rail pressure sensor (8) and the connector (10).
2. Disconnect the fuel hose (11) and the fuel return hose (12).

- | | |
|-----------------------------------|---------------------------|
| (1) Heater Relay | (7) SCV |
| (2) Intake Air Temperature Sensor | (8) Rail Pressure Sensor |
| (3) Intake Air Pressure Sensor | (9) Wire Harness |
| (4) Intake Air Heater | (10) Connector (Injector) |
| (5) EGR DC Motor | (11) Fuel Hose |
| (6) Fuel Temperature Sensor | (12) Fuel Return Hose |

9Y1210686TRS0123US0

Axle Support as a Unit

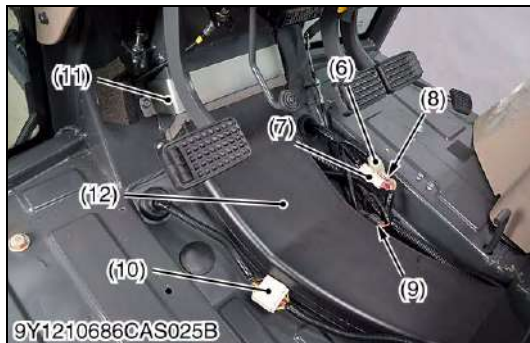
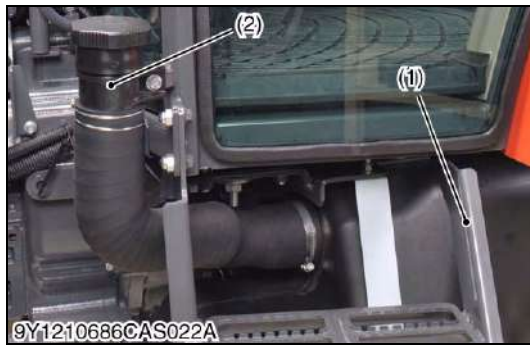
1. Make sure the clutch housing case and front frame are securely mounted on the disassembling stands.
2. Install the front axle rocking restrictor (1) (see page G-68) to the front axle bracket.
3. Remove the front frame mounting screws and separate the front axle as a unit from the engine.

(When reassembling)

Tightening torque	Front frame mounting screw (M14, 9T, UBS)	167 to 196 N·m 17.0 to 20.0 kgf·m 123 to 144 lbf·ft
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- (1) Front Axle Rocking Restrictor

9Y1210686ENS0021US0



Step, Floor Mats and Wiring Harness for Cabin Side

1. Remove the auxiliary step on both sides.
2. Remove the fuel filling port (2).
3. Remove the floor mat 1 (3) and mat 2 (4).
4. Remove the floor cover (5), the duct band (11) and the front duct (12).
5. Disconnect the connectors (6), (7), (8) and (9) for engine wire harness.
6. Disconnect the **17P** connector (10) for main wire harness.
7. Pull out these connectors from cabin.

- | | |
|--------------------------|---------------------------|
| (1) Auxiliary Step | (7) 3P Connector |
| (2) Fuel Filling Port | (8) 2P Connector |
| (3) Floor Mat 1 | (9) 4P Connector |
| (4) Floor Mat 2 | (10) 17P Connector |
| (5) Floor Cover | (11) Duct Band |
| (6) 10P Connector | (12) Front Duct |

9Y1210686ENS0022US0



9Y1210686ENS012A



9Y1210686ENS013A



9Y1210686ENS009A

Separating Engine from Clutch Housing

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

■ NOTE

- When you replace the engine with a new one, please record the serial number of new engine and the parts number and serial number of "DPF Full Assembly" which is incorporate with its new engine.

(When reassembling)

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

Tightening torque	Engine and clutch housing mounting screw and nut (M14, 7T)	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 lbf·ft
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9Y1210686ENS0040US0

[4] DISASSEMBLING AND ASSEMBLING

(1) Damper Disk and PTO Spline Boss



9Y1210686TRS012A

Damper Disk

1. Remove the damper disk (1).

(When reassembling)

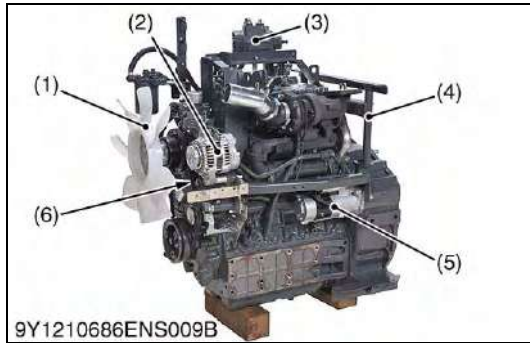
- Direct the shorter end of the damper disk boss toward the flywheel.
- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the spline.

Tightening torque	Damper disk mounting screw	48 to 55 N·m 4.9 to 5.7 kgf·m 36 to 41 lbf·ft
-------------------	----------------------------	---

- (1) Damper Disk

9Y1210686TRS0067US0

(2) External Parts



Fan, Starter, Alternator and Power Steering Controller

1. Remove the air conditioner drive belt (7).
2. Remove the fan (1) and fan belt (6).
3. Remove the alternator (2) and starter motor (5).
4. Remove the power steering controller (3).
5. Remove the DPF stay (4).

(When reassembling)

- Adjust the fan belt tension. (See page G-29.)
- Adjust the air conditioner drive belt tension. (See page G-29.)

- | | |
|-------------------------------|----------------------------|
| (1) Fan | (5) Starter Motor |
| (2) Alternator | (6) Fan Belt |
| (3) Power Steering Controller | (7) Conditioner Drive Belt |
| (4) DPF Stay | |

9Y1210686ENS0023US0

(3) Turbocharger and EGR



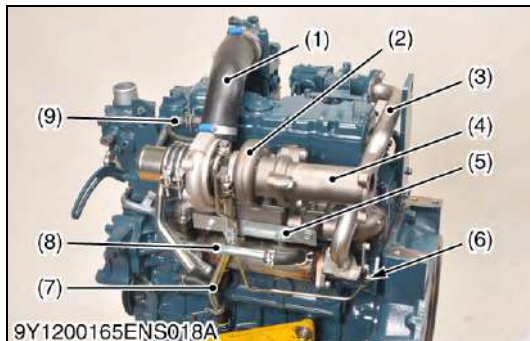
CAUTION

- While the engine operates or just after it stops, do not touch the hot turbocharger.

NOTE

- When you remove or install the turbocharger assembly, do not let dust, dirt and other unwanted materials in the oil pipes.
- After you replace the turbocharger assembly, fill clean engine oil through the oil filter port of the turbocharger.
- Before you start the engine, make sure that the air cleaner is in the correct position.

9Y1210686ENS0024US0



EGR Pipe, Turbocharger and EGR Cooler

1. Remove the intake hose (1).
2. Remove the EGR pipe (3).
3. Remove the muffler flange (4).
4. Remove the EGR cooler pipe (8).
5. Remove the breather pipe (9).
6. Remove the screw (6) for the oil pipe.
7. Remove the return pipe (crankcase side) (7).
8. Remove the cover (5).
9. Remove the turbocharger assembly (2).
10. Remove the EGR cooler (10).

(When reassembling)

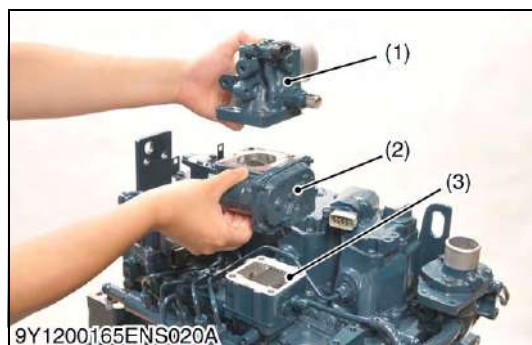
- Fill clean engine oil through the oil filter port of the turbocharger.
- Replace the gaskets with new ones.
- Do not let dust, dirt and other unwanted materials in the oil pipes.

NOTE

- Put tape or cover on all openings to prevent damage in the oil holes in the turbocharger by unwanted materials.

- | | |
|---------------------------|---------------------|
| (1) Intake Hose | (6) Screw |
| (2) Turbocharger Assembly | (7) Return Pipe |
| (3) EGR Pipe | (8) EGR Cooler Pipe |
| (4) Muffler Flange | (9) Breather Pipe |
| (5) Cover | (10) EGR Cooler |

9Y1210686ENS0025US0



Intake Throttle Valve and Intake Air Heater

1. Remove the air cleaner flange (1).
2. Remove the intake throttle valve (2).
3. Remove the intake air heater (3).

■ NOTE

- Do not disassemble the intake throttle valve.

(When reassembling)

- Replace the gaskets with new ones.

- (1) Air Cleaner Flange
(2) Intake Throttle Valve

- (3) Intake Air Heater

9Y1210686ENS0026US0



EGR Valve

1. Disconnect the cooler pipe (1), (2) of EGR valve.
2. Remove the EGR valve (3).

■ NOTE

- Do not disassemble the EGR valve assembly.

(When reassembling)

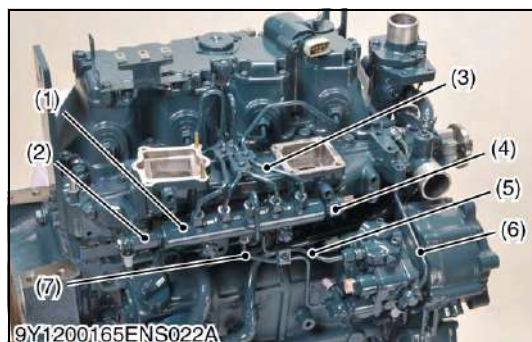
- Replace the gaskets with new ones.

- (1) Cooler Pipe
(2) Cooler Pipe

- (3) EGR Valve

9Y1210686ENS0027US0

(4) Common Rail



Common Rail and Injection Pipes



CAUTION

- Do not loosen the injection pipe when the fuel is under high pressure (within five minutes of stopping the engine).

■ NOTE

- Do not remove the pressure limiter (2) and rail pressure sensor (4) from the common rail (1).
- When removing the common rail (1), do not hold it by the pressure limiter (2) and rail pressure sensor (4).

1. Remove the injection pipe (5), (7).
2. Remove the overflow pipe (6).
3. Remove the injection pipes (3).
4. Remove the common rail (1).

■ IMPORTANT

- Store the injection pipes (3), (5), (7) so it does not get any dust in it.
- Store the common rail (1) so it does not get any dust in it.

(When reassembling)

■ NOTE

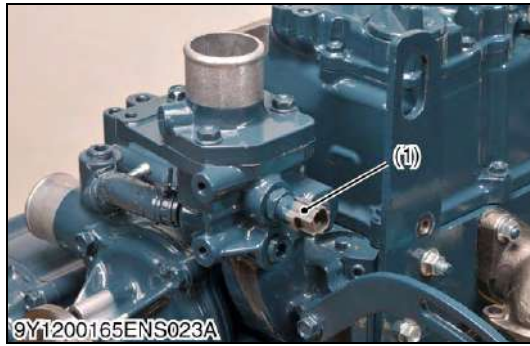
- Tighten the injection pipes securely to their specified torques.

Tightening torque	Common rail mounting screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Injection pipe retaining nut	23 to 36 N·m 2.3 to 3.7 kgf·m 17 to 26 lbf·ft

- (1) Common Rail
(2) Pressure Limiter
(3) Injection Pipe
(4) Rail Pressure Sensor

- (5) Injection Pipe
(6) Overflow Pipe
(7) Injection Pipe

9Y1210686ENS0028US0



Coolant Temperature Sensor

1. Remove the coolant temperature sensor (1).

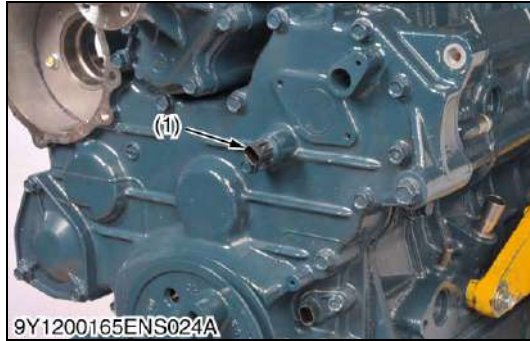
(When reassembling)

- Replace the gaskets with new ones.

Tightening torque	Coolant Temperature Sensor taper screw	16 to 23 N·m 1.6 to 2.4 kgf·m 12 to 17 lbf·ft
-------------------	--	---

(1) Coolant Temperature Sensor

9Y1210686ENS0029US0



Camshaft Position Sensor

1. Remove the camshaft position sensor mounting screw.
2. Remove the camshaft position sensor (1).

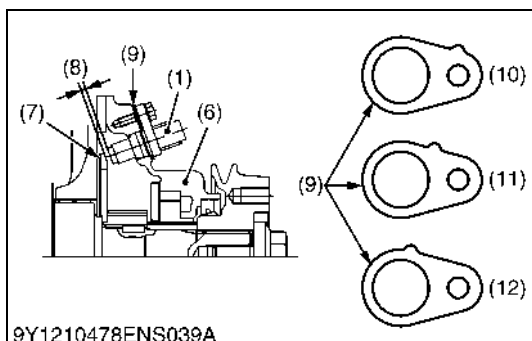
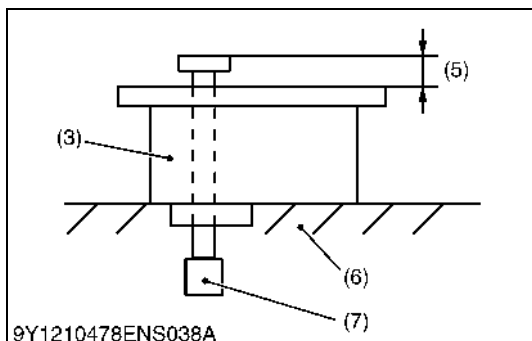
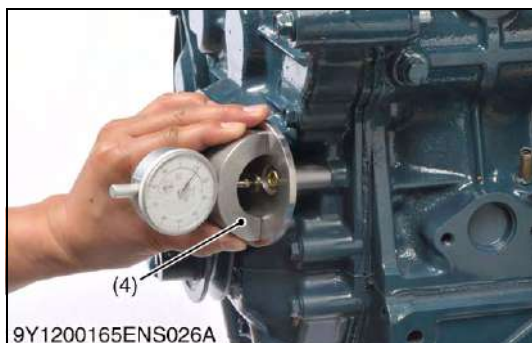
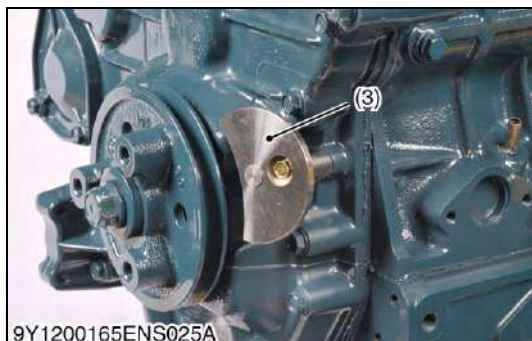
(When reassembling)

- Replace the O-ring with a new one.

Tightening torque	Camshaft position sensor mounting screw	4 to 5 N·m 0.4 to 0.6 kgf·m 3 to 4 lbf·ft
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(1) Camshaft Position Sensor

9Y1210686ENS0030US0



Crankshaft Position Sensor

1. Remove the crankshaft position sensor mounting screw (2).
2. Remove the crankshaft position sensor (1).

(When reassembling)

- Replace the O-ring with a new one.

■ IMPORTANT

- If you drop the sensor, do not reuse it.
- If the sensor (1), gear case (6) and/or pulsar gear (7) are replaced, use a combination of shims (9) to adjust the sensor's air gap.

Selecting adjustment shims

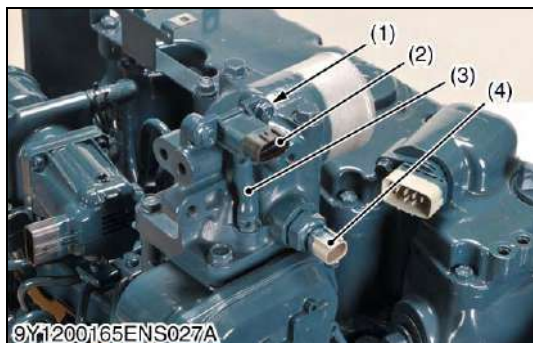
1. Align the TC mark of flywheel with the flywheel housing timing window.
2. Install the measurement jig 1 (3) to the sensor mounting position.
3. Set the dial gauge at the measurement jig 2 (4), then measure the protrusion (5) of the jig 1 (3).
4. Refer to the protrusion (5) you measured, and select the number of adjusting shims (9) from the following table.

Combination of Shims

Protrusion (5)	Thickness & Number of Shims		
	0.25 mm (0.0098 in.) (10)	0.50 mm (0.020 in.) (11)	1.00 mm (0.0394 in.) (12)
	1G381-04420	1G381-04430	1G381-04440
2.25 to 2.50 mm 0.0886 to 0.0984 in.	1		2
2.00 to 2.25 mm 0.0788 to 0.0885 in.			2
1.75 to 2.00 mm 0.0689 to 0.0787 in.	1	1	1
1.50 to 1.75 mm 0.0591 to 0.0688 in.		1	1
1.25 to 1.50 mm 0.0493 to 0.0590 in.	1		1
1.00 to 1.25 mm 0.0394 to 0.0492 in.			1
0.750 to 1.00 mm 0.0296 to 0.0393 in.	1	1	
0.500 to 0.750 mm 0.0197 to 0.0295 in.		1	
0.250 to 0.500 mm 0.00985 to 0.0196 in.	1		
0 to 0.250 mm 0 to 0.00984 in.			

Air Gap (8)	Factory specification	0.25 to 1.4 mm 0.0099 to 0.055 in.
Tightening torque	Crankshaft position sensor mounting screw	4 to 6 N·m 0.4 to 0.6 kgf·m 3 to 4 lbf·ft

- | | |
|---|----------------------------------|
| (1) Crankshaft Position Sensor | (7) Pulsar Gear |
| (2) Crankshaft Position Sensor Mounting Screw | (8) Air Gap |
| (3) Jig 1 | (9) Shim |
| (4) Jig 2 | (10) Shim (0.25 mm (0.0098 in.)) |
| (5) Protrusion | (11) Shim (0.50 mm (0.020 in.)) |
| (6) Gear Case | (12) Shim (1.00 mm (0.0394 in.)) |



Intake Air Temperature Sensor and Boost Sensor

■ IMPORTANT

- Be careful not to damage the sensor when removing the hose from the boost sensor.

1. Remove the intake air temperature sensor (4).
2. Remove the hose (3) from the boost sensor (2).
3. Remove the boost sensor mounting screw (1).
4. Remove the boost sensor (2).

(When reassembling)

- Replace the gaskets with new ones.
- If the hose is damaged, replace it with a new hose.

Tightening torque	Boost sensor mounting screw	30 to 39 N·m 3.0 to 4.0 kgf·m 22 to 28 lbf·ft
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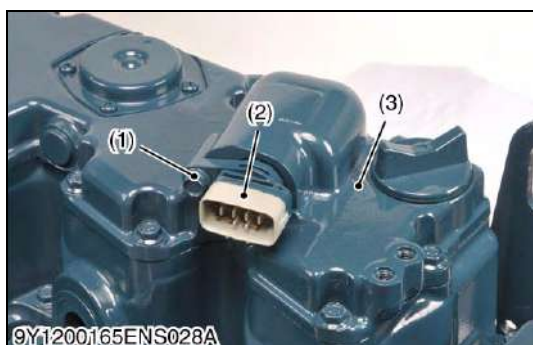
(1) Boost Sensor Mounting Screw

(3) Hose

(2) Boost Sensor

(4) Intake Air Temperature Sensor

9Y1210686ENS0032US0



Injector Harness Connector

1. Remove the screw (1).
2. Pull the injector harness connector (2) out from cylinder head cover 2 (3).
3. Remove the connector (2) from the injector harness (4).

■ IMPORTANT

- Be careful not to damage the harness when you pull the connector out.

(When reassembling)

- Replace the O-ring (5) with a new one.

(1) Screw

(4) Injector Harness

(2) Injector Harness Connector

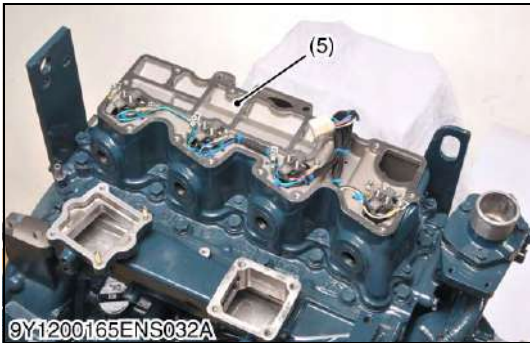
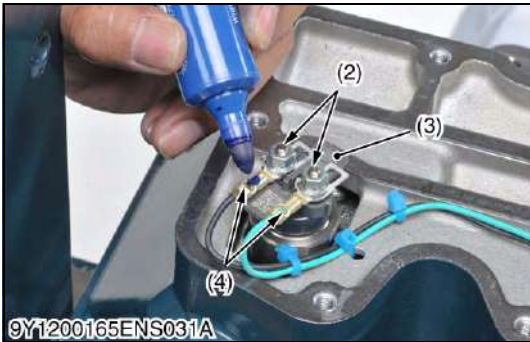
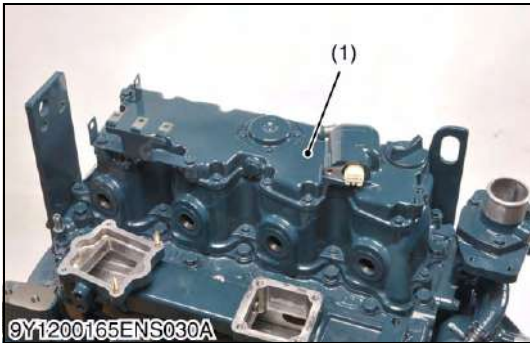
(5) O-ring

(3) Cylinder Head Cover 2

9Y1210686ENS0033US0



(5) Cylinder Head and Valves



Cylinder Head Cover

- 1. Remove cylinder head cover 2 (1).
- 2. To prevent miswiring during reassembly, mark the injector terminals (2) and the leads (4).
- 3. Remove the injector harness from the injectors.
- 4. Remove cylinder head cover 1 (5).

(When reassembling)

- Do not damage injector QR code tags (3) when installing cylinder head cover 1 (5).
- Replace the gasket of cylinder head cover 2 with a new one.
- Make sure to tighten the injector terminal nut with the specified torque.

Tightening torque	Cylinder head cover 1 screw	6.87 to 11.2 N·m 0.700 to 1.15 kgf·m 5.07 to 8.31 lbf·ft
	Cylinder head cover 2 screw	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft
	Injector terminal nut	1.6 to 2.2 N·m 0.16 to 0.23 kgf·m 1.2 to 1.6 lbf·ft

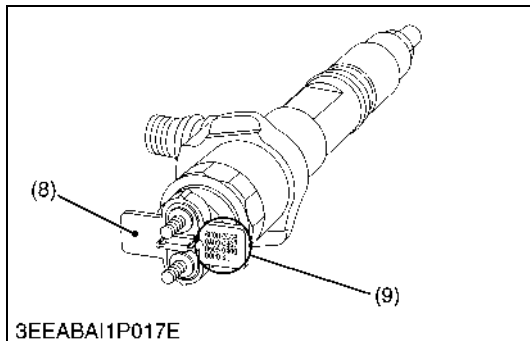
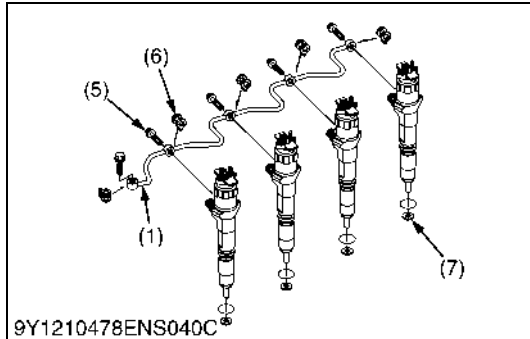
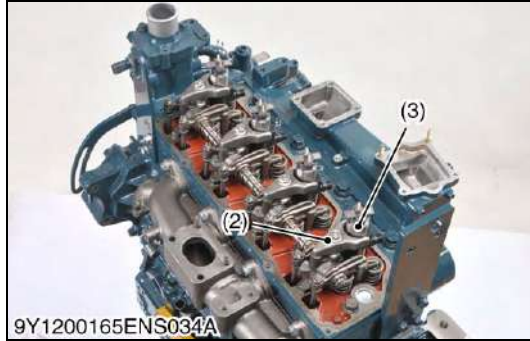
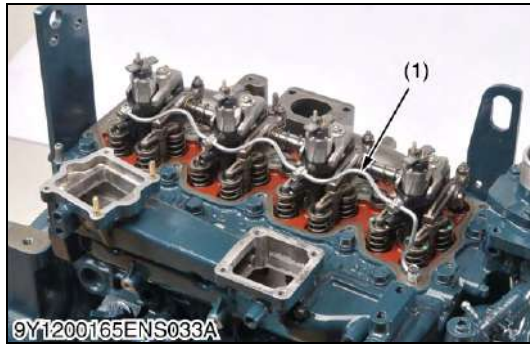
- (1) Cylinder Head Cover 2

(2) Injector Terminal

(3) Injector QR Code Tag
- (4) Lead

(5) Cylinder Head Cover 1

9Y1210686ENS0041US0



Overflow Pipe and Injectors

1. Remove the overflow pipe (1).
2. Remove the injector clamp (2).
3. Remove the injector (3) and its gasket (7).

■ IMPORTANT

- Do not disassemble the injector (3).
- Do not remove the injector QR code tag (8).
- Do not damage the injector QR code tag (8).
- Do not lose the ball (4) of the rocker arm bracket.
- Do not get the injectors out of order. If the injectors get out of order, it is necessary to perform injector correction (writing the injector ID codes (9) to the engine ECU).
- Store the injectors so they do not get any dust in them.

(When reassembling)

- Replace the injectors' gaskets (7) with new ones.
- When installing injector clamps (2), check and make sure the ball (4) is in the rocker arm bracket.
- When attaching the overflow pipe (1) to the injector, replace the gasket (6) with a new one.
- Install the overflow pipe joint screw (5).
- Tighten the injector clamp nuts securely to their specified torques.
- Tighten the overflow pipe joint screws (5) securely to their specified torques.
- After installing the overflow pipe, in order to check the fuel leakage, add pressure by air from the fuel pipe joint, and check the fuel leakage of overflow pipe and gasket (6).
- In case there is fuel leakage, replace the gasket (6), then check the fuel leakage again.

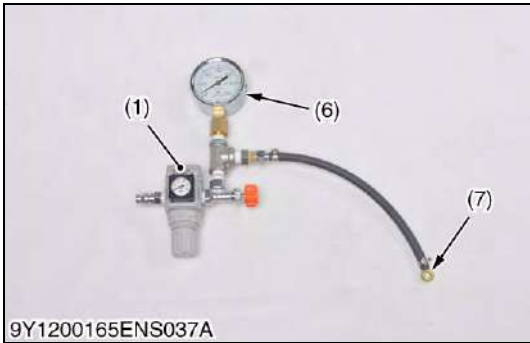
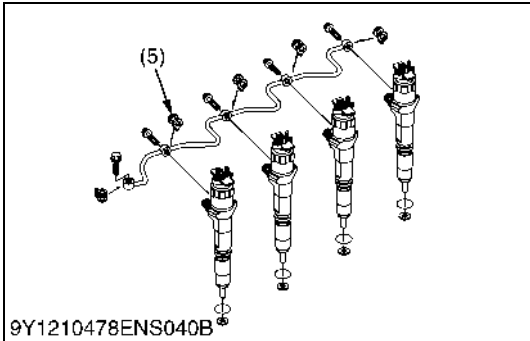
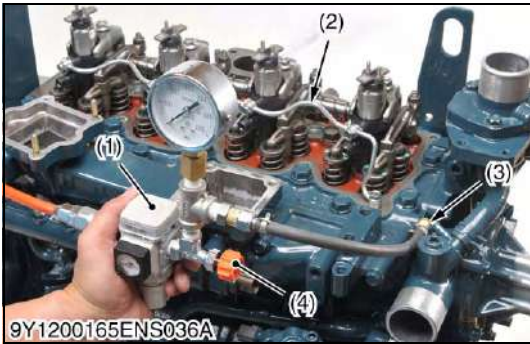
■ NOTE

- If you replace the injectors, it is necessary to perform injector correction (writing the injector ID codes (9) to the ECU).

Tightening torque	Injector clamp nut	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Overflow pipe joint screw (M6 × 1.0)	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft

- | | |
|-------------------------------|--------------------------|
| (1) Overflow Pipe | (6) Gasket |
| (2) Injector Clamp | (7) Gasket |
| (3) Injector | (8) Injector QR Code Tag |
| (4) Ball | (9) Injector ID Code |
| (5) Overflow Pipe Joint Screw | |

9Y1210686ENS0042US0



Check the Fuel Leakage of the Overflow Pipe

1. Connect the fuel pipe joint (7) of air pressure adjustment equipment to the eye joint bolt (3).
2. Tighten the valve (4).
3. Connect the air hose to the air pressure adjustment equipment.
4. Adjust air pressure of the regulator (1) between 0.03 and 0.05 MPa (0.3 and 0.5 kgf/cm², 5 and 7 psi).
5. Open the valve (4) gradually, then add 0.03 MPa (0.3 kgf/cm², 4 psi) pressure.
6. Tighten the valve (4).
7. Check the decreased pressure after 4 seconds.

■ **NOTE**

- If the decreased pressure is higher than 0.001 MPa (0.01 kgf/cm², 0.1 psi), it means that there is fuel leakage. Replace the gasket (5), and then check the fuel leakage again.

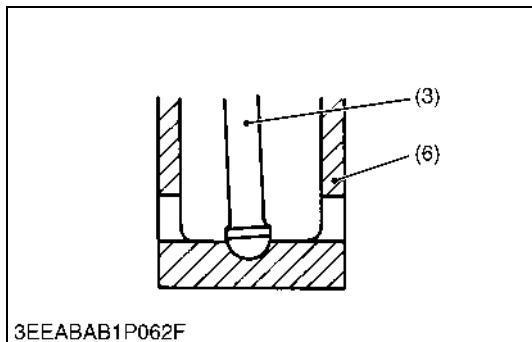
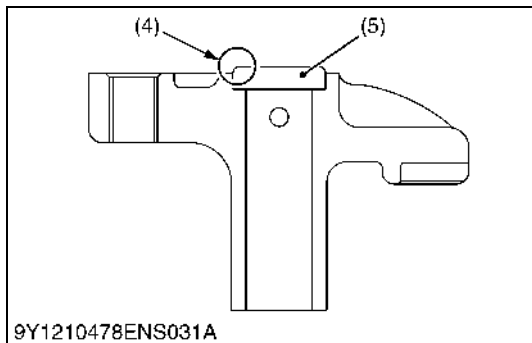
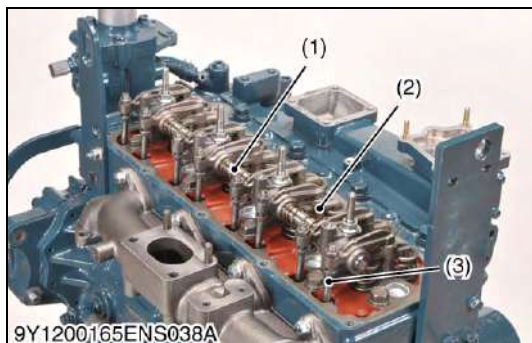
Leakage Check	Decreased pressure after 4 seconds is lower than 0.001 MPa (0.01 kgf/cm ² , 0.1 psi)
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Specification of components

Parts Name	Specification or Code No.
Regulator (1)	0.031 to 0.85 MPa 0.31 to 8.7 kgf/cm ² 4.4 to 120 psi
Pressure Gauge (6)	0 to 0.06 MPa 0 to 0.6 kgf/cm ² 0 to 8 psi
Fuel Pipe Joint (7)	14117-42560

- | | |
|--------------------|---------------------|
| (1) Regulator | (5) Gasket |
| (2) Overflow Pipe | (6) Pressure Gauge |
| (3) Eye Joint Bolt | (7) Fuel Pipe Joint |
| (4) Valve | |

9Y1210686ENS0043US0



Rocker Arms and Push Rods

1. Remove the rocker arm (1).
2. Remove the push rod (3).
3. Remove the valve bridge arm (2).

(When reassembling)

- Face the pad (5) R face (4) up and install it on the bridge arm.
- When installing the push rod (3), mount it securely in the groove of the tappet (6).

■ IMPORTANT

- **After installing the rocker arm, adjust the valve clearance.**

Tightening torque	Rocker arm bracket nut	49 to 55 N·m 5.0 to 5.7 kgf·m 37 to 41 lbf·ft
-------------------	------------------------	---

- | | |
|----------------------|------------|
| (1) Rocker Arm | (4) R Face |
| (2) Valve Bridge Arm | (5) Pad |
| (3) Push Rod | (6) Tappet |

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Injector Oil Seal (If necessary)

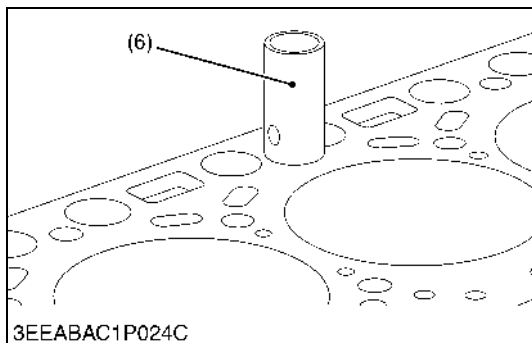
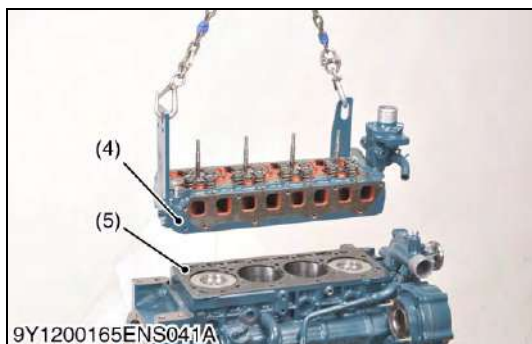
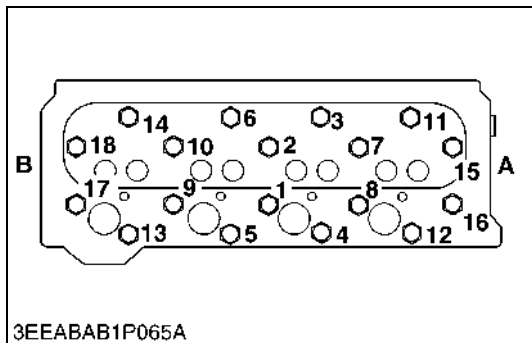
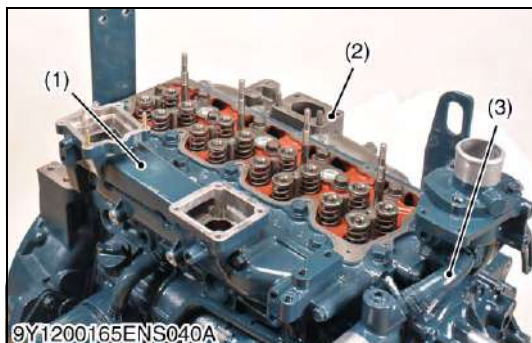
1. Remove the injector oil seal (2) from cylinder head cover1 (1).

(When reassembling)

- When install the injector oil seal (2), use the new one.

- | | |
|---------------------------|-----------------------|
| (1) Cylinder Head Cover 1 | (2) Injector Oil Seal |
|---------------------------|-----------------------|

9Y1210686ENS0045US0



Cylinder Head and Tappet

1. Loosen the pipe clamp and remove the water return hose (3).
2. Remove the inlet manifold (1) and exhaust manifold (2).
3. Remove the cylinder head mounting screw in the sequence of **18 to 1**, and remove the cylinder head (4).
4. Remove the cylinder head gasket (5).
5. Remove the tappets (6) from the crankcase,

(When reassembling)

- Replace the cylinder head gasket (5) with a new one.
- Before installing the tappets (6), apply engine oil thinly around them.
- When mounting the gasket, set it to the knock pin hole. Take care not to mount it reversely.
- The cylinder head should be free of scratches and dust.
- Take care for handling the gasket not to damage it.
- Install the cylinder head.
- Tighten the cylinder head mounting screw gradually in the sequence of **18 to 1** after applying engine oil.
- Be sure to adjust the valve clearance. (Refer to the "Valve Clearance")
- It is not necessary to retighten the cylinder head mounting screw after running the engine for 30 minutes.

■ IMPORTANT

- When replacing the piston, piston pin bushing, connecting rod or crank pin bearing, select the cylinder head gasket thickness to meet with the top clearance refer to the "To Select the Cylinder Head Gasket".

■ NOTE

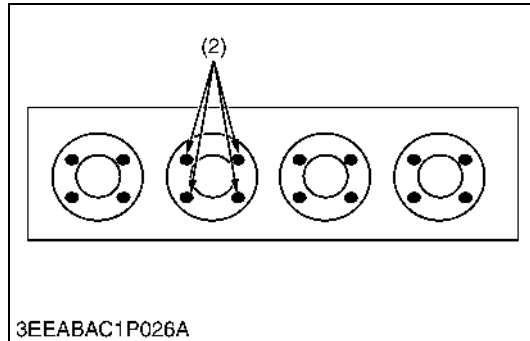
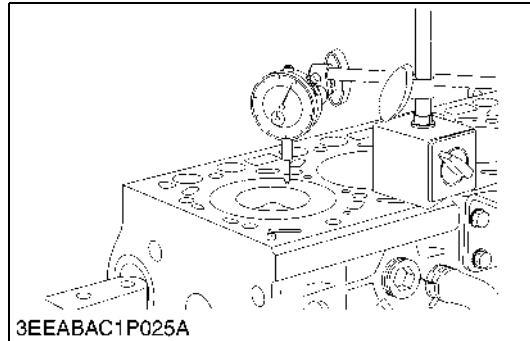
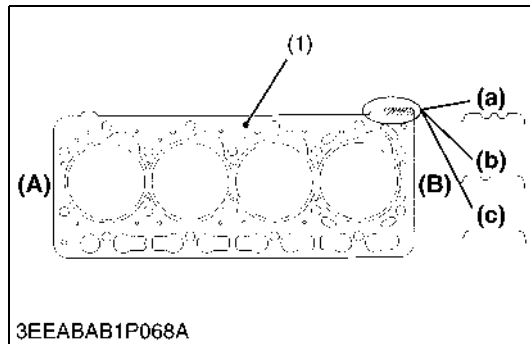
- Mark the cylinder number to the tappets to prevent interchanging.

Tightening torque	Cylinder head mounting screw	98.1 to 107 N·m 10.0 to 11.0 kgf·m 72.4 to 79.5 lbf·ft
-------------------	------------------------------	--

- (1) Inlet Manifold
- (2) Exhaust Manifold
- (3) Return Hose
- (4) Cylinder Head

- (5) Cylinder Head Gasket
 - (6) Tappet
- A: Gear Case Side**
B: Flywheel Side

9Y1210686ENS0046US0



To Select the Cylinder Head Gasket

■ Replacement of Cylinder Head Gasket

1. Make sure to note the notch (a), (b) or (c) of cylinder head gasket in advance.
2. Replace the same notch (a), (b) or (c) as the original cylinder head gasket (1).

■ To Select the Cylinder Head Gasket

- When replacing the piston, piston pin bushing, connecting rod or crank pin bearing, select the cylinder head gasket thickness to meet with the top clearance refer to the "To Select the Cylinder Head Gasket".
1. Measure protrusion as shown in figure.
Use average readings from all pistons to get your overall average piston protrusion height.

(Example)

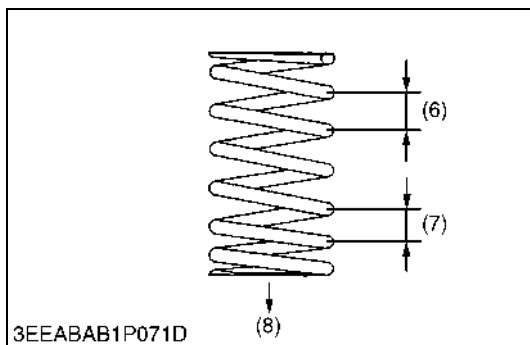
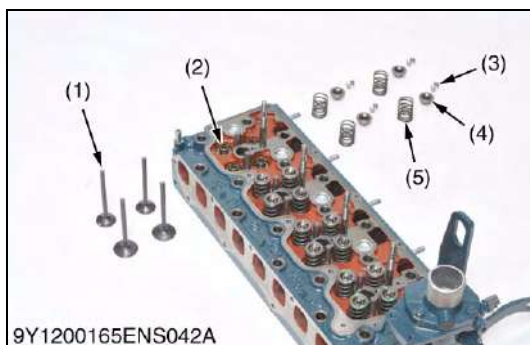
- Average each piston protrusion height.
 - 1st cylinder: $0.2+0.2+0.2+0.2/4=0.2$ mm
 - 2nd cylinder: $0.1+0.1+0.1+0.1/4=0.1$ mm
 - 3rd cylinder: $0.2+0.2+0.2+0.2/4=0.2$ mm
 - 4th cylinder: $0.1+0.1+0.1+0.1/4=0.1$ mm
 - Average all piston protrusion height.
 - $1st\ 0.2+2nd\ 0.1+3rd\ 0.2+4th\ 0.1/4=0.14$ mm (0.0059 in.)
2. When measuring, if protrusion is below -0.0700 mm (-0.00275 in.) or recessed from cylinder block, check connecting rods bearings.
 3. Use the table below to select an applicable cylinder head gasket.

Notch of Cylinder Head Gasket	Thickness of cylinder head gasket		Code Number	Piston Head's protrusion or recessing from the level of crankcase cylinder face. (average of 4 pistons)
	Before tightening	After tightening		
2 notches (a)	0.90 mm 0.035 in.	0.80 mm 0.031 in.	1G514-03310	-0.0700 to $+0.0490$ mm -0.00275 to $+0.00192$ in.
1 notch (b)	1.00 mm 0.0394 in.	0.90 mm 0.035 in.	1G514-03600	$+0.0500$ to $+0.149$ mm $+0.00197$ to $+0.00586$ in.
Without notch (c)	1.05 mm 0.0413 in.	0.95 mm 0.037 in.	1G514-03610	$+0.150$ to $+0.200$ mm $+0.00591$ to $+0.00787$ in.

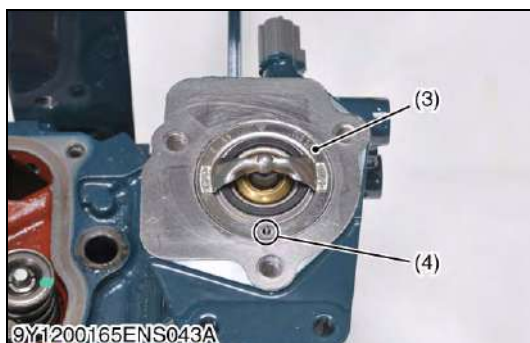
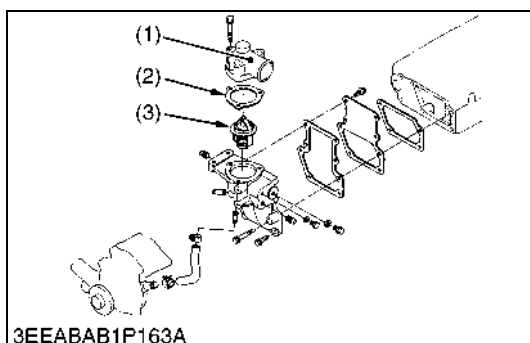
- (1) Cylinder Head Gasket
 (2) Points of Measurement
 (A) Gear Case Side
 (B) Flywheel Side

- (a) 2 Notches
 (b) 1 Notch
 (c) Without Notch

9Y1210686ENS0047US0



(6) Thermostat



Valve

1. Push the valve spring (5) with the valve spring retainer (4) and remove the valve spring collets (3).
2. Remove the valve spring (5) and valve (1).

(When reassembling)

- Install the valve spring with its small pitch (7) end downward (at the head side).
- Clean the valve stem and valve guide hole, and apply engine oil sufficiently.
- After you install the valve spring collets (3), lightly tap the stem tip to attach it correctly with the plastic hammer.

- | | |
|---------------------------|--|
| (1) Valve | (6) Large Pitch |
| (2) Valve Stem Seal | (7) Small Pitch |
| (3) Valve Spring Collet | (8) Install the Spring with Its Smaller Pitch End Downward (at the Head Side). |
| (4) Valve Spring Retainer | |
| (5) Valve Spring | |

9Y1210686ENS0048US0

Thermostat Assembly

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

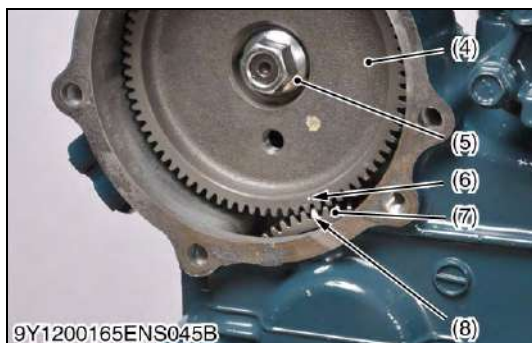
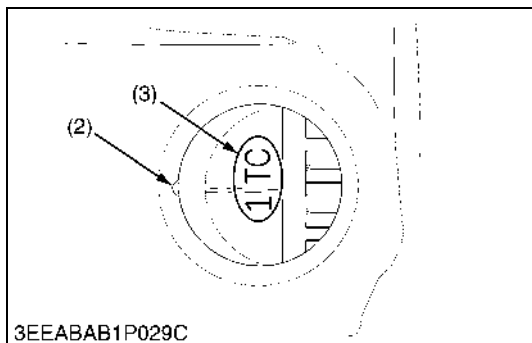
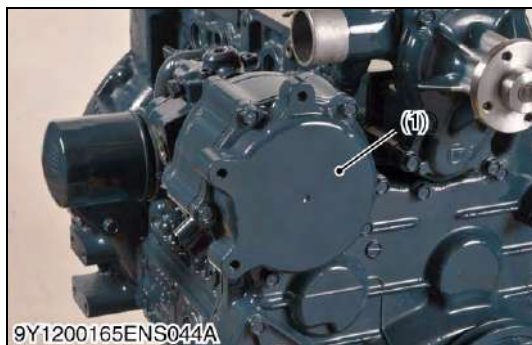
(When reassembling)

- Replace the gasket with a new one.
- Apply a liquid gasket (Three Bond 1217H) only at the thermostat cover side of the gasket (2).
- Attach the thermostat with its hole (4) facing toward the air suction side.

- | | |
|-----------------------------|-------------------------|
| (1) Thermostat Cover | (3) Thermostat Assembly |
| (2) Thermostat Cover Gasket | (4) Hole |

9Y1210686ENS0049US0

(7) Supply Pump



Supply Pump



CAUTION

- Do not loosen the injection pipe when the fuel is under high pressure (within five minutes of stopping the engine).

- Remove the supply pump's gear cover (1).
- Put the piston of the number 4 cylinder at TDC.

NOTE

- When positioning the piston of the 4th cylinder to TDC, rotate the flywheel counterclockwise and align the TC mark (3) on the flywheel with the mark (2) on the housing of the flywheel. If the supply pump gear timing mark (6) meshes with idle gear 2 (7), then the piston of the 4th cylinder is TDC. If they do not mesh, rotate the flywheel counterclockwise one revolution.

- Make a temporary mark (8) with a white paint marker pen on the tooth of idle gear 2 (7).

NOTE

- This mark is extremely useful during reassembly of the supply pump gear and idle gear 2 (7) to get the timing right.

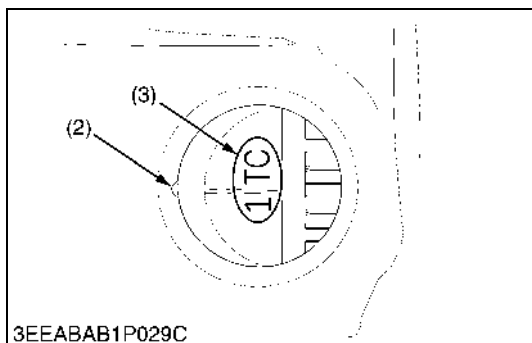
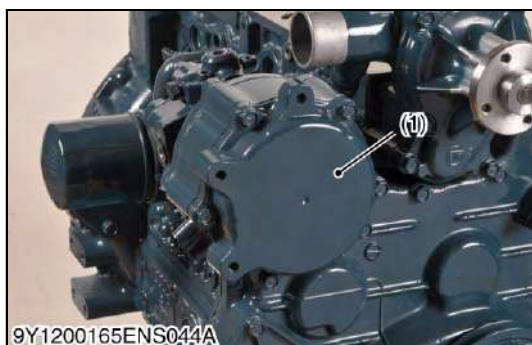
- Fix the flywheel in place.
- Remove the supply pump gear's mounting nut (5).
- Use gear puller (9) to remove the supply pump gear (4).
- Remove the supply pump (10).

NOTE

- Do not disassemble the supply pump.
- Store the supply pump so it does not get any dust in it.

- | | |
|-----------------------------------|------------------|
| (1) Supply Pump Gear Cover | (6) Timing Mark |
| (2) Mark | (7) Idle Gear 2 |
| (3) TC Mark | (8) Mark |
| (4) Supply Pump Gear | (9) Gear Puller |
| (5) Supply Pump Gear Mounting Nut | (10) Supply Pump |

(To be continued)

(Continued)**(When reassembling)**

- Align the alignment marks of the supply pump gear (4) and idle gear 2 (7).
- Replace the O-ring of the supply pump (10) with a new one.
- Replace the gasket of supply pump gear cover with a new one.
- Line up the key of the supply pump gear (4) and install the supply pump (10).
- Tighten the supply pump mounting nut.
- Tighten the supply pump gear mounting nut (5) to its specified torque.
- Mount the supply pump gear cover (1).

■ NOTE

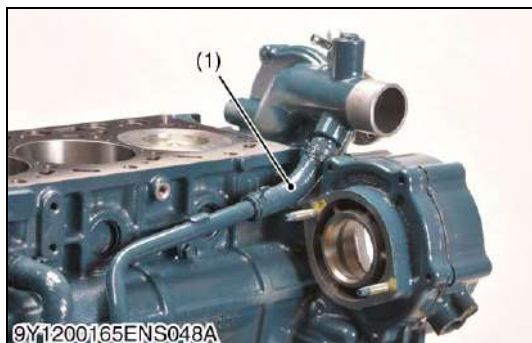
- **When replacing the supply pump with a new one, use the diagnosis tool to conduct learning of discrepancies in the new supply pump.**

Tightening torque	Supply pump mounting nut	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Supply pump gear mounting nut	59 to 68 N·m 6.0 to 7.0 kgf·m 44 to 50 lbf·ft
	Injection pipe retaining nut	23 to 36 N·m 2.3 to 3.7 kgf·m 17 to 26 lbf·ft
	Overflow pipe joint screw (M8)	7.9 to 12 N·m 0.80 to 1.3 kgf·m 5.8 to 9.4 lbf·ft
	Overflow pipe joint screw (M10)	16 to 19 N·m 1.6 to 2.0 kgf·m 12 to 14 lbf·ft
	Supply pump gear cover mounting screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft

- | | |
|-----------------------------------|------------------|
| (1) Supply Pump Gear Cover | (6) Timing Mark |
| (2) Mark | (7) Idle Gear 2 |
| (3) TC Mark | (8) Mark |
| (4) Supply Pump Gear | (9) Gear Puller |
| (5) Supply Pump Gear Mounting Nut | (10) Supply Pump |

9Y1210686ENS0050US0

(8) Water Pump and Oil Cooler



Water Pump

1. Remove the pipe band and the water pipe (water pump side) (1).
2. Remove the water pump (2).

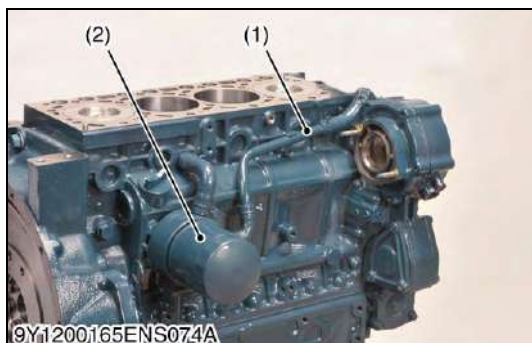
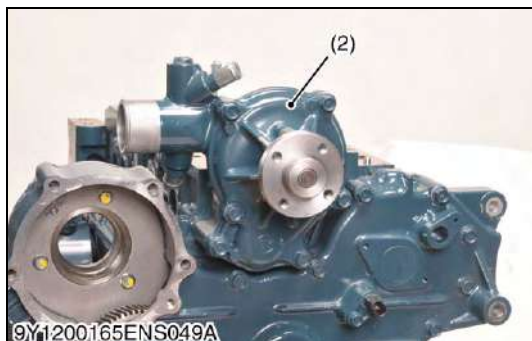
(When reassembling)

- When mounting the water pump, take care not to forget mounting the O-ring and not to let it out of position.

(1) Water Pipe

(2) Water Pump

9Y1210686ENS0051US0



Oil Cooler

1. Remove the water pipe (1).
2. Remove the oil filter cartridge (2).
3. Remove the oil cooler joint screw (4).
4. Remove the oil cooler (3).

Tightening torque	Oil cooler joint screw	40 to 44 N·m 4.0 to 4.5 kgf·m 29 to 32 lbf·ft
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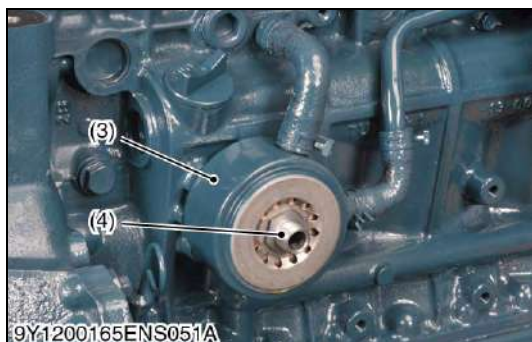
(1) Water Pipe

(3) Oil Cooler

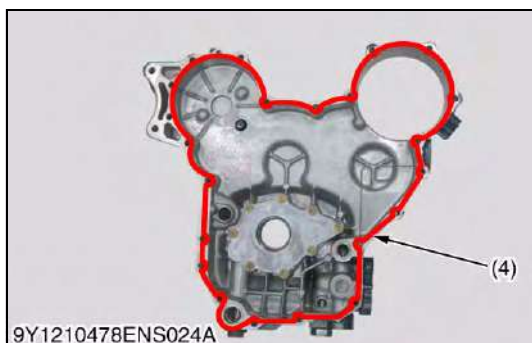
(2) Oil Filter Cartridge

(4) Oil Cooler Joint Screw

9Y1210686ENS0052US0



(9) Gear Case and Timing Gear



Fan Drive Pulley and Gear Case Cover

1. Mount a flywheel stopper on the flywheel.
2. Remove the crankshaft screw (2).
3. Remove the fan drive pulley (1).
4. Remove the gear case cover (3).

(When reassembling)

- In order to maintain an airtight seal, check and make sure there is no water, debris, or oil on the surface where the liquid gasket will be applied.
- Be careful to apply the liquid gasket (4) evenly. (Refer to the photo.)

■ NOTE

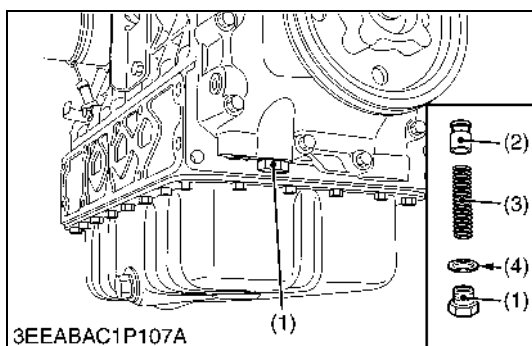
- Make sure the surfaces align when mounting parts with a liquid gasket applied to them.
- Mount parts with a liquid gasket within 10 minutes of application.
- Apply a liquid gasket (4) to the gear case cover (Three Bond 1217H).
- When the gear case is replaced, check the air gap of the crankshaft position sensor. (See page 1-S56.)

Tightening torque	Crankshaft screw	255 to 274 N·m 26.0 to 28.0 kgf·m 188 to 202 lbf·ft
	Gear case cover mounting screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft

- (1) Fan Drive Pulley
(2) Crankshaft Screw

- (3) Gear Case Cover
(4) Liquid Gasket

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Relief Valve

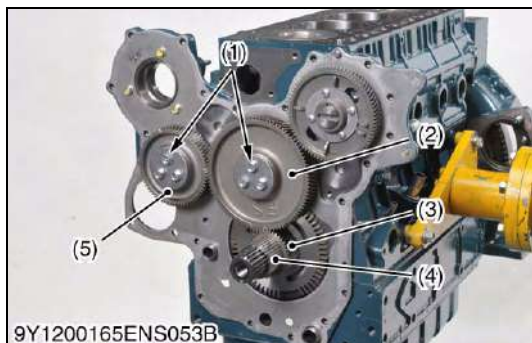
1. Remove the relief valve retaining screw (1).
2. Remove the relief valve (4), the spring (3) and the packing (2).

Tightening torque	Relief valve retaining screw	69 to 78 N·m 7.0 to 8.0 kgf·m 51 to 57 lbf·ft
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- (1) Relief Valve Retaining Screw
(2) Packing

- (3) Spring
(4) Relief Valve

9Y1210686ENS0054US0



Idle Gear 1, 2, Oil Pump Drive Gear and Crank Gear

1. Remove the idle gear mounting screw (1).
2. Remove the idle gear 1 (2) and idle gear 2 (5).
3. Remove the idle gear 1 (2).
4. Remove the oil pump drive gear (4).
5. Remove the crank gear (3).

(When reassembling)

- When mounting idle gear 1 (2) and idle gear 2 (5), bring the piston of cylinder 4 to TDC and mount the gears with their marks aligned to the respective gears.

NOTE

- When the crank gear is replaced, check the air gap of the crankshaft position sensor. (See page 1-S56.)
- When replacing the crank gear, it is necessary to calibrate the injection timing with the diagnosis tool.

Tightening torque	Idle gear mounting screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
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(1) Idle Gear Mounting Screw

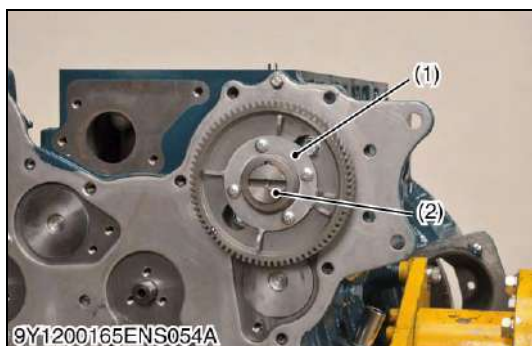
(2) Idle Gear 1

(3) Crank Gear

(4) Oil Pump Drive Gear

(5) Idle Gear 2

9Y1210686ENS0055US0



Camshaft

1. Remove the camshaft position pulsar gear (1).
2. Remove the camshaft set screws and draw out the camshaft (2).

(When reassembling)

- Align all mating marks on each gear to assemble the timing gears, set the idle gear last.
 - Idle gear 1 (4) and cam gear (3)
 - Idle gear 1 (4) and crank gear (5)
 - Idle gear 1 (4) and idle gear 2 (6)

Tightening torque	Camshaft set screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Camshaft position pulsar gear mounting screw	4.7 to 5.6 N·m 0.48 to 0.58 kgf·m 3.5 to 4.1 lbf·ft

(1) Camshaft Position Pulsar Gear

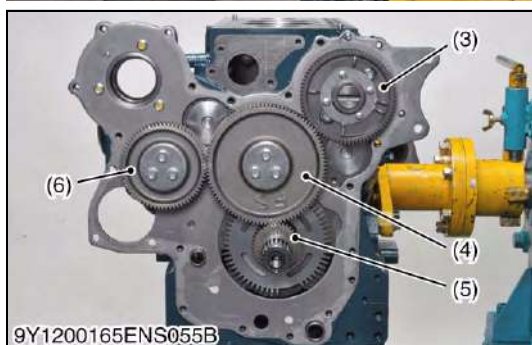
(2) Camshaft

(3) Cam Gear

(4) Idle Gear 1

(5) Crank Gear

(6) Idle Gear 2



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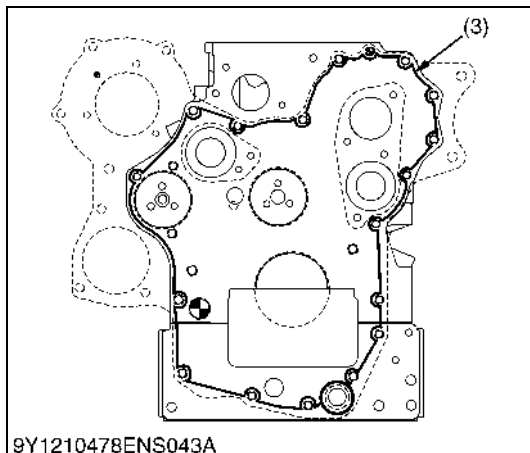


Plate (Gear Case)

1. Remove the plate mounting screws (1) and detach the plate (2).
- (When reassembling)**
- Apply liquid gasket (3) (Three Bond 1217H) on the surface of the crankcase side where the plate will be installed to.

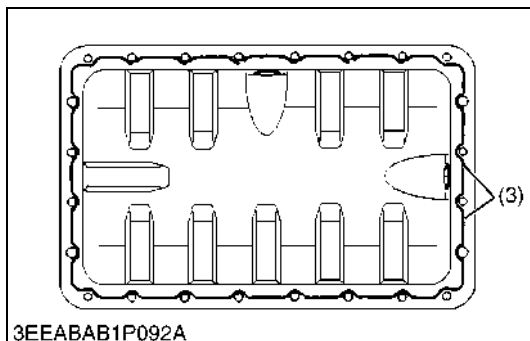
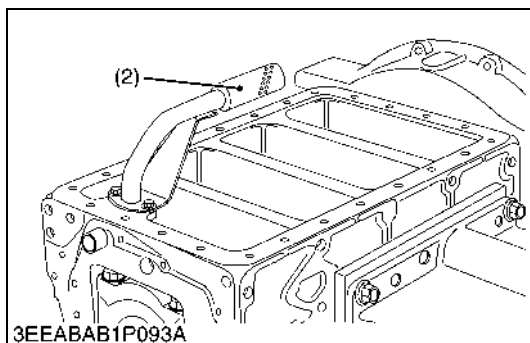
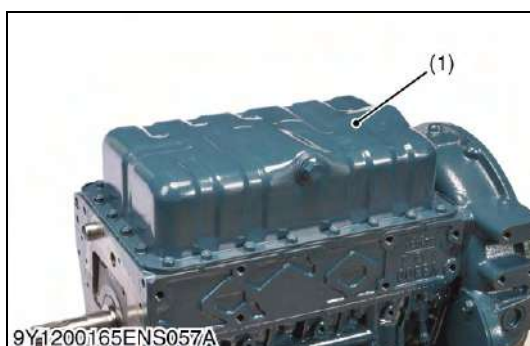
Tightening torque	Plate mounting screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
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- (1) Plate Mounting Screw
(2) Plate

- (3) Liquid Gasket

9Y1210686ENS0057US0

(10) Piston and Connecting Rod



Oil Pan and Oil Strainer

1. Unscrew the oil pan mounting screws and remove the oil pan (1).
2. Unscrew the oil strainer mounting screw, and remove the oil strainer (2).

(When reassembling)

- Install the oil strainer, using care not to damage the O-ring.
- Apply liquid gasket (3) (Three Bond 1217H) to the oil pan as shown in the figure.
- Confirm that the liquid gasket coating surface is free of water, dust and oil in order to maintain sealing effect.
- Carefully apply the adhesive evenly.

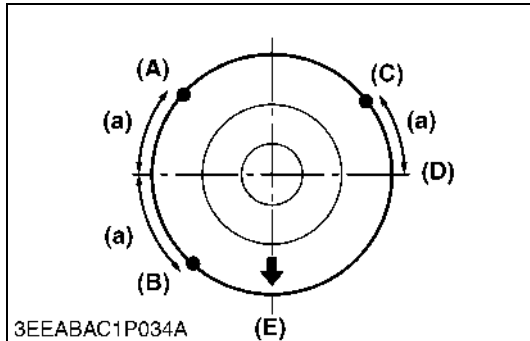
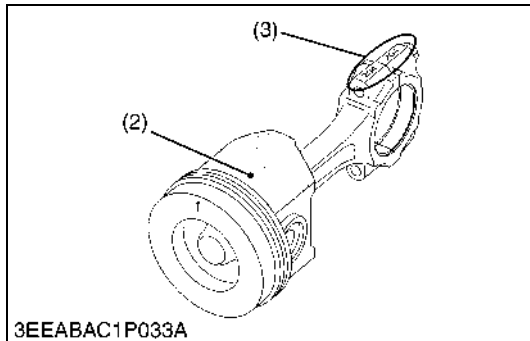
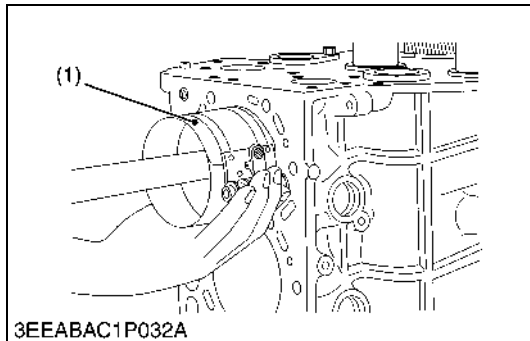
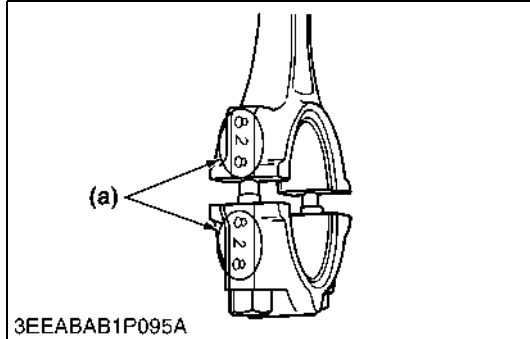
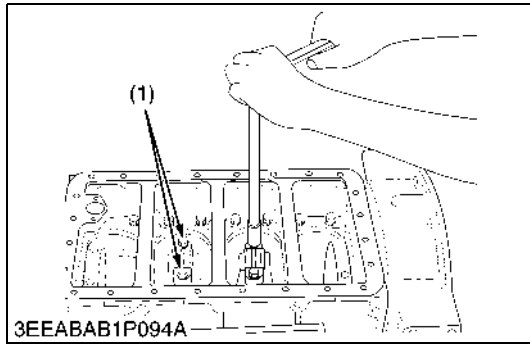
■ NOTE

- **Make sure the surfaces align when mounting parts with a liquid gasket applied to them.**
- **Mount parts with a liquid gasket within 10 minutes of application.**
- **Tighten the mounting screws of the oil pan in diagonal sequence from the center to tighten equally.**
- **After cleaning the oil strainer, install it.**
- **Attach the oil pan with its central drain plug facing toward the air suction side.**

- (1) Oil Pan
(2) Oil Strainer

- (3) Liquid Gasket

9Y1210686ENS0058US0



Connecting Rod Cap

1. Remove the connecting rod screws (1).
2. Remove the connecting rod cap.

(When reassembling)

- Align the marks (a) with each other. (Face the marks toward the supply pump.)
- Apply engine oil to the connecting rod screws and lightly screw it in by hand, then tighten it to the specified torque. If the connecting rod screw won't be screwed in smoothly, clean the threads. If the connecting rod screw is still hard to screw in, replace it.
- When using the existing crank pin bearing again, put tally marks on the crank pin bearing and the connecting rod in order to keep their positioning.

Tightening torque	Connecting rod screw	79 to 83 N·m 8.0 to 8.5 kgf·m 58 to 61 lbf·ft
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(1) Connecting Rod Screw

(a) Mark

9Y1210686ENS0059US0

Piston

1. Fully clean the carbon in the cylinders.
2. Turn the flywheel and move the piston to top dead center.
3. Lightly tap the piston from the bottom of the crankcase with the grip of a hammer to pull the piston out.

(When reassembling)

- Before you install the piston into the cylinder, apply sufficient engine oil to the piston.
- When you install the piston into the cylinder, point the mark (3) on the connecting rod to the supply pump.

■ IMPORTANT

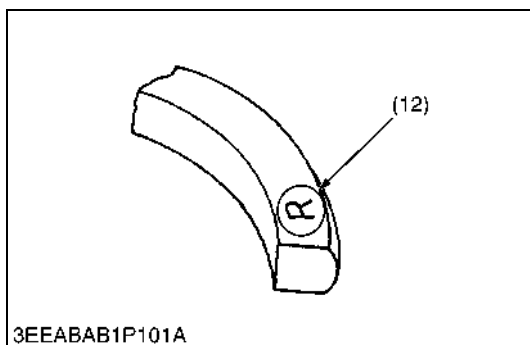
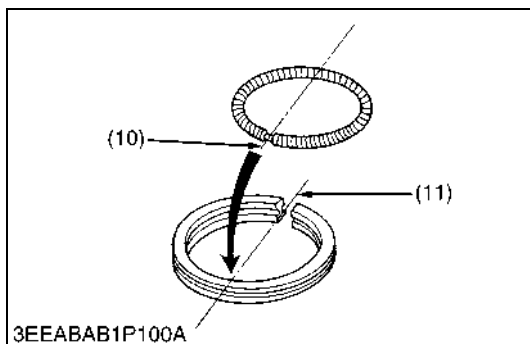
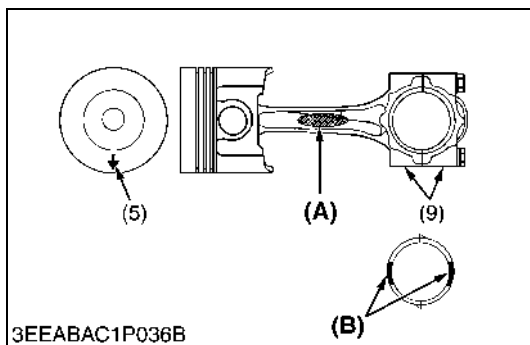
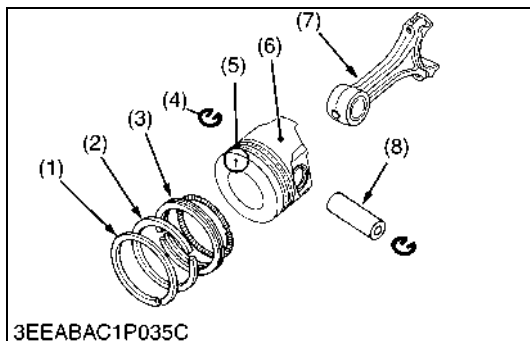
- Do not change the combination of cylinder and piston. Align the position of each piston by the its mark. For example, mark "1" on the No. 1 piston.
- When inserting the piston into the cylinder, place the gap of each piston ring like the figure.
- Install the pistons with a piston ring compressor (1) carefully. Otherwise, their chrome-plated section of piston rings may be scratched, causing trouble inside the liner.
- When you install the piston in position, do not give a damage to the layer of molybdenum disulfide on the piston skirt. This layer can decrease the clearance with the cylinder liner. Immediately after you press-fit the piston pin, the piston is hot and the layer comes off easily. Only put in the piston after its temperature decreases.

- (1) Piston Ring Compressor
(2) Layer of Molybdenum Disulfide in Piston Skirt
(3) Mark

- (A) Top Ring Gap
(B) Second Ring Gap
(C) Oil Ring Gap
(D) Piston Pin Hole
(E) Supply Pump Side

(a) 0.79 rad (45 °)

9Y1210686ENS0060US0



Piston Ring and Connecting Rod

1. Remove the piston rings with a piston ring tool.
2. Remove the piston pin (8) to disconnect the connecting rod (7) from the piston (6).

(When reassembling)

- Be sure the crank pin bearing and the connecting rod are same I.D. colors.
- When you install the rings to the piston, set the manufacturer mark (12) upward.
- When you install the oil ring on the piston, set the expander joint (10) on the opposite side of the oil ring gap (11).
- Apply engine oil to the piston pin.
- When you install the piston pin, put the piston fully in 80 °C (176 °F) oil for 10 to 15 minutes.
- When you install the piston to the connecting rod, align the mark (↑) (5) on the piston to the connecting rod numbering mark (9).
- The end faces of the oil ring are plated with hard chrome. When you install the piston into the cylinder, do not give a damage to the cylinder by the oil ring. If the ring's planting is scratched, it may get stuck on the cylinder wall, causing serious damage.

■ IMPORTANT

- Put a mark on the connecting rod and the piston with the same number to keep the same combination.

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

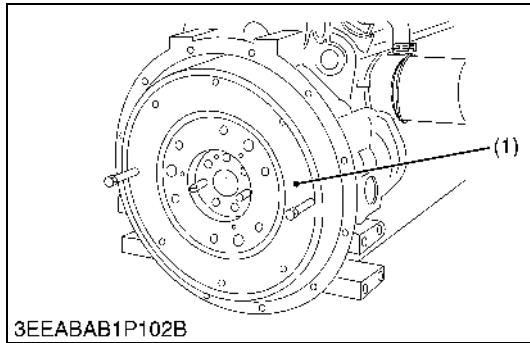
- | |
|------------------------|
| (10) Expander Joint |
| (11) Oil Ring Gap |
| (12) Manufacturer Mark |

(A) Connecting Rod ID Color: Blue or without Color

(B) Crank Pin Bearing ID Color: Blue or without Color

9Y1210686ENS0061US0

(11) Flywheel and Crankshaft



Flywheel

1. Attach the stopper to the flywheel.
2. Remove the flywheel screws.
3. Remove the flywheel (1).

■ NOTE

- Do not use an impact wrench. Serious damage will occur.

■ IMPORTANT

- The flywheel is very heavy, so securely hold the flywheel when removing.

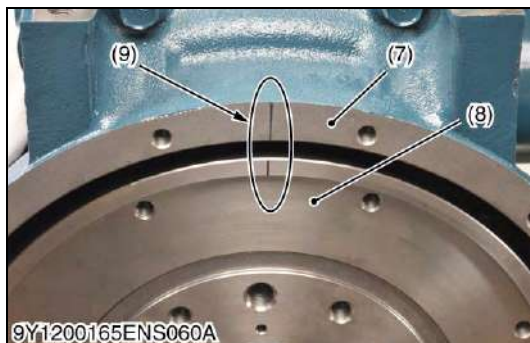
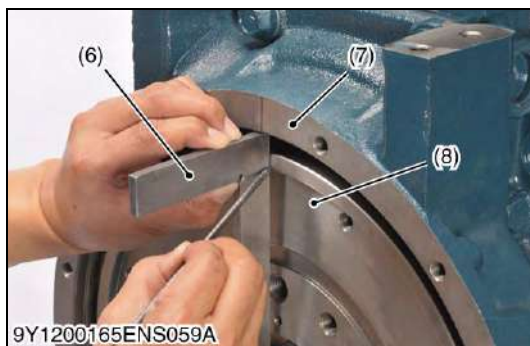
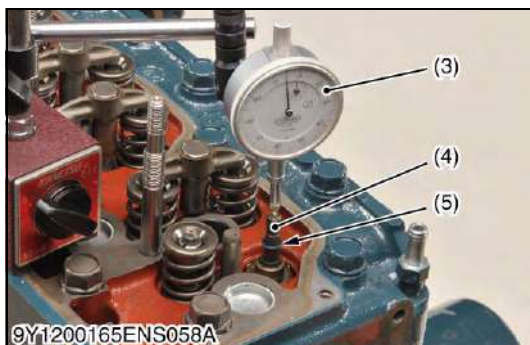
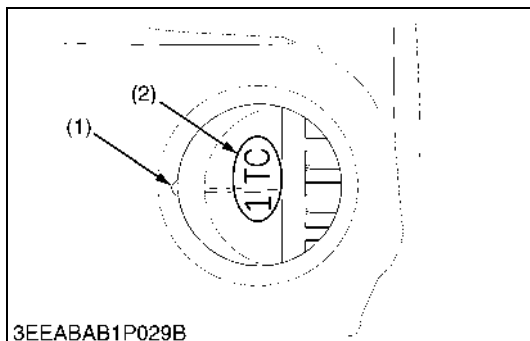
(When reassembling)

- Apply engine oil to the flywheel screws.
- Examine that there are no metal particles that remain on the flywheel mounting surfaces.
- The flywheel and the crankshaft fit together in just one position. Make sure they are securely fit and tighten the screws.

Tightening torque	Flywheel screw	98.1 to 107 N·m 10.0 to 11.0 kgf·m 72.4 to 79.5 lbf·ft
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(1) Flywheel

9Y1210686ENS0062US0



Measuring Angular Deviation between Crankshaft TDC and Crank Position Sensor Detected TDC

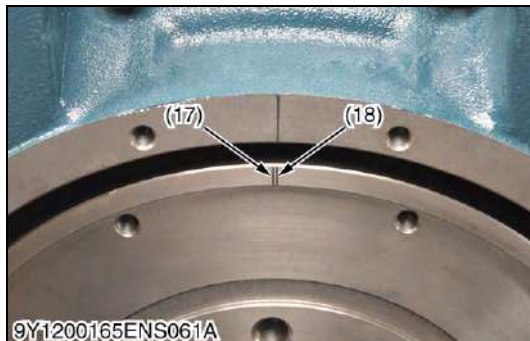
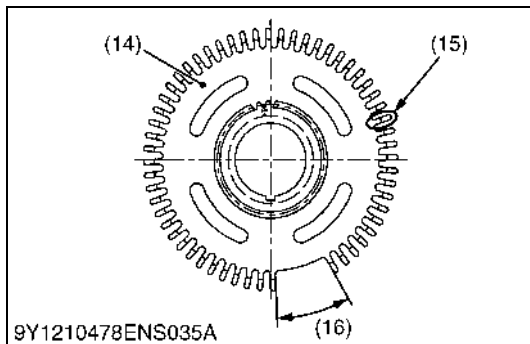
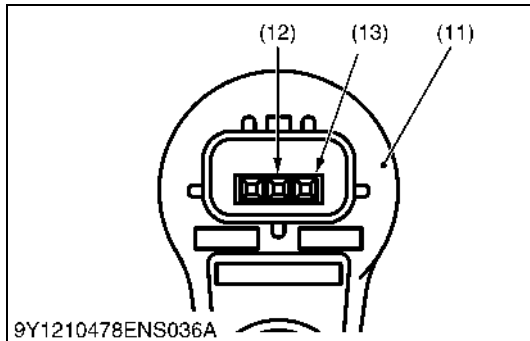
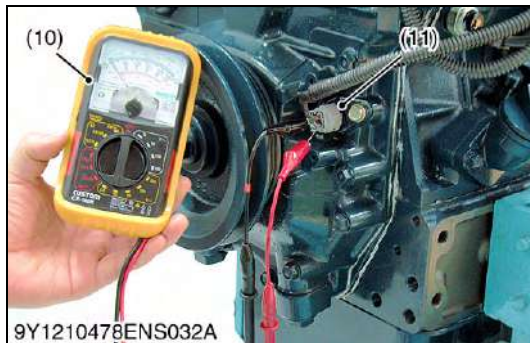
1. Remove the cylinder head cover, an injector and rocker arm.
2. Bring the piston of cylinder 4 to TDC.
3. Remove the #4 exhaust valve bridge arm and valve spring.
4. Insert a small O-ring (5) so the valve does not fall into the cylinder.
5. Set a dial gauge (3) on the tip of the valve (4).
6. Turn the flywheel counterclockwise and measure the position where the tip of the valve is the highest.
7. Stop the flywheel at the position where the tip of the valve is the highest.
8. Put a tri-square (6) on the flywheel housing (7) and flywheel (8) and draw a reference line (9).

■ IMPORTANT

- Do not drop the valve (4) into the cylinder.
- When measuring the highest position of the tip of the valve, do not rotate the flywheel clockwise. If you go past the highest point of the valve, back the flywheel up slightly and measure the highest point of the valve.
- The reference line (9) indicates the TDC of the crankshaft.

- | | |
|--------------------------------|----------------------|
| (1) TC Mark (Flywheel Housing) | (6) Tri-square |
| (2) TC Mark (Flywheel) | (7) Flywheel Housing |
| (3) Dial Gauge | (8) Flywheel |
| (4) Valve | (9) Reference Line |
| (5) O-ring | |

(To be continued)

(Continued)

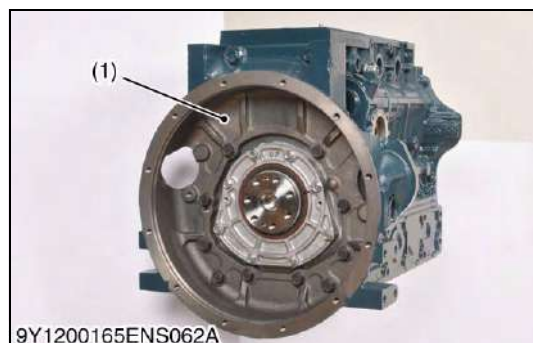
9. Connect the engine harness and the main switch.
10. Connect the battery.
11. Attach a tester (10) to the output terminal (13) and ground terminal (12) of the crankshaft position sensor (11).
12. Turn the main switch "ON".
13. Turn the flywheel and make sure that the voltage of the crankshaft position sensor goes from 0 → 5 V or 5 → 0 V.
14. Rotate the flywheel and align the crankshaft position sensor to the part of the pulsar gear (14) that is missing teeth (16).
15. The 14th tooth (15) from the missing teeth is the standard.
16. Slowly turn the flywheel counterclockwise and stop the flywheel at the point where the needle of the tester changes momentarily from 0 → 5 V, the 14th tooth.
17. That point is where the crankshaft position sensor detects TDC.
18. Set the tri-square (6) on the reference line (9) on the flywheel housing side and mark the detection point of crankshaft position sensor TDC (18) on the flywheel.
19. Measure the interval (19) between the crankshaft TDC (17) and the detection point of crankshaft position sensor TDC (18).
20. Calculation of fuel injection timing correction 1.0 mm (0.039 in.): 0.342 °.
Corrected angle = 0.342 ° X actual interval
21. Overwrite the injection timing correction value in the engine ECU.

■ IMPORTANT

- When the crankshaft position sensor detects the teeth of the pulsar gear, the tester indicates 0 V.
- The position where the needle of the tester changes momentarily from 0 → 5 V is the detection point of crankshaft position sensor TDC (18).
- The reference line indicates the crankshaft TDC (17) of the crankshaft. If the detected TDC is ahead of the crankshaft TDC, it is considered minus. If the detected TDC lags behind the crankshaft TDC, it is considered plus.

- | | |
|---------------------------------|--|
| (10) Tester | (16) Missing Teeth |
| (11) Crankshaft Position Sensor | (17) Crankshaft TDC |
| (12) Ground Terminal | (18) Detection Point of Crankshaft Position Sensor TDC |
| (13) Output Terminal | (19) Interval |
| (14) Pulsar Gear | |
| (15) 14th Tooth | |

9Y1210686ENS0063US0



Flywheel Housing

1. Remove the flywheel housing (1).

(When reassembling)

- Apply liquid gasket (Three Bond 1217H) to flywheel housing.
- Confirm that the liquid gasket coating surface is free of water, dust and oil in order to maintain sealing effect.
- Make sure the surface of the crankcase 1, 2 are clean and alignment between crankcase 1 and 2 is correct.
- Tighten the flywheel housing mounting screws with even force on the diagonal line.

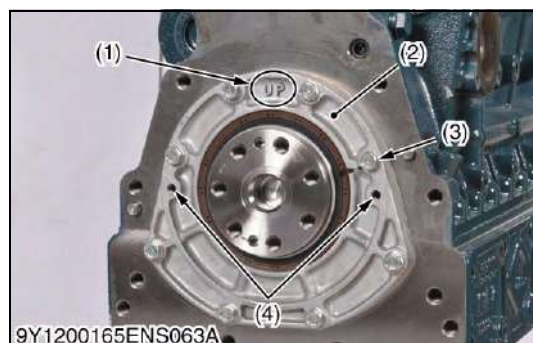
■ NOTE

- **Make sure the surfaces align when mounting parts with a liquid gasket applied to them.**
- **Mount parts with a liquid gasket within 10 minutes of application.**

Tightening torque	Flywheel housing mounting screw	78 to 90 N·m 7.9 to 9.2 kgf·m 58 to 66 lbf·ft
-------------------	---------------------------------	---

(1) Flywheel Housing

9Y1210686ENS0064US0



Bearing Case Cover

■ NOTE

- **Before disassembling check the side clearance of crankshaft. Also check it after reassembling.**

1. Remove the bearing case over mounting screws (3).
2. Set the screws in the jack-up holes (4) to remove the bearing case cover (2).

(When reassembling)

■ IMPORTANT

- In case of replacing the oil seal, insert the oil seal to the bearing case cover not to be tilted. The seal should be flush with the cover.
- Confirm that the liquid gasket coating surface is free of water, dust and oil in order to maintain sealing effect.
- Apply liquid gasket (5) (Three Bond 1217H) to the bearing case cover as shown in the figure.
- Before installing the bearing case cover / oil seal assembly, lube the seal and install it not to damage the seal.
- Install the bearing case cover / oil seal assembly to position the casting mark "UP" (1) on it upward.
- Tighten the bearing case cover mounting screws with even force on the diagonal line.

■ NOTE

- **When mounting the adhesive-applied parts, take care to fit them to the mating parts.**
- **Assemble the adhesive-applied parts within ten minutes.**

Tightening torque	Bearing case cover mounting screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
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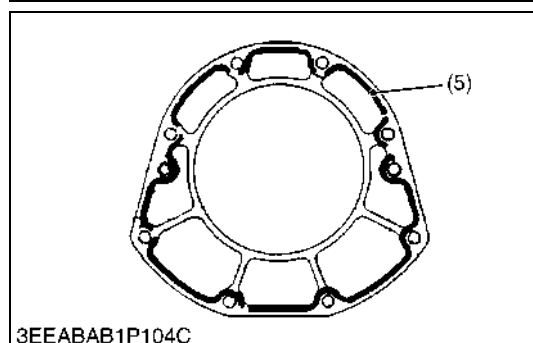
(1) Casting Mark "UP"

(4) Jack-up Hole

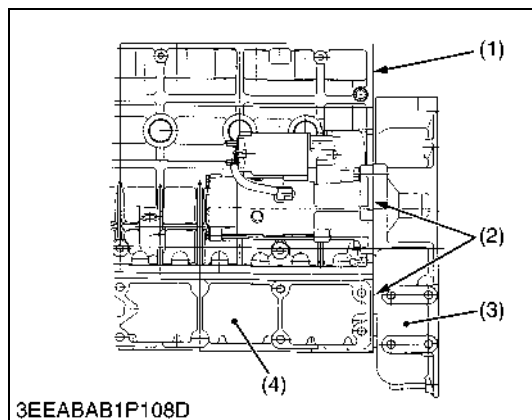
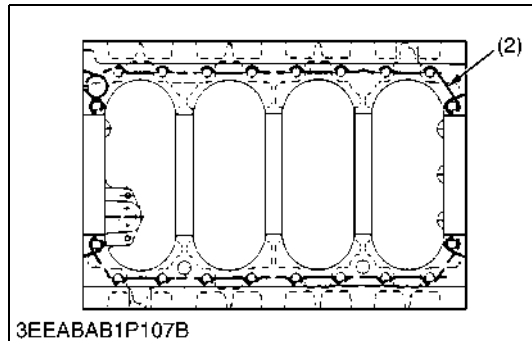
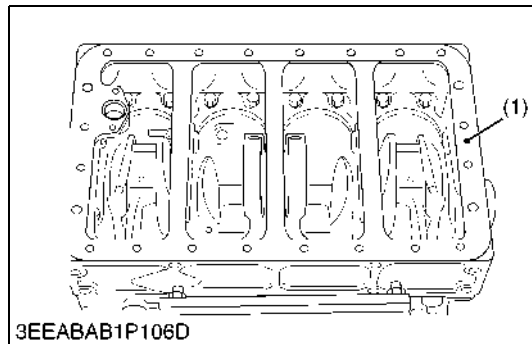
(2) Bearing Case Cover

(5) Liquid Gasket

(3) Bearing Case Cover Mounting Screw



9Y1210686ENS0065US0



Crankcase 2

1. Remove the crankcase 2 (1).

(When reassembling)

■ IMPORTANT

- Make sure the crankcase 1 and 2 are clean.
- Apply liquid gasket (2) (Three Bond 1217H) to the crankcase 2 as shown in the figure.
- Tighten the crankcase 2 mounting screws with even force on the diagonal line.
- Confirm that the liquid gasket coating surface is free of water, dust and oil in order to maintain sealing effect.
- Carefully apply the adhesive evenly.

■ NOTE

- Make sure the surfaces align when mounting parts with a liquid gasket applied to them.
- Mount parts with a liquid gasket within 10 minutes of application.

Tightening torque	Crankcase 2 mounting screw	49 to 55 N·m 5.0 to 5.7 kgf·m 37 to 41 lbf·ft
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(1) Crankcase 2

(2) Liquid Gasket

9Y1210686ENS0066US0

Crankcase 1 and Crankcase 2

(When reassembling)

- Using the surface that touches the flywheel housing as a reference, line up crankcases 1 and 2.
- Temporarily screw in the crankcase 2 mounting screws.
- Tighten the flywheel housing to the specified torque. Get the difference in the levels of crankcases 1 and 2 to as little as possible. The gap has to be 0.05 mm or less.

■ NOTE

- Make sure the surfaces align when mounting parts with a liquid gasket applied to them.
- Mount parts with a liquid gasket within 10 minutes of application. Get the difference in the levels of crankcases 1 and 2 to as little as possible. The gap has to be 0.05 mm (0.002 in.) or less.

Tightening torque	Crankcase 2 mounting screw	49 to 55 N·m 5.0 to 5.7 kgf·m 37 to 41 lbf·ft
	Flywheel housing mounting screw	78 to 90 N·m 7.9 to 9.2 kgf·m 58 to 66 lbf·ft

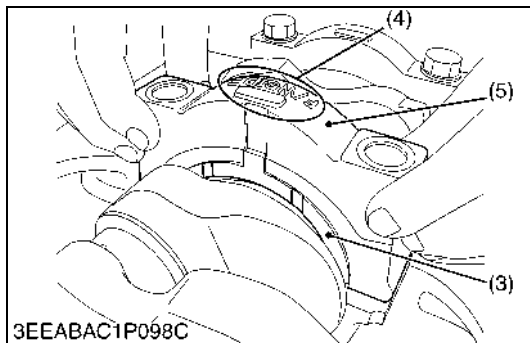
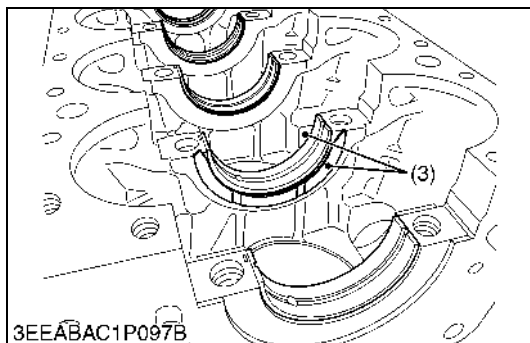
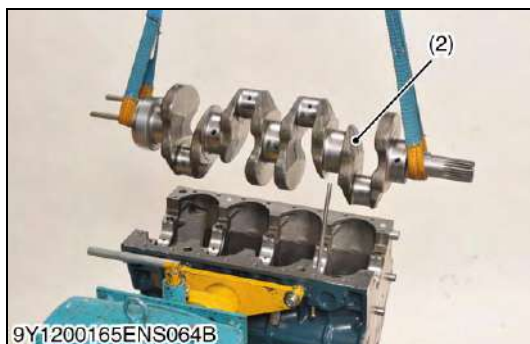
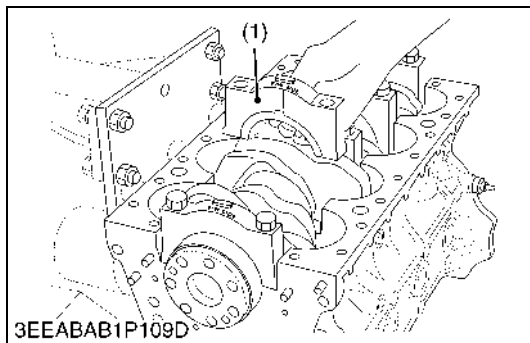
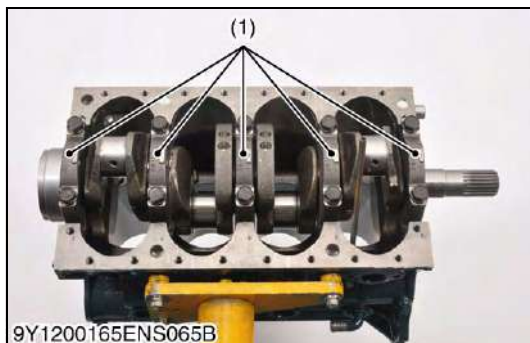
(1) Crankcase 1

(3) Flywheel Housing

(2) Gap in Alignment at 0.05 mm
(0.002 in.) or Less

(4) Crankcase 2

9Y1210686ENS0067US0



Crankshaft

1. Remove the main bearing case (1).
2. Remove the crankshaft (2).

(When reassembling)

- Reassemble the main bearing case having the same number as the one engraved on the crankcase, and set the casting mark "F / W SIDE" (4) on the main bearing case facing towards the flywheel side.
- Reassemble the thrust bearing (3), with the oil groove facing outside, into both side of the 4th main bearing case (5).
- Apply oil to the bearing case screws and tighten them to the specified torque.

Tightening torque	Main bearing case screw	138 to 147 N·m 14.0 to 15.0 kgf·m 102 to 108 lbf·ft
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(1) Main Bearing Case

(2) Crankshaft

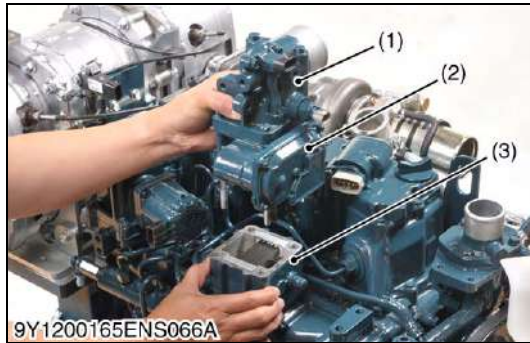
(3) Thrust Bearing

(4) F / W SIDE Mark

(5) 4th Main Bearing Case

9Y1210686ENS0068US0

(12) Intake Air Heater



Intake Air Heater

1. Remove the inlet hose.
2. Disconnect the lead.
3. Remove the air cleaner flange (1) and intake throttle valve (2).
4. Remove the intake air heater (3).

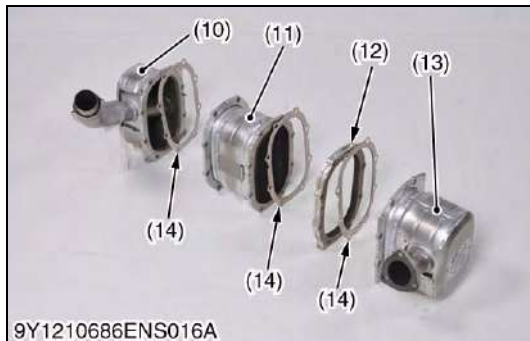
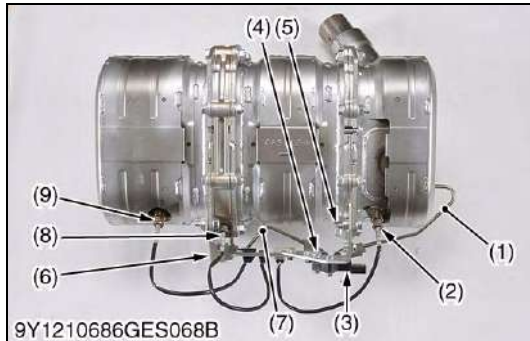
Tightening torque	Intake air heater terminal nut	3.5 to 5.3 N·m 0.35 to 0.55 kgf·m 2.6 to 3.9 lbf·ft
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- (1) Air Cleaner Flange
(2) Intake Throttle Valve

- (3) Intake Air Heater

9Y1210686ENS0069US0

(13) Diesel Particulate Filter (DPF)



Filter Comp

■ IMPORTANT

- Always work in the workshop equipped with a electric hoist (including mobile hoist).
- Put a product (engine) on a stable ground, and set the parking brake.
- As the DPF muffler full assembly is hot just after the engine shutdown, make sure to start operation after it gets cool.
- Make sure not to let any foreign substances enter the opening section during the operation.
- Make sure not to damage the DPF muffler full assembly by falling or impact as it contains a ceramic filter.
- Before removing the DPF for cleaning, keep the records of the engine serial number, DPF muffler full assembly part number, DPF muffler full assembly serial number, and engine operating time, which are required in preparing the DPF cleaning order form. Since the engine operating time is recorded in the ECU, check the operating time by connecting the service tool (Diagmaster).
- When installing and removing the muffler full assembly (DPF), make sure that the temperature sensor, differential pressure sensor, and differential pressure pipe do not make contact with surrounding parts.
- Be sure to loosen the temperature sensor or differential pressure pipe with crowfoot wrench to prevent the damage of the sensor or pipe.

If it is still hard to loosen, please apply the lubricant spray to threaded portion.

1. Remove the tube (4), (5) from the differential pressure pipe (1), (7).
2. Remove the temperature sensor.
3. Remove the differential pressure sensor (3).
4. Remove the DPF stay 2 (6).
5. Remove the filter comp (DPF) mounting screws and the filter comp (DPF) (11).

- (1) Differential Pressure Pipe
(2) Temperature Sensor (T₂)
(3) Differential Pressure Sensor
(4) Tube
(5) Tube
(6) DPF Stay 2
(7) Differential Pressure Pipe
(8) Temperature Sensor (T₁)
(9) Temperature Sensor (T₀)

- (10) Body (DPF Outlet)
(11) Filter Comp (DPF)
(12) Collar (DPF)
(13) Catalyst (DOC)
(14) Gasket
(15) Gas Flow →
(16) Bostik, NEVER SEEZ, Pure Nickel Special Grade

(To be continued)

(Continued)



(When reassembling)

⚠ CAUTION

- When you install the temperature sensors, be sure that the temperature sensors are installed to the original positions.

■ IMPORTANT

- Replacing the gaskets (14) with new ones.
- If the differential pressure tube is damaged or cracked, replace it.
- When the differential pressure pipe (1), (7) and temperature sensor (2), (8), (9) is removed, wipe off the "anti-seize & lubricating compound", apply a "anti-seize & lubricating compound" (Bostik, NEVER SEEZ, Pure Nickel Special Grade (16)), and then attach them to their correct position.
- When replacing the temperature sensor, check that it is coated with "anti-seize & lubricating compound", and then attach it to its correct position.
- Tighten bolts and nuts to their specified torque. Also tighten the temperature sensor tightening nut or the differential pressure pipe tightening nut to the specified torque with crowfoot wrench.
- After attaching the assembly, start the engine and make sure that there are no gas leaks.
- Reassemble the filter comp (DPF) (11) in the correct direction by referring the mark "GAS FLOW→" (15) (Catalyst (DOC) to body (DPF Outlet)) on the side showing the flow of exhaust gas.

- | | |
|----------------------------------|--------------------------------------|
| (1) Differential Pressure Pipe | (10) Body (DPF Outlet) |
| (2) Temperature Sensor (T_2) | (11) Filter Comp (DPF) |
| (3) Differential Pressure Sensor | (12) Collar (DPF) |
| (4) Tube | (13) Catalyst (DOC) |
| (5) Tube | (14) Gasket |
| (6) DPF Stay 2 | (15) Gas Flow → |
| (7) Differential Pressure Pipe | (16) Bostik, NEVER SEEZ, Pure Nickel |
| (8) Temperature Sensor (T_1) | Special Grade |
| (9) Temperature Sensor (T_0) | |

(To be continued)

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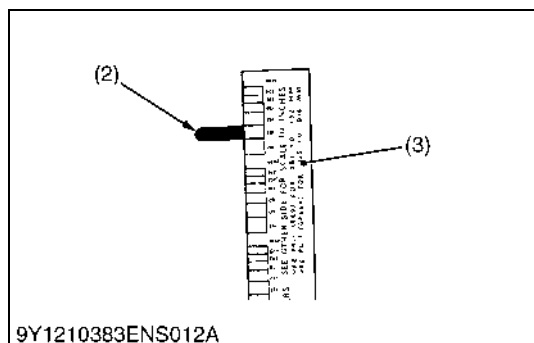
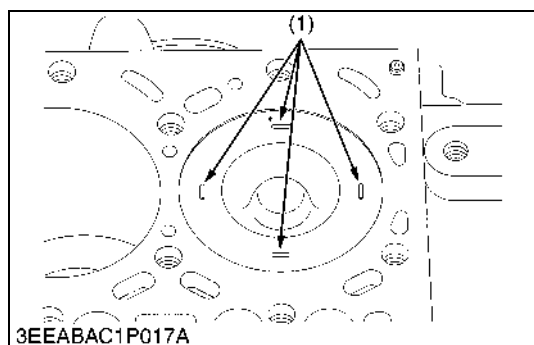
Tightening torque	Filter comp (DPF) mounting bolts	49 to 55 N·m 5.0 to 5.7 kgf·m 37 to 41 lbf·ft
	Temperature sensor	25 to 34 N·m 2.5 to 3.5 kgf·m 18 to 25 lbf·ft
	Differential pressure pipe	16 to 22 N·m 1.6 to 2.3 kgf·m 12 to 16 lbf·ft
	DPF Stay 2	49 to 55 N·m 5.0 to 5.7 kgf·m 37 to 41 lbf·ft

Tightening torque	DPF Stay 1	M8	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
		M10	49 to 55 N·m 5.0 to 5.7 kgf·m 37 to 41 lbf·ft
	Muffler flange		49 to 55 N·m 5.0 to 5.7 kgf·m 37 to 41 lbf·ft
	Muffler full assembly (DPF) mounting bolts		49 to 55 N·m 5.0 to 5.7 kgf·m 37 to 41 lbf·ft
	DPF bracket		78 to 90 N·m 7.9 to 9.2 kgf·m 58 to 66 lbf·ft

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[5] SERVICING

(1) Cylinder Head



Top clearance

1. Remove the cylinder head.
2. With the piston at TDC, use grease to affix three or four plastigauges (1) of a diameter 1.5 mm (0.059 in.) × 5.0 to 7.0 mm (0.20 to 0.27 in.) long to the crown of the piston; keep the gauges away from the intake valve and combustion chamber fittings.
3. Take the piston to an intermediate position, install the cylinder head and tighten the head bolts to the specified torque.
4. Turn the crankshaft so the piston goes through TDC.
5. Remove the cylinder head and compare the width of the crushed plastigauges (2) with the scale (3).
6. If they are out of spec, check the oil clearance of the crank pin, journal and piston pins.

■ NOTE

- Top clearance = Width of the crushed plastigauge (2)

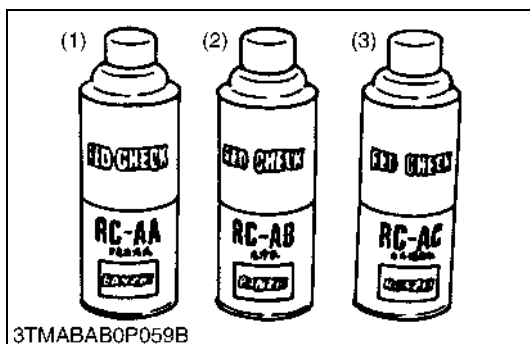
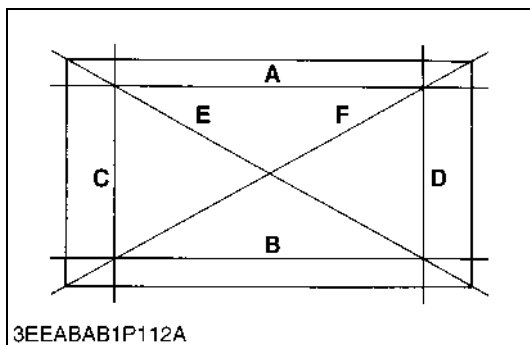
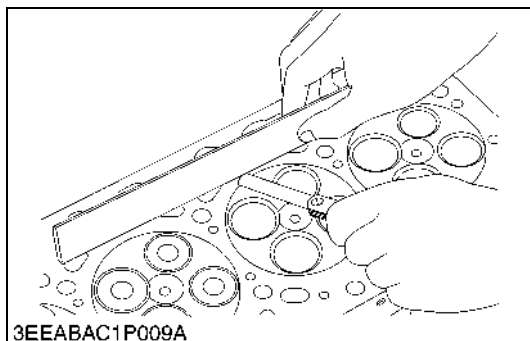
Top clearance	Factory specification	0.70 to 0.90 mm 0.028 to 0.035 in.
Tightening torque	Cylinder head mounting screw	98.1 to 107 N·m 10.0 to 11.0 kgf·m 72.4 to 79.5 lbf·ft

(1) Plastigauge

(3) Scale

(2) Crushed Plastigauge

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Cylinder Head Surface Flatness

1. Clean the cylinder head surface.
2. Place a straightedge on the cylinder head's four sides "A", "B", "C" and "D" and two diagonal "E" and "F" as shown in the figure. Measure the clearance with a feeler gauge.
3. If the measurement is more than the allowable limit, make it straight with a surface grinder.

■ IMPORTANT

- Examine the valve recessing after you correct.

Cylinder head surface flatness	Allowable limit	0.05 mm 0.002 in.
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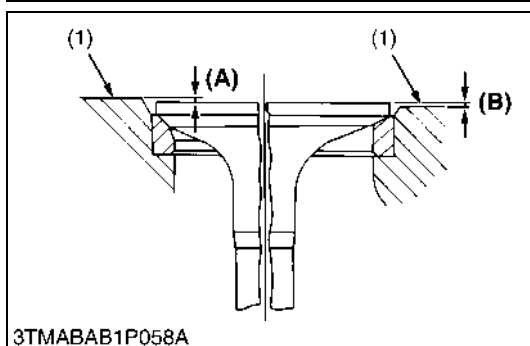
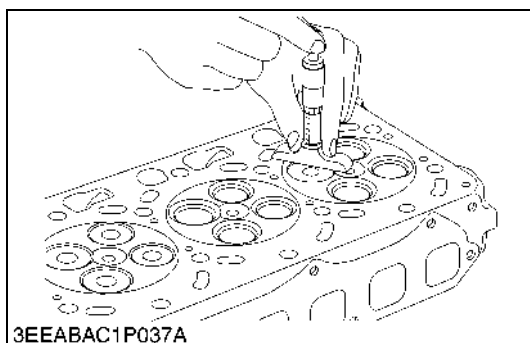
Cylinder Head Flaw

1. Prepare an air spray red check.
2. Clean the surface of the cylinder head with detergent (2).
3. Apply some red permeative liquid (1) on the cylinder head surface. After you apply, do not touch it for 5 to 10 minutes.
4. Clean away the red permeative liquid on the cylinder head surface with detergent (2).
5. Apply the white developer (3) on the cylinder head surface.
6. If you found a red flaw, replace the cylinder head.

- (1) Red Permeative Liquid
(2) Detergent

- (3) White Developer

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Valve Recessing

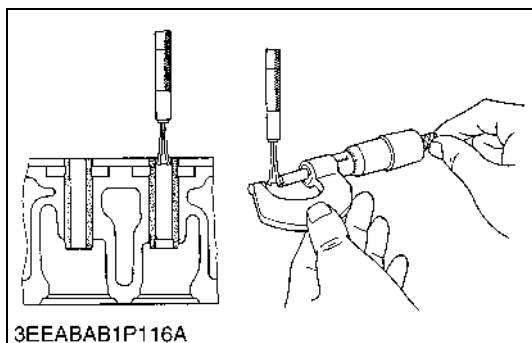
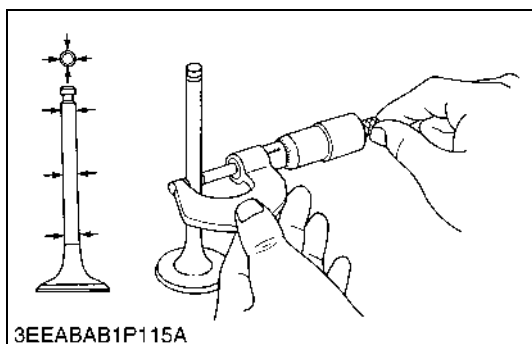
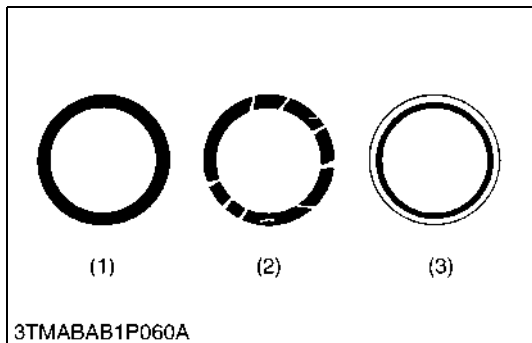
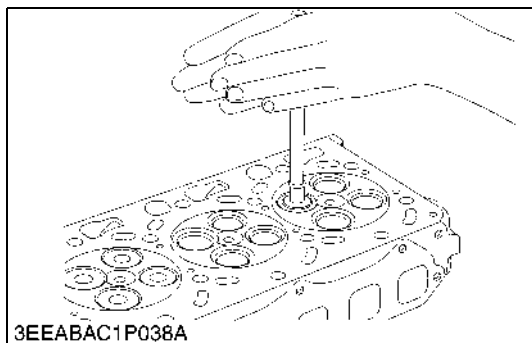
1. Clean the cylinder head surface, valve face and valve seat.
2. Set the valve into the valve guide.
3. Measure the valve recessing with a depth gauge.
4. If the measurement is more than the allowable limit, replace the valve. If it stays more than the allowable limit after you replace the valve, replace the cylinder head.

Valve recessing	Factory specification	Intake valve	(recessing) 0.60 to 0.80 mm 0.024 to 0.031 in.
		Exhaust valve	(recessing) 0.850 to 1.05 mm 0.0335 to 0.0413 in.
	Allowable limit	(recessing) 1.2 mm 0.047 in.	

- (1) Cylinder Head Surface

- (A) Recessing
(B) Protrusion

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Valve Lapping

1. Apply the compound equally to the valve lapping surface.
2. Put the valve into the valve guide. Lap the valve on its seat with a valve lapping tool.
3. After you lap the valve, clean away the compound and apply oil, then lap the valve again with oil.
4. Apply Prussian Blue to the contact surface to measure the seated rate. If the seated rate is less than 70 %, lap the valve again.

■ IMPORTANT

- After you complete the valve lapping and assemble the valve, examine the valve recessing and adjust the valve clearance.

- (1) Good
(2) Bad

- (3) Bad

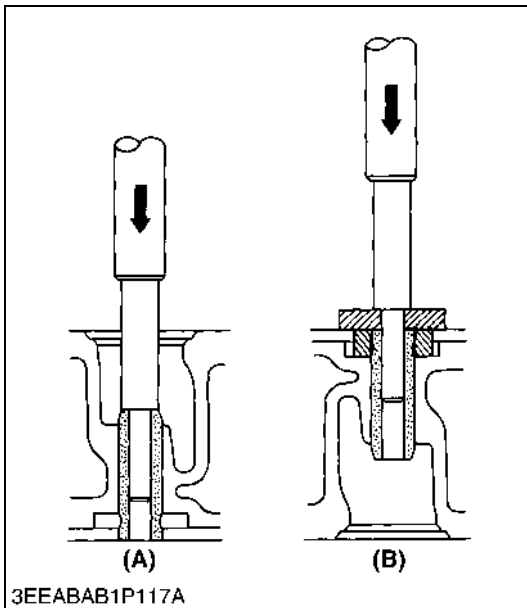
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Clearance between Valve Stem and Valve Guide

1. Remove carbon from the valve guide section.
2. Measure the valve stem O.D. with an external micrometer.
3. Measure the valve guide I.D. with a small hole gauge. Calculate the clearance.
4. If the clearance is more than the allowable limit, replace the valves. If the clearance stays more than the allowable limit, replace the valve guide also.

Clearance between valve stem and valve guide	Factory specification	Intake valve	0.035 to 0.065 mm 0.0014 to 0.0025 in.
		Exhaust valve	0.035 to 0.065 mm 0.0014 to 0.0025 in.
	Allowable limit	0.1 mm 0.004 in.	
Valve stem outside diameter	Factory specification	Intake valve	6.960 to 6.975 mm 0.2741 to 0.2746 in.
		Exhaust valve	6.960 to 6.975 mm 0.2741 to 0.2746 in.
Valve guide inside diameter	Factory specification	Intake valve	7.010 to 7.025 mm 0.2760 to 0.2765 in.
		Exhaust valve	7.010 to 7.025 mm 0.2760 to 0.2765 in.

9Y1210686ENS0075US0



Replacement of Valve Guide

(When removing)

1. Press out the used valve guide with the valve guide replacing tool.

(When installing)

1. Clean the new valve guide and valve guide bore, and apply engine oil to them.
2. Press fit the new valve guide with the valve guide replacing tool.
3. Ream accurately the I.D. of the valve guide to the specified dimension.

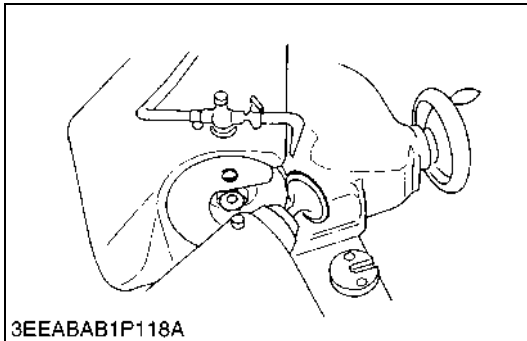
■ IMPORTANT

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

(A) When Removing

(B) When Installing

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Correction of Valve and Valve Seat

■ NOTE

- Before you correct the valve and seat, examine the valve stem and measure the I.D. of the valve guide section. Repair them if necessary.
- After you correct the valve seat, be sure to examine the valve recessing.

1) Correction of valve

1. Correct the valve with a valve refacer.

Valve face angle	Factory specification	Intake	1.0 rad 60 °
		Exhaust	0.79 rad 45 °

2) Correction of valve seat

1. Slightly correct the seat surface with a 1.0 rad (60 °) or 0.79 rad (45 °) valve seat cutter.
2. Correct the seat surface with a 0.52 rad (30 °) or 0.26 rad (15 °) valve seat cutter.

Valve seat width	Factory specification	Intake	1.5 to 1.9 mm 0.059 to 0.074 in.
		Exhaust	2.0 to 2.3 mm 0.079 to 0.091 in.

3. After you correct the seat, examine that the valve seating is flat. Apply a thin layer of compound between the valve face and valve seat, and lap them with a valve lapping tool.
4. Examine the valve seating with Prussian Blue. The valve seating surface must show good contact on all sides.

Valve seat angle	Factory specification	Intake	1.0 rad 60 °
		Exhaust	0.79 rad 45 °

- Valve Seat Width
- Identical Dimensions

(A) Examine the Contact

(B) Correct Seat Width

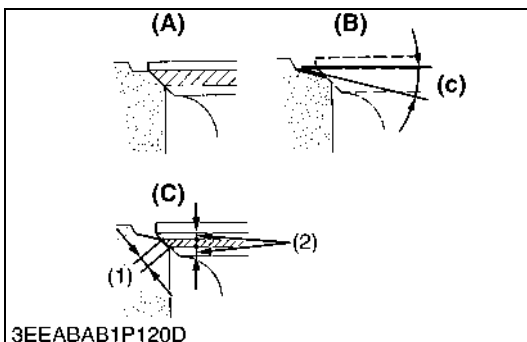
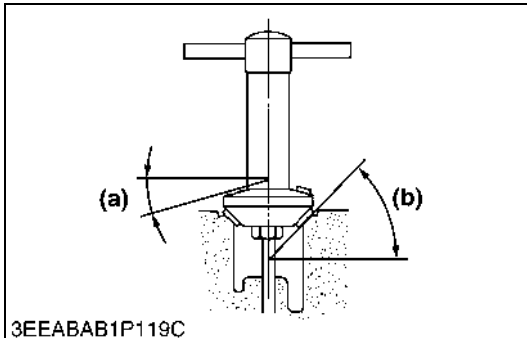
(C) Examine the Contact

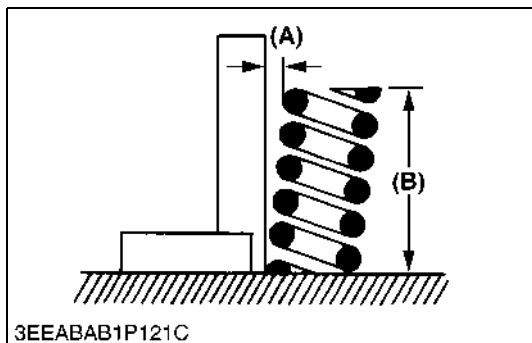
(a) 0.26 rad (15 °) or 0.52 rad (30 °)

(b) 0.79 rad (45 °) or 1.0 rad (60 °)

(c) 0.52 rad (30 °) or 0.26 rad (15 °)

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Free Length and Tilt of Valve Spring

1. Measure the free length **(B)** of valve spring with a vernier calipers. If the measurement is less than the allowable limit, replace it.
2. Put the valve spring on a surface plate, and put a square on the side of the valve spring. Turn the valve spring to measure the maximum tilt **(A)**. If the measurement is more than the allowable limit, replace it.
3. Examine the full surface of the valve spring for scratches. If there is a defect, replace it.

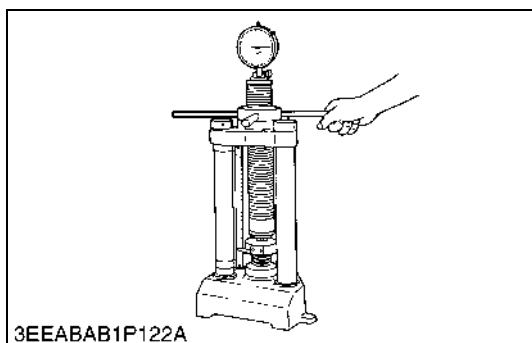
Tilt (A)	Allowable limit	1.0 mm 0.039 in.
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Free length (B)	Factory specification	Intake valve	35.1 to 35.6 mm 1.39 to 1.40 in.
		Exhaust valve	35.1 to 35.6 mm 1.39 to 1.40 in.
	Allowable limit	Intake valve	34.6 mm 1.36 in.
		Exhaust valve	34.6 mm 1.36 in.

(A) Tilt

(B) Free Length

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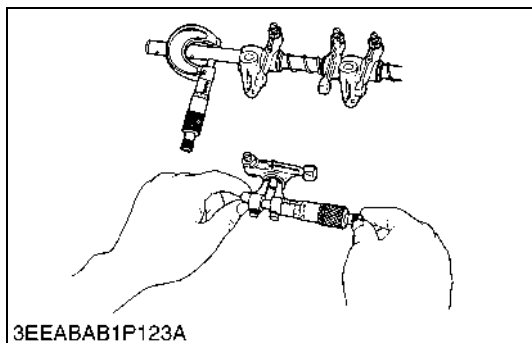


Setting Load of Valve Spring

1. Put the valve spring on a tester and compress the valve spring to the specified setting length.
2. Read the compression load on the gauge.
3. If the measurement is less than the allowable limit, replace the valve spring.

Setting load / Setting length	Factory specification	Intake valve	63.5 N / 31.5 mm 6.48 kgf / 31.5 mm 14.3 lbf / 1.24 in.
		Exhaust valve	63.5 N / 31.5 mm 6.48 kgf / 31.5 mm 14.3 lbf / 1.24 in.
	Allowable limit	Intake valve	45.9 N / 31.5 mm 4.68 kgf / 31.5 mm 10.3lbf / 1.24 in.
		Exhaust Valve	45.9 N / 31.5 mm 4.68 kgf / 31.5 mm 10.3lbf / 1.24 in.

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Oil Clearance between Rocker Arm and Rocker Arm Shaft

1. Measure the rocker arm I.D. with an internal micrometer.
2. Measure the rocker arm shaft O.D. with an external micrometer. Calculate the oil clearance.
3. If the oil clearance is more than the allowable limit, replace the rocker arm and measure the oil clearance again. If the oil clearance stays more than the allowable limit, replace the rocker arm shaft also.

Oil clearance between rocker arm and rocker arm shaft	Factory specification	0.016 to 0.045 mm 0.00063 to 0.0017 in.
	Allowable limit	0.15 mm 0.0059 in.

Rocker arm shaft O.D.	Factory specification	15.973 to 15.984 mm 0.62886 to 0.62929 in.
Rocker arm I.D.	Factory specification	16.000 to 16.018 mm 0.62993 to 0.63062 in.

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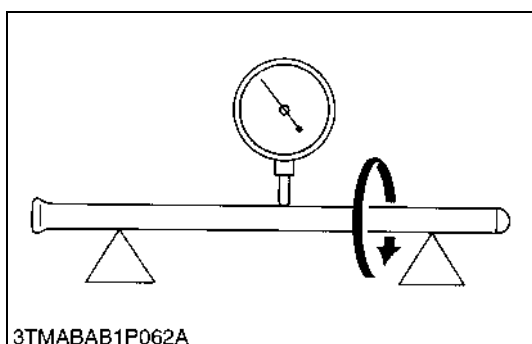
Oil Clearance between Valve Bridge Arm Shaft and Valve Bridge Arm

1. Measure the valve bridge arm I.D. with an internal micrometer.
2. Measure the valve bridge arm shaft O.D. with an external micrometer. Calculate the oil clearance.
3. If the oil clearance is more than allowable limit, replace the valve bridge arm and measure the oil clearance again. If the oil clearance stays more than the allowable limit, replace the valve bridge arm shaft also.

Oil clearance between valve bridge arm shaft and valve bridge arm	Factory specification	0.018 to 0.042 mm 0.00071 to 0.0016 in.
	Allowable limit	0.15 mm 0.0059 in.

Valve bridge shaft arm O.D.	Factory specification	9.023 to 9.032 mm 0.3552 to 0.3555 in.
Valve bridge arm I.D.	Factory specification	9.050 to 9.065 mm 0.3563 to 0.3568 in.

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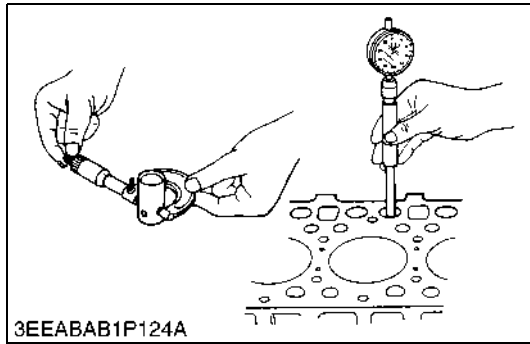


Push Rod Alignment

1. Put the push rod on V blocks.
2. Measure the push rod alignment.
3. If the measurement is more than the allowable limit, replace the push rod.

Push rod alignment	Allowable limit	0.25 mm 0.0099 in.
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Oil Clearance between Tappet and Tappet Guide Bore

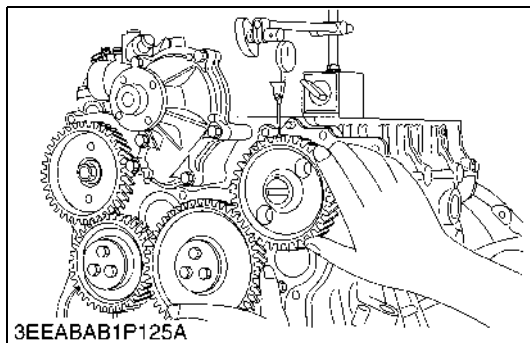
1. Measure the tappet O.D. with an external micrometer.
2. Measure the tappet guide bore I.D. with a cylinder gauge.
3. Calculate the oil clearance.
4. If the oil clearance is more than the allowable limit or the tappet has a damage, replace the tappet.

Oil Clearance between tappet and guide bore	Factory specification	0.020 to 0.062 mm 0.00079 to 0.0024 in.
	Allowable limit	0.07 mm 0.003 in.

Tappet O.D.	Factory specification	23.959 to 23.980 mm 0.94327 to 0.94409 in.
Tappet guide bore I.D.	Factory specification	24.000 to 24.021 mm 0.94489 to 0.94570 in.

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(2) Timing Gears



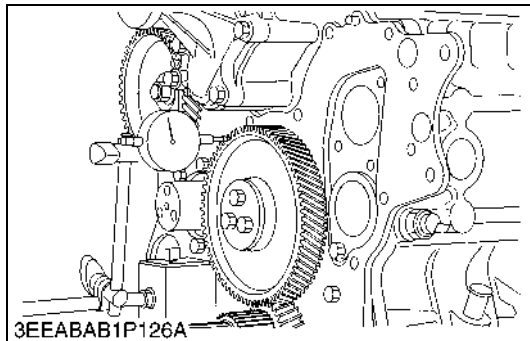
Timing Gear Backlash

1. Set a dial indicator (lever type) with its point on the gear tooth.
2. Hold the mating gear and move the gear to measure the backlash.
3. If the backlash is more than the allowable limit, measure the oil clearance in the journal part of each shaft.
4. If the oil clearance is correct, replace the gear.

Backlash between crank gear and idle gear 1	Factory specification	0.0490 to 0.193 mm 0.00193 to 0.00759 in.
	Allowable limit	0.22 mm 0.0087 in.

Backlash between idle gear 1 and cam gear	Factory specification	0.0490 to 0.189 mm 0.00193 to 0.00744 in.
	Allowable limit	0.22 mm 0.0087 in.

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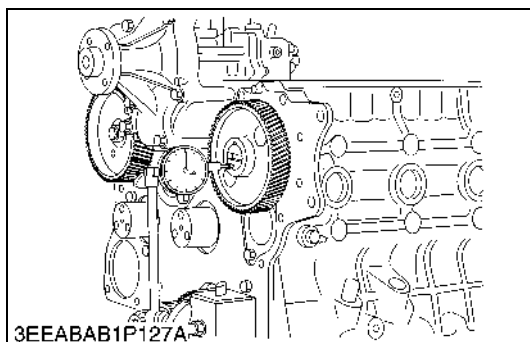


Side Clearance of Idle Gear

1. Set a dial indicator with its point on the idle gear.
2. Move the idle gear to the front and rear to measure the side clearance.
3. If the measurement is more than the allowable limit, replace the idle gear collar.

Side clearance of idle gear	Factory specification	0.15 to 0.30 mm 0.0059 to 0.011 in.
	Allowable limit	0.90 mm 0.035 in.

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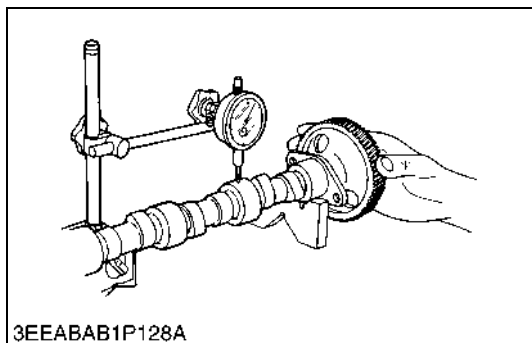


Side Clearance of Camshaft

1. Set a dial indicator with its point on the camshaft.
2. Move the cam gear to the front and rear to measure the side clearance.
3. If the measurement is more than the allowable limit, replace the camshaft stopper.

Side clearance of camshaft	Factory specification	0.070 to 0.22 mm 0.0028 to 0.0086 in.
	Allowable limit	0.30 mm 0.012 in.

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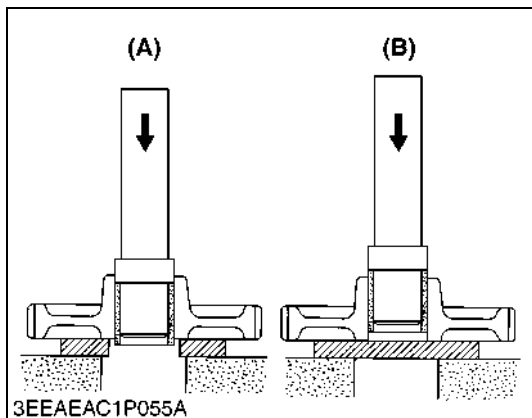


Camshaft Alignment

1. Hold the 2 end journals of camshaft with V blocks on the surface plate.
2. Set a dial indicator with its point on the middle journal.
3. Turn the camshaft slowly and read the variation on the indicator. (Half of the measurement)
4. If the measurement is more than the allowable limit, replace the camshaft.

Camshaft alignment	Allowable limit	0.01 mm 0.0004 in.
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Replacement of Idle Gear Bushing

(When removing)

1. Press out the used idle gear bushing with the replacing tool.

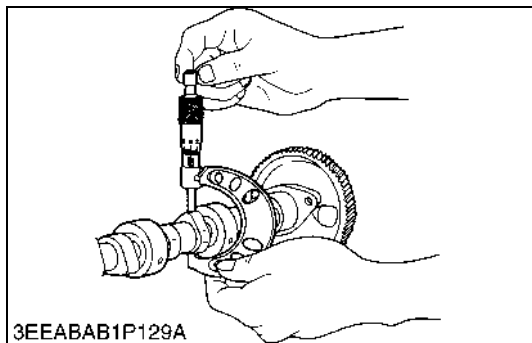
(When installing)

1. Clean a new idle gear bushing and idle gear bore, and apply engine oil to them.
2. Press fit the new bushing with the replacing tool. Make sure that the bushing end aligns the end of the idle gear.

(A) When Removing

(B) When Installing

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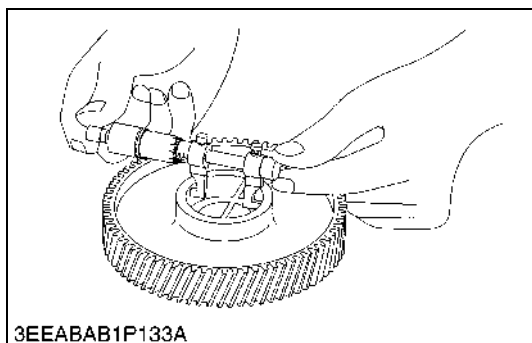
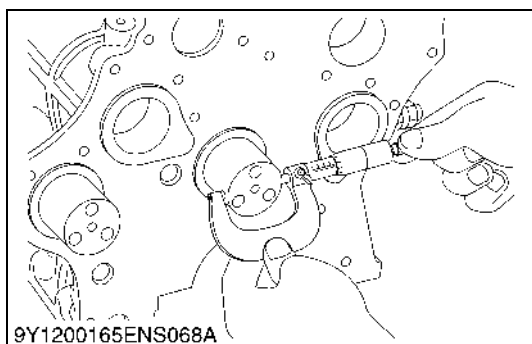
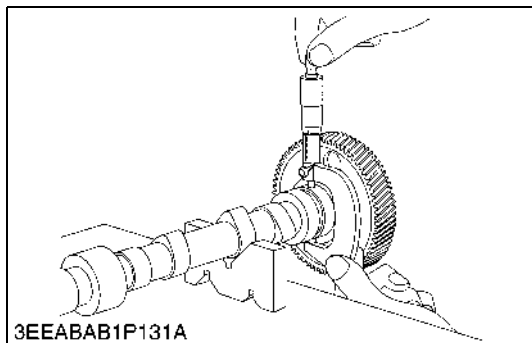
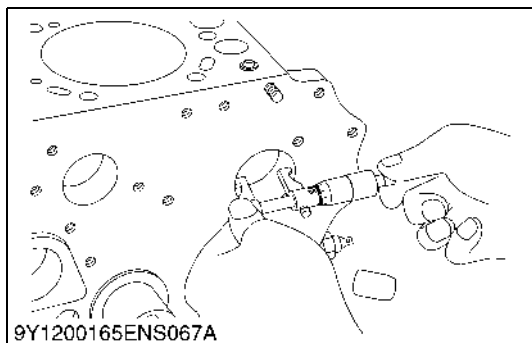


Cam Height

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

Cam height	Factory specification	Intake valve	37.64 mm 1.482 in.
		Exhaust valve	38.96 mm 1.534 in.
	Allowable limit	Intake valve	37.14 mm 1.462 in.
		Exhaust valve	38.46 mm 1.514 in.

9Y1210686ENS0089US0



Oil Clearance of Camshaft Journal

1. Measure the camshaft journal O.D. with an external micrometer.
2. Measure the cylinder block bore I.D. for the camshaft with a cylinder gauge.
3. Calculate the oil clearance.
4. If the oil clearance is more than the allowable limit, replace the camshaft.

Oil clearance of camshaft journal	Factory specification	0.050 to 0.091 mm 0.0020 to 0.0035 in.
	Allowable limit	0.15 mm 0.0059 in.

Camshaft journal O.D.	Factory specification	45.934 to 45.950 mm 1.8085 to 1.8090 in.
Camshaft bearing I.D.	Factory specification	46.000 to 46.025 mm 1.8111 to 1.8120 in.

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Oil Clearance between Idle Gear Shaft 1, 2 and Idle Gear 1, 2 Bushing

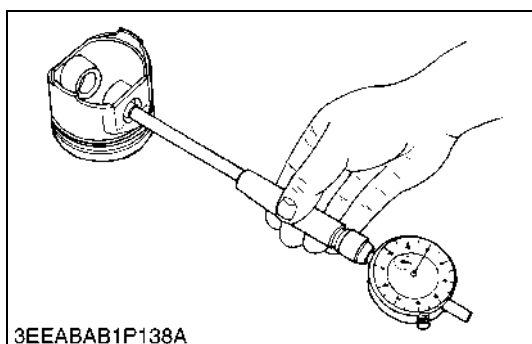
1. Measure the idle gear shaft O.D. with an external micrometer.
2. Measure the idle gear bushing I.D. with an internal micrometer.
3. Calculate the oil clearance.
4. If the oil clearance is more than the allowable limit, replace the bushing.

Oil clearance between idle gear shaft 1, 2 and idle gear 1, 2 bushing	Factory specification	0.050 to 0.091 mm 0.0020 to 0.0035 in.
	Allowable limit	0.10 mm 0.0039 in.

Idle gear 1, 2 bushing I.D.	Factory specification	45.025 to 45.050 mm 1.7727 to 1.7736 in.
Idle gear shaft 1, 2 O.D.	Factory specification	44.959 to 44.975 mm 1.7701 to 1.7706 in.

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(3) Piston and Connecting Rod

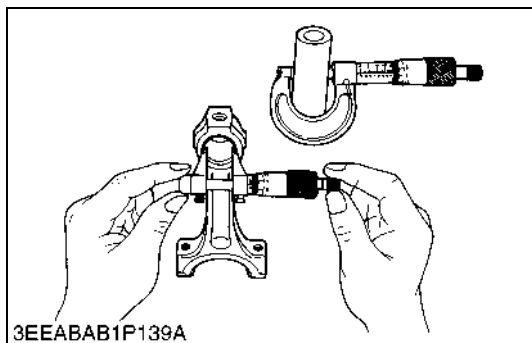


Piston Pin Bore I.D.

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

Piston pin bore I.D.	Factory specification	30.006 to 30.013 mm 1.1814 to 1.1816 in.
	Allowable limit	30.05 mm 1.183 in.

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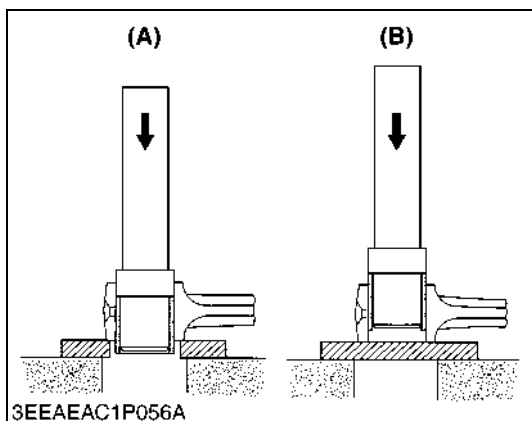
Oil Clearance between Piston Pin and Small End Bushing

1. Measure the O.D. of the piston pin where it contacts the bushing with an outside micrometer.
2. Measure the I.D. of the piston pin bushing at the connecting rod small end with a cylinder gauge.
3. Calculate the oil clearance.
4. If the clearance exceeds the allowable limit, replace the bushing.
5. If it still exceeds the allowable limit, replace the piston pin.

Oil clearance between piston pin and small end bushing	Factory specification	0.020 to 0.040 mm 0.00079 to 0.0015 in.
	Allowable limit	0.15 mm 0.0059 in.

Piston pin O.D.	Factory specification	30.006 to 30.011 mm 1.1814 to 1.1815 in.
Small end bushing I.D.	Factory specification	30.031 to 30.046 mm 1.1824 to 1.1829 in.

9Y1210686ENS0093US0



Replacing Small End Bushing

(When removing)

1. Press out the used bushing with small end bushing replacing tool.

(When installing)

1. Clean a new small end bushing and bore.
2. Apply engine oil to a new small end bushing and bore.
3. Insert a new bushing onto the tool.
4. Press-fit it with a press so that the seam (1) of bushing position as shown in the figure, until it is flash with the connecting rod.

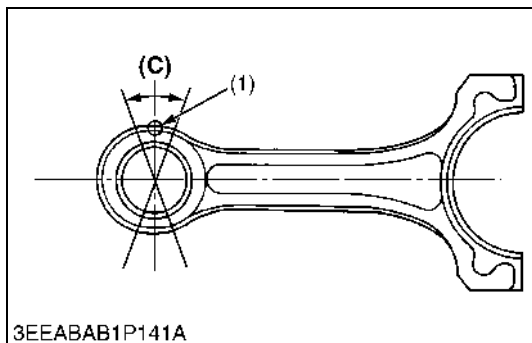
(1) Seam

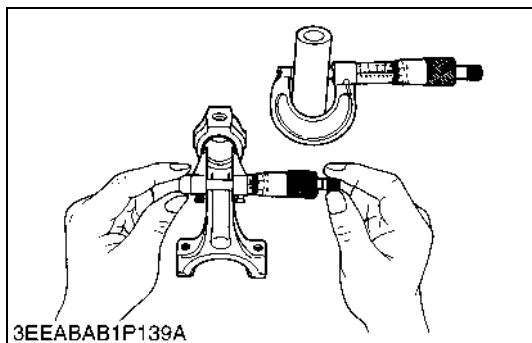
(A) When Removing

(B) When Installing

(C) 0.26 rad (15°)

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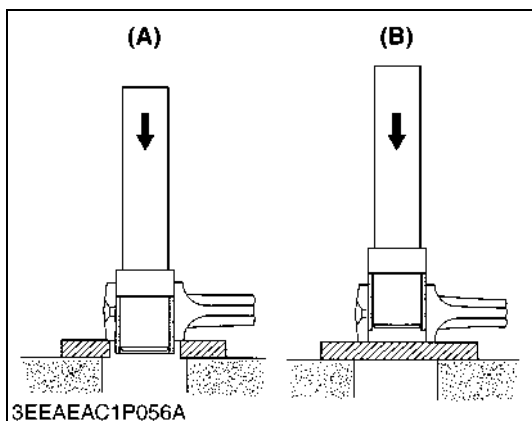
Oil Clearance between Piston Pin and Small End Bushing

1. Measure the O.D. of the piston pin where it contacts the bushing with an outside micrometer.
2. Measure the I.D. of the piston pin bushing at the connecting rod small end with a cylinder gauge.
3. Calculate the oil clearance.
4. If the clearance exceeds the allowable limit, replace the bushing.
5. If it still exceeds the allowable limit, replace the piston pin.

Oil clearance between piston pin and small end bushing	Factory specification	0.020 to 0.040 mm 0.00079 to 0.0015 in.
	Allowable limit	0.15 mm 0.0059 in.

Piston pin O.D.	Factory specification	30.006 to 30.011 mm 1.1814 to 1.1815 in.
Small end bushing I.D.	Factory specification	30.031 to 30.046 mm 1.1824 to 1.1829 in.

9Y1210686ENS0093US0



Replacing Small End Bushing

(When removing)

1. Press out the used bushing with small end bushing replacing tool.

(When installing)

1. Clean a new small end bushing and bore.
2. Apply engine oil to a new small end bushing and bore.
3. Insert a new bushing onto the tool.
4. Press-fit it with a press so that the seam (1) of bushing position as shown in the figure, until it is flash with the connecting rod.

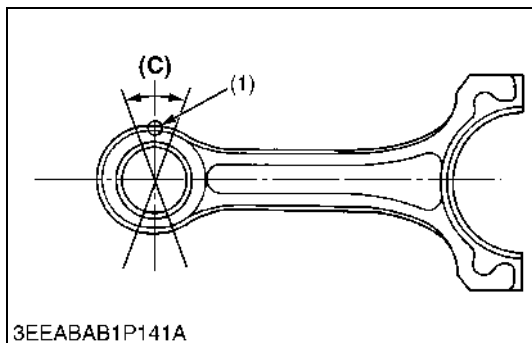
(1) Seam

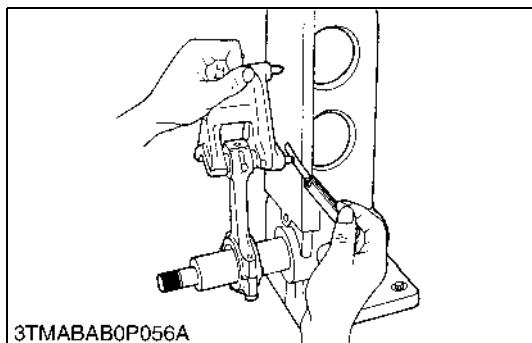
(A) When Removing

(B) When Installing

(C) 0.26 rad (15°)

9Y1210686ENS0094US0





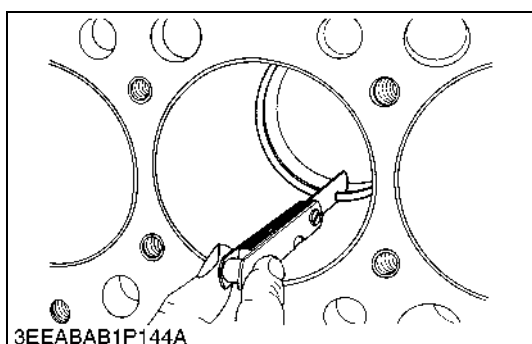
Connecting Rod Alignment

NOTE

- Make sure that the oil clearance of the small end bushing is less than the allowable limit.
- Remove the piston pin from the piston.
 - Install the piston pin into the connecting rod.
 - Install the connecting rod on the alignment tool of the connecting rod.
 - Put a gauge on the piston pin, and move it against the face plate.
 - If the gauge does not touch fully against the face plate, measure the space between the gauge pin and face plate.
 - If the measurement is more than the allowable limit, replace the connecting rod.

Connecting rod alignment	Allowable limit	0.05 mm 0.002 in.
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9Y1210686ENS0095US0



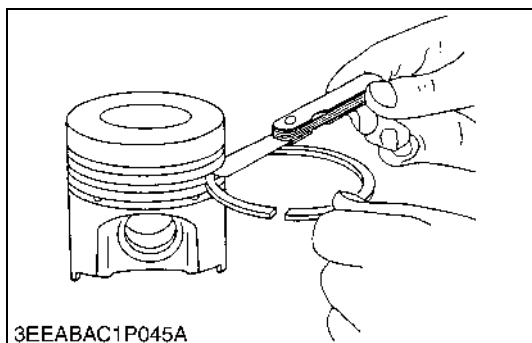
Piston Ring Gap

- Put the piston ring into the lower part of the liner (the least worn out part) with the piston.
- Measure the ring gap with a feeler gauge.
- If the ring gap is more than the allowable limit, replace the ring.

Top ring and second ring	Factory specification	0.30 to 0.45 mm 0.012 to 0.017 in.
	Allowable limit	1.25 mm 0.0492 in.

Oil ring	Factory specification	0.25 to 0.45 mm 0.0099 to 0.017 in.
	Allowable limit	1.25 mm 0.0492 in.

9Y1210686ENS0096US0



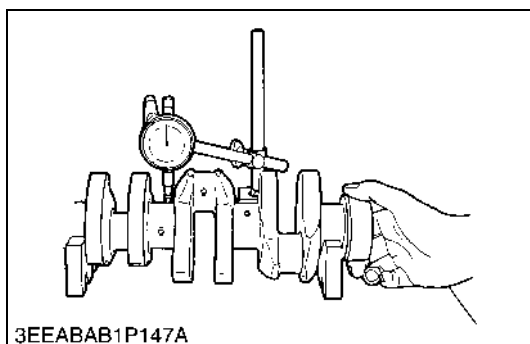
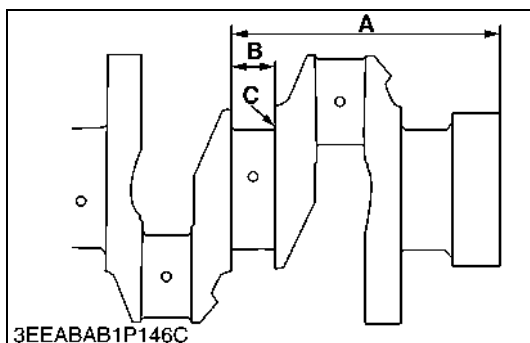
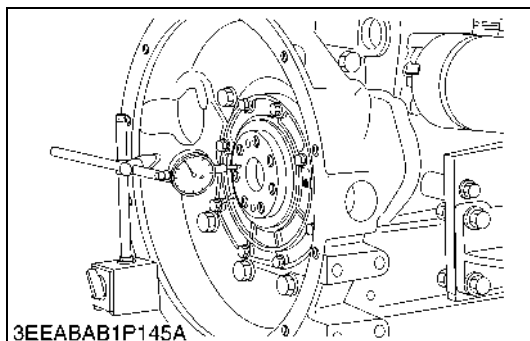
Clearance between Piston Ring and Ring Groove

- Clean the rings and the ring grooves, and install each ring in its groove.
- Measure the clearance between the ring and the groove with a feeler gauge or depth gauge.
- If the clearance is more than the allowable limit, replace the piston ring.
- If the clearance stays more than the allowable limit with new ring, replace the piston also.

Clearance between piston ring and ring groove	Factory specification	Top ring	0.05 to 0.09 mm 0.002 to 0.003 in.
		Second ring	0.0930 to 0.120 mm 0.00367 to 0.00472 in.
		Oil ring	0.020 to 0.060 mm 0.00079 to 0.0023 in.
	Allowable limit	Top ring	0.15 mm 0.0059 in.
		Second ring	0.20 mm 0.0079 in.
		Oil ring	0.15 mm 0.0059 in.

9Y1210686ENS0097US0

(4) Crankshaft



Side Clearance of Crankshaft

1. Set a dial indicator with its point on the end of the crankshaft.
2. Move the crankshaft to the front and rear to measure the side clearance.
3. If the measurement is more than the allowable limit, replace the thrust bearings.
4. If the same dimension bearing is not applicable because of the crankshaft journal wear, replace it with an oversize one. Refer to the table and figure.

Side clearance of crankshaft	Factory specification	0.15 to 0.31 mm 0.0059 to 0.012 in.
	Allowable limit	0.50 mm 0.020 in.

(Reference)

- Oversize dimensions of crankshaft journal

Oversize	0.2 mm 0.008 in.	0.4 mm 0.016 in.
Dimension A	169.10 to 169.15 mm 6.6575 to 6.6594 in.	169.2 to 169.25 mm 6.6615 to 6.6633 in.
Dimension B	29.20 to 29.25 mm 1.150 to 1.151 in.	29.40 to 29.45 mm 1.158 to 1.159 in.
Dimension C	2.8 to 3.2 mm radius 0.11 to 0.12 in. radius	2.8 to 3.2 mm radius 0.11 to 0.12 in. radius
The crankshaft journal must be fine-finished to higher than Rmax = 0.8S		

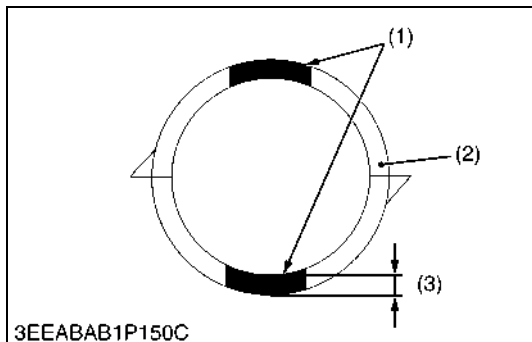
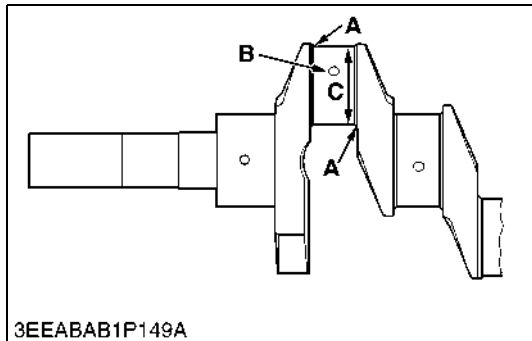
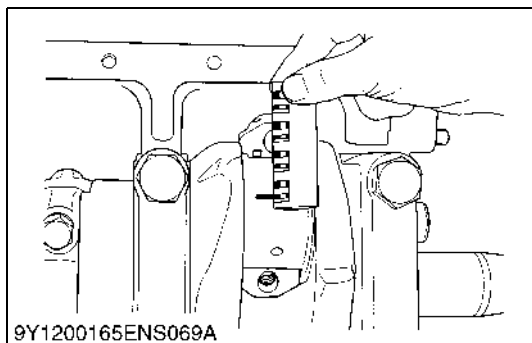
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Crankshaft Alignment

1. Hold the 2 end journals of crankshaft with V blocks on the surface plate.
2. Set a dial indicator with its point on the middle journal.
3. Turn the crankshaft slowly and read the variation on the indicator. (Half of the measurement)
4. If the measurement is more than the allowable limit, replace the crankshaft.

Crankshaft alignment	Allowable limit	0.02 mm 0.0008 in.
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9Y1210686ENS0099US0



Oil Clearance between Crank Pin and Crank Pin Bearing

1. Clean the crank pin and crank pin bearing.
2. Put a strip of Plastigauge on the center of the crank pin.
3. Install the connecting rod cap.
4. Tighten the connecting rod screws to the specified torque.
5. Remove the connecting rod cap again.
6. Measure the width that it becomes flat with the scale to get the oil clearance.
7. If the oil clearance is more than the allowable limit, replace the crank pin bearing.
8. If the same dimension bearing is not applicable because of the crank pin wear, replace it with an undersize one. Refer to the table and figure.

NOTE

- Do not put the Plastigauge into the crank pin oil hole.
- When you tighten the connecting rod screws, do not move the crankshaft.

Crank pin O.D.	Factory specification	52.977 to 52.990 mm 2.0857 to 2.0862 in.
Oil clearance between crank pin and crank pin bearing	Factory specification	0.018 to 0.051 mm 0.00071 to 0.0020 in.
	Allowable limit	0.20 mm 0.0079 in.

IMPORTANT

- To replace it with a specific STD service part, make sure the crank pin bearing has the same ID color as the connecting rod.

ID Color	Connecting rod	Crank pin bearing		
	Large-end in. dia.	Class	Part code	Center wall thick
Blue	56.010 to 56.020 mm 2.2052 to 2.2055 in.	L	1C020-22313	1.496 to 1.501 mm 0.05890 to 0.05909 in.
Without color	56.00 to 56.01 mm 2.2048 to 2.2051 in.	S	1C020-22334	1.491 to 1.496 mm 0.05870 to 0.05889 in.

(Reference)

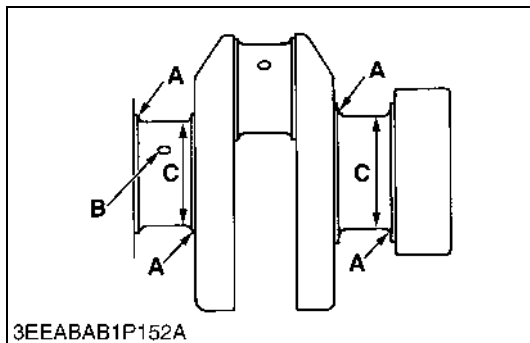
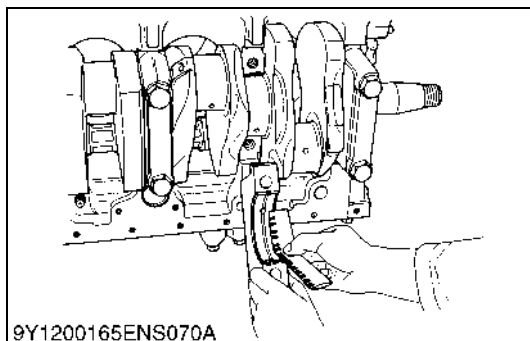
- Undersize dimensions of crank pin

Undersize	0.2 mm 0.008 in.	0.4 mm 0.02 in.
Dimension A	3.3 to 3.7 mm radius 0.13 to 0.14 in. radius	3.3 to 3.7 mm radius 0.13 to 0.14 in. radius
*Dimension B	1.0 to 1.5 mm relief 0.040 to 0.059 in. relief	1.0 to 1.5 mm relief 0.040 to 0.059 in. relief
Dimension C	52.777 to 52.790 mm dia. 2.0779 to 2.0783 in. dia.	52.577 to 52.590 mm dia. 2.0700 to 2.0704 in. dia.
The crank pin must be fine-finished to higher than Rmax = 0.8S *Holes to be de-burred and edges rounded with 1.0 to 1.5 mm (0.040 to 0.059 in.) relief.		

- (1) ID Color
(2) Crank Pin Bearing

- (3) Center Wall Thick

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Oil Clearance between Crankshaft Journal and Crankshaft Bearing

1. Clean the crankshaft journal and crankshaft bearing.
 2. Put a strip of Plastigauge on the center of the journal.
- **IMPORTANT**
- **Do not put the Plastigauge into the oil hole of the journal.**
3. Install the main bearing case.
 4. Tighten the screws to the specified torque.
 5. Remove the main bearing case again.
 6. Measure the width that it becomes flat with the scale to get the oil clearance.
 7. If the clearance exceeds the allowable limit, replace the crankshaft bearing.
 8. 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.

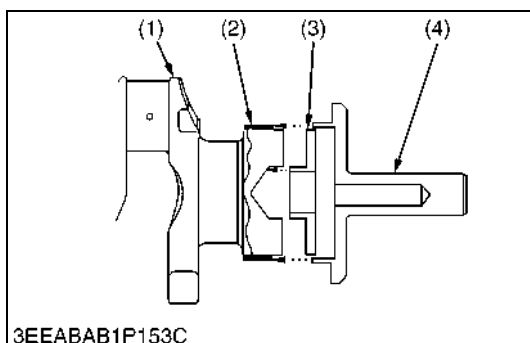
Crankshaft journal O.D.	Factory specification	74.977 to 74.990 mm 2.9519 to 2.9523 in.
Oil clearance between crankshaft journal and crankshaft bearing	Factory specification	0.018 to 0.062 mm 0.00071 to 0.0024 in.
	Allowable limit	0.20 mm 0.0079 in.

(Reference)

- Undersize dimensions of crankshaft journal

Undersize	0.2 mm 0.008 in.	0.4 mm 0.02 in.
Dimension A	2.8 to 3.2 mm radius 0.11 to 0.12 in. radius	2.8 to 3.2 mm radius 0.11 to 0.12 in. radius
*Dimension B	1.0 to 1.5 mm relief 0.040 to 0.059 in. relief	1.0 to 1.5 mm relief 0.040 to 0.059 in. relief
Dimension C	74.777 to 74.790 mm dia. 2.9440 to 2.9444 in. dia.	74.577 to 74.590 mm dia. 2.9361 to 2.9366 in. dia.
The crankshaft journal must be fine-finished to higher than Rmax = 0.8S *Holes to be de-burred and edges rounded with 1.0 to 1.5 mm (0.040 to 0.059 in.) relief.		

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Replacement of Crankshaft Sleeve

1. Remove the used crankshaft sleeve (2).
2. Set the sleeve guide (3) to the crankshaft (1).
3. Increase the temperature of a new sleeve to between 150 and 200 °C (302 and 392 °F).
4. Set the sleeve to the crankshaft as shown in figure.
5. Press fit the sleeve using the auxiliary socket for pushing (4).

■ NOTE

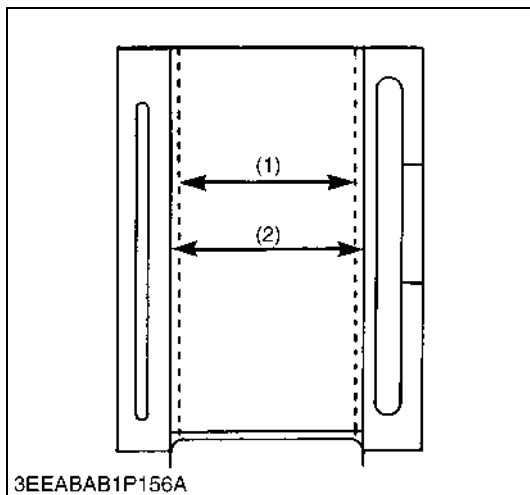
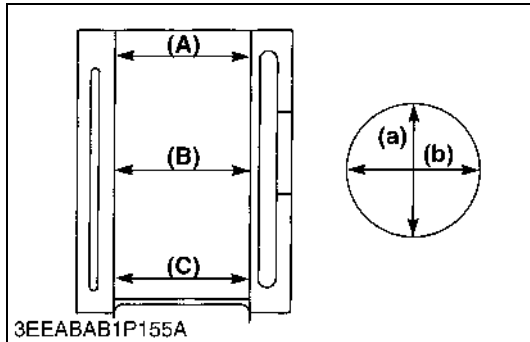
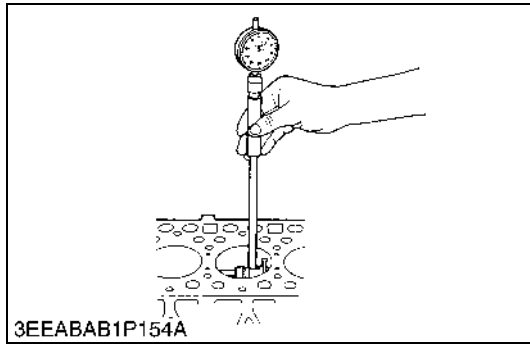
- **Make sure that the large chamfer of the sleeve points to outward.**

- (1) Crankshaft
(2) Crankshaft Sleeve

- (3) Sleeve Guide
(4) Auxiliary Socket for Pushing

9Y1210686ENS0102US0

(5) Cylinder



Cylinder Wear

1. Measure the I.D. of the cylinder at the 6 positions (see figure) with a cylinder gauge and find the maximum and minimum inner diameters.
2. Find the difference between the maximum and the minimum inner diameters.
3. If the maximum I.D. or the difference is more than the allowable limit, bore and hone it to the oversize dimension. (Refer to "Cylinder Correction (Oversize)".)
4. Examine the cylinder wall for scratches. If you find deep scratches, bore the cylinder. (Refer to "Cylinder Correction (Oversize)".)

Cylinder Bore I.D.	Factory specification	100.000 to 100.022 mm 3.93701 to 3.93787 in.
	Allowable limit	100.150 mm 3.9429 in.

(A) Top
(B) Middle
(C) Bottom

(a) Right-angled to Piston Pin
(b) Piston Pin Direction

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Cylinder Correction (Oversize)

1. If the cylinder wear is more than the allowable limit, bore and hone it to the specified dimension.

Oversize cylinder I.D.	Factory specification	100.500 to 100.522 mm 3.95670 to 3.95755 in.
Maximum wear	Allowable limit	100.650 mm 3.96260 in.
Finishing	Hone to 1.2 to 3.0 μ mRz (0.000048 to 0.00011 in.Rz)	

2. Replace the piston and piston rings with oversize ones (0.5 mm, 0.02 in.).

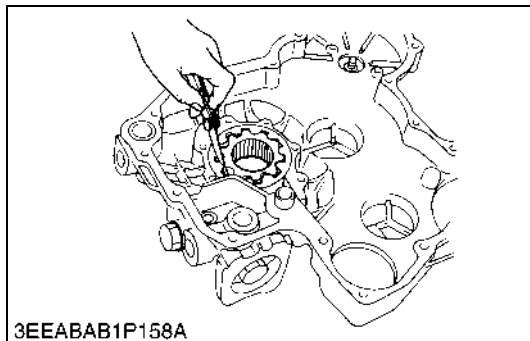
NOTE

- If the maximum I.D. or the difference for the oversize cylinder is more than the allowable limit, replace the cylinder block with a new one.

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

9Y1210686ENS0104US0

(6) Oil Pump

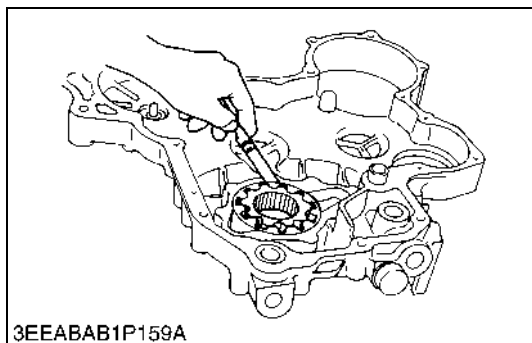


Clearance between Inner Rotor and Outer Rotor

1. Measure the clearance between the 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.

Clearance between Inner Rotor and Outer Rotor	Factory specification	0.040 to 0.16 mm 0.0016 to 0.0062 in.
	Allowable limit	0.3 mm 0.01 in.

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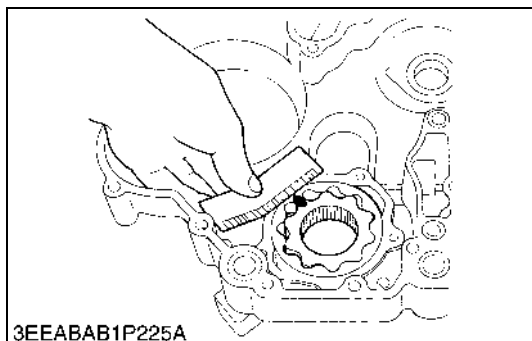


Clearance between Outer Rotor and Pump Body

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.
3. If still the clearance exceeds the allowable limit after replacing the oil pump rotor assembly, replace the gear case.

Clearance between outer rotor and pump body	Factory specification	0.100 to 0.184 mm 0.00394 to 0.00724 in.
	Allowable limit	0.3 mm 0.01 in.

9Y1210686ENS0106US0



Clearance between Rotor and Cover

1. Put a strip of Plastigauge on the rotor face with grease.
2. Install the cover and tighten the screws with the specified torque.
3. Remove the cover carefully.
4. Measure the width that Plastigauge becomes flat with the scale to get the oil clearance.
5. If the clearance is more than the allowable limit, replace oil pump rotor assembly and the cover.

Clearance between rotor and cover	Factory specification	0.025 to 0.075 mm 0.00099 to 0.0029 in.
	Allowable limit	0.225 mm 0.00886 in.

Tightening torque	Oil pump cover screw	7.9 to 9.3 N·m 0.80 to 0.95 kgf·m 5.8 to 6.8 lbf·ft
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2 TRANSMISSION

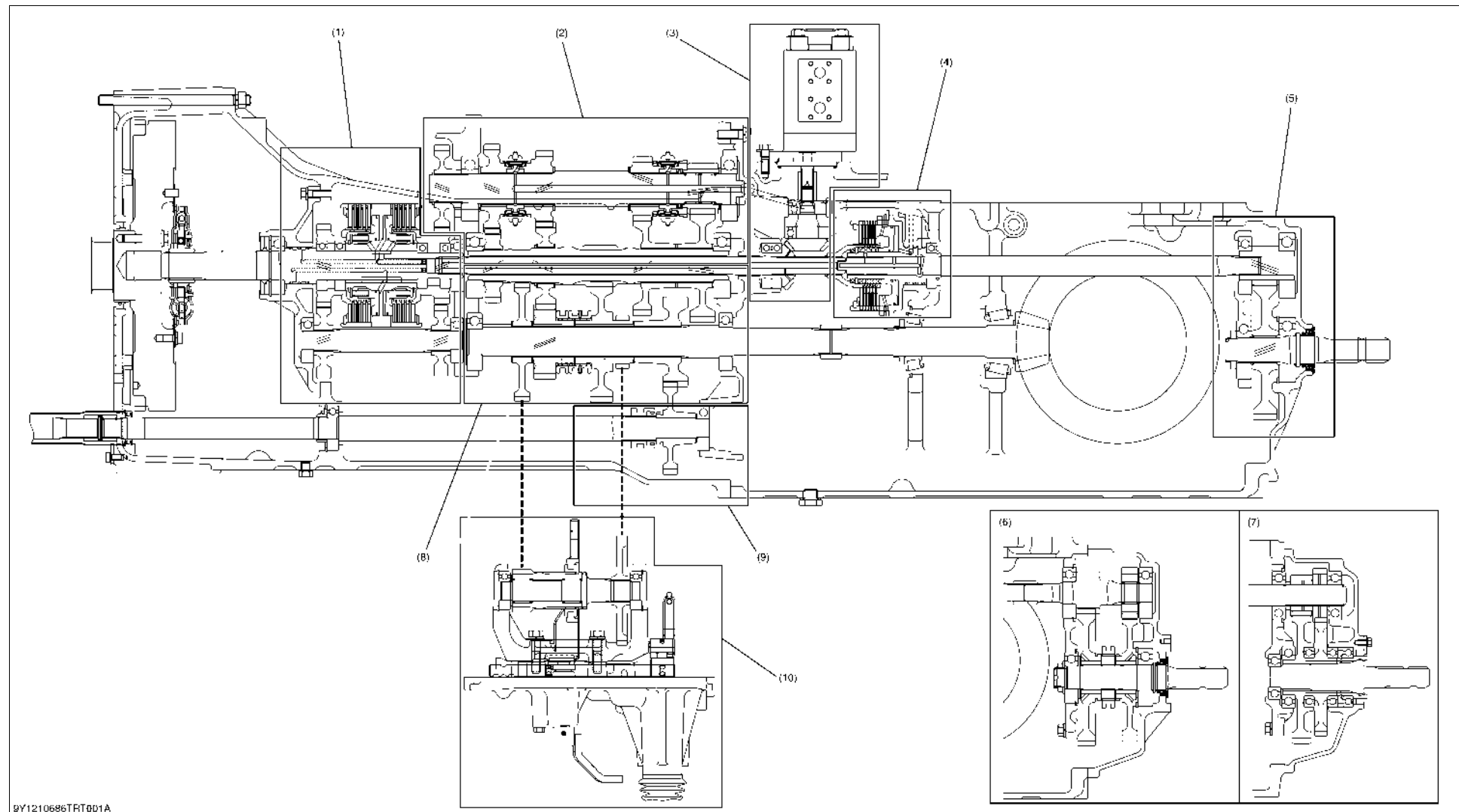
MECHANISM

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1. STRUCTURE

[1] F8/R8 SPEED TRANSMISSION MODEL



9Y1210696TRT001A

(1) Hydraulic Shuttle Section
(2) Main Gear Shift Section

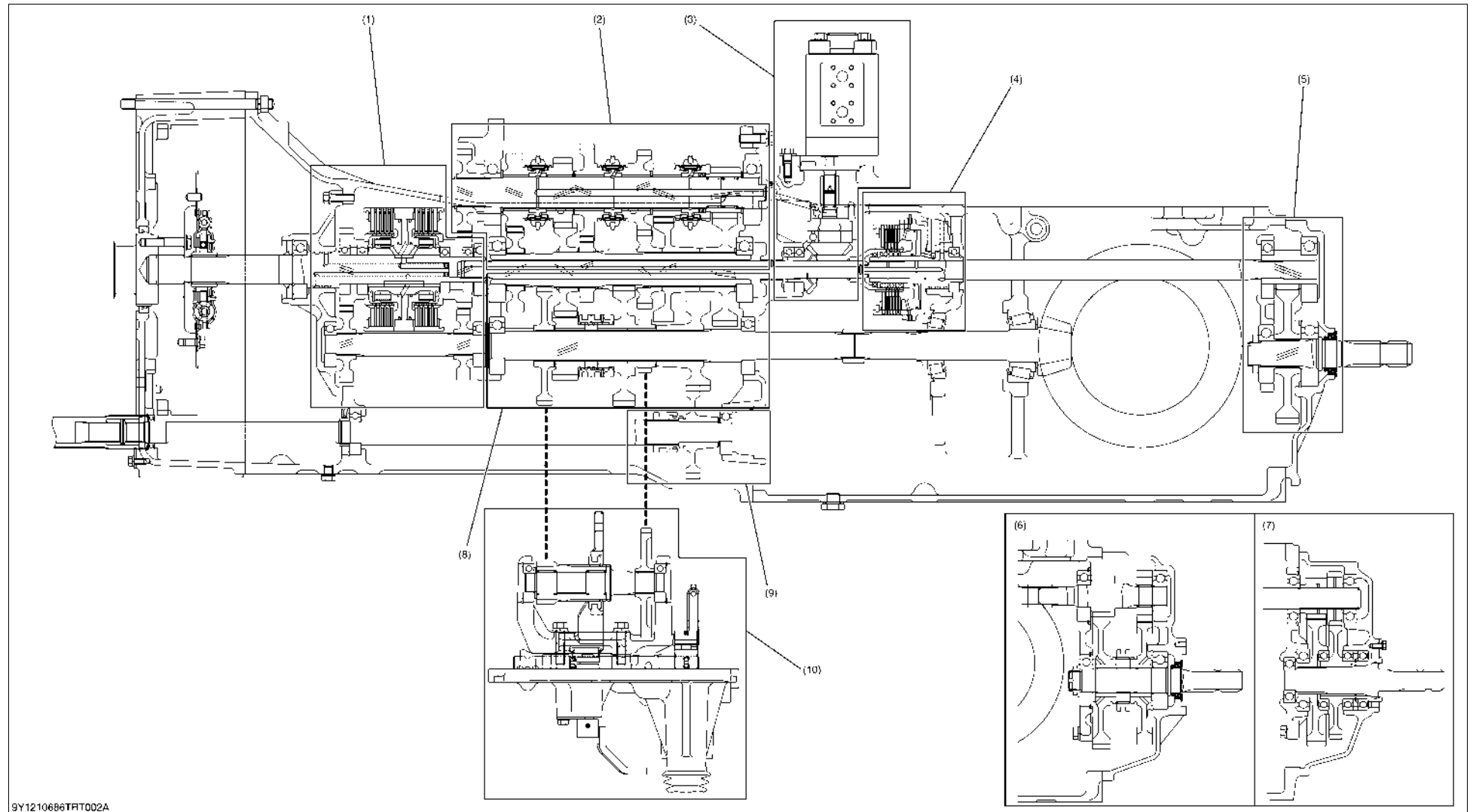
(3) Hydraulic Pump and Drive Section
(4) PTO Clutch Section

(5) PTO Gear Section (540 Type)
(6) PTO Gear Section (540-540E/Shift Type)
(Option)

(7) PTO Gear Section
(540-1000/Interchange Type) (Option)

(8) Range Gear Shift Section
(9) 4WD Section

(10) Creep Gear Section (Cassette Type) (Option)

[2] F12/R12 SPEED TRANSMISSION MODEL

9Y1210696TPT002A

(1) Hydraulic Shuttle Section
(2) Main Gear Shift Section

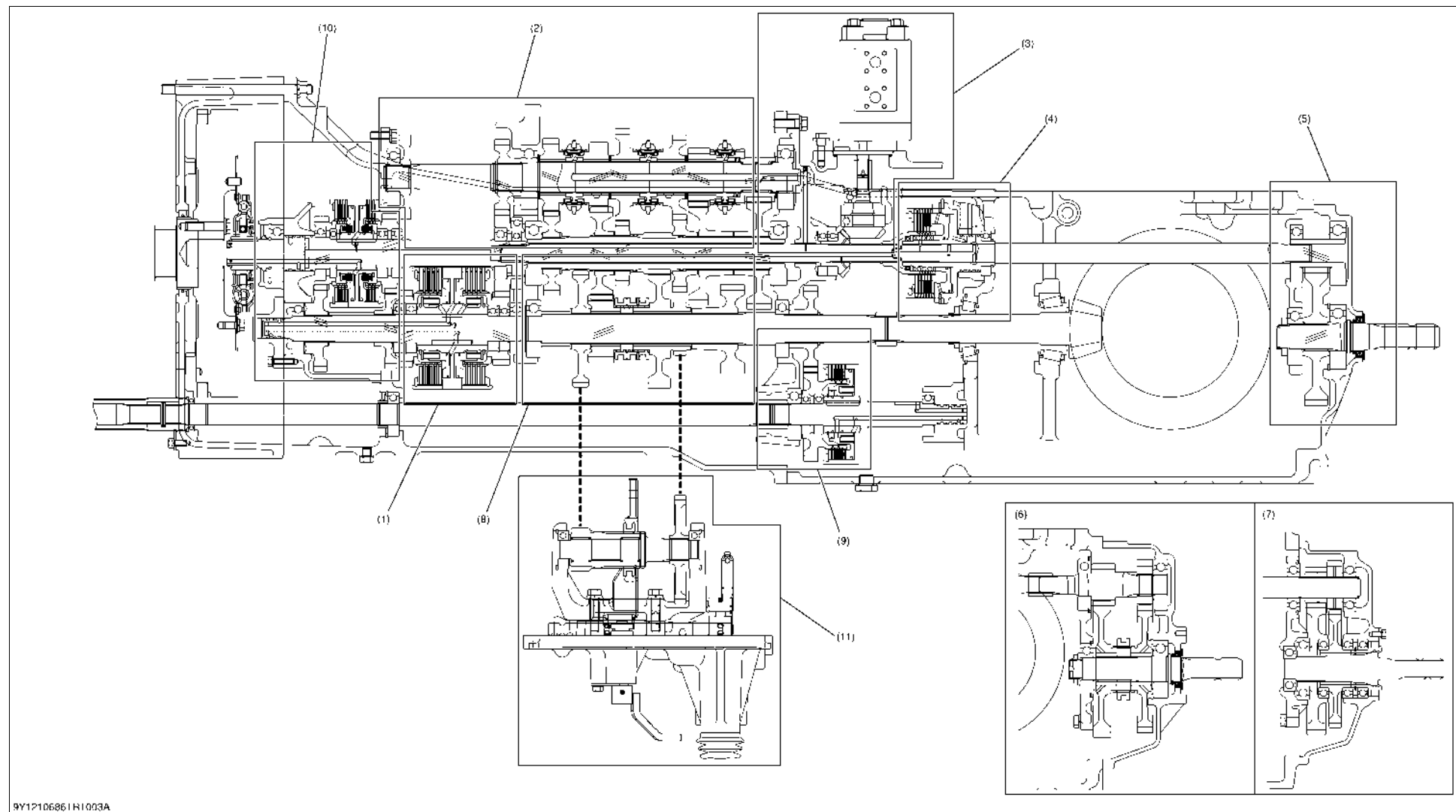
(3) Hydraulic Pump and Drive Section
(4) PTO Clutch Section

(5) PTO Gear Section (540 Type)
(6) PTO Gear Section (540-540E/Shift Type)
(Option)

(7) PTO Gear Section
(540-1000/Interchange Type) (Option)

(8) Range Gear Shift Section
(9) 4WD Section

(10) Creep Gear Section (Cassette Type) (Option)

[3] F24/R24 SPEED TRANSMISSION MODEL

9Y12106861R1003A

(1) Hydraulic Shuttle Section
(2) Main Gear Shift Section

(3) Hydraulic Pump and Drive Section
(4) PTO Clutch Section

(5) PTO Gear Section (540 Type)
(6) PTO Gear Section (540-540E/Shift Type)
(Option)

(7) PTO Gear Section
(540-1000/Interchange Type) (Option)

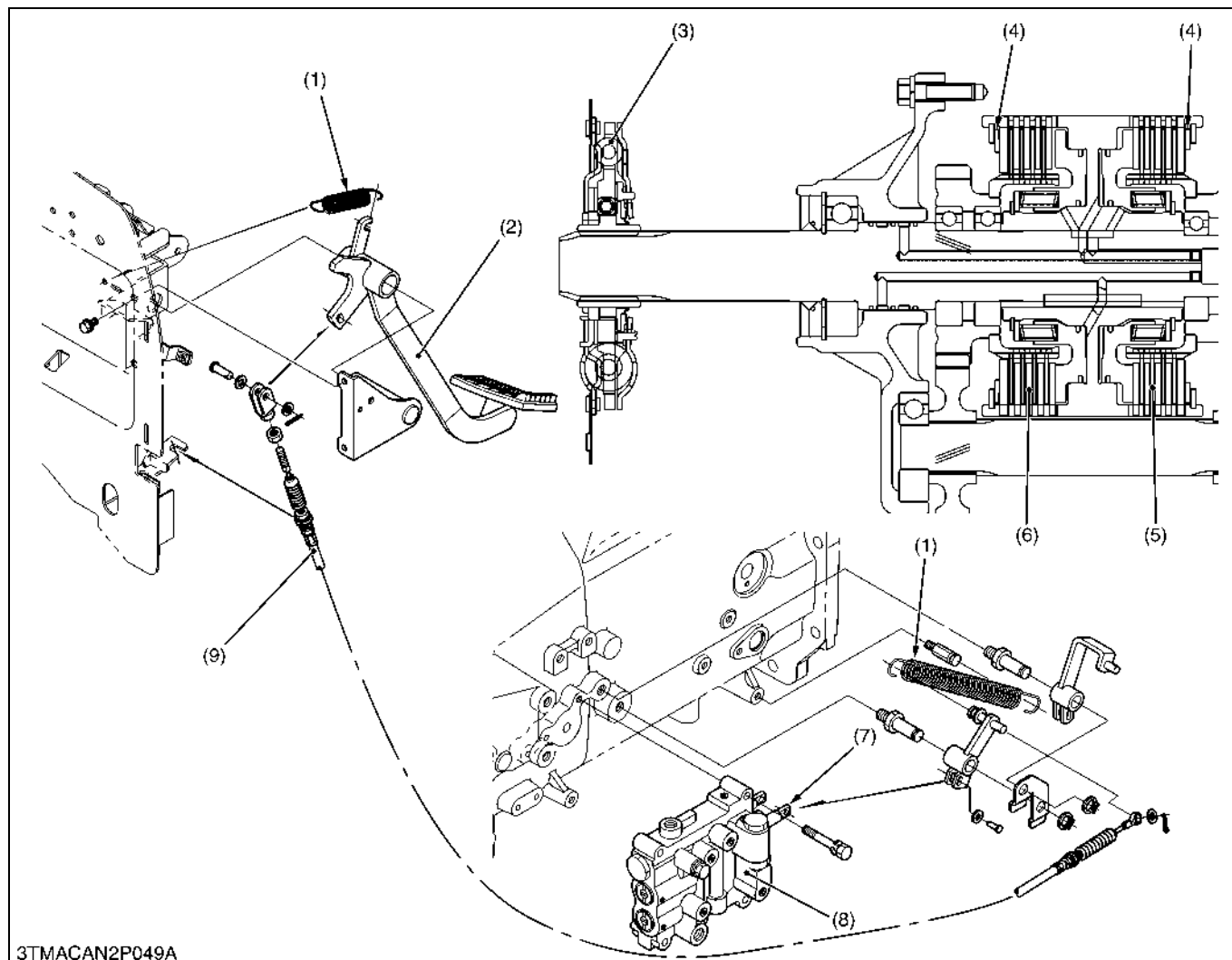
(8) Range Gear Shift Section
(9) 4WD Section

(10) Dual Speed Section
(11) Creep Gear Section (Cassette Type) (Option)

2. POWER TRAIN FOR TRAVELING GEAR

[1] HYDRAULIC SHUTTLE SHIFT SECTION

(1) Structure



- (1) Return Spring
- (2) Clutch Pedal
- (3) Damper Disk

- (4) Belleville Washer
(Cupped Spring Washer)
- (5) Forward Side Clutch

- (6) Reverse Side Clutch
- (7) Clutch Spool

- (8) Hydraulic Shuttle Valve
- (9) Clutch Cable

The damper disk (3) helps ease the shock load when engaging the shuttle clutch.

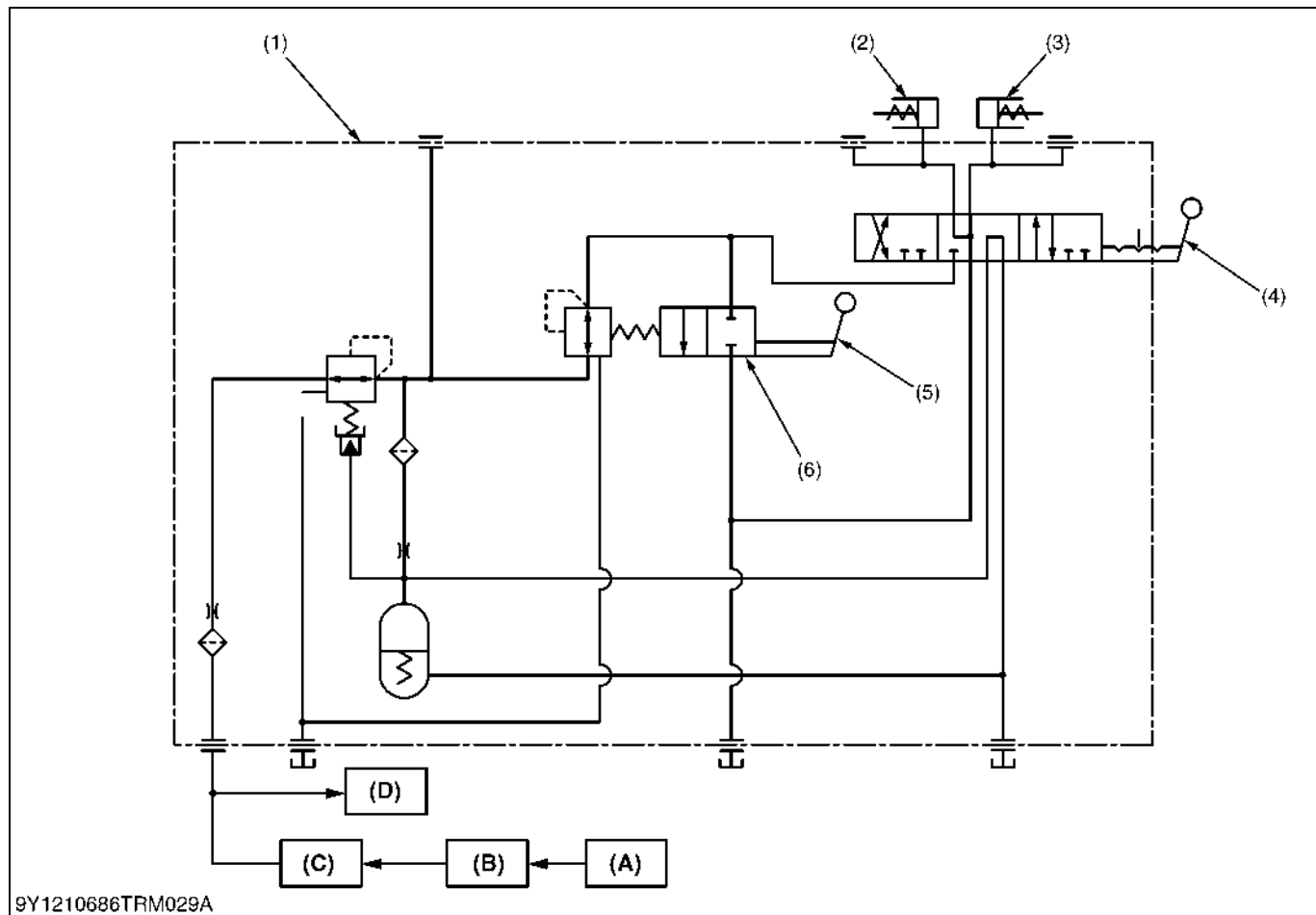
The belleville washer (cupped spring washer) (4) helps ease the engaging shock together with modulating valve effect.

The hydraulic shuttle clutch, which switches forward and reverse running, function as the traveling clutch. When the clutch pedal (2) is depressed, the clutch spool of shuttle valve (8) moves via the clutch cable (9).

As for the oil, it does not flow to both the forward side (5) and reverse side (6) of the clutch pack, the clutch pack enters the state of **"Disengaged"** and power is not transmitted.

9Y1210686TRM0004US0

(2) Oil Flow



(1) Shuttle Valve
(2) Reverse Clutch

(3) Forward Clutch
(4) Shuttle Lever

(5) Clutch Pedal
(6) Spool

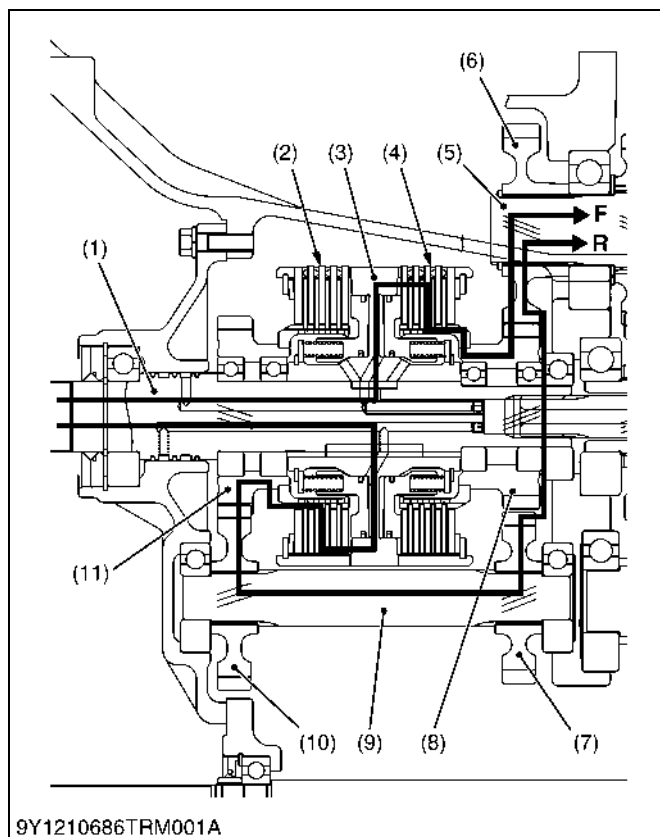
(A) Pump
(B) Power Steering Controller
(C) Oil Cooler
(D) PTO Clutch and Other Clutches

When the shuttle lever (4) shifts to the forward or reverse, the oil flows to the forward or reverse clutch (2), (3) respectively.

When clutch pedal (5) is depressed, feeding oil returns to the tank through the spool (6), and the clutch is in a **"Disengage"** position.

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(3) Hydraulic Clutch Pack



Shuttle Shift Section

The shuttle shift section allows the operators to change forward and reverse with a shuttle lever. It is using hydraulic clutch shifting.

When the shuttle lever is moved to the **F** or **R** position, clutch is engaged to the front or rear by the hydraulic.

■ F8/R8, F12/R12 Speed Transmission Model

(Forward)

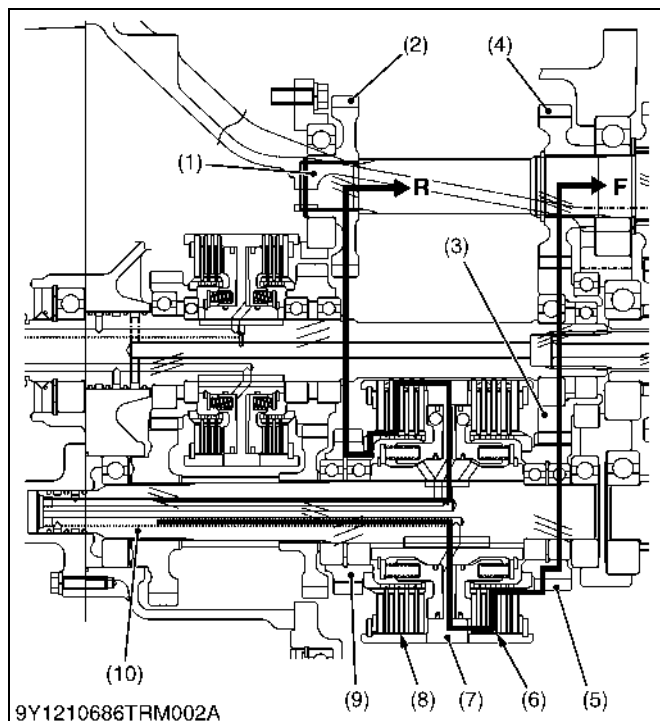
Input Shaft (1) → Shuttle Clutch Body (3) → Clutch Disk and Plate (4) → 26T Gear (8) → 30T Gear (6) → 1st Shaft (5)

(Reverse)

Input Shaft (1) → Shuttle Clutch Body (3) → Clutch Disk and Plate (2) → 28T Gear (11) → 26T Gear (10) → Counter Shaft (9) → 24T Gear (7) → 30T Gear (6) → 1st Shaft (5)

- | | |
|---------------------------|-------------------|
| (1) Input Shaft | (8) 26T Gear |
| (2) Clutch Disk and Plate | (9) Counter Shaft |
| (3) Shuttle Clutch Body | (10) 26T Gear |
| (4) Clutch Disk and Plate | (11) 28T Gear |
| (5) 1st Shaft | |
| (6) 30T Gear | F: Forward |
| (7) 24T Gear | R: Reverse |

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■ F24/R24 Speed Transmission Model

(Forward)

Shuttle Shaft (10) → Shuttle Clutch Body (7) → Clutch Disk and Plate (6) → 24T Gear (5) → 31T Gear (3) → 27T Gear (4) → 1st Shaft (1)

(Reverse)

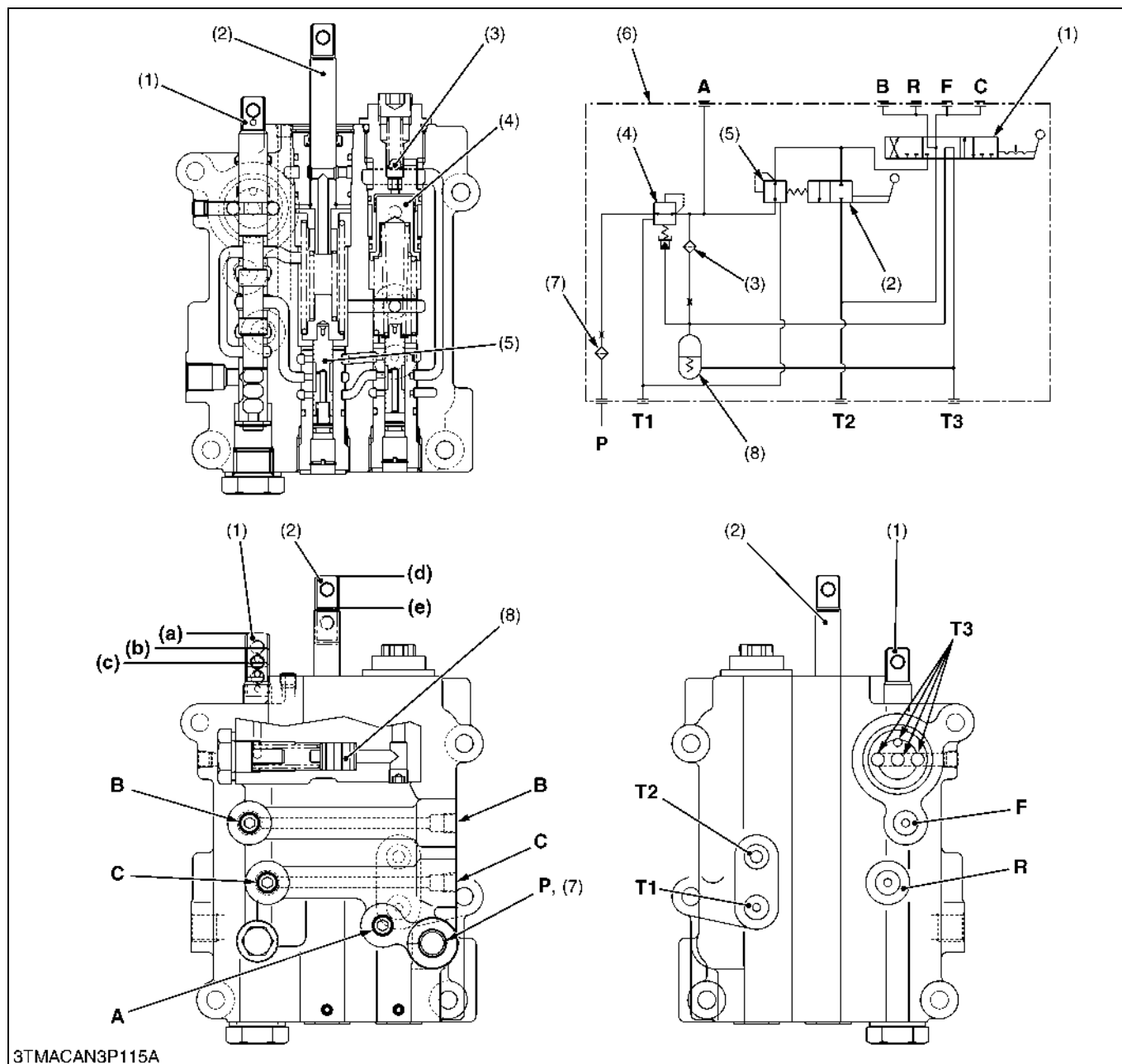
Shuttle Shaft (10) → Shuttle Clutch Body (7) → Clutch Disk and Plate (8) → 27T Gear (9) → 30T Gear (2) → 1st Shaft (1)

- | | |
|---------------------------|---------------------------|
| (1) 1st Shaft | (8) Clutch Disk and Plate |
| (2) 30T Gear | (9) 27T Gear |
| (3) 31T Gear | (10) Shuttle Shaft |
| (4) 27T Gear | |
| (5) 24T Gear | F: Forward |
| (6) Clutch Disk and Plate | R: Reverse |
| (7) Shuttle Clutch Body | |

9Y1210686TRM0007US0

[2] HYDRAULIC SHUTTLE VALVE SECTION

(1) Structure



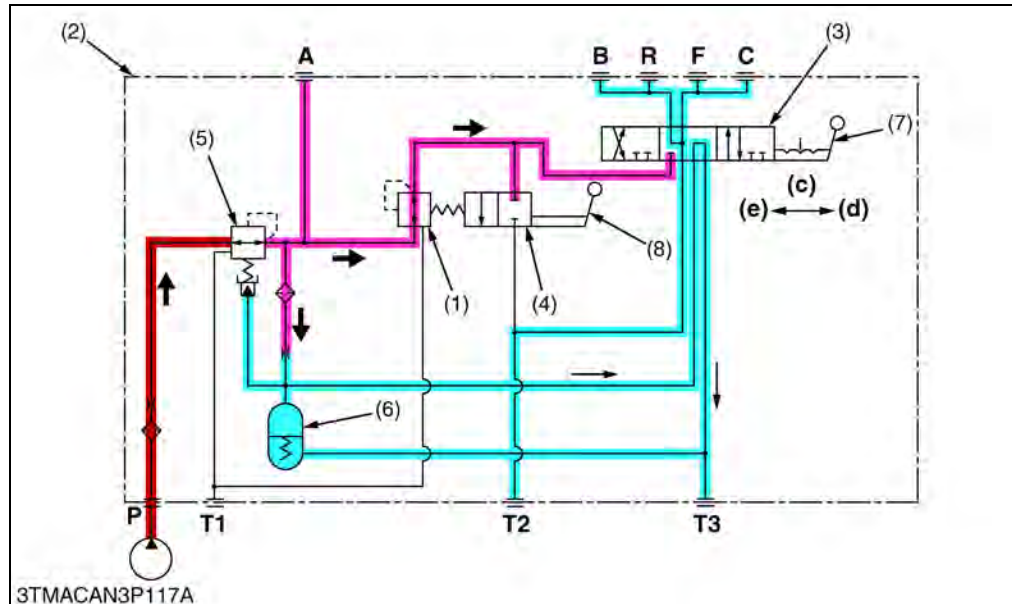
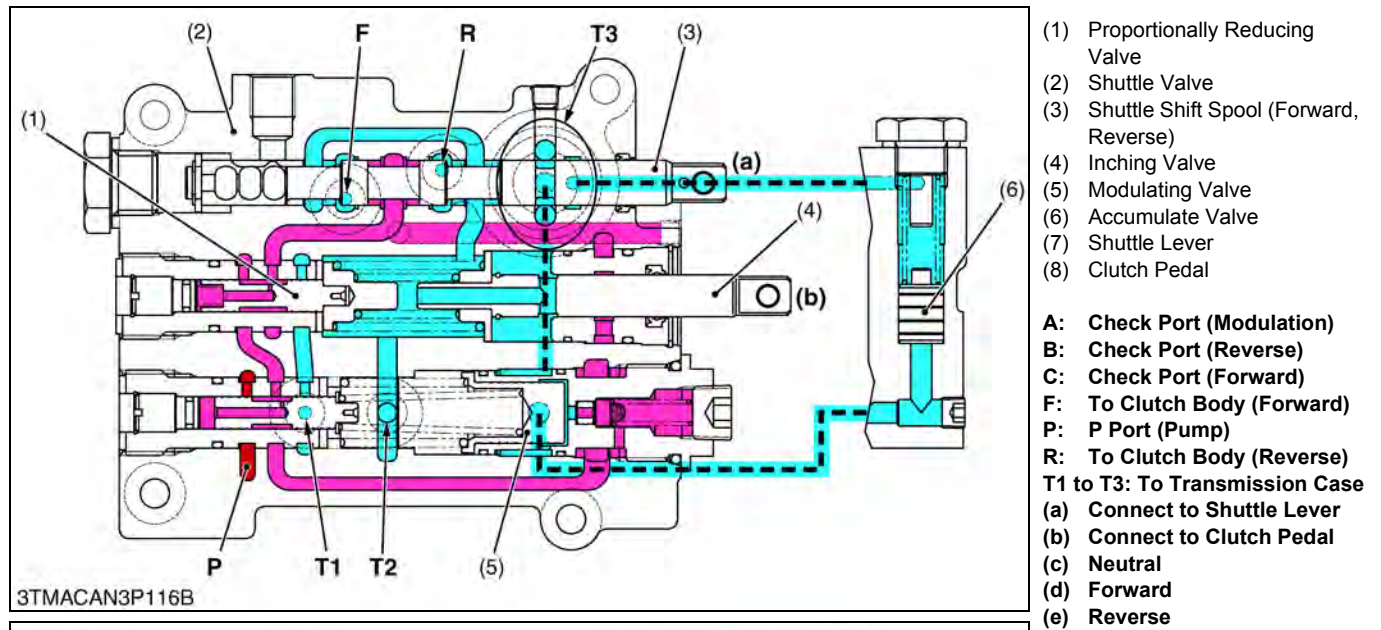
- | | | | |
|---|--|--|--------------------------------|
| (1) Shuttle Shift Spool
(Forward, Reverse) | (a) Shuttle Forward Position | A: Pressure Check Port
(Modulation) | F: To Clutch Body (Forward) |
| (2) Inching Valve Spool | (b) Shuttle Neutral Position | B: Pressure Check Port
(Reverse) | P: P Port (Pump) |
| (3) Line Filter | (c) Shuttle Reverse Position | C: Pressure Check Port
(Forward) | R: To Clutch Body (Reverse) |
| (4) Modulating Valve | (d) Clutch Pedal Depressed
Position | | T1 to T3: To Transmission Case |
| (5) Proportionally Reducing Valve | (e) Clutch Pedal Released
Position | | |
| (6) Shuttle Valve | | | |
| (7) Line Filter | | | |
| (8) Accumulate Valve | | | |

Hydraulic shuttle valve is composed of modulating valve (4), proportionally reducing valve (5), shuttle shift spool (1), accumulate valve (8) and other component parts.

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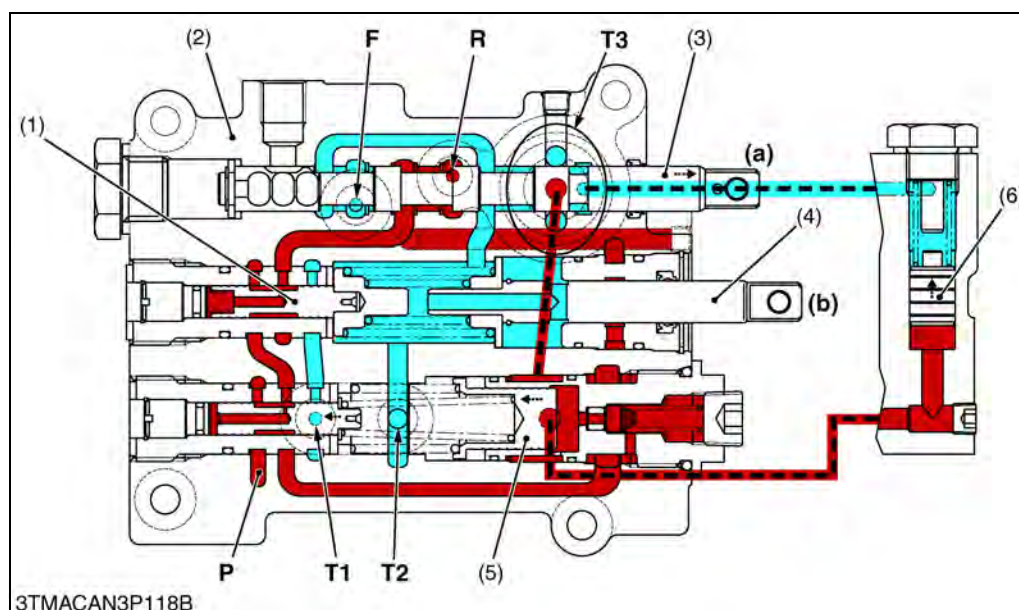
(2) Operation

Shuttle Lever at Neutral Position



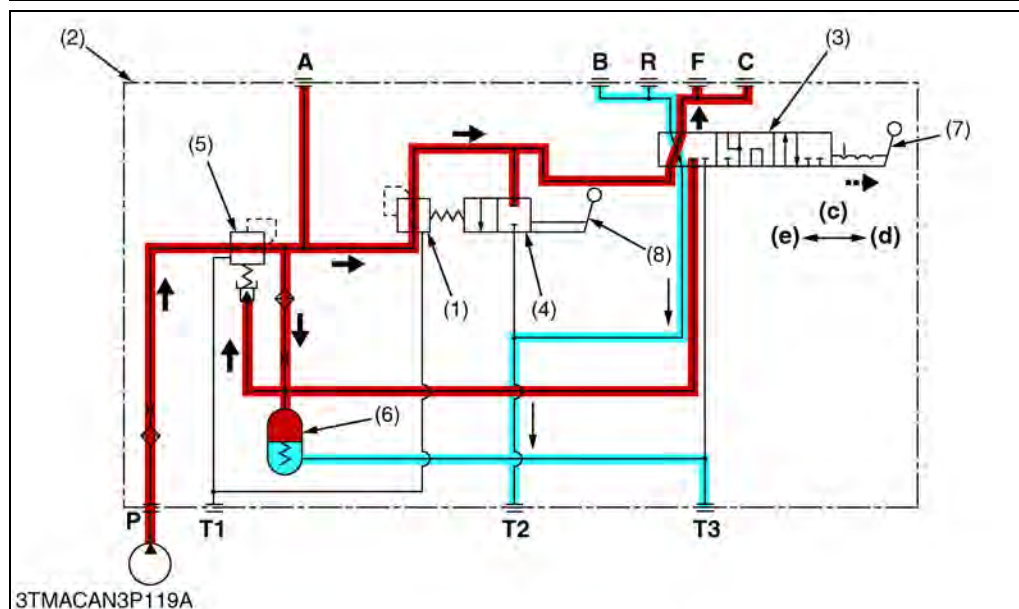
When the shuttle lever at **"Neutral"** position, as the oil passage between **P** port to **F** or **R** port is closed by shuttle shift spool (3), pressure-fed oil from **P** port flows to the **T3** port. Thus the shuttle clutch is not engaged.

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When Shuttle Lever is Shifting Neutral to Reverse or Forward Position (Clutch Pedal is Released)

- (1) Proportionally Reducing Valve
- (2) Shuttle Valve
- (3) Shuttle Shift Spool (Forward, Reverse)
- (4) Inching Valve
- (5) Modulating Valve
- (6) Accumulate Valve
- (7) Shuttle Lever
- (8) Clutch Pedal

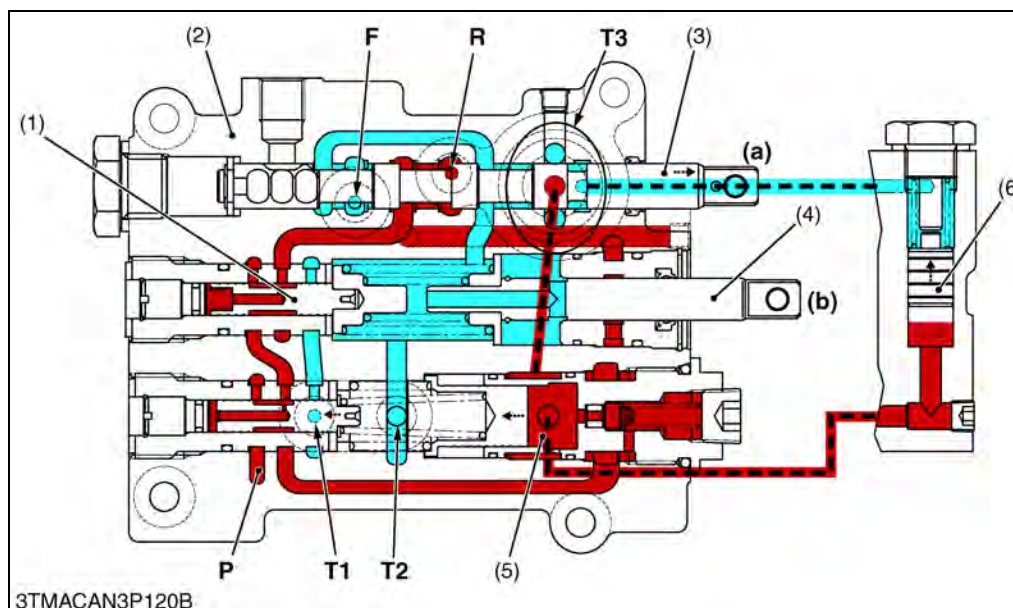
- A:** Check Port (Modulation)
- B:** Check Port (Reverse)
- C:** Check Port (Forward)
- F:** To Clutch Body (Forward)
- P:** P Port (Pump)
- R:** To Clutch Body (Reverse)
- T1 to T3:** To Transmission Case
- (a)** Connect to Shuttle Lever
- (b)** Connect to Clutch Pedal
- (c)** Neutral
- (d)** Forward
- (e)** Reverse



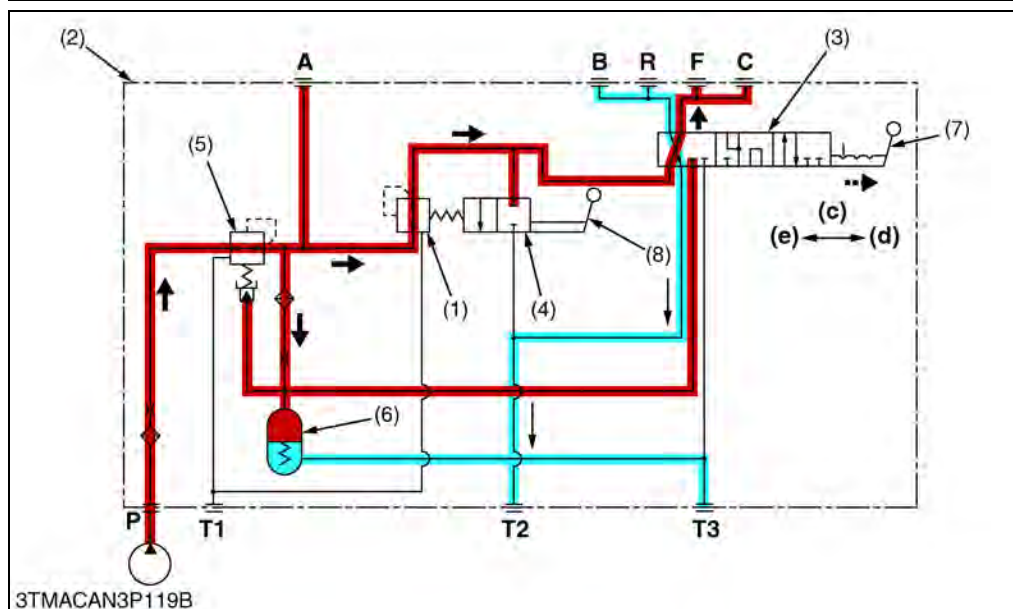
When the shuttle lever is moved to **"REVERSE"** or **"FORWARD"**, pressure-fed oil from **P** port flows into shuttle clutch via **R** or **F** port. At this time, the pressure of **R** or **F** port is increased gradually by modulating valve (5).

When the shuttle clutch is engaging, the accumulate valve (6) assists the operation of modulating valve (5) to reduce a shock.

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When Lever at Forward Position (Clutch Pedal is Released)

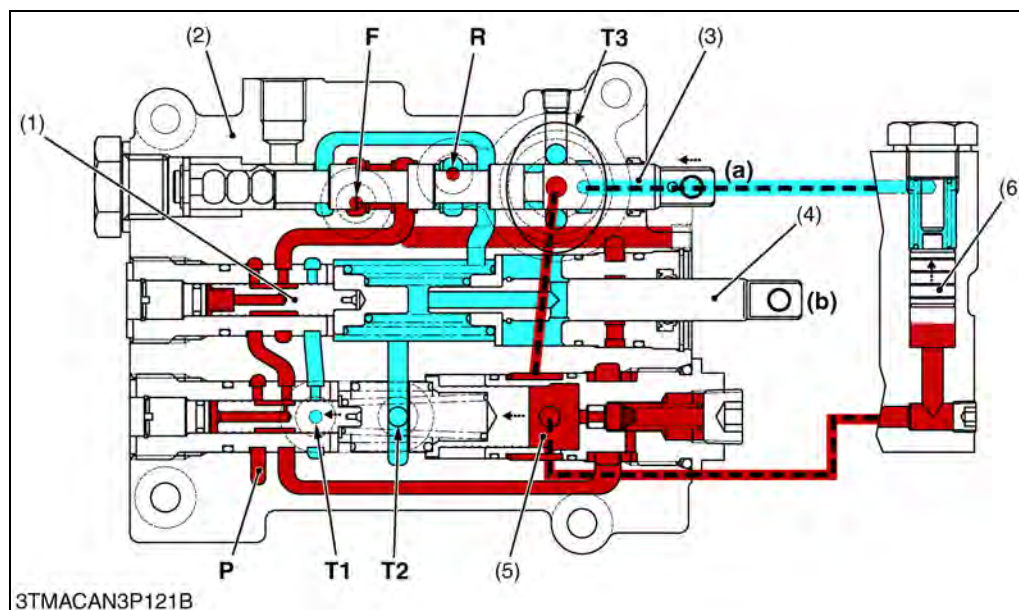
- (1) Proportionally Reducing Valve
 - (2) Shuttle Valve
 - (3) Shuttle Shift Spool (Forward, Reverse)
 - (4) Inching Valve
 - (5) Modulating Valve
 - (6) Accumulate Valve
 - (7) Shuttle Lever
 - (8) Clutch Pedal
- A:** Check Port (Modulation)
B: Check Port (Reverse)
C: Check Port (Forward)
F: To Clutch Body (Forward)
P: P Port (Pump)
R: To Clutch Body (Reverse)
T1 to T3: To Transmission Case
(a) Connect to Shuttle Lever
(b) Connect to Clutch Pedal
(c) Neutral
(d) Forward
(e) Reverse



When the shuttle lever has been setting on the **F** side, the oil pressure on **F** port is constantly controlled by proportionally reducing valve (1).

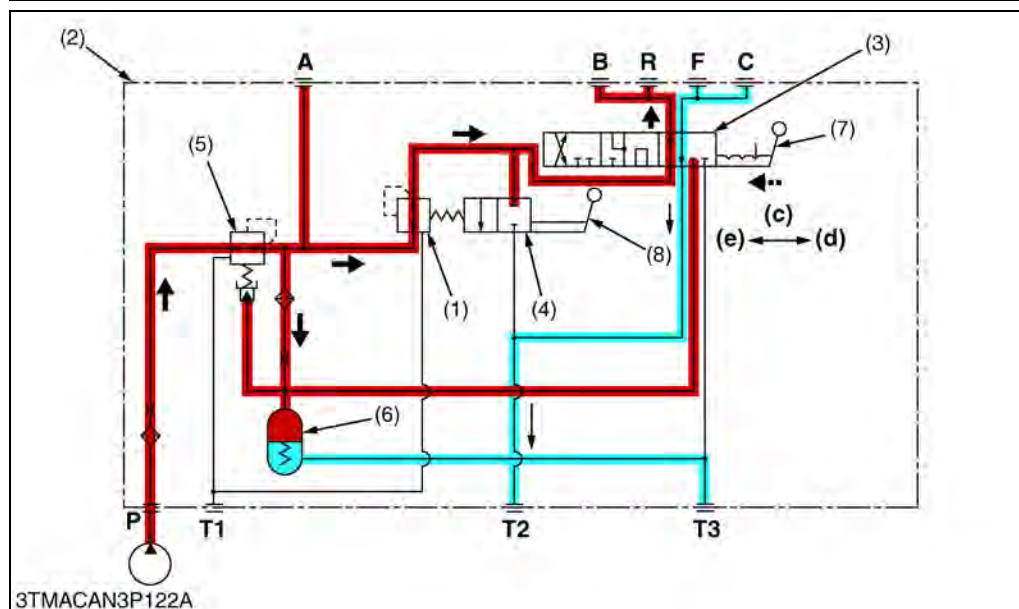
On the other hand, the oil in the **R** side of shuttle clutch returns to **T2** port through **R** port and shuttle shift spool (3).

9Y1210686TRM0011US0

When Lever at Reverse Position (Clutch Pedal is Released)

- (1) Proportionally Reducing Valve
- (2) Shuttle Valve
- (3) Shuttle Shift Spool (Forward, Reverse)
- (4) Inching Valve
- (5) Modulating Valve
- (6) Accumulate Valve
- (7) Shuttle Lever
- (8) Clutch Pedal

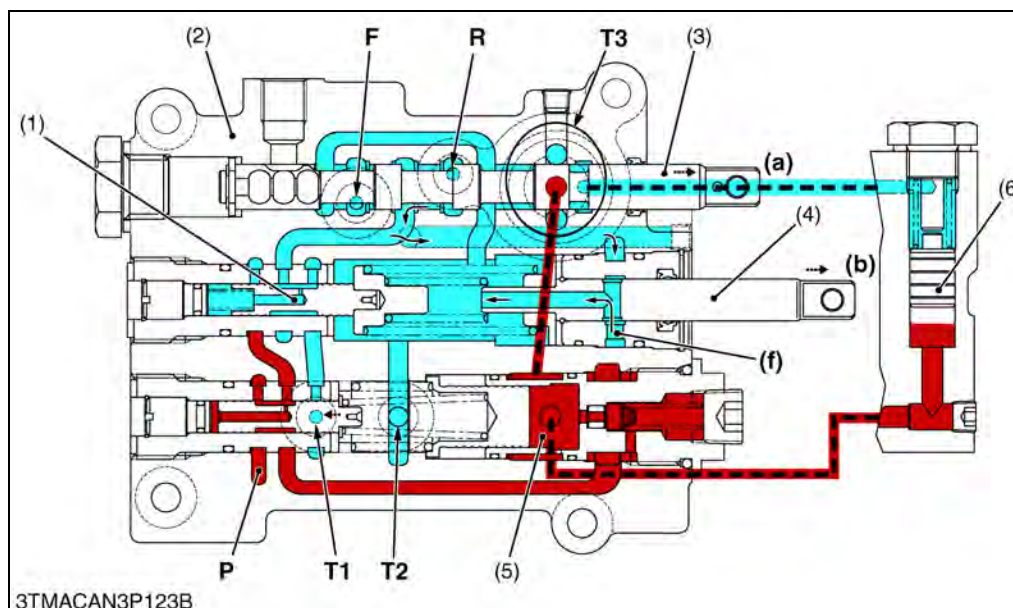
- A:** Check Port (Modulation)
- B:** Check Port (Reverse)
- C:** Check Port (Forward)
- F:** To Clutch Body (Forward)
- P:** P Port (Pump)
- R:** To Clutch Body (Reverse)
- T1 to T3:** To Transmission Case
- (a)** Connect to Shuttle Lever
- (b)** Connect to Clutch Pedal
- (c)** Neutral
- (d)** Forward
- (e)** Reverse



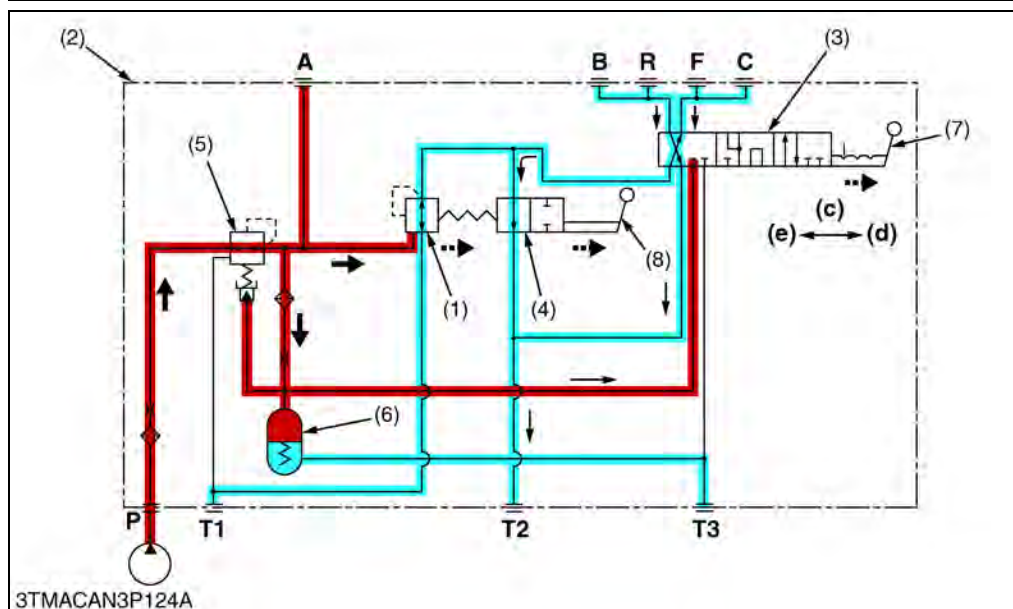
When the shuttle lever has been setting on the **R** side, the oil pressure on **R** port is constantly controlled by proportionally reducing valve (1).

On the other hand, the oil in the **F** side of shuttle clutch returns to **T2** through **F** port and shuttle shift spool (3).

9Y1210686TRM0012US0

When Clutch Pedal is Depressed (with Shuttle Lever at Reverse or Forward Position)

- (1) Proportionally Reducing Valve
 - (2) Shuttle Valve
 - (3) Shuttle Shift Spool (Forward, Reverse)
 - (4) Inching Valve
 - (5) Modulating Valve
 - (6) Accumulate Valve
 - (7) Shuttle Lever
 - (8) Clutch Pedal
- A:** Check Port (Modulation)
B: Check Port (Reverse)
C: Check Port (Forward)
F: To Clutch Body (Forward)
P: P Port (Pump)
R: To Clutch Body (Reverse)
T1 to T3: To Transmission Case
(a) Connect to Shuttle Lever
(b) Connect to Clutch Pedal
(c) Neutral
(d) Forward
(e) Reverse
(f) Passage



With the shuttle lever at **R** or **F** position, when the clutch pedal is depressed, the inching valve (4) is moved to the right. And connect the passage (f) to **T2** port. As the proportionally reducing valve (1) is moved to the right by pressure difference, **R** port (or **F** port) and **T2** port are connected.

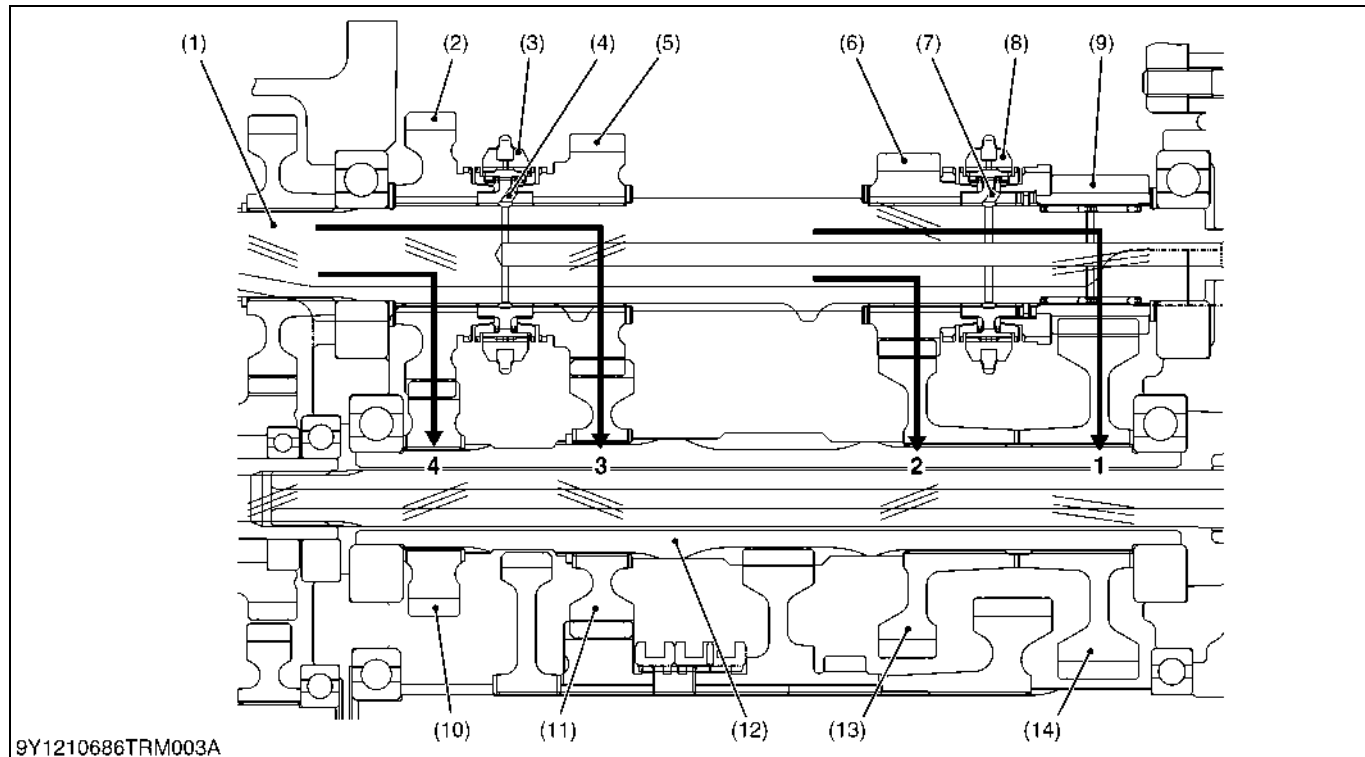
The oil in the shuttle clutch returns into the transmission case via **R** port (or **F** port) through the proportionally reducing valve (1) and **T2** port. This cause the shuttle clutch to be set to off.

As a result, even when the proportionally reducing valve (1) does not move, the oil passage from **R** port (or **F** side) to **T2** port is secured.

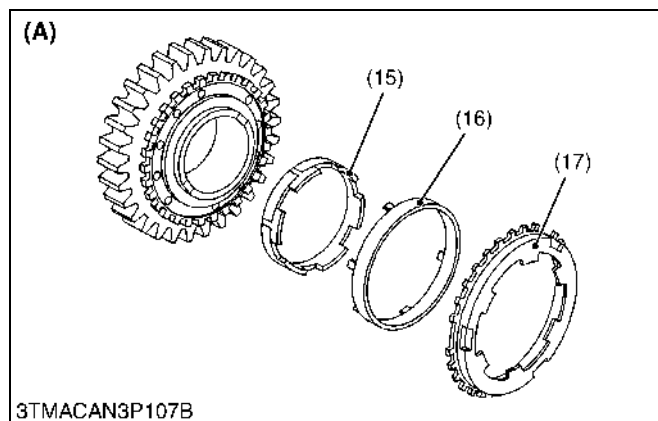
9Y1210686TRM0013US0

[3] MAIN GEAR SHIFT SECTION

(1) F8/R8 Speed Transmission Model



- | | | | |
|---------------|---------------|------------------------------|---|
| (1) 1st Shaft | (6) 21T Gear | (11) 30T Gear | (16) Center Ring |
| (2) 31T Gear | (7) Coupling | (12) 14T Gear Shaft | (17) Outer Synchronizer Ring |
| (3) Shifter | (8) Shifter | (13) 35T Gear | |
| (4) Coupling | (9) 17T Gear | (14) 43T Gear | |
| (5) 26T Gear | (10) 25T Gear | (15) Inner Synchronizer Ring | (A) Double Corn Type
Synchromesh |



The main shift section uses a synchromesh type transmission.

■ **1st Speed**

1st Shaft (1) → Coupling (7) → Shifter (8) → 17T Gear (9) → 43T Gear (14) → 14T Gear Shaft (12).

■ **2nd Speed**

1st Shaft (1) → Coupling (7) → Shifter (8) → 21T Gear (6) → 35T Gear (13) → 14T Gear Shaft (12).

■ **3rd Speed**

1st Shaft (1) → Coupling (4) → Shifter (3) → 26T Gear (5) → 30T Gear (11) → 14T Gear Shaft (12).

■ **4th Speed**

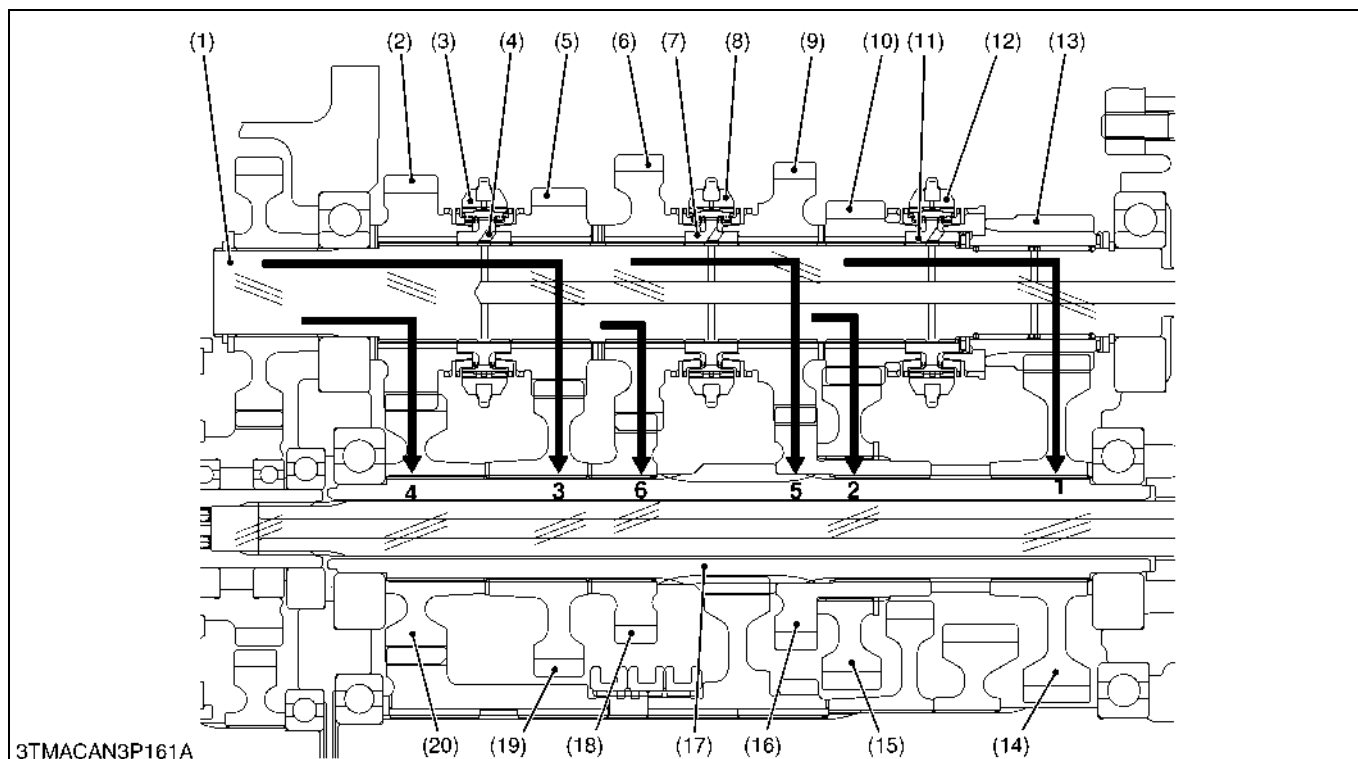
1st Shaft (1) → Coupling (4) → Shifter (3) → 31T Gear (2) → 25T Gear (10) → 14T Gear Shaft (12).

NOTE

- For synchro shuttle model uses a double corn type (key type) synchromesh.

9Y1210686TRM0014US0

(2) F12/R12 and F24/R24 Speed Transmission Model



- | | | | |
|---------------|---------------|---------------|---------------------|
| (1) 1st Shaft | (6) 35T Gear | (11) Coupling | (16) 27T Gear |
| (2) 27T Gear | (7) Coupling | (12) Shifter | (17) 14T Gear Shaft |
| (3) Shifter | (8) Shifter | (13) 17T Gear | (18) 22T Gear |
| (4) Coupling | (9) 30T Gear | (14) 43T Gear | (19) 33T Gear |
| (5) 23T Gear | (10) 20T Gear | (15) 37T Gear | (20) 30T Gear |

■ 1st Speed

1st Shaft (1) → Coupling (11) → Shifter (12) → 17T Gear (13) → 43T Gear (14) → 14T Gear Shaft (17).

■ 2nd Speed

1st Shaft (1) → Coupling (11) → Shifter (12) → 20T Gear (10) → 37T Gear (15) → 14T Gear Shaft (17).

■ 3rd Speed

1st Shaft (1) → Coupling (4) → Shifter (3) → 23T Gear (5) → 33T Gear (19) → 14T Gear Shaft (17).

■ 4th Speed

1st Shaft (1) → Coupling (4) → Shifter (3) → 27T Gear (2) → 30T Gear (20) → 14T Gear Shaft (17).

■ 5th Speed

1st Shaft (1) → Coupling (7) → Shifter (8) → 30T Gear (9) → 27T Gear (16) → 14T Gear Shaft (17).

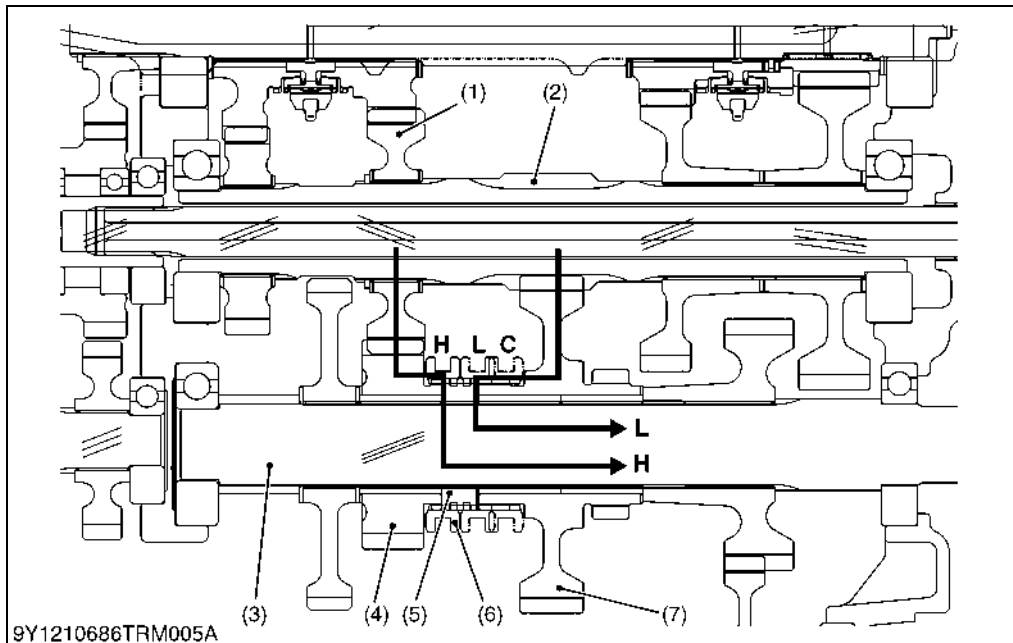
■ 6th Speed

1st Shaft (1) → Coupling (7) → Shifter (8) → 35T Gear (6) → 22T Gear (18) → 14T Gear Shaft (17).

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[4] RANGE GEAR SHIFT SECTION

(1) F8/R8 Speed Transmission Model



- (1) 30T Gear
- (2) 14T Gear Shaft (2nd Shaft)
- (3) 3rd Shaft
- (4) 25T Gear
- (5) Coupling
- (6) Shifter
- (7) 45T-22T Gear

H : Hi Speed Range
L : Lo Speed Range
C : Creep Speed Range
 (Option)

The range gear shift section allows the operator to change H-L speed with an range speed change lever is moved to the H-L position. The H-L shifter (6) slides to the front or rear by mechanical linkage to be engaged with the 25T gear (4) or 45T-22T gear (7).

Then, power is transmitted as follows.

(Hi Speed Range)

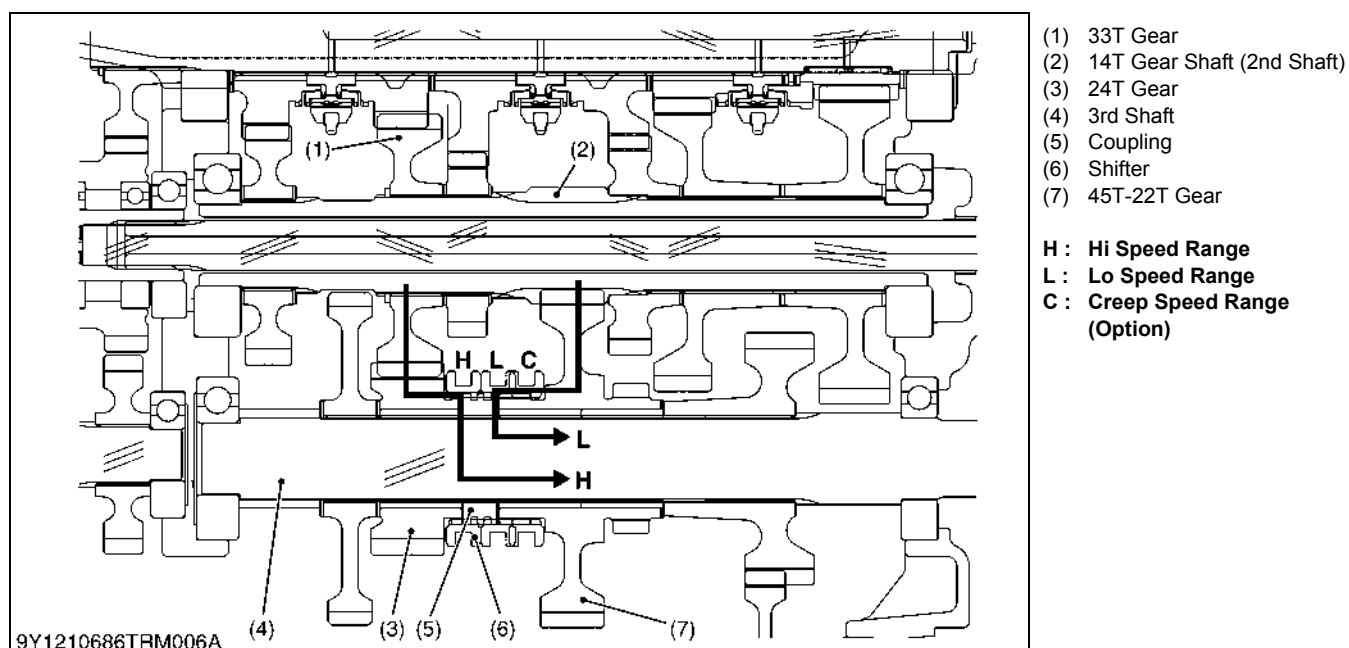
14T Gear Shaft (2) → 30T Gear (1) → 25T Gear (4) → Shifter (6) → Coupling (5) → 3rd Shaft (3).

(Lo Speed Range)

14T Gear Shaft (2) → 45T-22T Gear (7) → Shifter (6) → Coupling (5) → 3rd Shaft (3).

9Y1210686TRM0016US0

(2) F12/R12 and F24/R24 Speed Transmission Model



The range gear shift section allows the operator to change H-L with an range speed change lever is moved to the H-L position. The H-L shifter (6) slides to the front or rear by mechanical linkage to be engaged with the 24T gear (3) or 45T-22T gear (7).

Then, power is transmitted as follows.

(Hi Speed Range)

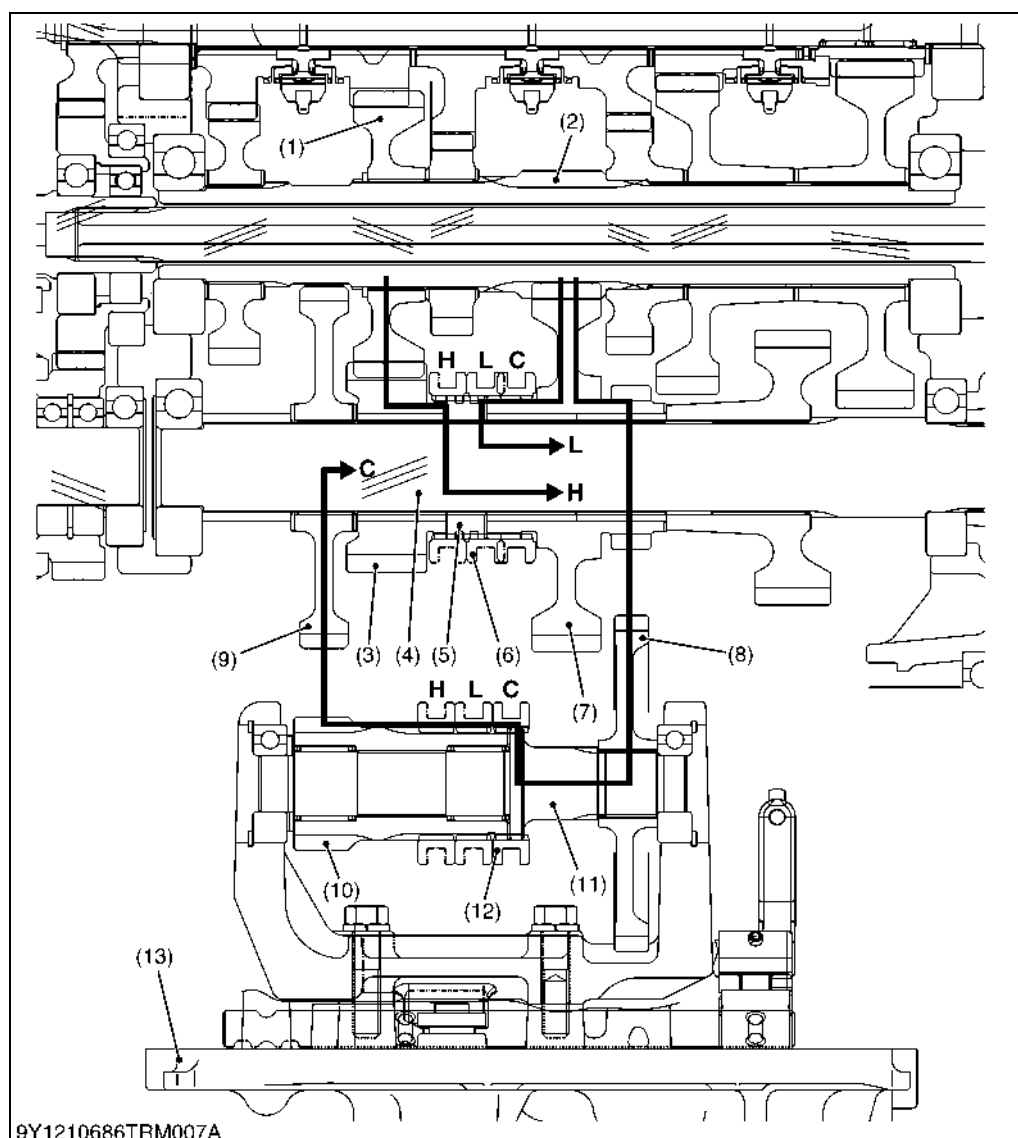
14T Gear Shaft (2) → 33T Gear (1) → 24T Gear (3) → Shifter (6) → Coupling (5) → 3rd Shaft (4).

(Lo Speed Range)

14T Gear Shaft (2) → 45T-22T Gear (7) → Shifter (6) → Coupling (5) → 3rd Shaft (4).

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(3) Creep Gear Shift Section (Option)



- (1) 33T Gear
- (2) 14T Gear Shaft (2nd Shaft)
- (3) 24T Gear
- (4) 3rd Shaft
- (5) Coupling
- (6) Shifter 1
- (7) 45T-22T Gear
- (8) 48T Gear
- (9) 53T Gear
- (10) 17T Gear
- (11) Creep Shaft
- (12) Shifter 2
- (13) Shift Charge Cover

H : Hi Speed Range
L : Lo Speed Range
C : Creep Speed Range (Option)

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The range gear shift section allows the operator to change an range speed change lever is moved to the H-L-C position. The shifter 1 (6) slides to the front or rear by mechanical linkage to be engaged with the 24T gear (3) or 45T-22T gear (7) for H and L position. The shifter 2 (12) slides to H, L or C position by mechanical linkage to be engaged with the 17T gear (10) and creep shaft (11) for L or C position.

Then, power is transmitted as follows.

The shifter 1 (6) for H-L locates on the 3rd shaft (4) and shifter 2 (12) for creep locates on the creep shaft (11).

They operated by one piece type shift fork same time.

(Hi Speed Range)

14T Gear Shaft (2) → 33T Gear (1) → 24T Gear (3) → Shifter 1 (6) → Coupling (5) → 3rd Shaft (4).

(Lo Speed Range)

14T Gear Shaft (2) → 45T-22T Gear (7) → Shifter 1 (6) → Coupling (5) → 3rd Shaft (4).

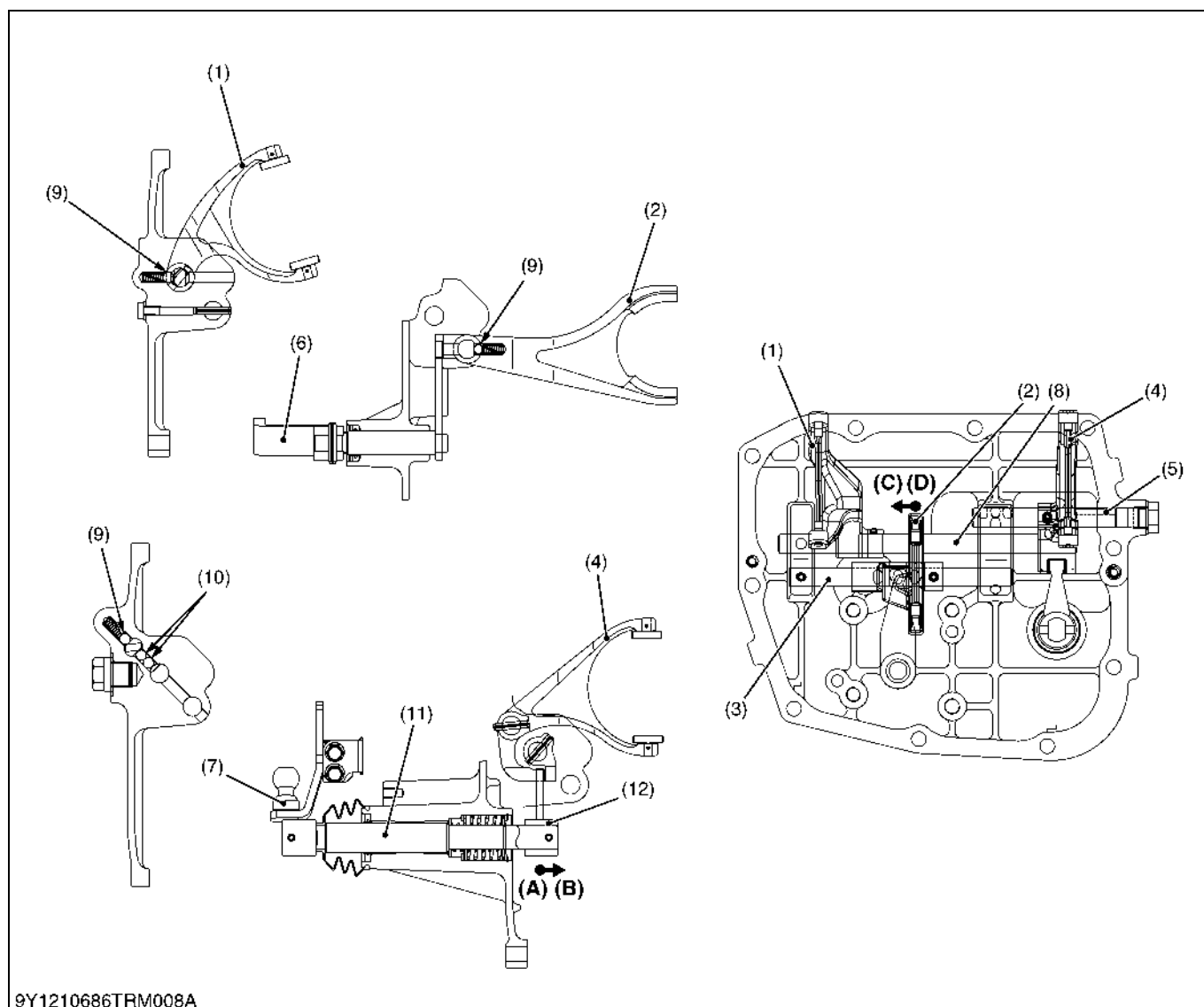
(Creep Speed Range) (Option)

14T Gear Shaft (2) → 45T-22T Gear (7) → 48T Gear (8) → Creep Shaft (11) → Shifter 2 (12) → 17T Gear (10) → 53T Gear (9) → 3rd Shaft (4).

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[5] SHIFT FORK ROD AND FORK

(1) F8/R8 Speed Transmission Model



9Y1210686TRM008A

(1) 3rd-4th Shift Fork

(2) H-L Fork

(3) H-L Rod

(4) 1st-2nd Shift Fork

(5) 1st-2nd Shift Fork Rod

(6) H-L Lever

(7) Main Shift Lever

(8) 3rd-4th Shift Fork Rod

(9) Detent Ball

(10) Interlock Ball

(11) Main Shift Shaft

(12) Select Arm

(A) Select 1st-2nd Shift Fork Rod

(B) Select 3rd-4th Shift Fork Rod

(C) Engage to Hi Position

(D) Engage to Lo Position

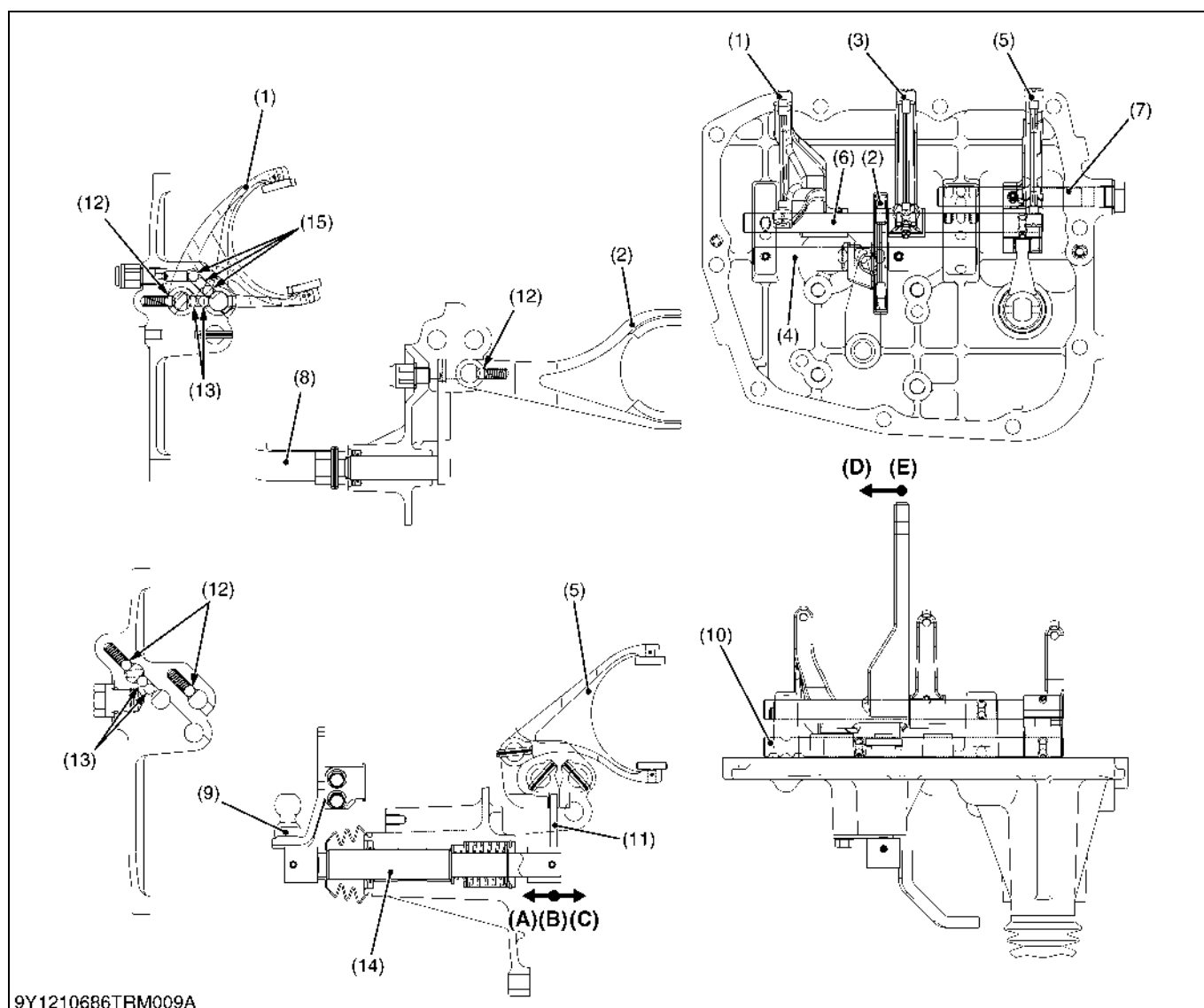
H: Hi Speed Range

L: Lo Speed Range

- Interlock balls (10) restrain the movement of the 1st-2nd shift fork rod (5) and 3rd-4th shift fork rod (8) at the same time. As a result, double engagement of the gear is prevented.
- Detent balls (9) prevent the self disengagement of the gears.
- When operating the main shift lever (7) with select motion, select the select arm (12) by pushing the main shift shaft (11).
There for select arm (12) select **(A)** (1st-2nd shift fork (4)) or **(B)** (3rd-4th shift fork rod (8)).
- When operating the H-L lever (6), the H-L fork (2) engages to H or L position.

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(2) F12/R12 and F24/R24 Speed Transmission Model



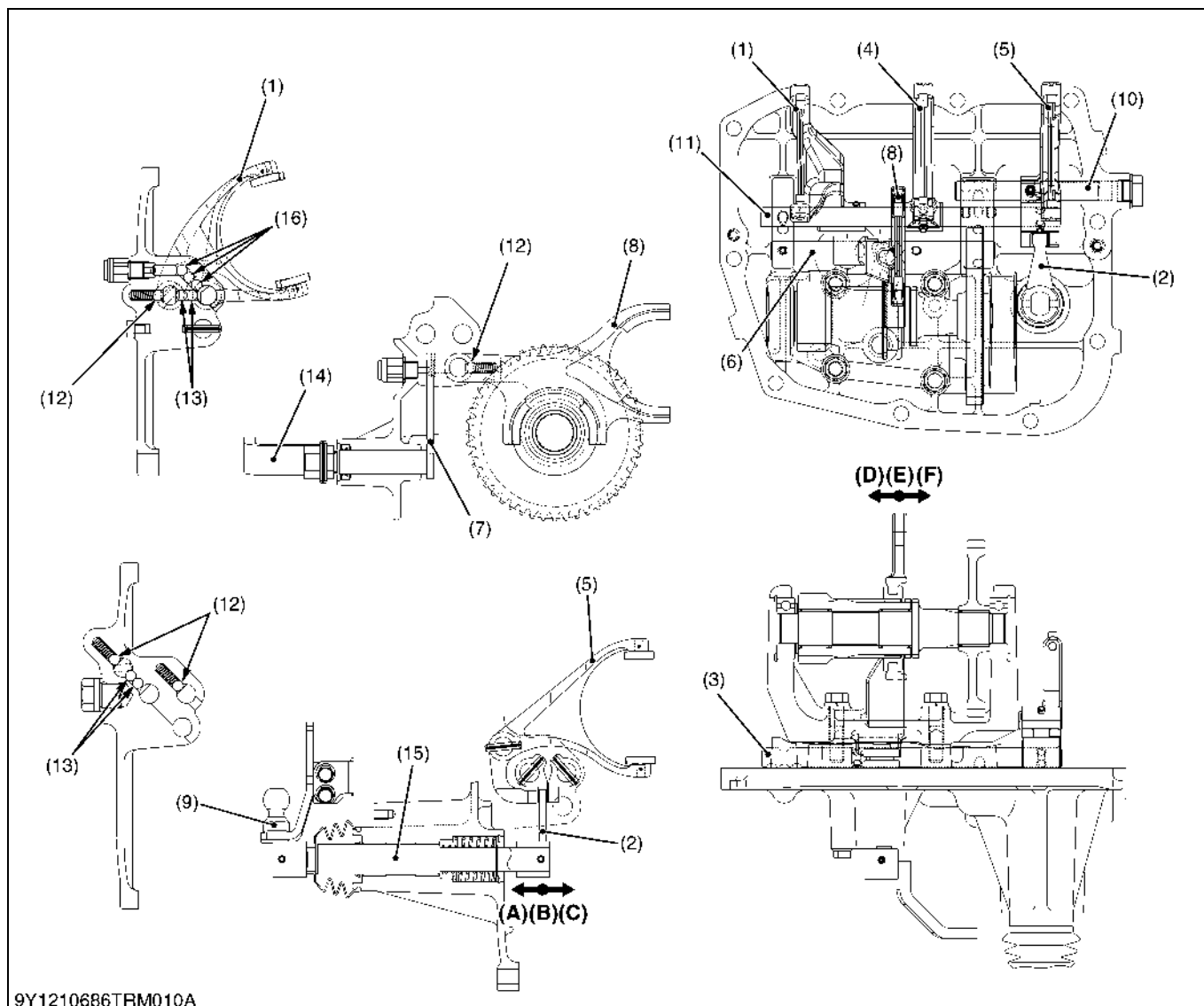
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- | | | | |
|----------------------------|-----------------------------|-----------------------------------|-----------------------------------|
| (1) 3rd-4th Shift Fork | (8) H-L Lever | (15) Interlock Ball 2 | (C) Select 5th-6th Shift Fork Rod |
| (2) H-L Fork | (9) Main Shift Lever | | (D) Engage to Hi Position |
| (3) 5th-6th Shift Fork | (10) 3rd-4th Shift Fork Rod | (A) Select 1st-2nd Shift Fork Rod | (E) Engage to Lo Position |
| (4) H-L Rod | (11) Select Arm | (B) Select 3rd-4th Shift Fork Rod | H: Hi Speed Range |
| (5) 1st-2nd Shift Fork | (12) Detent Ball | | L: Lo Speed Range |
| (6) 5th-6th Shift Fork Rod | (13) Interlock Ball 1 | | |
| (7) 1st-2nd Shift Fork Rod | (14) Main Shift Shaft | | |

- Interlock balls (13) restrain the movement of the 1st-2nd shift fork rod (7), 3rd-4th shift fork rod (10) and 5th-6th shift fork rod (6) at the same time. As a result, double engagement of the gear is prevented.
- When selecting the 5th-6th shift fork rod (6), interlock balls (15) turn on switch.
- Detent balls (12) prevent the self disengagement of the gears.
- When operating the main shift lever (9) with select motion, select the select arm (11) by pushing the main shift shaft (14).
There for select arm (11) select (A) (1st-2nd shift fork (5)) or (B) (3rd-4th shift fork rod (10)) or (C) (5th-6th shift fork rod (6)).
- When operating the H-L lever (8), the H-L fork (2) engages to H or L position.

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(3) Creep Gear Shift Section (Option)



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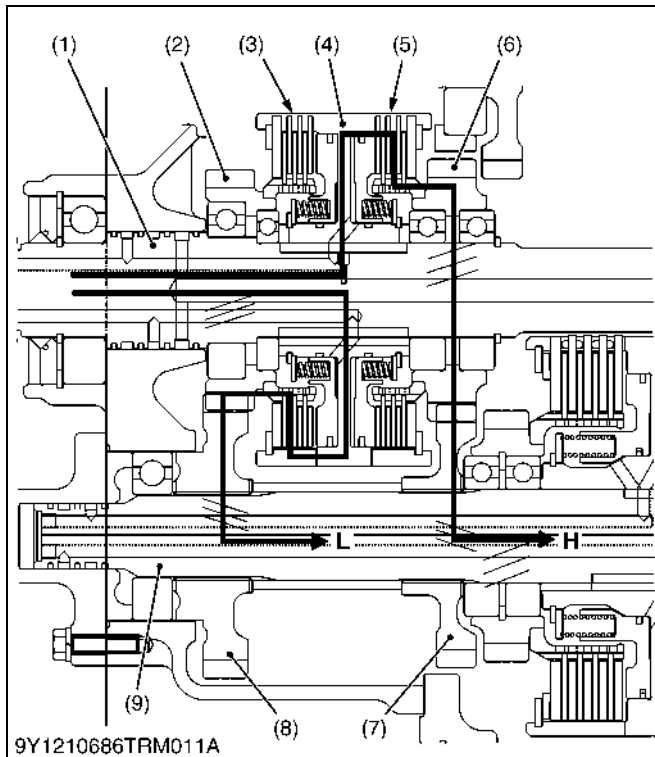
- | | | | |
|----------------------------|-----------------------------|-----------------------------------|-------------------------------|
| (1) 3rd-4th Shift Fork | (9) Main Shift Lever | (A) Select 1st-2nd Shift Fork Rod | (E) Engage to Lo Position |
| (2) Select Arm | (10) 1st-2nd Shift Fork Rod | (B) Select 3rd-4th Shift Fork Rod | (F) Engage to Creep Position |
| (3) 3rd-4th Shift Fork Rod | (11) 5th-6th Shift Fork Rod | (C) Select 5th-6th Shift Fork Rod | H: Hi Speed Range |
| (4) 5th-6th Shift Fork | (12) Detent Ball | (D) Engage to Hi Position | L: Lo Speed Range |
| (5) 1st-2nd Shift Fork | (13) Interlock Ball 1 | | C: Creep Speed Range (Option) |
| (6) H-L-C Rod | (14) H-L-C Lever | | |
| (7) H-L-C Arm | (15) Main Shift Shaft | | |
| (8) H-L-C Fork | (16) Interlock Ball 2 | | |

- Interlock balls (13) restrain the movement of the 1st-2nd shift fork rod (10), 3rd-4th shift fork rod (3) and 5th-6th shift fork rod (4) at the same time. As a result, double engagement of the gear is prevented.
- Detent balls (12) prevent the self disengagement of the gears.
- When operating the main shift lever (9) with select motion, select the arm (2) by pushing the main shift shaft (15). There for select arm (2) select (A) (1st-2nd shift fork (5)) or (B) (3rd-4th shift fork rod (3)) or (C) (5th-6th shift fork rod (11)).
- When operating the H-L-C lever (14), the H-L-C fork (8) engages to H, L or C position.

9Y1210686TRM0021US0

[6] DUAL SPEED SHIFT SECTION

(1) Hydraulic Clutch Pack



Dual Speed Section

The dual speed section is operated hydraulic clutch, solenoid valve and dual speed switch. When operate the lo to **H** position, travelling speed increase approx. 18 %.

When the **H-L** solenoid valve is operated to the **H** or **L** position, hydraulic clutch is engaged to the **H** or **L** position by the hydraulic. Then the power is transmitted as follows.

(H position)

Input Shaft (1) → Dual Speed Clutch Body (4) → Clutch Disk and Plate (5) → 28T Gear (6) → 29T Gear (7) → 1st Shaft (9).

(L position)

Input Shaft (1) → Dual Speed Clutch Body (4) → Clutch Disk and Plate (3) → 26T Gear (2) → 32T Gear (8) → 1st Shaft (9).

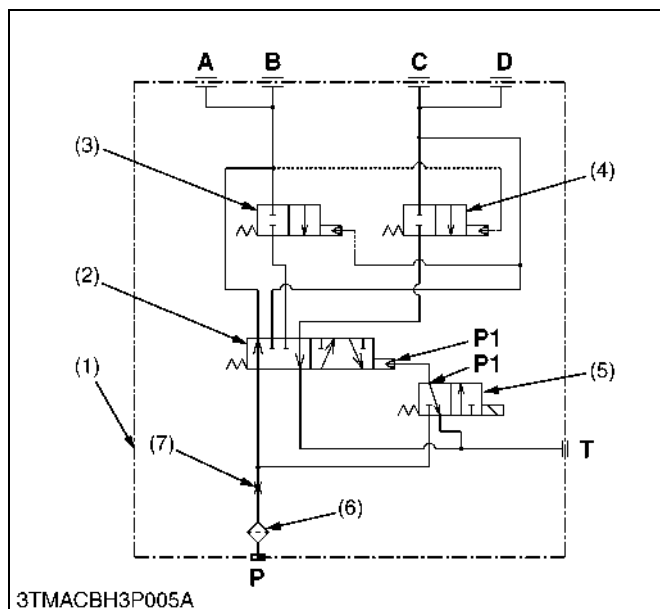
- | | |
|----------------------------|---------------|
| (1) Input Shaft | (7) 29T Gear |
| (2) 26T Gear | (8) 32T Gear |
| (3) Clutch Disk and Plate | (9) 1st Shaft |
| (4) Dual Speed Clutch Body | |
| (5) Clutch Disk and Plate | |
| (6) 28T Gear | |

H: Hi Speed Range

L: Lo Speed Range

9Y1210686TRM0022US0

(2) Dual Speed Valve



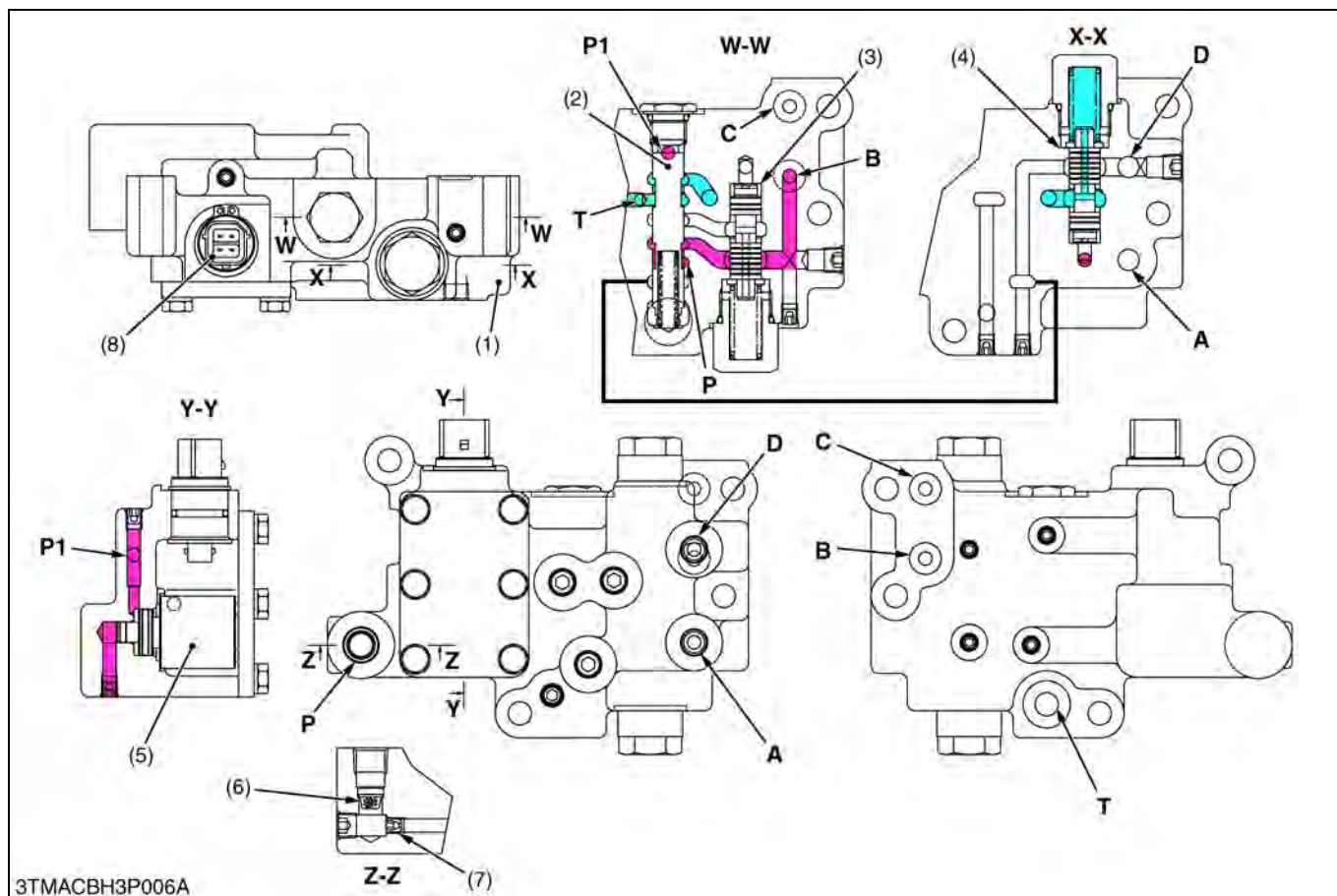
This valve change the oil flow to the dual speed **HI** clutch or **LO** clutch.

As the pilot valve DS (solenoid valve) (5) operates by energizing the solenoid, the flow of oil is switched to the **HI** side (**B**) or **LO** (**C**) side of dual speed clutch with DS spool (2).

When one of clutches are engaged, pilot valve **HI** (3) and pilot valve **LO** (4) are object in free which makes it do as for the other clutch.

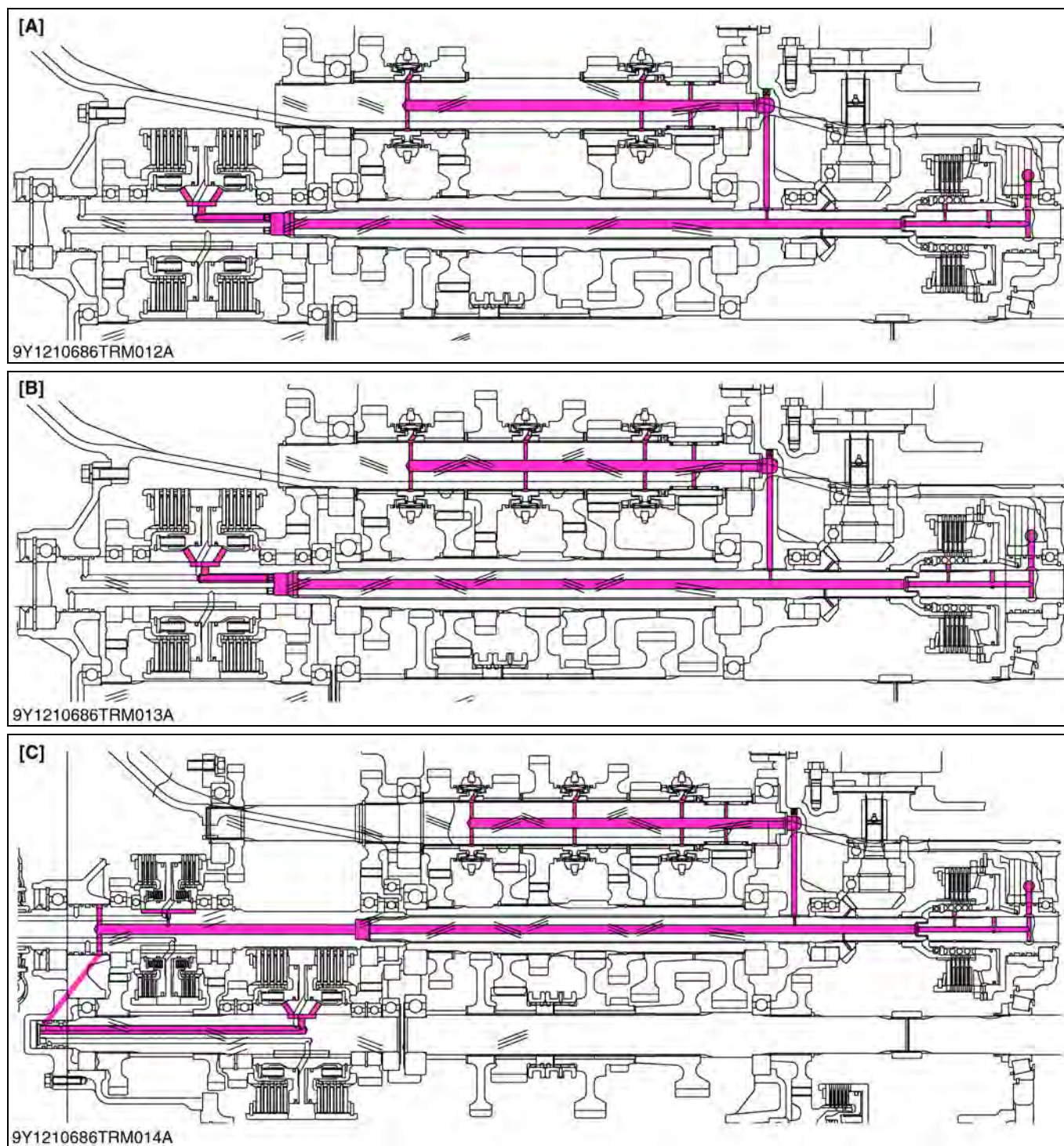
- (1) Valve Body
- (2) DS Spool
- (3) Pilot Valve HI
- (4) Pilot Valve LO
- (5) Pilot Valve DS (Solenoid Valve)
- (6) Line Filter
- (7) Orifice

- A: Check Port HI
- B: To Clutch Pack HI
- C: To Clutch Pack LO
- D: Check Port LO
- P: P Port
- T: Tank Port
- W-W: View W
- X-X: View X
- Y-Y: View Y
- Z-Z: View Z



9Y1210686TRM0023US0

3. LUBRICATION FOR TRANSMISSION



[A] F8/R8 Speed Transmission

[B] F12/R12 Speed
Transmission[C] F24/R24 Speed
Transmission

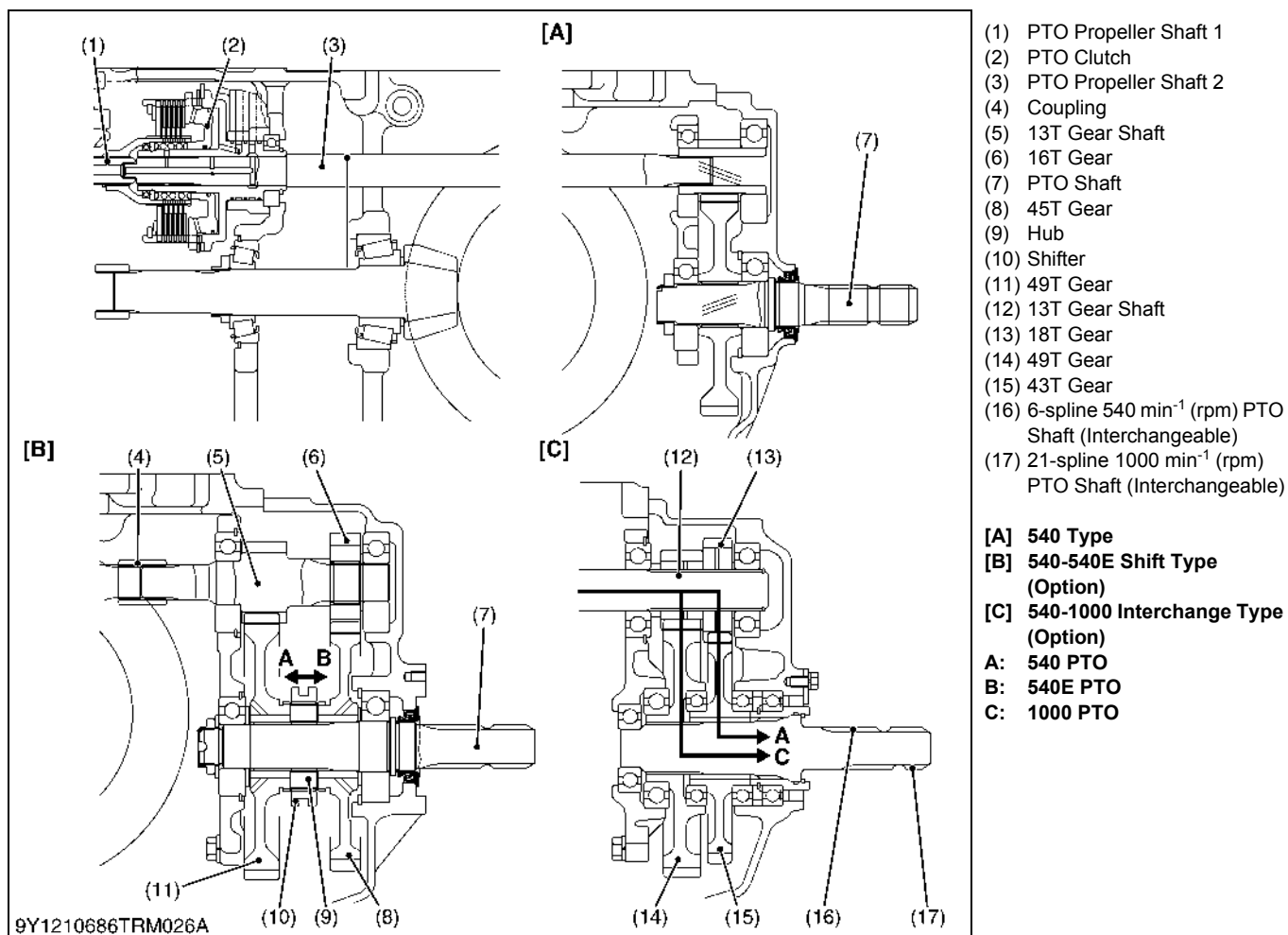
Hydraulic shuttle section, main shift change synchromesh gears, hydraulic pump drive / driven gear, PTO hydraulic pack and PTO brake are forcibly lubricated.

The lubrication oil from the PTO valve lubricates to PTO clutch holder and the each sections through PTO propeller shaft and 1st shaft.

9Y1210686TRM0024US0

4. POWER TRAIN FOR PTO SYSTEM

[1] PTO GEAR SECTION



[540 Type]

The PTO propeller shaft 1 is splined to the spline hub and is always rotating while the engine is running.

[540-540E/Shift Type] (Option)

Two different PTO speeds are available by operating the shift lever, to shift position of the shifter (10). Power is transmitted as follows.

■ Position A: 540 [540 min⁻¹ (rpm) at 2035 min⁻¹ (rpm) engine speed]

PTO Propeller Shaft 1 (1) → PTO Clutch (2) → PTO Propeller Shaft 2 (3) → 13T Gear Shaft (5) → 49T Gear (11) → Shifter (10) → Hub (9) → PTO Shaft (7).

■ Position B: 540E [540 min⁻¹ (rpm) at 1519 min⁻¹ (rpm) engine speed]

PTO Propeller Shaft 1 (1) → PTO Clutch (2) → PTO Propeller Shaft 2 (3) → 13T Gear Shaft (5) → 16T Gear (6) → 45T Gear (8) → Shifter (10) → Hub (9) → PTO Shaft (7).

■ NOTE

- This PTO gear section does not have neutral position.

[540-1000/Interchange Type] (Option)

By interchanging the PTO shafts (16), (17), two different PTO shaft speeds are available. Power is transmitted as follows.

■ Position A: With 6-spline PTO shaft (540 min⁻¹ (rpm) PTO speed)

PTO Transmitting Shaft → 13T Gear (12) → 49T Gear (14) → PTO Shaft (16).

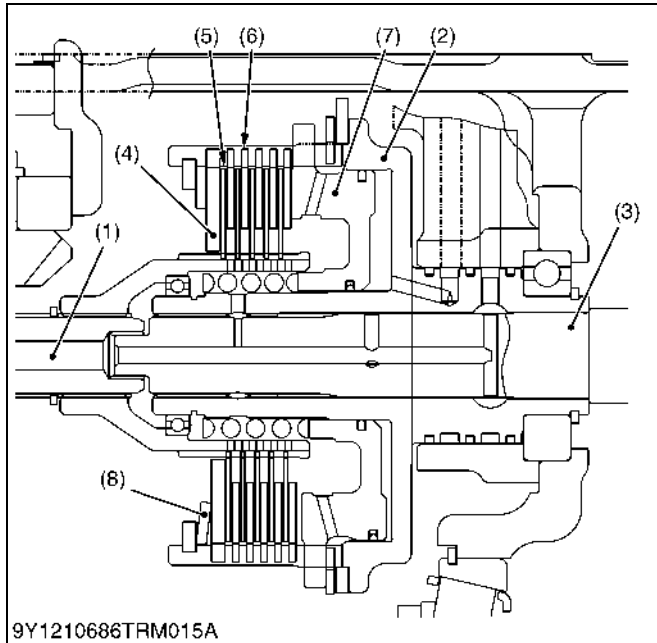
■ Position C: With 21-spline PTO shaft (1000 min⁻¹ (rpm) PTO speed)

PTO Transmitting Shaft → 18T Gear (13) → 43T Gear (15) → PTO Shaft (17).

9Y1210686TRM0026US0

[2] PTO HYDRAULIC CLUTCH SECTION

(1) PTO Hydraulic Clutch



The PTO clutch pack has five clutch disks (5), five drive plates (6), a belleville washer (cupped spring washer) (9) and one pressure plate (4). The clutch piston (8) actuated by hydraulic from PTO clutch valve, tightly presses the clutch disks (5) and drive plates (6) toward the pressure plate (4).

As a result, the rotation of the PTO propeller shaft 1 is transmitted to the PTO propeller shaft 2 (3) through the PTO clutch pack (2).

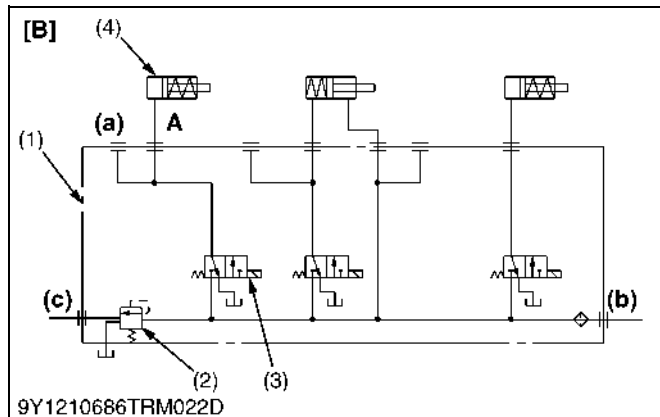
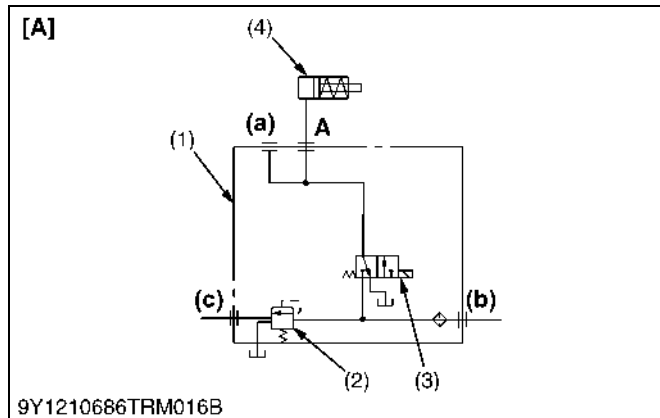
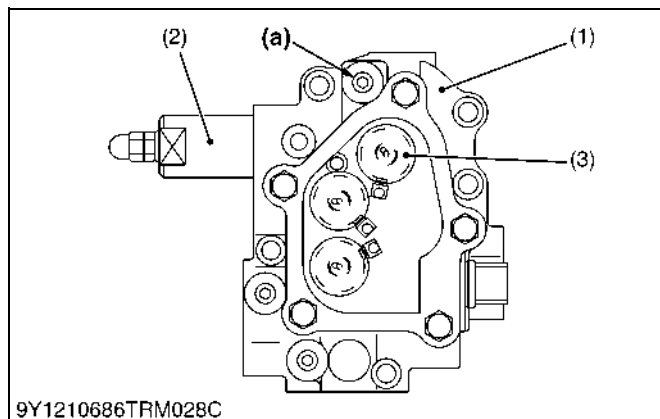
The belleville washer (cupped spring washer) (8) reduce the engaging shock. Thereby, the PTO clutch is engaged very smoothly.

- | | |
|---------------------------|------------------------|
| (1) PTO Propeller Shaft 1 | (6) Drive Plate |
| (2) PTO Clutch Pack | (7) Clutch Piston |
| (3) PTO Propeller Shaft 2 | (8) Belleville Washer |
| (4) Pressure Plate | (Cupped Spring Washer) |
| (5) Clutch Disk | |

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(2) PTO Solenoid Valve, Relief Valve and Oil Flow



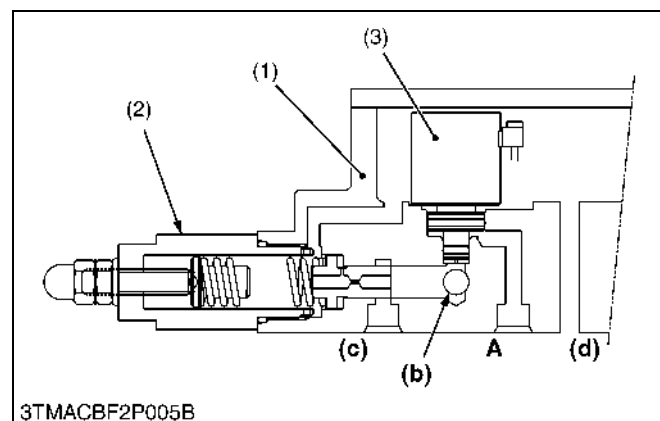
When the PTO switch is at the **OFF** position, the oil flows is stopped by the PTO solenoid valve (3).

When the PTO switch is at **ON** position, the solenoid valve (3) is operated and the oil flows through the PTO solenoid valve (3) to the PTO clutch pack (4) to engage it.

The relief valve (2) maintains the hydraulic system pressure and supply the oil to lubricate the shuttle section, synchro-mesh gears, PTO clutch pack and PTO brake section.

■ NOTE

- Hydraulic system pressure is a operating pressure for the PTO clutch pack.
(2.16 MPa, 22.0 kgf/cm², 313 psi)



- (1) Solenoid Valve Assembly
(2) Relief Valve
(3) PTO Solenoid Valve
(4) PTO Clutch Pack

- (b) P Port (From Power Steering Pump)
(c) Lubricating Port
(d) T Port (To Transmission Case)

- A: PTO Port
(a) Check Port for PTO Pressure

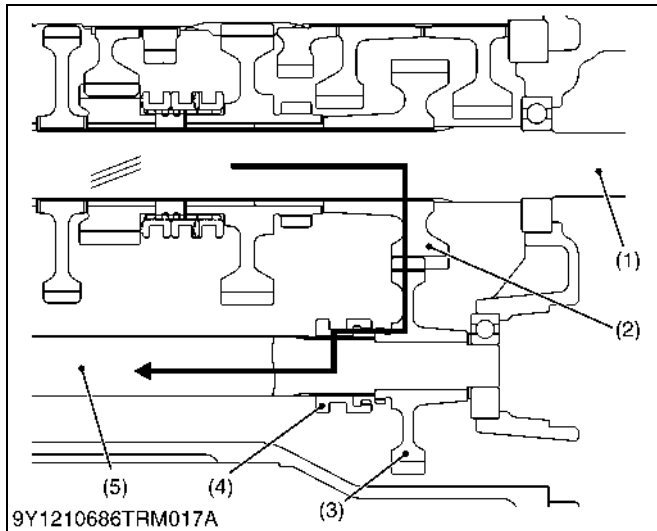
- [A] F8/R8 and F12/R12 Speed Transmission
[B] F24/R24 Speed Transmission

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5. POWER TRAIN FOR 4WD

[1] 4WD SHIFT SECTION

(1) 2WD-4WD Section



2 wheel drive or 4 wheel drive is selected by changing the position of shifter (4) on the propeller shaft 1 (5) using the front wheel drive lever.

When the front wheel drive lever is set to **"Disengaged"**, the shifter is in neutral and power is not transmitted to the propeller shaft 1 (5).

Power is transmitted as follows.

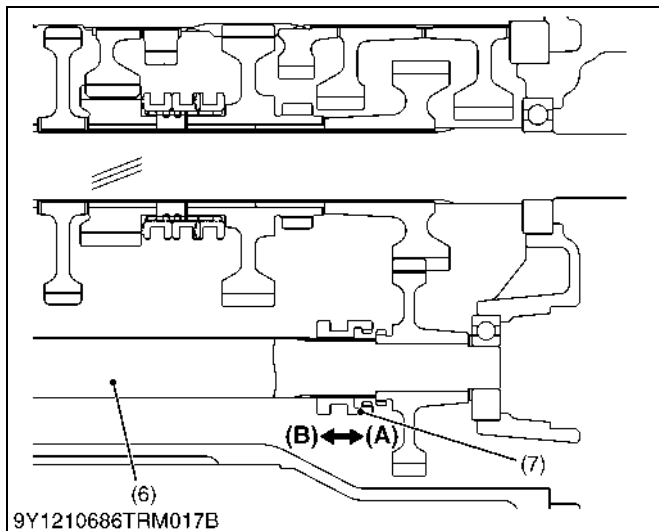
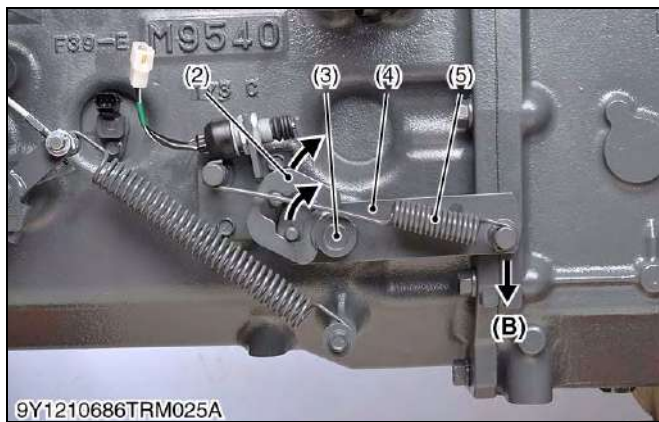
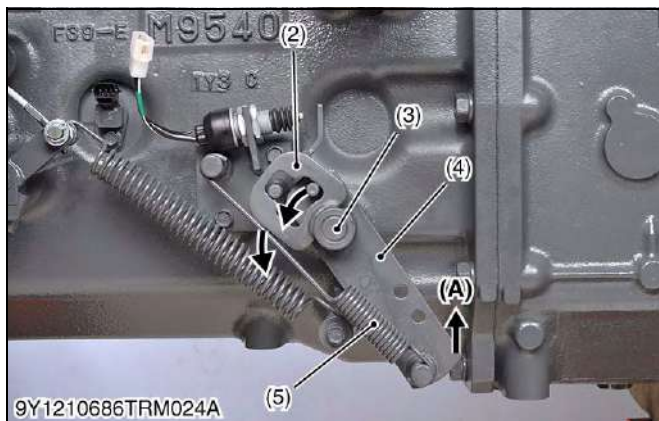
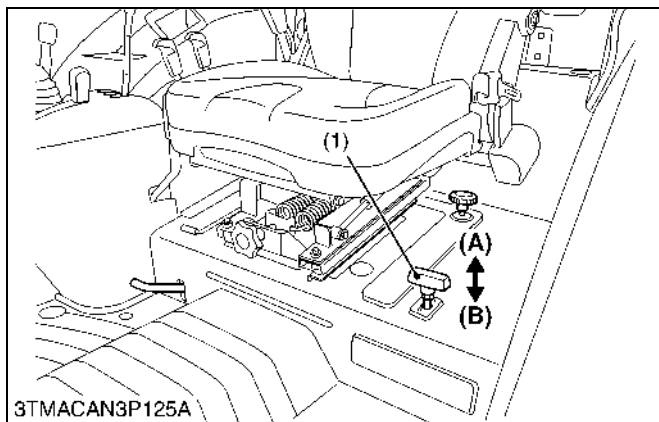
■ 4 Wheel Drive Engaged

3rd Shaft (1) → 33T Gear (2) → 35T Gear (3) → Shifter (4) → Propeller Shaft 1 (5).

- | | |
|---------------|-----------------------|
| (1) 3rd Shaft | (4) Shifter |
| (2) 33T Gear | (5) Propeller Shaft 1 |
| (3) 35T Gear | |

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(2) 2WD-4WD Shift Linkage



When operating the front wheel drive lever (1) from 2WD to 4WD, the shift lever (4) turn and push down the 4WD (2) to engage the shifter (7) via shift arm (3).

If the shifter (7) and propeller shaft (6) are not same speed, shifter does not engage, and 4WD spring (5) maintain the 4WD lever (2) is pushing down to shift the 4WD.

When propeller shaft 1 (6) and shifter (7) become same speed by acceleration or clutch operation, shifter (7) automatically engages by 4WD spring (5) tensioning effect.

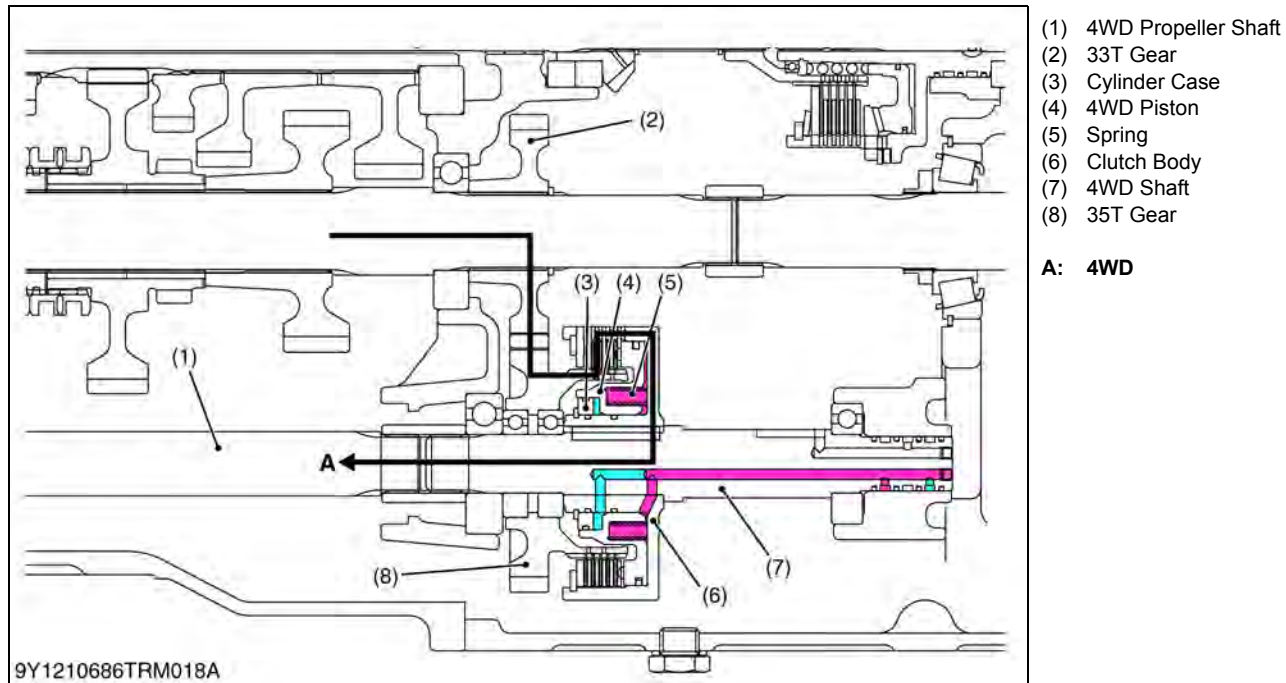
The 4WD spring tension is effecting for both 2WD and 4WD position of 4WD shift lever (4).

- | | |
|-----------------------------|-------------|
| (1) Front Wheel Drive Lever | (A) for 4WD |
| (2) 4WD Lever | (B) for 2WD |
| (3) Shift Arm | |
| (4) 4WD Shift Lever | |
| (5) 4WD Spring | |
| (6) Propeller Shaft 1 | |
| (7) Shifter | |

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[2] 4WD HYDRAULIC CLUTCH SECTION (DUAL SPEED MODEL)

(1) 4WD Hydraulic Clutch



- (1) 4WD Propeller Shaft
- (2) 33T Gear
- (3) Cylinder Case
- (4) 4WD Piston
- (5) Spring
- (6) Clutch Body
- (7) 4WD Shaft
- (8) 35T Gear

A: 4WD

The 4WD clutch is controlled by the solenoid valve and the hydraulic flow.

When the 4WD switch turn on, the front wheel drive (4WD) is engaged. When it is pushed once more, the 2-wheel drive is engaged. The power train are available as follows.

2-wheel drive (4WD switch is turned to "OFF")

- The hydraulic system pressure is fed to between the cylinder case (3) and 4WD piston (4) at 4WD switch is turned to "OFF" and hydraulic pressure does not come from 4WD solenoid valve to actuate the 4WD piston (4). So, the hydraulic system pressure actuate the 4WD piston (4) to the neutral position and power is not transmitted from 33T gear (2) to 4WD propeller shaft (1).
- When both brake pedals are depressed together while driving in 2WD mode, 2-brake switches operate the 4WD solenoid valve and activate to the 4WD mode. 4WD mode activate the 4WD braking system and the 4WD indicator lights up.

4-wheel drive (4WD switch is turned to "ON")

- The 4WD solenoid valve switches and supply the hydraulic pressure to actuate the 4WD piston (4) to engage the clutch pack together with the spring (5) tension force.

The power is transmitted as follow.

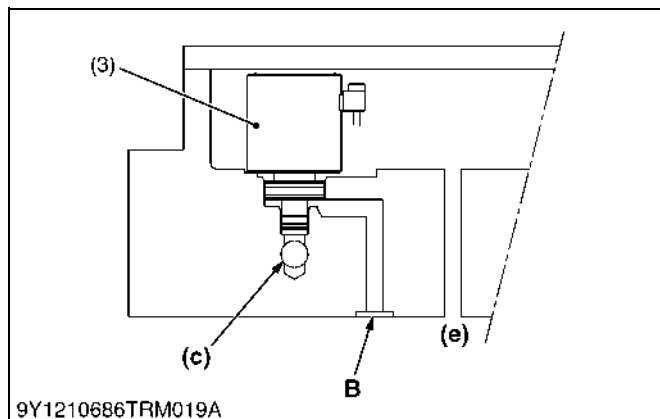
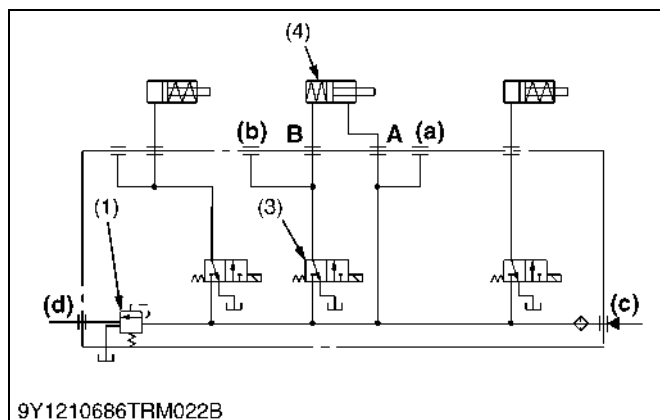
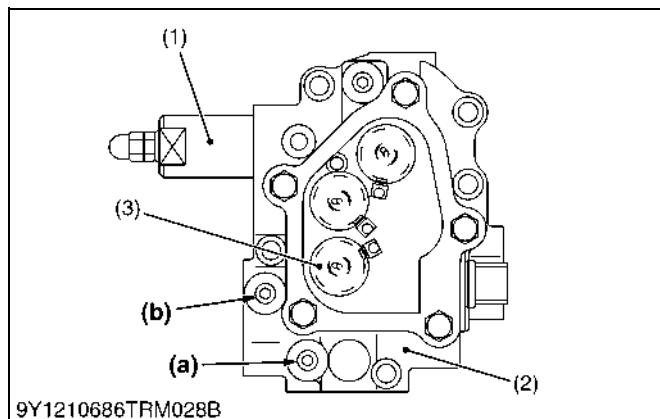
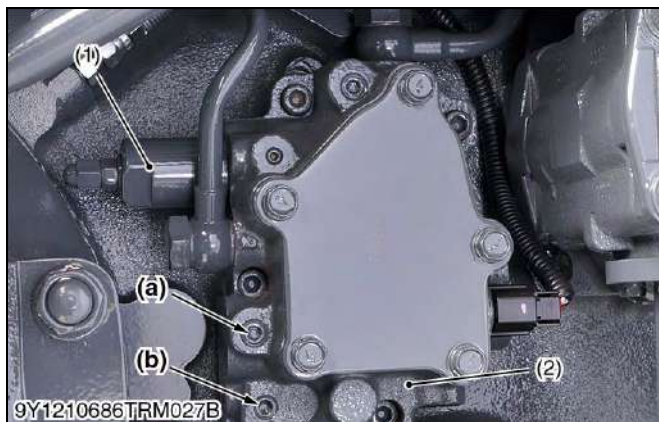
33T Gear (2) → 35T Gear (8) → Clutch Body (6) → 4WD Shaft (7) → 4WD Propeller Shaft (1).

Engine stop

- The 4WD piston (4) engages to 4WD mode by springs (5) tension force.

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(2) 4WD Oil Flow



Oil pressure-fed from the power steering hydraulic pump is flowed to the 4WD solenoid valve (3) through the steering controller and oil cooler. The system hydraulic pressure-fed to disengaged position for 4WD clutch (4) when 4WD switch at 2WD position. As the 4WD solenoid valve does not electrified, the oil flows to 2WD mode. When the 4WD switch turned on, the 4WD solenoid valve is electrified, the oil flow is switched and engage the 4WD clutch (4).

The maximum pressure against the clutch piston is regulated under approx. 2.16 MPa (22.0 kgf/cm², 313 psi) by the relief valve (1) of system pressure.

On the other hand, the return oil is flowed to the transmission case through the valve case.

- (1) Relief Valve
- (2) Solenoid Valve Assembly
- (3) 4WD Solenoid Valve
- (4) 4WD Clutch Pack

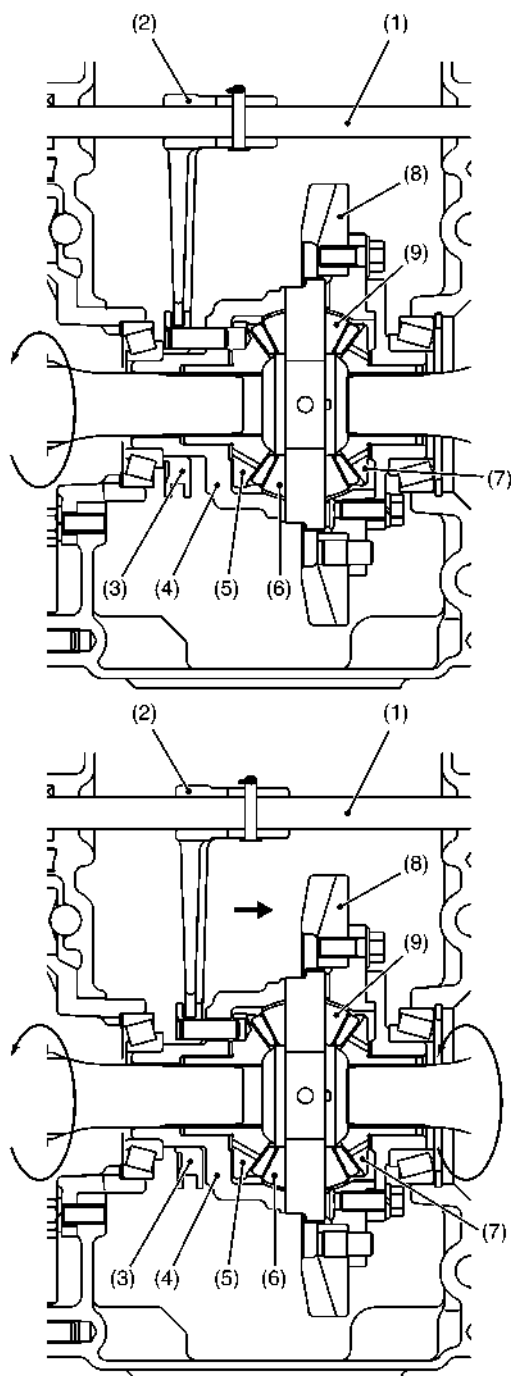
- (b) Check Port for 4WD Pressure
- (c) P Port (From Power Steering Pump)
- (d) Lubricating Port
- (e) T Port (To Transmission Case)

- A: 2WD Port
- B: 4WD Port
- (a) Check Port for 2WD Pressure (System Pressure)

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6. DIFFERENTIAL LOCK

[1] PIN TYPE



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 toward 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.

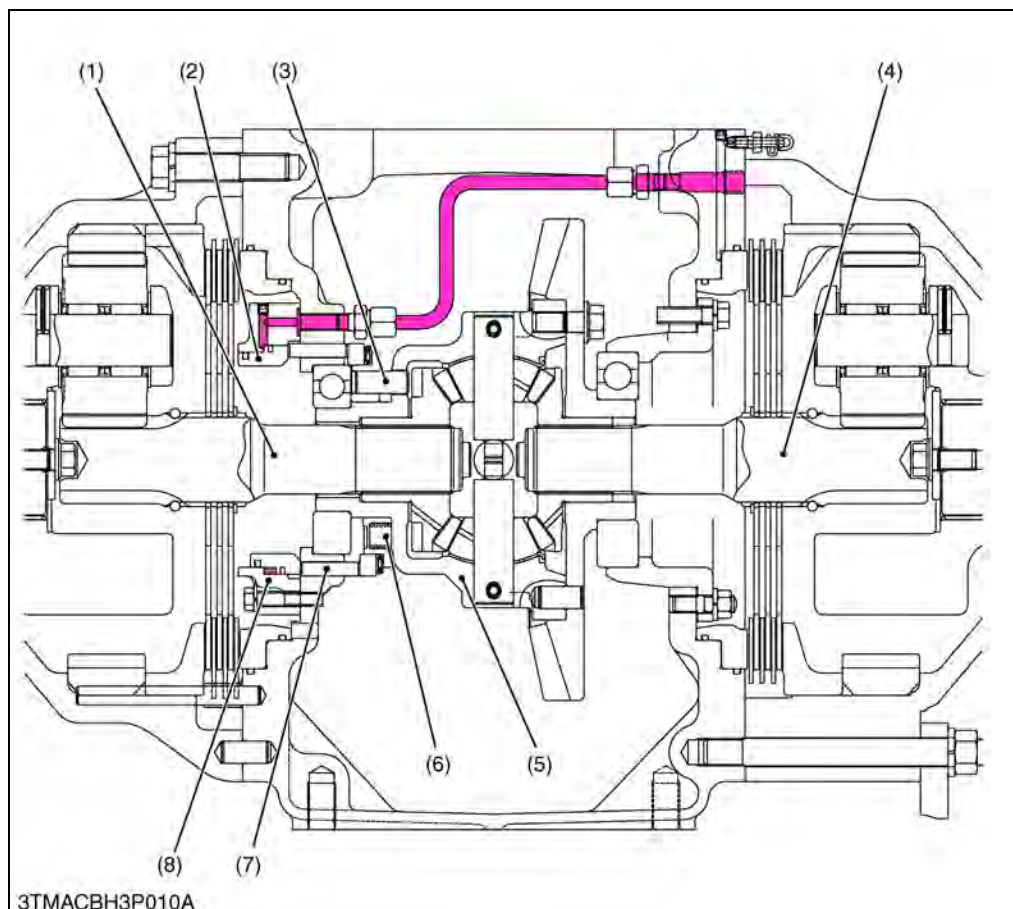
- | | |
|----------------------------------|----------------------------|
| (1) Differential Lock Cam Shaft | (6) Differential Pinion |
| (2) Differential Lock Shift Fork | (7) Differential Side Gear |
| (3) Differential Lock Shifter | (8) Ring Gear |
| (4) Differential Case | (9) Differential Pinion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

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[2] HYDRAULIC ACTUATED TYPE (DUAL SPEED MODEL)

(1) Structure



- (1) Shaft L.H.
- (2) Piston
- (3) Differential Lock Pin
- (4) Shaft R.H.
- (5) Differential Case
- (6) Spring
- (7) Pin
- (8) Piston Support



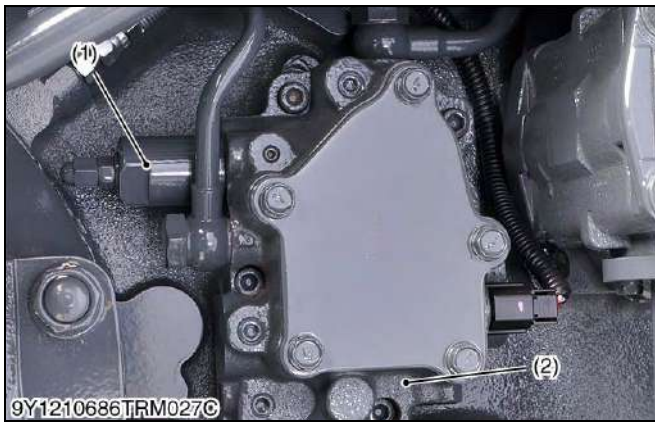
The differential lock can be operated easily with an electric switch.

When the switch is turned **ON**, the solenoid valve operates and oil flows to the piston (2). The differential lock pin (3) engages, and as a result, right and left shaft (1) and (4) rotates as a unit through differential case (3).

On the other hand, oil is not supplied when the switch is **OFF**, and differential lock pin (3) is maintained at the disengaged position by force of spring (6).

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(2) Oil Flow



Oil pressure-fed from the power steering hydraulic pump is flowed to the differential lock solenoid valve (3) through the steering controller and oil cooler. When the differential lock switch turned on, the differential lock solenoid valve is electrified, the oil flow is switched and engage the differential lock pin to lock position.

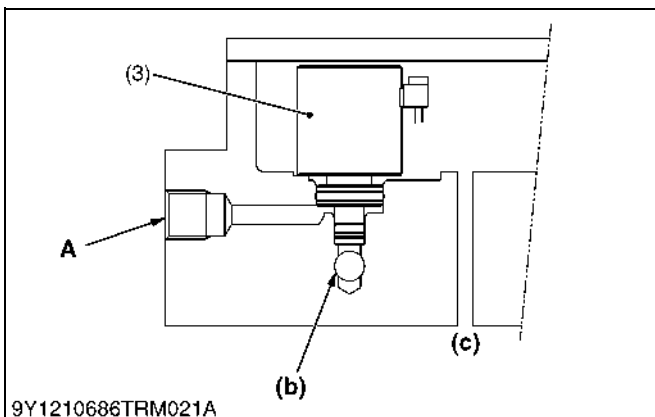
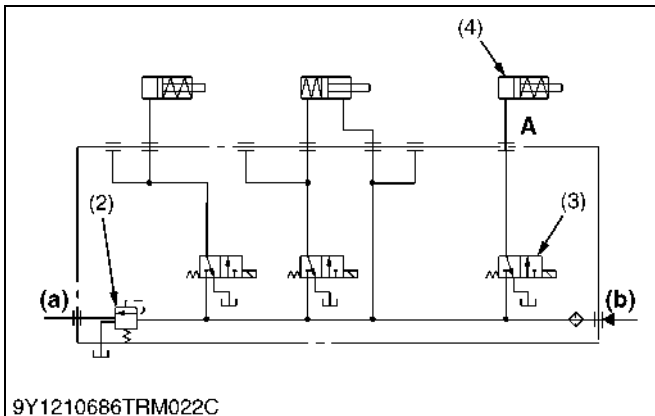
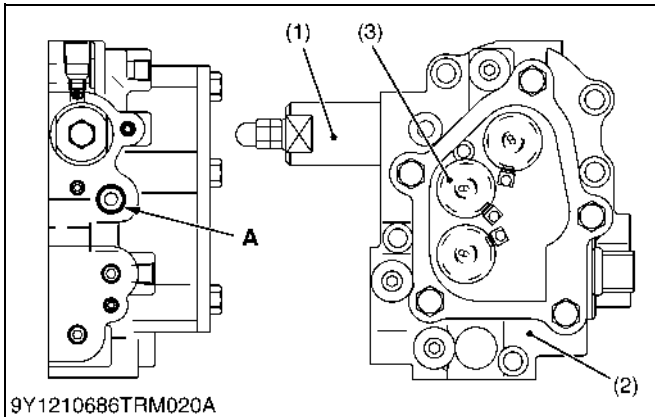
The maximum pressure against the clutch piston is regulated under approx. 2.16 MPa (22.0 kgf/cm², 313 psi) by the relief valve (1) of system pressure.

On the other hand, the return oil is flowed to the transmission case through the valve case.

- (1) Relief Valve
- (2) Solenoid Valve Assembly
- (3) Differential Lock Solenoid Valve
- (4) Differential Lock Piston

- A : Differential Lock Port**
- (a) Lubricating Port**
- (b) P Port (From Power Steering Pump)**
- (c) T Port (To Transmission Case)**

9Y1210686TRM0035US0



SERVICING

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1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Shuttle Clutch Slip	Operating pressure is low	Adjust	2-S20
	Shuttle clutch valve malfunctioning	Replace	2-S29
	Clutch disk or steel plate excessively worn	Replace	2-S59, 2-S103
	Deformation of piston or steel plate	Replace	–
Shuttle Clutch Operating Pressure Is Low	Transmission oil improper or insufficient	Replenish or change	G-12
	Relief valve malfunctioning	Adjust or replace	2-S20, 2-S29
Shuttle Clutch Drags	Return spring weak or broken	Replace	–
	Modulating valve malfunctioning	Replace	2-S29
	Deformation of piston or steel plate	Replace	–
Tractor Does Not Keep in Neutral	Shuttle linkage defective or deformed	Adjust or replace	2-S8
Dual Speed Clutch Slip	Operating pressure is low	Adjust	2-S23
	Dual speed clutch valve malfunctioning	Replace	2-S30
	Clutch disk or steel plate excessively worn	Replace	2-S68, 2-S104
	Deformation of piston or steel plate	Replace	–
Dual Speed Clutch Operating Pressure Is Low	Transmission oil improper or insufficient	Replenish or change	G-12
	Relief valve malfunctioning	Adjust or replace	2-S23, 2-S30
Dual Speed Clutch Drags	Return spring weak or broken	Replace	–
	Modulating valve malfunctioning	Replace	2-S30
	Deformation of piston or steel plate	Replace	–
PTO Clutch Slip	Operating pressure is low	Adjust	2-S21
	PTO solenoid valve malfunctioning	Replace	2-S29
	Clutch disk or drive plate excessively worn	Replace	2-S89
	Deformation of piston or return plate	Replace	2-S105
PTO Clutch Operating Pressure Is Low	Transmission oil improper or insufficient	Replenish or change	G-12
	Relief valve malfunctioning	Adjust or replace	2-S21, 2-S29
PTO Clutch Drags	Return spring weak or broken	Replace	–
	Modulating valve malfunctioning	Replace	2-S29
	Deformation of piston or steel plate	Replace	–
PTO Does Not Rotate	PTO clutch malfunctioning	Replace	2-S89
4WD Hard Shifting	Shifter or shift rod worn or damaged	Replace	2-S87
	Shift fork rod bent	Replace	2-S87
4WD Clutch Slip	Operating pressure is low	Adjust	2-S22
	4WD solenoid valve malfunctioning	Repair or replace	2-S29
	Clutch disk or drive plate excessively worn	Replace	2-S91
	Deformation of piston, steel plate or pressure plate	Replace	2-S106

Symptom	Probable Cause	Solution	Reference Page
Front Wheel Does Not Rotate	4WD shift malfunctioning	Repair or replace	2-S87, 2-S91
	4WD clutch malfunctioning	Repair or replace	2-S87, 2-S91
	4WD propeller shaft coupling disengaged	Engage	–
4WD Operating Pressure Is Low	Transmission oil improper or insufficient	Replenish or change	G-12
	Relief valve malfunctioning	Adjust or replace	2-S22, 2-S29
Differential Lock Pedal Does Not Return	Differential lock cam spring weaken or damaged	Replace	2-S94
	Differential shift fork pin damaged	Repair or replace	2-S94
	Differential lock holder pin damaged	Repair or replace	2-S94
Differential Lock Can Not Be Set	Differential lock shift fork damage	Replace	2-S94
	Differential lock shift fork mounting spring pin damaged	Replace	2-S94
	Movement of differential lock shifter improperly adjusted	Adjust	2-S97
	Solenoid valve defective	Replace	2-S29
	Piston seal defective	Replace	2-S98
Excessive Transmission Noise	Transmission fluid insufficient	Replenish	G-12
	Improper backlash between bevel pinion shaft and bevel gear	Adjust	2-S109
	Improper backlash between differential pinion and side gear	Adjust	2-S109
	Collars or shims have not been installed	Repair	–
	Bearing worn	Replace	2-S101
Gears Slip Out of Mesh	Shifter or shift fork worn or damaged	Replace	2-S72, 2-S78, 2-S101
	Shift fork spring weaken or damaged	Replace	–
	Interlock ball fallen	Reassemble	–
	Synchronizer unit damaged	Repair or replace	2-S78, 2-S101
Hard Shifting	Shifter or shift fork worn or damaged	Replace	2-S72, 2-S78, 2-S88, 2-S101
	Shift fork rod bent	Replace	–
	Synchronizer unit damaged	Repair or replace	2-S67, 2-S101
Gears Clash When Shifting	Synchronizer unit damaged	Repair or replace	2-S78, 2-S101

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2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Clutch Pedal (ROPS Model)	Free Travel	15 to 20 mm 0.59 to 0.79 in.	—
	Total Stroke	145 to 155 mm 5.71 to 6.10 in.	—
Clutch Pedal (CABIN Model)	Free Travel	15 to 25 mm 0.59 to 0.98 in.	—
	Total Stroke	155 to 165 mm 6.11 to 6.49 in.	—
Range Gear Shift Lever to Range Gear Shift Lever Guide (ROPS Model)	Clearance	10 to 15 mm 0.40 to 0.59 in.	—
Hand Accelerator Lever (ROPS Model)	Operating Force	5.0 to 10 N 0.51 to 1.0 kgf 1.2 to 2.2 lbf	—
Hand Accelerator Lever (CABIN Model)	Operating Force	10 to 30 N 1.1 to 3.0 kgf 2.3 to 6.7 lbf	—
Accelerator Wire (CABIN Model)	Length	0 to 5 mm 0 to 0.1 in.	—
Shuttle Clutch Valve Condition • Engine Speed Maximum • Oil temperature 45 to 55 °C (113 to 131 °F)	Shuttle Clutch Operating Pressure	2.16 to 2.25 MPa 20.0 to 23.0 kgf/cm ² 313 to 327 psi	—
PTO Switch is "ON" Position	PTO Pressure	1.97 to 2.15 MPa 20.0 to 22.0 kgf/cm ² 265 to 312 psi	—
PTO Switch is "OFF" Position	PTO Pressure	No pressure	—
4WD Switch is "4WD" Position	4WD Pressure	1.97 to 2.15 MPa 20.0 to 22.0 kgf/cm ² 265 to 312 psi	—
4WD Switch is "2WD" Position	4WD Pressure	No pressure	—
Hi and Lo check port	Dual Speed Pressure	1.97 to 2.15 MPa 20.0 to 22.0 kgf/cm ² 265 to 312 psi	—
Fuel Tank to Fuel Tank Band	Clearance	2.0 to 4.0 mm 0.079 to 0.16 in.	—
External Circlip to Collar on 1st Shaft	Clearance	Less than 0.2 mm 0.008 in.	—
Shift Fork to Shift Groove (for Main Change Section and Range Section)	Clearance	0.15 to 0.40 mm 0.0059 to 0.015 in.	0.80 mm 0.031 in.
Damper Disk Boss to Gear Shaft	Backlash (Displacement Around Disk Edge)	—	2.0 mm 0.079 in.

Item		Factory Specification	Allowable Limit
Valve Lever Pin to Lever Bushing	Clearance	0.0490 to 0.156 mm 0.00193 to 0.00614 in.	0.5 mm 0.02 in.
	O.D.	13.957 to 13.984 mm 0.54959 to 0.55055 in.	–
	I.D.	14.033 to 14.113 mm 0.55248 to 0.55562 in.	–
Internal Circlip to Belleville Washer (Cupped Spring Washer)	Clearance	1.8 to 2.0 mm 0.071 to 0.078 in.	3.6 mm 0.14 in.
Internal Circlip to Pressure Plate of Dual Speed Hydraulic Pack [F36/R36 Speed Transmission Model]	Clearance	1.3 to 1.7 mm 0.052 to 0.066 in.	2.0 mm 0.079 in.
PTO Clutch Disk	Thickness	2.5 to 2.7 mm 0.098 to 0.106 in.	2.1 mm 0.083 in.
PTO Steel Plate	Thickness	1.93 to 2.07 mm 0.0760 to 0.0814 in.	1.80 mm 0.0709 in.
PTO Piston	Flatness	–	0.15 mm 0.0059 in.
PTO Steel Plate	Flatness	–	0.30 mm 0.012 in.
PTO Return Spring	Free Length	46.0 mm 1.81 in.	37.5 mm 1.48 in.
Seal Ring	Thickness	2.45 to 2.50 mm 0.096 to 0.098 in.	2.0 mm 0.079 in.
4WD Clutch Disk	Thickness	2.1 to 2.3 mm 0.083 to 0.090 in.	1.9 mm 0.075 in.
4WD Steel Plate	Thickness	1.67 to 1.83 mm 0.0658 to 0.0720 in.	1.3 mm 0.051 in.
4WD Pressure Plate	Thickness	4.42 to 4.58 mm 0.174 to 0.180 in.	3.7 mm 0.15 in.
4WD Piston	Flatness	–	0.15 mm 0.006 in.
4WD Steel Plate	Flatness	–	0.40 mm 0.016 in.
4WD Pressure Plate	Flatness	–	0.30 mm 0.012 in.
Seal Ring	Thickness	2.39 to 2.44 mm 0.0941 to 0.0960 in.	2.0 mm 0.079 in.
18T Bevel Gear to 19T Bevel Gear	Backlash	0.15 to 0.30 mm 0.0059 to 0.011 in.	–
Spiral Bevel Pinion Shaft Only	Turning Torque	3.2 to 3.6 N·m 0.32 to 0.37 kgf·m 2.4 to 2.6 lbf·ft	–
Spiral Bevel Gear to Spiral Bevel Pinion Shaft	Backlash	0.2 to 0.3 mm 0.008 to 0.01 in.	0.4 mm 0.02 in.

Item		Factory Specification	Allowable Limit
Differential Case Bore to Differential Side Gear Boss	Clearance	0.0700 to 0.189 mm 0.00276 to 0.00744 in.	0.35 mm 0.014 in.
• Differential Case Bore	I.D.	49.07 to 49.15 mm 1.932 to 1.9354 in.	—
• Differential Side Gear Boss	O.D.	48.961 to 49.066 mm 1.9276 to 1.9317 in.	—
35T Bevel Gear Bore to Differential Side Gear Boss	Clearance	0.0700 to 0.189 mm 0.00276 to 0.00744 in.	0.35 mm 0.014 in.
• 35T Bevel Gear Bore	I.D.	49.07 to 49.15 mm 1.932 to 1.935 in.	—
• Differential Side Gear Boss	O.D.	48.961 to 49.066 mm 1.9276 to 1.9317 in.	—
Differential Pinion Shaft to Differential Pinion	Clearance	0.0600 to 0.102 mm 0.00237 to 0.00401 in.	0.25 mm 0.010 in.
• Differential Pinion Shaft	O.D.	22.959 to 22.980 mm 0.90390 to 0.90472 in.	—
• Differential Pinion	I.D.	23.040 to 23.061 mm 0.90709 to 0.90791 in.	—
Differential Pinion to Differential Side Gear	Backlash	0.15 to 0.30 mm 0.0059 to 0.011 in.	0.4 mm 0.02 in.
Differential Lock Shifter	Clearance	6.0 to 8.0 mm 0.24 to 0.31 in.	—

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3. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to G-14.)

Item	N·m	kgf·m	lbf·ft
Rear wheel mounting nut	344 to 392	35.0 to 40.0	254 to 289
Shuttle valve pipe mounting nut	49 to 68	5.0 to 7.0	37 to 50
Shuttle valve mounting screw	24 to 27	2.4 to 2.8	18 to 20
Joint screw for hydraulic pipe	30 to 34	3.0 to 3.5	22 to 25
Return pipe retaining nut	23 to 27	2.3 to 2.8	17 to 20
Power steering hose retaining nut	23 to 27	2.3 to 2.8	17 to 20
Starter's B terminal mounting nut	9.8 to 11	1.0 to 1.2	7.3 to 8.6
Oil cooler pipe nut	49 to 68	5.0 to 7.0	37 to 50
Intake air heater terminal mounting nut	3.5 to 5.3	0.35 to 0.55	2.6 to 3.9
Engine and clutch housing mounting screw and nut (M14, 7T)	124 to 147	12.6 to 15.0	91.2 to 108
Engine and clutch housing mounting stud bolt	62 to 73	6.3 to 7.5	46 to 54
Compressor bracket mounting screw (M8) to aluminum parts	18 to 20	1.8 to 2.1	13 to 15
Compressor bracket mounting screw (M8) to ordinariness parts	24 to 27	2.4 to 2.8	18 to 20
Compressor bracket mounting screw (M10) to ordinariness parts	48 to 55	4.9 to 5.7	36 to 41
High pressure hose mounting screw	7.9 to 11	0.80 to 1.2	5.8 to 8.6
Low pressure hose mounting screw	7.9 to 11	0.80 to 1.2	5.8 to 8.6
Master cylinder hose retaining nut	24 to 27	2.4 to 2.8	18 to 20
Power steering joint shaft mounting screw	24 to 27	2.4 to 2.8	18 to 20
Power steering pipe nut	49 to 68	5.0 to 7.0	37 to 50
ROPS under frame mounting screw (M16, 9T)	260 to 304	26.5 to 31.0	192 to 224
Step mounting screw and nut (for front side)	200 to 220	20 to 23	150 to 160
Step mounting screw and nut (for rear side)	24 to 27	2.4 to 2.8	18 to 20
PTO pipe eye joint screw	49 to 68	5.0 to 7.0	37 to 50
Oil cooler pipe (return)	49 to 68	5.0 to 7.0	37 to 50
3-point hitch delivery pipe 2 retaining nut	108 to 117	11.0 to 12.0	79.6 to 86.7
Brake pipe retaining nut	16 to 23	1.6 to 2.4	12 to 17
PTO solenoid valve pipe retaining eye screw	30 to 34	3.0 to 3.5	22 to 25
Power steering pipe and hydraulic pipe retaining nut	49 to 68	5.0 to 7.0	37 to 50
Hydraulic pipe joint screw	30 to 34	3.0 to 3.5	22 to 25
Clutch housing mounting screw and nut (M14, 7T)	124 to 147	12.6 to 15.0	91.2 to 108
Transmission case mounting screw and nut	124 to 147	12.6 to 15.0	91.2 to 108
Cylinder hose retaining nut	35 to 48	3.5 to 4.9	26 to 35
Top cover mounting screw and nut	124 to 147	12.6 to 15.0	91.2 to 108
PTO gear case assembly mounting screw	78 to 90	7.9 to 9.2	58 to 66
Rear axle case mounting screw and nut	197 to 225	20.0 to 23.0	145 to 166
Damper disk mounting screw	48 to 55	4.9 to 5.7	36 to 41
Shuttle case mounting screw and nut	48 to 55	4.9 to 5.7	36 to 41

Item	N·m	kgf·m	lbf·ft
Shuttle case and shuttle holder mounting screw and nut	48 to 55	4.9 to 5.7	36 to 41
Speed change cover mounting screw	78 to 90	7.9 to 9.2	58 to 66
PTO clutch holder mounting screw	24 to 27	2.4 to 2.8	18 to 20
Differential bearing support mounting screw	48 to 55	4.9 to 5.7	36 to 41
Spiral bevel pinion shaft staking nut	93.2 to 102	9.50 to 10.5	68.8 to 75.9
Spiral bevel gear mounting UBS screw	143 to 161	14.5 to 16.5	105 to 119
PTO shaft staking nut	226 to 264	23.0 to 27.0	167 to 195
PTO case cover mounting screw and reamer bolt	78 to 90	7.9 to 9.2	58 to 66
PTO case cover mounting screws	78 to 90	7.9 to 9.2	58 to 66
PTO gear case mounting screws	78 to 90	7.9 to 9.2	58 to 66
Spiral bevel pinion shaft	3.2 to 3.6	0.32 to 0.37	2.4 to 3.6

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4. CHECKING AND ADJUSTING

[1] HYDRAULIC SHUTTLE LEVER

(1) Hydraulic Shuttle Lever



CAUTION

- Park the machine on a firm, flat and level surface, set the parking brake and place the gear shift in neutral.
- Stop the engine and remove the key before checking and adjusting.

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Adjusting Shuttle Valve Neutral Position and Lever Guide Neutral Position

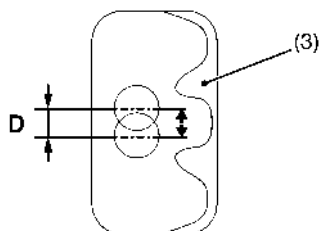
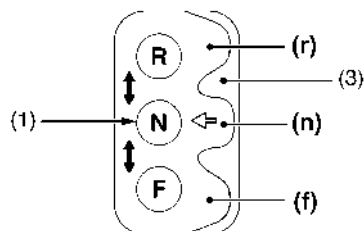
1. Remove the steering post cover (2).
2. The shuttle valve spool is provided with **F**, **N** and **R** ball detents. (Lift the shuttle lever (1) and slowly move it to the **F** and **R** directions until you feel the lever clicking at the ball detents.)
3. The shuttle lever guide (3) also has the **(f)**, **(n)** and **(r)** grooves for the shuttle lever.
4. In this adjustment procedure, make alignment between the shuttle valve neutral detent position and shuttle lever guide groove **N**.
5. Place the shuttle lever to the neutral position.
6. Lift the shuttle lever (1) then move it reverse and forward, and confirm the free play "**D**" of the shuttle lever (1) at neutral position.

- (1) Shuttle Lever
(2) Steering Post Cover
(3) Shuttle Lever Guide

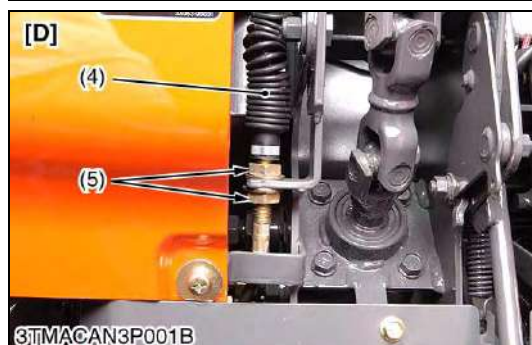
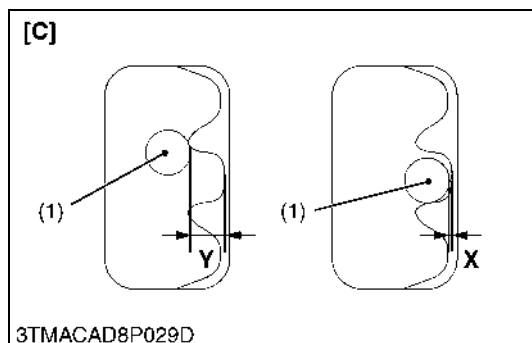
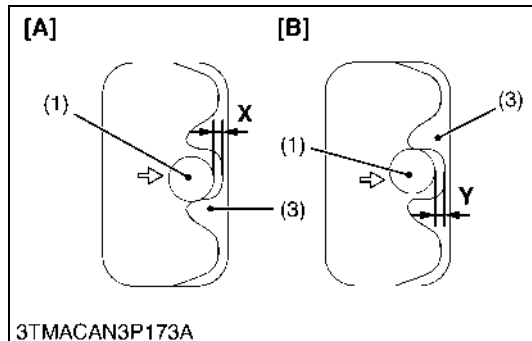
- (f)** Groove F
(n) Groove N
(r) Groove R

- F:** Forward
R: Reverse
N: Neutral
D: Free Play

(To be continued)



(Continued)



7. Shift the free play "D" toward the forward direction and slowly lower the shuttle lever as shown in the figure. And visually inspect the clearance "X".
8. Shift the free play "D" toward the rear direction and slowly lower the shuttle lever (1) as shown in the figure. And visually inspect the clearance "Y".
9. Make sure the two clearance "X" and "Y" are just the same, with shuttle cable retaining nut (5).

■ **NOTE**

- The figure [C] is an example when the length of the shuttle cable (4) is misadjusted.

- (1) Shuttle Lever
- (2) Steering Post Cover
- (3) Shuttle Lever Guide
- (4) Shuttle Cable
- (5) Retaining Nut

[A] When the shuttle lever shift to forward.

[B] When the shuttle lever shift to reverse.

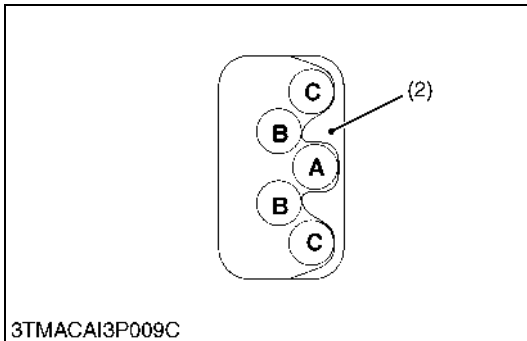
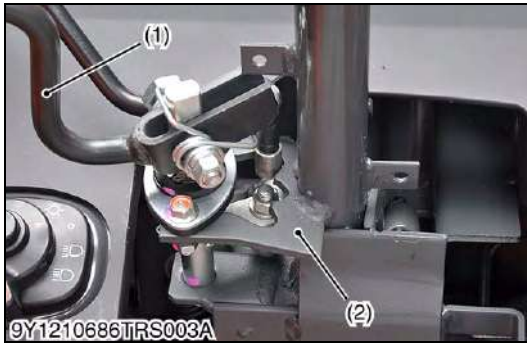
[C] The cable is misadjusted

[D] ROPS Model

[E] CABIN Model

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(2) Engine Start Condition



Engine Start Condition

■ IMPORTANT

- Before starting the engine, make sure the gear shift lever at the neutral position.
- Place the PTO lever to the OFF position.
- Apply the parking brake.

1. Check the engine start condition as follows:

■ NOTE

- Do not touch the shuttle lever (1) when the shuttle lever (1) is at specified position as shown in figure.

(Reference)

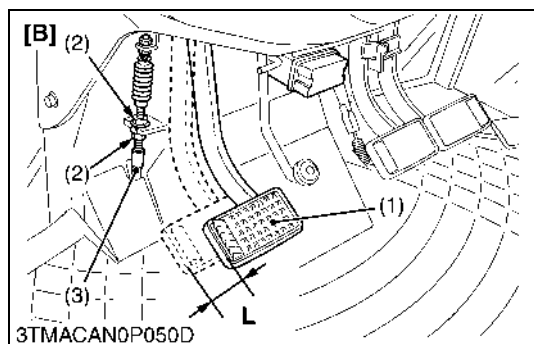
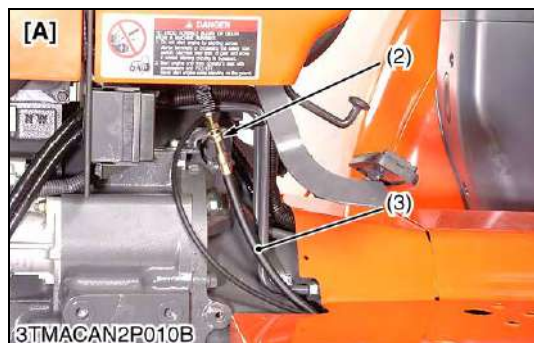
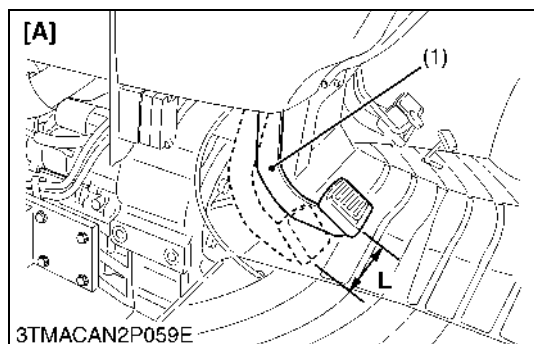
- Position **A**: Engine start
 - Position **B**: Engine does not start
 - Position **C**: Engine does not start
2. If the engine started at position **B** and/or **C**, adjust the shuttle cable with retaining nut.

(1) Shuttle Lever

(2) Shuttle Lever Guide

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[2] CLUTCH PEDAL FREE TRAVEL



Clutch Pedal Free Travel

1. Measure the clutch pedal free travel "L".
2. If adjustment is needed, change with clutch wire cable (3) retaining nut (2) so that the free travel becomes 15 to 20 mm (0.59 to 0.79 in.). (ROPS model)
3. If adjustment is needed, change with clutch wire cable (3) retaining nut (2) so that the free travel becomes 15 to 25 mm (0.59 to 0.98 in.). (CABIN model)
4. After adjustment is completed secure the nut.

Clutch pedal free travel "L"	Factory specification	ROPS model	15 to 20 mm 0.59 to 0.79 in.
		CABIN model	15 to 25 mm 0.59 to 0.98 in.
Clutch pedal total stroke	Factory specification	ROPS model	145 to 155 mm 5.71 to 6.10 in.
		CABIN model	155 to 165 mm 6.11 to 6.49 in.

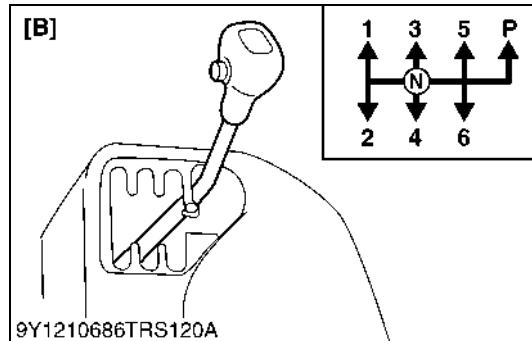
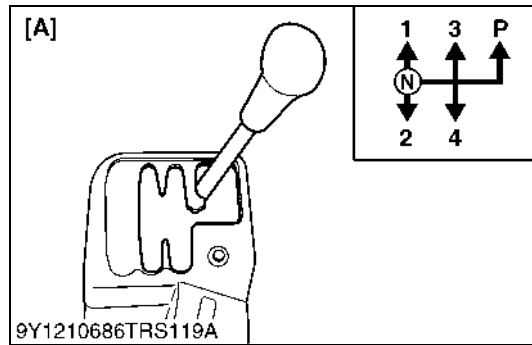
- (1) Clutch Pedal
(2) Nut
(3) Clutch Wire Cable

L: Free Travel
[A] ROPS Model
[B] CABIN Model

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[3] GEAR SHIFTING LINKAGE

(1) Main Gear Shift

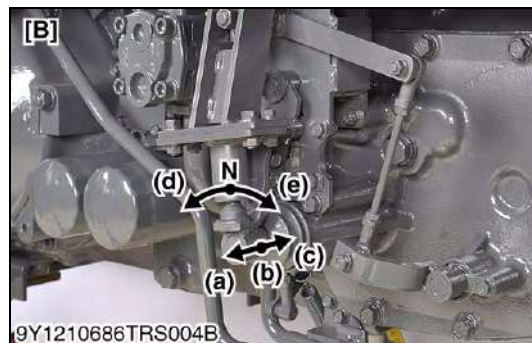
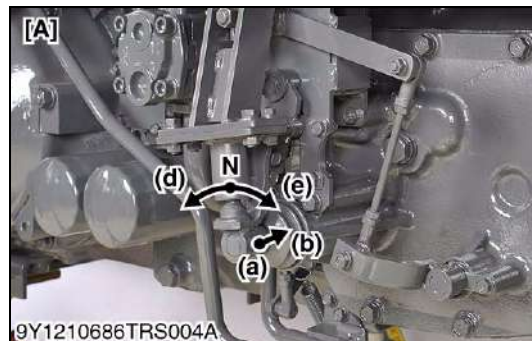


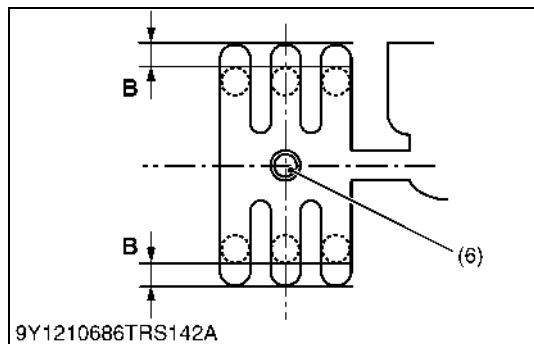
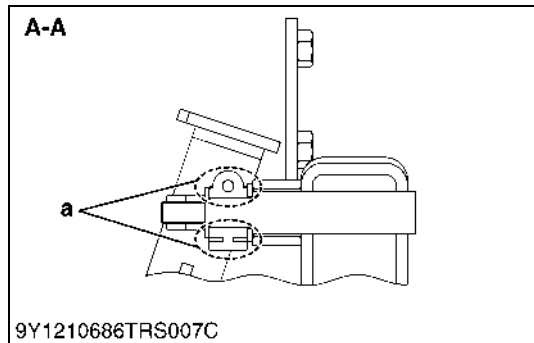
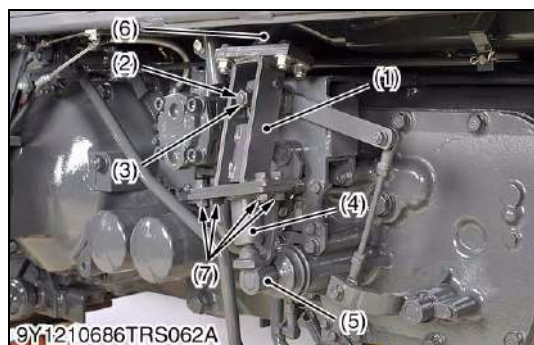
Checking Function of Main Gear Shift

1. Check the function of the main gear shift.
 - Neutral position to 1st gear position.
 - Neutral position to 2nd gear position.
 - Neutral position to 3rd gear position.
 - Neutral position to 4th gear position.
 - Neutral position to 5th gear position.
(F12/R12, F24/R24 speed transmission model)
 - Neutral position to 6th gear position.
(F12/R12, F24/R24 speed transmission model)
2. If shifting is not smooth, adjust the main gear shift following 2-S13.

- | | |
|--|---|
| [A] F8/R8 Speed Transmission Model | (a) Select 1st-2nd Gear Shift Position |
| [B] F12/R12 and F24/R24 Speed Transmission Model | (b) Select 3rd-4th Gear Shift Position |
| | (c) Select 5th-6th Gear Shift Position |
| | (d) Engage to 1st or 3rd or 5th Gear Position |
| | (e) Engage to 2nd or 4th or 6th Gear Position |

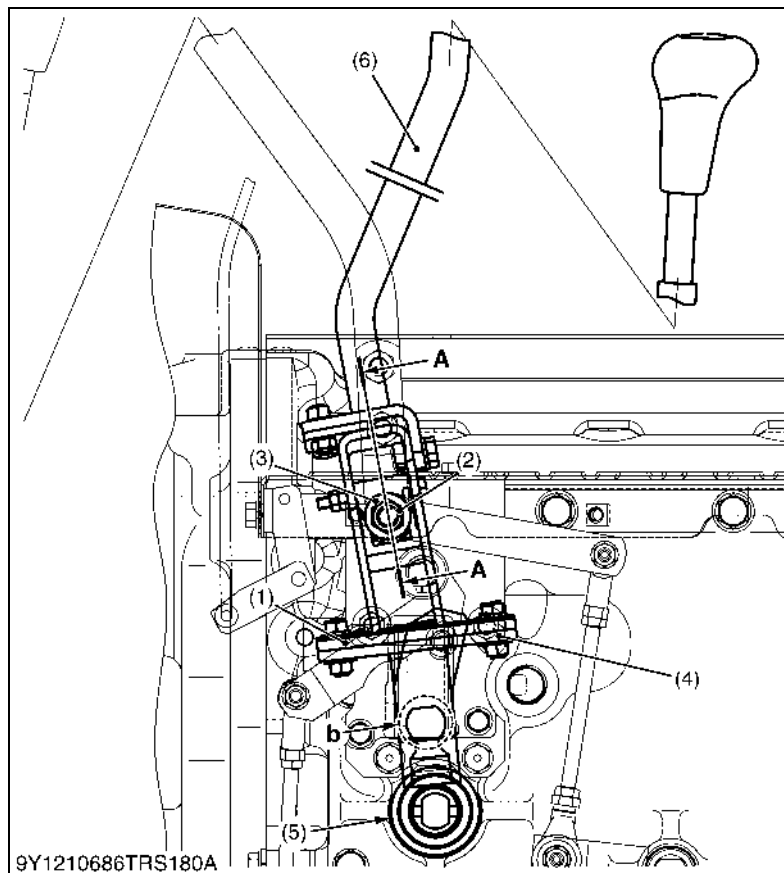
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Adjusting Main Gear Shift

1. If the main gear shift lever 1 (1) is loose or does not shift smoothly, tighten the lock nut (3) to adjust.
Make sure that there are sufficient grease applied to the sliding position 1 "a" and the sliding position 2 "b".
2. Loosen the nuts (7) and adjust the main gear shift lever 1 (1) so that when the main gear shift lever 4 (6) is in neutral position it is in the middle of the main gear shift lever guide and when you shift the main gear shift lever 4 (6) in all position the clearance "B" is the same value.

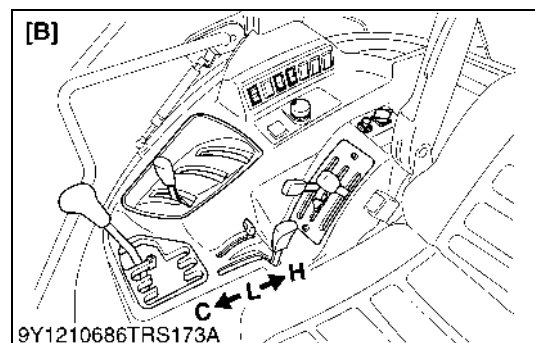
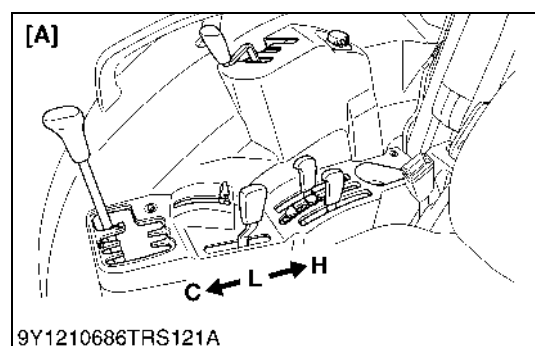


- (1) Main Gear Shift Lever 1
- (2) Main Gear Shift Fulcrum Pivot
- (3) Lock Nut
- (4) Main Gear Shift Lever 2
- (5) Main Gear Shift Lever 3
- (6) Main Gear Shift Lever 4
- (7) Nut

- B : Clearance**
a : Sliding Position 1
b : Sliding Position 2

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(2) Range Gear Shift



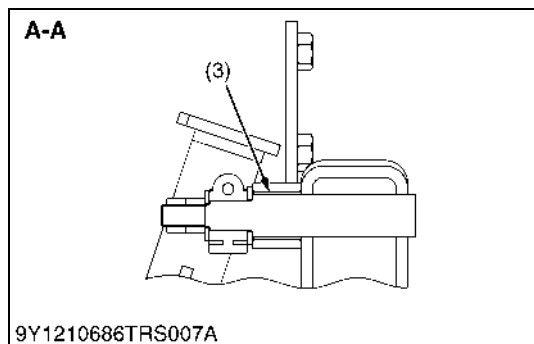
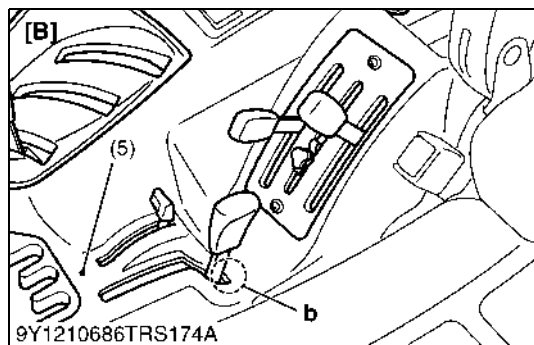
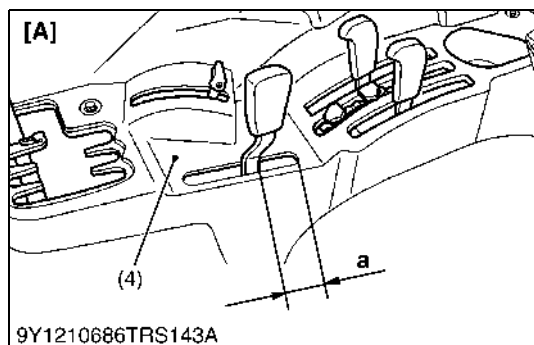
Checking Function of Range Shift

1. Check the function of the range gear shift.
 - H, L and C (Option) position.
2. If feeling abnormal shifting, adjust the range shift following 2-S15.

H : Hi Speed Range Position
 L : Lo Speed Range Position
 C : Creep Speed Range Position
 (Option)

[A] ROPS Model
 [B] CABIN Model

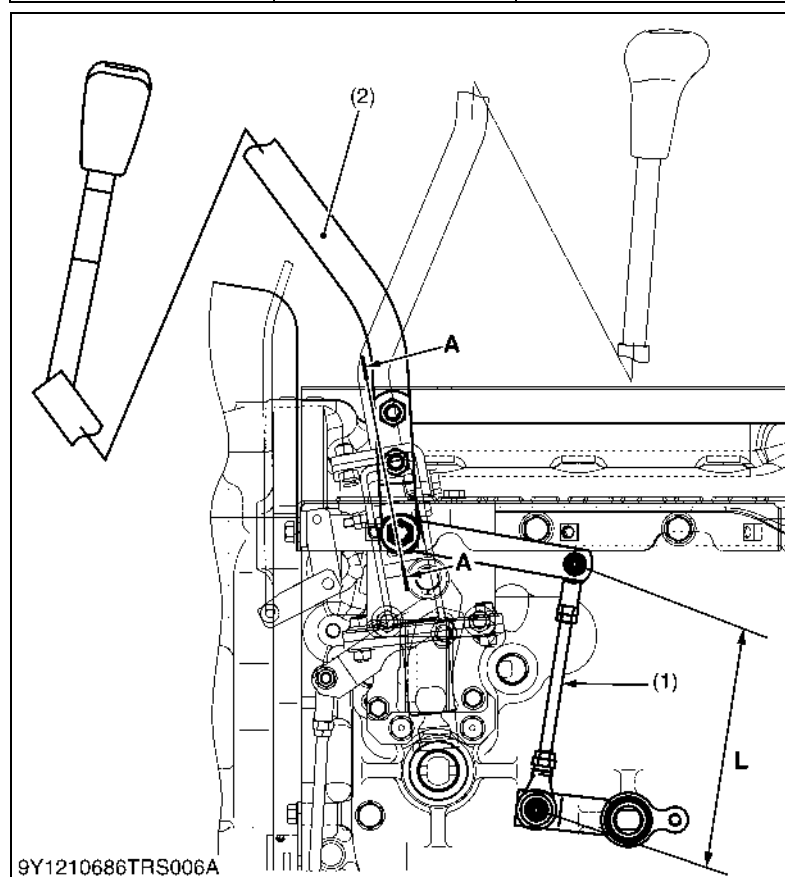
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Adjusting Range Gear Shift

1. Adjust the range gear shift rod (1) so that when the range gear shift lever (2) is shifted to the high speed range position, the clearance is "a" in the table below. (ROPS Model)
2. Adjust the range gear shift rod (1) so that the range gear shift lever (2) does not touch the inner cover (5) "b" on the high speed range side. (CABIN Model)
3. Make sure the range gear shift lever (2) does not touch the range gear shift lever guide cover (4) or the inner cover (5) and that it moves normally.
4. Make sure there is sufficient grease applied to the bush (3).

Clearance "a" between range gear shift lever and range gear shift lever guide	Factory specification	10 to 15 mm 0.40 to 0.59 in.
Length of range gear shift rod "L"	Reference value	175 mm 6.89 in.



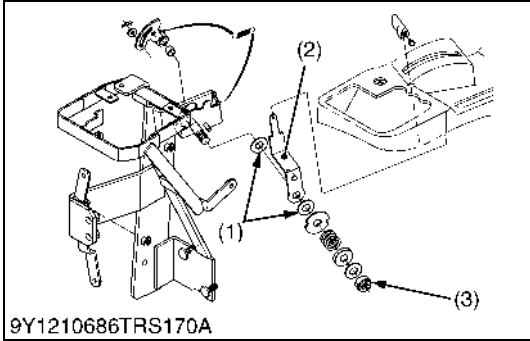
- (1) Range Gear Shift Rod
- (2) Range Gear Shift Lever
- (3) Bush
- (4) Guide Cover
- (5) Inner Cover (R.H.)

- [A] ROPS Model
[B] CABIN Model
a: Clearance
b: Inner Cover Position

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[4] ACCELERATOR SECTION

(1) Checking Accelerator Lever



Checking Accelerator Lever (ROPS Model)

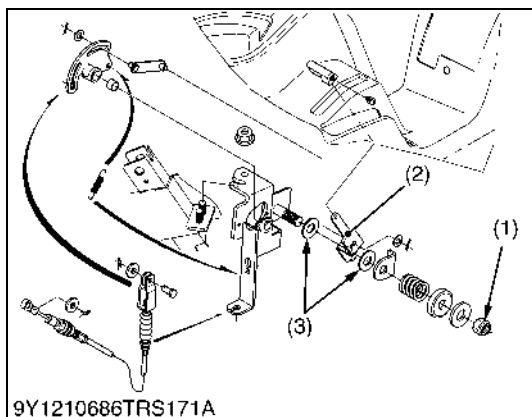
- 1. Check that grease is applied to between the accelerator plate (1) and the hand accelerator lever (2). If grease is not applied, apply grease to there.
- 2. Check the hand accelerator lever (2) operating force.
- 3. If measurement is not within the factory specification, adjust the locking nut (3) with hand accelerator lever (2).
- 4. When idling engine speed is poor, adjust the accelerator rod. (See page 2-S18.)

Operating force for hand accelerator lever	Factory specification	5.0 to 10 N 0.51 to 1.0 kgf 1.2 to 2.2 lbf
--	-----------------------	--

- (1) Accelerator Plate

(2) Hand Accelerator Lever
- (3) Locking Nut

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Checking Accelerator Lever (CABIN Model)

1. Check the grease is applied to between the accelerator plate (3) and the hand accelerator lever (2). If grease is not applied, apply grease to there.
2. Check the hand accelerator lever (2) operating force.
3. If measurement is not within the factory specification, adjust the locking nut (1) with hand accelerator lever (2).
4. When idling engine speed is poor, adjust the accelerator wire. (See page 2-S19.)

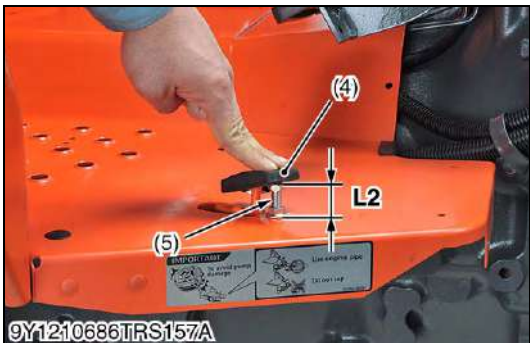
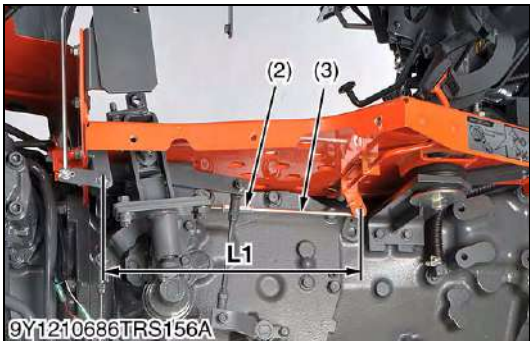
Operating force for hand accelerator lever	Factory specification	10 to 30 N 1.1 to 3.0 kgf 2.3 to 6.7 lbf
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- (1) Locking Nut
(2) Hand Accelerator Lever

- (3) Accelerator Plate

9Y1210686TRS0125US0

(2) Adjusting Accelerator Lever and Wire



Adjusting Accelerator Lever (ROPS Model)

1. When shifting the hand accelerator lever (1) to low engine speed and the accelerator pedal (4) is neutral position, adjust the turnbuckle (2) with accelerator rod (3) to hold the engine speed to minimum.
2. Touch the accelerator pedal (4) to bolt (5) and adjust the length of bolt (5) to hold the engine speed to maximum.

Length of accelerator rod "L1"	Reference value	358 mm 14.1 in.
Length of bolt "L2"	Reference value	50 mm 2.0 in.

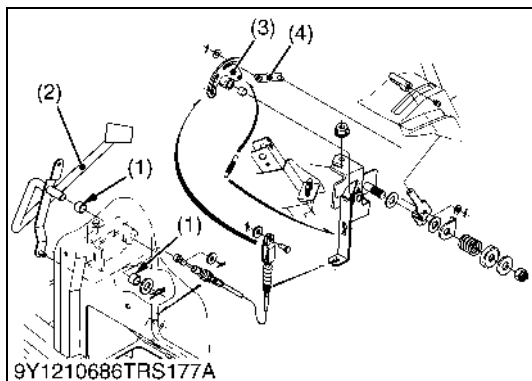
- (1) Hand Accelerator Lever

(2) Turnbuckle

(3) Accelerator Rod
- (4) Accelerator Pedal

(5) Bolt

9Y1210686TRS0126US0

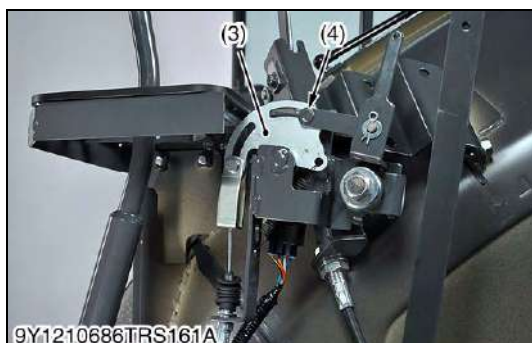


Adjusting Accelerator Wire (CABIN Model)

1. Apply grease to the bushes (1) with accelerator pedal (2).
2. When touching the accelerator pedal (2) to the bolt (5), adjust length of bolt "L2", so that the accelerator sensor lever (3) touches link pin (4).
3. Touch the accelerator pedal (2) to bolt (5), and fix the wire retaining nuts (8) to be a length (L1) between center of wire end (6) and center of accelerator pedal pin (7) as shown photo.

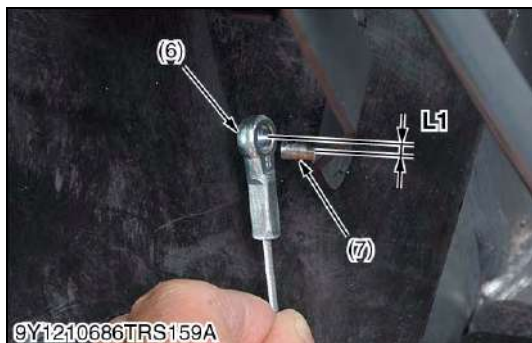
Accelerator wire length "L1"	Factory specification	0 to 5 mm 0 to 0.1 in.
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Length of bolt "L2"	Reference value	45 mm 1.8 in.
---------------------	-----------------	------------------



- | | |
|------------------------------|---------------------------|
| (1) Bush | (5) Bolt |
| (2) Accelerator Pedal | (6) Wire End |
| (3) Accelerator Sensor Lever | (7) Accelerator Pedal Pin |
| (4) Link Pin | (8) Wire Retaining Nut |

9Y1210686TRS0127US0



[5] HYDRAULIC CLUTCH VALVE



Shuttle Clutch Valve System Pressure

1. Prepare a can (3) for fuel and put in the fuel hose (1) and fuel return hose (2).
2. Remove the each plugs of **F**, **R**, **M** and install the adaptor (4) (see page G-80), threaded joint, cable, and pressure gauge (Code No.: 07916-52961).
3. Start the engine and measure the pressure of each port and each shuttle lever position as the pressure table.

Condition

- Engine speed
Approx. 2400 min⁻¹ (rpm) (ROPS Model)
Approx. 2600 min⁻¹ (rpm) (CABIN Model)
- 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	2.16 to 2.25 MPa 22.0 to 23.0 kgf/cm ² 313 to 327 psi
	Free	2.06 to 2.25 MPa 21.0 to 23.0 kgf/cm ² 299 to 327 psi	0	
Reverse	Fully pressed	0	0	2.06 to 2.25 MPa 21.0 to 23.0 kgf/cm ² 299 to 327 psi
	Free	0	2.06 to 2.25 MPa 21.0 to 23.0 kgf/cm ² 299 to 327 psi	
Neutral	—	0	0	0.27 to 0.28 MPa 2.7 to 2.9 kgf/cm ² 39 to 41 psi



WARNING

- Be sure to place the main gear shift lever in neutral and set the parking brake lever to parking position.

NOTE

- Be sure to use a pressure gauge with 5 MPa (50 kgf/cm², 700 psi) capacity.
- Apply Three Bond 1324N or equivalent to the plugs **F**, **R** and **M**, when install them.
- Plug (**F**, **R**, **M**) thread size is R1/8.

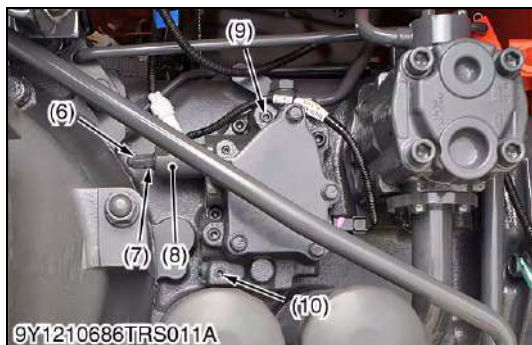
- (1) Fuel Hose
- (2) Fuel Return Hose
- (3) Can
- (4) Adaptor
- (5) Shuttle Valve

Plug F: Operation Oil Pressure
(For Forward)

Plug R: Operation Oil Pressure
(For Reverse)

Plug M: Operation Oil Pressure
(For Modulation Valve)

9Y1210686TRS0010US0



PTO Clutch Valve Operating Pressure

■ IMPORTANT

- Do not connect the universal joint of the implement to the tractor PTO shaft while testing.
 - Set the shuttle lever in Neutral position.
 - Set the parking brake lever in parking position.
 - Be sure to set the disassembling stand, under the transmission case when remove the rear wheel to adjust the relief valve pressure.
 - Be sure to set the disassembling stand, under the rear axle after removed rear wheel.
1. Place the disassembling stand under the transmission case.
 2. Remove the right rear wheel and right fender.
 3. Place the disassembling stand under the left rear axle case.
 4. Remove the plug (R1/8) (9) on the solenoid valve assembly (3).
 5. Assemble the adaptor (R1/8) (2) (see page G-80), threaded joint (4), hose (5) and pressure gauge (1).
 6. Start the engine and set the engine speed to maximum.
 7. Turn on the PTO switch and measure the oil pressure.
 8. If only the pressure in the PTO clutch engaged position is low, check the hydraulic PTO clutch system.
 9. If the measurement is not within the factory specifications, measure the system pressure, and adjust the system pressure with relief valve (8) if necessary.

PTO pressure (when PTO switch is "ON" position)	Factory specification	1.97 to 2.15 MPa 20.0 to 22.0 kgf/cm ² 265 to 312 psi
PTO pressure (when PTO switch is "OFF" position)	Factory specification	No pressure

Condition

- Engine speed
Approx. 2400 min⁻¹ (rpm) (ROPS Model)
Approx. 2600 min⁻¹ (rpm) (CABIN Model)
- Oil temperature: 45 to 55 °C (113 to 131 °F)

(Reference)

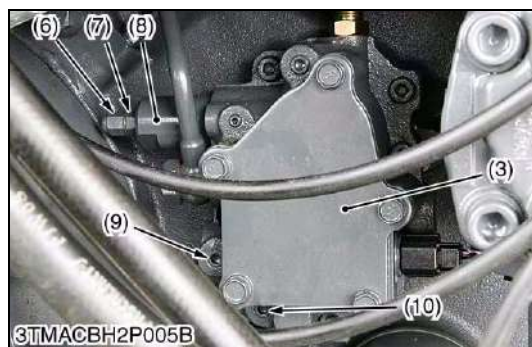
- Turn the adjusting screw after removed lock nuts (6) and (7).
- Turn the adjusting screw clockwise direction → Pressure increase
- Turn the adjusting screw counterclockwise direction → Pressure decrease.

■ NOTE

- Be sure to use a pressure gauge with 5 MPa (50 kgf/cm², 700 psi) capacity.
- Plug thread size: R1/8

- | | |
|-----------------------------|--|
| (1) Pressure Gauge | (6) Lock Nut |
| (2) Adaptor | (7) Lock Nut |
| (3) Solenoid Valve Assembly | (8) Relief Valve |
| (4) Threaded Joint | (9) Plug (PTO Clutch Check Port) |
| (5) Hose | (10) Plug (System Pressure Check Port) |

9Y1210686TRS0011US0



4WD Clutch Valve Operating Pressure (Dual Speed Model)

■ IMPORTANT

- Do not connect the universal joint of the implement to the tractor PTO shaft while testing.
- Set the shuttle lever in Neutral position.
- Set the parking brake lever in parking position.
- Be sure to set the disassembling stand, under the transmission case when remove the rear wheel to adjust the relief valve pressure.
- Be sure to set the disassembling stand, under the rear axle after removed rear wheel.

1. Place the disassembling stand under the transmission case.
2. Remove the right rear wheel and left fender.
3. Place the disassembling stand under the left rear axle case.
4. Remove the plug (R1/8) (10) on the solenoid valve assembly (3).
5. Assemble the adaptor (R1/8) (2) (see page G-80), threaded joint (4), cable (5) and pressure gauge (1).
6. Start the engine and set the engine speed to maximum.
7. Set the 4WD switch to **4WD** position and measure the oil pressure.
8. If only the pressure in the 4WD clutch engaged position is low, check the hydraulic 4WD clutch system.
9. If the measurement is not within the factory specifications, measure the system pressure, and adjust the system pressure with relief valve (8) if necessary.

4WD pressure (when 4WD switch at "4WD" position)	Factory specification	1.97 to 2.15 MPa 20.0 to 22.0 kgf/cm ² 265 to 312 psi
4WD pressure (when 4WD switch at "2WD" position)	Factory specification	No pressure

Condition

- Engine speed: Approx. 2600 min⁻¹ (rpm)
- Oil temperature: 45 to 55 °C (113 to 131 °F)

(Reference)

- Turn the adjusting screw after removed lock nuts (6) and (7).
- Turn the adjusting screw clockwise direction → Pressure increase
- Turn the adjusting screw counterclockwise direction → Pressure decrease.

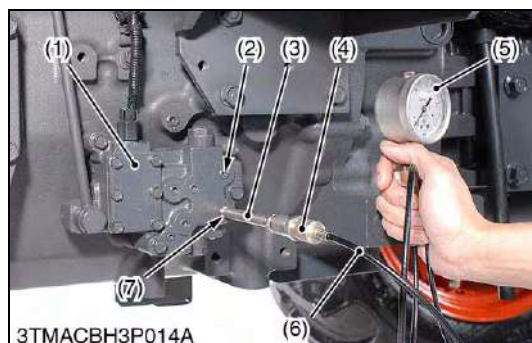
■ NOTE

- Be sure to use a pressure gauge with 5 MPa (50 kgf/cm², 700 psi) capacity.
- Plug thread size: R1/8

- (1) Pressure Gauge
- (2) Adaptor
- (3) Solenoid Valve Assembly
- (4) Threaded Joint
- (5) Cable

- (6) Lock Nut
- (7) Lock Nut
- (8) Relief Valve (System Pressure)
- (9) Plug (4WD Clutch Check Port)
- (10) Plug (System Pressure Check Port)

9Y1210686TRS0012US0



Dual Speed Clutch Valve Operating Pressure

■ IMPORTANT

- Do not connect the universal joint of the implement to the tractor PTO shaft while testing.
 - Set the shuttle lever in Neutral position.
 - Set the parking brake lever in parking position.
 - Be sure to set the disassembling stand, under the transmission case when remove the rear wheel to adjust the relief valve pressure.
 - Be sure to set the disassembling stand, under the rear axle after removed rear wheel.
1. Remove the plug (R1/8) (2) and/or (7) on the solenoid valve assembly (1).
 2. Assemble the adaptor (R1/8) (3) (see page G-80), threaded joint (4), cable (6) and pressure gauge (5).
 3. Start the engine and set the engine speed to maximum.
 4. Set the hi-low dual speed switch **Hi** or **Lo** position and measure the oil pressure.
 5. If only the pressure in the clutch engaged position is low, check the dual speed clutch system.
 6. If the measurement is not within the factory specifications, measure the system pressure, and adjust the system pressure with relief valve (9) if necessary.

Dual speed pressure (at Hi and Lo check port)	Factory specification	1.97 to 2.15 MPa 20.0 to 22.0 kgf/cm ² 265 to 312 psi
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Condition

- Engine speed: Approx. 2600 min⁻¹ (rpm)
- Oil temperature: 45 to 55 °C (113 to 131 °F)

(Reference)

- Turn the adjusting screw after removed lock nuts (8).
- Turn the adjusting screw clockwise direction → Pressure increase
- Turn the adjusting screw counterclockwise direction → Pressure decrease.

■ NOTE

- Be sure to use a pressure gauge with 5 MPa (50 kgf/cm², 700 psi) capacity.
- Plug thread size: R1/8

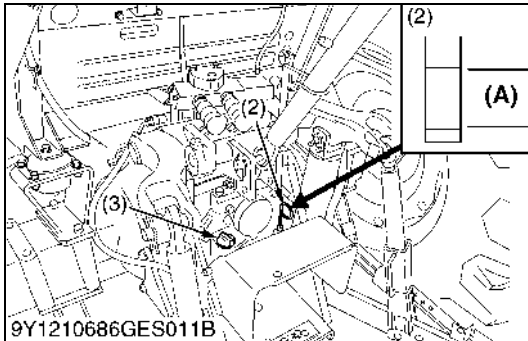
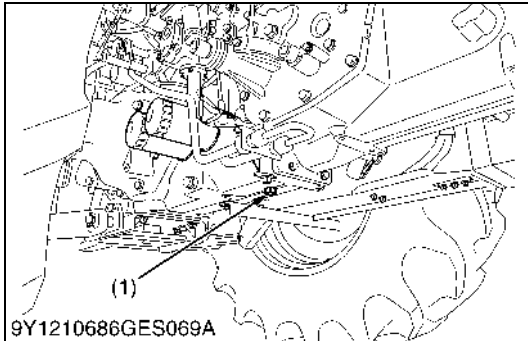
- | | |
|-------------------------------|------------------------------------|
| (1) Dual Speed Solenoid Valve | (6) Cable |
| (2) Check Port for Low Speed | (7) Check Port for Hi Speed |
| (3) Adaptor | (8) Lock Nut |
| (4) Threaded Joint | (9) Relief Valve (System Pressure) |
| (5) Pressure Gauge | |

9Y1210686TRS0013US0

5. DISASSEMBLING AND ASSEMBLING

[1] HYDRAULIC SHUTTLE VALVE AND SOLENOID VALVE

(1) Preparation for Disassembling and Assembling Valve



Draining Transmission Fluid

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

(When reassembling)

- Fill up from filling port (2) after removing the filling plug up to the upper notch on the dipstick (3).
- After running the engine for a 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	60.0 L 63.4 U.S.qts 52.7 Imp.qts
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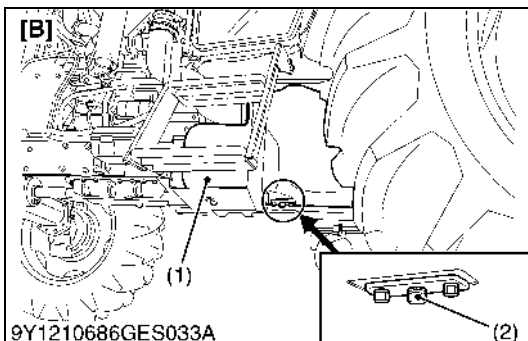
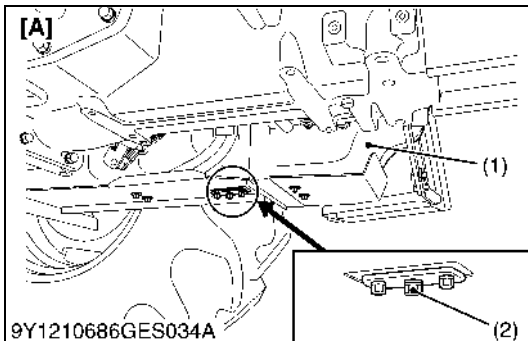
■ IMPORTANT

- Use only KUBOTA SUPER UDT fluid. Use of other oil may damage the transmission or hydraulic system. (Refer to G-12.)
- Do not mix different brands fluid together.

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

(A) Oil level is acceptable with this range.

9Y1210686TRS0014US0



Draining Fuel

1. Place oil pans under the right side fuel tank.
2. Remove the drain cover (2) at the bottom of side fuel tank (1).
3. Drain the fuel.
4. Reinstall the drain cover (2) on the fuel tank (1).

(When reassembling)

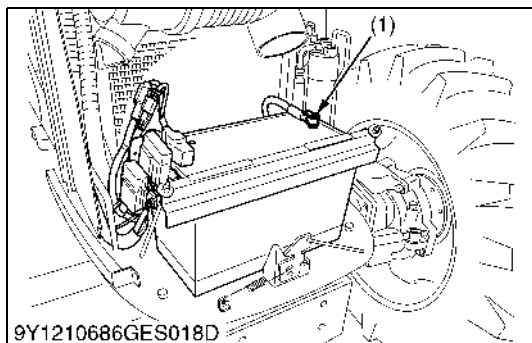
- Be sure to fix the O-ring is in position on the drain cover (2).

Fuel tank	Capacity	ROPS	90.0 L 23.8 U.S.gals 19.8 Imp.gals
		CABIN	110 L 29.1 U.S.gals 24.2 Imp.gals

- (1) Fuel Tank
(2) Drain Cover

[A] ROPS Model
[B] CABIN Model

9Y1210686TRS0120US0



Disconnecting battery negative terminal

1. Open the bonnet
2. Disconnect the battery negative terminal (1)

(1) Negative terminal

9Y1210686TRS0166US0

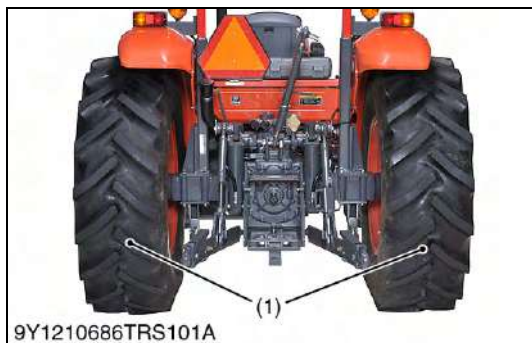


Front Axle Rocking Restrictor

1. Chock the wheels and install the front axle rocking restrictor (1) to the front axle bracket on both sides. (See page G-68)

(1) Front Axle Rocking Restrictor

9Y1210686TRS0026US0



Rear Wheels

1. Place the disassembling stand under the transmission case.
2. Remove the rear wheels (1).
3. Place the disassembling stand under the rear axle case on both sides.

(When reassembling)

Tightening torque	Rear wheel mounting nut	344 to 392 N·m 35.0 to 40.0 kgf·m 254 to 289 lbf·ft
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(1) Rear Wheel

9Y1210686TRS0015US0



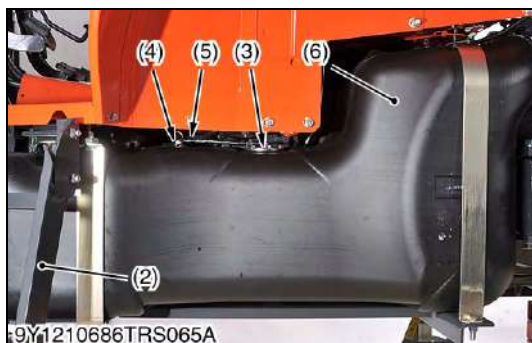
Auxiliary Step and Fuel Tank (ROPS Model)

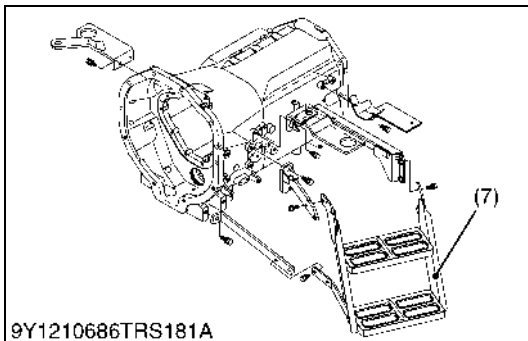
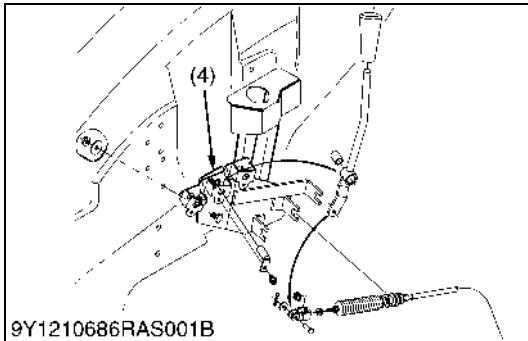
1. Remove the fuel filling port (1) mounting screw.
2. Remove the auxiliary step (2).
3. Disconnect the wire harness from fuel level sensor (3).
4. Remove the fuel hose (4) and fuel return hose (5).
5. Remove the fuel tank (6).

(1) Fuel Filling Port
(2) Auxiliary Step
(3) Fuel Level Sensor

(4) Fuel Hose
(5) Fuel Return Hose
(6) Fuel Tank

9Y1210686TRS0016US0





Fuel Filling Port, Fender and Auxiliary Step [Low Profile Model]

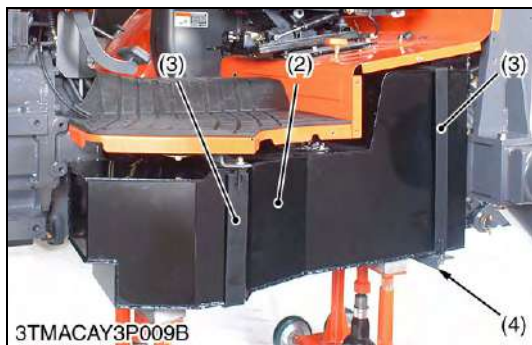
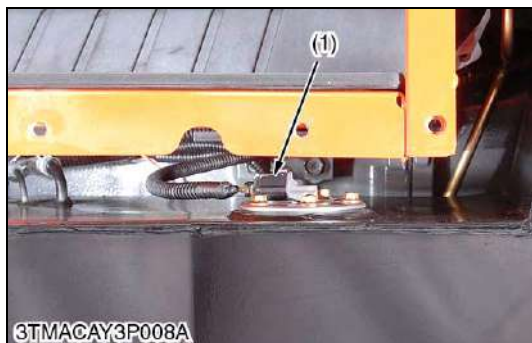
1. Remove the fuel filling port (1) fixing screw.
2. Remove the harness cover (2) and disconnect the **4P** connector (3).
3. Remove the auxiliary lever bracket (4).
4. Remove the fender (5), (6) and auxiliary step (7).

(When reassembling)

- Be sure to assemble the fender to the original height.

- | | |
|-----------------------------|--------------------|
| (1) Fuel Filling Port | (5) Fender L.H. |
| (2) Harness Cover | (6) Fender R.H. |
| (3) 4P Connector | (7) Auxiliary Step |
| (4) Auxiliary Lever Bracket | |

9Y1210686TRS0167US0



Fuel Tank [Low Profile Model]

1. Remove the fuel sensor **2P** connector (1).
2. Place the disassembling stand under the fuel tank (2).
3. Remove the fuel tank band (3).
4. Remove the fuel tank stay (4).
5. Lower the fuel tank (2) to disconnect the fuel hose (5) and (6).
6. Remove the fuel tank (2).

(When reassembling)

- Be sure to connect the fuel sensor connector.
- Tighten the fuel tank band so that the clearance **L** between the fuel tank and fuel tank band became as follow.

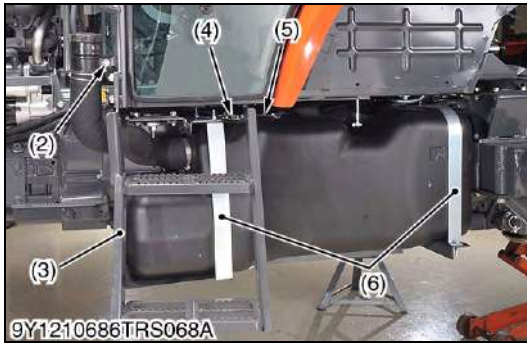
Clearance between fuel tank and fuel tank band	Factory specification	2.0 to 4.0 mm 0.079 to 0.16 in.
--	-----------------------	------------------------------------

- (1) Fuel Sensor **2P** Connector
- (2) Fuel Tank
- (3) Fuel Tank Band
- (4) Fuel Tank Stay

- (5) Fuel Hose (Return)
- (6) Fuel Hose

L: Clearance

9Y1210686TRS0168US0



Auxiliary Step and Fuel Tank (CABIN Model)

1. Remove the cover mounting screws (1).
2. Remove the fuel filling port mounting screw (2).
3. Remove the auxiliary step (3) and disconnect the wire harness from fuel level sensor (4).
4. Remove the fuel hose cover (5) and the both fuel tank band (6).
5. Draw out the fuel tank and disconnect the breather hoses (7) and (8).
6. Disconnect the fuel hose (9) and return hose (10).

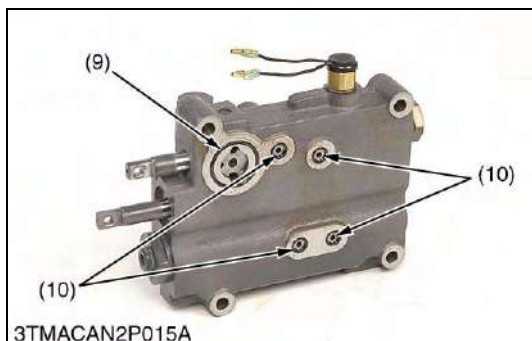
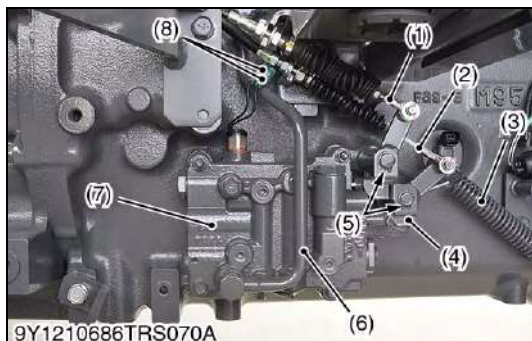
(When reassembling)

- Be sure to connect the fuel sensor connector.
- Be sure to fix the fuel hoses and breather hose.

- | | |
|--------------------------------------|---------------------------|
| (1) Under Cover Mounting Screw | (6) Fuel Tank Band |
| (2) Fuel Filling Port Mounting Screw | (7) Breather Hose (Front) |
| (3) Auxiliary Step | (8) Breather Hose (Rear) |
| (4) Fuel Level Sensor | (9) Fuel Hose |
| (5) Fuel Hose Cover | (10) Fuel Return Hose |

9Y1210686TRS0020US0

(2) Hydraulic Shuttle Valve



(3) Solenoid Valve



Shuttle Valve Assembly

1. Disconnect the shuttle cable (1).
2. Disconnect the clutch cable (2) and spring (3).
3. Remove the shuttle valve pipe (6).
4. Remove the external circlip (5) and plate (4).
5. Disconnect the neutral switch **1P** connectors (8).
6. Remove the shuttle valve assembly (7).

(When reassembling)

- Be sure to fix the O-ring (10) and (9) in position as shown in the photo and apply transmission fluid.
- Adjust the clutch pedal free travel (see page 2-S11).
- Turn the mark (11) to outward.

Tightening torque	Shuttle valve pipe mounting nut	49 to 68 N·m 5.0 to 7.0 kgf·m 37 to 50 lbf·ft
	Shuttle valve mounting screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft

- | | |
|------------------------|--|
| (1) Shuttle Cable | (7) Shuttle Valve Assembly |
| (2) Clutch Cable | (8) 1P Connector for Neutral Switch |
| (3) Spring | (9) O-ring |
| (4) Plate | (10) O-ring |
| (5) External Circlip | (11) Mark |
| (6) Shuttle Valve Pipe | (12) Shuttle Spool |

9Y1210686TRS0021US0

Solenoid Valve Assembly (F8/R8 and F12/R12 Speed Transmission Model)

1. Remove the I-joint screw (delivery pipe) (1).
2. Disconnect the connector (2).
3. Remove the solenoid valve assembly (3).

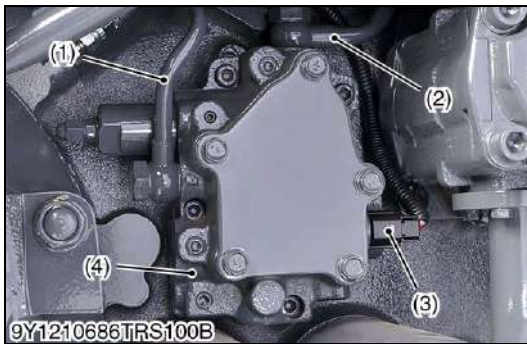
(When reassembling)

- Apply transmission fluid to the O-rings (4).
- Apply liquid gasket (Three Bond 1206C or equivalent) to joint face of transmission case and solenoid valve assembly.

Tightening torque	Joint screw for hydraulic pipe	30 to 34 N·m 3.0 to 3.5 kgf·m 22 to 25 lbf·ft
	Return pipe retaining nut	23 to 27 N·m 2.3 to 2.8 kgf·m 17 to 20 lbf·ft

- | | |
|-------------------|-----------------------------|
| (1) I-Joint Screw | (3) Solenoid Valve Assembly |
| (2) Connector | (4) O-ring |

9Y1210686TRS0022US0



Solenoid Valve Assembly (F24/R24 Speed Transmission Model)

1. Remove the I-joint screws and then remove delivery pipe (2) and differential lock pipe (1).
2. Disconnect the connector (3).
3. Remove the solenoid valve assembly (4).

(When reassembling)

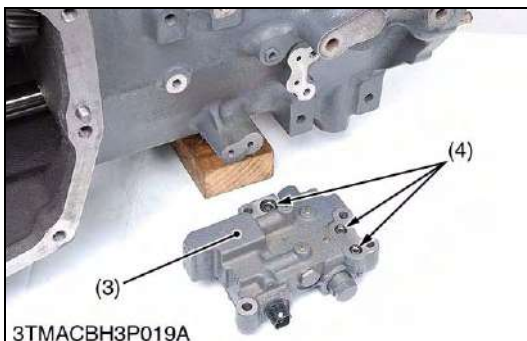
- Apply transmission fluid to the O-rings (5).
- Apply liquid gasket (Three Bond 1206C or equivalent) to joint face of transmission case and solenoid valve assembly.

Tightening torque	Joint screw for hydraulic pipe	30 to 34 N·m 3.0 to 3.5 kgf·m 22 to 25 lbf·ft
	Return pipe retaining nut	23 to 27 N·m 2.3 to 2.8 kgf·m 17 to 20 lbf·ft

- (1) Pipe (Differential Lock) (4) Solenoid Valve Assembly
(2) Pipe (Delivery) (5) O-ring
(3) Connector

9Y1210686TRS0023US0

(4) Dual Speed Solenoid Valve



Dual Speed Solenoid Valve Assembly

1. Disconnect the **3P** connector (1).
2. Remove the dual speed solenoid valve delivery pipe (2).
3. Remove the dual speed solenoid valve (3).

(When reassembling)

- Be sure to fix the O-rings (4) in position as shown photo and apply transmission fluid to the O-rings (4).

Tightening torque	Joint screw for hydraulic pipe	30 to 34 N·m 3.0 to 3.5 kgf·m 22 to 25 lbf·ft
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- (1) **3P** Connector (Dual Speed Solenoid Valve) (3) Dual Speed Solenoid Valve
(2) Dual Speed Solenoid Valve Delivery Pipe (4) O-ring

9Y1210686TRS0024US0

[2] PREPARATION FOR SEPARATING EACH BLOCK

(1) Lubricant and Coolant

Draining Transmission Fluid

- See page 2-S24.

9Y1210686TRS0025US0

Draining Fuel

- See page 2-S24.

9Y1210686TRS0129US0

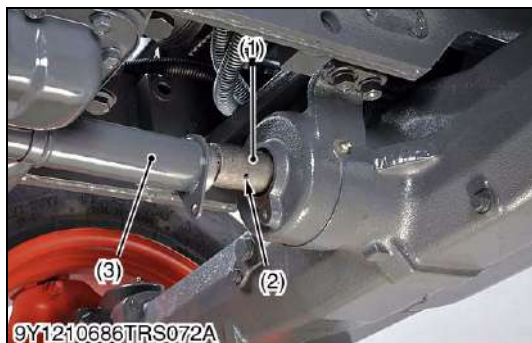
(2) Front Axle Rocking Restrictor

Front Axle Rocking Restrictor

- See page 2-S25.

9Y1210686TRS0173US0

(3) Propeller Shaft (4WD Model) and Power Steering Hose



Propeller Shaft

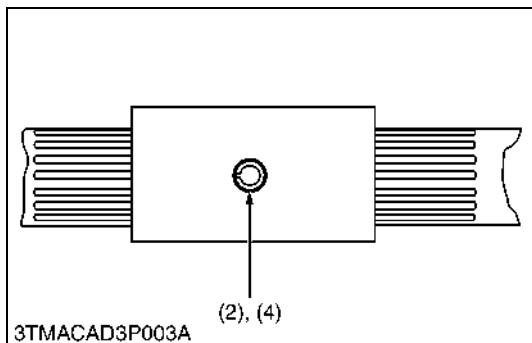
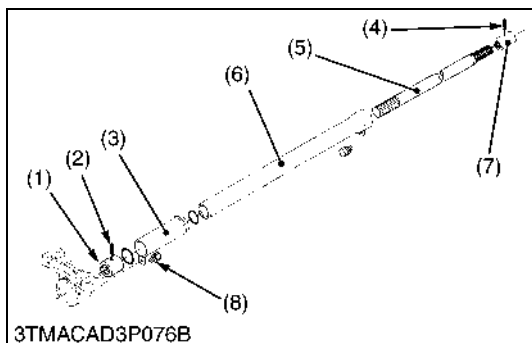
1. Slide the propeller shaft cover (3) after removing the screw (8).
2. Tap out the roll pins (2) and then slide the coupling (1) to the rear.

(When reassembling)

- Apply grease to the splines of the propeller shaft (5) and pinion shaft.
- Tap in the roll pins (2) as shown in figure.

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

9Y1210686TRS0027US0



Power Steering Hose

1. Disconnect both power steering hoses (2) from power steering cylinder (1).

(When reassembling)

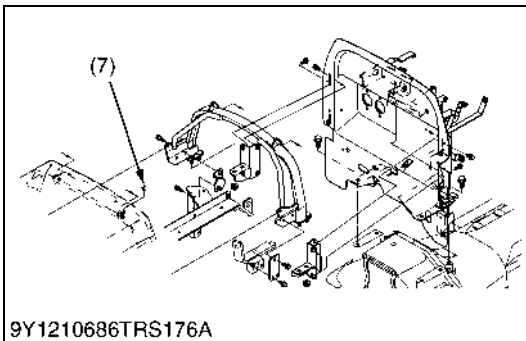
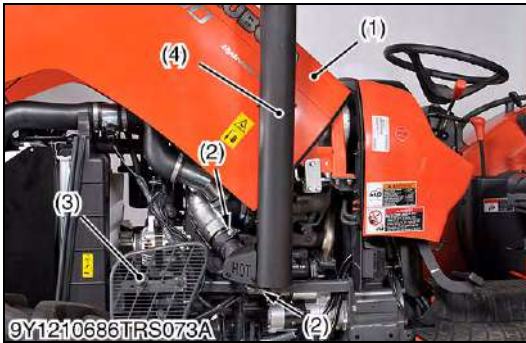
- Connect the power steering hose with blue tape to the R.H..

Tightening torque	Power steering hose retaining nut	23 to 27 N·m 2.3 to 2.8 kgf·m 17 to 20 lbf·ft
-------------------	-----------------------------------	---

- | | |
|-----------------------------|-------------------------|
| (1) Power Steering Cylinder | (2) Power Steering Hose |
|-----------------------------|-------------------------|

9Y1210686TRS0028US0

(4) Bonnet and Cover



Bonnet and Cover (ROPS Model)

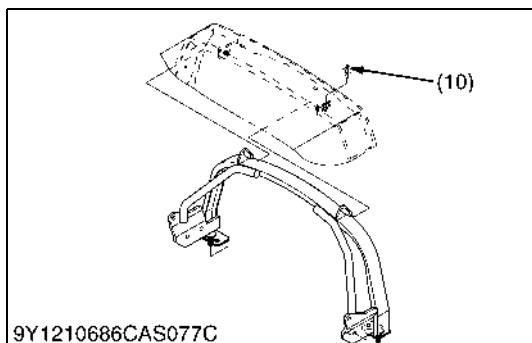
1. Open the bonnet (1) and disconnect the battery negative terminal.
2. Disconnect the **3P** connector (5) for head lights.
3. Remove the muffler pipe mounting screws (2) and then muffler pipe (4).
4. Remove the bonnet damper (6) on both sides.
5. Close the bonnet (1) and remove the plug.
6. Pull out the snap pin (7) and then remove the bonnet (1).
7. Remove the bonnet support mounting screws (8) and nuts (9) on both sides and then remove the bonnet support (10).
8. Remove the side cover (3) on both sides.
9. Remove the rubber sheet and steering (11).
10. Remove the steering support under cover (12) and steering post cover (13).
11. Remove the rear bonnet mounting screws and then remove rear bonnet (14).

■ IMPORTANT

- **When disconnecting the battery cables, disconnect the negative cable first. When connecting, connect the positive cable first.**
- **When assembling the bonnet damper (6), make sure that the rod part of bonnet damper (6) is on the backside.**

- | | |
|--------------------------------------|-----------------------------------|
| (1) Bonnet | (8) Bonnet Support Mounting Screw |
| (2) Muffler Pipe Mounting Screw | (9) Bonnet Support Mounting Nut |
| (3) Side Cover | (10) Bonnet Support |
| (4) Muffler Pipe | (11) Steering |
| (5) 3P Connector (Head Light) | (12) Steering Support Under Cover |
| (6) Bonnet Damper | (13) Steering Post Cover |
| (7) Snap Pin | (14) Rear Bonnet |

9Y1210686TRS0029US0



Bonnet and Cover (CABIN Model)

1. Open the bonnet (1) and disconnect the battery (2) negative terminal.
2. Remove the muffler pipe mounting screws 1 (7) and the muffler pipe (6).
3. Remove the cover (3), the side panel (4) and the side cover guide (5) on both sides.
4. Disconnect the **3P** connector (8) for head light and remove the bonnet damper (9).
5. Close the bonnet (1) and remove the plug.
6. Pull out the snap pin (10), and then remove the bonnet (1).
7. Remove the bonnet support mounting screw 2 (11), the bonnet mounting nut (12) on both side, and the bonnet support (13).

■ IMPORTANT

- When disconnecting the battery cables, disconnect the negative cable first. When connecting, connect the positive cable first.
- When assembling the bonnet damper (9), make sure that the rod part of bonnet damper (9) is on the backside.

- | | |
|-----------------------------------|--------------------------------------|
| (1) Bonnet | (8) 3P Connector (Head Light) |
| (2) Battery | (9) Bonnet Damper |
| (3) Side Cover | (10) Snap Pin |
| (4) Side Panel | (11) Bonnet Support Mounting Screw 2 |
| (5) Side Cover Guide | (12) Bonnet Support Mounting Nut |
| (6) Muffler Pipe | (13) Bonnet Support |
| (7) Muffler Pipe Mounting Screw 1 | |

9Y1210686TRS0172US0

(5) DPF Muffler



Disconnecting Connectors for DPF Muffler



CAUTION

- After running the engine, DPF muffler is very hot. When disconnecting the connectors, wait the cooling down.

1. Disconnect the connectors 1 (1) for the exhaust gas temperature sensor.
2. Disconnect the connector 2 (2) for differential pressure sensor.

(When reassembling)

- Each exhaust gas temperature sensor is different. Be attention for the color of connectors.
(Steering Side) Black → Gray → White (Front Side)

(1) Connector 1 (Exhaust Gas Temperature Sensor)

(2) Connector 2 (Differential Pressure Sensor)

9Y1210686TRS0032US0

[3] SEPARATING ENGINE AND CLUTCH HOUSING CASE

(1) ROPS Model



Power Steering Hose and Wire Harness for L.H. Side

1. Remove the power steering hose bands (1) with the power steering hose (2).
2. Disconnect the wire harness (3) from the alternator (4), the starter (5), the coolant temperature sensor (6), the engine oil pressure switch (7) and the intake air flow sensor (8).
3. Disconnect the wire harness (3) from the camshaft position sensor (9) and the crankshaft position sensor (10).

(When reassembling)

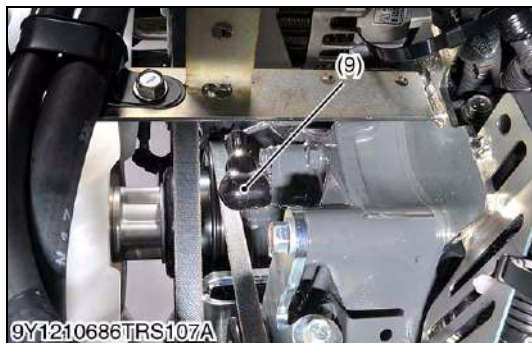
Tightening torque	Starter's B terminal mounting nut	9.8 to 11 N·m 1.0 to 1.2 kgf·m 7.3 to 8.6 lbf·ft
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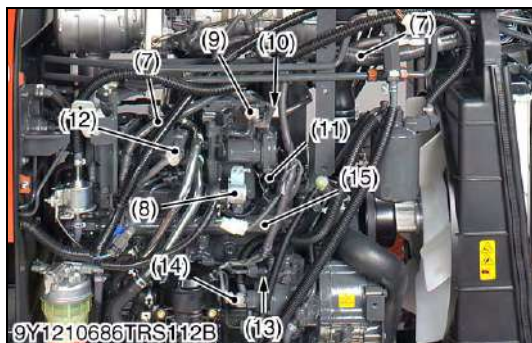
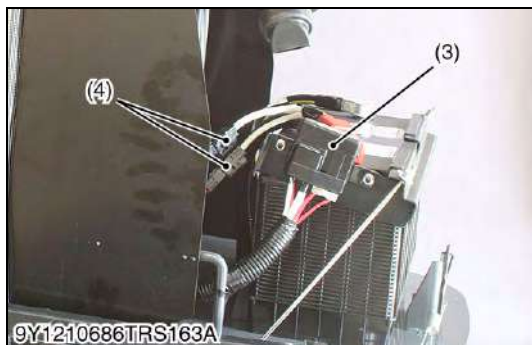
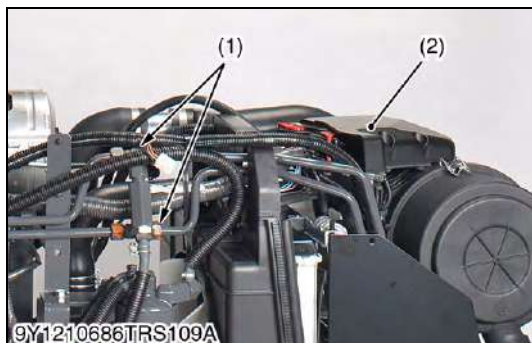
■ NOTE

- There are three bands for power steering hose. Hose band under the radiator is not in photo.
- There is the crankshaft position sensor (10) that is wrapped a white tape.
There is the camshaft position sensor (9) that is wrapped no tape.

- | | |
|-------------------------------------|---------------------------------|
| (1) Hose Band (Power Steering Hose) | (6) Coolant Temperature Sensor |
| (2) Power Steering Hose | (7) Engine Oil Pressure Switch |
| (3) Wire Harness | (8) Intake Air Flow Sensor |
| (4) Alternator | (9) Camshaft Position Sensor |
| (5) Starter | (10) Crankshaft Position Sensor |

9Y1210686TRS0033US0





Oil Cooler Pipe, Fuel Hoses and Wire Harness for R.H. Side

1. Disconnect the oil cooler pipe retaining nuts (1).
2. Remove the slow blow fuse box (3) from the battery support and disconnect the connectors 1 (4) for the battery.
3. Remove the engine ECU cover (2) and disconnect the **96P** connector and the **58P** connector.
4. Remove the relay (5), the CRS relays (6) and the ground cables from the engine ECU stay.
5. Disconnect the wire harness (7) from the heater relay (8), the intake air temperature sensor (9), the intake air pressure sensor (10), the intake air heater (11), the EGR DC motor (12), the fuel temperature sensor (13), the SCV (14), the rail pressure sensor (15) and the connector 2 (16).
6. Disconnect the fuel hose (17) and the fuel return hose (18).

(When reassembling)

Tightening torque	Oil cooler pipe nut	49 to 68 N·m 5.0 to 7.0 kgf·m 37 to 50 lbf·ft
	Intake air heater terminal mounting nut	3.5 to 5.3 N·m 0.35 to 0.55 kgf·m 2.6 to 3.9 lbf·ft



- | | |
|-----------------------------------|---------------------------------|
| (1) Oil Cooler Pipe Mounting Nut | (10) Intake Air Pressure Sensor |
| (2) Engine ECU Cover | (11) Intake Air Heater |
| (3) Slow Blow Fuse Box | (12) EGR DC Motor |
| (4) Connector 1 (Battery) | (13) Fuel Temperature Sensor |
| (5) Relay (Starter) | (14) SCV |
| (6) CRS Relay | (15) Rail Pressure Sensor |
| (7) Wire Harness | (16) Connector 2 (Injector) |
| (8) Heater Relay | (17) Fuel Hose |
| (9) Intake Air Temperature Sensor | (18) Fuel Return Hose |

9Y1210686TRS0034US0



Separating Engine from Clutch Housing

1. Make sure the engine and clutch housing case are securely mounted on the disassembling stands.
2. Remove the steering support mounting screw (1) for front side.
3. Remove the engine mounting screws and nut, and separate the engine from the clutch housing.

(When reassembling)

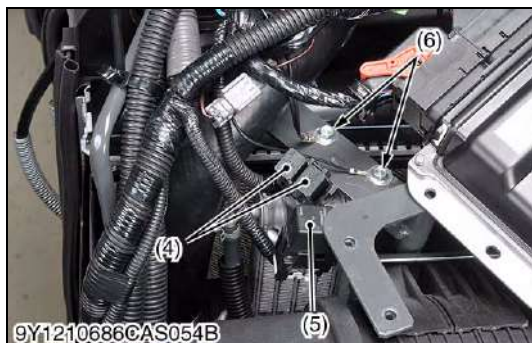
- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the splines of damper disc boss.
- Apply liquid gasket (Three Bond 1141, 1211 or equivalent) to joint face of the engine and clutch housing.

Tightening torque	Engine and clutch housing mounting screw and nut (M14, 7T)	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 lbf·ft
	Engine and clutch housing mounting stud bolt	62 to 73 N·m 6.3 to 7.5 kgf·m 46 to 54 lbf·ft

(1) Steering Support Mounting Screw

9Y1210686TRS0037US0

(2) CABIN Model



Wire Harness for Tractor Front Side

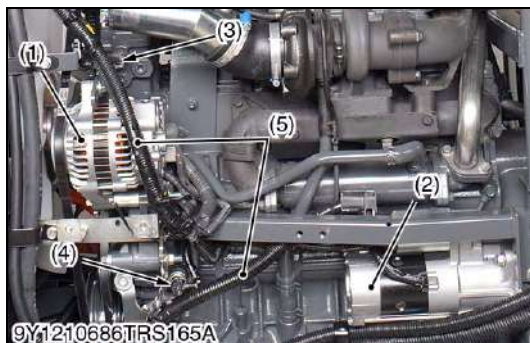
1. Remove the engine ECU cover (1).
2. Let the red handles of engine ECU be rotated 0.79 rad (45 °) and disconnect the **96P** connector (2) and **58P** connector (3).
3. Remove the relays (4).
4. Remove the relay (5).
5. Disconnect the ground wires (6).
6. Remove the slow blow fuse boxes (7) from the battery support and disconnect the connector (8) from the battery.

■ NOTE

- Do not be rotated over 0.79 rad (45 °). The red handle may be damaged.

- | | |
|---------------------------------------|-------------------------|
| (1) Engine ECU Cover | (5) Relay (Starter) |
| (2) 96P Connector (Engine ECU) | (6) Ground Wire |
| (3) 58P Connector (Engine ECU) | (7) Slow Blow Fuse Box |
| (4) Relay (CRS) | (8) Connector (Battery) |

9Y1210686ENS0111US0



Wire Harness for L.H. Side

1. Disconnect the wire harness (5) from the alternator (1), the starter (2), the coolant temperature sensor (3), the engine oil pressure switch (4).
2. Disconnect the wire harness (6) from the camshaft position sensor (6) and the crankshaft position sensor (7).

(When reassembling)

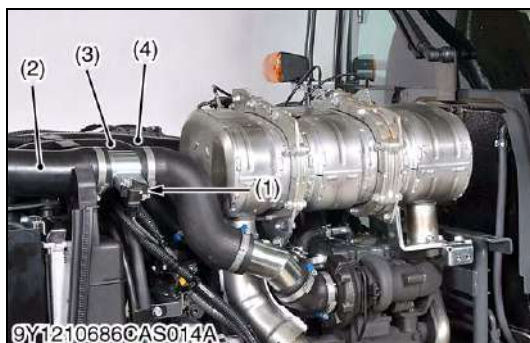
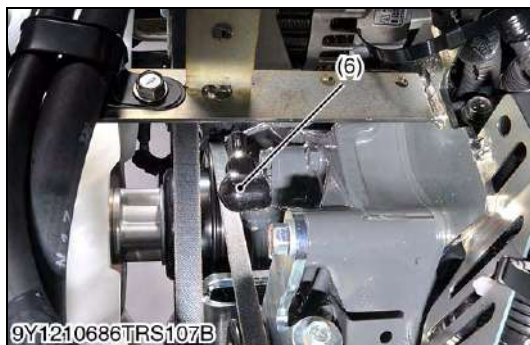
Tightening torque	Starter's B terminal mounting nut	9.8 to 11 N·m 1.0 to 1.2 kgf·m 7.3 to 8.6 lbf·ft
-------------------	-----------------------------------	--

■ NOTE

- There are three bands for power steering hose. Hose band under the radiator is not in photo.
- There is the crankshaft position sensor (7) that is wrapped a white tape.
There is the camshaft position sensor (6) that is wrapped no tape.

- | | |
|--------------------------------|--------------------------------|
| (1) Alternator | (5) Wire Harness |
| (2) Starter | (6) Camshaft Position Sensor |
| (3) Coolant Temperature Sensor | (7) Crankshaft Position Sensor |
| (4) Engine Oil Pressure Switch | |

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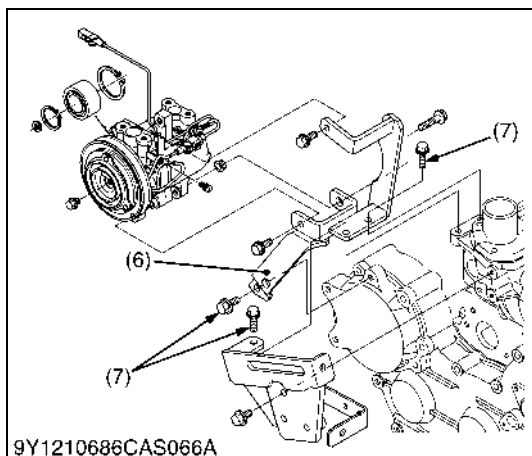


Hose

1. Disconnect the **5P** connector for mass air flow sensor (1) and the air cleaner hose (2).
2. Disconnect the intercooler hose 1 (3) and the intercooler hose 2 (4). (for M9960 Model)

- | | |
|--------------------------|------------------------|
| (1) Mass Air Flow Sensor | (3) Intercooler Hose 1 |
| (2) Air Cleaner Hose | (4) Intercooler Hose 2 |

9Y1210686CAS0058US0



Condenser and Compressor

■ Without discharging the refrigerant from system

1. Remove the screw 1 (1) from the condenser (2) and slide out the condenser (2).
2. Remove the hose clamps (3).
3. Disconnect **1P** connector (4) of magnetic clutch.
4. Remove the compressor stay (6) mounting screw 2 (7) from engine.
5. Remove the compressor (5) with hoses and compressor stay (6).

(When reassembling)

- Take care not to damage the air condenser fin.
- After reassembling the compressor, be sure to adjust the air conditioner belt tension. (See page G-29.)

Tightening torque	Compressor bracket mounting screw (M8) to aluminum parts	18 to 20 N·m 1.8 to 2.1 kgf·m 13 to 15 lbf·ft
	Compressor bracket mounting screw (M8) to ordinariness parts	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Compressor bracket mounting screw (M10) to ordinariness parts	48 to 55 N·m 4.9 to 5.7 kgf·m 36 to 41 lbf·ft

- | | |
|---|---|
| (1) Screw 1 | (6) Compressor Stay |
| (2) Condenser | (7) Compressor Support Mounting Screw 2 |
| (3) Hose Clamp | (8) Low Pressure Hose |
| (4) 1P Connector (Magnetic Clutch) | (9) High Pressure Hose |
| (5) Compressor | |

(To be continued)

(Continued)



■ With discharge the refrigerant from system

- 1. See page 9-S18.
- 2. Disconnect the low pressure hose (8) and high pressure hose (9) from compressor (5).

(When reassembling)

- Charge the refrigerator to the air conditioner system. (See page 9-S20.)
- Apply compressor oil (DENSO CO. ND-OIL8) to the O-rings and take care not to damage them.

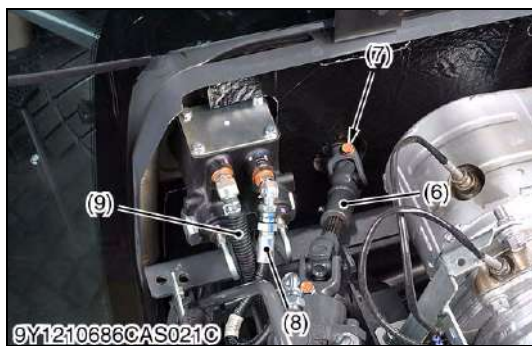
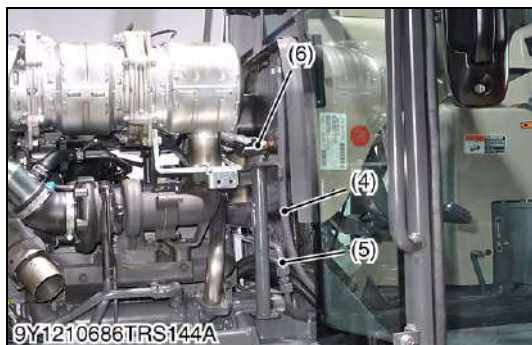
■ IMPORTANT

- After removing the condenser, return the front wheel to straight.

Tightening torque	High pressure hose mounting screw	7.9 to 11 N·m 0.80 to 1.2 kgf·m 5.8 to 8.6 lbf·ft
	Low pressure hose mounting screw	7.9 to 11 N·m 0.80 to 1.2 kgf·m 5.8 to 8.6 lbf·ft

- | | |
|------------------------------------|---|
| (1) Screw 1 | (6) Compressor Stay |
| (2) Condenser | (7) Compressor Support Mounting Screw 2 |
| (3) Hose Clamp | (8) Low Pressure Hose |
| (4) 1P Connector (Magnetic Clutch) | (9) High Pressure Hose |
| (5) Compressor | |

9Y1210686CAS0059US0



Heater Hose, Steering Pipe and Steering Joint Shaft

1. Remove the hose clamps (1).
2. Slide the hose clamp 2 (3) and disconnect the heater hoses (2) from the heater hose couples.
3. Disconnect the breather hose (4) and steering pipe 1 (5).
4. Remove the steering joint shaft mounting screw (7) then disconnect the steering joint shaft (6) from steering joint.
5. Disconnect the master cylinder hose (8), master cylinder return hose (9) and the steering pipe 2 (10).

(When reassembling)

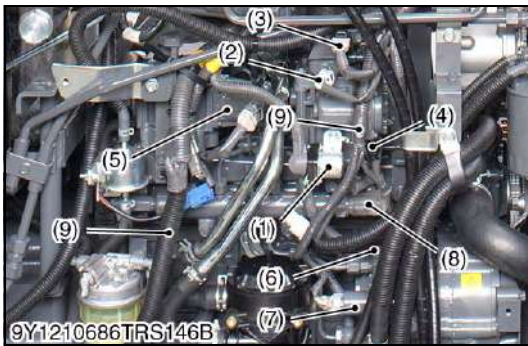
- Be sure to fix the heater hose to the original position. Note the inlet hose and outlet hoses.

Tightening torque	Master cylinder hose retaining nut	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Power steering joint shaft mounting screw	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft
	Power steering pipe nut	49 to 68 N·m 5.0 to 7.0 kgf·m 37 to 50 lbf·ft

- (1) Hose Clamp
- (2) Heater Hose
- (3) Hose Clamp 2
- (4) Breather Hose
- (5) Steering Pipe 1

- (6) Steering Joint Shaft
- (7) Screw
- (8) Master Cylinder Hose
- (9) Master Cylinder Return Hose
- (10) Steering Pipe 2

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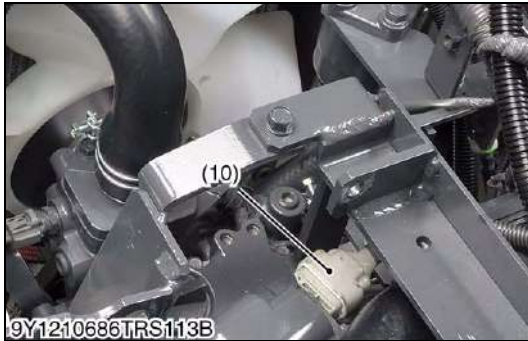


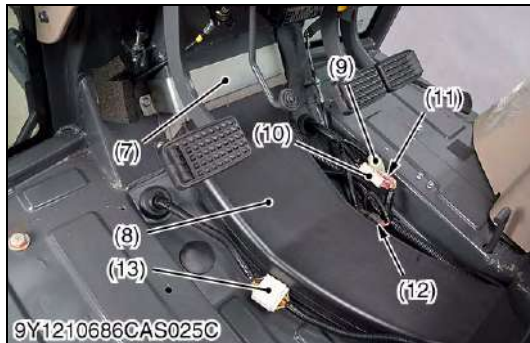
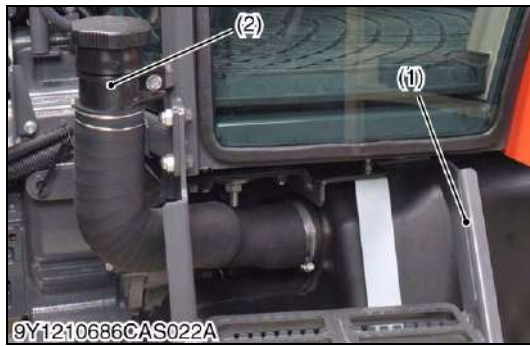
Fuel Hose and Wire Harness for R.H. Side

1. Disconnect the wire harness (9) from the heater relay (1), the intake air temperature sensor (2), the intake air pressure sensor (3), the intake air heater (4), the EGR DC motor (5), the fuel temperature sensor (6), the SCV (7), the rail pressure sensor (8) and the connector (10).
2. Disconnect the fuel hose (11) and the fuel return hose (12).

- | | |
|-----------------------------------|---------------------------|
| (1) Heater Relay | (7) SCV |
| (2) Intake Air Temperature Sensor | (8) Rail Pressure Sensor |
| (3) Intake Air Pressure Sensor | (9) Wire Harness |
| (4) Intake Air Heater | (10) Connector (Injector) |
| (5) EGR DC Motor | (11) Fuel Hose |
| (6) Fuel Temperature Sensor | (12) Fuel Return Hose |

9Y1210686TRS0123US0



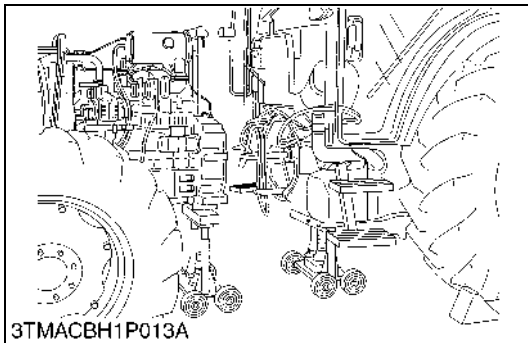


Step, Floor Mats and Wiring Harness for CABIN Side

1. Remove the auxiliary step on both sides.
2. Remove the fuel filling port (2).
3. Remove the floor mat 1 (3) and mat 2 (4).
4. Remove the floor cover (5) and seat under cover (6).
5. Remove the duct band and front duct.
6. Disconnect the connectors (9), (10), (11) and (12) for engine wire harness.
7. Disconnect the connector (13) and (14) for main wire harness.
8. Pull out these connectors from cabin.

- | | |
|-----------------------|---------------------------|
| (1) Auxiliary Step | (8) Front Duct |
| (2) Fuel Filling Port | (9) 10P Connector |
| (3) Floor Mat 1 | (10) 3P Connector |
| (4) Floor Mat 2 | (11) 2P Connector |
| (5) Floor Cover | (12) 4P Connector |
| (6) Seat Under Cover | (13) 17P Connector |
| (7) Duct Band | (14) 8P Connector |

9Y1210686TRS0131US0



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.
3. Separate the engine from the clutch housing.

(When reassembling)

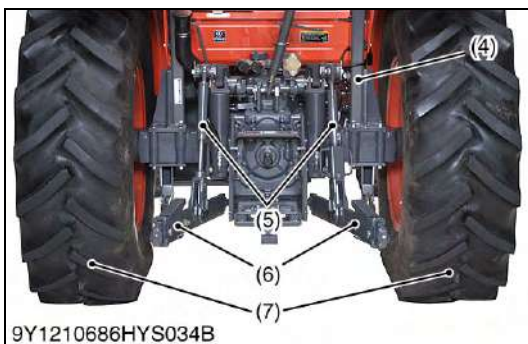
- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the splines of damper disk boss.
- Apply liquid gasket (Three Bond 1141, 1211 or equivalent) to joint face of the engine and clutch housing.

Tightening torque	Engine and clutch housing mounting screw and nut (M14, 7T)	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 lbf·ft
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9Y1210686TRS0043US0

[4] SEPARATING CLUTCH HOUSING CASE AND TRANSMISSION CASE

(1) Preparation for ROPS Model



ROPS, Lower Link, Lift Rod and Rear Wheel

1. Loosen the ROPS under frame (4) mounting screws. (Do not remove screws.)
2. Remove the ROPS upper frame (1).
3. Remove the lift rod (5) and lower link (6).
4. Chock the front wheels and place the disassembling stand under the transmission case.
5. Remove the both rear wheels (7) and then place the disassembling stand under the rear axle case.

(When reassembling)

- To assemble the ROPS, fix the upper frame with screw (2) and pin (3) temporarily, then tighten the under frame screws evenly with specified torque.
- Adjust the upper frame does not fall down with screw (2).

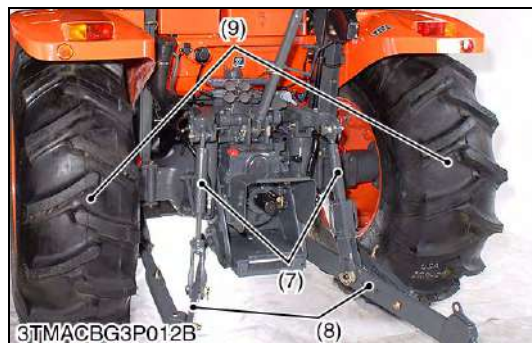
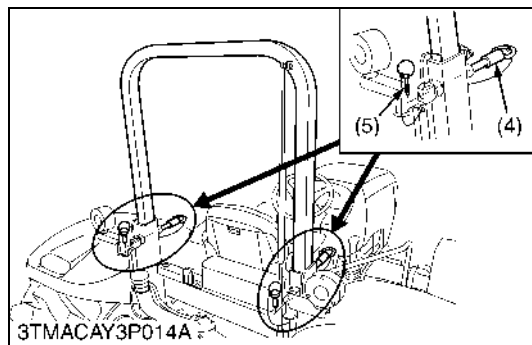
Tightening torque	Rear wheel mounting nut	344 to 392 N·m 35.0 to 40.0 kgf·m 254 to 289 lbf·ft
	ROPS under frame mounting screw (M16, 9T)	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 lbf·ft

ROPS upper frame lift up force at center of upper frame	Reference value	246 to 284 N 25.0 to 29.0 kgf 55.2 to 63.9 lbf
---	-----------------	--

- (1) ROPS Upper Frame
- (2) Screw
- (3) Pin
- (4) ROPS Under Frame

- (5) Lift Rod
- (6) Lower Link
- (7) Rear Wheel

9Y1210686TRS0044US0



ROPS, Lower Link, Lift Rod and Rear Wheel (Low Profile Model)

1. Hook the upper frame (1).
2. Remove the damper mounting nut (2).
3. Remove the lynch pin (5) and set bolt (4).
4. Remove the upper frame (1) using a hoist.
5. Remove the external position control rod (6).
6. Remove the lift rod (7) and lower link (8).
7. Place the disassembling stand under the transmission case.
8. Remove the rear wheels (9).

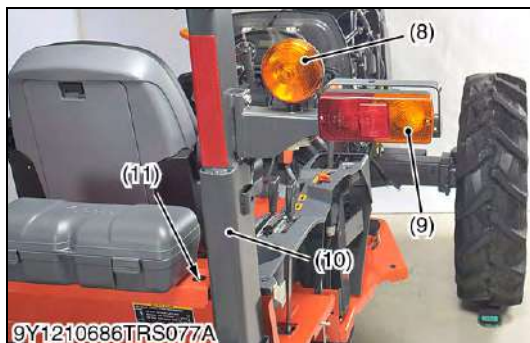
(When reassembling)

Tightening torque	Rear wheel mounting nut	344 to 392 N·m 35.0 to 40.1 kgf·m 254 to 289 lbf·ft
-------------------	-------------------------	---

- (1) Upper Frame
- (2) Nut
- (3) Damper
- (4) Set Bolt
- (5) Lynch Pin

- (6) External Position Control Rod
- (7) Lift Rod
- (8) Lower Link
- (9) Rear Wheel

9Y1210686TRS0169US0



Fender (R.H.) and ROPS Under (R.H.)

1. Remove the cover (1) and then disconnect **3P** connector for PTO clutch control switch.
2. Loosen the retaining nut (2).
3. Remove the pin (3) and then disconnect the auxiliary control valve wire (4).
4. Remove the auxiliary control valve wire cover (5).
5. Remove the screws (6) and then the fender (R.H.) (7).
6. Disconnect the **4P** connector and two **1P** connectors for combination lamp (9) and hazard lamp (8).
7. Remove the screw (11) and then remove the ROPS under (10).

(When reassembling)

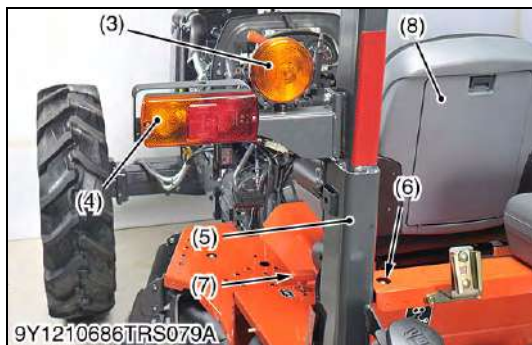
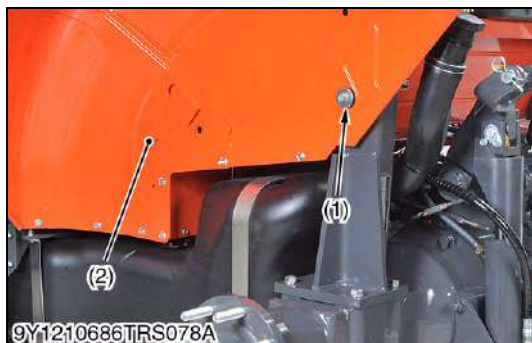
- Tighten the screw (6) with the cushion rubber.
- Be sure to connect the connectors.
- Be sure to reroute the OPC buzzer harness.

■ NOTE

- **After assembling, check the auxiliary control system (see page 7-S17).**

- | | |
|--|----------------------------------|
| (1) Cover (Auxiliary Control Valve Lever and PTO Switch) | (6) Fender (R.H.) Mounting Screw |
| (2) Retaining Nut | (7) Fender (R.H.) |
| (3) Pin | (8) Hazard Lamp |
| (4) Wire (Auxiliary Control Valve) | (9) Combination Lamp |
| (5) Auxiliary Wire Cover | (10) ROPS Under (R.H.) |
| | (11) Screw |

9Y1210686TRS0045US0



Fender (L.H.), ROPS Under (L.H.), Seat, 4WD Lever Grip and Hydraulic Lowering Speed Rod

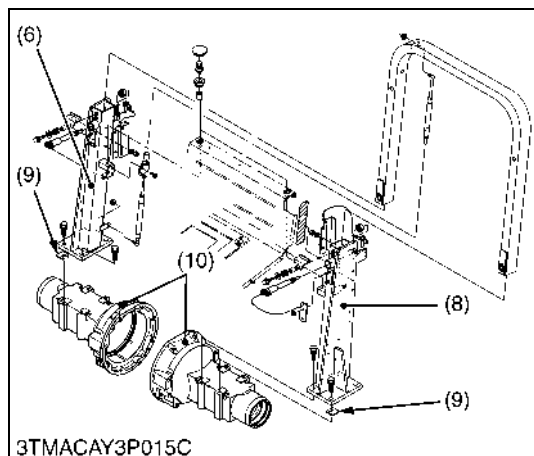
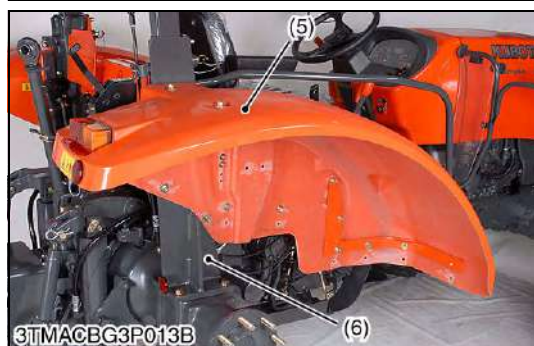
1. Unscrew the fender mounting screws (1) and then remove the fender (2).
2. Disconnect the **4P** connector and two **1P** connectors for combination lamp (4) and hazard lamp (3).
3. Unscrew the screw (6) then remove the ROPS under (5).
4. Remove the seat (8) and the 4WD lever grip (7).
5. Disconnect the hydraulic lowering speed rod (9).

(When reassembling)

- Tighten the screw (1) with the cushion rubber.
- Be sure to connect the connectors.
- Be sure to fix the breather hose.

- | | |
|-----------------------|----------------------------------|
| (1) Screw | (6) Screw |
| (2) Fender (L.H.) | (7) 4WD Lever Grip |
| (3) Hazard Lamp | (8) Seat |
| (4) Combination Lamp | (9) Hydraulic Lowering Speed Rod |
| (5) ROPS Under (L.H.) | |

9Y1210686TRS0046US0



Fender, ROPS Under, Seat, 4WD Lever Grip and Hydraulic Lowering Speed Rod (Low Profile Model)

1. Remove the fuel filling port (1) fixing screw.
2. Remove the harness cover (2) and disconnect the **4P** connector (3) and **1P** connector (4) and remove the wire harness from ROPS under.
3. Remove the both fenders (5).
4. Remove the screw (7) for both sides then take out the ROPS under L.H. (8) and R.H. (6).
5. Remove the seat (11) and the 4WD lever grip.
6. Disconnect the hydraulic lowering speed rod (12).

(When reassembling)

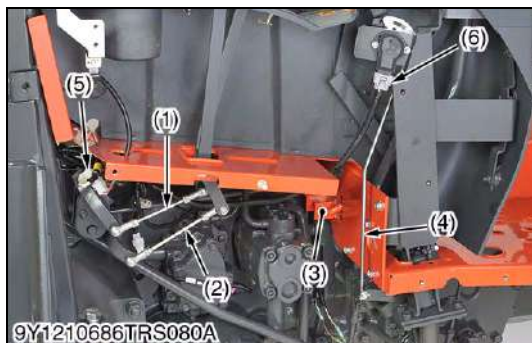
- Be sure to assemble the fender to the original height.
- If the adjusting shim (9) uses between the ROPS under and rear axle case, assemble the shim to the original position.
- Be sure to check the ROPS slides smoothly, after assembling. If ROPS does not slide smoothly, adjust with shim (9).

Tightening torque	ROPS under frame mounting screw (M16, 9T)	260 to 304 N·m 26.5 to 31.0 kgf·m 192 to 224 lbf·ft
-------------------	---	---



- | | |
|-------------------------|-----------------------------------|
| (1) Fuel Filling Port | (7) Screw |
| (2) Harness Cover | (8) ROPS Under L.H. |
| (3) 4P Connector | (9) Shim |
| (4) 1P Connector | (10) Rear Axle Case |
| (5) Fender | (11) Seat |
| (6) ROPS Under R.H. | (12) Hydraulic Lowering Speed Rod |

9Y1210686TRS0170US0



Hydraulic Control Rods, Differential Lock Rod, Accelerator Rod and Connectors

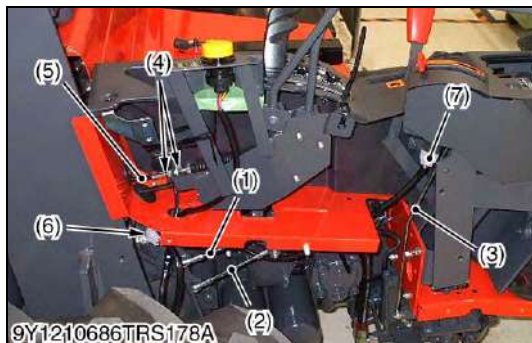
1. Disconnect the position control rod (1) and draft control rod (2).
2. Disconnect the differential lock rod (3) and the accelerator rod (4).
3. Disconnect the **2P** connector (5) for OPC buzzer and the **4P** connector (6) for speed sensor.

■ NOTE

- After assembling, check the hydraulic control rod (see page 7-S10) and auxiliary control system (see page 2-S18).

- | | |
|---------------------------|--|
| (1) Position Control Rod | (4) Accelerator Rod |
| (2) Draft Control Rod | (5) 2P Connector (OPC Buzzer) |
| (3) Differential Lock Rod | (6) 4P Connector (Speed Sensor) |

9Y1210686TRS0049US0



Hydraulic Control Rods, Auxiliary Control Valve Wire, Accelerator Rod and Connectors (Low Profile Model)

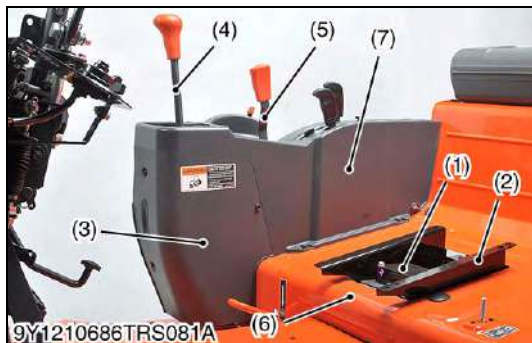
1. Disconnect the position control rod (1) and draft control rod (2).
2. Disconnect the accelerator rod (2) and differential lock rod.
3. Loosen the retaining nuts (4).
4. Remove the pin and then disconnect the auxiliary control valve wire (5).
5. Disconnect the **3P** connector (6) for PTO clutch control switch, the **4P** connector (11) for speed sensor and **2P** connector for OPC buzzer.

■ NOTE

- After assembling, check the hydraulic control rod (see page 7-S10) and auxiliary control system (see page 2-S18).

- | | |
|--------------------------|--|
| (1) Position Control Rod | (5) Auxiliary Control Valve Wire |
| (2) Draft Control Rod | (6) 3P Connector |
| (3) Accelerator Rod | (PTO Clutch Control Switch) |
| (4) Retaining Rod | (7) 4P Connector (Speed Sensor) |

9Y1210686TRS0171US0



Tractor ECU, Seat Support, Main Gear Shift Rod, Range Gear Shift Rod and Floor Cover

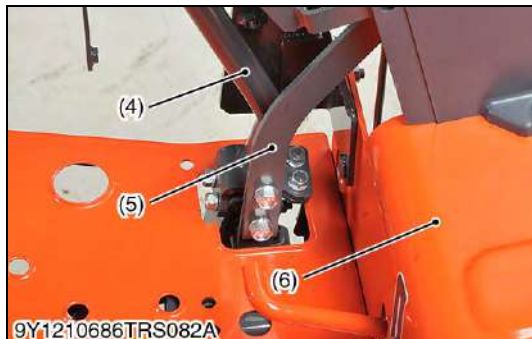
1. Disconnect the **44P** connector for tractor ECU (1) and then remove the ECU (1).
2. Remove the main gear shift rod cover (3) and then remove the main gear shift rod (4) and the range gear shift rod (5).
3. Remove the floor cover (6) with the guide cover (7).

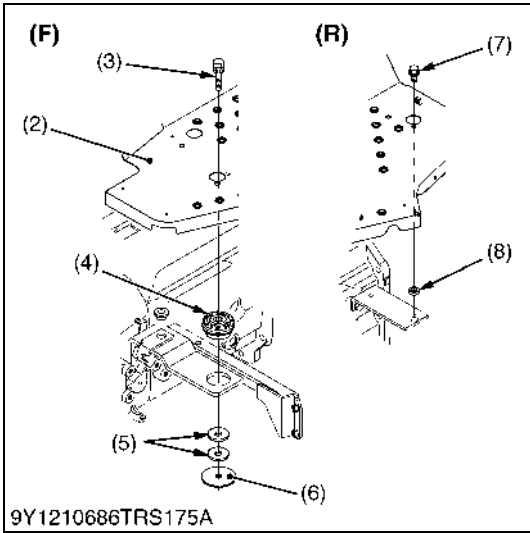
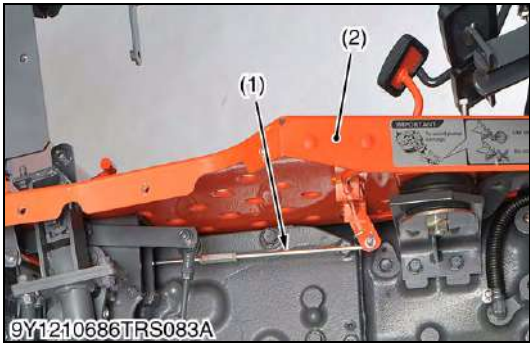
■ NOTE

- After assembling, check the main gear shifting linkage (see page 2-S13), the range gear shifting linkage (see page 2-S15) and the parking brake checking and adjusting (see page 4-S7).

- | | |
|-------------------------------|--------------------------|
| (1) Tractor ECU | (5) Range Gear Shift Rod |
| (2) Seat Bracket | (6) Floor Cover |
| (3) Main Gear Shift Rod Cover | (7) Guide Cover |
| (4) Main Gear Shift Rod | |

9Y1210686TRS0050US0





Accelerator Rod and Step

- 1. Disconnect the accelerator rod.
- 2. Remove the step (2) mounting bolts, and then remove the step (2).
- 3. Remove the step (2).

■ **NOTE**

- **After assembling check the speed change lever movement and adjust them if necessary (see page 2-S18).**

(When reassembling)

- Be sure to set the washers and rubber cushions of the step (2) mounting screw at an original positions as shown figure.

Tightening torque	Step mounting screw and nut (for front side)	200 to 220 N·m 20 to 23 kgf·m 150 to 160 lbf·ft
	Step mounting screw and nut (for rear side)	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft

- (1) Accelerator Rod

(2) Step

(3) Screw

(4) Rubber Cushion 1

(5) Plain Washer

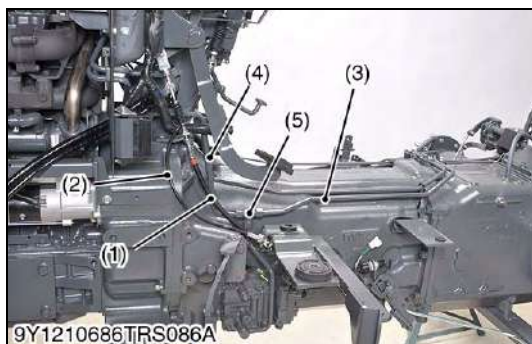
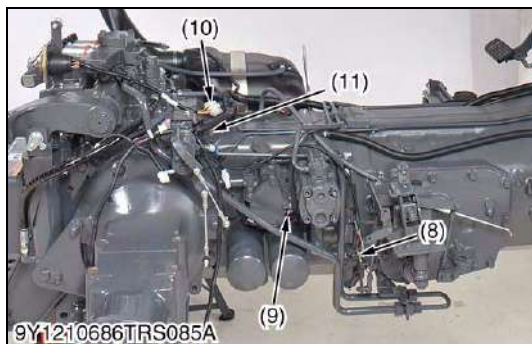
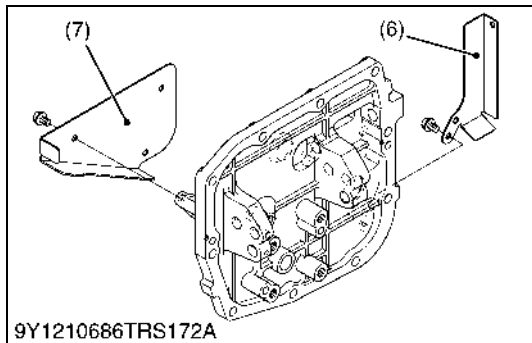
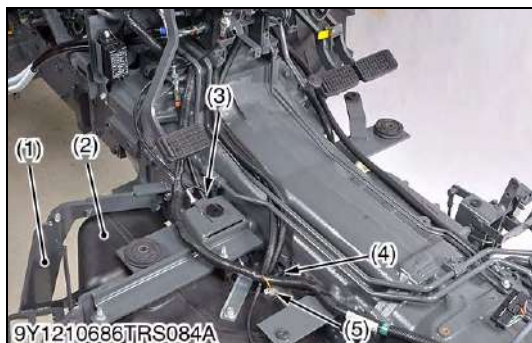
(6) Washer
- (7) Screw 2

(8) Rubber Cushion 2

(F) Front Side

(R) Rear Side

9Y1210686TRS0051US0



Step, Covers, Fuel Tank and Wire Harness

1. Remove the auxiliary step (1) and fuel tank (2). (See page 2-S25, 2-S27.)
2. Disconnect the **1P** connectors (3) for hydraulic shuttle valve, the **3P** connector (4) for revolution sensor and the **2P** connector (5) for 4WD safety switch.
3. Remove and parking brake cover (6).
4. Remove the shift cover (7). (F12/R12 speed transmission model).
5. Disconnect the **1P** connectors (8) for parking gear brake, **6P** connector (9) for solenoid valve, **8P** connector (10) for trailer coupler and ground wire (11).
6. Disconnect the **3P** connector (12) for revolution sensor.
7. Disconnect the **1P** connectors (13) for 6th gear position switch.
8. Disconnect the **1P** connectors (14) for Hi speed range position switch.

(1) Auxiliary Step

(2) Fuel Tank

(3) **1P** Connector(4) **3P** Connector(5) **2P** Connector

(6) Parking Brake Cover

(7) Shift Cover

(8) **1P** Connector(9) **6P** Connector(10) **8P** Connector

(11) Ground Wire

(12) **3P** Connector(13) **1P** Connector(14) **1P** Connector

[A] F12/R12 Speed Transmission Model

9Y1210686TRS0052US0

Pipes and Wire Cables

1. Disconnect the clutch cable (1) and shuttle cable (2) from shuttle valve.
2. Disconnect the solenoid valve pipe (3) and oil cooler return pipe (4) from T-joint (5).

(When reassembling)

Tightening torque	PTO pipe eye joint screw	49 to 68 N·m 5.0 to 7.0 kgf·m 37 to 50 lbf·ft
	Oil cooler pipe (return)	49 to 68 N·m 5.0 to 7.0 kgf·m 37 to 50 lbf·ft

(1) Clutch Cable

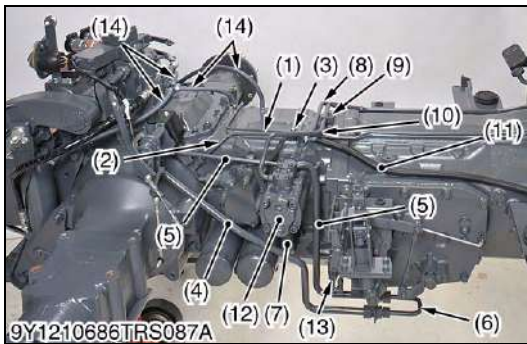
(2) Shuttle Cable

(3) Solenoid Valve Pipe

(4) Oil Cooler Pipe (Return)

(5) T-Joint

9Y1210686TRS0053US0



Hydraulic Pipe, Parking Lever Spring and Hydraulic Pump

1. Remove the brake pipe clamps (3), and both brake pipes (1), (2).
2. Remove the 3-point hitch delivery pipe (4), (5) with the 3-point hitch delivery pipe 3 (6).
3. Remove the suction pipe (7).
4. Remove the PTO solenoid valve pipe (8).
5. Remove the clamp (9) and then remove the power steering pipe (10) mounting screws.
6. Disconnect the brake return hose (11) and breather hose (14).
7. Remove the hydraulic pump mounting screws and draw out the hydraulic pump (12).
8. Disconnect the parking gear brake lever spring (13).

NOTE

- After assembling, be sure to bleed the air from brake system (see page 4-S6).

(When reassembling)

- Apply transmission fluid to the O-ring.

Tightening torque	3-point hitch delivery pipe 2 retaining nut	108 to 117 N·m 11.0 to 12.0 kgf·m 79.6 to 86.7 lbf·ft
	Brake pipe retaining nut	16 to 23 N·m 1.6 to 2.4 kgf·m 12 to 17 lbf·ft
	PTO solenoid valve pipe retaining eye screw	30 to 34 N·m 3.0 to 3.5 kgf·m 22 to 25 lbf·ft

- | | |
|-----------------------------------|--------------------------------------|
| (1) Brake Pipe (L.H.) | (8) PTO Solenoid Valve Pipe |
| (2) Brake Pipe (R.H.) | (9) Clamp |
| (3) Brake Pipe Clamp | (10) Power Steering Pipe |
| (4) 3-point Hitch Delivery Pipe 1 | (11) Return Hose (Brake) |
| (5) 3-point Hitch Delivery Pipe 2 | (12) Hydraulic Pump |
| (6) 3-point Hitch Delivery Pipe 3 | (13) Parking Gear Brake Lever Spring |
| (7) Suction Pipe | (14) Breather Hose |

9Y1210686TRS0054US0

Steering Support Unit

1. Unscrew the steering support screws (1).
2. Remove the steering support unit (2) as shown photo.

- | | |
|----------------------------|---------------------------|
| (1) Steering Support Screw | (2) Steering Support Unit |
|----------------------------|---------------------------|

9Y1210686TRS0055US0



(2) Preparation for CABIN Model



Removing Cabin from Body

1. Refer to 9-S34.

9Y1210686TRS0056US0

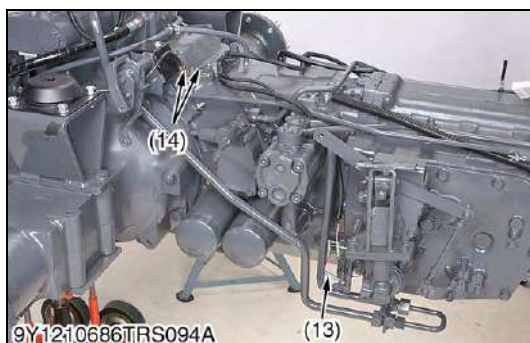
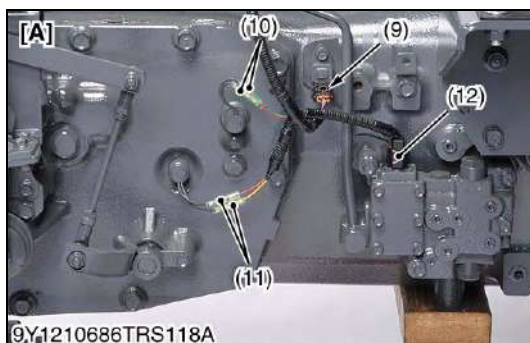
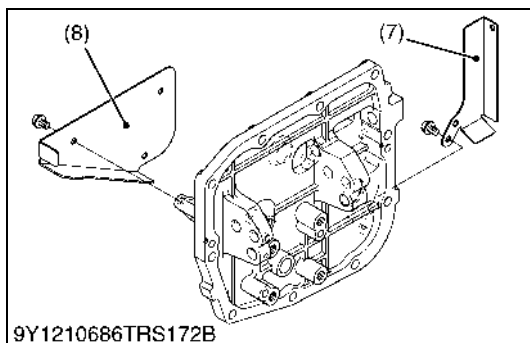


Fuel Tank

1. Remove the fuel tank (1). (See page 2-S28.)

(1) Fuel Tank

9Y1210686TRS0057US0



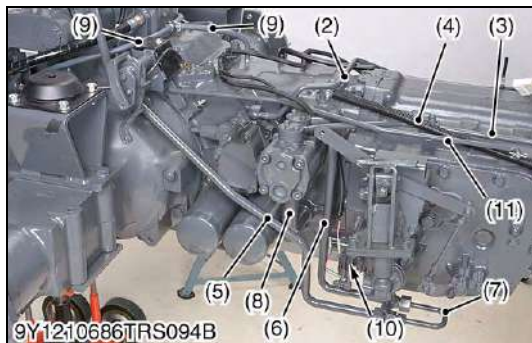
Wire Cables and Wire Harness

1. Remove the shuttle cable (1) and the clutch cable (2).
2. Remove the 4WD lever rod (3).
3. Disconnect the **1P** connector (3) for hydraulic shuttle valve, the **3P** connector (4) for revolution sensor and the **2P** connector (5) for 4WD safety switch.
4. Disconnect the **1P** connectors (6) for the solenoid valve switch.
5. Remove the parking brake cover (7).
6. Remove the shift cover (8). (F12/R12 and F24/R24 speed transmission model).
7. Disconnect the **3P** connector (9) for revolution sensor, the **1P** connectors (10) for 6th gear position switch, the **1P** connectors (11) for Hi speed range position sensor.
8. Remove the **6P** connector (12) for solenoid valve. (F24/R24 speed transmission model).
9. Disconnect the **1P** connectors (13) for parking gear brake, the **6P** connector for solenoid valve and the ground wires (14) and then remove the clamps and remove the wire harness.

- | | |
|-------------------------|--------------------------|
| (1) Shuttle Cable | (10) 1P Connector |
| (2) Clutch Cable | (11) 1P Connector |
| (3) 4WD Lever Rod | (12) 6P Connector |
| (4) 3P Connector | (13) 1P Connector |
| (5) 2P Connector | (14) Ground Wire |
| (6) 1P Connector | |
| (7) Parking Brake Cover | |
| (8) Shift Cover | |
| (9) 3P Connector | |

[A] F12/R12 and F24/R24 Speed Transmission Model

9Y1210686TRS0058US0



Differential Lock Rod, Parking Gear Brake Spring, Hydraulic Pipe and Hydraulic Pump

1. Remove the oil cooler return pipe (1).
2. Remove the solenoid valve pipe (2), the power steering pipe (3) and the brake return hose (4).
3. Remove the 3-point hitch delivery pipe (5), (6) with the 3-point hitch delivery pipe 3 (7).
4. Remove the suction pipe (8) and the breather hose (9).
5. Remove the parking gear brake spring (10) and the differential lock rod (11).
6. Remove the dual speed solenoid valve pipe (12).
7. Remove the hydraulic pump (13).

(When reassembling)

- Apply transmission fluid to the O-ring.

Tightening torque	3-point hitch delivery pipe 2 retaining nut	108 to 117 N·m 11.0 to 12.0 kgf·m 79.6 to 86.7 lbf·ft
	Power steering pipe and hydraulic pipe retaining nut	49 to 68 N·m 5.0 to 7.0 kgf·m 37 to 50 lbf·ft
	Hydraulic pipe joint screw	30 to 34 N·m 3.0 to 3.5 kgf·m 22 to 25 lbf·ft

- (1) Oil Cooler Return Pipe
- (2) Solenoid Valve Pipe
- (3) Power Steering Pipe
- (4) Brake Return Hose
- (5) 3-Point Hitch Delivery Pipe 1
- (6) 3-Point Hitch Delivery Pipe 2
- (7) 3-Point Hitch Delivery Pipe 3
- (8) Suction Pipe

- (9) Breather Hose
- (10) Parking Gear Brake Spring
- (11) Differential Lock Rod
- (12) Dual Speed Solenoid Valve Pipe
- (13) Hydraulic Pump

[A] F24/R24 Speed Transmission Model

9Y1210686TRS0132US0

(3) Clutch Housing Case



Separating Clutch Housing Case from Engine

1. Remove the clutch housing mounting screws and nuts.
2. Separate the clutch housing case.

(When reassembling)

- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to spline of input shaft.
- Apply liquid gasket (Three Bond 1211, 1141 or equivalent) to the seam of engine and clutch housing.

Tightening torque	Clutch housing mounting screw and nut (M14, 7T)	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 lbf·ft
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9Y1210686TRS0059US0



Separating Clutch Housing Case from Transmission Case

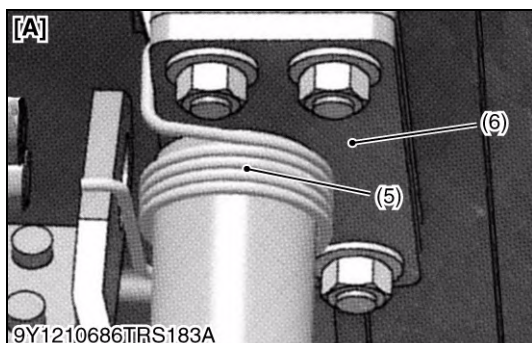
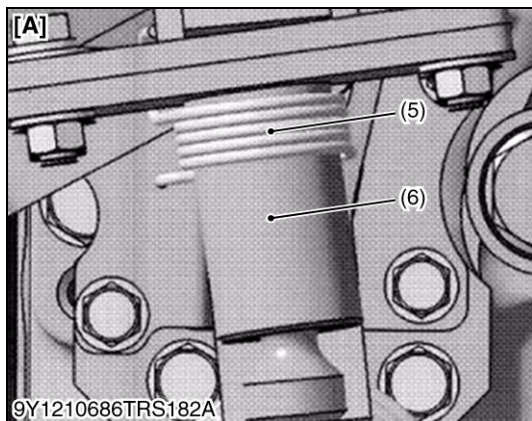
1. Remove the transmission case mounting screws and nuts.
2. Separate the clutch housing case from transmission case.

(When reassembling)

- Apply liquid gaskets (Three Bond TB1206C or equivalent) to joint face.

Tightening torque	Transmission case mounting screw and nut	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 lbf·ft
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9Y1210686TRS0060US0



Removing Main Shift Lever

1. Disconnect the range gear shift rod (1) and the parking gear brake rod (2).
2. Remove the main shift lever bracket assembly (3).
3. Tap out the roll pin and then pull out the main gear shift lever 1 (4).

NOTE

- After assembling, check the gear shift levers movement and adjust it, if necessary (see page 2-S13, 2-S15, 4-S7).
- When assembling, make sure that the spring (5) is attached to the shift lever 2 (6) as shown in the figure.

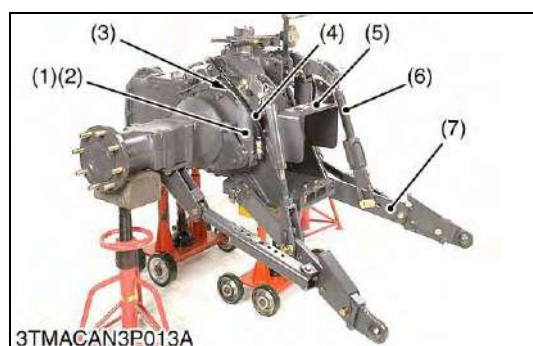
- (1) Range Gear Shift Rod
- (2) Parking Gear Brake Rod
- (3) Main Shift Lever Bracket Assembly
- (4) Main Shift Lever 1
- (5) Spring

- (6) Main Shift Lever 2

[A] F24/R24 Speed Transmission Model

9Y1210686TRS0174US0

(4) Transmission Case



3-Point Linkage and Hydraulic Cylinder

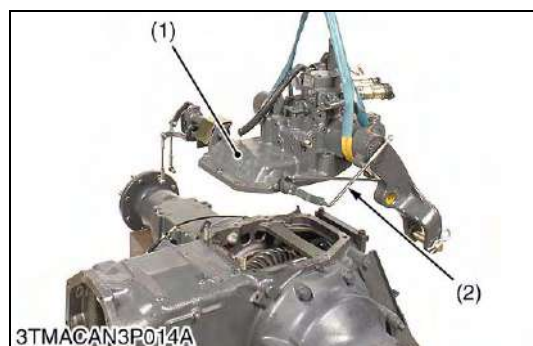
1. Remove the lower link (7) and lift rod (6).
2. Remove the cylinder cover (1).
3. Disconnect the cylinder hose (4) and return hose (3).
4. Remove the hydraulic cylinder (2).
5. Remove the PTO cover (5).

(When reassembling)

Tightening torque	Cylinder hose retaining nut	35 to 48 N·m 3.5 to 4.9 kgf·m 26 to 35 lbf·ft
-------------------	-----------------------------	---

- | | |
|------------------------|----------------|
| (1) Cylinder Cover | (5) PTO Cover |
| (2) Hydraulic Cylinder | (6) Lift Rod |
| (3) Return Hose | (7) Lower Link |
| (4) Cylinder Hose | |

9Y1210686TRS0061US0



Top Cover Assembly

1. Remove the top cover mounting screws and nuts.
2. Disconnect the position feedback rod (2).
3. Remove the top cover assembly (1).

(When reassembling)

- Apply liquid gaskets (Three Bond 1206C or equivalent) to joint face.

Tightening torque	Top cover mounting screw and nut	124 to 147 N·m 12.6 to 15.0 kgf·m 91.2 to 108 lbf·ft
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- | | |
|------------------------|---------------------------|
| (1) Top Cover Assembly | (2) Position Feedback Rod |
|------------------------|---------------------------|

9Y1210686TRS0062US0



PTO Gear Case Assembly

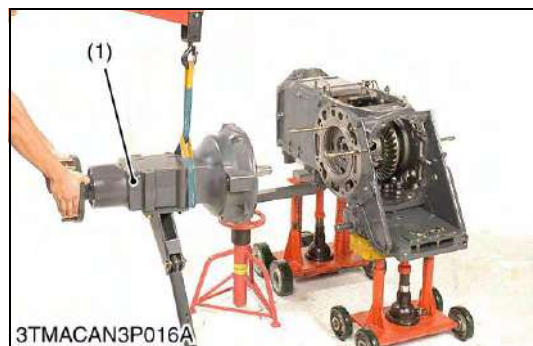
1. Remove the PTO gear case and PTO drive shaft as a unit.

(When reassembling)

- Apply liquid gasket (Three Bond 1206C or equivalent) to joint face.

Tightening torque	PTO gear case assembly mounting screw	78 to 90 N·m 7.9 to 9.2 kgf·m 58 to 66 lbf·ft
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9Y1210686TRS0063US0



Rear Axle Case Assembly

1. Remove the rear axle case mounting screws and nuts.
2. Remove the rear axle case assembly (1).

(When reassembling)

- Apply liquid gaskets (Three Bond 1206C or equivalent) to joint face.

Tightening torque	Rear axle case mounting screw and nut	197 to 225 N·m 20.0 to 23.0 kgf·m 145 to 166 lbf·ft
-------------------	---------------------------------------	---

- | |
|-----------------------------|
| (1) Rear Axle Case Assembly |
|-----------------------------|

9Y1210686TRS0065US0

[5] DAMPER DISK



Damper Disk

1. Remove the damper disk (1).

(When reassembling)

- Direct the shorter end of the damper disk boss toward the flywheel.
- Apply molybdenum disulphide (Three Bond 1901 or equivalent) to the spline.

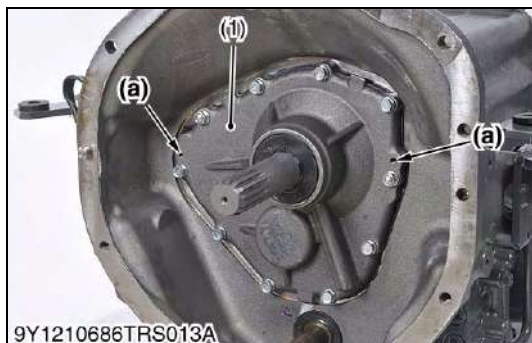
Tightening torque	Damper disk mounting screw	48 to 55 N·m 4.9 to 5.7 kgf·m 36 to 41 lbf·ft
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(1) Damper Disk

9Y1210686TRS0067US0

[6] SHUTTLE AND DUAL SPEED CLUTCH

(1) Removing Hydraulic Shuttle Clutch (F8/R8 and F12/R12 Speed Transmission Model)



Shuttle Case Assembly

CAUTION

- The shuttle case assembly is heavy, so that take care it when handling.

1. Remove the shuttle case mounting screws and nuts.
2. Remove the shuttle case assembly (1) by using M10 × Pitch 1.25 mm screws into holes (a).

(When reassembling)

- Be sure to fit the O-rings (2) and apply transmission fluid.
- The oil passage hole of oil (b) is free from liquid gaskets.
- Apply liquid gaskets (Three Bond 1206C or equivalent) to joint face of the shuttle case and clutch housing case.

Tightening torque	Shuttle case mounting screw and nut	48 to 55 N·m 4.9 to 5.7 kgf·m 36 to 41 lbf·ft
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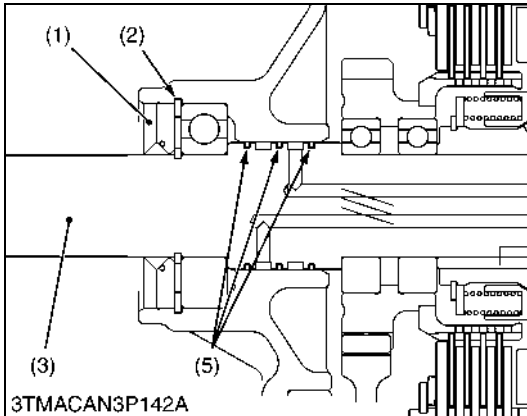
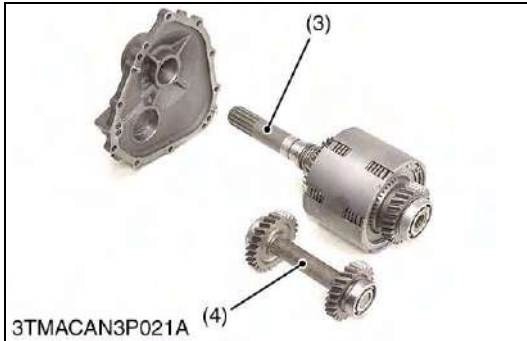
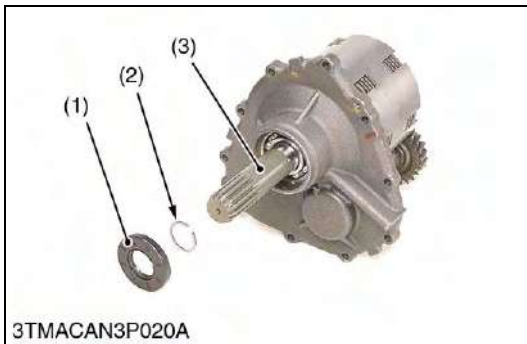
(1) Shuttle Case Assembly

(2) O-ring

(a) Threaded Hole

(b) Oil Passage Hole

9Y1210686TRS0068US0



Removing Shuttle Case Assembly

1. Remove the oil seal (1).
2. Remove the external circlip (2).
3. Tap out the input shaft (3) with shuttle clutch and 26T, 24T gear with shuttle shaft (4) together.

(When reassembling)

- Replace the seal rings (5), oil seal (1) and external circlip (2) with new ones.
- Apply transmission fluid to seal rings (5) and bearings.
- Apply grease to oil seal.

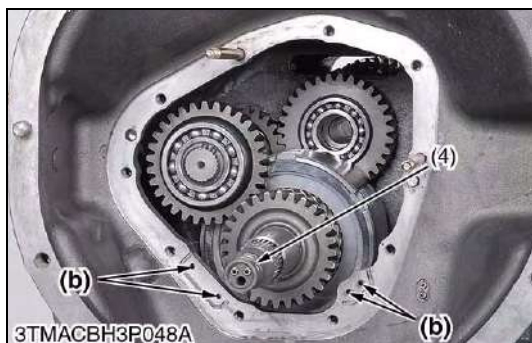
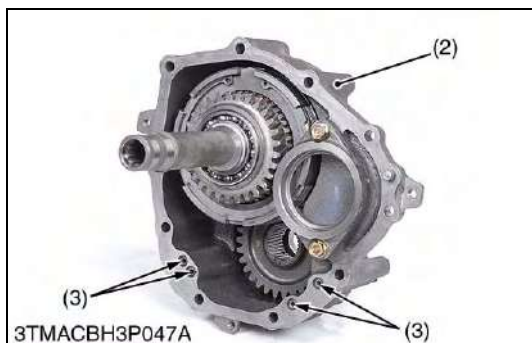
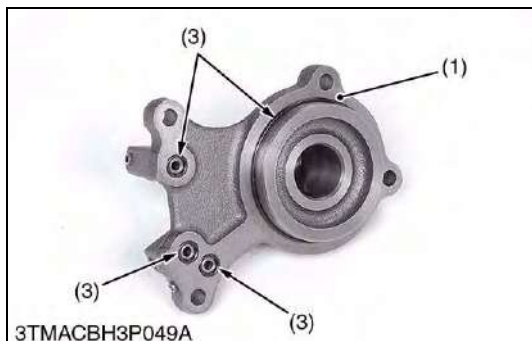
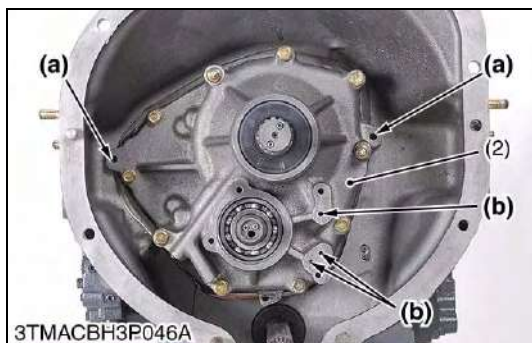
■ NOTE

- **Do not get in the seal rings (5) between input shaft (3) and shuttle case.**

- | | |
|----------------------|-------------------|
| (1) Oil Seal | (4) Shuttle Shaft |
| (2) External Circlip | (5) Seal Ring |
| (3) Input Shaft | |

9Y1210686TRS0069US0

(2) Removing Hydraulic Shuttle Clutch (F24/R24 Speed Transmission Model)



Removing Shuttle Case Assembly



CAUTION

- The shuttle case assembly is heavy, so that take care it when handling.

- Remove the shuttle holder (1).
- Remove the shuttle case mounting screws and nuts.
- Remove the shuttle case assembly (2) by using M10 × Pitch 1.25 mm screws into holes (a).

(When reassembling)

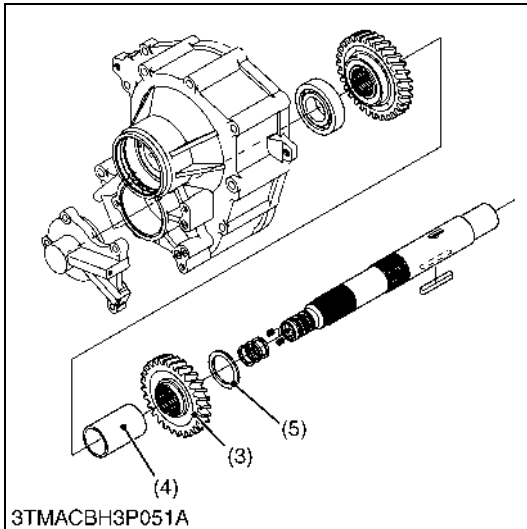
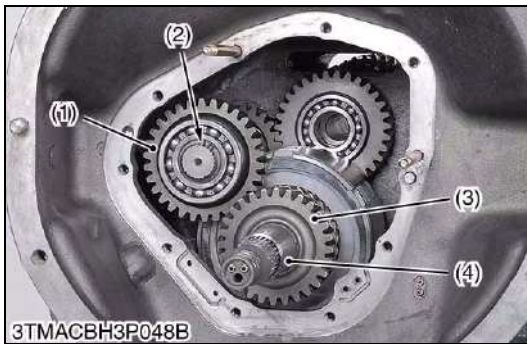
- Be sure to fit the O-rings (3).
- The oil passage hole (b) is free from liquid gaskets.
- Apply liquid gaskets (Three Bond 1206C or equivalent) to joint face of the shuttle case and clutch housing case.
- Apply grease to seal rings (4).

Tightening torque	Shuttle case and shuttle holder mounting screw and nut	48 to 55 N·m 4.9 to 5.7 kgf·m 36 to 41 lbf·ft
-------------------	--	---

- Shuttle Holder
- Shuttle Case Assembly
- O-ring
- Seal Ring

- Threaded Hole
- Oil Passage Hole

9Y1210686TRS0070US0



Removing Shuttle Clutch Pack

1. Remove the external circlip (2) and 30T gear (1).
2. Remove the spacer (4), collar (5) and 27T gear (3).
3. Pull the shuttle clutch pack (7) and lower the shuttle clutch pack (7) in the housing case.
4. Pull out the 31T gear (6) with bearing (8).
5. Remove the shuttle clutch pack (7).

NOTE

- Remove the 31T gear (6), then remove the shuttle pack.

(When reassembling)

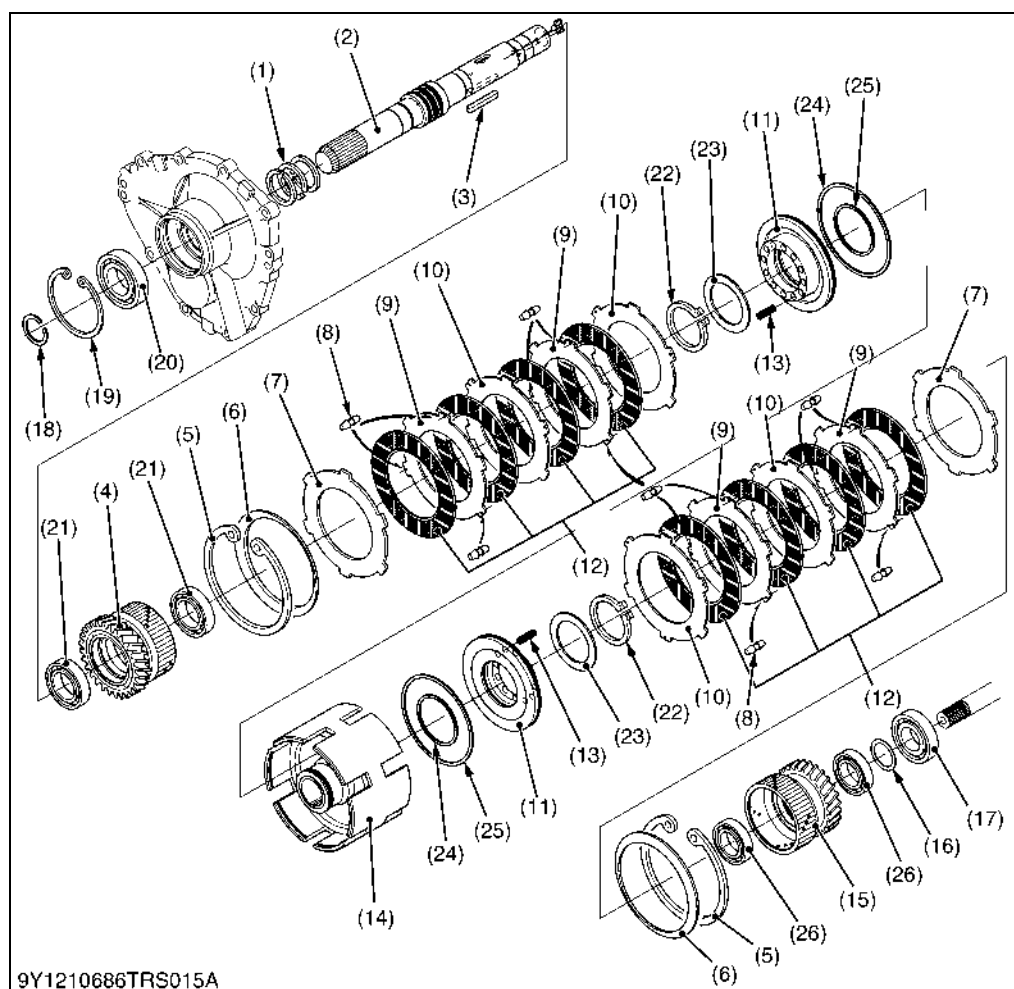
- Put in the shuttle clutch pack (7) to the housing case first, then be sure to assemble the 31T gear (6) with bearing (8).

- | | |
|----------------------|-------------------------|
| (1) 30T Gear | (5) Collar |
| (2) External Circlip | (6) 31T Gear |
| (3) 27T Gear | (7) Shuttle Clutch Pack |
| (4) Spacer | (8) Bearing |

9Y1210686TRS0071US0

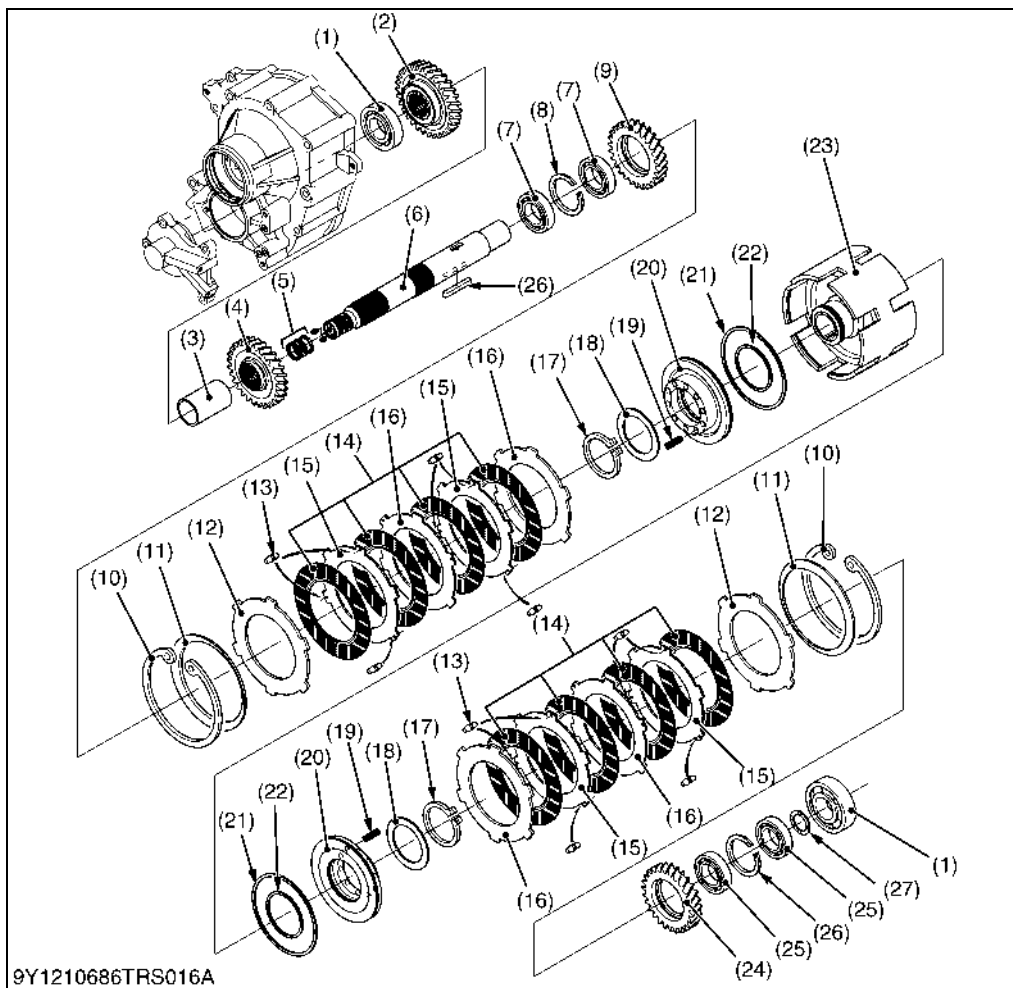
(3) Shuttle Clutch Assembly

Shuttle Clutch Assembly (F8/R8 and F12/R12 Speed Transmission Model)



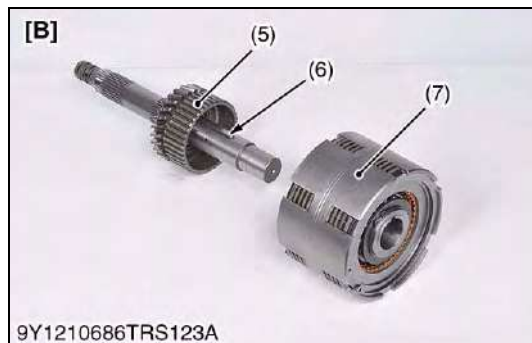
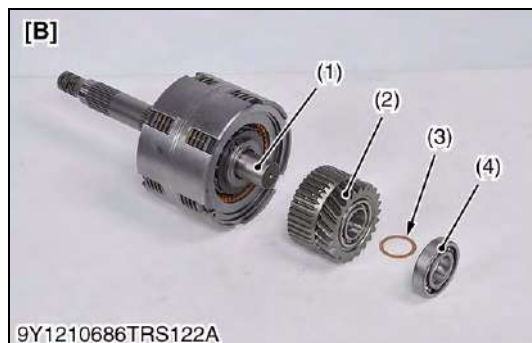
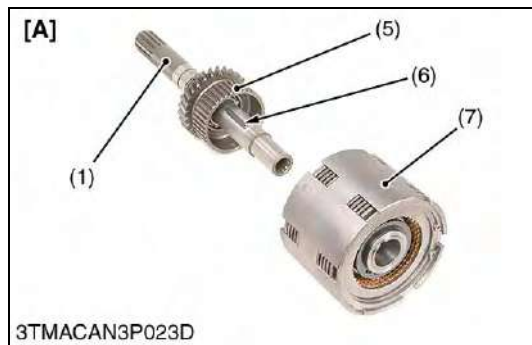
- (1) Seal Ring
- (2) Shuttle Shaft
- (3) Key
- (4) 28T Gear
- (5) Internal Circlip
- (6) Belleville Washer (Cupped Spring Washer)
- (7) Pressure Plate
- (8) Rubber
- (9) Steel Plate with Rubber
- (10) Steel Plate without Rubber
- (11) Piston
- (12) Disk
- (13) Spring
- (14) Clutch Body
- (15) 26T Gear
- (16) Washer
- (17) Bearing
- (18) External Circlip
- (19) Internal Circlip
- (20) Bearing
- (21) Bearing
- (22) External Circlip
- (23) Thrust Collar
- (24) Seal Ring
- (25) Seal Ring
- (26) Bearing

9Y1210686TRS0072US0

Shuttle Clutch Assembly (F24/R24 Speed Transmission Model)

- (1) Bearing
- (2) 32T Gear
- (3) Spacer
- (4) 29T Gear
- (5) Seal Ring
- (6) Shuttle Shaft
- (7) Bearing
- (8) Internal Circlip
- (9) 27T Gear
- (10) Internal Circlip
- (11) Belleville Washer (Cupped Spring Washer)
- (12) Pressure Plate
- (13) Rubber
- (14) Disk
- (15) Steel Plate with Rubber
- (16) Steel Plate without Rubber
- (17) External Circlip
- (18) Thrust Collar
- (19) Spring
- (20) Piston
- (21) Seal Ring
- (22) Seal Ring
- (23) Clutch Body
- (24) 24T Gear
- (25) Bearing
- (26) Internal Circlip
- (27) Washer
- (28) Key

9Y1210686TRS0073US0



Shuttle Shaft

1. Remove the bearing (4) and washer (3).
2. Remove the gear (2).
3. Tap out the shuttle shaft (1) with gear (5) to the forward.

NOTE

	F8/R8 and F12/R12 speed transmission model	F24/R24 speed transmission model
Gear (2)	26T gear	24T gear
Gear (5)	28T gear	27T gear

(When reassembling)

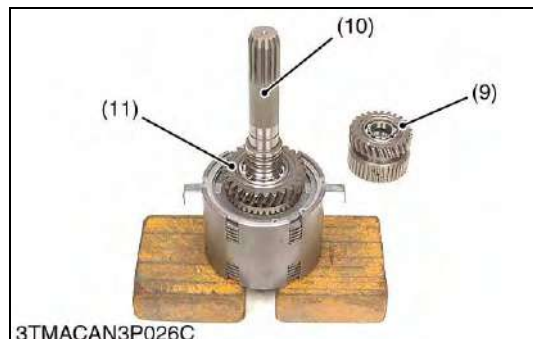
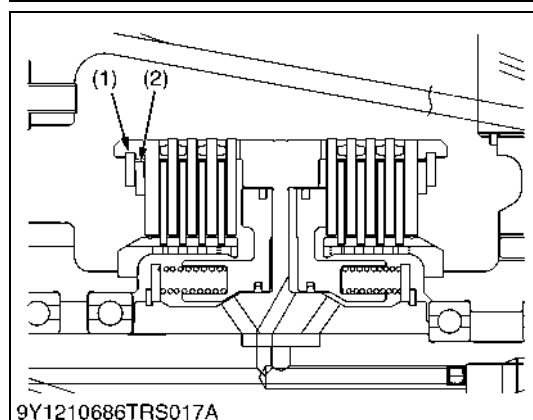
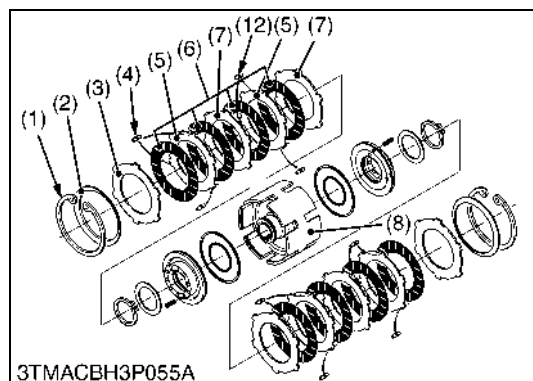
- Align the key (6) and groove.

- (1) Shuttle Shaft
- (2) Gear
- (3) Washer
- (4) Bearing
- (5) Gear
- (6) Key
- (7) Shuttle Pack

**[A] F8/R8 and F12/R12 Speed
Transmission Model**

**[B] F24/R24 Speed Transmission
Model**

9Y1210686TRS0074US0



Shuttle Clutch Pack

1. Remove the internal circlip (1).
2. Remove the belleville washer (2), pressure plate (3), steel plate (5), (7) and clutch disks (6).

(When reassembling)

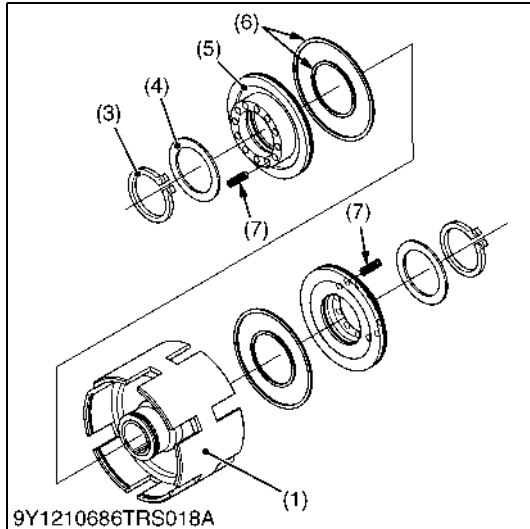
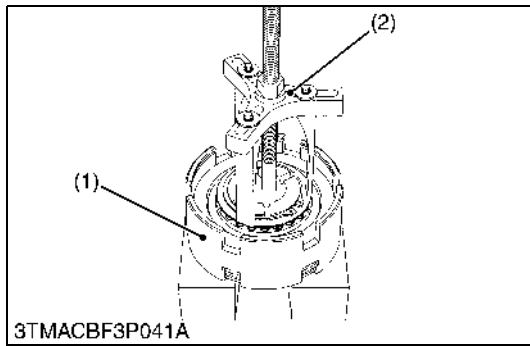
- Install the clutch disks (6) and steel plate (5), (7) mutually.
- Apply enough transmission fluid to the disks (6).
- Do not confuse the two types of steel plates.
The steel plate with rubbers (5) and without rubbers (7).
- Two steel plate match the position of rubber (4) from the piston side, and one remaining steel plate (7) is not matched.
- Do not confuse the pressure plates (3) and steel plate (7). The pressure plate (3) is thicker than the steel plate (7).
- Be sure to assemble the belleville washer (cupped spring washer) (2) direction as shown in figure.
- When installing the internal circlip (1) to the clutch body (8), align its split portion to the notched portion of clutch body as shown in photo.
- When assemble the shuttle shaft (10) with gear (11) for reverse side, temporary align the spline and clutch disk's teeth using the gear (9).
- Insert the steel piece (a) between belleville washer (cupped spring washer) (2) and pressure plate (3) to prevent turn the clutch disks (6) during assemble.
- Draw out the gear (9) after inserted the steel piece (a). Then tap in the shuttle shaft (10) with gear (11).
- Same procedure for forward side.
- Confirm the moving of the piston smoothly when pressure air at 0.50 to 0.60 MPa (5.1 to 6.1 kgf/cm², 73 to 87 psi) is sent to clutch pack.

NOTE

	F8/R8 and F12/R12 speed transmission model	F24/R24 speed transmission model
Gear (9)	26T gear	24T gear
Gear (11)	28T gear	27T gear

- | | |
|--|--------------------|
| (1) Internal Circlip | (8) Clutch Body |
| (2) Belleville Washer (Cupped Spring Washer) | (9) Gear |
| (3) Pressure Plate | (10) Shuttle Shaft |
| (4) Rubber | (11) Gear |
| (5) Steel Plate with Rubber | (12) Rubber |
| (6) Clutch Disk | |
| (7) Steel Plate without Rubber | |
- (a) Steel Piece

9Y1210686TRS0075US0



Piston

1. Press the thrust collar (4) lightly by the hand made jig (see page G-72), and remove the external circlip (3).
2. Remove the springs (7).
3. Draw out the piston (5) using a air pressure.

■ NOTE

- Ten springs for one side.
- The passage holes for the piston are beside the feather key groove.

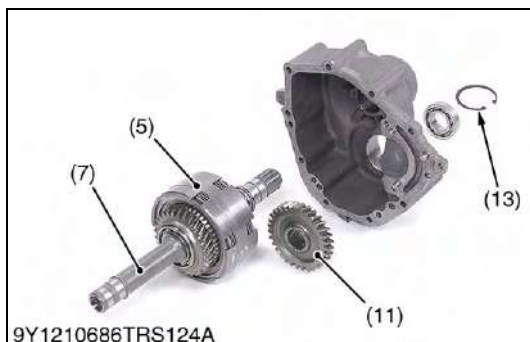
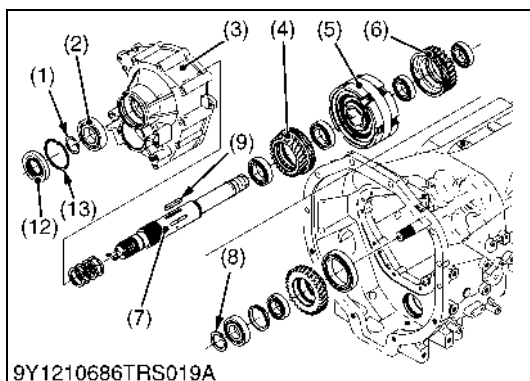
(When reassembling)

- Apply enough transmission fluid to seal rings (6).

- | | |
|----------------------|---------------|
| (1) Clutch Case | (5) Piston |
| (2) Jig | (6) Seal Ring |
| (3) External Circlip | (7) Spring |
| (4) Thrust Collar | |

9Y1210686TRS0076US0

(4) Removing Dual Speed Clutch



Dual Speed Clutch Assembly

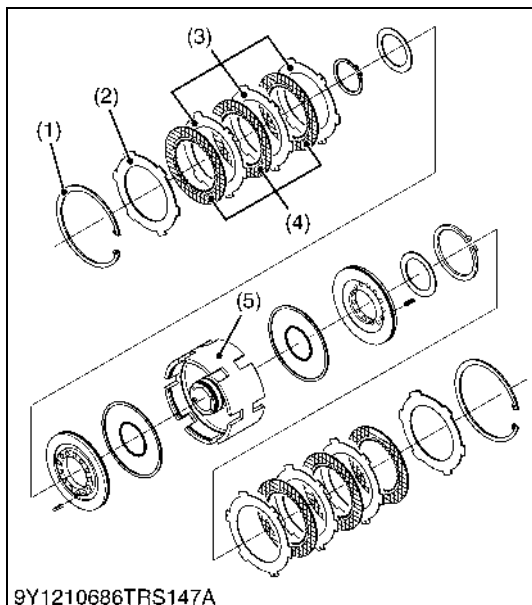
1. Remove the holder (10).
2. Remove the oil seal (12), external circlip (1) and internal circlip (13).
3. Tap out the dual speed shaft (7) with clutch pack (5).
4. Remove the external circlip (8) and 28T gear (6).
5. Tap out the dual speed shaft (7) with 26T gear (4) to forward.

(When reassembling)

- Align the key (9) and groove of clutch pack (5).
- Replace the oil seal (12) with new one.

- | | |
|-----------------------|-----------------------|
| (1) External Circlip | (8) External Circlip |
| (2) Bearing | (9) Key |
| (3) Shuttle Gear Case | (10) Holder |
| (4) 26T Gear | (11) 32T Gear |
| (5) Clutch Pack | (12) Oil Seal |
| (6) 28T Gear | (13) Internal Circlip |
| (7) Dual Speed Shaft | |

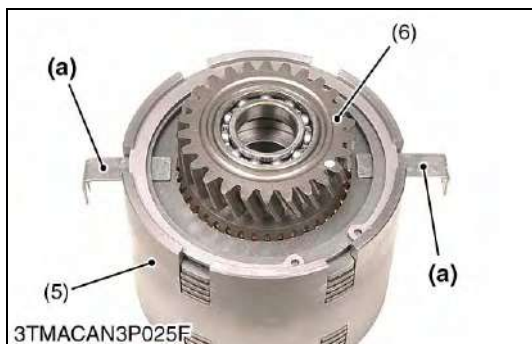
9Y1210686TRS0077US0



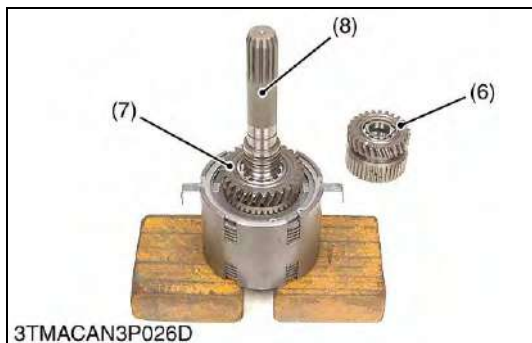
9Y1210686TRS147A



3TMACAN3P024F



3TMACAN3P025F



3TMACAN3P026D

Dual Speed Clutch Pack

1. Remove the internal circlip (1).
2. Take out the pressure plate (2), clutch disks (4) and steel plates (3).

(When reassembling)

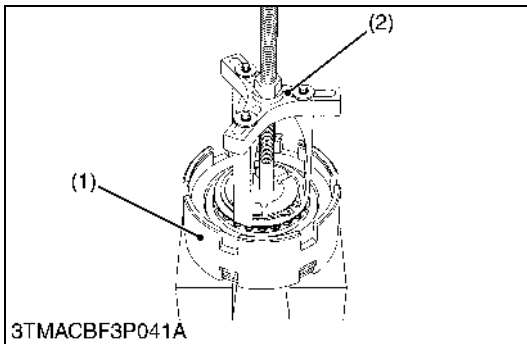
- Install the clutch disks (4) and steel plate (3) mutually.
- Apply enough transmission fluid to the disks (4).
- Do not confuse the pressure plate (2) and steel plate (3). The pressure plate (2) is thicker than the steel plate (3).
- When installing the internal circlip (1) to the clutch case (5) align its split portion to the notched portion of clutch case as shown in photo.
- When assembling the input shaft (8) with 26T gear (7) for low speed side, temporary align the spline and clutch disk's teeth using the 28T gear (6).
 - Insert the steel piece (a) between the internal circlip (1) and pressure plate (2) to prevent turn the clutch disks (4) during assemble.
 - Draw out the 28T gear (6) after inserted the steel piece (a). Then tap in the input shaft (8) with 26T gear (7).
 - Same procedure for forward side.
- Confirm the moving of the piston smoothly when pressure air at 0.50 to 0.60 MPa (5.1 to 6.1 kgf/cm², 73 to 87 psi) is sent to clutch pack.

- (1) Internal Circlip
- (2) Pressure Plate
- (3) Steel Plate
- (4) Clutch Disk
- (5) Clutch Case

- (6) 28T Gear
- (7) 26T Gear
- (8) Dual Speed Shaft

(a) Steel Piece

9Y1210686TRS0078US0



Piston

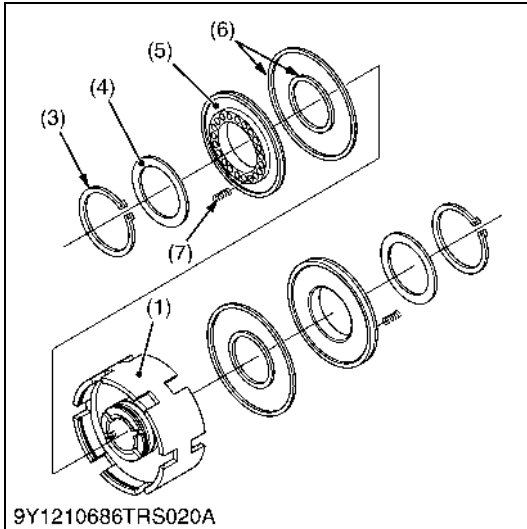
1. Press the washer (4) lightly by the hand made jig (see page G-72), and remove the external circlip (3).
2. Remove the springs (7).
3. Draw out the piston (5) using a air pressure.

■ NOTE

- 21 springs for one side.
- The passage holes for the piston are beside the feather key groove.

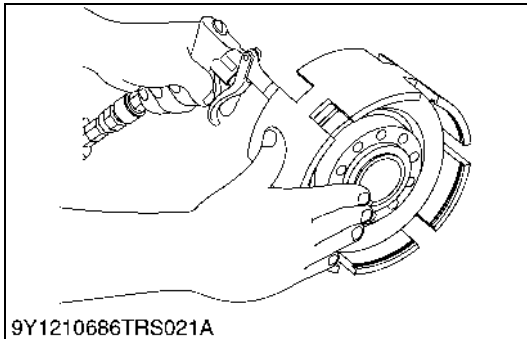
(When reassembling)

- Apply enough transmission fluid to seal rings (6).

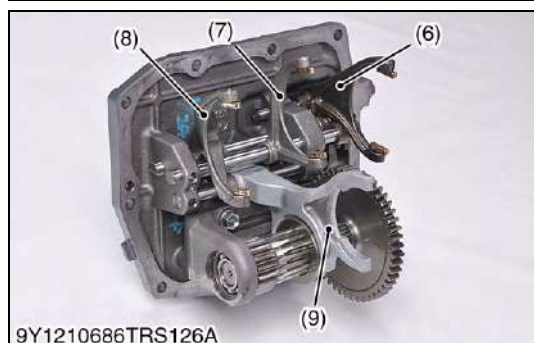
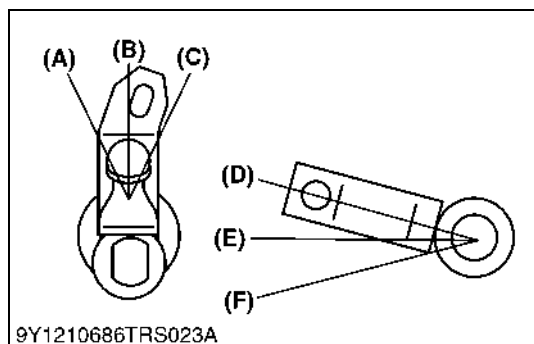


- | | |
|----------------------|---------------|
| (1) Clutch Case | (5) Piston |
| (2) Jig | (6) Seal Ring |
| (3) External Circlip | (7) Spring |
| (4) Washer | |

9Y1210686TRS0079US0



[7] SHIFT COVER



Speed Change Lever

1. Set the main change shift lever (3) to the neutral position.
2. Set the range shift lever (2) to the **Creep** speed range position (F).
3. Remove the shift cover (1) mounting screws.
4. Screw in the M8 × 1.25 mm screw (or M14 × Pitch 1.5 mm screw) to threaded hole (5) for jack up the shift cover (1).
5. Remove the shift cover (1) gently.

(When reassembling)

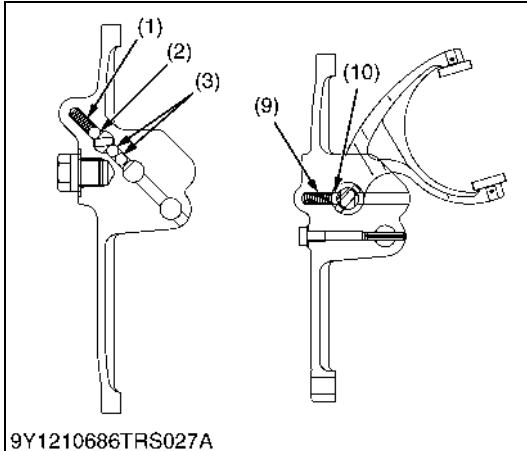
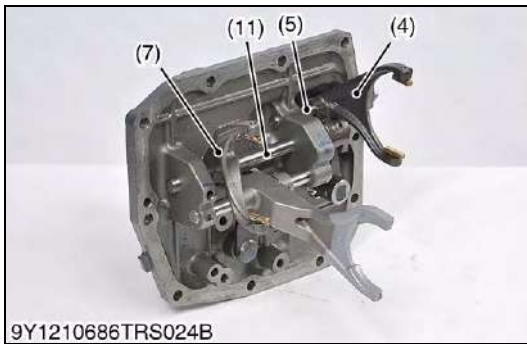
- Set the all main change shift fork (6), (7) and (8) to **"neutral"** position and shifters in the transmission on neutral position, and range shift fork (9) and shifter in the transmission on **H** speed range position side.
- Apply liquid gaskets (Three Bond 1206C or equivalent) to joint face.

Tightening torque	Speed change cover mounting screw	78 to 90 N·m 7.9 to 9.2 kgf·m 58 to 66 lbf·ft
-------------------	-----------------------------------	---

- (1) Shift Cover
- (2) Range Shift Lever
- (3) Main Shift Lever
- (4) Main Shift Shaft
- (5) Threaded Hole (for Jack Up)
- (6) 1st-2nd Shift Fork
- (7) 5th-6th Shift Fork
- (8) 3rd-4th Shift Fork
- (9) Range Shift Fork

- (A) 1st, 3rd or 5th Gear Position
- (B) Neutral or Parking Gear Brake Position
- (C) 2nd, 4th or 6th Gear Position
- (D) H Speed Range Position
- (E) L Speed Range Position
- (F) Creep Speed Range Position (Option)

9Y1210686TRS0080US0



Main Shift Fork (F8/R8 Speed Transmission Model)

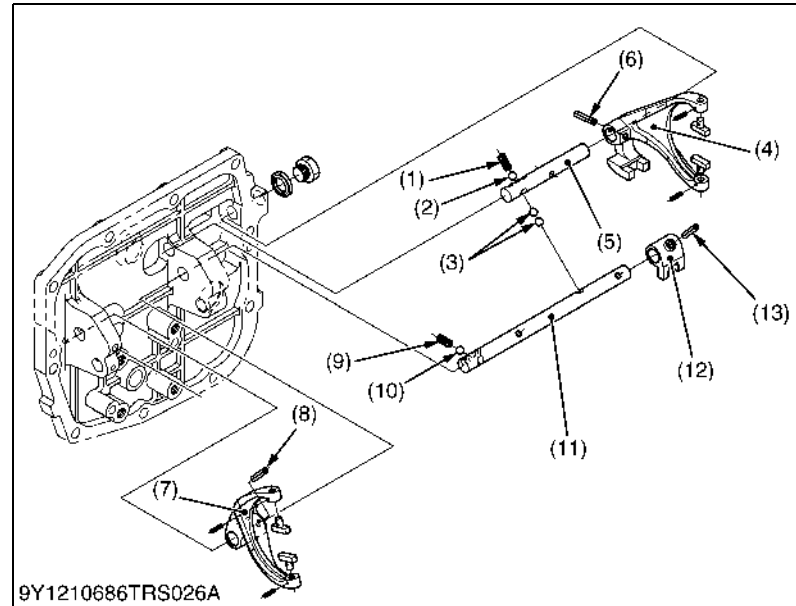
1. Remove the roll pin (8), (13), fork rod (11) and 3rd-4th fork (7).
2. Remove the roll pin (6), fork rod (5) and 1st-2nd fork (4).

NOTE

- Take care not to lose the balls and springs.

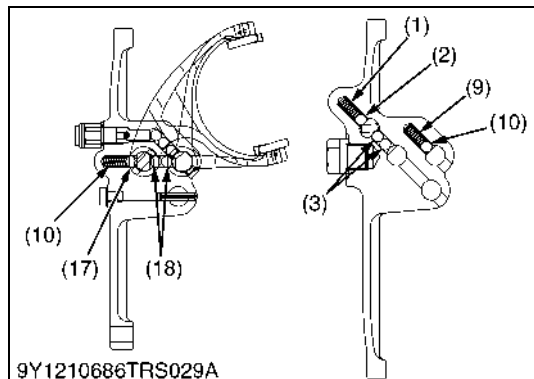
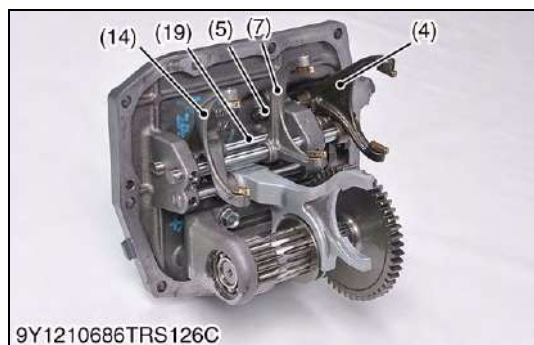
(When reassembling)

- Be sure to assemble the detent balls (2), (10) with springs (1), (9) and interlock ball (3).



- | | |
|----------------------|--------------------|
| (1) Spring | (8) Roll Pin |
| (2) Ball (Detent) | (9) Spring |
| (3) Ball (Interlock) | (10) Ball (Detent) |
| (4) 1st-2nd Fork | (11) Fork Rod |
| (5) Fork Rod | (12) Shifter |
| (6) Roll Pin | (13) Roll Pin |
| (7) 3rd-4th Fork | |

9Y1210686TRS0081US0



Main Shift Fork (F12/R12 and F24/R24 Speed Transmission Model)

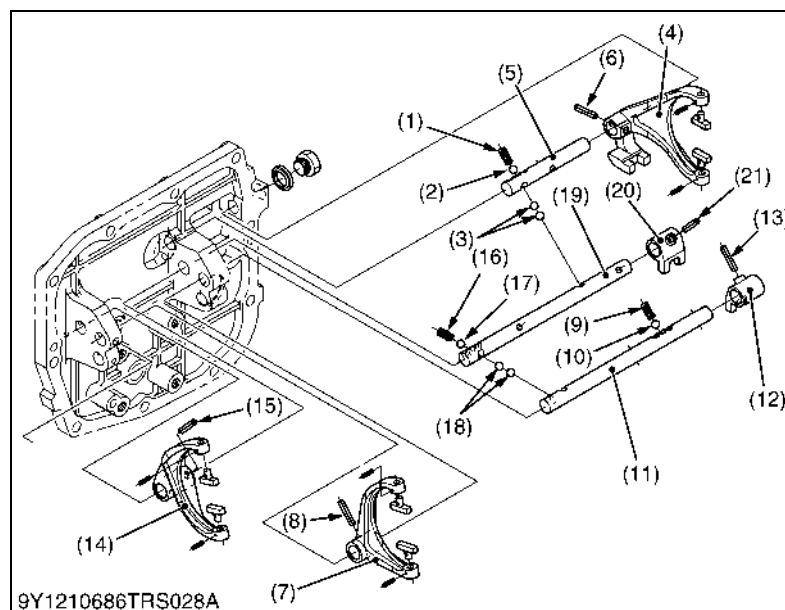
1. Remove the roll pins (8), (13), fork rod (11), shifter (12) and 5th-6th fork.
2. Remove the roll pins (15), (21), fork rod (19), shifter (20) and 3rd-4th fork.
3. Remove the roll pin (6), fork rod (5) and 1st-2nd fork (4).

NOTE

- Take care not to lose the balls and springs.

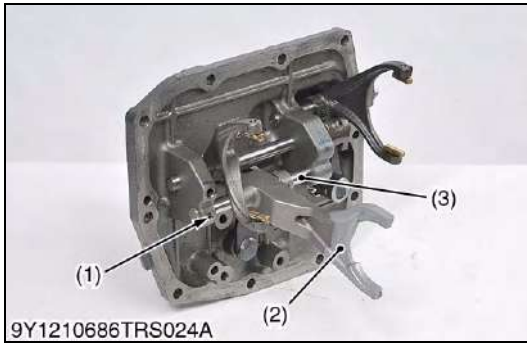
(When reassembling)

- Be sure to assemble the detent balls (2), (10), (17) with springs (1), (9), (10) and interlock balls (3), (18).



- | | |
|----------------------|-----------------------|
| (1) Spring | (11) Fork Rod |
| (2) Ball (Detent) | (12) Shifter |
| (3) Ball (Interlock) | (13) Roll Pin |
| (4) 1st-2nd Fork | (14) 3rd-4th Fork |
| (5) Fork Rod | (15) Roll Pin |
| (6) Roll Pin | (16) Spring |
| (7) 5th-6th Fork | (17) Ball (Detent) |
| (8) Roll Pin | (18) Ball (Interlock) |
| (9) Spring | (19) Fork Rod |
| (10) Ball (Detent) | (20) Shifter |
| | (21) Roll Pin |

9Y1210686TRS0082US0



Range Gear Shift Fork

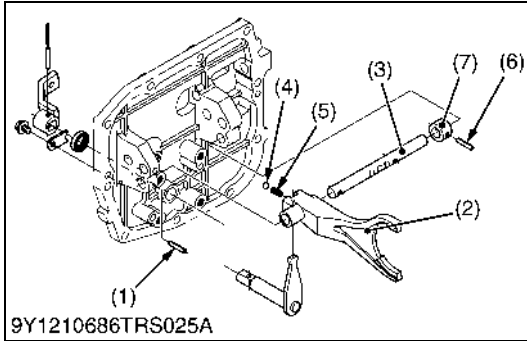
1. Remove the roll pin (1), (6), fork rod stopper collar (7), fork rod (3) and range shift fork (2).
2. Remove the ball (4) and spring (5).

■ NOTE

- Take care not to lose the detent ball (4) and spring (5).

- | | |
|----------------------|-----------------------------|
| (1) Roll Pin | (5) Spring |
| (2) Range Shift Fork | (6) Roll Pin |
| (3) Fork Rod | (7) Fork Rod Stopper Collar |
| (4) Ball (Detent) | |

9Y1210686TRS0083US0



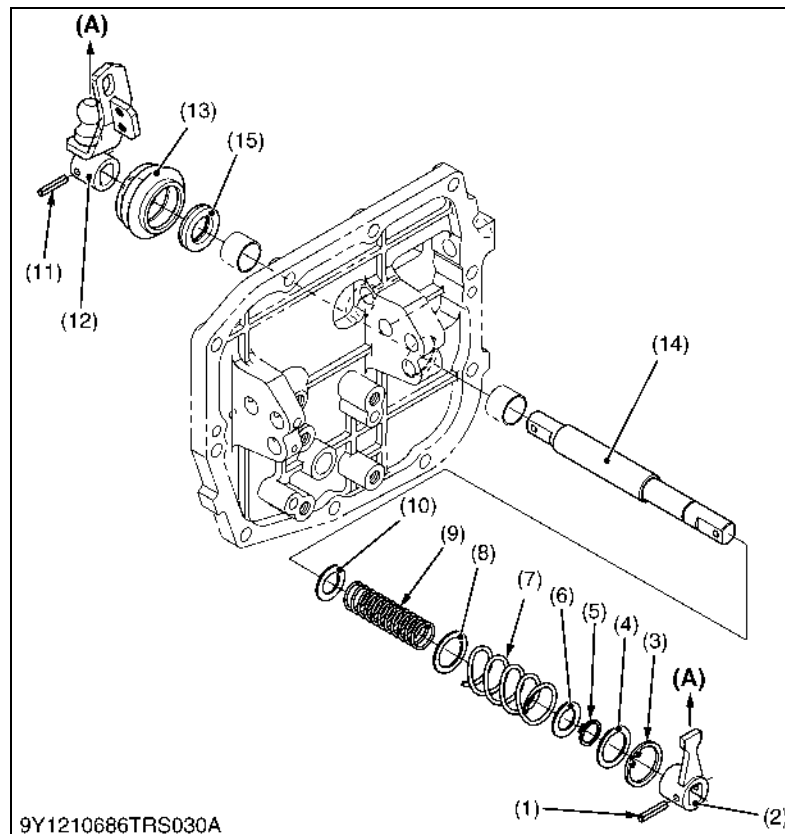


Main Shift Arm

1. Remove the roll pin (1) and main shift arm (2).
2. Remove the internal circlip (3) and collar (4) then remove the spring 1 (7).
3. Remove the external circlip (5) and collar (8) then remove the spring 2 (9) and collar (10).
4. Remove the roll pin (11), main shift lever (12) and rubber boots (13) then slide the main shift shaft (14).

(When reassembling)

- If oil seal (15) is damaged, replace the oil seal with new one.
- Assemble the main shift arm (2) and main shift lever (12) with align the both levers are the same direction as shown in the figure.

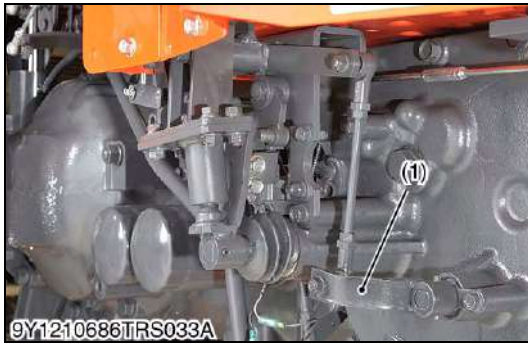


- (1) Roll Pin
- (2) Main Shift Arm
- (3) Internal Circlip
- (4) Collar
- (5) External Circlip
- (6) Collar
- (7) Spring 1
- (8) Collar
- (9) Spring 2

- (10) Collar
- (11) Roll Pin
- (12) Main Shift Lever
- (13) Rubber Boots
- (14) Main Shift Shaft
- (15) Oil Seal

(A) Align the Same Direction

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Range Shift Arm

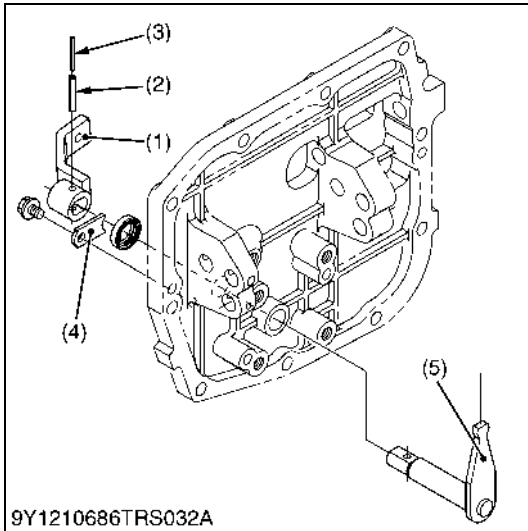
1. Remove the roll pin 1 (2), roll pin 2 (3) and stopper plate (4).
2. Draw out the range shift arm (5).

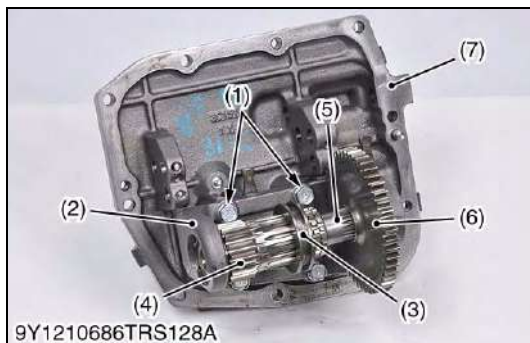
(When reassembling)

- Be sure to assemble the range shift lever (1) as an original direction as shown in photo.

- | | |
|-----------------------|---------------------|
| (1) Range Shift Lever | (4) Stopper Plate |
| (2) Roll Pin 1 | (5) Range Shift Arm |
| (3) Roll Pin 2 | |

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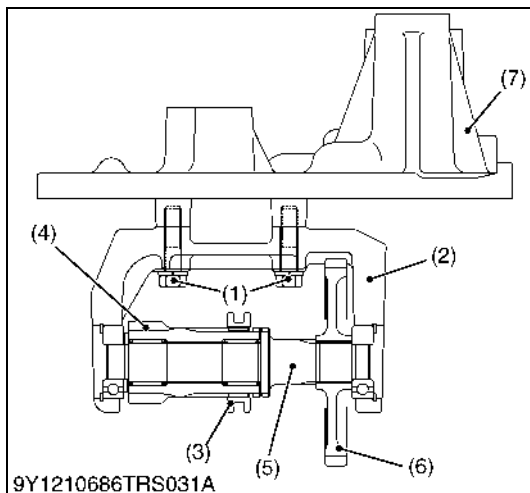


Creep Gear Assembly (If Equipped)

1. Remove the creep holder mounting screw (1) and the creep gear assembly.

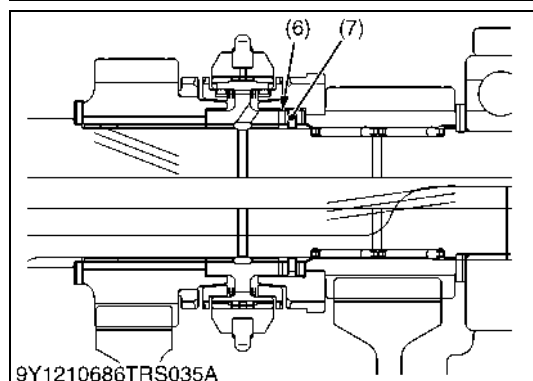
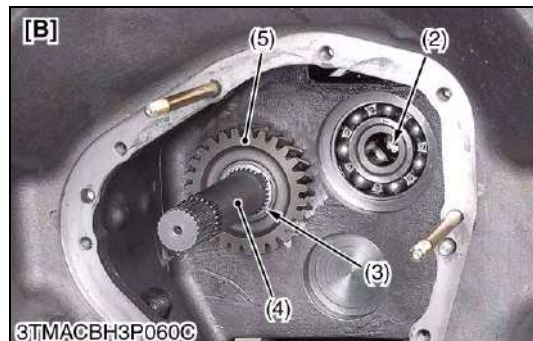
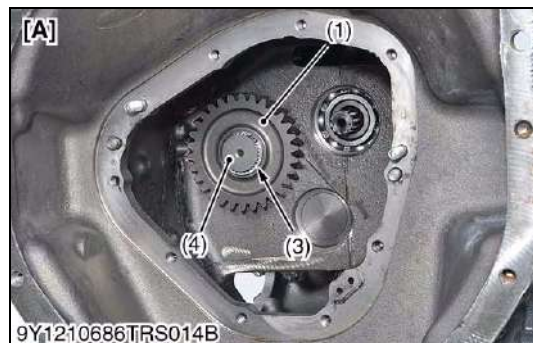
- | | |
|---------------------------------|-------------------------|
| (1) Creep Holder Mounting Screw | (5) Creep Shaft |
| (2) Creep Holder | (6) 48T Gear |
| (3) Shifter | (7) Shift Cover |
| (4) 17T Gear | (8) Creep Gear Assembly |

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[8] DISASSEMBLING CLUTCH HOUSING CASE

(1) Removing 1st Shaft, 2nd Shaft and 3rd Shaft



30T Gear (27T Gear)

1. Remove the external circlip 1 (3).
2. Remove the 30T gear (1) or 27T gear (5).

(When reassembling)

- Adjust the side clearance of 1st-2nd gears on the 1st shaft by adjusting collar (6).

(Reference)

- Thickness of adjusting collar (7):
 2.6 mm (0.10 in.) [Code No. 3C151-28490]
 2.8 mm (0.11 in.) [Code No. 3C151-28440]
 3.0 mm (0.12 in.) [Code No. 3C151-28410]
 3.2 mm (0.13 in.) [Code No. 3C151-28420]

Clearance "L" between external circlip and collar on 1st shaft	Factory specification	Less than 0.2 mm 0.008 in.
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- (1) 30T Gear (F8/R8 and F12/R12 Speed Transmission Model)
- (2) PTO Propeller Shaft
- (3) External Circlip 1
- (4) 1st Shaft
- (5) 27T Gear (F24/R24 Speed Transmission Model)
- (6) Adjusting Collar
- (7) External Circlip 2

[A] F8/R8 and F12/R12 Speed Transmission Model

[B] F24/R24 Speed Transmission Model

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