WSM

WORKSHOP MANUAL
UTILITY VEHICLE

RTV-X1100C

Kubota

KiSC issued 12, 2013 A

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.

December, 2013

I INFORMATION

INFORMATION

CONTENTS

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, may result in minor or moderate injury.**

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

■ NOTE
- **Gives helpful information.**

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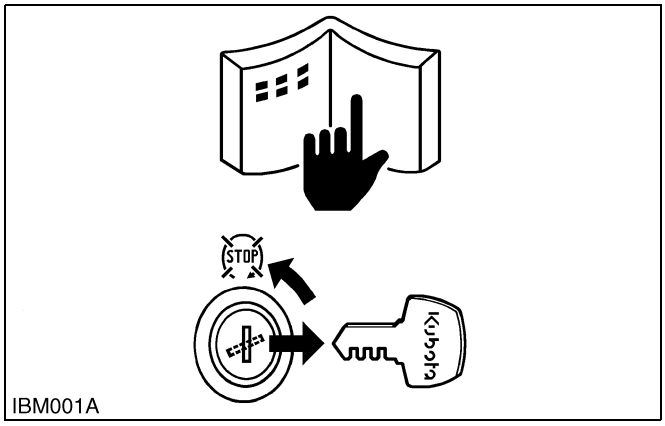

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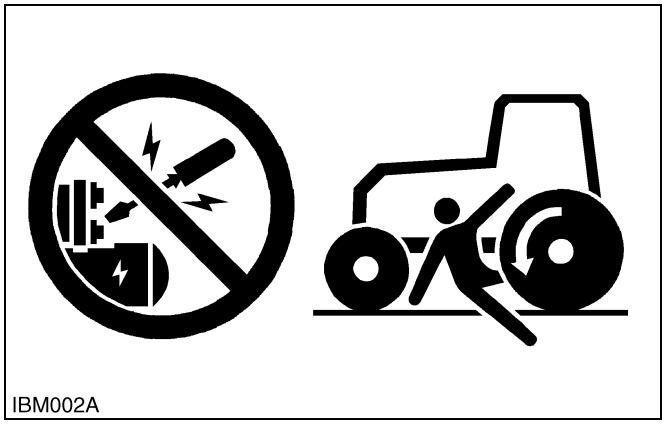
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BEFORE YOU START SERVICE

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

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START SAFELY

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

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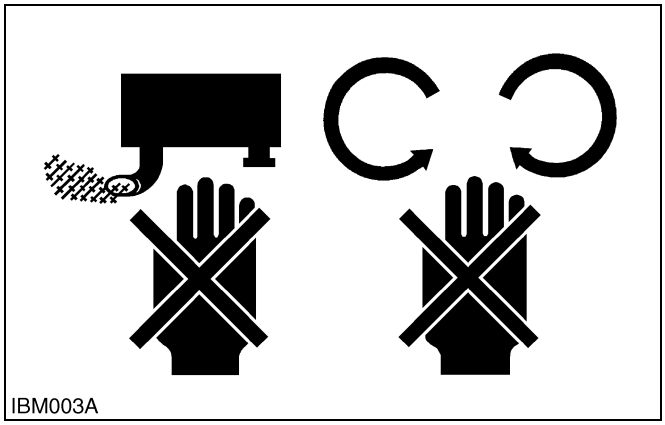
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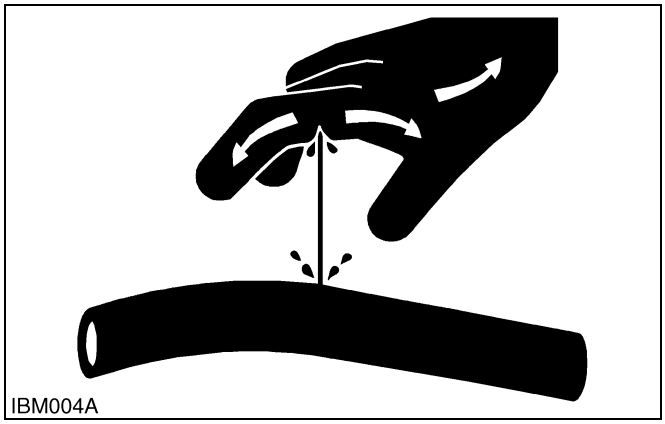
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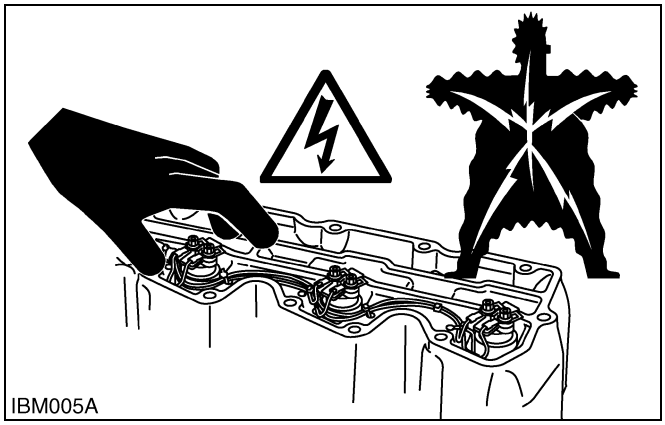
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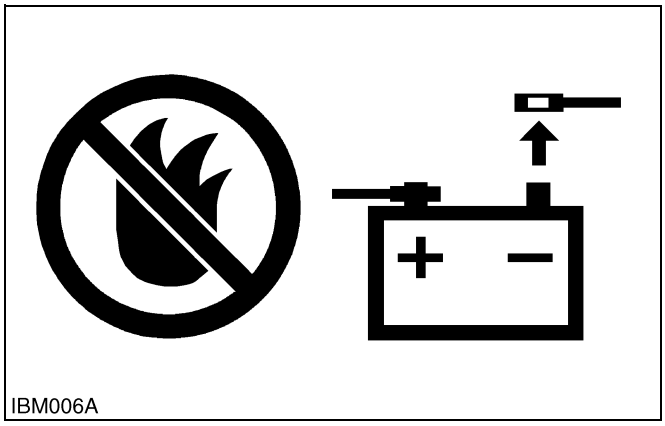
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OPERATE SAFELY

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

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PREVENT A FIRE

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

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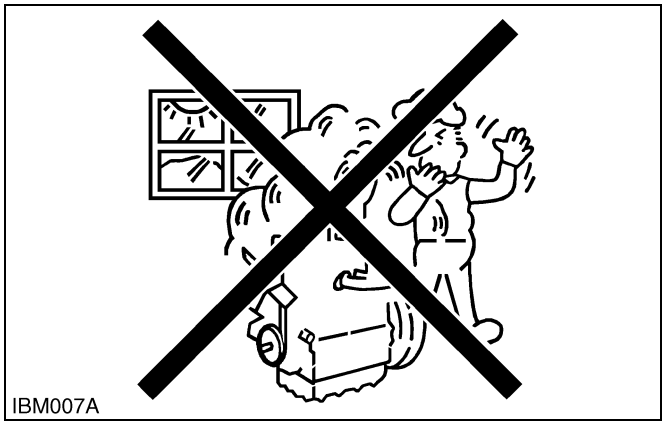
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KEEP A GOOD AIRFLOW IN THE WORK AREA

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

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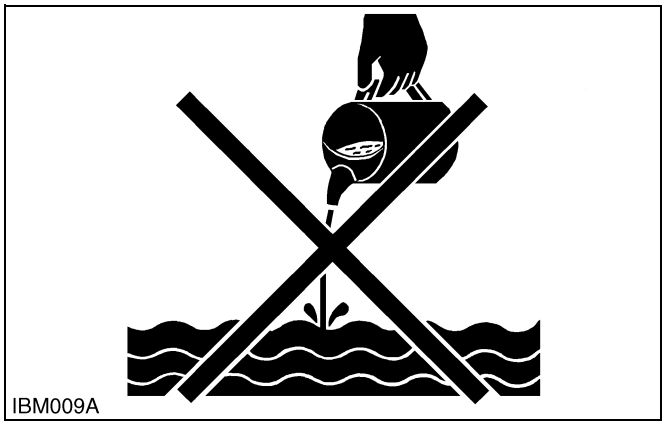
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DISCARD FLUIDS CORRECTLY

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

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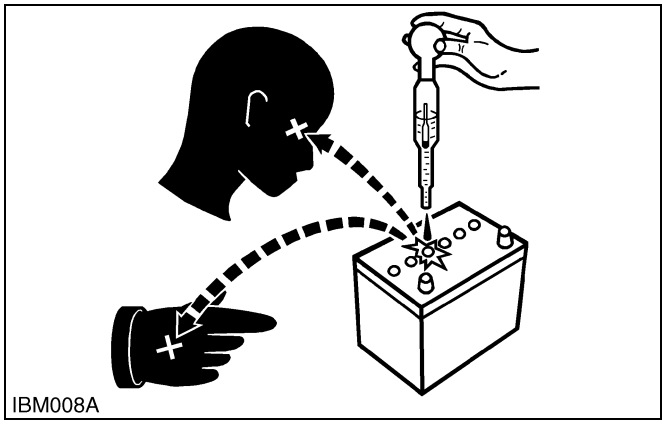
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PREVENT ACID BURNS

- 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.

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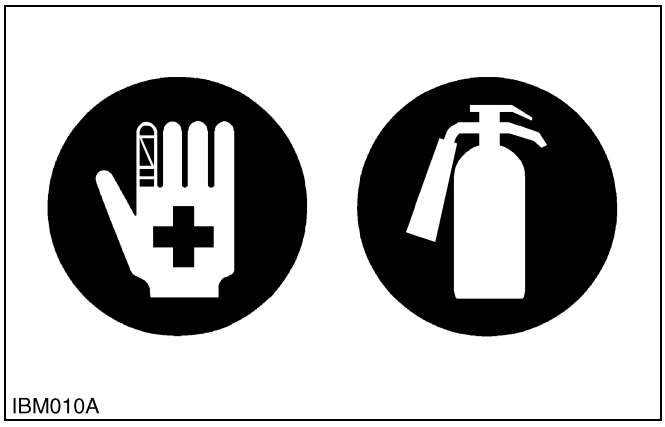
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PREPARE FOR EMERGENCIES

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

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2. SAFETY DECALS

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

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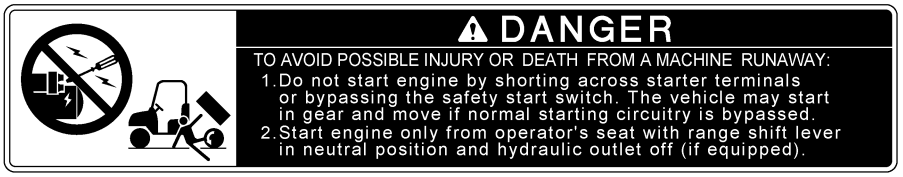
(2) Part No. K7731-6542-1



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(4) Part No. K7731-6541-1

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(5) Part No. K7731-6526-2

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(6) Part No. K7731-6577-2

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(7) Part No. K7591-6549-1

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(8) Part No. K7591-6538-2

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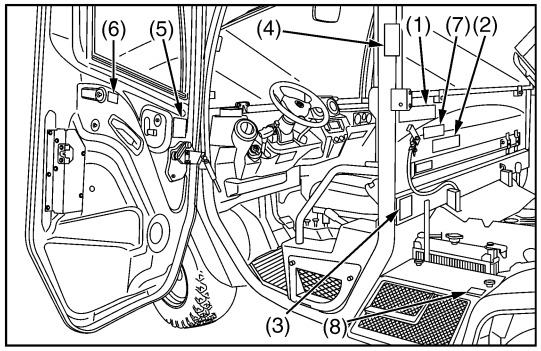

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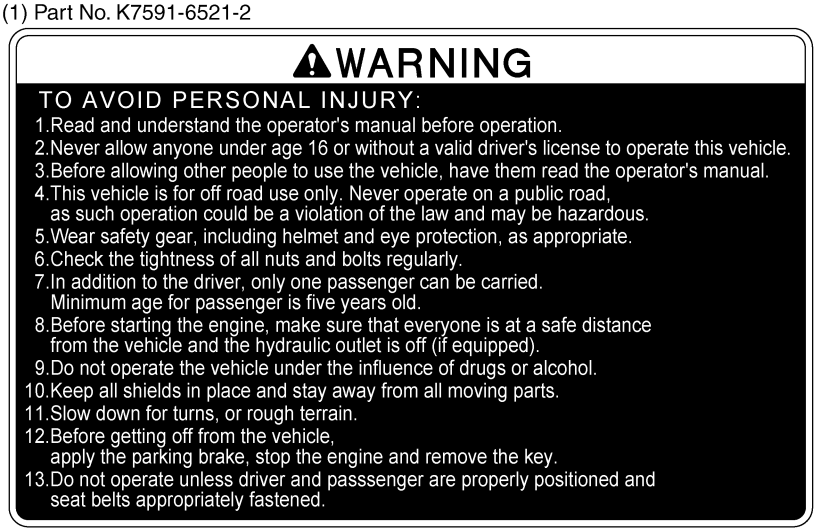

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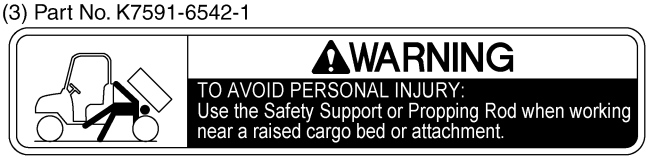

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(7) Part No. K7731-6543-1

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(6) Part No. K7591-6534-3

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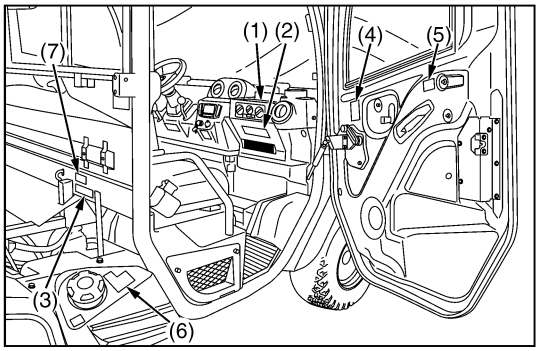

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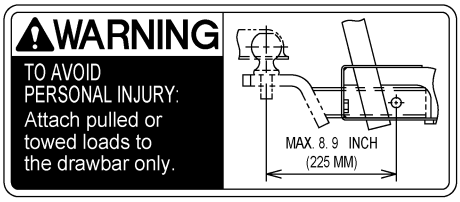

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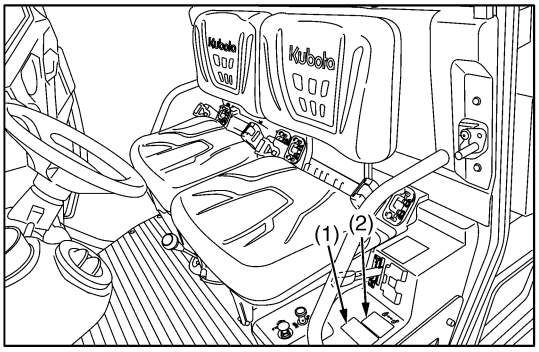

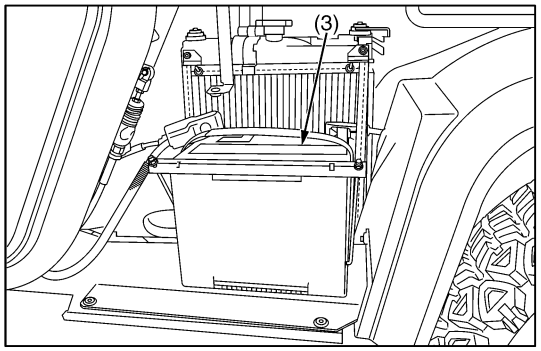

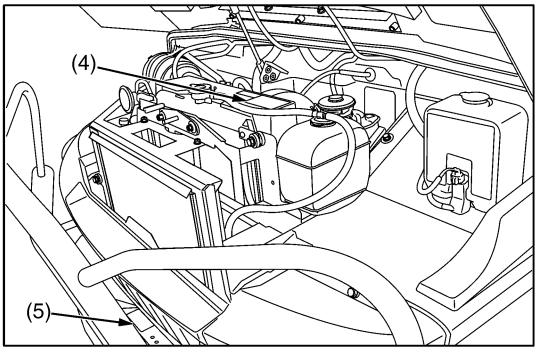

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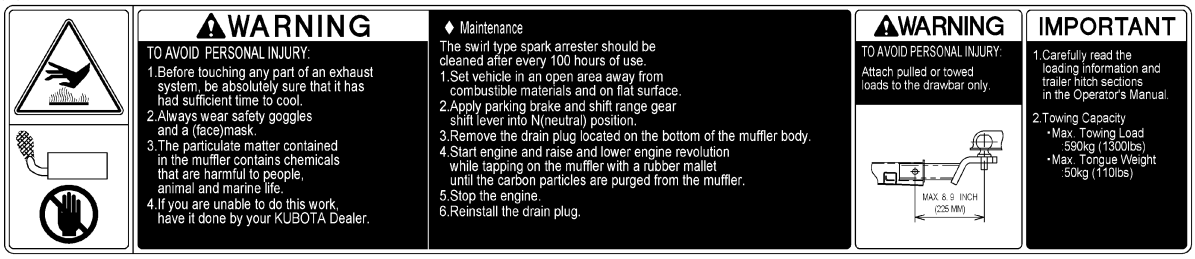

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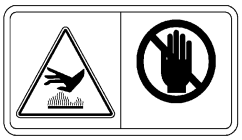

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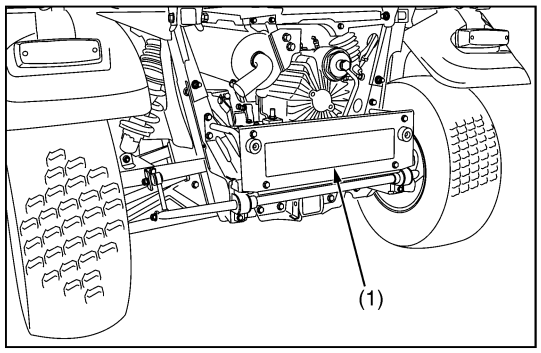

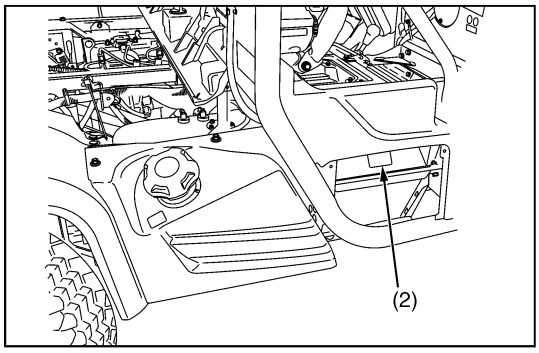

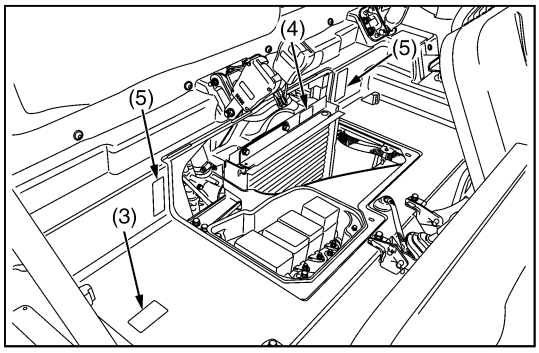

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CARE OF DANGER, WARNING AND CAUTION LABELS

1. Keep danger, warning and caution labels clean and free from obstructing material.
2. Clean danger, warning and caution labels with soap and water, dry with a soft cloth.
3. Replace damaged or missing danger, warning and caution labels with new labels.
4. If a component with danger, warning 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.

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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.**

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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)

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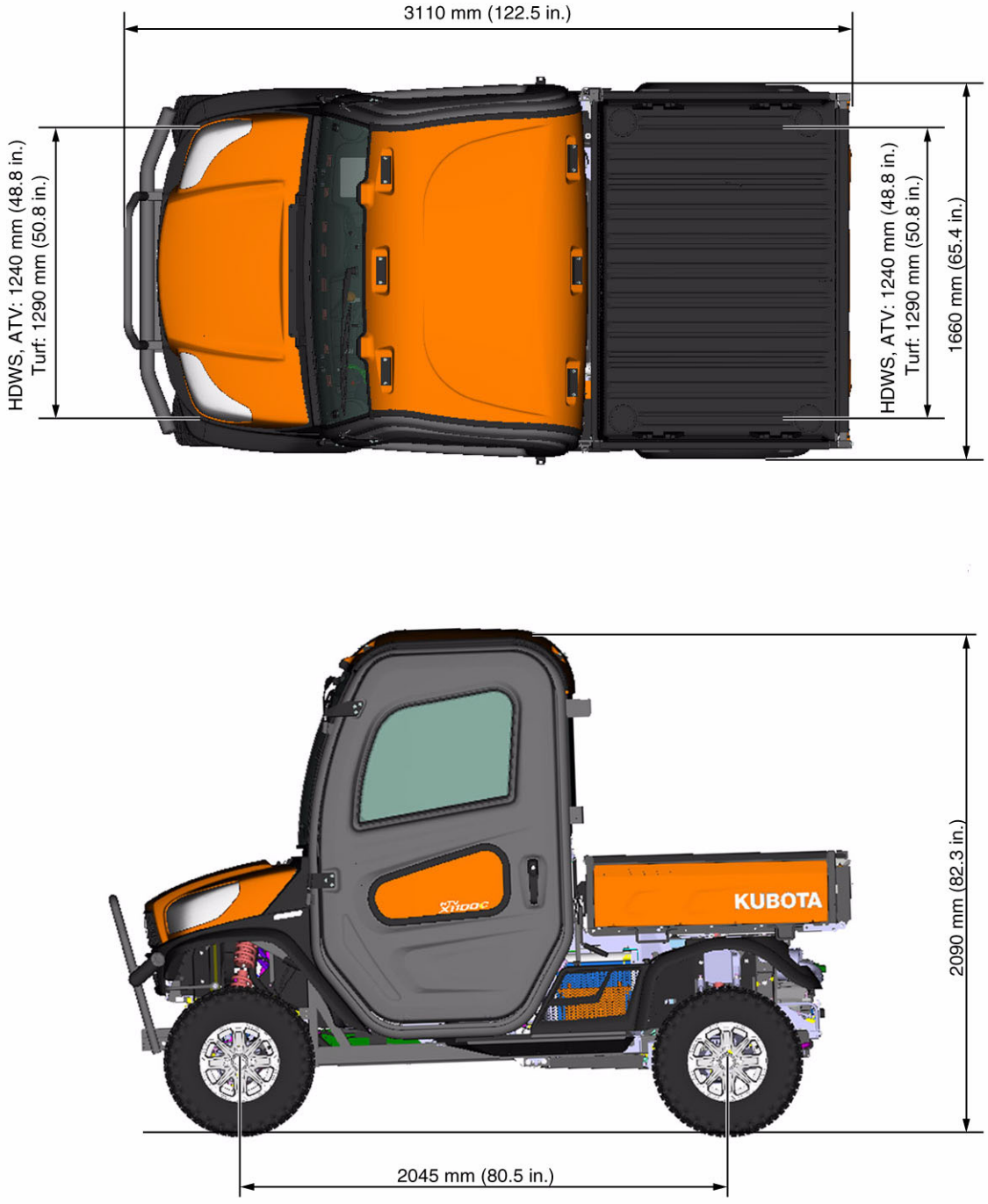
5. DIMENSIONS



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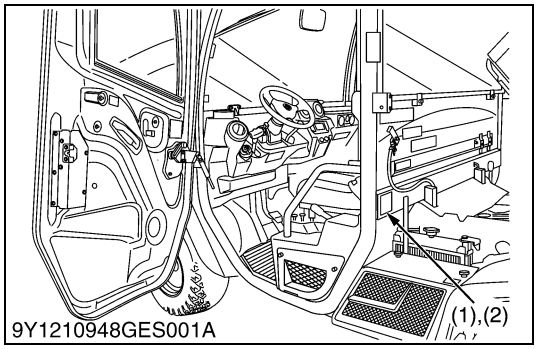
G GENERAL

GENERAL

CONTENTS

1. PRODUCT IDENTIFICATION



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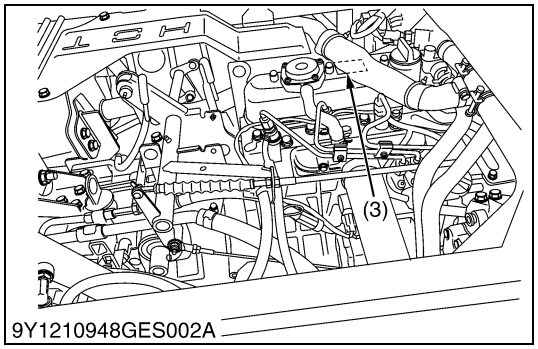

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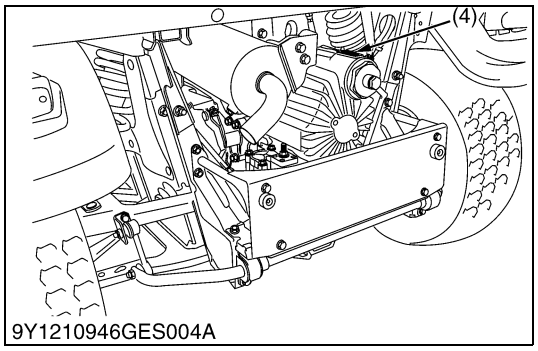

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When contacting your local KUBOTA distributor, always specify engine serial number, product serial number and hour meter reading.

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

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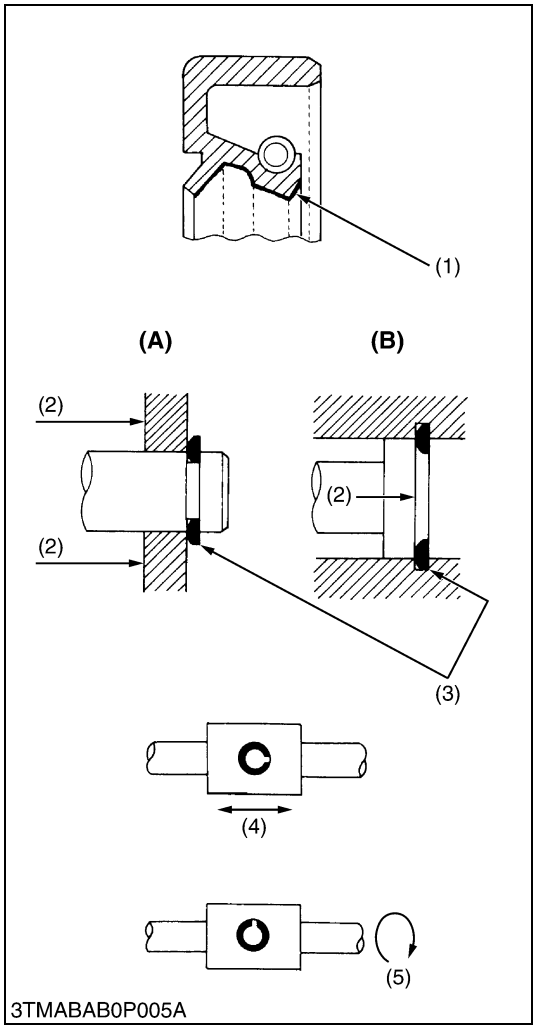
2. GENERAL PRECAUTIONS



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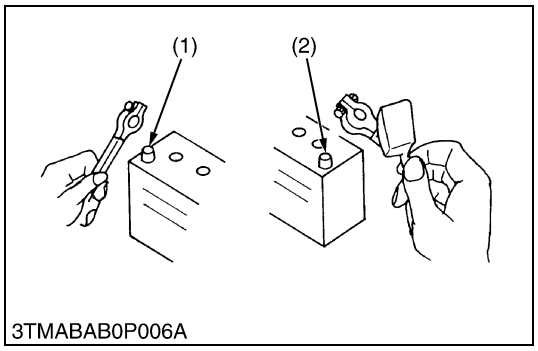
- When you disassemble, carefully put the parts in a clean area to make it easy to find the parts. You must install the screws, bolts and nuts in their initial position to prevent the reassembly errors.
- When it is necessary to use special tools, use KUBOTA special tools. Refer to the drawings when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

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

(A) External Circlip
(B) Internal Circlip

WSM000001GEG0106US0

3. HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING



3TMABAB0P006A

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

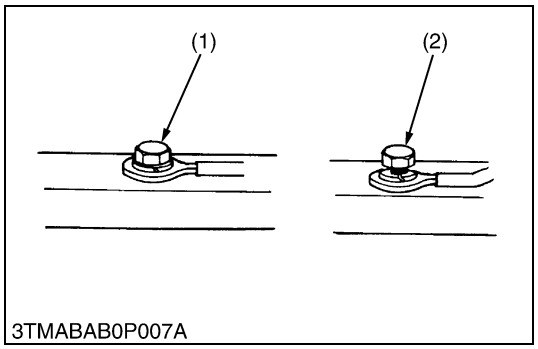
■ **IMPORTANT**

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

(1) Negative Terminal (2) Positive Terminal

WSM000001GEG0062US0

[1] WIRING

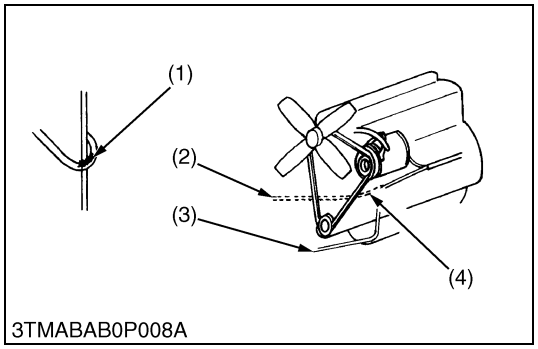


3TMABAB0P007A

- Securely tighten wiring terminals.

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

WSM000001GEG0063US0

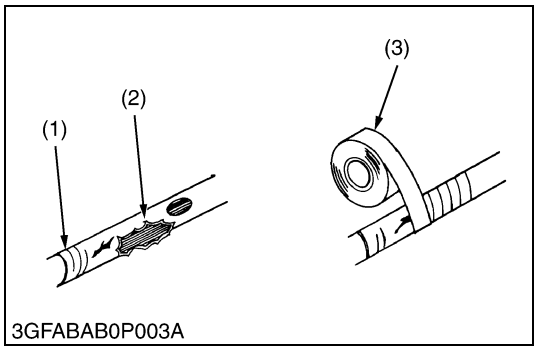


3TMABAB0P008A

- Do not let wiring contact dangerous part.

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

WSM000001GEG0064US0

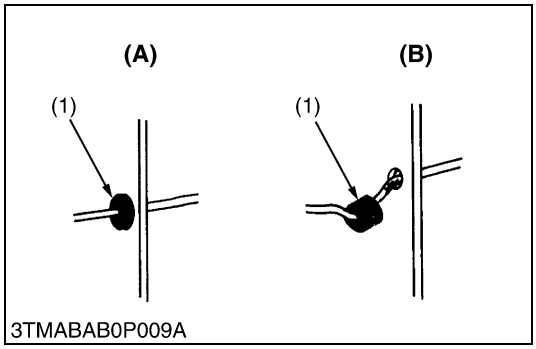


3GFABAB0P003A

- Repair or change torn or aged wiring immediately.

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

WSM000001GEG0065US0



3TMABAB0P009A

- Securely insert grommet.

(1) Grommet

(A) Correct
(B) Incorrect

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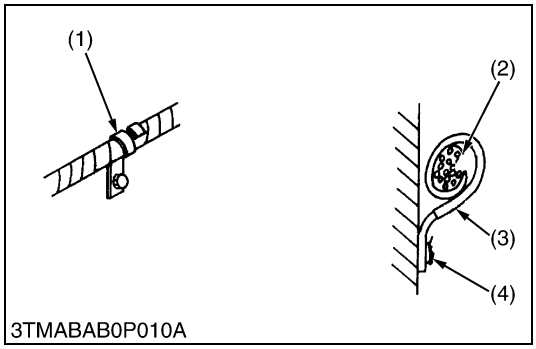

3TMABAB0P010A

- Securely clamp, being careful not to damage wiring.

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

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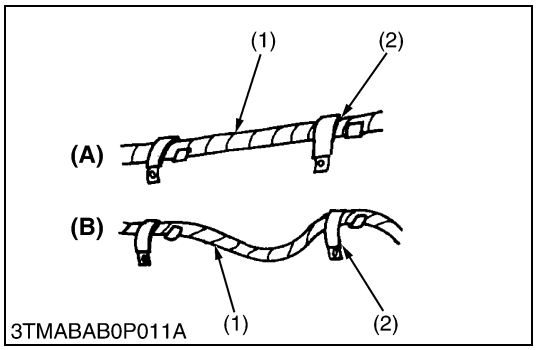

3TMABAB0P011A

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

(1) Wiring
(2) Clamp

(A) Correct
(B) Incorrect

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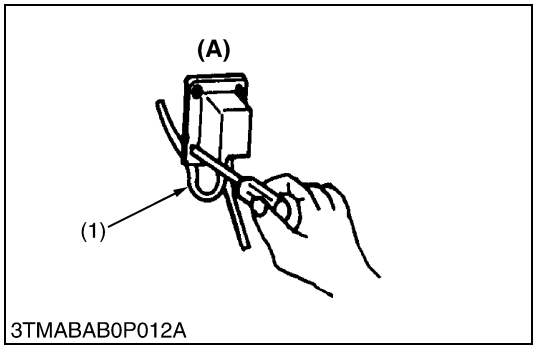

3TMABAB0P012A

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

(1) Wiring

(A) Incorrect

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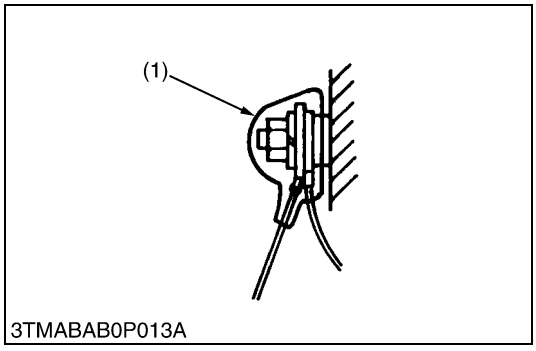

3TMABAB0P013A

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

(1) Cover
(Securely Install Cover)

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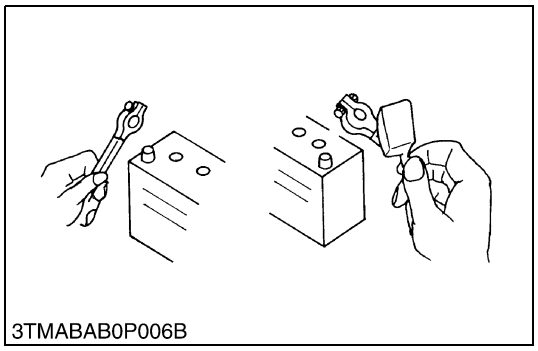
[2] BATTERY


3TMABAB0P006B

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

CAUTION

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

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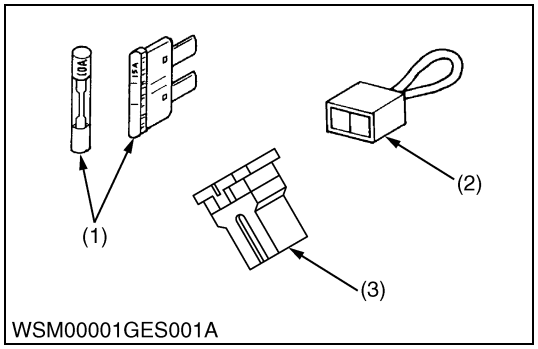
[3] FUSE



WSM00001GES001A

- 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

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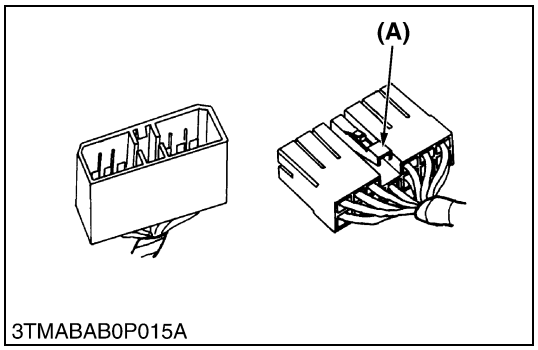
[4] CONNECTOR



3TMABAB0P015A

- For connector with lock, push lock to separate.

(A) Push

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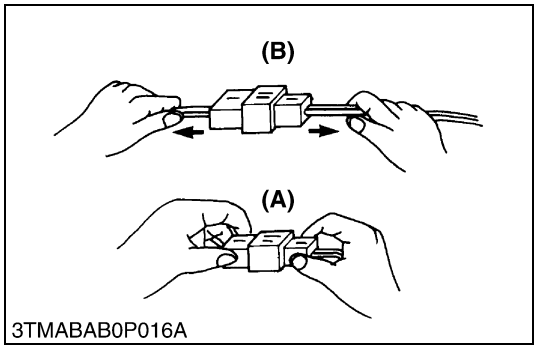
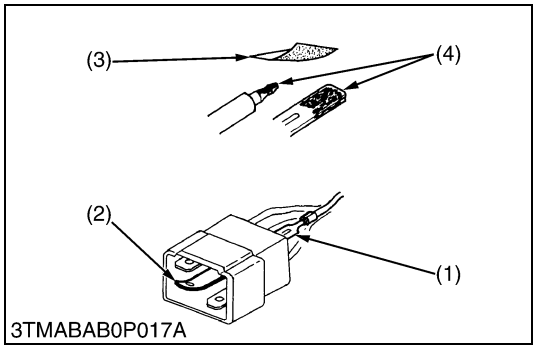


3TMABAB0P016A

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

(A) Correct
(B) Incorrect

WSM000001GEG0074US0



3TMABAB0P017A

- 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

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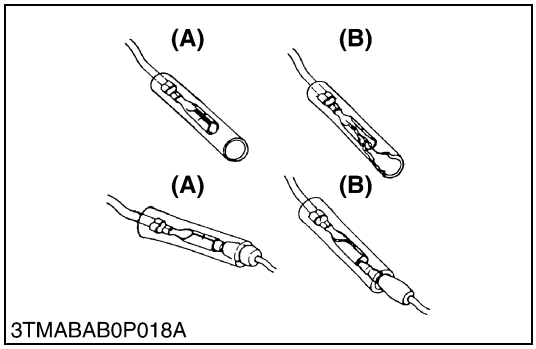

3TMABAB0P018A

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

(A) Correct
(B) Incorrect

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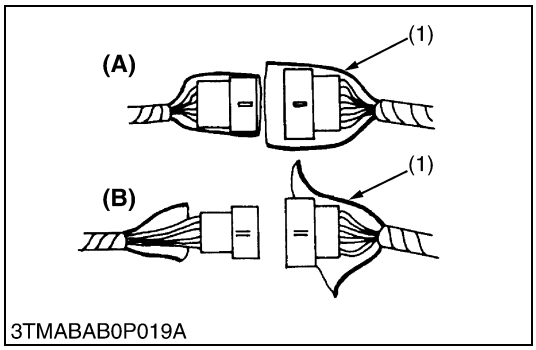


3TMABAB0P019A

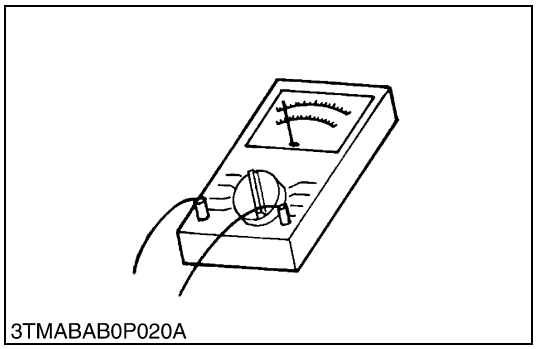
- Make sure that plastic cover is large enough to cover whole connector.

(1) Cover

(A) Correct
(B) Incorrect

WSM000001GEG0077US0

[5] HANDLING OF CIRCUIT TESTER


3TMABAB0P020A

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

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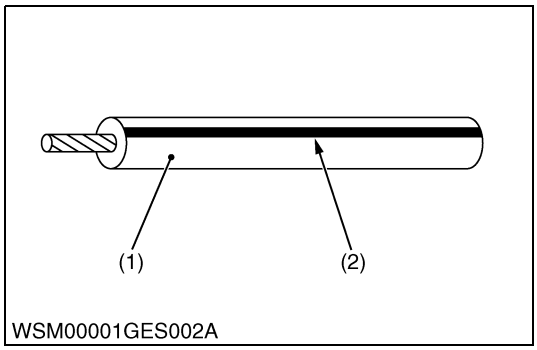
[6] COLOR OF WIRING



WSM00001GES002A

- 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	• 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 CF or higher • 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	KUBOTA UDT or SUPER UDT fluid*
5	Front axle case		0.6 L 0.6 U.S.qts 0.52 Imp.qts	KUBOTA UDT or SUPER UDT fluid*
6	Front knuckle case		(Reference) 0.25 L 0.26 U.S.qts 0.22 Imp.qts	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	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	
	Hand throttle cable [if equipped]	–		Antirust silicone grease

■ **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.**

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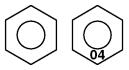
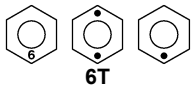
5. TIGHTENING TORQUES

[1] GENERAL USE SCREWS, BOLTS AND NUTS

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

Indication on top of bolt	 No-grade or 4T			 7T			 9T		
Indication on top of nut	 No-grade or 4T						 6T		
Material of opponent part	Ordinariness			Aluminum			Ordinariness			Aluminum			Ordinariness		
Unit	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M6	7.9 to 9.3	0.80 to 0.95	5.8 to 6.8	7.9 to 8.8	0.80 to 0.90	5.8 to 6.5	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31	7.9 to 8.8	0.80 to 0.90	5.8 to 6.5	12.3 to 14.2	1.25 to 1.45	9.05 to 10.4
M8	18 to 20	1.8 to 2.1	13 to 15	17 to 19	1.7 to 2.0	13 to 14	24 to 27	2.4 to 2.8	18 to 20	18 to 20	1.8 to 2.1	13 to 15	30 to 34	3.0 to 3.5	22 to 25
M10	40 to 45	4.0 to 4.6	29 to 33	32 to 34	3.2 to 3.5	24 to 25	48 to 55	4.9 to 5.7	36 to 41	40 to 44	4.0 to 4.5	29 to 32	61 to 70	6.2 to 7.2	45 to 52
M12	63 to 72	6.4 to 7.4	47 to 53	–	–	–	78 to 90	7.9 to 9.2	58 to 66	63 to 72	6.4 to 7.4	47 to 53	103 to 117	10.5 to 12.0	76.0 to 86.7
M14	108 to 125	11.0 to 12.8	79.6 to 92.5	–	–	–	124 to 147	12.6 to 15.0	91.2 to 108	–	–	–	167 to 196	17.0 to 20.0	123 to 144
M16	167 to 191	17.0 to 19.5	123 to 141	–	–	–	197 to 225	20.0 to 23.0	145 to 166	–	–	–	260 to 304	26.5 to 31.0	192 to 224
M18	246 to 284	25.0 to 29.0	181 to 209	–	–	–	275 to 318	28.0 to 32.5	203 to 235	–	–	–	344 to 402	35.0 to 41.0	254 to 296
M20	334 to 392	34.0 to 40.0	246 to 289	–	–	–	368 to 431	37.5 to 44.0	272 to 318	–	–	–	491 to 568	50.0 to 58.0	362 to 419

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[2] STUD BOLTS

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

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[3] HYDRAULIC FITTINGS

(1) Hydraulic Hose Fittings

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

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(2) Hydraulic Pipe Cap Nuts

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

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(3) Adaptors, Elbows and Others

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

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[4] METRIC SCREWS, BOLTS AND NUTS

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

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

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

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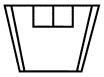
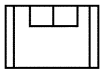
[6] PLUGS

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

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6. MAINTENANCE 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 Air cleaner should be cleaned more often in dusty conditions than in normal conditions.**
  ***2 Every year or every 6 times of cleaning.**
  ***3 Replace only if necessary.**
  ***4 When the battery is used for less than 100 hours per year, check the battery condition by reading the indicator annually.**
- **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	Reference page		
			50	100	150	200	250	300	350	400	450	500	550	600	650	700				
1	Engine start system	Check	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 hrs	G-30		
2	Greasing	Apply	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	every 50 hrs	G-31		
3	Engine oil	Change	★			☆				☆				☆			every 200 hrs	G-39		
4	Muffler [Spark arrester]	Clean		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-33		
5	Wheel fastener torque	Check	★	☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-33		
6	Battery condition	Check		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-34	*4	
7	Alternator belt	Adjust		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-36		
8	VHT neutral spring	Check		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-36		
9	VHT pressure release	Check		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-36		
10	Toe-in	Adjust		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-37		
11	Fuel filter element	Check		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-37		
		Replace										☆					every 500 hrs	G-51		@
12	Fuel line	Check		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-37		@
		Replace															every 2 years	G-52	*3	
13	Air cleaner element	Clean		☆		☆		☆		☆		☆		☆		☆	every 100 hrs	G-38	*1	@
		Replace															every 1 year	G-51	*2	
14	Engine oil filter	Replace	★			☆				☆				☆			every 200 hrs	G-39		
15	Transmission oil filter (VHT) (Yellow color)	Replace	★			☆				☆				☆			every 200 hrs	G-40		
16	Transmission oil filter (Suction) (Black color)	Replace	★			☆				☆				☆			every 200 hrs	G-40		
17	Brake pedal	Check	★			☆				☆				☆			every 200 hrs	G-41		*4
18	Parking brake	Adjust	★			☆				☆				☆			every 200 hrs	G-41		

No.	Item		Service Interval														After since	Reference page		
			50	100	150	200	250	300	350	400	450	500	550	600	650	700				
19	Brake light switch	Check	★			☆				☆				☆			every 200 hrs	G-42		
20	Front brake case	Check	★			☆				☆				☆			every 200 hrs	G-42		
21	Hydraulic tank oil	Change				☆				☆				☆			every 200 hrs	G-43		
22	Radiator hose, pipe and clamp	Check				☆				☆				☆			every 200 hrs	G-44		
		Replace															every 2 years	G-52		
23	Hydraulic oil line	Check				☆				☆				☆			every 200 hrs	G-45		
		Replace															every 2 years	G-52		
24	Intake air line	Check				☆				☆				☆			every 200 hrs	G-46		@
		Replace															every 2 years	G-52	*3	
25	Engine breather hose	Replace															every 2 years	G-52	*4	
26	Brake hose and pipe	Check	★			☆				☆				☆			every 200 hrs	G-47		
		Replace															every 4 years	G-55	*4	
27	Inner air filter	Clean				☆				☆				☆			every 200 hrs	G-48		
28	Air conditioner condenser	Check				☆				☆				☆			every 200 hrs	G-48		
29	Air conditioner drive belt	Adjust				☆				☆				☆			every 200 hrs	G-48		
30	Tire wear	Check	★					☆						☆			every 300 hrs	G-49		
31	Transmission fluid	Change								☆							every 400 hrs	G-49		
32	Front axle case oil	Change								☆							every 400 hrs	G-50		
33	Knuckle case oil	Change								☆							every 400 hrs	G-50		
34	Engine valve clearance	Adjust															every 800 hrs	G-51	*4	
35	Fuel injection nozzle Injection pressure	Check															every 1500 hrs	G-51	*4	@
36	Injection pump	Check															every 3000 hrs	G-51	*4	@
37	Air conditioner pipe and hoses	Check															every 1 year	G-51		
		Replace															every 2 years	G-52		
38	Brake master cylinder [inner parts]	Replace															every 2 years	G-52	*4	
39	Brake fluid	Change															every 2 years	G-52	*4	
40	Rear brake cylinder seal	Replace															every 2 years	G-52	*4	
41	Front brake seal	Replace															every 2 years	G-52	*4	
42	Cooling system	Flush															every 2 years	G-53		
43	Coolant	Change															every 2 years	G-53		

No.	Item		Service Interval														After since	Reference page		
			50	100	150	200	250	300	350	400	450	500	550	600	650	700				
44	Fuel system	Bleed															Service as required	G-56		
45	Fuse	Replace																G-56		
46	Around engine	Clean																G-56		
47	Light bulb	Replace																G-58		
48	Washer liquid	Add																G-59		
49	Refrigerant (gas)	Check																G-59		
50	Hydraulic tank	Check																G-58		

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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".**

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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.

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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.

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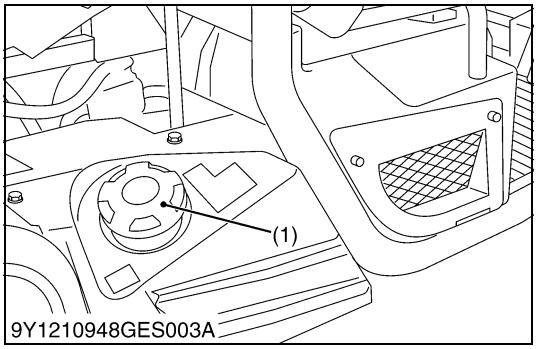

Checking and Refueling

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).

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

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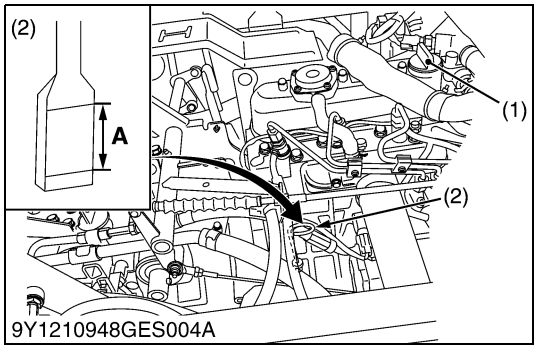

Checking Engine Oil Level

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 run engine.**

(1) Oil Inlet
(2) Dipstick

A: Oil level is acceptable within this range.

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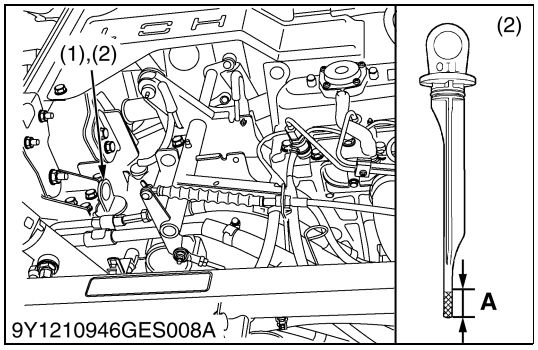

Checking Transmission Fluid Level

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 run 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.

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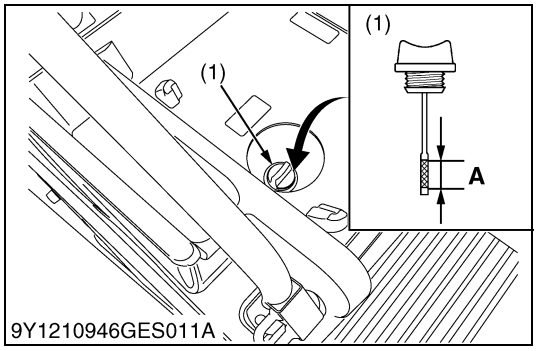

Checking Hydraulic Oil Tank Level

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 run engine.**

(1) Filling Plug with Dipstick — **A: Oil level is acceptable within this range.**

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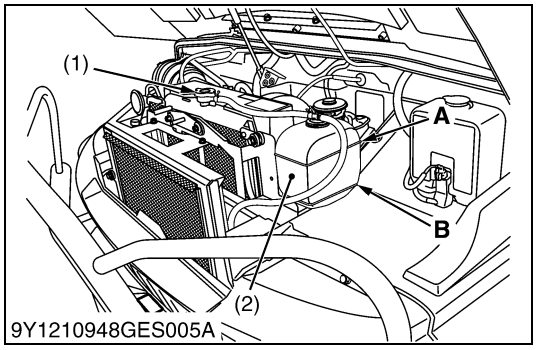

Checking Coolant Level

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**

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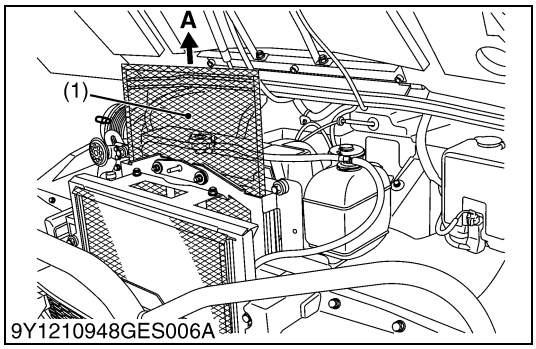

Cleaning Radiator Screen

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**

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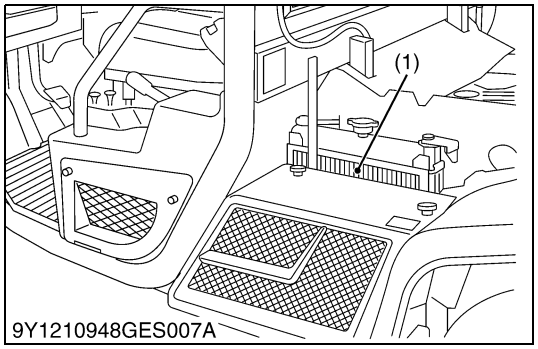

Cleaning Side Radiator Screen

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

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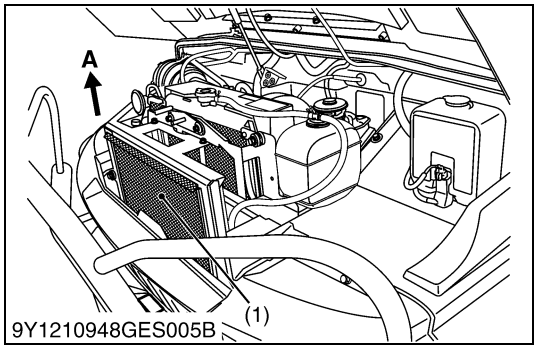

Cleaning Air Conditioner Condenser Screen

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**

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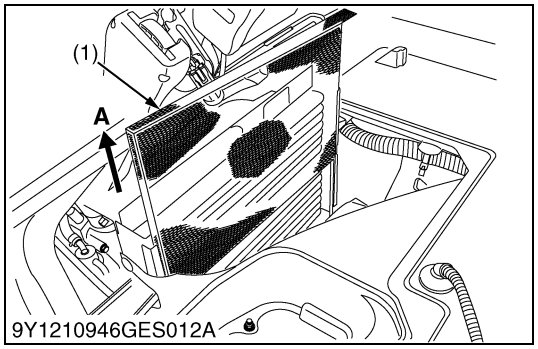

Cleaning Oil Cooler Net

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**

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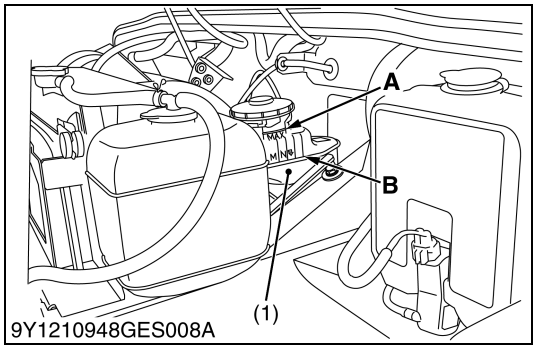

Checking Brake Fluid Level

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

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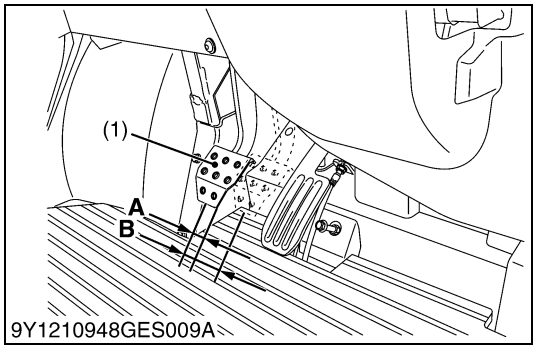

Checking Brake Pedal

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-41.)

(1) Brake Pedal
A: FREE TRAVEL
B: PEDAL STROKE

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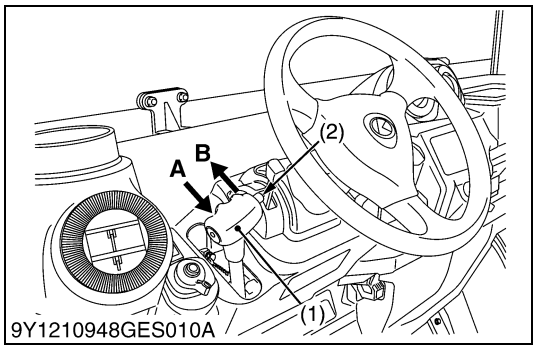

Checking Parking Brake

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
(2) Release Button
A: "PULL"
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.

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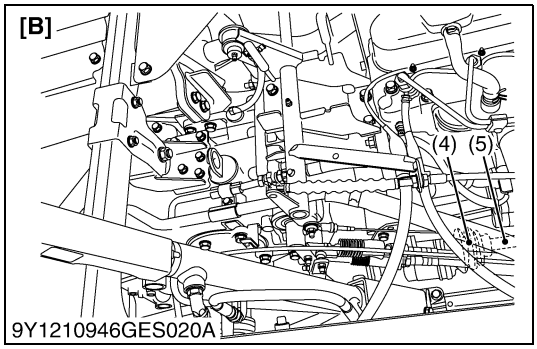
Checking Joint Boot

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

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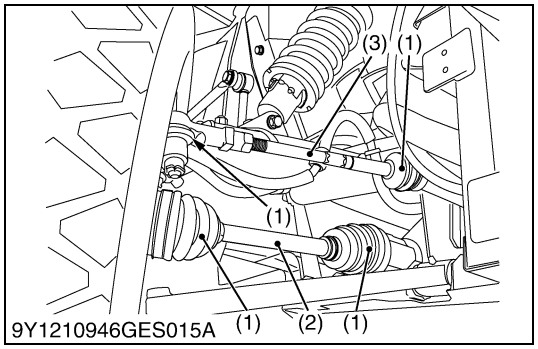

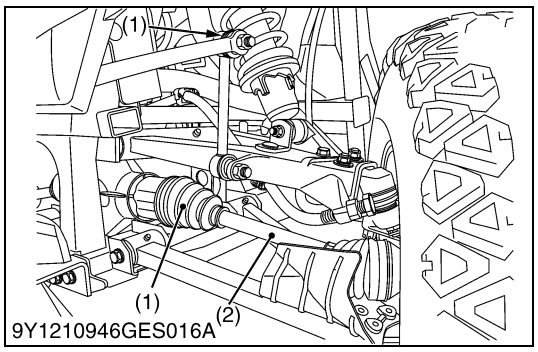

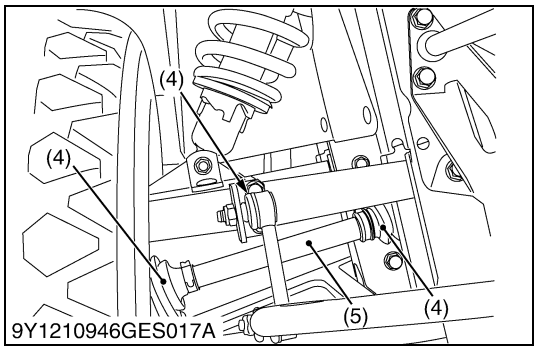

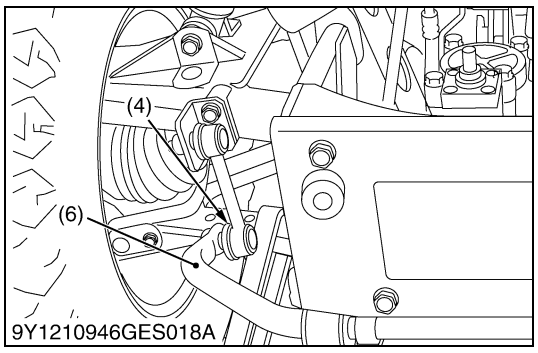

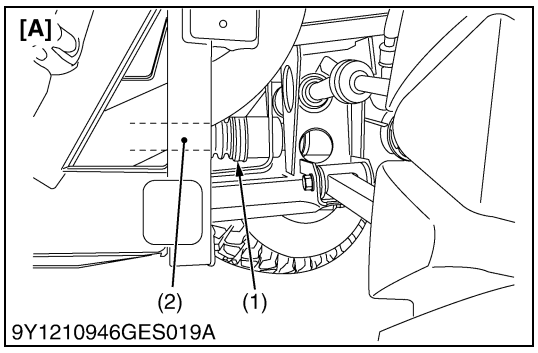

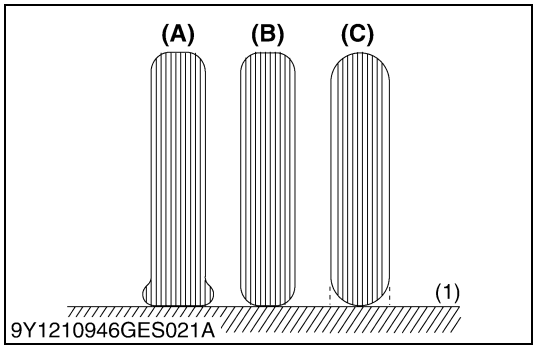

Checking Tire Inflation Pressure

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

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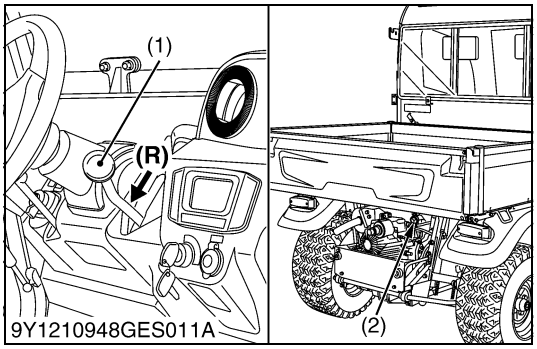

Checking Backup Beeper

[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
(2) Backup Beeper (if equipped)

(R) REVERSE

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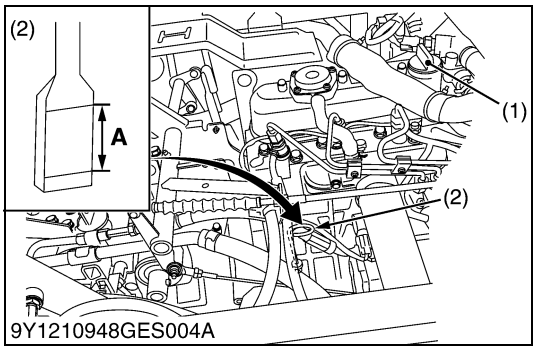
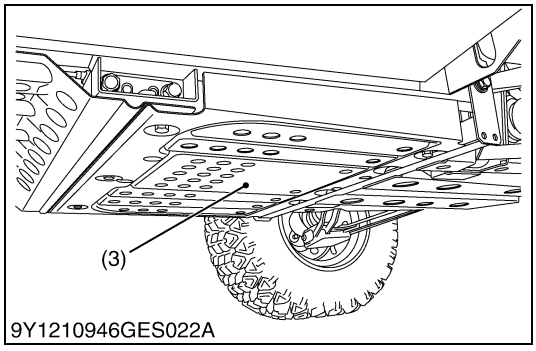
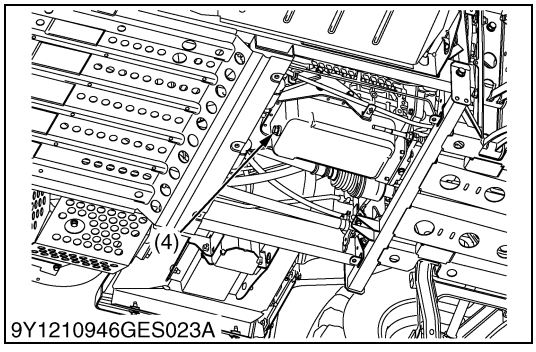
[2] CHECK POINTS OF INITIAL 50 HOURS







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.

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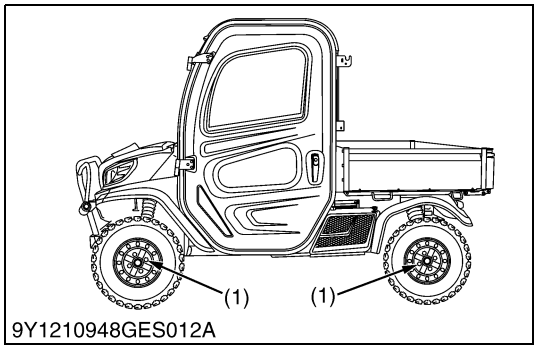

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Checking Wheel Fastener Torque

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

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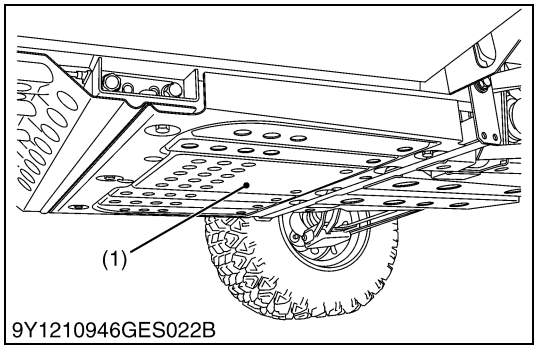

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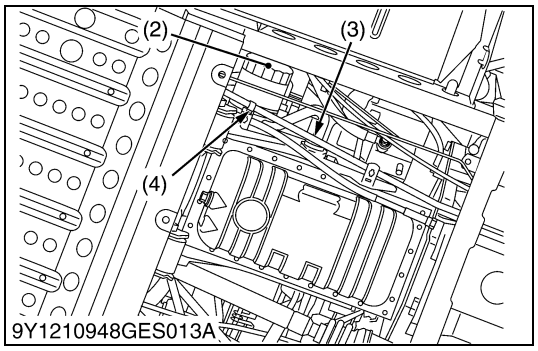

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Replacing Engine Oil Filter

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

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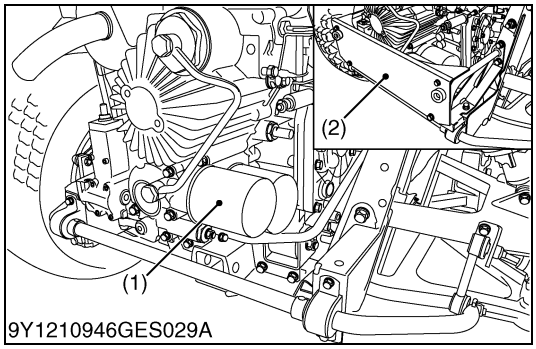

Replacing Transmission Oil Filter [VHT]

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 transmission oil up to the upper notch on the dipstick.
7. After running the engine for a few minutes, stop the engine and check the oil level 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): (Yellow Color)
(2) Rear Guard

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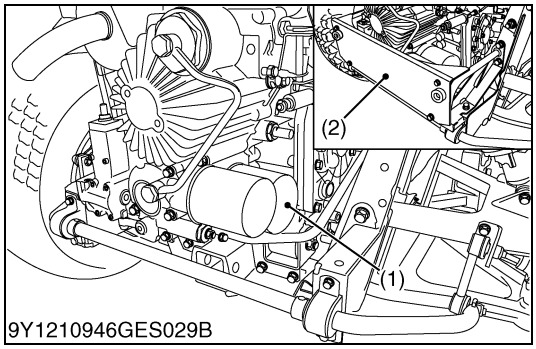

Replacing Transmission Oil Filter [SUCTION]

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 transmission oil up to the upper notch on the dipstick.
7. After running the engine for a few minutes, stop the engine and check the oil level 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) (Black Color)
(2) Rear Guard

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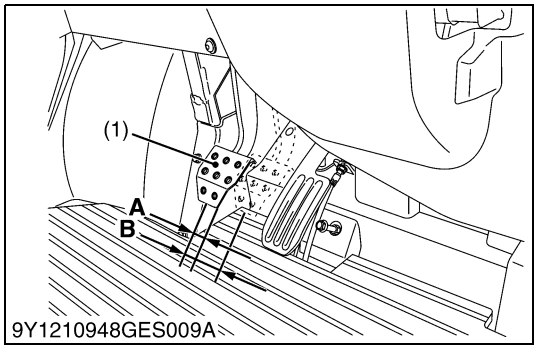

Checking Brake Pedal

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

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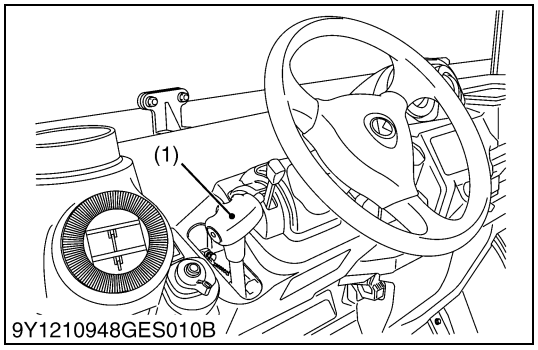

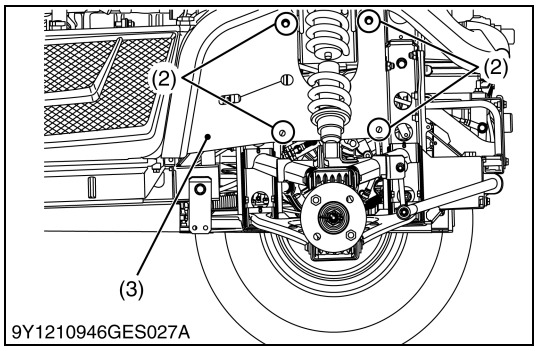

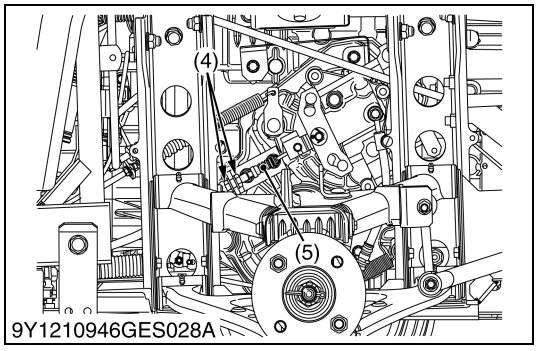

Adjusting Parking Brake

■ 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
(2) Push Rivet
(3) Mud Guard
(4) Lock Nut
(5) Cable Wire

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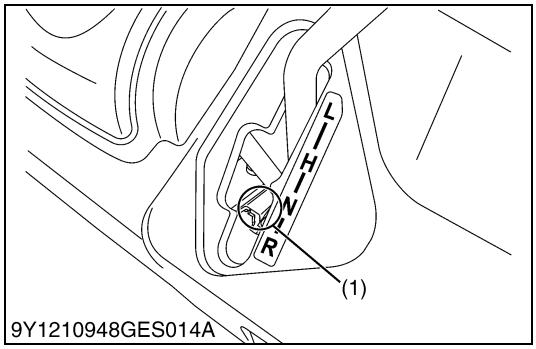

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Checking Brake Light Switch

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

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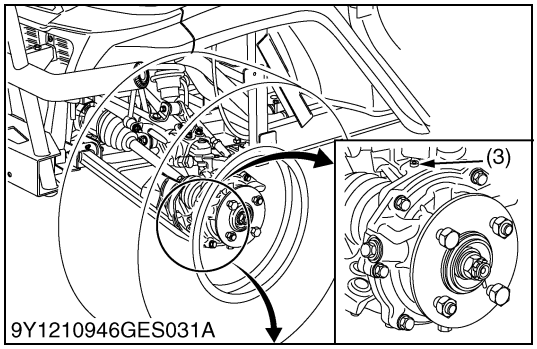

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Checking Front Brake Case

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

(1) Drain Plug
(2) Allen Key
(3) Air-Bleeding Hole Plug

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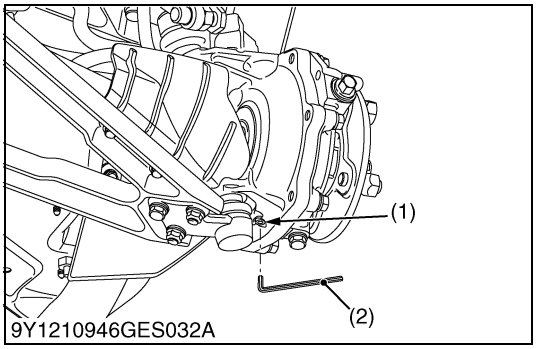

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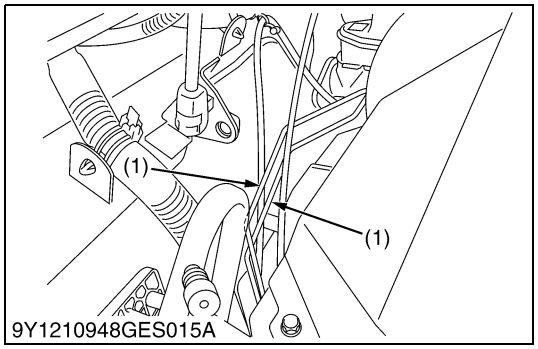

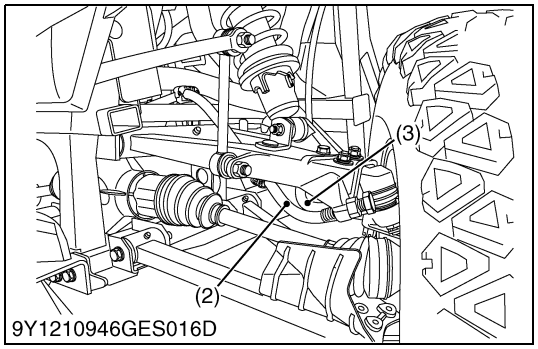

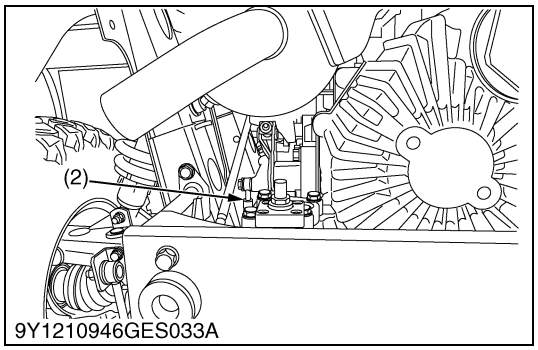

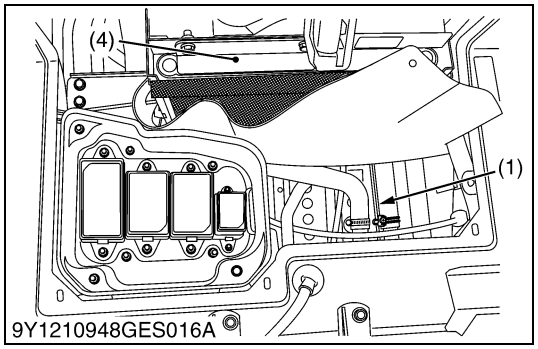

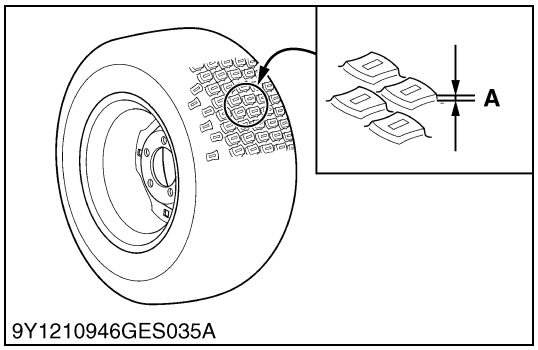

Checking Brake Hose and Pipe

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

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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.)

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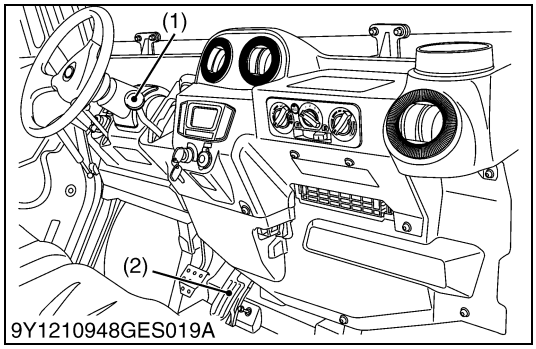
[3] CHECK POINTS OF EVERY 50 HOURS



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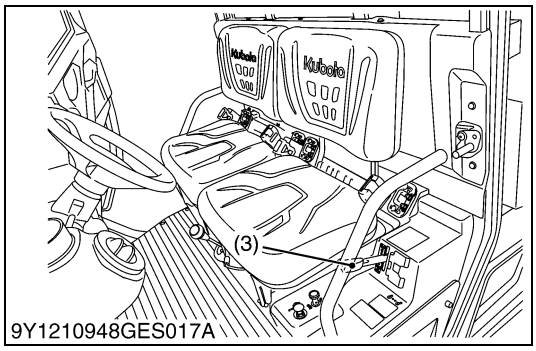

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Checking Engine Start System

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

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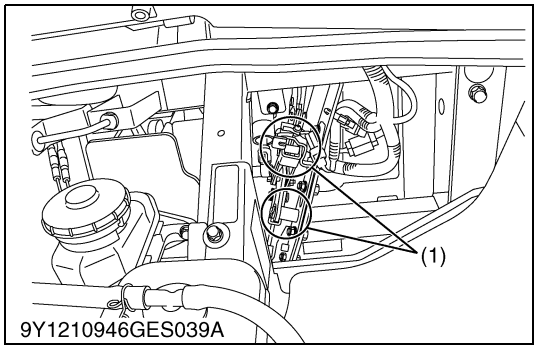
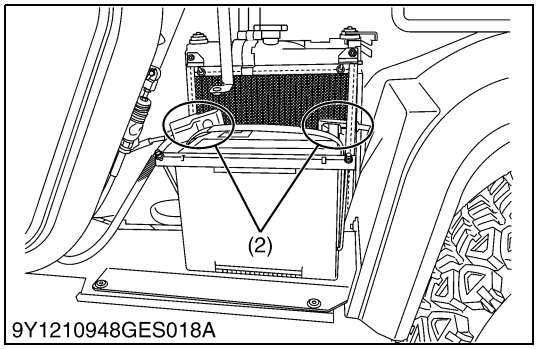
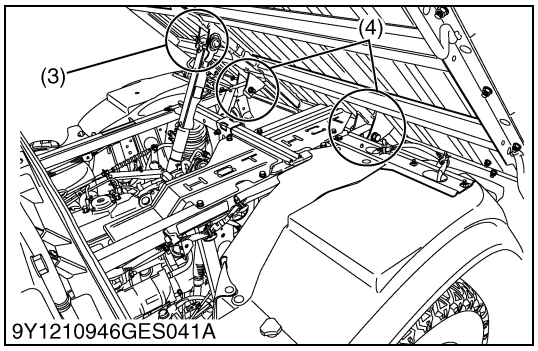
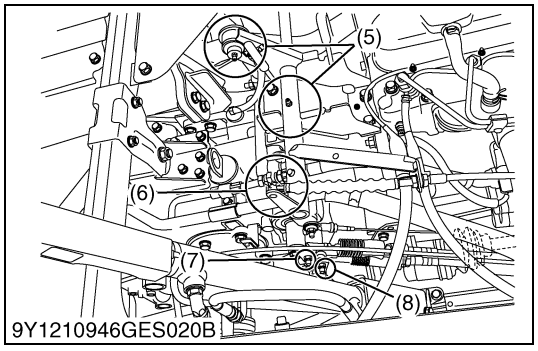
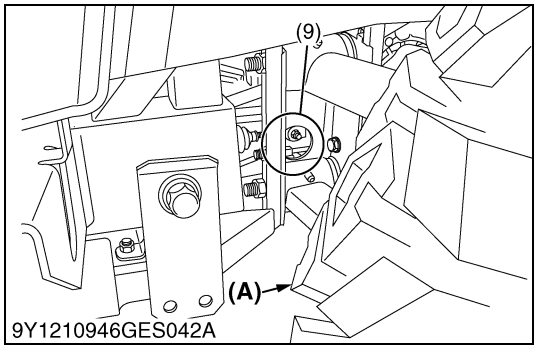










Greasing

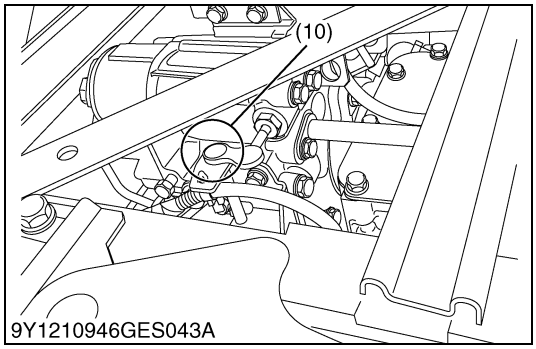
1. Apply a small amount of multi-purpose grease to the following points every 50 hours: If you operated the machine in extremely wet and muddy conditions, lubricate grease fittings more often.

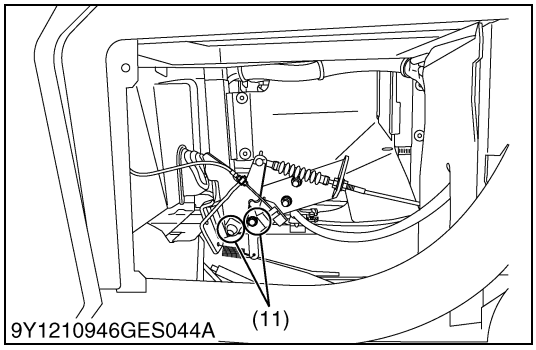
(1) Parking Brake Lever (Spray Type Grease)
(2) Battery Terminals
(3) Cargo Lift Cylinder Pivot (Grease Fitting)
(4) Cargo Bed Pivot (Spray Type Grease)
(5) VHT Link (Grease Fitting)
(6) VHT Link (Spray Type Grease)
(7) Valve Lever Link (Spray Type Grease)
(8) 4WD Lever Link (Spray Type Grease)
(9) Range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

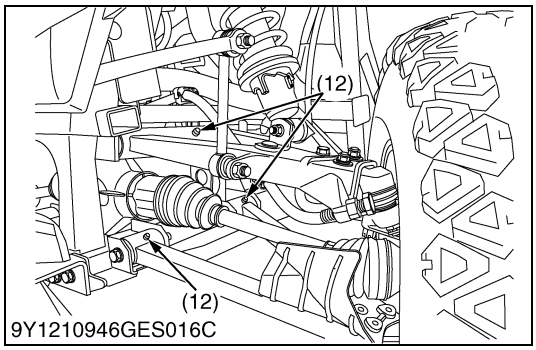
(A) Left Rear Tire

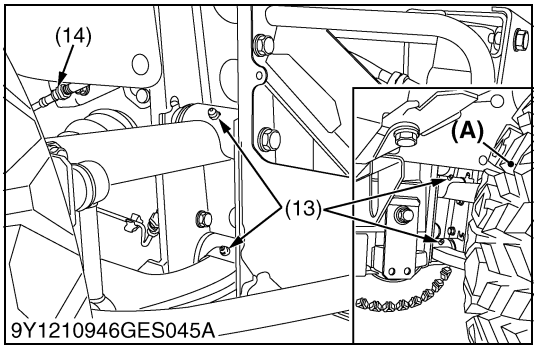
(To be continued)

(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

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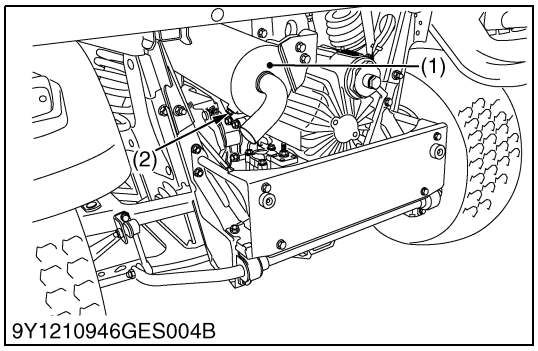
[4] CHECK POINTS OF EVERY 100 HOURS



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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

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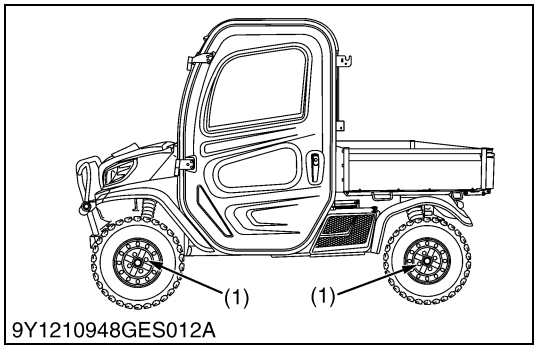

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Checking Wheel Fastener Torque

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

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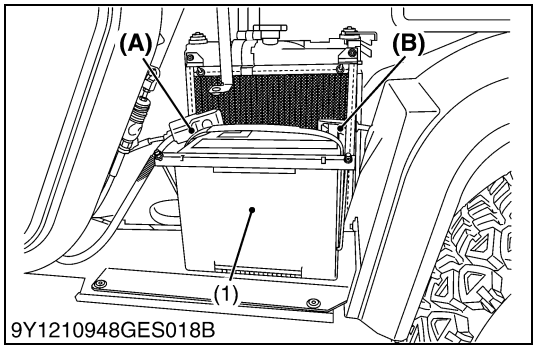

Checking Battery Condition

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 running.**
- **Keep electrolyte away from eyes, hands and clothes. If you are spattered with it, wash it away completely with water immediately and get medical attention.**
- **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)
624FMF	12	120	650	58	17.4

(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.

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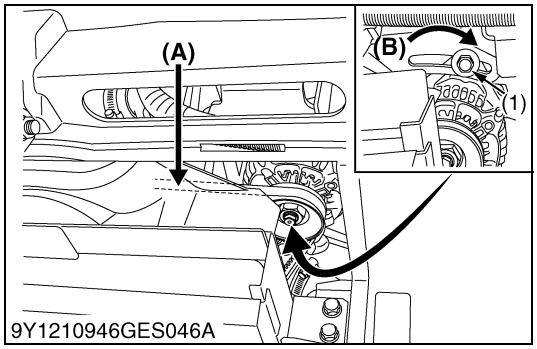

Adjusting Alternator Belt Tension

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

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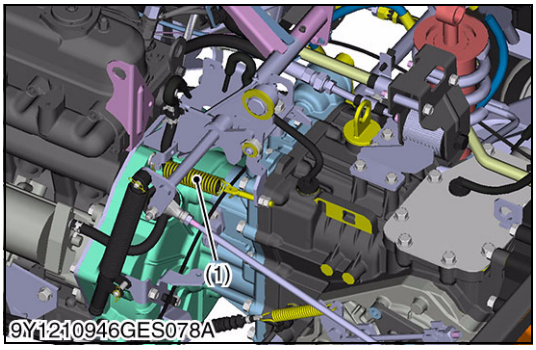

Checking VHT Neutral Spring

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

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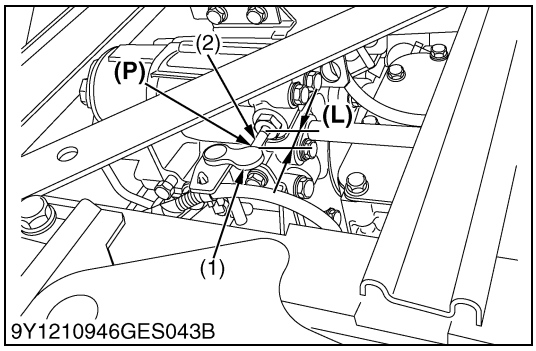

Checking VHT Pressure Release

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
(2) Unload Valve Rod

(L) 21.5 mm and over
(P) The Link is contact with the Rod.

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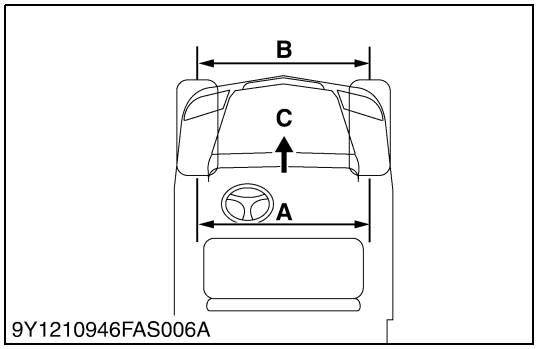

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Adjusting Toe-in

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

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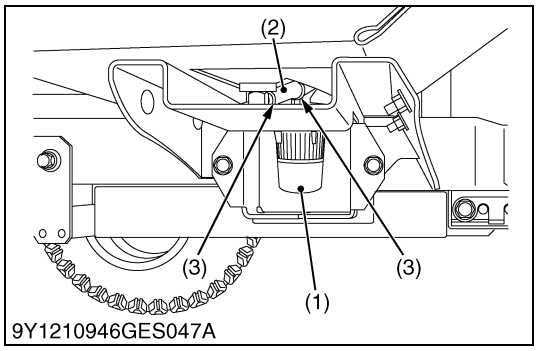

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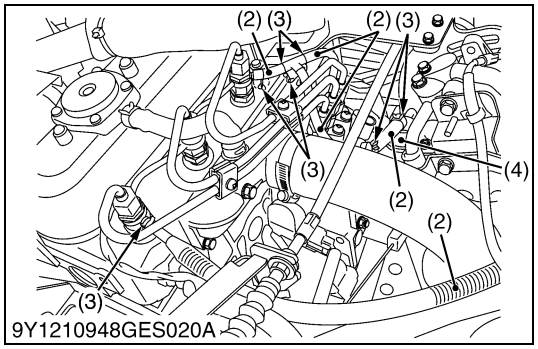

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Checking Fuel Line and Fuel Filter

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 running 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

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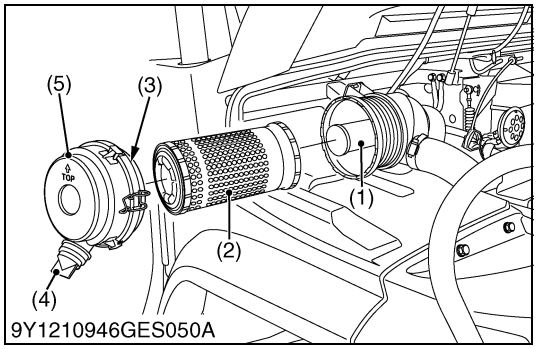

Cleaning Air Cleaner Primary Element

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/cm^2, 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 run 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
(2) Primary Element
(3) Rubber Seal
(4) Evacuator Valve
(5) Cover

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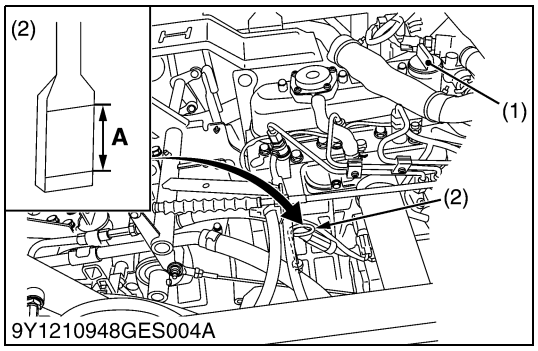
[5] CHECK POINTS OF EVERY 200 HOURS



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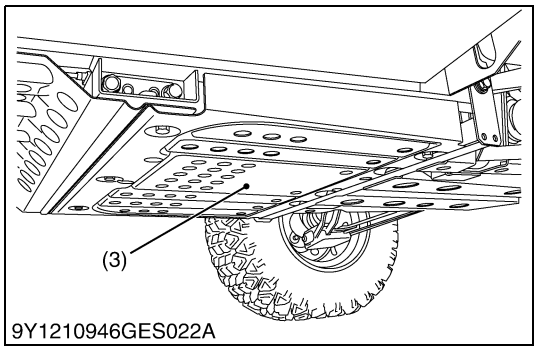

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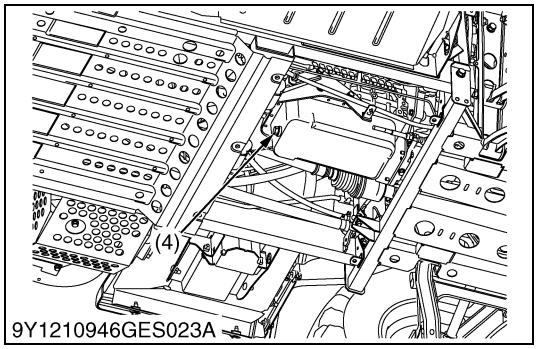

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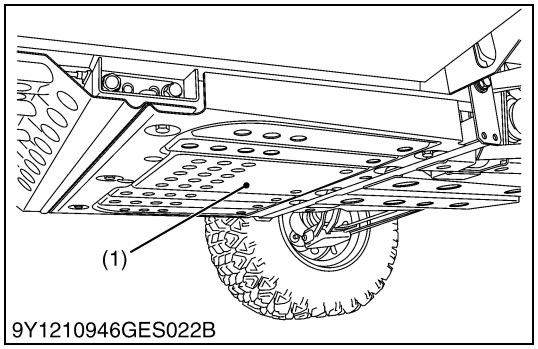

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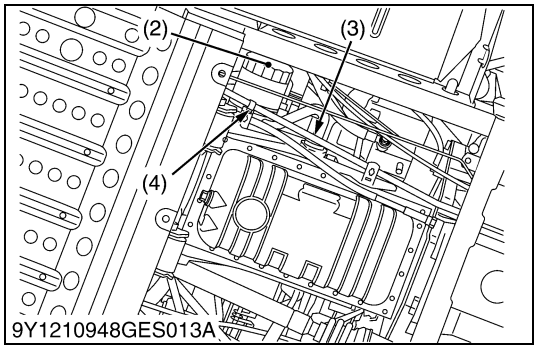

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Changing Engine Oil

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

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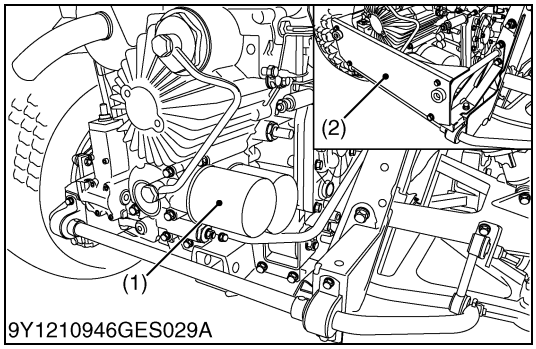

Replacing Transmission Oil Filter [VHT]

⚠ 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 transmission oil up to the upper notch on the dipstick.
7. After running the engine for a few minutes, stop the engine and check the oil level 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): (Yellow Color)
(2) Rear Guard

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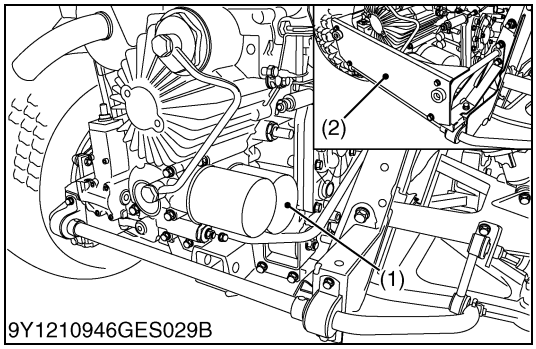

Replacing Transmission Oil Filter [SUCTION]

⚠ 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 transmission oil up to the upper notch on the dipstick.
7. After running the engine for a few minutes, stop the engine and check the oil level 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) (Black Color)
(2) Rear Guard

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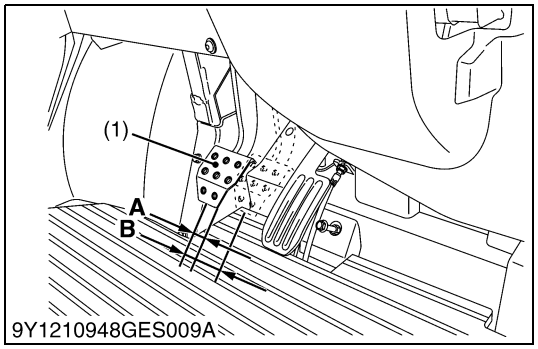

Checking Brake Pedal

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

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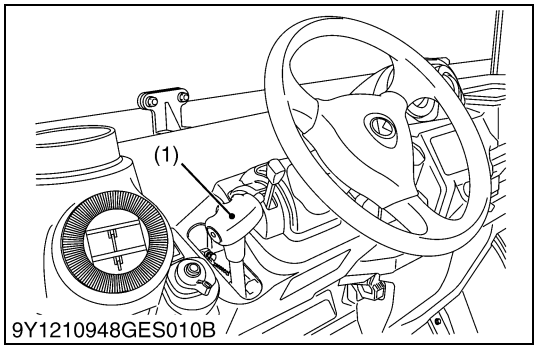

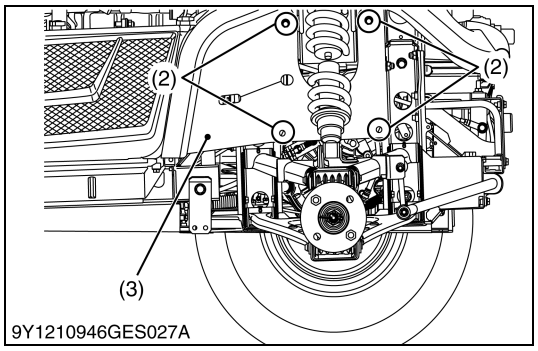

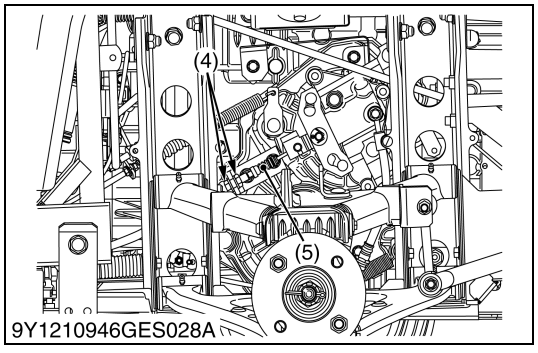

Adjusting Parking Brake

■ 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
(2) Push Rivet
(3) Mud Guard
(4) Lock Nut
(5) Cable Wire

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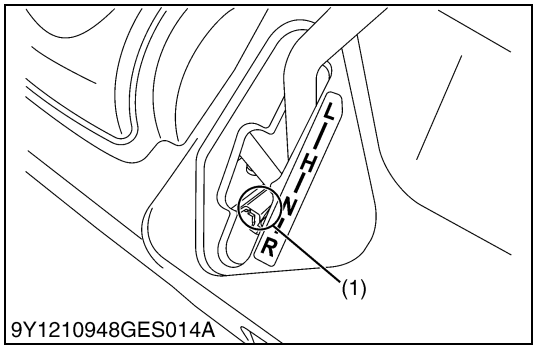

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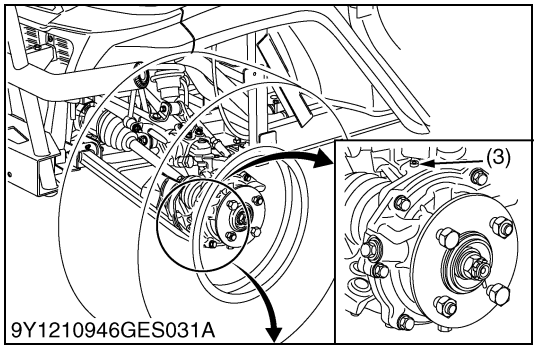
Checking Brake Light Switch

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



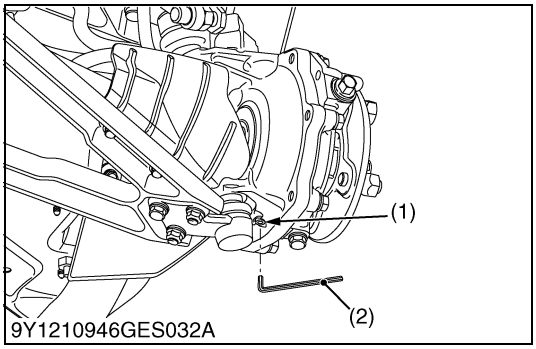
9Y1210946GES031A

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
(2) Allen Key
(3) Air-Bleeding Hole Plug

9Y1210948GEG0034US0



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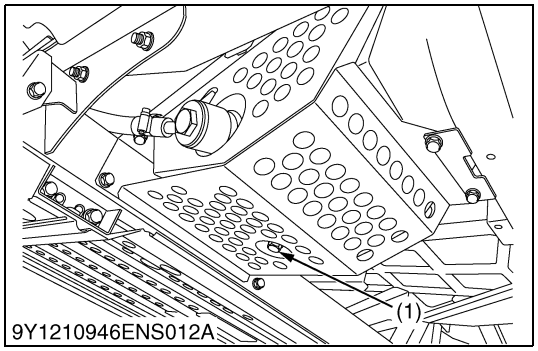


Changing Hydraulic Tank Oil

WARNING

To avoid serious injury:

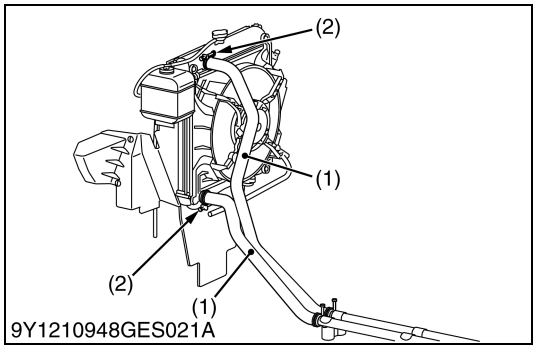
- **Be sure to stop the engine before changing the oil.**
- **Allow engine to cool down sufficiently, oil can be hot and can burn.**

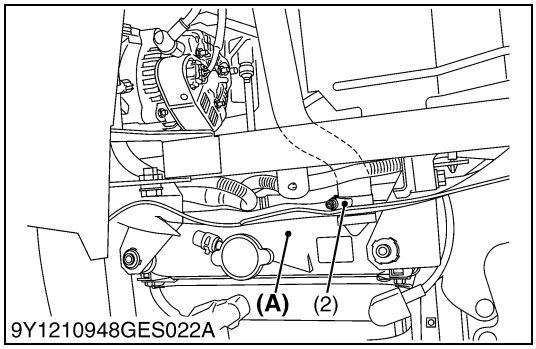
1. Park the vehicle on a level surface.
2. Open the seat and remove the utility box.
3. Remove the rubber cap.
4. To drain the used oil, remove the drain plug and filling plug and drain the oil completely into the oil pan.
5. After draining, reinstall the drain plug.
6. Fill with new KUBOTA SUPER UDT 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.

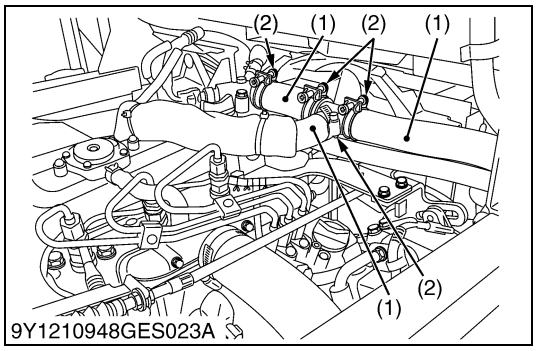
Hydraulic tank oil	Capacity	18.0 L 19.0 U.S.qts 16.0 Imp.qts

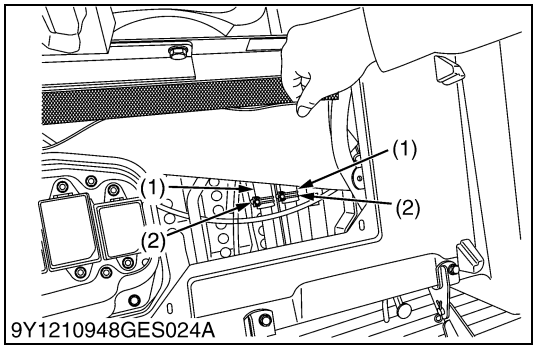
(1) Drain Plug

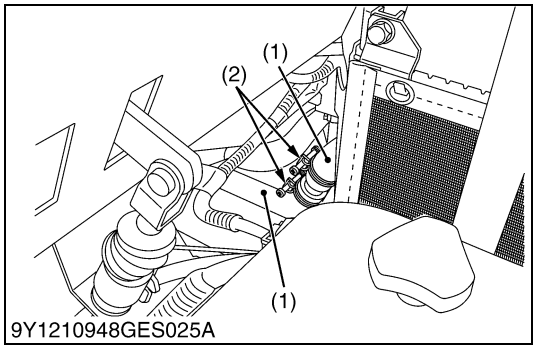
9Y1210948GEG0047US0











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.

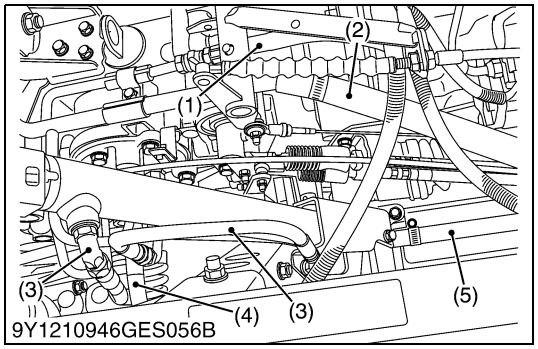
■ **Precaution at Overheating**

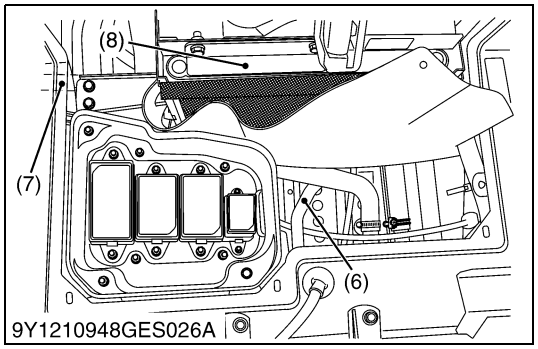
Take the following actions in the event the coolant temperature is close to or more than the boiling point, which is called Overheating.

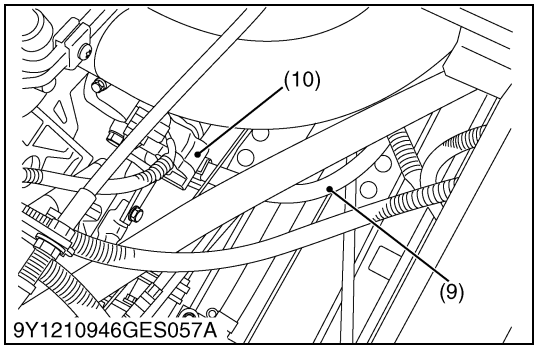
1. Stop the vehicle operation in a safe place, unload the engine and remain at idle.
2. Don't stop the engine suddenly, but stop it after about 5 minutes of unloaded idling.
3. Keep yourself well away from the vehicle for at least 10 minutes or while the steam is blowing out.
4. Check to confirm that 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.

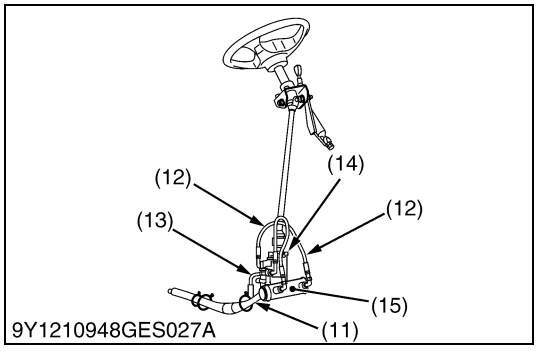
(1) Radiator Hose
(2) Clamp Band
(A) Side Radiator

9Y1210948GEG0048US0









Checking 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

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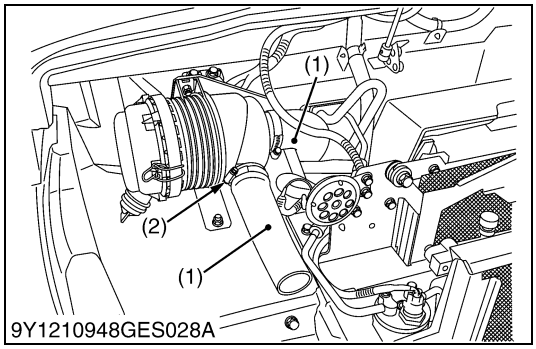
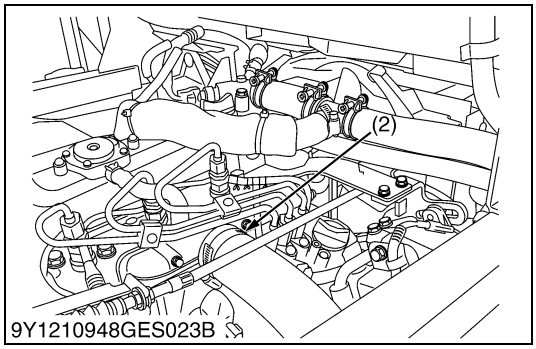
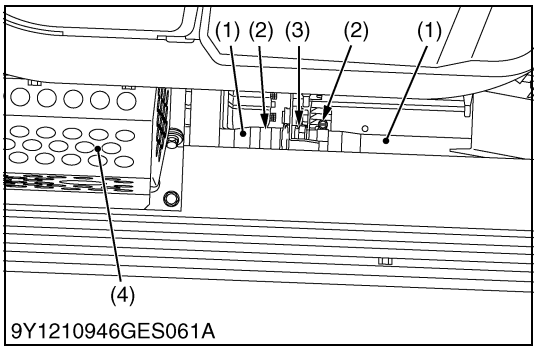




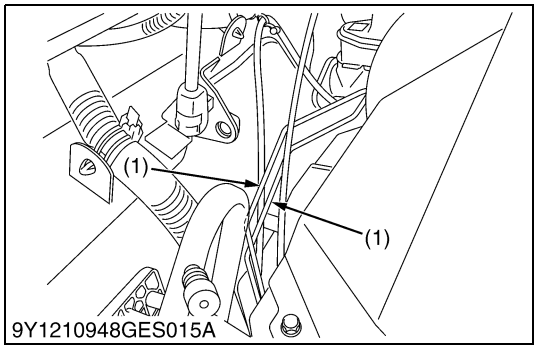


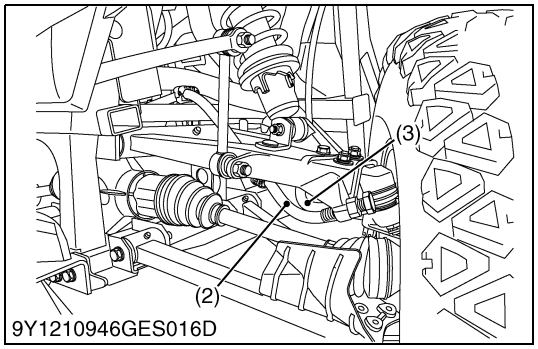
Checking Intake Air Line

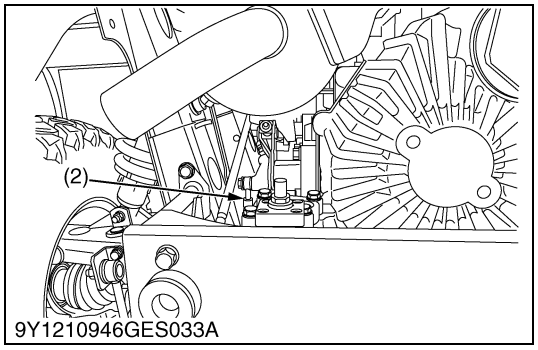
1. Check to see if the hoses and hose clamps are tight and not damaged.
2. If hoses and clamps are found to be worn or damaged, replace or repair them at once.

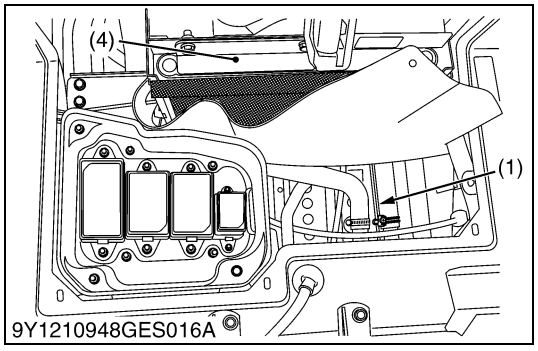
(1) Hose
(2) Hose Clamp
(3) Joint
(4) Hydraulic Tank

9Y1210948GEG0050US0







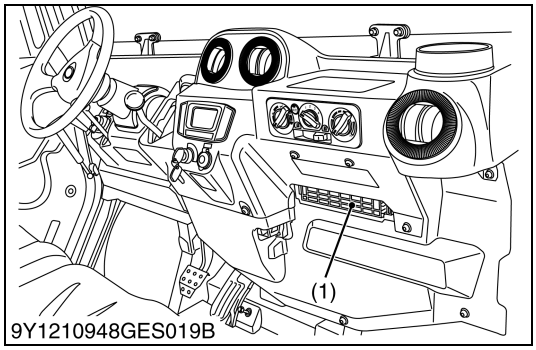


Checking Brake Hose and Pipe

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



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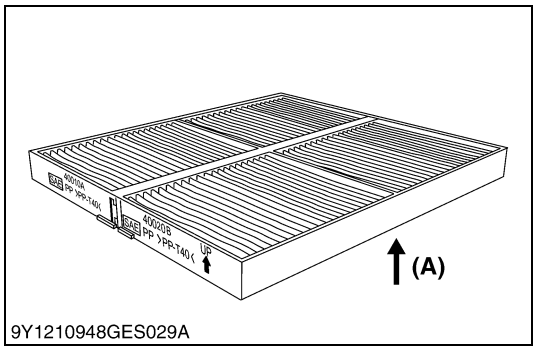


9Y1210948GES029A

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/cm^2, 30 psi).

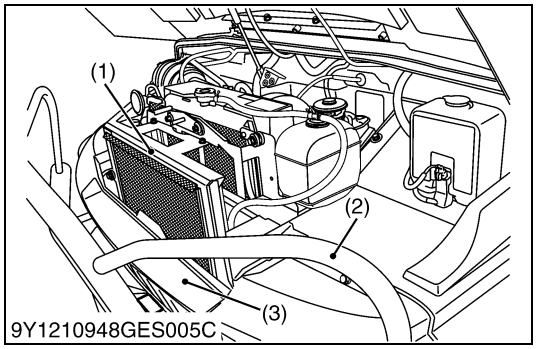
■ **IMPORTANT**
- **Do not hit the filter. If the filter becomes deformed, dust may enter into the air-conditioner, which may cause damage and malfunction.**

■ **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



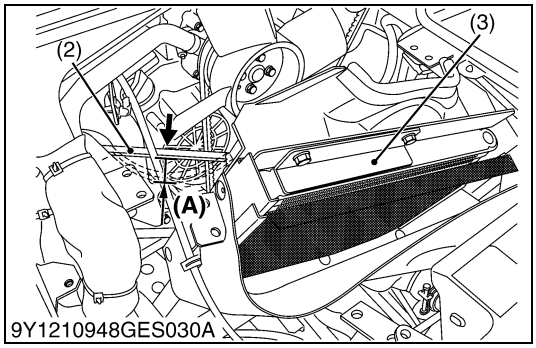
9Y1210948GES005C

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
(2) Front Guard
(3) Front Mask

9Y1210948GEG0052US0



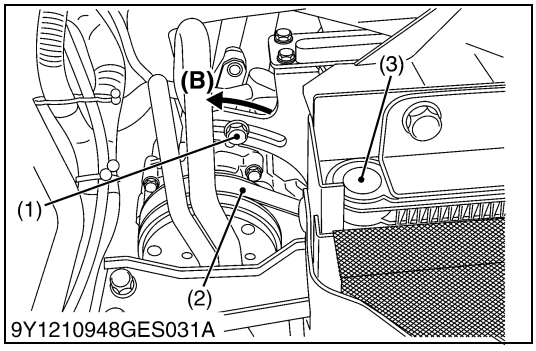
9Y1210948GES030A

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

9Y1210948GEG0053US0



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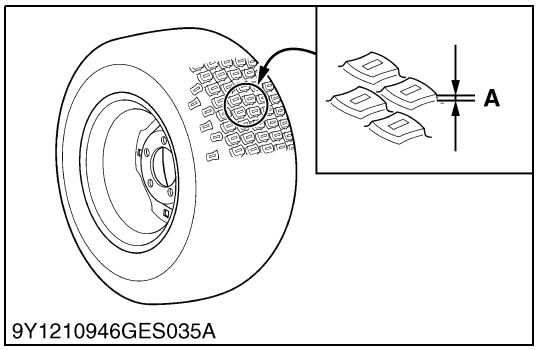
[6] CHECK POINT OF EVERY 300 HOURS



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.

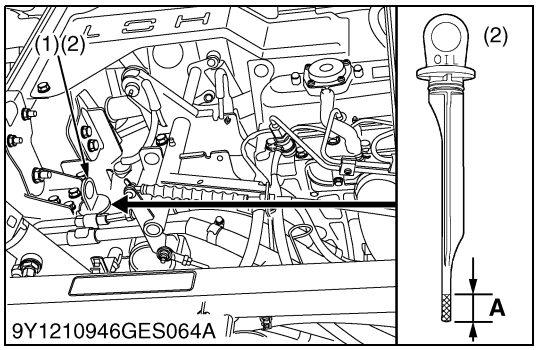
■ **Tire Tread Depth**

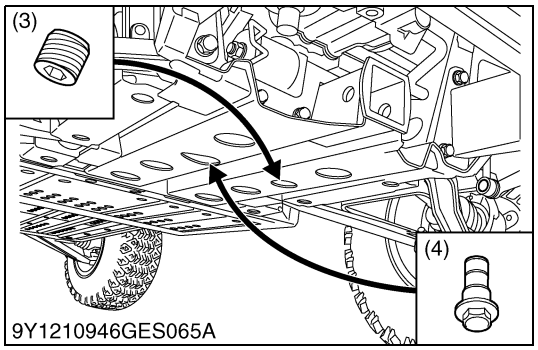
Always replace the tires when the tread depth is worn to minimum allowable.

A: 3 mm (0.12 in.)

9Y1210948GEG0036US0

[7] 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 running 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

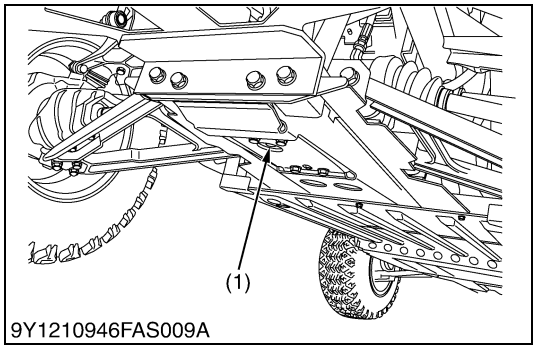
■ **IMPORTANT**

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



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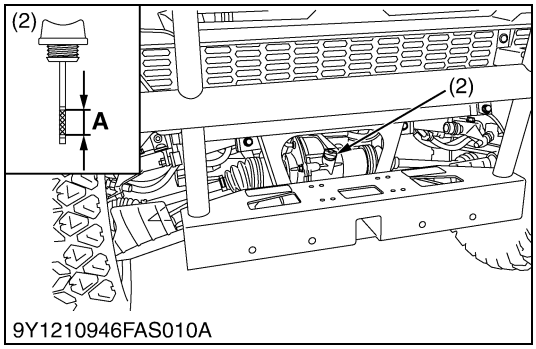

9Y1210946FAS010A

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.

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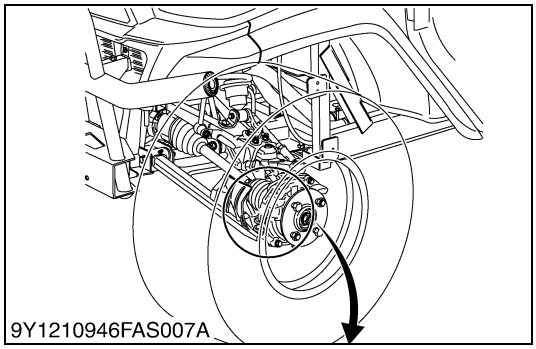
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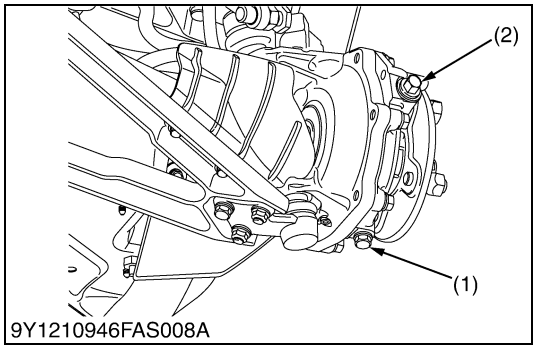

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Changing Front Knuckle Case Oil

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

[8] CHECK POINT OF EVERY 500 HOURS

Replacing Fuel Filter

1. See page G-37.

9Y1210948GEG0057US0

[9] CHECK POINT OF EVERY 800 HOURS

Adjusting Engine Valve Clearance

1. See page 1-S12.

9Y1210948GEG0058US0

[10] CHECK POINT OF EVERY 1500 HOURS

Checking Fuel Injection Nozzle Injection Pressure

1. See page 1-S14.

9Y1210948GEG0059US0

[11] CHECK POINT OF EVERY 3000 HOURS

Checking Injection Pump

1. See page 1-S19.

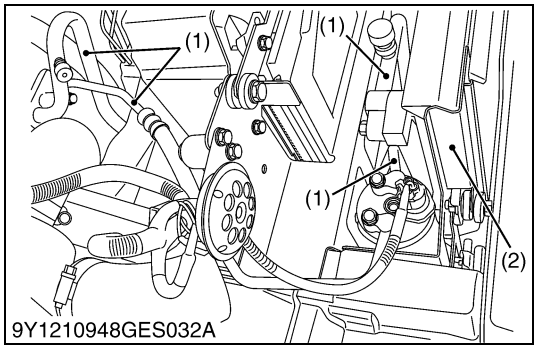
9Y1210948GEG0060US0

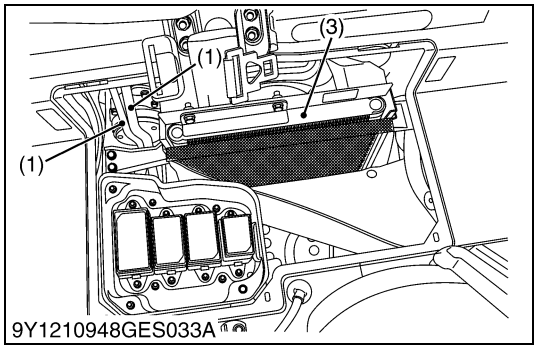
[12] CHECK POINTS OF EVERY 1 YEAR

Replacing Air Cleaner Primary Element

1. Replace the both primary. (See page G-38.)

9Y1210948GEG0061US0





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)
(2) Air Conditioner Condenser
(3) Oil Cooler

9Y1210948GEG0062US0

[13] CHECK POINTS OF EVERY 2 YEARS

Replacing Fuel Line

1. See page G-37.

9Y1210948GEG0063US0

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

1. See page G-44.

9Y1210948GEG0064US0

Replacing Hydraulic Oil Line

1. See page G-45.

9Y1210948GEG0065US0

Replacing Intake Air Line

1. See page G-46.

9Y1210948GEG0066US0

Replacing Engine Breather Hose

1. See page 1-S34.

9Y1210948GEG0067US0

Replacing Brake Master Cylinder (Inner Parts)

1. See page 4-S15.

9Y1210948GEG0068US0

Changing Brake Fluid

1. See page 4-S5.

9Y1210948GEG0069US0

Replacing Rear Brake Cylinder Seal

1. See page 4-S17.

9Y1210948GEG0070US0

Replacing Front Brake Seal

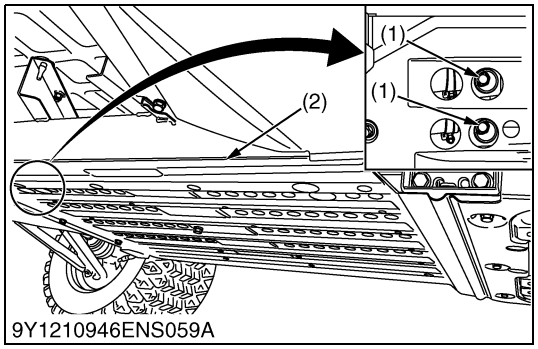
1. See page 4-S14.

9Y1210948GEG0071US0

Replacing Air Conditioner Pipe and Hoses

1. See page G-51.

9Y1210948GEG0072US0



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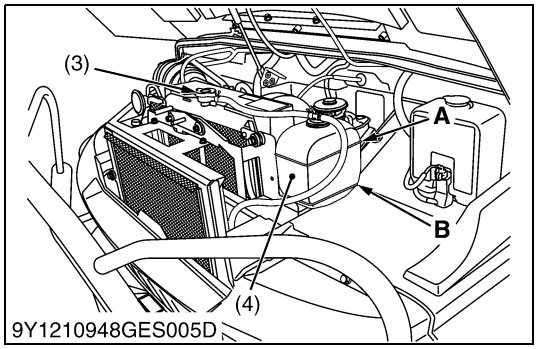

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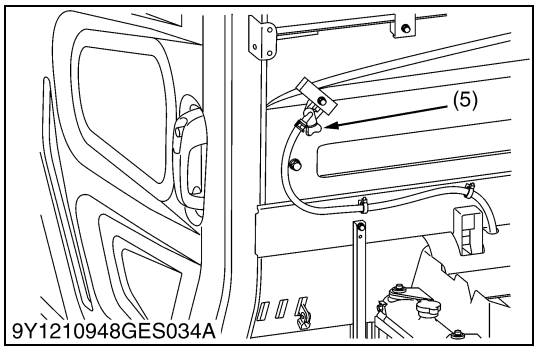


9Y1210948GES034A

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

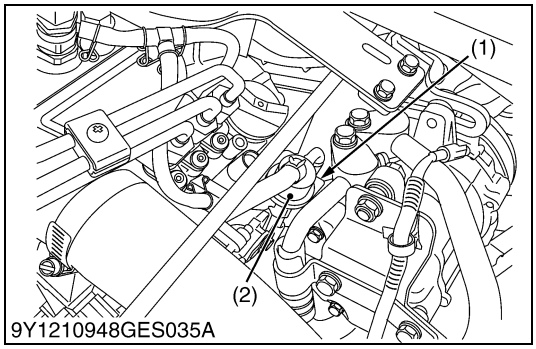
[14] CHECK POINT OF EVERY 4 YEARS

Replacing Brake Hose

1. See page G-47.

9Y1210948GEG0075US0

[15] 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 run for about 30 seconds, and then stop the engine.

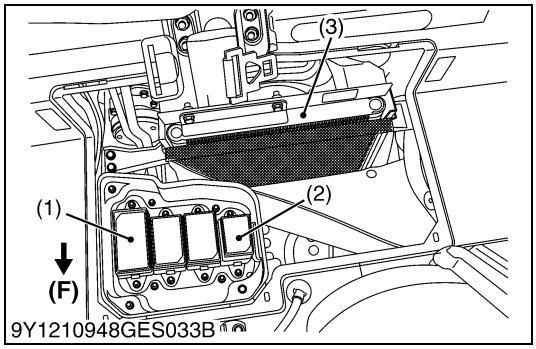
(1) Fuel Pump Lever (2) Fuel Pump

9Y1210948GEG0076US0

Cleaning around Engine

1. See page G-18.

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**

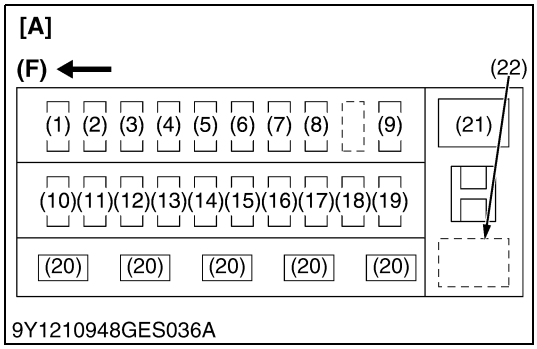
- **Before replacing a blown fuse, determine why the fuse blew and make any necessary repairs. Failure to follow this procedure may result in serious damage to the vehicle electrical system.**

■ **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



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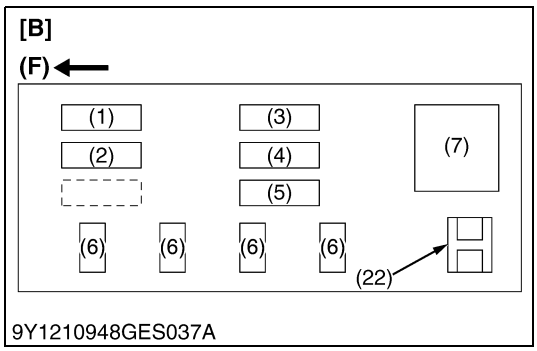

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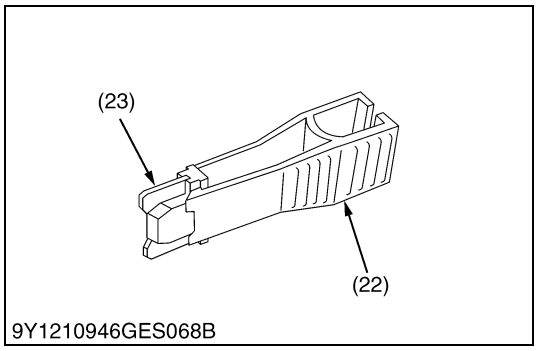


9Y1210946GES068B

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.

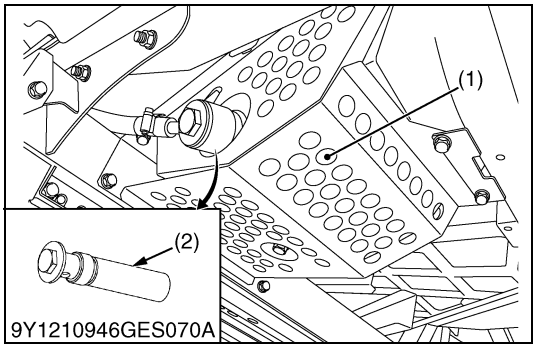
9Y1210948GEG0080US0

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

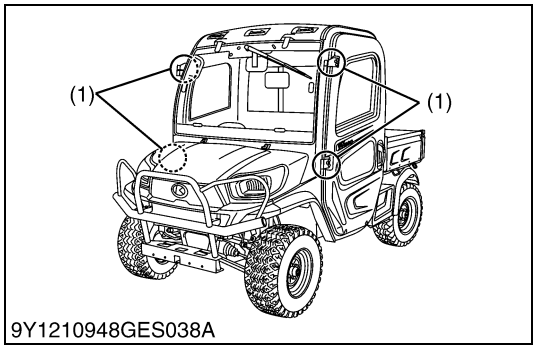


Checking Hydraulic Tank Suction Strainer

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

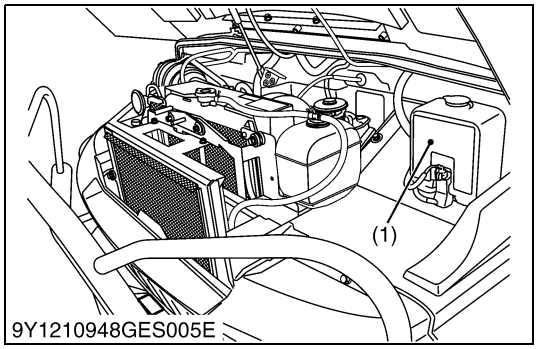
9Y1210948GEG0082US0

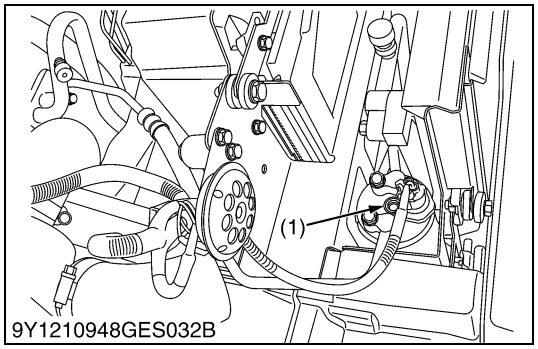


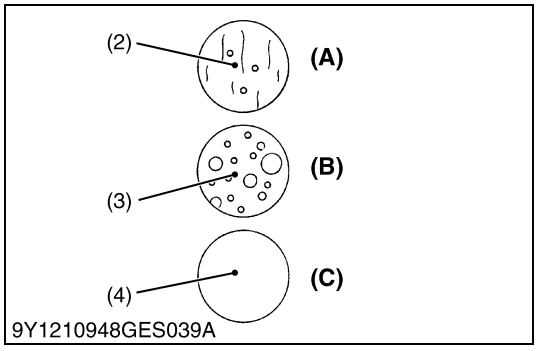
Lubricating Points

(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. Run 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).**

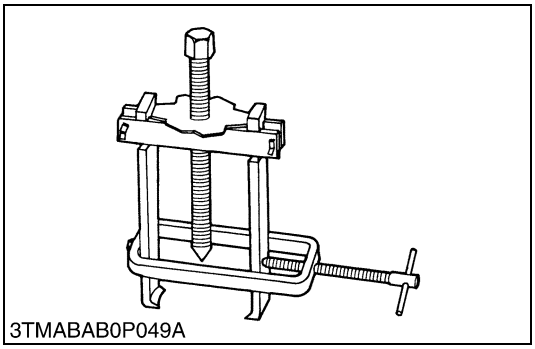
(1) Sight Glass
(2) Proper
(3) Low
(4) Overfull or No Refrigerant

(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

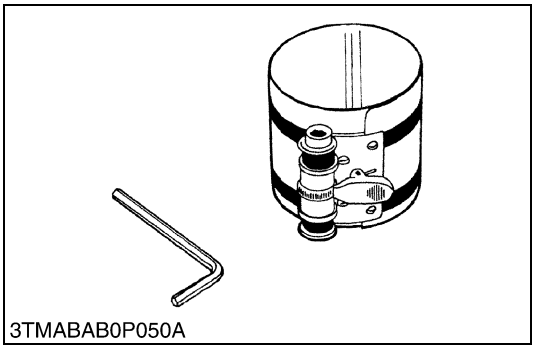

3TMABAB0P049A

Special Use Puller Set

Code No.
- 07916-09032

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

WSM000001GEG0011US0

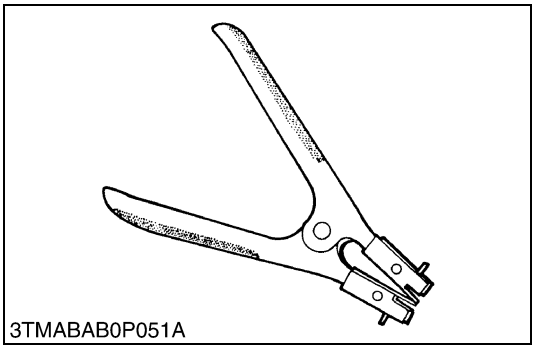

3TMABAB0P050A

Piston Ring Compressor

Code No.
- 07909-32111

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

WSM000001GEG0012US0

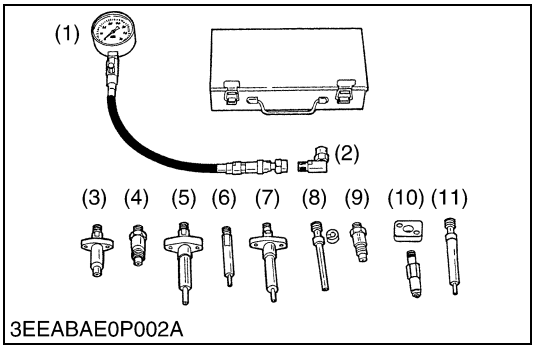

3TMABAB0P051A

Piston Ring Tool

Code No.
- 07909-32121

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

WSM000001GEG0013US0



3EEABAE0P002A

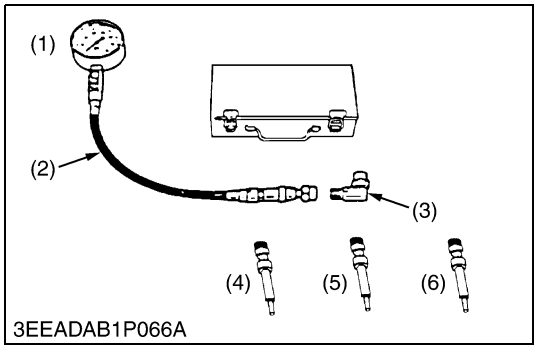
Diesel Engine Compression Tester (for Injection Nozzle)

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

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

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

WSM000001GEG0014US0



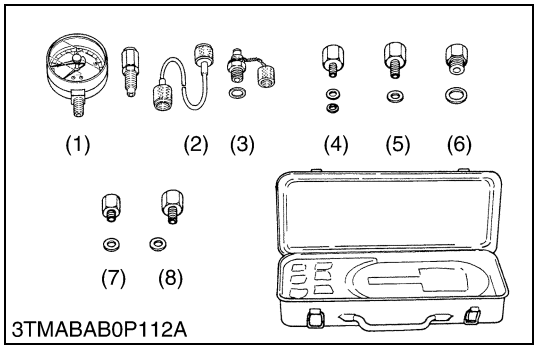
Diesel Engine Compression Tester (for Glow Plug)

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
(2) Hose Assembly
(3) **L** Joint
(4) Adaptor **K**
(5) Adaptor **L**
(6) Adaptor **M**

WSM000001GEG0096US0



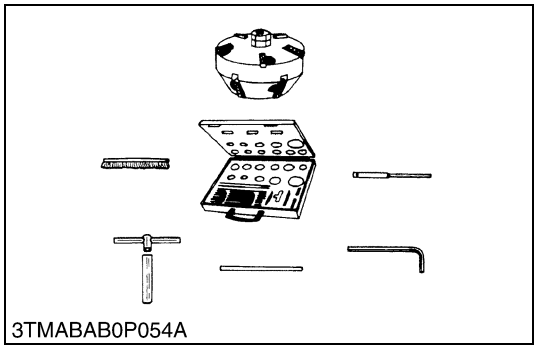
Oil Pressure Tester

Code No.
- 07916-32032

Application
- Use to measure lubricating oil pressure.

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

WSM000001GEG0015US0



Valve Seat Cutter

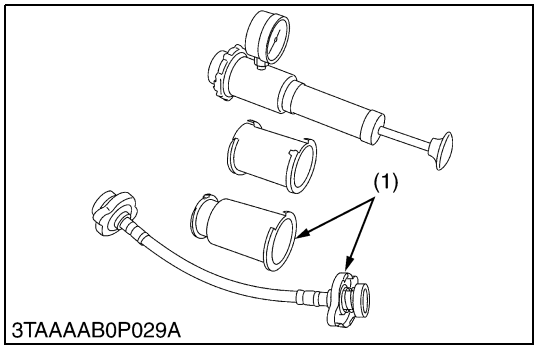
Code No.
- 07909-33102

Application
- Use to reseat 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

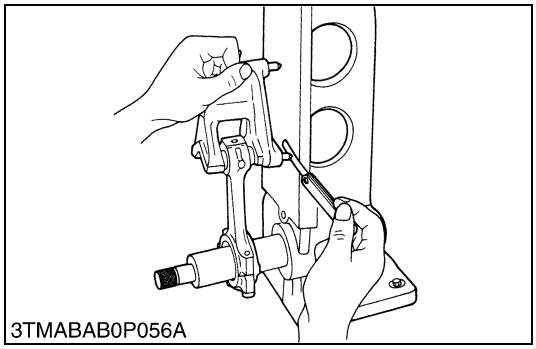
Code No.
- 07909-31551

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


3TMABAB0P056A

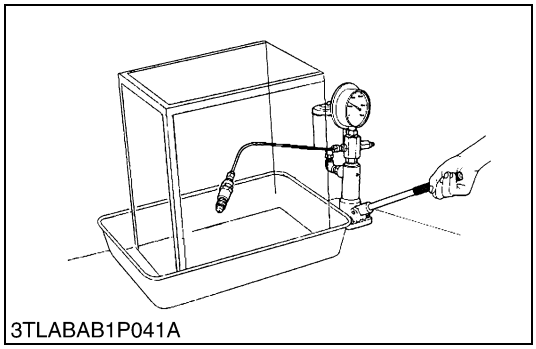
Connecting Rod Alignment Tool

Code No.
- 07909-31661

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


3TLABAB1P041A

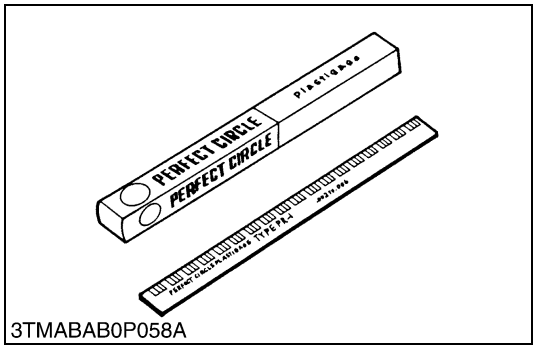
Nozzle Tester

Code No.
- 07909-31361

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

Measuring range
- 0 to 50 MPa (0 to 500 kgf/cm^2, 0 to 7200 psi)

WSM000001GEG0021US0



3TMABAB0P058A

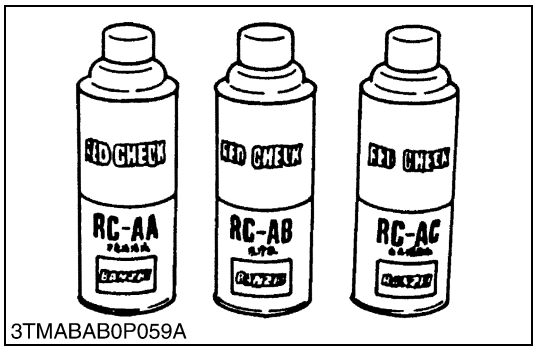
Plastigauge

Code No.
- 07909-30241

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



3TMABAB0P059A

Red Check

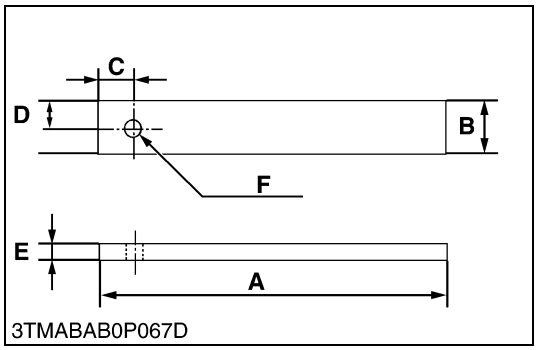
Code No.
- 07909-31371

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



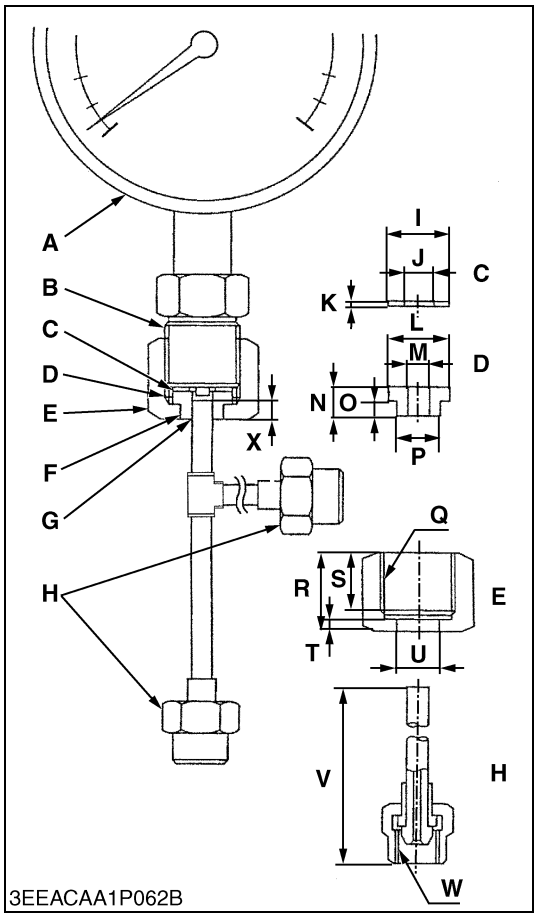
3TMABAB0P067D

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



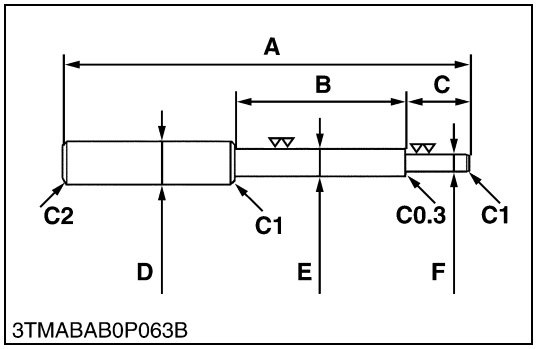
3EEACAA1P062B

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



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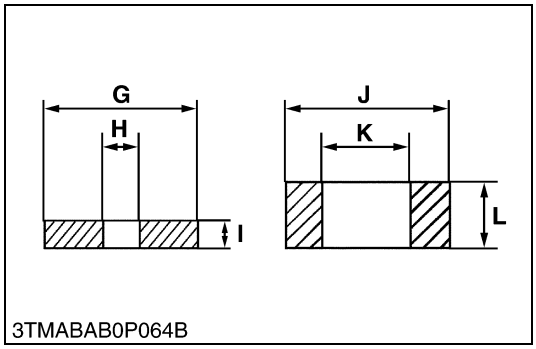

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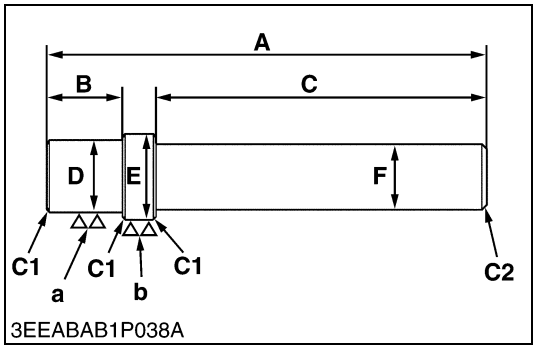


3EEABAB1P038A

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.

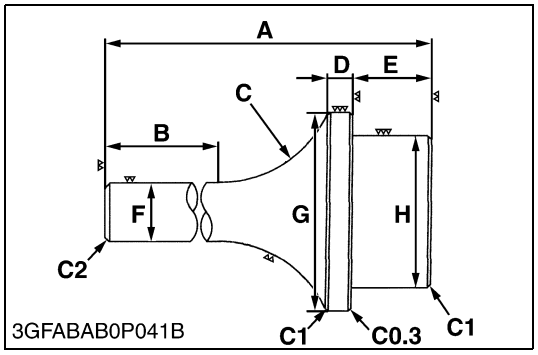
[For small end bushing]

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 µm (250 µin.)
b	6.3 µm (250 µin.)
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 µm (250 µin.)
b	6.3 µm (250 µin.)
C1	Chamfer 1.0 mm (0.039 in.)
C2	Chamfer 2.0 mm (0.079 in.)

9Y1210948GEG0090US0



3GFABAB0P041B

Crankshaft Bearing 1 Replacing Tool

Application

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

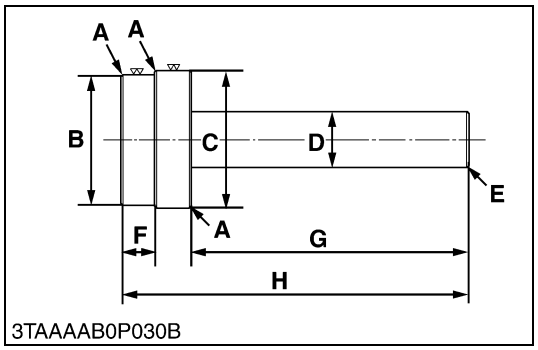
[Press Out]

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



3TAAAAB0P030B

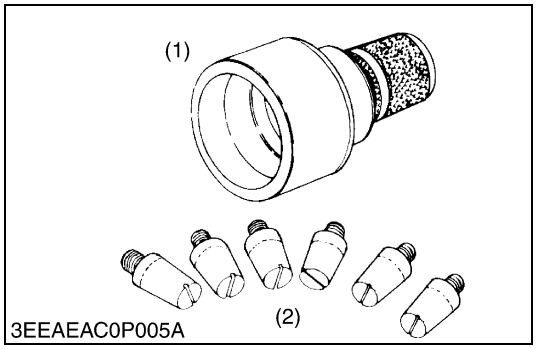
Governor Gear Holder Bushing Replacing Tool

Application

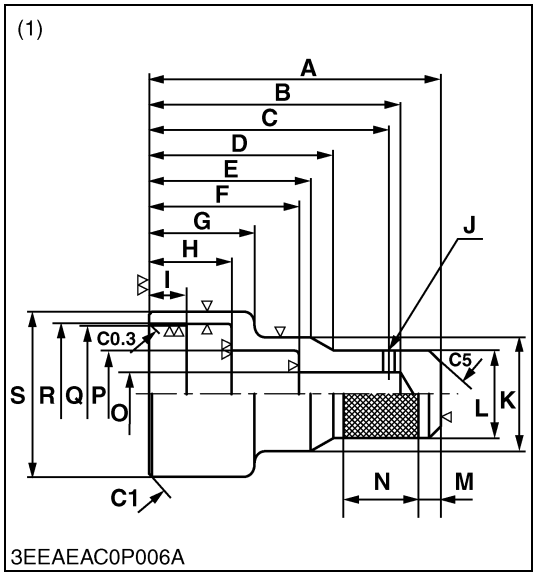
- Use to press out and to press fit the governor gear holder bushing.

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



3EEAEAC0P005A



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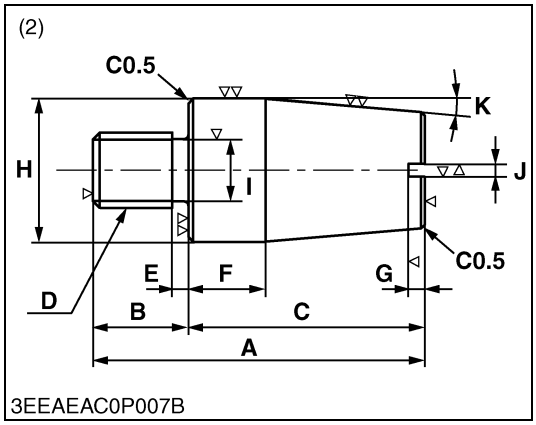


3EEAEAC0P007B

Crank Sleeve Setter

Application

- Use to fix the crankshaft sleeve.

(1) Auxiliary Socket for Pushing

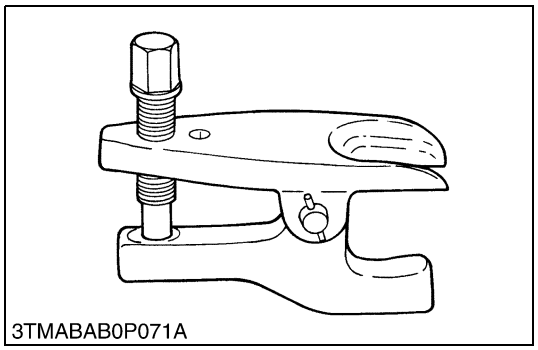
A	130 mm (5.12 in.)
B	112 mm (4.41 in.)
C	107 mm (4.21 in.)
D	82 mm (3.2 in.)
E	72 mm (2.8 in.)
F	67 mm (2.6 in.)
G	47 mm (1.8 in.)
H	36.00 to 36.20 mm (1.418 to 1.425 in.)
I	17 mm (0.67 in.)
J	5.0 mm dia. (0.20 in. dia.)
K	52 mm dia. (2.0 in. dia.)
L	40 mm dia. (1.6 in. dia.)
M	10 mm (0.39 in.)
N	33 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

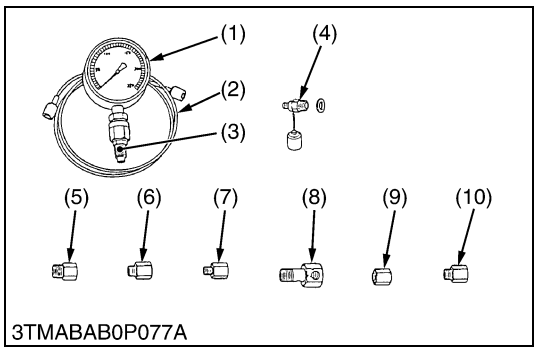

3TMABAB0P071A

Tie-rod End Lifter

Code No.
- 07909-39051

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

WSM000001GEG0029US0



3TMABAB0P077A

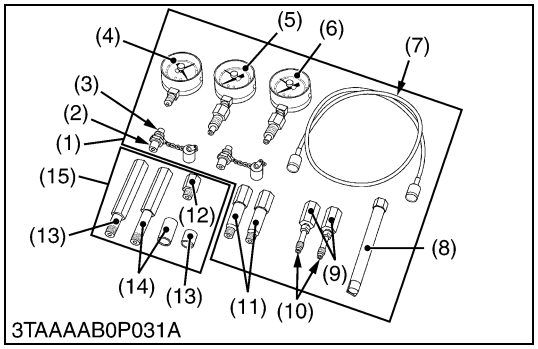
Relief Valve Pressure Tester

Code No.
- 07916-50045

Application
- This allows easy measurement of relief set pressure.

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

WSM000001GEG0027US0



3TAAAAB0P031A

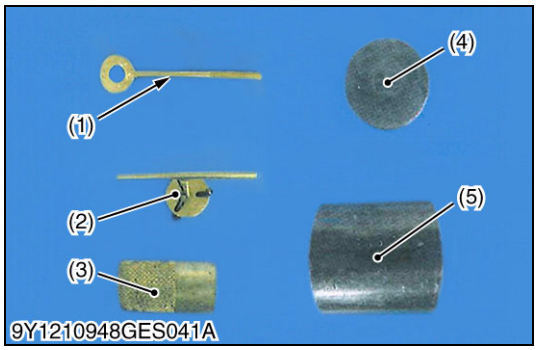
Hydrostatic Transmission Tester and HST Adaptor Set

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)
(2) Gasket (04714-00200)
(3) Connector **3** (07916-51331)
(4) Vacuum Gauge (07916-51331)
(5) Pressure Gauge (Low Pressure) (07916-51301)
(6) Pressure Gauge (High Pressure) (in Relief Valve Set Pressure Tester) (07916-50321)
(7) HN Tube (in Relief Valve Set Pressure Tester) (07916-50331)
(8) Valve Seat Driver (07916-60841)
(9) Connector **1** (07916-60811)
(10) Connector **2** (07916-60821)
(11) Long Connector (07916-60831)
(12) Adaptor **1** (07916-52621)
(13) Adaptor **2** with Collar (07916-52632)
(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 adn tighten the magnet clutch.

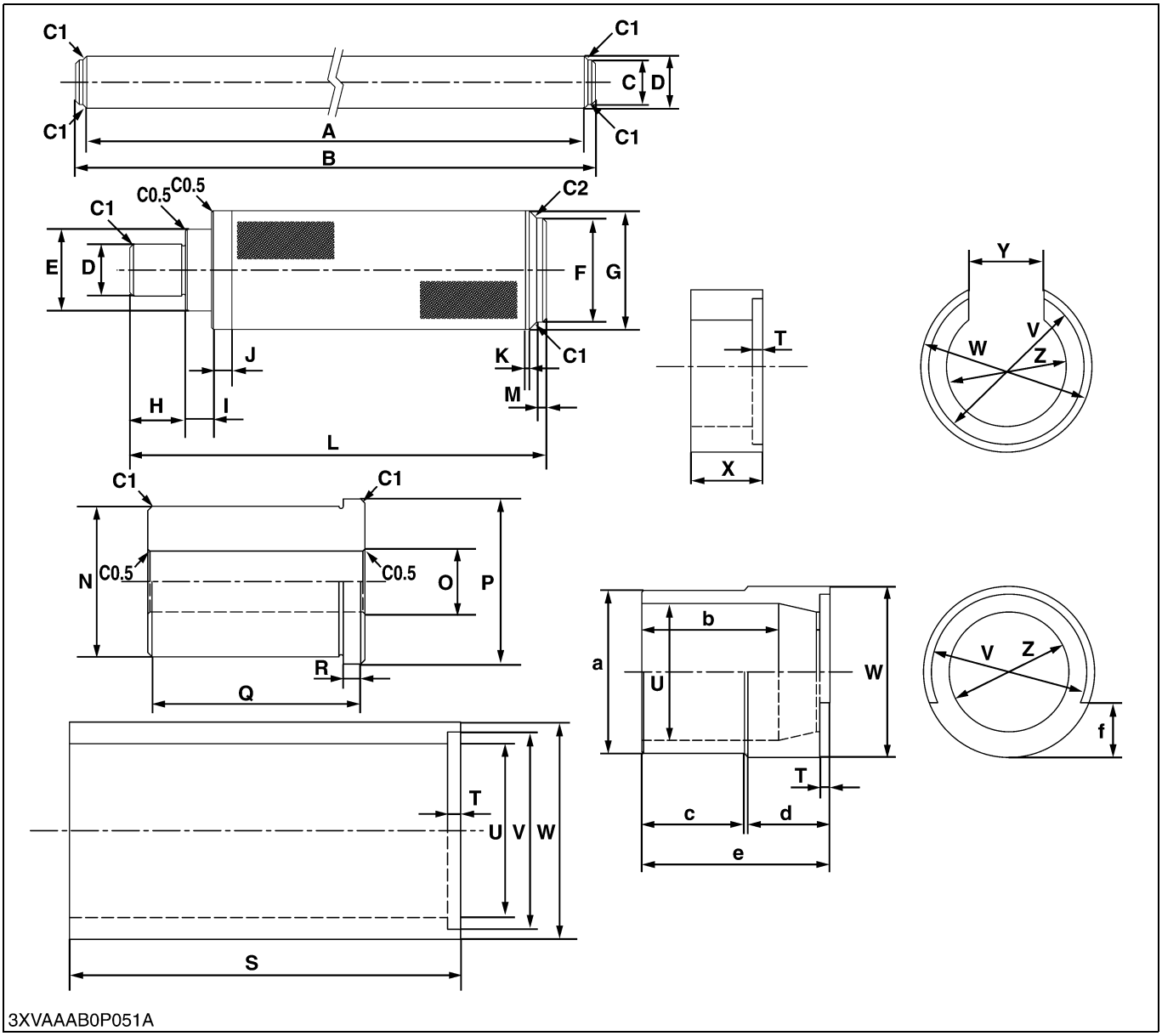
(1) Armature Plate Spanner
(2) Armature Plate Puller
(3) Armature Driver
(4) Rotor Puller Set
(5) Rotor Installation Driver

9Y1210948GEG0110US0

Lower Arm Bush Tool

Application

- Use for removing and installing lower arm rubber bush.



3XVAAAB0P051A

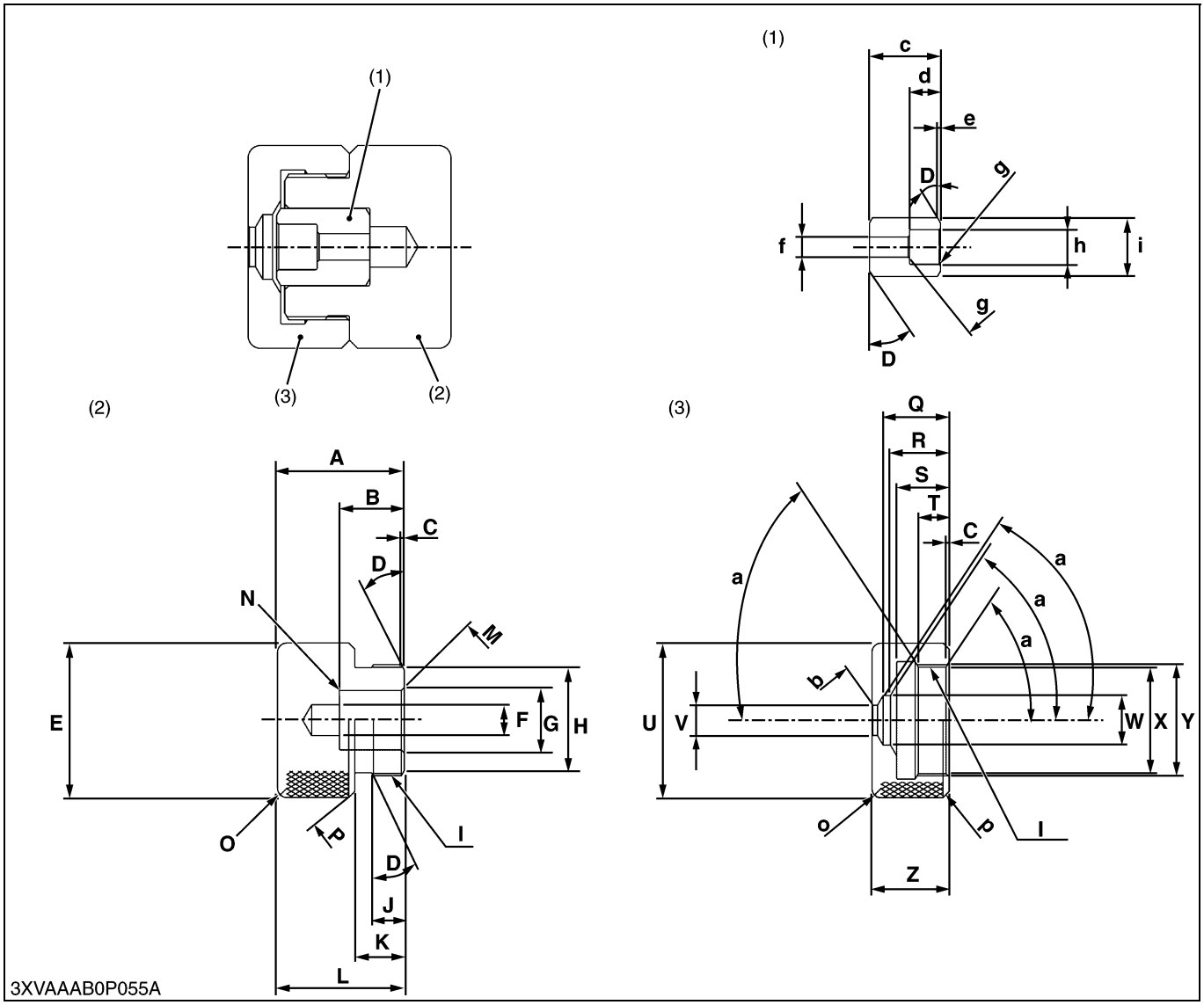
A	256.5 mm (10.10 in.)	**M**	2.6 mm (0.102 in.)	**Y**	22 mm (0.866 in.)
B	262.5 mm (10.33 in.)	**N**	34.65 mm dia. (1.364 in. dia.)	**Z**	35 mm dia. (1.378 in. dia.)
C	12 mm dia. (0.472 in. dia.)	**O**	14.1 mm dia. (0.555 in. dia.)	**a**	47.6 mm dia. (1.874 in. dia.)
D	14 mm dia. (0.551 in. dia.)	**P**	38 mm dia. (1.496 in. dia.)	**b**	40 mm (1.575 in.)
E	22 mm dia. (0.866 in. dia.)	**Q**	50 mm (1.969 in.)	**c**	30 mm (1.181 in.)
F	28 mm dia. (1.102 in. dia.)	**R**	5 mm (0.197 in.)	**d**	24 mm (0.945 in.)
G	32 mm dia. (1.260 in. dia.)	**S**	90 mm (3.543 in.)	**e**	55 mm (2.165 in.)
H	15 mm (0.591 in.)	**T**	3 mm (0.118 in.)	**f**	16 mm (0.630 in.)
I	7 mm (0.276 in.)	**U**	40 mm dia. (1.575 in. dia.)	**C0.5**	Chamfer 0.5 mm (0.020 in.)
J	5.5 mm (0.217 in.)	**V**	45.4 mm dia. (1.787 in. dia.)	**C1**	Chamfer 1 mm (0.039 in.)
K	1 mm (0.0394 in.)	**W**	50 mm dia. (1.969 in. dia.)	**C2**	Chamfer 2 mm (0.079 in.)
L	112.6 mm (4.433 in.)	**X**	21 mm (0.827 in.)		

9Y1210948GEG0094US0

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

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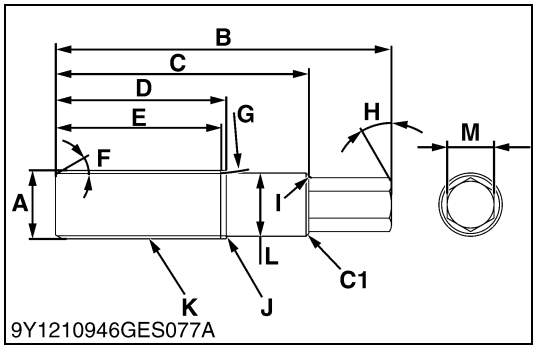

9Y1210946GES077A

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.))

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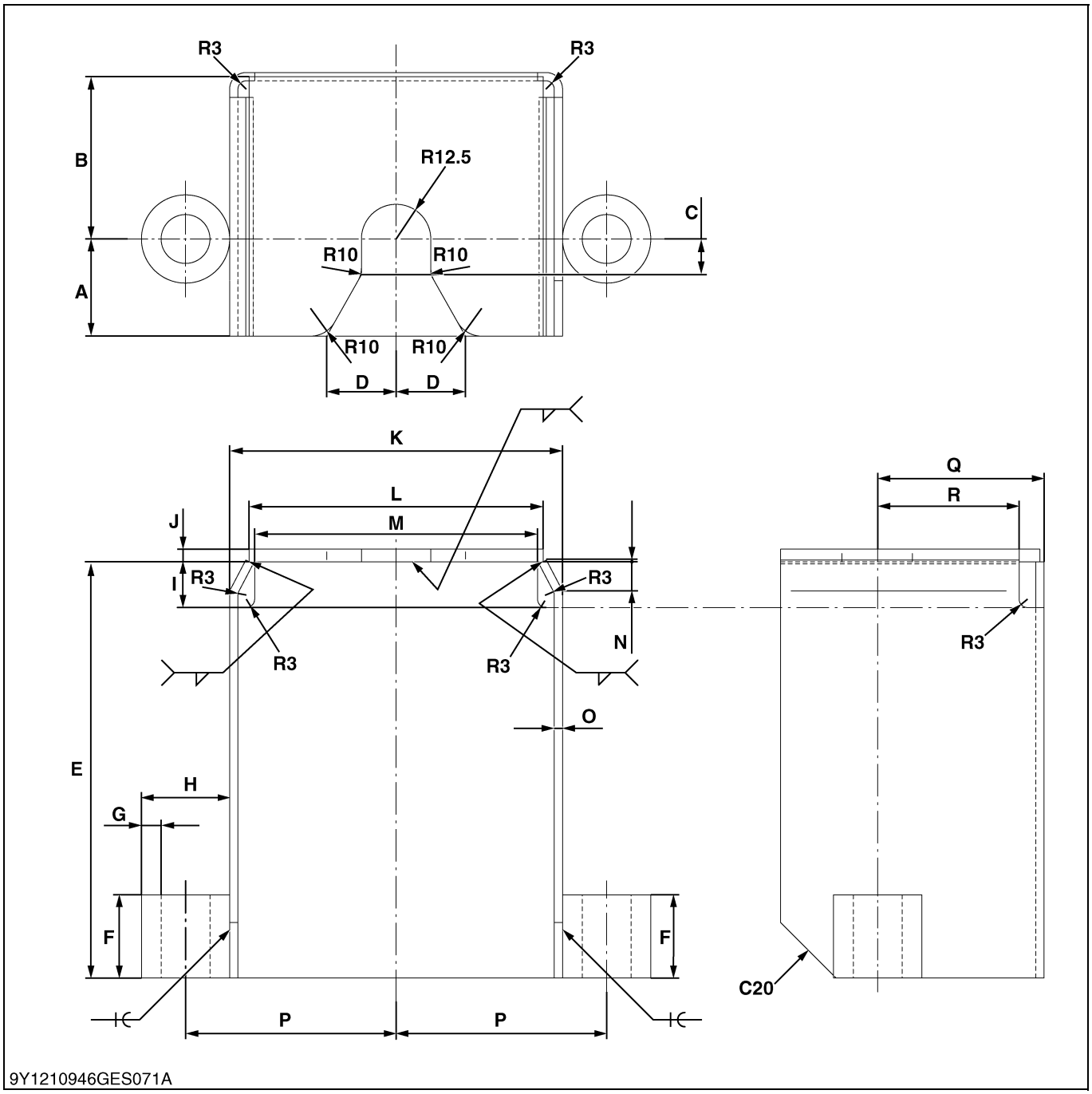
Rear Shock Absorber Spring Compressor 1



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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.)		

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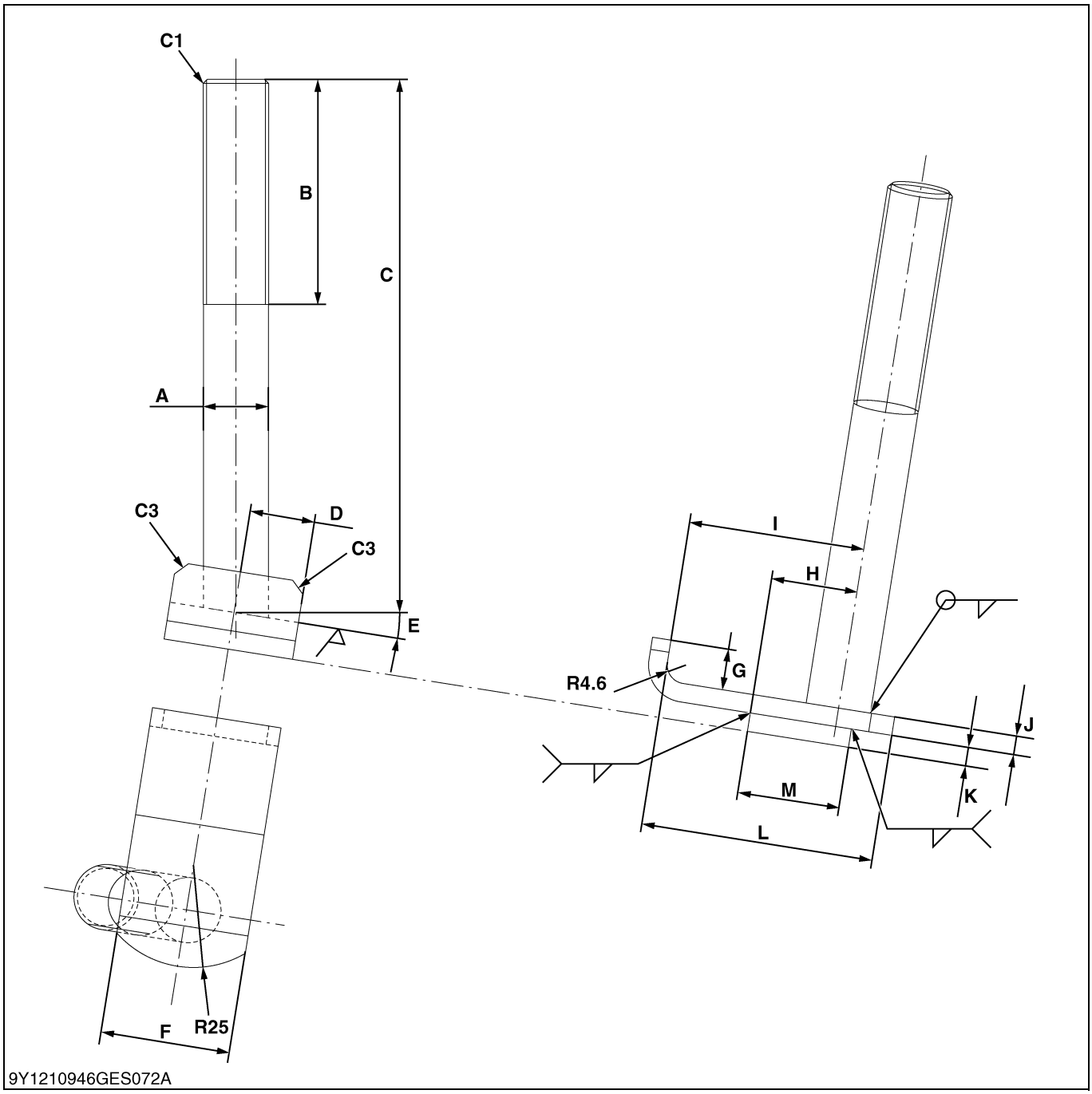
Rear Shock Absorber Spring Compressor 2



9Y1210946GES072A

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:

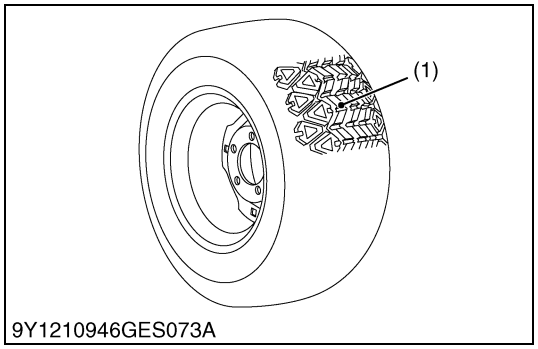
- **Do not attempt to mount a tire on a rim. This should be done by a qualified person with the proper equipment.**
- **Always maintain the correct tire pressure.**

IMPORTANT

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

9Y1210948GEG0099US0

[1] TYPE OF TIRES



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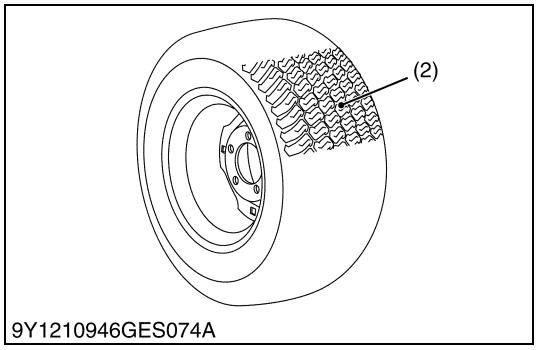

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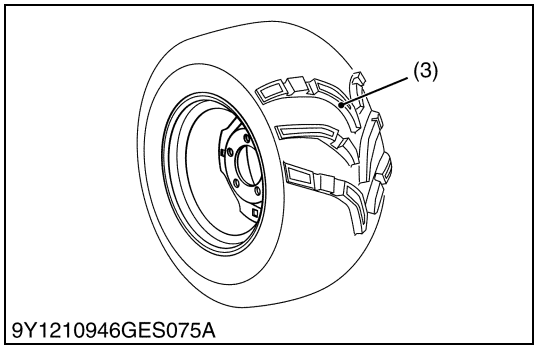

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Tire Type and Use

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

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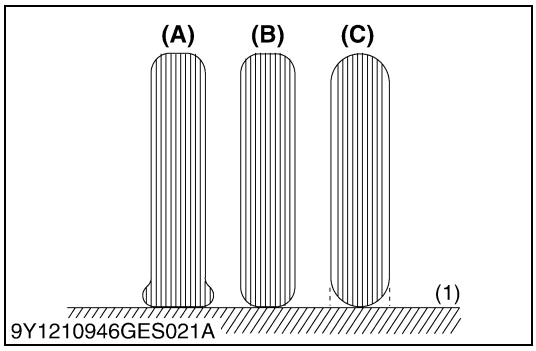
[2] TYPE PRESSURE



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, 20psi)
25 × 12 - 12 Turf, Front and Rear	
25 × 10 - 12 ATV, Front and Rear	

(1) Ground

(A) Insufficient
(B) Normal
(C) Excessive

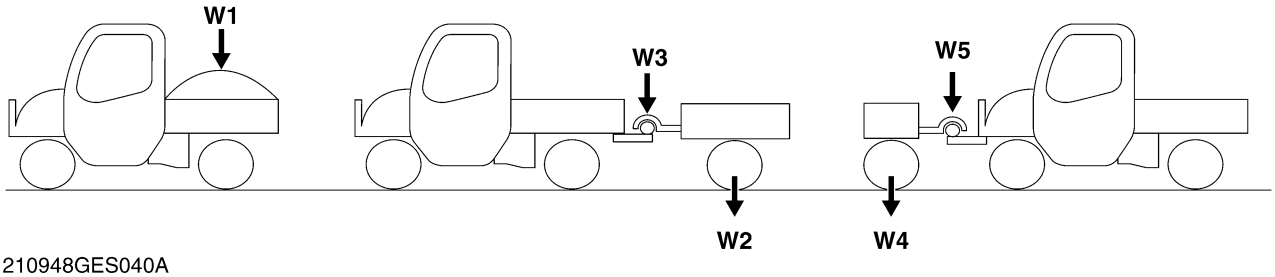
9Y1210948GEG0101US0

[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)



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[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	500kg (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

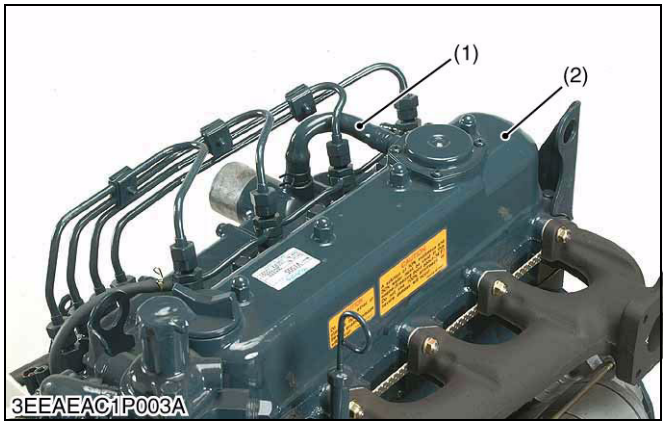
1 ENGINE

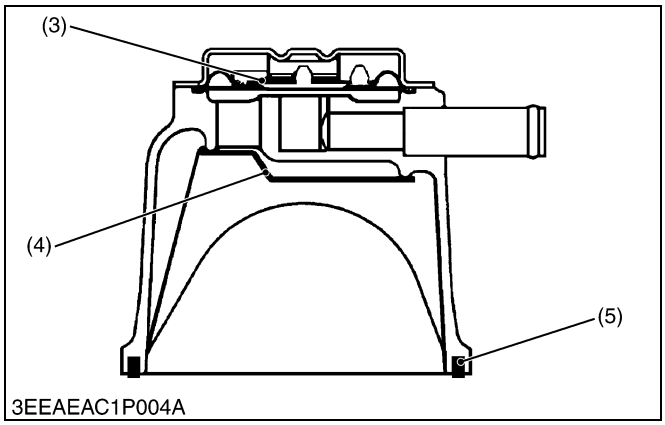
MECHANISM

CONTENTS

1. ENGINE BODY

[1] 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 in fed back to the intake manifold through breather valve (3) to be used for re-combustion.

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

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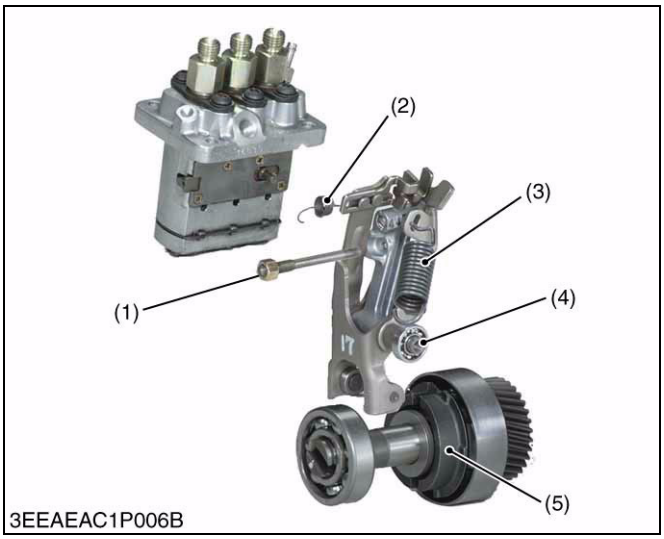
[2] GOVERNOR



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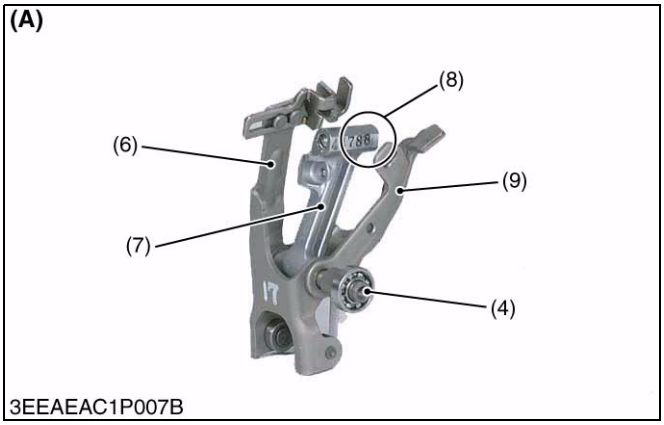

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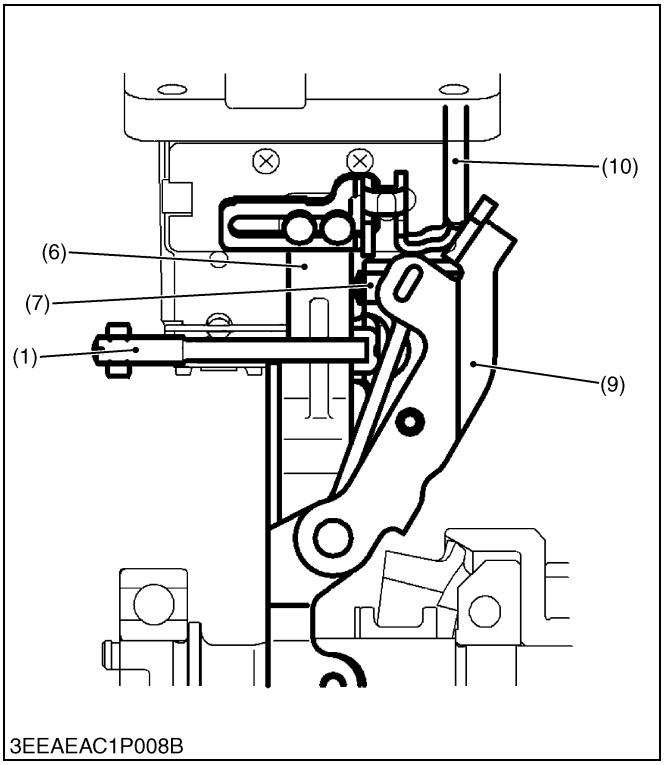

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Three Lever Type Fork Lever (for standard type)

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

(A) Fork Lever Assembly

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(At Rated Operation)

When the engine is running, 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
(6) Fork Lever 1
(7) Floating Lever
(9) Fork Lever 2
(10) Fuel Limitation Bolt

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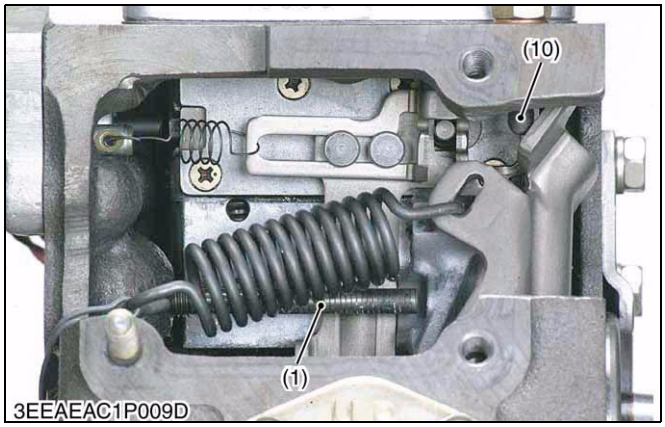

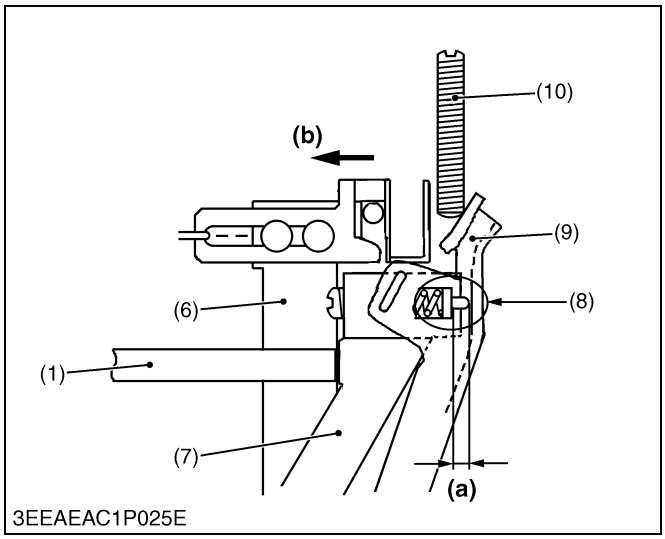

(Overloaded Operation)

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

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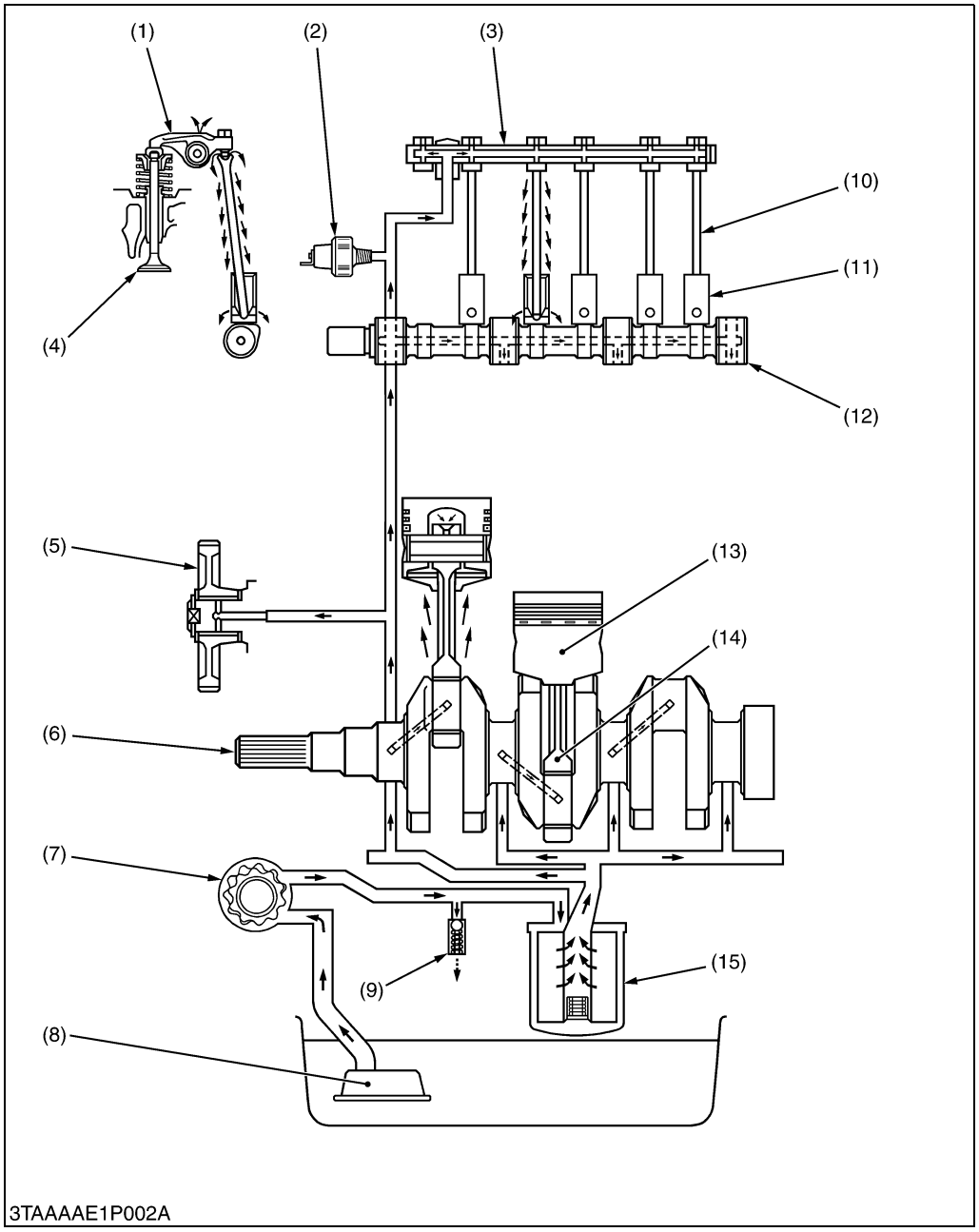
2. LUBRICATING SYSTEM



3TAAAAE1P002A

(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

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.

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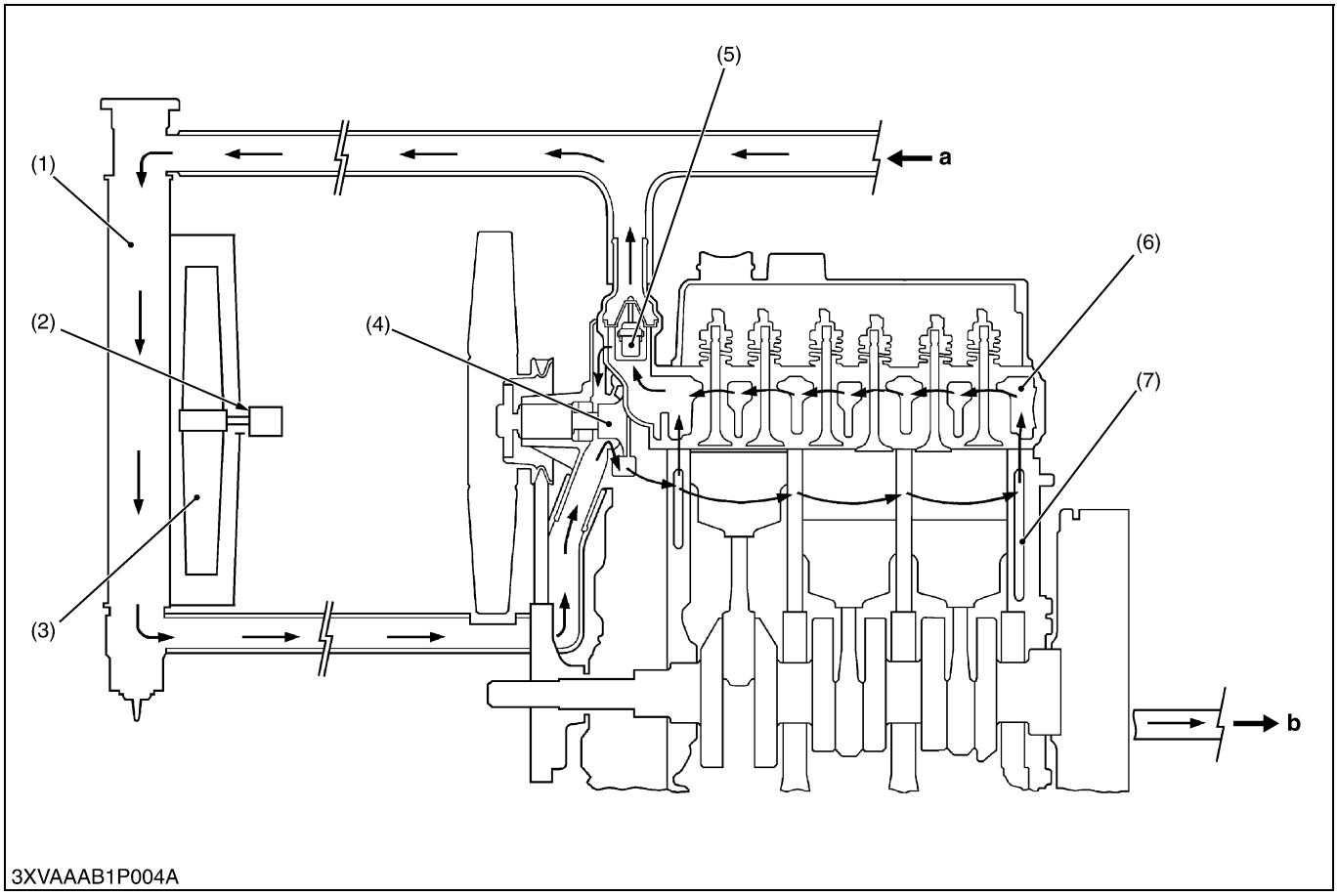
3. COOLING SYSTEM



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(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.

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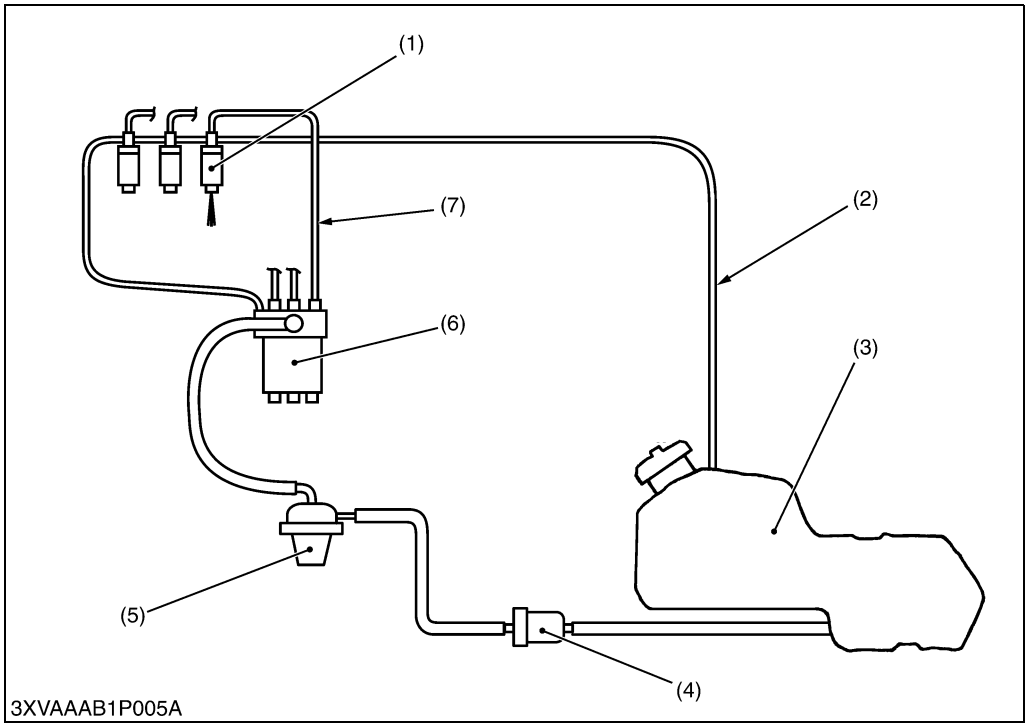
4. FUEL SYSTEM



(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 (5), and then enters the injection pump (8) after impurities such as dirt, water, etc. are removed.

The fuel pressurized by the injection pump to the opening pressure (13.73 to 14.71 MPa, 140 to 150 kgf/cm^2, 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.

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SERVICING

CONTENTS

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-56
	Water in the fuel system	Change fuel and repair or replace fuel system	G-37
	Fuel pipe clogged	Clean	G-37
	Fuel filter clogged	Change	G-37
	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-S34
	Incorrect injection timing	Adjust	1-S18
	Fuel camshaft worn	Replace	1-S40
	Injection nozzle clogged	Repair or replace	1-S14
	Injection pump malfunctioning	Replace	1-S39
	Seizure of crankshaft, camshaft, piston, cylinder or bearing	Replace	1-S41, 1-S43
	Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	1-S11, 1-S36
	Improper valve timing	Correct or replace timing gear	1-S40
	Piston ring and cylinder worn	Replace	1-S42, 1-S61
	Excessive valve clearance	Adjust	1-S12
	Engine stop solenoid malfunctioning	Replace	8-S13
Starter Does Not Run	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-37
	Air cleaner clogged	Clean or replace	G-38
	Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	1-S34
	Injection pump malfunctioning	Replace	1-S19, 1-S39
	Incorrect nozzle injection pressure	Adjust	1-S14
	Injection nozzle stuck or clogged	Repair or replace	1-S14
	Governor malfunctioning	Repair	1-S39

Symptom	Probable Cause	Solution	Reference Page
Either White or Blue Exhaust Gas Is Observed	Excessive engine oil	Reduce to specified level	G-19, G-24
	Piston ring and cylinder worn or stuck	Repair or replace	1-S41, 1-S42, 1-S55, 1-S56, 1-S61
	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-37
	Air cleaner clogged	Clean or replace	G-38
	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-S39
	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-S34, 1-S36
	Air cleaner dirty or clogged	Clean or replace	G-38
Excessive Lubricant Oil Consumption	Piston ring's gap facing the same direction	Shift ring gap direction	1-S41
	Oil ring worn or stuck	Replace	1-S42
	Piston ring groove worn	Replace piston	1-S56
	Valve stem and valve guide worn	Replace	1-S37, 1-S46, 1-S47
	Crankshaft bearing and crank pin bearing worn	replace	1-S44
	Oil leaking due to damaged seals or packing	Replace	1-S36, 1-S37
Fuel Mixed into Lubricant Oil	Injection pump's plunger worn	Replace injection pump	1-S19, 1-S39
	Deficient nozzle injection	Repair or replace nozzle	1-S14
	Injection pump broken	Replace	1-S39
Water Mixed into Lubricant Oil	Head gasket damaged	Replace	1-S36
	Cylinder block or cylinder head flawed	Replace	1-S36, 1-S45, 1-S46

Symptom	Probable Cause	Solution	Reference Page
Low Oil Pressure	Engine oil insufficient	Fill	G-19, G-24
	Oil strainer clogged	Clean	1-S37
	Oil filter clogged	Replace	G-25
	Relief valve stuck with dirt	Clean	–
	Relief valve spring weaken or broken	Replace	–
	Excessive oil clearance of crankshaft bearing	Replace	1-S58, 1-S59
	Excessive oil clearance of crankpin bearing	Replace	1-S57
	Excessive oil clearance of rocker arm	Replace	1-S35, 1-S49
	Oil passage clogged	Clean	–
	Different type of oil	Use specified type of oil	G-8, G-10, G-11
	Oil pump damaged	Replace	1-S62
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-19, G-24
	Fan belt broken or tensioned improperly	Replace or adjust	1-S16
	Coolant insufficient	Fill	G-20, G-53
	Radiator net and radiator fin clogged with dust	Clean	G-20
	Inside of radiator corroded	Clean or replace	G-53
	Coolant flow route corroded	Clean or replace	G-44
	Radiator cap damaged	Replace	1-S17
	Radiator hose damaged	Replace	G-44
	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-S36
	Incorrect injection timing	Adjust	1-S18
	Unsuitable fuel used	Use specified fuel	G-10, G-11

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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.
• Valve Stem	O.D.	6.960 to 6.975 mm 0.2741 to 0.2746 in.	–
• Valve Guide	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.

KiSC issued 12, 2013 A

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	Clearance	0.020 to 0.054 mm 0.00079 to 0.0021 in.	0.10 mm 0.0039 in.
• Idle Gear Shaft 1	O.D.	25.967 to 25.980 mm 1.0224 to 1.0228 in.	–
• Idle Gear Bushing	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	Clearance	0.014 to 0.038 mm 0.00056 to 0.0014 in.	0.15 mm 0.0059 in.
• Piston Pin	O.D.	22.002 to 22.011 mm 0.86622 to 0.86657 in.	–
• Small End Bushing	I.D.	22.025 to 22.040 mm 0.86713 to 0.86771 in.	–
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	Clearance	0.0850 to 0.122 mm 0.00335 to 0.00480 in.	0.2 mm 0.008 in.
• Oil Ring	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	Oil Clearance	0.029 to 0.091 mm 0.0012 to 0.0035 in.	0.20 mm 0.0079 in.
• Crankpin	O.D.	39.959 to 39.975 mm 1.5732 to 1.5738 in.	–
• Crankpin Bearing	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.

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[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.	–

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[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

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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-12.)

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
Mission frame mounting bolt and nut	77.5 to 90.2	7.90 to 9.20	57.2 to 66.5

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[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

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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.**

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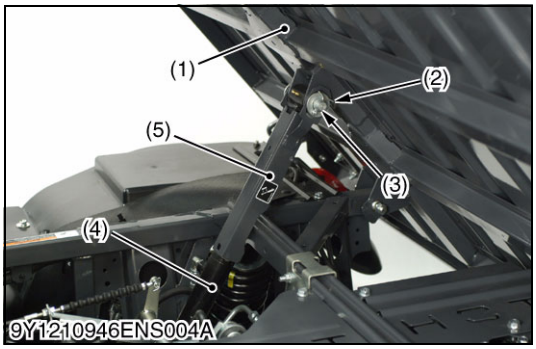
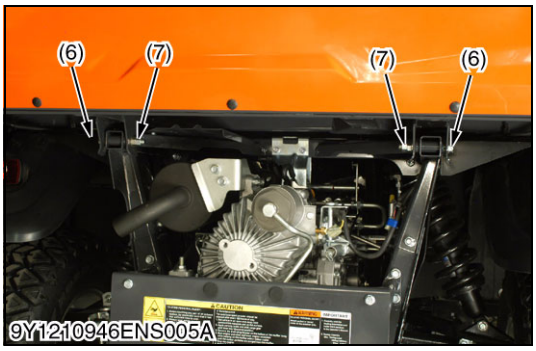
(1) Engine Body





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
(2) Cotter Pin
(3) Clevis Pin
(4) Hydraulic Cylinder
(5) Cylinder Lock
(6) Bolt
(7) Lock Nut

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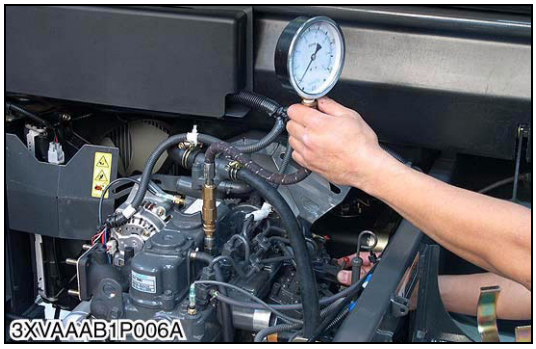

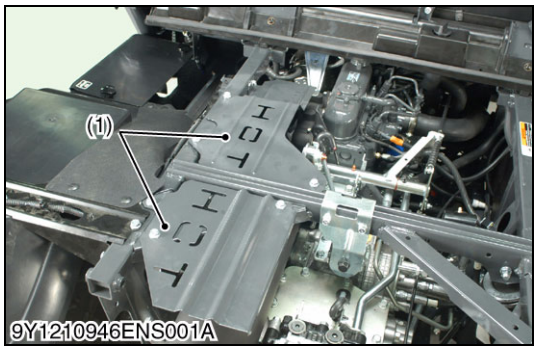

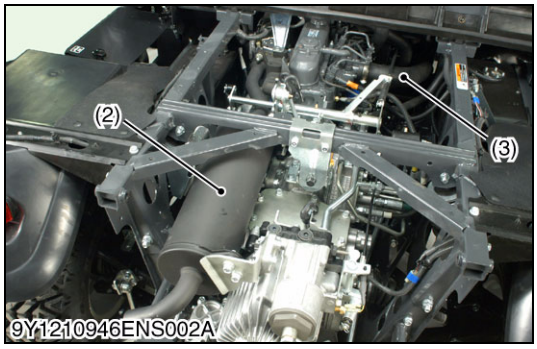

Compression Pressure

CAUTION

- **Work by two people when you measure pressure.**

1. Run the engine until it is warmed up.
2. Stop the engine.
3. Remove the muffler 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), run 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) Muffler Cover
(3) Muffler
(3) Air Cleaner Hose

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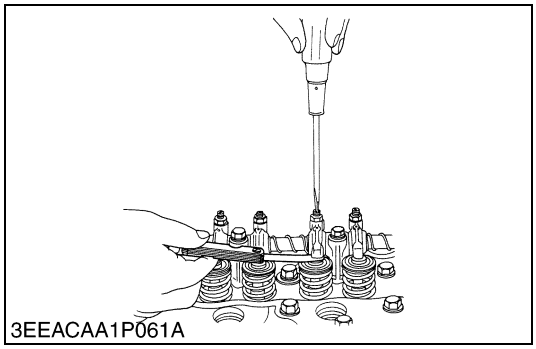
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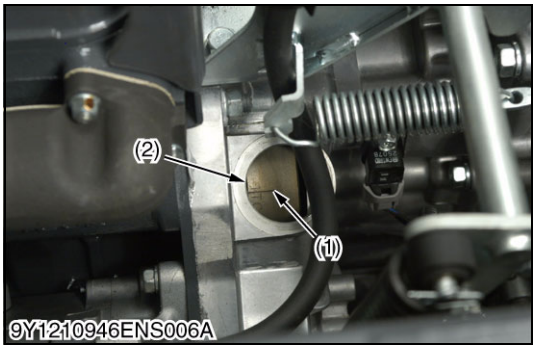

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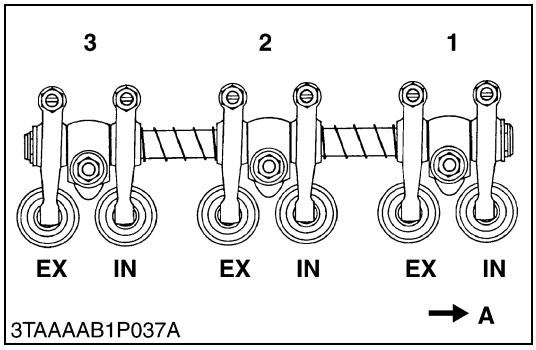

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Valve Clearance

■ **IMPORTANT**

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

1. Remove the 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.**

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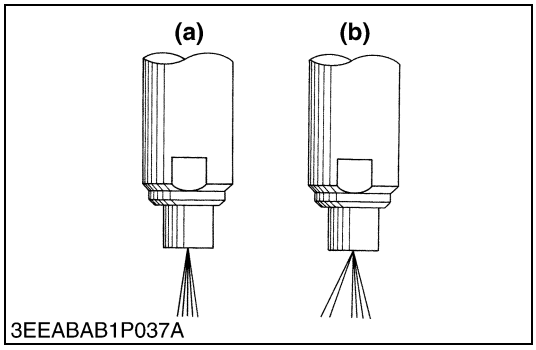

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Nozzle Spraying Condition

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**

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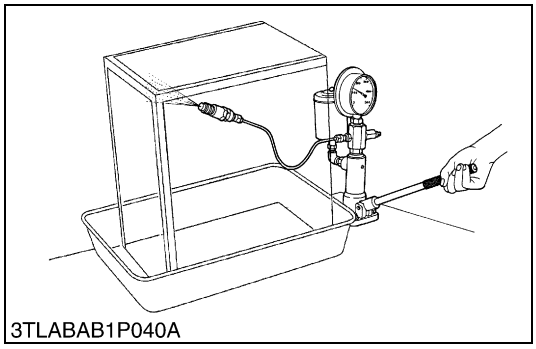
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Fuel Injection Pressure

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/cm^2, 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

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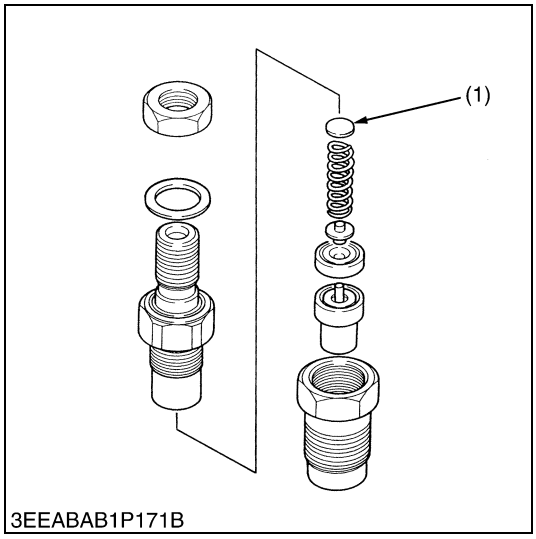

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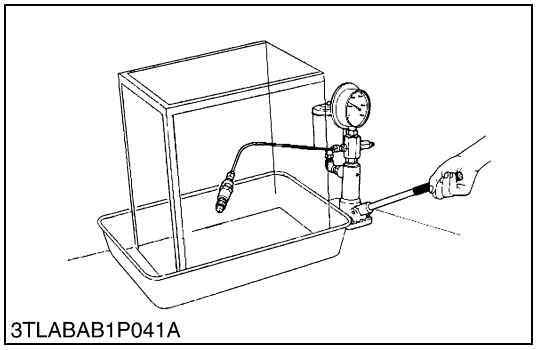
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Nozzle Valve Seat Tightness

1. Set the injection nozzle to a nozzle tester.
2. Raise the fuel pressure, and keep at 12.75 MPa (130.0 kgf/cm^2, 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

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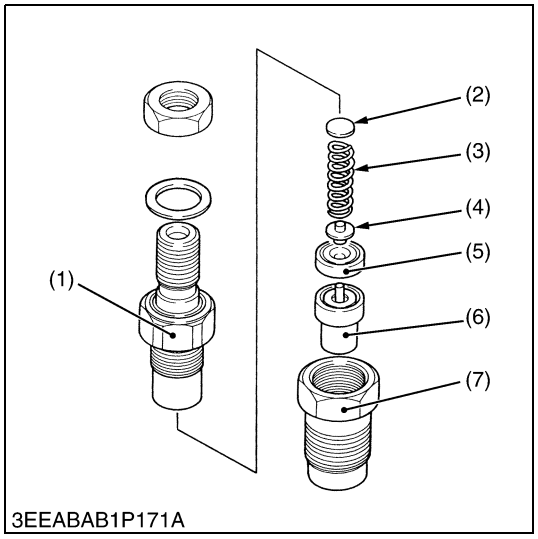

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Nozzle Holder

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

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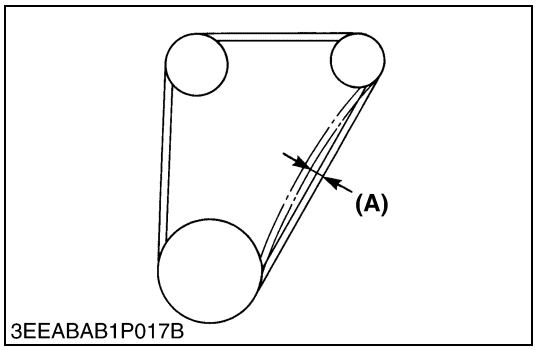
(3) Cooling System



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Fan Belt Tension

1. Measure the deflection **(A)**, depressing the belt halfway between the fan drive pulley and alternator pulley at specified force 98 N (10 kgf, 22 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

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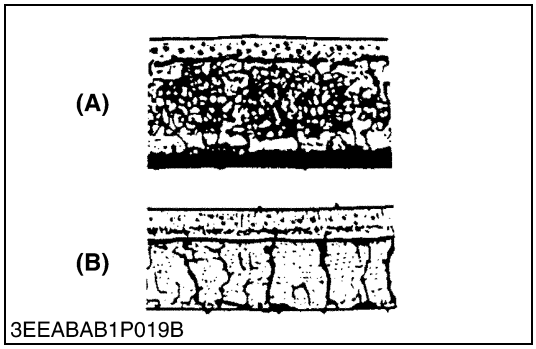

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Fan Belt Damage and Wear

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

(A) Good **(B) Bad**

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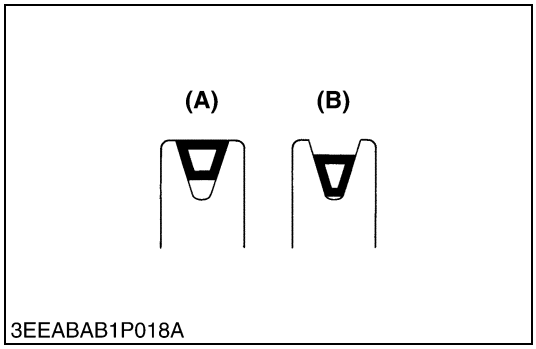

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CAUTION

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

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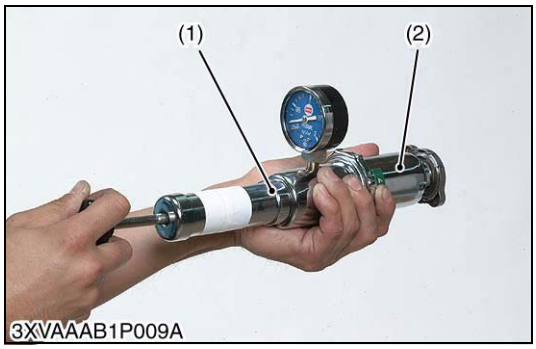

Radiator Cap Air Leakage

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

Pressure falling time	Factory 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

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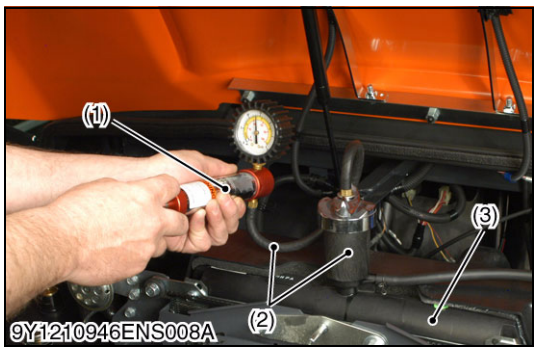

Radiator Water Leakage

1. Pour a specified amount of water into the radiator.
2. Set a radiator tester (1) and an adapter (2) and raise the water pressure to the specified pressure.
3. Check the radiator for water leaks.
4. 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

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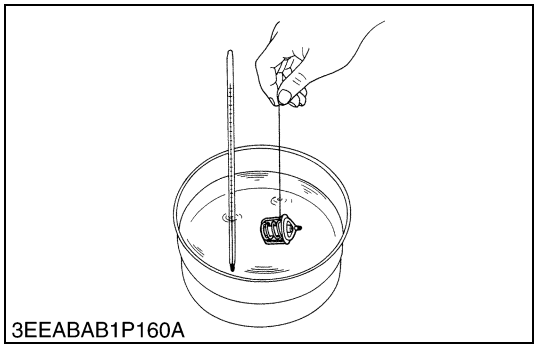

Thermostat Valve Opening Temperature

1. Suspend the thermostat in the water by a string with its end inserted between the valve and seat.
2. Heating the water gradually, read the temperature when the valve opens and leaves the string.
3. Continue heating and read the temperature when the valve opens approx. 8.0 mm (0.31 in.).
4. 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

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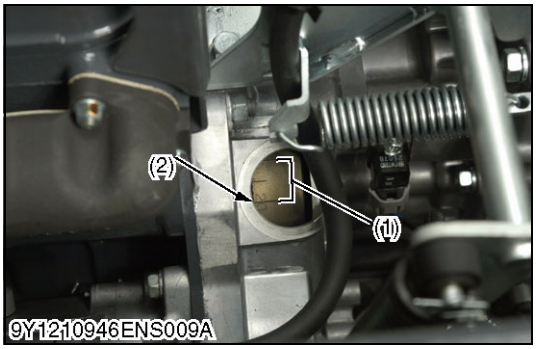
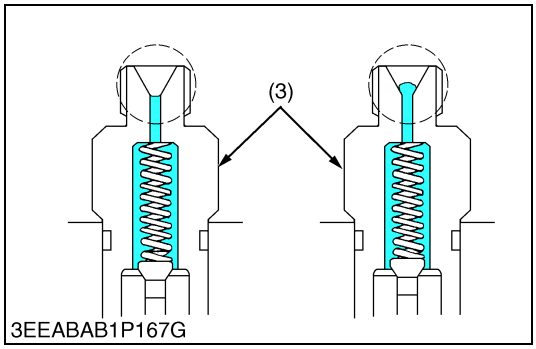
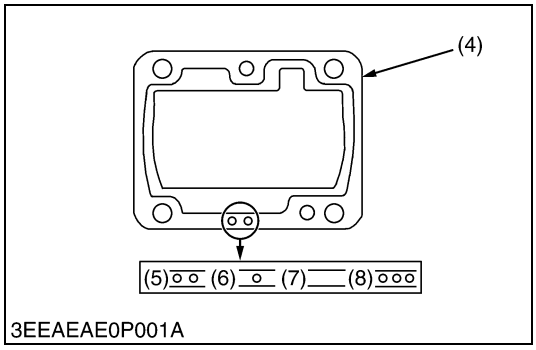
(4) Fuel System







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

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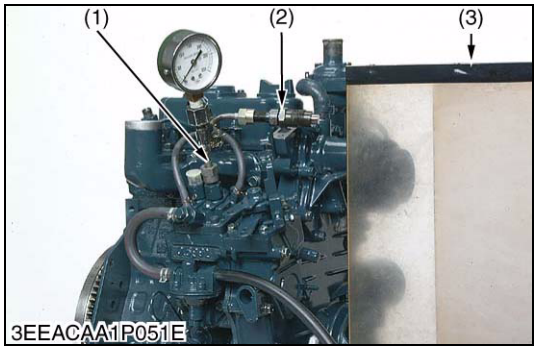

Fuel Tightness of Pump Element

1. Remove the engine stop solenoid.
2. Remove the injection pipes and glow plugs.
3. Install the injection pump pressure tester to the injection pump.
4. 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. Run 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

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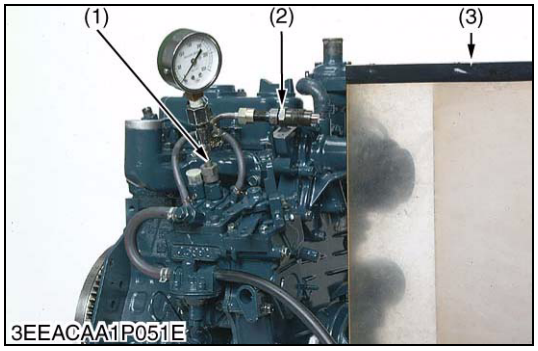


Fuel Tightness of Delivery Valve

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. Run 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/cm^2, 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/cm^2, 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/cm^2, 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**

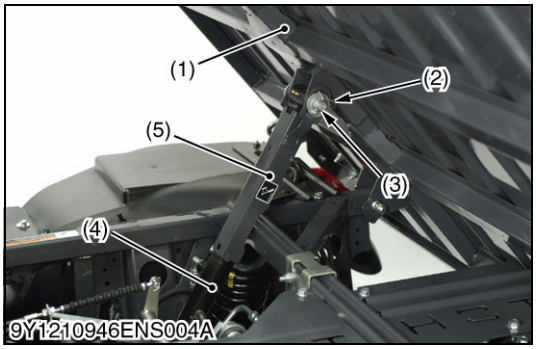
- **Never try to disassemble the injection pump assembly. For repairs, you are strongly requested to contact a KUBOTA-authorized pump service shop.**

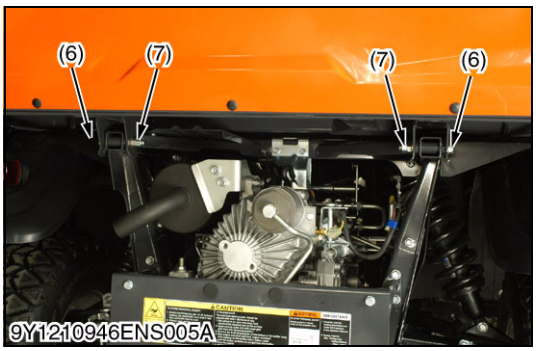
(1) Injection Pump Pressure Tester (3) Protection Cover for Jetted Fuel
(2) Injection Nozzle

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
(2) Cotter Pin
(3) Clevis Pin
(4) Hydraulic Cylinder
(5) Cylinder Lock
(6) Bolt
(7) Lock Nut

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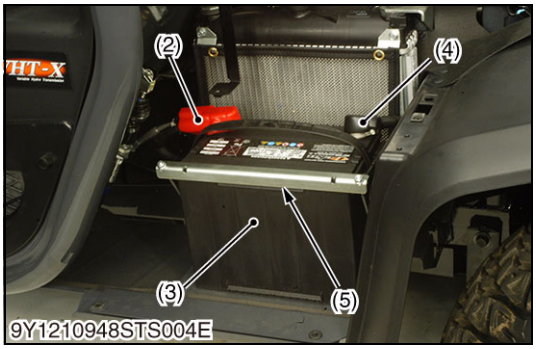

Battery

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
(2) Positive Cable
(3) Battery
(4) Negative Cable
(5) Battery Stay

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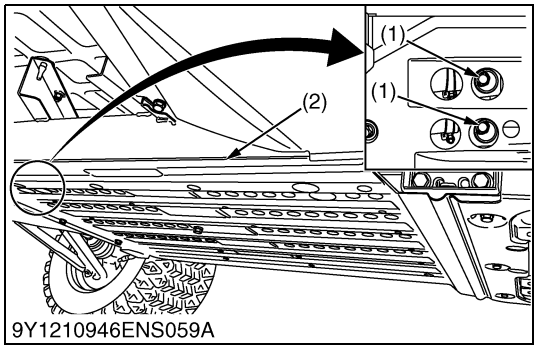

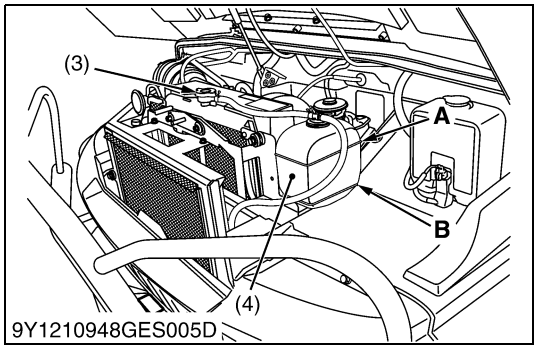

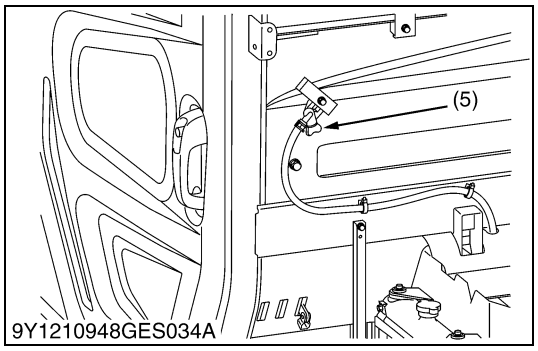

Draining Coolant

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.**

1. Stop the engine and let cool down.
2. Open the hood.
3. 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.
4. 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

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

A: FULL
B: LOW

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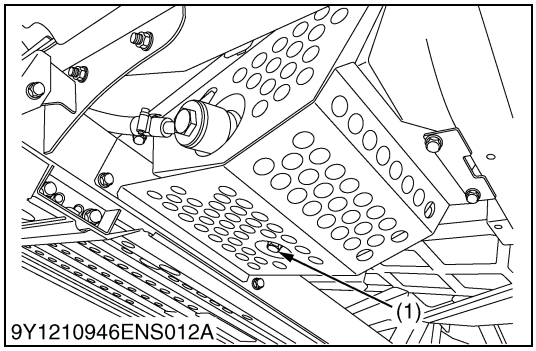

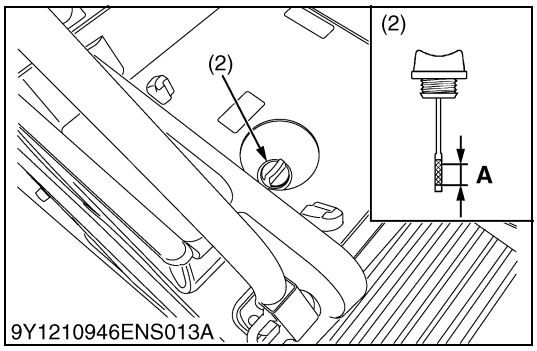

Draining Hydraulic Tank Oil

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.

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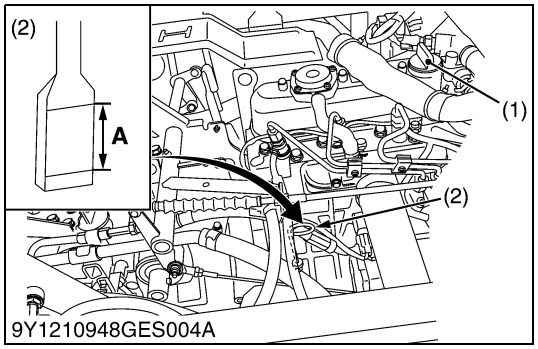

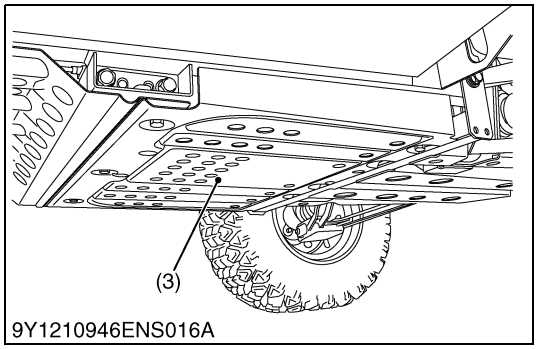

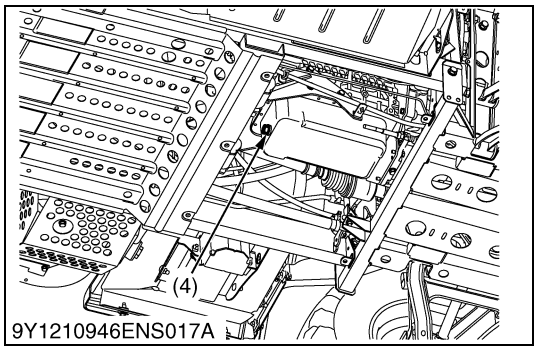

Draining Engine Oil

WARNING

To avoid personal injury:

- **Be sure to stop the engine before changing the oil.**
- **Allow engine to cool down sufficiently, oil can be not 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.

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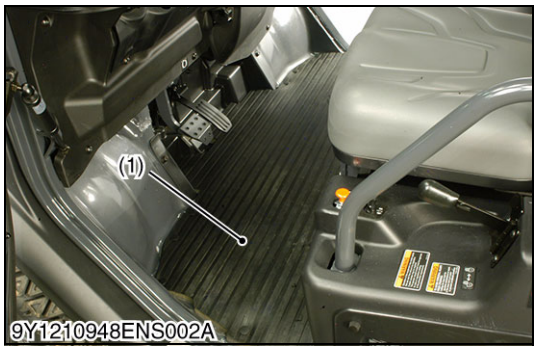

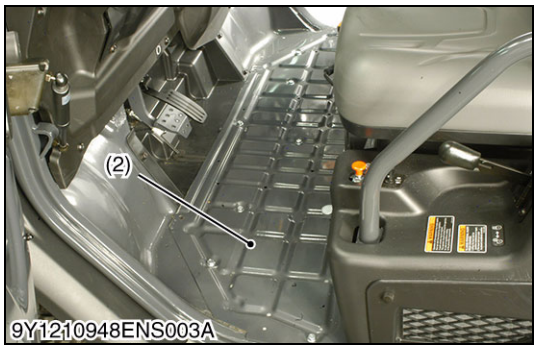

Mat and Center Step

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

(1) Mat
(2) Center Step

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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

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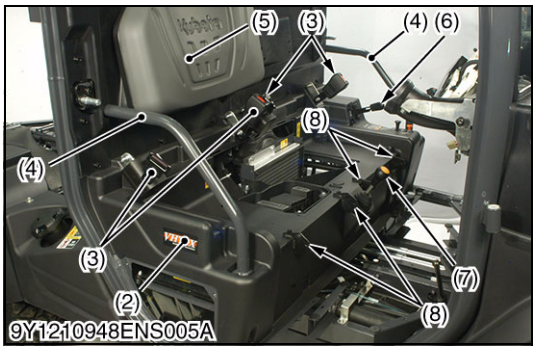

Back Seat, Seat Belt and Center Lower Cover

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 resembling)

- 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

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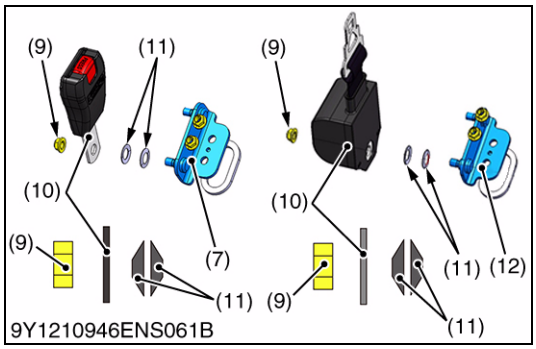

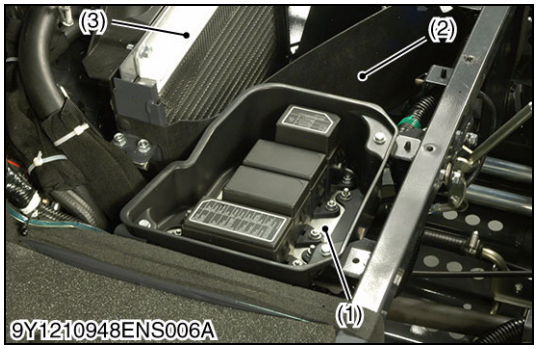

Fuse Box and Oil Cooler

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
(2) Front Oil Cooler Shield
(3) Oil Cooler

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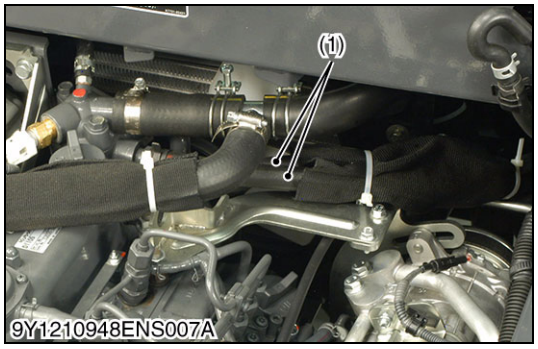

Heater Hoses

■ **NOTE**

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

1. Disconnect the heater hoses (1).

(1) Heater Hose

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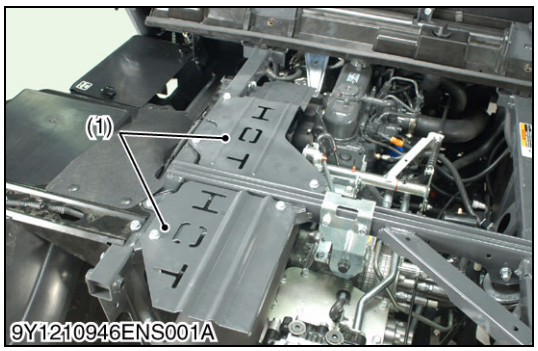

Muffler Cover

1. Remove the muffler cover (1).

(1) Muffler Cover

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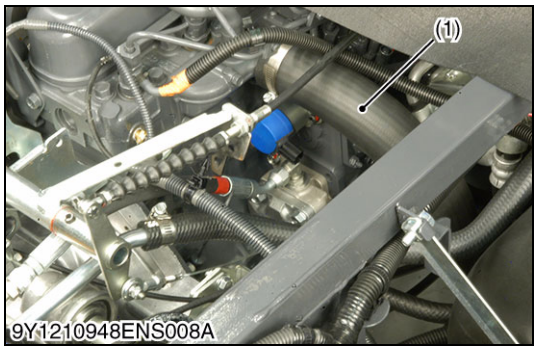

Intake Air Hose

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

(1) Intake Air Hose
(2) Clamp

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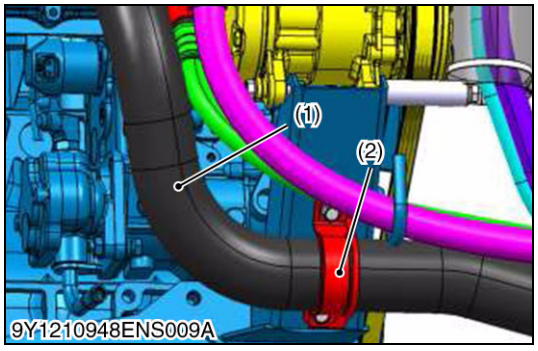

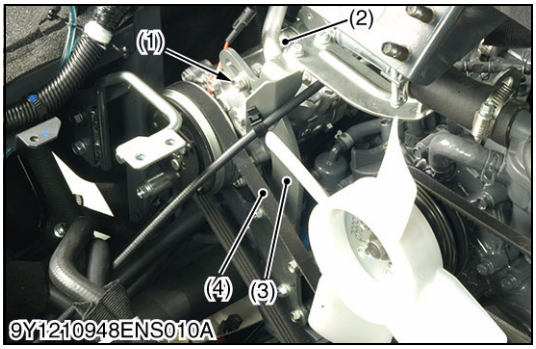

Compressor

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 (3). (See page G-48.)

(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

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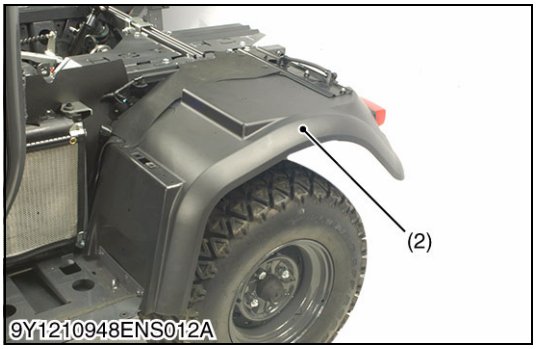

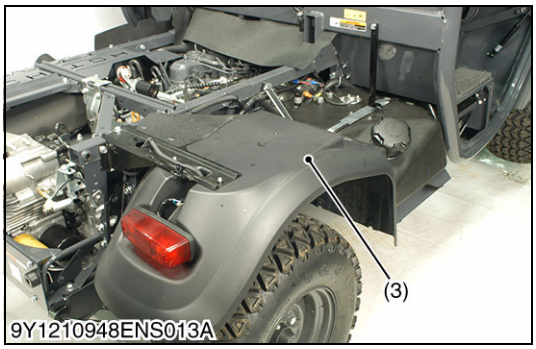

Rear Wheel

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

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Transmission Rear Cover

1. Remove the transmission rear cover (1).

(1) Transmission Rear Cover

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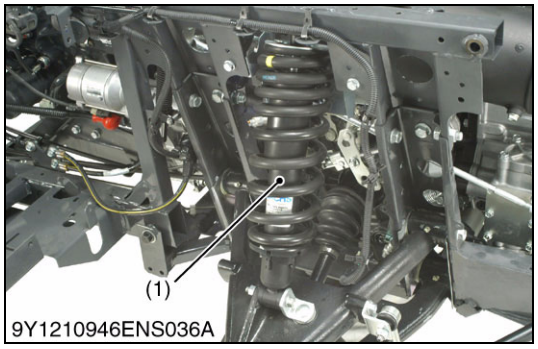

Rear Shock Absorber

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

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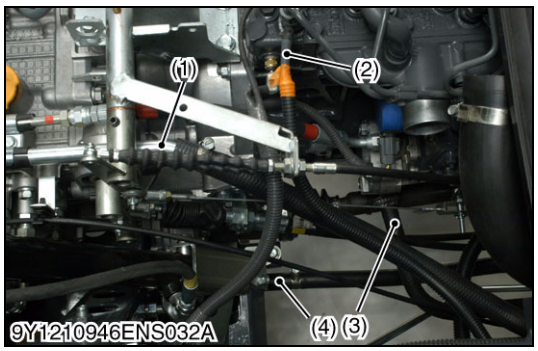

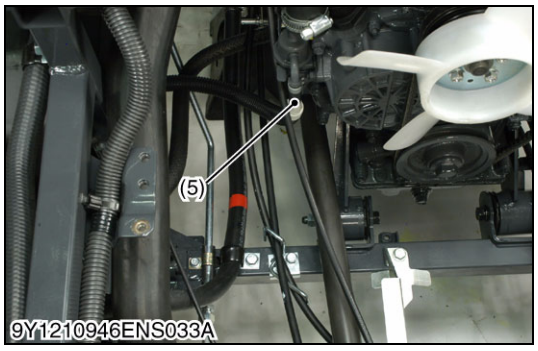

Hoses

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
(2) Fuel Return Hose
(3) Hydraulic Suction Hose
(4) HST Suction Hose
(5) Fuel Suction Hose

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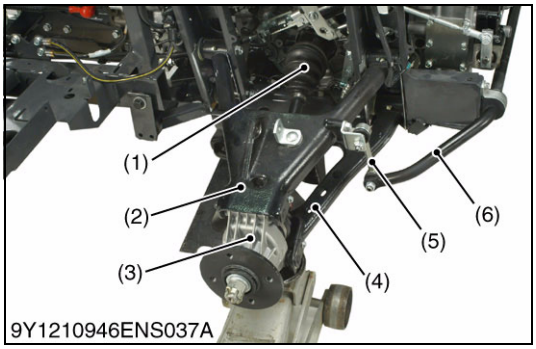


Rear Drive Shaft

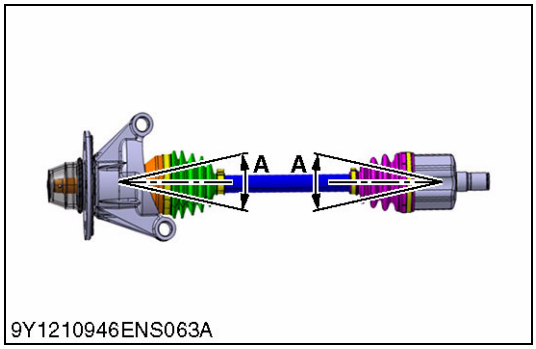
■ **NOTE**

- **Do not exceed the range ±25 ° while handling.**

1. Remove the rear stabilizer (6) and stabilizer linkage (5).
2. Remove the rear arm mounting bolts and nuts.
3. Remove the rear upper arm (2).
4. Remove the rear drive shaft (1) with rear knuckle case (3).
5. Remove the rear lower arm (4).

(When reassembling)

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



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

A: ±25 °

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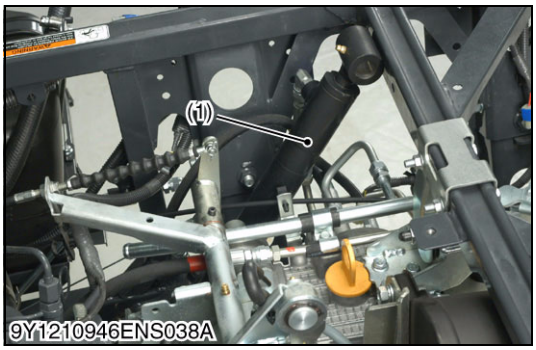

Hydraulic Lift Cylinder

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

(1) Hydraulic Lift Cylinder

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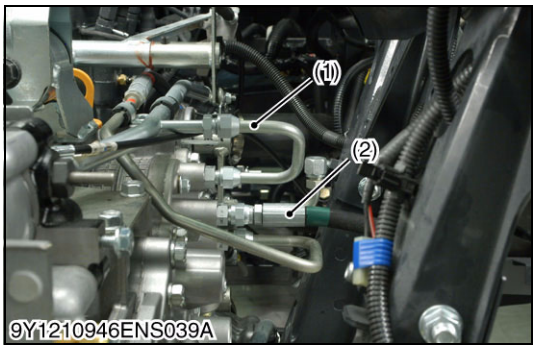

Power Steering Hose and Return Pipe

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

(1) Return Pipe
(2) Power Steering Hose

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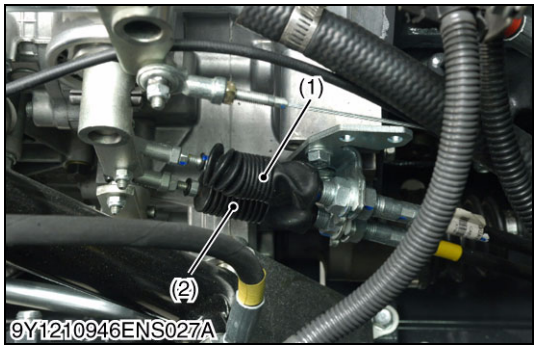

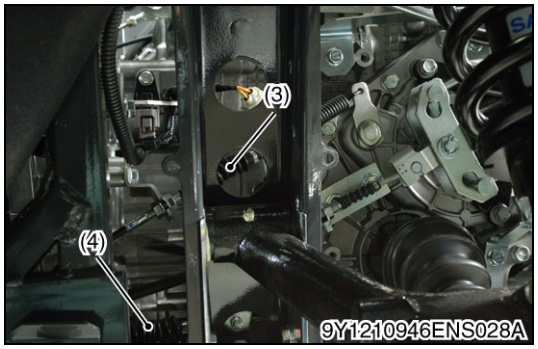

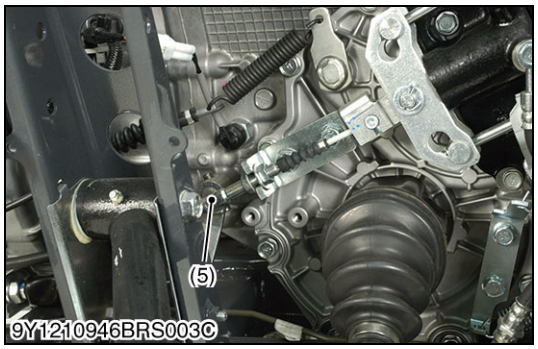

Cables

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-S5.)
- 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
(2) 4WD Shift Cable
(3) Differential Lock Cable
(4) Range Gear Shift Cable
(5) Parking Brake Cable

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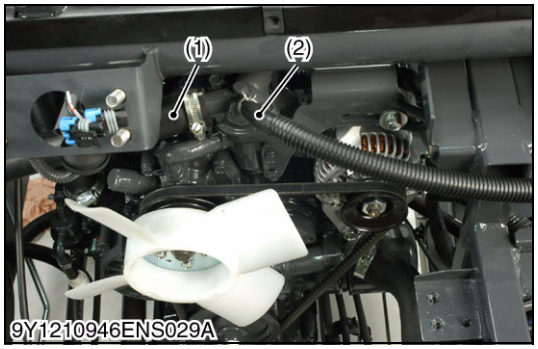

Radiator Hose

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

(1) Radiator Hose
(2) Breather Hose

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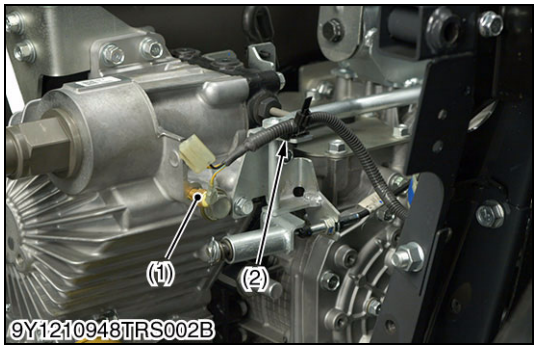

Unload Cable Linkage

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

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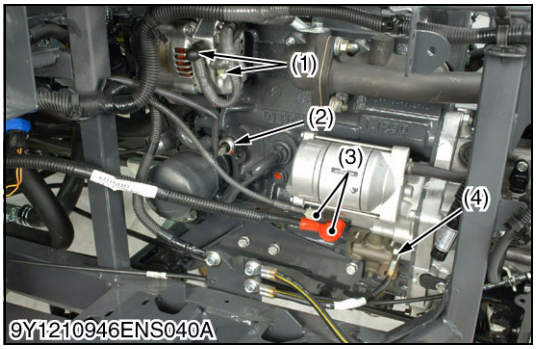

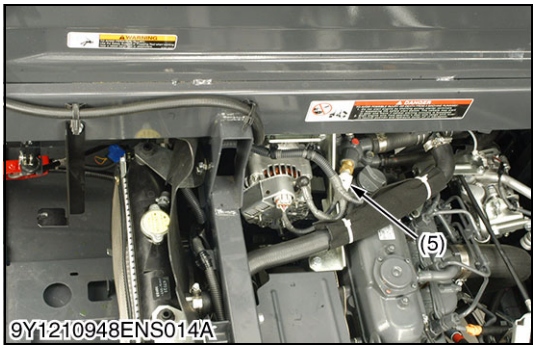

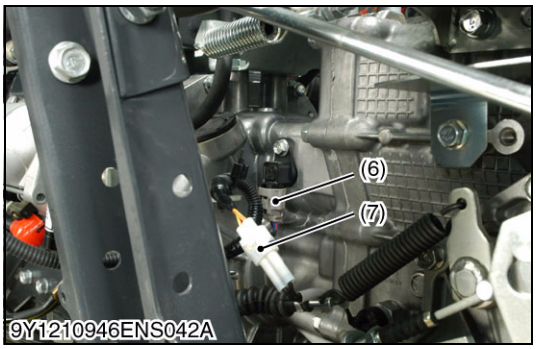

Wiring Harness LH

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

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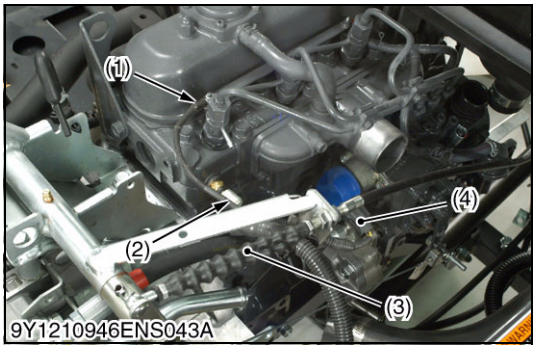

Wiring Harness RH and Speed Control Panel Cable

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
(2) Thermo Sensor Connector
(3) Speed Control Pedal Cable
(4) Engine Stop Solenoid Connector

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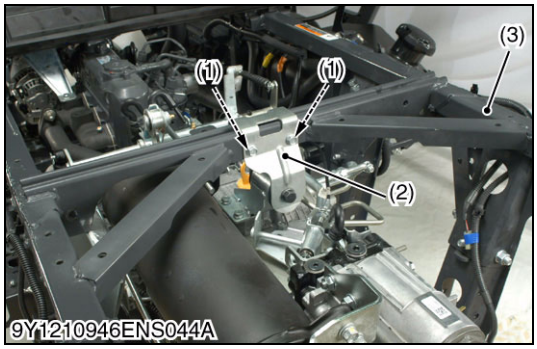

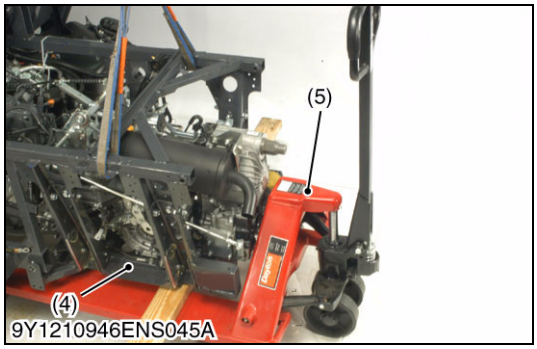

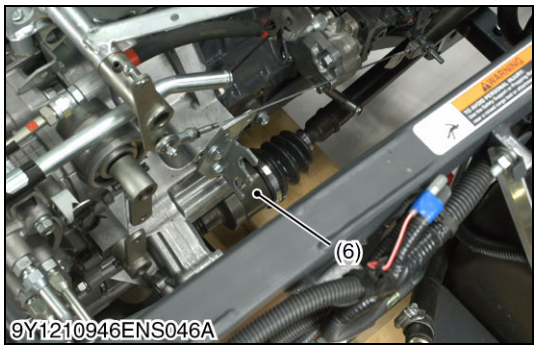

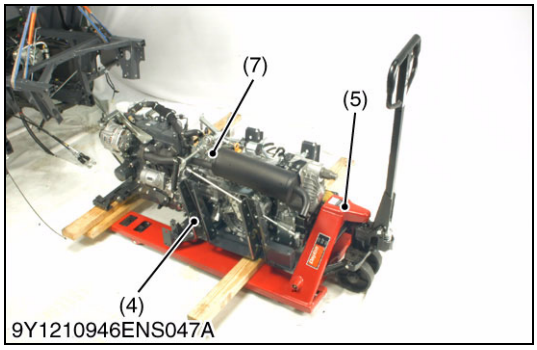

Dismounting Transmission and Engine One Piece Assembly

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

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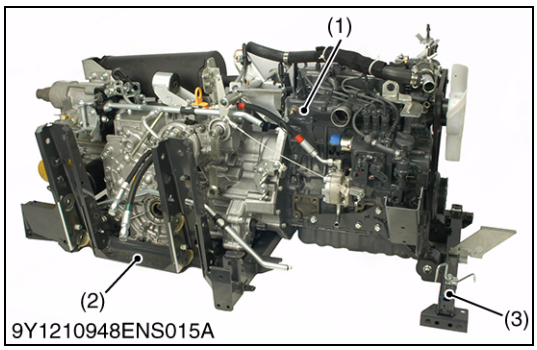

Mission Frame

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

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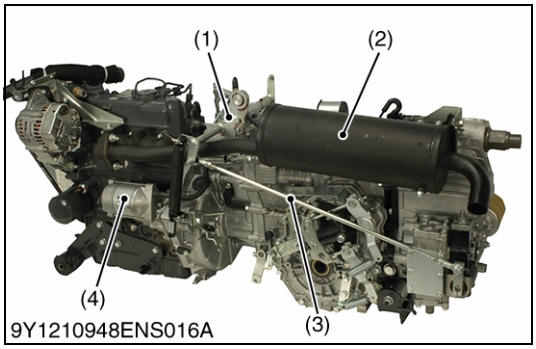
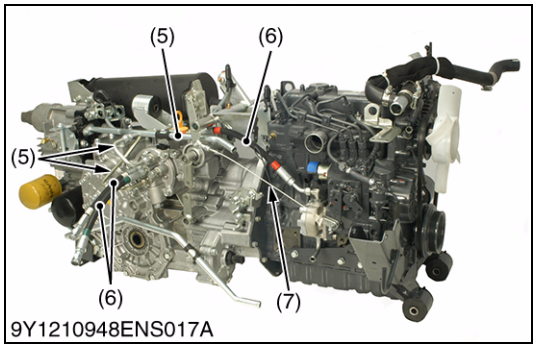
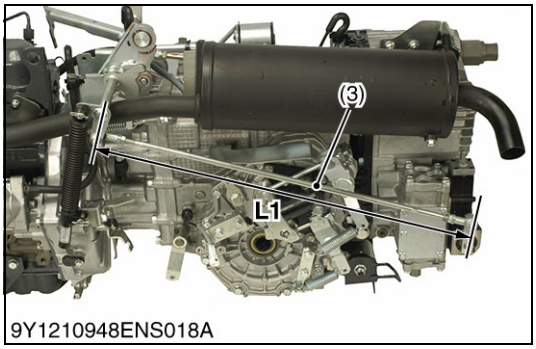
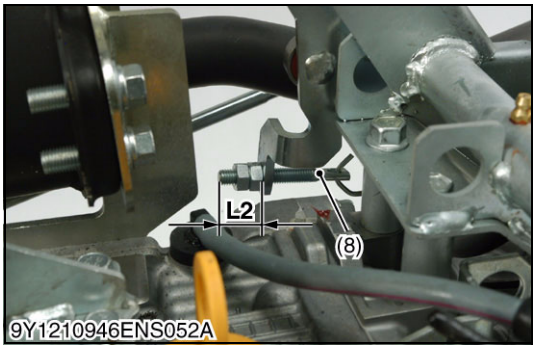
(2) Separating Transmission Engine









Linkage, Muffler, 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 muffler (2).
5. Remove the starter (4).
6. Remove the hydraulic hose (6) and hydraulic pipes (5).

(When reassembling)

- Adjust the length the HST rod (3).
- Replace the muffler gasket with new one.

(1) HST Linkage
(2) Muffler
(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.)

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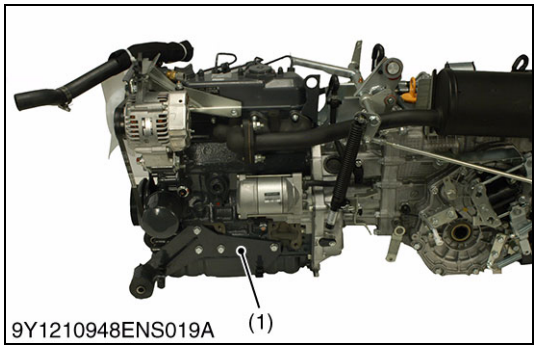

Separate the Transmission and Engine One Piece Assembly

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
(2) Engine
(3) Transmission

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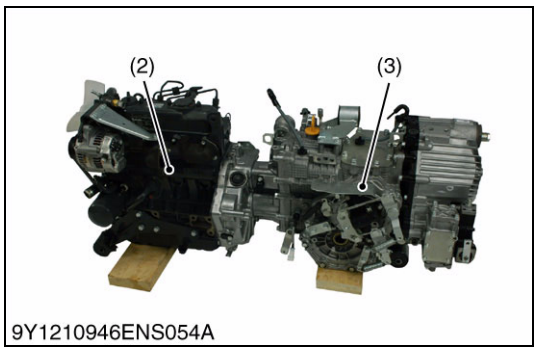
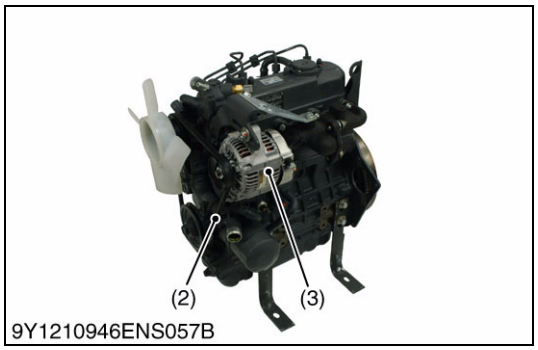


Outer Parts

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-36.)



(1) Input Flange
(2) Fan Belt
(3) Alternator
(4) Engine Stop Solenoid
(5) Hydraulic Pump
(6) Dipstick

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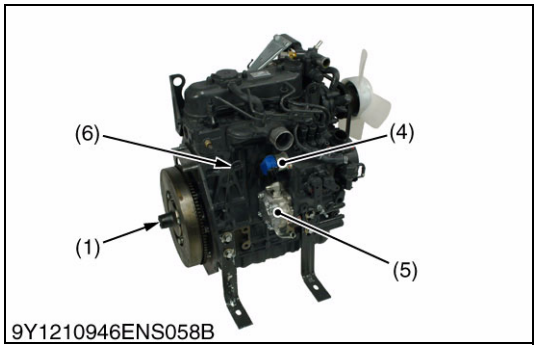
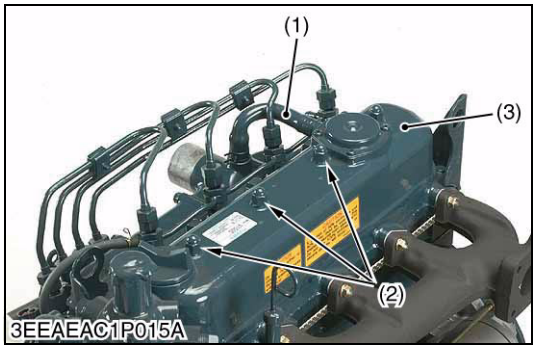


[3] DISASSEMBLING AND ASSEMBLING

(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
(2) Cylinder Head Cover Screw
(3) Cylinder Head Cover

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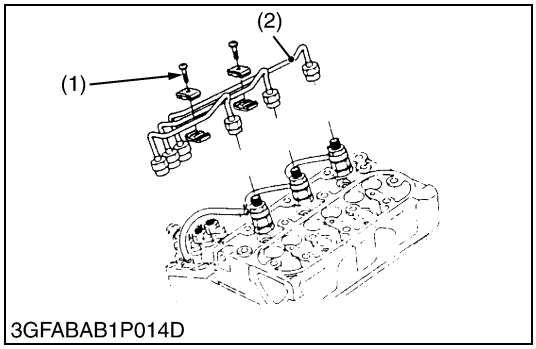

Injection Pipes

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

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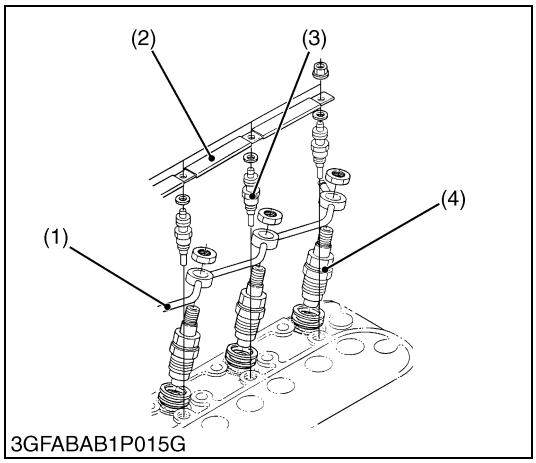

Nozzle Holder Assembly and Glow Plug

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
(2) Lead
(3) Glow Plug
(4) Nozzle Holder Assembly
(5) Copper Gasket
(6) Heat Seal

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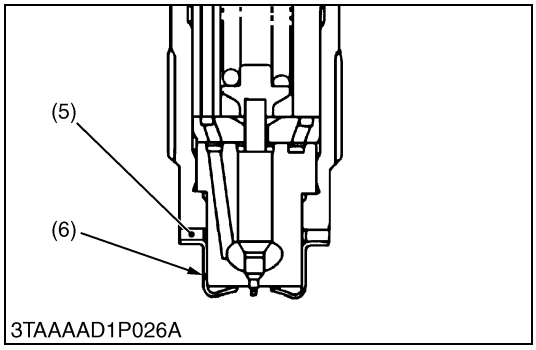

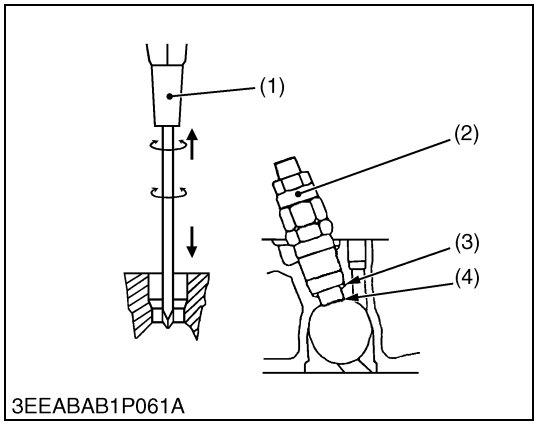

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Nozzle Heat Seal Service Removal Procedure

■ **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

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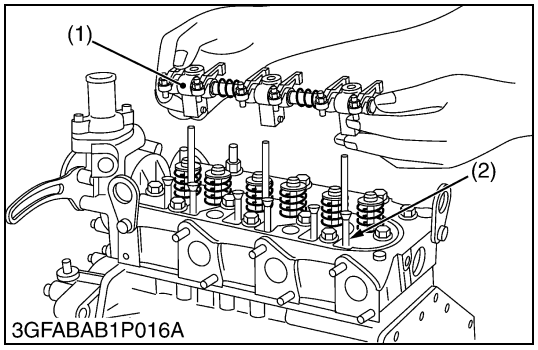

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Rocker Arm and Push Rod

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

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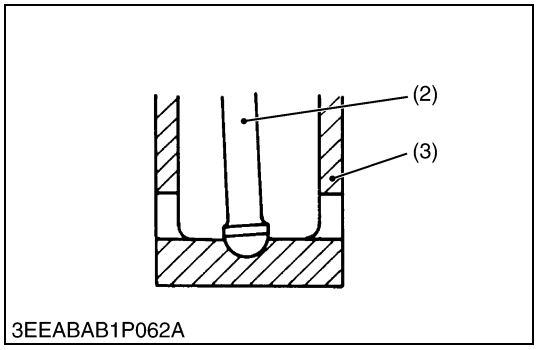

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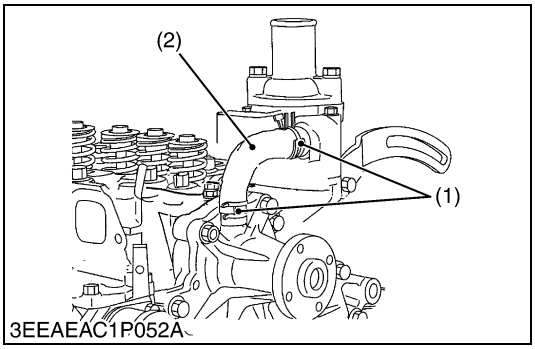

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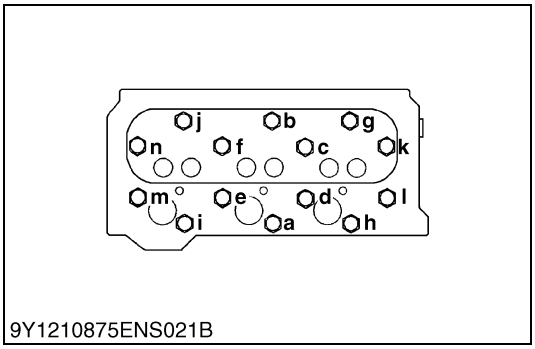

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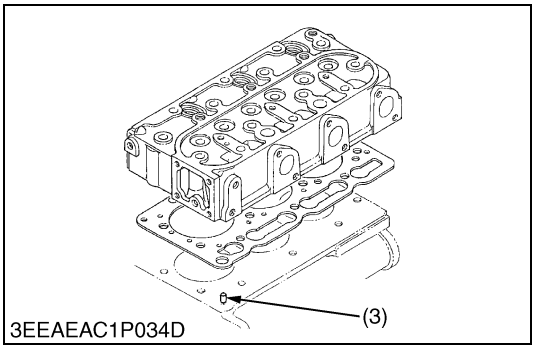

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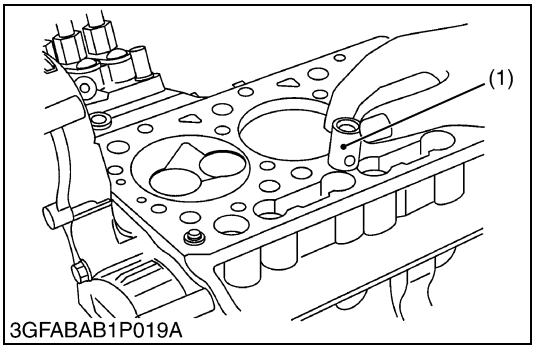

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Cylinder Head and Cylinder Head Gasket

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

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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

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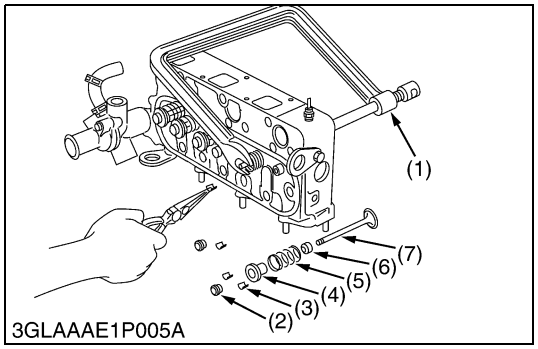

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Valves

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

(When reassembling)

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

■ **IMPORTANT**

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

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

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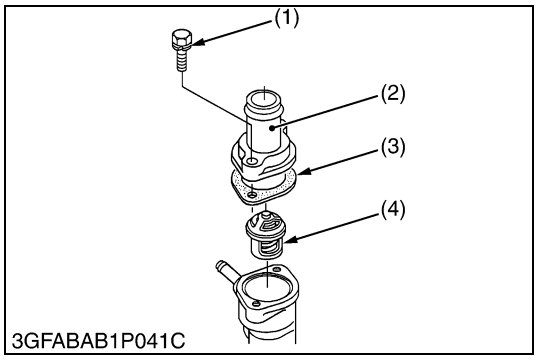

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Thermostat Assembly

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

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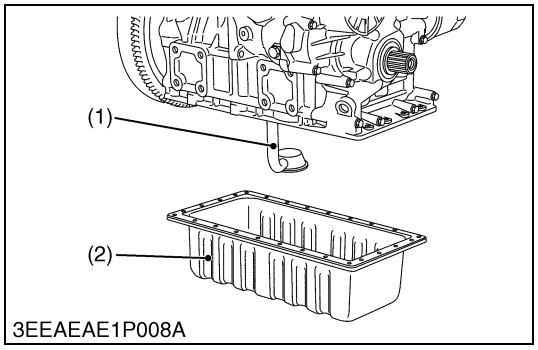
(2) Gear Case and Timing Gears



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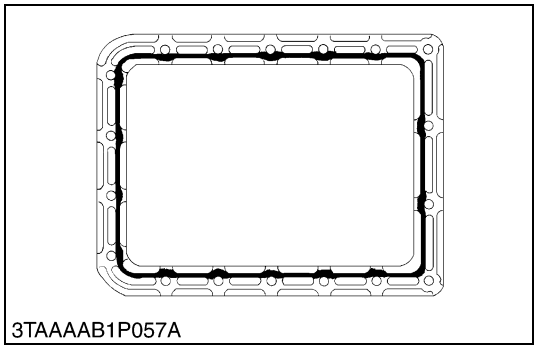
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Oil Pan and Oil Strainer

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 in 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 form 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

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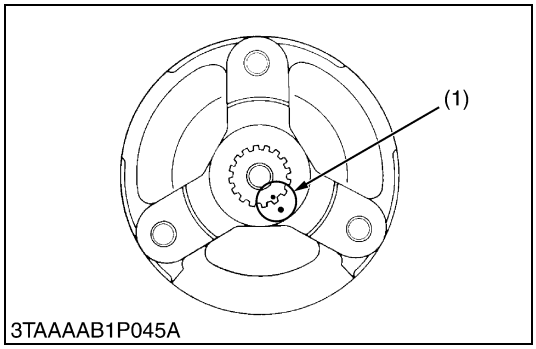

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Fan Drive Pulley

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

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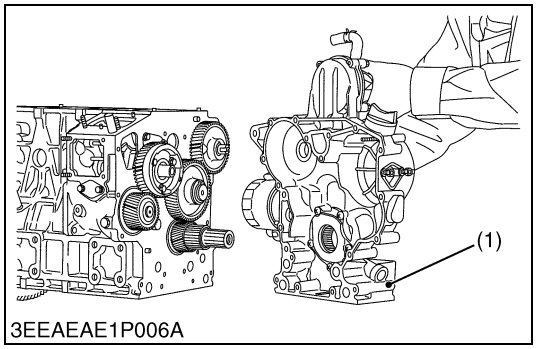

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Gear Case

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

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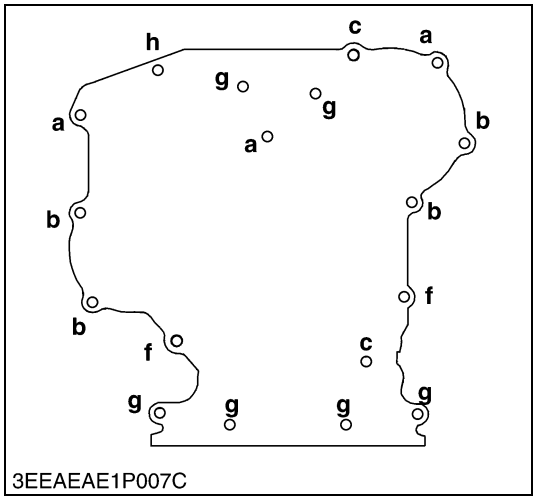

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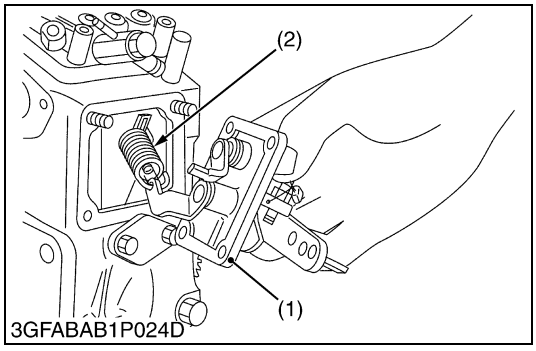

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Speed Control Plate

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

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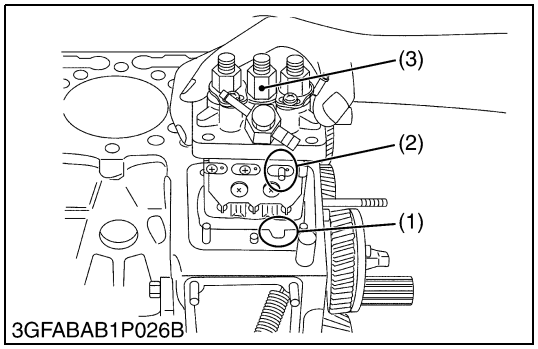

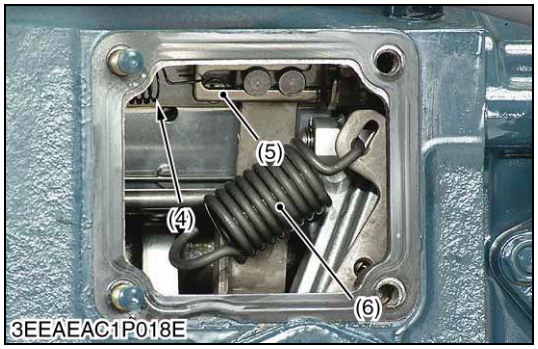

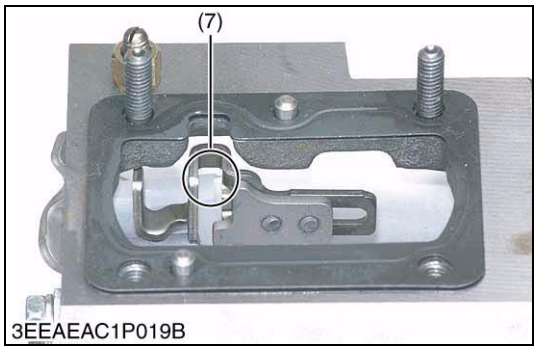

Injection Pump

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

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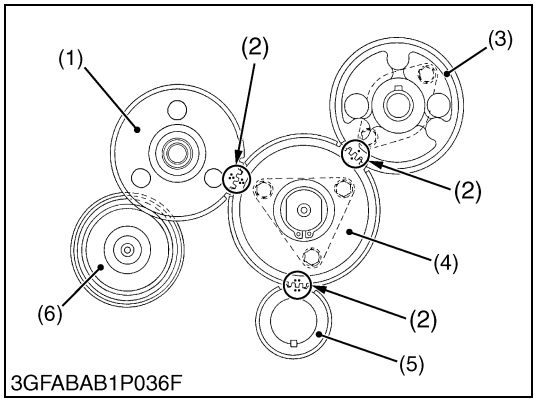

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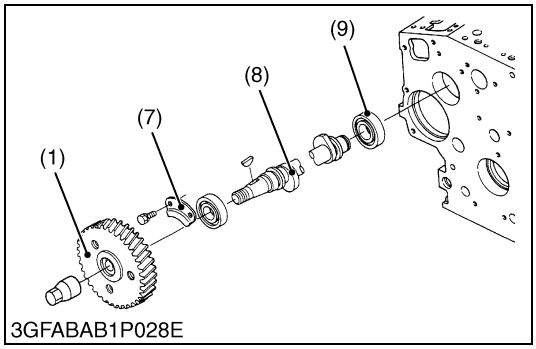

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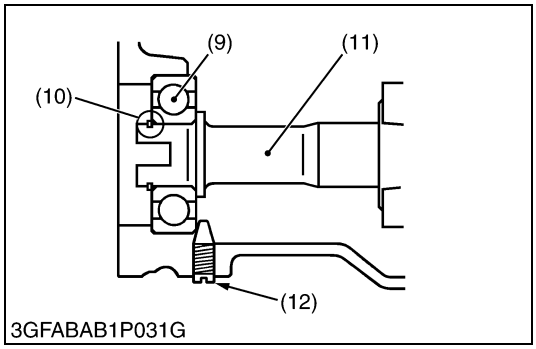

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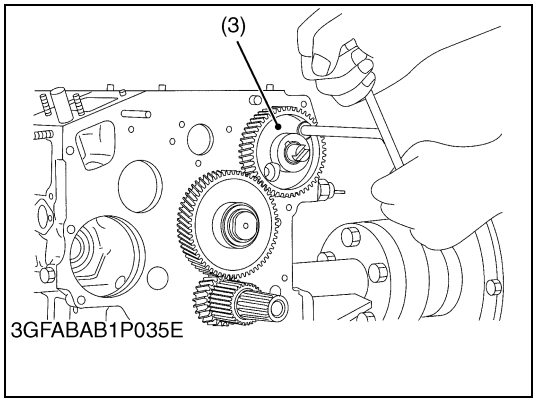

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Cam Gear, Idle Gear 1, 2 and Governor Gear

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

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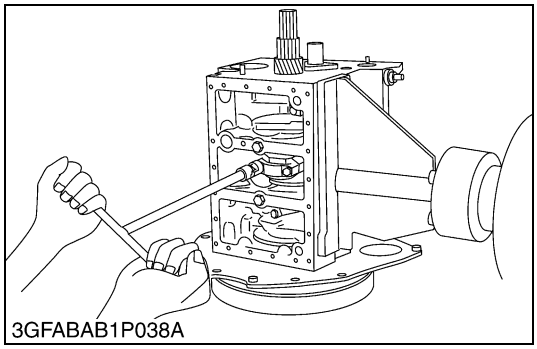
(3) Piston and Connecting Rod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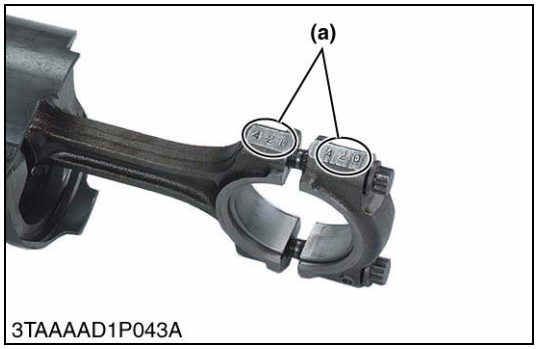

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Connecting Rod

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

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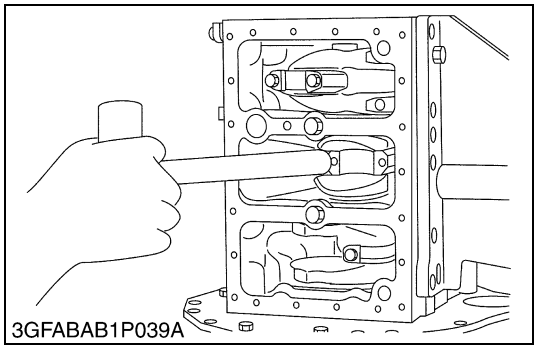
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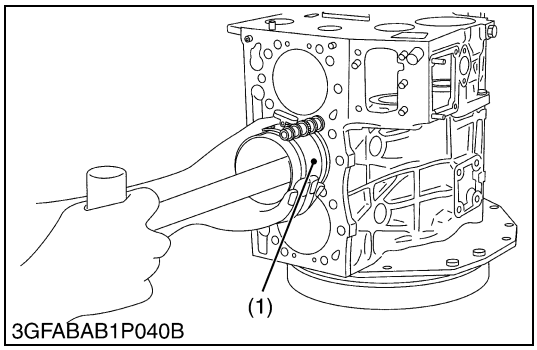

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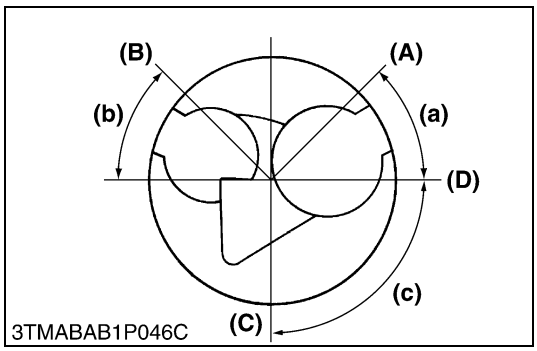

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Pistons

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

(When reassembling)

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

■ **IMPORTANT**

- **Do not change the combination of cylinder and piston. Make sure of the position of each piston by marking. For example, mark "1" on the No.1 piston.**
- **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) Top Ring Gap
(B) Second Ring Gap
(C) Oil Ring Gap
(D) Piston Pin Hole

(a) 0.79 rad (45 °)
(b) 0.79 rad (45 °)
(c) 1.6 rad (90 °)

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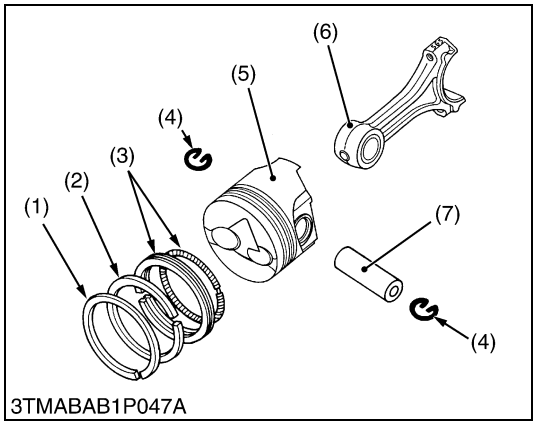

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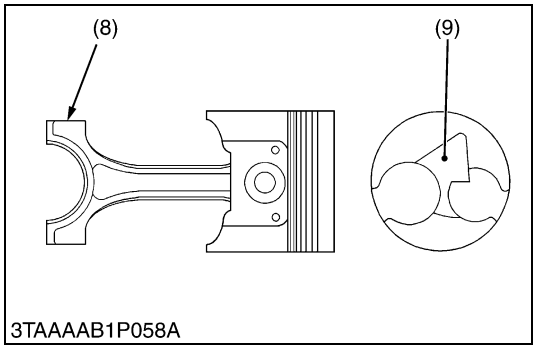

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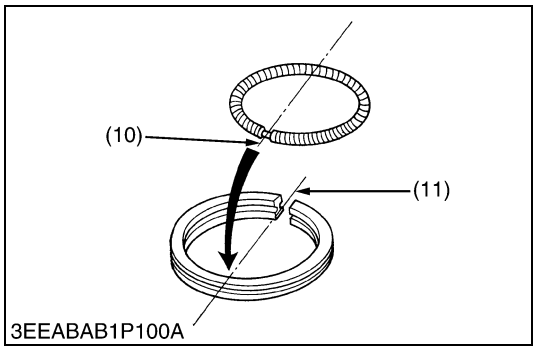

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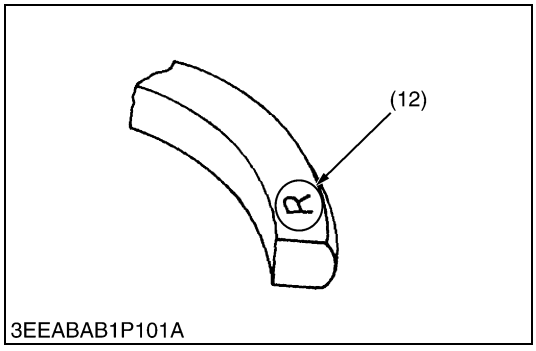

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Piston Ring and Connecting Rod

1. Remove the piston rings using a piston ring tool.
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
(2) Second Ring
(3) Oil Ring
(4) Piston Pin Snap Ring
(5) Piston
(6) Connecting Rod
(7) Piston Pin
(8) Mark
(9) Fan-shaped Concave
(10) Expander Joint
(11) Oil Ring Gap
(12) Manufacturer's Mark

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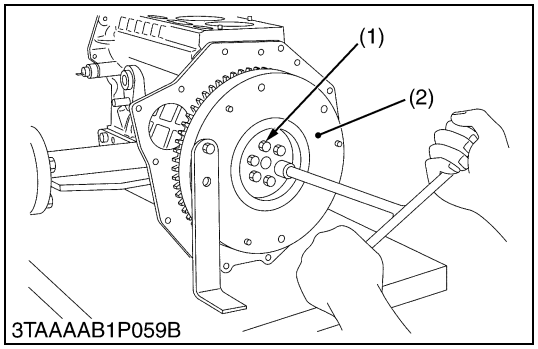
(4) Flywheel and Crankshaft



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

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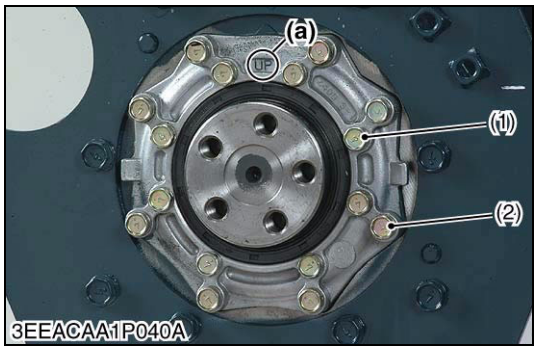

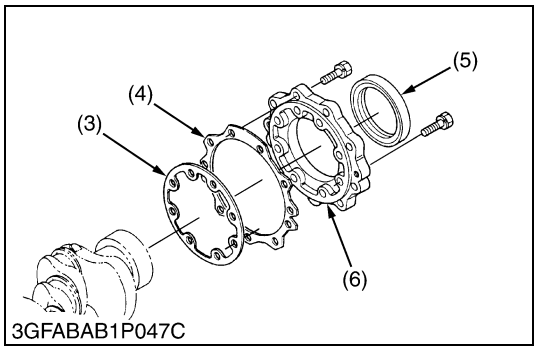

Bearing Case Cover

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)
(2) Bearing Case Cover Mounting Screw (Outside) (Short)
(3) Bearing Case Gasket
(4) Bearing Case Cover Gasket
(5) Oil Seal
(6) Bearing Case Cover
(a) Top Mark "UP"
(b) Upside

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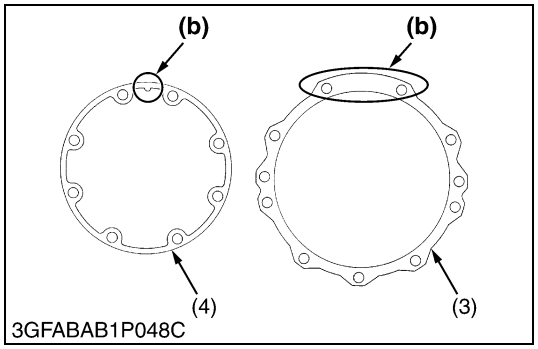

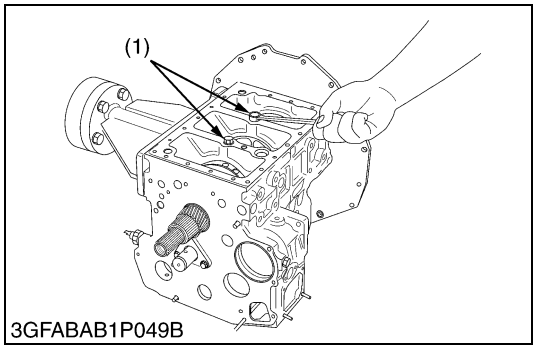

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Crankshaft Assembly

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

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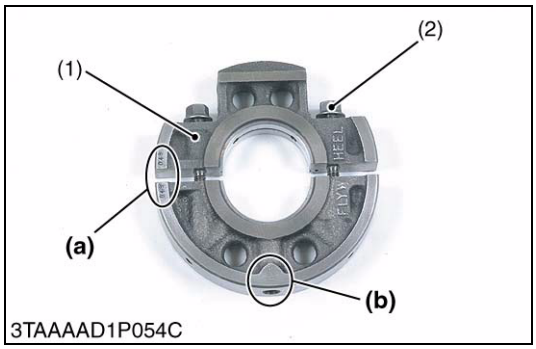

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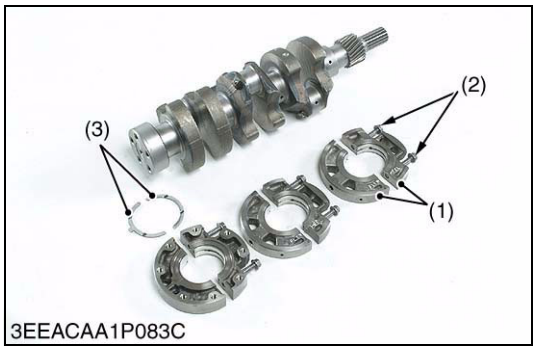

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Main Bearing Case Assembly

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.

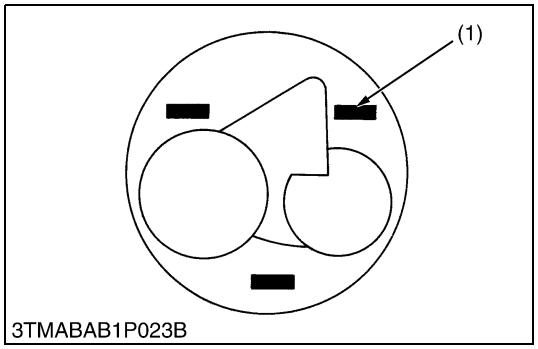
Tightening torque	Main bearing case screw 1	30 to 34 N·m 3.0 to 3.5 kgf·m 22 to 25 lbf·ft

(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



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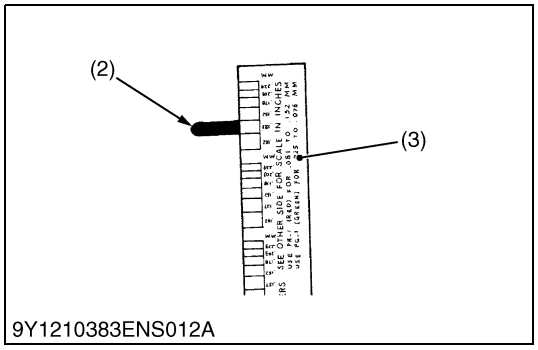

9Y1210383ENS012A

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

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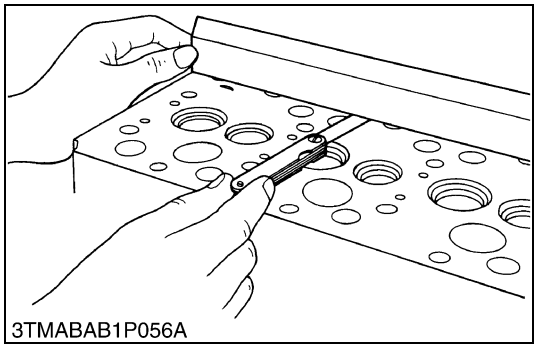
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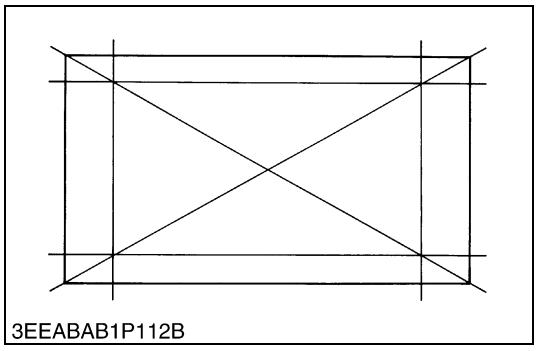
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Cylinder Head Surface Flatness

1. Clean the cylinder head surface.
2. Place a straightedge on the cylinder head's four sides and two diagonal as shown in the figure.
3. Measure the clearance with a 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.

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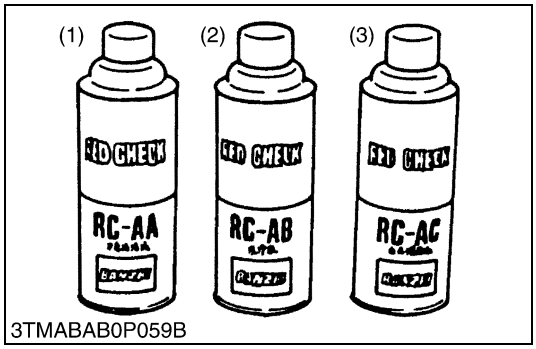

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Cylinder Head Flaw

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

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

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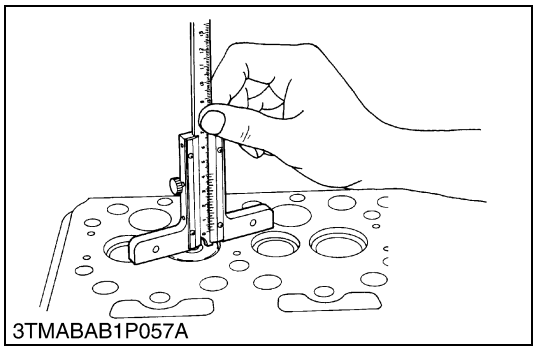
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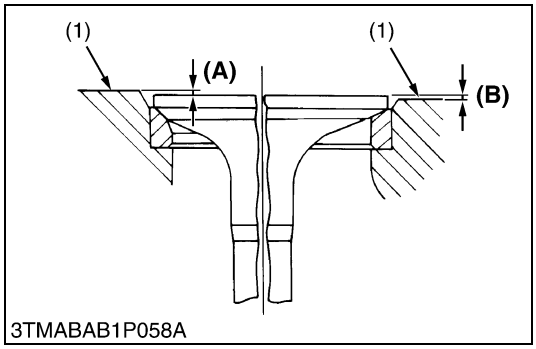
Valve Recessing

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.



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(1) Cylinder Head Surface
(A) Recessing
(B) Protrusion

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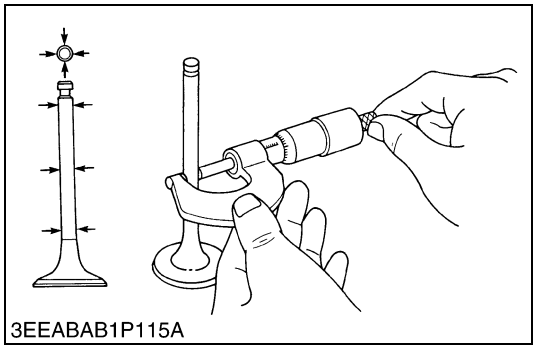
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Clearance between Valve Stem and Valve Guide

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

Clearance between valve stem and valve guide	Factory 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.

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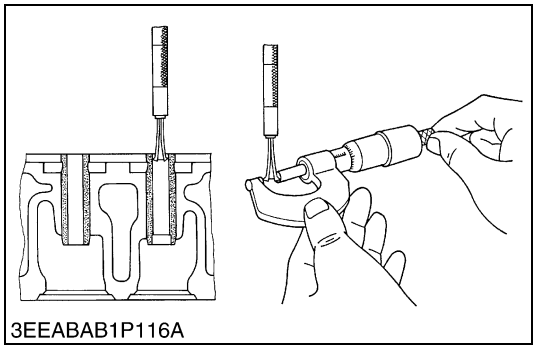
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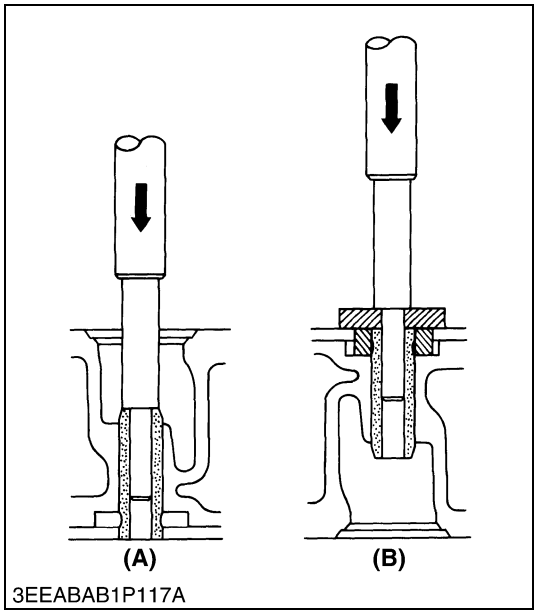

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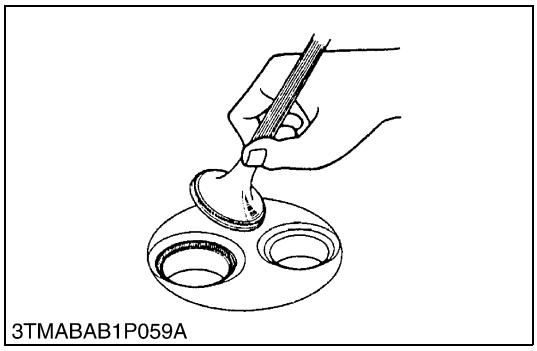
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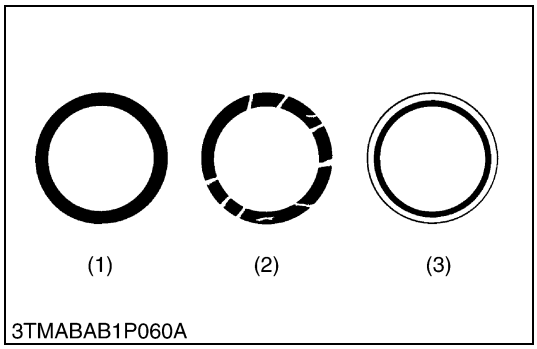

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Replacing Valve Guide

(When removing)

1. Press out the used valve guide using a valve guide replacing tool. (See page G-64.)

(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

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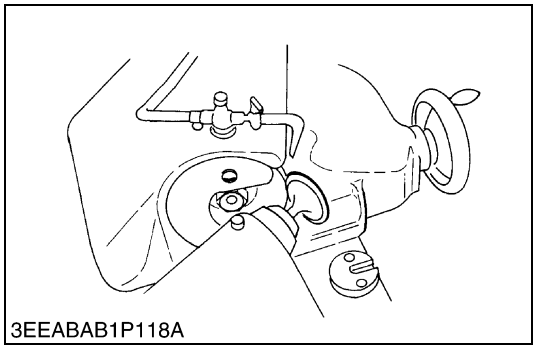
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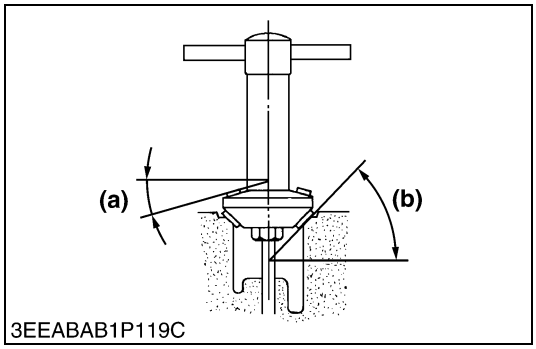

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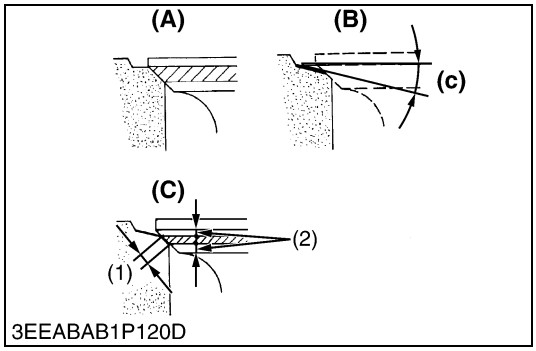

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Correcting Valve and Valve Seat

■ **NOTE**
- **Before correcting the valve and seat, check the valve stem and the I.D. of 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 °)

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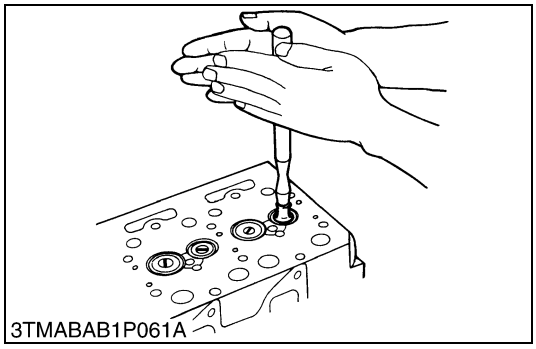
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Valve Lapping

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

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

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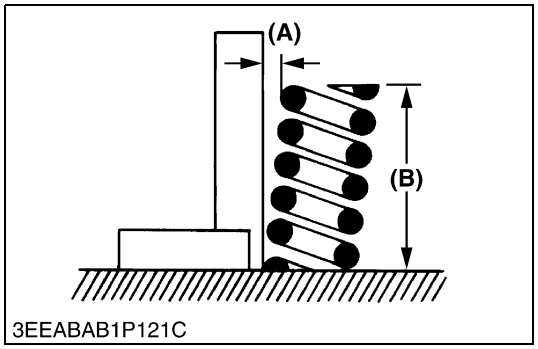

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Free Length and Tilt of Valve Spring

1. Measure the free length **(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**

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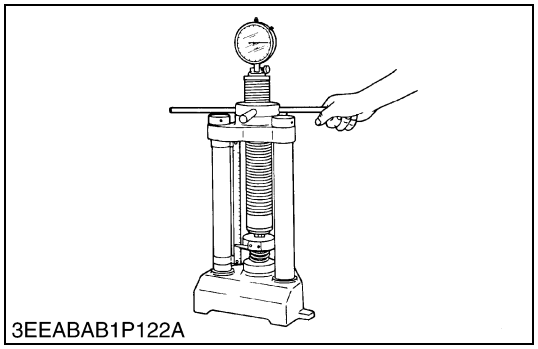
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Valve Spring Setting Load

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

Setting load / Setting length	Factory 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.

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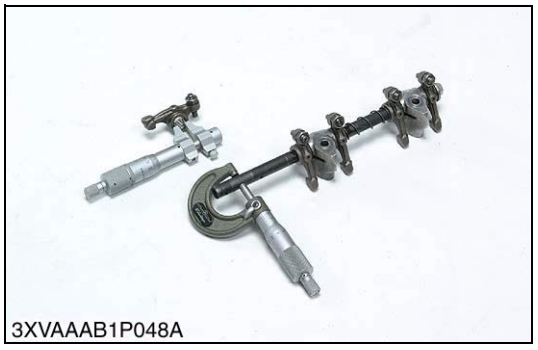
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Oil Clearance between Rocker Arm and Rocker Arm Shaft

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

Oil clearance between rocker arm and rocker arm shaft	Factory 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.

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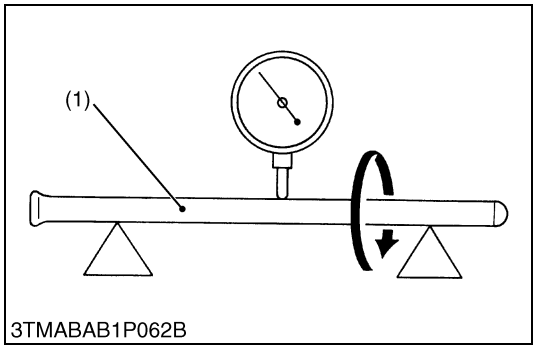

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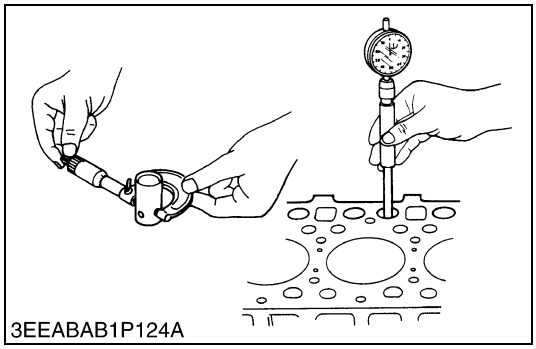
Push Rod Alignment

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

Push rod alignment	Allowable limit	0.25 mm 0.0098 in.

(1) Push Rod

9Y1210946ENS0111US0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Oil Clearance between Tappet and Tappet Guide Bore

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

Oil Clearance between tappet and tappet guide bore	Factory 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.

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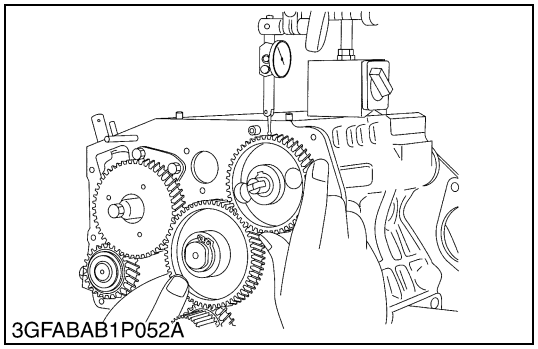
[2] Timing Gears, Camshaft and Governor Gear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Timing Gear Backlash

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

Backlash between idle gear 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.

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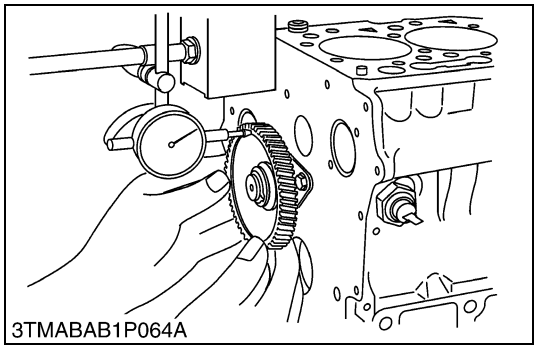
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Idle Gear 1 Side Clearance

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.

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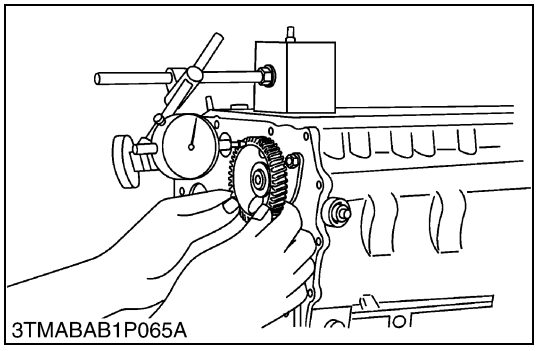
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Camshaft Side Clearance

1. Set a dial indicator with its tip on the camshaft.
2. Measure the side clearance by moving the cam gear to the front 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.

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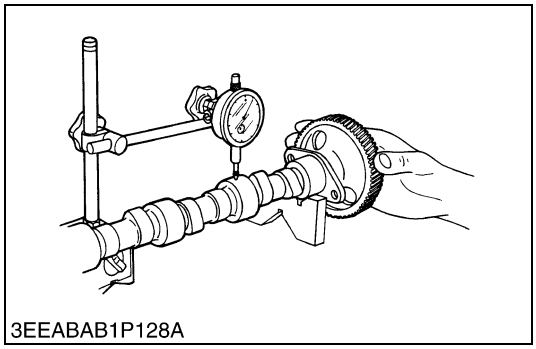
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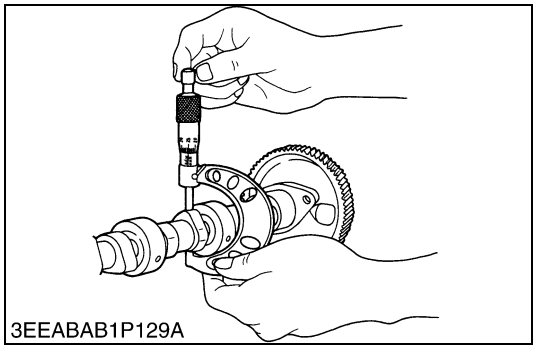
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Camshaft Alignment

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

Camshaft alignment	Allowable limit	0.01 mm 0.0004 in.

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.

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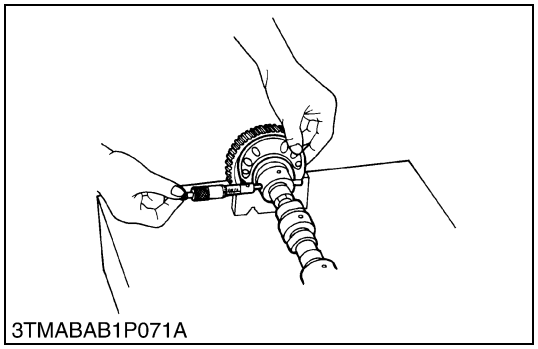
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Oil Clearance of Camshaft Journal

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

Oil clearance of camshaft journal	Factory 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.

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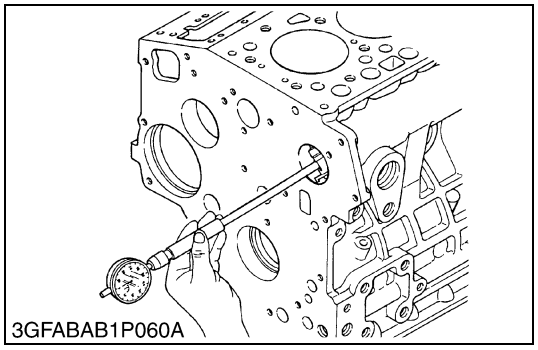
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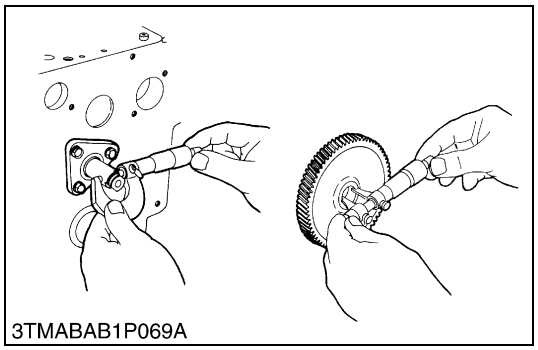
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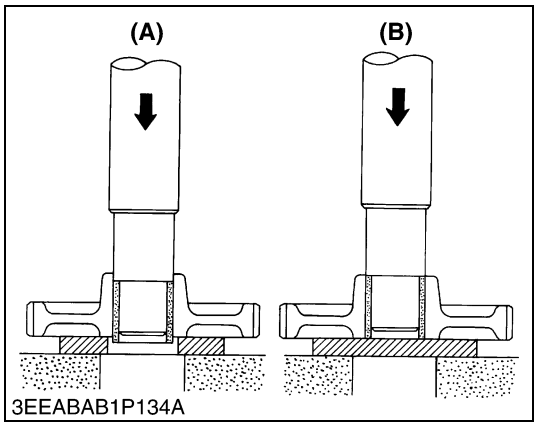
Oil Clearance between Idle Gear Shaft 1 and Idle Gear Bushing

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



3EEABAB1P134A

Replacing Idle Gear Bushing

(When removing)

1. Press out the used idle gear bushing using an idle gear bushing replacing tool. (See page G-64.)

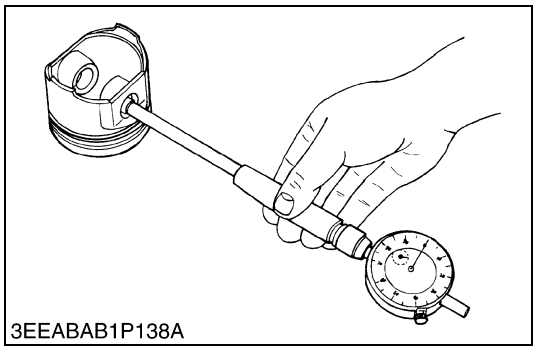
(When installing)

1. Clean a new idle gear bushing and idle gear bore, and apply engine oil to them.
2. Press in a new brushing 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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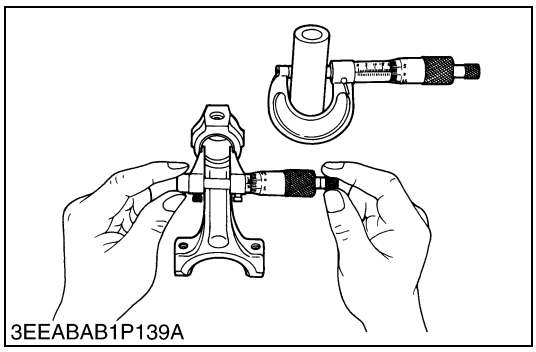
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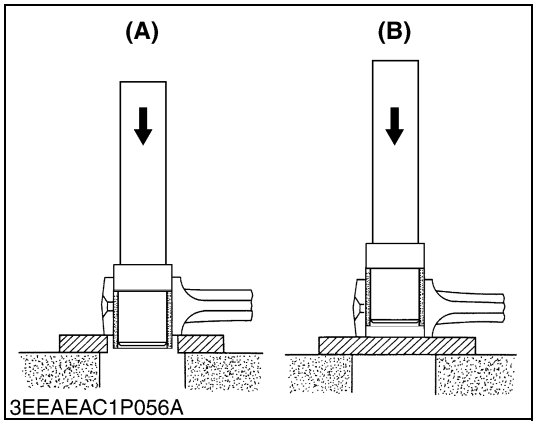

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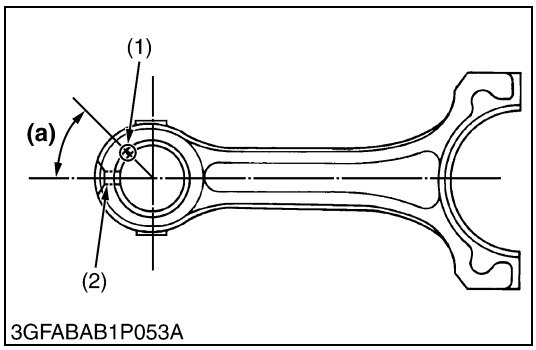

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Piston Pin Bore I.D.

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

Piston pin bore I.D.	Factory 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-64.)

(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.

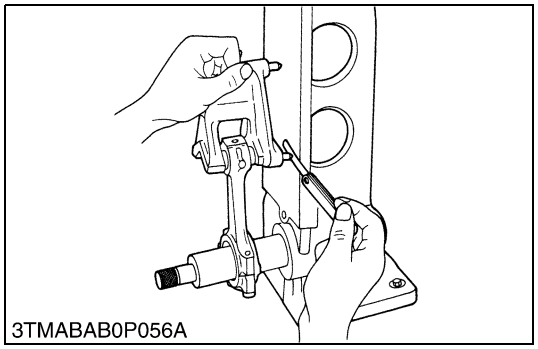
Oil clearance between piston pin and small end bushing (Spare parts)	Factory specification	0.014 to 0.038 mm 0.00056 to 0.0014 in.
	Allowable limit	0.15 mm 0.0059 in.

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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Connecting Rod Alignment

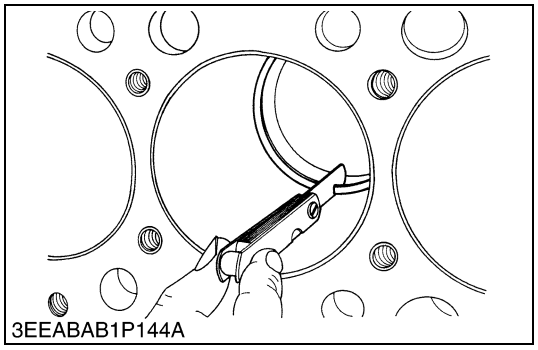
■ **NOTE**

- **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

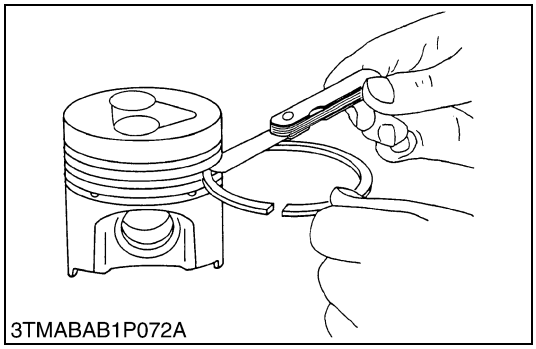

3EEABAB1P144A

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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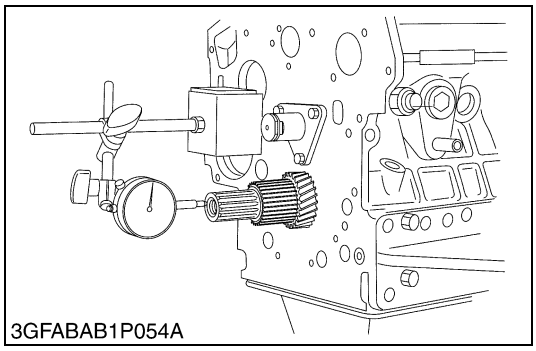
Clearance between Piston ring and Piston Ring Groove

1. Clean the rings and the ring grooves, and install each ring in its groove.
2. Measure the clearance between the ring and the groove with a feeler gauge 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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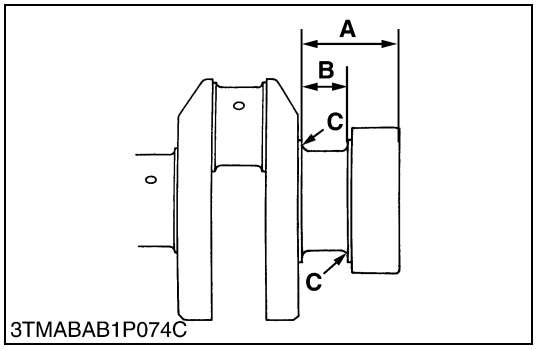
Crankshaft Side Clearance

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.



3TMABAB1P074C

(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		

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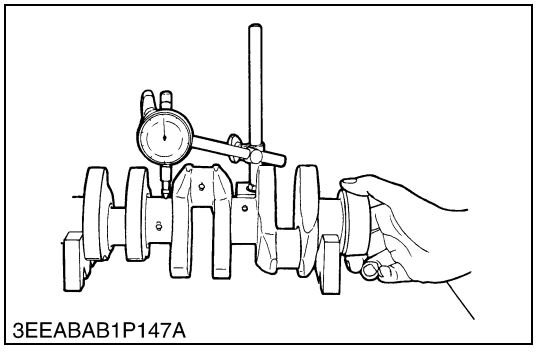
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Crankshaft Alignment

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

Crankshaft alignment	Allowable limit	0.02 mm 0.0008 in.

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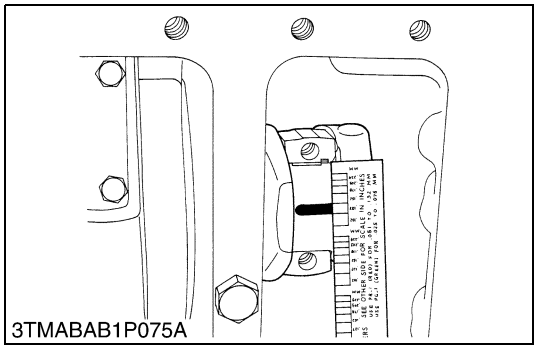
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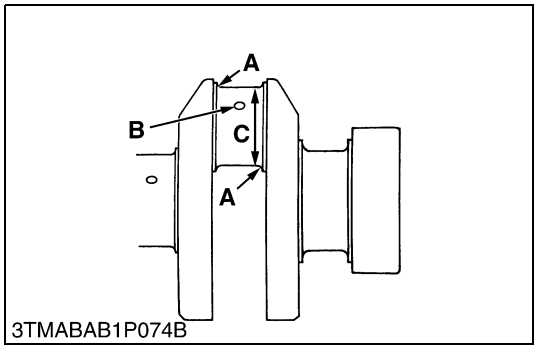

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Oil Clearance between Crankpin and Crankpin Bearing

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.		

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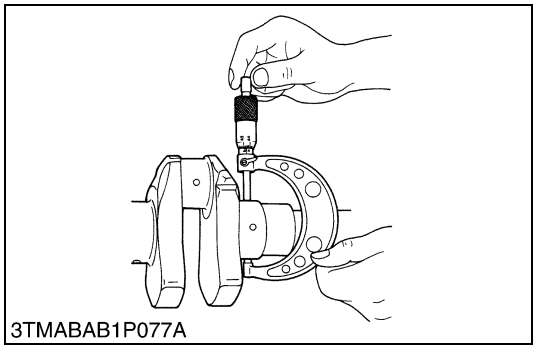
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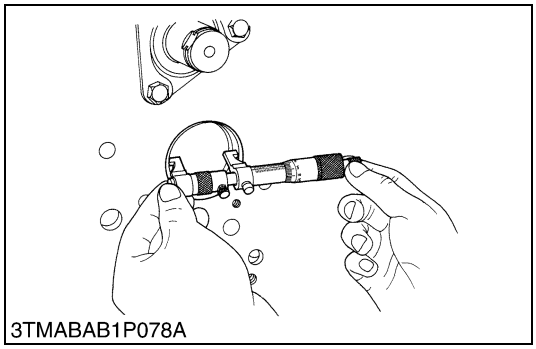
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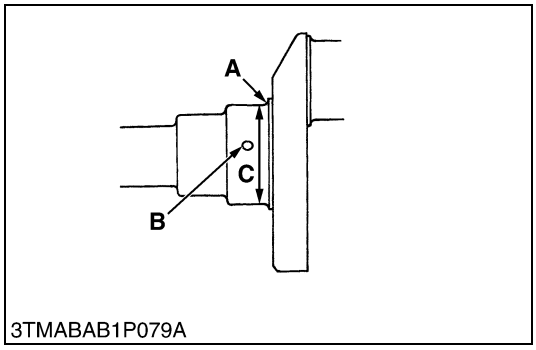

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Oil Clearance between Crankshaft Journal and Crankshaft Bearing 1

1. Measure the O.D. of the crankshaft front journal with an outside micrometer.
2. Measure the I.D. of the crankshaft bearing 1 with an inside micrometer, and calculate the oil clearance.
3. If the 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.		

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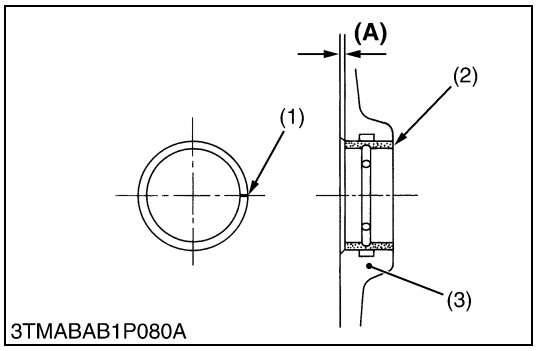

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Replacing Crankshaft Bearing 1

(When removing)

1. Press out the used crankshaft bearing 1 using a crankshaft bearing 1 replacing tool. (See page G-65.)

(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

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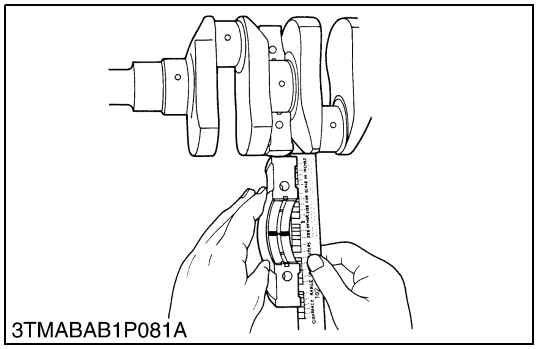
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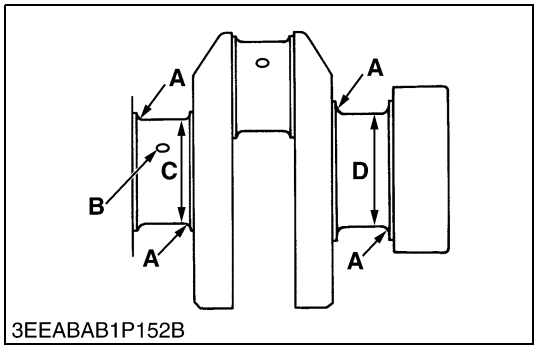

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Oil Clearance between Crankshaft Journal and Crankshaft Bearing 2 (Crankshaft Bearing 3)

1. Put a strip of plastigage on the center of the journal.
2. Install the bearing case and tighten the baring 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.		

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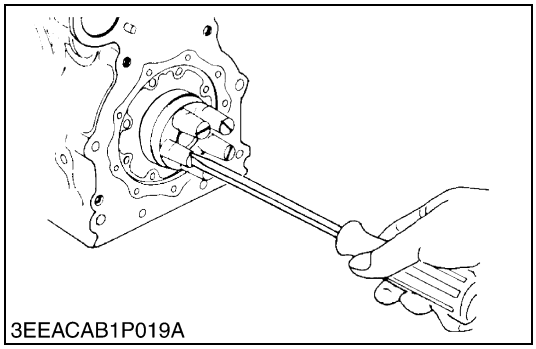
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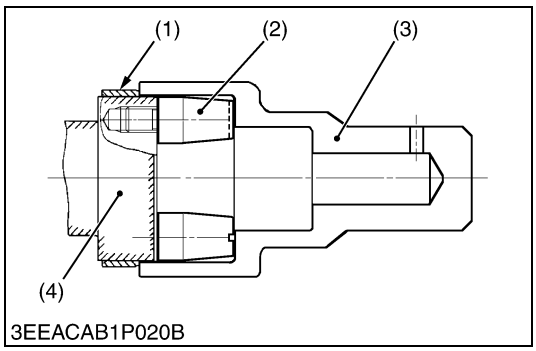

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Replacing Crankshaft Sleeve

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).

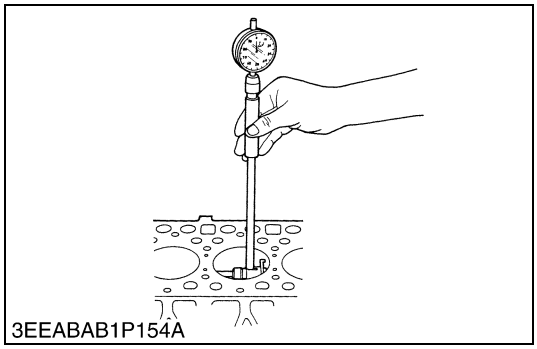
■ **NOTE**

- **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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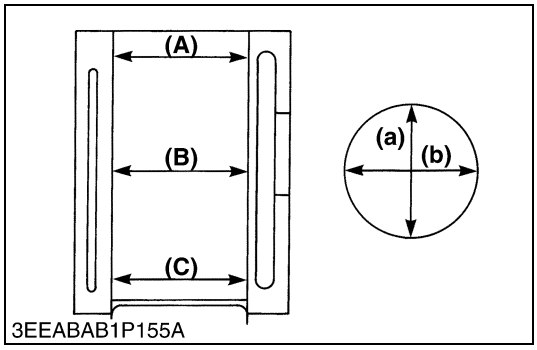

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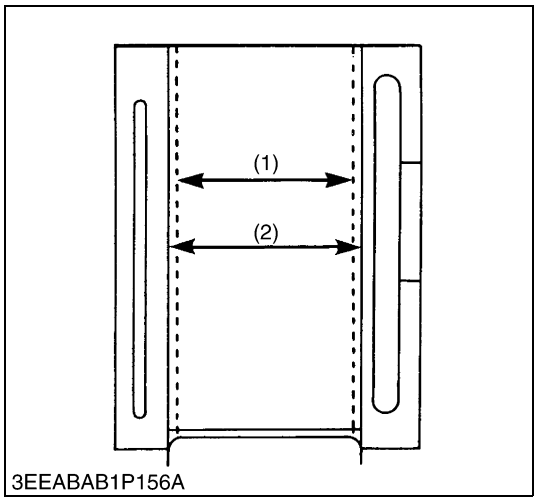

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Cylinder Wear

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

Cylinder I.D.	Factory 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 µm R max. (48 to 78 µin. R max.)	

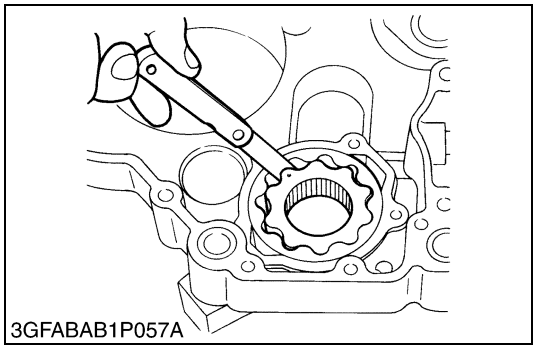
2. Replace the piston and piston rings with oversize one.
   Oversize: 0.5 mm (0.02 in.)

■ **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

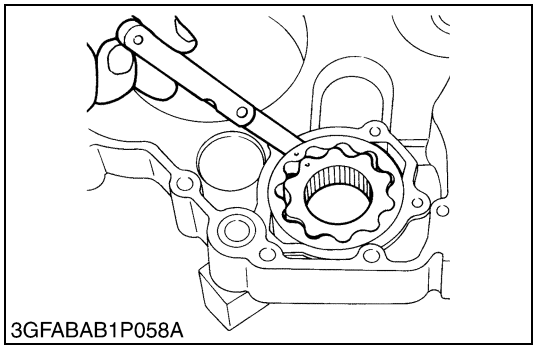

3GFABAB1P057A

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

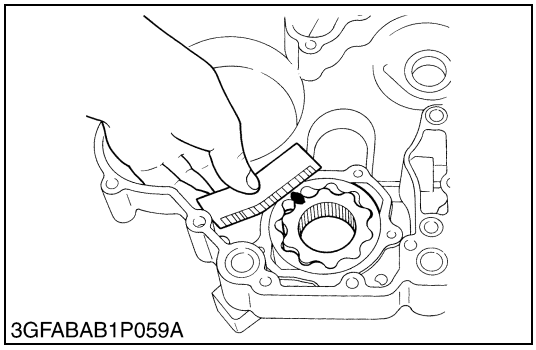

3GFABAB1P058A

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


3GFABAB1P059A

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.

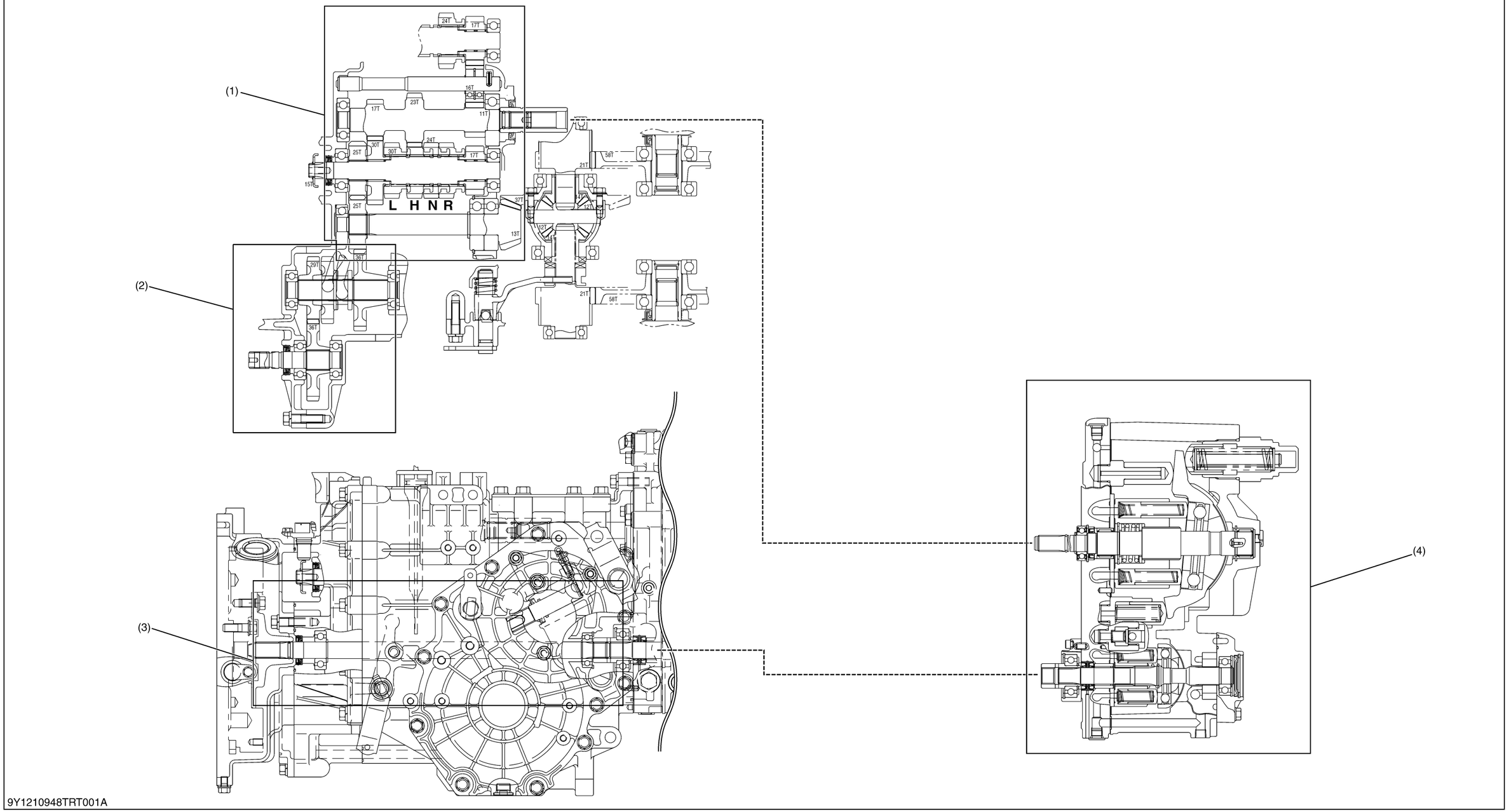
9Y1210946ENS0179US0

2 TRANSMISSION

MECHANISM

CONTENTS

1. STRUCTURE



(1) Range Shift Gear Section (2) Front Wheel Drive Section (3) Input Shaft Section (4) Hydraulic Transmission Section

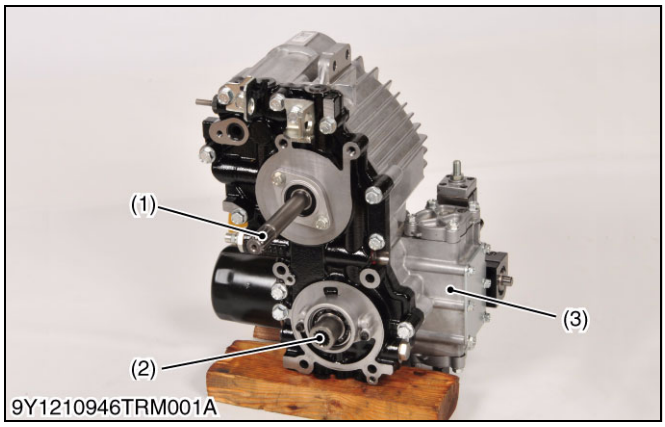
2. POWER TRAIN

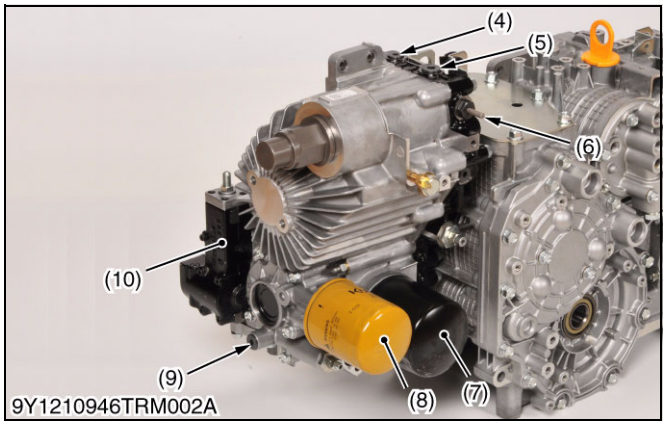
The transmission of this model consists of a series of gears and shafts as shown in previous page. The traveling system chiefly consists of hydrostatic transmission section, range gear shift section and front wheel drive section.

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)
(2) Input Shaft (Pump Shaft)
(3) Servo Piston
(4) Forward Pressure Check Port
(5) Dynamic Brake Pressure Check Port
(6) Unload Valve
(7) Oil Filter Cartridge (Suction) (Orange Color)
(8) Oil Filter Cartridge (HST) (Black Color)
(9) Charge Pressure Check Port
(10) Servo Regulator

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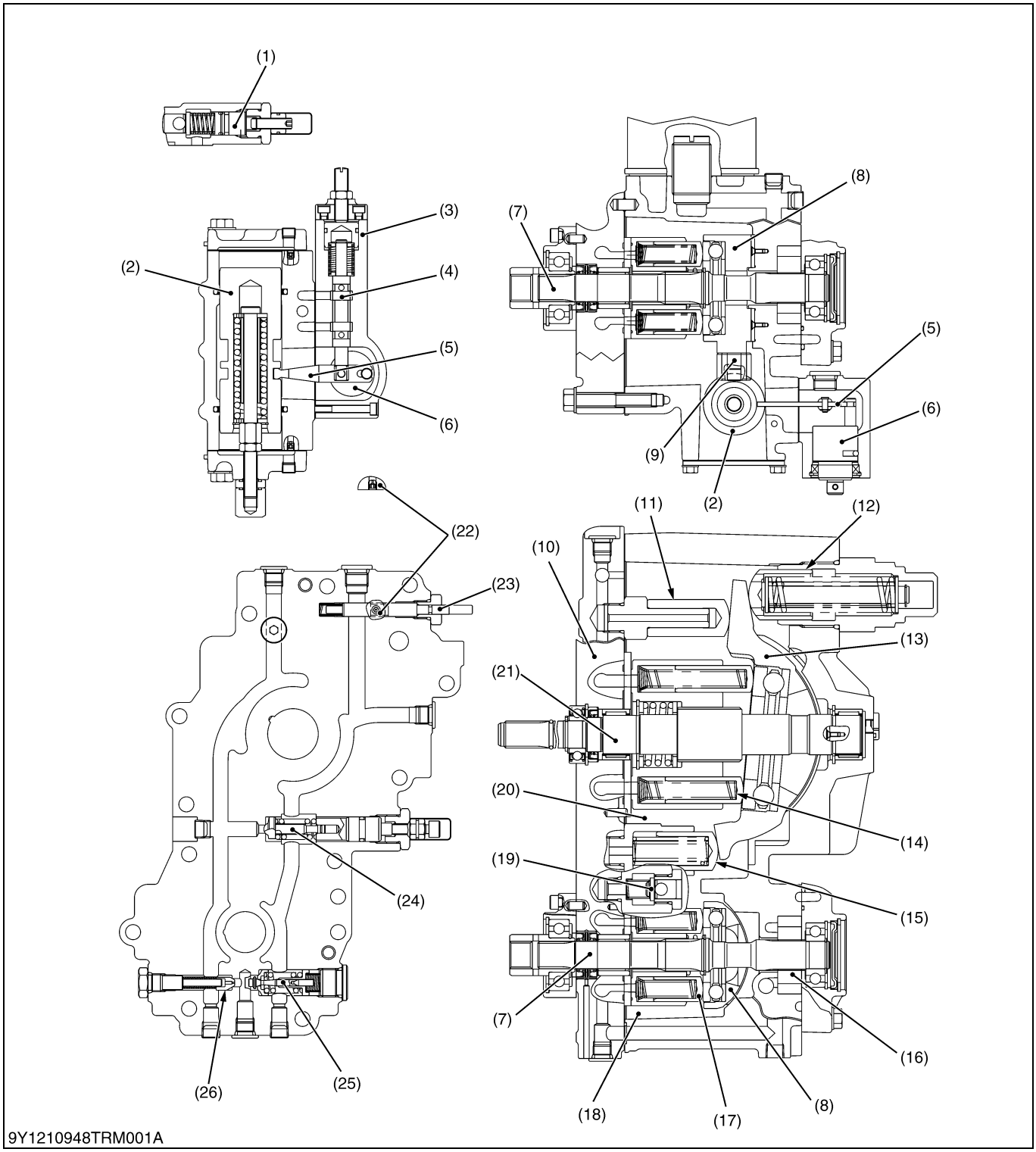
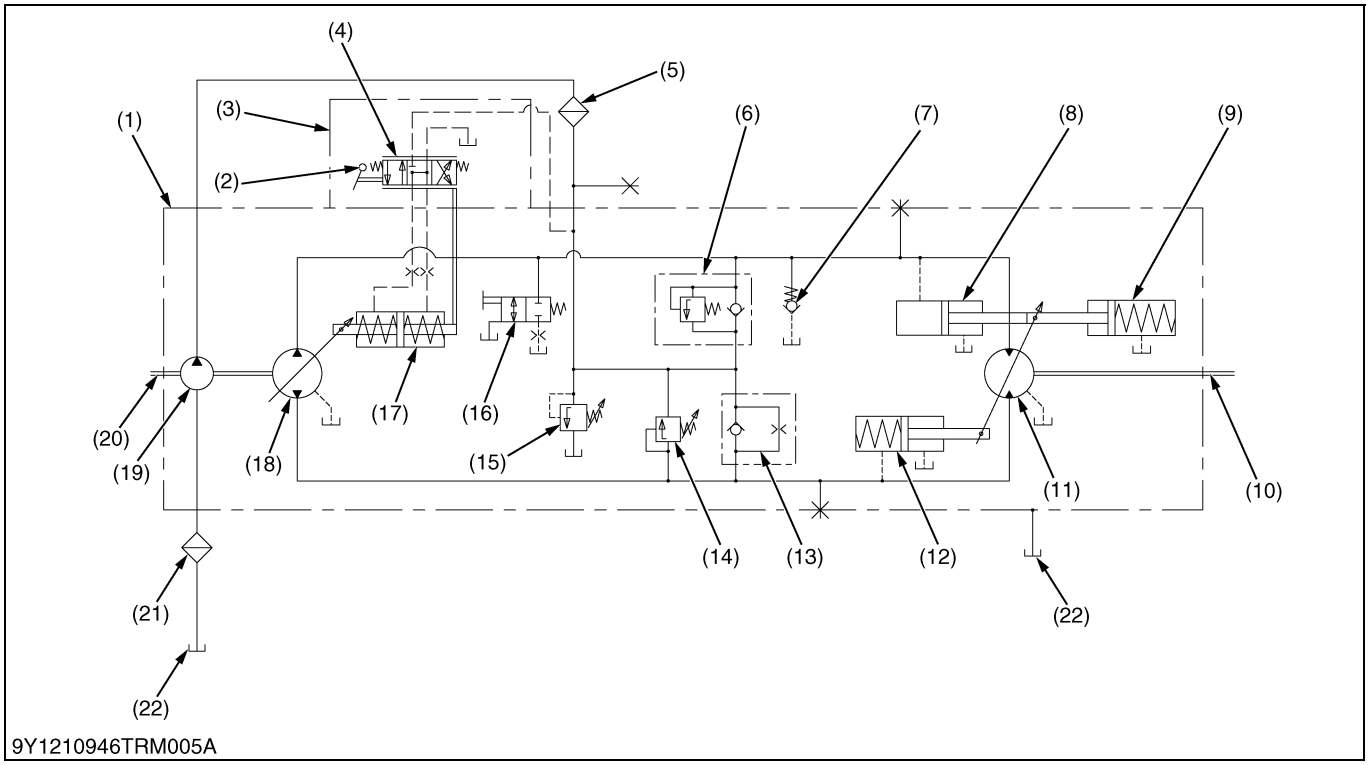


(1) Charge Relief Valve
(2) Servo Piston
(3) Regulator Valve Assembly
(4) Regulator Spool
(5) Feedback Lever
(6) Regulator Shaft
(7) Input Shaft (Pump Shaft)
(8) Variable Swashplate (Pump)
(9) Guide
(10) Port Block Cover
(11) Control Piston 1
(12) Control Piston 2
(13) Variable Swashplate (Motor)
(14)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

9Y1210948TRM0002US0

(2) Oil Flow



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

(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.

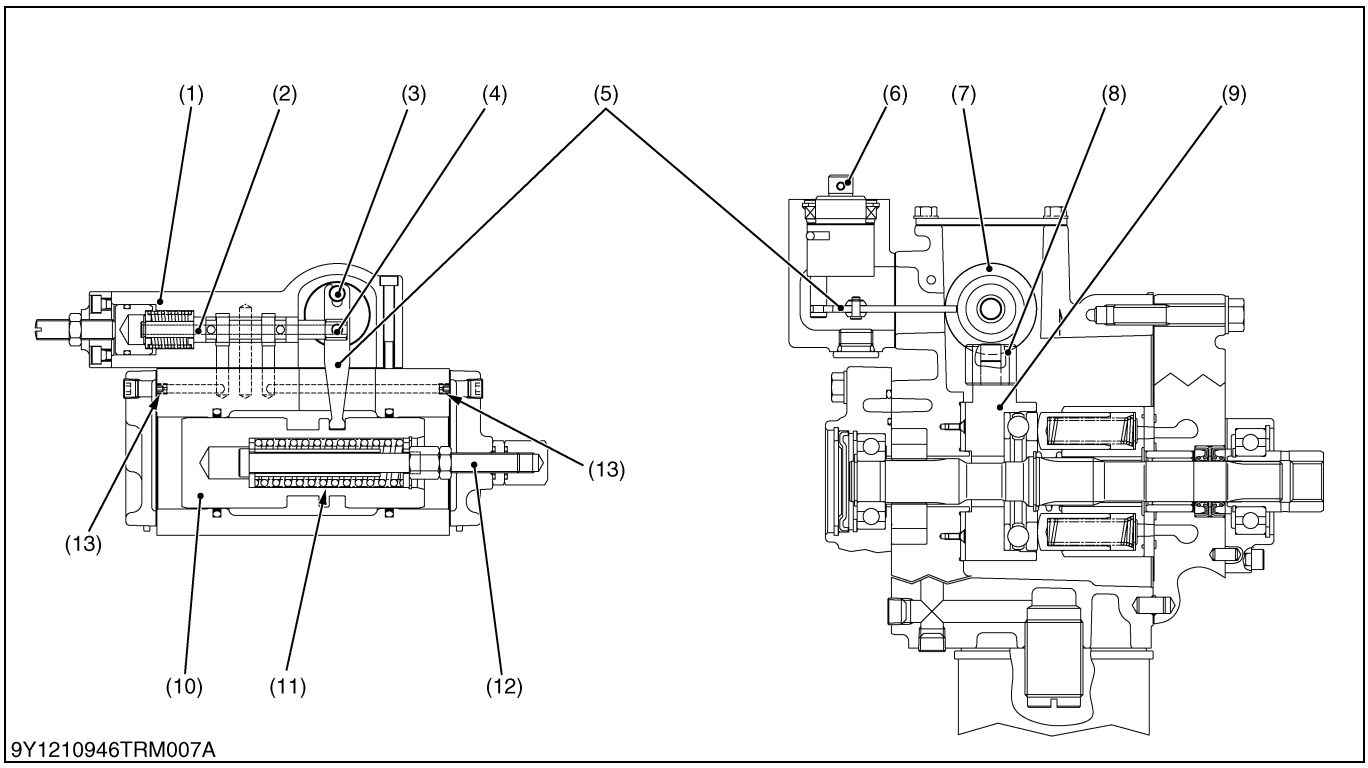
Specifications

(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



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

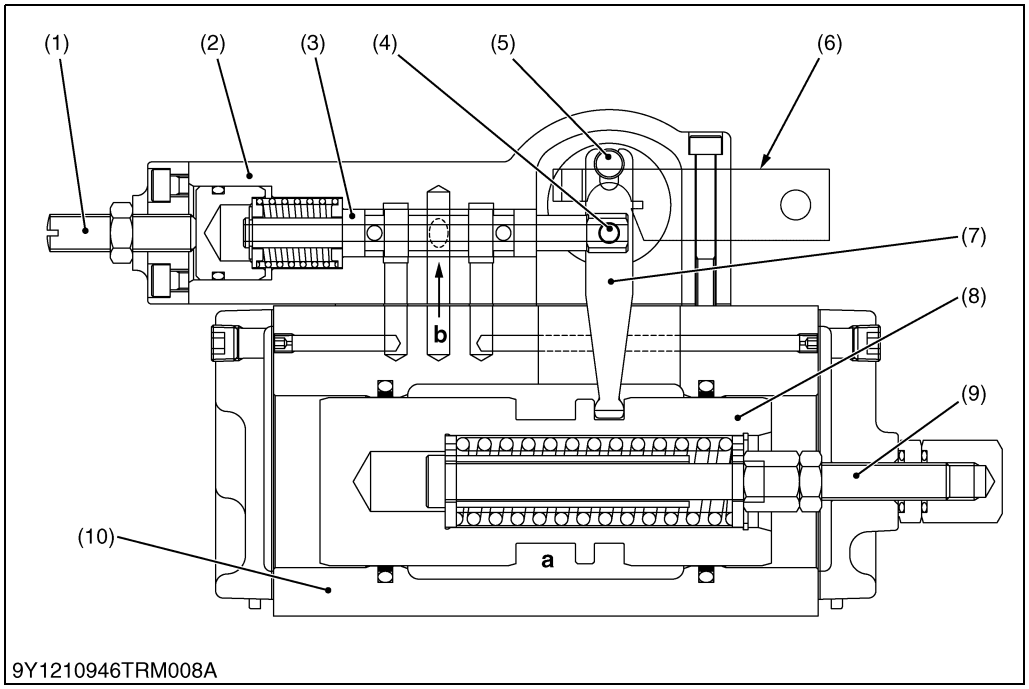
The servo piston moved by hydraulic force, is connected to the pump cylinder variable swashplate (9). Therefore, a tilt angle of swashplate is varied by servo piston movement.

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



9Y1210946TRM008A

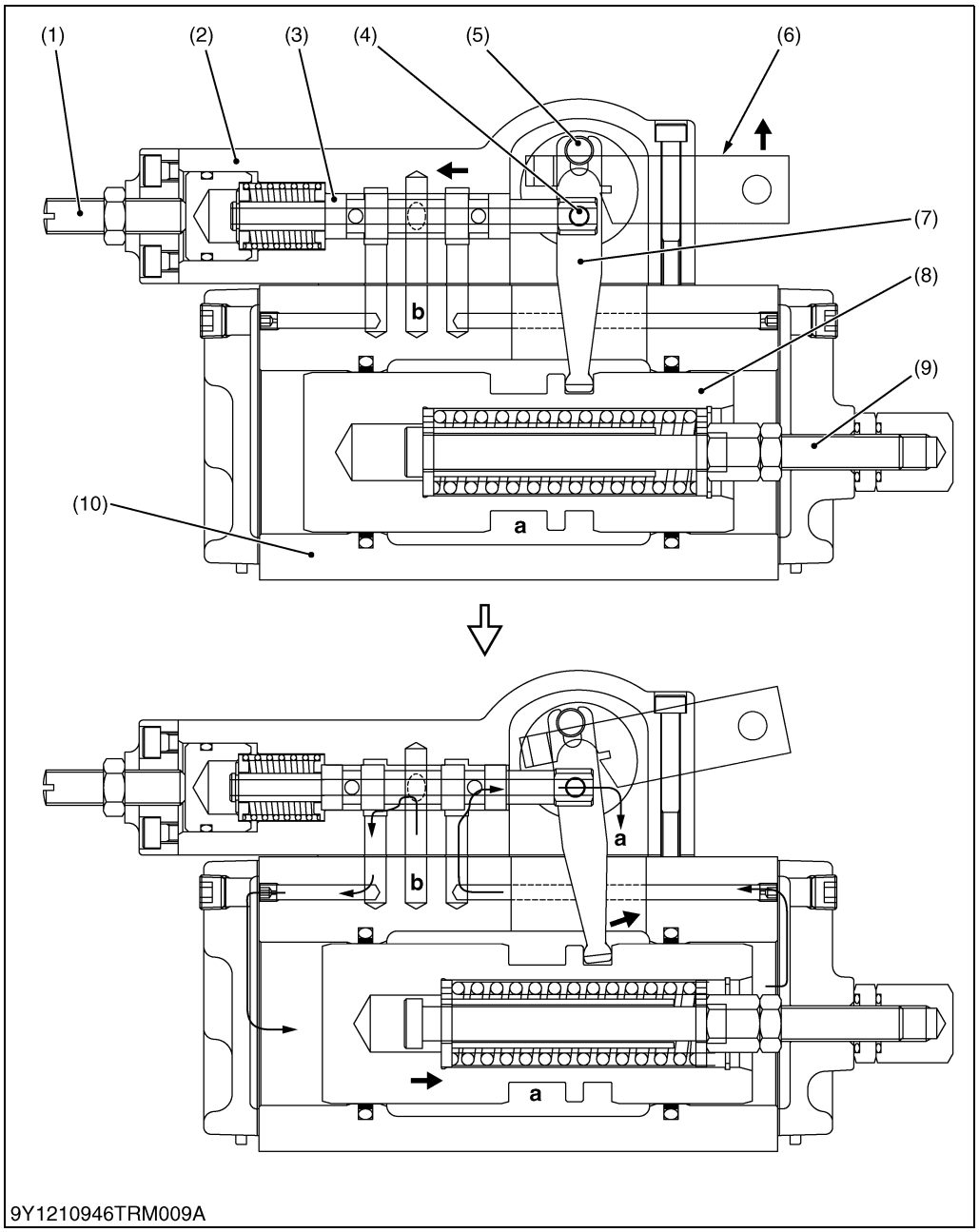
(1) Servo Adjusting Screw
(2) Regulator Valve Assembly
(3) Regulator Spool
(4) Pin B (Fixed with Spool)
(5) Pin A
(Fixed with Regulator Shaft)
(6) Control Lever
(7) Feedback Lever
(8) Servo Piston
(9) Piston Adjusting Screw
(10) HST Housing
a: Drain to HST Housing
b: From Charge Pump (Charge Pressure)

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)



9Y1210946TRM009A

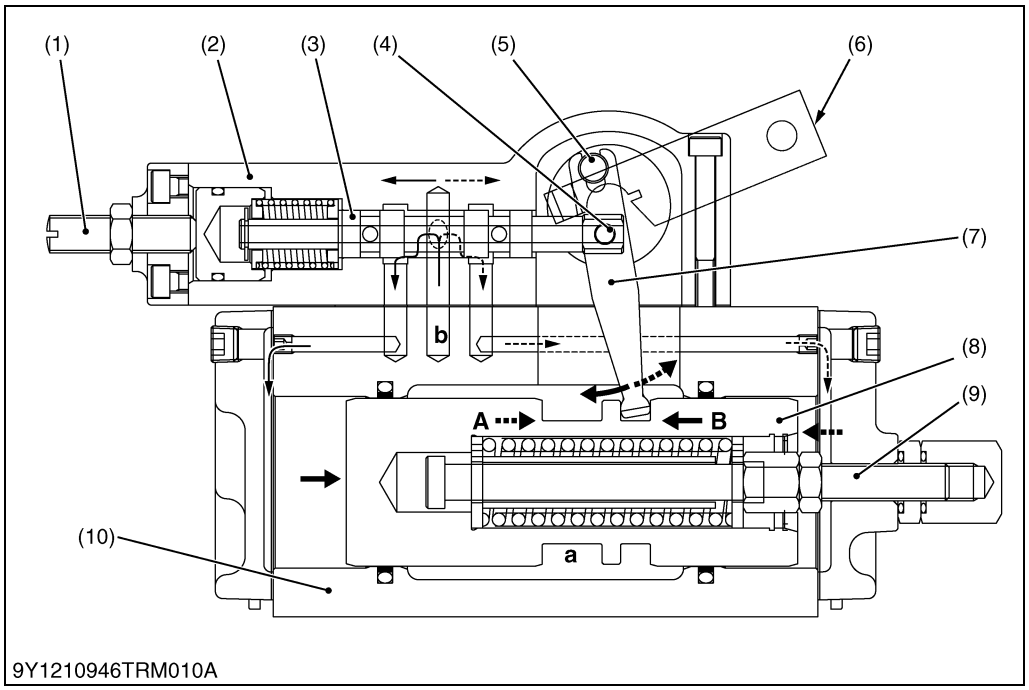
(1) Servo Adjusting Screw
(2) Regulator Valve Assembly
(3) Regulator Spool
(4) Pin B (Fixed with Spool)
(5) Pin A
(Fixed with Regulator Shaft)
(6) Control Lever
(7) Feedback Lever
(8) Servo Piston
(9) Piston Adjusting Screw
(10) HST Housing
a: Drain to HST Housing
b: From Charge Pump (Charge Pressure)

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)



9Y1210946TRM010A

(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
a: Drain to HST Housing
b: From Charge Pump (Charge Pressure)
A: Speed Up
B: Slow Down

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.

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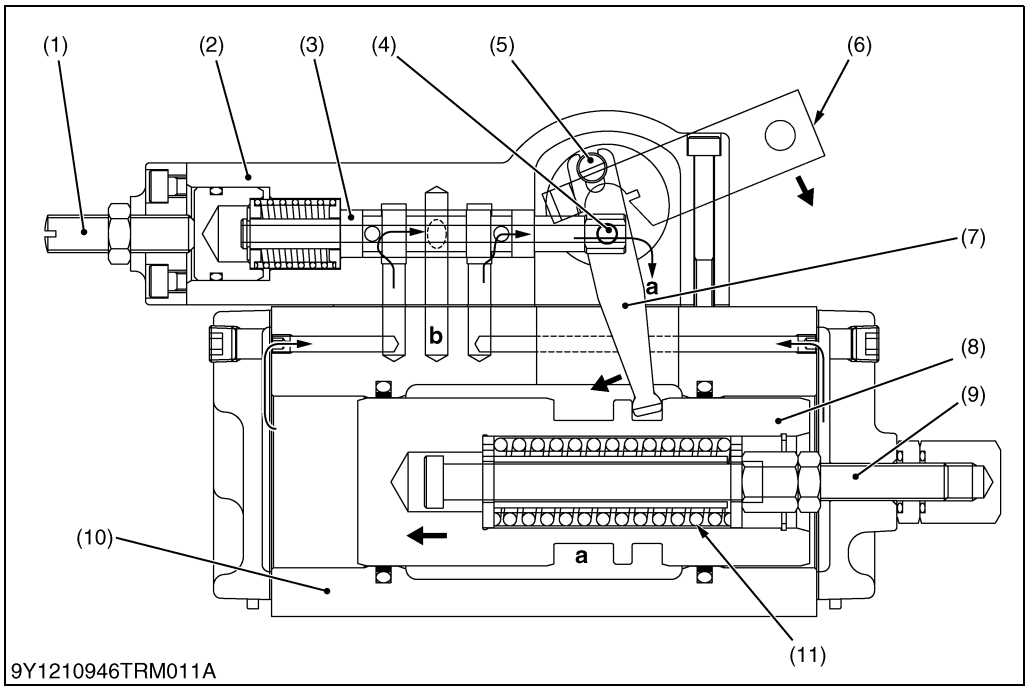
Control Lever Deactivated

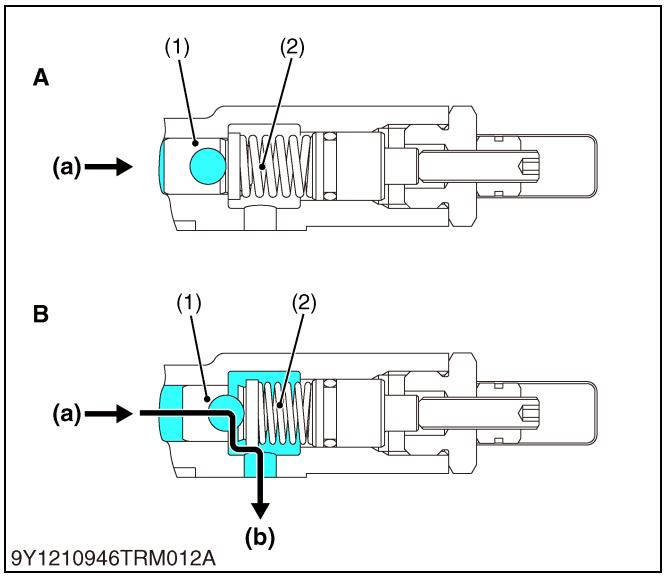


(1) Servo Adjusting Screw
(2) Regulator Valve Assembly
(3) Regulator Spool
(4) Pin B (Fixed with Spool)
(5) Pin A
(Fixed with Regulator Shaft)
(6) Control Lever
(7) Feedback Lever
(8) Servo Piston
(9) Piston Adjusting Screw
(10) HST Housing
(11) Servo Spring
a: Drain to HST Housing
b: From Charge Pump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

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



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.

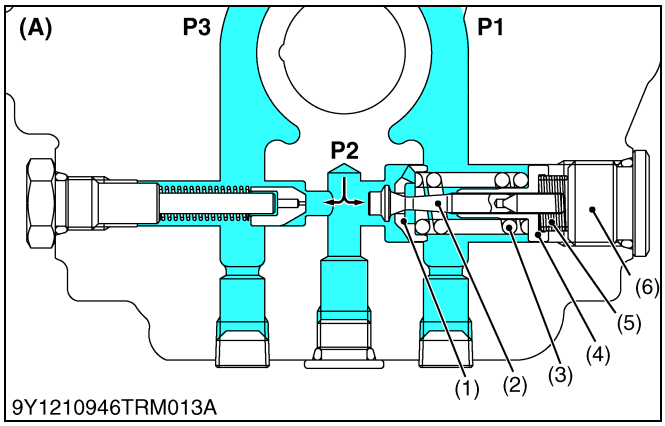
Oil temperature	Valve operating pressure
45 to 55 °C (113 to 131 °F)	0.43 to 0.85 MPa 4.4 to 8.6 kgf/cm^2 63 to 120 psi

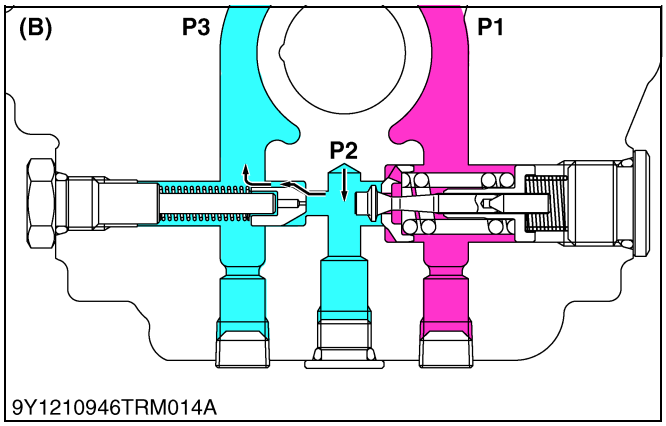
(1) Valve Poppet
(2) Spring

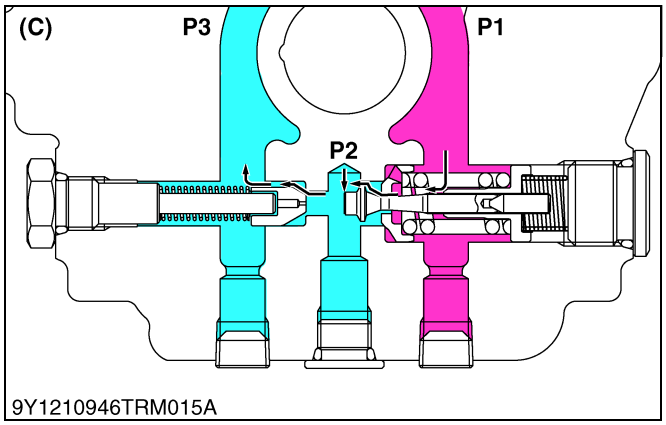
(a) From Charge Pump
(b) To HST Housing
A: Close
B: Open

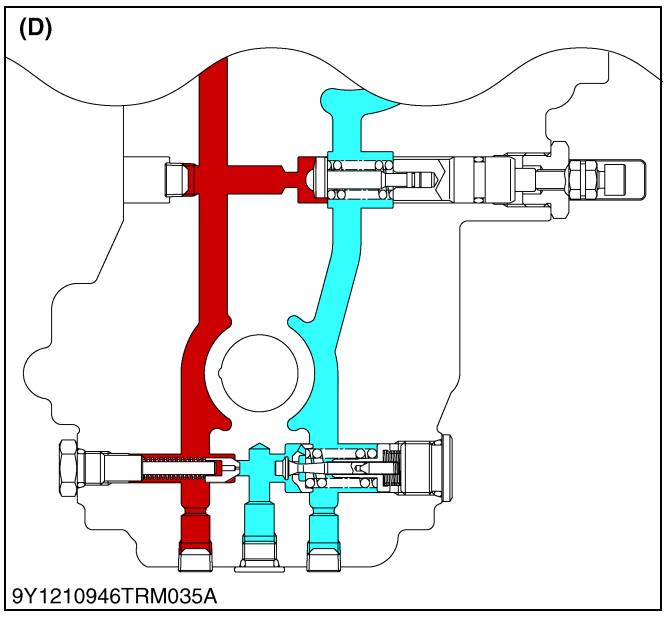
9Y1210946TRM0014US0

[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 running. This valve doubles as a check valve.

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

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

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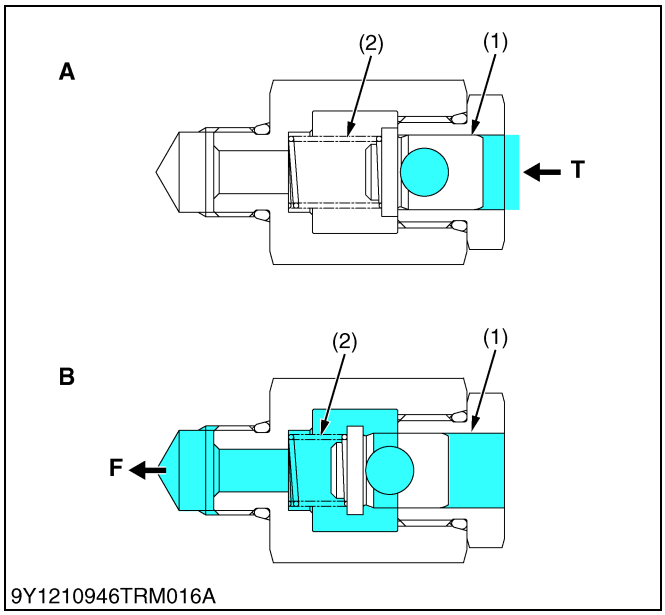
[E] Anti-cavitation Valve



9Y1210946TRM016A

The anti-cavitation valve is normally closed.

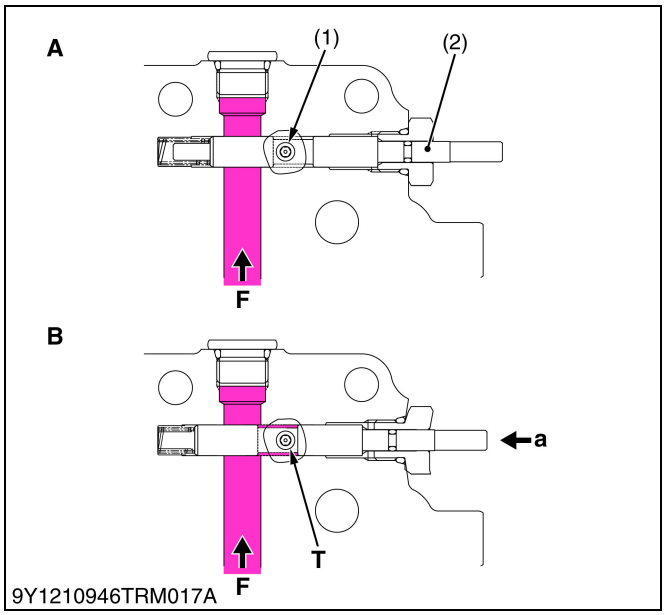
When the oil level in the charging circuit becomes low, the anti-cavitation valve opens and the necessary amount of oil is provided to the travel circuit from the HST housing due to the pressure difference between HST housing case and travel circuit.

(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 relived through the orifice (1).

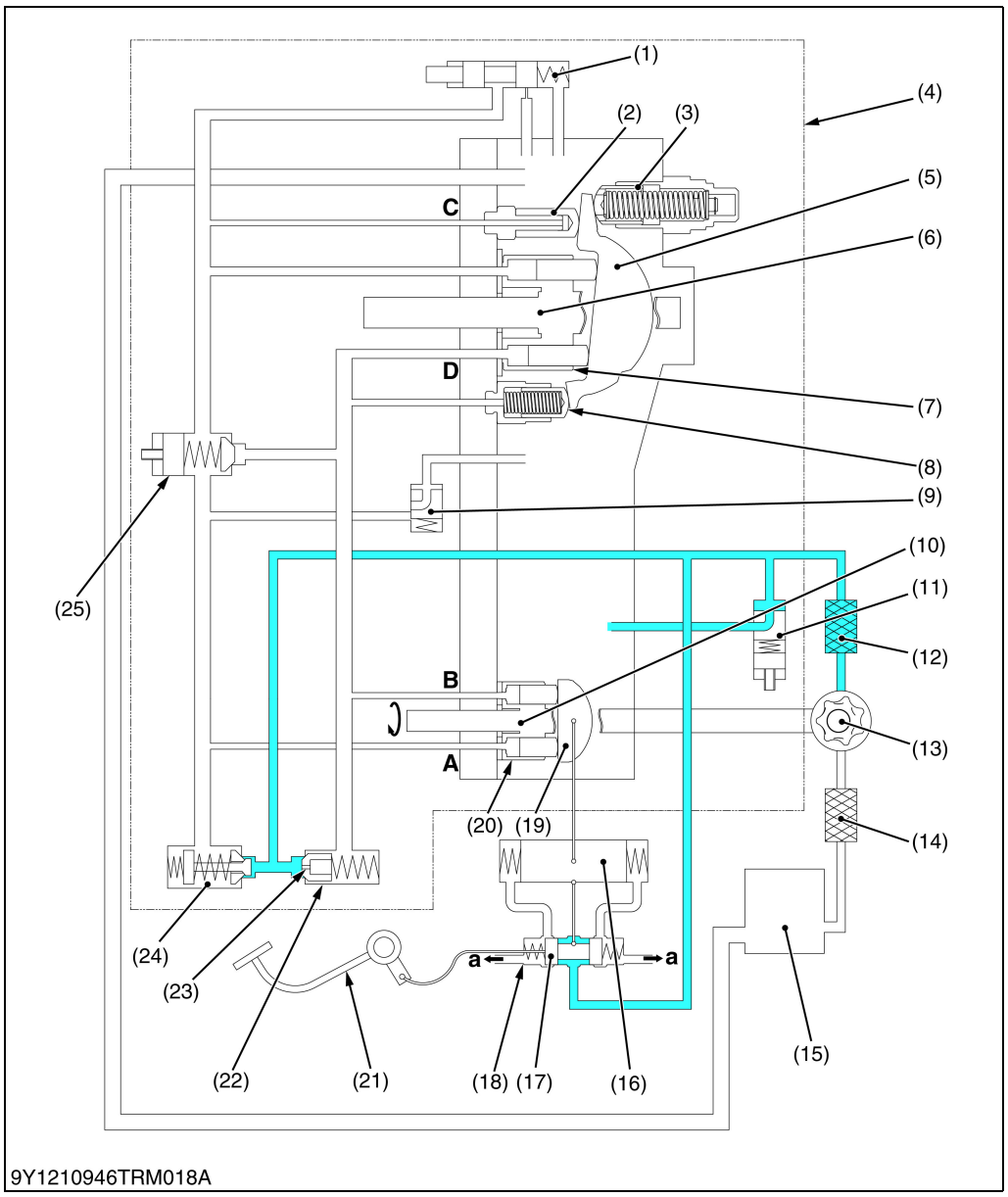
(1) Orifice
(2) Unload Valve

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



9Y1210946TRM018A

(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

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

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.

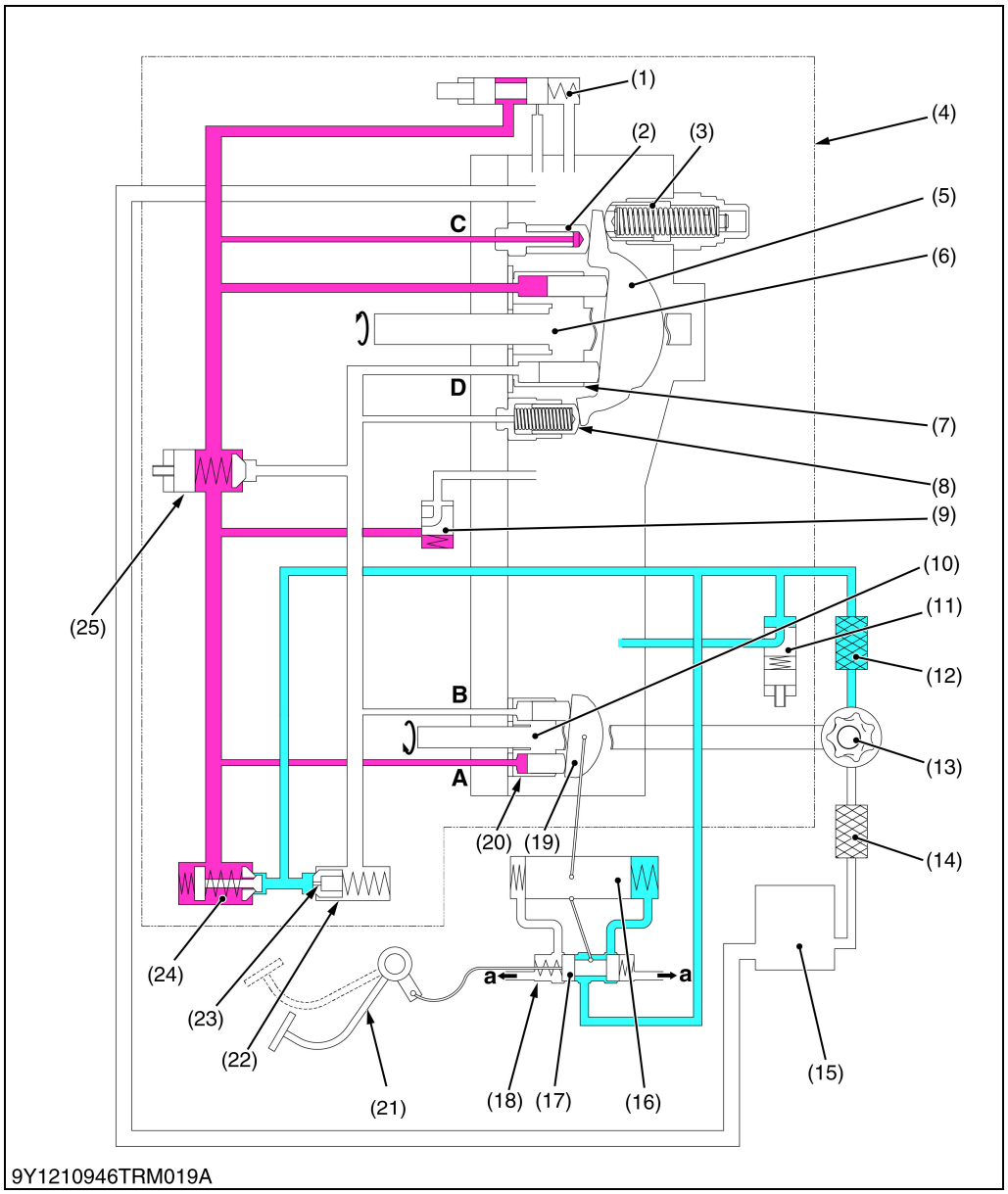
When the variable swashplate (19) is in neutral position, the oil from the pump piston is not supplied to the motor piston.

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

Therefore, as the cylinder block (motor 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



9Y1210946TRM019A

(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 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.

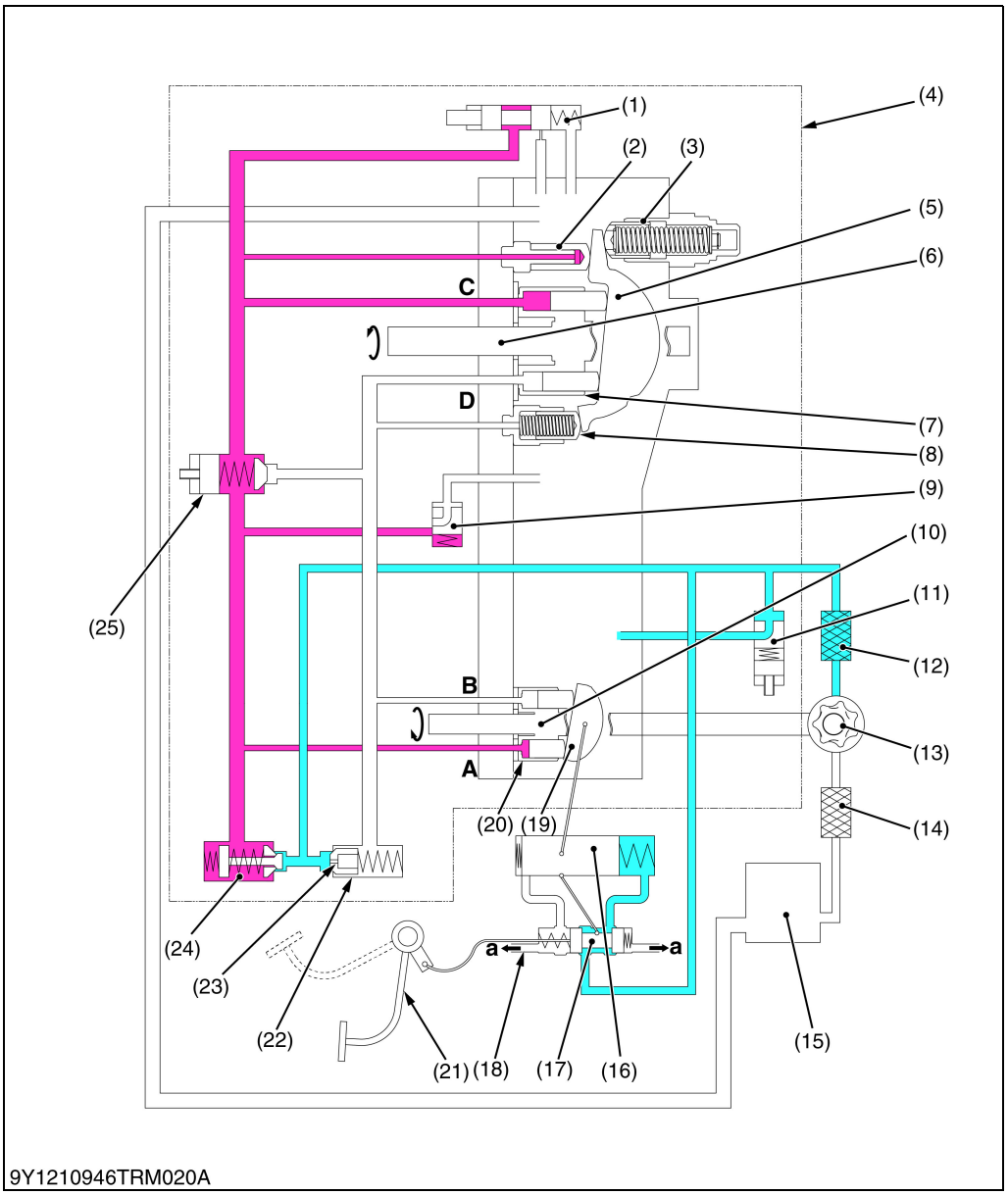
The motor cylinder block (7) is connected to the output shaft (6) so the output shaft (6) starts to rotate.

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



9Y1210946TRM020A

(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

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.

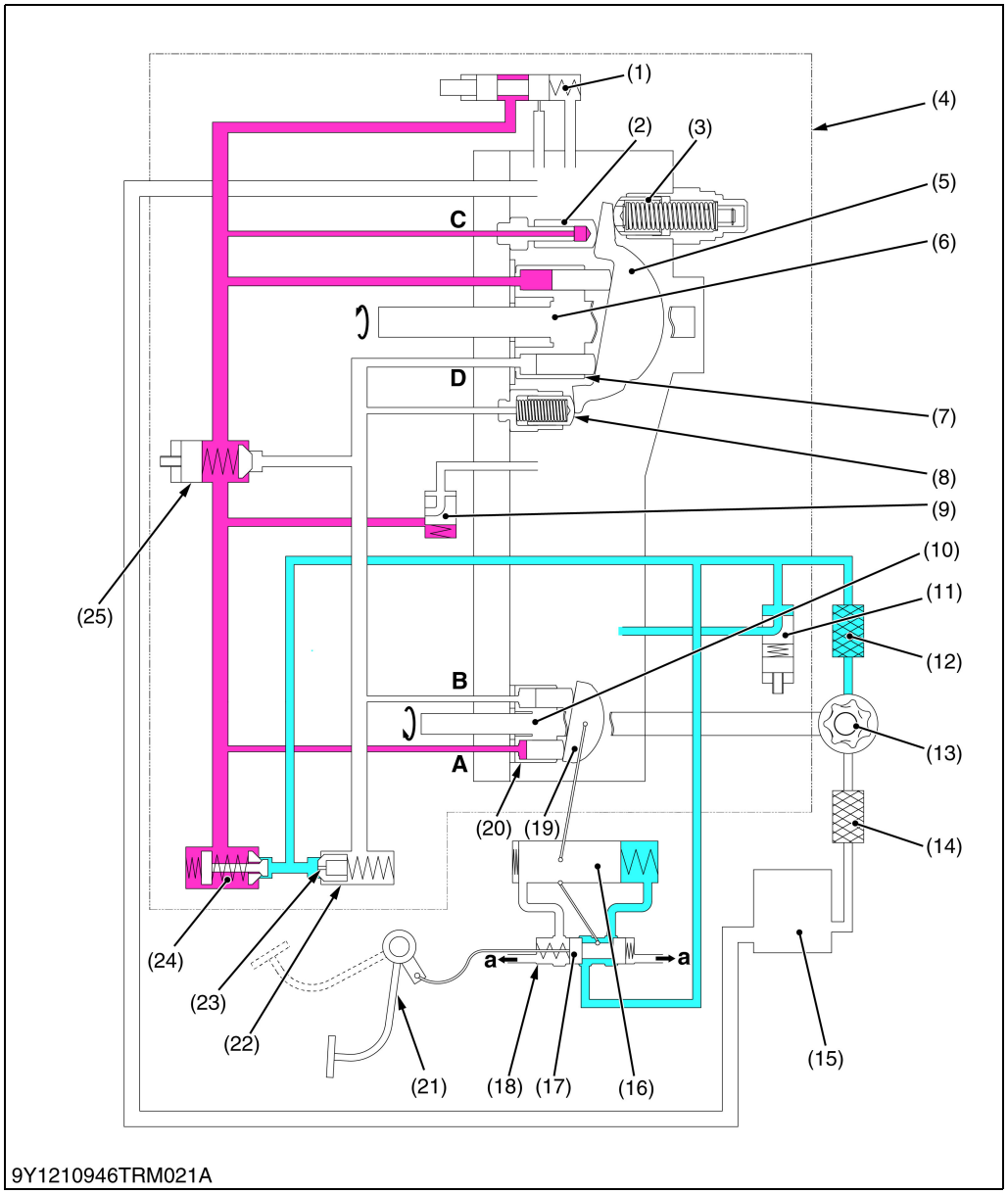
The oil discharged from the pump side does not have sufficient pressure to cause the variable swashplate (5) on the motor side to tilt.

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



9Y1210946TRM021A

(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

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.

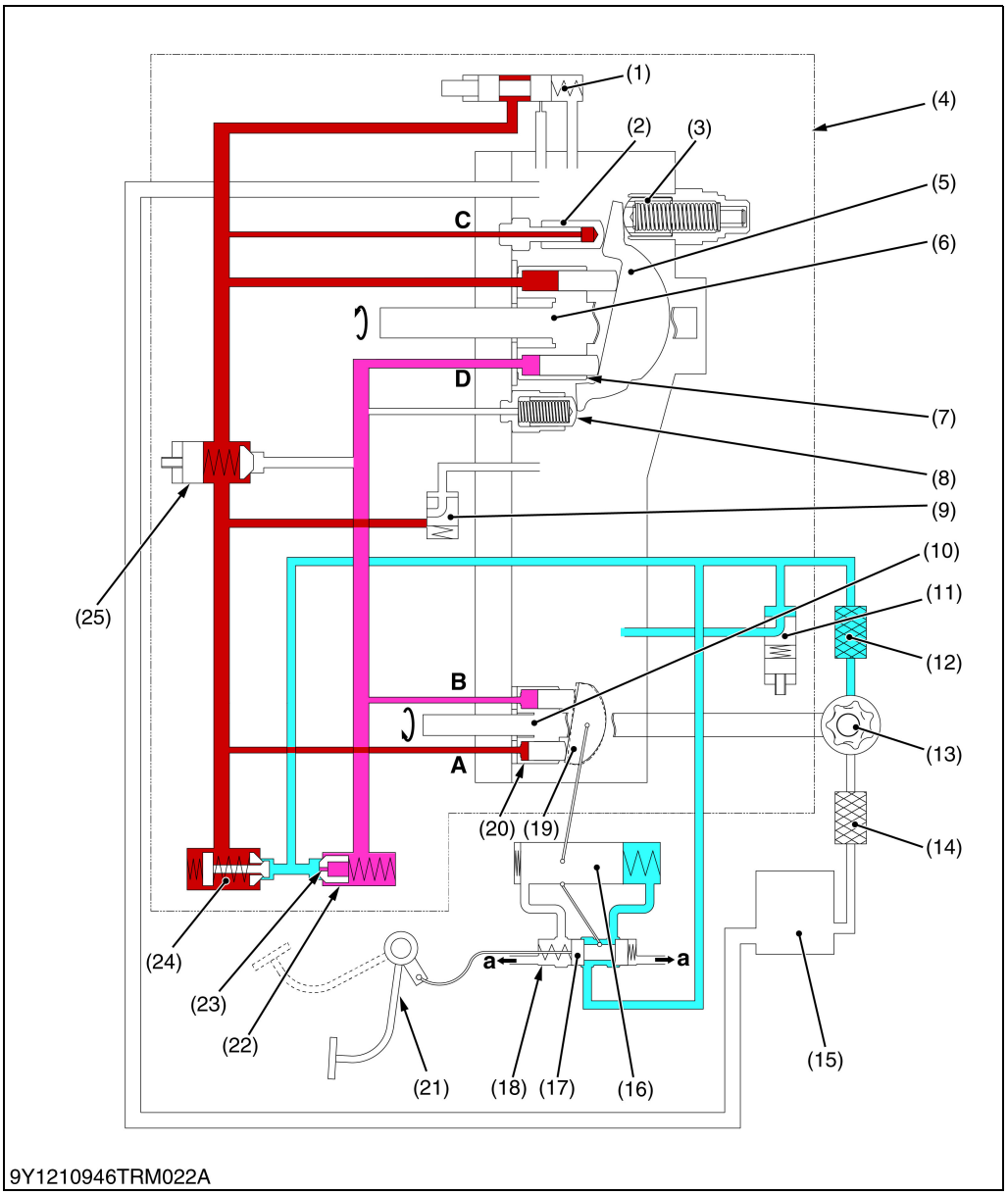
Based on pressure of oil discharged from the pump, the control piston 1 (2) starts to tilt the variable swashplate (5) on the motor.

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



9Y1210946TRM022A

(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

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.

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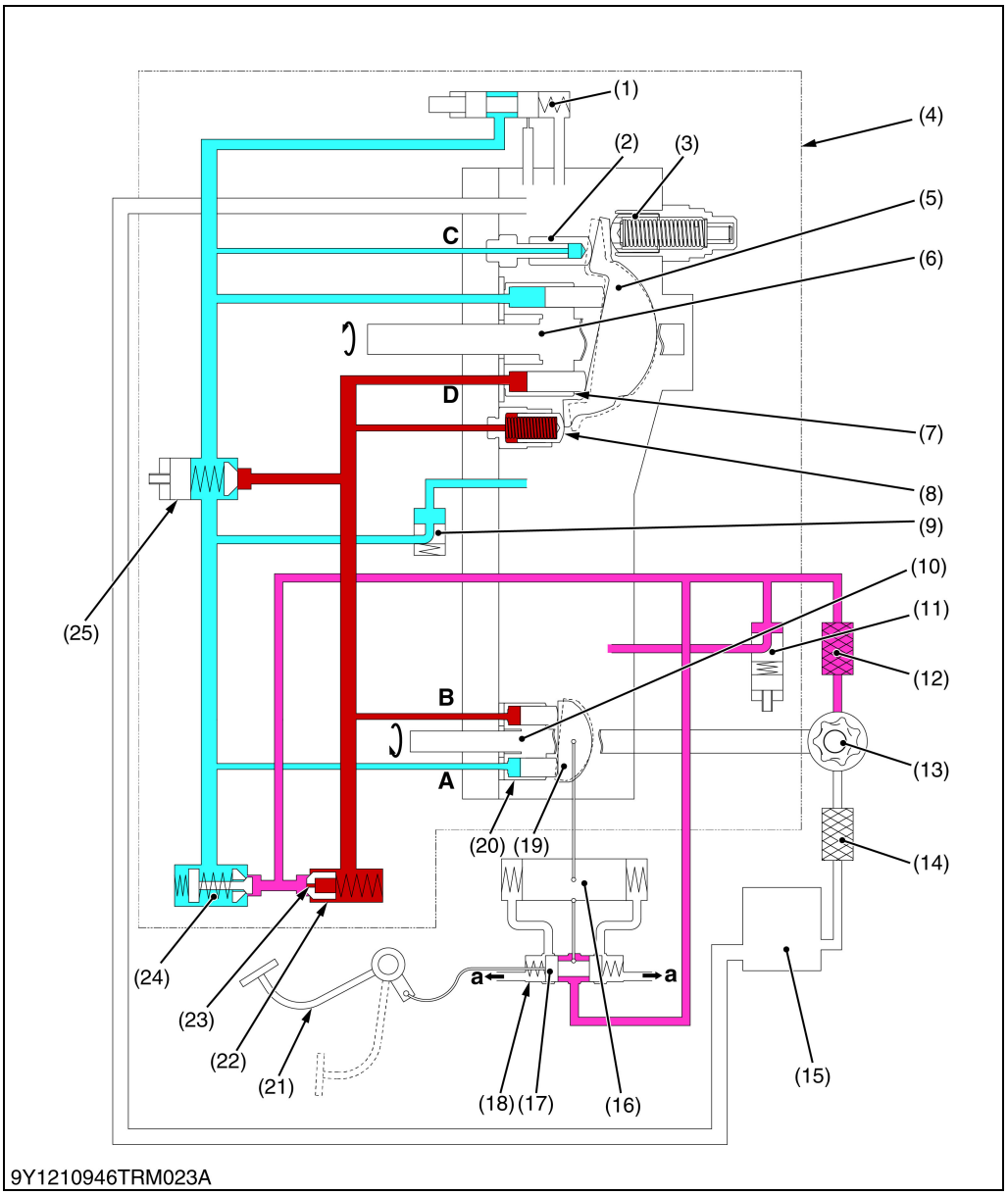
[F] When Dynamic Brake Is Engaged



9Y1210946TRM023A

(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).

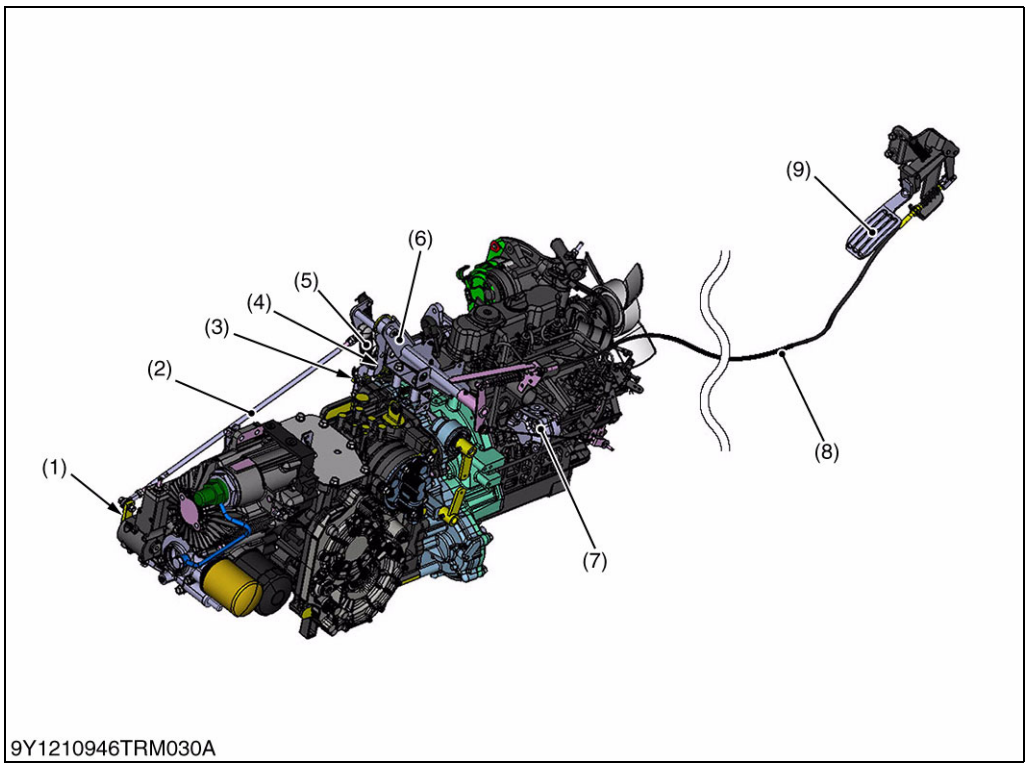
If oil returned from the high pressure relief valve (25) and oil supplied from the charge circuit is insufficient, the anti-cavitation valve (9) is activated through negative pressure.

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

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.

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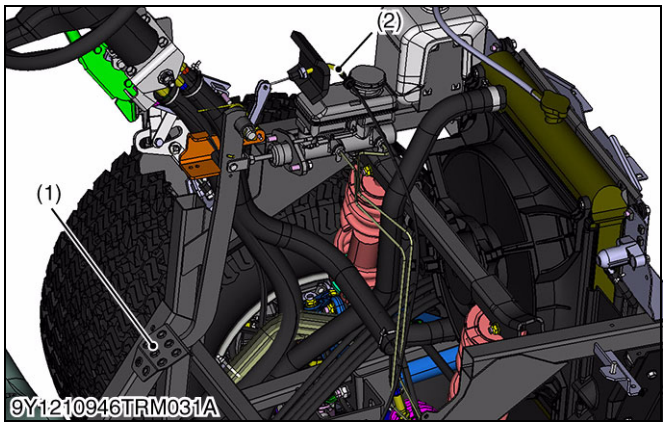
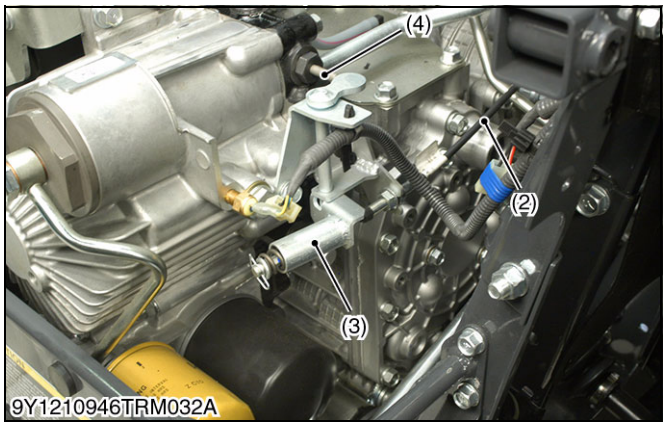
[B] Unload Valve Linkage





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

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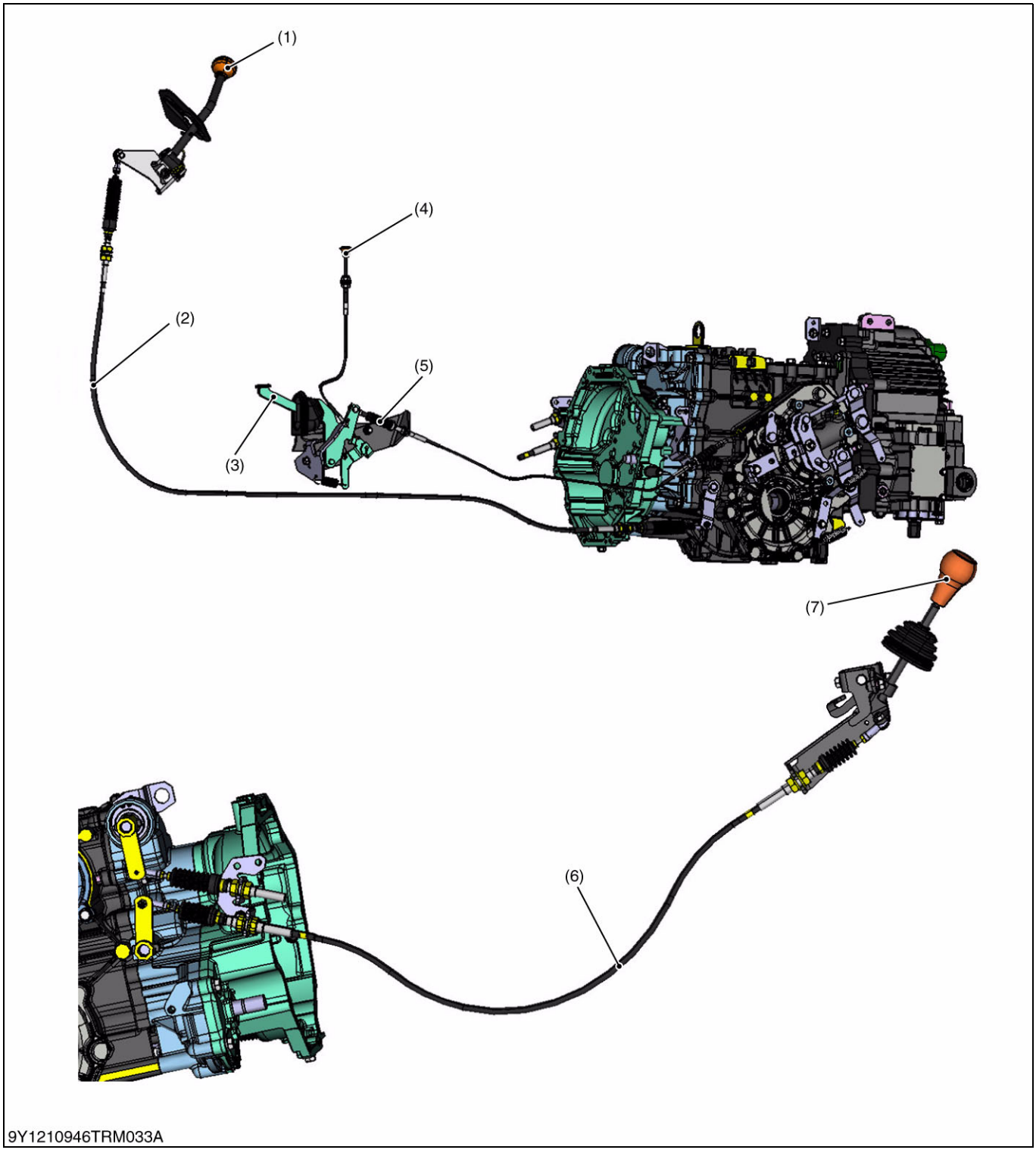
(6) Cables

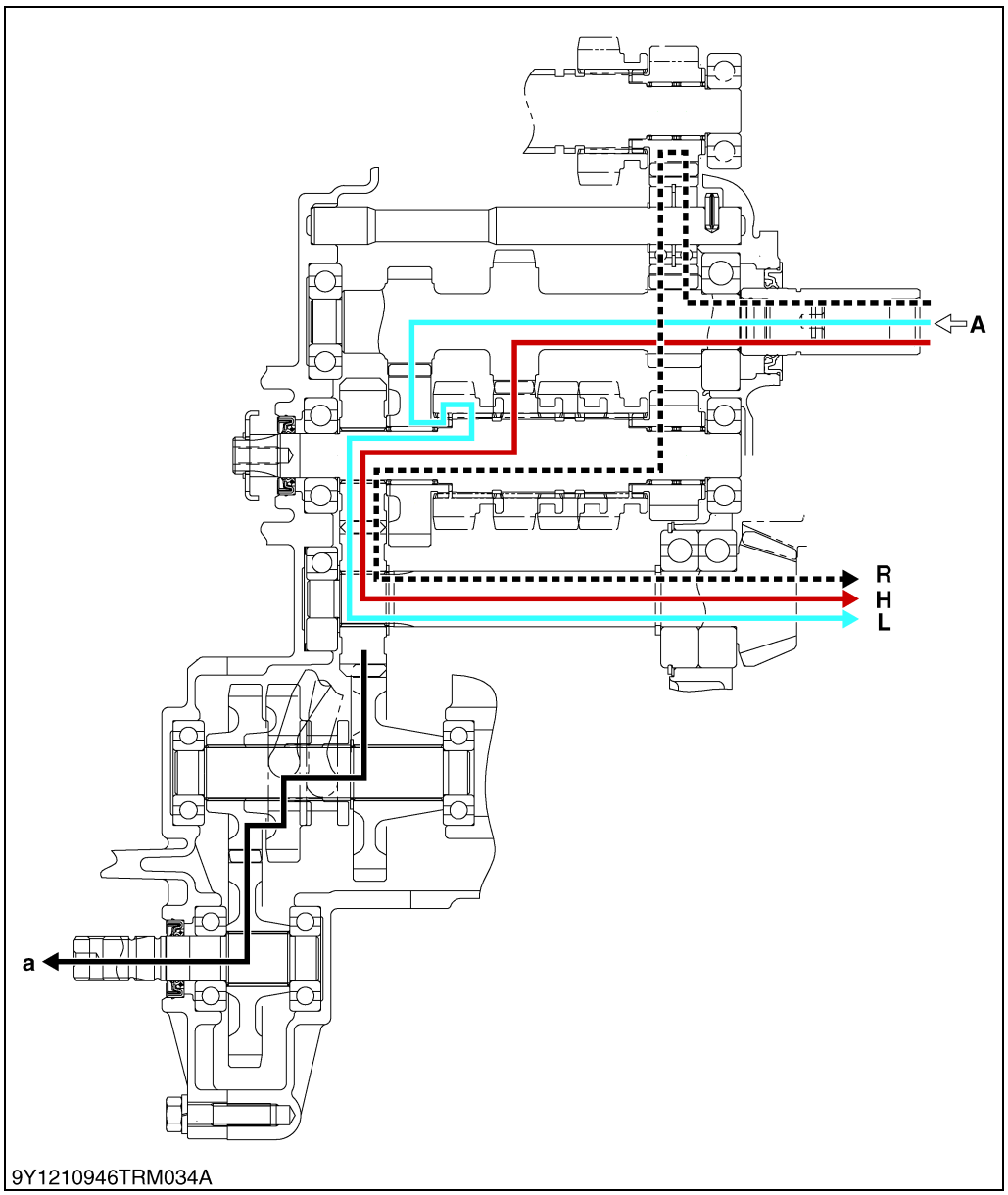


(1) Main Shift Lever
(2) Shift Cable
(3) Differential Lock Pedal
(4) Differential Lock Holder
(5) Differential Lock Cable
(6) 4WD Shift Cable
(7) 4WD Lever

Each control cable is the structure of figure.

9Y1210946TRM0032US0

[2] RANGE GEAR SHIFT SECTION AND FRONT WHEEL DRIVE SECTION



9Y1210946TRM034A

R: Reverse
L: Low Speed
H: High Speed
a: 4 Wheel Drive
A: From HST Output Shaft

■ 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

[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-19
	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-26
		2. Check charge pressure	2-S6
		3. Inspect or flush charge relief valve	2-S50
	Check and high pressure relief valve does not move smoothly	Inspect or replace check and high pressure relief valve	2-S50
	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-19
	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-26
		2. Check charge pressure	2-S6
		3. Inspect or flush charge relief valve	2-S50
	Check and high pressure relief valve does not move smoothly	Inspect or replace check and high pressure relief valve	2-S50
	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-19
	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-26
		2. Check charge pressure	2-S6
		3. Inspect or flush charge relief valve	2-S50
	Check and high pressure relief valve does not move smoothly	Inspect or replace check and high pressure relief valve	2-S50
	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-19
	Radiator and oil cooler net clogged clean radiator net	Excessive machine load Reduce machine load	G-20, G-21
	Improper charge pressure	Solution order 1. Check high relief pressure	2-S7
		2. Replace transmission oil filter cartridge	G-26
		3. Replace check and high pressure relief valve	2-S50
		4. Inspect and replace charge relief valve	2-S50
Machine Will Not Stop in Neutral Position	Control linkage is out of adjustment or sticking	Repair or replace linkage	2-S29, 2-S32
		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-S50

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-S36
	Bearings worn	Replace	2-S46
Gear Slip Out of Mesh	Shift fork spring tension insufficient	Replace	2-S36
	Shift fork or shiftier worn	Replace	2-S36
	Shift fork bent	Replace	2-S36

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[3] DIFFERENTIAL GEAR SECTION

Symptom	Probable Cause	Solution	Reference Page
Excessive or Unusual Nose at All Time	Improper backlash between spiral bevel pinion and bevel gear	Adjust	2-S48
	Improper backlash between differential pinion and differential side gear	Adjust	2-S47
	Bearing worn	Replace	2-S40
	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-S40
	Differential lock binding (does not disengage)	Replace	2-S38
	Bearings worn	Replace	2-S40
Differential Lock Can Not Be Set	Differential lock shift fork damaged	Replace	2-S38
	Differential lock shiftier mounting pin damaged	Replace	2-S38
Differential Lock Pedal Does Not Return	Differential lock pedal return spring weaken or damaged	Replace	2-S38
	Differential lock fork shaft rusted	Repair	2-S38

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-12.)

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
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

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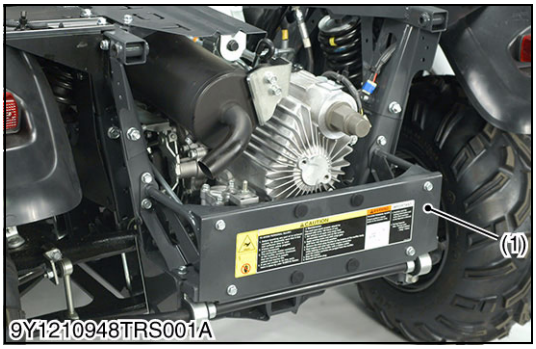
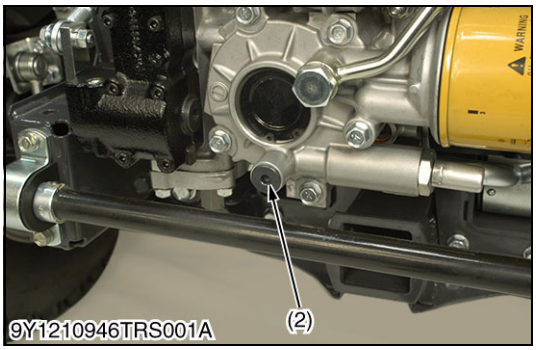
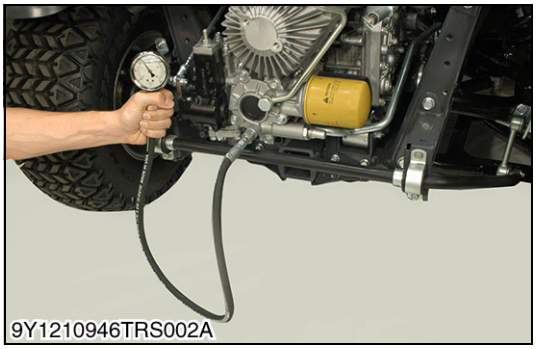
4. CHECKING AND ADJUSTING







Checking Charge Relief Pressure

CAUTION

- **If it is necessary to run engine in an enclosed area, use a gas tight exhaust pipe extension to remove the fumes.**
- **Always try to work in a ell-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-S50.)

(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/cm^2, 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

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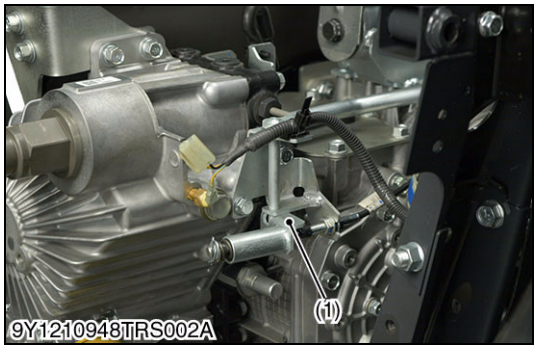

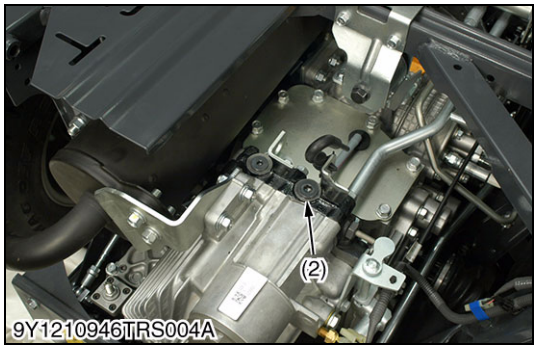

Checking High Pressure Relief Valve Pressure (Traveling Side)

CAUTION

- **If it is necessary to run 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-S50.)

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/cm^2, 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

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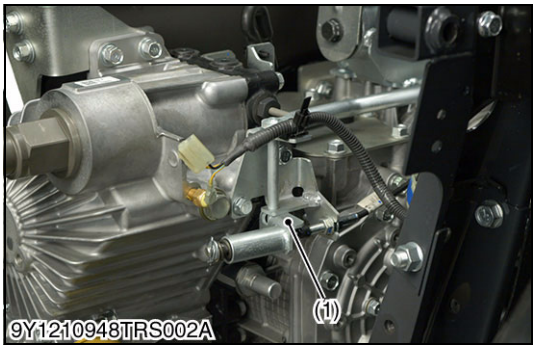
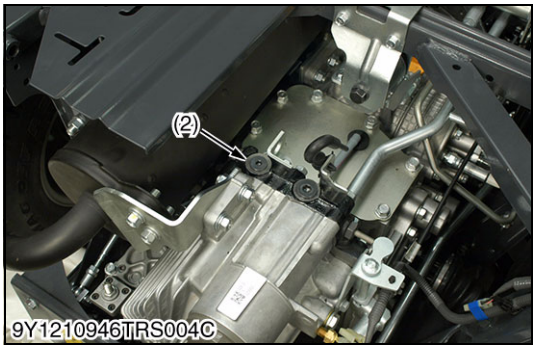
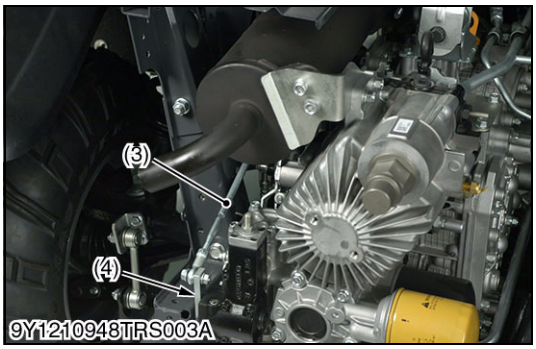
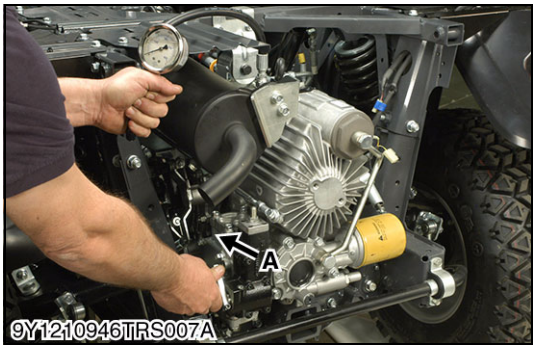








Checking High Pressure Relief Valve Pressure (Dynamic Brake)

CAUTION

- **If it is necessary to run 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 **P2** port (2). (**P2** is for dynamic brake.)
3. Install the HST adaptor and high pressure gauge to **P2** port (2).
4. Check to see that parking brake is applied.
5. Remove the neutral rod (HST control rod) (3) from the HST control lever (4).
6. Remove the unload linkage (1).
7. Set the 4WD lever to 2WD position.
8. Start the engine.
9. Shift the range gear shift lever in **R** position.
10. Depress the speed control pedal when measure pressure. (Engine speed is set by using the tachometer.)
11. Slowly push reverse **"A"** the HST control lever by hand and measure the check and high pressure relief valve pressure.
12. If the measurement is not within the operating pressure, replace the check and high pressure relief valve assembly with new one. (See page 2-S50.)

High pressure relief valve	Operating pressure	20.0 to 22.0 MPa 204 to 224 kgf/cm^2 2900 to 3190 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/cm^2, 4267 psi) full scale.**

(When reassembling)

- Be careful not to damage O-ring on plug.

(1) Unload Cable
(2) **P2** Port (for Dynamic Brake)
(3) Neutral Rod
(4) HST Control Lever

A: Dynamic Brake

(To be continued)

(Continued)

Condition

- Engine speed:
  Maximum while transmission stalling
- Oil temperature:
  45 to 55 °C (113 to 131 °F)

9Y1210948TRS0008US0

Checking Neutral

CAUTION

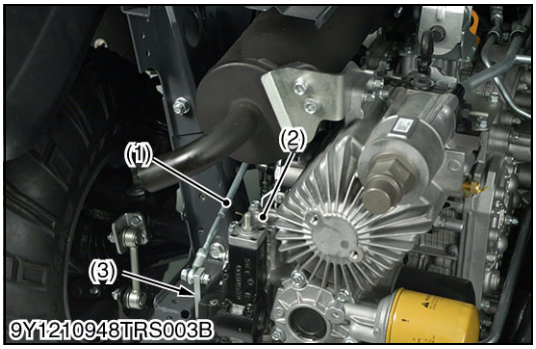
- **Park the machine on a hard and level surface.**
- **If it is necessary to run engine in an enclosed area, use a gas tight exhaust pipe extension to remove the fumes.**
- **Always try to work in a well-ventilated area.**
- **Lift up and secure with jack stands or blocking the front of machine, do not run the machine while adjusting.**
- **Work by two people when you checking and adjusting neutral.**

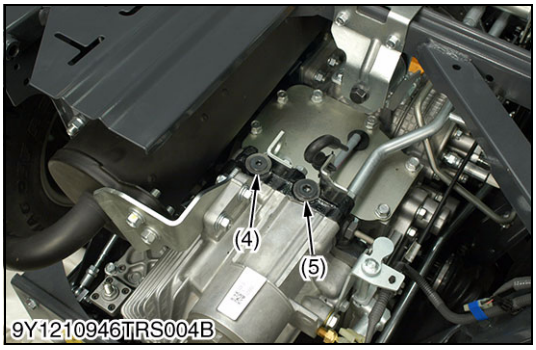
NOTE

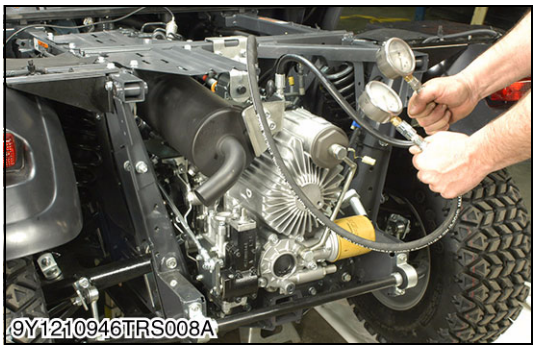
- **The hex. socket plug is securely tightened. Therefore, it is very important to use a proper-sized allen wrench and fit it securely onto the plug. Do not give a shock but put your weight on the plug slowly, paying attention not to damage its hex. socket section. If the allen wrench is fitted on the 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.**

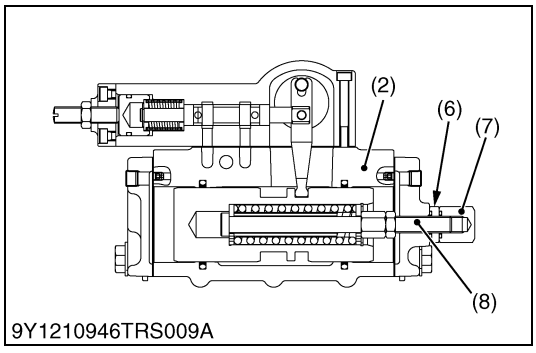
(To be continued)

(Continued)









■ **IMPORTANT**

- **When the neutral position of the machine is checked, it is advisable to divide the checking procedure as follows: First check the HST unit alone, and then connect the HST unit to the link for checking.**

1. Remove the cargo bed.
2. Remove the hex. socket head plug from **P1** port (5) and **P2** port (4).
3. Install the HST adaptor and low pressure gauge in **P1** port and **P2** port.
4. Remove the HST control rod (1) from the HST control lever (3) to make situation that HST control lever move freely.
5. Set the 4WD lever to 2WD position.
6. Start the engine and shift the range gear shift lever in **L** position for 5 seconds to make sure that the HST is in neutral position.
7. At this time, check both **P1** port (5) and **P2** port (4) pressure if the wheel rotates.
8. If the measurement is not within the factory specification, adjust with hex. socket head screw (8).

(Adjusting procedure)

- Adjust to loosen the lock nut (6) on a right side of servo piston and for the adjustment hex. socket head screw (8) to make both **P1** port (5) and **P2** port (4) pressure equal while seeing the pressure gauge.
- Retighten the lock nut (6) securely.

(Reference)

- The pressure of **P2** port (4) (dynamic brake) rises when turning the clockwise.
- The pressure **P1** port (5) (traveling side) rises when turning the counterclockwise

9. Reinstall the HST control rod (1) to HST control lever (3) after you make sure neutrality in the HST unit.
10. Adjust the rod length and much a neutral position if the wheel rotates after is stalling the HST control rod (1).

Difference pressure **P1** – **P2**	Factory specification	−0.40 to −0.10 MPa −4.0 to −1.1 kgf/cm^2 −58 to −15 psi

Condition

- Engine speed:
  1400 min^{-1} (rpm)
- Oil temperature:
  45 to 55 °C (113 to 131 °F)

(1) HST Control Rod
(2) Servo Piston
(3) HST Control Lever
(4) **P2** Port (for Dynamic Brake)
(5) **P1** Port (for Traveling G3/8)
(6) Lock Nut
(7) Cap
(8) Hex. Socket Head Screw

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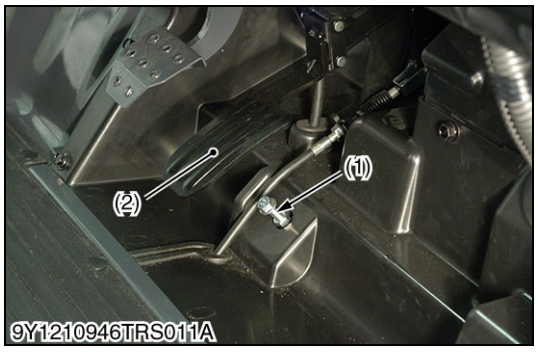
9Y1210946TRS010A

Checking Travelling Speed

CAUTION

- **Park the machine on a hard and level surface.**
- **If it is necessary to run 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.**
- **Lift up and secure with jack stands or blocking the front of machine, do not run the machine while adjusting.**
- **Work by two people when you checking and adjusting travelling speed.**

1. Set the 4WD lever to 2WD position.
2. Start the engine and shift the range shift lever in **H** position and depress the differential lock pedal.
3. Depress the speed control pedal (2) fully, and check the travel speed of panel.
4. If the measurement is not within the factory specification, loosen the lock nut and adjust the length of the speed control pedal stopper bolt (1).



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Travel speed	Reference	25 to 27 mile/h 40 to 43 km/h

(1) Speed Control Pedal Stopper Bolt
(2) Speed Control Pedal
(3) Panel

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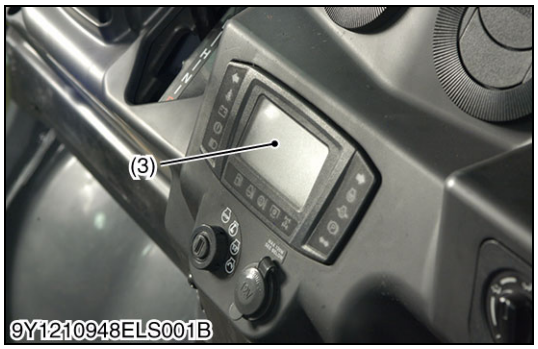

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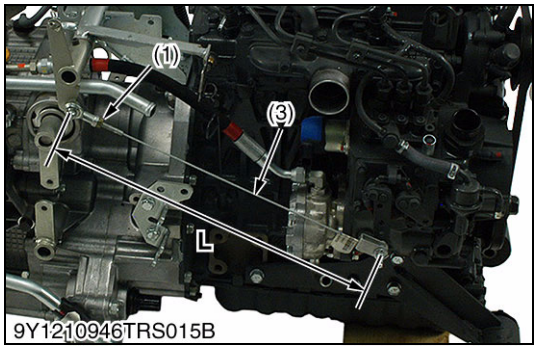
Checking Engine Cable

1. Make sure the mounting position for the engine cable (3) is the position indicated in the figure.
2. Adjust the adjustment nut (1) until there is no deflection in the engine cable (3).
3. Adjust the nut one rotation in the direction causing deflection of the engine cable (3).
4. Install the engine cable to the throttle lever in the position shown in the figure.



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Engine cable length **"L"**	Reference	383 mm 15.1 in.

(1) Adjustment Nut
(2) Throttle Lever
(3) Engine Cable
(4) Fixed Position

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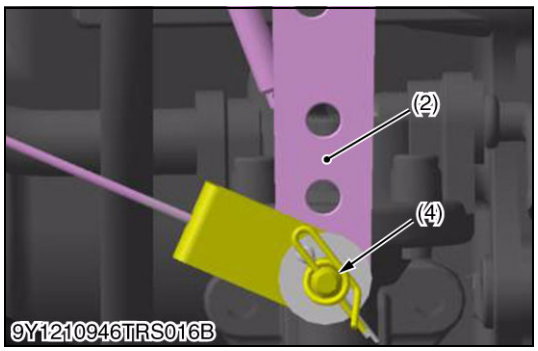

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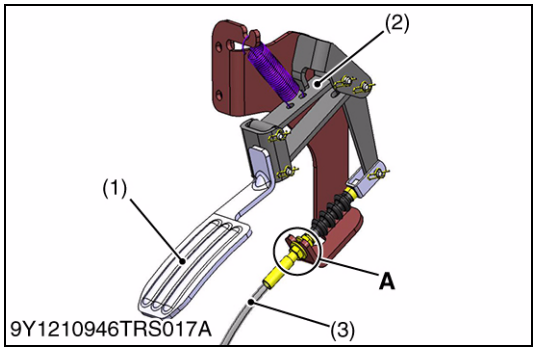

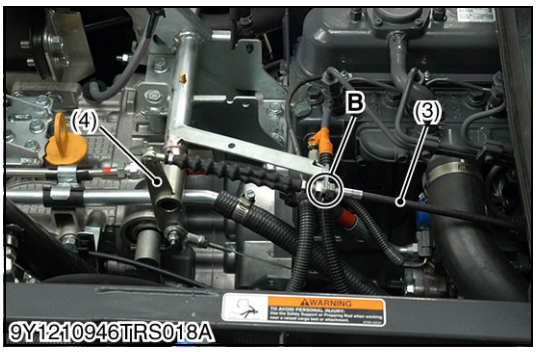

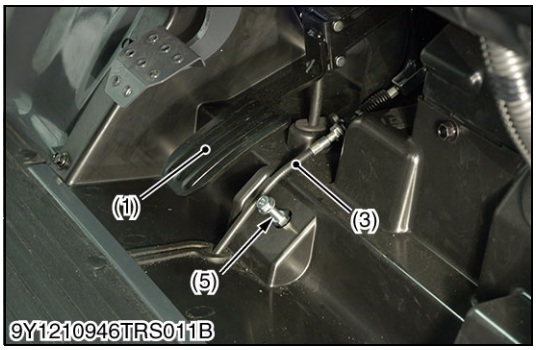

Checking Speed Control Pedal Stroke (Adjustment of the Speed Control Pedal Cable)

CAUTION

- **When checking, park the machine on flat ground, apply the parking brake.**
- **Work by two people when you checking and adjusting speed control pedal stroke.**

1. Mount the speed control pedal cable (3) on the bracket (2) and adjust until the speed control pedal (1) is in contact with the bracket (2).
2. Set the stopper bolt to a position where it is in contact with the speed control pedal (1) with the speed control pedal (1) pushed all the way down.
3. Then, loosen the stopper bolt (5) a half turn and fix in place with a lock nut.
4. Start the engine and check engine speed.
5. If the engine speed is outside of factory specifications, adjust the speed using the HST control rod and the engine cable.

NOTE

- **Speed control pedal cable (3) adjustment is performed through adjustment of the HST control rod and engine cable.**

Condition

- Engine speed:
  1400 min^{-1} (rpm)
- Engine maximum speed:
  3070 to 3170 min^{-1} (rpm)

(1) Speed Control Pedal
(2) Bracket
(3) Speed Control Pedal Cable
(4) HST Linkage
(5) Stopper Bolt

A: Center of thread
B: Adjust the nuts.

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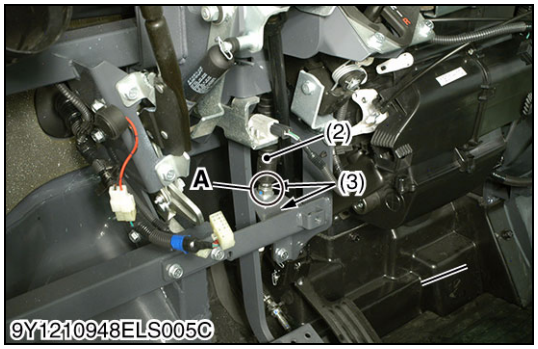

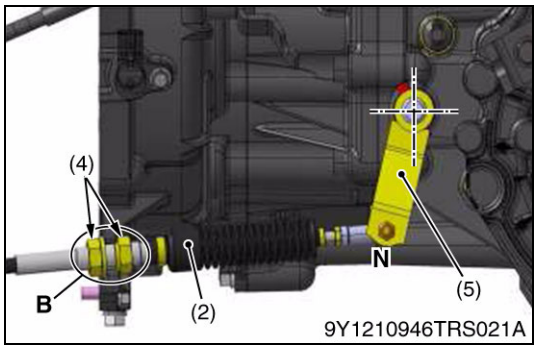

Checking Range Gear Shift Lever Position (Adjusting of the Shift Cable Length and the Select Cable Length)

CAUTION

- **When checking, park the machine on flat ground, and apply the parking brake.**
- **Work by 2 people when you checking and adjusting range gear shift lever position.**

1. Place the stand under the left side of under frame by jack.
2. Remove the rear skid plate (1).
3. Remove the rear wheel LH.
4. Remove the range gear shift cable (2) from the range gear shift arm (5).
5. Remove the range gear shift cable (2) from the range gear shift lever (6).
6. Adjust the range gear shift arm (5) to the neutral position, where the range gear shift arm (5) position to the position neutral position.
7. Set the range gear shift lever (6) position to the neutral position.
8. When installing the range gear shift cable (2) to the cable stay (5), set the adjusting screw at the center position.
9. Install the range gear shift cable (2) to the range gear shift arm (5).
10. Make sure that the range gear shift lever (6) is set at the natural position and install the range gear shift cable (2) to the lever support.
11. Move the range gear shift lever (6) from **"L"** to **"H"**, **"N"** and **"R"** and make sure that the range gear shift arm (5) moves smoothly into detent positions.
12. Make sure that the lock nut (3) of the range gear shift cable (2) is surely fastened.
13. Also check that the lock nuts (3) at the cable end and the ball joint are not loose. Check that the ball joint fitting nuts (lever side and arm side) are tightened.

(1) Rear Skid Plate
(2) Range Gear Shift Cable
(3) Lock Nut
(4) Lock Nut
(5) Range Gear Shift Arm
(6) Range Gear Shift Lever

A: Center of Tread
B: Adjust the nuts.
N: Neutral Position

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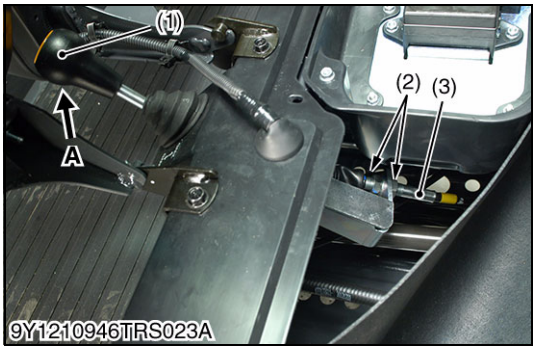

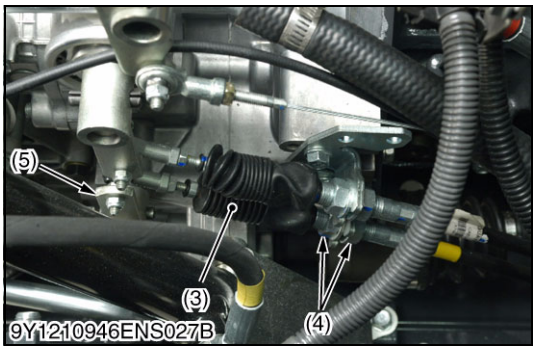

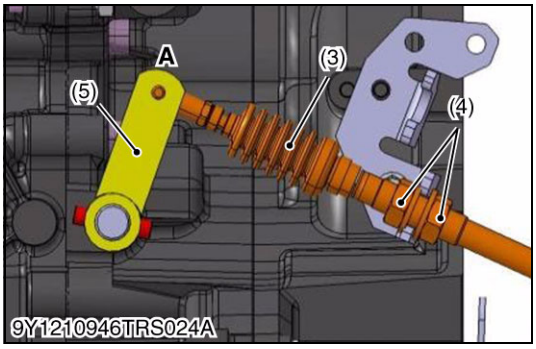

Checking Four Wheel Drive Lever Position (Adjustment of the 4WD Shift Cable Length)

CAUTION

- **When checking, park the machine on flat ground, apply the parking brake.**
- **Work by two people when you checking and adjusting four wheel drive lever position.**

1. Loosen the cable lock nut (2), (4) at the side, and remove the 4WD shift cable (3).
2. Check that the cable is fixed to the stay (4), with the cable outer section screw being set near the center.
   Also check that the lock nuts at the cable end and the ball joint are not loose. Check that the ball joint fitting nuts are tightened.
3. Shift the 4WD shift arm (5) to the 2WD position **"A"**.
4. Fix the 4WD lever (1) in the 2WD position.
5. Remove the slack of cable.
6. Check that the cable moves smoothly.
7. Keeping this condition, put the cable through the cable stay and adjust the length of the cable outer section while being careful not to move the 4WD lever (1).
8. Then tighten the lock nuts (2) firmly. Also check that the lock nuts at the cable end and the ball joint are not loose. Check that the ball joint fitting nuts (lever side and arm side) are tightened.

(1) 4WD Lever
(2) Lock Nut
(3) 4WD Shift Cable
(4) Lock Nut
(5) 4WD Shift Arm

A: 2WD Position

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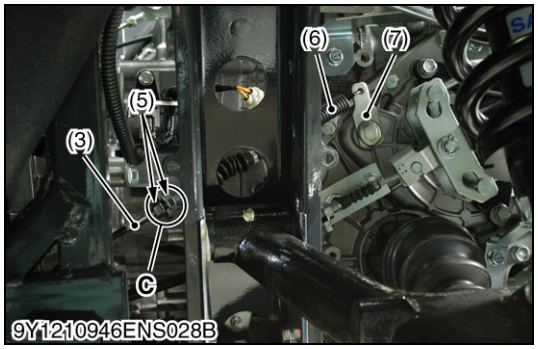

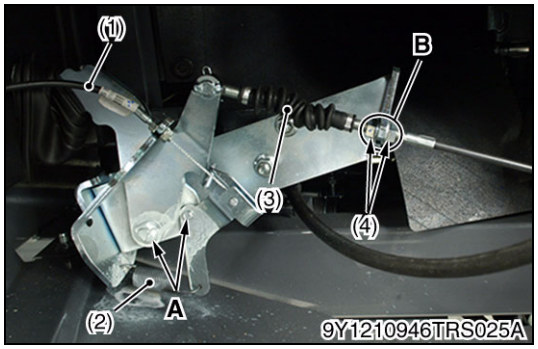

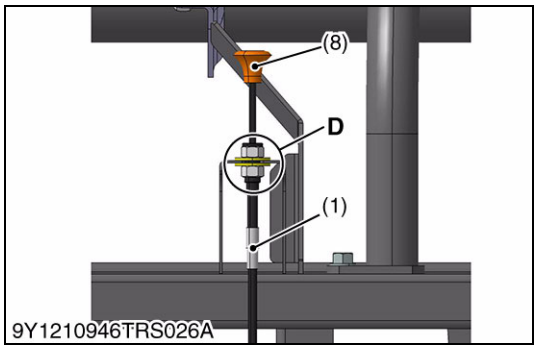

Checking Differential Lock Cable (Adjustment of the length of the cable for differential lock)

CAUTION

- **When checking, park the machine on flat ground, apply the parking brake.**

1. Check that the cable to the transmission case, with the cable outer section screw being set near the center.
2. Adjust the length of the cable outer section so that the differential lock spring (6) has no play, and tighten the lock nut (4).
3. Hook the end of wire to the hole.
4. Install the wire (1) on the stay, set the adjusting at the center position **"C"**.
5. Hook the spring (2).
6. Adjust the wire (1) on the stay, set the top of thread **"D"**.

(1) Wire
(2) Spring
(3) Differential Lock Cable
(4) Lock Nut
(5) Lock Nut
(6) Differential Lock Spring
(7) Differential Lock Lever
(8) Knob

A: Apply spray grease to pins.
B: Adjust the nuts.
C: Center of thread
D: Adjust the top of tread

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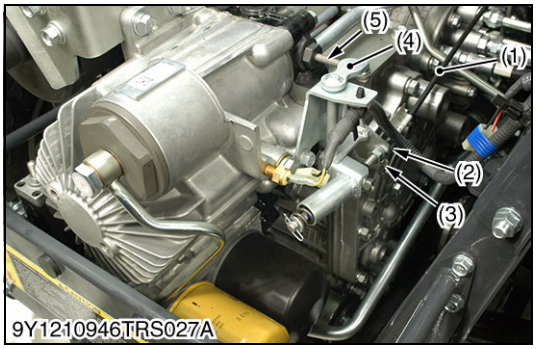

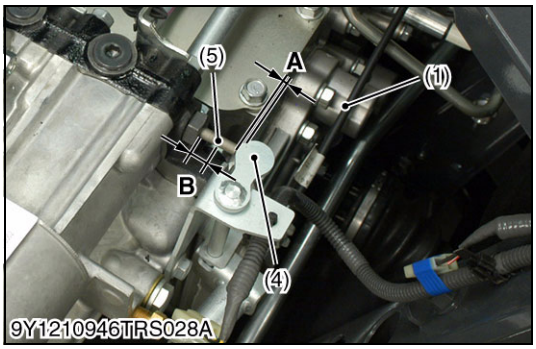

Checking VHT Pressure Release Cable (Unload Cable)

1. Check the unload cable (1) connect the brake pedal as shown is figure.
2. Move the arm (4) and spool (5) from side to side by hand and check a play.
3. If the play **"A"** is not from 0 to 1 mm (0 to 0.04 in.), adjust the unload cable (1) with a lock nuts.
4. When you fix the lock nuts, fix the backward lock nut (3) first, and then tighten the front lock nut (2).
5. Then, press the brake pedal, and check if the arm (4) pushes the spool (5).
6. When the arm (4) pushes the spool (5), check what the length is.
7. If the length which the spool (5) was pushed is not enough, adjust the play **"A"** with a lock nut again.

Play **"A"**	Reference	0 to 1 mm 0 to 0.04 in.
Length **"B"**	Reference	17.5 mm 0.689 in.

(1) Unload Cable
(2) Front Lock Nut
(3) Backward Lock Nut
(4) Arm
(5) Spool

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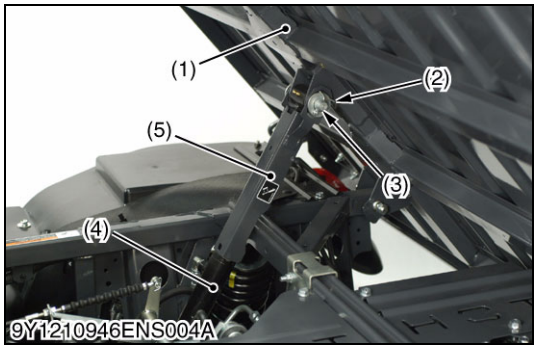
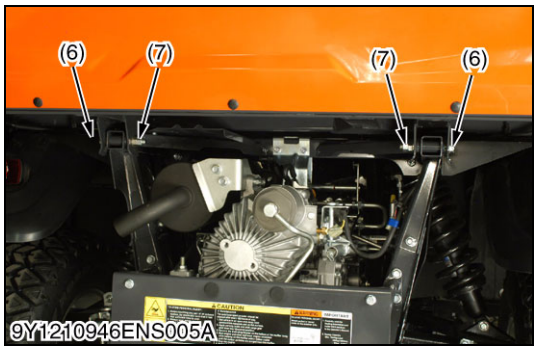
5. PREPARATION

[1] SEPARATING HYDRAULIC TRANSMISSION





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
(2) Cotter Pin
(3) Clevis Pin
(4) Hydraulic Cylinder
(5) Cylinder Lock
(6) Bolt
(7) Lock Nut

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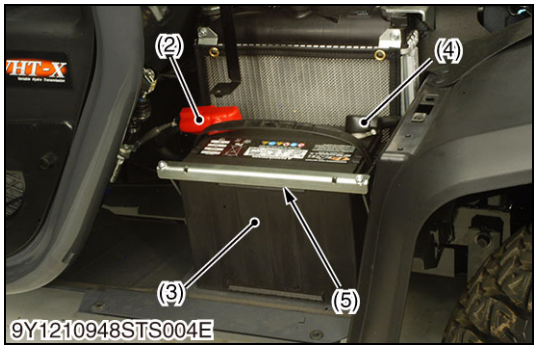

Battery

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
(2) Positive Cable
(3) Battery
(4) Negative Cable
(5) Battery Stay

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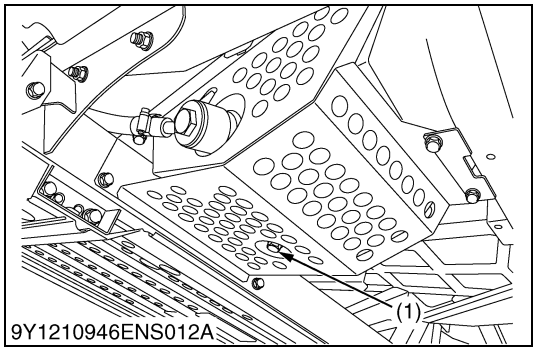

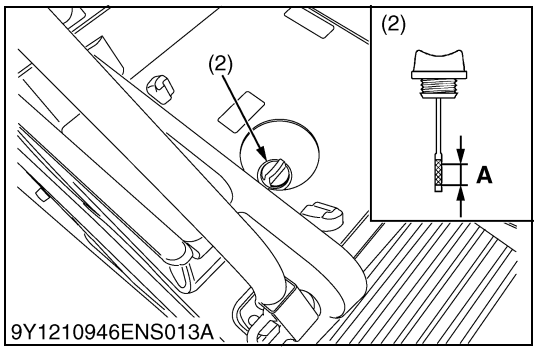

Draining Hydraulic Tank Oil

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.

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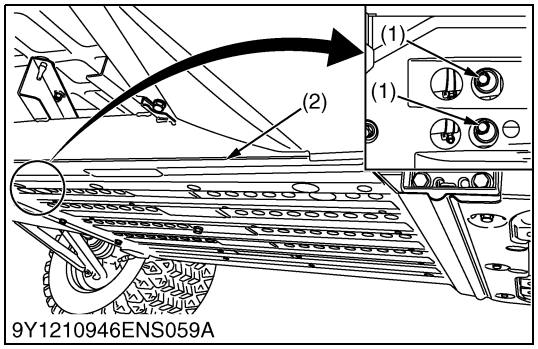

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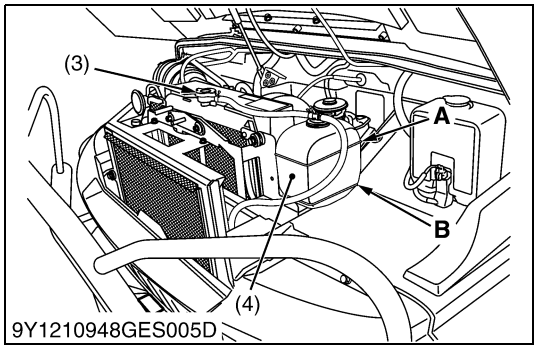

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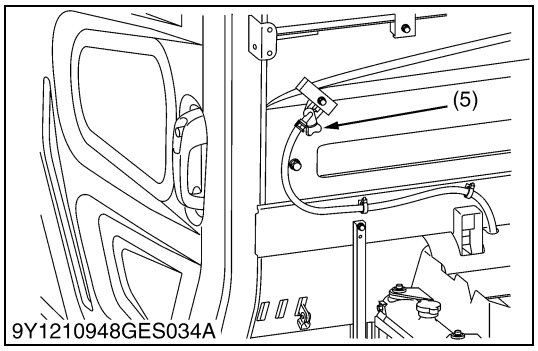

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Draining Coolant

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.**

1. Stop the engine and let cool down.
2. Open the hood.
3. 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.
4. 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

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

A: FULL
B: LOW

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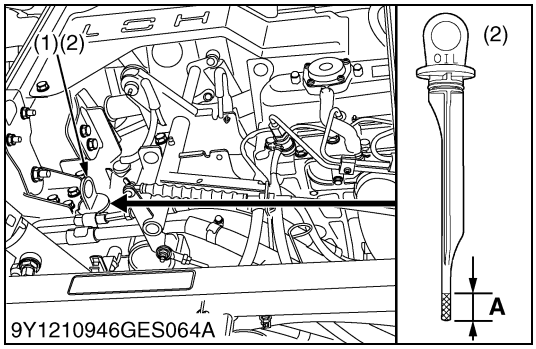

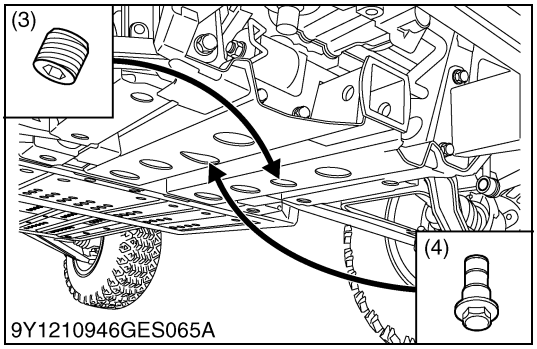

Draining Transmission Fluid

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.

(When reassembling)

- Fill with the new KUBOTA SUPER UDT fluid up to the upper cross hatched area on the dipstick.
- After running 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.**
  Run 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.

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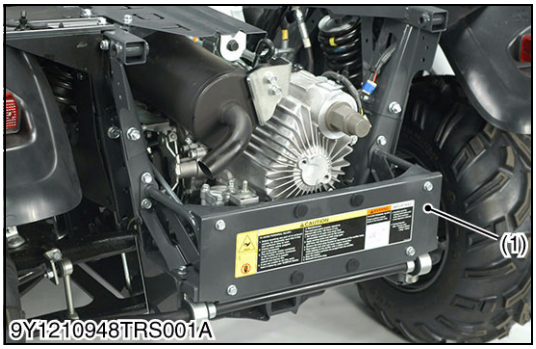

Transmission Rear Cover

1. Remove the transmission rear cover (1).

(1) Transmission Rear Cover

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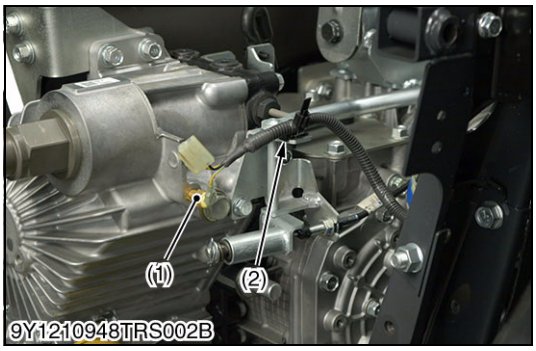

Unload Cable Linkage

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

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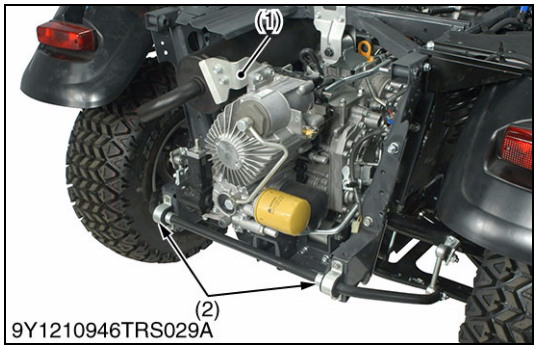

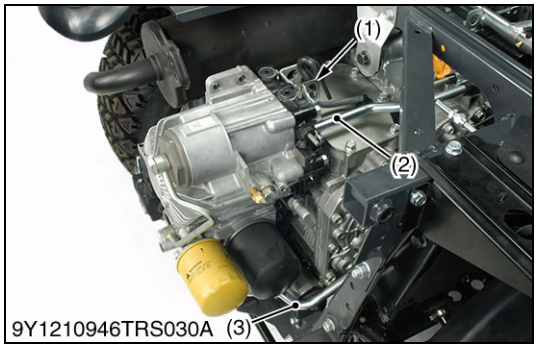

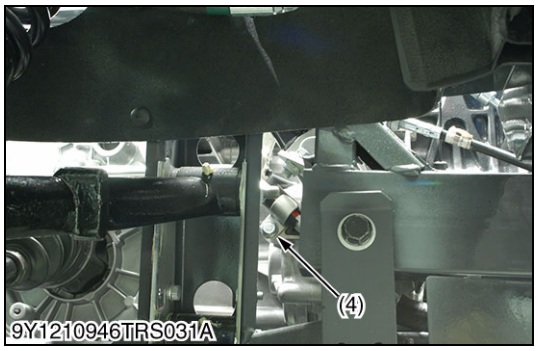

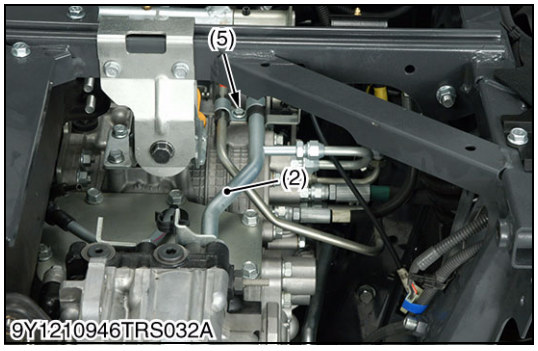

Stabilizer Stay and Muffler Bracket

1. Remove the stabilizer stay (2).
2. Remove the muffler bracket (1).

(When reassembling)

Tightening torque	Muffler bracket mounting bolt and nut	48.0 to 55.9 N·m 4.90 to 5.70 kgf·m 35.4 to 41.2 lbf·ft

(1) Muffler Bracket
(2) Stabilizer Stay

9Y1210946TRS0017US0

Pipes and Clamps

1. Remove the breather pipe clamp (1).
2. Remove the pipe clamps (4), (5).
3. Disconnect the return pipe (2).
4. Disconnect the suction pipe (3).

(When reassembling)

- Be careful not to damage the O-ring.

(1) Breather Pipe Clamp
(2) Return Pipe
(3) Suction Pipe
(4) Clamp
(5) Clamp

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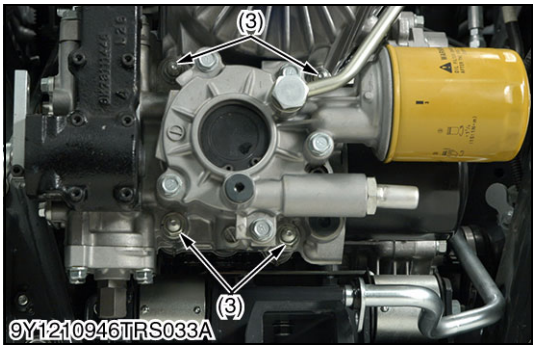
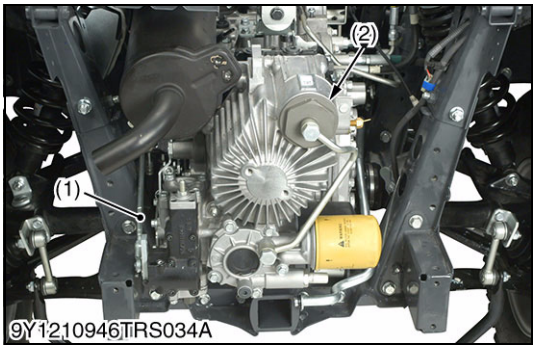
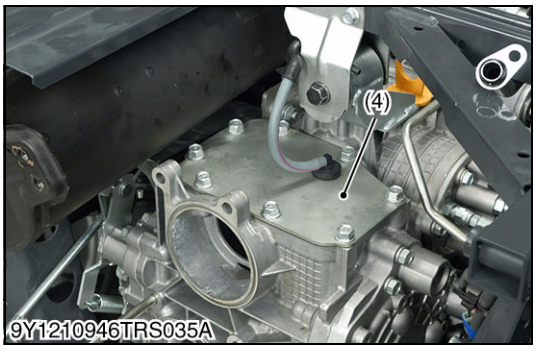
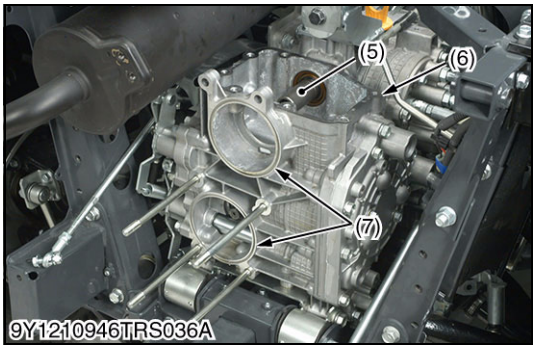








HST Assembly

1. Disconnect the HST control rod (1).
2. Remove the HST mounting nuts (3).
3. Remove the HST assembly (2).

(When reassembling)

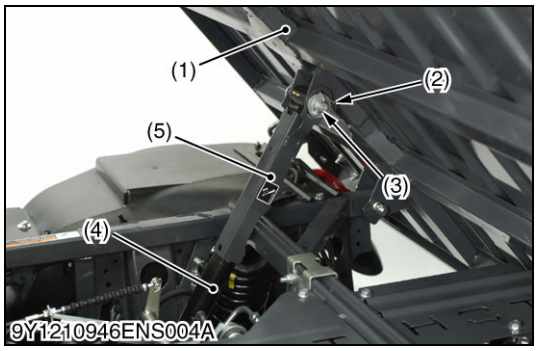
- Remove the upper cover (4).
- Be sure not to damage the O-ring (7).
- Align the HST output shaft and spline of coupling (5).
- Replace the upper cover gasket (6) with new one.

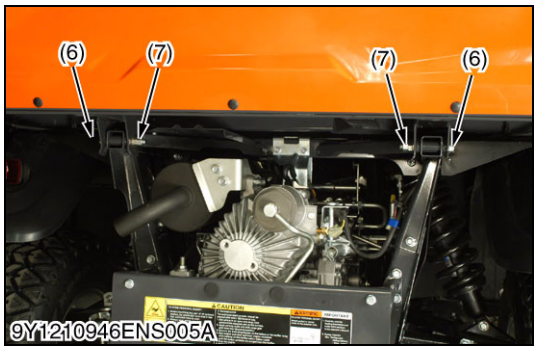
Tightening torque	HST assembly mounting nut	39 to 44 N·m 4.0 to 4.4 kgf·m 29 to 32 lbf·ft

(1) HST Control Rod
(2) HST Assembly
(3) HST Mounting Nut
(4) Upper Cover
(5) Coupling
(6) Gasket
(7) O-ring

9Y1210946TRS0019US0

[2] 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
(2) Cotter Pin
(3) Clevis Pin
(4) Hydraulic Cylinder
(5) Cylinder Lock
(6) Bolt
(7) Lock Nut

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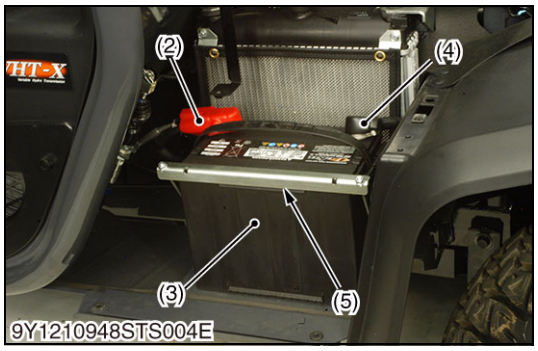

Battery

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
(2) Positive Cable
(3) Battery
(4) Negative Cable
(5) Battery Stay

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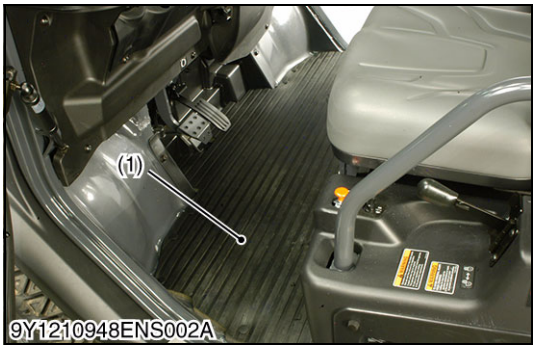

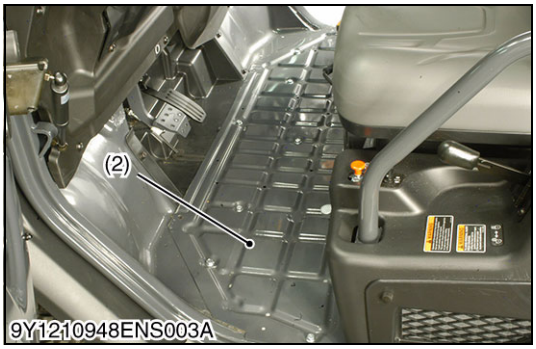

Mat and Center Step

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

(1) Mat
(2) Center Step

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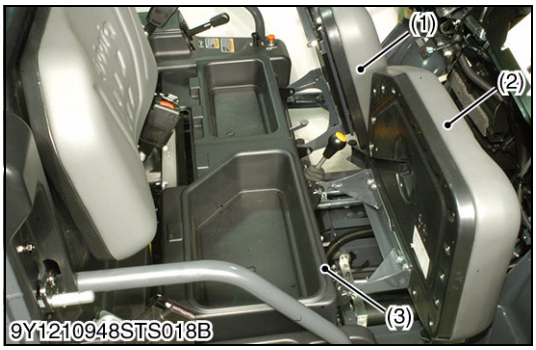

Seat, Center Box Cover and Lower Cover

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

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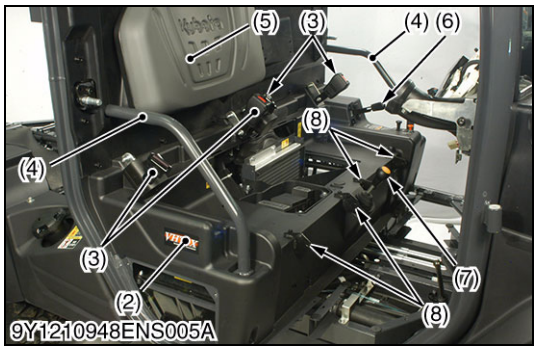

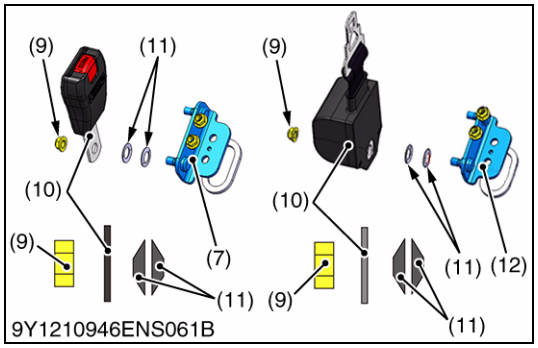

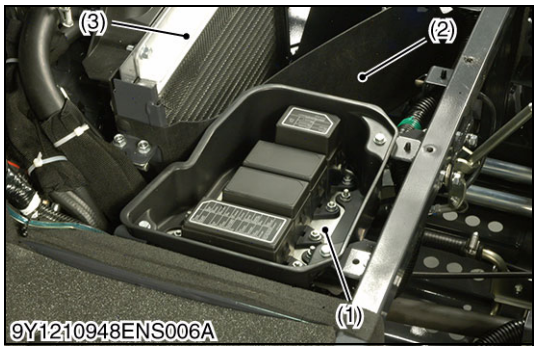

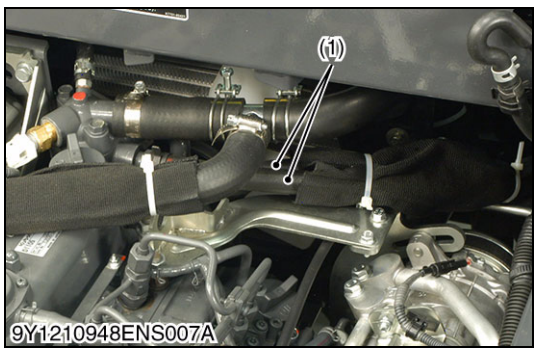

Back Seat, Seat Belt and Center Lower Cover

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 resembling)

- 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
(2) Front Oil Cooler Shield
(3) Oil Cooler

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Heater Hoses

■ **NOTE**

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

1. Disconnect the heater hoses (1).

(1) Heater Hose

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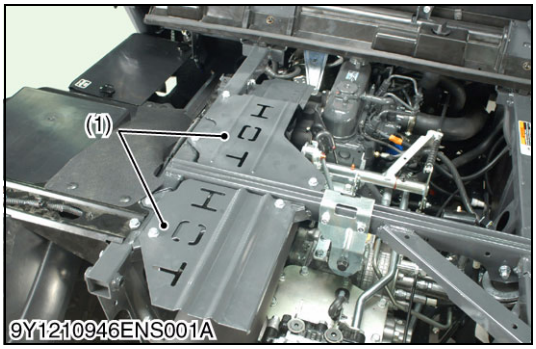

Muffler Cover

1. Remove the muffler cover (1).

(1) Muffler Cover

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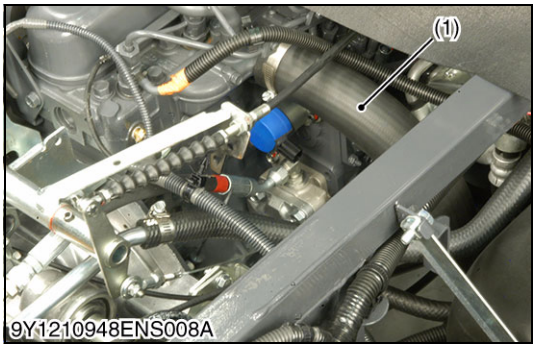

Intake Air Hose

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

(1) Intake Air Hose
(2) Clamp

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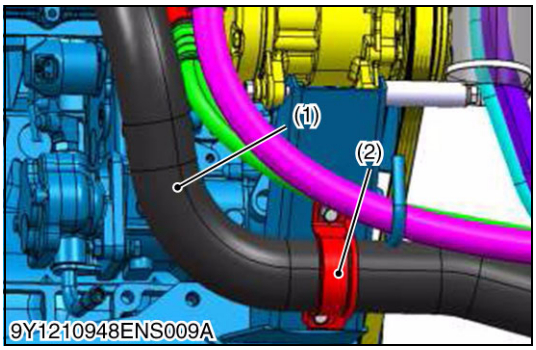

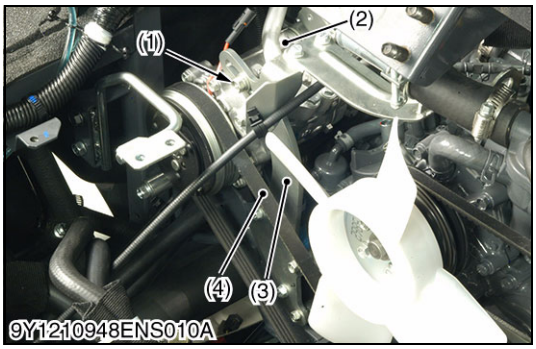

Compressor

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 (3). (See page G-48.)

(1) Adjusting Bolt
(2) Compressor
(3) Compressor Bracket
(4) Air Conditioner Belt

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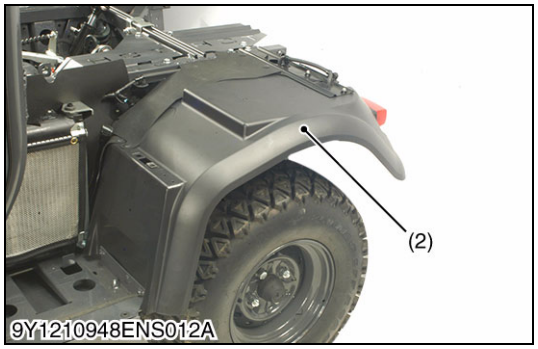

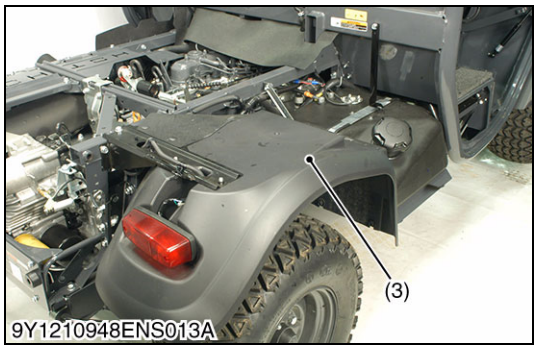

Fender and Fuel Cover

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

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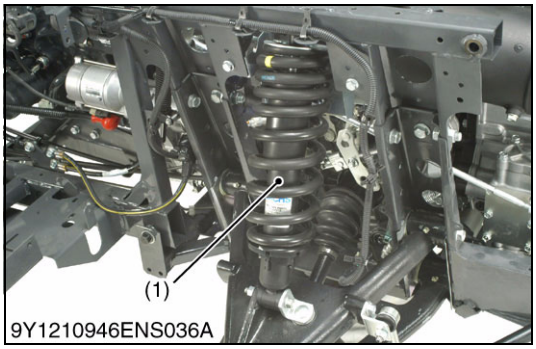

Rear Shock Absorber

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

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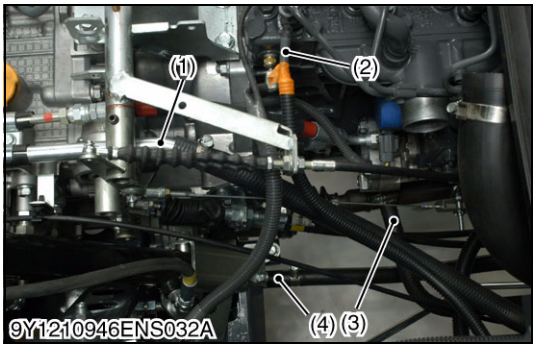

Hoses

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
(2) Fuel Return Hose
(3) Hydraulic Suction Hose
(4) HST Suction Hose
(5) Fuel Suction Hose

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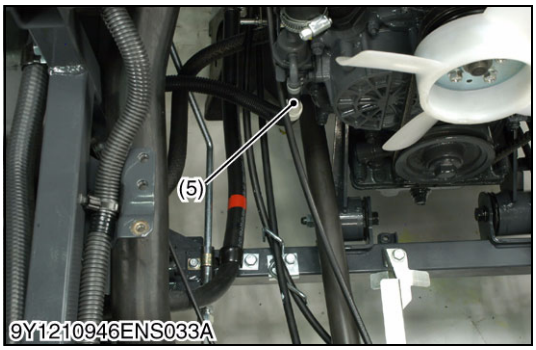

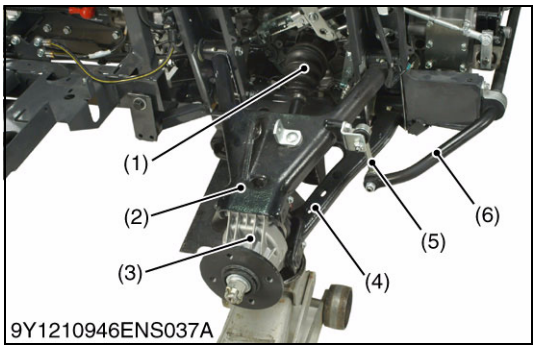

Rear Drive Shaft

■ **NOTE**

- **Do not exceed the range ±25 ° while handling.**

1. Remove the rear stabilizer (6) and stabilizer linkage (5).
2. Remove the rear arm mounting bolts and nuts.
3. Remove the rear upper arm (2).
4. Remove the rear drive shaft (1) with rear knuckle case (3).
5. Remove the rear lower arm (4).

(When reassembling)

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

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

A: ±25 °

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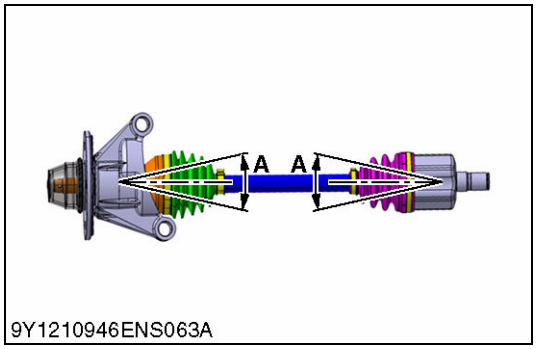

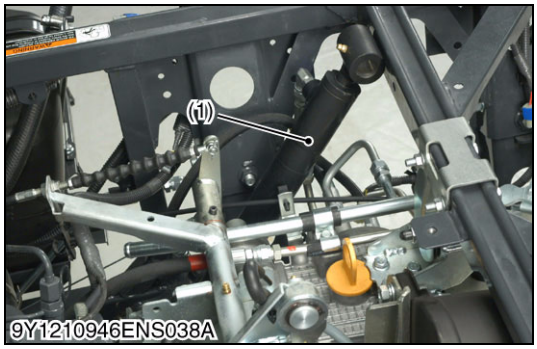

Hydraulic Lift Cylinder

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

(1) Hydraulic Lift Cylinder

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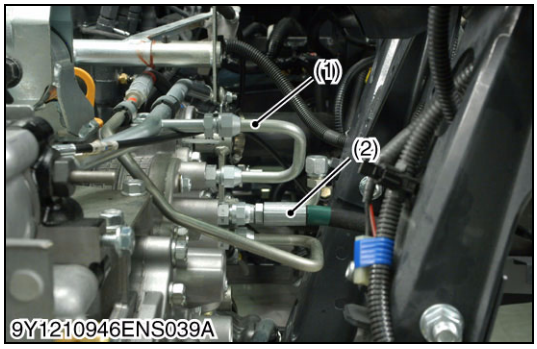

Power Steering Hose and Return Pipe

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

(1) Return Pipe
(2) Power Steering Hose

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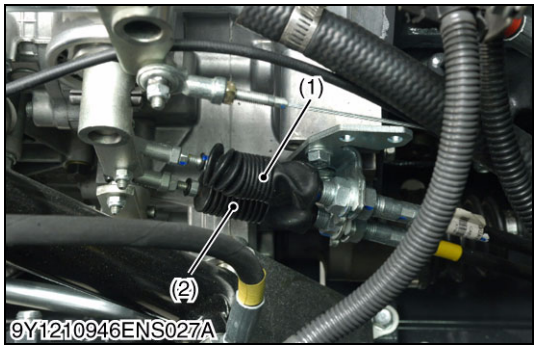
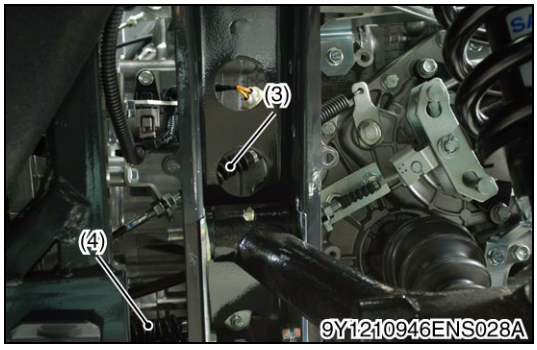


Cables

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-S5.)
- 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
(2) 4WD Shift Cable
(3) Differential Lock Cable
(4) Range Gear Shift Cable
(5) Parking Brake Cable

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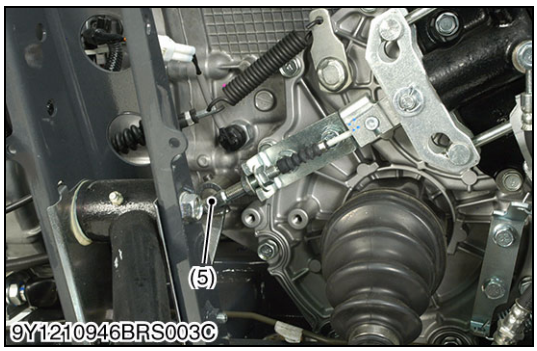

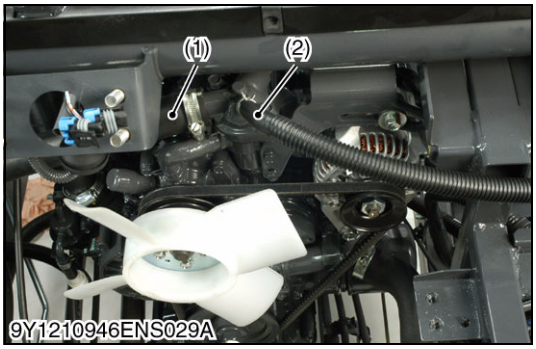

Radiator Hose

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

(1) Radiator Hose
(2) Breather Hose

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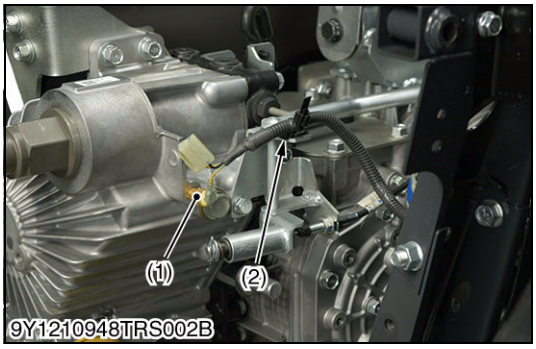

Unload Cable Linkage

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

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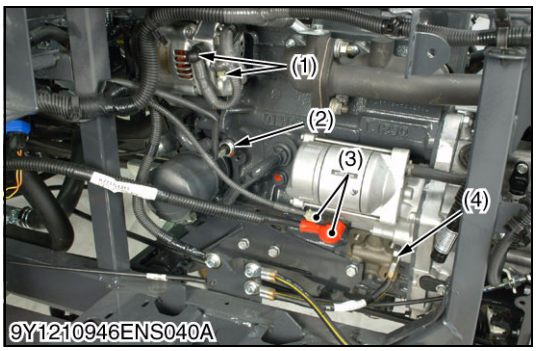

Wiring Harness LH

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

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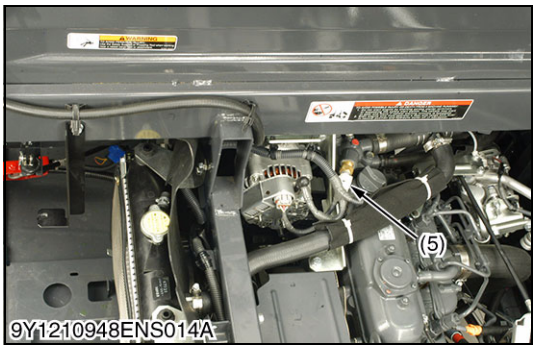

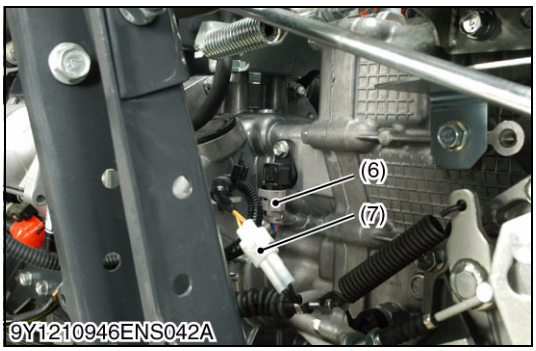

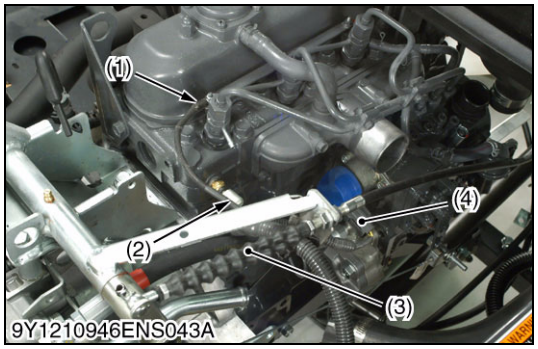

Wiring Harness RH and Speed Control Panel Cable

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
(2) Thermo Sensor Connector
(3) Speed Control Pedal Cable
(4) Engine Stop Solenoid Connector

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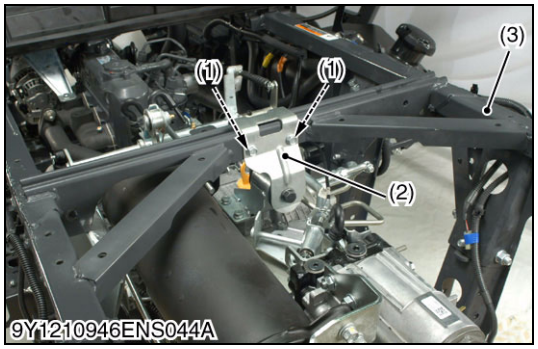


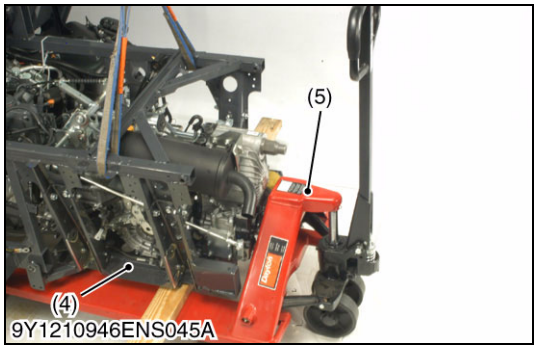
Dismounting Transmission and Engine One Piece Assembly

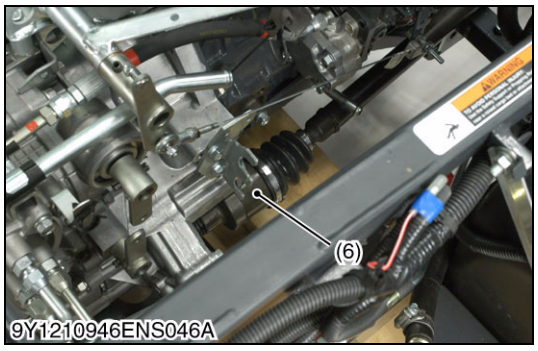
1. Remove the mission upper support (2) and collars (1).
2. Set the hand pallet trucks (5) as shown figure.
3. Lift the mainframe by using hoist as shown in figure.
4. Remove the mission mounting bolts and nuts.
5. Disconnect the 4WD propeller shaft (6).
6. Remove the transmission and engine one piece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

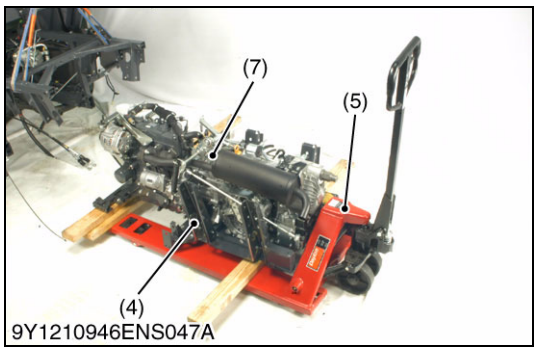
(When reassembling)

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

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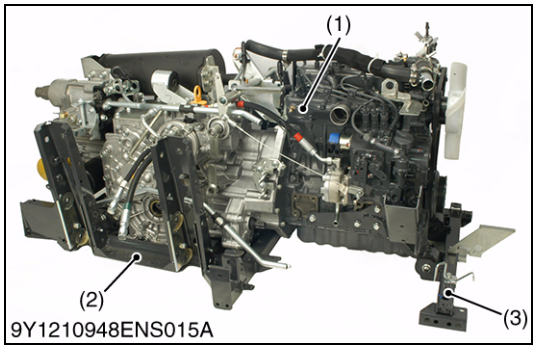

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Mission Frame

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

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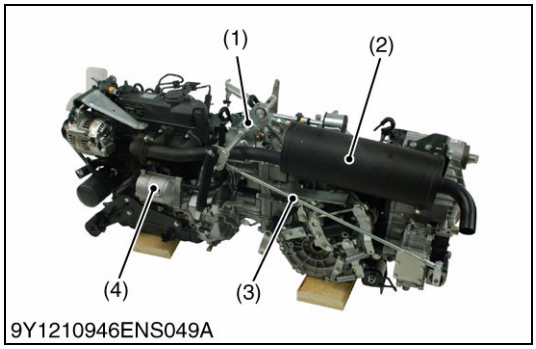
[3] SEPARATING TRANSMISSION AND ENGINE



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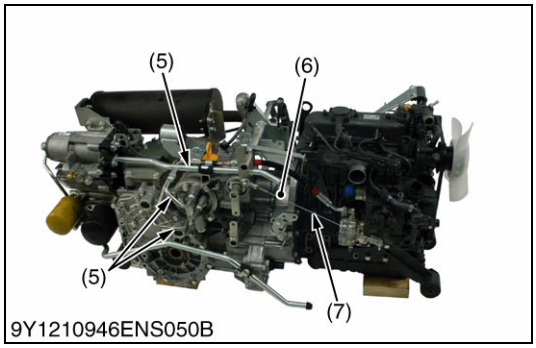

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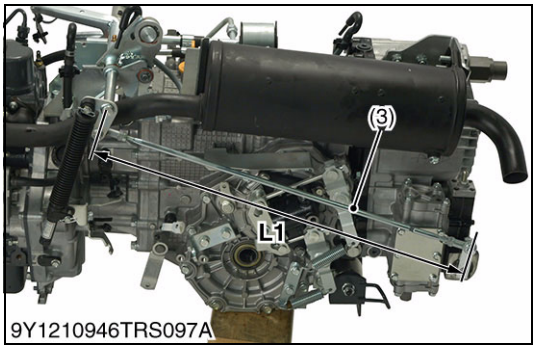

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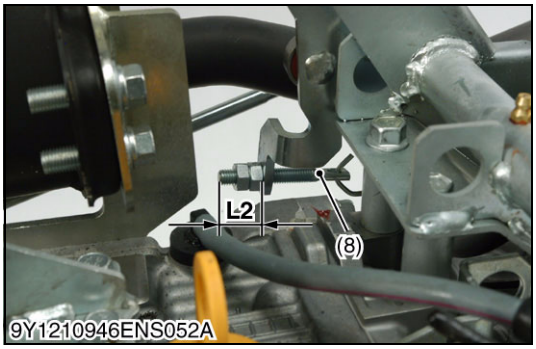

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Linkage, Muffler, Starter and Hydraulic Pipe

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

(When reassembling)

- Adjust the length the HST rod (3).
- Replace the muffler gasket with new one.

(1) HST Linkage
(2) Muffler
(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.)

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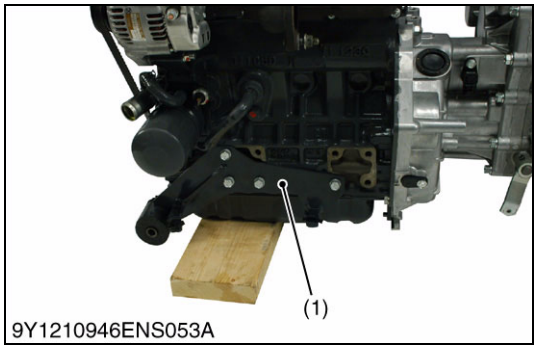

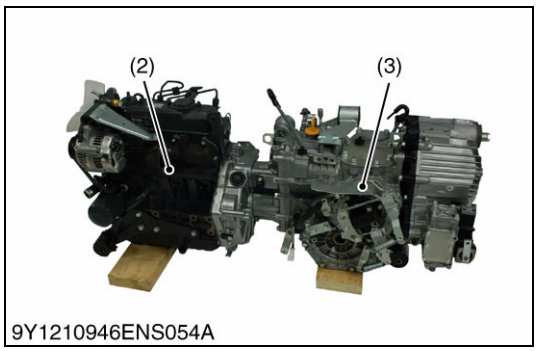

Separate the Transmission and Engine One Piece Assembly

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
(2) Engine
(3) Transmission

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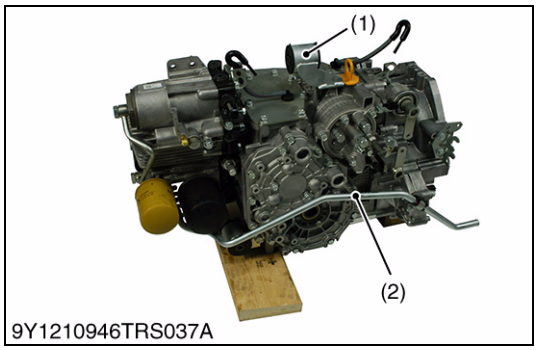

Outer Parts

1. Remove the hydraulic pipe (2).
2. Remove the mission upper bracket (1).
3. Remove the breather hoses (3), (4).
4. Remove the stay (7).
5. Remove the springs (6).
6. Remove the equalizer (5).

(When reassembling)

- Adjust the brake rod and parking brake cable. (See page 4-S7.)

(1) Upper Bracket
(2) Hydraulic Pipe
(3) Breather Hose
(4) Breather Hose
(5) Equalizer
(6) Spring
(7) Stay

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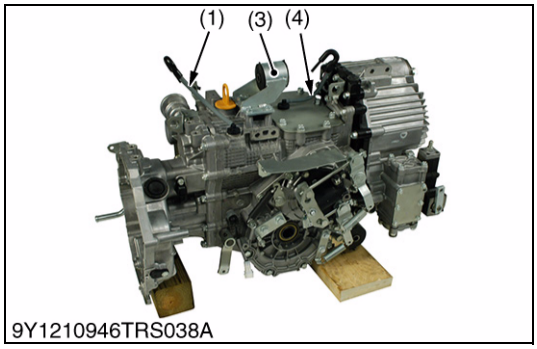
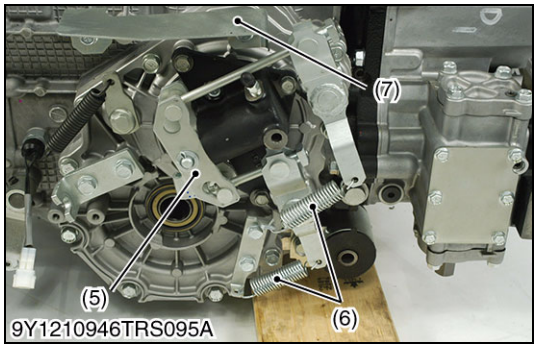
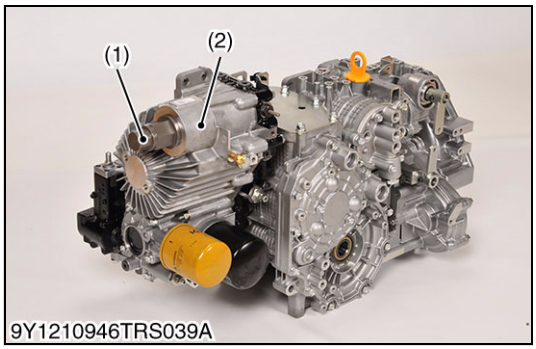


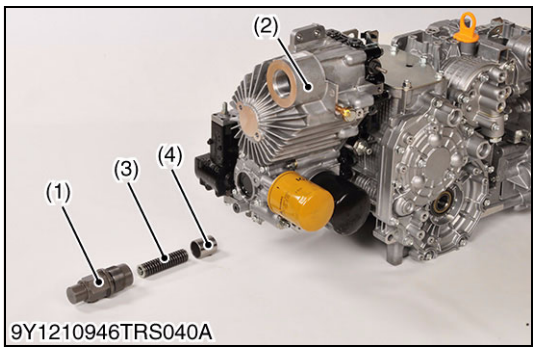


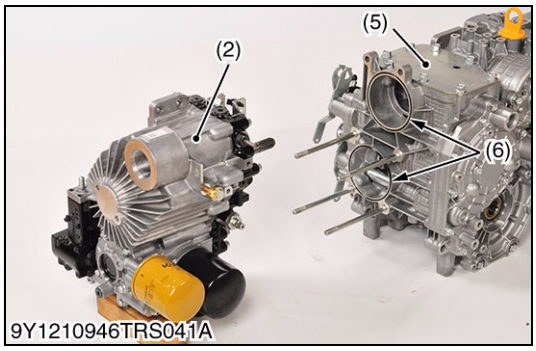
6. DISASSEMBLING AND ASSEMBLING

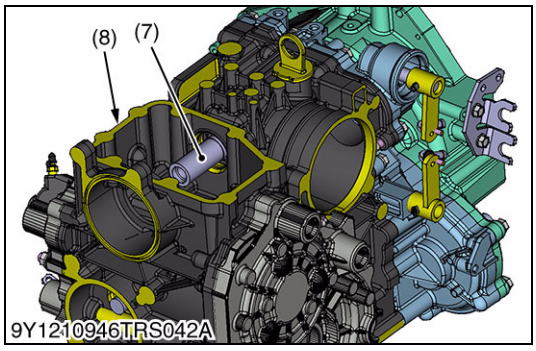
[1] TRANSMISSION

(1) Removing HST Assembly









HST Assembly

1. Remove the piston case (1), spring (3) and piston (4).
2. Remove the HST assembly (2).

(When reassembling)

- Remove the upper cover (5).
- Be sure not to damage the O-rings (6).
- Align the HST output shaft and spline of coupling (7).
- Replace the upper cover gasket (8) with new one.

Tightening torque	HST assembly mounting nut	39 to 44 N·m 4.0 to 4.4 kgf·m 29 to 32 lbf·ft
	Piston case	70 to 80 N·m 7.2 to 8.1 kgf·m 52 to 59 lbf·ft

(1) Piston Case
(2) HST Assembly
(3) Spring
(4) Piston
(5) Upper Cover
(6) O-ring
(7) Coupling
(8) Gasket

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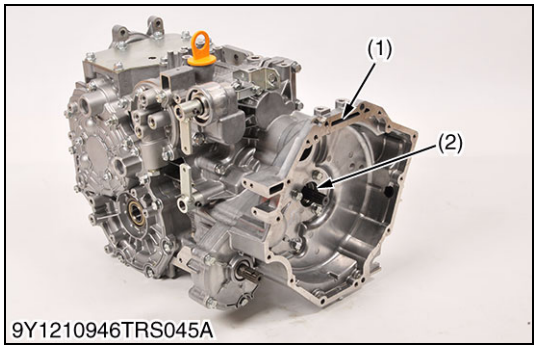
(2) Disassembling Transmission



Fly Wheel Cover

1. Remove the fly wheel cover (1).

(When reassembling)

- Be sure not to damaged the O-ring (2).
- Apply liquid gasket (Three Bond 1216E or equivalent) to joint face the fly wheel cover and front cover.

(1) Fly Wheel Cover
(2) O-ring

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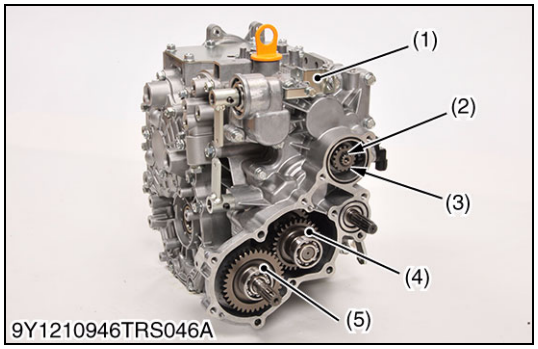

Four Wheel Drive Gear Shaft and Pulse Gear

1. Remove the four wheel drive gear shaft (5) and shifter gear (4).
2. Remove the air-clip (2) and pulse gear (3).
3. Remove the valve arm plate (1).

(1) Valve Arm Plate
(2) Air-clip
(3) Pulse Gear
(4) Shifter Gear
(5) Four Wheel Drive Gear Shaft

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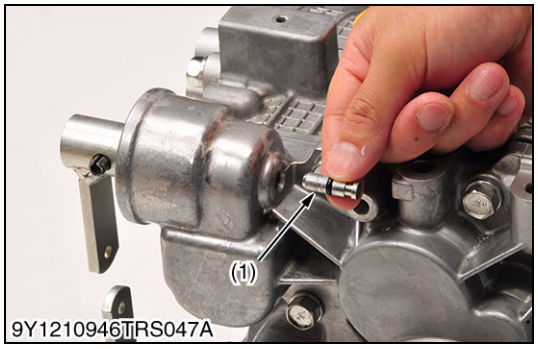

Control Valve Lever and Control Valve Arm

1. Remove the pin (1).
2. Remove the spring pin (4) and control valve lever (5).
3. Remove the internal snap ring (2) and valve arm cover (3).
4. Remove the control valve arm (6).

(1) Pin
(2) Internal Snap Ring
(3) Valve Arm Cover
(4) Spring Pin
(5) Control Valve Lever
(6) Control Valve Arm

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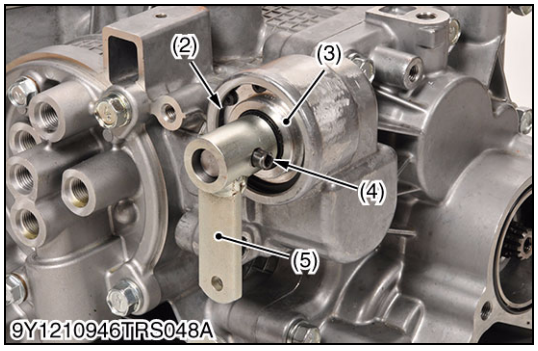

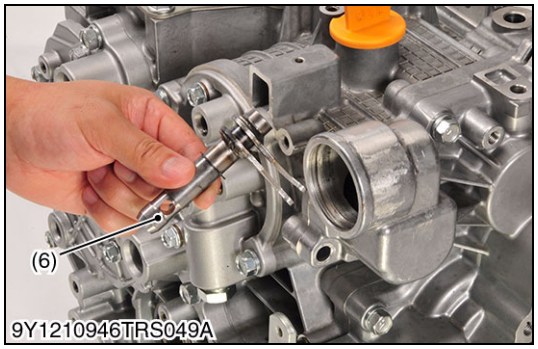

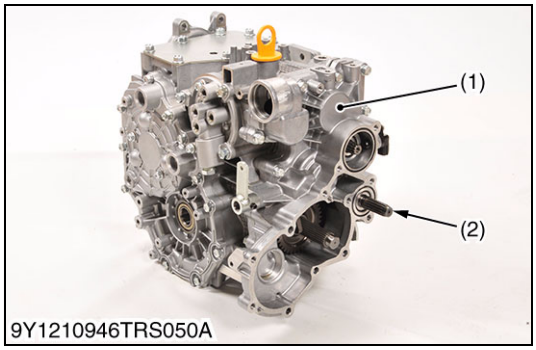

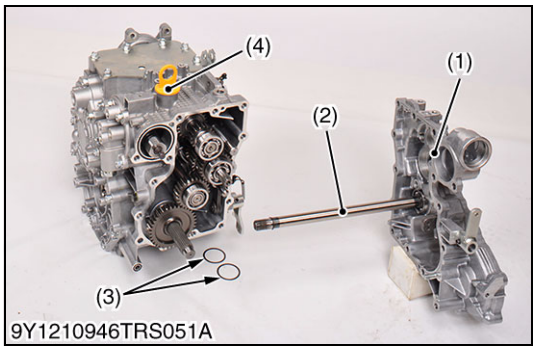

Front Cover and Dipstick

1. Remove the front cover (1) with input shaft (2).
2. Remove the dipstick (4).

(When reassembling)

- Be sure set the shims (3) to front cover (1).

(1) Front Cover
(2) Input Shaft
(3) Shim
(4) Dipstick

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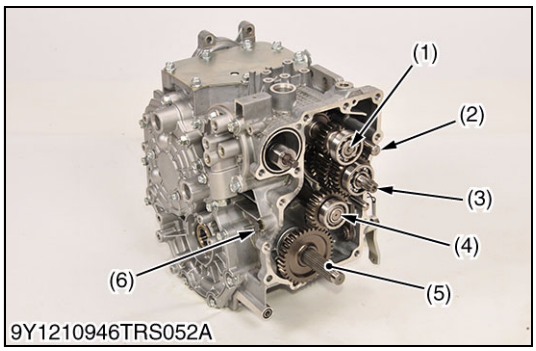
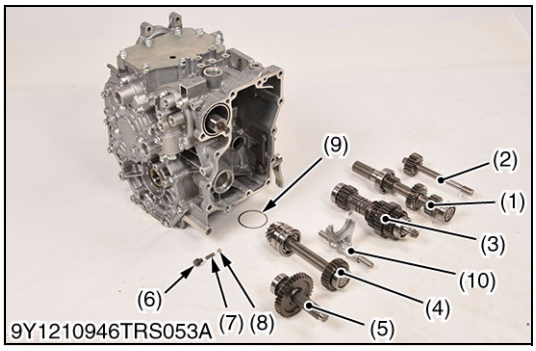




Shaft Assemblies

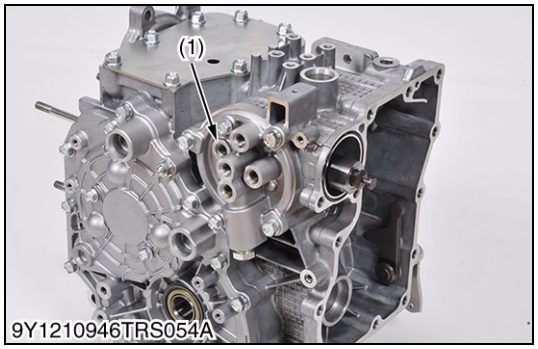
1. Remove the bolt (6) and spring (7) and ball (8).
2. Remove the four wheel drive gear shaft (5).
3. Remove the shaft assembly with shifter (10).

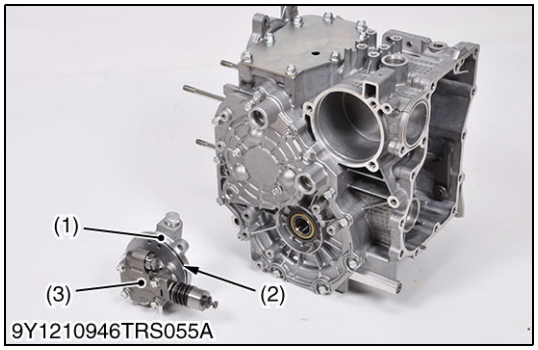
(When reassembling)

- Use same number of shim (9) as before disassembling.

(1) 17T-23T-11T Gear Shaft
(2) Idle Gear Shaft
(3) Range Gear Shaft Assembly
(4) 13T Spiral Bevel Pinion Shaft
(5) Four Wheel Drive Gear Shaft
(6) Bolt
(7) Spring
(8) Ball
(9) Shim
(10) Shifter

9Y1210946TRS0028US0





Control Valve

1. Remove the valve cover (1) with control valve (3).

(When reassembling)

- Be sure not to damage the O-ring (2).

(1) Valve Cover
(2) O-ring
(3) Control Valve

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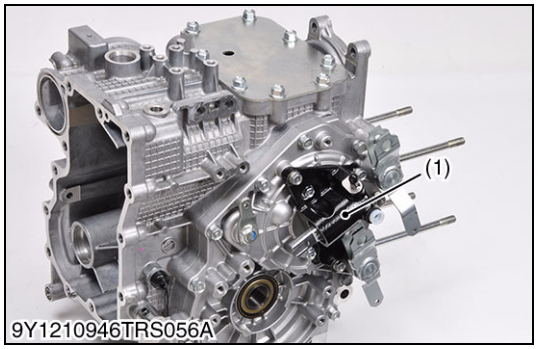

Brake Cylinder

1. Remove the brake cylinder (1).

(1) Brake Cylinder

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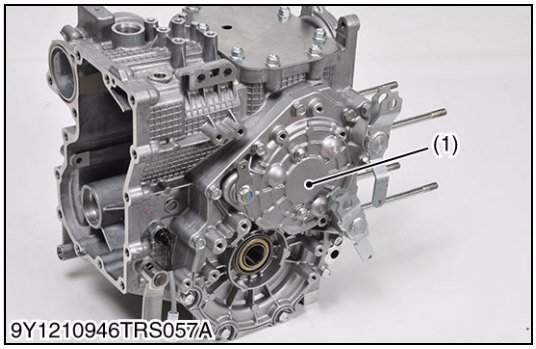

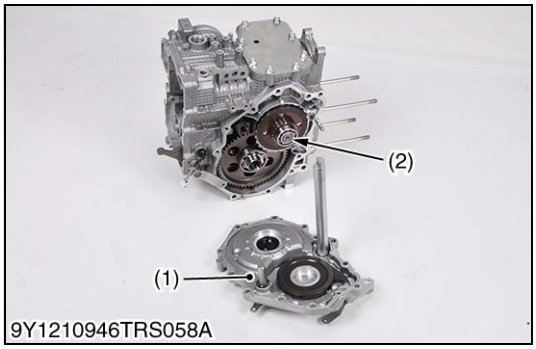

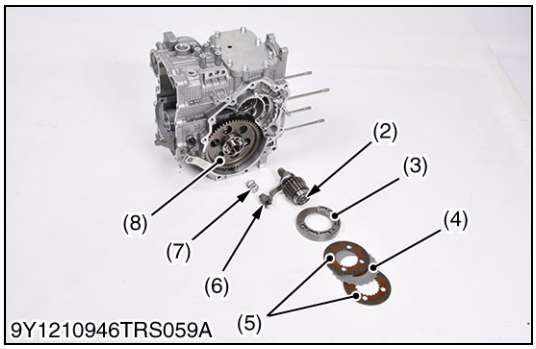

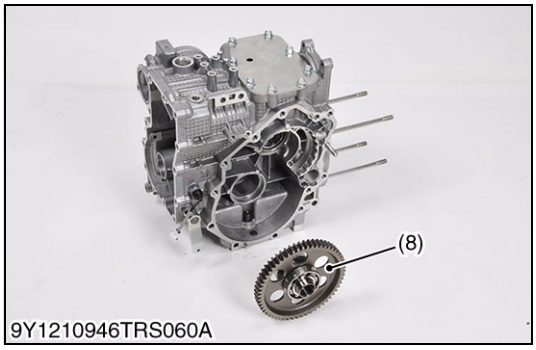

Side Cover LH, Differential Gear Shaft and Final Gear

1. Remove the side cover LH (1).
2. Remove the brake disks (5) and friction plate (4).
3. Remove the brake plate (3).
4. Remove the differential gear shaft (2) with differential lock clutch (6) and spring (7).
5. Remove the final gear (8).

(When reassembling)

- Apply liquid gasket (Three Bond 1216E or equivalent) to joint face of side cover LH (1) and transmission case.

(1) Side Cover LH
(2) Differential Gear Shaft
(3) Brake Plate
(4) Friction Plate
(5) Brake Disk
(6) Differenl Lock Clutch
(7) Spring
(8) Final Gear

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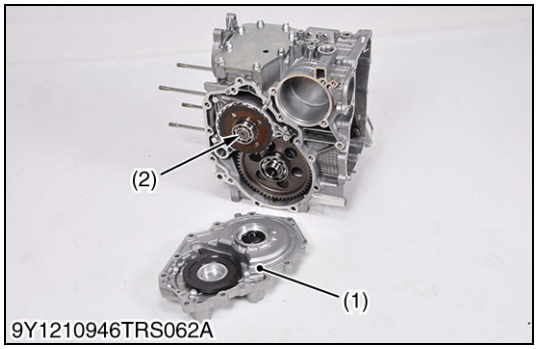

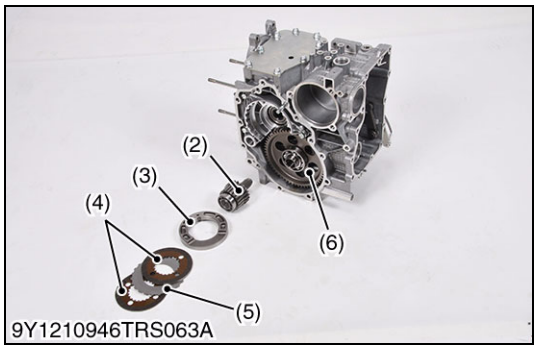

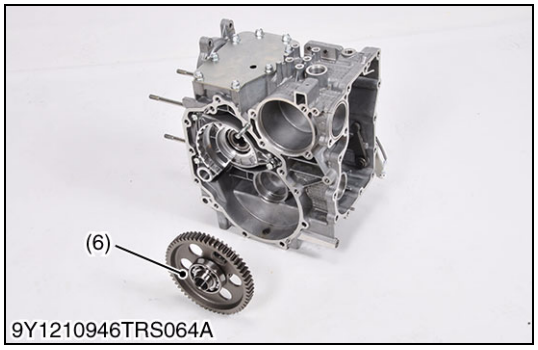

Side Cover RH, Differential Shaft and Final Gear

1. Remove the side cover RH (1).
2. Remove the brake disks (4) and friction plate (5).
3. Remove the brake plate (3).
4. Remove the differential gear shaft (2).
5. Remove the final gear (6).

(When reassembling)

- Apply liquid gasket (Three Bond 1216E or equivalent) to joint face of side cover RH (1) and transmission case.

(1) Side Cover RH
(2) Differential Gear Shaft
(3) Brake Plate
(4) Brake Disk
(5) Friction Plate
(6) Final Gear

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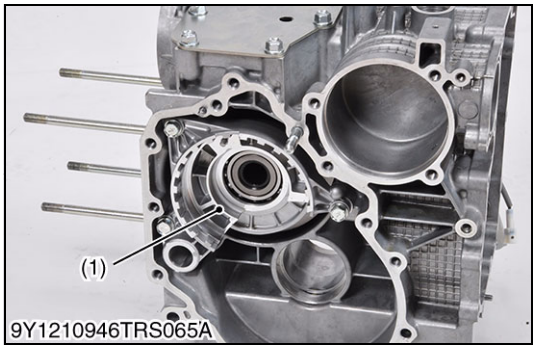
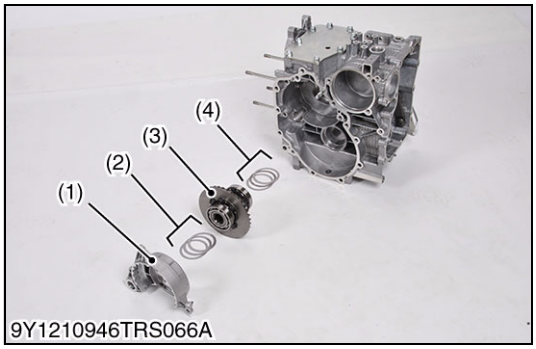




Differential Gear Assembly

1. Remove the bearing holder (1), nothing the number of right shims (2).
2. Remove the differential gear assembly (3), nothing the number of shims (2).

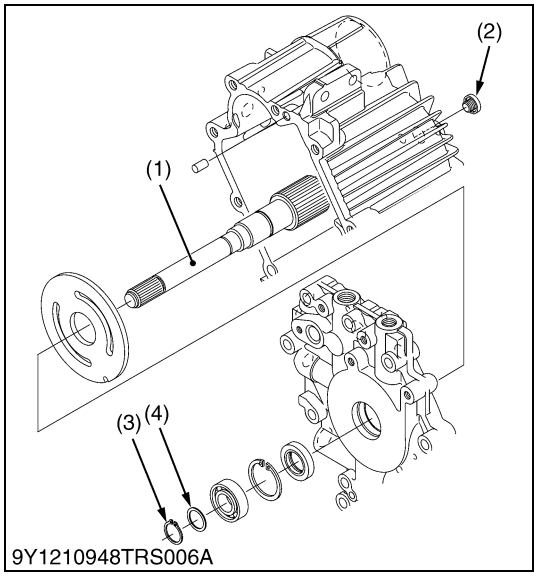
(When reassembling)

- Use same number oh shims as before disassembling.

(1) Bearing Holder
(2) Shim
(3) Differential Gear Assembly
(4) Shim

9Y1210946TRS0033US0

(3) Disassembling HST



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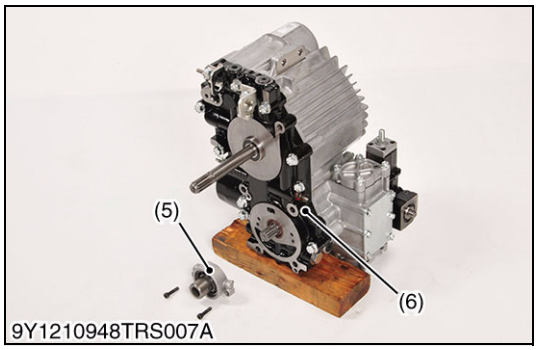

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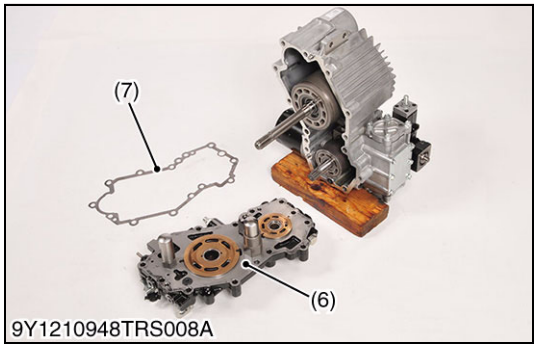

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Port Block Cover

1. Remove the plug (2) and install the M10 × pitch 1.0 mm screw.
2. Remove the snap ring (3) and washer (4).
3. Remove the bearing holder (5).
4. Remove the port block cover (6).

(When reassembling)

- Replace the port block cover gasket (7) with a new one.

Tightening torque	Port block cover mounting screw	39 to 44 N·m 4.0 to 4.4 kgf·m 29 to 32 lbf·ft

(1) Motor Shaft
(2) Plug
(3) Snap Ring
(4) Washer
(5) Bearing Holder
(6) Port Block Cover
(7) Gasket

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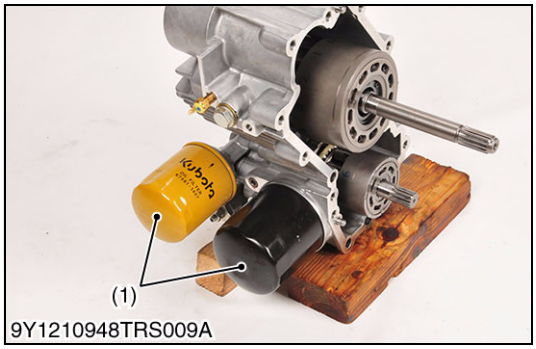

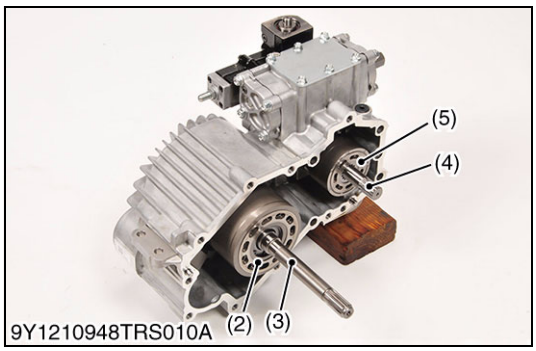

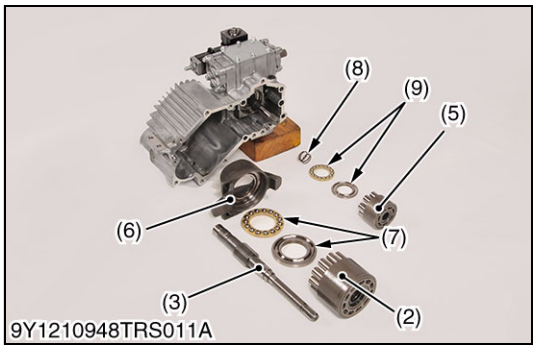

Cylinder Block

1. Remove the filters (1).
2. Remove the motor cylinder block (2) with motor shaft (3).
3. Remove the pump cylinder block (5).

(1) Filter
(2) Cylinder Block (Motor)
(3) Motor Shaft
(4) Pump Shaft
(5) Cylinder Block (Pump)
(6) Swashplate
(7) Thrust Bearing
(8) Spring
(9) Thrust Bearing

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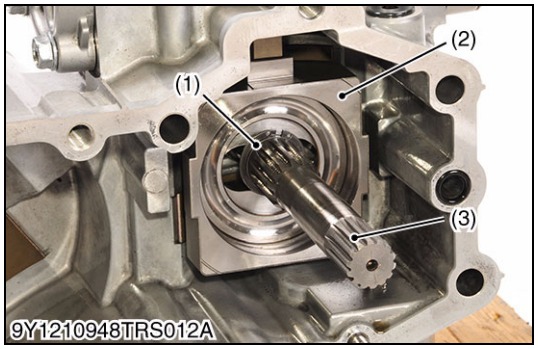

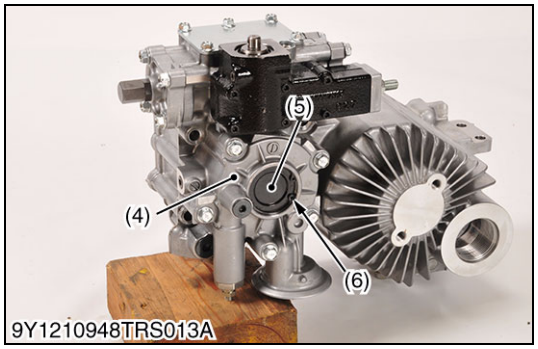

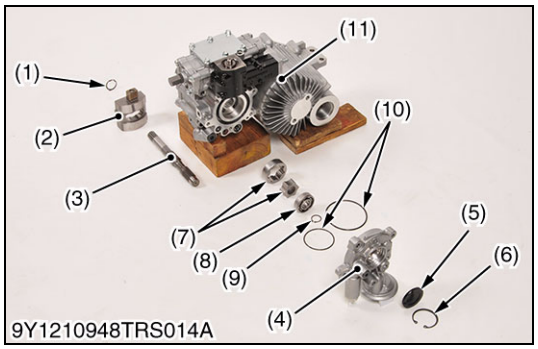

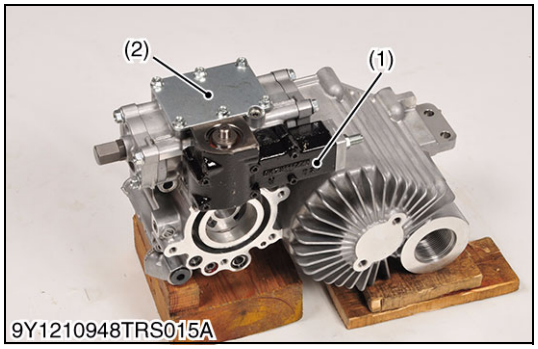

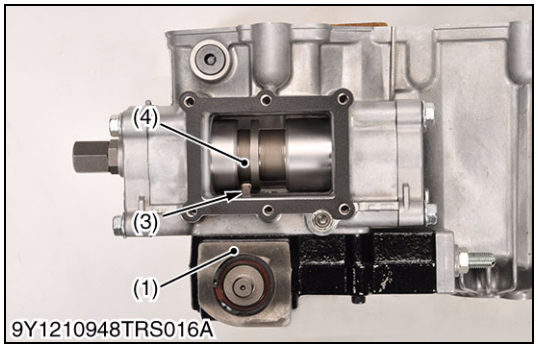

Pump Shaft

1. Remove the external snap ring (1) and swashpalte (2).
2. Remove the internal snap ring (6) and plug (5).
3. Remove the external snap ring (9) and pump shaft (3).
4. Remove the charge pump case (4).

(When reassembling)

- Place the swashplate (2) into the HST case (11), align the slot guide of swashplate and servo piston.
- Align in the same direction the alignment mark of the rotors.
- Be careful not to damage the O-ring (10) on the charge pump case (4).
- Replace the plug (5) with a new one.

Tightening torque	Charge pump case mounting screw	18 to 21 N·m 1.9 to 2.1 kgf·m 14 to 15 lbf·ft

(1) External Snap Ring
(2) Swashplate
(3) Pump Shaft
(4) Charge Pump Case
(5) Plug
(6) Internal Snap Ring
(7) Charge Pump
(8) Bearing
(9) External Snap Ring
(10) O-ring
(11) HST Case

9Y1210948TRS0027US0

Servo Regulator Assembly

1. Remove the servo piston cover (2).
2. Remove the regulator mounting hex. head screw.
3. Remove the servo regulator assembly (1).

(When reassembling)

- Replace the gasket with new one.
- Install the servo regulator assembly to the housing, align the feedback lever (3) of regulator and groove of servo piston (4).

■ **NOTE**

- **Since it has been factory-adjusted, do not disassemble the servo regulator assembly.**

Tightening torque	Regulator mounting hex. head screw	5.2 to 6.2 N·m 0.53 to 0.64 kgf·m 3.9 to 4.6 lbf·ft

(1) Servo Piston Assembly
(2) Servo Piston Cover
(3) Feedback Lever
(4) Groove Servo Piston

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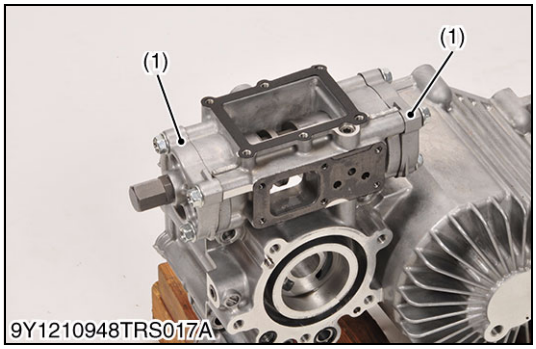

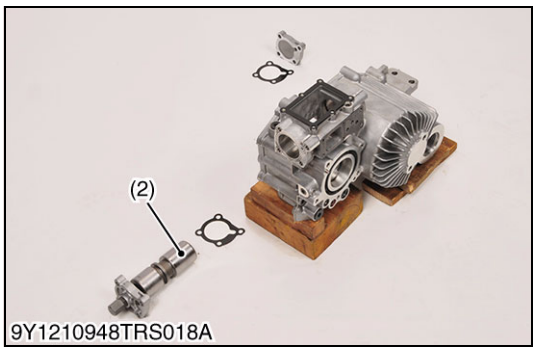

Servo Piston Assembly

1. Remove the servo piston assembly mounting hex. head screw.
2. Pull out the servo piston assembly (2) sightly by the hand.

(When reassembling)

- Replace the gasket with new one.

■ **NOTE**

- **Be careful not to do damage the surface of servo piston.**
- **Do not disassemble the servo piston assembly, if the there is no problem.**

Tightening torque	Servo piston and cover mounting screw	18 to 21 N·m 1.9 to 2.1 kgf·m 14 to 15 lbf·ft

(1) Servo Piston Cover (2) Servo Piston Assembly

9Y1210948TRS0029US0

7. SERVICING
[1] TRANSMISSION


3XVAAAB3P099A

Cable

1. Check that the cable moves smoothly within the cable outer.
2. If the cable movement is not smooth, or if the cable is frayed, or if the cable outer is damaged, replace the cable.

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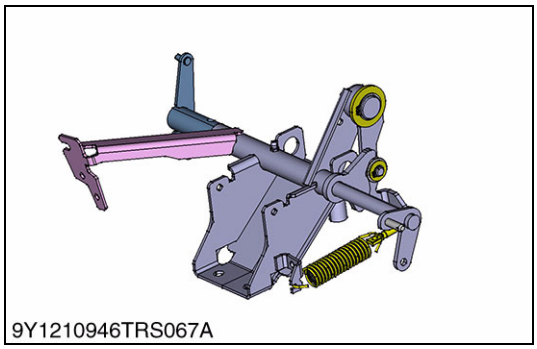
9Y1210946TRS067A

HST Neutral Linkage

1. Check that the linkage moves smoothly.
2. If the linkage movement is not smooth, or if the inside bearing is worn, replace the bearing.

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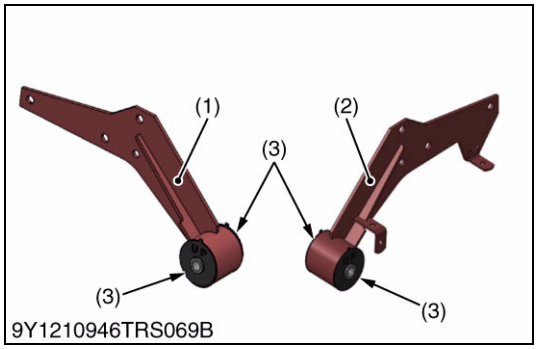

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Mission Frame and Rubber Bush

1. Visually check the engine support LH (2), engine support RH (1), mission upper bracket (5), mission bracket (4) and rubber bushes (3).
2. If the hole is miss happen, discolored, hardened or been otherwise damaged, replace the rubber bush.

(1) Engine Support RH
(2) Engine Support LH
(3) Rubber Bush
(4) Mission Bracket
(5) Mission Upper Bracket

C: Align Marks

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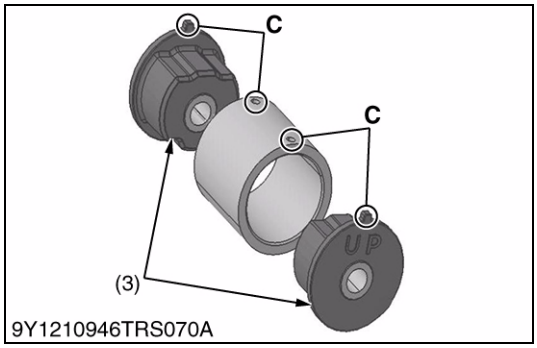

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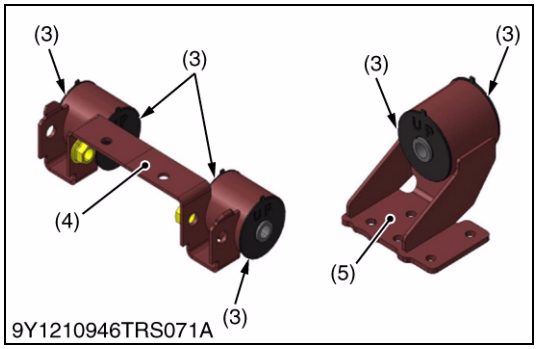

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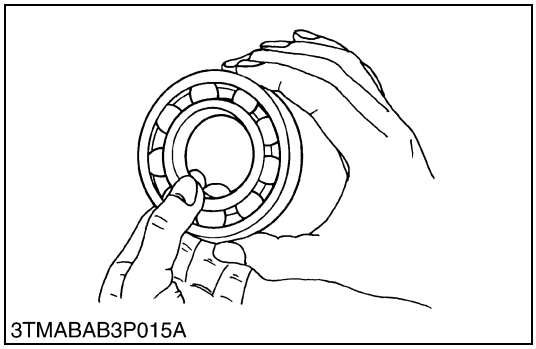
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Checking Bearing

1. Hold the inner race, and push and pull the outer race in all directions to check for wear and roughness.
2. Apply transmission fluid to the bearing, and hold the inner race. Then, turn the outer race to check rotation.
3. If there is any problem, replace it.

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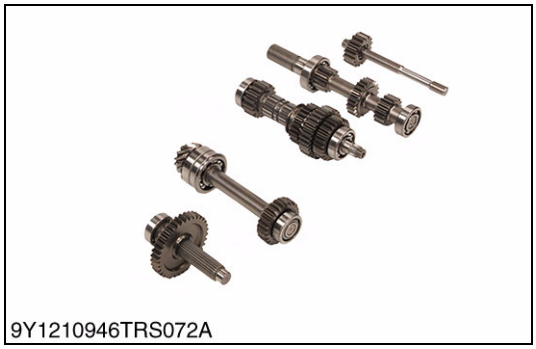
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Checking Gear

1. Visually check the tooth of gear which comes in contact.
2. If there is any doubt as to the condition of gears, replace it.

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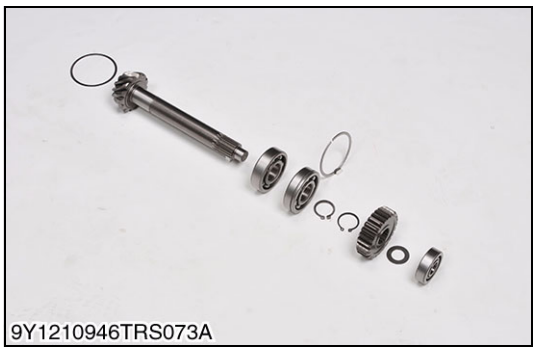
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13T Spiral Bevel Pinion Shaft, Gear and Ball Bearing

1. Remove the 25T gear by using the gear puller.
2. Check the ball bearing for abrasion, color change or other damage.
3. If there is any doubt as to the condition of a ball bearing, replace it.
4. Check both the shaft and the gear surface of the bearing contact point for abrasion, color change or other damage.
5. If there are any doubt as to the condition of shaft and gear.

9Y1210946TRS0038US0


9Y1210946TRS074A

Gear Shaft, Gear and Needle Bearing

1. Remove the bearing.
2. Check the needle bearing for abrasion, color, change or other damage.
3. If there is any doubt as to the condition of a needle bearing, replace it.
4. Check both the shaft and the gear surface of the bearing contact point for abrasion, color change or other damage.
5. If there are any doubt as to the condition of shaft and gear.

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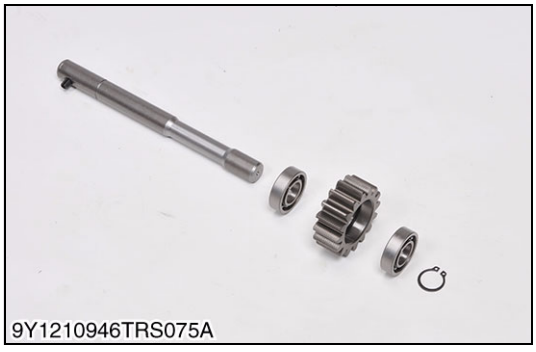
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Back Idle Gear, Shaft and Ball Bearing

1. Check the ball bearing for abrasion, color change, or other damage.
2. If there is any doubt as to the condition of a ball bearing, replace it.
3. Check both the shaft and gear bearing surface.

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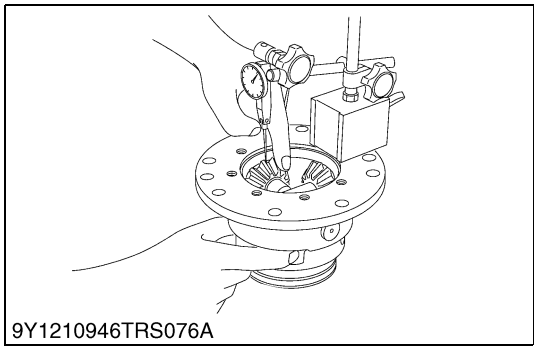
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Backlash between Differential Pinion and Differential Side

1. Set a dial indicator (lever type) on the tooth of the differential pinion.
2. Hold the differential side gear and move the differential pinion to measure the backlash.
3. If the measurement is not within the factory specifications, adjust with the differential side gear washer.

Backlash between differential pinion and differential side gear	Factory specification	0.15 to 0.30 mm 0.0059 to 0.011 in.

(Reference)

- Thickness of differential side gear washer
  0.80 mm (0.031 in.)
  1.0 mm (0.039 in.)
  1.2 mm (0.047 in.)

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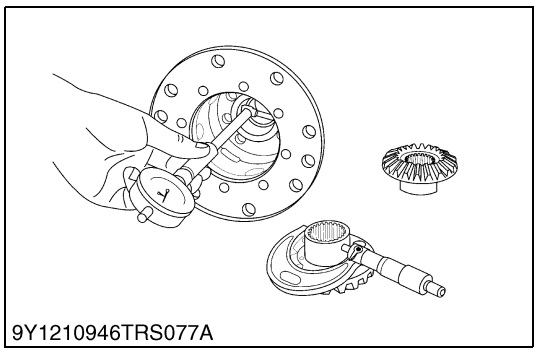
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Clearance between Differential Case and Differential Side Gear

1. Measure the differential side gear boss O.D. with an outside micrometer.
2. Measure the differential case I.D. with a cylinder gauge and calculate the clearance.
3. If the clearance exceeds the allowable limit, replace faulty parts.

Clearance between differential case and differential side gear	Factory specification	0.050 to 0.151 mm 0.0020 to 0.0059 in.
	Allowable limit	0.30 mm 0.0118 in.

Differential case I.D.	Factory specification	38.000 to 38.062 mm 1.4961 to 1.4985 in.
Differential side gear O.D.	Factory specification	37.911 to 37.950 mm 1.4926 to 1.4941 in.

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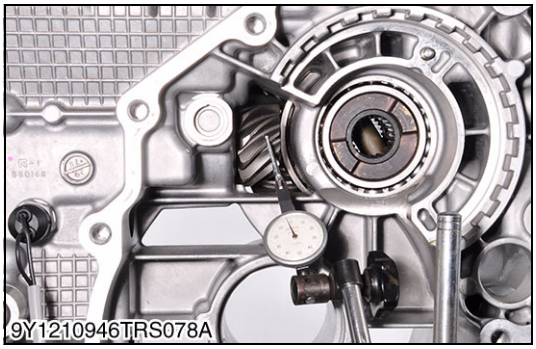
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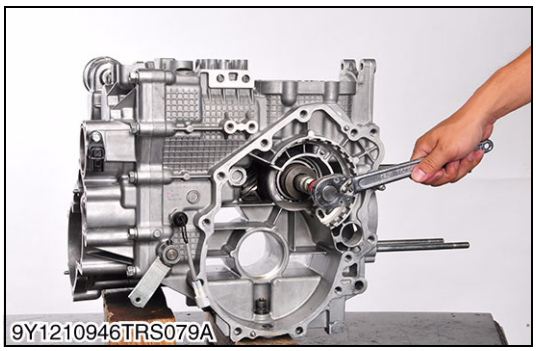
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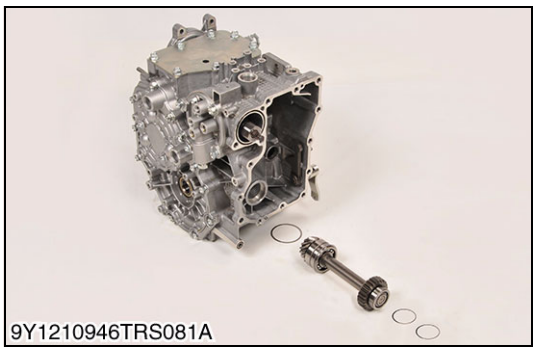
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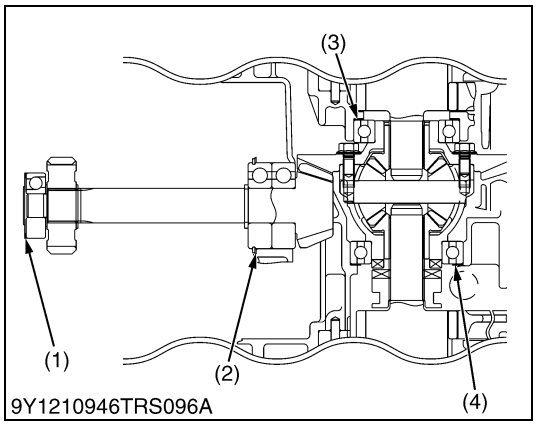


9Y1210946TRS096A

Backlash and Tooth Contact between Spiral Bevel Gear and Spiral Bevel Pinion Shaft

1. Set the dial indicator (lever type) with its finger on the tooth surface.
2. Measure the backlash by fixing the spiral bevel pinion shaft and moving the spiral bevel gear.
3. When the backlash is too large, decrease the number of shims (3), (4) in the side of the spiral bevel gear, and insert the shims (2) of the same thickness as the removed ones to the opposite side.
   When the backlash is too small, do the opposite way to increase backlash.
4. Adjust the backlash periphery by repeating the above procedure.
5. Apply red lead lightly over several teeth at three positions equally spaced on the spiral bevel gear.
6. Turn the differential gear using a jig as shown in the figure. (See page G-70.)
7. Check the tooth contact. If not proper, adjust according to the instructions below.

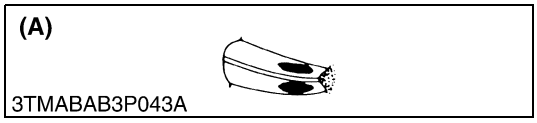
Backlash between spiral bevel gear and spiral bevel pinion shaft	Factory specification	0.20 to 0.30 mm 0.0079 to 0.011 in

(Reference)

- Thickness of shims (1):
  0.2 mm (0.008 in.)
  0.5 mm (0.02 in.)
- Thickness of shims (2):
  0.8 mm (0.031 in.)
  0.9 mm (0.035 in.)
  1.0 mm (0.039 in.)
  1.1 mm (0.043 in.)
  1.2 mm (0.047 in.)
- Thickness of shims (3), (4):
  0.2 mm (0.008 in.)
  0.5 mm (0.02 in.)

(1) Shim
(2) Shim
(3) Shim
(4) Shim

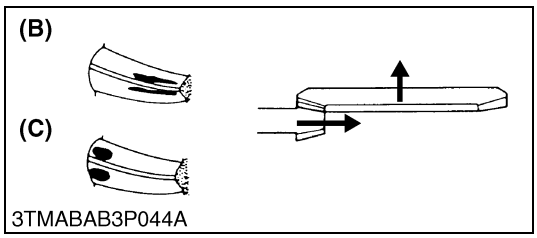
9Y1210948TRS0021US0



More than 35 % red lead contact area on the gear tooth surface. The center of tooth contact at 1/2 to 1/3 of the entire width from the small end.

(A) Proper Contact

9Y1210946FAS0025US0

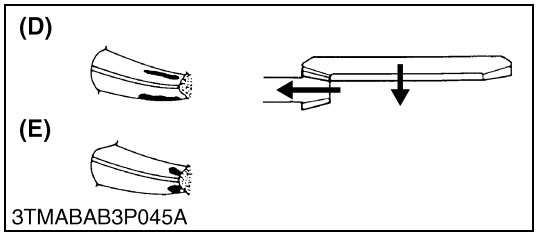


Change the adjusting collar to smaller size, and change the adjusting collar to larger size.

For move the spiral bevel gear rightward, reduce right side shim and add shim of the same thickness as the right side to left side.

(B) Shallow Contact **(C) Heel Contact**

9Y1210946FAS0026US0



Change the adjusting collar to larger size, and change the adjusting collar to smaller size.

For move the spiral bevel gear leftward, reduce left side shim and add shim of the same thickness as the left side to right side.

Repeat above until the proper tooth contact and backlash are achieved.

(D) Deep Contact **(E) Toe Contact**

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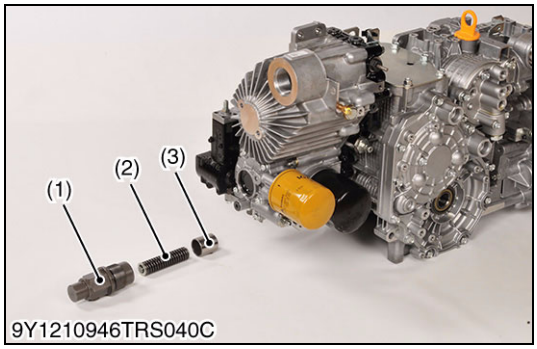
[2] HST

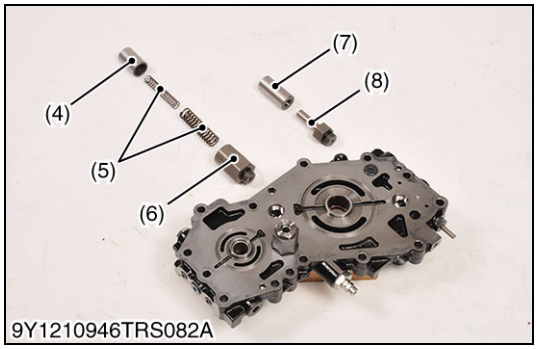


Piston, Springs and Stopper Rod

1. Check the springs (2), (5) for breakage and wear.
2. Check the piston (4), (7) for free movement in the piston case (1).

(1) Piston Case
(2) Spring
(3) Piston
(4) Piston
(5) Spring
(6) Piston Case
(7) Piston
(8) Piston Rod

9Y1210948TRS0022US0

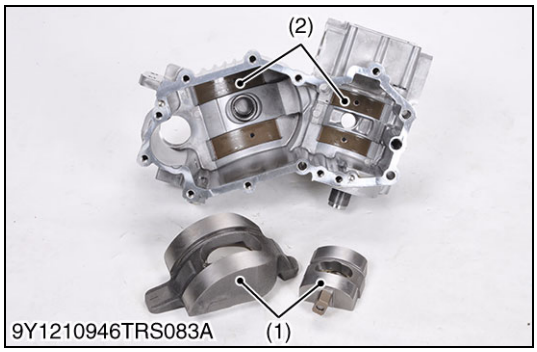


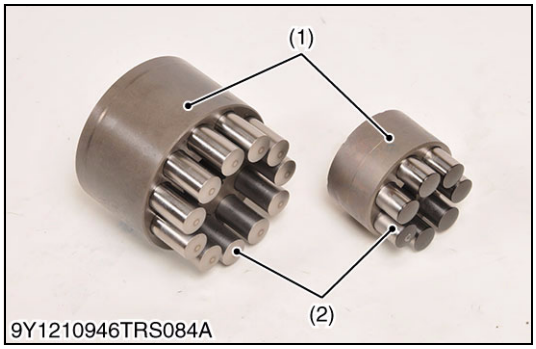
Swashplate and Cradle Bearing

1. Check the surface of swashplate (1) and cradle bearings (2) for scratches and excessive wear.
2. If worn or scored, replace them.

(1) Swashplate
(2) Cradle Bearing

9Y1210946TRS0045US0





Cylinder Block Bore and Pistons

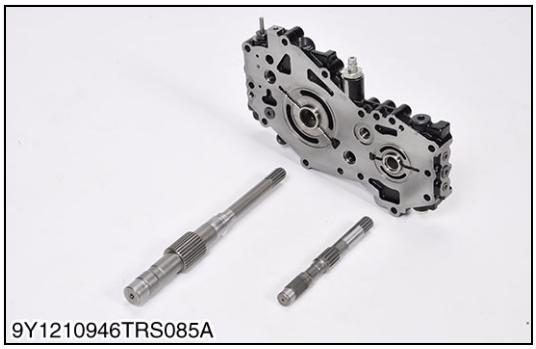
1. Check the pistons (2) for their free movement in the cylinder block (1) bores.
2. If the piston or the cylinder block bore is scored, replace cylinder block assembly.

■ **IMPORTANT**

- **Do not interchange pistons (2) between pump and motor cylinder block (1).**

(1) Cylinder Block
(2) Piston

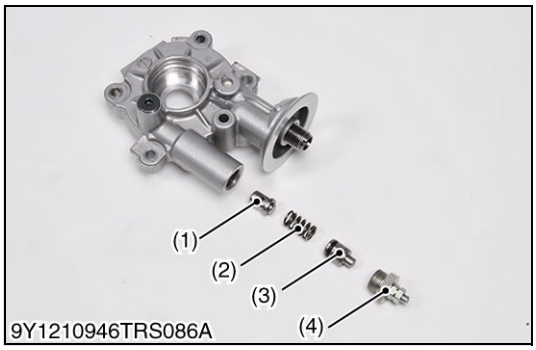
9Y1210946TRS0046US0



Pump Shaft, Motor Shaft and Bearings

1. Check bearings for abrasion, color change, or other damage.
2. If there is any doubt as to the condition of a bearing, replace it.
3. Check the shaft surface for abrasion, color change or other damage.
4. If there is any doubt as to the condition of shaft, replace it.

9Y1210946TRS0047US0

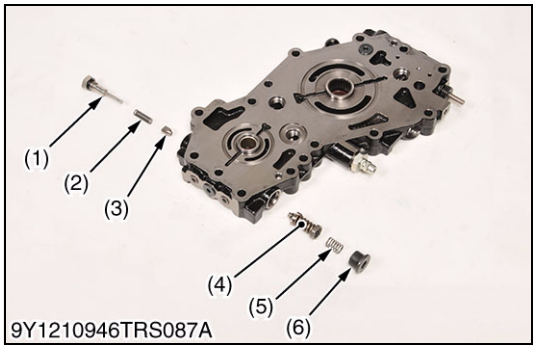


Charge Relief Valve

1. Check the spring (2) and charge relief valve poppet (1) for scratches, breakage and damage.
2. If any thing unusual, replace it.

(1) Poppet
(2) Spring
(3) Spring Holder
(4) Plug

9Y1210946TRS0048US0

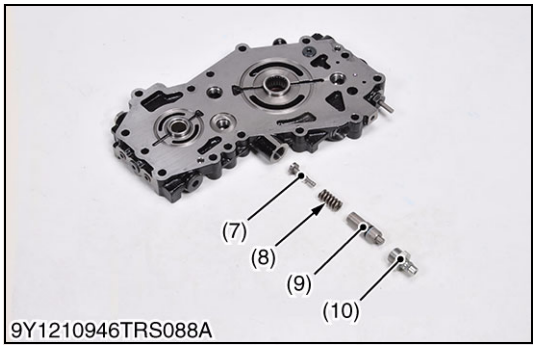


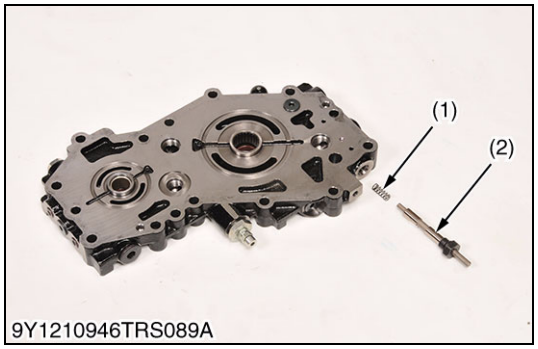
Check and High Pressure Relief Valve

1. Check the check plug (1), spring (2), (5), poppet (3) and check and high pressure relief valve (4) for scratches and damage.
2. Check the valve seat (7), spring (8) and valve holder (9) for scratches and damage.
3. If any thing unusual replace it.

(1) Check Plug
(2) Spring
(3) Poppet
(4) Check and High Pressure Relief Valve (Traveling)
(5) Spring
(6) Plug
(7) Valve Seat (Brake)
(8) Spring
(9) Valve Holder
(10) Plug

9Y1210946TRS0049US0





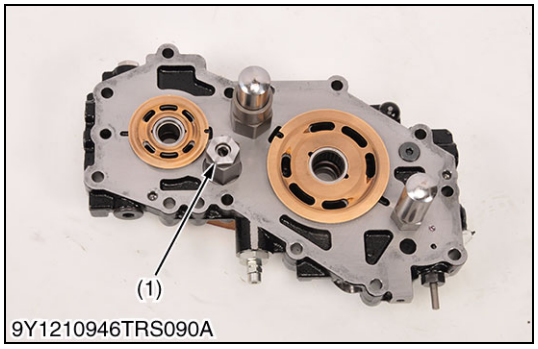
9Y1210946TRS089A

Unload Valve

1. Check the spring (1) and spool (2) for abrasion and damage.
2. If anything unusual, replace it.

(1) Spring
(2) Spool

9Y1210946TRS0050US0



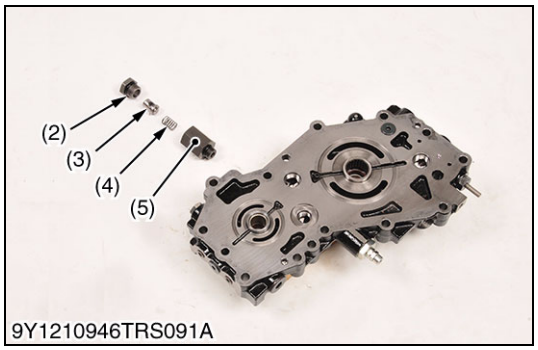
9Y1210946TRS090A

Anti-cavitation Valve

1. Check the spring (4) for scratches, breakage and damage.
2. If anything unusual, replace it.
3. Check the poppet (3) for abrasion and damage.
4. If anything unusual, replace it.

(1) Anti-cavitation Valve
(2) Valve Cover
(3) Poppet
(4) Spring
(5) Valve Case

9Y1210946TRS0051US0



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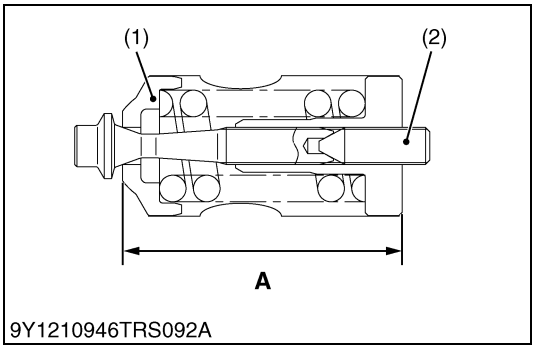

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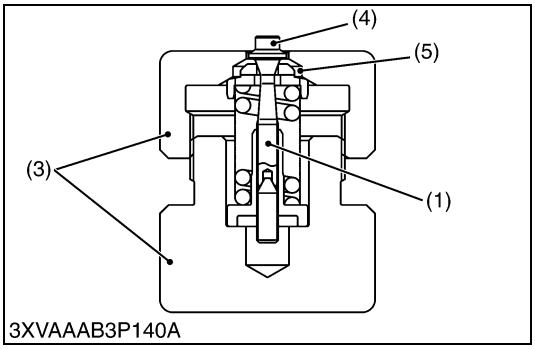

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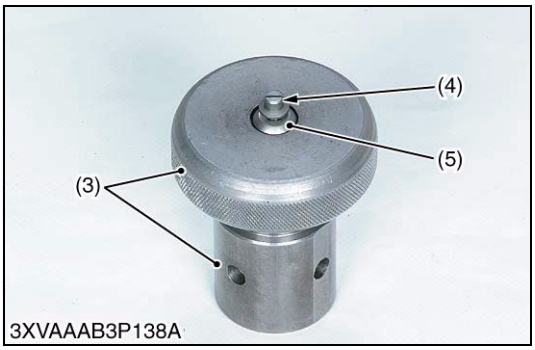

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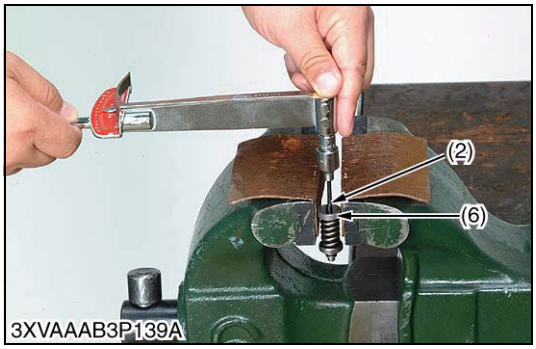

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Readjustment of Relief Valve (When the HST does not work due to its loose hexagon socket head screw)

■ **IMPORTANT**

- **The KUBOTA does not recommend the readjustment of relief valve. And KUBOTA will recommend the exchange with genuine parts.**
- **As the HST may be damaged if the pressure is set to higher by mistake, be careful when adjusting it.**

■ **NOTE**

- **The relief pressure is set in between (Forward: 25.5 to 26.5 MPa (260 to 270 kgf/cm^2, 3700 to 3840 psi), Reverse: 16.5 to 17.5 MPa (169 to 178 kgf/cm^2, 2400 to 2530 psi)) when shipped from the factory. But, for the purpose of after-sales services, as it is impossible to reset the pressure precisely as set in the factory, its setting range is defined as a slightly wider range between (Forward: 22.6 to 26.5 MPa (231 to 270 kgf/cm^2, 3280 to 3840 psi, Reverse: 15.3 to 17.5 MPa (156 to 178 kgf/cm^2, 2220 to 2530 psi)).**

1. Measure the pre-adjustment distance **"A"**.
2. Compress the spring of the relief valve with a relief valve assembling tool (3).
3. Then, find the distance **"A"** by turning the poppet (4) with a screwdriver.
   Reference: The distance **"A"** changes by about 0.50 mm (0.020 in.) per one turn of the poppet (4).
4. Repeat the same operation a few times to find the distance **"A"** as it is difficult to acquire at the first time.
5. After finding the distance **"A"**, hold the setscrew (6) to a vice and fasten the hexagon socket head screw (2) with specified torque.
   On this occasion, use a copper plate, etc. for the vice jaws not to damage the setscrew (6).
6. Install the relief valve in the HST.
7. Check the relief pressure as indicated in checking section. The distance **"A"** is for refresh only. Make sure to check the relief pressure after readjustment.
8. If the relief pressure does not fall within the readjustment pressure range, repeat the processes of the above item 1 onward.
   Reference: The pressure changes by 1.47 MPa (15 kgf/cm^2, 213.3 psi) per 0.1 mm (0.0039 in.) in distance **"A"**.

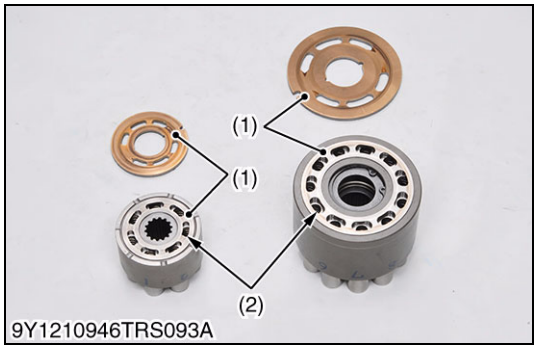
Tightening torque	Hex. socket head screw	2.5 to 3.0 N·m 0.26 to 0.30 kgf·m 1.9 to 2.2 lbf·ft

Relief valve readjusting pressure	Traveling	24.5 to 27.5 MPa 250 to 280 kgf/cm^2 3560 to 3980 psi

Distance **"A"**	Reference value	Traveling	38.60 to 38.70 mm 1.520 to 1.523 in.

(1) Relief Valve Assembly
(2) Hexagon Socket Head Screw
(3) Relief Valve Assembling Tool
(4) Poppet
(5) Valve Seat
(6) Setscrew

9Y1210948TRS0023US0



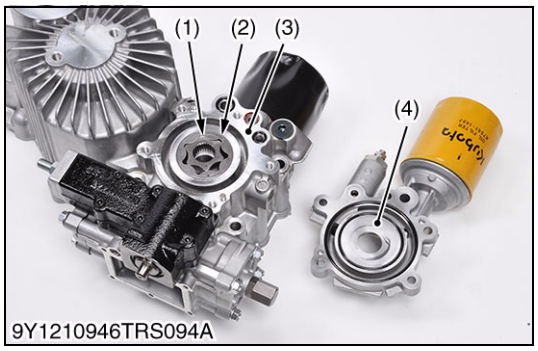
Cylinder Block Face and Valve Plate

1. Check the polished face (1) of cylinder block for scoring.
2. If scored, replace cylinder block assembly.
3. Check the spring (2) for breakage.
4. If broken, replace cylinder block assembly.
5. Check the valve plate for scratches, wear and erosion. (Run a finger nail across the valve plate surface. If worn, it will be felt.)
6. If worn or scored, replace.

■ **NOTE**
- **After checking, coat them with transmission oil.**
- **Valve plates are not interchangeable.**

(1) Polished Face
(2) Spring

9Y1210946TRS0053US0



Charge Pump

1. Check the charge pump housing (3), pump cover (4) and the rotor (1), (2) for scratches and wear.
2. If scratch or worn, replace the charge pump complete assembly.

(1) Inner Rotor
(2) Outer Rotor
(3) Charge Pump Housing
(4) Pump Cover

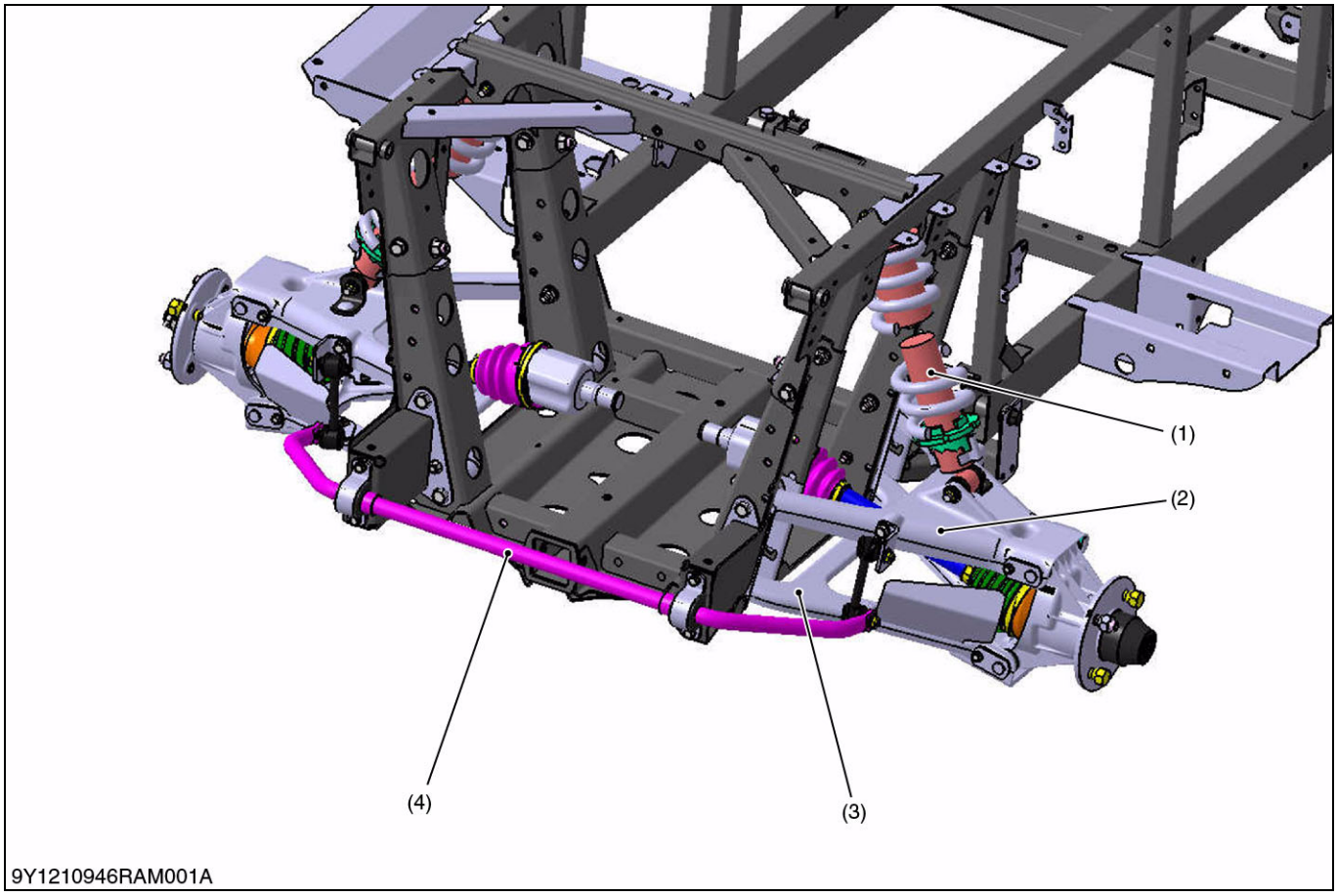
9Y1210946TRS0054US0

3 REAR AXLE

MECHANISM

CONTENTS

1. STRUCTURE



(1) Shock Absorber (2) Upper Arm (3) Lower Arm (4) Stabilizer

The suspension is double wishbone type.

The suspension is made up of upper and lower arms (2), (3), a shock absorbers (1), and a stabilizer (4).

The stabilizer (4) performs the function of a torsion bar.

The stabilizer (4) is connected to the upper arm (2) by a link.

When the upper arm (2) moves up and down, the stabilizer (4) moves with it. When the arms on one side move, a differential is applied to the stabilizer link that is connected to the arms on the opposite side causing torsion on the stabilizer (4).

Based on torsion action of the stabilizer, a force is applied retaining its position so the arm connected is kept horizontally.

9Y1210946RAM0001US0

SERVICING

CONTENTS

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Noise When Start	CV joint bearing worn	Replace	3-S4
Noise While Forward And Reverse	CV joint bearing worn	Replace	3-S4
Noise	Bearings damaged or broken	Replace	3-S6

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2. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to "5. TIGHTENING TORQUES" on page G-12.)

Item	N·m	kgf·m	lbf·ft
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
Rear axle slotted nut	190 to 200	19.4 to 20.3	141 to 147

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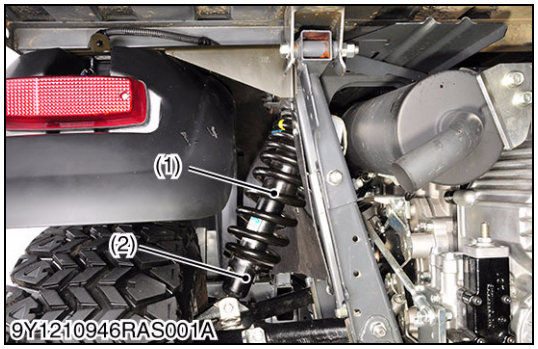
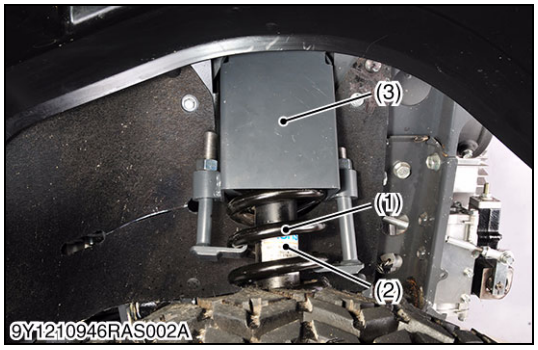
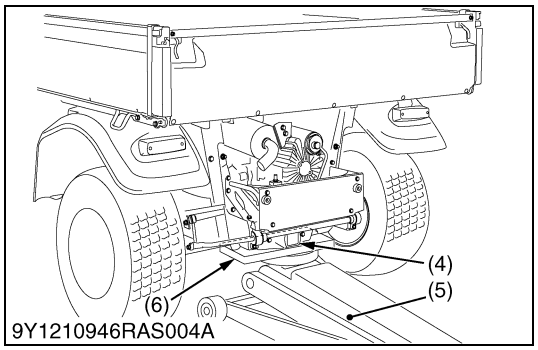
3. CHECKING, DISASSEMBLING AND SERVICING

[1] ADJSUTING







Adjusting Rear Shock Absorber

CAUTION

To avoid personal injury:

- **Be sure to work on a firm, flat an level surface with the engine shut off and parking brake "ON".**
- **Keep the position of the left right rear sock absorber equal. Uneven adjustment can cause poor handling and lose of control, which could lead to an accident.**

1. Set the rear shock absorber adjusting tool (3) as shown in the figure.
2. Jack up the rear end after placing a wooden block (6) under the bottom plate (4) of the transmission frame.
3. Adjust the rear shock absorber springs, turn the adjusting sleeves on the shock absorbers to the desired position with the hook wrench (7).

[Shock absorber position]

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

(1) Spring
(2) Shock Absorber
(3) Rear Shock Absorber Adjusting Tool
(4) Bottom Plate
(5) Jack
(6) Wooden Block
(7) Hook Wrench

9Y1210946RAS0003US0

[2] PREPARATION
(1) Rear Knuckle Case

Rear Wheel

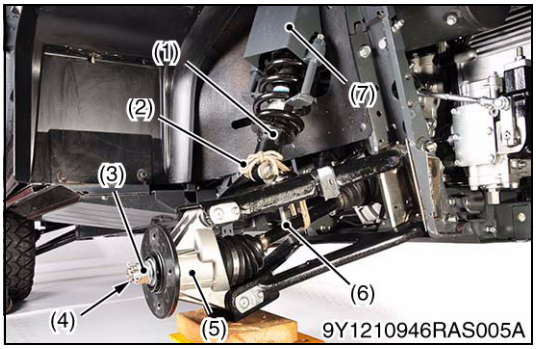
1. Jack up the rear end after placing a wooden block under the bottom plate of the transmission frame.
2. Remove the rear wheels.

(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

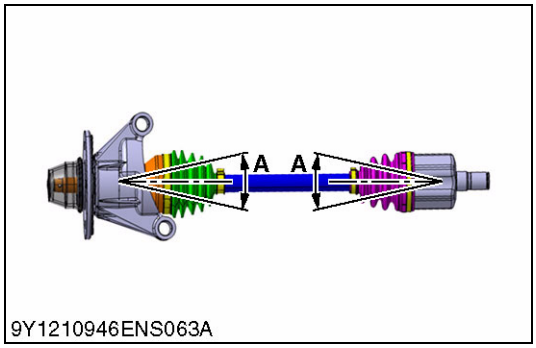


Rear Knuckle Case

■ **NOTE**
- **CV joint shall not exceed the allowable bend angle ±25 ° when being reassembled or disassembled.**

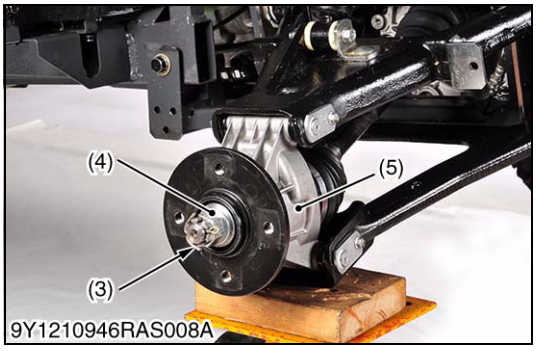
1. Set the rear shock absorber adjusting tool (7) as shown in the figure,
2. Support the CV joint (6) by something like a clamp (2) to prevent the CV joint (6) falling before removing the rear knuckle case (5).
3. Remove the cotter pin (4) and rear axle slotted nut (3).
4. Remove the rear knuckle case (5).

(When reassembling)
- Apply anti-fitting grease (RAILMASTER or equivalent) to spline of CV joint (6).
- After tightening the rear axle slotted nut (3) to specified torque, install a cotter pin (4) as shown in the figure.



■ **NOTE**
- **Tighten the slotted nut to 190 N·m (19.4 kgf·m, 140 lbf·ft). If the slot and pin hole do not meet, tighten the nut until they do meet and install cotter pin.**

Tightening torque	Rear axle slotted nut	190 to 200 N·m 19.4 to 20.3 kgf·m 141 to 147 lbf·ft



(1) Rear Shock Absorber
(2) Clamp
(3) Rear Axle Slotted Nut
(4) Cotter Pin
(5) Rear Knuckle Case
(6) CV Joint
(7) Rear Shock Absorber Adjusting Tool

A: ±25 °

9Y1210946RAS0004US0

(2) Rear Shock Absorber

Rear Wheel

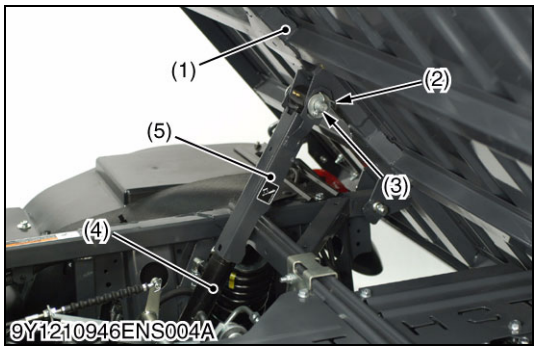
1. Jack up the rear end after placing a wooden block under the bottom plate of the transmission frame.
2. Remove the rear wheels.

(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

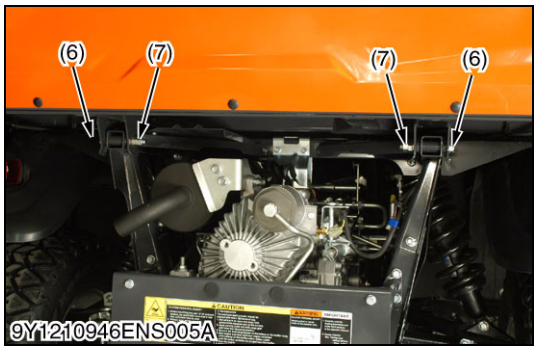


Cargo Bed

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).

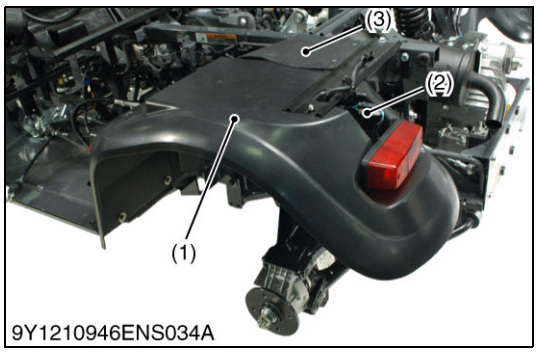
(When reassembling)

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



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

9Y1210946ENS0025US0

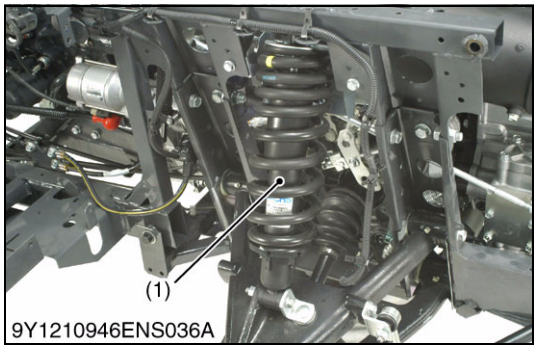


Fender

1. Disconnect the rear lamp connectors (2).
2. Remove the mud guard rivets.
3. Remove the rear fenders (1).

(1) Rear Fender
(2) Rear Lamp Connector
(3) Mud Guard

9Y1210946ENS0040US0



Rear Shock Absorber

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

(When reassembling)

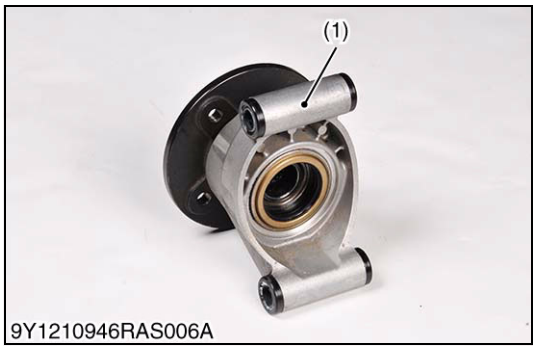
- Apply grease (Shell Godus S5 T100 or equivalent) to the rear shock absorber bushing before inserting collar.

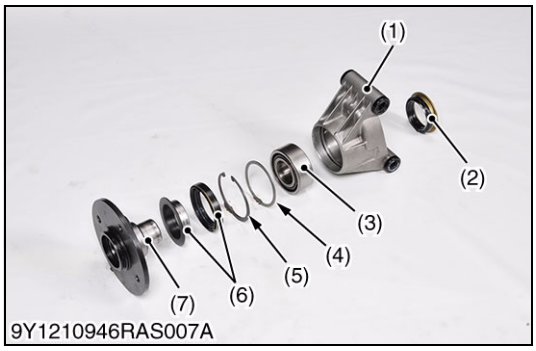
(1) Rear Shock Absorber

9Y1210946ENS0042US0

[3] DISASSEMBLING AND ASSEMBLING

(1) Rear Knuckle Case





Rear Knuckle Case

1. Tap out the rear axle (7).
2. Remove the oil seal (6).
3. Remove the internal snap ring (5) and spacer (4).
4. Remove the ball bearing (3).
5. Remove the oil seal (2).

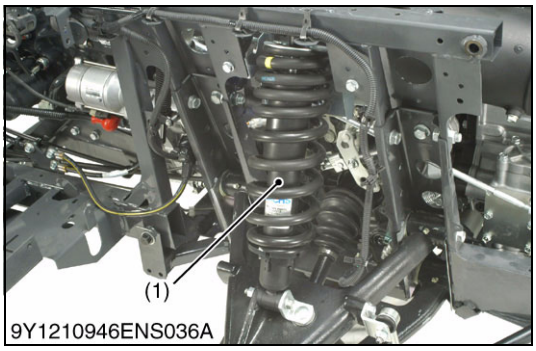
(When reassembling)

- Replace the oil seals with n new one.
- Apply grease (SHELL ALVANIA GREASE S2 or equivalent) the inside od the oil seal.

(1) Knuckle Case
(2) Oil Seal
(3) Ball Bearing
(4) Spacer
(5) Internal Snap Ring
(6) Oil Seal
(7) Rear Axle

9Y1210946RAS0005US0

[4] SERVICING



Checking Shock Absorber

1. Visually check the shock absorber (1) for breaks or distortion.
2. If the shock absorber is damaged in any way, replace it.
3. Check for oil leakage at the shock absorber.
4. If oil leakage is noted, replace it.
5. Push, shorten the shock absorber, and check whether to return in former state.
6. Replace the shock absorber for the new one if it does not return to former state.
7. Visually check the bush in the upper and lower mountings of the rear shock absorber.
8. If they are worn, cracked, hardened, or otherwise damaged, replace them with new one.

(1) Shock Absorber

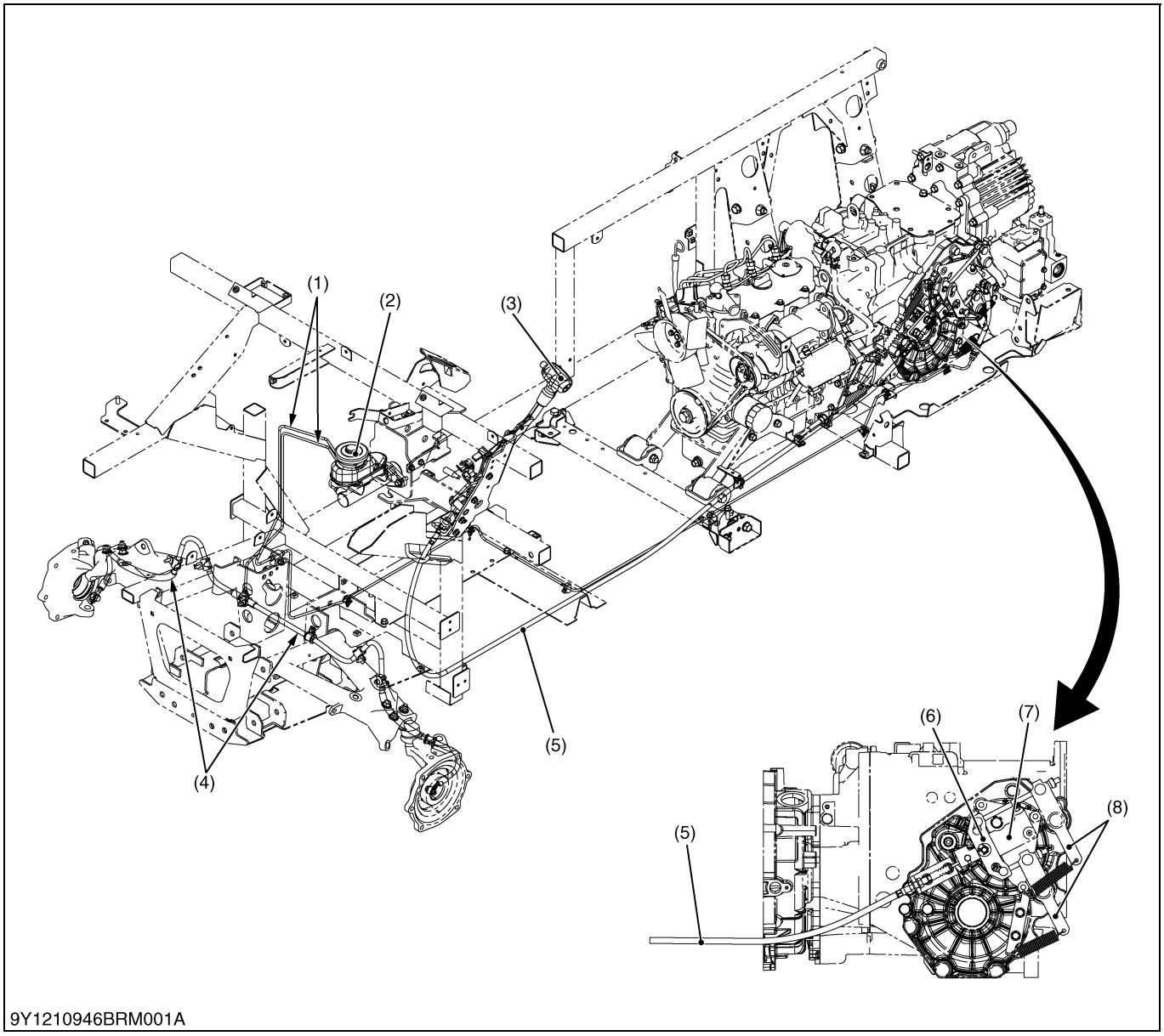
9Y1210946RAS0006US0

4 BRAKES

MECHANISM

CONTENTS

1. GENERAL OUTLINE



9Y1210946BRM001A

(1) Brake Pipe
(2) Master Cylinder
(3) Parking Brake Lever
(4) Brake Hose
(5) Parking Brake Cable
(6) Equalizer
(7) Brake Cylinder
(8) Brake Cam Lever

Description of the brake system with an illustration with all its component parts in place.

All the four wheels are equipped with an enclosed, wet multi-disk type brake. The system consists of brake pedal, master cylinder (2), brake hose (4), brake pipe (1), brake cylinder (7) and other parts.

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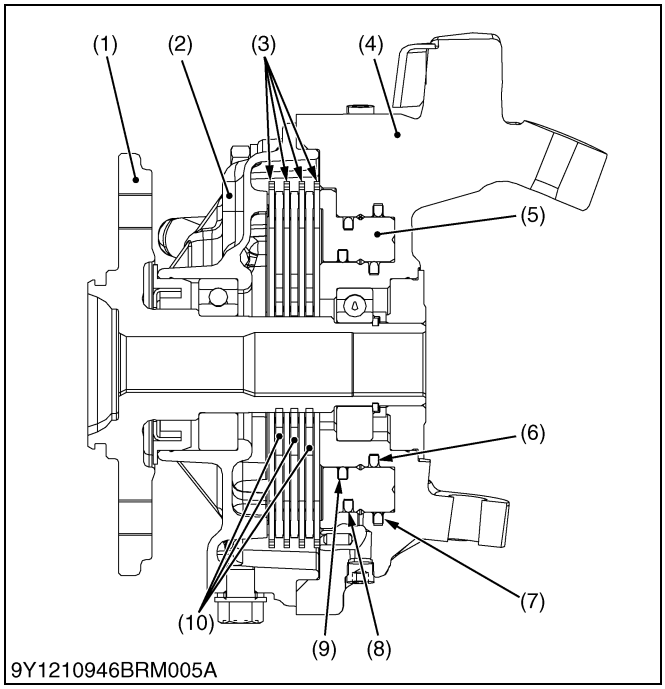
2. KNUCKLE (FRONT BRAKE)



9Y1210946BRM005A

Basically, the brake body is similar to that of the mechanical wet disk brake. It is designed to brake when the brake disk (10) rotating together with the front axle (1) is pressed.

The knuckle (4) of the hydraulic brake serves as a master cylinder.

When brake oil pressure increases, the brake piston (5) is forced out and presses the brake disks against the knuckle cover (2), thereby causing braking. This brake uses three brake disks to obtain big braking force.

(1) Front Axle
(2) Knuckle Cover
(3) Plate
(4) Knuckle
(5) Brake Piston
(6) Brake Seal 3
(7) Brake Seal 4
(8) Brake Seal 2
(9) Brake Seal 1
(10) Brake Disk

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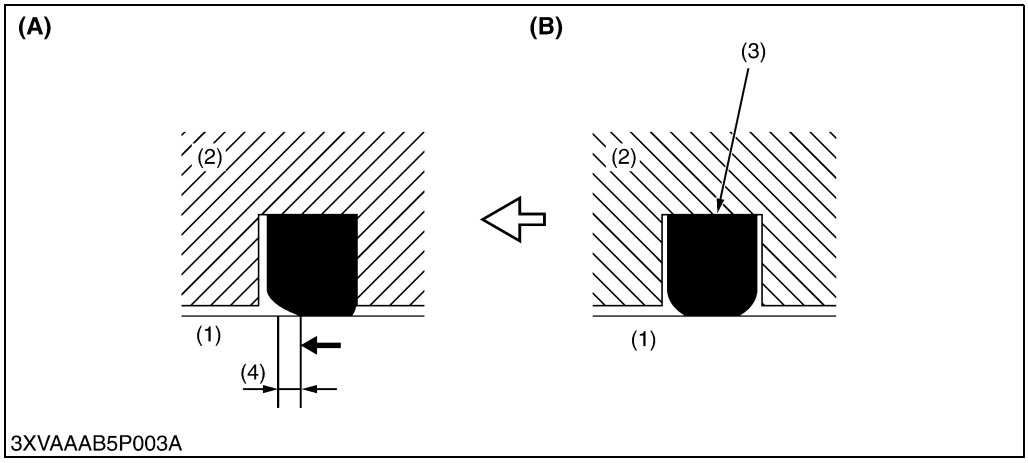
Automatic Brake Adjustment



3XVAAAB5P003A

(1) Knuckle
(2) Brake Piston
(3) Brake Seal
(4) Piston Return Stroke
(A) When brake pedal is pressed.
(B) When brake pedal is released.

With a mechanical brake system, when the brake pedal is released, the brake returns to its original position by spring tension and cam mechanism.

With a hydraulic brake system, the seal (3) serves to return the brake piston (2) to the original position (no braking force).

When the brake pedal is pressed, pressure in the knuckle case rises and the brake piston moves in the direction of arrow and causing the brake disks to press against the knuckle case. At this time, the brake seals are deformed in the knuckle case (1), and are subjected to elastic deformation as shown in the figure above.

When the brake pedal is released, pressure in the knuckle case reduces due to the brake seals reverting back to its original form. Together, a clearance is formed between the brake disk and brake piston to prevent the brake dragging.

Worn brake disks require longer brake piston movement. When the brake piston movement exceeds the elastic limit of brake seal, sliding occurs between the seals and the brake piston. With the brake seals deformed a clearance is automatically kept constant.

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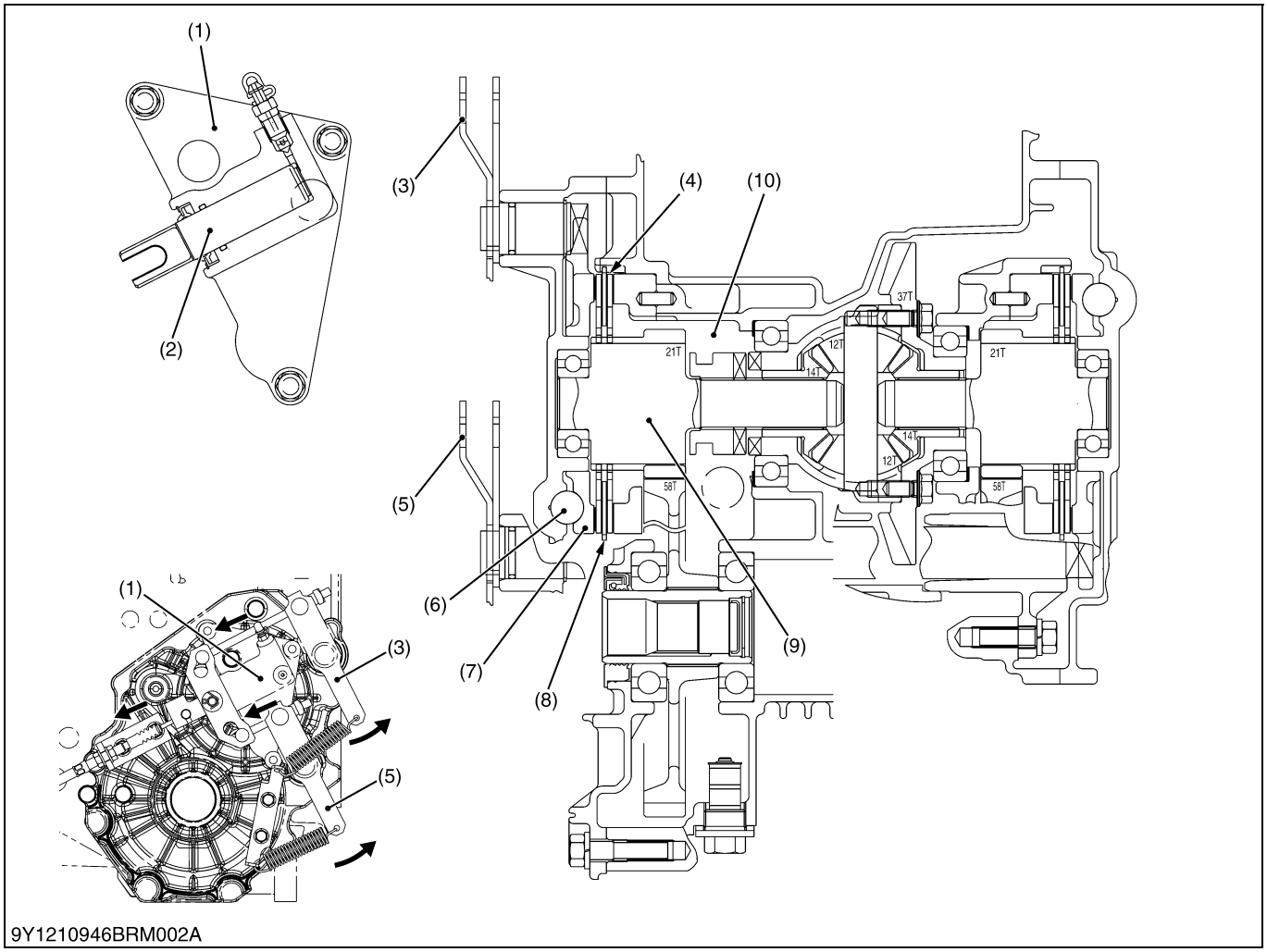
3. REAR BRAKE



(1) Brake Cylinder
(2) Brake Piston
(3) Brake Cam Lever LH
(4) Break Disk
(5) Brake Cam Lever RH
(6) Steel Ball
(7) Cam Plate (Actuator)
(8) Friction Plate
(9) Differential Gear Shaft
(10) Bearing Holder
(11) Equalizer

The brake body is incorporated in the differential side cover filled with transmission oil and is designed to brake when the brake disk (4) splined with the differential gear shaft (9) is pressed against the cam plate (7) by means of the cam mechanism incorporating steel balls (6).

For greater braking force, two brake disks are provided at the right and left sides respectively, and the friction plate (8) fixed to the rear axle case is arranged between the brake disks.

■ **During Braking**

When brake oil pressure increases, the brake piston (2) is shortened, the linkage causes the brake cam levers (3), (5) to turn into the direction of arrow shown in the above figure.

Therefore, the cam plate (7) also moves the direction of arrow. At this time, since the cam plate rides on the steel balls (6) set in the grooves of the bearing holder (10) to press the brake disk (4), the differential gear shaft (9) is braked by the frictional force generated by the cam plate (7) and brake disk (4).

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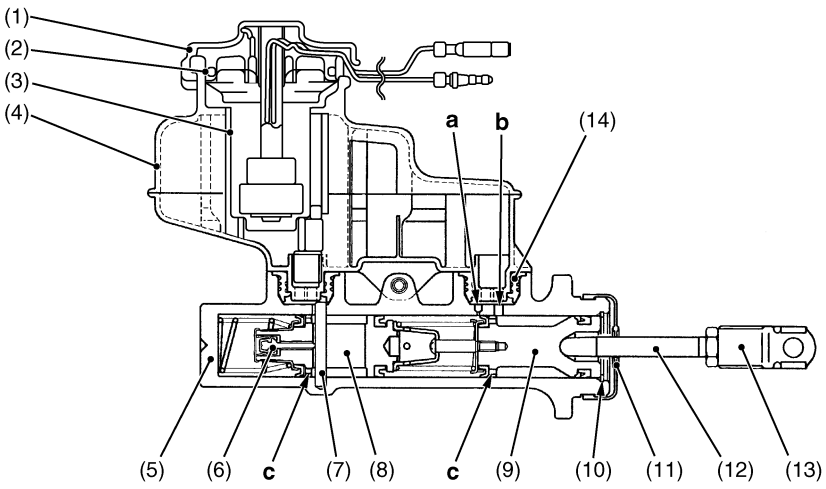
4. MASTER CYLINDER



9Y1210946BRM003A

(1) Cup
(2) Diaphragm
(3) Filter
(4) Reserve Tank
(5) Master Cylinder Body
(6) Needle
(7) Pin
(8) Primary Piston
(9) Secondary Piston
(10) Internal Circlip
(11) Boot
(12) Push Rod
(13) Yoke
(14) Grommet
a: Relief Port
b: Supply Port
c: Small Hole

The master cylinder is intended to convert the brake pedal operating force to the fluid pressure. It consists of the reservoir that contains the brake fluid and the cylinder proper that generates the fluid pressure. There are several different fluid pressure generating mechanisms. Kubota has picked up the tandem type cylinder out of them. Even if a pipe has got cracked and the front or rear set of wheels have failed to get braked, this mechanism can apply the brakes on the other set of wheels.

(This is to comply with the rules and regulations stipulating that two lines must be independently controlled.). Step on the brake pedal, and the push rod (12) drives the piston (9) the primary cup blocks the relief port **a**, and the path between the pressure chamber and reservoir is shut off. As the piston moves on, the brake fluid flows through the brake hose or pipe to the front wheel brake piston and the rear wheel brake cylinder, and the fluid pressure is then boosted.

Release the brake pedal, and the piston returns to its initial position under the force of the return spring. But the brake fluid in the front wheel brake piston and the rear wheel brake cylinder is delayed in flowing back, which puts the pressure chamber under negative pressure.

To get rid of the negative pressure, the brake fluid in the reservoir flows through the supply port **b**, supply chamber and piston-end small hole **c**, along the back of the primary cup, into the pressure chamber.

Now the brake fluid flows back from the front wheel brake piston and the rear wheel brake cylinder. The brake fluid in the reservoir fluctuates in volume, but there is no pressure fluctuation thanks to the reservoir cap that has a small hole open to the atmosphere.

The tandem type master cylinder works like this. Step on the brake pedal, and the push rod (12) activates the primary piston (8) first (spring force different between front and back; front one weaker), raising its pressure. The primary piston gets balanced in pressure with the secondary one (9) (fluid pressure adjustment). Now the brakes are applied.

The relief port **a** (at the secondary piston side) absorbs temperature dependent volumetric changes in the brake fluid. This helps prevent fluid pressure buildup when unnecessary. If this port is clogged, the braking effect may drag on. (At the primary piston side, the clearance between the needle (6) and piston, as well as the one between the pin (7) and master cylinder body (5), serve as the relief port.)

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5. BRAKE OIL

Non-mineral oil is used for the brake oil.

The brake oil for the machine is a brand of vegetable oil, that is basically the same as the DOT3 (FMVSS No. 116 Brake Fluid Standard) used on automotives and motorcycles.

Keep in mind that the UDT oil used for Kubota tractors so far cannot be applied as the brake oil.

If a coated surface gets stained with the brake oil, the paint becomes degraded. Immediately wipe off the oil just in case. Also immediately wipe the oil off the power steering hose if any.

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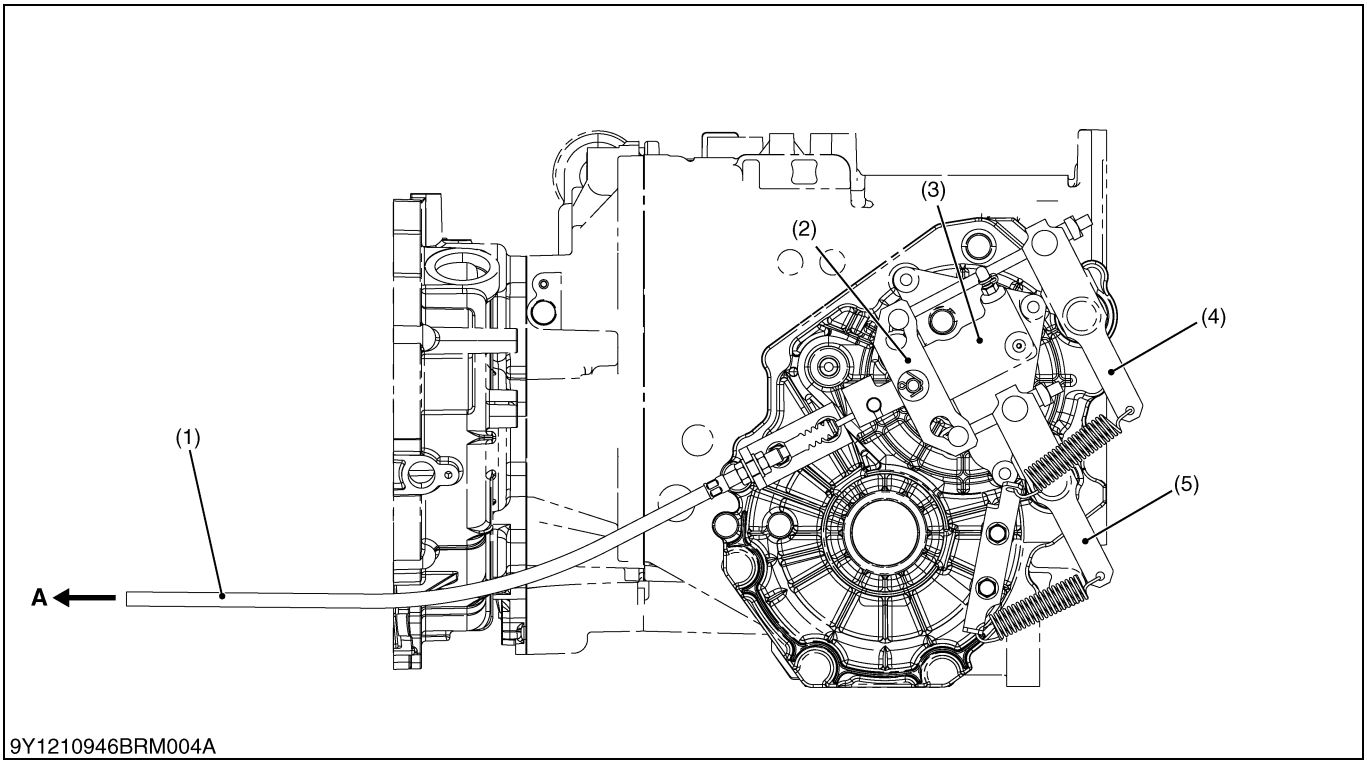
6. PARKING BRAKE



(1) Parking Brake Cable
(2) Mechanical Equalizer
(3) Brake Cylinder
(4) Brake Cam Lever LH
(5) Brake Cam Lever RH
A: To Parking Brake Lever

The parking brake is mechanical type which is connected to the brake cam levers (4), (5) by the parking brake cable (1). This parking brake is a mechanism that same brake disks as travelling brake is operated.

The parking brake consists basically of the following:

Brake cam lever, parking brake lever, mechanical equalizer and parking brake cable, etc..

Pull the parking brake lever, and the rear wheel brakes are applied and the rear axle comes to a halt. The equalizer is installed to adjust the right-to-left balance of mechanical force and to achieve an equal force.

9Y1210946BRM0007US0

SERVICING

CONTENTS

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Poor Braking Force	Brake pedal play excessive	Adjust	4-S4
	Brake disk worn	Replace	4-S16, 4-S17
	Brake fluid insufficient or improper	Fill or change with specified oil	4-S5
	Brake fluid leakage from brake pipes, bleeder, master cylinder	Repair or replace	4-S12
	Master cylinder malfunctioning	Repair or replace	4-S12
Uneven Braking Force	Brake disk worn	Replace	4-S16, 4-S17
	Brake fluid leakage from brake pipes, bleeder or master cylinder	Repair or replace	4-S12
	Master cylinder malfunctioning	Repair or replace	4-S12
Brake Drags	Brake pedal play too small	Adjust	4-S4
	Master cylinder return spring weaken or broken	Replace	4-S15
	Master cylinder malfunctioning	Repair or replace	4-S12
	Brake seal failure	Replace	4-S15
	Brake lines clogged	Clean	4-S12
	Brake pedal return spring weaken or broken	Replace	4-S15
	Brake fluid improper	Change with specified oil	4-S5
Spongy Brake Pedal	Brake fluid insufficient or improper	Fill or change with specified oil	4-S5
	Air in brake system	Bleed air	4-S6
Brake Oil Consumed Excessively	Brake seal failure	Replace	4-S14
	Brake fluid leakage in brake lines	Repair or replace	4-S12
Poor Parking Brake Force	Parking brake lever travel excessive	Adjust	4-S7
	Parking brake lever travel too small	Adjust	4-S7

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2. SERVICING SPECIFICATIONS

TRAVELLING BRAKE

Item		Factory Specification	Allowable Limit
Brake Pedal	Free Travel	8 to 18 mm 0.3 to 0.7 in.	–
	Stroke	Less than 150 mm 5.9 in.	–
Brake Disk	Thickness (Front)	3.3 to 3.5 mm 0.130 to 0.138 in.	3.0 mm 0.118 in.
	Thickness (Rear)	3.32 to 3.48 mm 0.131 to 0.137 in.	3.15 mm 0.124 in.
Friction Plate	Thickness (Front)	1.92 to 2.08 mm 0.0756 to 0.0819 in.	1.52 mm 0.0598 in.
	Thickness (Rear)	1.92 to 2.08 mm 0.0756 to 0.0819 in.	1.52 mm 0.0598 in.
Actuator and Bearing Holder	Flatness	–	0.30 mm 0.0118 in.
Cam Plate and Ball	Height	20.77 to 20.87 mm 0.8178 to 0.8216 in.	20.57 mm 0.8098 in.

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3. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to "5. TIGHTENING TORQUES" on page G-12.)

Item	N·m	kgf·m	lbf·ft
Front axle slotted nut	190 to 200	19.4 to 20.3	141 to 147
Front wheel mounting bolt and nut (Aluminum wheel)	90 to 110	9.2 to 11.2	66.4 to 81.1
Front wheel mounting bolt and nut (Steel wheel)	108 to 130	11.1 to 13.2	79.7 to 95.8
Tie-rod end slotted nut	50.0 to 55.0	5.10 to 5.60	36.9 to 40.5
Brake hose eye joint bolt (M10)	22.6 to 26.8	2.31 to 2.73	16.7 to 19.7
Brake pipe flare nut	13 to 17	1.4 to 1.7	9.6 to 12
Knuckle case cover mounting screw	48.1 to 55.9	4.91 to 5.70	35.5 to 41.2

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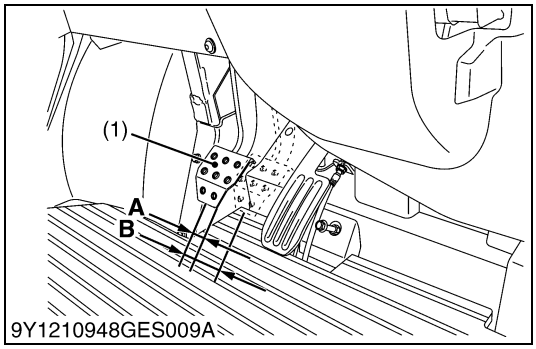
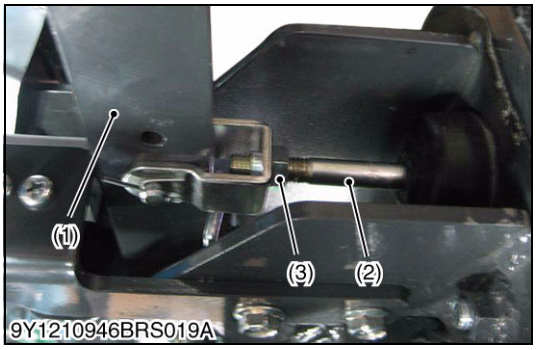
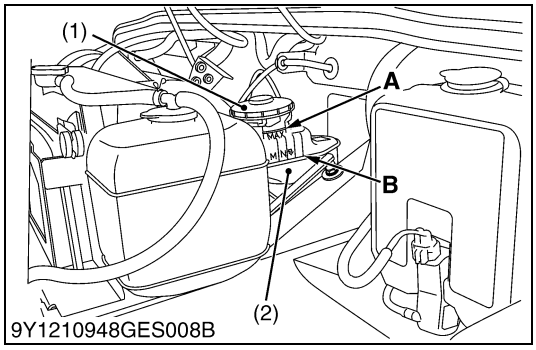
4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING







Brake Pedal

CAUTION

- **When checking, park the tractor on flat ground, and stop the engine.**

1. Measure the free play by depressing the brake pedal (1).
2. If the measurement is not within the factory specifications, adjust the free travel by the push rod (2).
3. After adjustment, tighten the lock nut (3) firmly.

Brake pedal free travel	Factory specification	8 to 18 mm 0.3 to 0.7 in.
Brake pedal stroke	Factory specification	Less than 150 mm 5.9 in. on the pedal

(1) Brake Pedal
(2) Push Rod
(3) Lock Nut

A: Free Play
B: Pedal Stoke

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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) Reservoir Cap
(2) Brake Fluid Reservoir

A: MAX
B: MIN

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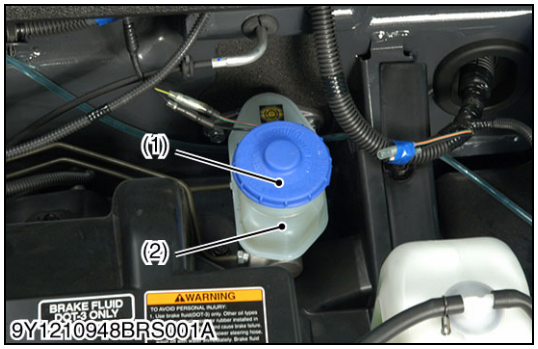

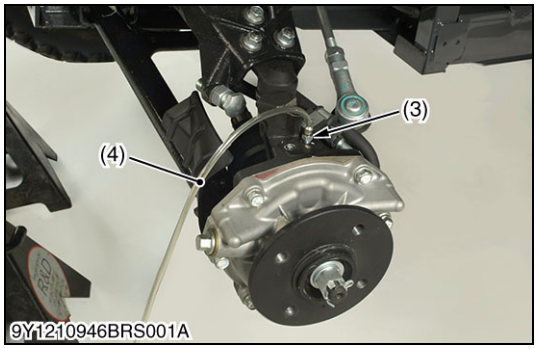

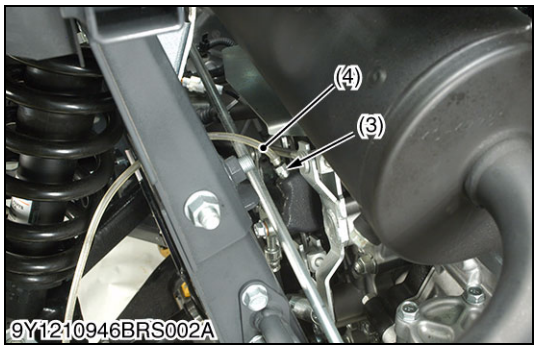

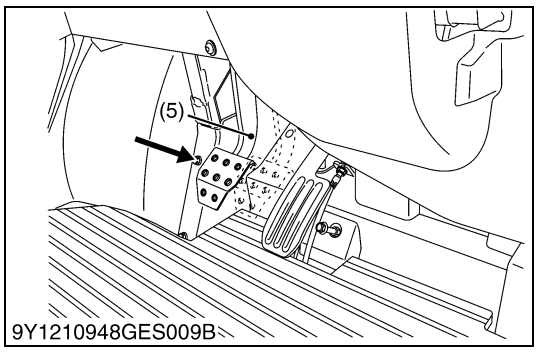

Brake Fluid Change

CAUTION

- **Use only DOT-3 brake fluid from a sealed container. Conforms to motor vehicle safety standard No. 116. Using other type of ail 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 power steering hoses, wash off with water immediately. Brake fluid quickly ruins synthetic resin or rubber hoses.**

NOTE

- **The fluid level must be checked several times during the fluid change and filled as necessary. If the fluid in the reservoir runs completely out any time during fluid changing, air bleeding must be done since air will have entered the line.**
- **Start with the rear either side and finish with the front either side.**

1. Jack up the front side of machine and remove the front wheels.
2. Connect a clear plastic hose (4) to the bleeder (3), running the other end of the hose into a container.
3. Remove the brake fluid reservoir cap (1).
4. Fill the reservoir (2) with new brake fluid.
5. Temporarily install the reservoir cap.
6. Open the bleeder.
7. Then, pump brake pedal (5) and hold it.
8. Close the bleeder and release the brake pedal.
9. Repeat the previous step for each wheel.
10. When brake fluid changing is finished, add the fluid to the upper level in the reservoir.
11. After changing the fluid, check the brake for good braking power, no brake drag, and no fluid leakage.
12. If necessary, bleed the air from the brake lines.

WARNING

- **If the brake pedal has a soft or "spongy feeling" when it is applied, there might be air in the brake line or the brake may be damaged. Since it is dangerous to operate the vehicle under such conditions, bleed the air from the brake line immediately.**

(1) Reservoir Cap
(2) Reservoir
(3) Bleeder
(4) Clear Plastic Hose
(5) Brake Pedal

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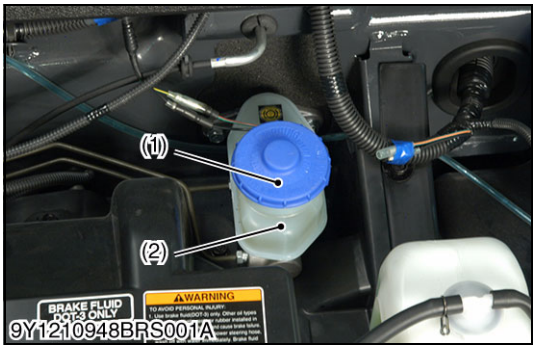

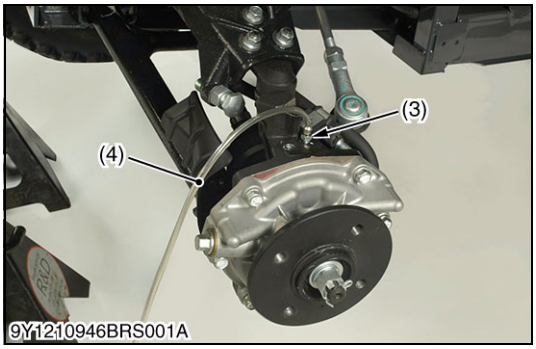

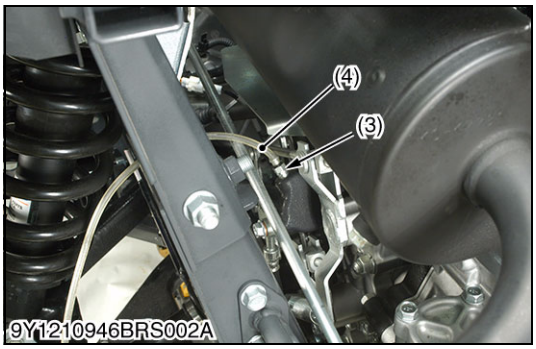

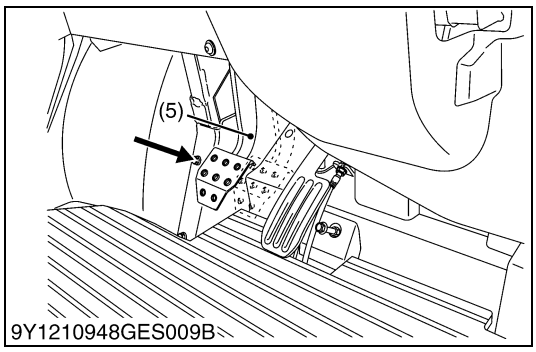

Brake Line Air Bleeding

CAUTION

- **Use only DOT-3 brake fluid from a sealed container. Conforms to motor vehicle safety standard No. 116. Using other type of ail 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 power steering hoses, wash off with water immediately. Brake fluid quickly ruins synthetic resin or rubber hoses.**

NOTE

- **The fluid level must be checked several times during the bleeding operation and filled as necessary. If the fluid in the reservoir runs completely out any time during bleeding, the bleeding operation must be done over again from the beginning since air will have entered the line.**

1. Jack up the front side of machine and remove the front wheels.
2. Connect a clear plastic hose (4) to the bleeder (3), running the other end of the hose into a container.
3. Pump the brake pedal (5) until it becomes hard, and apply the brake pedal and hold it.
4. Quickly open and close the bleeder (3) while holding the brake pedal applied.
5. Release the brake pedal.
6. Check the brake fluid level and fill the reservoir (2) with new brake fluid.
7. Repeat the previous step for each wheel.
8. Repeat this operation until no more air can be seen coming out into the plastic hose.
9. When air bleeding is finished, add fluid up to the upper level in the reservoir.
10. Apply the brake forcefully for a few seconds, and check for fluid leakage around the fittings.

WARNING

- **If the brake pedal has a soft or "spongy feeling" when it is applied, there might be air in the brake line or the brake may be damaged. Since it is dangerous to operate the vehicle under such conditions, bleed the air from the brake line immediately.**

(1) Reservoir Cap
(2) Reservoir
(3) Bleeder
(4) Clear Plastic Hose
(5) Brake Pedal

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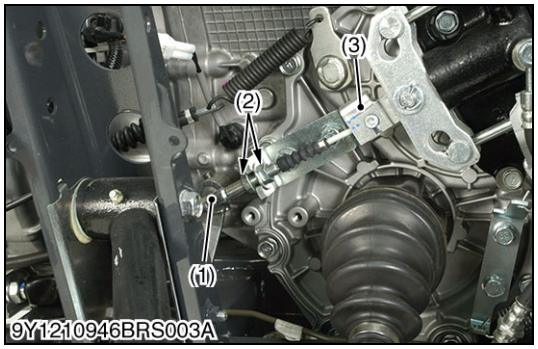

Parking Brake Lever (Adjustment of the Parking Brake Cable)

CAUTION

- **When checking, parking the machine on flat ground.**
- **Work by two people when you measure pressure.**

1. Adjust the length of the parking brake cable (1) outer section so that the cable does not pull the parking brake bracket (3).
2. Parking brake cable bearing to pull the parking brake bracket (3) when one notch pulled the parking brake lever (4).

(1) Parking Brake Cable
(2) Lock Nut
(3) Parking Brake Bracket
(4) Parking Brake Lever

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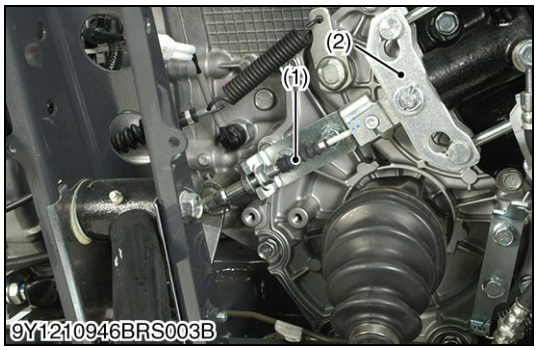

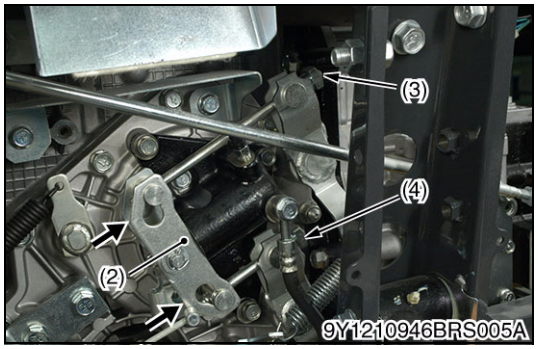

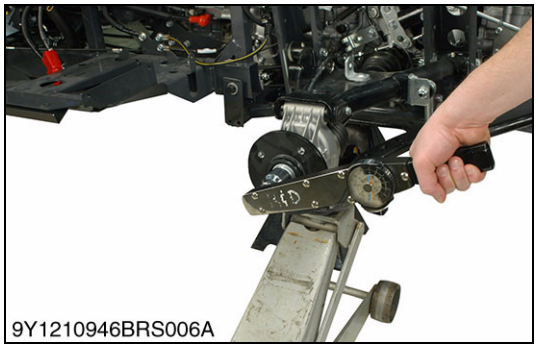

Brake Rod

CAUTION

- **When checking, park the machine on flat ground.**
- **Work by two people when you measure pressure.**

1. Jack up the rear end after placing a wooden block under the bottom plate of the transmission frame.
2. Remove the rear wheels.
3. Disconnect the parking brake cable (1).
4. Push the equalizer into the brake piston body and adjustment nuts so that there is no play in the brake rod.
5. Tighten the adjustment nut of the brake by hand until the point where it get firm.
6. Measure the turning torque of the CV joint, and then if the torque is over 10 N·m (1.02 kgf·m, 7.38 lbf·ft), loosen the adjustment nut half-turn.
7. After adjust the turning torque on right and left side, adjust the parking brake cable.

CAUTION

- **Over-pulling due to poor turnbuckle adjustment can result in the problem of brake drag (overheating and burning).**

(1) Parking Brake Cable
(2) Equalizer
(3) Adjustment Nut (Left Side)
(4) Adjustment Nut (Right Side)

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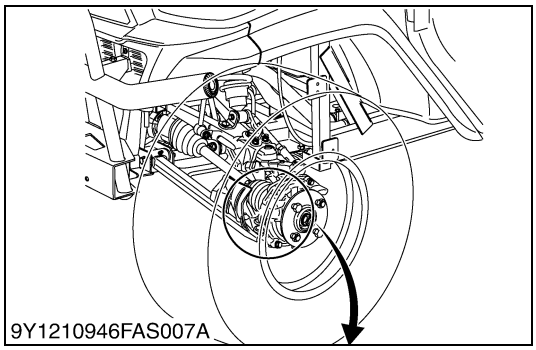
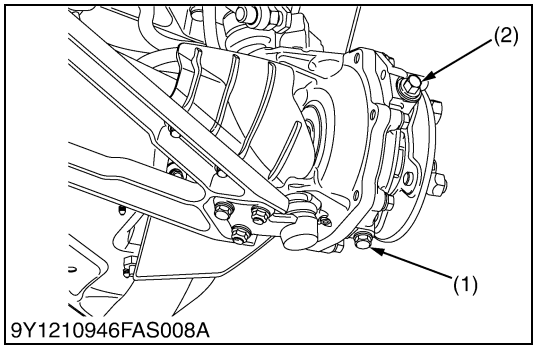
[2] PREPARATION

(1) Front Brake





Draining Knuckle Case Oil

1. Park the vehicle on a firm, flat, and level surface,
2. Remove the wheel.
3. To drain the used oil, remove the drain the filling plugs at the LH knuckle case and drain the oil completely into the oil pan.
4. After draining, reinstall the drain plug.
5. Use the same procedure to change the RH knuckle case oil.

Knuckle case oil	Reference capacity (one side)	0.25 L 0.26 U.S.qts 0.22 Imp.qts

(1) Drain Plug (2) Filling Plug

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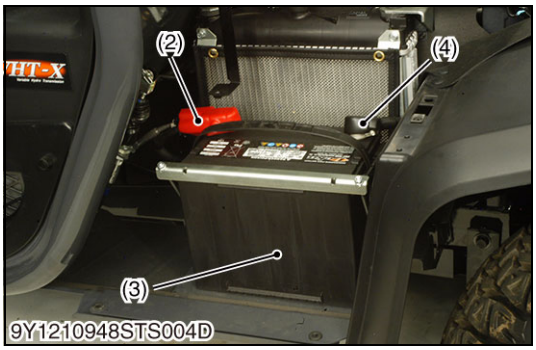

Battery

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

(1) Battery Cover (3) Battery
(2) Positive Cable (4) Negative Cable

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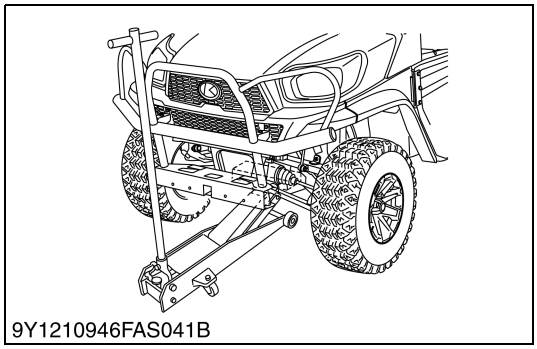
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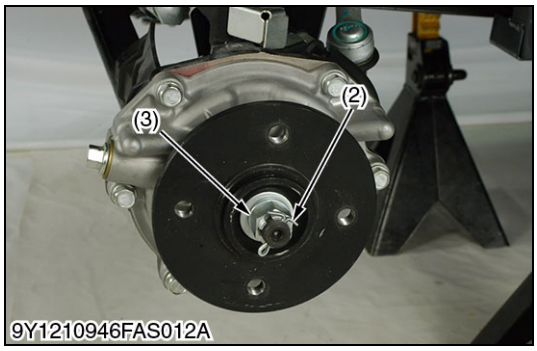

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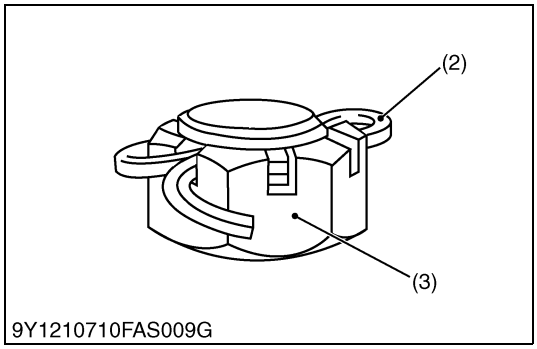

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Front Wheel and Front Axle Nut

WARNING

To avoid serious injury, death or vehicle damage:

- **Do not work under the vehicle unless it is secured by safe stands or suitable blocking.**

1. Jack up at the plate under the front axle case only.
2. Remove the cotter pin (2) and just loosen the slotted nut (3) for drive shaft.
3. Remove the front wheel mounting screw.

(When reassembling)

- After tightening the front axle slotted nut to specified torques, install a cotter pin as shown in the figure left.

NOTE

- **Tighten the slotted nut to 190 N·m (19.4 kgf·m, 140 lbf·ft). If the slot and pin hole do not meet, tighten the nut until they do meet, and install cotter pin.**

Tightening torque	Front axle slotted nut	190 to 200 N·m 19.4 to 20.3 kgf·m 141 to 147 lbf·ft
	Front wheel mounting bolt and nut (Aluminum wheel)	90 to 110 N·m 9.2 to 11.2 kgf·m 66.4 to 81.1 lbf·ft
	Front wheel mounting bolt and nut (Steel wheel)	108 to 130 N·m 11.1 to 13.2 kgf·m 79.7 to 95.8 lbf·ft

(1) Front Wheel
(2) Cotter Pin
(3) Slotted Nut

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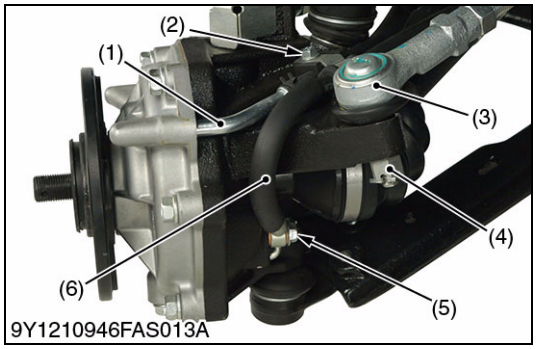

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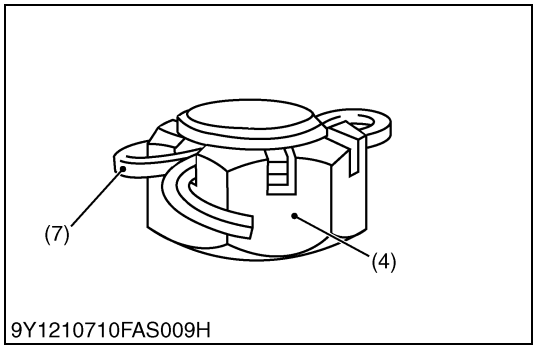

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Tie-rod End, Brake Hose and Breather Hose

CAUTION

- **When the brake hose is removed, the brake fluid come out. Be careful not to stain other hoses or rubber boot with the brake fluid.**
  Brake fluid stains should be washed and wiped off immediately. Likewise, the brake fluid on the tools should be wiped off immediately.

1. Remove the clamp (2).
2. Remove the eye joint bolt (5) for brake hose (6) and drain the brake fluid.
3. Remove the breather pipe (1).
4. Remove the cotter pin (7) and remove the tie-rod end slotted nut (4).

(When resembling)

- Replace the copper washers with new ones.
- Bleed air of the brake line after break hoses reassembled.
- Tighten the slotted nut to 50.0 N·m (5.10 kgf·m, 36.9 lbf·ft). If the slot and pin hole do not meet, tighten the nut until they do meet, and install cotter pin.

Tightening torque	Tie-rod end slotted nut	50.0 to 55.0 N·m 5.10 to 5.60 kgf·m 36.9 to 40.5 lbf·ft
	Brake hose eye joint bolt (M10)	22.6 to 26.8 N·m 2.31 to 2.73 kgf·m 16.7 to 19.7 lbf·ft

(1) Breather Pipe
(2) Clamp
(3) Tie-rod End
(4) Tie-rod Slotted Nut
(5) Eye Joint Bolt
(6) Brake Hose
(7) Cotter Pin

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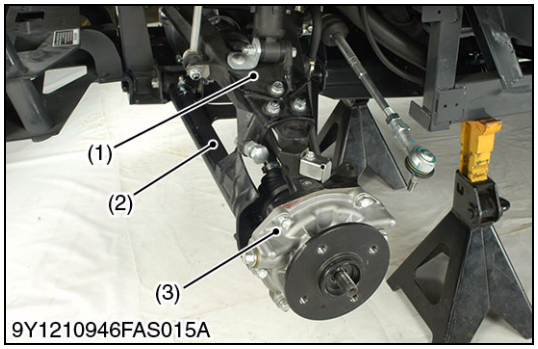

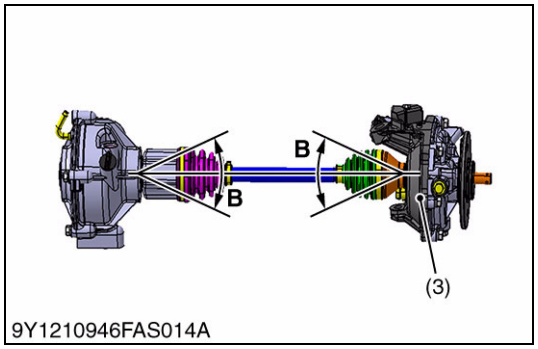

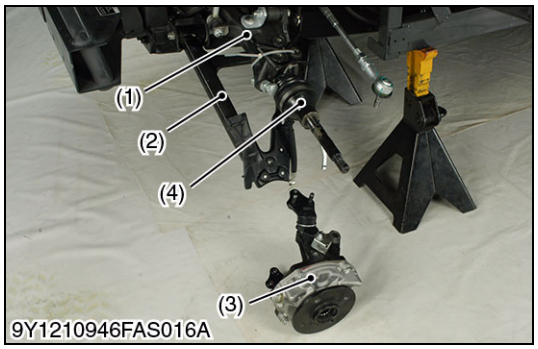

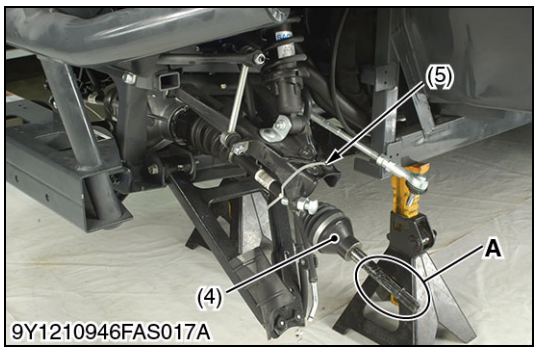

Knuckle Case

■ **NOTE**

- **CV joint shall not exceed the allowable bend angle ±25 ° when being reassembled or disassembled.**

1. Remove the lower arm (2) and upper arm (1) mounting screws and nuts.
2. Support the CV joint (4) by something like a clamp (5) to prevent the CV joint (4) falling before removing the knuckle case assembly (3).
3. Remove the knuckle case assembly (3).
4. Remove the CV joint (4).

(When resembling)

- Apply anti-fitting grease (RAILMASTER or equivalent) to the spline of CV joint (4).

(1) Upper Arm
(2) Lower Arm
(3) Knuckle Case Assembly
(4) CV Joint
(5) Clamp

A: Apply to grease.
B: ± 25 °

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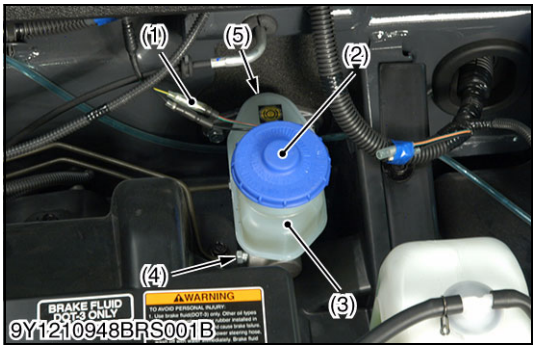
(2) Master Cylinder



Master Cylinder Assembly

CAUTION

- **Use only DOT-3 brake fluid from a sealed container. Conforms to motor vehicle safety standard No. 116. Using other type of ail 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 power steering hoses, wash off with water immediately. Brake fluid quickly ruins synthetic resin or rubber hoses.**

NOTE

- **Do not transform, and do not damage the brake pipe.**
- **Do not reuse the drained brake fluid.**
- **Do not the brake fluid of the other brand to prevent chemical change from occurring.**

1. Disconnect the connector (1).
2. Remove the brake fluid reservoir cap (2).
3. Drain the brake fluid.
4. Disconnect the brake pipes (4) from master cylinder (5).
5. Remove the master cylinder (5).

(When reassembling)

- Air bleed the brake line after master cylinder reassembled. (See page 4-S6.)
- Check and adjust the brake pedal free travel. (See page 4-S4.)

Tightening torque	Brake pipe flare nut	13 to 17 N·m 1.4 to 1.7 kgf·m 9.6 to 12 lbf·ft

(1) Connector
(2) Reservoir Cap
(3) Reservoir
(4) Brake Pipe
(5) Master Cylinder

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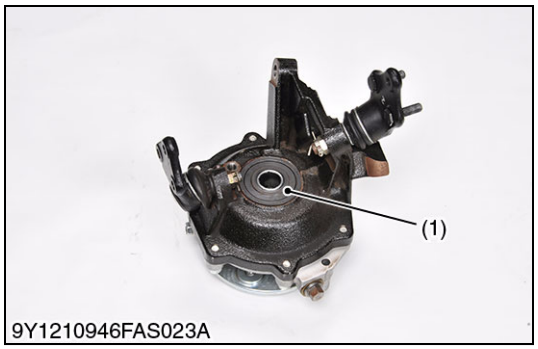
[3] DISASSEMBLING AND ASSEMBLING

(1) Front Brake



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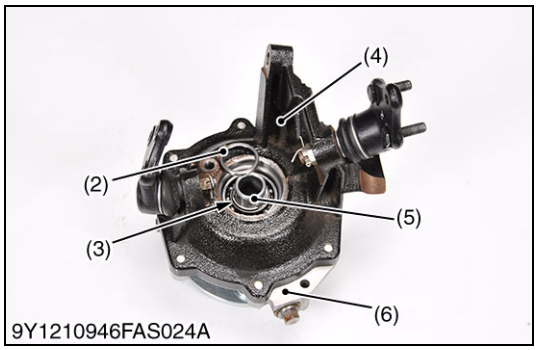

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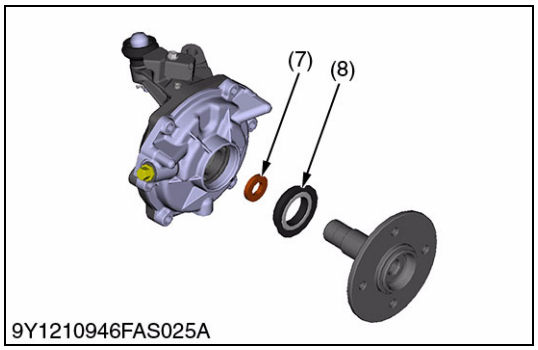

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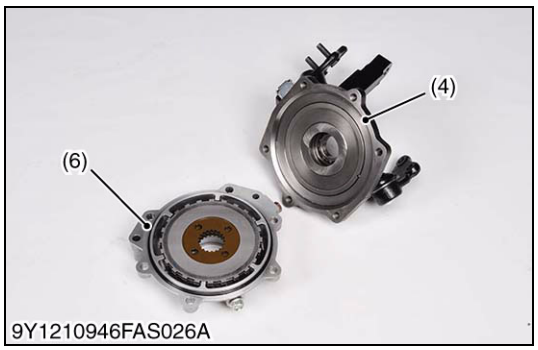

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Front Axle

1. Remove the oil seal (1).
2. Remove the snap ring collar (2) and remove the external snap ring (3).
3. Tap out the front axle (5) with plastic hammer.
4. Remove the knuckle case mounting screw.
5. Separate the knuckle case (4) and knuckle case cover (6).

(When reassembling)

- Be sure insert the external snap ring.
- Replace the oil seal with new one.
- Be careful not to damage the O-ring.
- Insert the bearing (7) and oil seal (8) first to the knuckle cover, and then install the knuckle case cover.

Tightening torque	Knuckle case cover mounting screw	48.1 to 55.9 N·m 4.91 to 5.70 kgf·m 35.5 to 41.2 lbf·ft

(1) Oil Seal
(2) Snap Ring Collar
(3) External Snap Ring
(4) Knuckle Case
(5) Front Axle
(6) Knuckle Case Cover
(7) Bearing
(8) Oil Seal

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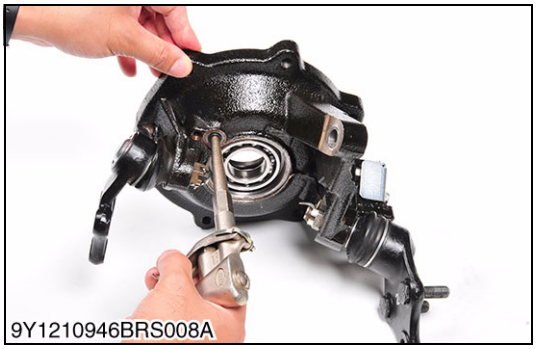
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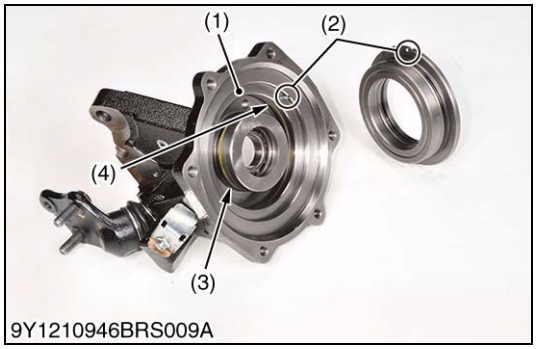

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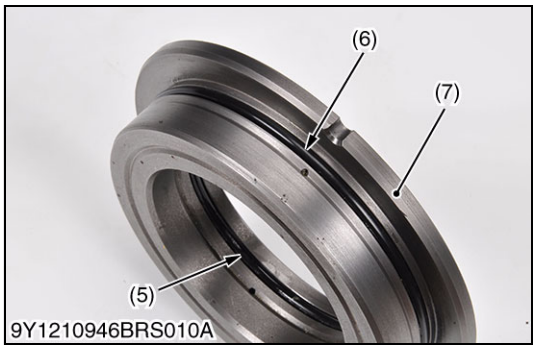

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Brake Piston

CAUTION

- **The brake seal 1 (5), 2 (6) are used for brake fluid only.**
- **The brake seal 3 (4), 4 (3) are used for transmission fluid only.**
- **Degrees both the piston (7) and the knuckle case (1) before installing each brake seal.**
- **Before installing both the piston (7), apply a thin coat of the special grease (KLUBER LUBRICATION: SEALUB-L-101 or equivalent) to the brake seal surface. The special grease is a dual use type that can be applied to the oil seal and the O-rings for both of the brake fluid and the transmission fluid.**
- **When servicing the brake, pay due attention to any oil adhered to your hands.**
- **Exert full care when handling the mineral oil (transmission fluid) and the brake fluid.**

NOTE

- **Align the each alignment mark (2) of piston and knuckle case.**
- **Assemble the bearing and oil seal of rear axle into the knuckle case cover side, and then assemble the rear axle.**

IMPORTANT

- **It is recommended to replace the brake seal with a new one every 2 years.**
- **Therefore, do not remove the piston unnecessarily from the knuckle case.**
- **If the piston should be removed, replace the seal ring with a new one.**

1. Remove the brake piston (7) by compressed air.

(When reassembling)

- Replace the brake seal 1 (5) and brake seal 2 (6).
- Replace the brake seal 3 (4) and brake seal 4 (3).

(1) Knuckle Case
(2) Alignment Mark
(3) Brake Seal 4
(4) Brake Seal 3
(5) Brake Seal 1
(6) Brake Seal 2
(7) Brake Piston

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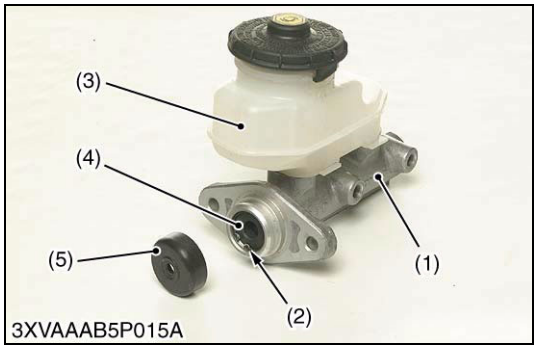
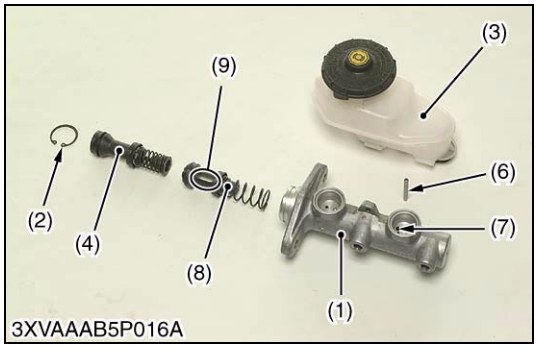
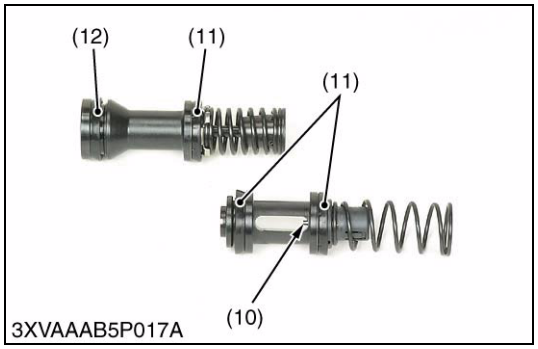
(2) Master Cylinder







Master Cylinder Inner Parts

1. Remove the reservoir (3) from master cylinder body (1).
2. Pushing in the piston (4), remove the internal snap ring (2).
3. Remove the piston from master cylinder body.
4. Pushing in the secondary piston (8), remove the stop pin (6).
5. Remove the secondary piston from master cylinder body.

■ **NOTE**

- **Keep the disassembled parts in order and prevent them from being contaminated with dust or dirt.**

(When reassembling)

- Wash the disassembled parts with the brake fluid and clean each port with the compressed air.
- Install the new grommet in the reservoir tank.
- Apply the brake fluid to the piston cup (11) and (12).
- Do not reuse the removed piton (4) and secondary piston (8).
- Before installation, tap the valve stem (10) through the slot (9) of the piston and check that the valve stem moves smoothly.
- Push in the secondary piston, match the slot of the piston with the stop pin (6) installation hole (7) and insert the stop pin (6).
- Apply a thin coat of special grease (COSMO RUBBER GREASE BY COSMO OIL CO.) to surface of piston cup (12) and hole of rod seal (5).

(1) Master Cylinder Body
(2) Internal Snap Ring
(3) Reservoir
(4) Piston
(5) Rod Seal
(6) Stop Pin
(7) Hole
(8) Secondary Piston
(9) Slot
(10) Valve Stem
(11) Piston Cup
(12) Piston Cup

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(3) Rear Brake

- Removing the rear brake assembly. (See page 2-S38, 2-S39.)

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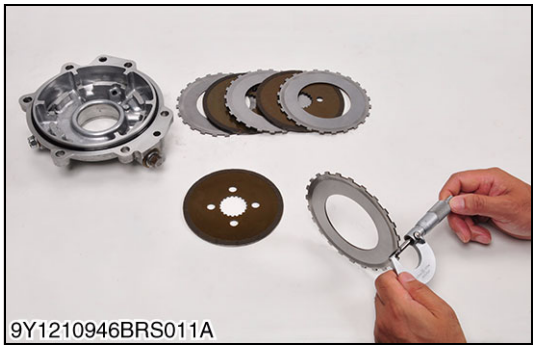
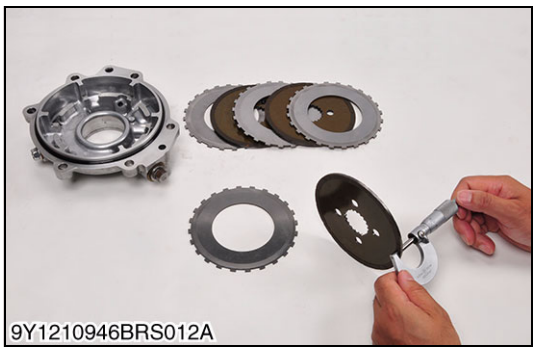
[4] SERVICING

(1) Front Brake





Brake Disk and Friction Plate Wear

1. Measure the brake disk thickness and the friction plate thickness with an outside micrometer.
2. If the thickness is less than the allowable limit, replace it.

Brake disk thickness	Factory specification	3.3 to 3.5 mm 0.130 to 0.138 in.
	Allowable limit	3.0 mm 0.118 in.

Friction plate thickness	Factory specification	1.92 to 2.08 mm 0.0756 to 0.0819 in.
	Allowable limit	1.52 mm 0.0598 in.

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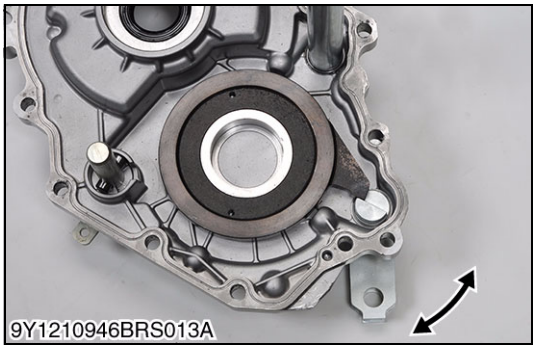
(2) Rear Brake



Brake Cam Lever Movement

1. Move the brake cam lever by hand to check the movement.
2. If the movement is heavy, refine the brake cam with emery paper.

9Y1210946BRS0015US0

Flatness of Actuator and Bearing Holder

1. Measure the height of the cam plate with the boll installed.
2. If the measurement is less than the allowable limit, replace the cam plate and balls.
3. Inspect the ball holes of cam plate for uneven wear.
4. If the uneven wear is found, replace it.

Flatness of actuator and bearing holder	Allowable limit	0.30 mm 0.0118 in.

9Y1210946BRS0016US0

Height of Cam Plate and Ball

1. Measure the height of the cam plate with the boll installed.
2. If the measurement is less than the allowable limit, replace the cam plate and balls.
3. Inspect the ball holes of cam plate for uneven wear.
4. If the uneven wear is found, replace it.

Height of cam plate and ball	Factory specification	20.77 to 20.87 mm 0.8178 to 0.8216 in.
	Allowable limit	20.57 mm 0.8098 in.

9Y1210946BRS0017US0

Brake Disk and Friction Plate Wear

1. Measure the brake disk thickness and the friction plate thickness with an outside micrometer.
2. If the thickness is less than the allowable limit, replace it.

Brake disk thickness	Factory specification	3.32 to 3.48 mm 0.131 to 0.137 in.
	Allowable limit	3.15 mm 0.124 in.

Friction plate thickness	Factory specification	1.92 to 2.08 mm 0.0756 to 0.0819 in.
	Allowable limit	1.52 mm 0.0598 in.

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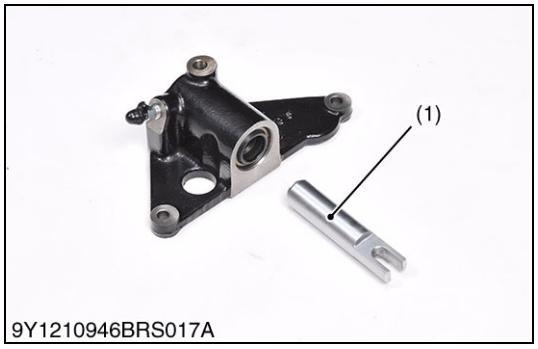
(3) Brake Piston



Brake Cylinder

1. Push the brake piston from brake rod connecting side, and pull out the brake piston (1).
2. Check the brake piston and brake cylinder for signs of scoring or other damage.
3. If there is any doubt as to the condition of a piston and cylinder, replace it.

■ **NOTE**

- **Apply a thin coat of the brake fluid to the piston before inserting it. Never use mineral oil, grease or the like.**

(1) Brake Piston

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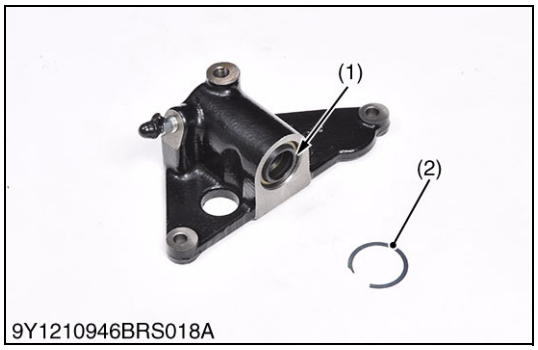


Dust Seal and O-ring

1. If oil leaks from dust seal.
2. Remove the internal circlip (2) and remove the dust seal (1) and O-ring and replace the new one.

■ **NOTE**

- **These O-ring and dust seal are designed specifically for brake fluid application. Use only Kubota genuine parts (for brake fluid use) for replacement. During replacement, be careful to avoid adherence of other oil or grease.**

(1) Dust Seal (2) Internal Circlip

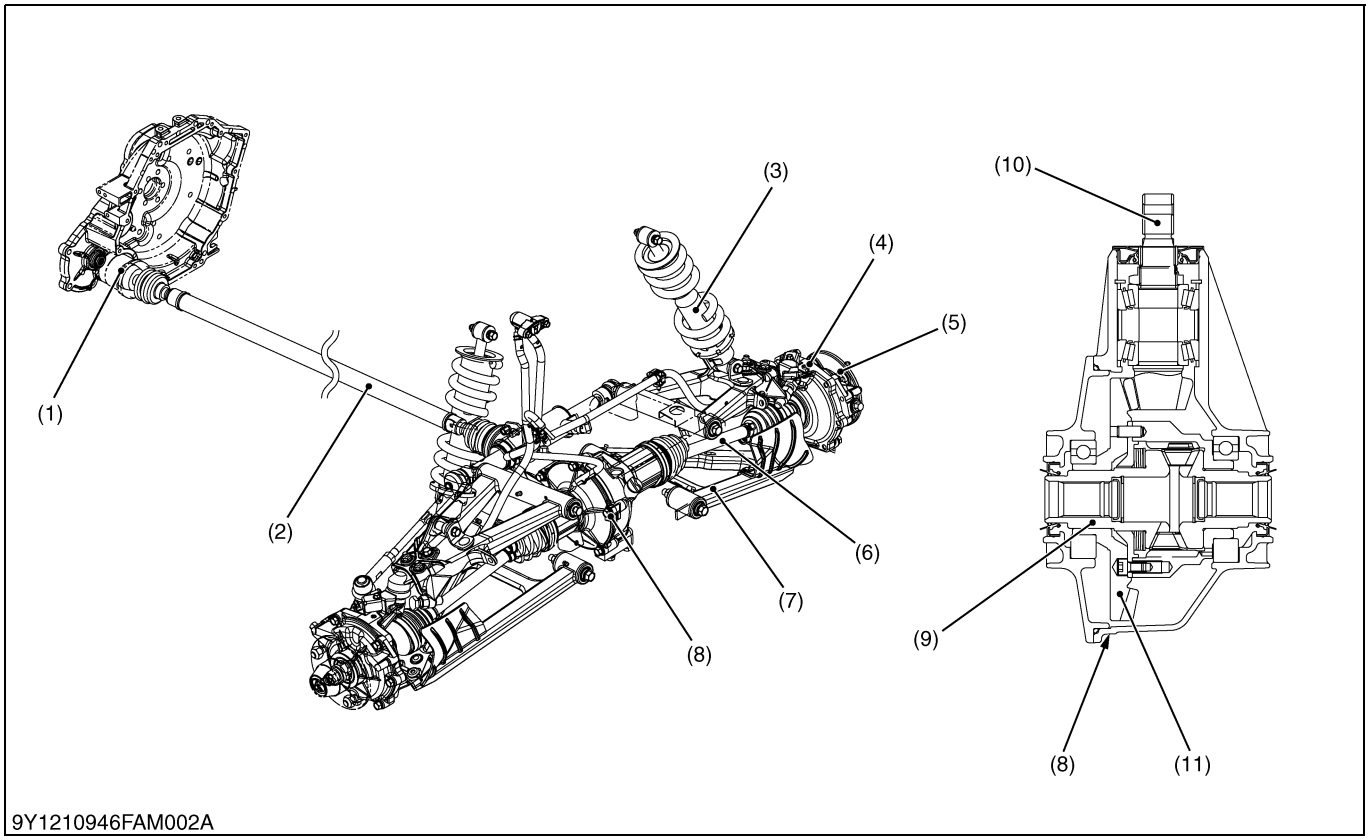
9Y1210946BRS0020US0

5 FRONT AXLE

MECHANISM

CONTENTS

1. STRUCTURE
[1] FRONT AXLE



9Y1210946FAM002A

(1) Transmission Output Shaft
(2) Propeller Shaft
(3) Strut
(4) Knuckle
(5) Front Axle
(6) Constant Velocity (CV) Joint
(7) Lower Arm
(8) Front Case
(9) Face Cam
(10) Bevel Gear Shaft (8T)
(11) Bevel Gear (35T)

The front axle consists mainly of knuckles (right and left), front case and CV (constant velocity) joint. (See the above illustration.)

Power is transmitted from the transmission output shaft (1) through the propeller shaft (2) to the bevel gear shaft. The power is further transmitted through the differential bevel gear and face cam (9) to the CV joint, and finally reaches the front axle in the knuckles. The knuckles and the front case are partitioned from each other. Which means each of the cases must be separately lubricated.

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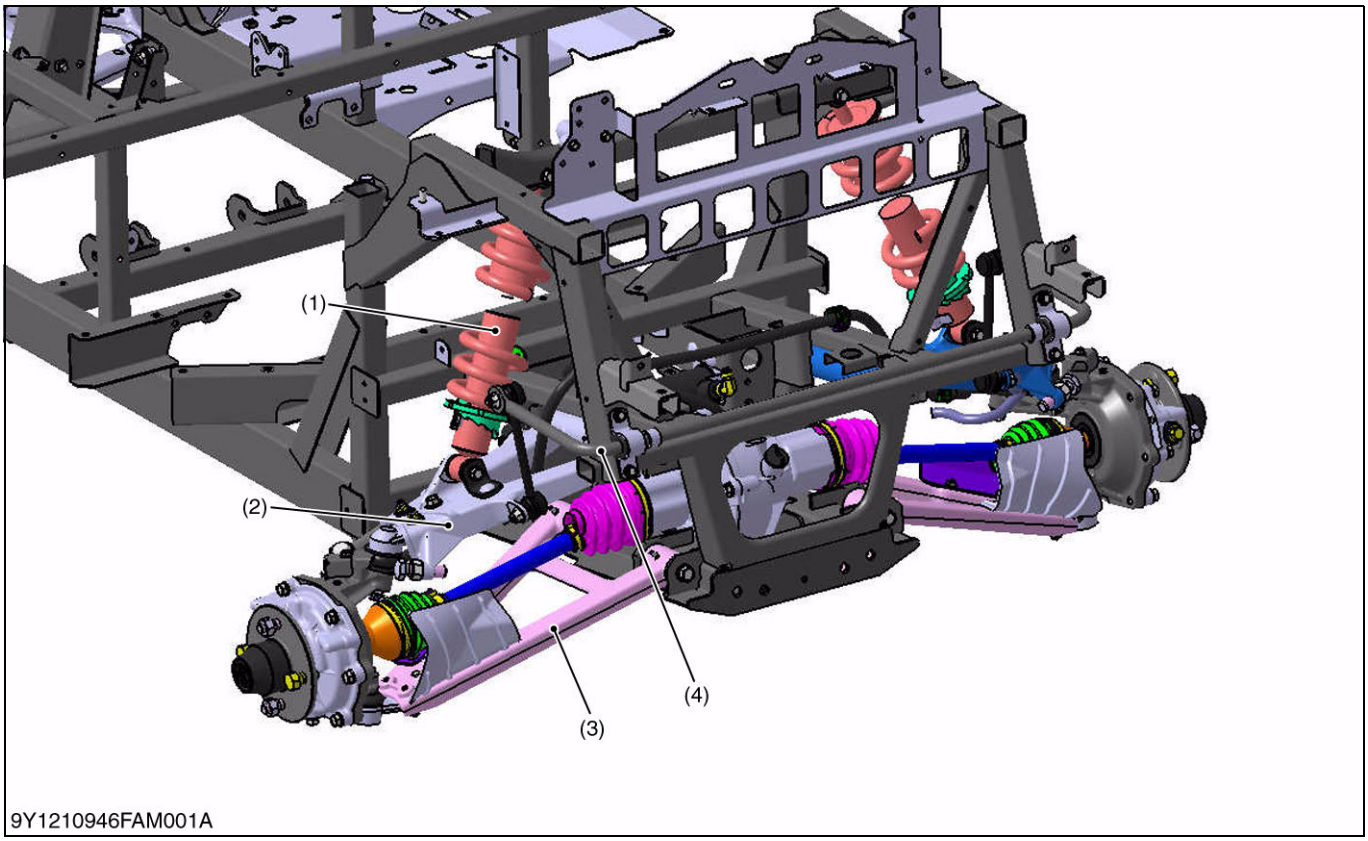
[2] FRONT SUSPENSION



(1) Shock Absorber (2) Upper Arm (3) Lower Arm (4) Stabilizer

The suspension is double wishbone type.

The suspension is made up of upper and lower arms (2), (3), a shock absorber (1), and a stabilizer (4).

The stabilizer (4) performs the function of a torsion bar.

The stabilizer (4) is connected to the upper arm (2) by a link.

When the upper arm (2) moves up and down, the stabilizer (4) moves with it.

When the arms on one side move, a differential is applied to the stabilizer link that is connected to the arms on the opposite side causing torsion on the stabilizer (4).

Based on torsion action of the stabilizer, a force is applied retaining its position so the arm connected is kept horizontally.

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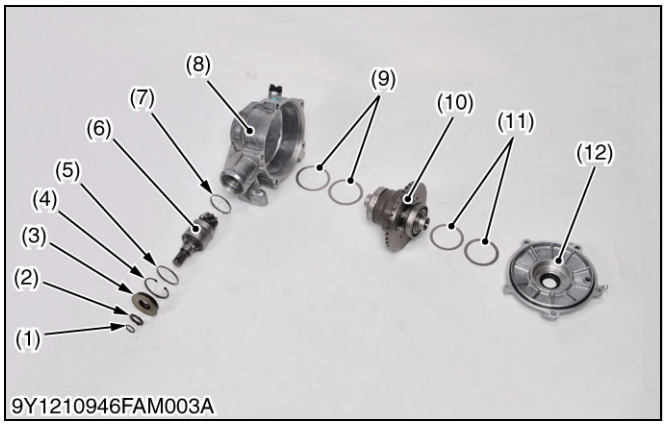
[3] LIMITED SLIP DIFFERENTIAL (LSD)

(1) Structure



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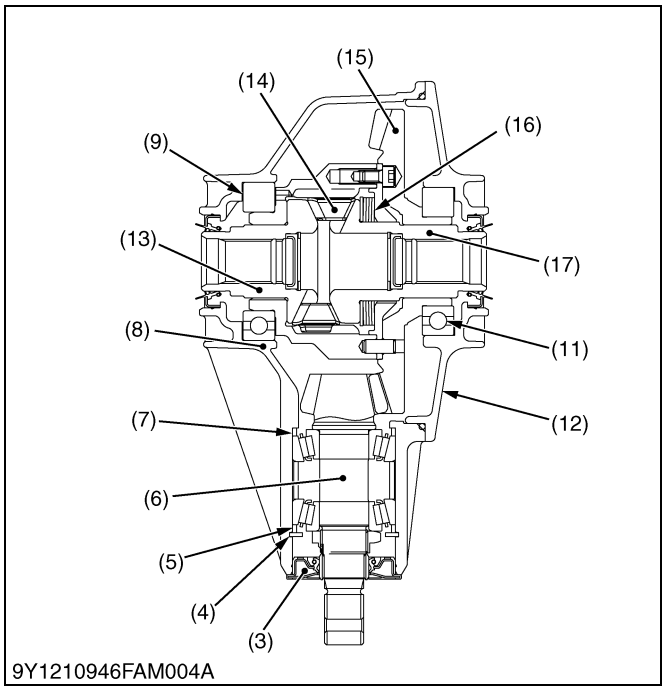

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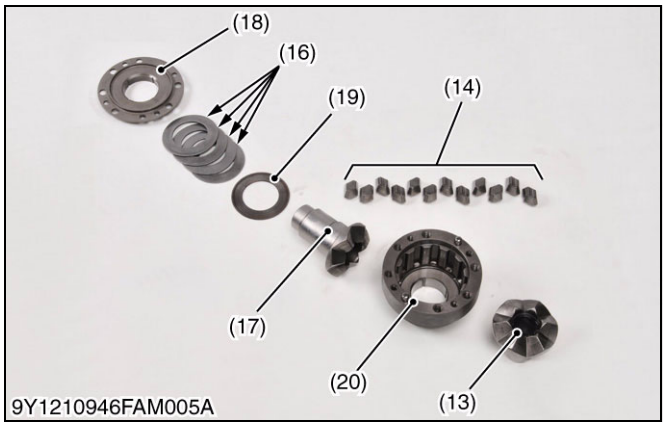

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The configuration of the differential gear is as shown in the figure.

The differential gear is prepared with an LSD function.

This is torque sensitive; therefore, even if the temperature of the LSD rises, the TBR (Torque Bias Ratio) is not reduced.

The structure is a differential case assembly (10), cam face (13), cam follower (14), disc spring (16), thrust washer (19), and differential case cap (18). The cam follower (14) has sintered metal and thermal processing and therefore superior durability.

(1) O-ring
(2) Plug
(3) Oil Seal
(4) Internal Cir-clip
(5) Collar
(6) Bevel Gear Shaft (8T)
(7) Collar
(8) Front Case
(9) Shim
(10) Differential Case Assembly
(11) Shim
(12) Front Case Cover
(13) Cam Face
(14) Cam Follower
(15) Bevel Gear (35T)
(16) Disc Spring
(17) Cam Face
(18) Differential Case Cap
(19) Thrust Washer
(20) Differential Case

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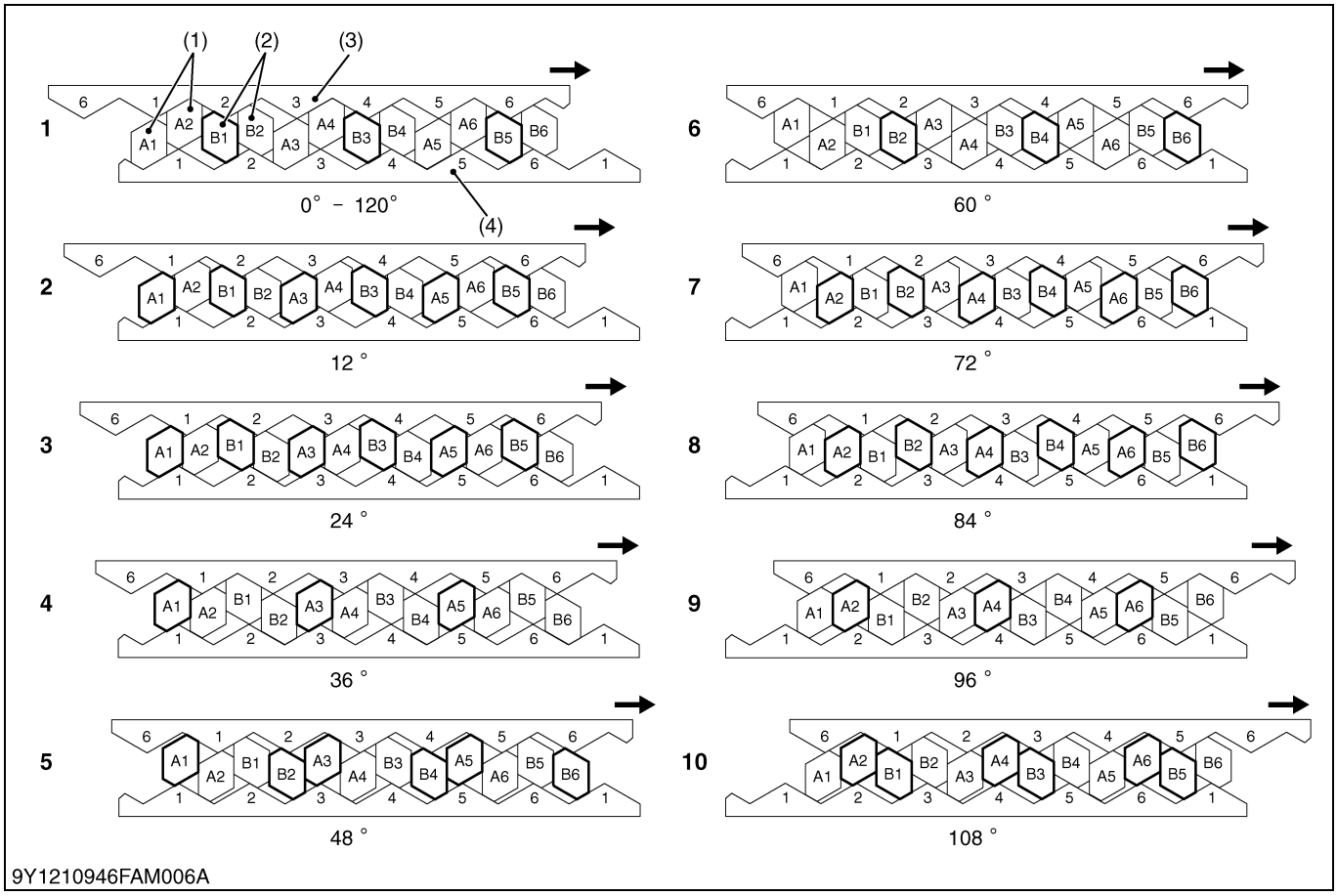
(2) Operation



(1) Cam Follower A (2) Cam Follower B (3) Face Cam (Move) (4) Face Cam (Fix)

The two face cams are described linearly and schematically.

This shows the difference in cross sectional shape of the cam followers A (1), B (2).

The cam followers transferring drive power are shown using thicker lines.

This is a figure showing drawings of the outer wheel moved by the face cam (3) 12 degrees each when turning.

Each of the cam followers (1), (2) are hooked into a groove on the differential case and so move in up and down directions.

The cam followers (1), (2) receive power from the differential case and transfer the drive force to the face cam (4) through the contact surface.

During turning, when the upper face cam (3) start to move earlier than the lower face cam (4), each of the cam followers start to move up and down.

When the face cam (3) is offset in order the cam followers slide obliquely providing space to ride over the cam lobes.

Illustrations **"1"** and **"6"** show the instant cam follower A (1) is riding over the cam lobe and the **"6"** cam followers A (1) are going over the upper and lower cam lobes at the same time.

Illustrations **"4"** and **"9"** are the instant that cam follower B (2) is riding over the cam lobe.

The continuous differential motion of from illustration **"1"** to **"10"** make 1 round.

This enables absorbing of the difference in rotation of the left and right wheels.

After straightening out, the cam followers are captured 2 to a space sandwiched between upper and lower cam (4) based on where they are.

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SERVICING

CONTENTS

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Front Wheels Wander to Right or Left	Tire pressure uneven	Adjust	G-24
	Improper toe-in adjustment (improper alignment)	Adjust	5-S4
	Tie-rod end loose	Tighten	5-S4
	Air sucked in power steering circuit	Bleed	–
Front Wheels Can Not Be Driven	CV joint broken	Replace	5-S9
	Front wheel drive gears in transmission broken	Replace	2-S36
	Front differential gear broken	Replace	5-S18
Noise	Gear backlash excessive	Adjust or replace	5-S24
	Oil insufficient	Fill	5-S10
	Bearings damaged or broken	Replace	5-S17
	Gears damaged or broken	Replace	5-S18
	Bevel pinion shaft turning force improper	Adjust	5-S21

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2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Front Wheel Alignment	Toe-in	5 to 15 mm 0.2 to 0.59 in.	–
Bevel Pinion Shaft	Turning Torque	0.79 to 0.98 N·m 0.080 to 0.10 kgf·m 0.058 to 0.72 lbf·ft	–
Bevel Pinion Shaft to Bevel Gear	Backlash	0.15 to 0.30 mm 0.0059 to 0.011 in.	–

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3. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to "5. TIGHTENING TORQUES" on page G-12.)

Item	N·m	kgf·m	lbf·ft
Tie-rod end lock nut	74 to 87	7.6 to 8.5	55 to 61.1
Front axle slotted nut	190 to 200	19.4 to 20.3	141 to 147
Front wheel mounting bolt and nut (Aluminum wheel)	90 to 110	9.2 to 11.2	66.4 to 81.1
Front wheel mounting bolt and nut (Steel wheel)	108 to 130	11.1 to 13.2	79.7 to 95.8
Tie-rod end slotted nut	50.0 to 55.0	5.10 to 5.60	36.9 to 40.5
Brake hose eye joint bolt (M10)	22.6 to 26.8	2.31 to 2.73	16.7 to 19.7
Front differentiae case mounting screw	39.2 to 44.1	4.00 to 4.49	29.0 to 32.5
Knuckle case cover mounting screw	48.1 to 55.9	4.91 to 5.70	35.5 to 41.2
Front differential case cover mounting screw	39.2 to 44.1	4.00 to 4.49	29.0 to 32.5
Bevel gear UBS screw	29.4 to 34.3	3.00 to 3.49	21.7 to 25.2
Differential case cap mounting screw	14 to 17	1.5 to 1.7	11 to 12

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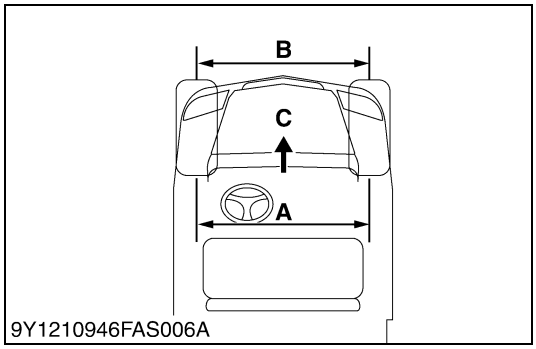
4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING



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Checking Toe-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 (**"A"**-**"B"**).
5. Measure distance between tire beads at rear of tire, at hub height.
6. Front distance should be shorter than distance.
   If not, adjust tie-rod length.

Toe-in (**"A"** – **"B"**)	Factory specification	5 to 15 mm 0.2 to 0.59 in.

A: Wheel to Wheel Distance at Rear **B: Wheel to Wheel Distance at Front**
C: Front

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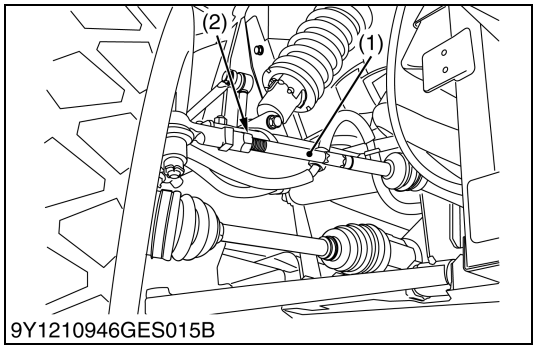

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Adjusting Toe-in

■ **IMPORTANT**
- **Keep the length of the left and right tie-rod equal.**

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

Tightening torque	Tie-rod end lock nut	74 to 84 N·m 7.6 to 8.5 kgf·m 55 to 61.1 lbf·ft

(1) Tie-rod (2) Lock Nut

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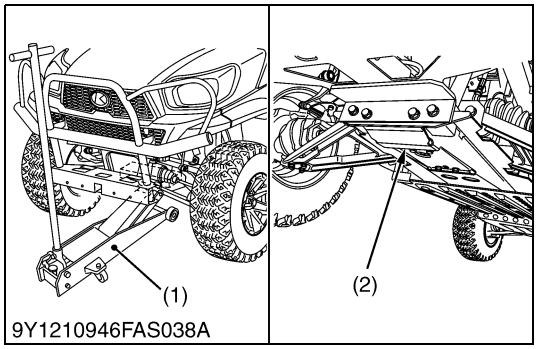

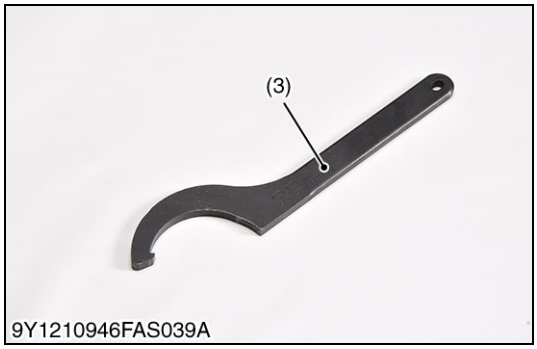

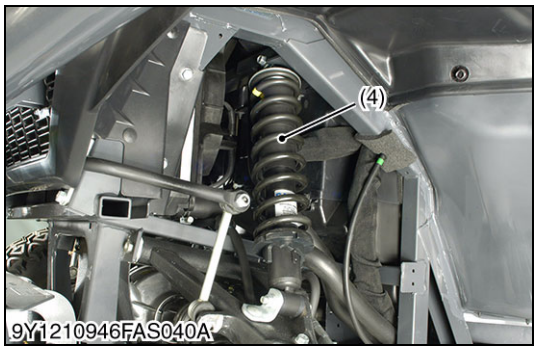

Adjusting Front Shock Absorber

CAUTION

To avoid personal injury:

- **Be sure to work on a firm, flat an level surface with the engine shut off and parking brake "ON".**
- **Keep the position of the left right rear shock absorber equal.**
  Uneven adjustment can cause poor handling and lose of control, which could lead to an accident.

1. Jack up the plate under the front axle case only.
2. Adjust the rear shock absorber springs, turn the adjusting sleeves on the shock absorbers to the desired position with the hook wrench.

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

(1) Jack
(2) Plate Under the Front Axle Case
(3) Hook Wrench
(4) Front Shock Absorber

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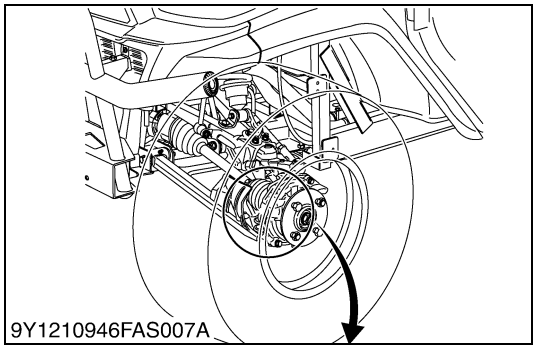
[2] PREPARATION

(1) Knuckle Case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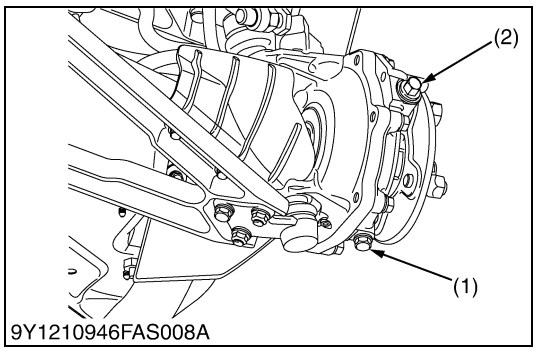

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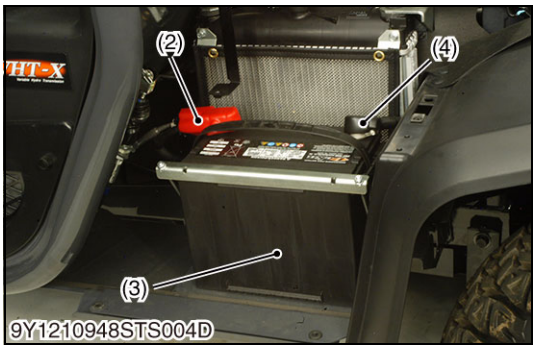

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Draining Knuckle Case Oil

1. Park the vehicle on a firm, flat, and level surface,
2. Remove the wheel.
3. To drain the used oil, remove the drain the filling plugs at the LH knuckle case and drain the oil completely into the oil pan.
4. After draining, reinstall the drain plug.
5. Use the same procedure to change the RH knuckle case oil.

Knuckle case oil	Reference capacity (one side)	0.25 L 0.26 U.S.qts 0.22 Imp.qts

(1) Drain Plug
(2) Filling Plug

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

(1) Battery Cover
(2) Positive Cable
(3) Battery
(4) Negative Cable

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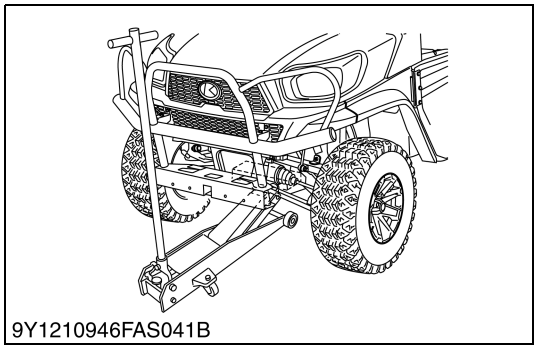
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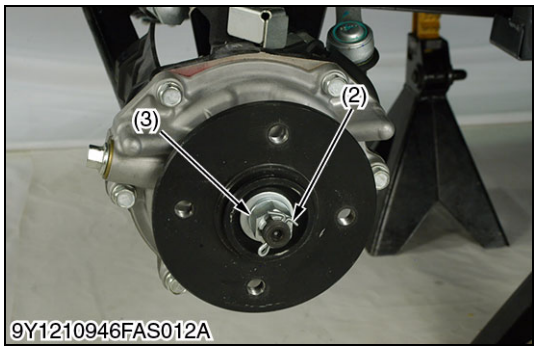

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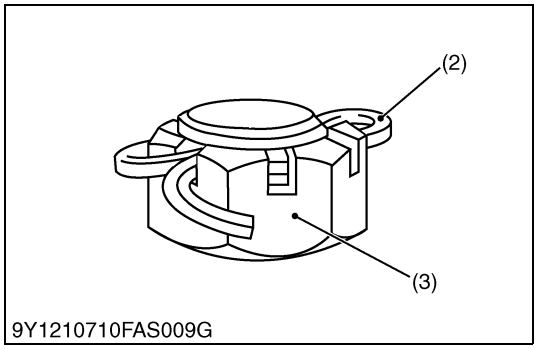

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Front Wheel and Front Axle Nut

WARNING

To avoid serious injury, death or vehicle damage:

- **Do not work under the vehicle unless it is secured by safe stands or suitable blocking.**

1. Jack up at the plate under the front axle case only.
2. Remove the cotter pin (2) and just loosen the slotted nut (3) for drive shaft.
3. Remove the front wheel mounting screw.

(When reassembling)

- After tightening the front axle slotted nut to specified torques, install a cotter pin as shown in the figure left.

NOTE

- **Tighten the slotted nut to 190 N·m (19.4 kgf·m, 140 lbf·ft). If the slot and pin hole do not meet, tighten the nut until they do meet, and install cotter pin.**

Tightening torque	Front axle slotted nut	190 to 200 N·m 19.4 to 20.3 kgf·m 141 to 147 lbf·ft
	Front wheel mounting bolt and nut (Aluminum wheel)	90 to 110 N·m 9.2 to 11.2 kgf·m 66.4 to 81.1 lbf·ft
	Front wheel mounting bolt and nut (Steel wheel)	108 to 130 N·m 11.1 to 13.2 kgf·m 79.7 to 95.8 lbf·ft

(1) Front Wheel
(2) Cotter Pin
(3) Slotted Nut

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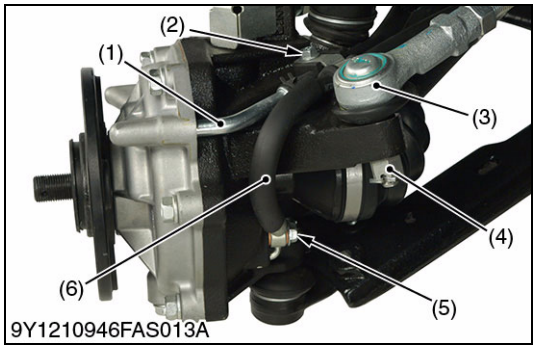

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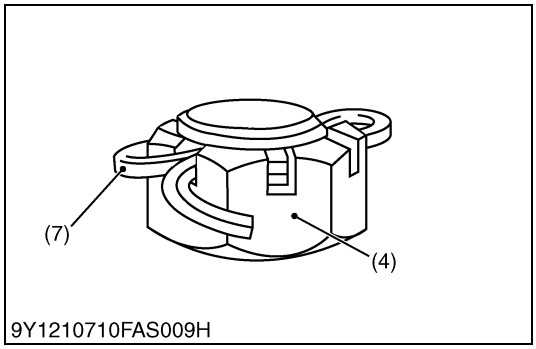

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Tie-rod End, Brake Hose and Breather Hose

CAUTION

- **When the brake hose is removed, the brake fluid come out. Be careful not to stain other hoses or rubber boot with the brake fluid.**
  Brake fluid stains should be washed and wiped off immediately. Likewise, the brake fluid on the tools should be wiped off immediately.

1. Remove the clamp (2).
2. Remove the eye joint bolt (5) for brake hose (6) and drain the brake fluid.
3. Remove the breather pipe (1).
4. Remove the cotter pin (7) and remove the tie-rod end slotted nut (4).

(When resembling)

- Replace the copper washers with new ones.
- Bleed air of the brake line after break hoses reassembled.
- Tighten the slotted nut to 50.0 N·m (5.10 kgf·m, 36.9 lbf·ft). If the slot and pin hole do not meet, tighten the nut until they do meet, and install cotter pin.

Tightening torque	Tie-rod end slotted nut	50.0 to 55.0 N·m 5.10 to 5.60 kgf·m 36.9 to 40.5 lbf·ft
	Brake hose eye joint bolt (M10)	22.6 to 26.8 N·m 2.31 to 2.73 kgf·m 16.7 to 19.7 lbf·ft

(1) Breather Pipe
(2) Clamp
(3) Tie-rod End
(4) Tie-rod Slotted Nut
(5) Eye Joint Bolt
(6) Brake Hose
(7) Cotter Pin

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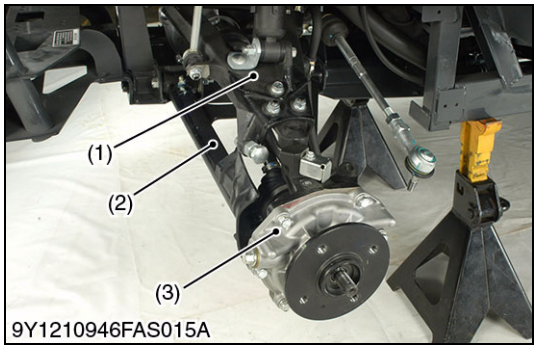

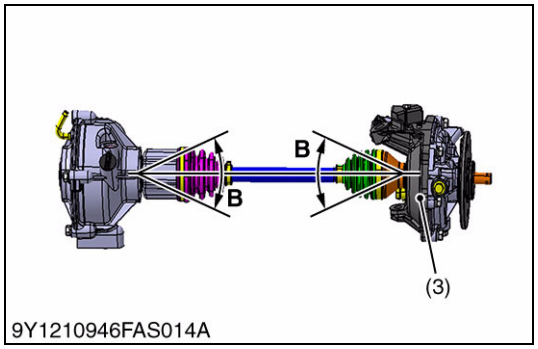

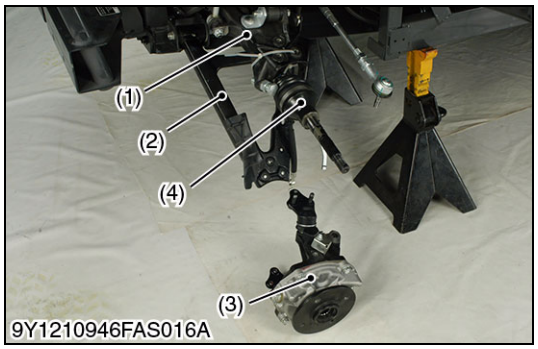

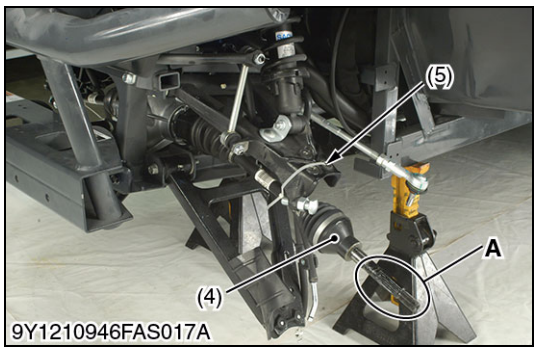

Knuckle Case

■ **NOTE**

- **CV joint shall not exceed the allowable bend angle ±25 ° when being reassembled or disassembled.**

1. Remove the lower arm (2) and upper arm (1) mounting screws and nuts.
2. Support the CV joint (4) by something like a clamp (5) to prevent the CV joint (4) falling before removing the knuckle case assembly (3).
3. Remove the knuckle case assembly (3).
4. Remove the CV joint (4).

(When resembling)

- Apply anti-fitting grease (RAILMASTER or equivalent) to the spline of CV joint (4).

(1) Upper Arm
(2) Lower Arm
(3) Knuckle Case Assembly
(4) CV Joint
(5) Clamp

A: Apply to grease.
B: ± 25 °

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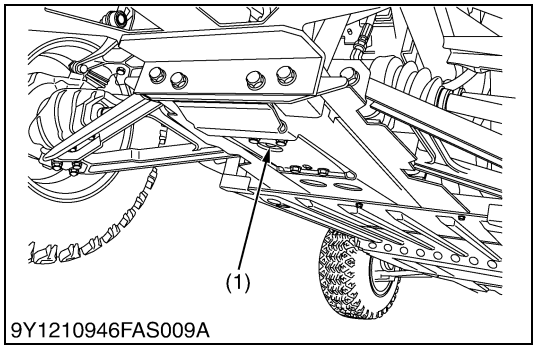
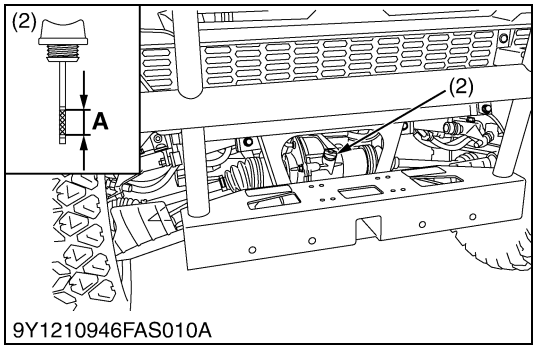
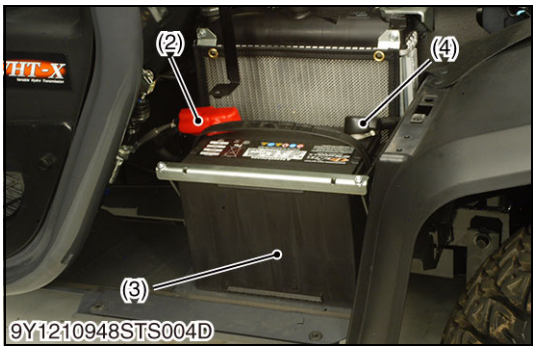
(2) Front Differential Case







Draining Front Axle Case Oil

1. Park the vehicle on a firm, flat and level surface.
2. Turn over the rubber sheet.
3. To drain the used oil, remove the drain and filling plugs at the front axle case and drain the oil completely into the oil pan.
4. After draining, reinstall the drain plug.

(When reassembling)

- Use KUBOTA UDT or KUBOTA SUPER UDT fluid. Refer to "4. LUBRICANTS, FUEL AND COOLANT" on page G-8.

Front axle case oil	Capacity	0.6 L 0.63 U.S.qts 0.52 Imp.qts

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

A: Oil level is acceptable within this range.

9Y1210948FBS0005US0

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

(1) Battery Cover
(2) Positive Cable
(3) Battery
(4) Negative Cable

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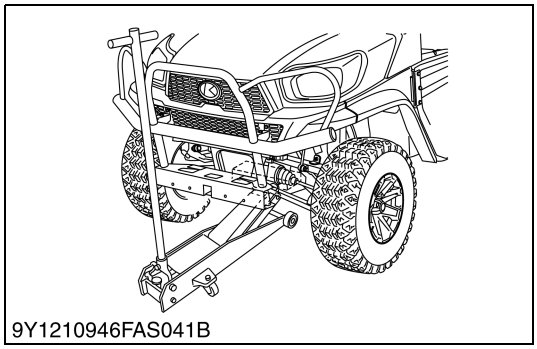
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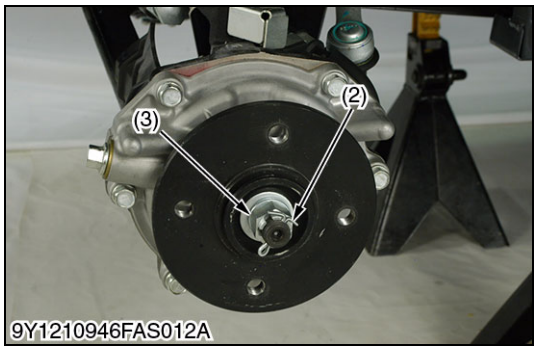

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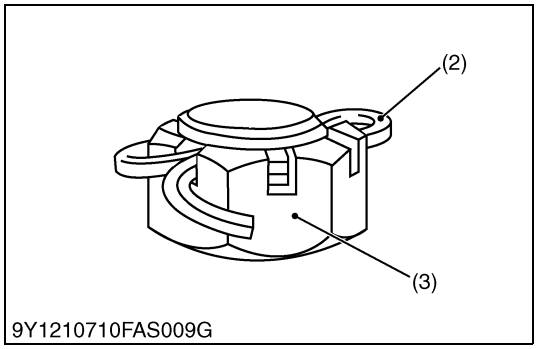

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Front Wheel and Front Axle Nut

WARNING

To avoid serious injury, death or vehicle damage:

- **Do not work under the vehicle unless it is secured by safe stands or suitable blocking.**

1. Jack up at the plate under the front axle case only.
2. Remove the cotter pin (2) and just loosen the slotted nut (3) for drive shaft.
3. Remove the front wheel mounting screw.

(When reassembling)

- After tightening the front axle slotted nut to specified torques, install a cotter pin as shown in the figure left.

NOTE

- **Tighten the slotted nut to 190 N·m (19.4 kgf·m, 140 lbf·ft). If the slot and pin hole do not meet, tighten the nut until they do meet, and install cotter pin.**

Tightening torque	Front axle slotted nut	190 to 200 N·m 19.4 to 20.3 kgf·m 141 to 147 lbf·ft
	Front wheel mounting bolt and nut (Aluminum wheel)	90 to 110 N·m 9.2 to 11.2 kgf·m 66.4 to 81.1 lbf·ft
	Front wheel mounting bolt and nut (Steel wheel)	108 to 130 N·m 11.1 to 13.2 kgf·m 79.7 to 95.8 lbf·ft

(1) Front Wheel
(2) Cotter Pin
(3) Slotted Nut

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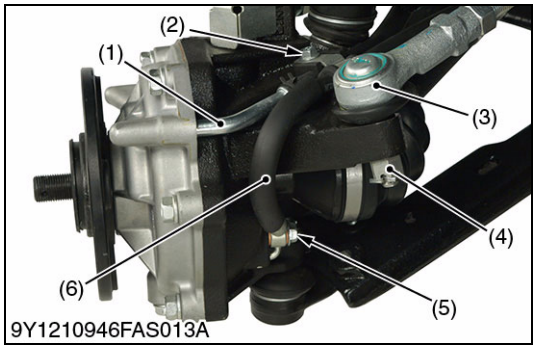

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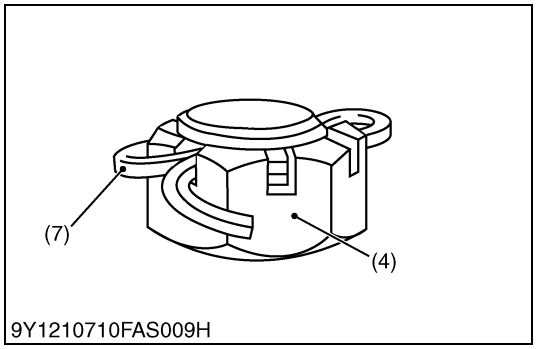

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Tie-rod End, Brake Hose and Breather Hose

CAUTION

- **When the brake hose is removed, the brake fluid come out. Be careful not to stain other hoses or rubber boot with the brake fluid.**
  Brake fluid stains should be washed and wiped off immediately. Likewise, the brake fluid on the tools should be wiped off immediately.

1. Remove the clamp (2).
2. Remove the eye joint bolt (5) for brake hose (6) and drain the brake fluid.
3. Remove the breather pipe (1).
4. Remove the cotter pin (7) and remove the tie-rod end slotted nut (4).

(When resembling)

- Replace the copper washers with new ones.
- Bleed air of the brake line after break hoses reassembled.
- Tighten the slotted nut to 50.0 N·m (5.10 kgf·m, 36.9 lbf·ft). If the slot and pin hole do not meet, tighten the nut until they do meet, and install cotter pin.

Tightening torque	Tie-rod end slotted nut	50.0 to 55.0 N·m 5.10 to 5.60 kgf·m 36.9 to 40.5 lbf·ft
	Brake hose eye joint bolt (M10)	22.6 to 26.8 N·m 2.31 to 2.73 kgf·m 16.7 to 19.7 lbf·ft

(1) Breather Pipe
(2) Clamp
(3) Tie-rod End
(4) Tie-rod Slotted Nut
(5) Eye Joint Bolt
(6) Brake Hose
(7) Cotter Pin

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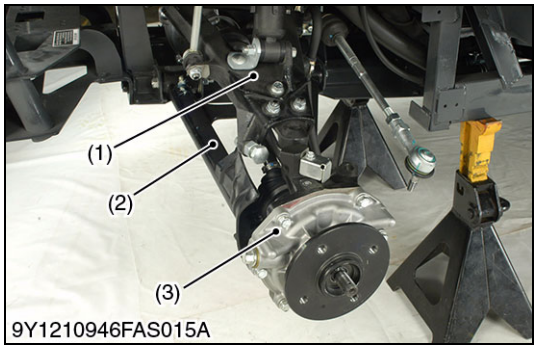

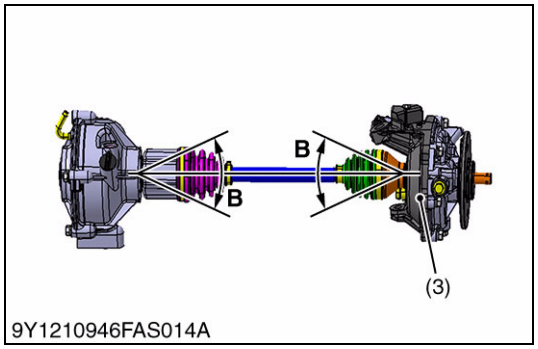

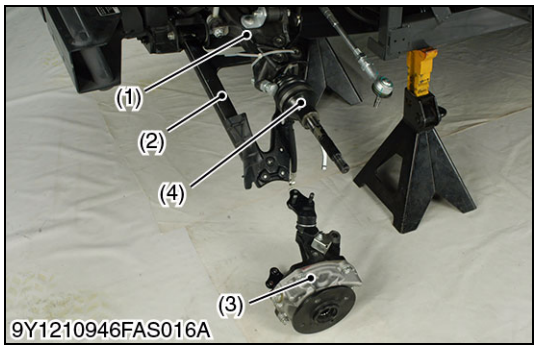

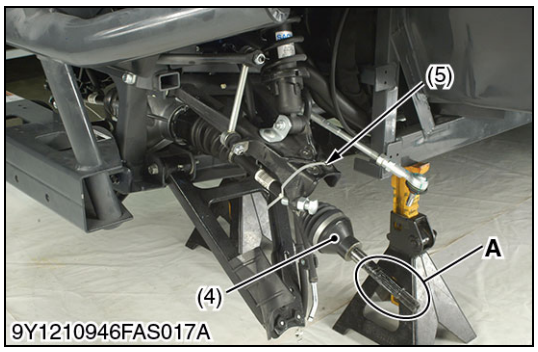

Knuckle Case

■ **NOTE**

- **CV joint shall not exceed the allowable bend angle ±25 ° when being reassembled or disassembled.**

1. Remove the lower arm (2) and upper arm (1) mounting screws and nuts.
2. Support the CV joint (4) by something like a clamp (5) to prevent the CV joint (4) falling before removing the knuckle case assembly (3).
3. Remove the knuckle case assembly (3).
4. Remove the CV joint (4).

(When resembling)

- Apply anti-fitting grease (RAILMASTER or equivalent) to the spline of CV joint (4).

(1) Upper Arm
(2) Lower Arm
(3) Knuckle Case Assembly
(4) CV Joint
(5) Clamp

A: Apply to grease.
B: ± 25 °

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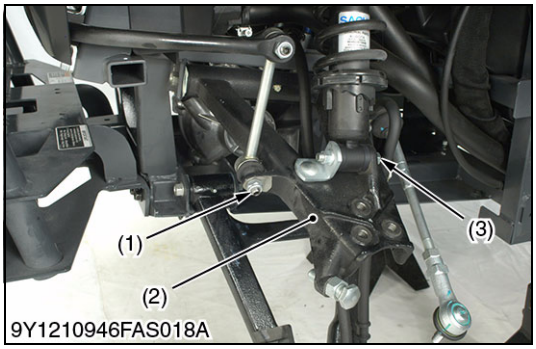

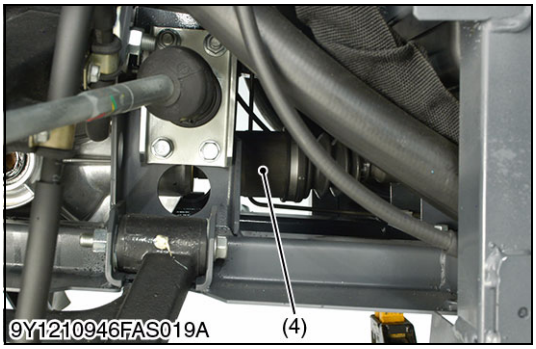

Upper Arm, Steering Cylinder and Propeller Shaft

1. Remove the front shock absorber lower bolt and nut (3).
2. Remove the stabilizer nut (1).
3. Remove the upper arm (2).
4. Disconnect the propeller shaft (4).

(When reassembling)

- Apply anti-fitting grease (RAILMASTER od equivalent) to the spline of pinion shaft.

(1) Stabilizer Nut
(2) Upper Arm
(3) Bolt and Nut
(4) Propeller Shaft

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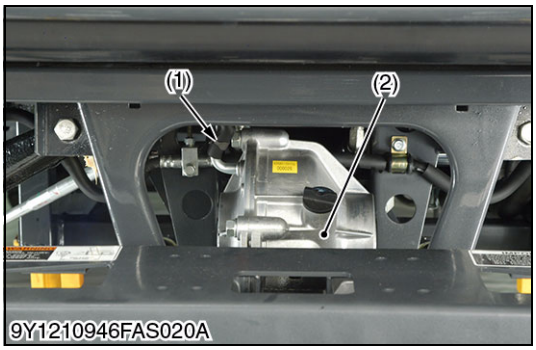

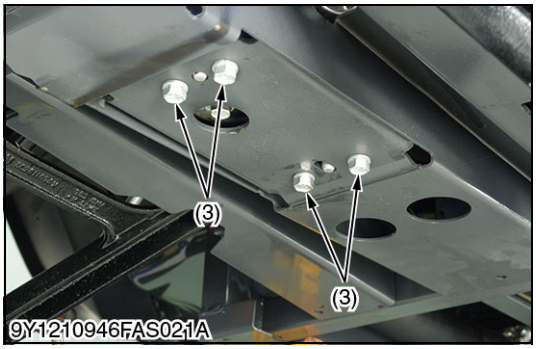

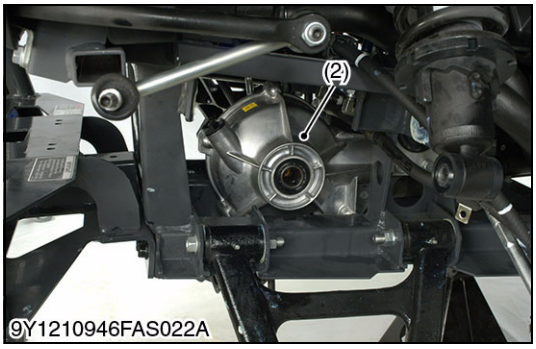

Front Differential Case

1. Disconnect the breather hose (1).
2. Remove the front differential case mounting screws (3).
3. Remove the front differential case (2).

(When reassembling)

Tightening torque	Front differentiae case mounting screw	39.2 to 44.1 N·m 4.00 to 4.49 kgf·m 29.0 to 32.5 lbf·ft

(1) Breather Hose
(2) Front Differential Case
(3) Front Differential Mounting Screw

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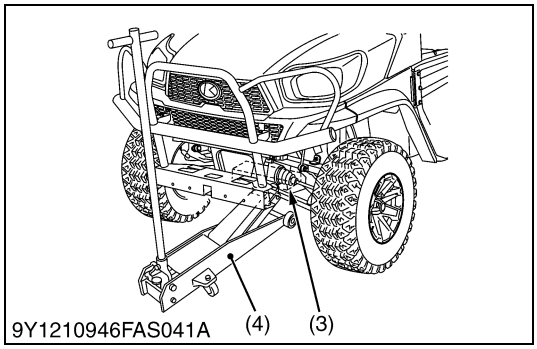
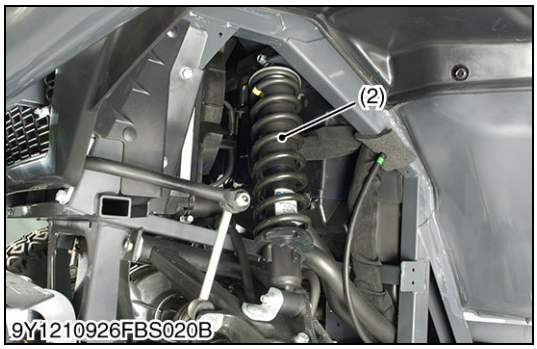
(3) Front Shock Absorber





Front Shock Absorber

WARNING

To avoid serious injury, death or vehicle damage:

- **Do not work under the vehicle unless it is secured by safe stands or suitable blocking.**

1. Jack up at the palte under the front axle case only.
2. Remove the front wheel mounting screw.
3. Remove the front shock absorber (2).

(When reassembling)

Tightening torque	Front wheel mounting bolt and nut (Aluminum wheel)	90 to 110 N·m 9.2 to 11.2 kgf·m 66.5 to 81.1 lbf·ft
	Front wheel mounting bolt and nut (Steel wheel)	108 to 130 N·m 11.1 to 13.2 kgf·m 79.7 to 95.8 lbf·ft

(1) Front Wheel
(2) Shock Absorber
(3) Wooden Block
(4) Jack

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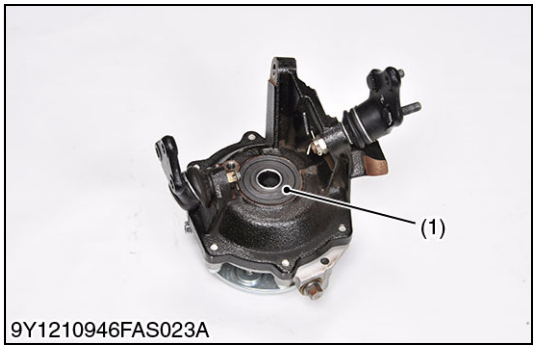
[3] DISASSEMBRING AND ASSEMBRING

(1) Knuckle Case



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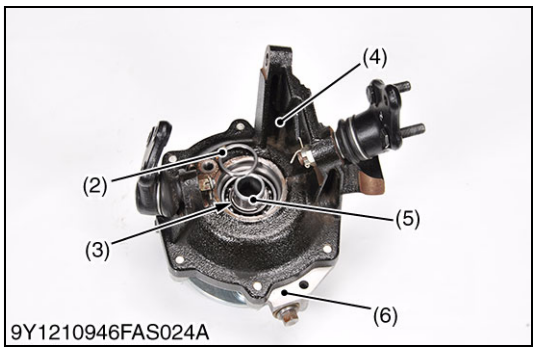

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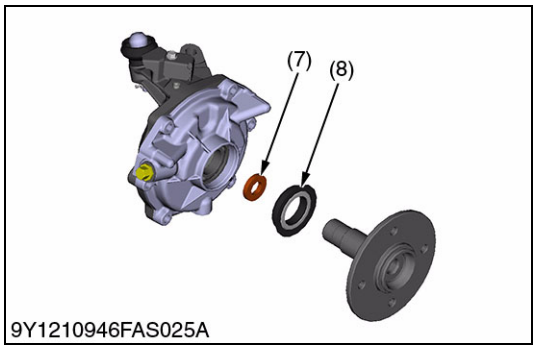

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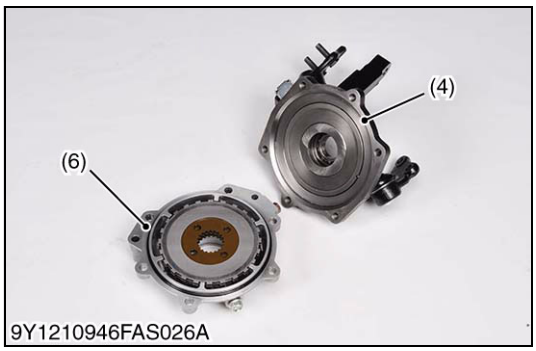

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Front Axle

1. Remove the oil seal (1).
2. Remove the snap ring collar (2) and remove the external snap ring (3).
3. Tap out the front axle (5) with plastic hammer.
4. Remove the knuckle case mounting screw.
5. Separate the knuckle case (4) and knuckle case cover (6).

(When reassembling)

- Be sure insert the external snap ring.
- Replace the oil seal with new one.
- Be careful not to damage the O-ring.
- Insert the bearing (7) and oil seal (8) first to the knuckle cover, and then install the knuckle case cover.

Tightening torque	Knuckle case cover mounting screw	48.1 to 55.9 N·m 4.91 to 5.70 kgf·m 35.5 to 41.2 lbf·ft

(1) Oil Seal
(2) Snap Ring Collar
(3) External Snap Ring
(4) Knuckle Case
(5) Front Axle
(6) Knuckle Case Cover
(7) Bearing
(8) Oil Seal

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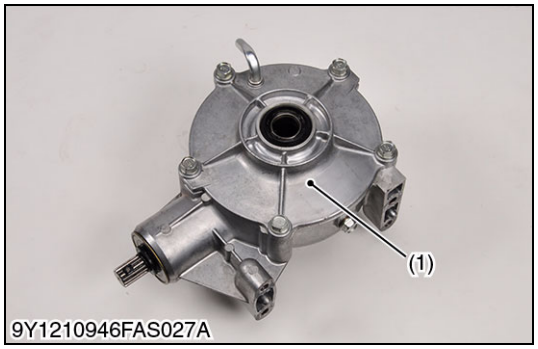
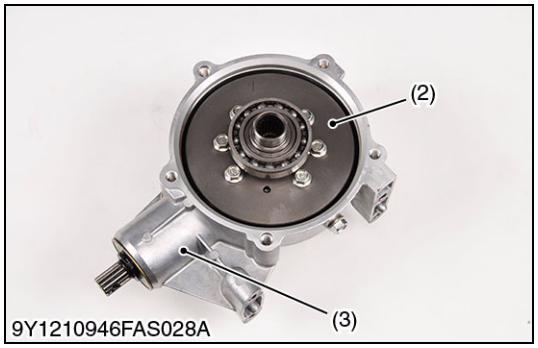
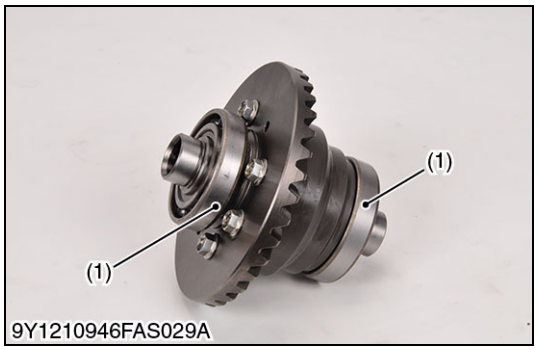
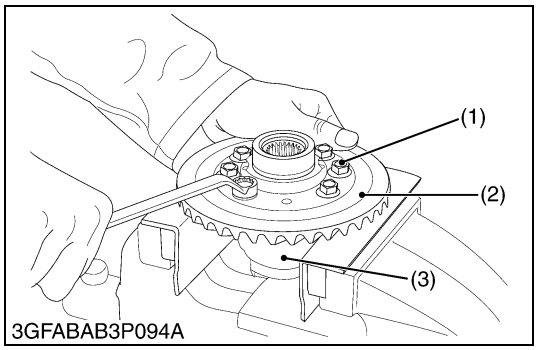
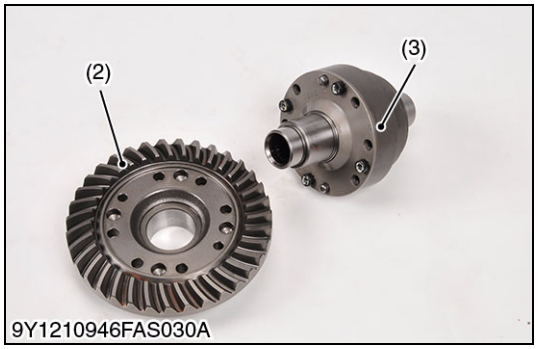
(2) Front Differential Case











Front Differential Assembly

1. Remove the front differential case cover mounting screws and separate the front differential case cover (1).
2. Remove the differential gear assembly (2).

(When reassembling)

- Use same number of shims as before disassembling.

Tightening torque	Front differential case cover mounting screw	39.2 to 44.1 N·m 4.00 to 4.49 kgf·m 29.0 to 32.5 lbf·ft

(1) Front Differential Case Cover
(2) Differential Gear Assembly
(3) Front Differential Case

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Bearing

1. Remove he right and left bearings (1) fro the differential case.

(1) Bearing

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Bevel Gear

1. Remove the bevel gear UBS screws (1).
2. Remove the bevel gear (2) from differential case (3).

(When reassembling)

- Apply liquid lock (Locktite 262 or its equivalent) to the spiral bevel gear UBS screws.

Tightening torque	Bevel gear UBS screw	29.4 to 34.3 N·m 3.00 to 3.49 kgf·m 21.7 to 25.2 lbf·ft

(1) Bevel Gear UBS Screw
(2) Bevel Gear
(3) Differential Case

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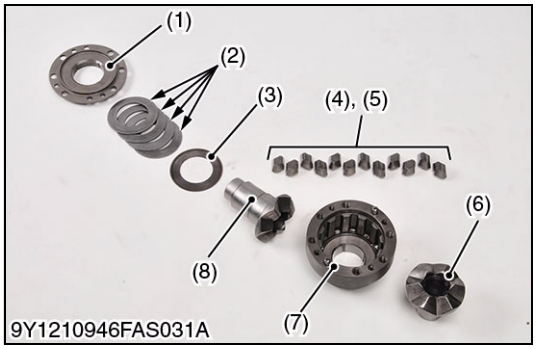

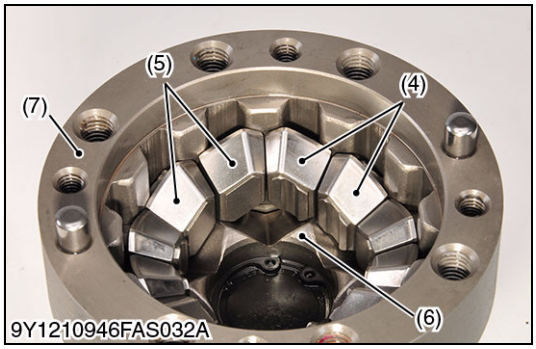

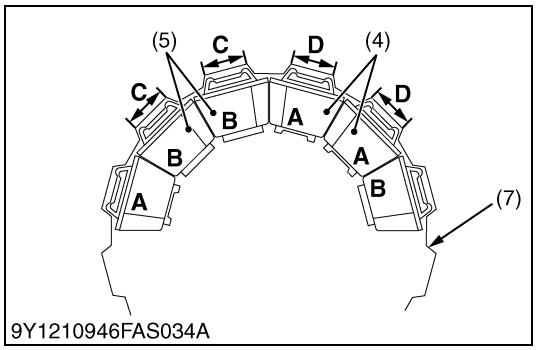

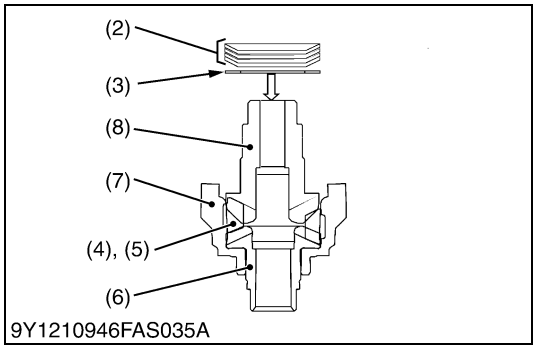

Differential Gear (LSD)

1. Remove the differential case cap (1).
2. Remove the disc springs (2) and thrust washer (3).
3. Remove the cam face (6).
4. Remove the cam followers (4), (5).
5. Remove the cam face (8).

(When reassembling)

- Make sure of the width of the grove by measuring.
- Assemble the cam followers B (5) two by two into the narrower groove **"C"** of the differential case (7) as shown in the figure.
- Assemble the cam followers A (4) in to the wider groove **"D"** of differential case (7) as shown in the figure.
- Assemble the disc spring (2) in the direction as shown in the figure.

Tightening torque	Differential case ca mounting screw	14 to 17 N·m 1.5 to 1.7 kgf·m 11 to 12 lbf·ft

(1) Differential Case Cap
(2) Disc Spring
(3) Thrust Washer
(4) Cam Follower A
(5) Cam Follower B
(6) Cam Face
(7) Differential Case
(8) Cam Face

C: Narrow
D: Wide

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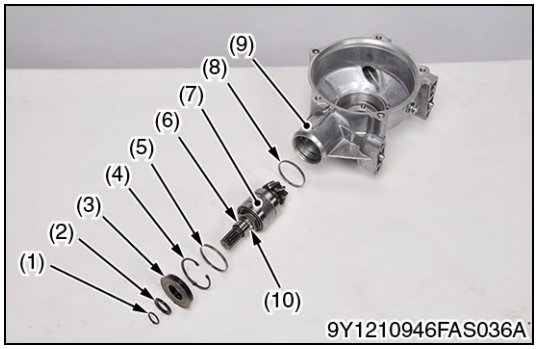

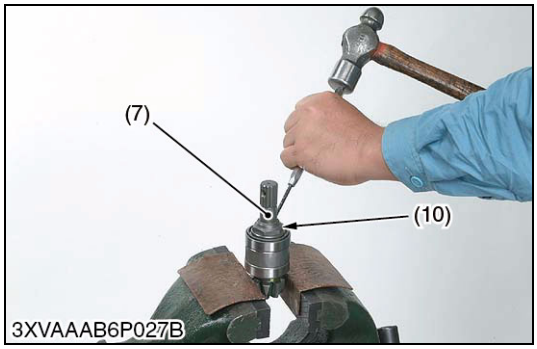

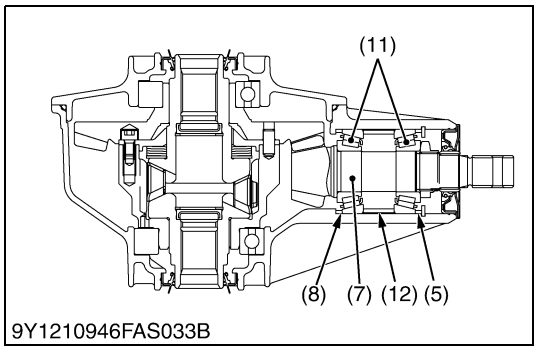

Bevel Pinion Gear Assembly

1. Remove the O-ring (1) and plug (2).
2. Remove the oil seal (3).
3. Remove the internal snap ring (4) and tap out the bevel pinion shaft (7) from front.
4. Remove the sleeve (6).
5. Clamp the bevel pinion shaft assembly in a vise.
6. Remove the stake of lock nut (10), and then remove the lock nut (10).

(When reassembling)

- Apply gear oil to the taper roller bearings (11) and install them correctly, noting their direction.
- Replace the lock nut (10) and oil seal (3) with new ones.
- After tighten the lock nut (10) to the specified torque, stake it firmly.
- Install the adjusting collars (5), (8) to their original position.
- Use same thickness of collars as before disassembling.

(1) O-ring
(2) Plug
(3) Oil Seal
(4) Internal Snap Ring
(5) Collar
(6) Sleeve
(7) Bevel Pinion Shaft
(8) Collar
(9) Front Differential Case
(10) Lock Nut
(11) Taper Roller Bearing
(12) Collar

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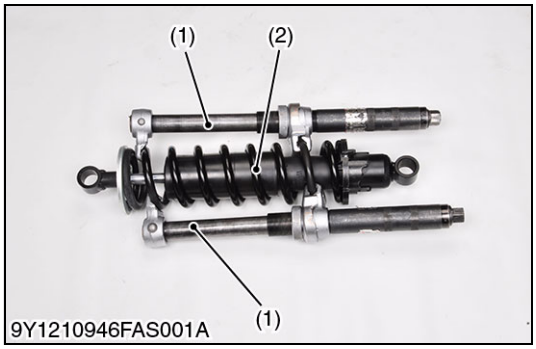
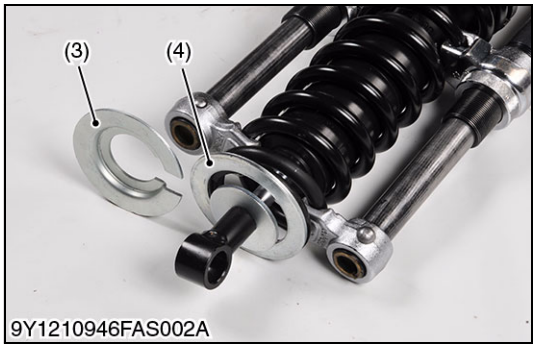
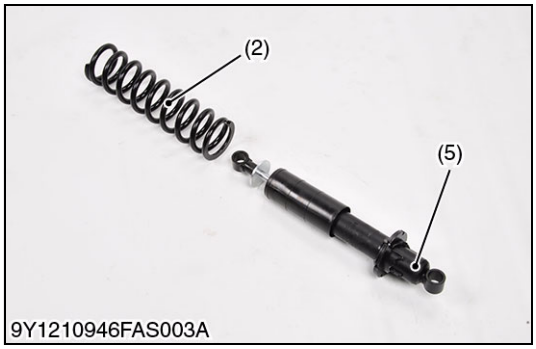
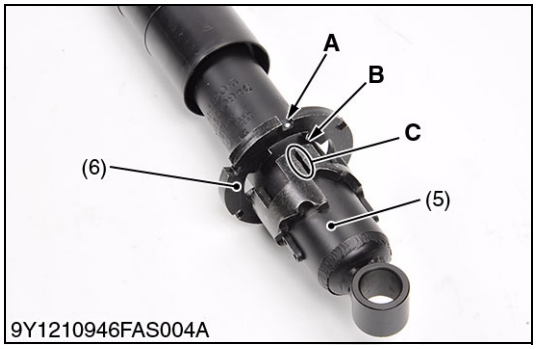
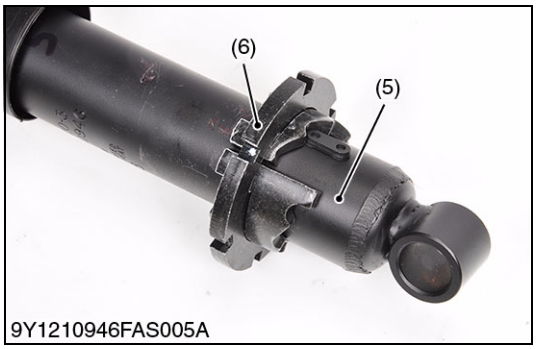
(3) Front Shock Absorber











Shock Absorber and Spring

1. Set the spring compressor (1).
2. Shorten spring with a spring compressor (1).
3. Remove the retainer (3) and spacer (4).
4. Remove the spring (2).

(When reassembling)

- Install the washer (6) to shock absorber (5), aligning the white mark **"A"**, grove **"B"** and slit **"C"**.

(1) Spring Compressor
(2) Spring
(3) Retainer
(4) Spacer
(5) Shock Absorber
(6) Washer

A: White Mark
B: Grove
C: Slit

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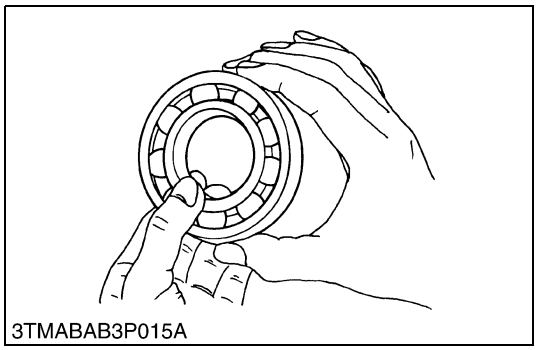
[4] SERVICING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Checking Bearing

1. Hold the inner race, and push and pull the outer race in all directions to check for wear and roughness.
2. Apply transmission fluid to the bearing, and hold the inner race. Then, turn the outer race to check rotation.
3. If there is any problem, replace it.

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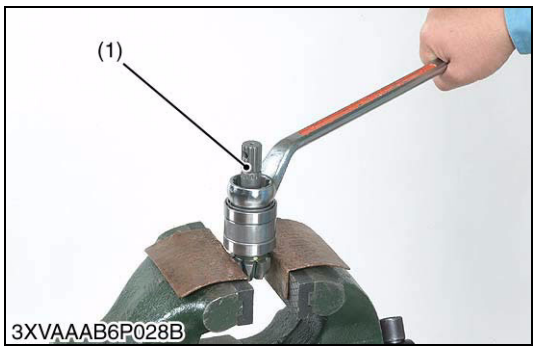

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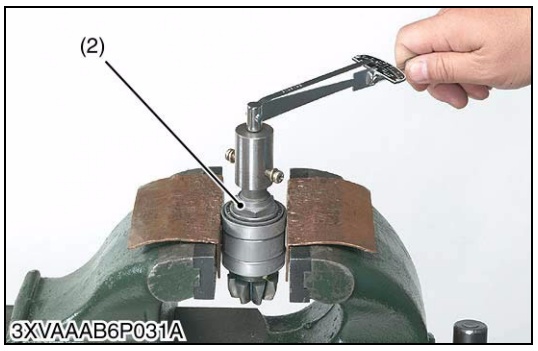
Turning Torque of Bevel Pinion Shaft

1. Clamp the spiral bevel pinion shaft assembly to the vise and tighten the staking nut.
2. Measure the turning torque of bevel pinion shaft.
3. If the turning torque is not within the factory specifications, adjust with the lock nut.

Turning torque	Factory specification	0.79 to 0.98 N·m 0.080 to 0.10 kgf·m 0.58 to 0.72 lbf·ft



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■ **NOTE**

- **After turning force adjustment, be sure to stake the lock nut.**

(1) Pinion Shaft (2) Staking Lock Nut

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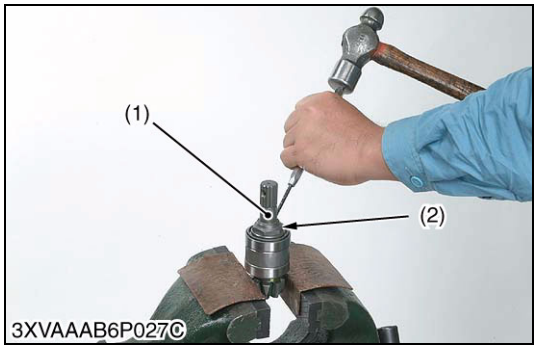

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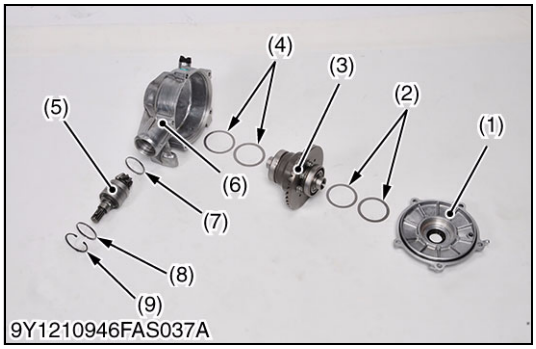

Tooth Contact between Bevel Pinion Shaft and Bevel Gear

(When checking)

- Use same number of shims as before disassembling.
- Use same thickness of collar as before disassembling.

1. Apply red lead (or prussian blue) lightly on the teeth of spiral bevel pinion shaft.
2. Reassemble the front differential case and front differential case cover.
3. Tighten the front differential case cover mounting screws to specified torque.
4. Turn the bevel pinion shaft to the clockwise by 5 to 6 rotations and 5 to 6 rotations to the counterclockwise.
5. Check the tooth contact. If not proper, adjust with shims and collars according to the instructions below.

(1) Front Differential Case Cover
(2) Adjusting Shim
(3) Front Differential Gear Assembly
(4) Adjusting Shim
(5) Bevel Pinion Shaft Assembly
(6) Front Differential Case
(7) Adjusting Collar
(8) Adjusting Collar
(9) Internal Snap Ring

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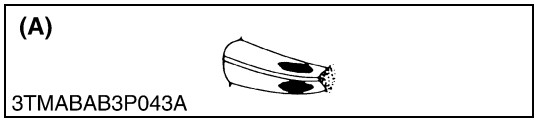

More than 35 % red lead contact area on the gear tooth surface. The center of tooth contact at 1/2 to 1/3 of the entire width from the small end.

(A) Proper Contact

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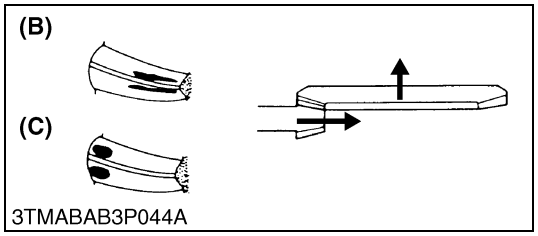

Change the adjusting collar to smaller size, and change the adjusting collar to larger size.

For move the spiral bevel gear rightward, reduce right side shim and add shim of the same thickness as the right side to left side.

(B) Shallow Contact **(C) Heel Contact**

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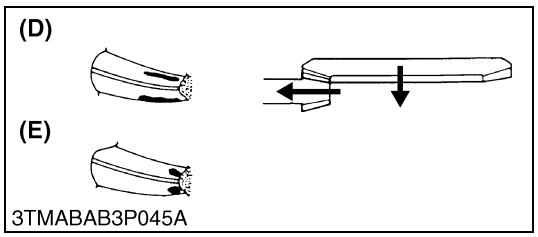

Change the adjusting collar to larger size, and change the adjusting collar to smaller size.

For move the spiral bevel gear leftward, reduce left side shim and add shim of the same thickness as the left side to right side.

Repeat above until the proper tooth contact and backlash are achieved.

(D) Deep Contact **(E) Toe Contact**

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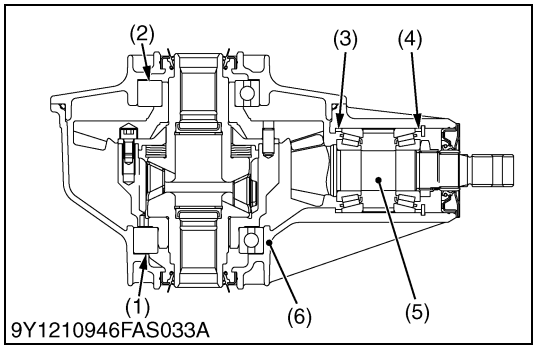

Backlash between Bevel Pinion Shaft and Bevel Gear

1. Put the solder (0.5 mm (0.020 in.) thickness) on the position where the tooth proper contact of bevel pinon shaft.
2. Reassemble the differential assembly and front case cover, and rotate the bevel pinion shaft carefully.
3. Separate the front differential case cover and remove the differential assembly, again.
4. Measure the backlash by thickness of the point where solder is the thinnest.
5. When the backlash is too large, decrease the number of shims (LH) in the side of the bevel gear, and insert the shim (RH) of the same thickness as the removed ones to the opposite side.
6. When the backlash is too small, do the opposite way to increase backlash.
   Adjust the backlash properly by repeating the above procedure.

Backlash between bevel pinion shaft and bevel gear	Factory specification	0.15 to 0.30 mm 0.0059 to 0.011 in.

(Reference)

- Thickness of shims (1) (LH):
  0.20 mm (0.0079 in.)
  0.30 mm (0.012 in.)
  0.50 mm (0.020 in.)
- Thickness of shims (2) (RH):
  0.10 mm (0.0039 in.)
  0.20 mm (0.0079 in.)
  0.30 mm (0.012 in.)
  0.50 mm (0.020 in.)
- Thickness of adjusting collars (3), (4):
  3.40 mm (0.134 in.)
  3.60 mm (0.142 in.)
  3.80 mm (0.150 in.)
  3.90 mm (0.154 in.)
  4.00 mm (0.157 in.)
  4.10 mm (0.161 in.)
  4.20 mm (0.165 in.)
  4.40 mm (0.173 in.)
  4.50 mm (0.177 in.)
  4.60 mm (0.181 in.)

(1) Adjusting Shim
(2) Adjusting Shim
(3) Adjusting Collar
(4) Adjusting Collar
(5) Bevel Pinion Shaft
(6) Front Differential Case Cover

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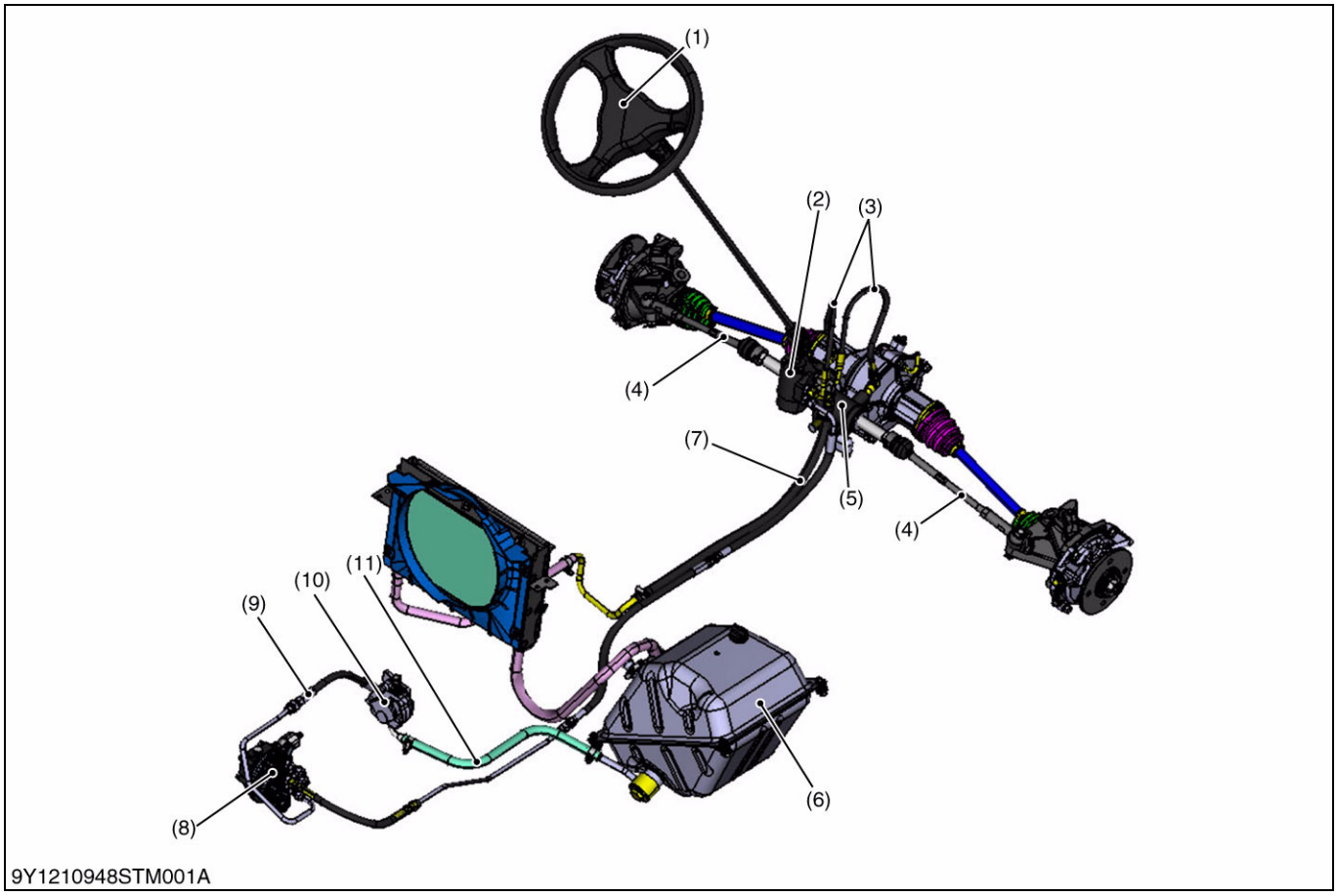
6 STEERING

MECHANISM

CONTENTS

1. STRUCTURE



(1) Steering Wheel
(2) Power Steering Controller
(3) Power Steering Cylinder Hose
(4) Tie-rod
(5) Power Steering Cylinder
(6) Hydraulic Oil Tank
(7) Return Hose
(8) Hydraulic Control Valve
(9) Delivery Hose
(10) Hydraulic Pump
(11) Suction Hose

The full hydrostatic type power steering is used on RTV-X1100C. This steering system consists of steering wheel, steering controller, steering cylinder and other components shown in the figure.

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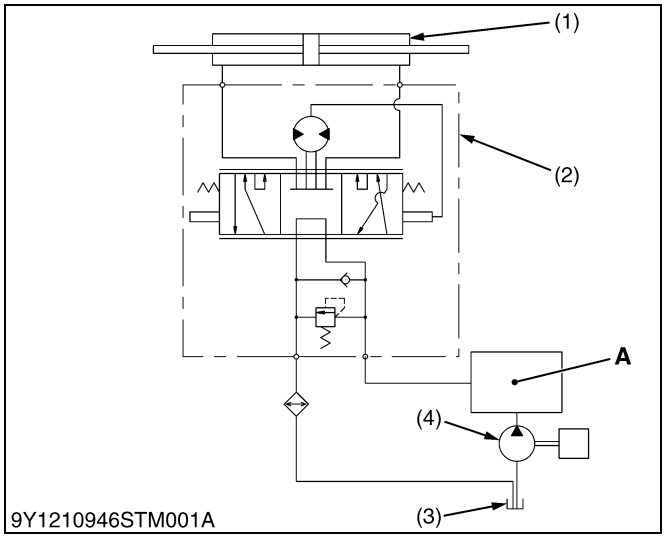
2. HYDRAULIC CIRCUIT



This model is provided with a full hydrostatic power steering.

In the full hydrostatic power steering, the steering controller is connected to the steering cylinder (1) with only the hydraulic piping. Accordingly, it does not have mechanical transmitting parts such as steering gear, pitman arm, drag link, etc. Therefore, it is simple in construction. This steering system consists of the power steering oil tank (3), hydraulic pump (4), steering controller (2), steering cylinder, etc.

An oil tank dedicated for power steering is located below the operator's seat. The oil in this tank is fed by the engine driven hydraulic pump to the steering controller. With the steering wheel at neutral, the oil returns through the controller to the oil tank. Turn the steering wheel, and just a required amount of oil is sent to the steering cylinder. The oil at the side opposite to the cylinder flows back to the tank.

This power steering controller is of non-load reaction type.

(1) Steering Cylinder
(2) Steering Controller
(3) Oil Tank
(4) Hydraulic Pump

A: Control Valve

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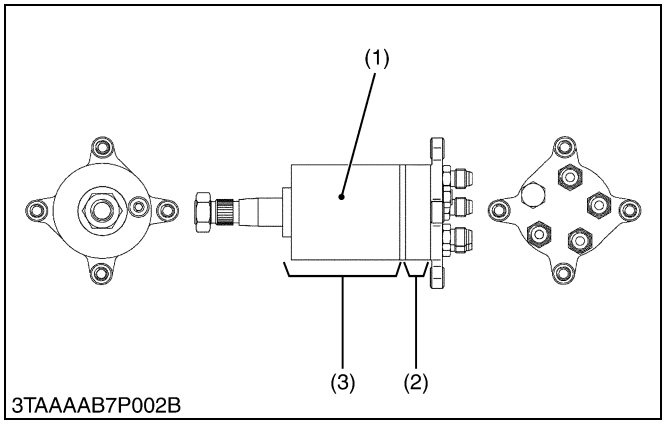
3. STEERING CONTROLLER



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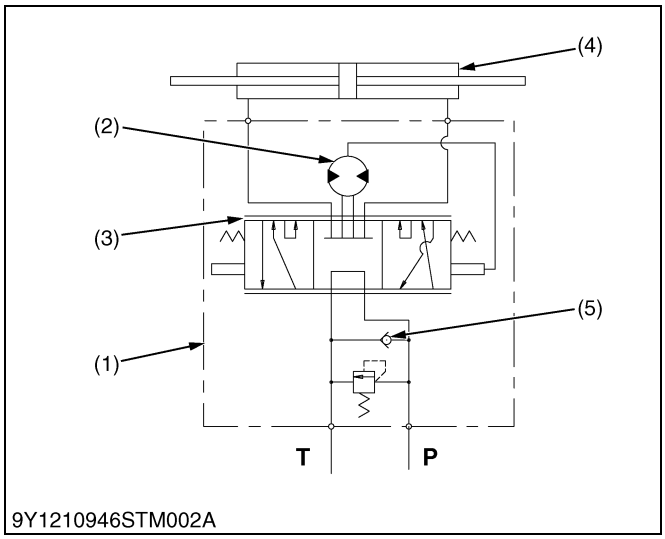

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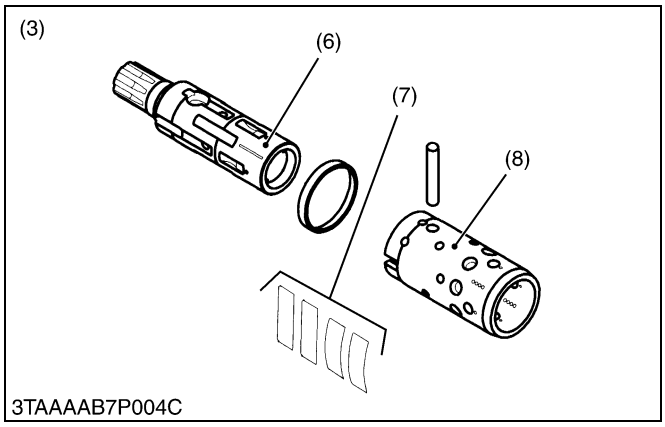

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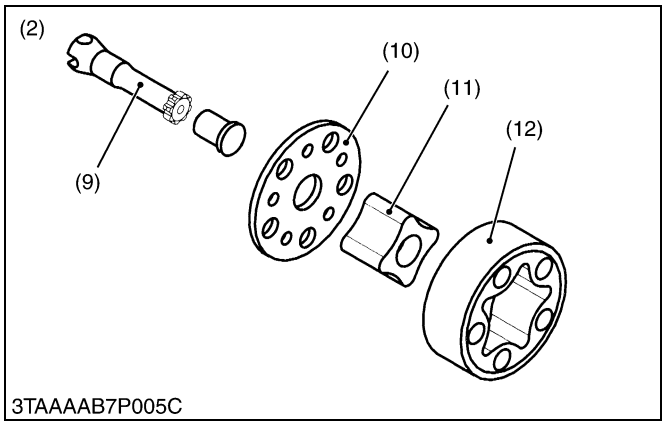

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The steering controller consists of a control valve (3) and a metering device (2).

■ **Control Valve**

The control valve is a rotating spool type.

When the steering wheel is not turned, the position of the spool (6) and sleeve (8) is kept neutral by the centering spring (7). This causes the forming of a "Neutral" oil circuit.

When the steering wheel is turned either clockwise or counterclockwise, the position of the spool and sleeve changes in relation to the centering spring. This allows the forming of a "Right Turning" or "Left Turning" oil circuit. At the same time, the gear pump (Metering device) rotates with the spool and sends the oil to the cylinder corresponding to the rotation of the steering wheel.

■ **Metering Device**

An oil, sent from the hydraulic pump to the steering cylinder, passes through the metering device (2).

Namely, when the rotor is driven, two chambers suck in oil due to volumetric change in the pup chambers formed between the rotor (11) and the stator (12), while oil is discharged from other two chambers. On the other hand, rotation of the steering wheel is directly transmitted to the rotor through the spool (6), drive shaft (9), etc.

Accordingly, the metering device serves to supply the steering cylinder with oil, amount of which corresponds to the rotation of the steering wheel. The wheels are thus turned by the angle corresponding to the rotation of the steering wheel.

When the engine stops or the hydraulic pump malfunctions, the metering device functions as a manual trochoid pump, which makes manual steering possible.

(1) Steering Controller
(2) Metering Device
(3) Control Valve
(4) Steering Cylinder
(5) Check Valve
(6) Spool
(7) Centering Spring
(8) Sleeve
(9) Drive Shaft
(10) Distributor Plate
(11) Rotor
(12) Stator

P: P Port (From Hydraulic Pump)
T: T Port (To Power Steering Oil Tank)

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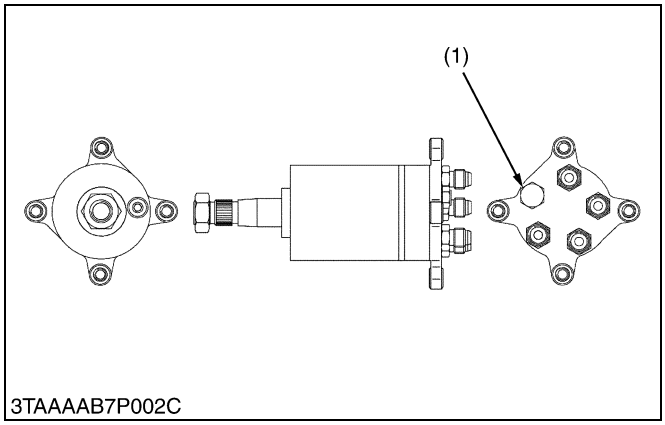

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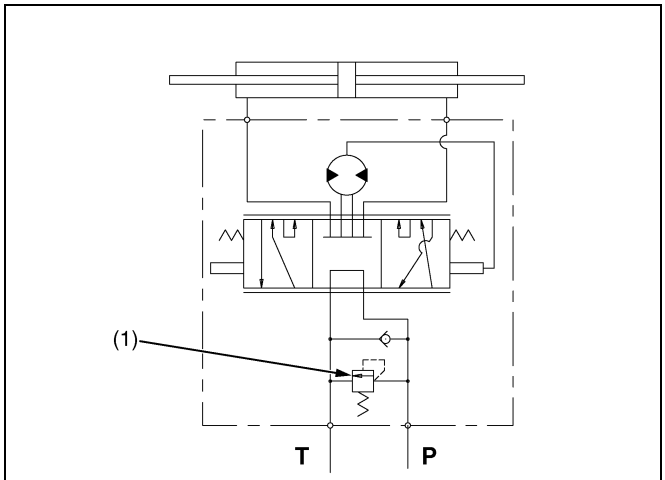

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■ Relief Valve

The relief valve (1) is located in the steering controller. It controls the maximum pressure of the power steering system.

Its setting pressure is as follows.

8.00 to 9.00 MPa

(81.6 to 91.7 kgf/cm^2, 1160 to 1300 psi)

(1) Relief Valve

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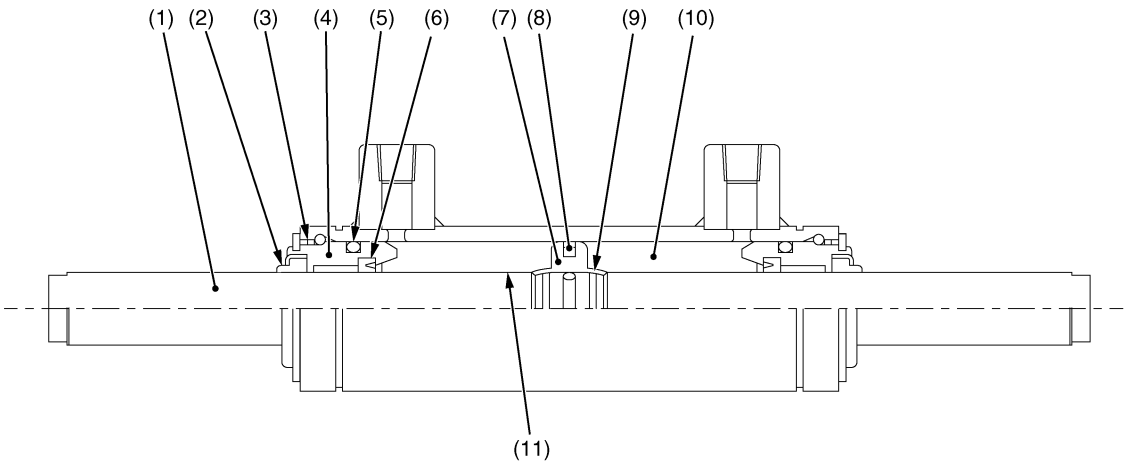
4. STEERING CYLINDER



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(1) Rod
(2) Wiper Ring
(3) Internal Snap Ring
(4) Guide
(5) O-ring
(6) Seal Ring
(7) Center Piston
(8) Piston O-ring
(9) External Snap Ring
(10) Cylinder Tube
(11) Rod O-ring

The steering cylinder is single piston both rod double-acting type. This steering cylinder is installed parallel to the front axle and connected to tie-rods.

The tie-rods connected to both knuckle arm guarantees equal steering movement to both front wheels.

The steering cylinder provide force in both directions. Depending upon direction the steering wheel is turned pressure oil enters at one end of the cylinder to extend, or the other end to retract it, thereby turning front wheel of the tractor.

9Y1210946STM0006US0

SERVICING

CONTENTS

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Cannot Be Steered	Hose broken	Replace	6-S11
	Steering controller malfunctioning	Replace	6-S5
Hard Steering	Power steering oil improper	Change with specified oil	G-43
	Hydraulic pump malfunctioning	Replace	7-S6
	Steering controller malfunctioning	Replace	6-S5
Steering Force Fluctuates	Steering controller malfunctioning	Replace	6-S5
	Air sucked in pump due to lack of oil	Fill	G-43
	Air sucked in pump from suction circuit	Repair	6-S11
Steering Wheel Turns Spontaneously When Released	Steering controller malfunctioning	Replace	6-S5
Front Wheels Wander to Right and Left	Steering controller malfunctioning	Replace	6-S5
	Air sucked in pump due to lack of oil	Fill	G-43
	Air sucked in pump from suction circuit	Repair	6-S11
	Insufficient bleeding	Bleed	–
	Cylinder malfunctioning	Repair or replace	6-S7
	Improper toe-in adjustment	Adjust	5-S4
	Tire pressure uneven	Inflate	G-24
Wheels Are Turned to A Direction Opposite to Steering Direction	Cylinder hoses connected in reverse	Repair	6-S7
Steering Wheel Turns Idle in Manual Steering	Insufficient bleeding	Bleed	–
	Air sucked in due to lack of oil	Fill	G-43
Noise	Air sucked in pump due to lack of oil	Fill	G-43
	Air sucked in pump from suction circuit	Repair	6-S11
Oil Temperature Increases Rapidly	Steering controller (relief valve) malfunctioning	Replace	6-S6

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2. SERVICING SPECIFICATIONS

POWER STEERING BODY

Item		Factory Specification	Allowable Limit
Relief Valve	Operating Pressure	8.00 to 9.00 MPa 81.6 to 91.7 kgf/cm^2 1160 to 1300 psi	–

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3. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to "5. TIGHTENING TORQUES" on page G-12.)

Item	N·m	kgf·m	lbf·ft
Steering wheel mounting nut	29 to 49	3.0 to 4.9	22 to 36
Power steering shaft post mounting screw	25.0 to 49.0	2.54 to 4.99	18.4 to 36.1
Power steering hose retaining nut	22.0 to 25.0	2.25 to 2.54	16.3 to 18.4
Power steering controller mounting screw	29.4 to 49.0	3.00 to 4.99	21.7 to 36.1
Tie-rod end slotted nut	50.0 to 55.0	5.10 to 5.60	36.9 to 40.5
Power steering cylinder hose retaining nut	22.0 to 25.0	2.25 to 2.54	16.3 to 18.4
Front wheel mounting bolt and nut (Aluminum wheel)	90 to 110	9.2 to 11.2	66.4 to 81.1
Front wheel mounting bolt and nut (Steel wheel)	108 to 130	11.1 to 13.2	79.7 to 95.8
Hydraulic control valve delivery hose retaining nut	22.0 to 25.0	2.25 to 2.54	16.3 to 18.4
Tie-rod screw	74 to 84	7.5 to 8.6	55 to 62

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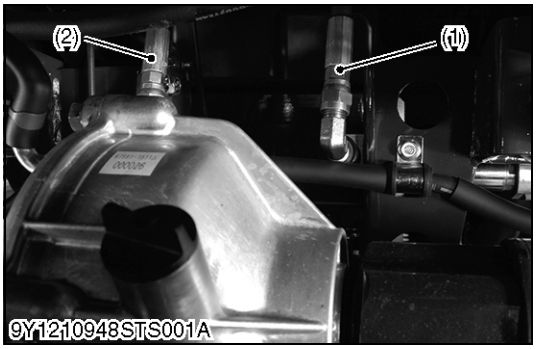
4. CHECKING, DISASSEMBLING AND SERVICING

[1] CHECKING AND ADJUSTING



Relief Valve Operating Pressure

CAUTION
- **When checking, park the machine on flat ground, apply the parking brake.**
- **Set the range gear shift lever in NEUTRAL position.**
- **Work by two people when you measure pressure.**

NOTE
- **After set a pressure gauge, be sure to bleed air.**
- **Note that the pressure value changes by the pump action of the power steering controller when the steering operation is continued after the steering wheel is lightly locked and accurate relief valve pressure cannot be measured.**

1. Disconnect the cylinder hose LH (2) (or RH (1)) from power steering cylinder, and set a pressure gauge.
2. Start the engine and set at maximum speed.
3. Fully turn the steering wheel to the left (or right) to check the feeling which the steering wheel lightly locks. Read the relief valve operating pressure when the steering wheel to the above mentioned lock position.

(Reference)
- Hose and adaptor Tee, swivel (9/16-18).

Relief valve operating pressure	Factory specification	8.00 to 9.00 MPa 81.6 to 91.7 kgf/cm^2 1160 to 1300 psi

Condition
- Engine speed:
  3200 min^{-1} (rpm)
- Oil temperature:
  45 to 55 °C (113 to 131 °F)

(1) Cylinder Hose RH (2) Cylinder Hose LH

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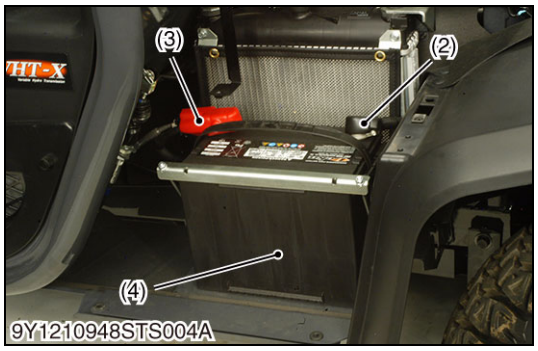
[2] PREPARATION

(1) Separating Power Steering Controller



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 (2) from the battery (4).
3. Disconnect the positive cable (3) from the battery (4).

(1) Battery Cover
(2) Negative Cable
(3) Positive Cable
(4) Battery

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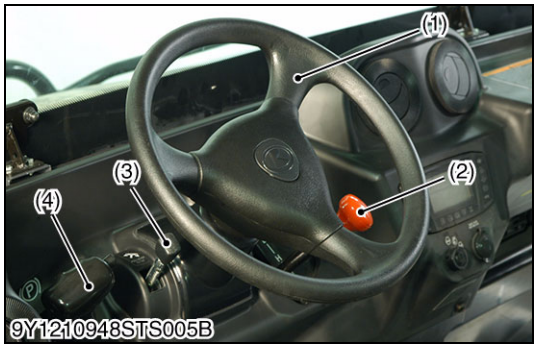

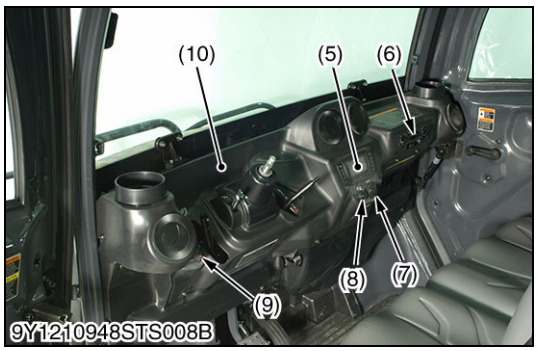

Control Panel

1. Remove the steering wheel (1).
2. Remove the shift lever grip (2), tilt lever grip (3), and the parking brake lever (4).
3. Disconnect the head light switch (9), meter assembly (5), starter switch (8), and ACC socket (7).
4. Disconnect the air conditioner control panel (6) from the panel (10).
5. Remove the panel (10).

Tightening torque	Steering wheel mounting nut	29 to 49 N·m 3.0 to 4.9 kgf·m 22 to 36 lbf·ft

(1) Steering Wheel
(2) Shift Lever Grip
(3) Tilt Lever Grip
(4) Parking Brake Lever
(5) Meter Assembly
(6) Air Conditioner Control Panel
(7) ACC Socket
(8) Starter Switch
(9) Head Light Switch
(10) Panel

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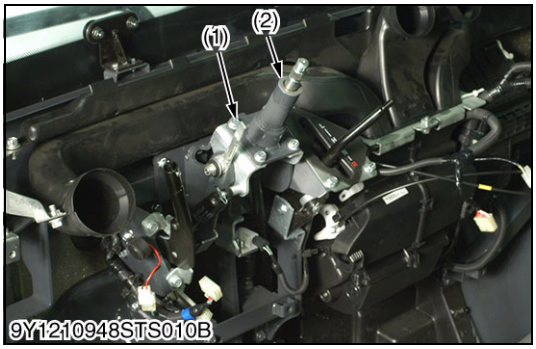

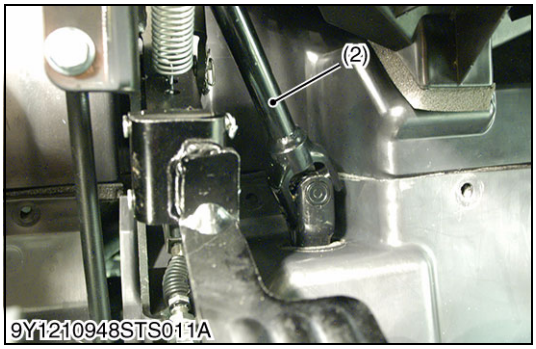

Steering Shaft

1. Remove the screws (1) holding the steering shaft assembly (2) to the tilt frame.
2. Remove the steering shaft assembly from the splined shaft on the power steering controller.

Tightening torque	Power steering shaft post mounting screw	25.0 to 49.0 N·m 2.54 to 4.99 kgf·m 18.4 to 36.1 lbf·ft

(1) Screw
(2) Steering Shaft Assembly

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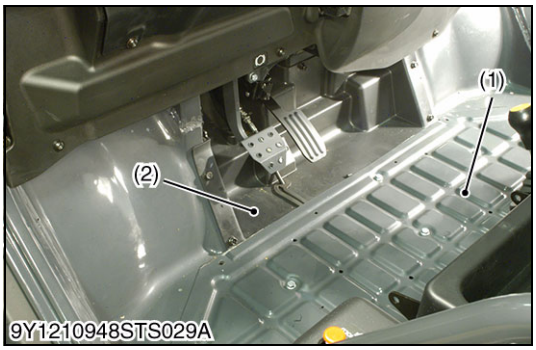

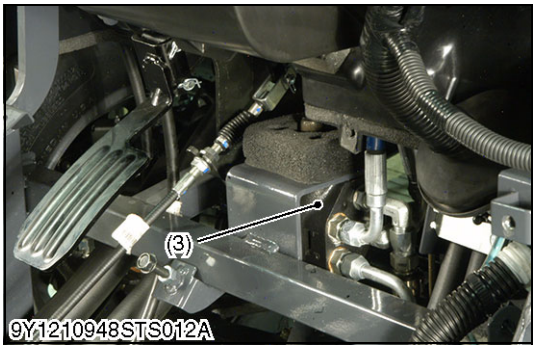

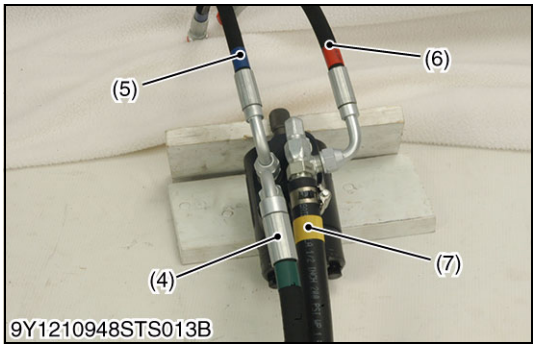

Steering Controller

1. Remove the step mat.
2. Remove the step (1).
3. Remove the front center cover (2).
4. Disconnect the power steering hoses (4), (5), (6), and (7) from the power steering controller (3).
5. Remove the power steering controller.

(When reassembling)

- Be sure to connect the power steering hoses to their original position, and tighten them to the specified torque.

Tightening torque	Power steering hose retaining nut	22.0 to 25.0 N·m 2.25 to 2.54 kgf·m 16.3 to 18.4 lbf·ft
	Power steering controller mounting screw	29.4 to 49.0 N·m 3.00 to 4.99 kgf·m 21.7 to 36.1 lbf·ft

(1) Step
(2) Front Center Cover
(3) Power Steering Controller
(4) Delivery Hose (Pump Port)
(5) Power Steering Cylinder Hose LH (**L** Port)
(6) Power Steering Cylinder Hose RH (**R** Port)
(7) Return Hose (Tank Port)

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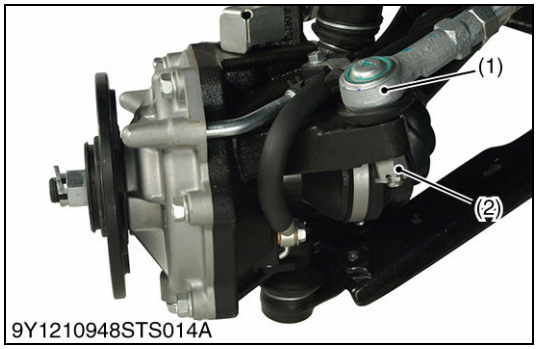
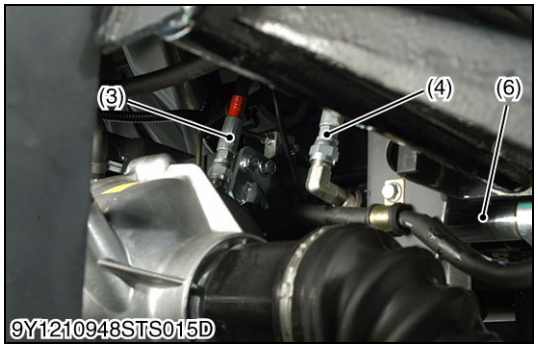
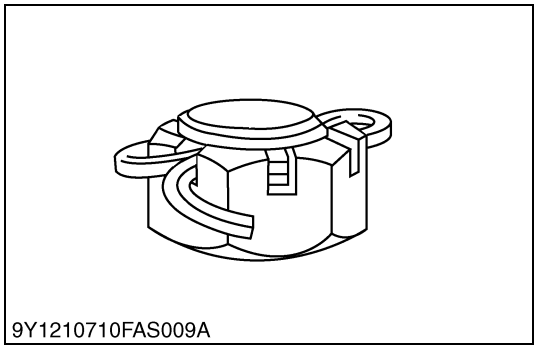
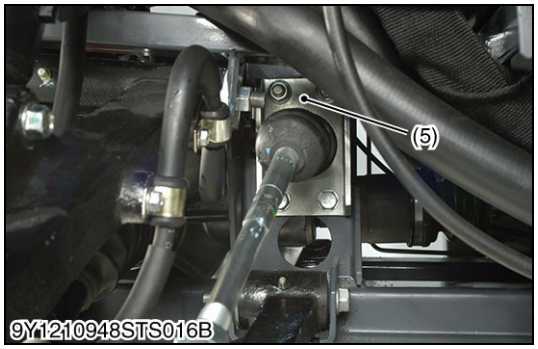
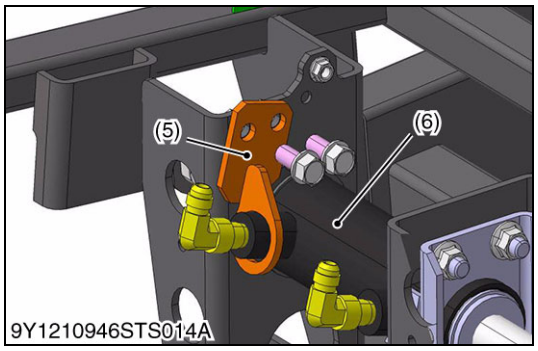
(2) Separating Power Steering Cylinder











Power Steering Cylinder

1. Place jack stands under both RH and LH side of the frame.
2. Remove the front wheels.
3. Remove the cotter pins and slotted nuts (2) for the tie-rod ends (1).
4. Disconnect the tie-rod ends (1) from the hubs.
5. Disconnect the power steering cylinder hoses (3), (4).
6. Remove the power steering cylinder bracket (5).
7. Remove the power steering cylinder (6) and tie-rods.

(When reassembling)

- When inserting the cotter pin, if the slots in the nut do not align with the cotter pin hole in tie-rod end, tighten the nut clockwise up to next alignment. It should be within 30 degree.
- Loosen once and tighten again when the slit goes past the nearest hole.
- After tightening the these slotted nut to specified torques, install a cotter pin as shown in the figure left.

Tightening torque	Tie-rod end slotted nut	50.0 to 55.0 N·m 5.10 to 5.60 kgf·m 36.9 to 40.5 lbf·ft
	Power steering cylinder hose retaining nut	22.0 to 25.0 N·m 2.25 to 2.54 kgf·m 16.3 to 18.4 lbf·ft
	Front wheel mounting bolt and nut (Aluminum wheel)	90 to 110 N·m 9.2 to 11.2 kgf·m 66.4 to 81.1 lbf·ft
	Front wheel mounting bolt and nut (Steel wheel)	108 to 130 N·m 11.1 to 132 kgf·m 79.7 to 95.8 lbf·ft

(1) Tie-rod End RH
(2) Slotted Nut (for Tie-rod End)
(3) Power Steering Cylinder Hose (RH)
(4) Power Steering Cylinder Hose (LH)
(5) Power Steering Cylinder Bracket
(6) Power Steering Cylinder

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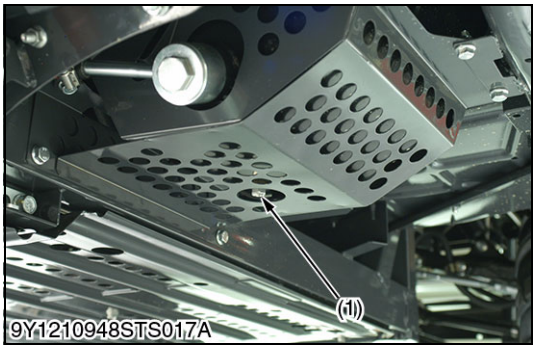
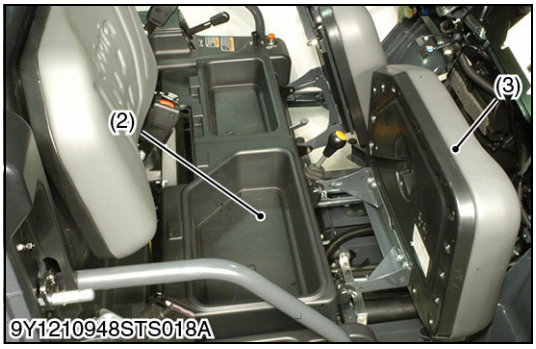
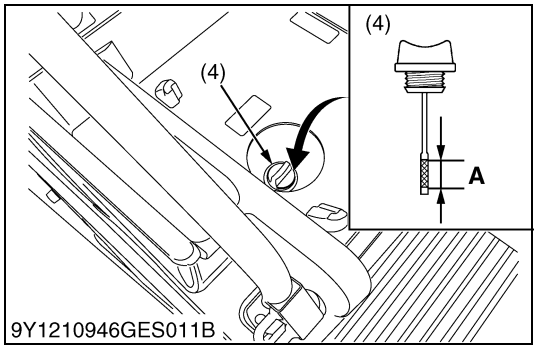
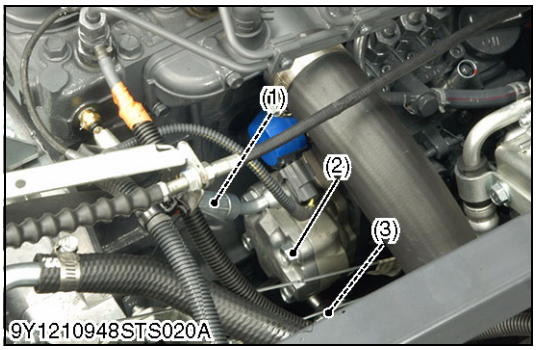
(3) Separating Hydraulic Pump









Draining the Hydraulic Oil

1. Park the vehicle on a firm, flat, and level surface.
2. Open the driver and passenger seats (3) and remove the utility box (2).
3. To drain the hydraulic oil, remove the drain plug (1) and filling plug with dipstick (4). Drain the oil completely into the oil drain pan.
4. After draining, reinstall the drain plug (1).

(When refilling)

- Fill with new KUBOTA SUPER UDT fluid up to the upper notch on the dipstick (4).
- Wipe the dipstick (4) clean with a rag, and reinstall the dipstick to filling hole. Remove the dipstick again to see if the oil level is between the upper and lower notch.

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

(1) Drain Plug
(2) Utility Box
(3) Seat
(4) Filling Plug with Dipstick

A: Oil level is acceptable within this range.

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Hydraulic Pump

1. Disconnect the suction hose (3) and delivery hose (1) from the hydraulic pump (2).
2. Remove the hydraulic pump from the engine.

(When reassembling)

Tightening torque	Hydraulic control valve delivery hose retaining nut	22.0 to 25.0 N·m 2.25 to 2.54 kgf·m 16.3 to 18.4 lbf·ft

(1) Delivery Hose
(2) Hydraulic Pump
(3) Suction Hose

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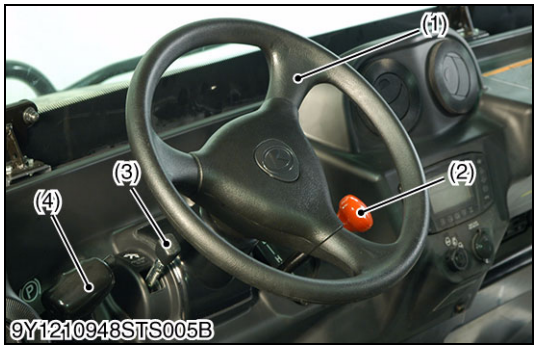
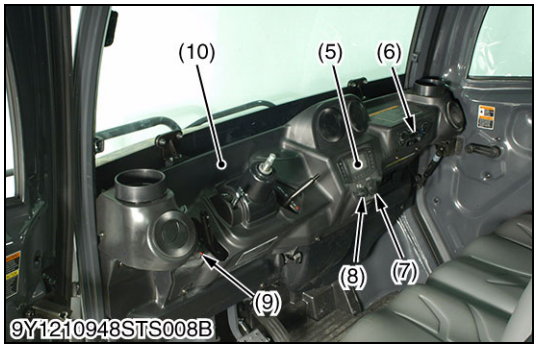
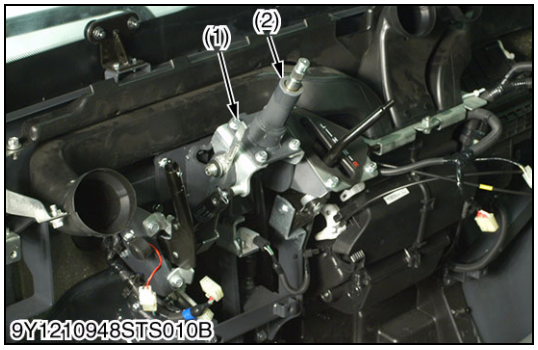
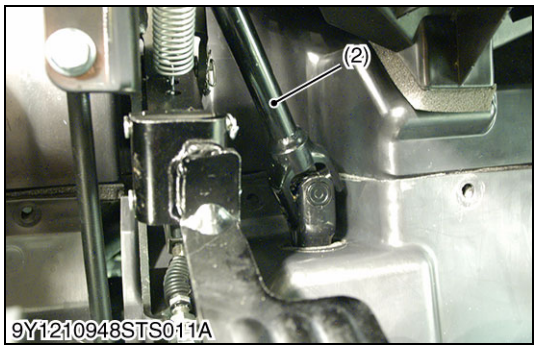
(4) Removing Power Steer Hoses









Control Panel

1. Remove the steering wheel (1).
2. Remove the shift lever grip (2), tilt lever grip (3), and the parking brake lever (4).
3. Disconnect the head light switch (9), meter assembly (5), starter switch (8), and ACC socket (7).
4. Disconnect the air conditioner control panel (6) from the panel (10).
5. Remove the panel (10).

Tightening torque	Steering wheel mounting nut	29 to 49 N·m 3.0 to 4.9 kgf·m 22 to 36 lbf·ft

(1) Steering Wheel
(2) Shift Lever Grip
(3) Tilt Lever Grip
(4) Parking Brake Lever
(5) Meter Assembly
(6) Air Conditioner Control Panel
(7) ACC Socket
(8) Starter Switch
(9) Head Light Switch
(10) Panel

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Steering Shaft

1. Remove the screws (1) holding the steering shaft assembly (2) to the tilt frame.
2. Remove the steering shaft assembly from the splined shaft on the power steering controller.

Tightening torque	Power steering shaft post mounting screw	25.0 to 49.0 N·m 2.54 to 4.99 kgf·m 18.4 to 36.1 lbf·ft

(1) Screw
(2) Steering Shaft Assembly

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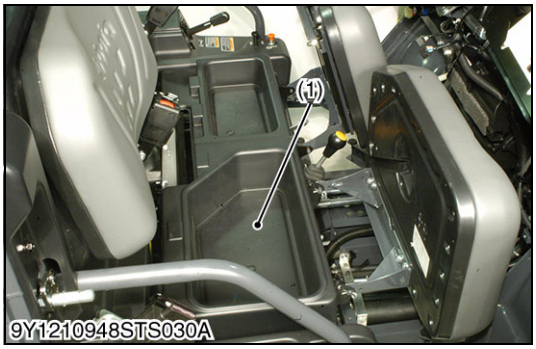

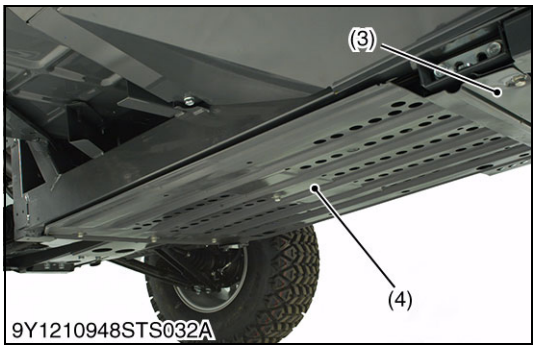

Covers

1. Remove the center box cover (1).
2. Remove the lower center cover (2).
3. Remove the front skid plate (4) and rear skid plate (3).

(1) Center Box Cover
(2) Lower Center Cover
(3) Rear Skid Plate
(4) Front Skid Plate

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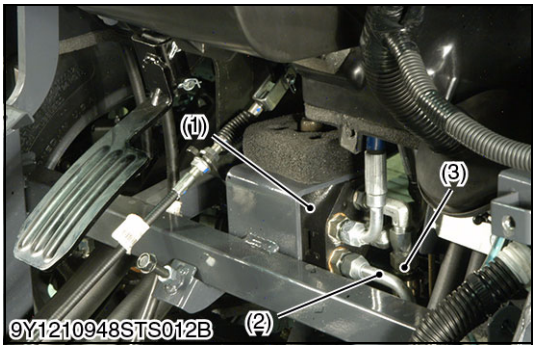

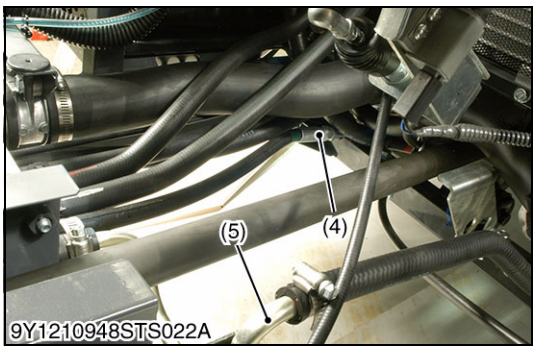

Power Steering Hose (Steering IN Hose and Steering OUT Hose)

1. Disconnect the steering IN hose (2) from the power steering controller (1).
2. Disconnect the steering IN hose from the rear PS CV tube (4), and remove the steering IN hose.
3. Disconnect the steering OUT hose (3) from the power steering controller (1).
4. Disconnect the steering OUT hose from the front oil cooler pipe (5), and remove the steering OUT hose.

(1) Steering Controller
(2) Steering IN Hose
(3) Steering OUT Hose
(4) Rear PS CV Tube
(5) Front Oil Cooler Pipe

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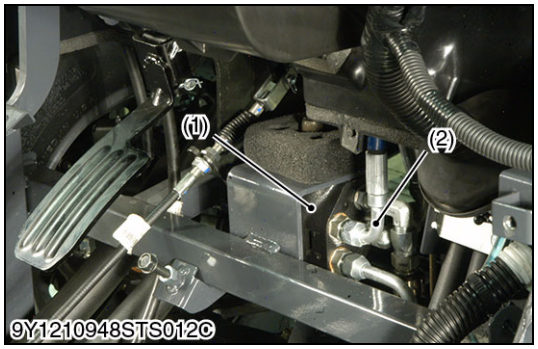

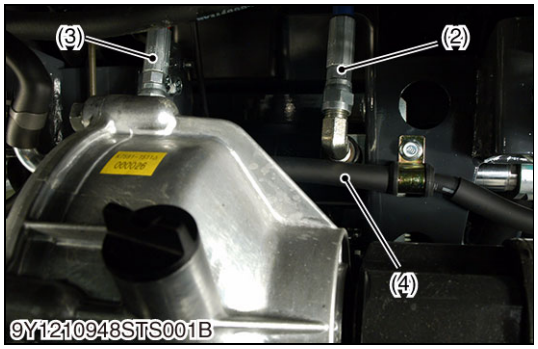

Power Steering Hose (Cylinder Hose)

1. Disconnect the LH power steering cylinder hose (2) from the power steering controller (1).
2. Disconnect the LH power steering cylinder hose from the power steering cylinder (4), and remove the LH hose.
3. Disconnect the RH power steering hose (3) from the power steering controller (1).
4. Disconnect the RH power steering hose from the from the power steering cylinder (4), and remove the RH hose.

(1) Power Steering Controller
(2) Power Steering Cylinder Hose LH
(3) Power Steering Cylinder Hose RH
(4) Power Steering Cylinder

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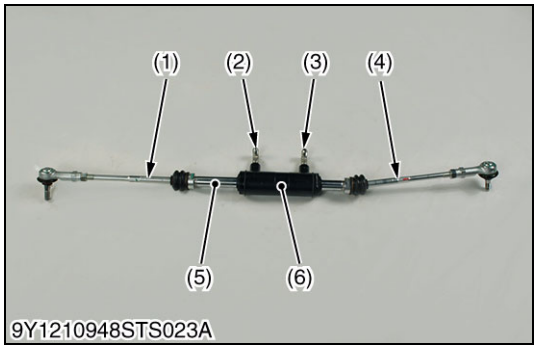
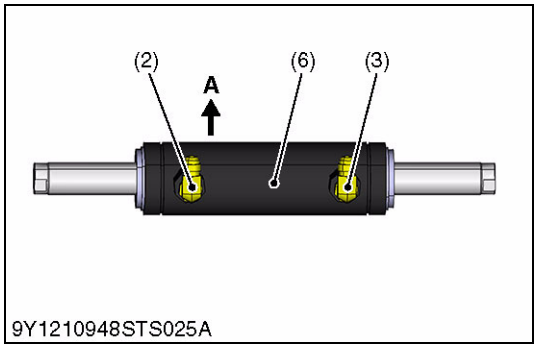
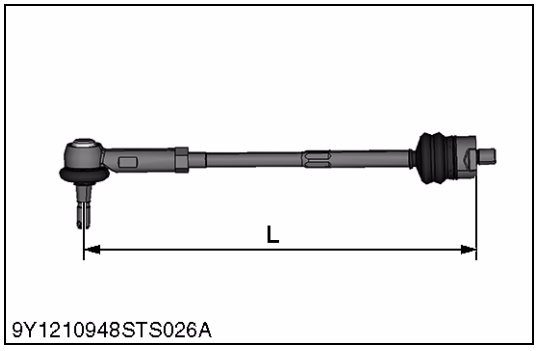
[3] DISASSEMBLING AND ASSEMBLING

(1) Power Steering Cylinder







Power Steering Cylinder and Tie-rod

1. Remove the cylinder hose adaptors (2), (3).
2. Remove the tie-rods (1), (4) from piston rod (5).

(When reassembling)

- Be sure to install the cylinder hose adaptors (2), (3) as shown figure left.
- After reassembling the tie-rod, be sure to adjust the toe-in. (See page 5-S4.)
- Apply liquid lock to the thread of piston rod (5).

Tightening torque	Tie-rod screw	74 to 84 N·m 7.5 to 8.6 kgf·m 55 to 62 lbf·ft

(1) Tie-rod LH
(2) Hose Adaptor LH
(3) Hose Adaptor RH
(4) Tie-rod RH
(5) Piston Rod
(6) Power Steering Cylinder

A: UP
L: 338 mm (13.3 in.)

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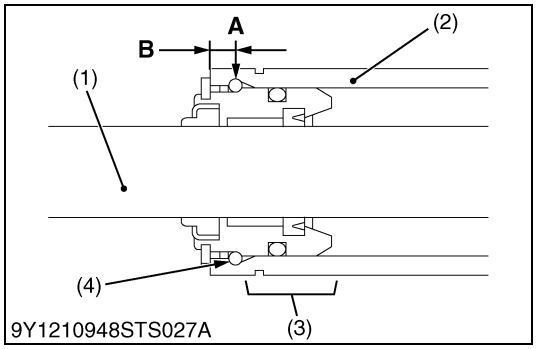

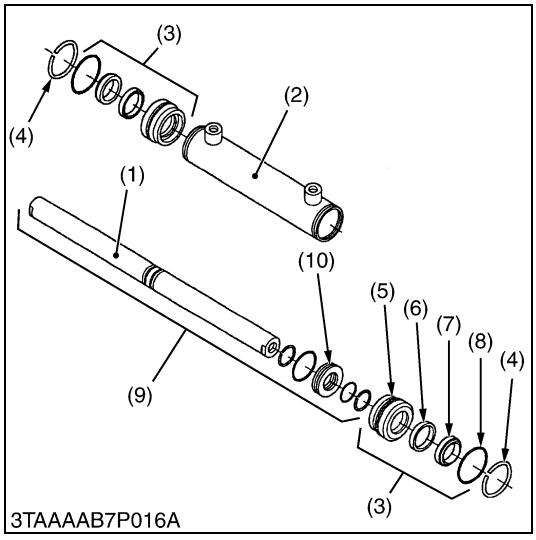

Power Steering Cylinder

1. Carefully clamp the cylinder in a vise.
2. Push one of the guide assembly (3) to inside of cylinder tube (2).
3. Drill a hole (2.5 mm dia., 0.1 in. dia.) on the cylinder tube (2) just over the snap ring (4) as shown figure left.
4. Take a little screwdriver and lift off the snap ring (4) from its groove. Simultaneousness support this action by pushing from the outside of the cylinder tube with another little screwdriver or another tool.
5. Push out the piston rod assembly (9) and take off the guide assembly (3).

(When reassembling)

■ **NOTE**

- **Seals must be exchanged after disassembling.**
- **Apply transmission fluid to the exchanged seals.**
- **Enter the piston rod and block the guide assemblies with the snap rings.**

(1) Piston Rod
(2) Cylinder Tube
(3) Guide Assembly
(4) Snap Ring
(5) Guide
(6) Seal Ring
(7) Wiper Seal
(8) O-ring
(9) Piston Rod Assembly
(10) Center Piston

A: Drill a Hole
B: 5.25 mm (0.267 in.)

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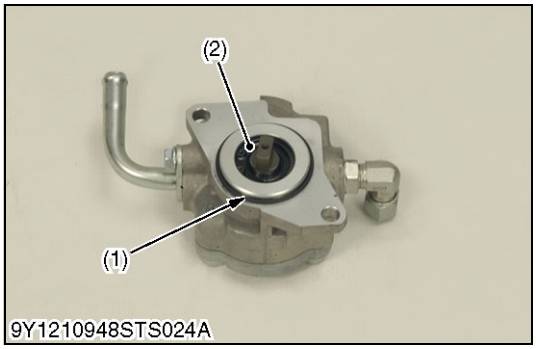
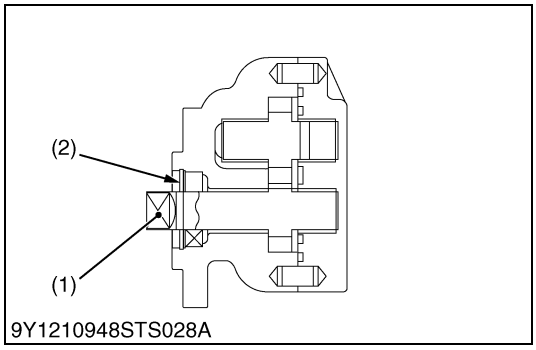
(2) Hydraulic Pump





Oil Seal

1. Remove the internal snap ring (2), and remove the oil seal (1).

(When reassembling)

- If the oil seal is damaged, worn or scratched, replace it.

(1) Oil Seal
(2) Internal Snap Ring

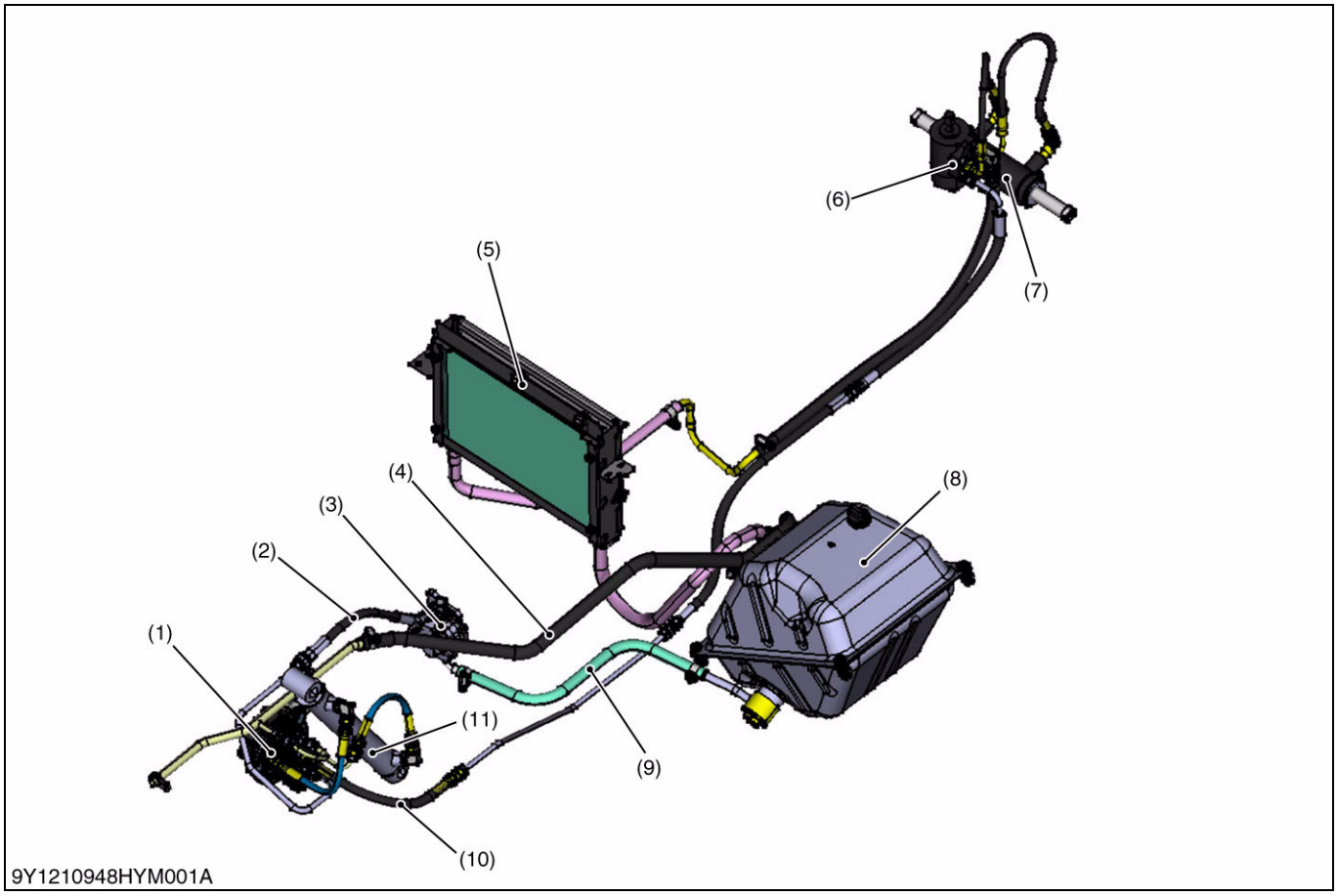
9Y1210948STS0017US0

7 HYDRAULIC SYSTEM

MECHANISM

CONTENTS

1. STRUCTURE



(1) Control Valve
(2) Delivery Hose
(3) Hydraulic Pump
(4) Return Hose
(5) Oil Cooler
(6) Power Steering Controller
(7) Power Steering Cylinder
(8) Oil Tank
(9) Suction Hose
(10) Hydraulic Hose
(11) Hydraulic Lift Cylinder

The hydraulic system of RTV-X1100C consists of the hydraulic pump (3), control valve (1), hydraulic lift cylinder (11), power steering controller (6), power steering cylinder (7), oil tank (8) and other components as shown in the figure.

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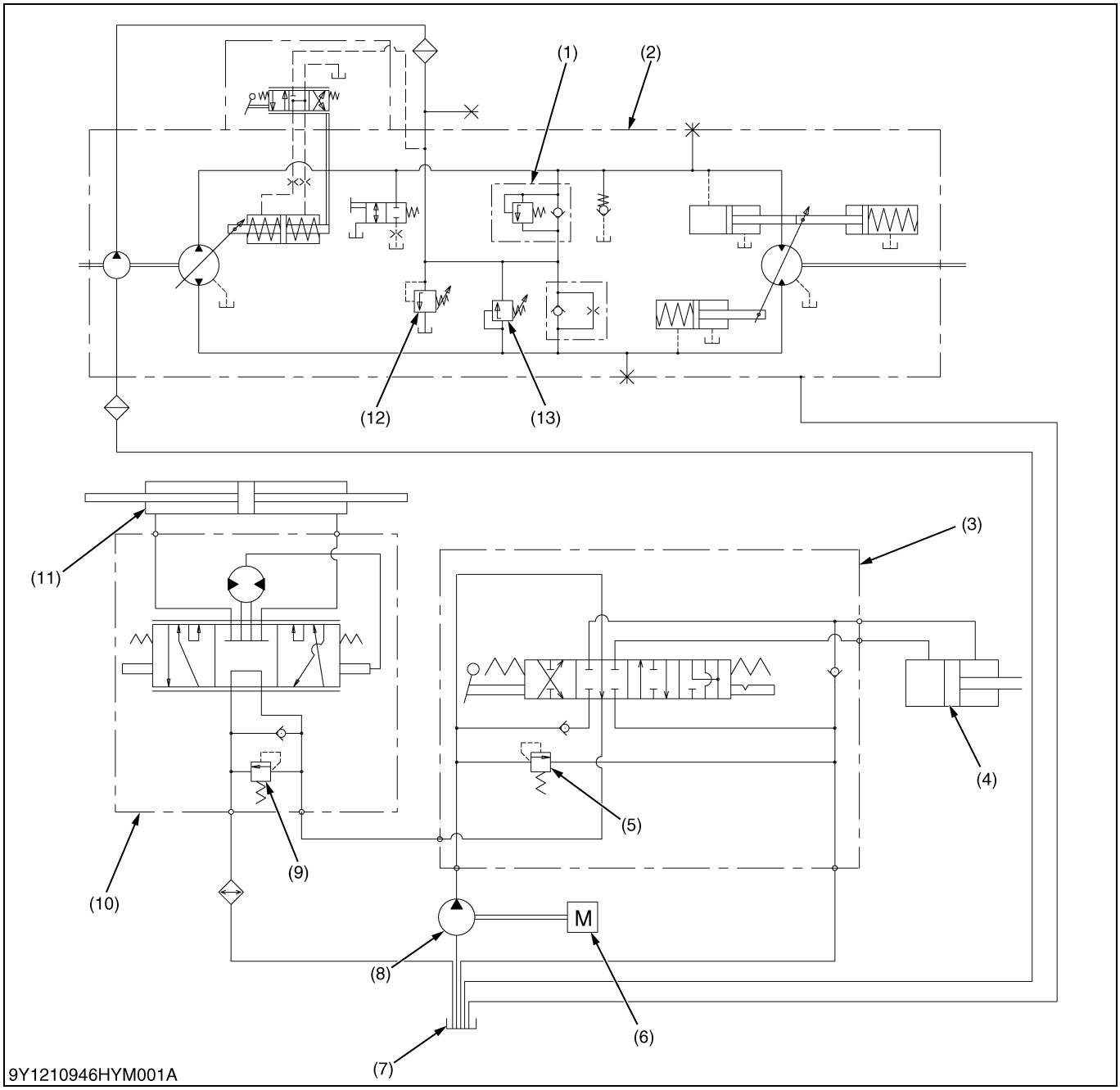
2. HYDRAULIC CIRCUIT



(1) Check and High Pressure Relief Valve
(2) HST Assembly
(3) Hydraulic Control Valve
(4) Lift Cylinder
(5) Hydraulic Control Valve
(6) Engine
(7) Oil Tank
(8) Hydraulic Pump
(9) Power Steering Controller Relief Vale
(10) Power Steering Controller
(11) Steering Cylinder
(12) Charge Relief Vale
(13) High Pressure Relief Valve

Specifications

(1)	24.5 to 27.5 MPa (250 to 280 kgf/cm^2, 3560 to 3980 psi)	(9)	8.00 to 9.00 MPa (81.6 to 91.7 kgf/cm^2, 1160 to 1300 psi) at 3000 min^{-1} (rpm)
(5)	12.5 to 13.5 MPa (128 to 137 kgf/cm^2, 1820 to 1950 psi) at 3000 min^{-1} (rpm)	(12)	0.43 to 0.85 MPa (4.4 to 8.6 kgf/cm^2, 63 to 120 psi)
(8)	9.0 L/min. (2.4 U.S.gals/min, 2.0 Imp.gals/min.) at 3000 min^{-1} (rpm)	(13)	15.0 to 17.0 MPa (153 to 173 kgf/cm^2, 2180 to 2460 psi)

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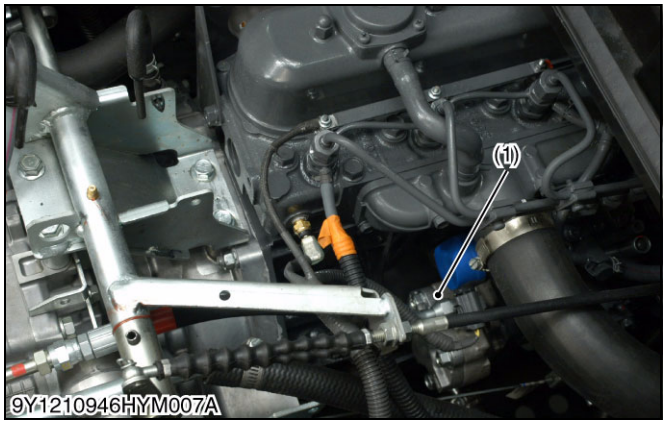
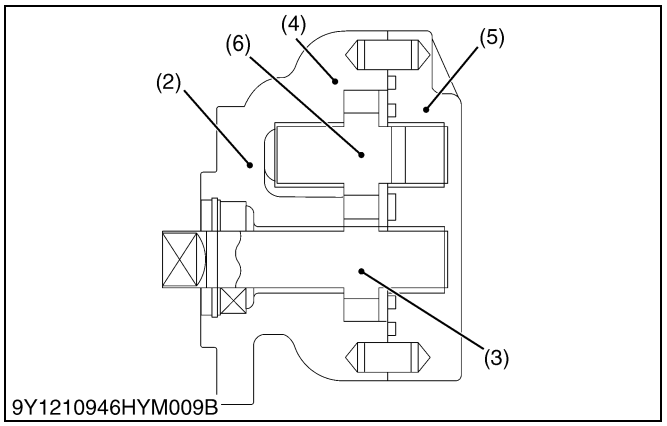
3. HYDRAULIC PUMP





The hydraulic pump (1) consists of the casing (4), cover (5), and two spur gears (drive gear (3) and driven gear (6)) that are in mesh.

Hydraulic pump (1) is driven by the input shaft in the transmission case.

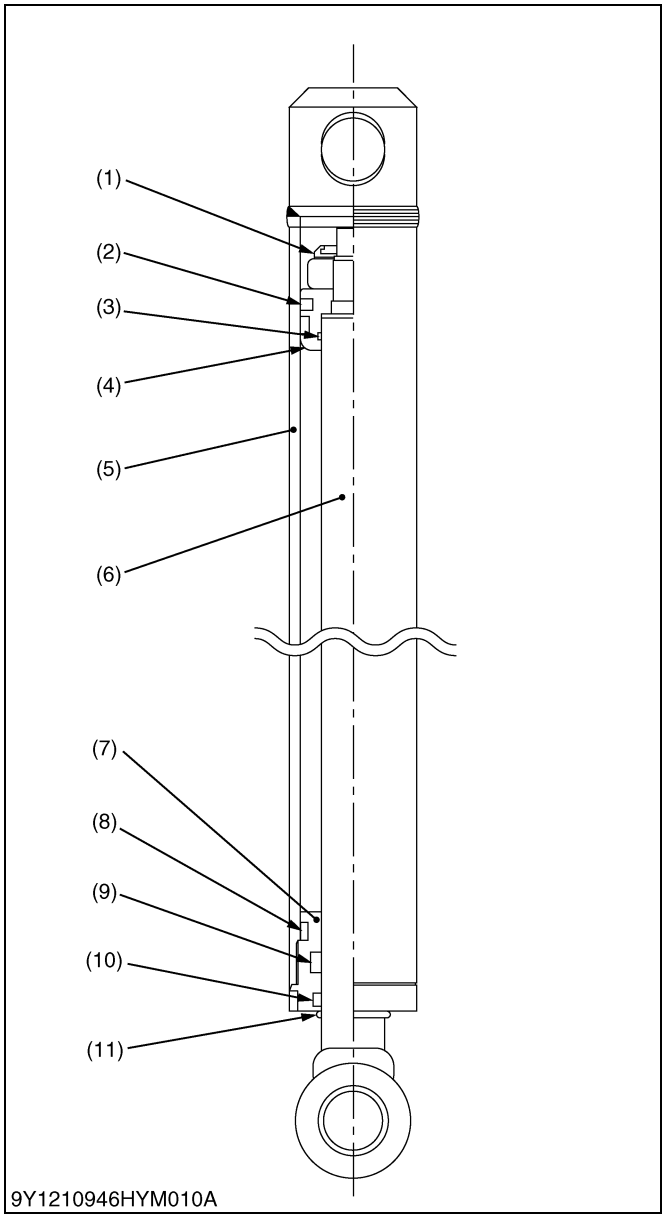
Maximum displacement is as follows.

Displacement	Engine speed	Condition
22.8 L/min. (6.0 U.S.gals/min., 5.0 Imp.gals/min.)	At 3000 min^{-1} (rpm)	at no load

(1) Hydraulic Pump
(2) Cover
(3) Drive Gear
(4) Casing
(5) Cover
(6) Driven Gear

9Y1210948HYM0003US0

4. HYDRAULIC CYLINDER



9Y1210946HYM010A

The external type hydraulic lift cylinder is used for cargo bed lifting system. This hydraulic lift cylinder is single double type, and it is installed directly between main frame arm cargo bed.

The main components of the hydraulic lift cylinder are shown in the figure.

(1) Piston Nut
(2) Piston Seal
(3) Piston O-ring
(4) Piston
(5) Cylinder Tube
(6) Rod
(7) End Cap
(8) End Seal
(9) End O-ring
(10) Internal Snap Ring
(11) Wiper Seal

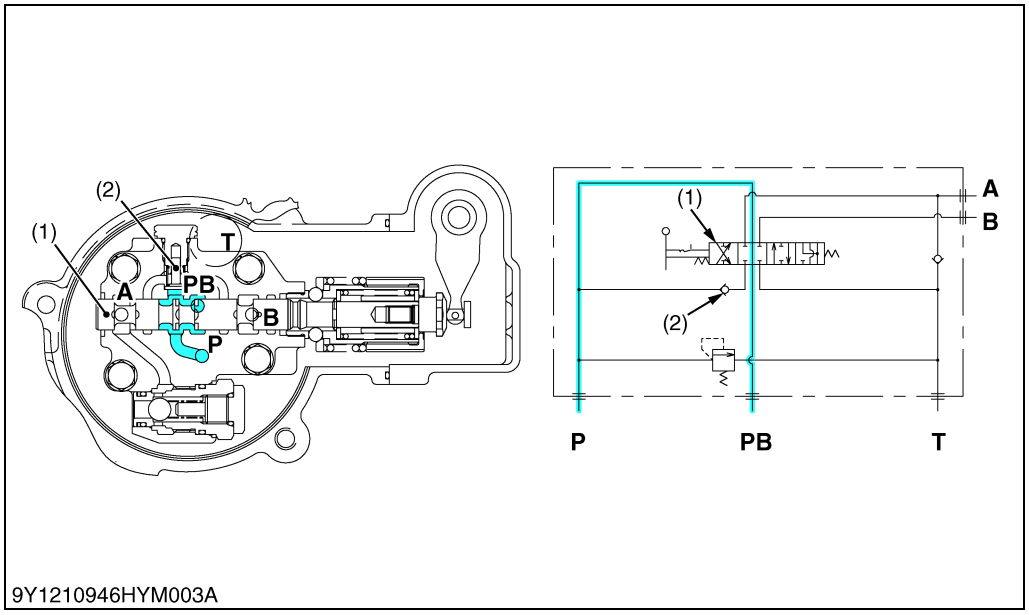
9Y1210948HYM0004US0

5. CONTROL VALVE

[1] DOUBLE ACTING TYPE 1

(1) Floating with Detent Valve

[A] Neutral



9Y1210946HYM003A

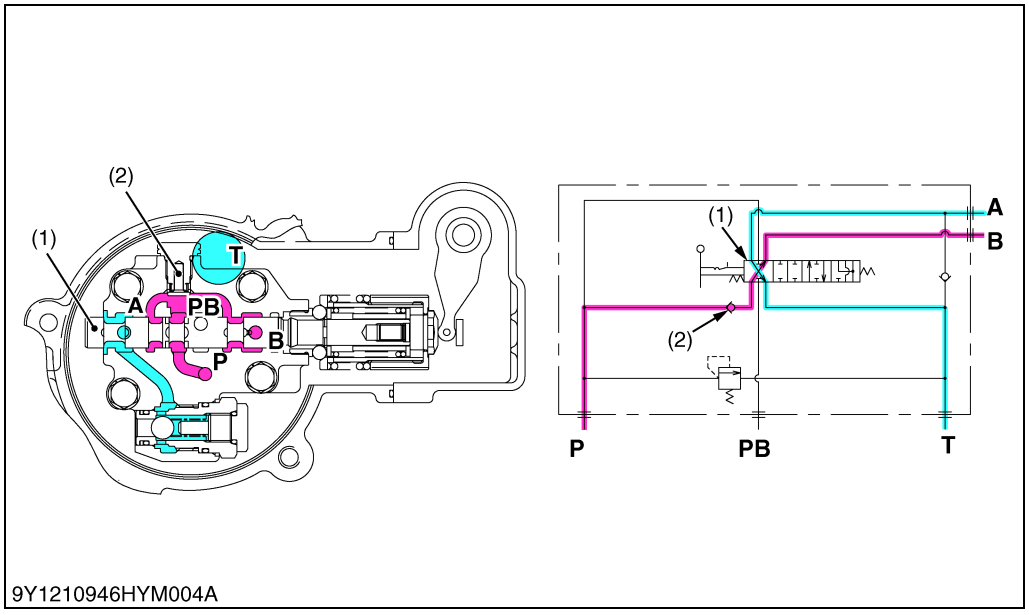
(1) Spool
(2) Check Valve

A: A Port (Lift Cylinder)
B: B Port (Lift Cylinder)
P: From Hydraulic Pump
T: To Oil Tank

Pressure-fed oil from the hydraulic pump is delivered into the **P** port, and flows to the oil tank through **T** port.

9Y1210946HYM0007US0

[B] Lift



9Y1210946HYM004A

(1) Spool
(2) Check Valve

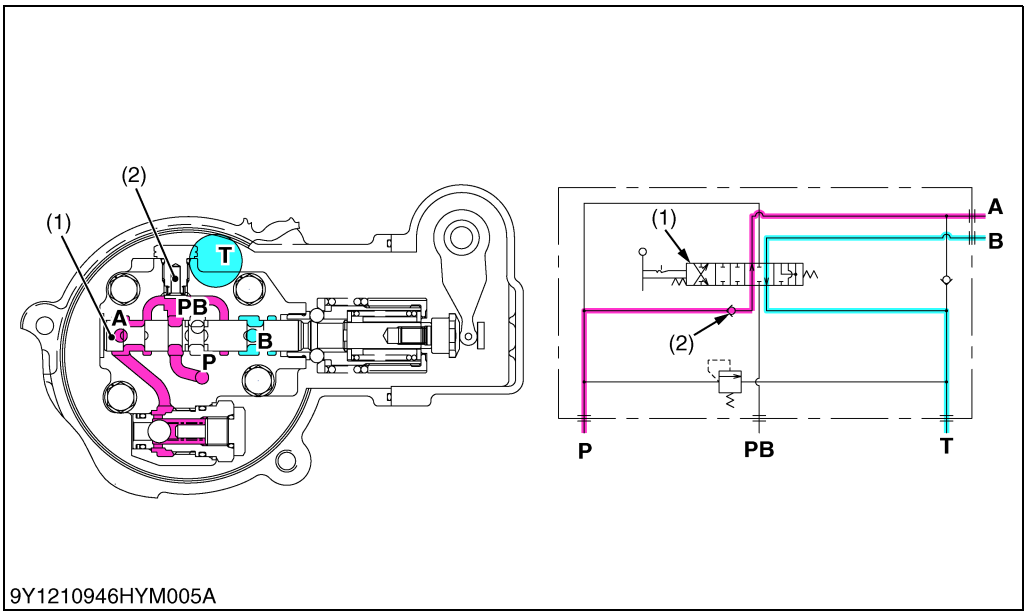
A: A Port (Lift Cylinder)
B: B Port (Lift Cylinder)
P: From Hydraulic Pump
T: To Oil Tank

When the spool (1) is moved in the direction of the arrow, the pressure-fed oil in the **P** port opens the check valve (2) and flows to the implement cylinder via **B** port.

Return oil from the implement cylinder flows from the **A** port to the transmission case through **T** port.

9Y1210946HYM0008US0

[C] Down



9Y1210946HYM005A

(1) Spool
(2) Check Valve

A: A Port (Lift Cylinder)
B: B Port (Lift Cylinder)
P: From Hydraulic Pump
T: To Oil Tank

When the spool (1) is moved in the direction of the arrow, the pressure-fed oil in the **P** port opens the check valve (2) and flows to the implement cylinder via **A** port.

Return oil from the implement cylinder flows from the **B** port to the oil tank through **T** port.

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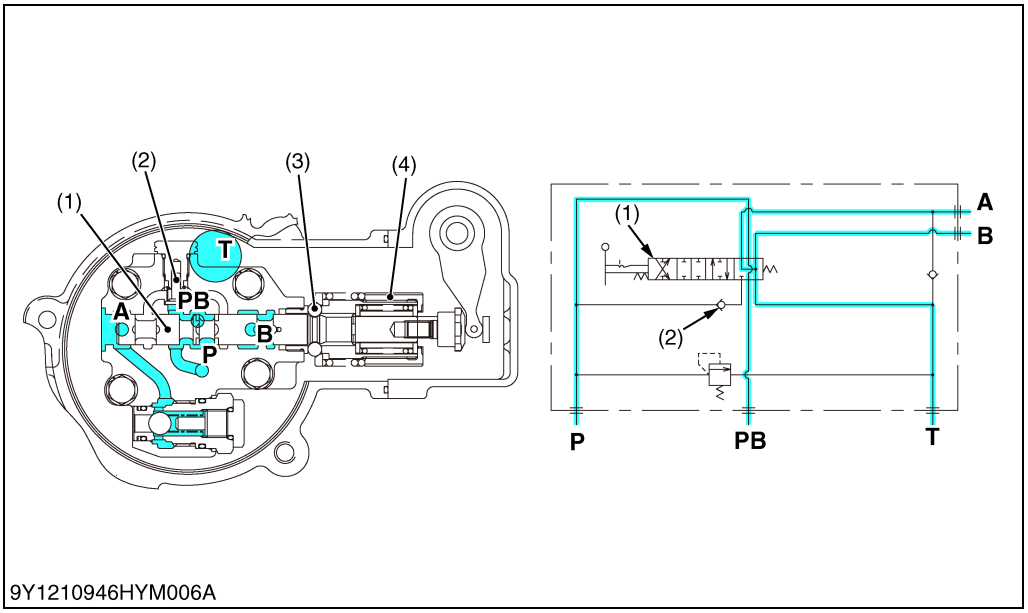
[D] Floating



9Y1210946HYM006A

(1) Spool
(2) Check Valve
(3) Detent Ball
(4) Detent Sleeve

A: A Port (Lift Cylinder)
B: B Port (Lift Cylinder)
P: From Hydraulic Pump
T: To Oil Tank

When the spool (1) moves to extreme right, the detent ball (3) and detent sleeve (4) holds the spool (2) at the floating position as shown in the figure. The pressure-fed oil from the hydraulic pump flows to oil tank through **T** port. And, the **A** port and **B** port lead to the **T** port along the notched sections of the spool (1). This result in the attached implement to follow the power from implement.

9Y1210946HYM0010US0

SERVICING

CONTENTS

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
Implement Does Not Rise (No Noise)	Control valve broken	Replace	2-S37
	Control valve improperly assembled	Repair	2-S37
	Relief valve spring damaged	Replace	7-S10
	Spool sticks	Repair	7-S10
	Piston O-ring or cylinder damaged	Replace	7-S10
(Noise)	Suction hose loosen or broken	Repair	7-S6
	Insufficient hydraulic lift oil	Repair or replace	G-43
	Relief valve setting pressure too low	Refill	7-S4
	Hydraulic pump broken	Adjust or replace	7-S6
Implement Does Not Lower	Control valve malfunctioning	Repair or replace	2-S37
Implement Drops by Its Weight	Hydraulic lift cylinder worn or damaged	Replace	7-S7
	Piston O-ring worn or damaged	Replace	7-S9
	Control valve malfunctioning	Replace	2-S37

9Y1210948HYS0001US0

2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Relief Valve	Setting Pressure	12.5 to 13.5 MPa 128 to 137 kgf/cm^2 1820 to 1950 psi	–

9Y1210948HYS0002US0

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-12.)

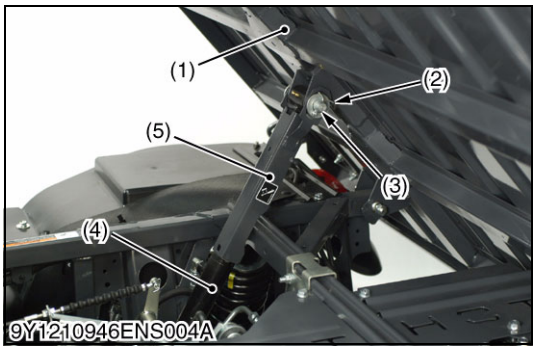
Item	N·m	kgf·m	lbf·ft
Hydraulic pump mounting torque	37.0 to 44.0	3.78 to 4.48	27.3 to 32.4
Hydraulic pump cover mounting screw	40 to 44	4.0 to 4.5	29 to 32
Hydraulic lift cylinder head	100 to 120	10.2 to 12.2	73.8 to 88.5
Hydraulic lift cylinder piston mounting nut	80.0 to 100	8.16 to 10.1	59.0 to 73.7
Relief valve plug	29.4 to 34.3	3.00 to 3.49	21.7 to 25.2
Control valve mounting screw	18 to 21	1.9 to 2.1	14 to 15
Check valve plug	19.6 to 24.5	2.00 to 2.49	14.5 to 18.0
Check valve seat	34 to 39	3.5 to 3.9	25 to 28

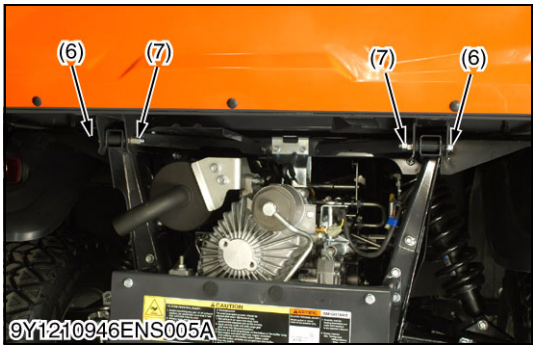
9Y1210948HYS0003US0

4. CHECKING AND DISASSEMBLING

[1] CHECKING AND ADJUSTING

(1) Hydraulic Control Valve, Pump and Cylinder





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
(2) Cotter Pin
(3) Clevis Pin
(4) Hydraulic Cylinder
(5) Cylinder Lock
(6) Bolt
(7) Lock Nut

9Y1210946ENS0025US0

Relief Valve Setting Pressure

1. Disconnect the lift cylinder hose.
2. Set the adaptor, cable and pressure gauge.
3. Start the engine and depress the speed control pedal.
4. Move the hydraulic lift cylinder lever way up to operate the relief valve and read the gauge.
5. If the pressure is not within the factory specifications, adjust with the adjusting shims (3).

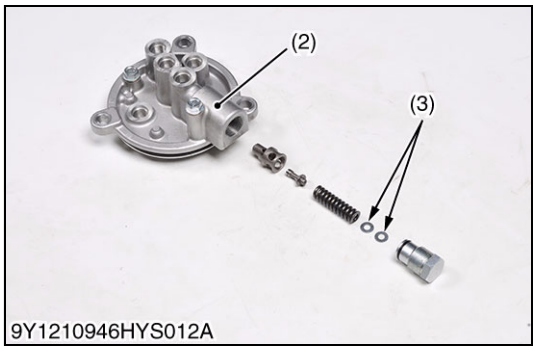
Relief valve setting pressure	Factory specification	12.5 to 13.5 MPa 128 to 137 kgf/cm^2 1820 to 1950 psi

Condition

- Engine speed:
  3000 min^{-1} (rpm)
- Oil temperature:
  45 to 55 °C (113 to 131 °F)

(Reference)

- Thickness of shims (3):
  0.10 mm (0.0039 in.),
  0.20 mm (0.0079 in.),
  0.40 mm (0.016 in.)
- 0.269 MPa (2.74 kgf/cm^2, 39.0 psi) pressure is increased whenever the thickness of adjusting shim is increased by 0.1 mm (0.0039 in.)



(1) Lift Cylinder
(2) Control Valve Cover
(3) Shim

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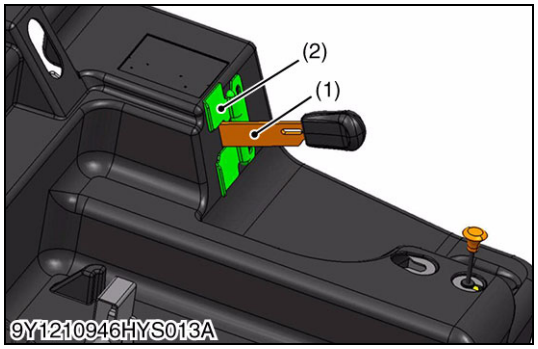
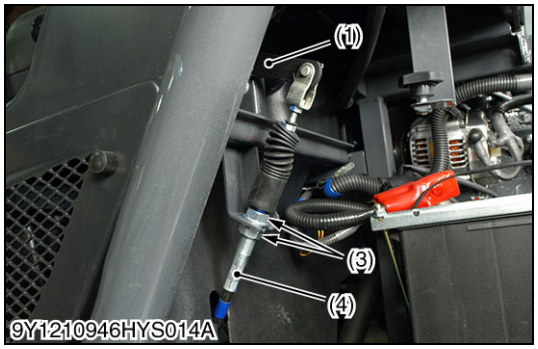
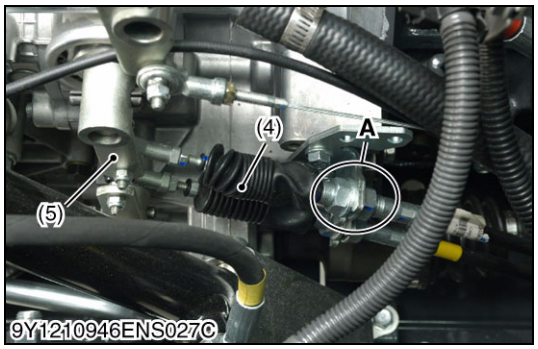






Checking Hydraulic Lift Cable

1. Set the hydraulic lift cylinder lever (1) to neutral position.
2. Set the restricting plate (2).
3. Check that the cable is fixed to the stay, with the cable outer section screw being set near the center **"A"**. Also check that the lock nuts at the cable end and the ball joint are not loose.
4. Check that the ball joint fitting nuts tightened.
5. Set the control valve lever (5) as shown in figure.
6. Then tighten the lock nuts (3) firmly.
7. Release the restricting plate (2).
8. Move the hydraulic lift cylinder lever and make sure to engage control valve to each positions correctly. (4 position.)

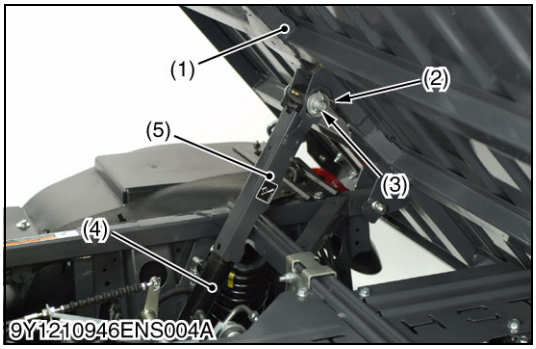
(1) Hydraulic Lift Cylinder Lever
(2) Restricting Plate
(3) Lock Nut
(4) Hydraulic Lift Cable
(5) Control Valve Lever

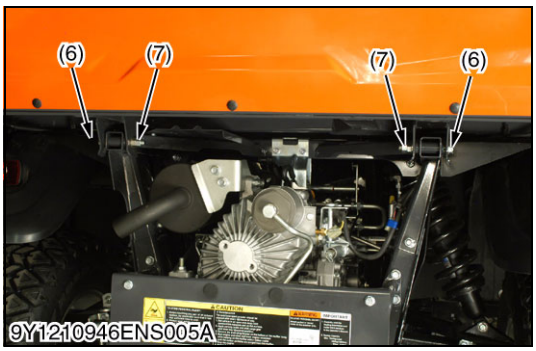
A: Center of Tread

9Y1210946HYS0012US0

[2] PREPARATION

(1) Removing Hydraulic Pump





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
(2) Cotter Pin
(3) Clevis Pin
(4) Hydraulic Cylinder
(5) Cylinder Lock
(6) Bolt
(7) Lock Nut

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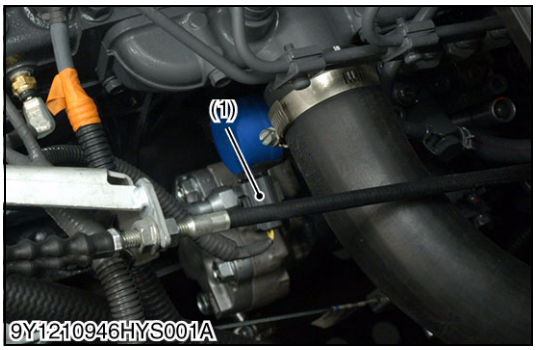
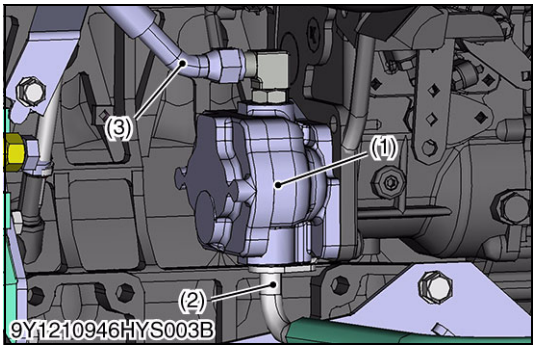




Hydraulic Pump

1. Disconnect the suction pipe (2) and delivery hose (3).
2. Remove the hydraulic pump (1).

(When reassembling)

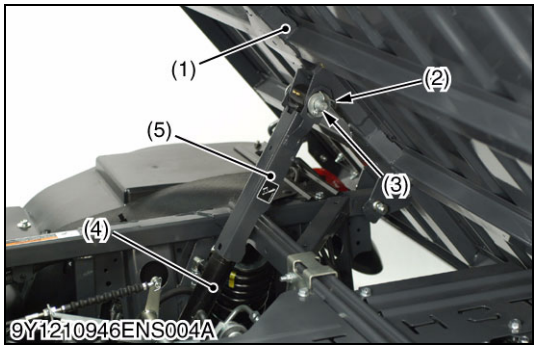
- Be careful not to damage the O-ring on the hydraulic pump (1) and suction pipe (2).

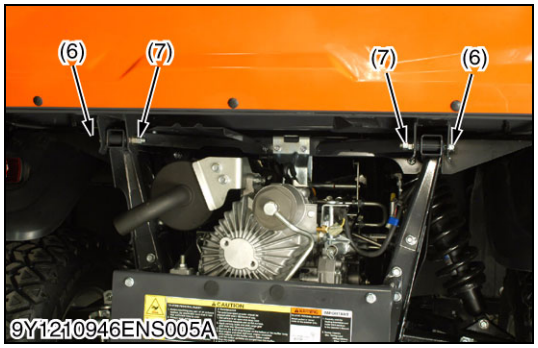
Tightening torque	Hydraulic pump mounting torque	37.0 to 44.0 N·m 3.78 to 4.48 kgf·m 27.3 to 32.4 lbf·ft

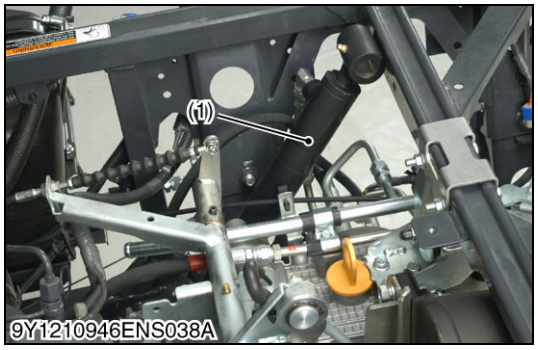
(1) Hydraulic Pump
(2) Suction Pipe
(3) Delivery Hose

9Y1210948HYS0005US0

(2) Removing Hydraulic Cylinder LIft Cylinder







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
(2) Cotter Pin
(3) Clevis Pin
(4) Hydraulic Cylinder
(5) Cylinder Lock
(6) Bolt
(7) Lock Nut

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Hydraulic Lift Cylinder

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

(1) Hydraulic Lift Cylinder

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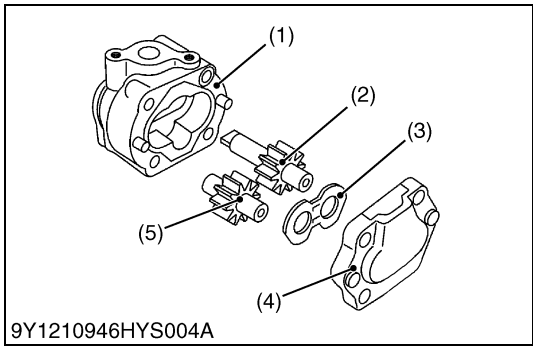
[3] DISASSEMBLING AND ASSEMBLING

(1) Hydraulic Pump



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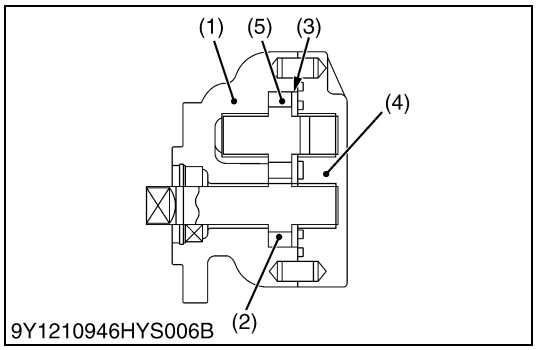

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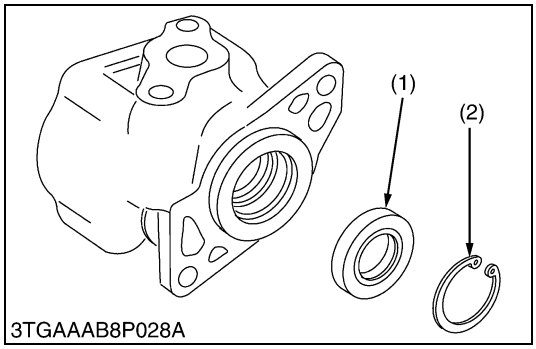

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Hydraulic Pump

1. Secure the hydraulic pump with a vise, and remove the hydraulic pump cover (4).
2. Remove the side plate (3).
3. Remove the drive gear (2) and driven gear (5) from the casing (1).

(When reassembling)

- Be careful not to damage the O-ring.
- Align the holes of the hydraulic pump cover (4) and casing (1).
- Install the side plate (3), nothing its location and direction.
- Install the gears, nothing its direction.

Tightening torque	Hydraulic pump cover mounting screw	40 to 44 N·m 4.0 to 4.5 kgf·m 29 to 32 lbf·ft

(1) Casing
(2) Drive Gear
(3) Side Plate
(4) Hydraulic Pump Cover
(5) Driven Gear

9Y1210948HYS0006US0

Oil Seal

1. Remove the internal snap ring (2), and remove the oil seal (1).

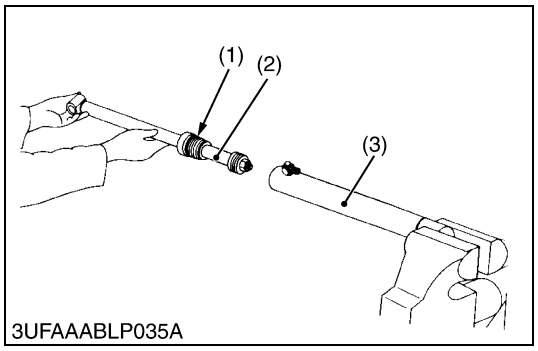
(When reassembling)

- If the oil seal is damaged, worn or scratched, replace it.

(1) Oil Seal
(2) Internal Snap Ring

9Y1210946HYS0007US0

(2) Hydraulic Lift Cylinder



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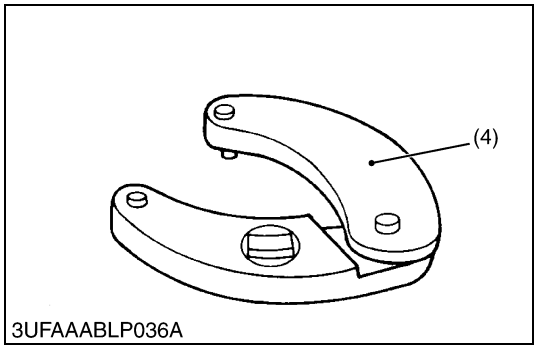

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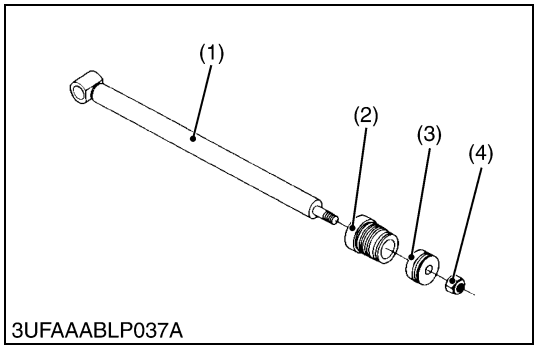

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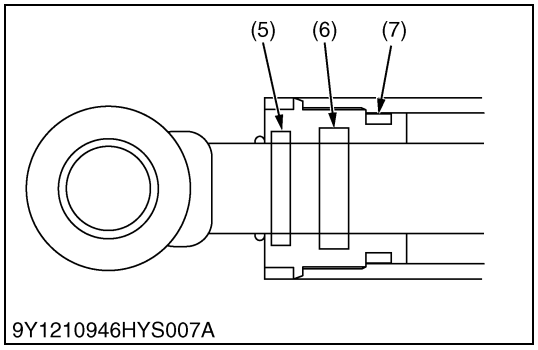

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Piston Rod Assembly

1. Drain hydraulic oil from the hydraulic lift cylinder, and set the tube end of the hydraulic lift cylinder in a vise.
2. Remove the cylinder head (1) with the adjustable gland nut wrench (4).
3. Pull out the piston rod assembly (2) from the cylinder tube (3).

(When reassembling)

- Visually inspect the cylinder tube for signs of scoring or damage.
- Insert the piston rod assembly to the cylinder tube, being careful not to damage the piston seal on the piston.
- Install the cylinder head to the cylinder tube, being careful not to damage the O-ring on the cylinder head.

(1) Cylinder Head
(2) Piston Rod Assembly
(3) Cylinder Tube
(4) Adjustable Gland Nut Wrench

9Y1210946HYS0008US0

Cylinder Head, Piston and Nut

1. Set the od end in a vise.
2. Remove the nut, remove the piston (3) and cylinder head (2) from the piston rod (1).

(When reassembling)

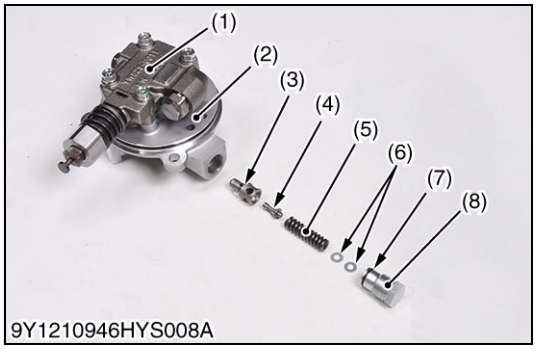
- Visually inspect all parts for signs of scoring or damage.
- Insert the piston rod to the cylinder head, being careful not to damage the wiper seal (5) and oil seal (6).
- Cylinder head apply Loctite 262 to the nut (4).

Tightening torque	Cylinder head	100 to 120 N·m 10.2 to 12.2 kgf·m 73.8 to 88.5 lbf·ft
	Cylinder piston mounting nut	80.0 to 100 N·m 8.16 to 10.1 kgf·m 59.0 to 73.7 lbf·ft

(1) Piston Rod
(2) Cylinder Head
(3) Piston
(4) Nut
(5) Wiper Seal
(6) Oil Seal
(7) Oil Seal

9Y1210946HYS0009US0

(3) Control Valve



Relief Valve and Control Valve

1. Remove the relief valve plug (8), shims (6), spring (5), poppet (4) and seat (3).
2. Remove the control valve (1).

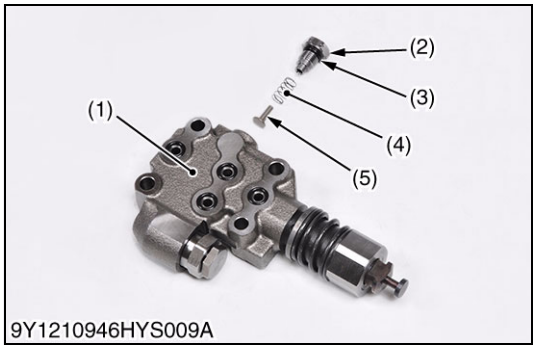
(When reassembling)

- Be careful not to damage the O-ring.

Tightening torque	Relief valve plug	29.4 to 34.3 N·m 3.00 to 3.49 kgf·m 21.7 to 25.2 lbf·ft
	Control valve mounting screw	18 to 21 N·m 1.9 to 2.1 kgf·m 14 to 15 lbf·ft

(1) Control Valve
(2) Control Valve Cover
(3) Seat
(4) Poppet
(5) Spring
(6) Shim
(7) O-ring
(8) Plug

9Y1210946HYS0010US0



Check Valve

1. Remove the plug (2) and remove the spring (4) and poppet (5).
2. Remove the plug (7) and remove the spring (8) and ball (9).
3. Remove the check valve seat (11).

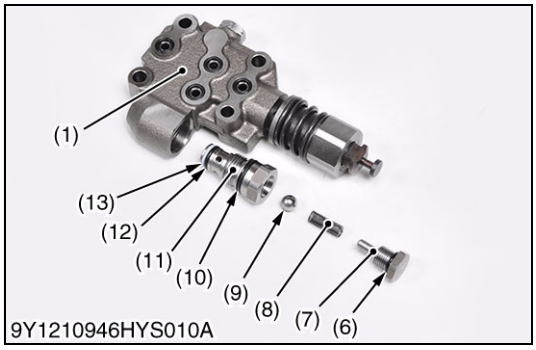
(When reassembling)

- Be careful not to damage the O-ring.

Tightening torque	Check valve plug (2), (7)	19.6 to 24.5 N·m 2.00 to 2.49 kgf·m 14.5 to 18.0 lbf·ft
	Check valve seat (11)	34 to 39 N·m 3.5 to 3.9 kgf·m 25 to 28 lbf·ft

(1) Control Valve
(2) Check Valve Plug
(3) O-ring
(4) Spring
(5) Poppet
(6) O-ring
(7) Check Valve Plug
(8) Spring
(9) Ball
(10) O-ring
(11) Check Valve Seat
(12) O-ring
(13) Back Up Ring

9Y1210946HYS0011US0

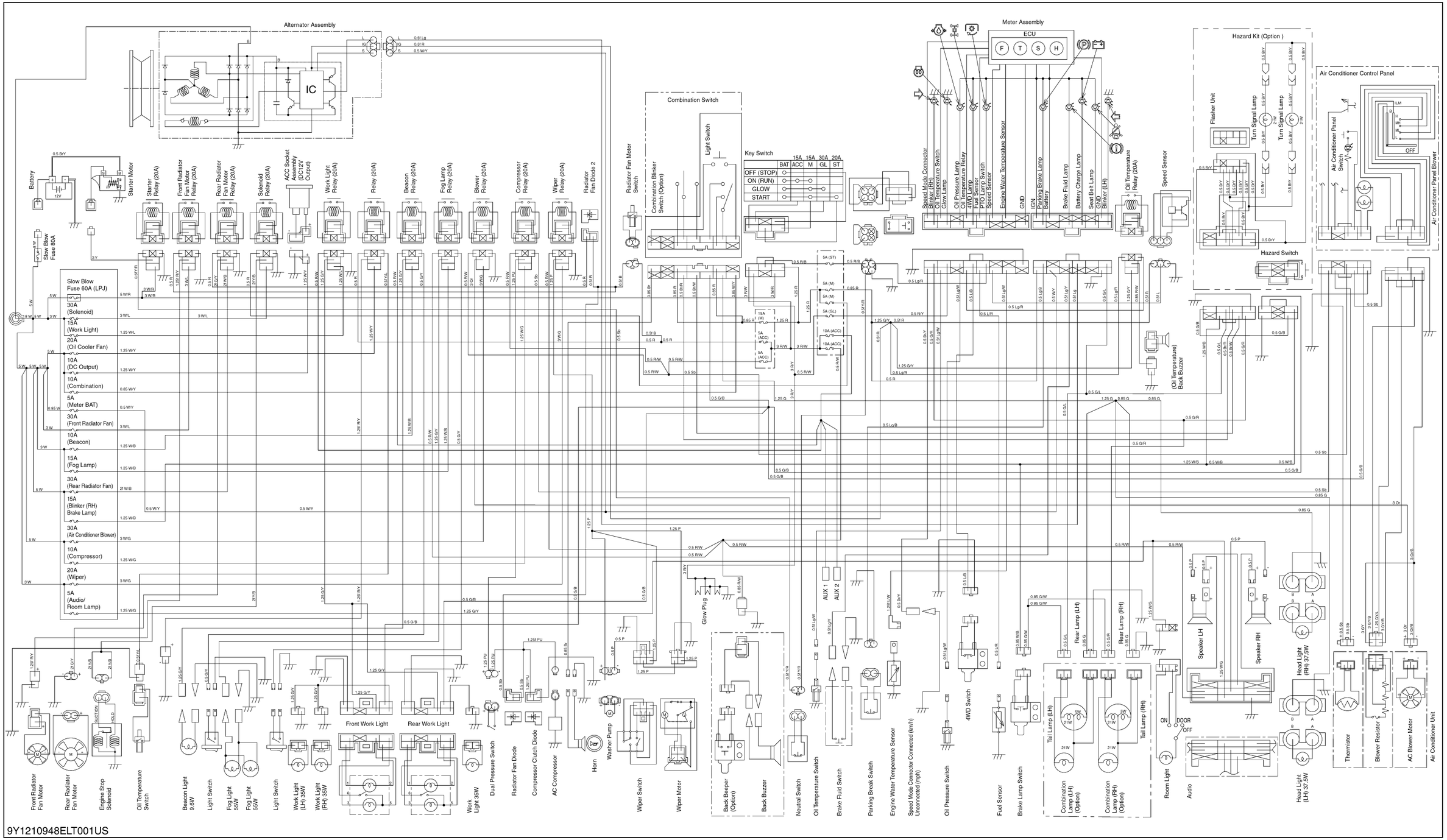


8 ELECTRICAL SYSTEM

MECHANISM

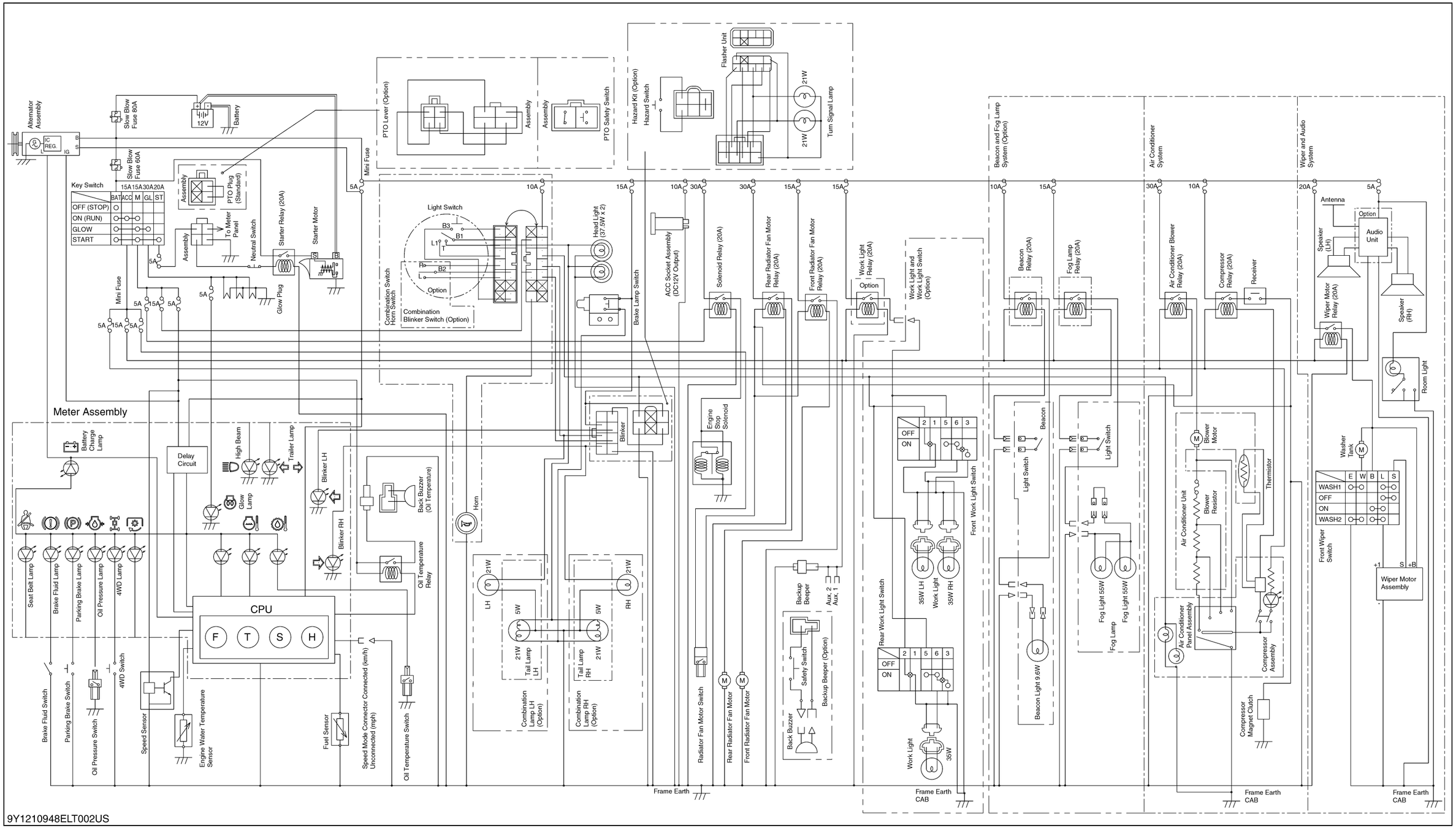
CONTENTS

1. WIRING DIAGRAM



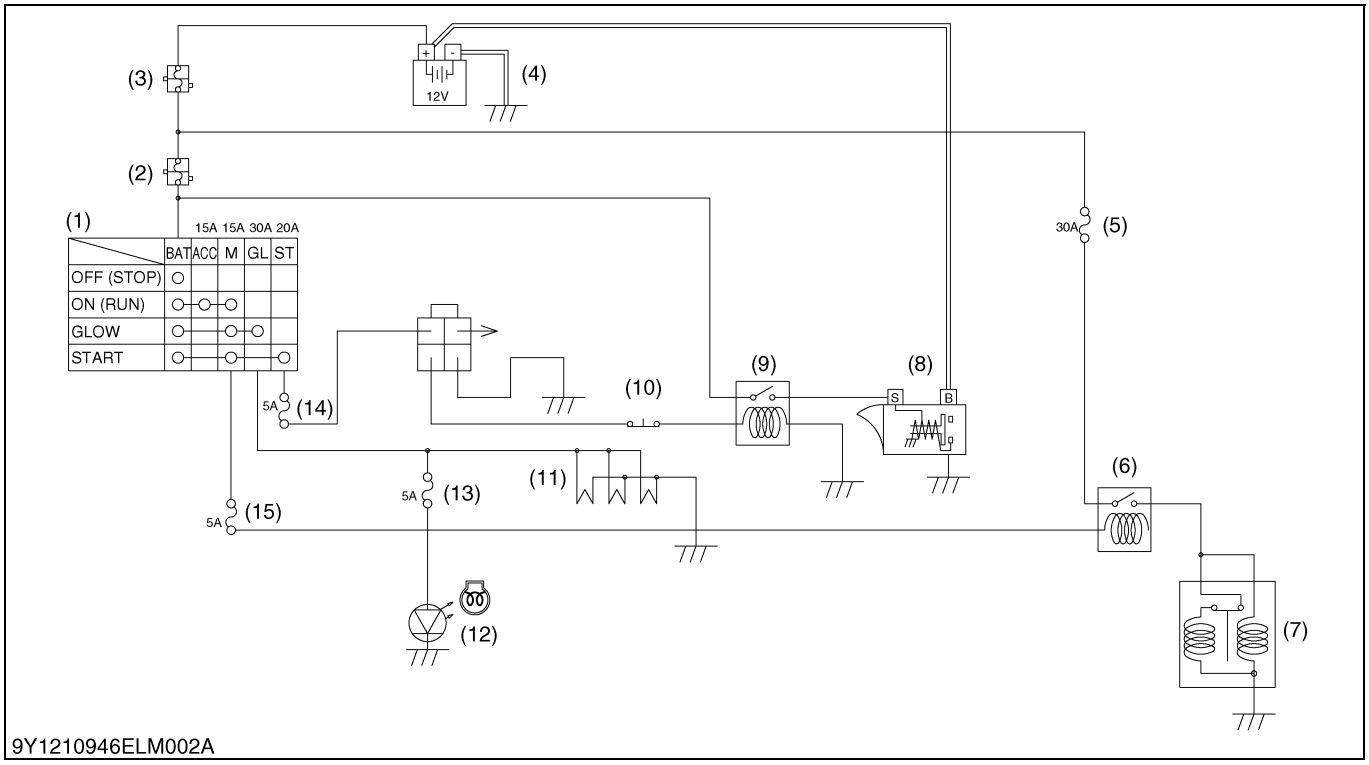
9Y1210948ELT001US

2. ELECTRICAL CIRCUIT



9Y1210948ELT002US

3. STARTING SYSTEM



(1) Key Switch
(2) Slow Blow Fuse (60A)
(3) Slow Blow Fuse (80A)
(4) Battery
(5) Fuse (30A)
(6) Solenoid Relay
(7) Engine Stop Solenoid
(8) Starter Motor
(9) Starter Relay
(10) Safety Switch (Neutral Switch)
(11) Glow Plug
(12) Glow Lamp
(13) Fuse (5A)
(14) Fuse (5A)
(15) Fuse (5A)

When the key switch (1) is turned to the **PREHEAT** position, the terminal **BAT** is connected to the terminals **GLOW** and **ON**. The glow plugs (11) become red-hot, and the preheat indicator lamp also lights on while preheating.

When the key switch is then turned to the **START** position with the safety switch (10) on, the terminal **BAT** is connected to the terminals **ST** and **ON**. Consequently, battery current flows to the starter motor and start the engine.

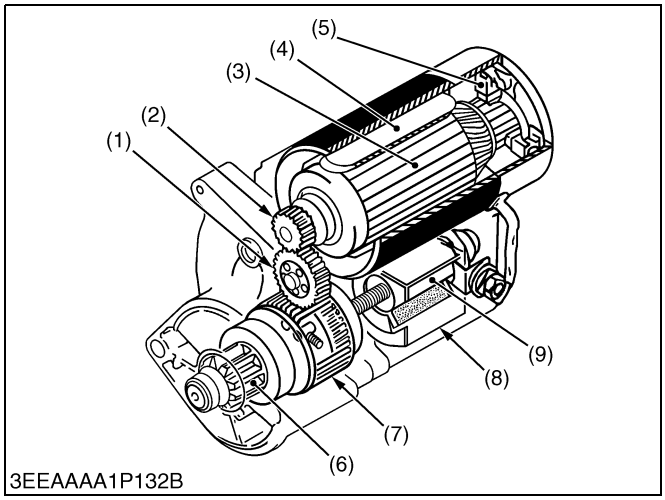
The key switch (1) automatically returns to the **ON** position, the terminal **BAT** is connected only to the terminal **ON**, thereby causing the starting circuit to be opened, stopping the starter motor (8).

When the key switch (1) turned from the **ON** position to the **OFF** position, the engine stop solenoid (7) moves the fuel injection pump control rack to the **"No Fuel Injection"** position and stop the engine.

9Y1210948ELM0008US0

[1] STARTER

(1) Structure

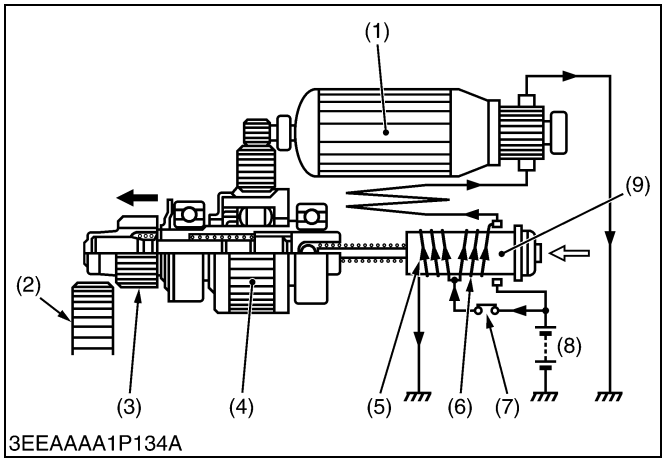


The starter is a reduction type starter with heat-resistant and vibration-resistant features that has a small, high-speed motor, and the revolutions of the armature drive the pinion gear approximately one-third the speed to increase torque.

(1) Idler Gear
(2) Drive Gear
(3) Armature
(5) Field Coil
(6) Brush
(6) Pinion Gear
(7) Overrunning Clutch
(8) Magnetic Switch
(9) Plunger

9Y1210946ELM0007US0

(2) Operation of Starter



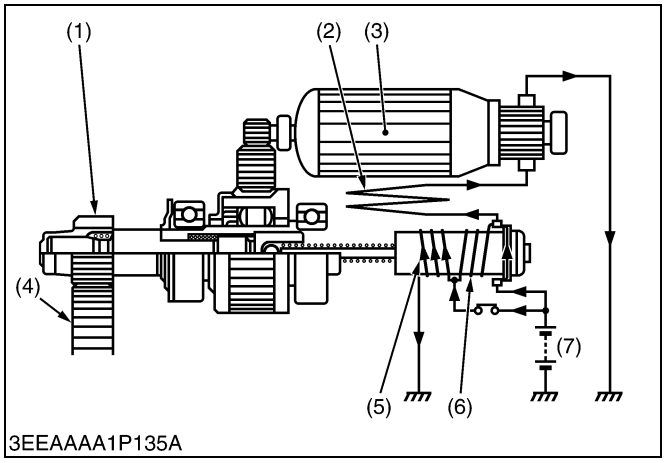
3EEAAAA1P134A

When Key Switch Is Turned to START Position

When key switch (7) is turned to **START** position, current from battery (8) flows to holding coil (5) and pull-in coil (6). The plunger (9) is motivated by magnetism and the pinion gear (3) is pushed out.

(1) Armature
(2) Ring Gear
(3) Pinion Gear
(4) Overrunning Clutch
(5) Holding Coil
(6) Pull-in Coil
(7) Key Switch
(8) Battery
(9) Plunger

9Y1210946ELM0008US0



3EEAAAA1P135A

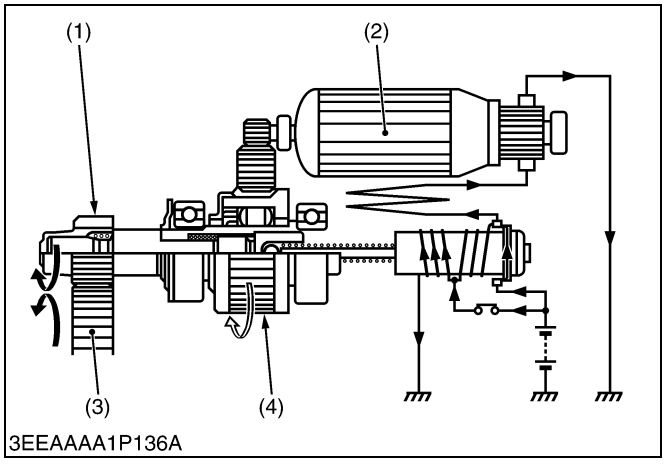
When Pinion Gear Meshes with Ring Gear

When the pinion gear (1) comes into mesh with the ring gear (4) on the flywheel and the magnetic switch is closed, a large current flows from the battery (7) directly into the field coil (2) and armature coil, but not through the pull-in coil (6).

This rotates the armature (3) at a high speed, which in turn drives the ring gear (4) through the pinion gear (1) at 200 to 300 min^{-1} (rpm).

(1) Pinion Gear
(2) Field Coil
(3) Armature
(4) Ring Gear
(5) Holding Coil
(6) Pull-in Coil
(7) Battery

9Y1210946ELM0009US0



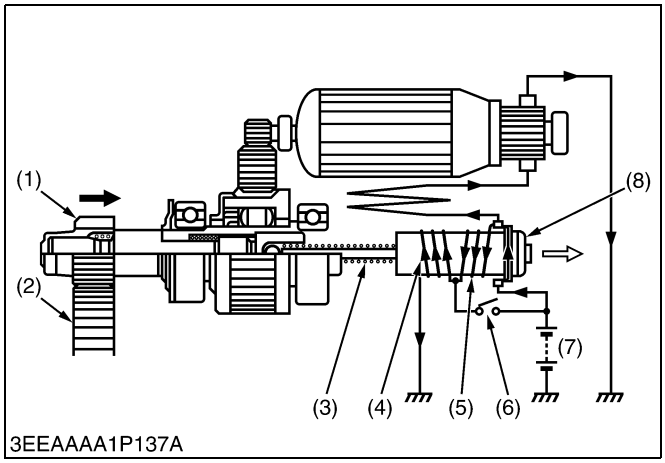
3EEAAAA1P136A

When Engine Has Started

When the engine starts and drives the pinion gear (1) with the ring gear (3), the overrunning clutch (4) disengages to prevent the armature (2) from being driven by the engine.

(1) Pinion Gear
(2) Armature
(3) Ring Gear
(4) Overrunning Clutch

9Y1210946ELM0010US0



3EEAAAA1P137A

When Key Switch Is Released

When releasing the key switch (6), it returns from **START** to **ON** position and the starter circuit opens.

Then, current flows from the battery (7) to the pull-in coil (5) and the holding coil (4) through the contact plate.

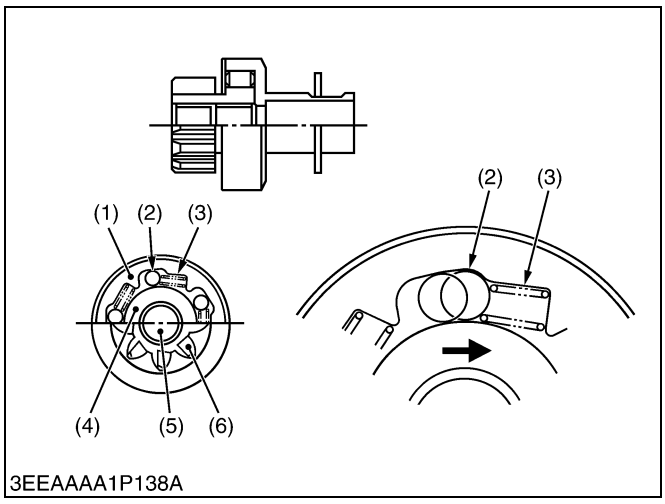
Since the magnetic force is generated in each coil in the opposite direction, the magnetic field collapses and the plunger (8) is returned to its former position by a return spring (3).

This open the contacts on the contact plate and separates the pinion gear (1) from the ring gear (2), whereupon the pinion gear stops rotating.

(1) Pinion Gear
(2) Ring Gear
(3) Return Spring
(4) Holding Coil
(5) Pull-in Coil
(6) Key Switch
(7) Battery
(8) Plunger

9Y1210946ELM0011US0

(3) Overrunning Clutch



3EEAAAA1P138A

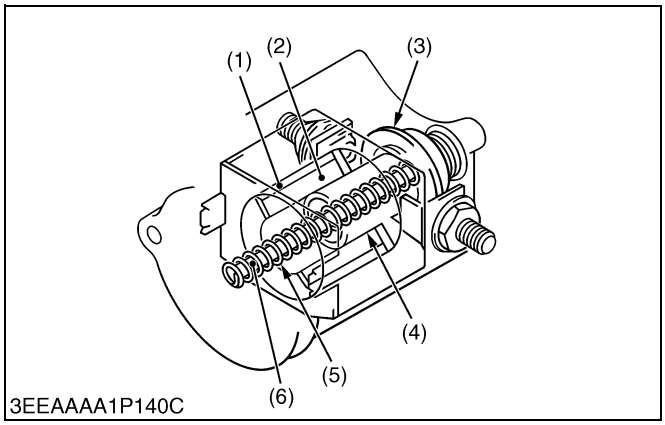
The overrunning clutch is so constructed that the power transmission relationship is automatically severed when the clutch pinion shaft (5) speed exceeds the clutch gear outer (1) speed at increased engine speeds.

Therefore, the armature drives the ring gear and is never driven by the engine.

(1) Clutch Gear Outer
(2) Roller
(3) Roller Spring
(4) Spline Tube Inner
(5) Clutch Pinion Shaft
(6) Pinion Gear

9Y1210946ELM0012US0

(4) Magnetic Switch



3EEAAAA1P140C

The plunger (4), contact plate (3) and plunger shaft (6) are mode as one unit. When the key switch is turned to **START** position, the plunger is drawn in and thus clutch pinion shaft is forced out.

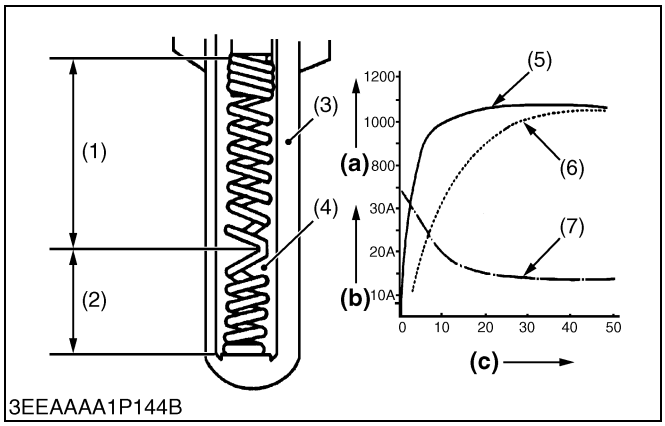
This meshes the pinion gear and ring gear, and causes the contact plate to close the contacts, causing the main current to flow into the armature.

When releasing the key switch, the plunger is returned to its former position by a return spring (5).

(1) Holding Coil
(2) Pull-in Coil
(3) Contact Plate
(4) Plunger
(5) Return Spring
(6) Plunger Shaft

9Y1210946ELM0013US0

[2] GLOW PLUG



3EEAAAA1P144B

Quick Glow System (QGS)

This plug is a two-material type QGS for quick temperature rises, and has self-controlling function as well as excellent durability.

The heater (2) connected in series to the heater which also functions as the resistor, is incorporated in the sheath tube (3) of the super glow plug.

The resistance of this heater (1) cum resistor is small when the temperature is low, while the resistance becomes large when the temperature rises.

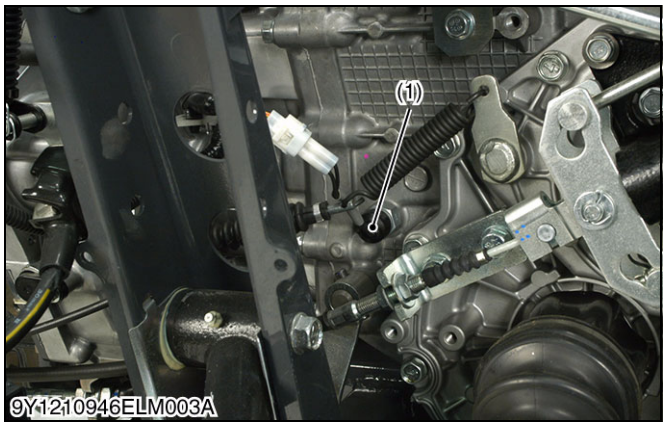
Therefore, because sufficient current is flow to the heater (2) during the initial period of energization, the temperature rise quickly and the resistance grows with the rise quickly and the resistance grows with the rise in the temperature of the resistor, the flowing current is reduced to prevent the heater (2) from being heated.

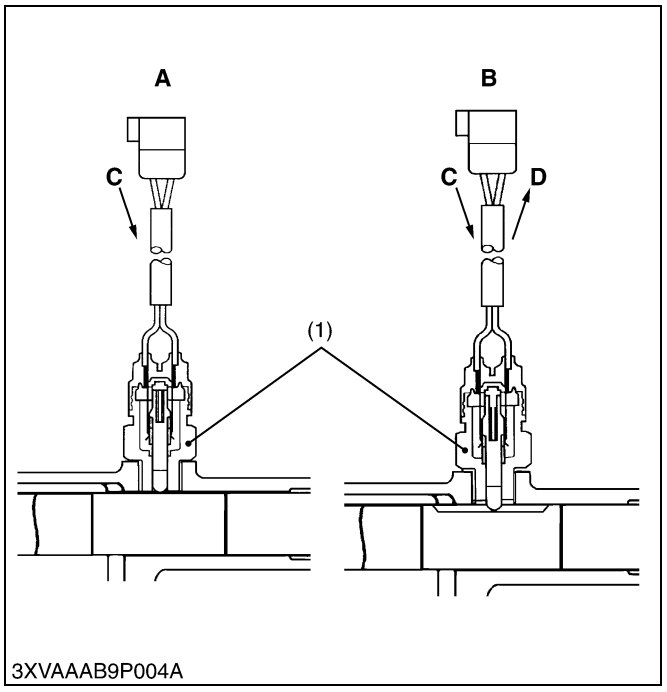
The ignition point is in the area of 2.0 to 3.0 mm (0.079 to 0.11 in.) from the tip of the plug in order to reduce its projection into the combustion chamber.

(1)	Heater also functioning as a Resistor	**(a)**	**Glow Plug Temperature (°C)**
(2)	Heater	**(b)**	**Current (A)**
(3)	Sheath Tube	**(c)**	**Time (Sec.)**
(4)	Insulation Powder		
(5)	Super Glow Plug		
(6)	Conventional Quick Heating Type Glow Plug		
(7)	Glow Plug Current		

9Y1210946ELM0014US0

[3] SAFETY SWITCH (NEUTRAL SWITCH)





The safety switch (1) prevents current from flowing to the starter when the point of contact is released. This is to ensure safe starting.

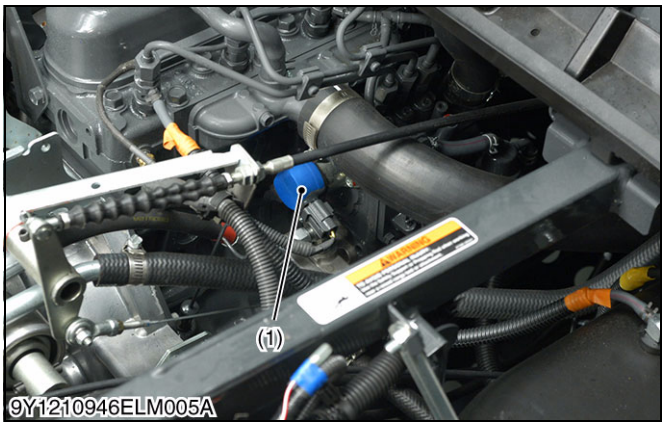
The location of the safety switch is located at the range gear shift lever of the transaxle case.

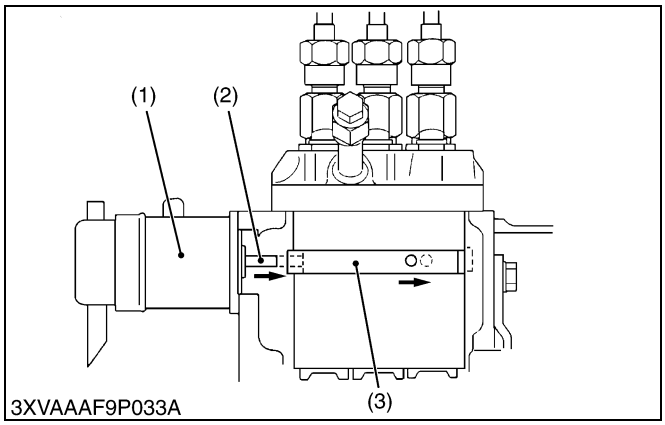
(1) Safety Switch

A: When Shifted
B: When Neutral
C: From Key Switch
D: To Starter

9Y1210946ELM0015US0

[4] ENGINE STOP SOLENOID



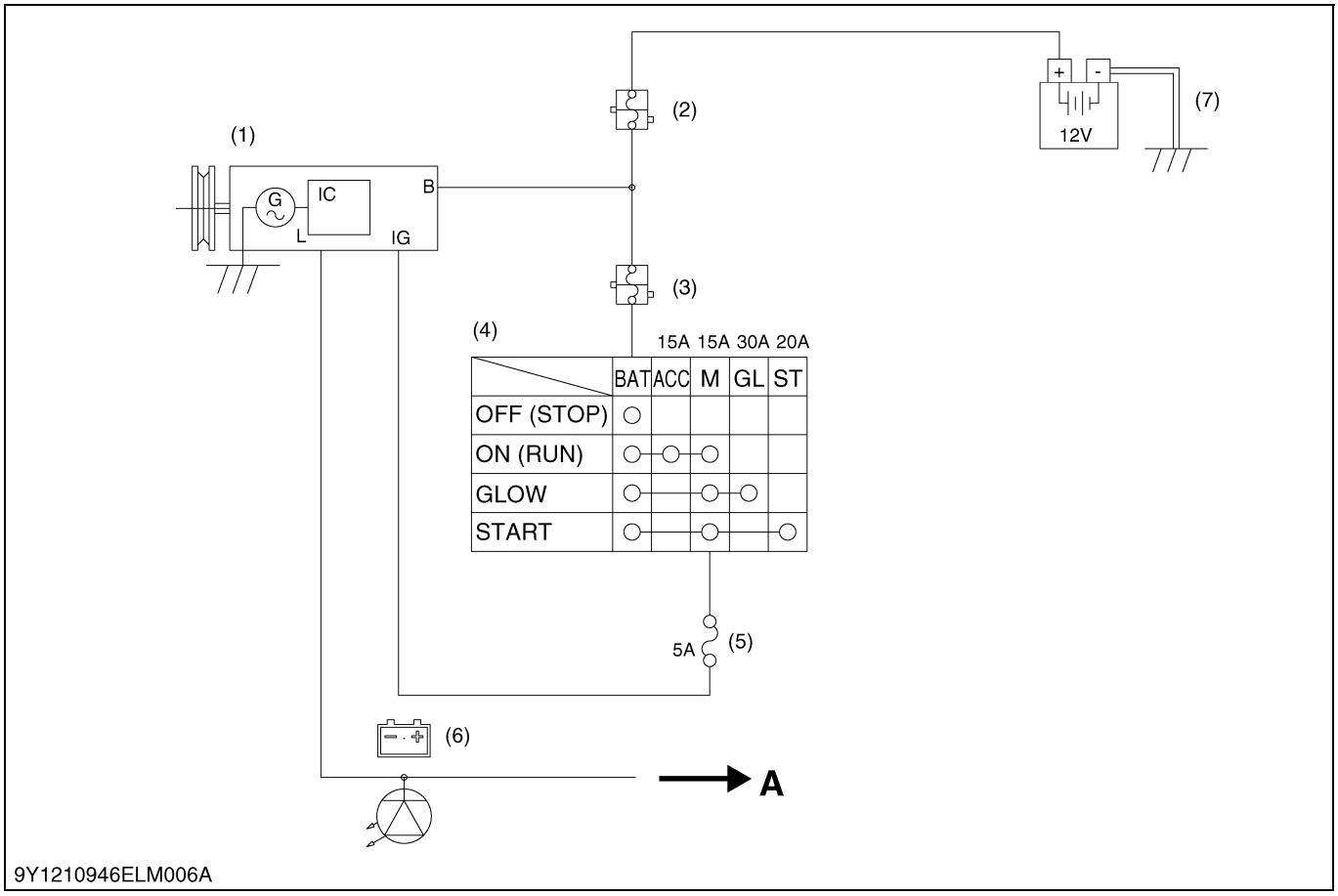


Flowing of the battery current into the stop solenoid (1), the plunger (2) move to left side so that the movement of control rack become free, when the battery current stops, the plunger (2) is returned to the in **"No fuel injection"** position.

(1) Stop Solenoid
(2) Plunger
(3) Control Rack

9Y1210946ELM0017US0

4. CHARGING SYSTEM



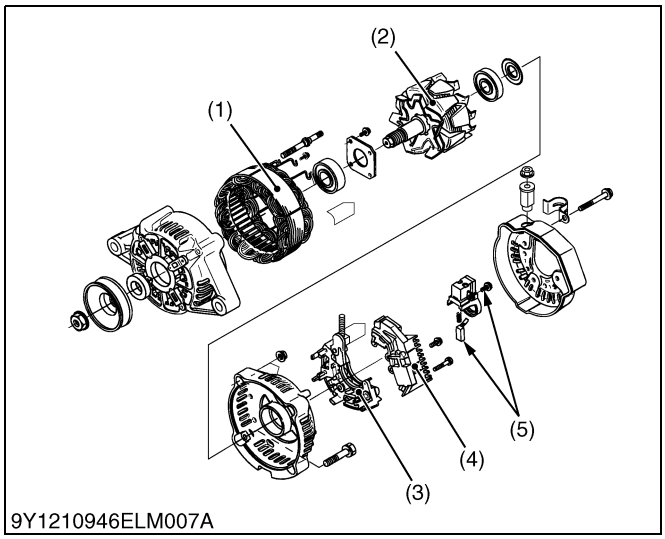
(1) Alternator
(2) Slow Blow Fuse (80A)
(3) Slow Blow Fuse (60A)
(4) Key Switch
(5) Fuse
(6) Battery Charge Lamp
(7) Battery
A: To Panel

The charging system supplies electric power for various electrical devices and also charges the battery while the engine runs.

This alternator has IC regulator.

9Y1210948ELM0009US0

[1] ALTERNATOR



9Y1210946ELM007A

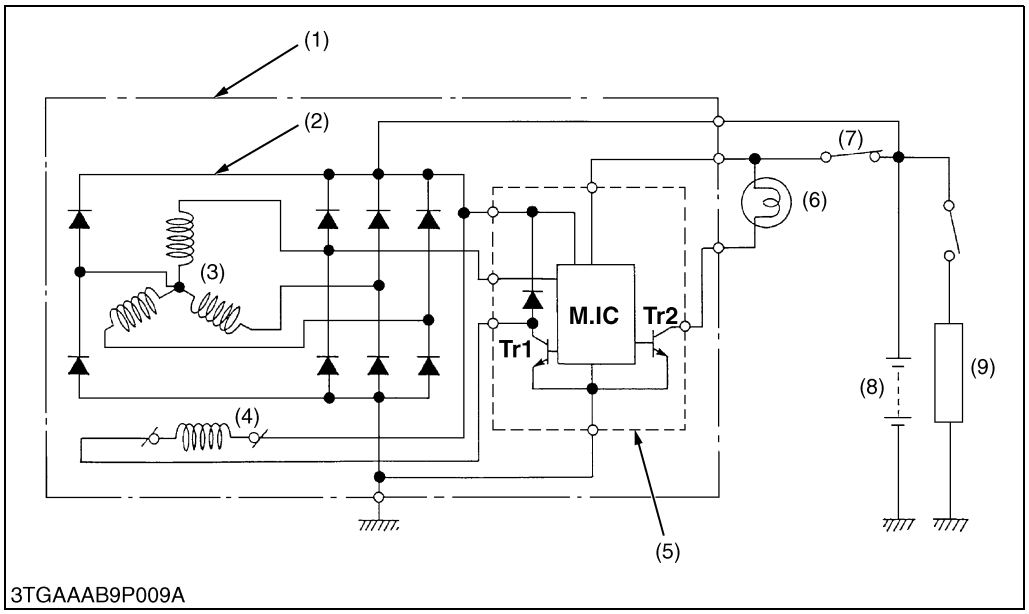
A compact alternator with an IC regulator is used, having the following characteristics:

- Approximately 26 % lighter and 17 % smaller than a standard alternator.
- Cooling performance and safety have been improved by combining the cooling fan with the rotor and incorporating the fan / rotor unit inside the alternator.
- IC regulator is fitted inside the alternator.
- The rectifier, IC regulator and similar components are easy to remove, making it easier to service the alternator.

(1) Stator
(2) Rotor
(3) Rectifier
(4) IC Regulator
(5) Brush Holder

9Y1210946ELM0019US0

[2] IC REGULATOR



3TGAAAB9P009A

(1) Alternator
(2) Rectifier
(3) Stator Coil
(4) Rotor Coil
(5) IC Regulator
(6) Charge Lamp
(7) Key Switch
(8) Battery
(9) Load

An IC regulator uses solid state transistors, chips or other semiconductor elements instead of the relays in a conventional regulator. Stable characteristics are achieved by cutting off the field current. IC regulators have the following characteristics.

- The control voltage does not change over time, so the need for readjustment is eliminated. Since there are no moving parts, IC regulators are extremely durable and resistant to vibration.
- The overheat compensation characteristics ensure that the control voltage is reduced as the temperature rises, so the battery is charged at just the right level.

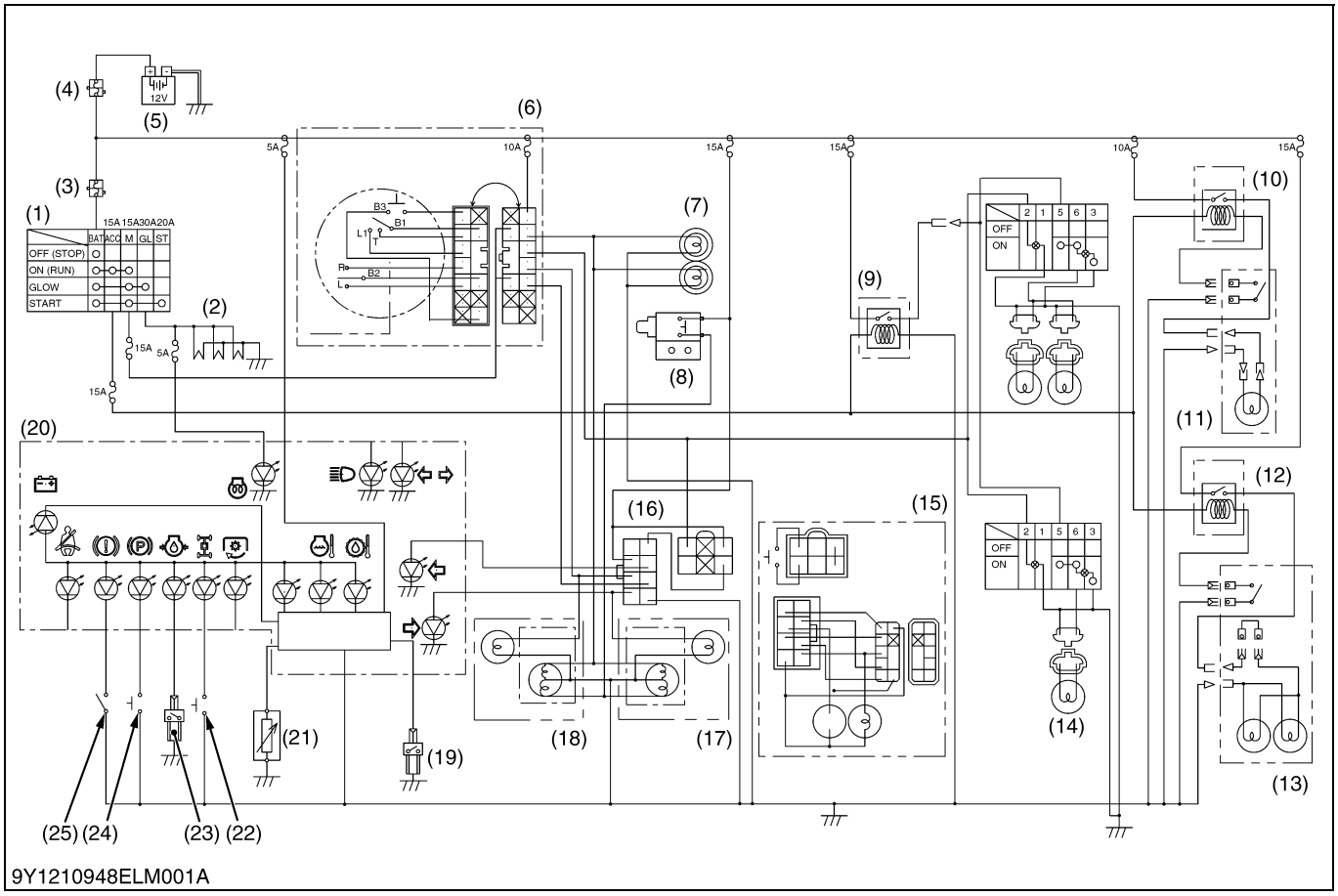
  The internal circuitry of the IC regulator is shown in the diagram. It consists of a hybrid IC incorporating a monolithic IC. (The internal circuitry of the monolithic IC is extremely complex, so it is shown as simply **"M.IC circuit"**.)

  Tr1 acts as the contacts controlling the field current, and **Tr2** acts as the charge lamp relay controlling the flashing of the charge lamp.

The M.IC circuit controls **Tr1** and **Tr2**, and monitors the alternator output voltage, and detects any drop in **L** terminal voltage or breaks in the rotor coil.

9Y1210946ELM0020US0

5. LIGHTING SYSTEM



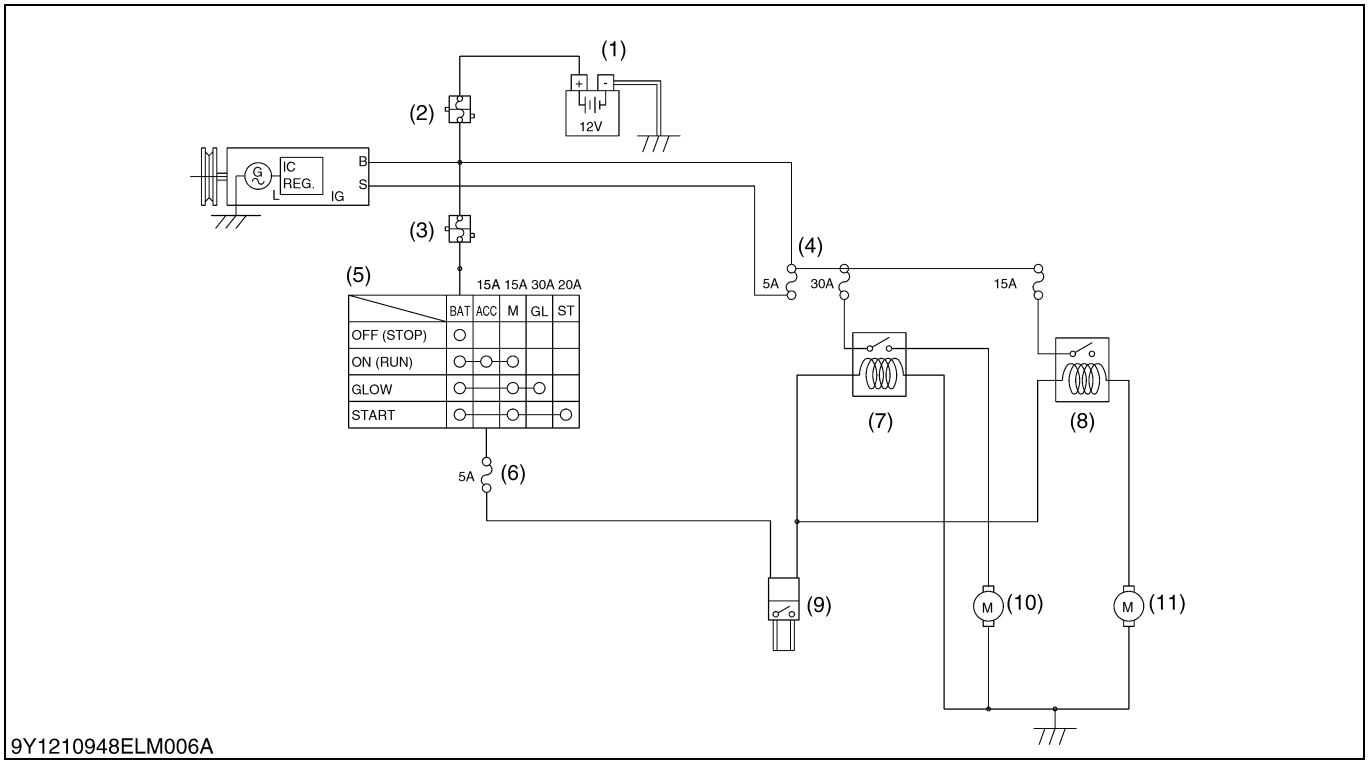
9Y1210948ELM001A

(1) Key Switch
(2) Glow Plug
(3) Slow Blow Fuse (60A)
(4) Slow Blow Fuse (80A)
(5) Battery
(6) Light Switch
(7) Head Light (37.5W)
(8) Brake Lamp Switch
(9) Work Light Relay (Option)
(10) Beacon Lamp Relay
(11) Beacon Lamp (Option)
(12) Fog Lamp Relay
(13) Fog Lamp (Option)
(14) Work Light (35W)
(15) Hazard Kit (Option)
(16) Blinker
(17) Combination Lamp (RH) (Option)
(18) Combination Lamp (LH) (Option)
(19) Oil Temperature Switch
(20) Meter Panel
(21) Engine Water Temperature Sensor
(22) 4WD Switch
(23) Oil Pressure Switch
(24) Parking Brake Switch
(25) Brake Fluid SWitch

The lighting system consists of key switch, light switch, head lights, tail lights, etc.

9Y1210948ELM0003US0

6. COOLING SYSTEM

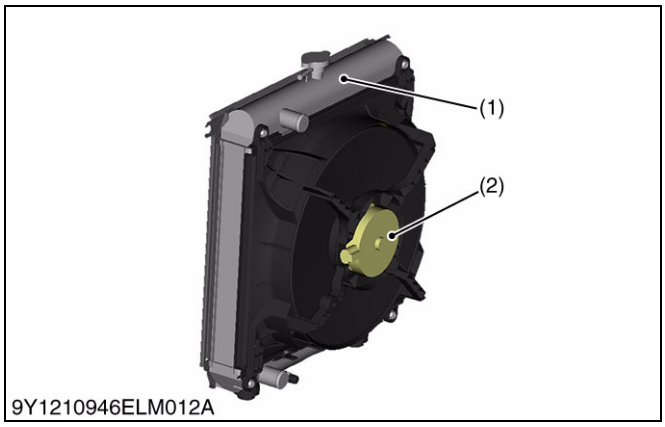


(1) Battery
(2) Slow Blow Fuse (80A)
(3) Slow Blow Fuse (60A)
(4) Fuse
(5) Key Switch
(6) Fuse (5A)
(7) Rear Radiator Fan Motor Relay
(8) Front Radiator Fan Motor Relay
(9) Radiator Fan Motor Switch
(10) Rear Radiator Fan Motor
(11) Front Radiator Fan Motor

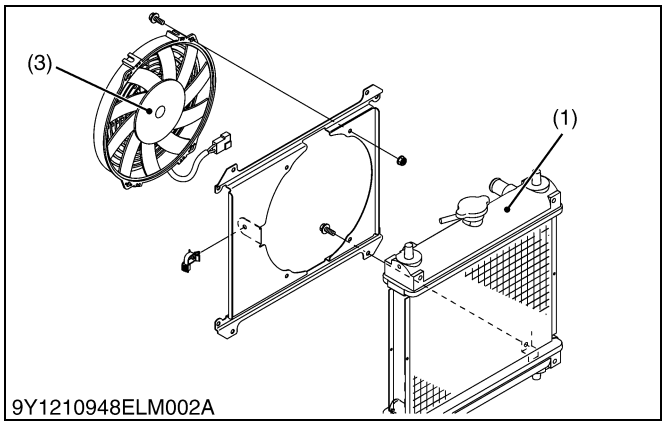
The cooling system consists of radiator fan motor switch, relay, fan motor, etc.

9Y1210948ELM0010US0

[1] FAN MOTOR



9Y1210946ELM012A



9Y1210948ELM002A

The cooling fan of this vehicle is not driven by the engine drive but an electric motor.

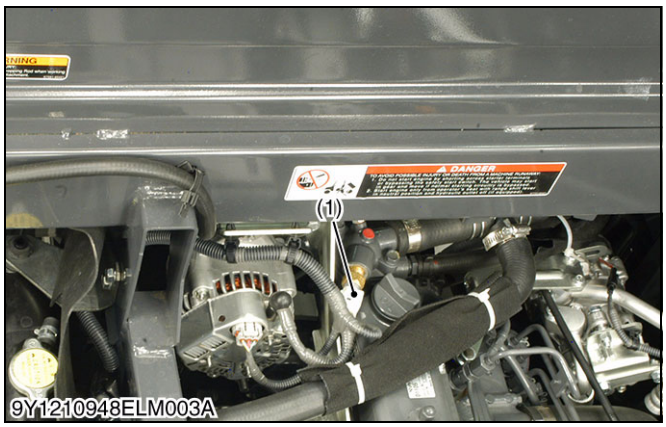
An electric fan can be installed by separating from the engine.

And, it can be operated when it is necessary.

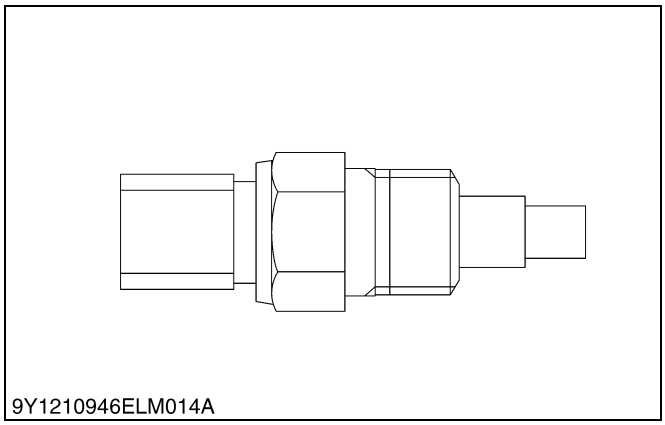
(1) Radiator
(2) Front Radiator Fan Motor
(3) Rear Radiator Fan Motor

9Y1210948ELM0004US0

[2] RADIATOR FAN MOTOR SWITCH



9Y1210948ELM003A


9Y1210946ELM014A

The radiator fan motor switch is installed to the water flange of engine, and its tip is in touch with the coolant.

The fan motor rotates when the radiator fan motor goes up more than the specified value.

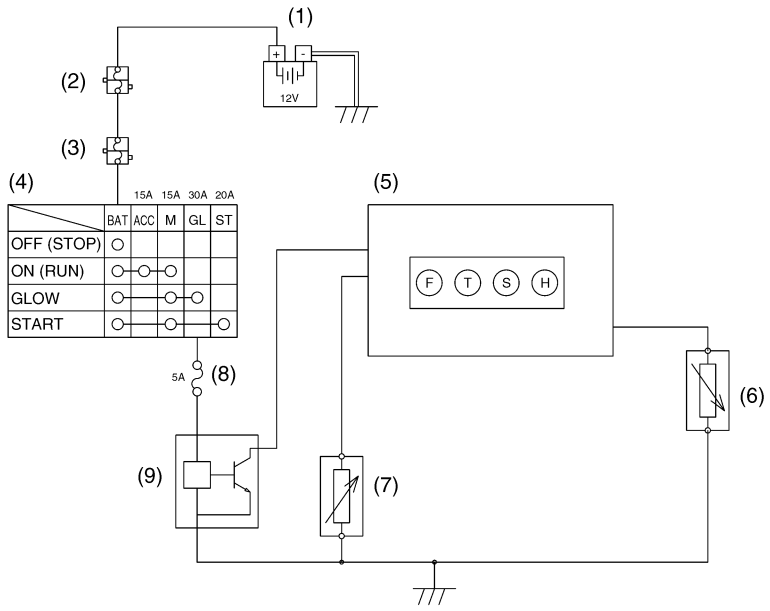
When the radiator fan motor falls below the specified value, the fan motor stops.

Characteristics of Radiator Fan Motor Switch		
Type	Operation Temperature	
	Fan motor rotate	Fan motor stop
Normally open	87 to 93 °C 189 to 199 °F	83 °C 181 °F

(1) Radiator Fan Motor Switch

9Y1210948ELM0005US0

7. GAUGES



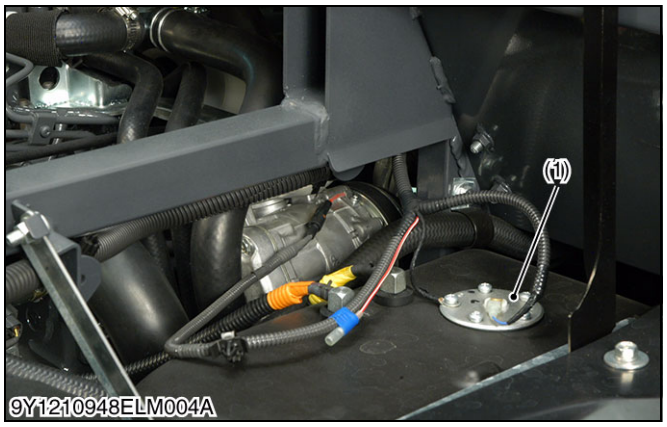
9Y1210946ELM015A

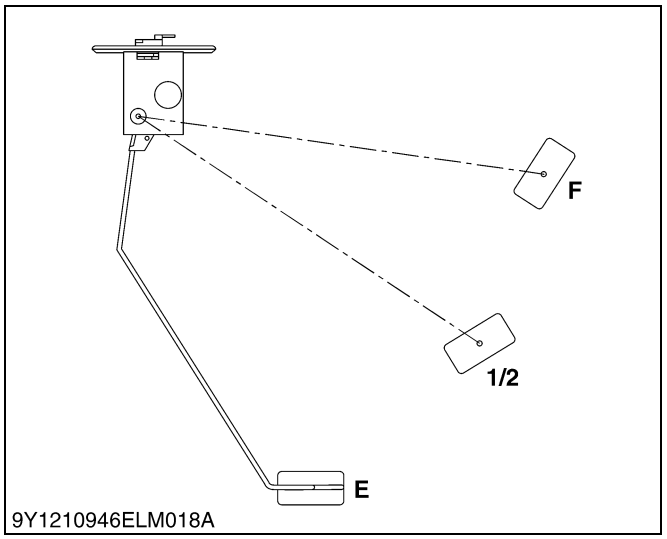
(1) Battery
(2) Slow Blow Fuse (60A)
(3) Slow Blow Fuse (80A)
(4) Key Switch
(5) Meter Panel (CPU)
(6) Fuel Sensor
(7) Engine Water Temperature Sensor
(8) Fuse (5A)
(9) Speed Sensor

The fuel quantity and engine water temperature sensor are indicated by the ammeters. The ammeters indicate each amperage flowing through the fuel level sensor for the fuel quantity detection and through the engine water temperature sensor for the engine water temperature sensor temperature detection.

9Y1210948ELM0011US0

[1] FUEL QUANTITY





Fuel

The remaining fuel quantity is detected by the fuel level sensor installed in the fuel tank and indicated on the fuel gauge. For detection, a float and a resistor are used.

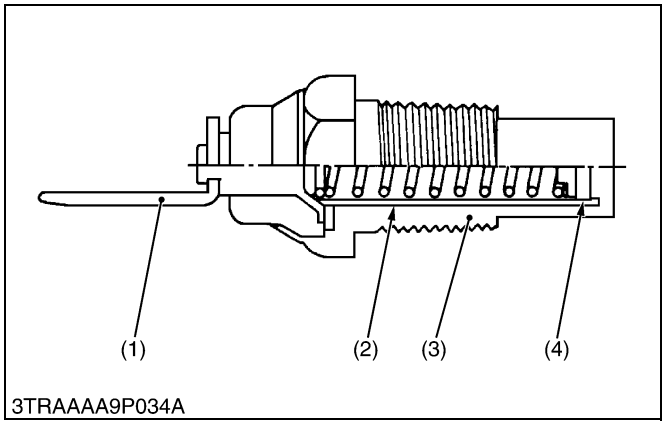
As the float lowers, the resistance of the variable resistor varies. The relation between the amount of fuel and the resistance is as follows.

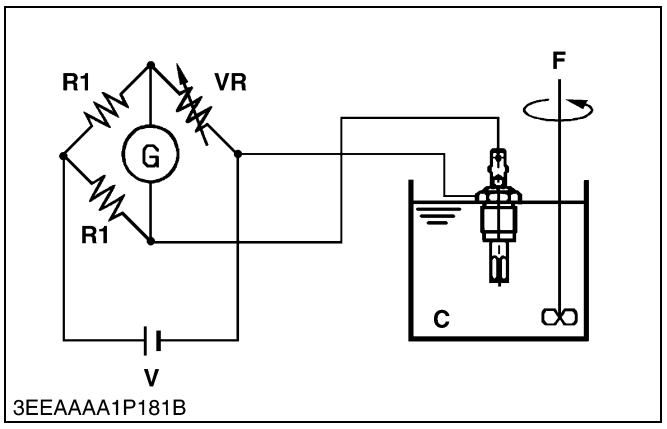
F	1/2	E
1 to 5 Ω	32.5 Ω	103 to 117 Ω

(1) Fuel Level Sensor

9Y1210948ELM0006US0

[2] ENGINE WATER TEMPERATURE SENSOR





Engine Water Temperature Sensor (Thermo Unit)

The engine water temperature sensor is installed to the cylinder head of engine, and its tip is in touch with the coolant. It contains a thermistor (4) whose electrical resistance decreases as the temperature increases.

Current varies with changes in the coolant temperature, and the increases or decreases in the current move the pointer of gauge.

Characteristics of Thermistor		
Temperature	**Resistance of VR: H**	**Condition**
50 °C (122 °F)	153.9 Ω	(A)
80 °C (176 °F)	51.9 Ω	
100 °C (212 °F)	27.4 Ω	
120 °C (248 °F)	16.1 Ω	

★ When galvanometer shows 0 (Zero).

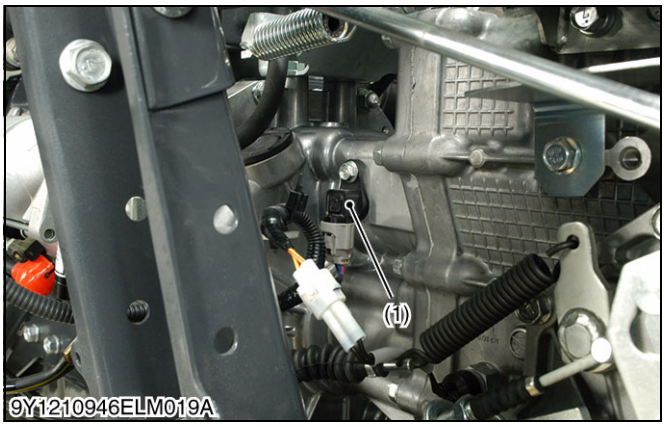
Condition	Setting Value
(A)	**R1**: 54.945 to 55.055 Ω **V**: DC 6.9 to 7.1 V

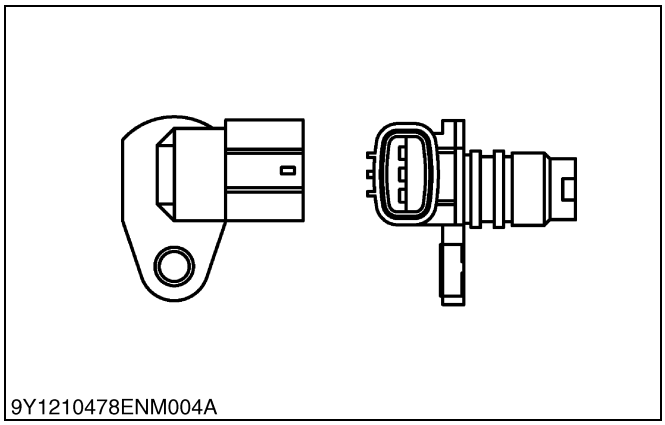
(1) Terminal
(2) Insulator
(3) Body
(4) Thermistor

C: Coolant or Silicon Oil
G: Galvanometer
VR: Variable Resistor
F: Flow Velocity (0.14 to 0.15 m/s)

9Y1210946ELM0030US0

[3] TRAVELING SPEED SENSOR





Measure the traveling speed with the rotation sensor at the left side of the transmission case.

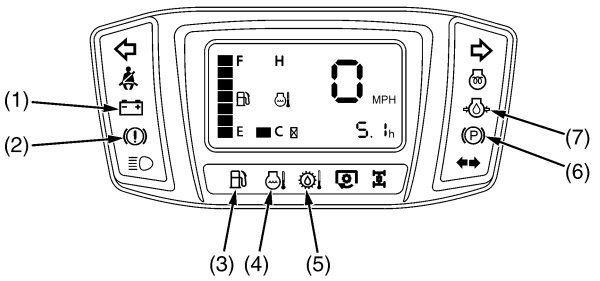
The sensor unit is a MRE (magnetic resistance element) type. For the MRE type, when the pulsar passes the sensor, the magnetic resistance changes and the voltage passing through the sensor changes. This change in voltage is amplified by the internal IC circuit and output to the engine ECU.

(1) Traveling Speed Sensor

9Y1210946ELM0031US0

8. METER PANEL

[1] EASY CHECKER™



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If the warning in the Easy Checker™ come on during operation, immediately stop the engine, and find the cause as shown below.

■ **Engine Oil Pressure WARNING Indicator**

If the oil pressure in the engine goes below the prescribed level, the warning lamp in the Easy Checker™ will come on.

■ **Electrical charge WARNING Indicator**

If the alternator in not charging the battery, the Easy Checker™ will come on.

If this should happen during operation, check the electrical charging system.

■ **Low Brake Level WARNING Indicator**

If the brake fluid goes below the prescribed level, the warning lamp in the Easy Checker™ will come on.

If this should in no oil leak in the brake system, and then add Dot3 brake fluid.

■ **VHT Oil Temperature WARNING Indicator**

If the HST temperature goes up above 123 °C (253 °F), and the temperature lasts for 5 seconds, the warning lamp in the Easy Checker™ will come on and the buzzer will sound.

If the HST temperature decrease below 116 °C (241 °F) and the temperature lasts for 5 seconds, the warning lamp in the Easy Checker™ and the buzzer will turn off.

■ **Parking Brake WARNING Indicator**

If the parking brake indicator is on during operation, release the parking brake lever immediately.

The parking brake indicator in the Easy Checker™ comes on if the parking brake is applied.

■ **Engine Overheat WARNING Indicator**

If the coolant temperature goes up above 120 °C (248 °F), and the temperature lasts for 5 seconds, the warning lamp in the Easy Checker™ will come on and the buzzer will sound.

If the coolant temperature decrease below 115 °C (239 °F) and the temperature lasts for 5 seconds, the warning lamp in the Easy Checker™ and the buzzer will turn off.

■ **Fuel level Indicator**

If the fuel in the tank goes below the prescribed level (approx. 3.0 L, 0.79 U.S.gals, 0.66 Imp.gals).

(1) Charge Lamp
(2) Brake Fluid Lamp
(3) Fuel Lamp
(4) Overheat Lamp
(5) VHT Oil Temperature Lamp
(6) Parking Brake Lamp
(7) Engine Oil Pressure Lamp

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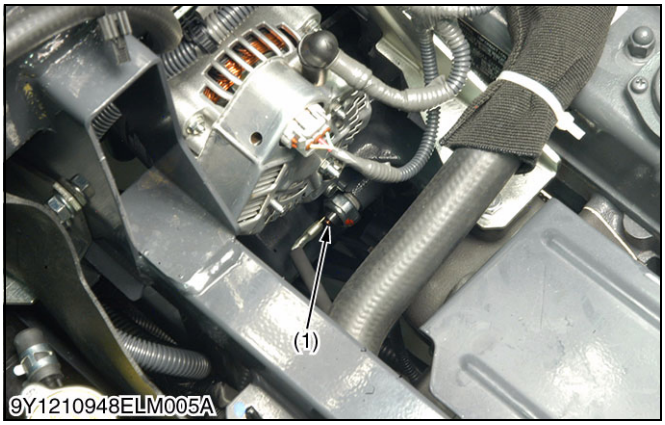

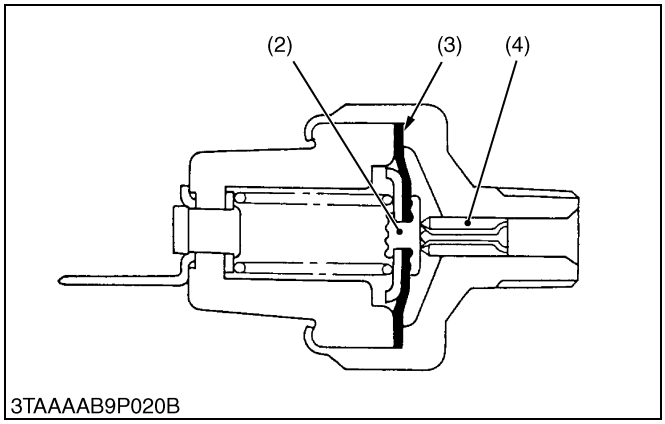

Oil Pressure Switch

While oil pressure is high and the force applied to the diaphragm (3) is larger than the spring tension, the terminal contact (2) is open separated from the body contact (4). If the pressure drops below approx. 49 kPa (0.5 kgf/cm^2, 7.1 psi), the contact closes.

(1) Oil Pressure Switch
(2) Terminal Contact
(3) Diaphragm
(4) Body Contact

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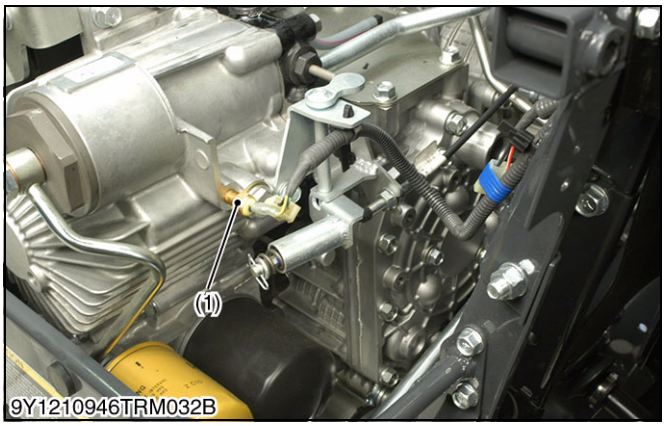

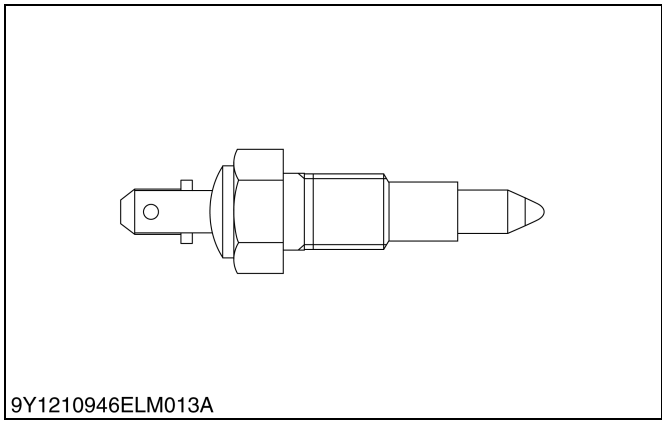

Oil Temperature Switch

The oil temperature switch is installed to the left side of HST, and its tip is in touch with the fluid.

The VHT oil overheated, the warning lamp in the Easy Checker™ will come on and the buzzer will sound.

When oil temperature decrease below specified value, the warning lamp in Easy Checker™ and the buzzer will turn off.

Characteristics of VHT Oil Temperature Switch		
Type	Operation Temperatures	
	Lamp and Buzzer ON	Lamp and Buzzer OFF
Normally open	120 to 126 °C 248 to 25 °F	116 °C 241 °F

(1) Oil Temperature Switch

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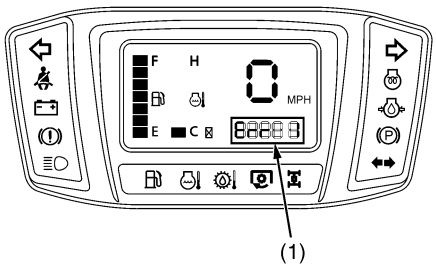
[2] ERROR CODE DISPLAY



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If trouble should occur at the meter panel, the indicator flashes and error code appears as a warning.

If the trouble is not corrected by restarting the machine, solve the problem according to the following table.

(1) Error Code

Error code	Trouble	Check point or solution
Err 1	Water temperature sensor power circuit trouble	Checking battery voltage or replacing meter panel
Err 2	Fuel sensor power circuit trouble	Checking battery voltage or replacing meter panel
Err 3	Meter panel memory reading trouble	Replacing meter panel

9Y1210946ELM0035US0

SERVICING

CONTENTS

1. TROUBLESHOOTING

Symptom	Probable Cause	Solution	Reference Page
All Electrical Equipments Does Not Operate	Battery discharged or damaged	Recharge or replace	G-34, 8-S8
	Battery positive cable disconnected or improperly connected	Repair or replace	8-S7
	Battery negative cable disconnected or improperly connected	Repair or replace	8-S7
	Slow blow fuse blown	Replace	G-58
Fuse Blown Frequently	Short-circuited	Repair or replace	G-56

BATTERY

Symptom	Probable Cause	Solution	Reference Page
Battery Discharges Too Quickly	Battery damaged	Replace	8-S8
	IC Regulator damaged	Replace	8-S28
	Wiring harness disconnected or improperly connected	Repair or replace	–
	Alternator fan belt slipping	Adjust tension	G-36

STARTING SYSTEM

Symptom	Probable Cause	Solution	Reference Page
Starter Motor Does Not Work	Battery discharged or damaged	Recharge or replace	8-S8
	Slow blow fuse blown	Replace	G-58
	Safety switch improperly adjusted or damaged	Repair or replace	8-S12
	Wiring harness disconnected or improperly connected	Repair or replace	–
	Starter motor damaged	Repair or replace	8-S26
	Key switch damaged	Repair or replace	8-S9
Engine Does Not Stop When Key Switch Is Turned Off Position	Fuse blown (5A)	Replace	G-56
	Wiring harness disconnected or improperly connected	Repair or replace	–
	Engine stop solenoid damaged	Replace	8-S13
	Key switch damaged	Replace	8-S9
Starter Works and Engine Does Not Start	Engine stop solenoid damaged	Replace	8-S13

CHARGING SYSTEM

Symptom	Probable Cause	Solution	Reference Page
Charging Lamp Does Not Light When Key Switch Is Turned ON Position	Fuse blown (5A)	Replace	G-56
	Wiring harness disconnected or improperly connected	Repair or replace	–
	Alternator damaged	Repair or replace	8-S28
Charging Lamp Does Not Go Off When Engine Is Running	Short curcuit between alternator **L** terminal lead and chassis	Repair or replace	–
	Alternator damaged	Repair or replace	8-S28

LIGHTING SYSTEM

Symptom	Probable Cause	Solution	Reference Page
Head Light Does Not Light	Fuse blown (15A)	Replace	G-56
	Light switch damaged	Replace	8-S16
	Bulb blown	Replace	G-58
	Wiring harness disconnected or improperly connected	Repair or replace	–
Tail Light Does Not Light	Fuse blown (15A)	Replace	G-56
	Bulb blown	Replace	G-58
	Wiring harness disconnected or improperly connected	Repair or replace	–
Glow Indicator Lamp Does Not Light When Key Switch Is in Glow Position	Battery discharged or damaged	Recharge or replace	8-S8
	Slow blow fuse blown	Replace	G-58
	Wiring harness disconnected or improperly connected	Repair or replace	–
	Key switch damaged	Replace	8-S9
Parking (Position) Light Does Not Light	Fuse blown (15A)	Replace	G-56
	Parking brake light switch damaged	Repair or replace	8-S18
	Wiring harness disconnected or improperly connected	Repair or replace	–

ENGINE OIL PRESSURE

Symptom	Probable Cause	Solution	Reference Page
Oil Pressure Lamp Lights Up When Engine Is Running	Engine oil pressure too low	Check and repair	1-S13
	Engine oil insufficient	Fill	G-24
	Oil pressure switch damaged	Replace	8-S17
	Short circuit between oil pressure switch lead and chassis	Repair	–
Oil Pressure Lamp Does Not Light When Key Switch Is Turned ON and Engine Is Not Running	Oil pressure switch damaged	Replace	8-S17
	Wiring harness disconnected or improperly connected	Repair or replace	–

COOLING SYSTEM

Symptom	Probable Cause	Solution	Reference Page
Fan Motor Does Not Rotate When Engine Overheats	Radiator fan motor switch damaged	Replace	8-S21
	Fuse blown (30A)	Replace	G-56
	Radiator fan motor relay damaged	Replace	8-S25
	Wiring harness disconnected or improperly connected	Repair or replace	–
	Radiator fan motor damaged	Replace	8-S22, 8-S22
	Battery discharged or damaged	Recharge or replace	8-S8
Fan Motor Rotates Always (When Key Switch Is ON Position)	Radiator fan motor switch damaged	Replace	8-S21
	Radiator fan motor relay damaged	Replace	8-S25

GAUGES

Symptom	Probable Cause	Solution	Reference Page
Fuel Gauge Does Not Function	Fuel gauge damaged	Replace the panel	–
	Fuel level sensor damaged	Replace	8-S23
	Wiring harness disconnected or improperly connected	Repair or replace	–
Engine Water Temperature Sensor Gauge Does Not Function	Engine water temperature sensor gauge damaged	Replace the panel	–
	Engine water temperature sensor damaged	Replace	8-S24
	Wiring harness disconnected or improperly connected	Repair or replace	–

HORN

Symptom	Probable Cause	Solution	Reference Page
Horn Does Not Sound When Horn Button Is Pushes	Fuse blown (10A)	Replace	G-56
	Horn switch damaged	Replace	8-S25
	Horn damaged	Replace	–
	Wiring harness disconnected or improperly connected	Repair or replace	–

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2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Battery	Voltage	More then 12 V	–
	Potential Difference	Less than 0.1 V	–
	Charging Current	10 to 15A	–
	Charging Voltage	140 to 15A	–
	Dynamo speed	5200 min^{-1} (rpm)	–
Glow Plug	Resistance	Approx. 1.1 Ω	–
Alternator	No-load Voltage	More then 14 V	–
• Stator	Resistance	Less than 0.1 Ω	–
• Rotor	Resistance	2.9 Ω	–
• Slip Ring	O.D.	14.4 mm 0.567 in.	14.0 mm 0.551 in.
• Brush	Length	10.5 mm 0.413 in.	8.4 mm 0.331 in.
Thermo Switch	Working Temperature	120 to 126 °C 24.80 to 258.8 °F	–
Starter			
• Commutator	O.D.	30.0 mm 1.181 in.	29.0 mm 1.142 in.
• Commutator	Difference of O.D.'s	Less than 0.02 mm 0.0008 in.	0.05 mm 0.0020 in.
• Mica	Undercut	0.50 to 0.80 mm 0.020 to 0.031 in.	0.2 mm 0.008 in.
• Brush	Length	14.0 mm 0.551 in.	9.0 mm 0.35 in.

9Y1210948ELS0002US0

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-12.)

Item	N·m	kgf·m	lbf·ft
Starter (**B** terminal nut)	5.9 to 11	0.60 to 1.2	4.4 to 8.6
Alternator (Pulley nut)	58.4 to 78.9	5.96 to 8.04	43.1 to 58.1

9Y1210948ELS0003US0

4. CHECKING, DISASSEMBLING AND SERVICING

CAUTION

- **To avoid accidental short circuit, be sure to attach the positive cable to the positive terminal before the negative cable is attached to the negative terminal.**
- **Never remove the battery cap while the engine is running.**
- **Keep electrolyte away from eyes, hands and clothes. If you are spattered with it, wash it away completely with water immediately.**
- **Keep open sparks and flames away from the battery at all times. Hydrogen gas mixed with oxygen becomes very explosive.**

IMPORTANT

- **If the machine is to be operated for a short time without battery (using a slave battery for starting), use additional current (lights) while engine is running and insulate terminal of battery. If this advice is disregarded, damage to alternator and regulator may result.**

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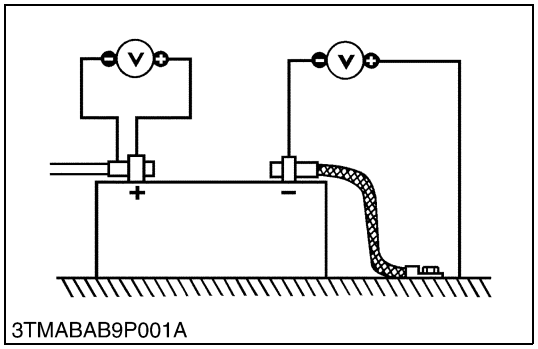
[1] CHECKING AND ADJUSTING

(1) Battery



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Battery Voltage

1. Stop the engine and turn the key switch off.
2. Connect the COM (-) lead of the voltmeter to the battery's negative terminal post and the (+) lead to the positive terminal post, and measure the battery voltage.
3. If the battery voltage is less than the factory specification, check the battery specific gravity and recharge the battery.

Battery voltage	Factory specification	More than 12 V

9Y1210948ELS0004US0

Battery Terminal Connection

1. Turn the key switch on, and turn on the head light.
2. Measure the voltage with a voltmeter across the battery's positive terminal post and the cable terminal, and the voltage across the battery's negative terminal post and the chassis.
3. If the measurement exceeds the factory specification, clean the battery terminal posts and cable clamps, and tighten them firmly.

Potential difference	Factory specification	Less than 0.1 V

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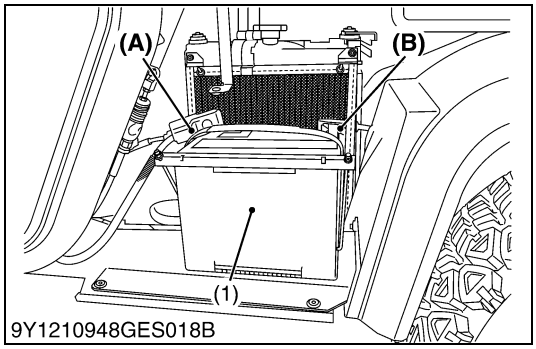

Battery Condition and Charging

■ **NOTE**

- **Follow the manufacture's instructions when you change battery or do maintenance.**

■ **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 week, 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 specifications in table below.**

Battery Type	Volts (V)	Reserve Capacity (min)	Cold Cranking Amps	Capacity at 20 hrs (A. H.)	Normal Charging Rate (A)
624FMF	12	120	650	58	17.4

(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 %

(1) Battery

(A) Positive Terminal
(B) Negative Terminal

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(2) Key Switch

Key Switch

1. Disconnect the connector and remove the key switch (1).
2. Perform the following checks.

(1) Key Switch

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Connector Voltage

1. Measure the voltage with a voltmeter across the connector **B** (white/red) terminal and chassis.
2. If the voltage differs from the battery voltage (11 to 14 V), the wiring harness is faulty.

Voltage	Connector **B** (white/red) terminal – Chassis	Approx. battery voltage

(1) Connector

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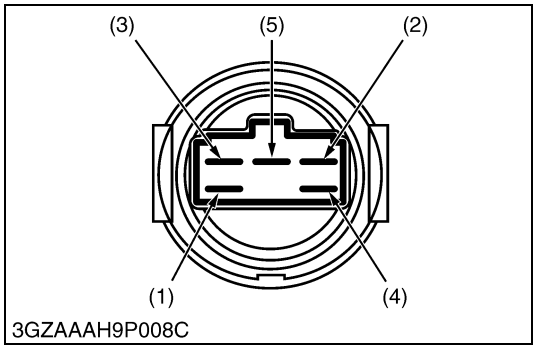

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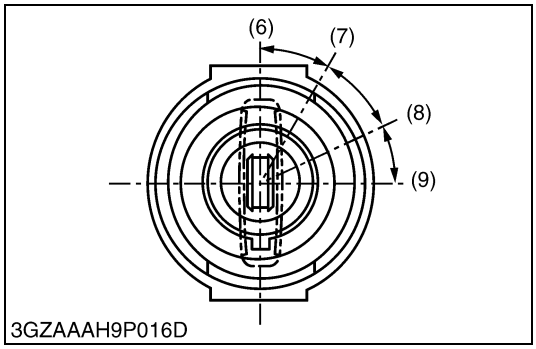

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Terminal Continuity

1. Remove the key switch from the instrument panel.
2. Measure the resistance with an ohmmeter across terminals when the key switch is set at **"OFF"**, **"ON"**, **"GLOW"** and **"START"** position.
3. If the resistance values specified below are not indicated, the key switch is faulty.

1) Key switch is set at "OFF" position

	B terminal	**ACC** terminal	**M** terminal	**G** terminal	**ST** terminal
B terminal	–	Infinity	Infinity	Infinity	Infinity
ACC terminal	Infinity	–	Infinity	Infinity	Infinity
M terminal	Infinity	Infinity	–	Infinity	Infinity
G terminal	Infinity	Infinity	Infinity	–	Infinity
ST terminal	Infinity	Infinity	Infinity	Infinity	–

2) Key switch is set at "ON" position

	B terminal	**ACC** terminal	**M** terminal	**G** terminal	**ST** terminal
B terminal	–	Continuity	Continuity	Infinity	Infinity
ACC terminal	Continuity	–	Continuity	Infinity	Infinity
M terminal	Continuity	Continuity	–	Infinity	Infinity
G terminal	Infinity	Infinity	Infinity	–	Infinity
ST terminal	Infinity	Infinity	Infinity	Infinity	–

3) Key switch is set at "GLOW" position

	B terminal	**ACC** terminal	**M** terminal	**G** terminal	**ST** terminal
B terminal	–	Infinity	Continuity	Continuity	Infinity
ACC terminal	Infinity	–	Infinity	Infinity	Infinity
M terminal	Continuity	Infinity	–	Continuity	Infinity
G terminal	Continuity	Infinity	Continuity	–	Infinity
ST terminal	Infinity	Infinity	Infinity	Infinity	–

4) Key switch is set at "START" position

	B terminal	**ACC** terminal	**M** terminal	**G** terminal	**ST** terminal
B terminal	–	Infinity	Continuity	Infinity	Continuity
ACC terminal	Infinity	–	Continuity	Infinity	Infinity
M terminal	Continuity	Continuity	–	Infinity	Continuity
G terminal	Infinity	Infinity	Infinity	–	Continuity
ST terminal	Continuity	Infinity	Continuity	Continuity	–

(1) **B** Terminal
(2) **ACC** Terminal
(3) **M** Terminal
(4) **G** Terminal
(5) **ST** Terminal
(6) **OFF Position**
(7) **ON Position**
(8) **GLOW** Position
(9) **START** Position

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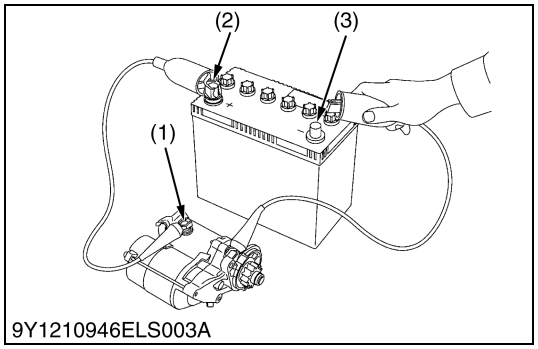
(3) Starter



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Motor Test

CAUTION

- **Secure the starter to prevent it from jumping up and down while testing the motor.**

1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable from the battery.
3. Disconnect the leads from the starter **B** terminal.
4. Remove the starter from the engine.
5. Connect a jumper lead from the starter **C** terminal (1) to the battery positive terminal (2).
6. Connect a jumper lead momentarily between the starter's body and the battery negative terminal (3).
7. If the motor does not run, starter is failure.
   Repair or replace the starter.

NOTE

- **B terminal: It is the terminal which connects the cable from the battery to the starter.**
- **C terminal: It is the terminal which connects the cable from the motor to the magnet switch.**

(1) **C** Terminal
(2) Positive Terminal
(3) Negative Terminal

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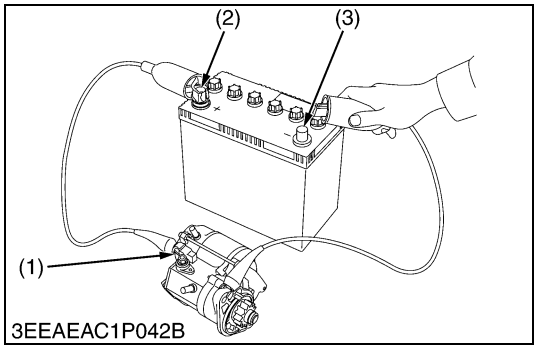

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Magnetic Switch Test

1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable from the battery.
3. Disconnect the leads from the starter **B** terminal.
4. Remove the starter from the engine.
5. Connect a jumper lead from the starter **S** terminal (1) to the battery positive terminal (2).
6. Connect a jumper lead momentarily between the starter's body and the battery negative terminal (3).
7. If the pinion gear does not pop out, the magnetic switch is failure.
   Repair or replace the starter.

NOTE

- **B terminal: It is the terminal which connects the cable from the battery to the starter.**
- **S terminal: It is the terminal which connects the cable from the starter switch to the magnet switch.**

(1) **S** Terminal
(2) Positive Terminal
(3) Negative Terminal

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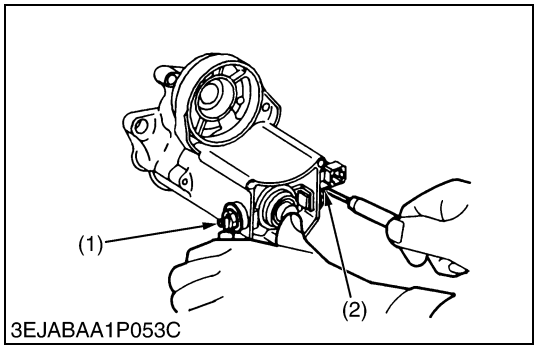

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Magnet Switch Continuity Test

1. Check the continuity across the **C** terminal (1) and the **B** terminal (2) with a circuit tester, pushing in the plunger.
2. If not continuous or if a certain value is indicated, replace the magnet switch.

(1) **C** Terminal
(2) **B** Terminal

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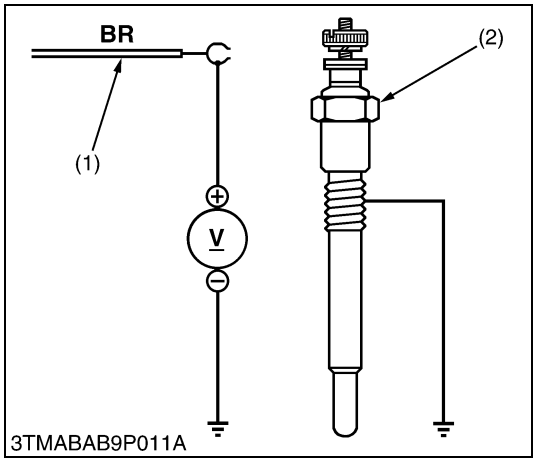
(4) Glow Plug



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Lead Terminal Voltage

1. Disconnect the wiring lead (1) from the glow plug (2) after turning the key switch off.
2. Turn the key switch key to the **"PREHEAT"** position, and measure the voltage between the lead terminal and the chassis.
3. Turn the key switch key to the **"START"** position, and measure the voltage with a voltmeter between the lead terminal and the chassis.
4. If the voltage at either position differs from the battery voltage, the wiring harness or key switch is faulty.

Voltage (Lead terminal – Chassis)	Key switch key at **"PREHEAT"**	Approx. battery voltage
	Key switch key at **"START"**	Approx. battery voltage

(1) Wiring Lead (Positive) (2) Glow Plug

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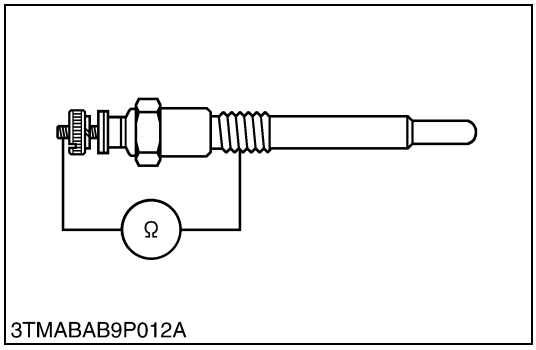

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Glow Plug Continuity

1. Disconnect the lead from the glow plugs.
2. Measure the resistance with an ohmmeter between the glow plug terminal and the chassis.
3. If 0 ohm is indicated, the screw at the tip of the glow plug and the housing are short-circuited.
4. If the factory specification is not indicated, glow plug resistance the glow plug is faulty.

Glow plug resistance	Factory specification	Approx. 1.1 Ω

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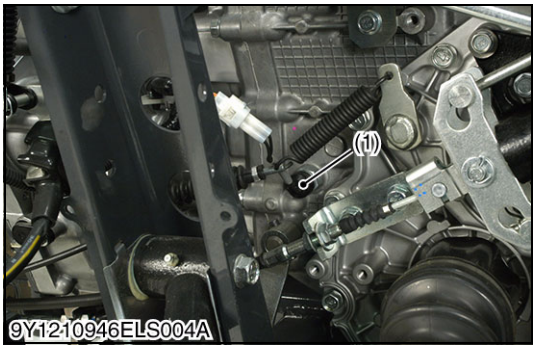
(5) Safety Switch



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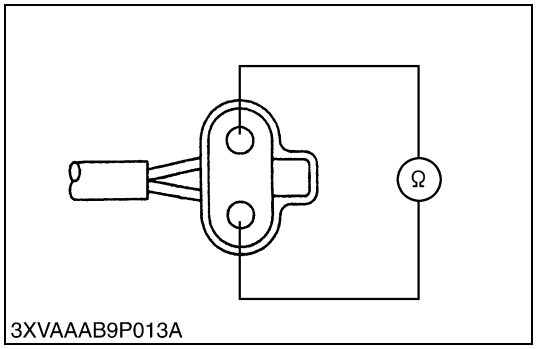

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Safety Switch (Neutral Switch) Continuity

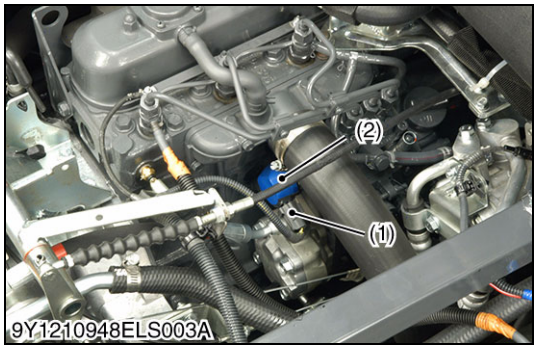
1. Remove the safety switch leads.
2. Connect the circuit tester to the safety switch leads.
3. Measure the resistance between leads.
4. If the safety switch is problem, replace it.

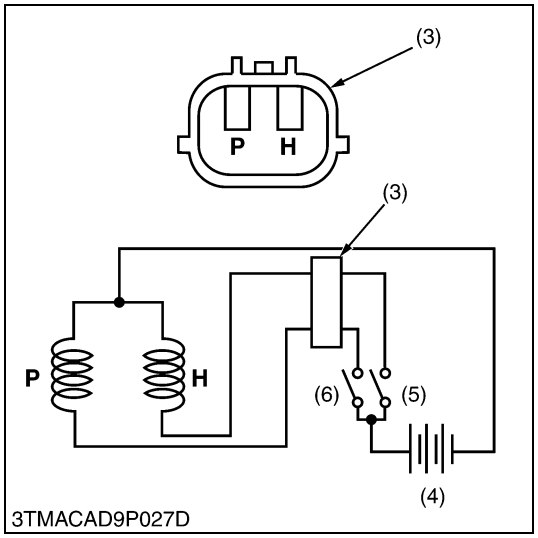
Resistance (Across switch terminal)	Except the neutral position	Infinity
	Neutral position	Continuity

(1) Safety Switch for Main Shift Lever

9Y1210946ELS0016US0

(6) Engine Stop Solenoid





Engine Stop Solenoid

1. Disconnect the **2P** connector (1) from the engine stop solenoid (2).
2. Remove the engine stop solenoid (2) from the engine.
3. Connect the jumper leads from the pulling coil **P** terminal to the switch (5), and from switch (5) to the battery positive terminal.
4. Connect the jumper leads from the holding coil **H** terminal to the switch (6), and from switch (6) to the battery positive terminal.
5. Connect the jumper leads from the engine stop solenoid body to the battery negative terminal.
6. When switch (6) is turn on, the plunger pulls into the solenoid body and then turn off the switch (6), the plunger comes out.
7. Turn on the switch (5) then turn on the switch (6), the plunger pulls into the solenoid body and it keeps in holding position after turning off the switch (6).
8. If the plunger is not attracted, the engine stop solenoid is faulty.

■ **IMPORTANT**

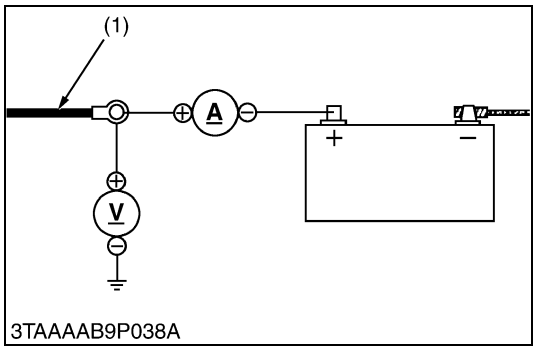
- **Never apply the current for pulling coil more than two seconds when inspecting.**

(1) **2P** Connector
(2) Engine Stop Solenoid
(3) Connector (of Engine Stop Solenoid)
(4) Battery
(5) Switch for Holding Coil
(6) Switch for Pulling Coil

P: Terminal for Pulling Coil
H: Terminal for Holding Coil

9Y1210948ELS0009US0

(7) Charging System



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Battery Charging Current

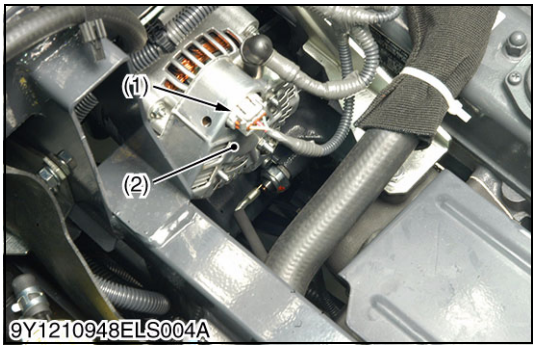
1. After starting the engine, disconnect the battery positive cord (+), and connect an ammeter and voltmeter. Then switch on all electrical loads (such as head lights) and measure the charging current.

■ **NOTE**
- **Connect an ammeter only after starting the engine.**
- **When the electrical loads is considerably low or the battery is fully charged, the specified reading may not be obtained.**

Current	Factory specification	14 to 15A
Voltage		14 to 15A
Dynamo speed		5200 min^{-1} (rpm)

(1) Battery Positive Cord

9Y1210946ELS0021US0



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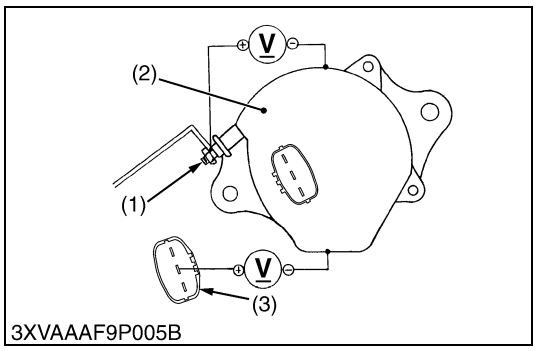
Alternator

1. Disconnect the **3P** connector (3) from alternator after turning the key switch **OFF**.
2. Perform the following checkings.

(1) **B** Terminal
(2) Alternator
(3) **3P** Connector

9Y1210948ELS0010US0



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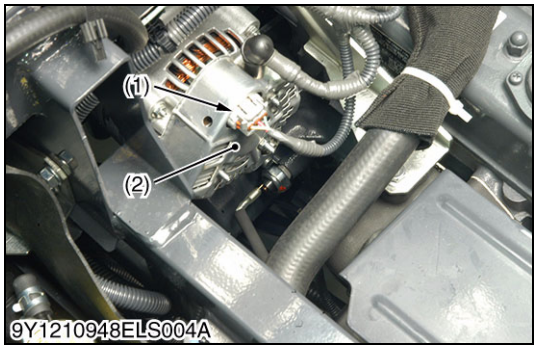
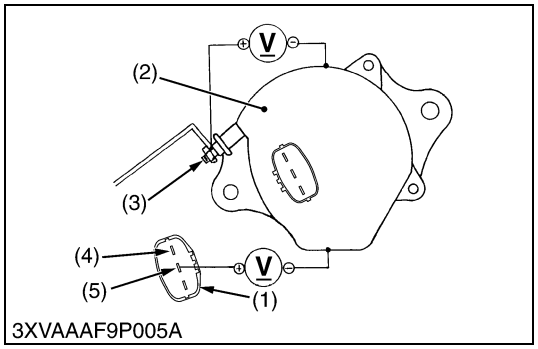




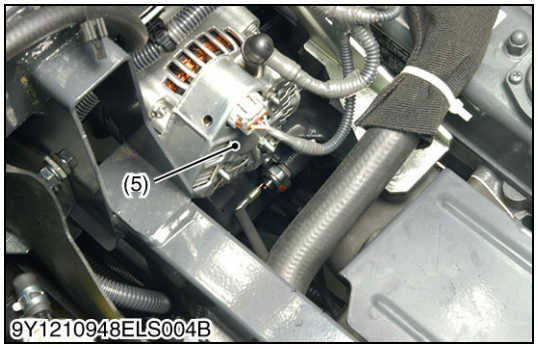
Connector Voltage

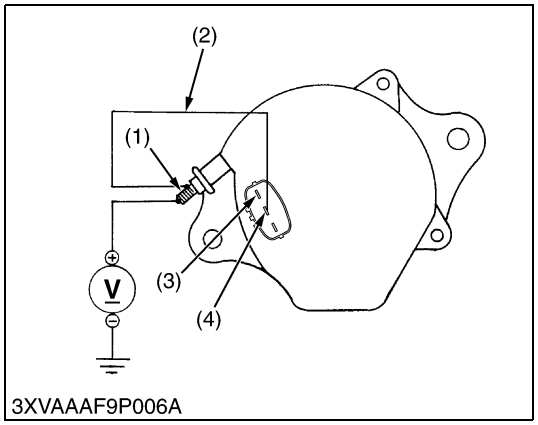
1. Disconnect the **3P** connector (1) from the alternator (2) after turning the main switch **OFF**.
2. Measure the voltage between the **B** terminal (3) and the chassis.
3. Turn the main switch **ON**. Measure the voltage between the **IG** terminal (5) and the chassis.

Voltage (Key switch at **OFF**)	**B** Terminal – Chassis	Approx. battery voltage
Voltage (Key switch at **ON**)	**IG** Terminal – Chassis	Approx. battery voltage

(1) **3P** Connector
(2) Alternator
(3) **B** Terminal
(4) **L** Terminal
(5) **IG** Terminal

9Y1210948ELS0011US0





No-Load Test

1. Connect the **3P** connector to previous positions of the alternator after turning the main switch **OFF**.
2. Connect the jumper lead (2) between **IG** terminal (4) and **B** terminal (1).
3. Start the engine and then set at idling speed.
4. Disconnect the negative cable from the battery.
5. Measure the voltage between the **B** terminal (1) and the chassis.
6. If the measurement is less than the factory specification, disassemble the alternator and check the IC regulator.

Voltage	Factory specification	More than 14 V

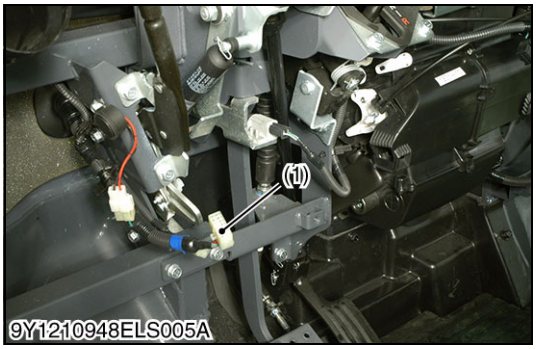
(Reference)

- Once the engine has started, the alternator temperature rises quickly up to an ambient temperature of 70 to 90 °C (158 to 194 °F). As the temperature goes higher than 50 °C (122 °F), the alternator voltage slowly drops; at higher than 100 °C (212 °F), it drops by about 1 V.

(1) **B** Terminal
(2) Jumper Lead
(3) **L** Terminal
(4) **IG** Terminal
(5) Alternator

9Y1210948ELS0012US0

(8) Lighting System



Light Switch

1. Disconnect the connector (1) and remove the light switch (2).
2. Remove the light switch (2) and perform the following checks **1)**.

(1) Connector
(2) Light Switch

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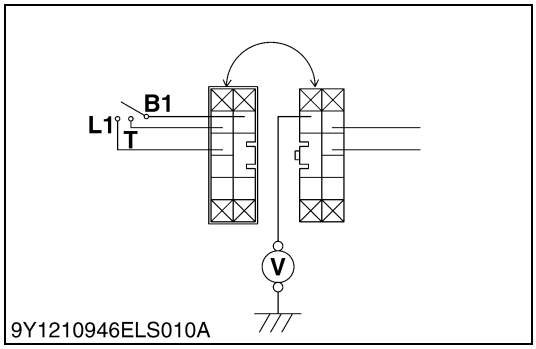

1) Connector Voltage

1. Connect the light switch connector to the main wire harness.
2. Measure the voltage with a voltmeter across the connector **B1** terminal and chassis when the key switch is **ON** position.
3. If the voltage differs from the battery voltage, the wiring harness and key switch is faulty.

Voltage	**B1** terminal – Chassis	Battery voltage

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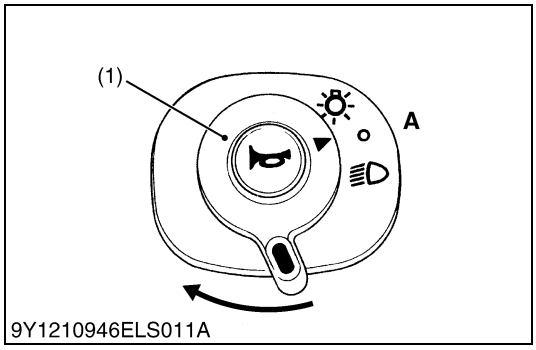
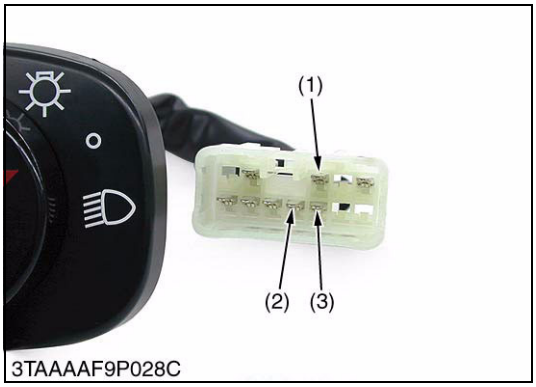


2) Head Light Switch Continuity when Setting Switch at "OFF" Position

1. Set the light switch to the **OFF** position.
2. Measure the resistance with an ohmmeter across the red / yellow lead (1) to the orange lead (3), the red / yellow lead (1) to the yellow lead (2).
3. If infinity is not indicated, the head light switch is faulty.

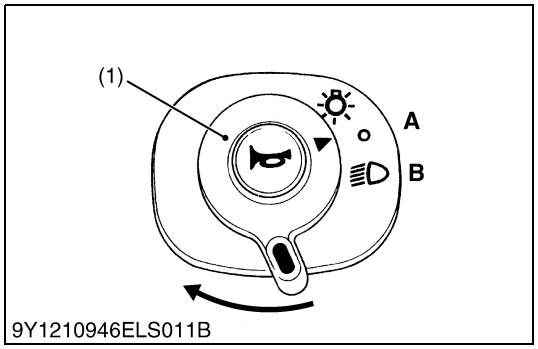
Resistance (Switch at **OFF** position)	Red / Yellow lead (1) – Orange lead (3)	Infinity
	Red / Yellow lead (1) – Yellow lead (2)	



(1) Red / Yellow Lead
(2) Yellow Lead
(3) Orange Lead

A: Head Light "OFF" Position

9Y1210946ELS0027US0



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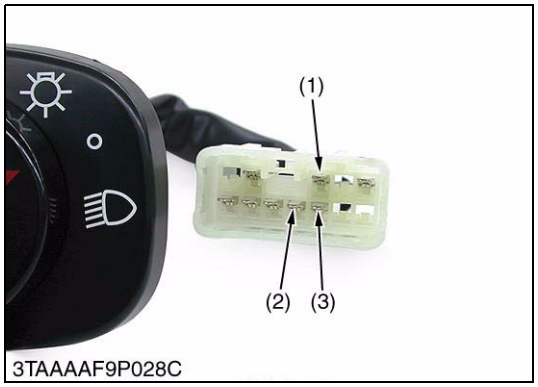

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3) Head Light Switch Continuity when Setting Switch at "ON" Position

1. Set the light switch to the **ON** position.
2. Measure the resistance with an ohmmeter across the red / yellow lead (1) to the orange lead (3) and the red / yellow lead (1) to the yellow lead (2).
3. If infinity is not indicated, the head light switch is faulty.

Resistance (Switch at **ON** position)	Red / Yellow lead (1) – Orange lead (3)	Continuity
	Red / Yellow lead (1) – Yellow lead (2)	

(1) Red / Yellow Lead
(2) Yellow Lead
(3) Orange Lead

A: Head Light "OFF" Position
B: Head Light "ON" Position

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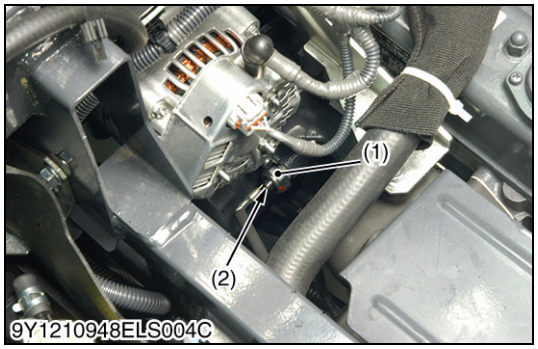

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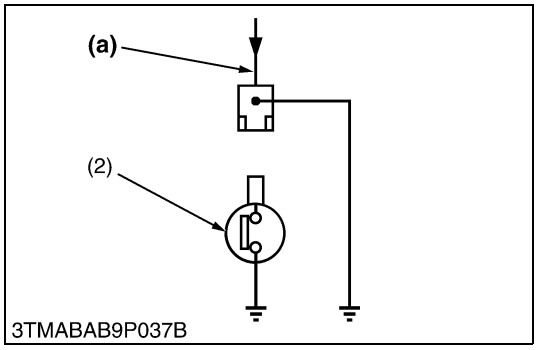
Engine Oil Pressure Lamp

1. Disconnect the wiring lead (2) from the engine oil pressure switch after turning the key switch **OFF**.
2. Turn the key switch **ON** and connect a jumper lead from the lead to the chassis.
3. If the engine oil pressure indicator lamp does not light, the wiring harness is faulty.

(1) Engine Oil Pressure Switch
(2) Wiring Lead

(a) From Oil Pressure Lamp

9Y1210948ELS0014US0



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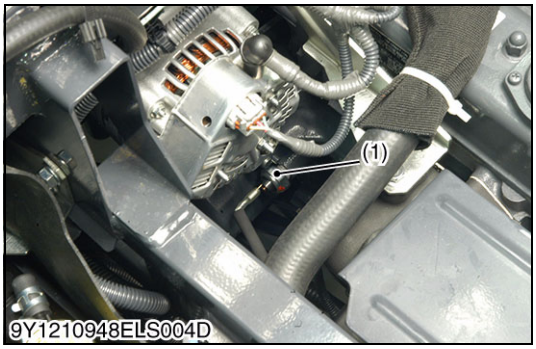
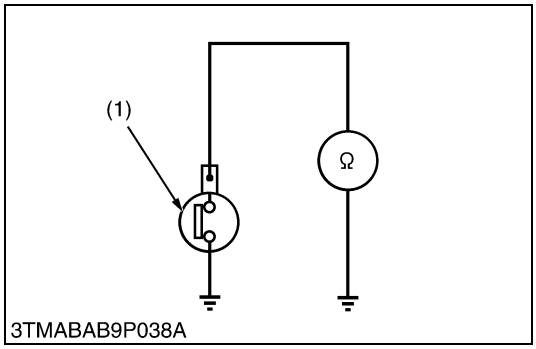




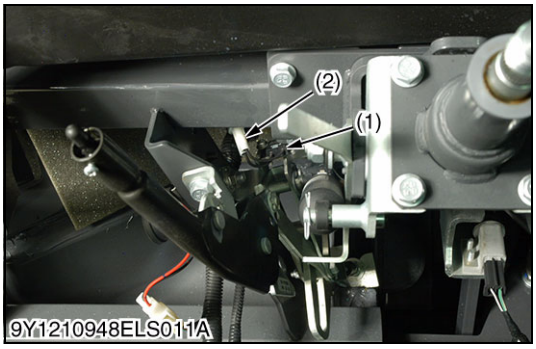
Engine Oil Pressure Switch Continuity

1. Measure the resistance with an ohmmeter across the switch terminal and the chassis.
2. If 0 ohm is not indicated in the normal state, the switch is faulty.
3. If infinity is not indicated at pressure over 49 kPa (0.50 kgf/cm^2, 7.1 psi), the switch is faulty.

Resistance (Switch terminal – Chassis)	In normal state	Continuity
Voltage	At pressure over approx. 49 kPa (0.50 kgf/cm^2, 7.1 psi)	Infinity

(1) Engine Oil Pressure Switch

9Y1210948ELS0015US0



Parking Brake Switch Continuity

1. Disconnect the connector from the parking brake switch (1) after turning the key switch **"OFF"**.
2. Measure the resistance across the two terminals.
3. If continuity is not indicated, the switch is faulty.

Resistance (Across switch terminals)	In normal state	Continuity

(1) Parking Brake Switch (2) Connector of Parking Brake Switch

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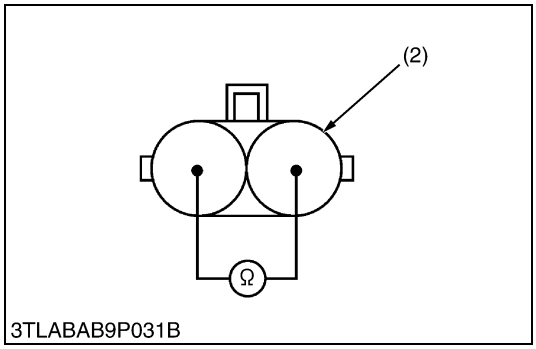

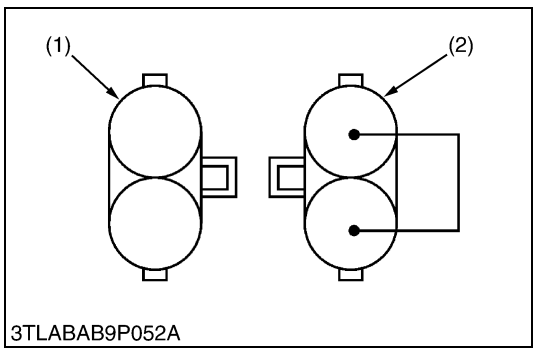

Parking Brake Switch Panel and Wiring Harness

1. Disconnect the connector from the parking brake switch after turning the key switch **"OFF"**.
2. Turn the key switch **"ON"** and connect a jumper lead between the connector terminals of wiring harness.
3. If the parking brake indicator lamp does not light, the panel circuit or wiring harness is faulty.

(1) Connector of Parking Brake Switch (2) Connector of Wiring Harness

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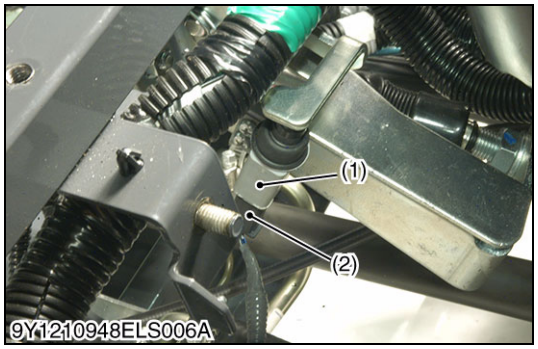

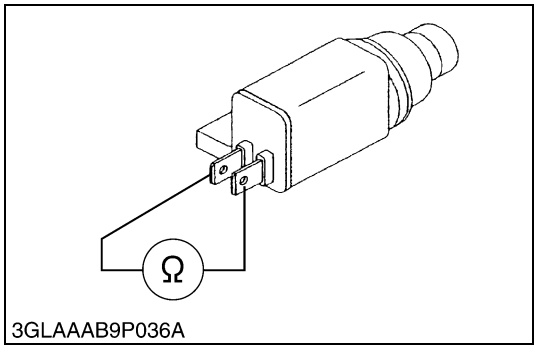

4WD Switch Continuity

1. Remove the side cover.
2. Disconnect the connector (2).
3. Connect the circuit tester to the 4WD switch leads.
4. Measure the resistance between leads.
5. If the 4WD switch (1) is problem, replace it.

Resistance (Across switch terminal)	When switch is pushed	Infinity
	When switch is released	Continuity

(1) 4WD Switch (2) Connector

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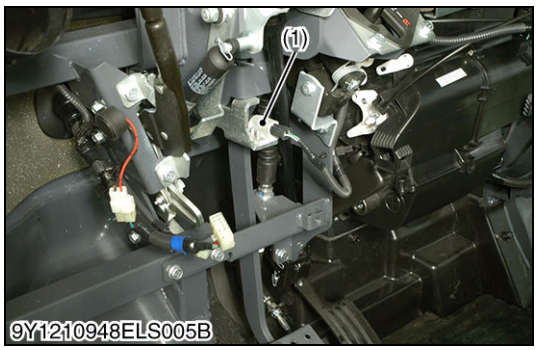

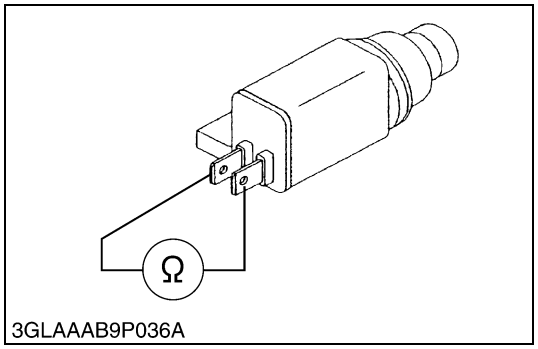

Brake Lamp Switch Continuity

1. Remove the brake lamp switch leads.
2. Connect the circuit tester to the brake lamp switch leads.
3. Measure the resistance between leads.
4. If the safety switch is problem, replace it.

Resistance	When switch is pushed	Infinity
	When switch is released	Continuity

(1) Brake Switch

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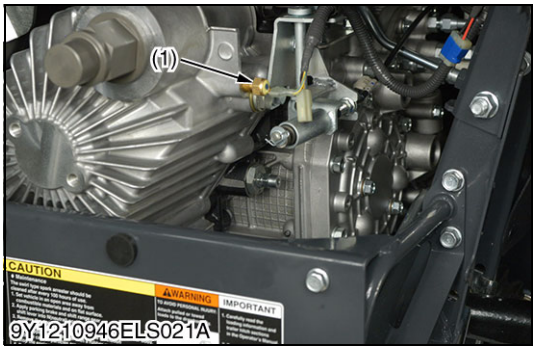

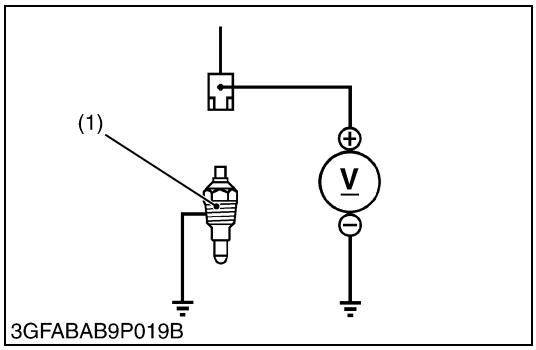

Oil Temperature Alarm Switch Connector Voltage

1. Disconnect the **1P** connector from the oil temperature alarm switch (1).
2. Turn the key switch to the **ON** position, and measure the voltage with a voltmeter between the connector terminal and the chassis.
3. If no voltage is indicated, the wiring harness id faulty.

Voltage (Connector terminal – Chassis)	Factory specification	Positive voltage

(1) Oil Temperature Alarm Switch

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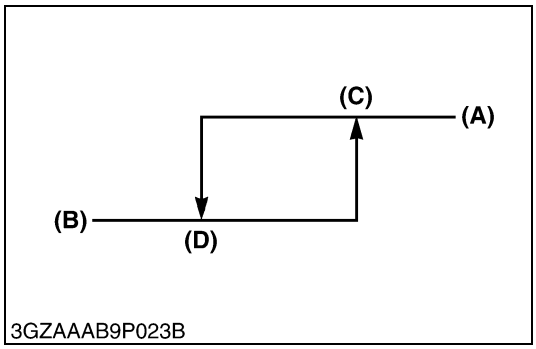


Thermo Switch Continuity

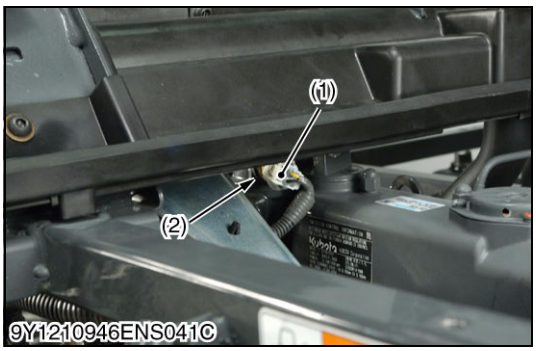
1. Disconnect the **1P** connector, and remove the thermo switch.
2. Using an ohmmeter, check for continuity between the switch terminal and the chassis.
3. If infinity is indicated at temperature over between specifications, the switch is faulty.

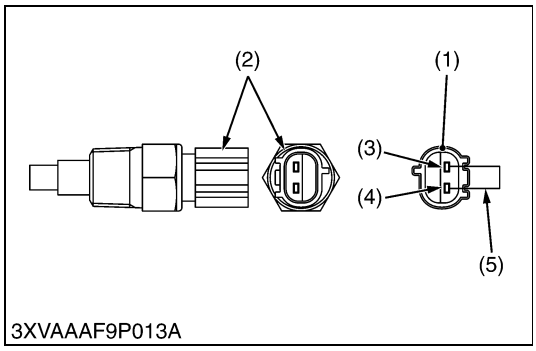
Working temperature	Factory specification	120 to 126 °C 24.80 to 258.8 °F

(A) ON
(B) OFF
(C) 120 to 126 °C (248.0 to 258.8 °F)
(D) 116 °C (240.8 °F) or more

9Y1210946ELS0037US0

(9) Cooling System





Radiator Fan Motor Wiring Harness

1. Disconnect the **2P** connector (1) from the radiator fan motor switch (2) after turning the key switch **OFF**.
2. Turn the key switch **ON** and connect a jumper lead (5) from the connector terminal **1** (3) to the connector terminal **2** (4).
3. If the fan motor does not rotate, wiring harness or fan motor relay is faulty.

(1) **2P** Connector
(2) Radiator Fan Motor Switch
(3) Connector Terminal **1** (to Fan Motor Relay)
(4) Connector Terminal **2** (to Grand)
(5) Jumper Lead

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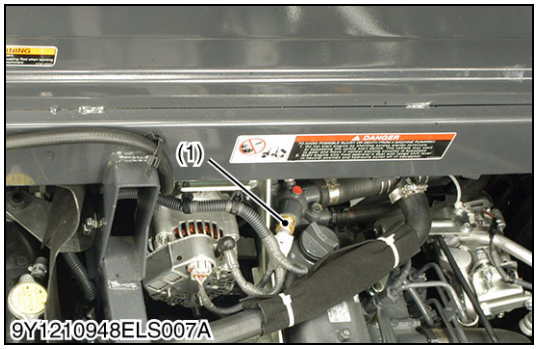

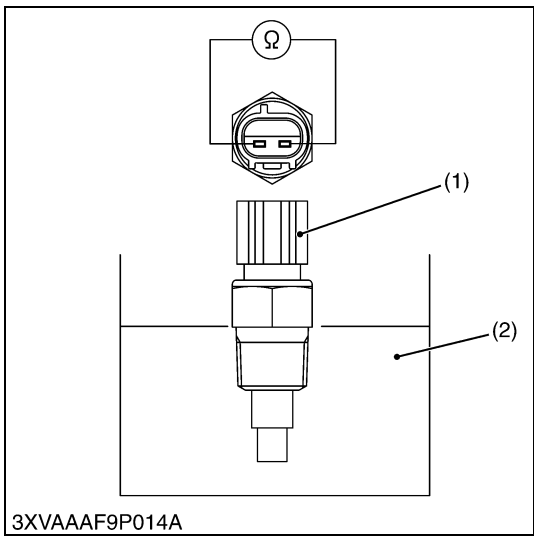

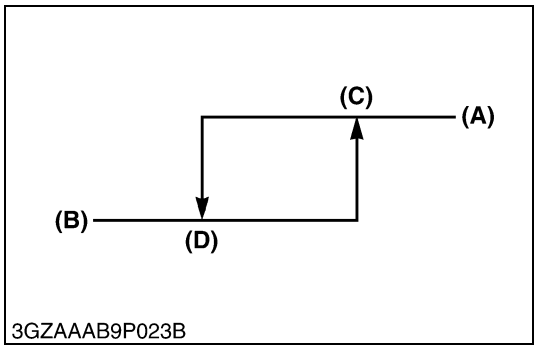

Radiator Fan Motor Switch

1. Measure the resistance with an ohmmeter across the switch terminals.
2. If infinity is not indicated when the coolant temperature is lower than 83 °C (181 °F), the switch is faulty.
3. If 0 ohms is not indicated when the coolant temperature is higher than 87 to 93 °C (189 to 199 °F), the switch is faulty.

Resistance	At coolant temperature lower than 83 °C (181 °F)	Infinity
	At coolant temperature more than 87 to 93 °C (189 to 199 °F)	Continuity

(1) Radiator Fan Motor Switch
(2) Coolant

(A) ON
(B) OFF
(C) 87 to 93 °C (189 to 199 °F)
(D) 83 °C (181 °F)

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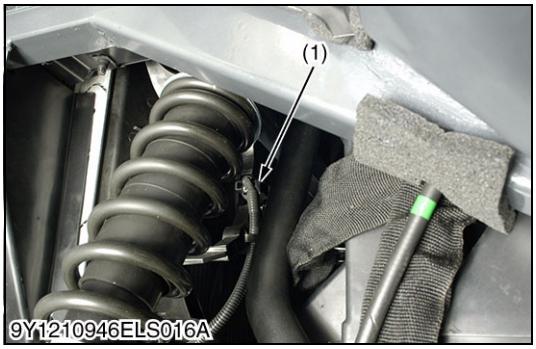

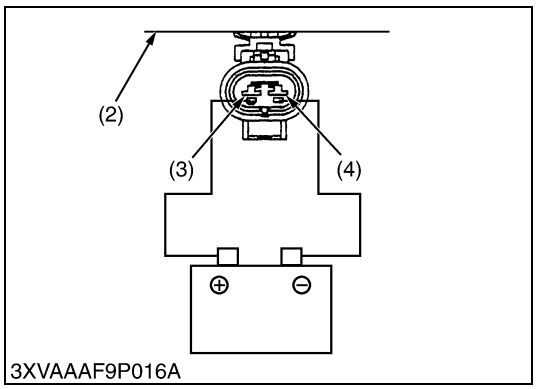

Front Radiator Fan Motor

1. Disconnect the **2P** connector (1) of fan motor after turning the key switch **OFF**.
2. Connect a jumper lead from the **1** terminal (3) to the battery positive terminal post.
3. Connect a jumper lead momentarily between the **2** terminal (4) and the battery negative terminal post.
4. If the fan motor does not run, replace it.

(1) **2P** Connector
(2) Radiator
(3) **1** Terminal (Positive Side)
(4) **2** Terminal (Negative Side)

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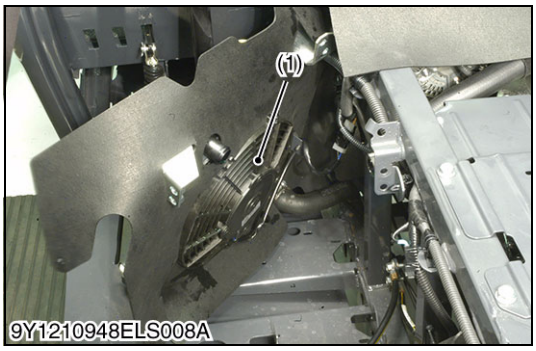

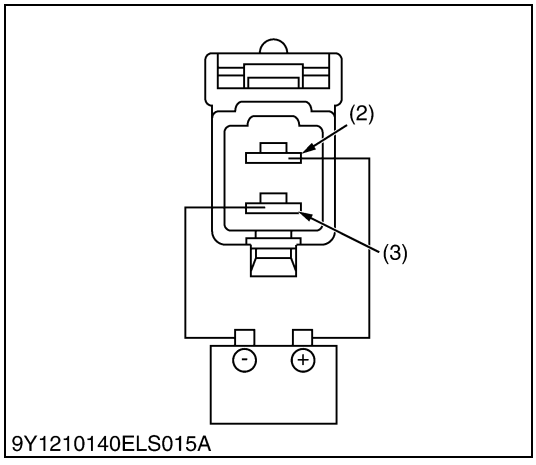

Rear Radiator Fan Motor

1. Disconnect the connector of cooling fan motor (1) after turning the main switch off.
2. Connect a jumper lead from the terminal **1** (2) to the battery positive terminal post.
3. Connect a jumper lead momentarily between the terminal **2** (3) and the battery negative terminal post.
4. If the cooling fan motor (1) does not run, replace the new one.

(1) Cooling Fan Motor
(2) Terminal **1** (Positive Side)
(3) Terminal **2** (Negative Side)

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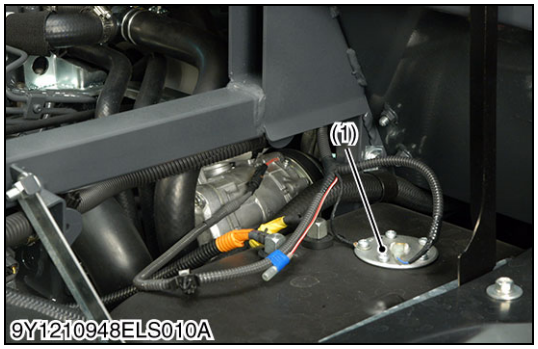
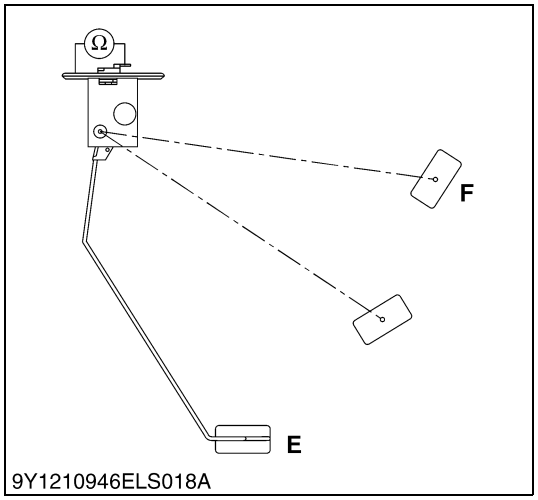
(10) Gauges





Fuel Lever Sensor

1) Sensor Continuity

1. Remove the fuel level sensor from the fuel tank.
2. Measure the resistance with an ohmmeter across the sensor terminal and its body.
3. If the reference value are not indicated, the sensor is faulty.

Resistance (Sensor terminal – its body)	Reference value	Float at upper-most position	1 to 5 Ω
		Float at lower-most position	103 to 117 Ω

(1) Fuel Level Sensor

E: Empty
F: Full

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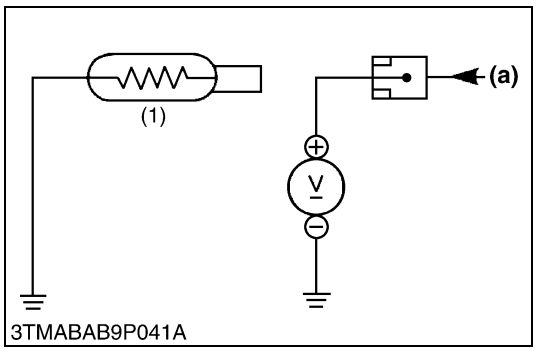

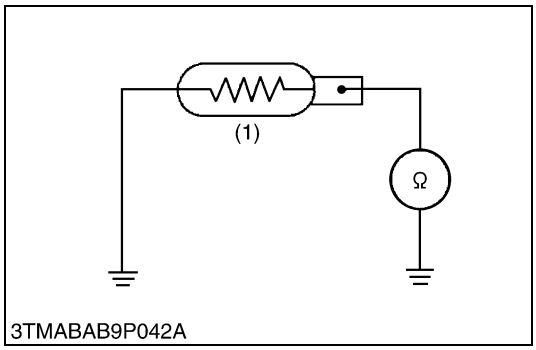

Engine Water Temperature Sensor

1) Lead Terminal Voltage

1. Disconnect the lead from the engine water temperature sensor after turning the key switch **OFF**.
2. Turn the key switch **ON** and measure the voltage with a voltmeter across the lead terminal and the chassis.
   If the voltage differs from the battery voltage, the wiring harness, fuse or coolant temperature gauge is faulty.

Voltage	Lead terminal – Chassis	Approx. battery voltage

2) Sensor Continuity

1. Measure the resistances with an ohmmeter across the sensor terminal and the chassis.
2. If the reference value is not indicated, the sensor is faulty.

Resistance (Sensor terminal – Chassis)	Reference value	Approx. 16.1 Ω at 120 °C (248 °F)
		Approx. 27.4 Ω at 100 °C (212 °F)
		Approx. 51.9 Ω at 80 °C (176 °F)
		Approx. 153.9 Ω at 50 °C (122 °F)

(1) Engine Water Temperature Sensor **(a) From Temperature Gauge**

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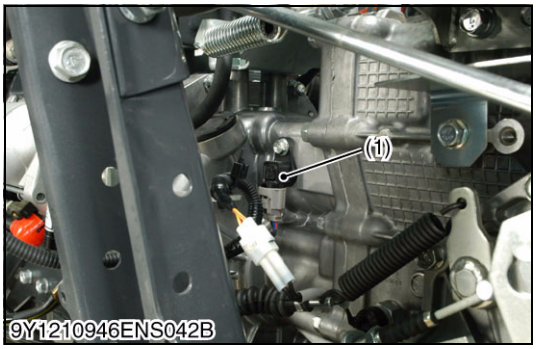

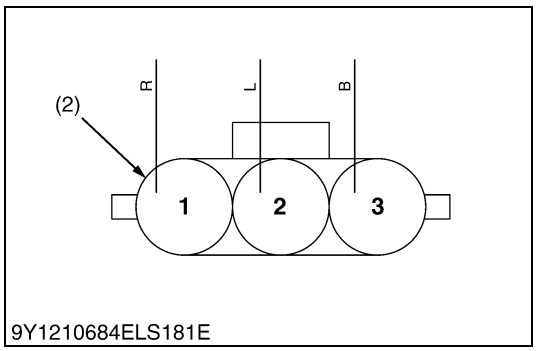

Traveling Speed Sensor Connector Voltage

■ **NOTE**

- **Since it is not possible to do unit checking for this sensor, judge the sensor is faulty if the relating electric circuit is normal.**

1. Disconnect the connector, and turn the main key switch **"ON"** position.
2. Measure the voltage with a voltmeter across the terminals shown in the table below.
3. If the reference value is not indicated as shown in the table below, check the relating electric circuit.

Voltage	Key switch at **"ON"**	Terminal **1** – Chassis	Approx. battery voltage
		Terminal **2** – Chassis	Approx. 5 V

(1) Traveling Speed Sensor (2) Connector (Harness Side)

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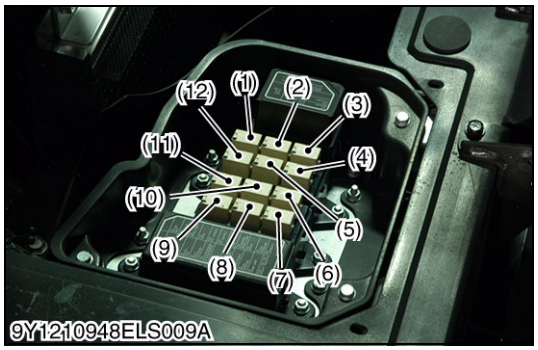
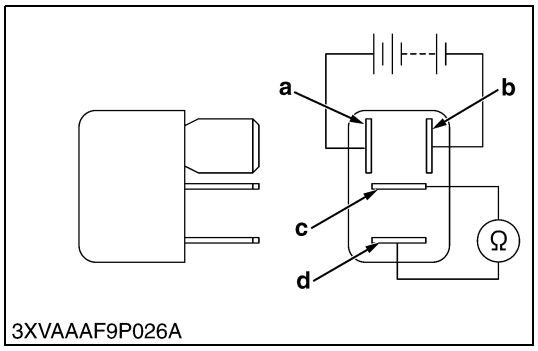
(11) Relays





Relay

1. Turn the key switch **OFF**.
2. Raise the seat.
3. Remove the relay which should be checked.
4. Connect the jumper load across the battery positive terminal to relay terminal **1 "a"**, and the battery negative terminal to relay terminal **2 "b"**.
5. Check the continuity with an ohmmeter between the relay terminal **5 "c"** and relay terminal **3 "d"**.
6. If there is continuity, the relay is proper.

(1) Starter Relay
(2) Solenoid Relay
(3) Rear Radiator Fan Motor Relay
(4) Beacon Relay
(5) Spare
(6) Work Light Relay
(7) Wiper Relay
(8) Fog Lamp Relay
(9) Oil Temperature Relay
(10) Compressor Relay
(11) Front Radiator Fan Motor Relay
(12) Blower Relay

a: Relay Terminal 1
b: Relay Terminal 2
c: Relay Terminal 5
d: Relay Terminal 3

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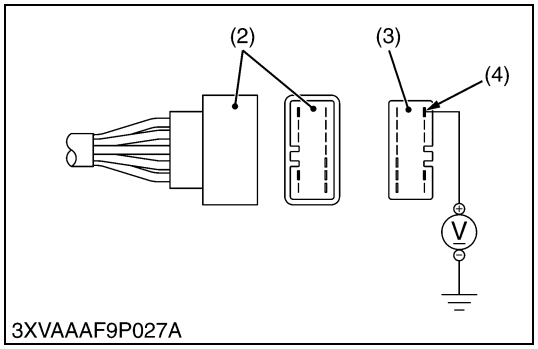
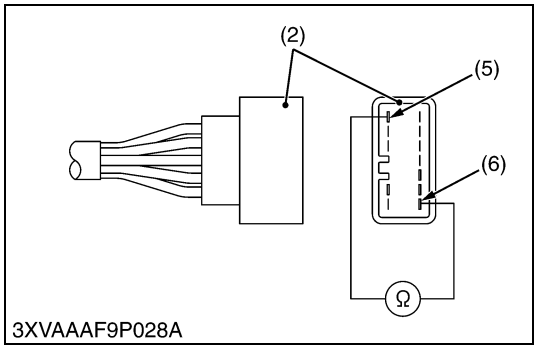
(12) Others





Light Switch (for Horn)

1) Connector Terminal Voltage

1. Disconnect the connector from the light switch (1) after turning the main switch **OFF**.
2. Turn the main switch **ON** and measure the voltage with a voltmeter across the connector terminal **B3** (4) to the chassis.
3. If the voltage differs from the battery voltage, the wiring harness or fuse is faulty.

Voltage	Connector terminal **B3** – Chassis	Approx. battery voltage

2) Switch Continuity

1. Disconnect the connector from the light switch (1) and remove it.
2. Measure the resistance with an ohmmeter across the switch terminal **B3** (5) to terminal **H** (6).
3. If the resistance differs from the factory specifications, the light switch is faulty.

Resistance	Factory specification	**OFF**	Infinity
		ON	Continuity

(1) Light Switch
(2) Connector (Switch Side)
(3) Connector (Harness Side)
(4) Connector Terminal **B3**
(5) Switch Terminal **B3**
(6) Switch Terminal **H**

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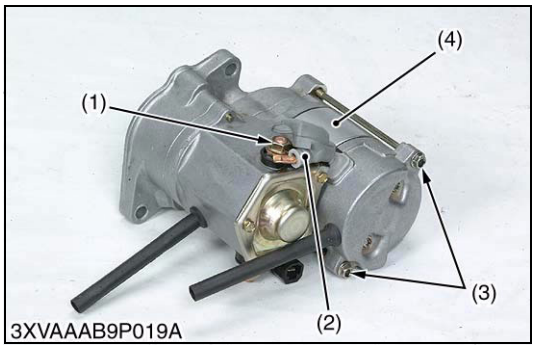
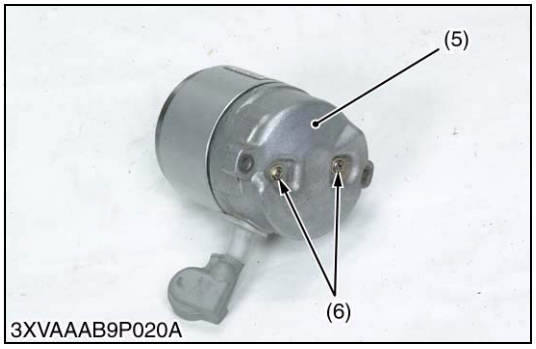
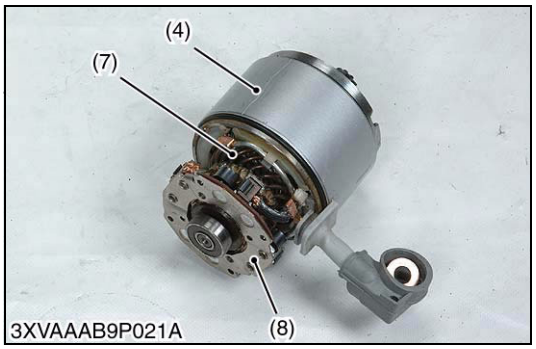
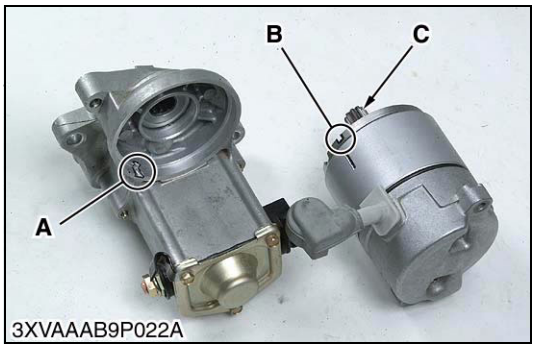
[2] DISASSEMBLING AND ASSEMBLING

(1) Starter









Motor

1. Remove the **B** terminal nut (1), and disconnect the connecting lead (2) from the magnet switch.
2. Remove the motor through screws (3), and then remove the yoke (4).
3. Remove the end frame screws (6) and then remove the end frame (5).
4. Separate the armature (7), the brush holder (8) from the yoke (4).

(When reassembling)

- Apply grease to the spline teeth **"C"** of the armature (7).
- Fit the projection **"B"** on the yoke into the notch **"A"** in the magnet switch.

Tightening torque	**B** terminal nut	5.9 to 11 N·m 0.60 to 1.2 kgf·m 4.4 to 8.6 lbf·ft

(1) **B** Terminal Nut
(2) Connecting Lead
(3) Motor Through Screw
(4) Yoke
(5) End Frame
(6) End Frame Screw
(7) Armature
(8) Brush Holder

A: Notch
B: Projection
C: Spline Teeth

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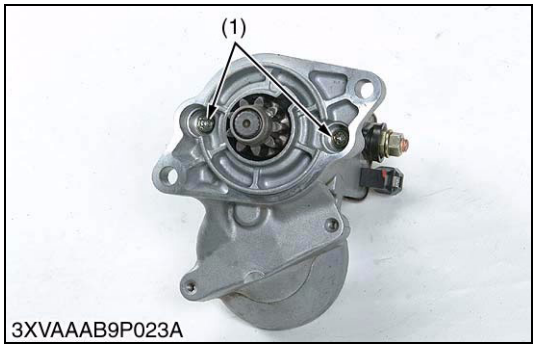

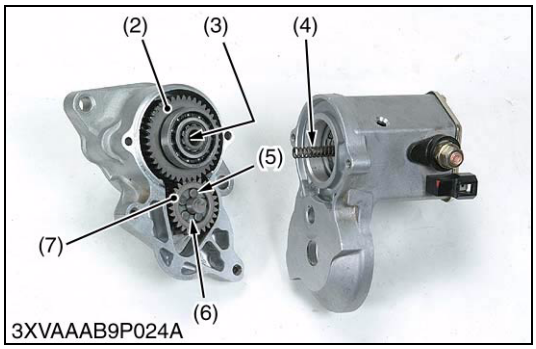

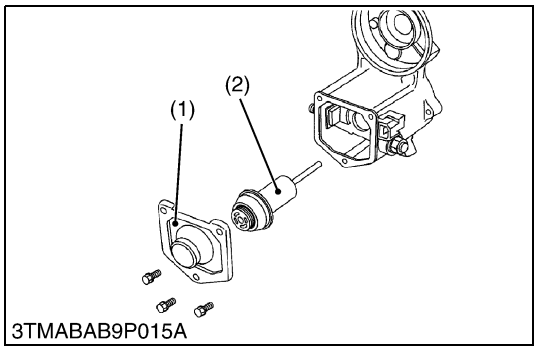

Magnet Switch

1. Remove the drive end frame mounting screws (1).
2. Remove the overrunning clutch (2), steel ball (3), spring (4), idle gear (7), rollers (5) and retainer (6).

(When reassembling)

- Apply grease the gear teeth of the idle gear (7) and the overrunning clutch (2), and the steel ball (3).

(1) Drive End Frame Mounting Screw
(2) Overrunning Clutch
(3) Steel Ball
(4) Spring
(5) Roller
(6) Retainer
(7) Idle Gear

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Plunger

1. Remove the end cover (1).
2. Remove the plunger (2).

(1) End Cover
(2) Plunger

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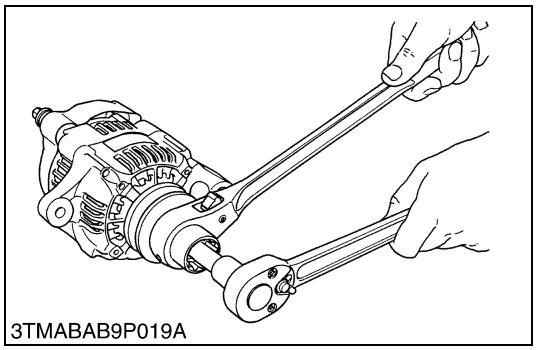
(2) Alternator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Pulley

1. Secure the hexagonal end of the pulley shaft with a double-ended ratchet wrench as shown in the figure.
2. Loosen the pulley nut with a socket wrench and remove it.

(When reassembling)

Tightening torque	Pulley nut	58.4 to 78.9 N·m 5.95 to 8.05 kgf·m 43.1 to 58.2 lbf·ft

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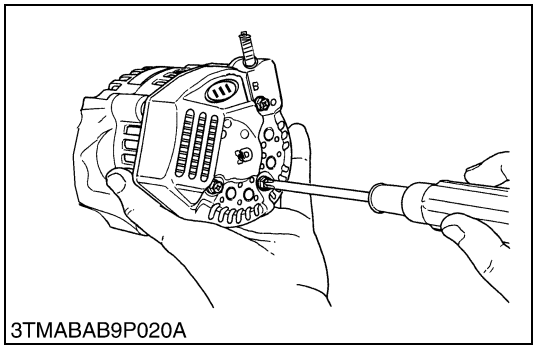
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Rear End Cover

1. Remove the three rear end cover screws and the **B** terminal nut, and remove the rear end cover.

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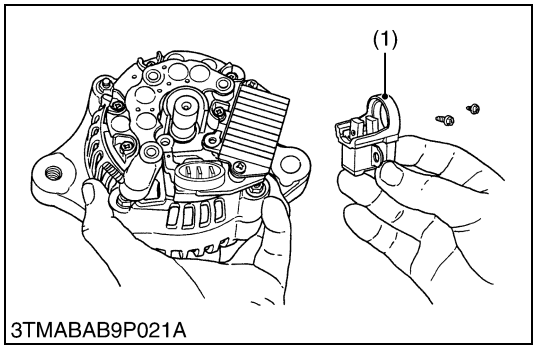

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Brush Holder

1. Remove the two screws holding the brush holder, and remove the brush holder (1).

(1) Brush Holder

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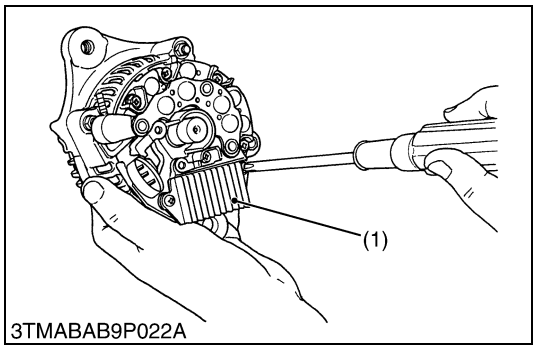

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IC Regulator

1. Remove the three screws holding the IC regulator, and remove the IC regulator (1).

(1) IC Regulator

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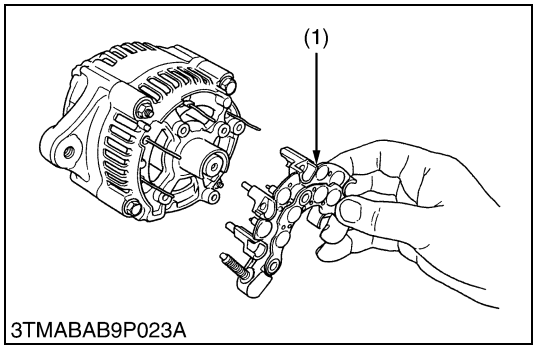

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Rectifier

1. Remove the four screws holding the rectifier and the stator lead wires.
2. Remove the rectifier (1).

(1) Rectifier

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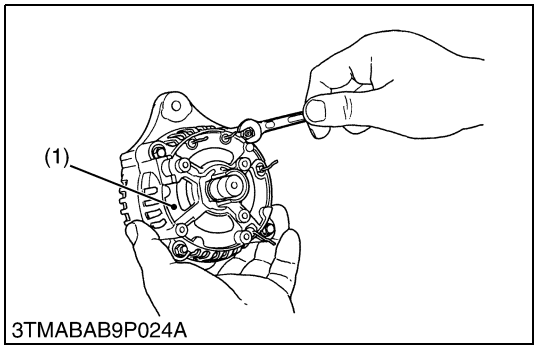

Rear End Frame

1. Remove the two nuts and two screws holding the drive end frame and the rear end frame.
2. Remove the rear end frame (1).

(1) Rear End Frame

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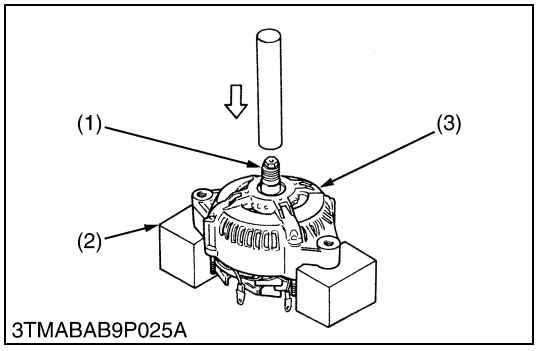

Rotor

1. Press out the rotor (1) from drive end frame (3).

■ **IMPORTANT**

- **Be very careful not to drop the rotor and damage the slip ring or fan, etc..**

(1) Rotor
(2) Block
(3) Drive End Frame

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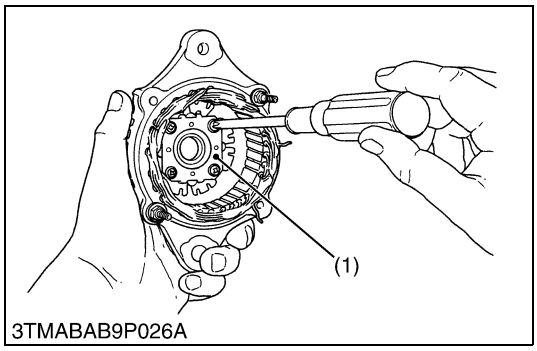

Retainer Plate

1. Remove the four screws holding the retainer plate, and remove the retainer plate (1).

(1) Retainer Plate

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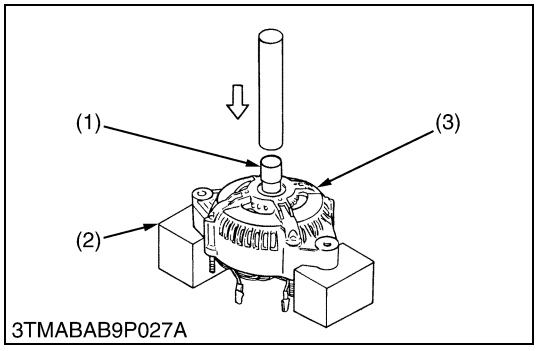

Bearing on Drive End Side

1. Press out the bearing from drive end frame (3) with a press and jig (1).

(1) Jig
(2) Block
(3) Drive End Frame

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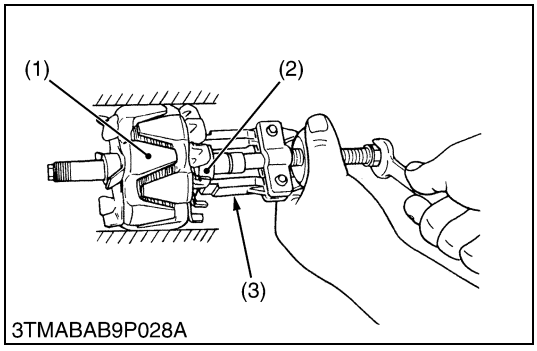

Bearing at Slip Ring Side

1. Lightly secure the rotor (1) with a vise to prevent damage, and remove the bearing (2) with a puller (3).

(1) Rotor
(2) Bearing
(3) Puller

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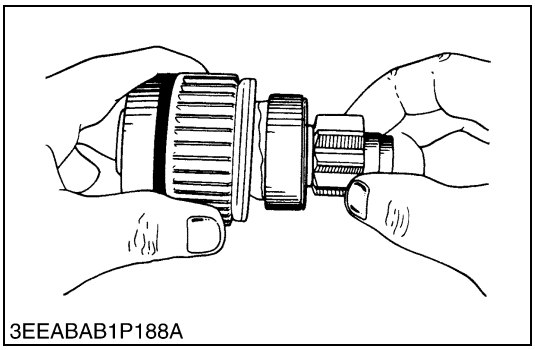
[3] SERVICING
(1) Starter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Overrunning Clutch

1. Inspect the pinion for wear or damage.
2. If there is any problem, replace the overrunning clutch assembly.
3. Check that the pinion turns freely and smoothly in the overrunning direction and does not slip in the cranking direction.
4. If the pinion slips or does not rotate in the both directions, replace the overrunning clutch assembly.

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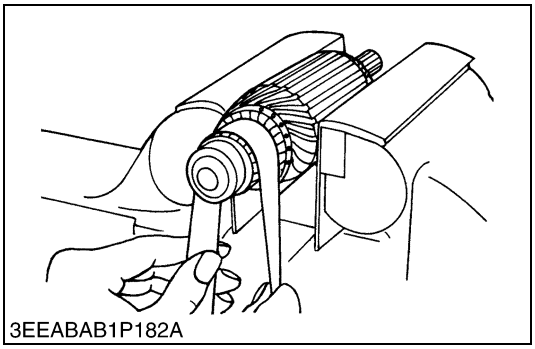
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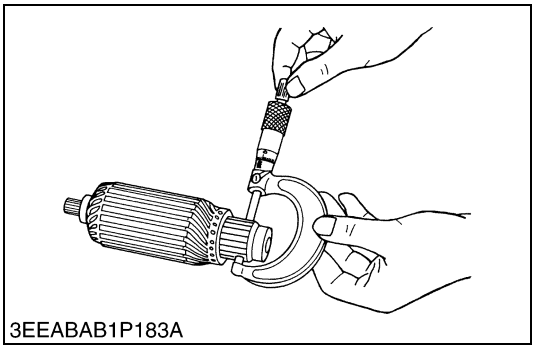
Commutator and Mica

1. Check the contact face of the commutator for wear, and grind the commutator with emery paper if it is slightly worn.
2. Measure the commutator O.D. with an outside micrometer at several points.
3. If the minimum O.D. is less than the allowable limit, replace the armature.
4. If the difference of the O.D.'s exceeds the allowable limit, correct the commutator on a lathe to the factory specification.
5. Measure the mica undercut.
6. If the undercut is less than the allowable limit, correct it with a saw blade and chamfer the segment edges.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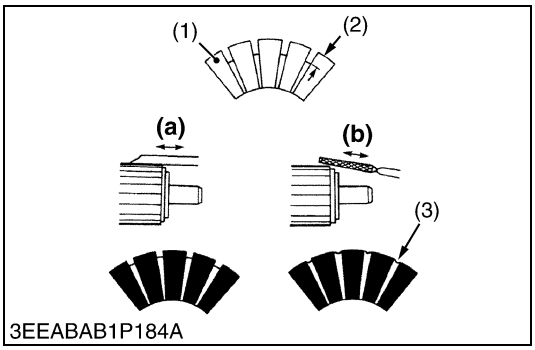
Commutator O.D.	Factory specification	30.0 mm 1.181 in.
	Allowable limit	29.0 mm 1.142 in.

Difference of O.D.'s	Factory specification	Less than 0.02 mm 0.0008 in.
	Allowable limit	0.05 mm 0.0020 in.

Mica undercut	Factory specification	0.50 to 0.80 mm 0.020 to 0.031 in.
	Allowable limit	0.2 mm 0.008 in.



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(1) Segment
(2) Undercut
(3) Mica
(a) Correct
(b) Incorrect

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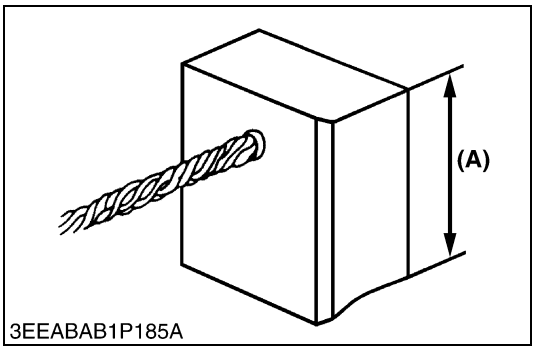

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Brush Wear

1. If the contact face of the brush is dirty or dusty, clean it with emery paper.
2. Measure the brush length **(A)** with vernier calipers.
3. If the length is less than the allowable limit, replace the yoke assembly and brush holder.

Brush length **(A)**	Factory specification	14.0 mm 0.551 in.
	Allowable limit	9.0 mm 0.35 in.

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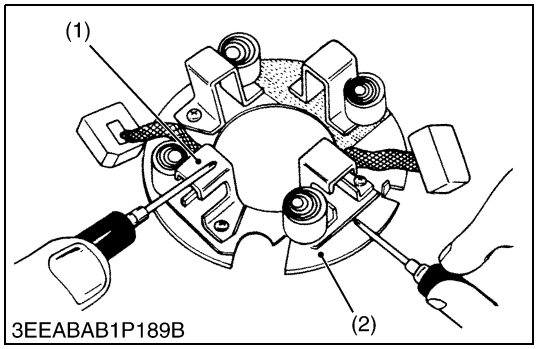

3EEABAB1P189B

Brush Holder

1. Check the continuity across the brush holder and the holder support with an ohmmeter.
2. If it conducts, replace the brush holder.

Resistance	Brush holder – Holder support	Infinity

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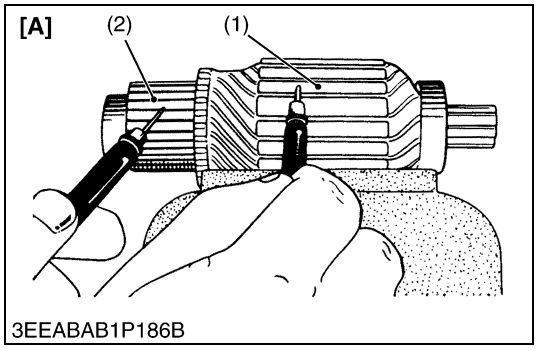

3EEABAB1P186B

Armature Coil

1. Check the continuity across the commutator and armature coil core with an ohmmeter. **[A]**
2. If it conducts, replace the armature.
3. Check the continuity across the segments of the commutator with an ohmmeter. **[B]**
4. If it does not conduct, replace the armature.

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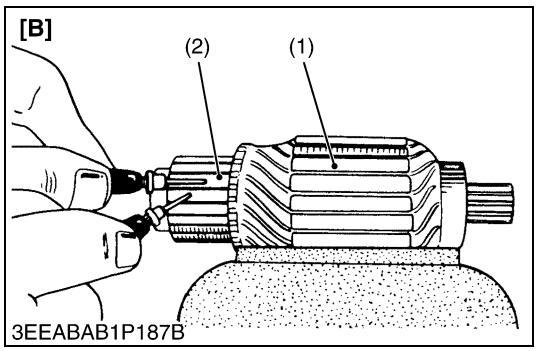

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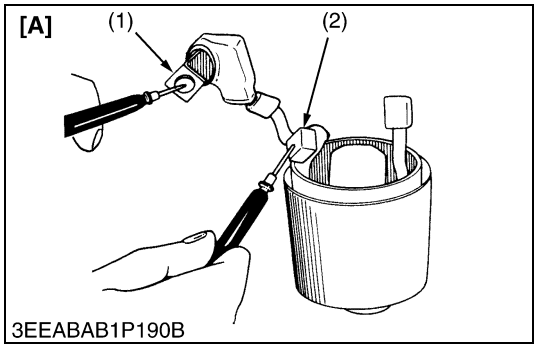

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Field Coil

1. Check the continuity across the lead (1) and brush (2) with an ohmmeter. **[A]**
2. If it does not conduct, replace the yoke assembly.
3. Check the continuity across the brush (2) and yoke (3) with an ohmmeter. **[B]**
4. If it conducts, replace the yoke assembly.

(1) Lead
(2) Brush
(3) Yoke

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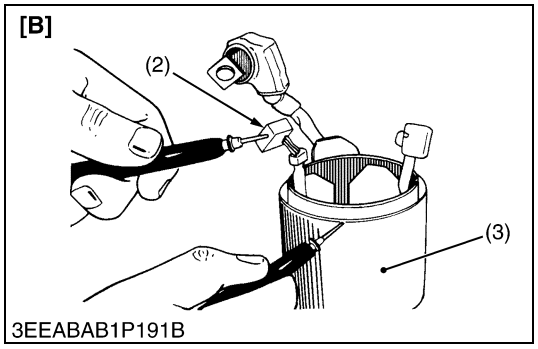

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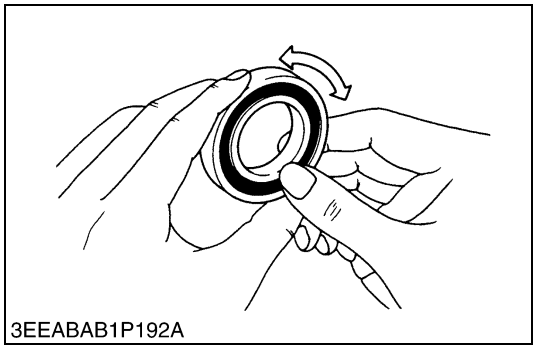
(2) Alternator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Bearing

1. Check the bearing for smooth rotation.
2. If it does not rotate smoothly, replace it.

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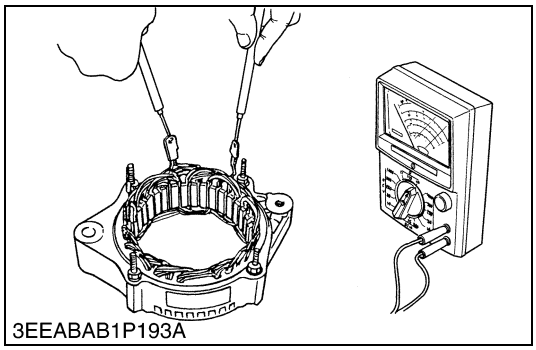
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Stator

1. Measure the resistance across each lead of the stator coil with an ohmmeter.
2. If the measurement is not within factory specification, replace it.
3. Check the continuity across each stator coil lead and core with an ohmmeter.
4. If the measurement is not within the factory specifications, replace it.

Resistance	Factory specification	Less than 1.0 Ω

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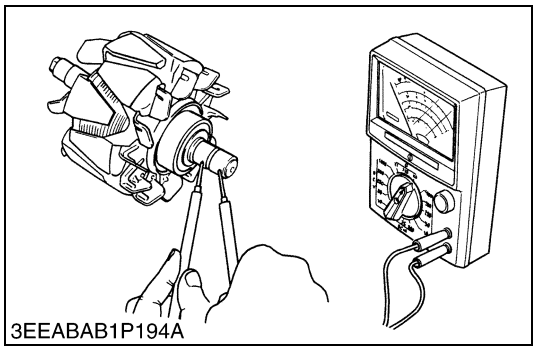
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Rotor

1. Measure the resistance across the slip rings with an ohmmeter.
2. If the resistance is not the factory specification, replace it.
3. Check the continuity across the slip ring and core with an ohmmeter.
4. If the measurement is not within the factory specifications, replace it.

Resistance	Factory specification	2.9 Ω

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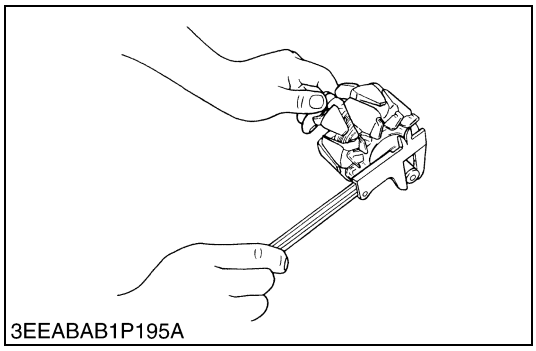
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Slip Ring

1. Check the slip ring for score.
2. If scored, correct with an emery paper or on a lathe.
3. Measure the O.D. of slip ring with vernier calipers.
4. If the measurement is less than the allowable limit, replace it.

Slip ring O.D.	Factory specification	14.4 mm 0.567 in.
	Allowable limit	14.0 mm 0.551 in.

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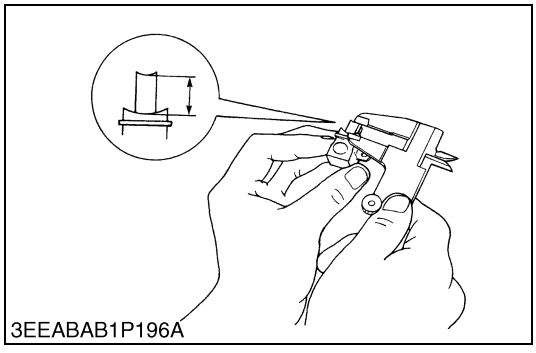
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Brush Wear

1. Measure the brush length with vernier calipers.
2. If the measurement is less than allowable limit, replace it.
3. Make sure that the brush moves smoothly.
4. If the brush is damaged, replace it.

Brush length	Factory specification	10.5 mm 0.413 in.
	Allowable limit	8.4 mm 0.331 in.

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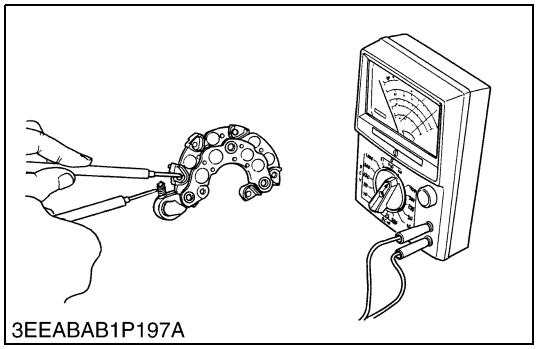
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Rectifier

1. Check the continuity across each diode of rectifier with an analog ohmmeter. Conduct the test in the (R x 1) setting.
2. The rectifier is normal if the diode in the rectifier conducts in one direction and does not conduct in the reverse direction.

■ **IMPORTANT**

- **Do not use a 500 V megohmmeter for measuring because it will destroy the rectifier.**

■ **NOTE**

- **Do not use an auto digital multimeter. Because it's very hard to check the continuity of rectifier by using it.**

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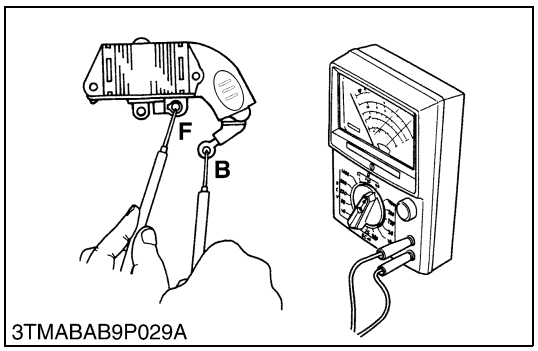

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IC Regulator

1. Check the continuity across the **B** terminal and the **F** terminal of IC regulator with an analog ohmmeter. Conduct the test in the (R x 1) setting.
2. The IC regulator is normal if the IC regulator conducts in one direction and does not conduct in the reverse direction.

■ **IMPORTANT**

- **Do not use a 500 V megohmmeter for measuring because it will destroy the IC regulator.**

■ **NOTE**

- **Do not use an auto digital multimeter. Because it is very hard to check the continuity of IC regulator by using it.**

WSM000001ELS0045US0

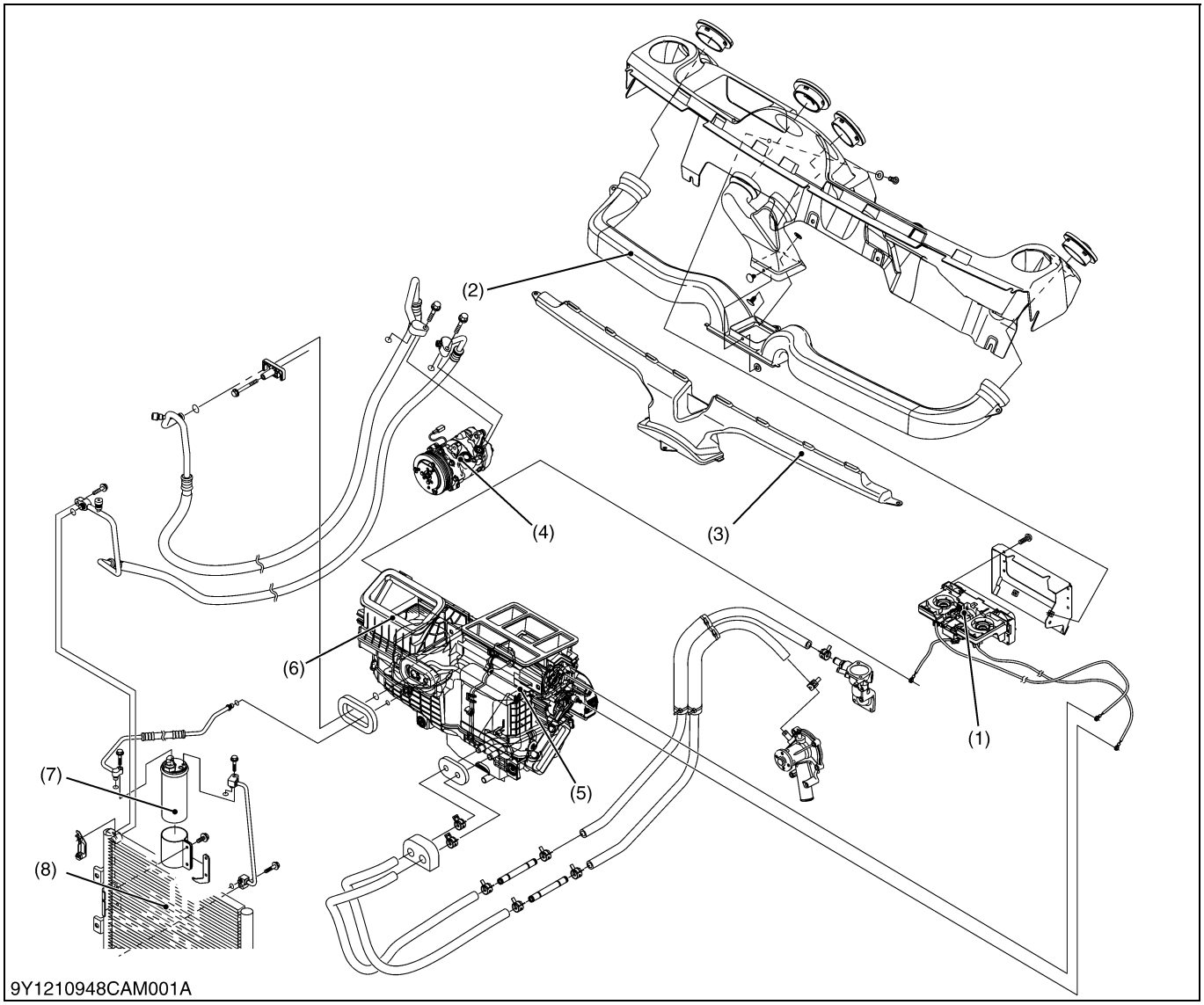
9 CABIN

MECHANISM

CONTENTS

1. AIR CONDITIONING SYSTEM

[1] OUTLINE OF AIR CONDITIONING SYSTEM



(1) Control Panel
(2) Face Blow Port
(3) Defroster Blow Port
(4) Compressor
(5) Air Conditioner Unit
(6) Inner Air Filter
(7) Receiver
(8) Condenser

The vehicle is equipped with a thin large-capacity air conditioner with outside air intake. Through the inside air filter (6) the air reaches the air conditioner unit (5). The air is then cooled and dehumidified by this unit.

The resulting air is heated to a comfortable level. In this way, the air being blown via the blow port can be kept at comfortable temperature and humidity.

The face blow port (2) can be opened and closed using the knob of each port. The defroster blow port (3) opened and closed using the mode switch on the control panel (1). You can feel that your head is cool and that your feet are warm by opening and closing these port.

(To be continued)

(Continued)

Capacity (Cooling)	Factory specification		2.6 kW or more
Capacity (Warming)	Factory specifi-cation	LLC* 50 %	3.3 kw or more
Kinds of refrigerant (Charge amount)	Factory specification		R134a 450 to 550 kg 0.992 to 1.21 lbs
Pressure sensor (Low)	Factory specification		0.196 MPa 2.00 kgf/cm^2 28.4 psi
Pressure sensor (High)	Factory specification		3.14 MPa 32.0 kgf/cm^2 455 psi

*LLC: Anti-freeze

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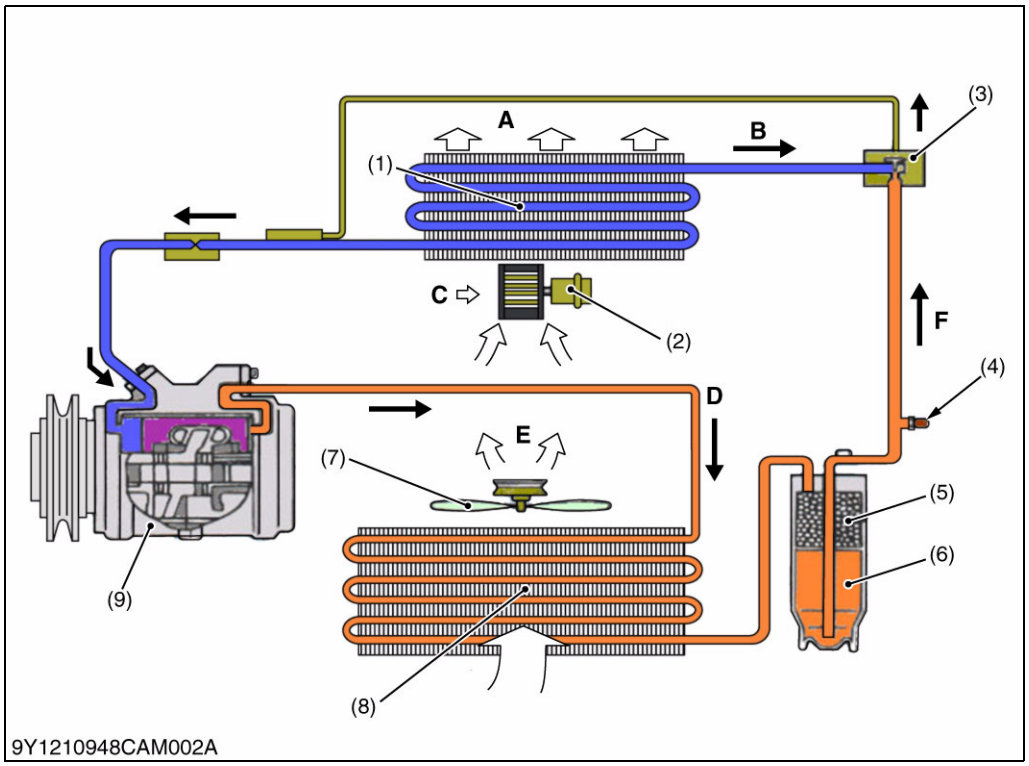
[2] SYSTEM LAYOUT AND COMPONENT PART



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(1) Evaporator
(2) Blow Motor
(3) Expansion Valve
(4) Pressure Switch
(5) Desiccant
(6) Receiver
(7) Front Radiator Fan
(8) Condenser
(9) Compressor

A: Cold Air
B: Low Pressure, Low Temperature Mist
C: Cabin Interior or Exterior Air
D: High Pressure, High Temperature Gas
E: Hot Air
F: Liquid

The refrigerant cycle of air conditioning system is as follows.

1. The gaseous refrigerant evaporated through the evaporator (1) is compressed in the compressor (9) to approx. 1.47 MPa (15 kgf/cm^2, 213 psi) and is also raised in temperature to approx. 70 °C (158 °F) and delivered to the condenser (8).
2. The gaseous refrigerant is cooled down through the condenser (8) to approx. 50 °C (122 °F) and delivered to the receiver (6) in the liquid state.
   At this time, heat removed from the cabin interior is extracted by means of the condenser (8).
3. The liquid refrigerant is collected in the receiver (6) for a certain period. At this time moisture are removed from the refrigerant by desiccant (5).
4. The liquid refrigerant after removing moisture and dust is jetted out of the small hole of the expansion valve (3) into the evaporator (1) as if it were distributed by an atomizer. Thus, the refrigerant is reduced in both pressure and temperature, and becomes easy to evaporate.
5. The refrigerant evaporates at 0 °C (32 °F) vigorously, taking heat from the surface of the pipes in the evaporator (1).
6. At this time, warm air in a cabin is drawn into the evaporator (1) by the blower motor and is passed over those pipes, transferring its heat to the refrigerant for evaporation. The air thus cooled is distributed to the cabin. (That is heat in a cabin is taken by the evaporator.)

(Reference)

- Since warm air in a cabin is cooled suddenly, water in the air is liquefied and removed, which means dehumidification is also performed.

7. The gaseous refrigerant from the evaporator (1) after having performed the cooling action is returned to the compressor (9), and is compressed to liquefy it (high pressure and high temperature). This cycle is repeated.
8. The air coming from the evaporator is fed to the air mixing doors, by which part of the air is introduced into the heater core. In doing so, the air temperature can be adjusted to a comfortable level. The air mixing doors are controlled through the cable connected with the control panel.

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(1) Compressor

The compressor is installed to on the engine and is driven by crank pulley through a belt.

The compressor is a pump designed to raise the pressure of refrigerant. Raising the pressure means raising the temperature. High temperature refrigerant vapor will condense rapidly in the condenser by releasing heat to the surrounding.

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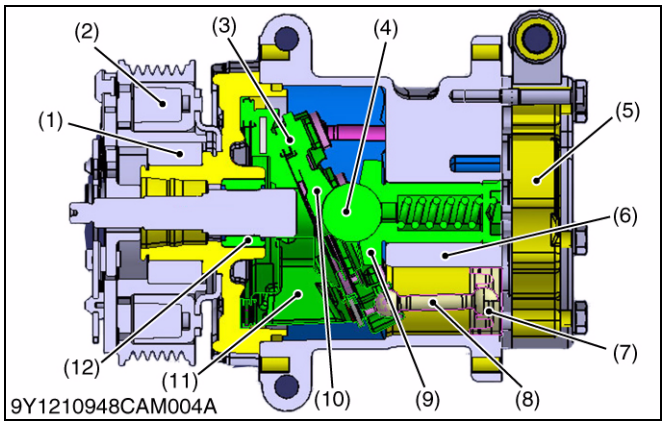
[A] Wobble Type Compressor



The wobble plate type, variable displacement compressor has a constant velocity joint mechanism equipped with an inner ring, an outer ring, and balls that are held between inner ring and outer ring guide races and that transmit power. The wobble plate is provided with a cylindrical part that extends in the axial direction of a swash plate. In the relative rotation structure between the swash plate and the wobble plate and the outer ring, the swash plate is supported to be able to rotate only in relation to the wobble plate by means of a bearing interposed between at least the aforementioned cylindrical part and the inner diameter portion of the swash plate, rather than being supported to be able to rotate relative to the external ring. With this wobble plate type, variable displacement compressor using the distinctive constant velocity joint mechanism, the relative rotation structure between the wobble plate, and the outer ring and the swash plate can be improved.

(1) Pulley Bearing
(2) Magnetic Clutch
(3) Wobble Plate
(4) Ball Bearing
(5) Cylinder Head
(6) Cylinder Block
(7) Piston
(8) Actuating Rod
(9) Fixing Gear
(10) Oscillating Gear
(11) Cam Rotor
(12) Needle Bearing

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Compressor Oil

The compressor oil dissolves in the refrigerant, circulates through the air-conditioning cycle, and functions to lubricate the compressor. But the conventional compressor oil for R12 doesn't dissolve in R134a, so it doesn't circulate through the cycle, and the life span of the compressor is considerably shortened.

It is still essential to ensure that the correct refrigerant oil is used. R12 systems were lubricated with mineral oil, which is totally unsuitable for R134a systems. The letter require PAG oil, which mixes very well with the refrigerant and provides ideal lubrication throughout the system.

Quantity (Total)	Brand Name
100 cc 0.106 U.S.qts 0.0880 Imp.qts	SP-10 oil or equipment

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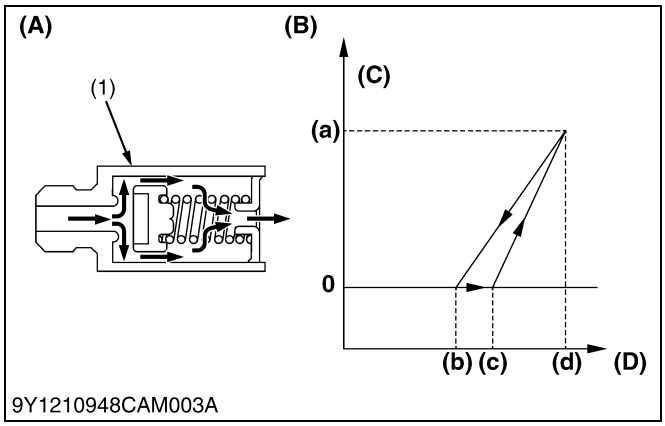
[B] Pressure Relief Valve



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If the high pressure is abnormally high, the pressure relief valve open, and the refrigerant is released into the atmosphere, and the system is kept. At the time, all of the refrigerant in the system is released into the atmosphere.

Even in the worst case, the outflow of refrigerant is stopped at the minimum limit.

(Reference)

- In normal operation, the high pressure switch is triggered first and the compressor stops, so the pressure relief valve is not triggered so easily.

(1) Pressure Relief Valve
(A) Gas Ejection Route When Operating
(a) 113 L/min. (27.2 U.S.gals/min., 24.86 Imp.gals/min.)
(B) Operation Characteristic
(b) 3.26 MPa (33.2 kgf/cm^2, 473 psi)
(C) Leakage Quantity
(c) 3.60 MPa (36.7 kgf/cm^2, 522 psi)
(D) Pressure
(d) 4.69 MPa (47.8 kgf/cm^2, 680 psi)

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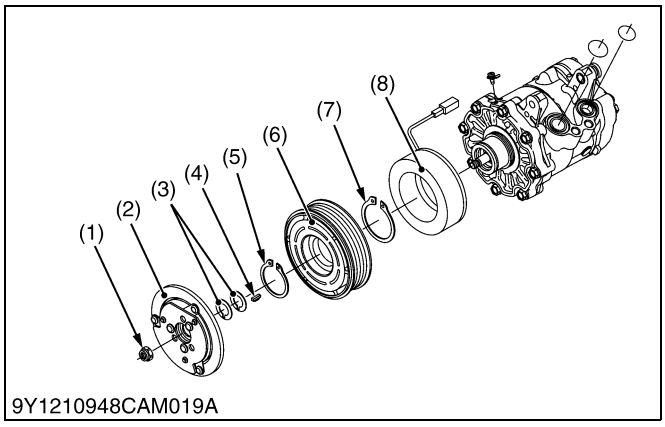
[C] Magnetic Clutch



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A magnetic clutch is used to engage and disengage the compressor from the engine. Main components are stator and rotor with pulley, and pressure plate to engage the drive pulley and compressor magnetically.

The stator is fixed on the compressor housing, and the pressure plate is attached to the compressor shaft. Two ball bearings are used between the inner surface of the rotor and the front housing of the compressor.

(1) Shaft Nut
(2) Armature Plate
(3) Clutch Shim
(4) Rotor Bearing Dust Cover
(5) Snap Ring
(6) Pulley and Bearing Assembly
(7) Snap Ring
(8) Field Coil

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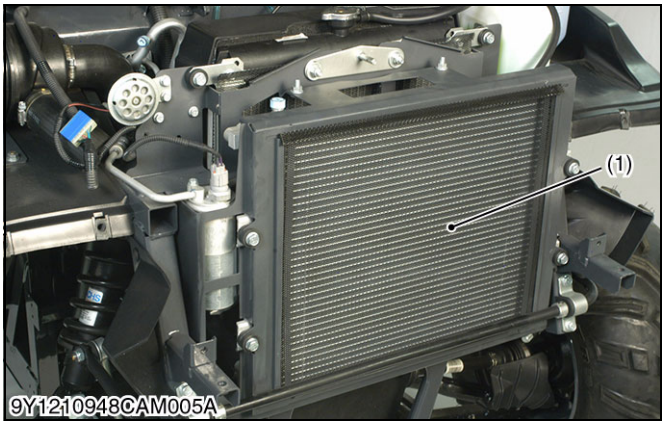
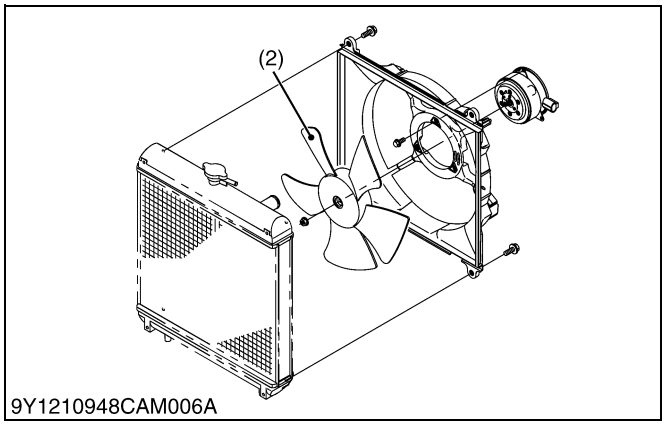
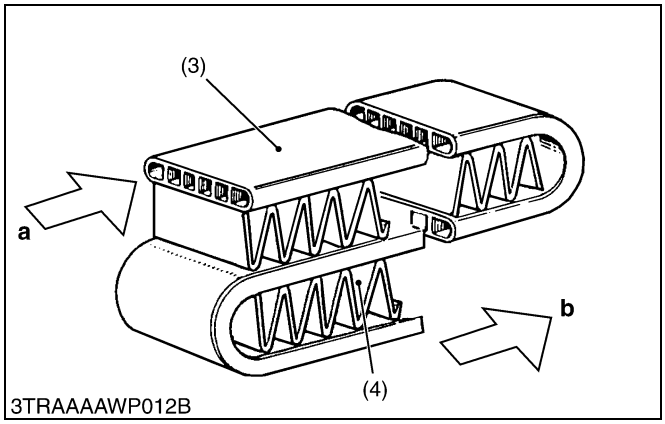
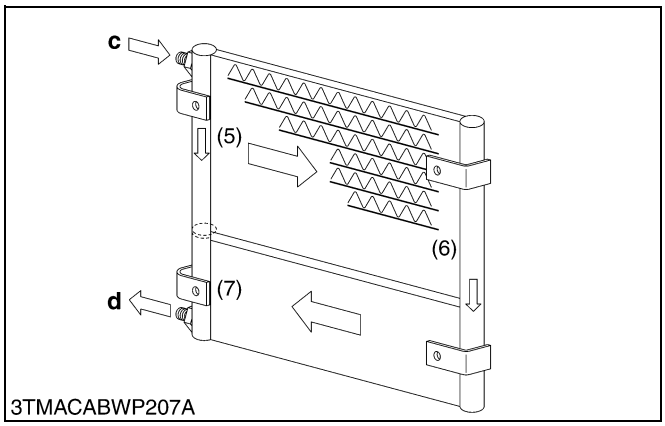
(2) Condenser









The condenser (1) is installed in the front side of the vehicle. The condenser equips with a fan (2) to enable forcible cooling.

The condenser is used for the purpose of cooling and robbing the heat from the refrigerant gas, which has been compressed by the compressor into high temperature, high pressure gas, so as to change this gas into liquid refrigerant.

The heat given off by the gaseous refrigerant in the condenser is the sum of the heat absorbed at the evaporator and the heat of work required by the compressor to compress the refrigerant. The greater the amount of heat give off in the condenser, the greater will be the cooling effect attainable by the evaporator.

(1) Condenser
(2) Fan
(3) Tube
(4) Fin
(5) Vapor
(6) Liquefying
(7) Liquefied

a: Gaseous Refrigerant
b: Liquid Refrigerant
c: Heated Vapor from Compressor (70 °C, 158 °F)
d: Cooled Liquid to Receiver (50 °C, 122 °F)

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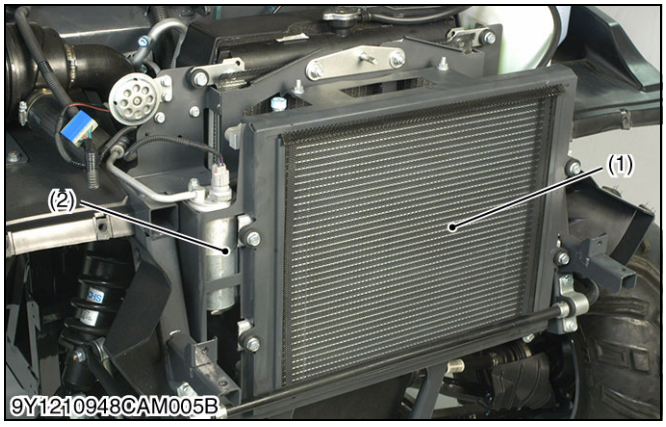
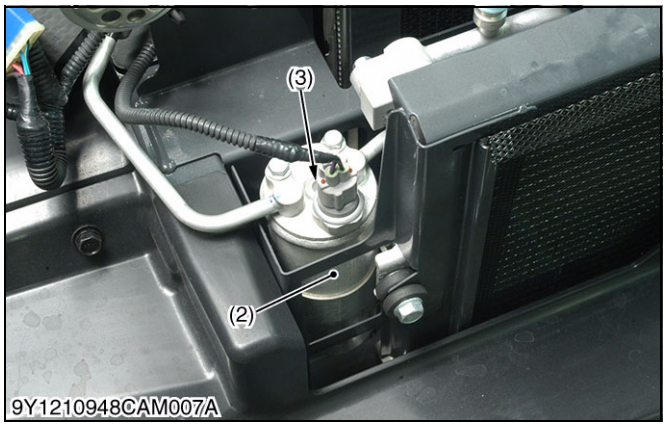
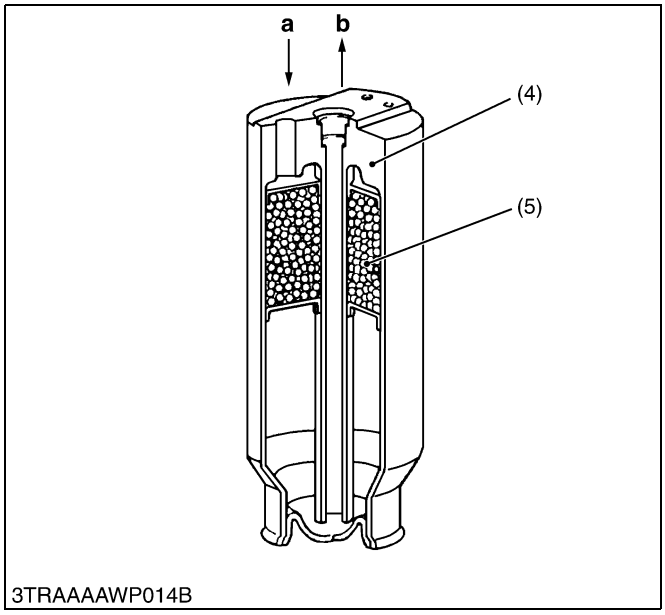
(3) Receiver







The receiver (2) serves the purpose of storing the liquid refrigerant. The amount of the liquid refrigerant flowing through the system varies with the operating condition of the air conditioner. To be accurate, the receiver stores excess amount of refrigerant when the heat load is lowered. It also releases stored refrigerant when additional cooling is needed, thus, keeping the optimum flow of refrigerant within the system.

The receiver includes a desiccant (5). It has the job of removing moisture as the refrigerant circulates within the system.

The sight glass (3) is installed on the top of receiver. Amount of refrigerant to be charged is very important for the efficiency of air conditioner. The sight glass is used to check the amount of refrigerant. If large flow of bubbles can be seen in the sight glass, there is insufficient refrigerant charged. If so, fill the refrigerant to the proper level.

(1) Condenser
(2) Receiver
(3) Sight Glass
(4) Receiver Body
(5) Desiccant

a: IN
b: OUT

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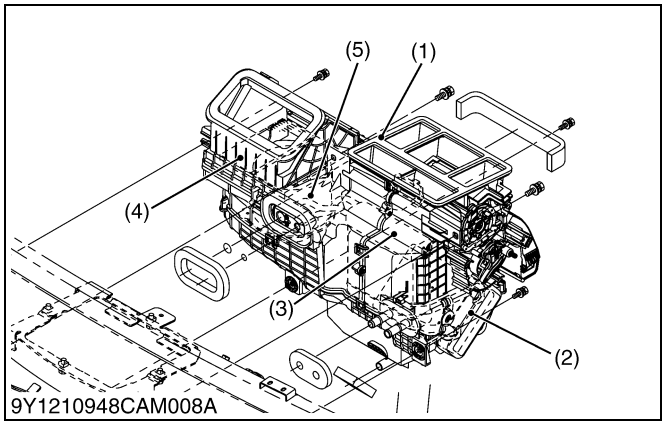
(4) Air Conditioner Unit



Air conditioner unit (1) consists of heater core (2), evaporator (3), blower (5), expansion valve (4), etc..

(1) Air Conditioner Unit
(2) Heater Core
(3) Evaporator
(4) Expansion Valve
(5) Blower

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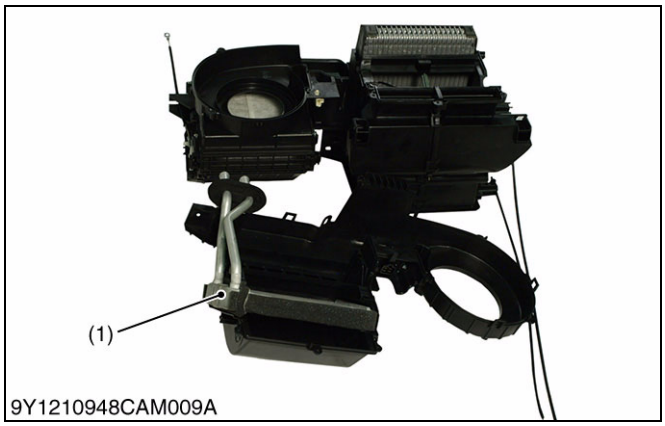
[A] Heater Core



The heater-sauce of heater utilizes coolant which becomes high temperature by heat of engine.

The inlet port of heater core is connected to the delivery side of engine water pump by a rubber hose, and the water valve is installed on the inlet port of heater core. Also, the outlet port of heater core is connected to the water flange in the engine.

The heater core is one of the heat exchangers like evaporator or condenser, and heat is exchanged between heated coolant passing through the core and air in the cabin or fresh outdoor air. Thus, air is heated.

(1) Heater Core
(2) Water Valve

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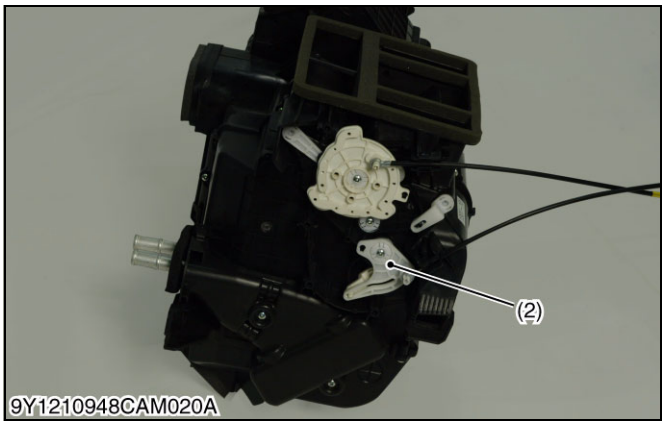
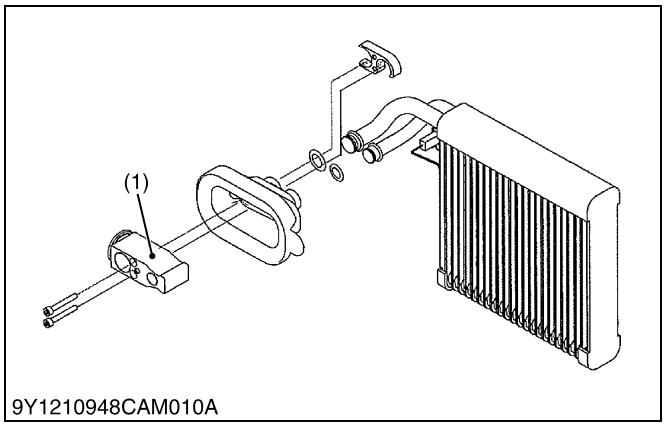


[B] Expansion Valve



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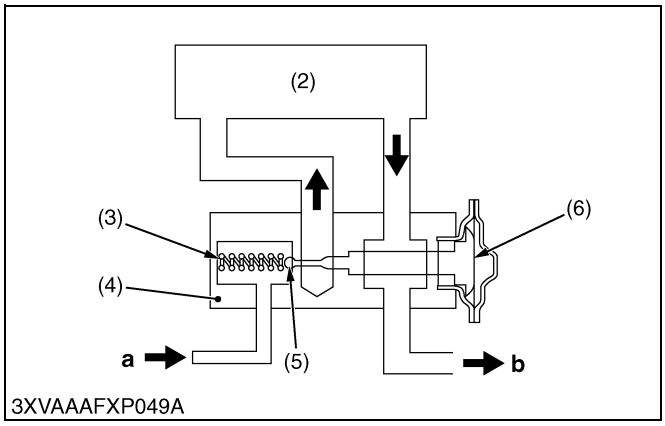

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The expansion valve (1) restricts the flow of liquid refrigerant as it passes through the expansion valve and delivers sprayed refrigerant to the evaporator (2) for facilitating refrigerant evaporation.

The cabin interior will not be cooled sufficiently if the expansion valve outlet is too small. If it is too wide, frost will be produced on the evaporator, decreasing cooling efficiency. Thus the size of this small spray hole has to be controlled according to various conditions.

(1) Expansion Valve
(2) Evaporator
(3) Spring
(4) Valve Body
(5) Needle Valve
(6) Diaphragm

a: From Receiver
b: To Compressor

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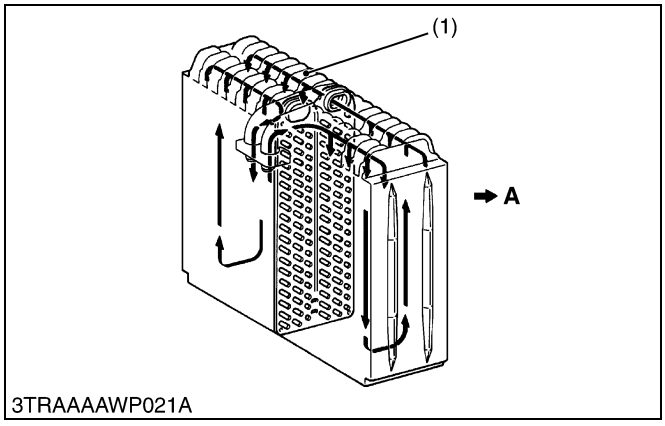
[C] Evaporator



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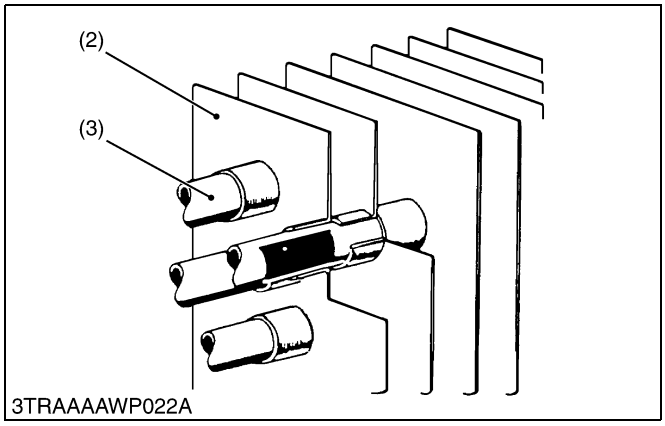

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The purpose of evaporator (1) is just opposite to that of the condenser. The state of refrigerant immediately after the expansion valve is 100 % liquid. As soon as the liquid pressure drops, it starts to boil, and in doing so, absorbs heat. This heat is removed from the air passing over the cooling fins of the evaporator and causes the air to cool.

If too much refrigerant is sent into the evaporator, it will not boil away so easily. Also, the evaporator filled with liquid refrigerant eliminates a place for the refrigerant to properly vaporize, which is necessary in order to take on heat. A flooding condition of the evaporator will allow an excess of liquid refrigerant to leave the evaporator and may cause serious damage to the compressor.

If too little refrigerant is sent into the evaporator, again the evaporator will not cool because the refrigerant will vaporize, or boil off, long before it passes through the evaporator.

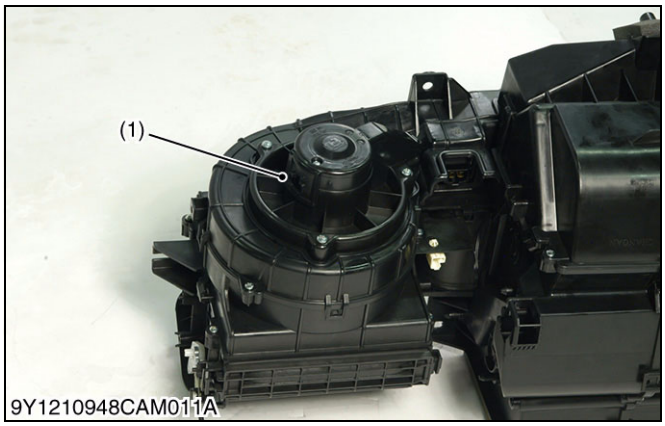
Refrigerant properly metered into the evaporator should allow for 100 % liquid just after the expansion valve, and 100 % gas at the outlet.

(1) Evaporator
(2) Fin
(3) Tube

A: Flow of Refrigerant

9Y1210948CAM0013US0

[D] Air Conditioner Blower



The blower is incorporated in the left-hand space of the air conditioner unit. It blows cool, warm of fresh air via the front and side blow ports into the cabin.

The speed of the blower motor (1) can be adjusted in 4 steps by the resistor.

The blower fan is centrifugal type. The air being sucked in parallel with the rotary shaft is blown in the centrifugal direction; in other words, perpendicular to the rotary shaft.

(1) Blower Motor

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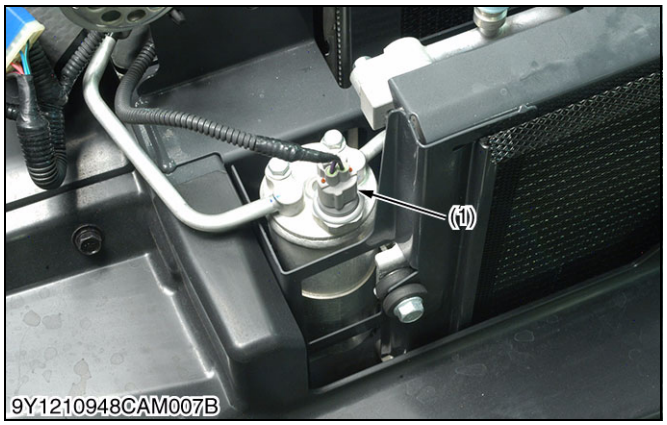
[E] Pressure Switch



The pressure switch detects the pressure in the refrigerant cycle, and when something is wrong, turns off the magnetic clutch to prevent the component from troubling. This system has dual type pressure switch (1), and this switch controls low pressure cut and high pressure cut.

(1) Pressure Switch

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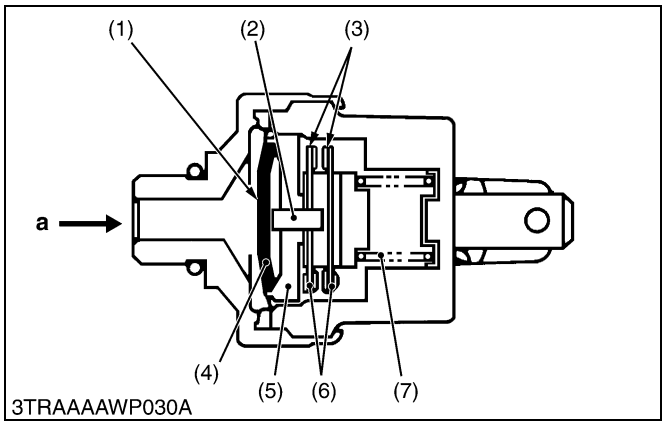

1) Pressure Switch (Dual Type)

The pressure switch is installed in inlet line (liquid line) between receiver and expansion valve.

The contact of pressure switch is normally open type.

(1) Diaphragm
(2) Pin
(3) Terminal
(4) Belleville Spring
(5) Plate
(6) Movable Contact
(7) Spring

a: Pressure

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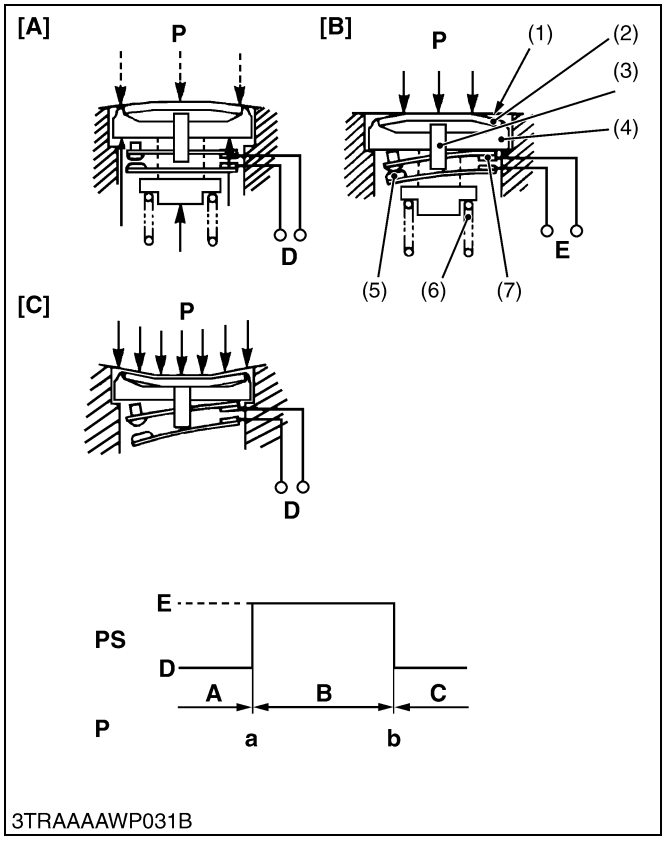

■ **OFF Position: [A] (When the Refrigerant Pressure is Low)**

The pressure switch detects the pressure drop when the refrigerant leaks from the system causing compressor seizure. When pressure of refrigerant is less than specified pressure, the switch is turned **OFF** and disengages magnetic clutch.

■ **ON Position: [B] (When the Refrigerant Pressure is Normal)**

When the pressure in the inlet line is between 0.196 MPa (2.00 kgf/cm^2, 28.4 psi) and 2.94 MPa (30.0 kgf/cm^2, 455 psi), the switch is turned **ON**, and engages magnetic clutch.

■ **OFF Position: [C] (When the Refrigerant Pressure is High)**

When the pressure in the inlet line is higher than specified pressure, the switch is turned **OFF**, and disengages magnetic clutch.

(1) Diaphragm
(2) Belleville Spring
(3) Pin
(4) Plate
(5) Contact
(6) Spring
(7) Terminal

D: OFF
E: ON
P: Pressure
PS: Pressure Switch
a: 0.196 MPa (2.00 kgf/cm^2, 28.4 psi)
b: 3.14 MPa (32.0 kgf/cm^2, 455 psi)

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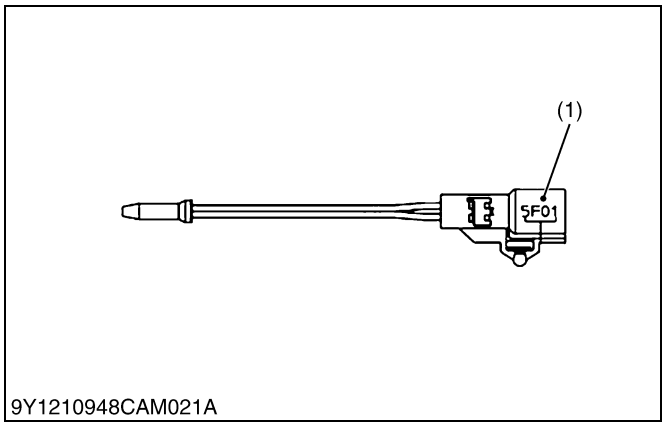
[F] Thermistor



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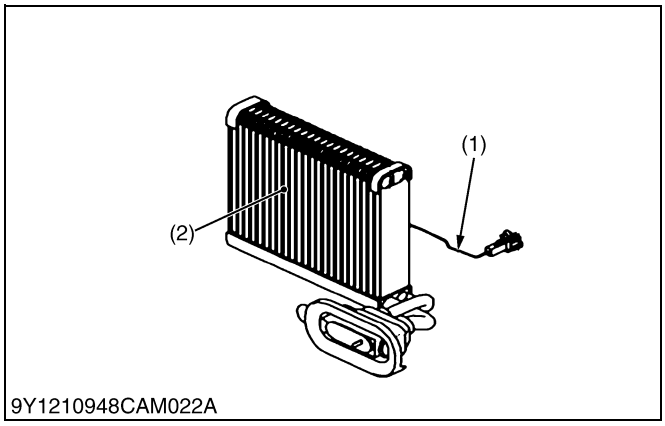

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Thermistor

This machine has a thermistor.

The thermistor prevents an evaporator from frosting.

A resistance of the thermistor is high when the temperature is low.

The thermistor controls the operation of the compressor by utilizing this characteristic.

The thermistor detects the temperature of the air flowing through the evaporator.

Depending on the air temperature, the resistance of the thermistor changes and sends a signal to the control panel assembly.

The control panel assembly sends a signal for controlling the compressor clutch relay **ON** and **OFF**.

If the air temperature of the evaporator is lower than the setting temperature, the compressor clutch relay is turned **OFF** and the compressor does not work.

This prevents the evaporator from frosting.

If the air temperature of the evaporator is higher than the setting temperature, the compressor clutch relay is turned **ON** and the compressor works.

This performs a cooling of the evaporator.

(Reference)

- Thermostat setting temperature:
  OFF: Approx. 2.0 °C (35.6 °F)
  ON: Approx. 4.0 °C (39.2 °F)

(1) Thermistor (2) Evaporator

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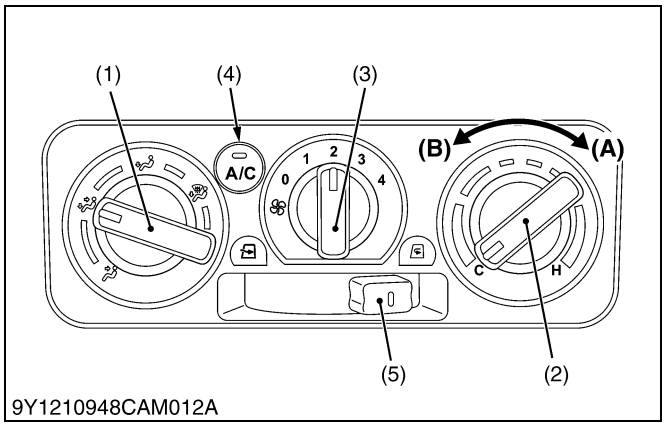
[3] SYSTEM CONTROL



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■ **Recirculation / Fresh Air Selection Lever**

• **RECIRCULATION (Right)**

In-CAB air will be recirculated. This is useful for cooling or heating the CAB quickly or keeping it extra cool or warm.

• **FRESH AIR (Left)**

Fresh air will flow into the CAB. This is helpful when you work in dusty conditions or if the glass windows get foggy.

■ **Air Conditioner Switch**

Push this switch to activate the air conditioner. An indicator light will light up when the switch is set to **"ON"**.

Push the switch again to turn the air conditioner off, in which case the indicator light will be off.

■ **Mode Switch**

• **FACE**

Air is blown from the face and side area air outlets.

• **FACE + FEET**

Air is blown from the face and feet air outlets.

• **FEET**

Air is blown from the feet air outlets

• **FEET + DEFROSTER**

Air is blown from the feet and defroster air outlets.

• **DEFOROSTER**

Air is blown from the defroster air outlets.

■ **Blower Switch**

Air volume can be changed in four steps. At the **"4"** position, the largest air volume is obtained.

■ **Air Conditioner Switch**

Push this switch to activate the air conditioner. An indicator will light up when the switch is set to **"ON"**. Push the switch again to turn the air conditioner off, in which case the indicator light will be off.

(1) Mode Switch
(2) Temperature Control Dial
(3) Blower Switch
(4) Air Conditioner Switch with Indicator Light
(5) Recirculation / Fresh Air Selection Lever

(A) "WARM"
(B) "COOL"

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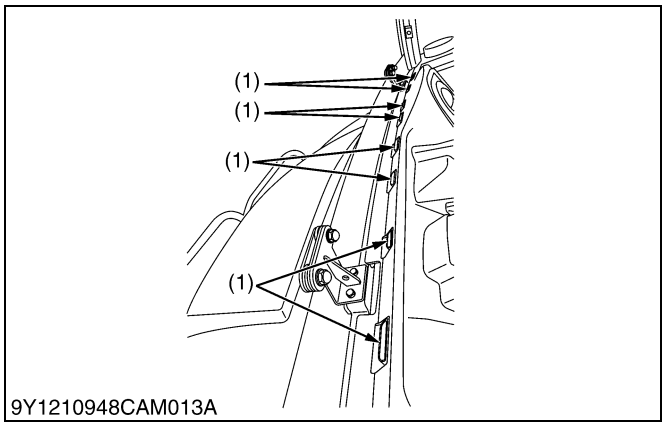
[4] AIR FLOW



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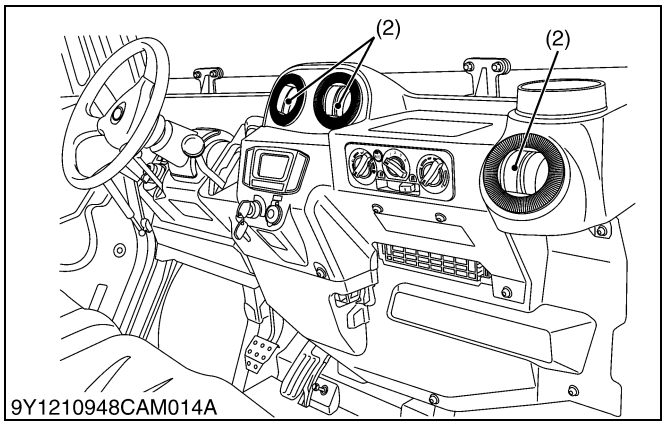

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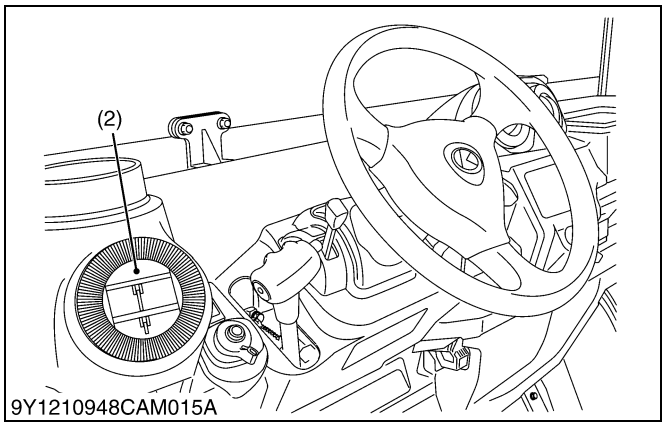

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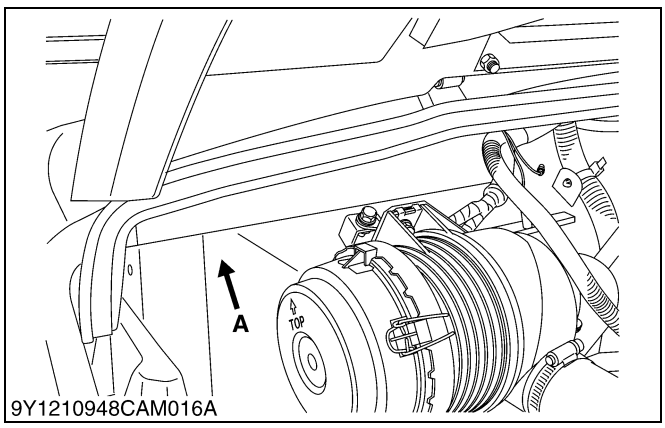

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Air in the cabin and fresh air introduced into the cabin flow as shown in the figures. Adjust the 5 air ports to obtain the desired condition.

■ **IMPORTANT**

- **Do not pour water directly into the fresh air port while washing the vehicle.**

(1) Defroster Air Outlet
(2) Dashboard Air Outlet

A: Fresh Air Inlet

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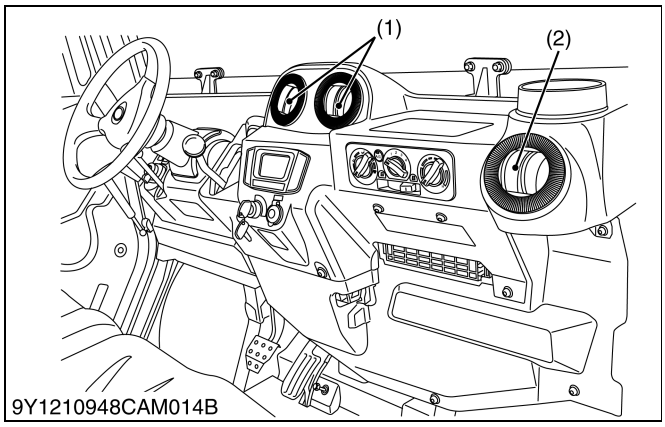
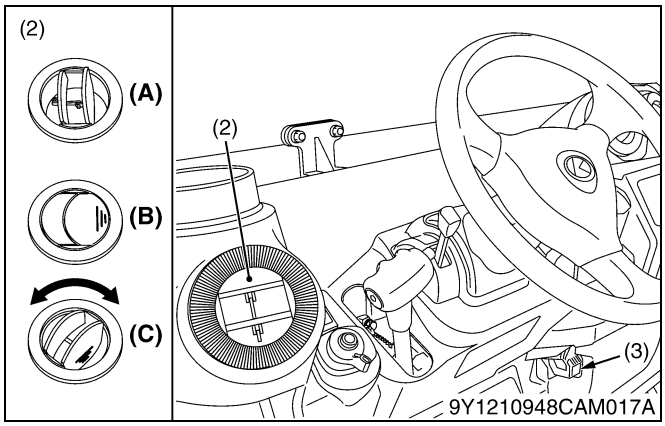
[5] AIR CONTROL VENT





The dashboard air outlet can be independently adjusted as required.

WARNING

To avoid serious injury:

- **Replace the water hoses every two years.**
- **Daily inspection**
  Have the vehicle repaired immediately if any of the following problem are discovered.
  (Such problem may cause burns or injury. They may also cause engine seizure or other serious failure.)
  - **Scratches, cracks or swelling in water hoses.**
  - **Water leakage at water hose joints.**
  - **Loose mounting bolts, damaged brackets.**
- **Do not touch the water hoses and the heater with your hand. You may get burned.**
- **If the window fails to defrost in extreme conditions or becomes cloudy when dehumidifying the CAB, wipe off moisture with a soft cloth.**
- **Do not block all the air outlets of the air conditioner. A trouble could occur.**

(1) Face Area Air Outlet
(2) Side Area Air Outlet
(3) Feet Area Air Outlet

(A) Open
(B) Shut
(C) Turn

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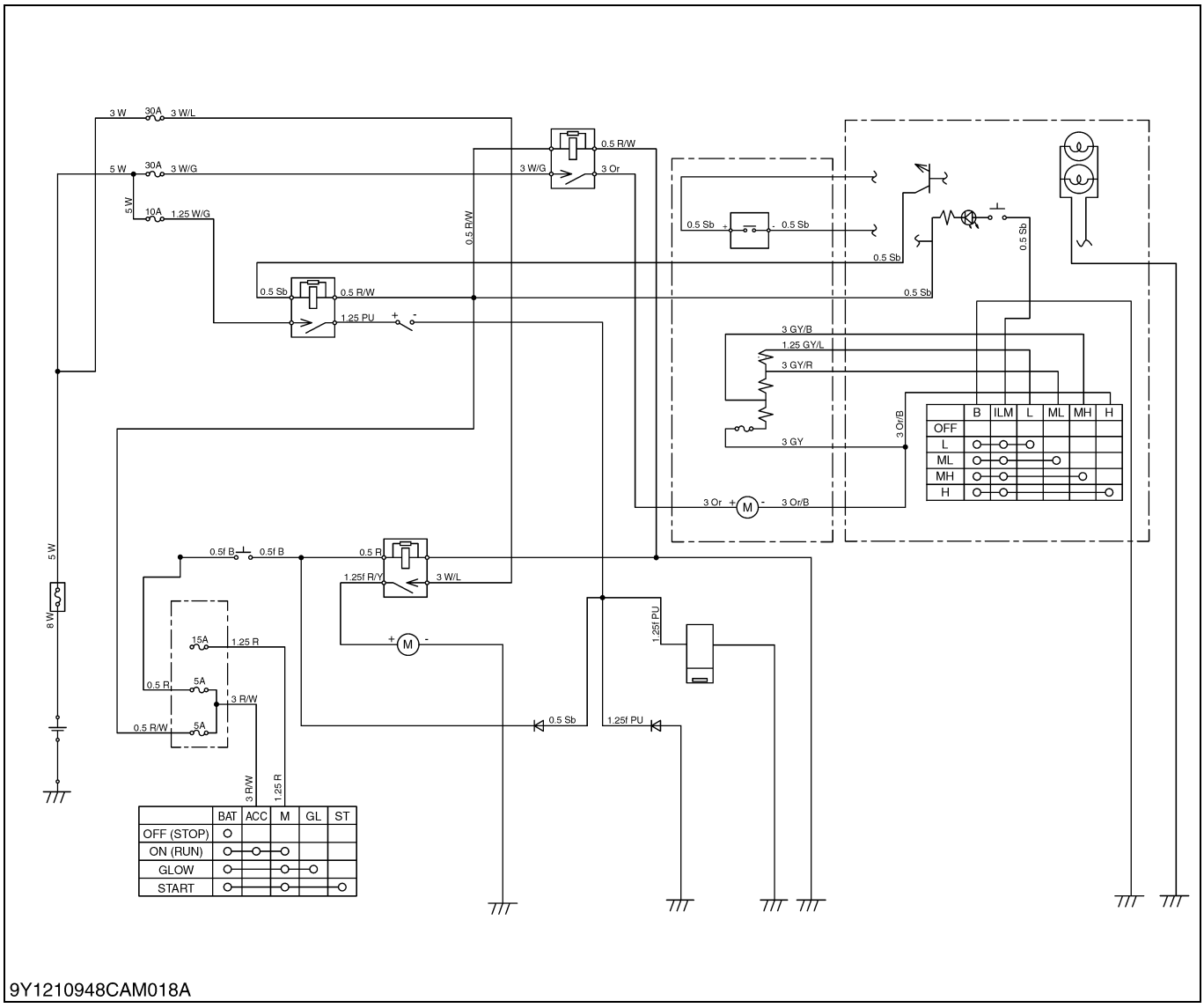
[6] ELECTRICAL SYSTEM
(1) Electrical Circuit



9Y1210948CAM018A

(1) Battery
(2) Key Switch
(3) Slow Blow Fuse (80A)
(4) Fuse (30A)
(5) Fuse (30A)
(6) Fuse (10A)
(7) Fuse (15A)
(8) Fuse (5A)
(9) Fuse (5A)
(10) Radiator Fan Motor Switch
(11) Compressor Relay
(12) Dual Pressure Switch
(13) Radiator Fan Motor Relay
(14) Radiator Fan Motor
(15) Blower Relay
(16) Radiator Fan Diode
(17) Compressor Clutch Diode
(18) Air Conditioner Compressor
(19) Air Conditioner Unit
(20) Thermistor
(21) Blower Resister
(22) Air Conditioner Blower Motor
(23) Air Conditioner Control Panel
(24) Air Conditioner Panel Switch
(25) Air Conditioner Panel Blower

9Y1210948CAM0022US0

SERVICING

CONTENTS

1. TROUBLESHOOTING

COMPRESSOR

Symptom	Probable Cause	Solution	Reference Page
Noisy (Compressor ON)	Bearing of compressor worn or damaged	Replace	9-S23
	Valves in compressor damaged	Replace	9-S23
	Belt slipping	Adjust or replace	G-48
	Compressor bracket mounting screws loosen	Tighten	G-48
	Piping resonant	Tighten or add clamp	9-S23
Noisy (Compressor OFF)	Blower motor damaged	Repair or replace	9-S31
	Bearings of magnetic clutch, idle pulley or crank pulley worn or damaged	Replace	9-S23

AIR CONDITIONING SYSTEM

Symptom	Probable Cause	Solution	Reference Page
Does Not Cool (No Air Flow)	Fuse blown	Replace	G-56
	Blower relay damaged	Replace	9-S22
	Blower motor damaged	Replace	9-S31
	Blower switch damaged	Replace	9-S18
	Wiring harness disconnected or improperly connected	Repair	–
Does Not Cool (Compressor Does Not Rotate)	Fuse blown	Replace	G-56
	Magnetic clutch damaged	Repair or replace	9-S23
	Blower switch damaged	Replace	9-S18
	Pressure switch damaged	Replace	9-S21
	Belt slipping	Adjust or replace	G-48
Does Not Cool (Others)	Insufficient refrigerant	Check with manifold gauge	9-S11
	Expansion valve damaged	Replace	9-S31
	Compressor damaged	Replace	9-S18
Insufficient Cooling (Insufficient Air Flow)	Air filter clogged	Clean or replace	G-48
	Evaporator frosted	Clean or replace thermo switch	9-S31
	Blower motor damaged	Replace	9-S31
	Blower resistor damaged	Replace	9-S20
Insufficient Cooling (Many Bubbles in Sight Glass)	Insufficient refrigerant	Check with manifold gauge	9-S11
	Gas leaking from some place in refrigerating cycle	Repair and charge refrigerant	9-S16
	Air mixed in	Check with manifold gauge	9-S11
Insufficient Cooling (No Bubbles in Sight Glass)	Too much refrigerant	Check with manifold gauge	9-S11

Symptom	Probable Cause	Solution	Reference Page
Insufficient Cooling (Compressor Does Not Rotate Properly)	Belt slipping	Adjust or replace	G-48
	Magnetic clutch damaged	Repair or replace	9-S23
	Compressor damaged	Replace	9-S23
Insufficient Cooling (Others)	Control cable damaged	Replace	9-S29
	Condenser fin clogged with dust	Clean	G-48
	Expansion valve damaged	Replace	9-S31
Insufficient Heating	Control cable damaged	Check and repair	9-S29
	Insufficient coolant	Fill	G-8
Too Low Air Flow Rate (Blower Motor Does Not Run)	Blower switch damaged	Check and repair	9-S18
	Blower relay damaged	Replace	9-S22
	Fuse blown out	Replace	G-56
	Wrong wiring or loose connections	Check and repair	–
Too Low Air Flow Rate (Flow Rate Does Not Change in 4 Steps)	Blower resistor damaged	Replace	9-S20
	Blower relay damaged	Replace	9-S22
	Blower switch damaged	Replace	9-S18
Too Low Air Flow Rate (Others)	Blower is not tightened enough	Check and repair	9-S31
	Blower deformed	Replace	9-S31
	Blower in contact with casing	Check and repair	9-S31
	Obstacle at or near suction port	Check and repair	9-S23
	Evaporator frosted	Clean or replace	9-S31
	Filter clogged	Clean or replace	G-48
	Blow duct clogged or missing	Check and repair	9-S31
Insufficient Cooling (Compressor Magnetic Clutch Does Not Work)	Low battery voltage	Charge	G-34
	Rotor in contact with stator	Replace	9-S23
	Wrong wiring loose connections	Check and repair	9-S23
	Compressor relay damaged	Replace	9-S22
	Coil shortage	Replace	9-S23
	Ground malfunction	Check and repair	–
	Coil burst out	Replace	9-S23
Insufficient Cooling (Hi-pressure Level is Too High)	Refrigerant overcharged	Check with manifold gauge	9-S11
	Condenser clogged with dust and dirt	Clean	G-48
	Air mixed	Check with manifold gauge	9-S11
Insufficient Cooling (Hi-pressure Level is Too Low)	Refrigerant too short	Check with manifold gauge	9-S11
	Compressor discharge valve damaged	Replace	9-S23
	Low-pressure pipe in trouble (Cracked or clogged)	Replace	9-S33

Symptom	Probable Cause	Solution	Reference Page
Insufficient Cooling (Low-pressure Level is Too High)	Refrigerant overcharged	Check with manifold gauge	9-S11
	Themistor damaged	Check and repair	9-S31
	Expansion valve too open	Replace	9-S31
Insufficient Cooling (Low-pressure Level is Too Low)	Refrigerant too short	Check with manifold gauge	9-S11
	Themistor damaged	Check and repair	9-S31
	Evaporator frosted	Clean or replace	9-S31
	Low-pressure pipe in trouble (Cracked or clogged)	Replace	9-S33
	Expansion valve clogged	Replace	9-S31
Insufficient Cooling (Both Hi-pressure and Low-pressure Level is Too High)	Refrigerant overcharged	Check with manifold gauge	9-S11
Insufficient Cooling (Both Hi-pressure and Low-pressure Level is Too Low)	Refrigerant too short	Check with manifold gauge	9-S11
Temperature Cannot be Controlled (Temperature Motor and / or Temperature control dial Malfunction)	Control cable damaged	Replace	9-S29
	Temperature control dial damaged	Replace	9-S29
	Wiring harness connector disconnected	Repair or Replace	–
Temperature Cannot be Controlled (Water Valve Does Not Open Properly)	Cable wrongly set	Repair	9-S29
	Cable disconnected	Repair	9-S29
Temperature Cannot be Controlled (Mode Motor and / or Mode Switch Malfunction)	Control cable damaged	Replace	9-S29
	Mode switch damaged	Replace	9-S29
	Wiring harness connector disconnected	Repair or replace	–
Temperature Cannot be Controlled (Heater Hoses Laid is Bad)	Heater hose caught	Repair	9-S30
	Heater hose twisted or bent	Repair or replace	9-S30

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2. SERVICING SPECIFICATIONS

Item		Factory Specification	Allowable Limit
Kinds of Refrigerant	Charge Amount	R134a 450 to 550 g 0.992 to 1.12 lbs	–
Refrigerating Cycle (Refrigerating Cycle is Normal Operating)	Pressure (**LO** Pressure Side)	0.15 to 0.19 MPa 1.5 to 2.0 kgf/cm^2 22 to 28 psi	–
	Pressure (**HI** Pressure Side)	1.28 to 1.66 MPa 13.0 to 17.0 kgf/cm^2 185 to 241 psi	–
Air-gap of Air Conditioner Compressor Magnet Clutch	Air-gap	0.40 to 0.80 mm 0.016 to 0.031 in.	–
Air Conditioner Drive Belt	Tension	10 to 12 mm (0.40 to 0.47 in.) deflection at 98 N (10 kgf, 22 lbs) of force	–
Pressure Switch (Dual Type) (When pressure switch is turned **OFF**)	Pressure (**LO** Pressure Side)	Less than approx. 0.196 MPa 2.00 kgf/cm^2 28.4 psi	–
	Pressure (**HI** Pressure Side)	More than approx. 2.94 MPa 30.0 kgf/cm^2 426 psi	–

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3. TIGHTENING TORQUES

Tightening torques of screws, bolts and nuts on the table below are especially specified.
(For general use screws, bolts and nuts: Refer to "5. TIGHTENING TORQUES" on page G-12.)

Item	N·m	kgf·m	lbf·ft
High pressure pipe and low pressure pipe mounting screw (Compressor side)	8.0 to 12	0.82 to 1.2	5.9 to 8.8
Compressor mounting screw	18 to 20	1.8 to 2.1	13 to 15
Armature nut (M8)	15 to 21	1.5 to 2.1	11 to 15
Steering wheel mounting nut	29 to 49	3.0 to 4.9	22 to 36
Air conditioner hose joint mounting screw	8.00 to 12.0	0.816 to 1.22	5.90 to 8.85
Condenser mounting screw	10.0 to 12.5	1.02 to 1.27	7.38 to 7.21
Tube mounting screw	8.00 to 12.0	0.816 to 1.22	5.90 to 8.85
High pressure hose and low pressure hose 1 mounting screw (Rear side)	8.0 to 12	0.82 to 1.2	5.9 to 8.8
Wiper arm nut	2.9 to 3.9	0.30 to 0.39	2.2 to 2.8
Wiper motor nut	6.4 to 9.3	0.66 to 0.94	4.8 to 6.8
Wiper motor mounting screw and nut	3.4 to 4.4	0.35 to 0.44	2.5 to 3.2
Front glass mounting cap nut	10.0 to 15.0	1.02 to 1.52	7.38 to 11.0
Door glass mounting bolt and nut	9.80 to 11.3	1.00 to 1.15	7.23 to 8.33

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4. PRECAUTIONS AT REPAIRING REFRIGERANT CYCLE

When checking or repairing the air conditioning system, the following precautions and rules must be observed. And it is of first importance that no other personnel than a well-trained serviceman should be allow to handle the refrigerant.

CAUTION

- **Since direct contact of the liquid refrigerant with your skin will cause frostbite, always be careful when handling the refrigerant. Always wear goggles to protect your eyes when working around the system.**
- **The refrigerant service container has a safe strength. However, if handled incorrectly, it will explode. Therefore, always follow the instructions on the label. In particular, never heat the refrigerant container above 40 °C (104 °F) or drop it from a high height.**
- **Do not steam clean on the system, especially condenser since excessively high pressure will build up in the system, resulting in explosion of the system.**
- **If you improperly connect the hose between the service valve of compressor and gauge manifold, or incorrectly handle the valves, the refrigerant service container or charging hose will explode. When connecting the hose or handling the valve, be sure to check the high pressure side or low pressure side.**
- **In case the refrigerant is charged while the compressor is operated, do not open the high pressure valve of the gauge manifold.**
- **Be careful of the toxicity of the gas. The gas is harmless and nontoxic in its original state, however it produces a toxic substance when it comes in contact with high temperature parts and decomposes.**
- **Do not heat the service can unless necessary. When it has to be heated, use warm water of 40 °C (104 °F) or lower. Do not heat using boiling water.**

■ IMPORTANT

- **If the refrigerant, O-rings, etc. for R12 are used in the R134a air conditioner system, problems such as refrigerant leakage or cloudiness in the sight glass may occur. Therefore, in order to prevent charging of refrigerant or erroneous connections, the shapes of the piping joint as well as the shapes of the service valve and the service tools have been changed.**
- **Always keep the working place clean and dry and free from dirt and dust. Wipe off water from the line fittings with a clean cloth before disconnecting.**
- **Use only for R134a refrigerant service tool.**
- **Use for R134a refrigerant recovery and recycling machine when discharging the refrigerant.**
- **Before attaching the charging hose to the can tap valve of the refrigerant container, check each packing for clogging.**
- **When disconnecting the charging hose from the charging valve of compressor and receiver, remove it as quick as possible so that gas leakage can be minimized.**
- **Be sure to charge the specified amount of refrigerant, but not excessively. Over-charging of the refrigerant in particular may cause insufficient cooling, etc..**
- **Since the charging hose can be connected to can tap valve by hand, do not use a pliers for tightening it.**
- **Keep refrigerant containers in a cool and dark place avoiding such place which are subject to strong sunlight or high temperature.**
- **R134a compressor oil absorbs moisture easily, so that be sure to seal after disconnecting the each parts.**
- **Do not use old-type refrigerant R12a or compressor oil for old-type refrigerant.**
- **When replacing the condenser**

(Refrigerant)

Kinds of refrigerant (Charge amount)	Factory specification	R134a 450 to 550 g 0.992 to 1.12 lbs

(Compressor Oil)

Quantity (Total)	Brand Name
100 cc 0.106 U.S.qts 0.0880 Imp.qts	SP10 oil <PAG* oil>

*PAG: Polyalkyleneglycol (Synthetic oil)

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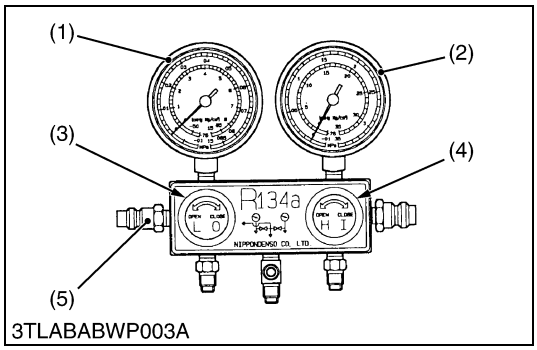
[1] HANDLING OF SERVICE TOOLS

(1) Manifold Gauge Set



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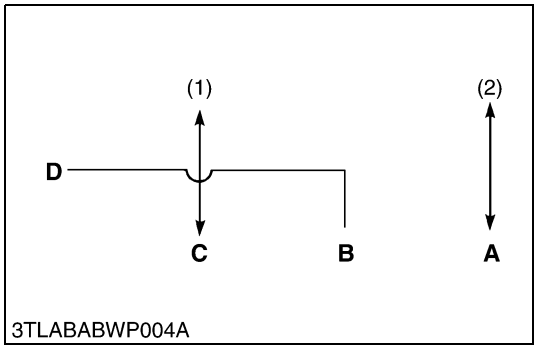
The hand valves on the manifold gauge set are used to open and close the valve. The hand valve inscribed **LO** is for the low pressure side valve (3) and **HI** is for the high pressure side valve (4). By opening or closing the high and low pressure hand valves, the following circuits are established.

(1) **LO** Pressure Gauge
(2) **HI** Pressure Gauge
(3) **LO** Pressure Side Valve
(4) **HI** Pressure Side Valve
(5) Schrader Valve

9Y1210948CAS0005US0

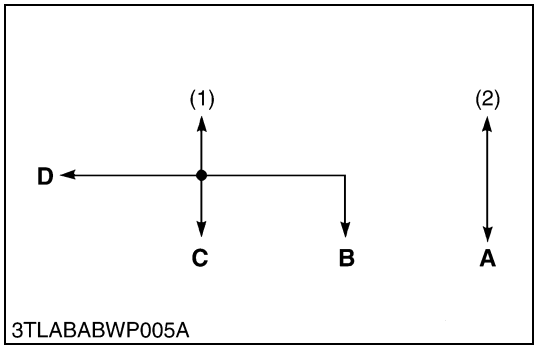


3TLABABWP004A

■ **When LO Pressure Side Valve and HI Pressure Side Valve are Closed**
Two circuits are established.
Port **"C"**→ **LO** pressure gauge (1)
Port **"A"**→ **HI** pressure gauge (2)

■ **NOTE**
- **Schrader valve "D" must be opened.**

9Y1210948CAS0006US0

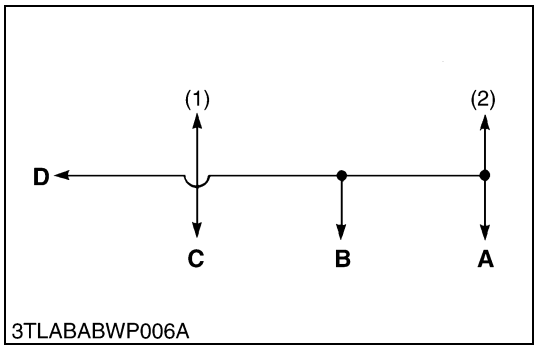


3TLABABWP005A

■ **When LO Valve is Opened and HI Valve is Closed**
Two circuits are established.
Port **"C"**→ **LO** pressure gauge (1)
→ Port **"B"**
→ Port **"D"**
Port **"A"**→ **HI** pressure gauge (2)

■ **NOTE**
- **Schrader valve "D" must be opened.**

9Y1210948CAS0007US0

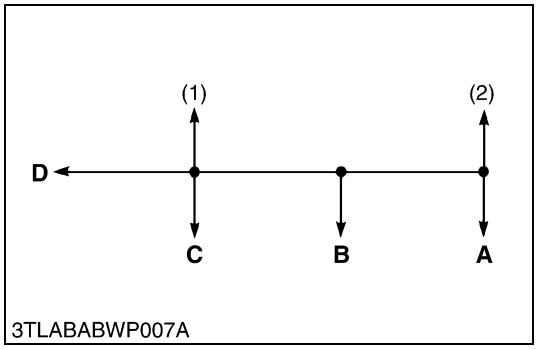


3TLABABWP006A

■ **When LO Valve is Closed and HI Valve is Opened**
Two circuits are established.
Port **"C"**→ **LO** pressure gauge (1)
→ Port **"B"**
→ Port **"D"**
Port **"A"**→ **HI** pressure gauge (2)

■ **NOTE**
- **Schrader valve "D" must be opened.**

9Y1210948CAS0008US0



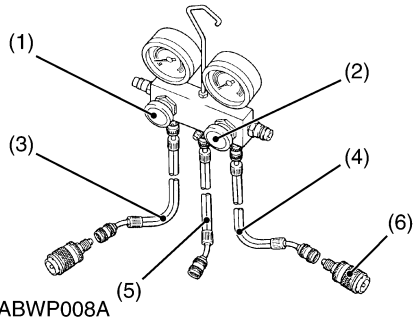
3TLABABWP007A

■ **When LO and HI Valve are Opened**
Circuits are established.
Port **"A"**→ **HI** pressure gauge (2)
→ **LO** pressure gauge (1)
→ Port **"B"**
→ Port **"C"**
→ Port **"D"**

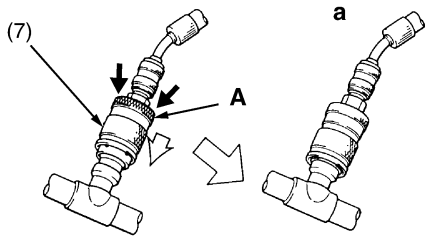
■ **NOTE**
- **Schrader valve "D" must be opened.**

9Y1210948CAS0009US0

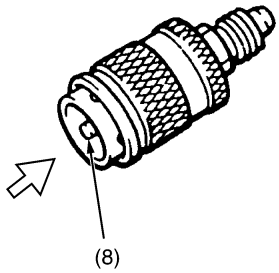
(2) Refrigerant Charging Hose



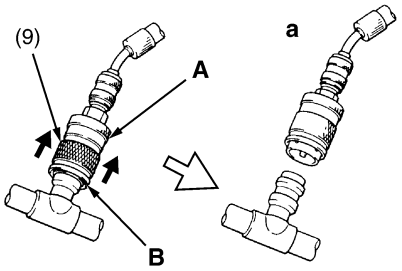
3TLABABWP008A



3TLABABWP009A



3TLABABWP010A



3TLABABWP011A

The charging hoses are classified into three colors. Each charging hose must be handled as follows:

- The air conditioner manufacture recommends that the blue hose (3) is used for the **LO** pressure side (suction side), the green hose (5) for refrigeration side (center connecting port) and the red hose (4) for **HI** pressure side (discharged side).

(When connecting)

- Push the quick disconnect adaptor (6) into the charging valve, and push on part **"A"** until a click is heard.

■ **NOTE**

- **When connecting, push carefully so the pipe doesn't bend.**
- **When connecting the quick disconnect connector, should the sleeve (7) move before the quick link connector can be connected to the charging valve, move the quick sleeve to its original position and try again.**
- **When some refrigerant remains in the charging hose at the time of connections, it may be difficult to connect the quick link connector. In this case, perform the operation after removing any residual pressure in the hose. (Remove the residual pressure by pushing the pusher (8).)**

(When reassembling)

- While holding on to part **"A"** of the quick disconnect adaptor, slide part **"B"** up.

■ **NOTE**

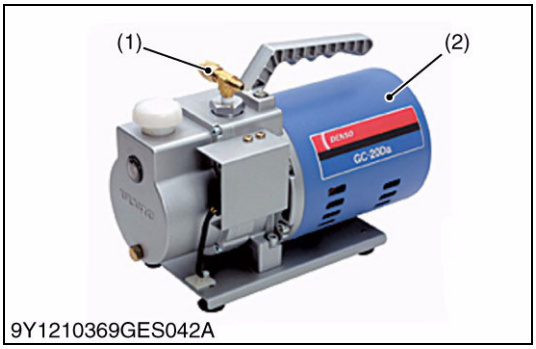
- **After removing the adaptor, ensure to cap the quick disconnect adaptor service valve.**

(1) **LO** Pressure Side Valve
(2) **HI** Pressure Side Valve
(3) Blue Hose
(4) Red Hose
(5) Green Hose
(6) Quick Disconnect Adaptor
(7) Sleeve
(8) Pusher
(9) Sleeve

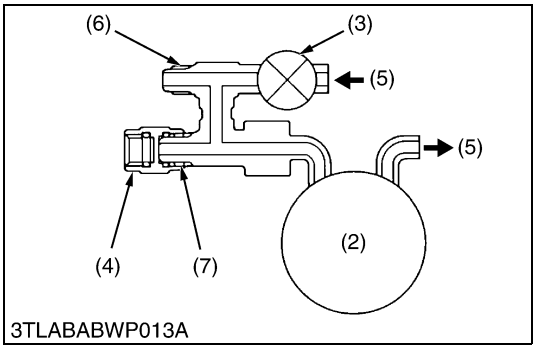
a: CLICK

9Y1210948CAS0010US0

(3) Vacuum Pump Adaptor



9Y1210369GES042A



3TLABABWP013A

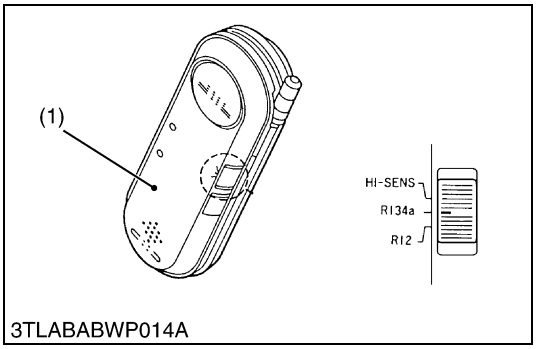
Objective of the Vacuum Pump Adaptor

1. After vacuum has been created in the air conditioning cycle, when the vacuum pump is stopped, since there is vacuum in hoses within the gauge manifold, the vacuum pump oil flows back into the charging hose. If the refrigerant is refilled with the system still in this state, the vacuum pump oil left in the charging hose enters the air conditioner cycle together with the refrigerant.
   Vacuum pump adaptor with a solenoid valve is used to prevent this back-flow of oil from the vacuum pump. The role of the solenoid valve is that when the current passes through the solenoid valve, the valve closes to keep out the outside air and allow the vacuum to build up, but when the current stops, the valve opens to allow in air and end the vacuum.
2. Attaching this adaptor to the R12 vacuum pump currently being used allows the pump to be used with both R134a and R12.

(1) Vacuum Pump Adaptor
(2) Vacuum Pump
(3) Magnetic Valve
(4) Blind Cap
(5) Air
(6) For R134a
(7) For R12

9Y1210948CAS0011US0

(4) Electric Gas Leak Tester



3TLABABWP014A

The current R12 gas leak tester has poor sensitivity for R134a and cannot be used. Therefore, a new electric gas leak tester with greater sensitivity has been designed and can be used with both R134a and R12.

(Reference)

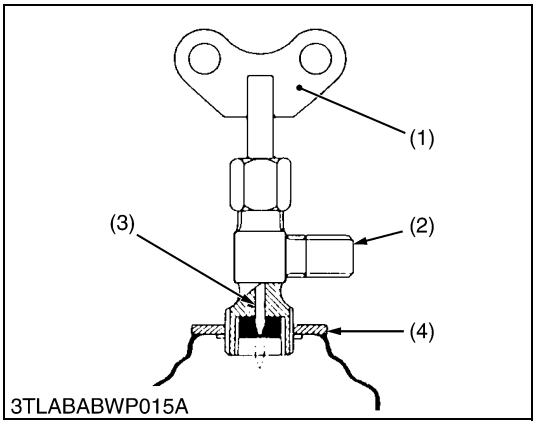
Leak tester with halide torch

- Since the reaction with chlorine within the refrigerant is used to detect gas leaks, R134a, which contains no chlorine, cannot be detected.

(1) Electric Gas Leak Tester

9Y1210948CAS0012US0

(5) Can Tap Valve



3TLABABWP015A

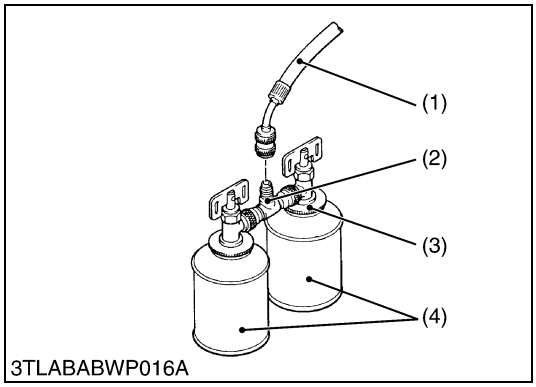
The can tap valve that is used to charge the refrigerant into the air conditioning system, should be used as follows:

1. Before putting the can tap valve on the refrigerant container, turn the handle (1) counterclockwise till the valve needle is fully retracted.
2. Turn the plate nut (disc) (4) counterclockwise till it reaches its highest position, then screw down the can tap valve into the sealed tap.
3. Turn the place nut clockwise fully, and fix the center charging hose to the valve.
4. Tighten the place nut firmly by hand.
5. Turn the handle (1) clockwise, thus making a hole in the sealed tap.
6. To charge the refrigerant into the system, turn the handle (1) counterclockwise. To stop charging, turn it clockwise.

(1) Butterfly Handle
(2) Connection
(3) Needle
(4) Disc

9Y1210948CAS0013US0

(6) T-joint



3TLABABWP016A

T-joint (2) is used to increase efficiency of gas charging using two refrigerant containers (4) at a time.

1. Install two refrigerant container service valves to T-joint (2) sides and connect the charging hose (1) to it.

(1) Charging Hose (Green)
(2) T-joint
(3) Can Tap Valve
(4) Refrigerant Container

9Y1210948CAS0014US0

(7) R134a Refrigerant Recovery and Recycling Machine

1. When there is necessity of discharging the refrigerant on repairing the tractor, it should use recovery and recycling machine.
   (Don't release the refrigerant into the atmosphere.)

■ **IMPORTANT**

- **Use only R134a refrigerant recovery and recycling machine, eliminate mixing R134a equipment, refrigerant and refrigerant oils with R12 systems to prevent compressor damage.**

9Y1210948CAS0015US0

5. CHECKING AND CHARGING REFRIGERANT CYCLE

[1] CHECKING WITH MANIFOLD GAUGE

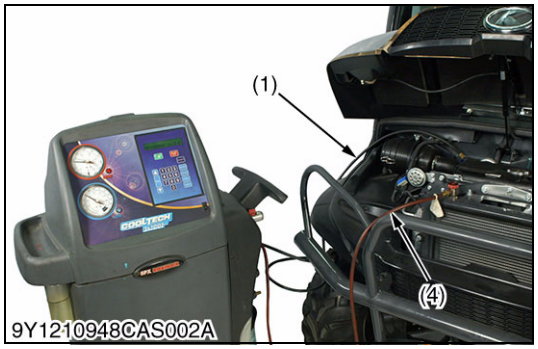
■ **IMPORTANT**

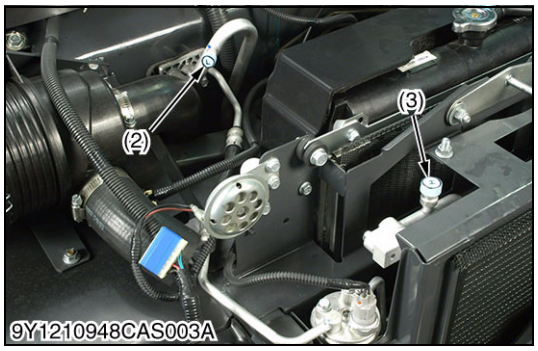
- **The gauge indications described in the following testing are those taken under the same condition, so it should be noted that the gauge readings will differs somewhat with the ambient conditions.**

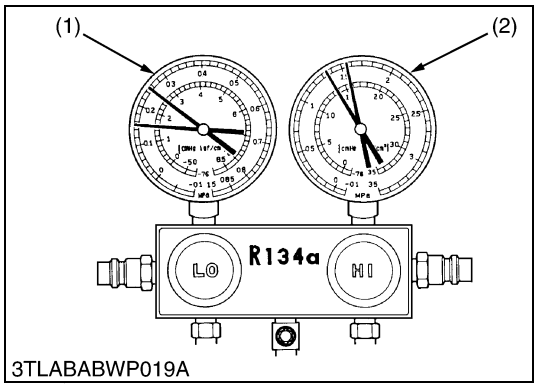
Condition

- Ambient temperature: **30 to 35 °C (86 to 95 °F)**
- Engine speed: Approx. **1500 min^{-1} (rpm)**
- Temperature control lever: **Maximum cooling position**
- Air conditioner switch: **ON**
- Blower switch: **HI** position

9Y1210948CAS0016US0







Manifold Gauge Connecting and Test Preparation

1. Close the **HI** and **LO** pressure side valve tightly.
2. Connect the charging hose (red) to the **HI** pressure side charging valve and connect the charging hose (black) to the **LO** pressure side charging valve.

■ **NOTE**

- **Be sure to drive out the air in the charging hoses at the connection end by utilizing the refrigerant pressure in the refrigerating cycle.**

3. Start the engine and set at approx. **1500 min^{-1} (rpm)**.
4. Turn on the air conditioner switch and set the temperature control lever to **maximum cooling** position.
5. Set the blower switch to **HI** position.

(1) Charging Hose (Black)
(2) **LO** Pressure Side Valve
(3) **HI** Pressure Side Valve
(4) Charging Hose (Red)

9Y1210948CAS0017US0

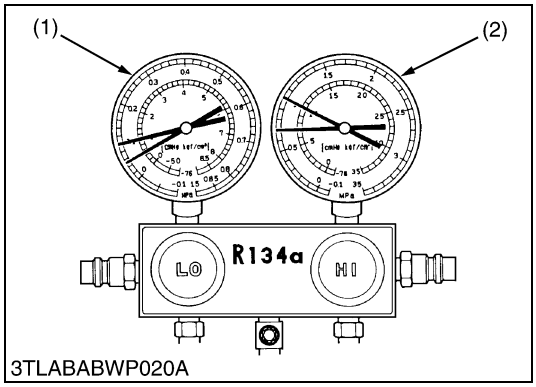
Normal Operating

If the refrigerating cycle is operating normally, the reading at the **LO** pressure side (1) should be generally by around 0.15 to 0.19 MPa (1.5 to 2.0 kgf/cm^2, 22 to 28 psi) and that at the **HI** pressure side (2) around 1.28 to 1.66 MPa (13.0 to 17.0 kgf/cm^2, 185 to 241 psi).

Gas pressure	Factory specification	Low pressure side	0.15 to 0.19 MPa 1.5 to 2.0 kgf/cm^2 22 to 28 psi
		High pressure side	1.28 to 1.66 MPa 13.0 to 17.0 kgf/cm^2 185 to 241 psi

(1) **LO** Pressure Side
(2) **HI** Pressure Side

9Y1210948CAS0018US0



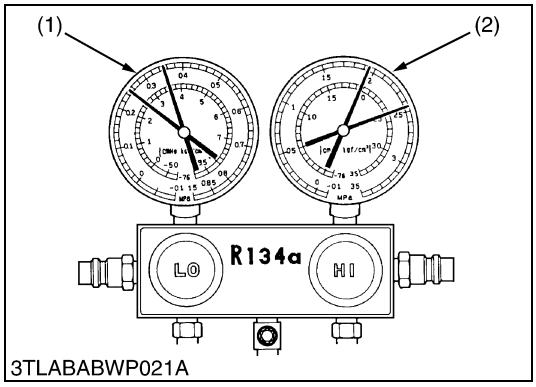
3TLABABWP020A

Insufficient Refrigerant

1. Symptoms seen in refrigerating cycle
   - Both **LO** and **HI** pressure side (1), (2) pressures too low.
     LO pressure side (1): 0.049 to 0.098 MPa (0.50 to 1.0 kgf/cm^2, 7.2 to 14 psi)
     HI pressure side (2): 0.69 to 0.98 MPa (7.0 to 10 kgf/cm^2, 100 to 140 psi)
   - Bubbles seen in sight glass.
   - Air discharged from air conditioner sightly cold.
2. Probable cause
   - Gas leaking from some place in refrigerant cycle.
3. Solution
   - Check for leakage with electric gas leak tester (see page 9-S9) and repair.
   - Recharge refrigerant to the proper level. (See page 9-S11.)

(1) **LO** Pressure Side (2) **HI** Pressure Side

9Y1210948CAS0019US0



3TLABABWP021A

Excessive Refrigerant or Insufficient Condenser Cooling

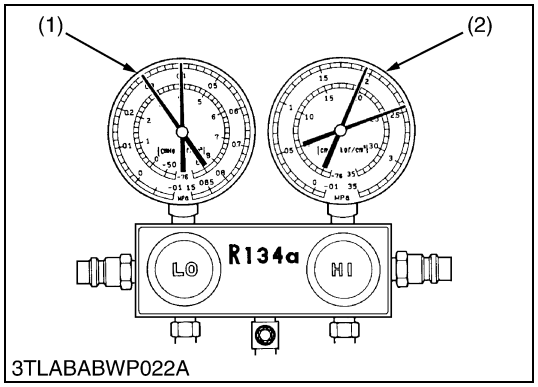
1. Symptoms seen in refrigerating cycle
   - Both **LO** and **HI** pressure side (1), (2) pressures too high.
     LO pressure side (1): 0.20 to 0.34 MPa (2.0 to 3.5 kgf/cm^2, 29 to 49 psi)
     HI pressure side (2): 2.0 to 2.4 MPa (20 to 25 kgf/cm^2, 290 to 350 psi)
2. Probable cause
   - Overcharging refrigerant into cycle.
   - Condenser cooling faulty.
3. Solution
   - Clean condenser. (See page G-21.)
   - Adjust air conditioner belt to proper tension. (See page G-48.)
   - If the above two items are in normal condition, check refrigerant quantity. (See page 9-S11.)

■ **NOTE**

- **If excessive refrigerant is to be discharged, loosen manifold gauge LO pressure side valve and vent out slowly.**

(1) **LO** Pressure Side (2) **HI** Pressure Side

9Y1210948CAS0020US0



3TLABABWP022A

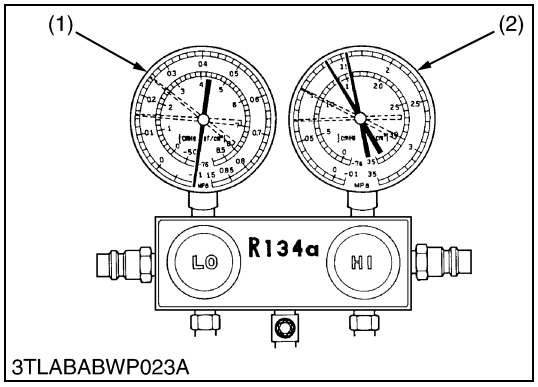
Air Entered in the Cycle

1. Symptoms seen in refrigerating cycle
   - Both **LO** and **HI** pressure side (1), (2) pressures too high.
     LO pressure side (1): 0.20 to 0.34 MPa (2.0 to 3.5 kgf/cm^2, 29 to 49 psi)
     HI pressure side (2): 2.0 to 2.4 MPa (20 to 25 kgf/cm^2, 290 to 350 psi)
   - **LO** pressure side (1) piping not cold when touched.
2. Probable cause
   - Air entered in refrigerating cycle.
3. Solution
   - Replace receiver.
   - Check compressor oil contamination and quantity.
   - Evacuate and recharge new refrigerant. (See page 9-S16.)

■ **NOTE**
- **The above cycle can be seen when the cycle is charged without evacuation.**

(1) **LO** Pressure Side (2) **HI** Pressure Side

9Y1210948CAS0021US0



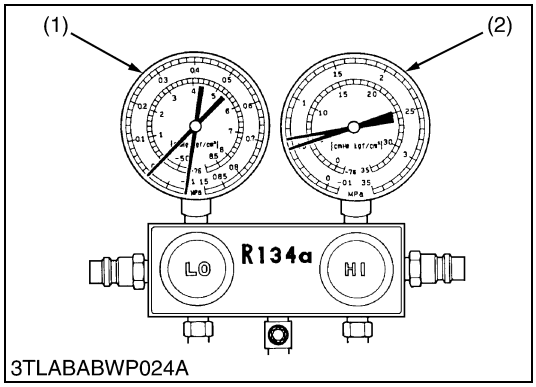
3TLABABWP023A

Moisture Entered in the Cycle

1. Symptoms seen in refrigerating cycle
   - The air conditioner operates normally at the beginning, but over time, **LO** pressure side (1) pressure is **vacuum** and **HI** pressure side (2) is low pressure.
     LO pressure side (1): Vacuum
     HI pressure side (2): 0.69 to 0.98 MPa (7.0 to 10 kgf/cm^2, 100 to 140 psi)
2. Probable cause
   - The moisture in the refrigerating cycle freezes in the expansion valve orifice and causes temporary blocking. After a time, the ice melts and condition returns to normal.
3. Solution
   - Replace receiver.
   - Remove moisture in cycle by means of repeated evacuation. (See page 9-S16.)
   - Recharge new refrigerant to the proper level. (See page 9-S11.)

(1) **LO** Pressure Side (2) **HI** Pressure Side

9Y1210948CAS0022US0



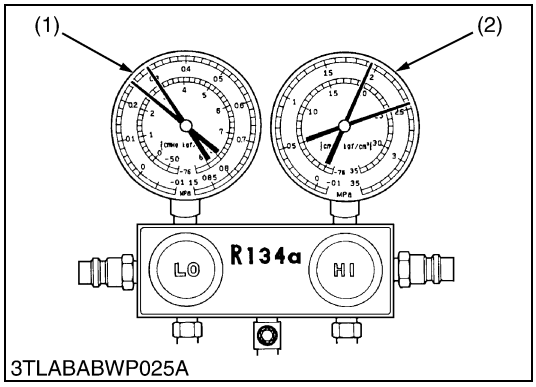
3TLABABWP024A

Refrigerant Fails to Circulate

1. Symptoms seen in refrigerating cycle
   - **LO** pressure side (1) pressure is vacuum and, **HI** pressure side (2) is low pressure.
     LO pressure side (1): Vacuum
     HI pressure side (2): 0.49 to 0.58 MPa (5.0 to 6.0 kgf/cm^2, 72 to 85 psi)
2. Probable cause
   - Refrigerant flow obstructed by moisture or dirt in the refrigerating cycle freezing or sticking on the expansion valve orifice.
3. Solution
   Allow to stand for same time and then resume operation to decide whether the plugging is due to moisture or dirt.
   - If caused by moisture, correct by referring to instructions in previous.
   - If caused by dirt, remove the expansion valve and blow out the dirt with compressed air.
   - If unable to remove the dirt, replace the expansion valve. Replace the receiver. Evacuate and charge in proper amount of new refrigerant. (See page 9-S16.)
   - If caused by gas leakage in heat sensitizing tube, replace the expansion valve.

(1) **LO** Pressure Side (2) **HI** Pressure Side

9Y1210948CAS0023US0



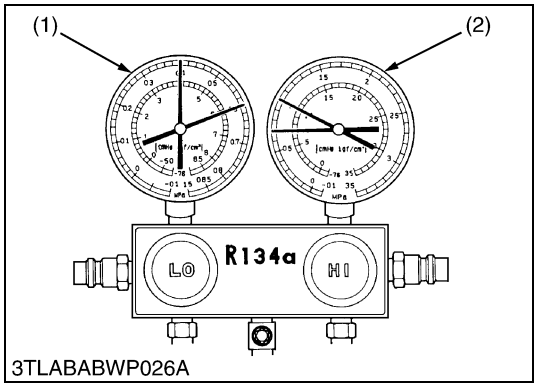
3TLABABWP025A

Expansion Valve Opens Too Far or Improper Installation of Heat Sensitizing Tube

1. Symptoms seen in refrigerating cycle
   - Both **LO** and **HI** pressure side (1), (2) pressures too high.
     LO pressure side (1): 0.30 to 0.39 MPa (3.0 to 4.0 kgf/cm^2, 43 to 56 psi)
     HI pressure side (2): 2.0 to 2.4 MPa (20 to 25 kgf/cm^2, 290 to 350 psi)
   - Frost or heavy dew on low pressure side piping.
2. Probable cause
   - Expansion valve trouble or heat sensitizing tube improperly installed.
   - Flow adjustment not properly done.
3. Solution
   - Check installed condition of heat sensitizing tube.
   - If installation of heat sensitizing tube is correct, replace the expansion valve.

(1) **LO** Pressure Side (2) **HI** Pressure Side

9Y1210948CAS0024US0



3TLABABWP026A

Faulty Compression of Compressor

1. Symptoms seen in refrigerating cycle
   - **LO** pressure side (1): 0.40 to 0.58 MPa (4.0 to 4.6 kgf/cm^2, 57 to 85 psi)
   - **HI** pressure side (2): 0.69 to 0.98 MPa (7.0 to 10 kgf/cm^2, 100 to 140 psi)
2. Probable cause
   - Leak in compressor.
3. Solution
   - Replace compressor. (See page 9-S23.)

■ **NOTE**

- **Manifold gauge indications (left side figure) at faulty compressing by compressor.**

(1) **LO** Pressure Side (2) **HI** Pressure Side

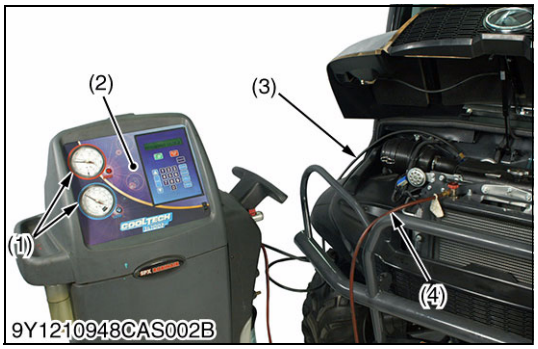
9Y1210948CAS0025US0

[2] DISCHARGING, EVACUATING AND CHARGING

■ **NOTE**
- **Follow the manufacture's instructions when you discharging, evacuating and charging the refrigerant system.**

9Y1210948CAS0026US0

(1) Discharging Evacuating and Charging the Refrigerant



Prepare for the R134a refrigerant recovery, and charging recycling machine.

1. Connect the charging hose (black) (3) to **LO** pressure side charging valve. Connect the charging hose (red) to **HI** pressure side charging valve.
2. Follow the manufacturers instructions and discharge, recovering, recycling and charging the system.

■ **IMPORTANT**
- **Use only R134a refrigerant recovering, recycling and charging machine (2). Eliminate mixing R134a equipment, refrigerant, and refrigerant oils with R12 system to prevent compressor damage.**

CAUTION
- **Protect fingers and eyes with cloth against frostbite by refrigerant when disconnecting the hose to the charging valve.**

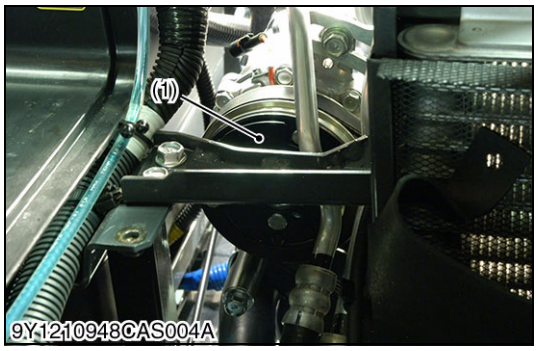
(1) Manifold Gauge
(2) Refrigerant Recovering, Recycling and Charging Machine
(3) Charging Hose (Black)
(4) Charging Hose (Red)

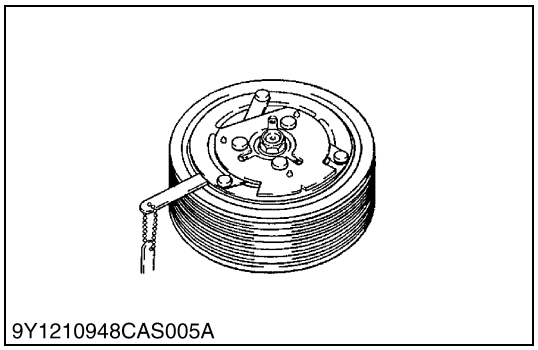
9Y1210948CAS0027US0

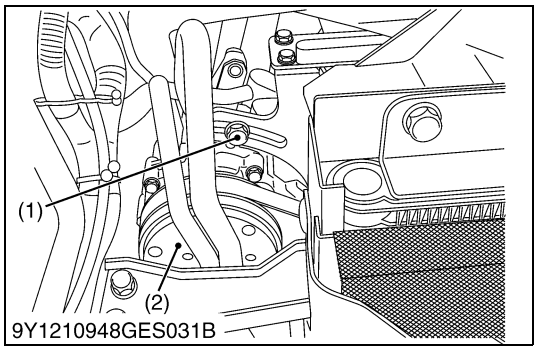
6. CHECKING, DISASSEMBLING AND SERVICING

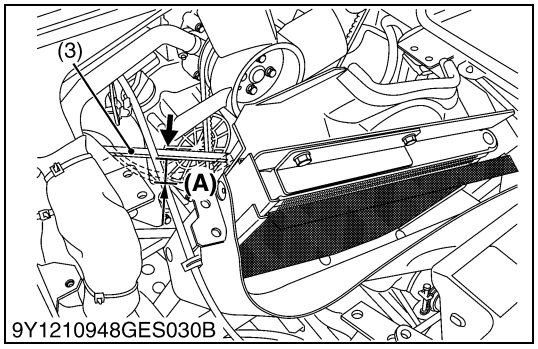
[1] CHECKING AND ADJUSTING

(1) Compressor









Operation of Magnetic Clutch

1. Turn off the air conditioner switch after starting the engine.
2. Check whether abrasion or abnormal noise is heard when only the magnetic clutch pulley is running.
3. Check that the magnetic clutch (1) does not slip when the air conditioner switch and blower switch are turned **ON** (when the air conditioner is in operation).
4. If anything abnormal is found, repair or replace.

(1) Magnetic Clutch

9Y1210948CAS0028US0

Air Gap

1. Check the air gap with feeler gauge.
2. If the measurement is not within the factory specifications, replace it. (See page 9-S23.)

Air gap	Factory specification	0.40 to 0.80 mm 0.016 to 0.031 in.

9Y1210948CAS0029US0

Adjusting Air Conditioner Belt Tension

CAUTION

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

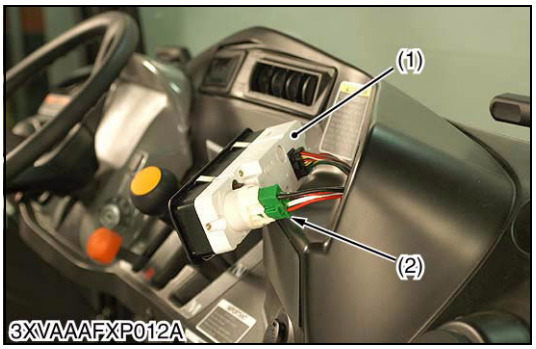
1. Stop the engine and remove the key.
2. Apply 98 N (10 kgf, 22 lbf) pressure to the belt between the pulleys.
3. If tension is incorrect, adjust the belt tension.
4. If belt is damaged, replace it.

Air conditioner belt tension	Factory specification	A deflection of between 10 to 12 mm (0.40 to 0.47 in.) when the belt is pressed in the middle of the span

(1) Adjusting Bolt
(2) Belt Tension Pulley
(3) Belt
(A) Deflection

9Y1210948CAS0030US0

(2) Control Panel (Blower Switch, Air Conditioner Switch, Mode Control Dial, Temperature Control Dial and Recirculation/Fresh Air Selection Switch)



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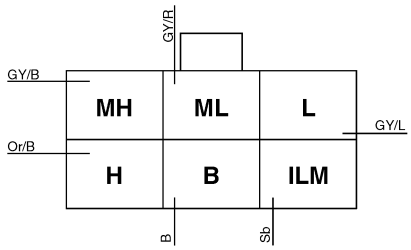

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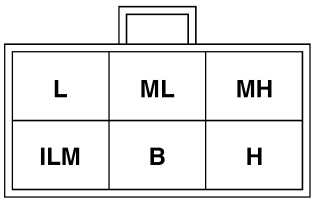
(A)



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Blower Switch Connector Voltage

1. Disconnect the **6P** connector (2) from blower switch.
2. Turn the main switch to **ON** position.
3. Measure the voltage with a voltmeter across the connector terminal **B** and terminal **H**.
4. If the voltage differs from the battery voltage, the wiring harness, air conditioner relay, fuse or main switch is faulty.

Voltage	Terminal **B** – Terminal **H**	Approx. battery voltage

(1) Control Panel
(2) **6P** Connector

(A) 6P Connector (Wire Harness Side)

9Y1210948CAS0031US0

Blower Switch Test

1. Check the continuity through the switch with an ohmmeter.
2. If the continuity specified below are not indicated, the switch is faulty.

Position		Terminal					
		B	**ILM**	**L**	**ML**	**MH**	**H**
Air conditioner switch	**OFF**						
	Low	●	●	●			
	Medium Low	●	●		●		
	Medium High	●	●			●	
	High	●	●				●

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(A) 6P Connector (Blower Switch Side)

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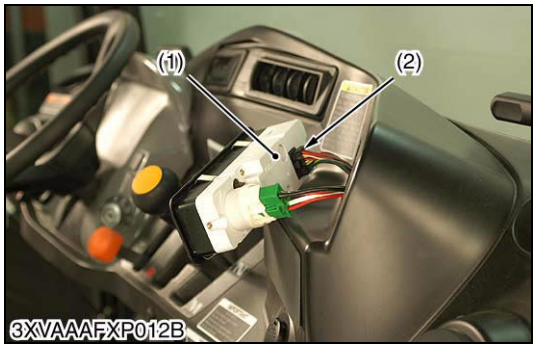

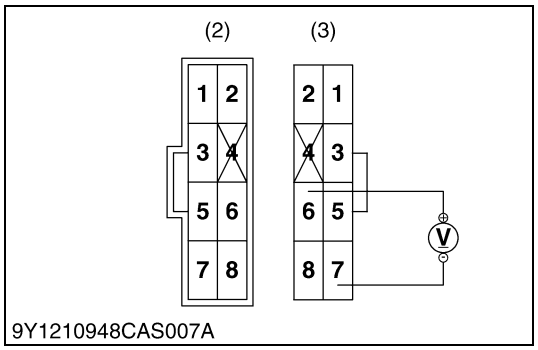

Connector Voltage

1. Disconnect the **8P** connector (2) from control panel switch.
2. Turn the main switch to **ON** position.
3. Measure the voltage with a voltmeter across the terminal **6** and terminal **7**.
4. If the voltage differs from the battery voltage, the wiring harness, air conditioner relay or fuse is faulty.

Voltage	Terminal **7** – Terminal **6**	Approx. battery voltage

(1) Control Panel
(2) **8P** Connector (Switch Side)
(3) **8P** Connector (Wire Harness Side)

9Y1210948CAS0033US0

(3) Blower Motor

Blower Motor Test

CAUTION

- **Do not touch the rotating blower fan.**

1. Turn the main switch to **OFF** position.
2. Turn the main switch to **ON** position
3. Turn the blower switch (1) to **1** position.
4. If the blower motor does not run, check it.
5. Next, turn the blower switch (1) from **1** to **4** position sequentially.
6. At this time, make sure the rotational speed of blower fan increase sequentially.
7. If the rotational speed of blower fan does not change by position of blower switch, check the blower resister.

(1) Blower Switch

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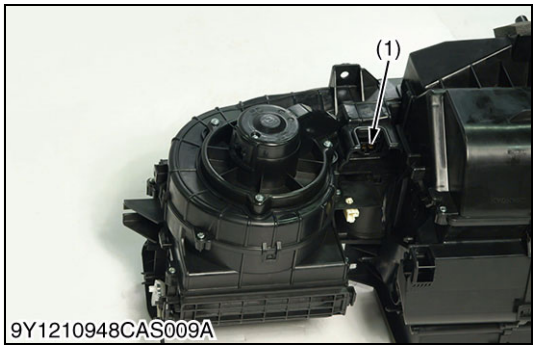
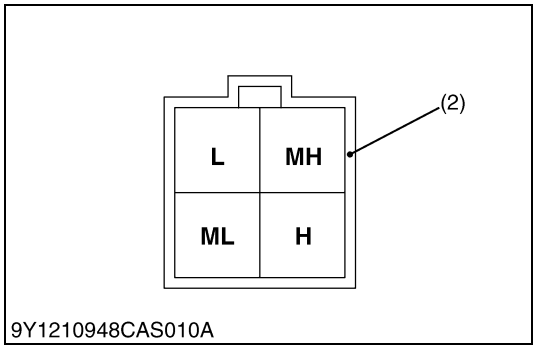
(4) Blower Resistor





Blower Resistor Check

■ **NOTE**
- **Perform the blower motor test, before checking of blower resister.**

1. Remove the air conditioner unit. (See page 9-S27.)
2. Measure each resistance from terminal HI of the blower resister (1).
3. If the factory specifications are not indicated, replace the blower resister (1).

Voltage	Factory specification	Terminal **H** – Terminal **ML**	Approx. 1.47 Ω
		Terminal **H** – Terminal **MH**	Approx. 0.55 Ω
		Terminal **H** – Terminal **L**	Approx. 3.3 Ω

(1) Blower Resistor (2) Connector

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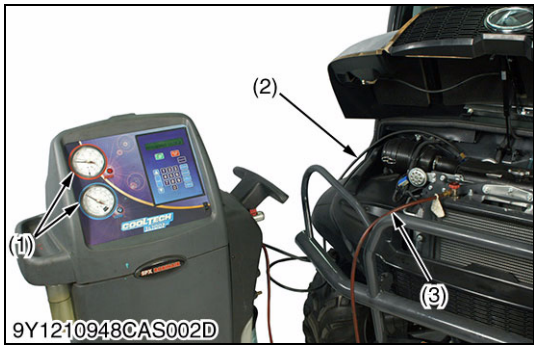
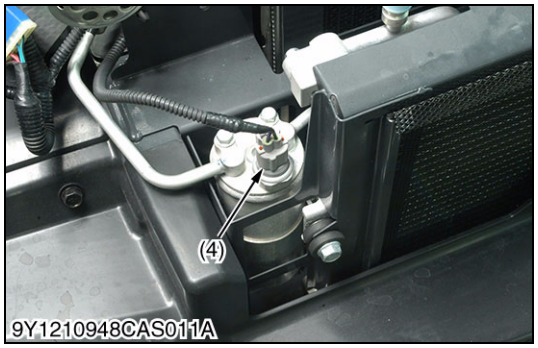
(5) Pressure Switch





Pressure Switch

■ **NOTE**

- **Be sure to drive out the air in the charging hoses at the manifold gauge connection end by utilizing the refrigerant pressure in the refrigerant cycle.**

1) HI Pressure Side

1. Close the **HI** and **LO** pressure side valves of manifold gauge tightly, and connect the charging hoses (red and black) to the respective compressor service valves.
2. Start the engine and set at approx. 1500 min^{-1} (rpm). Turn on the air conditioner switch, then set the blower switch to **HI** position.
3. Raise pressure on the **HI** pressure side of the refrigerant cycle by covering the condenser front with a corrugated cardboard, and the pressure switch is activated and the compressor magnetic clutch is turned off. At this time, read the **HI** pressure gauge of the manifold gauge. If this pressure reading differs largely with the setting pressure, replace the pressure switch with a new one.

Setting pressure	Factory specification	Pressure switch **OFF**	More than approx. 3.14 MPa 32.0 kgf/cm^2 455 psi

2) LO Pressure Side

1. Disconnect **2P** connector of pressure switch (4).
2. Measure the resistance with an ohmmeter across the connector terminals.
3. If 0 ohm is not indicated at normal condition, there is no refrigerant in the refrigerating cycle because gas leaks or pressure switch is damaged.

(Reference)

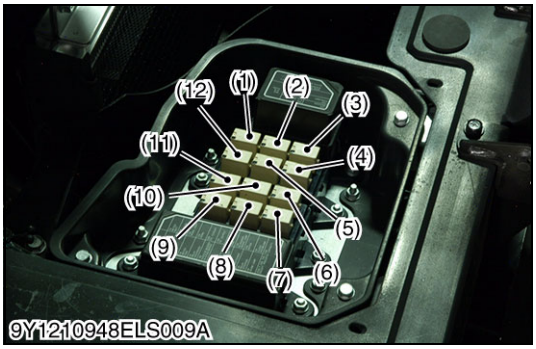
Setting pressure	Factory specification	Pressure switch **OFF**	Less than approx. 0.196 MPa 2.00 kgf/cm^2 28.4 psi

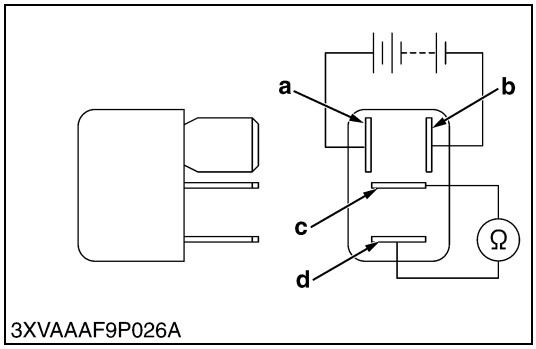
- The resistance of pressure switch is 0 ohm in normal condition, but it becomes infinity if the pressure is out of factory specification. Because the pressure switch starts to work.

(1) Manifold Gauge
(2) Charging Hose (Black)
(3) Charging Hose (Red)
(4) Pressure Switch

9Y1210948CAS0036US0

(6) Relays





Relay

1. Turn the main switch to **OFF** position.
2. Remove the cover.
3. Remove the relay which should be checked.
4. Connect the jumper load across the battery positive terminal to relay terminal **1 "a"**, and the battery negative terminal to relay terminal **2 "b"**.
5. Check the continuity with an ohmmeter between the relay terminal **5 "c"** and terminal **3 "d".**
6. If the continuity is 0 ohms, the relay is proper.

(1) Wiper Relay
(2) Rear Radiator Fan Motor Relay
(3) Blower Relay
(4) Compressor Relay
(5) Oil Temperature Relay
(6) Front Radiator Fan Motor Relay
(7) Starter Relay
(8) Solenoid Relay
(9) Work Light Relay
(10) Spare
(11) Beacon Relay
(12) Fog Lamp Relay

a: Relay Terminal 1
b: Relay Terminal 2
c: Relay Terminal 5
d: Relay Terminal 3

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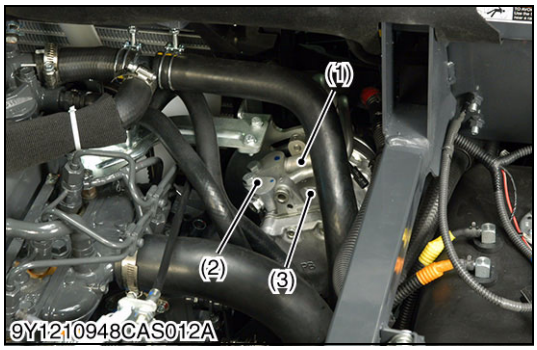
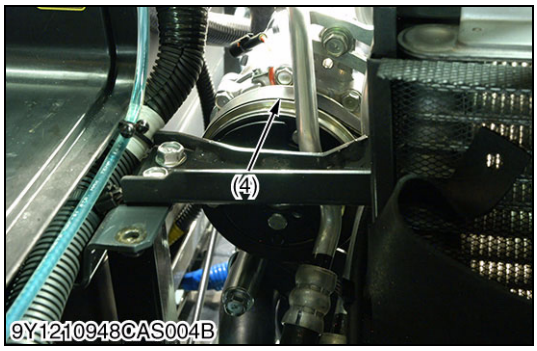
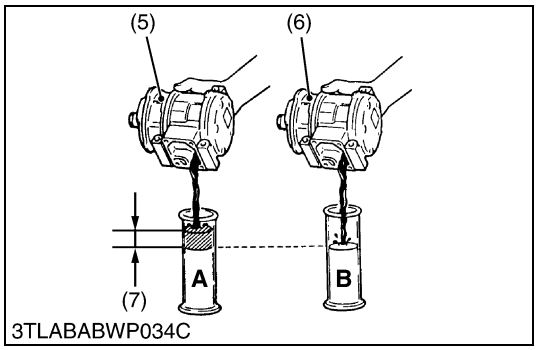
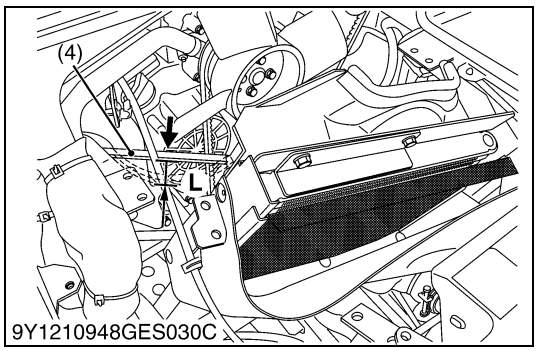
[2] DISASSEMBLING AND ASSEMBLING

(1) Removing Compressor Assembly









Compressor Assembly

■ **NOTE**

- **Follow the manufacture's instructions when you discharging the refrigerant system.**

1. Discharge the refrigerant from the system.
2. Disconnect the low pressure pipe (suction) (1) and high pressure pipe 1 (discharge) (2) from the compressor, then cap the open fitting immediately to keep moisture out of the system.
3. Disconnect the **1P** connector of magnetic clutch.
4. Remove the air conditioner belt (4) and remove the compressor (5).

(When reassembling)

- After reassembling the compressor, be sure to adjust the air conditioner belt tension and recharge the refrigerant to the system.
- Apply compressor oil (SP10 or equivalent) to the O-rings and be careful not to damage them.
- **"S"** letter is marked on the compressor for connecting the low pressure pipe (suction side).
- **"D"** letter is marked on the compressor for connecting the high pressure pipe (discharge side).
- When replacing the compressor with a new one, meet the oil amount with old one.
- Push on the belt between the pulleys at measurement point **"L"** with a finger. Deflection **"L"** of 10 to 12 mm (0.40 to 0.47 in.) under a 98 N (10 kgf, 22 lbf) load is appropriate.

Tightening torque	High pressure pipe and low pressure pipe mounting screw	8.0 to 12 N·m 0.82 to 1.2 kgf·m 5.9 to 8.8 lbf·ft
	Compressor mounting screws	18 to 20 N·m 1.8 to 2.1 kgf·m 13 to 15 lbf·ft

(1) Low Pressure Pipe
(2) High Pressure Pipe 1
(3) Compressor
(4) Air Conditioner Belt
(5) New Compressor
(6) Old Compressor
(7) Remove the Excess Oil (**A**-**B**)

A: Oil Flow New Compressor
B: Oil Flow Replace Compressor
L: Deflection (10 to 12 mm (0.40 to 0.48 in.))

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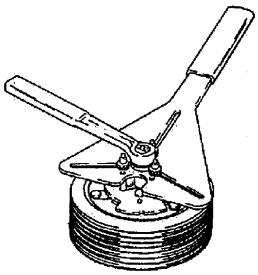
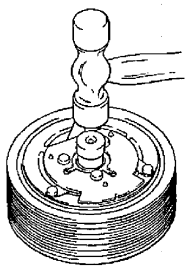


9Y1210948CAS013A



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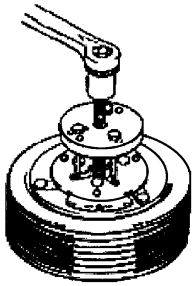

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Armature Nut

1. If armature dust cover is present, remove the 3 or 6 bolts holding it in place and remove cover. If auxiliary sheet metal pulley is present, remove the screws holding it in place. Then remove pulley.
2. Insert pins of armature plate spanner into threaded holes of armature assembly.
3. Hold armature assembly stationary while removing retaining nut with socket wrench, as appropriate.

(When reassembling)

- Replace retaining nut

Tightening torque	Armature nut (M8)	15 to 21 N·m 1.5 to 2.1 kgf·m 11 to 15 lbf·ft

9Y1210948CAS0039US0

Key Shaft Armature

1. Remove the armature plate assembly using puller.
2. Thread 3 puller bolts into the threaded holes in the armature assembly.
3. Turn the center screw clockwise until armature assembly comes loose.

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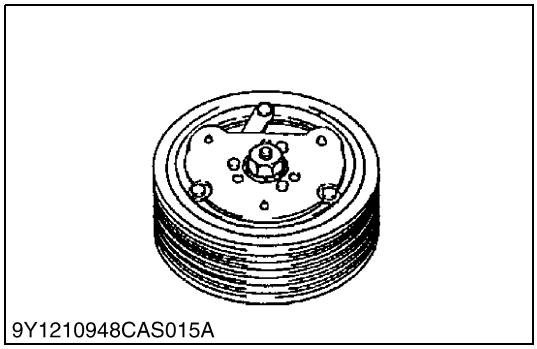
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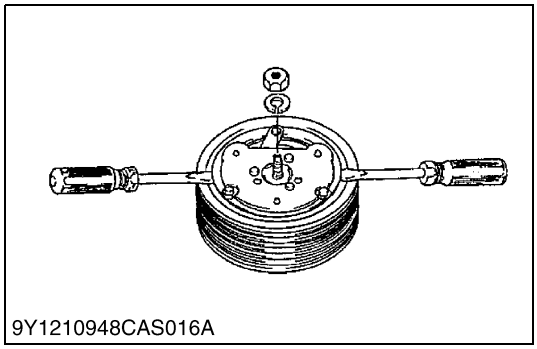
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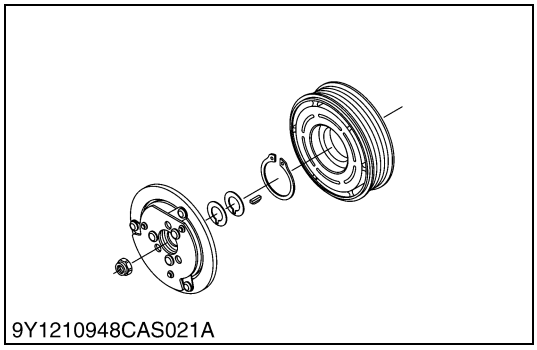
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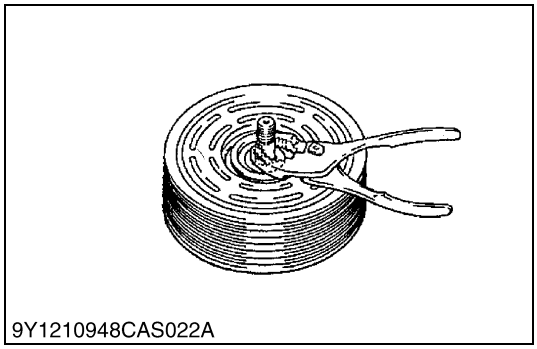
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Spline Shaft Armature

1. The spline shaft armature will not have threaded holes to accept the armature puller.
2. Lift off armature plate with fingers. If armature does not come off easily, spray an anti seizes oil into shaft to loosen. Armature plate can also be loosened by gently prying between rotor and armature plate with two flat screwdrivers.
3. Remove the shaft key and shims.

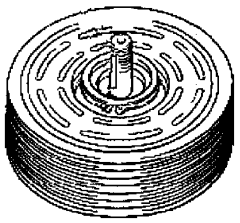
(When resembling)

1. Install clutch shims.

■ **NOTE**

- **Clutch air gap is determined by shim thickness. When installing a clutch on a used compressor, try the original shims first. When installing a clutch on a compressor that has not had a clutch installed before, first try 1.0 mm (0.04 in.), 0.5 mm (0.02 in.), 0.1 mm (0.004 in.) shims.**
  Install shaft key with pliers.
  Align keyway in armature assembly to shaft key.
- **Using driver and a hammer or arbor press, drive the armature assembly down over the shaft until it bottoms on the shims.**
- **A distinct sound change will be noted if driving with a hammer.**
- **Align slot in armature with locator tooth on shaft. Press armature towards rotor with hand until armature rests against the shims.**

9Y1210948CAS0041US0



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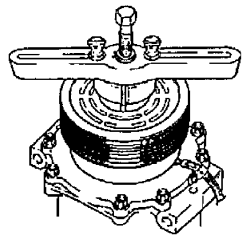

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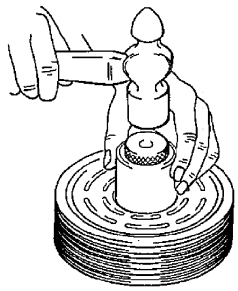

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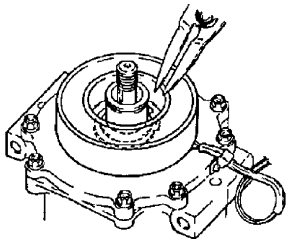

9Y1210948CAS019A

Rotor Pulley Assembly

1. Remove the rotor snap ring.
2. Insert the lip of the jaws into the snap ring groove.
3. Place rotor pulley shaft protector (puller set) over the exposed shaft.
4. Align thumb screws to puller jaws and finger tighten.
5. Turn puller center bolt clockwise using a socket wrench until rotor pulley is free.

(When reassembling)

1. Place compressor on support stand, supported at rear end of compressor. If the compressor must be clamped in a vise, clamp only on the mounting ears, never on the body if the compressor.
2. Set rotor squarely over the front housing boss.
3. Place the rotor installer ring into the bearing bore. Ensure that the edge rests only on the inner race of the bearing, not on the seal, pulley, or outer race of the bearing.
4. Place the driver into the ring and drive the rotor down onto the front housing with a hammer or arbor press. Drive the rotor against the front housing step. A distinct change of sound can be heard when using the hammer to install the rotor.
5. Reinstall rotor retaining snap ring with external snap ring pliers. If a bevel is present on the snap ring, it should face up (away from the body of the compressor).

9Y1210948CAS0042US0

Field Coil Assembly

1. Loosen lead wire clamp screw with #2 Phillips screw driver until wire(s) can be slipped out from under clamp.
2. Undo any wire connections on the compressor which would prevent removal of the field coil assembly.
3. Remove the field coil snap ring.
4. Remove the field coil assembly.

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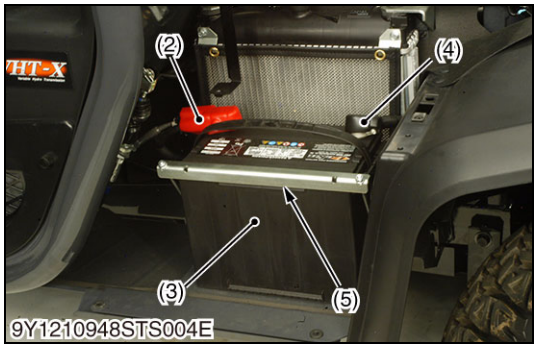
(2) Removing Air Conditioner Unit



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
(2) Positive Cable
(3) Battery
(4) Negative Cable
(5) Battery Stay

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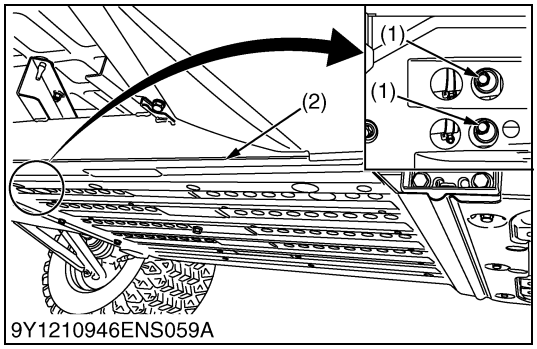

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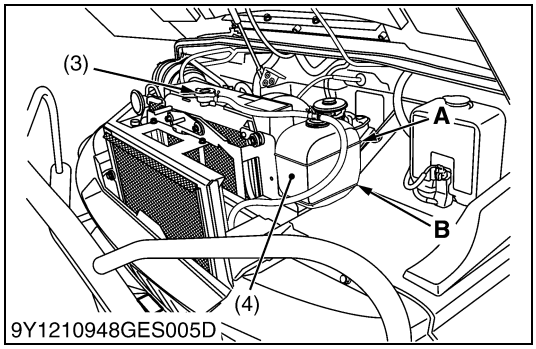

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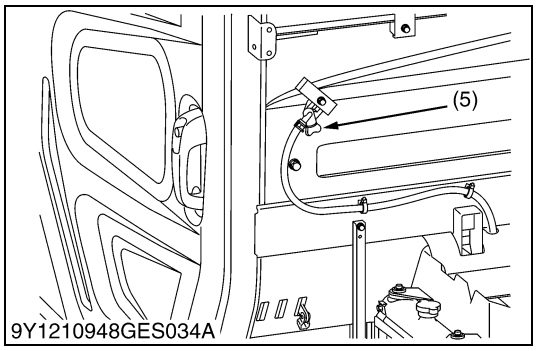


9Y1210948GES034A

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.**

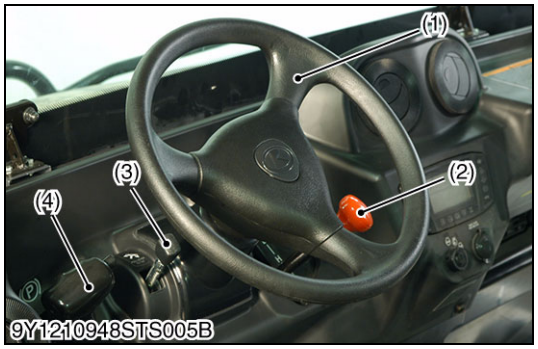
1. Stop the engine and let cool down.
2. Open the hood.
3. To drain the coolant, remove the radiator cap (3), open the engine coolant breather (5), and remove the radiator drain plugs (1). The radiator cap must be removed to completely drain the coolant.
4. After all coolant is drained, close the drain plug and engine coolant breather.

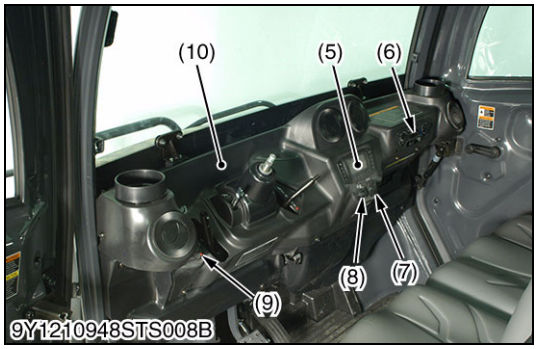
Radiator with recovery tank (Coolant)	Capacity	7.9 L 8.3 U.S.qts 7.0 Imp.qts

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

A: FULL
B: LOW

9Y1210948ENS0013US0





Control Panel

1. Remove the steering wheel (1).
2. Remove the shift lever grip (2), tilt lever grip (3), and the parking brake lever (4).
3. Disconnect the head light switch (9), meter assembly (5), starter switch (8), and ACC socket (7).
4. Disconnect the air conditioner control panel (6) from the panel (10).
5. Remove the panel (10).

(When reassembling)

- Connect the each cable set the below position.
  Made switch: Face position
  Blower switch: 0 position
  Temperature control dial: Coolest position
  Recirculation/Flash air selection lever: Recirculation position

Tightening torque	Steering wheel mounting nut	29 to 49 N·m 3.0 to 4.9 kgf·m 22 to 36 lbf·ft

(1) Steering Wheel
(2) Shift Lever Grip
(3) Tilt Lever Grip
(4) Parking Brake Lever
(5) Meter Assembly
(6) Air Conditioner Control Panel
(7) ACC Socket
(8) Starter Switch
(9) Head Light Switch
(10) Panel

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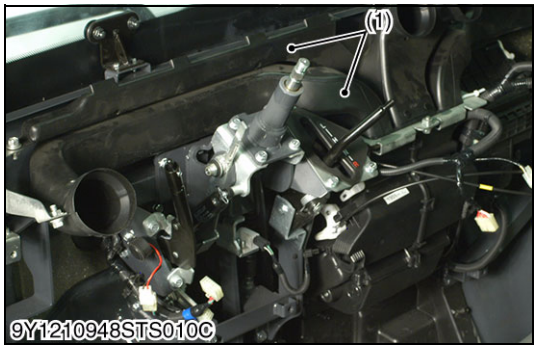

Air Duct

1. Remove the air ducts (1).

(1) Air Duct

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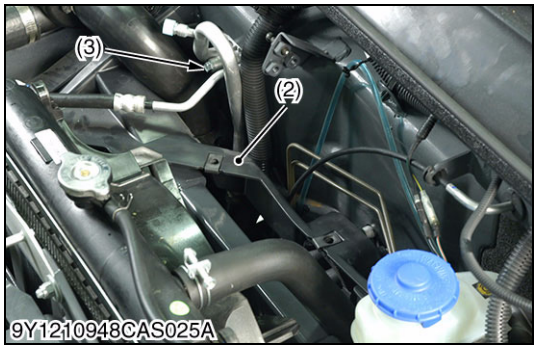


Radiator Cover

1. Remove the radiator upper cover (1).
2. Remove the radiator lower cover (2).
3. Remove the hose joint (3).

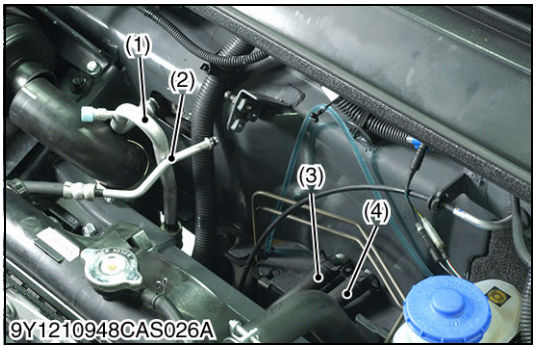
(When reassembling)

- Apply the compressor oil (SP10 or equivalent) to the O-ring and be careful not to damage them.

Tightening torque	Air conditioner hose joint mounting screw	8.00 to 12.0 N·m 0.816 to 1.22 kgf·m 5.90 to 8.85 lbf·ft

(1) Upper Cover
(2) Lower Cover
(3) Hose Joint

9Y1210948CAS0046US0



Heater Hoses and Air Conditioner Hoses

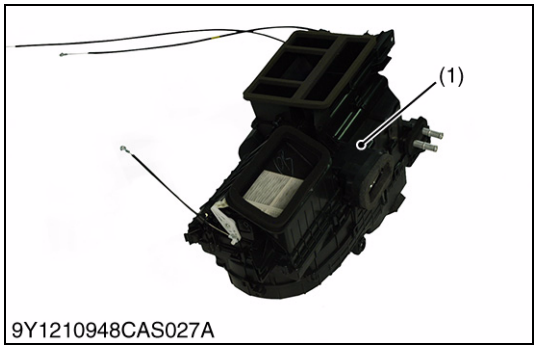
1. Disconnect the heater hoses (3), (4).
2. Disconnect the air conditioner hoses (1), (2).

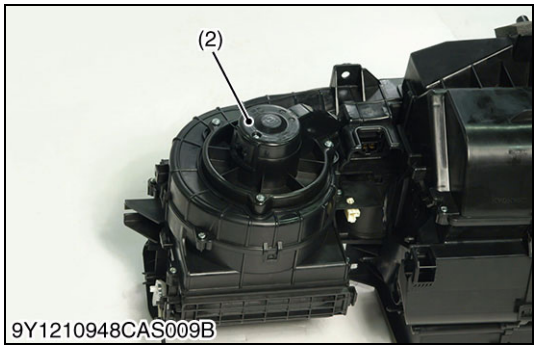
■ **NOTE**

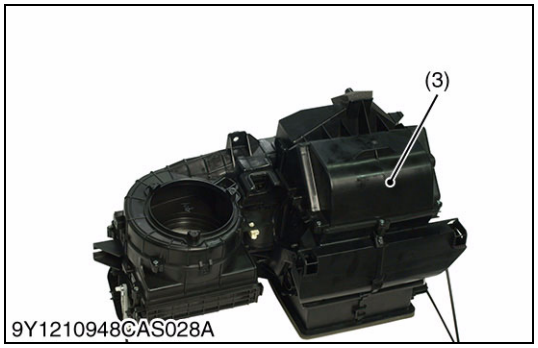
- **Cap the open fittings immediately to keep moisture out of the system.**

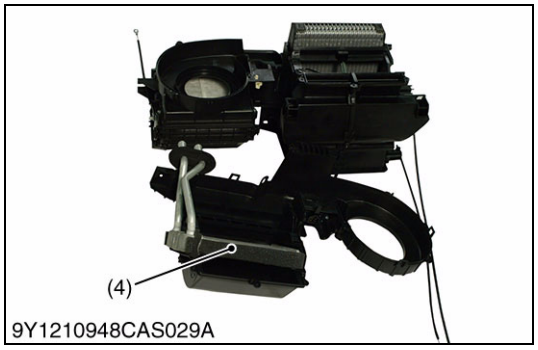
(1) Air Conditioner Hose (Suction)
(2) Air Conditioner Hose (Liquid)
(3) Heater Hose (OUT)
(4) Heater Hose (IN)

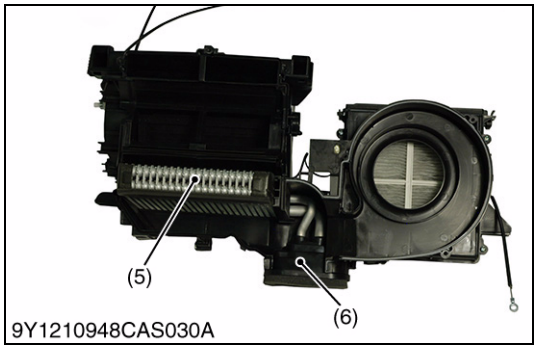
9Y1210948CAS0047US0











Air Contender Unit

1. Disconnect the connectors from blower motor, blower resister and thermistor.
2. Remove the air conditioner unit (1).
3. Remove the blower motor (2).
4. Remove the cover (3).
5. Remove the heater core (4).
6. Remove the evaporator (5) with expansion valve (6).

(1) Air Conditioner Unit
(2) Blower Motor
(3) Cover
(4) Heater Core
(5) Evaporator
(6) Expansion Valve

9Y1210948CAS0048US0

(3) Removing Condenser

Discharging Refrigerant Gas

1. See page 9-S15.

9Y1210948CAS0049US0

Front Guard and Bumper

1. Remove the front guard (1) and bumper (2).

(1) Front Guard (2) Bumper

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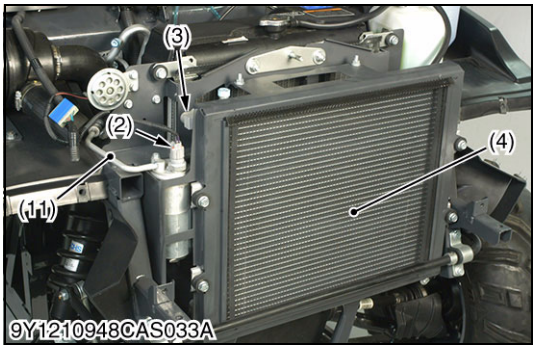
Condenser Assembly



1. Disconnect the pressure switch connector (2).
2. Disconnect the air conditioner hose (1).
3. Disconnect the air conditioner hose (3).
4. Remove the condenser (4) with receiver (5).
5. Remove the tube (6).
6. Remove the receiver (5).

(When reassembling)

Tightening torque	Air conditioner hose (liquid, discharge) mounting screw	8.00 to 12.0 N·m 0.816 to 1.22 kgf·m 5.90 to 8.85 lbf·ft
	Condenser mounting screw	10.0 to 12.5 N·m 1.02 to 1.27 kgf·m 7.38 to 7.21 lbf·ft
	Tube mounting screw	8.00 to 12.0 N·m 0.816 to 1.22 kgf·m 5.90 to 8.85 lbf·ft

- Apply the compressor oil (SP10 or equivalent) to the O-ring and be careful not to damage them.

(1) Air Conditioner Hose (Liquid)
(2) Pressure Switch Connector
(3) Air Conditioner Hose (Discharge)
(4) Condenser
(5) Receiver
(6) Tube

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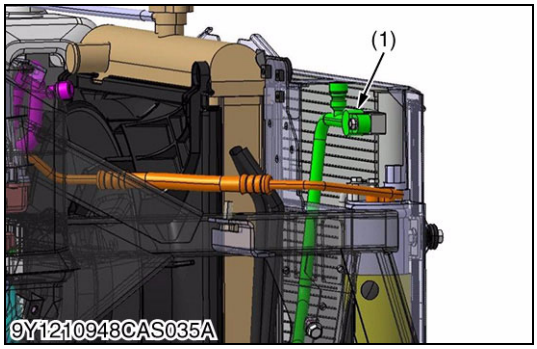
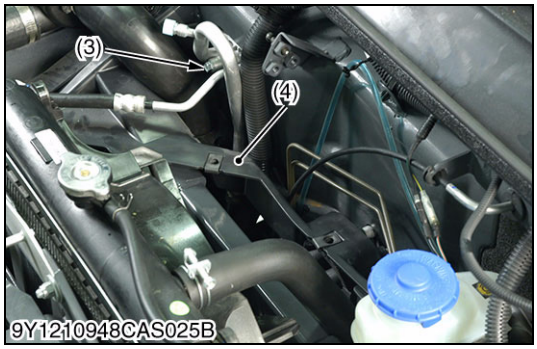
(4) Removing Air Conditioner Hoses





Discharging Refrigerant Gas

1. See page 9-S15.

9Y1210948CAS0049US0

Radiator Cover and Air Conditioner Hose (Front Side)

1. Open the front hood.
2. Disconnect the air conditioner hose (1).
3. Remove the upper cover (2) and lower cover (4).
4. Remove the hose joint (3).
5. Then cap the open fitting immediately to keep moisture out of system.

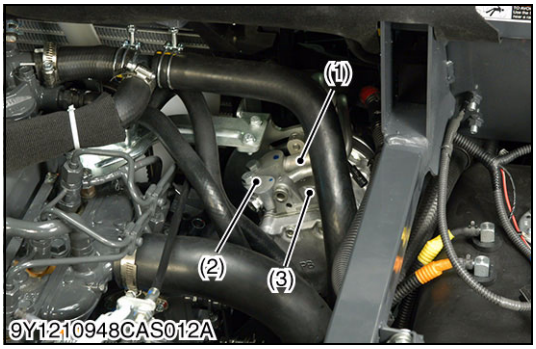
(When reassembling)

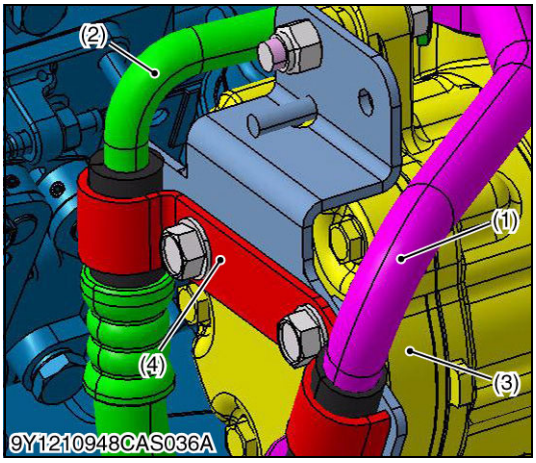
- Apply to compressor oil (SP10 or equivalent) to the O-ring and be careful not to damage them.

Tightening torque	Air conditioner hose joint mounting screw	8.00 to 12.0 N·m 0.816 to 1.22 kgf·m 5.90 to 8.85 lbf·ft

(1) Air Conditioner Hose
(2) Upper Cover
(3) Hose Joint
(4) Lower Cover

9Y1210948CAS0052US0





Air Conditioner Hose (Rear Side)

1. Disconnect the low pressure hose (suction) (1) from the compressor (3).
2. Disconnect the high pressure hose 1 (discharge) (2) from the compressor (3).
3. Then cap the open fitting immediately to keep moisture out of the system.
4. Remove the hose clamp (4).

(When reassembly)

- Apply compressor oil (SP10 or equivalent) to the O-rings and be careful not to damage them.
- **"S"** letter is marked on the compressor (3) for connecting the low pressure hose (suction side) (1).
- **"D"** letter is marked on the compressor (3) for connecting the high pressure hose 1 (discharge side) (2).

Tightening torque	High pressure hose and low pressure hose 1 mounting screw	8.0 to 12 N·m 0.82 to 1.2 kgf·m 5.9 to 8.8 lbf·ft

(1) Low Pressure Hose
(2) High Pressure Hose 1
(3) Compressor
(4) Hose Clamp

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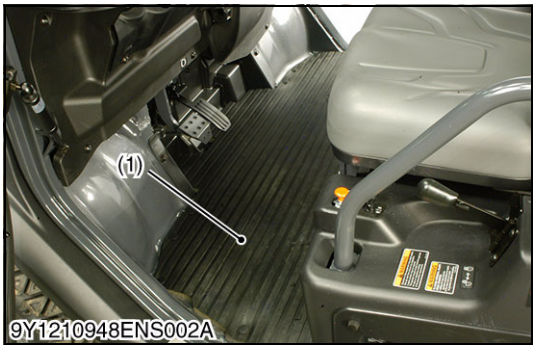

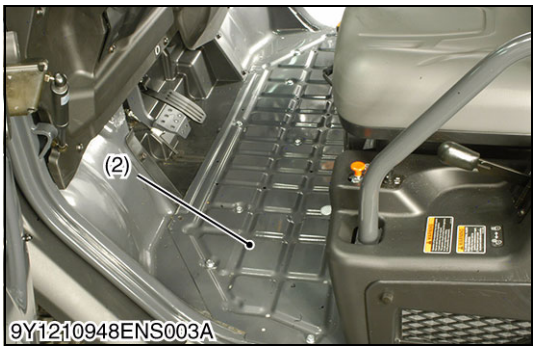

Mat and Center Step

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

(1) Mat
(2) Center Step

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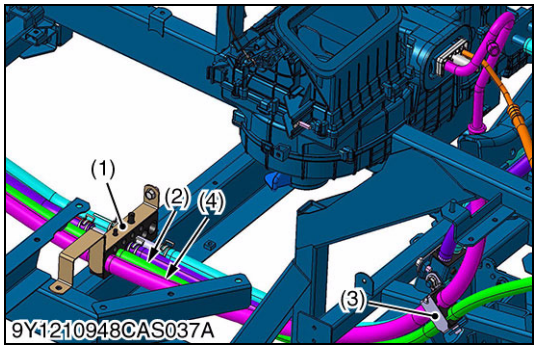

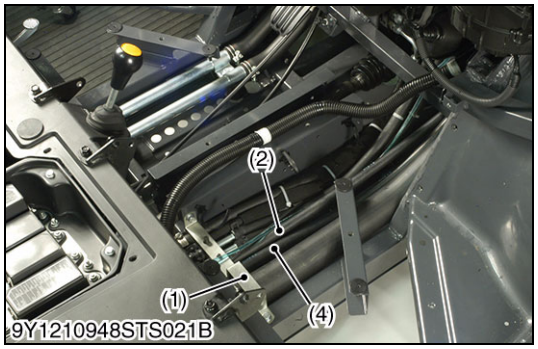

Air Conditioner Hoses

1. Remove the hose clamp (1), (3).
2. Remove the low pressure hose (4) and high pressure hose 1 (2).

(1) Hose Clamp
(2) High Pressure Hose 1
(3) Hose Clamp
(4) Low Pressure

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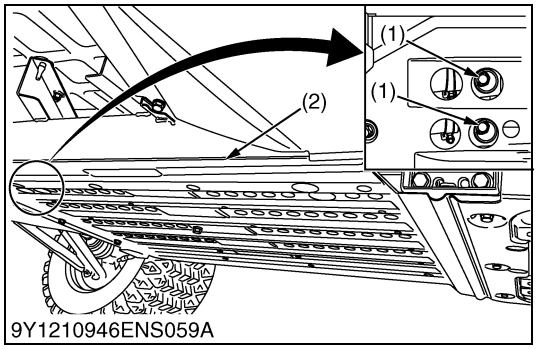
(5) Removing Heater Hoses



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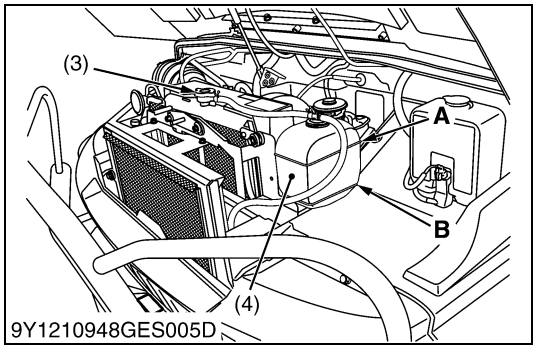

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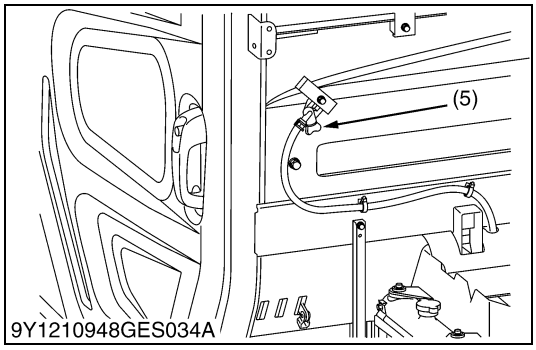


9Y1210948GES034A

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.**

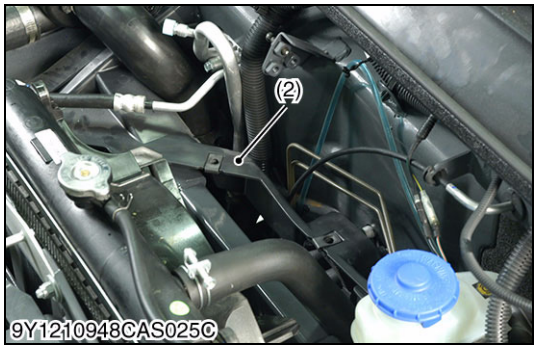
1. Stop the engine and let cool down.
2. Open the hood.
3. To drain the coolant, remove the radiator cap (3), open the engine coolant breather (5), and remove the radiator drain plugs (1). The radiator cap must be removed to completely drain the coolant.
4. After all coolant is drained, close the drain plug and engine coolant breather.

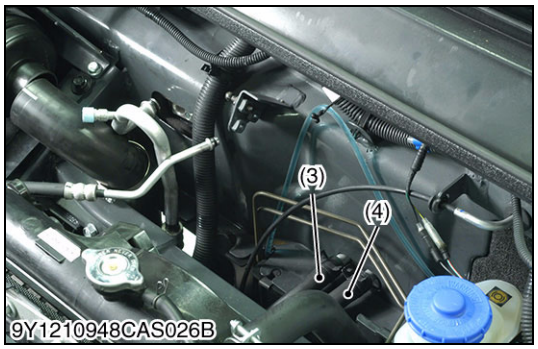
Radiator with recovery tank (Coolant)	Capacity	7.9 L 8.3 U.S.qts 7.0 Imp.qts

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

A: FULL
B: LOW

9Y1210948ENS0013US0





Radiator Cover and Heater Hose (Front Side)

■ **NOTE**

- **Before disconnecting the heater hoses (3), (4), put the parting marks on the hoses for marking proper reconnecting.**

1. Open the from hood.
2. Remove the upper cover (1) and lower cover (2).
3. Disconnect the heater hoses (3), (4).

(1) Upper Cover
(2) Lower Cover
(3) Heater Hose (OUT)
(4) Heater Hose (IN)

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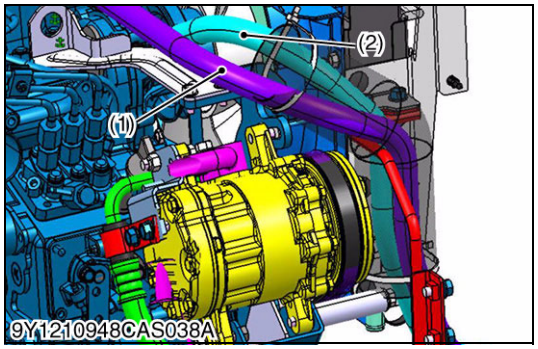

Heater Hoses (Rear Side)

■ **NOTE**

- **Before disconnecting the heater hoses (1), (2), put the parting marks on the hoses for marking proper reconnecting.**

1. Disconnect the heater hose (1) from engine upper side.
2. Disconnect the heater hose (2) from engine lower side.

(1) Heater Hose (IN)
(2) Heater Hose (OUT)

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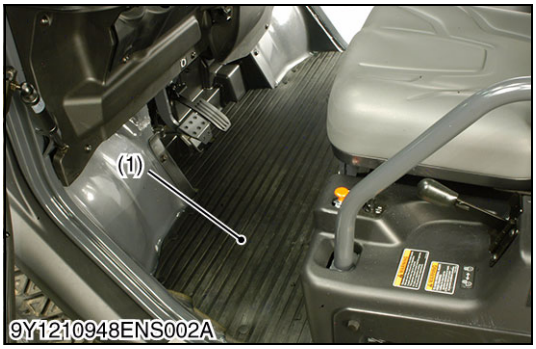

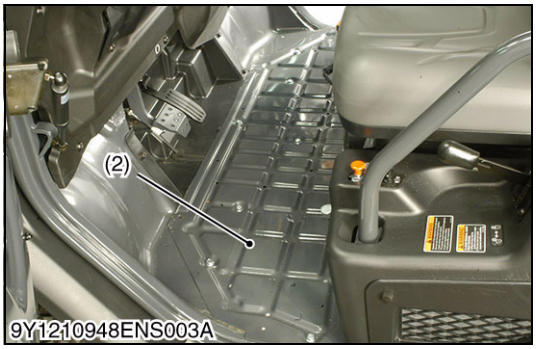

Mat and Center Step

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

(1) Mat
(2) Center Step

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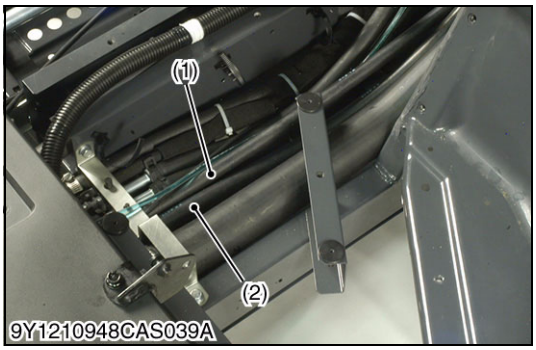

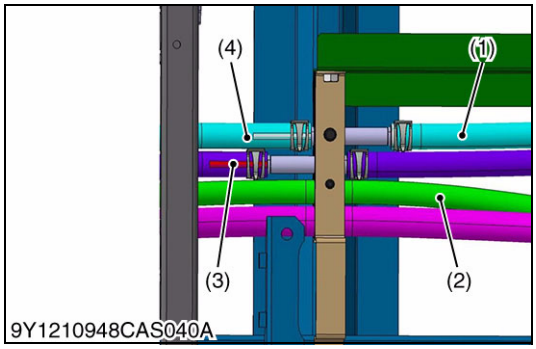

Heater Hoses

■ **NOTE**

- **Before disconnecting the heater hoses, put the parting marks on the hoses for marking proper reconnecting.**

1. remove the hose clamp.
2. remove the heater hoses (1), (2) from front side.
3. Remove the heater hoses (3), (4) from rear side.

(1) Heater Hose (OUT, Front)
(2) Heater Hose (IN, Front)
(3) Heater Hose (IN, Rear)
(4) Heater Hose (OUT, Rear)

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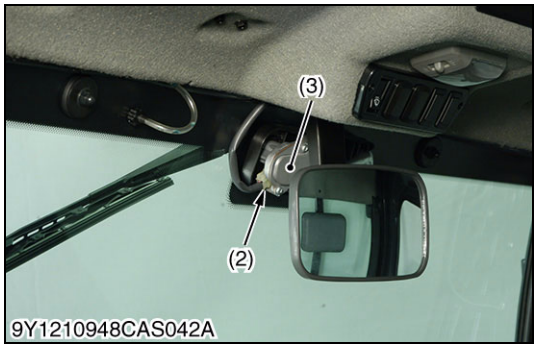
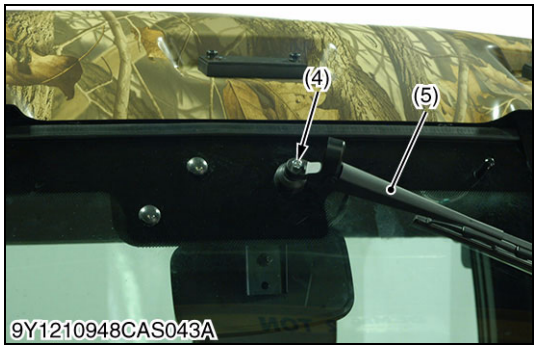
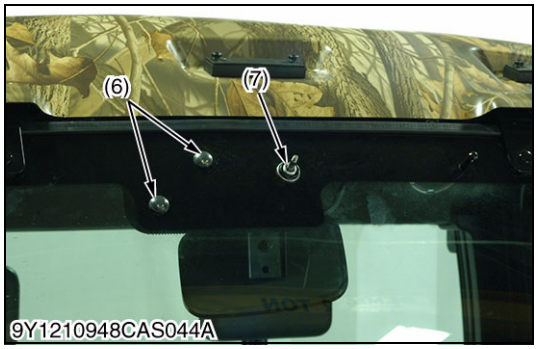
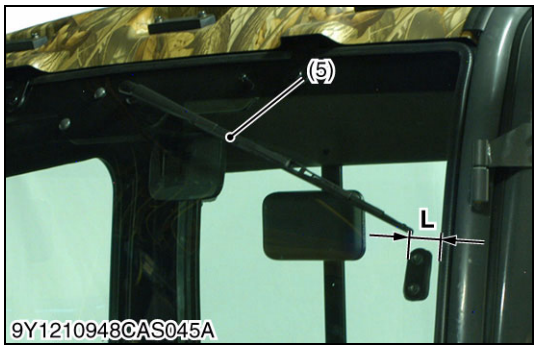
(6) Removing Front Glass









Wiper Arm and Wiper Motor

1. Remove the cover (1).
2. Disconnect the wiper motor connector (2).
3. Remove the wiper arm nut (4).
4. Remove the wiper arm (5).
5. Remove the wiper motor nut (7).
6. Remove the wiper motor (3).

(When reassembling)

Tightening torque	Wiper arm nut	2.9 to 3.9 N·m 0.30 to 0.39 kgf·m 2.2 to 2.8 lbf·ft
	Wiper motor nut	6.4 to 9.3 N·m 0.66 to 0.94 kgf·m 4.8 to 6.8 lbf·ft
	Wiper motor mounting screw and nut	3.4 to 4.4 N·m 0.35 to 0.44 kgf·m 2.5 to 3.2 lbf·ft

(1) Cover
(2) Wiper Motor Connector
(3) Wiper Motor
(4) Wiper Arm Nut
(5) Wiper Arm
(6) Wiper Motor Mounting Screw and Nut
(7) Wiper Motor Nut

L: 30 to 35 mm (1.2 to 1.3 in.)

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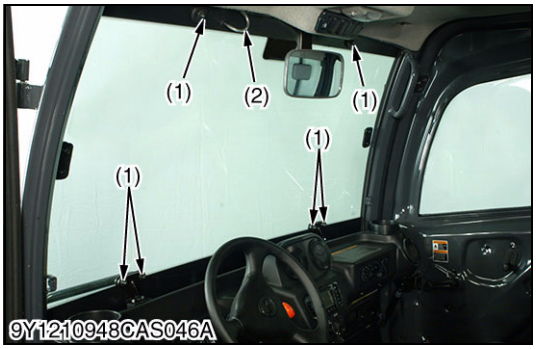
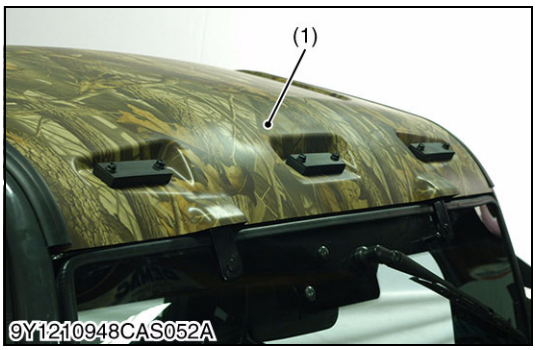
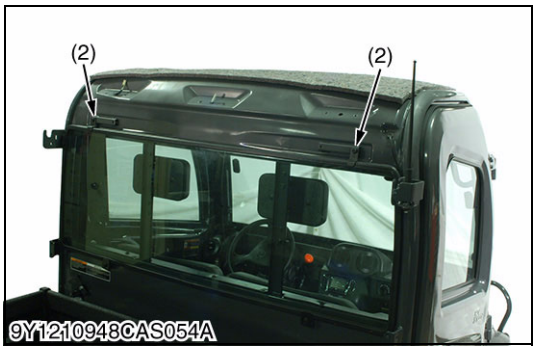


(7) Removing Rear Glass





Front Glass

1. Disconnect the window washer hose (2).
2. Remove the front glass.

(When reassembling)

Tightening torque	Front glass mounting cap nut	10.0 to 15.0 N·m 1.02 to 1.52 kgf·m 7.38 to 11.0 lbf·ft

(1) Cap Nut
(2) Window Washer Hose

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Rear Glass

1. Remove the outer roof (1).
2. Remove the retainer plates (2).
3. Remove the rear glass (3).

(1) Outer Roof
(2) Retainer Plate
(3) Rear Glass

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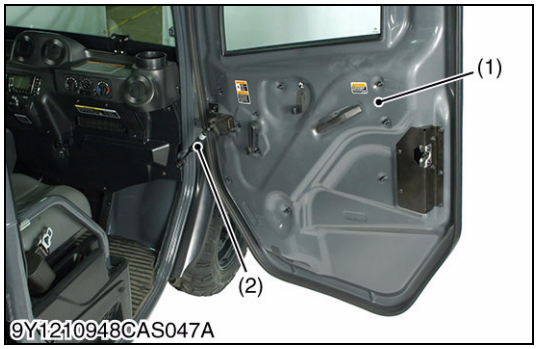
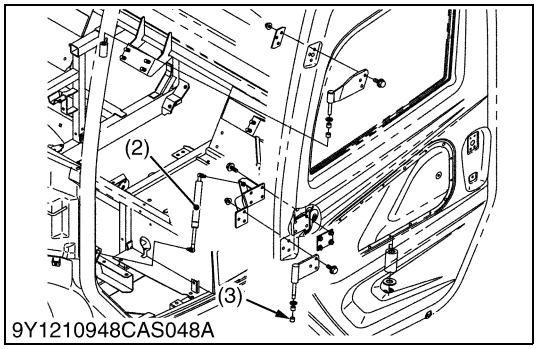
(8) Removing Door





Door

1. Remove the door damper (2).
2. Remove the external circlip (3).
3. Remove the door (1).

(1) Door
(2) Door Damper
(3) External Circlip

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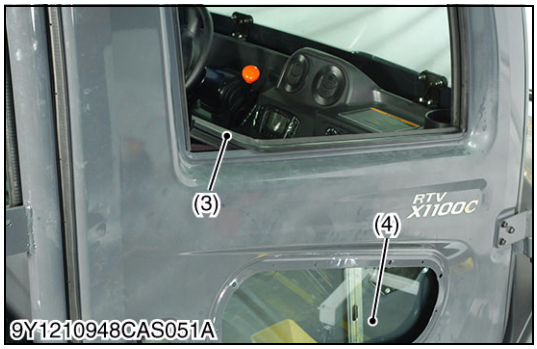
(9) Removing Door Glass



Door Glass

1. Remove the cover (1).
2. Remove the door glass mounting bolts and nuts (2).
3. Remove the weatherstrip (3).
4. Remove the door glass (4) from upper side.

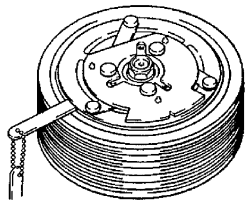
(When reassembling)

Tightening torque	Door glass mounting bolt and nut	9.80 to 11.3 N·m 1.00 to 1.15 kgf·m 7.23 to 8.33 lbf·ft

(1) Cover
(2) Door Glass Mounting Bolt and Nut
(3) Weatherstrip
(4) Door Glass

9Y1210948CAS0062US0

[3] SERVICING



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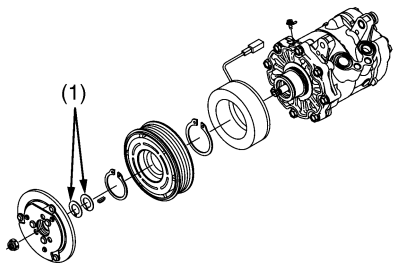

9Y1210948CAS056A

Adjustment of Air Gap

1. Measure the air gap with a feeler gauge.
2. When the measurement value comes off from factory specification, adjustment shim is added or deleted.

Air gap	Factory specification	0.40 to 0.80 mm 0.016 to 0.031 in.

(Reference)

- Adjusting shim size:
  0.10 mm (0.0039 in.)
  0.20 mm (0.0079 in.)
  0.30 mm (0.012 in.)
  0.50 mm (0.020 in.)
  0.80 mm (0.031 in.)
  1.0 mm (0.039 in.)
  1.2 mm (0.047 in.)

(1) Shim

9Y1210948CAS0063US0

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