

WSM

WORKSHOP MANUAL UTILITY VEHICLE

RTV-X1100C

Kubota

TO THE READER

This Workshop Manual tells the servicing personnel about the mechanism, servicing and maintenance of the RTV-X1100C. It contains 4 parts: **"Information"**, **"General"**, **"Mechanism"** and **"Servicing"**.

■ Information

This section primarily contains information below.

- Safety First
- Safety Decal
- Specifications
- Dimensions

■ 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) for the diesel engine that this workshop manual does not include.

■ Servicing

This section primarily contains information below.

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

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.

© KUBOTA Corporation 2013

December 2013

Record of Revisions

For pdf, use search function {Search word} to find all the revised locations.

Last digit of the Code No.	Month of Revision	Main Revised Point and Corrective Measures {Search word}	Reference Page
1	2014.07	Topic "Brake Pipe" is added.	1-S28, 2-S29
		Topic "Adjusting between Front Upper Arm and Stopper" is added.	6-S4
2	2014.09	Add the label because of battery change.	I-6
		Change lubricants.	G-8
3	2015.08	Maintenance interval change.	G-17
4	2017.08	Added starter sealant information.	1-S32, 2-S33, 8-S26
5	2019.03	Added Proposition 65 label and revised battery label.	I-4, I-6
		Revised callouts (7) and (8) on HST illustration: (7): (HST) changed to (Suction) (8): (Suction) (Orange Color) changed to (VHT) (Yellow Color)	2-M2
6	2019.10	Revised callouts (4) and (5) on HST illustration: (4): Forward changed to Dynamic Brake (5): Dynamic Brake changed to Forward	2-M2
		Added note for bearing installation	2-S48
7	2020.09	Revised electrical circuit for starting system.	8-M3
8	2021.02	Change of tightening torque by changing the material of the hydraulic hose.	1-S9 1-S28 1-S29 1-S32 2-S5 2-S29 2-S33 6-S3 6-S4 6-S6 6-S7 6-S8 6-S10 6-S11 7-S3 7-S5 7-S8
9	2021.04	Added 200 hrs or 3000 km maintenance item; Suspension arm bushings	G-17 G-45

Last digit of the Code No.	Month of Revision	Main Revised Point and Corrective Measures {Search word}	Reference Page
9Y121-26250	2021.08	The code number of this WSM has been changed from 9Y121-09489 to 9Y121-26250.	—
		Added HST return pipe bolt torque to tightening torque table	1-S9 2-S5
		Revised linkage, starter and hydraulic pipe	1-S32 2-S33
		Added removing muffler	1-S33 1-S33 2-S34 2-S34
1	2021.10	Added the thermistor information of the air conditioner unit.	9-S31

I INFORMATION

INFORMATION

CONTENTS

1. SAFETY FIRST	I-1
2. SAFETY DECALS	I-4
3. SPECIFICATIONS	I-8
4. TRAVELLING SPEEDS	I-9
5. DIMENSIONS	I-10

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 try 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, could result in minor or moderate injury.

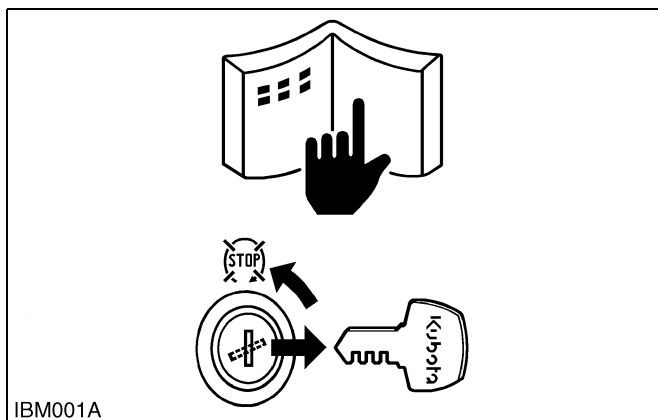
■ IMPORTANT

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

■ NOTE

- Gives helpful information.

WSM000001INI0001US1

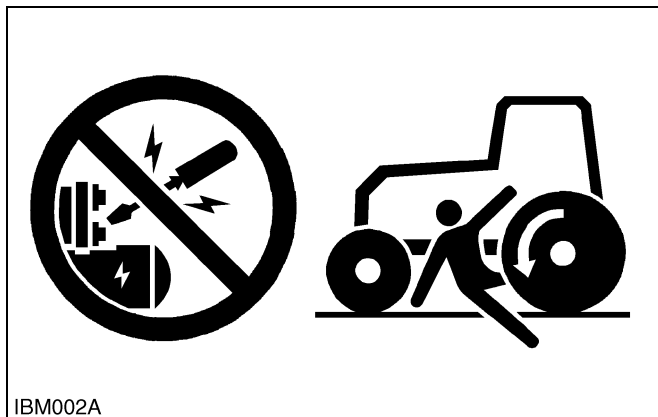


IBM001A

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.

WSM000001INI0010US0

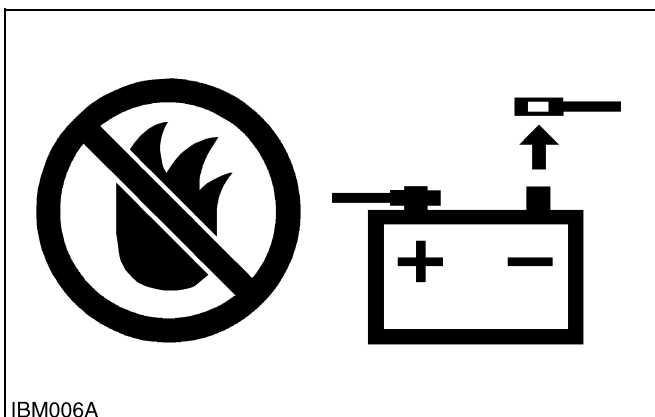
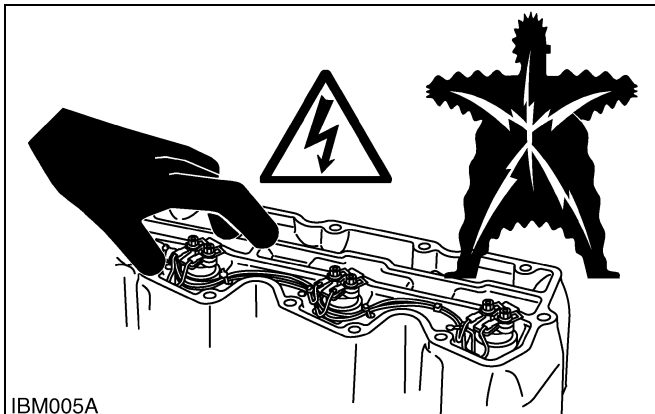
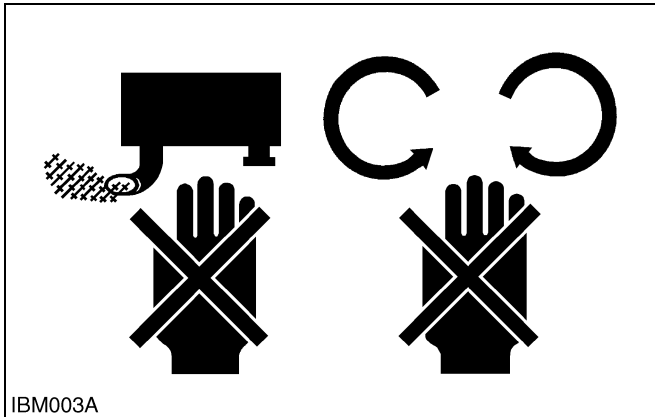


IBM002A

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.

WSM000001INI0015US0



OPERATE SAFELY

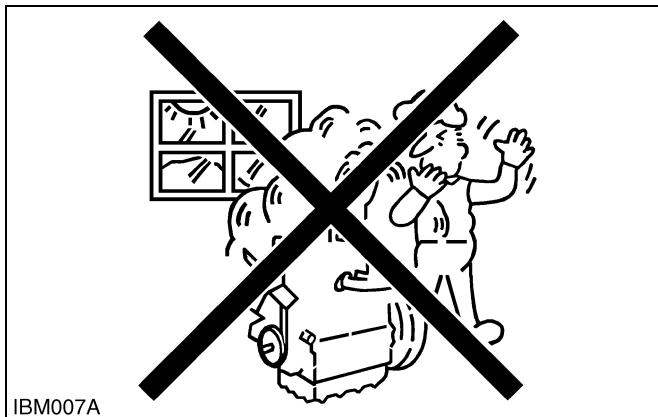
- Do not use the machine after you consume alcohol or medication or when you are tired.
- Put on applicable clothing and safety equipment.
- Use applicable tools only. Do not use alternative tools or parts.
- When 2 or more persons do servicing, make sure that you do it safely.
- Do not operate below 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.

WSM000001INI0012US0

PREVENT A FIRE

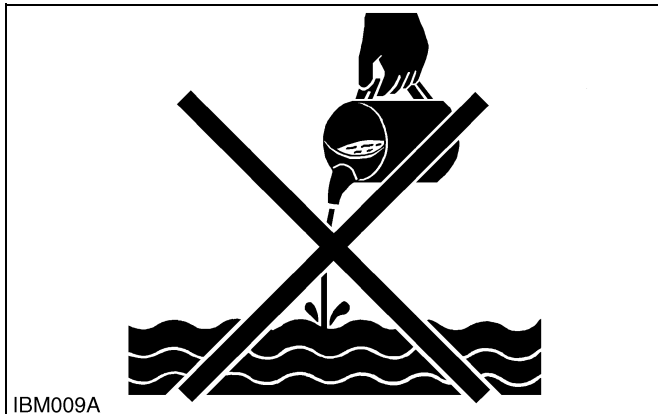
- Fuel is very flammable and explosive under some conditions. Do not smoke or let flames or sparks in your work area.
- To prevent sparks from an accidental short circuit, always disconnect the battery negative cable first and connect it last.
- The battery gas can cause an explosion. Keep the sparks 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.

WSM000001INI0005US0

**KEEP A GOOD AIRFLOW IN THE WORK AREA**

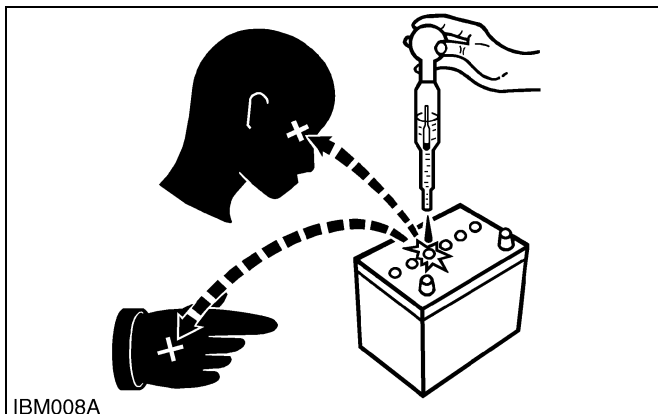
- If the engine is in operation, make sure that the area has good airflow. Do not operate the engine in a closed area. The exhaust gas contains poisonous carbon monoxide.

WSM000001INI0006US0

**DISCARD FLUIDS CORRECTLY**

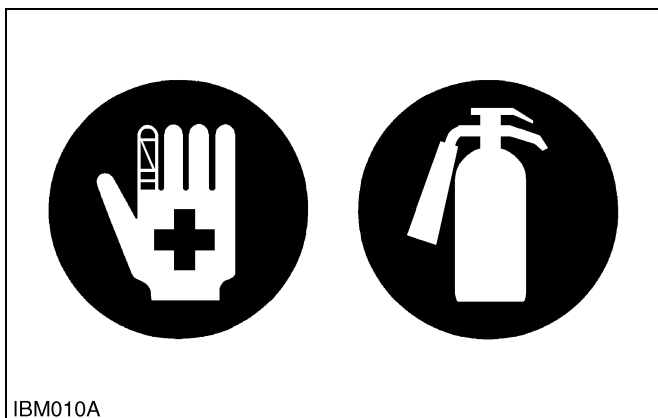
- Do not discard fluids on the ground, down the drain, into a stream, pond, or lake. Obey related environmental protection regulations when you discard oil, fuel, coolant, electrolyte and other dangerous waste.

WSM000001INI0007US0

**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.

WSM000001INI0008US0

**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.

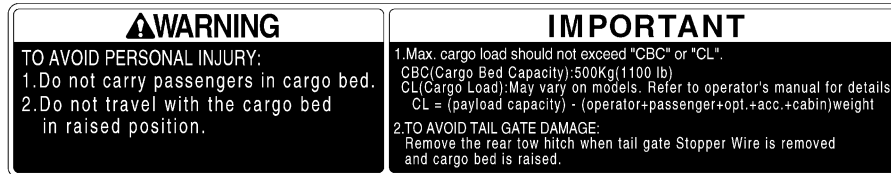
WSM000001INI0009US0

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.

WSM000001INI0013US0

(1) Part No. K7731-6523-1



1AYAACQAP221A

(4) Part No. K7731-6541-1



1AYAACQAP220A

(2) Part No. K7731-6542-1



1AYAACQAP016A

(3) Part No. K7591-6542-1



1AYAACQAP005A

(6) Part No. K7731-6577-2



1AYAACQAP021A

(5) Part No. K7731-6526-2



1AYAACQAP218A

(7) Part No. K7591-6549-1



1AYAACQAP008A

(8) Part No. K7591-6538-2

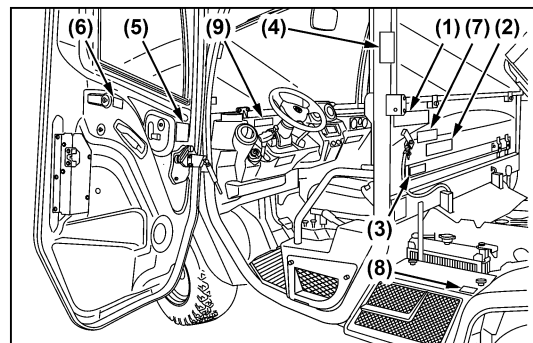


1AYAACQAP004A

(9) Part No. K7731-6596-1



1AYAACQAP275A



9Y1210948ICI005US

9Y1210948INI0001US0

(1) Part No. K7591-6521-2

⚠ WARNING

TO AVOID PERSONAL INJURY:

1. Read and understand the operator's manual before operation.
2. Never allow anyone under age 16 or without a valid driver's license to operate this vehicle.
3. Before allowing other people to use the vehicle, have them read the operator's manual.
4. This vehicle is for off road use only. Never operate on a public road, as such operation could be a violation of the law and may be hazardous.
5. Wear safety gear, including helmet and eye protection, as appropriate.
6. Check the tightness of all nuts and bolts regularly.
7. In addition to the driver, only one passenger can be carried.
Minimum age for passenger is five years old.
8. Before starting the engine, make sure that everyone is at a safe distance from the vehicle and the hydraulic outlet is off (if equipped).
9. Do not operate the vehicle under the influence of drugs or alcohol.
10. Keep all shields in place and stay away from all moving parts.
11. Slow down for turns, or rough terrain.
12. Before getting off from the vehicle, apply the parking brake, stop the engine and remove the key.
13. Do not operate unless driver and passenger are properly positioned and seat belts appropriately fastened.

1AYAACQAP020A

(2) Part No. K7731-6537-2

<p>⚠ WARNING REFRIGERANT UNDER HIGH PRESSURE</p> <p>TO AVOID PERSONAL INJURY: This air conditioning system should be serviced by your dealer or any other qualified service shop. See Workshop Manual for details.</p> <table border="0"> <tr> <td>Refrigerant</td> <td>oil</td> </tr> <tr> <td>R134a Max. 0.55kg(1.21lbs.)</td> <td>PAG OIL</td> </tr> <tr> <td>USE ONLY Min. 0.45kg(0.99lbs.)</td> <td>USE ONLY</td> </tr> </table>	Refrigerant	oil	R134a Max. 0.55kg(1.21lbs.)	PAG OIL	USE ONLY Min. 0.45kg(0.99lbs.)	USE ONLY	<p>IMPORTANT</p> <p>TO AVOID DAMAGE TO AIR CONDITIONER</p> <ol style="list-style-type: none"> 1. Do not spray water on any air conditioner parts. 2. Use air when cleaning the air conditioner.
Refrigerant	oil						
R134a Max. 0.55kg(1.21lbs.)	PAG OIL						
USE ONLY Min. 0.45kg(0.99lbs.)	USE ONLY						

1AYAACQAP222A

(3) Part No. K7591-6542-1

⚠ WARNING

TO AVOID PERSONAL INJURY:
Use the Safety Support or Propping Rod when working near a raised cargo bed or attachment.

1AYAACQAP005A

(6) Part No. K7591-6534-3

ULTRA LOW SULFUR DIESEL FUEL ONLY

⚠ CAUTION

NO STEP

1AYAACQAP003A

(4) Part No. K7731-6527-1

⚠ WARNING

TO AVOID PERSONAL INJURY OR DEATH:
Always fasten your seat belt.

⚠ WARNING

TO AVOID PERSONAL INJURY:

1. Do not stick your head out of the window while the engine is running.
2. Do not stick your body out of the window while traveling.

1AYAACQAP219A

(5) Part No. K7731-6577-2

⚠ WARNING

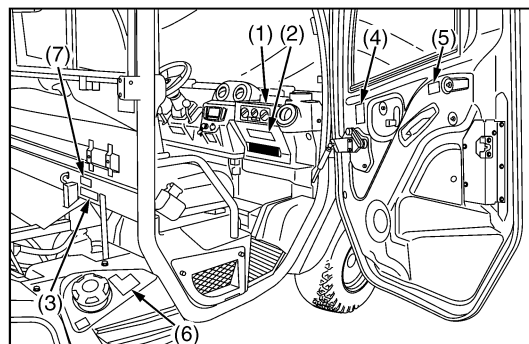
TO AVOID PERSONAL INJURY OR DEATH:
Secure the door properly.

1AYAACQAP021A

(7) Part No. K7731-6543-1



1AYAACQAP234A



9Y1210948ICI002US

9Y1210948INI0002US0

(1) Part No. K7591-6531-1



1AYAACQAP018A

(2) Part No. K7591-6583-3



1AYAACQAP183A

(3) Part No. K7731-6114-3

FLAMMABLES SHIELD EYES KEEP OUT OF THE REACH OF CHILDREN CAUTION OF SULFURIC ACID READ INSTRUCTION MANUAL CAREFULLY EXPLOSIVE		DANGER EXPLOSIVE GASES CIGARETTES, FLAMES OR SPARKS COULD CAUSE BATTERY TO EXPLODE. ALWAYS SHIELD EYES AND FACE FROM BATTERY. DO NOT CHARGE OR USE BOOSTER CABLES OR ADJUST POST CONNECTIONS WITHOUT PROPER INSTRUCTION AND TRAINING. POISON CAUSES SEVERE BURNS CONTAINS SULFURIC ACID. AVOID CONTACT WITH SKIN, EYES OR CLOTHING. IN EVENT OF ACCIDENT FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF REACH OF CHILDREN California Proposition 65 WARNING : This product can expose you to chemicals including lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov .	SMF 24R-670 PART No. K7731-61114 <table border="1"> <tr> <td>NOMINAL VOLTAGE</td> <td>12V</td> </tr> <tr> <td>COLD CRANKING AMPS</td> <td>670</td> </tr> <tr> <td>CRANKING AMPS</td> <td>800</td> </tr> <tr> <td>RESERVE CAPACITY(MINUTES)</td> <td>115</td> </tr> <tr> <td>AMP HOURS(@20 hr Rate)</td> <td>66</td> </tr> </table>	NOMINAL VOLTAGE	12V	COLD CRANKING AMPS	670	CRANKING AMPS	800	RESERVE CAPACITY(MINUTES)	115	AMP HOURS(@20 hr Rate)	66
NOMINAL VOLTAGE	12V												
COLD CRANKING AMPS	670												
CRANKING AMPS	800												
RESERVE CAPACITY(MINUTES)	115												
AMP HOURS(@20 hr Rate)	66												
FITTING DATE 1 2 3 4 5 6 7 8 9 10 11 12 YEAR MONTH		INDICATOR ● OK ○ CHARGE ● REPLACE MADE IN KOREA											

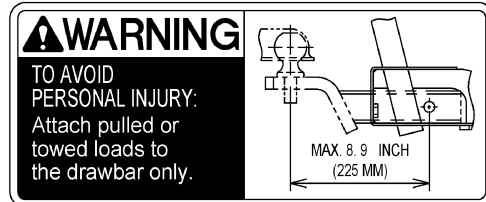
1AYAACQAP277A

(4) Part No. K7591-6524-1

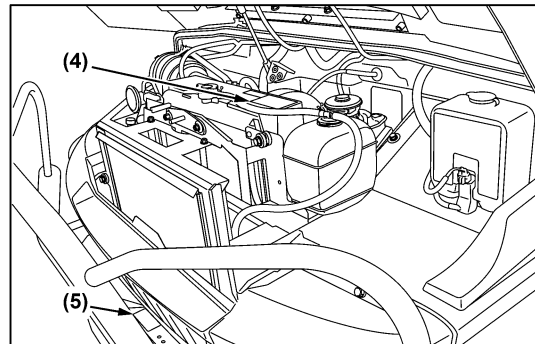
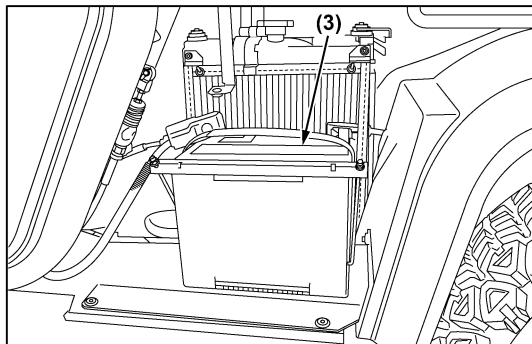
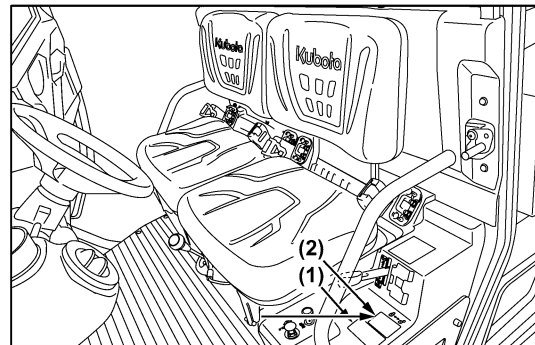


1AYAACQAP002A

(5) Part No. K7591-6544-2



1AYAACQAP007A



9Y1210948ICI006US

9Y1210948INI0003US0

(1) Part No. K7591-6545-2

**WARNING****TO AVOID PERSONAL INJURY:**

1. Before touching any part of an exhaust system, be absolutely sure that it has had sufficient time to cool.
2. Always wear safety goggles and a (face)mask.
3. The particulate matter contained in the muffler contains chemicals that are harmful to people, animal and marine life.
4. If you are unable to do this work, have it done by your KUBOTA Dealer.

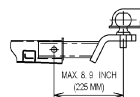
Maintenance

The swirl type spark arrester should be cleaned after every 100 hours of use.

1. Set vehicle in an open area away from combustible materials and on flat surface.
2. Apply parking brake and shift range gear shift lever into N(neutral) position.
3. Remove the drain plug located on the bottom of the muffler body.
4. Start engine and raise and lower engine revolution while tapping on the muffler with a rubber mallet until the carbon particles are purged from the muffler.
5. Stop the engine.
6. Reinstall the drain plug.

WARNING

TO AVOID PERSONAL INJURY:
Attach pulled or towed loads to the drawbar only.

**IMPORTANT**

1. Carefully read the loading information and trailer hitch sections in the Operator's Manual.

2. Towing Capacity
 - Max. Towing Load 590kg (1300lbs)
 - Max. Tongue Weight 50kg (110lbs)

1AYAACQAP009A

(2) Part No. K7591-6547-1



1AYAACQAP010A

(3) Part No. K7591-6533-1



1AYAACQAP010A

(4) Part No. K7591-6548-1

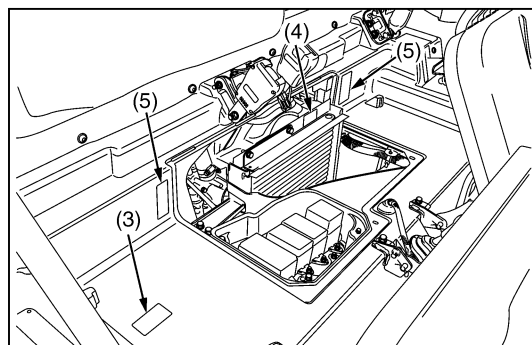
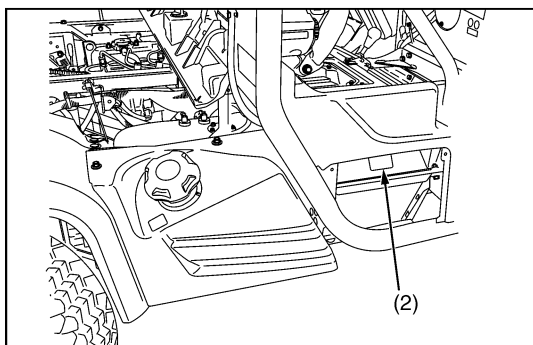
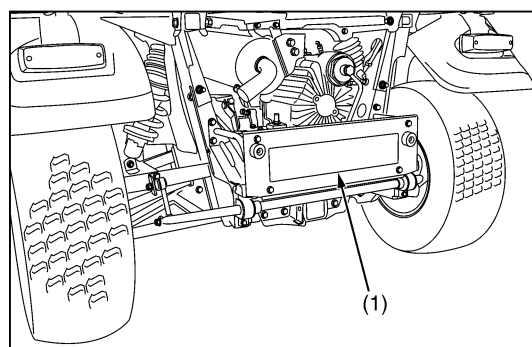


1AYAACQAP011A

(5) Part No. K7591-6532-1



1AYAACQAP017A



9Y1210948ICI004US

9Y1210948INI0004US0

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.

9Y1210948INI0005US0

3. SPECIFICATIONS

Model			RTV-X1100C	
			Worksite / Orange	Worksite / Camo
Engine	Make		D1105	
	Type		3 cylinders, 4-cycle, diesel, OHV	
	Displacement		1.123 L (68.530 cu. in.)	
	Horsepower		18.5 kw (24.8 HP)	
	Rated revolution		3000 min ⁻¹ (rpm)	
	Low idling revolution		1350 to 1450 min ⁻¹ (rpm)	
Fuel Capacity			30 L (7.9 U.S.gals, 6.6 Imp.gals)	
Transmission			Continuously variable hydro transmission (VHT)	
Wheels, Drive system			4, Rear 2WD or 4WD	
Differential lock			Standard; foot operated with mechanical holder	
Gear selection			Hi-Low range forward, neutral, reverse	
Brakes	Front / Rear		Wet disk brake	
	Parking brake		Rear wheel, hand lever	
Steering			Hydrostatic power	
Suspension	Front		Independent, Dual A-Arm type	
	Rear		Independent, Dual A-Arm type	
Dimensions	Length		3110 mm (122.5 in.)	
	Width		1660 mm (65.4 in.)	
	Height, overall		2090 mm (82.3 in.)	
	Front tread centers		1240 mm (48.8 in.) HDWS, ATV, 1290 mm (50.8 in.) Turf	
	Rear tread centers		1240 mm (48.8 in.) HDWS, ATV, 1290 mm (50.8 in.) Turf	
	Wheelbase		2045 mm (80.5 in.)	
	Ground clearance	front axle	266 mm (10.5 in.)	
		rear axle	263 mm (10.4 in.)	
Turning diameter		8.0 m (26.2 ft)		
Max. Rolling weight (Towing capacity)			Rear: 590 kg (1300 lbs), Front: 295 kg (650 lbs)	
Payload capacity			734 kg (1618 lbs)	
Weight			1075 kg (2370 lbs)	
Gross Vehicle Weight Rating (GVWR)			1814 kg (3999 lbs)	
Cargo bed	Width		1465 mm (57.7 in.)	
	Length		1030 mm (40.5 in.)	
	Depth		285 mm (11.2 in.)	
	Volume		0.43 m ³ (15.2 cu.ft.)	
	Bed height (unloaded)		887 mm (34.9 in.)	
	Cargo bed capacity		500 kg (1102 lbs)	
Sound level, operator ear			83 db (A)	
Tire	Front		25 × 10-12 HDWS, 6PLY 25 × 10-12 ATV, 6PLY 25 × 12-12 Turf, 4PLY	25 × 10-12 HDWS, 6PLY 25 × 10-12 ATV, 6PLY
	Rear		25 × 10-12 HDWS, 6PLY 25 × 10-12 ATV, 6PLY 25 × 12-12 Turf, 4PLY	25 × 10-12 HDWS, 6PLY 25 × 10-12 ATV, 6PLY
Tilt steering wheel			Standard	
Seat belt			2 point type	
Front deluxe guard			–	–
Front deluxe guard with light guard			Standard	Standard
Body color			Orange	Camo
Bed lift			Standard	Standard
Speedometer			Standard	Standard
Door			Standard	Standard
Seat slide			Standard	Standard

■ NOTE

- The company reserves the right to change the specifications without notice.
- The values in "Ground clearance" and "Weight" are those of the machine equipped with the tires in the table above.

9Y1210948INI0006US0

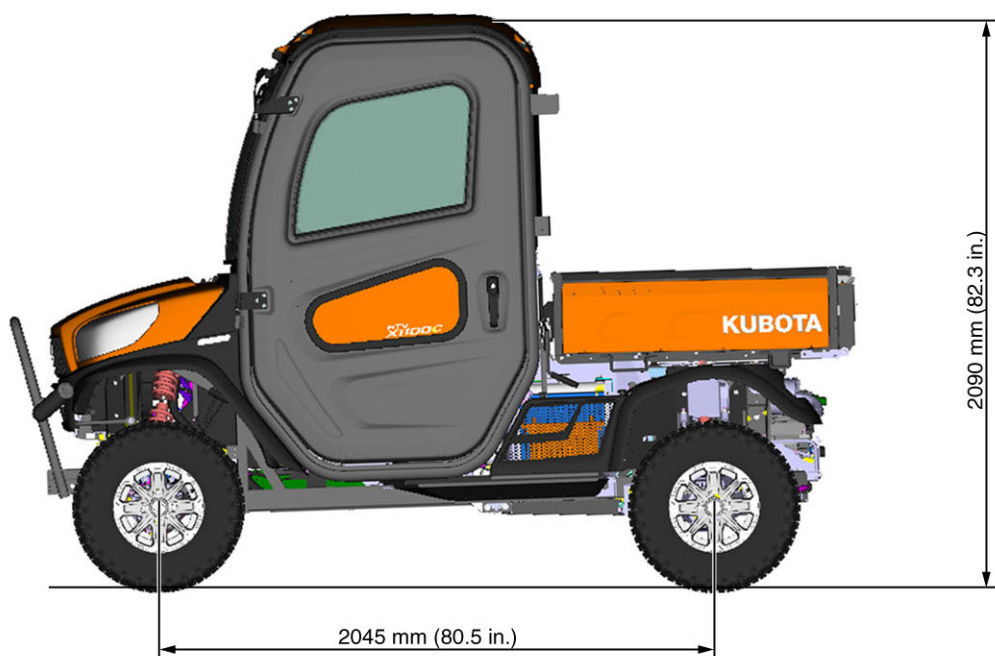
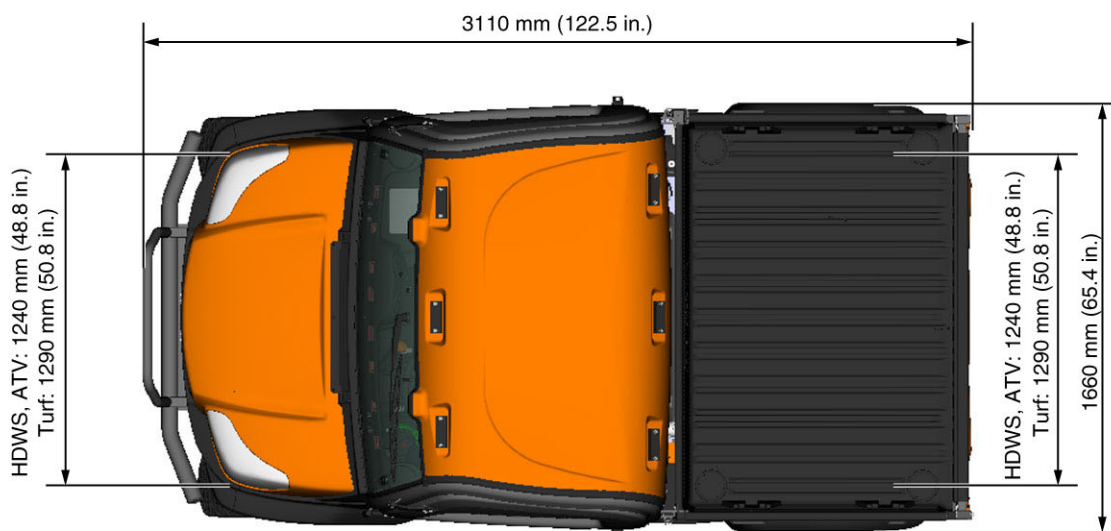
4. TRAVELLING SPEEDS

(At rated engine rpm)

Model	RTV-X1100C
Range gear shift lever	km/h (mph)
Low	24 (15)
High	40 (25)
Reverse	27 (17)

9Y1210948INI0007US0

5. DIMENSIONS



9Y1210948IFI001US

9Y1210948INI0008US0

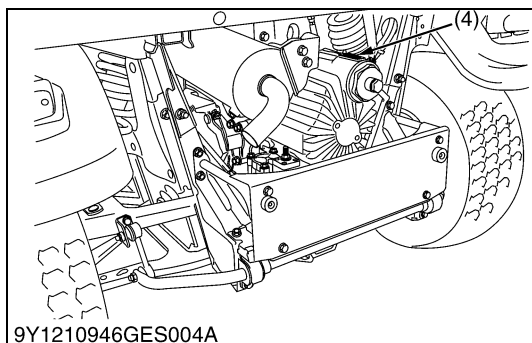
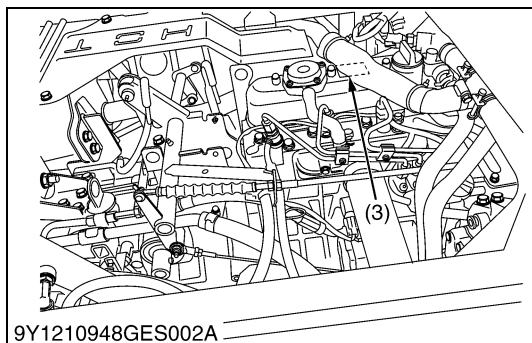
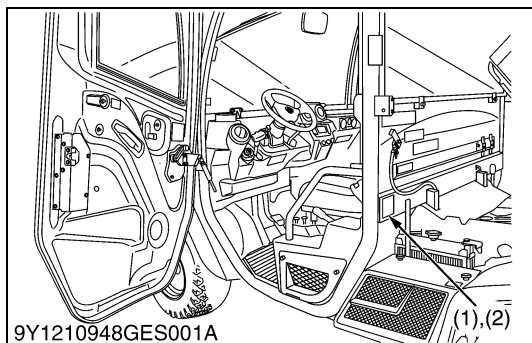
G GENERAL

GENERAL

CONTENTS

1. PRODUCT IDENTIFICATION	G-1
2. GENERAL PRECAUTIONS.....	G-2
3. HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING	G-3
[1] WIRING	G-3
[2] BATTERY	G-5
[3] FUSE	G-5
[4] CONNECTOR	G-5
[5] HANDLING OF CIRCUIT TESTER	G-6
[6] COLOR OF WIRING	G-7
4. LUBRICANTS, FUEL AND COOLANT.....	G-8
5. TIGHTENING TORQUES.....	G-14
[1] GENERAL USE SCREWS, BOLTS AND NUTS	G-14
[2] STUD BOLTS	G-14
[3] HYDRAULIC FITTINGS	G-15
(1) Hydraulic Hose Fittings.....	G-15
(2) Hydraulic Pipe Cap Nuts	G-15
(3) Adaptors, Elbows and Others.....	G-15
[4] METRIC SCREWS, BOLTS AND NUTS	G-16
[5] AMERICAN STANDARD SCREWS, BOLTS AND NUTS WITH UNC OR UNF THREADS	G-16
[6] PLUGS	G-16
6. MAINTENANCE CHECK LIST	G-17
7. CHECK AND MAINTENANCE	G-20
[1] DAILY CHECK.....	G-20
[2] CHECK POINTS OF INITIAL 50 HOURS	G-26
[3] CHECK POINTS OF EVERY 50 HOURS	G-31
[4] CHECK POINTS OF EVERY 100 HOURS	G-34
[5] CHECK POINTS OF EVERY 200 HOURS	G-40
[6] CHECK POINT OF EVERY 200 HOURS OR 3,000 KM	G-45
[7] CHECK POINT OF EVERY 300 HOURS	G-45
[8] CHECK POINTS OF EVERY 400 HOURS	G-46
[9] CHECK POINT OF EVERY 800 HOURS	G-48
[10]CHECK POINT OF EVERY 1000 HOURS OR EVERY 1 YEAR	G-48
[11]CHECK POINT OF EVERY 1500 HOURS	G-48
[12]CHECK POINT OF EVERY 2000 HOURS OR EVERY 2 YEARS	G-49
[13]CHECK POINT OF EVERY 3000 HOURS	G-51
[14]CHECK POINTS OF EVERY 1 YEAR.....	G-51
[15]CHECK POINT OF EVERY 2 YEARS.....	G-57
[16]CHECK POINTS OF EVERY 4 YEARS	G-57
[17]SERVICE AS REQUIRED	G-58
8. SPECIAL TOOLS	G-62
[1] SPECIAL TOOLS FOR ENGINE.....	G-62
[2] SPECIAL TOOLS FOR MACHINE	G-69
9. TIRES	G-74
[1] TYPE OF TIRES.....	G-74
[2] TIRE PRESSURE.....	G-75
[3] VEHICLE LIMITATIONS.....	G-76
[4] CARGO BED	G-77
[5] SHOCK ABSORBERS	G-78

1. PRODUCT IDENTIFICATION

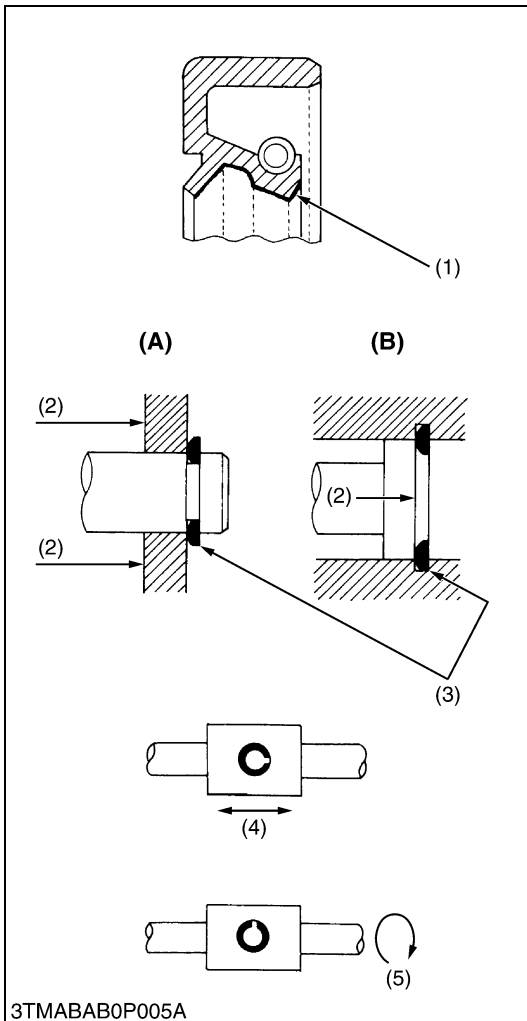


When contacting your local KUBOTA distributor, always specify engine serial number, product serial number and hour meter reading.

- | | |
|-----------------------------------|---|
| (1) Vehicle Identification Plate | (3) Engine Serial Number |
| (2) Product Identification Number | (4) Transmission Assembly Serial Number |

9Y1210948GEG0001US0

2. GENERAL PRECAUTIONS



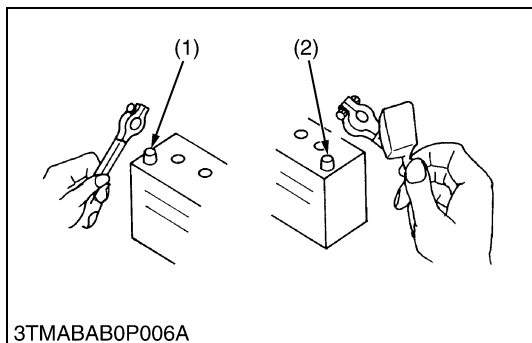
- When you disassemble, carefully put the parts in a clean area to make it easy to find the parts. You must install the screws, bolts and nuts in their initial position to prevent the reassembly errors.
- When it is necessary to use special tools, use KUBOTA special tools. Refer to the drawings when 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 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 circlips, 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 on the 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 check oil leakage.

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

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

WSM000001GEG0106US0

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

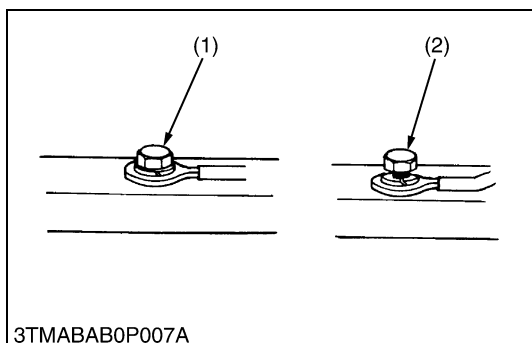
- Check electrical wiring for damage and loosened connection every year.
- When removing the battery cables, disconnect the negative cable first. When installing the battery cables, connect the positive cable first.

(1) Negative Terminal

(2) Positive Terminal

WSM000001GEG0062US0

[1] WIRING

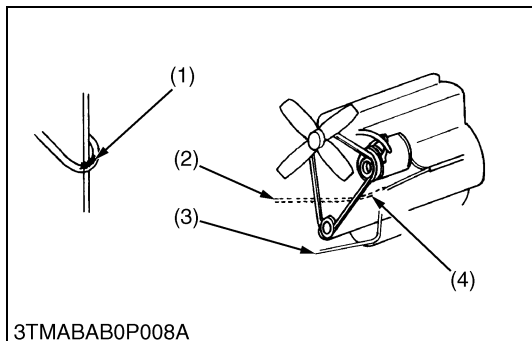


- Securely tighten wiring terminals.

(1) Correct
(Securely Tighten)

(2) Incorrect
(Loosening Leads to damaged Contact)

WSM000001GEG0063US0

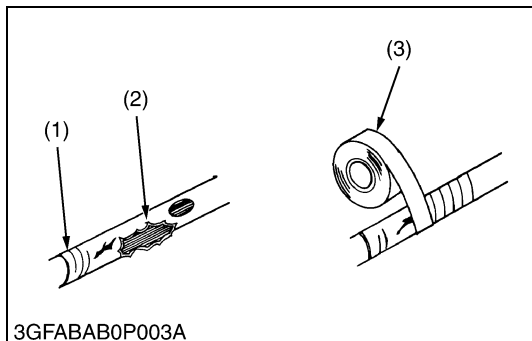


- Do not let wiring contact dangerous part.

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

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

WSM000001GEG0064US0

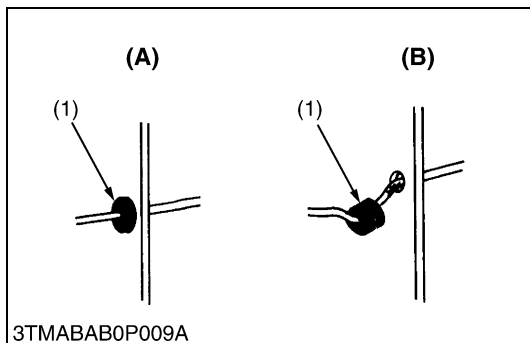


- Repair or change torn or aged wiring immediately.

(1) Aged
(2) Torn

(3) Electrical Tape

WSM000001GEG0065US0

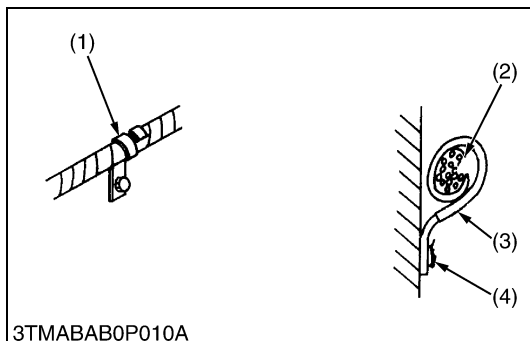


- Securely insert grommet.

(1) Grommet

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

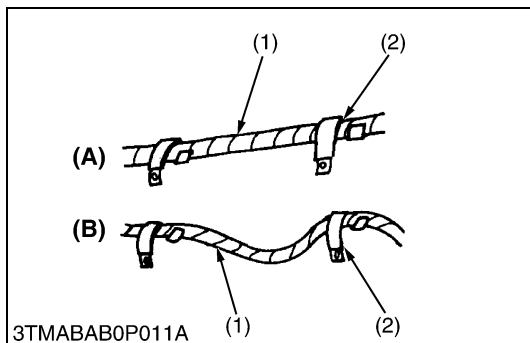
WSM000001GEG0066US0



- Securely clamp, being careful not to damage wiring.

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

WSM000001GEG0067US0

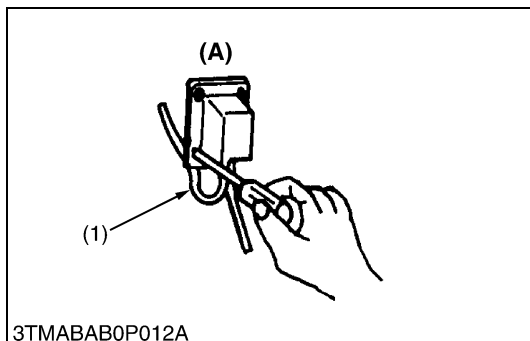


- Clamp wiring so that there is no twist, unnecessary sag, or excessive tension, except for movable part, where sag be required.

(1) Wiring
(2) Clamp

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

WSM000001GEG0068US0

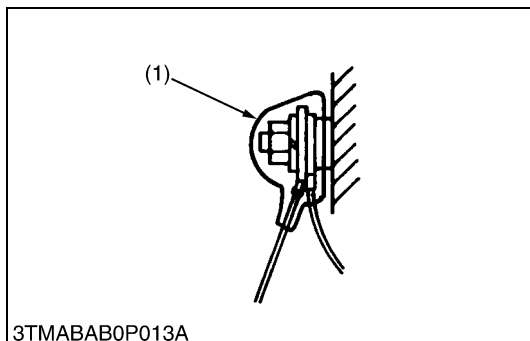


- In installing a part, be careful not to get wiring caught by it.

(1) Wiring

(A) **Incorrect**

WSM000001GEG0069US0

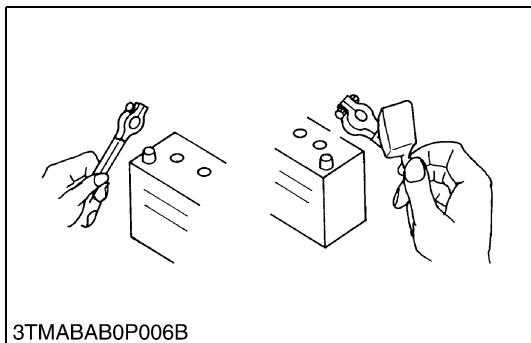


- After installing wiring, check protection of terminals and clamped condition of wiring.

(1) Cover
(Securely Install Cover)

WSM000001GEG0070US0

[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.



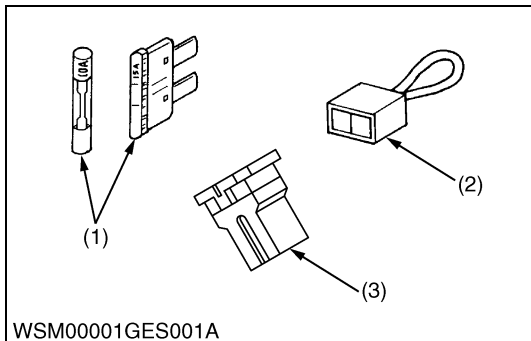
DANGER

To avoid serious injury or death:

- 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.

WSM000001GEG0071US0

[3] FUSE



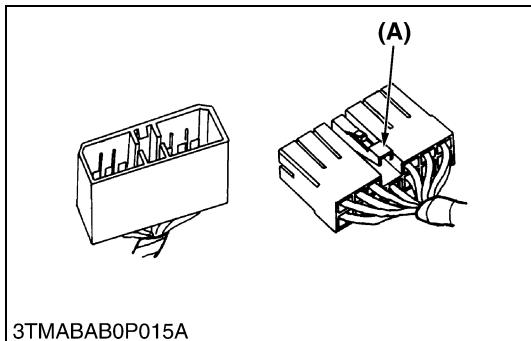
- Use fuses with specified capacity. Neither too large nor small capacity fuse is acceptable.
- Never use steel nor copper wire in place of fuse.
- Do not install working light, radio set, etc. on machine which is not provided with reserve power supply.
- Do not install accessories if fuse capacity of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

(1) Fuse
(2) Fusible Link

(3) Slow Blow Fuse

WSM000001GEG0072US0

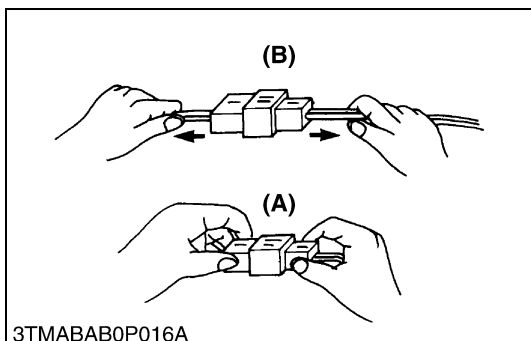
[4] CONNECTOR



- For connector with lock, push lock to separate.

(A) Push

WSM000001GEG0073US0

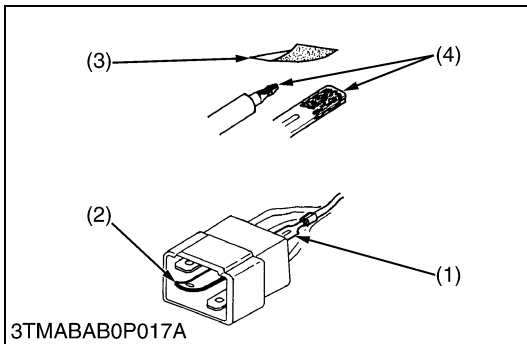


- In separating connectors, do not pull wire harnesses.
- Hold connector bodies to separate.

(A) Correct

(B) Incorrect

WSM000001GEG0074US0

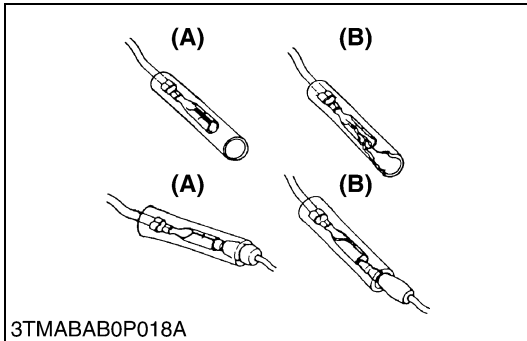


- Use sandpaper to remove rust from terminals.
- Repair deformed terminal. Make sure that there is no terminal being exposed or displaced.

(1) Exposed Terminal
(2) Deformed Terminal

(3) Sandpaper
(4) Rust

WSM000001GEG0075US0

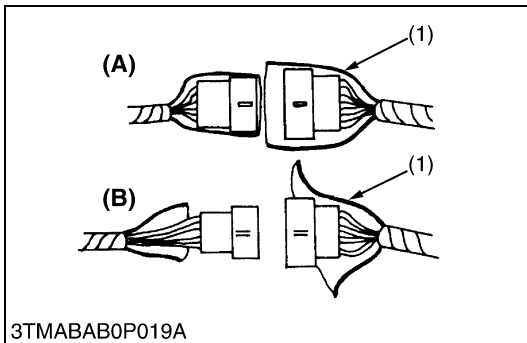


- Make sure that there is no female connector being too open.

(A) Correct

(B) Incorrect

WSM000001GEG0076US0



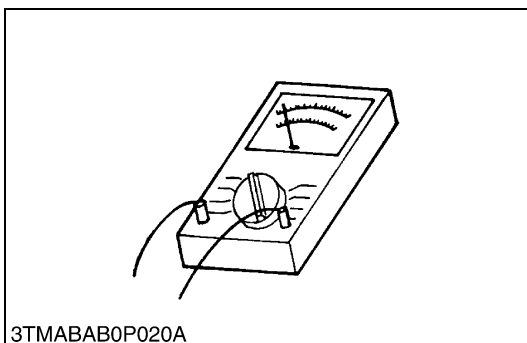
- Make sure that plastic cover is large enough to cover whole connector.

(1) Cover

(A) Correct
(B) Incorrect

WSM000001GEG0077US0

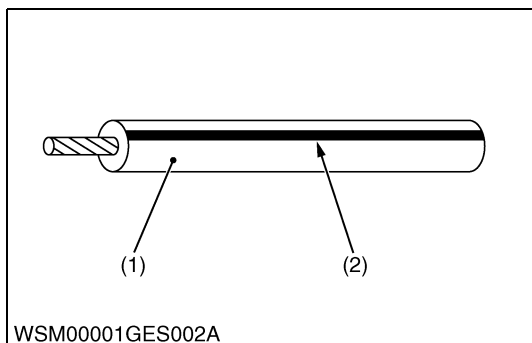
[5] HANDLING OF CIRCUIT TESTER



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

WSM000001GEG0078US0

[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. LUBRICANTS, FUEL AND COOLANT

No.	Place		Capacity	Lubricants, fuel and coolant
1	Fuel		30 L 7.9 U.S.gals 6.6 Imp.gals	<ul style="list-style-type: none"> No. 2-D diesel fuel No. 1-D diesel fuel if temperature is below -10°C (14°F)
2	Coolant (with reserve tank)		7.9 L 8.3 U.S.qts 7.0 Imp.qts	Fresh clean water with anti-freeze
3	Engine crankcase	Filter exchanged	4.1 L 4.3 U.S.qts 3.6 Imp.qts	Engine oil API Service Classification (See page G-10 "Engine Oil".) <ul style="list-style-type: none"> Above 25°C (77°F) SAE30, SAE10W-30 or 15W-40 0 to 25°C (32 to 77°F) SAE20, SAE10W-30 or 15W-40 Below 0°C (32°F) SAE10W, SAE10W-30
		Filter non-ex- changed	3.8 L 4.0 U.S.qts 3.3 Imp.qts	
4	Transmission case		7.0 L 1.8 U.S.gals 1.5 Imp.gals	For U.S.A. market: KUBOTA SUPER UDT2 fluid* For Canada market: Premium UDT fluid* For other than the above: KUBOTA UDT or SUPER UDT fluid*
5	Front axle case		0.6 L 0.6 U.S.qts 0.52 Imp.qts	For U.S.A. market: KUBOTA SUPER UDT2 fluid* For Canada market: Premium UDT fluid* For other than the above: KUBOTA UDT or SUPER UDT fluid*
6	Front knuckle case		(Reference) 0.25 L 0.26 U.S.qts 0.22 Imp.qts	For U.S.A. market: KUBOTA SUPER UDT2 fluid* For Canada market: Premium UDT fluid* For other than the above: KUBOTA UDT or SUPER UDT fluid*
7	Brake fluid (reservoir and lines)		0.4 L 0.4 U.S.qts 0.35 Imp.qts	KUBOTA DOT3 GENUINE BRAKE FLUID
8	Hydraulic tank oil		18.0 L 19.0 U.S.qts 15.8 Imp.qts	For U.S.A. market: KUBOTA SUPER UDT2 fluid* For Canada market: Premium UDT fluid* For other than the above: KUBOTA UDT or SUPER UDT fluid*
9	Washer liquid		1.5 L 1.6 U.S.qts 1.3 Imp.qts	Automobile washer liquid

Greasing				
No.	Place	No. of greasing point	Capacity	Type of grease
10	Parking brake lever	2	moderate amount	Multipurpose EP2 Grease (NLGI Grade No. 2)
	Battery terminal	2		
	Cargo lift cylinder pivot	1	Until grease overflows	
	Cargo bed pivot	2	moderate amount	
	VHT link	2	Until grease overflows	
		1	moderate amount	
	Valve lever link	1		
	4WD lever link	1		
	Range gear shift link	1		
	Unload link	1		
	Differential lock pedal	2		
	Front A-ARM	6	Until grease overflows	
	Rear A-ARM	8		
	Parking brake link	1	moderate amount	Antirust silicone grease
Hand throttle cable [if equipped]	—			

■ **NOTE**

- ***KUBOTA UDT or SUPER UDT fluid - KUBOTA original transmission hydraulic fluid**

9Y1210948GEG0002US0

For North American market

■ 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 internal EGR, external EGR or non-EGR) and the fuel.

Fuel used	Engine oil classification (API classification)	
	Oil class of engines except external EGR	Oil class of engines with external EGR
Ultra Low Sulfur Fuel [< 0.0015 % (15 ppm)]	CF, CF-4, CG-4, CH-4 or CI-4	CF or CI-4 (Class CF-4, CG-4 and CH-4 engine oils cannot be used on EGR type engines)

EGR: Exhaust Gas Re-circulation

- The **CJ-4** engine oil is intended for DPF (Diesel Particulate Filter) type engines, and cannot be used on this vehicle.

	except external EGR	With external EGR
Model	RTV-X1100C	—

Fuel

- Cetane number of 45 is 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

- To complete lubrication of the transmission, it is important that a multi-grade transmission fluid is used in this system.
We recommend the use of KUBOTA UDT or SUPER UDT fluid for optimum protection and performance.
Do not mix different brands together.

Hydraulic tank oil:

- To insure proper operation of the hydraulic and VHT system, it is important that a multi-grade transmission fluid is used in this system. We recommend the use of KUBOTA UDT or SUPER UDT fluid for optimum protection and performance.
Do not mix different brands together.

Brake fluid:

- Always use KUBOTA DOT3 GENUINE BRAKE FLUID from a sealed container. If it is not available, you should use only DOT3 fluid as a temporary replacement from a sealed container.
However, the use of any non-KUBOTA brake fluid can cause corrosion and decrease the life of the system. Have the brake system flushed and refilled with KUBOTA DOT3 GENUINE BRAKE FLUID as soon as possible.

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

9Y1210948GEG0003US0

For other than North American market

■ 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:
- With the emission control now in effect, the CF-4 and CG-4 lubricating oils have been developed for use of a low sulfur fuel on on-road vehicle engines. When an off-road vehicle engine runs on a high-sulfur fuel, it is advisable to employ the "CF or better" lubricating oil with a high Total Base Number (TBN of 10 minimum).
- Refer to the following table for the suitable API classification engine oil according to the engine type (with internal EGR, external EGR or non-EGR) and the fuel (low-sulfur or high-sulfur fuel).

Fuel used	Engine oil classification (API classification)	
	Oil class of engines except external EGR	Oil class of engines with external EGR
High Sulfur Fuel [≥ 0.05 % (500 ppm)]	CF (If the "CF-4, CG-4, CH-4, or CI-4" lubricating oil is used with a high-sulfur fuel, change the lubricating oil at shorter intervals. (approximately half))	—
Low Sulfur Fuel [< 0.05 % (500 ppm)] or Ultra Low Sulfur Fuel [< 0.0015 % (15 ppm)]	CF, CF-4, CG-4, CH-4 or CI-4	CF, CI-4 (Class CF-4, CG-4 and CH-4 engine oils cannot be used on EGR type engines)

EGR: Exhaust Gas re-circulation

- The **CJ-4** engine oil is intended for DPF (Diesel Particulate Filter) type engines, and cannot be used on this vehicle.

	except external EGR	with external EGR
Model	RTV-X1100C	—

Fuel

- Cetane number of 45 minimum. Cetane number greater than 50 is preferred, especially for temperatures below -20 °C or elevations above 1500 m.
- If diesel fuel with sulfur content greater than 0.5 % (5000 ppm) sulfur content is used, reduce the service interval for engine oil and filter by 50 %.
- NEVER use diesel fuel with sulfur content greater than 0.05 % (500 ppm) for EXTERNAL EGR type engine.
- DO NOT use diesel fuel with sulfur content greater than 1.0 % (10000 ppm).
- 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

- To complete lubrication of the transmission, it is important that a multi-grade transmission fluid is used in this system.
We recommend the use of KUBOTA UDT or SUPER UDT fluid for optimum protection and performance.
Do not mix different brands together.

Hydraulic tank oil:

- To insure proper operation of the hydraulic and VHT system, it is important that a multi-grade transmission fluid is used in this system. We recommend the use of KUBOTA UDT or SUPER UDT fluid for optimum protection and performance.
Do not mix different brands together.

Brake fluid:

- Always use KUBOTA DOT3 GENUINE BRAKE FLUID from a sealed container. If it is not available, you should use only DOT3 fluid as a temporary replacement from a sealed container.
However, the use of any non-KUBOTA brake fluid can cause corrosion and decrease the life of the system.
Have the brake system flushed and refilled with KUBOTA DOT3 GENUINE BRAKE FLUID as soon as possible.

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

BIODIESEL FUEL (BDF)

B0-B20 Biodiesel fuels (BDF): mixed diesel fuels containing 20% or less biodiesel can be utilized under the following conditions.

■ IMPORTANT

- **Refueling and handling fuel should be done with caution in order to avoid contact with the fuel and spillage that could create a potential environmental or fire hazard. Wear appropriate protective equipment when refueling.**

■ Applicable BDF:

1. Blended diesel fuels containing 6% through 20% BDF (B6 - B20) which comply with American Society for Testing and Materials (ASTM) D7467 Standard, as revised, can be used without adversely affecting the performance and durability of the engine and fuel system components.
2. Any mineral oil diesel fuel, if used, must conform to ASTM D975 (or the European EN590) Standard, as revised. B100 fuel used to make Biodiesel blended fuels must meet ASTM D6751 (or EN14214) Standard, as revised. The final blended fuel B20 must conform to ASTM D7467 Standard, as revised. Straight vegetable oil is NOT allowed in any blended fuel.
3. Allowable blended fuel is mineral oil diesel fuel blended with B100 (i.e. 100% BDF). The blended fuel ratio shall be less than 20% B100 and 80% or more diesel fuel. The B100 source used for Biodiesel blends must be purchased from an accredited BQ-9000 marketer or producer. More information about qualified marketer(s) and producer(s) can be found at <http://www.bq-9000.org>.

■ Preparation:

1. Before using BDF concentrations greater than B5, you are advised to replace the engine oil, engine oil filter and fuel filter with new oil and filters. For replacement procedures, refer to the "PERIODIC SERVICE" section.

■ Product Warranty, Emission and Other Precautions:

1. The engine emission control system was certified according to current regulations based on the use of non-BDF. When using BDF, the owner is advised to check applicable local and federal emission regulations and comply with all of them.
2. BDF may cause restricted or clogged fuel filters during cold weather conditions, resulting in the engine not operating properly.
3. BDF encourages the growth of microorganisms which may cause degradation of the fuel. This in turn may cause fuel line corrosion or reduce fuel filter flow earlier than expected.
4. BDF inherently absorbs moisture which may cause degradation of the fuel earlier than expected. To avoid this, drain the water separator and fuel filter port often.
5. Do not use Biodiesel concentrations higher than 20% (i.e. greater than B20). Engine performance and fuel consumption will be affected, and degradation of the fuel system components may occur.
6. Do not readjust the engine fuel control system as this will violate emission control levels for which the equipment was approved.
7. Compared with soybean-based and rapeseed-based feedstock, palm oil-based feedstock has a thicker consistency (i.e. higher viscosity) at lower temperatures. Consequently, fuel filter performance may be reduced, particularly during cold weather conditions.
8. The KUBOTA Warranty, as specified in the Owner's Warranty Information Guide, only covers defects in product materials and workmanship. Accordingly, any problems that may arise due to the use of poor quality fuels that fail to meet the above requirements, whether biodiesel or mineral oil based, are not covered by the KUBOTA Warranty.

■ Routine handling:

1. Avoid spilling BDF onto painted surfaces as this may damage the finish. If fuel is spilled immediately wipe clean and flush with soapy water to avoid permanent damage.
2. When using BDF, you are advised to maintain a full tank of fuel, especially overnight and during short term storage, to reduce condensation within the tank. Be sure to tighten the fuel cap after refueling to prevent moisture build up within the tank. Water in the Biodiesel mixture will damage fuel filters and may damage engine components.

(To be continued)

(Continued)**■ Maintenance Requirements when using BDF B0 through B5:**

Follow the oil change intervals recommended by referring to the "MAINTENANCE" section. Extended oil change intervals may result in premature wear or engine damage.

■ Maintenance Requirements when using BDF B6 through B20:

The maintenance interval for fuel related parts changes.

See the table below for the new maintenance interval.

Items		Interval	Remarks
Fuel filter element	Check	every 50 hrs	
	Replace	every 200 hrs	
Fuel line	Check	every 6 months	Replace if any deterioration (crack, hardening, scar or deformation) or damage occurred.
	Replace	every 2 years	

■ Long Term Storage:

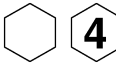


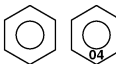
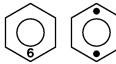
1. BDF easily deteriorates due to oxygen, water, heat and foreign substances.
Do not store B6 through B20 longer than 1 month and B5 longer than 3 months.
2. When using B6 through B20 and storing the machine longer than 1 month, drain the fuel from the tanks and replace with light mineral oil diesel fuel.
Subsequently, run the engine at least 30 minutes to remove all of the Biodiesel from the fuel lines.
3. When using B5 fuel and storing machine longer than 3 months, drain the fuel from the tanks and replace with light mineral oil diesel fuel.
Subsequently, run the engine at least 30 minutes to remove all of the Biodiesel from the fuel lines.

9Y1210948GEG0004US0

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						 7 7T						 9 9T		
Indication on top of nut	 04 No-grade or 4T												 6 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

WSM000001GEG0001US0

[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	—	—	—

WSM000001GEG0002US0

[3] HYDRAULIC FITTINGS

(1) Hydraulic Hose Fittings

Hose size	Thread size	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				

WSM000001GEG0097US0

(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



WSM000001GEG0098US0

(3) Adaptors, Elbows and Others

Item	Thread size	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
Adaptor	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



WSM000001GEG0099US0

[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



WSM000001GEG0003US0

[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

WSM000001GEG0008US0

[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	—	—	—

WSM000001GEG0005US0

6. MAINTENANCE CHECK LIST



WARNING

To avoid serious injury and vehicle damage:

- Be sure you have sufficient knowledge, experience, the proper replacement parts and tools before you attempt any vehicle maintenance task.

SERVICE INTERVALS

■ IMPORTANT

- The jobs indicated by ★ must be done after the first 50 hours of operation.
 - *1 The initial 50 hours should not be a replacement (change, check, adjustment) cycle.
 - *2 Air cleaner should be cleaned more often in dusty conditions than in normal conditions.
 - *3 Every 1000 hours or every 1 year whichever comes first.
 - *4 Replace if any deterioration (crack, hardening, scar, or deformation) or damage occurred.
 - *5 Every 2000 hours or every 2 years whichever comes first.
 - *6 Every 200 hours or 3,000 km, whichever comes first.
 - *7 When the battery is used for less than 100 hours per year, check the battery condition by reading the indicator annually.
- The items listed below (@marked) are registered as emission related critical parts by KUBOTA in the U.S.EPA non road emission regulation. As the engine owner, you are responsible for the performance of the required maintenance on the engine according to the below instruction. Please see Warranty Statement in detail.

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 hrs	G-31	
2	Greasing	Apply	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 hrs	G-32	
3	Engine oil	Change	★			☆				☆				☆			every 200 hrs	G-40	*1
4	Muffler [Spark arrester]	Clean		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-34	
5	Wheel fastener torque	Check	★	☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-34	*1
6	Battery condition	Check		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-35	*7
7	Alternator belt	Adjust		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-37	
8	VHT neutral spring	Check		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-37	
9	VHT pressure release	Check		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-37	
10	Toe-in	Adjust		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-38	
11	Fuel filter element	Check		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-38	@
		Replace								☆							every 400 hrs	G-47	
12	Fuel line	Check															every 1 year	G-38	*4
		Replace															every 4 years	G-57	@
13	Air cleaner element	Clean		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-39	*2
		Replace															every 1000 hrs or 1 year	G-48	*3 @
14	Engine oil filter	Replace	★			☆				☆				☆			every 200 hrs	G-40	*1
15	Transmission oil filter (VHT) (Yellow color)	Replace	★			☆				☆				☆			every 200 hrs	G-41	*1

No.	Item		Service Interval														After since	Refer- ence page		
			50	100	150	200	250	300	350	400	450	500	550	600	650	700				
16	Transmission oil filter (Suction) (Black color)	Replace	★			☆				☆				☆			every 200 hrs	G-41	*1	
17	Brake pedal	Check	★			☆				☆				☆			every 200 hrs	G-42	*1	
18	Parking brake	Adjust	★			☆				☆				☆			every 200 hrs	G-42	*1	
19	Brake light switch	Check	★			☆				☆				☆			every 200 hrs	G-43	*1	
20	Front brake case	Check	★			☆				☆				☆			every 200 hrs	G-43	*1	
21	Hydraulic tank oil	Change				☆				☆				☆			every 200 hrs	G-44		
22	Suspension arm bushings	Check				☆				☆				☆			every 200 hrs or 3,000 km	G-45	*6	
23	Hydraulic oil line	Check															every 1 year	G-53	*4	
		Replace															every 4 years	G-57		
24	Radiator hose, pipe and clamp	Check															every 1 year	G-54	*4	
		Replace															every 4 years	G-57		
25	Intake air line	Check															every 1 year	G-55	*4	@
		Replace															every 4 years	G-57		
26	Engine breather hose	Check															every 1 year	G-55	*4	
		Replace															every 4 years	G-57		
27	Brake hose and pipe	Check															every 1 year	G-56	*4	
		Replace															every 4 years	G-57		
28	Inner air filter	Clean				☆				☆				☆			every 200 hrs	G-44		
29	Air conditioner condenser	Check				☆				☆				☆			every 200 hrs	G-45		
30	Air conditioner drive belt	Adjust				☆				☆				☆			every 200 hrs	G-45		
31	Tire wear	Check	★					☆						☆			every 300 hrs	G-45	*1	
32	Transmission fluid	Change								☆							every 400 hrs	G-46		
33	Front axle case oil	Change								☆							every 400 hrs	G-46		
34	Knuckle case oil	Change								☆							every 400 hrs	G-47		
35	Engine valve clearance	Adjust															every 800 hrs	G-48		
36	Fuel injection nozzle Injection pressure	Check															every 1500 hrs	G-48		@
37	Injection pump	Check															every 3000 hrs	G-51		@
38	Air conditioner pipe and hose	Check															every 1 year	G-51	*4	
		Replace															every 4 years	G-57		
39	Brake master cylinder (inner parts)	Replace															every 4 years	G-57		

No.	Item		Service Interval													After since	Refer- ence page		
			50	100	150	200	250	300	350	400	450	500	550	600	650	700			
40	Brake fluid	Change															every 2 years	G-57	
41	Rear brake cylinder seal	Replace															every 4 years	G-57	
42	Front brake seal	Replace															every 4 years	G-57	
43	Cooling system	Flush															every 2000 hrs or 2 years	G-49	*5
44	Coolant	Change															every 2000 hrs or 2 years	G-49	*5
45	Fuel system	Bleed															Service as re- quired	G-58	
46	Fuse	Replace																G-58	
47	Around engine	Clean																G-58	
48	Light bulb	Replace																G-60	
49	Washer liquid	Add																G-61	
50	Refrigerant (gas)	Check																G-61	
51	Hydraulic tank	Check																G-60	

9Y1210948GEG0005US0

7. CHECK AND MAINTENANCE

[1] DAILY CHECK

For your own safety and maximum service life of the vehicle, make a thorough daily inspection before operating the vehicle to start the engine.



WARNING

To avoid serious injury:

- Be sure to check and service the vehicle on a flat surface with the engine shut off and the parking brake "ON".

9Y1210948GEG0006US0

Walk around Inspection

Look around and under the vehicle for such items as loose bolts, trash build-up, oil or coolant leaks, broken or worn parts.

9Y1210948GEG0007US0

Checking around Engine

1. Park the vehicle on a level surface.
2. Stop the engine.
3. Raise the cargo bed.
4. Mount the safety support.
5. Check around the engine for mud or foreign materials.
6. Remove all foreign materials if they are found.

9Y1210948GEG0008US0

Checking and Refueling

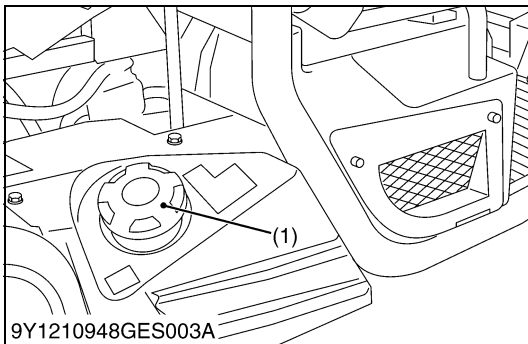


WARNING

To avoid serious injury:

- Do not smoke while refueling.
- Be sure to stop the engine before refueling.

1. Turn the key switch to "ON", check the amount of fuel by fuel gauge.
2. Fill fuel tank when fuel gauge shows 1/4 or less fuel in tank.
3. Use grade No.2-Diesel fuel at temperatures above -10°C (14°F).
Use grade No.1-Diesel fuel at temperatures below -10°C (14°F).



9Y1210948GES003A

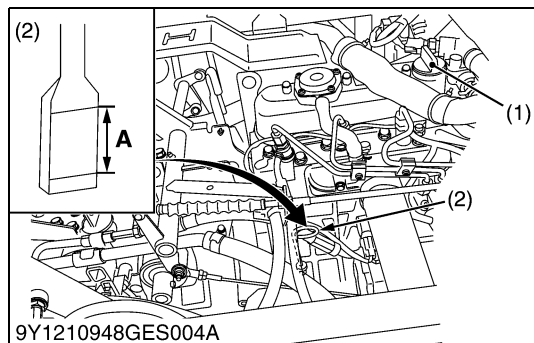
Fuel tank	Capacity	30 L 7.9 U.S.gals 6.2 Imp.gals
-----------	----------	--------------------------------------

■ IMPORTANT

- Do not permit dirt or trash to get into the fuel system.
- Be careful not to let the fuel tank become empty, otherwise air will enter the fuel system, necessitating bleeding before next engine start.
- Be careful not to spill during refueling. If should spill, wipe it off at once, or it may cause a fire.
- To prevent water condensation from accumulating in the fuel tank, fill the tank before parking overnight.

(1) Fuel Tank Cap

9Y1210948GEG0009US0



Checking Engine Oil Level



WARNING

To avoid serious injury:

- **Be sure to stop the engine before checking the oil level.**
1. Park the vehicle on a level surface.
 2. Raise the cargo bed and mount the safety support.
 3. Stop the engine.
 4. Check engine oil before starting the engine or 5 minutes or more after the engine has stopped.
 5. To check the oil level, draw out the dipstick, wipe it clean, replace it, and draw it out again. Check to see that the oil level lies between the 2 debossed lines.
- If the level is too low, add new oil to the prescribed level at the oil inlet.
(Refer to "4. LUBRICANTS, FUEL AND COOLANT" on page G-8.)

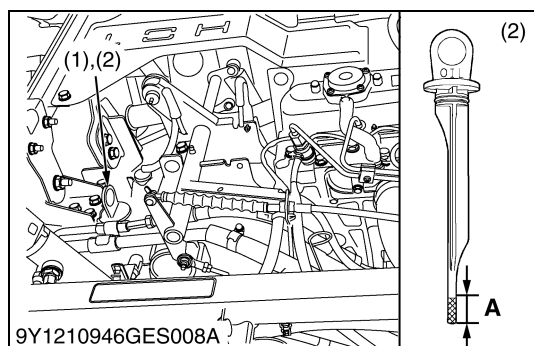
IMPORTANT

- **When using an oil of different maker or viscosity from the previous one, remove all of the old oil. Never mix 2 different types of oil.**
- **If oil level is low, do not operate engine.**

- (1) Oil Inlet
(2) Dipstick

A: Oil level is acceptable within this range.

9Y1210948GEG0010US0



Checking Transmission Fluid Level

1. Park the vehicle on a level surface.
 2. Raise the cargo bed and mount the safety support.
 3. Stop the engine.
 4. To check the oil level, draw out the dipstick, wipe it clean, replace it, and draw it out again. Check to see that the oil level lies within the cross hatched area.
- If the level is too low, add new oil to the prescribed level at the oil inlet.
(Refer to "4. LUBRICANTS, FUEL AND COOLANT" on page G-8.)

IMPORTANT

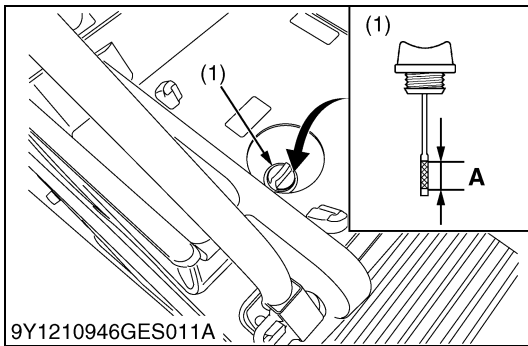
- **If oil level is low, do not operate engine.**

Transmission oil	Capacity	7.0 L 1.8 U.S.gals 1.5 Imp.gals
------------------	----------	---------------------------------------

- (1) Oil Inlet
(2) Dipstick

A: Oil level is acceptable within this range.

9Y1210948GEG0011US0



Checking Hydraulic Oil Tank Level

1. Park the vehicle on a level surface.
2. Stop the engine.
3. Open the seat and remove the utility box.
4. Remove the rubber cap.
5. To check the oil level, remove the dipstick, wipe it clean, screw it into filling hole and remove dipstick again.
If the level is too low, add new oil to the prescribed level at the oil inlet.
(Refer to "4. LUBRICANTS, FUEL AND COOLANT" on page G-8.)

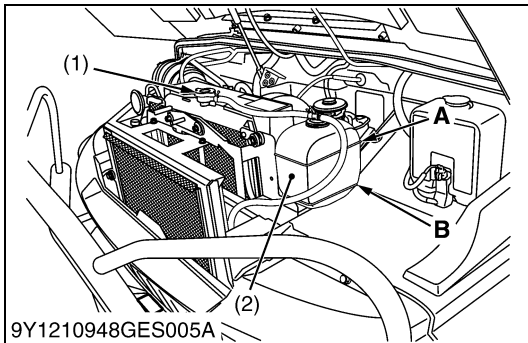
■ IMPORTANT

- If oil level is low, do not operate engine.

(1) Filling Plug with Dipstick

A: Oil level is acceptable within this range.

9Y1210948GEG0012US0



Checking Coolant Level



WARNING

To avoid serious injury:

- 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. Park the vehicle on a level surface.
2. Stop the engine.
3. Open the hood.
4. Check to see that the coolant level is between the "FULL" and "LOW" marks of recovery tank.
5. When the coolant level drops due to evaporation, add water only up to the full level.
In case of leakage, add anti-freeze and water in the specified mixing ratio up to the full level.
(Refer to "4. LUBRICANTS, FUEL AND COOLANT" on page G-8.)

■ IMPORTANT

- If the radiator cap has to be removed, follow the caution above and securely retighten the cap.
- Use clean, fresh water and anti-freeze to fill the recovery tank.

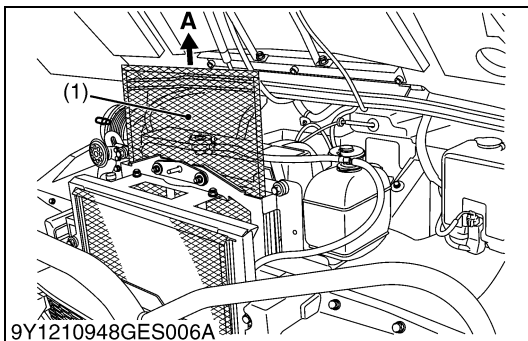
(1) Radiator Cap

A: FULL

(2) Recovery Tank

B: LOW

9Y1210948GEG0013US0



Cleaning Radiator Screen



WARNING

To avoid serious injury:

- Be sure to stop the engine before removing the screen.

1. Park the vehicle on a flat surface.
2. Stop the engine.
3. Open the hood.
4. Detach the screen and remove all foreign materials.

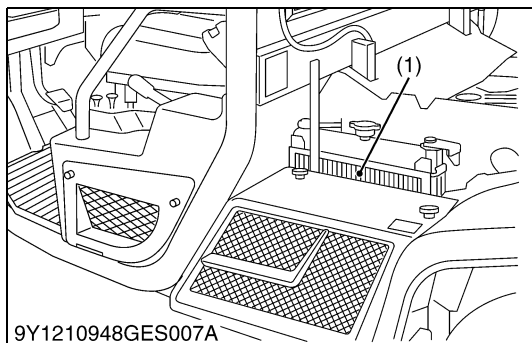
■ IMPORTANT

- Radiator screen must be clean from debris to prevent engine from overheating.

(1) Radiator Screen

A: DETACH

9Y1210948GEG0014US0



Cleaning Side Radiator Screen



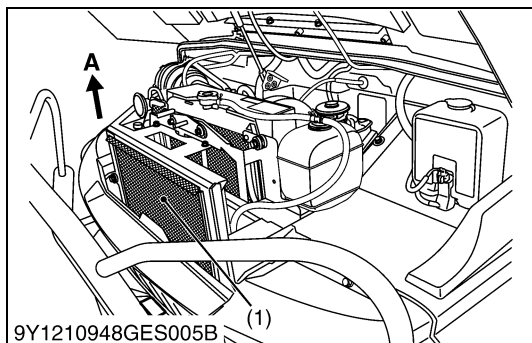
WARNING

To avoid serious injury:

- **Be sure to stop the engine before removing the screen.**
1. Park the vehicle on a flat surface.
 2. Stop the engine.
 3. Remove the battery cover.
 4. Detach the screen and remove all foreign materials.

(1) Side Radiator Screen

9Y1210948GEG0015US0

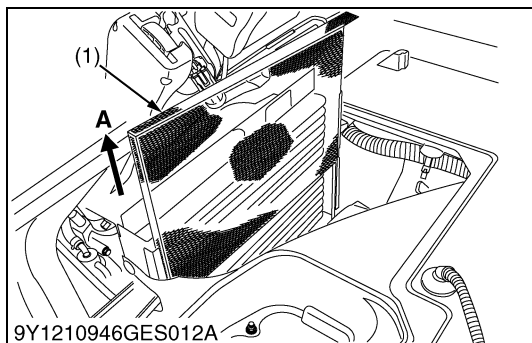


Cleaning Air Conditioner Condenser Screen

1. Park the vehicle on a flat surface and open the hood.
2. Detach the air conditioner condenser screen and remove all foreign materials.

(1) Air Conditioner Condenser Screen **A: DETACH**

9Y1210948GEG0109US0



Cleaning Oil Cooler Net



WARNING

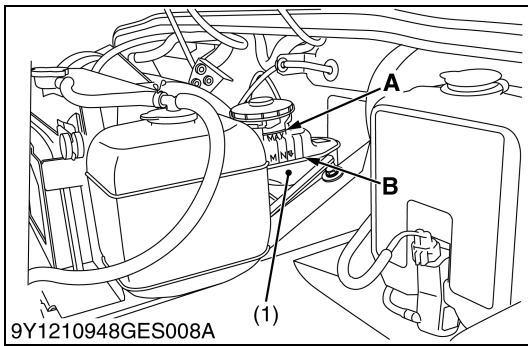
To avoid serious injury:

- **Allow oil cooler or oil line parts to cool down sufficiently, they can be hot and can cause injury.**
1. Park the vehicle on a flat surface.
 2. Stop the engine.
 3. Open the seats and remove the utility box and maintenance cover.
 4. Detach the oil cooler net and remove all trash.

(1) Oil Cooler Net

A: DETACH

9Y1210948GEG0016US0



Checking Brake Fluid Level

⚠ WARNING

To avoid serious injury:

- Never operate the vehicle, if the brake fluid is below the "MIN" mark.
- Use only KUBOTA DOT3 GENUINE BRAKE FLUID from a sealed container. Using other type of oil ruins synthetic resin or rubber installed in brake system components, and may cause brake failure.
- Avoid contamination of the brake fluid. Thoroughly clean area around the filler cap before removing. Do not open the brake fluid reservoir cap unless absolutely necessary.
- Use extreme care when filling the reservoir. If brake fluid is spilled on the power steering hose, wash off with water immediately. Brake fluid quickly ruins synthetic resin or rubber hoses.

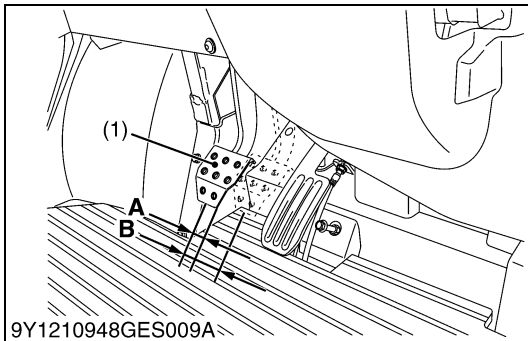
1. Park the vehicle on a level surface.
2. Open the hood.
3. Check to see that the brake fluid level is between the "MAX" and "MIN" marks.
4. If it is below the "MIN" mark, add brake fluid to the "MAX" mark.

(1) Oil Tank

A: MAX

B: MIN

9Y1210948GEG0017US0



Checking Brake Pedal

⚠ WARNING

To avoid serious injury:

- Stop the engine and chock the wheels before checking brake pedal.

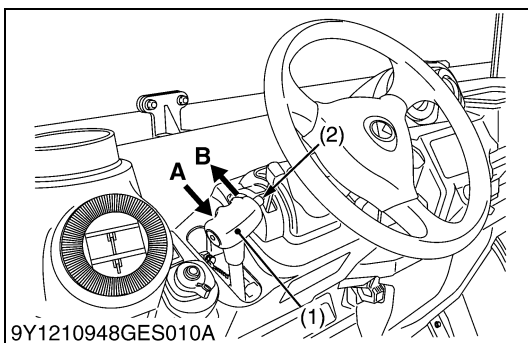
1. Inspect the brake pedals for free travel, and smooth operation.
2. Adjust if incorrect measurement is found. (See page G-42.)

(1) Brake Pedal

A: FREE TRAVEL

B: PEDAL STROKE

9Y1210948GEG0018US0



Checking Parking Brake

Pull the parking brake lever to apply the brakes. With the key switch at "ON" position, the parking brake indicator on the instrument panel lights up. To release the brakes, push in the button at the side of the parking brake lever and tilt the lever forward the lever.

■ NOTE

- Make sure the parking brake warning lamp on the Easy Checker™ goes off when parking brake lever is forward.

(1) Parking Brake Lever

A: "PULL"

(2) Release Button

B: "RELEASE"

9Y1210948GEG0019US0

Checking Easy Checker™

1. Inspect the instrument panel for broken Easy Checker™ lamps.

9Y1210948GEG0020US0

Checking Head Light, Turn Signal Light (If Equipped) etc.

1. Inspect the lights for broken bulbs and lenses.
2. Replace if broken.

9Y1210948GEG0021US0

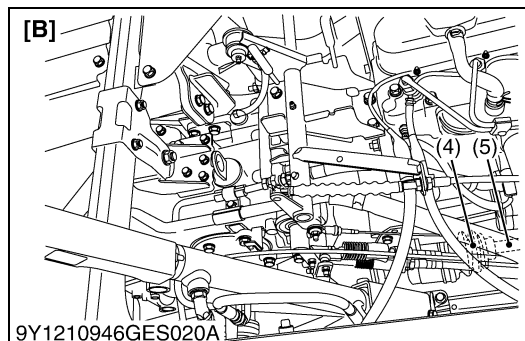
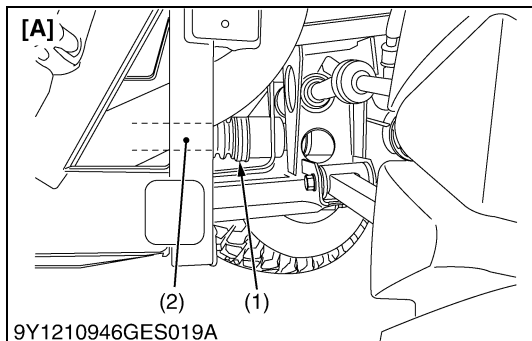
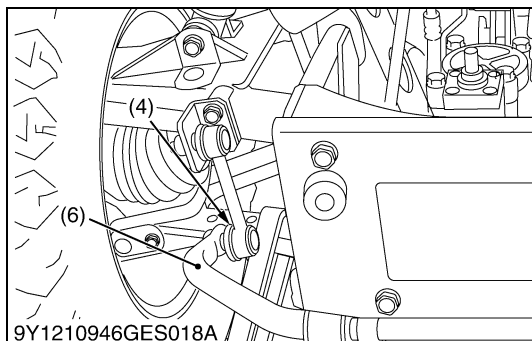
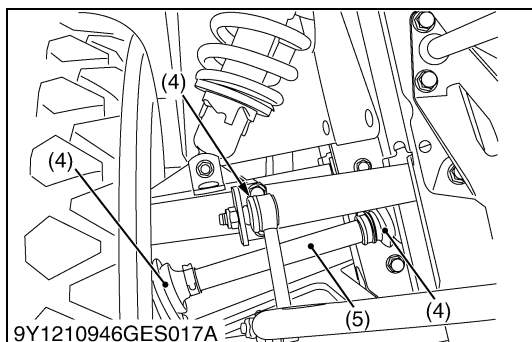
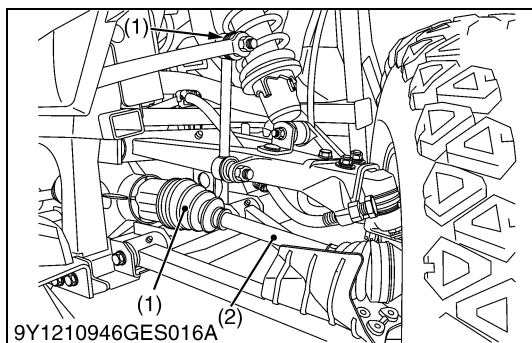
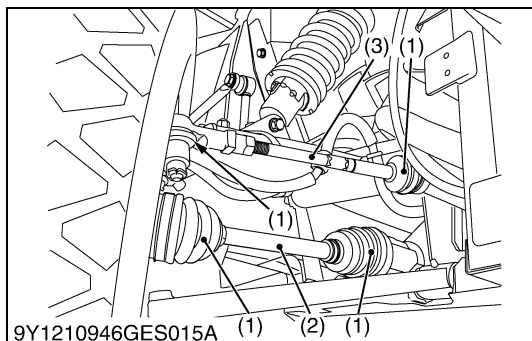
Checking Seat Belt

1. Always check condition of the seat belts before operating the vehicle.
2. Replace if damaged.

9Y1210948GEG0022US0

Checking Joint Boot

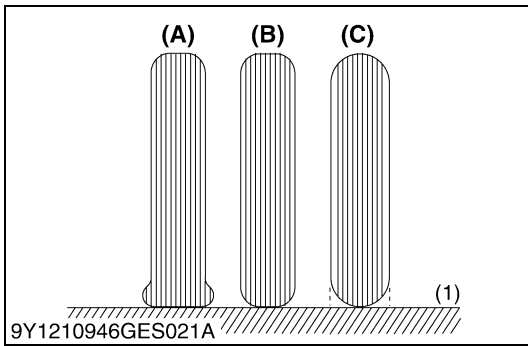
1. Check to see if the joint boots are not damaged.
2. If the boots are cuts, cracked or deterioration, replace the new one.



- (1) Joint Boot (Front)
- (2) Front Drive Shaft
- (3) Tie-rod
- (4) Joint Boot (Rear)
- (5) Rear Drive Shaft
- (6) Rear Stabilizer

[A] Front
[B] Rear

9Y1210948GEG0023US0



Checking Tire Inflation Pressure

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

Tire sizes	Inflation Pressure
25 × 10 – 12 HDWS, Front and Rear	140 kPa (1.4 kgf/cm ² , 20 psi)
25 × 12 – 12 Turf, Front and Rear	
25 × 10 – 12 ATV, Front and Rear	

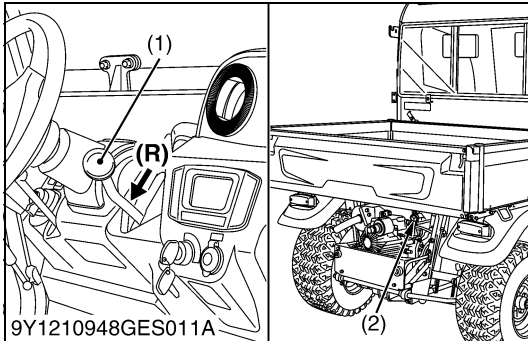
(1) Ground

(A) **INSUFFICIENT**

(B) **NORMAL**

(C) **EXCESSIVE**

9Y1210948GEG0024US0



Checking Backup Beeper

[If equipped]

1. Sit on the operator's seat.
2. Set the parking brake and stop the engine.
3. Shift the range gear shift lever to the **NEUTRAL** position.
4. Turn the key to **ON** position.
5. Shift the range gear shift lever to the **REVERSE** position.

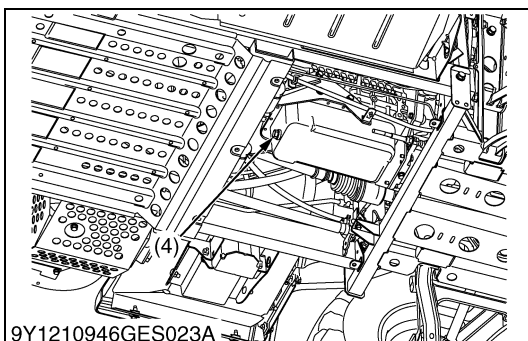
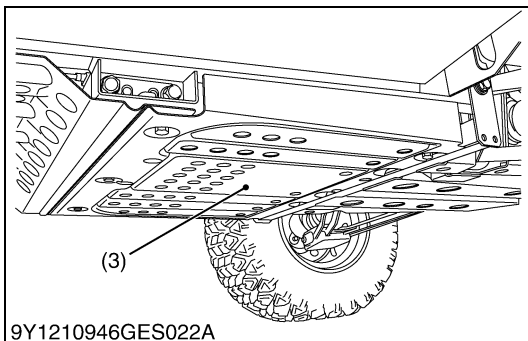
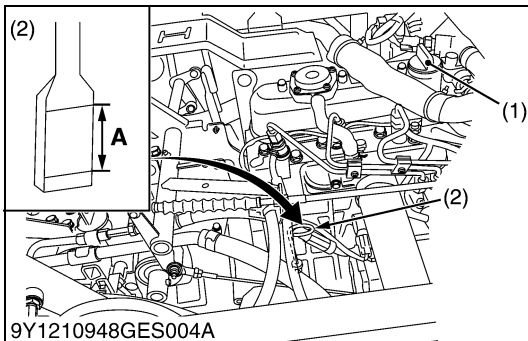
(1) Range Gear Shift Lever

(R) **REVERSE**

(2) Backup Beeper (if equipped)

9Y1210948GEG0025US0

[2] CHECK POINTS OF INITIAL 50 HOURS



Changing Engine Oil



WARNING

To avoid serious injury:

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

1. Park the vehicle on a level surface.
2. Raise the cargo bed and mount the safety support.
3. Stop the engine.
4. Remove the rear skid plate.
5. To drain the used oil, remove the drain plug at the bottom of the engine and completely drain the oil into an oil pan.
All the used oil can be drained out easily when the engine is still warm.
6. After draining, reinstall the drain plug.
7. Fill with the new oil up to the upper line on the dipstick.
(Refer to "4. LUBRICANTS, FUEL AND COOLANT" on page G-8.)

Engine oil	Capacity	[Filter exchanged] 4.1 L 4.3 U.S.qts 3.6 Imp.qts
		[Filter non-exchanged] 3.8 L 4.0 U.S.qts 3.3 Imp.qts

(1) Oil Inlet

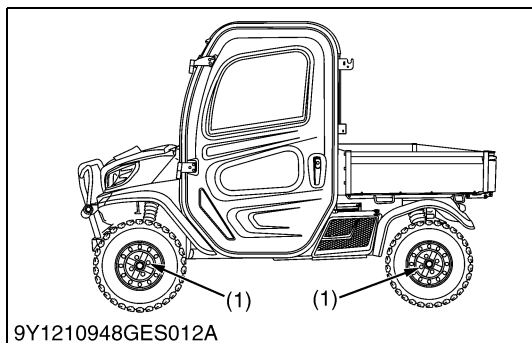
(2) Dipstick

(3) Rear Skid Plate

(4) Drain Plug

A: Oil level is acceptable within this range.

9Y1210948GEG0026US0



Checking Wheel Fastener Torque



WARNING

To avoid serious injury:

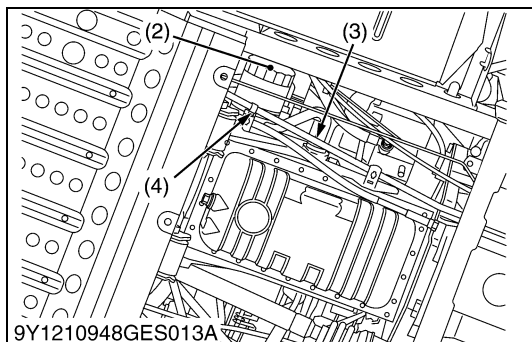
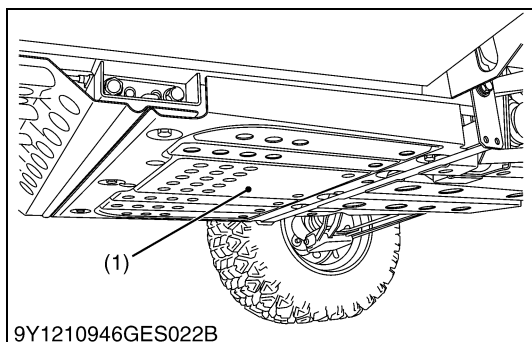
- Never operate vehicle with a loose wheel bolts.
- Any time bolts are loosened, retighten to the specified torque.
- Check all bolts frequently and keep them tight.

Check wheel bolts regularly especially when new. If they are loose, tighten them as follows.

Tightening torque	Aluminum wheel mounting bolt	90 to 110 N·m 9.2 to 11.2 kgf·m 66.4 to 81.1 lbf·ft
	Steel wheel mounting bolt and nut	108 to 130 N·m 11.1 to 13.2 kgf·m 79.7 to 95.8 lbf·ft

(1) Wheel Mounting Bolts

9Y1210948GEG0027US0



Replacing Engine Oil Filter



WARNING

To avoid serious injury:

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

1. Park the vehicle on a flat surface.
2. Stop the engine.
3. Remove the rear skid plate.
4. Remove the oil filter.
5. Put a film of clean engine oil on the rubber seal of the new filter.
6. Tighten the filter quickly until it contacts the mounting surface. Tighten the filter by hand an additional 1/2 turn only.
7. 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.

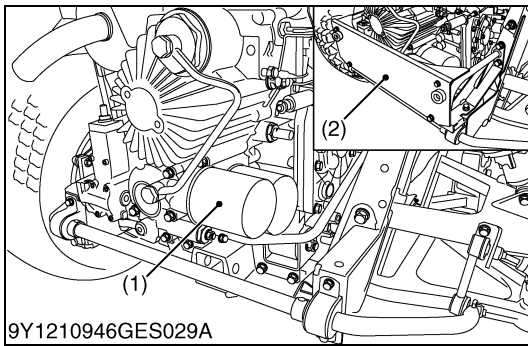
■ IMPORTANT

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

(1) Rear Skid Plate
(2) Engine Oil Filter

(3) Parking Cable
(4) Clamp

9Y1210948GEG0028US0



Replacing Transmission Oil Filter [VHT]

! WARNING

To avoid serious injury:

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

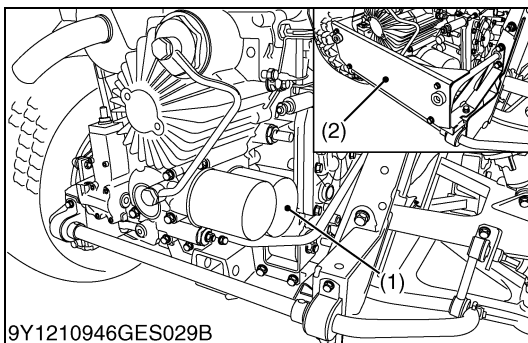
1. Park the vehicle on a flat surface.
2. Remove the rear guard.
3. Remove the oil filter.
4. Put a film of clean transmission oil on the rubber seal of the new filter.
5. Quickly tighten the filter by hand until it contacts the mounting surface, then, with a filter wrench, tighten it an additional 1/2 turn only.
6. After the new filter has been replaced, fill the hydraulic tank oil up to the upper notch on the dipstick.
7. After operating the engine for a few minutes, stop the engine and check the oil levels again, add oil to the prescribed level.
8. Make sure that the transmission fluid doesn't leak past the seal on the filters.
9. Install the rear guard.

■ IMPORTANT

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

- (1) Transmission Oil Filter (VHT): (2) Rear Guard
(Yellow Color)

9Y1210948GEG0029US0



Replacing Transmission Oil Filter [SUCTION]

! WARNING

To avoid serious injury:

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

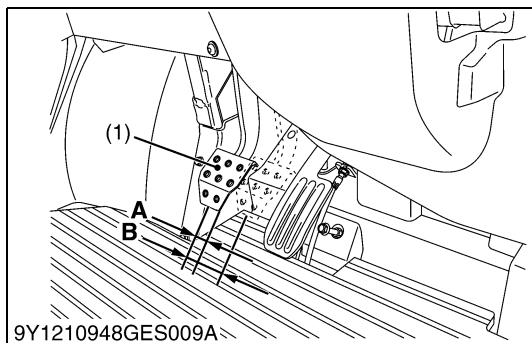
1. Park the vehicle on a flat surface.
2. Remove the rear guard.
3. Remove the oil filter.
4. Put a film of clean transmission oil on the rubber seal of the new filter.
5. Quickly tighten the filter by hand until it contacts the mounting surface, then, with a filter wrench, tighten it an additional 1/2 turn only.
6. After the new filter has been replaced, fill the hydraulic tank oil up to the upper notch on the dipstick.
7. After operating the engine for a few minutes, stop the engine and check the oil levels again, add oil to the prescribed level.
8. Make sure that the transmission fluid doesn't leak past the seal on the filters.
9. Install the rear guard.

■ IMPORTANT

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

- (1) Transmission Oil Filter (Suction) (2) Rear Guard
(Black Color)

9Y1210948GEG0030US0



Checking Brake Pedal



WARNING

To avoid serious injury:

- Stop the engine and chock the wheels before checking brake pedal.
- If movement is outside of the specifications, adjusting the brake.

■ Checking the brake pedal free travel

Proper brake pedal free travel	8 to 18 mm (0.3 to 0.7 in.) on the pedal
--------------------------------	--

1. Release the parking brake.
2. Slightly depress the brake pedal and measure free travel at the top of the pedal stroke.
3. If brake pedal free travel is outside of the specifications, adjusting the brake.

■ Checking the brake pedal stroke

Pedal stroke	Less than 150 mm (5.9 in.) on the pedal
--------------	---

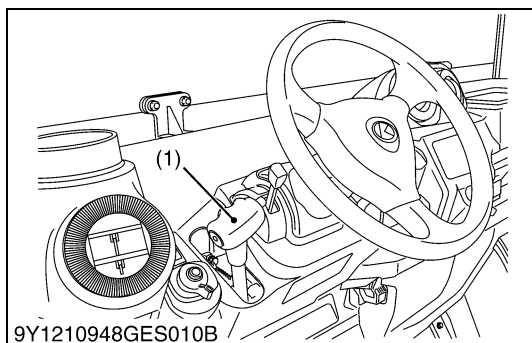
1. Release the parking brake.
2. Step on the pedal and measure the pedal stroke.
3. If brake pedal stroke is outside of the specifications, adjusting the brake.

(1) Brake Pedal

A: FREE TRAVEL

B: PEDAL STROKE

9Y1210948GEG0031US0



Adjusting Parking Brake

■ Adjusting procedure

1. Park the vehicle on a flat surface.
2. Stop the engine.
3. Jack up the rear wheels.
4. Remove the left rear tire.
5. Remove the mud guard of rubber.
6. Release the parking brake.
7. Loosen the lock nuts.
8. Adjust the cable wire length.
9. Tighten the lock nuts securely.
10. Install the mud guard.
11. Install the left rear tire.

Proper parking brake lever free play range	1 notch
--	---------

(1) Parking Brake Lever

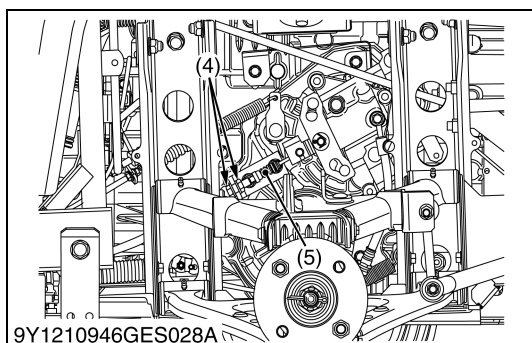
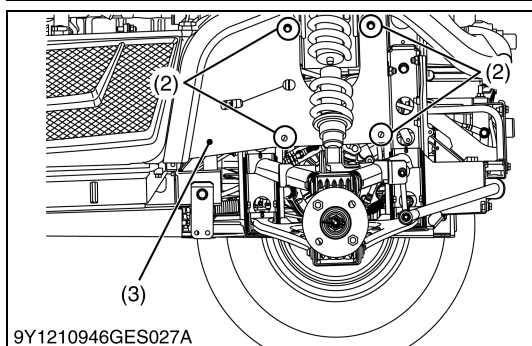
(4) Lock Nut

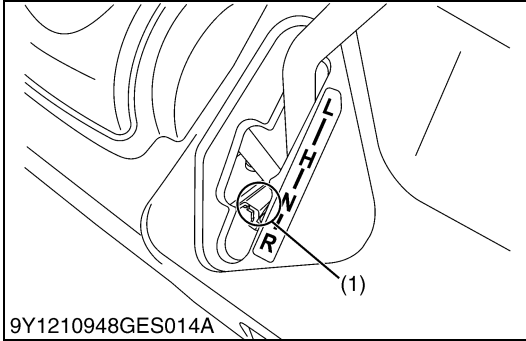
(2) Push Rivet

(5) Cable Wire

(3) Mud Guard

9Y1210948GEG0032US0



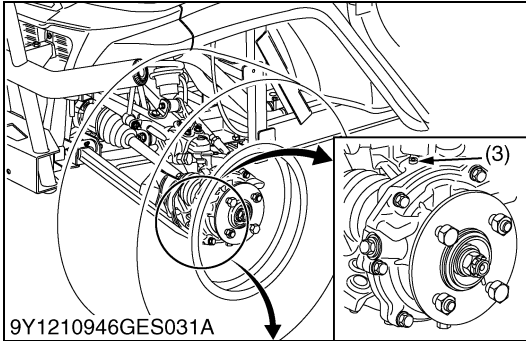


Checking Brake Light Switch

1. Park the vehicle on a flat surface.
2. Step on the brake pedal to check if the brake light comes on.
3. If it does not, check the bulb or brake light switch.

(1) Brake Light Switch

9Y1210948GEG0033US0



Checking Front Brake Case

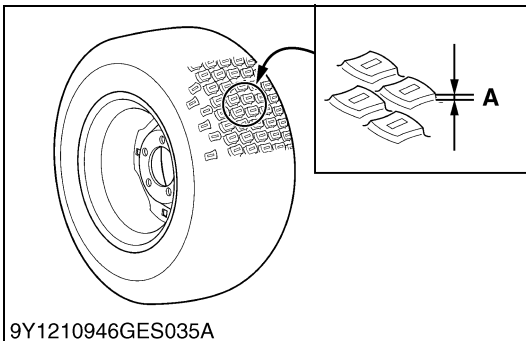
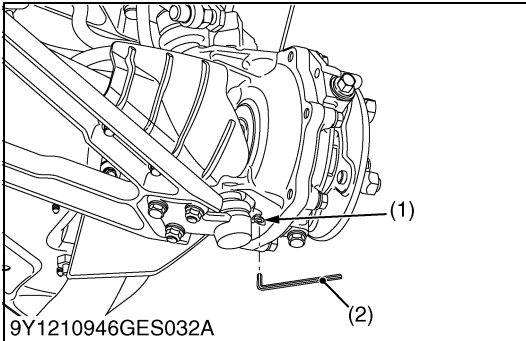
1. Remove the drain plugs and the air-bleeding hole plugs.
2. Check the brake case for brake fluid leak.

(1) Drain Plug

(3) Air-Bleeding Hole Plug

(2) Allen Key

9Y1210948GEG0034US0



Checking Tire

1. Check to see if tires are not damaged.
2. If the tires are cracked, bulged, or cut, or they are worn out, replace or repair them at once.

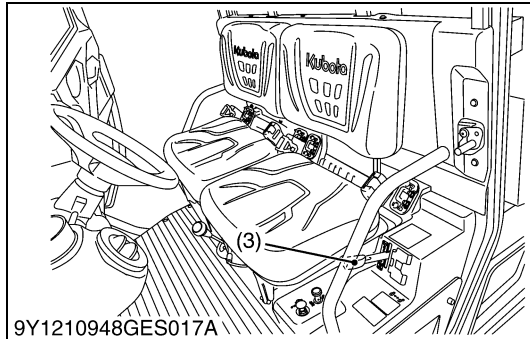
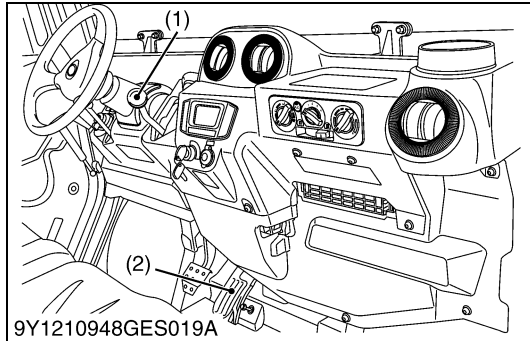
■ Tire Tread Depth

Always replace the tires when the tread depth is worn to minimum allowable.

A: 3 mm (0.12 in.)

9Y1210948GEG0036US0

[3] CHECK POINTS OF EVERY 50 HOURS



Checking Engine Start System



WARNING

To avoid serious injury:

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

■ Preparation before testing.

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

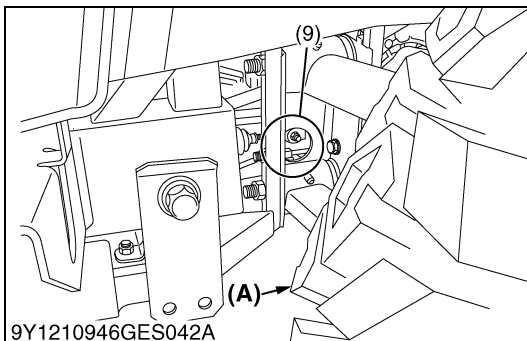
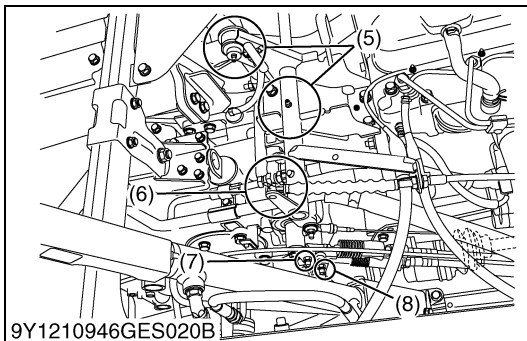
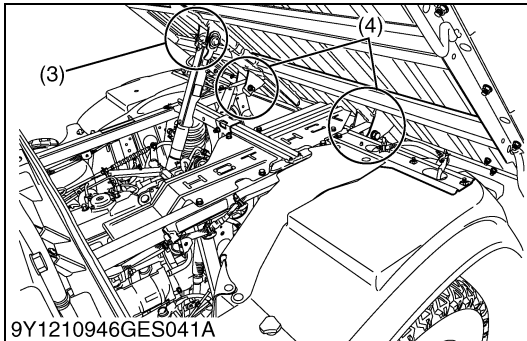
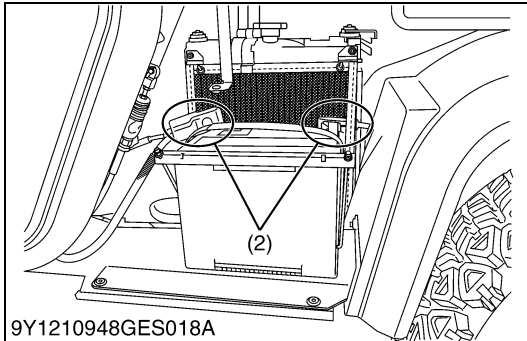
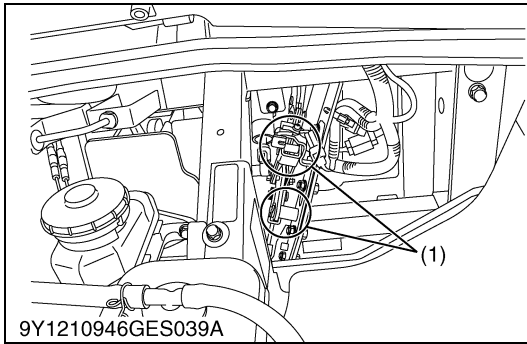
■ Test: Range gear shift lever safety switch

1. Sit on the operator's seat.
2. Shift the range gear shift lever to **H** position.
3. Return the Speed control pedal to the **NEUTRAL** position.
4. Shift the hydraulic lift cylinder lever to the **NEUTRAL** position.
5. Turn the key to **START** position.
6. The engine must not crank.
7. Repeat the step 2 to 6 with the range gear shift lever at **L** and **R** each position.
8. If it cranks, adjust or replace the required safety switch.

- (1) Range Gear Shift Lever
(2) Speed Control Pedal

- (3) Hydraulic Lift Cylinder Lever

9Y1210948GEG0037US0



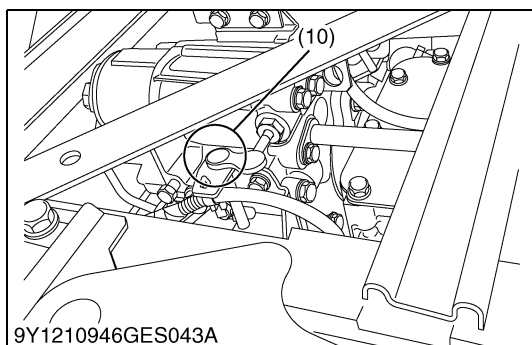
Greasing

1. Apply a small amount of multi-purpose grease to the following points every 50 hours: If you operated the machine in extremely wet and muddy conditions, lubricate grease fittings more often.

- | | |
|---|--|
| (1) Parking Brake Lever
(Spray Type Grease) | (7) Valve Lever Link
(Spray Type Grease) |
| (2) Battery Terminals | (8) 4WD Lever Link
(Spray Type Grease) |
| (3) Cargo Lift Cylinder Pivot
(Grease Fitting) | (9) Range Gear Shift Link
(Spray Type Grease) |
| (4) Cargo Bed Pivot
(Spray Type Grease) | |
| (5) VHT Link (Grease Fitting) | |
| (6) VHT Link (Spray Type Grease) | |

(A) Left Rear Tire

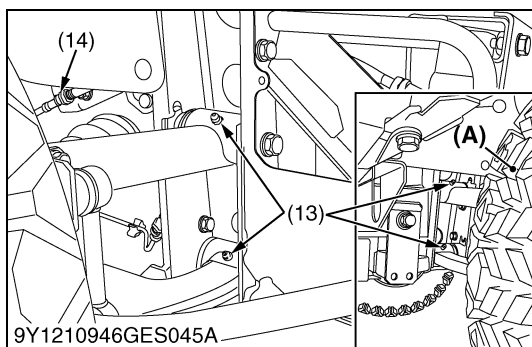
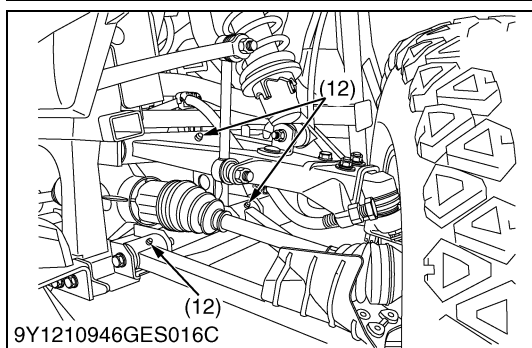
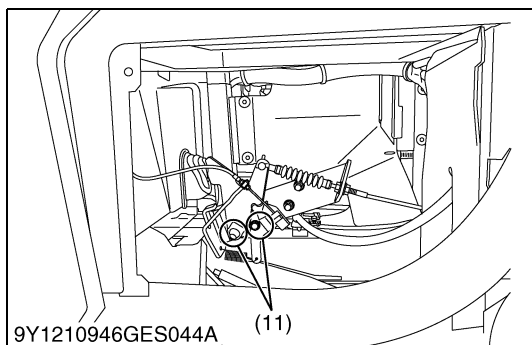
(To be continued)

(Continued)

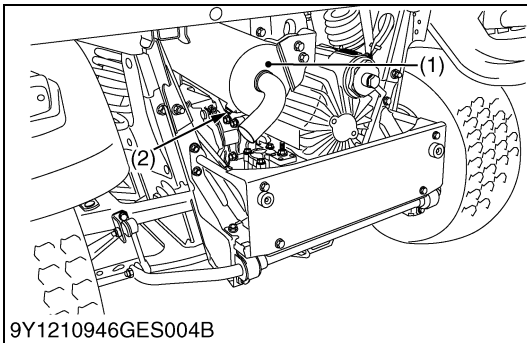
- (10) Unload Link (Spray Type Grease)
- (11) Differential Lock Pedal (Spray Type Grease)
- (12) Front A-ARM (Grease Fitting)
- (13) Rear A-ARM (Grease Fitting)
- (14) Parking Brake Link (Spray Type Grease)

(A) Left Rear Tire

9Y1210948GEG0038US0



[4] CHECK POINTS OF EVERY 100 HOURS



9Y1210946GES004B

Cleaning Muffler

[For Swirl Type Spark Arrester]



WARNING

To avoid serious injury:

- Before touching any part of an exhaust system, be absolutely sure that it has sufficient time to cool!
- Always wear safety goggles and a (face) mask.
- The particulate matter contained in the muffler contains chemicals that are harmful to people, animals and marine life.

■ **Cleaning spark arrester of muffler**

This swirl type spark arrester was examined, tested, and qualified in accordance with the USDA Forest Service Standard 5100-1c, "Spark Arresters for Internal Combustion Engines".

Maintenance and cleanout procedure:

The swirl type spark arrester should be cleaned and inspected after every 100 hours of use.

1. Set vehicle in an open area away from combustible materials and on flat surface.
2. Apply the parking brake and shift range gear shift lever into the **NEUTRAL** position.
3. Remove the drain plug located on the bottom of the muffler body.
4. Start engine and raise and lower engine revolution while tapping on the muffler with a rubber mallet until the carbon particles are purged from the muffler.
5. Stop the engine.
6. Reinstall the drain plug.

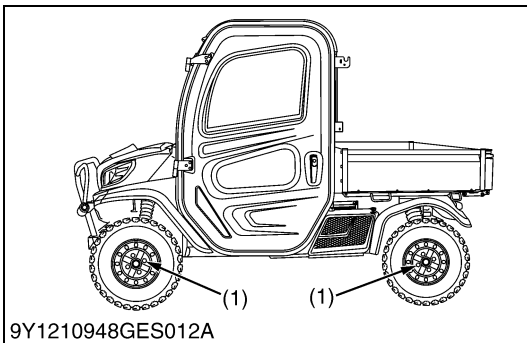
■ **IMPORTANT**

- Visually check the muffler for cracks or holes in the body, weldment or pipes at regular intervals.
- Replace the entire muffler if it is damaged.
- Do not operate the vehicle with a damaged muffler.

(1) Muffler

(2) Drain Plug

9Y1210948GEG0039US0



9Y1210948GES012A

Checking Wheel Fastener Torque



WARNING

To avoid serious injury:

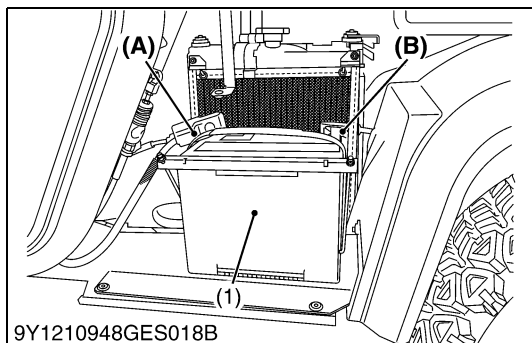
- Never operate vehicle with a loose wheel bolts.
- Any time bolts are loosened, retighten to the specified torque.
- Check all bolts frequently and keep them tight.

Check wheel bolts regularly especially when new. If they are loose, tighten them as follows.

Tightening torque	Aluminum wheel mounting bolt	90 to 110 N·m 9.2 to 11.2 kgf·m 66.4 to 81.1 lbf·ft
	Steel wheel mounting bolt and nut	108 to 130 N·m 11.1 to 13.2 kgf·m 79.7 to 95.8 lbf·ft

(1) Wheel Mounting Bolts

9Y1210948GEG0027US0



Checking Battery Condition

The factory-installed battery is non-refillable type. If the battery is weak, charge the battery or replace it with new one.



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** levels.



DANGER

To avoid serious injury or death:

- 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.



WARNING

To avoid serious injury:

- Batteries, battery posts, terminals and related accessories contain lead and lead compounds, and other chemicals known to the State of California to cause cancer and birth problems or other reproductive harm. **WASH HANDS AFTER HANDLING.**
- Never remove the battery cap while the engine is operating.
- 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.



IMPORTANT

- Mishandling the battery shortens the service life and adds to maintenance costs.

The original battery is maintenance free, but needs some servicing.

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.

- When exchanging an old battery for new one, use battery of equal specification in table below.

(1) Battery

(A) Positive Terminal

(B) Negative Terminal

(To be continued)

(Continued)

Battery Type	Volts (V)	Reserve Capacity (min)	Cold Cranking Amps	Capacity at 20 hrs (A. H.)	Normal Charging Rate (A)
24R-670	12	115	670	66	11.5

(For non-accessible maintenance-free type batteries.)

Maintenance-free, non-accessible batteries are designed to eliminate the need to add water. Yet the volume of electrolyte above plates may eventually become depleted due to abnormal conditions such as high heat or improper regulator setting. Use a voltmeter to check the state of charge. (See reference chart below to determine if charging is necessary.)

Battery voltage	Reference state of charge
12.6	100 % (Full charge)
12.4	75 %
12.2	50 %
12.0	25 %
11.8	0 %

■ Battery Charging



DANGER

To avoid serious injury or death:

- 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.



WARNING

To avoid serious injury:

- 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.

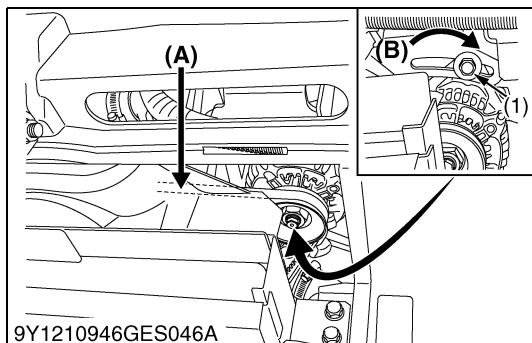
Use a voltmeter or hydrometer.

1. Park the vehicle on a flat surface.
2. Stop the engine.
3. Remove the battery cover.
4. 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.
5. 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. Failure to do this will shorten the battery's service life.
6. When exchanging an old battery for a new one, use battery of equal specification shown in table 1.

■ Direction for Storage

1. When storing the vehicle for a long period, remove the battery from vehicle, adjust the electrolyte to the proper level (refillable type only) and store in a dry place out of direct sunlight.
2. The battery self-discharges while it is stored. Recharge it once every 3 months in hot seasons and once every 6 months in cold seasons.

9Y1210948GEG0040US0



Adjusting Alternator Belt Tension



WARNING
To avoid serious injury:

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

Proper alternator belt tension	A deflection of between 7 to 9 mm (0.28 to 0.34 in.) when the belt is pressed in the middle of the span.
--------------------------------	--

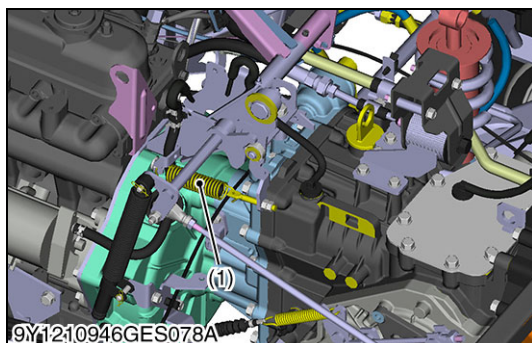
1. Park the vehicle on a flat surface, open the seat, remove utility box and maintenance cover.
2. Stop the engine.
3. Apply moderate thumb pressure to belt between pulleys
4. If tension is incorrect, loosen the alternator mounting bolts and, using a lever placed between the alternator and the engine block, pull the alternator out until the deflection of the belt falls within acceptable limits.
5. Replace alternator belt if it is damaged.

(1) Bolt

(A) Check the Belt Tension

(B) To Tighten

9Y1210948GEG0041US0

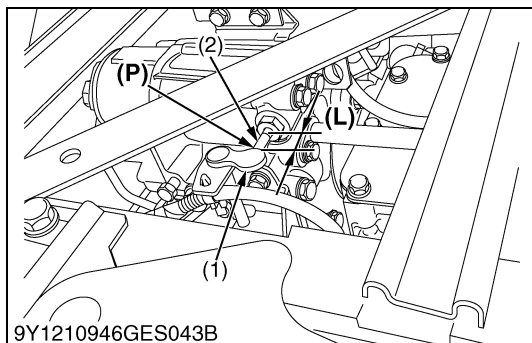


Checking VHT Neutral Spring

1. Park the vehicle on a flat place.
2. Set the parking brake.
3. Shift the range gear shift lever to the **NEUTRAL** position.
4. Lock the hydraulic lift cylinder lever to the **NEUTRAL** position with restricting plate.
5. Start the engine.
6. Make sure that the rotation speed of the engine returns to the idling rotation immediately when taking the foot off the pedal, after depressing the speed control pedal several times.
7. If does not operate normally check the linkage. (See page 1-S32.)

(1) Neutral Spring

9Y1210948GEG0042US0



Checking VHT Pressure Release



WARNING
To avoid serious injury:

- Do not touch muffler or exhaust pipes while they are hot; severe burns could result.

1. Park the vehicle on a level surface and set the parking brake.
2. Start the engine and shut it off soon.
3. Check the points as shown in the figures below.
 - (a) No clearance between rod and link.
 - (b) The length of the rod is appeared 21.5 mm (0.85 in.) and over.

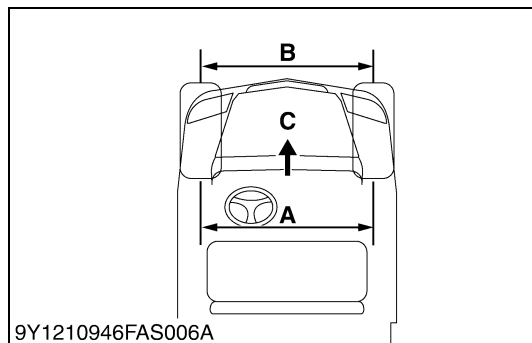
(1) Unload Link

(L) 21.5 mm and over

(2) Unload Valve Rod

(P) The Link is contact with the Rod.

9Y1210948GEG0043US0



Adjusting Toe-in

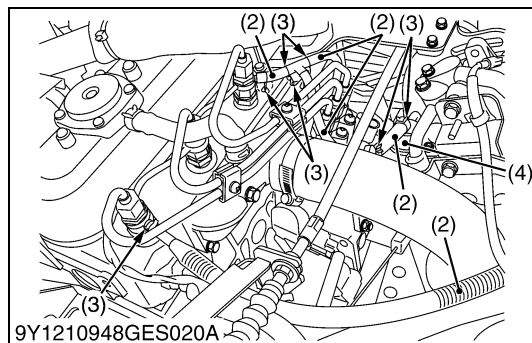
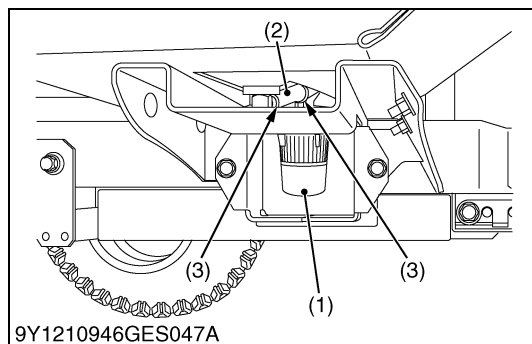
Proper toe-in	5 to 15 mm 0.2 to 0.59 in.
---------------	-------------------------------

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

A: Wheel-to-Wheel Distance at Rear C: FRONT

B: Wheel-to-Wheel Distance at Front

9Y1210948GEG0044US0



Checking Fuel Line and Fuel Filter



WARNING

To avoid serious injury:

- Be sure to stop the engine and remove the key when attempting to make the following checks and changes.
- Never fail to check the fuel lines periodically. The fuel lines are subject to wear and aging. Fuel may leak out onto the operating engine, causing a fire.

The fuel line connections should be checked annually or every 100 service hours, whichever comes first.

1. Park the vehicle on a flat surface, raise the cargo bed, mount the safety support and shut off the engine.
2. The fuel line is made of rubber and ages regardless of service period.
3. If the fuel line and clamps are found to be damaged or deteriorated, replace them.
4. Check fuel filter, if it is clogged by debris or contaminated with water, replace it.

■ IMPORTANT

- When the fuel line is disconnected for maintenance or repair, close both ends of the fuel line with a piece of clean cloth or paper to prevent dust and dirt from entering. In addition, particular care must be taken not to admit dust and dirt into the fuel pump. Entrance of even a small amount of dust or dirt cause premature wear and malfunction of the fuel pump and injector components.

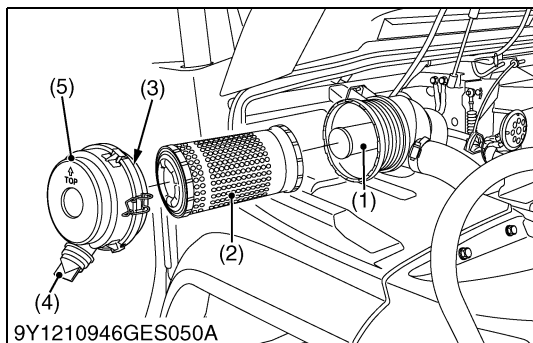
(1) Fuel Filter

(2) Fuel Line

(3) Pipe Clamp

(4) Fuel Pump

9Y1210948GEG0045US0



Cleaning Air Cleaner Primary Element

1. Remove the air cleaner cover and primary element.
2. Clean the primary element:
 - (1) 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).
 - (2) When carbon or oil adheres to the element, replace the element with new one even if it has not been used for 1 year.
3. Replace the primary element:
Once yearly or after every sixth cleaning, whichever comes first.

■ NOTE

- Check to see if the evacuator valve is blocked with dust.
- Check the rubber seal. Replace if damaged.

■ IMPORTANT

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

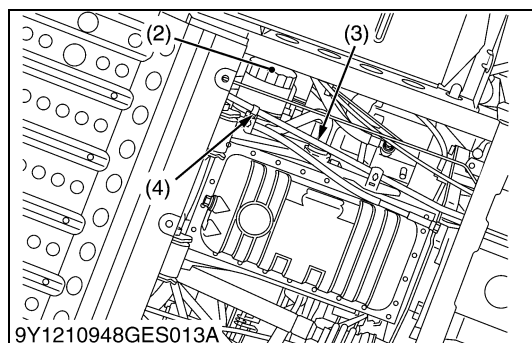
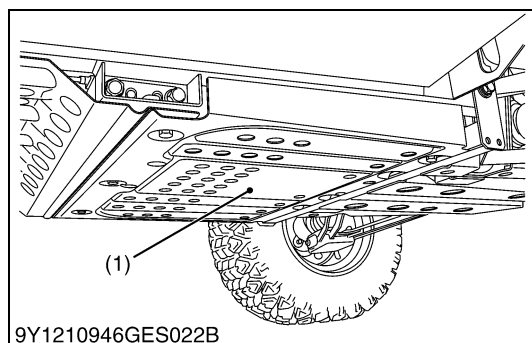
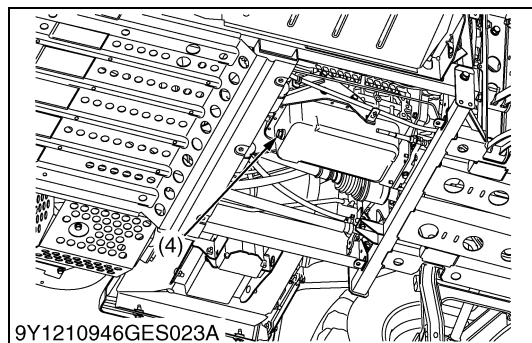
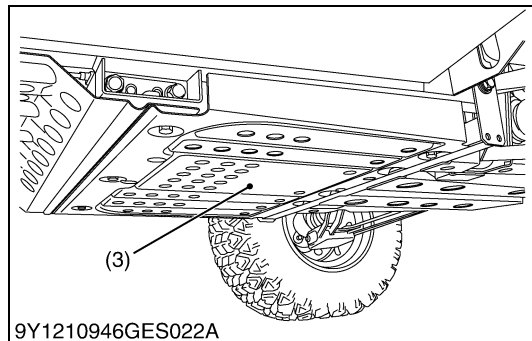
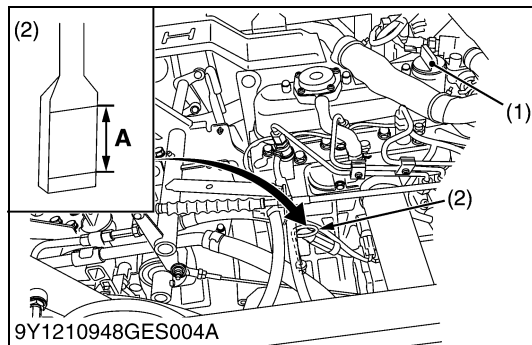
■ Evacuator Valve

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

- | | |
|--------------------------------|---------------------|
| (1) Secondary (Safety) Element | (4) Evacuator Valve |
| (2) Primary Element | (5) Cover |
| (3) Rubber Seal | |

9Y1210948GEG0046US0

[5] CHECK POINTS OF EVERY 200 HOURS



Changing Engine Oil



WARNING

To avoid serious injury:

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

1. Park the vehicle on a level surface.
2. Raise the cargo bed and mount the safety support.
3. Stop the engine.
4. Remove the rear skid plate.
5. To drain the used oil, remove the drain plug at the bottom of the engine and completely drain the oil into an oil pan. All the used oil can be drained out easily when the engine is still warm.
6. After draining, reinstall the drain plug.
7. Fill with the new oil up to the upper line on the dipstick. (Refer to "4. LUBRICANTS, FUEL AND COOLANT" on page G-8.)

Engine oil	Capacity	[Filter exchanged] 4.1 L 4.3 U.S.qts 3.6 Imp.qts
		[Filter non-exchanged] 3.8 L 4.0 U.S.qts 3.3 Imp.qts

- (1) Oil Inlet
- (2) Dipstick
- (3) Rear Skid Plate
- (4) Drain Plug

A: Oil level is acceptable within this range.

9Y1210948GEG0026US0

Replacing Engine Oil Filter



WARNING

To avoid serious injury:

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

1. Park the vehicle on a flat surface.
2. Stop the engine.
3. Remove the rear skid plate.
4. Remove the oil filter.
5. Put a film of clean engine oil on the rubber seal of the new filter.
6. Tighten the filter quickly until it contacts the mounting surface. Tighten the filter by hand an additional 1/2 turn only.
7. 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.

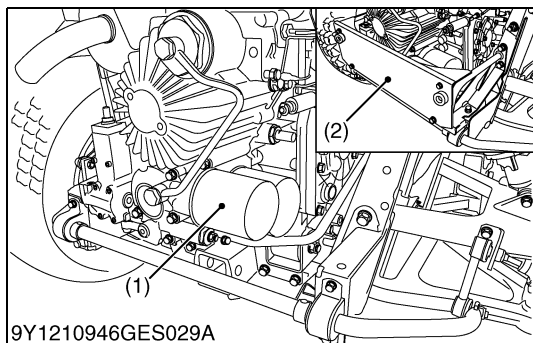
■ IMPORTANT

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

- (1) Rear Skid Plate
- (2) Engine Oil Filter

- (3) Parking Cable
- (4) Clamp

9Y1210948GEG0028US0



Replacing Transmission Oil Filter [VHT]

! WARNING

To avoid serious injury:

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

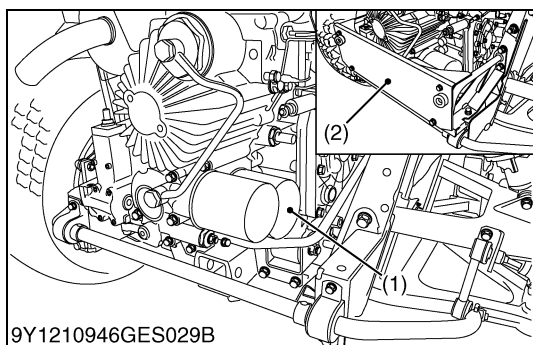
1. Park the vehicle on a flat surface.
2. Remove the rear guard.
3. Remove the oil filter.
4. Put a film of clean transmission oil on the rubber seal of the new filter.
5. Quickly tighten the filter by hand until it contacts the mounting surface, then, with a filter wrench, tighten it an additional 1/2 turn only.
6. After the new filter has been replaced, fill the hydraulic tank oil up to the upper notch on the dipstick.
7. After operating the engine for a few minutes, stop the engine and check the oil levels again, add oil to the prescribed level.
8. Make sure that the transmission fluid doesn't leak past the seal on the filters.
9. Install the rear guard.

■ IMPORTANT

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

- (1) Transmission Oil Filter (VHT): (2) Rear Guard
(Yellow Color)

9Y1210948GEG0029US0



Replacing Transmission Oil Filter [SUCTION]

! WARNING

To avoid serious injury:

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

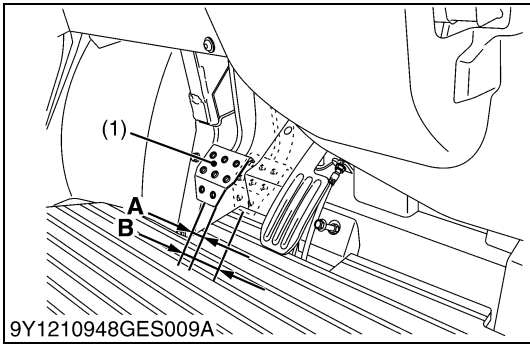
1. Park the vehicle on a flat surface.
2. Remove the rear guard.
3. Remove the oil filter.
4. Put a film of clean transmission oil on the rubber seal of the new filter.
5. Quickly tighten the filter by hand until it contacts the mounting surface, then, with a filter wrench, tighten it an additional 1/2 turn only.
6. After the new filter has been replaced, fill the hydraulic tank oil up to the upper notch on the dipstick.
7. After operating the engine for a few minutes, stop the engine and check the oil levels again, add oil to the prescribed level.
8. Make sure that the transmission fluid doesn't leak past the seal on the filters.
9. Install the rear guard.

■ IMPORTANT

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

- (1) Transmission Oil Filter (Suction) (2) Rear Guard
(Black Color)

9Y1210948GEG0030US0



Checking Brake Pedal

⚠ WARNING

To avoid serious injury:

- Stop the engine and chock the wheels before checking brake pedal.
- If movement is outside of the specifications, adjusting the brake.

■ Checking the brake pedal free travel

Proper brake pedal free travel	8 to 18 mm (0.3 to 0.7 in.) on the pedal
--------------------------------	--

1. Release the parking brake.
2. Slightly depress the brake pedal and measure free travel at the top of the pedal stroke.
3. If brake pedal free travel is outside of the specifications, adjusting the brake.

■ Checking the brake pedal stroke

Pedal stroke	Less than 150 mm (5.9 in.) on the pedal
--------------	---

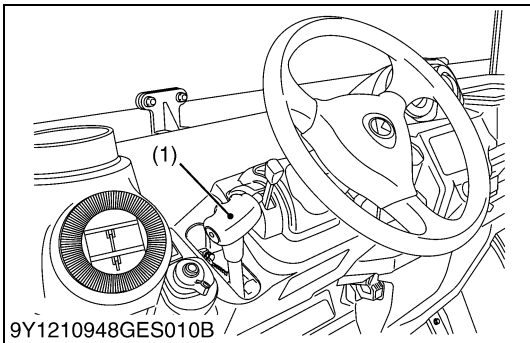
1. Release the parking brake.
2. Step on the pedal and measure the pedal stroke.
3. If brake pedal stroke is outside of the specifications, adjusting the brake.

(1) Brake Pedal

A: FREE TRAVEL

B: PEDAL STROKE

9Y1210948GEG0031US0



Adjusting Parking Brake

■ Adjusting procedure

1. Park the vehicle on a flat surface.
2. Stop the engine.
3. Jack up the rear wheels.
4. Remove the left rear tire.
5. Remove the mud guard of rubber.
6. Release the parking brake.
7. Loosen the lock nuts.
8. Adjust the cable wire length.
9. Tighten the lock nuts securely.
10. Install the mud guard.
11. Install the left rear tire.

Proper parking brake lever free play range	1 notch
--	---------

(1) Parking Brake Lever

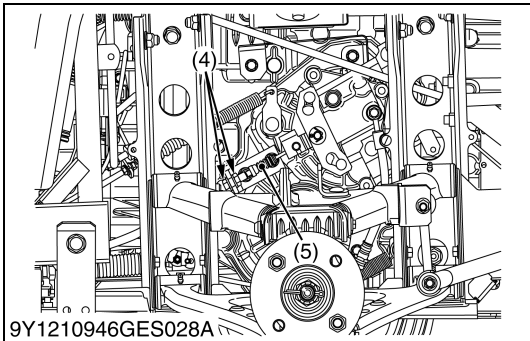
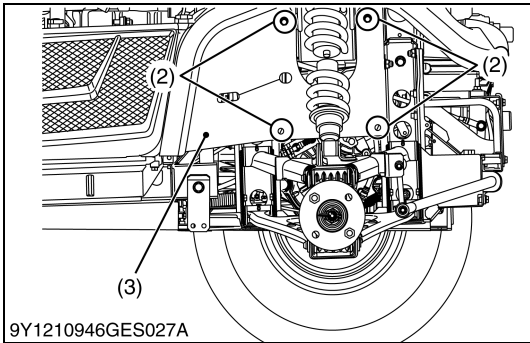
(4) Lock Nut

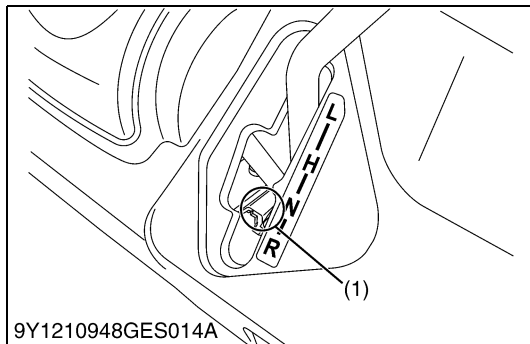
(2) Push Rivet

(5) Cable Wire

(3) Mud Guard

9Y1210948GEG0032US0



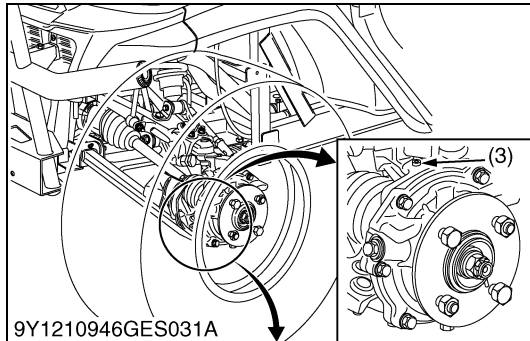


Checking Brake Light Switch

1. Park the vehicle on a flat surface.
2. Step on the brake pedal to check if the brake light comes on.
3. If it does not, check the bulb or brake light switch.

(1) Brake Light Switch

9Y1210948GEG0033US0



Checking Front Brake Case

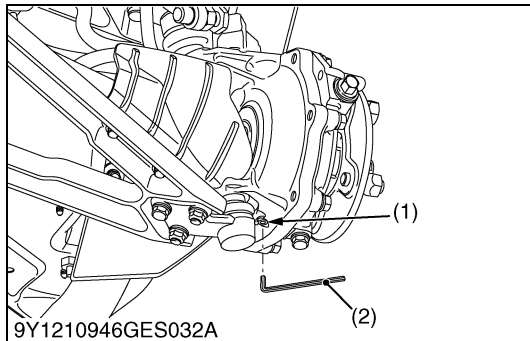
1. Remove the drain plugs and the air-bleeding hole plugs.
2. Check the brake case for brake fluid leak.

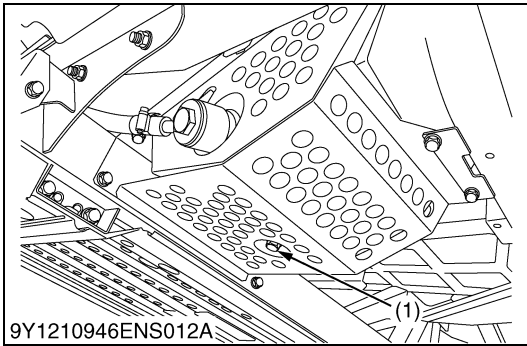
(1) Drain Plug

(3) Air-Bleeding Hole Plug

(2) Allen Key

9Y1210946GEG0034US0





Changing Hydraulic Tank Oil

WARNING

To avoid serious injury:

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

1. Park the vehicle on a level surface.
2. Open the seat and remove the utility box.
3. Remove the rubber cap.
4. To drain the used oil, remove the drain plug and filling plug and drain the oil completely into the oil pan.
5. After draining, reinstall the drain plug.
6. Fill with new KUBOTA SUPER UDT fluid up to the upper line on the dipstick.
(Refer to "4. LUBRICANTS, FUEL AND COOLANT" on page G-8.)

How to check:

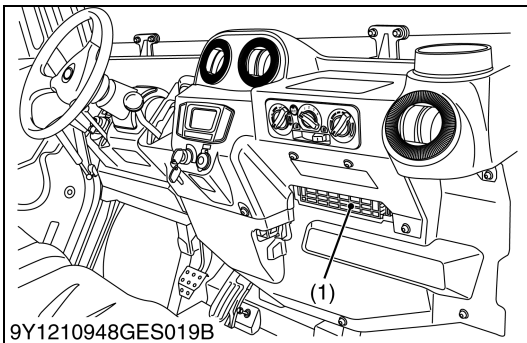
Wipe dipstick clean with a rag and screw it into filling hole. Remove dipstick again to see if the oil level is between the upper and lower line.

7. After filling, reinstall the filling plug.

Hydraulic tank oil	Capacity	18.0 L 19.0 U.S.qts 16.0 Imp.qts
--------------------	----------	--

(1) Drain Plug

9Y1210948GEG0047US0



Cleaning Air Filter

Remove the air filter cover and pull out filter.

■ NOTE

- Attach the filter and cover as the illustration above.

■ Cleaning the air filter

- Normal use

Blow air from the opposite direction to the filter's normal air flow. Pressure of compressed air must be under 205 kPa (2.1 kgf/cm², 30 psi).

■ IMPORTANT

- Do not hit the filter. If the filter becomes deformed, dust may enter into the air-conditioner, which may cause damage and malfunction.

■ NOTE

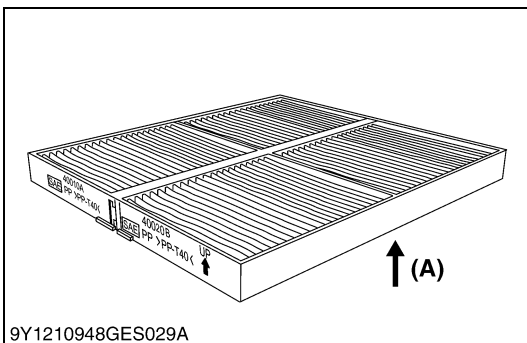
- If the filter is very dirty:

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

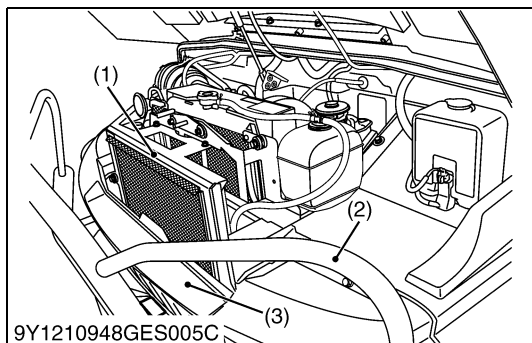
- Do not use gasoline, thinner or similar chemicals to clean the filter as damage to the filter may occur.
- If may also cause an unpleasant odor in the CAB when the system is used next.



(1) Air Filter Cover

(A) AIR CONDITIONER AIRFLOW

9Y1210948GEG0051US0

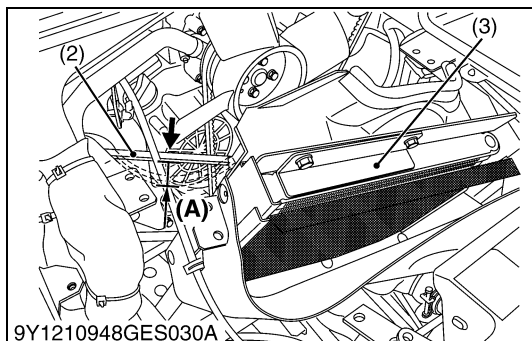


Checking Air Conditioner Condenser

Remove the bolts and take off the front guard and the front mask. Check air conditioner condenser to be sure it is clean of debris.

- (1) Air Conditioner Condenser (3) Front Mask
(2) Front Guard

9Y1210948GEG0052US0

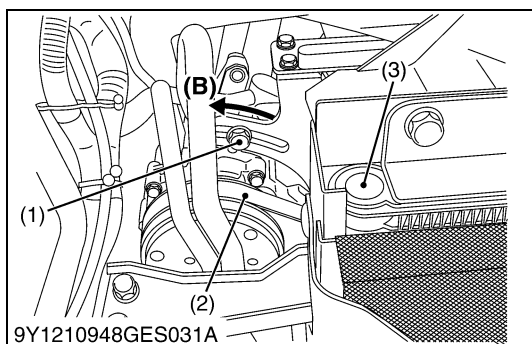


Adjusting Air-Conditioner Belt Tension

1. Remove the bolts of fuse box, and remove the bolts of oil cooler bracket.
Then put the oil cooler and bracket down on its front side.
2. Push on the belt between the pulleys with a finger. A deflection of 10 to 12 mm (0.4 to 0.48 in.) under a 98 N (10 kgf, 22 lbs) load is appropriate.
3. If tension is incorrect, loosen the belt tension within acceptable limits.

- (1) Adjusting Bolt (A) 10 to 12 mm (0.4 to 0.48 in.)
(2) Air Conditioner Belt (B) To Tighten
(3) Oil Cooler

9Y1210948GEG0053US0



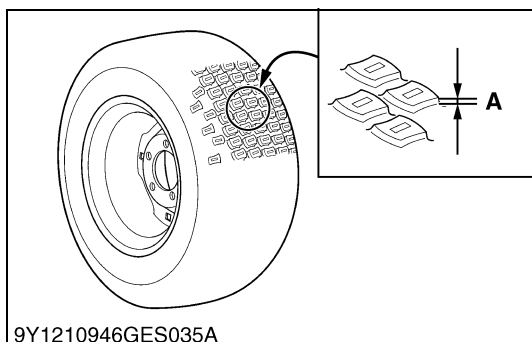
[6] CHECK POINT OF EVERY 200 HOURS OR 3,000 KM

Checking the Suspension Arm Bushings

1. Inspect the suspension arm bushings.
2. Replace the bushings or the pins, if necessary.

New9Y1210948GEG0036US0

[7] CHECK POINT OF EVERY 300 HOURS



Checking Tire

1. Check to see if tires are not damaged.
2. If the tires are cracked, bulged, or cut, or they are worn out, replace or repair them at once.

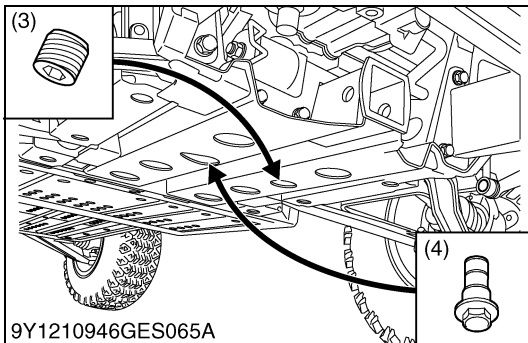
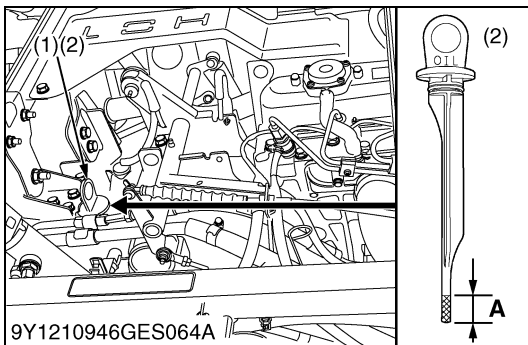
■ Tire Tread Depth

Always replace the tires when the tread depth is worn to minimum allowable.

A: 3 mm (0.12 in.)

9Y1210948GEG0036US0

[8] CHECK POINTS OF EVERY 400 HOURS



Changing Transmission Fluid



WARNING

To avoid serious injury:

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

1. Park the vehicle on a level surface.
2. Raise the cargo bed and mount the safety support.
3. To drain the used oil, remove the drain plug at the bottom of the transmission case and drain the oil completely into the oil pan.
4. After draining, reinstall the drain plug.
5. Fill with the new KUBOTA SUPER UDT fluid up to the upper cross hatched area on the dipstick.
(Refer to "4. LUBRICANTS, FUEL AND COOLANT" on page G-8.)
6. After operating the engine for a few minutes, stop the engine and check the oil level again; add oil to prescribed level.

Transmission oil	Capacity	7.0 L 1.8 U.S.gals 1.5 Imp.gals
------------------	----------	---------------------------------------

■ IMPORTANT

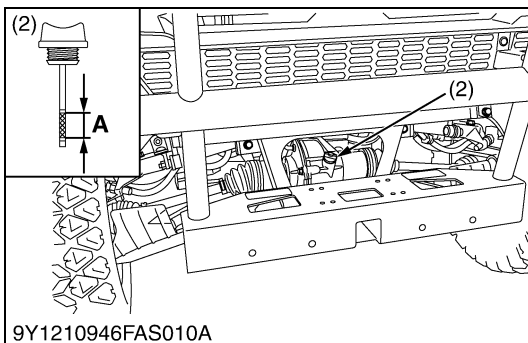
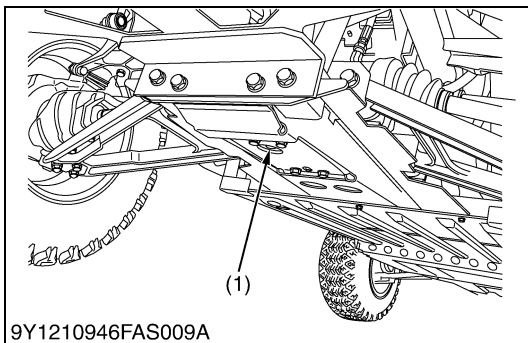
- Do not operate the vehicle immediately after changing the transmission fluid.

Operate the engine at medium speed for a few minutes to prevent damage to the transmission.

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

A: Oil level is acceptable within this range.

9Y1210948GEG0054US0



Changing Front Axle Case Oil

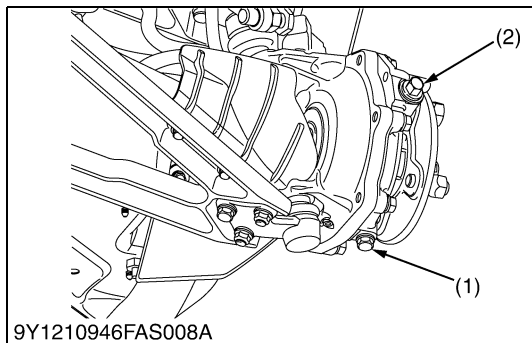
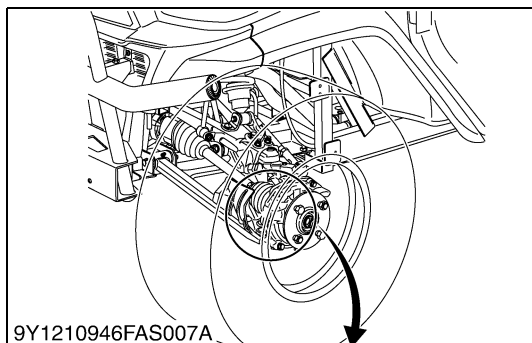
1. Park the vehicle on a level surface.
2. Turn over the rubber sheet.
3. To drain the used oil, remove the drain plug and the filling plug at the front axle case and drain the oil completely into the oil pan.
4. After draining, reinstall the drain plug.
5. Fill with the new oil up to the upper line on the dipstick.
(Refer to "4. LUBRICANTS, FUEL AND COOLANT" on page G-8.)
6. After filling, reinstall the filling plug.

Front axle case oil	Capacity	0.6 L 0.6 U.S.qts 0.52 Imp.qts
---------------------	----------	--------------------------------------

- (1) Drain Plug
- (2) Filling Plug with Dipstick

A: Oil level is acceptable with in this range.

9Y1210948GEG0055US0



Changing Front Knuckle Case Oil

1. Park the vehicle on a firm, flat and level surface.
2. Remove the tire.
3. To drain the used oil, remove the drain and filling plugs at the LH knuckle case and drain the oil completely into the oil pan.
4. After draining, reinstall the drain plug.
5. Fill with the new oil up to the filling port level.
(Refer to "4. LUBRICANTS, FUEL AND COOLANT" on page G-8.)
6. After filling, reinstall the filling plug.
7. Use the same procedure to change the RH knuckle case oil.

Front knuckle case oil	Capacity (one side)	(Reference)
		0.25 L
		0.26 U.S.qts
		0.22 Imp.qts

(1) Drain Plug

(2) Filling Plug

9Y1210948GEG0056US0

Replacing Fuel Filter

1. See page G-38.

9Y1210948GEG0057US0

[9] CHECK POINT OF EVERY 800 HOURS**Adjusting Engine Valve Clearance**

1. See page 1-S12.

9Y1210948GEG0058US0

[10] CHECK POINT OF EVERY 1000 HOURS OR EVERY 1 YEAR**Replacing Air Cleaner Primary Element**

1. Replace the both primary. (See page G-39.)

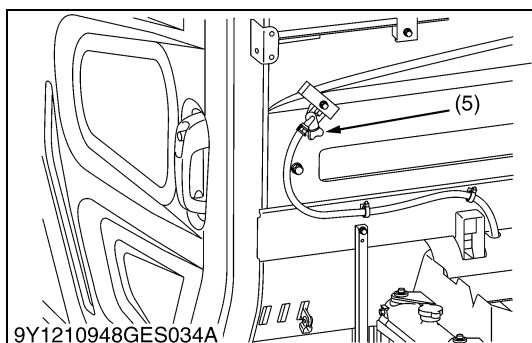
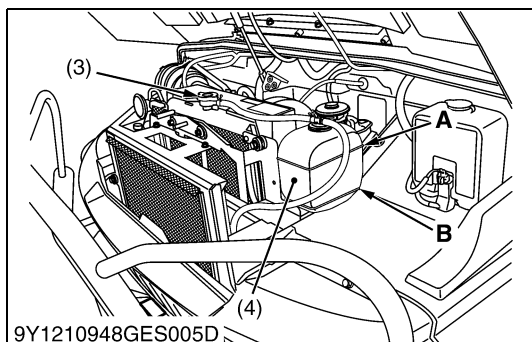
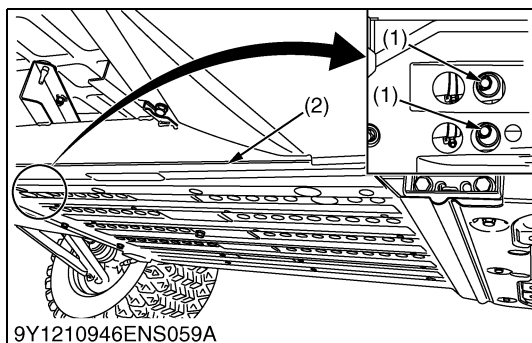
9Y1210948GEG0061US0

[11] CHECK POINT OF EVERY 1500 HOURS**Checking Fuel Injection Nozzle Injection Pressure**

1. See page 1-S14.

9Y1210948GEG0059US0

[12] CHECK POINT OF EVERY 2000 HOURS OR EVERY 2 YEARS



Flushing Cooling System and Changing Coolant



WARNING

To avoid serious injury:

- Do not remove the 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 cool down.
 2. Open the hood.
 3. To drain the coolant, open the radiator drain plug and remove radiator cap and engine coolant breather. The radiator cap must be removed to completely drain the coolant.
 4. After all coolant is drained, close the drain plug.
 5. Fill with clean water and cooling system cleaner.
 6. Follow directions of the cleaner instruction.
 7. After flushing, fill with clean distilled water and antifreeze until the coolant level is just below the radiator cap. Install the radiator cap securely.
 8. Fill with fresh distilled water up to the **"FULL"** mark on the recovery tank.
 9. Close the engine coolant breather.
 10. Start and operate the engine for few minutes.
 11. Stop the engine and let cool.
 12. Check coolant level of recovery tank and add coolant if necessary.

Coolant	Capacity	
		7.9 L
		8.3 U.S.qts
		7.0 Imp.qts

■ IMPORTANT

- Do not start engine without coolant.
- Do not remove the cap on the radiator.
- Use clean, fresh distilled water and anti-freeze to fill the radiator and recovery tank.
- When the anti-freeze is mixed with distilled water, the antifreeze mixing ratio is 50 %.
- Securely tighten radiator cap. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.
- Make sure that the engine coolant breather is closed, after filling the coolant.

- (1) Drain Plug
- (2) Front Skid Plate
- (3) Radiator Cap
- (4) Recovery Tank
- (5) Engine Coolant Breather

A: FULL
B: LOW

9Y1210948GEG0073US0

■ Anti-Freeze



WARNING

To avoid serious injury:

- When using anti-freeze, put on some protection such as rubber gloves. (Anti-freeze contains poison.)
- If it is swallowed, seek immediate medical help. Do NOT make a person throw up unless told to do so by poison control or a health care professional. Use standard first aid and CPR for signs of shock or cardiac arrest. Call your local Poison Control Center or your local emergency number for further assistance.
- When anti-freeze comes in contact with the skin or clothing, wash it off immediately.
- Do not mix different types of Anti-freeze. The mixture can produce chemical reaction causing harmful substances.
- Anti-freeze is extremely flammable and explosive under certain conditions. Keep fire and children away from anti-freeze.
- When draining fluids from the engine, place some container underneath the engine body.
- Do not pour waste onto the ground, down a drain, or into any water source.
- Also, observe the relevant environmental protection regulations when disposing of antifreeze.

Always use a 50/50 mix of long-life coolant and clean soft water in KUBOTA engines.

1. Long-life coolant (hereafter LLC) comes in several types. Use ethylene glycol (EG) type for this engine.
2. Before employing LLC-mixed cooling water, 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
Premix 50 % LLC with 50 % clean soft water. When mixing, stir it up well, and then fill into the radiator.
4. The procedure for the mixing of water and anti-freeze differs according to the make of the anti-freeze and the ambient temperature. Refer to SAE J1034 standard, more specifically also to SAE J814c.

■ IMPORTANT

When mixing the anti-freeze with water, the anti-freeze mixing ratio is 50 %.

Vol % Anti-freeze	Freezing Point		Boiling Point*	
	°C	°F	°C	°F
50	-37	-34	108	226

*At 1.013×10^5 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 coolant level reduces in the cooling system by evaporation.
 - (2) If there is a mixture leak, add the LLC of the same manufacturer and type in the mixing ratio 50 %.

* Never add any long-life coolant of different manufacturer. (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 anti-corrosive 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 represent industry standards that necessitate a minimum glycol content in the concentrated anti-freeze.

9Y1210948GEG0074US0

[13] CHECK POINT OF EVERY 3000 HOURS**Checking Injection Pump**

1. See page 1-S19.

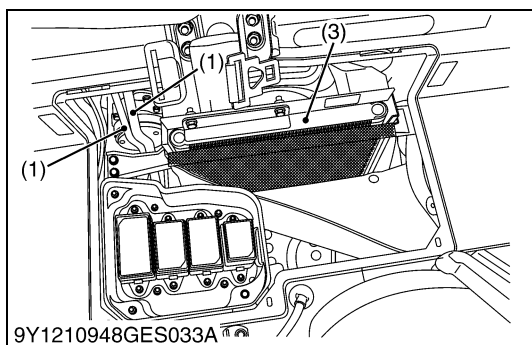
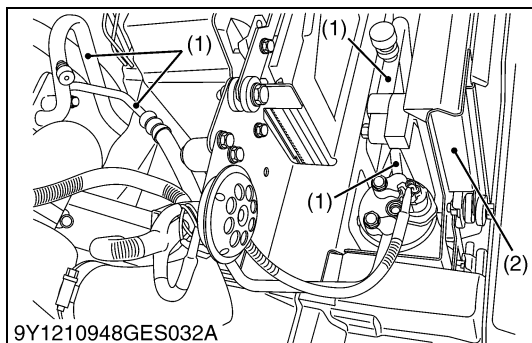
9Y1210948GEG0060US0

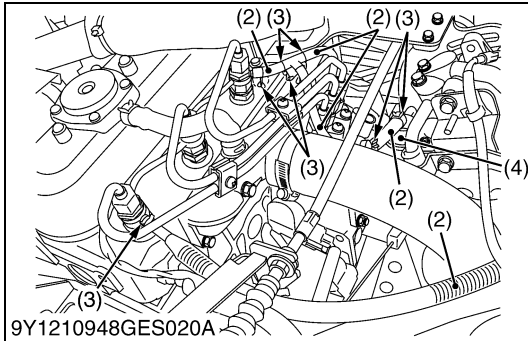
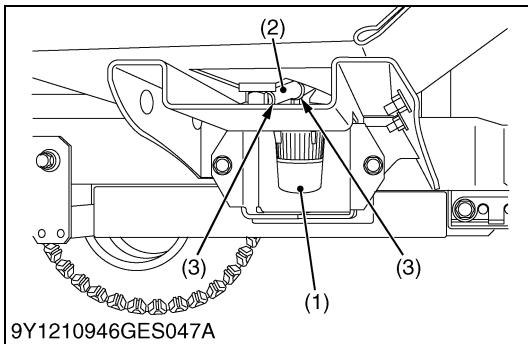
[14] CHECK POINTS OF EVERY 1 YEAR**Checking Air Conditioner Pipe and Hose**

1. Check to see that all lines and hose clamps are tight and not damaged.

- | | |
|------------------------------------|----------------|
| (1) Air Conditioner Pipe (or Hose) | (3) Oil Cooler |
| (2) Air Conditioner Condenser | |

9Y1210948GEG0062US0





Checking Fuel Line and Fuel Filter



WARNING

To avoid serious injury:

- Be sure to stop the engine and remove the key when attempting to make the following checks and changes.
- Never fail to check the fuel lines periodically. The fuel lines are subject to wear and aging. Fuel may leak out onto the operating engine, causing a fire.

The fuel line connections should be checked annually or every 100 service hours, whichever comes first.

1. Park the vehicle on a flat surface, raise the cargo bed, mount the safety support and shut off the engine.
2. The fuel line is made of rubber and ages regardless of service period.
3. If the fuel line and clamps are found to be damaged or deteriorated, replace them.
4. Check fuel filter, if it is clogged by debris or contaminated with water, replace it.

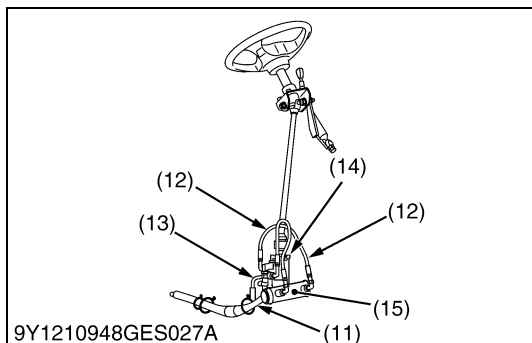
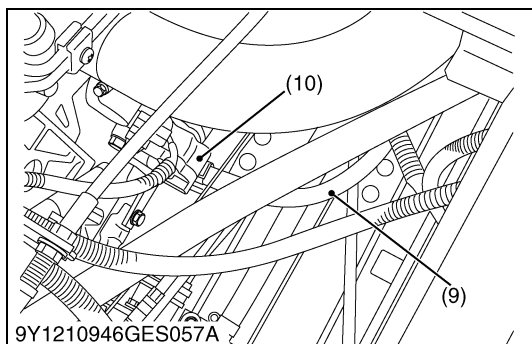
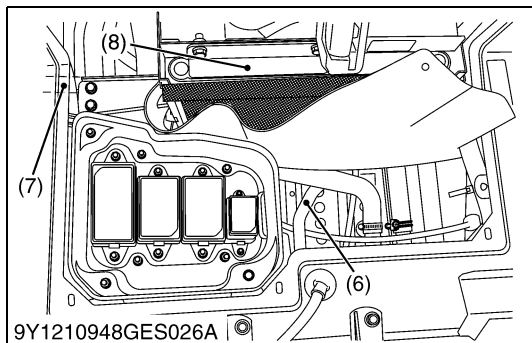
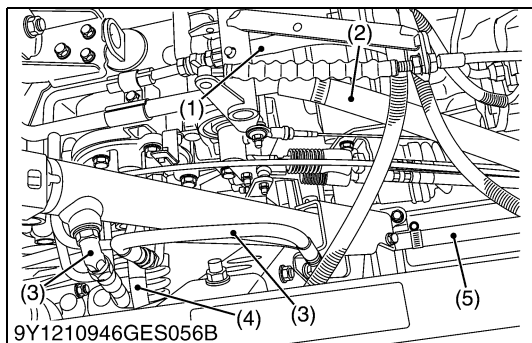
■ IMPORTANT

- When the fuel line is disconnected for maintenance or repair, close both ends of the fuel line with a piece of clean cloth or paper to prevent dust and dirt from entering. In addition, particular care must be taken not to admit dust and dirt into the fuel pump. Entrance of even a small amount of dust or dirt cause premature wear and malfunction of the fuel pump and injector components.

- (1) Fuel Filter
(2) Fuel Line

- (3) Pipe Clamp
(4) Fuel Pump

9Y1210948GEG0045US0

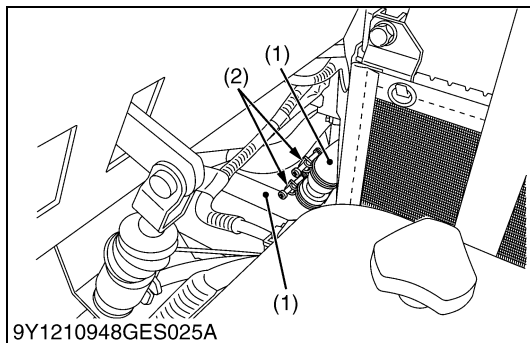
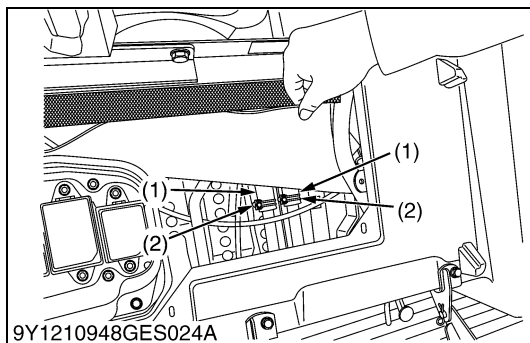
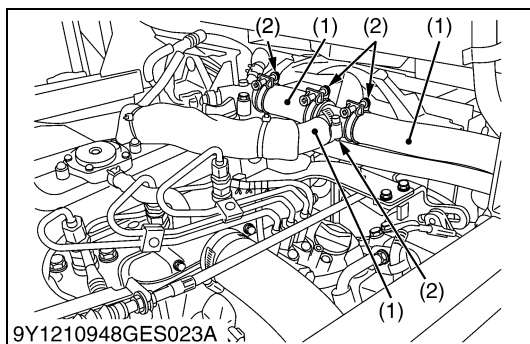
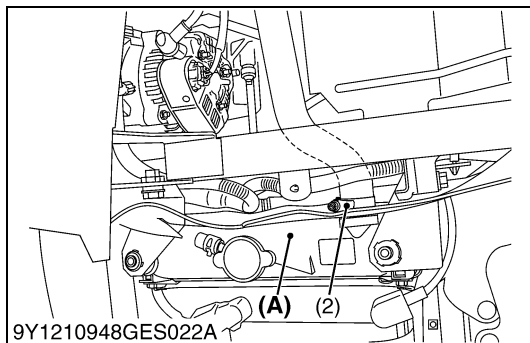
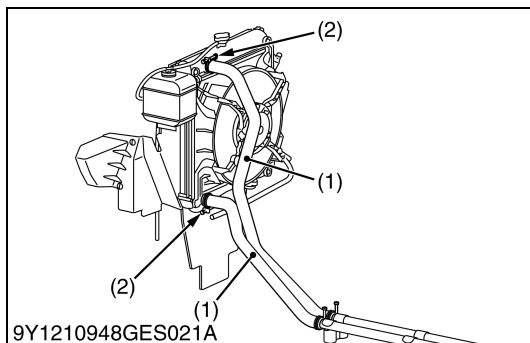


Checking Hydraulic Oil Line

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

- (1) Hydraulic Pump → Control Valve
- (2) HST → Oil Tank
- (3) Control Valve ↔ Lift Cylinder
- (4) Control Valve → Power Steering Unit
- (5) Oil Tank → HST
- (6) Power Steering Unit → Oil Cooler
- (7) Oil Cooler → Oil Tank
- (8) Oil Cooler
- (9) Oil Tank → Hydraulic Pump
- (10) Hydraulic Pump
- (11) Power Steering Hose (Power Steering Unit → Oil Cooler)
- (12) Power Steering Hose (Power Steering Unit ↔ Power Steering Cylinder)
- (13) Power Steering Hose
(With Hydraulic Dump: Power Steering Unit ← Control Valve,
Without Hydraulic Dump: Power Steering Unit ← Hydraulic Pump)
- (14) Power Steering Unit
- (15) Power Steering Cylinder

9Y1210948GEG0049US0



Checking Radiator Hose, Pipe and Clamp

Park the vehicle on a flat surface. Raise the cargo bed and mount the safety support.

Check to see if radiator hoses are properly fixed every 200 hours of operation or 6 months, whichever comes first.

1. If hose clamps are loose or water leaks, tighten bands securely.
2. Replace hoses and tighten hose clamps securely, if radiator hoses are swollen, hardened or cracked.

Replace hoses and hose clamps every 2 years or earlier if checked and found that hoses are swollen, hardened or cracked.

■ Precaution at Overheating

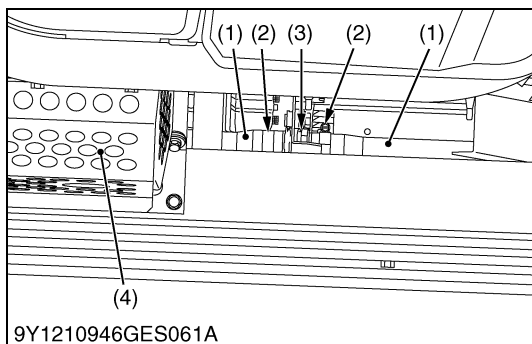
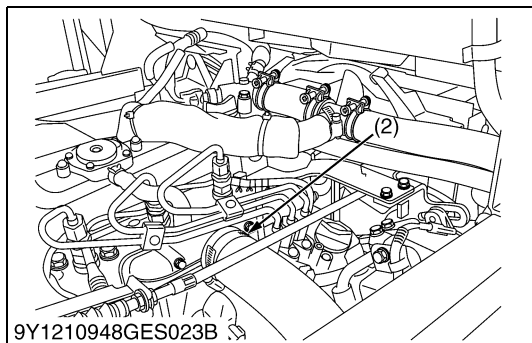
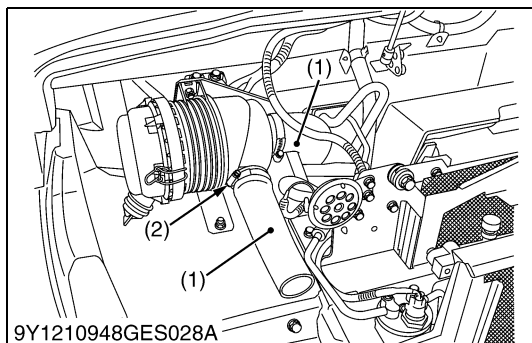
Take the following actions in the event the coolant temperature is close to or more than the boiling point, which is called Overheating.

1. Stop the vehicle operation in a safe place, unload the engine and remain at idle.
2. Don't stop the engine suddenly, but stop it after about 5 minutes of unloaded idling.
3. Keep yourself well away from the vehicle for at least 10 minutes or while the steam is blowing out.
4. Check to confirm that there is no danger from the overheat condition, check the cause of the overheat and fix the cause. After the engine has cooled, re-start the engine.

- (1) Radiator Hose
(2) Clamp Band

(A) Side Radiator

9Y1210948GEG0048US0



Checking Intake Air Line

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

- (1) Hose
(2) Hose Clamp

- (3) Joint
(4) Hydraulic Tank

9Y1210948GEG0050US0

Checking Engine Breather Hose

⚠ WARNING

To avoid serious injury:

- Be sure to stop the engine and remove the key before checking engine breather hose.

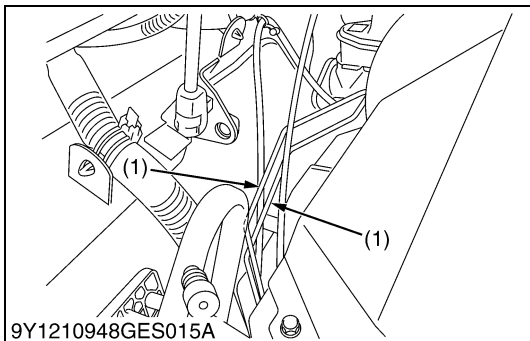
Check to see if engine breather hoses are properly fixed every 1 year.

1. Stop the engine and let cool down.
2. If hose clamps are loose or water leaks, tighten bands securely.
3. Replace hoses and tighten hose clamps securely, if engine breather hoses are swollen, hardened or cracked.

Replace hoses and hose clamps every 4 years or earlier if you checked and found that hoses are swollen, hardened or cracked.

- (1) Engine Breather Hose

9Y1210948GEG0111US0



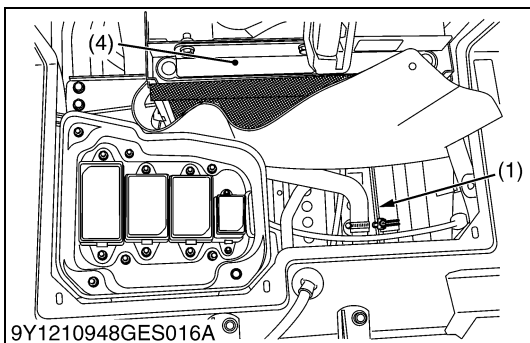
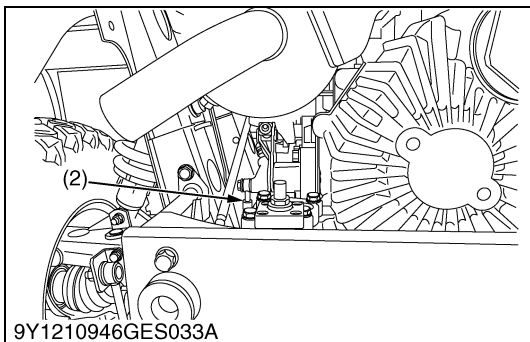
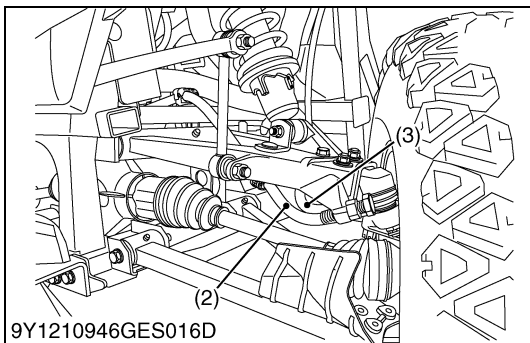
Checking Brake Hose and Pipe

1. Check to see that brake hose and pipe are not swollen, hardened or cracked.
2. Check the brake hose and pipe joints for oil leaks.
3. If there is any abnormality, replace the new one.

(1) Brake Pipe
(2) Brake Hose

(3) Breather Hose
(4) Oil Cooler

9Y1210948GEG0035US0



[15] CHECK POINT OF EVERY 2 YEARS

Changing Brake Fluid

1. See page 4-S5.

9Y1210948GEG0069US0

[16] CHECK POINTS OF EVERY 4 YEARS

Replacing Brake Hose

1. See page G-56.

9Y1210948GEG0075US0

Replacing Fuel Line

1. See page G-38.

9Y1210948GEG0063US0

Replacing Radiator Hose, Replace the Hoses and Clamps (Water Pipes)

1. See page G-54.

9Y1210948GEG0064US0

Replacing Hydraulic Oil Line

1. See page G-53.

9Y1210948GEG0065US0

Replacing Intake Air Line

1. See page G-55.

9Y1210948GEG0066US0

Replacing Engine Breather Hose

1. See page 1-S35.

9Y1210948GEG0067US0

Replacing Brake Master Cylinder (Inner Parts)

1. See page 4-S15.

9Y1210948GEG0068US0

Replacing Rear Brake Cylinder Seal

1. See page 4-S17.

9Y1210948GEG0070US0

Replacing Front Brake Seal

1. See page 4-S14.

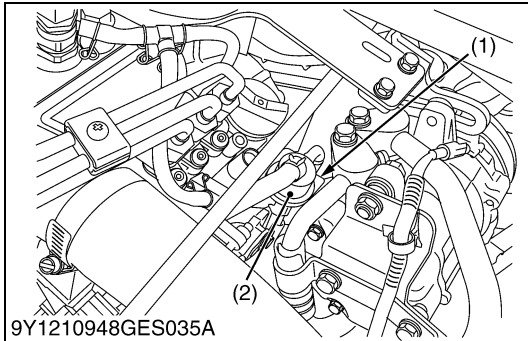
9Y1210948GEG0071US0

Replacing Air Conditioner Pipe and Hoses

1. See page G-51.

9Y1210948GEG0072US0

[17] SERVICE AS REQUIRED



Bleeding Fuel System

Air must be removed:

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

■ **Bleeding procedure is as follows:**

1. Fill the fuel tank with fuel.
2. Pump the fuel pump lever. The fuel pump lever will pump easily at first and with added resistance as air is purged from the system.
3. Start the engine and operate for about 30 seconds, and then stop the engine.

(1) Fuel Pump Lever

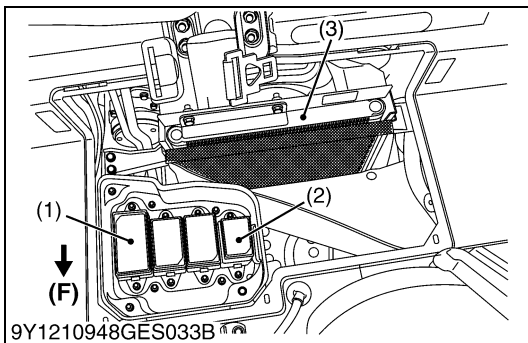
(2) Fuel Pump

9Y1210948GEG0076US0

Cleaning around Engine

1. See page G-20.

9Y1210948GEG0077US0



Replacing Fuse

The vehicle electrical system is protected from potential damage by fuses.

A blown fuse indicates that there is an overload or short somewhere in the electrical system.

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 vehicle electrical system.**

■ **Replacement procedure**

1. Disconnect the negative cable of the battery.
2. Open the seats and remove the utility box and maintenance cover.
3. Remove the fuse box cover.
4. Pull out the blown fuse using FUSE PULLER in the fuse box.
5. Insert a new fuse into the fuse box.
6. Install the fuse box cover and the maintenance cover.
7. Connect the negative battery cable.

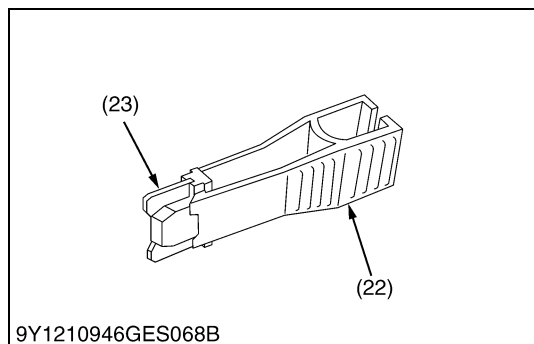
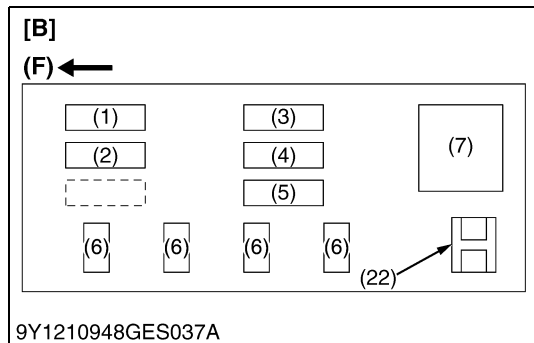
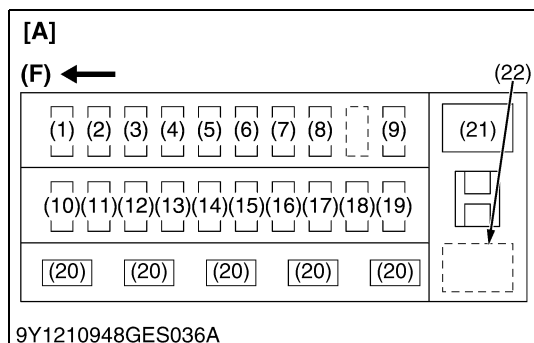
(1) Fuse Box 1

(2) Fuse Box 2

(3) Oil Cooler

(F) Front

9Y1210948GEG0078US0



Protected Circuit

Fuse box 1

Protected circuit

Fuse No.	Capacity (A)	Protected circuit
(1)	5	Glow lamp
(2)	5	Starter relay
(3)	5	Air conditioner
(4)	5	—
(5)	10	AUX
(6)	10	AUDIO / B, BUZZER RLY (FOG /WIPER)
(7)	5	Relay (SOLENOID)
(8)	5	Meter (IGN)
(9)	15	Head light blinker (Front)
(10)	5	Audio / Room lamp
(11)	20	Wiper
(12)	15	Blinker (Rear) brake lamp
(13)	30	Radiator fan (Rear)
(14)	10	DC output
(15)	20	—
(16)	10	Horn
(17)	15	Work light
(18)	30	Solenoid
(19)	5	Meter (BAT)
(20)	30, 20, 15, 10, 5	Spare
(21)	Slow-blow fuse (60)	Key switch
(22)	—	Fuse puller

Fuse box 2

Protected circuit

Fuse No.	Capacity (A)	Protected circuit
(1)	10	Beacon
(2)	15	Fog lamp
(3)	30	A / C blower
(4)	10	Compressor
(5)	20	Radiator fan (Front)
(6)	30, 20, 15, 10	Spare
(7)	Slow-blow fuse (80)	Alternator
(22)	—	Fuse puller

(22) Fuse Puller

(23) Fuse

[A] Fuse Box 1**[B] Fuse Box 2****(F) Front**

9Y1210948GEG0079US0

Replacing Slow-Blow Fuses

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

■ Replacement procedure

1. Disconnect the negative cable of the battery.
2. Open the seats and remove the utility box and maintenance cover.
3. Remove the fuse box cover.
4. Pull out the slow-blow fuse.
5. Insert a new slow-blow fuse into the slow-blow fuse box.
6. Install the slow-blow fuse box cover and the maintenance cover.
7. Connect the negative battery cable.

9Y1210948GEG0080US0

Replacing Light Bulb

1. Head light and turn signal light (front)
Take the bulb out of the light body and replace it with a new one.
2. Other lights
Detach the lens and replace the bulb.

Light	Capacity
Head light (Clear type)	37.5 W
Tail light	5 W
Brake light	21 W
Turn signal light (front)	21 W (if equipped)
Turn signal light (rear)	21 W (if equipped)
Work light (front)	35 W (if equipped)
Work light (rear)	35 W (if equipped)
Dome light	5 W

9Y1210948GEG0081US0

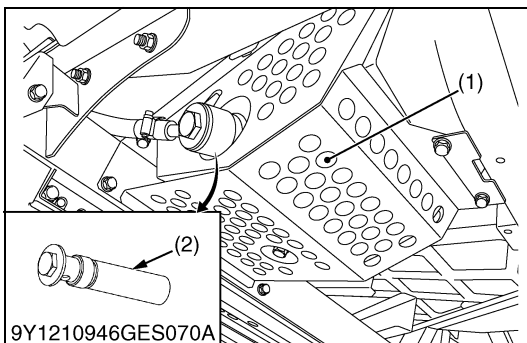
Checking Hydraulic Tank Suction Strainer

1. Make sure that the hydraulic tank is not damaged and the oil does not leak out of the hydraulic tank.
2. Make sure that the water is not mixed with the oil.
3. When the suction strainer is dirty, wash it with the light oil.

(1) Hydraulic Tank

(2) Suction Strainer

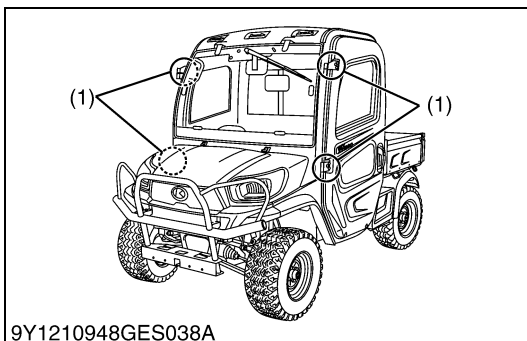
9Y1210948GEG0082US0

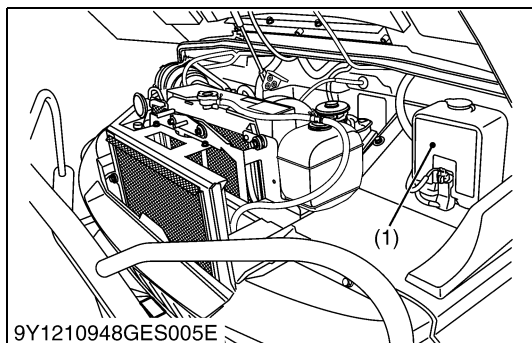


Lubricating Points

(1) Door Hinge

9Y1210948GEG0083US0





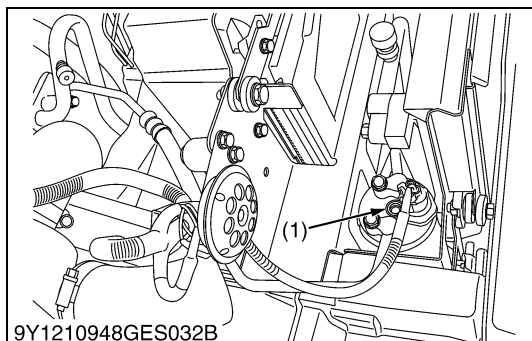
Adding Washer Liquid

Add a proper amount of automobile washer liquid.

Washer liquid tank	Capacity	
		1.5 L
		1.6 U.S.qts
		1.3 Imp.qts

(1) Washer Liquid Tank

9Y1210948GEG0084US0



Checking the Amount of Refrigerant (gas)



WARNING

To avoid serious injury:

- 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, ask your dealer to inspect and charge.

■ Checking procedure

1. Operate the air-conditioner in the following conditions.
 - Engine speed:
About 2000 min⁻¹ (rpm)
 - Temperature control dial:
Maximum cooling position
 - Fan switch:
Highest blow (HI)
 - Air-conditioner switch:
ON
2. Look into the sight glass to see if the refrigerant is flowing through its circuit.

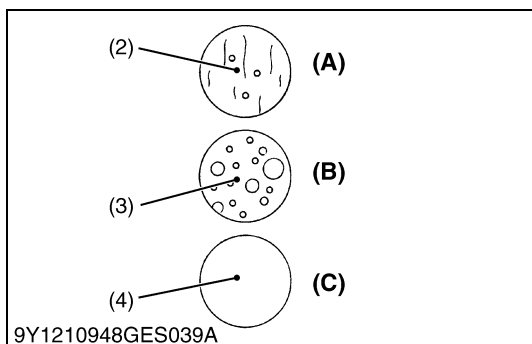
■ IMPORTANT

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

- (1) Sight Glass
(2) Proper
(3) Low
(4) Overfull or No Refrigerant

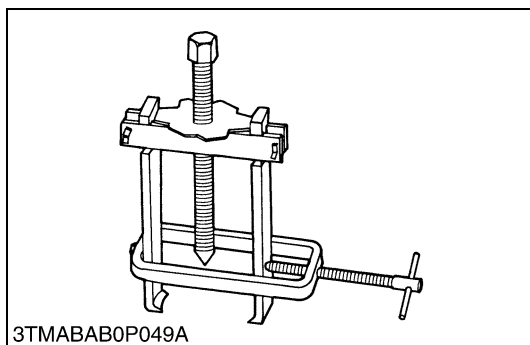
- (A) Little or no air bubbles in the refrigerant flow.
(B) Lots of air bubbles in the refrigerant flow (air bubbles or foam passing continuity)
(C) Colorless and transparent.

9Y1210948GEG0085US0



8. SPECIAL TOOLS

[1] SPECIAL TOOLS FOR ENGINE



Special Use Puller Set

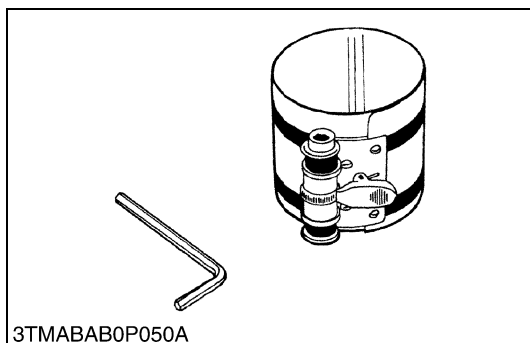
Code No.

- 07916-09032

Application

- Use exclusively to pull out bearing, gears and other parts with ease.

WSM000001GEG0011US0

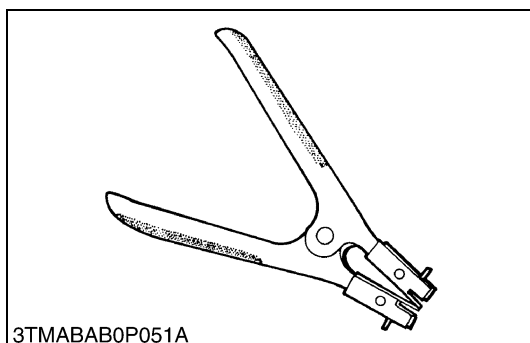


Piston Ring Compressor

Application

- Use exclusively to push in the piston with piston rings into the cylinder.

WSM000001GEG0012US0

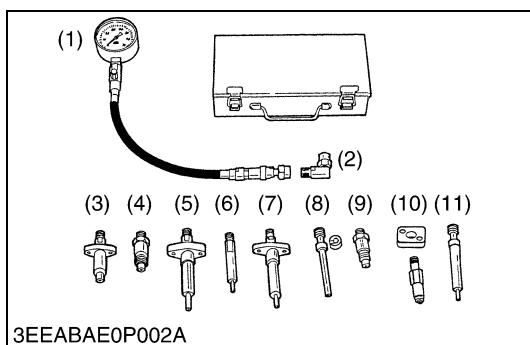


Piston Ring Tool

Application

- Use exclusively to remove or install the piston ring with ease.

WSM000001GEG0013US0



Diesel Engine Compression Tester (for Injection Nozzle)

Code No.

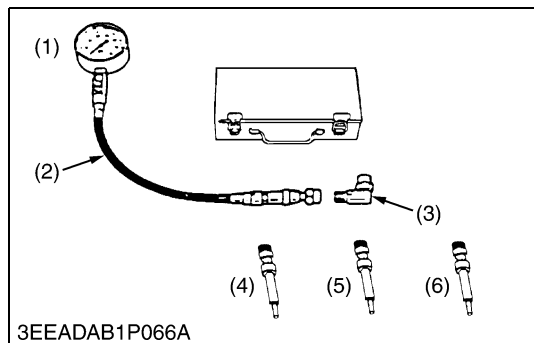
- 07909-30208 (Assembly)
- 07909-31211 (**E** and **F**)
- 07909-31231 (**H**)
- 07909-31251 (**G**)
- 07909-31271 (**I**)
- 07909-31281 (**J**)

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



Diesel Engine Compression Tester (for Glow Plug)

Code No.

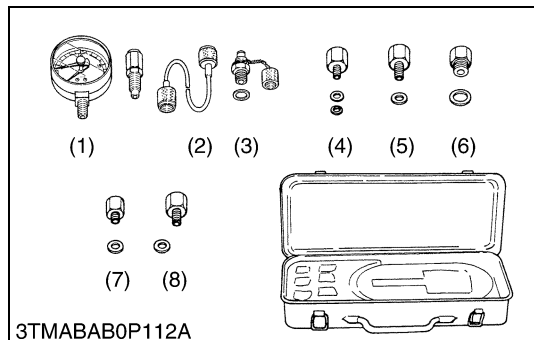
- 07909-39081 (Assembly)
- 07909-31291 (**K**)
- 07909-31301 (**L**)
- 07909-31311 (**M**)

Application

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

- | | |
|-------------------|----------------------|
| (1) Gauge | (4) Adaptor K |
| (2) Hose Assembly | (5) Adaptor L |
| (3) L Joint | (6) Adaptor M |

WSM000001GEG0096US0



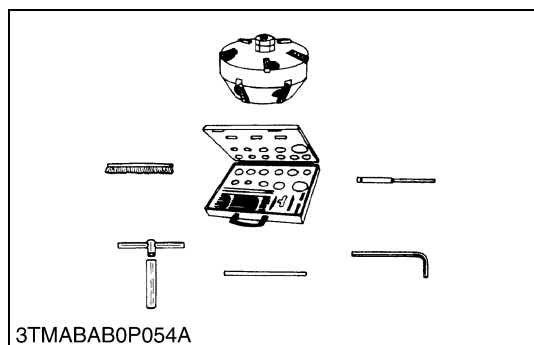
Oil Pressure Tester

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



Valve Seat Cutter

Application

- Use to reseal valves.

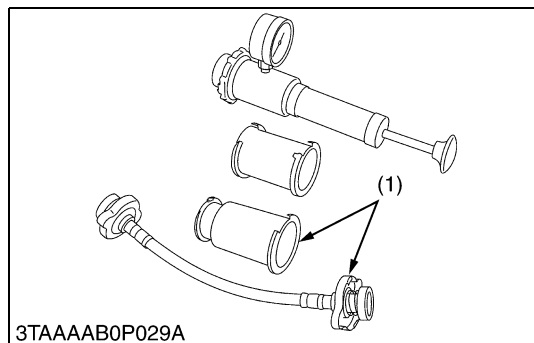
Angle

- 0.79 rad (45°)
- 0.26 rad (15°)

Diameter

- 28.6 mm (1.13 in.)
- 31.6 mm (1.24 in.)
- 35.0 mm (1.38 in.)
- 38.0 mm (1.50 in.)
- 41.3 mm (1.63 in.)
- 50.8 mm (2.00 in.)

WSM000001GEG0016US0



Radiator Tester

Application

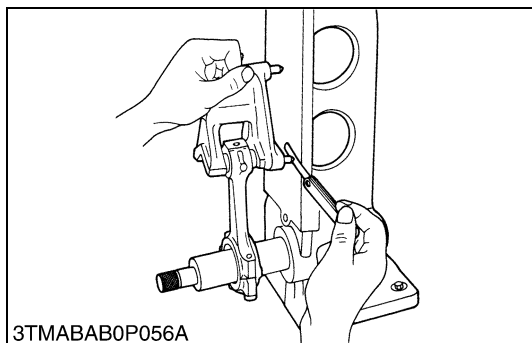
- Use to check of radiator cap pressure, and leaks from cooling system.

Remarks

- Adaptor (1) BANZAI Code No. RCT-2A-30S.

- (1) Adaptor

WSM000001GEG0017US0



Connecting Rod Alignment Tool

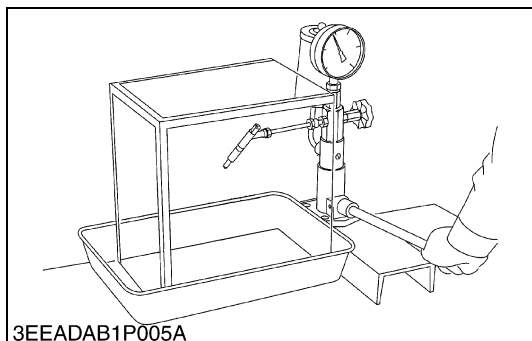
Application

- Use to check the connecting rod alignment.

Applicable range

- Connecting rod big end I.D.
30 to 75 mm dia. (1.2 to 2.9 in. dia.)
- Connecting rod length
65.0 to 300 mm (2.56 to 11.8 in.)

WSM000001GEG0020US0



Nozzle Tester

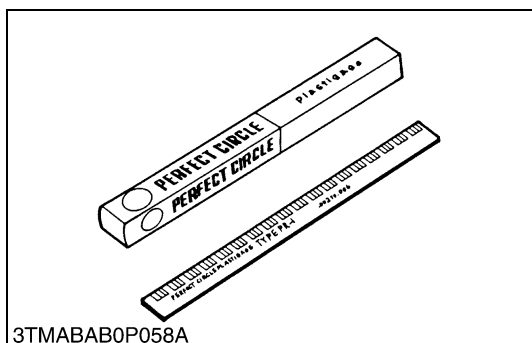
Application

- Use to check the fuel injection pressure and spray pattern of nozzle.

Measuring range

- 0 to 50 MPa (0 to 500 kgf/cm², 0 to 7200 psi)

WSM000001GEG0021US0



Plastigauge

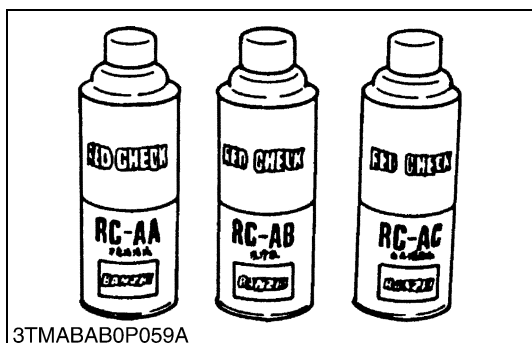
Application

- Use to check the oil clearance between crankshaft and bearing, etc..

Measuring range

- Green: 0.03 to 0.07 mm (0.001 to 0.003 in.)
- Red: 0.05 to 0.1 mm (0.002 to 0.006 in.)
- Blue: 0.1 to 0.2 mm (0.004 to 0.009 in.)

WSM000001GEG0022US0



Red Check

Application

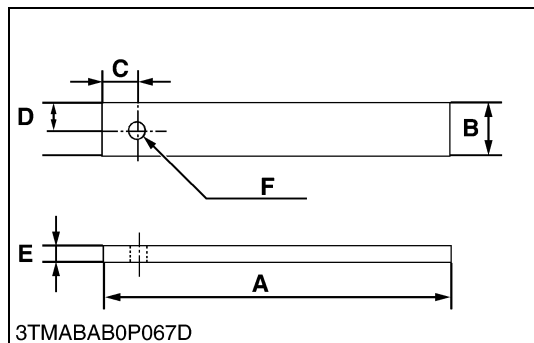
- Use to check cracks on cylinder head, cylinder block, etc..

WSM000001GEG0023US0

■ NOTE

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

9Y1210948GEG0086US0



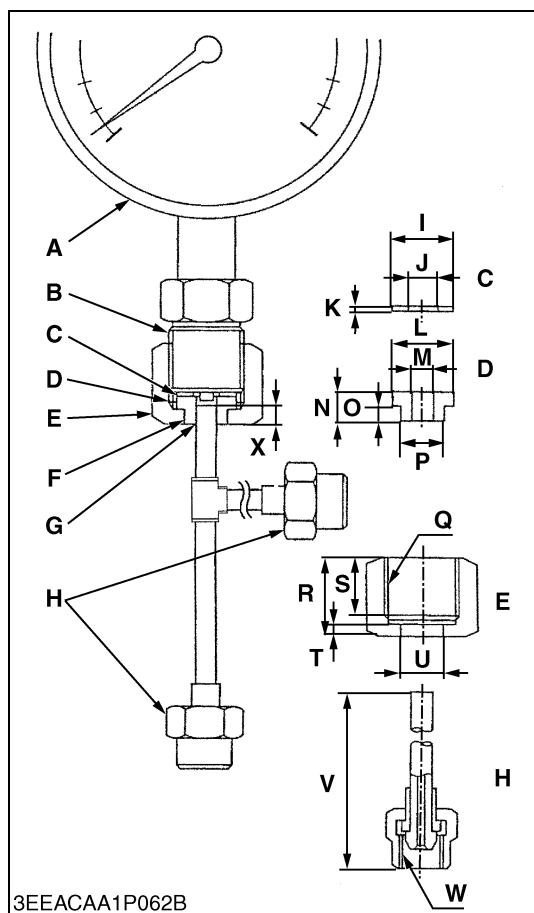
Flywheel Stopper

Application

- Use to loosen and tighten the flywheel screw.

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

9Y1210948GEG0087US0



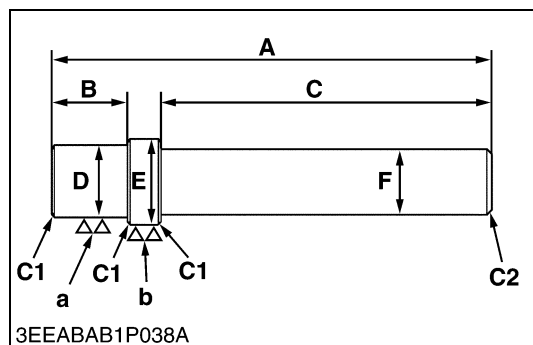
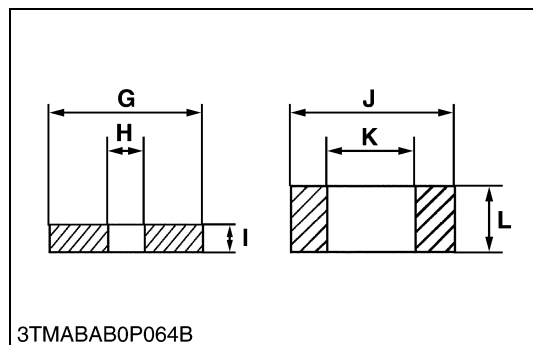
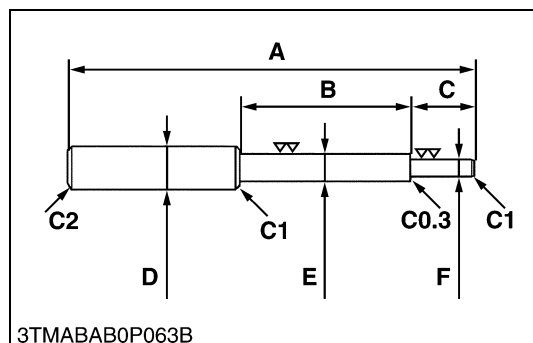
Injection Pump Pressure Tester

Application

- Use to check fuel tightness of injection pumps.

A	Pressure gauge full scale: More than 29.4 MPa (300 kgf/cm ² , 4270 psi)
B	PF 1/2
C	Copper gasket
D	Flange (Material Steel)
E	Hex. nut 27 mm (1.1 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	8.0 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. (0.241 to 0.244 in. dia.)
N	8.0 mm (0.31 in.)
O	4.0 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	4.0 mm (0.16 in.)
U	12.00 to 12.02 mm dia. (0.4725 to 0.4732 in. dia.)
V	100 mm (3.94 in.)
W	M12 × P1.5
X	5.0 mm (0.20 in.)

9Y1210948GEG0088US0



Valve Guide Replacing Tool

Application

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

A	225 mm (8.86 in.)
B	70 mm (2.8 in.)
C	45 mm (1.8 in.)
D	20 mm dia. (0.79 in. dia.)
E	11.7 to 11.9 mm dia. (0.461 to 0.468 in. dia.)
F	6.50 to 6.60 mm dia. (0.256 to 0.259 in. dia.)
G	25 mm dia. (0.98 in. dia.)
H	6.70 to 7.00 mm dia. (0.264 to 0.275 in. dia.)
I	5.0 mm (0.20 in.)
J	20 mm dia. (0.79 in. dia.)
K	12.5 to 12.8 mm dia. (0.493 to 0.503 in. dia.)
L	8.90 to 9.10 mm (0.351 to 0.358 in.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)
C0.3	Chamfer 0.30 mm (0.012 in.)

9Y1210948GEG0089US0

Bushing Replacing Tool

Application

- Use to press out and press fit the bushing.

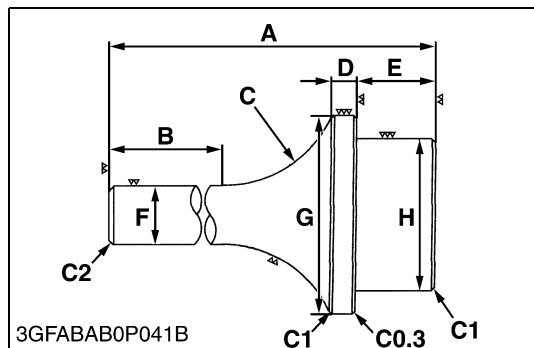
[For small end bushing]

A	157 mm (6.18 in.)
B	24 mm (0.94 in.)
C	120 mm (4.72 in.)
D	21.8 to 21.9 mm dia. (0.859 to 0.862 in. dia.)
E	24.8 to 24.9 mm dia. (0.977 to 0.980 in. dia.)
F	20 mm dia. (0.79 in. dia.)
a	6.3 μ m (250 μ in.)
b	6.3 μ m (250 μ in.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)

[For idle gear bushing]

A	196 mm (7.72 in.)
B	26 mm (1.0 in.)
C	150 mm (5.91 in.)
D	25.80 to 25.90 mm dia. (1.016 to 1.019 in. dia.)
E	28.80 to 28.90 mm dia. (1.134 to 1.137 in. dia.)
F	20 mm dia. (0.79 in. dia.)
a	6.3 μ m (250 μ in.)
b	6.3 μ m (250 μ in.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)

9Y1210948GEG0090US0



Crankshaft Bearing 1 Replacing Tool

Application

- Use to press out and press fit the crankshaft bearing 1.

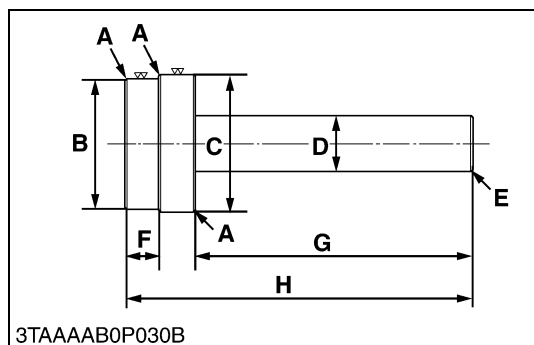
[Press Out]

A	135 mm (5.31 in.)
B	72 mm (2.8 in.)
C	40 mm radius (1.6 in. radius)
D	10 mm (0.39 in.)
E	24 mm (0.94 in.)
F	20 mm dia. (0.79 in. dia.)
G	51.20 to 51.40 mm dia. (2.016 to 2.023 in. dia.)
H	47.30 to 47.50 mm dia. (1.863 to 1.870 in. dia.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)
C0.3	Chamfer 0.30 mm (0.012 in.)

[Press Fit]

A	135 mm (5.31 in.)
B	72 mm (2.8 in.)
C	40 mm radius (1.6 in. radius)
D	10 mm (0.39 in.)
E	24 mm (0.94 in.)
F	20 mm dia. (0.79 in. dia.)
G	68 mm dia. (2.7 in. dia.)
H	47.30 to 47.50 mm dia. (1.863 to 1.870 in. dia.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)
C0.3	Chamfer 0.30 mm (0.012 in.)

9Y1210948GEG0091US0



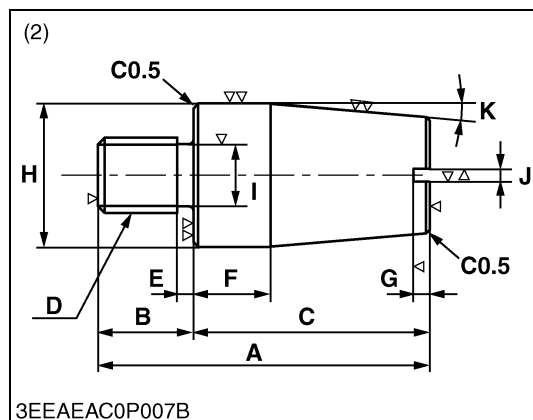
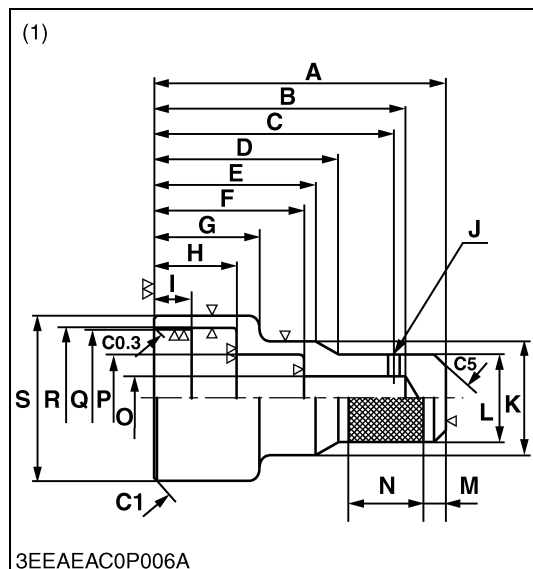
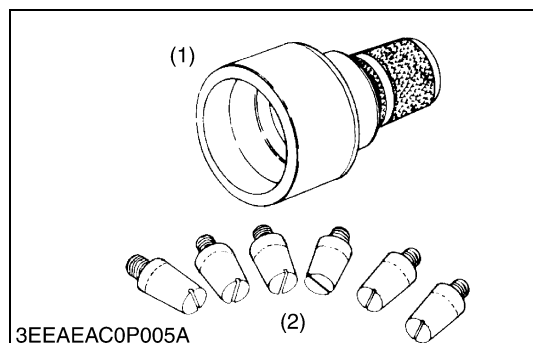
Governor Gear Holder Bushing Replacing Tool

Application

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

A	C1: Chamfer 1.0 mm (0.039 in.)
B	73.90 to 74.00 mm dia. (2.910 to 2.913 in. dia.)
C	69.80 to 69.90 mm dia. (2.748 to 2.751 in. dia.)
D	30 mm dia. (1.2 in. dia.)
E	C2: Chamfer 2.0 mm (0.079 in.)
F	18 mm (0.71 in.)
G	150 mm (5.91 in.)
H	188 mm (7.40 in.)

9Y1210948GEG0092US0



Crank Sleeve Setter

Application

- Use to fix the crankshaft sleeve.

(1) Auxiliary Socket for Pushing

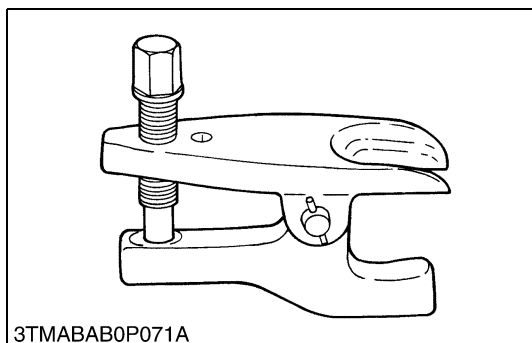
A	130 mm (5.12 in.)
B	112 mm (4.41 in.)
C	107 mm (4.21 in.)
D	82 mm (3.2 in.)
E	72 mm (2.8 in.)
F	67 mm (2.6 in.)
G	47 mm (1.8 in.)
H	36.00 to 36.20 mm (1.418 to 1.425 in.)
I	17 mm (0.67 in.)
J	5.0 mm dia. (0.20 in. dia.)
K	52 mm dia. (2.0 in. dia.)
L	40 mm dia. (1.6 in. dia.)
M	10 mm (0.39 in.)
N	33 mm (1.3 in.)
O	20 mm dia. (0.79 in. dia.)
P	40 mm dia. (1.6 in. dia.)
Q	72.10 to 72.15 mm dia. (2.839 to 2.840 in. dia.)
R	73 mm dia. (2.9 in. dia.)
S	83 mm dia. (3.3 in. dia.)
C0.3	Chamfer 0.30 mm (0.012 in.)
C1	Chamfer 1.0 mm (0.039 in.)
C5	Chamfer 5.0 mm (0.20 in.)

(2) Sleeve Guide

A	42 mm (1.7 in.)
B	12 mm (0.47 in.)
C	30 mm (1.2 in.)
D	M10 × Pitch 1.25
E	2.0 mm (0.079 in.)
F	10 mm (0.39 in.)
G	2.0 mm (0.079 in.)
H	17.90 to 17.95 mm dia. (0.7048 to 0.7066 in. dia.)
I	8.0 mm dia. (0.31 in. dia.)
J	1.8 mm (0.071 in.)
K	0.09 rad (5°)
C0.5	Chamfer 0.5 mm (0.02 in.)

9Y1210948GEG0093US0

[2] SPECIAL TOOLS FOR MACHINE



3TMABAB0P071A

Tie-rod End Lifter

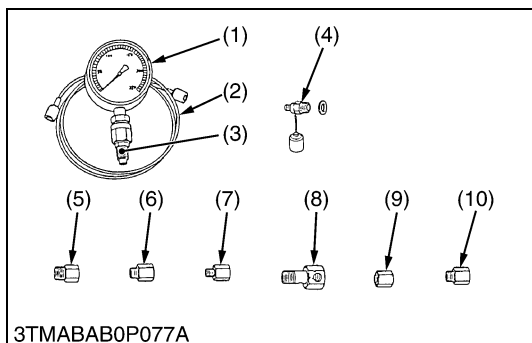
Code No.

- 07909-39051

Application

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

WSM000001GEG0029US0



3TMABAB0P077A

Relief Valve Pressure Tester

Code No.

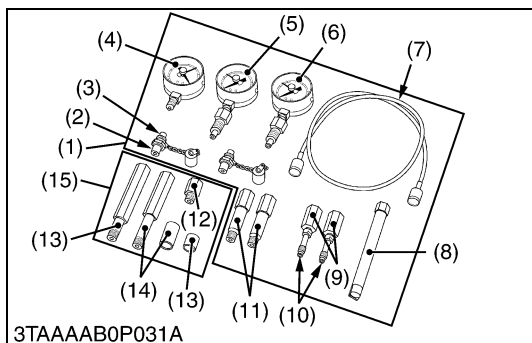
- 07916-50045

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



3TAAAB0P031A

Hydrostatic Transmission Tester and HST Adaptor Set

Code No.

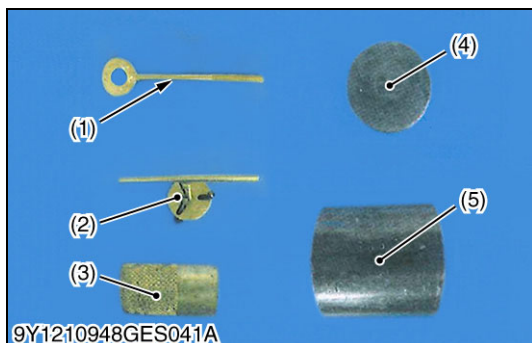
- 07916-52040 (Hydrostatic Transmission Tester)
- 07916-53072 (HST Adaptor Set)

Application

- This allows easy measurement of hydrostatic transmission pressure.

- | | |
|--|---|
| (1) Hydrostatic Transmission Tester (07916-52040) | (8) Valve Seat Driver (07916-60841) |
| (2) Gasket (04714-00200) | (9) Connector 1 (07916-60811) |
| (3) Connector 3 (07916-51331) | (10) Connector 2 (07916-60821) |
| (4) Vacuum Gauge (07916-51331) | (11) Long Connector (07916-60831) |
| (5) Pressure Gauge (Low Pressure) (07916-51301) | (12) Adaptor 1 (07916-52621) |
| (6) Pressure Gauge (High Pressure) (in Relief Valve Set Pressure Tester) (07916-50321) | (13) Adaptor 2 with Collar (07916-52632) |
| (7) HN Tube (in Relief Valve Set Pressure Tester) (07916-50331) | (14) Adaptor 3 with Collar (07916-52642) |
| | (15) HST Adaptor Set (07916-53072) |

WSM000001GEG0104US0



9Y1210948GES041A

Compressor Magnet Clutch Tool

Code No.

- SANDEN 2127
- SANDEN 2023
- SANDEN 2081
- SANDEN 2143A
- SANDEN CLJIGU-009

Application

- Use to loosen and tighten the magnet clutch.

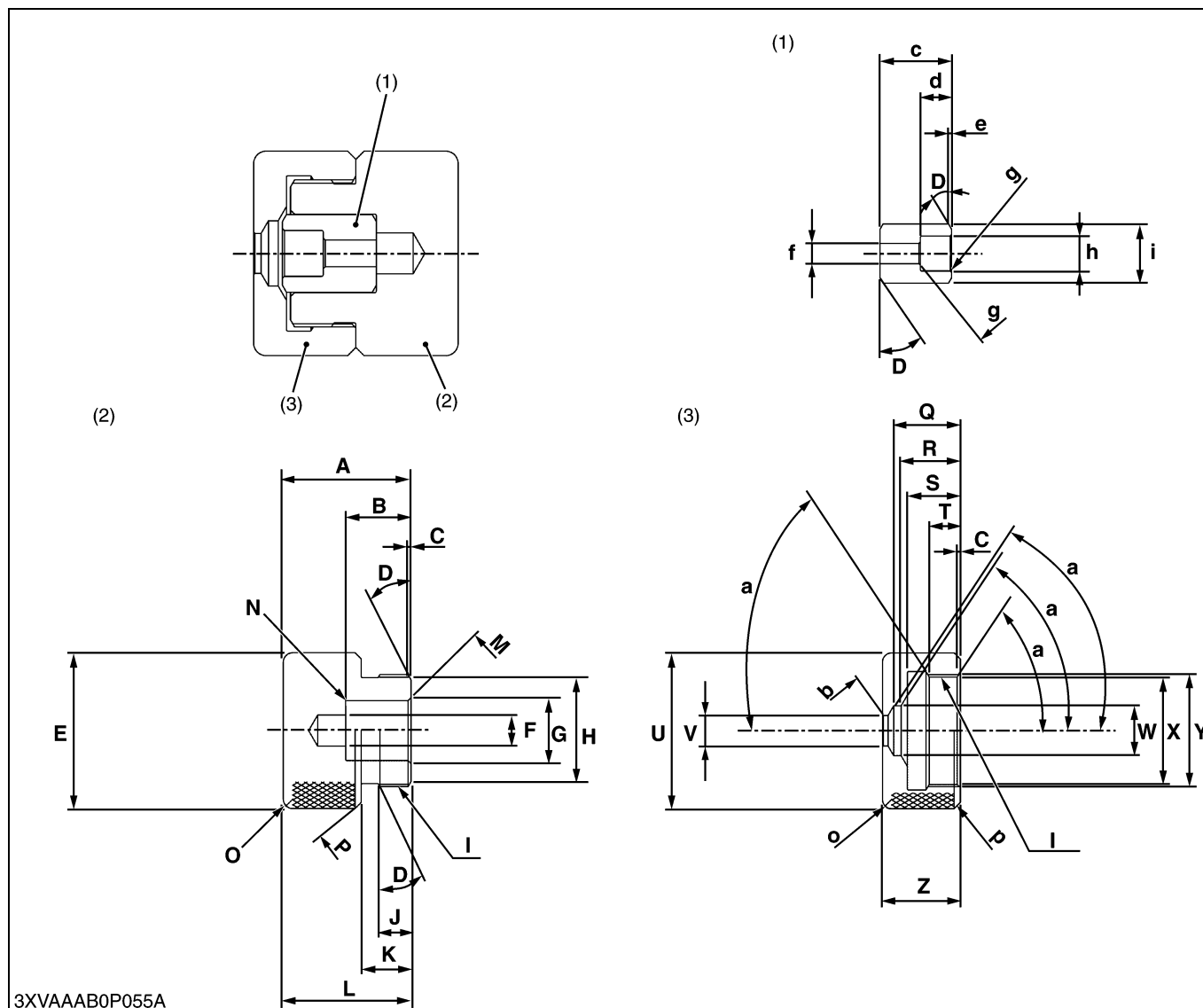
- | | |
|----------------------------|-------------------------------|
| (1) Armature Plate Spanner | (4) Rotor Puller Set |
| (2) Armature Plate Puller | (5) Rotor Installation Driver |
| (3) Armature Driver | |

9Y1210948GES0110US0

Check and High Pressure Relief Valve Assembly Tool

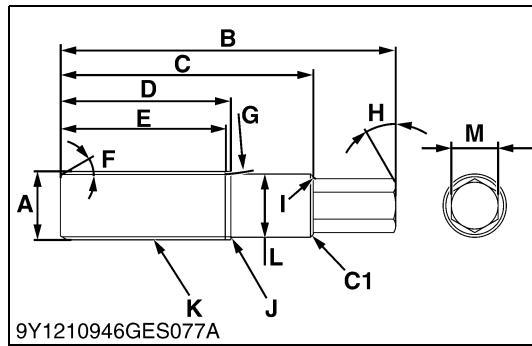
Application

- Use for Readjusting relief valve pressure.



A	30 mm (1.181 in.)	N	Chamfer 0.4 mm (0.157 in.)	a	1.05 rad (10°)
B	21 mm (0.827 in.)	O	Chamfer 3 mm (0.118 in.)	b	Chamfer 0.3 mm (0.012 in.)
C	1 mm (0.039 in.)	P	Chamfer 2 mm (0.079 in.)	c	23 mm (0.906 in.)
D	0.52 rad (30°)	Q	21.4 mm (0.843 in.)	d	10 mm (0.394 in.)
E	50 mm dia. (1.969 in. dia.)	R	19 mm (0.748 in.)	e	1 mm (0.039 in.)
F	10 mm dia. (0.394 in. dia.)	S	17 mm (0.669 in.)	f	6.5 mm (0.256 in.)
G	9.1 to 9.3 mm dia. (0.359 to 0.366 in.)	T	10 mm (0.393 in.)	g	Chamfer 0.5 mm (0.020 in.)
H	34 mm dia. (1.336 in. dia.)	U	50 mm dia. (1.969 in. dia.)	h	11.1 to 11.3 mm (0.437 to 0.445 in.)
I	M36 × 1.5 mm Pitch	V	9.8 mm dia. (0.386 in. dia.)	i	18.8 to 19.0 mm (0.740 to 0.748 in.)
J	10 mm (0.394 in.)	W	16 mm dia. (0.629 in. dia.)		
K	16 mm (0.630 in.)	X	34.5 mm dia. (1.358 in. dia.)	(1)	Spacer
L	41 mm (1.614 in.)	Y	38 mm dia. (1.496 in. dia.)	(2)	Block
M	Chamfer 1 mm (0.039 in.)	Z	25 mm (0.984 in.)	(3)	Cap

9Y1210948GEG0095US0



Differential Jig

Application

- Use for checking backlash and gear and spiral bevel pinion shaft.

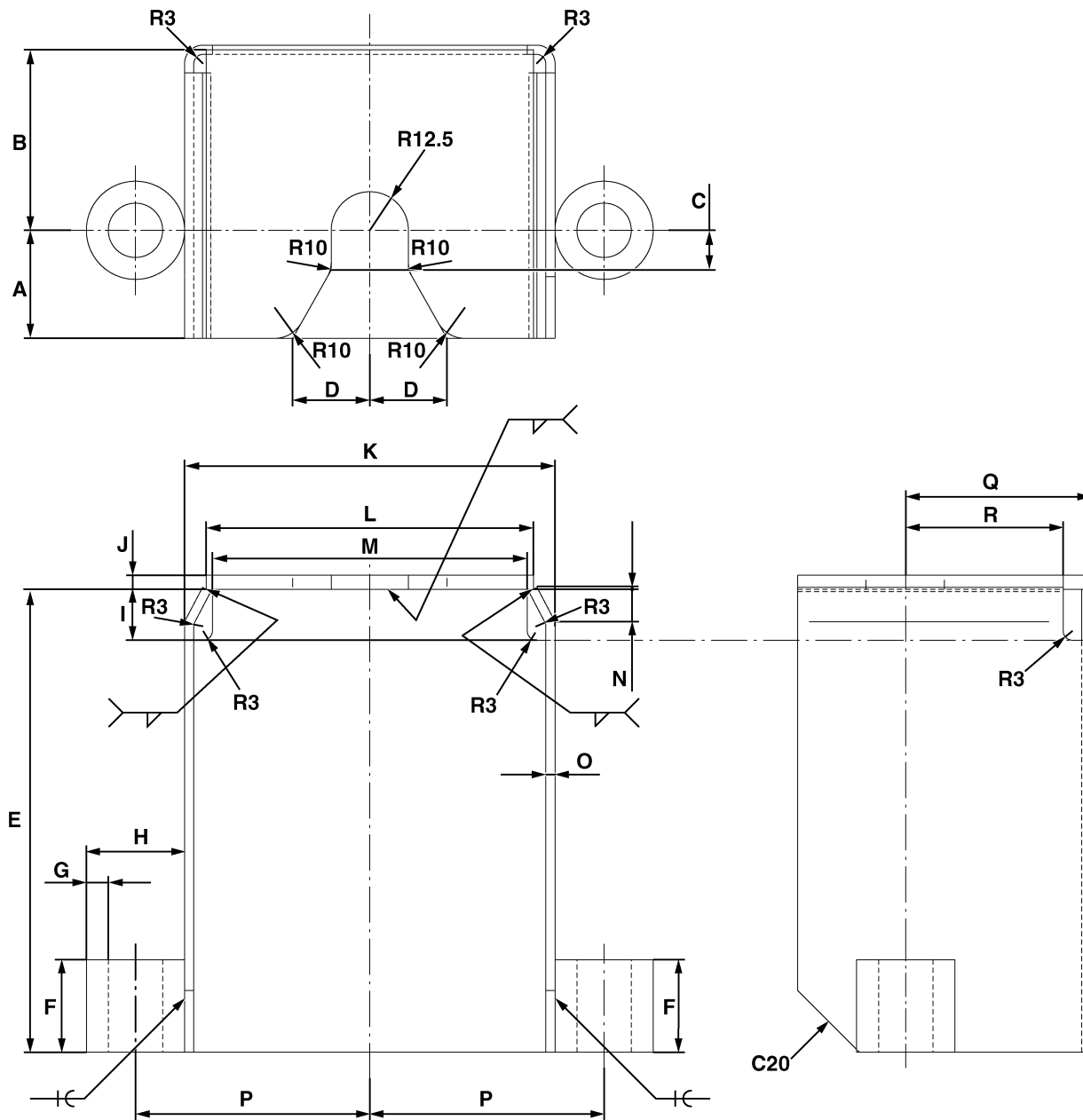
A	24.65 to 24.80 mm dia. (0.970 to 0.976 in. dia.)
B	122 mm (4.80 in.)
C	92.0 mm (3.62 in.)
D	62.0 mm (2.44 in.)
E	60.0 mm (2.36 in.) full spline
F	0.52 rad (30°)
G	60.0 mm dia. (2.36 in. dia.)
H	0.52 rad (30°)
I	0.4 mm (0.016 in.)
J	080 mm (0.031 in.)
K	Involute spline (refer to below)
L	23.0 mm dia. (0.906 in. dia.)
M	16.75 to 17.00 mm Hex. (0.6595 to 0.6692 in. Hex.)
C1	Chamfer 1.0 mm (0.039 in.)

(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	26.454 to 26.541 mm (1.0415 to 1.0449 in.) (Pin diameter = 1.8 mm (0.071 in.))

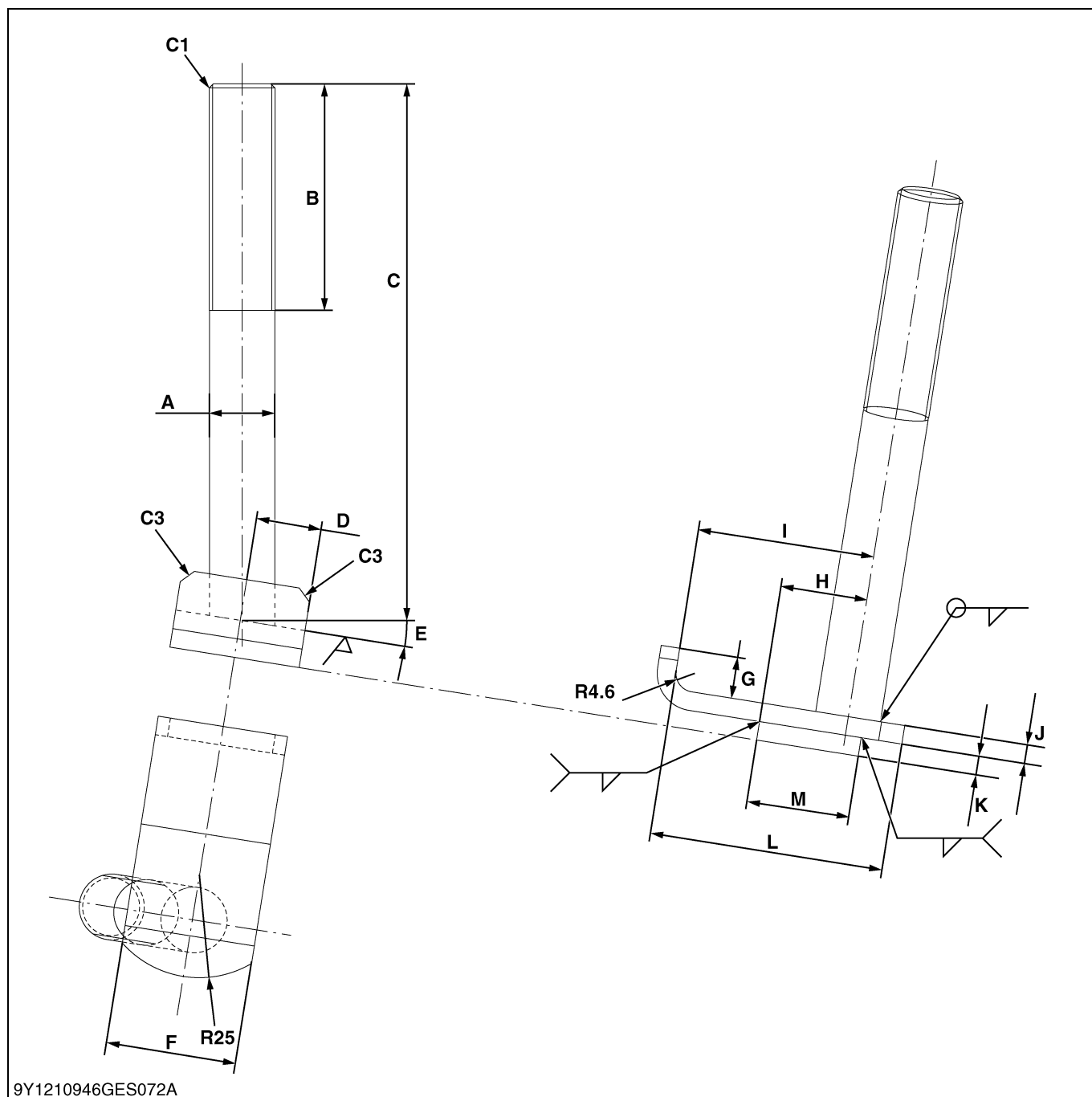
9Y1210948GEG0096US0

Rear Shock Absorber Spring Compressor 1

9Y1210946GES071A

A	35 mm (1.4 in.)	I	16.5 mm (0.65 in.)	Q	60 mm (2.4 in.)
B	58.5 mm (2.3 in.)	J	4.6 mm (0.18 in.)	R	51 mm (2.0 in.)
C	13 mm (0.51 in.)	K	120 mm (4.72 in.)	R3	Radius 3.0 mm (0.12 in.)
D	25 mm (0.98 in.)	L	106 mm (4.17 in.)	R10	Radius 10 mm (0.39 in.)
E	150 mm (5.91 in.)	M	102 mm (4.02 in.)	R12.5	Radius 12.5 mm (0.492 in.)
F	30 mm (1.2 in.)	N	10.5 mm (0.413 in.)	C20	Chamfer 20 mm (0.79 in.)
G	7.1 mm (0.28 in.)	O	3.0 mm (0.12 in.)		
H	31.8 mm dia. (1.25 in. dia.)	P	76 mm (3.0 in.)		

9Y1210948GEG0097US0

Rear Shock Absorber Spring Compressor 2

A	15.9 mm dia. (0.626 in. dia.)	G	10 mm (0.39 in.)	M	25 mm (0.98 in.)
B	70 mm (2.8 in.)	H	21 mm (0.83 in.)	C1	Chamfer 1.0 mm (0.039 in.)
C	130.4 mm (5.134 in.)	I	43 mm (1.7 in.)	C3	Chamfer 3.0 mm (0.12 in.)
D	15.9 mm (0.626 in.)	J	4.6 mm (0.18 in.)	R4.6	Radius 4.6 mm (0.18 in.)
E	0.2 rad (9°)	K	4.6 mm (0.18 in.)	R25	Radius 25 mm (0.98 in.)
F	31.8 mm (1.25 in.)	L	57 mm (2.2 in.)		

9Y1210948GEG0098US0

9. TIRES



WARNING

To avoid serious injury:

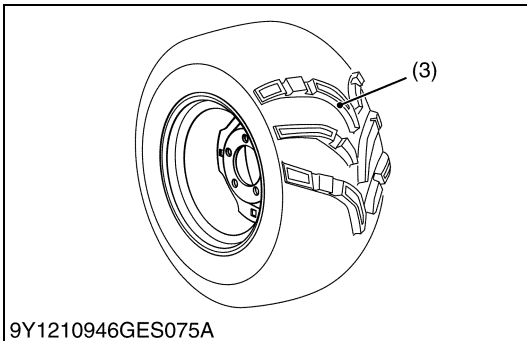
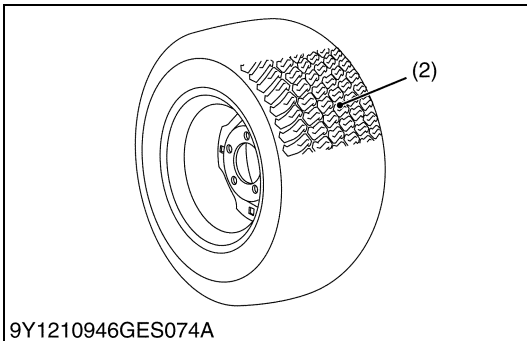
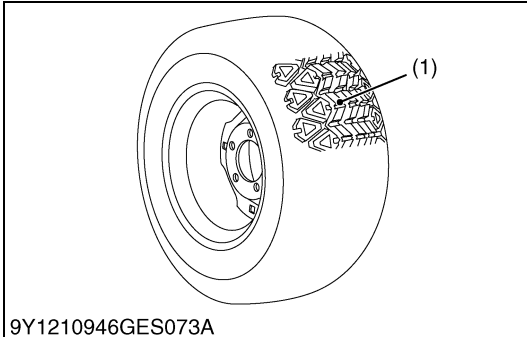
- Do not attempt to mount a tire on a rim. This should be done by a qualified person with the proper equipment.
- Always maintain the correct tire pressure.

■ IMPORTANT

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

9Y1210948GEG0099US0

[1] TYPE OF TIRES

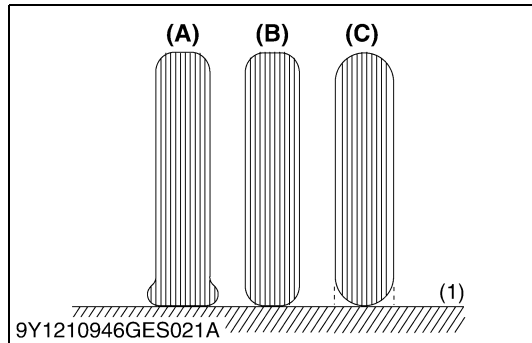


Tire Type and Use

- | | |
|-------------------------------|------------------------------|
| (1) Heavy Duty Work Site Tire | (3) All Terrain Vehicle Tire |
| (2) Turf Tire | |

9Y1210948GEG0100US0

[2] TIRE PRESSURE



Checking Tire Inflation Pressure

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

Tire sizes	Inflation Pressure
25 × 10 - 12 HDWS, Front and Rear	140 kPa (1.4 kgf/cm ² , 20 psi)
25 × 12 - 12 Turf, Front and Rear	
25 × 10 - 12 ATV, Front and Rear	

(1) Ground

(A) Insufficient

(B) Normal

(C) Excessive

9Y1210948GEG0101US0

[3] VEHICLE LIMITATIONS

The KUBOTA Vehicle has been thoroughly tested for proper performance with implements sold or approved by KUBOTA. Use with implements which are not sold or approved by KUBOTA and which exceed the maximum specifications listed below, or which are otherwise unfit for use with the KUBOTA Vehicle may result in malfunctions or failures of the vehicle, damage to other property and injury to the operator or others. [Any malfunctions or failures of the vehicle resulting from use with improper implements are not covered by the warranty.]

9Y1210948GEG0102US0

Cargo bed	Rear trailer hitch		Front trailer hitch	
Max. Cargo loading weight W1 should not exceed "CBC" and "PCL". PCL (Permissible Cargo load) is determined by the following calculus equation. PCL = PC - (operator + passenger + option + accessory + cabin) weight CBC (Cargo bed capacity): 500 kg (1100 lbs) PC: Payload Capacity option: option accessory: accessory	Max. rolling weight W2	Max. tongue weight W3	Max. rolling weight W4	Max. tongue weight W5
	590 kg (1300 lbs)	50 kg (110 lbs)	295 kg (650 lbs)	50 kg (110 lbs)

9Y1210948GES040A

9Y1210948GEG0103US0

[Payload Capacity (PC)]

Model	RTV-X1100C
Payload capacity	739 kg (1629 lbs)
Rolling weight	Trailer weight + Trailer load

■ NOTE

- Above mentioned specifications are based on level ground condition.

9Y1210948GEG0104US0

[4] CARGO BED

General Caution



WARNING

To avoid serious injury:

- Never carry passengers in the cargo bed. They can be tossed about or even thrown off causing serious injury or death.
- Never raise the cargo bed when it is loaded. (There is an exception. Only the vehicle equipped with hydraulic dump may do this operation at operator's seat after appropriate confirmation of safety.)
- Driving with the cargo bed tilted may be hazardous.
Always lower the bed and lock the hydraulic lift cylinder lever (if hydraulic dump is equipped) or latch the bed (if hydraulic dump is not equipped) before driving.
- Be careful not to put any part of your body, such as hands or arms, between the bed and vehicle.
- Drive slowly when it is loaded.

9Y1210948GEG0105US0

Max. Cargo Load

Never carry loads exceeding cargo bed capacity and the Permissible Cargo Load (PCL).

PCL = PC - (operator + passenger + option + accessory + cabin) weight

CBC (Cargo bed capacity): 500 kg (1100 lbs)

PC: Payload Capacity

OP: Operator

PA: Passenger

option: option

accessory: accessory

cabin: 125 kg (275 lbs)

[Payload Capacity (PC)]

Model	RTV-X1100C
Payload capacity	739 kg (1629 lbs)

9Y1210948GEG0106US0

[Quick Reference Table for Cargo Load]

Model		Occupant *1	Option + Accessory (W)	Cargo bed capacity	Permissible cargo load
RTV-X1100C	Worksite model	(OP) 95 kg (209 lbs)	Blade weight+ Winch weight+ other option and accessory weight	500 kg (1100 lbs)	644 kg (1420 lbs) - (W)
		(OP) 95 kg (209 lbs) + (PA) 95 kg (209 lbs) = 190 kg (418 lbs)			549 kg (1210 lbs) - (W)

*1: The calculation was made provided that the operator and the passenger weigh 95 kg (209 lbs) each.

■ IMPORTANT

- Cargo load should not exceed Cargo bed capacity and Permissible cargo load.

9Y1210948GEG0107US0

[5] SHOCK ABSORBERS**Shock Absorber Spring Adjustment****WARNING**

To avoid serious injury:

- For shock absorber spring adjustment. (See page 3-S3, 5-S5.)

The front and rear shock absorber springs can be adjusted for different riding and loading condition.

Position	Spring	Load
1	Stronger	Heavy
2	↑	↑
3 (default)	I	I
4	↓	↓
5	Weaker	Light

9Y1210948GEG0108US0

1 ENGINE

MECHANISM

CONTENTS

1. ENGINE BODY	1-M1
[1] CLOSED BREATHER	1-M1
[2] GOVERNOR.....	1-M2
2. LUBRICATING SYSTEM.....	1-M4
3. COOLING SYSTEM	1-M5
4. FUEL SYSTEM.....	1-M6

1. ENGINE BODY

[1] CLOSED BREATHER

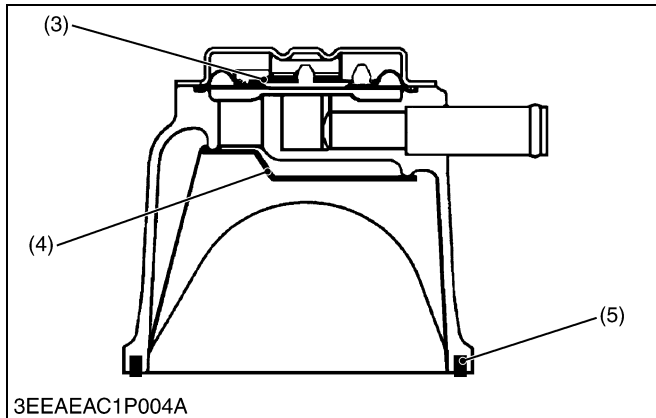


Closed breather system has been adopted to prevent the release of blow-by gas into the atmosphere.

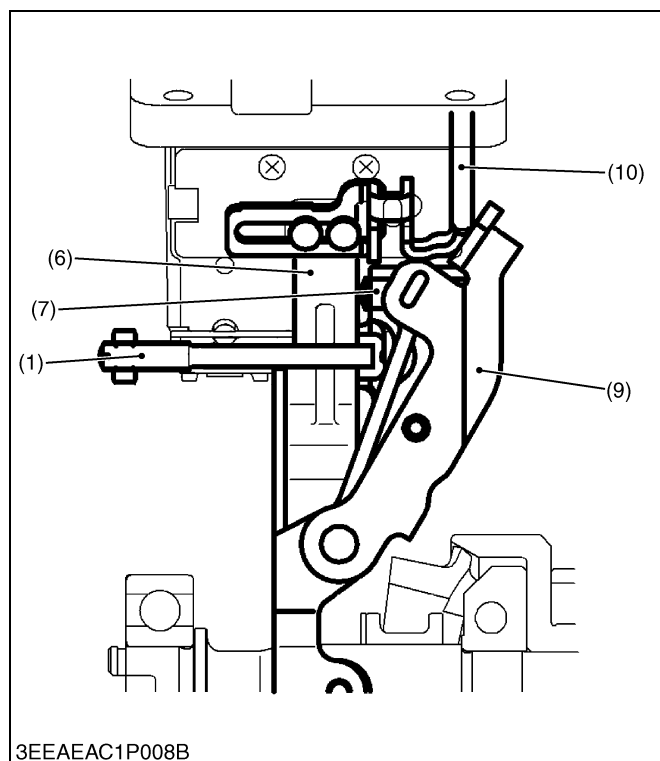
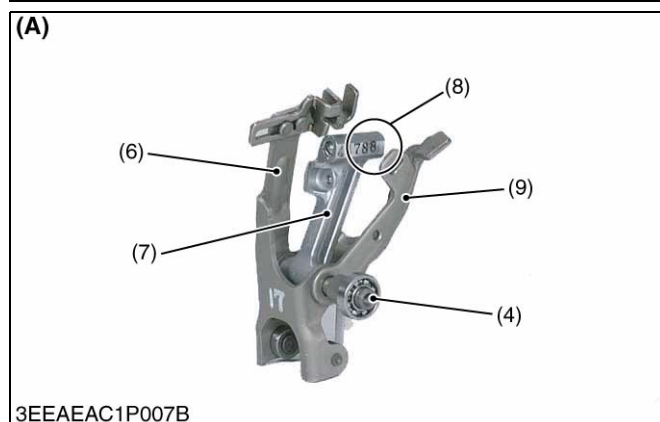
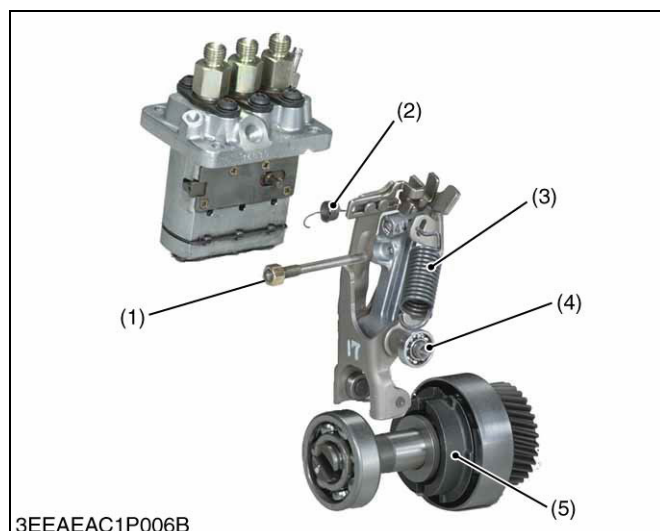
After its oil content is filtered by oil shield (4), the blow by gas is fed back to the intake manifold through breather valve (3) to be used for re-combustion.

- | | |
|-------------------------|--------------------|
| (1) Breather Tube | (4) Oil Shield |
| (2) Cylinder Head Cover | (5) Rubber Packing |
| (3) Breather Valve | |

9Y1210946ENM0009US0



[2] GOVERNOR



Three Lever Type Fork Lever (for standard type)

The governor system is a mechanical governor that used the flyweight (5).

The flyweight (5) is mounted on the governor shaft that rotates at the same speed as the crankshaft.

Because the feature of this mechanism removes the engine speed directly as a centrifugal force of weight, the speed control that the change in the engine rotational speed is sensitively transmitted to fork lever assembly (A) and accuracy is high is enabled.

The fork lever assembly of this engine consists of fork lever 1 (6), for lever 2 (9), and the floating lever (7). A slide plate is installed in fork lever 1. The governor spring (3) is hooked to fork lever 2 (9).

The floating lever (7) installs the torque pin (8) of the output drop prevention at the overload. The start spring (2) is hooked to a slide plate, and holds the control rack in the direction of the full fuel position.

Fork lever 2 (9) and the floating lever are installed in fork lever 1 (6) with the fork lever shaft (4). The max torque limitation (1) device limits the amount of the fuel injection at the overload with the torque pin.

- | | |
|------------------------|--------------------|
| (1) Max Torque Limiter | (7) Floating Lever |
| (2) Start Spring | (8) Torque Pin |
| (3) Governor Spring | (9) Fork Lever 2 |
| (4) Fork Lever Shaft | |
| (5) Flyweight | |
| (6) Fork Lever 1 | |

(A) Fork Lever Assembly

9Y1210946ENM0010US0

(At Rated Operation)

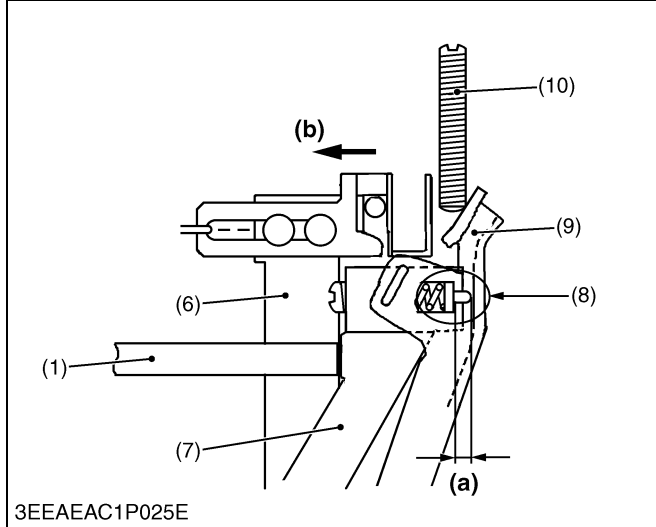
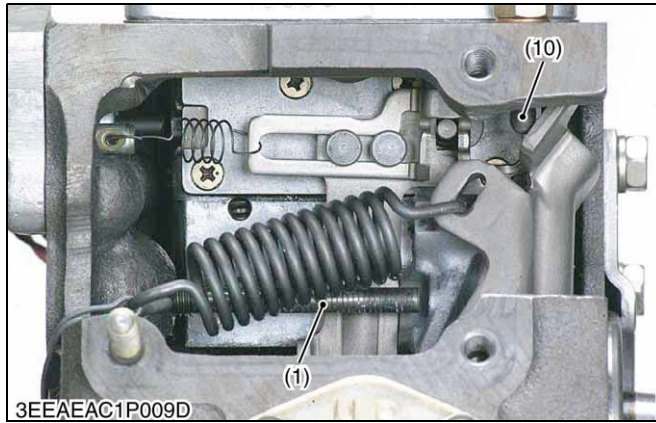
When the engine is operating, the fork lever 2 (9) and the floating lever (7) are moving with the fork lever 1 (6) due to the tension of the governor spring (3).

During the time, the torque pin (8) is pressed into the floating lever by centrifugal force of the governor weight (5).

The fork lever 2 (9) comes in contact with the fuel limitation bolt (10), and the fuel injection pump supplies a fuel necessary for rated operation.

- | | |
|------------------------|---------------------------|
| (1) Max Torque Limiter | (9) Fork Lever 2 |
| (6) Fork Lever 1 | (10) Fuel Limitation Bolt |
| (7) Floating Lever | |

9Y1210946ENM0011US0



(Overloaded Operation)

The amount of the movement of the fork lever assembly is limited with the fuel limitation bolt (10) and can not be moved in the direction of the fuel increase.

As overload reduces the centrifugal force of the governor weight, which is pressing the torque pin (8) into the floating lever (7), the floating lever pushes the fork lever 1 (6) in the way to increase the fuel supply with the help of the torque spring tension.

The fuel supply increases **(b)** in relation to the degree of the torque pin motion, thus preventing the engine speed from dropping.

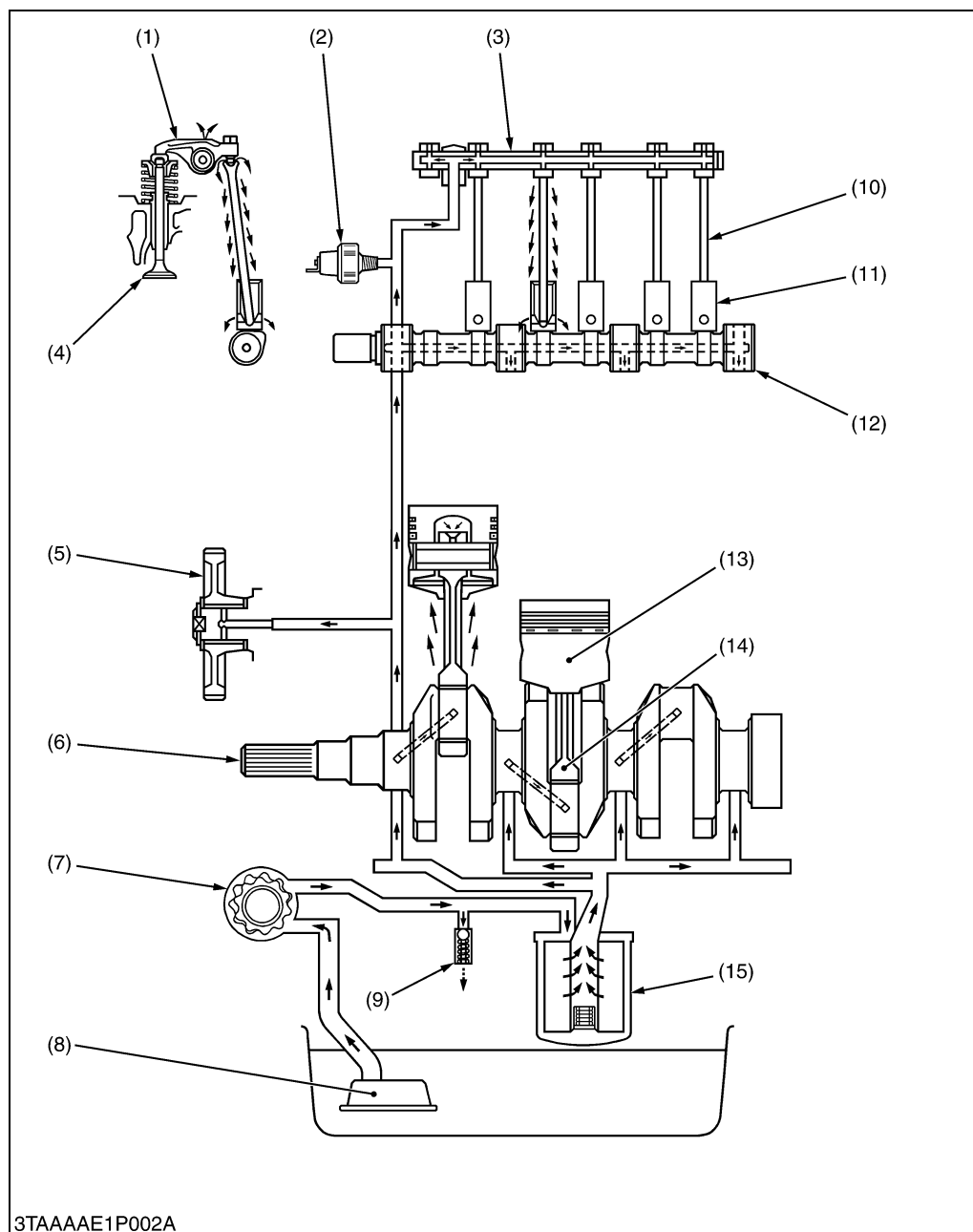
At the time, the maximum torque limiter (1) prevents superfluous fuel supply and suppresses the generation of black smoke.

- (1) Max Torque Limiter
- (6) Fork Lever 1
- (7) Floating Lever
- (8) Torque Pin
- (9) Fork Lever 2
- (10) Fuel Limitation Bolt

- (a) Distance to which torque pin (8) pushes fork lever 1 (6) out
- (b) Increase of fuel

9Y1210946ENM0012US0

2. LUBRICATING SYSTEM



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

3TA00001P002A

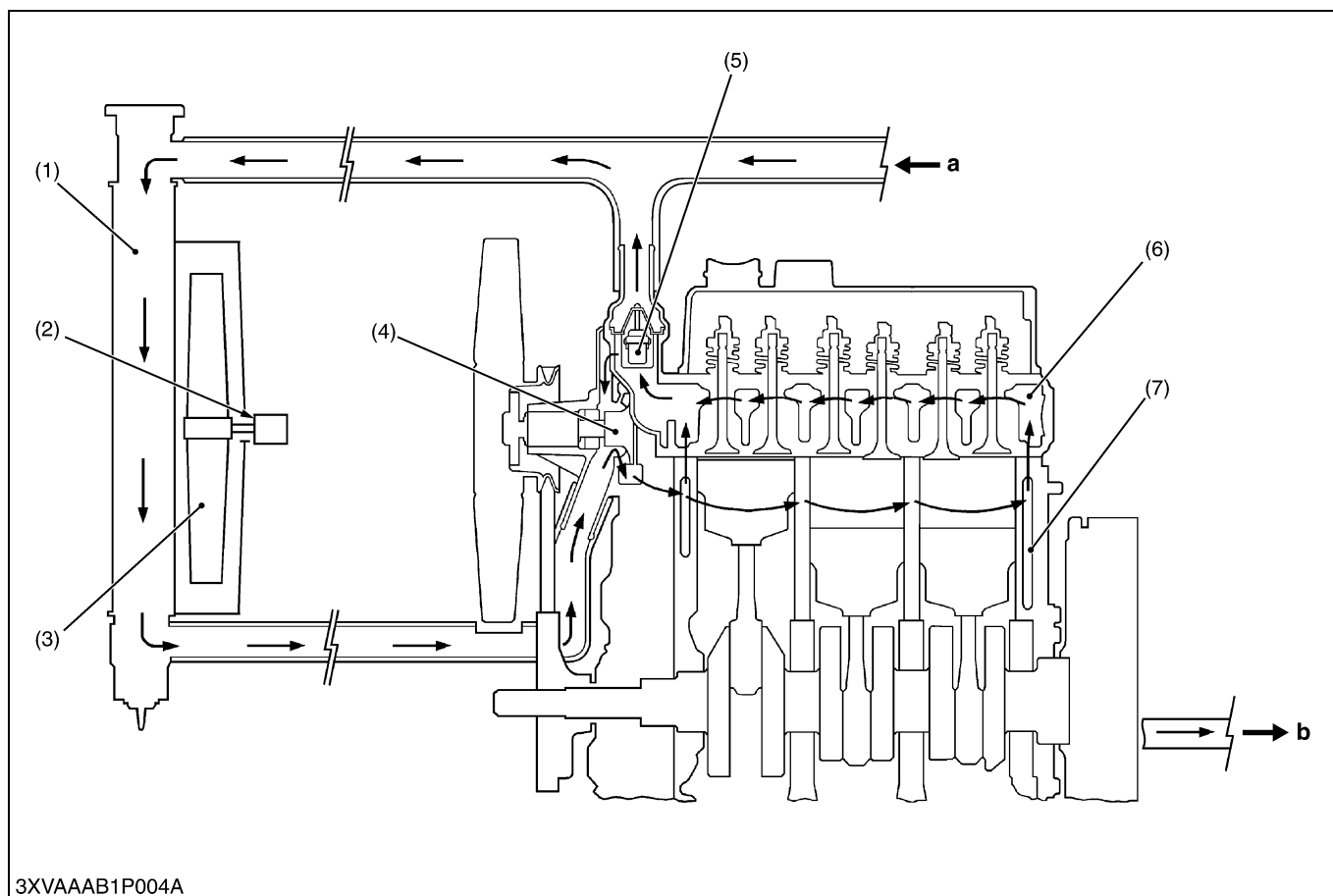
This engine's lubricating system consists of oil strainer (8), oil pump (7), relief valve (9), oil filter cartridge (15) and oil pressure switch (2).

The oil pump sucks lubricating oil from the oil pan through the oil strainer and the oil flows down to the filter cartridge, where it is further filtered. Then the oil is forced to crankshaft (6), connecting rods (14), idle gear (5), camshaft (12) and rocker arm shaft (3) to lubricate each part.

Some part of oil, splashed by the crankshaft or leaking and dropping from gaps of each part, lubricates these parts: piston (13), cylinders, small ends or connecting rods, tappets (11), push rods (10), inlet and exhaust valves (4) and timing gears.

9Y1210946ENM0005US0

3. COOLING SYSTEM



- (1) Radiator
- (2) Fan Drive Motor
- (3) Radiator Fan

- (4) Water Pump
- (5) Thermostat

- (6) Cylinder Head
- (7) Cylinder Block

a: From Transmission Oil Cooler

b: To Transmission Oil Cooler

The cooling system consists of a radiator (1), a radiator fan (3), a centrifugal water pump (4) and a thermostat (5). The coolant is cooled through the radiator core.

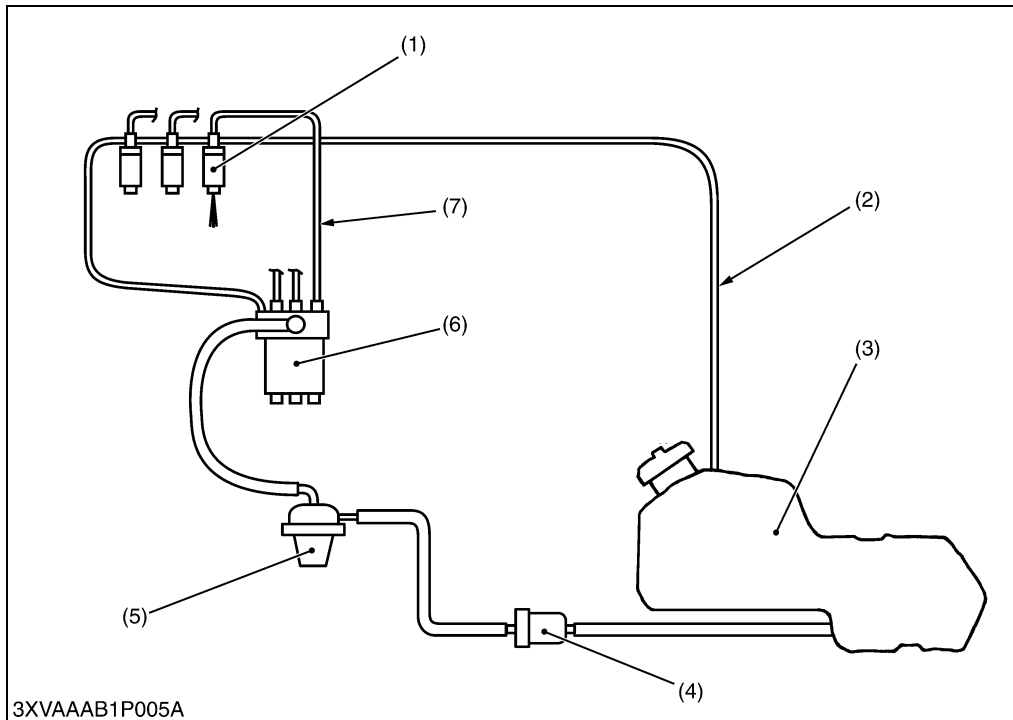
The radiator fan (3) is driven by the fan drive motor (2). The motor (2) moves or stops according to the coolant temperature. When the coolant temperature is high, the motor moves to pull cooling air to the radiator core. When the coolant temperature is low, the motor stops.

The water pump (4) receives coolant from the radiator or from the cylinder head, and forces it into the cylinder block (7). And the coolant flows to the transmission oil cooler through cylinder block (7).

The thermostat (5) opens or closes according to the coolant temperature. When the coolant temperature is high, the thermostat opens to allow the water to flow from the cylinder head to the radiator. When the coolant temperature is low, the thermostat closes to flow the coolant only to the water pump.

9Y1210946ENM0007US0

4. FUEL SYSTEM



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

Fuel from the fuel tank (3) passes through the fuel filter (4), and then enters the injection pump (6) after impurities such as dirt, water, etc. are removed.

The fuel pressurized by the injection pump to the opening pressure (13.73 to 14.71 MPa, 140 to 150 kgf/cm², 1990 to 2133 psi), of the injection nozzle (1) is injected into the combustion chamber.

Part of the fuel fed to the injection nozzle (1) lubricates the moving parts of the needle valve inside the nozzle, then returns to the fuel tank through the fuel overflow pipe (2) from the upper part of the nozzle holder.

9Y1210946ENM0008US0

SERVICING

CONTENTS

1. TROUBLESHOOTING.....	1-S1
2. SERVICING SPECIFICATIONS	1-S4
[1] Engine Body	1-S4
[2] Lubricating System	1-S7
[3] Cooling System	1-S8
[4] Fuel System.....	1-S8
3. TIGHTNING TORQUES	1-S9
[1] GENERAL	1-S9
[2] ENGINE BODY	1-S9
4. CHECKING, DISASSEMBLING AND SERVICING	1-S10
[1] CHECKING AND ADJUSTING	1-S10
(1) Engine Body	1-S10
(2) Lubricating System	1-S13
(3) Cooling System	1-S16
(4) Fuel System.....	1-S18
[2] PREPARATION	1-S20
(1) Dismounting Transmission and Engine	1-S20
(2) Separating Transmission Engine.....	1-S32
[3] DISASSEMBLING AND ASSEMBLING	1-S35
(1) Cylinder Head and Valve.....	1-S35
(2) Gear Case and Timing Gears.....	1-S38
(3) Piston and Connecting Rod.....	1-S42
(4) Flywheel and Crankshaft.....	1-S44
5. SERVICING	1-S46
[1] Cylinder Head and Valves	1-S46
[2] Timing Gears, Camshaft and Governor Gear.....	1-S52
[3] Piston and Connecting Rod.....	1-S55
[4] Crankshaft	1-S57
[5] Cylinder	1-S62
[6] Oil Pump	1-S63

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	No fuel	Fill fuel	G-8
	Air in the fuel system	Bleed	G-58
	Water in the fuel system	Change fuel and repair or replace fuel system	G-38
	Fuel pipe clogged	Clean	G-38
	Fuel filter clogged	Change	G-38
	Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	G-8, G-10, G-11
	Fuel with low cetane number	Use specified fuel	G-8, G-10, G-11
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S35
	Incorrect injection timing	Adjust	1-S18
	Fuel camshaft worn	Replace	1-S41
	Injection nozzle clogged	Repair or replace	1-S14
	Injection pump malfunctioning	Replace	1-S40
	Seizure of crankshaft, camshaft, piston, cylinder or bearing	Replace	1-S42, 1-S44
	Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S11, 1-S37
	Improper valve timing	Correct or replace timing gear	1-S41
	Piston ring and cylinder worn	Replace	1-S43, 1-S62
	Excessive valve clearance	Adjust	1-S12
	Engine stop solenoid malfunctioning	Replace	8-S13
Starter Does Not Operate	Battery discharged	Charge	8-S8
	Starter malfunctioning	Repair or replace	8-S11
	Key switch malfunctioning	Repair or replace	8-S9
	Safety switch malfunctioning	Adjust or replace	8-S12
	Wiring disconnected	Connect	8-M1, 8-M3
Engine Revolution Is Not Smooth	Fuel filter clogged or dirty	Replace	G-38
	Air cleaner clogged	Clean or replace	G-39
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S35
	Injection pump malfunctioning	Replace	1-S19, 1-S40
	Incorrect nozzle injection pressure	Adjust	1-S14
	Injection nozzle stuck or clogged	Repair or replace	1-S14
	Governor malfunctioning	Repair	1-S40

Symptom	Probable Cause	Solution	Reference Page
Either White or Blue Exhaust Gas Is Observed	Excessive engine oil	Reduce to specified level	G-21, G-26
	Piston ring and cylinder worn or stuck	Repair or replace	1-S42, 1-S43, 1-S56, 1-S57, 1-S62
	Incorrect injection timing	Adjust	1-S18
Either Black or Dark Gray Exhaust Gas Is Observed	Overload	Reduce the load	–
	Low grade fuel used	Use specified fuel	G-8, G-10, G-11
	Fuel filter clogged	Replace	G-38
	Air cleaner clogged	Clean or replace	G-39
	Deficient nozzle injection	Repair or replace nozzle	1-S14
Deficient Output	Incorrect injection timing	Adjust	1-S18
	Engine's moving parts seem to be seizing	Repair or replace	–
	Injection pump malfunctioning	Replace injection pump	1-S19, 1-S40
	Deficient nozzle injection	Repair or replace nozzle	1-S14
	Compression leak	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S11, 1-S35, 1-S37
	Air cleaner dirty or clogged	Clean or replace	G-39
Excessive Lubricant Oil Consumption	Piston ring's gap facing the same direction	Shift ring gap direction	1-S42
	Oil ring worn or stuck	Replace	1-S43
	Piston ring groove worn	Replace piston	1-S57
	Valve stem and valve guide worn	Replace	1-S38, 1-S47, 1-S48
	Crankshaft bearing and crank pin bearing worn	replace	1-S45
	Oil leaking due to damaged seals or packing	Replace	1-S37, 1-S38
Fuel Mixed into Lubricant Oil	Injection pump's plunger worn	Replace injection pump	1-S19, 1-S40
	Deficient nozzle injection	Repair or replace nozzle	1-S14
	Injection pump broken	Replace	1-S40
Water Mixed into Lubricant Oil	Head gasket damaged	Replace	1-S37
	Cylinder block or cylinder head flawed	Replace	1-S37, 1-S46, 1-S47

Symptom	Probable Cause	Solution	Reference Page
Low Oil Pressure	Engine oil insufficient	Fill	G-21, G-26
	Oil strainer clogged	Clean	1-S38
	Oil filter clogged	Replace	G-27
	Relief valve stuck with dirt	Clean	–
	Relief valve spring weaken or broken	Replace	–
	Excessive oil clearance of crankshaft bearing	Replace	1-S59, 1-S60
	Excessive oil clearance of crankpin bearing	Replace	1-S58
	Excessive oil clearance of rocker arm	Replace	1-S36, 1-S50
	Oil passage clogged	Clean	–
	Different type of oil	Use specified type of oil	G-8, G-10, G-11
	Oil pump damaged	Replace	1-S63
High Oil Pressure	Different type of oil	Use specified type of oil	G-8, G-10, G-11
	Relief valve damaged	Replace	–
Engine Overheated	Engine oil insufficient	Fill	G-21, G-26
	Fan belt broken or tensioned improperly	Replace or adjust	1-S16
	Coolant insufficient	Fill	G-22, G-49
	Radiator net and radiator fin clogged with dust	Clean	G-22
	Inside of radiator corroded	Clean or replace	G-49
	Coolant flow route corroded	Clean or replace	G-54
	Radiator cap damaged	Replace	1-S17
	Radiator hose damaged	Replace	G-54
	Electric parts of the cooling system broken	Replace	8-S20, 8-S21, 8-S22, 8-S22
	Overload running	Reduce the load	–
	Head gasket damaged	Replace	1-S37
	Incorrect injection timing	Adjust	1-S18
	Unsuitable fuel used	Use specified fuel	G-10, G-11

9Y1210948ENS0001US0

2. SERVICING SPECIFICATIONS

[1] Engine Body

Item		Factory Specification	Allowable Limit
Compression Pressure		3.73 to 4.11 MPa 38.0 to 42.0 kgf/cm ² 541 to 597 psi	2.26 MPa 23.0 kgf/cm ² 327 psi
• Difference among Cylinders		—	10 % or less
Valve Clearance (Cold)		0.145 to 0.185 mm 0.00571 to 0.00728 in.	—
Top Clearance		0.55 to 0.75 mm 0.022 to 0.029 in.	—
Cylinder Head Surface	Flatness	—	0.05 mm 0.002 in.
Valve Recessing	Intake and Exhaust	−0.050 to 0.25 mm −0.0020 to 0.0098 in.	0.40 mm 0.016 in.
Valve Stem to Valve Guide	Clearance	0.035 to 0.065 mm 0.0014 to 0.0025 in.	0.10 mm 0.0039 in.
	O.D.	6.960 to 6.975 mm 0.2741 to 0.2746 in.	—
	I.D.	7.010 to 7.025 mm 0.2760 to 0.2765 in.	—
Valve Seat	Angle (Intake)	1.0 rad 60°	—
	Angle (Exhaust)	0.79 rad 45°	—
	Width	2.12 mm 0.0835 in.	—
Valve Face	Angle (Intake)	1.0 rad 60°	—
	Angle (Exhaust)	0.79 rad 45°	—
Valve Spring	Tilt	—	1.0 mm 0.039 in.
	Free Length	37.0 to 37.5 mm 1.46 to 1.47 in.	36.5 mm 1.44 in.
	Setting Load	117.4 N / 31.0 mm 11.97 kgf / 31.0 mm 26.39 lbf / 1.22 in.	100.0 N / 31.0 mm 10.20 kgf / 31.0 mm 22.48 lbf / 1.22 in.

Item		Factory Specification	Allowable Limit
Rocker Arm Shaft to Rocker Arm	Clearance	0.016 to 0.045 mm 0.00063 to 0.0017 in.	0.10 mm 0.0039 in.
• Rocker Arm Shaft	O.D.	11.973 to 11.984 mm 0.47138 to 0.47181 in.	—
• Rocker Arm	I.D.	12.000 to 12.018 mm 0.47244 to 0.47314 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	O.D.	19.959 to 19.980 mm 0.78579 to 0.78661 in.	—
• Tappet Guide	I.D.	20.000 to 20.021 mm 0.78740 to 0.78822 in.	—
Timing Gear			
• Crank Gear to Idle Gear 1	Backlash	0.0320 to 0.115 mm 0.00126 to 0.00452 in.	0.15 mm 0.0059 in.
• Idle Gear 1 to Cam Gear	Backlash	0.0360 to 0.114 mm 0.00142 to 0.00448 in.	0.15 mm 0.0059 in.
• Idle Gear 1 to Injection Pump Gear	Backlash	0.0340 to 0.116 mm 0.00134 to 0.00456 in.	0.15 mm 0.0059 in.
Governor Gear			
• Governor Gear to Injection Pump Gear	Backlash	0.0300 to 0.117 mm 0.00119 to 0.00460 in.	0.15 mm 0.0059 in.
Idle Gear			
• Idle Gear 1	Side Clearance	0.20 to 0.51 mm 0.0079 to 0.020 in.	0.80 mm 0.031 in.
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	28.80 mm 1.134 in.	28.75 mm 1.132 in.
	Exhaust	29.00 mm 1.142 in.	28.95 mm 1.140 in.
Camshaft Journal to Cylinder Block Bore	Oil Clearance	0.050 to 0.091 mm 0.0020 to 0.0035 in.	0.15 mm 0.0059 in.
• Camshaft Journal	O.D.	35.934 to 35.950 mm 1.4147 to 1.4154 in.	—
• Cylinder Block Bore	I.D.	36.000 to 36.025 mm 1.4173 to 1.4183 in.	—

Item		Factory Specification	Allowable Limit
Idle Gear Shaft to Gear Bushing • Idle Gear 1 • Idle Gear Shaft 1 • Idle Gear Bushing	Clearance	0.020 to 0.054 mm 0.00079 to 0.0021 in.	0.10 mm 0.0039 in.
	O.D.	25.967 to 25.980 mm 1.0224 to 1.0228 in.	—
	I.D.	26.000 to 26.021 mm 1.0237 to 1.0244 in.	—
Piston Pin Bore	I.D.	22.000 to 22.013 mm 0.86615 to 0.86665 in.	22.03 mm 0.8673 in.
Piston Pin to Small End Bushing • Piston Pin • Small End Bushing	Clearance	0.014 to 0.038 mm 0.00056 to 0.0014 in.	0.15 mm 0.0059 in.
	O.D.	22.002 to 22.011 mm 0.86622 to 0.86657 in.	—
	I.D.	22.025 to 22.040 mm 0.86713 to 0.86771 in.	—
Connecting Rod	Alignment	—	0.05 mm 0.002 in.
Piston Ring Gap	Top Ring	0.15 to 0.25 mm 0.0059 to 0.0098 in.	1.20 mm 0.0472 in.
	Second Ring	0.40 to 0.55 mm 0.016 to 0.021 in.	1.20 mm 0.0472 in.
	Oil Ring	0.25 to 0.45 mm 0.0099 to 0.017 in.	1.25 mm 0.0492 in.
Piston Ring to Piston Ring Groove • Second Ring • Oil Ring	Clearance	0.0850 to 0.122 mm 0.00335 to 0.00480 in.	0.2 mm 0.008 in.
	Clearance	0.02 to 0.06 mm 0.0008 to 0.002 in.	0.15 mm 0.0059 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.
Crankpin to Crankpin Bearing • Crankpin • Crankpin Bearing	Oil Clearance	0.029 to 0.091 mm 0.0012 to 0.0035 in.	0.20 mm 0.0079 in.
	O.D.	39.959 to 39.975 mm 1.5732 to 1.5738 in.	—
	I.D.	40.040 to 40.050 mm 1.5764 to 1.5767 in.	—

Item		Factory Specification	Allowable Limit
Crankshaft to Crankshaft Bearing 1	Oil Clearance	0.0340 to 0.114 mm 0.00134 to 0.00448 in.	0.20 mm 0.0079 in.
• Crankshaft	O.D.	47.934 to 47.950 mm 1.8872 to 1.8877 in.	—
• Crankshaft Bearing 1	I.D.	47.984 to 48.048 mm 1.8892 to 1.8916 in.	—
Crankshaft to Crankshaft Bearing 2	Oil Clearance	0.034 to 0.095 mm 0.0014 to 0.0037 in.	0.20 mm 0.0079 in.
• Crankshaft Journal	O.D.	47.934 to 47.950 mm 1.8872 to 1.8877 in.	—
• Crankshaft Bearing 2	I.D.	47.984 to 48.029 mm 1.8892 to 1.8908 in.	—
Crankshaft to Crankshaft Bearing 3	Oil Clearance	0.0340 to 0.103 mm 0.00134 to 0.00405 in.	0.20 mm 0.0079 in.
• Crankshaft Journal	O.D.	51.921 to 51.940 mm 2.0442 to 2.0448 in.	—
• Crankshaft Bearing 3	I.D.	51.974 to 52.024 mm 2.0463 to 2.0481 in.	—
Cylinder Liner	I.D.	78.000 to 78.019 mm 3.0709 to 3.0716 in.	78.15 mm 3.077 in.
Cylinder (Oversized)	I.D.	78.500 to 78.519 mm 3.0906 to 3.0912 in.	78.65 mm 3.096 in.

9Y1210948ENS0002US0

[2] Lubricating System

Item		Factory Specification	Allowable Limit
Engine Oil Pressure	At Idle Speed	More than 49 kPa 0.50 kgf/cm ² 7.1 psi	—
	At Rated Speed	197 to 441 kPa 2.00 to 4.50 kgf/cm ² 28.5 to 64.0 psi	147 kPa 1.50 kgf/cm ² 21.3 psi
Inner Rotor to Outer Rotor	Clearance	0.060 to 0.18 mm 0.0024 to 0.0071 in.	—
Outer Rotor to Pump Body	Clearance	0.100 to 0.180 mm 0.00394 to 0.00708 in.	—
Inner Rotor to Cover	Clearance	0.025 to 0.075 mm 0.00099 to 0.0029 in.	—

9Y1210948ENS0003US0

[3] Cooling System

Item		Factory Specification	Allowable Limit
Fan Belt	Tension	7.0 to 9.0 mm / 98 N 0.28 to 0.35 in. / 98 N (10 kgf, 22 lbf)	—
Radiator Cap	Pressure Falling Time	10 seconds or more 88 → 59 kPa 0.90 → 0.60 kgf/cm ² 13 → 8.6 psi	—
Radiator	Water Leakage Test Pressure	157 kPa 1.6 kgf/cm ² 23 psi	—
Thermostat	Valve Opening Temperature (At Beginning)	80.0 to 84.0 °C 176 to 183 °F	—
	Valve Opening Temperature (Opened Completely)	95 °C 203 °F	—

9Y1210948ENS0004US0

[4] Fuel System

Item		Factory Specification	Allowable Limit
Injection Nozzle	Injection Pressure	13.73 to 14.70 MPa 140.0 to 150.0 kgf/cm ² 1992 to 2133 psi	—
Injection Nozzle Valve Seat	Valve Seat Tightness	When the pressure is 12.75 MPa (130.0 kgf/cm ² , 1849 psi), the valve seat must be fuel tightness.	—
Injection Pump	Injection Timing (3000 min ⁻¹ (rpm))	0.3011 to 0.3272 rad (17.25 to 18.75°) before T.D.C.	—
Pump Element	Fuel Tightness	—	13.73 MPa 140.0 kgf/cm ² 1991 psi
Delivery Valve	Fuel Tightness	10 seconds 13.73 → 12.75 MPa 140.0 → 130.1 kgf/cm ² 1991 → 1849 psi	5 seconds 13.73 → 12.75 MPa 140.0 → 130.0 kgf/cm ² 1991 → 1849 psi

9Y1210948ENS0005US0

3. TIGHTNING TORQUES

[1] GENERAL

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to "5. TIGHTENING TORQUES" on page G-14.)

Item	N·m	kgf·m	lbf·ft
Oil pressure switch	15 to 19	1.5 to 2.0	11 to 14
Nozzle holder	35 to 39	3.5 to 4.0	26 to 28
Overflow pipe retaining nut	35 to 39	3.5 to 4.0	26 to 28
Nozzle holder assembly	49 to 68	5.0 to 7.0	37 to 50
Seat stay mounting screw	23.6 to 27.4	2.40 to 2.80	17.4 to 20.2
Rear aluminum wheel mounting bolt	90 to 110	9.2 to 11.2	66.4 to 81.1
Rear steel wheel mounting bolt and nut	108 to 130	11.1 to 13.2	79.7 to 95.8
Brake pipe retaining nut	13 to 17	1.4 to 1.7	9.6 to 12
Hydraulic lift cylinder hose retaining nut	24.0 to 25.0	2.45 to 2.54	17.7 to 18.4
Hydraulic lift cylinder pipe retaining nut	24.0 to 25.0	2.45 to 2.54	17.7 to 18.4
HST return pipe bolt	17.6 to 20.6	1.80 to 2.10	13.0 to 15.1
Power steering hose retaining nut	24.0 to 25.0	2.45 to 2.54	17.7 to 18.4
Return pipe retaining nut	24.0 to 25.0	2.45 to 2.54	17.7 to 18.4
Mission frame mounting bolt and nut	77.5 to 90.2	7.90 to 9.20	57.2 to 66.5

9Y1210948ENS0006US0

[2] ENGINE BODY

■ NOTE

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

Item	Dimension × Pitch	N·m	kgf·m	lbf·ft
Cylinder head cover screw	M7 × 1.0	7 to 8	0.7 to 0.9	5 to 6
Injection pipe retaining nut	M12 × 1.5	25 to 34	2.5 to 3.5	18 to 25
Glow plug	M8 × 1.0	7.9 to 14	0.80 to 1.5	5.8 to 10
*Rocker arm bracket nut	M7 × 1.0	22 to 26	2.2 to 2.7	16 to 19
Cylinder head screw	M10 × 1.25	64 to 68	6.5 to 7.0	47 to 50
*Fan drive pulley screw	M14 × 1.5	236 to 245	24.0 to 25.0	174 to 180
*Connecting rod screw	M8 × 1.0	42 to 46	4.2 to 4.7	31 to 33
*Flywheel screw	M10 × 1.25	54 to 58	5.5 to 6.0	40 to 43
Bearing case cover mounting screw	M6 × 1.0	10.8 to 12.2	1.10 to 1.25	7.96 to 9.04
*Main bearing case screw 2	M9 × 1.25	49 to 53	5.0 to 5.5	37 to 39
*Main bearing case screw 1	M8 × 1.25	30 to 34	3.0 to 3.5	22 to 25

9Y1210948ENS0007US0

4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING

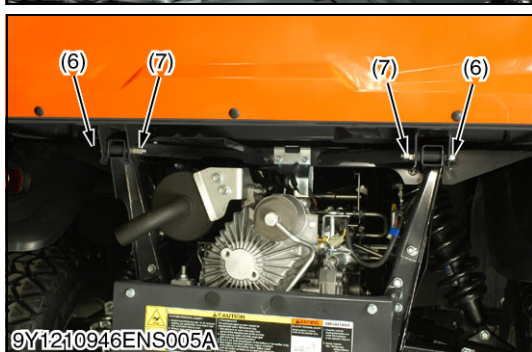
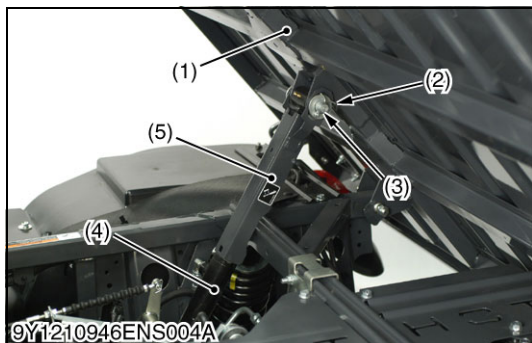


CAUTION

- Be sure to check that the speed is neutrality before the following checks.
- When checking, park the machine on flat ground and apply the parking brake.

9Y1210946ENS0005US0

(1) Engine Body



Preparation for Compression Pressure

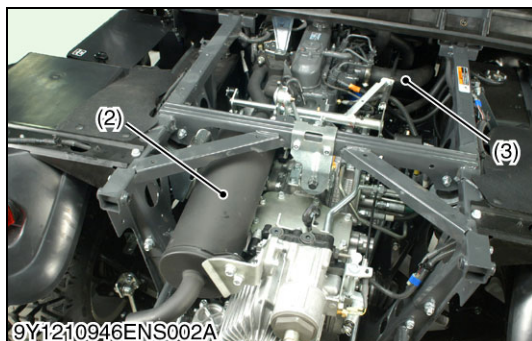
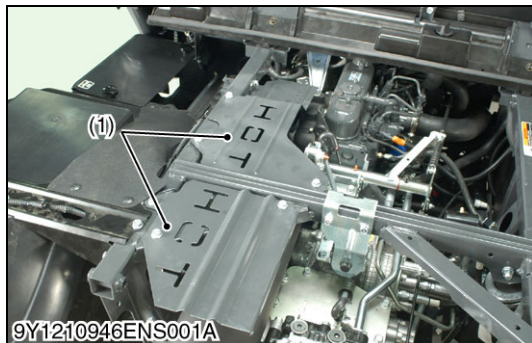
1. Lift up the cargo bed (1) and support it so that the hydraulic cylinder (4) should not drop. (If hydraulic cylinder equipped.)
2. Remove the cotter pin (2), clevis pin (3) and cylinder lock (5). (If hydraulic cylinder equipped.)
3. Loosen the lock nuts (7) and remove the bolts (6).
4. Remove the cargo bed (1).

(When reassembling)

- Install the cotter pin both side bending.

- | | |
|------------------------|-------------------|
| (1) Cargo Bed | (5) Cylinder Lock |
| (2) Cotter Pin | (6) Bolt |
| (3) Clevis Pin | (7) Lock Nut |
| (4) Hydraulic Cylinder | |

9Y1210946ENS0006US0



Compression Pressure

⚠ CAUTION

- **Work by two people when you measure pressure.**
1. Operate the engine until it is warmed up.
 2. Stop the engine.
 3. Remove the muffer covers (1).
 4. Remove the air cleaner hose (3), the muffler (2) and all glow plugs.
 5. Disconnect the accelerator wire.
 6. Engage the parking brake.
 7. Set a compression tester (Code No. 07909-30208) with the adaptor (Adaptor L, code No. 07909-31301) to the glow plug hole.
 8. After making sure that the stop lever is set at the stop position (non-injection), operate the engine with the starter and measure the compression pressure.
 9. Repeat steps 6 and 7 for each cylinder.
 10. If the measurement is below the allowable limit, apply a small amount of oil to the cylinder wall through the glow plug hole and measure the compression pressure again.
 11. If the compression pressure is still less than the allowable limit, check the top clearance, valve clearance and cylinder head.
 12. If the compression pressure increases after applying oil, check the cylinder wall and piston rings.

■ NOTE

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

Compression pressure	Factory specification	3.73 to 4.11 MPa 38.0 to 42.0 kgf/cm ² 541 to 597 psi
	Allowable limit	2.26 MPa 23.0 kgf/cm ² 327 psi

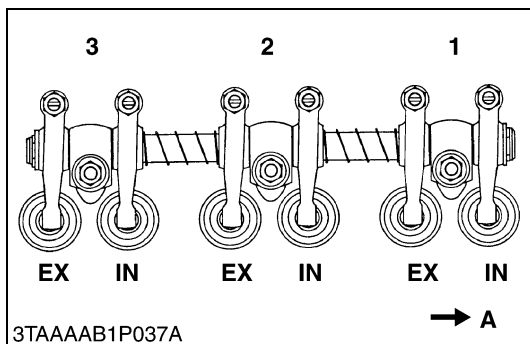
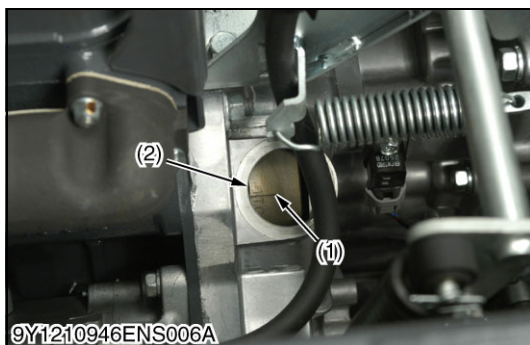
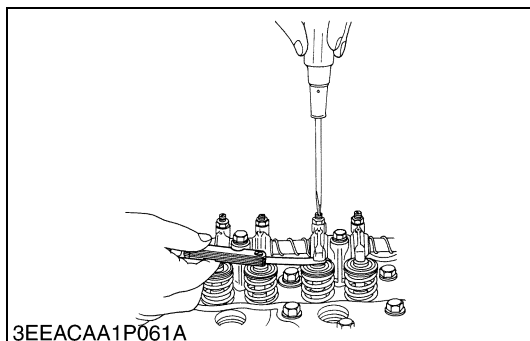
(Condition)

- Coolant temperature:
80 to 90 °C (176 to 194 °F)

- (1) Muffer Cover
(2) Muffler

- (3) Air Cleaner Hose

9Y1210948ENS0008US0



Valve Clearance

■ IMPORTANT

- Valve clearance must be checked and adjusted when engine is cold.
1. Remove the cylinder head cover and the glow plugs and the timing window cover.
 2. Align the "1TC" mark (1) on the flywheel and timing window (2) on the transmission case so that the No. 1 piston comes to the compression top dead center.
 3. Check the following valve clearance marked with "★" using a feeler gauge.
 4. If the clearance is not within the factory specifications, adjust with the adjusting screw.
 5. Then turn the flywheel 6.28 rad (360°), and align the "1TC" mark (1) on the flywheel and timing window (2) on the rear end plate so that the No. 1 piston comes to the overlap position.
 6. Check the following valve clearance marked with "☆" using a feeler gauge.
 7. If the clearance is not within the factory specifications, adjust with the adjusting screw.

Adjustable cylinder location of piston	Number of cylinders Valve arrangement	
	Intake valve	Exhaust valve
No.1	★	★
No.2	☆	★
No.3	★	☆

★: When No. 1 piston is at the compression top dead center position.

☆: When No. 1 piston is at the overlap position.

Intake and exhaust valve clearance (cold)	Factory specification	0.145 to 0.185 mm 0.00571 to 0.00728 in.
---	-----------------------	---

■ NOTE

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

- (1) "1TC" Mark
(2) Timing Window

A: Gear Case Side

9Y1210946ENS0008US0

(2) Lubricating System



Engine Oil Pressure

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

Engine oil pressure	At idle speed	Factory specification	More than 49 kPa 0.50 kgf/cm ² 7.1 psi
	At rated speed	Factory specification	197 to 441 kPa 2.00 to 4.50 kgf/cm ² 28.5 to 64.0 psi
		Allowable limit	147 kPa 1.50 kgf/cm ² 21.3 psi

(When reassembling)

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

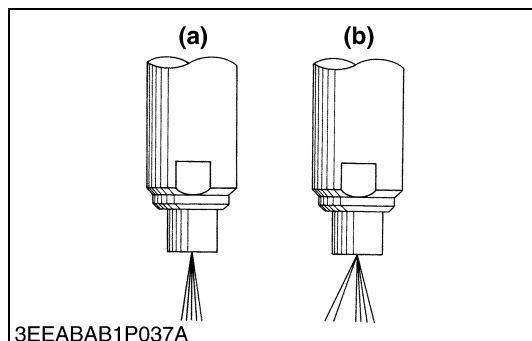
Tightening torque	Oil pressure switch	15 to 19 N·m 1.5 to 2.0 kgf·m 11 to 14 lbf·ft
-------------------	---------------------	---

9Y1210948ENS0012US0

CAUTION

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

9Y1210946ENS0019US0



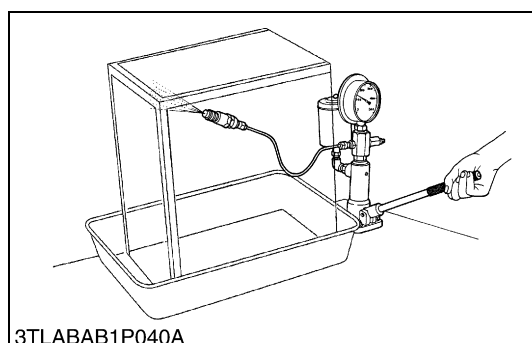
Nozzle Spraying Condition

1. Set the injection nozzle to a nozzle tester, and check the nozzle spraying condition.
2. If the spraying condition is damaged, replace the nozzle piece.

(a) Good

(b) Bad

9Y1210946ENS0020US0



Fuel Injection Pressure

1. Set the injection nozzle to a nozzle tester.
2. Slowly move the tester handle to measure the pressure at which fuel begins jetting out from the nozzle.
3. If the measurement is not within the factory specifications, replace the adjusting washer (1) in the nozzle holder to adjust it.

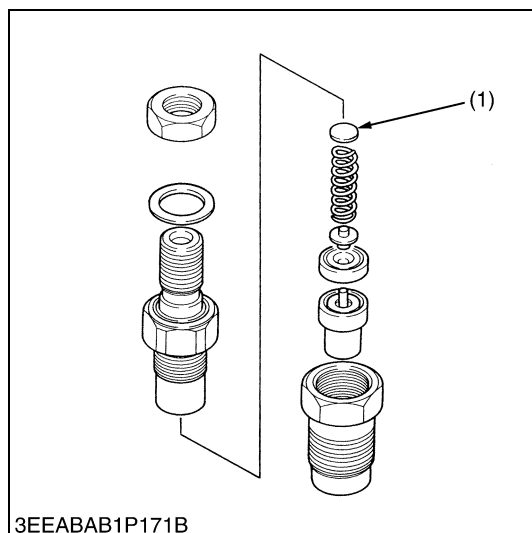
(Reference)

- Pressure variation with 0.025 mm (0.00098 in.) difference of adjusting washer thickness.
Approx. 590 kPa (6.0 kgf/cm², 85 psi)

Fuel injection pressure	Factory specification	13.73 to 14.70 MPa 140.0 to 150.0 kgf/cm ² 1992 to 2133 psi
-------------------------	-----------------------	--

(1) Adjusting Washer

9Y1210946ENS0021US0

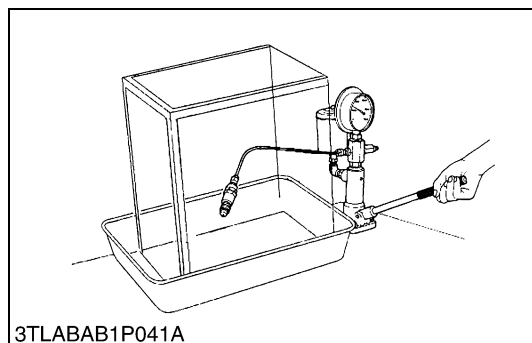


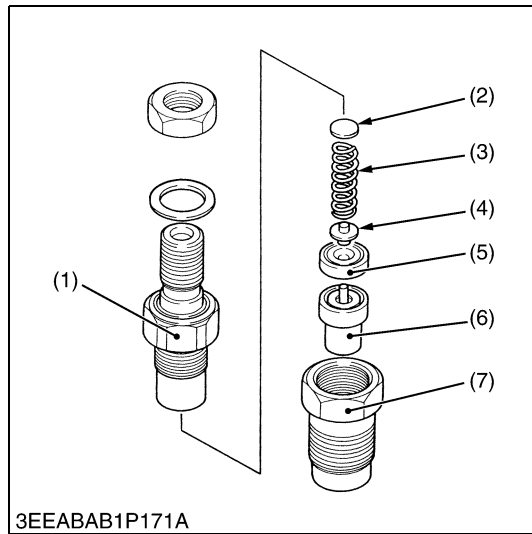
Nozzle Valve Seat Tightness

1. Set the injection nozzle to a nozzle tester.
2. Raise the fuel pressure, and keep at 12.75 MPa (130.0 kgf/cm², 1849 psi) for 10 seconds.
3. If any fuel leak is found, replace the nozzle piece.

Valve seat tightness	Factory specification	No fuel leak at 12.75 MPa 130.0 kgf/cm ² 1849 psi
----------------------	-----------------------	---

9Y1210946ENS0022US0





Nozzle Holder

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

(When reassembling)

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

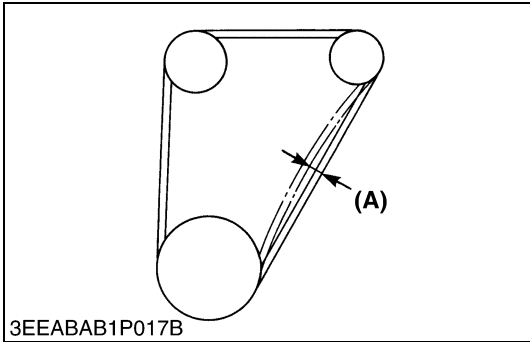
Tightening torque	Nozzle holder	35 to 39 N·m 3.5 to 4.0 kgf·m 26 to 28 lbf·ft
	Overflow pipe retaining nut	35 to 39 N·m 3.5 to 4.0 kgf·m 26 to 28 lbf·ft
	Nozzle holder assembly	49 to 68 N·m 5.0 to 7.0 kgf·m 37 to 50 lbf·ft

- (1) Nozzle Holder
 (2) Adjusting Washer
 (3) Nozzle Spring
 (4) Push Rod

- (5) Distance Piece
 (6) Nozzle Piece
 (7) Nozzle Retaining Nut

9Y1210948ENS0009US0

(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	7.0 to 9.0 mm 0.28 to 0.35 in.
----------------	-----------------------	-----------------------------------

(A) Deflection

9Y1210946ENS0010US0



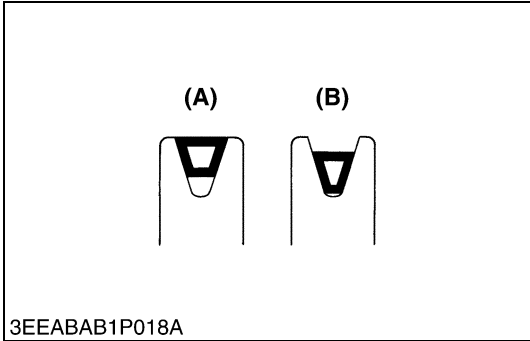
Fan Belt Damage and Wear

- 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

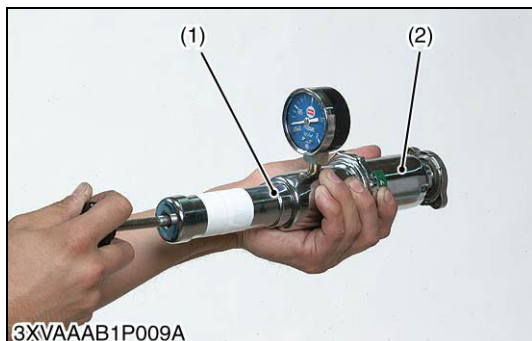
9Y1210946ENS0011US0



**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.

9Y1210946ENS0012US0

**Radiator Cap Air Leakage**

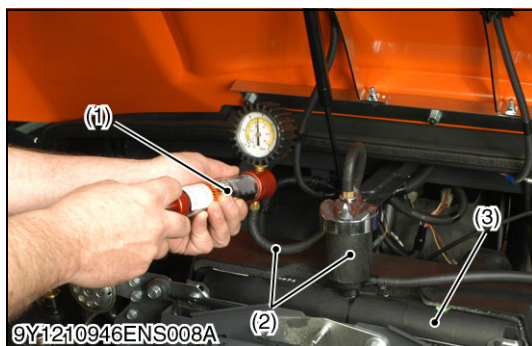
- Set a radiator tester (1) and an adaptor (2) on the radiator cap.
- Apply the specified pressure (88 kPa, 0.9 kgf/cm², 13 psi), and measure the time for the pressure to fall to 59 kPa (0.6 kgf/cm², 9 psi).
- If the measurement is less than the factory specification, replace the radiator cap.

Pressure falling time	Factory specification	More than 10 seconds for pressure fall from 88 to 59 kPa (from 0.90 to 0.60 kgf/cm ² , from 13 to 8.6 psi)
-----------------------	-----------------------	---

(1) Radiator Tester

(2) Adaptor

9Y1210946ENS0013US0

**Radiator Water Leakage**

- Pour a specified amount of water into the radiator.
- Set a radiator tester (1) and an adaptor (2) and raise the water pressure to the specified pressure.
- Check the radiator for water leaks.
- For water leak from the pinhole, repair with the radiator cement. When water leak is excessive, replace the radiator.

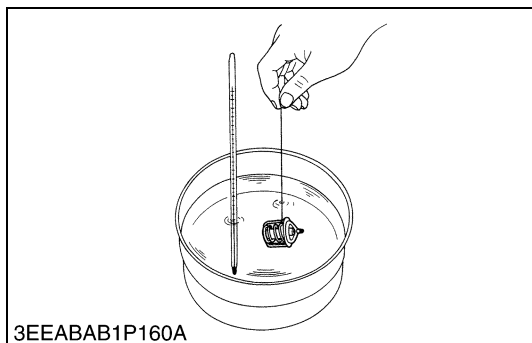
Radiator water leakage test pressure	Factory specification	157 kPa 1.6 kgf/cm ² 23 psi
--------------------------------------	-----------------------	--

(1) Radiator Tester

(3) Radiator

(2) Adaptor

9Y1210946ENS0014US0

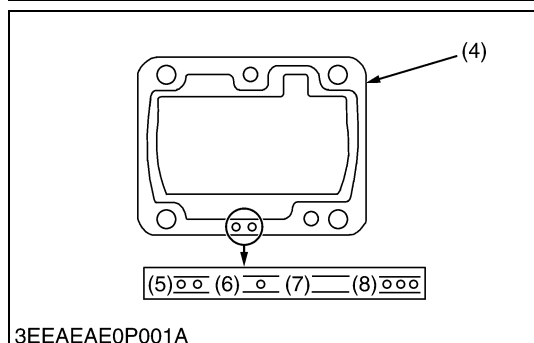
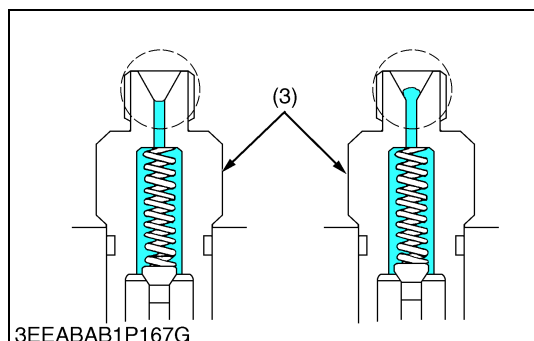
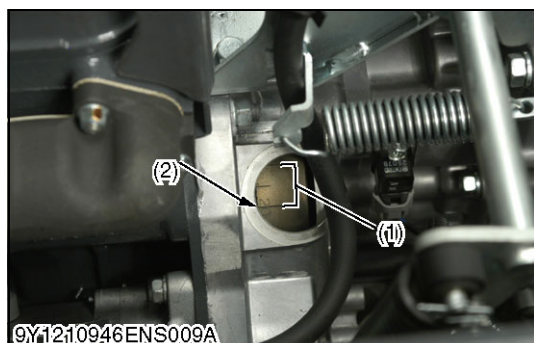
**Thermostat Valve Opening Temperature**

- Suspend the thermostat in the water by a string with its end inserted between the valve and seat.
- Heating the water gradually, read the temperature when the valve opens and leaves the string.
- Continue heating and read the temperature when the valve opens approx. 8.0 mm (0.31 in.).
- If the measurement is not within the factory specifications, replace the thermostat.

Thermostat's valve opening temperature	Factory specification	80.0 to 84.0 °C 176 to 183 °F
Temperature at which thermostat completely opens	Factory specification	95 °C 203 °F

9Y1210946ENS0015US0

(4) Fuel System



Injection Timing

1. Remove the injection pipes.
2. Remove the engine stop solenoid and the timing window cover.
3. Turn the flywheel counterclockwise (viewed from flywheel side) until the fuel fills up to the hole of the delivery valve holder (3) for No. 1 cylinder.
4. After the fuel fills up to the hole of the delivery valve holder for No. 1 cylinder, turn back (clockwise) the flywheel around 1.6 rad (90°).
5. Turn the flywheel counterclockwise to set at around 0.44 rad (25°) before T.D.C..
6. Slowly turn the flywheel counterclockwise and stop turning when the fuel begins to come up, to get the present injection timing.
7. Check to if the timing angle lines on the flywheel is aligned with the center of timing window (2).
The flywheel has mark "1TC", "10" and "20" for the crank angle before the top dead center of No. 1 cylinder.
8. If injection timing is out of adjustment, readjust the timing with shims.

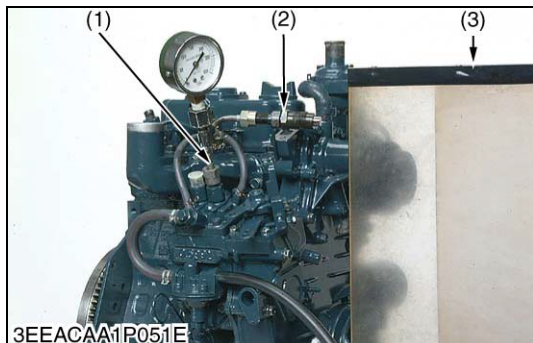
Injection timing	Factory specification	0.3011 to 03272 rad (17.25 to 18.75°) before T.D.C.
------------------	-----------------------	---

■ NOTE

- The liquid gasket is not required for assembling.
- Shims are available in thickness of 0.20 mm (0.0079 in.), 0.25 mm (0.0098 in.), 0.30 mm (0.012 in.), 0.35 mm (0.014 in.) and 0.175 mm (0.00689 in.). Combine these shims for adjustments.
- Addition or reduction of shim (0.025 mm, 0.00098 in.) delays or advances the injection timing by approx. 0.0044 rad (0.25°).
- In disassembling and replacing the injection pump, be sure to use the same number of new shims with the same thickness.
- The 0.175 mm (0.00689 in.) thick shim is coated only on the lower face. Therefore, do not use the 0.175 mm (0.00689 in.) thick shim as the top shim of the combination (injection pump side), because this can cause oil leakage.
- Refer to figure of the shim to check the thickness of the shims.
- The injection timing might be changed by the application.

- | | |
|-----------------------------------|---------------------------------------|
| (1) Timing Line | (5) Two-holes: 0.20 mm (0.0079 in.) |
| (2) Timing Window | Two-holes: 0.175 mm (0.00689 in.) |
| (3) Delivery Valve Holder | (6) One-hole: 0.25 mm (0.0098 in.) |
| (4) Shim (Soft Metal Gasket Shim) | (7) Without hole: 0.30 mm (0.012 in.) |
| | (8) Three-holes: 0.35 mm (0.014 in.) |

9Y1210948ENS0010US0



Fuel Tightness of Pump Element

1. Remove the engine stop solenoid.
2. Remove the injection pipes and glow plugs.
3. Install the injection pump pressure tester to the injection pump.
4. Install the injection nozzle (2) jetted with the proper injection pressure to the injection pump pressure tester (1). (Refer to the photo.)
5. Set the speed control lever to the maximum speed position.
6. Operate the starter to increase the pressure.
7. If the pressure can not reach the allowable limit, replace the pump with new one or repair with a KUBOTA-authorized pump service shop.

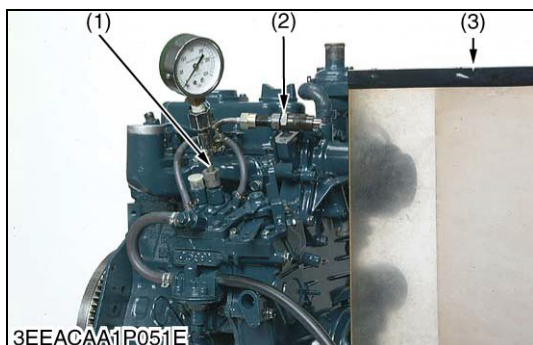
Fuel tightness of pump element	Allowable limit	13.73 MPa 140.0 kgf/cm ² 1991 psi
--------------------------------	-----------------	--

NOTE

- **Never try to disassemble the injection pump assembly. For repairs, you are strongly requested to contact a KUBOTA-authorized pump service shop.**

- (1) Injection Pump Pressure Tester (3) Protection Cover for Jetted Fuel
(2) Injection Nozzle

9Y1210946ENS0017US0



Fuel Tightness of Delivery Valve

1. Remove the engine stop solenoid.
2. Remove the injection pipes and glow plugs.
3. Set a pressure tester to the fuel injection pump.
4. Install the injection nozzle (2) jetted with the proper injection pressure to the injection pump pressure tester (1).
5. Operate the starter to increase the pressure.
6. Stop the starter when the fuel jets from the injection nozzle. After that, turn the flywheel by hands and raise the pressure to approx. 13.73 MPa (140.0 kgf/cm², 1991 psi).
7. Now turn the flywheel back about half a turn (to keep the plunger free). Keep the flywheel at this position and clock the time taken for the pressure to drop from 13.73 to 12.75 MPa (from 140.0 to 130.0 kgf/cm², from 1991 to 1849 psi).
8. Measure the time needed to decrease the pressure from 13.73 to 12.75 MPa (from 140.0 to 130.0 kgf/cm², from 1991 to 1849 psi).
9. If the measurement is less than allowable limit, replace the pump with new one or repair with a KUBOTA-authorized pump service shop.

Fuel tightness of delivery valve	Factory specification	10 seconds 13.73 → 12.75 MPa 140.0 → 130.0 kgf/cm ² 1991 → 1849 psi
	Allowable limit	5 seconds 13.73 → 12.75 MPa 140.0 → 130.0 kgf/cm ² 1991 → 1849 psi

NOTE

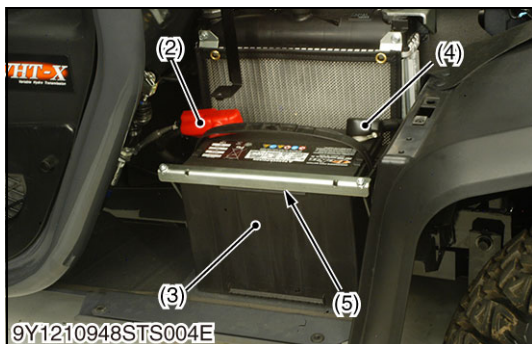
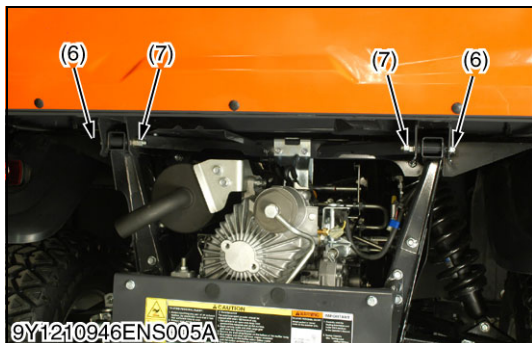
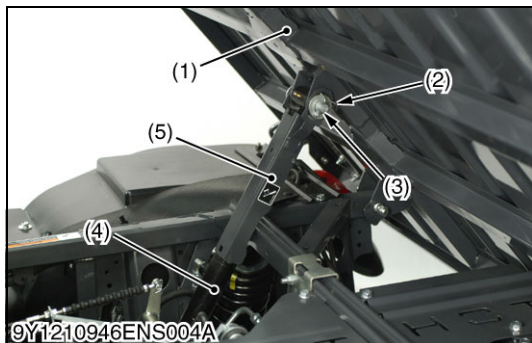
- **Never try to disassemble the injection pump assembly. For repairs, you are strongly requested to contact a KUBOTA-authorized pump service shop.**

- (1) Injection Pump Pressure Tester (3) Protection Cover for Jetted Fuel
(2) Injection Nozzle

9Y1210946ENS0018US0

[2] PREPARATION

(1) Dismounting Transmission and Engine



Cargo Bed

1. Lift up the cargo bed (1) and support it so that the hydraulic cylinder (4) should not drop. (If hydraulic cylinder equipped.)
2. Remove the cotter pin (2) clevis pin (3) and cylinder lock (5). (If hydraulic cylinder equipped.)
3. Loosen the lock nuts (7) and remove the bolts (6).
4. Remove the cargo bed (1).

(When reassembling)

- Be sure that the split pin is bent to both sides.

- | | |
|------------------------|-------------------|
| (1) Cargo Bed | (5) Cylinder Lock |
| (2) Cotter Pin | (6) Bolt |
| (3) Clevis Pin | (7) Lock Nut |
| (4) Hydraulic Cylinder | |

9Y1210946ENS0025US0

Battery



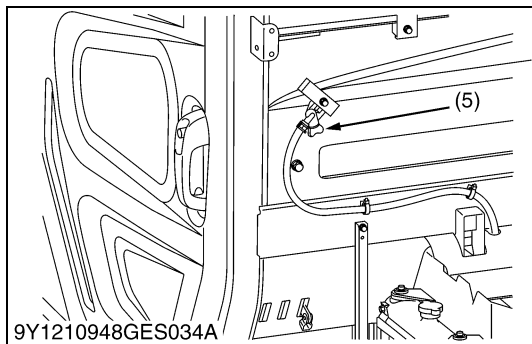
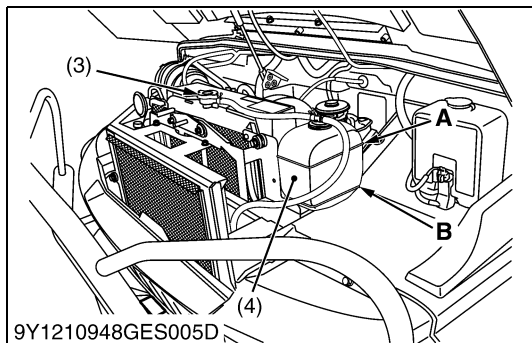
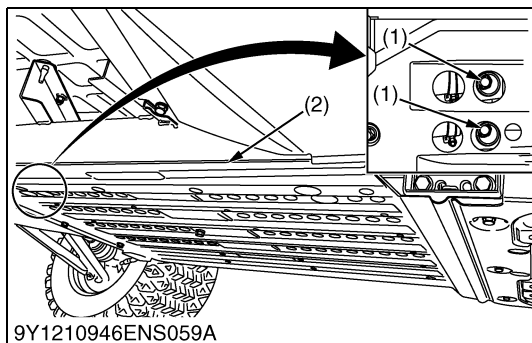
CAUTION

- When disconnecting the battery cables, disconnect the negative cable from the battery first. When connecting, connect the positive cable to the battery first.

1. Remove the battery cover (1).
2. Disconnect the negative cable (4) from the battery.
3. Disconnect the positive cable (2) from the battery.
4. Remove the battery stay (5).
5. Remove the battery (3).

- | | |
|--------------------|--------------------|
| (1) Battery Cover | (4) Negative Cable |
| (2) Positive Cable | (5) Battery Stay |
| (3) Battery | |

9Y1210948ENS0011US0



Draining Coolant



WARNING

To avoid serious injury:

- Do not remove the 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.

IMPORTANT

- Do not start engine without coolant.
 - Do not remove the cap on the radiator.
 - Use clean, fresh distilled water and anti-freeze to fill the radiator and recovery tank.
 - When the anti-freeze is mixed with distilled water, the antifreeze mixing ratio is 50 %.
 - Securely tighten radiator cap. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.
 - Make sure that the engine coolant breather is closed, after filling the coolant.
- Stop the engine and let cool down.
 - Open the hood.
 - To drain the coolant, remove the radiator cap (3), open the engine coolant breather (5), and remove the radiator drain plugs (1). The radiator cap must be removed to completely drain the coolant.
 - After all coolant is drained, close the drain plug and engine coolant breather.

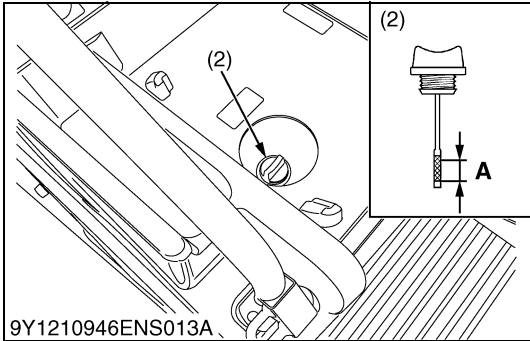
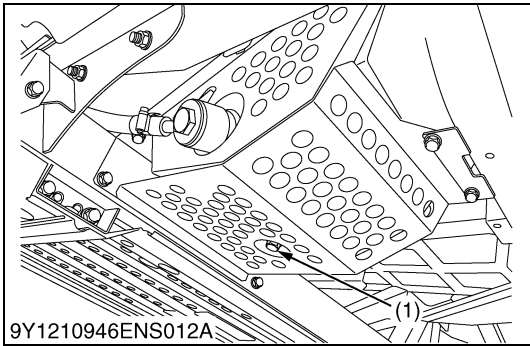
Radiator with recovery tank (Coolant)	Capacity	7.9 L 8.3 U.S.qts 7.0 Imp.qts
---------------------------------------	----------	-------------------------------------

- Drain Plug
- Front Skid Plate
- Radiator Cap
- Recovery Tank
- Engine Coolant Breather

A: FULL

B: LOW

9Y1210948ENS0013US0



Draining Hydraulic Tank Oil

⚠ WARNING

To avoid personal injury:

- Be sure to stop the engine before changing the oil
 - Allow engine to cool down sufficiently, oil can be hot and can burn.
1. Park the vehicle on a level surface.
 2. Open the seat and remove the utility box.
 3. Remove the rubber cap.
 4. To drain the used oil, remove the drain plug (1) and filling plug (2) plug and drain the oil completely into the oil pan.
 5. After draining, reinstall the drain plug.

(When reassembling)

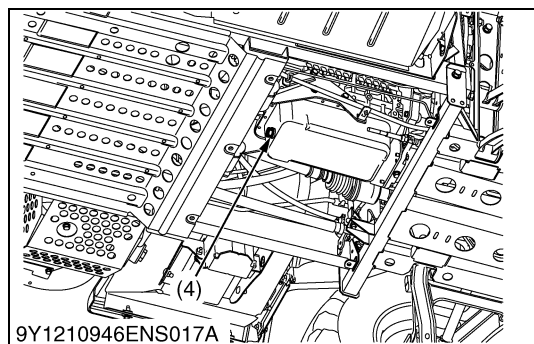
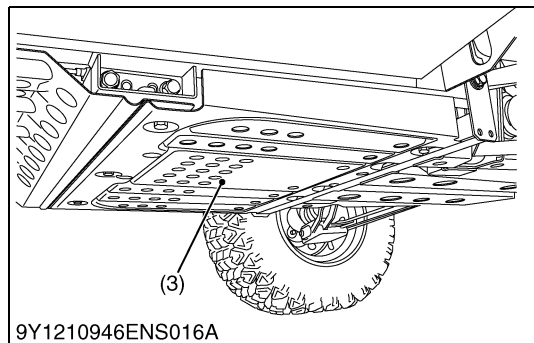
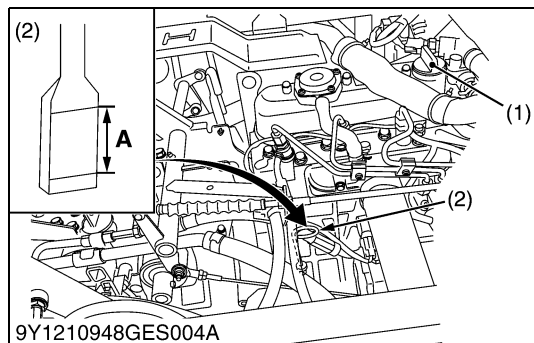
- Fill with new KUBOTA SUPER UDT fluid up to the upper notch on the dipstick.
- How to check:
Wipe dipstick clean a rag and screw it into filling hole. Remove dipstick again to see if the oil level is between the upper and lower notch.
- After filling, reinstall the filling plug.

Hydraulic tank oil	Capacity	18.0 L 19.0 U.S.qts 15.8 Imp.qts
--------------------	----------	--

- (1) Drain Plug
(2) Filling Plug with Dipstick

A: Oil level is acceptable within this range.

9Y1210946ENS0027US0



Draining Engine Oil



WARNING

To avoid personal injury:

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

1. Park the vehicle on a level surface.
2. Raise the cargo bed and mount the safety support.
3. Stop the engine.
4. Remove the rear skid plate (3).
5. To drain the used oil, remove the drain plug (4) at the bottom of the engine and completely drain the oil into an oil pan. All the used oil can be drained out easily when the engine is still warm.
6. After draining, reinstall the drain plug.

(When reassembling)

- Fill the new oil up to the upper notch on the dipstick.

Engine oil	Capacity	[Filter exchanged] 4.1 L 4.3 U.S.qts 3.6 Imp.qts
		[Filter non-exchanged] 3.8 L 4.0 U.S.qts 3.3 Imp.qts

- (1) Oil Inlet
- (2) Dipstick
- (3) Rear Skid Plate
- (4) Drain Plug

A: Oil level is acceptable within this range.

9Y1210948ENS0014US0

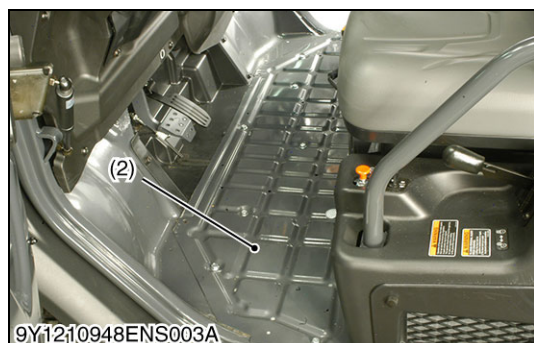
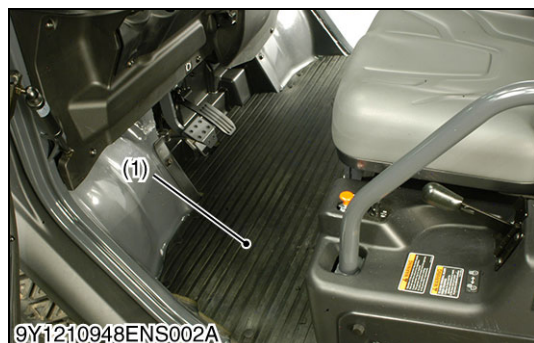
Mat and Center Step

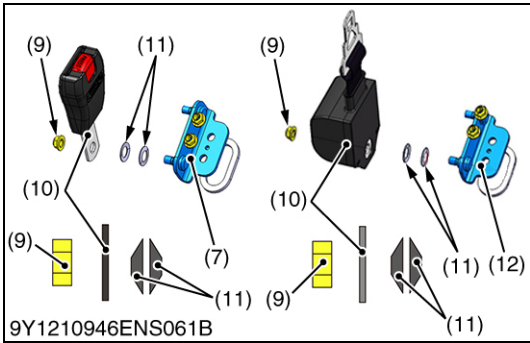
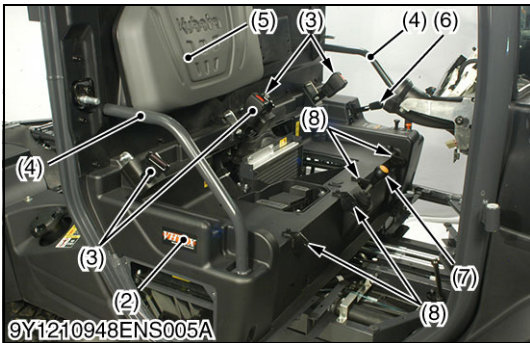
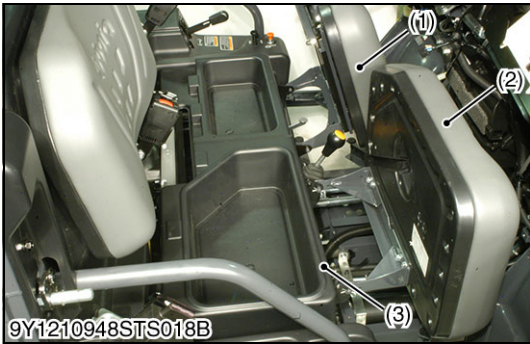
1. Remove the mat (1).
2. Remove the center step (2).

(1) Mat

(2) Center Step

9Y1210948ENS0015US0





Seat, Center Box Cover and Lower Cover

- 1. Remove the seat assembly (1).
- 2. Remove the seat (2).
- 3. Remove the center box cover (3).
- 4. Remove the lower cover (4).

- (1) Seat Assembly
- (2) Seat
- (3) Box Cover
- (4) Lower Cover

9Y1210948ENS0016US0

Back Seat, Seat Belt and Center Lower Cover

- 1. Remove the side covers (1).
- 2. Remove the back seat (5).
- 3. Remove the seat belts (3).
- 4. Remove the hydraulic lift grip (6) and 4WD grip (7).
- 5. Remove the seat stays (8).
- 6. Remove the handrail frames (4).
- 7. Remove the center lower cover (2).

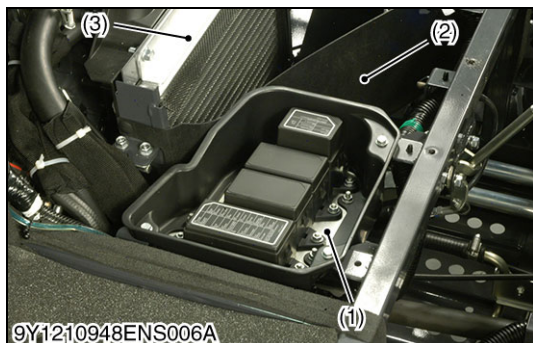
(When reassembling)

- Be sure to assembling the seat belt assembly as shown in the figure.

Tightening torque	Seat stay mounting screw	23.6 to 27.4 N·m 2.40 to 2.80 kgf·m 17.4 to 20.2 lbf·ft
-------------------	--------------------------	---

- (1) Side Cover
- (2) Center Lower Cover
- (3) Seat Belt
- (4) Handrail Frame
- (5) Back Seat
- (6) Hydraulic Lift Grip
- (7) 4WD Grip
- (8) Seat Stay
- (9) Locking Nut
- (10) Buckle
- (11) Spring Plate
- (12) Stay

9Y1210948ENS0017US0



Fuse Box and Oil Cooler

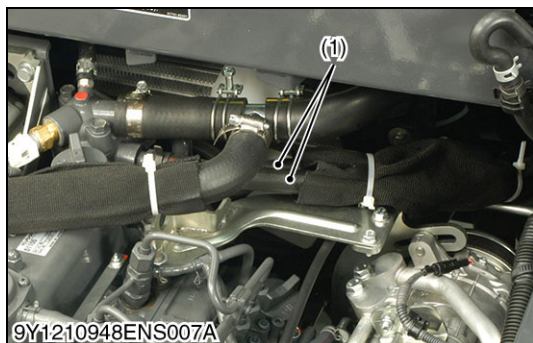
1. Remove the fuse box mounting screws.
2. Remove the oil cooler stay mounting screws.
3. Move to the front side of the fuse box (1).
4. Disconnect the oil cooler hoses.
5. Remove the front oil cooler shield (2).
6. Remove the oil cooler (3).

(1) Fuse Box

(3) Oil Cooler

(2) Front Oil Cooler Shield

9Y1210948ENS0018US0



Heater Hoses

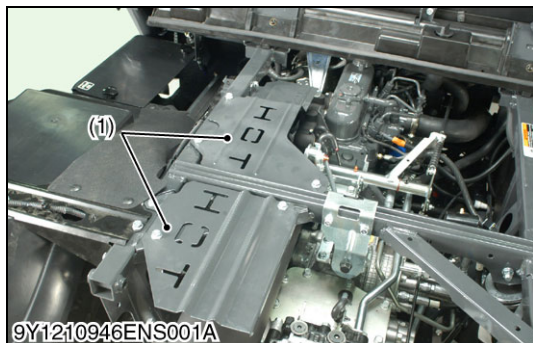
■ NOTE

- Before disconnecting the heater hoses, be sure to note their position.

1. Disconnect the heater hoses (1).

(1) Heater Hose

9Y1210948ENS0019US0

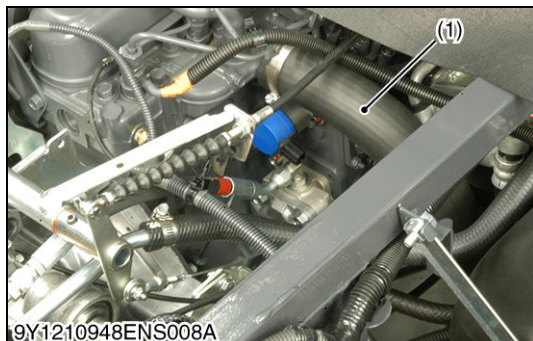


Muffler Cover

1. Remove the muffler cover (1).

(1) Muffler Cover

9Y1210948ENS0020US0



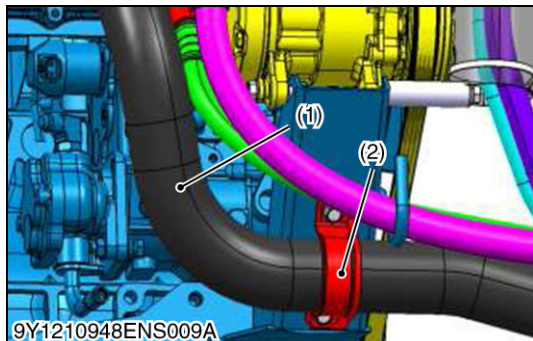
Intake Air Hose

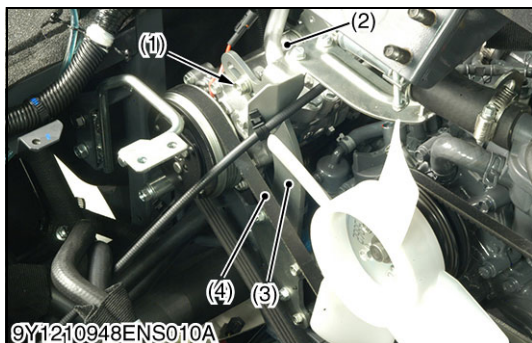
1. Disconnect the intake air hose (1).
2. Disconnect the intake hose clamp (2) from the frame.

(1) Intake Air Hose

(2) Clamp

9Y1210948ENS0021US0





Compressor

1. Remove the adjusting bolt (1).
2. Remove the air conditioner belt (4).
3. Disconnect the compressor (2) from the compressor bracket (3).
4. Remove the compressor bracket (3).

(When reassembling)

- Adjust the air conditioner belt (4). (See page G-45.)

(1) Adjusting Bolt

(2) Compressor

(3) Compressor Bracket

(4) Air Conditioner Belt

9Y1210948ENS0022US0



Fender and Fuel Cover

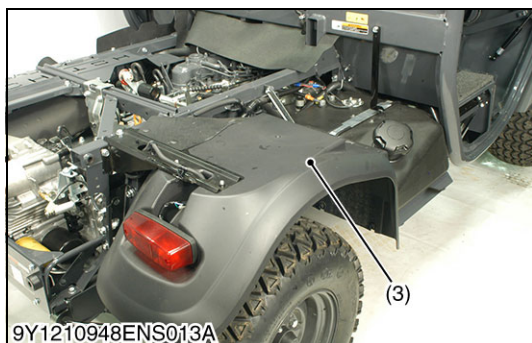
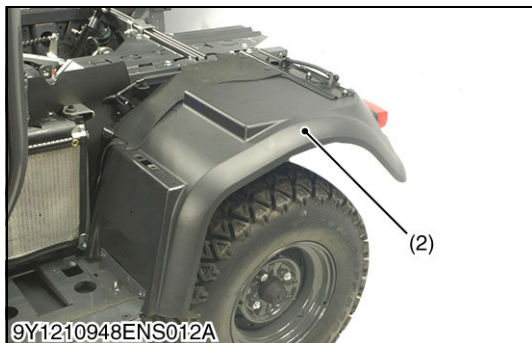
1. Remove the fuel tank cover (1).
2. Remove the rear fender LH (2) and RH (3).

(1) Tank Cover

(2) Fender LH

(3) Fender RH

9Y1210948ENS0023US0



Rear Wheel

1. Jack up the rear end after placing a wooden block under the bottom plate of the transmission frame.
2. Remove the rear wheels.

(When reassembling)

Tightening torque	Rear aluminum wheel mounting bolt	90 to 110 N·m 9.2 to 11.2 kgf·m 66.4 to 81.1 lbf·ft
	Rear steel wheel mounting bolt and nut	108 to 130 N·m 11.1 to 13.2 kgf·m 79.7 to 95.8 lbf·ft

(1) Rear Wheel

9Y1210946ENS0029US0

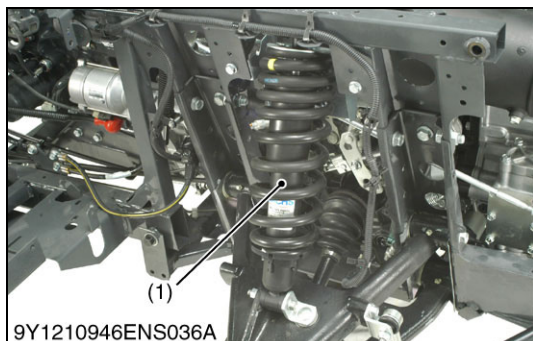


Transmission Rear Cover

1. Remove the transmission rear cover (1).

(1) Transmission Rear Cover

9Y1210948ENS0036US0



Rear Shock Absorber

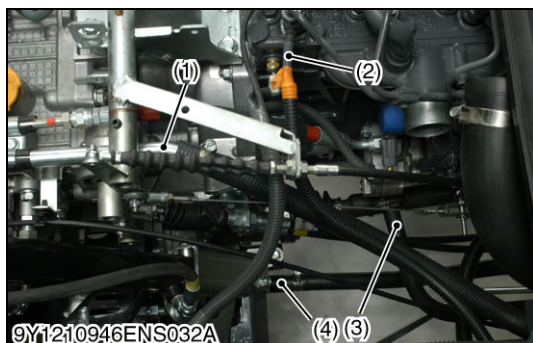
1. Jack up the rear drive shaft.
2. Remove the rear shock absorber (1).

(When reassembling)

- Apply grease (Shell Godus S5 T100 or equivalent) to the rear shock absorber bushing before inserting collar.

(1) Rear Shock Absorber

9Y1210946ENS0042US0



Hoses

1. Disconnect the HST drain hose (1) and HST suction hose (4).
2. Disconnect the hydraulic suction hose (3).
3. Disconnect the fuel suction hose (5) and fuel return hose (2).

(1) HST Drain Hose

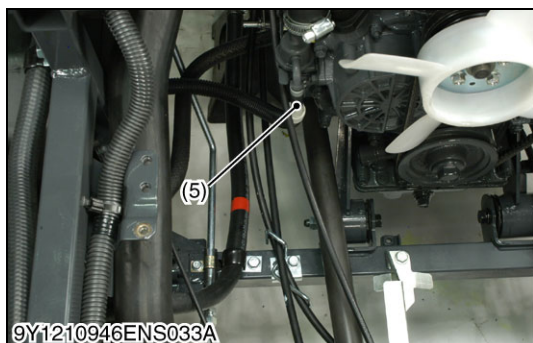
(4) HST Suction Hose

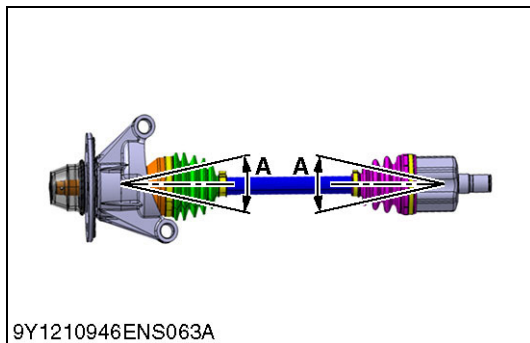
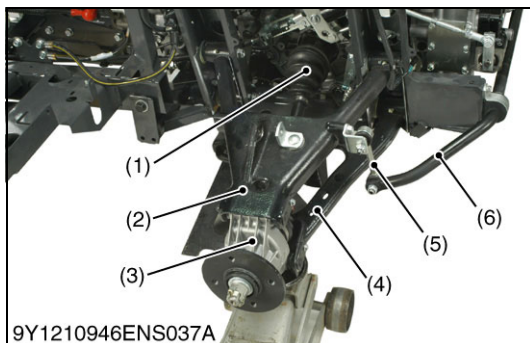
(2) Fuel Return Hose

(5) Fuel Suction Hose

(3) Hydraulic Suction Hose

9Y1210946ENS0039US0





Rear Drive Shaft

NOTE

- Do not exceed the range $\pm 25^\circ$ while handling.
- Remove the rear stabilizer (6) and stabilizer linkage (5).
 - Remove the rear arm mounting bolts and nuts.
 - Remove the rear upper arm (2).
 - Remove the rear drive shaft (1) with rear knuckle case (3).
 - Remove the rear lower arm (4).

(When reassembling)

- Apply grease (RAILMASTER or equivalent) to splines of rear drive shaft.

- | | |
|------------------|------------------------|
| (1) Drive Shaft | (5) Stabilizer Linkage |
| (2) Upper Arm | (6) Rear Stabilizer |
| (3) Knuckle Case | |
| (4) Lower Arm | |

A: $\pm 25^\circ$

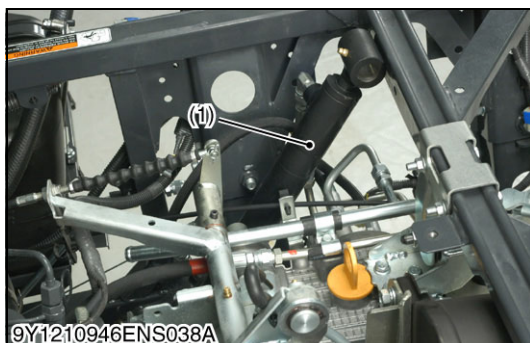
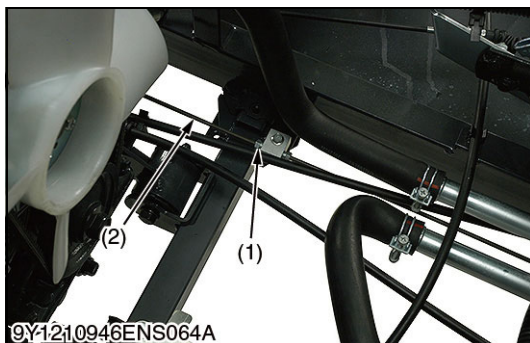
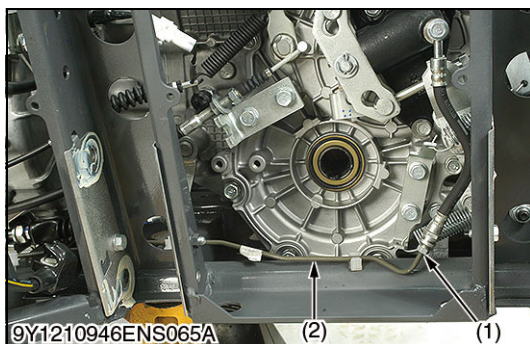
9Y1210946ENS0043US0

Brake Pipe

- Remove the brake pipe retaining nuts (1).
- Remove the brake pipe (2).

(When reassembling)

- After reassembling the brake pipe, bleed the air from the brake line immediately.



Hydraulic Lift Cylinder

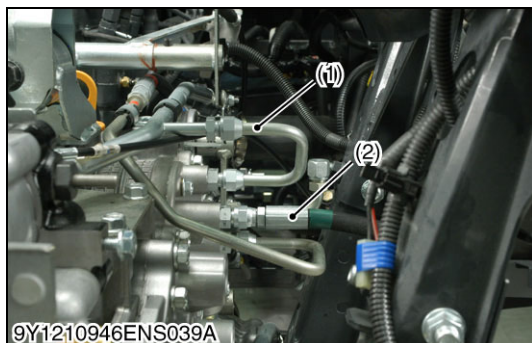
- Disconnect the hydraulic hoses.
- Remove the hydraulic lift cylinder (1) and cylinder bracket.

(When reassembling)

Tightening torque	Hydraulic lift cylinder hose retaining nut	24.0 to 25.0 N·m 2.45 to 2.54 kgf·m 17.7 to 18.4 lbf·ft
Tightening torque	Hydraulic lift cylinder pipe retaining nut	24.0 to 25.0 N·m 2.45 to 2.54 kgf·m 17.7 to 18.4 lbf·ft

- (1) Hydraulic Lift Cylinder

9Y1210946ENS0044US0



Power Steering Hose and Return Pipe

1. Disconnect the power steering hose (2).
2. Remove the return pipe (1).

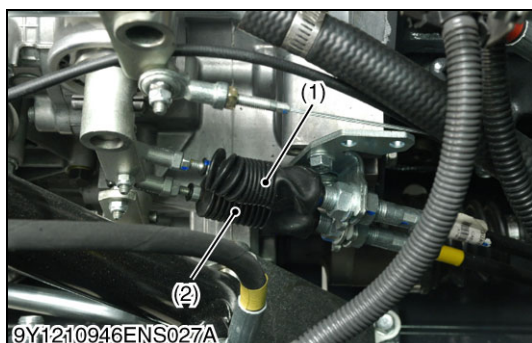
(When reassembling)

Tightening torque	Power steering hose retaining nut	24.0 to 25.0 N·m 2.45 to 2.54 kgf·m 17.7 to 18.4 lbf·ft
Tightening torque	Return pipe retaining nut	24.0 to 25.0 N·m 2.45 to 2.54 kgf·m 17.7 to 18.4 lbf·ft

(1) Return Pipe

(2) Power Steering Hose

9Y1210946ENS0045US0



Cables

1. Disconnect the hydraulic lift cable (1).
2. Disconnect the 4WD shift cable (2).
3. Disconnect the differential lock cable (3).
4. Disconnect the range gear shift cable (4).
5. Disconnect the parking brake cable (5).

(When reassembling)

- Adjust the length of hydraulic lift cable. (See page 7-S6.)
- Adjust the length of 4WD shift cable. (See page 2-S14.)
- Adjust the length of differential lock cable. (See page 2-S15.)
- Adjust the length of range gear shift cable. (See page 2-S13.)
- Adjust the length of parking brake cable. (See page 4-S7.)

(1) Hydraulic Lift Cable

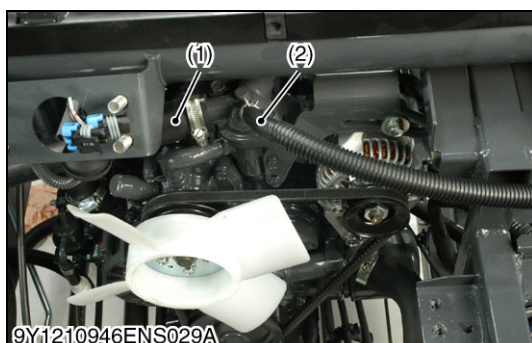
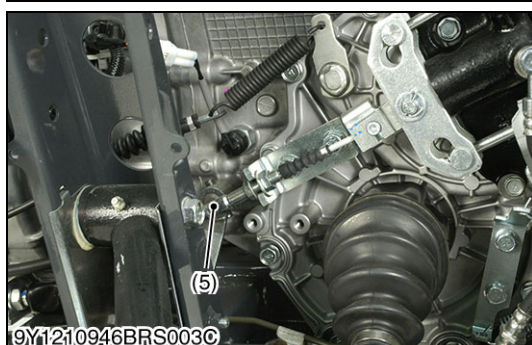
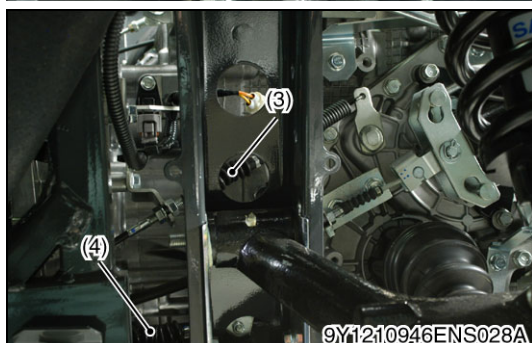
(4) Range Gear Shift Cable

(2) 4WD Shift Cable

(5) Parking Brake Cable

(3) Differential Lock Cable

9Y1210948ENS0024US0



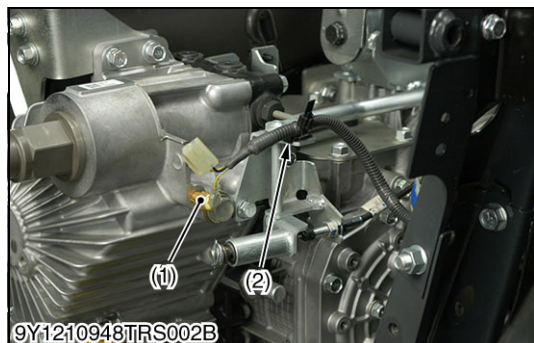
Radiator Hose

1. Disconnect the radiator hose (1).
2. Disconnect the breather hose (2).

(1) Radiator Hose

(2) Breather Hose

9Y1210946ENS0036US0



Unload Cable Linkage

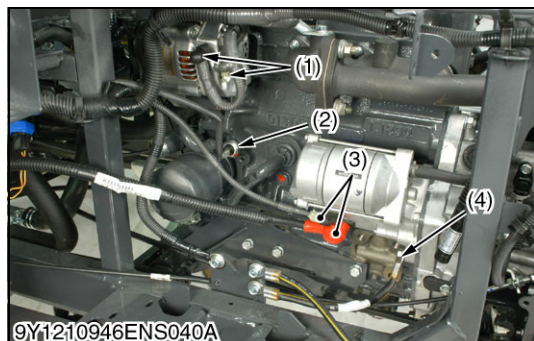
1. Disconnect the oil temperature switch connector (1).
2. Remove the unload cable linkage (2) with unload cable.

(When reassembling)

- Adjust the unload cable. (See page 2-S16.)

- (1) Oil Temperature Switch Connector (2) Unload Cable Linkage

9Y1210948ENS0025US0

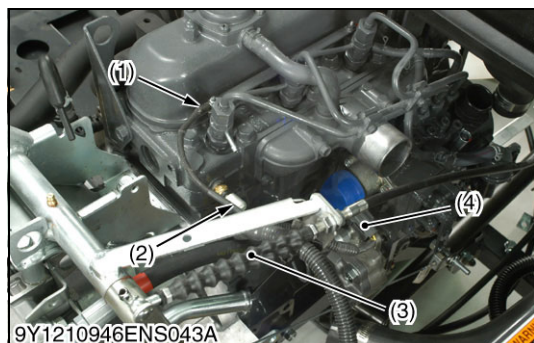
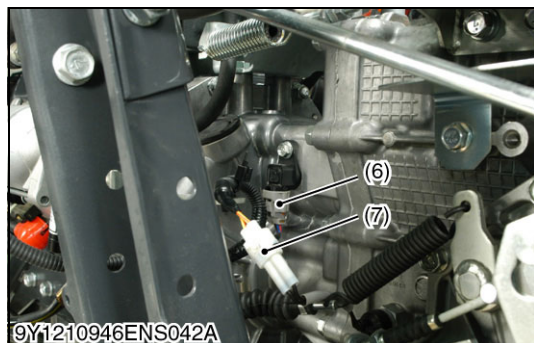


Wiring Harness LH

1. Disconnect the starter connectors (3).
2. Disconnect the engine oil pressure switch connector (2).
3. Disconnect the ground cables (4).
4. Disconnect the alternator connectors (1).
5. Disconnect the thermometer switch connector (5).
6. Disconnect the speed sensor connector (6).
7. Disconnect the safety switch connector (7).

- | | |
|--|----------------------------------|
| (1) Alternator Connector | (4) Ground Cable |
| (2) Engine Oil Pressure Switch Connector | (5) Thermometer Switch Connector |
| (3) Starter Connector | (6) Speed Sensor Connector |
| | (7) Safety Switch Connector |

9Y1210948ENS0026US0



Wiring Harness RH and Speed Control Panel Cable

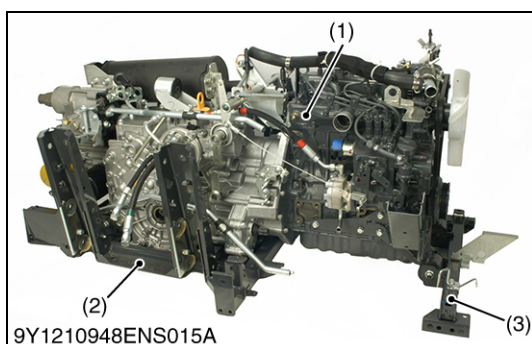
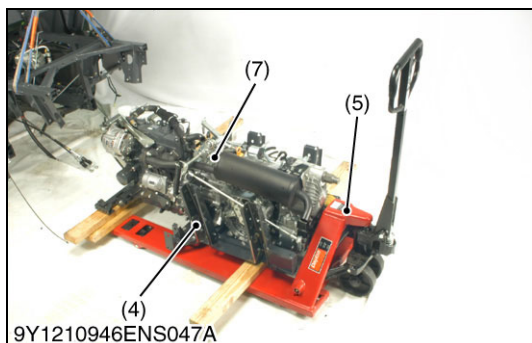
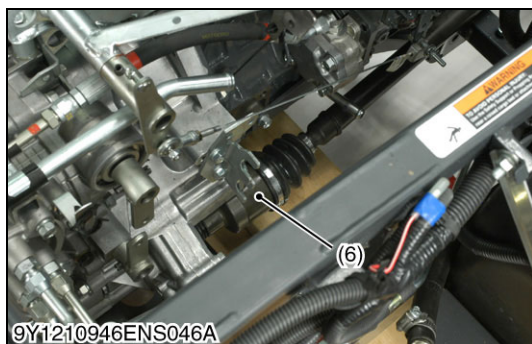
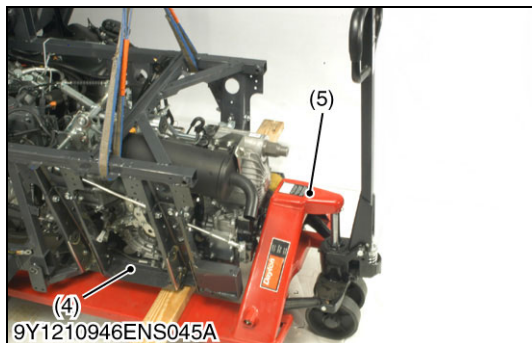
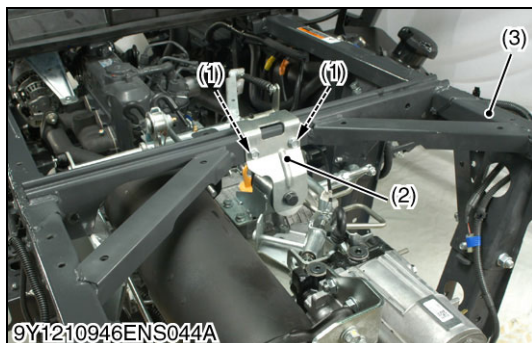
1. Disconnect the glow connector (1).
2. Disconnect the thermo sensor connector (2).
3. Disconnect the engine stop solenoid connector (4).
4. Disconnect the speed control pedal cable (3).

(When reassembling)

- Adjust the length of speed control pedal cable. (See page 2-S12.)

- | | |
|-----------------------------|------------------------------------|
| (1) Glow Connector | (3) Speed Control Pedal Cable |
| (2) Thermo Sensor Connector | (4) Engine Stop Solenoid Connector |

9Y1210948ENS0027US0



Dismounting Transmission and Engine One Piece Assembly

1. Remove the mission upper support (2) and collars (1).
2. Set the hand pallet trucks (5) as shown figure.
3. Lift the mainframe by using lift as shown in figure.
4. Remove the mission mounting bolts and nuts.
5. Disconnect the 4WD propeller shaft (6).
6. Remove the transmission and engine one piece assembly (7).

(When reassembling)

- Apply grease (RAILMASTER or equivalent) to 4WD propeller shaft (6).
- Transmission and engine one piece assembly (mission frame) into the main frame, do not forget to assemble the 4WD propeller shaft (6) as well.

Tightening torque	Mission frame mounting bolt and nuts	77.5 to 90.2 N·m 7.90 to 9.20 kgf·m 57.2 to 66.5 lbf·ft
-------------------	--------------------------------------	---

- | | |
|---------------------------|--|
| (1) Collar | (5) Hand Pallet Truck |
| (2) Mission Upper Support | (6) 4WD Propeller Shaft |
| (3) Main Frame | (7) Transmission and Engine One Piece Assembly |
| (4) Mission Frame | |

9Y1210946ENS0048US0

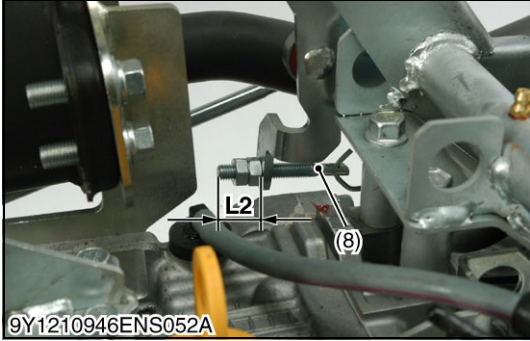
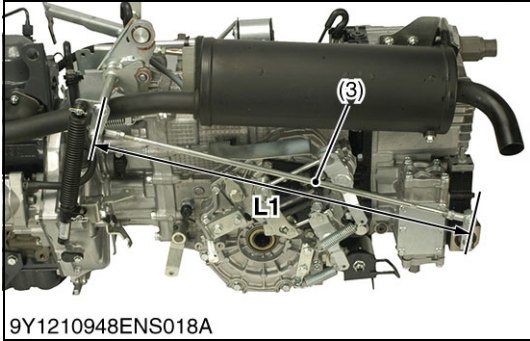
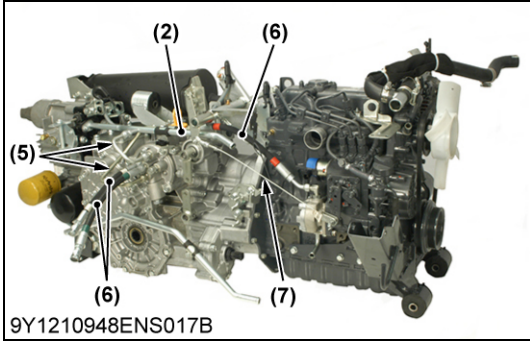
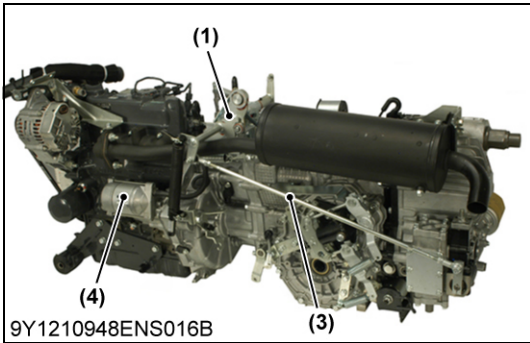
Mission Frame

1. Lift the transmission and engine one piece assembly (1) with mission frame (2) and engine frame (3).
2. Remove the mission frame (2).

- | | |
|--|-------------------|
| (1) Transmission and Engine One Piece Assembly | (2) Mission Frame |
| | (3) Engine Frame |

9Y1210948ENS0028US0

(2) Separating Transmission Engine



Linkage, Starter and Hydraulic Pipe

- 1. Remove the HST rod (3).
- 2. Remove the engine cable (7).
- 3. Remove the HST linkage (1).
- 4. Remove the starter (4).
- 5. Remove the hydraulic hose (6) and hydraulic pipes (5).
- 6. Remove the HST return pipe (2).

(When reassembling)

- Adjust the length the HST rod (3).
- Apply LOCTITE-5699 or equivalent to mounting surface of starter assembly.

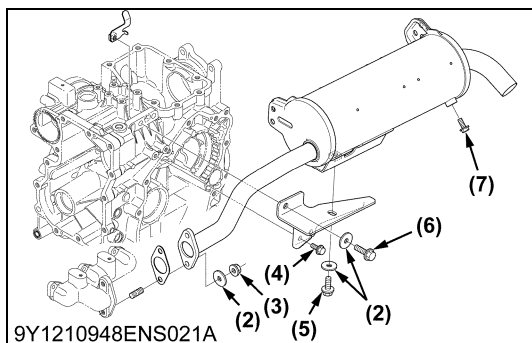
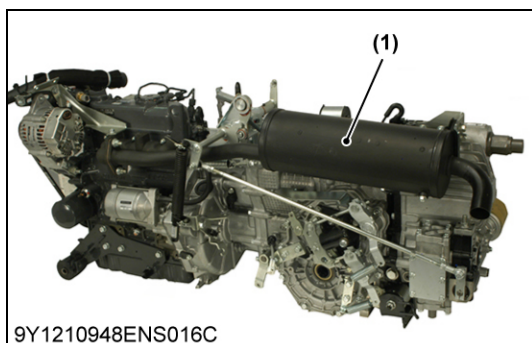
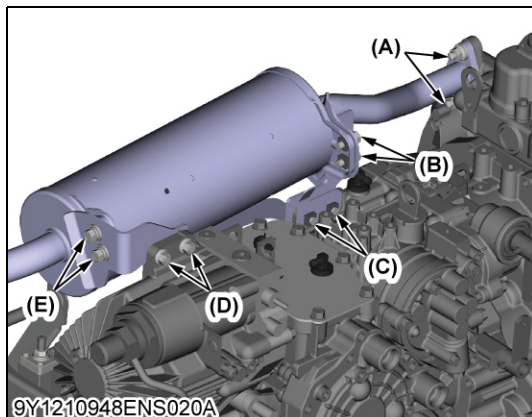
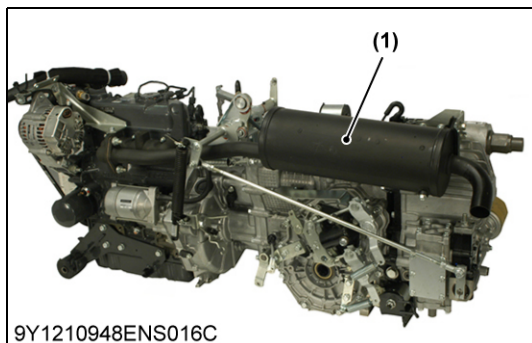
Tightening torque	Hydraulic pipe retaining nut	24.0 to 25.0 N·m 2.45 to 2.54 kgf·m 17.7 to 18.4 lbf·ft
	Hydraulic hose retaining nut	24.0 to 25.0 N·m 2.45 to 2.54 kgf·m 17.7 to 18.4 lbf·ft
	HST return pipe bolt	17.6 to 20.6 N·m 1.80 to 2.10 kgf·m 13.0 to 15.1 lbf·ft

- (1) HST Linkage
- (2) HST Return Pipe
- (3) HST Rod
- (4) Starter
- (5) Hydraulic Pipe
- (6) Hydraulic Hose
- (7) Engine Cable
- (8) Tension Bolt

(Reference)

L1: 620 mm (24.4 in.)
L2: 20 mm (0.79 in.)

9Y1210948ENS0029US0



Muffler (RTV-X1100 S/N <= 58342)

1. Remove the muffler (1).

(When reassembling)

- Replace the muffler gasket with a new one.
- Tighten in the specified tightening sequence shown.

Step	Action	Specification	Sequence
1	Hand tighten	Hand tight	From (A) to (E)
2	Tighten	48.0 to 55.9 N·m 4.90 to 5.70 kgf·m 35.4 to 41.2 lbf·ft	From (A) to (E)

(1) Muffler

NEW-9Y1210948ENS0029-1US0

Muffler (RTV-X1100 S/N => 58343)

1. Remove the muffler (1).

(When reassembling)

- Replace the muffler gasket with a new one.
- Tighten in the specified tightening sequence shown.

Step	Action	Specification	Sequence
1	Hand tighten	Hand tight	(3), (6), (4), (5)
2	Tighten	48.0 to 55.9 N·m 4.90 to 5.70 kgf·m 35.4 to 41.2 lbf·ft	(3), (6), (5)
3	Tighten	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.4 to 20.2 lbf·ft	(4), (7)

(1) Muffler

(2) Washer

(3) Nut

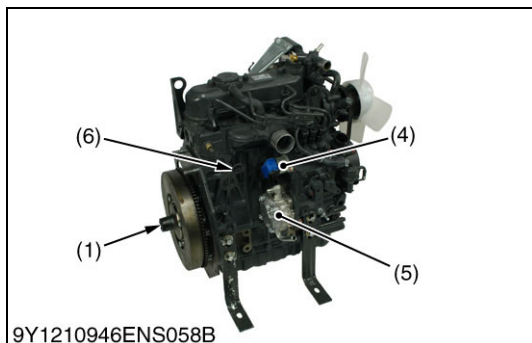
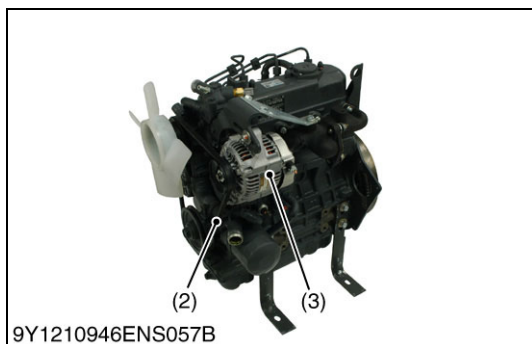
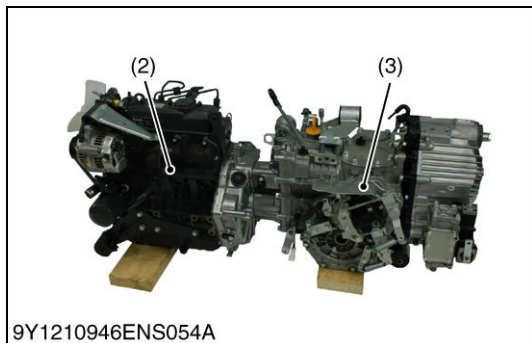
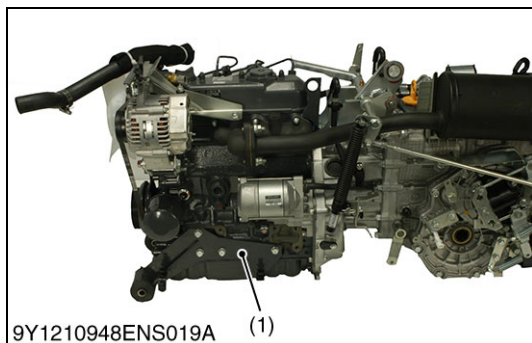
(4) Flange Bolt (M8x20)

(5) Flange Bolt (M10x25)

(6) Flange Bolt (M10x35)

(7) Flange Bolt (M8x12)

NEW-9Y1210948ENS0029-2US0



Separate the Transmission and Engine One Piece Assembly

1. Remove the engine support (1).
2. Remove the engine mounting screws to separate the engine from the transmission.
3. Install the engine stand.

(When reassembling)

- Apply grease (RAILMASTER or equivalent) to spline hole of input flange
- Apply liquid gasket (LOCKTITE-5699 or equivalent) to joint face of engine rear and plate and the transmission case.

(1) Engine Support

(3) Transmission

(2) Engine

9Y1210948ENS0030US0

Outer Parts

1. Remove the input flange (1).
2. Remove the alternator (3) and fan belt (2).
3. Remove the dipstick (6).
4. Remove the engine stop solenoid (4).
5. Remove the hydraulic pump (5).

(When reassembling)

- Adjust the alternator belt tension. (See page G-37.)

(1) Input Flange

(4) Engine Stop Solenoid

(2) Fan Belt

(5) Hydraulic Pump

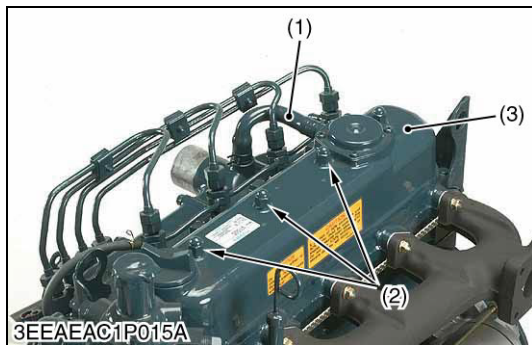
(3) Alternator

(6) Dipstick

9Y1210948ENS0031US0

[3] DISASSEMBLING AND ASSEMBLING

(1) Cylinder Head and Valve



Cylinder Head Cover

1. Disconnect the breather hose (1).
2. Remove the cylinder head cover screw (2).
3. Remove the cylinder head cover (3).

(When reassembling)

- Check to see if the cylinder head cover gasket is not damaged.

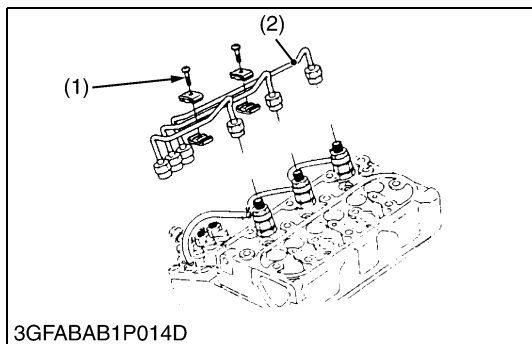
Tightening torque	Cylinder head cover screw	7 to 8 N·m 0.7 to 0.9 kgf·m 5 to 6 lbf·ft
-------------------	---------------------------	---

(1) Breather Hose

(3) Cylinder Head Cover

(2) Cylinder Head Cover Screw

9Y1210946ENS0078US0



Injection Pipes

1. Loosen the screws to the pipe clamp (1).
2. Remove the injection pipes (2).

(When reassembling)

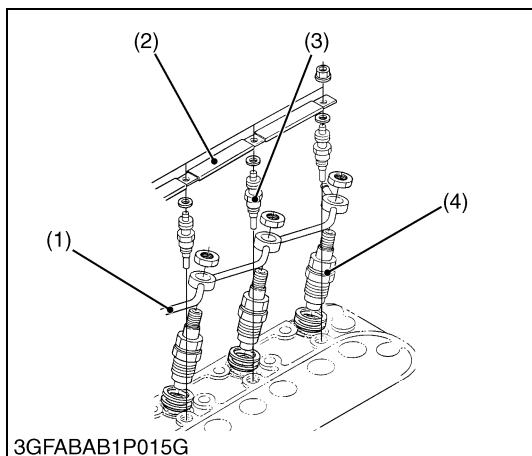
- Send compressed air into the pipes to blow out dust. Then, reassemble the pipes in the reverse order.

Tightening torque	Injection pipe retaining nut	25 to 34 N·m 2.5 to 3.5 kgf·m 18 to 25 lbf·ft
-------------------	------------------------------	---

(1) Pipe Clamp

(2) Injection Pipe

9Y1210946ENS0079US0



Nozzle Holder Assembly and Glow Plug

1. Remove the overflow pipe (1).
2. Remove the nozzle holder assemblies (4).
3. Remove the copper gasket (5) and heat seal (6).
4. Remove the lead (2) from the glow plugs (3).
5. Remove the glow plugs (3).

(When reassembling)

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

Tightening torque	Overflow pipe retaining nut	35 to 39 N·m 3.5 to 4.0 kgf·m 26 to 28 lbf·ft
	Nozzle holder assembly	49 to 68 N·m 5.0 to 7.0 kgf·m 37 to 50 lbf·ft
	Glow plug	7.9 to 14 N·m 0.80 to 1.5 kgf·m 5.8 to 10 lbf·ft

(1) Overflow Pipe

(4) Nozzle Holder Assembly

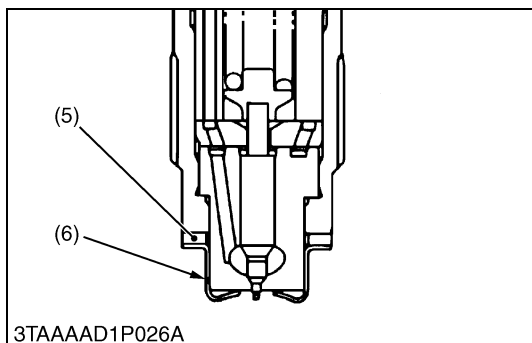
(2) Lead

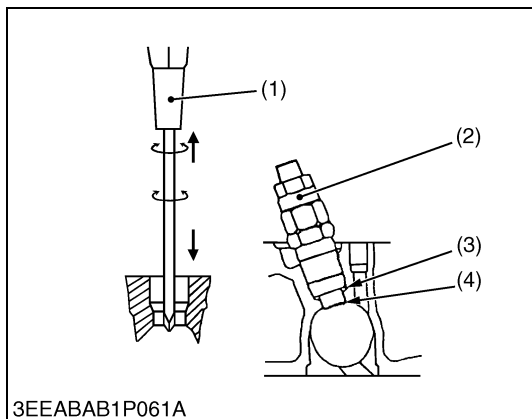
(5) Copper Gasket

(3) Glow Plug

(6) Heat Seal

9Y1210946ENS0080US0





Nozzle Heat Seal Service Removal Procedure

■ IMPORTANT

- Use a plus (Phillips head) screw driver (1) that has a diameter which is bigger than the heat seal hole (Approx. 6.0 mm (0.24 in.)).

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

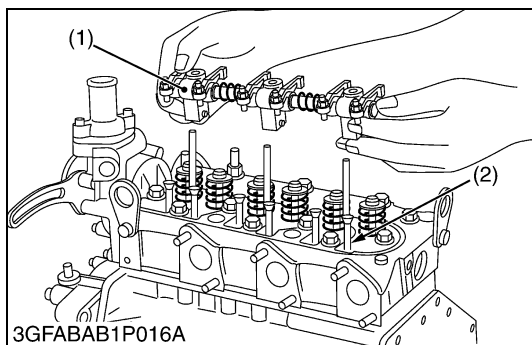
(When reassembling)

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

- (1) Plus Screw Driver
(2) Injection Nozzle

- (3) Injection Nozzle Gasket
(4) Heat Seal

9Y1210946ENS0056US0



Rocker Arm and Push Rod

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

(When reassembling)

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

■ IMPORTANT

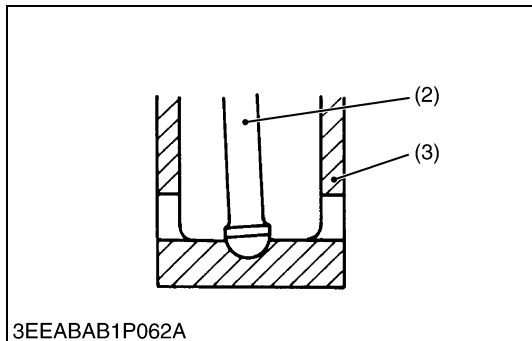
- After installing the rocker arm, be sure to adjust the valve clearance.

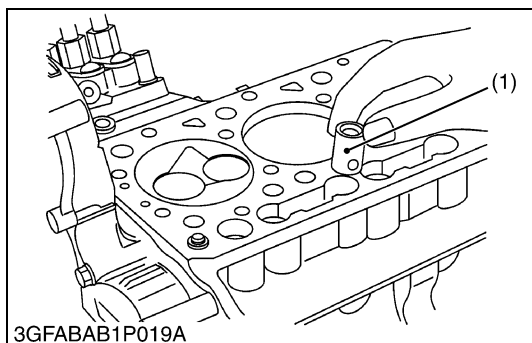
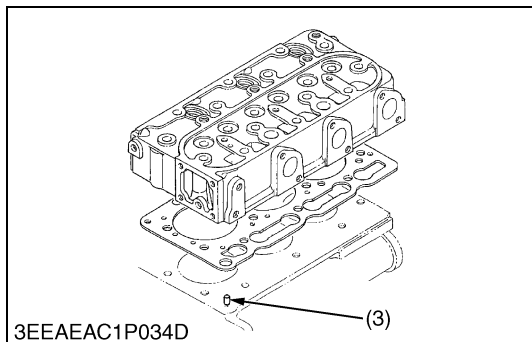
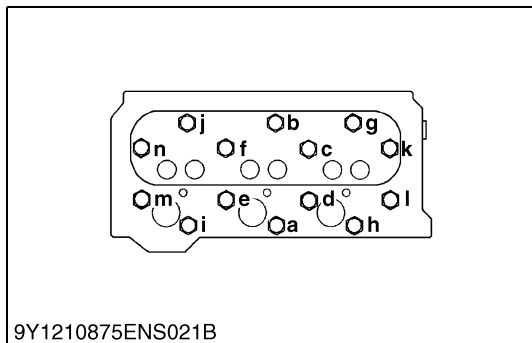
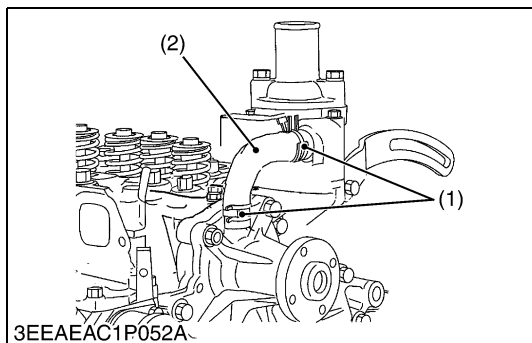
Tightening torque	Rocker arm bracket nut	22 to 26 N·m 2.2 to 2.7 kgf·m 16 to 19 lbf·ft
-------------------	------------------------	---

- (1) Rocker Arm Assembly
(2) Push Rod

- (3) Tappet

9Y1210946ENS0082US0





Cylinder Head and Cylinder Head Gasket

1. Loosen the pipe clamps (1), and remove the water return pipe (2).
2. Remove the cylinder head screw in the order of "n" or "r" to "a" and remove the cylinder head.
3. Remove the cylinder head gasket.

(When reassembling)

- Replace the cylinder head gasket with new one.
- When mounting the gasket, set it to the pin pipe holes. Be careful not to mount it reversely.
- The cylinder head should be free of scratches and dust.
- Install the cylinder head, using care not to damage the gasket.
- After applying engine oil to the thread of screws, tighten them in several steps and specified sequence "a" to "n" or "r".

■ NOTE

- Do not use O-ring on the pin pipe.
- It is not necessary to retighten the cylinder head screw and to readjust valve clearance after engine warmed up.

Tightening torque	Cylinder head screw	64 to 68 N·m 6.5 to 7.0 kgf·m 47 to 50 lbf·ft
-------------------	---------------------	---

- (1) Clamp
- (2) Return Pipe
- (3) Pin Pipe

"n" or "r" to "a": To Loosen
"a" to "n" or "r": To Tighten

9Y1210946ENS0083US0

Tappets

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

(When reassembling)

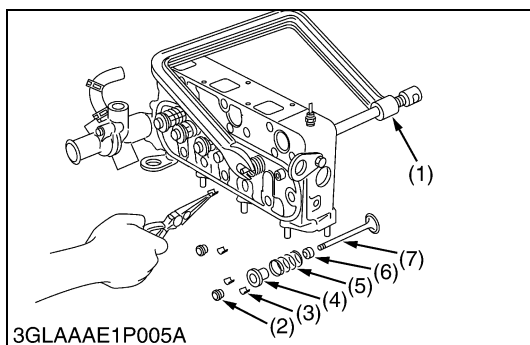
- Visually check the contact between tappets and cams for proper rotation. If problem is found, replace tappets.
- Before installing the tappets, apply engine oil thinly around them.

■ IMPORTANT

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

- (1) Tappet

9Y1210946ENS0084US0



Valves

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

(When reassembling)

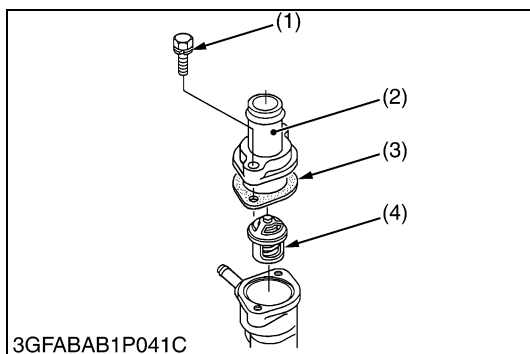
- Wash the valve stem and valve guide hole, and apply engine oil sufficiently.
- After installing the valve spring collets, lightly tap the stem to assure proper fit with a plastic hammer.

■ IMPORTANT

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

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

9Y1210946ENS0085US0



Thermostat Assembly

1. Remove the thermostat cover mounting screws (1), and remove the thermostat cover (2).
2. Remove the thermostat assembly (4).

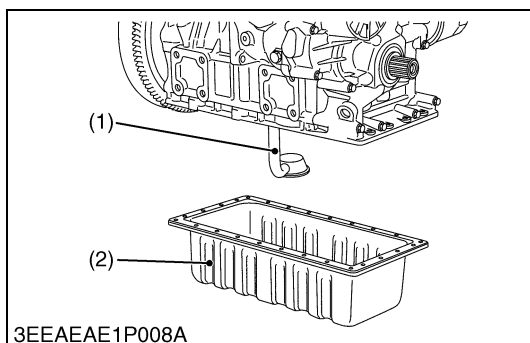
(When reassembling)

- Replace the gasket (3) with a new one.

- | | |
|-------------------------------------|-----------------------------|
| (1) Thermostat Cover Mounting Screw | (3) Thermostat Cover Gasket |
| (2) Thermostat Cover | (4) Thermostat Assembly |

9Y1210946ENS0061US0

(2) Gear Case and Timing Gears



Oil Pan and Oil Strainer

1. Remove the oil pan mounting screws.
2. Remove the oil pan (2).
3. Remove the oil strainer (1).

(When reassembling)

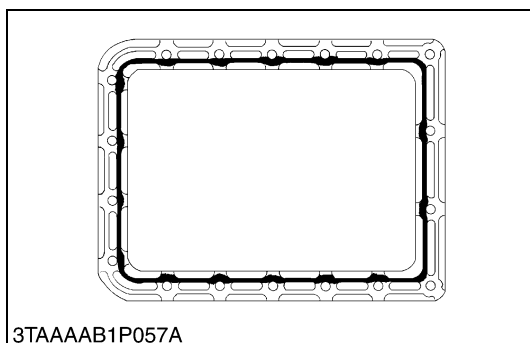
- After cleaning the oil strainer, check to see that the filter mesh is clean, and install it.
- Visually check the O-ring, apply engine oil, and install it.
- Securely fit the O-ring to the oil strainer.
- To avoid uneven tightening, tighten oil pan mounting screws in diagonal order from the center.

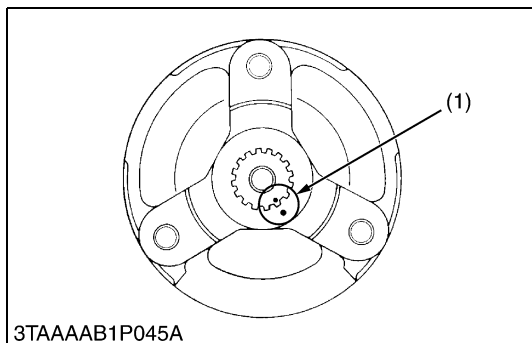
■ IMPORTANT

- **Scrape off the old adhesive completely. Wipe the sealing surface clean using waste cloth soaked with gasoline.**
- **Apply "liquid gasket" (Three Bond 1207D or equivalent) about 3.0 to 5.0 mm (0.12 to 0.19 in.) thick. Within 20 minutes after the application of liquid gasket, reassemble the components.**

- | | |
|------------------|-------------|
| (1) Oil Strainer | (2) Oil Pan |
|------------------|-------------|

9Y1210946ENS0087US0





Fan Drive Pulley

1. Secure the flywheel to keep it from turning.
2. Remove the fan drive pulley screw.
3. Draw out the fan drive pulley with a puller.

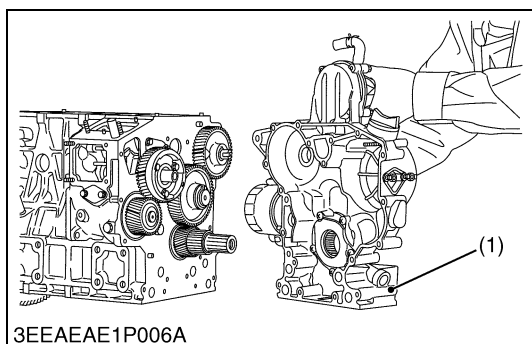
(When reassembling)

- Install the pulley to crankshaft, aligning the mark (1) on them (3-cylinder engine).
- Apply engine oil to the fan drive pulley retaining screw. And tighten it.

Tightening torque	Fan drive pulley screw	236 to 245 N·m 24.0 to 25.0 kgf·m 174 to 180 lbf·ft
-------------------	------------------------	---

(1) Aligning Mark

9Y1210946ENS0088US0



Gear Case

1. Remove the fuel feed pump.
2. Remove the gear case.

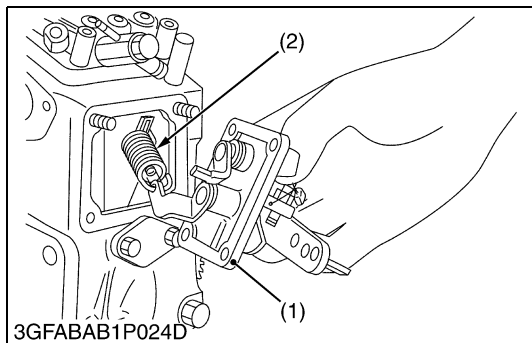
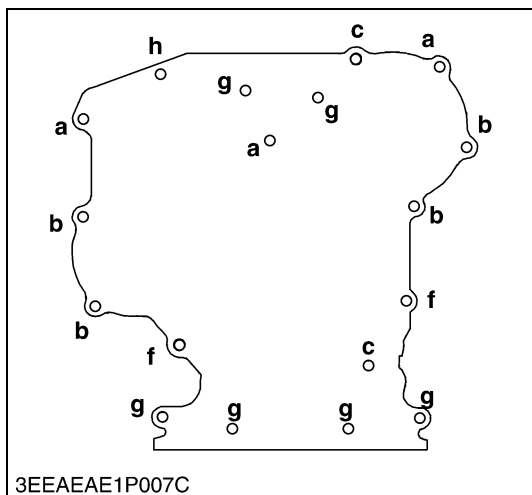
(When reassembling)

- Grease thinly to the oil seal, and install it, ensuring the lip does not come off.

(1) Gear Case

- a: Bolt Length = 45 mm (1.8 in.)
b: Bolt Length = 50 mm (2.0 in.)
c: Bolt Length = 55 mm (2.2 in.)
f: Bolt Length = 70 mm (2.8 in.)
g: Bolt Length = 85 mm (3.3 in.)
h: Nut

9Y1210946ENS0089US0



Speed Control Plate

1. Remove the engine stop solenoid.
2. Remove the speed control plate (1).

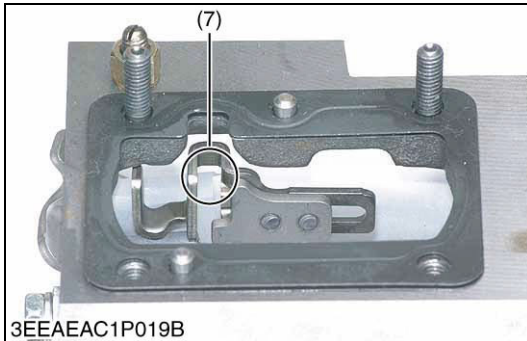
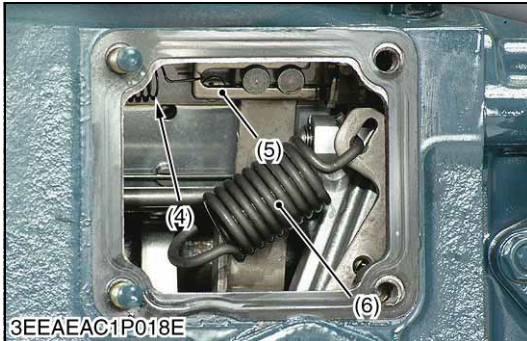
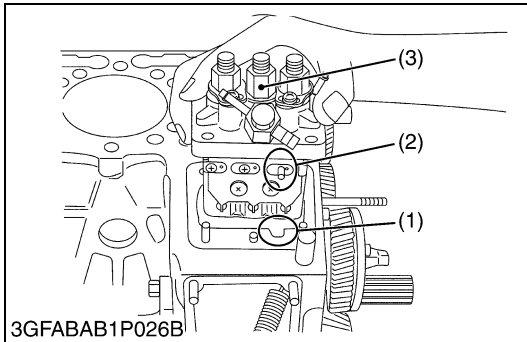
(When reassembling)

- Apply a liquid gasket (Three Bond 1215 or equivalent) to both sides of the solenoid cover gasket and control plate gasket.
- Be careful not to drop the governor spring (2) into the crankcase.

(1) Plate

(2) Governor Spring

9Y1210946ENS0090US0



Injection Pump

1. Disconnect the start spring (4) on the thrust lever side (5).
2. Align the control rack pin (2) with the notch (1) on the crankcase, and remove the injection pump (3).
3. Remove the injection pump shims.
4. In principle, the injection pump should not be disassembled.

(When reassembling)

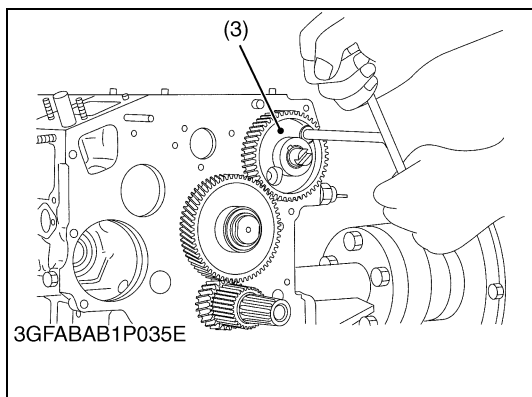
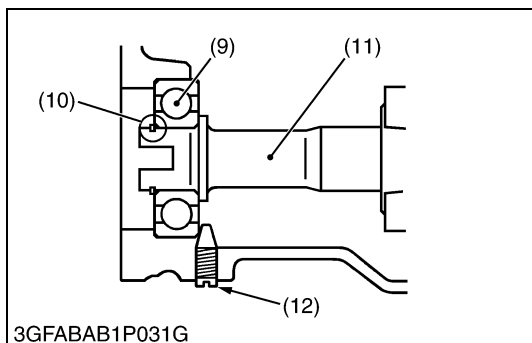
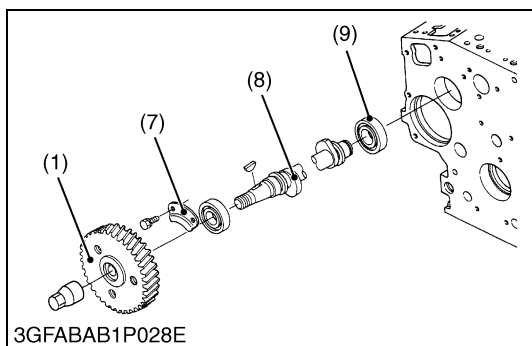
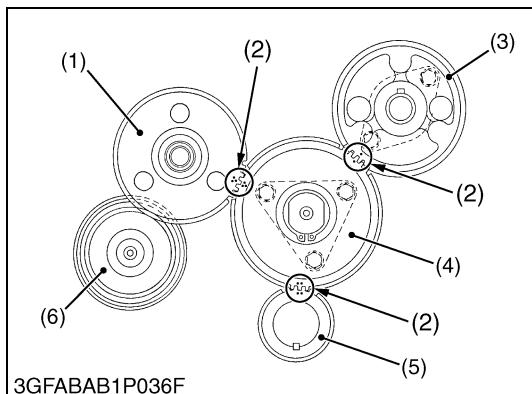
- When installing the injection pump, insert the control rack pin (2) firmly into the groove (7) of the thrust lever of fork lever.

■ NOTE

- Addition or reduction of shim (0.05 mm, 0.0020 in.) delays or advances the injection timing by approx. 0.0087 rad (0.5°).
- In disassembling and replacing, be sure to use the same number or new gasket shims with the same thickness.

- | | |
|----------------------|---------------------|
| (1) Notch | (6) Governor Spring |
| (2) Control Rack Pin | (7) Groove |
| (3) Injection Pump | |
| (4) Start Spring | |
| (5) Thrust Lever | |

9Y1210946ENS0091US0



Cam Gear, Idle Gear 1, 2 and Governor Gear

1. Remove the idle gear 1 (4).
2. Remove the fuel camshaft stopper (7).
3. Draw out the fuel cam gear (1) with fuel camshaft (8).
4. Remove the camshaft stopper bolt.
5. Remove the cam gear (3) with camshaft.
6. Remove the external snap ring (10) from the governor shaft (11).
7. Remove the governor gear (6) with governor shaft (11).

NOTE

- **Three-lever type fork lever**

To remove the governor shaft, follow the procedures in 5, 6 above and never remove fork lever and the max torque limiter.

(When reassembling)

- Apply engine oil thinly to the fuel camshaft before installation.
- Make sure to assemble the external snap ring of the governor shaft.
- Check the governor shaft for smooth rotation.

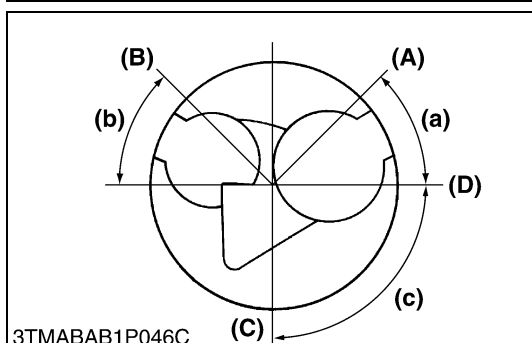
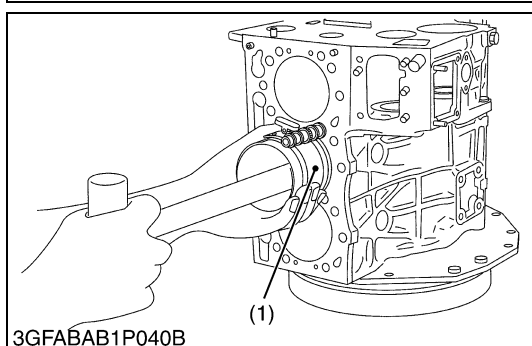
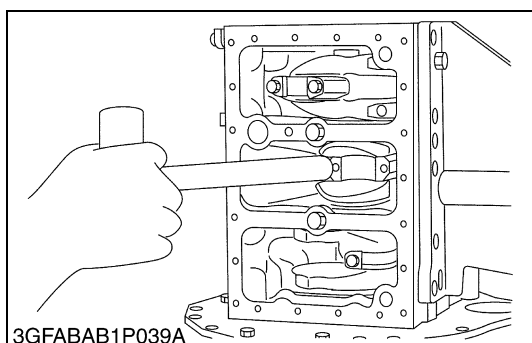
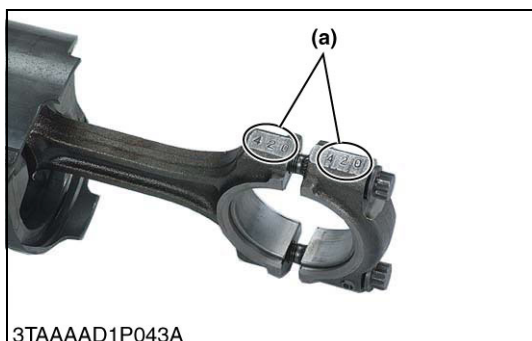
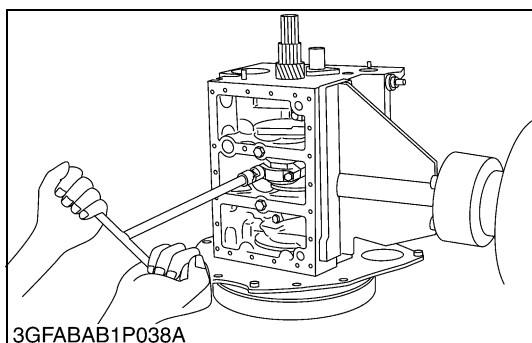
IMPORTANT

- When replacing the ball bearing of governor shaft, securely fit the ball bearing (9) to the crankcase, apply an adhesive (Three Bond 1324B or equivalent) to the set screw (12), and fasten the screw until its tapered part contacts the circumferential end of the ball bearing.
- When installing the idle gear, be sure to align the alignment marks on each gears.

- | | |
|--------------------|---------------------------|
| (1) Fuel Cam Gear | (7) Fuel Camshaft Stopper |
| (2) Alignment Mark | (8) Fuel Camshaft |
| (3) Cam Gear | (9) Ball Bearing |
| (4) Idle Gear 1 | (10) External Snap Ring |
| (5) Crank Gear | (11) Governor Shaft |
| (6) Governor Gear | (12) Set Screw |

9Y1210946ENS0092US0

(3) Piston and Connecting Rod



Connecting Rod

1. Remove the connecting rod cap.

(When reassembling)

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

Tightening torque	Connecting rod screw	42 to 46 N·m 4.2 to 4.7 kgf·m 31 to 33 lbf·ft
-------------------	----------------------	---

(a) Mark

9Y1210946ENS0093US0

Pistons

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

(When reassembling)

- Before inserting the piston into the cylinder, apply enough engine oil to the piston.
- When inserting the piston into the cylinder, face the mark on the connecting rod to the injection pump.

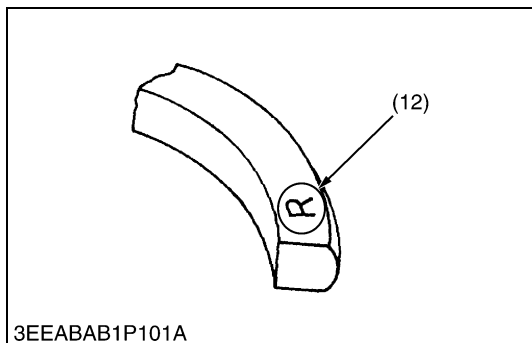
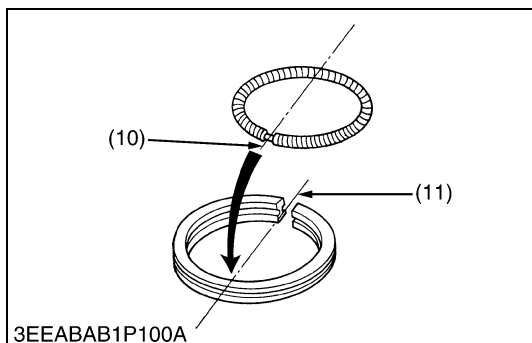
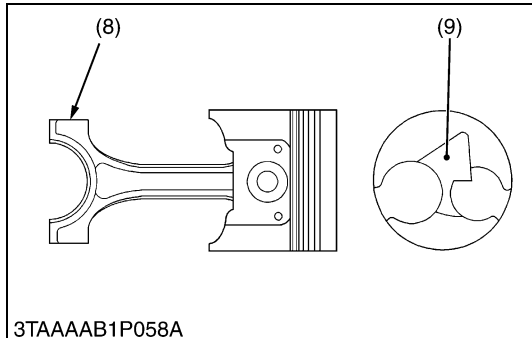
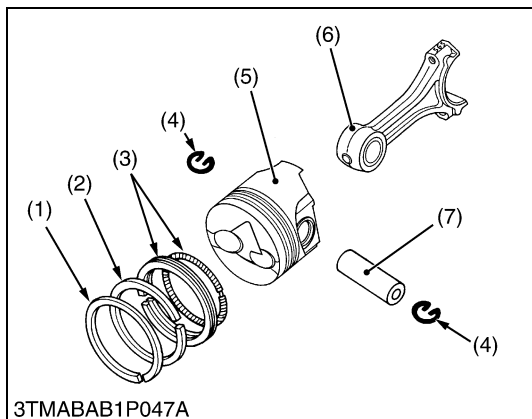
■ IMPORTANT

- Do not change the combination of cylinder and piston. Make sure of the position of each piston by marking. For example, mark "1" on the No.1 piston.
- When installing the piston into the cylinder, place the gaps of all the piston rings as shown in the figure.
- Carefully insert the pistons using a piston ring compressor (1). Otherwise, their chrome-plated section may be scratched, causing trouble inside the cylinder.

- | | |
|----------------------------|--------------------|
| (1) Piston Ring Compressor | (a) 0.79 rad (45°) |
| | (b) 0.79 rad (45°) |
| | (c) 1.6 rad (90°) |

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

9Y1210946ENS0094US0



Piston Ring and Connecting Rod

1. Remove the piston rings using a piston ring tool.
2. Remove the piston pin (7), and separate the connecting rod (6) from the piston (5).

(When reassembling)

- When installing the ring, assemble the rings so that the manufacturer's mark (12) near the gap faces the top of the piston.
- When installing the oil ring onto the piston, place the expander joint (10) on the opposite side of the oil ring gap (11).
- Apply engine oil to the piston pin.
- When installing the connecting rod to the piston, immerse the piston in 80 °C (176 °F) oil for 10 to 15 minutes and insert the piston pin to the piston.
- When installing the connecting rod to the piston, align the mark (8) on the connecting rod to the fan-shaped concave (9).

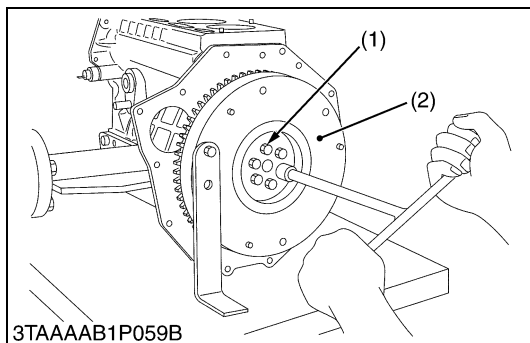
■ NOTE

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

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

9Y1210946ENS0095US0

(4) Flywheel and Crankshaft



Flywheel

1. Secure the flywheel to keep it from turning, using a flywheel stopper.
2. Remove all flywheel screws (1) and then remove the flywheel (2).

(When reassembling)

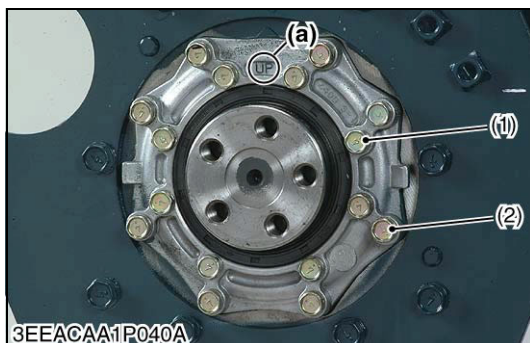
- Apply engine oil to the threads and the undercut surface of the flywheel screw and fit the screw.

Tightening torque	Flywheel screw	54 to 58 N·m 5.5 to 6.0 kgf·m 40 to 43 lbf·ft
-------------------	----------------	---

(1) Flywheel Screw

(2) Flywheel

9Y1210946ENS0096US0



Bearing Case Cover

1. Remove the bearing case cover mounting screws.
2. Remove the bearing case cover (6).

■ IMPORTANT

- The length of inside screws (1) and outside screws (2) are different. Do not take a mistake using inside screws and outside screws.

(When reassembling)

- Fit the bearing case gasket (3) and the bearing case cover gasket (4) with correct directions.
- Install the bearing case cover (6) to position the casting mark "UP" on it upward.
- Apply engine oil to the oil seal (5) lip and be careful that it is not rolled when installing.
- Tighten the bearing case cover mounting screws with even force on the diagonal line.

Tightening torque	Bearing case cover mounting screw	10.8 to 12.2 N·m 1.10 to 1.25 kgf·m 7.96 to 9.04 lbf·ft
-------------------	-----------------------------------	---

(1) Bearing Case Cover Mounting Screw (Inside) (Long)

(5) Oil Seal

(2) Bearing Case Cover Mounting Screw (Outside) (Short)

(6) Bearing Case Cover

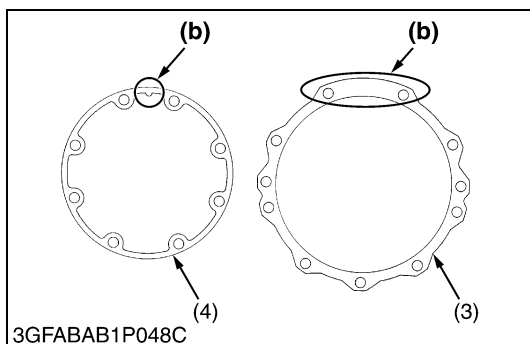
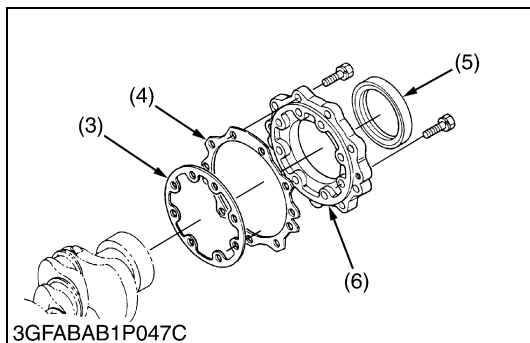
(3) Bearing Case Gasket

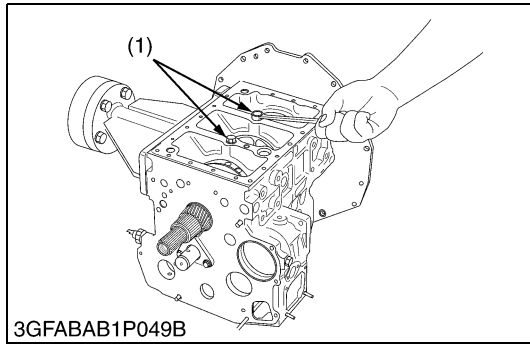
(a) Top Mark "UP"

(4) Bearing Case Cover Gasket

(b) Upside

9Y1210946ENS0097US0





Crankshaft Assembly

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

■ IMPORTANT

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

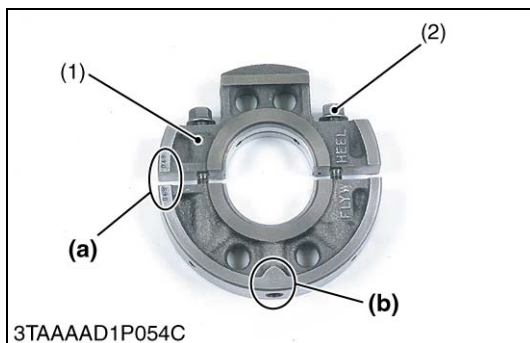
(When reassembling)

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

Tightening torque	Main bearing case screw 2	49 to 53 N·m 5.0 to 5.5 kgf·m 37 to 39 lbf·ft
-------------------	---------------------------	---

(1) Main Bearing Case Screw 2

9Y1210946ENS0098US0



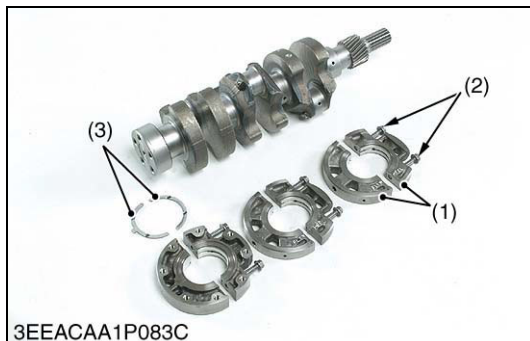
Main Bearing Case Assembly

1. Remove the two main bearing case screws 1 (2) of each main bearing cases.
2. Remove the main bearing case from crankshaft.

(When reassembling)

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

Tightening torque	Main bearing case screw 1	30 to 34 N·m 3.0 to 3.5 kgf·m 22 to 25 lbf·ft
-------------------	---------------------------	---



(1) Main Bearing Case Assembly 1

(2) Main Bearing Case Screw 1

(3) Thrust Bearing

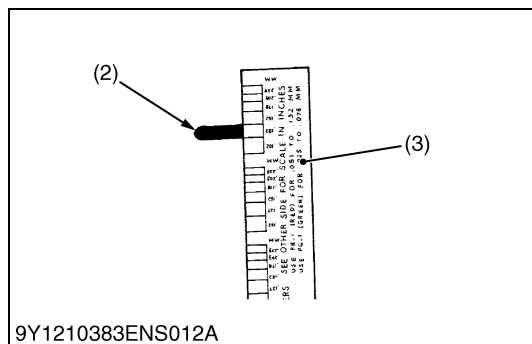
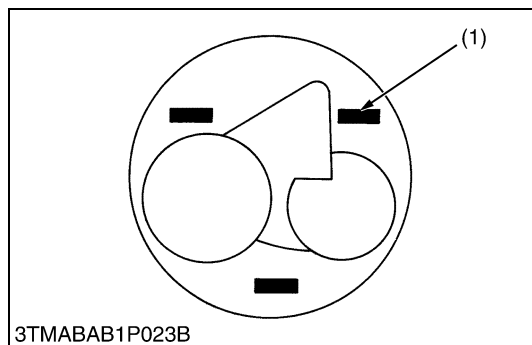
(a) Alignment Number

(b) Marking (A, B, C)

9Y1210946ENS0180US0

5. SERVICING

[1] Cylinder Head and Valves



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.
6. If they are out of spec, check the oil clearance of the crank pin, journals and piston pins.

■ NOTE

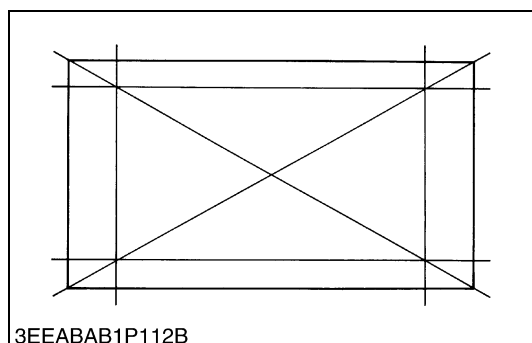
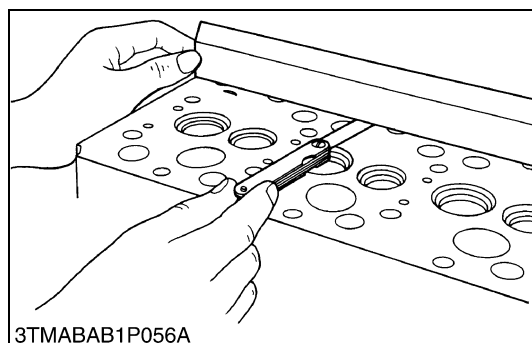
- Top clearance = Width of the crushed plastigauge (2).

Top clearance	Factory specification	0.55 to 0.75 mm 0.022 to 0.029 in.
Tightening torque	Cylinder head screw	64 to 68 N·m 6.5 to 7.0 kgf·m 47 to 50 lbf·ft

- (1) Plastigauge
(2) Crushed Plastigauge

(3) Scale

9Y1210946ENS0139US0



Cylinder Head Surface Flatness

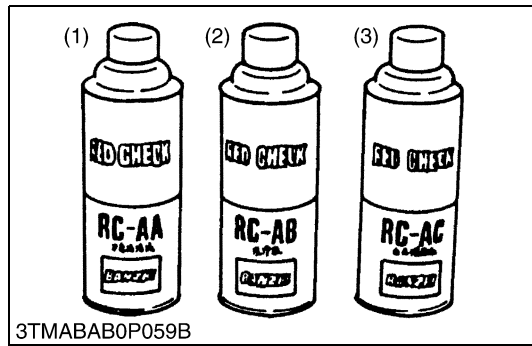
1. Clean the cylinder head surface.
2. Place a straightedge on the cylinder head's four sides and two diagonal as shown in the figure.
3. Measure the clearance with a thickness gauge.
4. If the measurement exceeds the allowable limit, correct it with a surface grinder.

■ IMPORTANT

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

Cylinder head surface flatness	Allowable limit	0.05 mm 0.002 in.
--------------------------------	-----------------	----------------------

9Y1210946ENS0140US0



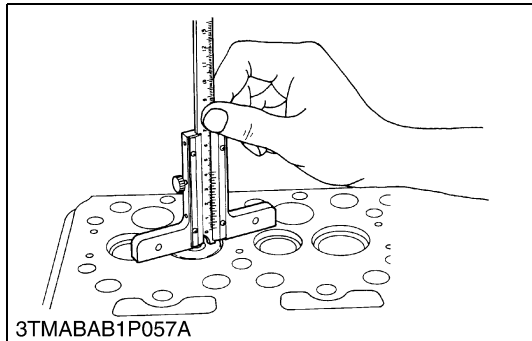
Cylinder Head Flaw

1. Prepare an air spray red check.
2. Clean the surface of the cylinder head with detergent (2).
3. Spray the cylinder head surface with the red permeative liquid (1). Leave it five to ten minutes after spraying.
4. Wash away the red permeative liquid on the cylinder head surface with the detergent (2).
5. Spray the cylinder head surface with white developer (3).
6. If flawed, it can be identified as red marks.

(1) Red Permeative Liquid
(2) Detergent

(3) White Developer

9Y1210946ENS0101US0



Valve Recessing

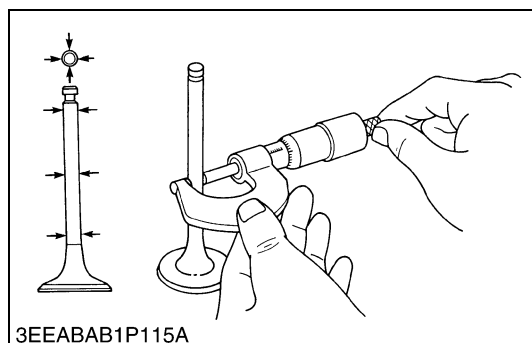
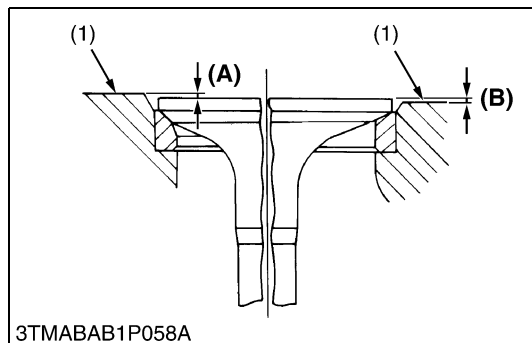
1. Clean the cylinder head surface, valve face and valve seat.
2. Insert the valve into the valve guide.
3. Measure the valve recessing with a depth gauge.
4. If the measurement exceeds the allowable limit, replace the valve.
5. If it still exceeds the allowable limit after replacing the valve, replace the cylinder head.

Valve recessing	Factory specification	0.050 (protrusion) to 0.25 (recessing) mm 0.0020 (protrusion) to 0.0098 (recessing) in.
	Allowable limit	0.40 (recessing) mm 0.016 (recessing) in.

(1) Cylinder Head Surface

(A) Recessing
(B) Protrusion

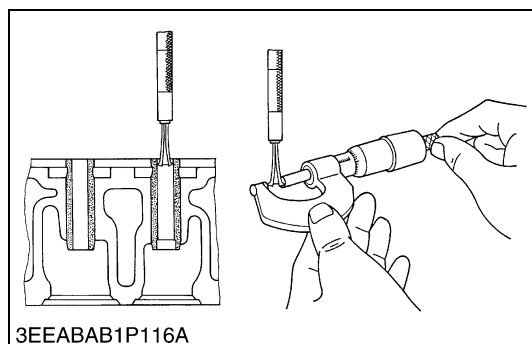
9Y1210946ENS0142US0



Clearance between Valve Stem and Valve Guide

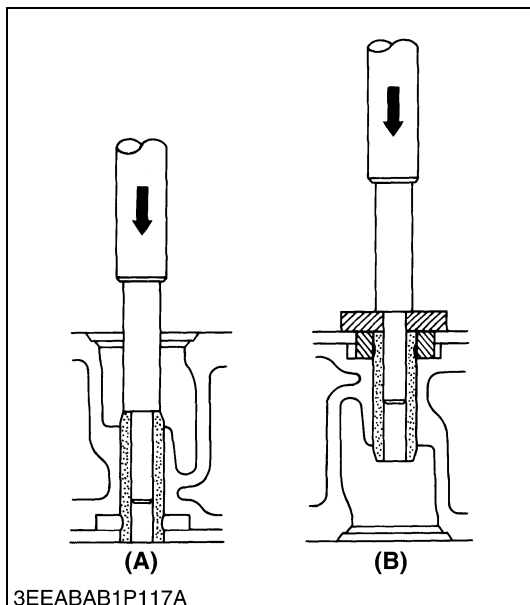
1. Remove carbon from the valve guide section.
2. Measure the valve stem O.D. with an outside micrometer.
3. Measure the valve guide I.D. with a small hole gauge, and calculate the clearance.
4. If the clearance exceeds the allowable limit, replace the valves.
If it still exceeds the allowable limit,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

Clearance between valve stem and valve guide	Factory specification	0.035 to 0.065 mm 0.0014 to 0.0025 in.
	Allowable limit	0.10 mm 0.0039 in.



Valve stem O.D.	Factory specification	6.960 to 6.975 mm 0.2741 to 0.2746 in.
Valve guide I.D.	Factory specification	7.010 to 7.025 mm 0.2760 to 0.2765 in.

9Y1210946ENS0143US0



Replacing Valve Guide

(When removing)

1. Press out the used valve guide using a valve guide replacing tool. (See page G-66.)

(When installing)

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

Valve guide I.D. (Intake and exhaust)	Factory specification	7.010 to 7.025 mm 0.2760 to 0.2765 in.
--	-----------------------	---

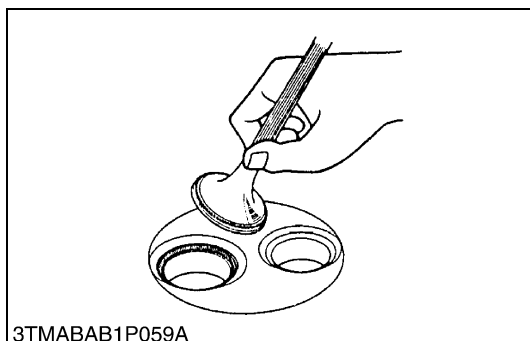
■ NOTE

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

(A) When Removing

(B) When Installing

9Y1210948ENS0035US0



Valve Seating

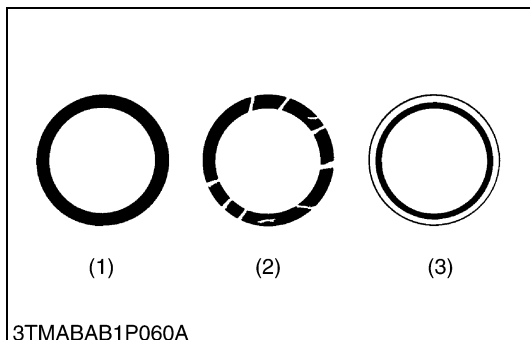
1. Coat the valve face lightly with prussian blue and put the valve on its seat to check the contact.
2. If the valve does not seat all the way around the valve seat or the valve contact is less than 70 %, correct the valve seating as follows.
3. If the valve contact does not comply with the reference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

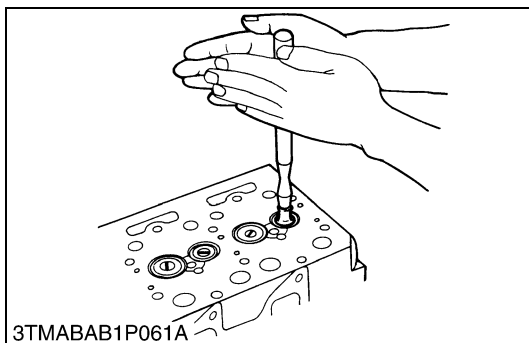
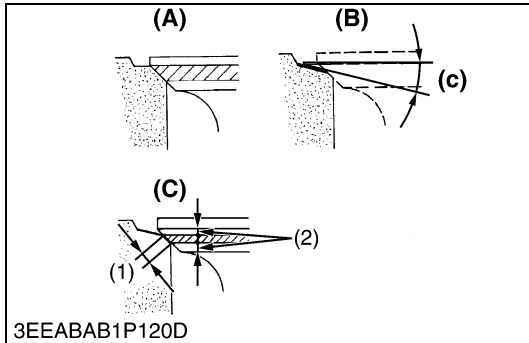
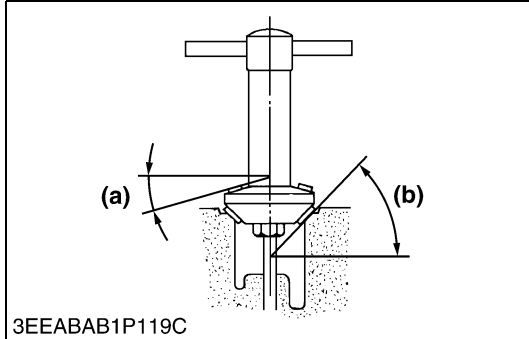
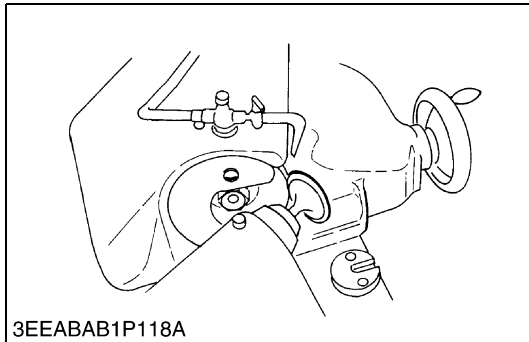
Valve seat width	Factory specification	2.12 mm 0.0835 in.
------------------	-----------------------	-----------------------

- (1) Correct
(2) Incorrect

(3) Incorrect

9Y1210946ENS0105US0





Correcting Valve and Valve Seat

NOTE

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

(1) Correcting Valve

1. Correct the valve with a valve refacer.

Valve face angle	Factory specification	IN.	1.0 rad 60°
		EX.	0.79 rad 45°

(2) Correcting Valve Seat

1. Slightly correct the seat surface with a 1.0 rad (60°) (intake valve) or 0.79 rad (45°) (exhaust valve) valve seat cutter.
2. Resurface the seat surface with a 0.52 rad (30°) valve seat cutter to intake valve seat and with a 0.26 rad (15°) valve seat cutter to exhaust valve seat so that the width is close to specified valve seat width (2.12 mm, 0.0835 in.)
3. After resurfacing the seat, inspect for even valve seating, apply a thin film of compound between the valve face and valve seat, and fit them with valve lapping tool.
4. Check the valve seating with prussian blue. The valve seating surface should show good contact all the way around.

Valve seat angle	Factory specification	IN.	1.0 rad 60°
		EX.	0.79 rad 45°

- (1) Valve Seat Width
(2) Identical Dimensions

- (A) Check Contact
(B) Correct Seat Width
(C) Check 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°)

9Y1210946ENS0146US0

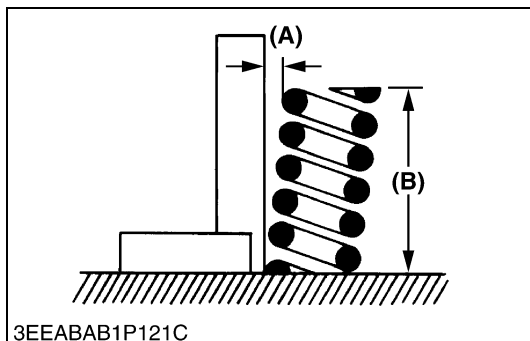
Valve Lapping

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

IMPORTANT

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

9Y1210946ENS0147US0



Free Length and Tilt of Valve Spring

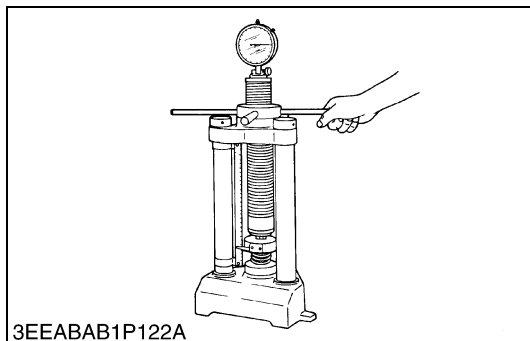
1. Measure the free length **(B)** of valve spring with vernier calipers. If the measurement is less than the allowable limit, replace it.
2. Put the valve spring on a surface plate, place a square on the side of the valve spring.
3. Check to see if the entire side is in contact with the square. Rotate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

Tilt (A)	Allowable limit	1.0 mm 0.039 in.
Free length (B)	Factory specification	37.0 to 37.5 mm 1.46 to 1.47 in.
	Allowable limit	36.5 mm 1.44 in.

(A) Tilt

(B) Free Length

9Y1210946ENS0148US0



Valve Spring Setting Load

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

Setting load / Setting length	Factory specification	117.4 N / 31.0 mm 11.97 kgf / 31.0 mm 26.39 lbf / 1.22 in.
	Allowable limit	100.0 N / 31.0 mm 10.20 kgf / 31.0 mm 22.48 lbf / 1.22 in.

9Y1210946ENS0149US0



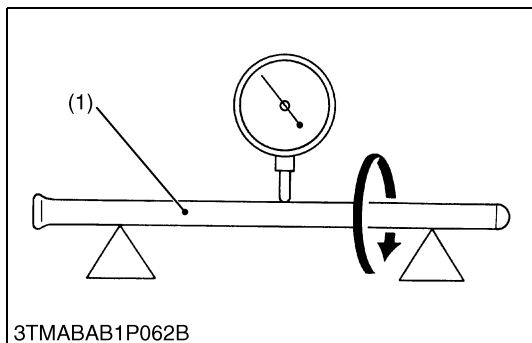
Oil Clearance between Rocker Arm and Rocker Arm Shaft

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

Oil clearance between rocker arm and rocker arm shaft	Factory specification	0.016 to 0.045 mm 0.00063 to 0.0017 in.
	Allowable limit	0.10 mm 0.0039 in.

Rocker arm shaft O.D.	Factory specification	11.973 to 11.984 mm 0.47138 to 0.47181 in.
Rocker arm I.D.	Factory specification	12.000 to 12.018 mm 0.47244 to 0.47314 in.

9Y1210946ENS0150US0



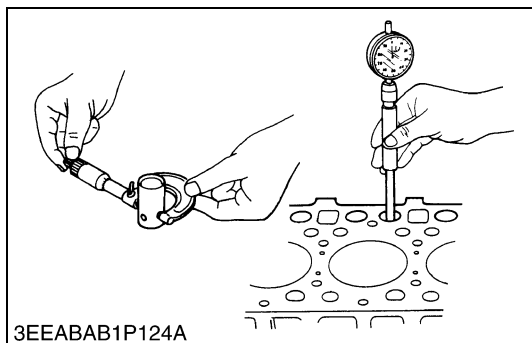
Push Rod Alignment

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

Push rod alignment	Allowable limit	0.25 mm 0.0098 in.
--------------------	-----------------	-----------------------

(1) Push Rod

9Y1210946ENS0111US0



Oil Clearance between Tappet and Tappet Guide Bore

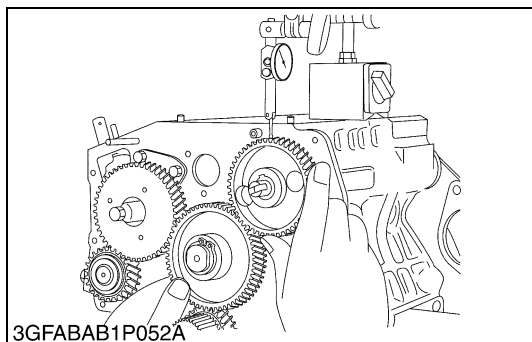
1. Measure the tappet O.D. with an outside micrometer.
2. Measure the I.D. of the tappet guide bore with a cylinder gauge, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit or the tappet is damaged, replace the tappet.

Oil Clearance between tappet and tappet guide bore	Factory 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	19.959 to 19.980 mm 0.78579 to 0.78661 in.
Tappet guide bore I.D.	Factory specification	20.000 to 20.021 mm 0.78740 to 0.78822 in.

9Y1210946ENS0152US0

[2] Timing Gears, Camshaft and Governor Gear



Timing Gear Backlash

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

Backlash between idle gear 1 and crank gear	Factory specification	0.0320 to 0.115 mm 0.00126 to 0.00452 in.
	Allowable limit	0.15 mm 0.0059 in.

Backlash between idle gear 1 and cam gear	Factory specification	0.0360 to 0.114 mm 0.00142 to 0.00448 in.
	Allowable limit	0.15 mm 0.0059 in.

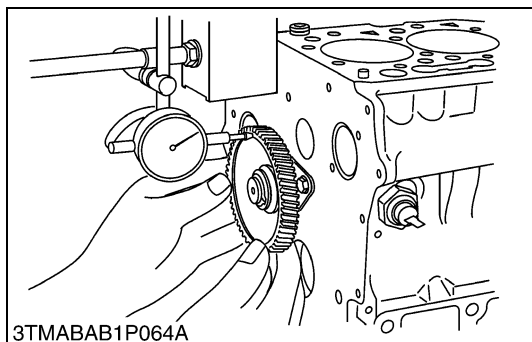
Backlash between idle gear 1 and injection pump gear	Factory specification	0.0340 to 0.116 mm 0.00134 to 0.00456 in.
	Allowable limit	0.15 mm 0.0059 in.

9Y1210946ENS0153US0

Governor Gear Backlash

Backlash between injection pump gear and governor gear	Factory specification	0.0300 to 0.117 mm 0.00119 to 0.00460 in.
	Allowable limit	0.15 mm 0.0059 in.

9Y1210946ENS0154US0

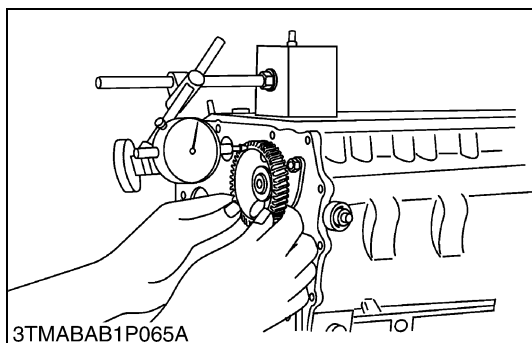


Idle Gear 1 Side Clearance

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

Idle gear 1 side clearance	Factory specification	0.20 to 0.51 mm 0.0079 to 0.020 in.
	Allowable limit	0.80 mm 0.031 in.

9Y1210946ENS0155US0

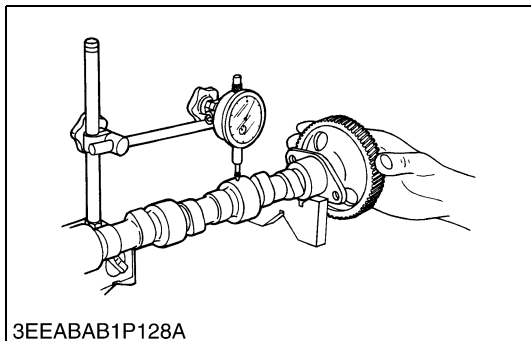


Camshaft Side Clearance

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

Camshaft side clearance	Factory specification	0.070 to 0.22 mm 0.0028 to 0.0086 in.
	Allowable limit	0.30 mm 0.012 in.

9Y1210946ENS0156US0

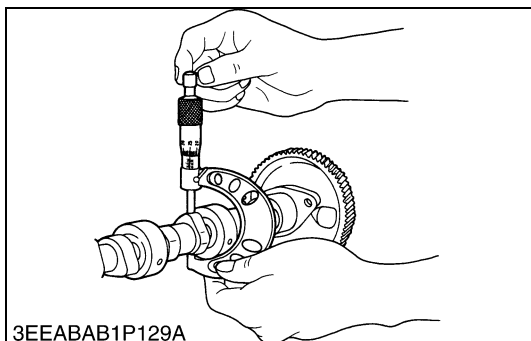


Camshaft Alignment

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

Camshaft alignment	Allowable limit	0.01 mm 0.0004 in.
--------------------	-----------------	-----------------------

9Y1210946ENS0157US0



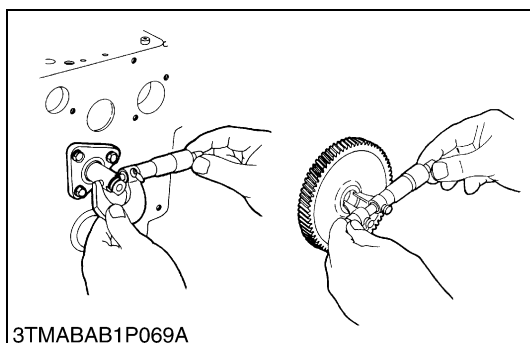
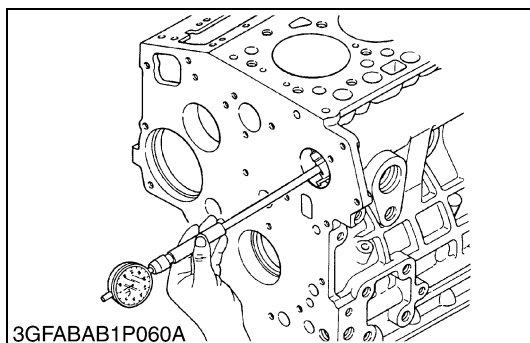
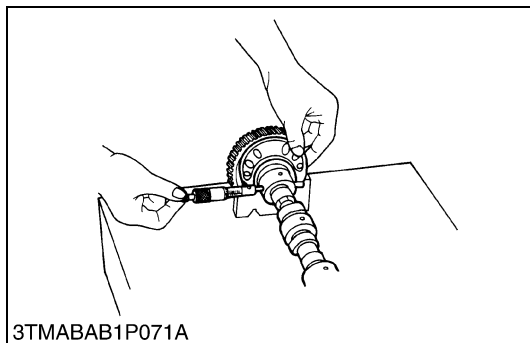
Cam Height

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

Cam height of intake	Factory specification	28.80 mm 1.134 in.
	Allowable limit	28.75 mm 1.132 in.

Cam height of exhaust	Factory specification	29.00 mm 1.142 in.
	Allowable limit	28.95 mm 1.140 in.

9Y1210946ENS0158US0



Oil Clearance of Camshaft Journal

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

Oil clearance of camshaft journal	Factory 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	35.934 to 35.950 mm 1.4148 to 1.4154 in.
Camshaft bearing I.D. (Cylinder block bore I.D.)	Factory specification	36.000 to 36.025 mm 1.4174 to 1.4183 in.

9Y1210946ENS0159US0

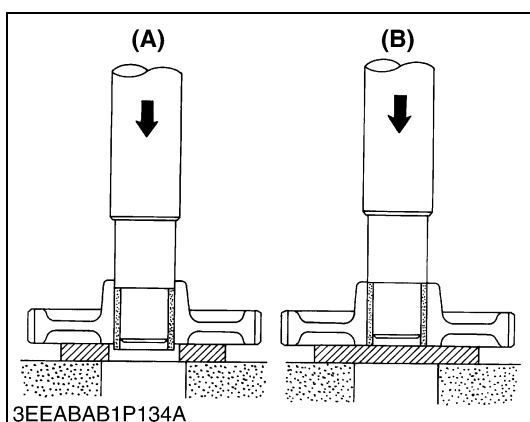
Oil Clearance between Idle Gear Shaft 1 and Idle Gear Bushing

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

Oil clearance between idle gear shaft 1 and idle gear bushing	Factory specification	0.020 to 0.054 mm 0.00079 to 0.0021 in.
	Allowable limit	0.10 mm 0.0039 in.

Idle gear shaft 1 O.D.	Factory specification	25.967 to 25.980 mm 1.0224 to 1.0228 in.
Idle gear bushing 1 I.D.	Factory specification	26.000 to 26.021 mm 1.0237 to 1.0244 in.

9Y1210946ENS0160US0



Replacing Idle Gear Bushing

(When removing)

1. Press out the used idle gear bushing using an idle gear bushing replacing tool. (See page G-66.)

(When installing)

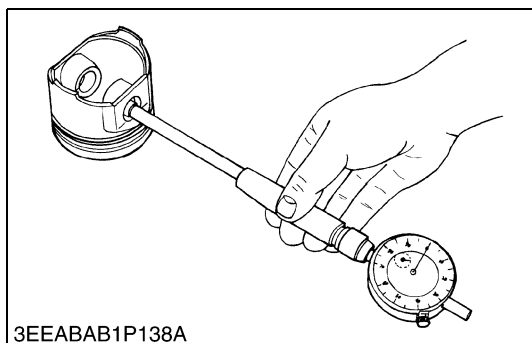
1. Clean a new idle gear bushing and idle gear bore, and apply engine oil to them.
2. Press in a new bushing using an idle gear bushing replacing tool, until it is flush with the end of the idle gear.

(A) When Removing

(B) When Installing

9Y1210948ENS0032US0

[3] Piston and Connecting Rod

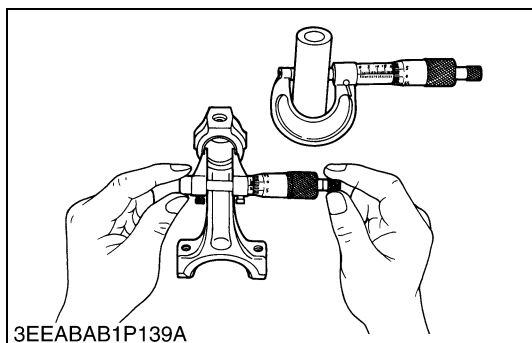


Piston Pin Bore I.D.

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

Piston pin bore I.D.	Factory specification	22.000 to 22.013 mm 0.86615 to 0.86665 in.
	Allowable limit	22.03 mm 0.8673 in.

9Y1210946ENS0086US0



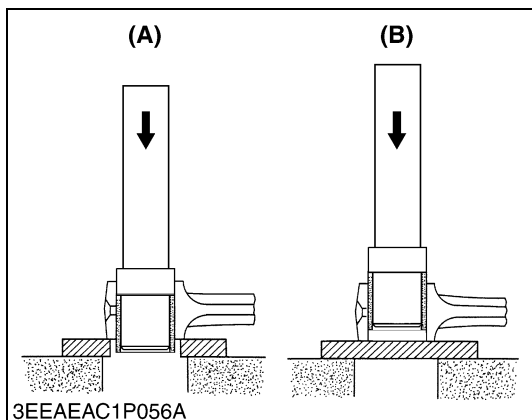
Oil Clearance between Piston Pin and Small End Bushing

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

Oil clearance between piston pin and small end bushing	Factory specification	0.014 to 0.038 mm 0.00056 to 0.0014 in.
	Allowable limit	0.15 mm 0.0059 in.

Piston pin O.D.	Factory specification	22.002 to 22.011 mm 0.86622 to 0.86657 in.
Small end bushing I.D.	Factory specification	22.025 to 22.040 mm 0.86713 to 0.86771 in.

9Y1210946ENS0163US0



Replacing Small End Bushing

(When removing)

1. Press out the used bushing using a small end bushing replacing tool. (See page G-66.)

(When installing)

1. Clean a new small end bushing and bore, and apply engine oil to them.
2. Using a small end bushing replacing tool, press fit a new bushing (service parts) taking due care to see that the connecting rod oil hole matches the bushing hole.

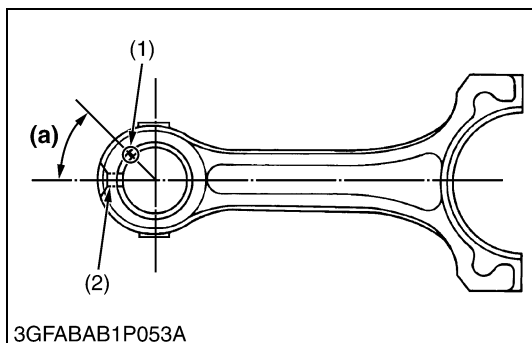
Oil clearance between piston pin and small end bushing (Spare parts)	Factory specification	0.014 to 0.038 mm 0.00056 to 0.0014 in.
	Allowable limit	0.15 mm 0.0059 in.

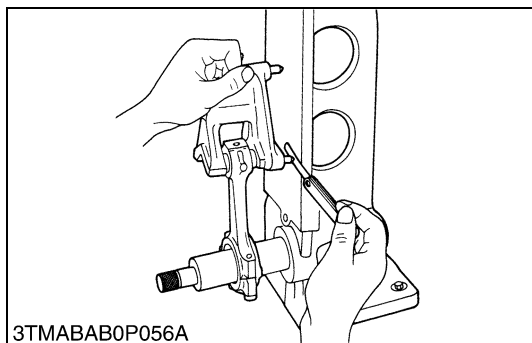
Small end bushing I.D. (Spare parts)	Factory specification	22.025 to 22.040 mm 0.86713 to 0.86771 in.
--------------------------------------	-----------------------	---

- (1) Seam
(2) Oil Hole

- (A) When Removing**
(B) When Installing
(a) 0.79 rad (45°)

9Y1210948ENS0033US0





Connecting Rod Alignment

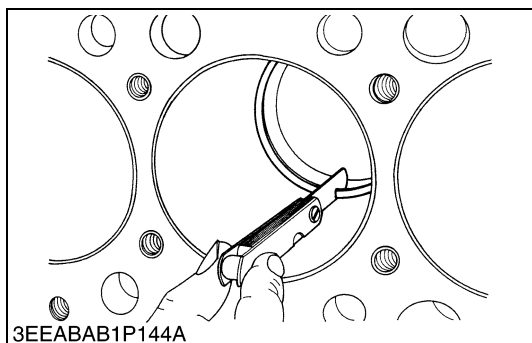
■ NOTE

- Since the I.D. of the connecting rod small end bushing is the basis of this check, check bushing for wear beforehand.

1. Install the piston pin into the connecting rod.
2. Install the connecting rod on the connecting rod alignment tool.
3. Put a gauge over the piston pin, and move it against the face plate.
4. If the gauge does not fit squarely against the face plate, measure the space between the pin of the gauge and the face plate.
5. If the measurement exceeds the allowable limit, replace the connecting rod.

Connecting rod alignment	Allowable limit	0.05 mm 0.002 in.
--------------------------	-----------------	----------------------

9Y1210946ENS0124US0

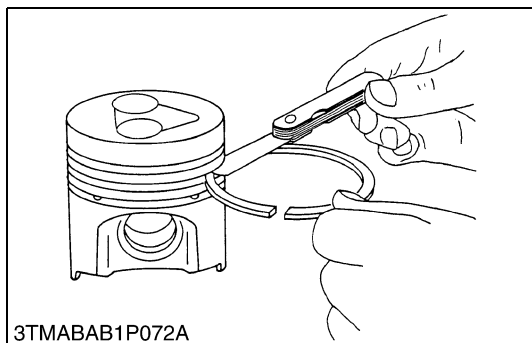


Piston Ring Gap

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

Piston ring gap	Top ring	Factory specification	0.15 to 0.25 mm 0.0059 to 0.0098 in.
		Allowable limit	1.20 mm 0.0472 in.
	Second ring	Factory specification	0.40 to 0.55 mm 0.016 to 0.021 in.
		Allowable limit	1.20 mm 0.0472 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.

9Y1210946ENS0166US0



3TMABAB1P072A

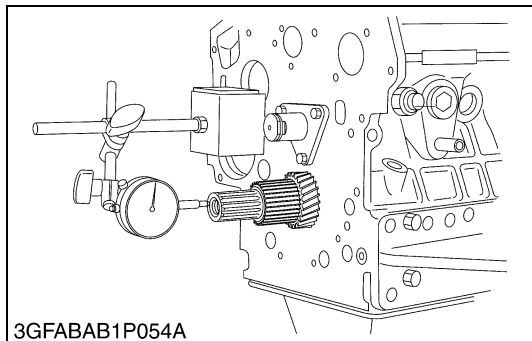
Clearance between Piston ring and Piston Ring Groove

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

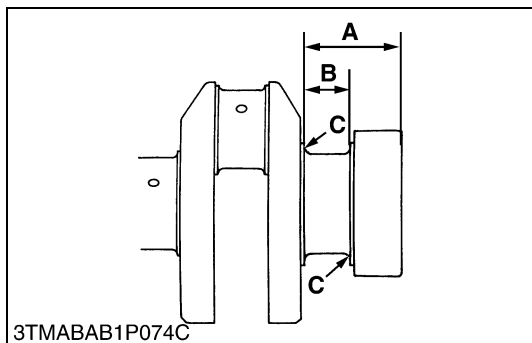
Clearance between piston ring and piston ring groove	Second ring	Factory specification	0.0850 to 0.122 mm 0.00335 to 0.00480 in.
		Allowable limit	0.2 mm 0.008 in.
	Oil ring	Factory specification	0.02 to 0.06 mm 0.0008 to 0.002 in.
		Allowable limit	0.15 mm 0.0059 in.

9Y1210946ENS0167US0

[4] Crankshaft



3GFABAB1P054A



3TMABAB1P074C

Crankshaft Side Clearance

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 size bearing is useless because of the crankshaft journal wear, replace it with an oversize one referring to the table and figure.

Crankshaft side clearance	Factory 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 0.0079 in.	0.4 mm 0.016 in.
Dimension A	51.50 to 51.70 mm 2.028 to 2.035 in.	51.60 to 51.80 mm 2.032 to 2.039 in.
Dimension B	28.20 to 28.25 mm 1.111 to 1.112 in.	28.40 to 28.45 mm 1.119 to 1.120 in.
Dimension C	2.3 to 2.7 mm radius 0.091 to 0.10 in. radius	2.3 to 2.7 mm radius 0.091 to 0.10 in. radius
The crankshaft journal must be fine-finished to higher than Rmax = 0.8S		

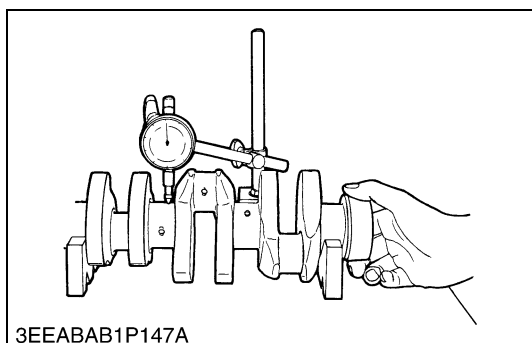
9Y1210946ENS0168US0

Crankshaft Alignment

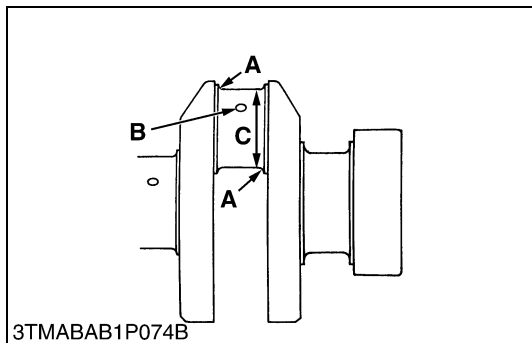
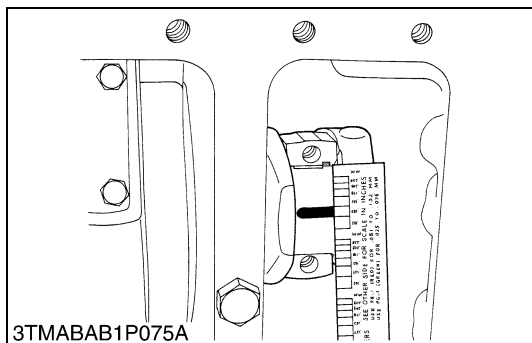
1. Support the crankshaft with V blocks on the surface plate at both end journals.
2. Set a dial indicator with its tip on the intermediate journal.
3. Measure the crankshaft alignment.
4. If the measurement exceeds the allowable limit, replace the crankshaft.

Crankshaft alignment	Allowable limit	0.02 mm 0.0008 in.
----------------------	-----------------	-----------------------

9Y1210946ENS0169US0



3EEABAB1P147A



Oil Clearance between Crankpin and Crankpin Bearing

1. Clean the crankpin and crankpin bearing.
2. Put a strip of plastigage on the center of the crankpin.
3. Install the connecting rod cap and tighten the connecting rod screws to the specified torque, and remove the cap again.
4. Measure the amount of the flattening with the scale, and get the oil clearance.
5. If the oil clearance exceeds the allowable limit, replace the crankpin bearing.
6. If the same size bearing is useless because of the crankpin wear, replace it with an undersize one referring to the table and figure.

NOTE

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

Oil clearance between crankpin and crankpin bearing	Factory specification	0.029 to 0.091 mm 0.0012 to 0.0035 in.
	Allowable limit	0.20 mm 0.0079 in.

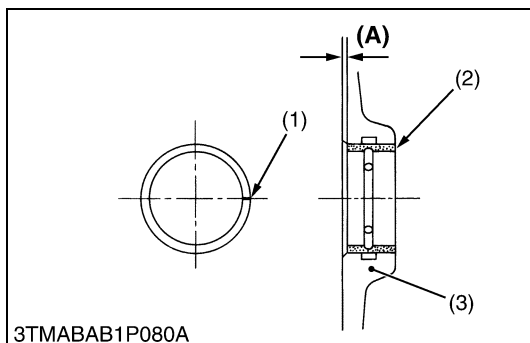
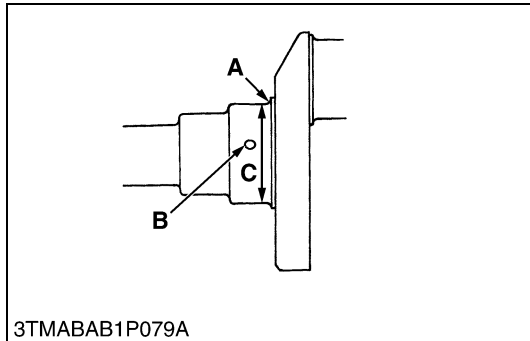
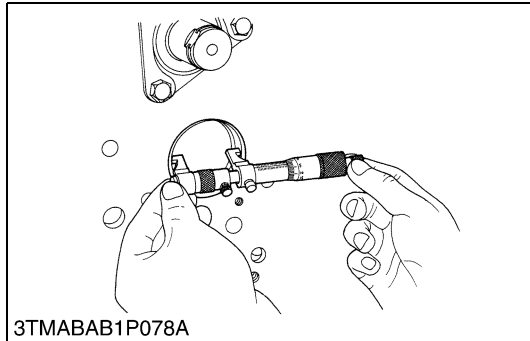
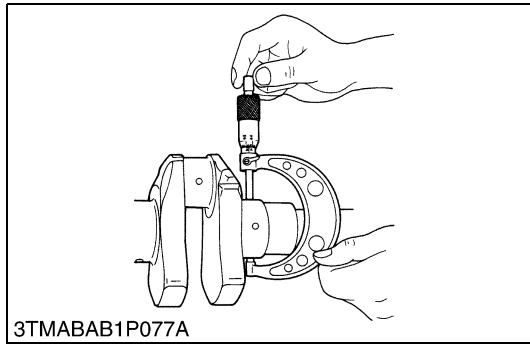
Crank pin O.D.	Factory specification	39.959 to 39.975 mm 1.5732 to 1.5738 in.
Crank pin bearing I.D.	Factory specification	40.040 to 40.050 mm 1.5764 to 1.5767 in.

(Reference)

- Undersize dimensions of crank pin

Undersize	0.20 mm 0.0079 in.	0.40 mm 0.016 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	39.759 to 39.775 mm dia. 1.5654 to 1.5659 in. dia.	39.559 to 39.575 mm dia. 1.5575 to 1.5580 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.		

9Y1210946ENS0170US0



Oil Clearance between Crankshaft Journal and Crankshaft Bearing 1

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

Oil clearance between crankshaft journal and crankshaft bearing 1	Factory specification	0.0340 to 0.114 mm 0.00134 to 0.00448 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankshaft journal O.D.	Factory specification	47.934 to 47.950 mm 1.8872 to 1.8877 in.
Crankshaft bearing 1 I.D.	Factory specification	47.984 to 48.048 mm 1.8892 to 1.8916 in.

(Reference)

- Undersize dimensions of crankshaft journal

Undersize	0.20 mm 0.0079 in.	0.40 mm 0.016 in.
Dimension A	2.3 to 2.7 mm radius 0.091 to 0.10 in. radius	2.3 to 2.7 mm radius 0.091 to 0.10 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	47.734 to 47.750 mm dia. 1.8793 to 1.8799 in. dia.	47.534 to 47.550 mm dia. 1.8715 to 1.8720 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.		

9Y1210946ENS0171US0

Replacing Crankshaft Bearing 1

(When removing)

1. Press out the used crankshaft bearing 1 using a crankshaft bearing 1 replacing tool. (See page G-67.)

(When installing)

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

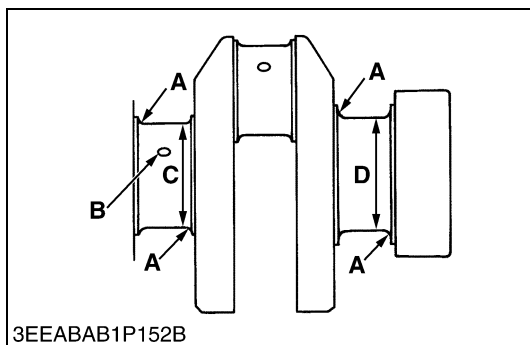
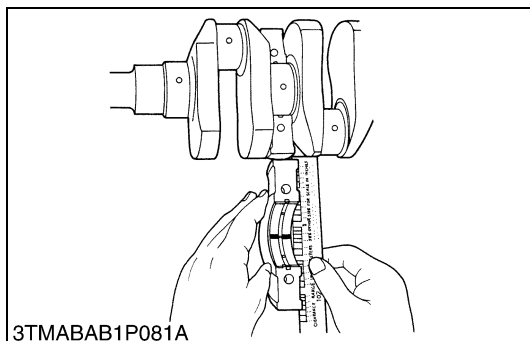
(Reference)

Dimension (A)	Factory specification	0 to 0.3 mm 0 to 0.01 in.
---------------	-----------------------	------------------------------

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

(A) Dimension

9Y1210948ENS0034US0



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

1. Put a strip of plastigage on the center of the journal.
2. Install the bearing case and tighten the bearing case screws 1 to the specified torque, and remove the bearing case again.
3. Measure the amount of the flattening with the scale and get the oil clearance.
4. If the clearance exceeds the allowable limit, replace the crankshaft bearing 2 (1) and crankshaft bearing (3).
5. If the same size bearing is useless because of the crankshaft journal wear, replace it with an undersize one referring to the table and figure.

■ NOTE

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

Oil clearance between crankshaft journal and crankshaft bearing 2	Factory specification	0.034 to 0.095 mm 0.0014 to 0.0037 in.
	Allowable limit	0.20 mm 0.0079 in.

Crankshaft journal O.D. (Intermediate)	Factory specification	47.934 to 47.950 mm 1.8872 to 1.8877 in.
Crankshaft bearing 2 I.D.	Factory specification	47.984 to 48.029 mm 1.8892 to 1.8908 in.

Oil clearance between crankshaft journal and crankshaft bearing 3	Factory specification	0.0340 to 0.103 mm 0.00134 to 0.00405 in.
	Allowable limit	0.20 mm 0.0079 in.

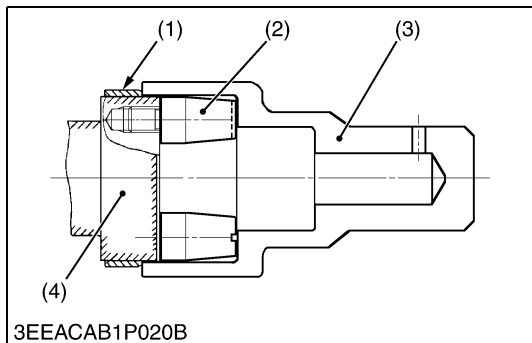
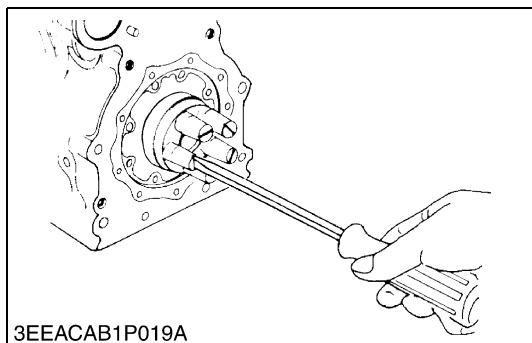
Crankshaft journal O.D. (Flywheel side)	Factory specification	51.921 to 51.940 mm 2.0442 to 2.0448 in.
Crankshaft bearing 3 I.D.	Factory specification	51.974 to 52.024 mm 2.0463 to 2.0481 in.

(Reference)

- Undersize dimensions of crankshaft journal

Undersize	0.20 mm 0.0079 in.	0.40 mm 0.016 in.
Dimension A	2.3 to 2.7 mm radius 0.091 to 0.10 in. radius	2.3 to 2.7 mm radius 0.091 to 0.10 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	47.734 to 47.750 mm dia. 1.8793 to 1.8799 in. dia.	47.534 to 47.550 mm dia. 1.8715 to 1.8720 in. dia.
Dimension D	51.721 to 51.740 mm dia. 2.0362 to 2.0370 in. dia.	51.521 to 51.540 mm dia. 2.0284 to 2.0291 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.		

9Y1210946ENS0173US0



Replacing Crankshaft Sleeve

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

■ NOTE

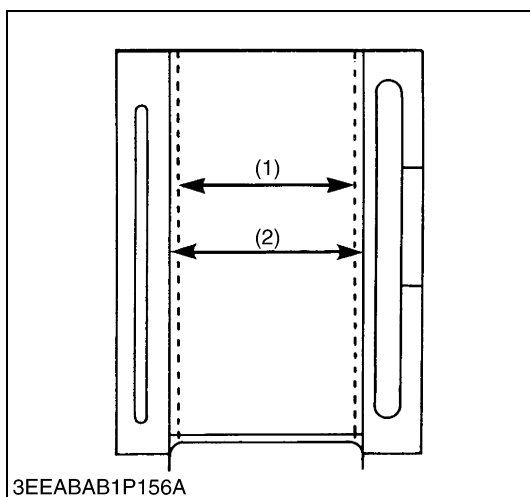
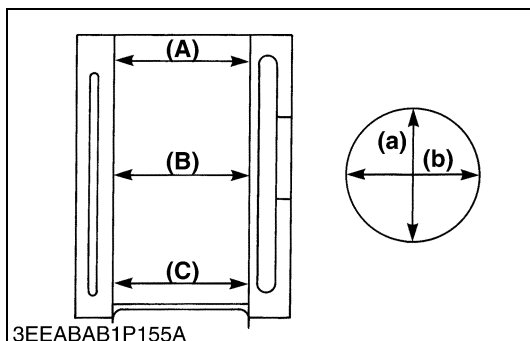
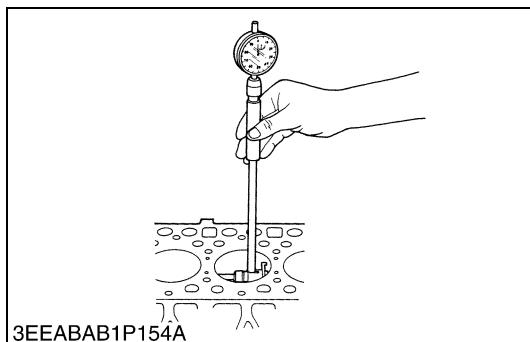
- Mount the sleeve with its largely chamfered surface facing outward.
- Should heating is not enough, a sleeve might stop halfway, so careful.

- (1) Crankshaft Sleeve
(2) Sleeve Guide

- (3) Auxiliary Socket for Pushing
(4) Crankshaft

9Y1210946ENS0174US0

[5] Cylinder



Cylinder Wear

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

Cylinder I.D.	Factory specification	78.000 to 78.019 mm 3.0709 to 3.0716 in.
	Allowable limit	78.15 mm 3.077 in.

- (A) Top
(B) Middle
(C) Bottom (Skirt)

- (a) Right-angled to Piston Pin
(b) Piston Pin Direction

9Y1210946ENS0175US0

Correcting Cylinder

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

Oversized cylinder liner I.D.	Factory specification	78.500 to 78.519 mm 3.0906 to 3.0912 in.
	Allowable limit	78.65 mm 3.096 in.
Finishing	Hone to 1.2 to 2.0 μ m R max. (48 to 78 μ in. R max.)	

2. Replace the piston and piston rings with oversize one.
Oversize: 0.5 mm (0.02 in.)

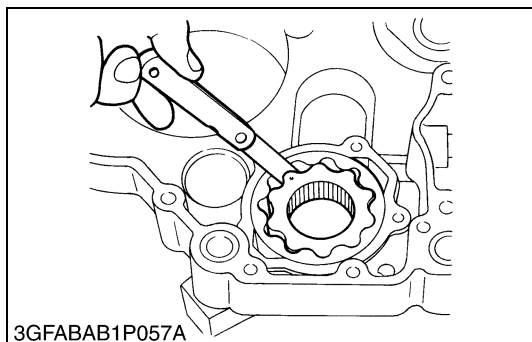
NOTE

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

- (1) Cylinder I.D. (Before Correction) (2) Cylinder I.D. (Oversize)

9Y1210946ENS0176US0

[6] Oil Pump

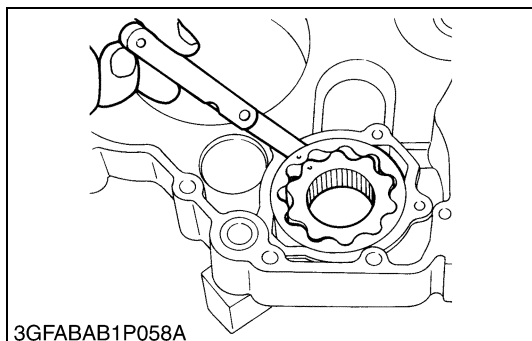


Rotor Lobe Clearance

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

Rotor lobe clearance	Factory specification	0.060 to 0.18 mm 0.0024 to 0.0071 in.
----------------------	-----------------------	--

9Y1210946ENS0177US0

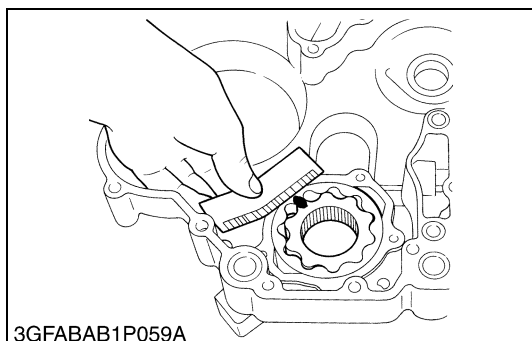


Clearance between Outer Rotor and Pump Body

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

Clearance between outer rotor and pump body	Factory specification	0.100 to 0.180 mm 0.00394 to 0.00708 in.
---	-----------------------	---

9Y1210946ENS0178US0



Clearance between Rotor and Cover

1. Put a strip of plastigage onto the rotor face with grease.
2. Install the cover and tighten the screws.
3. Remove the cover carefully, and measure the amount of the flattening with the scale and get the clearance.
4. If the clearance exceeds the factory specifications, replace the oil pump rotor assembly.

Clearance between rotor and cover	Factory specification	0.025 to 0.075 mm 0.00099 to 0.0029 in.
-----------------------------------	-----------------------	--

9Y1210946ENS0179US0

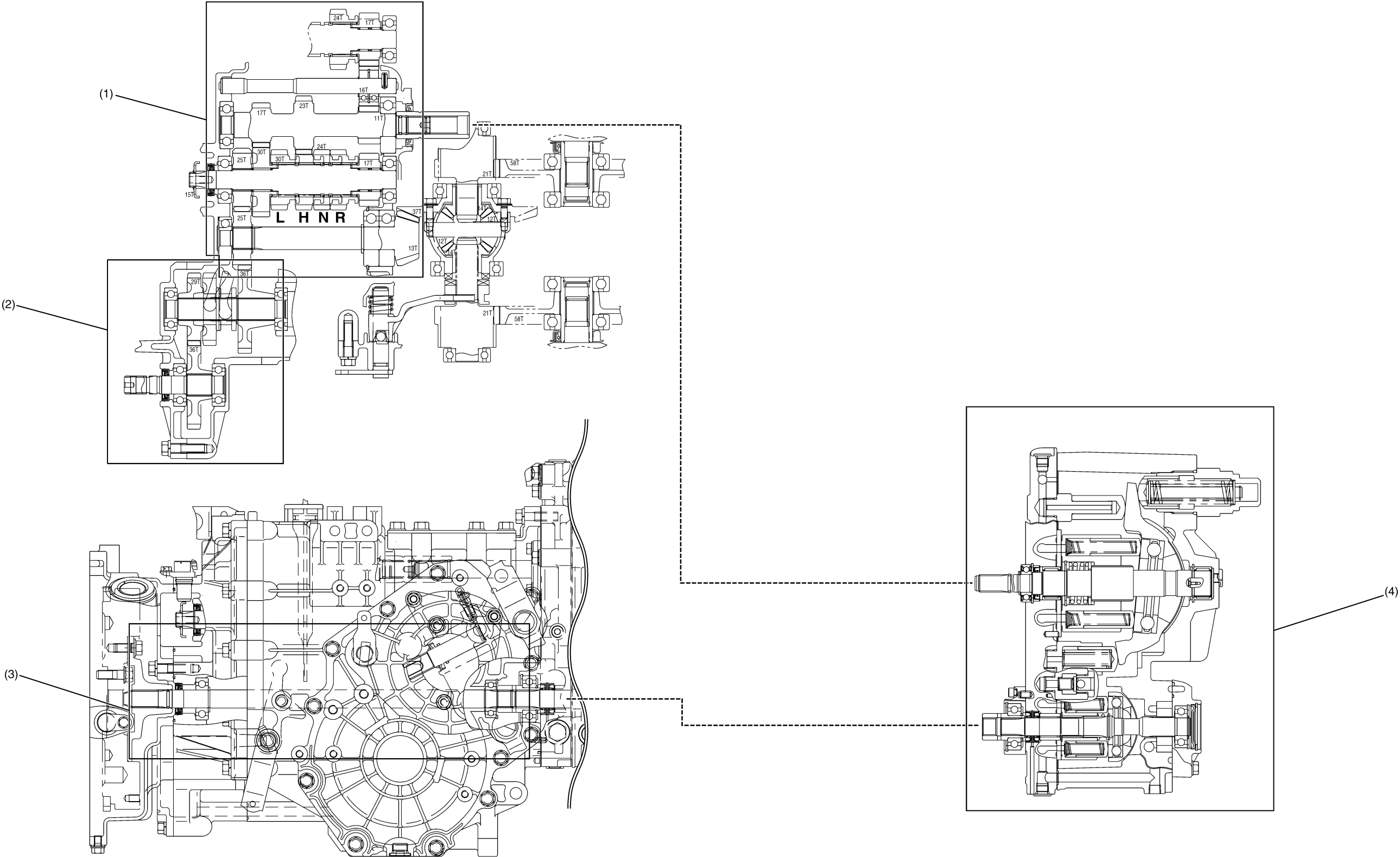
2 TRANSMISSION

MECHANISM

CONTENTS

1. STRUCTURE.....	2-M1
2. POWER TRAIN	2-M2
[1] HYDROSTATIC TRANSMISSION (HST).....	2-M2
(1) Structure	2-M2
(2) Oil Flow.....	2-M4
(3) Function of Components	2-M5
(4) HST Oil Flow	2-M13
(5) HST Control Linkage	2-M19
(6) Cables	2-M21
[2] RANGE GEAR SHIFT SECTION AND FRONT WHEEL DRIVE SECTION.....	2-M22

1. STRUCTURE



9Y1210948TRT001A

(1) Range Shift Gear Section

(2) Front Wheel Drive Section

(3) Input Shaft Section

(4) Hydraulic Transmission Section

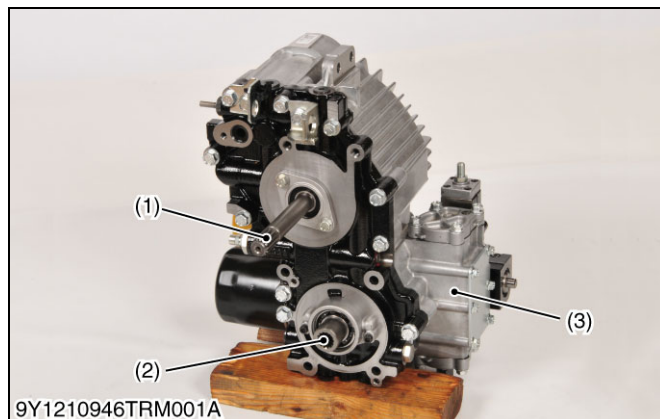
2. POWER TRAIN

The transmission of this model consists of a series of gears and shafts as shown in previous page. The traveling system chiefly consists of hydrostatic transmission section, range gear shift section and front wheel drive section.

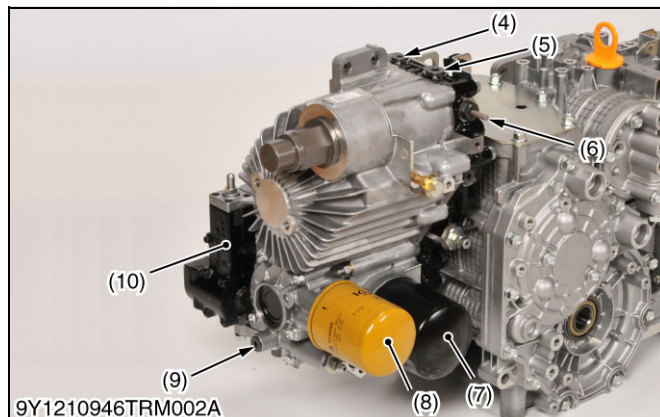
9Y1210946TRM0003US0

[1] HYDROSTATIC TRANSMISSION (HST)

(1) Structure

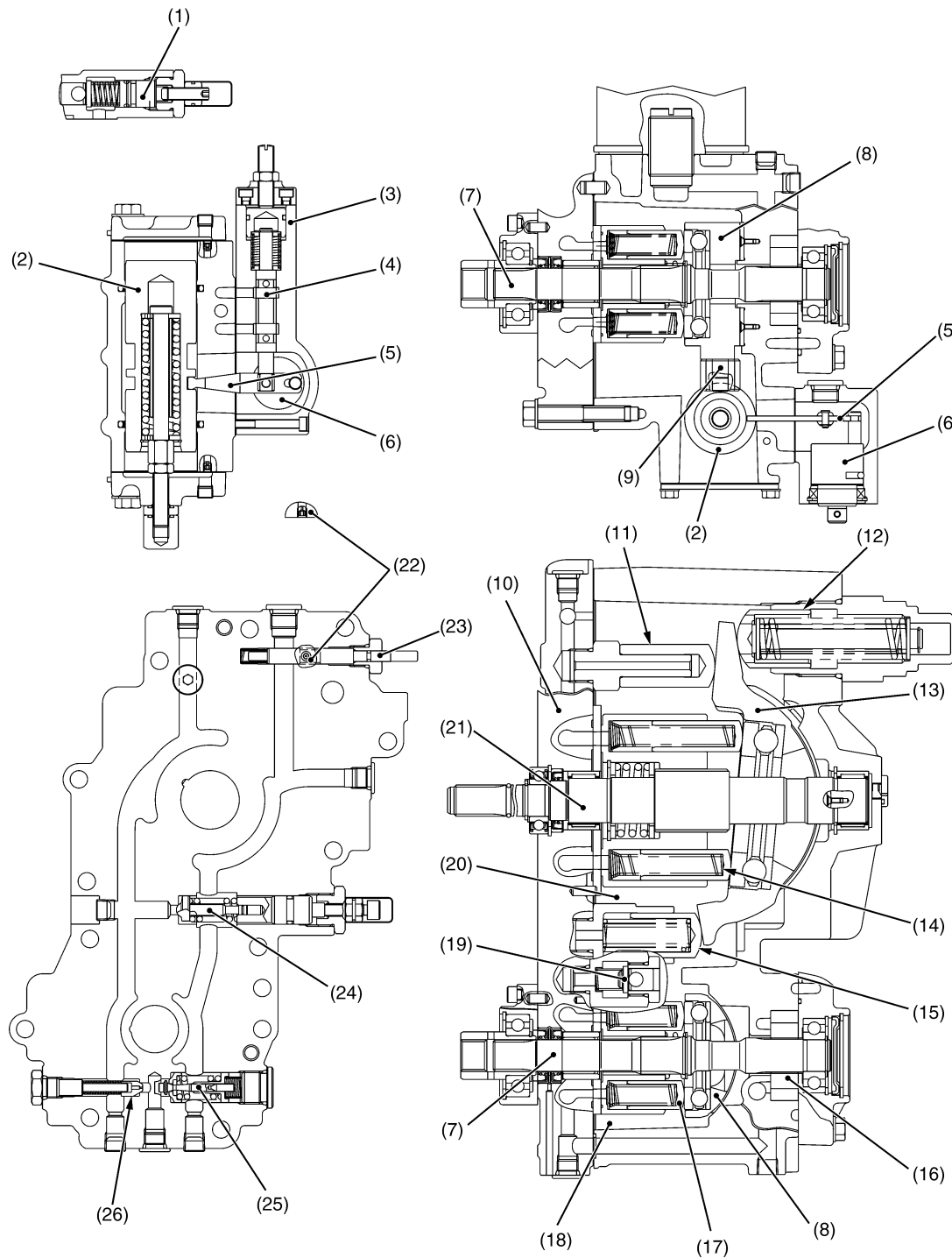


The New RTV-X series has its HST built into the transmission case and incorporates a hydraulically operated servomechanism. The servomechanism controls the pedal operation hydraulically. As a result a smoother pedal operation can be achieved. The components of the RTV-X series HST (transmission case) are variable displacement piston pump, variable displacement piston motor, charge pump, servo-regulator, unload valve and various valves. Refer to the next page for detailed parts in the HST.



- | | |
|---------------------------------------|--|
| (1) Output Shaft (Motor Shaft) | (6) Unload Valve |
| (2) Input Shaft (Pump Shaft) | (7) Oil Filter Cartridge (Suction) (Black Color) |
| (3) Servo Piston | (8) Oil Filter Cartridge (VHT) (Yellow Color) |
| (4) Dynamic Brake Pressure Check Port | (9) Charge Pressure Check Port |
| (5) Forward Pressure Check Port | (10) Servo Regulator |

9Y1210948TRM0005US0

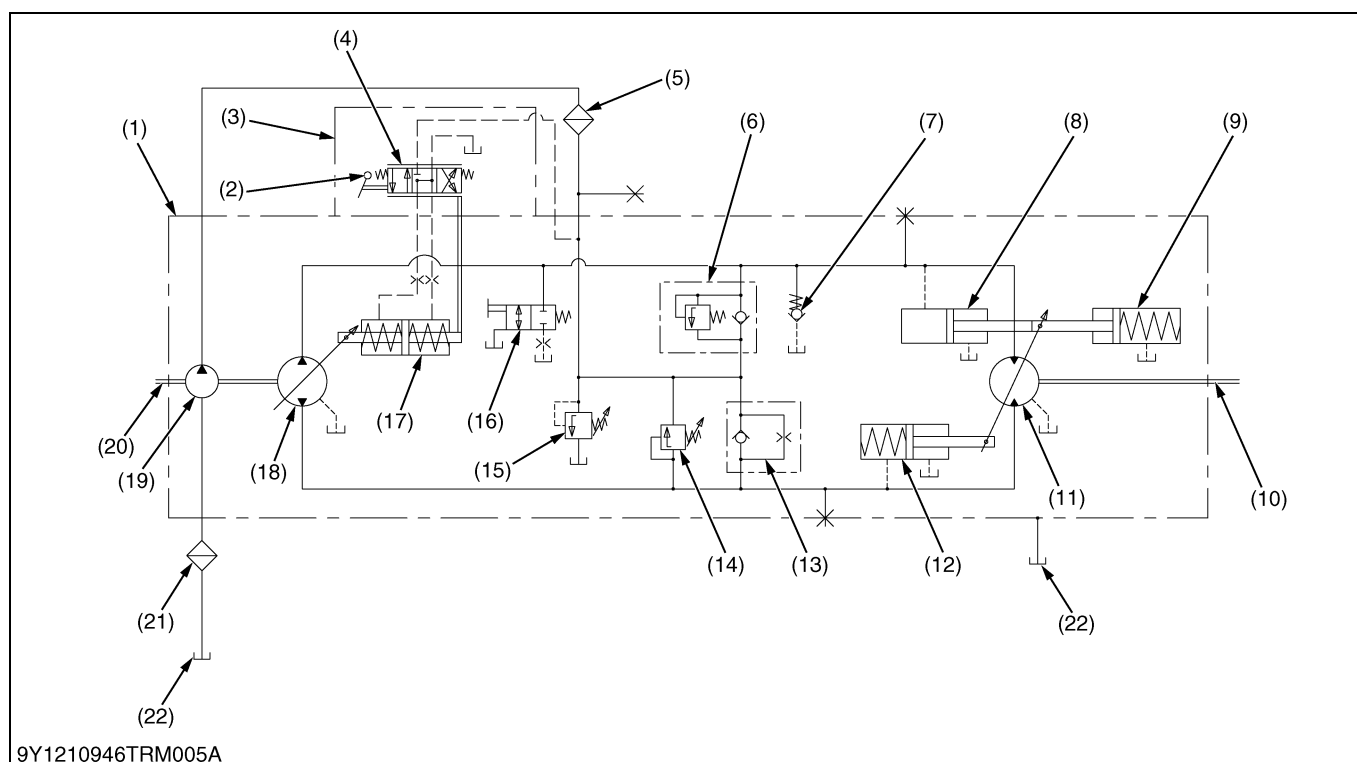


9Y1210948TRM001A

- | | | | |
|------------------------------|----------------------------------|---------------------------------|---|
| (1) Charge Relief Valve | (8) Variable Swashplate (Pump) | (15) Control Piston 3 | (22) Orifice |
| (2) Servo Piston | (9) Guide | (16) Charge Pump | (23) Unload Spool |
| (3) Regulator Valve Assembly | (10) Port Block Cover | (17) Piston (Pump) | (24) High Pressure Relief Valve (Travelling Side) |
| (4) Regulator Spool | (11) Control Piston 1 | (18) Cylinder Block (Pump) | (25) Check and High Pressure Relief Valve (Dynamic Brake) |
| (5) Feedback Lever | (12) Control Piston 2 | (19) Anti-cavitation Valve | (26) Check Valve |
| (6) Regulator Shaft | (13) Variable Swashplate (Motor) | (20) Cylinder Block (Motor) | |
| (7) Input Shaft (Pump Shaft) | (14) Piston (Motor) | (21) Output Shaft (Motor Shaft) | |

9Y1210948TRM0002US0

(2) Oil Flow



- | | | | |
|--|---------------------------------|---------------------------------|-------------------------------|
| (1) HST Assembly | (7) Anti-cavitation Valve | (13) Check Valve | (18) Cylinder Block (Pump) |
| (2) Control Lever (Pedal) | (8) Control Piston 1 | (14) High Pressure Relief Valve | (19) Charge Pump |
| (3) Servo Regulator Assembly | (9) Control Piston 2 | (Dynamic Brake) | (20) Input Shaft (Pump Shaft) |
| (4) Regulator Valve | (10) Output Shaft (Motor Shaft) | (15) Charge Relief Valve | (21) Oil Filter Cartridge |
| (5) Oil Filter Cartridge | (11) Cylinder Block (Motor) | (16) Unload Valve | (22) Oil Tank |
| (6) Check and High Pressure Relief Valve | (12) Control Piston 3 | (17) Servo Piton | |

(Traveling Side)

A charge pump (19) is used to feed oil to the hydrostatic transmission (HST). The oil coming from the charge pump (19) flows through the oil filter cartridge (5) into the HST main circuit and regulator valve (4). At this time, the servo regulator valve (4) and HST main circuit (that is closed with the control lever at neutral position) are kept at the charge relief valve (15) set pressure. Step on the pedal (2), and the regulator valve switches its oil passage to allow the oil into the service port. Being interlocked with the servo piston (17), the swashplate now tilts to activate the variable pump. Pressurized oil is then forced into the variable motor, which then rotates to circulate oil between the pump and motor.

The heavier the load on the output shaft (10), the higher the pressure of the oil coming from the pump. Now the assist motor is activated to increase the output torque. When the load on the output shaft decreases, the oil pressure in the main circuit also drops returns to its neutral position and just the variable motor keeps torque to the output shaft (10). Now a closed circuit is formed by the pump and variable motor. The unload valve (16) consists of the manual operation spool and the spool that operates in synchronization with the brake.

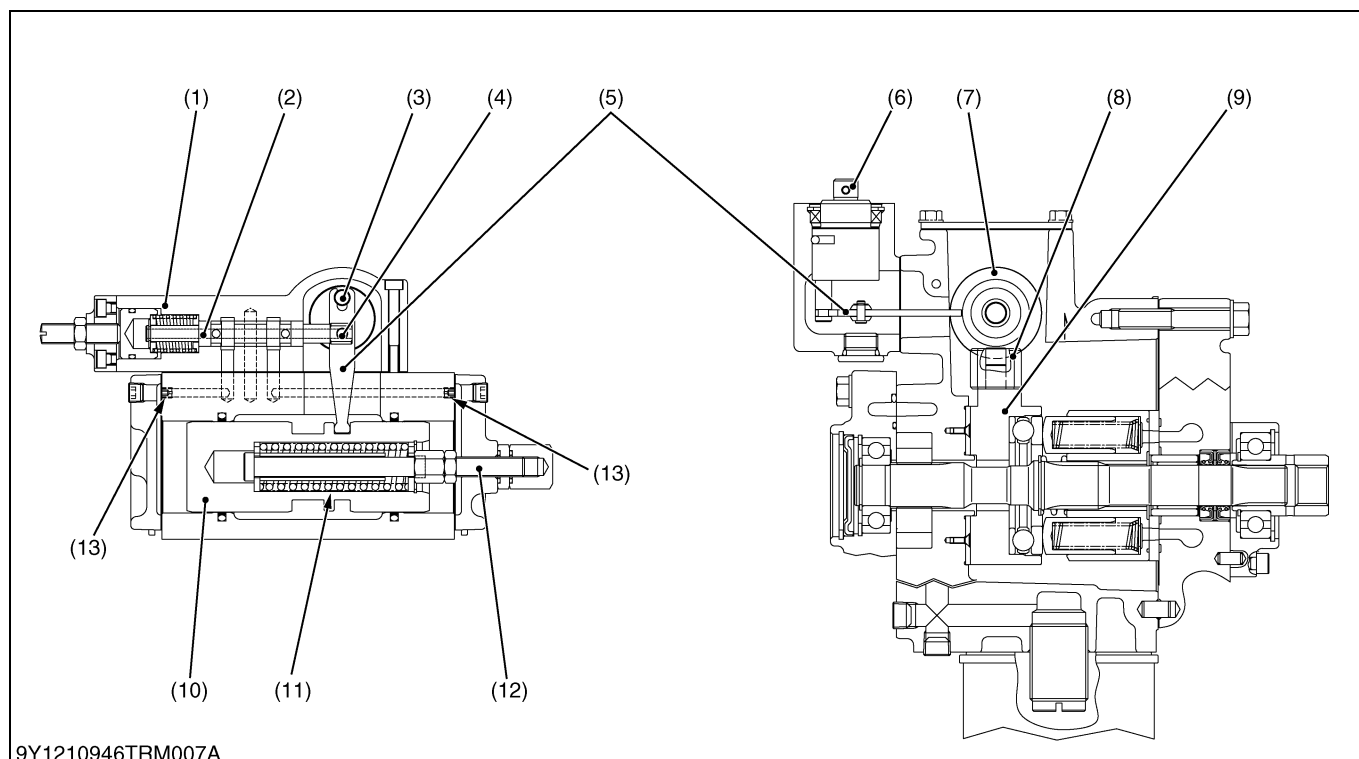
Specifications

(6)	24.5 to 27.5 MPa (250 to 280 kgf/cm ² , 3560 to 3980 psi)	(15)	0.43 to 0.85 MPa (4.4 to 8.6 kgf/cm ² , 63 to 120 psi) at 1400 min ⁻¹ (rpm)
(14)	15.0 to 17.0 MPa (153 to 173 kgf/cm ² , 2180 to 2460 psi)		

9Y1210948TRM0003US0

(3) Function of Components

[A] Servomechanism



9Y1210946TRM007A

- | | | | |
|---|------------------------------|-------------------------------------|-----------------------------|
| (1) Regulator Valve Assembly | (4) Pin B (Fixed with Spool) | (7) Servo Piston | (10) Servo Piston |
| (2) Regulator Spool | (5) Feedback Lever | (8) Guide (for Variable Swashplate) | (11) Servo Spring |
| (3) Pin A
(Fixed with Regulator Shaft) | (6) Regulator Shaft | (9) Variable Swashplate (Pump) | (12) Piston Adjusting Screw |
| | | | (13) Orifice |

The servomechanism consists of the following. The regulator valve assembly (1) is connected to the pedal through cable and linkages, and controls the flow of oil to the servo piston (10) by the pedal operation.

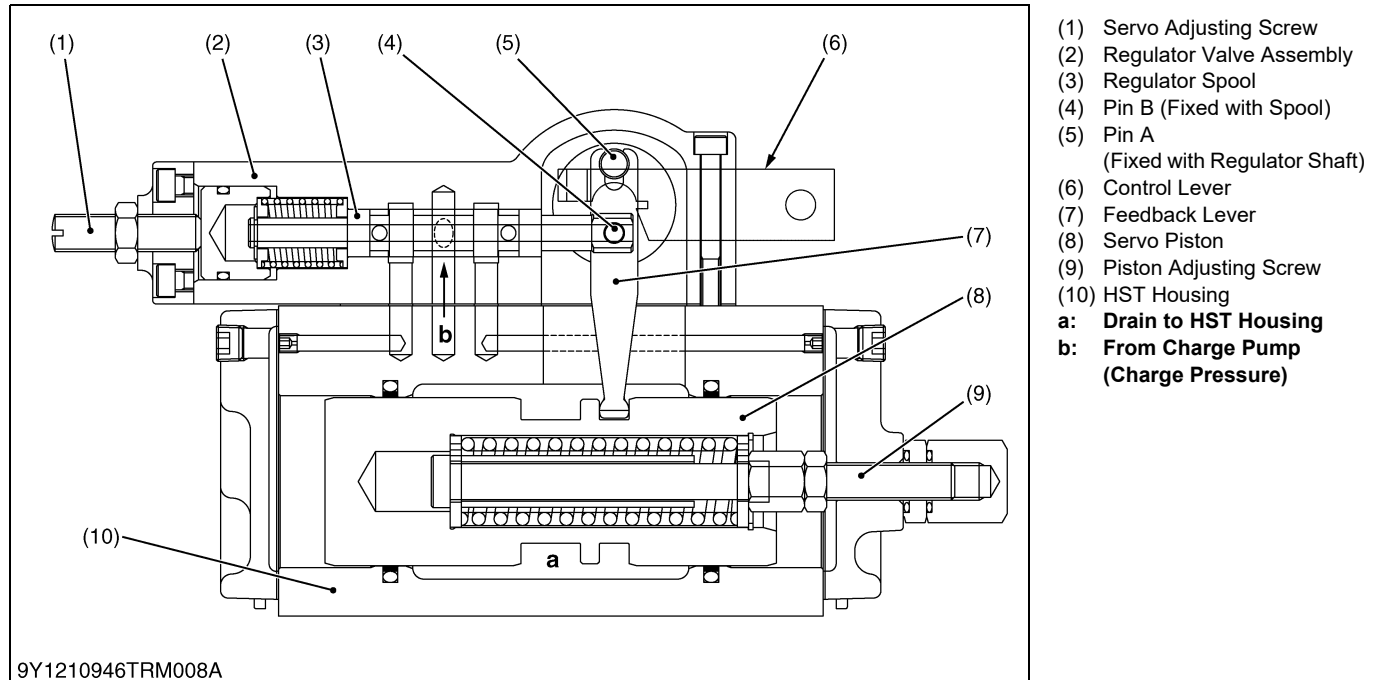
The servo piston moved by hydraulic force, is connected to the pump cylinder variable swashplate (9). Therefore, a tilt angle of swashplate is varied by servo piston movement.

The regulator and the servo piston are connected with feedback lever (5), and the movement of the piston is restricted according to the amount of depressing of the pedal.

9Y1210946TRM0009US0

[B] Regulator and Servo Piston Operation

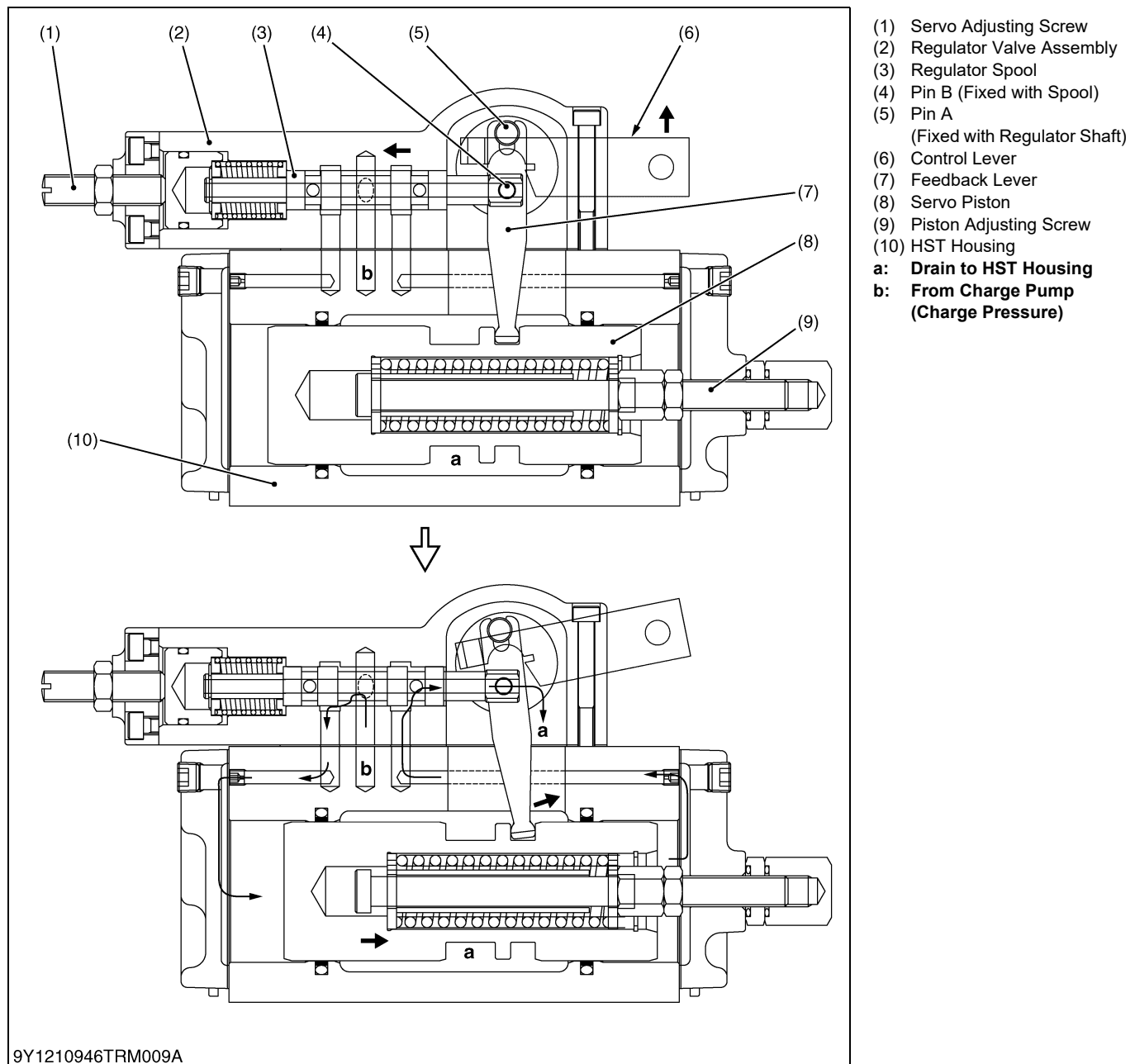
Control Lever at Neutral



The regulator spool (3) is preset to the neutral position by the servo adjust screw (1). In this state, both ends of the servo piston (8) are opened to the drain port.

With the feedback lever (7) is between the spool senses the servo piston position. When the spool is at the neutral position, the piston adjusting screw (9) serves to position the servo piston so that the pump's variable swashplate gets neutral.

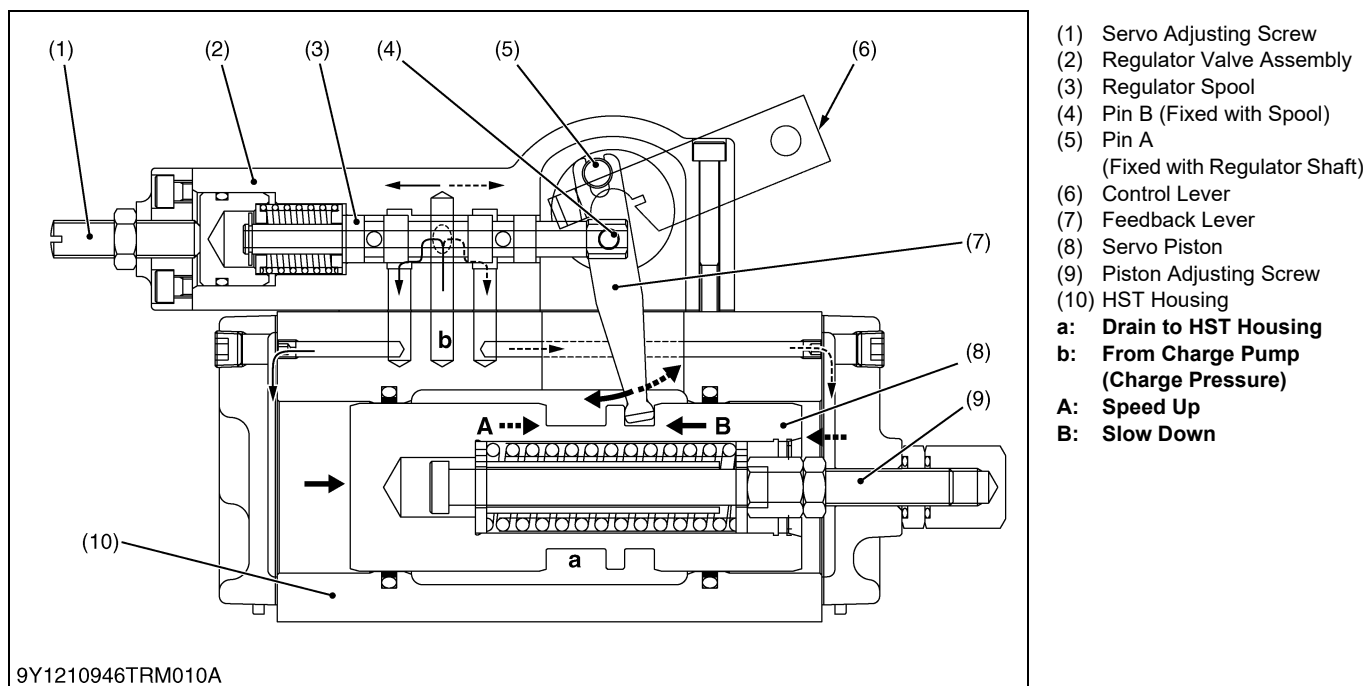
9Y1210946TRM0010US0

Control Lever Activated (First Step: Moving the Control Lever)

When moving the control lever (step on the pedal), and the feedback lever (7) connected with the regulator spool (3) goes against the servo piston (8). Such resistance pulls the regulator spool from the feedback lever. As a result, the hydraulic circuit is formed as shown here.

The servo piston is affected by the charge pressure and starts moving in the direction of arrow.

9Y1210946TRM0011US0

Control Lever Activated (with Control Lever at Desired Position)

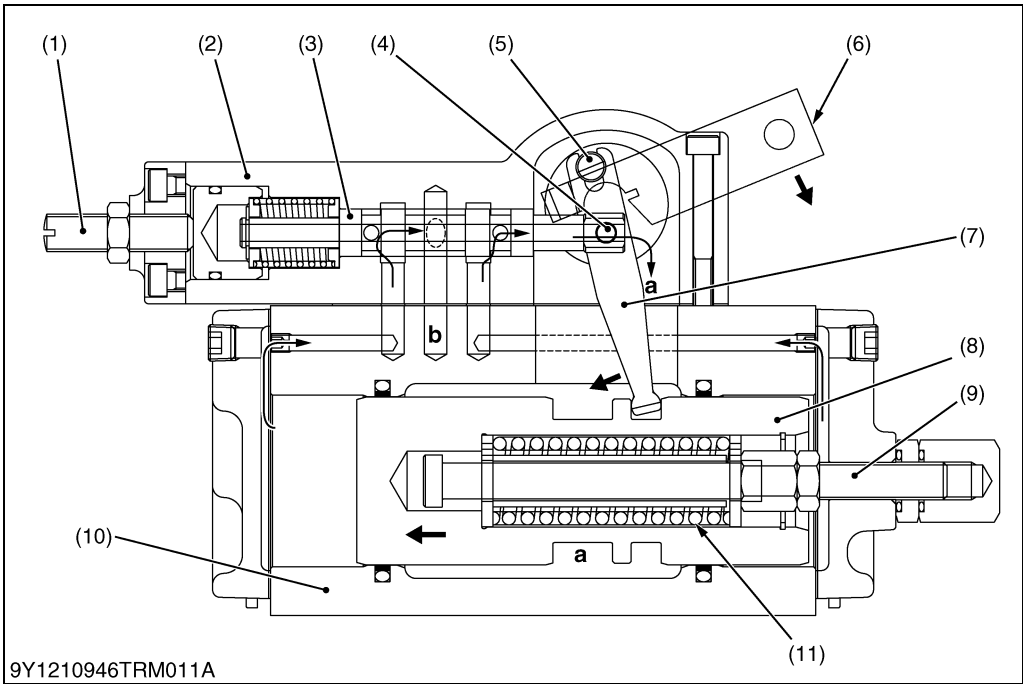
When the control lever has been set to a desired position, the regulator's feedback lever (7) and the servo piston (8) get balanced with each other. Now the regulator spool (3) goes to the neutral position. The pump's variable swashplate interlocked with the servo piston is kept in place to achieve a desired speed.

The load on the HST pump is not constant, however. A heavier load returns the servo piston toward the slow-down side. In so doing, the feedback lever works on the spool to switch the hydraulic circuit to the speed-up side. Then the servo piston is brought back (speed-up) until it gets well balanced with the feedback lever.

A smaller load, on the other hand, moves the servo piston toward the speed-up side. The feedback lever now works on the regulator spool to switch the hydraulic circuit to the slow-down side. The servo piston's charge pressure is let out at the slow-down side and introduced at the speed-up side. Then the servo piston is brought back (slow-down) until it gets well balanced with the feedback lever. This cycle of motions is repeated to keep the desired position.

9Y1210946TRM0012US0

Control Lever Deactivated



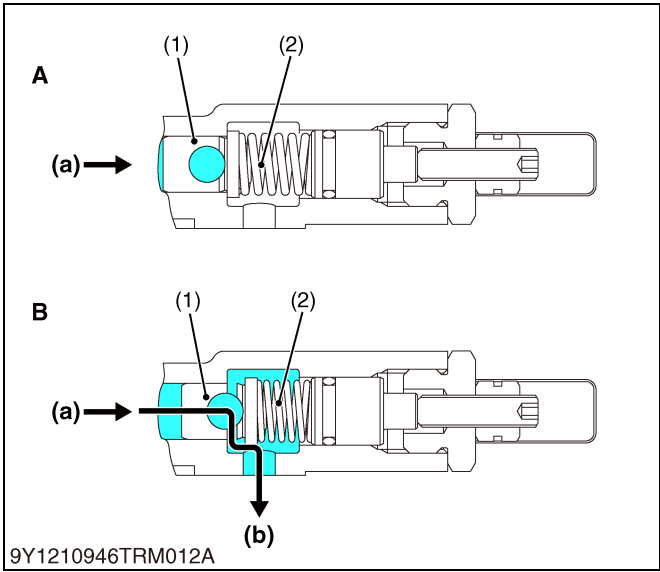
- (1) Servo Adjusting Screw
- (2) Regulator Valve Assembly
- (3) Regulator Spool
- (4) Pin B (Fixed with Spool)
- (5) Pin A (Fixed with Regulator Shaft)
- (6) Control Lever
- (7) Feedback Lever
- (8) Servo Piston
- (9) Piston Adjusting Screw
- (10) HST Housing
- (11) Servo Spring
- a: Drain to HST Housing
- b: From Charge Pump (Charge Pressure)

9Y1210946TRM011A

Release the control lever (release the pedal), and the spool comes back to the neutral position. The oil at both ends of the servo piston (8) flows back to the tank. The oil from the charge pump also flows back to the HST housing. With such circuit formed, the servo spring (11) pushes the servo piston back to the neutral position.

9Y1210946TRM0013US0

[C] Charge Relief Valve



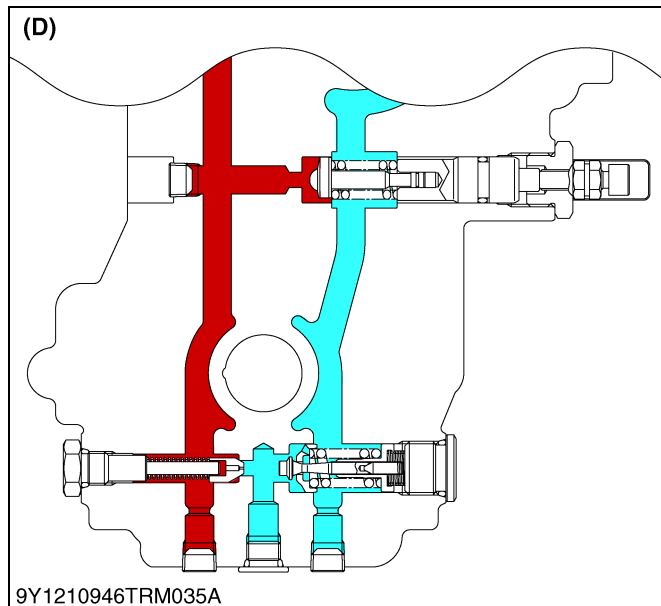
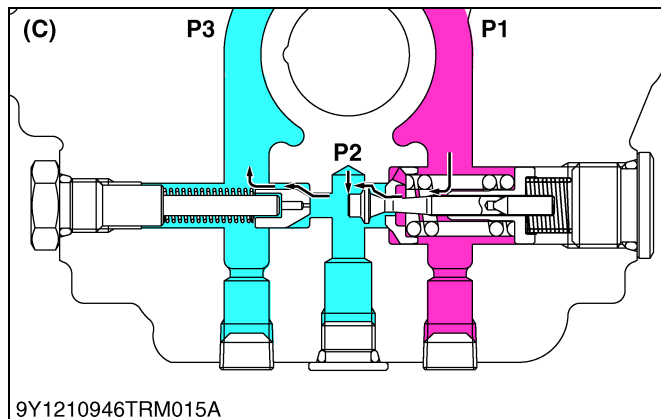
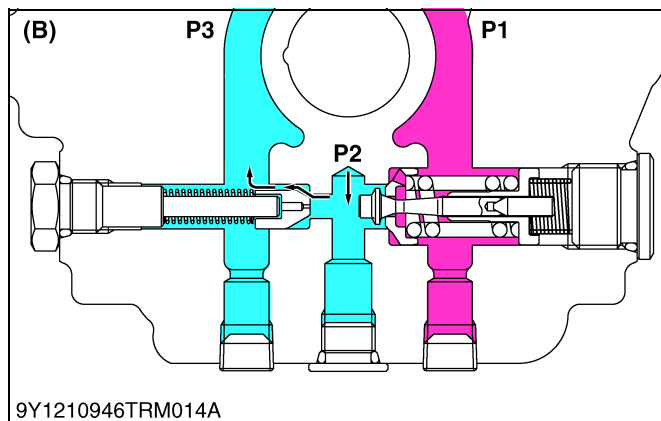
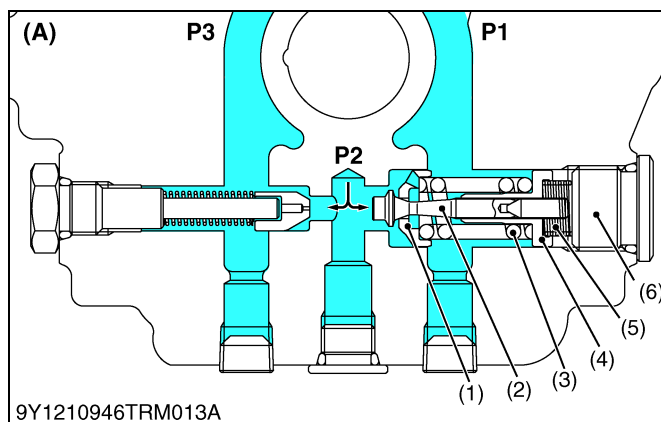
9Y1210946TRM012A

The charge pump feeds oil to the HST main circuit (closed circuit) and the regulator assembly. Oil may leak out of the HST main circuit (in the HST housing) depending on the pressure, oil temperature and other factors. With this in mind, oil must be constantly. Charge relief valve will open when oil pressure exceeds valve operating pressure.

Oil temperature	Valve operating pressure
45 to 55 °C (113 to 131 °F)	0.43 to 0.85 MPa 4.4 to 8.6 kgf/cm ² 63 to 120 psi

- (1) Valve Poppet
- (2) Spring
- (a) From Charge Pump
- (b) To HST Housing
- A: Close
- B: Open

9Y1210946TRM0014US0

[D] Check and High Pressure Relief Valve

The cartridge-type check and high-pressure relief valve consists of pressure poppet (2), check valve seat (1), relief valve spring (3), spring guide (4) and check valve spring (5). The spring guide (4) is provided with an anti-rotation, which keeps the threads tight after a pressure has been set.

The valve is used to prevent an overload that would happen at a quick start, sudden stop or even during usual operation. This valve doubles as a check valve.

The check and high-pressure relief valves are laid out facing each other as shown in the figure.

When the pressure of both main oil circuit are below the pressure of **P2**, both valves are open and charging oil enters into the main oil circuit through the valves.

At normal operation, the check valve in the high-pressure side is closed and it pushes and opens the another one. An excessive charge flow goes through the charge relief valve into HST housing.

The check and high-pressure relief valve along the high-pressure line serves as a high-pressure relief valve. If the pressure exceeds a high-pressure limit level, the spring (3) force and opens the valve seat that is located between the check valve seat (1) and the pressure poppet (2). Now the flow goes from **P1** to **P2** and **P3**.

If the **P1** pressure drops, the relief valve spring forces the valve seat closed against the pressure. The high-pressure oil at **P1** does not flow to **P2** any longer.

As discussed above, the check and high-pressure relief valve protects engines, pumps, motors, gears and even the machine itself from overload.

- (1) Check Valve Seat
- (2) Pressure Poppet
- (3) Relief Valve Spring
- (4) Spring Guide
- (5) Check Valve Spring
- (6) Valve Plug

- (A) When both Check Valve Activating.
- (B) When Check Valve Activating.
- (C) When High Pressure Relief Valve Activating. (Travelling Side)
- (D) When High Pressure Relief Valve Activating. (Dynamic Brake side)

(To be continued)

(Continued)

Condition

- Engine speed:
Maximum while transmission stalling

Oil temperature	Port	Valve operating pressure
45 to 55 °C (113 to 131 °F)	(P1) Traveling side	24.5 to 27.5 MPa 250 to 280 kgf/cm ² 3560 to 3980 psi
	(P3) Dynamic brake side	20.3 to 22.0 MPa 204 to 224 kgf/cm ² 2900 to 3190 psi

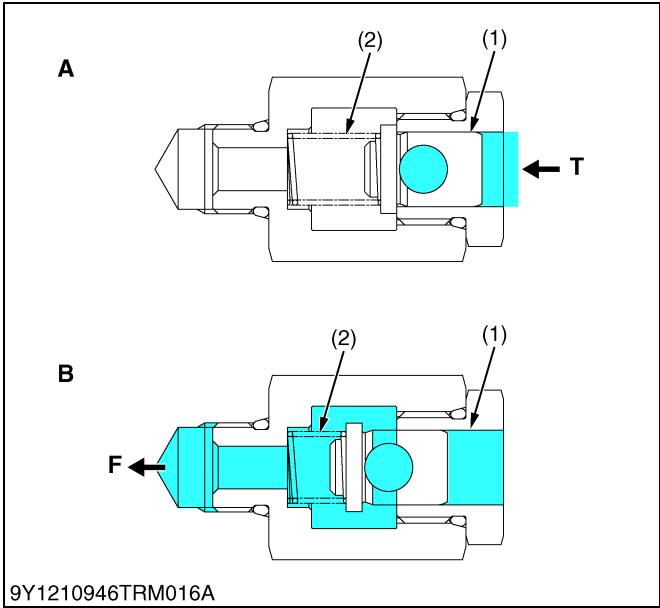
Condition

- Engine speed:
1400 min⁻¹ (rpm)

Oil temperature	Port	Valve operating pressure
45 to 55 °C (113 to 131 °F)	(P2) Charge	0.43 to 0.85 MPa 4.4 to 8.6 kgf/cm ² 63 to 120 psi

9Y1210948TRM0004US0

[E] Anti-cavitation Valve



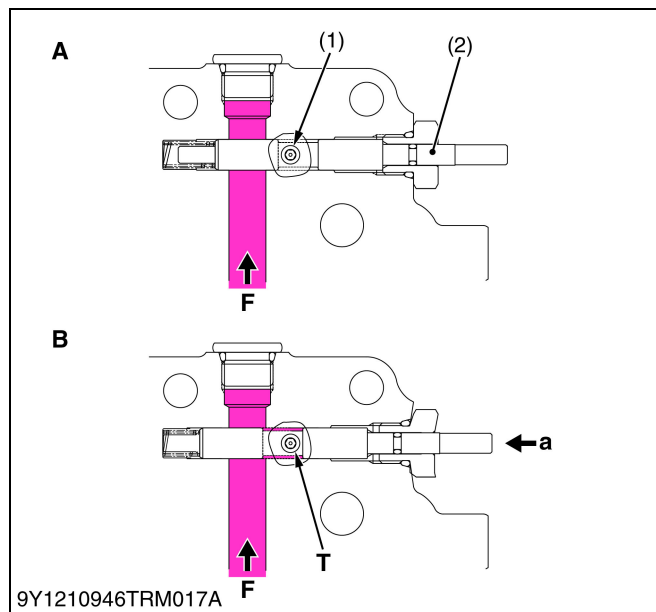
The anti-cavitation valve is normally closed.

When the oil level in the charging circuit becomes low, the anti-cavitation valve opens and the necessary amount of oil is provided to the travel circuit from the HST housing due to the pressure difference between HST housing case and travel circuit.

- (1) Anti-cavitation Valve
- (2) Spring

- A: Anti-cavitation Valve is Closed.**
- B: Anti-cavitation Valve is Opened.**
- F: To Travel Circuit (Forward Circuit)**
- T: From HST Housing Case**

9Y1210946TRM0016US0

[F] Unload Valve

When starting from a stopped position on a slope (the brake pedal is not depressed), due to residual pressure in the HST circuit, shifting to the neutral position cannot always be fully achieved.

This time, to eliminate this problem, an unload valve is employed in the traveling circuit.

When the brake pedal is depressed, the unload valve opens and the residual pressure in the travel circuit is relieved through the orifice (1).

- (1) Orifice
- (2) Unload Valve

**F: From Travel Circuit
(Forward Circuit)**

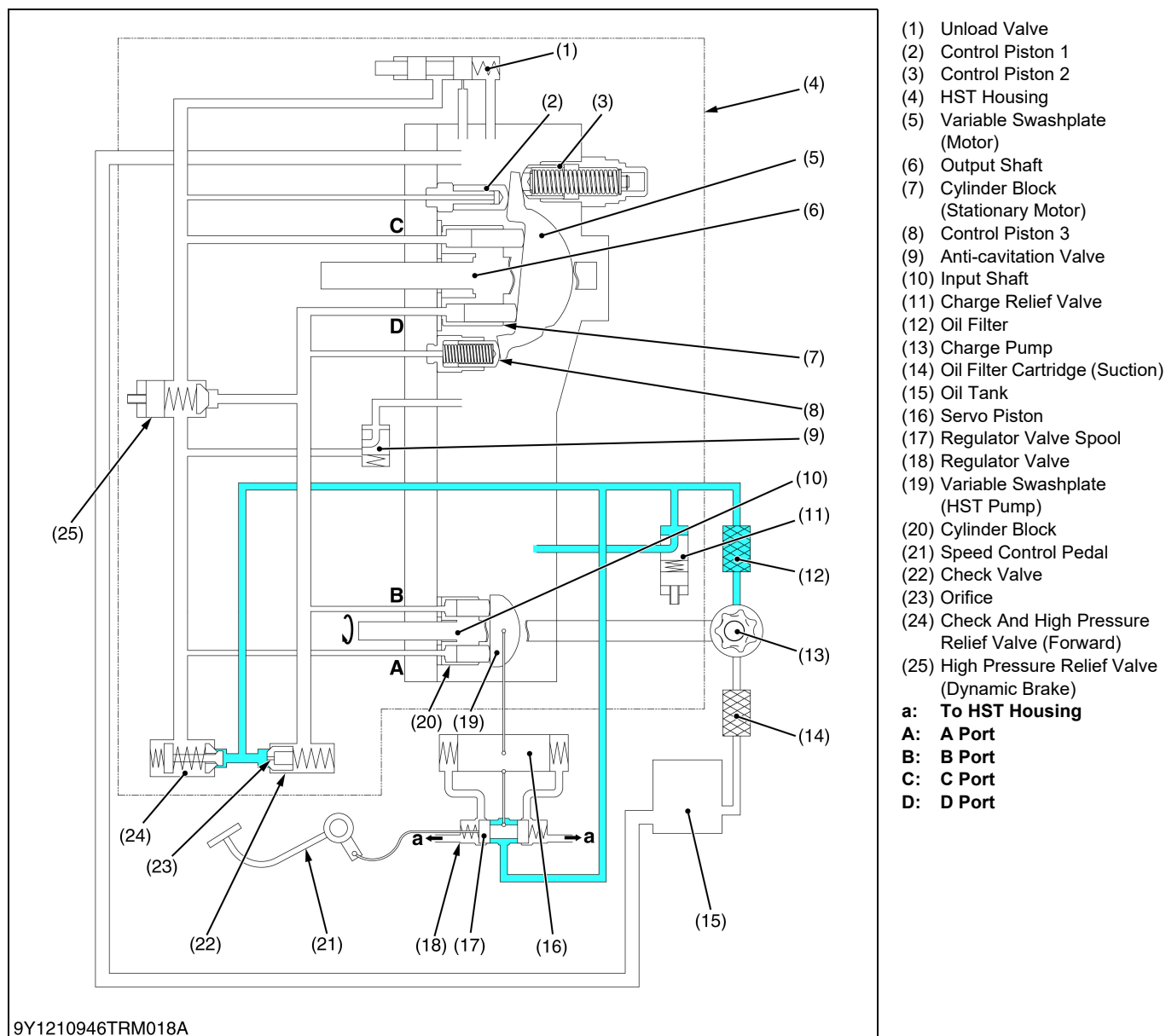
T: To HST Housing Case

a: Brake Pedal is Depressed

A: Unload Valve Close

B: Unload Valve Open

9Y1210946TRM0017US0

(4) HST Oil Flow**[A] Neutral**

The transmission oil is suctioned by a charge pump (13) while the engine is operating.

The oil passes through a oil filter cartridge (suction) (14) and oil filter (12) and is then supplied to a HST circuit regulator valve (18).

The oil in the HST circuit is controlled by a charge relief valve (11) and surplus oil is returned from the charge relief valve (11) to the HST housing (4).

When the speed control pedal (21) is released, the regulator Valve Spool (17) for the regulator valve (18) also enters neutral position.

When the regulator valve (18) is in neutral position, oil is not supplied to the servo piston (16) so the servo piston also keeps neutral position.

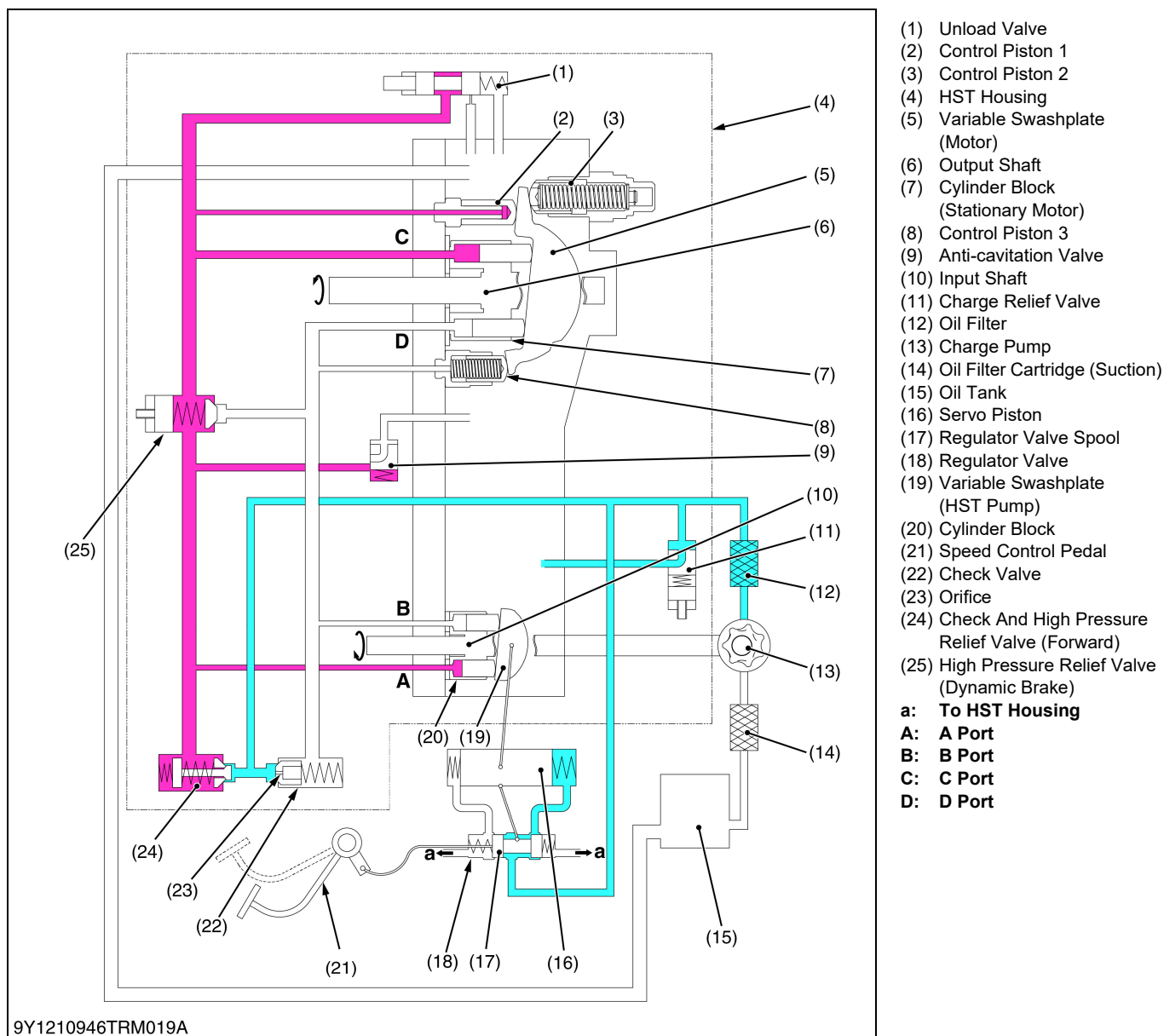
The servo piston (16) and variable swashplate (19) are connected.

When the variable swashplate (19) is in neutral position, the oil from the pump piston is not supplied to the motor piston.

The cylinder block (7) and output shaft (6) are connected using a spline.

Therefore, as the cylinder block (engine side) does not rotate, the output shaft (6) also does not rotate and power from the engine is not transferred.

9Y1210946TRM0018US0

[B] Half Stroke Movement of Pedal and Light Load Condition

When a half stroke of pushing on the speed control pedal (21) is performed, the regulator valve spool (17) moves as shown in the diagram.

Oil from the charge circuit moves the servo piston (16) causing inclination of the variable swashplate (19).

Inclination of the variable swashplate (19) causes the pump piston to move back and forth.

This moving back and forth enables providing high pressure oil from port **A** of the pump.

High pressure oil from pump port **A** flows to port **C** on the motor.

The cylinder block (7) of the motor is driven by the motor piston.

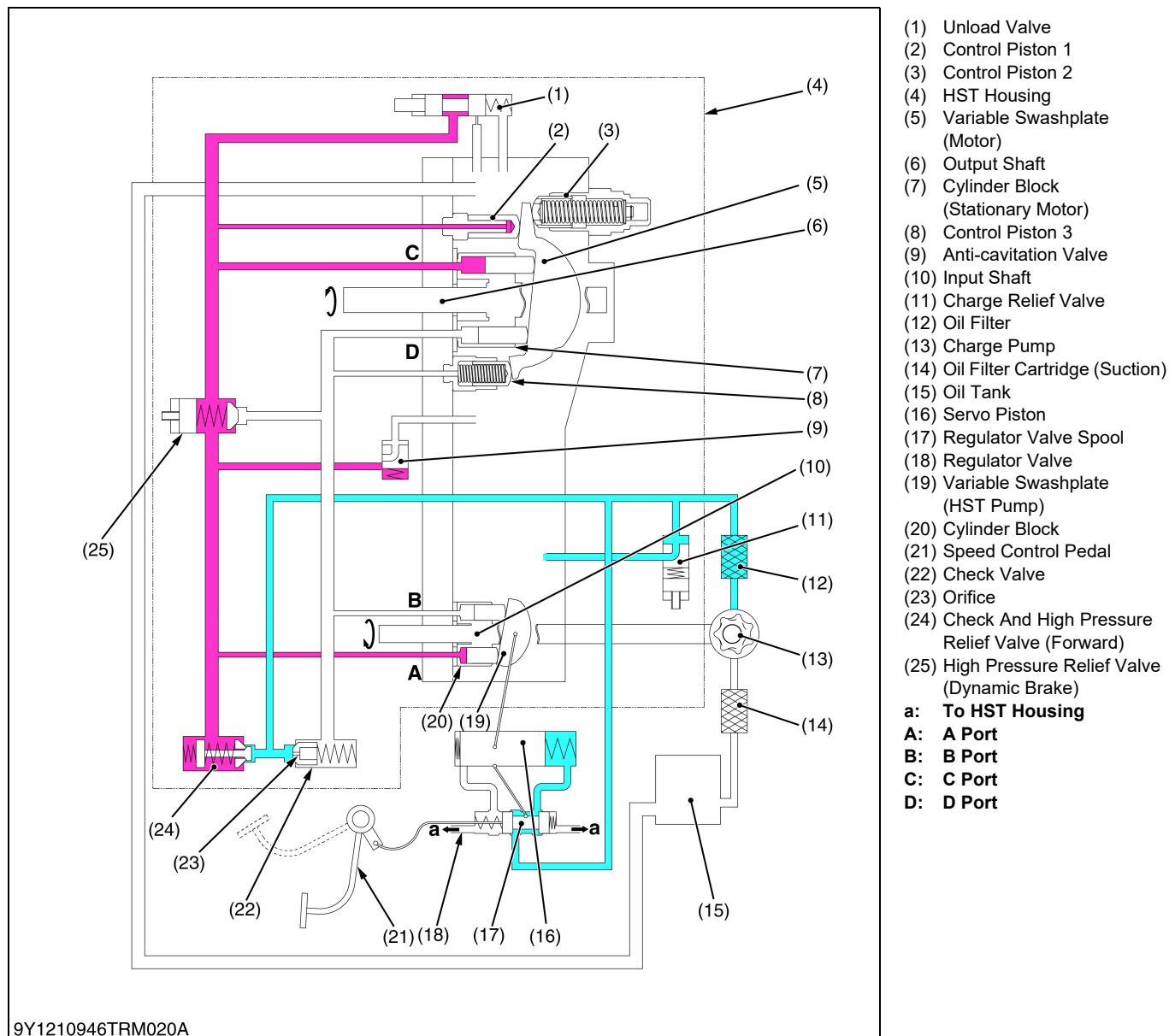
The motor cylinder block (7) is connected to the output shaft (6) so the output shaft (6) starts to rotate.

The output shaft (6) starts to rotate based on rotating speed of the pump.

Low pressure oil from port **D** on the motor returns to port **B** on the pump

9Y1210946TRM0019US0

[C] Low Load When Speed Control Pedal Is Pressed



The diagram shows the motion of the regulator valve spool (17) when the speed control pedal (21) is pressed all the way down.

The servo piston (16) tilts the variable swashplate (19) on the pump side to the maximum position.

The pump cylinder block (20) is driven by the input shaft and high pressure oil is discharged from port **A**.

High pressure oil that is discharged from port **A** of the pump flows along the circuit to port **C** on the motor side.

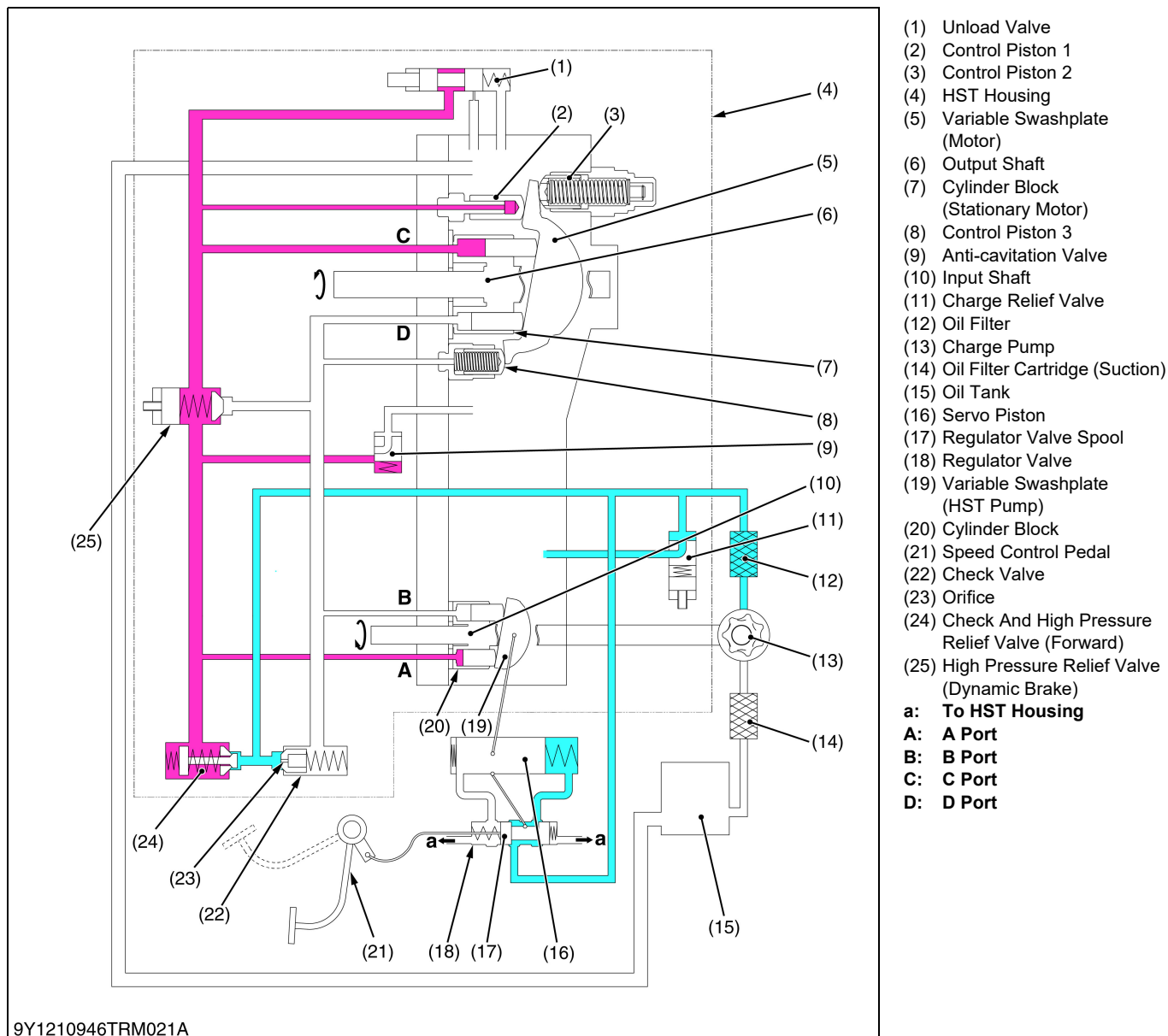
The oil discharged from the pump side does not have sufficient pressure to cause the variable swashplate (5) on the motor side to tilt.

Therefore, the cylinder block (7) on the motor rotates in the position shown on the diagram and transfers power to the output shaft (6).

Thereafter, low pressure oil discharged from the cylinder block (7) on the motor returns from port **C** to port **B**.

9Y1210946TRM0020US0

[D] Swashplate On The Motor Is Starting To Tilt From Low Load When The Speed Control Pedal Is Pressed



The diagram shows the motion of the regulator valve spool when the speed control pedal (21) is pressed all the way down.

The servo piston tilts the variable swashplate on the pump side to the maximum position.

The pump cylinder block (20) is driven by the input shaft (10) and high pressure oil is discharged from port **A**.

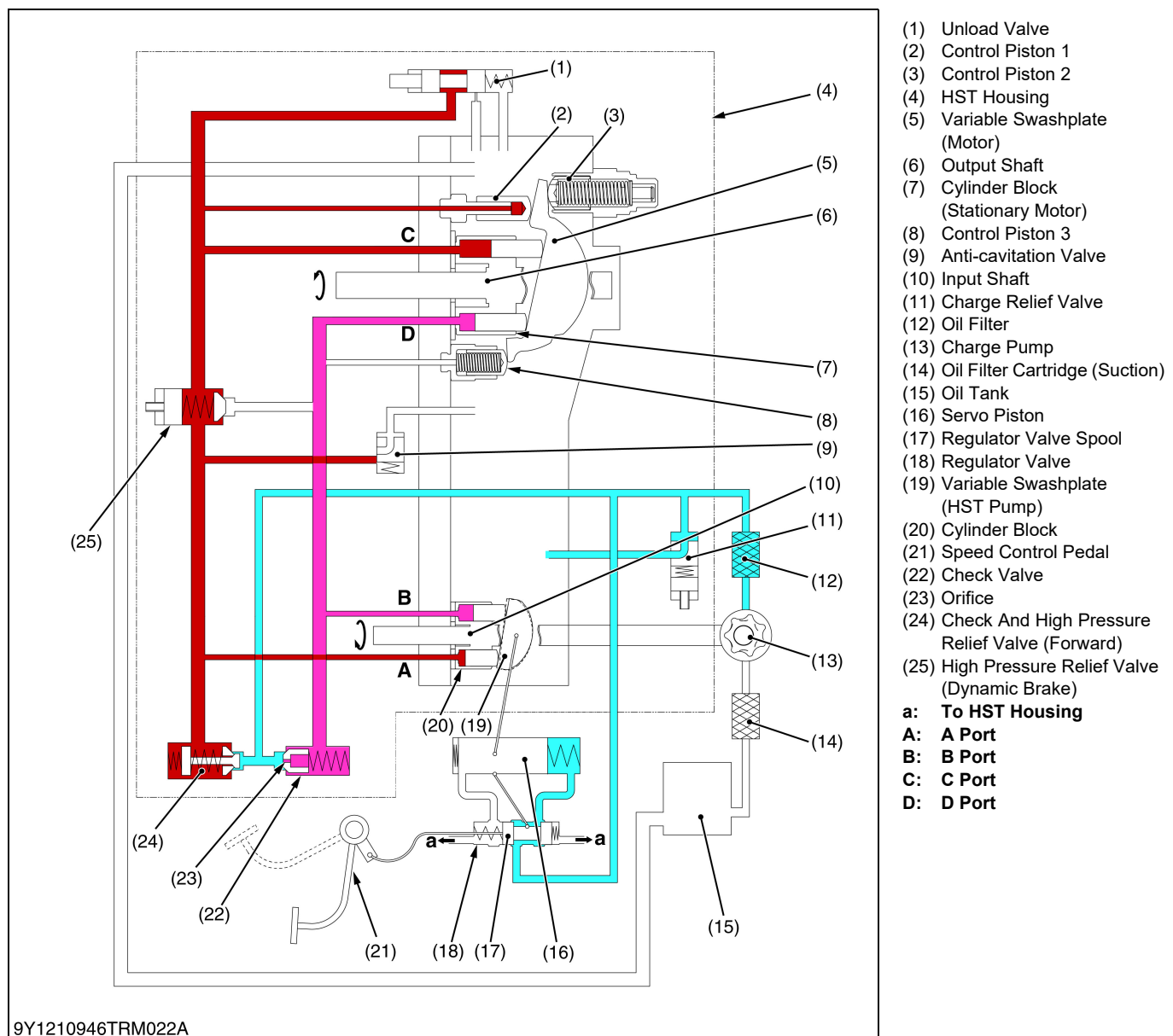
High pressure oil that is discharged from port **A** of the pump flows along the circuit to port **C** on the motor side.

Based on pressure of oil discharged from the pump, the control piston 1 (2) starts to tilt the variable swashplate (5) on the motor.

Rotational speed of the output shaft (6) is lowered due to tilting of the cylinder block (7) on the motor.

Torque is increased through reduction in rotational speed of the output shaft (6).

9Y1210946TRM0021US0

[E] Horse-power Control When The Speed Control Pedal Is Pressed While Overloaded

The diagram shows the motion of the regulator valve spool (17) when the speed control pedal (21) is pressed all the way down.

The servo piston (16) tilts the variable swashplate (19) on the pump side to the maximum position.

The pump block is driven by the input shaft (10) and high pressure oil is discharged from port **A**.

High pressure oil that is discharged from port **A** of the pump flows along the circuit to port **C** on the motor side.

Based on pressure of oil discharged from the pump, the control piston 1 (2) tilts the cylinder block variable swashplate (5) on the motor to the maximum position.

Here, the piston volume on the motor is maximized.

When a heavier load is applied, the variable swashplate (19) on the pump side moves to neutral.

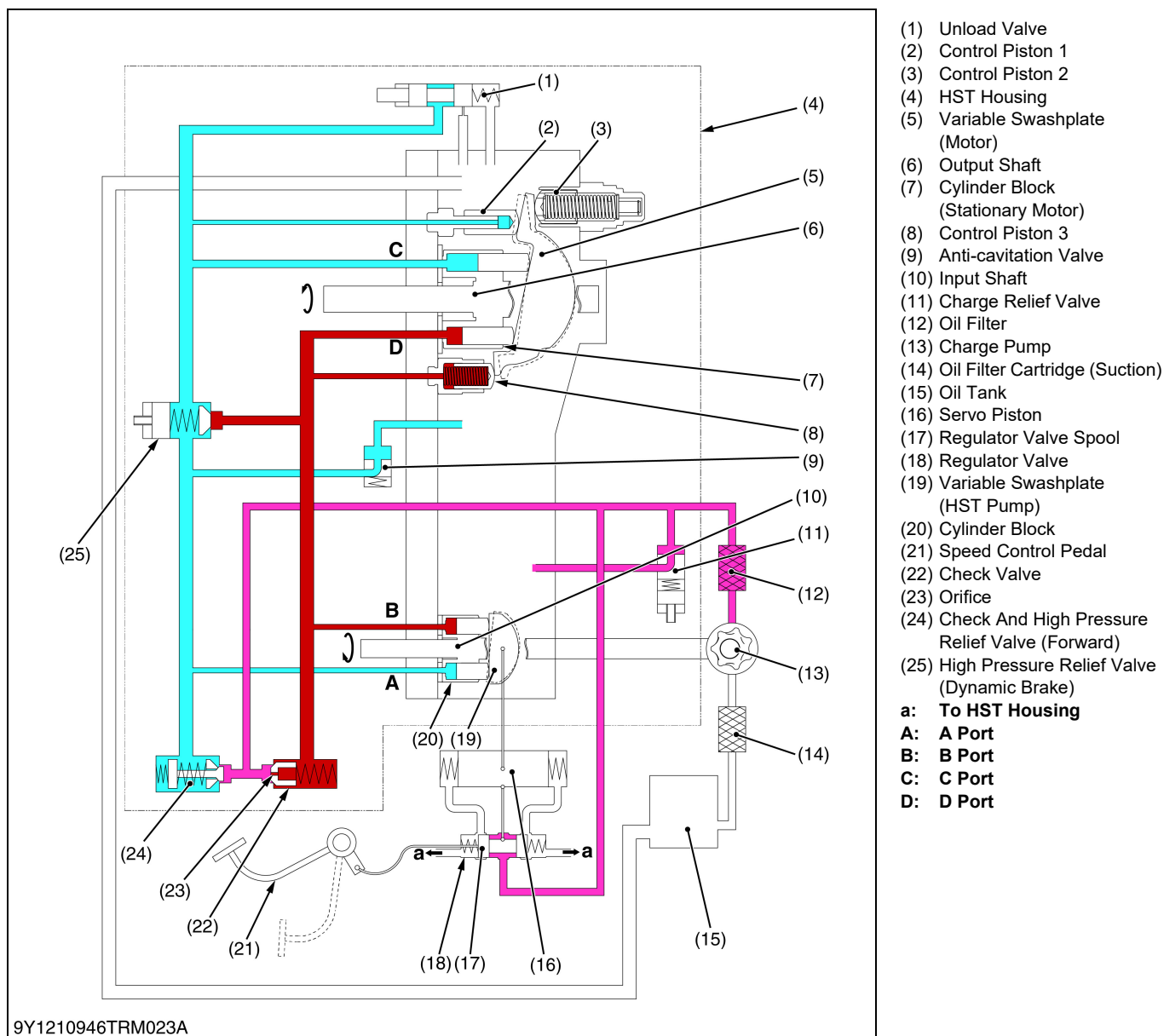
When the swashplate returns to neutral, the load on the engine is lightened.

When the load on the engine is lightened, engine speed rises again.

The discharge flow from the pump is reduced at the same time but engine speed recovers before the set pressure of the high pressure relief valve (24) is reached.

Here, maximum output torque is reached.

9Y1210946TRM0022US0

[F] When Dynamic Brake Is Engaged

- (1) Unload Valve
 - (2) Control Piston 1
 - (3) Control Piston 2
 - (4) HST Housing
 - (5) Variable Swashplate (Motor)
 - (6) Output Shaft
 - (7) Cylinder Block (Stationary Motor)
 - (8) Control Piston 3
 - (9) Anti-cavitation Valve
 - (10) Input Shaft
 - (11) Charge Relief Valve
 - (12) Oil Filter
 - (13) Charge Pump
 - (14) Oil Filter Cartridge (Suction)
 - (15) Oil Tank
 - (16) Servo Piston
 - (17) Regulator Valve Spool
 - (18) Regulator Valve
 - (19) Variable Swashplate (HST Pump)
 - (20) Cylinder Block
 - (21) Speed Control Pedal
 - (22) Check Valve
 - (23) Orifice
 - (24) Check And High Pressure Relief Valve (Forward)
 - (25) High Pressure Relief Valve (Dynamic Brake)
- a: To HST Housing**
A: A Port
B: B Port
C: C Port
D: D Port

When the speed control pedal (21) is released, the regulator valve (18) and service port enter neutral position. The variable swashplate (19) of the pump also returns to neutral position. If the machine continues to travel due to inertia, the variable swashplate (19) on the pump is in neutral so oil does not flow.

The output shaft (6) rotates so it continues to rotate in the same direction as when the speed control pedal (21) was released.

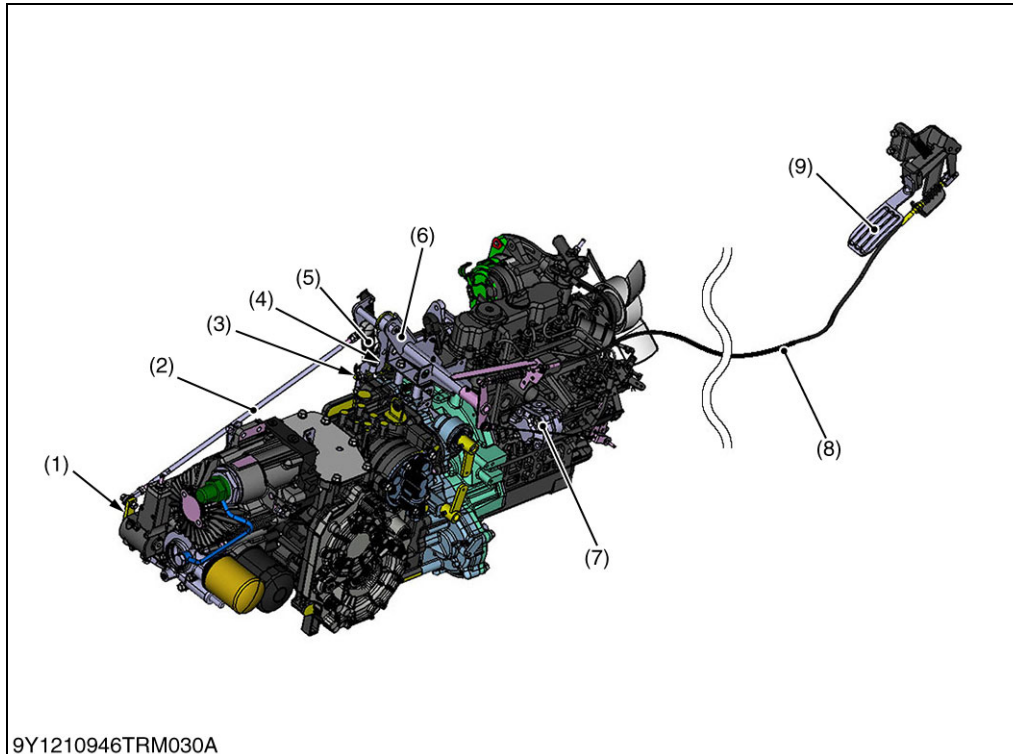
Here, similar to the pump side, oil suctioned from port **C** of the motor side is discharged to port **D**. Oil from port **D** flows to port **B** and transfers power to the input shaft (10). In this manner, engine rotation and rotation of the output shaft (6) operate as a dynamic brake. Oil from port **D** opens the high pressure relief valve (25), passes through the check valve (24) and returns to port **C**.

Operation of the dynamic brake is determined by the setting of the high pressure relief valve (25). If oil returned from the high pressure relief valve (25) and oil supplied from the charge circuit is insufficient, the anti-cavitation valve (9) is activated through negative pressure. The anti-cavitation valve (9) plays the role of suctioning oil from the HST housing (4) to the negative pressure travel circuit.

9Y1210946TRM0023US0

(5) HST Control Linkage

[A] Speed Control Linkage



- (1) HST Control Lever
- (2) HST Control Rod
- (3) Neutral Lever
- (4) Neutral Holder
- (5) Damper
- (6) Neutral Holder Arm
- (7) Engine Speed Control Wire
- (8) Speed Control Pedal Cable
- (9) Speed Control Pedal

9Y1210946TRM030A

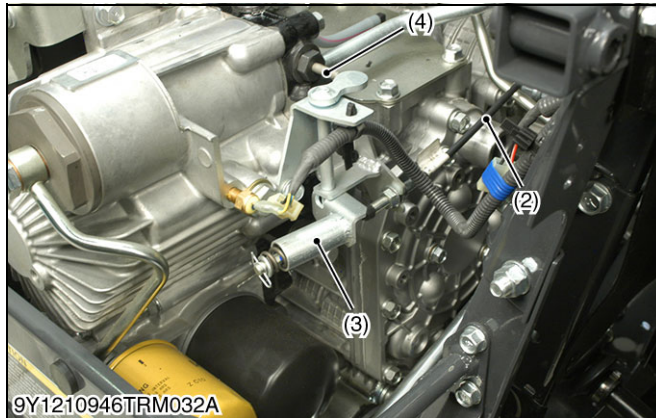
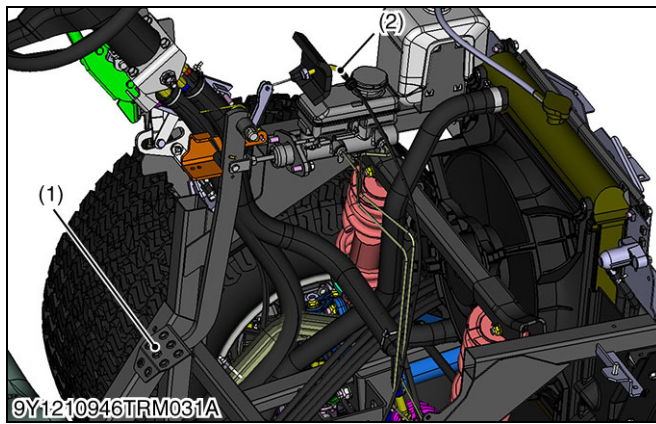
The speed control pedal (9) and neutral holder arm (6) are connected with speed control pedal cable (8). And the HST control lever (1) and neutral holder arm (6) are linked with HST control rod (2).

The speed control wire (7) connected with neutral holder arm (6) is able to be pulled by synchronizing with the speed control pedal cable (8).

As the speed control pedal (9) is depressed, the HST control lever (1) is rotated, then the swashplate is tilted by servomechanism and forward travelling speed increases. Then the swashplate is returned to neutral with the neutral holder arm (6), when the speed control pedal (9) is released. The ball bearing on the neutral holder (4) pulled with the neutral lever (3) seats the detent of the neutral holder arm (6) so that the neutral holder arm returns to neutral.

The damper (5) is connected the neutral holder arm (6), restricts the movement of the linkage to prevent abrupt operation.

9Y1210946TRM030US0

[B] Unload Valve Linkage

When starting from a stopped position on a slope (the brake pedal (1) is not depressed), due to residual pressure in the HST circuit, shifting to the neutral position cannot always be fully achieved.

This time, to eliminate this problem, an unload valve is employed in the travel circuit.

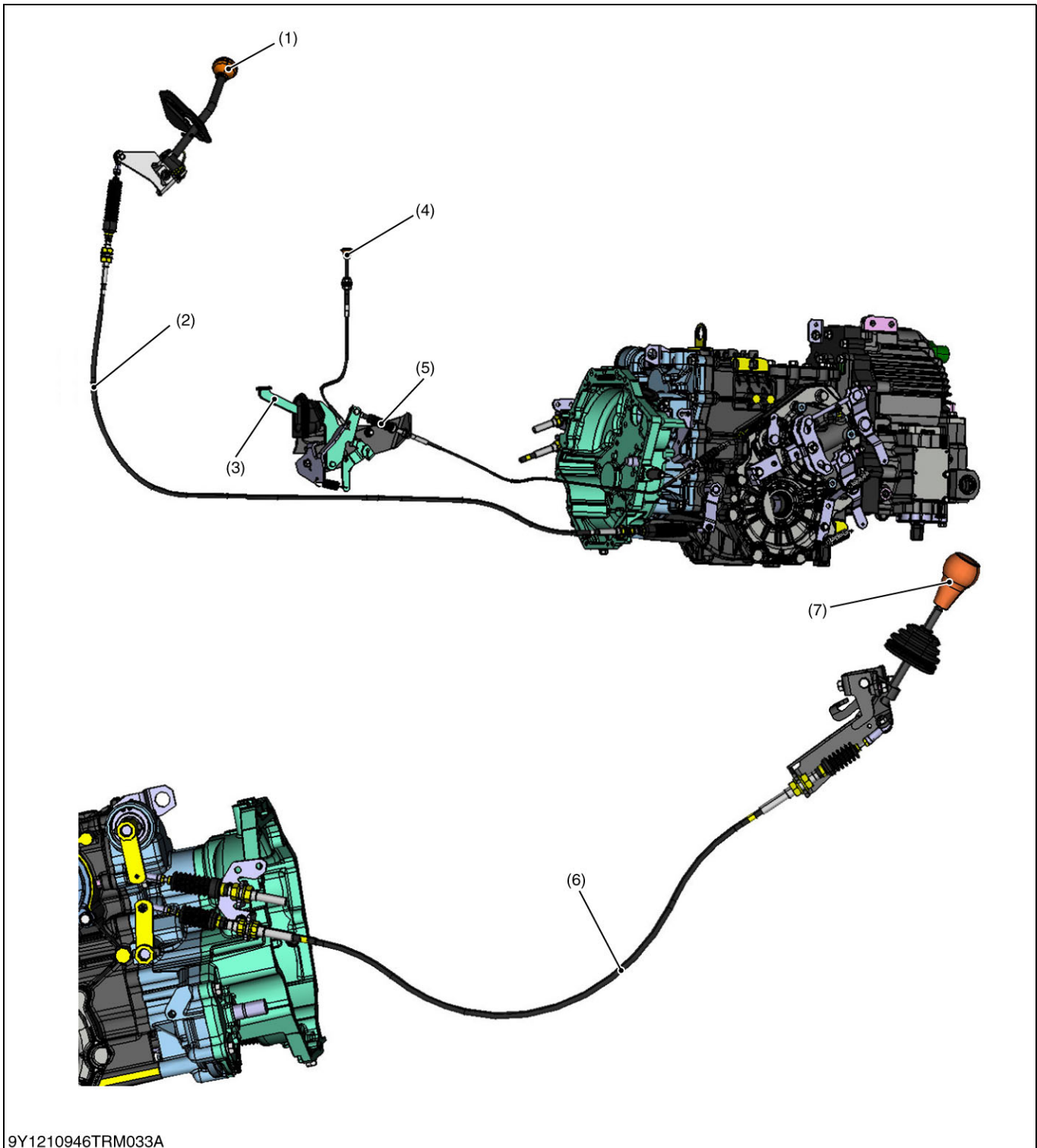
When the brake pedal (1) is depressed, the unload valve opens and the residual pressure in the travel circuit is relieved the orifice.

- (1) Brake Pedal
- (2) Unload Cable

- (3) Unload Link
- (4) Unload Spool

9Y1210946TRM0031US0

(6) Cables



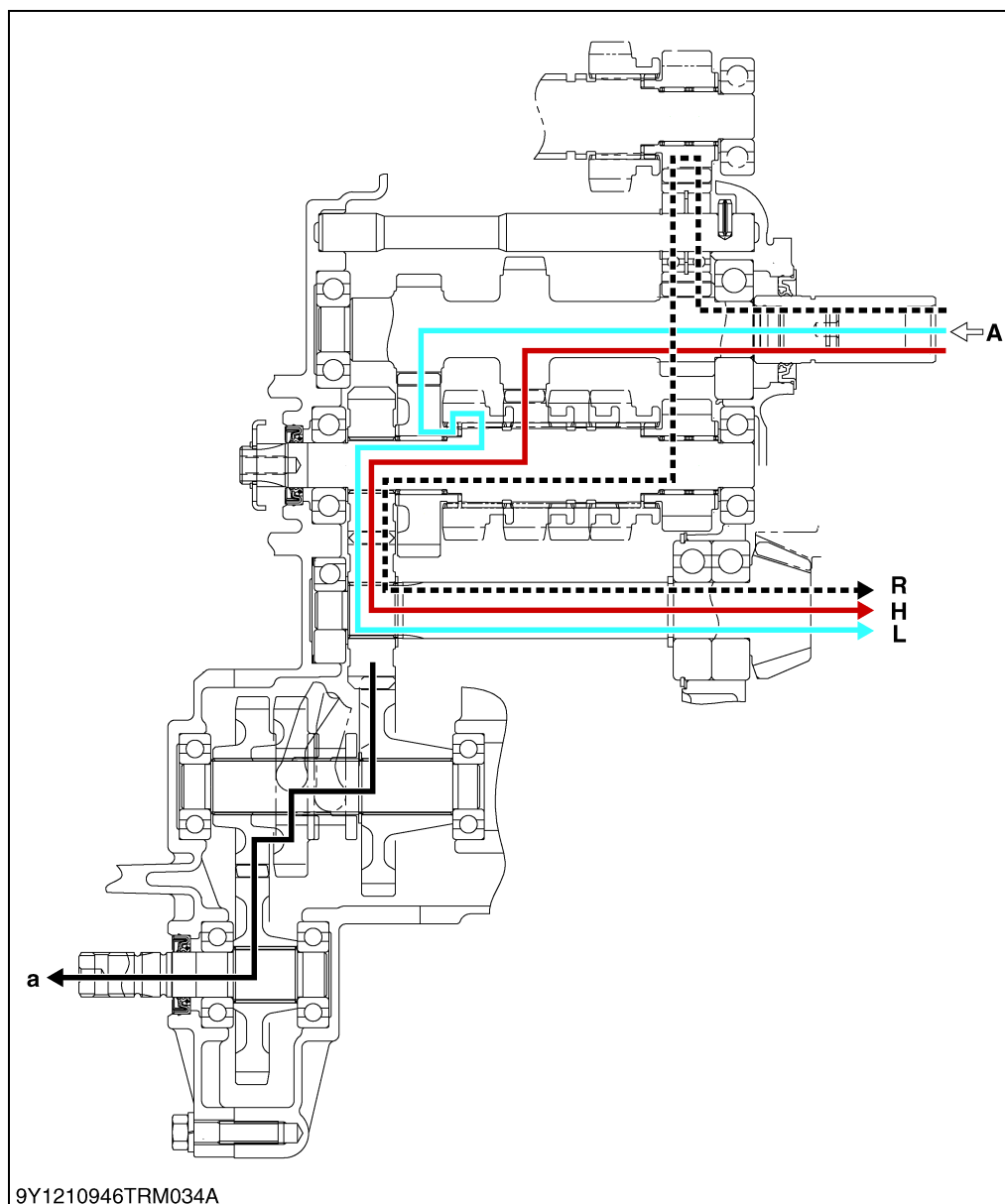
9Y1210946TRM033A

- | | | | |
|----------------------|------------------------------|-----------------------------|---------------|
| (1) Main Shift Lever | (3) Differential Lock Pedal | (6) 4WD Shift Cable | (7) 4WD Lever |
| (2) Shift Cable | (4) Differential Lock Holder | (5) Differential Lock Cable | |

Each control cable is the structure of figure.

9Y1210946TRM0032US0

[2] RANGE GEAR SHIFT SECTION AND FRONT WHEEL DRIVE SECTION



R: Reverse
 L: Low Speed
 H: High Speed
 a: 4 Wheel Drive
 A: From HST Output Shaft

9Y1210946TRM034A

■ Range Gear Shift Section

First, power is transmitted to the HST at the back of the transmission case. The HST power is then removed to the front and transmitted further to the range shift section.

The speed can be changed in 2 steps forward and in single step backward. The shifting is made through the cable linkage of the shift lever at the operator's seat. The speed change system is of constant mesh type.

■ Front Wheel Drive Section

This section is located near the range gear shift section. The front wheel drive select lever at the operator's seat is used to switch between the two wheel and four wheel drive. The front wheel drive select lever and the range gear shift lever are cable connected. Sliding gear system is adopted, in which the shifter gears are directly moved.

9Y1210946TRM0033US0

SERVICING

CONTENTS

1. TROUBLESHOOTING.....	2-S1
[1] HYDROSTATIC TRANSMISSION	2-S1
[2] TRAVELLING GEAR SHIFT SECTION.....	2-S3
[3] DIFFERENTIAL GEAR SECTION	2-S3
2. SERVICING SPECIFICATIONS	2-S4
3. TIGHTENING TORQUES	2-S5
4. CHECKING AND ADJUSTING	2-S6
5. PREPARATION	2-S17
[1] SEPARATING HYDRAULIC TRANSMISSION	2-S17
[2] DISMOUNTING TRANSMISSION AND ENGINE	2-S23
[3] SEPARATING TRANSMISSION AND ENGINE	2-S33
6. DISASSEMBLING AND ASSEMBLING	2-S36
[1] TRANSMISSION	2-S36
(1) Removing HST Assembly.....	2-S36
(2) Disassembling Transmission.....	2-S37
(3) Disassembling HST	2-S43
7. SERVICING	2-S47
[1] TRANSMISSION	2-S47
[2] HST	2-S51

1. TROUBLESHOOTING

[1] HYDROSTATIC TRANSMISSION

Symptom	Probable Cause	Solution	Reference Page
System Will Not Operate in Both Direction	Oil level is low	Check oil level or fill oil to proper level	G-21
	Control linkage or cable damaged (speed control cable)	Repair linkage	2-S31
	Charge pressure is too low	Solution order 1. Replace oil filter cartridge	G-28
		2. Check charge pressure	2-S6
		3. Inspect or flush charge relief valve	2-S52
	Check and high pressure relief valve does not move smoothly	Inspect or replace check and high pressure relief valve	2-S52
	HST component parts damaged	Replace hydrostatic transmission assembly	2-S17
Vibration and Noise	Oil level is too low	Check oil level or fill oil to proper level	G-21
	Control linkage or cable damaged (speed control cable)	Repair linkage	2-S31
	Charge pressure is too low	Solution order 1. Replace oil filter cartridge	G-28
		2. Check charge pressure	2-S6
		3. Inspect or flush charge relief valve	2-S52
	Check and high pressure relief valve does not move smoothly	Inspect or replace check and high pressure relief valve	2-S52
	HST component part is damaged	Replace hydrostatic transmission assembly	2-S17

Symptom	Probable Cause	Solution	Reference Page
Loss of Power	Oil level is low	Check oil level or fill oil to proper level	G-21
	Control linkage or cable damaged (speed control cable)	Repair linkage	2-S31
	Charge pressure is too low	Solution order 1. Replace oil filter cartridge	G-28
		2. Check charge pressure	2-S6
		3. Inspect or flush charge relief valve	2-S52
	Check and high pressure relief valve does not move smoothly	Inspect or replace check and high pressure relief valve	2-S52
	Component parts damaged	Replace hydrostatic transmission assembly	2-S17
	Unload cable problem	Solution order 1. Adjust the cable	2-S16
		2. Replace	2-S20
Transmission Oil Over Heats	Low transmission oil level	Fill transmission oil level up to proper level	G-21
	Radiator and oil cooler net clogged	Clean radiator net	G-22, G-23
	Excessive machine load	Reduce machine load	–
	Improper charge pressure	Solution order 1. Check high relief pressure	2-S7
		2. Replace transmission oil filter cartridge	G-28
		3. Replace check and high pressure relief valve	2-S52
		4. Inspect and replace charge relief valve	2-S52
Machine Will Not Stop in Neutral Position	Control linkage is out of adjustment or sticking	Repair or replace linkage	2-S30, 2-S33
		Adjust neutral position	2-S9
System Operates in One Direction Only	Control linkage damaged	Repair or replace linkage	2-S31
	Check and high pressure relief valve damaged	Replace check and high pressure relief valve	2-S52

9Y1210948TRS0001US0

[2] TRAVELLING GEAR SHIFT SECTION

Symptom	Probable Cause	Solution	Reference Page
Noise from Transmission	Transmission oil insufficient	Refill	2-S20
	Gear worn or broken	Replace	2-S38
	Bearings worn	Replace	2-S48
Gear Slip Out of Mesh	Shift fork spring tension insufficient	Replace	2-S38
	Shift fork or shiftier worn	Replace	2-S38
	Shift fork bent	Replace	2-S38

9Y1210948TRS0002US0

[3] DIFFERENTIAL GEAR SECTION

Symptom	Probable Cause	Solution	Reference Page
Excessive or Unusual Noise at All Time	Improper backlash between spiral bevel pinion and bevel gear	Adjust	2-S50
	Improper backlash between differential pinion and differential side gear	Adjust	2-S49
	Bearing worn	Replace	2-S42
	Insufficient or improper type of transmission fluid used	Fill or change	2-S20
Noise While Turning	Differential pinions or differential side gears worn or damaged	Replace	2-S42
	Differential lock binding (does not disengage)	Replace	2-S40
	Bearings worn	Replace	2-S42
Differential Lock Can Not Be Set	Differential lock shift fork damaged	Replace	2-S40
	Differential lock shiftier mounting pin damaged	Replace	2-S40
Differential Lock Pedal Does Not Return	Differential lock pedal return spring weaken or damaged	Replace	2-S40
	Differential lock fork shaft rusted	Repair	2-S40

9Y1210948TRS0003US0

2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Charge Relief Valve	Setting Pressure	0.43 to 0.83 MPa 4.4 to 8.6 kgf/cm ² 63 to 120 psi	—
Servo Piston Operation Pressure (When Neutral Adjusted)	Difference Pressure	−0.40 to −0.10 MPa −4.0 to −1.1 kgf/cm ² −58 to −15 psi	—
Differential Pinion to Differential Side Gear	Backlash	0.15 to 0.30 mm 0.0059 to 0.011 in.	—
Differential Case to Differential Side Gear	Clearance	0.050 to 0.151 mm 0.0020 to 0.0059 in.	0.30 mm 0.0118 in.
Differential Case	I.D.	38.000 to 38.062 mm 1.4961 to 1.4985 in.	—
Differential Side Gear	O.D.	37.911 to 37.950 mm 1.4926 to 1.4941 in.	—
Spiral Bevel Gear to Spiral Bevel Pinion Shaft	Backlash	0.20 to 0.30 mm 0.0079 to 0.011 in	—

9Y1210948TRS0004US0

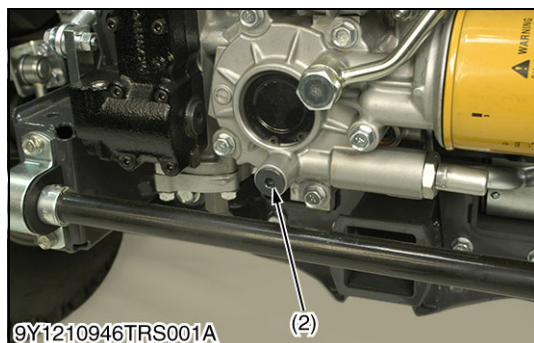
3. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to "5. TIGHTENING TORQUES" on page G-14.)

Item	N·m	kgf·m	lbf·ft
Muffler bracket mounting bolt and nut	48.0 to 55.9	4.90 to 5.70	35.4 to 41.2
HST assembly mounting nut	39 to 44	4.0 to 4.4	29 to 32
Seat stay mounting screw	23.6 to 27.4	2.40 to 2.80	17.4 to 20.2
Rear aluminum wheel mounting bolt	90 to 110	9.2 to 11.2	66.4 to 81.1
Rear steel wheel mounting bolt and nut	108 to 130	11.1 to 13.2	79.7 to 95.8
Brake pipe retaining nut	13 to 17	1.4 to 1.7	9.6 to 12
Hydraulic lift cylinder hose retaining nut	24.0 to 25.0	2.45 to 2.54	17.7 to 18.4
Hydraulic lift cylinder pipe retaining nut	24.0 to 25.0	2.45 to 2.54	17.7 to 18.4
HST return pipe bolt	17.6 to 20.6	1.80 to 2.10	13.0 to 15.1
Power steering hose retaining nut	24.0 to 25.0	2.45 to 2.54	17.7 to 18.4
Return pipe retaining nut	24.0 to 25.0	2.45 to 2.54	17.7 to 18.4
Mission frame mounting bolt and nuts	77.5 to 90.2	7.90 to 9.20	57.2 to 66.5
Piston case	70 to 80	7.2 to 8.1	52 to 59
Port block cover mounting screw	39 to 44	4.0 to 4.4	29 to 32
Charge pump case mounting screw	18 to 21	1.9 to 2.1	14 to 15
Regulator mounting hex. head screw	5.2 to 6.2	0.53 to 0.64	3.9 to 4.6
Servo piston and cover mounting screw	18 to 21	1.9 to 2.1	14 to 15
Hex. socket head screw	2.5 to 3.0	0.26 to 0.30	1.9 to 2.2

9Y1210948TRS0005US0

4. CHECKING AND ADJUSTING



Checking Charge Relief Pressure



CAUTION

- If it is necessary to operate engine in an enclosed area, use a gas tight exhaust pipe extension to remove the fumes.
- Always try to work in a well-ventilated area.
- When checking, park the machine on flat ground, and apply the parking brake.
- Work by two people when you measure pressure.
- Note that the allen wrench does not come off firmly because the plug is not loose hard. Otherwise, the plug might be damaged, and the plug not be loosened.

NOTE

- The hex. socket plug is securely tightened. Therefore, it is very important to use a proper-sized allen wrench and fit it securely onto the plug. Do not give a shock but put your weight on the plug slowly, paying attention not to damage its hex.socket section. If the allen wrench is fitted on the plug at a slant or an improper-sized allen wrench is used to loose the plug, the hex. socket section will be damaged and you won't be able to the plug.

1. Remove the cargo bed.
2. Remove the transmission rear cover.
3. Remove the hex. socket head plug from **P3** port (2).
4. Install the HST adaptor and high pressure gauge to **P3** port (2).
5. Place the range gear shift lever in neutral.
6. Set the 4WD lever to 2WD position.
7. Start the engine.
8. Depress the speed control pedal, and measure the charge pressure. (Engine speed is set by using the tachometer.)
9. If the measurement is not within the factory specification, check the charge relief valve. (See page 2-S52.)

(When reassembling)

- Be careful not to damaged O-ring on plug.

Charge pressure	Factory specification	0.43 to 0.83 MPa 4.4 to 8.6 kgf/cm ² 63 to 120 psi
-----------------	-----------------------	---

NOTE

- Low pressure gauge is 2.94 MPa (30.0 kgf/cm², 427 psi) full scale.

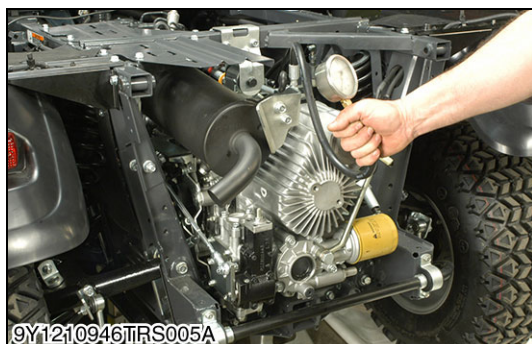
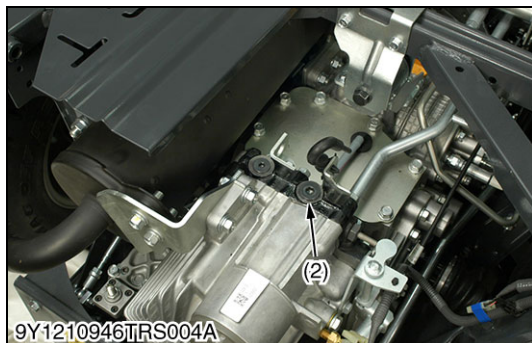
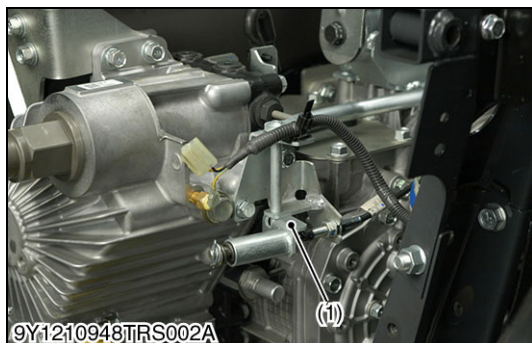
Condition

- Engine speed:
1400 min⁻¹ (rpm)
- Oil temperature:
45 to 55 °C (113 to 131 °F)

(1) Transmission Rear Cover

(2) **P3** Port (Charge) G1/4

9Y1210948TRS0006US0



Checking High Pressure Relief Valve Pressure (Traveling Side)

⚠ CAUTION

- If it is necessary to operate engine in an enclosed area, use a gas tight exhaust pipe extension to remove the fumes.
- Always try to work in a well-ventilated area.
- When checking, park the machine on flat ground, and apply the parking brake.
- Work by two people when you measure pressure.
- Note that the allen wrench does not come off firmly because the plug is not loose hard. Otherwise, the plug might be damaged, and the plug not be loosened.

■ NOTE

- The hex. socket plug is securely tightened. Therefore, it is very important to use a proper-sized allen wrench and fit it securely onto the plug. Do not give a shock but put your weight on the plug slowly, paying attention not to damage its hex. socket section. If the allen wrench is fitted on the plug at a slant or an improper-sized allen wrench is used to loose the plug, the hex. socket section will be damaged and you won't be able to loose the plug.

1. Remove the cargo bed.
2. Remove the hex. socket head plug from **P1** port (2). (**P1** is for traveling side.)
3. Install the HST adaptor and high pressure gauge to **P1** port (2).
4. Check to see that parking brake is applied.
5. Remove the unload linkage (1).
6. Set the 4WD lever to 2WD position.
7. Start the engine.
8. Place the range gear shift lever in **H** position.
9. Depress the speed control pedal, and measure the check and high pressure relief valve pressure. (Engine speed is set by using the tachometer.)
10. If the measurement is not within the operating pressure, replace the check and high pressure relief valve assembly with new one. (See page 2-S52.)

High pressure relief valve	Operating pressure	24.5 to 27.5 MPa 250 to 280 kgf/cm ² 3560 to 3980 psi
----------------------------	--------------------	--

■ IMPORTANT

- Measure quickly so that the relief valve may not be in operation more than 10 seconds.

■ NOTE

- High pressure gauge is 29.4 MPa (300 kgf/cm², 4267 psi) full scale.

(When reassembling)

- Be careful not to damage O-ring on the plug.

Condition

- Engine speed:
Maximum while transmission stalling
- Oil temperature:
45 to 55 °C (113 to 131 °F)

(1) Unload Linkage

(2) **P1** Port (for Traveling side) G3/8

9Y1210948TRS0007US0