WSM

WORKSHOP MANUAL
KUBOTA EXCAVATOR

KX042-4

Kubota

KiSC issued 03, 2019 A

TO THE READER

This Workshop Manual provides service personnel with information about the mechanisms, service and maintenance of the construction machinery. This Workshop Manual is divided into 3 sections, General, Mechanisms and Service.

■ **General**

This section contains information such as engine and equipment ID numbers, general precautions, maintenance schedules, inspections and maintenance items and special tools.

■ **Mechanisms**

This section describes the structure of mechanisms and explains their functions.Be sure that you fully understand this Mechanisms section prior to performing any service work, such as troubleshooting or when performing any disassembly or assembly work.

■ **Service**

This section contains information and procedures for performing maintenance on the backhoe, such as troubleshooting, service specification tables, torque specifications, items to be inspected and adjusted, disassembly and assembly procedures, as well as precautions, maintenance standard values and usage limits.

All of the illustrations, specifications and other information in this manual were created based on the latest model at the time of publication.

Please be aware that changes to the content may be made without prior notice.

March, 2019

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KiSC issued 03, 2019 A

SUPPLEMENTARY INFORMATION

For the engine servicing information, please refer to the following engine WSM, DM, or DPF handling manual.

■ **NOTE**

- **The PDF No. may be changed by revision.**

Manuals related to the engine (D1803-CR-TE4-BH)

Manuals	Title	PDF No.
WSM	D1803-CR-TE4B	9Y111-07827 (English) 9Y111-10986 (French) 9Y111-10996 (German) 9Y111-11026 (Italian) 9Y111-11016 (Spanish)
DM	KX042-4 (D1803-CR-TE4-BH)	RY910-25540 (English)
DPF handling manual	DIESEL PARTICULATE FILTER HANDLING MANUAL (FOR EXCAVATOR)	RY910-22370 (English)

Record of Revisions

Last digit of the Code No.	Date	Page	Main Revised Point and Corrective Measures	Remarks
1	2017.10	G-25 to G-27	Added replacing the water separator filter element to the maintenance interval.	R. T
		1-S13	Added filter function to the water separator.	
2	2019.03	1-S3 1-S4	Addition of quick coupler bucket information.	M. M
		3-M2 3-S2 4-S3 4-S11 4-S30, 4-S32 APPEN- DISE- CES	Addition of temperature sensor for hydraulic fluid (from #50555).	
3				
4				

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1. SAFETY FIRST

⚠ SAFETY FIRST

- **This "Safety Alert Symbol" is used in this manual and on labels on equipment to indicate important issues and warn of the danger of personal injury. Read and follow these warnings carefully.**
- **It is important that you thoroughly read these instructions and safety rules prior to working on the equipment and that you always follow them.**

⚠ DANGER
- **Indicates that failure to follow the warning will result in serious injury or death.**

⚠ WARNING
- **Indicates that failure to follow the warning may result in serious injury or death.**

⚠ CAUTION
- **Indicates that failure to follow the warning may result in injury.**

■ IMPORTANT
- **Indicates that failure to follow the warning may result in damage to or a breakdown of the equipment.**

■ NOTE
- **Indicates supplementary explanations that will be helpful when using the equipment.**

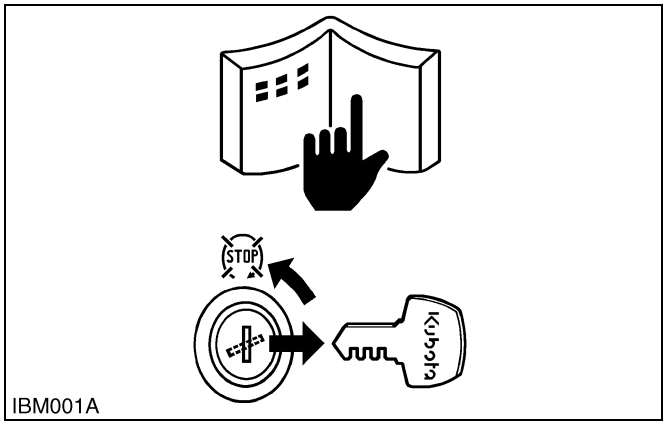
[NOTE]
- Indicates other supplementary information to take note of.

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2. IN THE INTEREST OF WORK SAFETY

[1] WORKING SAFELY WITH THE EQUIPMENT MEANS ALWAYS FOLLOWING THESE INSTRUCTIONS:

(1) Precautions Before Working on the Machine

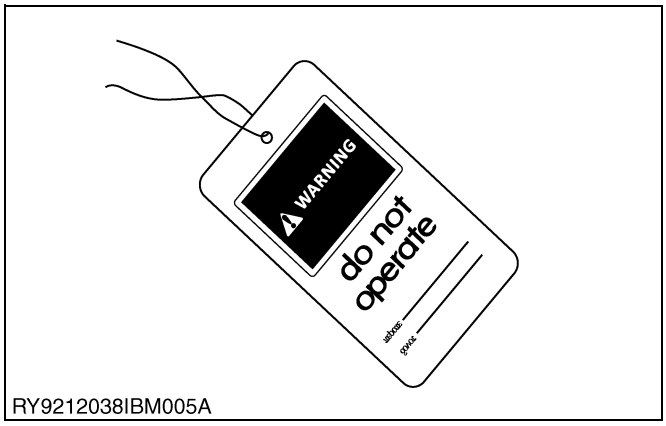


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Before starting any service or maintenance work

- Read all the general and safety instructions in this manual, as well as the decals on your equipment.
- Always stop the engine whenever you leave the driver's seat to inspect or clean the machine or its devices, or to inspect or adjust parts.
- Choose a safe spot for inspecting the equipment-on flat, hard ground.

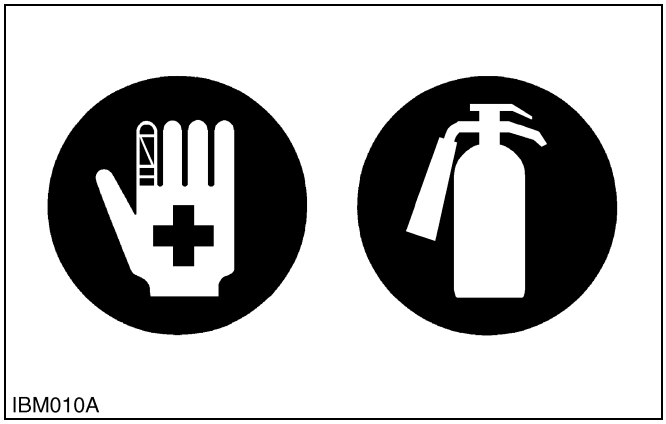
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- When performing maintenance on the equipment, hang the DO NOT OPERATE sign where it will be obvious from and around the driver's seat.
- When performing maintenance or repairs, always lower attachments to the ground, stop the engine and attach the warning sign clearly visible.
- When performing maintenance on the equipment, always disconnect the negative battery cable.
- Before using tools, make sure you understand how to use them correctly and use tools in good condition and of the right size for the job.

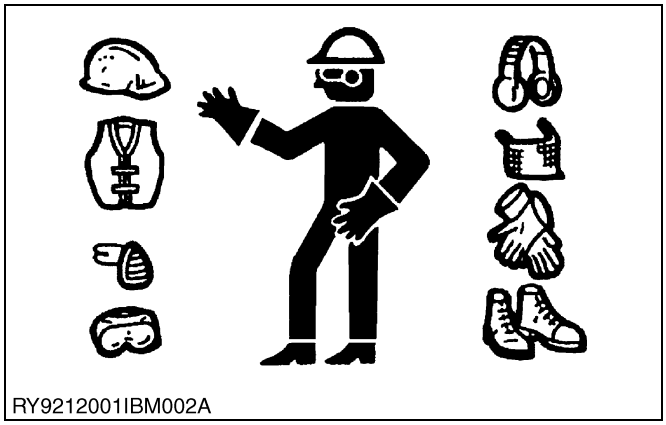
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IBM010A

Be Ready for an Emergency

- Keep a first-aid kit and fire extinguisher close at hand so you can use it when needed.
- Keep emergency contact information for doctors, hospitals and ERs handy.

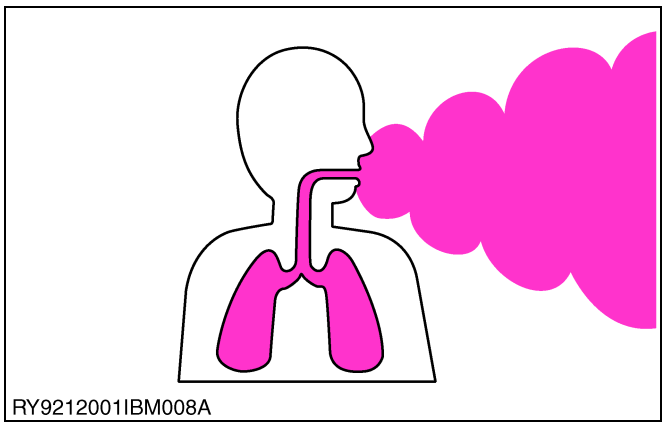
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- Wear clothes appropriate for working on equipment. Do not wear loose-fitting clothes as they may catch on the machine controls.
- When working on the equipment, use all safety gear, such as a helmet, safety glasses and shoes, that are required by law or regulation.
- Never perform maintenance while drowsy or under the influence of alcohol or drugs.

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(2) Precautions Before Working on the Equipment


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- Stop the machine on a hard and level location and make sure the area around the machine is free of obstacles and hazardous materials. When parking the machine indoors, select a spot that can be properly ventilated.
- When performing work such as with a hammer, fragments may chipping off, so make sure only authorized persons are around the machine.
- Before servicing the machine, clean it off so there is no mud, debris, oil or the like sticking to it.

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- Before getting on/off of the machine, clean off around the steps so there is no mud on them. Always give yourself 3-point support when getting on/off the machine.

CAUTION

- **3-point support means using both legs and one hand or both hands and one leg as you climb up/down.**

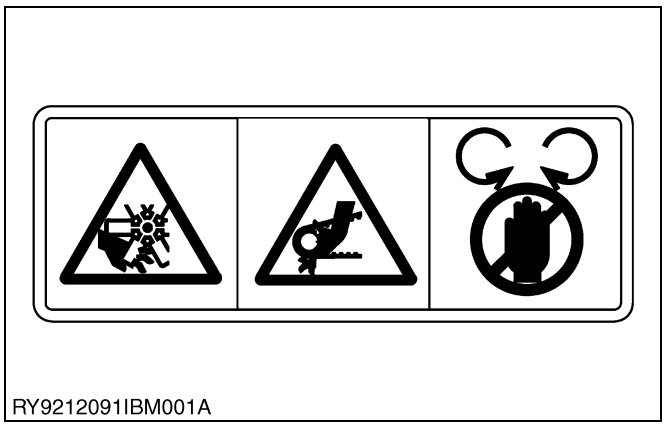
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Starting the Machine Safely

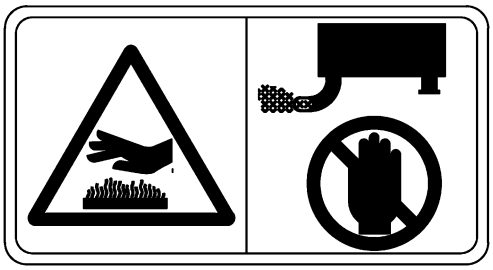
- Before starting the engine, always sit in the driver's seat and make sure the area is safe and clear.
- As it is dangerous, never start the engine from anywhere but the driver's seat.
- Always check and make sure control lever(s) are not engaged before starting the engine.
- Never start the engine by hot-wiring the starter circuit. This is not only dangerous, but may damage the machine.

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- Whenever it is necessary to open the engine covers or bonnet in order to service the machine, always prop them open.
- If it is absolutely necessary to run the engine while working on the machine, make sure you are clear of all rotating or moving parts. Also take care not to leave anything, such as tools or rags, near any moving parts.

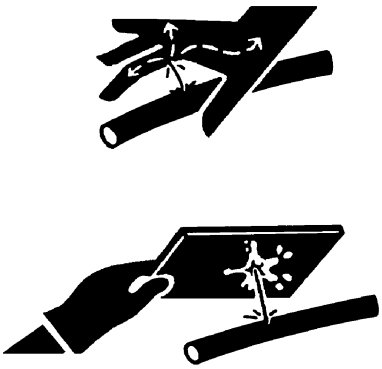
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- The engine, muffler, radiator, hydraulic line, etc., have parts that remain very hot even after the engine has been stopped. Be sure to avoid these parts, as touching them can result in burns. Radiator coolant, hydraulic fluid and oil also remain hot. Therefore, do not attempt to remove caps and plugs, etc., before these fluids have sufficiently cooled.
- Make sure the coolant temperature has dropped sufficiently before opening the radiator cap.
  Also, since the inside of the radiator is pressurized, when removing the cap, first loosen it to release the pressure before removing the cap completely.

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- The pressure in the hydraulic circuit stays at pressure even after the engine stops.
  Before removing parts, such as hydraulic devices from the machine, first release the pressure. Please note that when releasing residual pressure, the machine itself and/or implements may move without warning, so be very careful when releasing the pressure.
- Oil gushing out under pressure is extremely dangerous as it may pierce your skin or your eyes. Similarly, oil leaking out of pinholes is not visible.
  So when checking for oil leaks, always wear safety glasses and gloves and use a piece of cardboard or a wood block to shield yourself from oil.

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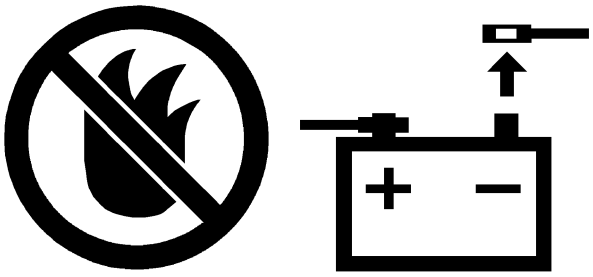


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No Smoking or Open Flames while Fueling

- Fuel is extremely flammable and dangerous.
  Never smoke near fuel. If fuel is spilled on the machine, its engine, or electrical parts, it may cause a fire. If fuel is spilled, wipe it all up immediately.
- Never smoke while filling the machine with fuel.
  And always tighten the fuel cap securely and wipe up any spilled fuel.

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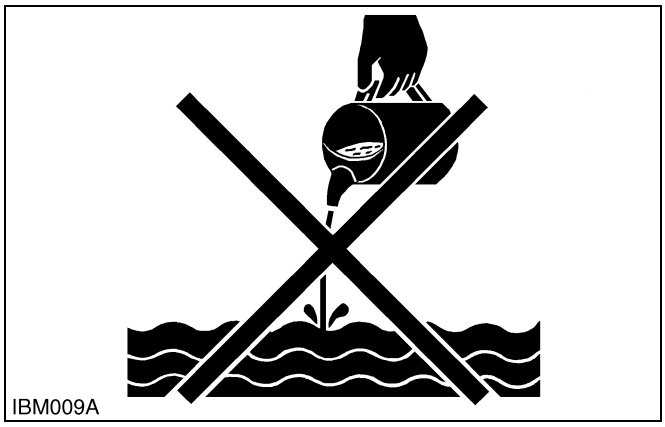
- Always wear safety glasses and gloves when handling the battery.
- The gas generated by the battery is flammable. Never weld or use tools like a grinder near the battery. And never smoke near it.
- When disconnecting the battery, always disconnect the negative cable first. When connecting the battery, always connect the positive cable first.

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- Grease is under high pressure inside the hydraulic cylinder. It is very dangerous to loosen a grease nipple quickly as it may shoot off. Always loosen grease nipples slowly.
- And never face a grease nipple while loosening it.

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IBM009A

Dispose of Waste Fluids Properly

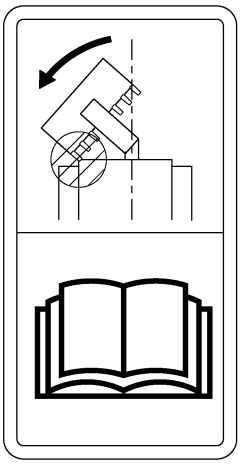
- Never dispose of waste fluids on the ground, in the gutter, a river, pond or lake. Always dispose of hazardous substances like waste oil, coolant and electrolytic fluid in accordance with the relevant environmental protection regulations.
- Keep the safety plates clean so they can be read. If a safety plate is damaged and comes off or becomes illegible, put a plate with the same warnings back in its place.

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3. LABELS DISPLAYED TO PROMOTE WORK SAFETY

[1] LOCATIONS

(1) Part No. RD839-5739-1

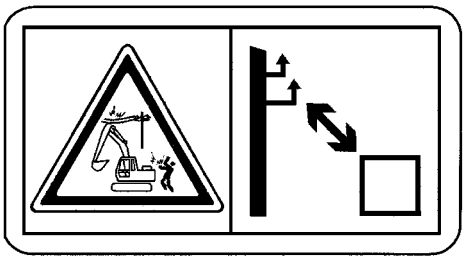


When using a wider or dipper bucket, take good care when swinging or retracting the front attachments to make sure that the bucket does not hit the cab.

Read the operator's manual.

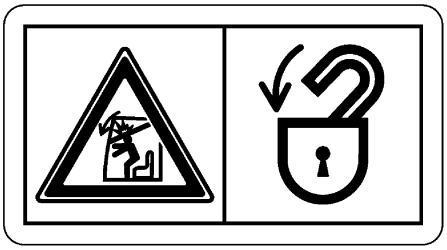
1BAAAADAP1580

(2) Part No. RD517-5788-2
Check overhead clearance from electric wires.



1BAABAGAP2720

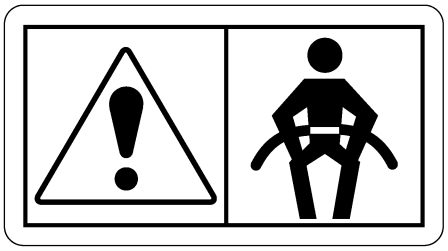
(3) Part No. RB419-5793-2
Do not forget to lock the front window.



1BAAABYAP158E

(4) Part No. RD809-5743-1

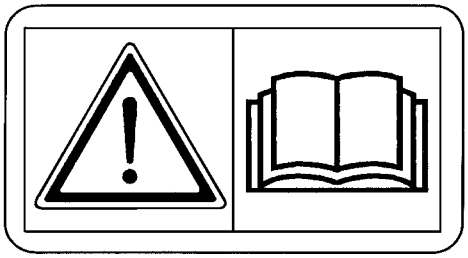
Caution Use the seat belt.



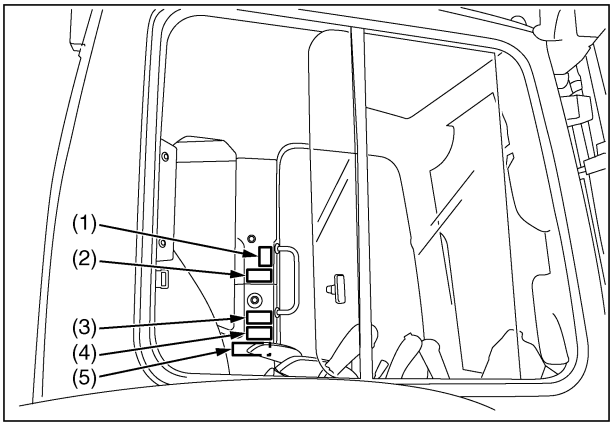
1BAAAADAP1590

(5) Part No. 69198-5784-1

Caution Read the operator's manual.



1BAAABVAP0630

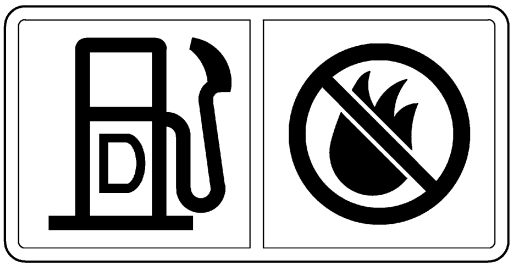


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(1) Part No. RB238-5736-1

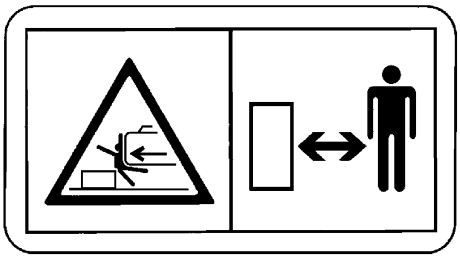
Diesel fuel only No fire



1BAAACDAP2090

(2) Part No. RC788-5727-2

Do not allow any persons within the working range.

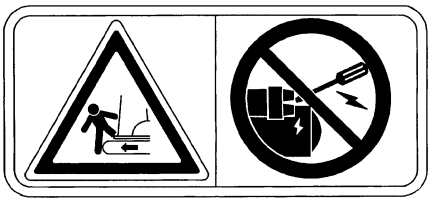


1BAAEAJAP069A

(3) Part No. RA228-5739-1

Start engine only from operator's seat.

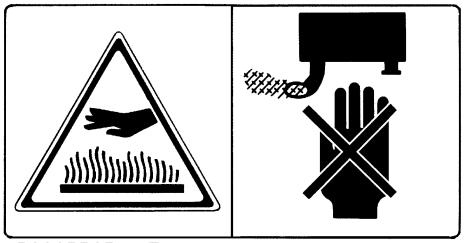
Do not start engine by shorting across starter terminals.



1BAAAADAP1600

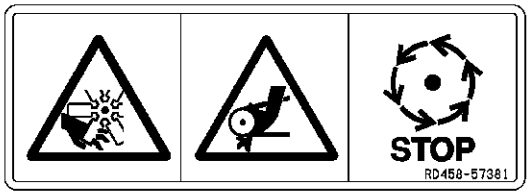
(4) Part No. RD809-5745-1

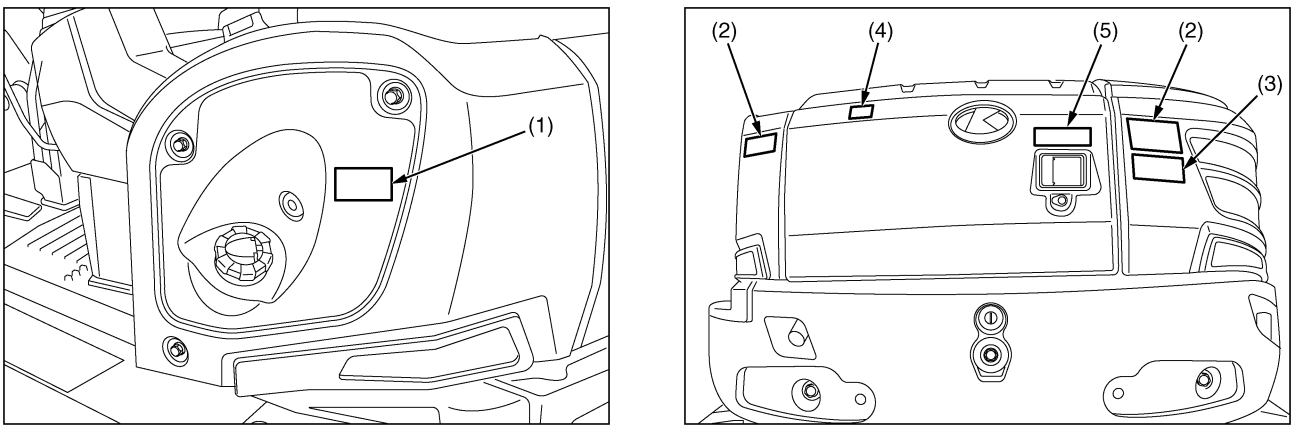
Do not touch hot parts such as exhaust etc.



1BAAABBAP073E

(5) Part No. RD458-5738-1

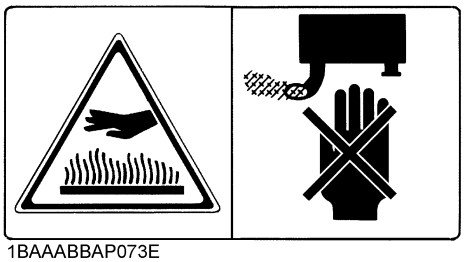




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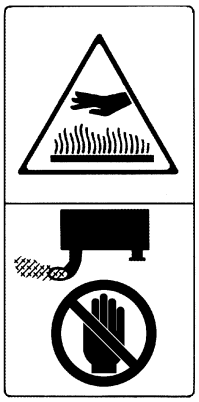
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(1) Part No. RD158-5745-1
Do not touch hot parts such as exhaust etc.



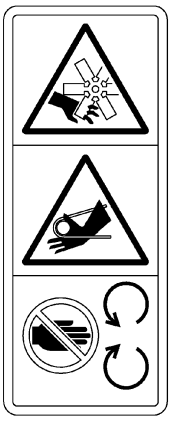
1BAAABBAP073E

(2) Part No. RB449-5738-1
Do not touch hot parts such as exhaust etc.



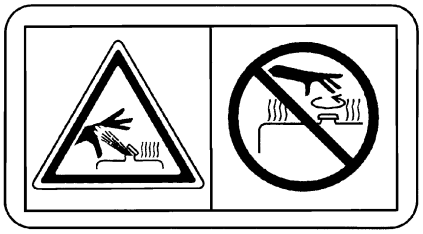
1BAAAADAP0810

(3) Part No. RC418-5737-4
Keep away from fan and fan belt.

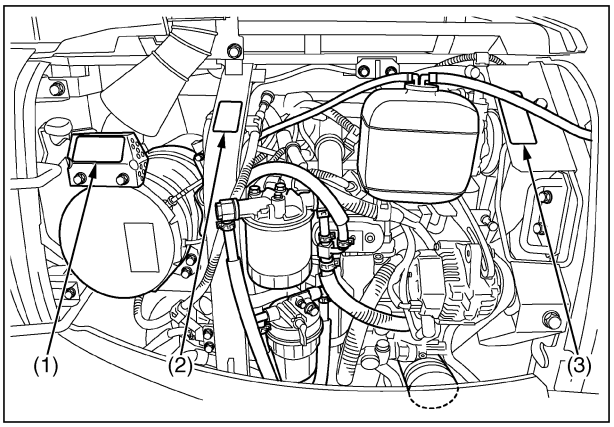


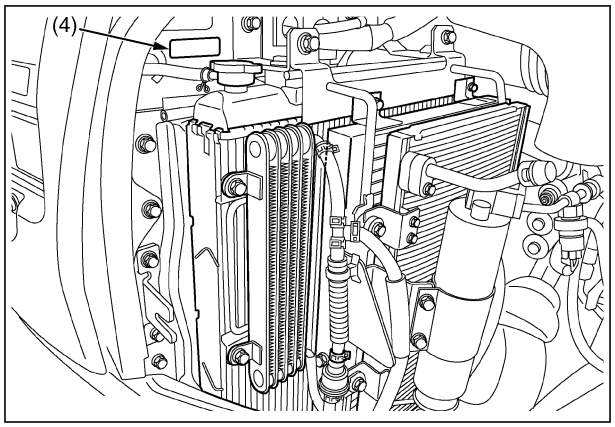
1BAAEBBAP0020

(4) Part No. RD829-5723-1
Do not open the radiator cap before the radiator has cooled down.



1BAABAGAP2650





RY9212509ICI003A

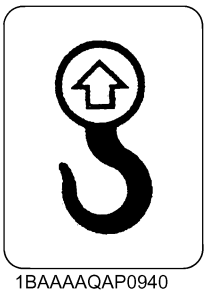
RY9212509INI0003US0

(1) Part No. RD517-5789-2 [Both sides]
Do not allow any person within the working range.



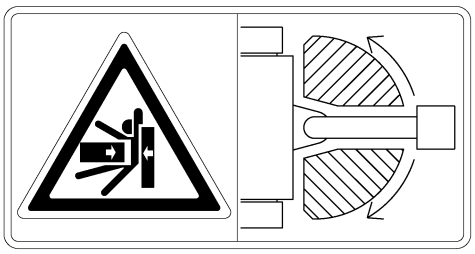
1BAABAGAP2610

(2) Part No. RC108-5796-1 [Both sides]
Lifting point



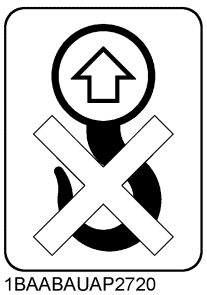
1BAAAAQAP0940

(3) Part No. RA228-5722-1 [Both sides]
Do not allow any person within the working range.



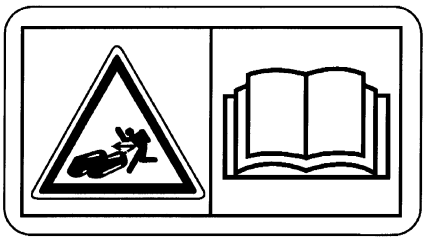
1BAAABVAP1050

(4) Part No. RB419-5796-2 [Both sides]
Do not use the hook for lifting.

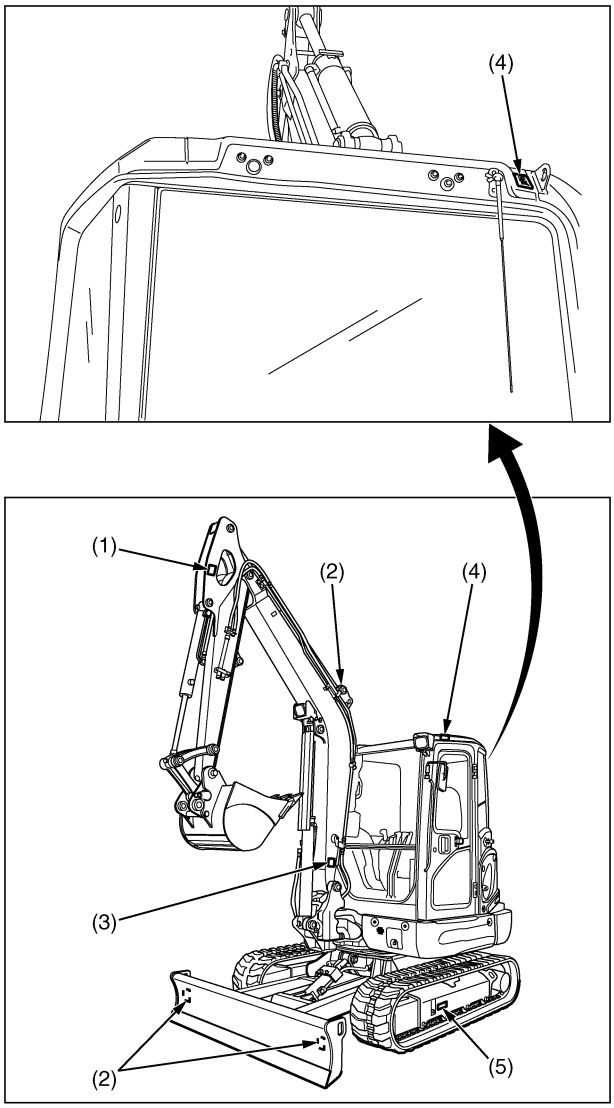


1BAABAUAP2720

(5) Part No. RD809-5795-1
Do not loosen the grease nipple completely or too quickly.



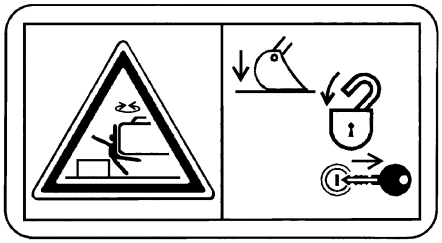
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RY9212509ICI004A

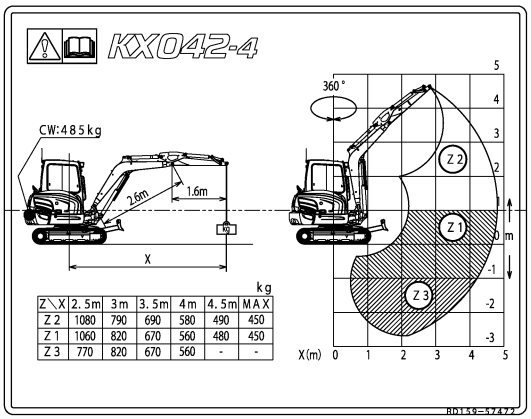
RY9212509INI0004US0

(1) Part No. RD517-5783-2
Before leaving the machine,
• Keep bucket on the ground.
• Lock all control levers.
• Stop the engine and remove the key.



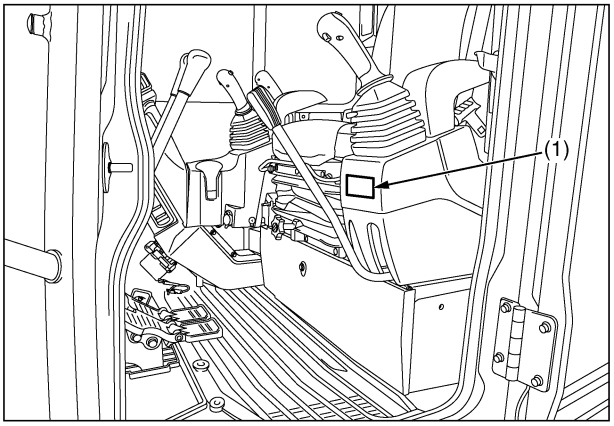
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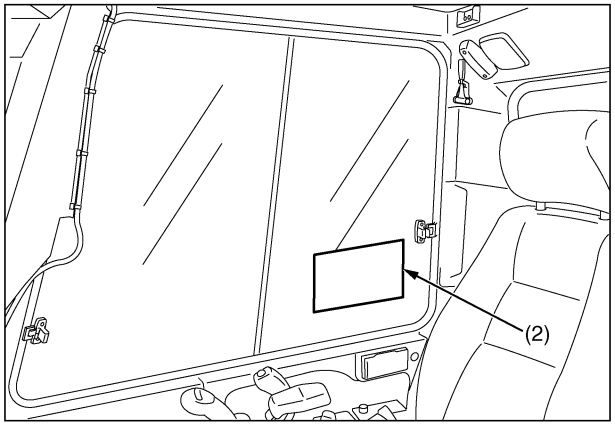
(2) Part No. RD159-5747-2



Z\X	2.5m	3m	3.5m	4m	4.5m	MAX
Z2	1080	790	690	580	490	450
Z1	1060	820	670	560	480	450
Z3	770	820	670	560	-	-

kg





RY9212509ICI005A

RY9212509INI0005US0

[2] LABEL MAINTENANCE

Thoroughly Read, Understand and Follow Safety Precautions on Labels

- Always keep labels in a clean, undamaged state.
- If labels get dirty, wipe them off with soapy water and a soft cloth.
  If solvents such as paint thinner or engine oil are used, the text and or figures may fade away.
- When using a pressure washer to clean the equipment, do not spray any labels directly as doing so may make them peel off.
- If a label is damaged or lost, order a new one from your dealer and affix it as before.
- Before affixing a new label, completely wipe off any dirt or grime on the surface, allow it to dry and then affix in the same place.
- When replacing a part that has a label on it, replace the label at the same time.

RY9212001INI0018US0

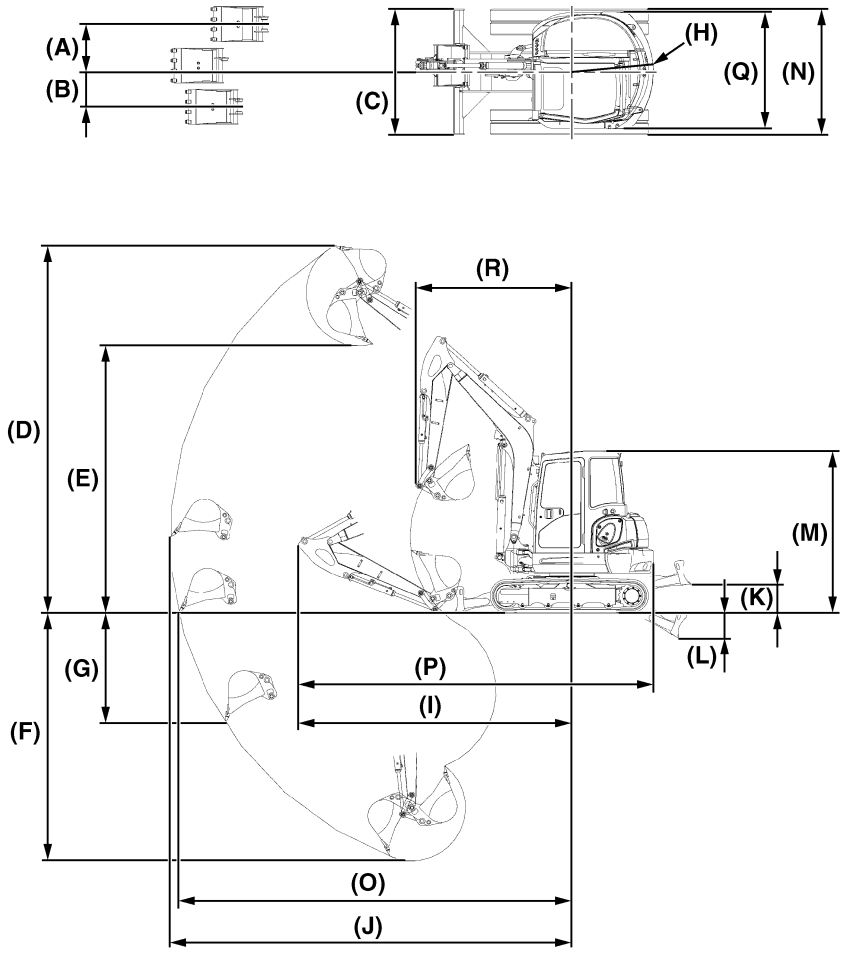
4. TABLE OF MAIN SPECIFICATIONS

			KUBOTA EXCAVATOR
Model name			KX042-4
Machine weight *1			4125 kg
Operating weight *2			4200 kg
Bucket (KUBOTA)	Capacity (CECE)		0.2 m^3
	Width with teeth		624 mm
Engine	Type		Water-cooled 3-cylinder four-stroke diesel engine
	Model name	Without air conditioner	D1803-CR-TE4-BH5
		With air conditioner	D1803-CR-TE4-BH6, AC
	Displacement		1826 cm^3
	Engine performance (ISO 9249)		28.7 kW
	Rated speed		2200 min^{-1}
Performance	Swivel speed swivel frame		9.2 min^{-1}
	Vehicle speed	Travel speed	5.0 km/h
		Low speed	2.9 km/h
	Ground pressure (with driver 75 kg)		32.3 kPa (0.33 kgf/cm^2)
	Climbing performance		36 % (20 degrees)
	Max. lateral sway		27 % (15 degrees)
Blade	width × height		1700 × 350 mm
Swing angle of the boom	Left		70 degrees
	Right		55 degrees
Auxiliary port 1	Max. flow rate (theoretical)		65 L/min
	Max. pressure		20.6 MPa (206 bar)
Auxiliary port 2	Max. flow rate (theoretical)		37 L/min
	Max. pressure		20.6 MPa (206 bar)
Fuel tank capacity			64 l
Pulling capacity at the towing eyes			70450 N
Vertical load at the towing eyes			7210 N
Noise level	LpA		79 dB (A)
	LwA (2000/14/EC)		95 dB (A)
Vibration *3	Hand arm system (ISO 5349-2: 2001)	Digging	< 2.5 m/s^2 RMS
		Levelling	< 2.5 m/s^2 RMS
		Driving	< 2.5 m/s^2 RMS
		Idling	< 2.5 m/s^2 RMS
	Whole body (ISO 2631-1: 1997)	Digging	< 0.5 m/s^2 RMS
		Levelling	< 0.5 m/s^2 RMS
		Driving	< 0.5 m/s^2 RMS
		Idling	< 0.5 m/s^2 RMS

*1: With Japanese deep bucket 87.0 kg, ready for operation.
*2: Machine weight, incl. operator 75 kg.
*3: These values are measured under specific conditions at maximum engine speed and can deviate, depending on the operating situation.

RY9212509INI0008US0

5. DIMENSIONS



RY9212182INI001A

	(A)	(B)	(C)	(D)	(E)	(F)
KX042-4	575 mm 22.6 in.	395 mm 15.6 in.	1700 mm 66.9 in.	5290 mm 208.3 in.	3915 mm 154.1 in.	3375 mm 132.9 in.

	(G)	(H)	(I)	(J)	(K)	(L)
KX042-4	2330 mm 91.73 in.	1300 mm 51.2 in.	3790 mm 149.2 in.	5520 mm 217.3 in.	400 mm 15.7 in.	405 mm 15.9 in.

	(M)	(N)	(O)	(P)	(Q)	(R)
KX042-4	CAB 2485 mm 97.8 in.	1700 mm 66.9 in.	5380 mm 211.8 in.	5085 mm 200.2 in.	1700 mm 66.9 in.	2180 mm 85.8 in.

■ **NOTE**
- **Above dimensions are based on the machine with QUICK HITCH BUCKET.**
- **Above dimensions are based on the machine with rubber track.**
- **Specifications subject to change without notice.**

RY9212509INI0009US0

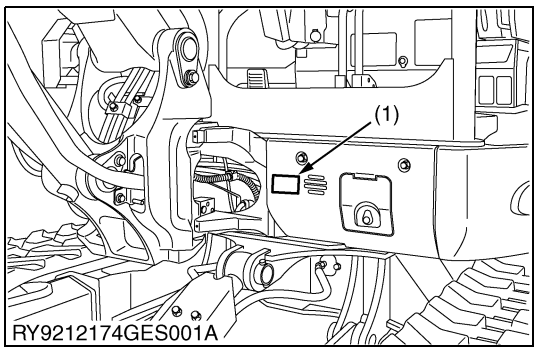
G GENERAL

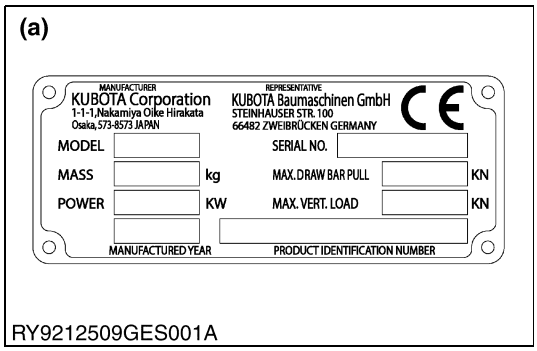
GENERAL

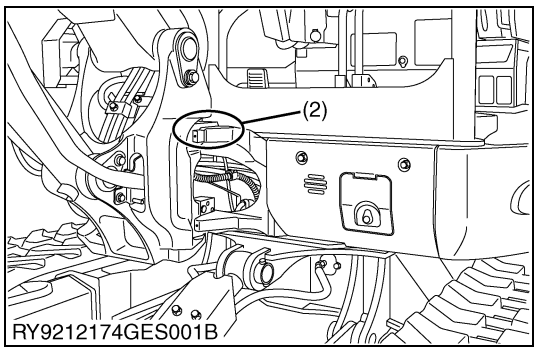
CONTENTS

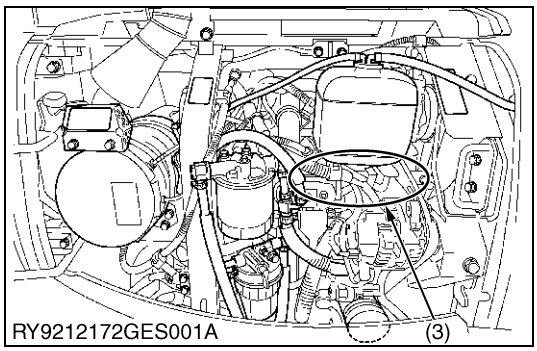
1. CHECKING EXCAVATOR IDENTIFICATION G-1
2. ENGINE IDENTIFICATION G-2
   [1] MODEL NAME AND SERIAL NUMBER G-2
   [2] E4B ENGINE G-3
   [3] CYLINDER NUMBER G-4
3. MUFFLER FULL ASSEMBLY IDENTIFICATION G-5
   [1] PART NUMBER AND SERIAL NUMBER G-5
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5. HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING G-11
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   [2] FUSES G-13
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   [4] WASHING THE MACHINE WITH A HIGH-PRESSURE WASHER G-15
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   [1] TORQUES FOR GENERAL USE NUTS AND BOLTS G-16
   [2] STUD BOLTS G-17
   [3] TORQUE FOR HYDRAULIC HOSE FITTINGS G-17
      (1) Torque for Hydraulic Hose Fittings G-17
      (2) Torques of Lock-Nuts for Elbows with Male Seats and Adaptors with O-rings (Straight Threads) G-18
   [4] HOSE CLAMP SCREW TORQUE G-19
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8. MAINTENANCE INTERVALS G-22

1. CHECKING EXCAVATOR IDENTIFICATION









When consulting with your local KUBOTA dealer about this machine, please provide the model of the machine, its frame and engine numbers and the number of hours on the hour meter.

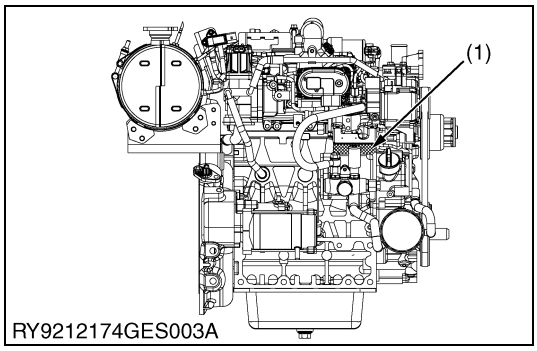
(1) Machine Nameplate (Model, frame number, engine number)
(2) Frame Number
(3) Engine Number

(a) Model Nameplate

RY9212509GEG0001US0

2. ENGINE IDENTIFICATION

[1] MODEL NAME AND SERIAL NUMBER



RY9212174GES003A

Be sure to check the engine nameplate and serial number when you wish to consult about the engine. The model and serial number of the engine need to be checked prior to servicing the engine or replacing any of its parts.

Engine Serial No.

The engine serial number is the numerical ID of the engine and is printed after the engine's model number. The year and month of manufacture are indicated as follows.

Engine Series

Number or Alphabet	Series	Number or Alphabet	Series
1	05 (include: WG)	6	GZ, OC, AC, EA, E
2	V3	7	03
3	08	8	07
4	SM (include: WG)	A	EA, RK
5	Air Cooled Gasoline	B	03 (KET Production)

Production Year

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

(1) Engine Model Name and Serial Number

(To be continued)

(Continued)

Production Month and Lot Number

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

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

(a) (b)(c)(d) (e)
e.g. V2607 - 8 C L A001

(a) **V2607**: Engine Model Name
(b) **8**: Engine Series (07 series)
(c) **C**: Production Year (2012)
(d) **L**: Production Month (June)
(e) **A001**: Lot Number: (**0001 to 9999** or **A001 to Z999**)

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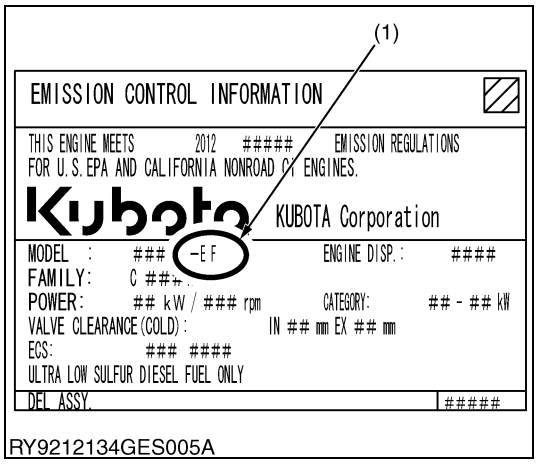
[2] E4B ENGINE

[Example: Engine Model Name D1803-CR-**TE4(C)B**-XXXX or D1803-CR-**TIE4(C)B**-XXXX]

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

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

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



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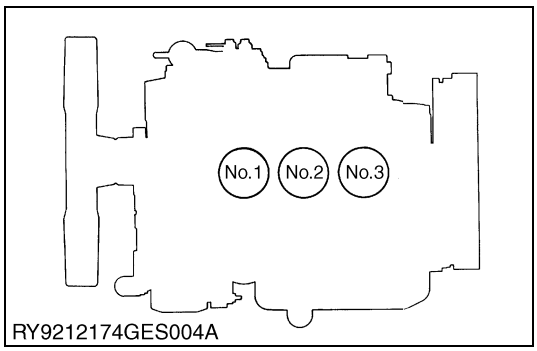
Category (1)	Engine output classification	EPA regulation
EF	Less than 19 kW	Tier 4
	From 19 to less than 56 kW	Interim Tier 4
	From 56 to less than 75 kW	Interim Tier 4
	From 75 to less than 130 kW	Interim Tier 4

■ **NOTE**

- **"E4B" engines are identified with "EF" at the end of the Model designation, on the US EPA label.**
  "E4B" designates some Interim Tier 4 / Tier 4 models, depending on engine output classification.

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[3] CYLINDER NUMBER



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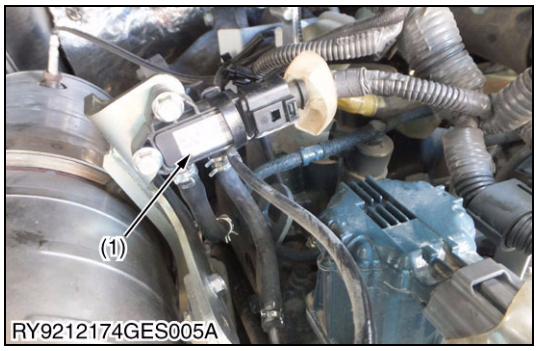
You can see the cylinder numbers of KUBOTA diesel engine in the figure.

The sequence of cylinder numbers is No.1, No.2 and No.3 and it starts from the front cover side.

RY9212509GEG0008US0

3. MUFFLER FULL ASSEMBLY IDENTIFICATION

[1] PART NUMBER AND SERIAL NUMBER



Diesel Particulate Filter (hereinafter referred to as the "DPF") Muffler Full Assembly Serial Number

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

It shows the month and year of manufacture as below.

Year of manufacture

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

Month of manufacture

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

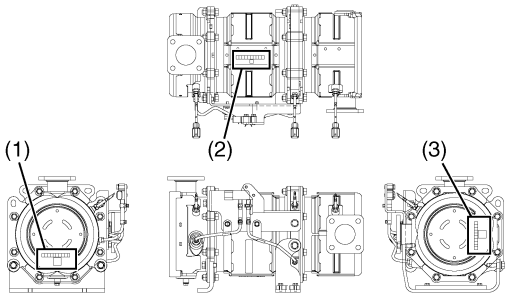
* Alphabetical letters "I" and "O" are not used.

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

(1) DPF Muffler Full Assembly Part Number and Serial Number

(a) Year: C indicates 2012
(b) Month: L or M indicates June
(c) Lot Number: (**0001 to 9999** or **A001 to Z999**)

RY9212174GEG0004US0



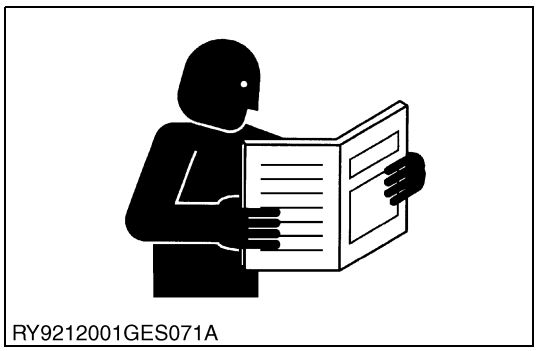
RY9212174GES006A

You must keep the records of the filter component (DPF) part number and serial number before you remove the DPF for cleaning.

(1) Body (DPF Outlet) Part Number and Serial Number
(2) Filter Component (DPF) Part Number and Serial Number
(3) Catalyst (DOC) Part Number and Serial Number

RY9212174GEG0005US0

4. GENERAL PRECAUTIONS


RY9212001GES071A

Whenever performing maintenance on the machine, always read the Safety Precautions in this manual and the Operator's Manual carefully, become familiar with them and perform the work safely.

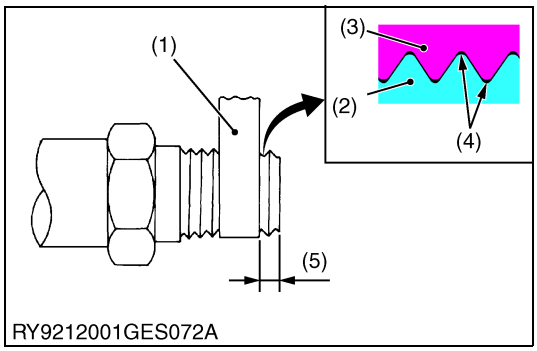
Before performing any maintenance on the machine, make sure it is sufficiently clean and choose a sufficiently clean location to perform any disassembly.

Before performing maintenance on the machine, always disconnect the negative battery cable first.

Whenever a special tool is required, use the special tool that KUBOTA recommends. Make any special tools that are not used very frequently according to the diagrams in this manual.

Always use genuine KUBOTA parts to maintain the performance and safety characteristics of the machine.

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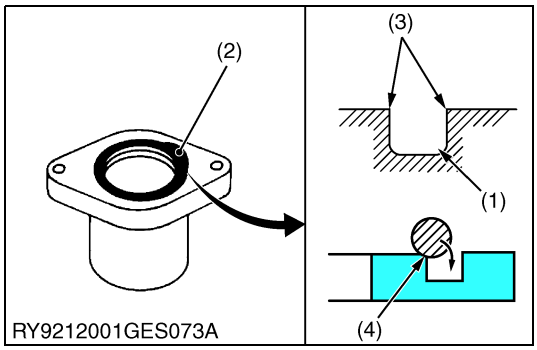
RY9212001GES072A

Plumber's Tape

- Wrap plumber's tape on the threads before tightening taper couplings. After wrapping (2 wraps) the plumber's tape, tighten to the specified torque. Once the coupling is tightened, do not loosen it as this will cause an oil leak.

(1) Plumber's Tape
(2) External Thread
(3) Internal Thread
(4) Gap
(5) Leave 1 to 2 Threads

RY9212001GEG0012US0



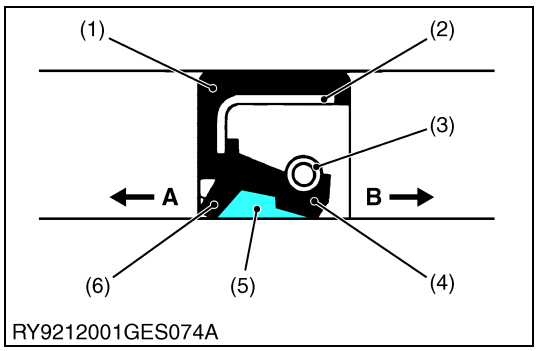
RY9212001GES073A

O-Ring

- Clean the groove the O-ring goes in and remove any burrs. Apply grease on the O-ring when inserting it in the groove (Except floating seals).
- When putting the O-ring in the groove, be careful as it is easy at the very end to twist the O-ring against the inside of the groove. If it gets twisted, roll it gently with your fingertip to untwist it.

(1) O-Ring Groove
(2) O-Ring
(3) Check for Burrs
(4) If the Ring Touches This Corner, It Will Twist

RY9212001GEG0013US0



RY9212001GES074A

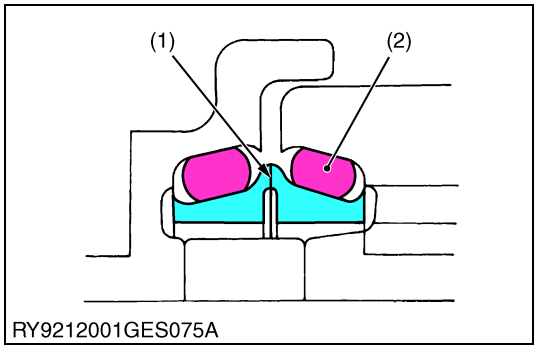
Oil Seal

- Do not face the lip of the oil seal in the wrong direction. Face the main lip toward the material to be sealed.
- After oil seals are replaced, apply grease to the moving parts around the lip to prevent the dry surfaces from wearing against each other when the engine is started. If the seal has a dust lip, fill the gap between the lips with grease.
- As a general rule, use a press to insert the oil seal in place. If that is not possible, use an appropriate tool to gently and evenly tap it into place, taking care that it does not go in at a slant. Press the seal all the way so it seats in the boss.

(1) Gasket
(2) Metal Ring
(3) Spring
(4) Main Lip
(5) Grease
(6) Dust Lip

A : Air (Outside)
B : Hydraulic Chamber (Inside)

RY9212001GEG0014US0



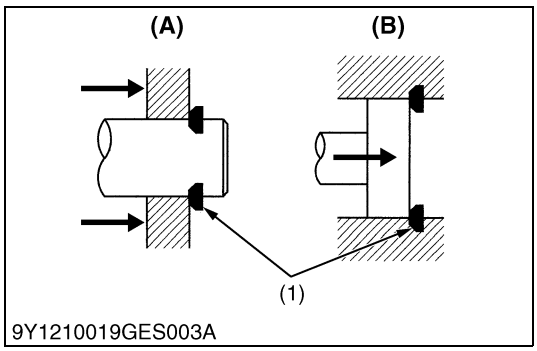
RY9212001GES075A

Floating Seal

- Be sure to wipe off any oil from the O-ring or surfaces that touch the O-ring (For wheel motors, apply a light film).
- When putting an O-ring into a floating seal, make sure the O-ring does not twist.
- Apply a light film of oil to surrounding surfaces when working to get the floating seal with O-ring in place; take care that the surrounding surfaces, O-ring and housing are parallel with each other.
- After getting the seal in place, turn the engine over 2 or 3 revolutions, to both create a film of oil on surrounding surfaces and to properly seat the face of the seal.

(1) Surrounding Surfaces (2) O-Ring

RY9212001GEG0015US0



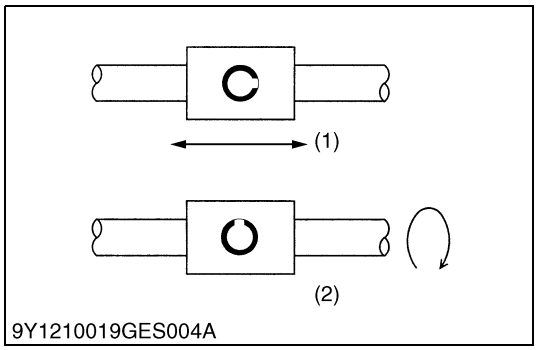
9Y1210019GES003A

Snap Ring Related

- When installing external or internal snap rings, orient them as shown in the diagram so the angled side faces the direction of force.

(1) Position so the Angled Part Receives the Force
(A) External
(B) Internal

RY9212001GEG0016US0



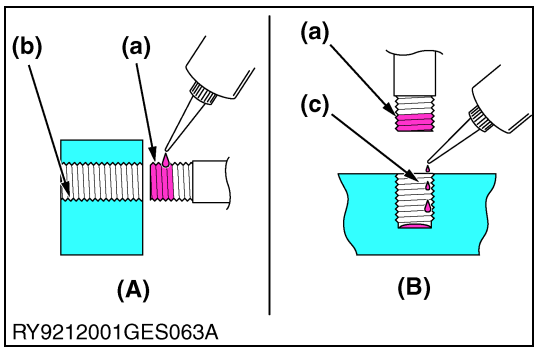
9Y1210019GES004A

Spring Pins

- When driving a spring pin, face the split in the direction that receives the force, as shown in the diagram.

(1) With Lateral Movement (2) With Rotational Movement

RY9212001GEG0017US0



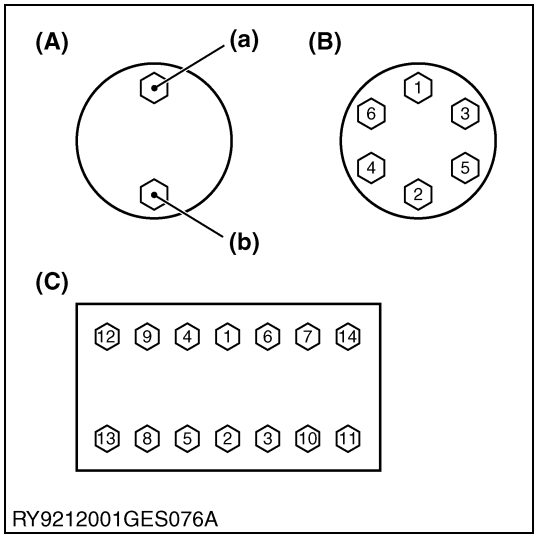
RY9212001GES063A

Adhesive

- Clean and dry the area where adhesive will be applied with a solvent so it is free of moisture, oil and dirt.
- Apply adhesive all around the threads of the bolt except the first set of threads at the tip and fill the grooves between the threads. If the threads or the grooves are large, adjust the amount of adhesive accordingly and apply it all around the bolt hole as well.

(A) Bolt Through-Hole (Nut)
(B) Pocket Bolt Hold (Capsule Shape, etc.)
(a) Apply Here
(b) Do Not Apply
(c) Drip On

RY9212001GEG0018US0



RY9212001GES076A

Tightening Bolts and Nuts

- Tighten bolts and nuts to their specified torque.
- Tighten nuts and bolts alternately top/bottom **(a) (b)**, left/right so the torque is distributed evenly.

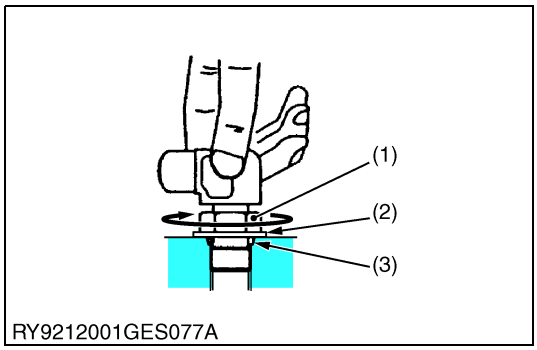
(A) Top/Bottom Alternately
(B) Across Diagonally
(C) Diagonally Across the Center

RY9212001GEG0019US0

Assembling Hydraulic Hoses

- Tighten to their specified torque.
- Before assembling, wipe the inside of metal fittings clean of any dirt.
- After assembly, put the fitting under normal pressure and check that it does not leak.

RY9212001GEG0020US0

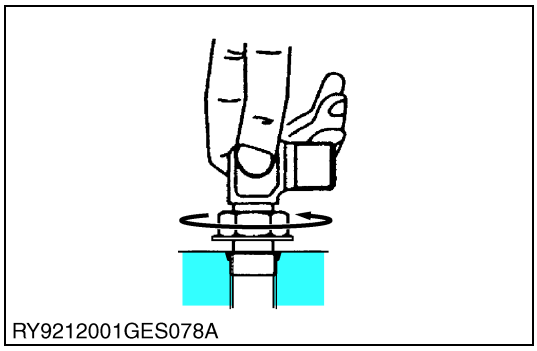


RY9212001GES077A

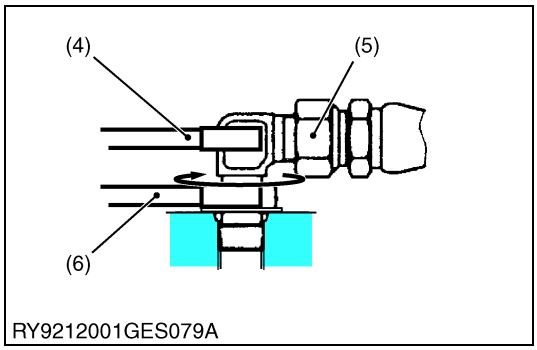
Elbow with Male Seat Assembly Procedure

When assembling an elbow with male seat, adhere to the following procedures to prevent deformation of O-rings and leaks.

1. Connecting to Valves
   - Clean the blow with male seat and the surface of the seal opposite and mount with the lock-nut on top.
   - Finger tighten till it touches the washer.


RY9212001GES078A

2. Positioning
   - Turn the mouth of the elbow back so it faces the right direction (not back over 1 turn).

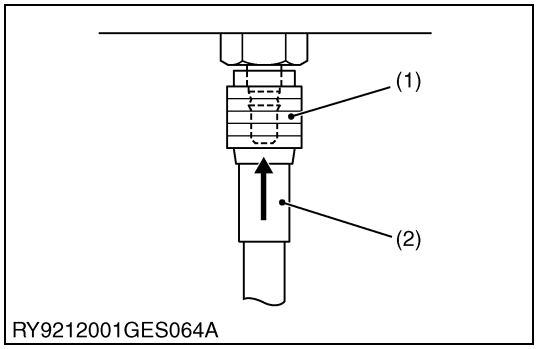


RY9212001GES079A

3. Fasten
   - Tighten the lock-nut to the specified torque with a wrench.

(1) Lock-Nut
(2) Washer
(3) Seal (O-Ring)
(4) Wrench for Holding
(5) Hose
(6) Torque Wrench for Tightening

RY9212001GEG0021US0



RY9212001GES064A

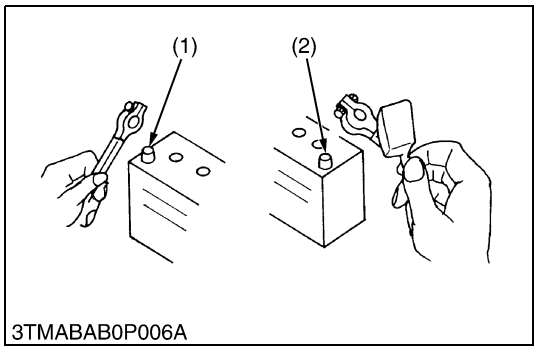
Installing and Removing Quick Couplings

- To remove a quick hose coupling, push the fitting in the direction of the arrow and pull on the plastic part in the opposite direction.
- To attach a quick coupler, push it in firmly in the direction of the arrow. Then check that it will not pull off.

(1) Plastic Part (2) Fitting

RY9212001GEG0022US0

5. HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING



3TMABAB0P006A

Follow the precautions below for handling electrical parts and wiring to ensure safety and prevent damage to the machine and nearby equipment.

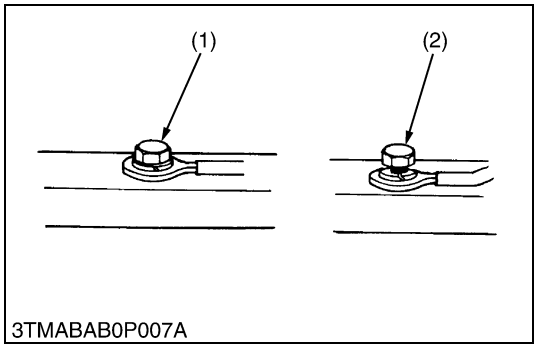
■ **IMPORTANT**

- **Inspect electrical wiring for damage and/or loose connections.**
- **Do not alter or rewire any electrical parts or wiring.**
- **Always remove the negative battery cable first when disconnecting the battery and attach the positive cable first when connecting it.**

(1) Battery Cable (-) Side (2) Battery Cable (+) Side

RY9212001GEG0023US0

[1] WIRING

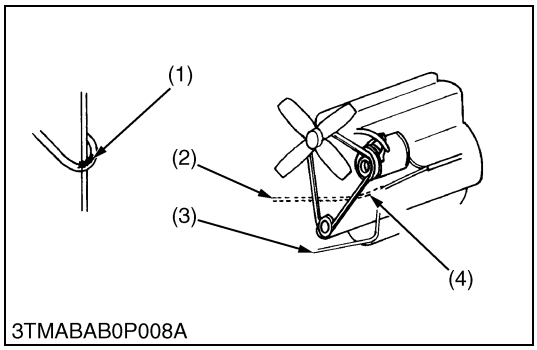


3TMABAB0P007A

- Tighten wiring terminals securely.

(1) Correct (Tightened Securely) (2) Incorrect (Poor Contact if Loose)

RY9212001GEG0024US0

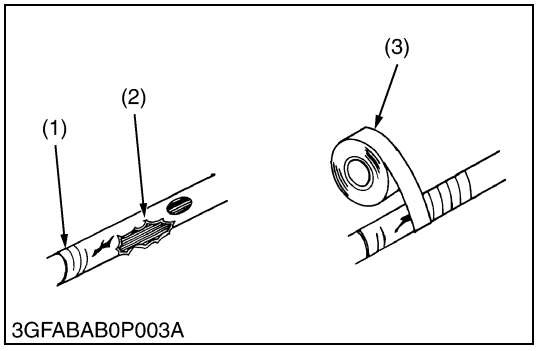


3TMABAB0P008A

- Keep wiring away from hazards.

(1) Hazardous Positioning (3) Wiring Position (Right)
(2) Wiring Position (Wrong) (4) Hazardous Position

RY9212001GEG0025US0

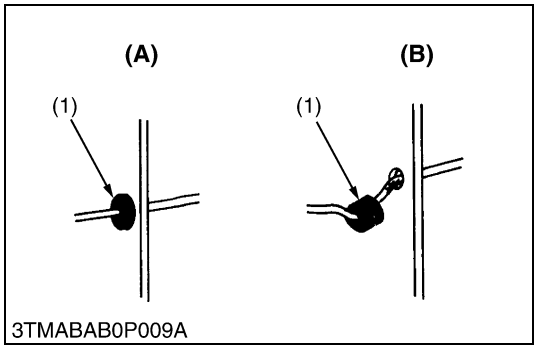


3GFABAB0P003A

- Immediately repair or replace old or damaged wiring.

(1) Damaged (3) Electrical Tape
(2) Torn

RY9212001GEG0026US0

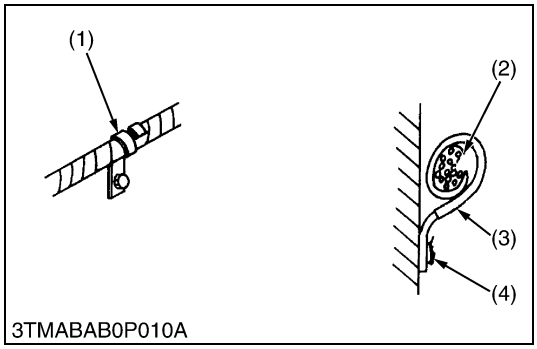


3TMABAB0P009A

- Insert grommet securely.

(1) Grommet
(A) Correct
(B) Incorrect

RY9212001GEG0027US0

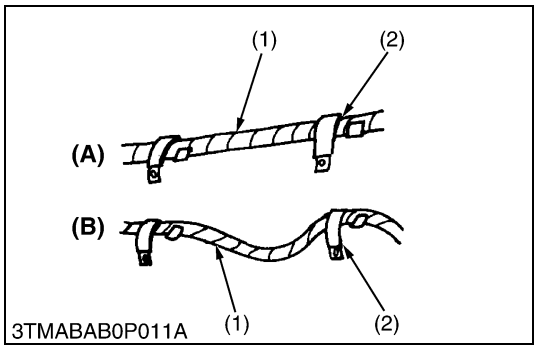


3TMABAB0P010A

- Clamp wiring securely but do not damage wires with the clamp.

(1) Clamp (Spiral Clamp Around Wire)
(2) Wire
(3) Clamp
(4) Welding Mark

RY9212001GEG0028US0

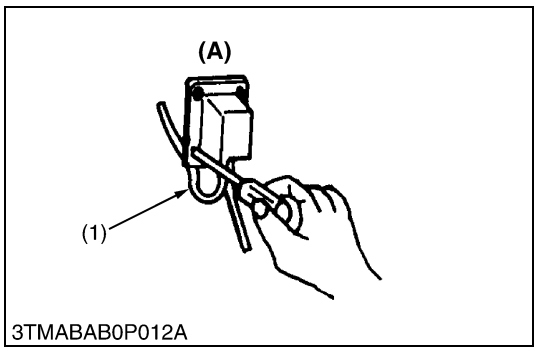


3TMABAB0P011A

- Clamp wiring so it is not twisted, pulled too tight or sag too much. However, moving parts may require play in the wiring.

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

RY9212001GEG0029US0

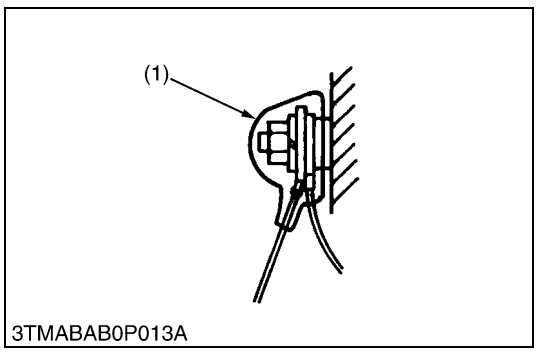


3TMABAB0P012A

- Do not pinch or bind wiring when installing parts.

(1) Wire
(A) Incorrect

RY9212001GEG0030US0

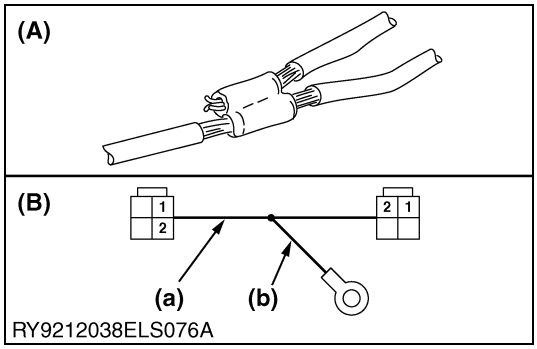


3TMABAB0P013A

- After wiring, double-check terminal protectors and clamps before connecting battery cables.

(1) Cover (Install Covers Securely)

RY9212001GEG0031US0



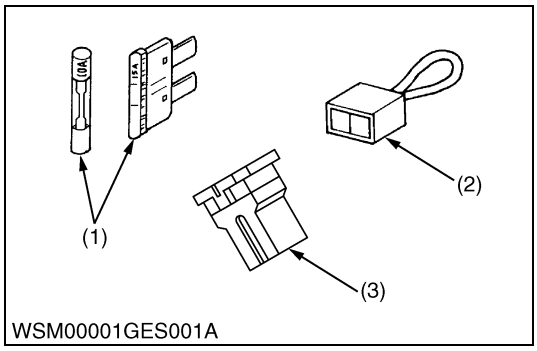
RY9212038ELS076A

- Do not modify harnesses. The diameter of wires in each harness is determined after calculating its capacity.
- Modifying harnesses may cause a malfunction or a fire.

(A) Wiring Diagram **(a) Standard Wiring**
(B) Diagram of Modification **(b) Modified Wiring**

RY9212038ELS0008US0

[2] FUSES



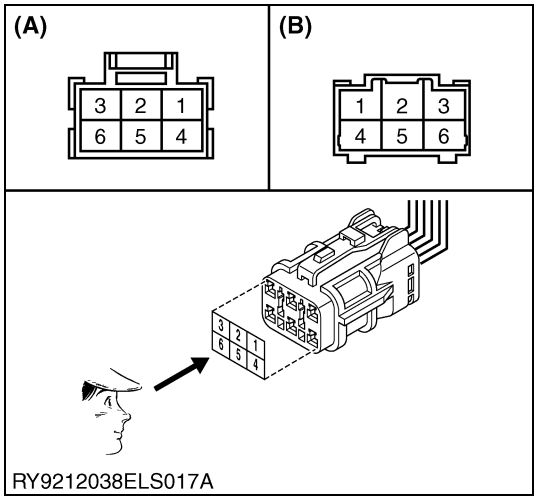
WSM00001GES001A

- Always use fuses of the specified capacity.
  Never use over or undersized fuses.
- Never use copper or steel wire in place of a fuse.
- Do not install accessories such as work lights, radios, etc., if your machine does not have an auxiliary circuit.
- Do not install accessories as they will exceed the capacity of fuses.

(1) Fuse (3) Slow-Blow Fuse
(2) Fusible Link

RY9212001GEG0032US0

[3] CONNECTOR



RY9212038ELS017A

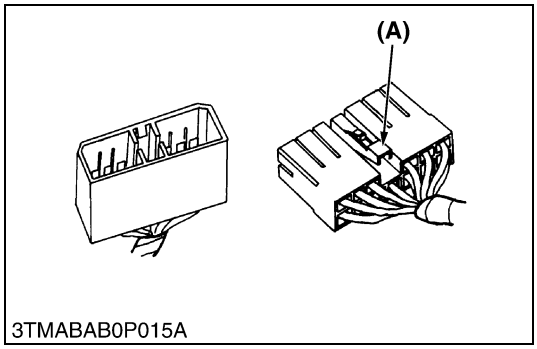
Connectors

The terminals of female connector are numbered from #1 on the top right when facing it.

Male terminals are numbered from #1 on the top left.

(A) Female connector terminals **(B) Male connector terminals**

RY9212038ELS0010US0

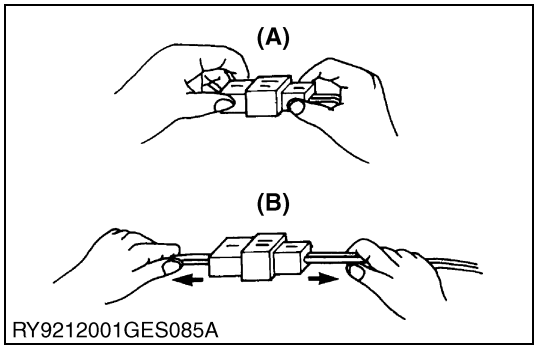


3TMABAB0P015A

- Press the lock to disconnect locking connectors.

(A) Push

RY9212001GEG0033US0

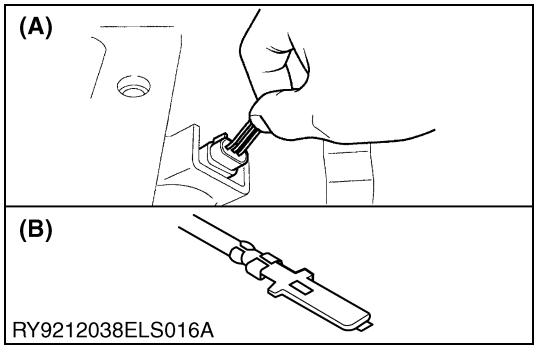


RY9212001GES085A

- Hold the connectors when separating them.
- Do not pull on the wire harness to separate the connectors.

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

RY9212001GEG0034US0

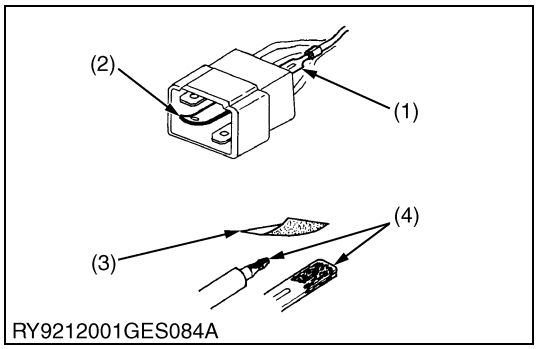


RY9212038ELS016A

Pull on the harness from the connector and make sure the harness does not come off. (Pull with 3 kgf (30 N, 7 lbf) or less of force)

(A) Pull **(B) Loosened Crimping**

RY9212038ELS0011US0

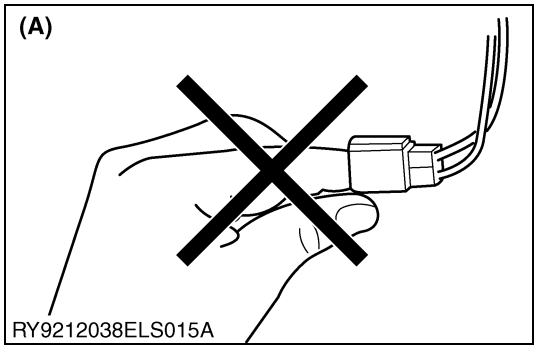


RY9212001GES084A

- Straighten bent prongs and make sure none are sticking out or missing.
- Remove corrosion from terminals with sandpaper.

(1) Missing Terminal (3) Sandpaper
(2) Bent Prong (4) Corrosion

RY9212001GEG0035US0

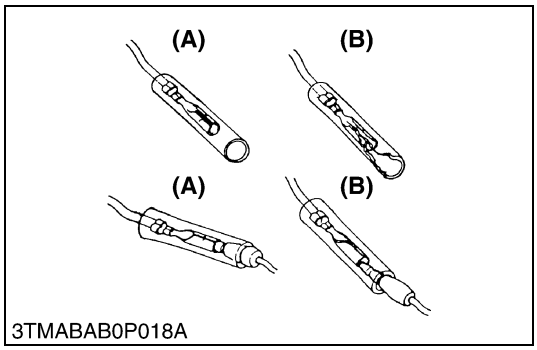


RY9212038ELS015A

- Do not touch the terminals of connectors with bare hands.

(A) Do not touch

RY9212038ELS0012US0

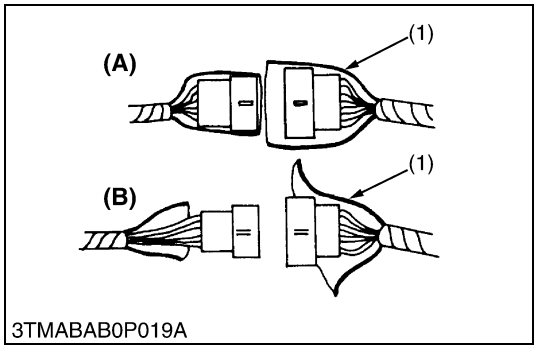


3TMABAB0P018A

- Female connectors must not be spread too far open

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

RY9212001GEG0036US0



3TMABAB0P019A

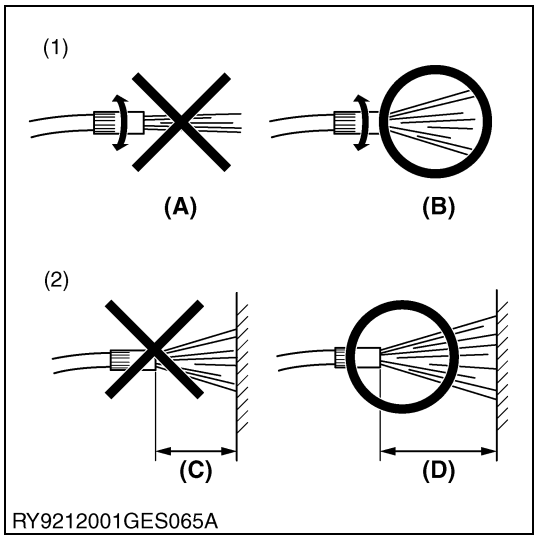
- The plastic covers of connectors must cover them completely.

(1) Cover

(A) Correct
(B) Incorrect

RY9212001GEG0037US0

[4] WASHING THE MACHINE WITH A HIGH-PRESSURE WASHER



RY9212001GES065A

Using a high-pressure washer incorrectly can lead to personal injury and/or damage, break or cause parts of the machine to fail, so use the power washer properly according to its operator's manual and labels.

CAUTION

- **Stand at least 2.0 meters from the machine and adjust the nozzle for a wide spray so it does not cause any damage. If you blast the machine with water or wash it from too close a distance,**

1. It may cause a fire due to damaged or cuts in the insulation of electrical wiring.
2. An injury may result if hydraulic oil gushes out under high pressure, due to damaged hydraulic hoses.
3. It may damage, break or cause parts of the machine to fail. (E.g.)
(1) Stickers or labels may come off
(2) Electrical parts or the engine may fail due to water in them.
(3) Damage glass, resins, etc. or the rubber of oil seals.
(4) Tear off paint or the film from plating

(1) Do Not Blast with Water
(2) Never Wash from Too Close

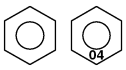
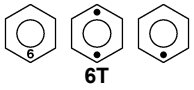
(A) Blasting
(B) Wide Spray
(C) Less Than 2.0 m (80 in.)
(D) Over 2.0 m (80 in.)

RY9212001GEG0038US0

6. TIGHTENING TORQUES

[1] TORQUES FOR GENERAL USE NUTS AND BOLTS

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

Indication on top of bolt	 No-grade or 4T						 7T						 9T		
Indication on top of nut	 No-grade or 4T												 6T		
Material of opponent part	Ordinariness			Aluminum			Steel			Aluminum			Steel		
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	0.8 to 0.95	5.8 to 6.8	7.9 to 8.8	0.8 to 0.9	5.8 to 6.5	9.81 to 11.2	1.0 to 1.15	7.24 to 8.31	7.9 to 8.8	0.8 to 0.9	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	76 to 86.7
M14	108 to 125	11 to 12.8	79.6 to 92.5	–	–	–	124 to 147	12.6 to 15	91.2 to 108	–	–	–	167 to 196	17 to 20	123 to 144
M16	167 to 191	17 to 19.5	123 to 141	–	–	–	197 to 225	20 to 23	145 to 166	–	–	–	260 to 304	26.5 to 31	192 to 224
M18	246 to 284	25 to 29	181 to 209	–	–	–	275 to 318	28 to 32.5	203 to 235	–	–	–	344 to 402	35 to 41	254 to 296
M20	334 to 392	34 to 40	246 to 289	–	–	–	368 to 431	37.5 to 44	272 to 318	–	–	–	491 to 568	50 to 58	362 to 419

RY9212032GEG0001US0

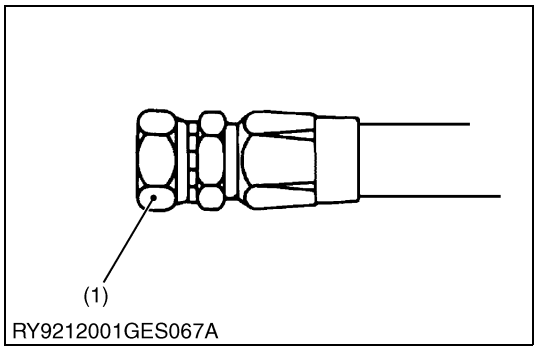
[2] STUD BOLTS

Material of opponent part	Steel			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] TORQUE FOR HYDRAULIC HOSE FITTINGS

(1) Torque for Hydraulic Hose Fittings



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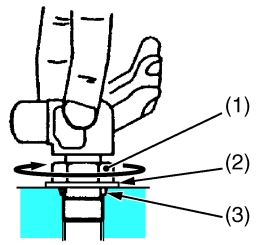
Union Nuts

Tightening torque	1/8	7.8 to 11.8 N·m 0.8 to 1.2 kgf·m 5.7 to 8.7 lbf·ft
	1/4	24.5 to 29.2 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 lbf·ft
	3/8	37.2 to 42.1 N·m 3.8 to 4.3 kgf·m 27.5 to 31.1 lbf·ft
	1/2	58.8 to 63.7 N·m 6.0 to 6.5 kgf·m 43.4 to 47.0 lbf·ft
	3/4	117.6 to 127.4 N·m 12.0 to 13.0 kgf·m 86.8 to 94.0 lbf·ft
	1	181.3 to 191.1 N·m 18.5 to 19.5 kgf·m 133.8 to 141.0 lbf·ft
	1-1/4	210.7 to 220.5 N·m 21.5 to 22.5 kgf·m 162.7 to 168.0 lbf·ft

(1) Union Nuts

RY9212001GEG0041US0

(2) Torques of Lock-Nuts for Elbows with Male Seats and Adaptors with O-rings (Straight Threads)



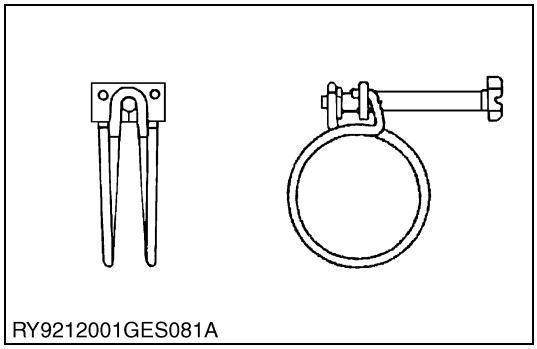
RY9212001GES077A

Tightening torque	1/8	15.0 to 16.5 N·m 1.5 to 1.7 kgf·m 11.1 to 12.2 lbf·ft
	1/4	24.5 to 29.4 N·m 2.5 to 3.0 kgf·m 18.1 to 21.7 lbf·ft
	3/8	49.0 to 53.9 N·m 5.0 to 5.5 kgf·m 36.1 to 39.8 lbf·ft
	1/2	58.8 to 63.7 N·m 6.0 to 6.5 kgf·m 43.4 to 47.0 lbf·ft
	3/4, 1	117.6 to 127.4 N·m 12.0 to 13.0 kgf·m 86.8 to 94.0 lbf·ft
	1-1/4	220.5 to 230.3 N·m 22.5 to 23.5 kgf·m 162.8 to 170.0 lbf·ft

(1) Lock-Nut
(2) Washer
(3) Seal (O-Ring)

RY9212001GEG0043US0

[4] HOSE CLAMP SCREW TORQUE

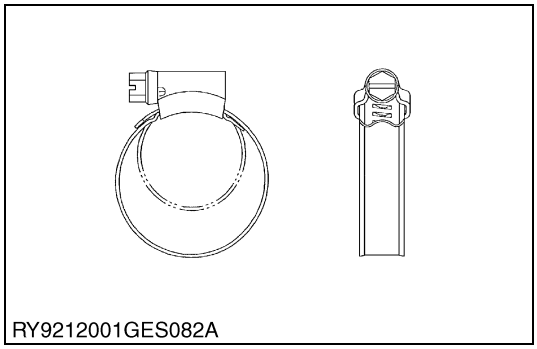


RY9212001GES081A

Type 1

Tightening torque	ϕ10-ϕ14	6C040-58721	2.5 to 3.4 N·m 25 to 35 kgf·cm 1.8 to 2.5 lbf·ft
	ϕ12-ϕ16	09318-89016	2.5 to 3.4 N·m 25 to 35 kgf·cm 1.8 to 2.5 lbf·ft
	ϕ19-ϕ25	09318-89024	2.5 to 3.4 N·m 25 to 35 kgf·cm 1.8 to 2.5 lbf·ft
	ϕ31-ϕ40	09318-89039	2.5 to 3.4 N·m 25 to 35 kgf·cm 1.8 to 2.5 lbf·ft
	ϕ36-ϕ46	09318-89045	2.5 to 3.4 N·m 25 to 35 kgf·cm 1.8 to 2.5 lbf·ft
	ϕ44-ϕ53	09318-89052	3.9 to 4.9 N·m 40 to 50 kgf·cm 2.9 to 3.6 lbf·ft
	ϕ51-ϕ59	09318-89058	3.9 to 4.9 N·m 40 to 50 kgf·cm 2.9 to 3.6 lbf·ft
	ϕ86-ϕ96	RD809-42241	2.5 to 3.4 N·m 25 to 35 kgf·cm 1.8 to 2.5 lbf·ft

RY9212001GEG0045US0



RY9212001GES082A

Type 2

Tightening torque	ϕ13-ϕ20	RB101-63631	2.5 to 3.4 N·m 25 to 35 kgf·cm 1.8 to 2.5 lbf·ft
	ϕ15-ϕ25	RC101-64581	4.9 to 5.9 N·m 50 to 60 kgf·cm 3.6 to 4.3 lbf·ft
	ϕ19-ϕ28	R1401-63211	4.9 to 5.9 N·m 50 to 60 kgf·cm 3.6 to 4.3 lbf·ft
	ϕ22-ϕ32	R1401-63151	4.9 to 5.9 N·m 50 to 60 kgf·cm 3.6 to 4.3 lbf·ft
	ϕ26-ϕ38	68311-72821	4.9 to 5.9 N·m 50 to 60 kgf·cm 3.6 to 4.3 lbf·ft
	ϕ32-ϕ44	RD411-63821	4.9 to 5.9 N·m 50 to 60 kgf·cm 3.6 to 4.3 lbf·ft
	ϕ40-ϕ55	RC411-63181	4.9 to 5.9 N·m 50 to 60 kgf·cm 3.6 to 4.3 lbf·ft
	ϕ50-ϕ65	RC401-63191	4.9 to 5.9 N·m 50 to 60 kgf·cm 3.6 to 4.3 lbf·ft
	ϕ58-ϕ75	36919-04591	4.9 to 5.9 N·m 50 to 60 kgf·cm 3.6 to 4.3 lbf·ft
	ϕ60-ϕ80	RD809-63101	4.9 to 5.9 N·m 50 to 60 kgf·cm 3.6 to 4.3 lbf·ft
	ϕ68-ϕ85	RD809-63061	4.9 to 5.9 N·m 50 to 60 kgf·cm 3.6 to 4.3 lbf·ft
	ϕ77-ϕ95	69284-63171	4.9 to 5.9 N·m 50 to 60 kgf·cm 3.6 to 4.3 lbf·ft

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7. OIL AND WATER CAPACITY TABLE

Item		KX042-4
Engine oil (when filter changed)		5.0 L (1.3 U.S.gals)
Coolant		7.0 L (1.8 U.S.gals)
Reserve tank		1.1 L (0.3 U.S.gals)
Fuel (Full)		65.3 L (17.3 U.S.gals)
Hydraulic Fluid	Total oil capacity	67 L (17.4 U.S.gals)
	Inside tank (middle of gauge)	42 L (11.0 U.S.gals)
Travel motor		0.65 L (0.2 U.S.gals)
Idler assy		80 ml (4.88 cu.in.)
Track roller		
Carrier roller		50 ml (3.05 cu.in.)
Grease		–

RY9212509GEG0002US0

8. MAINTENANCE INTERVALS

Serial No. to #50155

Operator maintenance chart

Servicing		Tasks	Hours of operation indicator																			Maintenance intervals	
			50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	
Walk-around inspection		Check																				Daily	
Dust valve		Clean																				Daily	
Engine oil level		Check																				Daily	
Coolant level		Check																				Daily	
Radiator and condenser		Check																				Daily	
V-belt		Check																				Daily	
Exhaust system leakage		Check																				Daily	
Hydraulic oil level		Check																				Daily	
Water separator		Check																				Daily	
Bucket bolt and bucket linkage bolt		Grease																				Daily	
Lubricate the front-end attachments	Swing bracket	Grease																				Daily	
	Other Greasing points	Grease																				Daily	
Fuel level		Check																				Daily	
Fluid level of the wiper/washer system		Check																				Daily	
Electrical equipment		Check																				Daily	
Fuel tank		Drain	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	50 h	
Battery		Check	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	50 h	
Swivel gear		Grease	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	50 h	
Crawler tension		Check	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	50 h	
		Set	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	50 h	
Water separator		Clean	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	50 h	
Swivel bearing		Grease				❍				❍				❍				❍				❍	200 h	
Interior air filter		Check				❍				❍				❍				❍				❍	200 h	*1
		Clean				❍				❍				❍				❍				❍	200 h	
Air filter		Check				❍				❍				❍				❍				❍	200 h	*1
		Clean				❍				❍				❍				❍				❍	200 h	
Coolant hoses and hose clamps		Check				❍				❍				❍				❍				❍	200 h	
Fuel lines and air intake hoses		Check				❍				❍				❍				❍				❍	200 h	

- *1: Under very dusty conditions, the air filter and the interior air filter must be cleaned or replaced more frequently.

(To be continued)

(Continued)

Servicing by skilled personnel

Carry out "Pre-operational services" each time the machine is serviced.

Servicing	Tasks	Hours of operation indicator																					Maintenance intervals	
		50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000			
V-belt	Set				❍				❍				❍				❍				❍		200 h	
Engine oil and oil filter	Change										❍										❍		500 h	
Drive unit oil	Change	●									❍										❍		500 h	*3
Fuel filter	Change										❍										❍		500 h	
Tank breather filter	Change										❍										❍		500 h	
Return filter	Change					●															❍		1000 h	*2
Pilot circuit filter	Change																				❍		1000 h	
Hydraulic oil and suction filter	Change																				❍		1000 h	*2
Interior air filter	Change																				❍		1000 h	*1
Air filter	Change																				❍		1000 h	*1
Oil in idler and track roller	Change	Please contact your KUBOTA dealer.																					2000 h	
Alternator and starter motor	Check	Please contact your KUBOTA dealer.																					2000 h	
Safety inspection	Check																						Annually	*4
Coolant hoses and hose clamps	Change	Please contact your KUBOTA dealer.																					Every 2 years	
Fuel lines and air intake hoses	Change	Please contact your KUBOTA dealer.																					Every 2 years	
Pipes and hoses of the air conditioner	Change	Please contact your KUBOTA dealer.																					Every 2 years	
Coolant	Change																						Every 2 years	
Hydraulic hoses	Change	Please contact your KUBOTA dealer.																					Every 6 years	
Refrigerant content	Check	Please contact your KUBOTA dealer.																					Maintenance on demand	
Oil separator	Change	Please contact your KUBOTA dealer.																					1500 h	
EGR cooler	Check	Please contact your KUBOTA dealer.																					1500 h	
EGR system	Check	Please contact your KUBOTA dealer.																					3000 h	
Turbocharger	Check	Please contact your KUBOTA dealer.																					3000 h	
Diesel particle filter	Clean	Please contact your KUBOTA dealer.																					3000 h	
Load pressure sensor and mass air flow sensor	Check	Please contact your KUBOTA dealer.																					Annually	
Condition of DPF muffler	Check	Please contact your KUBOTA dealer.																					Annually	
DPF differential pressure sensor and tubes for gas leakage	Check	Please contact your KUBOTA dealer.																					Annually	
DPF exhaust gas temperature sensor	Check	Please contact your KUBOTA dealer.																					Annually	
EGR and tubes for gas leakage	Check	Please contact your KUBOTA dealer.																					Annually	
Cooling system	Flush	Please contact your KUBOTA dealer.																					Every 2 years	
Crankcase ventilation and hoses	Change	Please contact your KUBOTA dealer.																					Every 2 years	
DPF differential pressure sensor hoses (front and rear)	Change	Please contact your KUBOTA dealer.																					Every 2 years	
Suction pipe downstream from mass air flow sensor	Change	Please contact your KUBOTA dealer.																					Every 2 years	
Load pressure sensor hose	Change	Please contact your KUBOTA dealer.																					Every 2 years	
EGR cooler hose	Change	Please contact your KUBOTA dealer.																					Every 2 years	

(To be continued)

(Continued)

- The maintenance tasks identified with ● must be carried out once the specified hours of operation after initial commissioning have been reached.
- *1: Under very dusty conditions, the air filter and the interior air filter must be cleaned or replaced more frequently.
- *2: When using a breaker over 20 % → every 800 h.
  When using a breaker over 40 % → every 400 h.
  When using a breaker over 60 % → every 300 h.
  When using a breaker over 80 % → every 200 h.
- *3: Earlier if necessary.
- *4: At least annually.

RY9212509GEG0003US0

Recommended lubricants

		Ambient temperature conditions	Recommendation		Filled at the factory		Note
			Viscosity	Quality standard	Brand	Type	
Engine oil	Engine	Above 25 °C (77 °F)	SAE 30 SAE 10W-30 SAE 15W-40	API CJ-4 *1	JXTG	JASO DH-2 SAE 10W-30	
		0 to 25 °C (32 to 77 °F)	SAE 20 SAE 10W-30 SAE 15W-40				
		Below 0 °C (32 °F)	SAE 10W SAE 10W-30 SAE 15W-40				
	Front idlerTruck roller		SAE 30	API CD	–	API CD *2 SAE 30	
Coolant			–	SAE J1034 MB 325.0 ASTM D3306 ASTM D4985	KUBOTA	LLC-N-50F Mixture ratio 50%	Always use distilled water as the admixture for antifreeze. Refer to the respective coolant manufacturer's recommendations for the correct mixing ratio. Do not mix with other coolants.
Grease		Pin, Bushing, Bearing, Gear	NLGI-2	DIN 51825 KP2K-30	COSOMO	Dynamax EP2	
Hydraulic oil		In winter or at low ambient temperatures	VG 32 VG 46	ISO	SHELL	Tellus S2M46ISO VG 46	
		In summer or at high ambient temperatures	VG 46 VG 68				
Gear oil		Travel motor	SAE 90	API GL-4	–	API GL-4 *2 SAE 90	
Fuel			–	EN 590	–	–	The fuel filled at the factory is not winter diesel.When preparing the machine for the winter, fill the fuel tank with winter diesel and let the motor run for a few minutes.
Refrigerant			–	HFC134a (R134a)	–	HFC134a (R134a)	

- *1 If use CJ-4 to the non common rail engine, must use specified EN590 diesel fuel (maximum sulfer 10 ppm).
- *2 This gear oil is filled up at the manufacturer factory.

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Serial No. from #50156

Operator maintenance chart

Servicing		Tasks	Hours of operation indicator																			Maintenance intervals	
			50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	
Walk-around inspection		Check																				Daily	
Dust valve		Clean																				Daily	
Engine oil level		Check																				Daily	
Coolant level		Check																				Daily	
Radiator and condenser		Check																				Daily	
V-belt		Check																				Daily	
Exhaust system leakage		Check																				Daily	
Hydraulic oil level		Check																				Daily	
Water separator		Check																				Daily	
Bucket bolt and bucket linkage bolt		Grease																				Daily	
Lubricate the front-end attachments	Swing bracket	Grease																				Daily	
	Other Greasing points	Grease																				Daily	
Fuel level		Check																				Daily	
Fluid level of the wiper/washer system		Check																				Daily	
Electrical equipment		Check																				Daily	
Fuel tank		Drain	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	50 h	
Battery		Check	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	50 h	
Swivel gear		Grease	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	50 h	
Crawler tension		Check	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	50 h	
		Set	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	50 h	
Water separator		Clean	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	50 h	
Swivel bearing		Grease				❍				❍				❍				❍				❍	200 h	
Interior air filter		Check				❍				❍				❍				❍				❍	200 h	*1
		Clean				❍				❍				❍				❍				❍	200 h	
Air filter		Check				❍				❍				❍				❍				❍	200 h	*1
		Clean				❍				❍				❍				❍				❍	200 h	
Coolant hoses and hose clamps		Check				❍				❍				❍				❍				❍	200 h	
Fuel lines and air intake hoses		Check				❍				❍				❍				❍				❍	200 h	

- *1: Under very dusty conditions, the air filter and the interior air filter must be cleaned or replaced more frequently.

(To be continued)

(Continued)

Servicing by skilled personnel

Carry out "Pre-operational services" each time the machine is serviced.

Servicing	Tasks	Hours of operation indicator																				Maintenance intervals	
		50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000		
V-belt	Set				❍				❍				❍				❍				❍	200 h	
Water separator filter element	Change					❍					❍					❍					❍	250 h	
Engine oil and oil filter	Change										❍										❍	500 h	
Drive unit oil	Change	●									❍										❍	500 h	*3
Fuel filter	Change										❍										❍	500 h	
Tank breather filter	Change										❍										❍	500 h	
Return filter	Change					●															❍	1000 h	*2
Pilot circuit filter	Change																				❍	1000 h	
Hydraulic oil and suction filter	Change																				❍	1000 h	*2
Interior air filter	Change																				❍	1000 h	*1
Air filter	Change																				❍	1000 h	*1
Oil in idler and track roller	Change	Please contact your KUBOTA dealer.																				2000 h	
Alternator and starter motor	Check	Please contact your KUBOTA dealer.																				2000 h	
Safety inspection	Check																					Annually	*4
Coolant hoses and hose clamps	Change	Please contact your KUBOTA dealer.																				Every 2 years	
Fuel lines and air intake hoses	Change	Please contact your KUBOTA dealer.																				Every 2 years	
Pipes and hoses of the air conditioner	Change	Please contact your KUBOTA dealer.																				Every 2 years	
Coolant	Change																					Every 2 years	
Hydraulic hoses	Change	Please contact your KUBOTA dealer.																				Every 6 years	
Refrigerant content	Check	Please contact your KUBOTA dealer.																				Maintenance on demand	
Oil separator	Change	Please contact your KUBOTA dealer.																				1500 h	
EGR cooler	Check	Please contact your KUBOTA dealer.																				1500 h	
EGR system	Check	Please contact your KUBOTA dealer.																				3000 h	
Turbocharger	Check	Please contact your KUBOTA dealer.																				3000 h	
Diesel particle filter	Clean	Please contact your KUBOTA dealer.																				3000 h	
Load pressure sensor and mass air flow sensor	Check	Please contact your KUBOTA dealer.																				Annually	
Condition of DPF muffler	Check	Please contact your KUBOTA dealer.																				Annually	
DPF differential pressure sensor and tubes for gas leakage	Check	Please contact your KUBOTA dealer.																				Annually	
DPF exhaust gas temperature sensor	Check	Please contact your KUBOTA dealer.																				Annually	
EGR and tubes for gas leakage	Check	Please contact your KUBOTA dealer.																				Annually	
Cooling system	Flush	Please contact your KUBOTA dealer.																				Every 2 years	
Crankcase ventilation and hoses	Change	Please contact your KUBOTA dealer.																				Every 2 years	
DPF differential pressure sensor hoses (front and rear)	Change	Please contact your KUBOTA dealer.																				Every 2 years	
Suction pipe downstream from mass air flow sensor	Change	Please contact your KUBOTA dealer.																				Every 2 years	
Load pressure sensor hose	Change	Please contact your KUBOTA dealer.																				Every 2 years	
EGR cooler hose	Change	Please contact your KUBOTA dealer.																				Every 2 years	

(To be continued)

(Continued)

- The maintenance tasks identified with ● must be carried out once the specified hours of operation after initial commissioning have been reached.
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  When using a breaker over 60 % → every 300 h.
  When using a breaker over 80 % → every 200 h.
- *3: Earlier if necessary.
- *4: At least annually.

RY9212509GEG0005US0

Recommended lubricants

	Recommendation			Filled at the factory		Note
	Ambient temperature conditions	Viscosity	Quality standard	Brand	Type	
Engine oil	In winter and/or at low temperatures	SAE 10W SAE 20W	API CJ-4*	–	–	Never use diesel fuel with a sulphur content exceeding 0.0015 % (15 ppm).
	In summer and/or at high ambient temperatures	SAE 30 SAE 40 SAE 50		–	–	
	All-weather*	10W30* 10W40		JX Nippon Oil & Energy Coorporation *	DH-2*	
Coolant	–	G048*	SAE J1034* MB 325.0* ASTM D3306* D4985*	KUBOTA*	AntifreezeLL C-N-50F Mixing ratio 50 %*	Always use distilled water to mix with antifreeze. Always follow the recommendations of the coolant manufacturer for the mixing ratio. Do not mix with other coolants.
Grease	–	NLGI-2*	DIN 51825* KP2K-30*	COSMO*	EP2*	–
	–	NLGI-1	–	–	–	–
Hydraulic oil	In winter and/or at low temperatures	ISO 32 ISO 46*	–	Shell*	Tellus S2MX 46*	–
	In summer and/or at high ambient temperatures	ISO 46* ISO 68	–	–	–	–
Biodegradable Hydraulic oil (option)	–	–	–	PANOLIN	HLP SYNTH 46	Less than 2 % mineral oil remains in the system as per ISO 15380.
Gear oil	In winter and/or at low temperatures	SAE 75 SAE 80	MIL-L-2105C*	–	–	–
	In summer and/or at high ambient temperatures	SAE 90* SAE 140		–	–	–
	All-weather	80W-90		–	–	–
Diesel	–	–	EN 590 ASTM D975	–	–	Never use diesel fuel with a sulphur content exceeding 0.0015 % (15 ppm). The fuel filled at the factory is not winter diesel. For preparing the excavator for use in winter, fill the fuel tank with winter diesel and allow the engine to run for a few minutes.
Refrigerant	–	–	HFC134a* R134a	–	–	–

- * These lubricants are used by the manufacturer for the initial filling.

RY9212509GEG0007US0

1 MACHINE BODY

SERVICING

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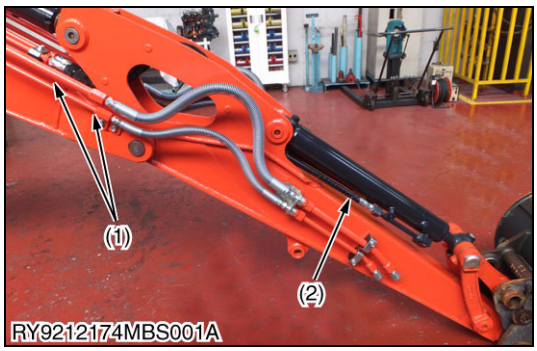
1. FRONT

[1] REMOVING AND INSTALLING THE BOOM

CAUTION

- **Wear protective gear, such as a helmet, eye protection, etc., during assembly/disassembly.**
- **For group work, decide on signals for communication, make sure everyone understands and uses them and be very careful about safety.**
- **Never put your finger in the pin hole when aligning the pin with the hole.**
- **When hoisting anything heavy, always determine its center of gravity before hoisting it.**
- **When working with a sling, use a cloth or the like in places that may be hit hard by the nylon sling.**

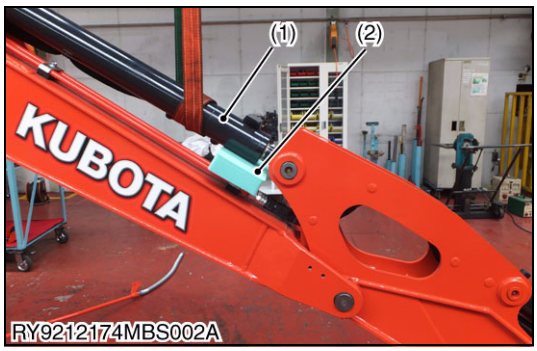
RY9212148MBS0012US0



1. Lower the front to the ground.
   Disconnect the bucket cylinder hose.
   Disconnect the AUX hoses and remove the AUX lines from the bracket.

(1) AUX Line (2) Bucket Cylinder Hose

RY9212174MBS0001US0



2. Suspend the arm cylinder temporarily and remove the pin on the rod side.
   Operate the crane and lower the arm cylinder onto a block on top of the boom.

(1) Arm Cylinder (2) Block

RY9212174MBS0002US0



3. Suspend the arm and bucket temporarily with the crane, then remove the linkage pin between the arm and the boom and then remove the bucket and the arm.

Weight	Approx. 305kg (672lbs)

(1) Pin

RY9212174MBS0003US0



4. Set the end of the boom on the ground.
   Suspend the boom cylinder temporarily and remove the pin on the rod side.
   Operate the crane and lower the boom cylinder onto a stand.

(1) Pin (2) Cylinder Stand

RY9212174MBS0004US0



5. Remove all the arm cylinder and bucket cylinder hoses.

(1) Arm Cylinder Pipes (2) Bucket Cylinder Pipes

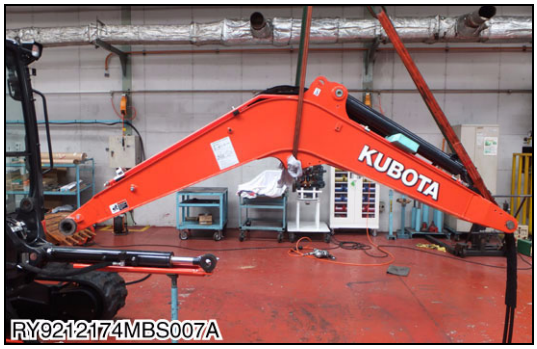
RY9212174MBS0005US0



6. Suspend the boom temporarily and remove the pin at the base of the boom.

(1) Pin

RY9212174MBS0006US0



7. Operate the crane and remove the boom.

Boom weight	Approx. 220 kg (485 lbs)

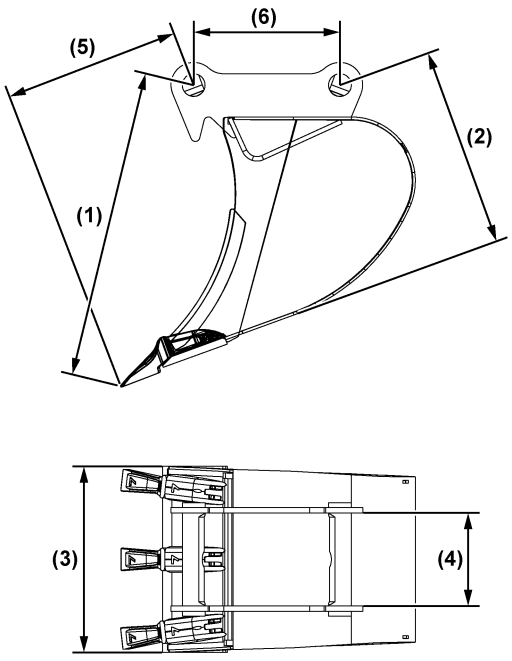
RY9212174MBS0007US0

8. Perform the procedure in reverse for assembly.

RY9212148HYS0096US0

[2] TABLE OF DIMENSIONS

(1) Quick Coupler Bucket



RY9212509MBS006A

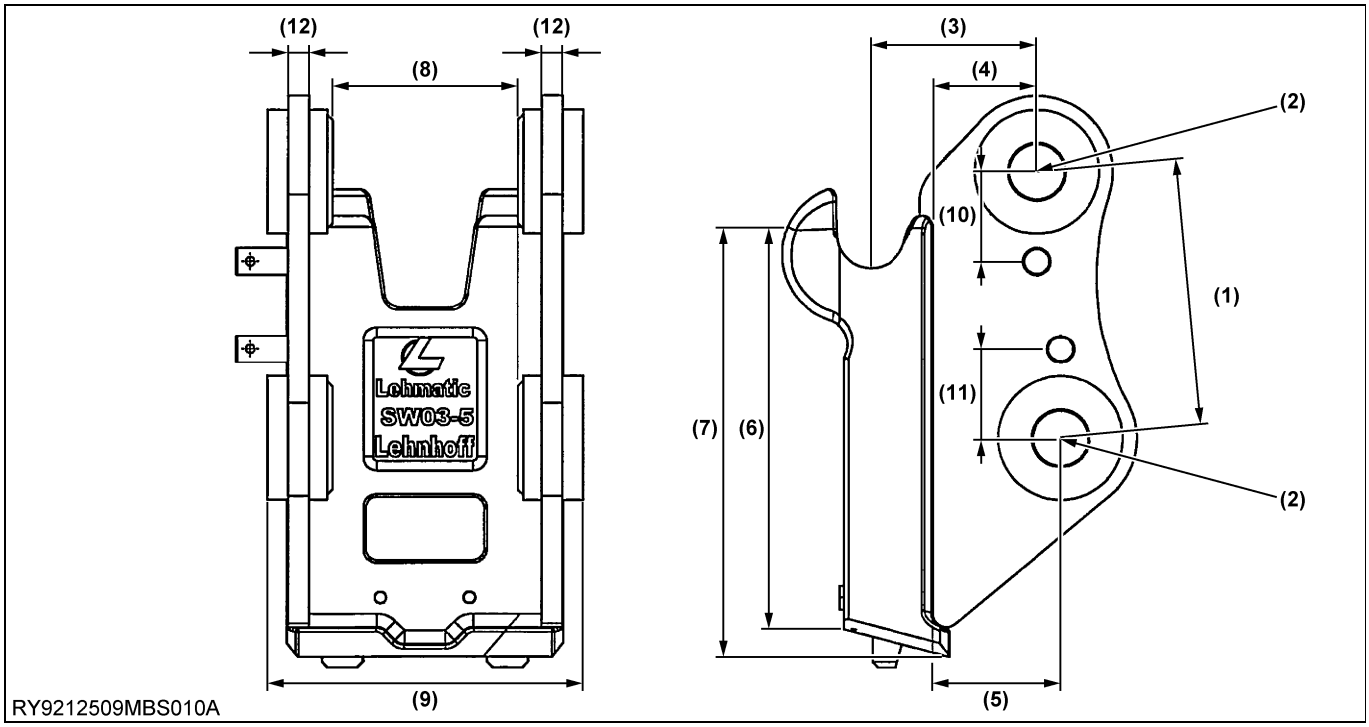
■ **NOTE**

- **All specifications and service specifications described in this manual is measured with the quick coupler bucket attached.**

(1)	682 mm 26.9 in.
(2)	441 mm 17.4 in.
(3)	600 mm 23.6 in.
(4)	205 mm 8.07 in.
(5)	388 mm 15.3 in.
(6)	322 mm 12.7 in.

RY9212509MBS0023US0

(2) Quick Coupler



RY9212509MBS010A

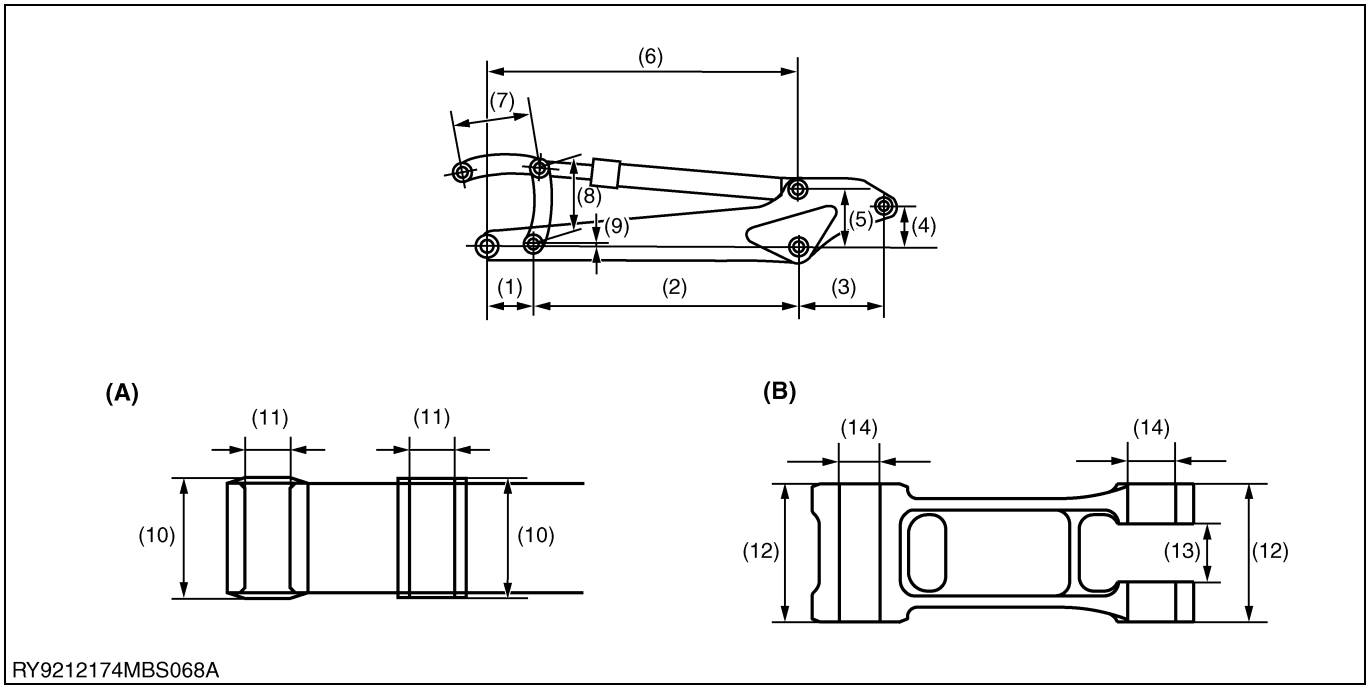
■ **NOTE**

- **All specifications and service specifications described in this manual is measured with the quick coupler attached.**

	Dimensions		Dimensions
(1)	195 mm 7.7 in.	(7)	308 mm 12.1 in.
(2)	ϕ40 mm ϕ1.57 in.	(8)	134.5 mm 5.3 in.
(3)	121 mm 4.8 in.	(9)	228.5 mm 9.0 in.
(4)	75 mm 3.0 in.	(10)	65 mm 2.6 in.
(5)	92 mm 3.6 in.	(11)	65 mm 2.6 in.
(6)	288 mm 11.3 in.	(12)	15 mm 0.6 in.

RY9212509MBS0024US0

(3) Arm



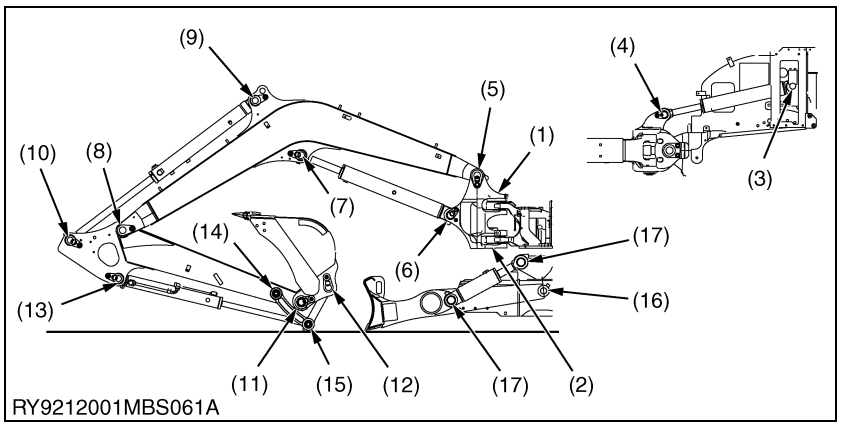
RY9212174MBS068A

(A) Arm Tip **(B) Bucket Link 1**

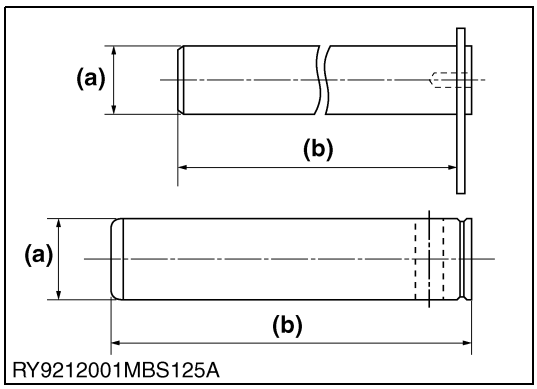
No.	KX042-4	No.	KX042-4	No.	KX042-4
(1)	175 mm 6.89 in.	(6)	1235 mm 48.62 in.	(11)	ϕ50 mm ϕ1.97 in.
(2)	1425 mm 56.10 in.	(7)	310 mm 12.20 in.	(12)	134 mm 5.28 in.
(3)	310 mm 12.20 in.	(8)		(13)	51 mm 2.01 in.
(4)	210 mm 8.27 in.	(9)	10 mm 0.39 in.	(14)	ϕ50 mm ϕ1.97 in.
(5)	260 mm 10.24 in.	(10)	134 mm 5.28 in.		

RY9212509MBS0001US0

(4) Front Pin



RY9212001MBS061A



RY9212001MBS125A

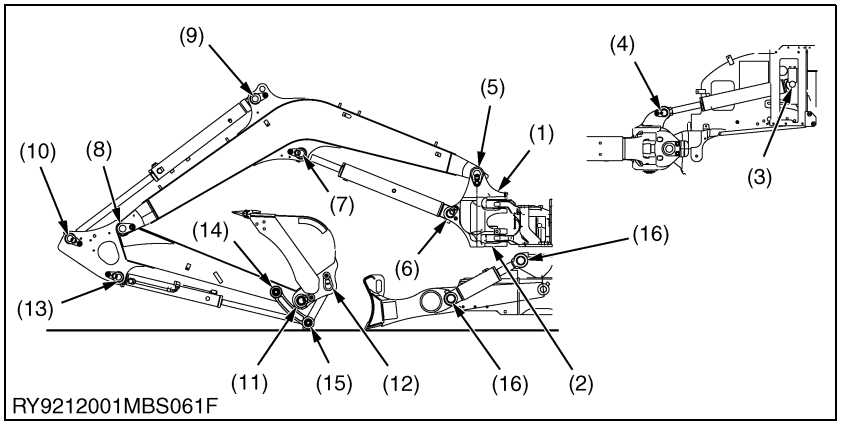
Item	Pin dia. × length
(1)	ϕ87 × 166 mm ϕ3.43 × 6.54 in.
(2)	ϕ87 × 140 mm ϕ3.43 × 5.51 in.
(3)	ϕ45 × 158 mm ϕ1.77 × 6.22 in.
(4)	ϕ45 × 131 mm ϕ1.77 × 5.16 in.
(5)	ϕ50 × 347 mm ϕ1.97 × 13.66 in.
(6)	ϕ50 × 173 mm ϕ1.97 × 6.81 in.
(7)	ϕ50 × 176 mm ϕ1.97 × 6.93 in.
(8)	ϕ50 × 235 mm ϕ1.97 × 9.25 in.
(9)	ϕ45 × 176 mm ϕ1.77 × 6.93 in.
(10)	ϕ45 × 152 mm ϕ1.77 × 5.98 in.
(11)	ϕ40 × 233 mm ϕ1.57 × 9.17 in.
(12)	ϕ40 × 233 mm ϕ1.57 × 9.17 in.
(13)	ϕ40 × 152 mm ϕ1.57 × 5.98 in.
(14)	ϕ40 × 193 mm ϕ1.57 × 7.60 in.
(15)	ϕ40 × 193 mm ϕ1.57 × 7.60 in.
(16)	ϕ40 × 161 mm ϕ1.57 × 6.34 in.
(17)	ϕ45 × 138 mm ϕ1.77 × 5.43 in.

- The pin usage limit is when the wear exceeds 1.0mm (0.039 in.) from the factory spec. from new.

(a) Pin Diameter
(b) Length

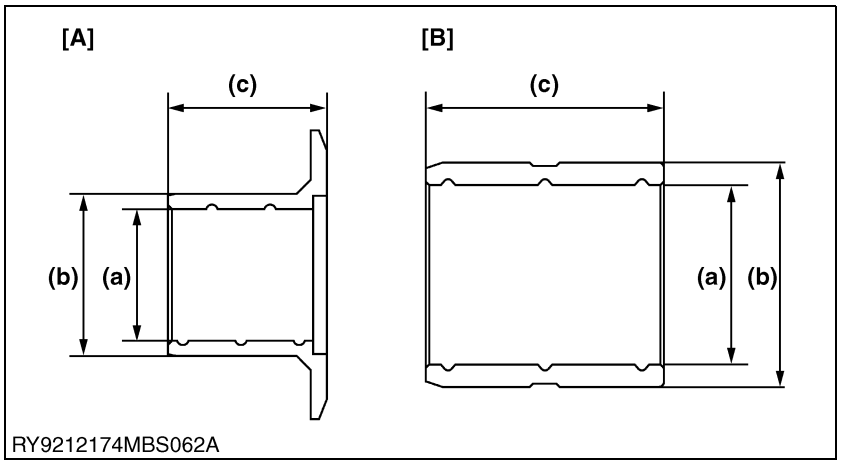
RY9212509MBS0002US0

(5) Front Bushings



RY9212001MBS061F

[A] Flanged Bushing
[B] Normal Bushing
(a) I.D.
(b) O.D.
(c) Length



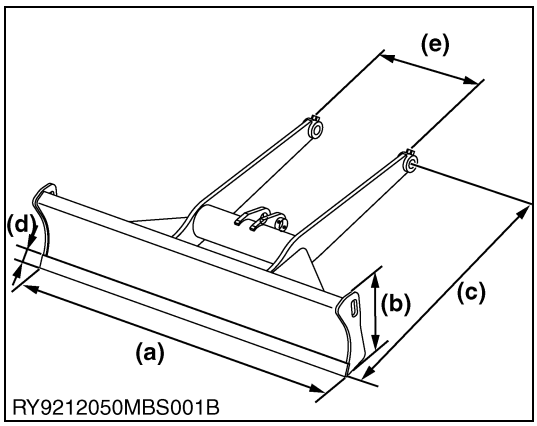
RY9212174MBS062A

Item	Point used	I.D. × O.D. × Length	Item	Point used	I.D. × O.D. × Length
(1)	Swing bracket top	ϕ87 × 99 × 50 mm ϕ3.43 × 3.90 × 1.97 in.	(7)	Cylinder	ϕ50 × 60 × 70 mm ϕ1.97 × 2.36 × 2.76 in.
	Swivel frame	ϕ87 × 100 × 60 mm ϕ3.43 × 3.94 × 2.36 in.	(8)	Arm ends	ϕ50 × 60 × 65 mm ϕ1.97 × 2.36 × 2.56 in.
	Swing bracket bottom	ϕ87 × 99 × 37 mm ϕ3.43 × 3.90 × 1.46 in.	(9)	Cylinder	ϕ45 × 55 × 60 mm ϕ1.77 × 2.17 × 2.36 in.
(2)	Swivel frame	ϕ87 × 100 × 50 mm ϕ3.43 × 3.94 × 1.97 in.	(10)	Cylinder	ϕ45 × 55 × 60 mm ϕ1.77 × 2.17 × 2.36 in.
	Swing bracket bottom	ϕ87 × 99 × 34 mm ϕ3.43 × 3.90 × 1.34 in.	(11)	Arm ends	ϕ40 × 50 × 45 mm ϕ1.57 × 1.97 × 1.77 in.
(3)	Cylinder	ϕ45 × 55 × 60 mm ϕ1.77 × 2.17 × 2.36 in.	(12)	Bucket link	ϕ40 × 50 × 40 mm ϕ1.57 × 1.97 × 1.57 in.
(4)	Swing bracket ends	ϕ45 × 55 × 30 mm ϕ1.77 × 2.17 × 1.18 in.	(13)	Cylinder	ϕ45 × 55 × 60 mm ϕ1.77 × 2.17 × 2.36 in.
	Cylinder	ϕ45 × 55 × 60 mm ϕ1.77 × 2.17 × 2.36 in.	(14)	Arm ends	ϕ40 × 50 × 45 mm ϕ1.57 × 1.97 × 1.77 in.
(5)	Swing bracket ends	ϕ50 × 60 × 49 mm ϕ1.97 × 2.36 × 1.93 in.	(15)	Bucket link	ϕ40 × 50 × 32 mm ϕ1.57 × 1.97 × 1.26 in.
	Boom ends	ϕ50 × 60 × 65 mm ϕ1.97 × 2.36 × 2.56 in.		Cylinder	ϕ40 × 50 × 40 mm ϕ1.57 × 1.97 × 1.57 in.
(6)	Swing bracket ends	ϕ50 × 60 × 45 mm ϕ1.97 × 2.36 × 1.77 in.	(16)	Blade	ϕ60 × 70 × 88 mm ϕ2.36 × 2.76 × 3.46 in.
	Cylinder	ϕ50 × 60 × 65 mm ϕ1.97 × 2.36 × 2.56 in.			

- The usage limit for bushings is when the wear exceeds 1.0 mm (0.039 in.) from the factory spec. from new.

RY9212509MBS0003US0

(6) Blade



RY9212050MBS001B

No.	Item	
(a)	Width	1700 mm 66.93 in.
(b)	Height	350 mm 13.78 in.
(c)	Length	1200 mm 47.24 in.
(d)	Tip height - plate thickness	65 × t 12 mm 2.56 × t 0.47 in.
(e)	Distance between supports	490 mm 19.29 in.

RY9212509MBS0004US0

2. SWIVEL FRAME

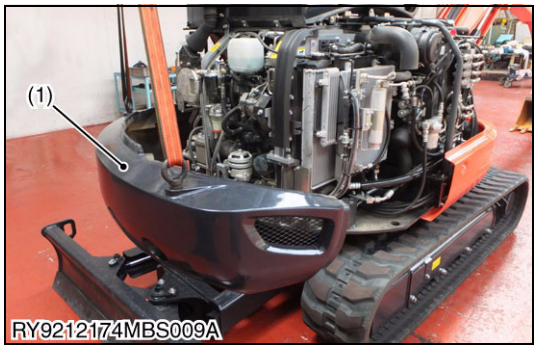
[1] REMOVING AND INSTALLING THE WEIGHT



1. Remove the left, right and rear bonnets.

(1) Rear Bonnet
(2) Left Bonnet
(3) Right Bonnet

RY9212509MBS0019US0



2. Suspend the weight with a crane.
3. Remove the weight mounting bolts, then remove the weight.

CAUTION

- **Find its center of gravity and suspend it securely.**

Tightening torque	Weight	367.7 to 431.5 N·m 37.5 to 44.0 kgf·m 271.2 to 318.3 lbf·ft

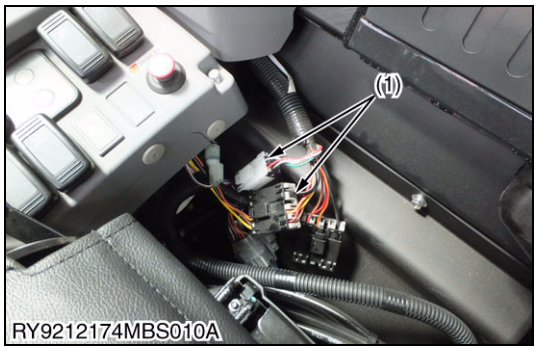
During installation, apply a threadlock. (Loctite 271)

Weight of the weight	Approx. 485 kg (1069 lbs)

(1) Weight

RY9212174MBS0011US0

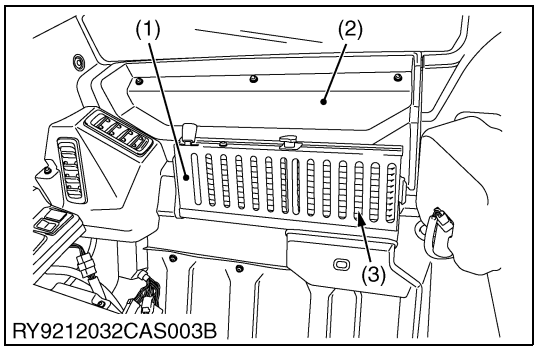
[2] REMOVING AND INSTALLING THE CABIN



1. Slide the seat toward the front of the cabin and disconnect the cabin harness.

(1) Cabin Harness

RY9212174MBS0051US0



2. Remove the cover, AC filter cover and the AC filter.

(1) AC Filter Cover
(2) Cover
(3) AC Filter

RY9212174MBS0052US0

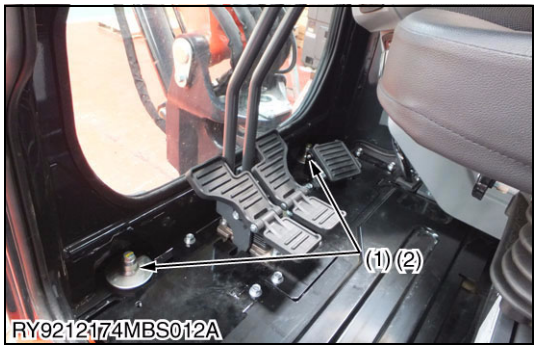


3. Remove the A/C panel cover and the blower cover.

■ **IMPORTANT**
- **Remove the blower cover and the air duct as an assembly.**

(1) A/C Panel Cover
(2) Blower Cover

RY9212174MBS0053US0



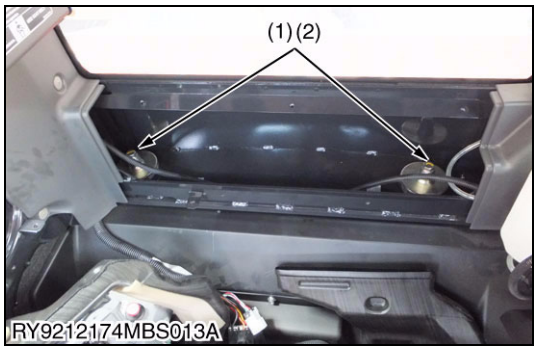
4. Remove the floor mat.
5. Suspend the cabin with the crane and remove the cabin mounting nuts at the front of the machine.

■ **IMPORTANT**
- **Apply a threadlock (Loctite 271) to the stud bolts.**

Tightening torque	Nut	107.9 to 127.4 N·m 11.0 to 13.0 kgf·m 79.6 to 94.0 lbf·ft
	Stud bolt	81.6 to 127.4 N·m 8.0 to 13.0 kgf·m 60.2 to 94.0 lbf·ft

(1) Nut
(2) Stud Bolt (M16 x 1.5)

RY9212174MBS0012US0



6. Remove the mounting nuts at the rear of the machine.

■ **IMPORTANT**
- **Apply a threadlock (Loctite 271) to the stud bolts.**

Tightening torque	Nut	107.9 to 127.4 N·m 11.0 to 13.0 kgf·m 79.6 to 94.0 lbf·ft
	Stud bolt	81.6 to 127.4 N·m 8.0 to 13.0 kgf·m 60.2 to 94.0 lbf·ft

(1) Nut
(2) Stud Bolt (M16 x 1.5)

RY9212174MBS0054US0

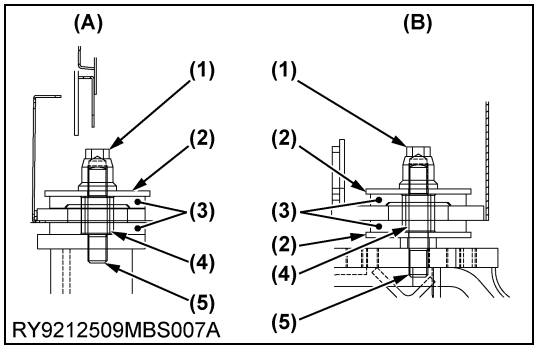


7. Remove the cabin.

■ **IMPORTANT**
- **Find its center of gravity and suspend it securely.**

Cabin weight	Approx. 211 kg (465 lbs)

RY9212174MBS0013US0



(1) Nut
(2) Washer
(3) Vibration-Proof Rubber
(4) Collar
(5) Stud Bolt

(A) Front of Machine Two Places
(B) Back of Machine Two Places

RY9212509MBS0020US0

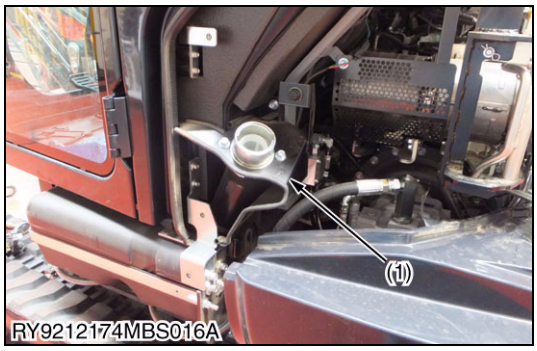
[3] REMOVING AND INSTALLING THE FUEL TANK



1. Remove the left bonnet and the left swivel cover.

(1) Left Bonnet (2) Left Swivel Cover

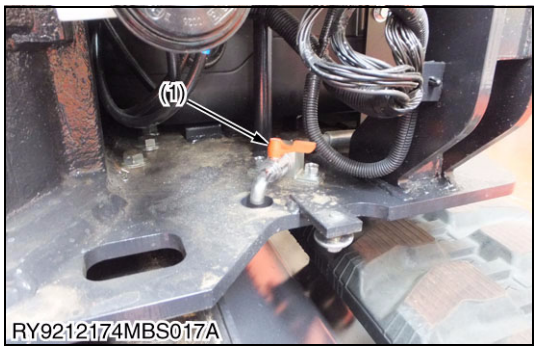
RY9212174MBS0055US0



2. Remove the cover.

(1) Cover

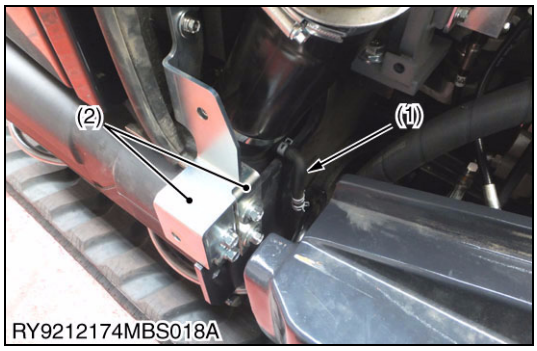
RY9212174MBS0056US0



3. After draining the fuel, remove the water drain cock.

(1) Water Drain Cock

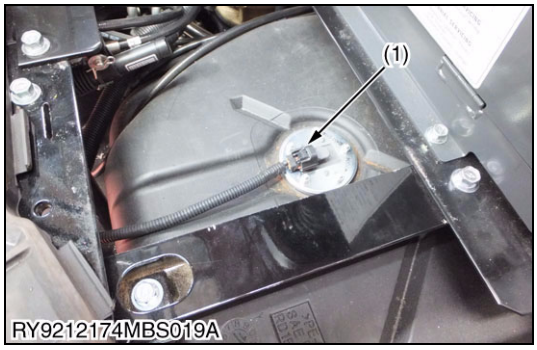
RY9212174MBS0057US0



4. Remove the fuel hose and bracket.

(1) Fuel Hose (2) Bracket

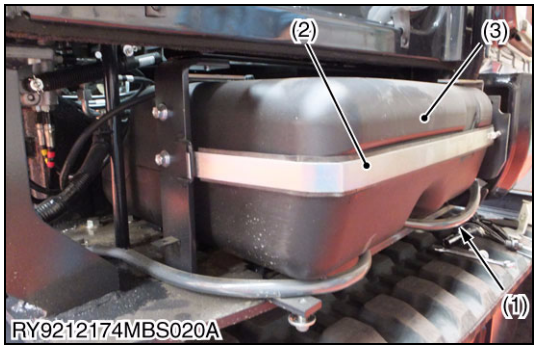
RY9212174MBS0058US0



5. Remove the connector to the fuel sensor.

(1) Connector

RY9212174MBS0059US0

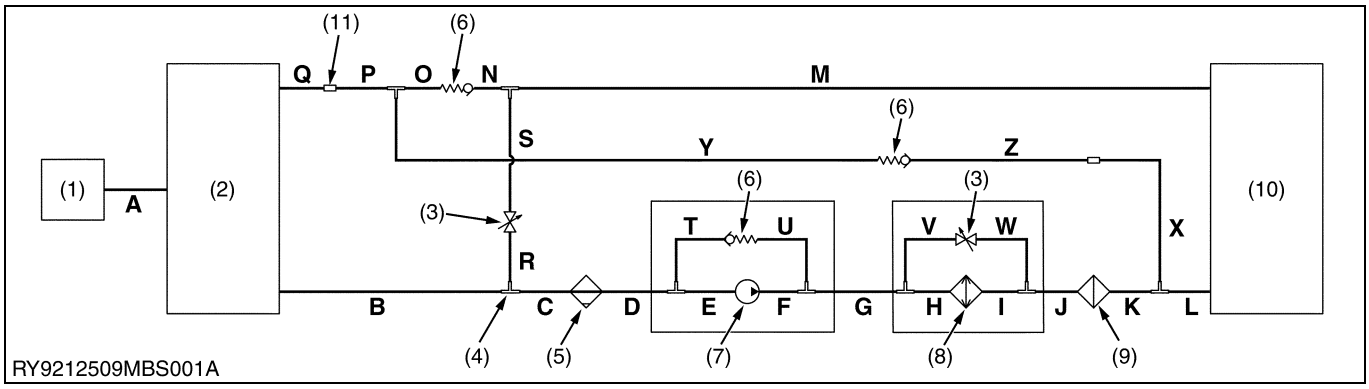


6. Remove the fuel hose.
7. Remove the band for mounting the fuel tank and then remove the fuel tank.

(1) Fuel Hose
(2) Fuel Tank Mounting Band
(3) Fuel Tank

RY9212174MBS0060US0

Fuel hose routing

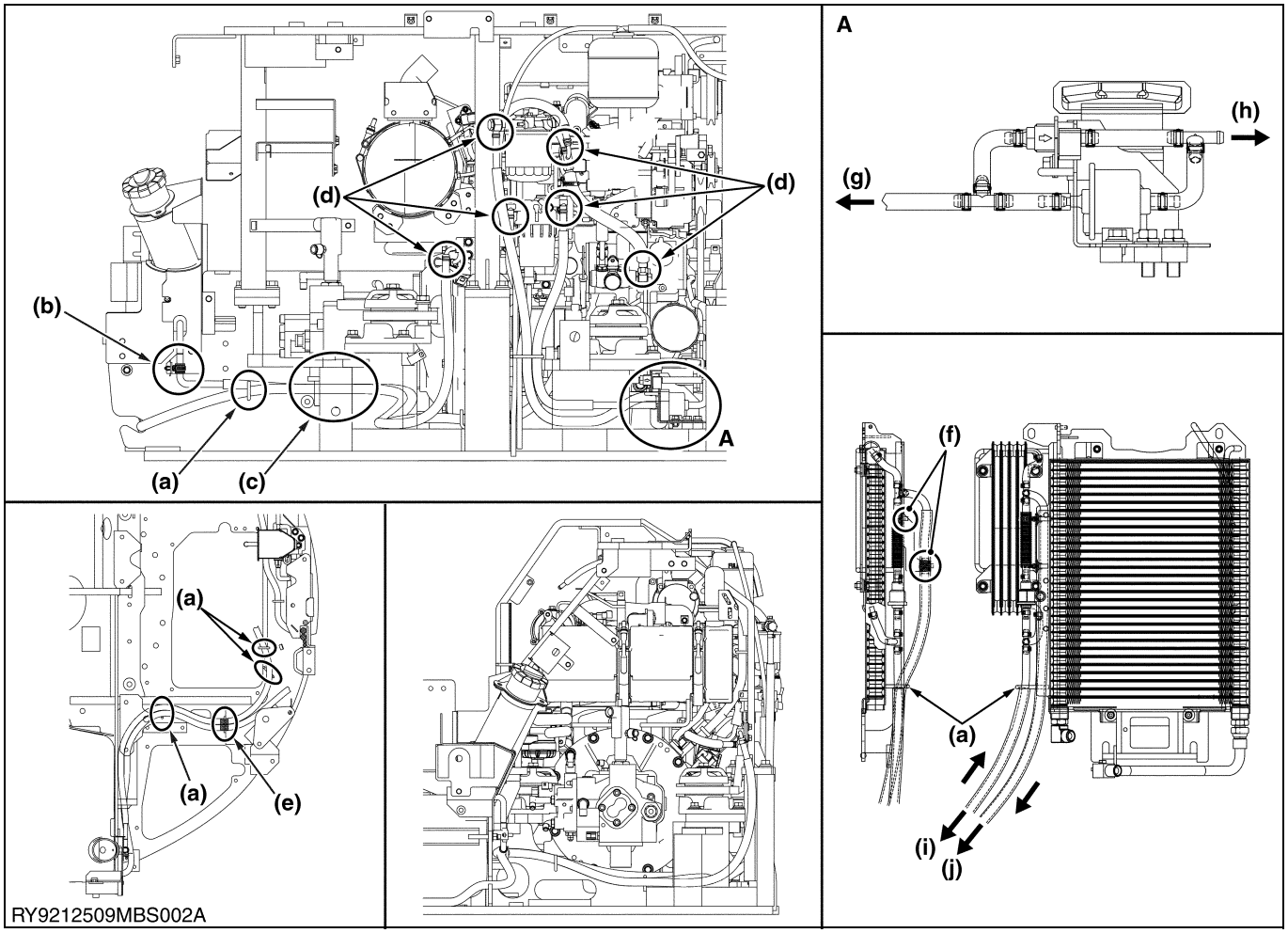


(1) Drain Cock
(2) Fuel Tank
(3) Thermostatic-Flow Valve
(4) T-Joint
(5) Water Separator
(6) Check Valve
(7) Fuel Pump
(8) Fuel Cooler
(9) Fuel Filter
(10) Engine
(11) Straight Pipe Joint

	Tube		Protective tube			Tube		Protective tube	
	Length	I.D.	Length	I.D.		Length	I.D.	Length	I.D.
A	730 mm 28.7 in.	9.0 mm 0.4 in.	610 mm 24.0 in.	16 mm 0.6 in.	N	45 x 35 mm 1.8 x 1.4 in.	8.0 mm 0.31 in.	–	–
B	1800 mm 70.9 in.	8.0 mm 0.31 in.	1700 mm 66.9 in.	15 mm 0.6 in.	O	280 mm 11.0 in.		200 mm 8.2 in.	15 mm 0.6 in.
C	460 mm 18.1 in.		380 mm 15.0 in.		P	1400 mm 55.1 in.		1300 mm 51.2 in.	
D	600 mm 23.6 in.		500 mm 19.7 in.		Q	35 x 60 mm 1.4 x 2.4 in.		–	–
E	60 mm 2.4 in.		–	–	R	300 mm 11.8 in.		200 mm 7.9 in.	15 mm 0.6 in.
F	35 x 60 mm 1.4 x 2.4 in.		–	–	S	50 mm 2.0 in.		–	–
G	525 mm 20.7 in.		425 mm 17.4 in.	15 mm 0.59 in.	T	35 x 60 mm 1.4 x 2.4 in.		–	–
H	35 x 60 mm 1.4 x 2.4 in.		–	–	U	80 mm 3.15 in.		–	–
I	100 mm 3.9 in.		–	–	V	50 mm 2.0 in.		–	–
J	1800 mm 70.9 in.		1650 mm 65.0 in.	15 mm 0.59 in.	W	150 mm 5.9 in.		100 mm 3.9 in.	15 mm 0.6 in.
K	50 mm 2.0 in.		–		X	550 mm 21.7 in.		425 mm 17.4 in.	
L	310 mm 12.2 in.	11 mm 0.4 in.	220 mm 8.7 in.	19.5 mm 0.8 in.	Y	50 mm 2.0 in.		–	–
M	80 mm 3.31 in.	8.0 mm 0.31 in.	–	–	Z	35 x 45 mm 1.4 x 1.8 in.		–	–

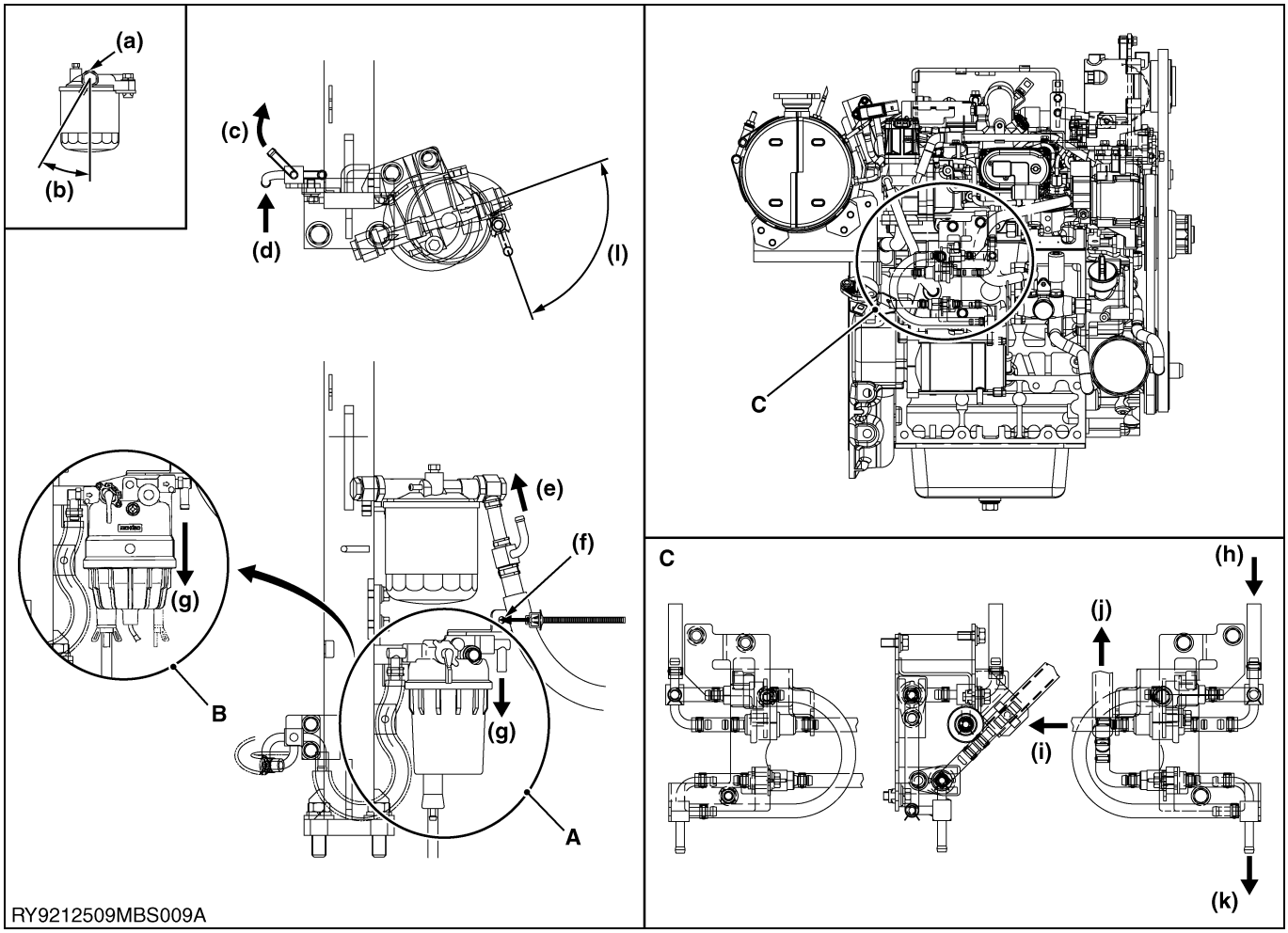
RY9212509MBS0005US0

Fuel hose routing



- (a): Hang on the round bar.
- (b): Clamp the fuel hose.
- (c): Pass above the boss.
- (d): Install the band knob to backside direction of machine.
- (e): Pass blue tape to righit and white tape to left side.
- (f): After putting together with the protective tube and band parts, insert securely into the bracket holes.
- (g): Water separator side
- (h): Fuel cooler side
- (i): Fuel pump side
- (j): Fuel filter side

RY9212509MBS0006US0



A: Serial No. to #50155
B: Serial No. from #50156

- (a): Install with the hex top facing up.
- (b): 30 ° (0.52 rad)
- (c): Thermostatic flow valve side
- (d): Fuel tank side
- (e): Air-bleed circuit
- (f): After putting together with the protective tube and band parts, insert securely into the bracket holes.
- (g): To fuel pump
- (h): From the engine
- (i): To fuel supply side
- (j): From air-bleed circuit
- (k): Fuel tank side
- (l): 90 ° (1.6 rad)

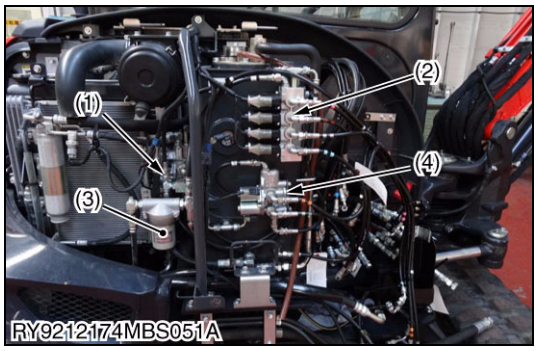
RY9212509MBS0022US0

[4] REMOVING AND INSTALLING THE HYDRAULIC OIL TANK



1. Remove the control valve. Refer to the chapter Control Valve Assembly/Disassembly.

RY9212174MBS0075US0

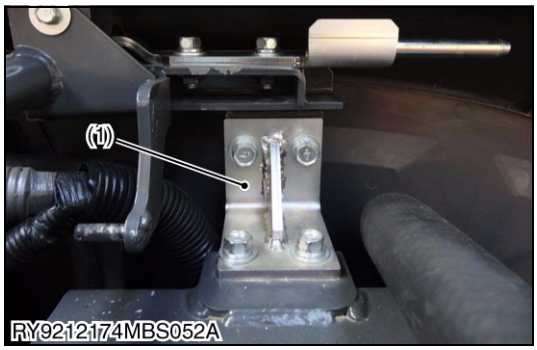


2. Remove the unload valve, AUX solenoid valve, pilot filter and angle solenoid valve from the hydraulic oil tank.
3. After draining the hydraulic oil, disconnect the harness and oil pressure ground connected to the hydraulic oil tank.

■ **IMPORTANT**
- **Plug the disconnected hoses and adapters.**

(1) Unload Valve
(2) AUX Solenoid Valve
(3) Pilot Filter
(4) Angle Solenoid Valve

RY9212174MBS0076US0



4. Remove the hydraulic oil tank mounting bracket.

(1) Bracket

RY9212174MBS0077US0



5. Suspend the hydraulic oil tank with a crane.
6. Remove the 6 hydraulic tank mounting bolts, then lift the tank with the crane and remove it.

■ **IMPORTANT**
- **Apply a threadlock (Loctite 271).**

Tightening torque	Bolt	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 lbf·ft

Hydraulic tank weight	Approx. 33 kg (73 lbs)

(1) Hydraulic Oil Tank

RY9212174MBS0078US0

[5] REMOVING AND INSTALLING THE ENGINE RELATED COMPONENTS

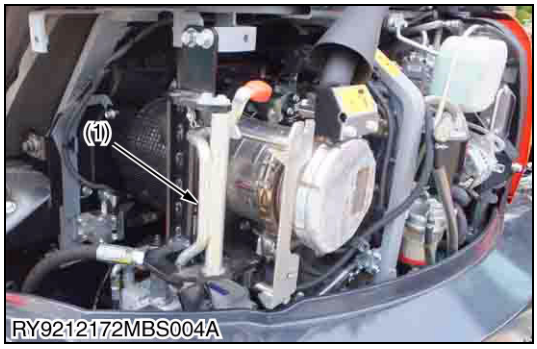
(1) DPF Muffler



1. Remove the left and rear bonnets.

(1) Rear Bonnet (2) Left Bonnet

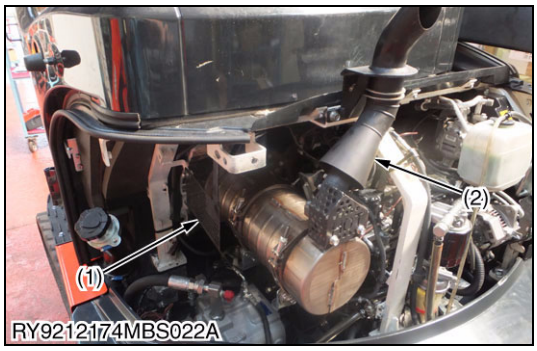
RY9212174MBS0014US0



2. Remove the stay.

(1) Stay

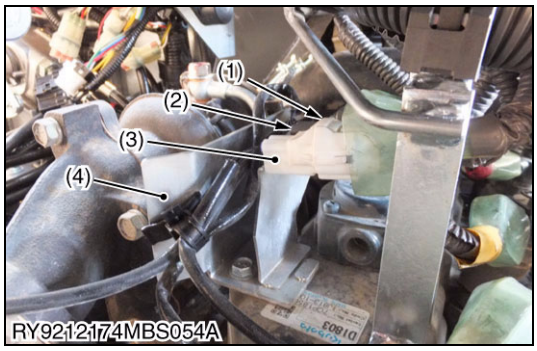
RY9212172MBS0008US0



3. Remove the DPF muffler cover and the DPF exhaust pipe.

(1) DPF Muffler Cover (2) DPF Exhaust Pipe

RY9212174MBS0015US0



4. Remove the bracket and then remove the DOC intake temperature sensor, DOC outlet temperature sensor and DPF outlet temperature sensor connectors.

(1) DOC Intake Temperature Sensor Connector
(2) DOC Outlet Temperature Sensor Connector
(3) DPF Outlet temperature Sensor Connector
(4) Bracket

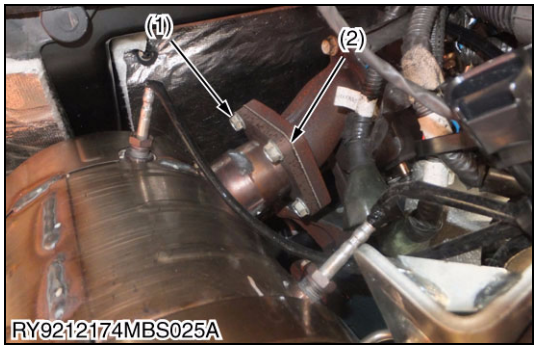
RY9212172MBS0002US0



5. Remove the DPF pressure differential sensor connector.

(1) DPF Pressure Differential Sensor Connector

RY9212174MBS0017US0



6. Remove the 4 flange nuts.

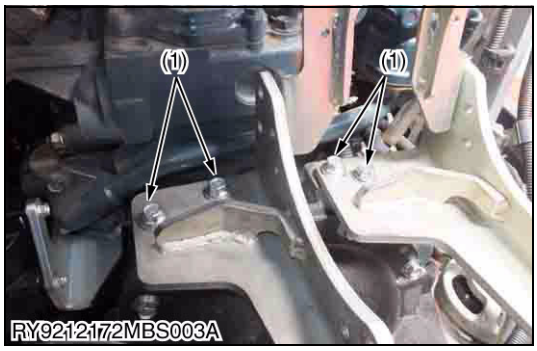
■ **IMPORTANT**
- **During installation, first mount all the flange nuts and bracket mounting bolts loosely and then tilt the muffler itself in position, adjusting it so there is no stress on it while tightening first the flange nuts and then the bracket mounting bolts.**

DPF muffler weight	Approx. 18 kg (40 lbs)

Tightening torque	Flange nut	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.3 to 20.3 lbf·ft

(1) Flange Nut (2) Gasket

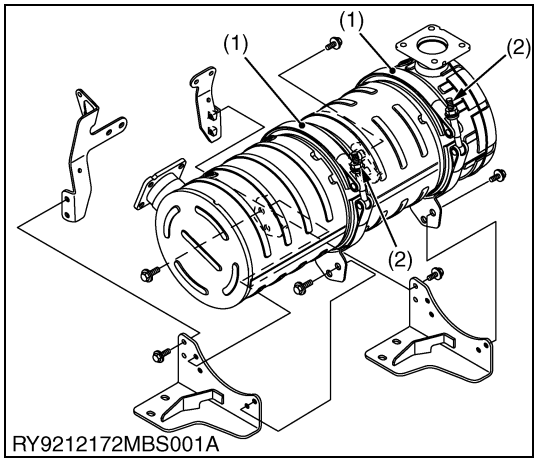
RY9212172MBS0003US0



7. Remove the 4 bracket mounting bolts and then the DPF muffler. (Shown without the DPF muffler at left)

(1) Bolt (M10)

RY9212172MBS0004US0



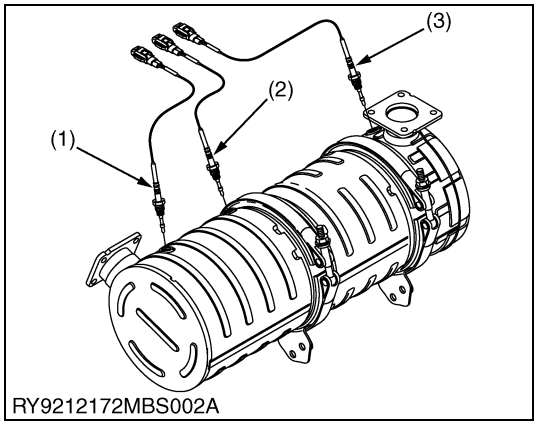
8. Remove the DPF muffler bracket and muffler mounting band from the DPF muffler.

■ **IMPORTANT**
- **During installation, when fully tightening the nuts, tilt the muffler itself, adjusting it so it is not under stress.**
- **Record the machine number, engine number and DPF muffler number.**
- **Refer to the DPF handling manual for cleaning DPF.**

Tightening torque	Muffler mounting band	16 to 20 N·m 1.7 to 2.0 kgf·m 12 to 14 lbf·ft

(1) Muffler Mounting Band (2) Nut

RY9212172MBS0006US0



9. Remove the exhaust temperature sensor from the DPF muffler.
- Tools: Flare nut wrench

■ **IMPORTANT**
- **To prevent nut gets damaged, never use a standard flat spanner.**
- **If the exhaust temperature sensor does not be loosened, apply the lubricant (KURE CRC) on the screw part and leave it for a day and restart the work.**
- **When tightening the exhaust temperature sensor, apply anti-seize lube ("Pure Nickel Special" in Never-Seez Anti-Seize and Lubricating Compounds).**

Tightening torque	Exhaust temperature sensor	25.0 to 34.0 N·m 2.5 to 3.5 kgf·m 18.0 to 25.0 lbf·ft

(1) Exhaust Temperature Sensor (T0) (3) Exhaust Temperature Sensor (T2)
(2) Exhaust Temperature Sensor (T1)

RY9212172MBS0007US0

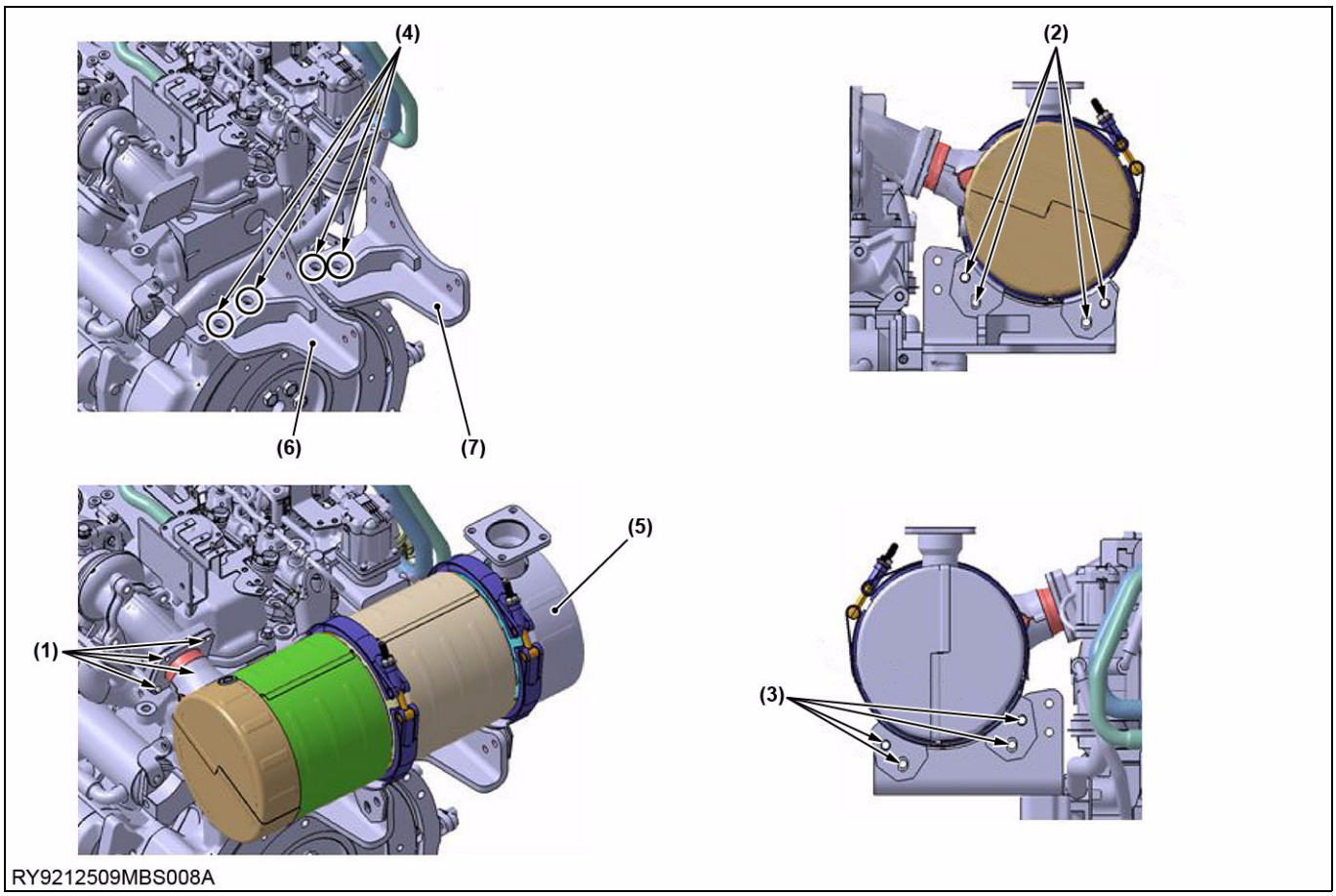
Installing

CAUTION

- **The DPF muffler remains hot, even after the engine has been switched off. Allow the DPF muffler to cool sufficiently before installing the DPF muffler assembly.**

IMPORTANT

- **Take care of the muffler when removing it. Make sure not to damage the DPF muffler full assembly by falling or impact as it contains a ceramic filter.**
- **When the bolts are tightened in the wrong sequence, there is a possibility that DPF is damaged by stress crack.**
- **Replacing the gaskets by new ones.**
- **If the differential pressure tube is damaged or cracked, replace it.**
- **Tighten bolts and nuts divided into few times. Do not tighten at once.**



RY9212509MBS008A

(1) Nut
(2) Bolt (M10 × 16)
(3) Bolt (M10 × 16)
(4) Bolt (M10 × 30)
(5) Muffler, Full Assy
(6) DPF Bracket 1
(7) DPF Bracket 2

[DPF muffler, full assy assembly procedure]

1. Tigten the bolts (4) slightly to install the bracket (7).
2. Set the muffler assy, and tighten the nuts (1) to install the exhaust manifold.
3. Tighten the DPF front side section (2).
4. Tighten the DPF rear side section (3).
5. Tighten the DPF support section (4).

Tightening torque	Nut (1)	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m
	Bolt (2) (3)	49.0 to 55.9 N·m 5.0 to 5.7 kgf·m
	Bolt (4)	60.8 to 70.8 N·m 6.2 to 7.2 kgf·m

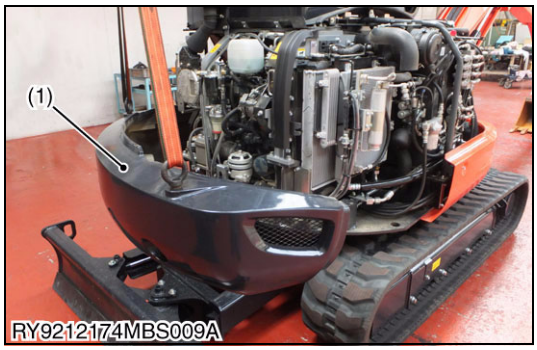
RY9212509MBS0021US0

(2) Engine

CAUTION

- **Wear protective gear, such as a helmet, safety glasses, etc., during assembly/disassembly.**
- **Disconnect the negative terminal of the battery prior to any assembly/disassembly work.**
- **For group work, decide on signals for communication, make sure everyone understands and uses them and be very careful about safety.**

RY9212148MBS0058US0



1. Remove the weight.

Refer to the section Weight Assembly/Disassembly for the weight removal/mounting procedure.

(1) Weight

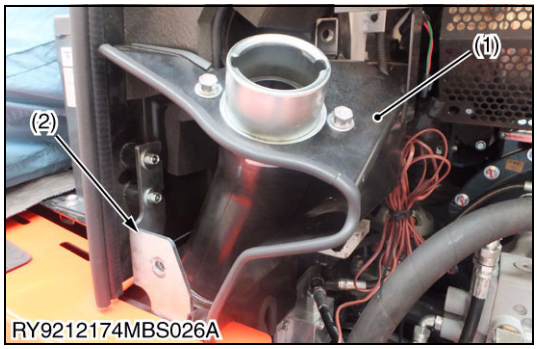
RY9212174MBS0020US0



2. Remove the cabin.

Refer to the section Cabin removing and installing for the cabin removal/mounting procedure.

RY9212174MBS0021US0



3. Remove the fuel tank cover and bracket.

(1) Fuel Tank Cover (2) Bracket

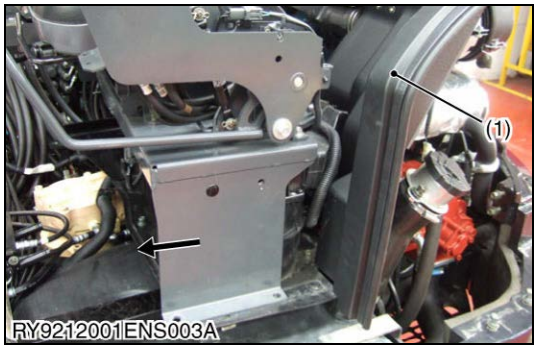
RY9212174MBS0022US0



4. Remove the right bonnet and partition plate.

(1) Right Bonnet (2) Partition Plate

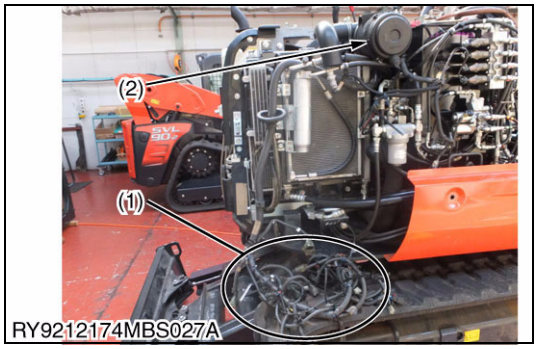
RY9212174MBS0061US0



5. Remove the seat.
6. Remove the seat support mounting bolts and slide the seat support toward the front of the machine. Remove the AC duct and the center bonnet.

(1) Center Bonnet

RY9212174MBS0062US0



7. Disconnect all electrical wires mounted on the arch and place them on radiator side for temporary stocking.
8. Remove the air cleaner.

(1) Electrical Wiring (2) Air Cleaner

RY9212174MBS0023US0



9. Remove the reserve tank hose and then the arch frame.

■ **IMPORTANT**
- **Find its center of gravity and suspend it securely.**
- **Be careful of the electrical wiring.**

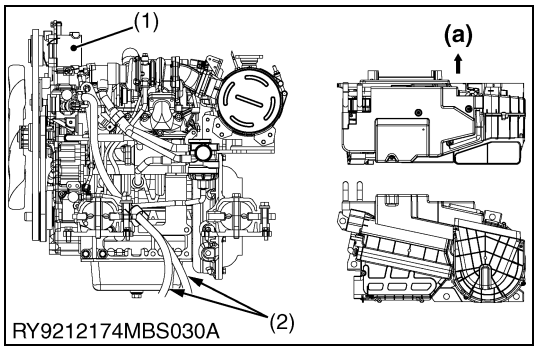
Tightening torque	Bolt	123.6 to 147.1 N·m 12.6 to 15.0 kgf·m 91.2 to 108.5 lbf·ft

Apply thread lock compound (Loctite 271).

Arch frame weight	Approx. 45 kg (99 lbs)

(1) Arch Frame

RY9212174MBS0024US0

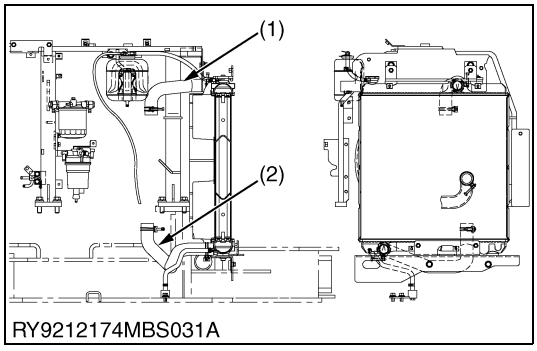


10. Remove the compressor.
11. Drain the coolant inside the radiator and disconnect the heater hoses.

■ **IMPORTANT**
- **Move the compressor across to the condenser side.**
- **Plug the disconnected heater hoses.**

(1) Compressor
(2) Heater Hose
(a) Bottom of Machine

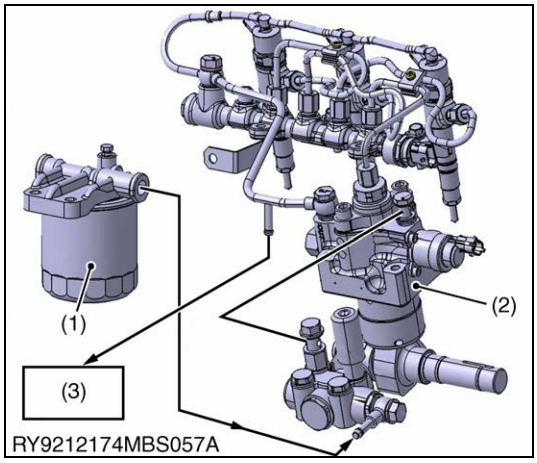
RY9212174MBS0025US0



12. Disconnect the upper and lower hoses.

(1) Upper Hose (2) Lower Hose

RY9212174MBS0026US0



13. Disconnect the fuel hoses on the supply pump side.

■ **IMPORTANT**
- **Between the fuel filter and supply pump**
- **Between the supply pump and fuel tank**
- **Plug the disconnected hoses.**
- **Remove the fuel hose mounting bracket if necessary.**

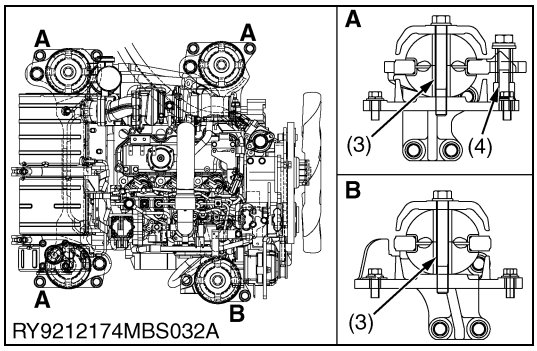
(1) Fuel Filter
(2) Supply Pump
(3) Fuel Tank

RY9212174MBS0027US0



14. Remove the pump mounting bolts and disconnect from the pump connector.
15. Suspend the engine and remove the bolts holding the engine to its mounts.
16. Disconnect the ground terminal and remove the engine.

CAUTION
- **Find its center of gravity and suspend it securely.**
- **Make sure you have not forgotten to disconnect any electrical wiring before removing the engine.**



Tightening torque	Bolt (M14)	123.6 to 147.1 N·m 12.6 to 15.0 kgf·m 91.2 to 108.5 lbf·ft
	Bolt (M16)	196.1 to 225.6 N·m 20.0 to 23.0 kgf·m 144.6 to 166.4 lbf·ft

Apply thread lock compound (Loctite 271).

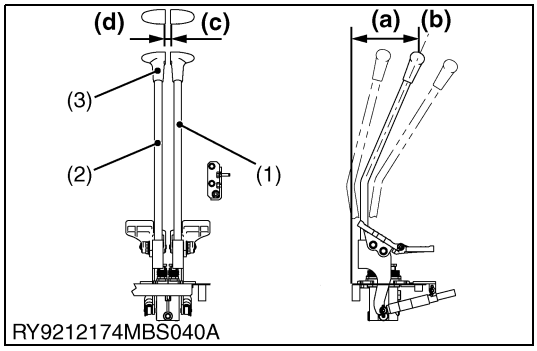
Engine weight	Approx. 250 kg (551 lbs)

(1) Engine
(2) Pump
(3) Bolt (M14)
(4) Bolt (M16)

RY9212174MBS0029US0

[6] ASSEMBLING OPERATING LEVERS

(1) Travel Lever

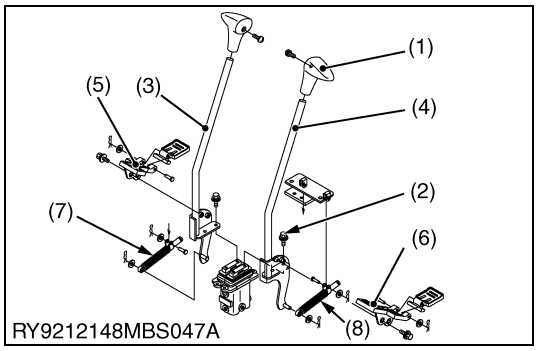


RY9212174MBS040A

(1) Left Travel Lever
(2) Right Travel Lever
(3) Grip

(a) 193 ± 5 mm (7.6 ± 0.2 in.)
(b) When in Neutral
(c) 11 to 22mm (0.43 to 0.87 in.)
(d) Fwd/Rear Deviation of L/R Levers to be within 2mm (0.08 in.)

RY9212174MBS0030US0



RY9212148MBS047A

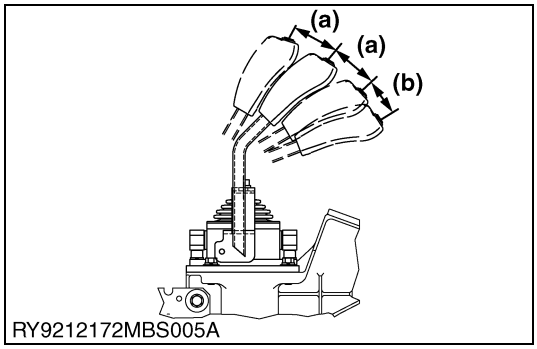
1. Install the left and right travel levers.
   The pilot valve side is aluminum die cast so be careful not to over tighten; tighten to the torques indicated below.

Tightening torque	Left/right travel levers	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.1 to 15.2 lbf·ft

(1) Grip
(2) Bolt
(3) Right Travel Lever
(4) Left Travel Lever
(5) Right Pedal
(6) Left Pedal
(7) Right Damper
(8) Left Damper

RY9212174MBS0031US0

(2) Blade Lever

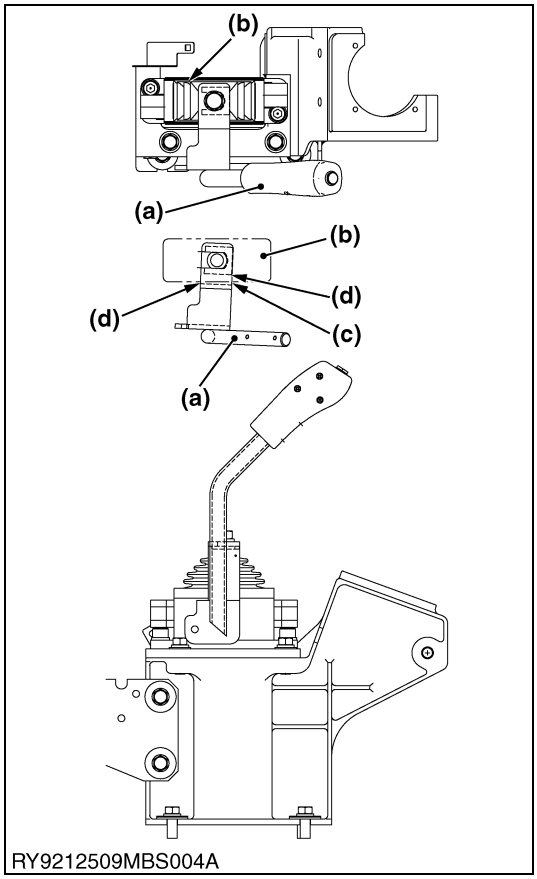


RY9212172MBS005A

Neutral position

(a) 62.0 mm (2.4 in.)
(b) 39.0 mm (1.5 in.)

RY9212172MBS0005US0



RY9212509MBS004A

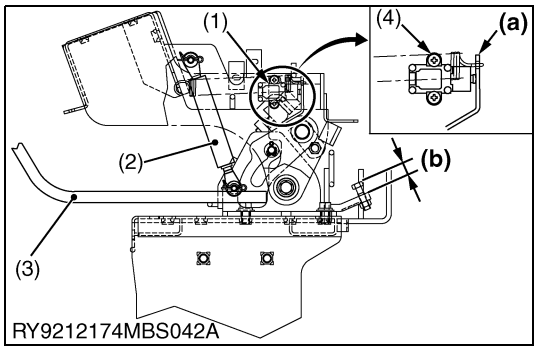
Mounting procedure

■ **NOTE**
- **Check the clearance (d) after installing. The lever operating force increases by touching the rubbor boot.**

(a) Blade Lever
(b) Rubber Boots
(c) Lever Welded Material
(d) Secure Clearance.

RY9212509MBS0008US0

(3) Limit Switch



RY9212174MBS042A

1. Clearance **(a)** to disappear when limit switch operated.

Tightening torque	Bolt	3.9 to 4.9 N·m 0.4 to 0.5 kgf·m 2.9 to 3.6 lbf·ft

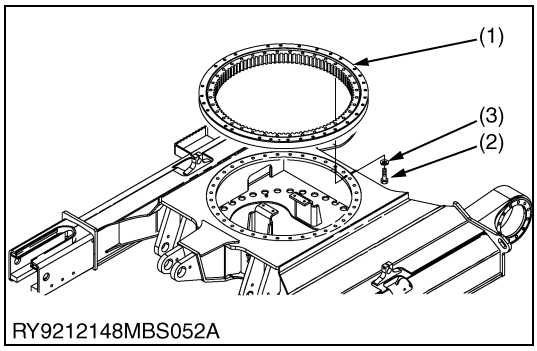
Apply thread lock compound (ThreeBond TB1401B).

(1) Limit Switch
(2) Damper
(3) Unload Lever
(4) Bolt
(a) Clearance
(b) 16 mm (0.6 in.)

RY9212174MBS0033US0

3. TRACK FRAME

[1] REMOVING AND INSTALLING THE SWIVEL BEARING



RY9212148MBS052A

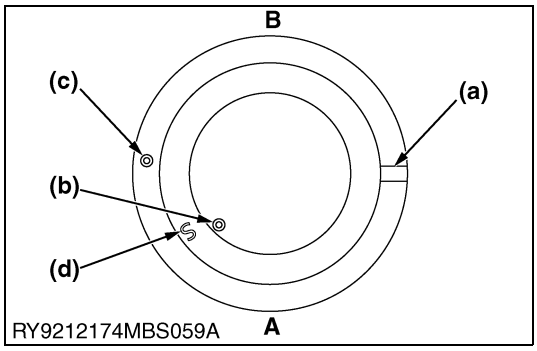
1. Suspend the swivel bearing with a crane, remove the swivel bearing mounting bolts on the bottom side, then remove the swivel bearing.

Swivel bearing weight (reference value)	50 kg (110 lbs)

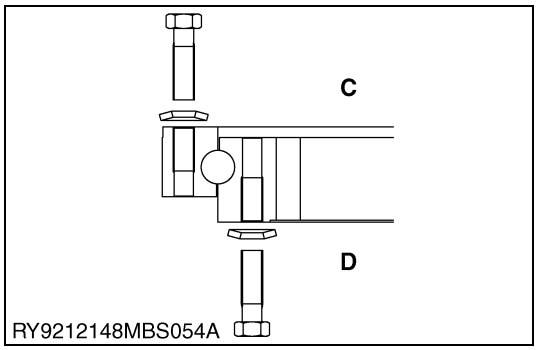
Component names

No.	Name of part	Qty
(1)	Swivel bearing	1
(2)	Bolt	22
(3)	Diaphragm spring	22

RY9212174MBS0082US0



RY9212174MBS059A



RY9212148MBS054A

Mounting Procedure

1. Set the "S" mark on the right side of the machine and mount all swivel bearing mounting bolts hand tight.
   Then tighten them in a diagonal pattern to the specified torque.

Tightening torque	Swivel bearing	259.9 to 304.0 N·m 26.5 to 31.0 kgf·m 191.7 to 224.2 lbf·ft

   Thread locking compound (Loctite 263)

■ **IMPORTANT**

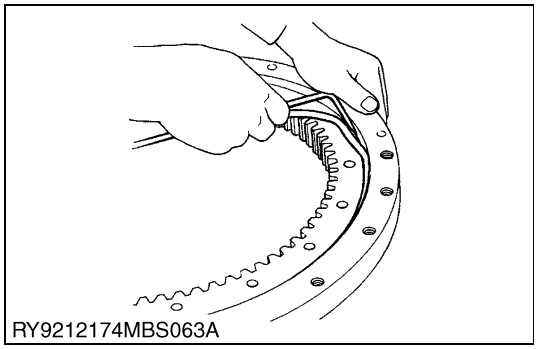
- **Make sure the diaphragm springs face in the correct direction.**
- **After mounting the bearing, apply grease so that it covers the entire surface of bearing teeth.**

(a) Ball Insertion Holes (Outer Soft Zone)
(b) Tooth Surface Grease Application Zone
(c) Port for Applying Grease to the Balls (Mates with Hole in Swivel Frame)
(d) 'S' Mark

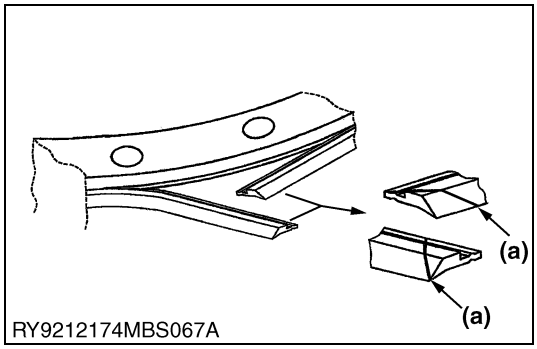
A : Front of Machine
B : Back of Machine
C : Swivel Frame Side
D : Track Frame Side

RY9212174MBS0083US0

[2] REPLACEMENT OF THE SWIVEL BEARING SEAL


RY9212174MBS063A

1. Clean up the swivel bearing and remove the soil.
2. Remove the swivel bearing seal.
3. Remove the adhesive around the inner & outer of the seal groove.
   [Recommendation]
   - Use thinner-absorbed dry cotton to clean.
4. Make sure the seal groove is dry enough and put the adhesive in the whole seal groove.
   - Adhesive: Threebond 1745



RY9212174MBS067A

5. Put the new seal in the groove.
6. Attach the seal in the whole length of the groove and cut the last end **(a)** at 45 degree.
7. Put the adhesive on the cut surface.
   - Adhesive: Threebond 1701
8. Put the seal of the both cross-section attached in to the groove.

RY9212174MBS0088US0

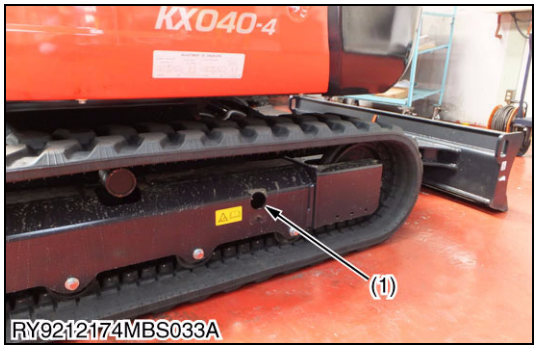
[3] TRACK

CAUTION

- **As the grease cylinder is under high pressure, loosening the grease nipple all at once may cause the nipple pop out and/or grease to spray out.**
- **Do not get your face or any body part right in front of the nipple while loosening it and loosen the nipple gradually.**

RY9212509MBS0017US0

(1) Removing and Installing the Rubber Track

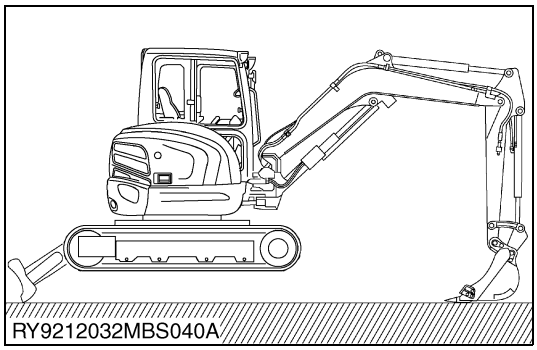


RY9212174MBS033A

1. Remove the cover to gain access to the grease nipple.
2. Use a socket wrench to loosen the big adapter and remove it slowly.
   If there are any rocks or the like caught in the sprocket, remove the rocks first.
   - Tool to use: 19 mm socket

(1) Grease Nipple

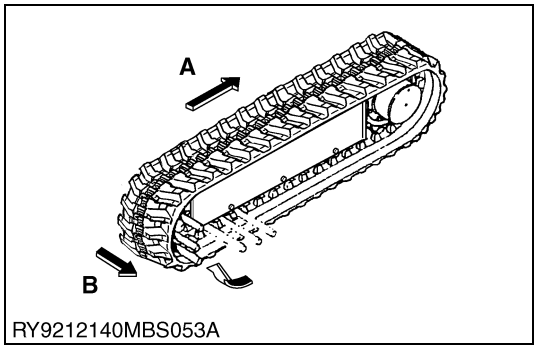
RY9212174MBS0034US0


RY9212032MBS040A

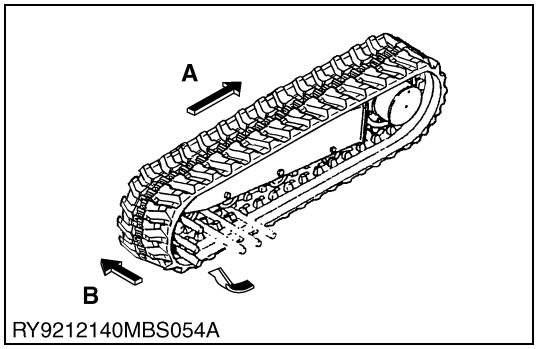
3. Jack up the body using the front end and blade, expel grease from inside the grease cylinder, and fully loosen up the track. When the track loosens up, attach the grease nipple.

Tightening torque	Grease nipple	98.0 to 107.8 N·m 10.0 to 11.0 kgf·m 72.0 to 80.0 lbf·ft

RY9212148MBS0003US0



RY9212140MBS053A



RY9212140MBS054A

4. With the machine lifted up, wedge a steel pipe into the track and turn the sprocket backwards in direction **A**.
   When the steel pipe reaches halfway up the idler and the track lifts off the idler, stop turning the sprocket and slide the track sideways in direction **B** to remove it.
   - Weight of rubber track: approximately 190 kg (419 lbs)

A : Backwards **B : Direction to Slide**

RY9212174MBS0035US0

Assembling the Rubber Track

1. Jack up the machine with the front and the blade and with it lifted slightly off the ground, wedge the track onto the sprocket and set it on the frame.
2. Wedge steel pipes into the track and rotate the sprocket backwards in direction **A**. When a steel pipe reaches halfway up the idler, stop turning the sprocket. Slide the track sideways in direction **B** and set the track onto the idler. Lower the machine and drive it backwards to make sure the tracks are on securely. Adjust the tension of the track.

CAUTION
- **Make sure to assemble the rubber track facing the right way.**

A : Backwards **B : Direction to Slide**

RY9212148MBS0013US0

[4] FRONT IDLER

(1) Removing and Installing the Front Idler


RY9212032MBS033B


RY9212001MBS117A

1. Remove the track. (Refer to the chapter Assembly/Disassembly of the Rubber Track.)

IMPORTANT
- **Jack up the machine with the front-end and the blade and place jack stands under the frame.**

2. Use a crowbar to separate the front idler and the yoke from the track frame.

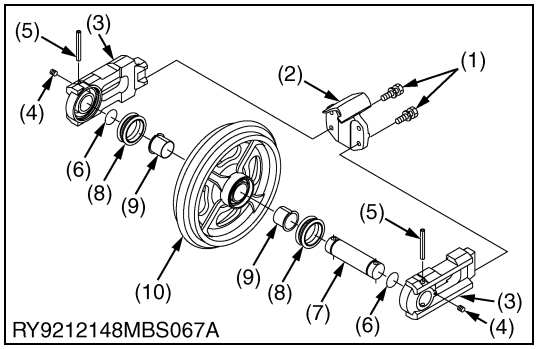
Front idler assembly weight	Approx. 32 kg (71 lbs)

3. Use a crane during assembly.

IMPORTANT
- **Wipe off any dirt, sand, etc. sticking to the inside of the track frame prior to inserting the component.**
- **Make sure it slides smoothly and insert it.**

RY9212509MBS0009US0

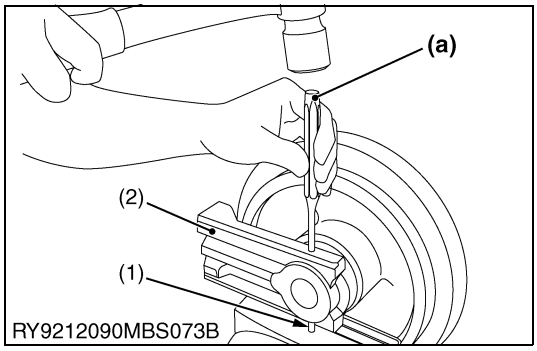
(2) Disassembling and Assembling



RY9212148MBS067A

No.	Name of part	Qty	Notes
(1)	Bolt	4	123.6 to 147.1 N·m 12.6 to 15.0 kgf·m 91.2 to 108.5 lbf·ft
(2)	Yoke	1	
(3)	Bracket	2	
(4)	Plug	2	R1/8
(5)	Spring pin	2	
(6)	O-ring	2	
(7)	Shaft	1	
(8)	Floating seal	2	
(9)	Bushing	2	
(10)	Idler	1	

RY9212148MBS0097US0



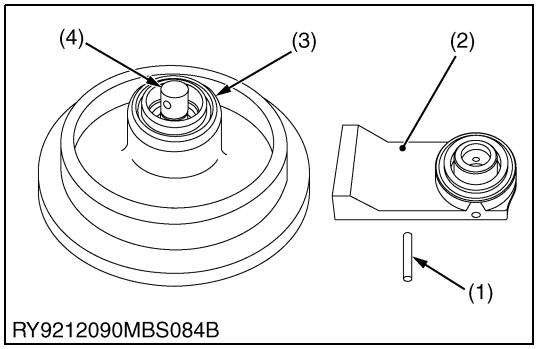
RY9212090MBS073B

Disassembly Procedures

1. Remove the plug from the bracket and drain the oil.
2. Use a pin punch to extract the left and right spring pins and then remove the bracket.

(1) Spring Pin
(2) Bracket
(a) Pin Punch

RY9212148MBS0006US0

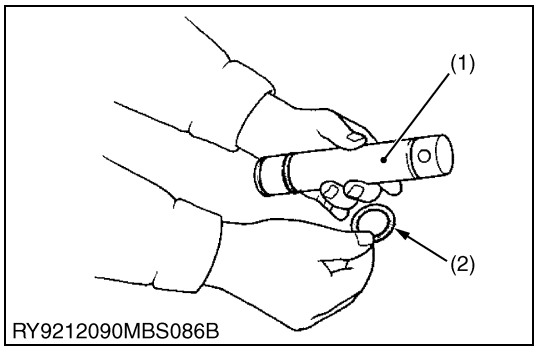


RY9212090MBS084B

3. Remove the floating seal.
4. Remove the shaft.

(1) Spring Pin
(2) Bracket
(3) Floating Seal
(4) Shaft

RY9212148MBS0007US0



RY9212090MBS086B

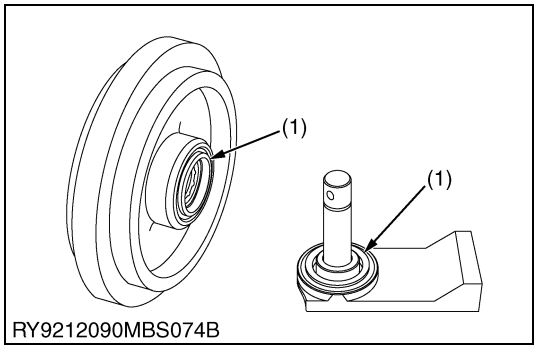
Assembly Procedures

1. Mount the O-rings on the shaft.

■ **IMPORTANT**
- **Apply engine oil to the O-rings.**

(1) Shaft
(2) O-Ring

RY9212148MBS0008US0



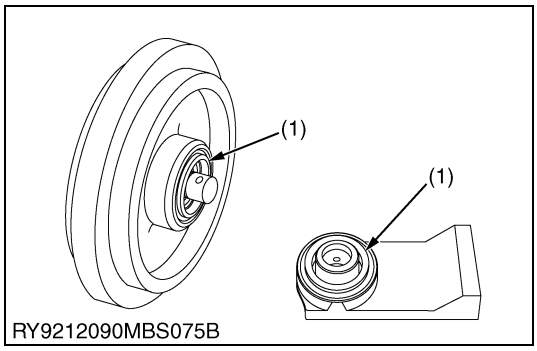
RY9212090MBS074B

2. After installing a floating seal on one side of the bracket, mount the shaft and fix it in place with a spring pin.
3. Install a floating seal on the idler.

■ **IMPORTANT**
- **Face the split in the spring pin so it is perpendicular to the shaft and tap it in.**
- **Make sure there is no oil or debris on the O-ring or the O-ring seat.**
- **Apply a thin film of oil to the sliding surfaces.**
- **Make sure there are no scratches in the sliding surfaces or the O-rings.**

(1) Floating Seal

RY9212148MBS0098US0



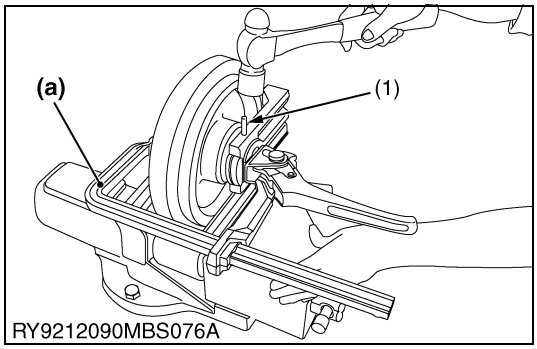
RY9212090MBS075B

4. Install a floating seal to the bracket on the other side of the idler.

■ **IMPORTANT**
- **Make sure there is no oil or debris on the O-ring or the O-ring seat.**
- **Apply a thin film of oil to the sliding surfaces.**
- **Make sure there are no scratches in the sliding surfaces or the O-rings.**

(1) Floating Seal

RY9212148MBS0099US0



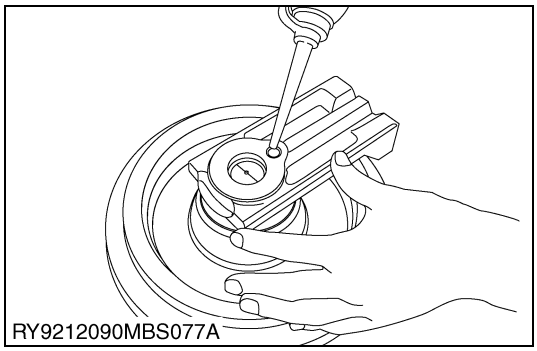
RY9212090MBS076A

5. Align the holes in the shaft and the brackets, hold them in place with a clamp and tap in a spring pin.

■ **IMPORTANT**
- **Face the split in the spring pin so it is perpendicular to the shaft and tap it in.**
- **After completing the assembly, turn the idler a little to form a film of oil on the sliding surface of the floating seals.**

(1) Spring Pin **(a) Clamp**

RY9212148MBS0009US0


RY9212090MBS077A

6. Fill with engine oil via the plug hole in the bracket.
7. Install the plug.

Lubricant	Type SAE #30CD engine oil	80 cc 4.88 cu.in

Tightening torque	Plug	10.0 N·m 1.0 kgf·m 7.4 lbf·ft

Apply thread lock compound (Loctite 503 or equivalent)

RY9212148MBS0010US0

[5] GREASE CYLINDER

(1) Removing and Installing the Grease Cylinder



1. Remove the track and the front idler. (Refer to the chapters for removing and installing of the track and front idler.)
2. Remove the grease cylinder from the track frame.

Grease cylinder weight	Approx. 9.0 kg (20 lbs)

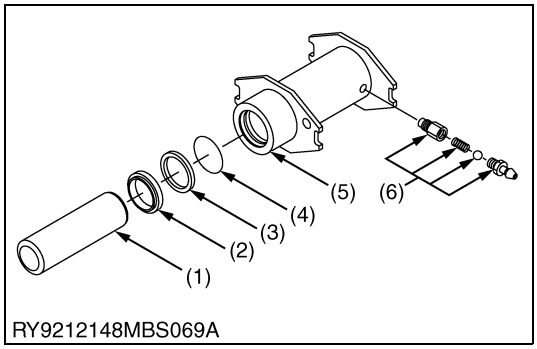
3. Use a crane during assembly.

■ **IMPORTANT**

- **Wipe off any dirt, sand, etc. sticking to the inside of the track frame prior to inserting the component.**
- **Make sure it slides smoothly and insert it.**

RY9212509MBS0010US0

(2) Components



No.	Name of part	Qty	Notes
(1)	Rod	1	
(2)	Seal	1	
(3)	Backup ring	1	
(4)	O-ring	1	
(5)	Cylinder tube	1	
(6)	Grease nipple	1	98.0 to 107.8 N·m 10.0 to 11.0 kgf·m 72.3 to 79.5 lbf·ft

RY9212148MBS0101US0

[6] TENSIONER

(1) Removing and Installing the Tensioner



1. Remove the track front idler and grease cylinder. (Refer to the the Track and Front Idler and Grease Cylinder sections for their assembly/disassembly procedures.)
2. Remove the tensioner from the track frame.

Tensioner weight	Approx. 17 kg (37 lbs)

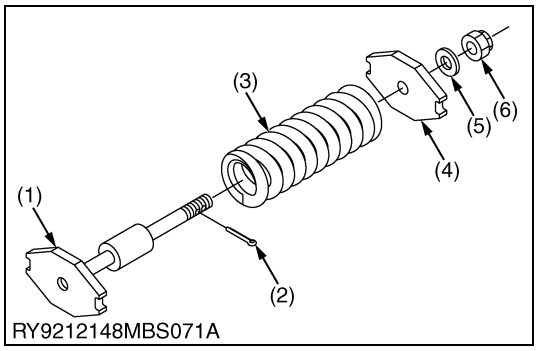
3. Use a crane during assembly.

■ **IMPORTANT**

- **Wipe off any dirt, sand, etc. sticking to the inside of the track frame prior to inserting the component.**
- **Make sure it slides smoothly and insert it.**

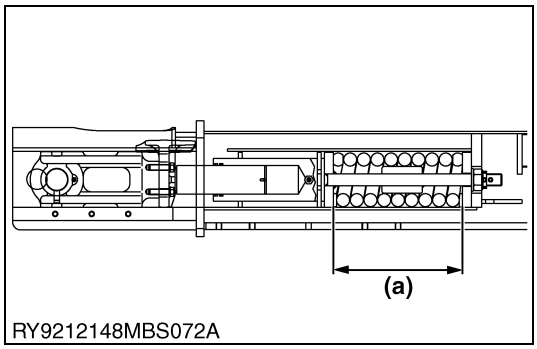
RY9212509MBS0011US0

(2) Components



No.	Name of part	Qty	Notes
(1)	Bolt	1	
(2)	Split pin	1	
(3)	Spring	1	
(4)	Retainer	1	
(5)	Washer	1	
(6)	Nut	1	

RY9212148MBS0103US0



When switching from a rubber track to a steel one or vice versa, set to the appropriate preset length.

Preset length	Steel	Factory specifica-tion	241.5 mm 9.5 in.
	Rubber		

(a) Preset Length

RY9212174MBS0039US0

[7] TRACK ROLLERS

(1) Removing and Installing the Track Roller

CAUTION

- **As the grease cylinder is under high pressure, loosening the grease nipple all at once may cause the nipple to jump out and/or grease to spray out.**
- **Do not get your face or any body part right in front of the nipple while loosening it and loosen the nipple gradually.**

RY9212148MBS0016US0


RY9212032MBS034A


RY9212001MBS040A

4. Jack up the body using the front end and blade, expel grease from inside the grease cylinder, and fully loosen up the track. When the track is loose, attach the grease nipple and place jack stands under the track frame.
5. Remove the track roller(s).

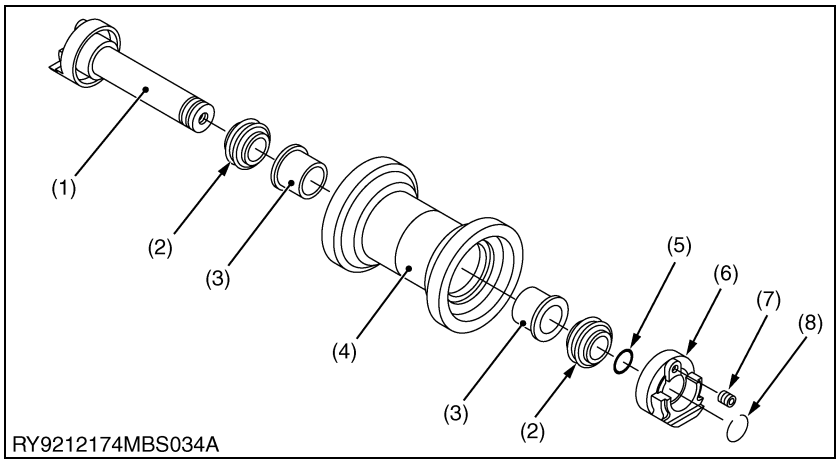
Track roller weight	Approx. 8 kg (17.6 lbs)

Tightening torque	Bolt	259.8 to 303.9 N·m 26.5 to 31.0 kgf·m 191.6 to 224.2 lbf·ft

Thread locking compound (ThreeBond 1305P)

RY9212174MBS0040US0

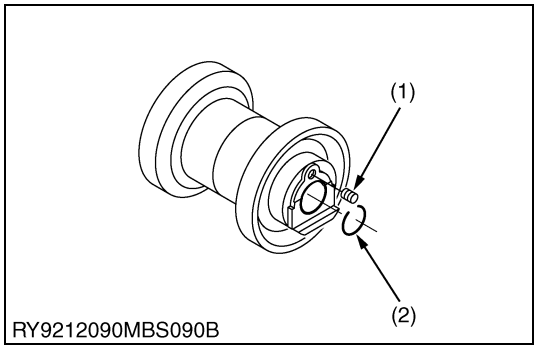
(2) Disassembling and Assembling



RY9212174MBS034A

No.	Component names	Q'ty
(1)	Shaft	1
(2)	Floating seal	2
(3)	Bushing	2
(4)	Roller	1
(5)	O-ring	1
(6)	Bracket	1
(7)	Plug (R1/8)	1
(8)	Wire	1

RY9212174MBS0069US0



RY9212090MBS090B

Disassembly

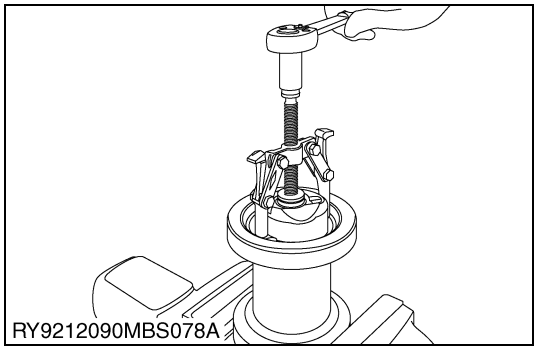
1. Remove the plug from the bracket, drain the oil and remove the wire.

■ **IMPORTANT**

- **Take care so the wire does not jump out.**

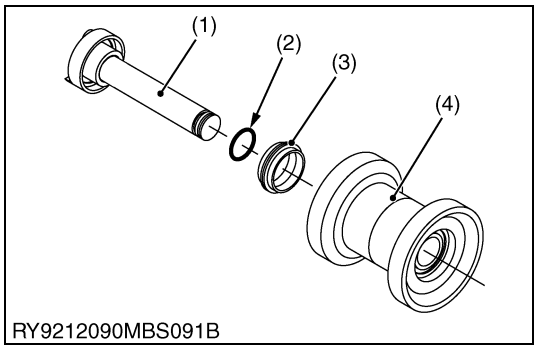
(1) Plug (R1/8) (2) Wire

RY9212174MBS0063US0


RY9212090MBS078A

2. Use a puller to pull the bracket.

RY9212090MBS0075US0

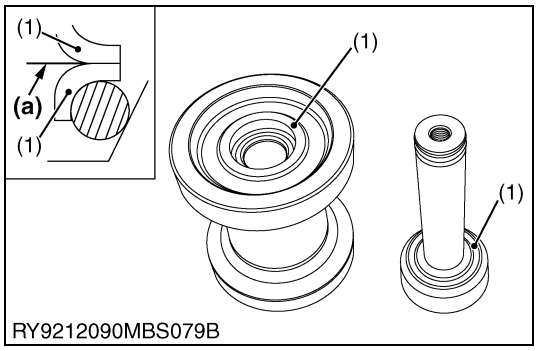


RY9212090MBS091B

3. Remove the O-ring, floating seal and the shaft.

(1) Shaft
(2) O-Ring
(3) Floating Seal
(4) Roller

RY9212174MBS0064US0



RY9212090MBS079B

Assembly

1. Install floating seals to the shaft assembly and the track roller.

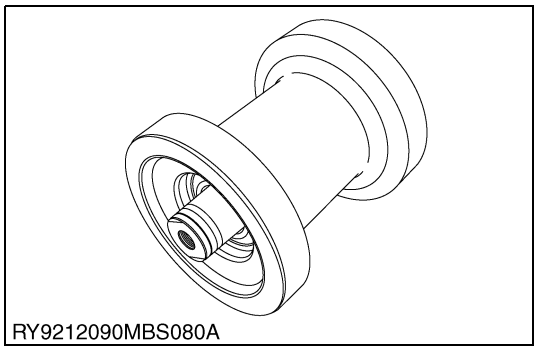
■ **IMPORTANT**
- **Make sure there is no oil or debris on the O-ring or the O-ring seat.**
- **Apply a thin film of oil to the sliding surfaces.**
- **Make sure there are no scratches in the sliding surfaces or the O-rings.**

(1) Floating Seal
(a) Sliding Surface

RY9212174MBS0065US0

2. Install the shaft ASSY into the track roller.

RY9212090MBS0078US0


RY9212090MBS080A

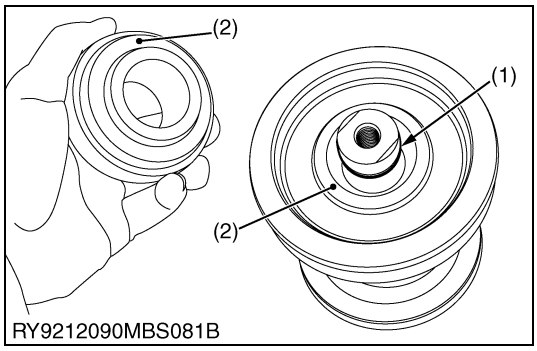
3. Install the O-ring on the shaft ASSY.

■ **IMPORTANT**
- **Apply grease to the O-ring.**

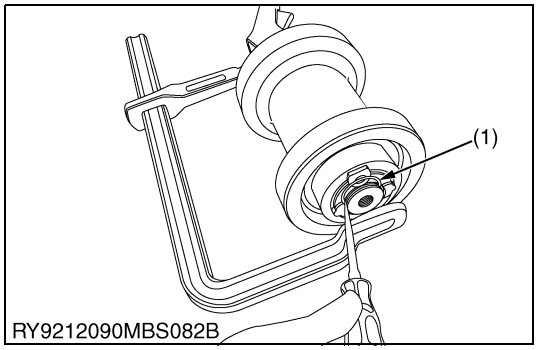
4. Install floating seals to the bracket and the track roller.

(1) O-Ring
(2) Floating Seal

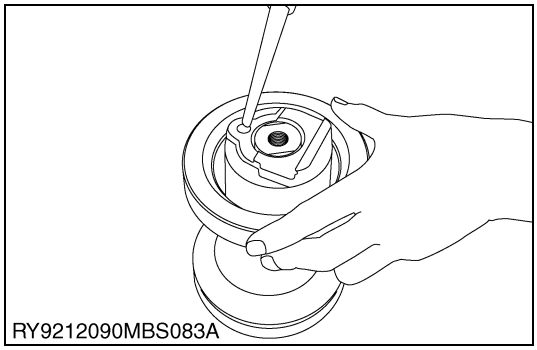
RY9212174MBS0066US0



RY9212090MBS081B



RY9212090MBS082B


RY9212090MBS083A

5. Install the bracket on the track roller, clamping it as shown at left and install the wire.

■ **IMPORTANT**

- **After completing the assembly, rotate the roller 2 to 3 turns to form a film of oil on the sliding surface of the floating seals.**

(1) Wire

RY9212174MBS0067US0

6. Fill with engine oil via the plug hole in the bracket.

Lubricant	Type SAE 30 CD engine oil	80 cc

7. Install the plug.

Tightening torque	Plug	10 N·m 1.0 kgf·m 7.4 lbf·ft

Apply thread lock compound (Loctite 503 or equivalent).

RY9212174MBS0068US0

[8] CARRIER ROLLERS

(1) Removing and Installing the Carrier Roller


RY9212032MBS034A


RY9212174MBS047A

1. Jack up the body using the front end and blade, expel grease from inside the grease cylinder, and fully loosen up the track. When the track is loose, attach the grease nipple and place jack stands under the track frame.
2. Insert a supporting block between the track frame and the track and remove the carrier roller.

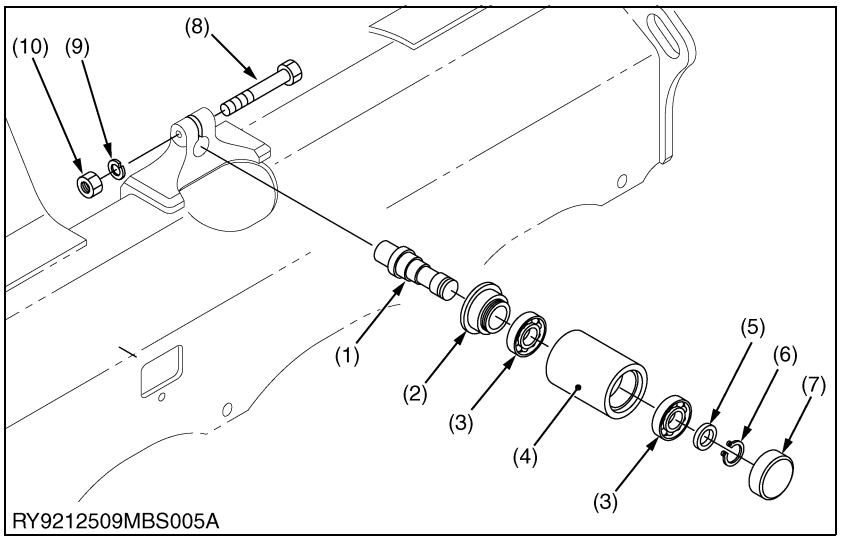
Carrier roller weight	Approx. 3.2 kg (7.1 lbs)

Tightening torque	Bolt	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 lbf·ft

Apply thread lock compound (Loctite 271).

RY9212174MBS0070US0

(2) Components



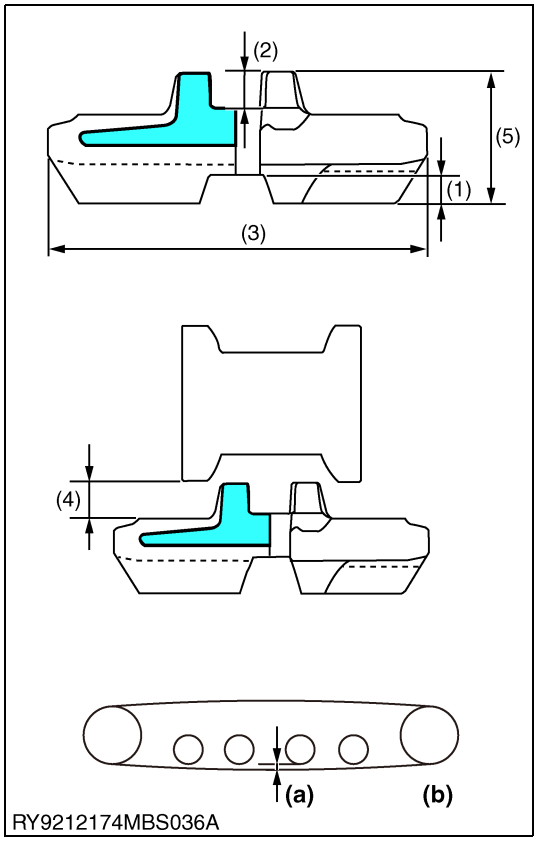
RY9212509MBS005A

No.	Component names	Q'ty
(1)	Shaft	1
(2)	Oil seal	1
(3)	Bearing	2
(4)	Roller	1
(5)	Spacer	1
(6)	Wire	1
(7)	Plug	1
(8)	Bolt	1
(9)	Spring washer	1
(10)	Nut	1

RY9212509MBS0012US0

[9] TABLE OF DIMENSIONS

(1) Rubber Track



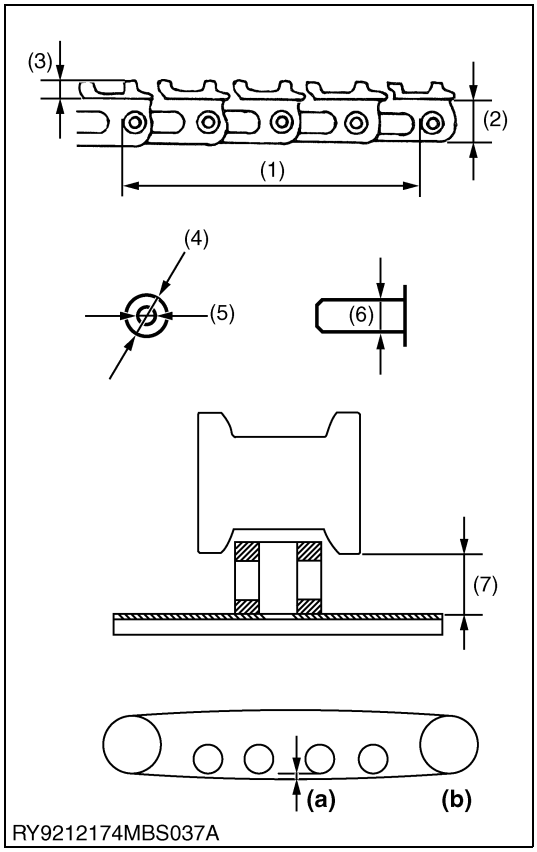
RY9212174MBS036A

No.	Item	
(1)	Lug height	17 mm 0.67 in.
(2)	Link height	23 mm 0.91 in.
(3)	Track width	350 mm 13.78 in.
(4)	Track tension	10 to 15 mm 0.39 to 0.59 in.
(5)	Track height	85.5 mm 3.37 in.
	No. of cored bars	86
	Circumference in middle	4687 mm 184.53 in.
	Cored bar pitch	54.5 mm 21.5 in.
	Endless ID mark	∞

(a) Track Adjustment Point **(b) Idler Side**

RY9212509MBS0013US0

(2) Steel Track



RY9212174MBS037A

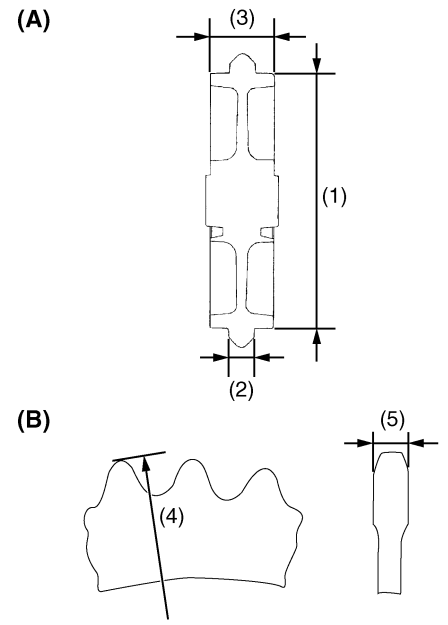
No.	Item	
	Track width	350 mm 13.78 in.
	No. of links	45
(1)	4 links length (A) / (B)	406.4 / 422.4 mm 16.00 / 16.63 in.
(2)	Height (A) / (B)	70.5 / 65.5 mm 2.78 / 2.58 in.
(3)	Grouser height (A) / (B)	22.5 / 12.5 mm 0.89 / 0.49 in.
(4)	Bush O.D. (A) / (B)	ϕ32.2 / 31.2 mm ϕ1.27 / 1.23 in.
(5)	Bushing I.D. (A) / (B)	ϕ19.0 / 21.5 mm ϕ0.75 / 0.85 in.
(6)	Pin O.D. (A) / (B)	ϕ19.0 / 16.0 mm ϕ0.75 / 0.63 in.
(7)	Track tension	85 - 90 mm 3.35 - 3.54 in.

(A): Std. when new
(B): Recommended replacement values

(a) Track Adjustment Point **(b) Idler Side**

RY9212509MBS0014US0

(3) Idler Sprocket



RY9212001MBS097A

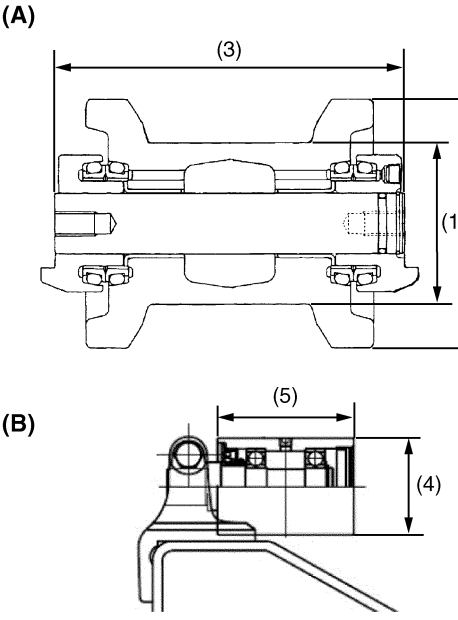
No.	Item	
Front Idler		
(1)	O.D. (A) / (B)	ϕ305 / 299 mm ϕ12.01 / 11.77 in.
(2)	Guide width (A) / (B)	40 / 34 mm 1.57 / 1.34 in.
(3)	Width	82 mm 3.23 in.
Sprocket		
(4)	O.D. (A) / (B)	ϕ390 / 378 mm ϕ15.35 / 14.88 in.
(5)	Wheel Width	38 mm 1.50 in.

(A): Factory spec. when new
(B): Recommended replacement values

(A) Front Idler **(B) Sprocket**

RY9212509MBS0015US0

(4) Carrier Rollers and Track Rollers



RY9212032GES004B

No.	Item	
Track Roller		
(1)	Guide width (A) / (B)	ϕ80 / 62 mm ϕ3.15 / 2.44 in.
(2)	O.D. (A) / (B)	ϕ124 / 106 mm ϕ4.88 / 4.17 in.
(3)	Roller width	175 mm 6.89 in.
Carrier Rollers		
(4)	O.D. (A) / (B)	ϕ80 / 74 mm ϕ3.15 / 2.91 in.
(5)	Roller width	110 mm 4.33 in.

(A): Factory spec. when new
(B): Recommended replacement values

(A) Track Roller **(B) Carrier Rollers**

RY9212509MBS0016US0

4. MEASURING MACHINE PERFORMANCE

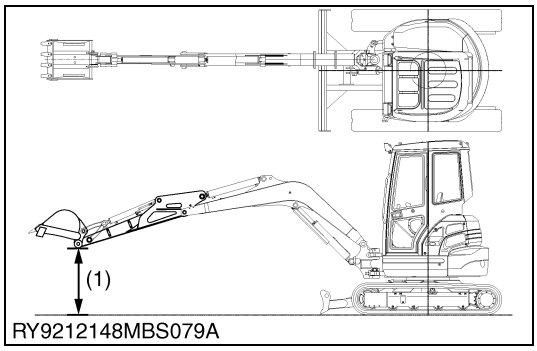
[1] MEASURING FRONT PERFORMANCE

(1) Measuring Swivel Gear Backlash

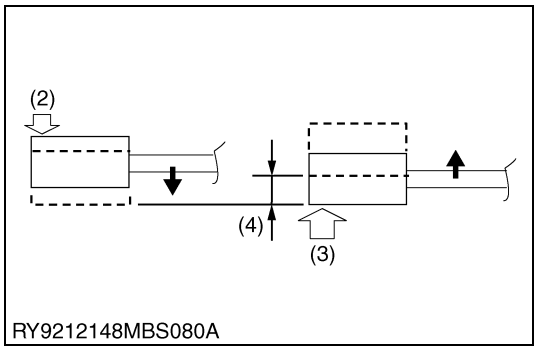
Purpose

- Measure the degree of overall wear in the front and replace pins and/or bushings or add shims as needed.
- When there is a great deal of play, it may cause wear in the swivel bearing teeth, swivel motor pinion gear and front pins and bushings.

RY9212148MBS0112US0



RY9212148MBS079A



RY9212148MBS080A

Measurement preparation

1. To make the measurements, position the machine so the arm cylinder and bucket cylinder are fully compressed with the end of the arm at a height of 1.0 m (40 in.) off the ground.
2. Stop the engine.

[Left play measurement]

1. Push to the right with 50 N (5.0kgf, 11 lbs) of pressure, making that position the zero point; then press to the left with 300 N (30 kgf, 67.4 lbs) of pressure and take a reading at that point.
2. Take three measurements, determine the average and take that as the measured value.

[Right play measurement]

1. Push to the left with 50 N (5.0 kgf, 11 lbs) of pressure, making that position the zero point; then press to the right with 300 N (30 kgf, 67.4 lbs) of pressure and take a reading at that point.
2. Take three measurements, determine the average and take that as the measured value.

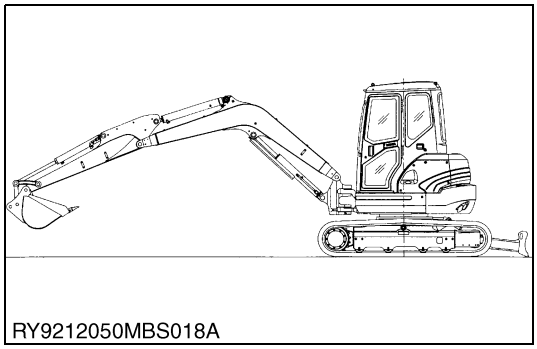
(1) 1.0 m (40 in.)
(2) 50 N (5.0 kgf, 11 lbs)
(3) 300 N (30 kgf, 67.4 lbs)
(4) Amount of Play

RY9212148MBS0113US0

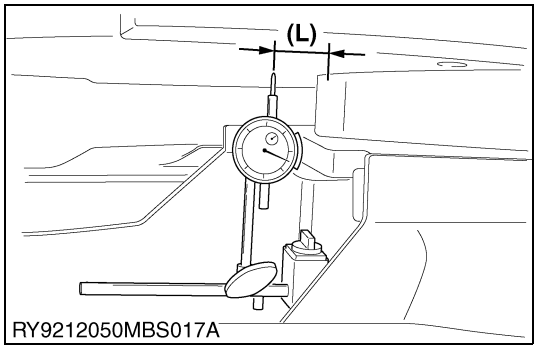
(2) Measuring Swivel Bearing Play

Purpose

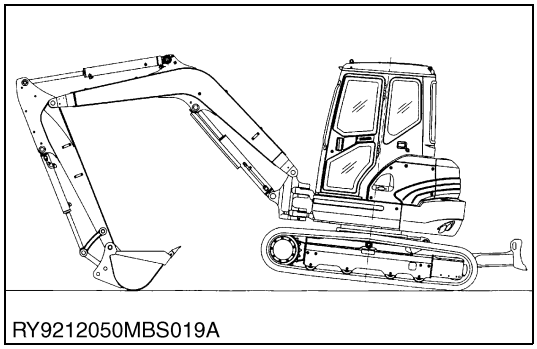
- Assesses the degree of wear in the ball bearings and race surfaces of the swivel bearing according to the amount of wear in the inner and outer races.



RY9212050MBS018A



RY9212050MBS017A



RY9212050MBS019A

[Measurement preparation]

1. Make sure there is no looseness in the swivel bearing mounting bolts.
2. Operate the swivel and make sure there are no abnormal sounds and that it operates smoothly.
3. Fasten the dial gauge and the dial gauge stand to the track frame so the probe of the dial gauge touches the swivel frame.

[Measurement]

1. Arm cylinder fully compressed and bucket cylinder fully extended, keeping the boom base pin and the arm end pin at the same height.
2. Zero the dial gauge.
3. Use the front attachment to tilt the body of the machine upwards and take a reading on the dial gauge.
4. Take three measurements, determine the average and take that as the measured value.

(L) Measurement Position 70 mm (2.76 in.)

RY9212174MBS0080US0

5. SWIVEL GEAR BACKLASH PERFORMANCE

No.	Item		Factory Specification	Notes
(1)	Front play		≤73 mm ≤2.87 in.	
(2)	Swivel bearing play	Std. when new	1.36 mm 0.05 in.	
		Usage limit	2.71 mm 0.11 in.	

RY9212174MBS0049US0

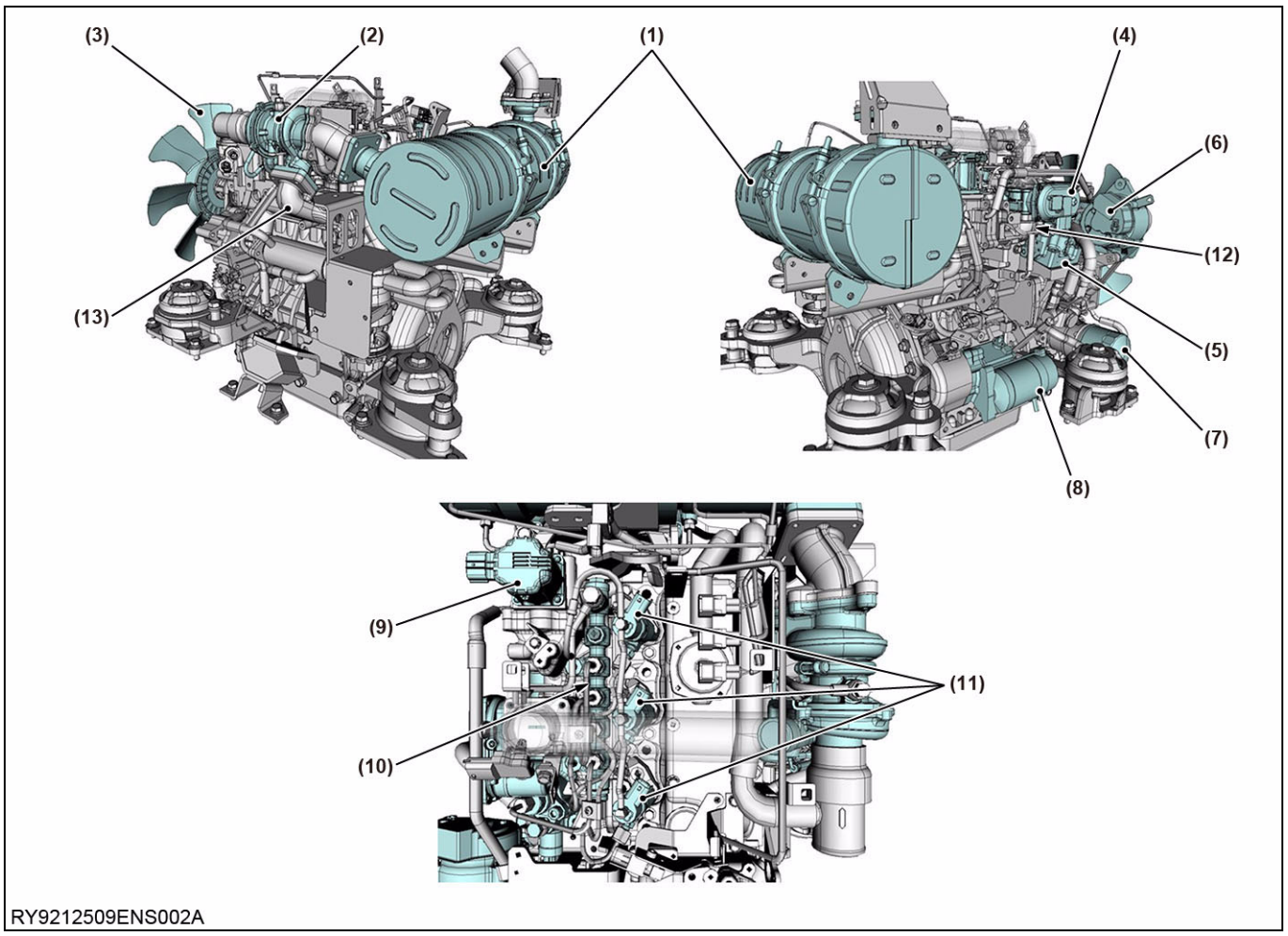
2 ENGINE

GENERAL

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2. SPECIFICATIONS 2-G3
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1. ENGINE DEVICES LAYOUT

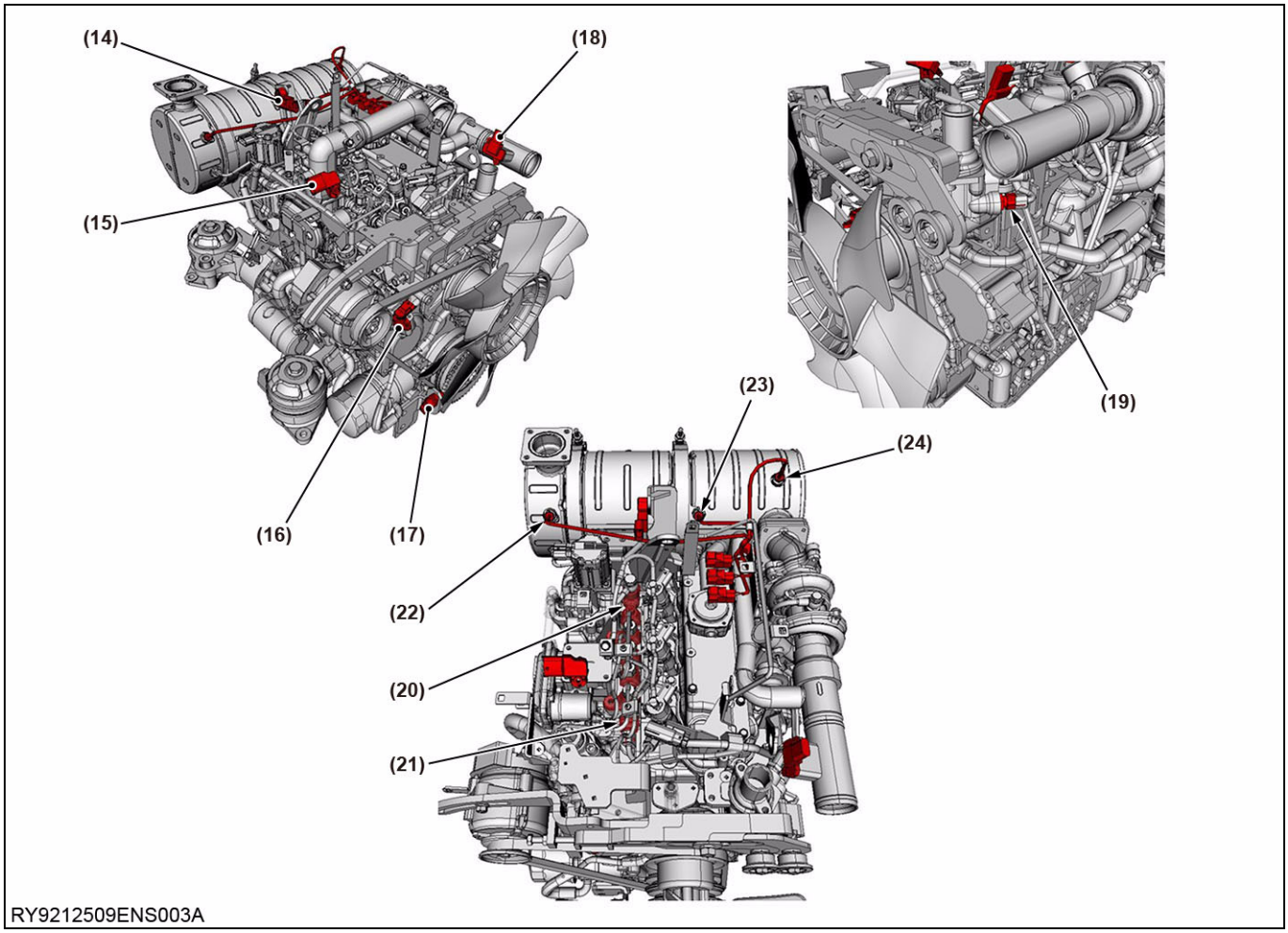


RY9212509ENS002A

(1) DPF Muffler
(2) Turbo Charger
(3) Fan
(4) Intake Throttle Valve
(5) Supply Pump
(6) Alternator
(7) Engine Oil Filter
(8) Starter Motor
(9) EGR Valve
(10) Rail
(11) Injector
(12) In Take Manifold
(13) Out Take Manifold

(To be continued)

(Continued)



(14) Differential Pressure Sensor
(15) Intake Pressure Sensor
(16) Camshaft Sensor
(17) Crank Shaft Sensor
(18) Air Flow Sensor
(19) Water Temperature Sensor
(20) Pressure Limiter
(21) Rail Pressure Sensor
(22) Exhaust Gas Temperature Sensor 2 (T2)
(23) Exhaust Gas Temperature Sensor 1 (T1)
(24) Exhaust Gas Temperature Sensor 0 (T0)

RY9212509END0003US0

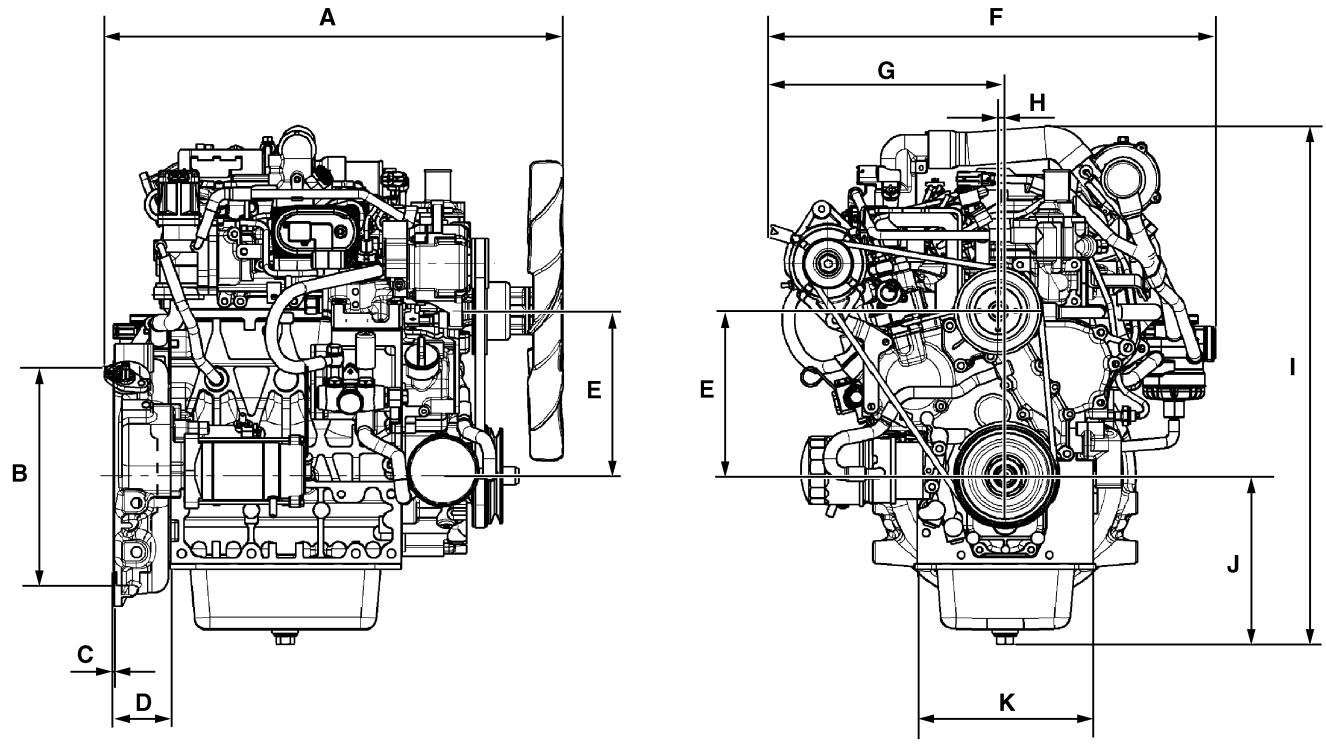
2. SPECIFICATIONS

		KX042-4	
Model		D1803-CR-TE4-BH5 (Not air conditioning)	D1803-CR-TE4-BH6 (Air conditioning)
No. of cylinders		3	
Cylinder Bore X Stroke		87.0 x 102.4 mm (3.43 x 4.03 in.)	
Total displacement		1826 cm^3 (111.4 cu.in.)	
Idling RPM		1150 min^{-1}	
Rated RPM		2200 min^{-1}	
Maximum RPM		2300 min^{-1}	
Rated output/RPM	NET (SAE J1349 JUN95)	29.0 kW / 2200 min^{-1} 38.9 HP / 2200 min^{-1}	28.7 kW / 2200 min^{-1} 38.5 HP / 2200 min^{-1}
	NET (ISO8178)	29.7 kW / 2200 min^{-1} 39.8 HP/ 2200 min^{-1}	
	GROSS (SAE J1995 JUN95)	30.1 kW / 2200 min^{-1} 40.4 HP / 2200 min^{-1}	
Max torque/RPM	NET (SAE J1349 JUN95)	146.9 N·m / 1500 min^{-1} 14.98 kgf·m / 1500 min^{-1} 108.3 lbf·ft / 1500 min^{-1}	146.3 N·m / 1500 min^{-1} 14.92 kgf·m / 1500 min^{-1} 107.9 lbf·ft / 1500 min^{-1}
	NET (ISO8178)	148.3 N·m / 1500 min^{-1} 15.12 kgf·m / 1500 min^{-1} 109.4 lbf·ft / 1500 min^{-1}	
	GROSS (SAE J1995 JUN95)	150.5 N·m / 1500 min^{-1} 15.35 kgf·m / 1500 min^{-1} 111.0 lbf·ft / 1500 min^{-1}	
Machine dimensions (L x W x H)		624 x 610 x 708 mm (24.57 x 24.02 x 27.87 in.)	
Dry weight		205 kg (452 lbs)	
Combustion type		Re-entrant, direction injection type (E-CDIS)	
Fuel injection pump type		Bosch common rail system	
Governor type			
Nozzle type			
Fuel injection timing			
Fuel injection pressure			
Rotation direction		Counterclockwise viewed from flywheel side	
Firing sequence		1-2-3	
Compression ratio		18.1	
EGR		External EGR	
Compression pressure		2.94 to 3.23 MPa (3.0 to 3.3 kgf/cm^2, 426 to 468 psi)	
Fuel consumption (at rated RPM)	NET (ISO8178)	234.6 g/kW·h 174.9 g/HP·h 0.386 lb/HP·h	237.1 g/kW·h 176.8 g/HP·h 0.390 lb/HP·h
	GROSS (SAE J1995 JUN95)	226.0 g/kW·h 168.5 g/HP·h 0.372 lb/HP·h	
Engine oil consumption (at rated RPM)		0.68 g/kW·h (0.50 g/PS·h) or less	
Alternator		12 V, 720 W	

		KX042-4
Battery	ETN	RC125 (MIN), 680CCA (SAE)
	DIN	65Ah (20hr), 680CCA (EN)
	JIS	12V, 52Ah (5hr), 90D26L
Starter motor		12 V, 1.4 kW

RY9212509END0001US0

3. DIMENSIONS

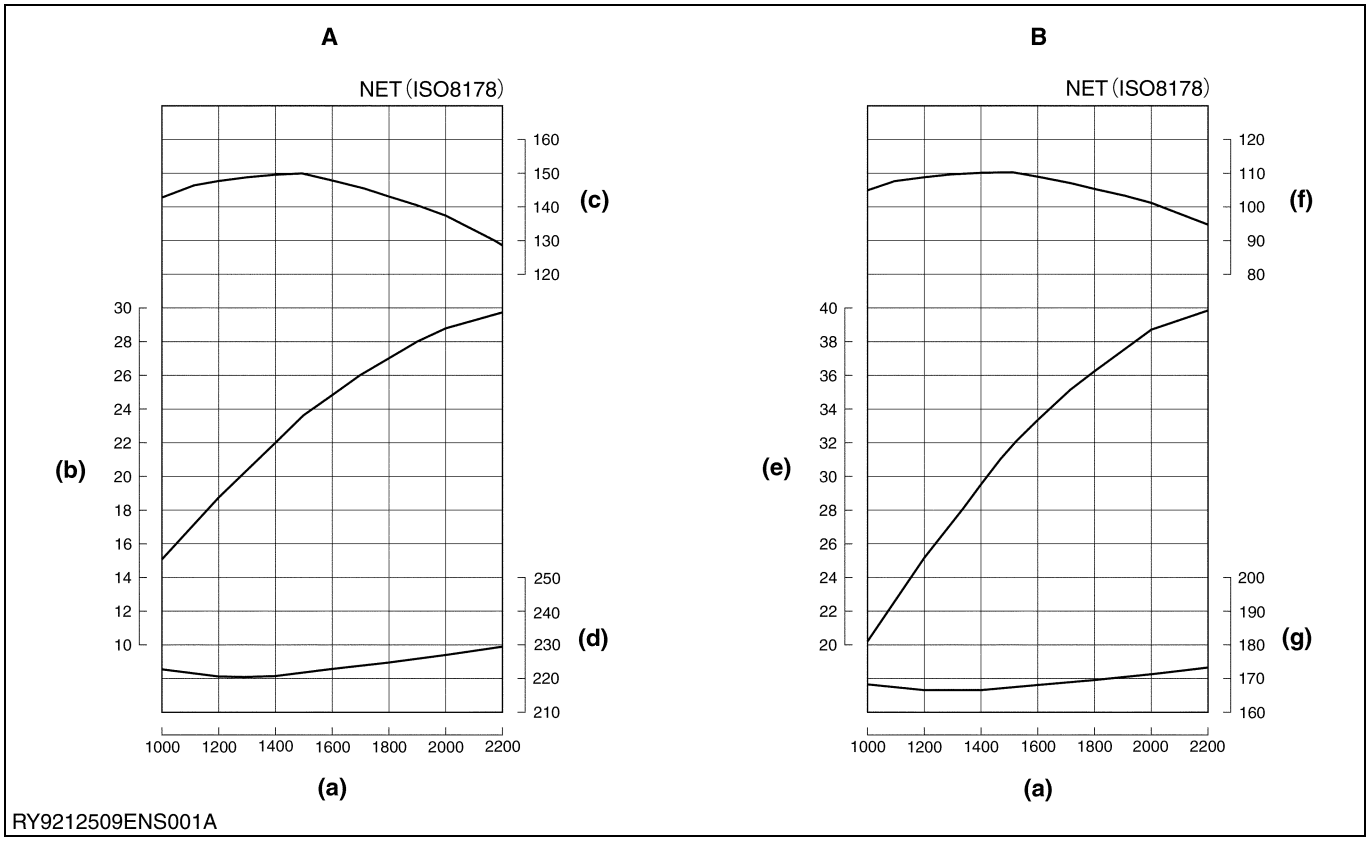


RY9212174ENS001A

A	624.4 mm (24.58 in.)	**E**	225 mm (8.86 in.)	**I**	708.1 mm (27.88 in.)
B	ϕ300 mm (11.81 in.)	**F**	610 mm (24.02 in.)	**J**	230.5 mm (9.07 in.)
C	1.2 mm (0.05 in.)	**G**	323.9 mm (12.75 in.)	**K**	240 mm (9.45 in.)
D	78 mm (3.07 in.)	**H**	10 mm (0.39 in.)		

RY9212174END0002US0

4. PERFORMANCE CURVES



RY9212509ENS001A

(a) Engine RPM
(b) Output (kW)
(c) Torque (N·m)
(d) Fuel Consumption (g/kWh)
(e) Output (HP)
(f) Torque (ft/lb)
(g) Fuel Consumption (g/HPh)
A : SI Unit
B : US Units of Work

RY9212509END0002US0

3 HYDRAULIC SYSTEM

MECHANISM

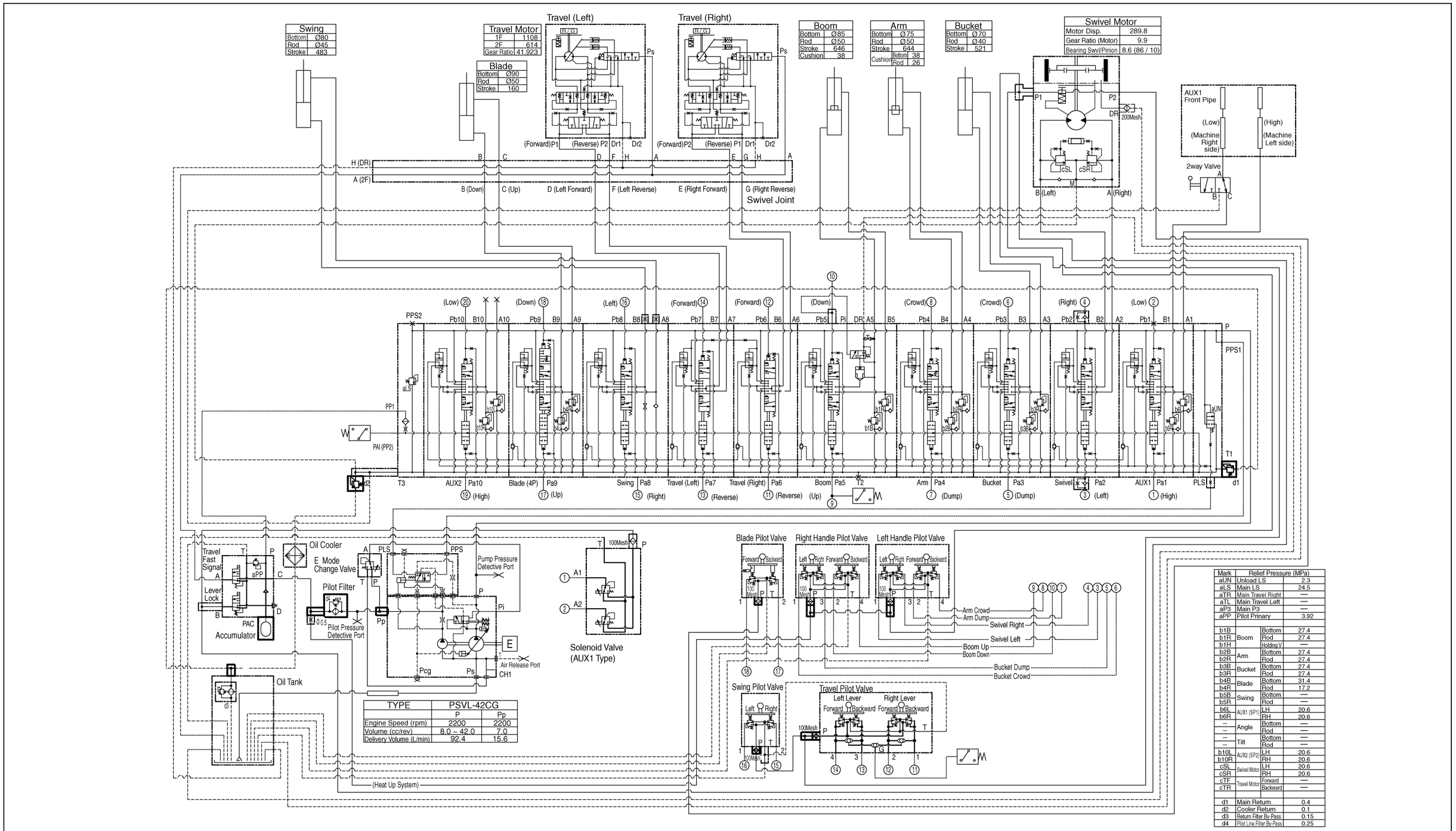
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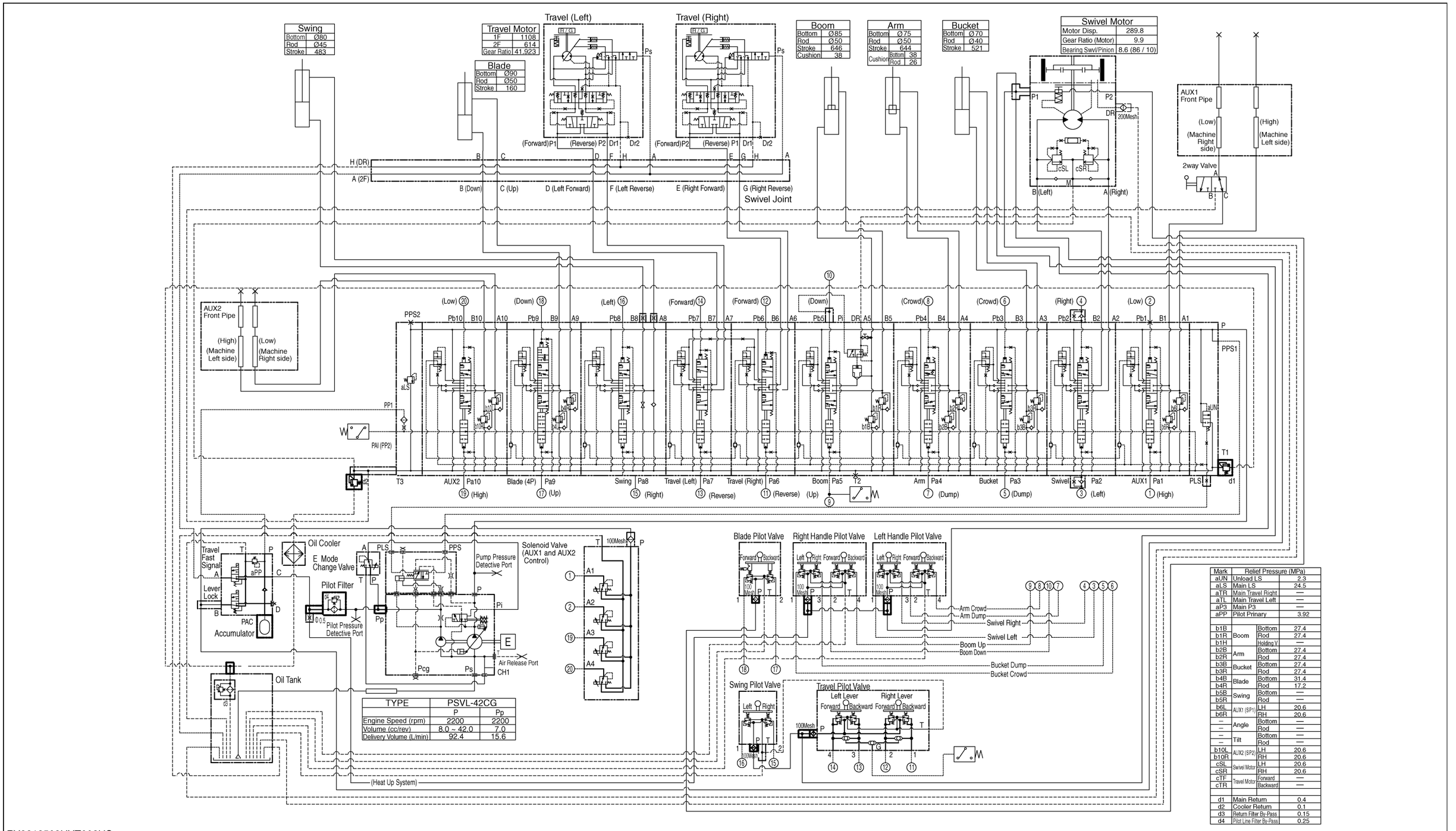
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1. HYDRAULIC CIRCUIT DIAGRAM

[1] HYDRAULIC CIRCUIT DIAGRAM (STANDARD SPECIFICATIONS (AUX1, AUX2)



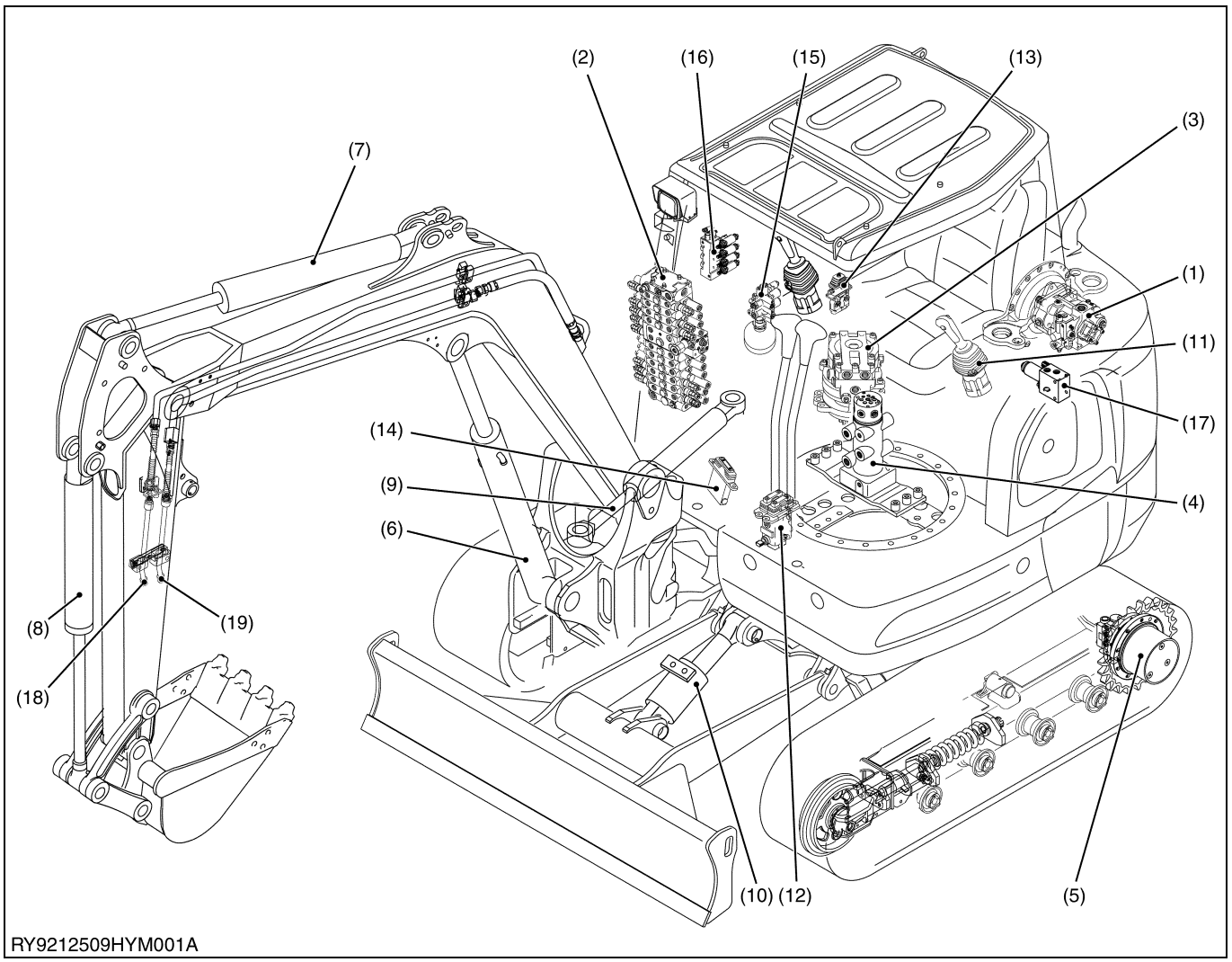
RY9212509HYT001US



Mark	Relief Pressure (MPa)		
aUN	Unload LS		2.3
aLS	Main LS		24.5
aTR	Main Travel Right		—
aTL	Main Travel Left		—
aP3	Main P3		—
aPP	Pilot Primary		3.92
b1B	Boom	Bottom	27.4
b1R		Rod	27.4
b1H		Holding V	—
b2B	Arm	Bottom	27.4
b2R		Rod	27.4
b3B	Bucket	Bottom	27.4
b3R		Rod	27.4
b4B	Blade	Bottom	31.4
b4R		Rod	17.2
b5B	Swing	Bottom	—
b5R		Rod	—
b6L	AUX1 (SP1)	LH	20.6
b6R		RH	20.6
–	Angle	Bottom	—
–		Rod	—
–	Tilt	Bottom	—
–		Rod	—
b10L	AUX2 (SP2)	LH	20.6
b10R		RH	20.6
cSL	Swivel Motor	LH	20.6
cSR		RH	20.6
cTF	Travel Motor	Forward	—
cTR		Backward	—
d1	Main Return		0.4
d2	Cooler Return		0.1
d3	Return Filter By-Pass		0.15
d4	Pilot Line Filter By-Pass		0.25

RY9212509HYT002US

2. HYDRAULIC DEVICE LAYOUT

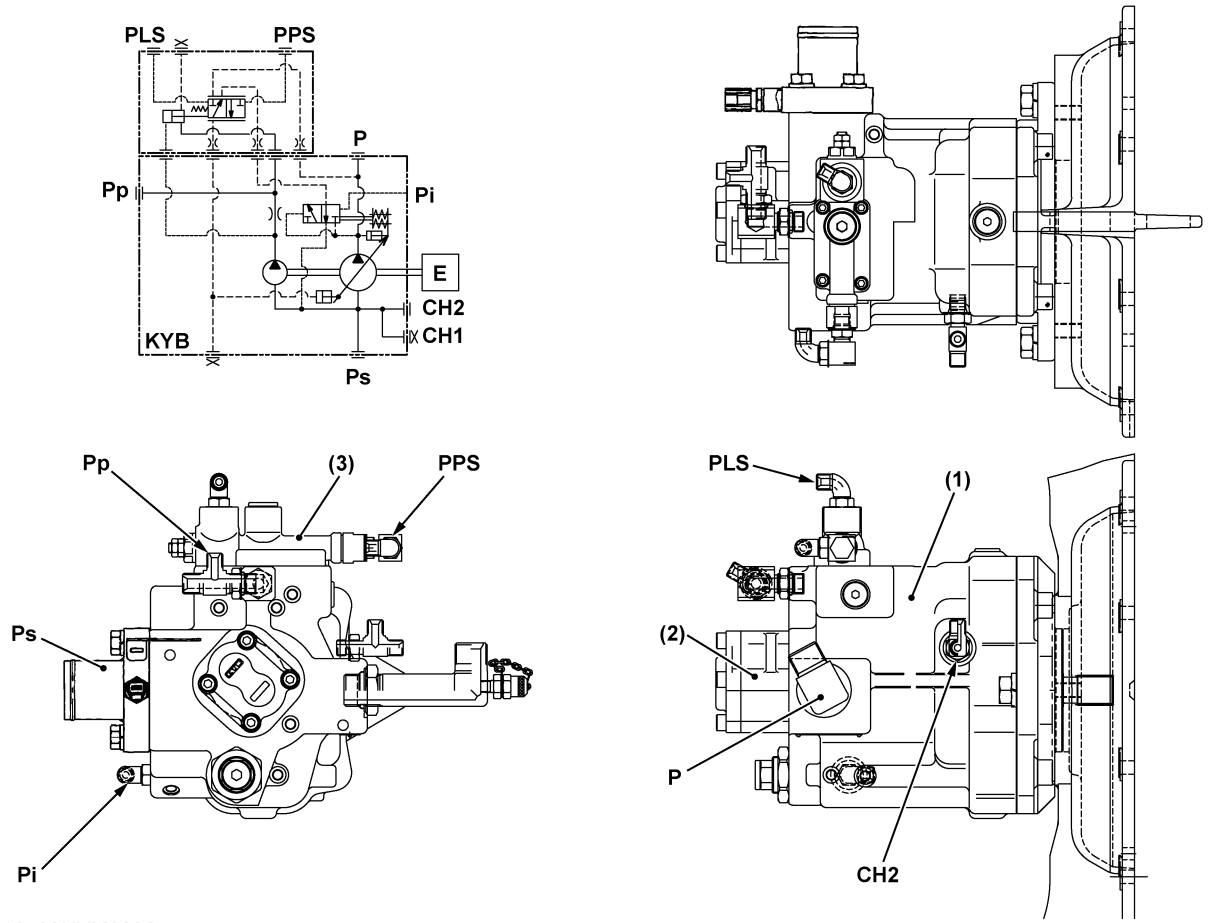


RY9212509HYM001A

(1) Pump
(2) Control Valve
(3) Swivel Motor
(4) Swivel Joint
(5) Travel Motor
(6) Boom Cylinder
(7) Arm Cylinder
(8) Bucket Cylinder
(9) Swing Cylinder
(10) Blade Cylinder
(11) Control Pilot Valve
(12) Travel Pilot Valve
(13) Blade Pilot Valve
(14) Swing Pilot Valve
(15) Unload Valve
(16) AUX Solenoid Valve
(17) EP Solenoid Valve
(18) AUX1
(19) AUX2

RY9212509HYM0002US0

3. PUMP
[1] SPECIFICATIONS



RY9212509HYM003A

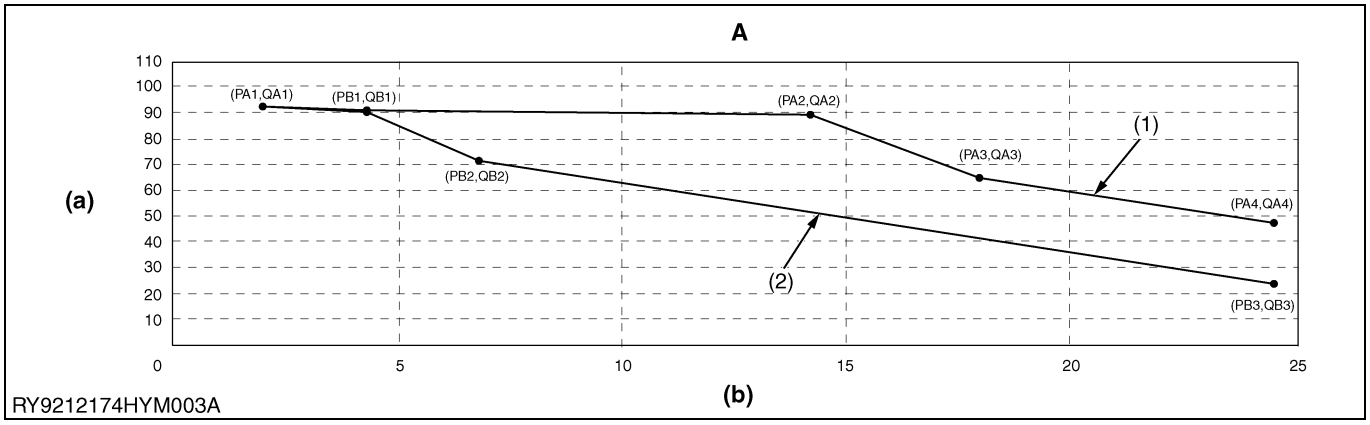
(1) Variable Pump
(2) Gear Pump (Pp)
(3) L/S Regulator

P: Piston Pump Discharge Pressure
Pp : Pilot Pump Discharge Pressure
PLS:Load Pressure
PPS:Valve Inlet Pressure
PS: Suction Pressure
CH2:Air Bleed
Pi : EP Mode Limit Pressure

Maker		KYB
Model		PSVL-42-E
Rated RPM		2200 rpm
Rotation direction		Right
Piston pump	Max displacement	42.0 cc/rev 2.2 cu.in./rev
Pilot pump		7.0 cc/rev 0.4 cu.in./rev
Standby flow amount		17.6 L/min 4.6 U.S.gals.

RY9212509HYM0007US0

Piston pump horsepower control curve



(1) Pi = 3.6 MPa (P-Mode)
(2) Pi = 0 MPa

(A) Piston Pump Power Constant Characteristics

(a) Delivery Flow: Q (L/min)

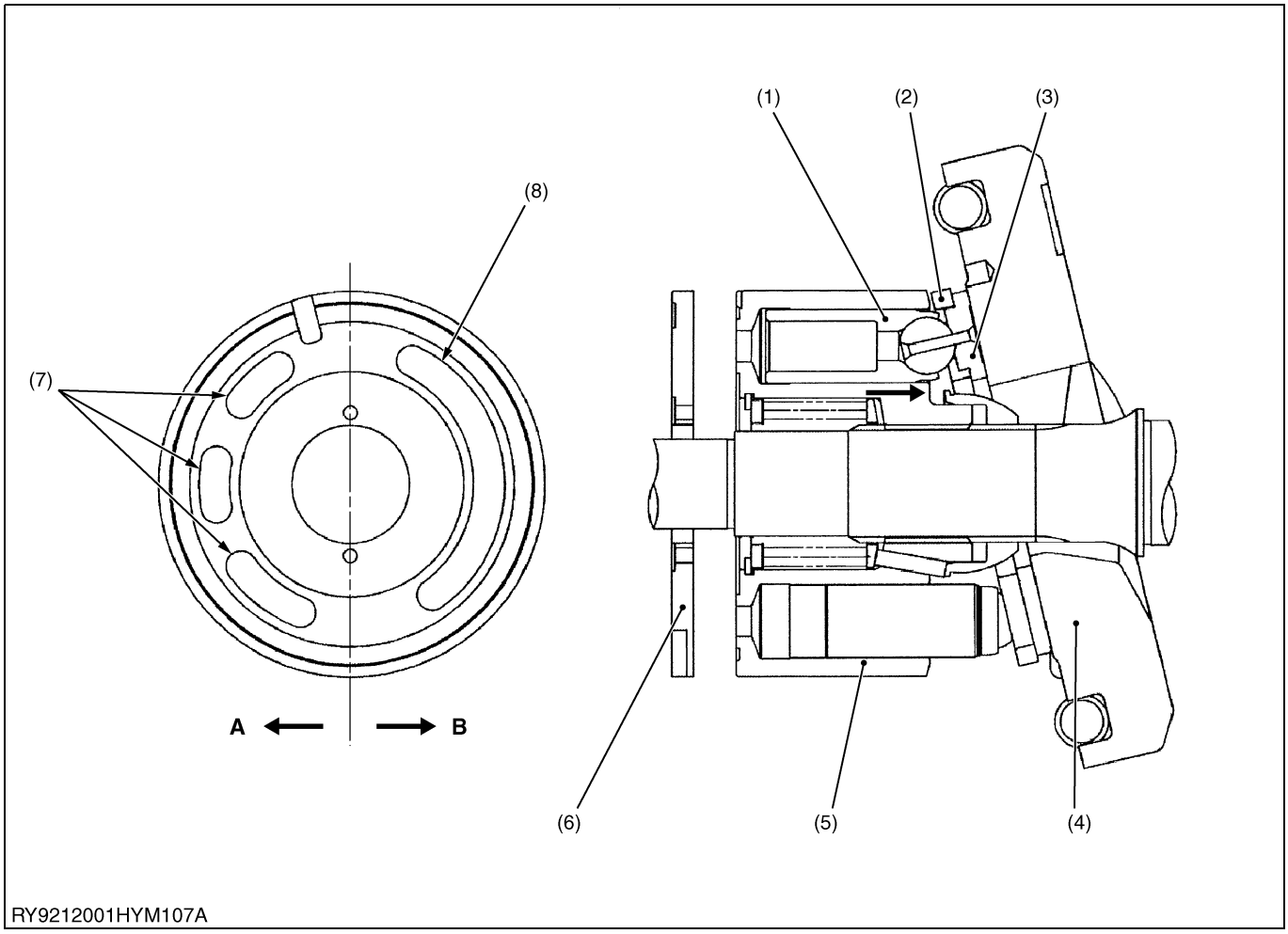
(b) Pressure: P (MPa)

Shaft speed: 2200 rpm			
P mode		**ECO mode**	
Pressure (MPa)	**Delivery flow (L/min)**	**Pressure (MPa)**	**Delivery flow (L/min)**
PA1 = 2.0	QA1 = 92.4	PB1 = 4.3	QB1 = 90.4
PA2 = 14.5	QA2 = 87.9	PB2 = 6.8	QB2 = 71.6
PA3 = 19.0	QA3 = 65.0	PB3 = 24.5	QB3 = 23.3
PA4 = 24.5	QA3 = 51.0		

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[2] FUNCTION AND STRUCTURE

(1) Operating Principles



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(1) Piston	(4) Swash Plate	(7) Discharge Port	**A : Discharge Side**
(2) Retainer Plate	(5) Cylinder Block	(8) Suction Port	**B : Suction Side**
(3) Shoe	(6) Valve Plate		

There are nine pistons (1) built into the cylinder block (5) and it is coupled to the axle via a spline.

Also, one end of the cylinder block is in contact with a valve plate (6), which has two half-moon shaped ports (kidney ports); these two kidney ports are connected to suction and discharge ports respectively, so when the cylinder block rotates, the pistons are connected to the passage on the suction side for an interval of 180 degrees and to the discharge side for the remaining interval.

The shoes (3) are crimped so they can rotate freely against the ball on the end of the piston, and the retainer plate (2) presses them against the swash-plate (4).

As a result, the shoes are always in contact with the swash-plate as it moves, so as the angle of the swash-plate changes, that translates into changes in the stroke of the piston and ultimately alters the amount of discharge from the pump.

As a result of the cylinder block rotation, the side that is pressed into the cylinder block by the piston via the swash-plate is the discharge path.

At that point, the compressed chambers of the cylinder block are connected to the kidney ports on the discharge side **A** and the side where the pistons are being withdrawn become the suction path and are connected to the suction side kidney port.

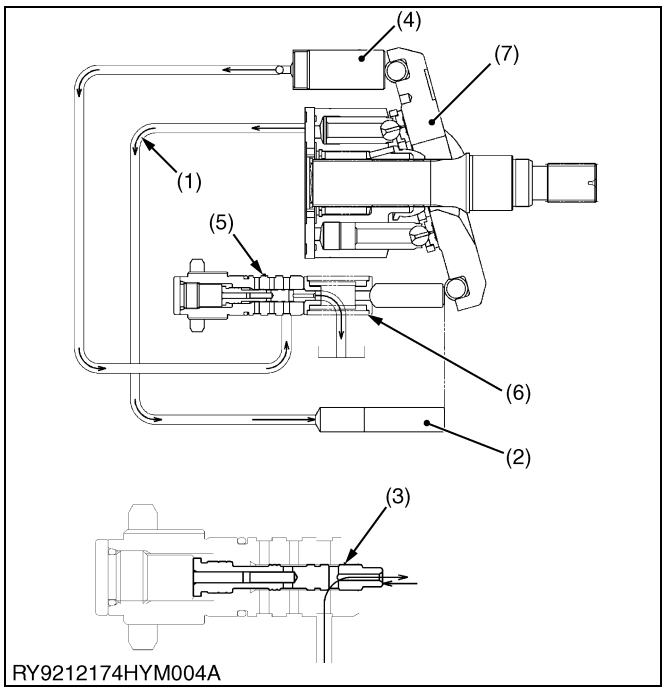
As a consequence, during the interval of one revolution of the cylinder block, each piston alternately provides suction at the suction port and then discharge at the discharge port. Thus smooth pump operation is achieved by having nine pistons constantly alternating between suction and discharge.

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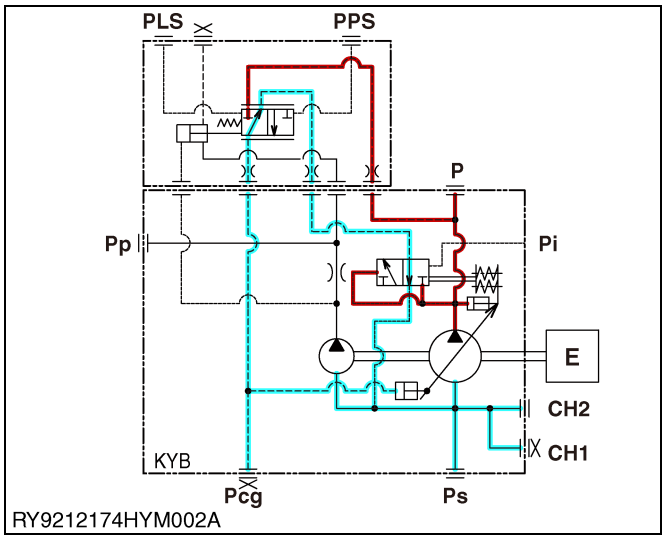
(2) Horsepower Control

Horsepower control is a matter of controlling the discharge flow of the piston pump in such a way that the total consumed horsepower (torque) of the pump does not exceed the specified horsepower (torque) of the engine.

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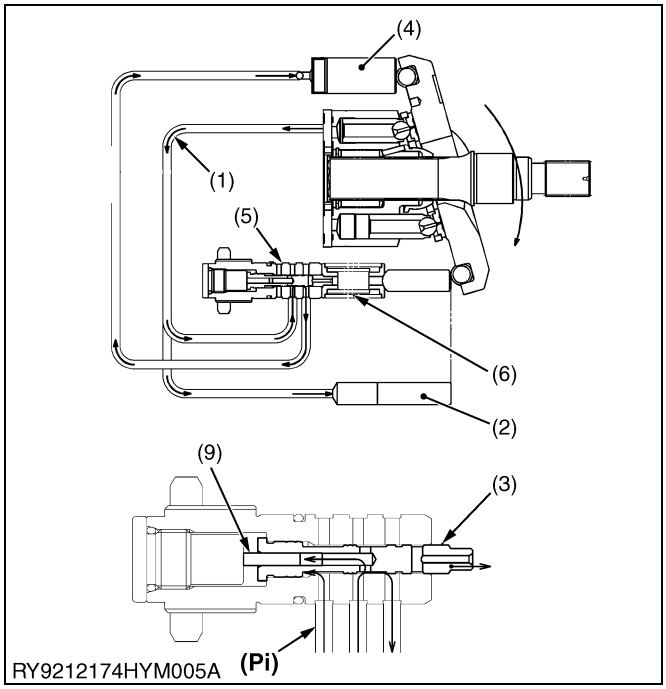
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1. When pressure P is low (when the load is low)

The discharge pressure (1) from the piston pump is guided to control pin A (2) via oil passages inside the case. The pressure guided to control pin A produces a bias pressure equivalent to the pressure P against the swash-plate, thus pressuring the swash-plate. When pressure P is low, the horsepower control spool (3) is positioned at the far left, thus connecting control pin B (4) to the tank via the horsepower control spool, so there is no force on control pin B, which results in the maximum swash-plate tilt angle and discharge flow.

(1) Discharge Pressure P
(2) Control Pin A
(3) Horsepower Control Spool
(4) Control Pin B
(5) Horsepower Control Valve
(6) Horsepower Control Spring
(7) Swash Plate

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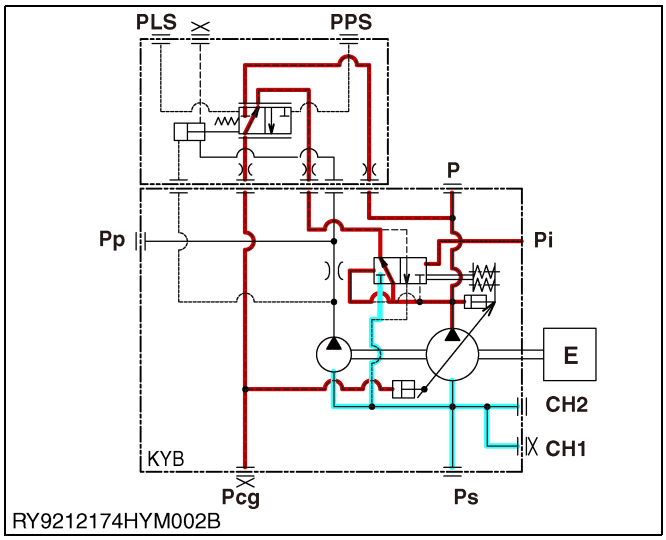
2. When pressure P increases (when the load increases)

When the piston pump discharges pressure P (1) rises due to the load, the horsepower control spool (3) in the middle of the diagram moves to the right. This connects discharge pressure P to control pin B (4), creating pressure on control pin B and thus reducing the swash-plate tilt angle and reducing discharge flow. The pump discharge pressure P is also connected to control pin A (2), but due to the difference in surface area, the swash-plate tilt angle is reduced. When the swash-plate tilt angle is reduced, the horsepower control spool is moved back to the left by the horsepower control springs (6), cutting off the connection between discharge pressure P and control pin B, and this results in a balance of pressure.

Increasing pressure on the E-mode control pressure **(Pi)** exerts a load on the horsepower control spool (3) pushing to the left, so compared to when pressure is not applied to the E-mode control pressure **(Pi)**, it allows an increase in the pump's effective horsepower.

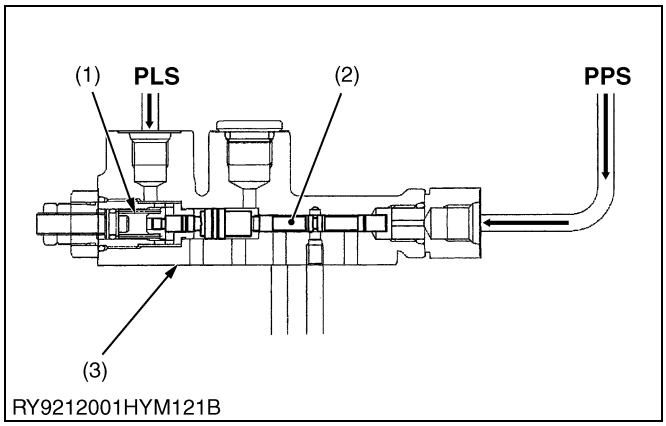
(1) Discharge Pressure P
(2) Control Pin A
(3) Horsepower Control Spool
(4) Control Pin B
(5) Horsepower Control Valve
(6) Horsepower Control Spring
(9) Reaction Pin
(Pi) From E-mode Limit Pressure

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(3) Flow Control (LS Control)

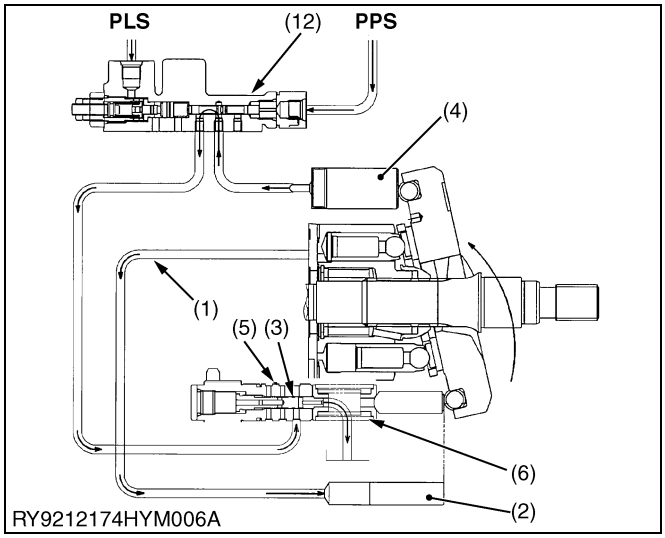


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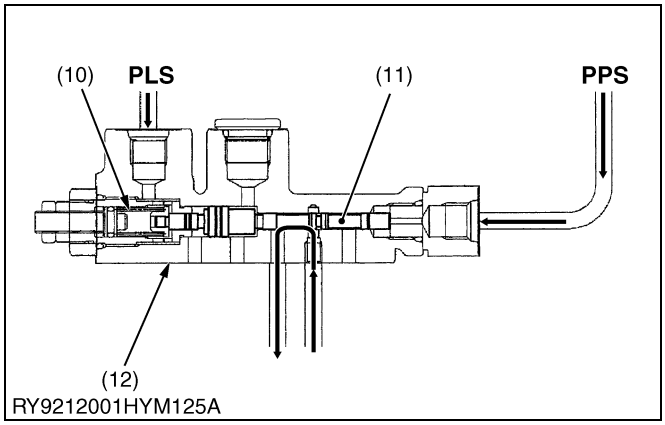
LS control supplies the pressure and flow needed for a given load by controlling the pump's discharge pressure and flow so that pump discharge pressure PPS = load pressure PLS + spring pressure.

(10) Spring
(11) Spool
(12) L/S Regulator

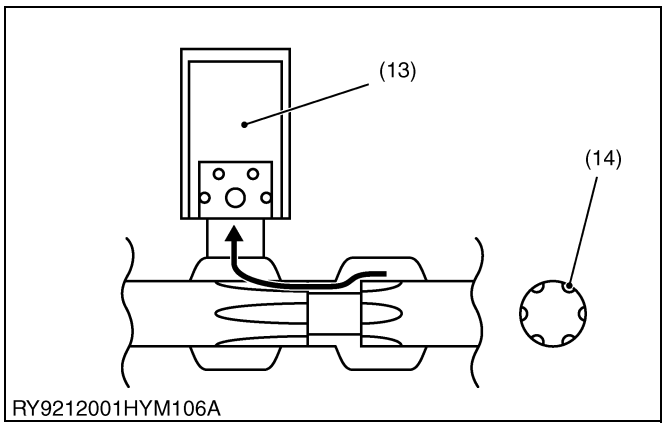
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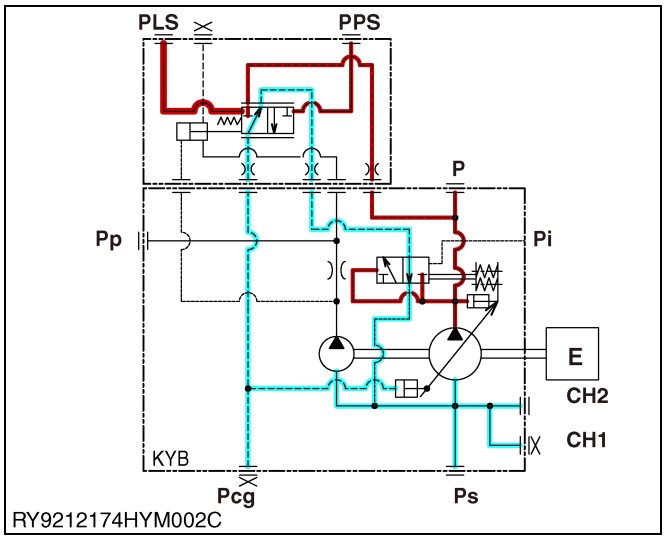
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RY9212001HYM106A



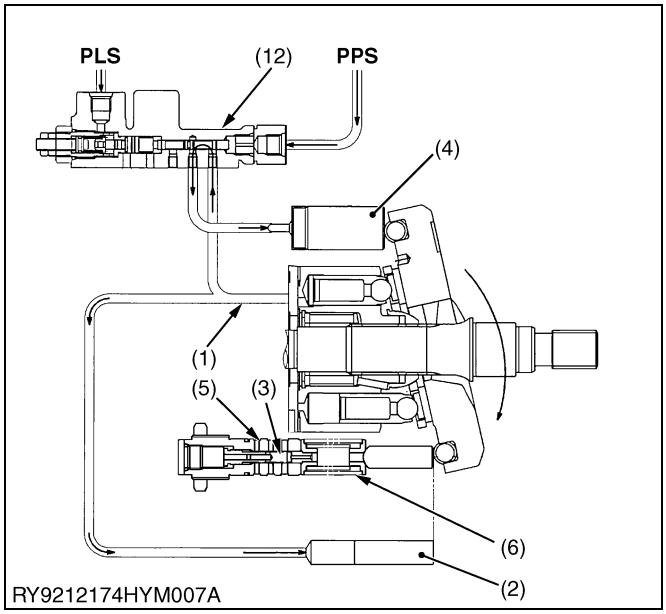
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1. When the control valve is open wide

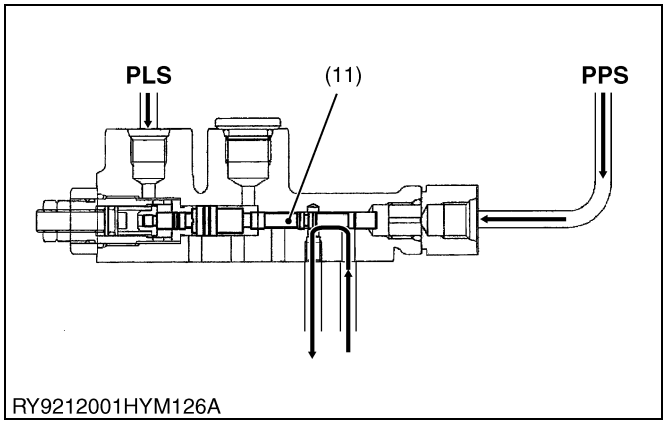
If the control valve spool is opened wide (14) in order to quickly actuates the actuator, the pressure differential between the pump discharge pressure P (1) and the load pressure drops temporarily, moving the spool (11) of the L/S regulator (12) to the right; this connects control pin B (4) to the horsepower control valve (5). When this happens, the horsepower control spool (3) moves to the left, connecting the control pin B to the tank, thus increasing the swash-plate tilt angle and increasing discharge flow. This equalizes the differential pressure and moves the L/S regulator spool back to the left.

(1) Discharge Pressure P
(2) Control Pin A
(3) Horsepower Control Spool
(4) Control Pin B
(5) Horsepower Control Valve
(6) Horsepower Control Spring
(10) Spring
(11) Spool
(12) L/S Regulator
(13) Compensator Spool
(14) Opening Area

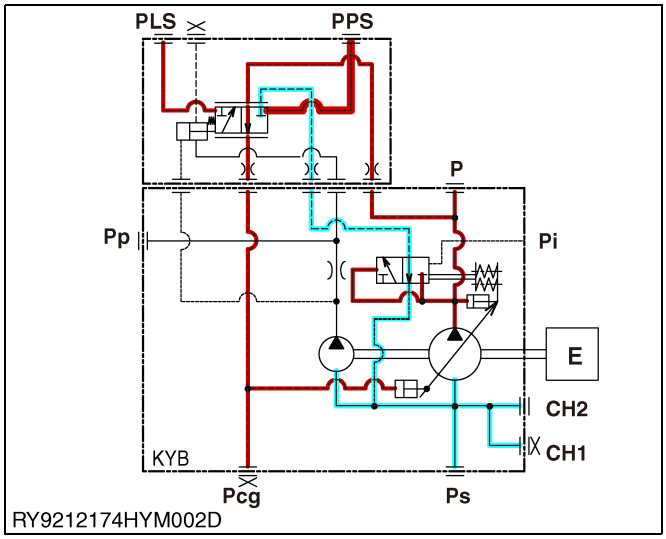
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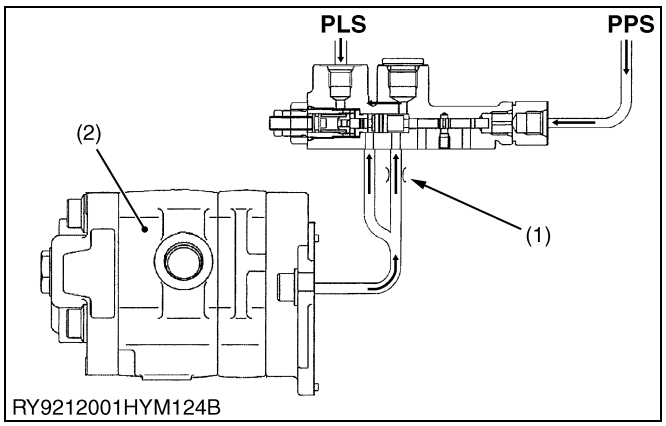
2. When the control valve is slightly open

When the control valve is only slightly open, it produces a large difference in pressure between the pump discharge pressure P (1) and the load pressure, so the spool of the L/S regulator moves to the left and the discharge pressure P and control pin B (4) are connected. When this happens, it creates pressure on control pin B, thus reducing the swash-plate tilt angle and reducing the discharge flow. The pump discharge pressure is also connected to control pin A (2), but due to the difference in surface area, the swash-plate tilt angle is reduced.

(1) Discharge Pressure P
(2) Control Pin A
(3) Horsepower Control Spool
(4) Control Pin B
(5) Horsepower Control Valve
(6) Horsepower Control Spring
(11) Spool
(12) L/S Regulator

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(4) Gain Control

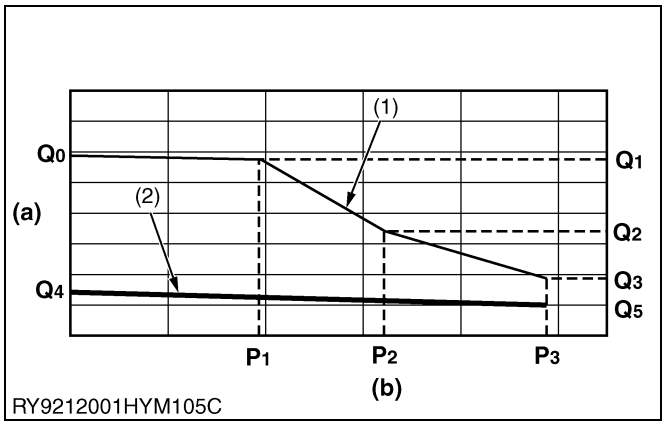


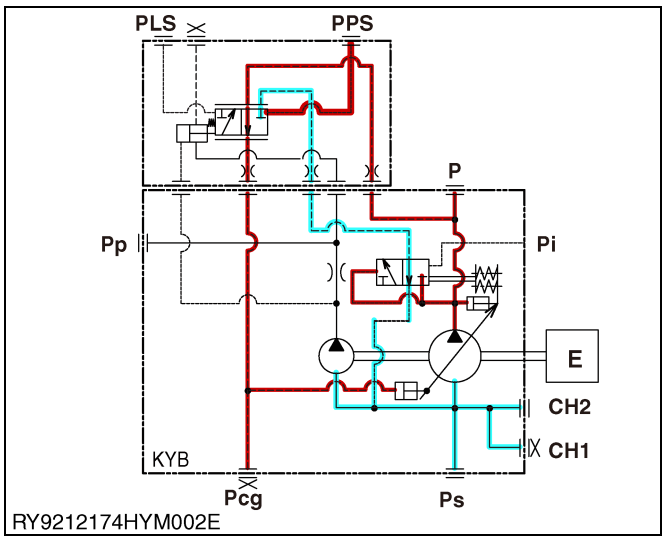
There is an orifice (1) in the discharge circuit of the pilot pump (2) that leads to the spool of the L/S regulator for differential pressures that arise from acceleration in engine RPM. This orifice makes it possible to control pump discharge pressure and flows so that pump discharge pressure PPS = load pressure PLS + spring pressure + differential pressure. In other words, it changes the PPS and PLS differential pressure control from a constant control to a variable control and enables the proportional flow control of the engine RPM by how wide the same control valve is open.

(1) Orifice (2) Gear Pump (Pilot Pump)

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(5) Standby Flow Amount





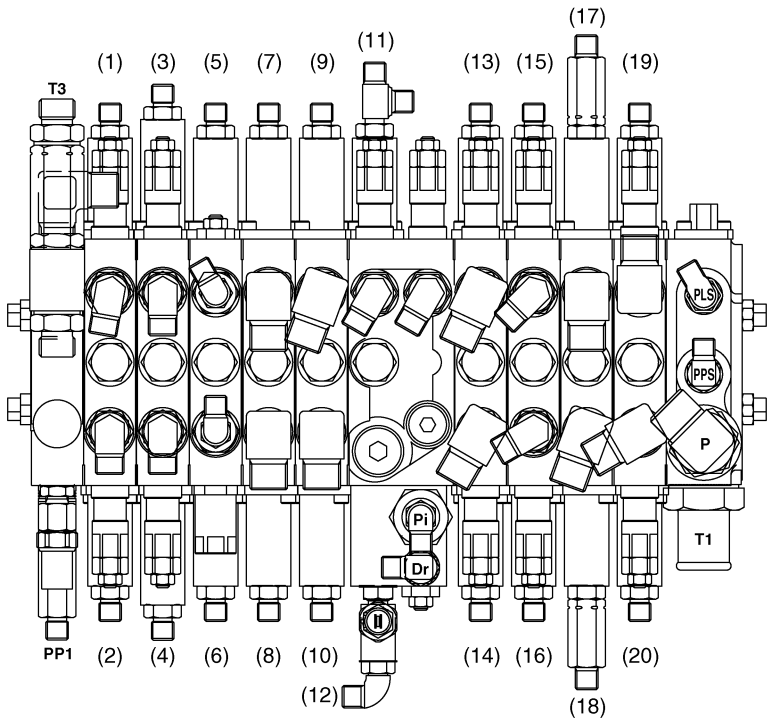
A standby flow volume is established so that oil is always flowing in the hydraulic system, even when idling. Because oil is always flowing to the oil cooler, it is possible to lower the oil temperature. The control valve is in a center closed circuit, so when all the sections are in neutral, the operating oil returns to the tank via an unload valve.

(1) Horsepower Control Curve **(a) Discharge Flow**
(2) Standby Flow Amount **(b) Discharge Pressure**

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4. CONTROL VALVE

[1] SPECIFICATIONS



RY9212172HYM001A

(1) AUX2 Low (Pb10)
(2) AUX2 High (Pa10)
(3) Blade Down (Pb9)
(4) Blade Up (Pa9)
(5) Swing Left (Pb8)
(6) Swing Right (Pa8)
(7) Travel Left Forward(Pb7)
(8) Travel Left Reverse (Pa7)
(9) Travel Right Forward (Pb6)
(10) Travel Right Reverse (Pa6)
(11) Boom Down (Pb5)
(12) Boom Up (Pa5)
(13) Arm Crowd (Pb4)
(14) Arm Dump (Pa4)
(15) Bucket Crowd (Pb3)
(16) Bucket Dump (Pa3)
(17) Swivel Right (Pb2)
(18) Swivel Left (Pa2)
(19) AUX1 Low (Pb1)
(20) AUX1 High (Pa1)

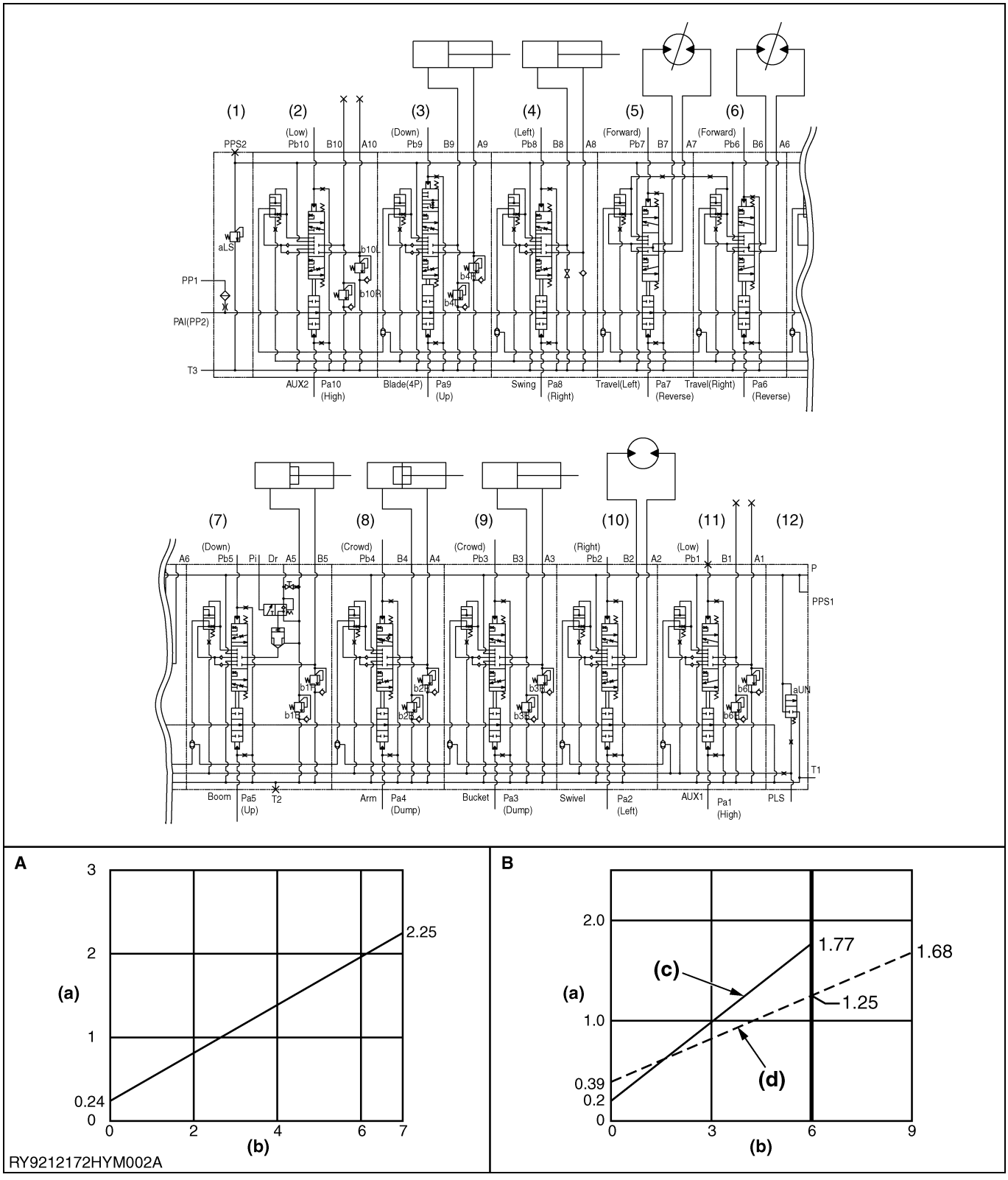
(To be continued)

(Continued)

Item				Notes
Maker			KYB	
Model			KVSX-12B-10	
Main relief valve setting pressure	Unload (aUN)		2.7 MPa 28 kgf/cm^2 392 psi	23 L/min, 5.8 U.S.gals
	Main LS (aLS)		24.5 MPa 250 kgf/cm^2 3550 psi	42 L/min., 11.1 U.S.gals
Overload relief valve setting pressure	Boom	b1B b1R	27.4 MPa 279 kgf/cm^2 3974 psi	At 5 L/min (300 cu.in./min, 1.3 USGPM)
	Arm	b2B b2R	27.4 MPa 279 kgf/cm^2 3974 psi	
	Bucket	b3B b3R	27.4 MPa 279 kgf/cm^2 3974 psi	
	Blade	b4B	31.4 MPa 320 kgf/cm^2 4554 psi	
		b4R	17.2 MPa 175 kgf/cm^2 2495 psi	
	AUX1	b6L b6R	20.6 MPa 210 kgf/cm^2 2990 psi	
	AUX2	b10L b10R	20.6 MPa 210 kgf/cm^2 2990 psi	

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Hydraulic Circuit Diagram



(1) Outlet
(2) AUX2
(3) Blade
(4) Swing
(5) Travel Left
(6) Travel Right
(7) Boom
(8) Arm
(9) Bucket
(10) Swivel
(11) AUX1
(12) Inlet

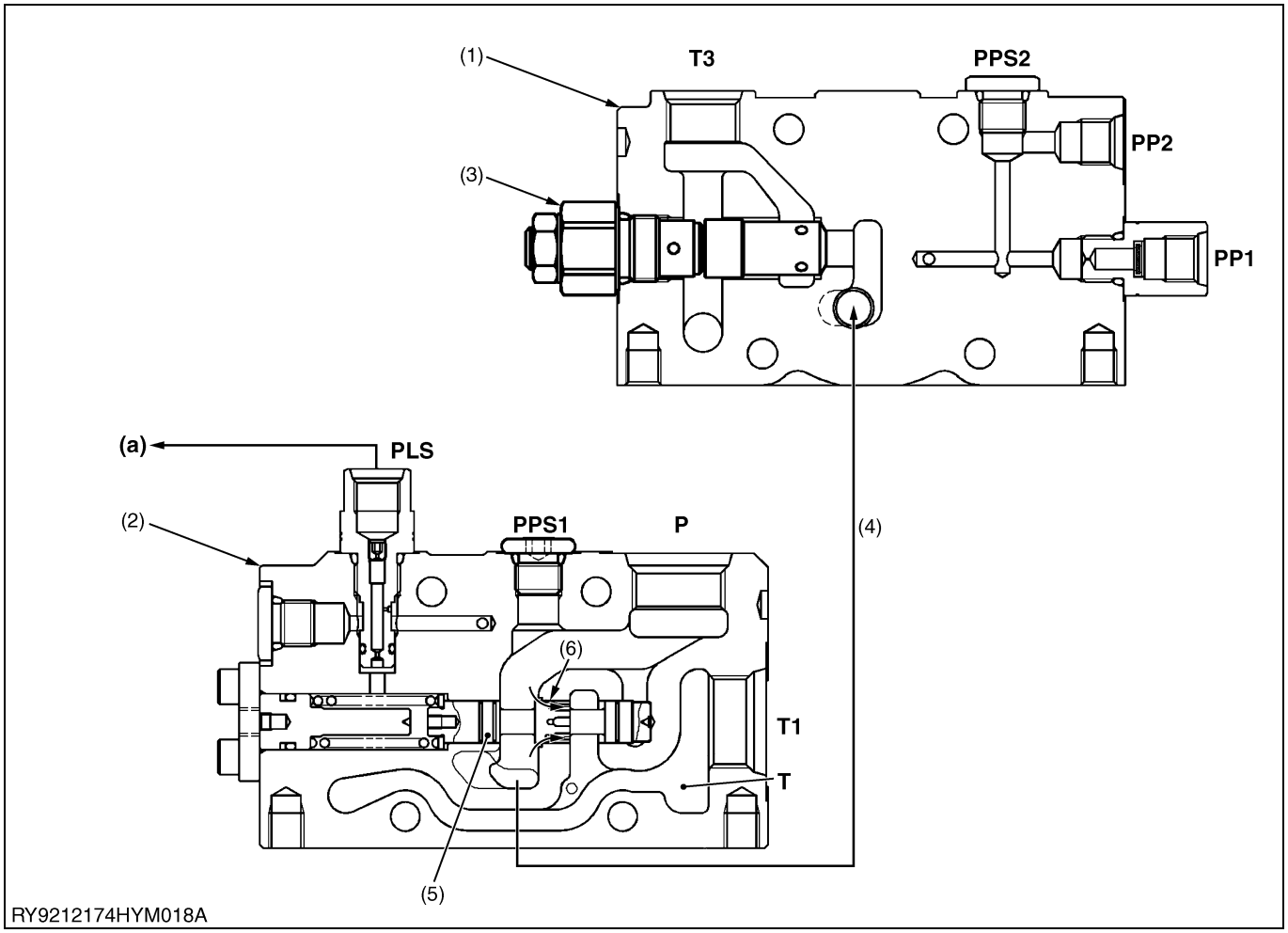
A : Main Spool Pressure Receiver Characteristics
B : Blade Section Receiver Characteristics
(a) Pilot Pressure (MPa)
(b) Spool Stroke (mm)
(c) Pa9
(d) Pb9

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[2] FUNCTION AND STRUCTURE

(1) Unload Valve Section

When in neutral

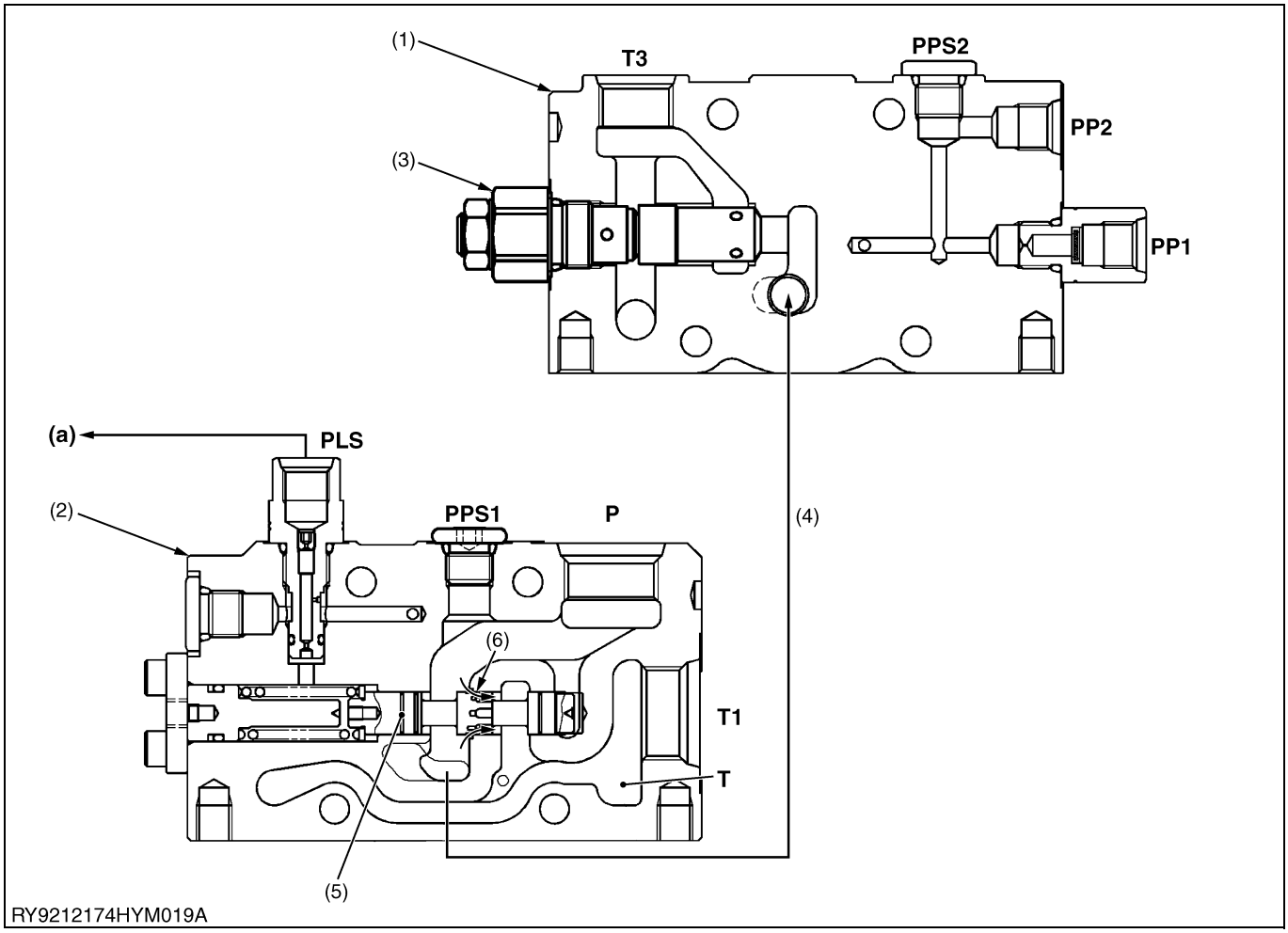


(1) Outlet Section
(2) Inlet Section
(3) Main Relief Valve (aLS)
(4) Spool Section
(5) Unload Spool
(6) Notch
(a) To Pump

- Pump discharge pressure PPS and maximum load pressure PLS act on either end of the unload spool (5).
- When the spool section is in neutral, no PLS pressure is generated, so PLS=tank pressure ≈ 0 and only spring pressure (unload valve setting pressure) acts on the left side of the unload spool (5).
- Hydraulic oil flowing from the pump port P is guided to each spool section, but when a spool section is in neutral, the pump pressure passage is shut off and pump discharge pressure PPS rises.
- When pump discharge pressure PPS rises to the unload valve setting pressure, the unload spool moves to the left side, and the pump pressure passage is connected to the tank circuit via the notch (6) in the unload spool (5). This mechanism maintains the pump pressure passage PPS at the unload valve setting pressure.
- The unload valve is set at a pressure somewhat higher than the LS control differential pressure value set for the pump, so the pump maintains a standby flow rate status (fixed flow rate).

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During Fine Operation of the Spool Section

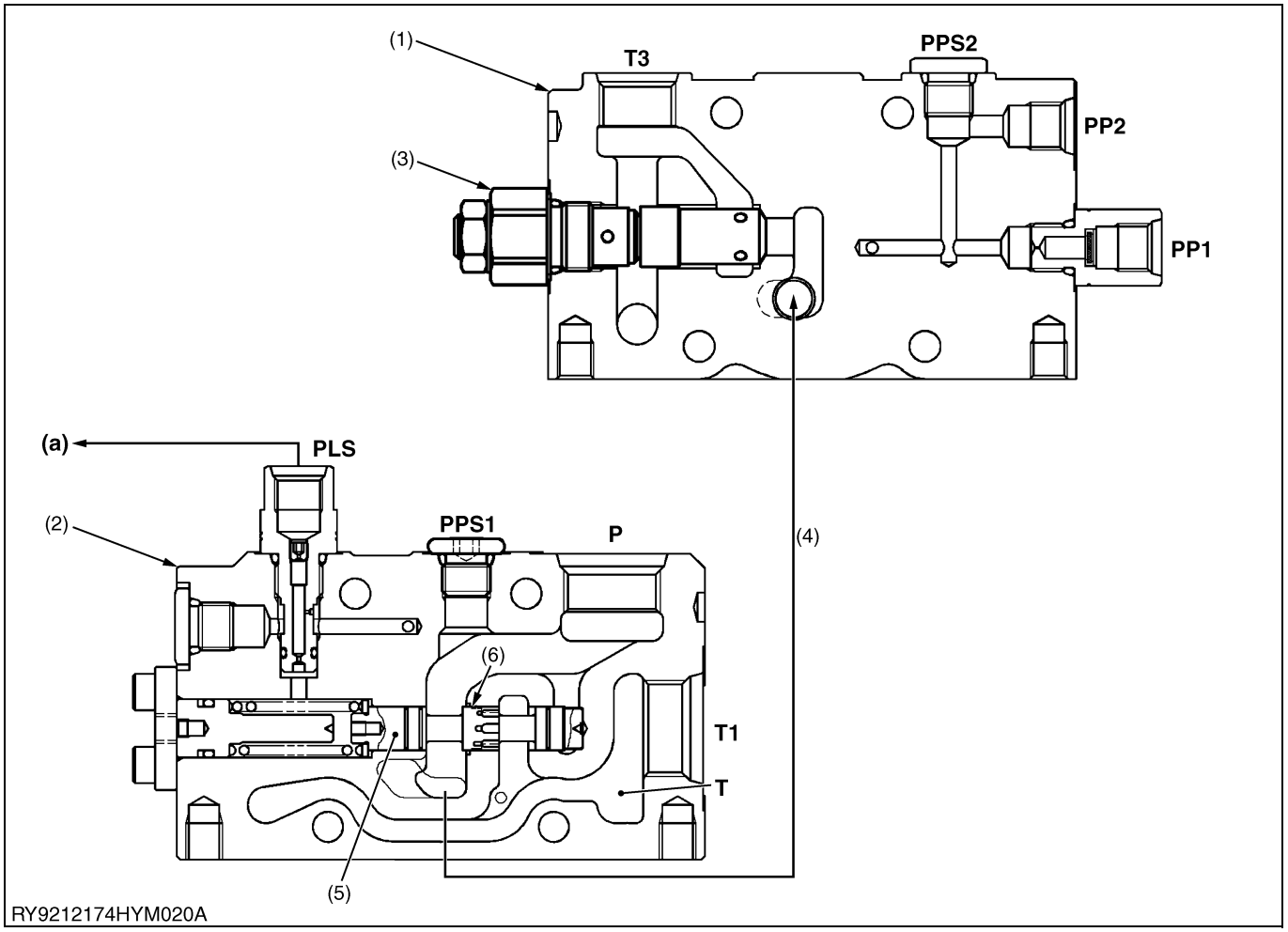


(1) Outlet Section
(2) Inlet Section
(3) Main Relief Valve (aLS)
(4) Spool Section
(5) Unload Spool
(6) Notch
(a) To Pump

- When the spool section is switched, the oil in the pump pressure passage passes through the main spool and is discharged to the cylinder port. The operating load pressure of the cylinder port is guided from inside the spool section to the PLS pressure passage and becomes the PLS pressure. (Refer to the explanation of how the spool section operates.)
- As long as the amount switched from the spool section is small (fine operation), the open area of the spool section becomes also small, so it increases the pressure differential (PPS-PLS) between the pump pressure PPS and PLS.
- Once the pressure differential (PPS-PLS) between the pump pressure PPS and PLS reaches the unload valve setting pressure, the unload spool (5) moves to the left side, automatically adjusting the open area in the notch between the pump pressure passage and the tank passage, thus maintaining a steady pressure differential (PPS-PLS) between the pump pressure PPS and PLS. (The area open at the notch is smaller than when the spool section is in neutral)
- The mechanism described above maintains a constant pressure differential (PPS-PLS) between the pump pressure PPS and PLS, even when there is a change in the spool section operating load pressure.
- The unload valve is set at a pressure somewhat higher than the LS control differential pressure value set for the pump, so the pump maintains a standby flow rate status (fixed flow rate).

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During Operation of the Spool Section



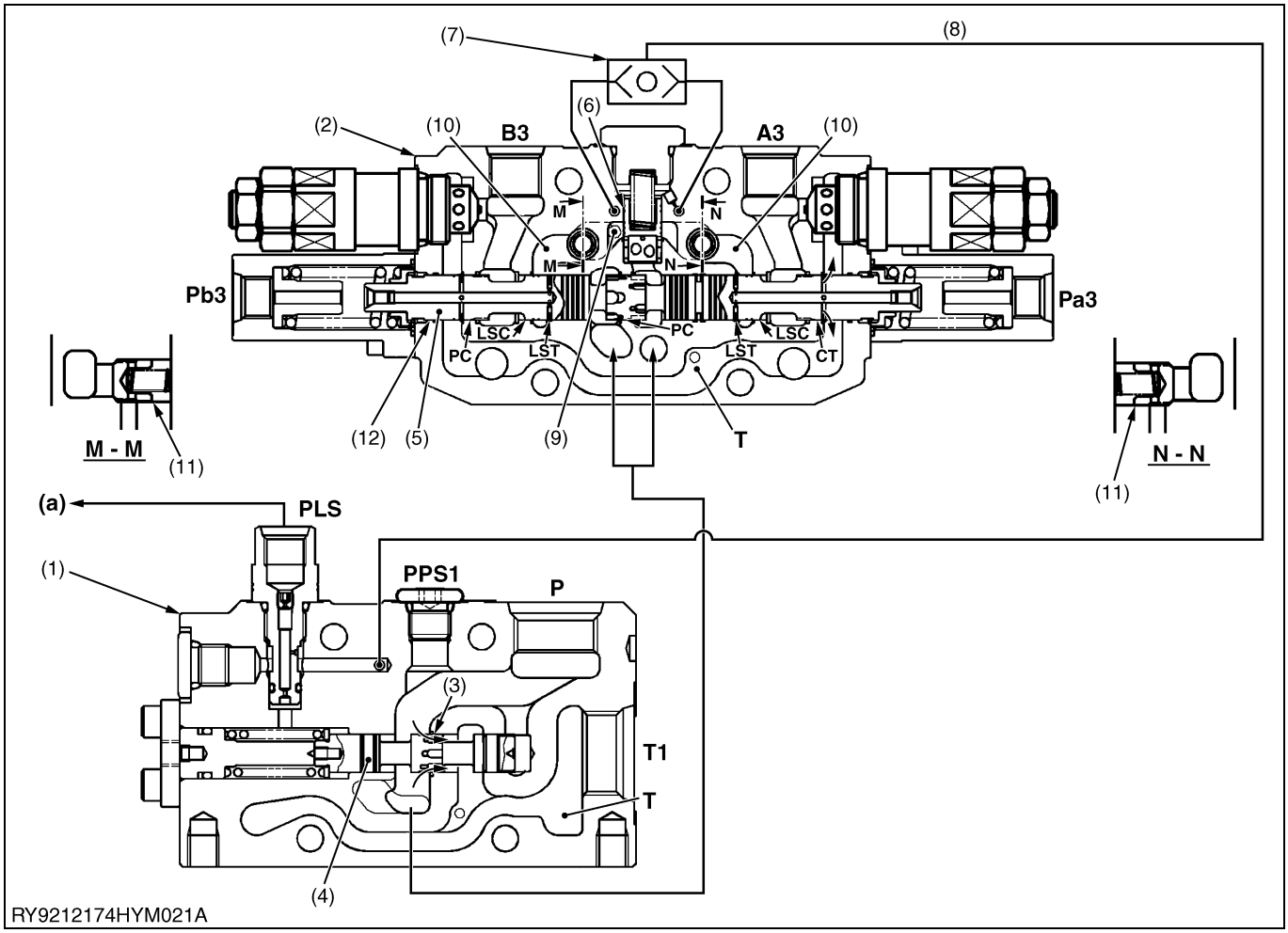
(1) Outlet Section
(2) Inlet Section
(3) Main Relief Valve (aLS)
(4) Spool Section
(5) Unload Spool
(6) Notch
(a) To Pump

- When the spool section is switched, the oil in the pump pressure passage passes through the main spool and is discharged to the cylinder port. The operating load pressure of the cylinder port is guided from inside the spool section to the PLS pressure passage and becomes the PLS pressure. (Refer to the explanation of how the spool section operates.)
- When the shifting amount of the spool in the section is large, the area of the spool section that opens is large, so it reduces the pressure differential (PPS-PLS) between the pump pressure PPS and PLS.
- When the pressure differential (PPS-PLS) between the pump pressure PPS and PLS drops to the unload valve setting pressure, the unload spool (5) moves to the right side, closing the opening at the notch between the pump pressure passage and the tank circuit, thus completely closing the unload spool.
- If the pressure differential (PPS-PLS) between the pump pressure PPS and PLS drops further to the LS limit pressure differential setting set for the pump, it increases the pump's swash-plate tilt angle, thus increasing the pump's discharge flow rate.
- The pump automatically changes the discharge flow rate according to the amount the spool section is switched and changes in the operating load pressure, thus limiting it to maintain a constant differential pressure (PPS-PLS) between the pump pressure PPS and PLS.

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(2) Spool Section Operation

When in neutral

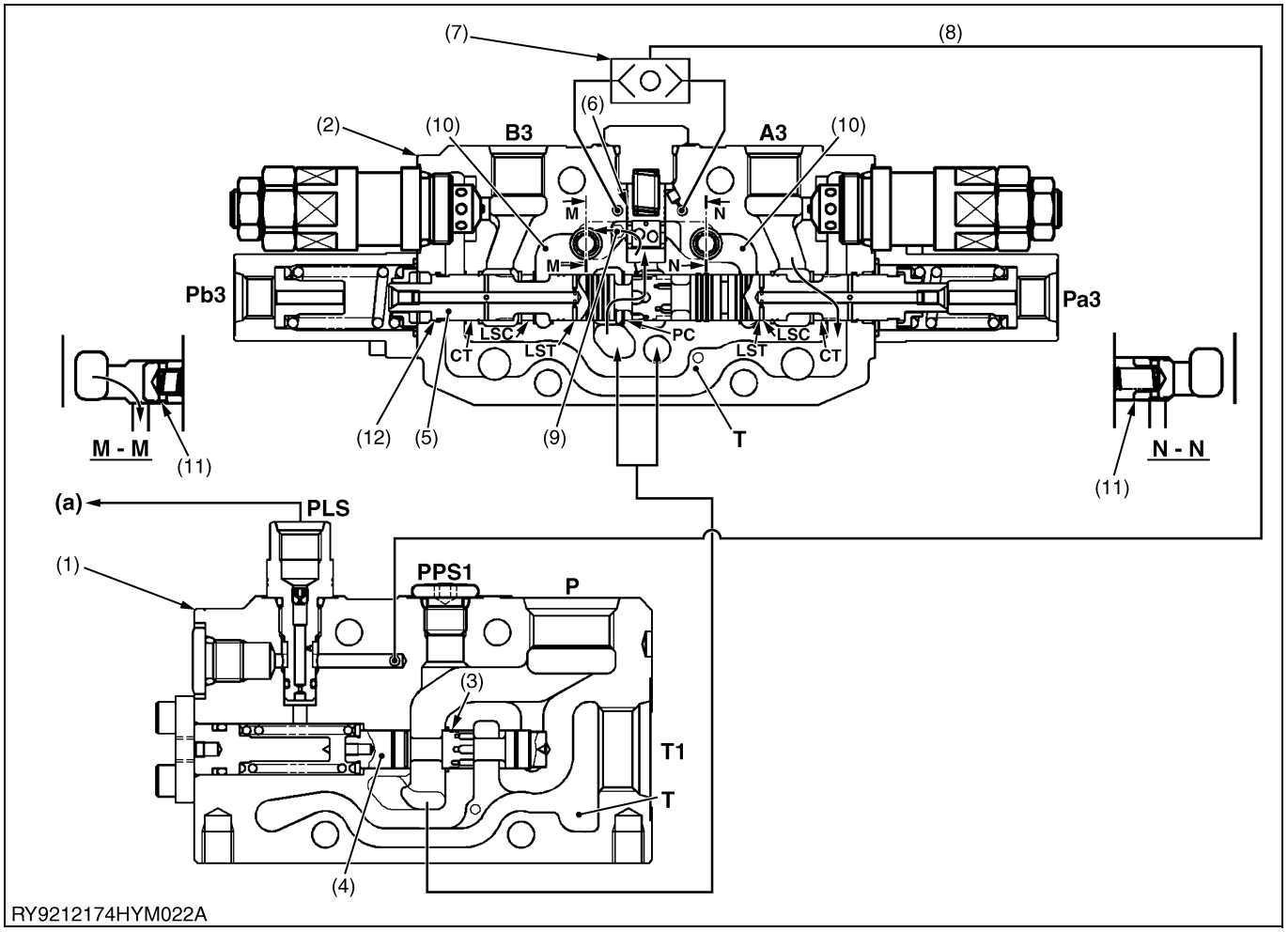


(1) Inlet Section	(5) Main Spool	(9) LS Pressure Guide	**(a) To Pump**
(2) Bucket Section	(6) Compensator Spool	(10) LS	
(3) Notch	(7) High-Pressure Selector Plate	(11) Load Check Poppet	
(4) Unload Spool	(8) PLS Pressure Circuit	(12) Air Bleed Micro-Orifice	

- Oil flowing from pump port P is guided into the pump pressure passage.
- The main spool PC notch, which opens/closes the pump pressure passage and the compensator upstream passage, is closed.
- Pump pressure PPS becomes the unload valve setting pressure and with the pump discharge flow rate at standby flow, the entire flow from the unload valve is returned to the tank circuit. (Refer to the explanation of the unload valve operation.))
- The main spool LSC and CT notch, which are connected to the cylinder port, are closed, keeping the actuator connected to the cylinder port in a stopped state.
- The LS and tank circuit are linked via the LST hole drilled in the main spool so LS=tank pressure.

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When Pb port pressurized

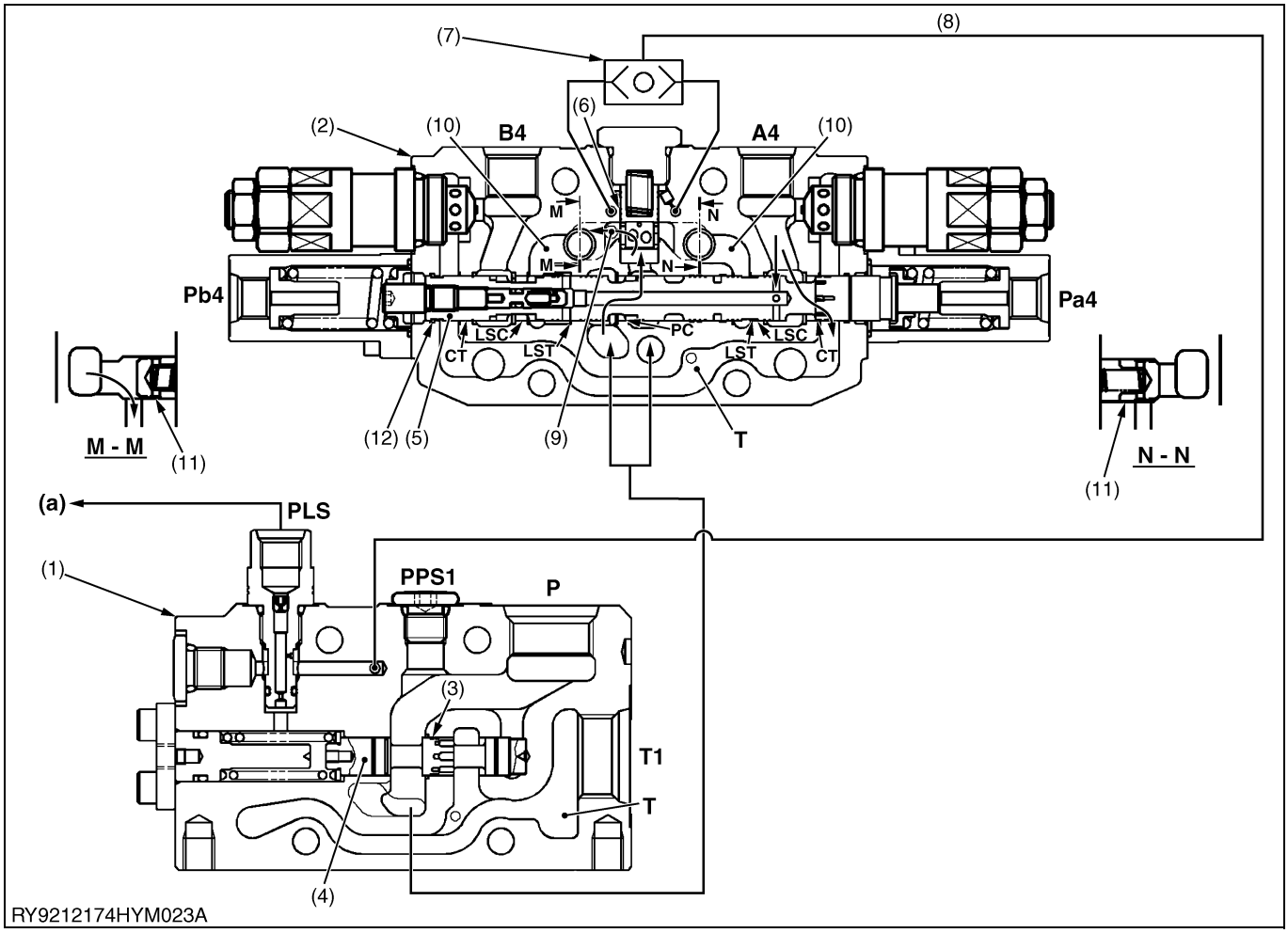


(1)	Inlet Section	(5) Main Spool	(9) LS Pressure Guide	**(a) To Pump**
(2)	Bucket Section	(6) Compensator Spool	(10) LS	
(3)	Notch	(7) High-Pressure Selector Plate	(11) Load Check Poppet	
(4)	Unload Spool	(8) PLS Pressure Circuit	(12) Air Bleed Micro-Orifice	

- When the spool is shifted by the Pb port pressure, the pump pressure PPS is guided to cylinder port B via the main spool PC notch, compensator spool C notch, the left load check and the main spool LSC notch.
- When the Pb port is pressurized, part of the hydraulic oil flow passes through the air bleed micro-orifice and returns to the tank circuit.
- The pressure (load pressure) in the load check upstream passage is guided to the PLS pressure circuit via the valve housing LS pressure guide and high pressure selector plate, becoming the PLS pressure; it is then guided to the pump as the PLS signal pressure from the PLS port.
- The pressure PPS in the pump pressure passage is guided to the pump from the PPS port as the pump signal pressure.
- Oil flowing back from the actuator is guided from cylinder port A to the tank circuit via the main spool CT notch.
- It flows in the reverse direction when the Pa port is pressurized.

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(3) Arm Regeneration Function

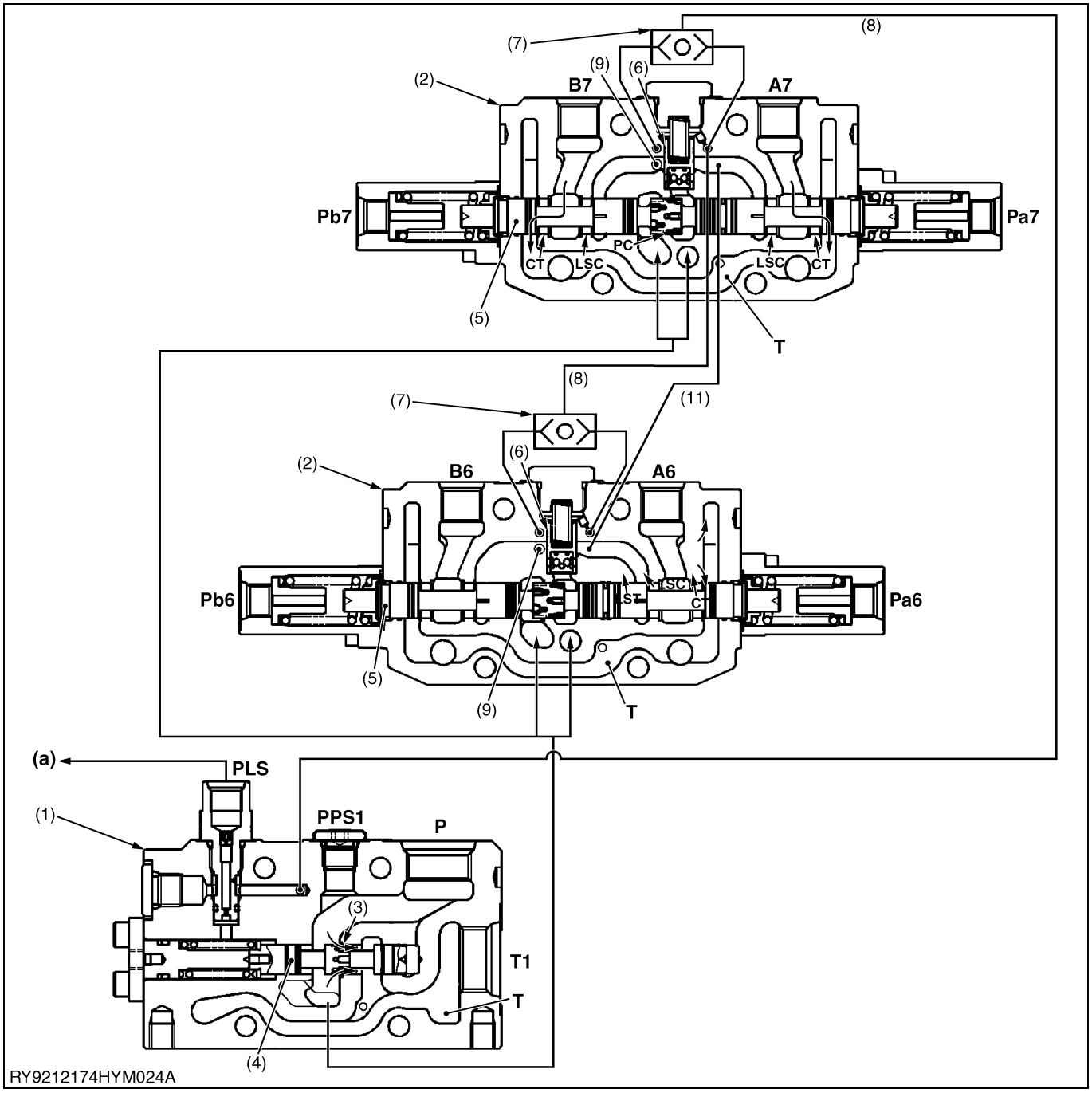


(1) Inlet Section	(5) Main Spool	(9) LS Pressure guide	**(a) To Pump**
(2) Bucket Section	(6) Compensator Spool	(10) LS	
(3) Notch	(7) High-Pressure Selector plate	(11) Load Check Poppet	
(4) Unload Spool	(8) PLS Pressure Circuit	(12) Air bleed Micro-Orifice	

- When the spool is shifted by the Pb port pressure, the pump pressure PPS is guided to cylinder port B via the main spool PC notch, compensator spool C notch, the left load check and the main spool LSC notch.
- When the Pb port is pressurized, part of the hydraulic oil flow passes through the air bleed micro-orifice and returns to the tank circuit.
- The pressure (load pressure) in the load check upstream passage is guided to the PLS pressure circuit via the valve housing LS pressure guide and high pressure selector plate, becoming the PLS pressure; it is then guided to the pump as the PLS signal pressure from the PLS port.
- The pressure PPS in the pump pressure passage is guided to the pump from the PPS port as the pump signal pressure.
- Part of the oil flowing back from the actuator flows from cylinder port A through a passage inside the spool to the downstream passage of the load check poppet and is combined as a regenerative flow. And part of the returning oil passes through the CT notch in the main spool and returns to the tank circuit.

RY9212174HYM0042US0

(4) Travel Section Operation



(1) Inlet Section
(2) Travel Section
(3) Notch
(4) Unload Spool
(5) Main Spool
(6) Compensator Spool
(7) High-Pressure Selector Plate
(8) PLS Pressure Circuit
(9) LS Pressure Guide
(10) LS
(11) Travel Communication Circuit
(a) To Pump

[In neutral]

- Oil flowing from pump port P is guided into the pump pressure passage.
- Pump pressure PPS becomes the unload valve setting pressure and with the pump discharge flow rate at standby flow, the entire flow from the unload valve is returned to the tank circuit. (Refer to the explanation of the unload valve operation.))
- Cylinder ports A6 (A7) and B6 (B7) are connected to the tank circuit via the CT notch in the main spool.

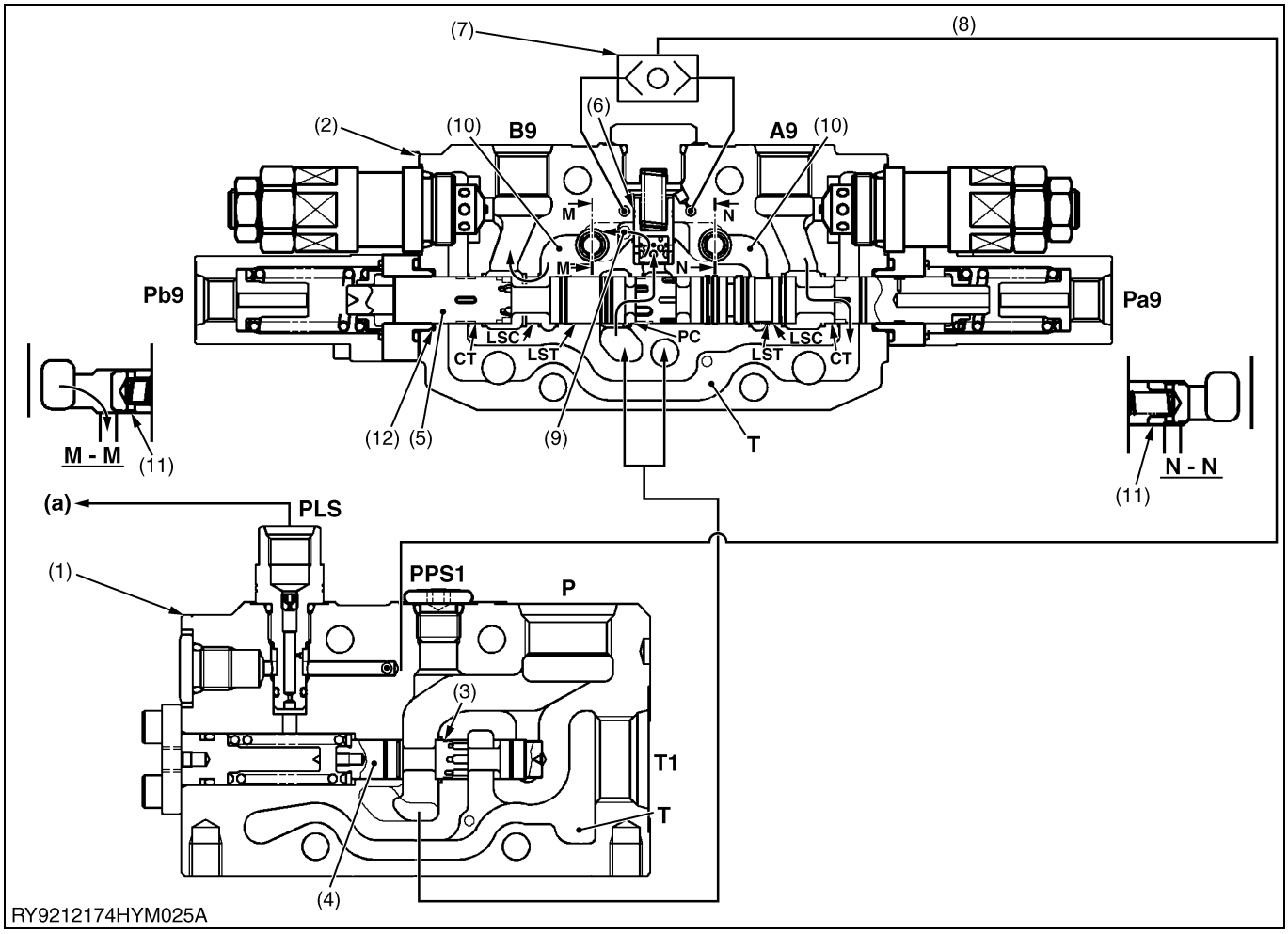
[When Pa port is pressurized]

- When the main spool is shifted, the pump pressure PPS flows to the cylinder port A6 (A7) via the main spool PC notch, the compensator spool C notch and the main sloop LSC notch. When this happens, the travel communication circuit (the ports that supply oil to the left/right travel motors communicate) maintains a straight travel path forward.

- The pressure (load pressure) in the compensator downstream passage is guided to the PLS pressure circuit via the valve housing LS pressure guide and high pressure selector plate, becoming the PLS pressure; it is then guided to the pump as the PLS signal pressure from the PLS port.
- The pressure PPS in the pump pressure passage is guided to the pump from the PPS port as the pump signal pressure.
- Oil flowing back from the actuator returns from cylinder port B6 (B7) to the tank circuit via the main spool CT notch.
- It flows in the reverse direction when the Pb port is pressurized.

RY9212174HYM0044US0

(5) Blade Section Operation



(1)	Inlet Section	(5)	Main Spool	(9) LS Pressure Guide
(2)	Blade Section	(6)	Compensator Spool	(10) LS
(3)	Notch	(7)	High-Pressure Selector Plate	(11) Load Check Poppet
(4)	Unload Spool	(8)	PLS Pressure Circuit	(12) Air bleed Micro-Orifice

(a) To Pump

[When Pb port pressurized 6mm, 0.24in. stroke)]

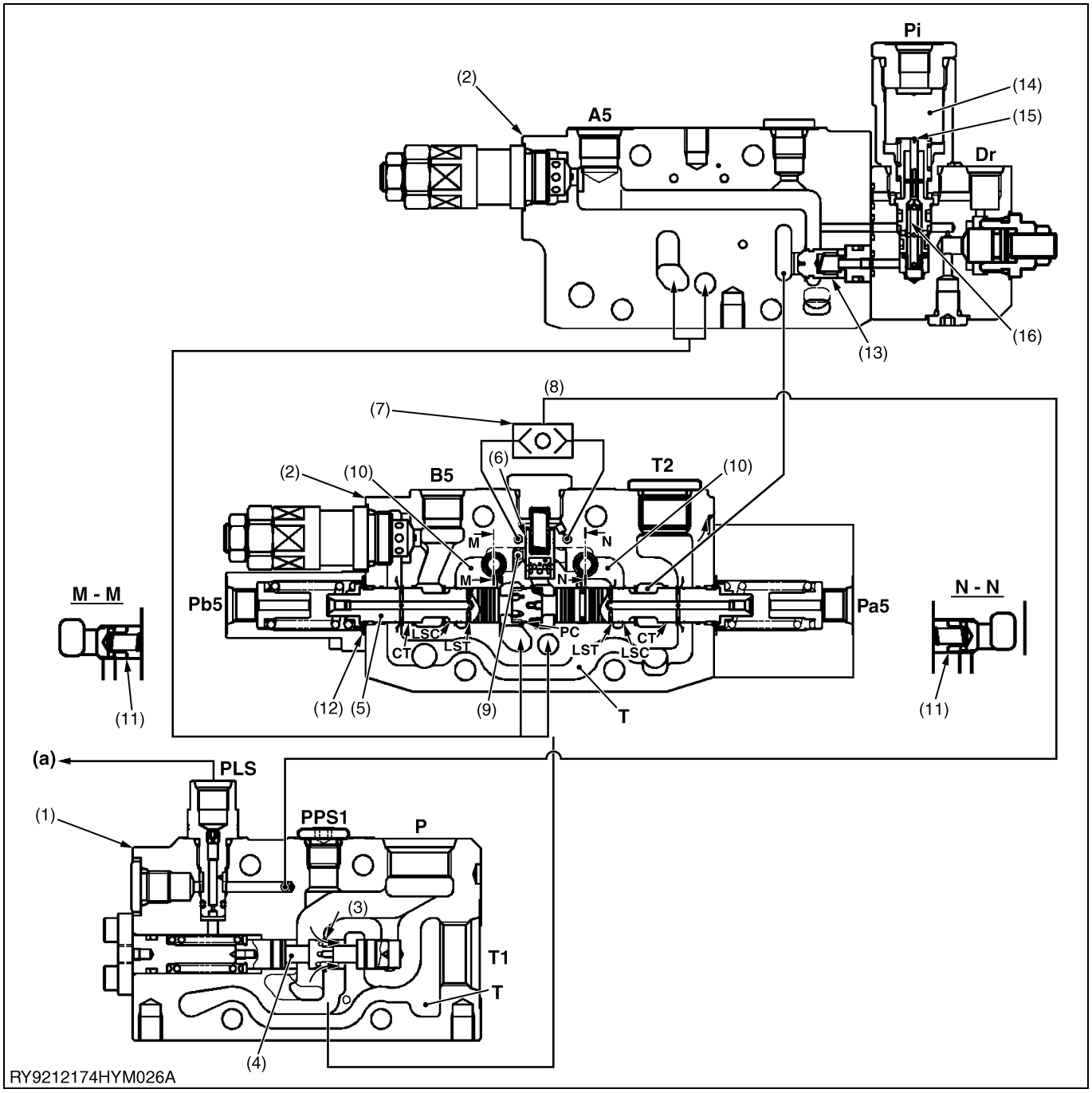
- When the spool is shifted by the Pb port pressure, the pump pressure PPS flows to cylinder port B9 via the main spool PC notch, compensator spool C notch, the left load check and the main spool LSC notch.
- When the Pb port is pressurized, part of the hydraulic oil flow passes through the air bleed micro-orifice and returns to the tank circuit.
- The pressure (load pressure) in the load check upstream passage is guided to the PLS pressure circuit via the valve housing LS pressure guide and high pressure selector plate, becoming the PLS pressure; it is then guided to the pump as the PLS signal pressure from the PLS port.
- The pressure PPS in the pump pressure passage is guided to the pump from the PPS port as the pump signal pressure.
- Oil flowing back from the actuator returns from cylinder port A to the tank circuit via the main spool CT notch.

[When Pb port is pressurized (full stroke=float position)]

- When the main spool is shifted by the Pb port pressure (full stroke), cylinder port A9 and B9 are connected to the tank circuit.

RY9212174HYM0045US0

(6) Anti-Drift Function



(1) Inlet Section
(2) Boom Section
(3) Notch
(4) Unload Spool
(5) Main Spool
(6) Compensator Spool
(7) High-Pressure Selector Plate
(8) PLS Pressure Circuit
(9) LS Pressure Guide
(10) LS
(11) Load Check Poppet
(12) Air Bleed Micro-Orifice
(13) Poppet A
(14) Piston
(15) Spool
(16) Poppet B
(a) To Pump

[In neutral]

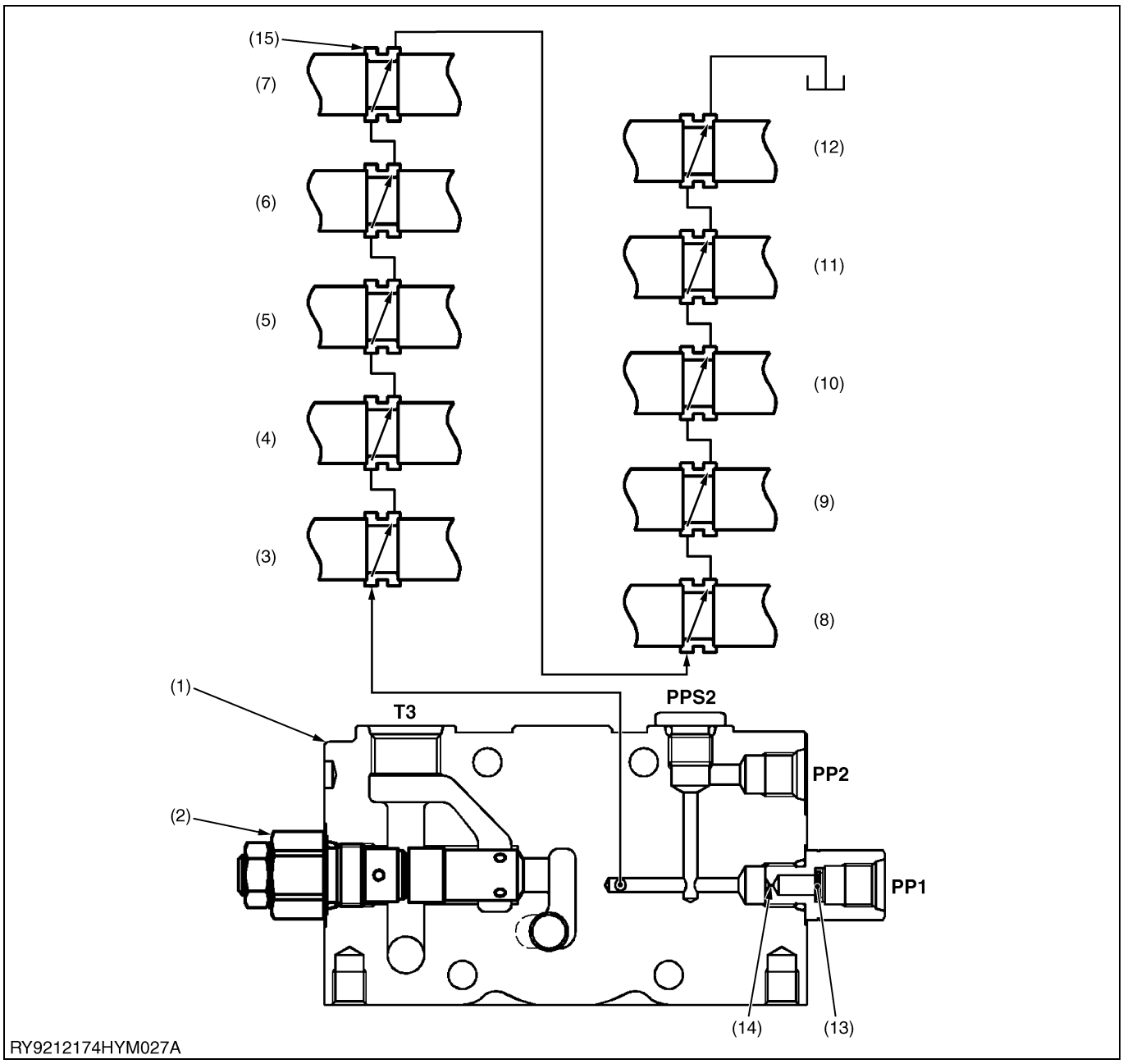
- The boom cylinder holding pressure (pressure from port A connected to the bottom side) acts on the spring chamber side of anti-drift valve poppet A, thus seating poppet A and contributing to reducing the amount leaked (reducing boom drift).

[During boom down operation]

- When port Pb is pressurized, both port Pb and the linked port Pi are also pressurized by external force, so the piston, spool and poppet B are actuated and the spring chamber of poppet A is connected to DR; this opens poppet A and the oil returning from the actuator passes from cylinder port A via main spool CT notch back to the tank circuit.

RY9212174HYM0046US0

(7) Signal Circuit



(1) Outlet Section
(2) Main LS Valve
(3) AUX2
(4) Blade
(5) Swing
(6) Travel Left
(7) Travel Right
(8) Boom
(9) Arm
(10) Bucket
(11) Swivel
(12) AUX1
(13) Filter
(14) Micro-orifice
(15) Main Spool Signal Passage Switch

[In neutral]

- Pilot pump pressure is guided to the hydraulic supply port PP1 of the signal circuit.
- The pilot pump pressure supplied to port PP1 of the outlet section (1) returns to the tank circuit via the filter (13) and micro-orifice (14) and via the main spool signal passage switch (15) of all sections so port PP1=tank pressure.

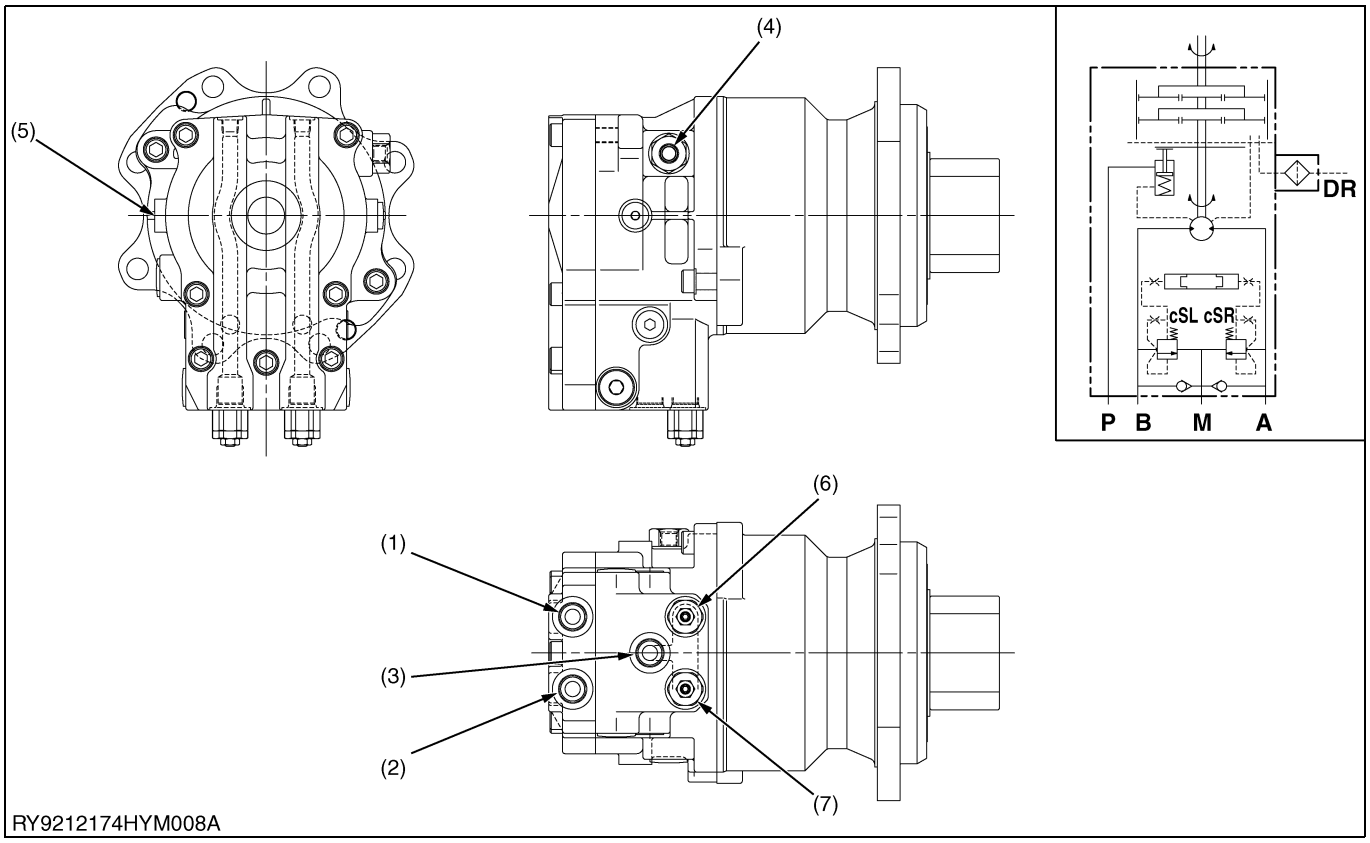
[When AI signal pressure rises (idling signal)]

- It switches the main spool of each section to either the A or the B port side and cuts off the passage that connects the PP1 port micro-orifice downstream and the tank circuit.
- This raises the PP2 port pressure to the PP1 port pressure (that is the pilot pump pressure).

RY9212174HYM0047US0

5. SWIVEL MOTOR

[1] SPECIFICATIONS



(1) Port A
(2) Port B
(3) Make-Up Port
(4) Drain Port
(5) Pilot Port (Parking Brake)
(6) Relief Valve (cSR)
(7) Relief Valve (cSL)

RY9212174HYM0011US0

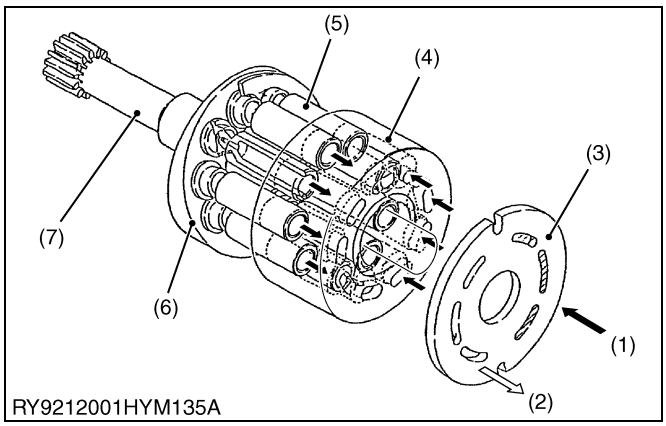
Item		Notes
Maker	Kubota Seiki	
Model	SM29G2	
Motor displacement	29.271 cc/rev (1.786 cu.in./rev)	
Reduction ratio	9.90	
Total displacement	289.78 cc/rev (17.68 cu.in./rev)	
Max flow	22.0 L/min (5.81 U.S.gals.)	
Theoretical RPM	75.9 rpm	
Relief Valve Brake Pressure	20.6 MPa (210 kgf/cm^2) (2990 psi)	at 22.0 L/min (5.81 U.S.gals.)
Mechanical Brake Torque	950 N·m (96.9 kgf·m) (701 lbf·ft)	
Parking Brake Release Pressure	1.5 ≥ MPa (15 ≥ kgf/cm^2) (220 ≥ psi)	

RY9212174HYM0012US0

[2] FUNCTION AND STRUCTURE

(1) Operating Principles

[A] Motor



RY9212001HYM135A

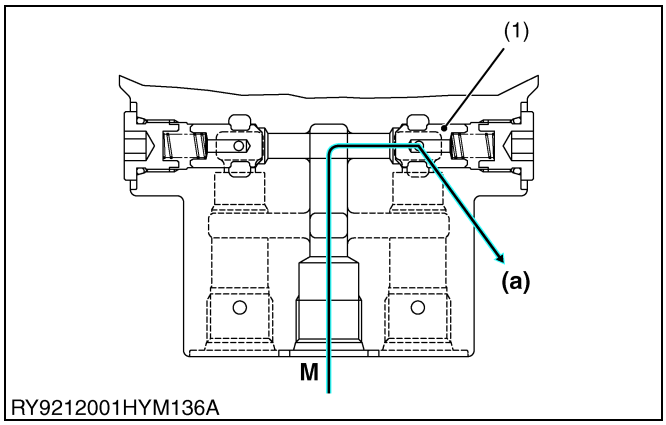
The pressurized oil from port A (1) goes through valve plate (3), enters piston (5) inside cylinder block (4) and presses against the swash-plate (6). The pistons receive the counterforce from the swash-plate, part of which becomes rotational force, and the block rotates due to the sum total of the rotational forces exerted by the pistons that the hydraulic oil entered. The cylinder block and the shaft (7) are linked via a spline, so rotation is transferred to the shaft.

When in reverse, hydraulic oil flows in via port B (2) and is discharged via port A.

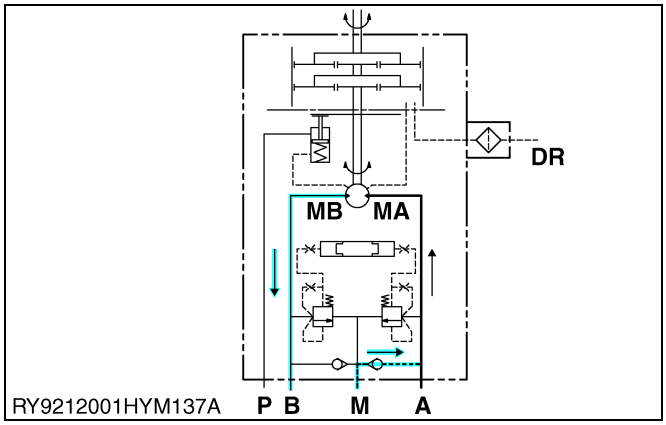
(1) Port A
(2) Port B
(3) Valve Plate
(4) Cylinder Block
(5) Piston
(6) Swash Plate
(7) Shaft

RY9212001HYM0066US0

[B] Make Up Circuit



RY9212001HYM136A



RY9212001HYM137A

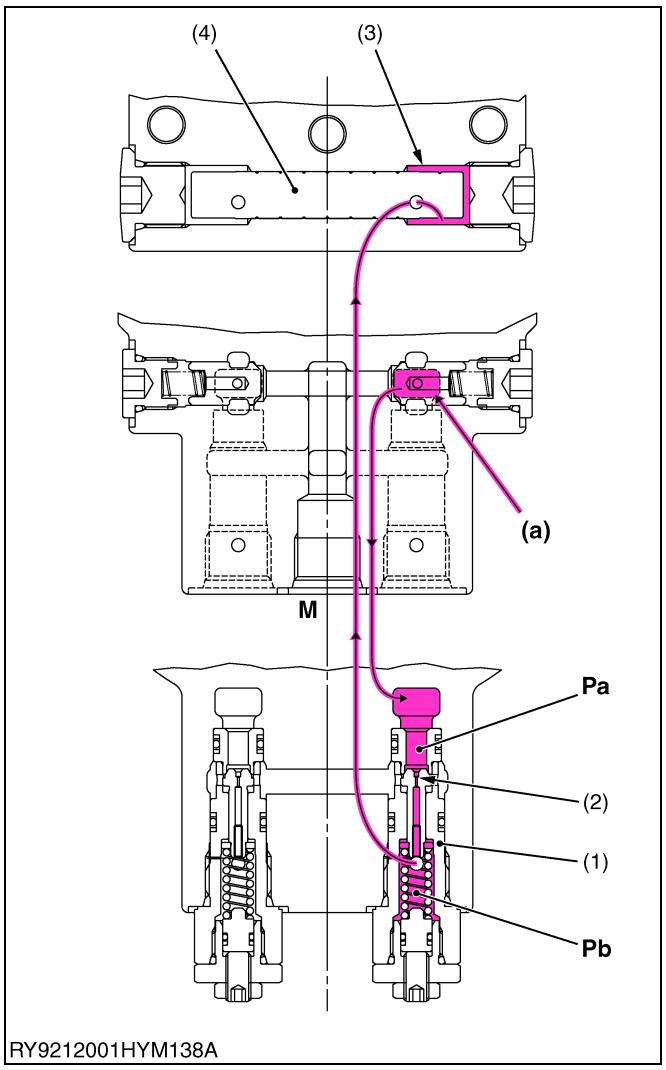
If the swivel is decelerated with the pressurized oil supplied via port A, the motor rotates due to the inertia of the swiveling equipment, and the motor drives the pump. As a result, the load shifts to the port A side.

In order to prevent this, the oil on the return side passes through the poppet (1) in the make up circuit and is supplied to the port A side.

(1) Poppet
(a) To Motor MA Circuit

RY9212001HYM0067US0

(2) Shockless Valves



RY9212001HYM138A

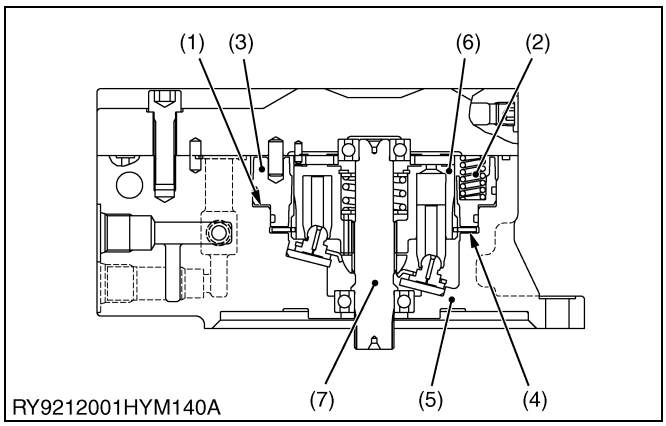
- At start up and shutdown, the oil that has flowed into port A passes through the orifice (2) of the relief valve (1) and into chamber A (3). At such time, the Pa pressure > Pb pressure, so the relief valve operates at a pressure lower than its pressure setting. (Primary relief pressure)
- When piston (4) reaches the left side as in the diagram, the pressure in chamber A rises, so Pa=Pb. For this reason, the relief valve operates at the pressure setting. (Secondary relief pressure)
- Because of this, the system can suppress dramatic changes in pressure and can mitigate the shock of starting up and stopping the equipment.

(1) Relief Valve
(2) Orifice
(3) Chamber A
(4) Piston

(a) From Port A

RY9212001HYM0068US0

(3) Parking Brake



RY9212001HYM140A

1. When the parking brake is operated

When the unload lever is raised, the oil in the brake piston chamber (1) passes through the unload valve and returns to the hydraulic oil tank, thus allowing the force of the spring (2) to press the brake piston (3) downwards.

As a result, the friction plate (4) is squeezed between the brake piston and the case (5), and the friction prevents any rotation.

The friction plate and the cylinder block (6), the cylinder block and the shaft (7) are coupled via a spline, so the motor (shaft) will not rotate.

2. When the parking brake is released

When the unload lever is lowered, the oil from the pilot pump passes through the unload valve and flows into the brake piston chamber, overpowering the spring and pressing the brake piston upwards, as in the diagram.

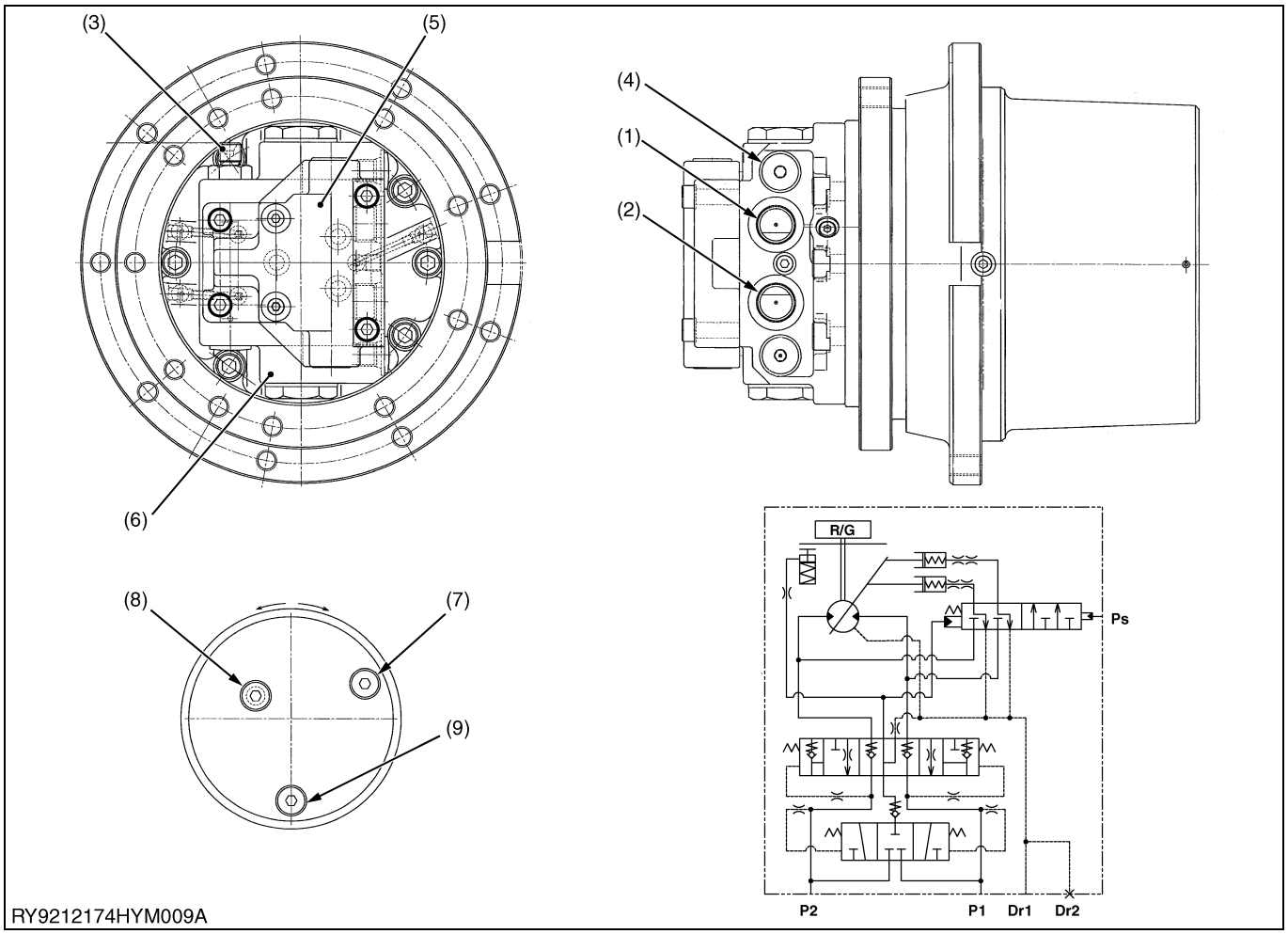
By doing so, the friction of the friction plate is released and the motor (shaft) rotates.

(1) Brake Piston Chamber
(2) Spring
(3) Brake Piston
(4) Friction Plate
(5) Case
(6) Cylinder Block
(7) Shaft

RY9212001HYM0069US0

6. TRAVEL MOTOR

[1] SPECIFICATIONS



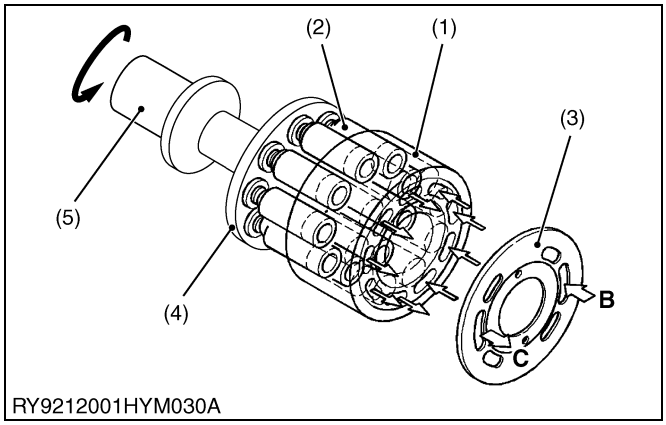
(1) P1 Port
(2) P2 Port
(3) Travel 2nd Speed Signal
(4) Drain Port
(5) Anticavitation Valve
(6) Counterbalance Valve
(7) Supply Port
(8) Oil inspection Port
(9) Oil drain Port

Maker		Kubota Seiki
Decelerator	Reduction ratio	39.286
	Output torque (1F/2F)	4325 / 2394 N·m 441.2 / 244.2 kgf·m 3190.1 / 1765.8 lbf·ft
	RPM (1F/2F)	37.0 /66.8 rpm
Hydraulic motor	Displacement (1F/2F)	28.213 / 15.616 cm^3/rev 1.72 / 0.95 cu.in./rev
	Flow rate	41.0 L/min 10.8 U.S.gals.
	2nd speed switch pressure	4.0 MPa 40.8 kgf/cm^2 580 psi
	Auto deceleration switch pressure	19.5 MPa 199 kgf/cm^2 2828 psi
Parking brake	Release pressure	1.17 MPa 11.9 kgf/cm^2 169.7 psi

RY9212174HYM0030US0

[2] FUNCTION AND STRUCTURE

(1) Operating Principles



RY9212001HYM030A

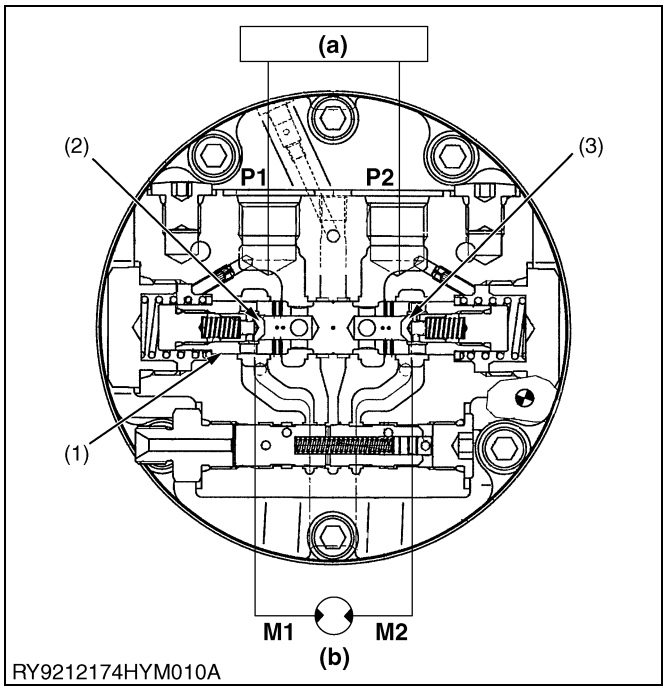
- Nine pistons are built into the cylinder block, and the end section of the block is in contact with a valve plate, which has two half-moon shaped ports (port **B** and port **C** for switching between high and low pressure).
- If high-pressure oil is guided to port **B**, the pressurized oil passes through port **B** and presses on the swash-plate.
- The pistons receive the counterforce from the swash-plate, part of which is converted into rotational force, and the block rotates due to the sum total of the rotational forces exerted by pistons that the hydraulic oil entered.
- The cylinder block and the shaft are linked via a spline, so the rotation is transferred to the shaft.

(1) Cylinder Block
(2) Piston
(3) Valve Plate
(4) Swash Plate
(5) Shaft

B : Port B
C : Port C

RY9212001HYM0002US0

(2) Counterbalance Valve



RY9212174HYM010A

When in neutral

Role of the counter-balance valve

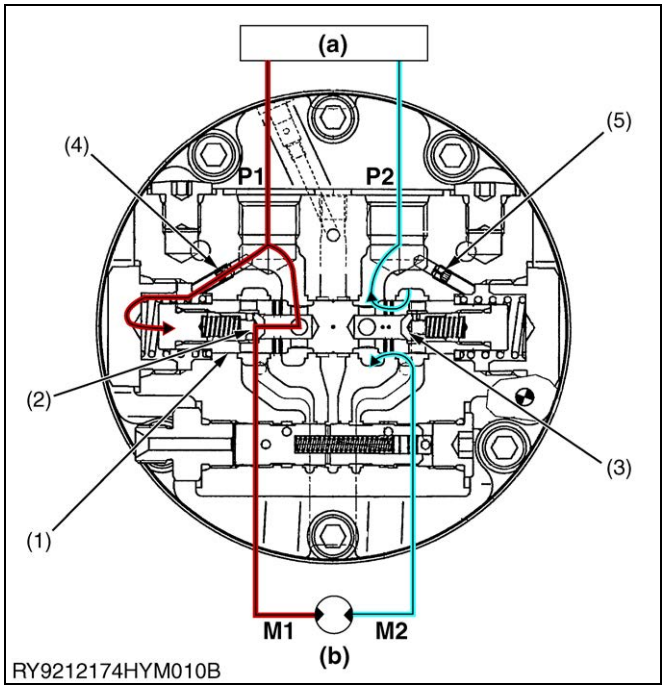
1. Stops the motor **(b)**
2. Prevents overrun

When control valve **(a)** is in neutral, no pressure is generated at either port P1 or P2, so ports M1 and M2 are blocked by plunger (1), check valve L (2) and check valve R (3), so the motor does not rotate.

(1) Plunger
(2) Check Valve L
(3) Check Valve R

(a) Control Valve
(b) Motor

RY9212174HYM0013US0



If pressurized oil flows to P1

The pressurized oil that passed through P1 flows through check valve L (2) to the motor **(b)** via the M1 port, thus turning the motor.

The oil returning from the motor flows to the counter-balance valve from port M2, but it is blocked by the check valve R (3), so the pump discharge pressure rises. Pressurized oil passes through orifice L (4) and acts on the left side of plunger (1), moving the plunger to the right.

Oil returning from port M2 passes through the orifice (5) and while it generates back pressure on port M2, it returns to the tank via port P2 and the control valve **(a)**.

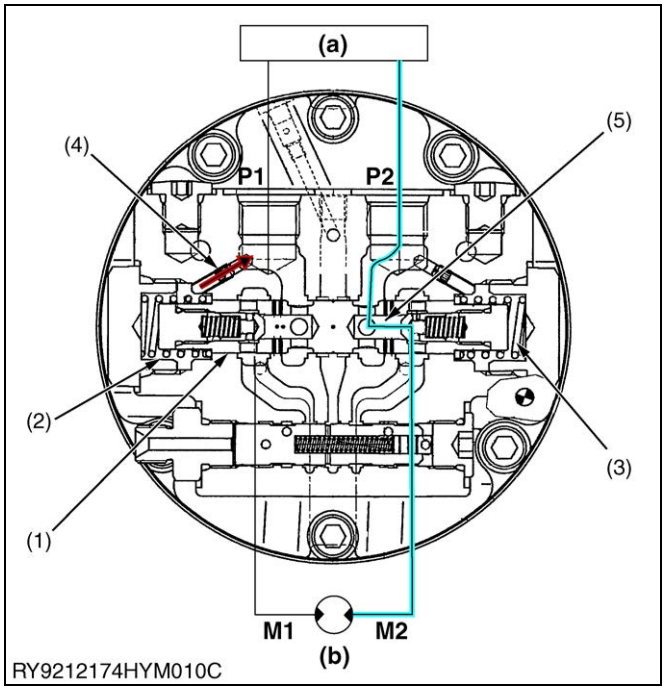
As the pump's discharge pressure rises further, the plunger moves further to the right and it passes through both the orifice and around the spool, thus reducing the back pressure.

In this way it automatically adjusts the area in the return circuit so that the motor rotates at a speed that matches the pressure on the port P1 side.

(1) Plunger
(2) Check Valve L
(3) Check Valve R
(4) Orifice L
(5) Orifice

(a) Control Valve
(b) Motor

RY9212174HYM0014US0



Brake operation

When the control valve **(a)** returns to neutral, it cuts off the supply of pressurized oil from the pump, and the pressures at ports P1 and P2 equalize, so spring R (3) works to return the plunger (1) to its neutral position. (moves to the left)

When the plunger moves to the left, the oil returning from M2 does so only from the orifice (5). Also, the motor **(b)** tries to turn due to inertia, which causes the pressure on the port M2 side to rise. When the plunger moves to the left, the oil in the left pressure chamber (2) escapes to the port P1 side, but due to the constricting effect of orifice L (4), the speed with which the plunger moves to the left is limited. By controlling the speed of the plunger, the motor is stopped without generating cavitation while also absorbing the shock pressure from the inertia of the motor.

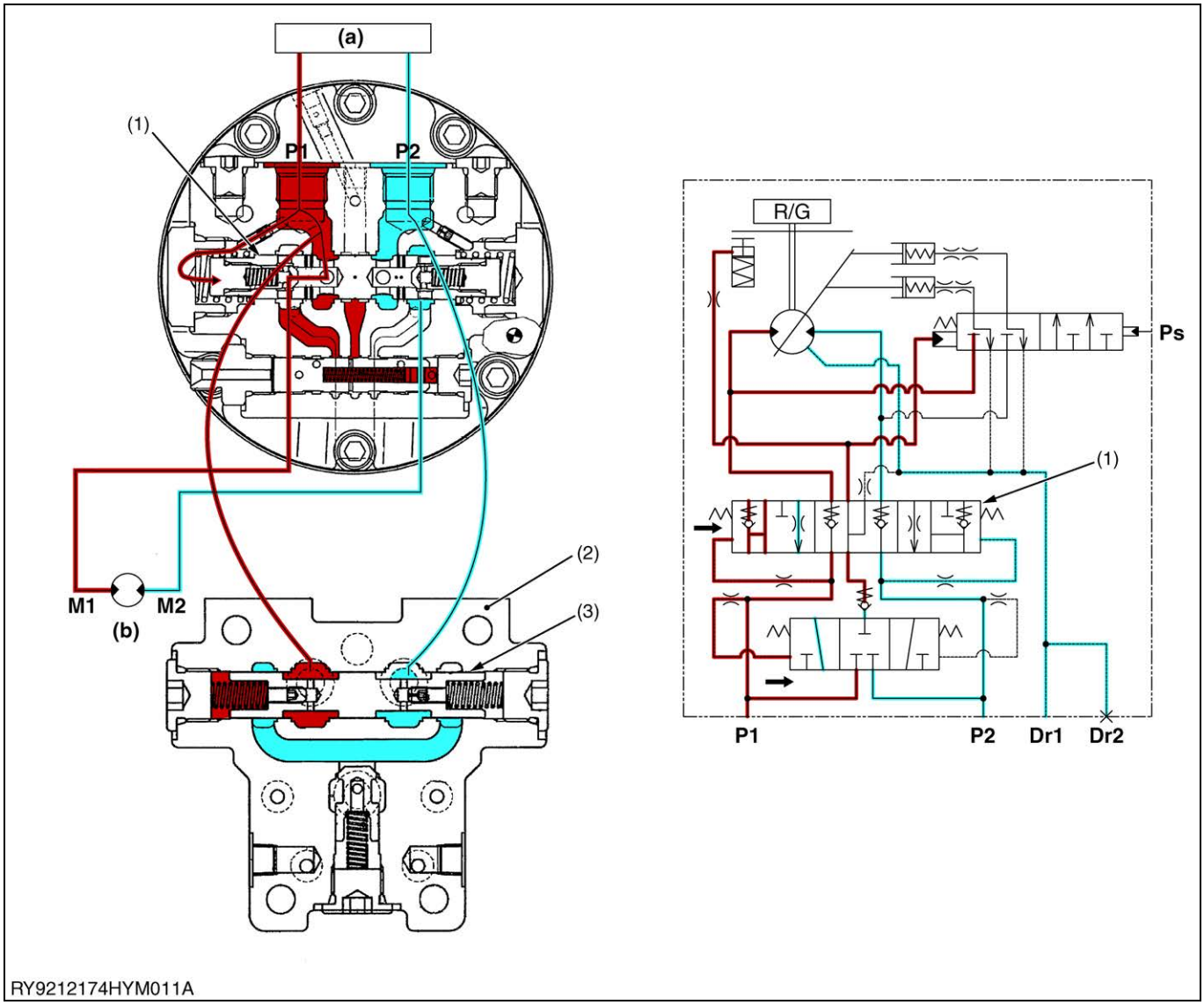
(1) Plunger
(2) Left Pressure Chamber
(3) Spring R
(4) Orifice L
(5) Orifice

(a) Control Valve
(b) Motor

RY9212174HYM0015US0

(3) Anti-Cavitation Valve

When the motor stops → starts and when the motor is rotating



(1) Plunger (2) Anti-cavitation Valve (3) Spool

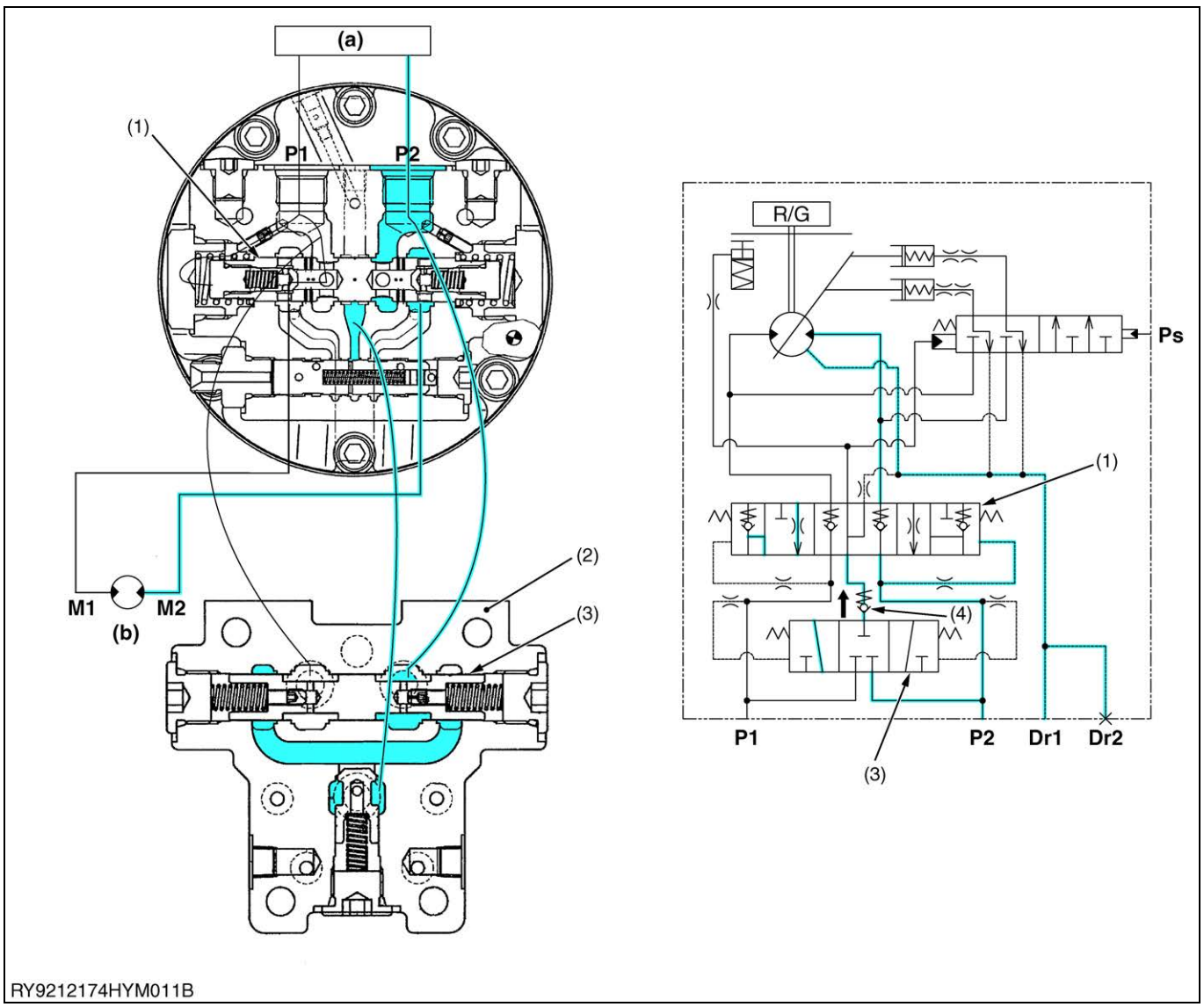
(a) Control Valve
(b) Motor

If pressurized oil flows to port P1, plunger (1) moves to the right and oil flows to the motor via passage M1, passes through passage M2 and is expelled from port P2.

Pressurized oil also flows to the left end of spool (3) of the anti-cavitation valve (2) and presses the spool to the right.

RY9212174HYM0016US0

When going from a steady motor speed → deceleration



(1) Plunger
(2) Anti-cavitation Valve
(3) Spool
(4) Check Valve
(a) Control Valve
(b) Motor

When decelerating, the motor continues to turn due to its inertia. As long as the counterbalance valve is open (the plunger (1) is moved to the right), the motor's return oil is expelled from port P2.

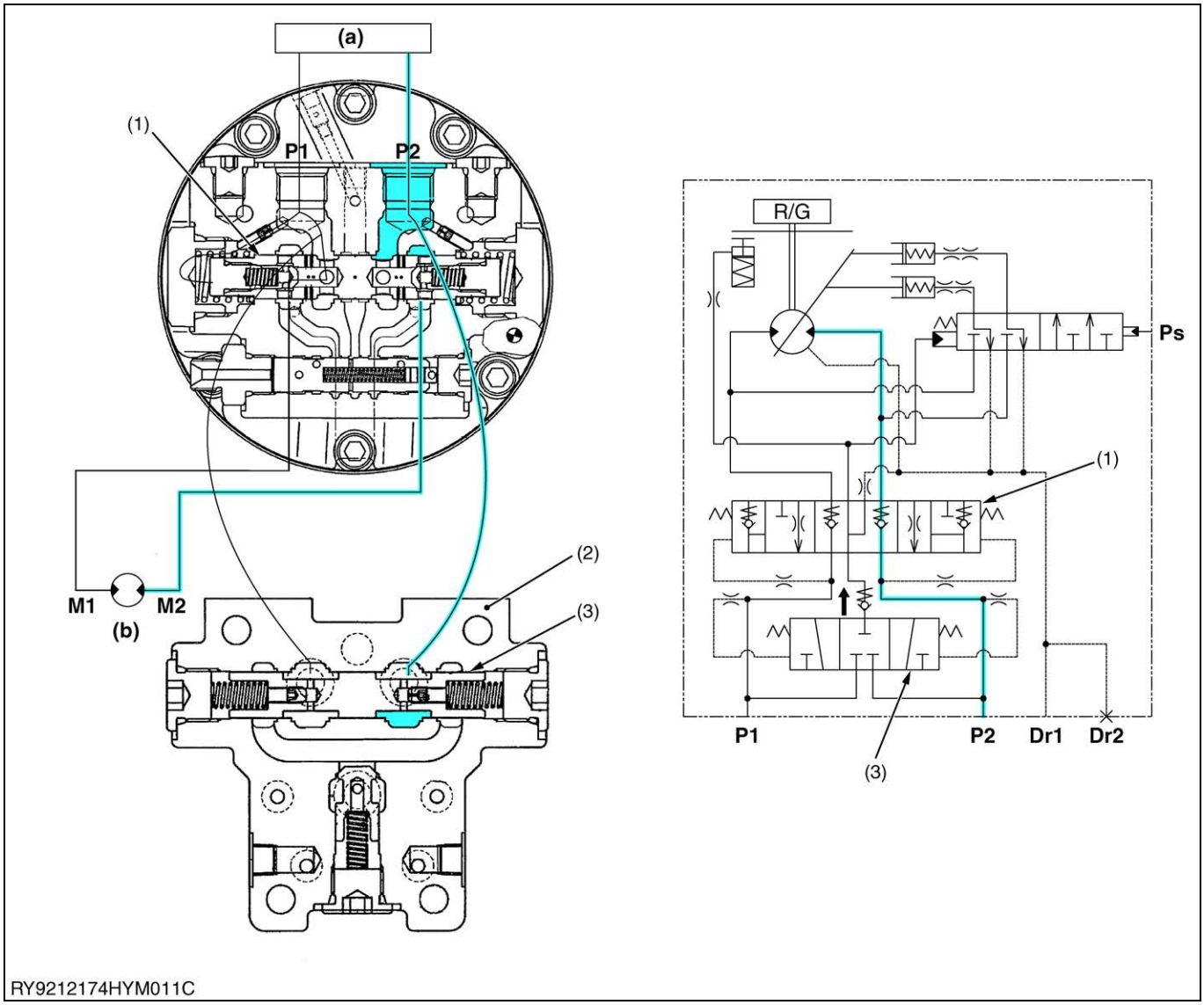
At such time, there is not enough oil supplied under pressure from port P1, resulting in cavitation.

With this mechanism, the spool (3) of the anti-cavitation valve (2) moves to the right, and the pressure on the M2 passage side rises due to inertia, so the motor's return oil is resupplied to the motor via the anti-cavitation valve (2) → check valve (4) → around the plunger → M1 passage, so cavitation is reduced. (Anti-cavitation function)

The mechanism is structured such that when the plunger (1) and the spool (3) move from the stroke end to neutral, their speed is regulated by the orifice. with the speed of the spool (3) set to be less than the speed of the plunger (1). As a result, the anti-cavitation function operates while the spool (3) is returning to neutral. (Low-pressure selection method)

RY9212174HYM0017US0

When motor decelerating → stop



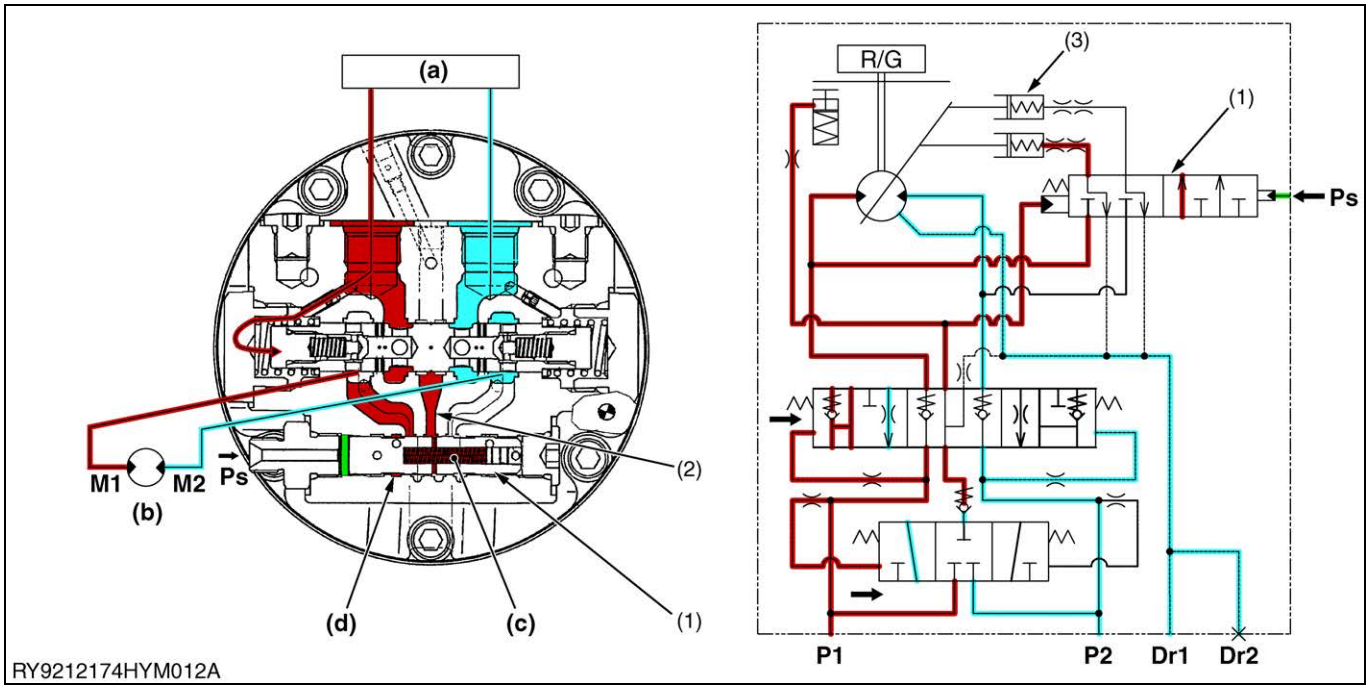
(1) Plunger (2) Anti-cavitation Valve (3) Spool **(a) Control Valve** **(b) Motor**

When the pressure on the supply side and the return side equalize, both the plunger (1) and the spool (3) of the anti-cavitation valve (2) return to neutral.

RY9212174HYM0018US0

(4) Auto-Decelerator Function

When under low load



(1) 2nd Speed Switching Spool
(2) Motor Load Pressure
(3) 2nd Speed Switch Piston
(a) Control Valve
(b) Motor
(c) Motor Load Pressure
(d) To 2nd Speed Switch Piston

This function gives priority to power for traveling and when the machine is traveling in the 2nd speed, if the travel load becomes great, it automatically decelerates to 1st speed (low-speed).

When the travel load is low, it operates in the 2nd speed (high-speed).

When the 2nd speed switch button is pressed, it actuates the solenoid of the unload valve, thus guiding oil from the pilot pump to the PS port.

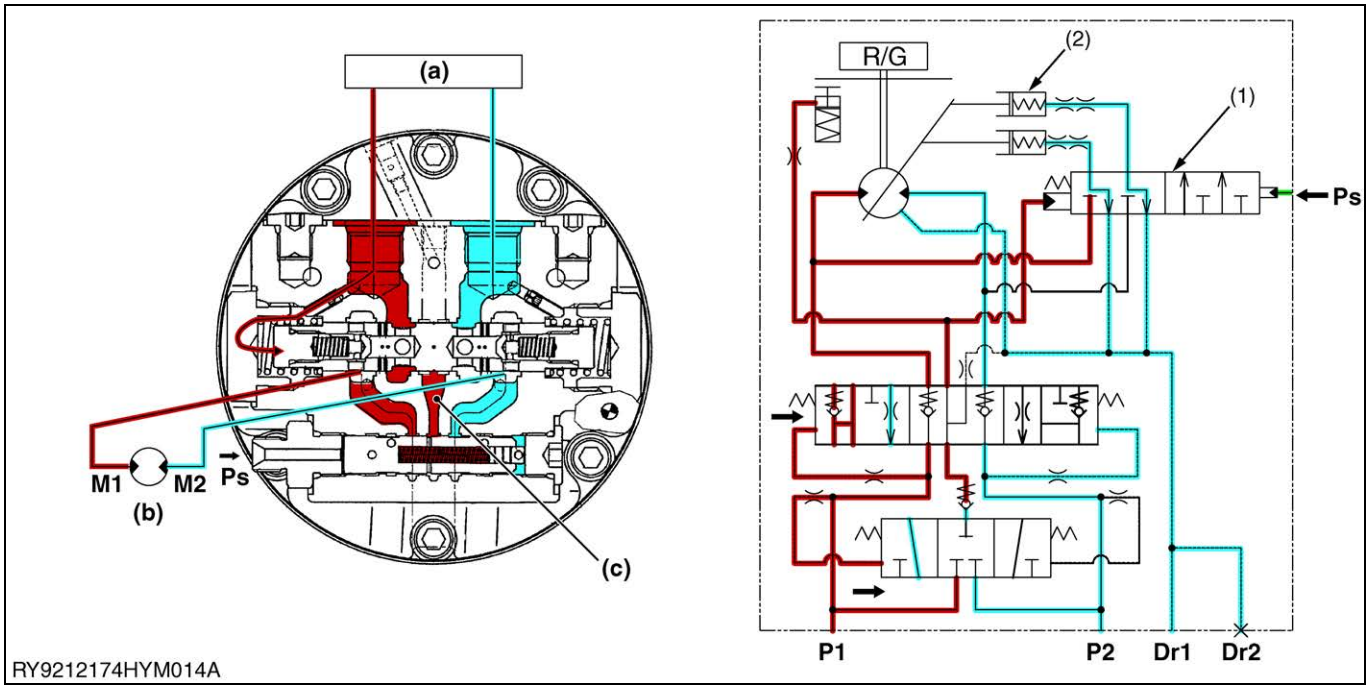
When pressurized oil flows to the PS port, it presses the 2nd speed switch spool (1) to the right as in the diagram. (presses to the left in the circuit diagram) On the other hand, the load pressure **(c)** of the motor is applied in the motor load pressure chamber (2) and presses the 2nd speed switch spool to the left, as in the diagram (presses to the right in the circuit diagram).

When the load is low, the force applied in the motor load pressure chamber is low and the area of the motor load pressure chamber is smaller than the area on the PS port side, so the 2nd speed switch spool is pressed to the right, as in the diagram, which keeps the motor in 2nd speed (high speed).

Consequently, high pressure oil is supplied via the 2nd speed switch spool to the 2nd speed switch piston (3).

RY9212174HYM0019US0

When the load is heavy



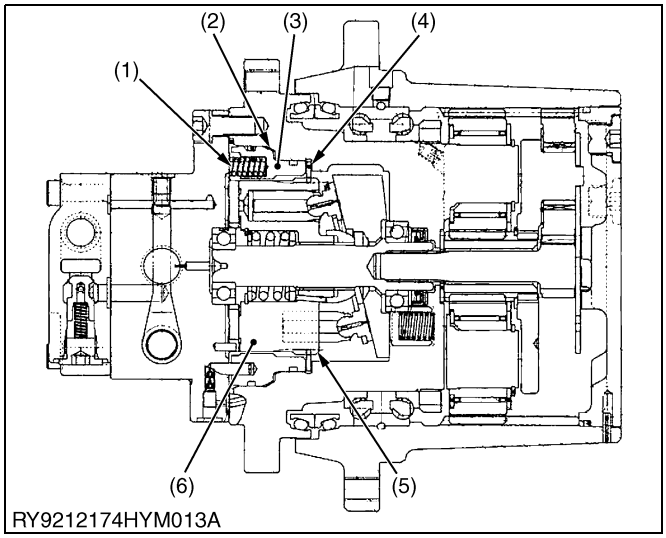
(1) 2nd Speed Spool
(2) 2nd Speed Piston
(a) Control Valve
(b) Motor
(c) Motor Load Pressure

The motor load pressure **(c)** rises, so it overpowers the oil pressure from the PS port and moves the 2nd speed switch spool (1) to the left, as in the diagram (to the right in the circuit diagram) and switches to 1st speed (low speed).

When traveling in 1st speed, pressurized oil is not applied to the PS port, so it acts the same as when under a heavy load.

RY9212174HYM0020US0

(5) Parking Brake



The parking brake is a negative brake composed of a rotating disc (friction material) (4), a brake piston (3) and a spring (1). When the travel motor is stopped (the travel lever in neutral), the parking brake takes effect.

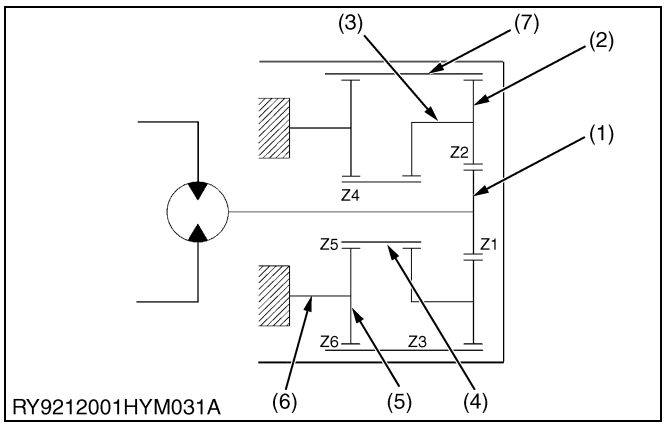
The cylinder block (6) and the disc are linked via a spline (5) and a friction material is applied to both sides of the disc. The disc is spring-loaded and friction is generated between the flange holder and the brake piston, and this limits the force with which the motor can turn, allowing it to function as a parking brake

When pressurized oil is guided into the brake piston chamber (2), it generates an amount of thrust that matches the area of the brake piston that receives the pressure and overcomes the spring, thus moving the brake piston. The disk rotates freely between the flange holder and the brake piston, negating the parking brake function.

(1) Spring
(2) Brake piston chamber
(3) Brake piston
(4) Disc (friction material)
(5) Spline
(6) Cylinder block

RY9212174HYM0021US0

(6) Decelerator



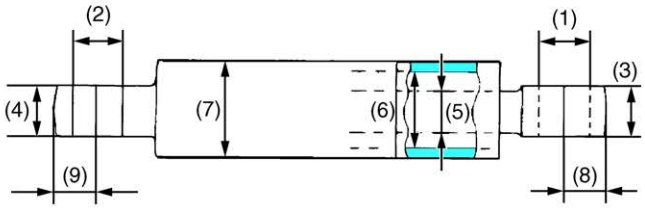
- The drive gear meshes with the 1st stage planetary gear while the 2nd stage sun gear meshes with the 2nd stage planetary gear.
- The 2nd stage planetary carrier is fixed to the body of the decelerator.
- Planetary gears and mesh with ring gear (the housing).
- The drive force from the piston motor is transmitted to the drive gear, which is decelerated by each of the gears.
- The decelerated drive force is transmitted to the ring gears via the 2nd stage planetary gear of the 2nd stage planetary carrier, which is fixed to the final stage of the decelerator. (The drive force from the 1st stage planetary gear is also transmitted.)
- However, the input rotation is opposite the output rotation.

(1) Drive Gear
(2) 1st Stage Planetary Gear
(3) 1st Stage Planetary Carrier
(4) 2nd Stage Sun Gear
(5) 2nd Stage Planetary Gear
(6) 2nd Stage Planetary Carrier
(7) Ring Gear (Housing)

RY9212001HYM0003US0

7. HYDRAULIC CYLINDER

[1] SPECIFICATIONS



RY9212148HYM022A

	Boom	Arm	Bucket	Blade	Swing
(1)	50 mm 1.97 in.	45 mm 1.77 in.	40 mm 1.57 in.	45 mm 1.77 in.	
(2)	50 mm 1.97 in.	45 mm 1.77 in.	40 mm 1.57 in.	45 mm 1.77 in.	
(3)	70 mm 2.76 in.	60 mm 2.36 in.	50 mm 1.97 in.	60 mm 2.36 in.	
(4)	70 mm 2.76 in.	60 mm 2.36 in.	50 mm 1.97 in.	60 mm 2.36 in.	
(5)	50 mm 1.97 in.	45 mm 1.77 in.	40 mm 1.57 in.	50 mm 1.97 in.	45 mm 1.77 in.
(6)	85 mm 3.35 in.	75 mm 2.95 in.	70 mm 2.76 in.	90 mm 3.54 in.	80 mm 3.15 in.
(7)	103 mm 4.06 in.	91 mm 3.58 in.	85 mm 3.35 in.	107 mm 4.21 in.	96 mm 3.78 in.
(8)	50 mm 1.97 in.	45 mm 1.77 in.	41.3 mm 1.63 in.	49 mm 1.93 in.	
(9)	50 mm 1.97 in.	40 mm 1.57 in.	39 mm 1.54 in.	50 mm 1.97 in.	48 mm 1.89 in.
Max compressed length	996 mm 39.21 in.	981 mm 38.62 in.	815 mm 32.09 in.	525 mm 20.67 in.	785 mm 30.91 in.
Stroke	646 mm 25.43 in.		521 mm 20.51 in.	160 mm 6.3 in.	483 mm 19.02 in.

■ **NOTE**

- **Pin hole dimensions for rod and bottom side are inner diameter of installed bushings.**

RY9212172HYM0003US0

[2] FUNCTION AND STRUCTURE

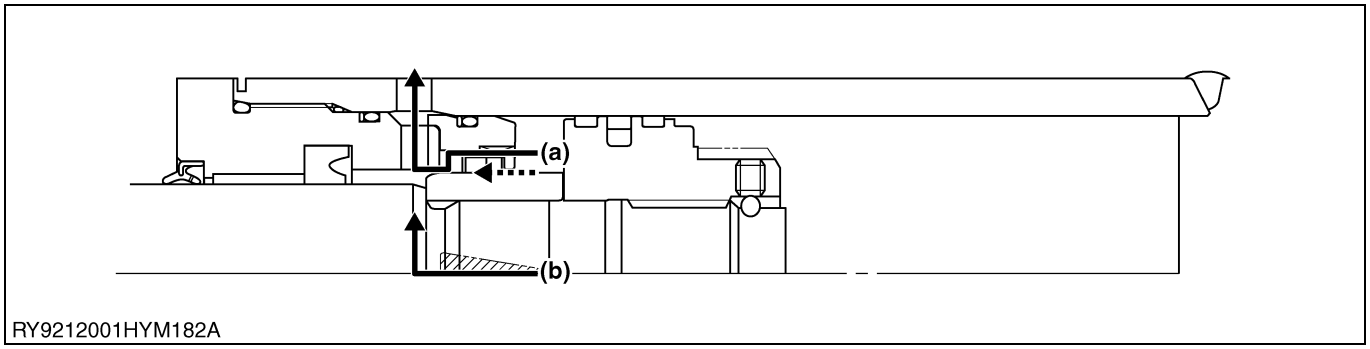
(1) Operating Principles

• Cushion Function

The device is equipped with a cushion to prevent spilling of earth or the like when it reaches the end of the cylinder.

RY9212148HYM0050US0

Cushion function on the lift end of the boom



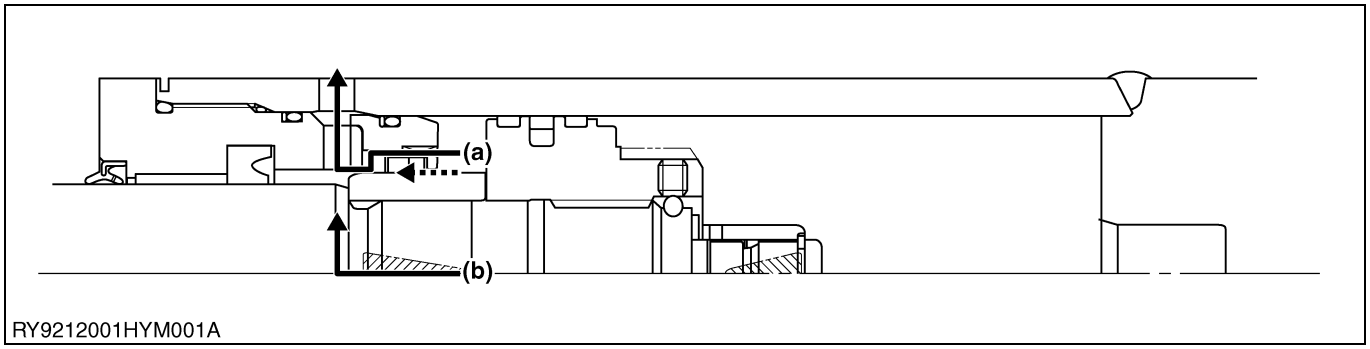
RY9212001HYM182A

(a) Flow Via a Slit **(b) Flow from Indentation**

The discharge pressurized oil is automatically reduced on the lift end of the boom, slowing the operation of the cylinder and cushioning the shock on the lift end of the boom. An indentation and a split in the cushion bearing are provided as a means to reduce the pressure.

RY9212148HYM0027US0

Cushion function on the rake end of the arm



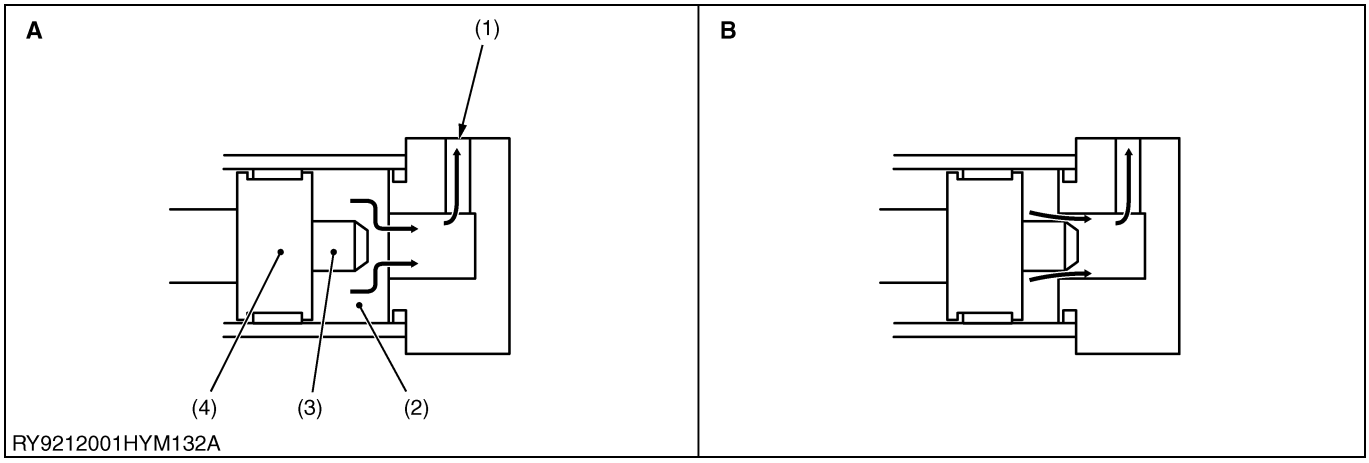
RY9212001HYM001A

(a) Flow Via a Slit **(b) Flow from Indentation**

The discharge pressurized oil is automatically reduced on the rake end of the arm, slowing the operation of the cylinder and cushioning the shock on the rake end of the arm. An indentation and a split in the cushion bearing are provided as a means to reduce the pressure.

RY9212148HYM0028US0

Cushion function on dumping end of arm



RY9212001HYM132A

(1) Port
(2) Cushion Chamber
(3) Cushion Plunger
(4) Piston

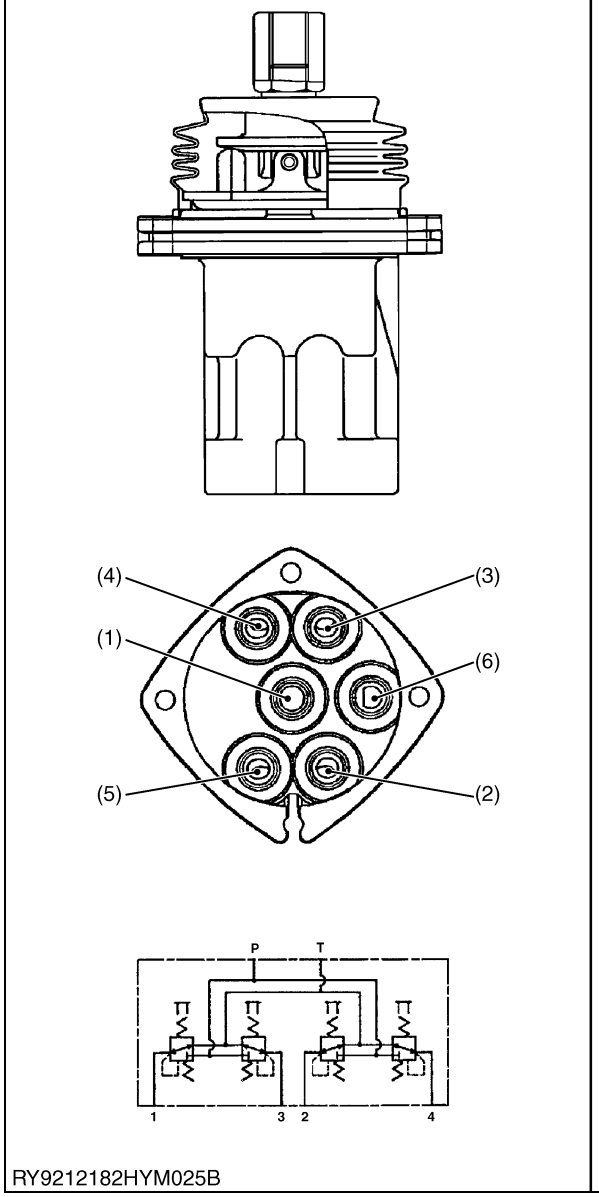
A : Before Cushion Enters
B : After Cushion Enters

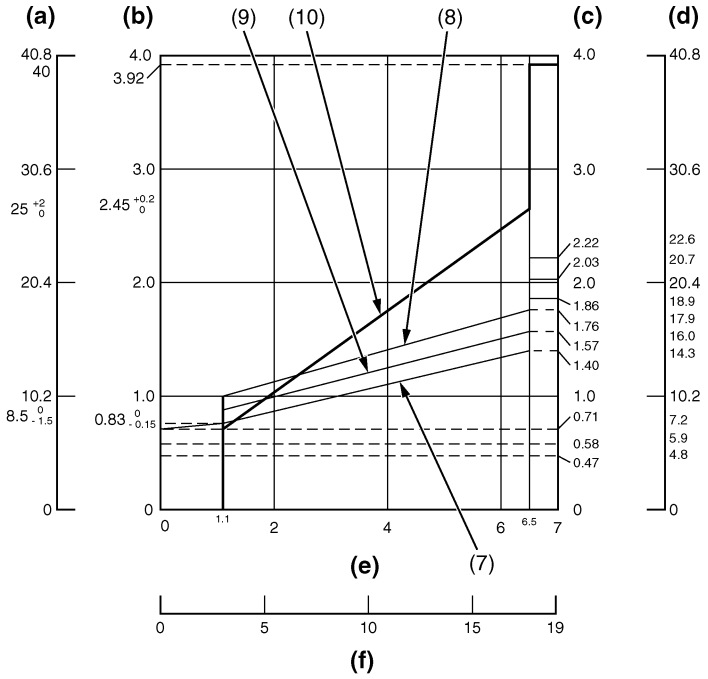
RY9212148HYM0029US0

8. PILOT VALVE

[1] CONTROL PILOT VALVES

(1) Specifications





RY9212182HYM025B

(1) Port P
(2) Port 1 (Left)
(3) Port 2 (Front)
(4) Port 3 (Right)
(5) Port 4 (Rear)
(6) Port T
(7) Independent Operation Torque (Ports 1, 3)
(8) Independent Operation Torque (Port 2)
(9) Independent Operation Torque (Port 4)
(10) Secondary Pressure

(a) Secondary Pressure (kgf/cm^2)
(b) Secondary Pressure (MPa)
(c) Operating Torque (N·m)
(d) Operating Torque (kgf·cm)
(e) Pushrod Stroke (mm)
(f) Operating Angle (deg)

Maker		Kawasaki Heavy Industries, Ltd.
Model	Left	STD: PV48M2197, AUX2: PV48M2199
	Right	PV48M2198

RY9212174HYM0029US0

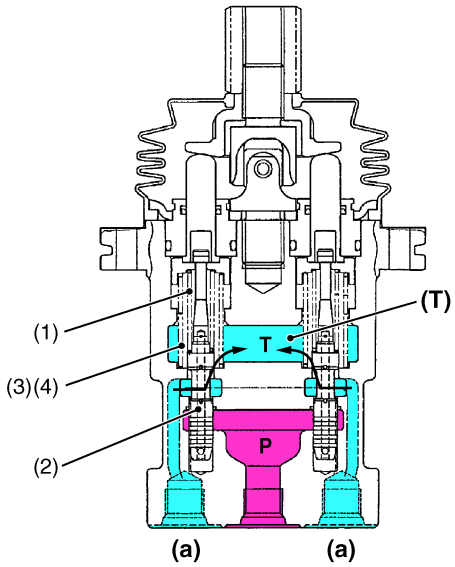
(2) Function and Structure

[A] Function

The pilot valve is the valve that controls the direction and volume of the stroke of the control valve, and lowers the primary pressure from the unload valve to a secondary pressure only as much as is necessary to move the control valve spool.

RY9212001HYM0001US0

[B] Operation



RY9212001HYM017C

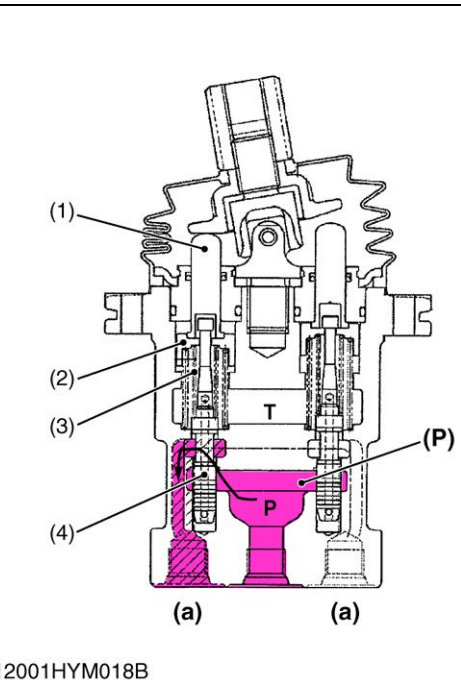
1. When the control lever is in neutral

The force of the secondary pressure spring (1) does not press on the spool (2). As a result, the spool is held in a neutral position by the return spring (3) or (4). At such time, the output port (control valve port) **(a)** and port T **(T)** are connected.

(1) Secondary Pressure Spring
(2) Spool
(3) Return Spring
(4) Return Spring

(a) Output Port
(T) Port T

RY9212148HYM0005US0



RY9212001HYM018B

2. When the control lever has been actuated

When the control lever is actuated, the pushrod (1) presses down on the spool (4) via the spring seat (2) and the secondary pressure spring (3). In doing so, port P **(P)** and the output port **(a)** are connected, so the oil from the pilot pump flows through the output port to the control valve.

The pressure at the output port rises until it is equivalent to the force of the secondary pressure spring, thus balancing the hydraulic pressure on the spool with the tension of the secondary pressure spring and maintaining a fixed output port pressure.

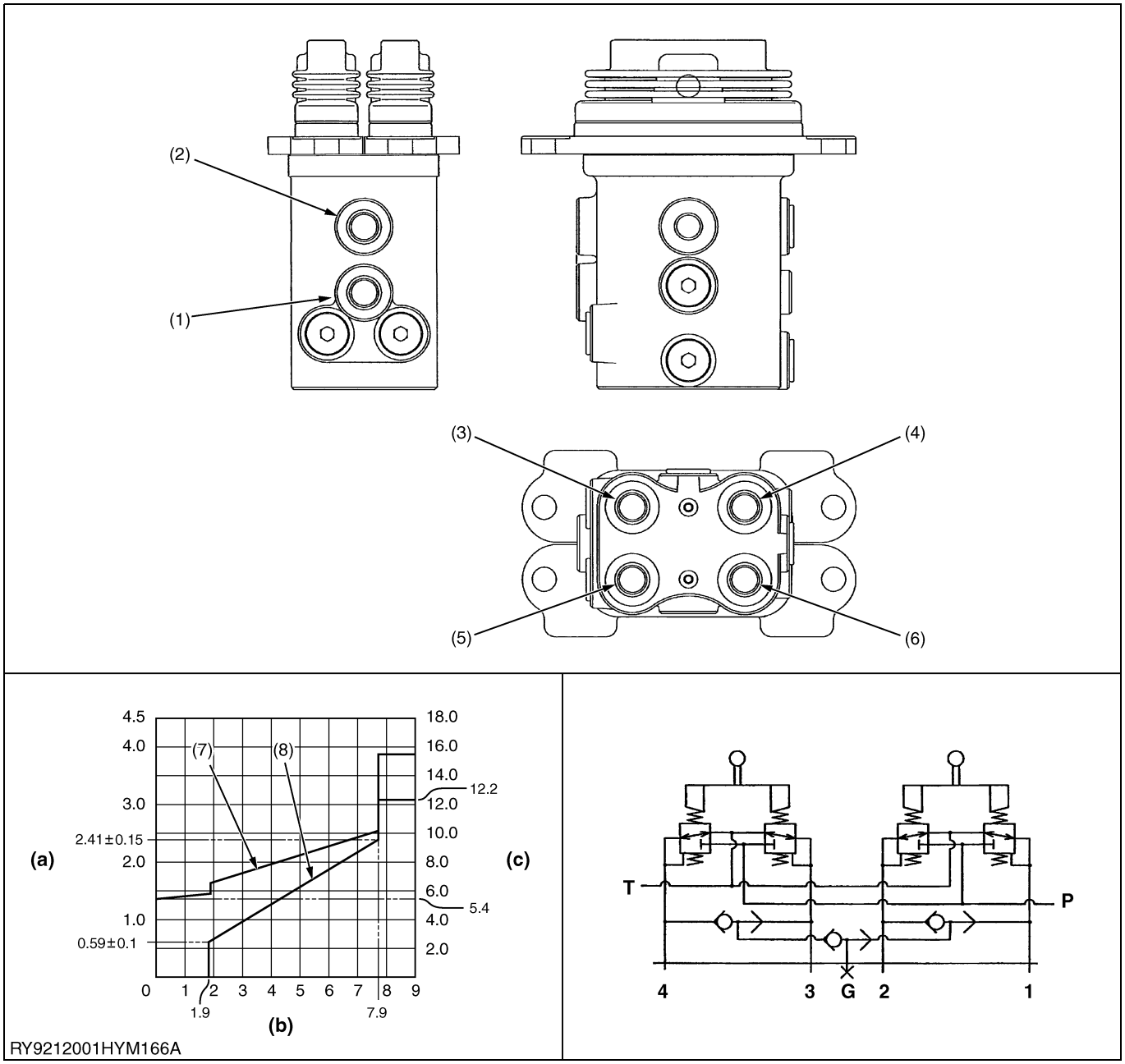
(1) Pushrod
(2) Spring Seat
(3) Secondary Pressure Spring
(4) Spool

(a) Output Port
(P) Port P

RY9212148HYM0006US0

[2] TRAVEL PILOT VALVE

(1) Specifications



(1) Port P
(2) Port T
(3) Port 1
(4) Port 2
(5) Port 3
(6) Port 4
(7) Operating Torque
(8) Secondary Pressure

(a) Secondary Pressure (MPa)
(b) Operating Angle (deg)
(c) Operating Torque (N·m)

Maker	Nishina Industrial
Model	–
Secondary pressure	Noted separately

RY9212001HYM0114US0

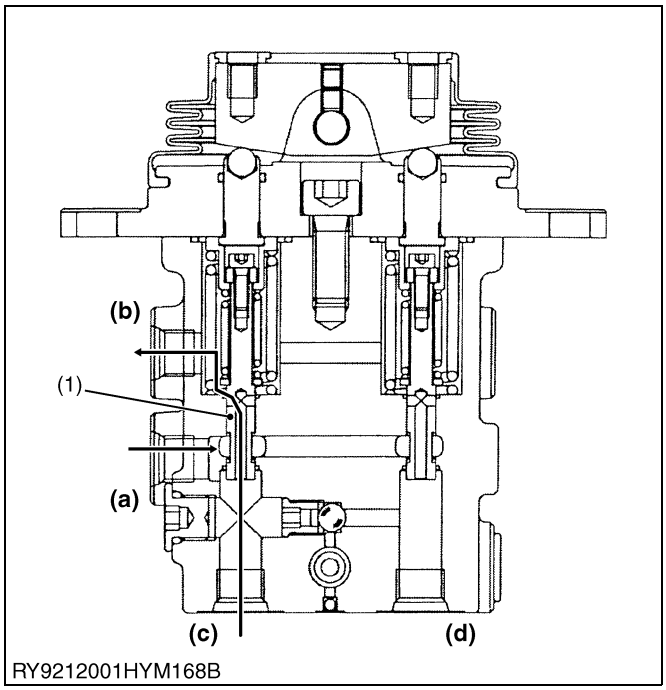
(2) Function and Structure

[A] Function

The pilot valve is the valve that controls the direction and volume of the stroke of the control valve, and lowers the primary pressure from the unload valve to a secondary pressure only as much as is necessary to move the control valve spool.

RY9212001HYM0001US0

[B] Operation



RY9212001HYM168B

1. When the control lever is in neutral

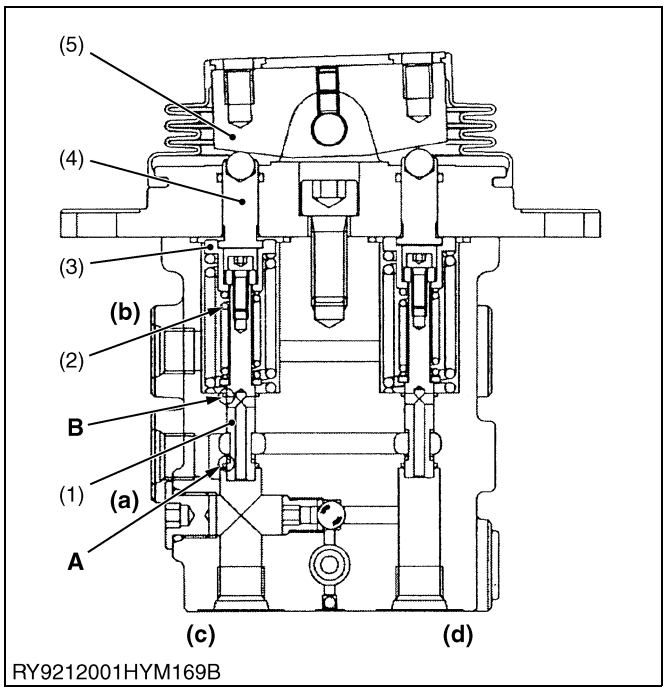
The oil from the pilot pump that flows into Port P **(a)** via the unload valve is cut off from port T **(b)** and port 1 **(c)** by the spool **(1)**.

And port 1 is connected to port T through the inside of the spool, so port 1 is at the tank pressure.

(1) Spool

(a) Port P
(b) Port T
(c) Port 1
(d) Port 2

RY9212174HYM0022US0



RY9212001HYM169B

2. When the control lever has been actuated (during governing pressure)

When the cam (5) operating angle exceeds 1.9 °, the pushrod (4) presses down on the spool (1) via the spring seat (3) and the secondary pressure setting spring (2).

At part A, port P **(a)** and port 1 **(c)** are connected, while at part **B**, port 1 and port T **(b)** are cut off, so the oil flows from port P to port 1.

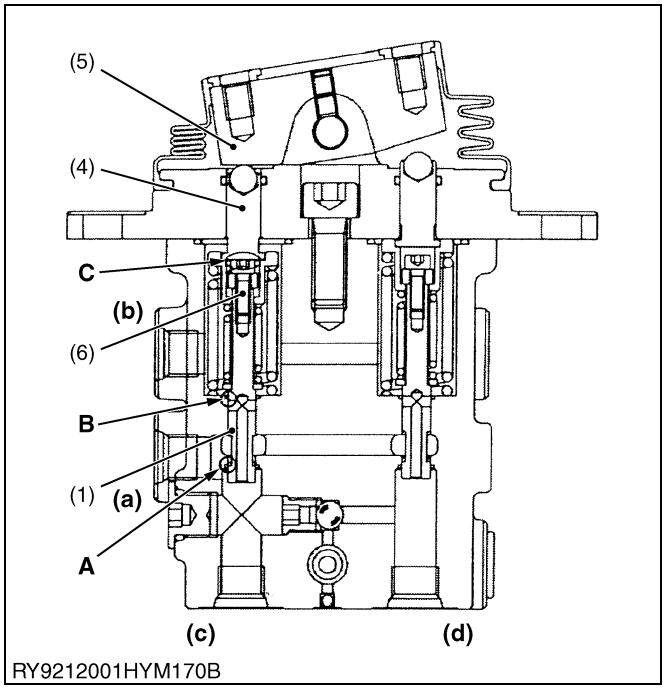
When the pressure at port 1 gets high enough, it counters the secondary pressure setting spring and presses the spool up, thus cutting off port P and port 1 at part **A** and allowing port 1 and port T to be connected at part **B**, and lowering the pressure at port 1. The repetition of this process maintains a constant pressure equal to the secondary pressure setting spring load.

If the cam is depressed further, the position of the spool does not change and the pushrod and spring seat move downwards, compressing the secondary pressure setting spring and putting a large load on the spring; this generates pressure equivalent to this load at port 1.

(1) Spool
(2) Spring
(3) Spring Seat
(4) Pushrod
(5) Cam

(a) Port P
(b) Port T
(c) Port 1
(d) Port 2

RY9212174HYM0023US0



RY9212001HYM170B

3. When the control lever has been actuated (when shorted)

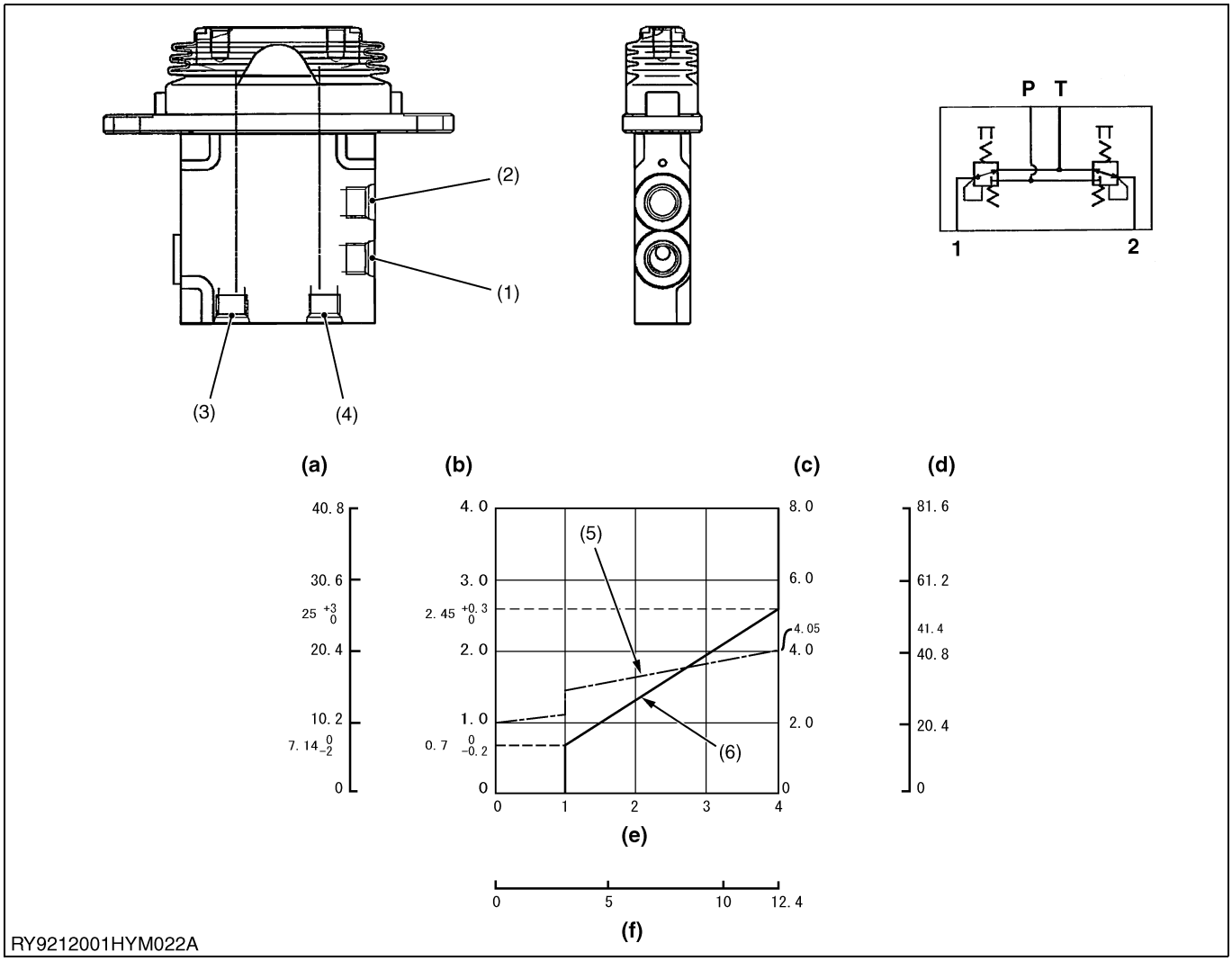
When the cam (5) operating angle exceeds 7.8 °, the pushrod (4) and the hex socket bolt (6) come in contact at part **C** and the spool (1) stops providing control by balancing the pressure. As a result, part **A** is left open, part B is left closed and the pressures of port P and port 1 equalize.

(1)	Spool	**(a)**	**Port P**
(4)	Pushrod	**(b)**	**Port T**
(5)	Cam	**(c)**	**Port 1**
(6)	Hex Socket Bolt	**(d)**	**Port 2**

RY9212174HYM0024US0

[3] SWING PILOT VALVE

(1) Specifications



RY9212001HYM022A

(1) Port P
(2) Port T
(3) Port 1
(4) Port 2
(5) Operating Torque
(6) Secondary Pressure
(a) Secondary Pressure (kgf/cm^2)
(b) Secondary Pressure (MPa)
(c) Operating Torque (N·m)
(d) Operating Torque (kgf·cm)
(e) Pushrod Stroke (mm)
(f) Pedal Operating Angle (deg)

Maker	KPM (Kawasaki Precision Machinery)
Model	PV6P1082A
Secondary pressure	Noted separately

RY9212001HYM0119US0

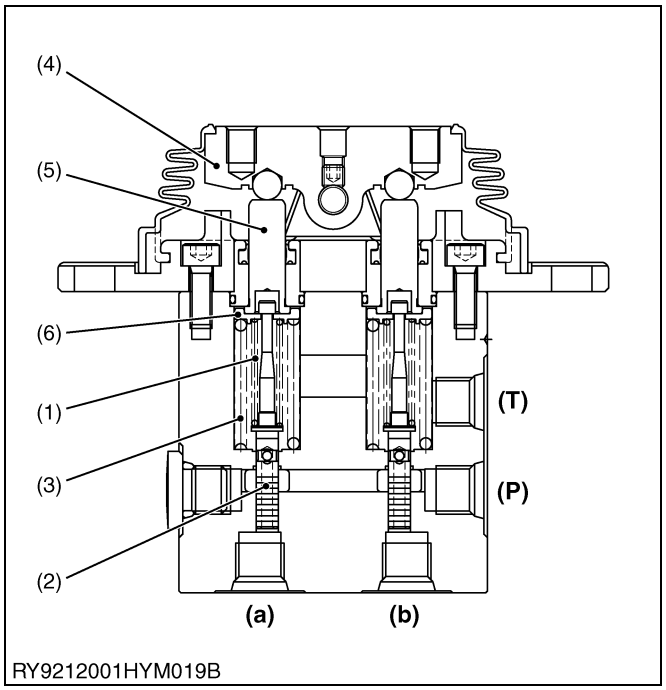
(2) Function and Structure

[A] Function

The pilot valve is the valve that controls the direction and volume of the stroke of the control valve, and lowers the primary pressure from the unload valve to a secondary pressure only as much as is necessary to move the control valve spool.

RY9212001HYM0001US0

[B] Operation



RY9212001HYM019B

1. When the control lever or pedal are in neutral

The force of the secondary pressure setting spring (1) does not press on the spool (2). As a result, the spool is held in a neutral position by the return spring (3). At such time, the output port (control valve port and port 1 **(a)** and port 2 **(b)**) and port T **(d)** are connected.

2. When the control lever or pedal have been actuated

The cam (4) is turned counterclockwise, the port 1 side pushrod (5) presses down on the spool (2) via the spring seat (6) and the secondary pressure setting spring (1). When doing so, port P **(c)** and port 1 **(a)** are connected, so the oil from the pilot pump flows through port 1 to the control valve.

The pressure at port 1 rises until it is equivalent to the force of the secondary pressure setting spring, thus balancing the hydraulic pressure on the spool with the tension of the secondary pressure setting spring and maintaining a fixed port 1 pressure.

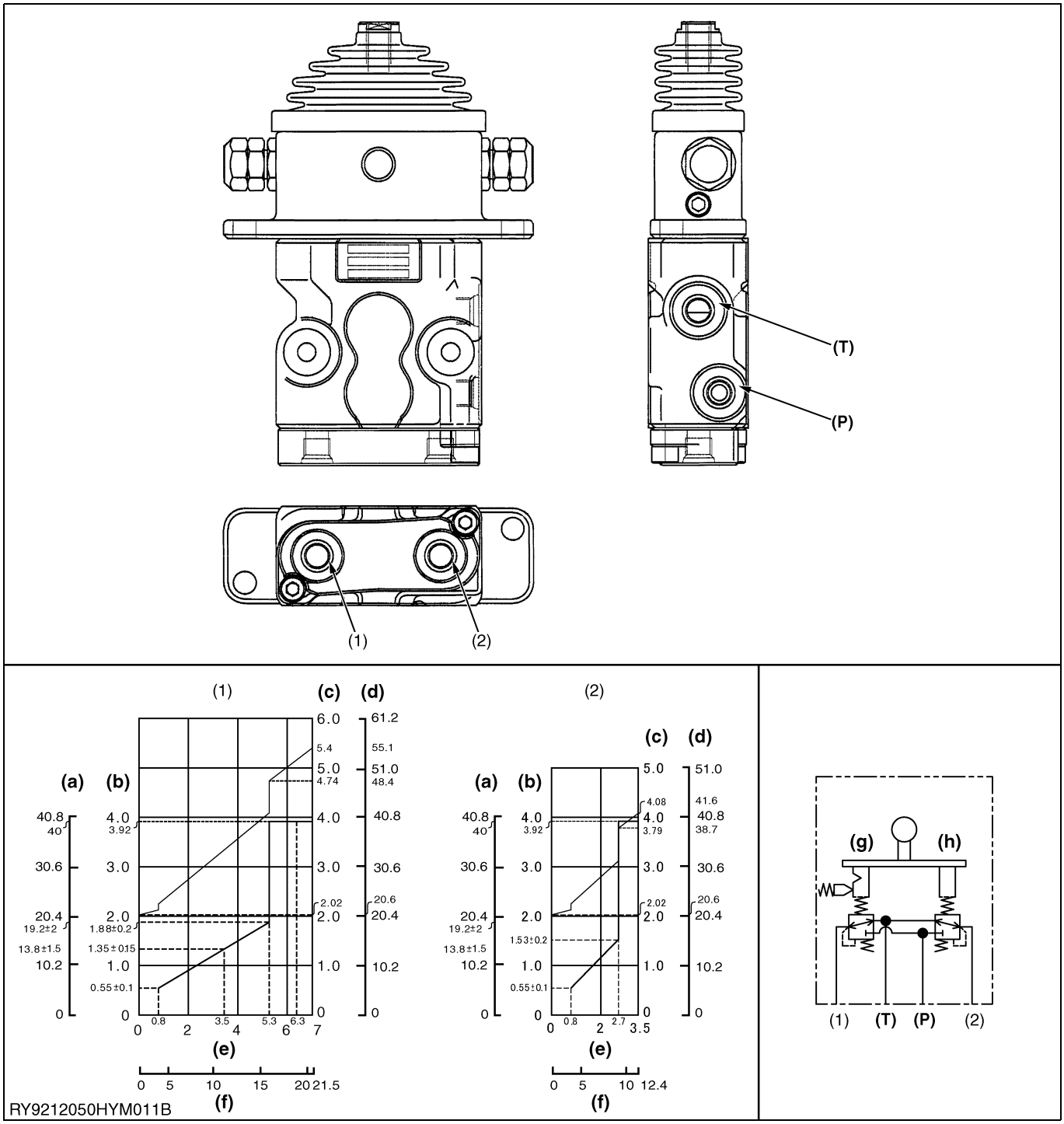
(1) Spring
(2) Spool
(3) Spring
(4) Cam
(5) Pushrod
(6) Spring Seat

(a) Port 1
(b) Port 2
(c) Port P
(d) Port T

RY9212174HYM0025US0

[4] BLADE PILOT VALVES

(1) Specifications



(1) Port 1
(2) Port 2
(P) Port P
(T) Port T

(a) Secondary Pressure (kgf/cm^2)
(b) Secondary Pressure (MPa)
(c) Operating Torque (N·m)
(d) Operating Torque (kgf·m)
(e) Pushrod stroke (mm)
(f) Operating Angle (deg)
(g) Down
(h) Up

Maker	Kawasaki Heavy Industries, Ltd.
Model	TH40P1048B

RY9212158HYM0004US0

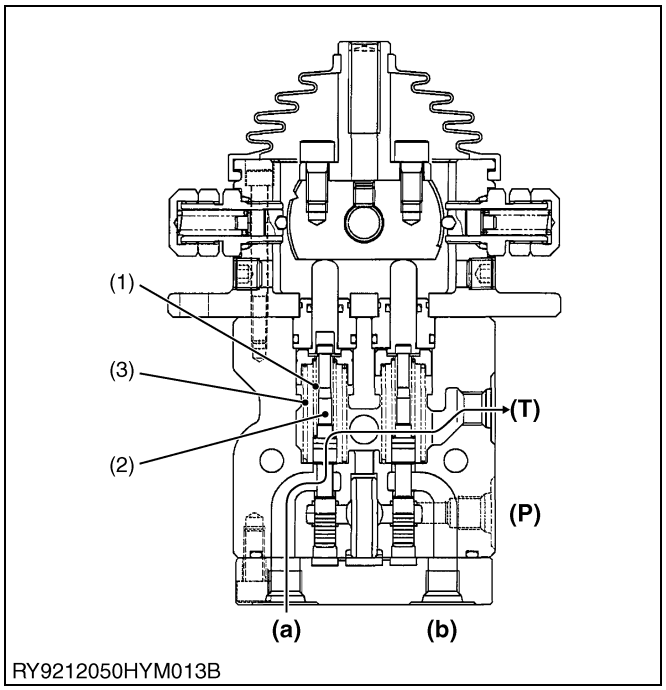
(2) Function and Structure

[A] Function

The pilot valve is the valve that controls the direction and volume of the stroke of the control valve, and lowers the primary pressure from the unload valve to a secondary pressure only as much as is necessary to move the control valve spool.

RY9212001HYM0001US0

[B] Operation



RY9212050HYM013B

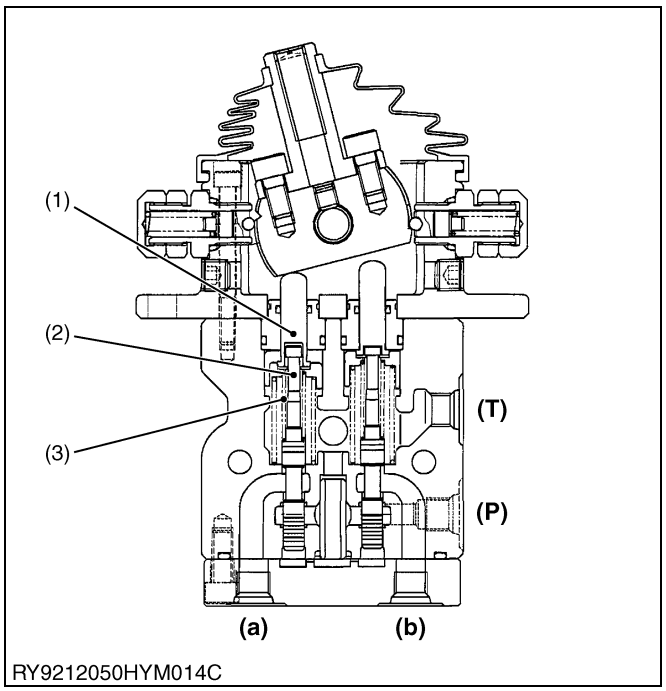
1. When the control lever is in neutral

The force of the secondary pressure spring (1) does not press on the spool (2). Consequently, spool (2) is pushed up by the return spring (3), and port 1 **(a)**and port T **(T)** are connected.

(1) Secondary Pressure Spring
(2) Spool
(3) Return Spring

(a) Port 1
(b) Port 2
(P) Port P
(T) Port T

RY9212158HYM0005US0



RY9212050HYM014C

2.When the control lever has been actuated

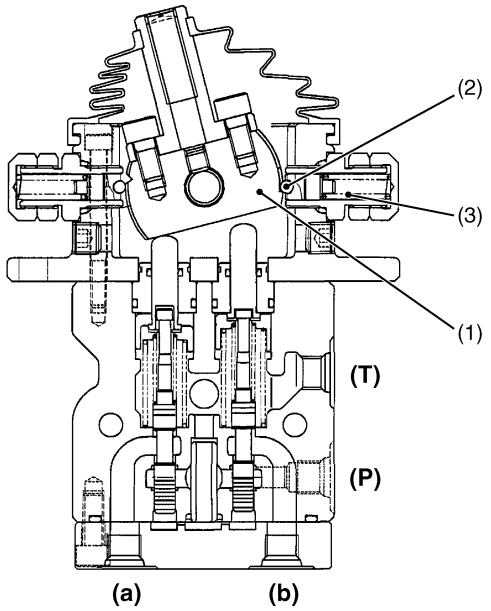
When the control lever is tilted and pushrod (1) goes through its stroke, spool (2) moves downwards, port P**(P)**and port 1 **(a)** are connected, and oil from the pilot pump flows via port 1 to the control valve.

The pressure at the port rises until it is equivalent to the force of the secondary pressure spring (3), thus balancing the hydraulic pressure on the spool with the tension of the secondary pressure spring and maintaining a fixed port pressure.

(1) Pushrod
(2) Spool
(3) Secondary Pressure Spring

(a) Port 1
(b) Port 2
(P) Port P
(T) Port T

RY9212158HYM0006US0



RY9212050HYM014D

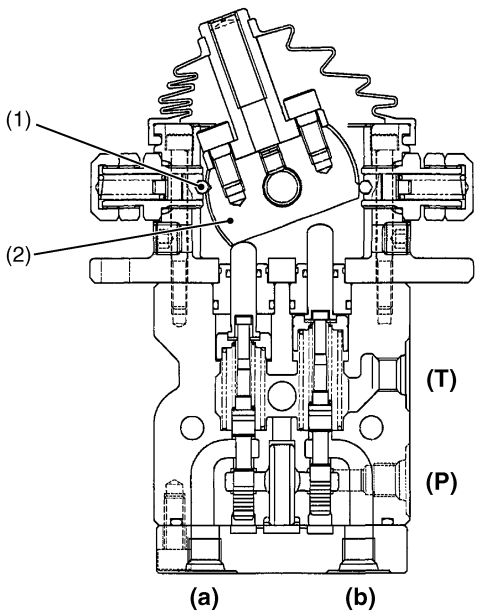
3. Pre-detent operation

Pre-detent is activated at a specified operating angle. When steel ball (2) in the stepped section of the disc (1) passes the step, operating torque increases owing to compression of the spring (3). Due to this change in operating torque, the operator knows he is close to the actuation angle of detent operation at a predetermined actuation angle.

(1) Disc
(2) Steel Ball
(3) Spring

(a) Port 1
(b) Port 2
(P) Port P
(T) Port T

RY9212158HYM0007US0



RY9212050HYM015B

4. When detent is activated

At the detent operation activation angle before the end of stroke, the steel ball (1) slides into the V-shaped groove of the disc (2), which is detent operation status.

If the operator releases the lever during detent operation, the lever control angle is maintained and a fixed secondary pressure continues to be applied.

(1) Steel Ball
(2) Disc

(a) Port 1
(b) Port 2
(P) Port P
(T) Port T

RY9212158HYM0008US0

5. When detent is released

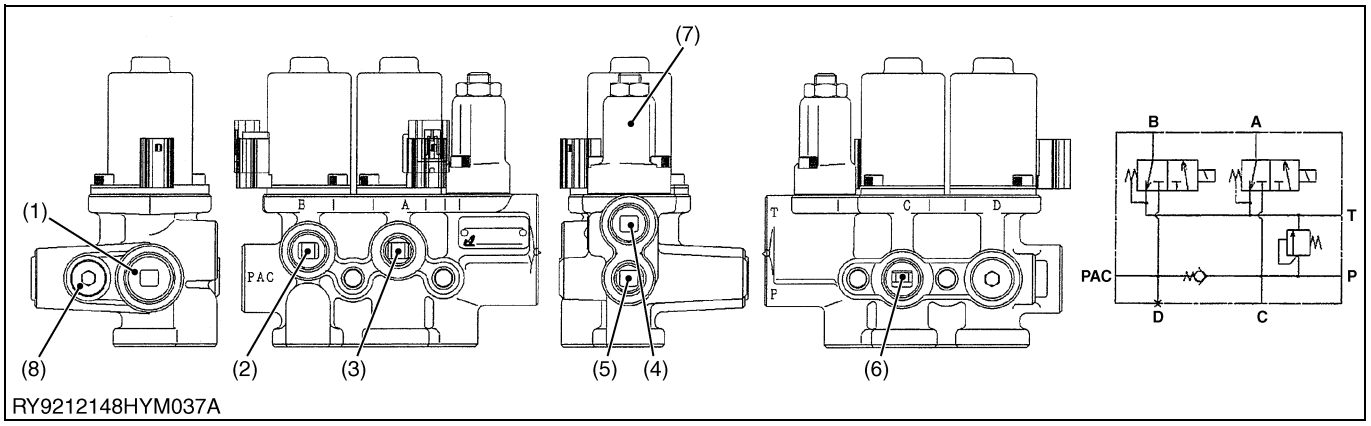
Detent can be released manually by applying a force greater than the release torque to the operating lever in the direction of neutral.

RY9212050HYM0022US0

9. SOLENOID VALVE

[1] UNLOAD VALVE

(1) Specifications



(1) PAC Port (Accumulator)
(2) Port A (2nd Speed Travel Switch)
(3) Port B (Pilot Operation, Swivel Parking Brake)
(4) Drain Port (to Hydraulic Oil Tank)
(5) Port P (to Control Valve)
(6) Port C (from Pilot Pump)
(7) Pilot Primary Relief Valve (aPP)
(8) Check Valve

Maker	Nishina Industrial	Notes
Rated Voltage	12 V	
Relief Valve Pressure Setting (aPP)	3.92 + 0.29 MPa 40.0 + 3.0 kgf/cm^2 570 + 42 psi	at Temp. 50 °C (144 °F), 14.7 L/min (897 cu.in./min, 3.9 USGPM)
Leak volume port P → port T	130 ml/min 7.9 cu.in./min 0.03 USGPM	at 2.5 MPa (25.5 kgf/cm^2, 363 psi)
Leak volume port PAC → other ports	90 ml/min 5 cu.in./min 0.02 USGPM	at 3.9 MPa (40.0 kgf/cm^2, 569 psi)

RY9212148HYM0022US0

(2) Function and Structure

[A] Function

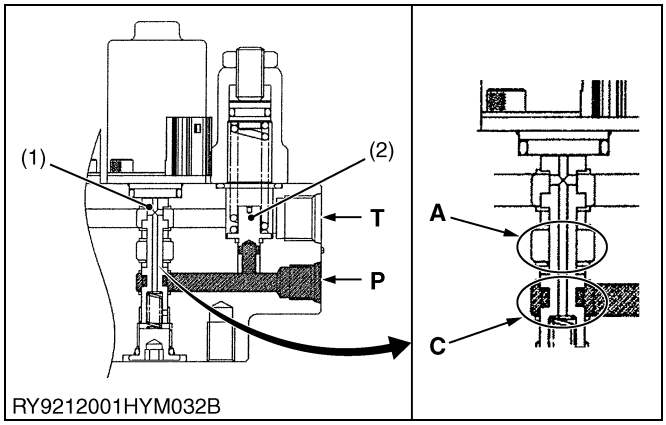
The unload valve consists of two directional change valves operated by solenoid, a check valve and a relief valve; it perform functions such as unloading control pressure from the pilot pump (returning oil to the hydraulic oil tank) and supplying control pressures to pilot valves for operation and travel, as well as to the swivel motor (for the parking brake) and the travel motor (for switching the two speeds).

RY9212001HYM0124US0

[B] Operation

With this device, oil from the pilot pump enters port C and is supplied to the control valve from port P, but that is functionally identical to when oil from the pilot pump enters from port P and supplied to the control valve from port C. Following is a description of when oil enters from port P from the pilot pump.

RY9212001HYM0125US0



RY9212001HYM032B

1. When the solenoid is off

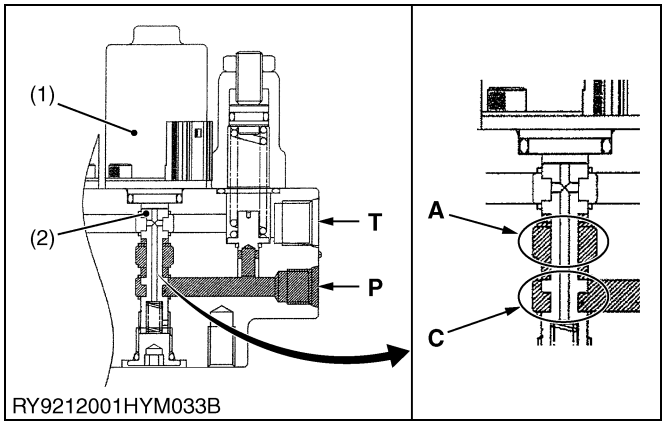
Oil from port P is cut off from passages to port A and port T by a spool (1) and plunger (2). Ports A and T are connected. And Port C and Port P are connected, so the pressures at port C and port P are always the same.

When the pressure from port P reaches the relief valve pressure setting, the oil from port P returns to the tank via the relief valve (pushes the plunger up).

(1) Spool
(2) Plunger

A : Port A
C : Port C
P : Port P
T : Port T

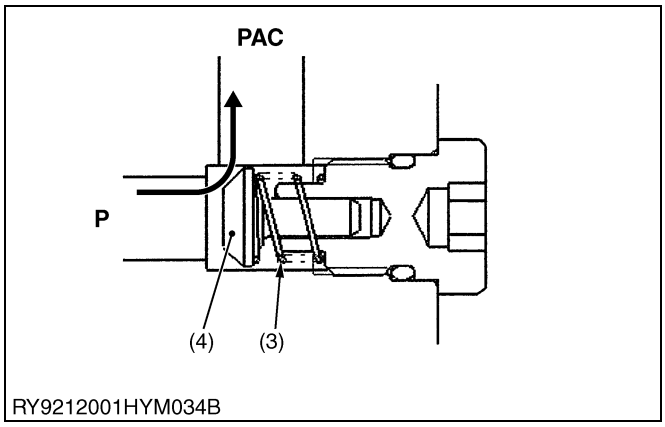
RY9212148HYM0023US0



RY9212001HYM033B

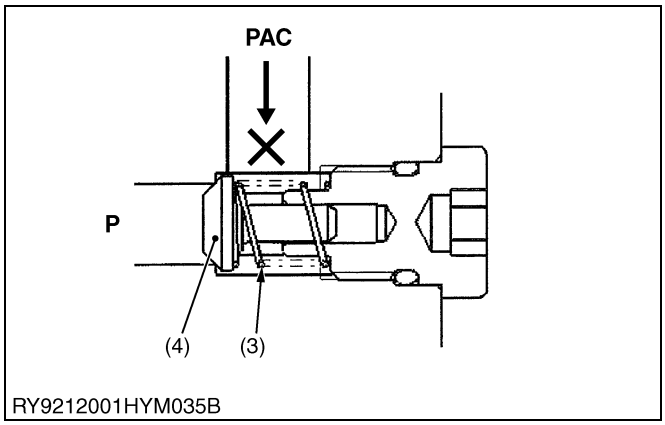
2. When the solenoid is on

When the solenoid (1) is energized, the solenoid's pushrod presses the spool (2) down, connecting port P to port A and cutting off port A and port T, so the oil from port P flows to port A.



RY9212001HYM034B

When port P pressure reaches a pressure at or greater than the spring (3), the plunger (4) moves to the right and pressure oil flows from port P to port PAC.



RY9212001HYM035B

When the pressure at port P is low, the oil from port PAC is cut off, preventing backflow.

(1) Solenoid
(2) Spool
(3) Spring
(4) Plunger

A : Port A
C : Port C
P : Port P
T : Port T

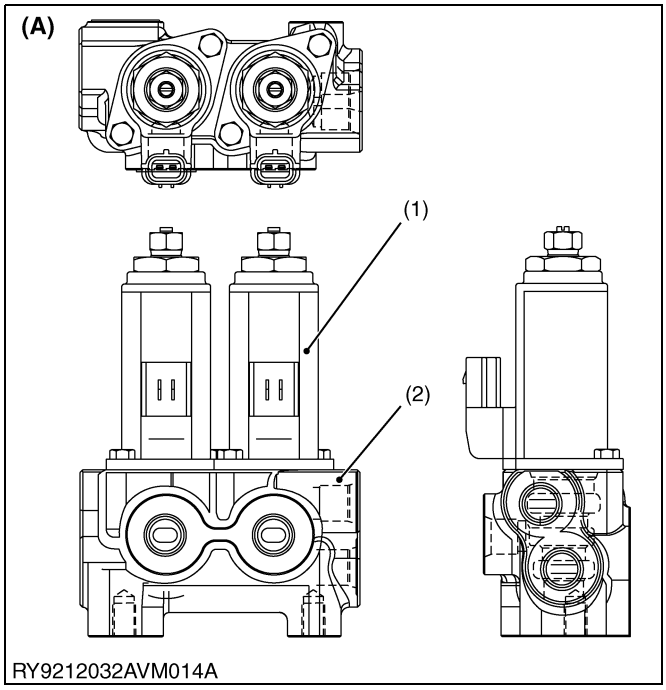
RY9212148HYM0024US0

[2] AUX SOLENOID VALVE

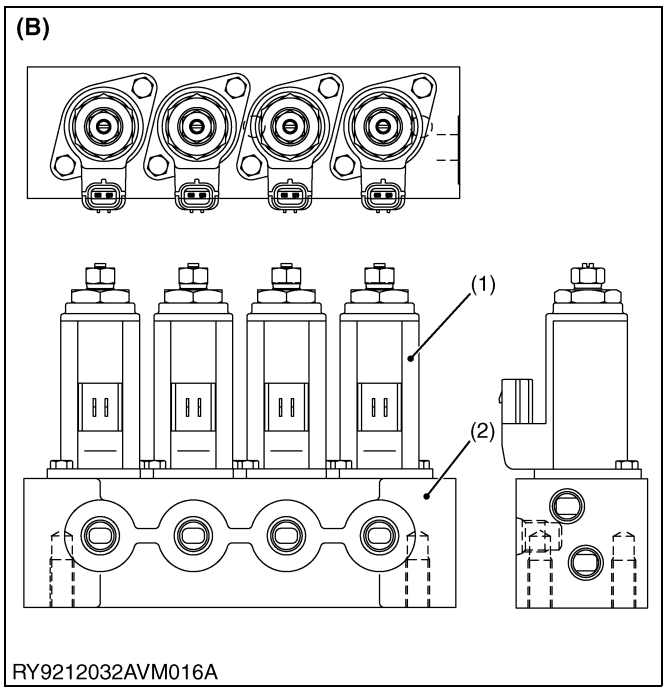
(1) Specifications

Proportional Control Solenoid Valve

This valve is an electromagnetic solenoid valve. Normally, a solenoid valve is turned off and on via 12V battery voltage, but this valve is controlled via pulsed signals from the computer built into the ECU and the meter panel. (PWM Control)



RY9212032AVM014A



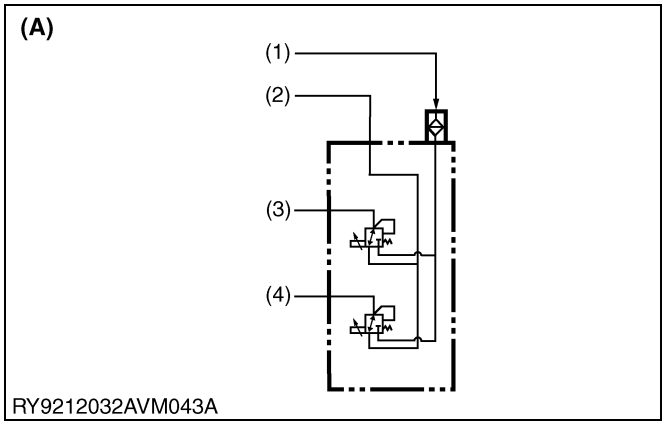
RY9212032AVM016A

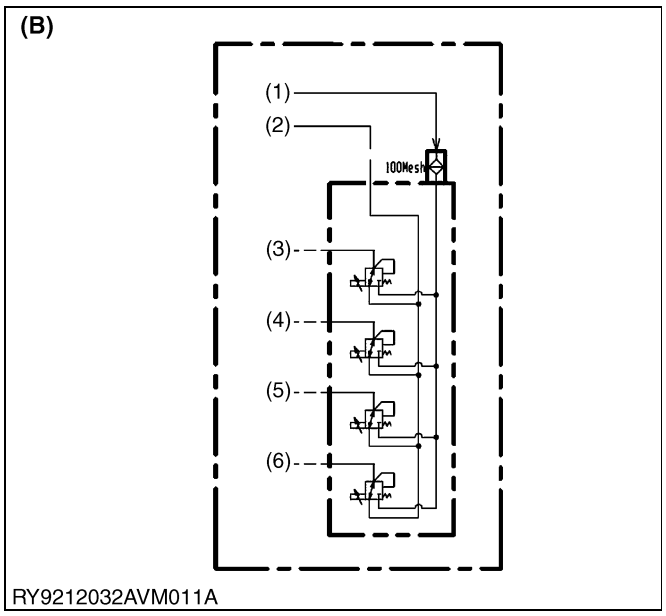
Item	Specifications
Max operating pressure (input pressure)	3.9 MPa 40 kgf/cm^2 570 psi
Allowable back pressure (pressure T)	1.0 MPa 10 kgf/cm^2 100 psi
Maximum proportional valve operating flow volume (input flow volume)	15.6 L/min, 4.1 GPM
Drain volume when solenoid off	AUX1: 0.4 L/min ≥ AUX1, 2: 0.8 L/min ≥ (At 20 cST, port P pressure = 4.9 MPa, 50 kgf/cm^2, 710 psi)
Waterproof Standard	JIS D 0203 S2 equivalent
Vibration Proof Standard	JIS D 1601–1995
Hydraulic Oil Grade	ISO VG32 to 68 equivalent
Hydraulic Oil Contamination Level	NAS Class 10 ≥
Electrical Specifications	Rated Amperage: 1600 mA Coil resistance: 3.2 ± 0.5 Ω (at 20 °C, 68 °F)
Second pressure control range	0 to 2.7 MPa 0 to 27 kgf/cm^2 0 to 390 psi

(1) Solenoid
(2) Case
(A) AUX1 Version
(B) AUX1, 2 Version

RY9212174HYM0026US0

Hydraulic Circuit Diagram

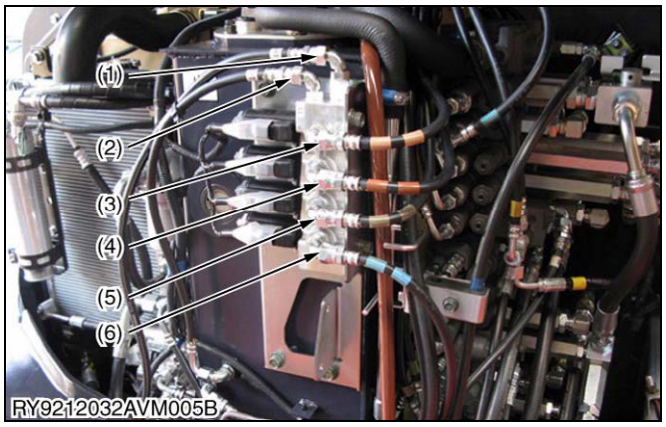


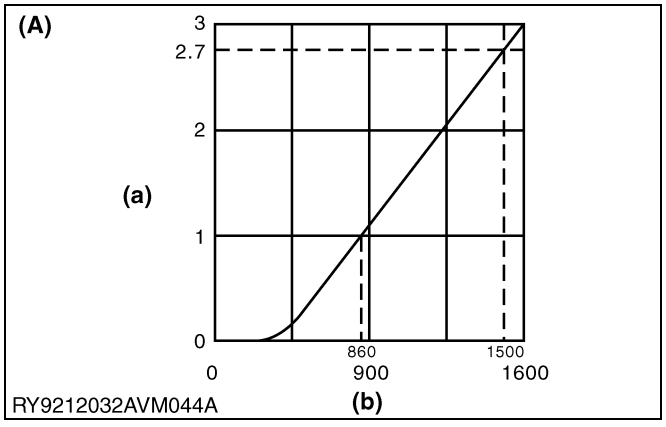


(1) Port P
(2) Port T
(3) AUX1 LH Port
(4) AUX1 RH Port
(5) AUX2 LH Port
(6) AUX2 RH Port

(A) AUX1 Version
(B) AUX1, 2 Version

RY9212174HYM0027US0





(1) Port P
(2) Port T
(3) AUX1 LH Port
(4) AUX1 RH Port
(5) AUX2 LH Port
(6) AUX2 RH Port

(A) Control Diagram

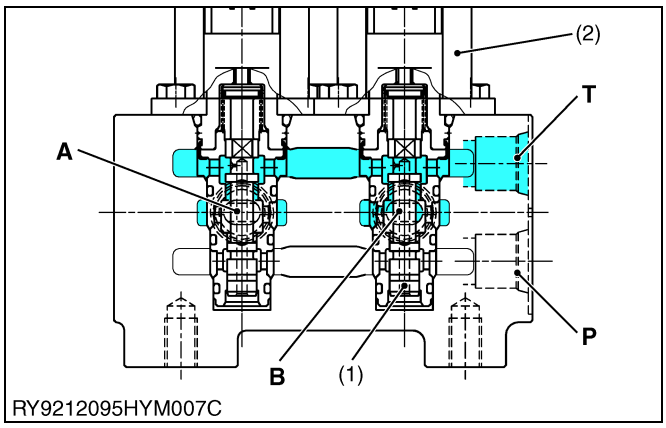
(a) Secondary Pressure (MPa)
(b) Input Current (mA)

RY9212032HYM0037US0

(2) Function and Structure

The pressure from port P is supplied or cut off from port A or port B by the solenoid valve used when operating the AUX.

RY9212095HYM0019US0



RY9212095HYM007C

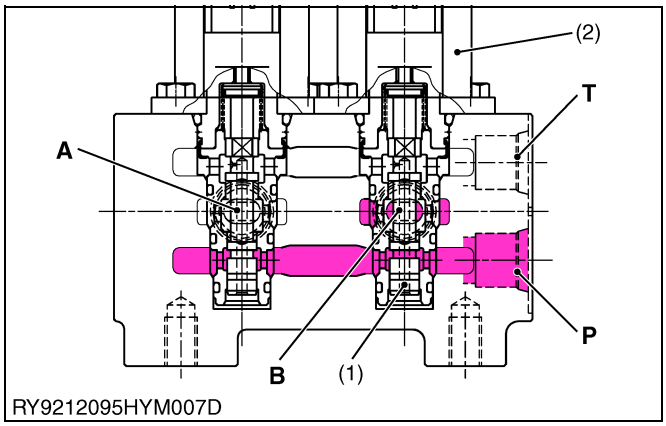
1. When the solenoid is off

When the solenoid is off, port P and port B are cut off by the spool. Port B and port T are connected, so no pressure is produced at port B.

(1) Spool
(2) Solenoid

A : Port A
B : Port B
P : Port P
T : Port T

RY9212095HYM0020US0



RY9212095HYM007D

2. When the solenoid is on

When the solenoid is on, the spool is pressed down, connecting port P and port B. And as port B and port T are cut off, the oil from port P flows to port B.

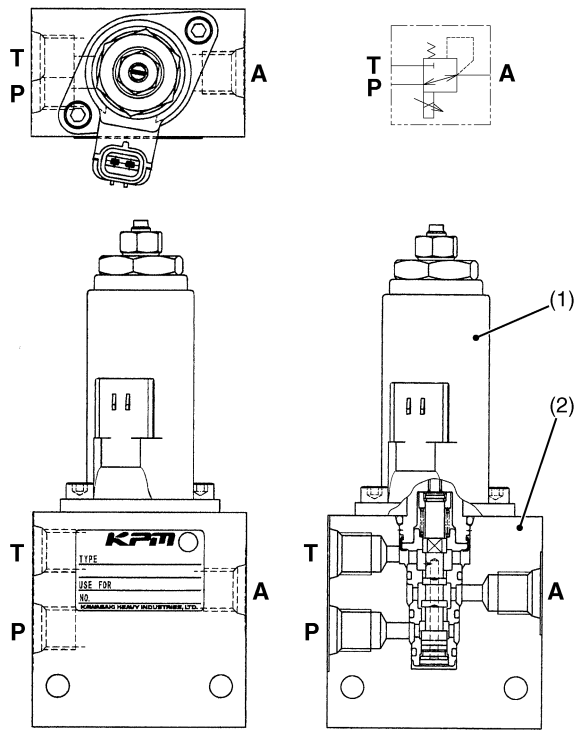
(1) Spool
(2) Solenoid

A : Port A
B : Port B
P : Port P
T : Port T

RY9212095HYM0021US0

[3] EP MODE SOLENOID VALVE

(1) Specifications



RY9212148HYM038A

Item	Specifications
Max operating pressure (input pressure)	3.9 MPa 40 kgf/cm^2 570 psi
Allowable back pressure (pressure T)	1.0 MPa 10 kgf/cm^2 100 psi
Maximum proportional valve operating flow volume (input flow volume)	10.0 L/min (2.64 U.S.gals./min)
Drain volume when solenoid off	0.6 L/min (0.2 U.S.gals../min) ≥ [At 20 cST, port P pressure = 4.9 MPa (50 kgf/cm^2, 710 psi)]
Electrical Specifications	Rated Amperage: 1600 mA Coil resistance: 3.3 Ω [at 20 °C (68 °F)]

(1) Solenoid
(2) Case

A : Port A
P : Port P
T : Port T

RY9212148HYM0026US0

SERVICING

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1. PUMP

[1] REMOVING AND INSTALLING THE PUMP

CAUTION

- **When removing a hydraulic device after operating the excavator, lower the bucket and blade to the ground and turn off the engine.**
- **Each of the devices and the hydraulic oil are hot right after stopping the excavator. The oil is hot enough to cause a burn, so always let it cool down before starting any work.**
- **Oil gushing out under pressure has enough force to injure you by piercing your skin. Always relieve any pressure remaining in the system prior to working to remove any hydraulic equipment or lines.**

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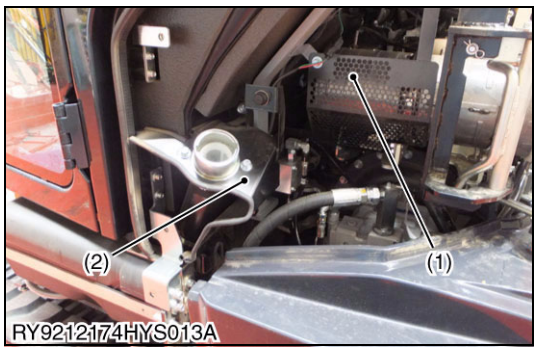
1. Remove the left and rear bonnets.

■ **IMPORTANT**

- **For bonnet removal, a minimum of 2 persons is needed.**

(1) Rear Bonnet (2) Left Bonnet

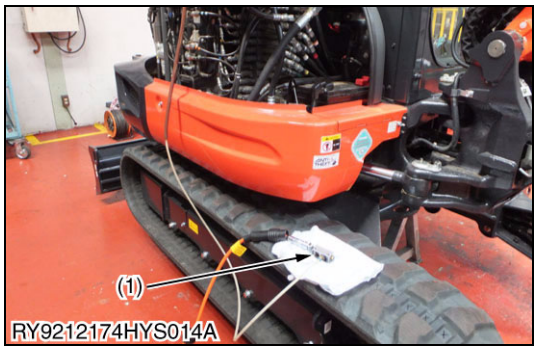
RY9212174HYS0017US0



2. Remove the DPF muffler cover and the fuel tank cover.

(1) DPF muffler Cover (2) Fuel Tank Cover

RY9212174HYS0085US0



3. Attach a vacuum pump and depressurize the inside of the tank.

■ **IMPORTANT**

- **Plug the breather hose.**

(1) Vacuum Pump

RY9212174HYS0018US0

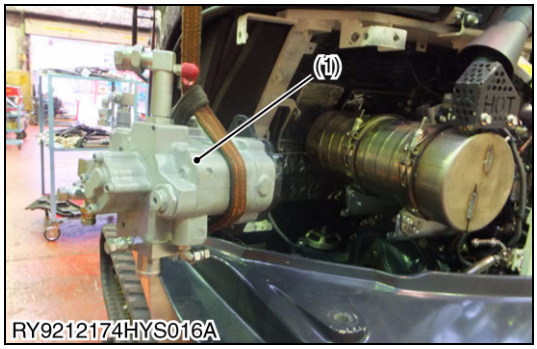


4. Remove the bottom cover of the pump and disconnect all the hoses connected to the pump.

■ **IMPORTANT**

- **Plug the disconnected hoses and adapters.**

RY9212174HYS0019US0



5. Suspend the pump with a crane and remove the pump mounting bolts (two).
   Use the crane to remove the pump.

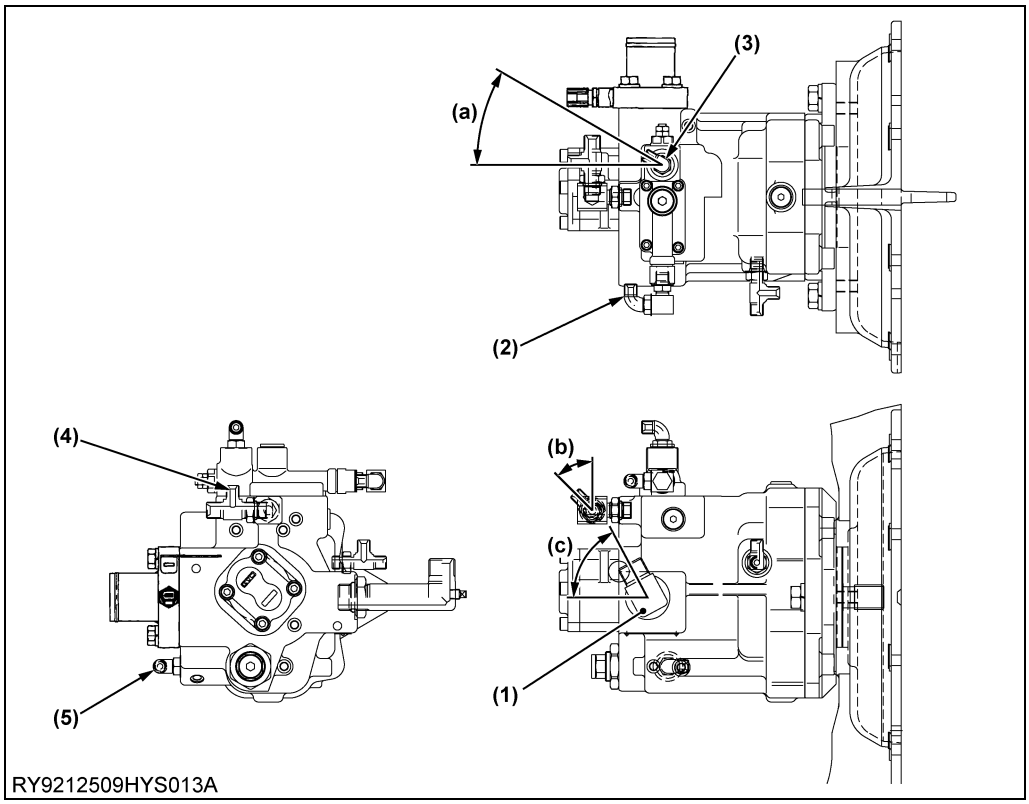
Tightening torque	Bolt	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 lbf·ft

Pump weight	Approx. 32 kg (71 lbs)

(1) Pump

RY9212174HYS0020US0

Adapter angle

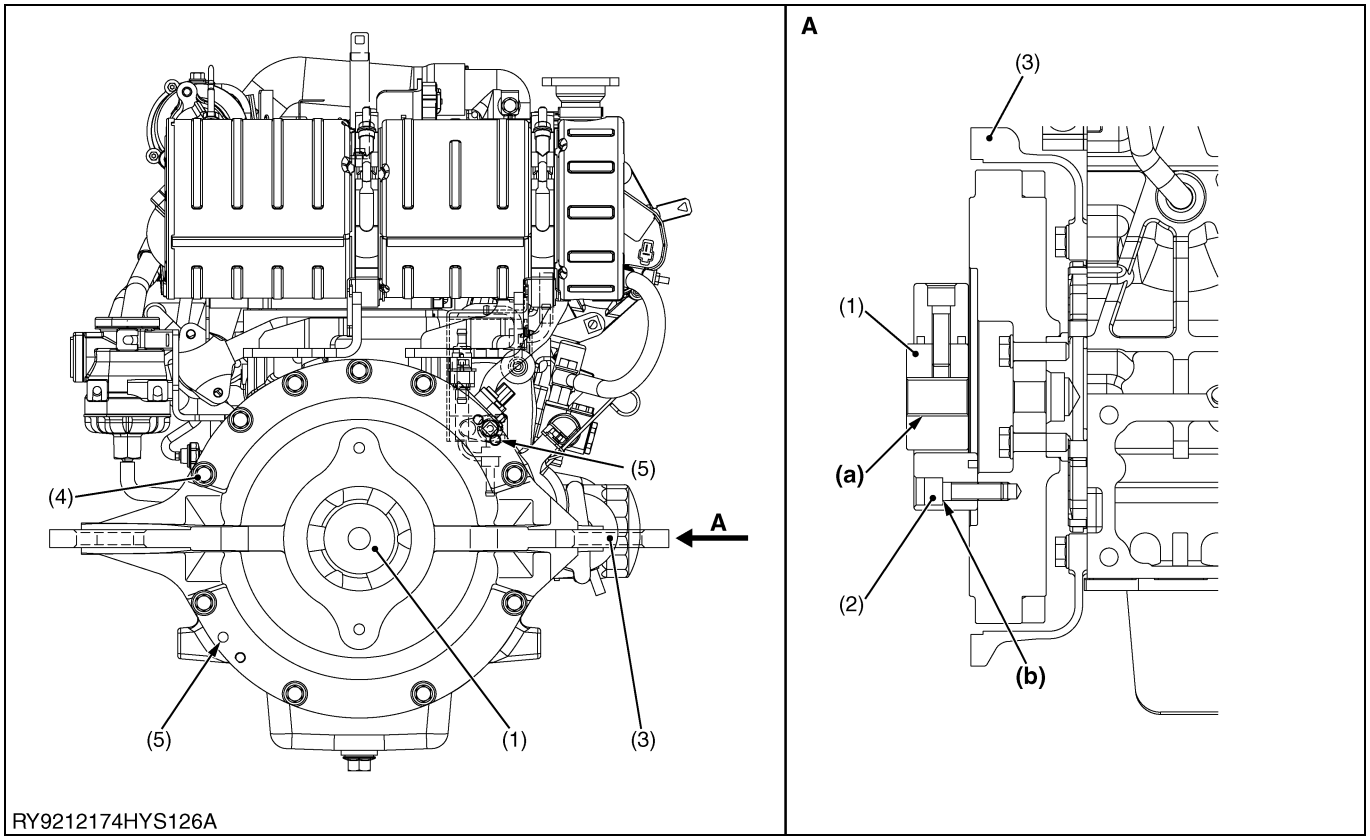


(1) P1
(2) Pps
(3) Pls
(4) Pp
(5) Pi

(a) 30 ° (0.52 rad)
(b) 60 ° (1.0 rad)
(c) 62 ° (1.08 rad)

RY9212509HYS0014US0

Pump Coupling and Housing Assembly Diagram



(1) Coupling
(2) Coupling Mounting Bolt
(3) Pump Housing
(4) Housing Mounting Bolt
(5) Parallel Pin

- (a) Apply grease to the spline.
- (b) Apply a very thin film to the connector seat before installing.

■ **IMPORTANT**

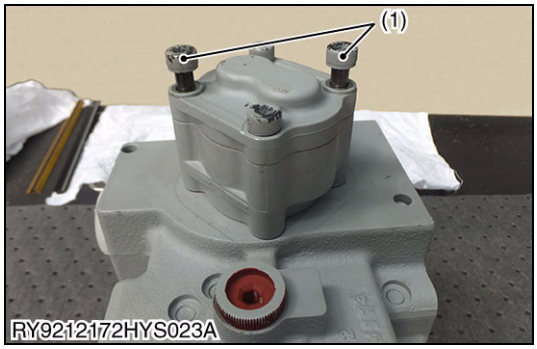
- **Do not use a thread lock on the connector mounting bolts.**
- **Do not apply grease to the connector rubber seal.**
- **Align the parallel pin before tightening the pump housing mounting bolts.**

Tightening torque	Connector mounting bolt	85.0 to 94.0 N·m 8.7 to 9.6 kgf·m 62.7 to 9.3 lbf·ft
	Housing mounting bolt	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 lbf·ft

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[2] DISASSEMBLING AND ASSEMBLING THE PUMP

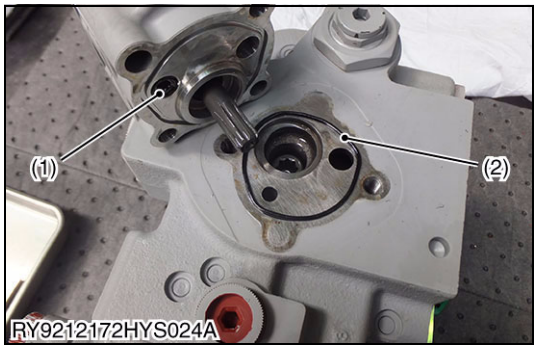
(1) Disassembling



1. Remove four cap bolts.
   - Tool to use: 6 mm hexagon socket

(1) Bolt M8 × 65 × 2

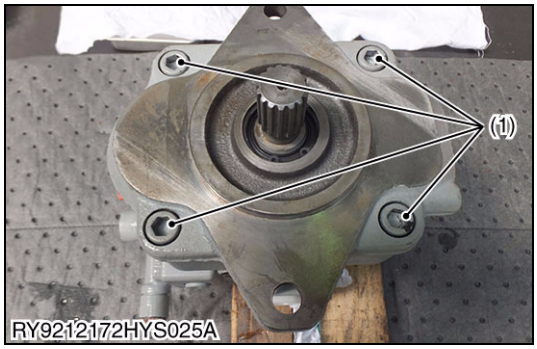
RY9212172HYS0031US0



2. Remove the gear pump and the O-ring.

(1) O-Ring (2) O-Ring

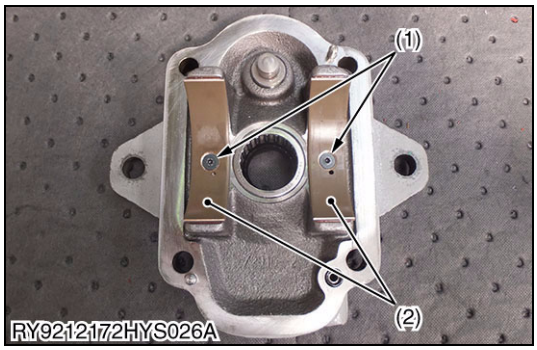
RY9212172HYS0032US0



3. Remove four cap bolts and the flange.
   - Tool to use: 6 mm hexagon socket

(1) Bolt M12 × 35 × 4

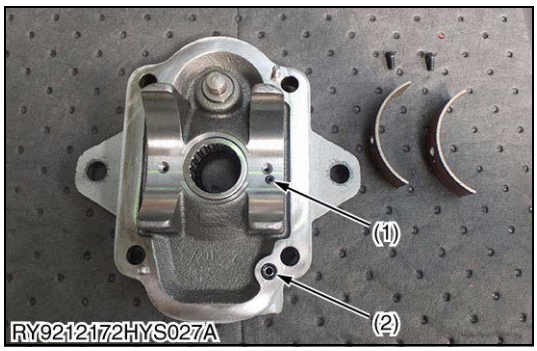
RY9212172HYS0033US0



4. Remove two screws and bushing.
   - Tool to use: 3 mm hexagon socket

(1) Screw M5 × 10 × 2 (2) Bushing

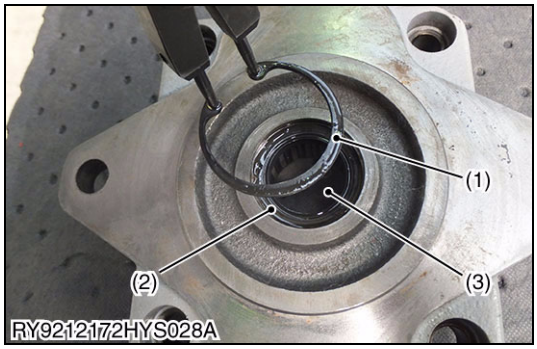
RY9212172HYS0034US0



5. Remove the O-ring.

(1) O-Ring (2) O-Ring

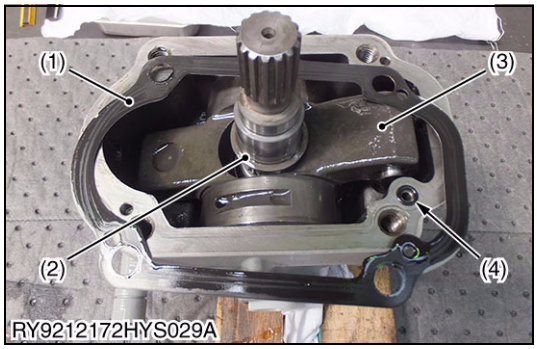
RY9212172HYS0035US0



6. Remove the circlip from the flange, and remove the oil seal and needle bearing.
   - Tool to use: Circlip plier

(1) Circlip
(2) Oil Seal
(3) Bearing

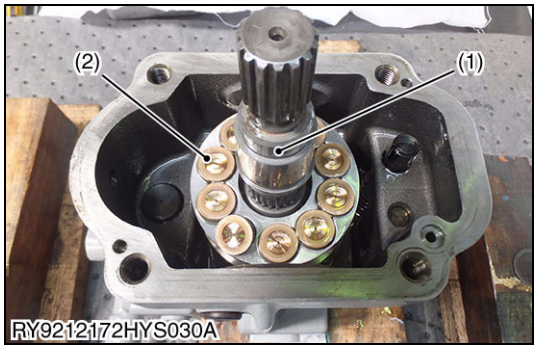
RY9212172HYS0036US0



7. Remove the flange and gasket, the swash plate, O-ring and the thrust washer from the shaft.

(1) Gasket
(2) Thrust Washer
(3) Swash Plate
(4) O-Ring

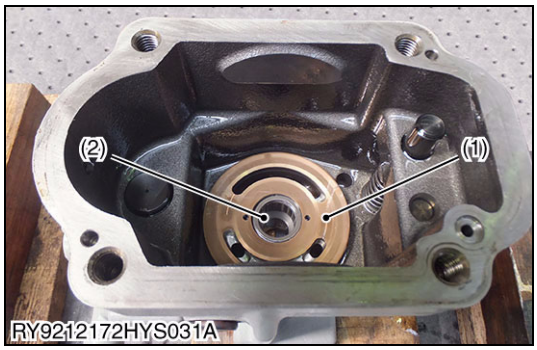
RY9212172HYS0037US0



8. Remove the shaft and cylinder block assembly.

(1) Shaft
(2) Cylinder Block ASSY

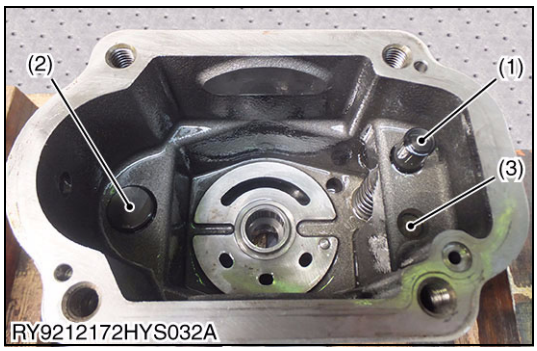
RY9212172HYS0038US0



9. Remove the valve plate and the thrust washer.

(1) Valve Plate
(2) Thrust Washer

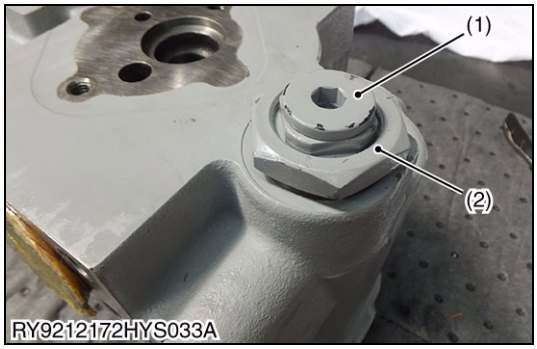
RY9212172HYS0039US0



10. Remove the feedback pin A and B, the control pin.
    - Tool to use: Magnetic pick-up tool

(1) Control Pin
(2) Feedback Pin B
(3) Feedback Pin A

RY9212172HYS0040US0

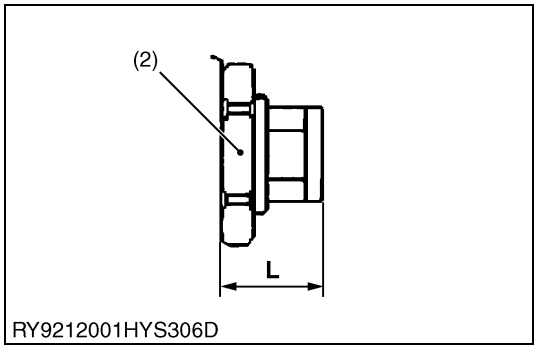


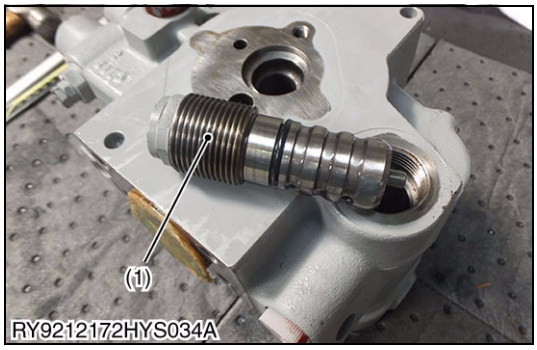
11. Remove the lock nut.
    - Tool to use: 41 mm spanner

■ **NOTE**
- **The set-length of L before loosening.**

(1) Horsepower Control Valve
(2) Lock Nut
L : Distance

RY9212172HYS0041US0

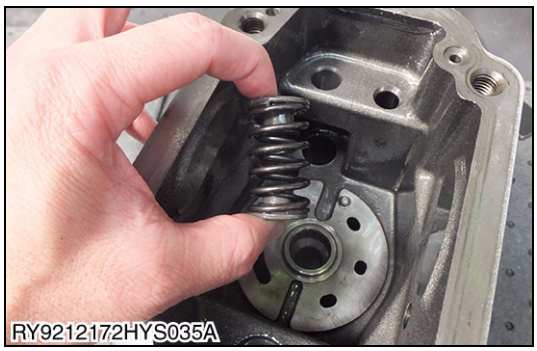




12. Remove the horsepower control valve assembly.
    - Tool to use: 8 mm hexagon wrench

(1) Horsepower Control Valve

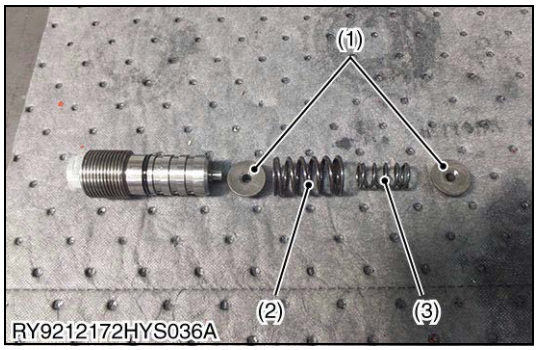
RY9212172HYS0042US0

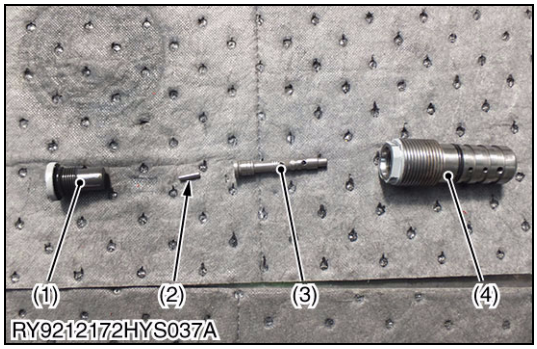


13. Remove the spring and spring seat from the case.

(1) Spring Seat
(2) Spring
(3) Spring

RY9212172HYS0043US0

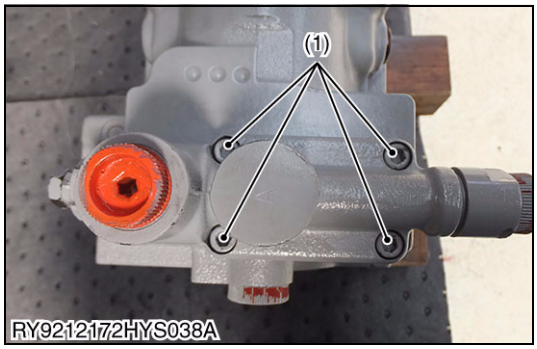




Horsepower control valve components

(1) Plug
(2) Pin
(3) Spool
(4) Valve Sleeve

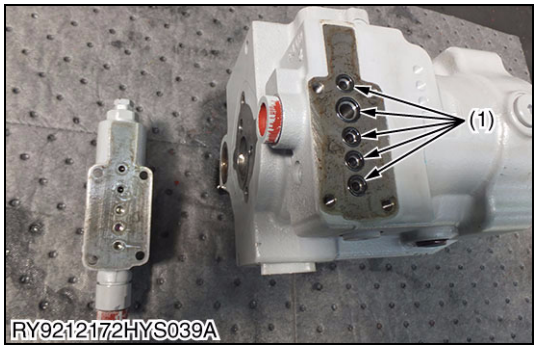
RY9212172HYS0044US0



14. Remove four cap bolts and the LS regulator assembly.
    - Tool to use: 5 mm hexagon wrench

(1) Bolt M6 × 15 × 4

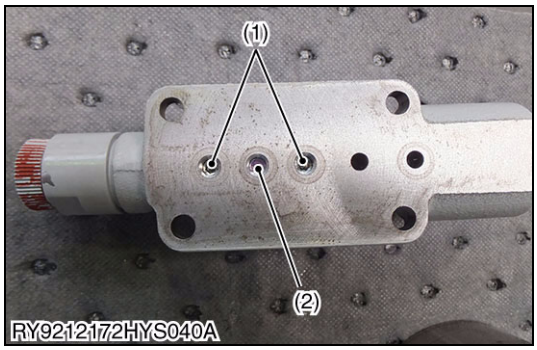
RY9212172HYS0045US0



15. Remove five O-rings.

(1) O-Ring

RY9212172HYS0046US0

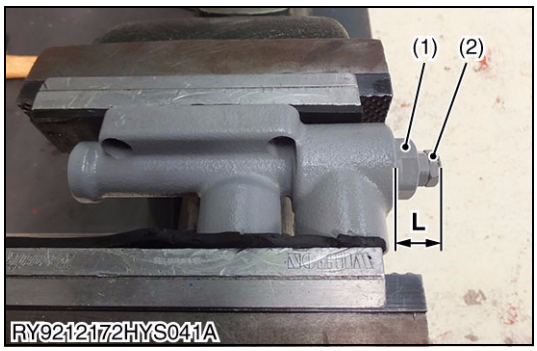


16. Remove three orifices from the LS regulator assembly.
    - Tool to use: 3 mm hexagon wrench

■ **NOTE**
- **Location of orifices before removing.**

(1) Orifice
(2) Orifice

RY9212172HYS0047US0

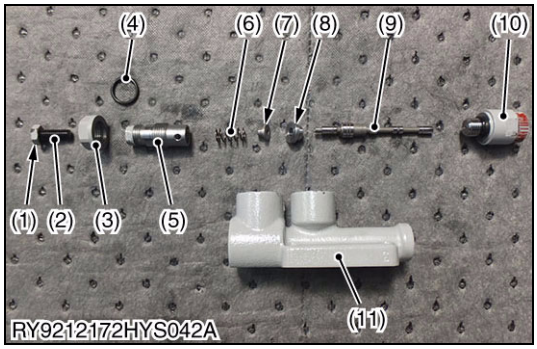


17. Loosen the lock nut to remove the lock nut.
    - Tool to use: 5 mm hexagon wrench

■ **NOTE**
- **The set-length of L before loosening.**

(1) Lock Nut
(2) Nut
L : Distance

RY9212172HYS0048US0

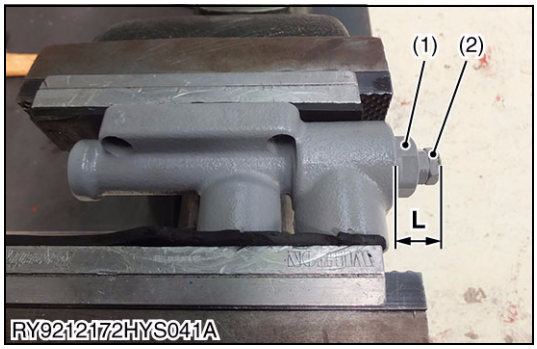


LS regulator components

(1) Nut
(2) Set Screw
(3) Nut
(4) O-Ring
(5) Cap
(6) Spring
(7) Spring Seat
(8) Bushing
(9) Spool
(10) Plug
(11) Valve Body

RY9212172HYS0049US0

(2) Assembling

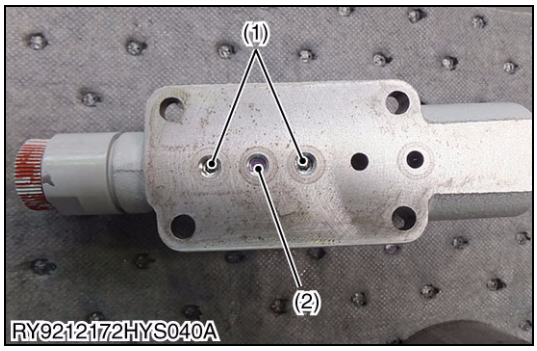


1. Assemble the LS regulator, and tighten the lock nut by specified torque.
   - Set-length L should be exactly same as before loosening.

Tightening torque	Nut (1)	40.0 N·m 4.1 kgf·m 29.5 lbf·ft
	Nut (2)	8.9 N·m 0.9 kgf·m 6.6 lbf·ft

(1) Nut (2) Nut

RY9212172HYS0050US0

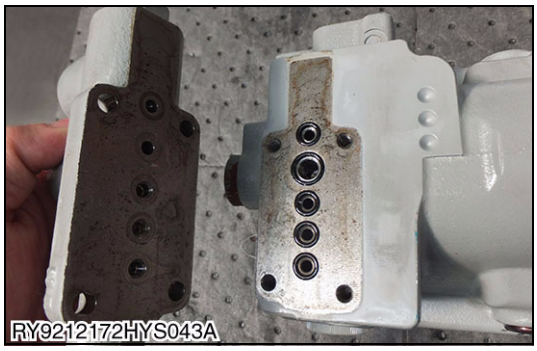


2. Install three orifices.

Tightening torque	Orifice (1) (2)	2.45 N·m 0.2 kgf·m 1.8 lbf·ft

(1) Orifice (2) Orifice

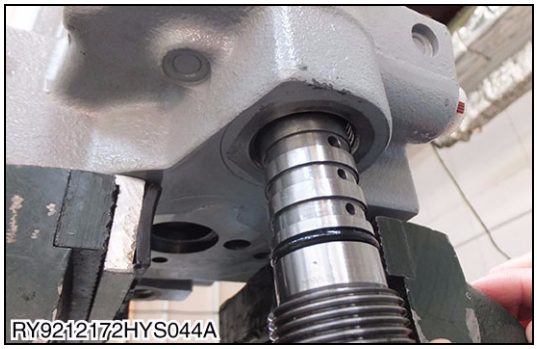
RY9212172HYS0051US0

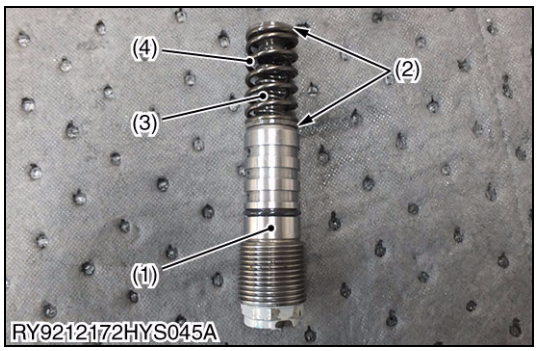


3. Install the o-rings to the case. Install the LS regulator assembly to the case.

Tightening torque	Mounting bolt	12.65 N·m 1.3 kgf·m 9.3 lbf·ft

RY9212172HYS0052US0


RY9212172HYS044A



RY9212172HYS045A

4. Install an o-ring to the horsepower control valve assembly, and install to the case.
   - Apply hydraulic oil to the o-ring and sliding surface.

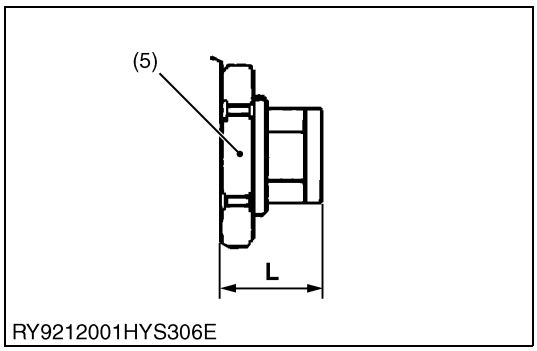
   Install the horsepower control valve assembly to the case by specified torque, and tighten the lock nut.
   - Set-length L should be exactly same as before loosening.

Tightening torque	Nut (5)	68.6 N·m 7.0 kgf·m 50.6 lbf·ft

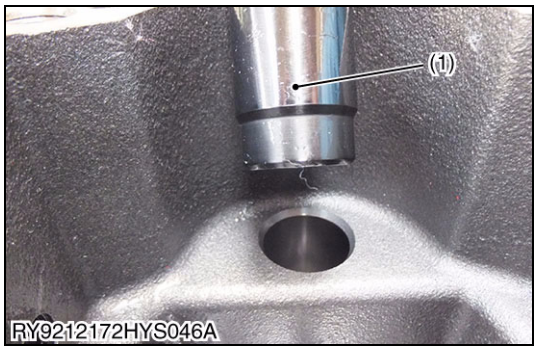
(1) Horsepower Control Valve Assembly
(2) Spring Seat
(3) Spring
(4) Spring
(5) Nut

L : Distance

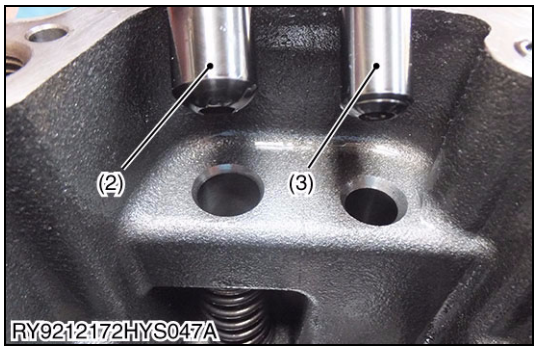
RY9212172HYS0053US0



RY9212001HYS306E



RY9212172HYS046A

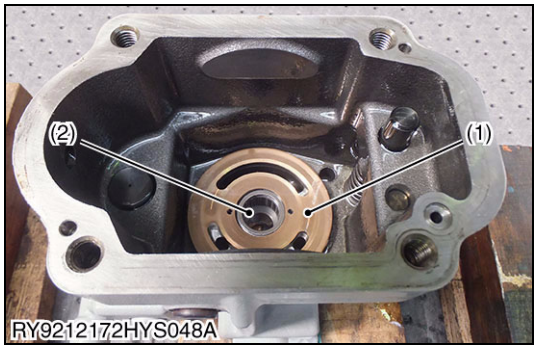


RY9212172HYS047A

5. Install the feedback pin A and B, the control pin.

(1) Feedback Pin B
(2) Control Pin
(3) Feedback Pin A

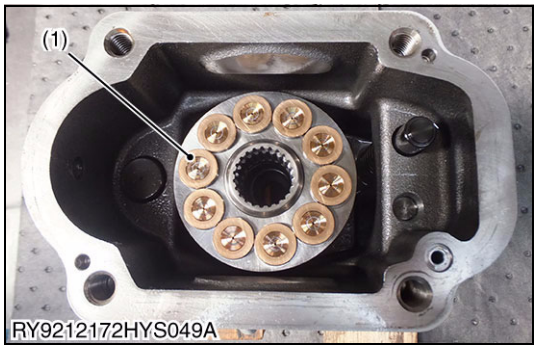
RY9212172HYS0054US0



6. Install the valve plate and the thrust washer.

(1) Valve Plate (2) Thrust Washer

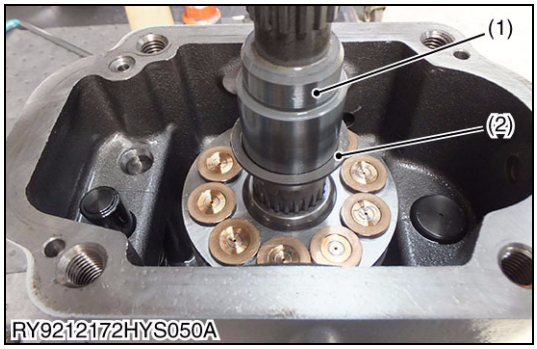
RY9212172HYS0055US0



7. Install the cylinder block assembly.

(1) Cylinder Block Assembly

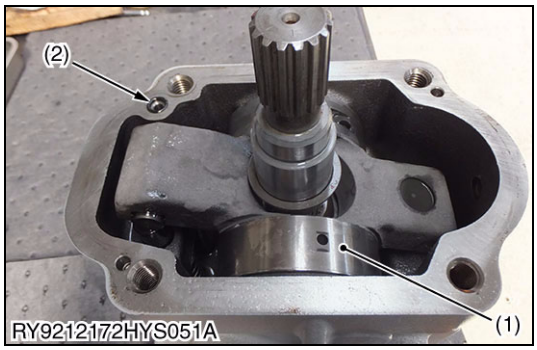
RY9212172HYS0056US0



8. Install the shaft and the thrust washer.

(1) Shaft (2) Thrust Washer

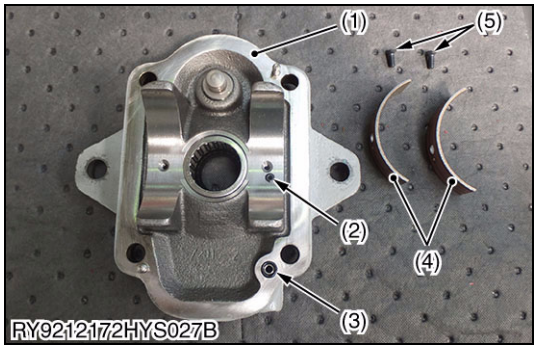
RY9212172HYS0057US0



9. Install the swash plate and O-ring.

(1) Swash Plate (2) O-Ring

RY9212172HYS0058US0

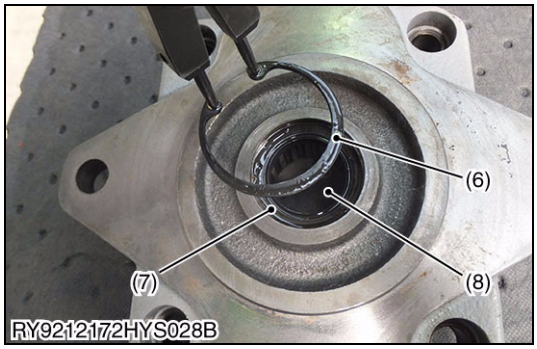


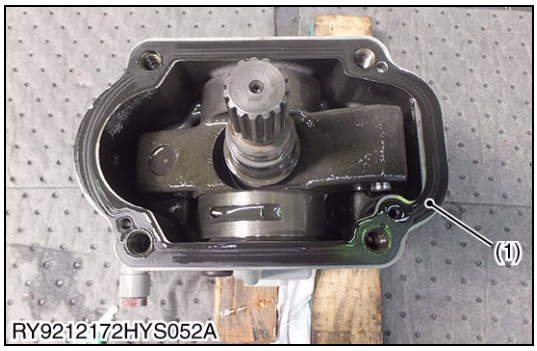
10. Install the circlip to the flange.

Tightening torque	Screw (5)	5.9 N·m 0.6 kgf·m 4.4 lbf·ft

(1) Flange
(2) O-Ring
(3) O-Ring
(4) Bushing
(5) Screw
(6) Snap Ring
(7) Oil Seal
(8) Bearing

RY9212172HYS0059US0

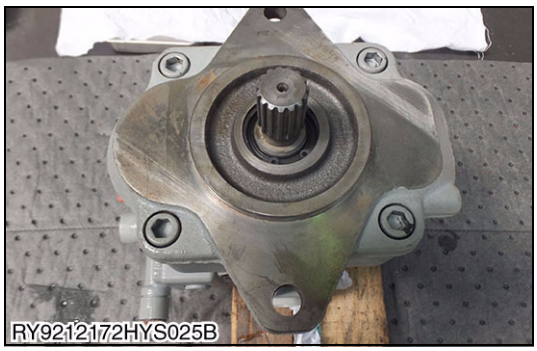




11. Install the gasket and flange.

(1) Gasket

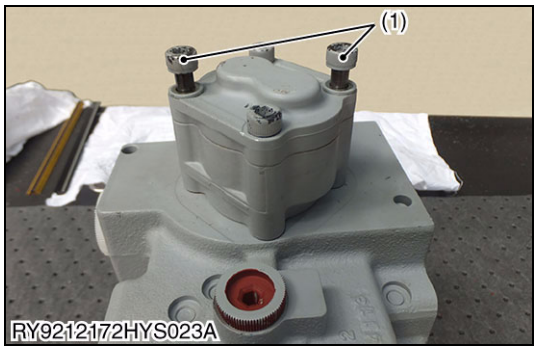
RY9212172HYS0060US0



12. Install the flange to the case.

Tightening torque	Bolt	106.9 N·m 10.9 kgf·m 78.8 lbf·ft

RY9212172HYS0061US0



13. Install the gear pump.

Tightening torque	Bolt	28.9 N·m 2.9 kgf·m 21.3 lbf·ft

(1) Bolt

RY9212172HYS0062US0

2. CONTROL VALVE

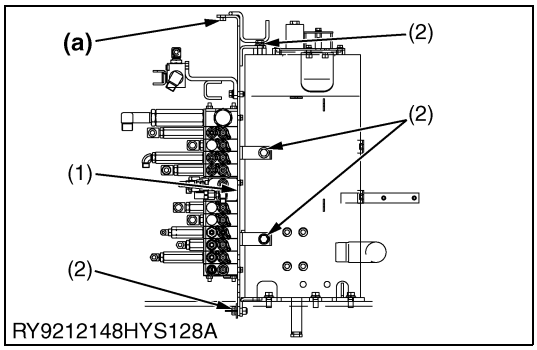
[1] REMOVING AND INSTALLING THE CONTROL VALVE



1. Remove the cover.
2. Attach a vacuum pump and depressurize the inside of the tank.

(1) Cover

RY9212174HYS0235US0



3. Disconnect all the hoses and wiring connected to the control valve.
4. Attach eye bolts to the base of the control valve and suspend the control valve with a crane.
5. Remove the 6 base mounting bolts, then lift with the crane and remove it.

■ **IMPORTANT**

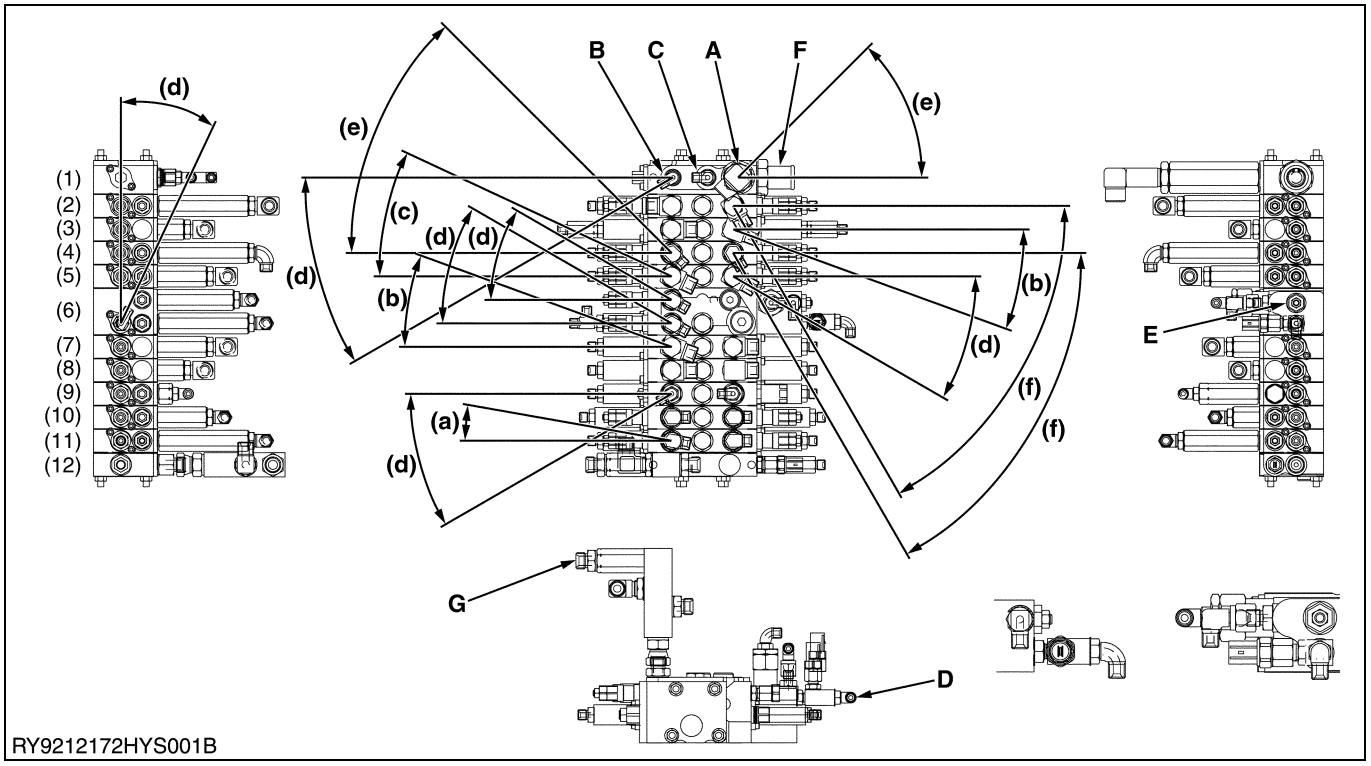
- **Plug the disconnected hoses and adapters.**
- **Label all of the disconnected hoses so you can identify them during assembly.**

(1) Base
(2) Bolt
(a) Eye Bolt Mounting Hole (M10, Pitch 1.25)

RY9212174HYS0236US0



Adapter angle



(1) Inlet
(2) AUX1
(3) Swivel
(4) Bucket
(5) Arm
(6) Boom
(7) Travel Right
(8) Travel Left
(9) Swing
(10) Blade
(11) AUX2
(12) Outlet

A : P1
B : Pps
C : Pls
D : Pp
E : Emergency Valve
F : T1
G : T3

(a) 10° (0.2 rad)
(b) 20° (0.3 rad)
(c) 25° (0.4 rad)
(d) 30° (0.5 rad)
(e) 45° (0.8 rad)
(f) 60° (1.0 rad)

RY9212509HYS0002US0

[2] DISASSEMBLING AND ASSEMBLING THE CONTROL VALVE

Precautions during Disassembly / Assembly

Precautions during Disassembly

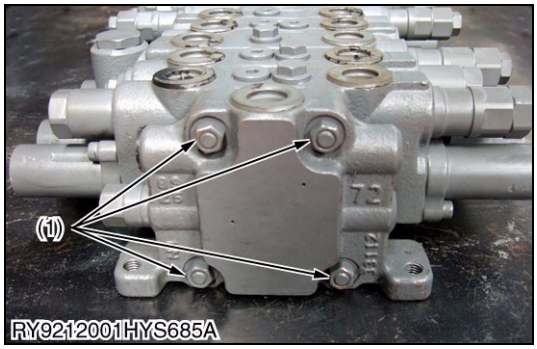
1. Generally, hydraulic devices are precision machined, and disassembly should therefore be conducted in a clean environment to prevent entry of debris into the narrow interstices formed in the device structure.
2. Always use clean tools and cleaning oil.
3. After removing from the machine, first wash the outside of the assembly.
4. Before starting work, prepare the necessary parts for the aims and extent of disassembly. Before reassembling, as a rule you should replace all seals and O-rings, etc. Also, since a subassembly is available with the required parts if parts cannot be supplied as single items, refer to the parts catalog beforehand in preparation.

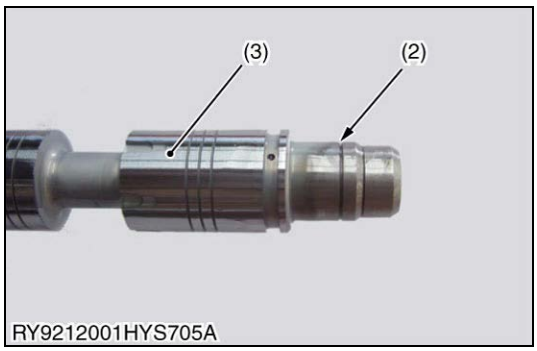
Precautions on Assembly

1. Apply clean grease or hydraulic fluid to O-rings and their countersunk parts for mounting.
2. There should be no flaws in O-rings due to forming, and no marks or heat deformation incurred when handling.
3. If permanently deformed, O-rings will not straighten out (Make sure that no flaws are incurred by an O-ring when passing it through sharp angled sections of a spool).
4. Do not turn over O-rings on installation (Fouled O-rings are difficult to re-install and can easily result in oil leakage).

Before assembling, at the mating surface of each section, make sure no cleaning oil, hydraulic fluid, etc., is adhered to the outer surface of the O-ring groove (If you assemble with oil adhered to a mating surface, this may be mistakenly recognized as oil leakage from that location when the machine is running).

RY9212001HYS0140US0





Control Valve Disassembly / Assembly Procedures

1. Loosen the nuts on one side with a ring spanner.

Tightening torque	Nut (four locations)	26.5 to 29.4 N·m 2.7 to 3.0 kgf·m 19.6 to 21.6 lbf·ft

2. Pull out each section with a tie rod, and arrange in order on a workbench.

CAUTION

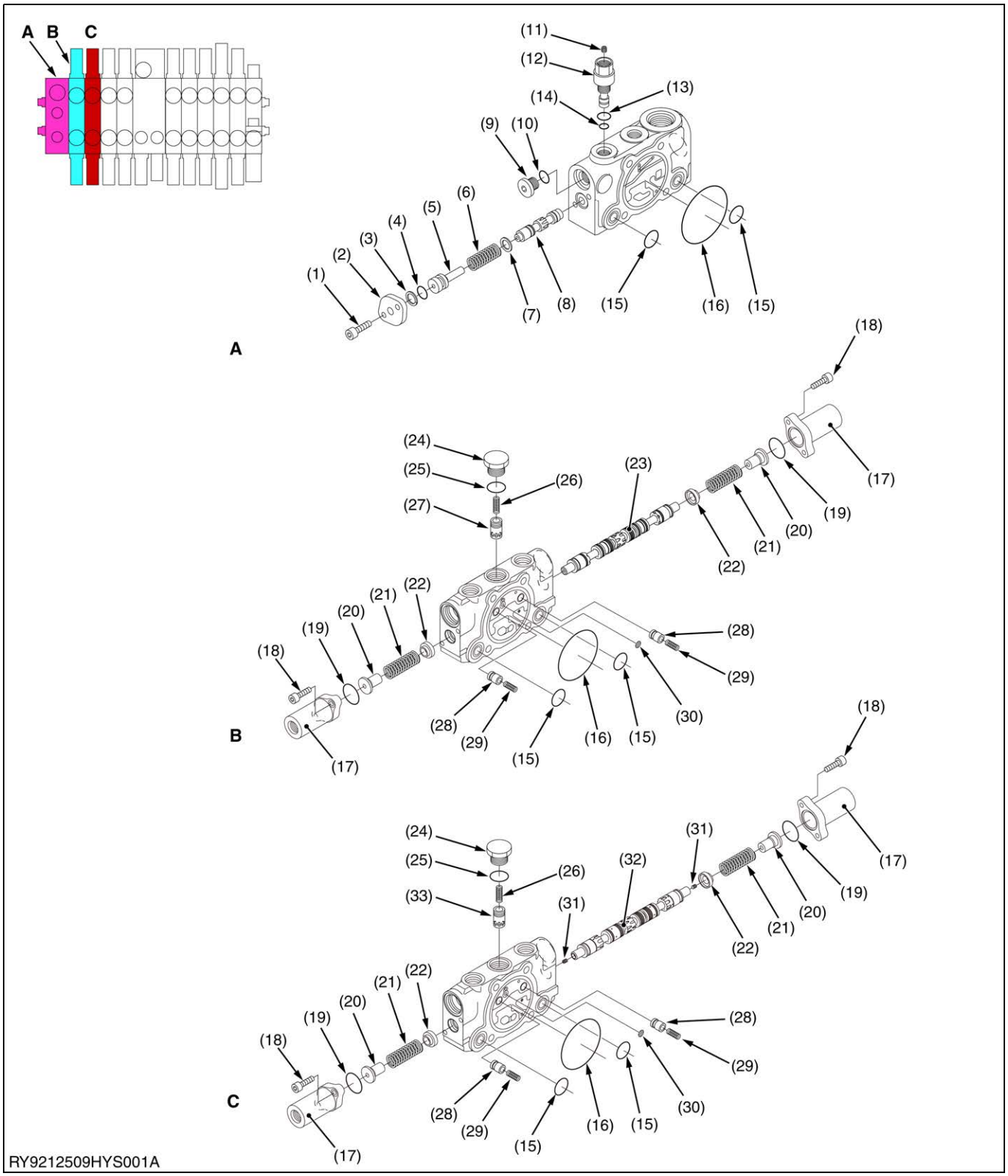
- **When removing each section, take care not to lose the load check valve and spring of the mating surface.**
- **Identify the load check valve and spring of each section so that they are not mismatched.**
- **Apply a location mark for each section.**
- **Excess torque on threads will cause defective spool operation. Therefore, be sure to use the specified torque.**
- **Take care over the direction of installation of each spool, align with the holes and insert slowly.**

(1) Nut
(2) Identification Groove for Spool Assembly Orientation
(3) Spool

RY9212001HYS0141US0

[3] CONTROL VALVE COMPONENTS

Inlet, AUX1 and Swivel Section Components



A : Inlet Section **B : AUX1 Section** **C : Swivel Section**

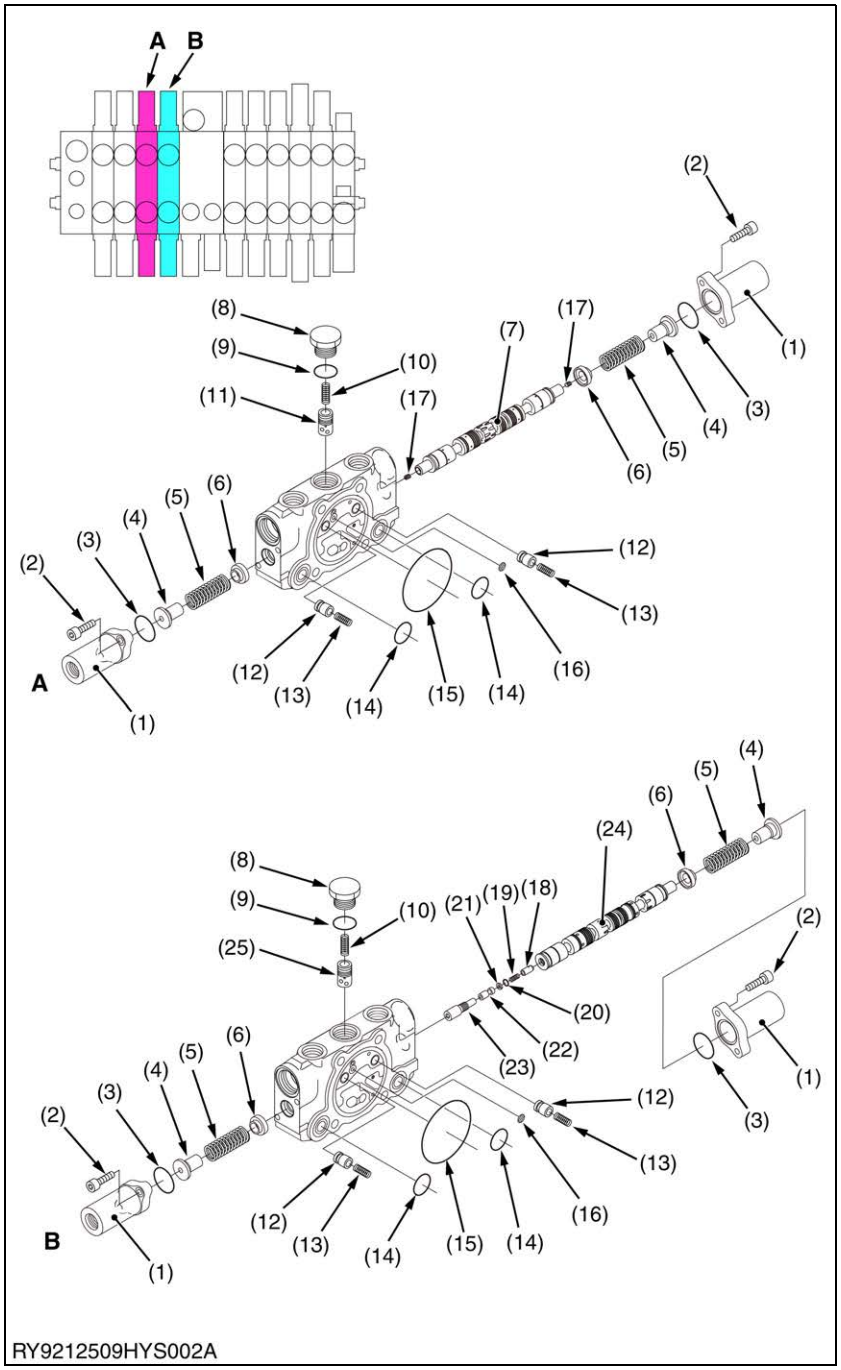
(To be continued)

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No.	Parts Name	Q'ty	Tightening torque	No.	Parts Name	Q'ty	Tightening torque
(1)	Hex socket bolt	2	8.8 to 11.0 N·m 0.9 to 1.1 kgf·m 6.5 to 8.1 lbf·ft	(18)	Hex socket bolt	8	7.5 N·m 0.76 kgf·m 5.5 lbf·ft
(2)	Flange	1		(19)	O-Ring	4	
(3)	Backup ring	1		(20)	Spring seat	4	
(4)	O-Ring	1		(21)	Spring	4	
(5)	Spacer	1		(22)	Spring seat	4	
(6)	Spring	1		(23)	Spool	1	
(7)	Washer	1		(24)	Plug	2	69 to 78 N·m 7.1 to 7.9 kgf·m 51.0 to 57.0 lbf·ft
(8)	Spool	1		(25)	O-Ring	2	
(9)	Plug	1	28.4 to 30.4 N·m 2.9 to 3.1 kgf·m 21.0 to 22.4 lbf·ft	(26)	Spring	2	
(10)	O-Ring	1		(27)	Spool	1	
(11)	Orifice	1		(28)	Poppet	4	
(12)	Plug	1	28.4 to 30.4 N·m 2.9 to 3.1 kgf·m 21.0 to 22.4 lbf·ft	(29)	Spring	4	
(13)	O-Ring	1		(30)	Plate	2	
(14)	O-Ring	1		(31)	Plug	2	
(15)	O-Ring	6		(32)	Spool	1	
(16)	O-Ring	3		(33)	Spool	1	
(17)	Cap	4					

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Bucket and Arm Section Components



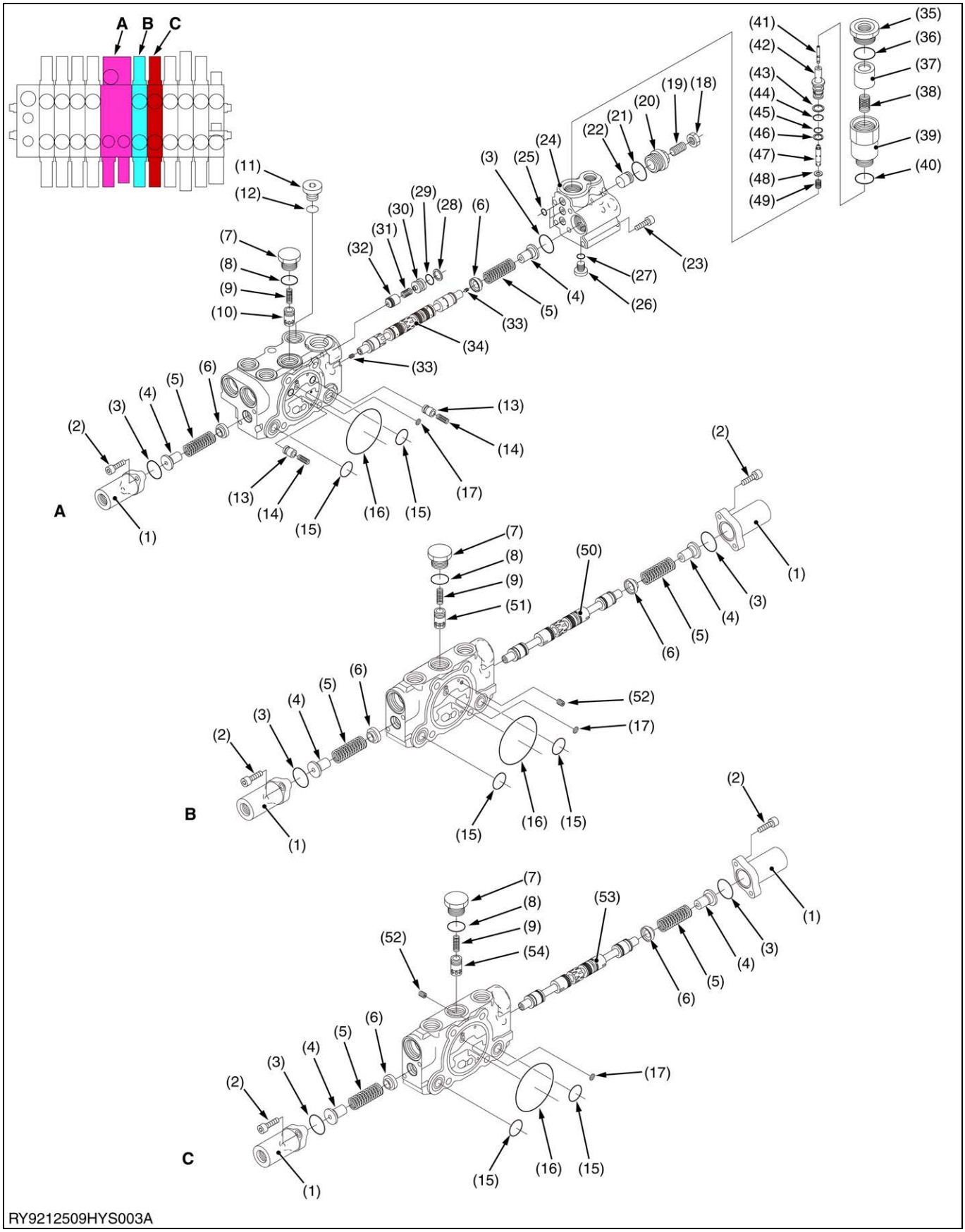
RY9212509HYS002A

No.	Parts Name	Q'ty	Tightening torque
(1)	Cap	4	
(2)	Hex socket bolt	8	7.5 N·m 0.76 kgf·m 5.5 lbf·ft
(3)	O-Ring	4	
(4)	Spring seat	4	
(5)	Spring	4	
(6)	Spring seat	4	
(7)	Spool	1	
(8)	Plug	2	69 to 78 N·m 7.1 to 7.9 kgf·m 51.0 to 57.0 lbf·ft
(9)	O-Ring	2	
(10)	Spring	2	
(11)	Spool	1	
(12)	Poppet	4	
(13)	Spring	4	
(14)	O-Ring	4	
(15)	O-Ring	2	
(16)	Plate	2	
(17)	Plug	2	
(18)	Poppet	1	
(19)	Spring	1	
(20)	O-Ring	1	
(21)	Backup ring	1	
(22)	Spacer	1	
(23)	Spool head	1	
(24)	Spool	1	
(25)	Spool	1	

A : Bucket Section
B : Arm Section

RY9212509HYS0004US0

Boom, Travel Right and Travel Left Section Components



A : Boom Section **B : Travel Right Section** **C : Travel Left Section**

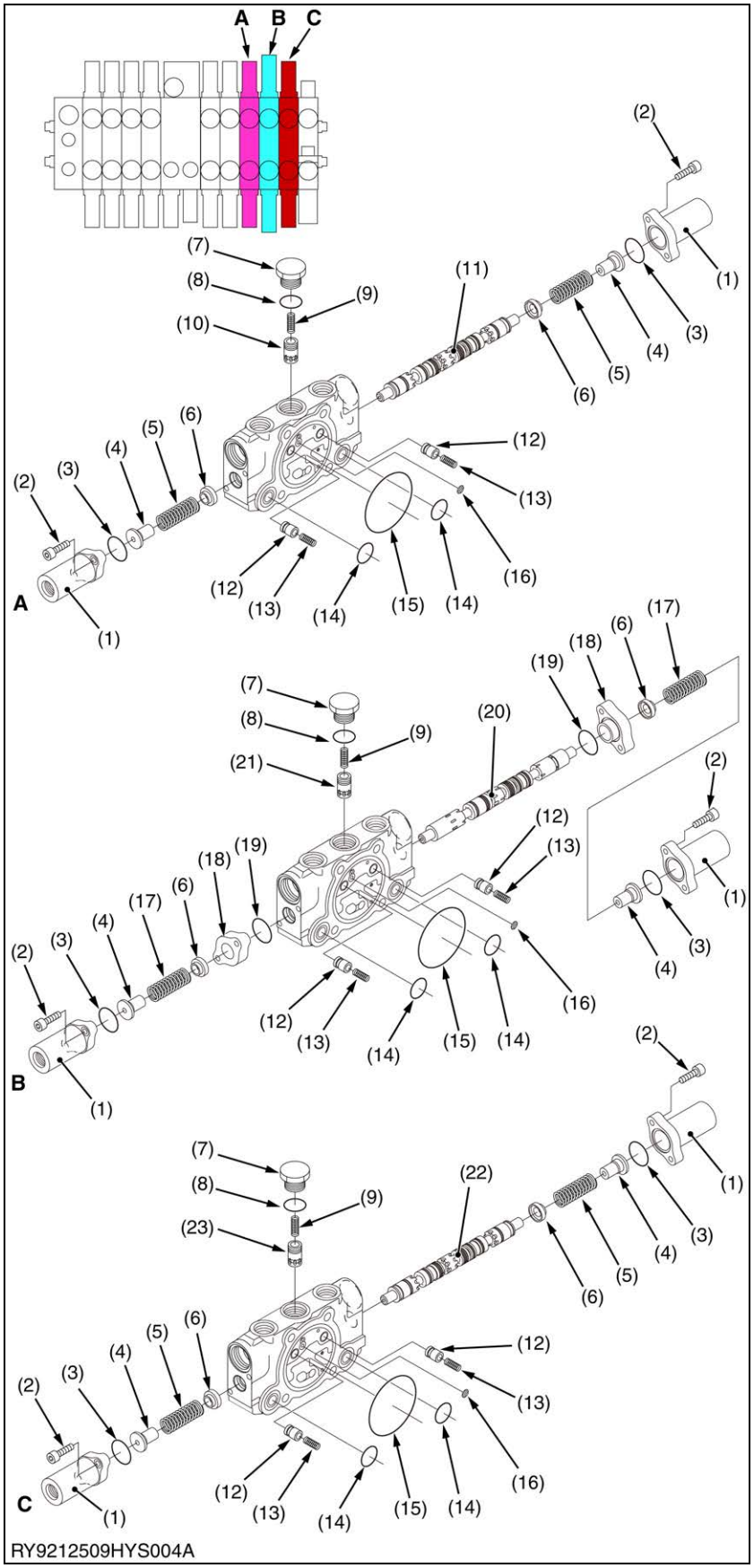
(To be continued)

(Continued)

No.	Parts Name	Q'ty	Tightening torque	No.	Parts Name	Q'ty	Tightening torque
(1)	Cap	5		(28)	Backup ring	1	
(2)	Hex socket bolt	10	7.5 N·m 0.76 kgf·m 5.5 lbf·ft	(29)	O-Ring	1	
(3)	O-Ring	6		(30)	Spacer	1	
(4)	Spring seat	6		(31)	Spring	1	
(5)	Spring	6		(32)	Poppet	1	
(6)	Spring seat	6		(33)	Plug	2	
(7)	Plug	3	69 to 78 N·m 7.1 to 7.9 kgf·m 51.0 to 57.0 lbf·ft	(34)	Spool	1	
(8)	O-Ring	3		(35)	Plug	1	69 to 78 N·m 7.1 to 7.9 kgf·m 51.0 to 57.0 lbf·ft
(9)	Spring	3		(36)	O-Ring	1	
(10)	Spool	1		(37)	Piston	1	
(11)	Plug	1	28.4 to 30.4 N·m 2.9 to 3.1 kgf·m 21.0 to 22.4 lbf·ft	(38)	Spring	1	
(12)	O-Ring	1		(39)	Plug	1	69 to 78 N·m 7.1 to 7.9 kgf·m 51.0 to 57.0 lbf·ft
(13)	Check valve	2		(40)	O-Ring	1	
(14)	Spring	2		(41)	Spool	1	
(15)	O-Ring	6		(42)	Sleeve	1	
(16)	O-Ring	3		(43)	Backup ring	1	
(17)	Plate	3		(44)	O-Ring	1	
(18)	Hex nut	1		(45)	O-Ring	1	
(19)	Set screw	1		(46)	Backup ring	1	
(20)	Plug	1		(47)	Poppet	1	
(21)	O-Ring	1		(48)	Spring seat	1	
(22)	Poppet	1		(49)	Spring	1	
(23)	Hex socket bolt	5	8.8 to 11.0 N·m 0.9 to 1.1 kgf·m 6.5 to 8.1 lbf·ft	(50)	Spool	1	
(24)	Body	1		(51)	Spool	1	
(25)	O-Ring	3		(52)	Orifice	2	
(26)	Plug	1	15 N·m 1.5 kgf·m 11.1 lbf·ft	(53)	Spool	1	
(27)	O-Ring	1		(54)	Spool	1	

RY9212509HYS0005US0

Swing, Blade and AUX2 Section Components



No.	Parts Name	Q'ty	Tightening torque
(1)	Cap	6	
(2)	Hex socket bolt	12	7.5 N·m 0.76 kgf·m 5.5 lbf·ft
(3)	O-Ring	6	
(4)	Spring seat	6	
(5)	Spring	4	
(6)	Spring seat	6	
(7)	Plug	3	69 to 78 N·m 7.1 to 7.9 kgf·m 51.0 to 57.0 lbf·ft
(8)	O-Ring	3	
(9)	Spring	3	
(10)	Spool	1	
(11)	Spool	1	
(12)	Check valve	6	
(13)	Spring	6	
(14)	O-Ring	4	
(15)	O-Ring	3	
(16)	Plate	3	
(17)	Spring	2	
(18)	Spacer	2	
(19)	O-Ring	2	
(20)	Spool	1	
(21)	Spool	1	
(22)	Spool	1	
(23)	Spool	1	

A : Swing Section
B : Blade Section
C : AUX2 Section

RY9212509HYS0006US0

3. SWIVEL MOTOR

[1] REMOVING AND INSTALLING THE SWIVEL MOTOR

CAUTION

- **When removing a hydraulic device after operating the excavator, lower the bucket and blade to the ground and turn off the engine.**
- **Each of the devices and the hydraulic oil are hot right after stopping the excavator. The oil is hot enough to cause a burn, so always let it cool down before starting any work.**
- **Oil gushing out under pressure has enough force to injure you by piercing your skin. Always relieve any pressure remaining in the system prior to working to remove any hydraulic equipment or lines.**

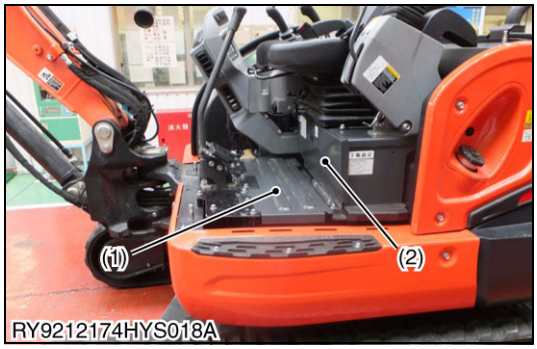
RY9212148HYS0149US0



1. Remove the cabin.

   Refer to the section REMOVING AND INSTALLING THE CABIN for removing the cabin.

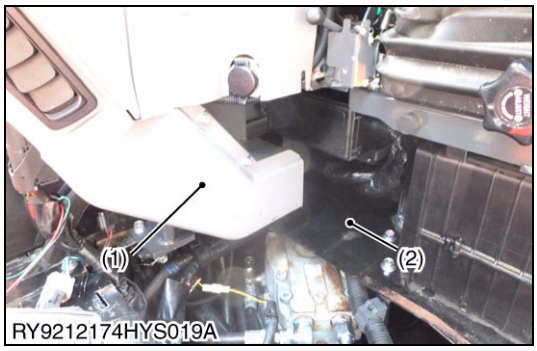
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2. Remove the step and cover.

(1) Step (2) Cover

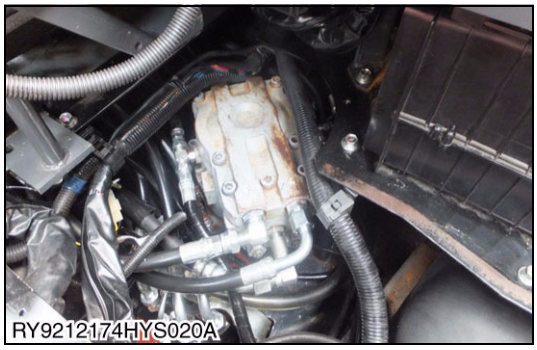
RY9212174HYS0089US0



3. Remove the duct and step.

(1) Duct (2) Step

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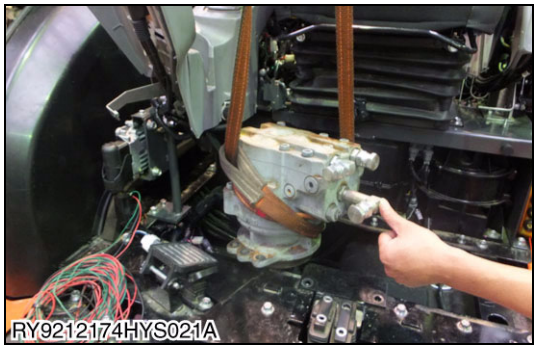


4. Disconnect all the hoses connected to the swivel motor.

■ **IMPORTANT**

- **Plug the disconnected hoses and adapters.**

RY9212174HYS0021US0



5. Remove the six swivel motor mounting bolts and remove the swivel motor.

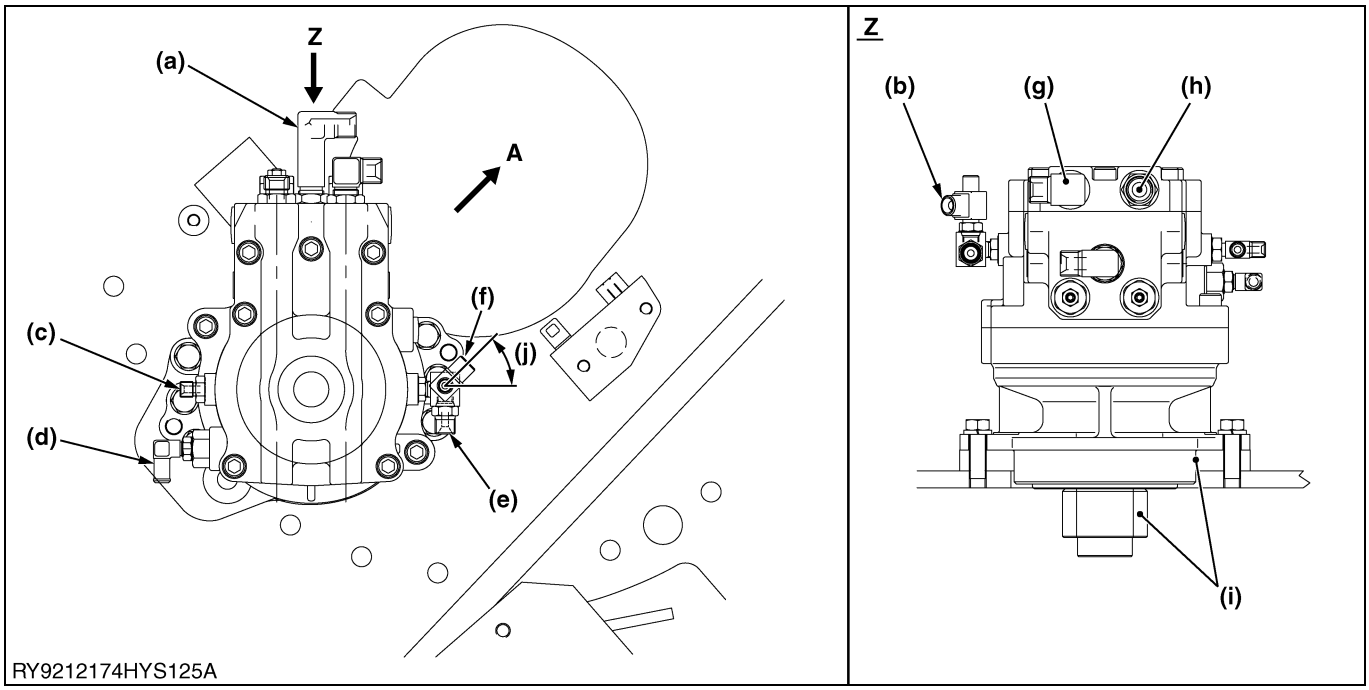
Tightening torque	Bolt	166.7 to 196.1 N·m 17.0 to 20.0 kgf·m 123.0 to 144.6 lbf·ft

- Apply thread lock compound (Loctite 263).

Swivel motor weight	Approx. 40 kg (90 lbs)

RY9212174HYS0022US0

Swivel motor adapter angles

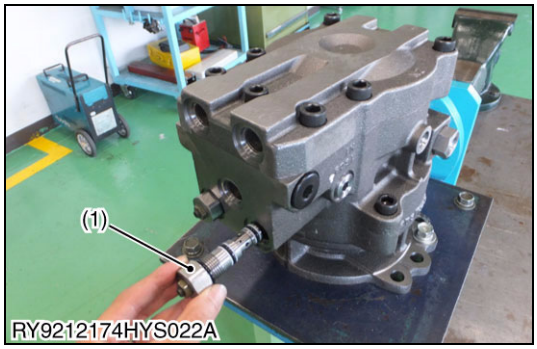


(a) Make-Up Port
(b) Left Control Pilot Valve Port P
(c) Blade Pilot Valve Port P
(d) Drain
(e) From Unload Valve (B)
(f) Travel Pilot valve Port P
(g) Swivel Left
(h) Swivel Right
(i) Apply grease to and install the rabbeted flange and the Pinion.
(j) 45 ° (0.79 rad)
A : Front Side

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[2] DISASSEMBLING AND ASSEMBLING THE SWIVEL MOTOR

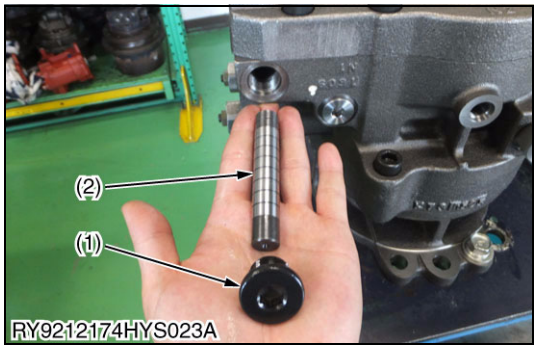
(1) Disassembling



1. Mount the swivel motor on an assembly platform.
2. Remove the relief valve.
   - Tool to use: 26 mm socket

(1) Relief Valve

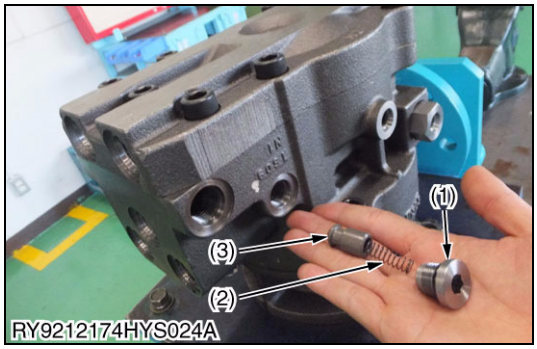
RY9212174HYS0093US0



3. Remove the plug and then the shockless piston.
   - Tool to use: 10 mm hex socket

(1) Plug (2) Shockless Piston

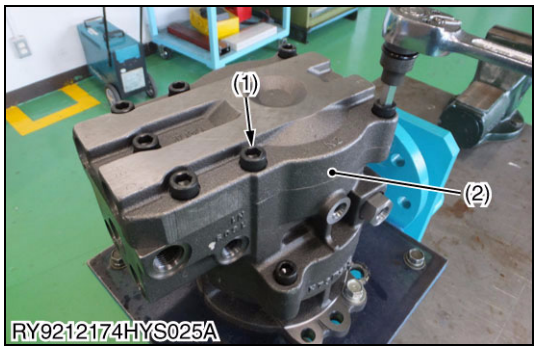
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4. Remove the plug, spring and poppet in order.
   - Tool to use: 8 mm hex socket

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

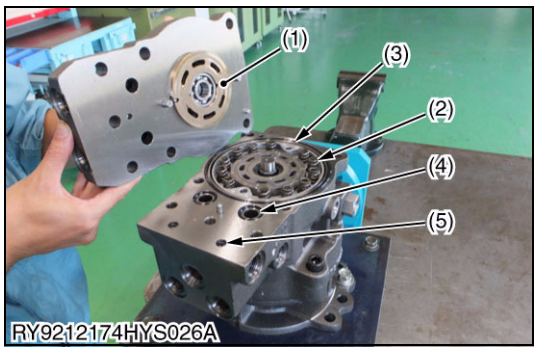
RY9212174HYS0095US0



5. Remove the hex socket bolts and then the cover.
   - Tool to use: 10 mm hex socket

(1) Hex Socket Bolt (2) Cover

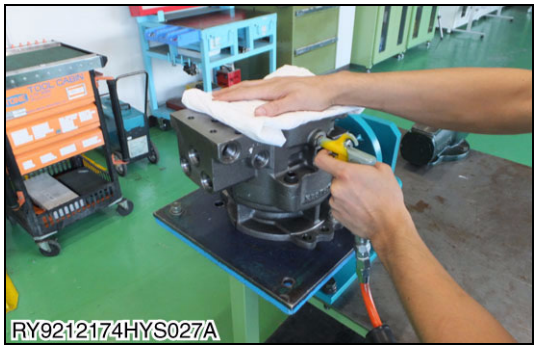
RY9212174HYS0023US0



6. Remove the valve plate, springs and O-rings.
   - Tool to use: 12 mm hex socket

(1) Valve Plate (4) O-Ring
(2) Spring (5) O-Ring
(3) O-Ring

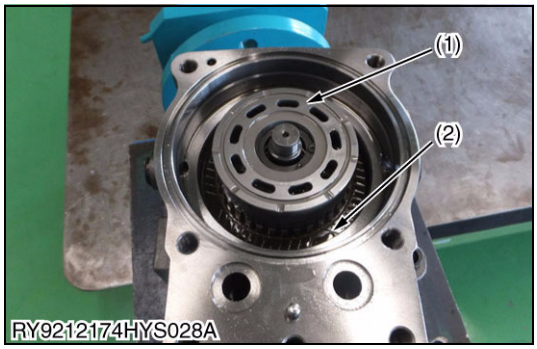
RY9212174HYS0096US0



7. While pressing down on the brake piston with a rag, blow air through the brake release oil passage hole and remove the brake piston.
   - Tool to use: air gun

CAUTION
- **Be careful because if you blast air into the passage, the brake piston may pop out.**

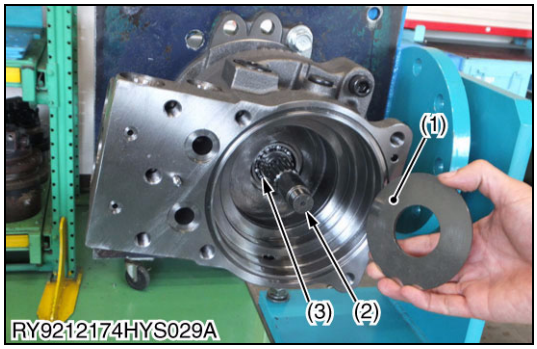
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8. Remove the cylinder block ASSY and the friction plate.

(1) Cylinder Block ASSY
(2) Friction Plate

RY9212174HYS0097US0

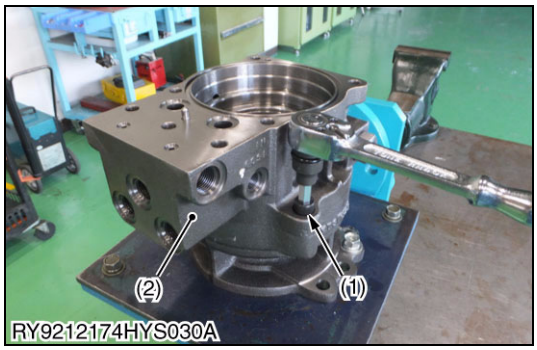


9. Remove the thrust plate, shaft and ball bearing.

IMPORTANT
- **Turn the assembly platform 1.6 rad (90°).**

(1) Thrust Plate
(2) Shaft
(3) Ball Bearing

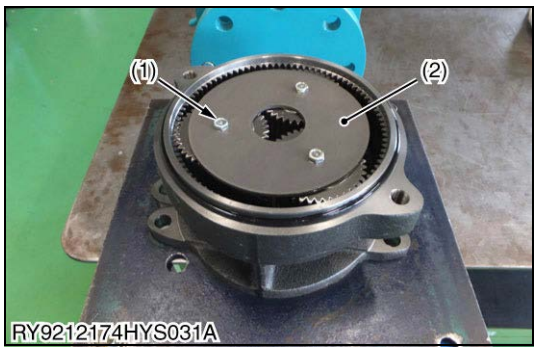
RY9212174HYS0098US0



10. Remove the hex socket bolts and then the housing.
    - Tool to use: 10 mm hex socket

(1) Hex Socket Bolt
(2) Housing

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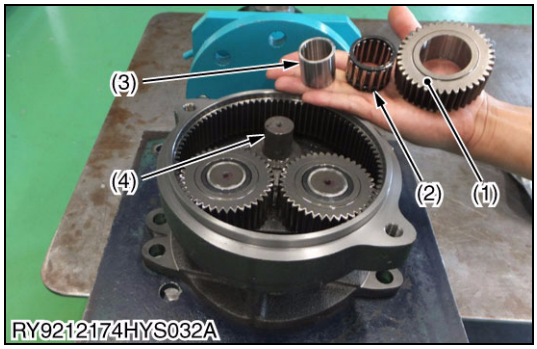


11. Remove the bolts and then the thrust plate.
    - Tool to use: 10 mm socket

IMPORTANT
- **If the bolts are tight and you can't loosen them, heat them with a heat gun or the like.**
- **Always tap out threads that have thread lock compound sticking to them.**

(1) Bolt
(2) Thrust plate

RY9212174HYS0100US0



12. Remove the planetary gear, needle bearing, inner race and the holder.

(1) Planetary Gear
(2) Needle Bearing
(3) Inner Race
(4) Holder

RY9212174HYS0101US0

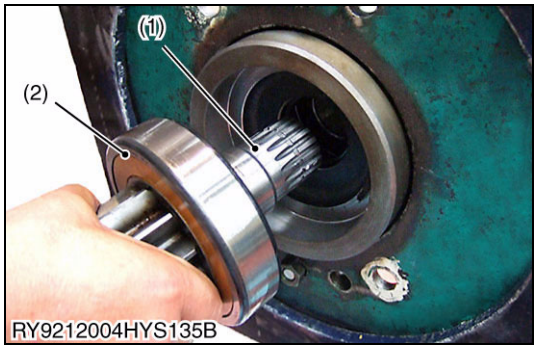


13. Remove the circlip.
- Tool to use: snap ring pliers

CAUTION
- **Turn the assembly platform 1.6 rad (90°) so the pinion shaft doesn't fall.**

(1) Circlip

RY9212174HYS0102US0

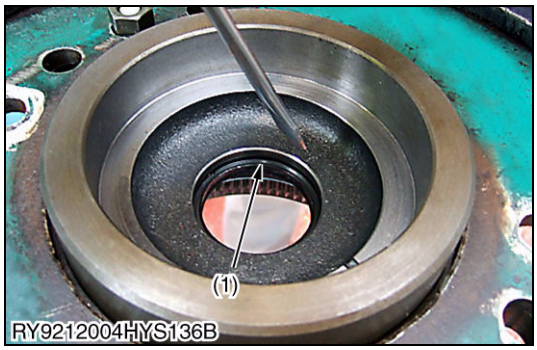


14. Remove the pinion shaft and ball bearing.
- Tool to use: plastic hammer

IMPORTANT
- **Take care so the pinion shaft does not pop out.**
- **At the end, take the pinion shaft out by hand.**

(1) Pinion Shaft
(2) Ball Bearing

RY9212174HYS0103US0



15. Remove the oil seal.
- Tool to use: Slotted screwdriver

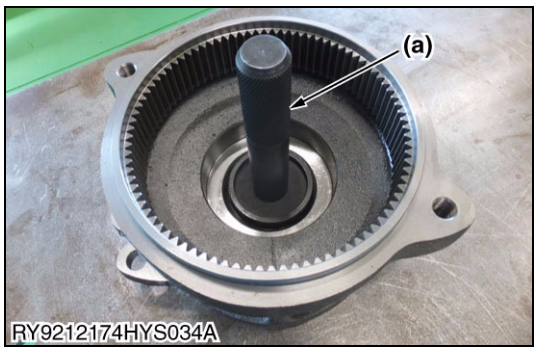
(1) Oil Seal

RY9212174HYS0025US0

(2) Assembling

- Prior to assembly, clean all of the parts and make sure there is no dirt or other debris sticking to them.
- Always replace all of the O-rings, backup rings and oil seals with new ones.

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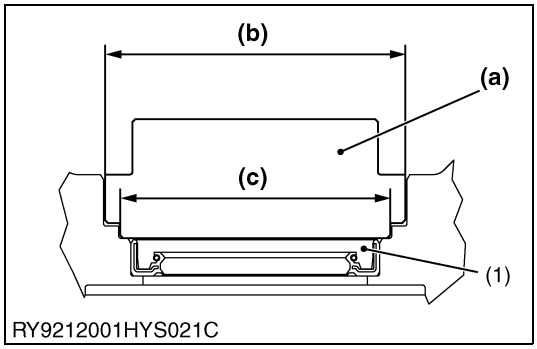


1. Install the oil seal.
   - Tool to use: hammer
   - Tool to use: Oil seal installation tool

■ **IMPORTANT**
- **Apply grease to the lip and circumference of the oil seal.**

(a) Oil Seal Installation Tool

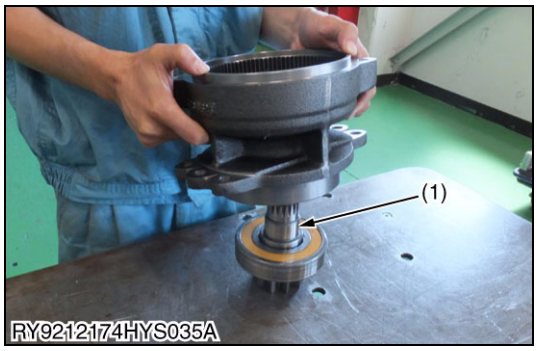
RY9212174HYS0026US0



(a)Oil seal installation tool

(1) Oil Seal	**(b) ϕ89.80 ± 0.05 mm (3.520 ± 0.002 in.)**
(a) Oil Seal Installation Tool	**(c) ϕ61.00 ± 0.05 mm (2.400 ± 0.002 in.)**

RY9212174HYS0104US0



2. Mount the gear case on the pinion shaft.

■ **IMPORTANT**
- **Do not scratch the oil seal.**

(1) Pinion Shaft

RY9212174HYS0105US0

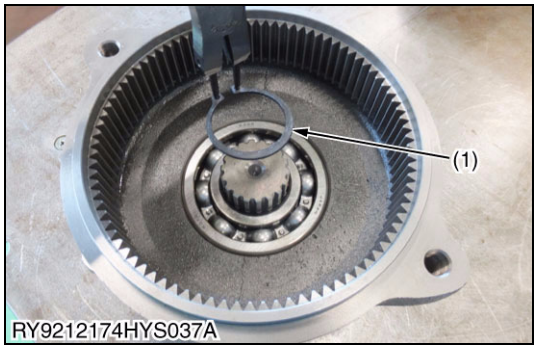


3. Install the ball bearing.

■ **IMPORTANT**
- **Face the ball bearing so the inscription is up.**
- **Apply grease to the circumference of the ball bearing.**

(1) Ball Bearing

RY9212174HYS0106US0

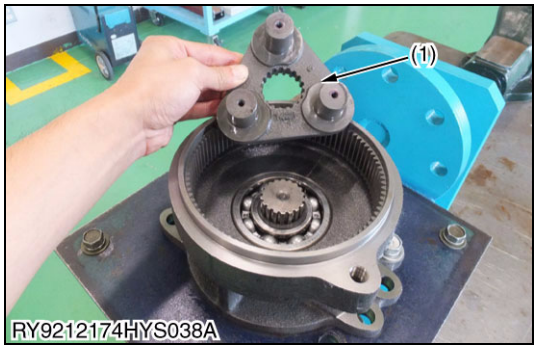


4. Install the circlip.
   - Tool to use: snap ring pliers

■ **IMPORTANT**
- **Install with the rounded side down.**

(1) Circlip

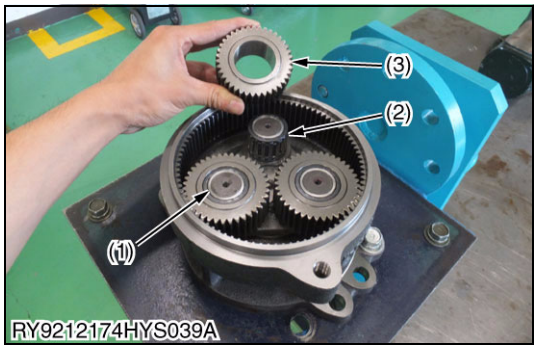
RY9212174HYS0107US0



5. Put the gear case on the assembly platform and install the holder.

(1) Holder

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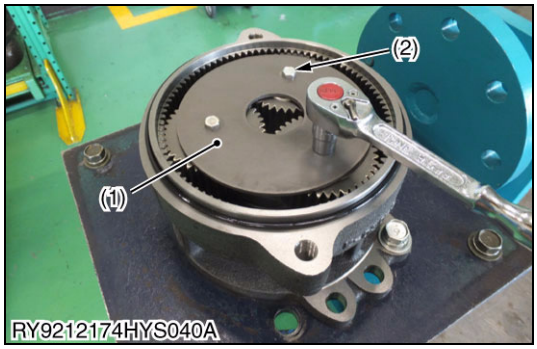


6. Install the inner race, needle bearing and planetary gear on the holder.

■ **IMPORTANT**
- **Install the planetary gear with the protruding side up.**

(1) Inner Race
(2) Needle Bearing
(3) Planetary Gear

RY9212174HYS0109US0



7. Mount the thrust plate.

■ **IMPORTANT**
- **Apply a thread lock (Loctite 242) to the bolts.**

Tightening torque	Bolt	9.8 to 11.3 N·m 1.0 to 1.2 kgf·m 7.2 to 8.3 lbf·ft

(1) Thrust Plate
(2) Bolt

RY9212174HYS0110US0

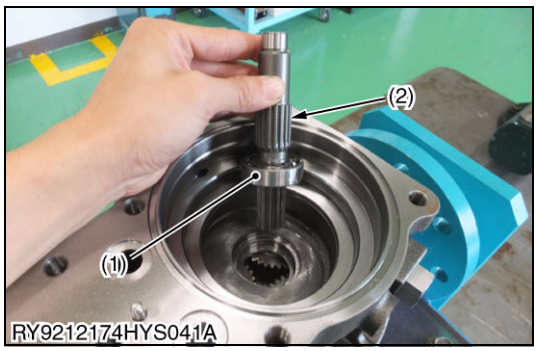


8. Install the housing.
- Tool to use: 10 mm hex socket

Tightening torque	Hex socket bolt	102.9 to 117.6 N·m 10.5 to 12.0 kgf·m 75.9 to 86.7 lbf·ft

(1) Housing

RY9212174HYS0111US0

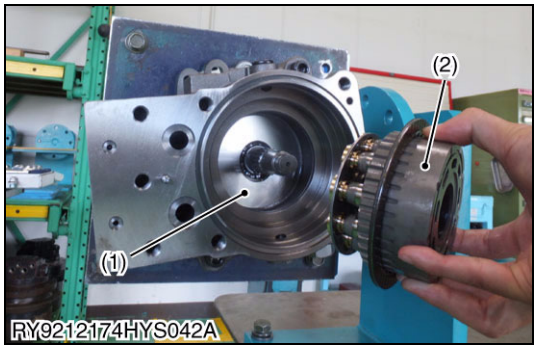


9. Tap the ball bearing in and install the shaft.

■ **IMPORTANT**
- **Face the ball bearing so the inscription is up.**
- **Apply grease to the circumference of the ball bearing.**

(1) Ball Bearing
(2) Shaft

RY9212174HYS0112US0

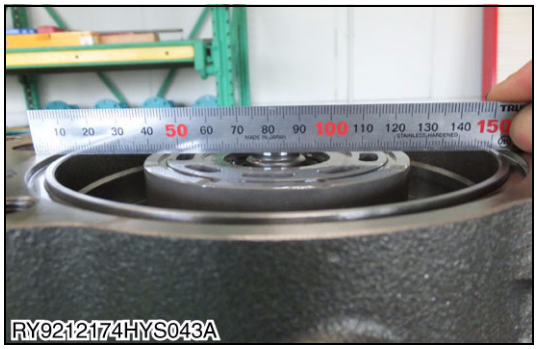


10. Install the thrust plate and cylinder block assembly.

■ **IMPORTANT**
- **Turn the assembly platform 1.6 rad (90 °).**
- **Apply grease to the back of the thrust plate.**
- **Install the thrust plate with its tapered side down.**
- **Dip the whole thing in hydraulic oil and then install it.**

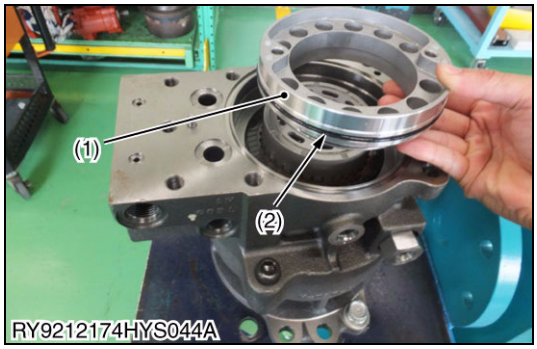
(1) Thrust Plate (2) Cylinder Block ASSY

RY9212174HYS0113US0



11. After installing the cylinder block, make sure it is recessed below the level of the edge of the housing.

RY9212174HYS0114US0

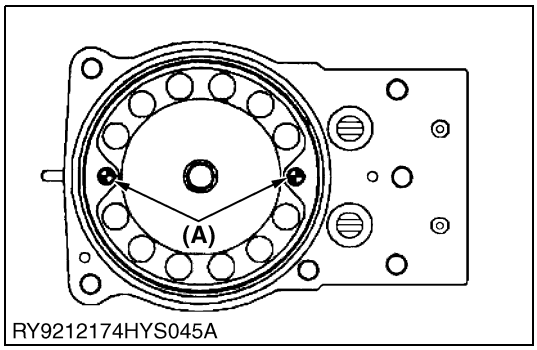


12. Mount the O-ring on the brake piston and install it in the housing.

■ **IMPORTANT**
- **Apply grease to the O-ring.**
- **Take care to position the holes in the brake piston correctly.**

(1) Brake Piston (2) O-Ring

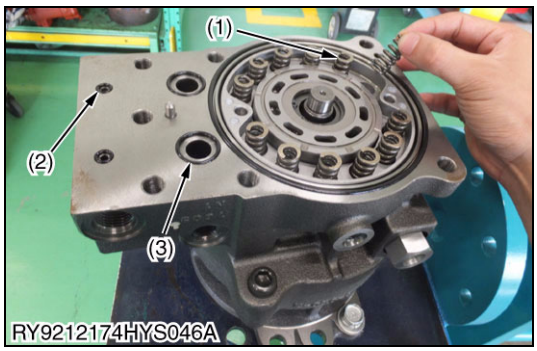
RY9212174HYS0115US0



Brake piston hole alignment positions

(A) Brake Piston Holes

RY9212174HYS0116US0

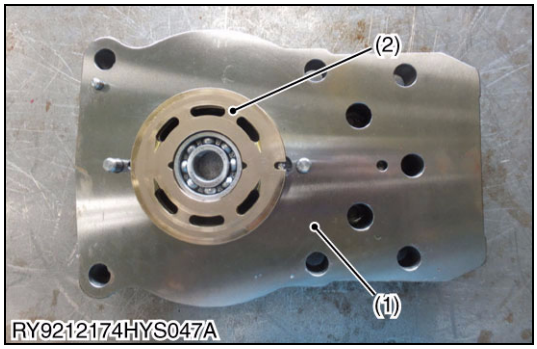


13. Install the springs and O-rings.

■ **IMPORTANT**
- **Apply grease to the O-rings.**

(1) Spring (3) O-Ring
(2) O-Ring

RY9212174HYS0117US0

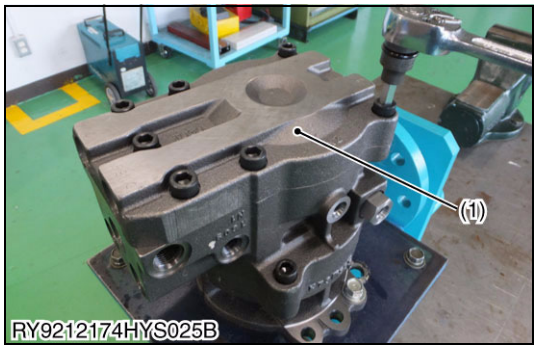


14. Install the cover on the valve plate.

■ **IMPORTANT**
- **Apply grease to the back of the valve plate.**
- **Take care to face the valve plate correctly.**

(1) Cover (2) Valve Plate

RY9212174HYS0118US0

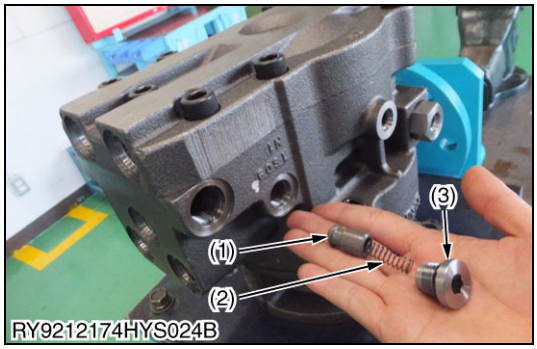


15. Install the cover.
- Tool to use: 10 mm hex socket

Tightening torque	Socket head bolt	102.9 to 117.6 N·m 10.5 to 12.0 kgf·m 75.9 to 86.7 lbf·ft

(1) Cover

RY9212174HYS0119US0



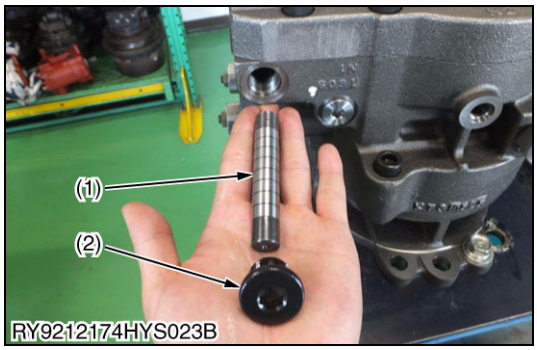
16. Install the poppets, springs and plugs.
- Tool to use: 8 mm hex socket

■ **IMPORTANT**
- **Apply hydraulic fluid to the spool.**

Tightening torque	Plug	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.2 to 43.4 lbf·ft

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

RY9212174HYS0120US0



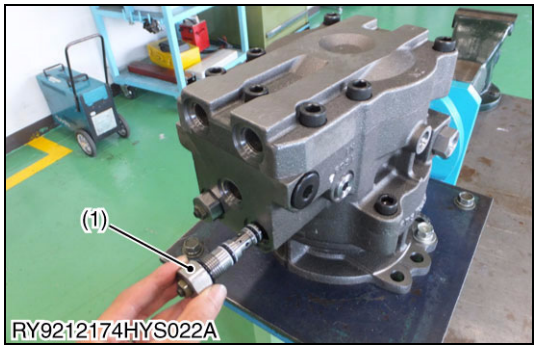
17. Install the shockless piston and plug.
- Tool to use: 8 mm hex socket

■ **IMPORTANT**
- **Apply hydraulic oil to the shockless piston.**
- **The piston itself should slide smoothly.**

Tightening torque	Plug	58.8 to 68.6 N·m 6.0 to 7.0 kgf·m 43.4 to 50.6 lbf·ft

(1) Shockless Piston (2) Plug

RY9212174HYS0121US0



18. Install the relief valve.
- Tool to use: 26 mm socket

■ **IMPORTANT**
- **Apply hydraulic oil to the relief valve.**

Tightening torque	Relief valve	58.8 to 68.6 N·m 6.0 to 7.0 kgf·m 43.4 to 50.6 lbf·ft

(1) Relief Valve

RY9212174HYS0122US0

4. SWIVEL JOINT

[1] REMOVING AND INSTALLING THE SWIVEL JOINT

CAUTION

- **When removing a hydraulic device after operating the excavator, lower the bucket and blade to the ground and turn off the engine.**
- **Each of the devices and the hydraulic oil are hot right after stopping the excavator. The oil is hot enough to cause a burn, so always let it cool down before starting any work.**
- **Oil gushing out under pressure has enough force to injure you by piercing your skin. Always relieve any pressure remaining in the system prior to working to remove any hydraulic equipment or lines.**

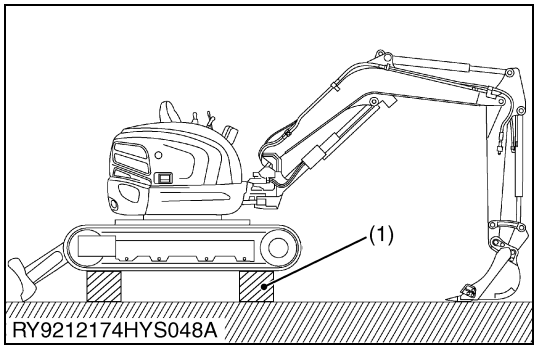
RY9212148HYS0149US0



1. Remove the cabin.

   Refer to the section REMOVING AND INSTALLING THE CABIN for removing the cabin.

RY9212174HYS0088US0



2. Use the front and the blade to jack up the excavator.

CAUTION

- **Always put supporting blocks under the track while the excavator is jacked up.**

(1) Block

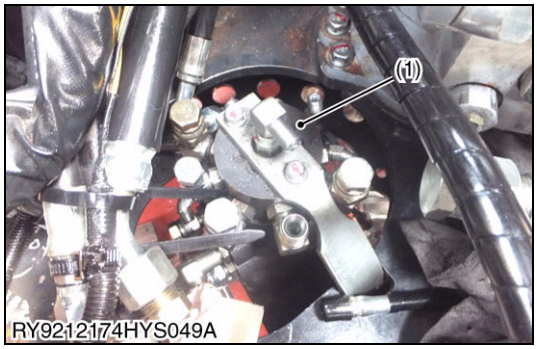
RY9212174HYS0124US0



3. Remove the step.

(1) Step

RY9212174HYS0125US0



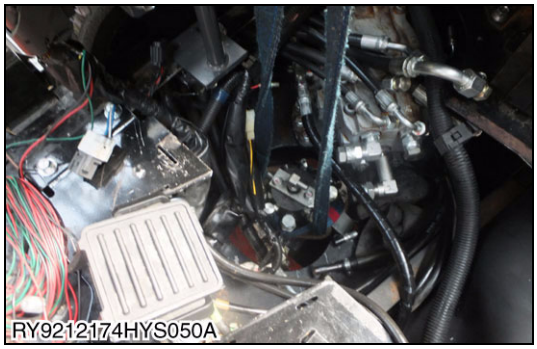
4. Disconnect all the hydraulic hoses on the swivel joint shaft side (inside the swivel frame).
5. Remove the bottom cover of the track frame.
6. Disconnect all the hydraulic hoses on the body side (inside the track frame).

IMPORTANT

- **Plug and cap all the adapters and hoses.**

(1) Swivel Joint

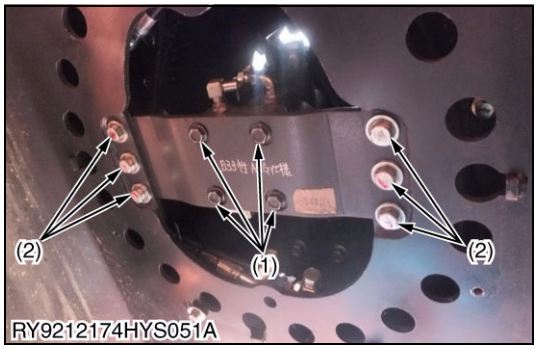
RY9212174HYS0126US0


RY9212174HYS050A

7. Mount a nylon sling to the swivel joint and suspend it.

Swivel joint weight	Standard Spec.	Approx. 18 kg (40 lbs)

RY9212172HYS0002US0



RY9212174HYS051A

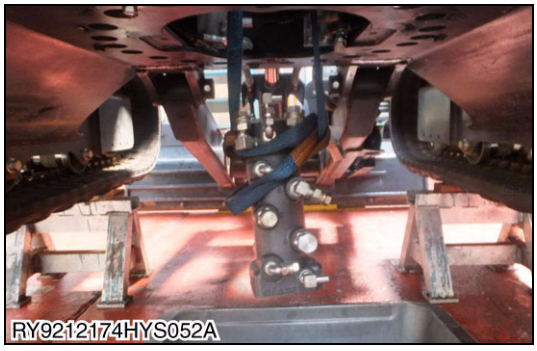
8. Remove the six bolts.
9. Use the crane to lift the swivel joint off the bottom cover.
10. Remove the four bolts and the bottom cover.

■ **IMPORTANT**
- **Apply thread lock (ThreeBond 1324 or equivalent) to the bolts (1).**
- **Apply a thread lock (Loctite 271) to the bolts (2).**

Tightening torque	Bolt (1)	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 lbf·ft
	Bolt (2)	166.7 to 196.1 N·m 17.0 to 20.0 kgf·m 123.0 to 144.6 lbf·ft

(1) Bolt (2) Bolt

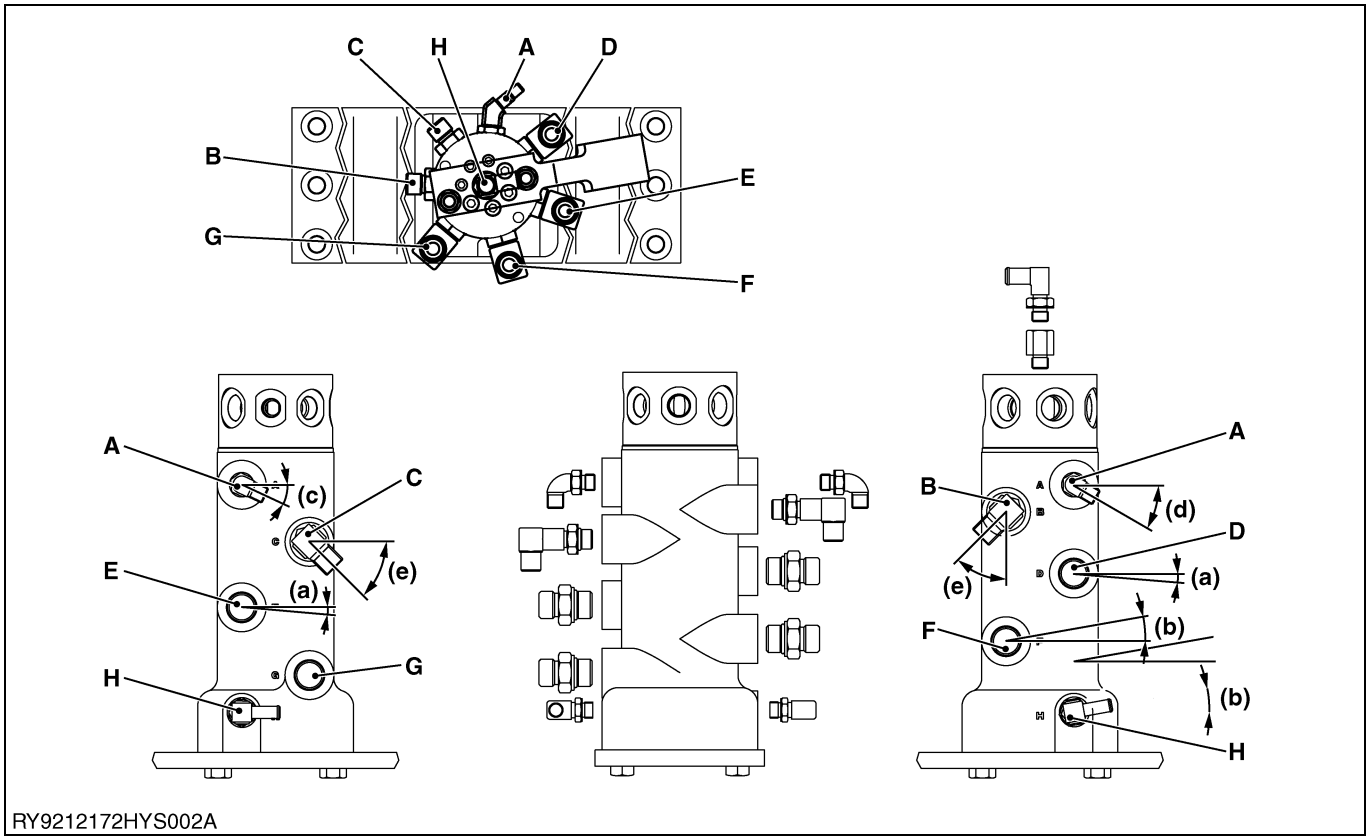
RY9212174HYS0128US0


RY9212174HYS052A

11. Remove the swivel joint carefully.

RY9212174HYS0129US0

Adapter angle



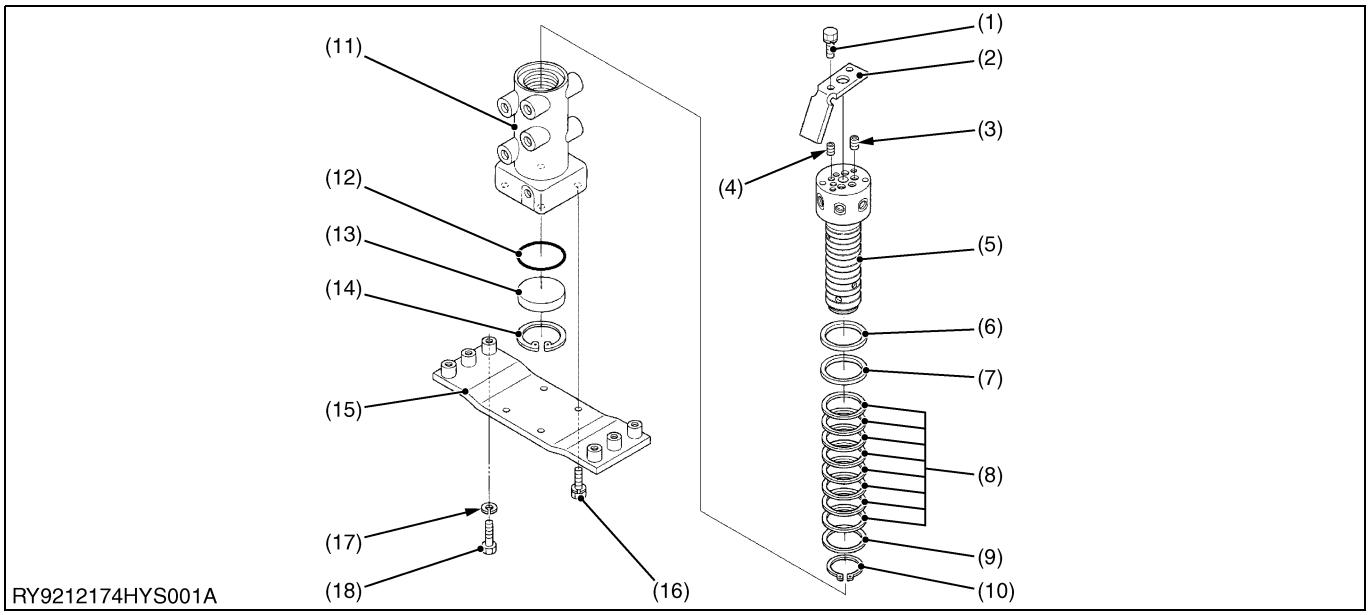
(a) 5° (0.09 rad)
(b) 10° (0.17 rad)
(c) 25° (0.44 rad)
(d) 30° (0.52 rad)
(e) 45° (0.79 rad)

A : 2nd Speed Pilot
B : Blade Down
C : Blade Up
D : Travel Left Forward
E : Travel Right Forward
F : Travel Left Rear
G : Travel Right Rear
H : Drain

RY9212172HYS0003US0

[2] DISASSEMBLING AND ASSEMBLING THE SWIVEL JOINT

Components

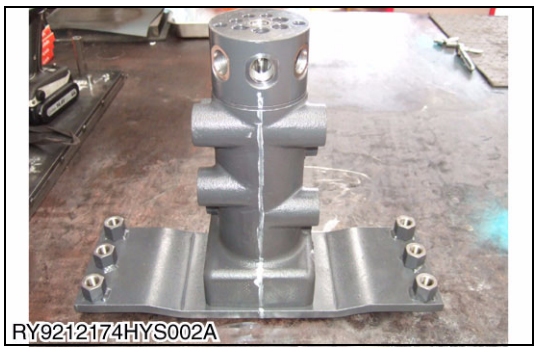


No.	Part Name	Q'ty	Notes
(1)	Bolt	2	Locktite
(2)	Stopper	1	
(3)	Plug (PT1/4)	4	40.2 ± 3.9 N·m 4.1 ± 0.4 kgf·m 29.6 ± 2.9 lbf·ft
(4)	Plug (PT1/8)	3	24.5 ± 4.9 N·m 2.5 ± 0.5 kgf·m 18.1 ± 3.6 lbf·ft
(5)	Shaft	1	
(6)	Collar	1	
(7)	Packing (U)	1	
(8)	Seal	8	
(9)	Collar	1	
(10)	Circlip	1	
(11)	Body	1	
(12)	O-ring	1	
(13)	Cover	1	
(14)	Circlip	1	
(15)	Bottom cover	1	
(16)	Bolt	4	83.9 ± 6.4 N·m 8.6 ± 0.6 kgf·m 61.8 ± 4.7 lbf·ft Thread locking compound (Loctite 1324 or equivalent)
(17)	Spring washer	6	
(18)	Bolt	6	181.4 ± 14.7 N·m 18.5 ± 1.5 kgf·m 133.8 ± 10.8 lbf·ft Thread locking compound (Loctite 271)

- During disassembly always tap out threads that have thread lock sticking to them.

RY9212172HYS0004US0

(1) Disassembling



1. Prior to disassembly, mark the alignment of the shaft and body.

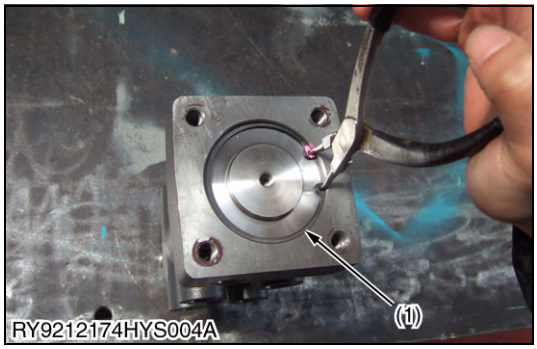
RY9212174HYS0003US0



2. Remove the bolts and then the bottom cover.
   - Tool to use: 17 mm socket

(1) Bottom Cover

RY9212174HYS0004US0



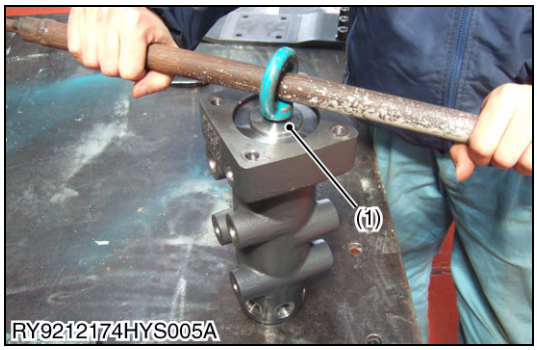
3. Remove the circlip.

■ **IMPORTANT**
- **Be careful so the circlip does not pop out.**

- Tool to use: snap ring pliers

(1) Circlip

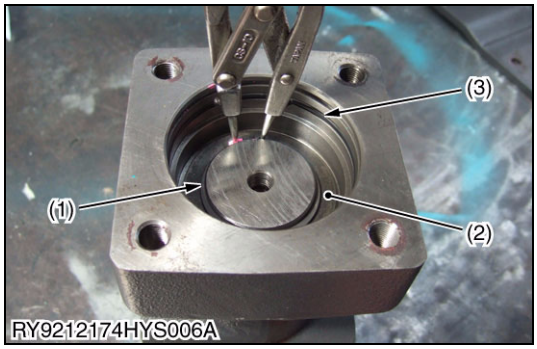
RY9212174HYS0005US0



4. Mount an eye bolt on the cover and put a bar through the hole of the eye bolt. Knock upwards on both sides of the bar and remove the cover.

(1) Cover

RY9212174HYS0006US0



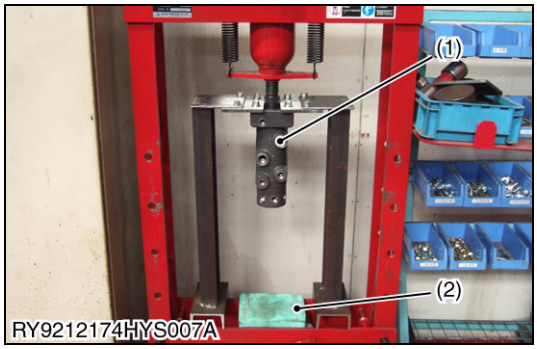
5. Remove the circlip, collar and O-ring.

■ **IMPORTANT**
- **Be careful so the circlip does not pop out.**

- Tool to use: snap ring pliers

(1) Circlip
(2) Collar
(3) O-Ring

RY9212174HYS0007US0

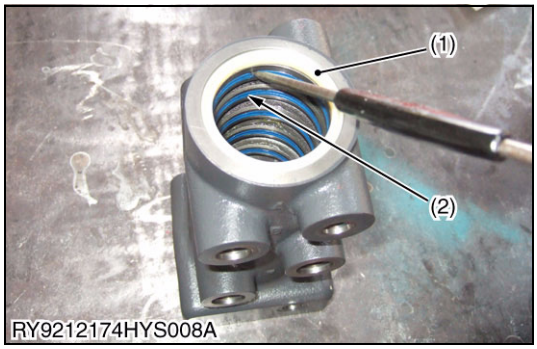


6. Use a press to remove the shaft.

■ **IMPORTANT**
- **Make sure that the shaft does not fall down.**

(1) Swivel joint (2) Protective mat

RY9212174HYS0008US0



7. Remove the U packing and seal inside the body.
- Tool to use: awl

■ **Work Tip**
- Depending on the position where the seal is inserted, turn the body counterclockwise to remove it.

(1) Packing (U) (2) Seal

RY9212174HYS0009US0

(2) Assembling

- Prior to assembly, clean all of the parts and make sure they are not damaged and there is no dirt or other debris sticking to them.
- After washing parts, blow them dry to remove any detergent (Be particularly careful to remove any detergent around port holes and bolt holes).
- Always replace all of the O-rings, seals and U packings with new ones.

RY9212174HYS0001US0



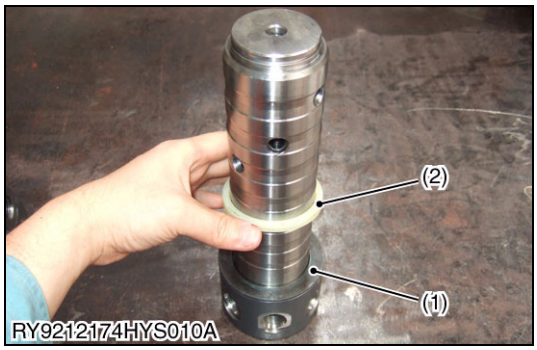
1. Install the seal in the body.

■ **IMPORTANT**
- **Apply grease uniformly onto the seal.**
- **Manipulate the seal until it seats perfectly into the groove.**

■ **Work Tip**
- Depending on where the seal is being inserted, turn the body the opposite direction to mount it.
- If it is difficult to get the seal in, use a spatula with rounded edges to mount it.

(1) Seal

RY9212174HYS0010US0



2. Mount the collar and U packing in order on the top of the shaft.

■ **IMPORTANT**
- **Apply grease uniformly on the U packing.**
- **Make sure the collar and U packing stick to the head of the shaft.**

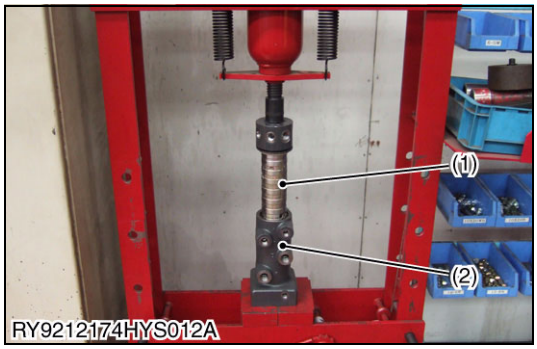
(1) Collar (2) Packing (U)

RY9212174HYS0011US0


RY9212174HYS011A

3. Apply grease uniformly onto the shaft.

RY9212174HYS0012US0



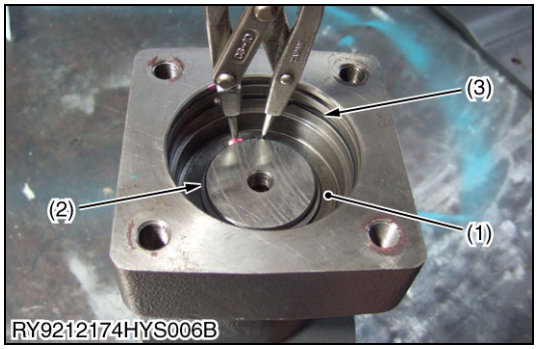
RY9212174HYS012A

4. Check the positioning of the alignment mark and insert the shaft.

■ **IMPORTANT**
- **Make sure there are no scratches or debris.**

(1) Shaft (2) Body

RY9212174HYS0013US0



RY9212174HYS006B

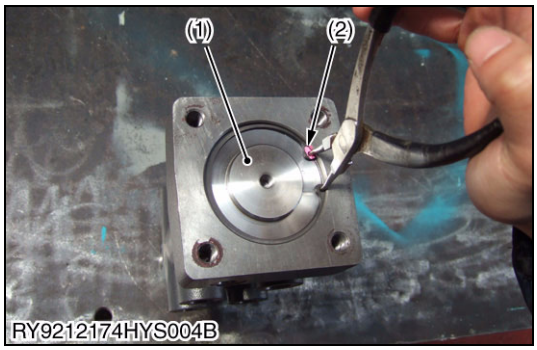
5. Install the collar, circlip, and O-ring.

■ **IMPORTANT**
- **Install the circlip with the rounded side down.**

- Tool to use: snap ring pliers

(1) Collar (3) O-Ring
(2) Circlip

RY9212174HYS0014US0



RY9212174HYS004B

6. After installing the cover, install a circlip.

■ **IMPORTANT**
- **Install the circlip with the rounded side down.**

- Tool to use: snap ring pliers

(1) Cover (2) Circlip

RY9212174HYS0015US0



RY9212174HYS003A

7. Mount the bottom cover.

Tightening torque	Bolt	83.9 ± 6.4 N·m 8.6 ± 0.6 kgf·m 61.8 ± 4.7 lbf·ft

- Tool to use: 17 mm socket

■ **IMPORTANT**
- **Apply a thread lock (Loctite 271) to the bolts.**

(1) Bottom Cover

RY9212174HYS0016US0

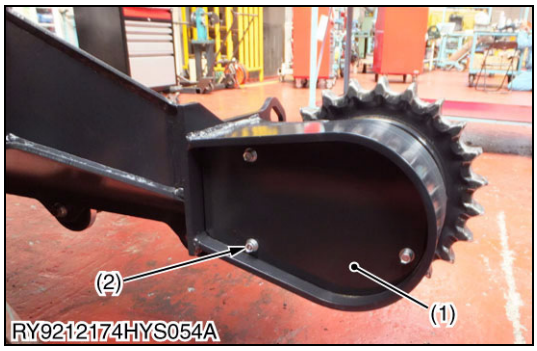
5. TRAVEL MOTOR

[1] REMOVING AND INSTALLING THE TRAVEL MOTOR

CAUTION

- **Before removing hydraulic devices, lower the bucket and blade to the ground and stop the engine.**
- **Each of the devices and the hydraulic oil are hot right after stopping the excavator. The oil is hot enough to cause a burn, so always let it cool down before starting any work.**
- **When hydraulic oil is under pressure, it has enough force to pierce your skin or eyes. When working with hydraulic lines always relieve any residual pressure before starting work.**

RY9212148HYS0091US0



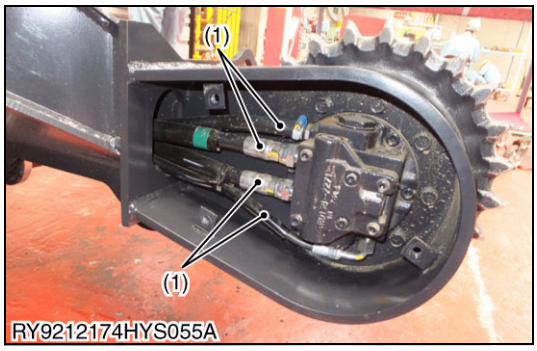
1. Remove the track and the cover.
   - Tool to use: 14 mm socket

DANGER

- **Always support the track frame with supporting blocks.**

(1) Cover (2) Bolt

RY9212174HYS0070US0



2. Use a vacuum pump to depressurize the hydraulic oil tank and then disconnect the hoses that are connected to the travel motor.

(1) Hose

RY9212174HYS0071US0



3. Suspend the travel motor with a nylon sling and remove the bolts.

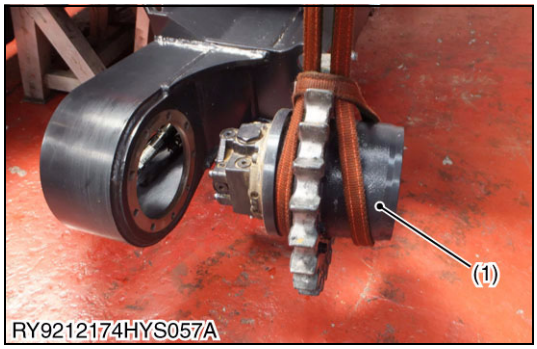
IMPORTANT

- **Apply a thread lock (Loctite 271).**

Tightening torque	Travel Motor	103.7 to 117.7 N·m 10.5 to 12.0 kgf·m 76.0 to 86.8 lbf·ft

(1) Bolt

RY9212174HYS0072US0



4. Use a crane to hoist and remove the travel motor.

IMPORTANT

- **Apply a thread lock (Loctite 271).**

Tightening torque	Sprocket	103.7 to 117.7 N·m 10.5 to 12.0 kgf·m 76.0 to 86.8 lbf·ft

(1) Travel Motor

RY9212174HYS0073US0

5. Perform the procedure in reverse for assembly.

RY9212148HYS0096US0

[2] DISASSEMBLING AND ASSEMBLING THE TRAVEL MOTOR

(1) Disassembling

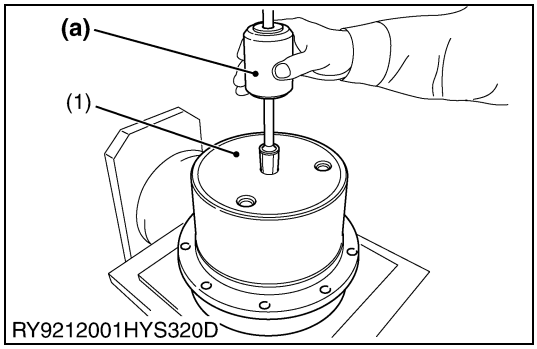
[A] Gear Case



1. Mount the travel motor to the special disassembly platform and remove the plug and spring pin.
   - Tool to use: 8mm hex socket, 4mm pin punch, hammer

(1) Plug (2) Spring Pin

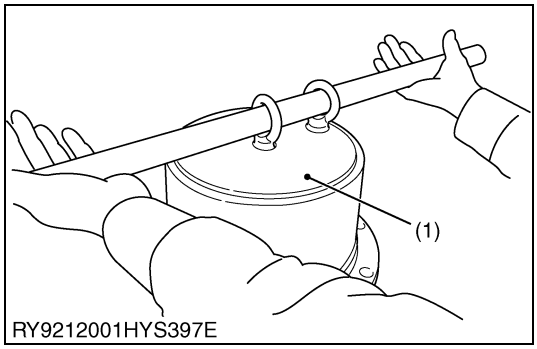
RY9212174HYS0131US0



2. Attach the cover removal tool and knock it up to remove the cover.
   - Tool to use: Cover removal tool

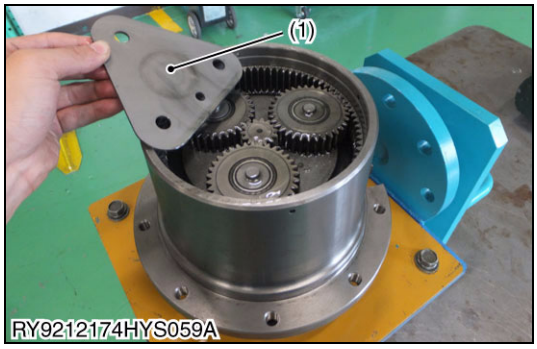
If a cover removal tool is not available

- Mount an eye bolt on the cover and put a bar through the hole in the eye bolt.
- Knock upwards on both sides of the bar and remove the cover.



(1) Cover **(a) Cover Removal Tool**

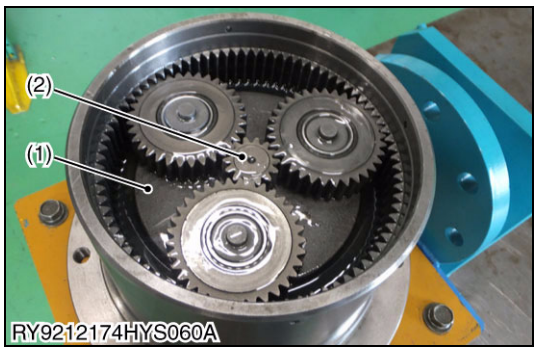
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3. Remove thrust plate C.

(1) Thrust Plate C

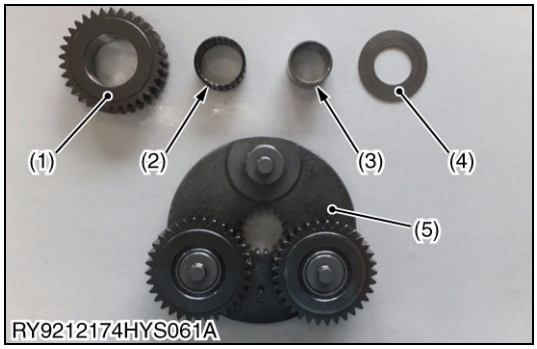
RY9212174HYS0132US0



4. Remove the holder sub-assembly and the drive gear.

(1) Holder Sub-Assembly (2) Drive Gear

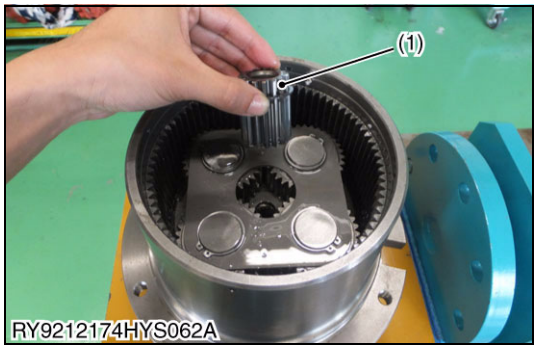
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Holder sub-assembly components

(1) Planetary Gear A
(2) Needle Bearing
(3) Collar
(4) Thrust Plate A
(5) Holder

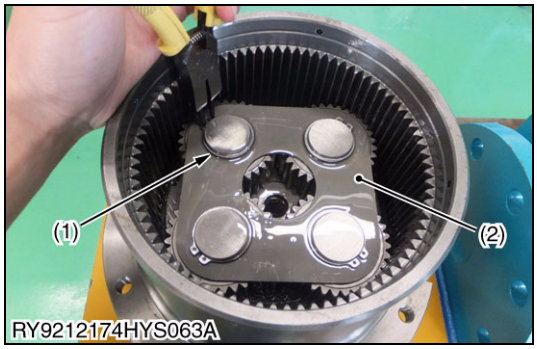
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5. Remove the sun gear.

(1) Sun Gear

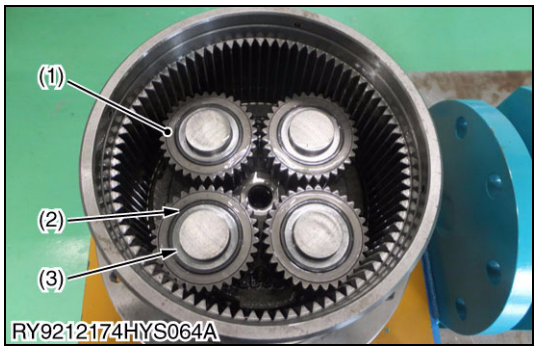
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6. Remove the circlip and thrust plate B2 in order.

(1) Circlip
(2) Thrust Plate B2

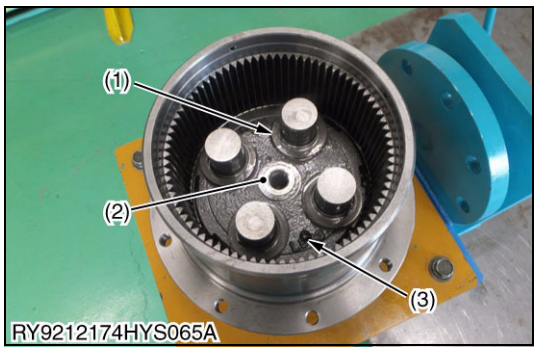
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7. Remove planetary gear B, the needle bearing, and collar in order.

(1) Planetary Gear B
(2) Needle Bearing
(3) Collar

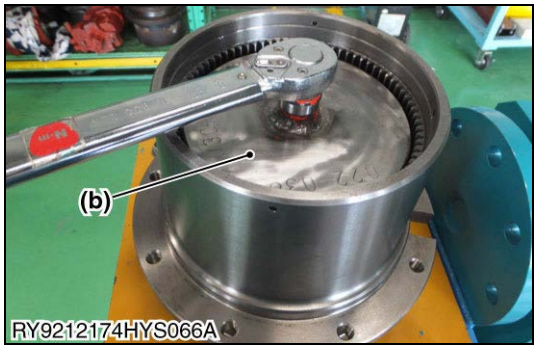
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8. Remove thrust plate B, thrust plate D, and set screws.
   - Tool to use: 4 mm hex socket

(1) Thrust Plate B
(2) Thrust Plate D
(3) Set Screw

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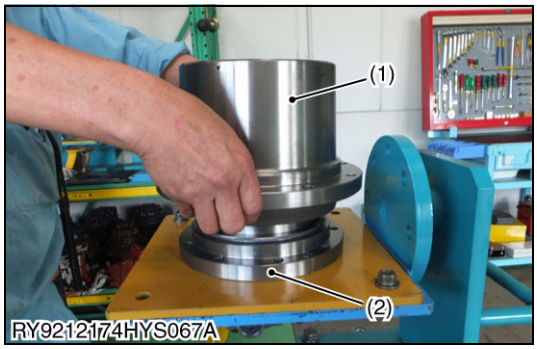


9. Remove the ring nut.
   - Tool to use: Ring nut socket

■ **IMPORTANT**
- **Be careful that the ring nut socket doesn't come off during installation/removal.**

(b) Ring Nut Socket

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10. Remove the gear case from the flange holder.

(1) Gear Case (2) Flange Holder

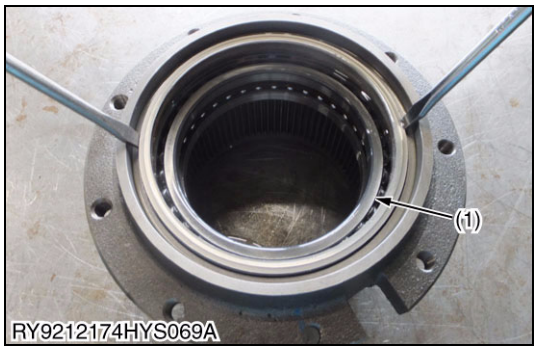
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11. Remove the floating seal from the flange holder side.
    - Tool to use: Slotted screwdriver

(1) Floating Seal

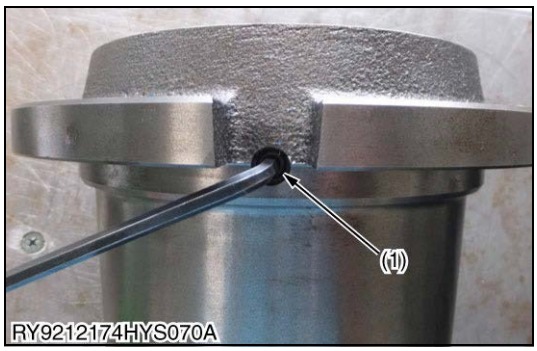
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12. Remove the floating seal from the gear case side.
    - Tool to use: Slotted screwdriver

(1) Floating Seal

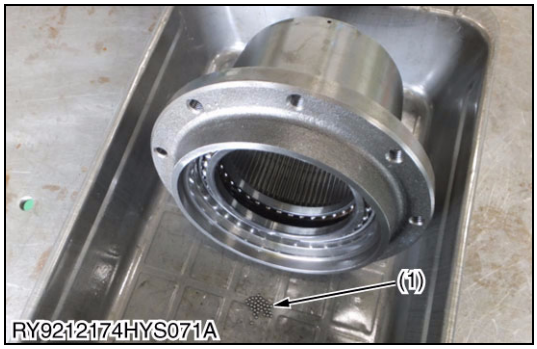
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13. Remove the plug.
    - Tool to use: 5 mm hex socket

(1) Plug

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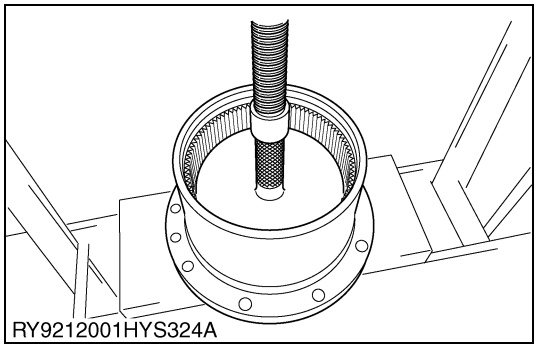


14. Take out the 132 balls.

■ **IMPORTANT**
- **Do not lose any of the balls.**
- **If you fail to remove even one of the balls, the bearing cannot be removed, so keep close track of the balls.**

(1) Ball

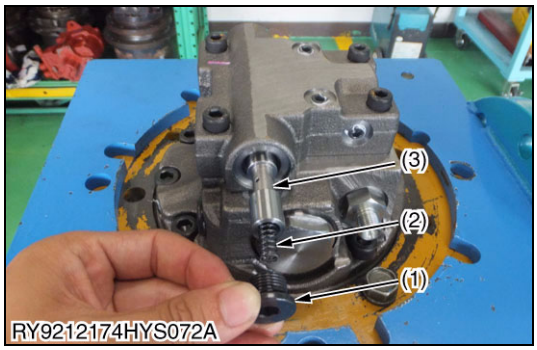
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15. Use a press to remove the angular bearing.

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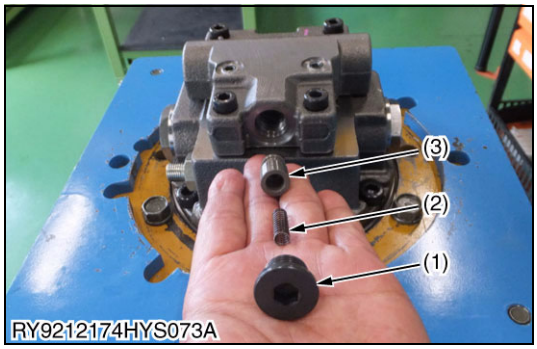
[B] Motor



1. Remove the plug, spring, and anticavitation spool in order.
   - Tool to use: 8 mm hex socket

(1) Plug
(2) Spring
(3) Anticavitation Spool

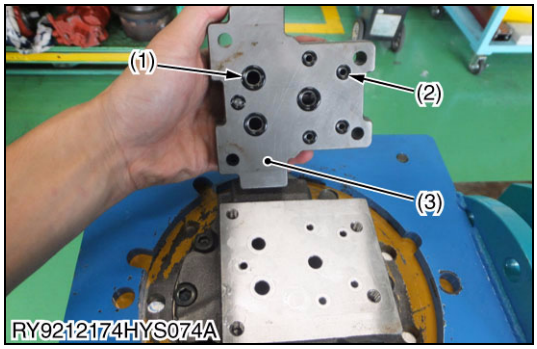
RY9212174HYS0146US0



2. Remove the plug, spring, and poppet in order.
   - Tool to use: 8 mm hex socket

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

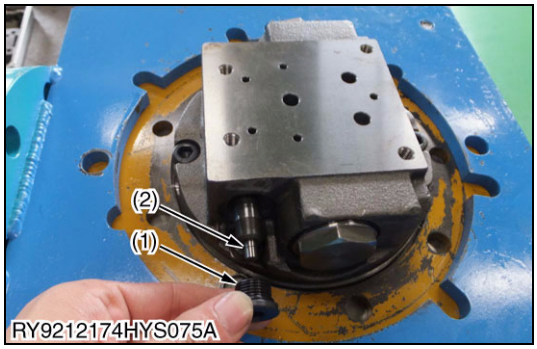
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3. Remove the body.
   - Tool to use: Hex socket 6mm

(1) O-Ring
(2) O-Ring
(3) Body

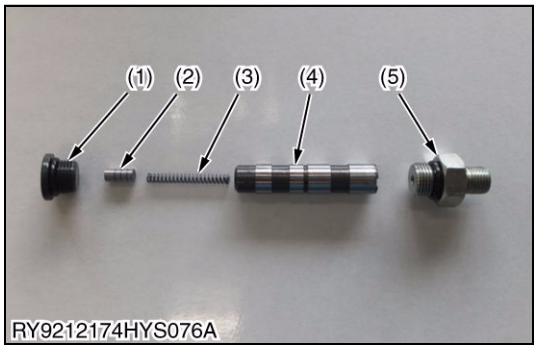
RY9212174HYS0148US0



4. Remove the plug, 2nd speed shift spool (S), spring and 2nd speed shift spool in order.
   - Tool to use: 22 mm socket

(1) Plug
(2) 2-Speed Switch Spool

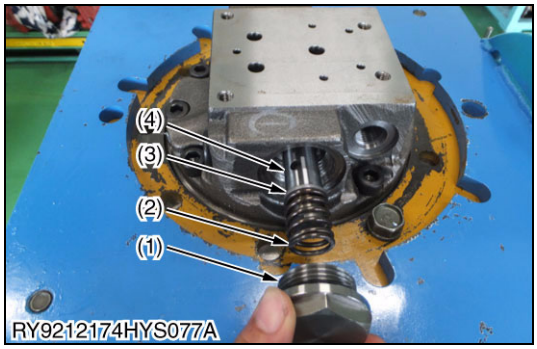
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Components of the 2-speed Switch

(1) Plug
(2) 2nd Speed Shift Spool (S)
(3) Spring
(4) 2nd Speed Shift Spool
(5) Pipe Joint

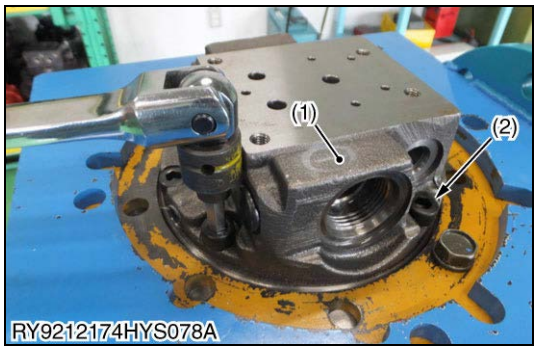
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5. Remove the plug, spring washer, and plunger in order.
   - Tool to use: 36 mm socket

(1) Plug
(2) Spring
(3) Metal Washer
(4) Plunger

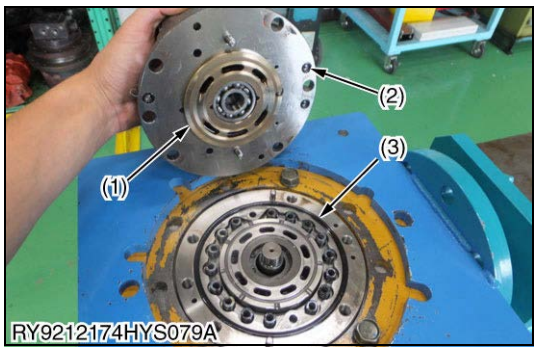
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6. Remove the hex socket bolts and then the base plate.
   - Tool to use: 8 mm hex socket

(1) Base Plate
(2) Socket Head Bolt

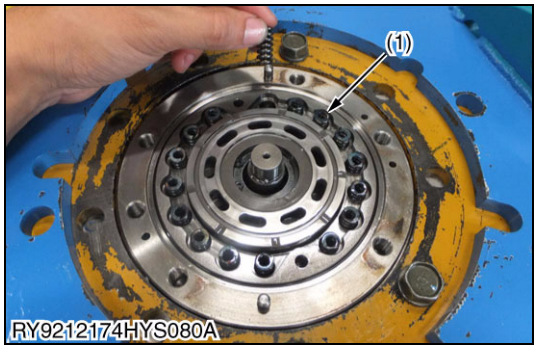
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7. Remove the valve plate and O-rings.

(1) Valve Plate
(2) O-Ring
(3) O-Ring

RY9212174HYS0153US0



8. Remove the springs.

(1) Spring

RY9212174HYS0154US0

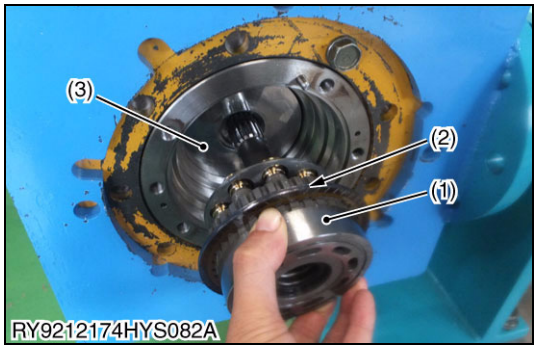


9. While pressing down on the brake piston with a rag, blow air through the brake release oil passage hole and remove the brake piston.

CAUTION

- **Be careful because if you blast air into the passage, the brake piston may pop out.**
- **The brake release oil passage hole is the smaller hole between bolts (3 bolts).**

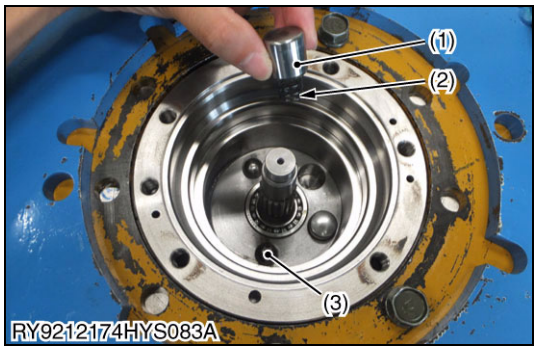
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10. Turn the assembly stand 1.6 rad (90°) and remove the cylinder block sub-assembly, friction plate and swash-plate.

(1) Cylinder Block Sub-Assembly
(2) Friction Plate
(3) Swash-Plate

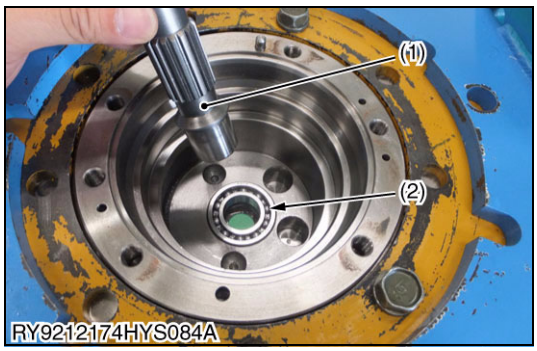
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11. Turn the assembly platform back as it was and remove the piston ASSY, spring, and steel balls.

(1) Piston ASSY
(2) Spring
(3) Steel Ball

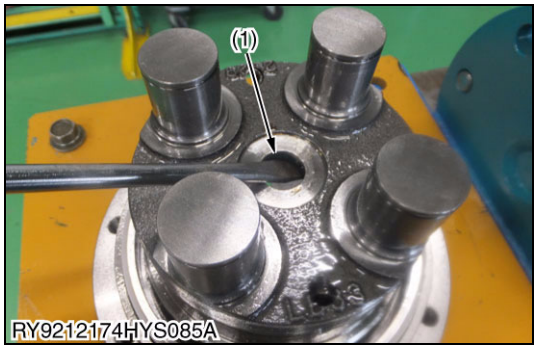
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12. Remove the shaft and ball bearing.

(1) Shaft
(2) Ball Bearing

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13. Turn the assembly platform and remove the oil seal.
    - Tool to use: slotted screwdriver and hammer

(1) Oil Seal

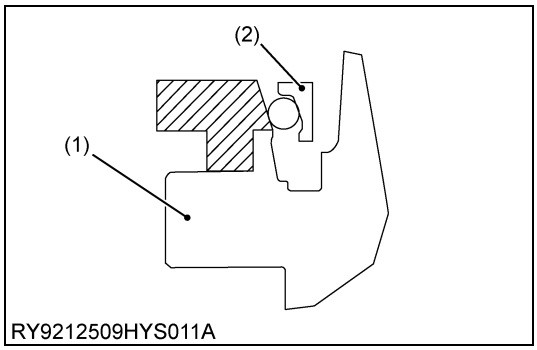
RY9212174HYS0159US0

(2) Assembling

[A] Motor

- Prior to assembly, clean all of the parts and make sure they are not damaged and there is no dirt or other debris sticking to them.
- Always replace all of the O-rings, backup rings, oil seals and floating seals with new ones.

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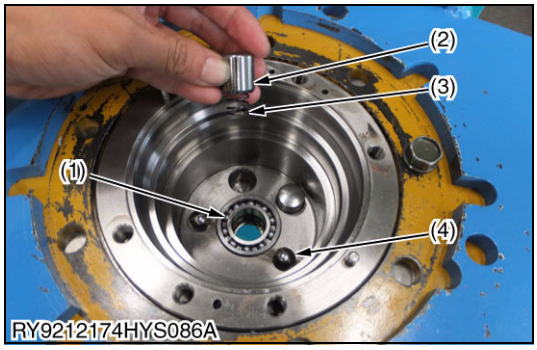


1. Put the flange holder on the assembly platform and install the oil seal.
    - Tool to use: hammer
    - Tool to use: Oil seal installation tool

■ **IMPORTANT**
- **Take care to face the oil seal the right direction.**
- **Apply grease to its lip and circumference.**

(1) Flange Holder (2) Seal

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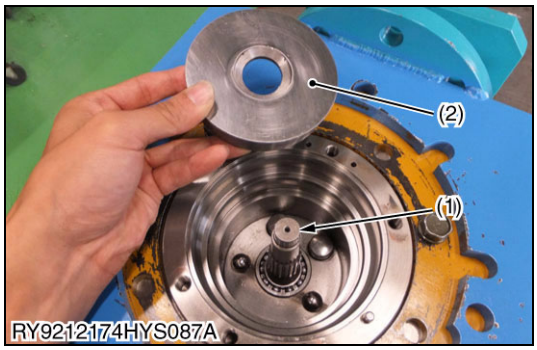


2. Install the ball bearing, piston ASSY, spring and steel balls.

■ **IMPORTANT**
- **Face the ball bearing so the inscription is up.**
- **Apply grease to the circumference of the ball bearing.**
- **Apply hydraulic oil to the outside of the piston.**
- **Press the piston down and make sure it moves smoothly.**
- **Apply grease to the spring and steel balls.**

(1) Ball Bearing (3) Spring
(2) Piston ASSY (4) Steel Ball

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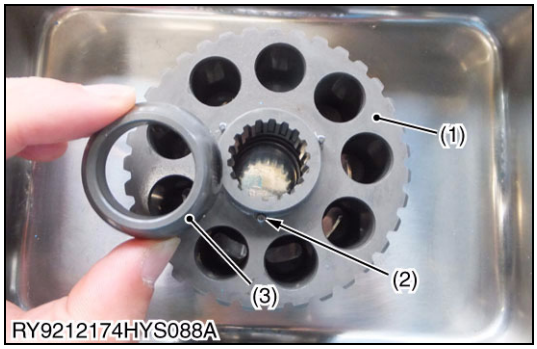


3. Install the shaft and swash-plate in order.

■ **IMPORTANT**
- **Dip the entire swash-plate in hydraulic oil and then install it.**
- **Make sure the piston ASSY moves smoothly.**
- **Fill the spline hole in the shaft with grease.**

(1) Shaft (2) Swash-Plate

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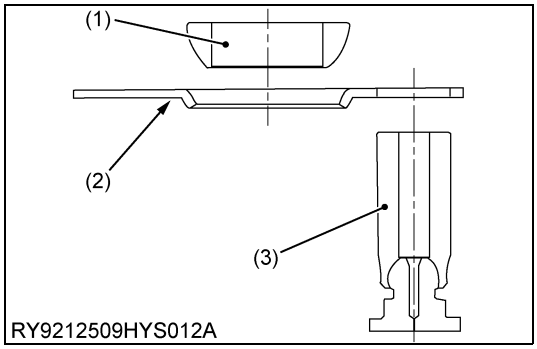


4. Install the three pins in the cylinder block and mount the retainer holder.

■ **IMPORTANT**
- **Apply grease to the pins.**

(1) Cylinder Block
(2) Pin
(3) Retainer Holder

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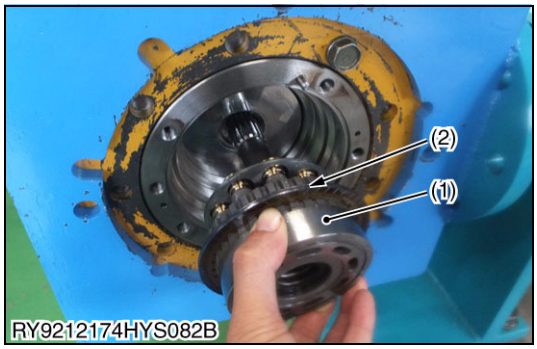


5. Install the piston ASSY into the retainer plate and then install it into the cylinder block.

■ **IMPORTANT**
- **Apply hydraulic oil to the pistons.**
- **Make sure the pistons move smoothly.**
- **Be careful that the retainer plate faces the right direction.**

(1) Retainer Holder
(2) Retainer Plate
(3) Piston ASSY

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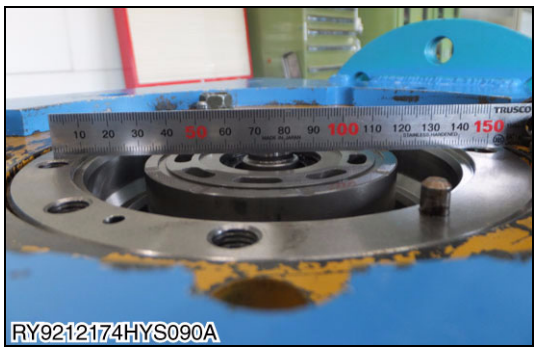


6. Install the cylinder block sub-assembly, and the friction plate.

■ **IMPORTANT**
- **Turn the assembly platform 1.6 rad (90°) to install them and then turn it back afterwards.**

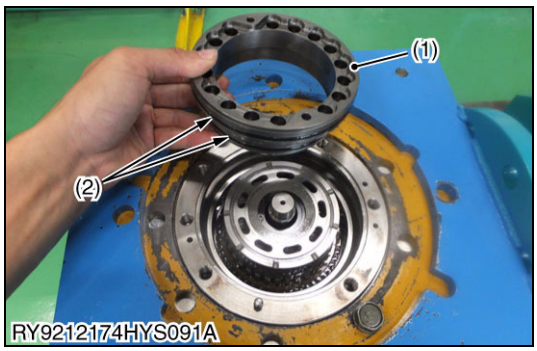
(1) Cylinder Block Sub-Assembly
(2) Friction Plate

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7. Check and make sure the sliding surface of the cylinder block is sunk below the mating surface of the flange holder.

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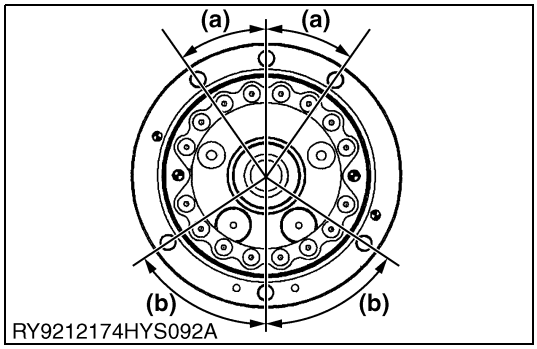


8. Install the brake piston.

■ **IMPORTANT**
- **Apply grease to the O-rings.**

(1) Brake Piston
(2) O-Ring

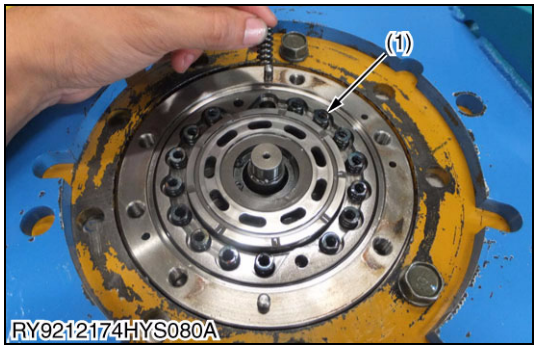
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Brake piston hole alignment positions

(a) 0.61 rad (35°) **(b) 0.96 rad (55°)**

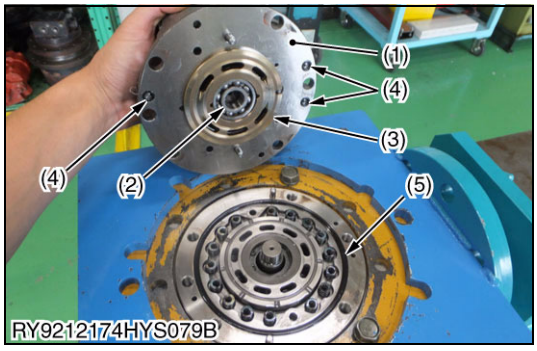
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9. Install the springs.

(1) Spring

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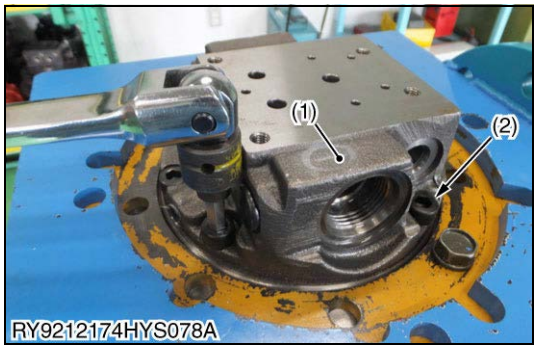


10. Install the ball bearing, valve plate and O-rings on the base plate.

■ **IMPORTANT**
- **Be careful that the valve plate faces the right direction.**
- **The valve plate comes off easily, so apply some grease to it.**
- **Apply grease to the O-rings.**

(1) Base Plate
(2) Ball Bearing
(3) Valve Plate
(4) O-Ring
(5) O-Ring

RY9212174HYS0170US0



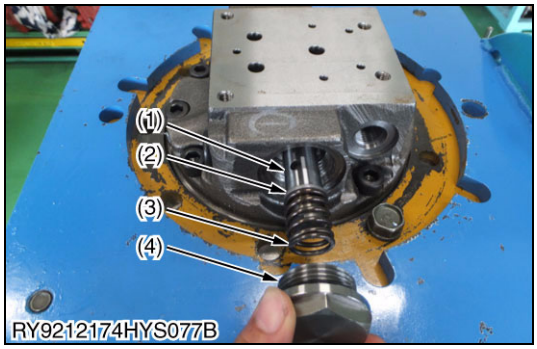
11. Install the base plate.
- Tool to use: 8 mm hex socket

■ **IMPORTANT**
- **Be careful so the base plate does not fall off.**
- **Tighten the hex socket bolts diagonal to each other.**

Tightening torque	Socket head bolt	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 lbf·ft

(1) Base Plate
(2) Socket Head Bolt

RY9212174HYS0171US0



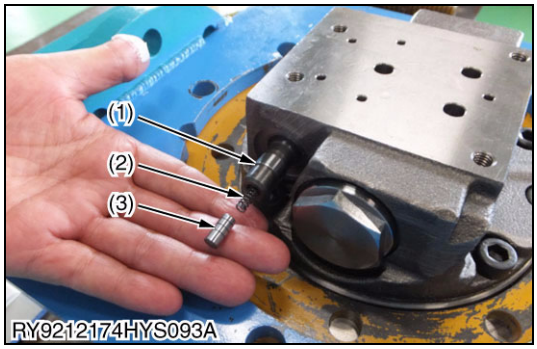
12. Install the plunger, washer, spring and plug in order.
- Tool to use: 36 mm socket

■ **IMPORTANT**
- **Make sure the spool slides smoothly on its own.**
- **Apply hydraulic oil to the spool.**
- **Apply grease to the O-rings.**

Tightening torque	Plug	235.0 to 245.0 N·m 24.0 to 25.0 kgf·m 173.0 to 181.0 lbf·ft

(1) Plunger
(2) Metal Washer
(3) Spring
(4) Plug

RY9212174HYS0172US0

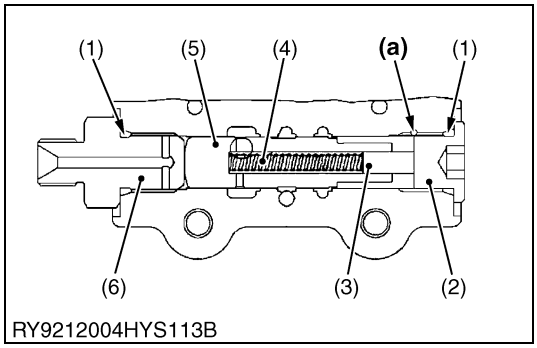


13. Install the 2-speed switch spool, spring and 2nd speed shift spool (S) in order.

■ **IMPORTANT**
- **Make sure the spool slides smoothly on its own.**
- **Apply hydraulic oil to the spools.**
- **Be careful that the spools face the right direction.**

(1) 2nd Speed Shift Spool
(2) Spring
(3) 2nd Speed Shift Spool (S)

RY9212174HYS0173US0



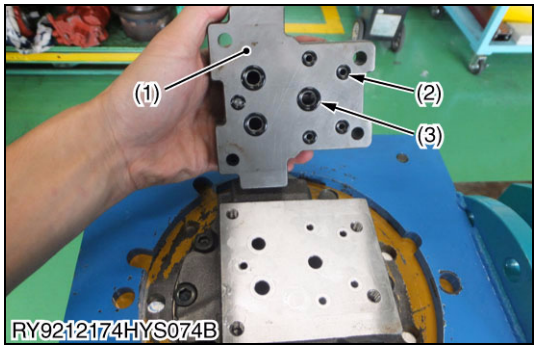
14. Install the plug and adapter.
- Tool to use: 8mm hex wrench, 22mm box wrench

■ **IMPORTANT**
- **Apply grease to the O-rings.**

Tightening torque	Plug, adapter	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.1 to 43.4 lbf·ft

(1) O-Ring
(2) Plug
(3) 2nd Speed Shift Spool (S)
(4) Spring
(5) 2nd Speed Shift Spool
(6) Adapter
(a) Drain hole

RY9212174HYS0174US0



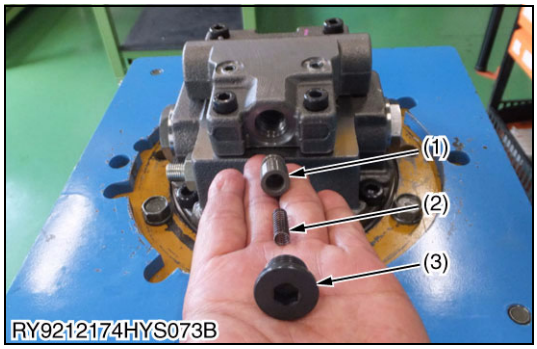
15. Install the anticavitation body.
- Tool to use: 6 mm hex socket

■ **IMPORTANT**
- **Apply grease to the O-rings.**

Tightening torque	Socket head bolt	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.3 to 20.3 lbf·ft

(1) Anticavitation Body
(2) O-Ring
(3) O-Ring

RY9212174HYS0175US0



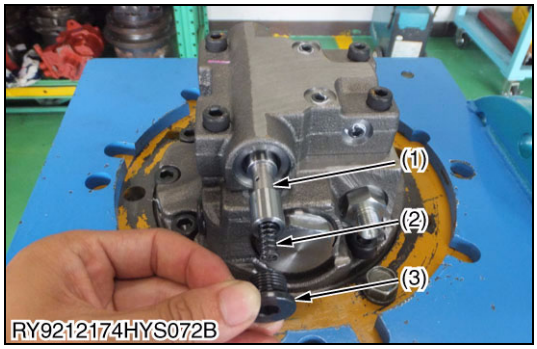
16. Install the poppet, spring and plug in order.
- Tool to use: 8 mm hex socket

■ **IMPORTANT**
- **Apply grease to the O-ring.**

Tightening torque	Plug	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.1 to 43.4 lbf·ft

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

RY9212174HYS0176US0



17. Install the anticavitation spool, spring and plug in order.
- Tool to use: 8 mm hex socket

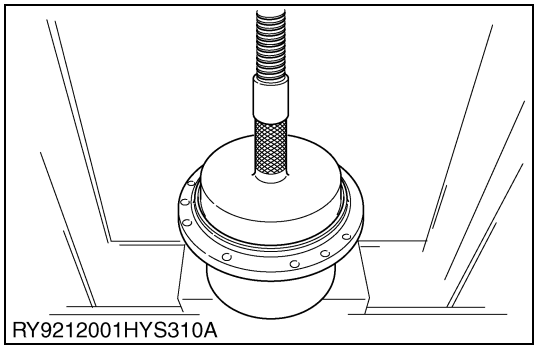
■ **IMPORTANT**
- **Make sure the spools slide smoothly.**
- **Apply hydraulic oil to the spool.**
- **Apply grease to the O-ring.**

Tightening torque	Plug	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.1 to 43.4 lbf·ft

(1) Anticavitation Spool
(2) Spring
(3) Plug

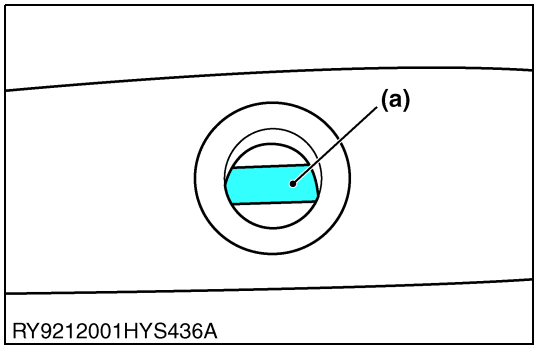
RY9212174HYS0177US0

[B] Gear Case


RY9212001HYS310A

1. Set the angular bearing in the gear case and install it with a press.

RY9212174HYS0178US0



RY9212001HYS436A

2. After installing it, check and make sure the groove **(a)** around the circumference of the bearing comes right to the center.

(a) Circumference Groove

RY9212174HYS0179US0

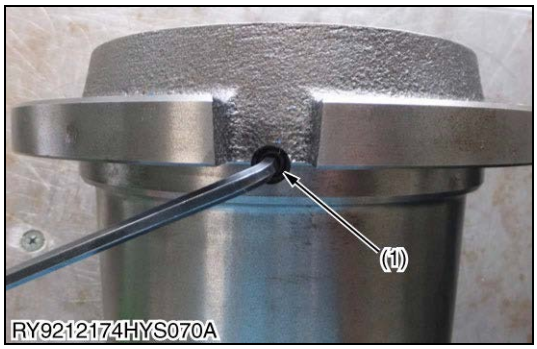


RY9212174HYS094A

3. Put the 132 balls in.

(1) Ball

RY9212174HYS0180US0



RY9212174HYS070A

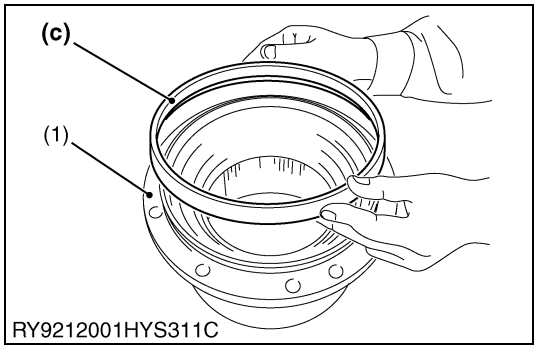
4. Wrap the plug with plumber's tape and install it.
   - Tool to use: 5 mm hex socket

■ **NOTE**
- **If the plug is new, the plumber's tape is not needed.**

Tightening torque	Plug	9.8 to 14.7 N·m 1.0 to 1.5 kgf·m 7.2 to 10.8 lbf·ft

(1) Plug

RY9212174HYS0181US0

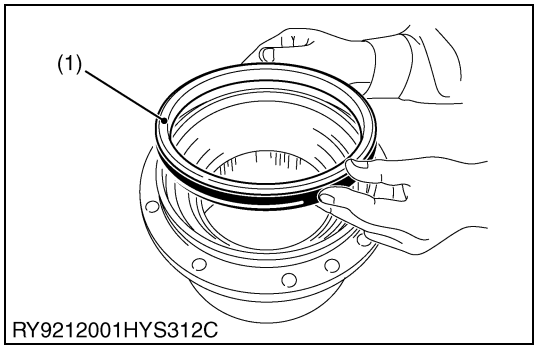


RY9212001HYS311C

5. Set the floating seal installation tool on the gear case.

(1) Gear case
(c) Floating Seal Installation Tool (for housing)]

RY9212174HYS0182US0

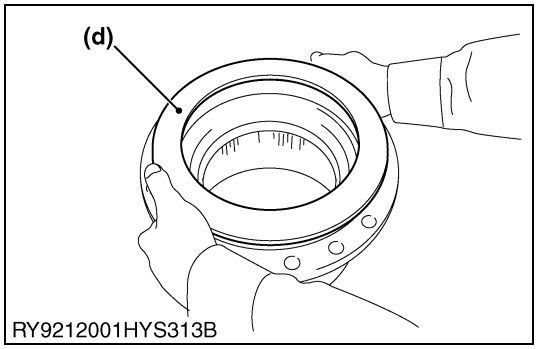


6. Set the seal in the gear case.

■ **IMPORTANT**
- **Apply grease to the O-ring.**

(1) Floating Seal

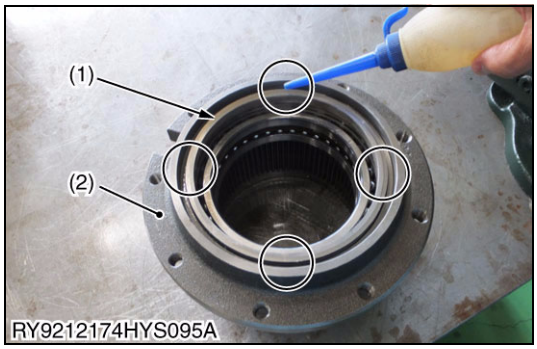
RY9212174HYS0183US0



7. Install the floating seal in the gear case with the floating seal installation tool.

(d) Floating Seal Installation Tool (pusher)

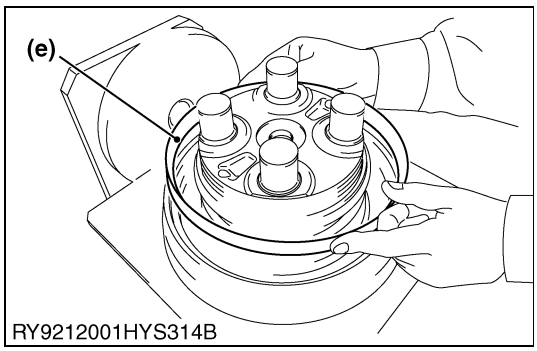
RY9212174HYS0184US0



8. Apply a little gear oil on the sliding surface of the floating seal. [4 places, every 1.6 rad (90°)]

(1) Floating Seal (2) Gear Case

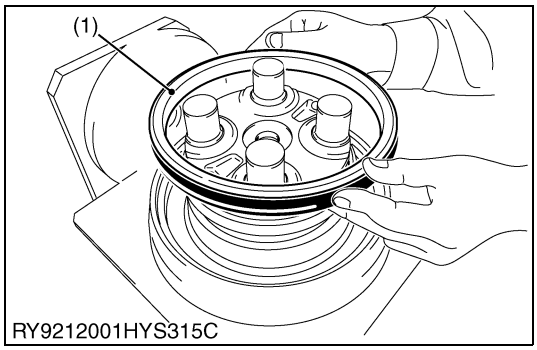
RY9212174HYS0185US0



9. Set the floating seal installation tool on the flange holder.

(e) Floating Seal Installation Tool (for flange holder)

RY9212174HYS0186US0

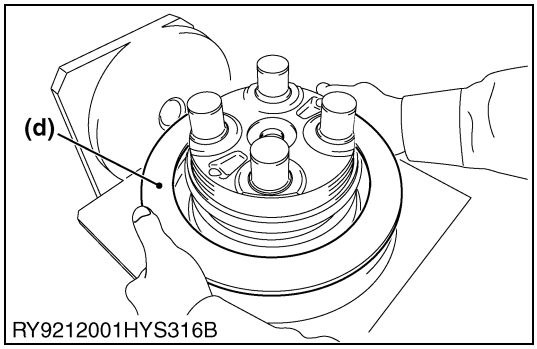


10. Set the floating seal on the flange holder.

■ **IMPORTANT**
- **Apply grease to the O-ring.**

(1) Floating Seal

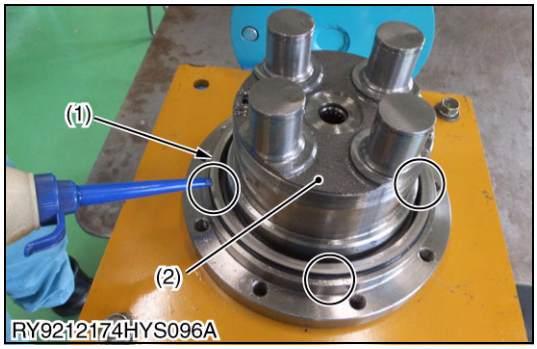
RY9212174HYS0187US0



11. Install the floating seal in the flange holder with the floating seal installation tool.

(d) Floating Seal Installation Tool (pusher)

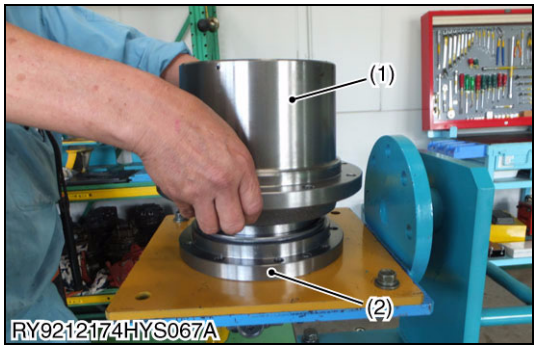
RY9212174HYS0188US0



12. Apply a little gear oil on the sliding surface of the floating seal. [4 places, every 1.6 rad (90 °)]

(1) Floating Seal (2) Flange Holder

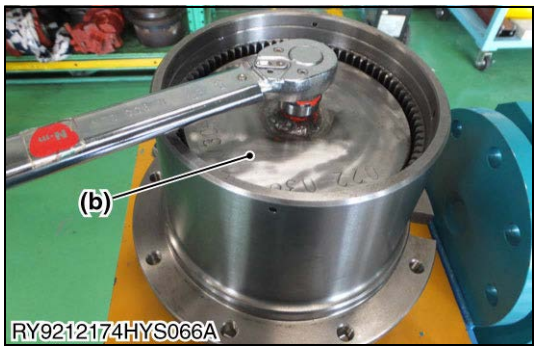
RY9212174HYS0189US0



13. Install the gear case.

(1) Gear Case (2) Flange Holder

RY9212174HYS0190US0



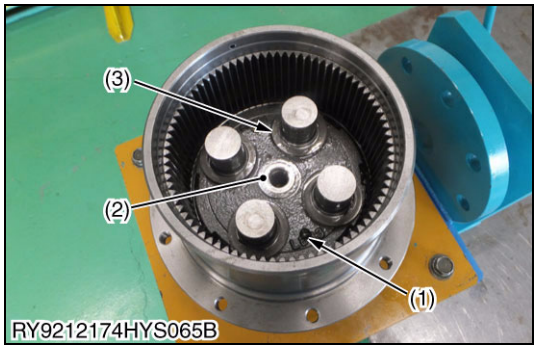
14. Install the ring nut.
- Tool to use: Ring nut socket

Tightening torque	Ring nut	225.2 to 244.8 N·m 23.0 to 25.0 kgf·m 166.1 to 180.6 lbf·ft

■ **IMPORTANT**
- **Be careful that the ring nut socket doesn't come off during installation/removal.**

(b) Ring Nut Socket

RY9212174HYS0191US0



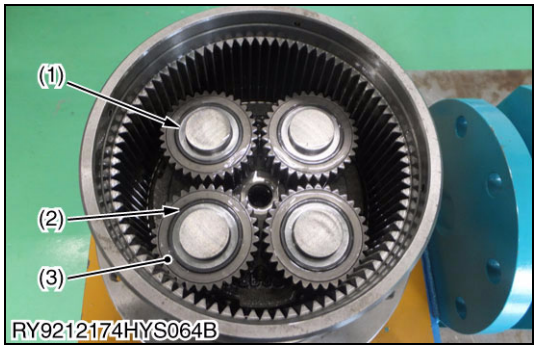
15. Install the set screws, thrust plate D and thrust plate B.
- Tool to use: 4 mm hex socket

■ **IMPORTANT**
- **Apply Loctite to the set screws.**
- **If new parts are used, plumber's tape is not needed.**
- **Install thrust plate B2 with the rounded side down.**

Tightening torque	Set screw	12.3 to 14.2 N·m 1.25 to 1.45 kgf·m 9.07 to 10.5 lbf·ft

(1) Set Screw (M8 Sealock) (3) Thrust Plate B
(2) Thrust Plate D

RY9212174HYS0192US0

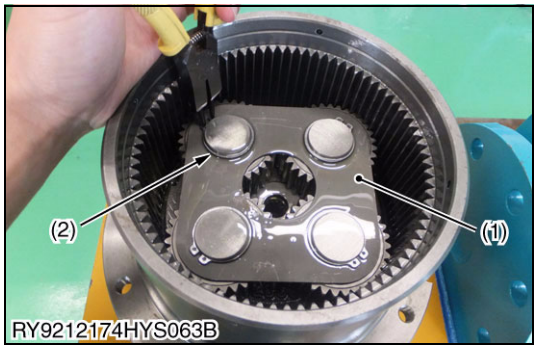


16. Install the collar, needle bearing and planetary gear B in order.

■ **IMPORTANT**
- **Face the beveled side of the collar down.**
- **Install planetary gear B with the indented side facing up.**

(1) Collar
(2) Needle Bearing
(3) Planetary Gear B

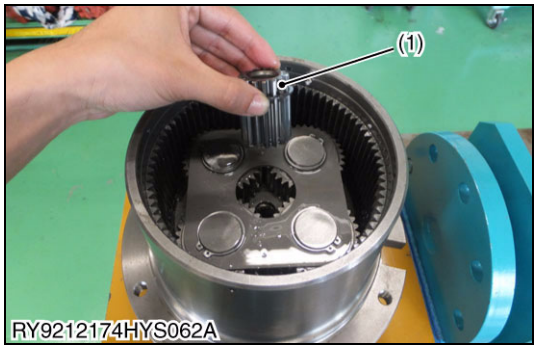
RY9212174HYS0193US0



17. Install thrust plate B2 and the circlip in order.
- Tool to use: snap ring pliers

(1) Thrust Plate B2
(2) Circlip

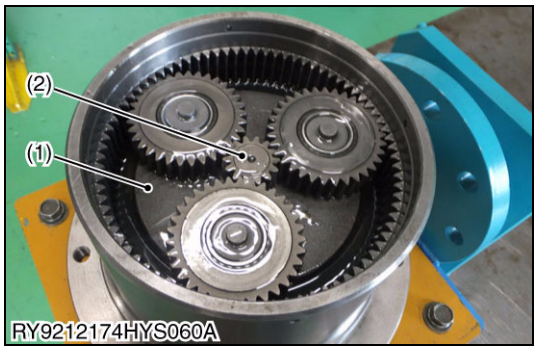
RY9212174HYS0194US0



18. Install the sun gear.

(1) Sun Gear

RY9212174HYS0195US0

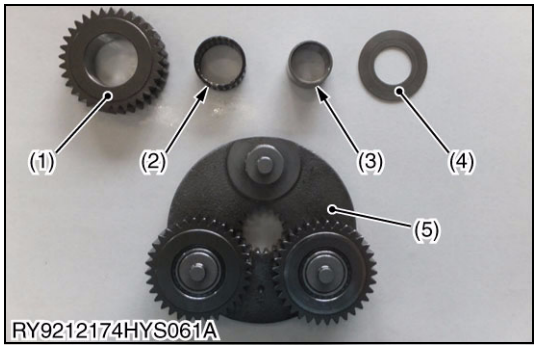


19. Install the holder sub-assembly and the drive gear.

■ **IMPORTANT**
- **Install thrust plate A with the rounded side down.**
- **Install planetary gear A with the indented side facing up.**

(1) Holder sub-assembly
(2) Drive Gear

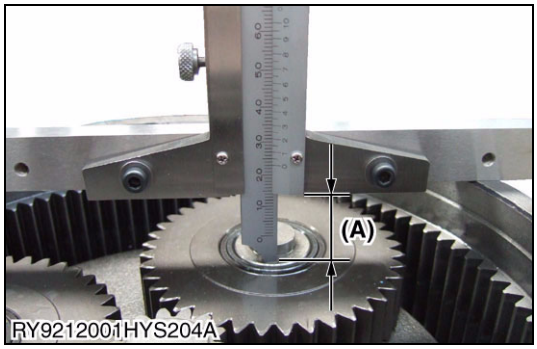
RY9212174HYS0196US0

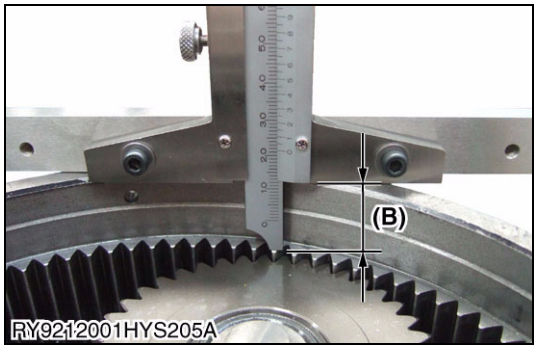


Holder sub-assembly components

(1) Planetary Gear A
(2) Needle Bearing
(3) Collar
(4) Thrust Plate A
(5) Holder

RY9212174HYS0197US0





20. Measure the distance between the edge of the holder and the gear case.
    This is measurement A **(A)**.

    Measure the distance between the gear case tooth surface and the gear case.
    This is measurement B **(B)**.
- Tool to use: depth gauge

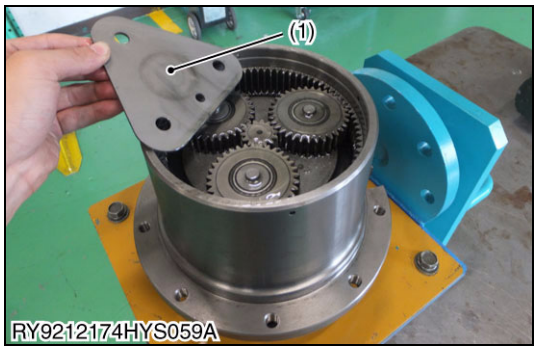
Subtract measurement B **(B)** from measurement A **(A)** to calculate measurement C.
Select the appropriate plate (thrust, C) to suit measurement C.

Measurement A (A) – Measurement B (B) = Measurement C

- Ex.) 23.4 - 22.0 = 1.4

Measurement C	Plate thickness
0.65 to 1.20	1.6
1.20 to 1.75	2.3
1.75 to 2.35	3.0

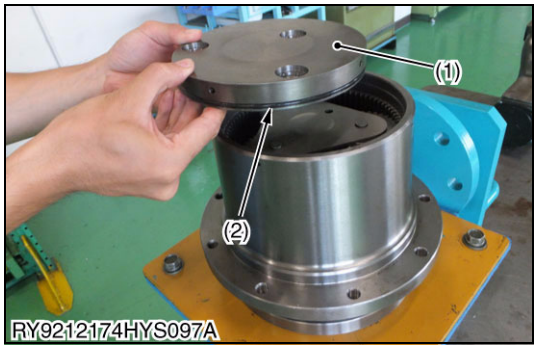
RY9212174HYS0198US0



21. Install the selected thrust plate C.

(1) Thrust Plate C

RY9212174HYS0199US0



22. Install the cover.

■ **IMPORTANT**
- **Apply grease to the O-ring.**

(1) Cover (2) O-Ring

RY9212174HYS0200US0

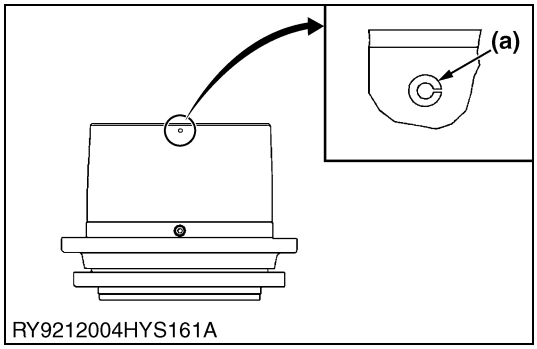


23. Tap in the 4 spring pins.
- Tool to use: hammer

■ **IMPORTANT**
- **Take care to face the split in the spring pin correctly.**
- **The split must face to the side.**

(1) Spring Pin

RY9212174HYS0201US0



RY9212004HYS161A

(a) Spring Pin Split Positioning

RY9212174HYS0202US0



RY9212174HYS099A

24. Install the plug.
- Tool to use: 8 mm hex socket

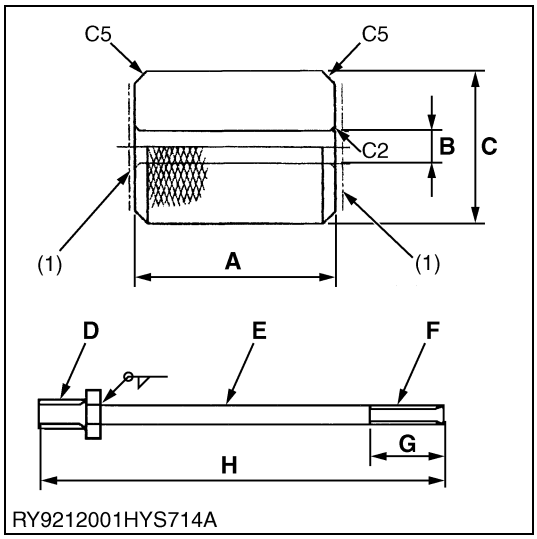
■ **IMPORTANT**
- **This device must be filled with the specified amount of gear oil prior to installing it.**
- **Apply grease to the O-ring.**

Tightening torque	Plug	49.0 to 58.8 N·m 5.0 to 6.0 kgf·m 36.1 to 43.4 lbf·ft

(1) Plug

RY9212174HYS0203US0

[3] SPECIAL TOOLS



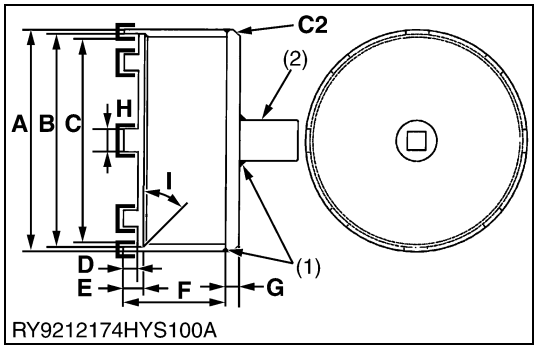
RY9212001HYS714A

(a) Cover removal tool

A	80 mm (3.15 in.)
B	ϕ13 mm (0.51 in.)
C	ϕ60 mm (2.36 in.)
D	R3/8
E	ϕ12.5 mm (0.49 in.)
F	M12 × P1.25
G	25 mm (0.98 in.)
H	315 mm (12.40 in.)
C2	2.0 mm (0.08 in.) bevel
C5	5.0 mm (0.20 in.) bevel

(1) Tempered

RY9212174HYS0027US0



RY9212174HYS100A

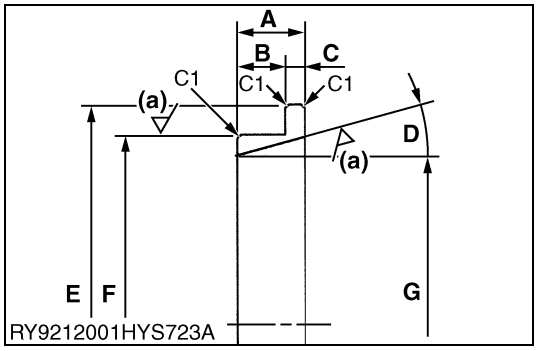
(b) Ring nut socket

A	ϕ152 mm (5.98 in.)
B	ϕ146 mm (5.75 in.)
C	ϕ142 mm (5.59 in.)
D	10 mm (0.39 in.)
E	14 mm (0.55 in.)
F	70 mm (2.76 in.)
G	9.0 mm (0.35 in.)
H	8 – 16 mm (0.31 – 0.63 in.)
I	0.79 rad (45 °)
C2	2.0 mm (0.08 in.) bevel

- Bold line indicates high-frequency tempering

(1) Weld (2) 19 mm Socket

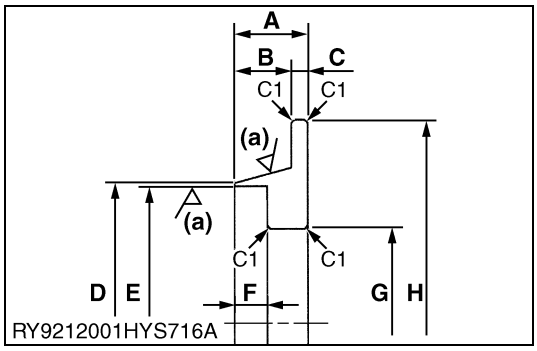
RY9212174HYS0204US0



(c) Floating seal installation tool (for housing)]

A	17 mm (0.67 in.)
B	12 mm (0.47 in.)
C	5.0 mm (0.20 in.)
D	0.26 rad (15 °)
E	ϕ198 mm (7.80 in.)
F	ϕ180 mm (7.07 in.)
G	ϕ171 mm (6.71 in.)
C1	1.0 mm (0.04 in.) bevel
(a)	Ra=6.3a

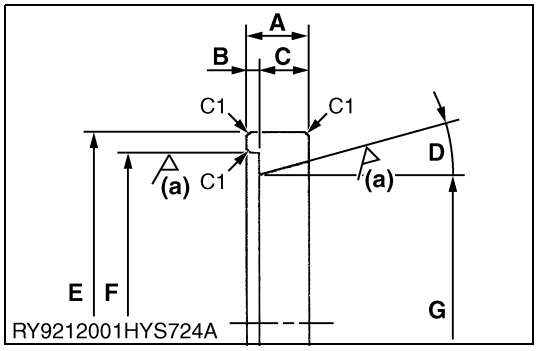
RY9212174HYS0205US0



(d) Floating seal installation tool (pusher)

A	21.8 mm (0.86 in.)
B	16.8 mm (0.66 in.)
C	5.0 mm (0.20 in.)
D	ϕ170 mm (6.70 in.)
E	ϕ169 mm (6.63 in.)
F	7.0 mm (0.28 in.)
G	ϕ156 mm (6.14 in.)
H	ϕ208 mm (8.19 in.)
C1	1.0 mm (0.04 in.) bevel
(a)	Ra=6.3a

RY9212174HYS0206US0



(e) Floating seal installation tool (for flange holder)

A	20 mm (0.79 in.)
B	3.0 mm (0.12 in.)
C	17 mm (0.67 in.)
D	0.26 rad (15 °)
E	ϕ198 mm (7.80 in.)
F	ϕ179 mm (7.06 in.)
G	ϕ171 mm (6.71 in.)
C1	1.0 mm (0.04 in.) bevel
(a)	Ra=6.3a

RY9212174HYS0207US0

6. HYDRAULIC CYLINDER

[1] TIGHTENING TORQUE

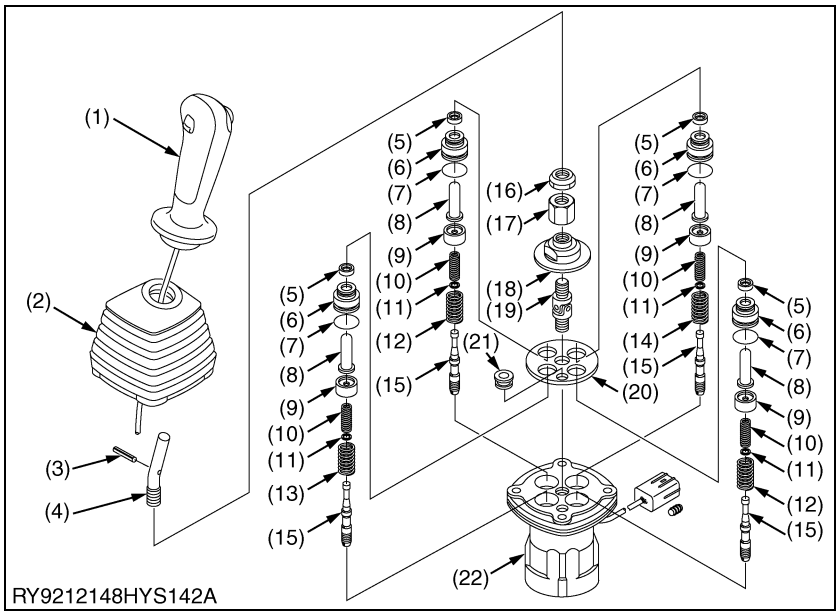
		KX042-4	Notes
Boom	Maker	KYB	
	Screw torque	16.2 N·m 1.7 kgf·m 11.9 lbf·ft	
	Screw size	M8 × 1.25	• Tap with punch in two places
	Piston torque	1620 N·m 165.2 kgf·m 1194.9 lbf·ft	
	Width across hex-head.	60	
	Head torque	530 N·m 54.1 kgf·m 390.9 lbf·ft	
Arm	Maker	KYB	
	Screw torque	16.2 N·m 1.7 kgf·m 11.9 lbf·ft	
	Screw size	M8 × 1.25	• Tap with punch in two places
	Piston torque	1200 N·m 122.4 kgf·m 885.1 lbf·ft	
	Width across hex-head.	55	
	Head torque	451 N·m 46.0 kgf·m 332.7 lbf·ft	
Bucket	Maker	Kubota Seiki	
	Screw torque	6.6 to 7.0 N·m 0.67 to 0.71 kgf·m 4.9 to 5.2 lbf·ft	
	Screw size	M6 × 1	• Tap with punch in two places
	Piston torque	620 to 660 N·m 63.2 to 67.3 kgf·m 457.3 to 486.8 lbf·ft	• Apply Never-Seez White food grade
	Piston size	M30 × 2	
	Head torque	700 to 750 N·m 71.4 to 76.5 kgf·m 516.3 to 553.2 lbf·ft	• Tap with punch in two places • Apply Never-Seez White food grade
Blade	Maker	Kubota Seiki	
	Screw torque	6.6 to 7.0 N·m 0.67 to 0.71 kgf·m 4.9 to 5.2 lbf·ft	
	Screw size	M6 × 1	• Tap with punch in two places
	Piston torque	1090 to 1160 N·m 111.2 to 118.3 kgf·m 804.0 to 855.6 lbf·ft	• Apply Never-Seez White food grade
	Piston size	M36 × 3	
	Head torque	900 to 950 N·m 91.8 to 96.9 kgf·m 663.8 to 700.7 lbf·ft	• Tap with punch in two places • Apply Never-Seez White food grade

		KX042-4	Notes
Swing	Maker	Kubota Seiki	
	Screw torque	6.6 to 7.0 N·m 0.67 to 0.71 kgf·m 4.9 to 5.2 lbf·ft	
	Screw size	M6 × 1	• Tap with punch in two places
	Piston torque	800 to 850 N·m 81.6 to 86.7 kgf·m 590.1 to 627.0 lbf·ft	• Apply Never-Seez White food grade
	Piston size	M30 × 2	
	Head torque	800 to 850 N·m 81.6 to 86.7 kgf·m 590.1 to 627.0 lbf·ft	• Tap with punch in two places • Apply Never-Seez White food grade

RY9212509HYS0007US0

7. PILOT VALVE (CONTROL)

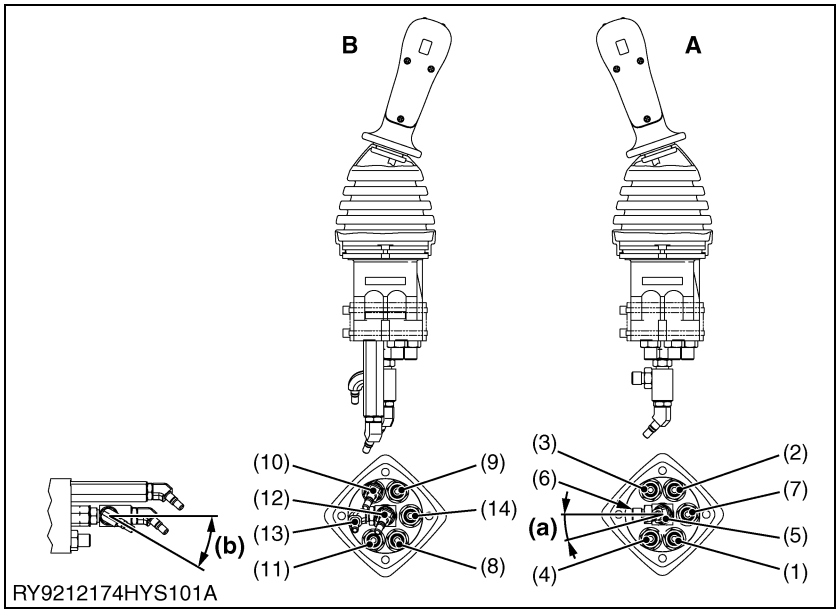
[1] CONTROL PILOT VALVES



RY9212148HYS142A

No.	Part Name	Qty
(1)	Handle	1
(2)	Bellows	1
(3)	Spring pin	1
(4)	Lever	1
(5)	Seal	4
(6)	Plug	4
(7)	O-ring	4
(8)	Pushrod	4
(9)	Spring seat	4
(10)	Secondary pressure spring	4
(11)	Shim	4
(12)	Return spring (Ports 1 and 3)	2
(13)	Return Spring (Port 2)	1
(14)	Return Spring (Port 4)	1
(15)	Spool	4
(16)	Lock nut	1
(17)	Adjusting nut	1
(18)	Round plate nut	1
(19)	U-joint	1
(20)	Plate	1
(21)	Bushing	1
(22)	Casing	1

RY9212148HYS0226US0



RY9212174HYS101A

Adapter angles

A	Point used	Tape color
(1)	Swivel left	Gray
(2)	Arm dump	Black
(3)	Swivel right	Light blue
(4)	Arm crowd	Blue
(5)	P	66666666
(6)	P	None
(7)	T	55555555

B	Point used	Tape color
(8)	Bucket crowd	White
(9)	Boom down	Yellow
(10)	Bucket dump	Red
(11)	Boom up	Green
(12)	P	44444444
(13)	P	None
(14)	T	33333333

(a) 15 ° (0.26 rad)
(b) 30 ° (0.52 rad)
A : Left pilot Valve
B : Right pilot Valve

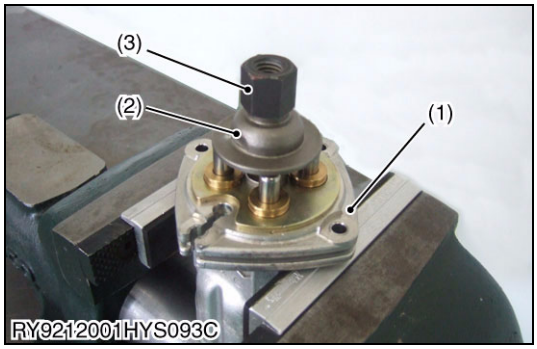
RY9212174HYS0077US0

(1) Disassembling

CAUTION

- **All of the parts are precision parts, so be very careful in handling them and take care not to drop or hit parts against each other.**
- **If you hit a part too hard while working on it, it may result in burrs or other damage, thus preventing installation as well as oil leaks and/or compromised performance, so be careful when handling parts.**
- **If parts are left disassembled or left partway disassembled, humidity or foreign matter may cause rust, so if interrupting the work is unavoidable, take precautions to protect the parts from rust and dust.**

RY9212148HYS0150US0



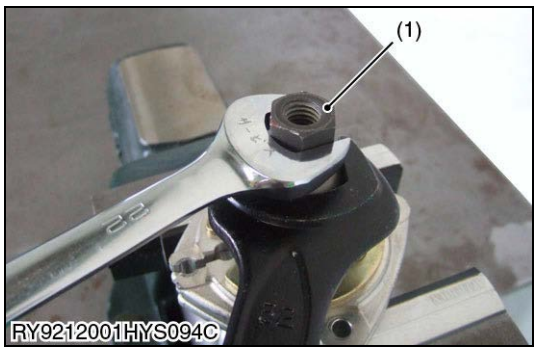
1. Clamp the pilot valve in a vise.

■ **IMPORTANT**

- **When clamping it in a vise, use a sheet of copper to prevent scratching the pilot valve.**

(1) Casing
(2) Round Plate Nut
(3) Adjusting Nut

RY9212148HYS0151US0

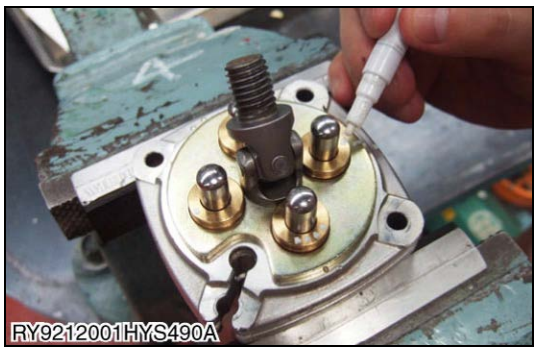


2. Use wrenches to remove the adjusting nut and round plate nut.

- Tools to use: 22 mm and 32 mm wrenches

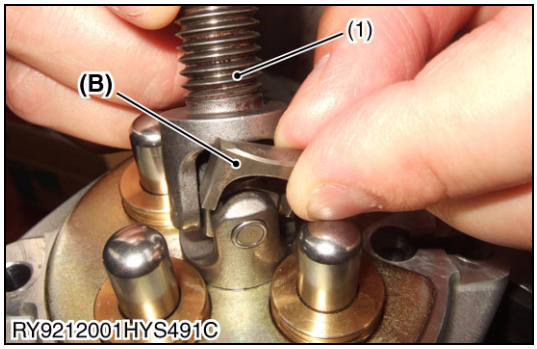
(1) Adjusting Nut

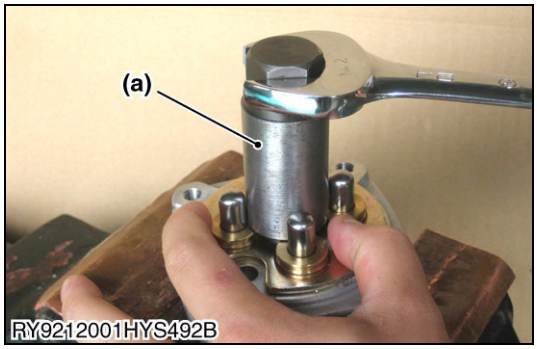
RY9212148HYS0152US0

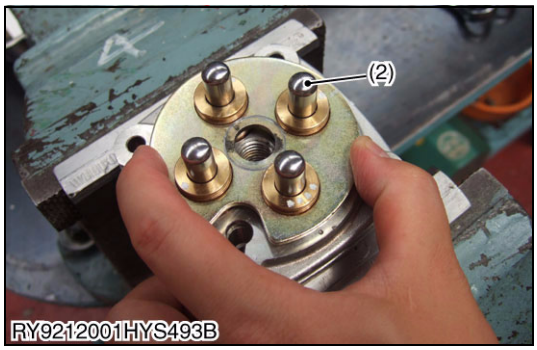


3. Mark the alignment of holes to the casing.

RY9212001HYS0479US0







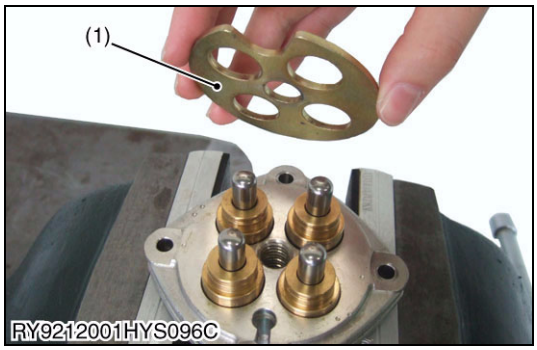
4. After mounting tool **(b)** on the U-joint, use tool **(a)** to turn the U-joint counterclockwise and loosen it.

- Tool **(a)**: U-joint clamping tool
- Tool **(b)**: Bushing (two)

CAUTION
- **When removing the U-joint, take care that it does not pop off.**

(1) U-Joint (2) Plug

RY9212148HYS0153US0



5. Remove the plate.

(1) Plate

RY9212148HYS0154US0

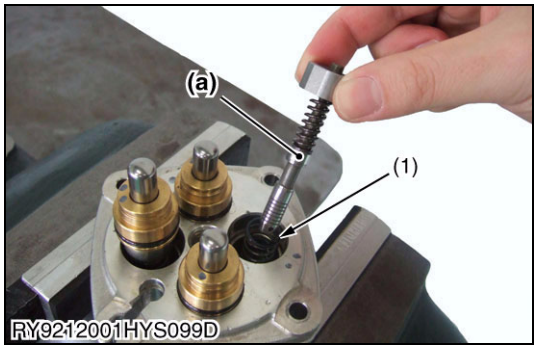


6. Slip a slotted screwdriver in the groove in the plug to remove the plug.

CAUTION
- **Take care so the plug does not pop out.**
- **Take care not to damage it by exerting force unevenly.**
- **If a burr is formed, use a whetstone to remove it.**

(1) Plug

RY9212148HYS0155US0



7. Remove the reducing valve ASSY and the return spring.

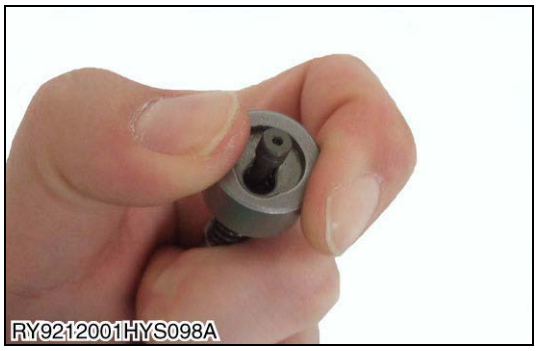
■ **IMPORTANT**
- **Tag the return springs to positively ID which port they go to.**

(1) Return Spring
(a) Reducing Valve ASSY

RY9212148HYS0156US0

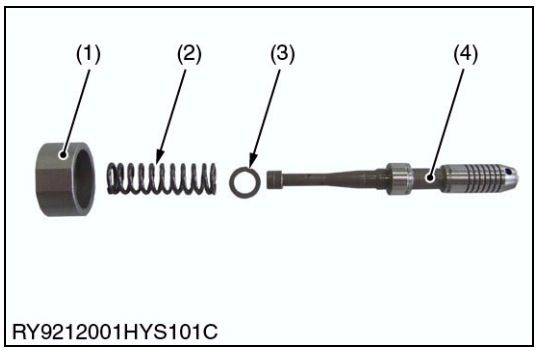


8. To disassemble a reducing valve, press the spring seat in and while compressing the secondary pressure spring, shift the spring seat to the side and remove it from the spool via the larger hole.



■ **IMPORTANT**
- **Be careful not to scratch the surface of the spool.**
- **Do not depress the spring seat more than 6mm (0.24 in.).**
- **Do not disassemble the reducing valve unless there is a problem with it.**

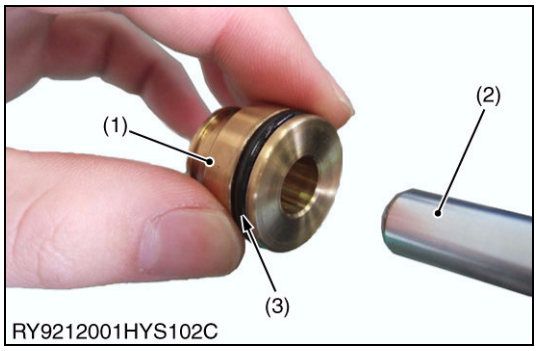
Components of the reducing valve



(1) Spring Seat
(2) Secondary Pressure Spring
(3) Washer
(4) Spool

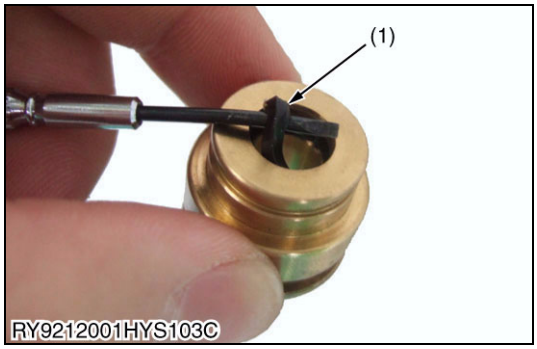
RY9212148HYS0157US0

9. Remove the plug from the pushrod.



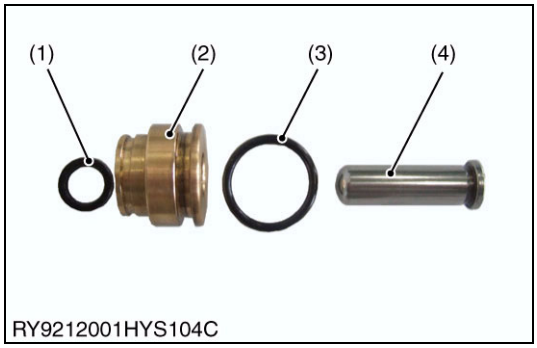
(1) Plug
(2) Pushrod
(3) O-Ring

RY9212148HYS0158US0



10. Remove the O-ring and seal from the plug.

■ **IMPORTANT**
- **Use a mini slotted screwdriver.**
- **Be careful not to scratch the inside surface of the plug.**



Components of the Plug

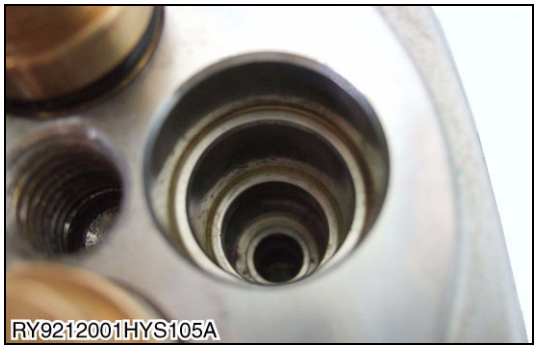
(1) Seal
(2) Plug
(3) O-Ring
(4) Pushrod

RY9212148HYS0159US0

(2) Assembling

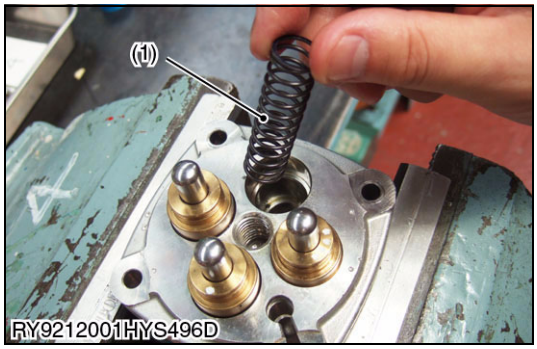
CAUTION
- **Prepare your workbench in the same way as for disassembly.**
- **Follow the same general precautions as in the disassembly.**
- **When assembling the parts, remove all bits of metal or foreign matter from all the parts and make sure there aren't any burrs or dings on the parts.**
- **Replace used O-rings with new ones.**
- **Take care not to damage the O-rings when installing them.**

RY9212148HYS0160US0



1. Make sure there aren't any burrs or scratches inside the casing.

RY9212001HYS0487US0

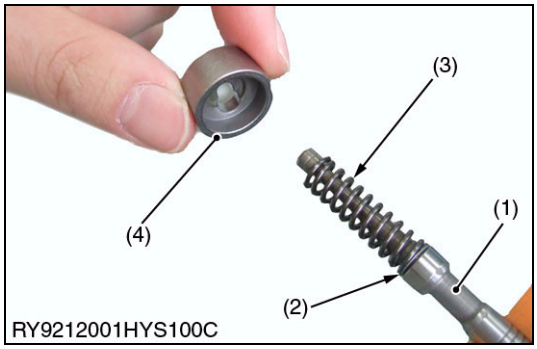


2. Install the return spring in the casing.

■ **IMPORTANT**
- **Install it in the same position as before disassembly.**

(1) Return Spring

RY9212148HYS0161US0

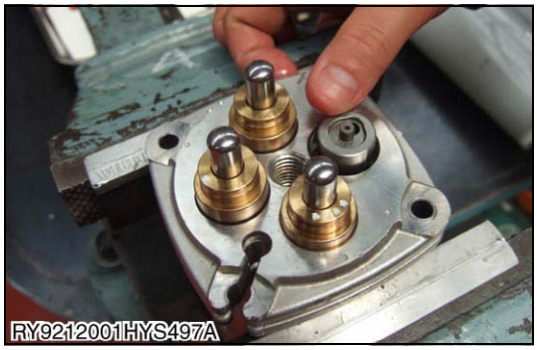


3. Install the washer, secondary pressure spring and spring seat on the spool in order.

■ **IMPORTANT**
- **Do not depress the spring seat more than 6 mm (0.24 in.).**
- **Be careful not to scratch the spool.**

(1) Spool
(2) Washer
(3) Secondary Pressure Spring
(4) Spring Seat

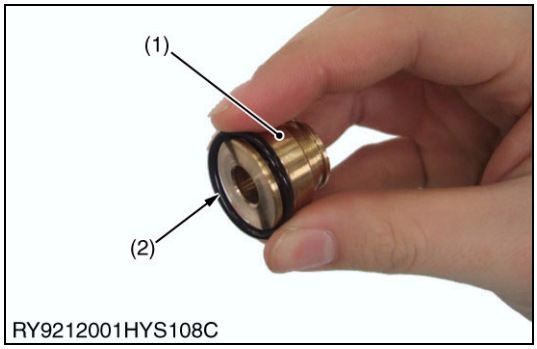
RY9212148HYS0162US0



4. Install the reducing valve ASSY.
After installing it, make sure the spool moves smoothly.

■ **IMPORTANT**
- **Install it in the same position as before disassembly.**

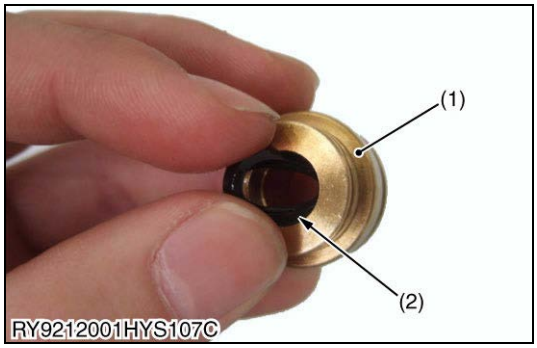
RY9212001HYS0490US0



5. Install the O-ring on the plug.

(1) Plug
(2) O-Ring

RY9212148HYS0163US0

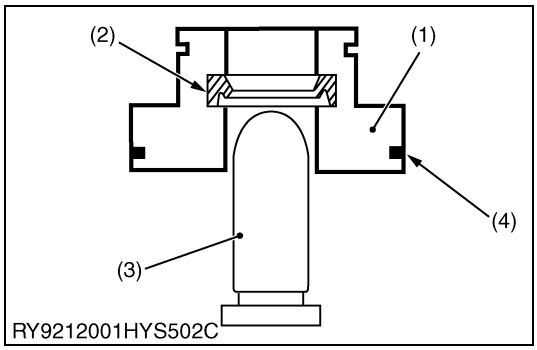


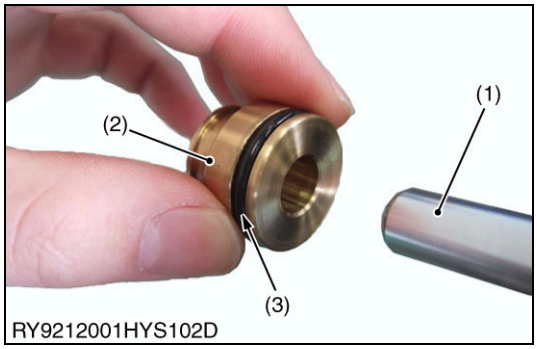
6. Install the seal on the plug.

■ **IMPORTANT**
- **Be careful that the seal faces the right direction.**
- **Apply hydraulic oil on the circumference and lip of the seal.**

(1) Plug
(2) Seal
(3) Pushrod
(4) O-Ring

RY9212148HYS0164US0





7. Install the plug on the pushrod.

■ **IMPORTANT**
- **Apply hydraulic oil to the pushrod.**

(1) Pushrod
(2) Plug
(3) O-Ring

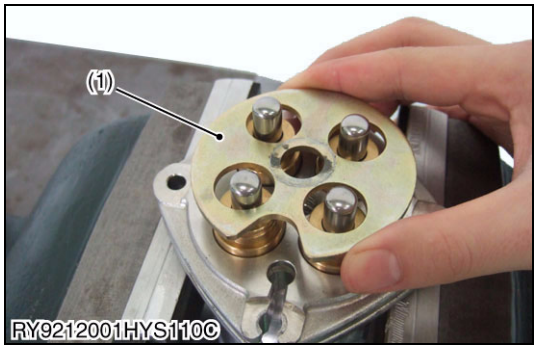
RY9212148HYS0165US0



8. Install the plug ASSY into the case.
If the return spring is too stiff, use the plate to install the ASSY.

■ **IMPORTANT**
- **Make sure not to scratch the hole of the case.**
- **Take care so the plug ASSY does not pop out.**

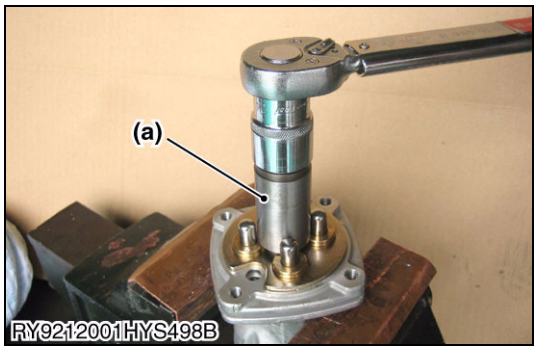
RY9212001HYS0494US0



9. Install the plate.

(1) Plate

RY9212148HYS0166US0

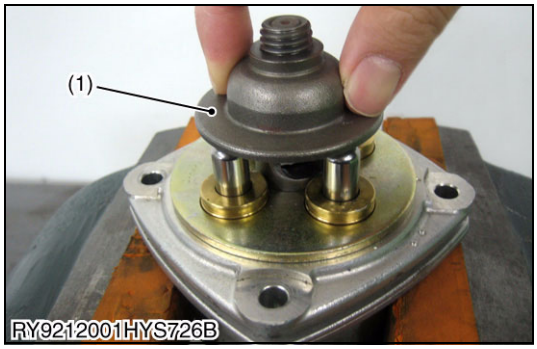


10. Install the U-joint.

Tightening torque	U-joint	47.0 ± 3.0 N·m 4.8 ± 0.3 kgf·m 35.0 ± 2.0 lbf·ft

- Tool **(a)**: U-joint clamping tool

RY9212148HYS0167US0

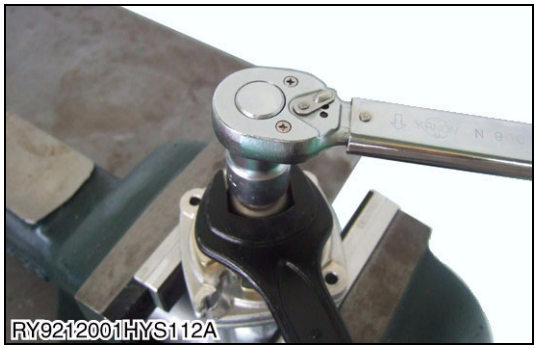


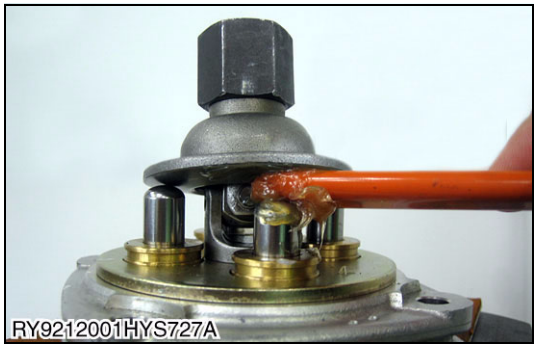
11. Install the round plate nut on the U-joint.
Tighten it until it touches all four pushrods equally.

■ **IMPORTANT**
- **Apply Loctite 262 to the top threads of the U-joint.**
- **Do not overtighten the round plate nut.**

(1) Round Plate Nut

RY9212148HYS0168US0


RY9212001HYS112A


RY9212001HYS727A

12. Install the adjusting nut.
    Hold a wrench on the head of the round plate nut while tightening the nut.

    • Tools to use: 22 mm and 32 mm wrenches

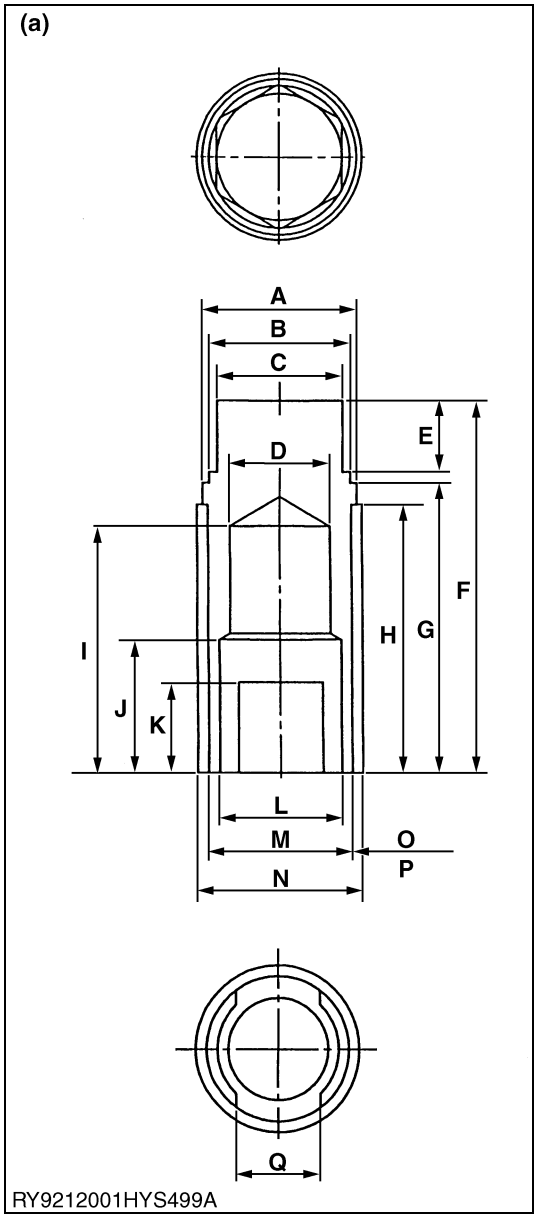
Tightening torque	Adjusting nut	70.0 ± 5.0 N·m 7.0 ± 0.5 kgf·m 51.6 ± 4.0 lbf·ft

RY9212148HYS0169US0

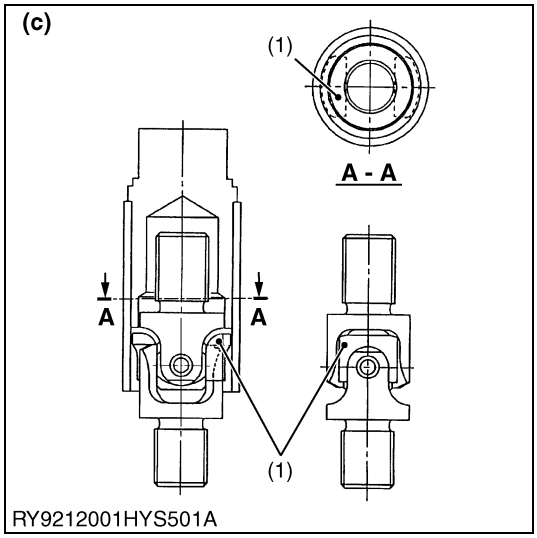
13. Apply grease to the rotating parts of the universal joint and to the ends of the pushrods.

RY9212001HYS0499US0

(3) Special Tools

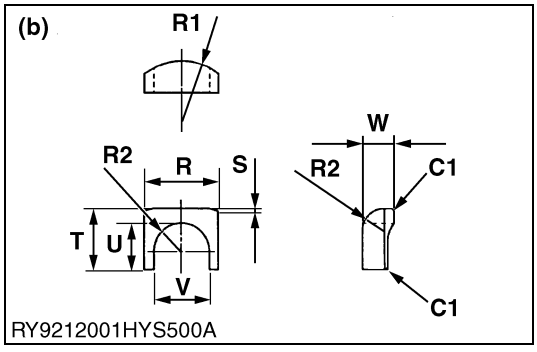


RY9212001HYS499A



RY9212001HYS501A

A	ϕ29 mm (ϕ1.142 in.)
B	ϕ26.5 mm (ϕ1.043 in.)
C	23.5 mm (0.925 in.) (nut width)
D	ϕ19 mm (ϕ0.748 in.)
E	13 mm (0.512 in.)
F	69 mm (2.717 in.)
G	54 mm (2.126 in.)
H	50 mm (1.968 in.)
I	46 mm (1.811 in.)
J	25 mm (0.984 in.)
K	17 mm (0.669 in.)
L	ϕ23 mm (ϕ0.906 in.)
M	ϕ27 mm (ϕ1.063 in.)
N	ϕ31 mm (ϕ1.220 in.)
O	Hole H 6
P	Axle n 6
Q	16 mm (0.6299 in.)
R	15.5 mm (0.6102 in.)
S	0.5 mm × 15 mm (0.0197 in. × 0.591 in.)
T	12.5 mm (0.492 in.)
U	9.5 mm (0.374 in.)
V	11.6 mm (0.457 in.)
W	6.5 mm (0.256 in.)
C1	0.5 mm (0.0197 in.) bevel
R1	R 13 mm (0.512 in.)
R2	R 5.8 mm (0.228 in.)
R3	R 4.5 mm (0.177 in.)



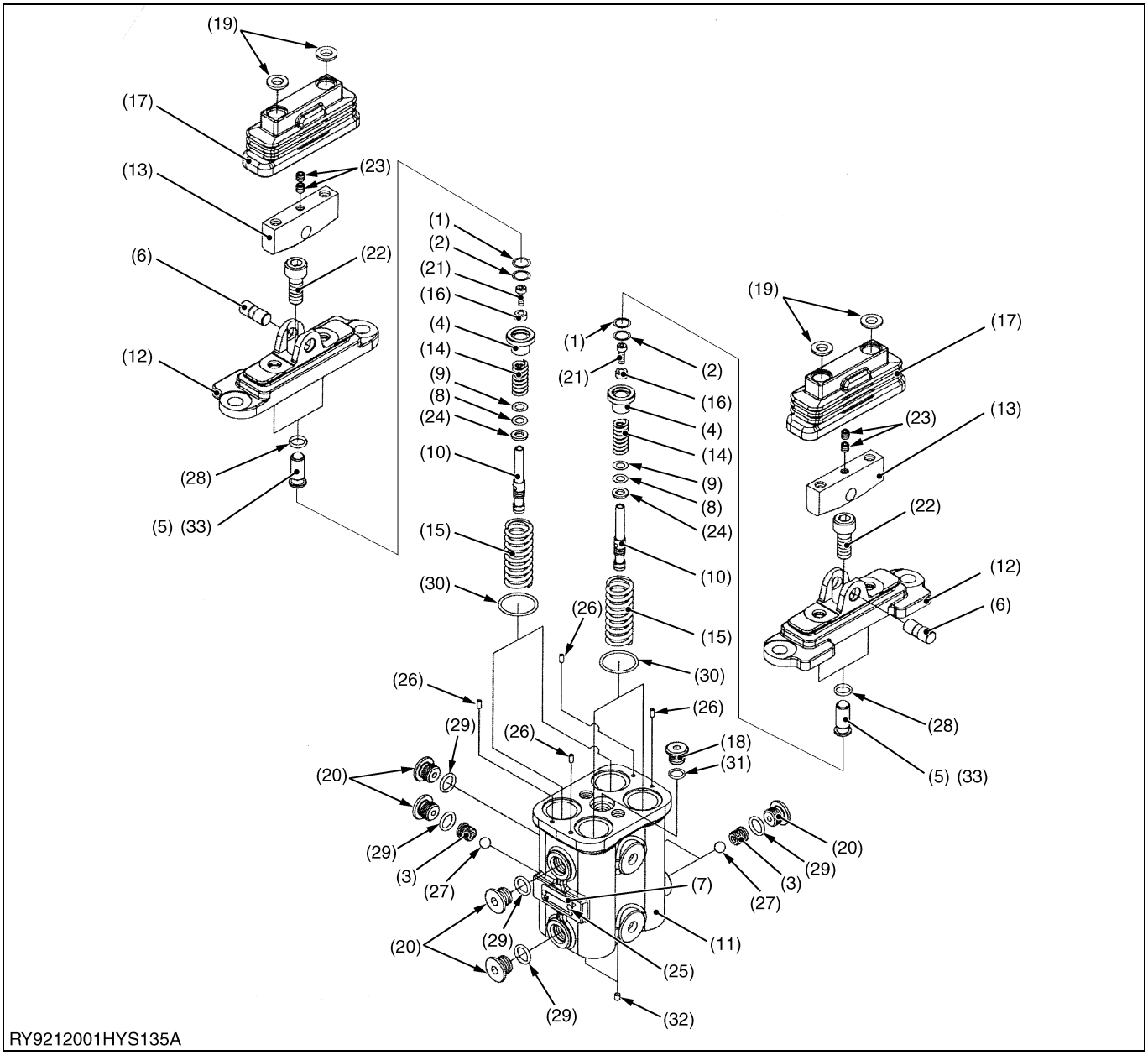
RY9212001HYS500A

(1) Bushing

(a) U-Joint Tightening Tool, Detailed Schematic
(b) Bushing, Detailed Schematic
(c) Assembled U-Joint

RY9212001HYS0500US0

[2] TRAVEL PILOT VALVE

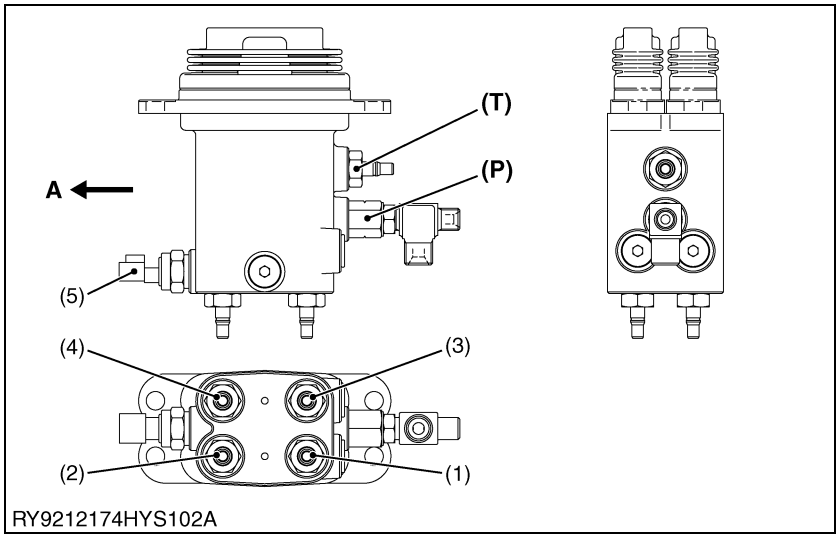


RY9212001HYS135A

No.	Name of part	No.	Name of part	No.	Name of part
(1)	Shim (t=0.1)	(12)	Cover	(23)	Hex set screw
(2)	Shim (t=0.2)	(13)	Cam	(24)	Flat metal washer
(3)	Seat	(14)	Spring	(25)	Rivet screw
(4)	Sleeve	(15)	Spring	(26)	Parallel pin
(5)	Pusher	(16)	Collar	(27)	Ball
(6)	Pin	(17)	Bushing	(28)	O-ring
(7)	Nameplate	(18)	Plug	(29)	O-ring
(8)	Shim (t=0.2)	(19)	Collar	(30)	O-ring
(9)	Shim (t=0.1)	(20)	Flanged plug	(31)	O-ring
(10)	Spool	(21)	Hex socket bolt	(32)	Expander
(11)	Body	(22)	Hex socket bolt	(33)	Pusher ASSY

- Use shims (1), (2), (8) or (9) as needed. It is not a problem if there are no shims at all or a lot of shims.
- Shims are used as needed, so be sure to install them where they were used before.

RY9212174HYS0028US0



RY9212174HYS102A

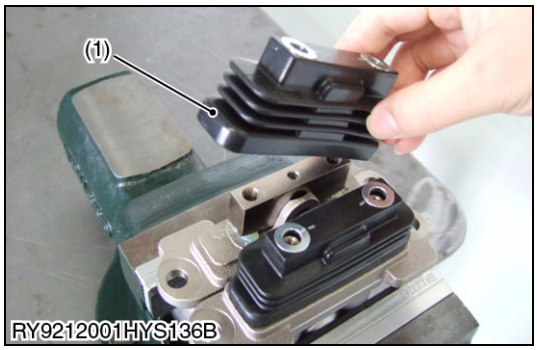
Adapter angles

	Point used	Tape color
(1)	Right backward	Yellow
(2)	Right forward	Green
(3)	Left backward	Red
(4)	Left forward	Blue
(5)	Pressure sensor	None
(P)	Port P	None
(T)	Port T	None

A : Front Side

RY9212174HYS0078US0

(1) Disassembling

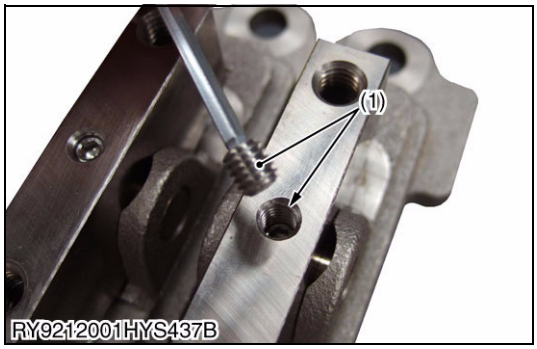


RY9212001HYS136B

1. Remove the boot.

(1) Bushing

RY9212174HYS0029US0



RY9212001HYS437B

2. Remove the two hex socket set screws.

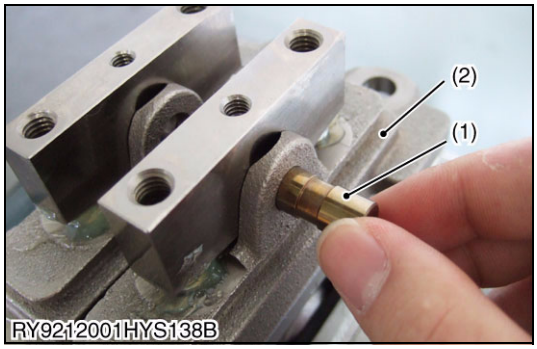
- Tool to use: M3 hex socket

CAUTION

- **Note that there are two hex set screws per hole.**

(1) Hex Set Screw

RY9212174HYS0030US0



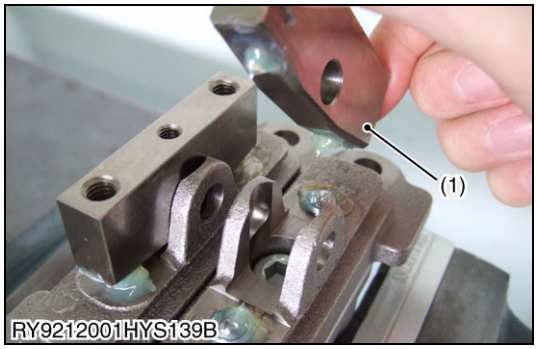
RY9212001HYS138B

3. Remove the pin.

- Tool to use: Hammer and pin punch

(1) Pin (2) Cover

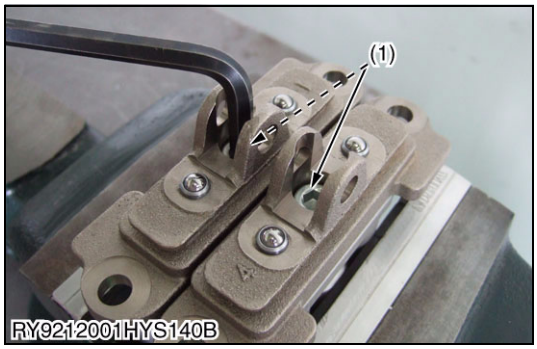
RY9212174HYS0031US0



4. Remove the cam.

(1) Cam

RY9212174HYS0032US0

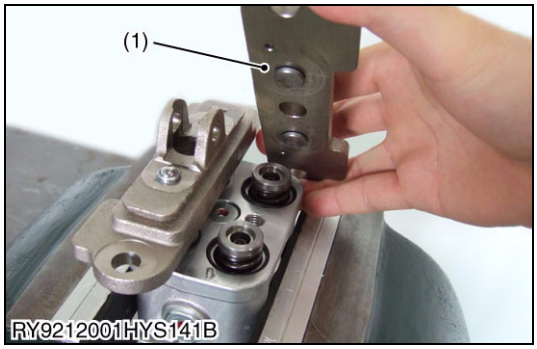


5. Remove the two cap bolts.

- Tool to use: M8 hex socket

(1) Cap Bolt

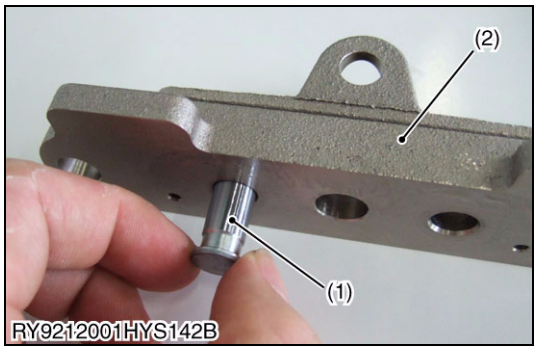
RY9212174HYS0033US0



6. Remove the cover.

(1) Cover

RY9212174HYS0034US0

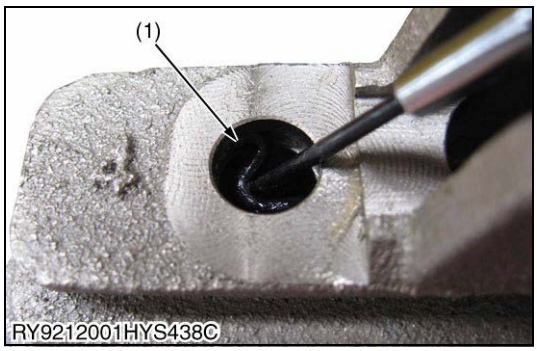


7. Remove the pusher ASSY.

■ **IMPORTANT**
- **There is a shim on the edge of the pusher ASSY.**
- **If it comes off, return it to the top of the sleeve.**

(1) Pusher ASSY (2) Cover

RY9212174HYS0035US0



8. Remove the O-rings.

- Tool to use: Slotted screwdriver

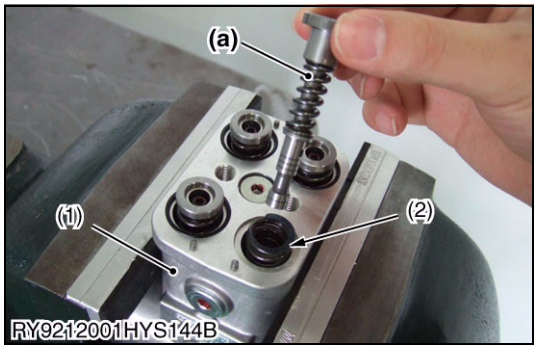
(1) O-Ring

RY9212174HYS0036US0


RY9212001HYS145A

9. Mark the positioning of the body hole and the spool ASSY.

RY9212001HYS0512US0

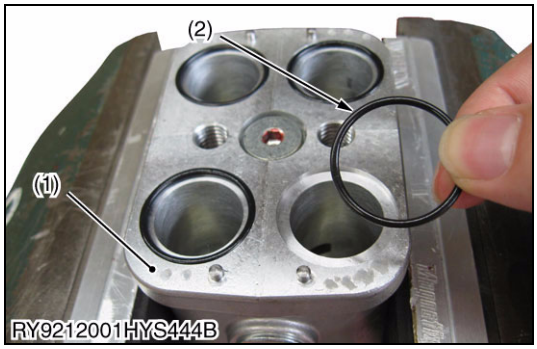


RY9212001HYS144B

10. Spool ASSY from the body **(a)** Remove the spring.

(1) Body
(2) Spring
(a) Spool ASSY

RY9212174HYS0037US0

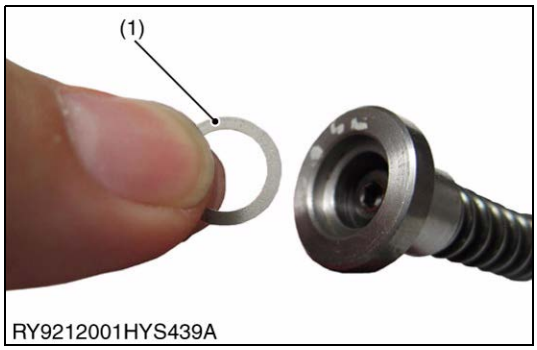


RY9212001HYS444B

11. Remove the O-ring from the body.

(1) Body
(2) O-Ring

RY9212174HYS0038US0

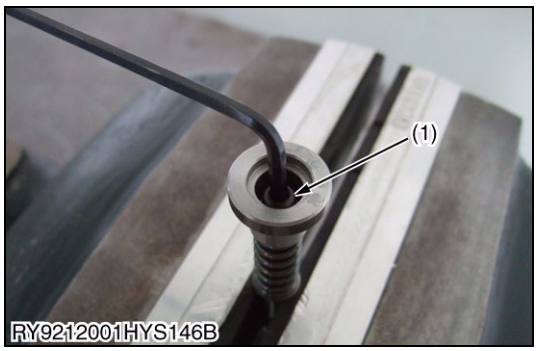


RY9212001HYS439A

12. Remove the shim.

(1) Shim

RY9212174HYS0039US0



RY9212001HYS146B

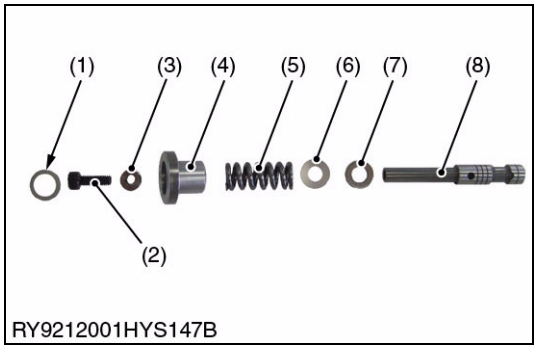
13. Clamp the spool in a vice and remove the hex socket bolt.

■ **IMPORTANT**
- **Use a copper plate in the vice to prevent it from scratching the spool.**
- **Be careful not to overtighten the vice as this will deform the spool.**

- Tool to use: M3 hex socket

(1) Hex Socket Bolt

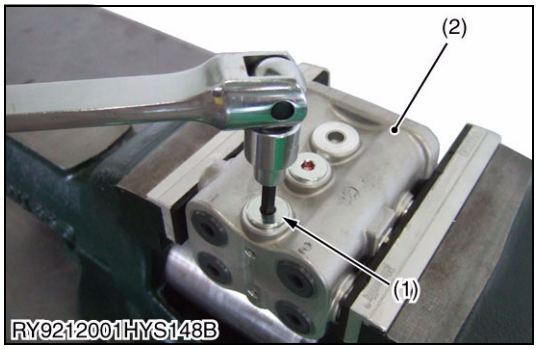
RY9212174HYS0040US0



Components of the Spool ASSY

(1) Shim
(2) Hex Socket Bolt
(3) Collar
(4) Sleeve
(5) Spring
(6) Shim
(7) Flat Metal Washer
(8) Spool

RY9212174HYS0041US0

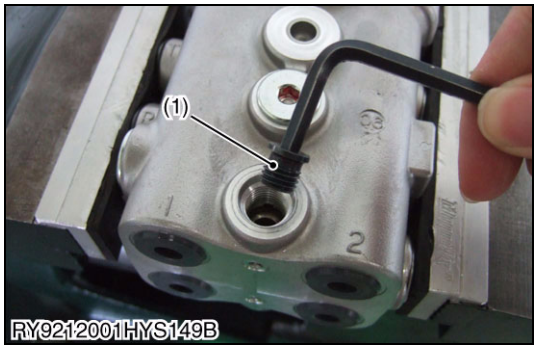


14. Remove the flanged plug.

- Tool to use: M6 hex socket

(1) Flanged Plug
(2) Body

RY9212174HYS0042US0

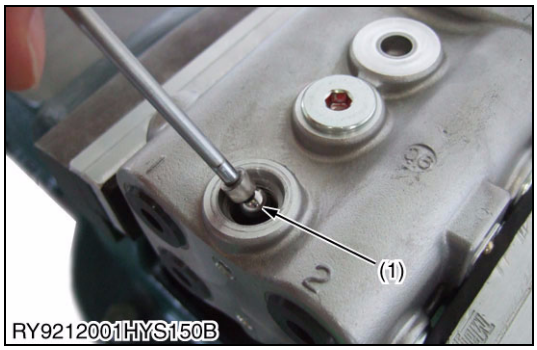


15. Remove the seat.

- Tool to use: M5 hex socket

(1) Seat

RY9212174HYS0043US0



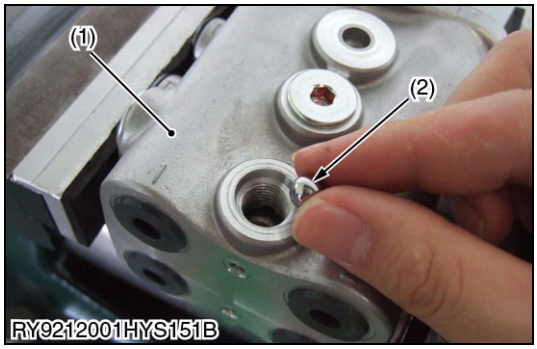
16. Remove the ball.

- Tool to use: Magnet

(1) Ball

RY9212174HYS0044US0

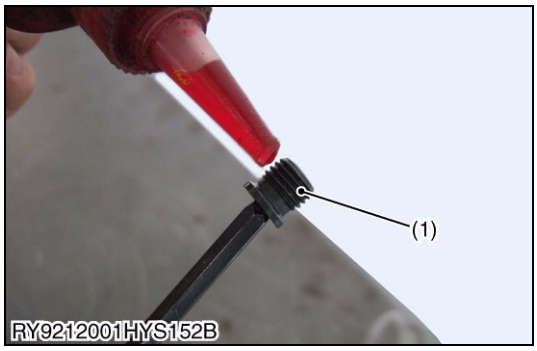
(2) Assembling



1. Insert the ball in the body.

(1) Body (2) Ball

RY9212174HYS0045US0

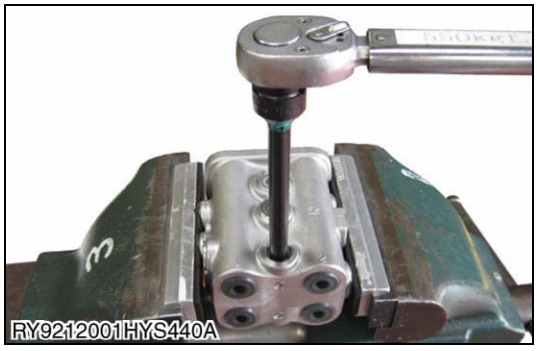


2. Apply Loctite to the threads of the seat.

- Tool to use: Loctite #262

(1) Seat

RY9212174HYS0046US0

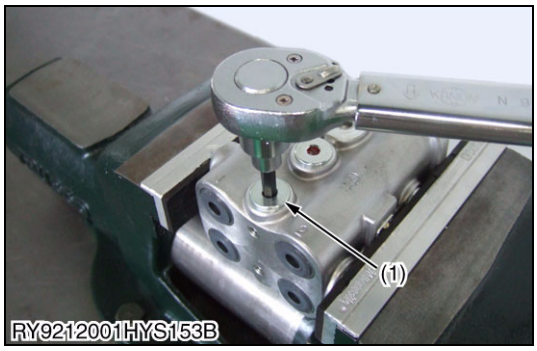


3. Install the seat.

Tightening torque	Seat	14.7 N·m 1.5 kgf·m 10.8 lbf·ft

- Tool to use: M5 hex socket

RY9212174HYS0047US0



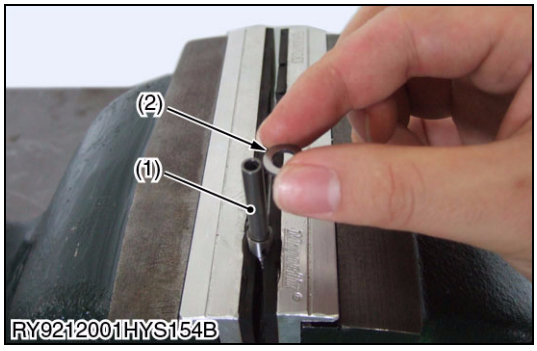
4. Install the flanged plug.

Tightening torque	Flanged plug	24.5 N·m 2.5 kgf·m 18.1 lbf·ft

- Tool to use: M6 hex socket

(1) Flanged Plug

RY9212174HYS0048US0

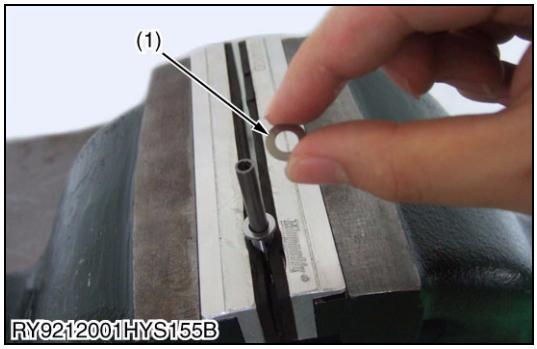


5. Clamp the spool in a vice and install the flat metal washer.

■ **IMPORTANT**
- **Be careful to follow the order of installation.**
- **Use a copper plate in the vice to prevent it from scratching the spool.**
- **Be careful not to overtighten the vice as this will deform the spool.**

(1) Spool (2) Flat Metal Washer

RY9212174HYS0049US0

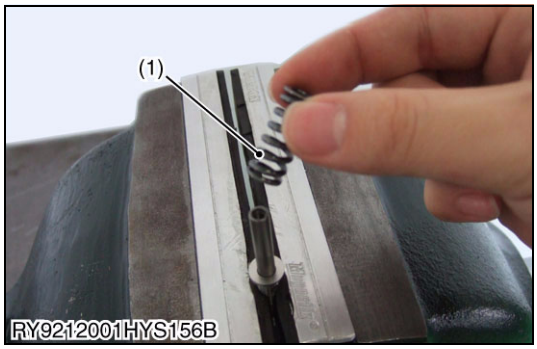


6. Install the shim.

■ **IMPORTANT**
- **Be careful to follow the order of installation.**

(1) Shim

RY9212174HYS0050US0

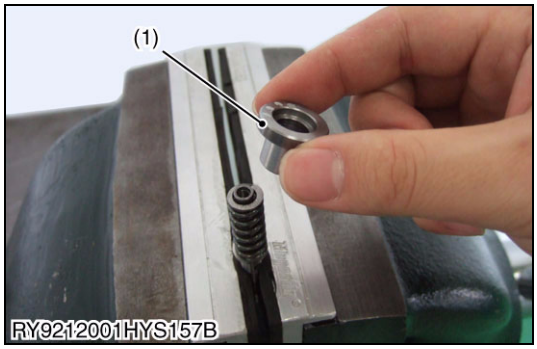


7. Install the spring.

■ **IMPORTANT**
- **Be careful to follow the order of installation.**

(1) Spring

RY9212174HYS0051US0

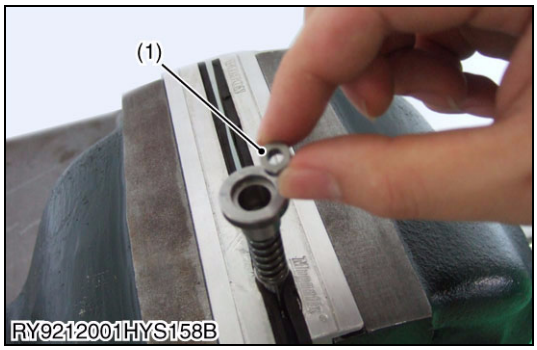


8. Install the sleeve.

■ **IMPORTANT**
- **Be careful to follow the order of installation.**

(1) Sleeve

RY9212174HYS0052US0

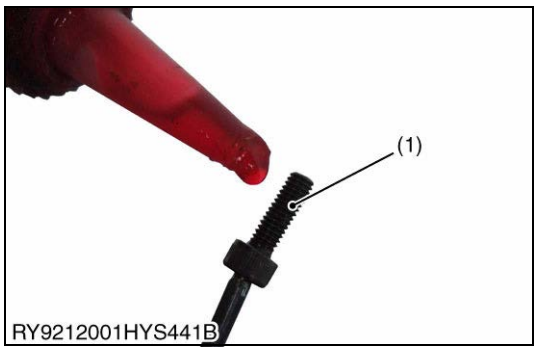


9. Install the collar.

■ **IMPORTANT**
- **Be careful to follow the order of installation.**

(1) Collar

RY9212174HYS0053US0

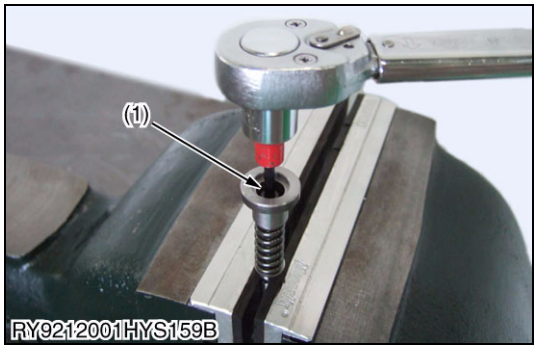


10. Apply Loctite to the threads of hex socket bolt.

- Loctite #242

(1) Hex Socket Bolt

RY9212174HYS0054US0



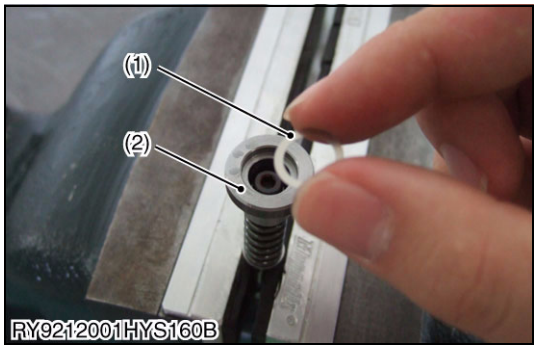
11. Install the hex socket bolt.

Tightening torque	Hex socket bolt	4.9 N·m 0.5 kgf·m 3.6 lbf·ft

- Tool to use: M3 hex socket

(1) Hex Socket Bolt

RY9212174HYS0055US0

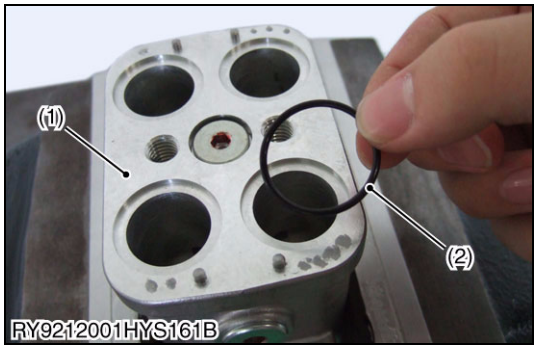


12. Install the shim.

■ **IMPORTANT**
- **Install the same number of shims as were disassembled.**

(1) Shim (2) Sleeve

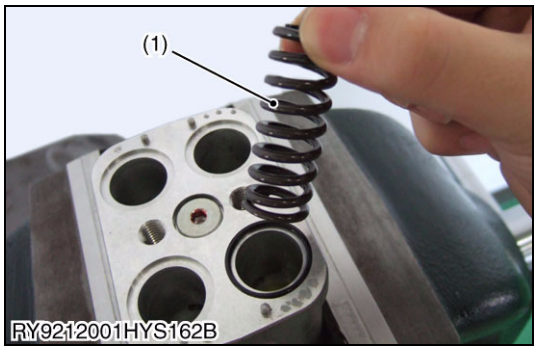
RY9212174HYS0056US0



13. Install the O-ring.

(1) O-Ring (2) Body

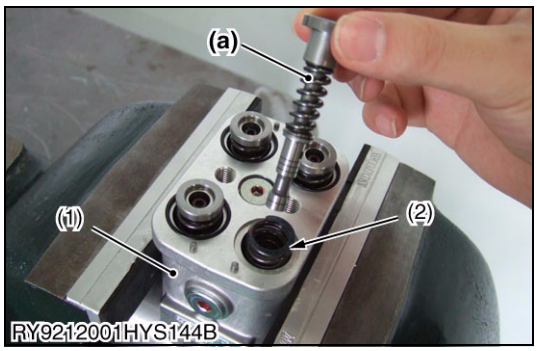
RY9212174HYS0057US0



14. Install the spring.

(1) Spring

RY9212174HYS0058US0

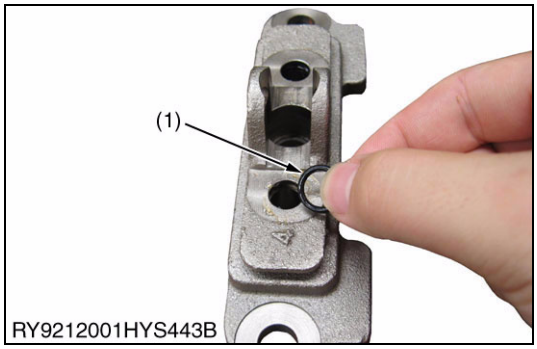


15. Install the spool ASSY **(a)**.

■ **IMPORTANT**
- **Install in the same holes in the body as during disassembly.**

(1) Body **(a) Spool ASSY**
(2) Spring

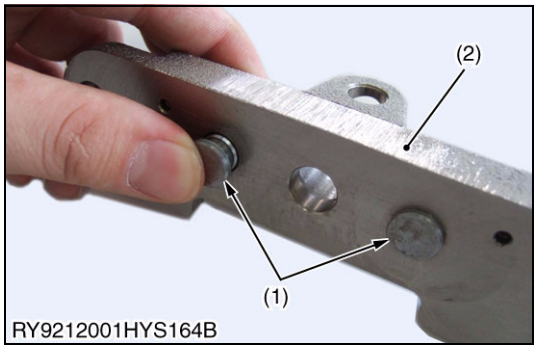
RY9212174HYS0059US0



16. Install the O-ring in the cover.

(1) O-Ring

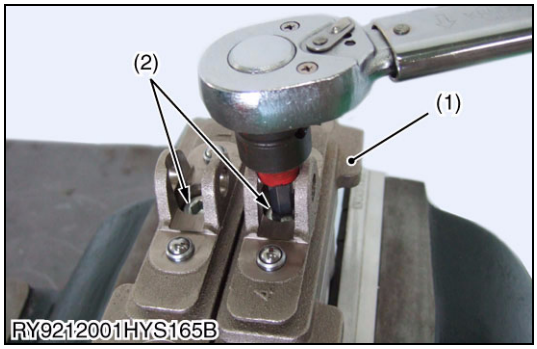
RY9212174HYS0060US0



17. Install the pusher ASSY.

(1) Pusher ASSY (2) Cover

RY9212174HYS0061US0



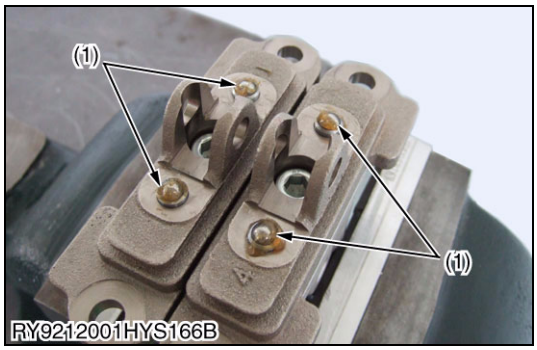
18. Install the cover.

Tightening torque	Cover	22.6 N·m 2.3 kgf·m 16.7 lbf·ft

- Tool to use: M8 hex socket

(1) Cover (2) Hex Socket Bolt

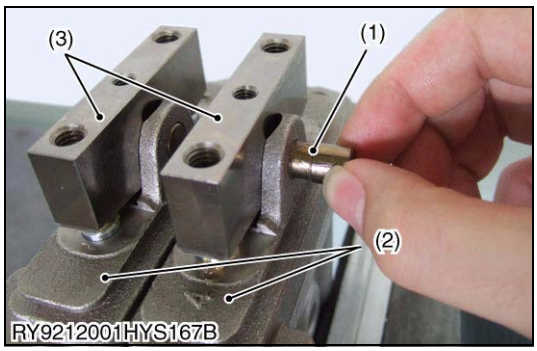
RY9212174HYS0062US0



19. Apply grease to the sliding part of the pin and install it.

(1) Pusher ASSY

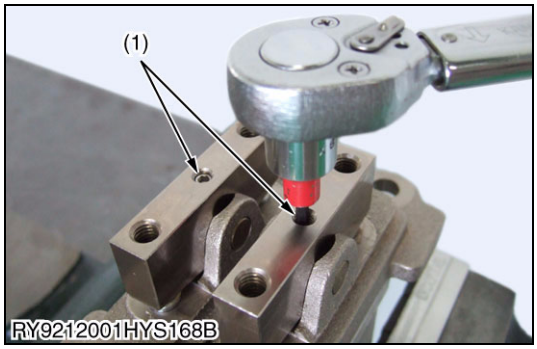
RY9212174HYS0063US0



20. Apply grease to the sliding part of the pin and install it.

(1) Pin (3) Cam
(2) Cover

RY9212174HYS0064US0



21. Install the hex socket set screws.

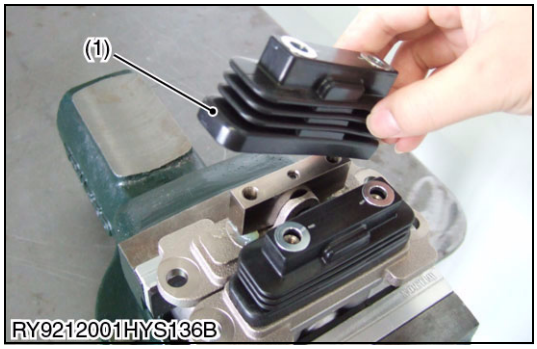
■ **IMPORTANT**
- **Note that each one has two hex socket set screws.**

Tightening torque	Hex set screw	9.8 N·m 1.0 kgf·m 7.2 lbf·ft

- Tool to use: M3 hex socket

(1) Hex Set Screw

RY9212174HYS0065US0

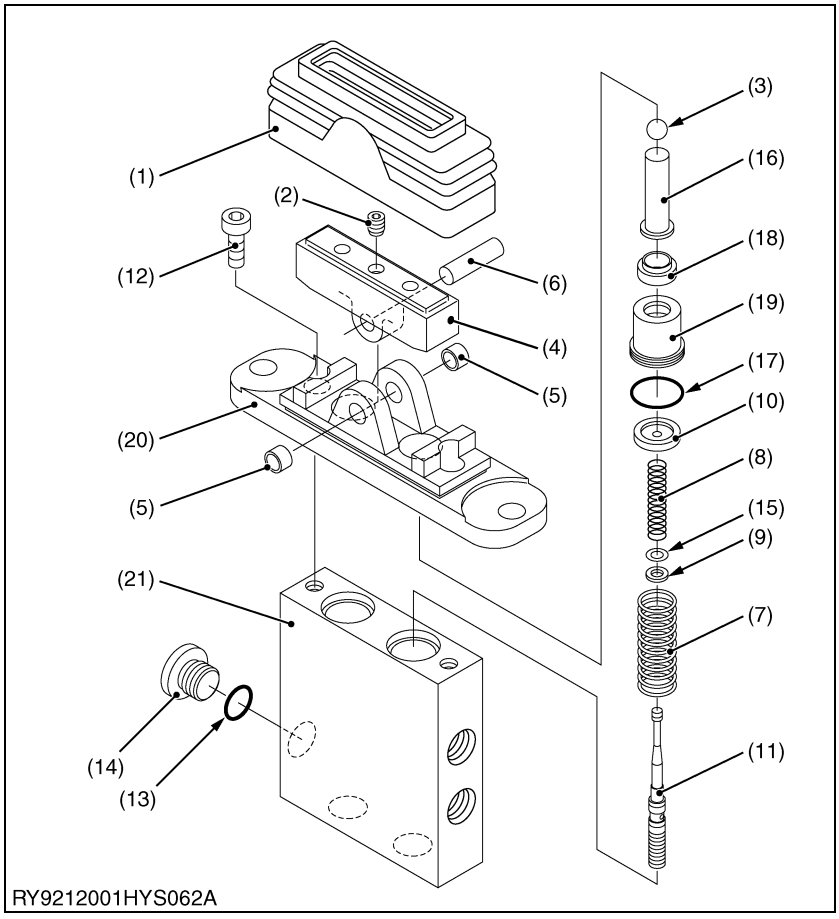


22. Install the boot.

(1) Bushing

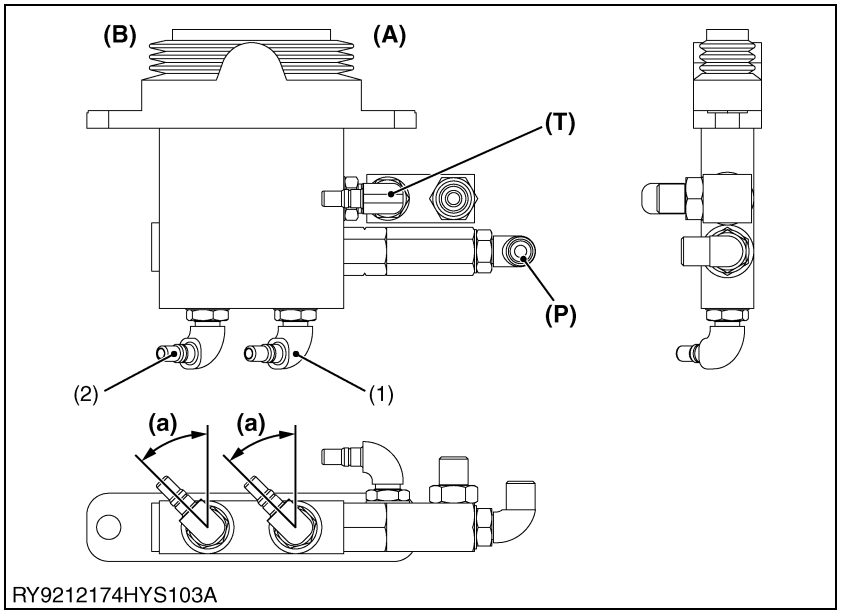
RY9212174HYS0066US0

[3] SWING PILOT VALVE



No.	Part Name	Qty
(1)	Bellows	1
(2)	Set screw	1
(3)	Ball	2
(4)	Cam	1
(5)	Bushing	2
(6)	Cam shaft	1
(7)	Return spring	2
(8)	Secondary pressure spring	2
(9)	Metal washer	2
(10)	Spring seat	2
(11)	Spool	2
(12)	Hex socket bolt	2
(13)	O-ring	1
(14)	Plug	1
(15)	Shim	2
(16)	Pushrod	2
(17)	O-ring	2
(18)	Gasket	2
(19)	Plug	2
(20)	Cover	1
(21)	Casing	1

RY9212148HYS0170US0



RY9212174HYS103A

Adapter angles

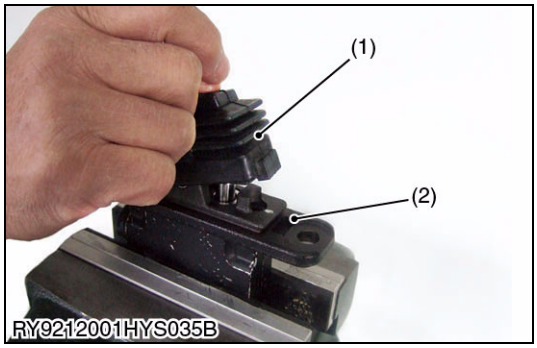
	Point used	Tape color
(1)	Right	Orange
(2)	Left	Pea green
(P)	Port P	None
(T)	Port T	None

(A) Right Swing
(B) Left Swing

(a) 45 ° (0.79 rad)

RY9212174HYS0067US0

(1) Disassembling



RY9212001HYS035B

1. Clamp the pilot valve in a vise.
2. Remove the bellows from the cover.

■ **IMPORTANT**
- **Use a copper plate when clamping the part.**

(1) Bellows (2) Cover

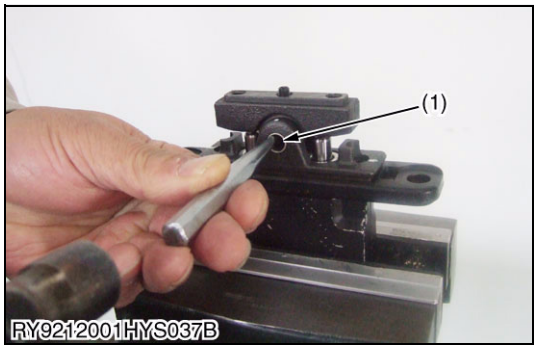
RY9212148HYS0171US0


RY9212001HYS036A

3. Remove the set screw.

■ **IMPORTANT**
- **The set screw is held with a thread lock, so be careful when removing it.**
- Tool to use: 3 mm hex socket

RY9212148HYS0172US0

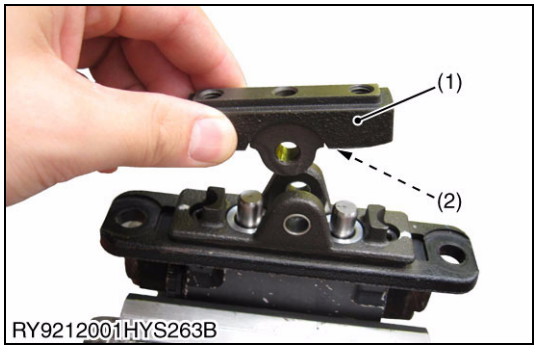


RY9212001HYS037B

4. Put a pin punch against the edge of the cam shaft and tap it lightly with a hammer to remove it.
- Tool to use: Hammer and pin punch (ϕ7 mm, ϕ0.3 in. ≥)

(1) Cam Shaft

RY9212148HYS0173US0

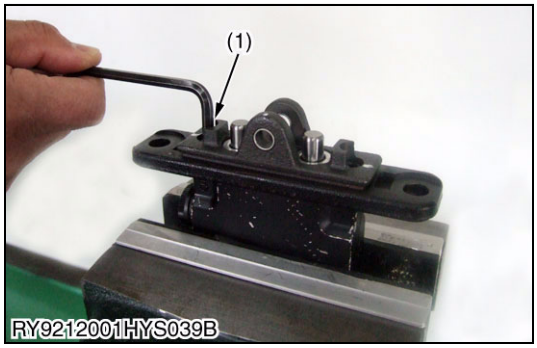


5. Remove the cam.

■ **IMPORTANT**
- **Handle the cam and the ball as an assembly. (Cannot be disassembled)**
- **Mark the relationship between the cam and the cover.**

(1) Cam
(2) Ball

RY9212148HYS0174US0

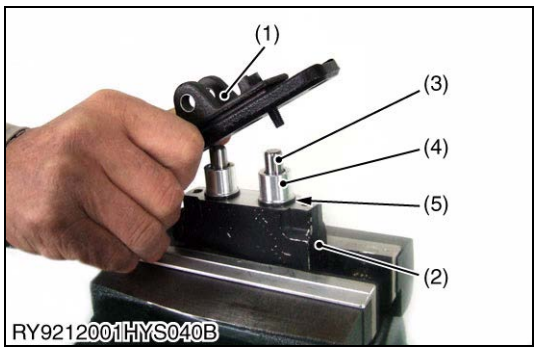


6. Remove the hex socket bolt.

- Tool to use: hex socket 5 mm

(1) Hex Socket Bolt

RY9212148HYS0175US0

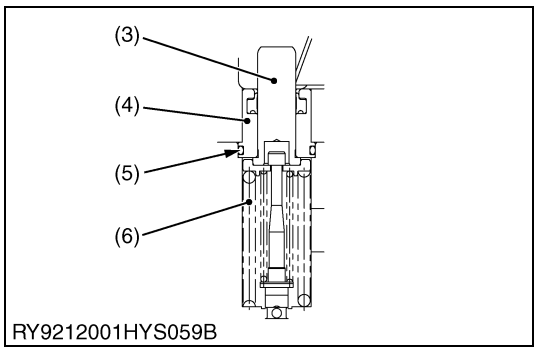


7. Remove the cover.

CAUTION
- **Mark the relationship between the cover and the casing.**
- **Be careful so the pushrod and the plug don't pop out.**

(1) Cover
(2) Casing
(3) Pushrod
(4) Plug
(5) O-ring
(6) Return Spring

RY9212148HYS0176US0

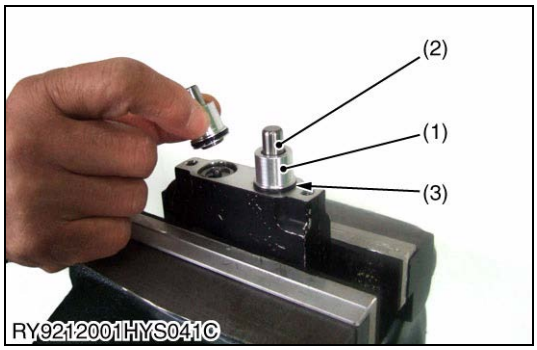


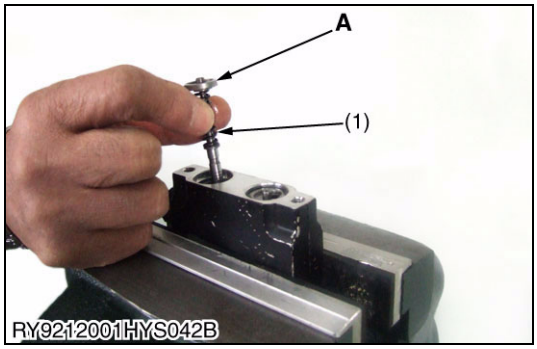
8. Take the plug out with the pushrod still in place.

■ **IMPORTANT**
- **Mark the relationship between the plug and the casing.**

(1) Plug
(2) Pushrod
(3) O-ring

RY9212148HYS0177US0



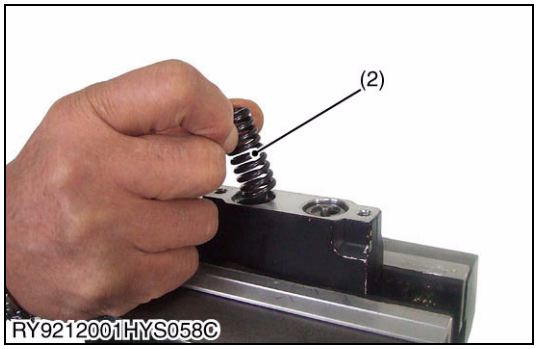


9. Remove the reducing valve ASSY, secondary pressure spring and return spring from the casing.

■ **IMPORTANT**
- **Mark the relationship of the casing holes.**

(1) Secondary Pressure Spring
(2) Return Spring
A : Reducing Valve ASSY

RY9212148HYS0178US0

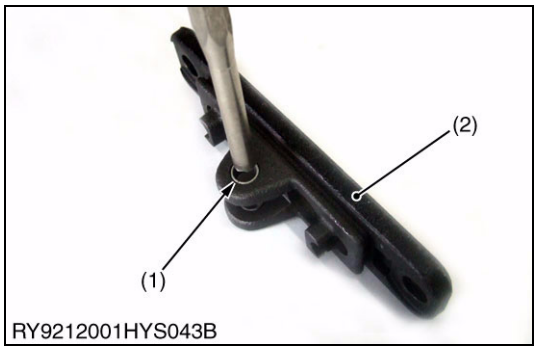


10. Put the cover on its side, put a pin punch against the bushing and lightly tap it with a hammer to remove it.

- Tools to use : Hammer and pin punch (ϕ10 mm, ϕ0.39 in. ≥)

(1) Bushing
(2) Cover

RY9212148HYS0179US0

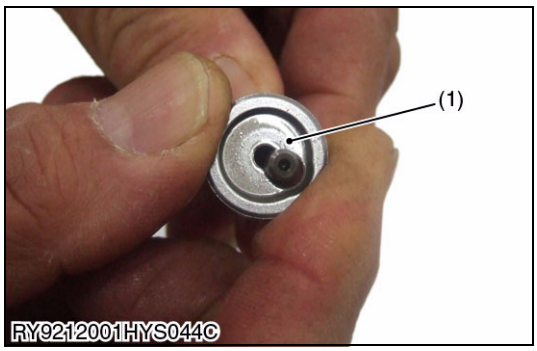


11. To disassemble the reducing valve, compress the secondary pressure spring, shift the spring seat to the side and remove the spool via the large hole.

■ **IMPORTANT**
- **Be careful not to scratch the spool.**
- **Do not depress the spring seat more than 4 mm (0.16 in.).**
- **Do not disassemble the reducing valve unless there is a problem with it.**

(1) Spring Seat

RY9212148HYS0180US0

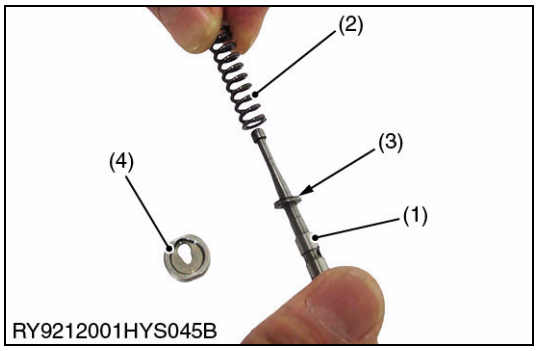


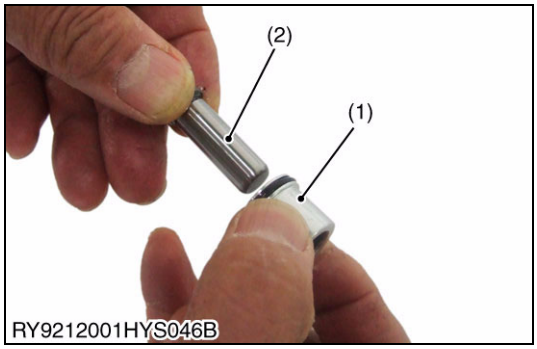
12. Remove the spool, secondary pressure spring shim(s) and washer.

■ **IMPORTANT**
- **Treat as an assembly until reassembly.**
- **The thickness of the metal washers is different for each spool ASSY due to the preset adjustment of the secondary pressure spring.**
- **A metal washer is not used in the figure.**

(1) Spool
(2) Secondary Pressure Spring
(3) Shim
(4) Spring Seat

RY9212148HYS0181US0

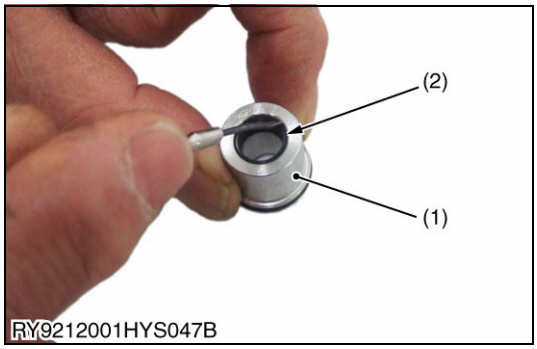




13. Remove the plug from the pushrod.

(1) Plug (2) Pushrod

RY9212148HYS0182US0



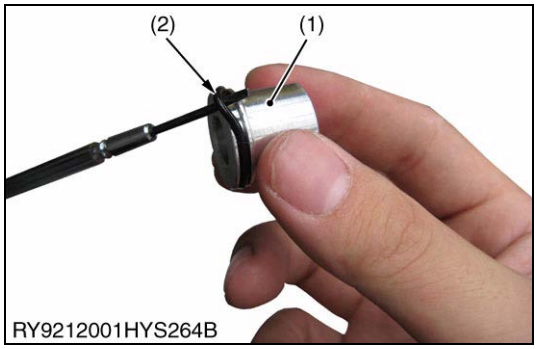
14. Remove the gasket from the plug.

CAUTION
- **Use a mini slotted screwdriver to remove it.**
- **Be careful not to scratch the inside surface of the plug.**

- Tool to use: Slotted screwdriver

(1) Plug (2) Gasket

RY9212148HYS0183US0

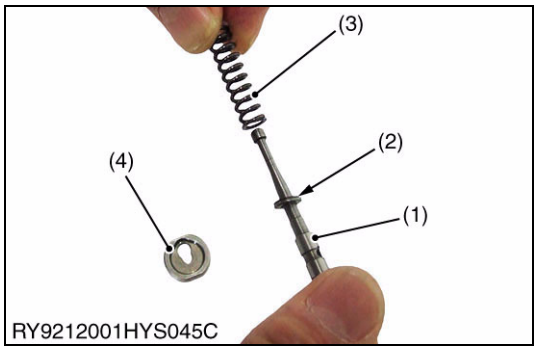


15. Remove the O-ring from the plug.

(1) Plug (2) O-Ring

RY9212148HYS0184US0

(2) Assembling

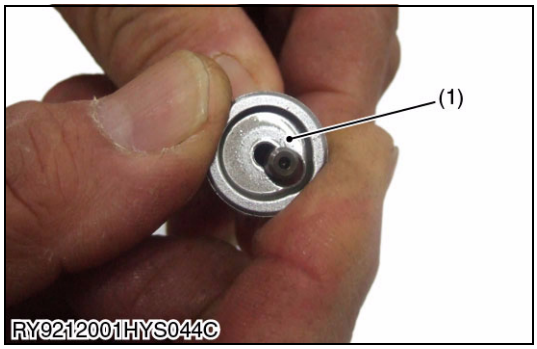


1. Install the metal washer, shim, secondary pressure spring and spring seat in order on the spool.

■ IMPORTANT
- **The thickness of the metal washers is different for each spool ASSY due to the preset adjustment of the secondary pressure spring.**

(1) Spool (3) Secondary Pressure Spring
(2) Shim (4) Spring Seat

RY9212148HYS0185US0

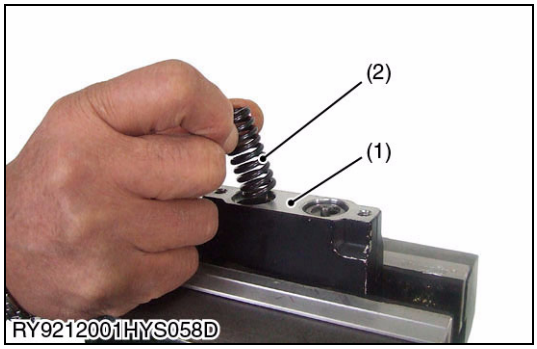


2. Pass the end of the spool through the larger part of the hole in the spring seat (10), compressing the spring and shifting the spring seat to the side to install it.

■ IMPORTANT
- **Be careful not to scratch the spool.**
- **Do not depress the spring seat more than 4 mm.**

(1) Spring seat

RY9212148HYS0186US0

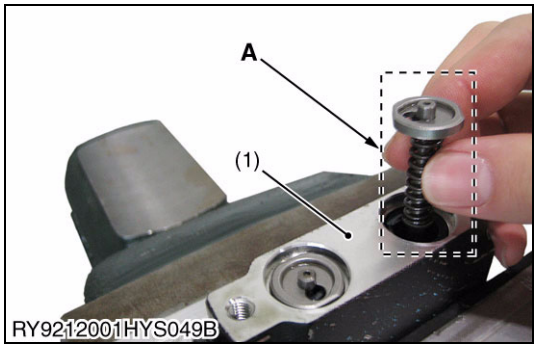


3. Clamp the casing in a vise.
   Install the return spring in the casing.

■ **IMPORTANT**
- **Install it in the same position as before disassembly.**

(1) Casing
(2) Return spring

RY9212148HYS0187US0



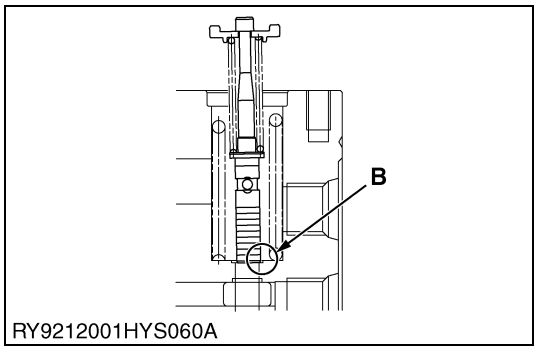
4. Install the reducing valve ASSY **A** to the casing.

■ **IMPORTANT**
- **Install it in the same position as before disassembly.**
- **When installing the reducing valve ASSY, take care not to hit the bottom edge of the spool hard against the corner B or the casing.**

(1) Casing

A : Reducing Valve ASSY
B : Corner of Casing

RY9212148HYS0188US0

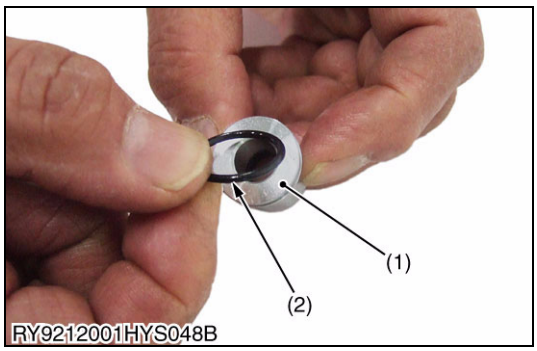


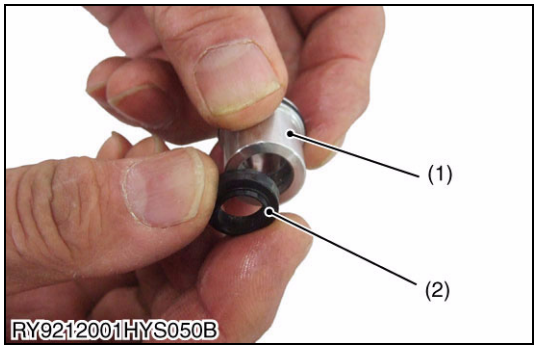
5. Install the O-ring on the plug.

■ **IMPORTANT**
- **Apply hydraulic oil to the O-ring.**

(1) Plug
(2) O-Ring

RY9212148HYS0189US0



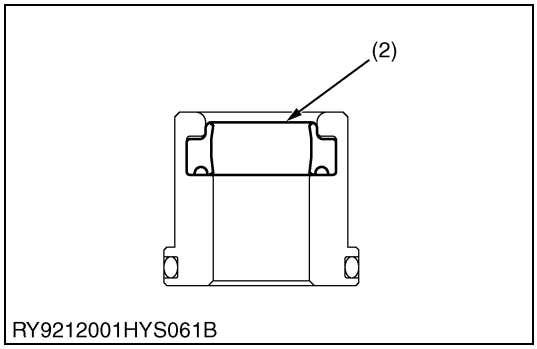


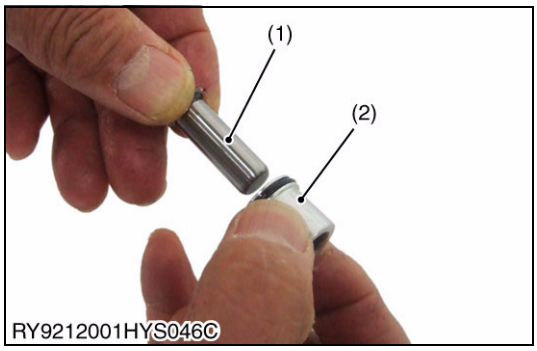
6. Install the gasket on the plug.

■ **IMPORTANT**
- **Be careful that the gasket faces the right direction (The gasket has an uneven shape ; put the end with a larger diameter in first).**
- **Apply hydraulic oil on the circumference and lip of the gasket.**

(2) Gasket (1) Plug

RY9212148HYS0190US0



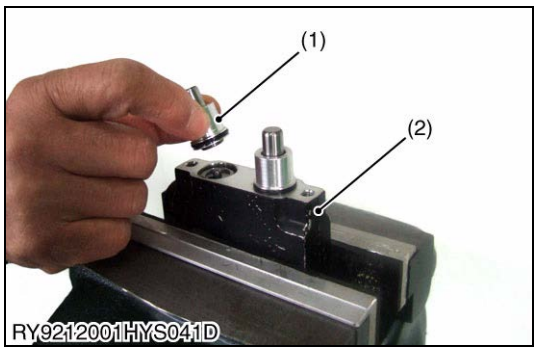


7. Install the pushrod into the plug.

■ **IMPORTANT**
- **Apply hydraulic oil to the pushrod.**
- **Do not force the gasket in as it may damage its lip.**

(1) Pushrod (2) Plug

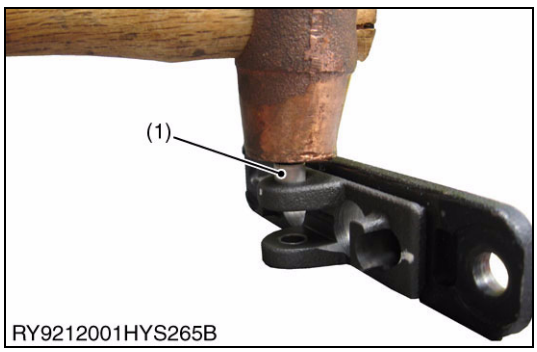
RY9212148HYS0191US0



8. Install the pushrod and plug ASSY in the casing.

(1) Plug (2) Casing

RY9212148HYS0192US0



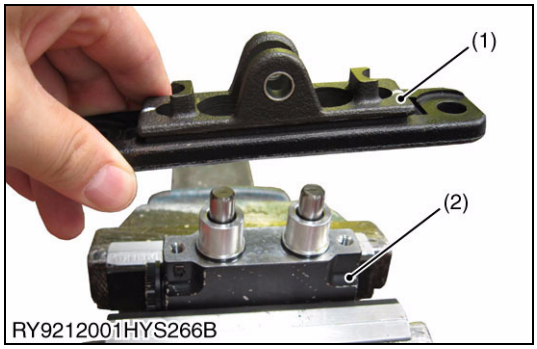
9. Turn the cover on its side and tap lightly on the bushing with a hammer to install it.

■ **IMPORTANT**
- **Take care not to knock the bushing so it sticks out from the inside of the cover.**

- Tool to use: hammer

(1) Bushing

RY9212148HYS0193US0

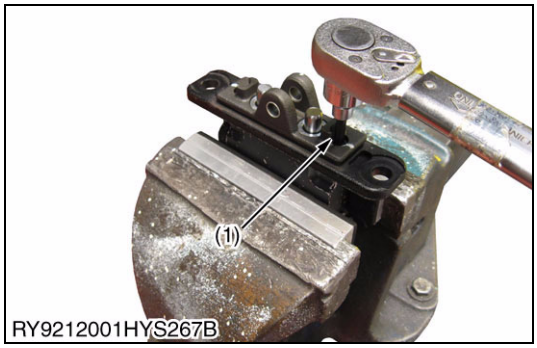


10. Install the cover on the casing.

■ **IMPORTANT**
- **Install it in the same position as before disassembly.**
- **Note that the cover will ride up due to the springs.**

(1) Cover (2) Casing

RY9212148HYS0194US0



11. Install the hex socket bolts.

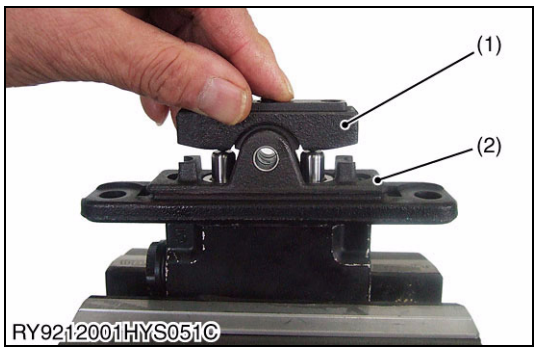
■ **IMPORTANT**
- **Install them so the cover sits flat.**

Tightening torque	Cover	8.8 ± 0.8 N·m 0.90 ± 0.08 kgf·m 6.5 ± 0.6 lbf·ft

- Tool to use: hex socket 5 mm

(1) Hex Socket Bolt

RY9212148HYS0195US0

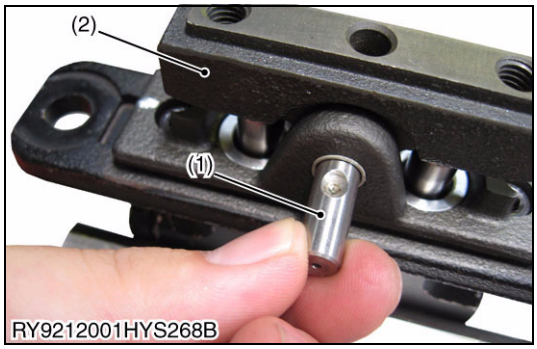


12. Install the cam on the cover.

■ **IMPORTANT**
- **Install it in the same position as before disassembly.**

(1) Cam (2) Cover

RY9212148HYS0196US0



13. Install the camshaft.

■ **IMPORTANT**
- **Grease the sliding part that holds the camshaft.**
- **Install the indentation in the cam faces up.**

(1) Cam Shaft (2) Cam

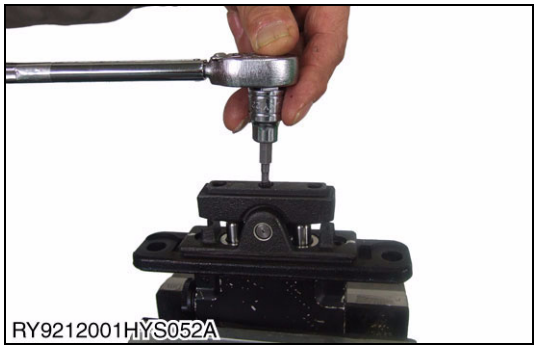
RY9212148HYS0197US0



14. Apply Loctite to the threads of the hex socket bolt.

- Loctite #241

RY9212148HYS0302US0

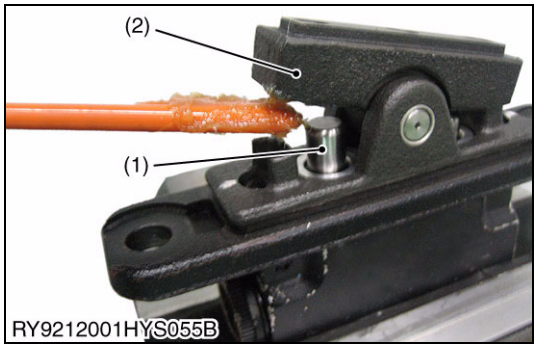

RY9212001HYS052A

15. Install the hex socket bolt.

Tightening torque	Hex socket bolt	6.9 ± 1.0 N·m 0.7 ± 0.1 kgf·m 5.1 ± 0.7 lbf·ft

- Tool to use: hex socket 3 mm

RY9212148HYS0199US0



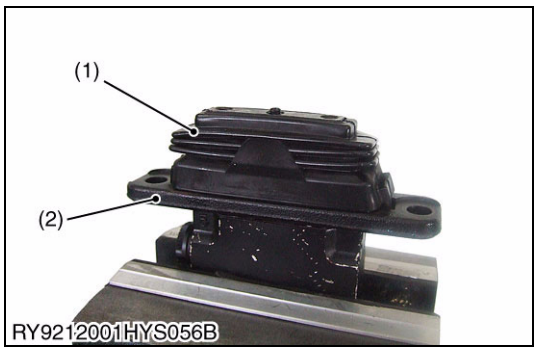
RY9212001HYS055B

16. Apply grease to the ends of the pushrods.

■ **IMPORTANT**
- **Use a soft spatula to apply the grease so you don't scratch the surfaces of the pushrods or the plugs.**

(1) Pushrod (2) Cam

RY9212148HYS0200US0



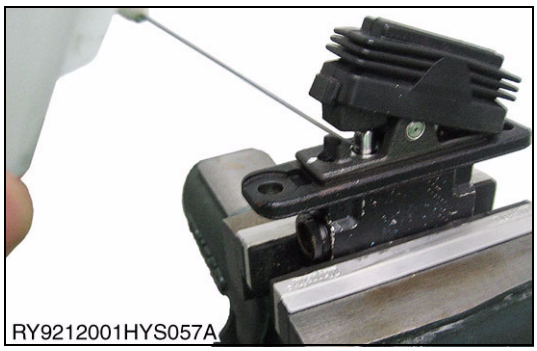
RY9212001HYS056B

17. After fitting the top of the bellows onto the cam, fit the bottom edge into the groove in the cover.

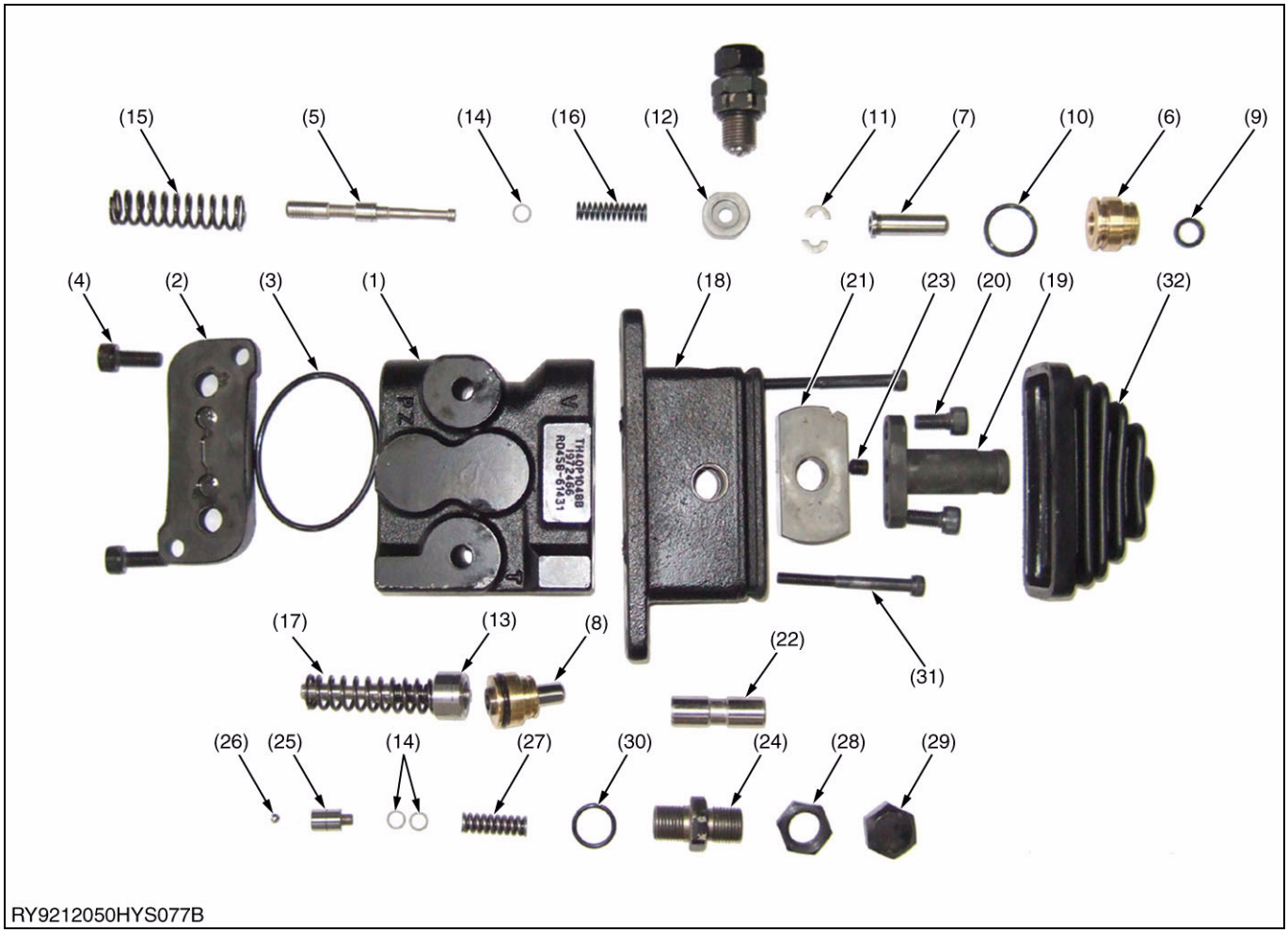
■ **IMPORTANT**
- **Before fitting the bottom edge of the bellows into the groove of the cover, apply an anti-rust oil to the parts inside the bellows.**

(1) Bellows (2) Cover

RY9212148HYS0201US0


RY9212001HYS057A

[4] BLADE PILOT VALVES



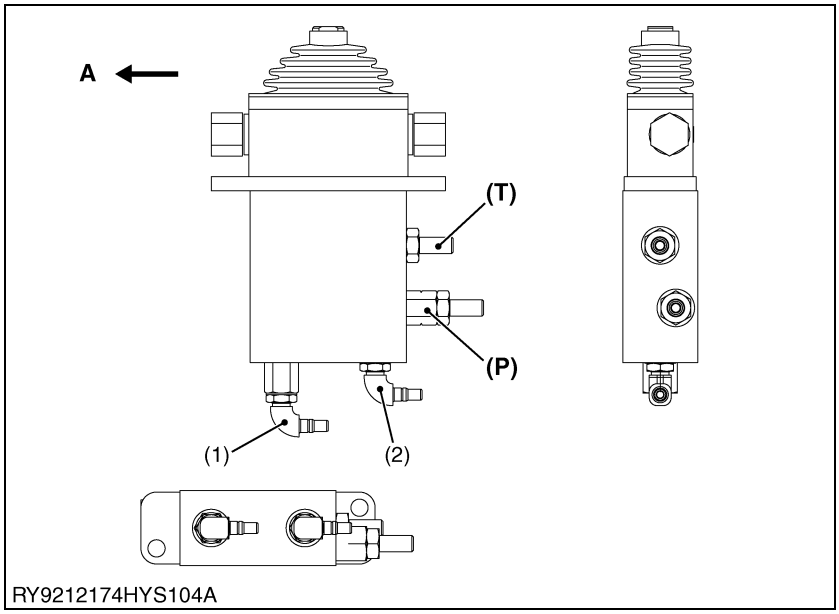
RY9212050HYS077B

No.	Part Name	Qty	No.	Part Name	Qty	No.	Part Name	Qty
(1)	Casing	1	(12)	Spring seat 1	1	(23)	Set screw	1
(2)	Port plate	1	(13)	Spring seat 2	1	(24)	Detent plug	2
(3)	O-ring	1	(14)	Washer 2	Select thick-ness	(25)	Holder	2
(4)	Hex socket bolt	2	(15)	Return spring	2	(26)	Steel ball	2
(5)	Spool	2	(16)	Secondary pressure spring 1	1	(27)	Spring	2
(6)	Plug	2	(17)	Secondary pressure spring 2	1	(28)	Lock nut	2
(7)	Pushod 1	1	(18)	Cover	1	(29)	Adjusting nut	2
(8)	Pushod 2	1	(19)	Lever	1	(30)	O-ring	2
(9)	Seal	2	(20)	Hex socket bolt	2	(31)	Hex socket bolt	2
(10)	O-ring	2	(21)	Disc	1	(32)	Bellows	1
(11)	Washer 1	4	(22)	Camshaft	1			

- Thickness of washer 2 as per table below

Point used	Thickness
Detent	0 to 2 mm (0 to 0.08 in.) or less
Reducing valve	0.4 mm (0.02 in.) One washer

RY9212158HYS0071US0



RY9212174HYS104A

Adapter angles

	Point used	Tape color
(1)	Down	Brown
(2)	Up	Pink
(P)	Port P	2222222
(T)	Port T	1111111

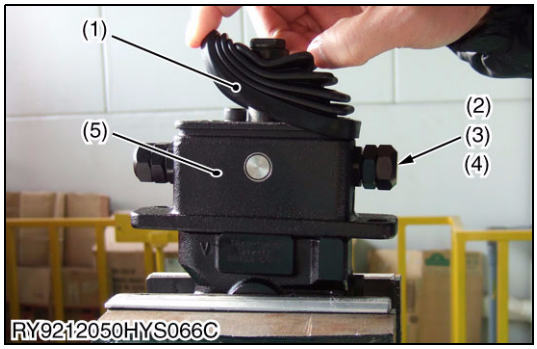
A : Front of Machine

RY9212174HYS0208US0

(1) Disassembling

- To ensure parts that are reused are installed in the same place as before disassembly, mark the parts as needed during disassembly.

RY9212158HYS0073US0



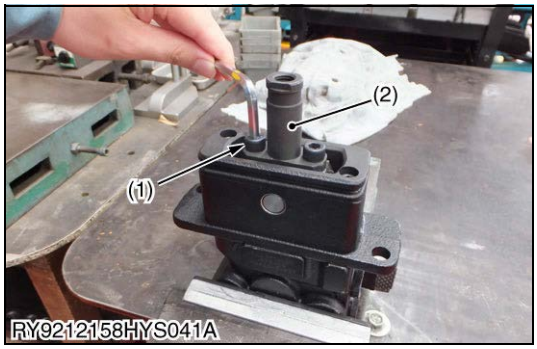
1. Clamp the pilot valve in a vise.
2. Remove the bellows from the cover.
3. Remove the detent parts from the outwards in and remove the ball, holder, washer 2 and the spring that are inside it.
   - Tool to use: 22 mm socket

■ **IMPORTANT**

- **Use a copper plate when clamping the pilot valve.**

(1) Bellows
(2) Detent Plug
(3) Lock Nut
(4) Adjusting Nut
(5) Cover

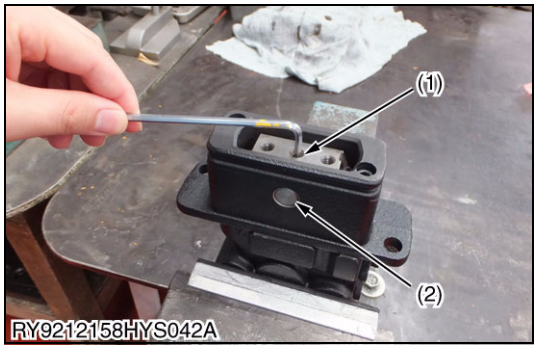
RY9212158HYS0074US0



4. Remove the hex socket bolts and then the lever.
   - Tool to use: 6 mm hex socket

(1) Hex Socket Bolt
(2) Lever

RY9212158HYS0075US0



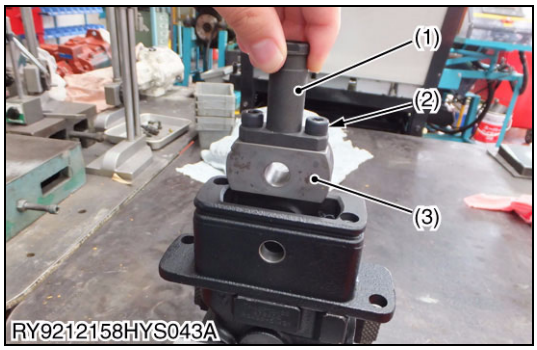
5. Remove the set screw and camshaft.
   - Tool to use: 4 mm hex socket

■ **IMPORTANT**

- **The set screw is held with thread lock, so be careful when removing it.**

(1) Set Screw
(2) CamShaft

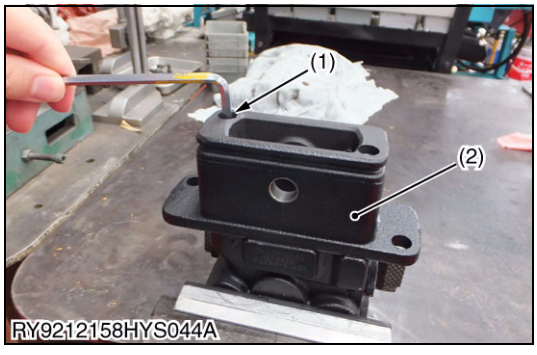
RY9212158HYS0076US0



6. Use the lever and the hex bolts to take the disc out.

(1) Lever
(2) Hex Socket Bolt
(3) Disc

RY9212158HYS0077US0



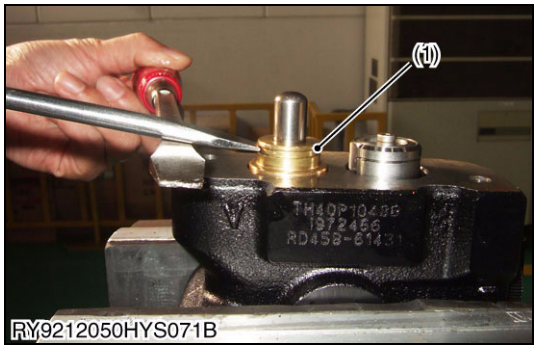
7. Remove the hex socket bolts and then the cover.
   - Tool to use: 5 mm hex socket

■ **IMPORTANT**

- **If the return spring is strong, when you loosen a hex socket bolt, the cover, plug and pushrod will lift up at the same time, so loosen the bolts alternately so the cover stays level.**

(1) Hex Socket Bolt
(2) Cover

RY9212158HYS0078US0

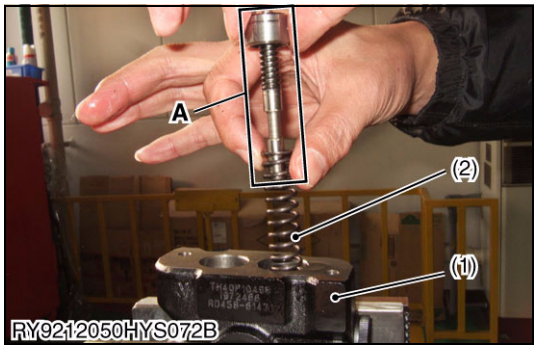


8. If the plug stays in the casing, use a slotted screwdriver to get the plug out.
   - Tool to use: Slotted screwdriver

■ **IMPORTANT**
- **Take care not to use too much force with the screwdriver when removing the plug so you don't damage it.**
- **Also note that the plug may pop out due to the force of the spring.**

(1) Plug

RY9212158HYS0079US0

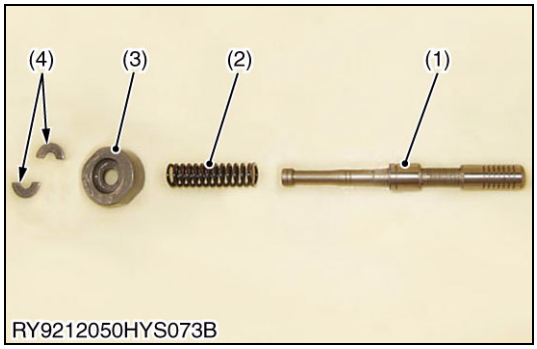


9. Remove the reducing valve and the return spring.

■ **IMPORTANT**
- **Be careful not to scratch the spool.**
- **Do not disassemble the reducing valve unless there is a problem with it.**

(1) Casing
(2) Return Spring
A : Reducing Valve

RY9212158HYS0080US0

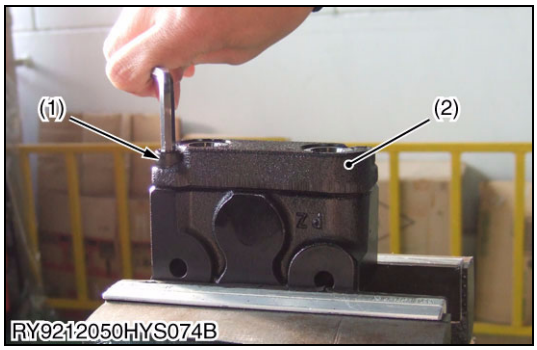


Reducing valve

■ **IMPORTANT**
- **Do not depress the spring seat more than 4 mm (0.16 in.).**
- **The metal washer 2 is not used in the photo at left.**
- **The thickness of washer 2 varies for each spool due to the preset adjustment of the secondary pressure spring.**

(1) Spool
(2) Secondary Pressure Spring
(3) Spring Seat
(4) Washer 1

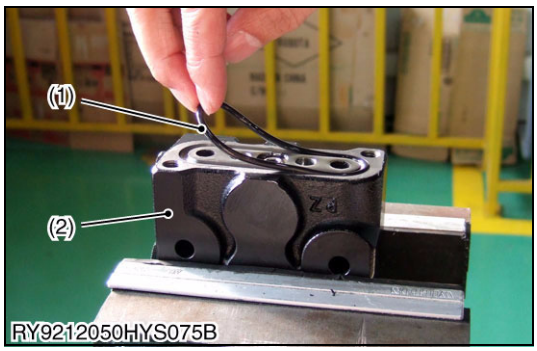
RY9212158HYS0081US0



10. Flip the casing over in the vise and remove the hex socket bolts and the port plate.
    - Tool to use: 6 mm hex socket

(1) Hex Socket Bolt
(2) Port Plate

RY9212158HYS0082US0

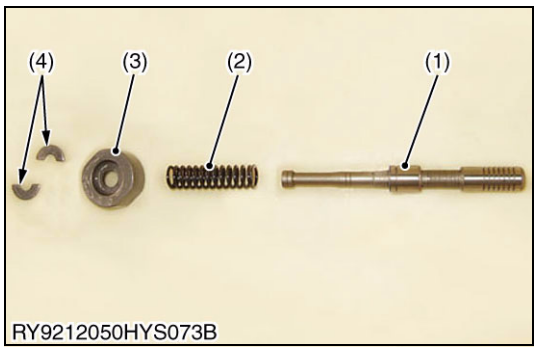


11. Remove the O-ring from the casing.

(1) O-ring
(2) Casing

RY9212158HYS0083US0

(2) Assembling

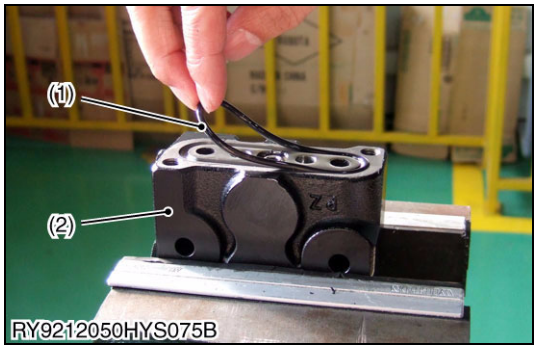


1. Assemble the reducing valve.
   Install the secondary pressure setting spring and the spring seat in that order on the spool, then press the spring seat down and install the two half-circle shaped pieces of washer 1 on the spring seat so they don't overlap.

■ **NOTE**
- **Face washers 1 edge side up so they catch the head of the spool.**
- **Do not depress the spring seat more than 4 mm (0.16 in.).**
- **The metal washer 2 is not used in the photo at left.**
- **The thickness of washer 2 varies for each spool due to the preset adjustment of the secondary pressure spring.**

(1) Spool
(2) Secondary Pressure Spring
(3) Spring Seat
(4) Washer 1

RY9212158HYS0084US0

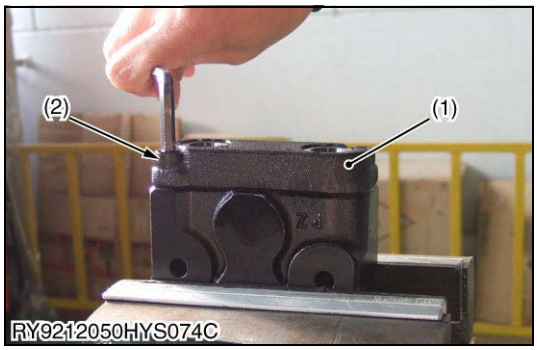


2. Install the O-ring on the casing.

■ **IMPORTANT**
- **Apply hydraulic oil to the O-ring.**

(1) O-ring
(2) Casing

RY9212158HYS0085US0

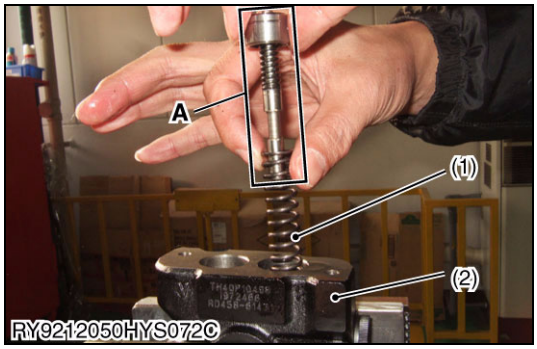


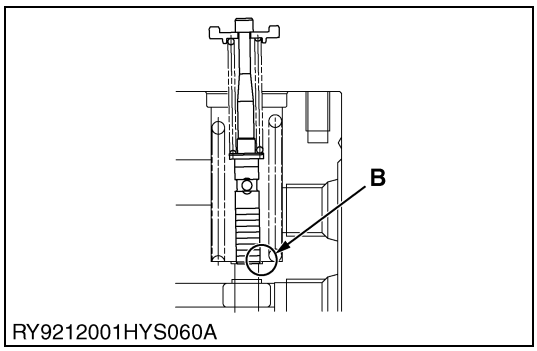
3. Install the port plate on the casing and tighten it with the hex socket bolts.
   - Tool to use: 6 mm hex socket

Tightening torque	Hex socket bolt	29.4 ± 2.0 N·m 3.0 ± 0.2 kgf·m 21.7 ± 1.5 lbf·ft

(1) Port Plate
(2) Hex Socket Bolt

RY9212158HYS0086US0



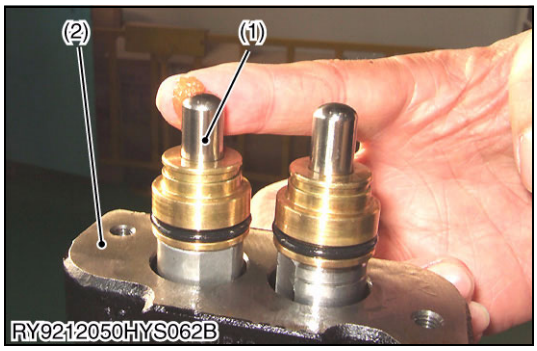


4. Install the return spring and reducing valve into the casing.

■ **NOTE**
- **When installing the reducing valve, do not hit the bottom of the spool on the corners of the casing with any force.**

(1) Return Spring
(2) Casing
A : Reducing Valve
B : Corner of Casing

RY9212158HYS0087US0

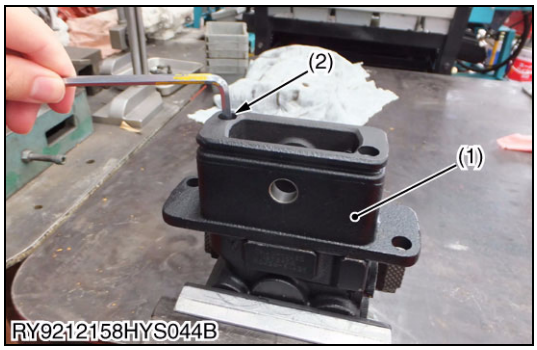


5. Apply grease to the ends of the pushrods and install them in the casing.

■ **NOTE**
- **If the force of the return springs is weak, the plug may be stuck to the casing by the O-ring's resistance to sliding.**
- **If the force of the return springs is strong, put the top cover on and tighten the hex socket bolts alternately so the top cover is installed evenly.**
- **Apply hydraulic oil to the O-ring.**

(1) Pushrod
(2) Casing

RY9212158HYS0088US0

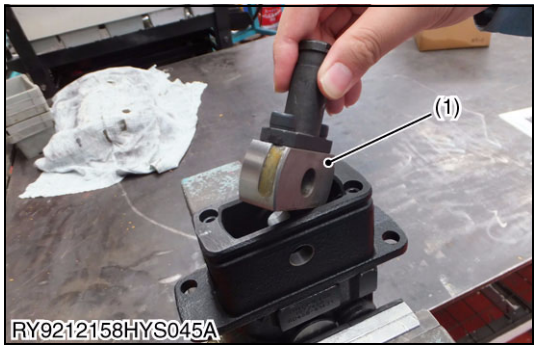


6. Install the cover on the casing and tighten it with the hex socket bolts.
- Tool to use: 5 mm hex socket

Tightening torque	Hex socket bolt	11.8 ± 1.0 N·m 1.2 ± 0.1 kgf·m 8.7 ± 0.7 lbf·ft

(1) Cover
(2) Hex Socket Bolt

RY9212158HYS0089US0

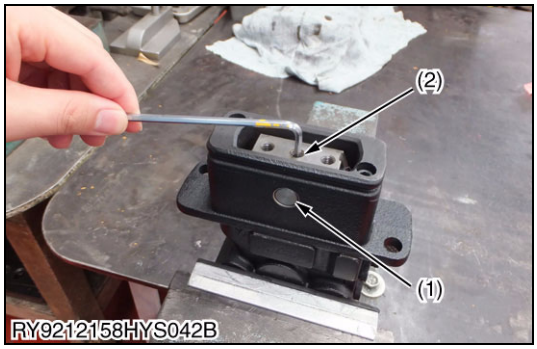


7. Wipe off any thread lock compound remaining on the screw holes on the top of the disc.

■ **IMPORTANT**
- **Apply grease to the surface of the disc where the steel ball rides.**

(1) Disc

RY9212158HYS0090US0



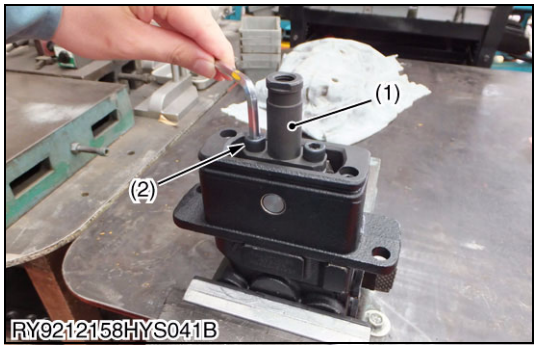
8. After inserting the disc and the camshaft, tighten the set screws.
   - Tool to use: 4 mm hex socket

■ **NOTE**
- **Wipe clean any excess thread lock compound from the set screws.**
- **Apply a thread lock (Loctite 241) to the set screws.**

Tightening torque	Set screw	16.7 ± 1.0 N·m 1.7 ± 0.1 kgf·m 12.3 ± 0.7 lbf·ft

(1) Camshaft (2) Set Screw

RY9212158HYS0091US0



9. Mount the lever on top of the disc and tighten the hex socket bolts.
   - Tool to use: 6 mm hex socket

Tightening torque	Hex socket bolt	29.4 ± 2.0 N·m 3.0 ± 0.2 kgf·m 21.7 ± 1.5 lbf·ft

(1) Lever (2) Hex Socket Bolt

RY9212158HYS0092US0

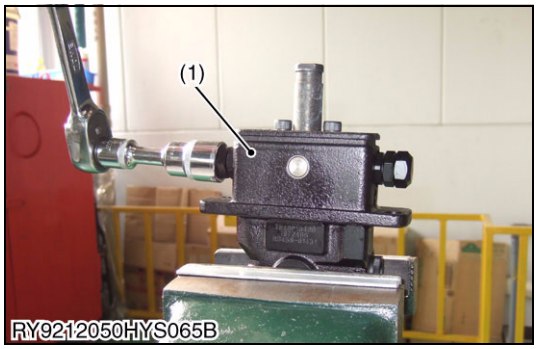


10. Assemble the steel ball, the holder, washer 2 and the spring inside the detent plug and test fit the lock nut and the adjusting nut.

■ **IMPORTANT**
- **Apply plenty of grease to the area around the steel ball.**

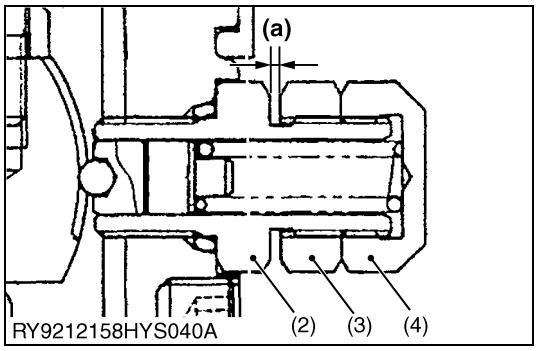
(1) Detent plug

RY9212158HYS0093US0



11. Install the detent plug in the cover and tighten.
12. Turn the adjusting plug to adjust the force required to release the detent and tighten the lock nut.
   - Tool to use: 22 mm socket

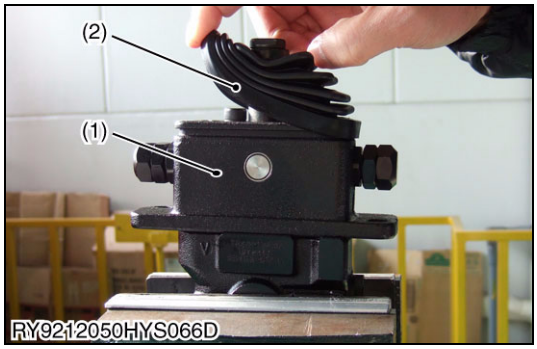
Tightening torque	Detent plug lock nut	41.2 ± 2.9 N·m 4.2 ± 0.3 kgf·m 30.4 ± 2.1 lbf·ft



(1) Cover
(2) Detent plug
(3) Lock Nut
(4) Adjusting Nut

(a) 1.0 to 3.0 mm (0.04 to 0.12 in.)

RY9212158HYS0094US0



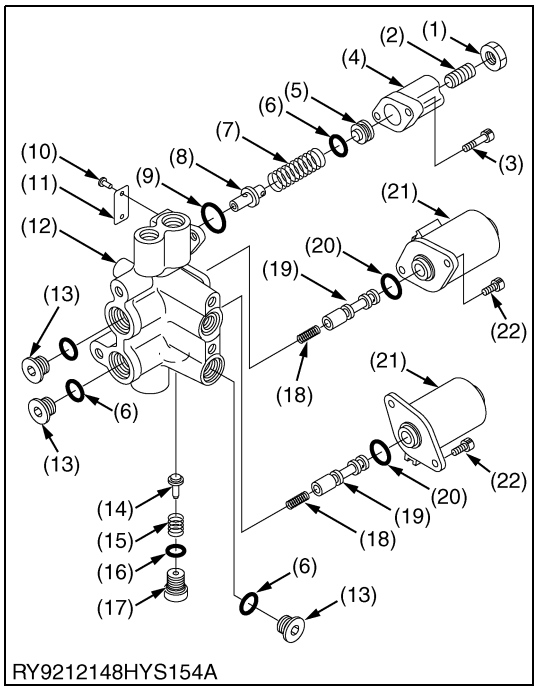
13. Apply an anti-rust oil to the parts inside the cover.
14. Install the bellows on top of the cover.

(1) Cover (2) Bellows

RY9212158HYS0095US0

8. SOLENOID VALVE

[1] UNLOAD VALVE

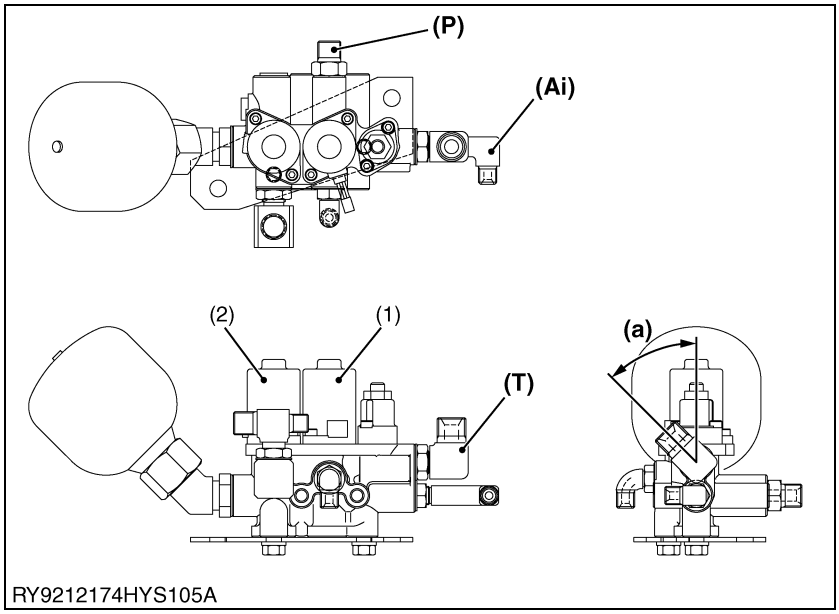


RY9212148HYS154A

Components

No.	Name of part	Qty	Torque
(1)	Hex nut	1	15.7 ± 1.6 N·m 1.6 ± 0.2 kgf·m 11.6 ± 1.2 lbf·ft
(2)	Adjuster screw	1	
(3)	Hex socket bolt	2	3.9 N·m 0.4 kgf·m 2.9 lbf·ft
(4)	Cover	1	
(5)	Plug	1	
(6)	O-ring	4	
(7)	Spring	1	
(8)	Plunger	1	
(9)	O-ring	1	
(10)	Rivet screw	2	
(11)	Nameplate	1	
(12)	Body	1	
(13)	Plug	3	26.5 ± 2.7 N·m 2.7 ± 0.3 kgf·m 19.5 ± 2.0 lbf·ft
(14)	Plunger	1	
(15)	Spring	1	
(16)	O-ring	1	
(17)	Plug	1	21.0 ± 2.1 N·m 2.1 ± 0.2 kgf·m 15.5 ± 1.5 lbf·ft
(18)	Spring	2	
(19)	Spool	2	
(20)	O-ring	2	
(21)	Solenoid	2	
(22)	Hex socket bolt	4	3.9 N·m 0.4 kgf·m 2.9 lbf·ft

RY9212148HYS0277US0



RY9212174HYS105A

Adapter angles

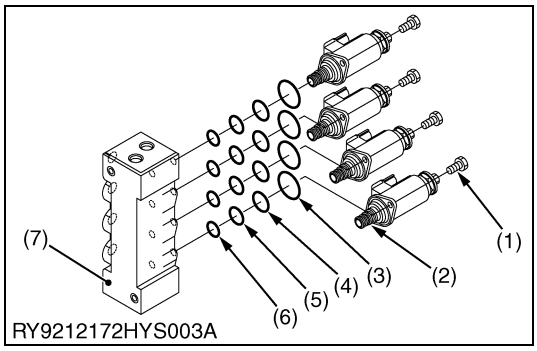
(1) Travel 2-Speed Solenoid
(2) Pilot Solenoid

(P) Port P
(T) Port T
(Ai) AI Signal

(a) 45 ° (0.79 rad)

RY9212174HYS0068US0

[2] AUX SOLENOID VALVE

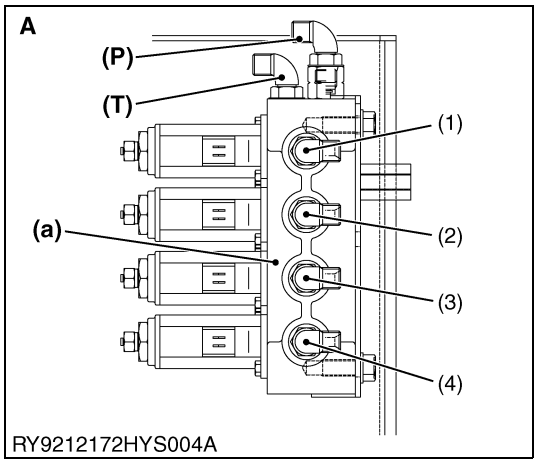


RY9212172HYS003A

Components

No.	Name of part	Qty	Torque
(1)	Bolt	8	7.0 ± 1.0 N·m 0.7 ± 0.1 kgf·m 5.2 ± 0.7 lbf·ft
(2)	Solenoid	4	
(3)	O-ring	4	
(4)	O-ring	4	
(5)	O-ring	4	
(6)	O-ring	4	
(7)	Body	1	

RY9212172HYS0006US0



RY9212172HYS004A

Adapter angles

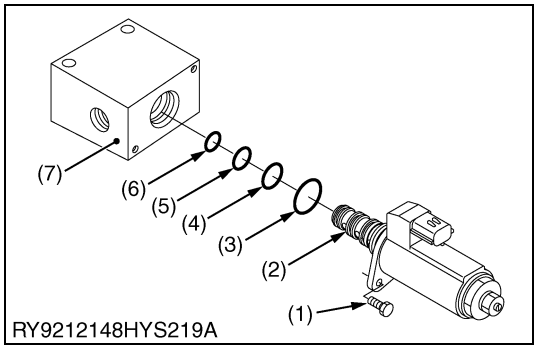
(1) AUX1 High Pressure
(2) AUX1 Low Pressure
(3) AUX2 High Pressure
(4) AUX2 Low Pressure

A : AUX1/2 spec.

(a) AUX1/2 solenoid Valve
(P) Port P
(T) Port T

RY9212172HYS0007US0

[3] EP MODE SOLENOID VALVE



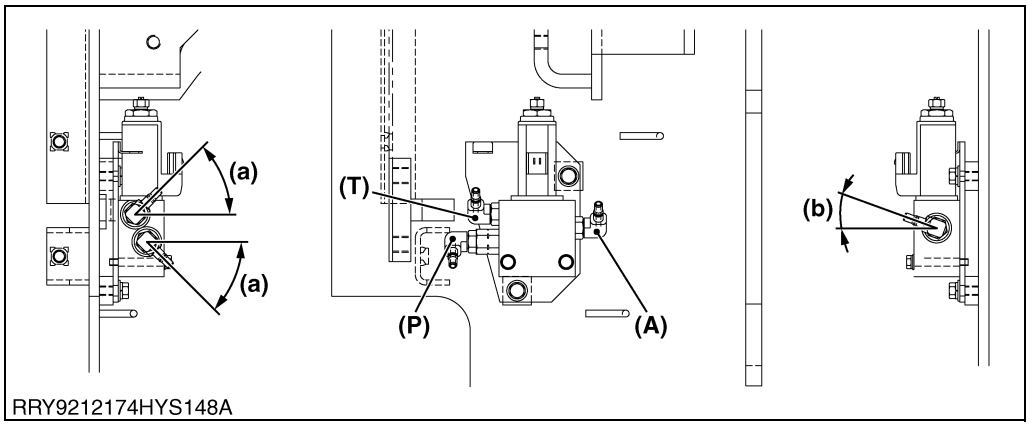
RY9212148HYS219A

Components

No.	Name of part	Qty	Torque
(1)	Bolt	2	7.0 ± 1.0 N·m 0.7 ± 0.1 kgf·m 5.2 ± 0.7 lbf·ft
(2)	Solenoid	1	
(3)	O-ring	1	
(4)	O-ring	1	
(5)	O-ring	1	
(6)	O-ring	1	
(7)	Body	1	

RY9212148HYS0283US0

Adapter angles



RRY9212174HYS148A

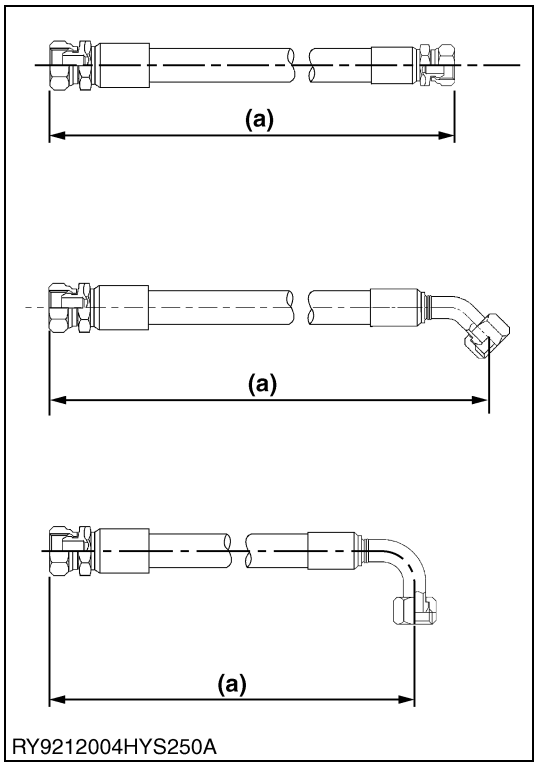
(A) Port A (to tank)
(P) Port P (from tank)
(T) Port T

(a) 45 ° (0.79 rad)
(b) 20 ° (0.35 rad)

RY9212174HYS0069US0

9. ROUTING OF HYDRAULIC HOSES

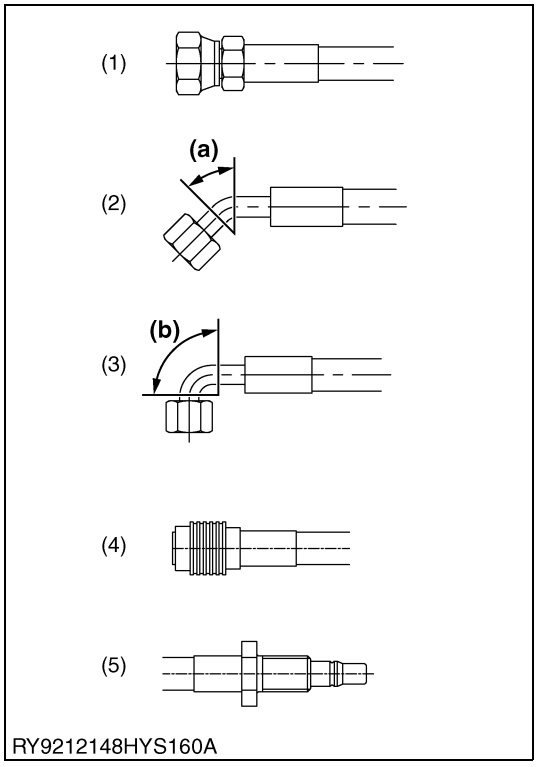
[1] TYPES OF HYDRAULIC HOSES



RY9212004HYS250A

(a) Total Length

RY9212004HYS0147US0



RY9212148HYS160A

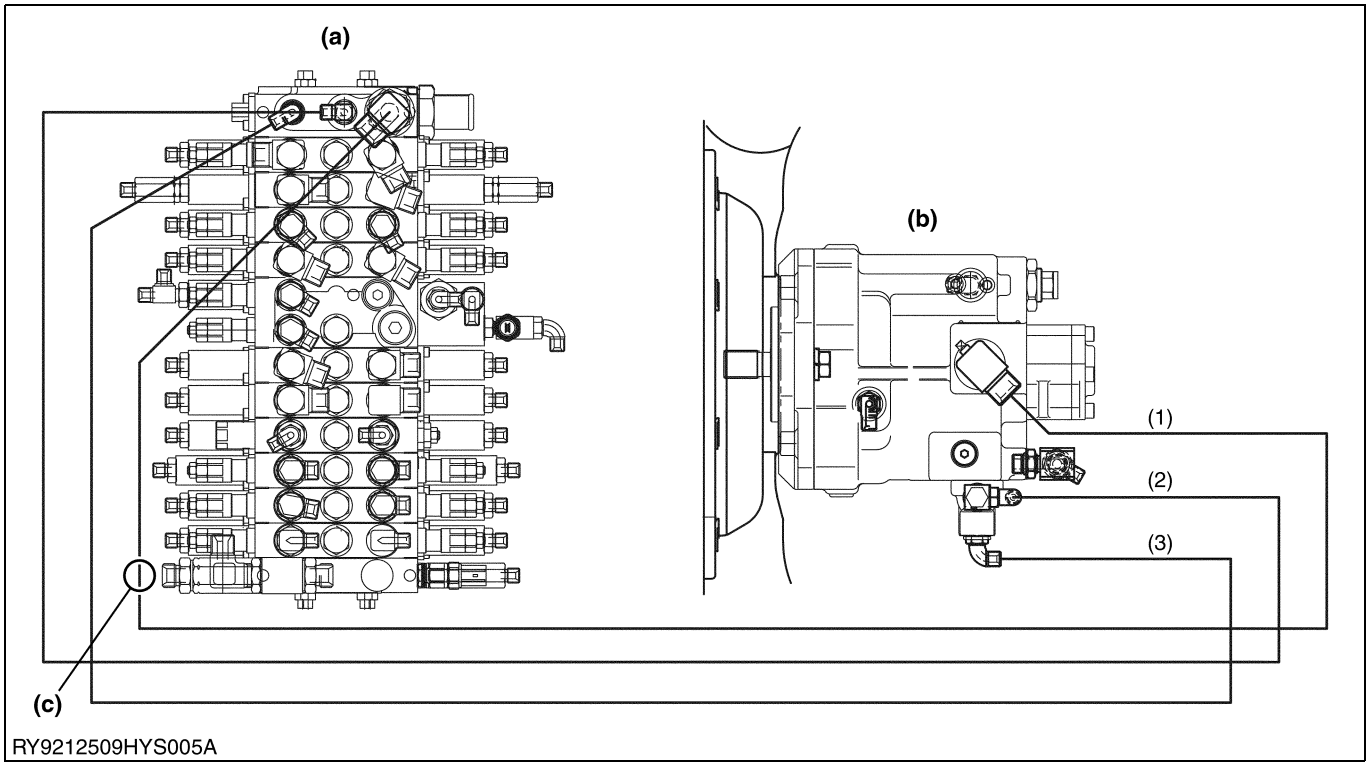
(1) C Type (Straight)
(2) CR4 Type (45°)
(3) CR9 Type (90°)
(4) QM Type (Quick)
(5) Q Type (Quick)

(a) 45 °
(b) 90 °

RY9212148HYS0202US0

[2] HIGH-PRESSURE HOSES

(1) Deliver Hose Routing



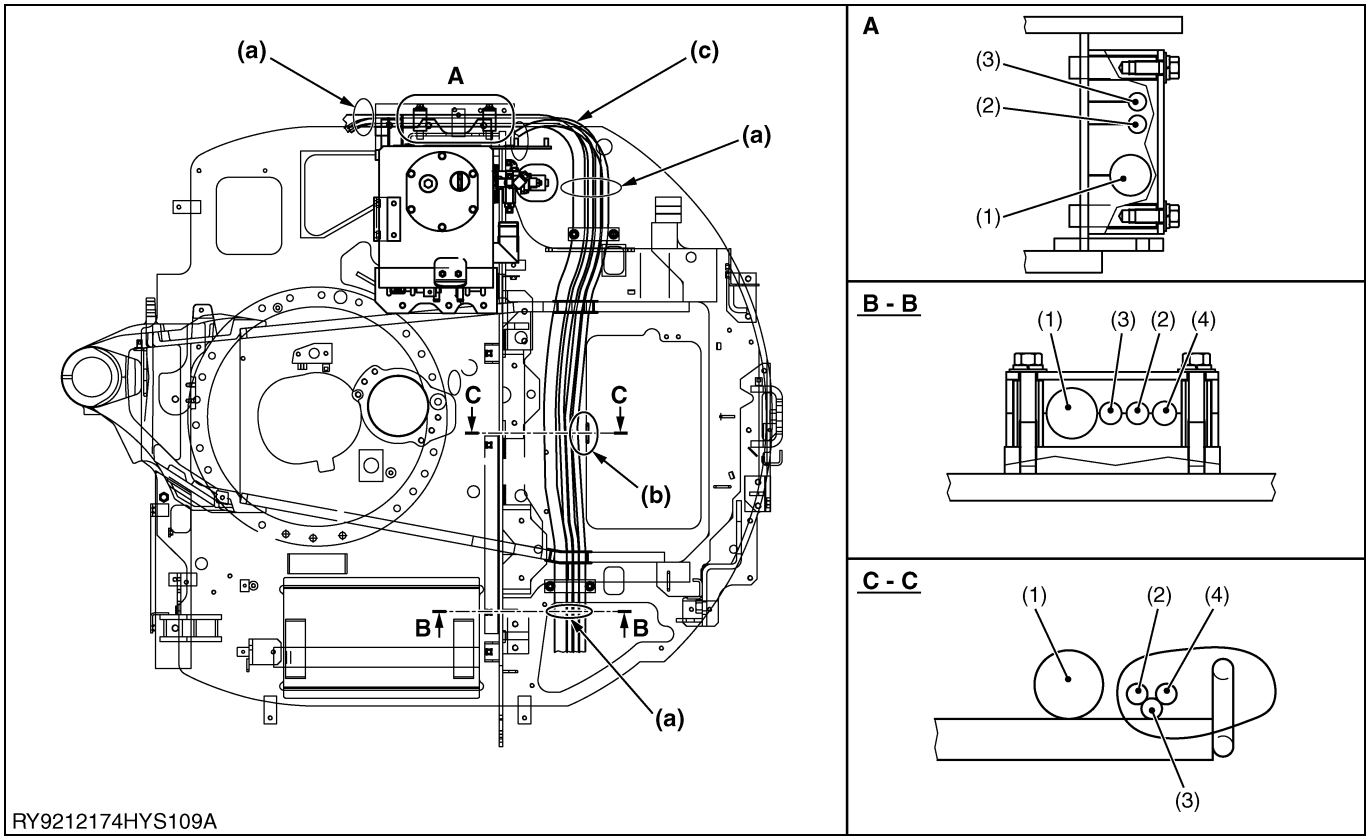
RY9212509HYS005A

(a) Control Valve **(b) Pump** **(c) Do Not Touch the Hose Adapter**

No.	Function	Hose			Fitting		Guard	Point used
		Total length	Tape color	Hose class	Type	Size		
(1)	P1	3100 mm 122.0 in.	Green White	PA2812	C·C	3/4		Pump (P) to C/V (P)
(2)	PPS	2890 mm 113.8 in.	22222222	PFW04	C·C	1/4	Resin spirals	Pump (PPS) to C/V (PPS)
(3)	PLS	2600 mm 102.4 in.	11111111	PFW04	C·C	1/4	Resin spirals	Pump (PLS) to C/V (PLS)

RY9212509HYS0008US0

Delivery Hose Clamp Positions

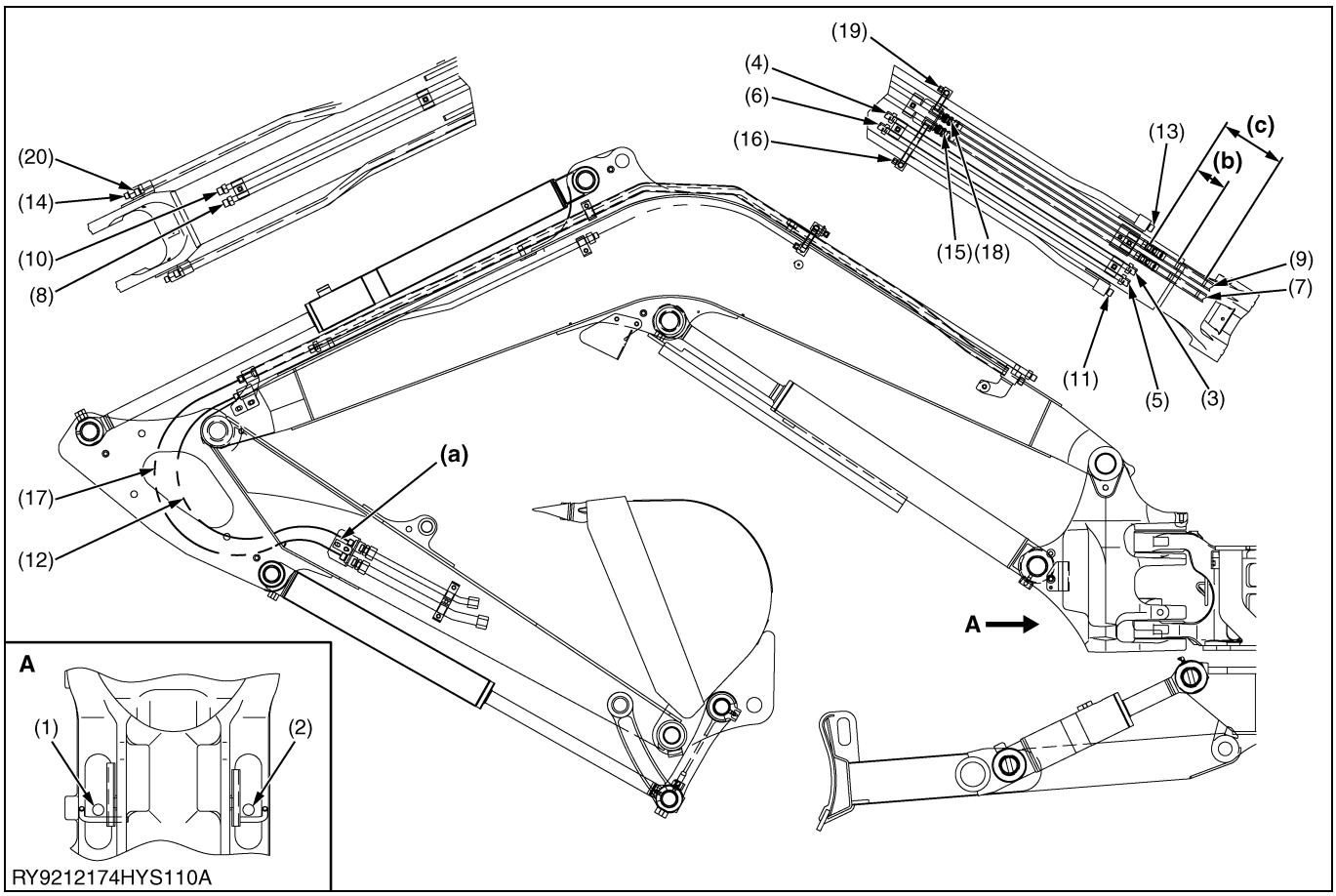


(1) P1
(2) PPS
(3) PLS
(4) Pp

(a) Do not rub against each other.
(b) Pass hoses inside the bar.
(c) Do not touch the weight.

RY9212174HYS0210US0

(2) Front Hose Routing



(a) Plate on arm side

(b) 80 to 120 mm (3.15 to 4.72 in.)

(c) 350 to 400 mm (13.8 to 15.7 in.)

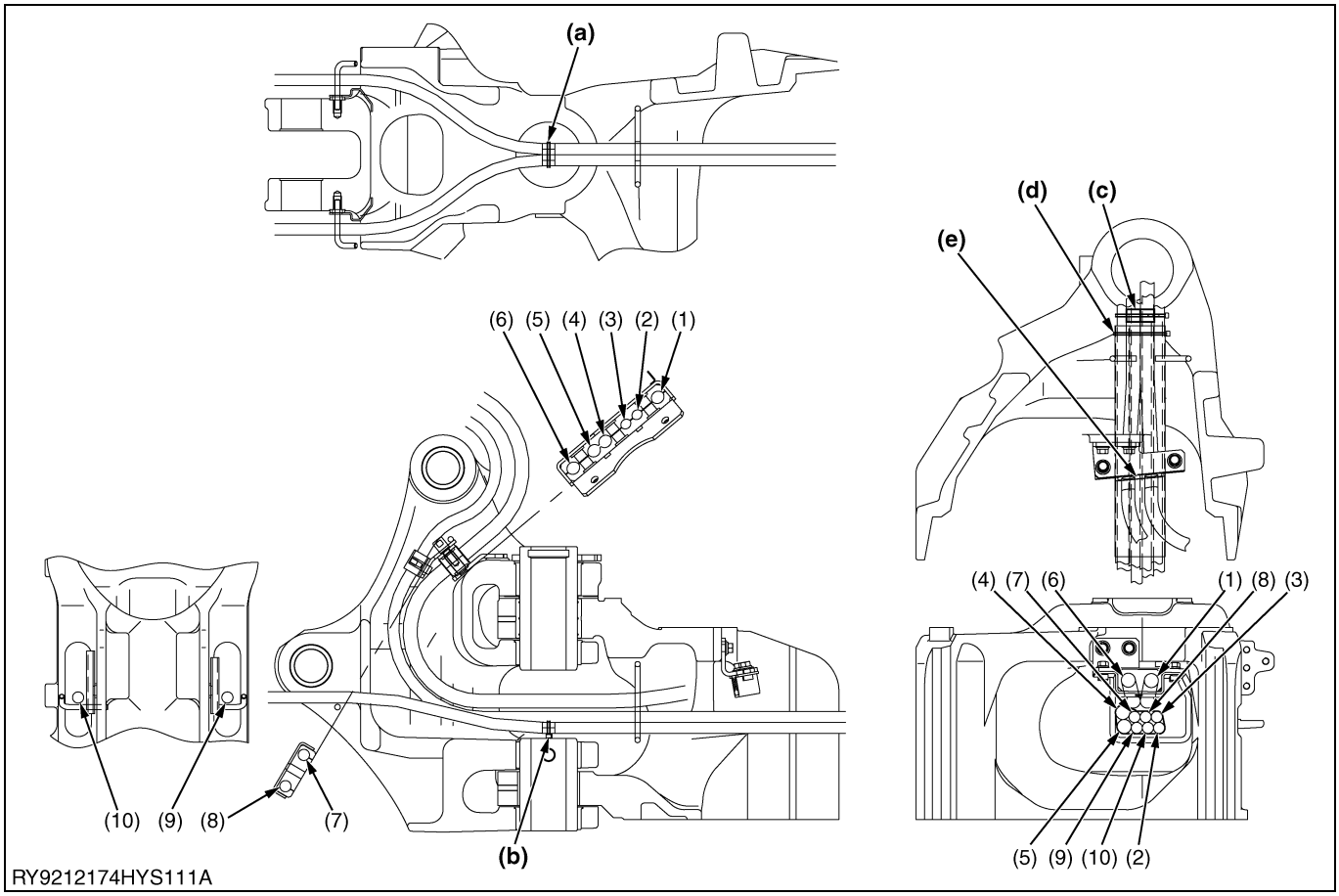
(To be continued)

(Continued)

No.	Function	Hose			Fitting		Guard	Point used
		Total length	Tape color	Hose class	Type	Size		
(1)	Boom up	1880 mm 74.0 in.	Green		C·C	3/8	Resin spirals	C/V (Boom up) to boom cylinder (bottom)
(2)	Boom down	2120 mm 83.5 in.	Yellow		C·C	3/8	Resin spirals	C/V (Boom down) to boom cylinder (rod)
(3)	Arm crowd	1940 mm 76.4 in.	Blue		C·C	1/2	Resin spirals	C/V (arm crowd) to boom back (pipe)
(4)		650 mm 25.6 in.			C·C	1/2		Boom back (pipe) to arm cylinder (bottom)
(5)	Arm dump	1940 mm 76.4 in.	Black		C·C	1/2	Resin spirals	C/V (arm dump) to boom back (pipe)
(6)		1370 mm 53.9 in.			C·C	1/2		Boom back (pipe) to arm cylinder (rod)
(7)	Bucket crowd	1935 mm 76.2 in.	White		C·C	3/8	Resin spirals	C/V (bucket crowd) to boom back (pipe)
(8)		1320 mm 52.0 in.		PFW08	C·C	1/2	Resin spirals	Boom back (pipe) to bucket cylinder (bottom)
(9)	Bucket dump	1900 mm 74.8 in.	Red		C·C	3/8	Resin spirals	C/V (bucket dump) to boom back (pipe)
(10)		1320 mm 52.0 in.		PFW08	C·C	1/2	Resin spirals	Boom back (pipe) to bucket cylinder (rod)
(11)	AUX1 High pressure	1895 mm 74.6 in.	Pink		C·C	1/2	Resin spirals	C/V (AUX1 Hi) to boom back (pipe)
(12)		860 mm 33.9 in.		PF2110	C·C	1/4	Total spring length	Boom back (pipe) to arm plate side (AUX1 Hi)
(13)	AUX1 Low pressure	1985 mm 78.1 in.	Brown		C·C	1/2	Resin spirals	C/V (AUX1 Lo) to boom back (pipe)
(14)		860 mm 33.9 in.		PF2110	C·C	1/4	Total spring length	Boom back (pipe) to arm plate side (AUX1 Lo)
(15)	AUX2 High pressure	2615 mm 103.0 in.	Gray		C·C	3/8	Resin spirals	C/V (AUX2 Hi) to boom back (pipe)
(16)		640 mm 25.2 in.			C·C	3/8		Boom back (pipe) to boom side face (pipe) (Left)
(17)		700 mm 27.6 in.		PF2106	C·C	3/8	Total spring length	Boom back (pipe) (Left) to arm side plate (AUX2 Hi)
(18)	AUX2 Low pressure	2680 mm 105.5 in.	Light blue		C·C	3/8	Resin spirals	C/V (AUX2 Lo) to boom back (pipe)
(19)		640 mm 25.2 in.			C·C	3/8		Boom back (pipe) to boom side face (pipe) (Right)
(20)		700 mm 27.6 in.			C·C	3/8	Total spring length	Boom back (pipe) (Right) to arm side plate (AUX2 Lo)

RY9212172HYS0009US0

Front Hose Clamp Positions



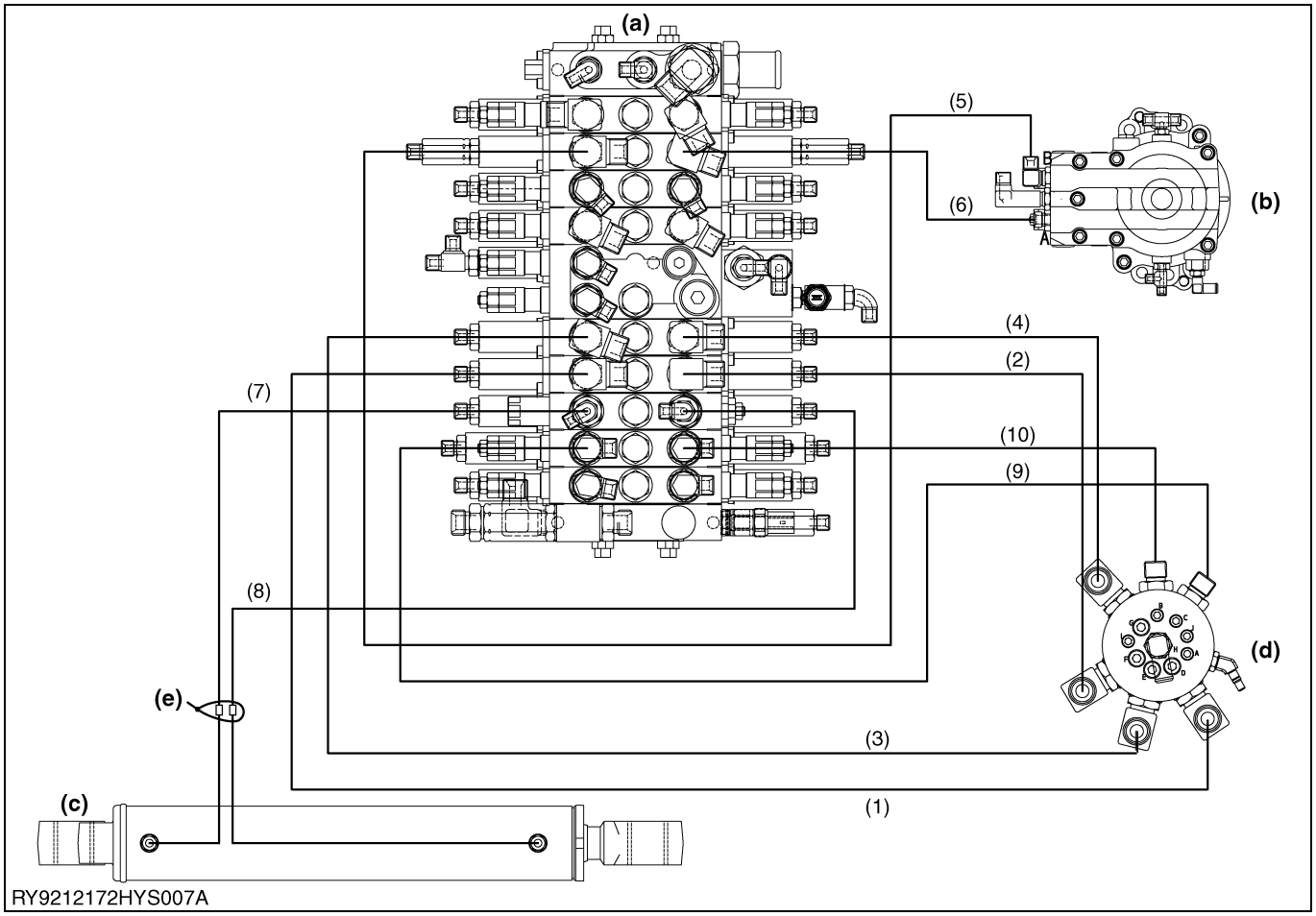
(1) Brown (AUX1 RH)
(2) Red (Bucket dump)
(3) White (Bucket crowd)
(4) Blue (Arm crowd)
(5) Black (Arm dump)
(6) Pink (AUX1 LH)
(7) Gray (AUX2 LH)
(8) Light blue (AUX2 RH)
(9) Yellow (Boom down)
(10) Green (Boom up)

■ **NOTE**

- **(a): Align the position of tapes (green, yellow) and clamp.**
- **(b): Install so the band is on the lower side.**
- **(c): Run the AUX1 hose (pink, brown) on top of the eight hoses below, align the tape position and clamp. Bundle hoses on the right side of the machine.**
- **(d): Align the tape position and clamp each hose (green, yellow, black, blue, red, white, gray, light blue). Bundle hoses on the right side of the machine.**
- **(e): Clamp at the tape position.**

RY9212174HYS0080US0

(3) Travel, Swivel, Blade, Swing and Angle Hose Routing



(a) Control Valve **(b) Swivel Motor** **(c) Swing Cylinder** **(d) Swivel Joint**

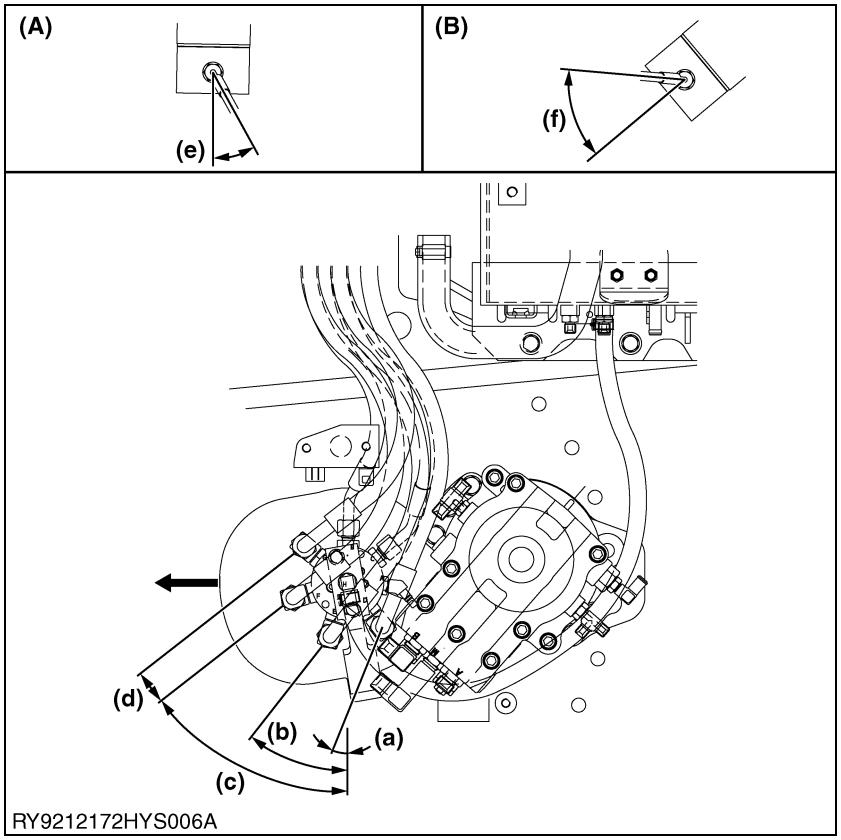
■ **NOTE**

- **(e): Clamp the swing L hose and the swing R hose at the pea green and the orange tape position.**

No.	Function	Hose			Fitting		Point used
		Total length	Tape color	Hose class	Type	Size	
(1)	Travel left forward	730 mm 28.7 in.	Blue	PFW08	C·CR9	1/2	C/V - (Travel L-FWD) to S/J (D)
(2)	Travel left rear	650 mm 25.6 in.	Red	PFW08	C·CR9	1/2	C/V (Travel L-FWD) to S/J (F)
(3)	Travel right forward	770 mm 30.3 in.	Green	PFW08	C·CR9	1/2	C/V (Travel R-FWD) to S/J (E)
(4)	Travel right rear	620 mm 24.4 in.	Yellow	PFW08	C·CR9	1/2	C/V (Travel R-BWD) to S/J (G)
(5)	Swivel left	740 mm 29.1 in.	Gray		C·C	1/2	C/V (Swivel left) to swivel motor (L)
(6)	Swivel right	930 mm 36.6 in.	Light blue		C·CR9	1/2	C/V (Swivel right) to swivel motor (R)
(7)	Swing left	460 mm 18.1 in.	Pea green	PFW04	C·C	1/4	C/V (L) to swing cylinder (bottom)
(8)	Swing right	650 mm 25.6 in.	Orange	PFW04	C·C	1/4	C/V (R) to swing cylinder (rod)
(9)	Blade up	560 mm 22.0 in.	Pink	PFW06	C·CR4	3/8	C/V (Blade up) to S/J (C)
(10)	Blade down	620 mm 24.4 in.	Brown	PFW06	C·CR4	3/8	C/V (Blade down) to S/J (B)

RY9212172HYS0010US0

(4) Swivel and Rotary Joint Hose Routing



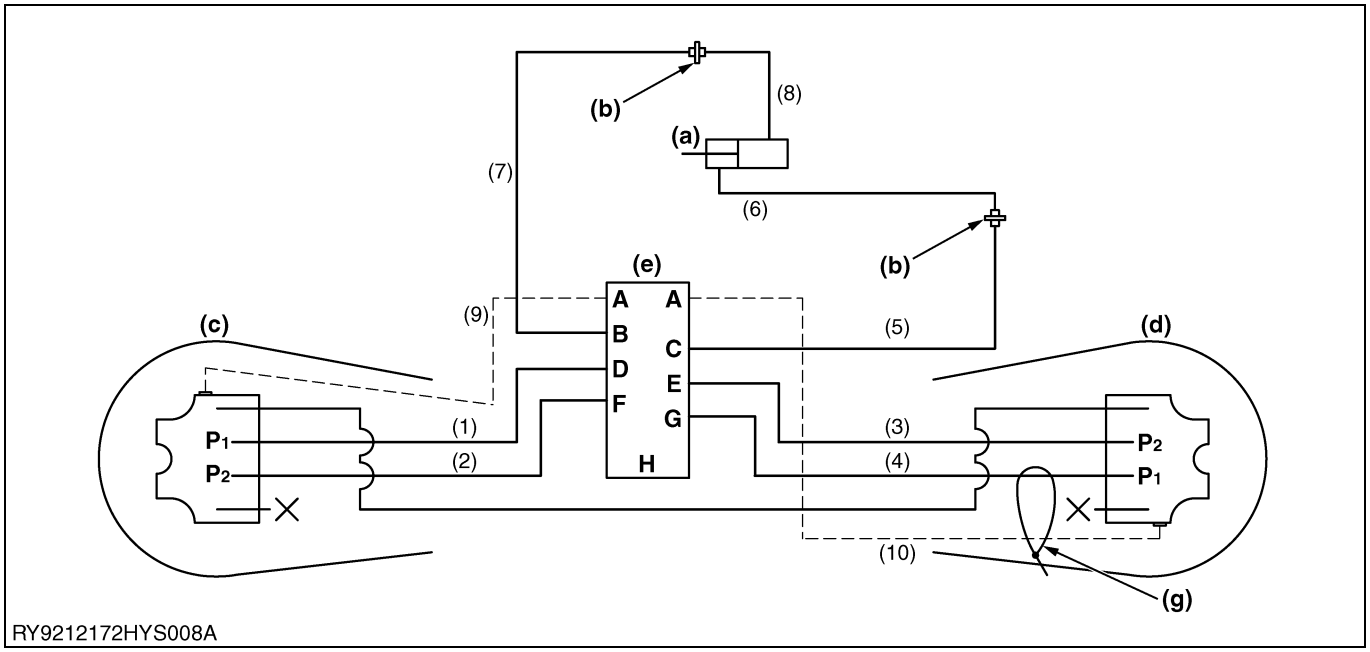
RY9212172HYS006A

(A) S/J Port B Hose Angle
(B) S/J Port C Hose Angle

(a) 22° (0.38 rad)
(b) 38° (0.66 rad)
(c) 52° (0.91 rad)
(d) Parallel
(e) 30° (0.52 rad)
(f) 45° (0.79 rad)

RY9212172HYS0011US0

(5) Undercarriage Hose Routing



(a) Blade Cylinder **(c) Travel Motor LH** **(d) Travel Motor RH** **(e) Swivel Joint**
(b) Blade Bulkhead Fitting

■ **NOTE**

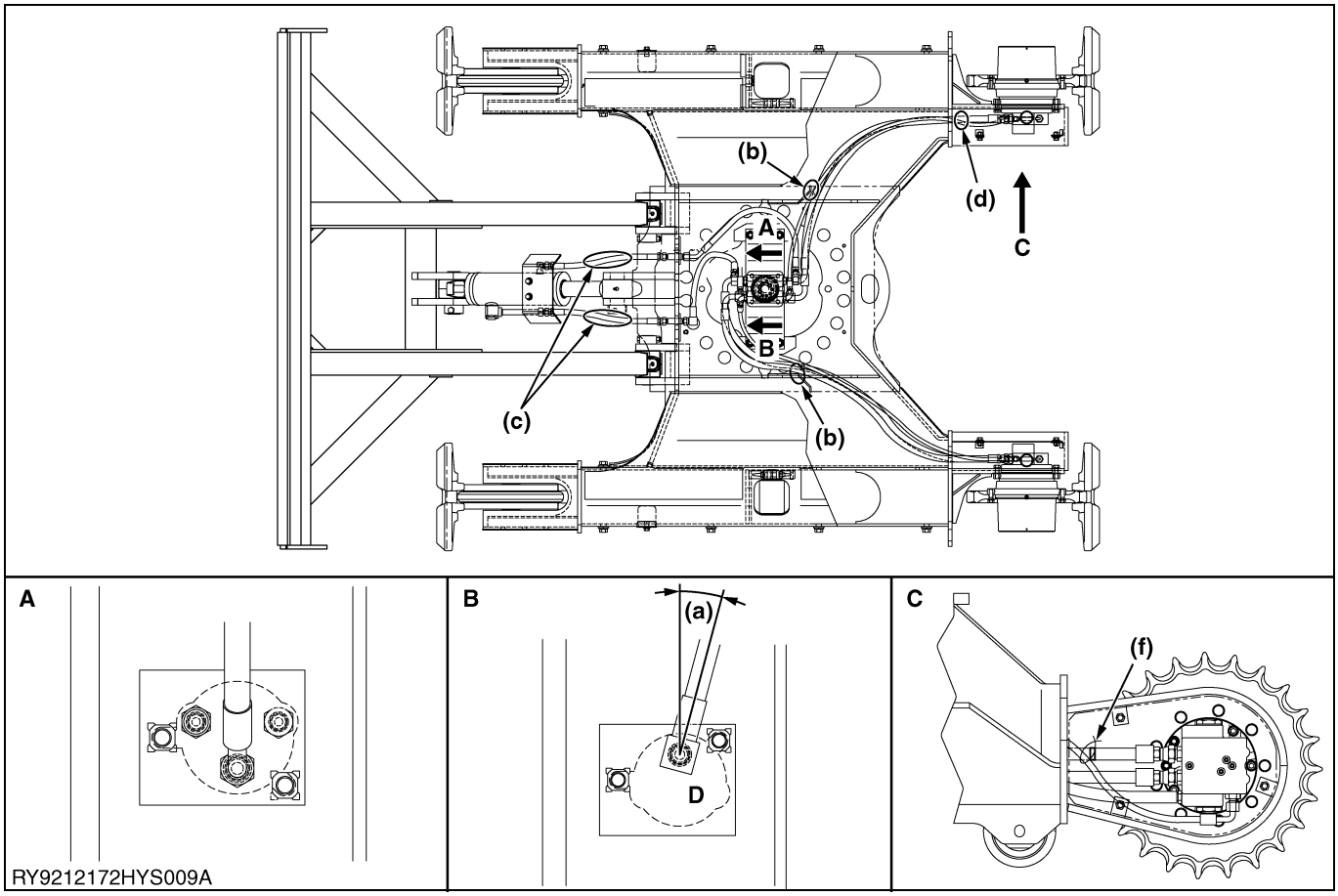
- **(g): Clamp the 2nd speed switch hose and the P1 hose. (right motor only) Must not touch the track frame.**

No.	Function	Hose			Fitting		Guard	Point used
		Total length	Tape color	Hose class	Type	Size		
(1)	Travel left forward	1200 mm 47.2 in.	Blue	PFW08	CR9·C	G1/2	PVC tube	S/J (D) to travel motor (left fwd)
(2)	Travel left rear	1200 mm 47.2 in.		PFW08	CR9·C	G1/2	PVC tube	S/J (F) to travel motor (left backward)
(3)	Travel right forward	1060 mm 41.7 in.	Green	PFW08	CR9·C	G1/2	PVC tube	S/J (E) to travel motor (right fwd)
(4)	Travel right rear	1060 mm 41.7 in.		PFW08	CR9·C	G1/2	PVC tube	S/J (G) to travel motor (right backward)
(5)	Blade up	585 mm 23.0 in.		PFW06	CR4·C	G3/8		S/J (C) to blade joint
(6)		465 mm 18.3 in.		PFW06	CR4·C	G3/8	Total spring length	Blade joint to blade cylinder (rod)
(7)	Blade down	420 mm 16.5 in.		PFW06	C·CR9	G3/8		S/J (B) to blade joint
(8)		465 mm 18.3 in.		PFW06	CR4·C	G3/8	Total spring length	Blade joint to blade cylinder (bottom)
(9)	Drain	1180 mm 46.5 in.		OKE08	–	–	Plastic tube	S/J (H) to travel motor (left drain)
(10)		1030 mm 40.6 in.		OKE08	–	–	Plastic tube	S/J (H) to travel motor (right drain)

RY9212172HYS0012US0

(6) Hose Routing Inside the Track Frame

Front Hose Clamp Positions



(a) 15° (0.26 rad)

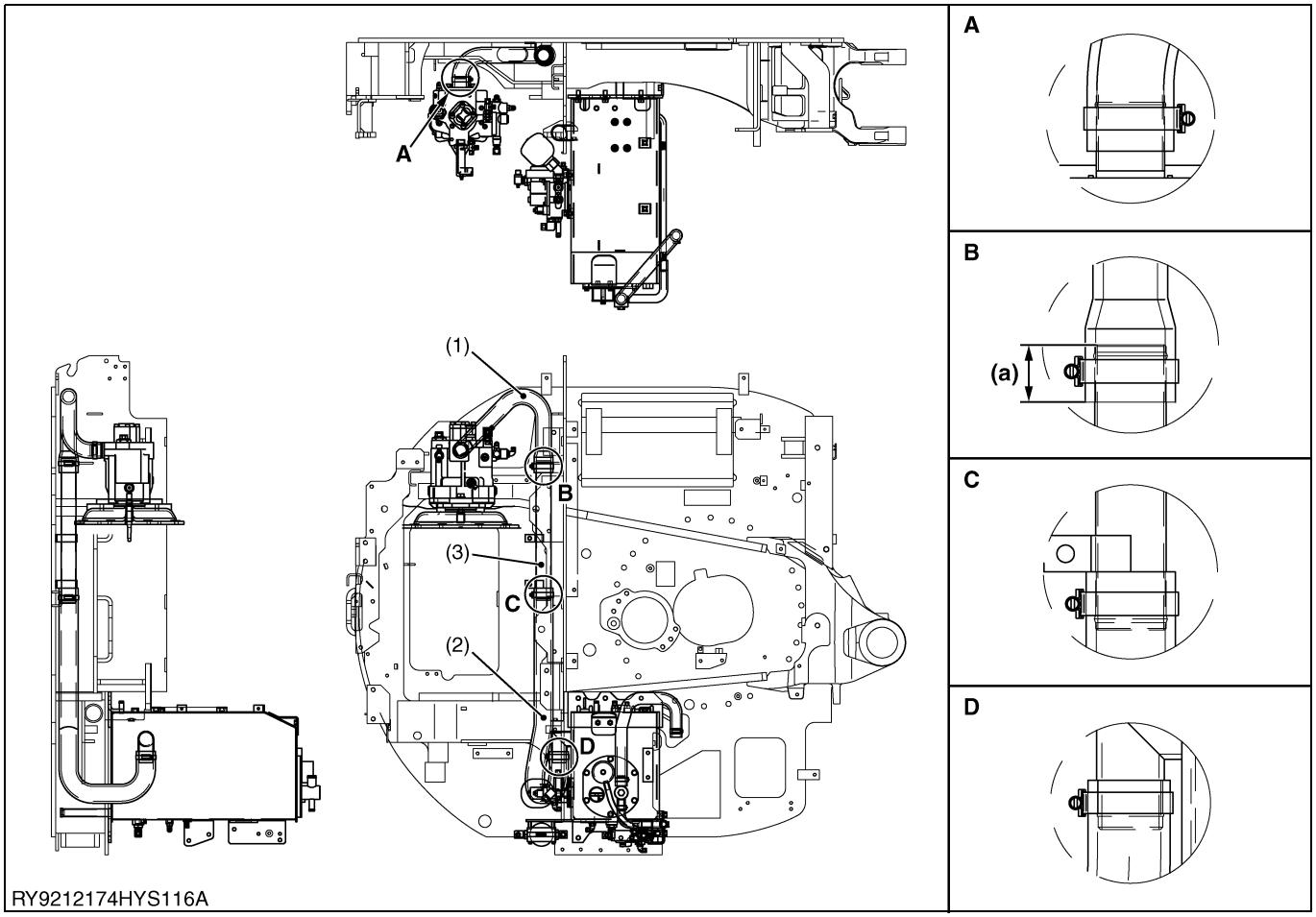
■ **NOTE**

- **(b): Hoses not to have strong contact with the track frame.**
- **(c): Install the hoses so the flex crease of the hoses at point A face to the outside.**
- **(d): Use speed clamps near where the ID tape is.**

RY9212172HYS0013US0

[3] LOW-PRESSURE HOSES

(1) Suction Pipe and Hose Routing



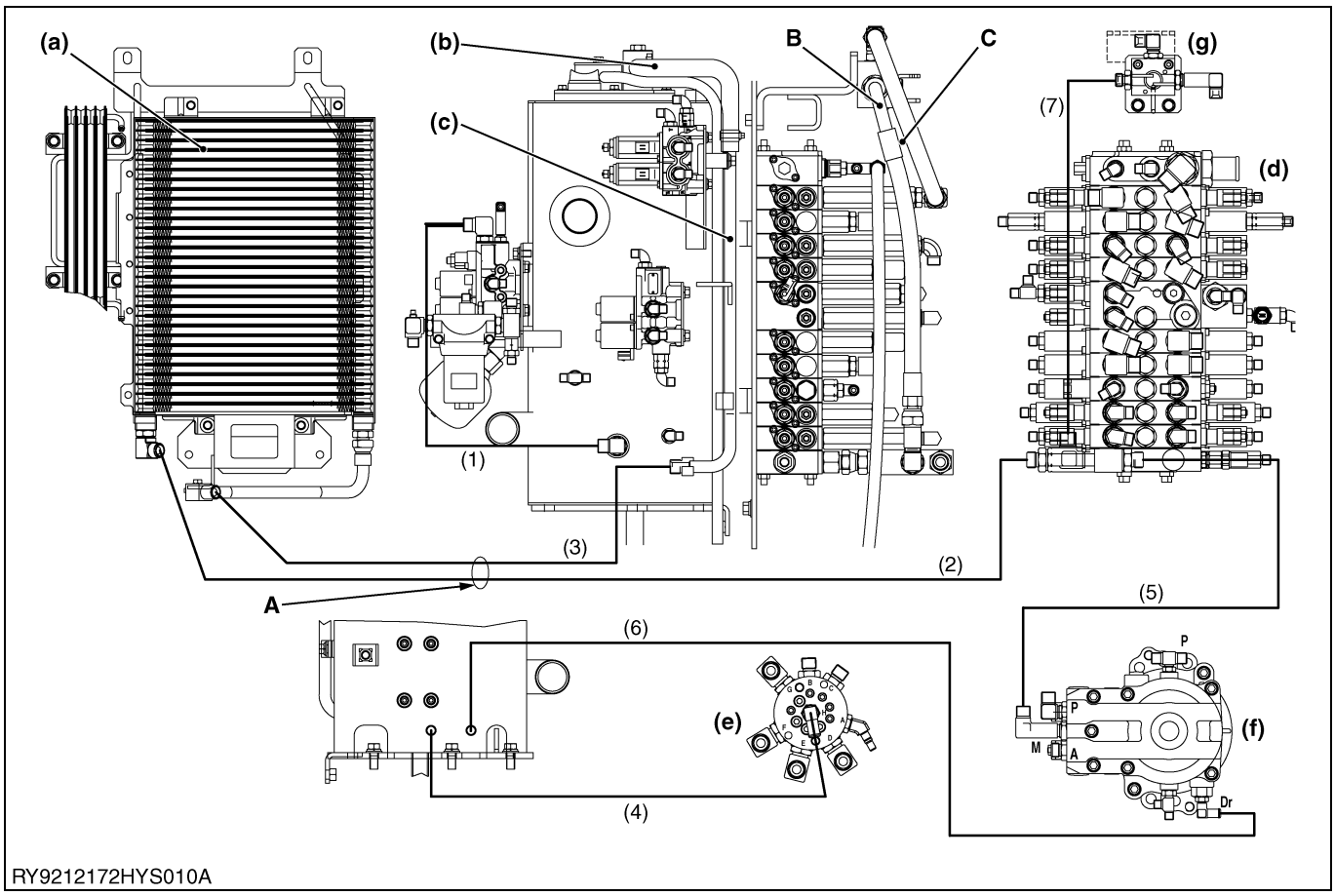
RY9212174HYS116A

(1) Suction hose 1 (2) Suction hose 2 (3) Suction pipe **(a) 40 mm (1.57 in.)**

No.	Function	Point used
(1)	Suction	Pump to suction pipe
(2)		Oil tank to suction pipe

RY9212174HYS0082US0

(2) Drain Hose Routing



RY9212172HYS010A

(a) Oil cooler
(b) Return hose
(c) Return pipe
(d) Control Valve
(e) Swivel joint
(f) Swivel motor
(g) Third line Valve

■ **NOTE**

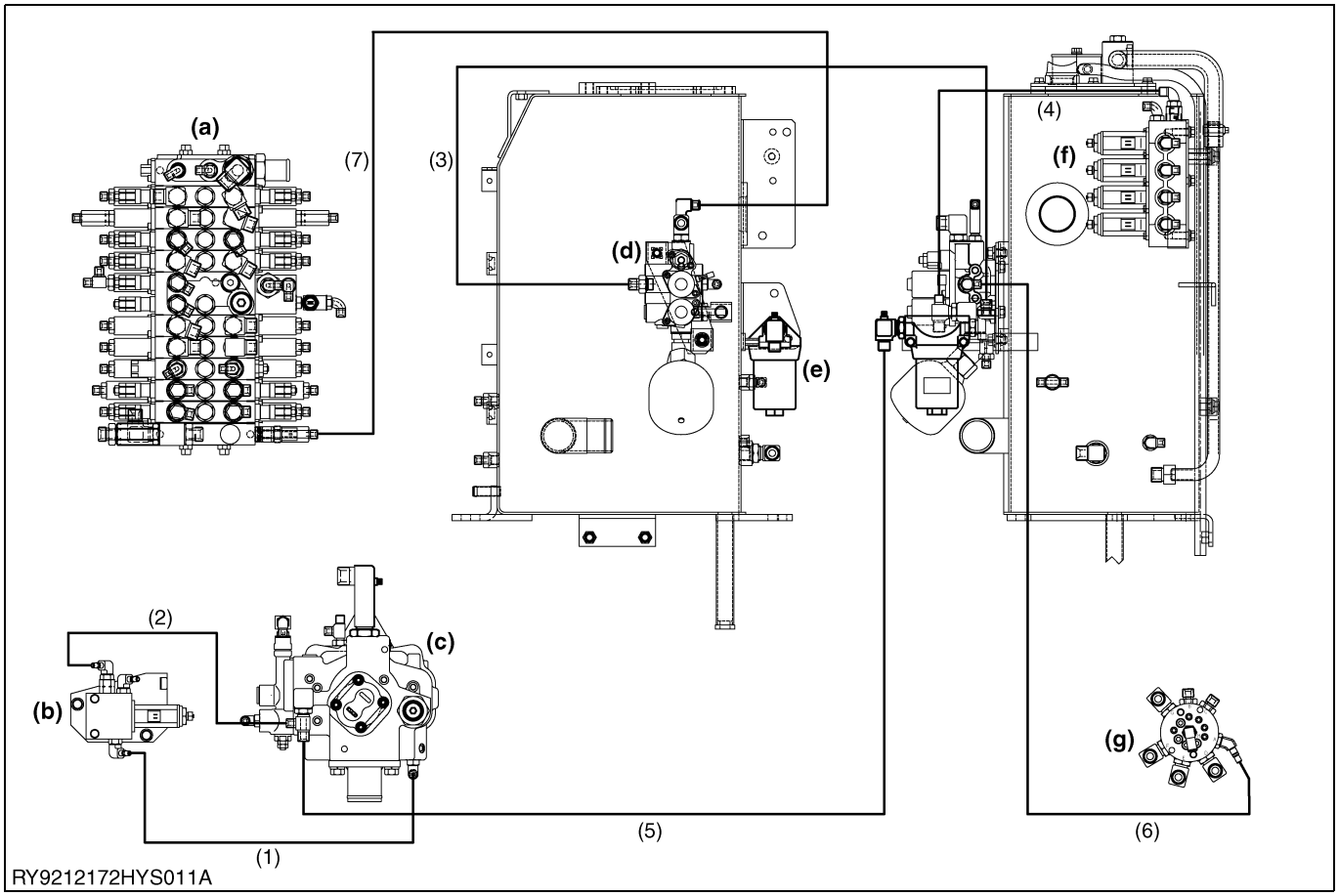
- **A: Hang on the arch rod.**
- **B: Install the hoses don't have kinks.**
- **C: Mount the hoses don't touch each other.**

No.	Function	Hose		Fitting		Guard	Point used	Specifications
		Total length	Hose class	Type	Size			
(1)	Drain	520 mm 20.5 in.	PF0708	CR9·C	G1/2		Unload valve (T) to O/T	
(2)		1060 mm 41.7 in.	PA0310	CR9·C	G1/2		C/V (T3) to O/C	
(3)		600 mm 23.6 in.	PA0310	CR4·C	G1/2		O/C to return pipe	
(4)		950 mm 37.4 in.	OKE08	–	–		O/T to S/J (H)	
(5)		630 mm 24.8 in.	PA0310	CR4·C	G1/2	PVC tube	Swivel motor (make-up) to C/V (T2)	
(6)		360 mm 14.2 in.	OKE08	–	–		O/T to swivel motor (drain)	
(7)		475 mm 18.7 in.	PA0310	CR4·C	G1/2		Third line valve (B) to C/V (T3)	

RY9212172HYS0014US0

[4] PILOT HOSES

(1) Port P Hose Routing (1/2)

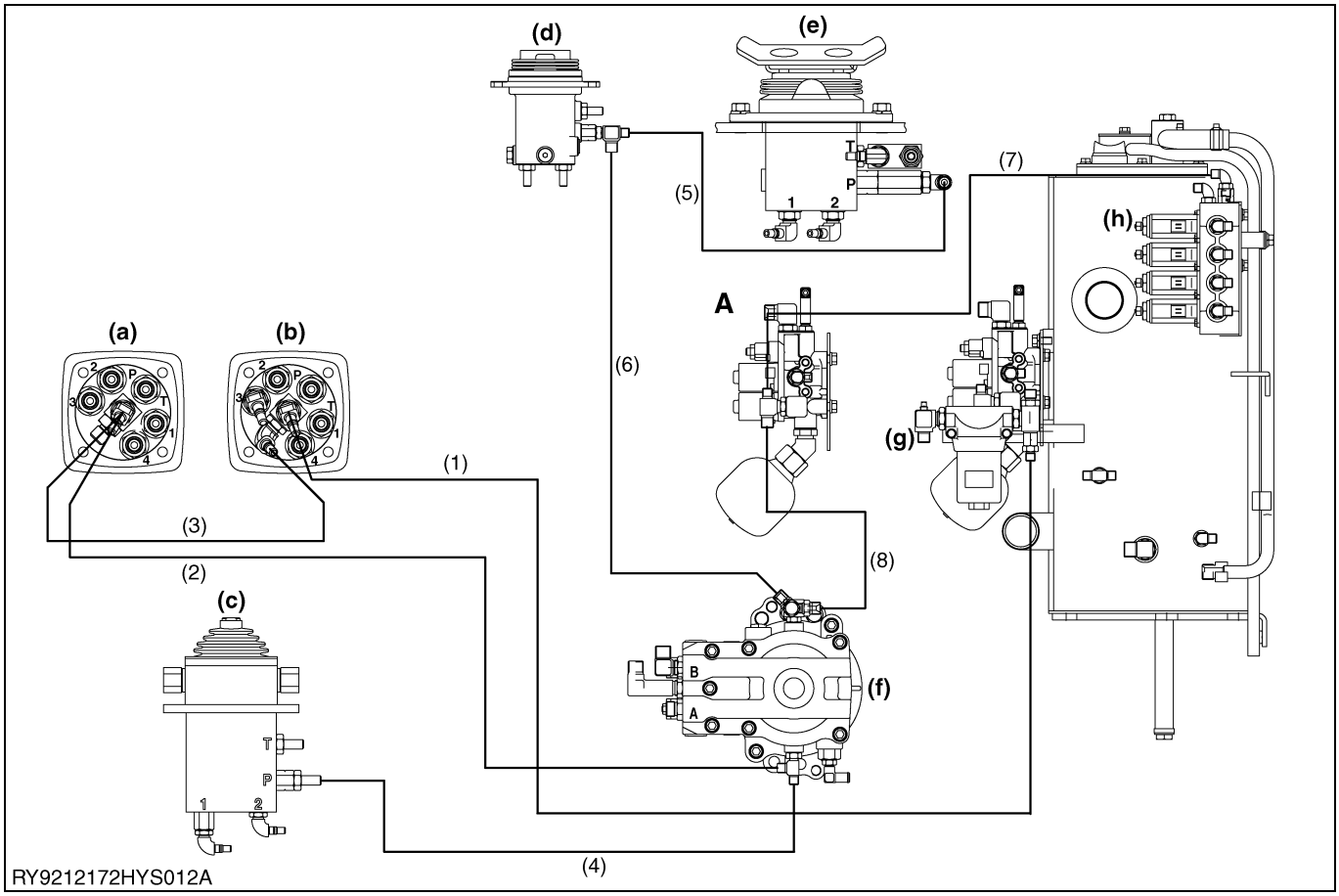


(a) Control Valve
(b) EP Mode Solenoid Valve
(c) Pump
(d) Unload Valve
(e) Line Filter
(f) AUX1,2 Solenoid Valve
(g) Swivel Joint

No.	Function	Hose			Fitting		Guard	Point used
		Total length	Tape color	Hose class	Type	Size		
(1)	Flow control	380 mm 15.0 in.	AAAA AAAA		CR9·Q	G1/4·Q		Pump (Pi) to EP mode solenoid
(2)	EP mode SOL P	290 mm 11.4 in.	PPPP PPPP		CR9·Q	G1/4·Q		Pump (Pp) to EP mode solenoid (P)
(3)	Unload valve P	440 mm 17.3 in.		PLT06	CR9·C	G3/8		Line filter to unload valve (P)
(4)	AUX1,2 solenoid valve	520 mm 20.5 in.			C·C	G1/4		Unload valve (B) to AUX1,2 solenoid valve (P)
(5)	PP delivery	1820 mm 71.7 in.	33333333	PLT06	C·C	G3/8	Resin spirals	Pump (Pp) to line filter
(6)	Travel 2nd speed	2710 mm 106.7 in.			CR9·Q	G1/4·Q		Unload valve (A) to R/J travel 2nd speed
(7)	Signal circuit (AUX1, 2 spec.)	1520 mm 59.8 in.	White * 2		CR9·C	G1/4		C/V (Pp1) to unload valve (P)

RY9212172HYS0015US0

(2) Port P Hose Routing (2/2)

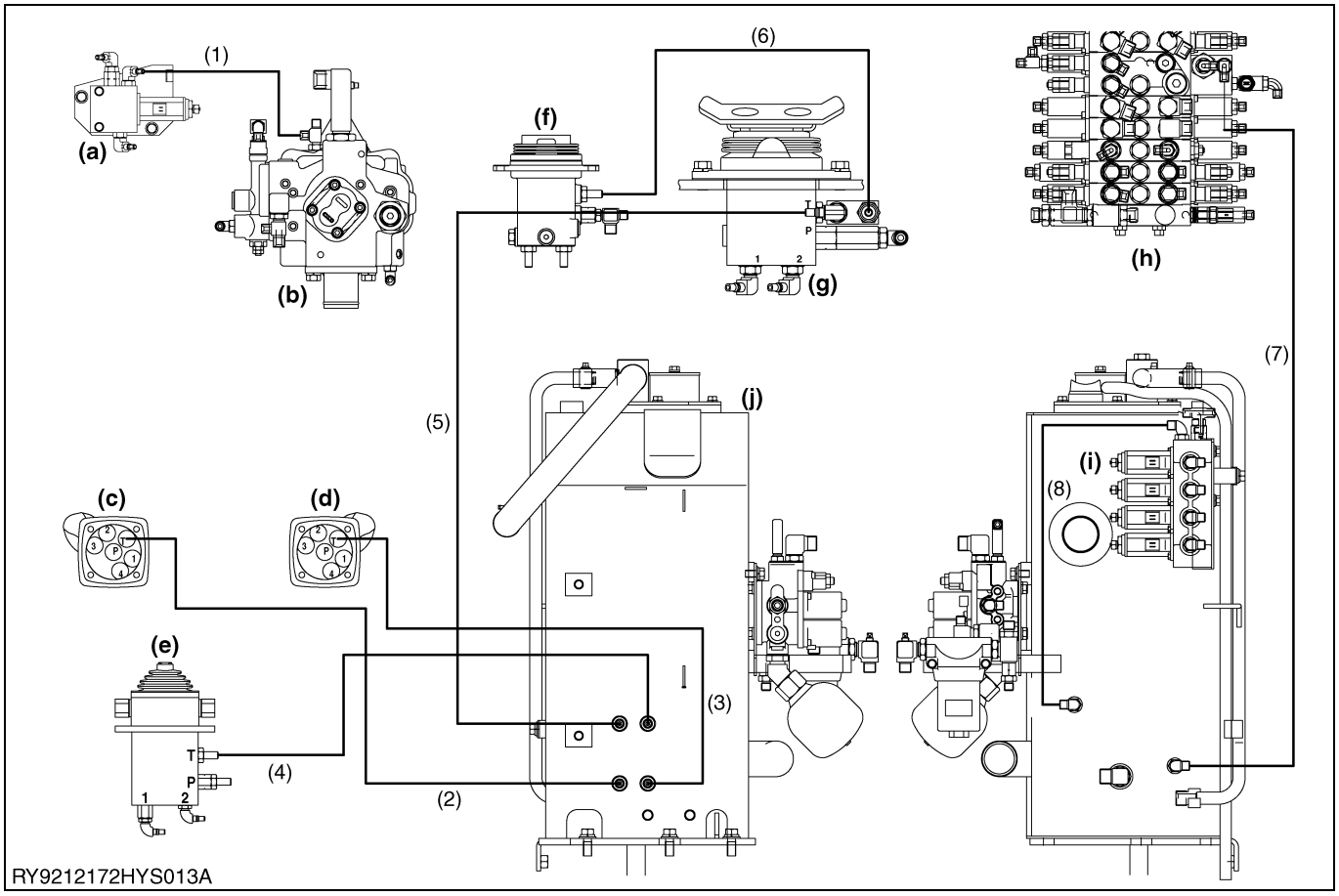


(a) Control P/V Left
(b) Control P/V Right
(c) Blade P/V
(d) Travel P/V
(e) Swing P/V
(f) Swivel Motor
(g) Line Filter
(h) AUX1,2 Solenoid Valve
A : Unload Valve Hose Routing

No.	Function	Hose			Fitting		Guard	Point used
		Total length	Tape color	Hose class	Type	Size		
(1)	Heat up	2880 mm 113.4 in.	44444444		CR4·Q	G1/4·Q		Line filter to P/V (Right) (P)
(2)	Control left P	1540 mm 60.6 in.	White		CR9·Q	G1/4·Q		Swivel motor to P/V (left) (P)
(3)	Control right P	1100 mm 43.3 in.			CR9·Q	G1/4·Q		P/V (left) (P) to P/V (right) (P)
(4)	Blade P	690 mm 27.2 in.	22222222		CR9·Q	G1/4·Q		Swivel motor to blade P/V (P)
(5)	Dump P	620 mm 24.4 in.	TR-P		CR9·C	G1/4		Swing P/V (P) to travel P/V (P)
(6)	Travel P	600 mm 23.6 in.			CR9·C	G3/8	Total length resin spirals	Travel P/V (P) to swivel motor (P)
(7)	AUX1,2 solenoid valve	520 mm 20.5 in.			C·C	G1/4		Unload valve (B) to AUX1,2 solenoid valve (P)
(8)	Swivel brake release	2000 mm 78.7 in.	White	PLT06	CR4·C	G3/8		Unload valve (B) to swivel motor brake

RY9212172HYS0016US0

(3) Port T Hose Routing

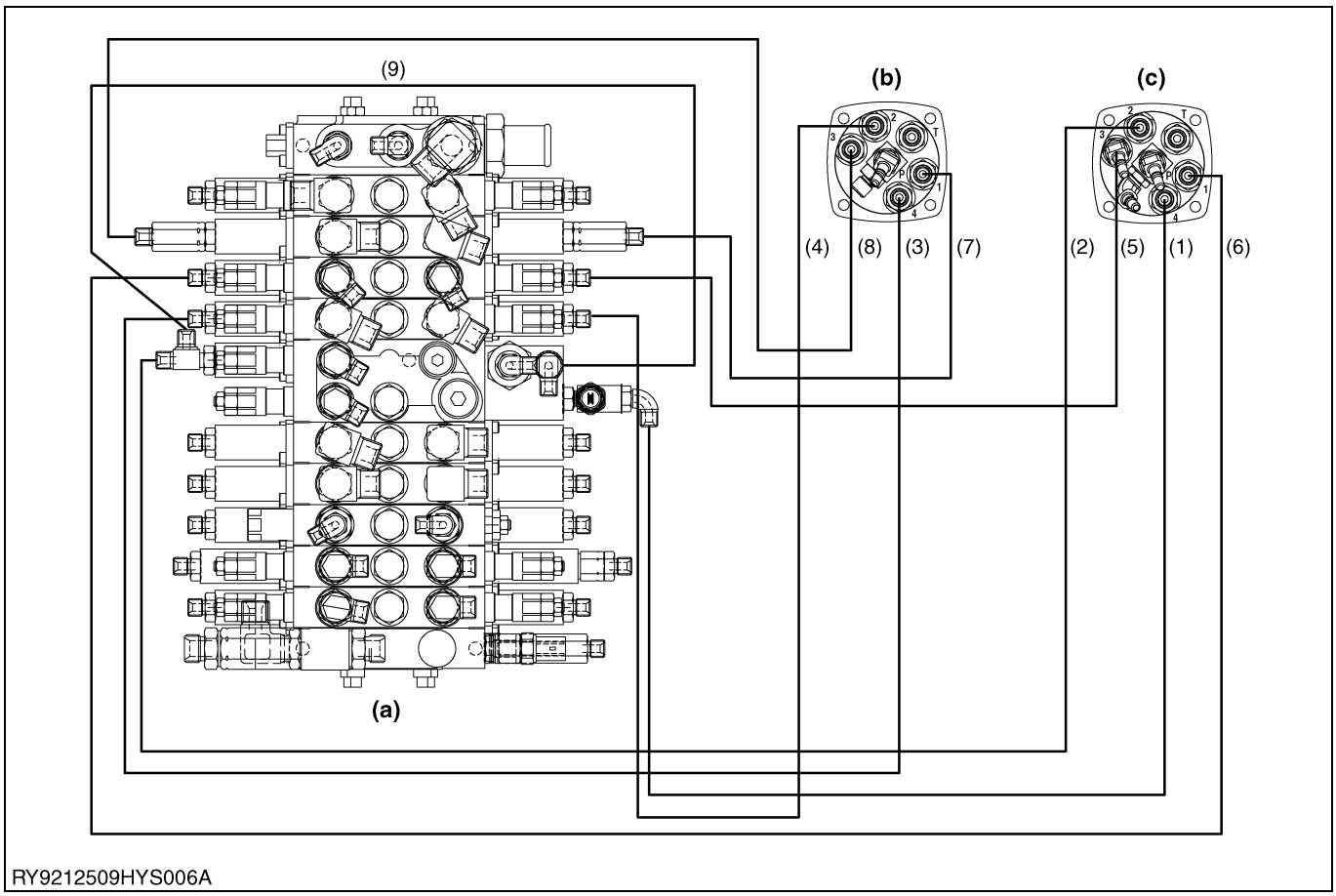


(a) EP Mode Solenoid Valve
(b) Pump
(c) Control P/V Left
(d) Control P/V Right
(e) Blade P/V
(f) Travel P/V
(g) Swing P/V
(h) Control Valve
(i) AUX Solenoid Valve
(j) Oil Tank

No.	Function	Hose		Fitting		Point used
		Total length	Tape color	Type	Size	
(1)	Drain	330mm 13.0 in.	TTTTTTTT	C·Q	G1/4·Q	Pump (air bleed) to EP mode solenoid (T)
(2)		1850 mm 72.8 in.	White	C·Q	G1/4·Q	O/T left down to P/V (left) (T)
(3)		1300 mm 51.2 in.	White	C·Q	G1/4·Q	O/T right down to P/V (right) (T)
(4)		1210 mm 47.6 in.	White	CR4·Q	G1/4·Q	O/T right up to blade P/V (T)
(5)		1350 mm 53.1 in.	Pea green Orange	CR4·Q	G1/4·Q	O/T left up to swing P/V (T)
(6)		620 mm 24.4 in.	TR-T	CR9·Q	G1/4·Q	Swing P/V (T) to travel P/V (T)
(7)		1240 mm 48.8 in.	BM-T White	CR9·C	G1/4	C/V (Dr) to O/T
(8)		530 mm 20.9 in.	AX1-T	CR9·C	G1/4	O/T to AUX1,2 solenoid valve (T)

RY9212172HYS0017US0

(4) Pilot Valve Hose Routing (1/2)



(a) Control Valve **(b) Control P/V Left** **(c) Control P/V Right**

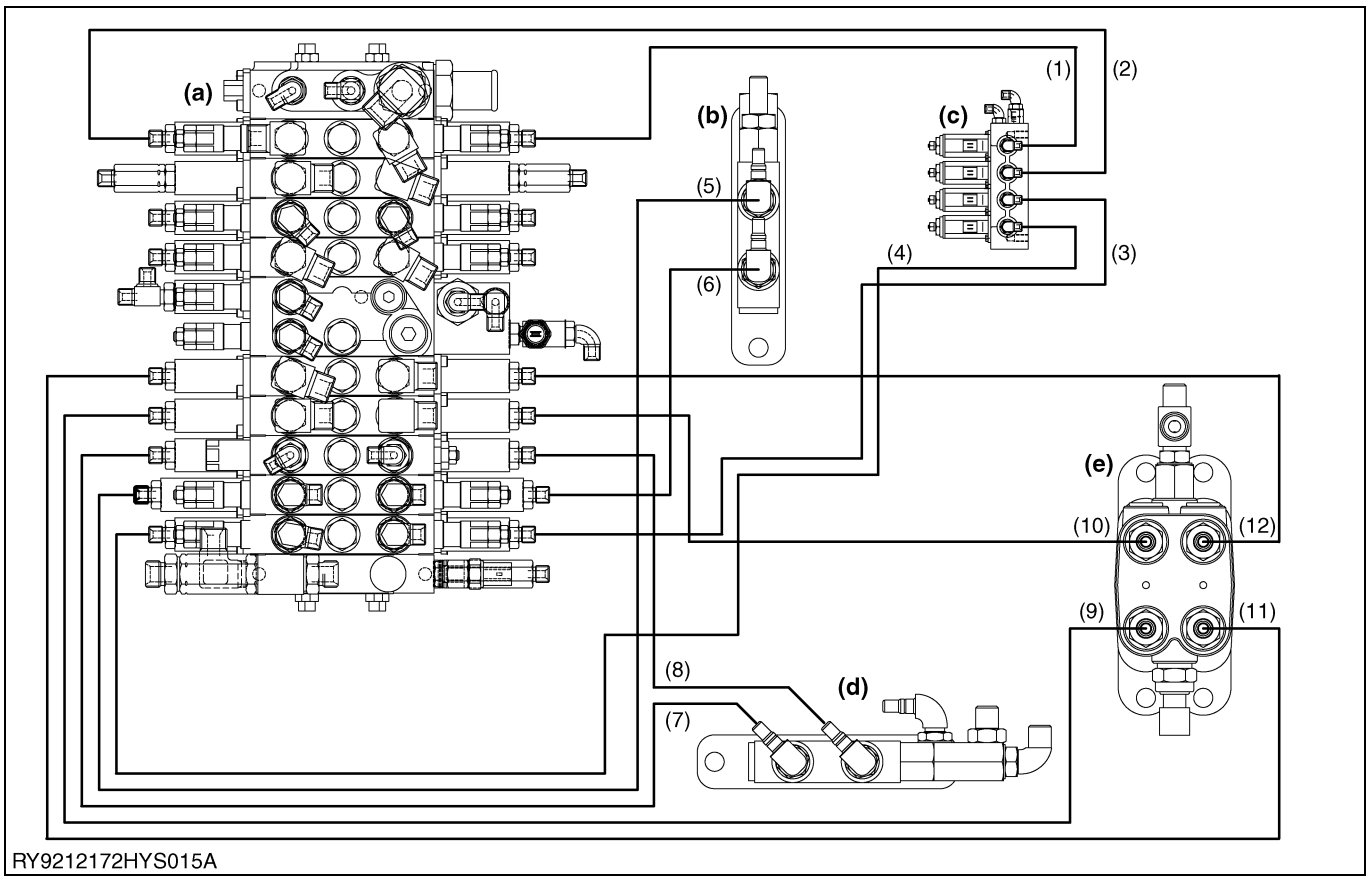
(To be continued)

(Continued)

No.	Function	Hose		Fitting		Point used
		Total length	Tape color	Type	Size	
(1)	Boom up	1410 mm 55.51 in.	Green	C·Q	G1/4·Q	C/V (Boom up) to P/V (Boom up)
(2)	Boom down	2540 mm 100.0 in.	Yellow	CR9·Q	G1/4·Q	C/V (Boom down) to P/V (Boom down)
(3)	Arm dump	2190 mm 86.22 in.	Black White Black	CR9·Q	G1/4·Q	C/V (arm dump) to P/V (arm dump)
(4)	Arm crowd	3080 mm 121.3 in.	Blue	CR9·Q	G1/4·Q	C/V (arm crowd) to P/V (arm crowd)
(5)	Bucket dump	1485 mm 58.5 in.	Red	CR9·Q	G1/4·Q	C/V (bucket dump) to P/V (bucket dump)
(6)	Bucket crowd	2435 mm 95.9 in.	White	CR9·Q	G1/4·Q	C/V (bucket crowd) to P/V (bucket crowd)
(7)	Swivel left	2195 mm 86.4 in.	Gray	CR9·Q	G1/4·Q	C/V (Swivel left) to P/V (swivel left)
(8)	Swivel right	3020 mm 118.9 in.	Light blue	CR9·Q	G1/4·Q	C/V (Swivel right) to P/V (swivel right)
(9)	Boom lock release	645 mm 25.4 in.	White	CR9·C	G1/4	C/V (Pi) to C/V (boom lock valve)

RY9212509HYS0009US0

(5) Pilot Valve Hose Routing (2/2)



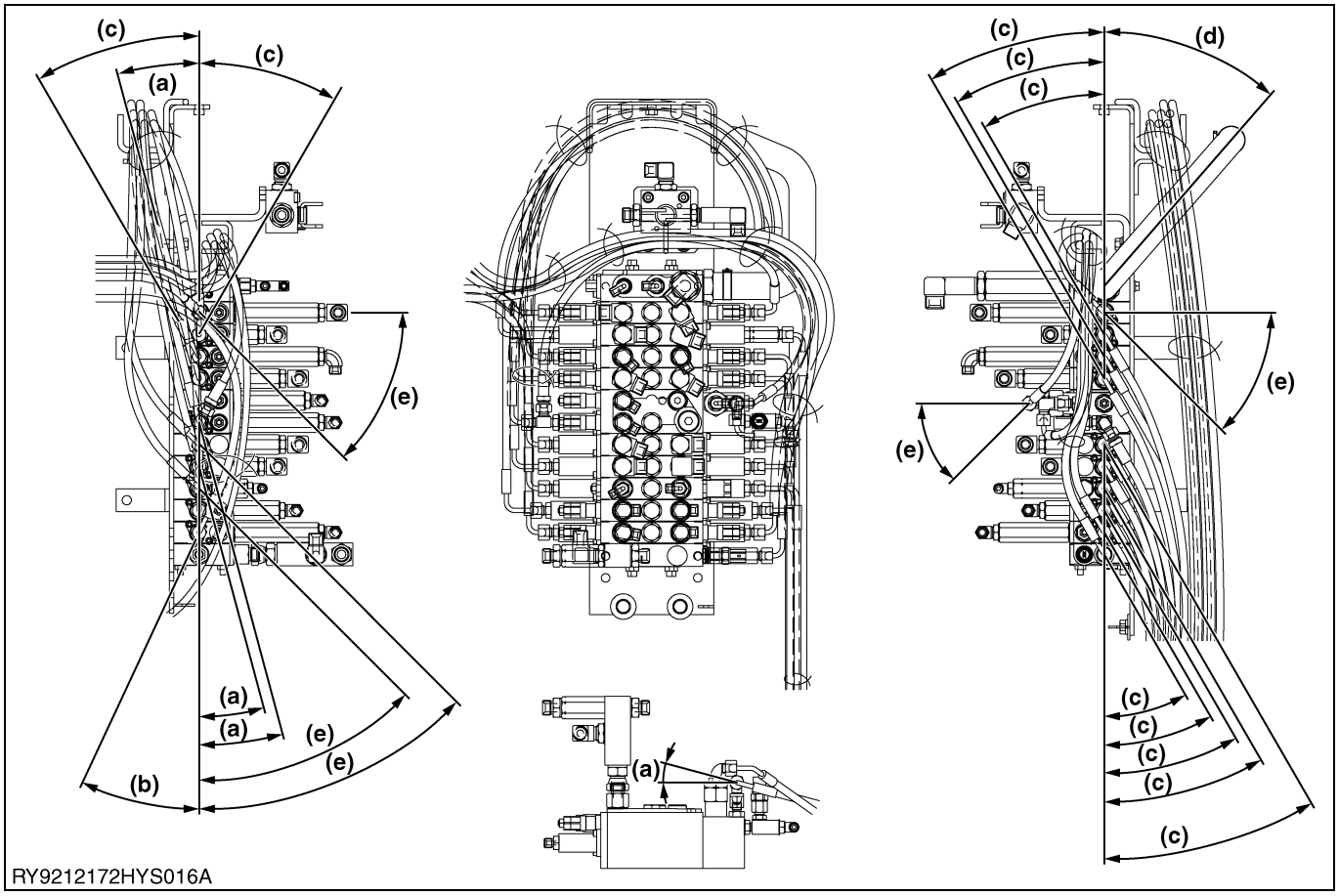
RY9212172HYS015A

(a) Control Valve **(c) AUX Solenoid Valve** **(d) Swing P/V** **(e) Travel P/V**
(b) Blade P/V

No.	Function	Hose		Fitting		Point used
		Total length	Tape color	Type	Size	
(1)	AUX1 LH pressure	670 mm 26.4 in.	Pink	CR9·C	G1/4	C/V (AUX1 Hi) to 4-way P/V (A1)
(2)	AUX1 RH pressure	260 mm 10.2 in.	Brown	CR4·C	G1/4	C/V (AUX1 Lo) to 4-way P/V (A2)
(3)	AUX2 LH pressure	1000 mm 39.4 in.	Gray	CR9·C	G1/4	C/V (AUX2 Hi) to 4-way P/V (A3)
(4)	AUX2 RH pressure	500 mm 19.7 in.	Light blue	CR9·C	G1/4	C/V (AUX2 Lo) to 4-way P/V (A4)
(5)	Blade up	1160 mm 45.7 in.	Pink	CR9·Q	G1/4·Q	C/V (blade up) to blade P/V (up)
(6)	Blade down	2460 mm 96.9 in.	Brown	CR9·Q	G1/4·Q	C/V (blade down) to blade P/V (down)
(7)	Swing left	2540 mm 100.0 in.	Pea green	CR9·Q	G1/4·Q	C/V (swing left) to swing P/V (left)
(8)	Swing right	1300 mm 51.2 in.	Orange	CR9·Q	G1/4·Q	C/V (swing right) to swing P/V (right)
(9)	Travel left forward	2660 mm 104.7 in.	Blue	CR9·Q	G1/4·Q	C/V (travel L fwd) to travel P/V (L fwd)
(10)	Travel left rear	1440 mm 56.7 in.	Red	CR9·Q	G1/4·Q	C/V (travel L bwd) to travel P/V (L bwd)
(11)	Travel right forward	2580 mm 101.6 in.	Green	CR9·Q	G1/4·Q	C/V (travel R fwd) to travel P/V (R fwd)
(12)	Travel right rear	1480 mm 58.3 in.	Yellow	CR9·Q	G1/4·Q	C/V (travel R bwd) to travel P/V (R bwd)

RY9212172HYS0019US0

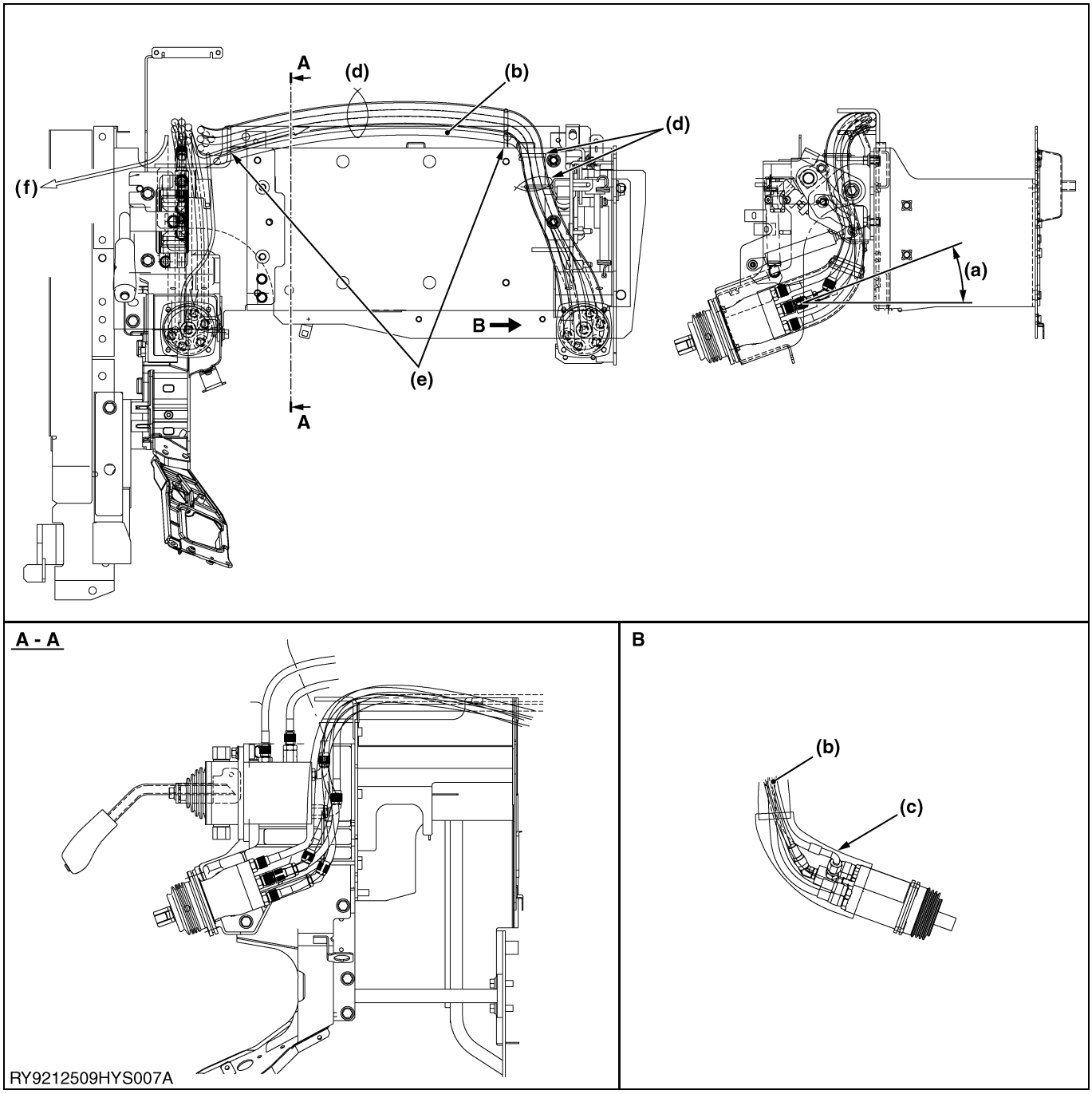
(6) Pilot Valve Hose Routing (Control Valves)



(a) 15° (0.26 rad) **(c) 30° (0.52 rad)** **(d) 41° (0.72 rad)** **(e) 45° (0.79 rad)**
(b) 25° (0.44 rad)

RY9212172HYS0020US0

(7) Pilot Valve Hose Routing (Around the Driver's Seat)



(a) 20 ° (0.35 rad)

■ **NOTE**
- **(b): Install hoses out of the cover.**
- **(c): Cover all hoses.**
- **(d): Clamp with a speed clamp.**
- **(e): Hook the bundle of pilot hoses on the guide (Round rod) and Pass it through.**
- **(f): To oil tank and control valve**

RY9212509HYS0010US0

10. MEASURING HYDRAULIC DEVICE PERFORMANCE

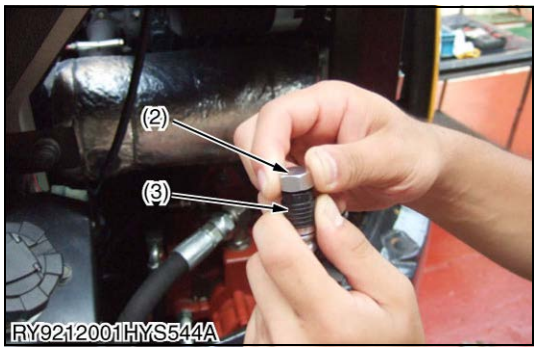
[1] PISTON PUMP AIR BLEEDING PROCEDURE

Purpose

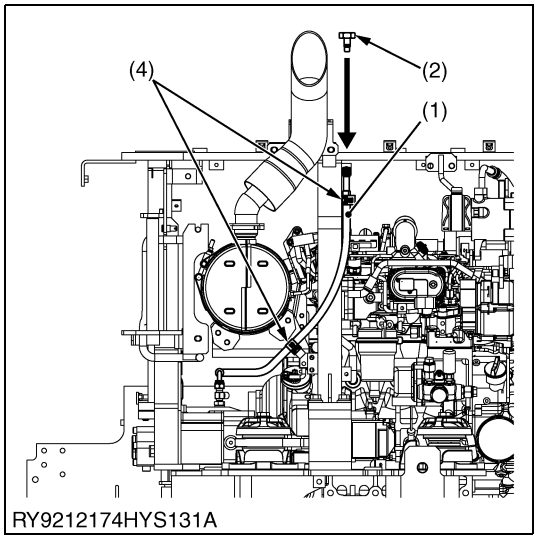
- When disassembling or replacing hydraulic equipment and/or hoses, etc., after changing the hydraulic fluid and using the vacuum pump, and before operating the machine, always air bleed the pump to prevent pump scorching or cavitation.

RY9212148HYS0310US0









Work Tip

To prevent cavitation, never relieve pressure during air bleeding.

1. With the engine stopped, remove the hose at the top of the pump from its clamp.
2. Press the hexagonal plug and the black plastic lock section as well. Then hold the black plastic lock section and pull out the hexagonal plug.
3. Drape the hose on the front of the weight, and leave for 30 seconds.
4. Fit a hexagonal plug to the hose, start and idle the engine, and check whether there is any cavitation noise from the pump.
5. Repeat operations 2, 3 and 4 until pump cavitation noise subsides.
6. When cavitation noise subsides, raise the engine speed to 1500 rpm, slowly operate the arm and check whether any cavitation noise is produced.
7. If there is no cavitation noise, raise the engine speed to 2000 rpm, slowly operate the arm, and check again for cavitation noise. If cavitation noise is produced, stop the engine and carry out steps 2 and 3.
8. Take the engine to max RPM, slowly operate the arm and check for cavitation noise. If cavitation noise is produced, stop the engine and carry out steps 2 and 3.
9. Clamp the air bleed hose in its original position.

(1) Air Bleed Hose
(2) Hexagonal Plug
(3) Lock Section
(4) Clamp

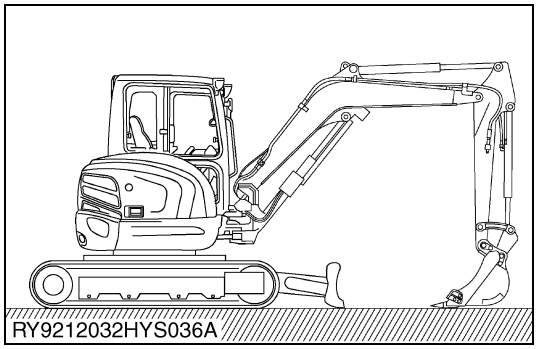
RY9212174HYS0224US0

[2] RELEASE OF RESIDUAL PRESSURE IN THE HYDRAULIC SYSTEM

Purpose

- It is necessary to release the pressure in the hydraulic system when removing/mounting hydraulic devices and as preparation for taking measurements. Always release the pressure in such cases.

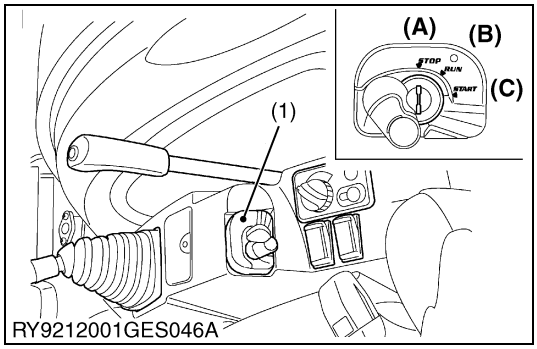
RY9212148HYS0311US0


RY9212032HYS036A

Hydraulic System Pressure Release Procedure

1. Place the machine on firm, level ground, lower the bucket and blade to ground level, and stop the engine.

RY9212032HYS0060US0



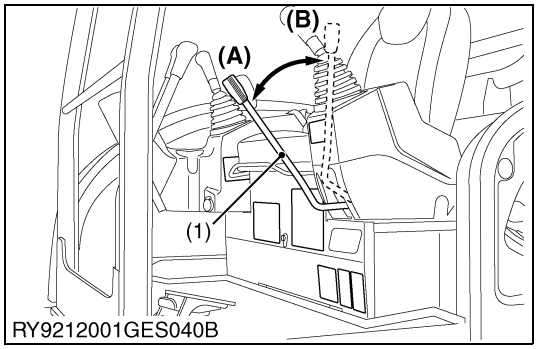
RY9212001GES046A

2. Without starting the engine, place the engine starter switch in the "RUN" **(B)** position.

(1) Starter Switch

(A) STOP
(B) RUN
(C) START

RY9212001HYS0648US0



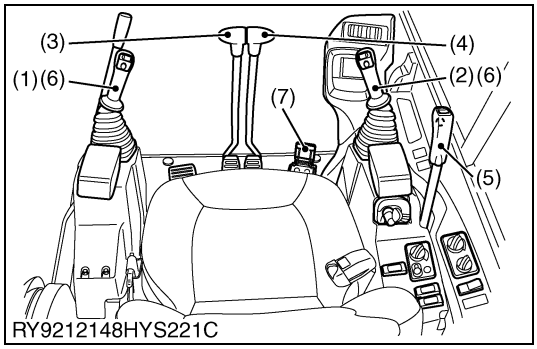
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3. Place the machine lock lever in the release position.

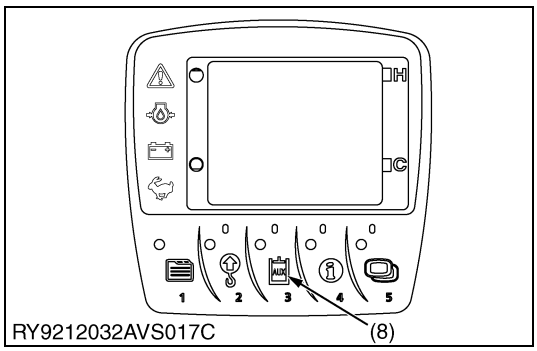
(1) Machine Lock Lever

(A) Release
(B) Lock

RY9212001HYS0649US0



RY9212148HYS221C



RY9212032AVS017C

4. Operate each control lever for the boom, arm, bucket and swivel to full stroke.
5. Operate each of the travel levers, blade levers and swing pedals switches to full stroke.
6. Use the AUX enable switch to turn the AUX ports ON and then operate each of the AUX port knob switches full stroke.
7. Place the machine's lock lever in the "Lock" position, and the engine starter switch to the "STOP" position.
8. Loosen the filler port on top of the hydraulic oil tank one half to a full turn to relieve pressure.

(1) Left Machine Control Lever
(2) Right Machine Control Lever
(3) Travel Lever Left
(4) Travel Lever Right
(5) Blade Control Lever
(6) AUX Port Knob Switch
(7) Swing Pedal
(8) AUX Enable Switch

RY9212172HYS0022US0

[3] MANUAL BOOM LOWERING PROCEDURE

Purpose

- This procedure is used in cases where the accumulator stops working and you have an urgent need to lower the boom.

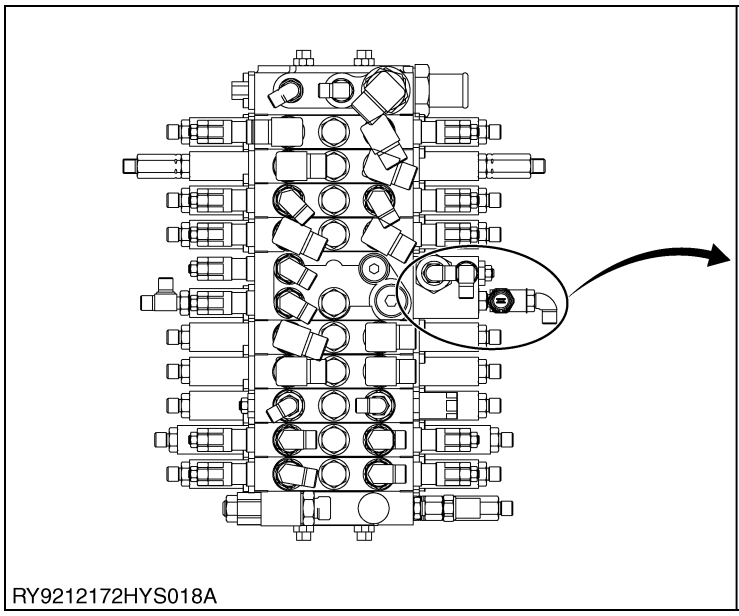
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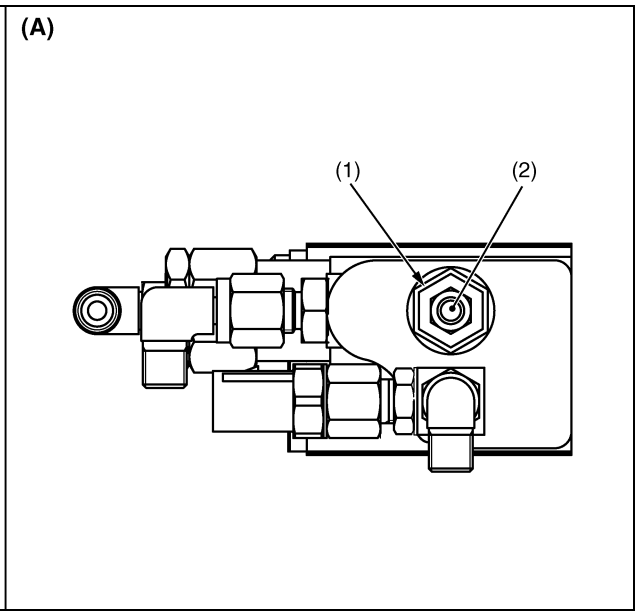
Work Procedure

1. With the engine stopped, loosen the shut-off valve nut on the boom lock valve.
2. Loosen the boom lock valve screw 45 degrees (0.79 rad).

CAUTION
- **Never get under the boom.**
- **After lowering the boom, be sure to retighten the screw and nut to their original positions.**

■ **NOTE**
- The screw can not be loosened completely.
  Even if loosen the boom lock valve screw, Hydraulic oil will not leak to the outside of valve.


RY9212172HYS018A



(1) Nut (2) Screw **(A) Boom Lock Valve**

RY9212172HYS0023US0

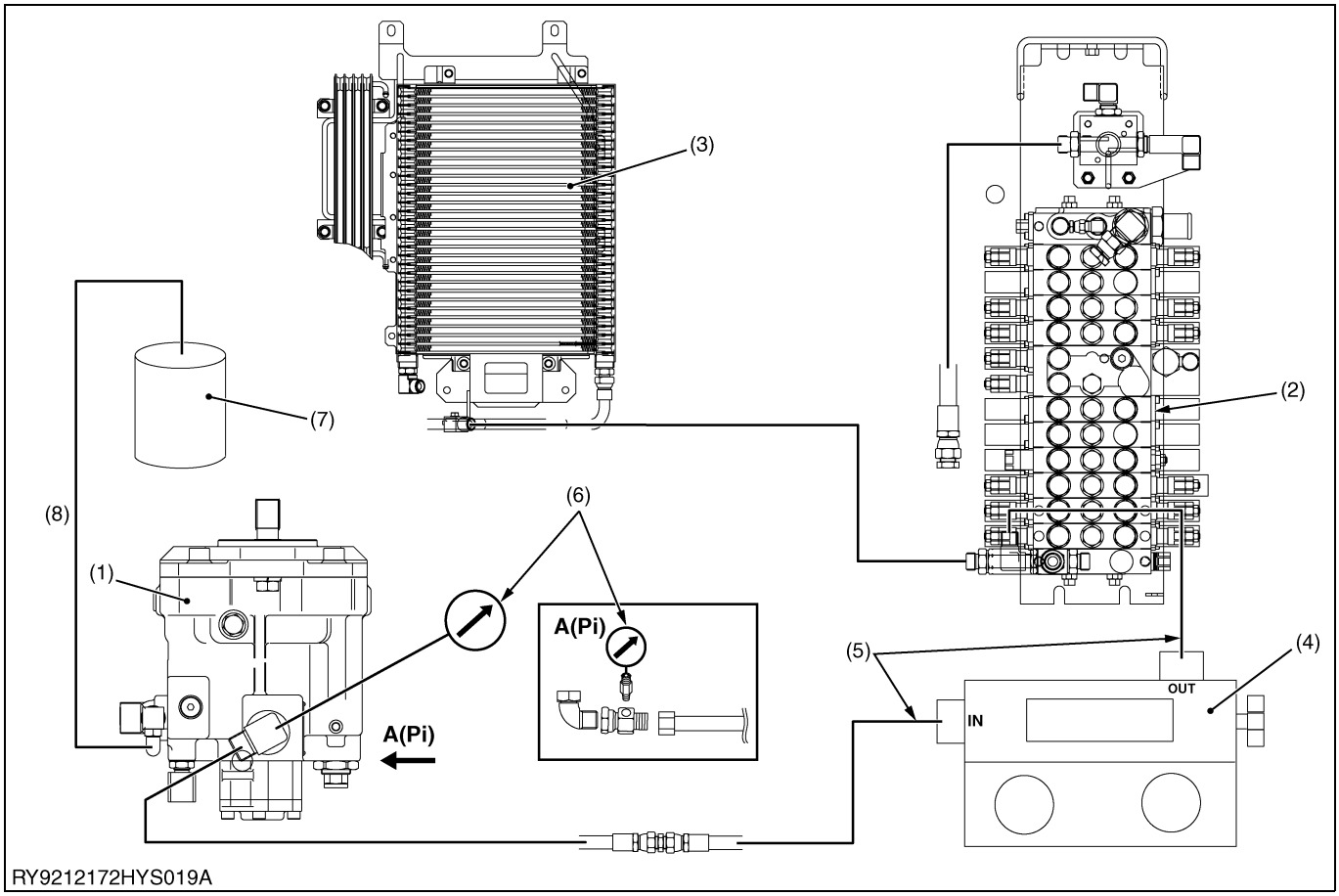
[4] MEASURING THE FLOW RATE

(1) Measuring Main Pump Flow

Purpose

- Measuring the amount of oil discharged from the main pump allows an assessment of its performance.
- If the discharge volume is lower than the factory specification, something may be wrong with the main pump or the engine.

RY9212148HYS0312US0



RY9212172HYS019A

(1) Pump
(2) Control Valve
(3) Oil Cooler
(4) Flow Meter
(5) Test Hose
(6) Pressure Gauge
(7) Oil Receptacle
(8) Pps Hose

RY9212172HYS0024US0

[Measurement preparations]

1. Place the machine on flat hard ground, lower the bucket and the blade, and stop the engine.
2. Follow the chapter Releasing Pressure in the Hydraulic System and release pressure in the hydraulic lines.
3. Use the vacuum pump and attach a pressure gauge to the pressure test port and the Pi port.
4. Disconnect the control valve side of the delivery hose and plug port P of the control valve.
5. Connect the delivery hose to the test hose and connect the flow meter on the IN side.
6. Disconnect the hose that connects the 2-way valve and the control valve (T2) on the control valve (T2) side and plug the disconnected hose.
7. Disconnect the Pps hose from control valve and plug it. Collect the drain oil from LS controler in a drain tray.
8. Use a test hose to connect the control valve (T2) and the OUT side of the flow meter.
9. Remove the vacuum pump.
10. Bleed air from the pump and make sure there are not any oil leaks in any of the lines.

RY9212174HYS0238US0

[Measurement]
1. Open the loading valve of the flow meter all the way and start the engine.
2. Bring the hydraulic oil temperature to 50 ± 5 °C (122 ± 9 °F).
3. Position each of the switches as follows.

Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
Max RPM	P mode	OFF	OFF

4. Gradually close the flow meter's loading valve until it reaches the main LS relief pressure, then measure the oil flow and engine RPM at each pressure.
5. Take three measurements of the oil flow, determine the average and take that as the measured value.
6. Convert the measured value to what it would be with the engine at its rated RPM.

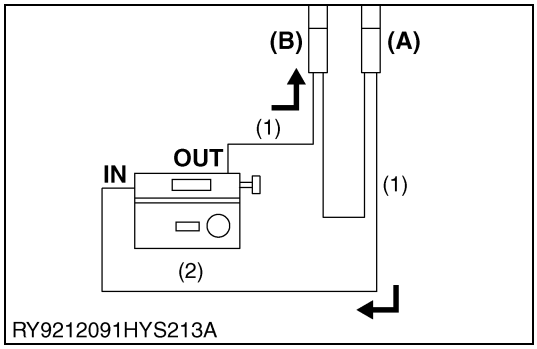
RY9212148HYS0317US0

(2) Measuring the AUX Proportional Limit

Purpose

- Measuring the maximum amount of oil flow at each step allows an assessment of solenoid valve performance.

RY9212148HYS0318US0



RY9212091HYS213A

[Measurement preparations]
1. Place the excavator on flat hard ground, lower the bucket and the blade, and stop the engine.
2. Follow the chapter Releasing Pressure in the Hydraulic System and release pressure in the hydraulic lines.
3. Connect a vacuum pump.
4. Connect the AUX discharge (high-pressure side) and the IN side of the flow meter with a test hose.
5. Connect the OUT side of the flow meter and the AUX discharge (low-pressure side) with a test hose.
6. Remove the vacuum pump.

[Measurement]
1. Open the loading valve of the flow meter completely and start the engine.
2. Hydraulic oil temperature of 50 ± 5 °C (122 ± 9 °F).
3. Position each of the switches as follows.

Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
Max RPM	P mode	OFF	OFF
	E mode		

4. Operate the meter panel and measure the flow when at each AUX flow setting step by step.
5. Take three measurements of the oil flow, determine the average and take that as the measured value.

■ **IMPORTANT**
- **First ensure the correct flow direction of the flow meter. Secondly ensure that the AUX slide is activated in the correct direction.**
- **Refer to the Operator's Manual for how to set the flow limit values.**

(1) Test Hose
(2) Flow Meter
(A) AUX LH Pressure Side
(B) AUX RH Pressure Side

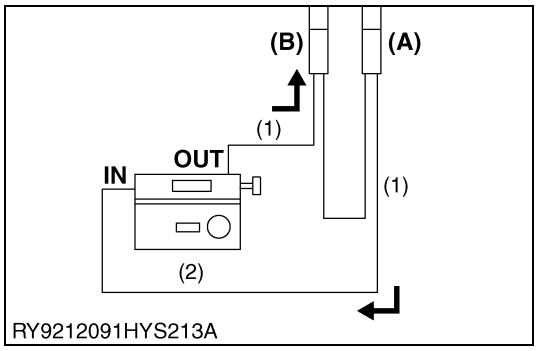
RY9212148HYS0307US0

(3) Measuring AUX Discharge Flow

Purpose

- Measuring the flow at the AUX discharge port allows you to confirm AUX port discharge while under load.

RY9212148HYS0349US0



RY9212091HYS213A

[Measurement preparations]

1. Place the excavator on flat hard ground, lower the bucket and the blade, and stop the engine.
2. Follow the chapter Releasing Pressure in the Hydraulic System and release pressure in the hydraulic lines.
3. Connect a vacuum pump.
4. Connect the AUX discharge (high-pressure side) and the IN side of the flow meter with a test hose.
5. Connect the OUT side of the flow meter and the AUX discharge (low-pressure side) with a test hose.
6. Remove the vacuum pump.

[Measurement]

1. Open the loading valve of the flow meter completely and start the engine.
2. Hydraulic oil temperature of 50 ± 5 °C (122 ± 9 °F).
3. Position each of the switches as follows.

Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
Max RPM	P mode	OFF	OFF
Max RPM	E mode	OFF	OFF

4. Gradually close the flow meter's loading valve until it reaches the relief pressure, then measure the oil flow at each pressure.
5. Take three measurements of the oil flow, determine the average and take that as the measured value.

■ **IMPORTANT**

- **First ensure the correct flow direction of the flow meter. Secondly ensure that the AUX slide is activated in the correct direction.**

(1) Test Hose
(2) Flow Meter
(A) AUX LH Pressure Side
(B) AUX RH Pressure Side

RY9212148HYS0308US0

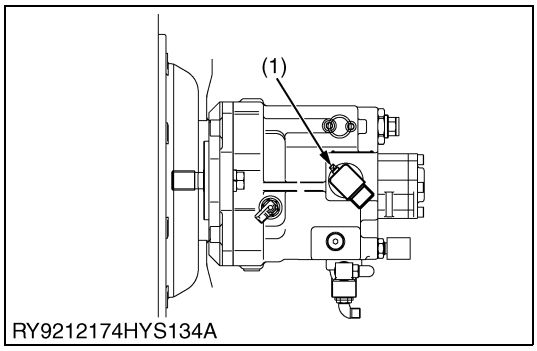
[5] MEASURING PRESSURE

(1) Measuring the Main Relief Valve Pressure

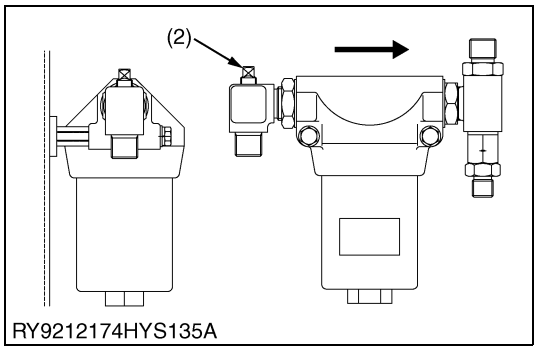
Purpose

- Verification of correct pressure setting.
- If the measured value is low, there may be a problem with the relief valve and/or leaks in other hydraulic devices.

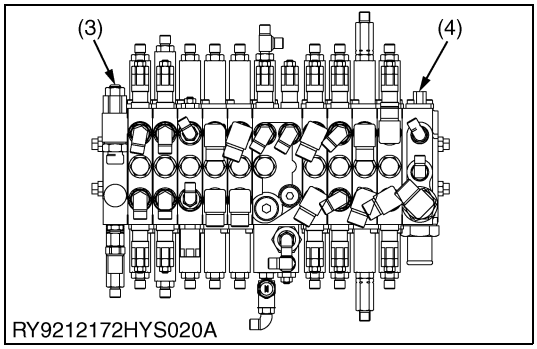
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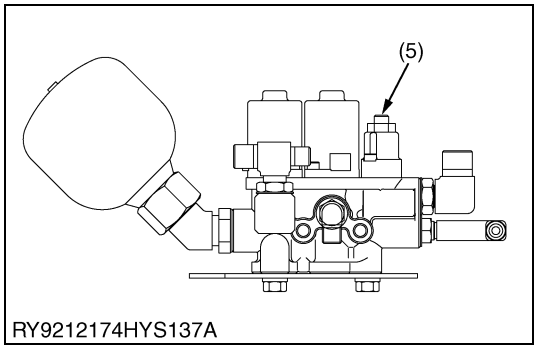
RY9212174HYS134A



RY9212174HYS135A



RY9212172HYS020A



RY9212174HYS137A

[Measurement preparations]

1. Place the machine on flat hard ground, lower the bucket and the blade, and stop the engine.
2. Follow the chapter Release of Residual Pressure in the Hydraulic System and release the residual pressure in the hydraulic lines.
3. Attach a pressure gauge to the pressure test port to be measured.
4. Start and idle the engine, and check that there is no oil leakage.
5. Hydraulic oil temperature of 50 ± 5°C (122 ± 9°F).

[Measurement]

1. Position each of the switches as follows.

Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
Max RPM	P mode	OFF	OFF

2. Slowly operate the control lever of the front equipment to be measured, operating it until the cylinder reaches the end of its stroke, until relieve.
3. When testing the unload LS pressure, check the discharge pressure without operating any of the control levers.
4. When testing the Pilot Primary Pressure, check the discharge pressure of P4 without operating any of the control levers.
5. Measure the pressure three times, determine the average and take that as the measured value.

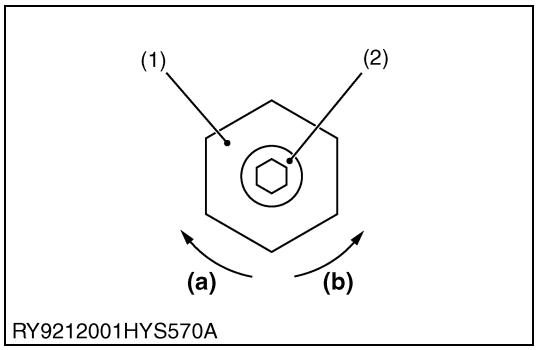
(1) P pressure Test Port
(2) Pp pressure Test Port
(3) Main LS Valve (aLS)
(4) Unload LS Valve (aUN)
(5) Pilot Primary Pressure Relief Valve (aPP)

RY9212172HYS0025US0

Adjusting the Main Relief Valve

CAUTION

- **Only adjust the valve if the pressure setting of the main relief valve is lower than specification.**
- **If the pressure is raised above the setting value, it may cause damage to equipment, so never raise the pressure above the setting value.**



RY9212001HYS570A

1. Loosen the relief valve lock nut.
2. Use a hexagonal wrench to turn the adjuster screw, and tighten the lock nut.
3. After setting the pressure, always check the setting according to the section Measuring the Main Relief Valve Pressure.

(1) Lock Nut
(2) Adjuster Screw
(a) Pressure Increase
(b) Pressure Decrease

RY9212148HYS0319US0

Pressure Change/Turn for Main Relief Valve (Reference Values)

Amount adjuster screw turned	1/4	1/2	3/4	1
• Unload LS valve	4.4 MPa 45.1 kgf/cm^2 642 psi	8.9 MPa 90.8 kgf/cm^2 1291 psi	13.3 MPa 135.4 kgf/cm^2 1925 psi	17.7 MPa 180.5 kgf/cm^2 2567 psi
• Pilot primary pressure relief valve	0.2 MPa 2.0 kgf/cm^2 29 psi	0.4 MPa 4.1 kgf/cm^2 58 psi	0.6 MPa 6.1 kgf/cm^2 87 psi	0.8 MPa 8.2 kgf/cm^2 116 psi

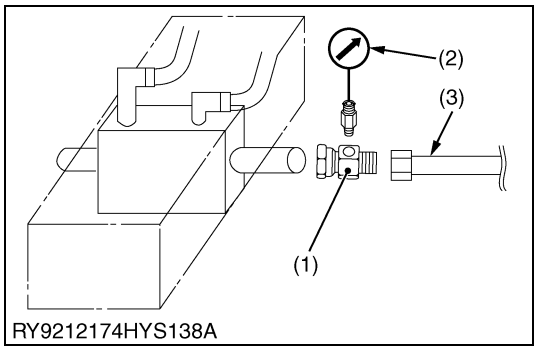
RY9212174HYS0229US0

(2) Measuring Pilot Secondary Pressure

Purpose

- Measure the pressure between the control valves and the oil from each pilot valve and solenoid and make sure they are at specified values.
- If the pressure is lower than the factory specification, in general it indicates something may be wrong with the pilot valve or solenoid valve.

RY9212148HYS0323US0



RY9212174HYS138A

[Measurement preparations]

1. Place the machine on flat hard ground, lower the bucket and the blade, and stop the engine.
2. Follow the chapter Release of Residual Pressure in the Hydraulic System and release pressure in the hydraulic lines.
3. Use the vacuum pump and then fit a T-joint to the pilot port on the control valve side to be measured, and attach a pressure gauge.
4. Remove the vacuum pump.
5. Start and idle the engine, and check that there is no oil leakage.
6. Hydraulic oil temperature of 50 ± 5 °C (122 ± 9°F).

[Measurement]

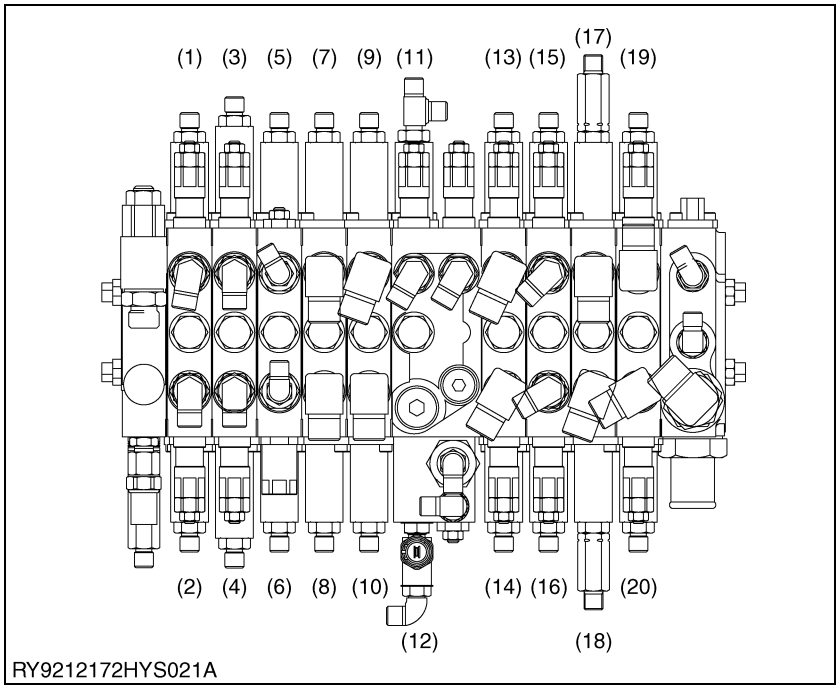
1. Position each of the switches as follows.

Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
Max RPM	P mode	OFF	OFF

2. Operate the lever to be tested and measure the secondary pilot pressure at full stroke.
   - When measuring cylinder secondary pressure, take the measurement when at the cylinder end.
   - When measuring motor secondary pressure, take the measurement with it locked.
3. Measure the pressure three times, determine the average and take that as the measured value.

(1) Adapter
(2) Pressure Gauge
(3) Test Hose

RY9212174HYS0230US0



RY9212172HYS021A

(1) AUX2, RH
(2) AUX2, LH
(3) Blade Down
(4) Blade Up
(5) Swing LH
(6) Swing RH
(7) Travel Left Forward
(8) Travel Left Rear
(9) Travel Right Forward
(10) Travel Right Rear
(11) Boom Up
(12) Boom Down
(13) Arm Crowd
(14) Arm Dump
(15) Bucket Crowd
(16) Bucket Dump
(17) Swivel RH
(18) Swivel LH
(19) AUX1. RH
(20) AUX1. LH

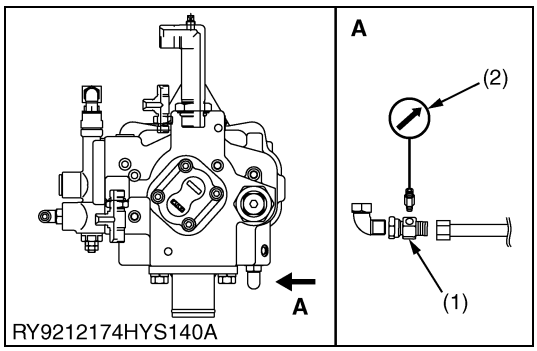
RY9212172HYS0026US0

(3) Measuring the EP Proportional Solenoid Pressure

Purpose

- Measuring the pressure from the EP proportional solenoid valve to the pump allows assessment of the performance of the EP solenoid valve.

RY9212148HYS0326US0



[Measurement preparations]

1. Place the machine on flat hard ground, lower the bucket and the blade, and stop the engine.
2. Follow the chapter Release of Residual Pressure in the Hydraulic System and release the residual pressure in the hydraulic lines.
3. Connect a vacuum pump.
4. Disconnect the hose from the EP proportional solenoid valve to the pump from the pump side and attach an adapter and a pressure gauge.
5. Remove the vacuum pump.
6. Start the engine with idle rpm, and check that there is no oil leakage.
7. Hydraulic oil temperature of 50 ± 5 °C (122 ± 9°F).

[Measurement]

1. Position each of the switches as follows and measure the pressure for each configuration.

Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
Max RPM	P mode	OFF	OFF
Max RPM			ON
Max RPM	E mode	OFF	OFF

2. Position each of the switches as follows, and measure the pressure when traveling or at boom up full stroke.

Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
Max RPM	E mode	OFF	OFF

3. Measure the pressure three times, determine the average and take that as the measured value.

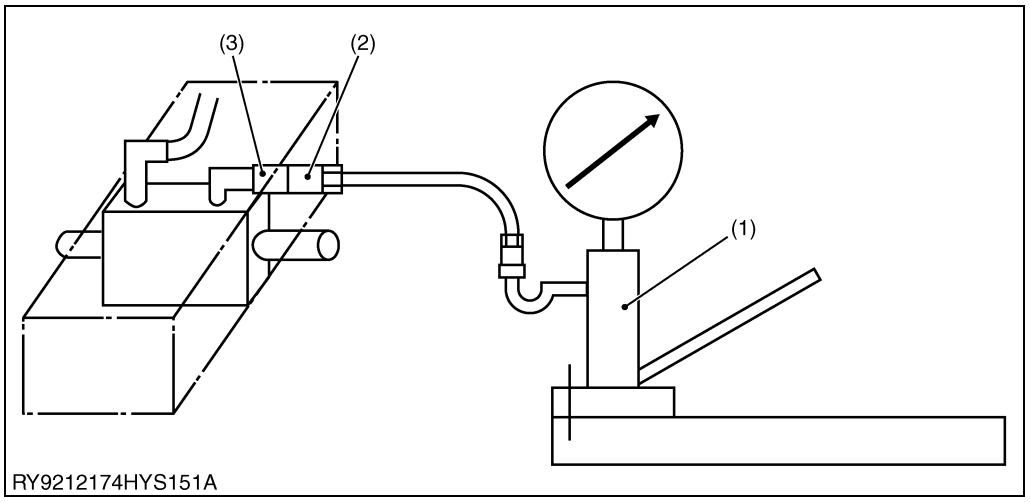
(1) Adapter (2) Pressure Gauge

RY9212174HYS0231US0

(4) Measuring the Overload Relief Valve Pressure

■ **IMPORTANT**

- **If it is necessary to check the overload relief pressure on this machine, measure the main relief pressure of each circuit (boom, arm, bucket, blade and AUX) and if the main relief pressures are within factory specifications, the overload relief valve is judged to be normal.**
- **If there is a problem, we recommend replacing the overload relief valve as an assembly.**
- **If a measurement has to be made for some reason, the procedures is as follows.**



RY9212174HYS151A

(1) Pressure Measuring Kit
(2) Straight Pipe Joint (G3/8-G1/4)
(3) Straight Pipe Joint (G1/2-G3/8)

RY9212172HYS0027US0

[Measurement preparations]

1. Place the excavator on flat hard ground, lower the bucket and the blade, and stop the engine.
2. Follow the chapter Release of Residual Pressure in the Hydraulic System and release the residual pressure in the hydraulic lines.
3. Use the vacuum pump and disconnect the high pressure hose from the port where the overload relief valve to be measured is mounted and plug the hose.
4. Attach the pressure measuring kit to the disconnected port.
5. Remove the vacuum pump.
6. Hydraulic oil temperature of 50 ± 5 °C (122 ± 9 °F).

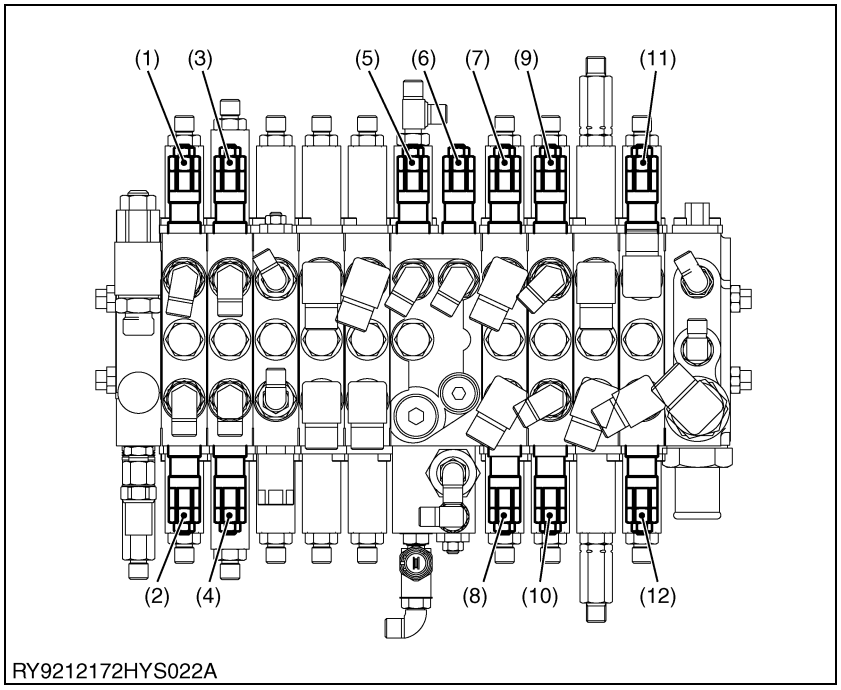
[Measurement]

1. Increase the pressure with the pressure measuring kit until the overload relief valve opens.
2. Measure the pressure three times, determine the average and take that as the measured value.

CAUTION

- **When disconnecting the pressure measuring kit, take appropriate care in removing it as the line is pressurized.**

RY9212148HYS0329US0



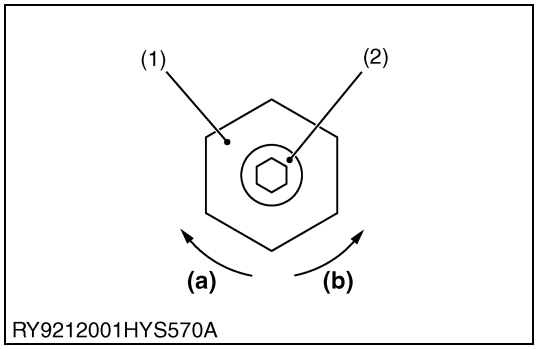
RY9212172HYS022A

(1) AUX2 RH (b10R)
(2) AUX2 LH (b10L)
(3) Blade Bottom (b4B)
(4) Blade Rod (b4R)
(5) Boom Bottom (b1B)
(6) Boom Rod (b1R)
(7) Arm Bottom (b2B)
(8) Arm Rod (b2R)
(9) Bucket Bottom (b3B)
(10) Bucket Rod (b3R)
(11) AUX1 RH (b6R)
(12) AUX1 LH (b6L)

RY9212172HYS0028US0

Adjusting the overload relief valve

CAUTION
- **Only adjust the valve if the pressure setting of the overload relief valve is low.**
- **If the pressure is raised above the setting value, it may cause damage to equipment, so never raise the pressure above the setting value.**



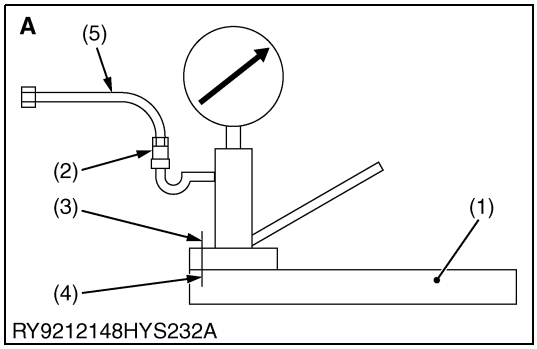
RY9212001HYS570A

1. Loosen the relief valve lock nut.
2. Use a hexagonal wrench to turn the adjuster screw and then tighten the lock nut.
3. After setting the pressure, always check the setting according to the section Measuring the Overload Relief Valve Pressure.

(1) Lock Nut
(2) Adjuster Screw
(a) Pressure Increase
(b) Pressure Decrease

RY9212148HYS0331US0

(5) Pressure Measuring Kit



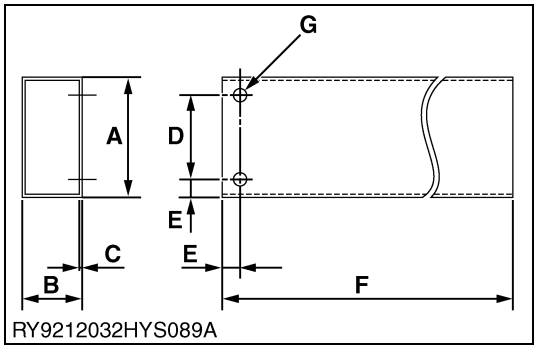
No.	Name of part	Q'ty
(1)	Support	1
(2)	Pipe joint (M12-G1/4)	1
(3)	Bolt (M10 x 35)	2
(4)	Nut (M10)	2
(5)	Test hose	1

CAUTION

- **Use a test hose that can withstand pressure up to the measurement pressure.**

A : Nozzle Tester

RY9212148HYS0336US0

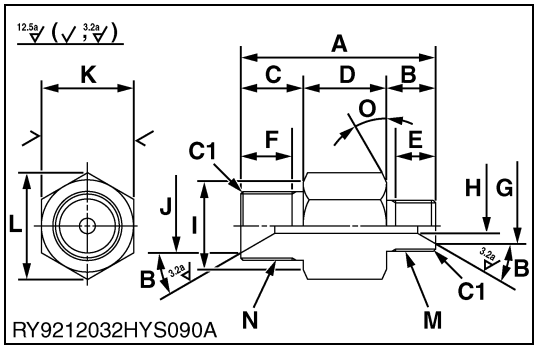


(1) Support

A	100 mm (3.94 in.)
B	50 mm (2.0 in.)
C	t = 2.3 mm (0.09 in.)
D	70 mm (2.8 in.)
E	15 mm (0.59 in.)
F	600 mm (23.6 in.)
G	2–11 mm (2–0.43 in.)

Material std.: STKR400

RY9212148HYS0337US0



(2) Pipe joint (M12-G1/4)

A	47 mm (1.8 in.)
B	12 mm (0.47 in.)
C	15 mm (0.59 in.)
D	20 mm (0.79 in.)
E	10 mm (0.39 in.) ≤
F	12 mm (0.47 in.) ≤
G	ϕ8 mm (0.3 in.)
H	ϕ3 mm (0.1 in.)
I	ϕ18 mm (0.71 in.)
J	ϕ9.5 ± 0.2 mm (0.37 ± 0.01 in.)
K	19 +0, –0.35 mm (0.75 +0, –0.01 in.)
L	21.9 mm (0.86 in.)
M	M12 × 1.5
N	G1/4
O	0.52 rad (30 °)

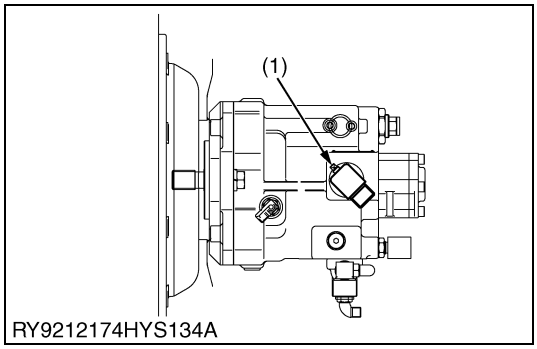
RY9212148HYS0309US0

(6) Measuring Swivel Relief Pressure

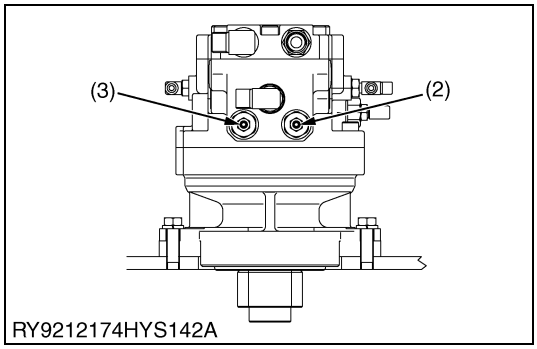
■ **IMPORTANT**

- **When checking the relief pressure of the swivel motor on the machine, measure the main relief pressure and if the main relief pressure is within factory specifications, the swivel relief valve is considered to be normal.**
- **If there is a problem, we recommend replacing the swivel relief valve as an assembly.**

RY9212148HYS0338US0



RY9212174HYS134A



RY9212174HYS142A

[Measurement preparations]

1. Place the machine on flat hard ground, lower the bucket and the blade, and stop the engine.
2. Follow the chapter Release of Residual Pressure in the Hydraulic System and release pressure in the hydraulic lines.
3. Connect a pressure gauge to the pump discharge side.
4. Remove the vacuum pump.
5. Start and idle the engine, and check that there is no oil leakage.
6. Hydraulic oil temperature of 50 ± 5 °C (122 ± 9°F).

[Measurement]

1. Position each of the switches as follows.

Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
1500 rpm	P mode	OFF	OFF

2. Choose one direction and slowly press the bucket against the obstacle (stumbling block) in one direction, until the relief pressure is reached. Then repeat the same procedure to the other side.
3. Measure the pressure three times, determine the average and take that as the measured value.

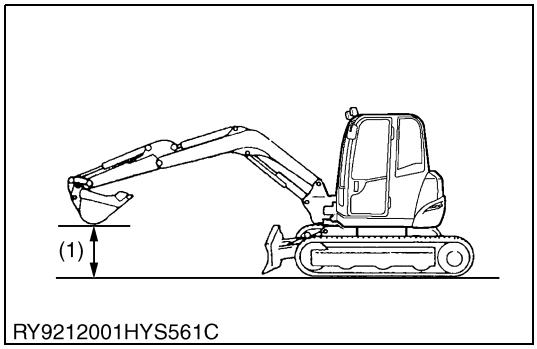
(1) P1 Pressure Test Port
(2) Swivel Right Relief Valve (cSR)
(3) Swivel Left Relief Valve (cSL)

RY9212174HYS0242US0

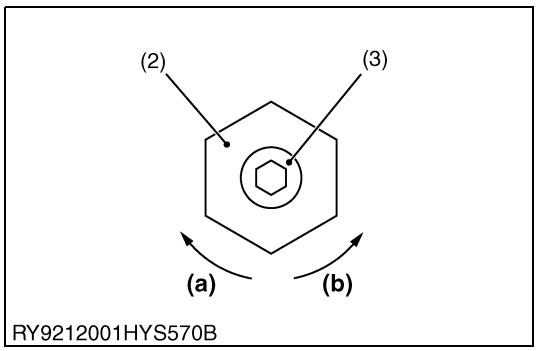
(7) Adjusting the LS Control Differential Pressure Adjusting Spring

CAUTION

- **Perform this adjustment procedure only when the LS regulator has been disassembled or when readjustment is necessary.**
- **Increasing the speed above the factory specification may damage the machine so never raise the speed above the factory specification.**
- **If it is out of adjustment, matching for the entire machine will be off and the operating speed of each device, including the boom, arm, etc. will be altered.**



RY9212001HYS561C



RY9212001HYS570B

[Measurement]

1. Measure the speed of the swing according the section Measuring Hydraulic Cylinder Operating Time.
2. If a value within factory specifications is not obtained, loosen the LS regulator lock nut.
3. Turn the adjuster screw with a hex wrench to adjust the spring tension.
   After setting the pressure, always check the swing speed according to the section Measuring Hydraulic Cylinder Operating Time.
4. Tighten the lock nut.
5. Measure each operating time and make sure they are within specifications.

(1) 1.0 m (40 in.)
(2) Lock Nut
(3) Adjuster Screw

(a) Increase Speed
(b) Reduce Speed

RY9212148HYS0340US0

[6] MEASURING SWIVEL PERFORMANCE

(1) Measuring Swivel Motor Drain Volume

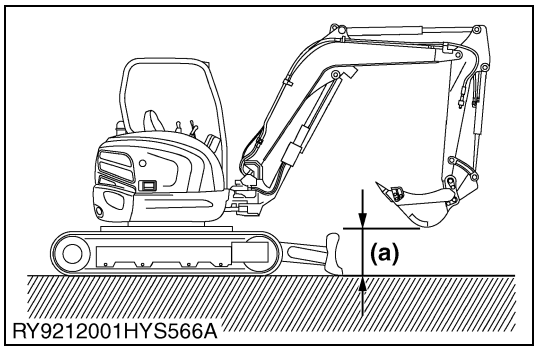
Purpose

- Measuring the drain volume when operating and locked allows an assessment of swivel motor performance.

■ **IMPORTANT**

- **Swivel motor performance is used along with swivel block performance and measurement of swivel speed to make a comprehensive assessment.**
- **Before commencing measurement, make sure there are no persons or obstacles within the swivel range.**

RY9212174HYS0243US0



RY9212001HYS566A


RY9212001HYS552A

Measurement preparation

1. Place the machine on flat hard ground, lower the bucket and the blade, and stop the engine.
2. Follow the chapter Releasing Pressure in the Hydraulic System and release pressure in the hydraulic lines.
3. Attach a vacuum pump.
4. Disconnect the swivel motor's drain hose from the swivel motor side, and insert a plug in the disconnected hose.
5. Connect the measuring use hose (e.g., low-pressure use polyvinyl hose) to the drain port on the swivel motor side.
6. Remove the vacuum pump.
7. Operate the swivel and operate the swivel to warm up.
   - Hydraulic oil temperature of 50 ± 5°C (122 ± 9°F).

(a) 1.0 m (40 in.)

RY9212174HYS0244US0

Measurement

[Measurement when turning]

1. Position each of the switches as follows.

Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
Max RPM	P mode	OFF	OFF

2. Operate a swivel lever to full stroke and check the drain from the test hose while maintaining a uniform swivel speed.
3. Collect and measure the hydraulic oil that drains for one minute from the point oil starts coming out.
4. Measure the drain volume 3 times each left and right, determine the average and take that as the measured value.

[Measurement when locked]

1. Position each of the switches as follows.

Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
Max RPM	P mode	OFF	OFF

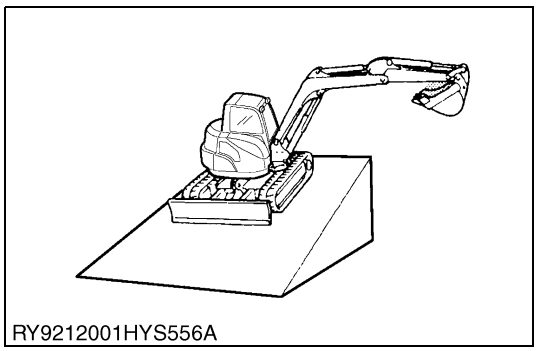
2. Choose one direction and slowly press the bucket against the obstacle (stumbling block) in one direction, until the relief pressure is reached. And check the drain from test hose.
3. Collect and measure the hydraulic oil that drains for one minute from the point oil starts coming out.
4. Measure the drain volume 3 times each left and right, determine the average and take that as the measured value.

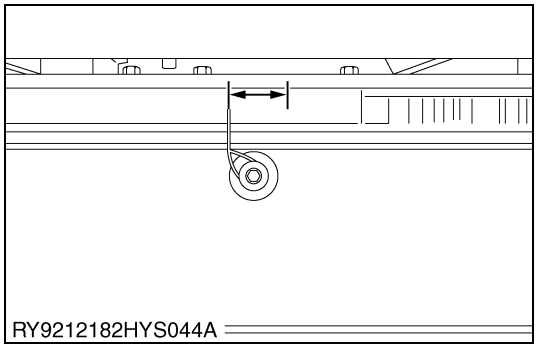
RY9212174HYS0245US0

(2) Measuring Swivel Block Performance

Purpose

- Measure how much the machine slips on sloping ground to asses the performance of the swivel parking brake.


RY9212001HYS556A


RY9212182HYS044A

[Measurement preparation]

1. Repeat swivel left and right operations to sufficiently warm up the swivel motor.

Hydraulic oil temperature	50 ± 5 °C (122 ± 9°F)

2. Place dirt or a weight of the specified weight (JIS heap x specific gravity 1.8) in the bucket.

Specified weight	216 kg (476 lbs)

3. Climb onto a slope of 0.35 rad (20 °) but whose surface is even and swivel the machine so the top is at 1.6 rad (90 °) to the slope.
4. The front position should be with the arm cylinder fully compressed and bucket cylinder fully extended, keeping the boom base pin and the arm end pin at the same height.
5. Place marks on the circumference of the swivel bearing and the track frame.

CAUTION

- **Before commencing measurement, make sure there are no persons or obstacles within the swivel range.**

[Measurement]

1. Position each of the switches as follows.

Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
Idling	P mode	OFF	OFF

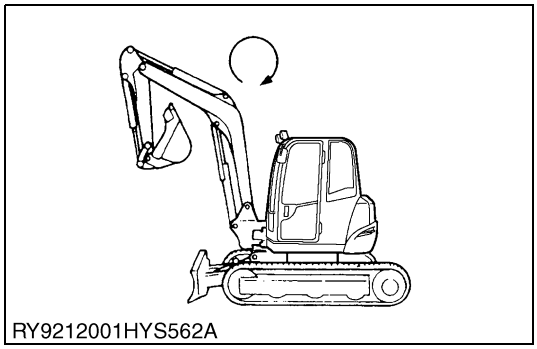
2. Start the engine, release the safety lock lever (lower) and after 1.0 minute, measure any deviation between the marks on the swivel bearing and the track frame.
3. Measure the swing 3 times each right/left with the engine stopped and at idle and take the average as the measured value.

RY9212174MBS0048US0

(3) Measuring Swivel Speed

Purpose

- Measure how long it takes to swivel 3 times to assess the overall performance of the swivel drive system (main and pilot lines).


RY9212001HYS562A

[Measurement preparation]

1. Repeat swivel left and right operations to sufficiently warm up the swivel motor.

Hydraulic oil temperature	50 ± 5 °C (122 ± 9 °F)

2. The position for measurement should be with maximum extension of the boom cylinder, arm cylinder and bucket cylinder.

CAUTION

- **Before commencing measurement, make sure there are no persons or obstacles within the swivel range.**

[Measurement]

1. Position each of the switches as follows.

Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
Max RPM	P mode	OFF	OFF

2. Operate the swivel control lever at full stroke, and once it reaches a uniform speed, measure the time taken for three turns of the swivel unit.
3. Take three measurements each swiveling left and right, determine the average and take that as the measured value.

RY9212148MBS0130US0

[7] MEASURING TRAVEL PERFORMANCE

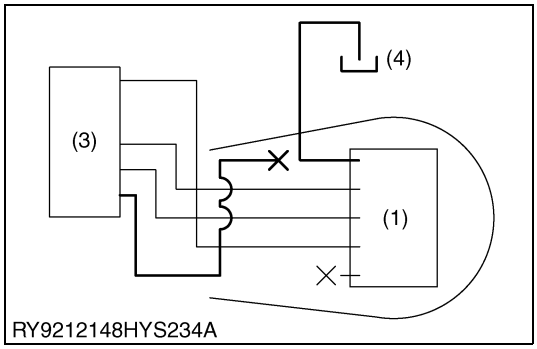
(1) Measuring Travel Motor Drain Volume

Purpose

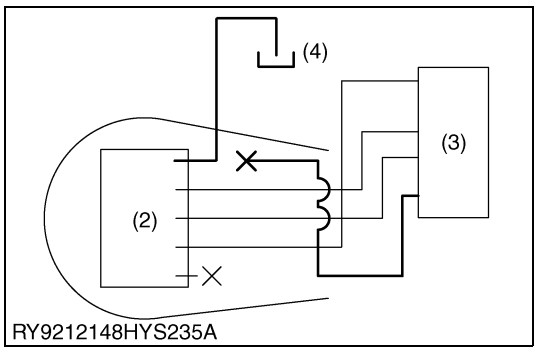
- Measuring the drain volume when operating and when locked allows an assessment of the travel motor performance.
- Travel motor performance is used along with travel block performance, travel speed and travel drift to make a comprehensive assessment.

RY9212148HYS0344US0


RY9212032HYS035A



RY9212148HYS234A



RY9212148HYS235A

[Measurement preparations]

1. Repeat left and right travel operations to sufficiently warm up the travel motor.
   - Hydraulic oil temperature of 50 ± 5 °C (122 ± 9 °F).
2. Place the machine on flat hard ground, lower the bucket and the blade, and stop the engine.
3. Follow the chapter Releasing Pressure in the Hydraulic System and release pressure in the hydraulic lines.
4. Use a vacuum pump and disconnect the travel motor's drain hose from the travel motor side, and insert a plug in the disconnected hose.
5. Connect a test hose to the travel motor drain port and remove the vacuum pump.
6. Start the engine and jack up the machine.

CAUTION

- **Place safety jack stands under the jacked up machine to prevent it from dropping.**
- **When working near rotating parts, take care not to get your gloves/clothes caught in them.**

(1) RH Travel Motor
(2) LH Travel Motor
(3) Swivel Joint
(4) Graduated Cylinder

RY9212148HYS0345US0

[Measurement when turning]

1. Position each of the switches as follows.

Travel speed switch	Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
1st	Max RPM	P mode	OFF	OFF
2nd	Max RPM	P mode	OFF	OFF

2. Operate the travel lever on one side and full stroke and measure while maintaining a uniform travel speed. Measure the drain volume coming from the test hose in 1 minute.
3. Measure the drain volume 3 times each in 1st and 2nd speeds, determine the average and take that as the measured value.

[Measurement when locked]

1. Position each of the switches as follows.

Travel speed switch	Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
1st	Max RPM	P mode	OFF	OFF
2nd	Max RPM	P mode	OFF	OFF

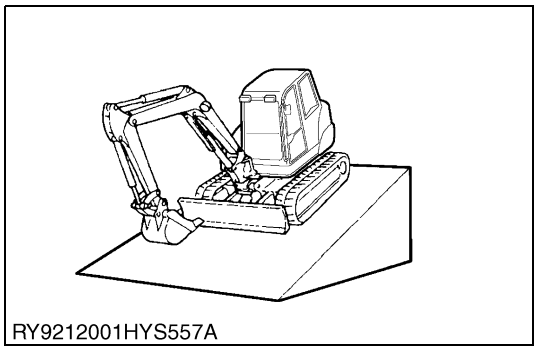
2. Lock the travel, slowly operate the travel lever forwards and backwards full stroke and measure the drain volume from the test hose in 1 minute.
3. Measure the drain volume 3 times each in 1st and 2nd speeds, determine the average and take that as the measured value.

RY9212148HYS0379US0

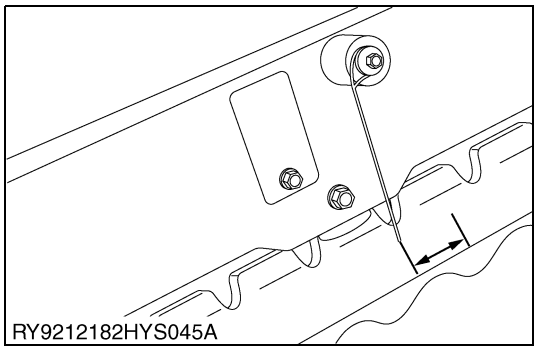
(2) Measuring Travel Block Performance

Purpose

- Measure how much the machine slips on sloping ground to asses the performance of the parking brake.



RY9212001HYS557A



RY9212182HYS045A

[Measurement preparation]

1. Repeat left and right travel operations to sufficiently warm up the travel motor.

Hydraulic oil temperature	50 ± 5 °C (122 ± 9 °F)

2. Climb onto a slope of 0.35 rad (20°) but whose surface is even.
3. Stop the machine on the slope, and set the front to travel position.

[Measurement]

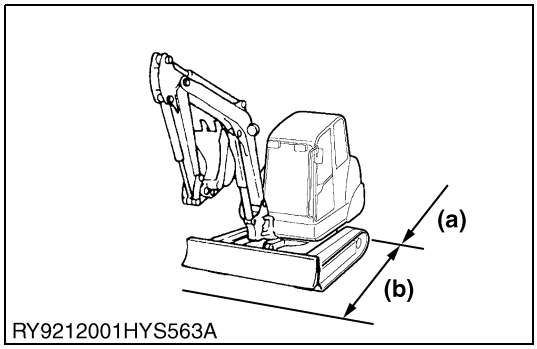
1. Place the travel lever in neutral and stop the engine.
2. Make marks in the track frame and crawler, and measure the slippage after ten minutes.

RY9212148MBS0134US0

(3) Measuring Travel Speed

Purpose

- Measure how long it takes to travel a distance to assess the overall performance of the travel drive system (main and pilot lines).



RY9212001HYS563A

[Measurement preparation]

1. Adjust the left and right crawlers to their specified dimensions and operate the travel motor to thoroughly warm it up.

Hydraulic oil temperature	50 ± 5 °C (122 ± 9 °F)

2. Set a level course on flat, hard ground of 10 m (390 in.) for the measurement with a run up course of 5.0 m (200 in.).
3. Measure travel performance in the travel position.

[Measurement]

1. Position each of the switches as follows.

No.	Travel 2nd speed switch	Accelera-tor dial	Eco mode switch	Auto-idling switch	AC switch
1	1st	Max RPM	P mode	OFF	OFF
2	2nd	Max RPM	P mode	OFF	OFF

2. Measure travel speed forwards/backwards three times each in 1st and 2nd and take the average as the measured value.

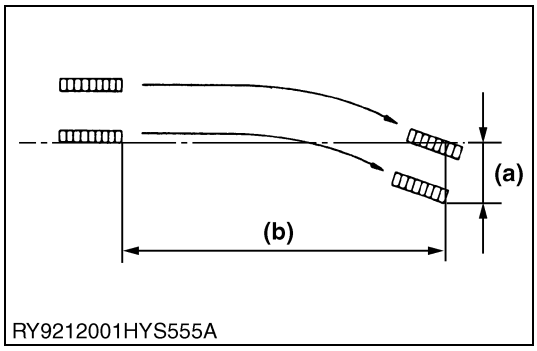
(a) Run-up 5.0 m (200 in.) **(b) Measurement distance 10 m (390 in.)**

RY9212148MBS0136US0

(4) Measuring Travel Drift

Purpose

- Measure travel drift to assess left/right balance in the travel drive system (main and pilot lines).



RY9212001HYS555A

[Measurement preparation]

1. Adjust the left and right crawlers to their specified dimensions and operate the travel motor to thoroughly warm it up.

Hydraulic oil temperature	50 ± 5 °C (122 ± 9 °F)

2. Determine a 10 m (390 in.) travel course on hard, flat ground, and put the machine in travel position for the measurement.

[Measurement]

1. Position each of the switches as follows.

No.	Travel 2nd speed switch	Accelera-tor dial	Eco mode switch	Auto-idling switch	AC switch
1	1st	Max RPM	P mode	OFF	OFF
2	2nd	Max RPM	P mode	OFF	OFF

2. Measure travel drift forwards/backwards three times each in 1st and 2nd and take the average as the measured value.

(a) Drift **(b) 10 m (390 in.)**

RY9212148MBS0138US0

[8] MEASURING CYLINDER SPEED

(1) Measuring Hydraulic Cylinder Operating Time

Purpose

- Measure the amount of time it takes to operate each of the hydraulic cylinders to assess the overall performance of the front drive system (main and pilot lines).

RY9212148MBS0114US0

Measurement preparation

1. Stop the machine on hard, level ground.
2. Repeat front operations and fully warm up each cylinder.
   - Hydraulic oil temperature of 50 ± 5 °C (122 ± 9 °F).

RY9212148MBS0115US0

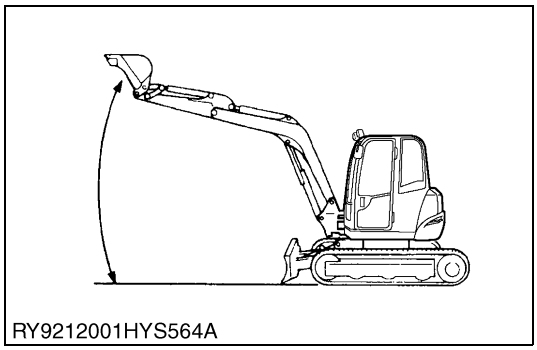
Measurement

1. Position each of the switches as follows.

Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
Max RPM	P mode	OFF	OFF

2. Measure the speed of each cylinder three times and take the average as the measured value.
3. Make the measurements for each cylinder in the position given below.

RY9212148MBS0116US0

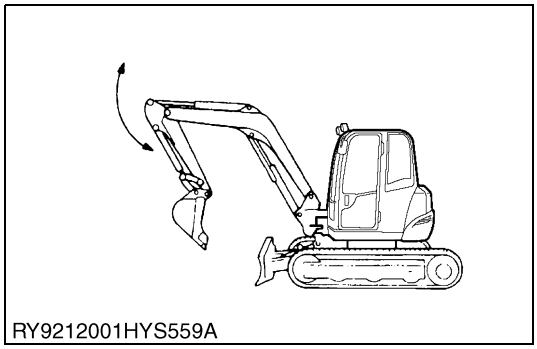


RY9212001HYS564A

Boom Cylinder

1. Arm and bucket cylinder fully compressed.
2. Operate the boom control lever at full stroke and measure the time it takes the boom to go from having the bucket on the ground to the maximum lift position.
   - **Do not include cushion operating time.**

RY9212148MBS0117US0

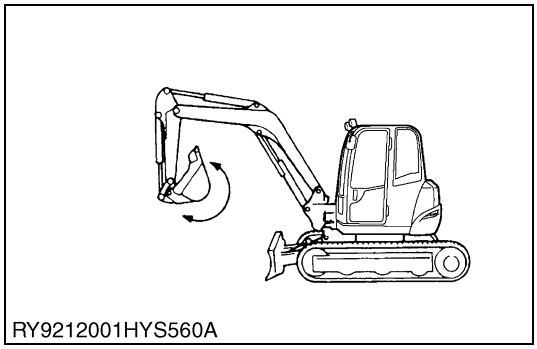


RY9212001HYS559A

Arm Cylinder

1. Boom cylinder fully extended and bucket cylinder fully compressed.
2. Operate the arm control lever at full stroke and measure the time it takes the arm to go full stroke from dump to crowd.
   - **Do not include cushion operating time.**

RY9212148MBS0118US0

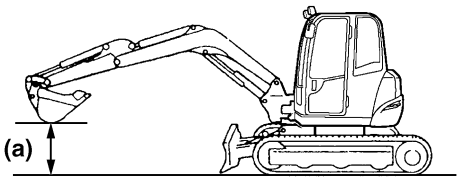


RY9212001HYS560A

Bucket Cylinder

1. Adjust the arm and the boom to positions in which the bucket will not hit the machine when the bucket is operated through its full stroke.
2. Operate the bucket control lever at full stroke and measure the time it takes the bucket to go full stroke from dump to crowd.

RY9212148MBS0119US0



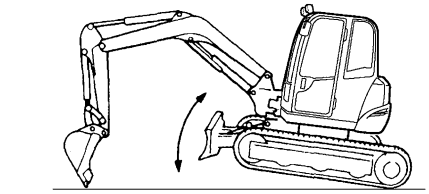
RY9212001HYS561B

Swing cylinder

1. Arm cylinder fully compressed, bucket cylinder fully extended, and bucket bottom approximately 1.0 m (40 in.) above ground level.
2. Operate the swing pedal full stroke and measure how long it takes to swing full stroke to the right and to the left.

(a) 1.0 m (40 in.)

RY9212148MBS0120US0



RY9212001HYS558A

Blade cylinder

1. Jack up the machine with the front to ensure the blade can move through its entire stroke top to bottom.
2. Operate the blade control lever full stroke and measure the time it takes the blade to go full stroke up and down.

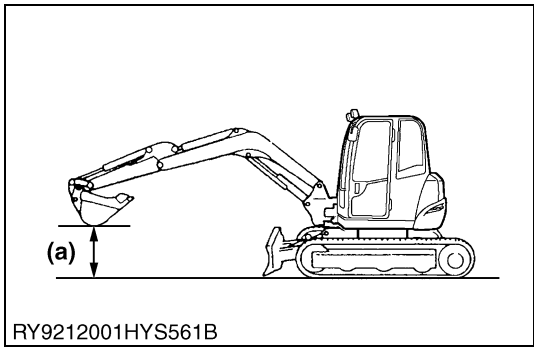
RY9212148MBS0121US0

(2) Measuring Hydraulic Cylinder Drift

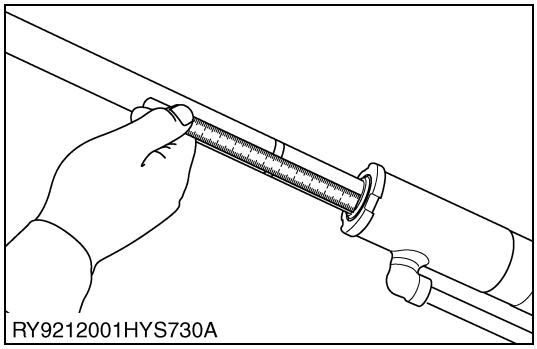
Purpose

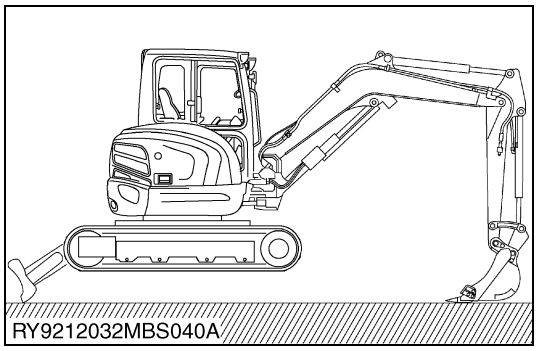
- Measure how far a cylinder drops to asses leakage inside the cylinder, control valve and/or holding valve.
- When measuring a cylinder that has just been replaced, insure to purge any air prior to taking the measurements. Slowly operate the cylinder repeatedly to end stroke and full retraction.

RY9212148MBS0124US0



RY9212001HYS561B


RY9212001HYS730A


RY9212032MBS040A

Measuring drift of the boom, arm and bucket cylinders

[Measurement preparation]

1. Repeat front operations and fully warm up each cylinder.

Hydraulic oil temperature	50 ± 5 °C (122 ± 9°F)

2. Place dirt or a weight of the specified weight (JIS heap x specific gravity 1.8) in the bucket and position the machine on flat, hard ground.

Specified weight	216 kg (476 lbs)

3. Arm cylinder fully compressed, bucket cylinder fully extended, and bucket bottom approximately 1.0 m (40 in.) above ground level. Note that the arm cylinder should return about 50 mm (2.0 in.) from the stroke end, and be outside the cushion range.

[Measurement]

1. Stop the engine, and place marks on the boom, arm and bucket cylinder rods.
2. After ten minutes has elapsed, measure the boom cylinder compression, arm cylinder extension and bucket cylinder compression.

(a) 1.0 m (40 in.)

RY9212174MBS0046US0

Measuring blade cylinder drift

[Measurement preparation]

1. Repeat blade operations and fully warm up the cylinders.

Hydraulic oil temperature	50 ± 5 °C (122 ± 9 °F)

2. Use the blade and front to jack up the machine so blade cylinder is fully extended, the arm is perpendicular to the ground and the excavator is level.

[Measurement]

1. Stop the engine and mark the rod of the blade cylinder.
2. After 10 minutes, measure how much the blade cylinder is compressed.

CAUTION

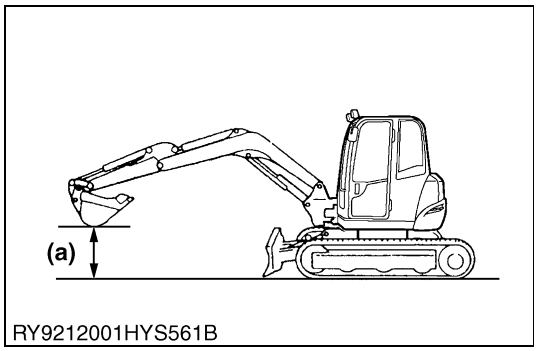
- **Never allow your feet or any body part to be under the machine when it is jacked up.**

RY9212148MBS0126US0

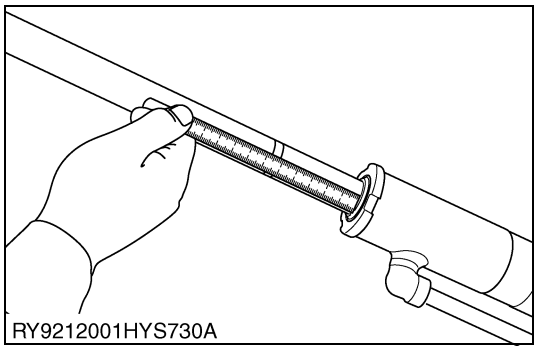
(3) Measuring Swing Cylinder Deviation

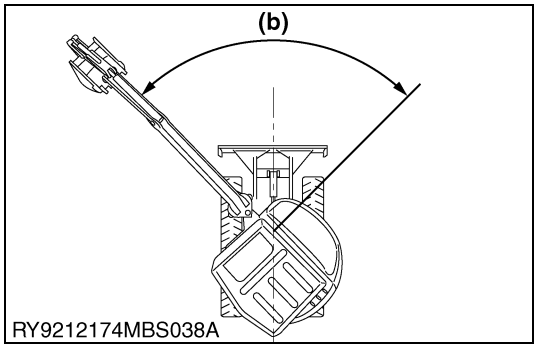
Purpose

- Measure how far the cylinder deviates to assess leakage inside the cylinder and/or control valve.
- When measuring a cylinder that has just been replaced, insure to purge any air prior to taking the measurements. Slowly operate the cylinder repeatedly to end stroke and full retraction.



RY9212001HYS561B


RY9212001HYS730A



RY9212174MBS038A

[Measurement preparation]

1. Repeat swing operations through their full stroke and fully warm up the cylinders.

Hydraulic oil temperature	50 ± 5 °C (122 ± 9 °F)

2. Place dirt or a weight of the specified weight (JIS heap x specific gravity 1.8) in the bucket and position the machine on flat, hard ground.

Test weight	216 kg (476 lbs)

3. Arm cylinder fully compressed, bucket cylinder fully extended, and bucket bottom approximately 1.0 m (40 in.) above ground level.
4. Put the arm in its central swing position and then swing it back and forth 5 times and stop.

[Measurement]

1. Stop the engine and mark the rod of the swing cylinder.
2. Position each of the switches as follows.

Accelerator dial	Eco mode switch	Auto-idle switch	AC switch
Max RPM	P mode	OFF	OFF

3. Swing the front through 1.6 rad (90 °) and stop 100 times and then measure the deviation.

■ **IMPORTANT**

- **When you stop after swinging the front, let the wobbling of the front stabilize and then perform the following operation.**

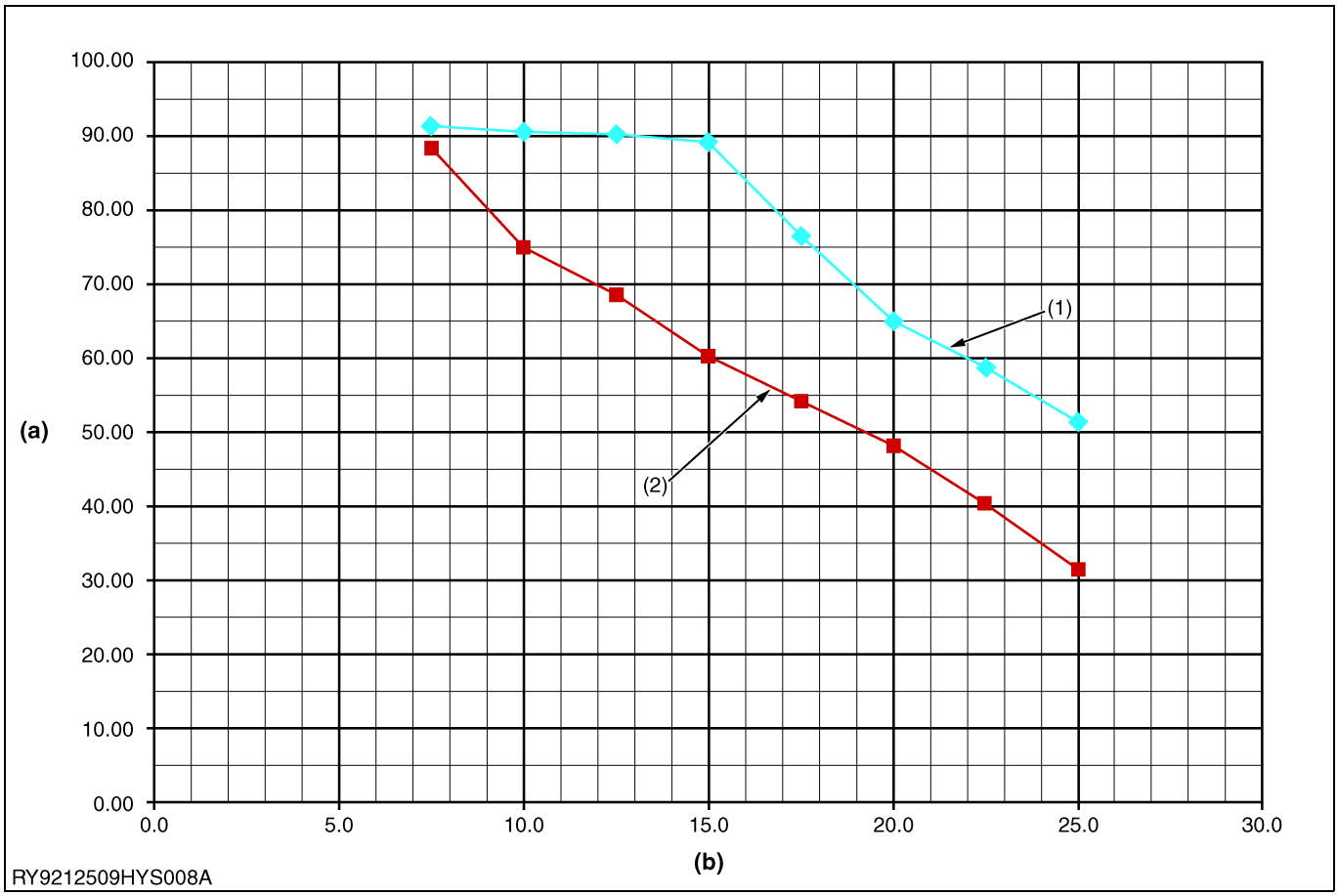
(a) 1.0 m (40 in.) **(b) 1.6 rad (90 °)**

RY9212174MBS0047US0

11. HYDRAULIC DEVICE PERFORMANCE STANDARDS

[1] FLOW RATE

(1) Main Pump Discharge Flow Rate Data (Measured Values)



(1) P Mode (Pi=3.6 MPa, 37 kgf/cm^2, 522 psi)

(2) E Mode (Pi=0 MPa, 0 kgf/cm^2, 0 psi)

(a) Flow Rate (L/min)

(b) Pressure (MPa)

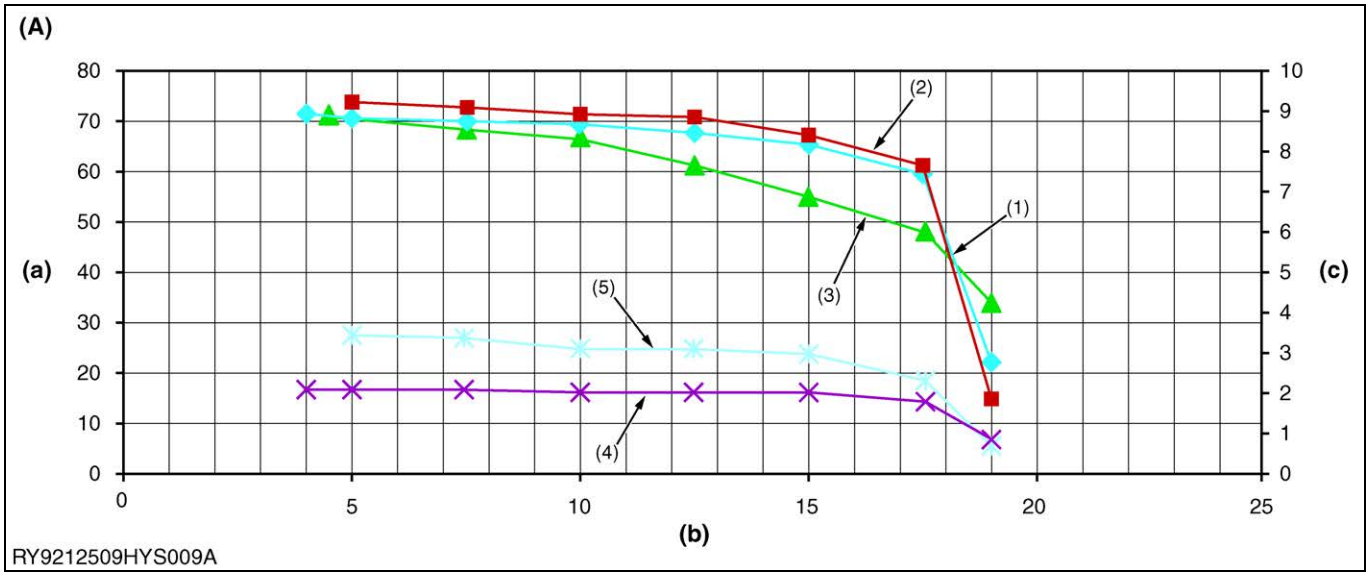
CAUTION

- **Measured values may vary depending on the machine.**
- **This data is of values converted to the rated RPM.**
- **The usage limit is 80% of the discharge volume.**

Pressure	MPa kgf/cm^2 psi	7.5 76.5 1087.8	10 102.0 1450.4	12.5 127.5 1813.0	15.0 153.0 2175.6	17.5 178.4 2538.2	20.0 203.9 2900.8	22.5 229.4 3263.3	25.0 254.9 3625.9
P mode	L/min U.S.gals	91.63 24.18	90.87 23.98	90.17 23.79	89.14 23.52	76.45 20.17	64.94 17.13	58.64 15.47	51.26 13.53
E mode		88.52 23.36	75.06 19.81	68.18 17.99	60.36 15.93	54.13 14.28	47.34 12.49	40.84 10.78	32.98 8.70

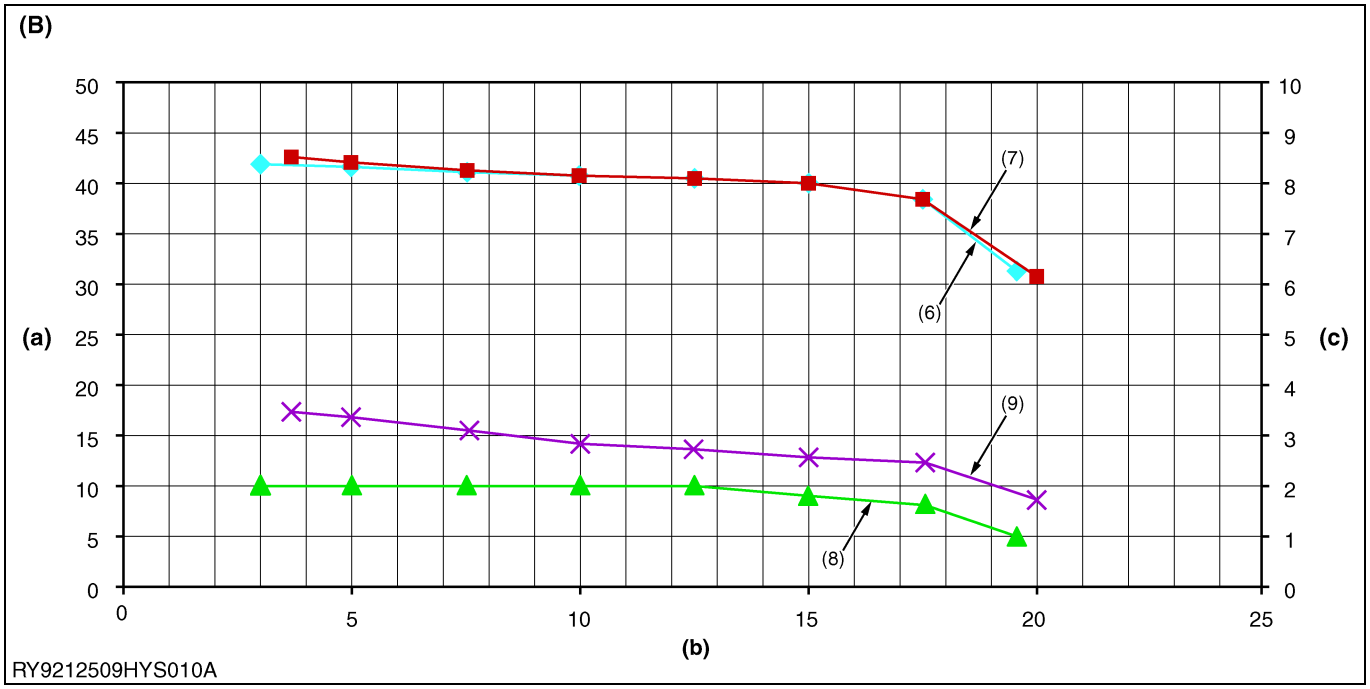
RY9212509HYS0011US0

(2) AUX Discharge Flow Rate Data (Measured Values)



(1) LH (TL Open)
(2) LH (TL Close)
(3) RH
(4) Back Pressure (TL Open)
(5) Back Pressure (TL Close)
(a) Flow Rate (L/min)
(b) Pressure (MPa)
(c) Back Pressure (MPa)
(A) AUX1

- TL: Third line



(6) LH
(7) RH
(8) Back Pressure (LH)
(9) Back Pressure (RH)
(a) Flow Rate (L/min)
(b) Pressure (MPa)
(c) Back Pressure (MPa)
(B) AUX2

CAUTION

- **Measured values may vary depending on the machine.**
- **This measurement data is of the values set for the max discharge flow rate. (limit = max)**

RY9212509HYS0012US0

[2] RELIEF PRESSURE (MEASURED VALUES)

Item			Notes
Main LS (aLS)		25.0 ± 0.5 MPa 255 ± 5 kgf/cm^2 3626 ± 73 psi	
Unload LS (aUN)		3.0 MPa 31 kgf/cm^2 435 psi	
Pilot primary (aPP)		4.3 ± 0.2 MPa 44 ± 2 kgf/cm^2 624 ± 29 psi	
EP proportional solenoid pressure	P mode	3.6 ± 0.2 MPa 37 ± 2 kgf/cm^2 522 ± 29 psi	
	P mode (AC ON)	2.8 ± 0.2 MPa 29 ± 2 kgf/cm^2 406 ± 29 psi	Compressor: ON
	E mode	0.6 ± 0.2 MPa 6.1 ± 2 kgf/cm^2 87 ± 29 psi	
	E mode (during operation)	1.6 ± 0.2 MPa 16.3 ± 2 kgf/cm^2 232 ± 29 psi	
Boom	Bottom (b1B)	27.4 ± 1.0 MPa 279 ± 10 kgf/cm^2 3974 ± 145 psi	
	Rod (b1R)		
Arm	Bottom (b2B)	27.4 ± 1.0 MPa 279 ± 10 kgf/cm^2 3974 ± 145 psi	
	Rod (b2R)		
Bucket	Bottom (b3B)	27.4 ± 1.0 MPa 279 ± 10 kgf/cm^2 3974 ± 145 psi	
	Rod (b3R)		
Blade	Bottom (b4B)	31.4 ± 1.0 MPa 320 ± 10 kgf/cm^2 4554 ± 145 psi	
	Rod (b4R)	19.0 ± 1.0 MPa 194 ± 10 kgf/cm^2 2756 ± 145 psi	Measurement location: pressure test port
AUX1	Left (b6L)	20.5 ± 1.0 MPa 209 ± 10 kgf/cm^2 2973 ± 145 psi	Measurement location: pressure test port
	Right (b6R)		
AUX2	Left (b10L)	20.0 ± 1.0 MPa 204 ± 10 kgf/cm^2 2901 ± 145 psi	Measurement location: pressure test port
	Right (b10R)		
Swivel	Left (cSL)	21.5 ± 1.0 MPa 219 ± 10 kgf/cm^2 3118 ± 145 psi	Measurement location: pressure test port Engine RPM: 1500
	Right (cSR)		

RY9212172HYS0029US0

[3] SWIVEL PERFORMANCE

Item			Notes
Swivel motor drain volume	When turning	less than 0.5 L/min less than 30.5 cu.in./min	
	When locked	less than 4.0 L/min less than 244 cu.in./min	
Swivel Block Performance	When turning	≤ 5.0 mm ≤ 0.20 in.	
	When locked	≤ 30.0 mm ≤ 1.18 in.	
Swivel speed	3 revs	17.5 to 21.2 sec	

RY9212174HYS0256US0

[4] TRAVEL PERFORMANCE

Item				Notes
Travel motor	When turning (1st speed)		less than 0.5 L/min less than 30.5 cu.in./min	
	When locked (1st speed)		less than 4.0 L/min less than 244 cu.in./min	
	When turning (2nd speed)		less than 0.5 L/min less than 30.5 cu.in./min	
	When locked (2nd speed)		less than 4.0 L/min less than 244 cu.in./min	
Travel block performance			0 mm 0 in.	
Travel speed	Rubber	1st speed	11.6 to 14.4 sec	
		2nd speed	6.7 to 8.2 sec	
	Steel	1st speed	12.4 to 15.7 sec	
		2nd speed	6.9 to 8.6 sec	
Amount of travel drift			≤ 600 mm ≤ 23.6 in.	

RY9212174HYS0257US0

[5] CYLINDER SPEED

Item				Notes
Hydraulic cylinder operating time	Boom	Ground to max lift	2.5 ± 0.3 sec	
		Max lift to ground	3.0 ± 0.3 sec	
	Arm	Crowd	2.7 ± 0.3 sec	
		Dump	2.5 ± 0.3 sec	
	Bucket	Crowd	2.4 ± 0.3 sec	
		Dump	2.1 ± 0.3 sec	
	Swing	Left	5.2 ± 0.5 sec	
		Right	6.3 ± 0.5 sec	
	Blade	Max down to Max up	2.2 ± 0.3 sec	
		Max up to Max down	2.8 ± 0.3 sec	
Hydraulic cylinder drift	Boom	Std. when new	≤ 20.0 mm ≤ 0.79 in.	
		Usage limit	≤ 100.0 mm ≤ 3.94 in.	
	Arm	Std. when new	≤ 20.0 mm ≤ 0.79 in.	
		Usage limit	≤ 100.0 mm ≤ 3.94 in.	
	Bucket	Std. when new	≤ 10.0 mm ≤ 0.39 in.	
		Usage limit	≤ 50.0 mm ≤ 1.97 in.	
	Blade	Std. when new	≤ 20.0 mm ≤ 0.79 in.	
		Usage limit	≤ 70.0 mm ≤ 2.76 in.	
Swing cylinder deviation		Std. when new	≤ 10.0 mm ≤ 0.39 in.	
		Usage limit	≤ 50.0 mm ≤ 1.97 in.	

RY9212172HYS0030US0

12. TROUBLESHOOTING

[1] TROUBLESHOOTING ALL ACTUATORS

When all actuators are slow or fail to work

- Likely to be a problem in the pilot system and/or with the engine.
- Check for problems in hydraulic oil level and/or quality.

No.	Cause	Remedy	Notes
1	Low engine RPM	• Check the engine RPM. • Inspect fuel lines and air intake lines. • Test the accelerator dial. • Meter panel settings.	
2	Faulty limit switch lever lock	• Check the operation of the limit switch. Move the unload valve up/down and check for continuity in the tester mode. (when locked: OFF, when released: ON)	
3	Faulty unload valve	• Check unload valve operation. 1. Disconnect the unload valve connector and test for continuity. 2. Check for damage to the spool.	
4	Pilot primary pressure relief valve (aPP) faulty	• Measure pilot primary pressure. 1. Disassemble, clean and adjust or replace the relief valve.	
5	Main LS valve (aLS) faulty	• Measure main LS valve pressure. 1. Disassemble, clean and adjust or replace the relief valve.	
6	Unload LS valve (aUN) faulty	• Measure unload LS valve pressure. 1. Disassemble, clean and adjust or replace the relief valve.	
7	EP proportional solenoid valve faulty	• Check operation of EP proportional solenoid valve. 1. Turn the E mode switch ON/OFF and test continuity in the tester mode. 2. Disconnect the EP proportional solenoid valve connector and test for continuity and voltage. 3. Measure Pi pressure.	
8	Stuck LS spool inside the pump LS regulator	• Inspect the LS spool. 1. Take the LS spool out of the LS regulator and clean it. 2. Make sure there are no scratches on the spool and put back in place.	
9	LS control differential pressure adjusting spring out of adjustment	• Adjust the LS control differential pressure adjusting spring force.	
10	Pump internal parts worn or damaged	• Measure oil flow rate. If efficiency is less than 80% of when new: repair or replace the pump. If efficiency is 80% or more of when new: some other problem.	
11	Oil leak in PLS signal circuit inside the control valve or contamination of the orifice	• No pressure differential between PLS and PPS ports when boom up operated slowly at idle RPM. If there's a great difference in pressure: clean the orifice and/or disassemble and check the control valve.	
12	Pump fitting Connector faulty	• Replace pump connector.	
13	Pump drive shaft damaged	• Replace shaft.	

RY9212174HYS0249US0

[2] TROUBLESHOOTING FRONT SYSTEMS

When just certain cylinder(s) fail to work, are slow or jerky

- Identify whether the fault is in the main system or the pilot system.
- If a circuit lacks power, test the pressure of the corresponding main relief valve or the overload relief valve.

No.	Cause	Remedy	Notes
1	Defective pilot valve	• Measure the pilot secondary pressure.	
2	• Leak inside a cylinder • Leak inside a control valve section	• Measure the hydraulic drift. If hydraulic drift is outside of factory specs, take the following steps. 1. Exchange hoses with a normally operating section (on control valve side). 2. Test the hydraulic drift again. **[Assessment]** Within factory specs: control valve and/or overload relief valve faulty. Outside specs: replace cylinder seals.	
3	Overload relief valve faulty	• Diagnose the overload relief valve. Temporarily replace with a known good overload relief valve and determine whether faulty or not.	
4	Main spool inside control valve sticking or damaged	• Inspect the main spool or replace the valve. 1. Take the main spool out of the control valve and clean it. 2. After applying hydraulic oil, check whether it slides properly and return to the control valve.	
5	Pressure compensation valve sticking	• Inspect the pressure compensation valve. 1. Take the pressure compensation valve out of the control valve and clean it. 2. After applying hydraulic oil, check whether it slides properly and return to the control valve.	

RY9212148HYS0355US0

Boom operation slow or jerky

No.	Cause	Remedy	Notes
1	Anti-drop check valve sticking or damaged	• Inspect the anti-drop check valve. 1. Remove the anti-drop check valve from the control valve. 2. Check the inside and inspect for abnormalities.	

RY9212174HYS0250US0

Arm operation slow or jerky

No.	Cause	Remedy	Notes
1	Arm regenerative valve faulty	• Inspect the arm regenerative valve. 1. Take the spool out of the control valve and clean it. 2. Check the inside and inspect for abnormalities.	

RY9212148HYS0357US0

Swing slow or fails to move

No.	Cause	Remedy	Notes
1	Swing external orifice faulty	• Clean swing external orifice. If same thing happens: problem with anti-void and/or shut-off valves.	

RY9212148HYS0358US0

Swing extends or contracts

No.	Cause	Remedy	Notes
1	Anti-void faulty 1. Seat NG: extends 2. Suction NG: makes it sway	• Disassemble and clean or replace the anti-void valve.	

RY9212148HYS0359US0

When lever operated, it goes down and then back up

No.	Cause	Remedy	Notes
1	Load check valve inside the control valve faulty	• Inspect the load check valve. Remove and clean the load check valve.	

RY9212148HYS0360US0

A great deal of hydraulic drift

No.	Cause	Remedy	Notes
1	1. Leak inside a cylinder 2. Leak inside a control valve	• Measure the hydraulic drift. If hydraulic drift is outside of factory specs, take the following steps. 1. Exchange hoses with a normally operating section (on control valve side). 2. Test the hydraulic drift again. **[Assessment]** Within factory specs: control valve and/or overload relief valve faulty. Outside specs: cylinder seals faulty.	
2	Overload relief valve faulty	• Diagnose the overload relief valve. Temporarily replace with a known good overload relief valve and determine whether faulty or not.	

RY9212148HYS0361US0

Slow during multiple operations

No.	Cause	Remedy	Notes
1	Seat of unload LS valve (aUN) faulty	• Measure unload LS valve pressure. 1. Disassemble and clean or replace the relief valve.	
2	Seat of LS main relief valve (aLS) faulty	• Measure LS main relief valve pressure. 1. Disassemble, clean and adjust or replace the relief valve.	
3	Horsepower control valve faulty or loose	Check and adjust for loose nuts.	

RY9212148HYS0362US0

Downstream flow from certain section(s) is slow (works normally when operated at same time as upstream section)

No.	Cause	Remedy	Notes
1	High pressure selection valve sticking and/or seat faulty	• Clean the high pressure selection valve at the mating surfaces of each section.	

RY9212148HYS0363US0

[3] TRAVEL SYSTEM TROUBLESHOOTING

Fails to travel right and left or is slow

- It is unlikely that the right and left pilot valve, travel motor, control valves (travel section), etc. would become faulty at the same time.
- If neither right nor left will travel, it is likely a common pilot system is faulty.
- Adjust the left/right track tension and get rid of any clumps of mud.

No.	Cause	Remedy	Notes
1	Travel pilot valve filter blockage	Clean the pilot valve filter.	

RY9212174HYS0251US0

One side fails to travel, is slow or meanders

No.	Cause	Remedy	Notes
1	Defective travel pilot valve	• Measure the pilot secondary pressure.	
2	Main spool inside control valve or travel section is sticking or damaged	• Swap the left-right travel hoses on the control valve side and see if the problem changes sides too. **[Assessment]** If problem switches sides: main spool is sticking or damaged. If problem doesn't change: swivel joint and/or travel motor are faulty.	
3	Defective travel motor	• Measure the drain volume. **[Assessment]** If within factory specs: swivel joint is faulty. If outside specs: travel motor is faulty.	
4	Swivel joint faulty	• Swap the left/right travel hoses (swivel joint to travel motor) on the swivel joint side and see if the problem changes sides too.	

RY9212174HYS0252US0

Won't switch to high-speed travel

- Check whether the travel speed switch is switching in the tester mode.

No.	Cause	Remedy	Notes
1	Faulty 2nd speed solenoid valve at unload unit	• Check 2nd speed solenoid valve operation. 1. Check whether there is electricity to the unload valve. 2. Check whether the spool is switching inside.	
2	• Defective travel motor • Swivel joint faulty	• Measure the pressure at the travel motor 2nd speed switch port. **[Assessment]** Rated pressure: travel motor faulty. Below rated pressure: swivel joint faulty.	

RY9212148HYS0366US0

[4] SWIVEL SYSTEM TROUBLESHOOTING

When the swivel is slow, fails to work or is jerky.

- Identify whether the fault is in the main system or the pilot system.

No.	Cause	Remedy	Notes
1	Defective pilot valve	• Measure the pilot secondary pressure.	
2	Slow return valve faulty	Clean or replace the slow return valve.	
3	Swivel relief valve faulty	• Temporarily swap the left/right swivel relief valves. **[Assessment]** If the problem changes sides: swivel relief valve faulty. If problem is the same: the main spool is sticking or damaged or the anticavitation valve and/or swivel motor are faulty.	
4	Anticaviation valve faulty	• Swap anticavitation valves. **[Assessment]** If the problem changes sides: anticavitation valve faulty. If problem is the same: the main spool is sticking or damaged or the swivel motor is faulty.	
5	Swivel motor faulty	• Measure the drain volume.	
6	Main spool inside control valve sticking or damaged	• Inspect the main spool or replace the valve. 1. Take the main spool out of the control valve and clean it. 2. After applying hydraulic oil, check whether it slides properly and return to the control valve.	
7	Pressure compensation valve sticking or damaged	• Inspect the pressure compensation valve. 1. Take the pressure compensation valve out of the control valve and clean it. 2. After applying hydraulic oil, check whether it slides properly and return to the control valve.	

RY9212174HYS0253US0

Swivel drifts

- Identify whether the fault is in the main system or the pilot system.

No.	Cause	Remedy	Notes
1	Slow return valve faulty	Clean or replace the slow return valve.	
2	Pilot valve spool damaged	Check that the pilot valve spool returns to neutral.	
3	Swivel relief valve faulty	• Temporarily swap the left/right swivel relief valves. **[Assessment]** If the problem changes sides: swivel relief valve faulty. If problem is the same: the main spool is sticking or damaged or the anticavitation valve and/or swivel motor are faulty.	
4	Anticaviation valve faulty	• Clean or replace the anticavitation valve. **[Assessment]** If problem is not resolved: the main spool is sticking or damaged or the swivel motor is faulty.	
5	Swivel motor faulty	• Measure the drain volume.	
6	Main spool inside control valve sticking or damaged	• Inspect the main spool or replace the valve. 1. Take the main spool out of the control valve and clean it. 2. After applying hydraulic oil, check whether it slides properly and return to the control valve.	

RY9212174HYS0254US0

4 ELECTRICAL SYSTEM

SERVICING

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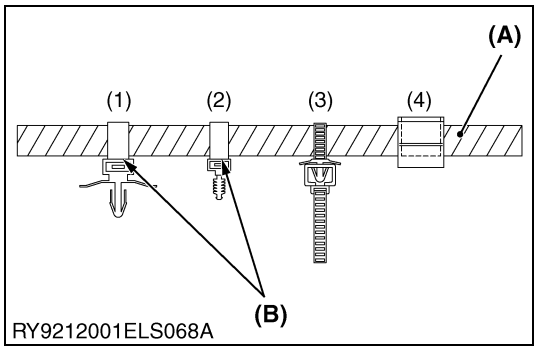
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1. ELECTRICAL DEVICE LAYOUT AND WIRING CIRCUIT

[1] PRECAUTIONS ON HOW TO CLAMP THE ELECTRICAL WIRING

1. Do not touch the wiring or the area around it.
   Do not touch where uncovered.
2. Do not clamp to fuel hoses.
3. Connect connectors and terminals securely so they do not come unplugged when pulled on gently.
4. Be sure to clamp the harness at the clamp position.
5. Clamps for securing harnesses



(1) Anchor Type
(Insert Firmly Until it Catches).
(2) Screw Type
(Insert to the End of the Screw).
(3) and (4) Insert Type: Insert Until it Locks.

(A) Harness
(B) Clamp the Harness so It Stays in Position and Does Not Move. Insert the End of the Cable Tie Into the Hole on the Other Side to Clamp the Harness.

RY9212001ELS0025US0

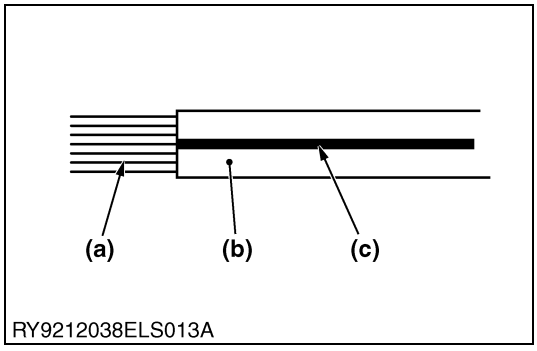
[2] PRECAUTIONS ON HANDLING ELECTRICAL CONNECTORS

1. When disconnecting connectors, grasp the body of the connector and pull it out; do not pull on the wiring harness. If the connector is the locking type, release the lock and then pull to disconnect.
2. When removing a connector's plastic cover (for water protection) to inspect it, be careful not to let any water get in the connector. If water does get in, dry it thoroughly before reassembling the connector and putting its plastic cover securely in place.
3. Straighten any bent connector terminals and make sure none are sticking out or missing. Also make sure there is no corrosion on the connector's terminals before connecting it.
4. When connecting a locking connector, be sure to press it in until you hear it click and then pull gently on the harness close to the connector and make sure the harness does not come out.

RY9212174ELS0075US0

Colors of Wiring

Color of wiring	Color code	Color of wiring	Color code
Black	B	Blue / Green	L/G
Green	G	Blue / Orange	L/Or
Blue	L	Blue / Red	L/R
Pink	P	Blue / White	L/W
Red	R	Blue / Yellow	L/Y
White	W	Light Green / Blue	Lg/B
Yellow	Y	Light Green / Red	Lg/R
Brown	Br	Light Green / White	Lg/W
Gray	GY	Light Green / Yellow	Lg/Y
Light Green	Lg	Orange / White	Or/W
Orange	Or	Pink / White	P/W
Sky Blue	Sb	Pink / Blue	P/L
Black / Green	B/G	Red / Black	R/B
Black / Blue	B/L	Red / Green	R/G
Black / Pink	B/P	Red / Blue	R/L
Black / Violet	B/V	Red / White	R/W
Black / Red	B/R	Red / Yellow	R/Y
Black / White	B/W	Violet / White	V/W
Black / Yellow	B/Y	White / Black	B/W
Brown / Black	Br/B	White / Green	W/G
Brown / Yellow	Br/Y	White / Blue	W/L
Brown / Red	Br/R	White / Red	W/R
Green / Black	G/B	White / Yellow	W/Y
Green / Blue	G/L	Yellow / Black	Y/B
Green / Red	G/R	Yellow / Green	Y/G
Green / White	G/W	Yellow / Blue	Y/L
Green / Yellow	G/Y	Yellow / Red	Y/R
Blue / Black	L/B		



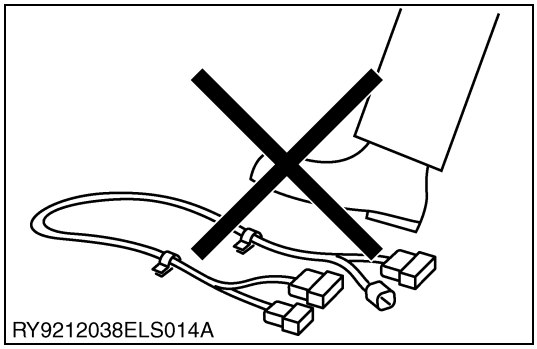
RY9212038ELS013A

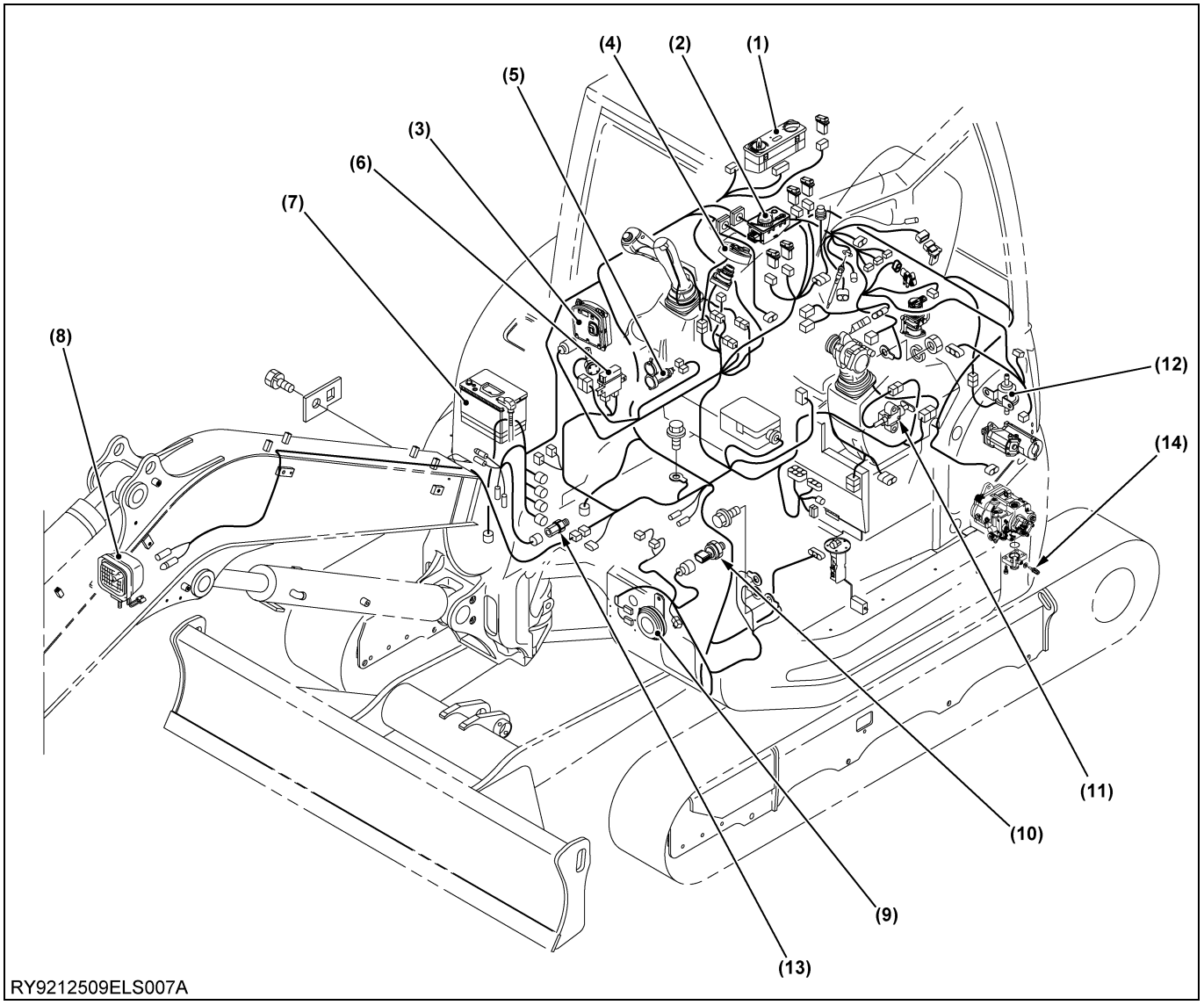
(E.g.)
1.25-Y/R means:
1.25 : Wire size (mm^2)
Y : Base color (yellow)
R : Stripe color (red)

- Do not pull on or step on wires. Also, do not cut wires on burred edges or the like.
- Do not twist or pinch wiring when installing it.

(a) Wire Size (mm^2)
(b) Insulation Base Color
(c) Stripe Color

RY9212038ELS0009US0


RY9212038ELS014A



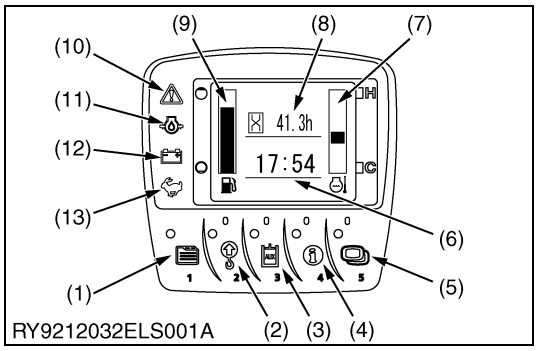
RY9212509ELS007A

(1) A/C Unit
(2) AI Console
(3) Meter
(4) Anti-Theft Antenna
(5) Cigar Socket
(6) Slow Blow Fuse
(7) Battery
(8) Front Worklight
(9) Horn
(10) Travel Pressure Switch
(11) Limit Switch
(12) Electrical Pump
(13) Boom Rising Pressure Sensor
(14) Oil Temperature Sensor

RY9212509ELS0017US0

2. METER PANEL OPERATION

[1] NAMES AND FUNCTIONS OF METERS

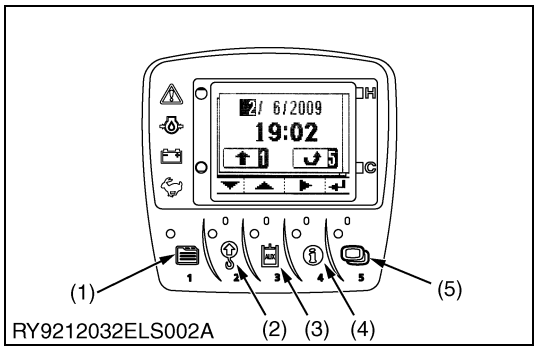


RY9212032ELS001A

Normal display

(1) User Setting Switch (Switch 1)
(2) Overload Warning Switch (Switch 2)
(3) AUX Port Enable Switch (Switch 3)
(4) Information Switch (Switch 4)
(5) Display Selector Switch (Switch 5)
(6) Clock Display
(7) Water Temperature Gauge
(8) Hour Meter - Engine Tachometer
(9) Fuel Gauge
(10) Warning Lamp (Red, Yellow)
(11) Oil Lamp
(12) Charge Lamp
(13) 2nd Speed Indicator Lamp

RY9212148ELS0001US0



RY9212032ELS002A

Display at menu-selection

(1) Direction cursor switch (Switch 1)
Stop each setting and return to the original screen.
(2) Cursor move switches (Switch 2)
Move Down the Selection Item.
Move Down the Menu-Selection Position.
(3) Cursor Move Switches (Switch 3)
Move Up the Selection Item.
Move Up the Menu-Selection Position.
(4) Cursor Move Switch (Switch 4)
(5) Save switch (Switch 5)
Decision of the Selection Item.
Selecting the Item at the Menu-Selection Position.

RY9212007ELS0002US0

[2] USER SETTINGS MODE

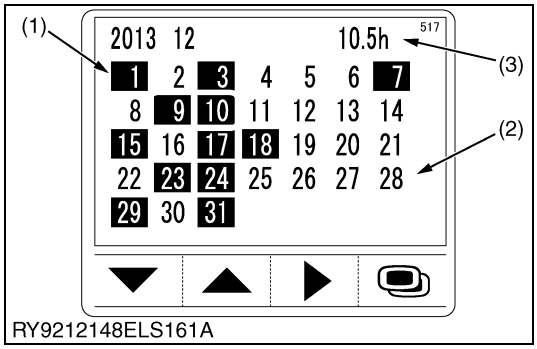
- Turn the key from OFF to ON and press switch 1 to enter the user settings mode.

	Item	Description
(1)	Log Record	Allows you to check the hours in use for each day for up to 3 months prior.
(2)	Periodic Check	Allows you to check the periodic check items and operate the meter panel after conducting periodic inspections.
(3)	Set Clock	Sets the clock.
(4)	Set AUX Flow Ctrl	Sets the AUX flow control.
(5)	Various Settings	Allows you to change the order of the date display and the clock display method.
(6)	Language Setting	Changes the language of the meter panel display.

RY9212148ELS0002US0

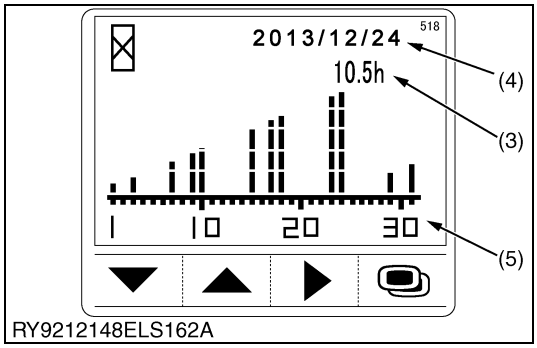
(1) Log Record

- Allows you to check the hours in use for each day for up to 3 months prior.



RY9212148ELS161A

1. Select Log Record.
2. Select the month and day of the hours in operation you wish to check to display the hours in use in the upper right of the screen.
3. If you press switch 5, you can check the hours in operation for one month.



RY9212148ELS162A

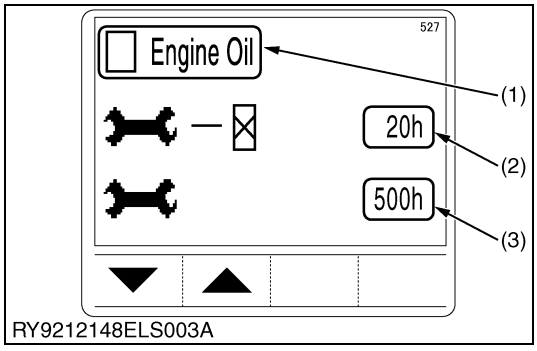
[Sample screenshot using switch 5]

(1) Days in Use (B/W reversed)
(2) Days not in Use
(3) Hours Used for Selected Date
(4) Selected Date
(5) Horizontal Axis (Day)

RY9212148ELS0016US0

(2) Periodic Check

- Allows you to check the periodic check items and operate the meter panel after conducting periodic inspections.



RY9212148ELS003A

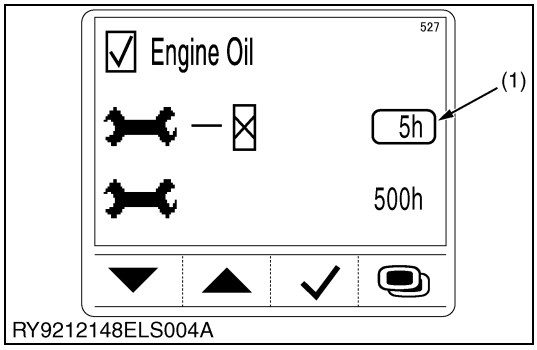
1. Select Periodic Check and check the periodic check items.

■ **IMPORTANT**

- **Once an item is within 10 hours of its periodic check time, switches 4 and 5 can be selected.**

(1) Check Item
(2) Hours Until Service (Next check time - service hour meter)
Service Hour Meter: hour meter + offset time
(3) Next Check Time

RY9212148ELS0017US0



RY9212148ELS004A

<u>Operation after making a periodic check</u>

1. Select Periodic Check and select the periodic check item that was performed.
2. Press switch 4 and make sure the check mark is displayed in the upper left of the meter panel.
3. Press switch 5.

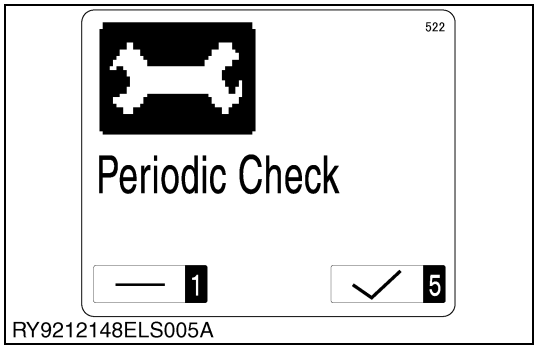
■ **IMPORTANT**

- **When "Periodic Check Selection" is set to Manual, switch 4 cannot be selected unless the worklight is pressed "ON". (Std. for European spec)**
- **When the "Periodic Check Selection" is set to Auto, turning the key ON/OFF 10 times means the periodic check has been done. (Std. for other than European specs)**

4. To perform the check, press switch 5. To return, press switch 1.

■ **IMPORTANT**

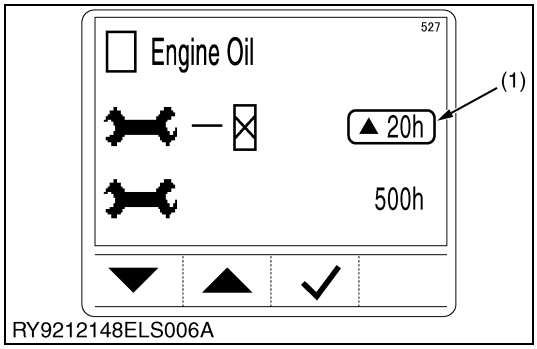
- **Once you initiate a check (switch 5), you cannot go back.**



RY9212148ELS005A

(1) Hours Until Service (5 hours until periodic check time)

RY9212148ELS0018US0



RY9212148ELS006A

[Display when periodic check time exceeded]

E.g.) 20 hours past time to change the engine oil
Service hour meter: 520 hours

(1) Hours Until Service (past 20 hours)

RY9212148ELS0019US0

Periodic Check Items List (The following check items are displayed on the LCD screen at the correspondinghour meter time.)

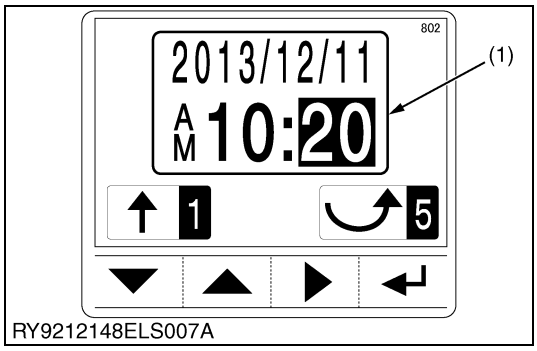
No.	Check points		Measures	Hour meter indicator										Intervals
				50	100	250	500	600	750	1000	1500	2000	3000	
1	Engine oil (CJ-4)		change				❍			❍	❍	❍	❍	every 500 hrs
2	Fuel filter		replace				❍			❍	❍	❍	❍	every 500 hrs
3	Engine oil filter						❍			❍	❍	❍	❍	every 500 hrs
4	Drive unit oil		change	●			❍			❍	❍	❍	❍	every 500 hrs
5	Breather filter		replace				❍			❍	❍	❍	❍	every 500 hrs
6	Hydraulic oil		change							❍		❍	❍	every 1000 hrs
7	Air filter element	Outer element	replace							❍		❍	❍	every 1000 hrs
		Inner element								❍		❍	❍	every 1000 hrs
8	Hydraulic return filter element									❍		❍	❍	every 1000 hrs
9	Hydraulic suction filter element									❍		❍	❍	every 1000 hrs
10	Pilot filter									❍		❍	❍	every 1000 hrs
11	Idler, Track roller, Grease		–									❍		every 2000 hrs
12	DPF		clean										❍	every 3000 hrs

● First operation

RY9212509ELS0020US0

(3) Set Clock

- Sets the clock.



RY9212148ELS007A

1. Select "Set Clock" and set the clock.

[NOTE]

- Clock precision: 2 seconds/day

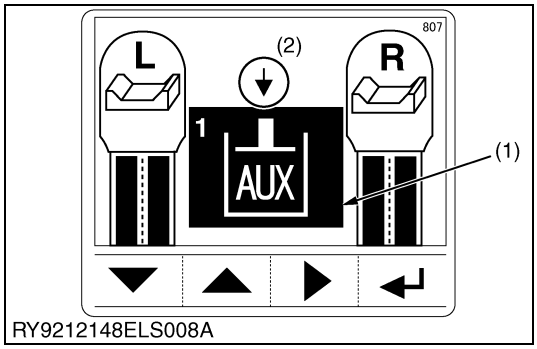
■ **NOTE**

- **Clock settings can be made with the display methods in the "Various Settings" mode.**

(1) Clock Setting Screen

RY9212148ELS0021US0

(4) Set AUX Flow Ctrl



RY9212148ELS008A

1. Select "Set AUX Flow Ctrl" and set the auxiliary flow control.

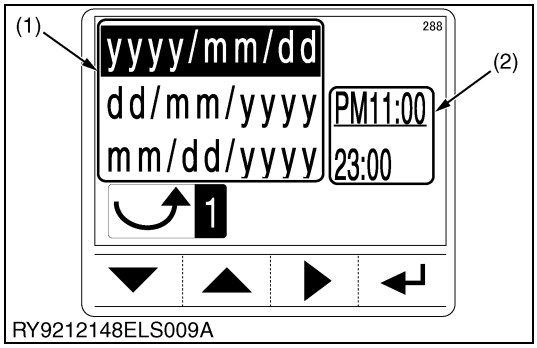
■ **NOTE**
- **When shipped only icons 1 and 2 are recorded. (N.A. and Australia specs)**
- **When shipped only icons 1, 2 and 3 are recorded. (Eur. spec.)**

(1) Icons (1 to 5) (2) Cursor

RY9212172ELS0002US0

(5) Various Settings

- Allows you to change the order of the date display and the clock display method.



RY9212148ELS009A

1. Select Various Settings and then Calendar.
2. Select the date and clock display methods as desired.

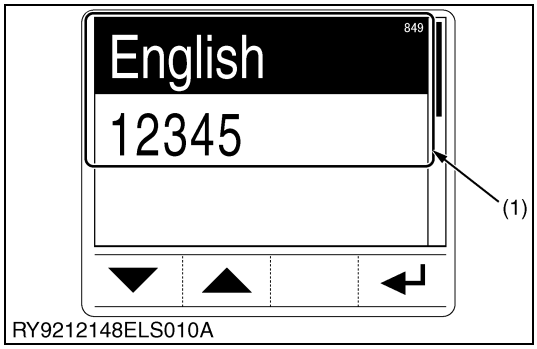
When shipped	N.A. and Australia Specs	MDY/AM-PM
	Eur. spec.	DMY/24 Hour
	Japan spec	YMD/AM-PM

(1) Select the Y/M/D Display Order (2) Select Either AM-PM or 24 Hour Display

RY9212148ELS0023US0

(6) Language Setting

- Changes the language of the meter panel display.



RY9212148ELS010A

1. Select "Language Setting" and select a language.

■ **IMPORTANT**
- **In Eur. spec., 14 languages are available.**
- **In US and Australia specs, English only.**
- **In Canada spec., English and French only.**

(1) Language Selection Screen

RY9212509ELS0001US0

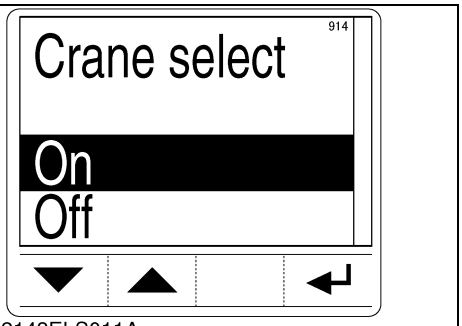
[3] SERVICE DEALER SETTING

- Turning the key ON while holding SW1 down, allows you to enter the hide user mode.
- There are two items in the hide user mode, the crane mode and the arm control mode.

RY9212148ELS0025US0

(1) Crane Mode

- Disables the overload alarm on excavators that have the overload alarm. (Eur. spec.)
- Disables the crane function on excavators with the crane specification. (Japan spec.)



RY9212148ELS011A

1. Select the crane mode.
2. Select the desired setting.
3. Press SW5 to make the setting.

- When shipped: enabled

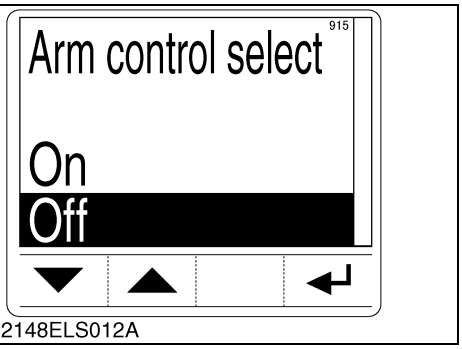
■ **IMPORTANT**

- **The setting is displayed and can be made on the N.A. and Australia specifications as well. (Does not affect this machine.)**

RY9212172ELS0004US0

(2) Arm Control Mode (Only on Japan Spec.)

- Disables the ability to switch the arm control on machines with the arm control specification.



RY9212148ELS012A

1. Select the arm control mode.
2. Select the desired setting.
3. Press SW5 to make the setting.

- When shipped: enabled

■ **IMPORTANT**

- **The setting is displayed and can be made on the Japan specification as well (Does not affect this machine).**

RY9212148ELS0027US0

[4] SERVICE/DEALER MODE

- Turning the key ON while holding down SW5 puts the machine in the service/dealer mode.
- Select a language. (Eur. spec.: 5 languages, US and Australia spec.:1 language, Canada spec.: 2 languages)
- There are 2 items in the service/dealer mode, namely "Diagnosis" and "Setting," which allow you to check/set the content in the tables below.

Mode	Item		Description	Notes
(1) Diagnosis	[A] Tester		Checks the data from each sensor and switch.	
	[B] Retrieve Fail Record		Checks the record of past failures.	
	[C] Delete Fail Record		Deletes the record of past failures.	
(2) Setting	[A] AI Set		Make the setting when the AI motor, accelerator dial or governor sensor is touched. Also make the setting when part(s) are replaced.	
	[B] AUX1 Set	(A) Knob Set	Set when the AUX1 knob is replaced.	
		(B) (w/attach) Start Point Set	Set when the AUX1 proportional valve and/or spool are replaced. (w/ attachment mounted)	
		(C) (w/o attach) Start Point Set	Set when the AUX1 proportional valve and/or spool are replaced. (w/ pressure gauge mounted)	
		(D) Feeling Adj.	Make setting when the AUX1 start point is inaccurate.	
	[C] AUX2/Thumb Set	(A) Knob Set	Make setting when the AUX2 knob is replaced.	
		(B) (w/attach) Start Point Set	Set when the AUX2 proportional valve, spool and/or ECU are replaced. (w/ attachment mounted)	
		(C) (w/o attach) Start Point Set	Set when the AUX2 proportional valve, spool and/or ECU are replaced. (w/ pressure gauge mounted)	
		(D) Feeling Adj.	Make setting when the AUX2 start point is inaccurate.	
	[D] AS Set	(A) Front Angle Set	Set when the AS position meter is replaced.	Only on RX series (Japan)
		(B) Start Point Set	Set when the AS 4-way proportional valve and/or control valve are replaced.	
		(C) Feeling Adj.	Set when you wish to change the sensitivity of the AS cylinder end cushion feel.	
		(D) Bucket Set	Set when using a bucket that is wider than the standard bucket.	
	[E] Crane Set	(A) Front Angle Set	Set when the crane's position meter is replaced.	Crane spec. only (Japan)
		(B) Maximum Set	Make the setting when the AI motor, accelerator dial or governor sensor is touched. Also make the setting when part(s) are replaced.	
	[F] Over Load Warning		Sets/changes the overload warning pressure.	Eur. spec. only
	[G] Model Set		Set when the ECU and/or meters are replaced.	

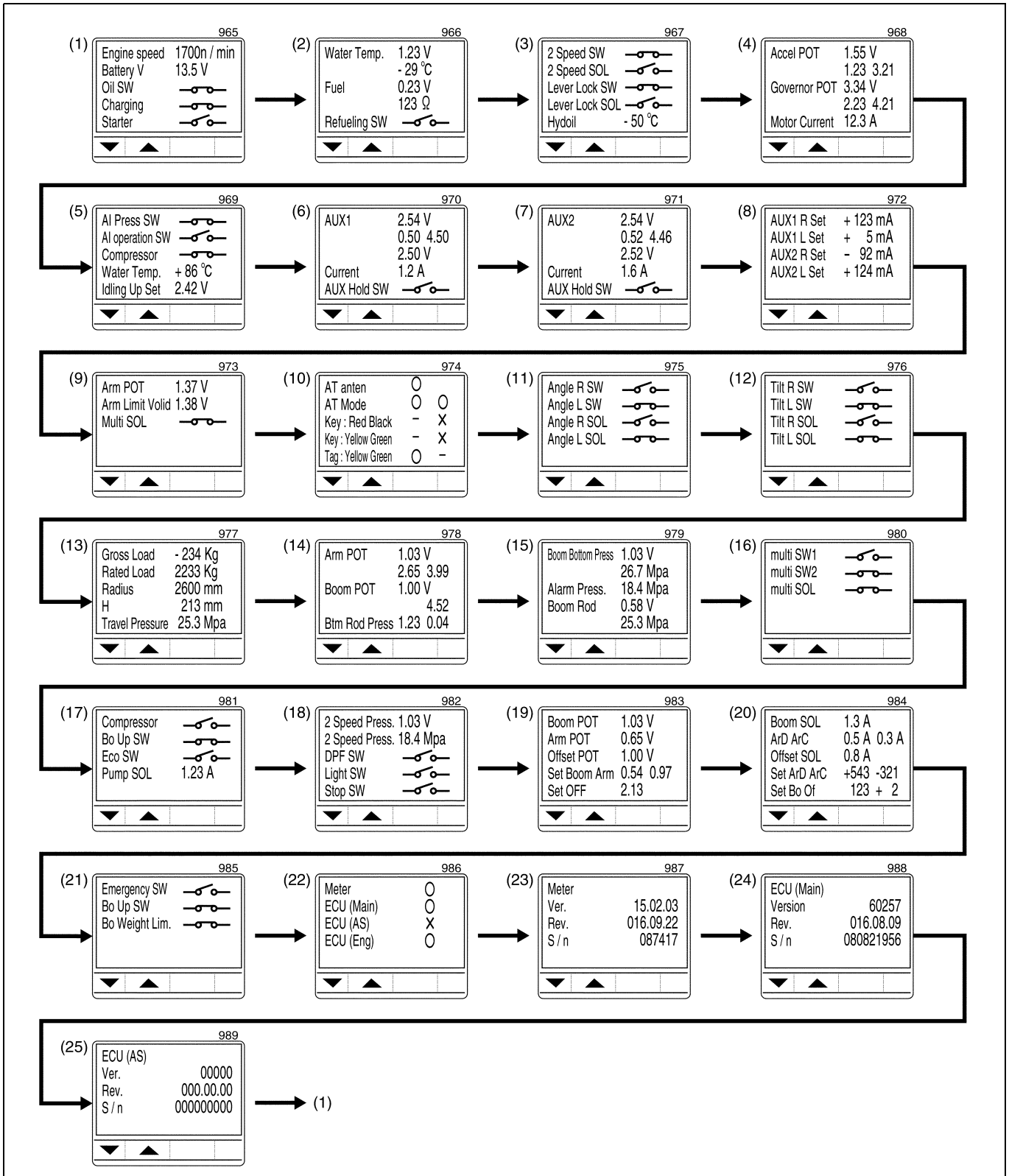
Mode	Item		Description	Notes
(2) Setting	[H] Others	(A) AI Motor Drive	Moves the AI motor position when the accelerator dial is replaced.	
		(B) Exchange (AUX1) (2/Thumb)	Operates AUX2 via the AUX1 knob and operates AUX1 via the AUX2 knob.	
		(C) Periodic Check Selection	Changes the method of canceling the periodic check guidance to automatic or to manual.	
		(D) Periodic Check Display	Turns off the display of periodic check guidance. Or turns it on.	
		(E) Annual Guidance	Turns on the display of annual check guidance. Or turns it off.	
		(F) Periodic Check Set	When the meter is replaced, sets the periodic check time prior to replacement to prevent a discrepancy in the periodic check time.	
		(G) Clock Set Warning (Y/N)	Turns the message, "Set clock" to be displayed/not when the clock has the wrong time.	
		(H) Arm Control Adj	Set when making fine adjustments to the stop position of the arm crowd limit.	Japan spec. only
		(I) Multipurpose Mode	Changes the operating conditions of the multi-purpose switch.	
		(J) All Fail Record	Checks all the fail records since the machine was shipped.	
		(K) Opening Select	Changes the opening display screen.	

RY9212172ELS0005US0

(1) Diagnosis

[A] Tester

- Makes it possible to check the data from each sensor and switch.
- Determines when a setting is outside parameters and when a switch or solenoid is irregular in terms of continuity.
- Selecting Diagnosis → Tester puts it into this diagnosis mode.



RY9212509ELS001US

(To be continued)

(Continued)

Screen No.	Content displayed	Description/std. value			Notes
1	Engine RPM	• Current value (n/min)			
	Battery voltage	• Battery voltage ± 0.5 V			
	Oil switch	• Prior to engine start: ON • After engine start: OFF			
	Charge				
	Starter	• Key in the Start position: ON • Key in any other position: OFF			
2	Water temperature	• Current value (V) • Current value (°C)			Common rail spec. voltage (V) is dummy data
	Fuel	• Current value (V) • Current value (Ω)			
			When cut off	When shorted	
		Voltage	5.0 V	0 V	
		Resistance	260 Ω	0 Ω	
		[NOTE]			
		Full	5.0 Ω or less		
		Showing 1/2	35.83 Ω		
		3 dots remaining	86.2 Ω		
		Empty	101.0 Ω or higher		
		• Fuel low warning displayed when 3 dots remaining.			
	Fuel supply switch	• Press switch: ON • Release switch: OFF			
3	2nd speed switch	• Press switch: ON • Release switch: OFF			
	2nd speed solenoid	• With output signal from ECU: ON • No output signal from ECU: OFF			
	Lever lock switch	• Lever down: ON • Lever up: OFF			
	Lever lock solenoid	• With output signal from ECU: ON • No output signal from ECU: OFF			
	Oil temperature sensor	• Current value (°C)			
4	Accelerator POT	• Current value: 1.50 to 3.30 V • Current value: idle, MAX			
	Governor POT	• Current value: 0.25 to 4.75 V • Current value: idle, MAX			Common rail spec. is dummy data
	Motor amperage	• AI motor operating: 0.0 to 15.0 A • AI motor stopped: 0.0 to 2.0 A			
5	AI pressure switch	• Not operating: ON • Operating: OFF			
	AI control switch	• Press switch: ON • Release switch: OFF			
	Compressor	• Operating: ON			
	Water temperature	• Current value (°C)			
	Idle up	• Idle up setting value (V)			Common rail spec. is dummy data
6	AUX1	• Current value: 0.25 to 4.75 V • Setting value: left or right • Setting value: neutral			Only specs equipped with the sensor/switch (Eur., N.A. and Australia)
	Amperage	• Operating: 0.5 to 2.0 A • Stopped: 0 to 0.2 A			
	AUX hold switch	• Press switch: ON • Release switch: OFF			

Screen No.	Content displayed	Description/std. value			Notes
7	AUX2	• Current value: 0.25 to 4.75 V • Setting value: left or right • Setting value: neutral			Only specs equipped with the sensor/switch (Eur., N.A. and Australia)
	Amperage	• Operating: 0.5 to 2.0 A • Stopped: 0 to 0.2A			
	AUX hold switch	• Press switch: ON • Release switch: OFF			
8	AUX1 right setting	• AUX start point setting value			Only specs equipped with the sensor/switch (Eur., N.A. and Australia)
	AUX1 left setting				
	AUX2 right setting				
	AUX2 left setting				
9	Arm POT	• Current value: 0.25 to 4.75 V			Arm limit spec only (Japan)
	Arm limit setting value	• Arm stop setting value			
	Arm limit solenoid	• With output signal from ECU: ON • No output signal from ECU: OFF			
10	Anti-theft antenna	• Antenna working normally: O • Antenna malfunction: X			If unknown or cancelled: –
	On/off enabled/cancelled	Registered key: O No key: X	Anti-theft mode: O Anti-theft off: X		
	Red key, Black key	Registered red key: O Different red key: X	Registered black key: O Wrong red or black key: X		
	Yellow or green key	Registered yellow key: O Different yellow key: X	Registered green key: O Different green key: X		
	(Tag) yellow or green	Registered yellow key: O Different yellow key: X	Registered green key: O Different green key: X		
11	Angle right switch	• Press switch: ON • Release switch: OFF			Angle spec. only (N.A.)
	Angle left switch				
	Angle right solenoid	• With output signal from ECU: ON • No output signal from ECU: OFF			
	Angle left solenoid				
12	Tilt right switch	• Press switch: ON • Release switch: OFF			Tilt spec. only (N.A.)
	Tilt left switch				
	Tilt right solenoid	• With output signal from ECU: ON • No output signal from ECU: OFF			
	Tilt left solenoid				
13	Actual load	• Current value (kg)			Crane spec. only (Japan)
	Rated load	• Current value (kg)			
	Radius	• Current value (mm)			
	Height	• Current value (mm)			
	Travel pressure	• Current value (MPa)			
14	Arm POT	• Current value: 0.25 to 4.75 V • Setting value: arm crowded, arm dump end			
	Boom POT	• Current value: 0.25 to 4.75 V • Setting value: boom up end			
	Bottom pressure, rod pressure	• Current value: 0.50 to 4.50 V			

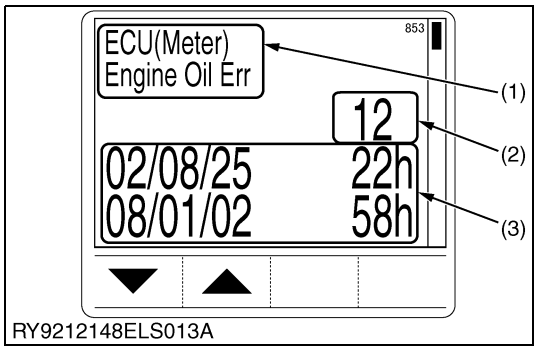
Screen No.	Content displayed	Description/std. value		Notes
15	Boom bottom pressure	• Current value (V) • Current value (MPa)		Eur. spec. only
	Warning pressure	• Current value (MPa)		
	Boom rod pressure	• Current value (V) • Current value (MPa)		Dummy data
16	Multi-purpose switch 1 (AI control dial)	• Press switch: ON • Release switch: OFF		
	Multi-purpose switch 2 (AUX left knob)			
	Multi-purpose solenoid	• With output signal from ECU: ON • No output signal from ECU: OFF		
17	Compressor	• Operating: ON		
	Boom up pressure switch	• Stopped or fine operation: ON • Full stroke operations: OFF		
	EP switch	• Press switch: ON • Release switch: OFF		
	EP solenoid	• Current amperage (A)		
		P mode (A/C OFF)	0 mA	A/C: Air Conditioner
		P mode (A/C ON)	600 mA	
		E mode (During travel or full boom up stroke operation)	940 mA	
		E mode	1300 mA	
18	Travel pressure sensor	• Current value (V) • Current value (MPa)		
	DPF switch	• Press switch: ON • Release switch: OFF		
	Worklight switch			
	Stop engine switch			
19	Boom POT	• Current value: 0.25 to 4.75 V		Only on RX series (Japan)
	Arm POT			
	Offset POT			
	Setting Bo Ar	• Setting value: boom up, arm crowded		
	Setting Of	• Setting value: offset right		
20	Boom solenoid	• Operating: 0.4 to 1.2 A • Stopped: 0.0 to 0.6 A		
	Arm dump/crowd			
	Offset solenoid			
	Setting ArD ArC	• Start point setting: arm dump, arm crowd		
	Setting Bo Of	• Starting point setting: boom up, offset right		
21	Emergency switch	• Press switch: ON • Release switch: OFF		
	Boom up pressure switch	• During boom up operation: ON • Not operating: OFF		
	Boom height limit	• Normally: ON • At height limit: OFF		
22	Meter	• Normally: O [If the meter exists, then O]		
	ECU (main)	• Normally: O [If the ECU (main) exists, then O]		
	ECU (AS)	• Normally: O [If the ECU (AS) exists, then O]		Only on RX series (Japan)
	ECU (CRS)	• Normally: O [If the ECU (CRS) exists, then O]		

Screen No.	Content displayed	Description/std. value	Notes
23	Meter		
	Ver	• Program version	
	Rev	• Program creation date (Y/M/D)	
	Serial No.	• Serial no. (different number each machine)	
24	ECU (main)		
	Ver	• Program version	
	Rev	• Program creation date (Y/M/D)	
	Serial No.	• Serial no. (different number each machine)	
25	ECU (AS)		Only on RX series (Japan)
	Ver	• Program version	
	Rev	• Program creation date (Y/M/D)	
	Serial No.	• Serial no. (different number each machine)	

RY9212509ELS0002US0

[B] Retrieve Fail Record

- Checks the record of past failures.



RY9212148ELS013A

1. Select Diagnosis → Retrieve Fail Record.
2. If there are more than one failure records, you can toggle the display each time you press switch 2 or 3.

[Display when fail record exists]

(1) Content of Failure detected by the ECU (main or meter or AS) that detected it
(2) Number of occurrences (1 to 255)
(3) Date and hour meter of initial occurrence and date and hour meter of last occurrence

RY9212148ELS0030US0



RY9212148ELS014A

[Display when no fail record exists]

RY9212148ELS0031US0

[C] Delete Fail Record

- Deletes the record of past failures.



RY9212148ELS015A

1. Select Diagnosis → Delete Fail Record.

[Display when fail record deleted]

■ **IMPORTANT**

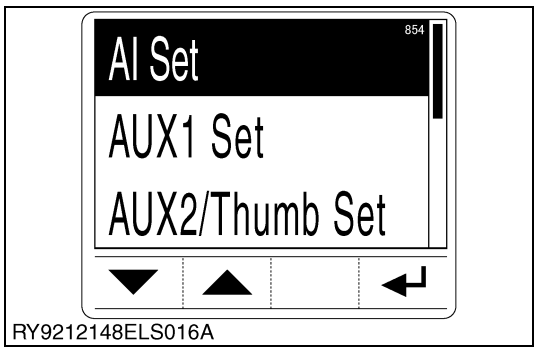
- **Even when fail records are deleted, they are still recorded in the all fail record.**

RY9212148ELS0032US0

(2) Setting

[A] AI Set

- Make the setting when the AI motor, accelerator dial or governor sensor is touched. Also make the setting when part(s) are replaced.



RY9212148ELS016A

1. Select Setting → AI set.
2. Follow the instructions on the meter panel.
3. Press SW5 to make the setting.
4. Follow the instructions on the meter panel and repeat steps 2 and 3.

[Work flow]

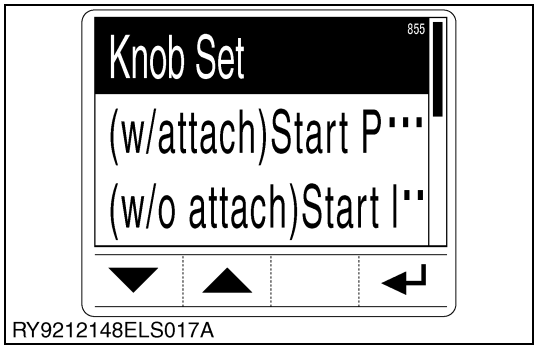
Accel to MAX → Accel to Idling

RY9212148ELS0033US0

[B] AUX1 Set

(A) Knob Set

- Set when the knob is replaced.



RY9212148ELS017A

1. Select Setting → AUX1 Set → Knob set.
2. Follow the instructions on the meter panel.
3. Press SW5 to make the setting.
4. Follow the instructions on the meter panel and repeat steps 2 and 3.

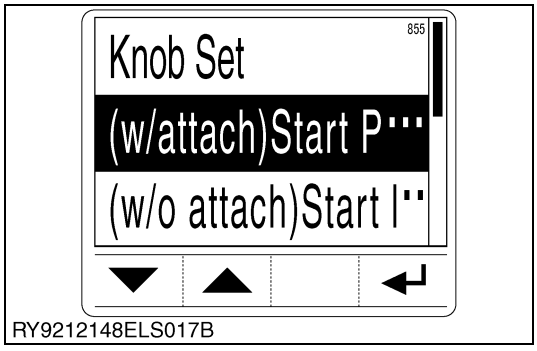
[Work flow]

AUX Knob R END → AUX Knob L END → Knob to neutral.

RY9212148ELS0034US0

(B) (w/attach) Start Point Set

- Make setting when the AUX1 proportional valve, spool and/or AUX1 knob is replaced.
- Mount an attachment on the AUX1 port and make the setting.



RY9212148ELS017B

1. Select Setting → AUX1 Set → (w/attach) Start Point Set.
2. Follow the instructions on the meter panel.
3. Press SW5 to make the setting.
4. Follow the instructions on the meter panel and repeat steps 2 and 3.

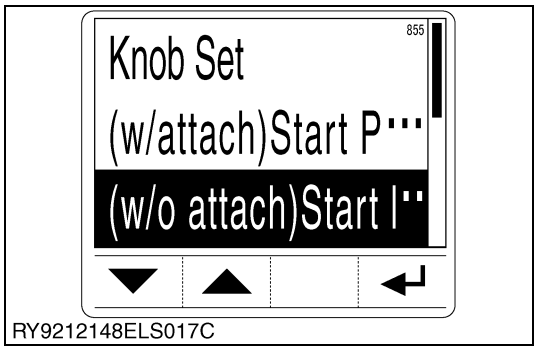
[Work flow]

Accel to MAX → Measure L when attachment moves → Measure R when attachment moves.

RY9212148ELS0035US0

(C) (w/o attach) Start Point Set

- Make setting when the AUX1 proportional valve, spool and/or AUX1 knob is replaced.
- Use this setting method when an attachment is not available.



RY9212148ELS017C

1. Place the excavator on flat hard ground, lower the bucket and the blade, and stop the engine.
2. Follow the chapter Release of Residual Pressure in the Hydraulic System and release the residual pressure in the hydraulic line.
3. Attach a pressure gauge at the end of the AUX1 ports (LH and RH).
4. Select Setting → AUX1 Set → (w/o attach) Start Point Set.
5. Follow the instructions on the meter panel.
6. Press SW5 to make the setting.
7. Follow the instructions on the meter panel and repeat steps 5 and 6.

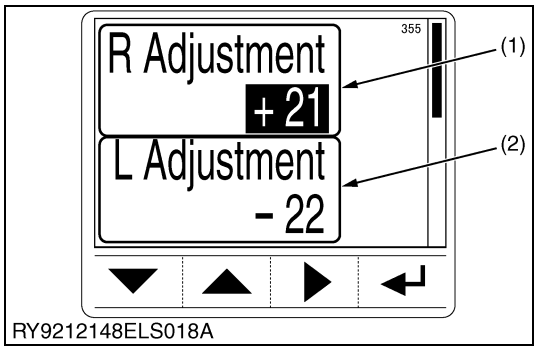
[Work flow]

Accel to MAX → Measure L when pressure rises → Measure R when pressure rises.

RY9212148ELS0036US0

(D) Feeling Adj.

- Adjust the AUX1 start point to customer's specification.



RY9212148ELS018A

1. Select Setting → AUX1 Set → Feeling Adj.
2. Follow the instructions on the meter panel and change the number while monitoring the feel.
3. Press SW5 to make the setting.

CAUTION

- **Only use if it does not work properly even after making the start point setting.**

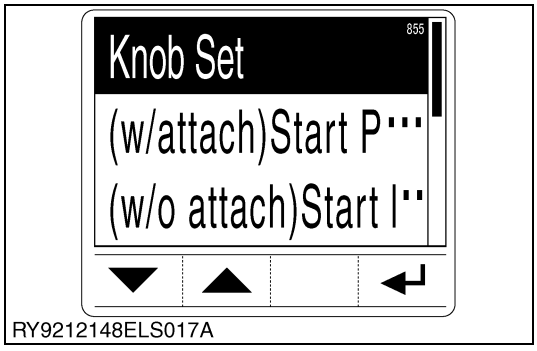
(1) Right Fine Adjustment Value (2) Left Fine Adjustment Value

RY9212148ELS0037US0

[C] AUX2/Thumb Set

(A) Knob Set

- Set when the AUX2 knob is replaced.



RY9212148ELS017A

1. Select Setting → AUX2/Thumb Set → Knob set.
2. Follow the instructions on the meter panel.
3. Press SW5 to make the setting.
4. Follow the instructions on the meter panel and repeat steps 2 and 3.

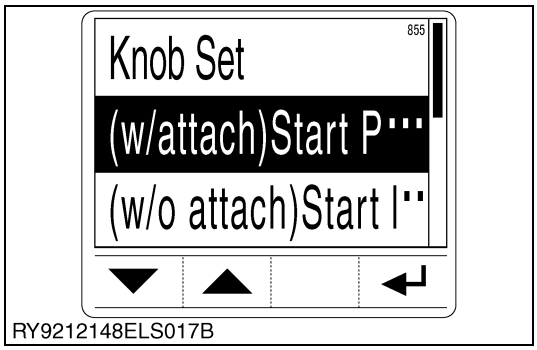
[Work flow]

AUX Knob R END → AUX Knob L END → Knob to neutral

RY9212148ELS0038US0

(B) (w/attach) Start Point Set

- Make setting when the AUX2 proportional valve, spool and/or AUX2 knob is replaced.
- Mount an attachment on the AUX2 port and make the setting.



RY9212148ELS017B

1. Select Setting → AUX2/Thumb Set → (w/attach) Start Point Set.
2. Follow the instructions on the meter panel.
3. Press SW5 to make the setting.
4. Follow the instructions on the meter panel and repeat steps 2 and 3.

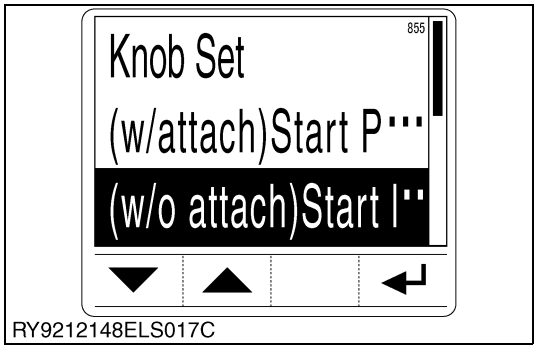
[Work flow]

Accel to MAX → Measure L when attachment moves → Measure R when attachment moves.

RY9212148ELS0039US0

(C) (w/o attach) Start Point Set

- Make setting when the AUX2 proportional valve, spool and/or AUX2 knob is replaced.
- Use this setting method when an attachment is not available.



RY9212148ELS017C

1. Place the machine on flat hard ground, lower the bucket and the blade, and stop the engine.
2. Follow the chapter Release of Residual Pressure in the Hydraulic System and Release Pressure in the Hydraulic Line.
3. Attach a pressure gauge at the end of the AUX2 ports (LH and RH).
4. Select Setting → AUX2/Thumb Set → (w/o attach) Start Point Set.
5. Follow the instructions on the meter panel.
6. Press SW5 to make the setting.
7. Follow the instructions on the meter panel and repeat steps 5 and 6.

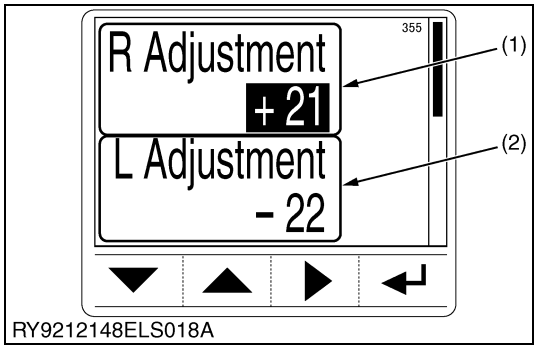
[Work flow]

Accel to MAX → Measure L when pressure rises → Measure R when pressure rises

RY9212148ELS0040US0

(D) Feeling Adj.

- Adjust the AUX2 start point to customer's specification.



RY9212148ELS018A

1. Select Setting → AUX2/Thumb Set → Feeling Adj.
2. Follow the instructions on the meter panel and change the number while monitoring the feel.
3. Press SW5 to make the setting.

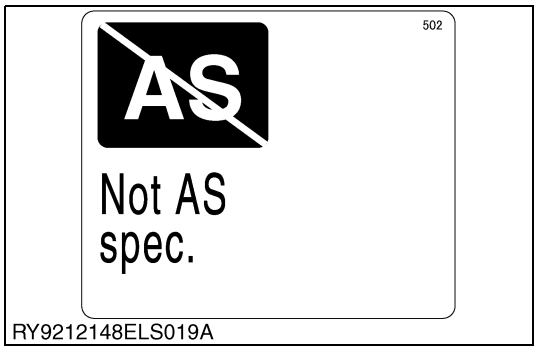
CAUTION

- **Only use when it does not work properly even after making the start point setting.**

(1) Right fine adjustment value (2) Left fine adjustment value

RY9212148ELS0041US0

[D] AS Set (Japan Spec. Only)

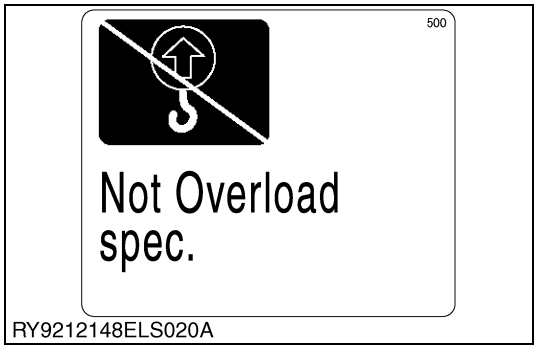


RY9212148ELS019A

[Display when not the Japan spec.]

RY9212148ELS0042US0

[E] Crane Set (Japan Spec. Only)



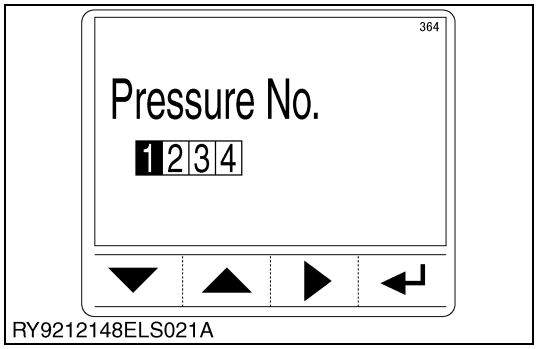
RY9212148ELS020A

[Display when not the Japan spec.]

RY9212148ELS0043US0

[F] Overload Warning (Eur. Spec. Only)

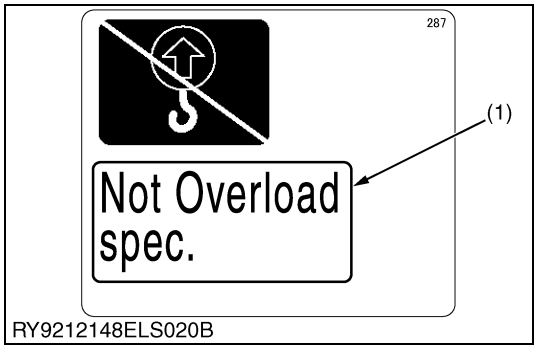
- Sets/changes the overload warning pressure.



RY9212148ELS021A

1. Select Setting → Overload warning.
2. Enter a pressure warning value appropriate for the specification.

RY9212158ELS0002US0



RY9212148ELS020B

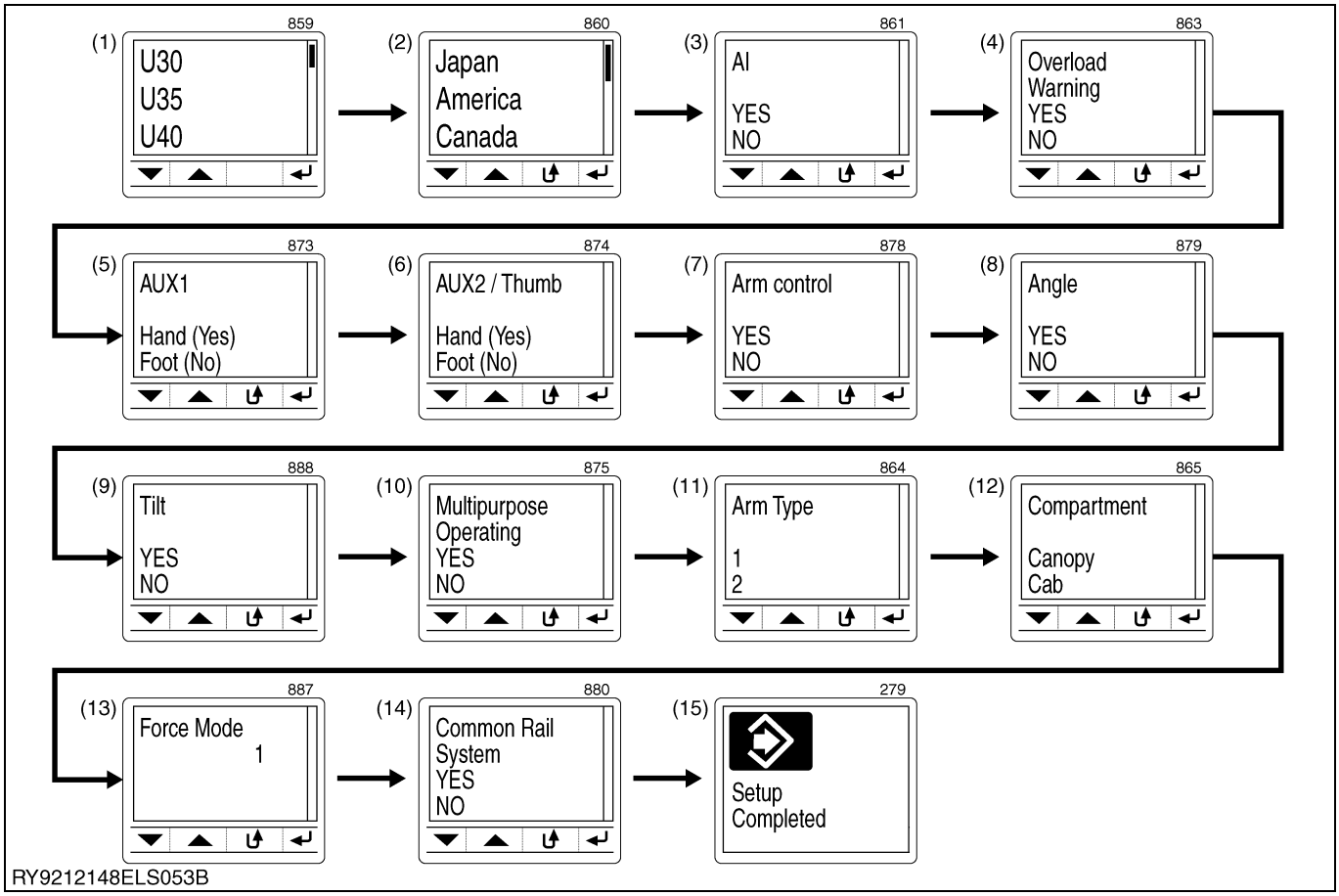
[Display when not overload warning spec.]

(1) Not the crane spec. or the overload warning spec.

RY9212148ELS0045US0

[G] Model Set

- Set when the ECU and/or meters are replaced.
- Select Settings → Model Set to make this setting.
- After setting the model, it is necessary to make the AI, AUX1 knob, AUX2 knob and over load warning settings (if have already installed these options).



RY9212148ELS053B

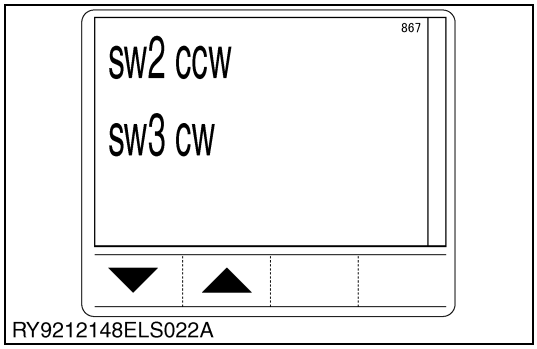
Screen No.	Content displayed	Notes	Initial setting values
(1)	Model name		KX040
(2)	Destination		EU
(3)	AI		YES
(4)	Overload Warning		NO
(5)	AUX1		Hand (Yes)
(6)	AUX2 / Thumb		Hand (Yes)
(7)	Arm Control	Japan spec.: YES (Arm limit spec. only)	NO
(8)	Angle	N.A. spec.: YES (Angle spec. only)	NO
(9)	Tilt	N.A. spec.: YES (Tilt spec. only)	NO
(10)	Multipurpose Operating	Has multi-purpose switch connector spec.: YES	YES
(11)	Arm Type		2
(12)	Compartment		Cab
(13)	Force Mode	W/ eco mode spec.: 1 (KX042-4) W/AC mode spec.: 2 No AC spec.: 0	1
(14)	Common Rail System		YES
(15)	Setup Completed		

RY9212509ELS0003US0

[H] Others

(A) AI Motor Drive

- Moves the AI motor position when the accelerator dial is replaced.



RY9212148ELS022A

1. Select Setting → Others → AI Motor Drive.
2. Press switch 2 or 3 to move the lever position.

- Switch 2: Counterclockwise
- Switch 3: Clockwise

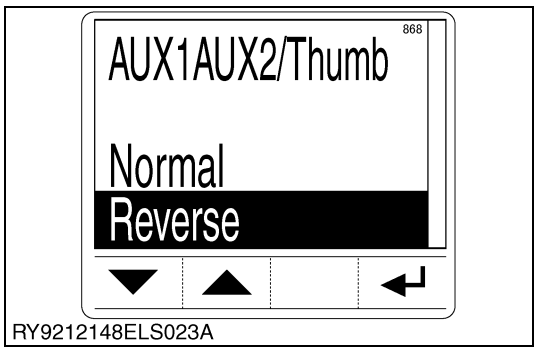
■ **IMPORTANT**

- **The common rail spec. does not have an AI motor, so this does not function.**

RY9212148ELS0003US0

(B) Exchange (AUX1) (2/Thumb)

- Operates AUX2 via the AUX1 knob. Or operates AUX1 via the AUX2 knob.



RY9212148ELS023A

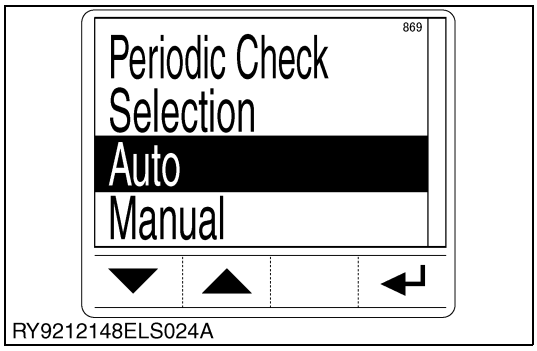
1. Select Setting → Others → Exchange (AUX1) (2/Thumb).
2. Select the desired operating method.
3. Press SW5 to make the setting.

	AUX1	AUX2
Normal	Right control lever	Left control lever
Reverse	Left control lever	Right control lever

RY9212148ELS0004US0

(C) Periodic Check Selection

- Changes the method of canceling the periodic check guidance to automatic or to manual.



RY9212148ELS024A

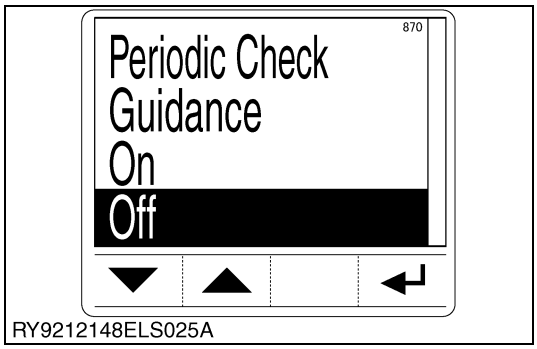
1. Select Setting → Others → Periodic Check Selection.
2. Select the desired operating method.
3. Press SW5 to make the setting.

Selection mode	Method for canceling periodic check guidance
Auto (N.A. and Australia specs)	Turn the key ON/OFF 10 times or operate the meter panel after making periodic checks.
Manual (Eur. spec.)	Operate meter panel after making periodic check.

RY9212172ELS0008US0

(D) Periodic Check Display

- Turns off the display of periodic check guidance. Or turns it on.



RY9212148ELS025A

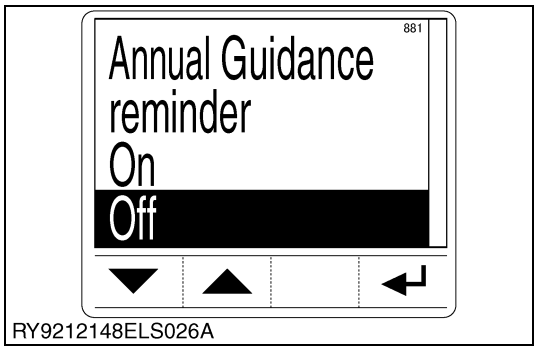
1. Select Setting → Others → Periodic Check Display.
2. Select the desired operating method.
3. Press SW5 to make the setting.

- When shipped: displays

RY9212148ELS0006US0

(E) Annual Guidance

- Turns on the display of annual check guidance. Or turns it off.

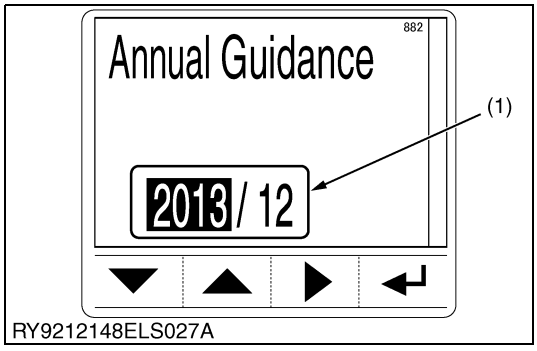


RY9212148ELS026A

1. Select Setting → Others → Annual Guidance.
2. Select the desired operating method.
3. Press SW5 to make the setting.

- When shipped: does not display

RY9212148ELS0007US0



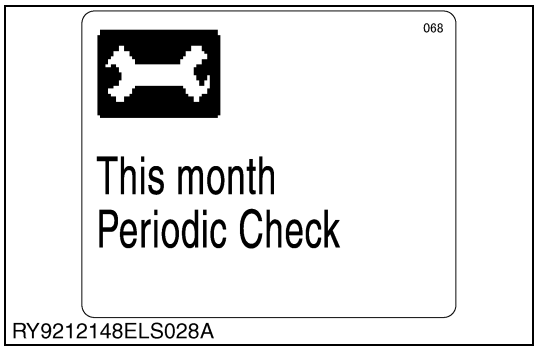
RY9212148ELS027A

[When display is selected]

1. Set the year and month to be displayed.
2. Press SW5 to make the setting.

(1) Annual check guidance display period (Y/M)

RY9212148ELS0008US0



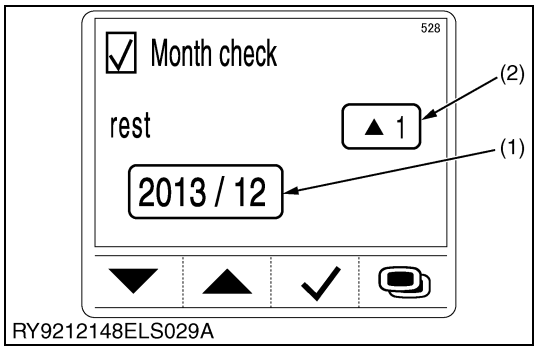
RY9212148ELS028A

[Display when the set month is reached]

■ **IMPORTANT**

- **Each time the key is turned ON, the message is displayed for 10 seconds on the normal screen.**
- **Use Periodic Check in the user setting mode to turn it off.**

RY9212148ELS0009US0



RY9212148ELS029A

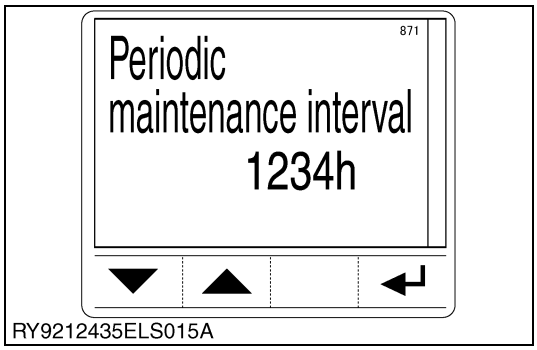
[Display from Periodic Check in the user setting mode]

(1) Selected year and month.
(2) Minus 1 month (E.g.: one month past the period set for the check.)

RY9212148ELS0010US0

(F) Periodic Check Set

- When the meter is replaced, sets the periodic check time prior to replacement to prevent a discrepancy in the periodic check time.



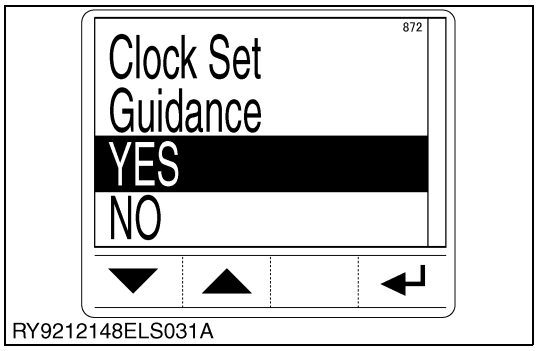
RY9212435ELS015A

1. Select Setting → Others → Periodic Check Set.
2. Enter the service hour meter prior to replacing the meter.
3. Press SW5 to make the setting.

RY9212435ELS0016US0

(G) Clock Set Warning (Y/N)

- Sets whether to display the message, "Set clock" or not.



RY9212148ELS031A

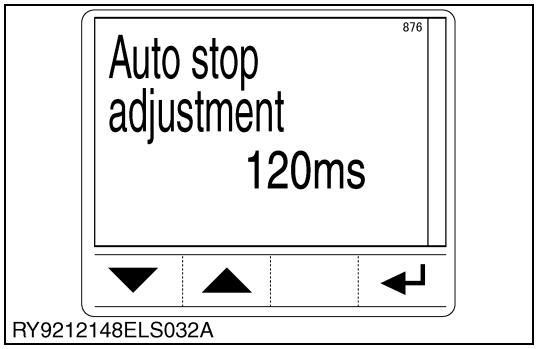
1. Select Setting → Others → Clock Set Warning (Y/N).
2. Select the desired operating method.
3. Press SW5 to make the setting.

- When shipped: prompts to set the clock

RY9212148ELS0012US0

(H) Arm Control Adj (Japan spec. only)

- Set when making fine adjustments to the stop position of the arm crowd limit.



RY9212148ELS032A

1. Select Setting → Others → Arm control Adj.
2. Change to the desired value (0 to 250ms).
3. Press SW5 to make the setting.

- When shipped: 150ms
  Increasing the value: stops closer to the dump side than the original stop position
  Reducing the value: stops closer to the near side than the original stop position

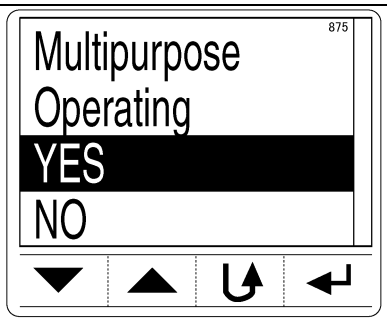
■ **IMPORTANT**

- **The setting is displayed and can be made on the Japan specification as well (Does not affect this machine).**

RY9212148ELS0013US0

(l) Multipurpose Mode

- Enabling the multi-purpose switch function on machines equipped with AUX1 and AUX2 makes 10 modes available for use.
- Depending on the selected mode, it becomes necessary to add equipment to the machine, such as ON/OFF switches, solenoid valves, wire harness, hydraulic hoses, etc.
- The multi-purpose switch allows you to control added solenoid valves and to operate hydraulic devices.

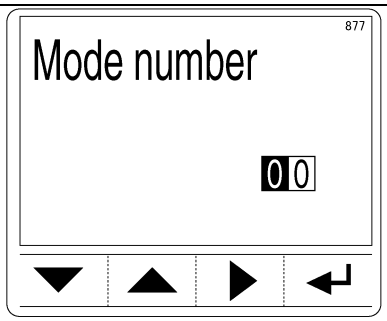


RY9212148ELS033A

1. Select Setting → Model Set.
2. Make sure the multi-purpose specification is set to "YES."

■ **IMPORTANT**

- **If the multi-purpose specification is set to "NO," the multi-purpose mode will not work, so select "YES" and redo the setting.**



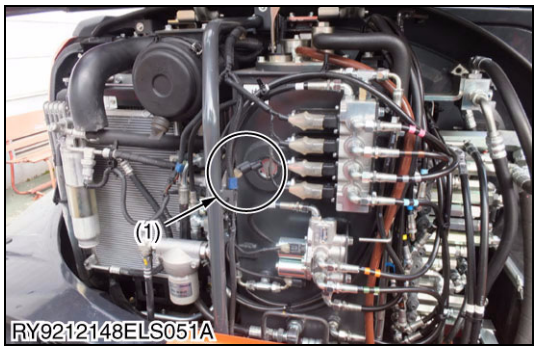
RY9212148ELS034A

3. Select Setting → Others → Multi-purpose mode.
4. Enter the number of the mode you wish to use.
5. Press SW5 to make the setting.

- Available mode numbers: 00 to 10
  Mode number when shipped: 00
  (Multi-purpose switch function disabled and AUX2 hold function disabled)

RY9212148ELS0014US0

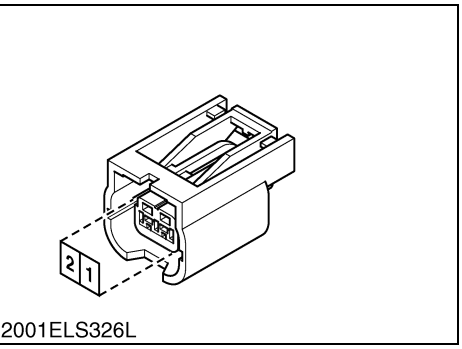
(a) Position of Connector for Operating Added Solenoid Valve



RY9212148ELS051A

(1) Multi-Purpose Connector

RY9212174ELS0077US0

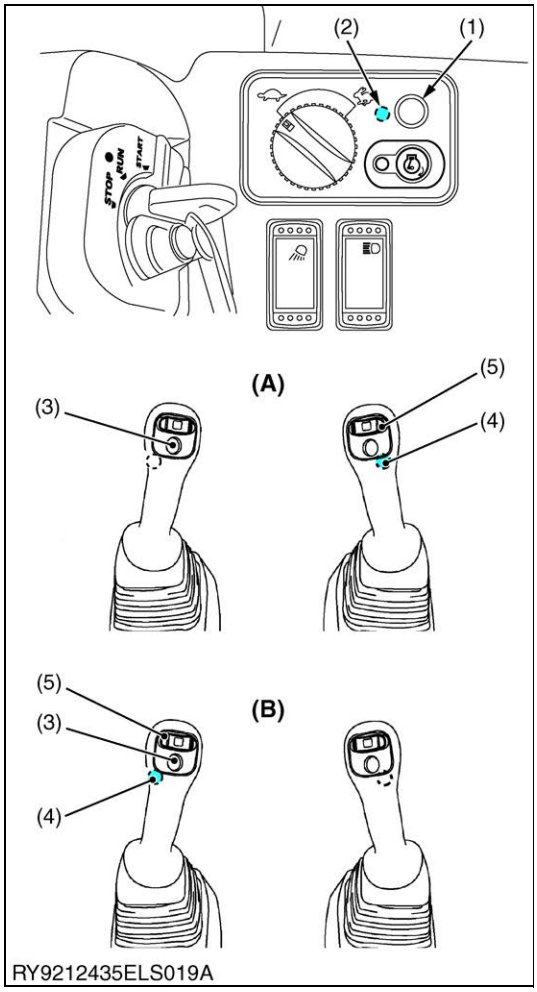


RY9212001ELS326L

Pin No.	Terminal	Max rated amperage
<1>	+ Terminal	1 A
<2>	- Terminal	–

RY9212148ELS0049US0

(b) Names of Parts



RY9212435ELS019A

(1) Multi-Purpose Switch 1
(2) Indicator
(3) Multi-Purpose Switch 2
(4) AUX2/Thumb Hold Switch
(5) AUX2/Thumb Knob

(A) N.A. Spec.
(B) Australia/Eur. Spec.

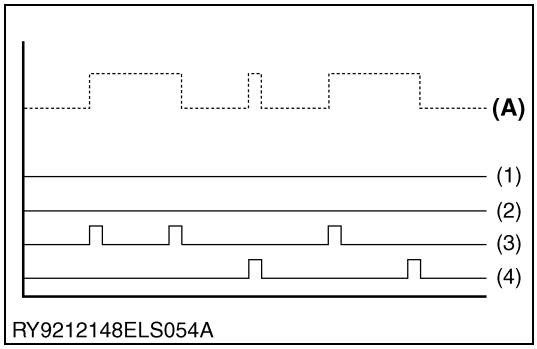
RY9212435ELS0017US0

(c) Description of Each Mode

Mode No. 01: Enables the AUX2 hold switch.

- Pressing the AUX2/Thumb hold switch turns the AUX2 signal ON. Pressing the switch again turns the AUX2 signal OFF.
- The AUX2/Thumb knob signal takes priority over the AUX2/thumb hold switch signal.

Example of Usage: Attachment that is not influenced by the operation of the front, such as a mower (rotary type).



RY9212148ELS054A

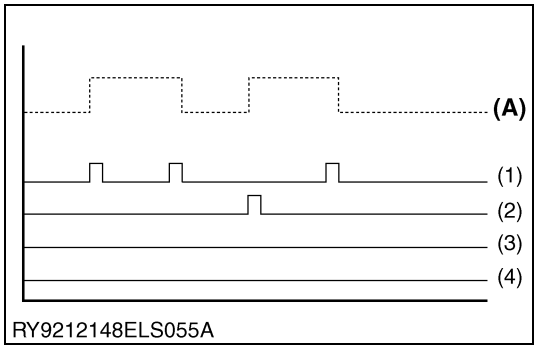
(1) Multi-Purpose Switch 1
(2) Multi-Purpose Switch 2
(3) AUX2/Thumb Hold Switch
(4) AUX2/Thumb Knob

(A) AUX2 signal

RY9212148ELS0051US0

Mode No. 02: (E.g.) Switches swivel/swing operation ON/OFF.

- Pressing multi-purpose switch A or multi-purpose switch B turns and keeps the multi-purpose signal ON. Pressing the switch again turns the multi-purpose signal OFF.



RY9212148ELS055A

(1) Multi-Purpose Switch 1
(2) Multi-Purpose Switch 2
(3) AUX2/Thumb Hold Switch
(4) AUX2/Thumb Knob

(A) Multipurpose signal

RY9212148ELS0052US0

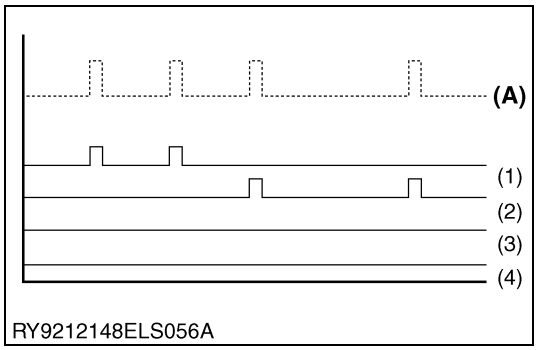
Mode No. 03: Mode No. 01 + Mode No. 02

- Enables the AUX2 hold switch.
- Pressing multipurpose switch A or multipurpose switch B switches the operation of swivel/swing ON/OFF.

RY9212148ELS0053US0

Mode No. 04: Turns the water sprinkler for asphalt planer, etc. ON/OFF.

- The multi-purpose signal is ON only while multipurpose switch A or B is pressed.



RY9212148ELS056A

(1) Multi-Purpose Switch 1
(2) Multi-Purpose Switch 2
(3) AUX2/Thumb Hold Switch
(4) AUX2/Thumb Knob

(A) Multipurpose signal

RY9212148ELS0054US0

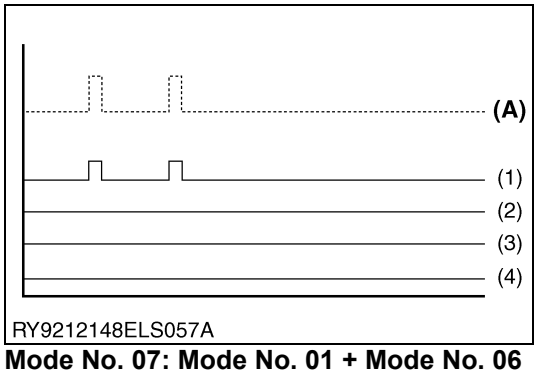
Mode No. 05: Mode No. 01 + Mode No. 04

- Enables the AUX2 hold switch.
- The multi-purpose signal is ON only while multipurpose switch A or B is pressed.

RY9212148ELS0055US0

Mode No. 06: Operates the hydraulic quick hitch (operation of blade, swing, etc.).

- Turns the multipurpose switch signal ON while multipurpose switch A is pressed.
- Operating the actuator while multipurpose switch A is pressed operates the quick hitch.
- Enables the hydraulic quick hitch for single or multi-operation.



RY9212148ELS057A

(1) Multi-Purpose Switch 1
(2) Multi-Purpose Switch 2
(3) AUX2/Thumb Hold Switch
(4) AUX2/Thumb Knob

(A) Multipurpose signal

RY9212148ELS0056US0

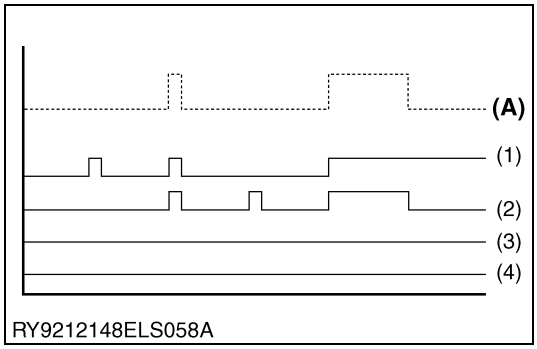
Mode No. 07: Mode No. 01 + Mode No. 06

- Enables the AUX2 hold switch.
- Operating the swing while multipurpose switch A is pressed operates the quick hitch.

RY9212148ELS0057US0

Mode No. 08: Operates the hydraulic quick hitch or for using Tiltrotator.

- The multi-purpose signal is ON only while multipurpose switches A and B are pressed simultaneously.
- Enables a spring-locked hydraulic quick hitch.



RY9212148ELS058A

(1) Multi-Purpose Switch 1
(2) Multi-Purpose Switch 2
(3) AUX2/Thumb Hold Switch
(4) AUX2/Thumb Knob

(A) Multipurpose signal

RY9212148ELS0058US0

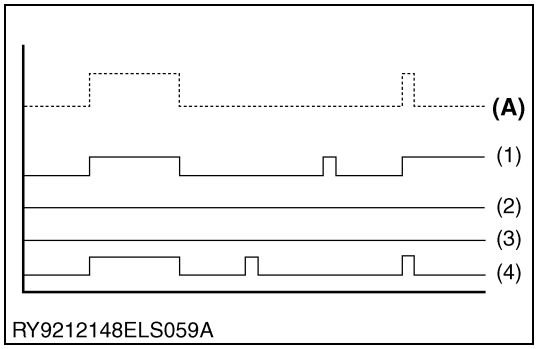
Mode No. 09: Mode No. 01 + Mode No. 08

- Enables the AUX2 hold switch.
- Operates a hydraulic quick hitch or for using Tiltrotator.

RY9212148ELS0059US0

Mode No. 10: Operates a hydraulic quick hitch (Assigns AUX2 to the dedicated quick hitch port).

- While pressing multipurpose switch A, operating the AUX2/thumb knob turns the multipurpose switch signal ON.
- Enables the hydraulic quick hitch for single or multi-operation.



RY9212148ELS059A

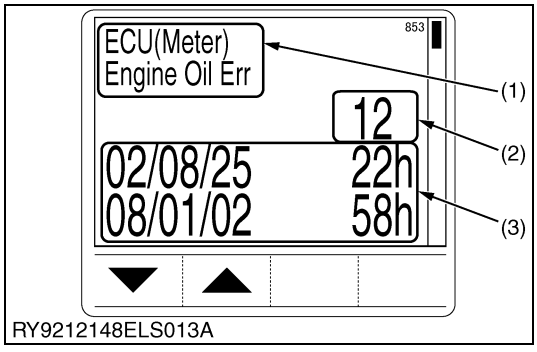
(1) Multi-Purpose Switch 1
(2) Multi-Purpose Switch 2
(3) AUX2/Thumb Hold Switch
(4) AUX2/Thumb Knob

(A) Multipurpose signal

RY9212148ELS0060US0

(J) All Fail Record

- Checks all the fail records since the machine was shipped.



RY9212148ELS013A

1. Select Setting → Others → All Fail Record.
2. If more than one failure record exists, each press of switch 2 or 3 toggles the display.

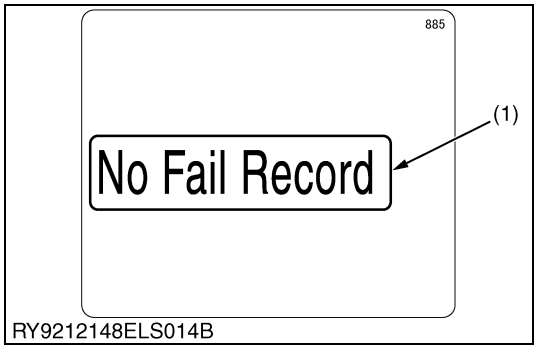
[Display when fail record exists]

■ **IMPORTANT**

- **The content displayed when retrieving all fail records is not deleted even if you delete individual fail records.**

(1) Content of failure detected by the ECU (main or meter or AS) that detected it
(2) Number of occurrences (1 to 255)
(3) Date and hour meter of initial occurrence and date and hour meter of last occurrence

RY9212148ELS0061US0



RY9212148ELS014B

[Display when no fail record exists]

■ **IMPORTANT**

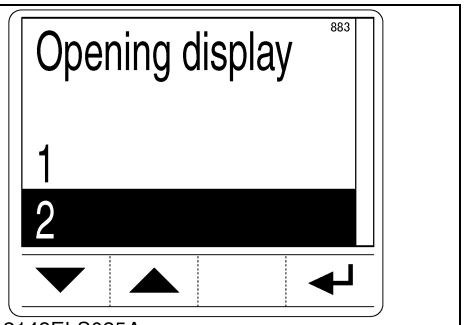
- **As the failures governed by the engine ECU are not left on this machine (all fail record), use the engine diagnosis tool.**

(1) No fail records

RY9212148ELS0062US0

(K) Opening Select

- Changes the opening display screen.



RY9212148ELS035A

(1)



(2)

Kubota

RY9212148ELS036A

1. Select Setting → Others → Opening select.
2. Select the number of the desired display method.
3. Press SW5 to make the setting.

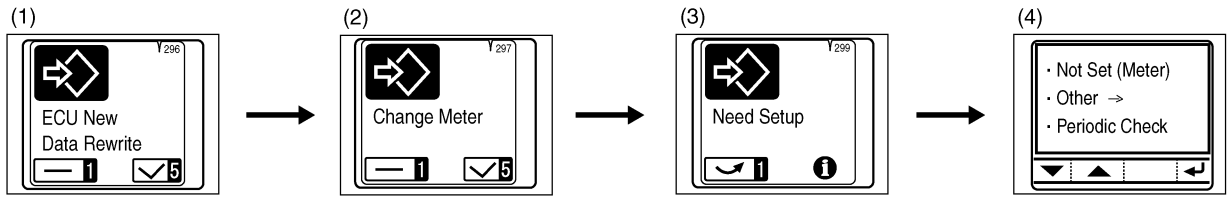
Number	Screen display
(1)	Silhouette of the excavator
(2)	Kubota logo

- When shipped: 2

RY9212148ELS0063US0

[5] SETTINGS WHEN REPLACING ELECTRONIC DEVICES

(1) When Replacing the Meter or Main ECU



RY9212148ELS038A

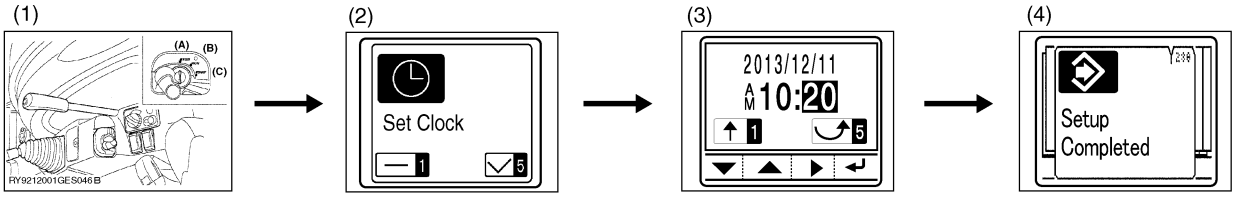
	Content displayed	Explanation
(1)	Overwrite ECU with new data	Press switch 5 "Yes" to overwrite data. Press switch 1 "No" when checking whether another machine's meter or ECU that is temporarily installed is working or not. If "No" is selected, the normal screen appears.
(2)	Meter changed	**[Initializes saved settings.]** Press switch 5 "Yes" if the meter has been changed. Press switch 1 "No" if the ECU has been changed.
(3)	Need setup	Pressing switch 4 allows you to check the items that need to be set up.
(4)	List of items that need to be set up	After checking the items that need to be set up, turn the key to OFF to make the settings.

■ **IMPORTANT**

- **Never install an ECU from a previous model (spec. other than common rail) as doing so will damage the ECU.**

RY9212148ELS0064US0

(2) When the Battery is Removed



RY9212148ELS039A

No.	Content displayed	Explanation
(1)	(A) STOP (B) RUN (C) START	Install the battery and turn the key to **[RUN]**.
(2)	Set Clock	Press switch 5 "Yes" to set. Press switch 1 "No" to skip setting it. If "No" is selected, the normal screen appears.
(3)	Setting screen	**[Clock setting guide]** • Pressing switch 4 (▶) changes the setting item from Yr→ Mo→ Day→ Hr→ Min→ Yr. • Pressing switch 2 (▼) reduces the number. • Pressing switch 2 (▲) increases the number. • Pressing switch 1 while on the clock setting screen takes the screen back without changing the time.
(4)	Setup complete	

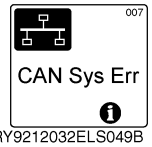
- When in the dealer mode, it is also possible to disable the warning via "Clock Set Warning (Y/N)." (Set to display when shipped)
- After removing the battery, the condenser inside the meter holds its charge for about 2 days.

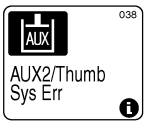
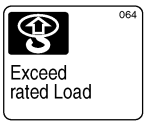
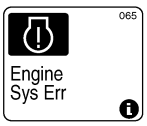
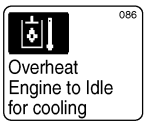
RY9212148ELS0015US0

[6] TABLE OF METER PANEL MESSAGES AND ERROR HISTORY LIST

(1) Red Warning Lamp Lit

When needed, pressing switch 4 ⓘ displays a detailed description.

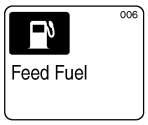
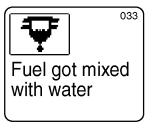
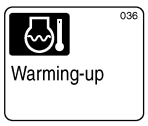
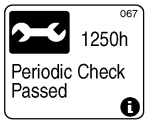
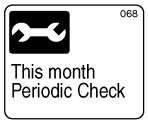
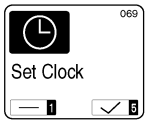
No.	Screen display	Pressing SW4 ⓘ	Message in fail record	Reason detected/steps to take
1	 RY9212032ELS044B	–	[Meter] Engine oil pressure error	a) Engine oil pressure low b) Oil switch always ON c) Short in harness
2	 RY9212032ELS045B	–	[Meter] Overheated	Engine overheated [118°C (244°F)--automatically goes to idle]
3	 RY9212032ELS046B	–	[Meter] Charging System Error	Low alternator voltage detected a) Alternator faulty b) Fan belt loose/off c) Break in harness d) Fuse blown (10A)
4	 RY9212032ELS047B	–	[Meter] Fuel Sensor Error	a) Connector disconnected b) Break in harness
5	 RY9212435ELS016A	–	[Meter] Water temp sensor Error	The coolant temperature sensor has developed a fault; the coolant temperature gauge does not appear in the display.
6	 RY9212032ELS049B	CANSys (main)	[Meter] CAN Sys (Main)	a) Connector disconnected b) ECU (+B) fuse blown (10A) c) Break or short in harness
		CANSys (CRS)	[Meter] CAN Sys (CRS)	a) Connector disconnected b) Slow blow fuse (CRS) blown (30A) c) Engine ECU relay faulty d) Break or short in harness
7	 RY9212148ELS043A	–	[Meter] Setup Data Error	Go through the model setup again. If this doesn't fix it, it's a faulty meter.
8	 RY9212032ELS051B	2nd speed solenoid	[Main ECU] 2nd speed SOL	a) 2nd speed solenoid line short
9	 RY9212148ELS040A	AUX1 knob	[Main ECU] AUX1 knob	a) AUX1 knob connector disconnected b) Break or short in harness
		AUX1 RH SOL	[Main ECU] AUX1 right SOL	a) AUX1 right solenoid connector disconnected b) Break or short in harness
		AUX1 LH SOL	[Main ECU] AUX1 left solenoid	a) AUX1 left solenoid connector disconnected b) Break or short in harness

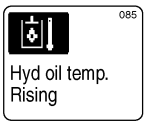
No.	Screen display	Pressing SW4 ⓘ	Message in fail record	Reason detected/steps to take
10	 RY9212148ELS041A	AUX2/thumb knob	[Main ECU] AUX2/thumb knob	a) AUX2 knob connector disconnected b) Break or short in harness
		AUX2/thumb RH SOL	[Main ECU] AUX2/thumb right solenoid	a) AUX2 right solenoid connector disconnected b) Break or short in harness
		AUX2/thumb LH SOL	[Main ECU] AUX2/thumb left solenoid	a) AUX2 left solenoid connector disconnected b) Break or short in harness
11	 RY9212032ELS052B	Over voltage	[Main ECU] Over voltage	a) Activated by 18V+ b) Alternator faulty
12	 RY9212148ELS062A	Boom bottom	[Main ECU] Boom bottom	a) Connector disconnected b) Break or short in harness
13	 RY9212032ELS053B	Accelerator sensor	[Main ECU] Accelerator sensor	a) AI console connector disconnected b) Break or short in harness
14	 RY9212032ELS050B	Lever lock solenoid	[Main ECU] Lever lock solenoid	a) Lever lock solenoid line short
15	 RY9212148ELS042A	Multipurpose SOL	[Main ECU] Multipurpose solenoid	a) Multipurpose solenoid line short
16	 RY9212032ELS055B	External 5 V	[Main ECU] External 5 V	Short in 5 V line
17	 RY9212148ELS069A	–	–	Suspended weight is over the rated load (Eur. overload warning spec. only)
18	 RY9212148ELS063A	1 to 64	–	Engine system error
19	 RY9212435ELS045A	–	[Main ECU] Hydraulic temp sensor	Hydraulic oil temperature rising (over 100 °C). Engine speed is reduced down to idle rpm automatically.

RY9212509ELS0021US0

(2) Yellow Warning Lamp Lit

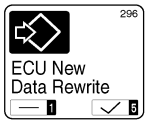
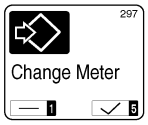
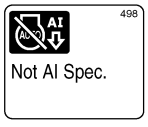
When needed, pressing switch 4 ⓘ displays a detailed description.

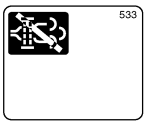
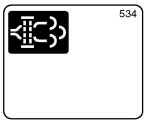
No.	Screen display	Pressing SW4 ⓘ	Message in fail record	Reason detected/steps to take
1	 RY9212148ELS065A	–	–	Fuel low Displayed at 6 minute intervals.
2	 RY9212148ELS066A	–	–	Water temperature rising. Displayed at 6 minute intervals. (110 to 117°C, 230 to 242°F)
3	 RY9212435ELS020A	–	–	a) Water mixed with fuel in the fuel filter b) Short in the fuel filter line
4	 RY9212435ELS047A	–	–	When hydraulic sensor temperature is only low the warming-up mode automatically starts.
5	 RY9212148ELS067A	–	–	Tried to start engine with an unregistered key (Anti-theft spec. only)
6	 RY9212148ELS068A	–	–	Tried to start engine with a red key (Anti-theft spec. only)
7	 RY9212148ELS070A	Check location displayed	–	Displayed 10 hours before periodic check due
8	 RY9212148ELS071A	Check location displayed	–	Past time for periodic check
9	 RY9212148ELS072A	–	–	Annual check
10	 RY9212148ELS048A	–	–	The clock may have the wrong time.

No.	Screen display	Pressing SW4 ⓘ	Message in fail record	Reason detected/steps to take
11	 RY9212435ELS046A	–	–	Hydraulic temperature over 96 °C (205 °F).

RY9212509ELS0022US0

(3) Other Screens

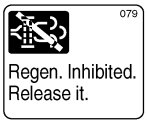
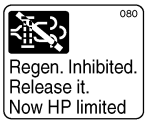
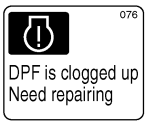
No.	Screen display	Pressing SW4 Ⓡ	Message in fail record	Reason detected/steps to take
1	 RY9212148ELS050A	–	–	Switch 2 (crane) pressed on machine w/o overload warning
2	 RY9212148ELS046A	–	–	When meter or ECU replaced without doing setup
3	 RY9212148ELS045A	–	–	During setup after changing the meter or the ECU, this screen comes up to confirm the meter has been changed.
4	 RY9212148ELS044A	The setup item is displayed.	–	When neither the meter nor the ECU have been replaced, but some setting needs to be made.
5	 RY9212032ELS067B	–	–	If you attempt to start the engine with the lever lock still down.
6	 RY9212032ELS074B	–	–	If you press switch 3 (AUX) with the lever lock still up.
7	 RY9212148ELS073A	–	–	If you turned the key OFF but fail to take it out (Anti-theft spec. only)
8	 RY9212166ELS083A	–	–	• If you press switch 3 (AUX) on a machine w/o AUX1/AUX2/thumb spec. • If you setup the model as AUX1 (w/o) and press switch 3 (AUX).
9	 RY9212148ELS074A	–	–	• If you press the AI switch on a machine w/o the AI spec. • If you set up the model as AI (w/o) spec. and press the AI switch.
10	 RY9212148ELS049A	–	–	If you press the multipurpose switch before registering it.

No.	Screen display	Pressing SW4 ⓘ	Message in fail record	Reason detected/steps to take
11	 RY9212148ELS075A	–	–	During communication with the key (Anti-theft spec. only)
12	 RY9212148ELS076A	–	–	Displayed for 5 seconds when put in the Eco mode.
13	 RY9212148ELS077A	–	–	Displayed for 5 seconds when auto-regeneration of the DPF is inhibited.
14	 RY9212148ELS078A	–	–	Displayed for 5 seconds when the inhibition on DPF auto-regeneration is cancelled.

RY9212148ELS0067US0

(4) PM Clog Level and the State of the Machine

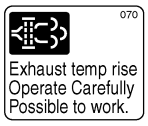
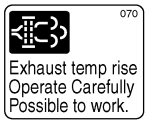
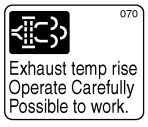
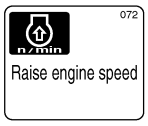
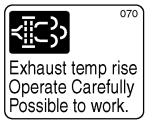
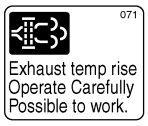
Inhibit switch ON

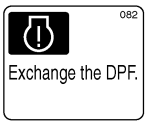
Clog Level	Warning lamp	Buzzer	Engine output	Screen	Content displayed	Status and correction
Level 0	OFF	–	–	–	–	–
Level 1	OFF	–	–	–	–	–
Level 2	Blinking (Yellow)	··PiPiPi·· (Continue)	–	 RY9212148ELS088A	Regeneration of DPF is inhibited. Allow regeneration.	–
Level 3	Blinking (Red)	··PiPiPi·· (0 to 50 sec.) Pi-···Pi- (50 to 60 sec.)	50 %	 RY9212148ELS089A	Regeneration of DPF is inhibited. Allow regeneration. HP limited to low power.	*2
		Pi-···Pi- (from 60 sec.)	–	 RY9212148ELS092A	Engine forced to stop Increase RPM and restart	Turn and maximize the accelerator dial and restart *1
Level 4	Blinking (Red)	PiPiPiPi (0 to 50 sec.) Pi-···Pi- (from 50 sec.)	50 %	 RY9212148ELS085A	DPF clogged up Needs maintenance	Use the engine diagnosis tool and regenerate it manually *1 *2
Level 5	Blinking (Red)	PiPiPiPi (Continue)	50 %	 RY9212148ELS091A	Replace the DPF	DPF is clogged. Needs replacement.

The engine rpm drops up to only 2200 rpm while pressing the AI switch.
PM clog level does not change when the key is turned OFF. The level stays the same when the engine restarts.
*1 : If the lever lock is up, the engine stops forcibly in 60 seconds.
*2 : If the lever lock is down, the engine does not stop. The same buzzer from 0 to 50 sec. keeps sounding.

RY9212174ELS0079US0

Inhibit switch OFF

Clog Level	Warning lamp	Buzzer	Engine output	Engine RPM	Screen	Contents displayed	Status and correction
Level 0	OFF	–	–	–	–	–	–
Level 1	Blinking (Yellow)	··PiPiPi·· (Every 60 sec.)	–	–	 RY9212148ELS080A	Exhaust temperature rising Operate carefully Can continue working	More than 2200 engine RPM: DPF regenerates Less than 2200 engine RPM: DPF may not auto-regenerate due to open air and water temp.
Level 2	Blinking (Yellow)	··PiPiPi·· (Every 60 sec.)	–	More than 2200 rpm	 RY9212148ELS080A	Exhaust temperature rising Operate carefully Can continue working	Being auto-regenerated
				Less than 2200 rpm	 RY9212148ELS080A	Exhaust temperature rising Operate carefully Can continue working	• When the engine RPM is low, DPF may not auto-regenerate due to open air and water temp. • The screen changes every 3 sec.
					 RY9212148ELS082A	Increase engine RPM	
Level 3	Blinking (Yellow)	PiPiPi (Every 60 sec.)	50 %	More than 2200 rpm	 RY9212148ELS080A	Exhaust temperature rising Operate carefully Can continue working	• Being auto-regenerated • The screen is changed every 3 sec.
					 RY9212148ELS079A	HP limited to low power	
	Blinking (Red)	··PiPiPi·· (0-50 sec.) Pi-···Pi- (50-60 sec.)	50 %	Less than 2200 rpm	 RY9212148ELS081A	Exhaust temperature rising Operate carefully Can continue working	• When the engine RPM is low, DPF may not auto-regenerate due to open air and water temp. • The screen changes every 3 sec. *2
					 RY9212148ELS084A	Increase engine RPM HP limited low power	
		Pi-···Pi- (from 60 sec.)	–		 RY9212148ELS092A	Engine forced to stop Increase RPM and restart	Turn and maximize the accelerator dial and restart. *1
Level 4	Blinking (Red)	PiPiPiPi (0-50 sec.) Pi-···Pi- (from 50 sec.)	50 %	–	 RY9212148ELS085A	DPF clogged up Needs maintenance	Use the engine diagnosis tool and regenerate it manually *1 *2

Clog Level	Warning lamp	Buzzer	Engine output	Engine RPM	Screen	Contents displayed	Status and correction
Level 5	Blinking (Red)	PiPiPiPi (Continue)	50 %	–	 RY9212148ELS091A	Replace the DPF	DPF is clogged. Needs replacement.

The engine rpm drops up to only 2200 rpm while pressing the AI switch.
PM clog level does not change when the key is turned OFF. The level stays the same when the engine restarts.
*1 : If the lever lock is up, the engine stops forcibly in 60 seconds.
*2 : If the lever lock is down, the engine does not stop. The same buzzer from 0 to 50 sec. keeps sounding.

RY9212174ELS0080US0

(5) Table of Engine System Error Numbers

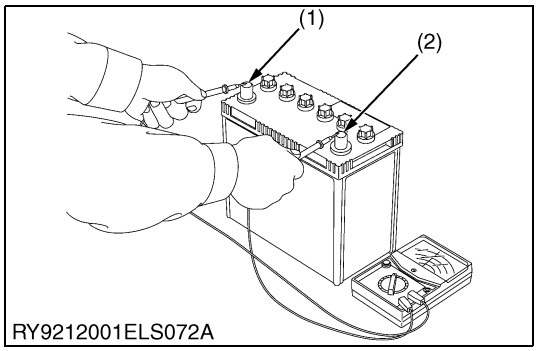
Symptom when error occurs	●	Always happens
	❍	May happen

No. Displayed	Error location	Engine performance			Notes
		Limited RPM	Limited HP	Won't start	
1	RPM sensor system	❍	❍	❍	
2	Fuel/rail pressure system	●	●	●	Fuel may run out.
3	SCV system error	●	●		
4	Intake temperature sensor system				
5	Water temperature sensor system	●	●		
6	Fuel temperature sensor system				
7	Injector system	●	●	❍	
8	Intake pressure sensor system		❍		
9	Battery voltage related	●	●	❍	
10	Sensor voltage related	●	●	❍	
11	Main relay related				
12	Atmospheric pressure sensor related		❍		
13	EGR valve related		●		
14	EGR starting to close warning				
15	Emissions warning		●		
16	Air heater related				
17	Engine ECU	❍	❍	❍	
18	Communication error	❍	❍		
19	Mass airflow sensor related		❍		
20	Intake throttle				
21	Pressure differential sensor related				
22	Exhaust temperature sensor (DOC intake)				
23	Exhaust temperature sensor (DOC outlet)				
24	Exhaust temperature sensor (DPF outlet)				
25	Simultaneous break in all exhaust temperature sensors				
26	DOC reaction	●	●		
27	DPF regeneration time up				
28	Insufficient DPF regeneration water temperature rise				
29	Regeneration too frequent		●		
30	Engine fuel system (P/L)	●	●		
31	Engine fuel system (rail pressure)	●	●		
32	Engine fuel system (fuel leak)	●	●	●	
33	Engine fuel system (SCV)	●	●	●	
34	Engine fuel system (Supply pump)	●	●		
35	Engine air intake system (Insufficient intake)	●	●		
36	Engine air intake system (Insufficient boost pressure)	●	●		
37	Engine exhaust temperature (DOC inlet temperature error)			●	
38	Engine exhaust temperature (DPF inlet temperature error)			●	
39	Engine exhaust temperature (DPF outlet temperature error)			●	
40	Starter relay start warning				
60	Other errors	❍	❍	❍	

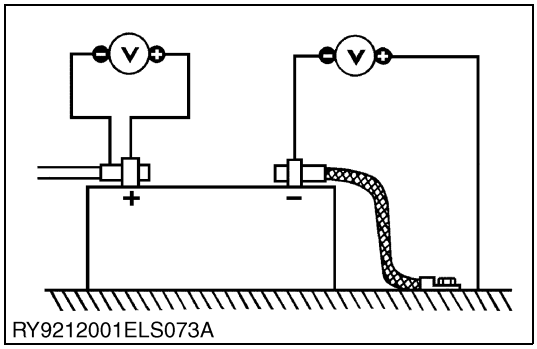
RY9212148ELS0069US0

3. INSPECTIONS

[1] POWER AND GROUND



RY9212001ELS072A



RY9212001ELS073A

Battery

Check the voltage between the terminals

1. Connect a circuit tester between the (+) and (-) terminals of the battery and measure the voltage across the terminals.
2. If the measurement is below factory specs, check the specific gravity of the electrolyte.

Voltage between terminals	Factory specification	At least DC 12 V

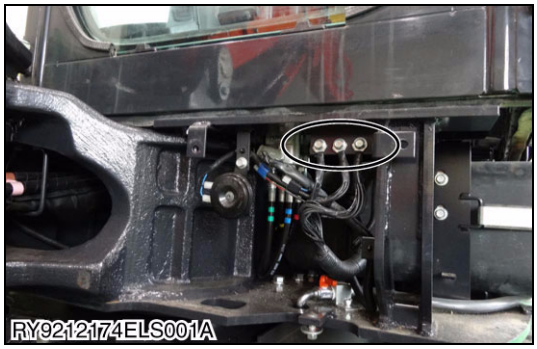
Check the condition of terminal connections

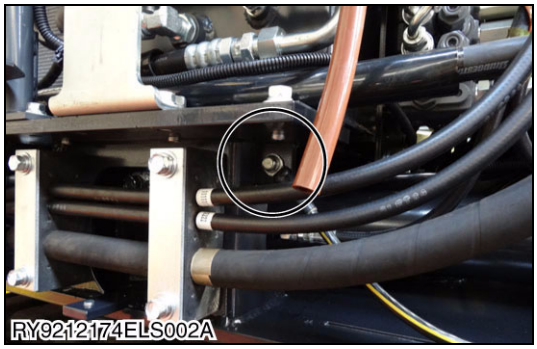
1. Put an electrical load on the battery. (E.g.: Turn the key switch to RUN and turn a worklight on.
2. Connect the (+) side if the circuit tester to the (+) terminal of the battery and the (-) side of the circuit tester to the (+) battery cable. Measure the voltage.
3. Connect the (-) side if the circuit tester to the (-) terminal of the battery and the (+) side of the circuit tester to the (-) battery cable. Measure that voltage.
4. If the measurements are greater than factory specs, check the condition of the contacts at the terminals.

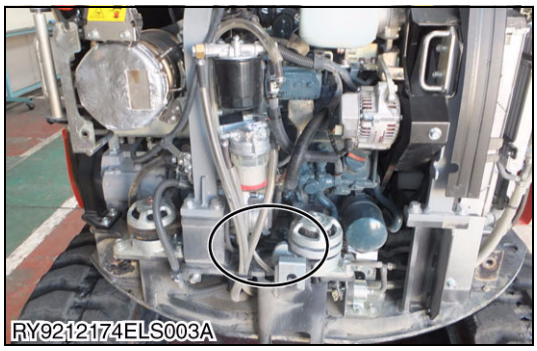
Voltage between terminals	Factory specification	Less than DC 0.1 V

(1) (-) Terminal (2) (+) Terminal

RY9212001ELS0034US0


RY9212174ELS001A

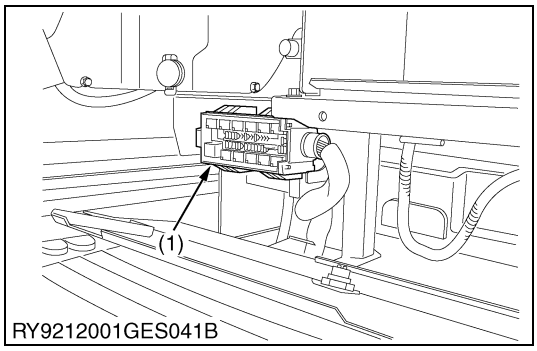

RY9212174ELS002A


RY9212174ELS003A

Ground

Check whether GND wire(s) are securely connected to the body.

RY9212174ELS0005US0



RY9212001GES041B

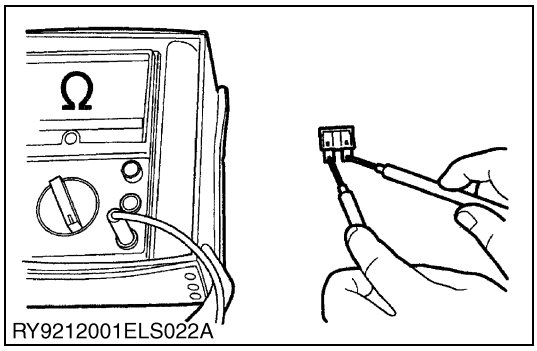
Fuses

■ **IMPORTANT**

- **When replacing a fuse, always use the same capacity fuse and replace it after determining why it blew.**

(1) Fuse Box

RY9212001ELS0029US0

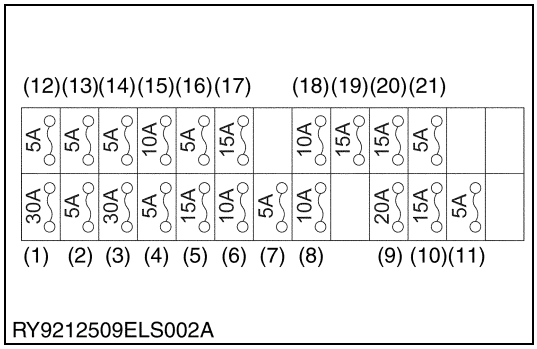


RY9212001ELS022A

Inspecting fuses

- Measurement parameter: check continuity across its terminals

RY9212001ELS0031US0

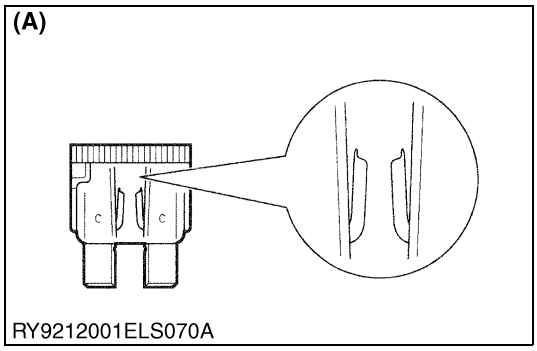


RY9212509ELS002A

[CAB (Air-conditioner type)]

(1)	Blower Motor	(12)	Fuel Pump
(2)	A/C Controller	(13)	Relay
(3)	ECU (POWER)	(14)	Lever Lock
(4)	Room Light	(15)	Alternator
(5)	Beacon	(16)	ECU (AC)
(6)	Meter (+B)	(17)	Electrical Outlet
(7)	Horn Switch	(18)	Compressor
(8)	Horn	(19)	Radio (AC)
(9)	Cab Work Light	(20)	Wiper / Washer
(10)	Front Work Light	(21)	CRS (Common Rail System)
(11)	Starter		

RY9212509ELS0004US0

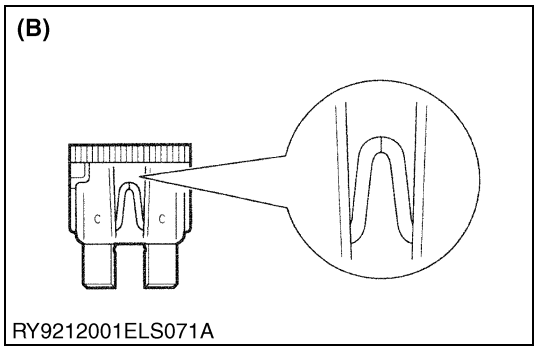


RY9212001ELS070A

Precautions when a Fuse Blows

When a fuse blows, there are 2 potential causes. The first is when an overload of current exceeds the rated amperage of the fuse, blowing it; the other is when it blows due to a repetitive, intermittent current.
These two cases can be readily recognized visually, so when a fuses blows, take note of the following points.

1. When a fuse blows due to an overload of current exceeding its rated capacity.
   An overload current produces a blown fuse such as shown at left **(A)**.
   You should not immediately replace a fuse that blows in this way with a new one.
   The fuse will just blow again when subjected to the overload current, so first inspect the circuit for a short or a problem with a device, then after fixing the problem, install a fuse of the same capacity.
   The purpose of the original fuse is to provide a margin of safety, so never replace a fuse with one of a higher capacity.
   If you replace a fuse with one of a higher capacity, it presents the danger of a current overload damaging the electrical device(s) and/or the wiring in the circuit before blowing the fuse.

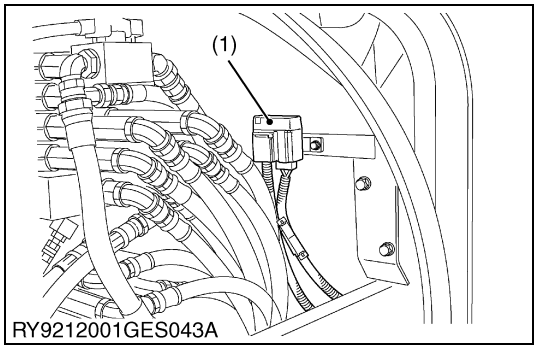


RY9212001ELS071A

2. When a fuse blows due to a repetitive, intermittent current.
   A repetitive, intermittent current produces a blown fuse such as shown at left **(B)**. In general, this kind of blown fuse occurs after a relatively long period of time, so it does not happen very often.
   With this kind of blown fuse, it is OK to replace it with a fuse of the same capacity.

(A) Fuse Blown by Current Overload (B) Fuse Blown by Thermal Fatigue

RY9212001ELS0032US0



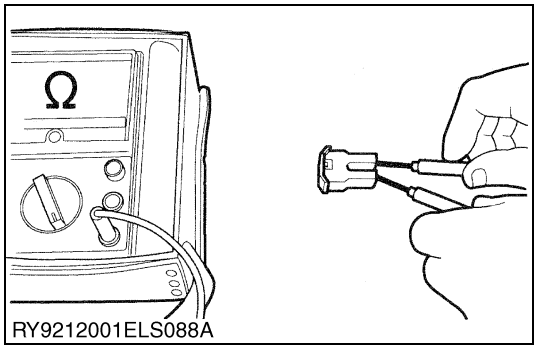
Slow-blow fuses

■ **IMPORTANT**

- **When replacing a slow-blow fuse, always use the same capacity fuse and replace it after determining why it blew.**

(1) Slow-Blow Fuses

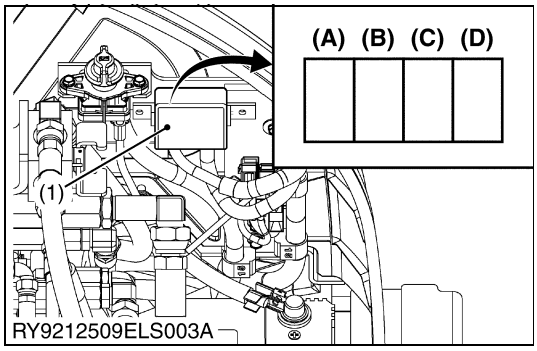
RY9212001ELS0027US0



Inspecting slow-blow fuses

- Measurement parameter: check continuity across its terminals

RY9212001ELS0028US0



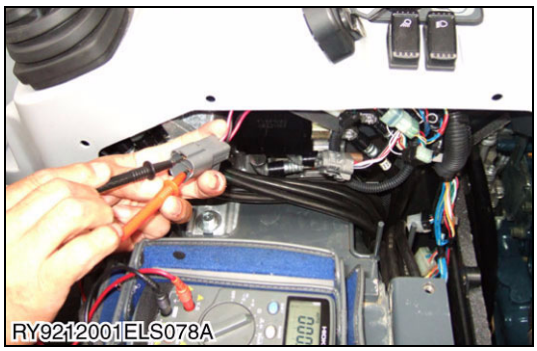
Slow Blow Fuse Layout and Capacities

(A)	Alternator (80 A)
(B)	Engine ECU (30 A)
(C)	Main Power 1 (50 A)
(D)	Main Power 2 (50 A)

(1) Slow-Blow Fuses

RY9212509ELS0005US0

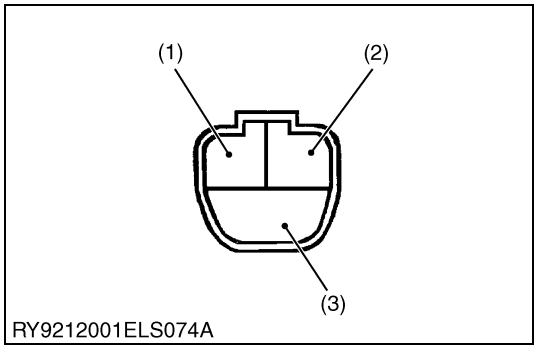
[2] STARTING AND STOPPING DEVICE



Key switch

Checks

1. Remove the key switch's 3P connector.
2. Turn the key switch to the RUN position and then check the continuity between the red / white wire terminal of the connector on the key switch side and the red wire terminal on the connector.
3. Turn the key switch to the START position and then check the continuity between the black/white wire terminal of the connector on the key switch side and the red wire terminal on the connector.



Key switch circuit table

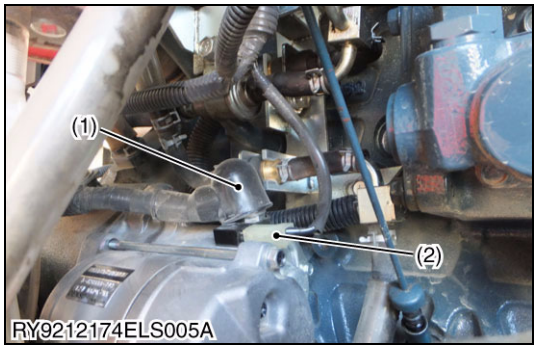
(●—● : Continuity)

Position	(3)	(1)	(2)
STOP			
RUN	●	●	
START	●	●	●

RY9212050ELS011A

(1) Red / White
(2) Black / White
(3) Red

RY9212050ELS0027US0



Starter

1. Power supply to terminal B

■ **IMPORTANT**

- **The battery voltage always exists at terminal B of the starter, so do not short it during inspection.**

1. Connect the (+) side of the circuit tester to terminal B of the starter and the (–) side to the body and measure the voltage.
2. If the measurement meets the factory spec, the harness between the battery and terminal B is OK.
3. If the measurement is outside of factory specs, check the condition of the battery cable (+) contact and that of the GND (–) cable and the body.

Measured voltage	Factory specification	11 to 14 V (battery voltage)

2. Power supply to starter's pull-in and holding coils

1. Remove the connector from the starter's S terminal.
2. Connect the (+) of the circuit tester to the connector on the harness side and the (–) to the body.
3. Put the lever lock in the lock position and measure the voltage with the key switch held in the START position.

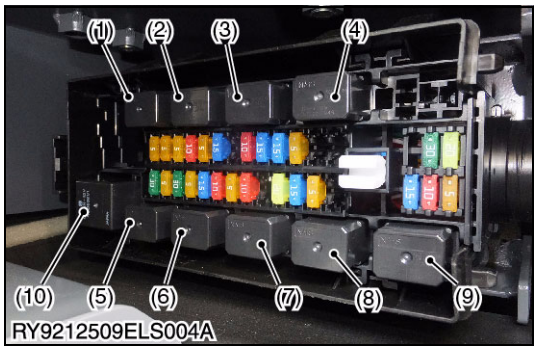
If the measurement meets factory specs, the circuit from the battery to the S terminal is OK (harness, key switch, auto-release relay).

Measured voltage	Factory specification	11 to 14 V (battery voltage)

(1) Terminal B (2) Terminal S

RY9212174ELS0008US0

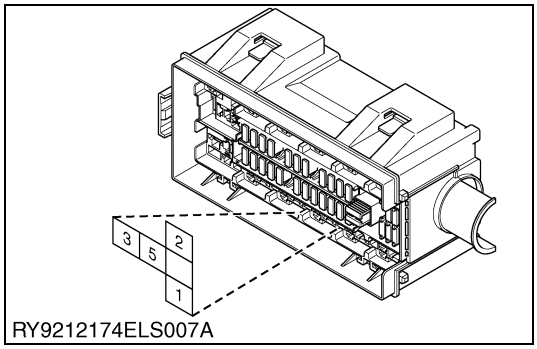
[3] RELAY LAYOUT



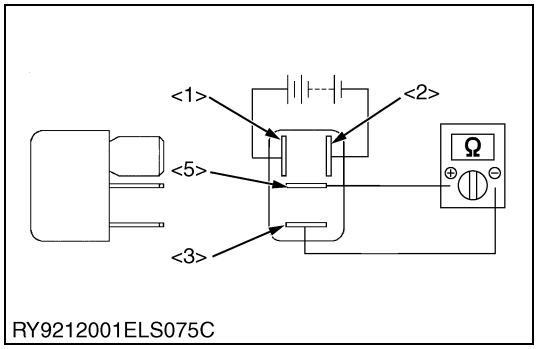
Relay Layout and Capacities

(1)	Blower relay (20 A)
(2)	Worklight relay (20 A)
(3)	Main ECU (power) relay (20 A)
(4)	Horn relay (20 A)
(5)	Engine ECU relay (20 A)
(6)	Compressor relay (cabin spec.) (20 A)
(7)	Starter relay (20 A)
(8)	Beacon relay (20 A)
(9)	Glow relay (20 A)
(10)	Power relay (40 A)

RY9212509ELS0006US0



RY9212174ELS007A



RY9212001ELS075C

Testing the Starter Relay

1. Voltage check
[Measurement Conditions]
1. Remove the starter relay.
2. Key switch: ON
3. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (+ terminal side)	Pin No.
1	Starter relay	<1>	Starter relay	<2>
2	Starter relay	<1>	Body GND	–

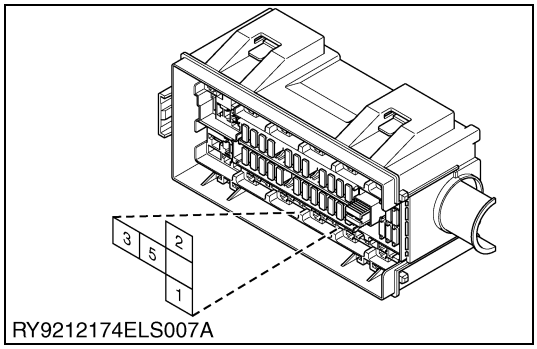
Normal: 12 V (battery voltage)
Irregular: Large discrepancy from 12V

2. Continuity check
[Measurement Conditions]
1. Key switch: OFF
2. Remove the starter relay.
3. Apply battery voltage across relay terminals 1 and 2.
4. Check for continuity based on the table below.

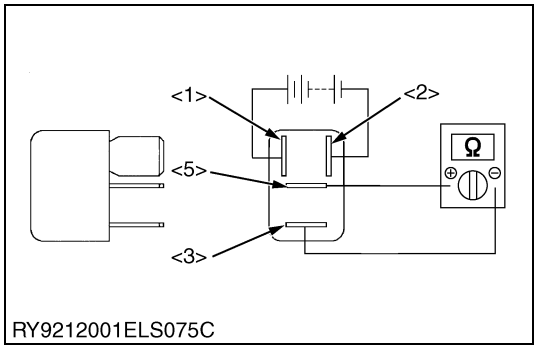
Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (+ terminal side)	Pin No.
1	Starter relay	<5>	Starter relay	<3>

Regular: Continuity
Irregular: No continuity

RY9212174ELS0010US0



RY9212174ELS007A



RY9212001ELS075C

Testing the Glow Relay

1. Voltage check
[Measurement Conditions]
1. Remove the glow relay.
2. Key switch: ON
3. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (+ terminal side)	Pin No.
1	Glow relay	<1>	Glow relay	<3>

Normal: 12 V (battery voltage)
Irregular: Large discrepancy from 12V

2. Continuity check
[Measurement Conditions]
1. Key switch: OFF
2. Remove the glow relay.
3. Apply battery voltage across relay terminals 1 and 2.
4. Check for continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (+ terminal side)	Pin No.
1	Glow relay	<1>	Glow relay	<2>

Regular: Continuity
Irregular: No continuity

RY9212174ELS0011US0

4. TROUBLESHOOTING (START-UP EQUIPMENT VERSION)

Engine does not start

Checkpoint	Cause	Solution
Check whether "Wrong Key" is displayed when it is in the start position. Determine whether it is the registered key or not in the tester mode.	The engine was not started with the registered key.	Start the engine with the registered key.
Check slow-blow and other fuses.	Slow-blow and/or other fuses are blown.	After determining the cause of slow-blow and/or other fuses blowing, replace them.
Check whether GND wire(s) are securely connected to the body.	Ground defective	Tighten GND wire bolt(s).
Check battery voltage and specific gravity.	Battery fault	Recharge or replace the battery.
Check continuity between key switch terminals.	Key switch faulty	Replace the key switch.
Measure the voltage at terminal B of the starter.	Break in continuity of the harness or starter relay.	Repair the harness. Replace the harness, starter relay and/or fuses.
Measure the voltage at terminal S of the starter.	Break in continuity in the harness, starter relay and/or fuses.	Repair the harness. Replace the harness, starter relay and/or fuses.

The engine fails to start sometimes.

Checkpoint	Cause	Solution
Is the key on a metal keyring or have a metal fob?	The key fob and/or keyring are interfering with communication between the key and the antenna.	Get rid of the key fob and/or ring.

Engine starts even with unregistered keys

Checkpoint	Cause	Solution
Check whether the anti-theft system is "OFF" or not initialized.	As the anti-theft function is not working, even unregistered keys can start the engine.	Please contact Kubota service.

RY9212148ELS0135US0

5. METHODS FOR DIAGNOSING ERRORS

The most important thing in diagnosing a malfunction is inferring the cause of the problem. It is important because inferring the cause allows for a narrowing of the places that need to be inspected, and thus reducing wasted inspection work. And the inference has to be supported by theory and practice--relying on intuition does not work.

RY9212038ELS0013US0

[1] GUIDE TO DIAGNOSING ERRORS

When diagnosing errors if you fail to go through the proper procedures, it clouds the view of the actual problem and conversely, in the end you are liable to make an incorrect guess about the cause and repair. For that reason, it is necessary to think through the following 4 steps when diagnosing errors.

1	**Error Diagnosis Procedure**	• Accurately observe what the problem is. Check whether that problem is the only one or whether there are other problems.
2	**Infer the Cause of the Error**	• When inferring the cause of an error, it is important to grasp the circuits in the wiring diagram as a system. Of course you have to know how switches, relays, etc. function, but having a broader view of the causes of errors, such as from experience of what caused past errors that you repaired, is necessary to making inferences.
3	**Test Specified Locations and Find the Cause**	• Error diagnosis is a matter of building up facts from tests and step by step getting closer to the real cause. While making checks, you always have to be thinking, which test can I make where to be more effective.
4	**Check your Repairs**	• After repairing a fault, always check and make sure the system is functioning normally. And make sure no new problem has arisen.

These materials provide information necessary for diagnosing errors and the overall wiring diagram and circuit diagrams for each system were compiled with a view to simplifying error diagnosis.

1. The circuit diagrams show the layout of connectors and wiring routing on the machine.
2. The circuit diagrams show the structure of circuits in the system and indicate the normal (not operating) state of all of the kinds of switches.
3. The flow of electricity when switches are operated is explained based on the circuit diagrams and how each device operates is indicated.
4. Troubleshooting tips are provided to help identify the causes of errors from multiple pieces of information and using common sense.
   If you cannot pinpoint the cause based on these tips, follow the circuit for each system to diagnose the error.

RY9212148ELS0071US0

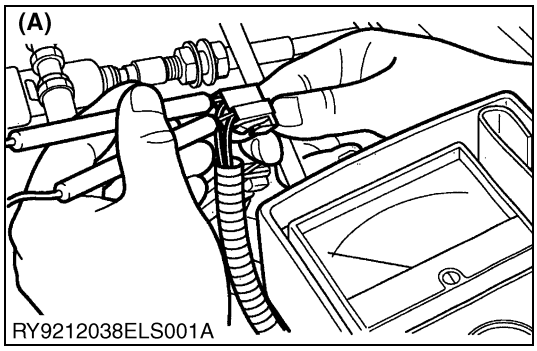
[2] ERROR DIAGNOSIS PROCEDURE

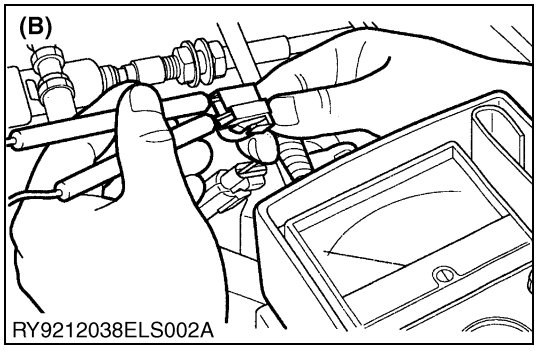
All diagnoses of malfunctions should narrow down the cause via the following procedures and specify the faulty location (Not following the procedures results in not knowing the cause of the fault).

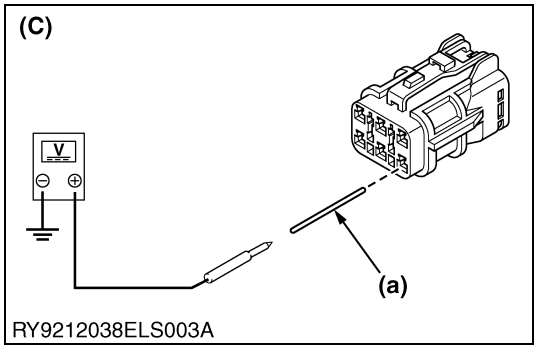
1	**Observing the Malfunction**	• Normal meter display • Abnormal meter display
2	**Checking the Faulty Line**	• Check in the meter's service mode. Checking for breaks in wiring.
3	**Specify the Faulty Circuit with a Circuit Tester**	• Test related circuits with a circuit tester. Specify any faulty circuits in a harness.
4	**Diagnose Sensors and Actuators with the Tester**	• Judge sensors and actuators as normal or abnormal.
5	**Final Operation Check**	• Clear the history display after completing repairs. After clearing the history and thoroughly checking operations, check for a history display again.

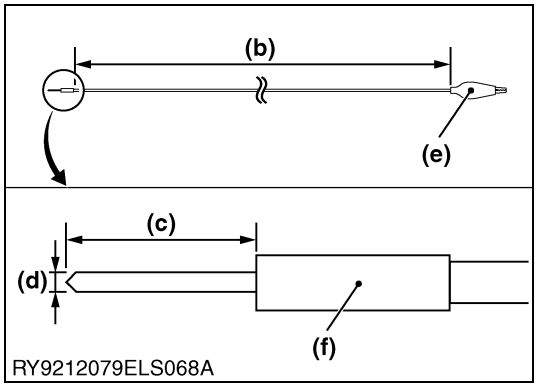
RY9212038ELS0015US0

[3] TESTING WITH A CIRCUIT TESTER









Testing Voltage and Continuity at a Connector

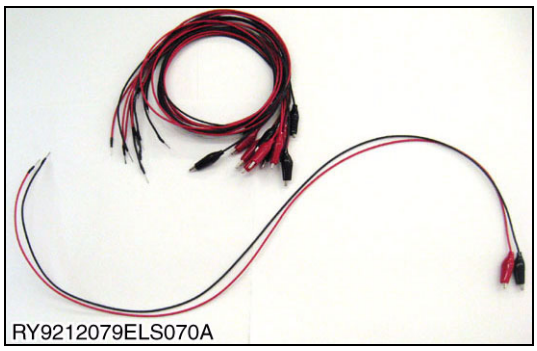
To prevent damage to the connector terminal contacts and/or reducing the water-proofing of the connector when testing a connector for voltage and/or continuity, follow the guidelines below.

RY9212038ELS0016US0

1. General (not waterproof) connectors
   - Insert the test lead from the harness side. Female terminals are particularly prone to damage so always insert the test leads from the harness side.
   - ECU connector terminal pins are extremely small, so do not try and force a test lead in; use the special tool.

2. Waterproof connectors
   - If you try to test the circuit when it is in a closed state and force the test leads in from the harness side, it will reduce the effectiveness of its waterproofing, leading to corrosion, so never do this.
   - When testing a male pin, touch the test lead directly to the pin. In this situation, be very careful not to short circuit across connector terminals.

3. Special tools
   - When the connector pin holes are smaller than the test leads, use thin wires.



(A) Correct Example
(B) Incorrect Example
(C) Using a Special Tool

(a) Measuring Harness
(b) 600 to 700 mm (23.7 to 27.5 in.)
(c) 10 mm (0.39 in.)
(d) 0.6 mm (0.02 in.)
(e) Clip
(f) Tape

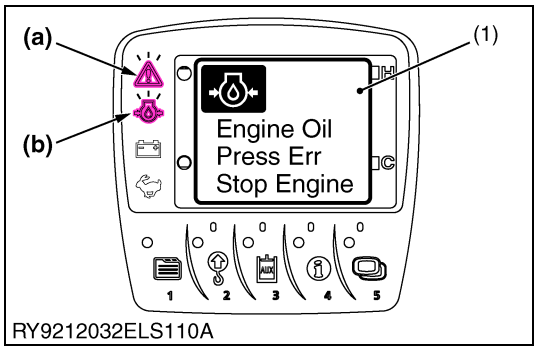
RY9212038ELS0017US0

6. TROUBLESHOOTING (METER PANEL VERSION)

[1] MACHINE RELATED SYSTEM

(1) Engine Oil Pressure Errors

[A] Checking the Meter Panel



RY9212032ELS110A

1. Information displayed on the meter panel

1. When an error appears on the meter panel, stop the engine right away.
2. Check the level of the engine oil.
3. Check whether or not the warning lamp **(a)** on the panel is blinking red.
4. Check whether the oil lamp **(b)** is lit in red or off.

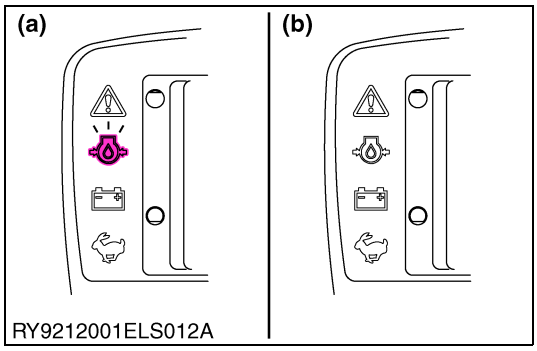
[Reason error screen displayed]

- Engine oil pressure low
- Oil switch always ON
- Short in harness

(1) Engine Oil Press Err Stop Engine

(a) Warning Lamp
(b) Oil Lamp

RY9212148ELS0072US0



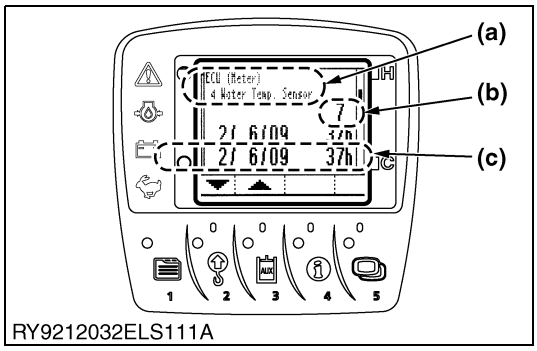
RY9212001ELS012A

[Test Conditions]

1. Key switch: ON

(a) If the oil lamp is lit: caused by a short
(b) If the oil lamp is off: caused by break in wiring

RY9212148ELS0073US0



RY9212032ELS111A

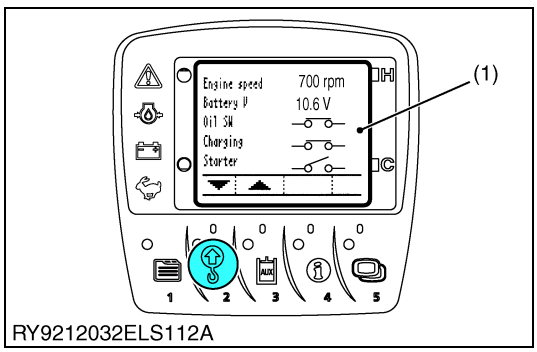
2. Reading the failure history

1. Select the failure history read mode.
2. Read the failure history and check the date (y/m/d) and hour meter of the last occurrence.

E.g.) The last failure record was February 6, 2009 at 37 hours.

(a) Failure
(b) Number of Failure
(c) The Last Breakdown Date (y/m/d) and Hour Meter.

RY9212032ELS0001US0



RY9212032ELS112A

3. Tester mode

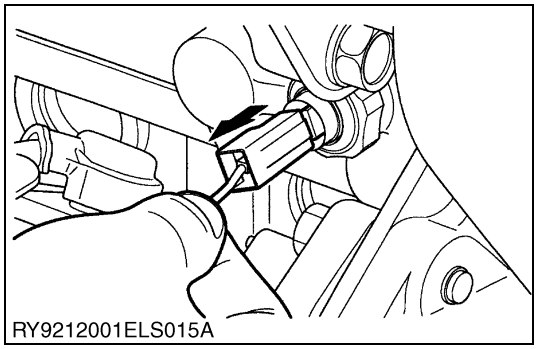
1. Select the tester mode.
2. Check the operation of the oil switch according to the table below.

	Regu-lar	Oil Lamp	When cut off	Oil Lamp	When shorted	Oil Lamp
Key Off	—o o—	Off	—o o—	Off	—o o—	Off
Key On	—o o—	Lit	—o o—	Off	—o o—	Lit
Key Start	—o o—	Off	—o o—	Off	—o o—	Lit

(1) Engine Speed
Battery V
Oil SW
Charging
Starter

RY9212148ELS0074US0

[B] Inspecting each Device Visually and Physically


RY9212001ELS015A

1. Causes when a break in wiring

[Test Conditions]
1. Key switch: OFF
2. The oil switch connector is disconnected.
3. There is a break somewhere in the wiring.

Pull on the harness and make sure the connector/harness does not come off. (pull with a max of 3 kgf (30 N, 7 lbf) of force) If it comes off, plug the connector back in securely and check the operation of the oil switch again in the tester mode.

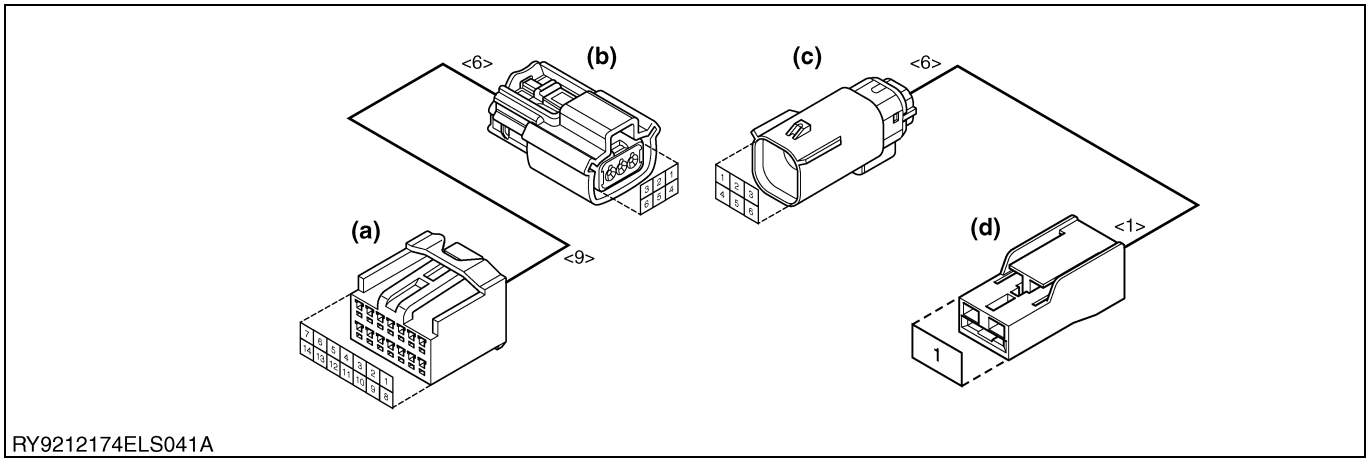
RY9212148ELS0075US0

2. Causes when a short

[Test Conditions]
1. Key switch : OFF
2. The oil switch wire is pinched against or touching the body.
   If the insulation is damaged, repair it properly and check the operation of the oil switch again in the tester mode.

RY9212174ELS0012US0

[C] Testing with a Circuit Tester



RY9212174ELS041A

(a) Meter Panel Connector **(b) Sensor (CRSB) Connector** **(c) Main (Sensor, CRSB) Connector** **(d) Engine Oil Pressure Switch Connector**

RY9212174ELS0072US0

1. Voltage check

[Measurement Conditions]
1. Disconnect the oil switch connector.
2. Key switch : ON
3. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Engine oil pressure switch	<1>	Body GND	–

Regular : 12 V
Irregular : Large discrepancy from 12 V

RY9212174ELS0036US0

2. Continuity check

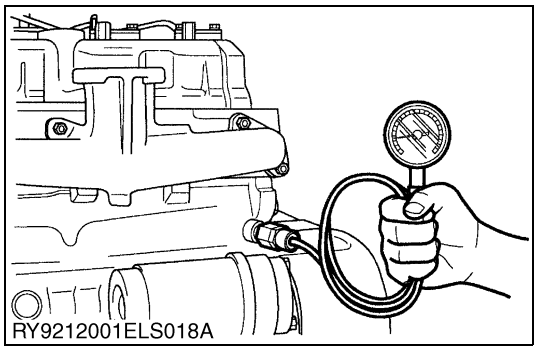
[Measurement Conditions]
1. Key switch : OFF
2. Disconnect meter connector.
3. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Engine oil pressure switch connector	<1>	Meter (Sensor, CRSB)	<6>
(2)	Meter panel	<9>	Sensor (CRSB)	<6>

Regular : Continuity
Irregular : No continuity

RY9212174ELS0037US0

[D] Testing the Equipment Itself


RY9212001ELS018A

1. Measuring engine pressure

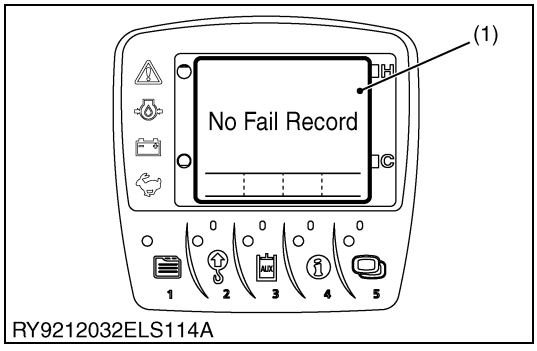
[Measurement Conditions]
1. Remove the oil switch, attach a pressure gauge and measure the pressure.

Engine Oil Pressure	When Idling	Usable Limit	50 kPa 0.5 kgf/cm^2 7.1 psi
	At Rated RPM	Factory specification	300 to 440 kPa 3.0 to 4.5 kgf/cm^2 43 to 64 psi
		Usable Limit	250 kPa 2.5 kgf/cm^2 36 psi

Tightening torque	Oil switch tapering screw R1/8	15 to 19 N-m 1.5 to 2.0 kgf·m 11.1 to 14.0 lbf·ft

RY9212174ELS0038US0

[E] Steps to Take after Completing Repairs



RY9212032ELS114A

1. Delete failure record

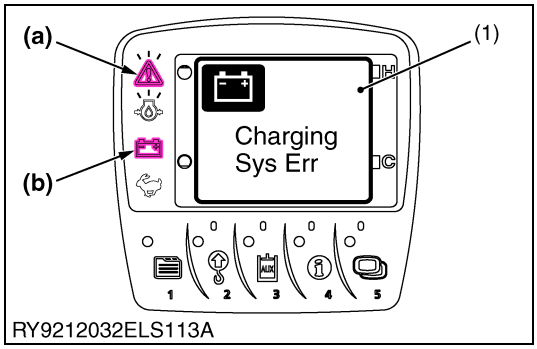
1. While in the service/dealer mode, select Delete Fail Record and delete the record.
2. After deleting the record, start the engine again and check to make sure the warning is not shown on the meter panel.

(1) No Fail Record

RY9212148ELS0148US0

(2) Charging System Errors

[A] Checking the Meter Panel



RY9212032ELS113A

1. Information displayed on the meter panel

1. Check whether or not the warning lamp **(a)** on the panel is blinking red.
2. Check whether the charging lamp **(b)** is lit in red or off.

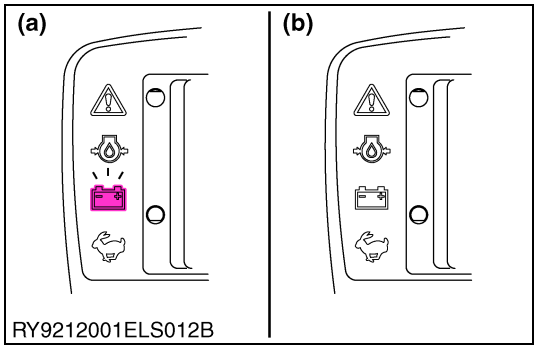
[Reason error screen displayed]

- Alternator faulty
- Fan belt loose/off
- Break in the harness
- Fuse blown (10A)

(1) Charging Sys Err

(a) Warning Lamp
(b) Charging Lamp

RY9212148ELS0078US0



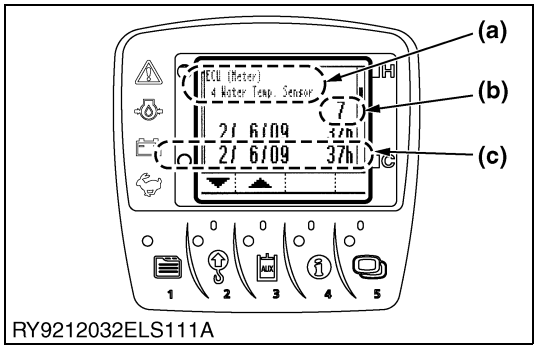
RY9212001ELS012B

[Test Conditions]

1. Key switch: ON

(a) If the charging lamp is lit: caused by a short
(b) If the charging lamp is off: caused by break in wiring

RY9212148ELS0079US0



RY9212032ELS111A

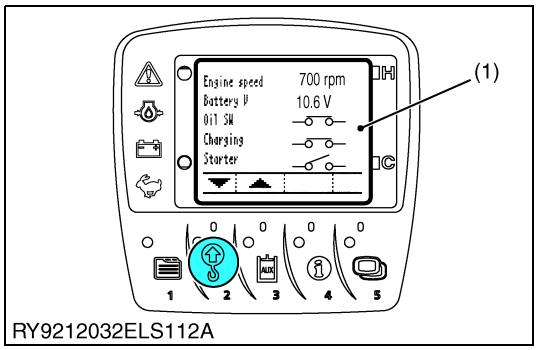
2. Reading the failure history

1. Select the failure history read mode.
2. Read the failure history and check the date (y/m/d) and hour meter of the last occurrence.

E.g.) The last failure record was February 6, 2009 at 37 hours.

(a) Failure
(b) Number of Failure
(c) The Last Breakdown Date (y/m/d) and Hour Meter.

RY9212032ELS0001US0



RY9212032ELS112A

3. Tester mode

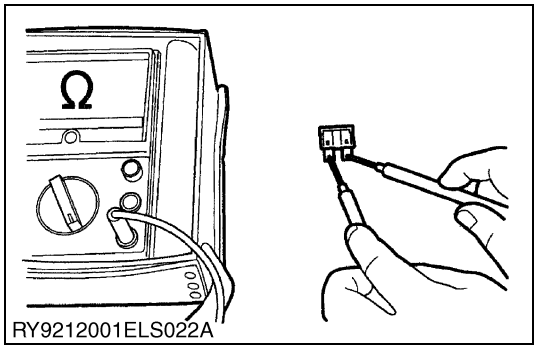
1. Select the tester mode.
2. Check the operation of the charge according to the table below.

	Regu-lar	Charge	When cut off	Charge	When shorted	Charge
Key Off	—o o—	Off	—o o—	Off	—o o—	Off
Key On	—o—o—	Lit	—o o—	Off	—o—o—	Lit
Key Start	—o o—	Off	—o o—	Off	—o—o—	Lit

(1) Engine Speed
Battery V
Oil SW
Charging
Starter

RY9212148ELS0080US0

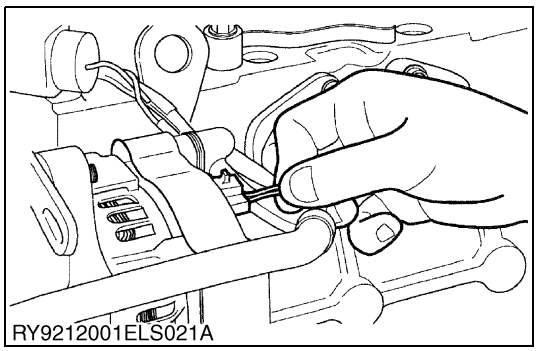
[B] Inspecting each Device Visually and Physically



1. Checking fuses

Check whether the alternator fuse (10A) is blown.

RY9212001ELS0064US0



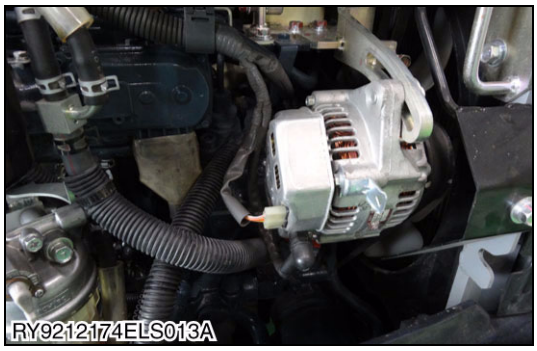
2. Causes when a break in wiring

[Test Conditions]

1. Key switch: OFF
2. The alternator connector is disconnected.
3. There is a break somewhere in the wiring.

Pull on the harness and make sure the connector/harness does not come off. (pull with a max of 3 kgf (30 N, 7 lbf) of force) If it comes off, plug the connector back in securely and check the operation of the charging switch again in the tester mode.

RY9212148ELS0081US0



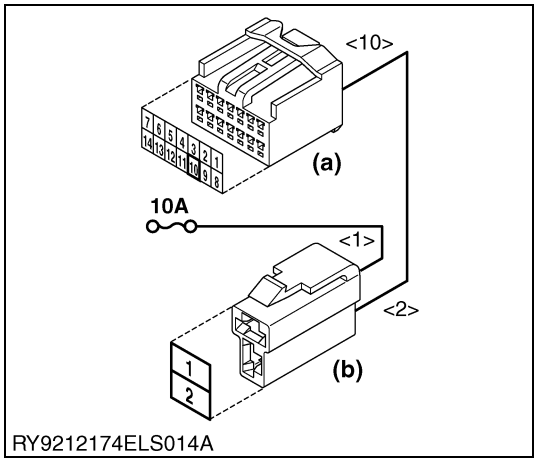
3. Causes when a short

[Test Conditions]

1. Key switch : OFF
2. The alternator connector wire is pinched against or touching the body.
   If the insulation is damaged, repair it properly and check the operation of the charging switch again in the tester mode.

RY9212174ELS0013US0

[C] Testing with a Circuit Tester



1. Voltage check

[Measurement Conditions]

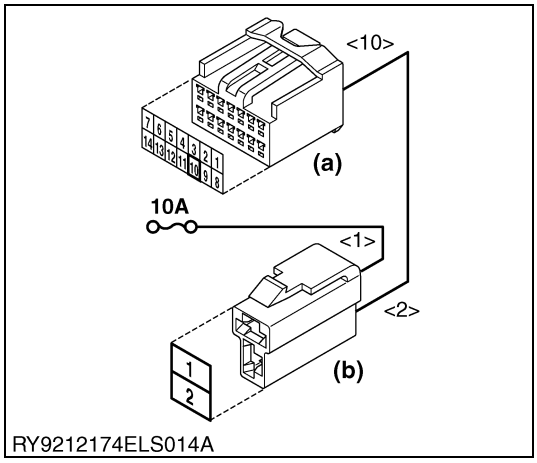
1. Disconnect alternator connector.
2. Key switch : ON
3. Measure the voltage based on the table below.

Mea-sure-ment	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Alternator	<1>	Body GND	–
(2)	Alternator	<2>	Body GND	–

Regular : 12 V
Irregular : Large discrepancy from 12 V

(a) Meter Connector (b) Alternator Connector

RY9212174ELS0039US0



RY9212174ELS014A

2. Continuity check

[Measurement Conditions]

1. Key switch : OFF
2. Disconnect meter connector.
3. Remove the 10 A fuse.
4. Test the continuity based on the table below.

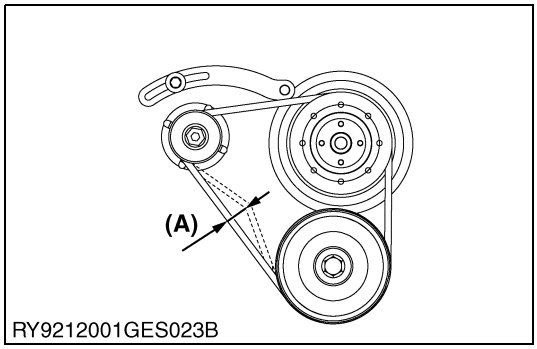
Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Alternator	<2>	Meter	<10>
(2)	Meter	<1>	10A fuse	–

Regular : Continuity
Irregular : No continuity

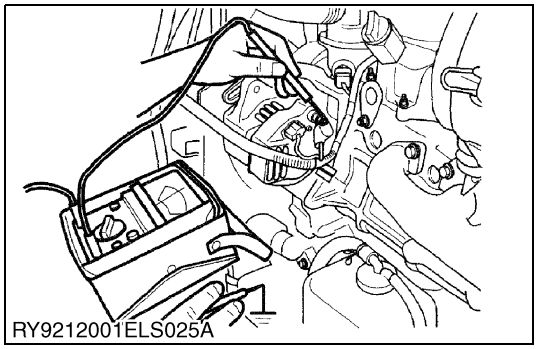
(a) Meter Connector (b) Alternator Connector

RY9212174ELS0040US0

[D] Testing the Equipment Itself



RY9212001GES023B


RY9212001ELS025A

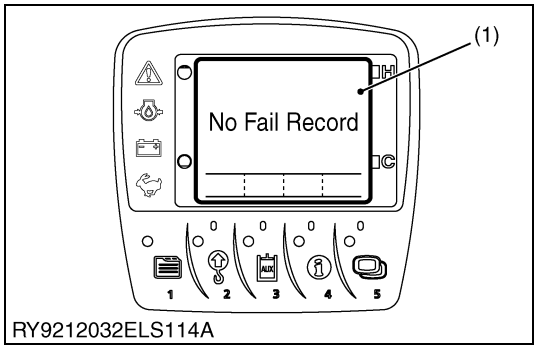
1. Inspecting the alternator

1. Check for a cut, loose or slipping fan belt.
2. Measure the voltage between terminal B of the alternator and body GND. If the measured voltage is about 12 V, it is normal. If the measured voltage is low, it may indicate insufficient battery capacity or looseness in connections somewhere before the alternator.
3. Next, start the engine and measure the voltage generated when the alternator is operating. Take the measurement between terminal B on the alternator side and the body GND. If the measured voltage is about 14 V, it is normal. If the measured voltage does not vary from the battery voltage (about 12 V), then the alternator itself or the regulator is faulty.

(A) Displacement 7 to 9 mm (0.28 to 0.35 in.)

RY9212174ELS0014US0

[E] Steps to Take after Completing Repairs



RY9212032ELS114A

1. Delete failure record

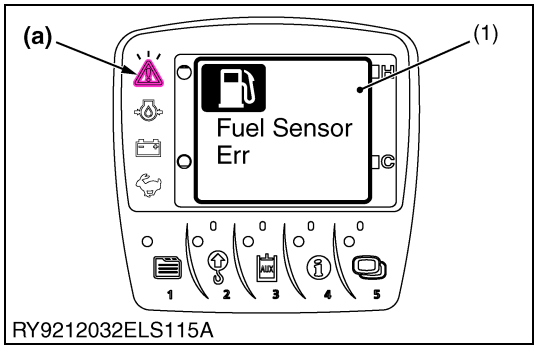
1. While in the service/dealer mode, select Delete Fail Record and delete the record.
2. After deleting the record, start the engine again and check to make sure the warning is not shown on the meter panel.

(1) No Fail Record

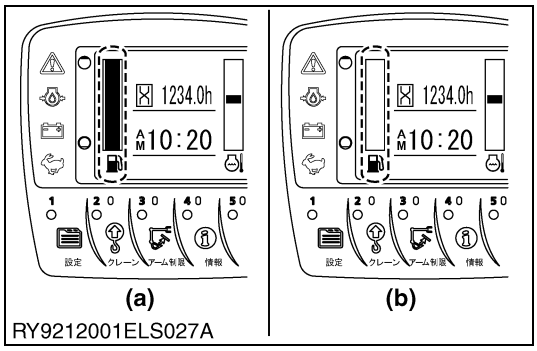
RY9212148ELS0148US0

(3) Fuel Sensor Errors

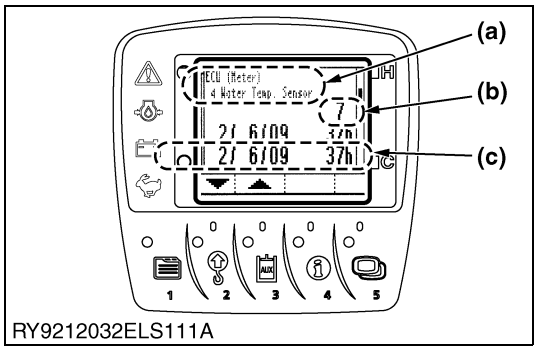
[A] Checking the Meter Panel



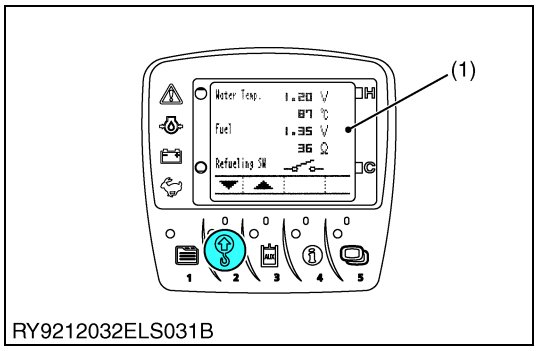
RY9212032ELS115A



RY9212001ELS027A



RY9212032ELS111A



RY9212032ELS031B

1. Information displayed on the meter panel

Check whether or not the warning lamp **(a)** on the panel is blinking red.

[Reason error screen displayed]

- Connector disconnected
- Break in the harness

(1) Fuel Sensor Err
(a) Warning Lamp

RY9212148ELS0084US0

[Test Conditions]

1. Key switch: ON

(a) If the fuel level is at the top: caused by a short
(b) If the fuel level is blank: caused by a break

RY9212148ELS0085US0

2. Reading the failure history

1. Select the failure history read mode.
2. Read the failure history and check the date (y/m/d) and hour meter of the last occurrence.

E.g.) The last failure record was February 6, 2009 at 37 hours.

(a) Failure
(b) Number of Failure
(c) The Last Breakdown Date (y/m/d) and Hour Meter.

RY9212032ELS0001US0

3. Tester mode

1. Select the tester mode.
2. Start the engine.
3. Check the display for the voltage and resistance of the fuel based on the following table.

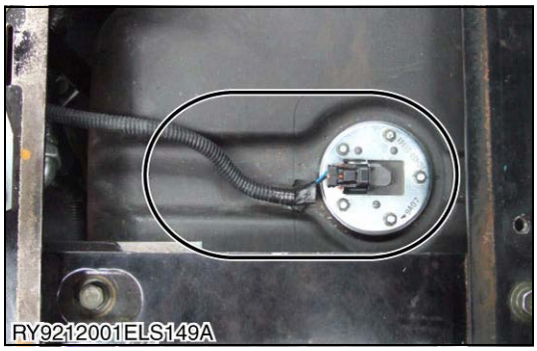
	Fuel voltage	Resistance
When cut off	5.00 V	218 Ω
When shorted	0.00 V	0 Ω

(1) Water Temp.
Fuel
Refueling SW

RY9212148ELS0086US0

[B] Inspecting each Device Visually and Physically





1. Causes when a break in wiring

[Test Conditions]
1. Key switch: OFF
2. Fuel sensor connector disconnected.
3. There is a break somewhere in the wiring.

Pull on the harness and make sure the connector/harness does not come off. (pull with a max of 3 kgf (30 N, 7 lbf) of force) If it comes off, plug the connector back in securely and check the voltage and resistance for the fuel again in the tester mode.

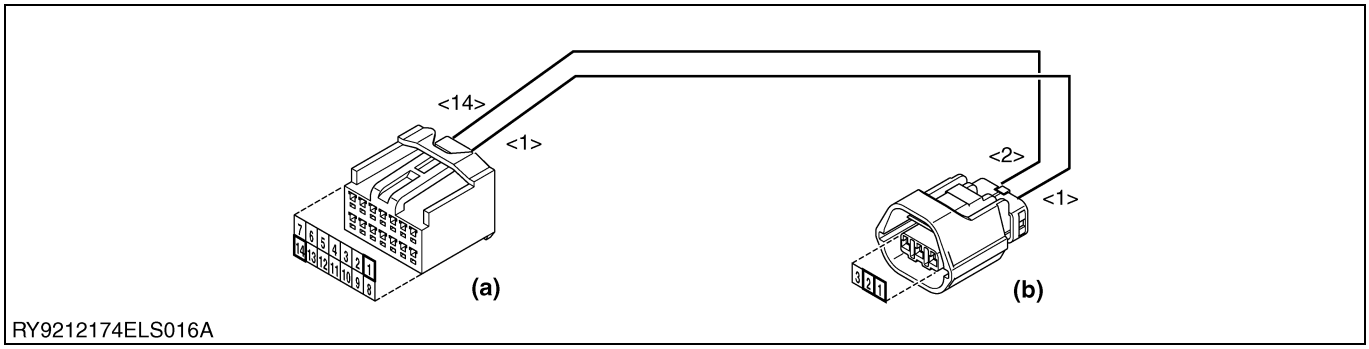
RY9212148ELS0087US0

2. Causes when a short

[Test Conditions]
1. Key switch: OFF
2. The fuel sensor wire is pinched against or touching the body. If the insulation is damaged, repair it properly and check the voltage and resistance for the fuel again in the tester mode.

RY9212148ELS0088US0

[C] Testing with a Circuit Tester



RY9212174ELS016A

(a) Meter Connector **(b) Fuel Sensor Connector**

RY9212174ELS0071US0

1. Voltage check

[Measurement Conditions]
1. Disconnect the fuel sensor connector.
2. Key switch : ON
3. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Fuel sensor	<1>	Fuel sensor	<2>
(2)	Fuel sensor	<1>	Body GND	–

Regular : 12 V
Irregular : Large discrepancy from 12 V

RY9212174ELS0041US0

2. Continuity check

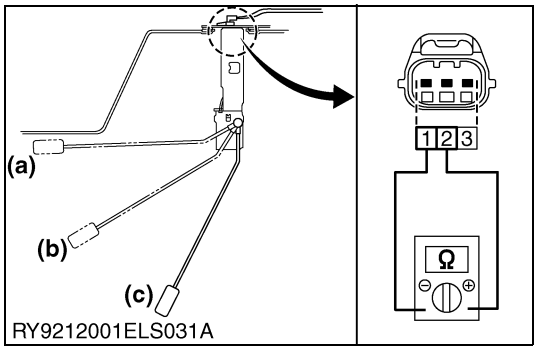
[Measurement Conditions]
1. Key switch : OFF
2. Disconnect meter connector.
3. Test the continuity based on the table below.

Mea-sure-ment	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Fuel sensor	<1>	Meter	<1>
(2)	Fuel sensor	<2>	Meter	<14>

Regular : Continuity
Irregular : No continuity

RY9212174ELS0042US0

[D] Testing the Equipment Itself



RY9212001ELS031A

1. Inspecting the fuel sensor

[Measurement Conditions]
1. Key switch : OFF
2. Disconnect the fuel sensor connector and take measurements.
3. Refer to the following table for the resistance at different float positions.

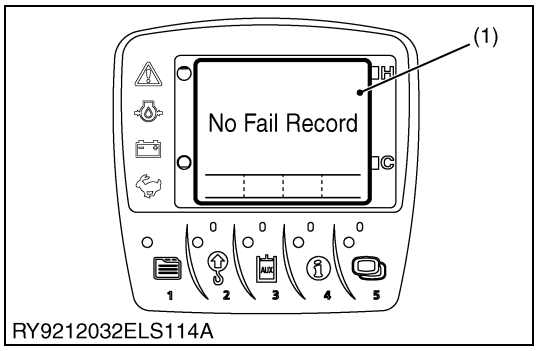
Factory Spec

Float position	F (a)	1/2 (b)	E (c)
Resistance value (Ω)	5 ≥	35.83	101.0 ≤

(a) Full
(b) Half
(c) Empty

RY9212174ELS0043US0

[E] Steps to Take after Completing Repairs



RY9212032ELS114A

1. Delete failure record

1. While in the service/dealer mode, select Delete Fail Record and delete the record.
2. After deleting the record, start the engine again and check to make sure the warning is not shown on the meter panel.

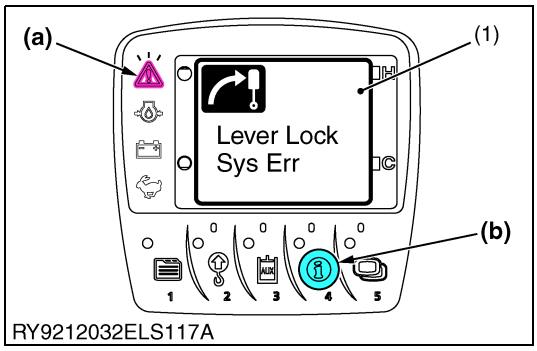
(1) No Fail Record

RY9212148ELS0148US0

[2] FRONT-END SYSTEMS

(1) Lever Lock System Errors

[A] Checking the Meter Panel



RY9212032ELS117A

1. Information displayed on the meter panel

1. Check whether or not the warning lamp **(a)** on the panel is blinking red.
2. Press the info button **(b)** and check the additional content.

   E.g.) Lever lock solenoid

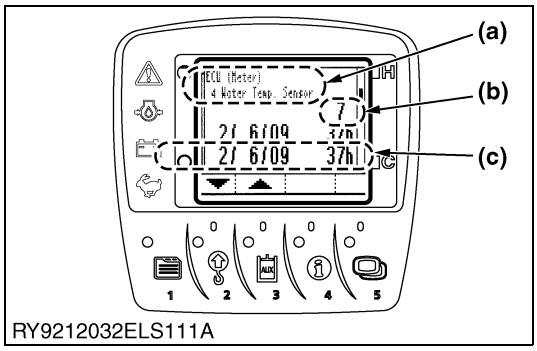
[Reason error screen displayed]

- Lever lock solenoid line short.

(1) Lever Lock Sys Err

(a) Warning Lamp
(b) Info Button

RY9212148ELS0090US0



RY9212032ELS111A

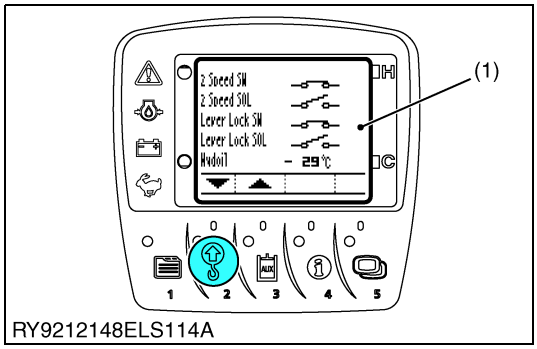
2. Reading the failure history

1. Select the failure history read mode.
2. Read the failure history and check the date (y/m/d) and hour meter of the last occurrence.

   E.g.) The last failure record was February 6, 2009 at 37 hours.

(a) Failure
(b) Number of Failure
(c) The Last Breakdown Date (y/m/d) and Hour Meter.

RY9212032ELS0001US0

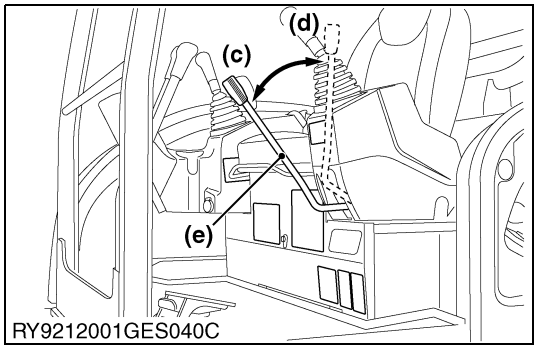


RY9212148ELS114A

3. Tester mode

1. Select the tester mode.
2. Start the engine.
3. Put the lever lock in the [Unlock] position.
4. Operate the lever lock switch and lever lock solenoid and check the switch according to the following table.

	Regular	Warning lamp	When cut off	Warning lamp	When short	Warning lamp
Lever lock switch ON		Off		Off		Off
Lever lock switch OFF		Off		Off		Off
Lever lock solenoid ON		Off		Off		Off
Lever lock solenoid OFF		Off		Off		Off



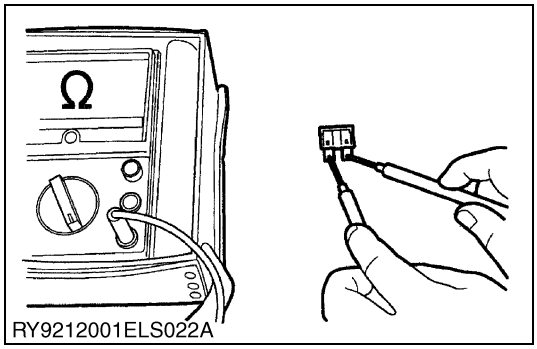
RY9212001GES040C

(1) 2nd Speed SW
2nd Speed SOL
Lever Lock SW
Lever Lock SOL
Hydraulic Oil Temperature

(c) Unlock
(d) Lock
(e) Lever Lock

RY9212148ELS0091US0

[B] Inspecting each Device Visually and Physically



1. Checking fuses

1. Check whether the 5A lever lock fuse is blown.

RY9212001ELS0088US0



2. Causes when a break in wiring

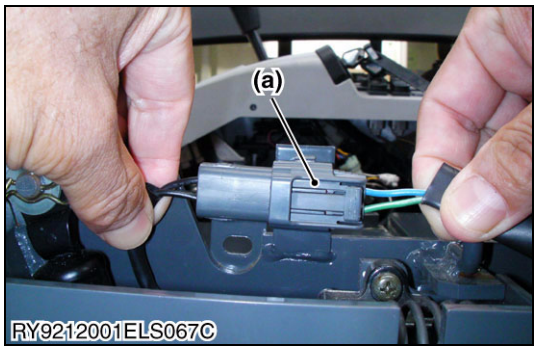
[Test Conditions]

1. Key switch : OFF
2. The lever lock switch connector is disconnected.
3. The lever lock solenoid connector is disconnected.
4. There is a break somewhere in the wiring.

Pull on the harness and make sure the connector/harness does not come off. (pull with a max of 3 kgf (30 N, 7 lbf) of force) If it comes off, plug the connector back in securely and check the lever lock switch and lever lock solenoid in the tester mode.

(a) Lever Lock Switch Connector

RY9212174ELS0015US0



3. Causes when a short

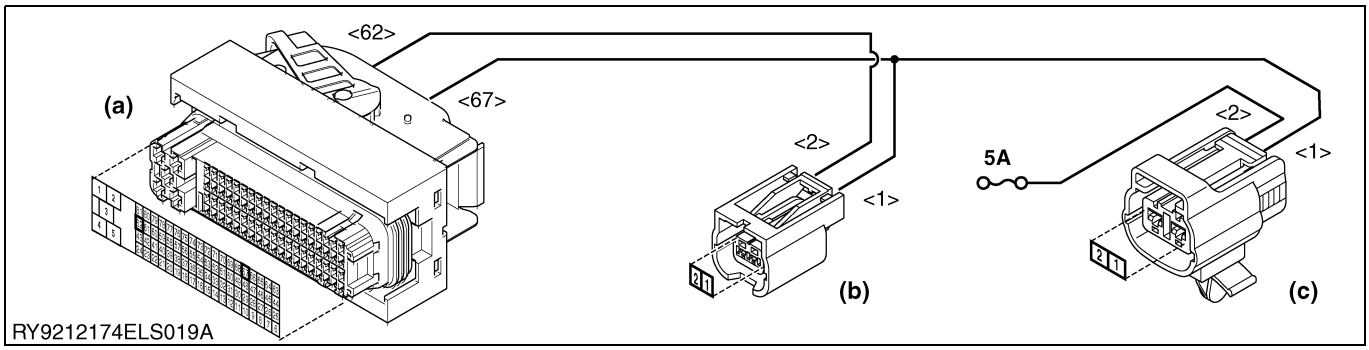
[Test Conditions]

1. Key switch : OFF
2. The lever lock switch connector wire and/or lever lock solenoid connector are pinched against or touching the body.
   If the insulation is damaged, repair it properly and check the lever lock switch and the lever lock solenoid again in the tester mode.

(a) Lever Lock Switch Connector

RY9212174ELS0016US0

[C] Testing with a Circuit Tester



(a) Main ECU Connector **(b) Lever lock solenoid Connector** **(c) Lever lock switch Connector**

RY9212174ELS0073US0

1. Voltage check (lever lock switch)

[Measurement Conditions]

1. Disconnect the lever lock switch connector.
2. Key switch : ON
3. Put the lever lock in the [Unlock] position.
4. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Lever lock switch	<2>	Lever lock switch	<1>
(2)	Lever lock switch	<2>	Body GND	–

Regular : 12 V
Irregular : Large discrepancy from 12 V

RY9212174ELS0044US0

2. Continuity check (lever lock switch)

[Measurement Conditions]

1. Key switch : OFF
2. Disconnect lever lock switch connector and lever lock solenoid connector.
3. Put the lever lock in the [Unlock] position.
4. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Lever lock fuse	–	Lever lock switch	<2>
(2)	Lever lock switch	<1>	Lever lock solenoid	<1>

Regular : Continuity
Irregular : No continuity

RY9212174ELS0045US0

3. Voltage check (lever lock solenoid)

[Measurement Conditions]
1. Disconnect lever lock solenoid connector.
2. Key switch : ON
3. Put the lever lock in the [Unlock] position.
4. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Lever lock solenoid	<1>	Lever lock solenoid	<2>
(2)	Lever lock solenoid	<1>	Body GND	–

Regular : 12 V
Irregular : Large discrepancy from 12 V

RY9212174ELS0046US0

4. Continuity check (lever lock solenoid)

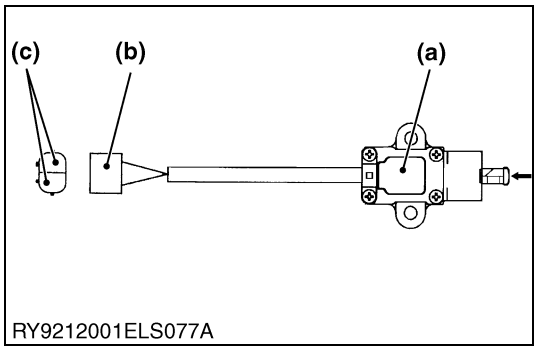
[Measurement Conditions]
1. Key switch : OFF
2. Disconnect the ECU connector.
3. Disconnect lever lock solenoid connector.
4. Put the lever lock in the [Unlock] position.
5. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Lever lock solenoid	<1>	ECU	<67>
(2)	Lever lock solenoid	<2>	ECU	<62>

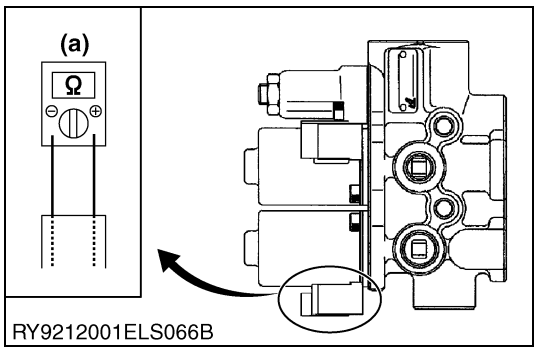
Regular : Continuity
Irregular : No continuity

RY9212174ELS0047US0

[D] Testing the Equipment Itself



RY9212001ELS077A



RY9212001ELS066B

1. Inspecting the lever lock switch

[Test Conditions]
1. Key switch: OFF
2. Disconnect the lever lock switch connector from the machine and press the switch and check for continuity.

   Regular: Continuity
   Irregular: No continuity

(a) Lever Lock Switch
(b) Lever Lock Switch Connector
(c) Lever Lock Switch Connector Terminals

RY9212148ELS0094US0

2. Testing the lever lock solenoid

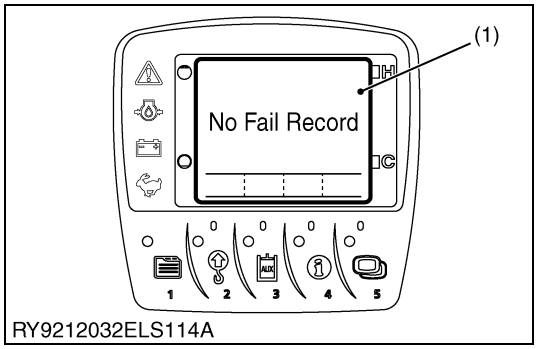
[Test Conditions]
1. Key switch: OFF
2. Disconnect lever lock solenoid connector from the machine and test the solenoid separately.

Lever lock solenoid	Factory specification	12 Ω ±10 %

(a) Lever Lock Solenoid Terminals

RY9212148ELS0095US0

[E] Steps to Take after Completing Repairs



RY9212032ELS114A

1. Delete failure record

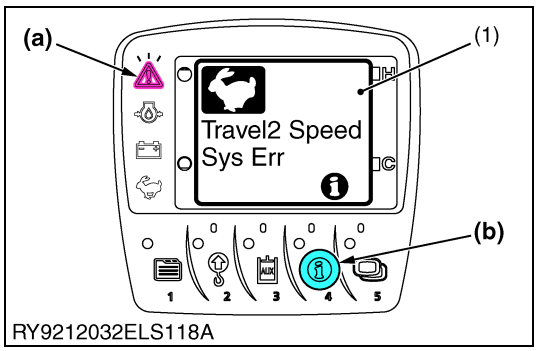
1. While in the service/dealer mode, select Delete Fail Record and delete the record.
2. After deleting the record, start the engine again and check to make sure the warning is not shown on the meter panel.

(1) No Fail Record

RY9212148ELS0148US0

(2) Travel 2nd Speed System Error

[A] Error from the Meter Panel



RY9212032ELS118A

1. Information displayed on the meter panel

1. Check whether or not the warning lamp **(a)** on the panel is blinking red.
2. Press the info button **(b)** and check the additional content.

   E.g.) 2nd speed solenoid

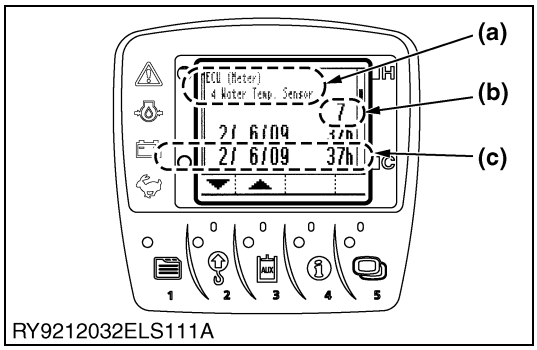
[Reason error screen displayed]

- 2nd speed solenoid line short

(1) Travel2 Speed Sys Err

(a) Warning Lamp
(b) Info Button

RY9212148ELS0096US0



RY9212032ELS111A

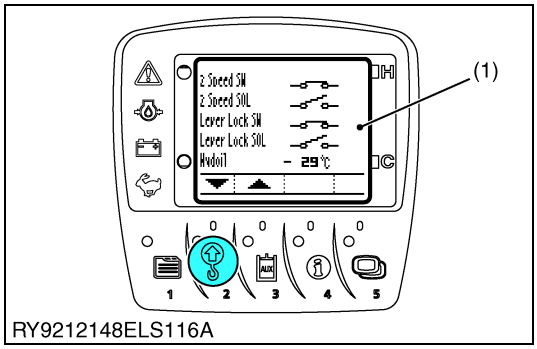
2. Reading the failure history

1. Select the failure history read mode.
2. Read the failure history and check the date (y/m/d) and hour meter of the last occurrence.

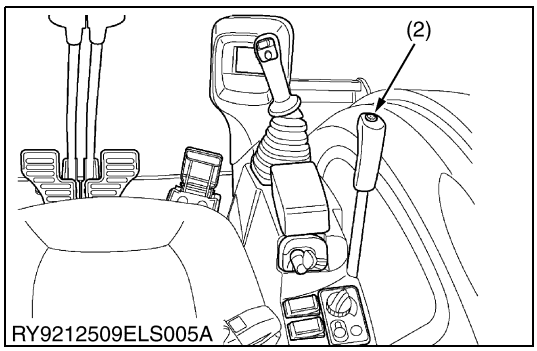
   E.g.) The last failure record was February 6, 2009 at 37 hours.

(a) Failure
(b) Number of Failure
(c) The Last Breakdown Date (y/m/d) and Hour Meter.

RY9212032ELS0001US0



RY9212148ELS116A



RY9212509ELS005A

3. Tester mode

1. Select the tester mode.
2. Start the engine.
3. Put the lever lock in the [Unlock] position and press the 2nd speed switch.
4. Operate the 2nd speed switch and check the 2nd speed switch and 2nd speed solenoid based on the following table.

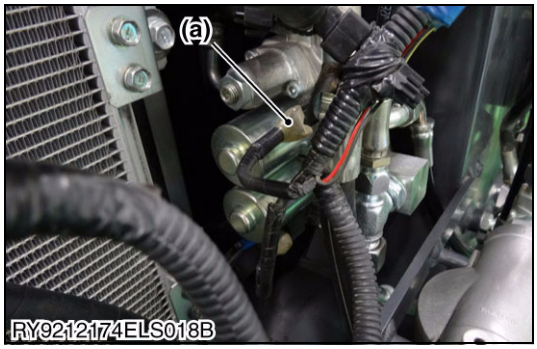
	Regu-lar	2nd speed lamp	When cut off	2nd speed lamp	When shorte d	2nd speed lamp
2nd speed switch ON		Lit		Lit		Off
2nd speed switch OFF		Off		Off		Off
2nd speed solenoid ON		Lit		Lit		Off
2nd speed solenoid OFF		Off		Off		Off

(1) 2nd Speed SW
2nd Speed SOL
Lever Lock SW
Lever Lock SOL
Hydraulic Oil Temperature

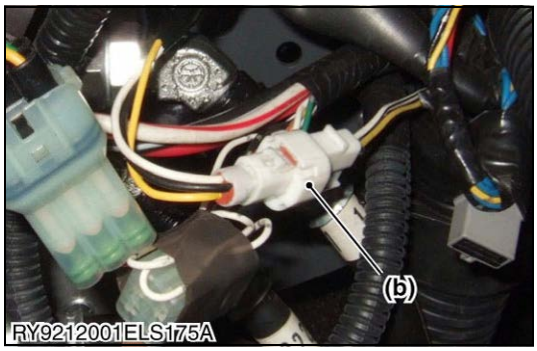
(2) 2nd Speed Switch

RY9212509ELS0007US0

[B] Inspecting each Device Visually and Physically



RY9212174ELS018B



RY9212001ELS175A

1. Causes when a break in wiring

[Test Conditions]

1. Key switch : OFF
2. The 2nd speed solenoid connector disconnected.
3. The 2nd speed switch connector disconnected.
4. There is a break somewhere in the wiring.

Pull on the harness and make sure the connector/harness does not come off. (pull with a max of 3 kgf (30 N, 7 lbf) of force) If it comes off, plug the connector back in securely and check the 2nd speed solenoid and the 2nd speed switch in the tester mode.

(a) 2nd Speed Solenoid Connector **(b) 2nd Speed Switch Connector**

RY9212509ELS0008US0

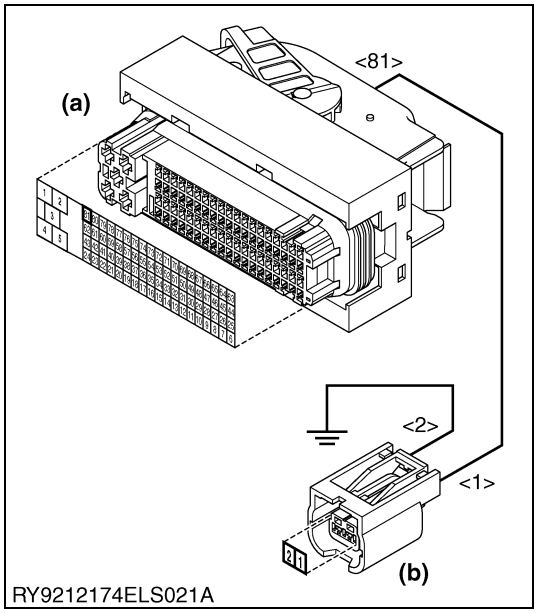
2. Causes when a short

[Test Conditions]

1. Key switch : OFF
2. The wiring of the 2nd speed solenoid connector and/or the 2nd speed switch connector are pinched against or touching the body
   If the insulation is damaged, repair it properly and check the 2nd speed solenoid and the 2nd speed switch again in the tester mode.

RY9212174ELS0018US0

[C] Testing with a Circuit Tester



RY9212174ELS021A

1. Voltage check (2nd speed solenoid)

[Measurement Conditions]

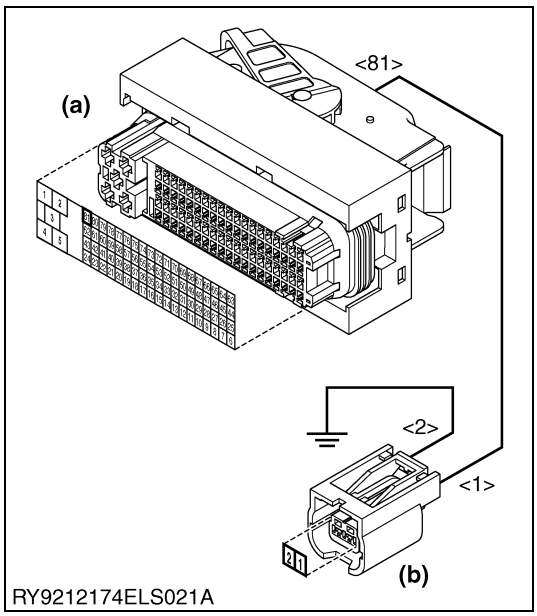
1. Disconnect the travel 2nd speed solenoid connector.
2. Key switch : ON
3. Put the lever lock in the [Unlock] position and press the 2nd speed switch.
4. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	2nd speed solenoid	<1>	2nd speed solenoid	<2>
(2)	2nd speed solenoid	<1>	Body GND	–

Regular : 12 V
Irregular : Large discrepancy from 12 V

(a) Main ECU Connector **(b) 2nd Speed Solenoid Connector**

RY9212174ELS0048US0



RY9212174ELS021A

2. Continuity check (2nd speed solenoid)

[Measurement Conditions]

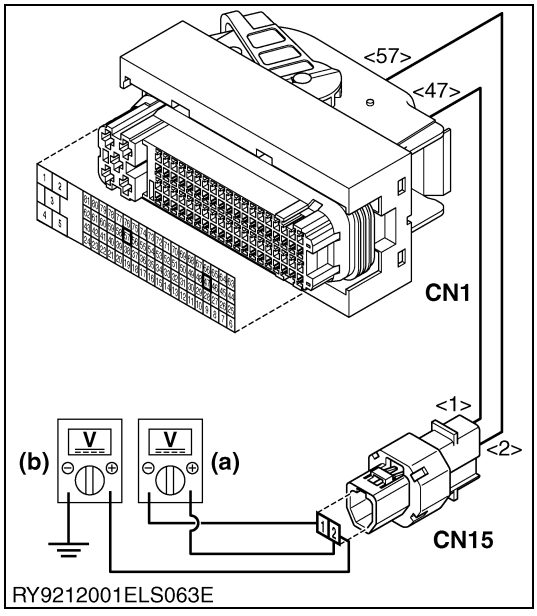
1. Key switch : OFF
2. Disconnect the travel 2nd speed solenoid connector.
3. Disconnect the ECU connector.
4. Put the lever lock in the [Unlock] position and press the 2nd speed switch.
5. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	2nd speed solenoid	<1>	ECU	<81>

Regular : Continuity
Irregular : No continuity

(a) Main ECU Connector **(b) 2nd Speed Solenoid Connector**

RY9212174ELS0049US0



RY9212001ELS063E

3. Voltage check (2nd speed switch)

[Measurement Conditions]

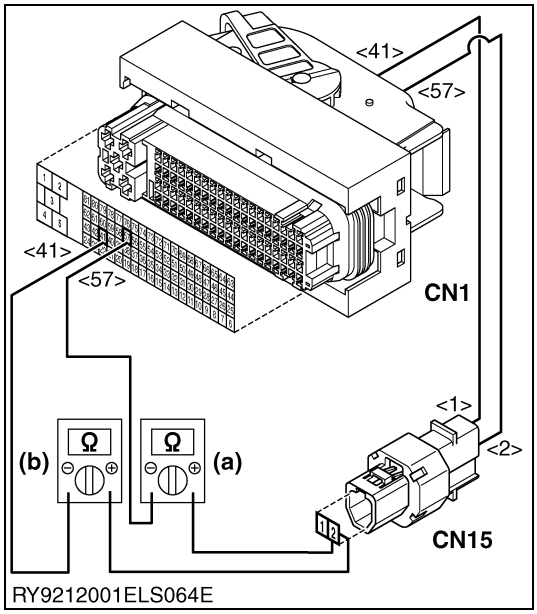
1. Disconnect the 2nd speed switch connector.
2. Key switch : ON
3. Put the lever lock in the [Unlock] position and press the 2nd speed switch.
4. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	2nd speed switch	<2>	2nd speed switch	<1>
(2)	2nd speed switch	<1>	Body GND	–

Regular : 12 V
Irregular : Large discrepancy from 12 V

(a) Main ECU Connector **(b) 2nd Speed Switch Connector**

RY9212509ELS0009US0



RY9212001ELS064E

4. Continuity check (2nd speed switch)

[Measurement Conditions]

1. Key switch : OFF
2. Disconnect the ECU connector.
3. Put the lever lock in the [Unlock] position and press the 2nd speed switch.
4. Test the continuity based on the table below.

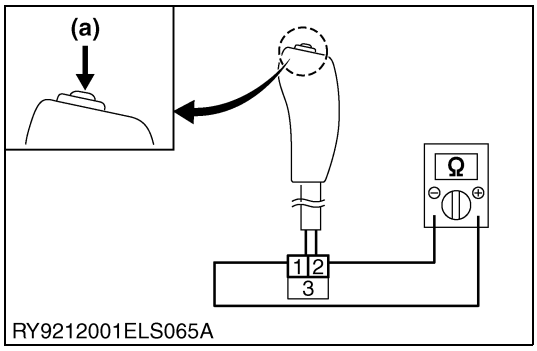
Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	2nd speed switch	<2>	ECU	<57>
(2)	2nd speed switch	<1>	ECU	<41>

Regular : Continuity
Irregular : No continuity

(a) Main ECU Connector **(b) 2nd Speed Switch Connector**

RY9212509ELS0010US0

[D] Testing the Equipment Itself



RY9212001ELS065A

1. Testing the 2nd speed switch

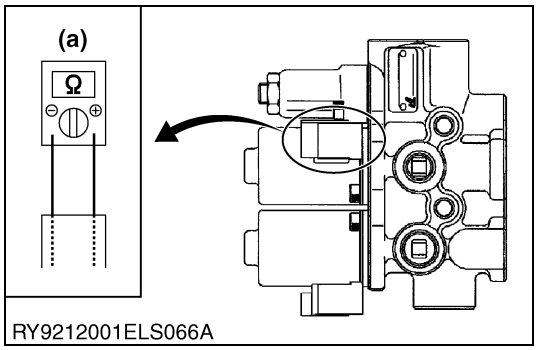
[Test Conditions]

1. Key switch: OFF
2. Disconnect the 2nd speed switch connector from the machine and press the switch and check for continuity.

Regular: Continuity
Irregular: No continuity

(a) 2nd Speed Switch

RY9212509ELS0011US0



RY9212001ELS066A

2. Testing the 2nd speed solenoid

[Test Conditions]

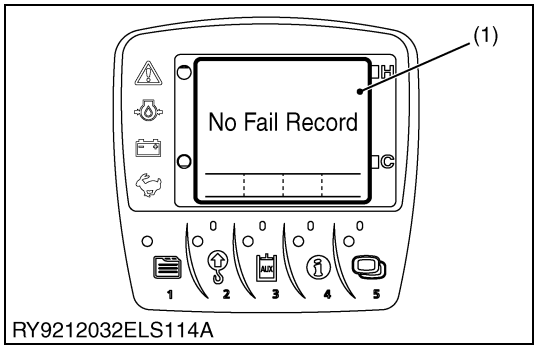
1. Key switch: OFF
2. Disconnect 2nd speed solenoid connector from the machine and test the solenoid separately.

2nd speed solenoid	Factory specification	12 Ω ±10%

(a) 2nd Speed Solenoid Terminals

RY9212148ELS0101US0

[E] Steps to Take after Completing Repairs



RY9212032ELS114A

1. Delete failure record

1. While in the service/dealer mode, select Delete Fail Record and delete the record.
2. After deleting the record, start the engine again and check to make sure the warning is not shown on the meter panel.

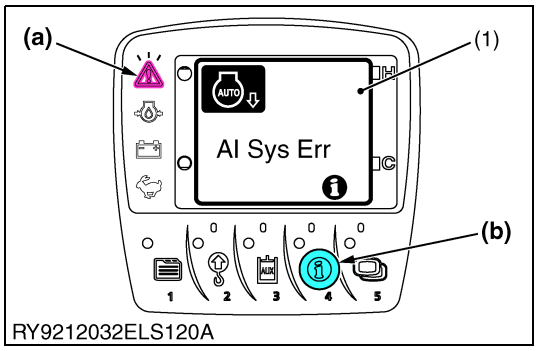
(1) No Fail Record

RY9212148ELS0148US0

[3] AUTO IDLING (AI) SYSTEM

(1) AI System Errors

[A] Checking the Meter Panel



RY9212032ELS120A

1. Information displayed on the meter panel

1. Check whether or not the warning lamp **(a)** on the panel is blinking red.
2. Press the info button **(b)** and check the additional content.

   E.g.) Accelerator sensor

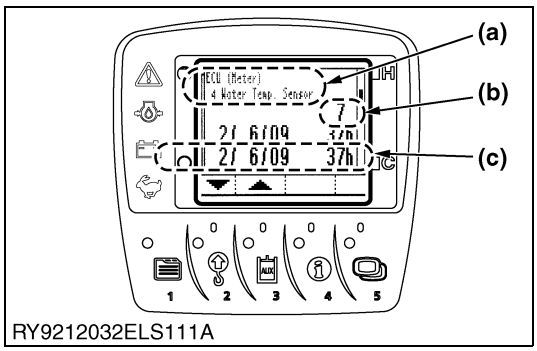
[Reason error screen displayed]

- AI console connector disconnected
- Break or short in harness

(1) AI Sys Err

(a) Warning Lamp
(b) Info Button

RY9212148ELS0104US0



RY9212032ELS111A

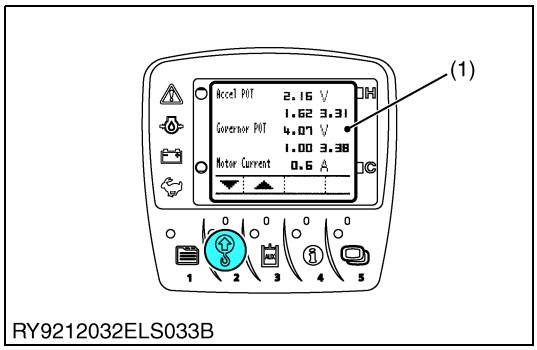
2. Reading the failure history

1. Select the failure history read mode.
2. Read the failure history and check the date (y/m/d) and hour meter of the last occurrence.

   E.g.) The last failure record was February 6, 2009 at 37 hours.

(a) Failure
(b) Number of Failure
(c) The Last Breakdown Date (y/m/d) and Hour Meter.

RY9212032ELS0001US0

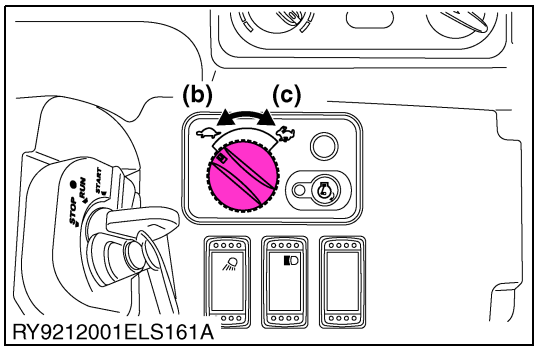


RY9212032ELS033B

3. Tester mode

1. Select the tester mode.
2. Start the engine.
3. Turn the accelerator dial to the right (hi-speed) and to the left (lo-speed) and check the accelerator POT voltage based on the following table.

Design Value	Accelerator POT	Regular	When cut off	When shorted
	Idling	Approx. 1.50 V	0.01 V	Voltage fails to stabilize
	MAX	Approx. 3.30 V	0.01 V	



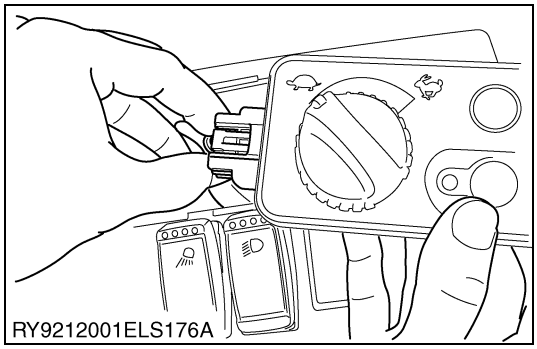
RY9212001ELS161A

(1) Accel POT
Governor POT
Motor Current

(b) Slow
(c) Fast

RY9212148ELS0105US0

[B] Inspecting each Device Visually and Physically


RY9212001ELS176A

1. Causes when a break in wiring

[Test Conditions]
1. Key switch: OFF
2. AI console connector disconnected.
3. There is a break somewhere in the wiring.

Pull on the harness and make sure the connector/harness does not come off. (pull with a max of 3 kgf (30 N, 7 lbf) of force) If it comes off, plug the connector back in securely, turn the accelerator dial to the right (hi-speed) and the left (lo-speed) and check the voltage of the accelerator sensor again in the tester mode.

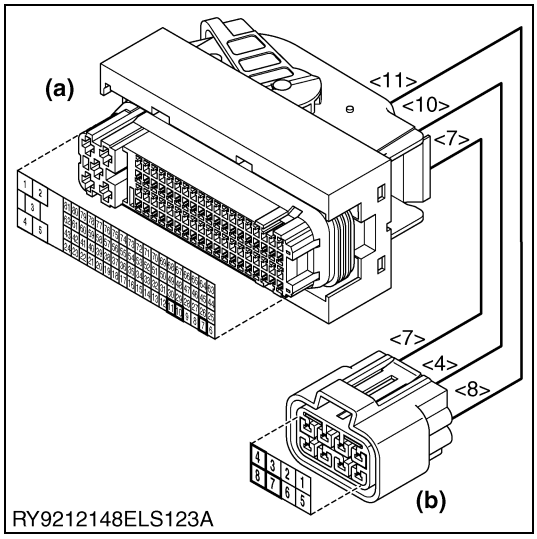
RY9212148ELS0106US0

2. Causes when a short

[Test Conditions]
1. Key switch: OFF
2. The wiring of the AI console connector is pinched against or touching the body.
   If the insulation is damaged, repair it properly, turn the accelerator dial to the right (hi-speed) and the left (lo-speed) and check the voltage of the accelerator sensor again in the tester mode.

RY9212148ELS0107US0

[C] Testing with a Circuit Tester



RY9212148ELS123A

1. Voltage check

[Measurement Conditions]
1. Disconnect the AI console connector.
2. Key switch: ON
3. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	AI console	<8>	AI console	<4>
(2)	AI console	<8>	Body GND	–

Regular: 5V
Irregular: Large discrepancy from 5V

(a) Main ECU Connector **(b) AI console Connector**

RY9212148ELS0168US0

2. Continuity check

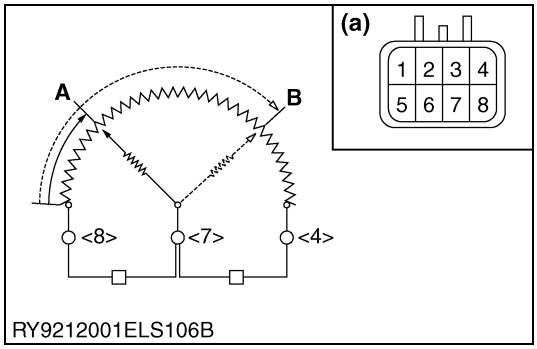
[Measurement Conditions]
1. Key switch: OFF
2. Disconnect the connector to be tested.
3. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	AI console	<7>	Main ECU	<7>
(2)	AI console	<8>	Main ECU	<11>
(3)	AI console	<4>	Main ECU	<10>

Regular: Continuity
Irregular: No continuity

RY9212148ELS0169US0

[D] Testing the Equipment Itself



RY9212001ELS106B

1. Testing the accelerator sensor

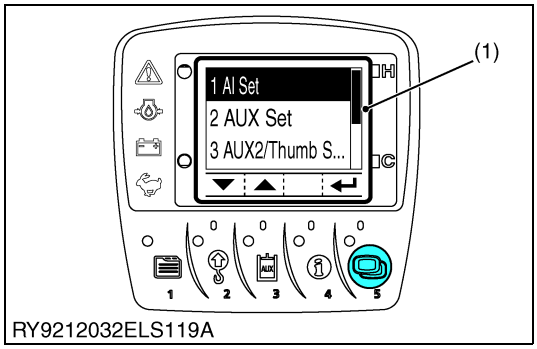
[Measurement Conditions]

1. Key switch: OFF
2. Disconnect the accelerator sensor from the machine and test it separately.

Factory specification	Min.	Max.
Accelerator sensor 4 to 8	1 kΩ ± 10 %	1 kΩ ± 10 %
Accelerator sensor 7 to 8	720 Ω	380 Ω
Accelerator sensor 4 to 7	380 Ω	720 Ω

(a) Accelerator Dial Terminal Numbers

RY9212148ELS0108US0



RY9212032ELS119A

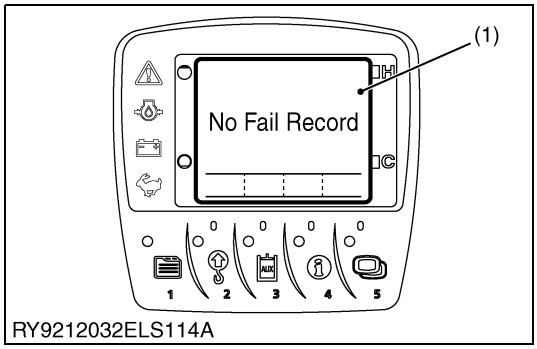
2. Settings after replacing device

1. Make AI settings.

(1) AI Set
AUX Set
AUX2/Thumb Set

RY9212148ELS0109US0

[E] Steps to Take after Completing Repairs



RY9212032ELS114A

1. Delete failure record

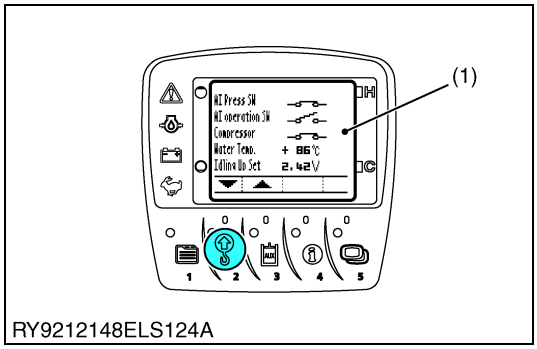
1. While in the service/dealer mode, select Delete Fail Record and delete the record.
2. After deleting the record, start the engine again and check to make sure the warning is not shown on the meter panel.

(1) No Fail Record

RY9212148ELS0148US0

(2) Testing the AI Pressure Switch

[A] Checking the Meter Panel



RY9212148ELS124A

1. Tester mode

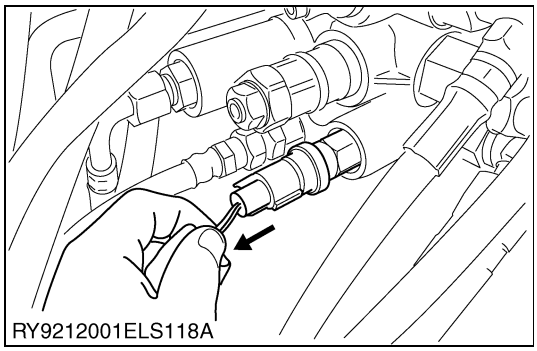
1. Select the tester mode.
2. Start the engine.
3. Check the operation of the AI pressure switch according to the table below.

	Regular	When cut off	When shorted
Operating			
Not operating			

(1) AI Press SW
AI operation SW
Compressor
Water Temp.
Idling Up Set

RY9212148ELS0110US0

[B] Inspecting each Device Visually and Physically


RY9212001ELS118A

1. Causes when a break in wiring

[Test Conditions]

1. Key switch : OFF
2. The AI pressure switch connector is disconnected.
3. There is a break somewhere in the wiring.

Pull on the harness and make sure the connector/harness does not come off. (pull with a max of 3 kgf (30 N, 7 lbf) of force) If it comes off, plug the connector back in securely and check the operation of the auto-idle switch again in the tester mode.

RY9212148ELS0111US0

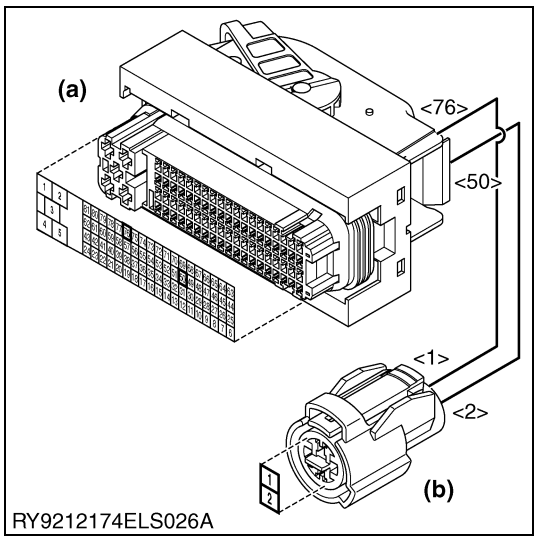
2. Causes when a short

[Test Conditions]

1. Key switch : OFF
2. The wire of the AI pressure switch connector is pinched against or touching the body.
   If the insulation is damaged, repair it properly and check the operation of the auto-idle switch again in the tester mode.

RY9212174ELS0020US0

[C] Testing with a Circuit Tester



RY9212174ELS026A

1. Voltage check

[Measurement Conditions]

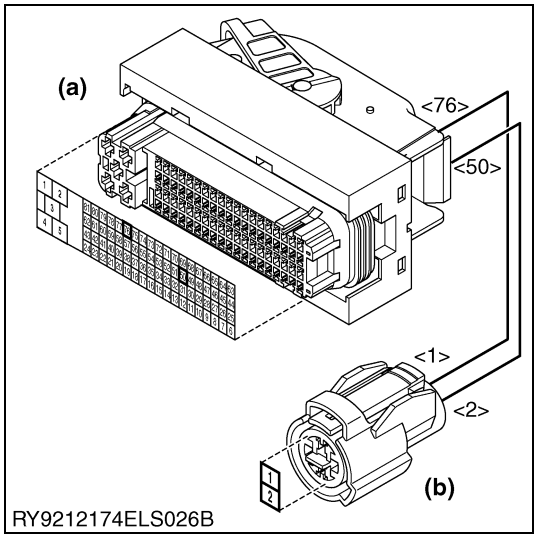
1. Disconnect the AI pressure switch connector.
2. Key switch : ON
3. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	AI pressure switch	<1>	AI pressure switch	<2>
(2)	AI pressure switch	<1>	Body GND	–

Regular : 12 V
Irregular : Large discrepancy from 12 V

(a) Main ECU Connector **(b) AI Pressure Switch Connector**

RY9212174ELS0054US0



RY9212174ELS026B

2. Continuity check

[Measurement Conditions]

1. Key switch : OFF
2. Disconnect the AI pressure switch connector.
3. Disconnect the ECU connector.
4. Test the continuity based on the table below.

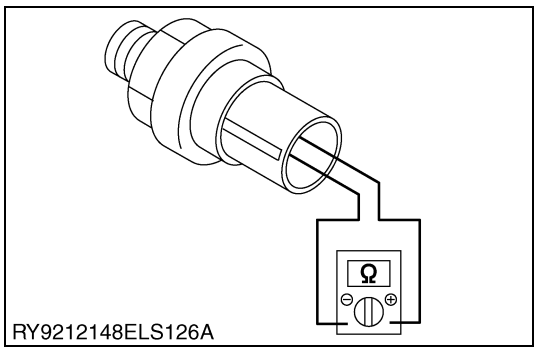
Mea-sure-ment	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	AI pressure switch	<1>	ECU	<76>
(2)	AI pressure switch	<2>	ECU	<50>

Regular : Continuity
Irregular : No continuity

(a) Main ECU Connector **(b) AI Pressure Switch Connector**

RY9212174ELS0055US0

[D] Testing the Equipment Itself



RY9212148ELS126A

1. Testing the AI pressure switch

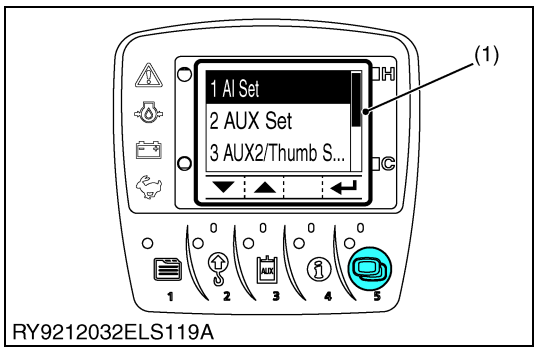
[Test Conditions]

1. Key switch: OFF
2. Disconnect the AI pressure switch connector from the control valve and attach the tester.
3. Start the engine and check continuity when it is operating and when not operating.

When operating: No continuity
When not operating: Continuity

The AI switch is normally closed (normally ON)

RY9212148ELS0173US0



RY9212032ELS119A

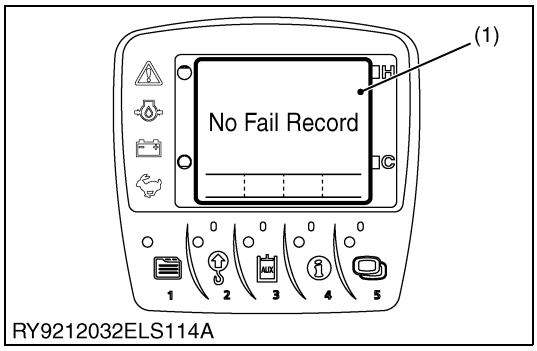
2. Settings after replacing device

1. Make AI settings.

(1) AI Set
AUX Set
AUX2/Thumb Set

RY9212148ELS0205US0

[E] Steps to Take after Completing Repairs



RY9212032ELS114A

1. Delete failure record

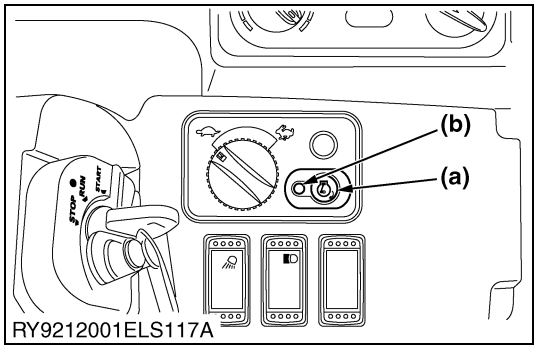
1. While in the service/dealer mode, select Delete Fail Record and delete the record.
2. After deleting the record, start the engine again and check to make sure the warning is not shown on the meter panel.

(1) No Fail Record

RY9212148ELS0148US0

(3) Testing the AI Switch

[A] Checking the Meter Panel



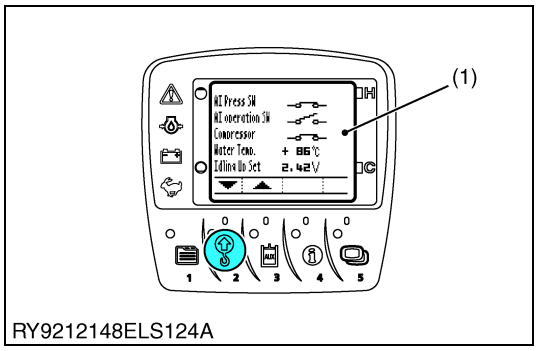
1. Information displayed on the meter panel

1. When the AI switch **(a)** on the panel is pressed, check whether the AI lamp **(b)** lights or is off.

   Regular: lamp lights
   Irregular: lamp off

(a) AI switch **(b) AI Lamp**

RY9212148ELS0113US0



2. Tester mode

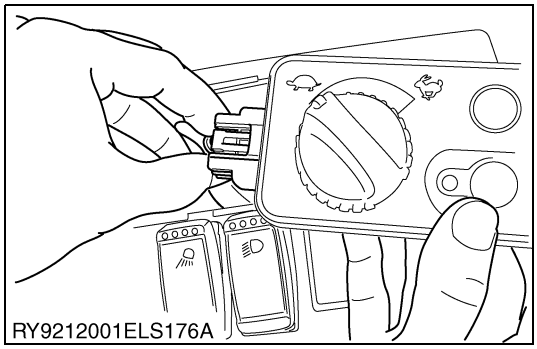
1. Select the tester mode.
2. Check the operation of the AI switch according to the table below.

	Regular	When cut off	When shorted
With AI SW pressed			
With AI SW released			

(1) AI Press SW
AI operation SW
Compressor
Water Temp.
Idling Up Set

RY9212148ELS0114US0

[B] Inspecting each Device Visually and Physically



1. Causes when a break in wiring

[Test Conditions]

1. Key switch: OFF
2. AI console connector disconnected.
3. There is a break somewhere in the wiring.

Pull on the harness and make sure the connector/harness does not come off. (pull with a max of 3 kgf (30 N, 7 lbf) of force) If it comes off, plug the connector back in securely and check the operation of the AI switch again in the tester mode.

RY9212148ELS0115US0

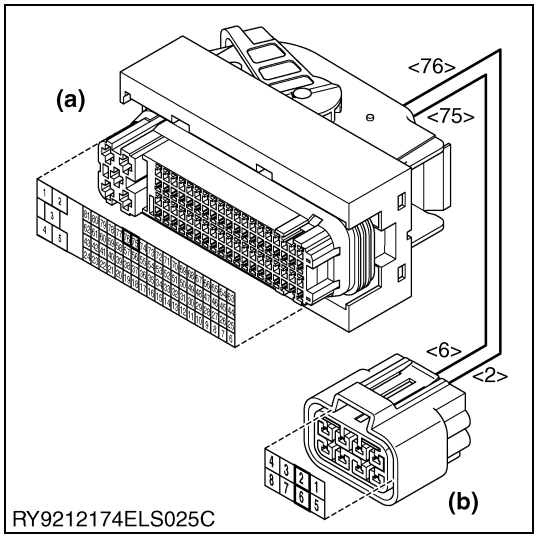
2. Causes when a short

[Test Conditions]

1. Key switch: OFF
2. The wiring of the AI console connector is pinched against or touching the body.
   If the insulation is damaged, repair it properly and check the operation of the AI switch again in the tester mode.

RY9212148ELS0116US0

[C] Testing with a Circuit Tester



RY9212174ELS025C

1. Voltage check

[Measurement Conditions]

1. Disconnect AI console connector.
2. Key switch : ON
3. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	AI console	<2>	AI console	<6>
(2)	AI console	<2>	Body GND	–

Regular : 12 V
Irregular : Large discrepancy from 12 V

(a) Main ECU Connector **(b) AI Console Connector**

RY9212174ELS0056US0

2. Continuity check

[Measurement Conditions]

1. Key switch : OFF
2. Disconnect AI console connector.
3. Disconnect the ECU connector CN1.
4. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	AI console	<6>	ECU	<75>
(2)	AI console	<2>	ECU	<76>

Regular : Continuity
Irregular : No continuity

RY9212174ELS0057US0

[D] Testing the Equipment Itself


RY9212001ELS154A

1. Testing the AI switch

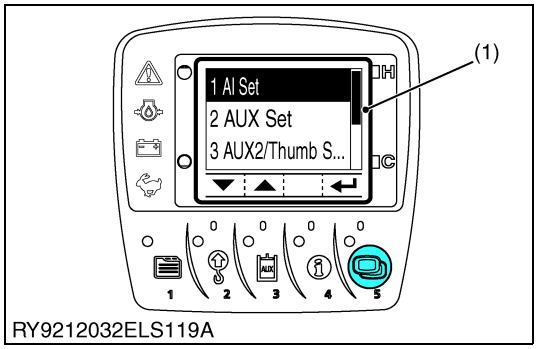
[Measurement Conditions]

1. Key switch: OFF
2. Remove the AI console from the machine and replace with a new AI console.
3. Select the tester mode and check the operation of the AI switch.

Criteria

Regular	AI switch released: no continuity AI switch pressed: continuity
Irregular	Other than above

RY9212148ELS0117US0



RY9212032ELS119A

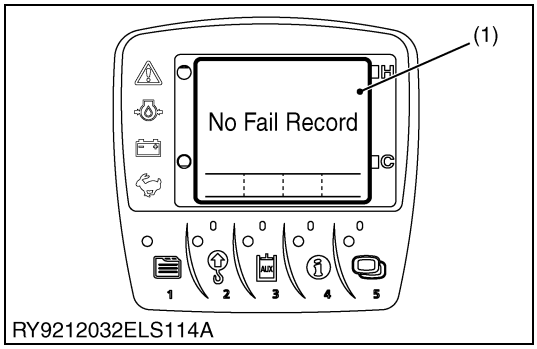
2. Settings after replacing device

1. Make AI settings.

(1) AI Set
AUX Set
AUX2/Thumb Set

RY9212148ELS0118US0

[E] Steps to Take after Completing Repairs



RY9212032ELS114A

1. Delete failure record

1. While in the service/dealer mode, select Delete Fail Record and delete the record.
2. After deleting the record, start the engine again and check to make sure the warning is not shown on the meter panel.

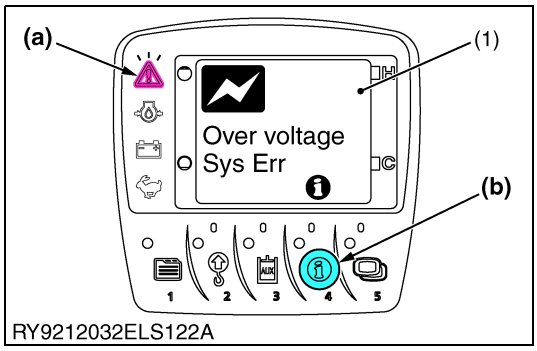
(1) No Fail Record

RY9212148ELS0148US0

[4] POWER SUPPLY SYSTEM

(1) Over Voltage

[A] Checking the Meter Panel



RY9212032ELS122A

1. Information displayed on the meter panel

1. Check whether or not the warning lamp **(a)** on the panel is blinking red.
2. Press the info button **(b)** and check the additional content.

E.g.) Over voltage

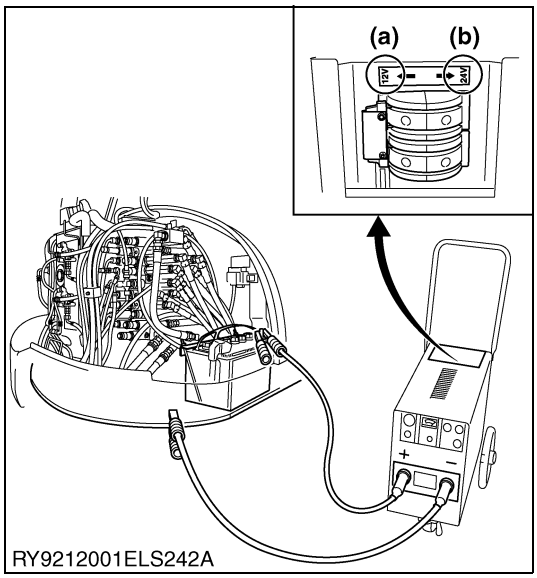
[Reason error screen displayed]

- Activated by 18V+
- Alternator faulty

(1) Over voltage Sys Err

(a) Warning Lamp
(b) Info Button

RY9212148ELS0124US0



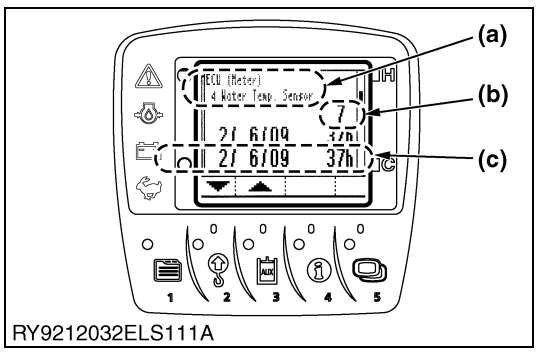
RY9212001ELS242A

Check whether the machine has been jump started with a 24 V battery.

E.g.) Whether switched to 24V

(a) 12 V **(b) 24 V**

RY9212001ELS0207US0



RY9212032ELS111A

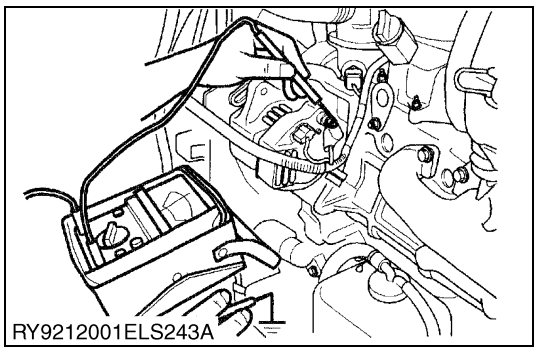
2. Reading the failure history

1. Select the failure history read mode.
2. Read the failure history and check the date (y/m/d) and hour meter of the last occurrence.

E.g.) The last failure record was February 6, 2009 at 37 hours.

(a) Failure
(b) Number of Failure
(c) The Last Breakdown Date (y/m/d) and Hour Meter.

RY9212032ELS0001US0

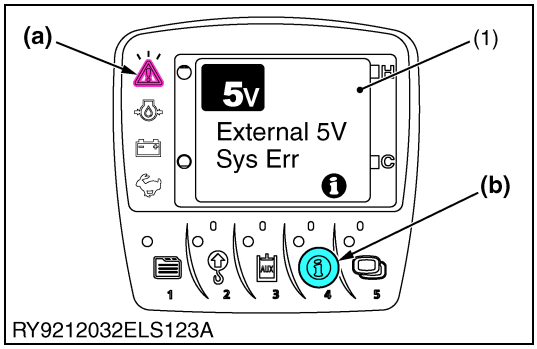

RY9212001ELS243A

An alternator recharging error is also possible.
Refer to the pages on the recharging system errors.

RY9212001ELS0209US0

(2) 5 V Short System Error

[A] Checking the Meter Panel



RY9212032ELS123A

1. Information displayed on the meter panel

1. Check whether or not the warning lamp **(a)** on the panel is blinking red.
2. Press the info button **(b)** and check the additional content.

   E.g.) External 5 V

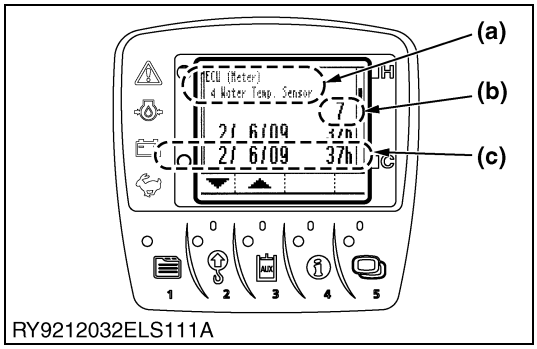
[Reason error screen displayed]

- Short in 5 V line

(1) External 5 V Sys Err

(a) Warning Lamp
(b) Info Button

RY9212148ELS0125US0



RY9212032ELS111A

2. Reading the failure history

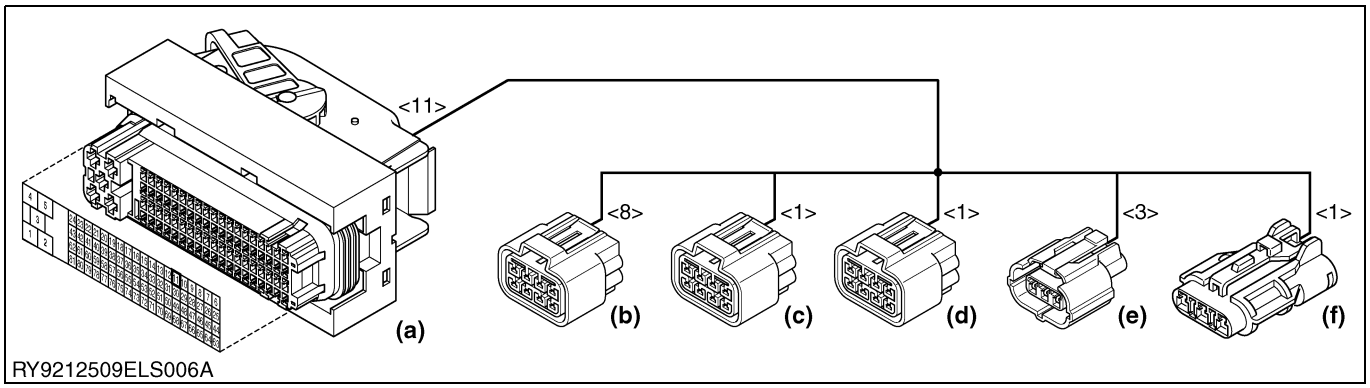
1. Select the failure history read mode.
2. Read the failure history and check the date (y/m/d) and hour meter of the last occurrence.

   E.g.) The last failure record was February 6, 2009 at 37 hours.

(a) Failure
(b) Number of Failure
(c) The Last Breakdown Date (y/m/d) and Hour Meter.

RY9212032ELS0001US0

Testing the 5 V line



RY9212509ELS006A

(a) Main ECU Connector
(b) AI Console Connector
(c) AUX1 Switch Connector
(d) AUX2/Thumb Switch Connector
(e) Travel Pressure Sensor Connector
(f) Boom Bottom Pressure Sensor Connector

[Test Conditions]

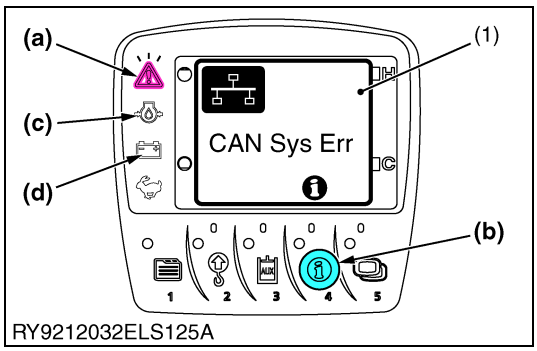
1. Check whether each line is pinched against or touching the body. If the insulation is damaged, repair it properly and check the meter display again.

RY9212509ELS0016US0

[5] COMMUNICATION SYSTEM

(1) CAN Communication Errors

[A] Checking the Meter Panel



RY9212032ELS125A

1. Information displayed on the meter panel

1. Check whether or not the warning lamp **(a)** on the panel is blinking red.
2. Press the info button **(b)** and check the additional content.

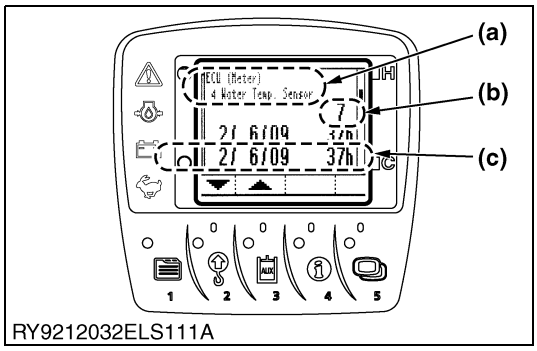
   Ex.)
   - CAN system (main)
   - CAN Sys (CRS)

[Reason error screen displayed]
- ECU connector disconnected
- Fuse blown
- Break or short in harness
- Engine ECU relay faulty

(1) CAN Sys Err

(a) Warning Lamp
(b) Info Button
(c) Oil Lamp
(d) Charging Lamp

RY9212148ELS0127US0



RY9212032ELS111A

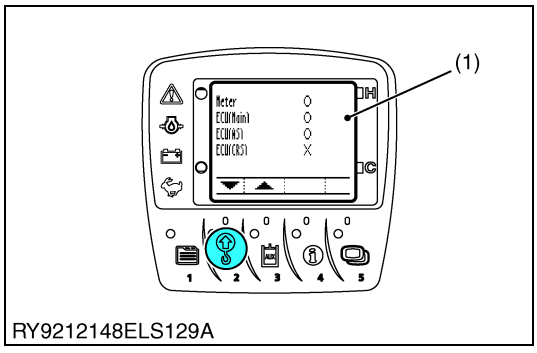
2. Reading the failure history

1. Select the failure history read mode.
2. Read the failure history and check the date (y/m/d) and hour meter of the last occurrence.

   E.g.) The last failure record was February 6, 2009 at 37 hours.

(a) Failure
(b) Number of Failure
(c) The Last Breakdown Date (y/m/d) and Hour Meter.

RY9212032ELS0001US0



RY9212148ELS129A

3. Tester mode

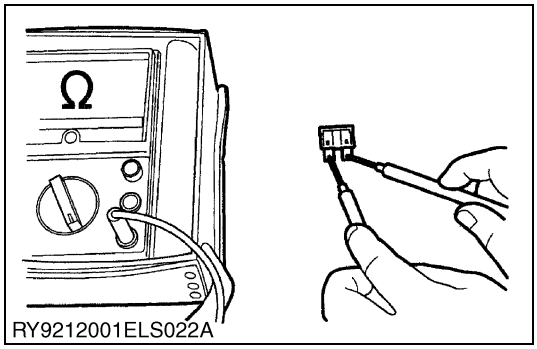
1. Select the tester mode.
2. Confirm the ECU is OK.

	Regular	Irregular
ECU (main)	❍	×
ECU (AS)	×	×
ECU (CRS)	❍	×

(1) Meter
ECU (Main)
ECU (AS)
ECU (CRS)

RY9212148ELS0128US0

[B] Inspecting each Device Visually and Physically

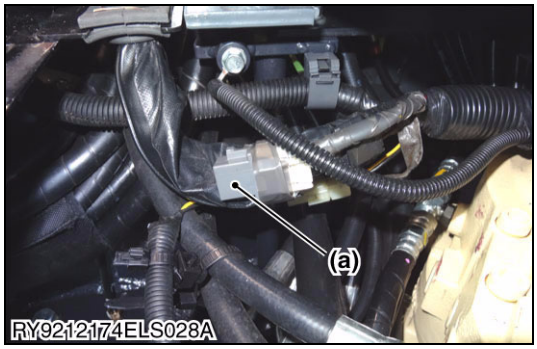


(A) If a CAN system (main) error

1. Checking fuses

1. Check if the 5A ECU (+B) fuse is blown.

RY9212509ELS0018US0



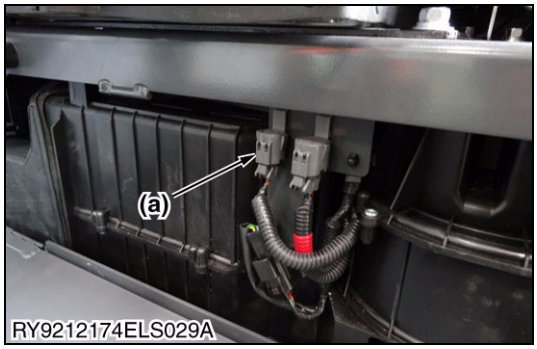
2. Causes when a break in wiring

[Test Conditions]

1. Key switch: OFF
2. Check whether the joint connector is disconnected.
3. Check whether the machine's ECU connector is disconnected.

(a) Joint Connector

RY9212174ELS0022US0



3. Causes when a short

[Test Conditions]

1. Key switch: OFF
2. The CAN connector wire is pinched against or touching the body.
   If the insulation is damaged, repair it properly and check the ECU (main) again in the tester mode.

(a) CAN Communication (2 Wires)

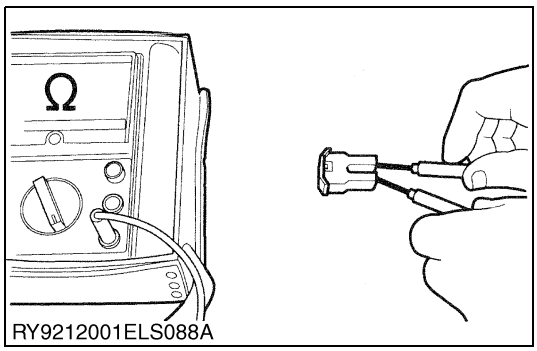
RY9212174ELS0023US0

(B) If a CAN system (CRS) error

1. Checking fuses

1. Check if the 30A engine ECU slow blow fuse is blown.

RY9212509ELS0019US0

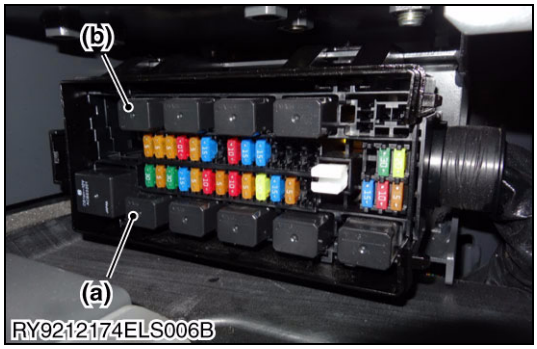


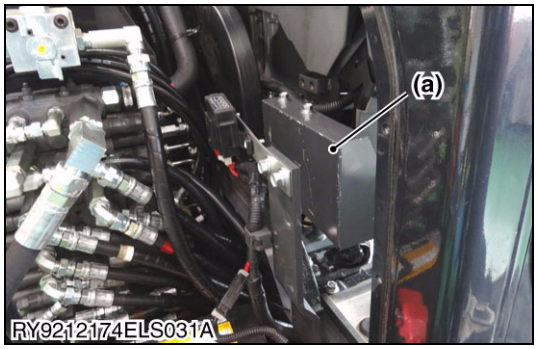
2. Checking relays

1. Replace the engine ECU relay and blower relays.
   After replacing them, check for normal operation.

(a) Engine ECU Relay **(b) Blower Relay**

RY9212174ELS0024US0





3. Causes when a break in wiring

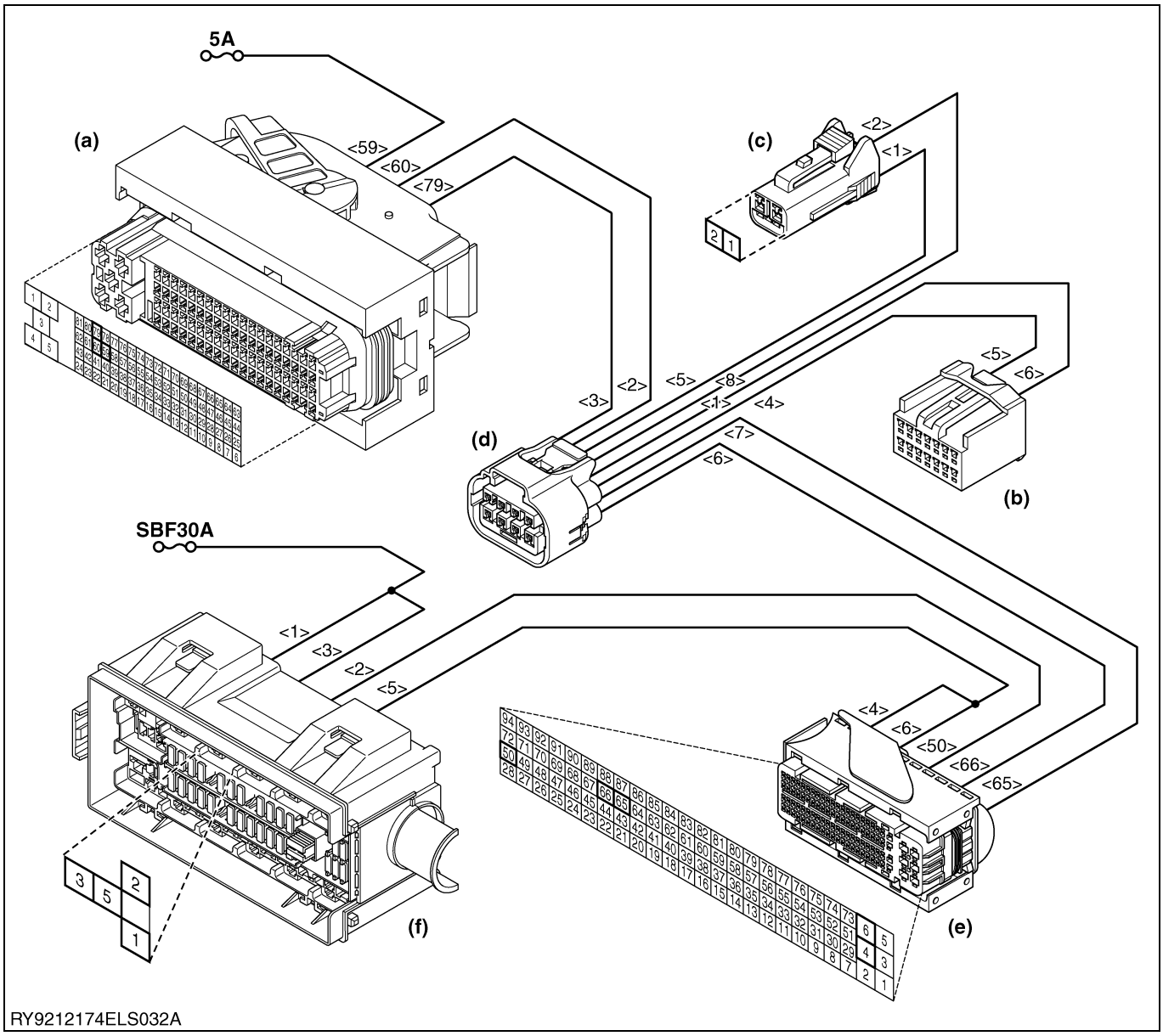
[Test Conditions]

1. Key switch: OFF
2. Check whether the engine ECU connector is disconnected.

(a) Engine ECU

RY9212174ELS0025US0

[C] Testing with a Circuit Tester



(a) Main ECU connector
(b) Meter panel connector
(c) CAN comm connector
(d) Joint connector
(e) Engine ECU (94 pin) connector
(f) Relay

RY9212174ELS0059US0

CAN communication error (main)

1. Voltage check

[Measurement Conditions]

1. Disconnect the ECU connector.
2. Key switch: ON
3. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Main ECU	<59>	Body GND	–

Regular: 12 V
Irregular: Large discrepancy from 12 V

RY9212148ELS0182US0

2. Continuity check

[Measurement Conditions]

1. Key switch: OFF
2. Disconnect the connector to be tested.
3. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	5A fuse	–	Main ECU	<59>
(2)	Main ECU	<60>	Joint connector	<2>
(3)	Main ECU	<79>	Joint connector	<3>
(4)	Joint connector	<5>	CAN connector	<1>
(5)	Joint connector	<8>	CAN connector	<2>
(6)	Joint connector	<1>	Meter panel	<6>
(7)	Joint connector	<4>	Meter panel	<5>

Regular: Continuity
Irregular: No continuity

RY9212158ELS0010US0

CAN communication error (Eng)

1. Voltage check

[Measurement Conditions]

1. Disconnect the ECU connector.
2. Key switch: ON
3. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Main ECU	<4>	Body GND	–
(2)	Main ECU	<6>	Body GND	–
(3)	Main ECU	<50>	Body GND	–

Regular: 12 V
Irregular: Large discrepancy from 12V

RY9212174ELS0026US0

2. Continuity check

[Measurement Conditions]

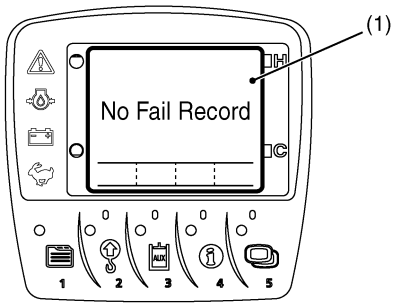
1. Key switch: OFF
2. Disconnect the connector to be tested.
3. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	SBF (CRS) 30A	–	Engine ECU relay	<1>
(2)	SBF (CRS) 30A	–	Engine ECU relay	<3>
(3)	Engine ECU relay	<5>	Engine ECU	<4>
(4)	Engine ECU relay	<5>	Engine ECU	<6>
(5)	Engine ECU relay	<2>	Engine ECU	<50>
(6)	Joint connector	<6>	Engine ECU	<66>
(7)	Joint connector	<7>	Engine ECU	<65>

Regular: Continuity
Irregular: No continuity

RY9212174ELS0027US0

[D] Steps to Take after Completing Repairs



RY9212032ELS114A

1. Delete failure record

1. While in the service/dealer mode, select Delete Fail Record and delete the record.
2. After deleting the record, start the engine again and check to make sure the warning is not shown on the meter panel.

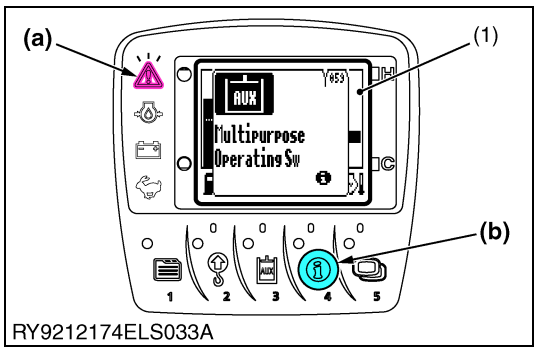
(1) No Fail Record

RY9212148ELS0148US0

[6] MULTIPURPOSE SWITCH

(1) Multipurpose Switch Control System Errors

[A] Checking the Meter Panel



RY9212174ELS033A

1. Information displayed on the meter panel

1. Check whether or not the warning lamp on the panel is blinking red.
2. Press the info button and check the additional content.

   E.g.) Multipurpose solenoid

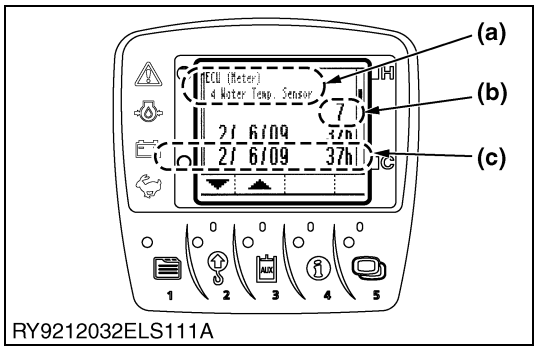
[Reason error screen displayed]

- Short in multipurpose solenoid line.

(1) Multipurpose Operating SW

(a) Warning Lamp
(b) Info Button

RY9212174ELS0060US0



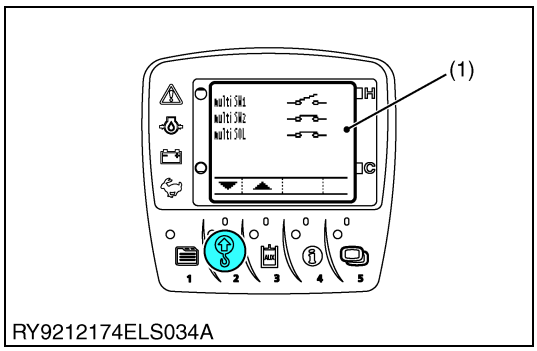
RY9212032ELS111A

2. Retrieving the failure record

1. Select the retrieve failure record mode.
2. Retrieve the failure record and check the last selected date (YY/MM/DD) and hour meter.

(a) Error Description
(b) Times Error Occurred
(c) Date (YY/MM/DD) and Hour Meter of Last Occurrence

RY9212174ELS0061US0



RY9212174ELS034A

3. Tester mode

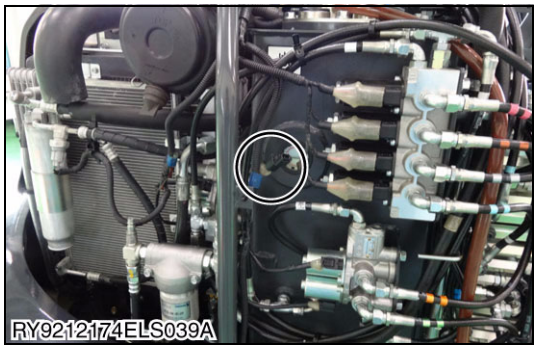
1. Select the tester mode.
2. Start the engine.
3. Operate the multipurpose switch and solenoid and check the switch according to the following table.

	Regular	When cut off	When shorted
Multipurpose switch ON			
Multipurpose switch OFF			
Multipurpose solenoid ON			
Multipurpose solenoid OFF			

(1) Multipurpose SW1
Multipurpose SW2
Multipurpose SOL

RY9212174ELS0062US0

[B] Inspecting each Device Visually and Physically


RY9212174ELS039A

1. Causes when a break in wiring

[Test Conditions]

1. Key switch: OFF
2. Multipurpose switch solenoid connector disconnected.
3. There is a break somewhere in the wiring.

Pull on the harness and make sure the connector/harness does not come off. (pull w/3kgf or less force)
If it comes off, plug the connector back in securely and check operation of the boom up pressure switch again in the tester mode.

RY9212174ELS0063US0

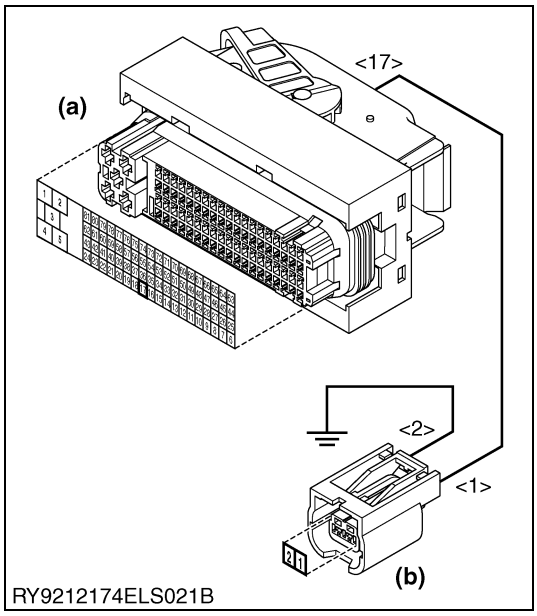
2. Causes when a short

[Test Conditions]

1. Key switch: OFF
2. The multipurpose solenoid connector wire is pinched against or touching the body.
   If the insulation is damaged, repair it properly and check the operation of the multipurpose solenoid switch again in the tester mode.

RY9212174ELS0064US0

[C] Testing with a Circuit Tester



RY9212174ELS021B

1. Voltage check (multipurpose solenoid)

[Measurement Conditions]

1. Disconnect the multipurpose solenoid connector.
2. Key switch: ON
3. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
	Multipurpose solenoid	<1>	Multipurpose solenoid	<2>
	Multipurpose solenoid	<1>	Body GND	–

Regular: 12 V
Irregular: Large discrepancy from 12V

(a) Main ECU Connector **(b) Multipurpose solenoid Connector**

RY9212174ELS0065US0

2. Continuity check (multipurpose solenoid)

[Measurement Conditions]

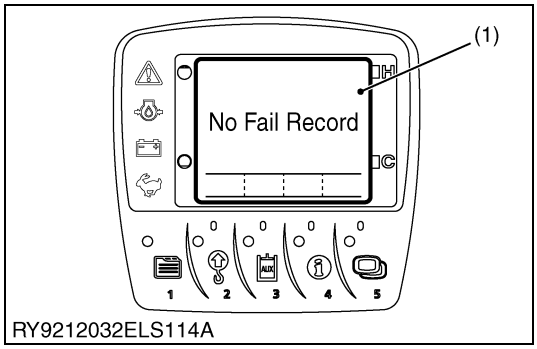
1. Key switch: OFF
2. Disconnect the multipurpose solenoid connector.
3. Disconnect the main ECU connector.
4. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
	Multipurpose solenoid	<1>	Main ECU	<17>

Regular: Continuity
Irregular: No continuity

RY9212174ELS0066US0

[D] Steps to Take after Completing Repairs



RY9212032ELS114A

1. Delete failure record

1. While in the service/dealer mode, select Delete Fail Record and delete the record.
2. After deleting the record, start the engine again and check to make sure the warning is not shown on the meter panel.

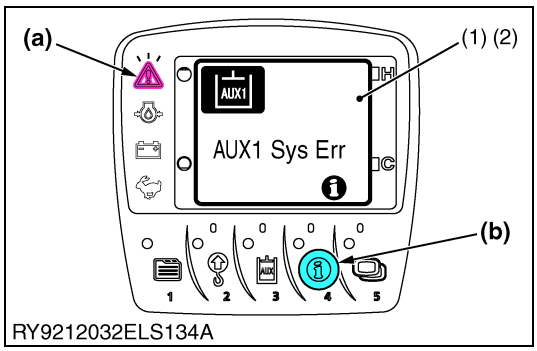
(1) No Fail Record

RY9212148ELS0148US0

[7] AUX SYSTEM

(1) AUX1 / AUX2 (Thumb) System Errors

[A] Checking the Meter Panel



RY9212032ELS134A

1. Information displayed on the meter panel

1. Check whether or not the warning lamp **(a)** on the panel is blinking red.
2. Press the info button **(b)** and check the additional content.

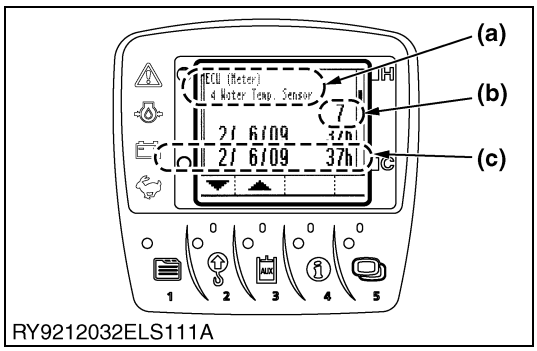
E.g.)
- AUX1/AUX2 (thumb) knob
- AUX1/AUX2 (thumb) RH SOL
- AUX1/AUX2 (thumb) LH SOL

[Reason error screen displayed]
- AUX1/AUX2 (thumb) control lever connector disconnected
- AUX1/AUX2 (thumb) solenoid connector disconnected
- Break or short in harness

(1) AUX1 Sys Err
(2) AUX2 Sys Err

(a) Warning Lamp
(b) Info Lamp

RY9212148ELS0130US0



RY9212032ELS111A

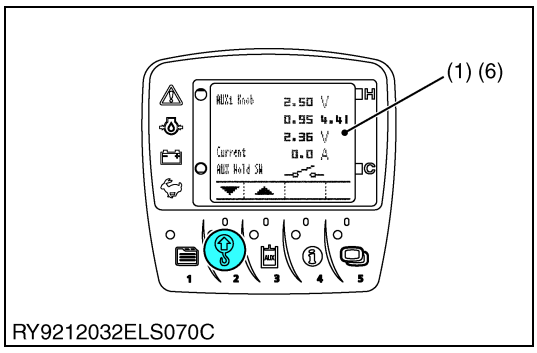
2. Reading the failure history

1. Select the failure history read mode.
2. Read the failure history and check the date (y/m/d) and hour meter of the last occurrence.

E.g.) The last failure record was February 6, 2009 at 37 hours.

(a) Failure
(b) Number of Failure
(c) The Last Breakdown Date (y/m/d) and Hour Meter.

RY9212032ELS0001US0



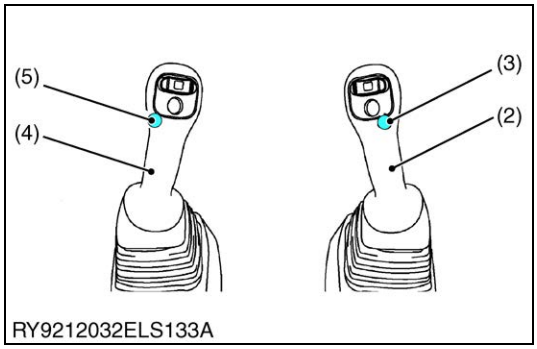
RY9212032ELS070C

3. Tester mode

1. Select the tester mode.
2. Start the engine.
3. Measure the voltage of AUX switch based on the table below.

	Indicated value	Set value (e.g.)			At stop
		LH (small)	RH (large)	Center (medium)	
AUX1 knob switch	0.25 to 4.75 V	0.95 V	4.41 V	2.36 V	0 V
AUX2 / Thumb knob switch	0.25 to 4.75 V	0.77 V	4.21 V	2.59 V	0 V
Output current	0.5 to 2.0 A				0 to 0.2 A

	Regular	When cut off	When shorted
Press the AUX one way hold SW			
Release the AUX one way hold SW			

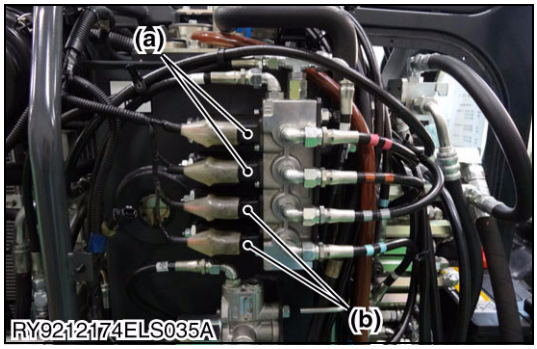


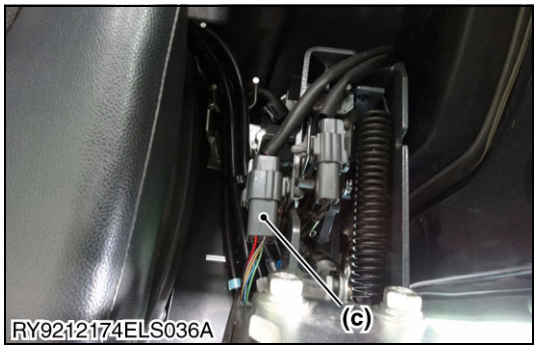
RY9212032ELS133A

(1) AUX1 Knob
Current
AUX Hold SW
(2) Control Lever (RH)
(3) AUX One Way Hold SW
(4) Control Lever (LH)
(5) AUX One Way Hold SW
(6) AUX2 / Thumb knob
Current
AUX Hold SW

RY9212148ELS0131US0

[B] Inspecting each Device Visually and Physically





1. Causes when a break in wiring

[Test Conditions]

1. Key switch: OFF
2. AUX1/AUX2 solenoid connector disconnected.
3. AUX control lever connector disconnected.
4. There is a break somewhere in the wiring.

Pull on the harness and make sure the connector/harness does not come off. (Pull with a max of 3kgf of force) If it comes off, plug the connector back in securely and check the AUX1 and 2 solenoids in the tester mode.

(a) AUX1 SOL
(b) AUX2 SOL
(c) AUX control lever Connector

RY9212174ELS0028US0

2. Causes when a short

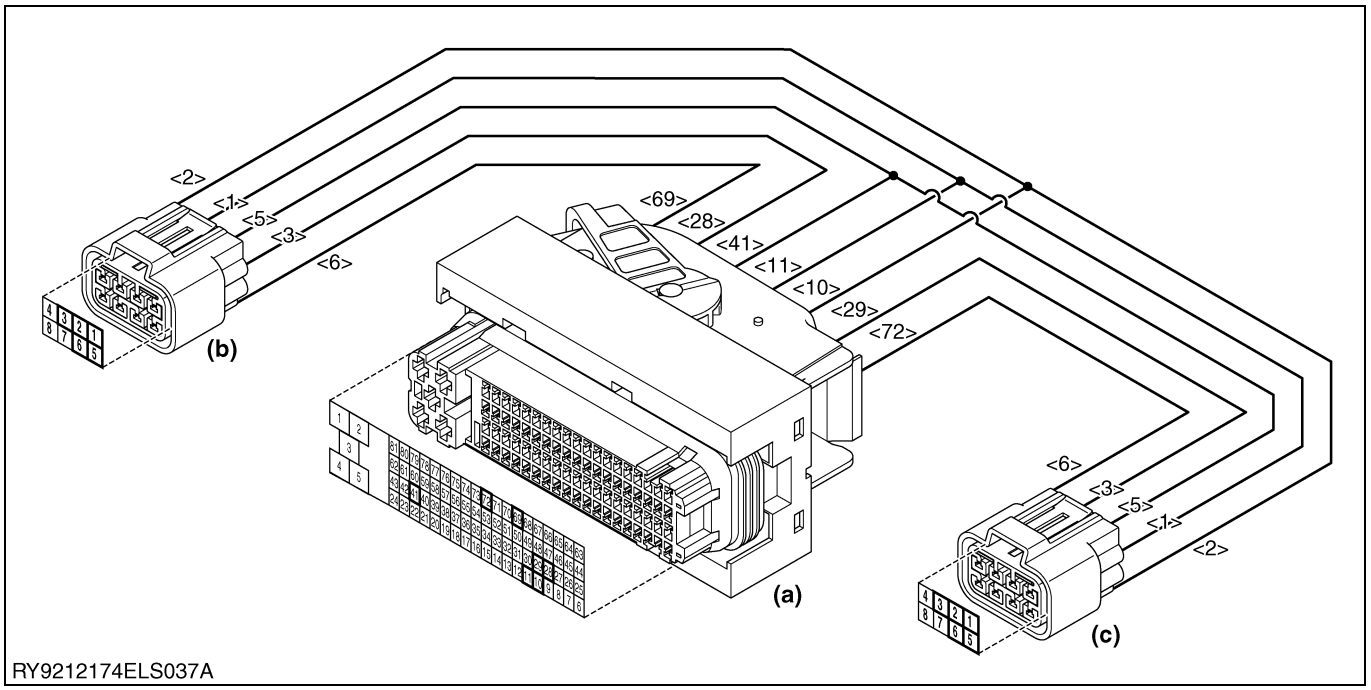
[Test Conditions]

1. Key switch: OFF
2. The AUX1, AUX2 solenoid connector and/or AUX control lever connector wiring is pinched and touching the body, or if the insulation is damaged, repair it properly and check the AUX solenoids again in the tester mode.

RY9212174ELS0029US0

[C] Testing with a Circuit Tester

Switch side



(a) Main ECU Connector (b) RH Control Lever Connector (c) LH Control Lever Connector

RY9212174ELS0067US0

1. Voltage check (AUX hold switch)

[Measurement Conditions]

1. Disconnect the AUX1/AUX2 control lever connector.
2. Key switch: ON
3. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Control lever RH	<5>	Control lever RH	<6>
(2)	Control lever RH	<5>	Body GND	–
(3)	Control lever LH	<5>	Control lever LH	<6>
(4)	Control lever LH	<5>	Body GND	–

Regular: 12V
Irregular: Large discrepancy from 12V

RY9212148ELS0187US0

2. Voltage check (AUX1/AUX2 switch)

[Measurement Conditions]

1. Disconnect the AUX1/AUX2 control lever connector.
2. Key switch: ON
3. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Control lever RH	<1>	Control lever RH	<2>
(2)	Control lever RH	<1>	Body GND	–
(3)	Control lever LH	<1>	Control lever LH	<2>
(4)	Control lever LH	<1>	Body GND	–

Regular: 5V
Irregular: Large discrepancy from 5V

RY9212174ELS0030US0

3. Continuity check (AUX hold switch)

[Measurement Conditions]

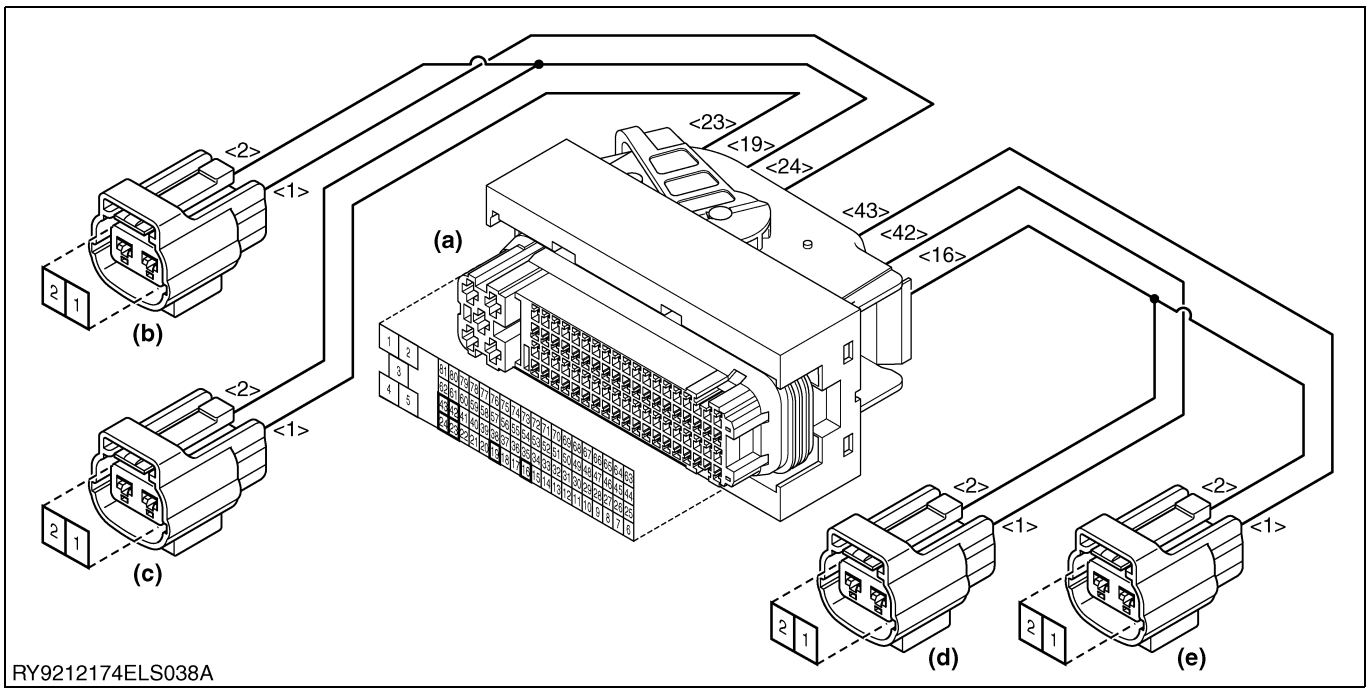
1. Key switch: OFF
2. Disconnect the connector to be tested.
3. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Control lever RH	<5>	Main ECU	<41>
(2)	Control lever RH	<6>	Main ECU	<69>
(3)	Control lever LH	<5>	Main ECU	<41>
(4)	Control lever LH	<6>	Main ECU	<72>

Regular: Continuity
Irregular: No continuity

RY9212174ELS0031US0

Solenoid side



RY9212174ELS038A

(a) Main ECU Connector
(b) AUX1 (RH) Solenoid Connector
(c) AUX1 (LH) Solenoid Connector
(d) AUX2 (RH) Solenoid Connector
(e) AUX2 (LH) Solenoid Connector

RY9212174ELS0068US0

4. Continuity check (AUX1/AUX2 switch)

[Measurement Conditions]
1. Key switch: OFF
2. Disconnect the connector to be tested.
3. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Control lever RH	<1>	Main ECU	<11>
(2)	Control lever RH	<2>	Main ECU	<10>
(3)	Control lever RH	<3>	Main ECU	<28>
(4)	Control lever LH	<1>	Main ECU	<11>
(5)	Control lever LH	<2>	Main ECU	<10>
(6)	Control lever LH	<3>	Main ECU	<29>

Regular: Continuity
Irregular: No continuity

RY9212174ELS0032US0

5. Continuity check (AUX1 solenoid)

[Measurement Conditions]
1. Key switch: OFF
2. Disconnect the connector to be tested.
3. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	AUX1 (RH) solenoid	<1>	Main ECU	<24>
(2)	AUX1 (RH) solenoid	<2>	Main ECU	<19>
(3)	AUX1 (LH) solenoid	<1>	Main ECU	<23>
(4)	AUX1 (LH) solenoid	<2>	Main ECU	<19>

Regular: Continuity
Irregular: No continuity

RY9212174ELS0069US0

6. Continuity check (AUX2 solenoid)

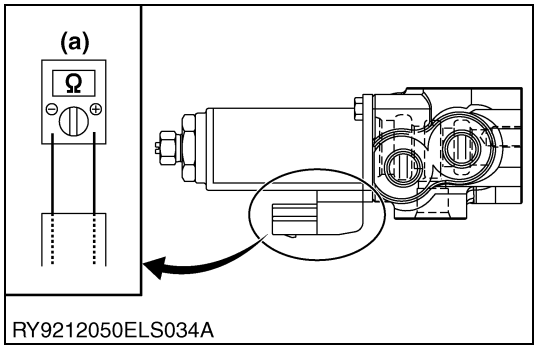
[Measurement Conditions]
1. Key switch: OFF
2. Disconnect the connector to be tested.
3. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	AUX2 (RH) solenoid	<1>	Main ECU	<42>
(2)	AUX2 (RH) solenoid	<2>	Main ECU	<16>
(3)	AUX2 (LH) solenoid	<1>	Main ECU	<43>
(4)	AUX2 (LH) solenoid	<2>	Main ECU	<16>

Regular: Continuity
Irregular: No continuity

RY9212174ELS0070US0

[D] Testing the Equipment Itself



RY9212050ELS034A

1. Testing the AUX1 / AUX2 solenoid

[Test Conditions]

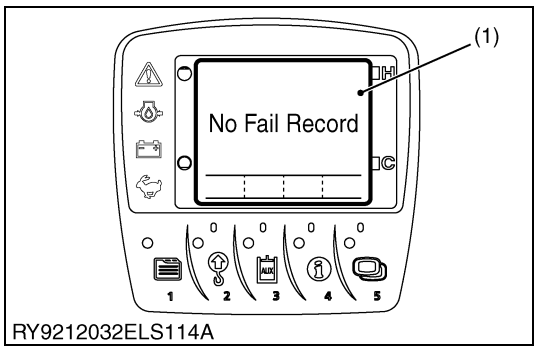
1. Key switch: OFF
2. Disconnect AUX1 / AUX2 solenoid connector from the machine and test the solenoid separately.

AUX1 / AUX2 solenoid	Factory specification	3.2 ± 0.5 Ω (at 20 °C, 68 °F)

(a) AUX1 / AUX2 Solenoid Terminals

RY9212148ELS0134US0

[E] Steps to Take after Completing Repairs



RY9212032ELS114A

1. Delete failure record

1. While in the service/dealer mode, select Delete Fail Record and delete the record.
2. After deleting the record, start the engine again and check to make sure the warning is not shown on the meter panel.

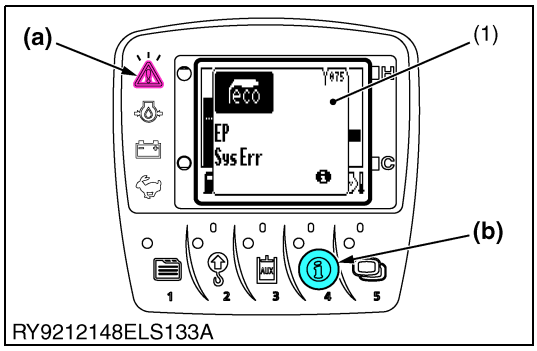
(1) No Fail Record

RY9212148ELS0148US0

[8] ECO MODE SYSTEM

(1) EP System Errors

[A] Checking the Meter Panel



RY9212148ELS133A

1. Information displayed on the meter panel

1. Check whether or not the warning lamp **(a)** on the panel is blinking red.
2. Press the info button **(b)** and check the additional content.

   E.g.) EP solenoid travel pressure

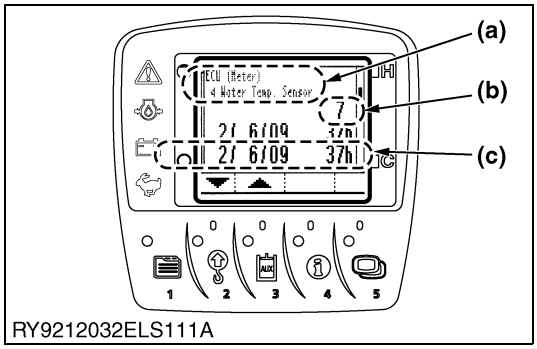
[Reason error screen displayed]

- Pressure sensor connector disconnected
- EP solenoid connector disconnected
- Break or short in harness

(1) EP Sys Err

(a) Warning Lamp
(b) Info Button

RY9212148ELS0194US0



RY9212032ELS111A

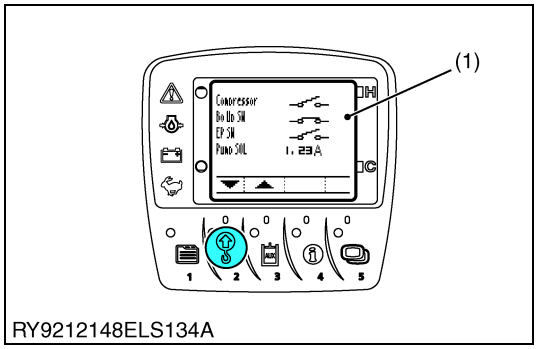
2. Reading the failure history

1. Select the failure history read mode.
2. Read the failure history and check the date (y/m/d) and hour meter of the last occurrence.

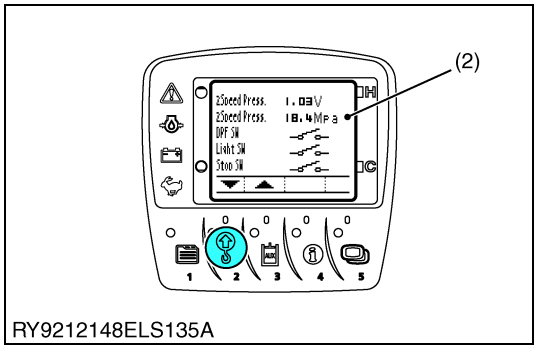
   E.g.) The last failure record was February 6, 2009 at 37 hours.

(a) Failure
(b) Number of Failure
(c) The Last Breakdown Date (y/m/d) and Hour Meter.

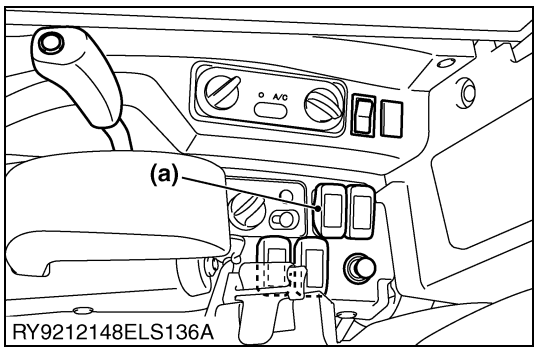
RY9212032ELS0001US0



RY9212148ELS134A



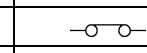
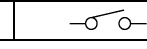
RY9212148ELS135A



RY9212148ELS136A

3. Tester mode

1. Select the tester mode.
2. Start the engine.
3. Put the machine's lever lock in the unlock position and press the EP switch.
4. Operate the EP switch and check operation of the EP switch and EP solenoid based on the table below.
5. Put the excavator in travel and check the travel pressure sensor operation.

	Regular	When cut off	When shorted
EP SW ON			
EP SW OFF			

	Mode	Factory specification
EP solenoid	P mode	0 to 0.6 A
	E mode	0.84 to 1.65 A

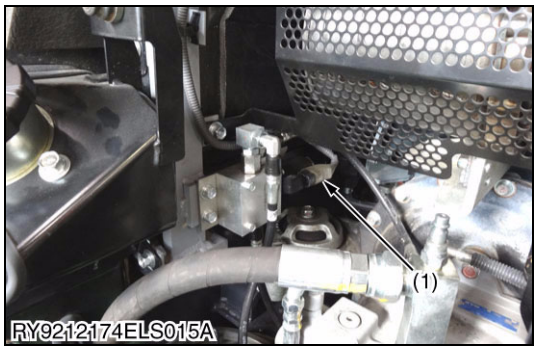
Design Value	Regular	When cut off	When shorted
Travel pressure	Current value	0 V	Not stable

(1) Compress
Boom Up SW
EP SW
Pump SOL
(2) 2Speed Press
2Speed Press
DPF SW
Light SW
Stop SW

(a) EP Switch

RY9212148ELS0195US0

[B] Inspecting each Device Visually and Physically



1. Causes when a break in wiring

[Test Conditions]

1. Key switch: OFF
2. EP solenoid connector disconnected.
3. Travel pressure sensor connector disconnected.
4. There is a break somewhere in the wiring.

Pull on the harness and make sure the connector/harness does not come off. (pull w/3kgf or less force)

If it comes off, plug the connect or back in and check again in the tester mode.

(1) EP Solenoid Connector

RY9212174ELS0034US0



2. Causes when a short

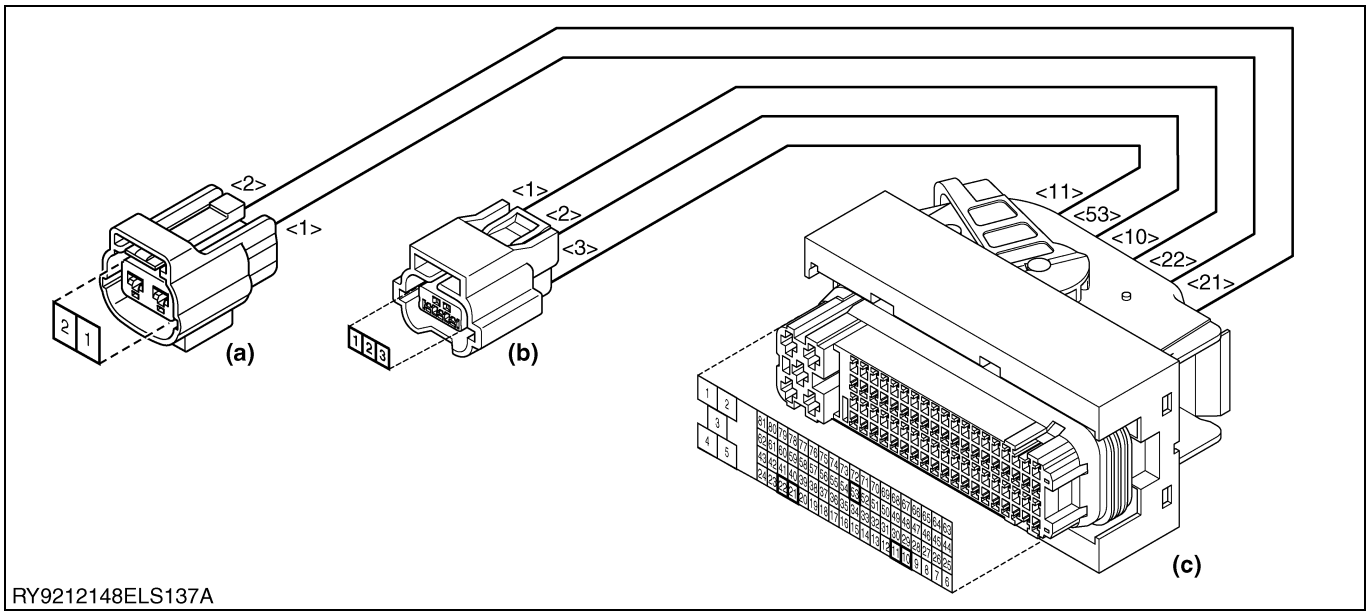
[Test Conditions]

1. Key switch: OFF
2. The EP solenoid connector and/or travel pressure sensor connector wires are pinched against or touching the body.
   If the insulation is damaged, repair it properly and check the EP solenoid and travel pressure sensor again in the tester mode.

(1) Travel Pressure Sensor Connector

RY9212174ELS0035US0

[C] Testing with a Circuit Tester



(a) EP Solenoid Connector **(b) Travel Pressure Sensor Connector** **(c) Main ECU Connector**

RY9212148ELS0198US0

1. Voltage check (EP solenoid)

[Measurement Conditions]
1. Disconnect the EP solenoid connector.
2. Key switch: ON
3. EP switch: ON
4. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	EP solenoid	<1>	EP solenoid	<2>
(2)	EP solenoid	<1>	Body GND	–

Regular: 12V
Irregular: Large discrepancy from 12V

RY9212148ELS0199US0

2. Continuity check (EP solenoid)

[Measurement Conditions]
1. Key switch: OFF
2. Disconnect the connector to be tested.
3. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	EP solenoid	<1>	Main ECU	<22>
(2)	EP solenoid	<2>	Main ECU	<21>

Regular: Continuity
Irregular: No continuity

RY9212148ELS0200US0

3. Voltage check (travel pressure sensor)

[Measurement Conditions]
1. Disconnect the travel pressure sensor connector.
2. Key switch: ON
3. Measure the voltage based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Travel pressure sensor	<3>	Travel pressure sensor	<1>
(2)	Travel pressure sensor	<3>	Body GND	–

Regular: 5V
Irregular: Large discrepancy from 5V

RY9212148ELS0201US0

4. Continuity check (travel pressure sensor)

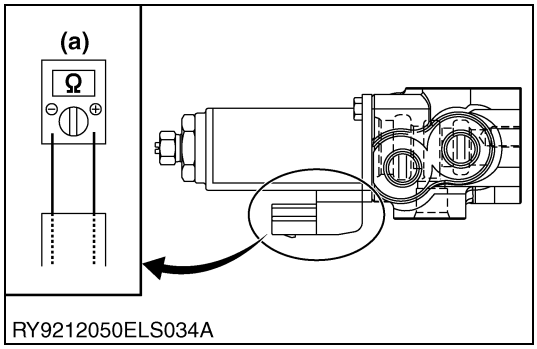
[Measurement Conditions]
1. Key switch: OFF
2. Disconnect the connector to be tested.
3. Test the continuity based on the table below.

Measurement	Connector Name (+ terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(1)	Travel pressure sensor	<1>	Main ECU	<10>
(2)	Travel pressure sensor	<2>	Main ECU	<53>
(3)	Travel pressure sensor	<3>	Main ECU	<11>

Regular: Continuity
Irregular: No continuity

RY9212148ELS0202US0

[D] Testing the Equipment Itself



RY9212050ELS034A

1. Testing the EP solenoid

[Measurement Conditions]

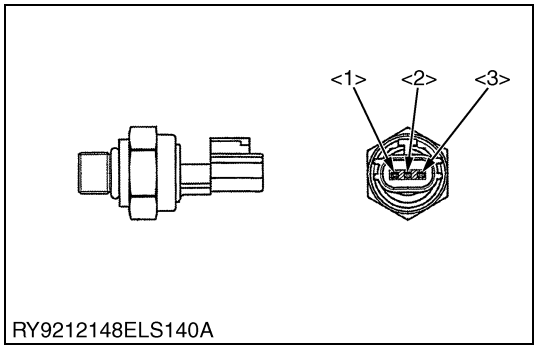
1. Key switch: OFF
2. Disconnect EP solenoid connector from the machine and test the solenoid separately.

EP solenoid	Factory specification	3.2 ± 0.5 Ω [20 °C (68 °F)]

Regular: Within factory spec.
Irregular: Outside factory spec.

(a) EP Solenoid Terminal

RY9212148ELS0203US0



RY9212148ELS140A

2. Testing the pressure sensor

[Measurement Conditions]

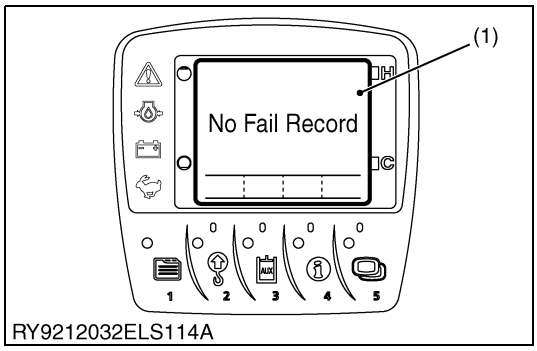
1. Key switch: OFF
2. Disconnect the pressure sensor connector from the machine and test the pressure sensor independently.

Pressure sensor <2> - <3>	Factory specification	22 kΩ

Regular: Within factory spec.
Irregular: Outside factory spec.

RY9212148ELS0204US0

[E] Steps to Take after Completing Repairs



RY9212032ELS114A

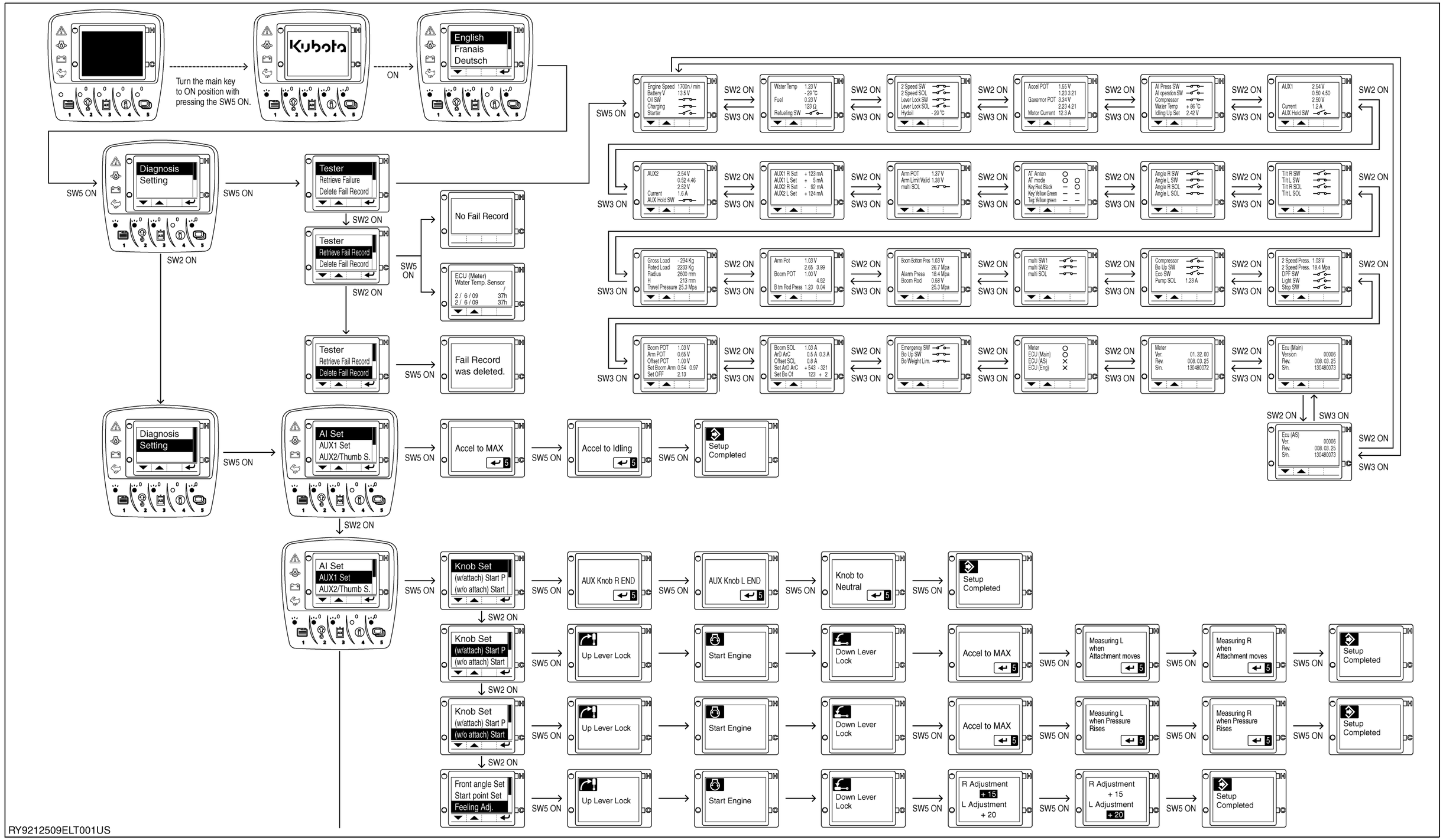
1. Delete failure record

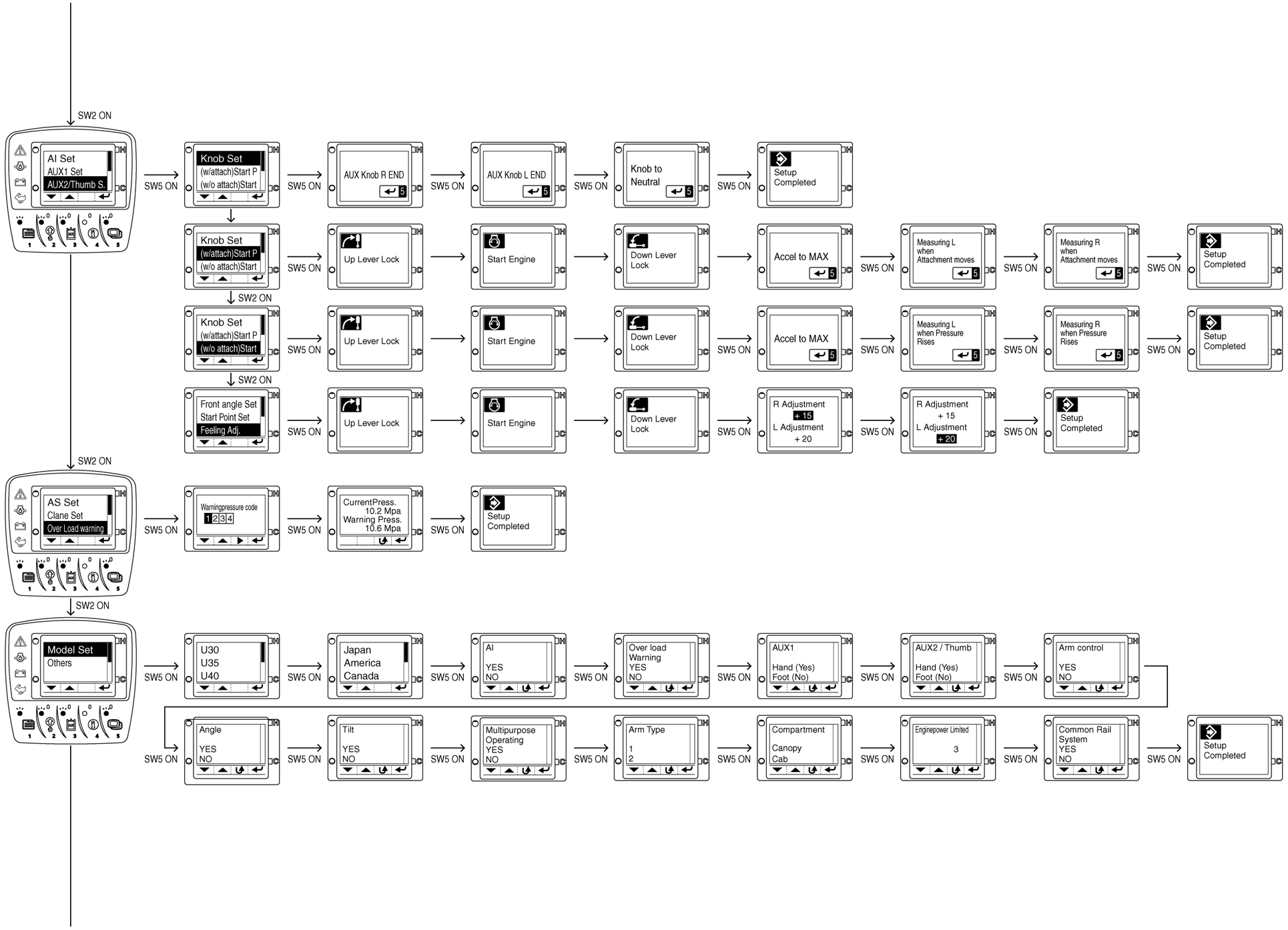
1. While in the service/dealer mode, select Delete Fail Record and delete the record.
2. After deleting the record, start the engine again and check to make sure the warning is not shown on the meter panel.

(1) No Fail Record

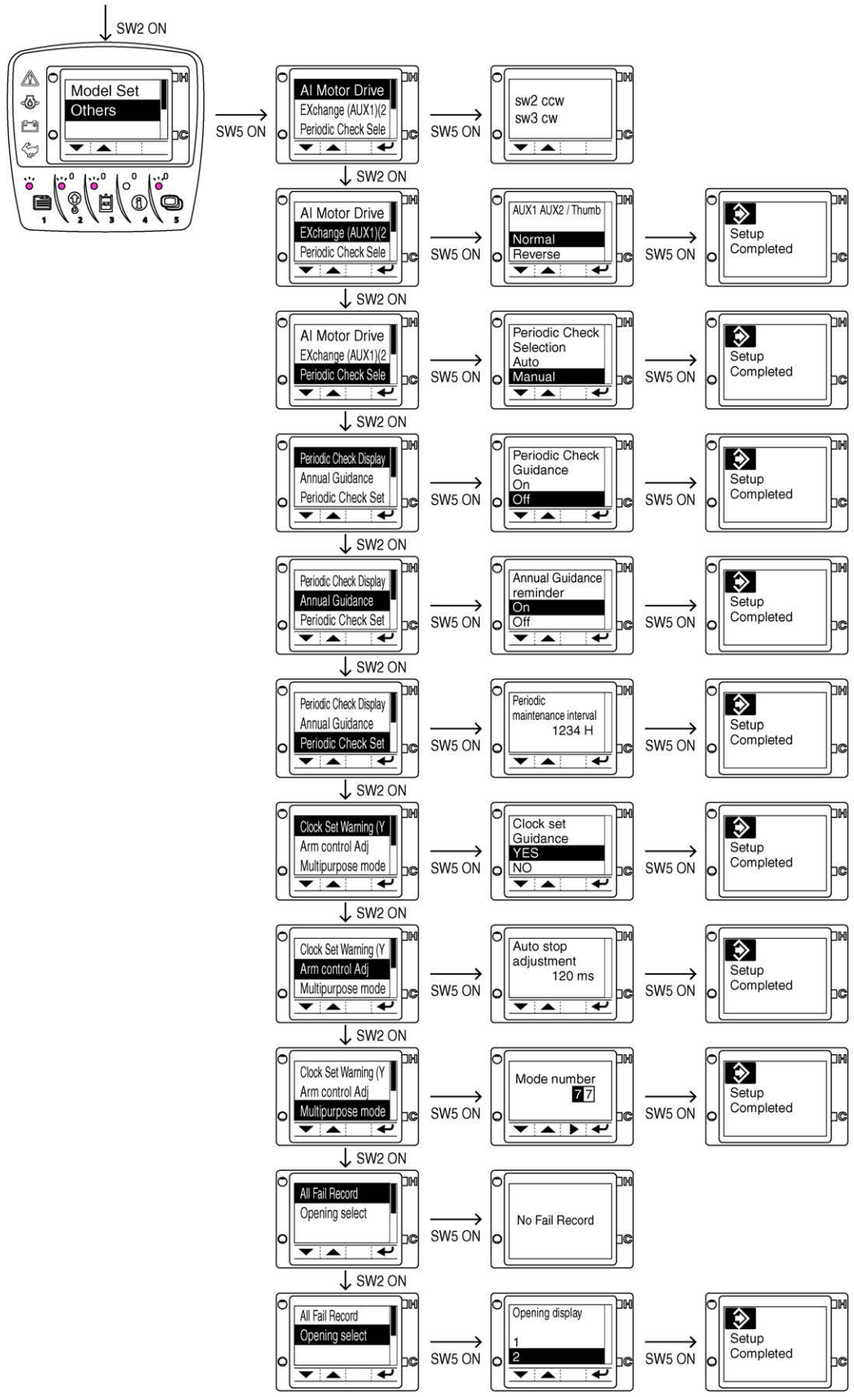
RY9212148ELS0148US0

7. DEALER SETTING MODE FLOWCHART





RY9212509ELT002US



RY9212435ELT003US

5 CABIN

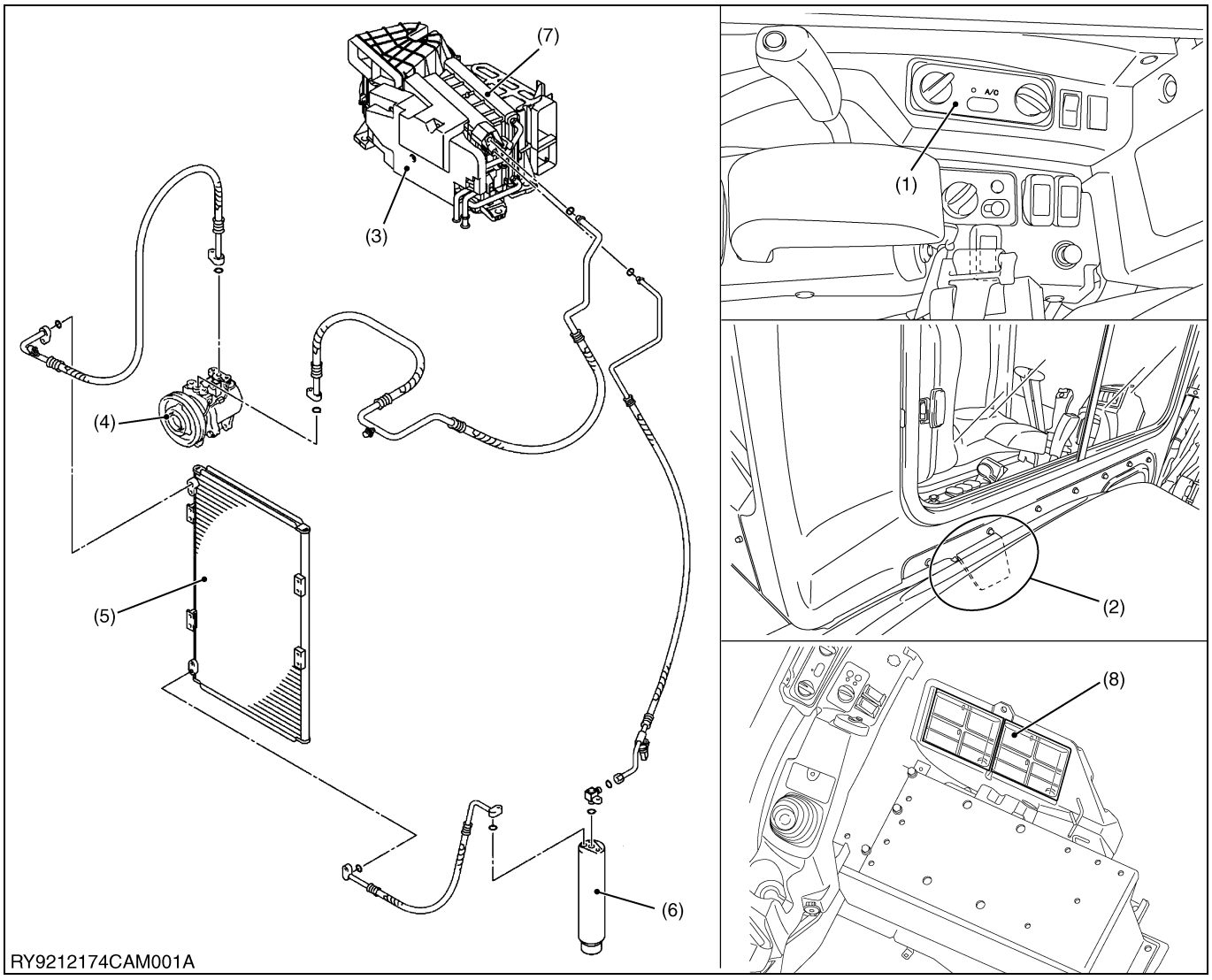
MECHANISM

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1. AIR CONDITIONING SYSTEM

[1] STRUCTURE



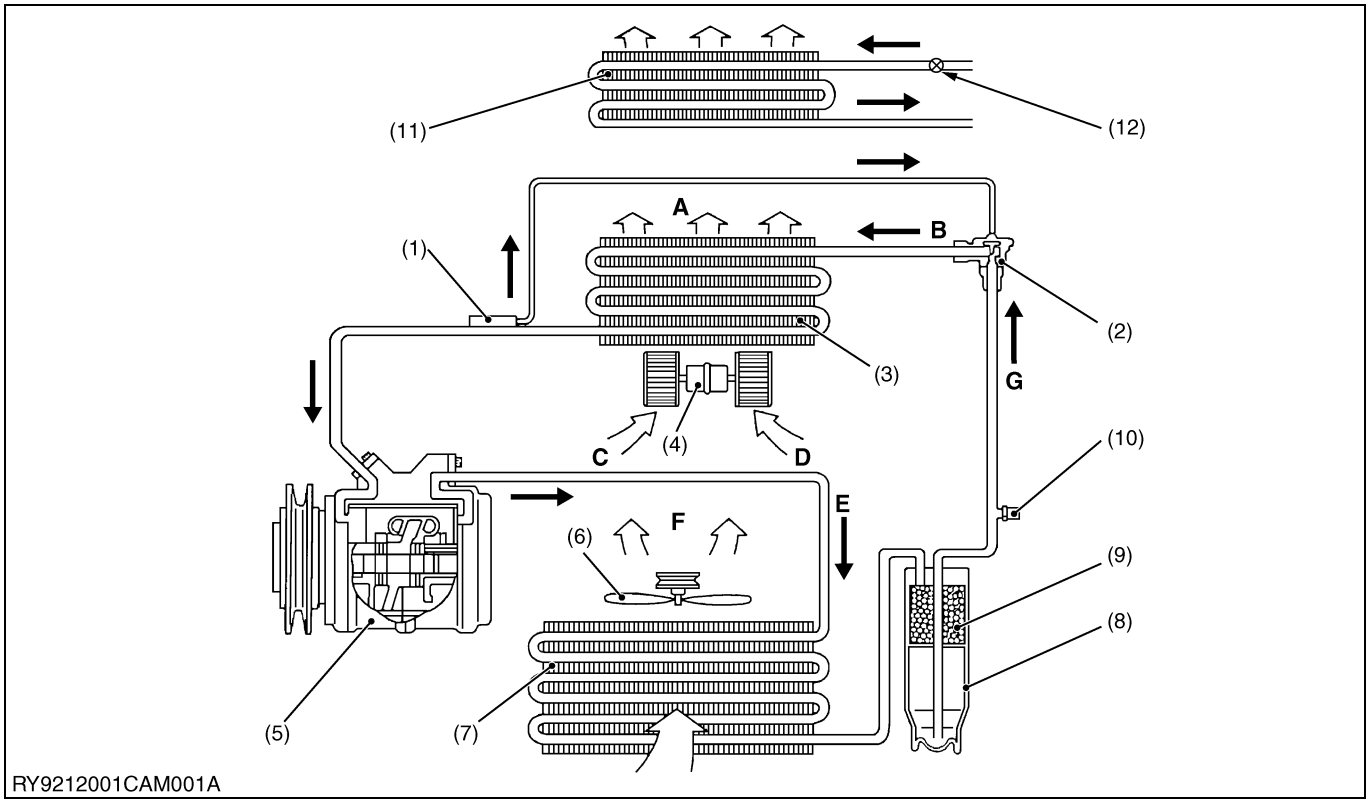
(1) Control Panel
(2) External Air Intake
(3) Air conditioning Unit
(4) Compressor
(5) Condenser
(6) Receiver
(7) Heater Core
(8) AC Filter

The cabin is equipped with a high-capacity, low-profile air conditioner that can circulate cabin air or bring in fresh air from outside. Cabin air and outside air are directed through the AC filter to the AC unit. The cabin or outside air that is sucked into the AC unit is cooled and dehumidified by the cooler of the AC unit. When the system is used for heating, the air is heated by the heater core and then expelled from the air vents. The air vents can be opened and closed and the direction of the airflow can be adjusted.

Cooling capacity	Factory specifications	3.4 kW ± 10 %
Heating capacity		4.1 kW ± 10 %
Type of refrigerant (charge capacity)		R134a 0.65 to 0.75 kg 1.4 to 1.7 lbs
Pressure sensor (low)		0.196 MPa 2.0 kgf/cm^2 28.4 psi
Pressure sensor (high)		3.14 MPa 32.0 kgf/cm^2 455 psi

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[2] HOW THE MECHANISMS OF THE SYSTEM WORK



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(1) Capillary Tube (Heat Sensitive Capillary Tube)
(2) Expansion Valve
(3) Evaporator
(4) Blower Motor
(5) Compressor
(6) Engine Cooling Fan
(7) Condenser
(8) Receiver
(9) Dryer
(10) Pressure Switch
(11) Heater Core
(12) Hot Water Valve

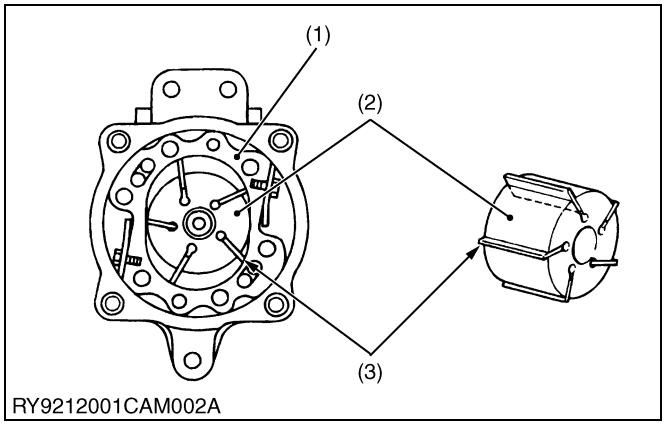
A : Cooled Air
B : Low Pressure and Temperature Vapor
C, D : Air Passes Through In / Outside Air Filter
E : High Pressure/Temperature Gas
F : Hot Air
G : Liquid

This air conditioning system works as follows.

1. Refrigerant passes through the evaporator (3), is vaporized and then is compressed by the compressor (5) to approximately 1.47 MPa (15 kgf/cm^2, 210 psi) and raised to a temperature of approximately 70 °C (158 °F) the refrigerant is then sent in this state to the condenser (7).
2. The vaporized refrigerant passes through the condenser (7), where it is cooled down to approximately 50 °C (122 °F) and the refrigerant changes back from a vapor to a liquid; it is then sent on to the receiver (8).
   Then the heat from inside the cabin that is captured by the condenser (7) is released outside the cabin.
3. The liquid refrigerant collects in the receiver (8) and any moisture is removed from the refrigerant by the dryer (9).
4. The liquid refrigerant then passes on to the expansion valve (2), where it is sprayed through the small holes in the valve into the evaporator (3), which produces a mist of the refrigerant; its pressure and temperature drop and the refrigerant evaporates.
5. The refrigerant simultaneously captures heat from the surface of the evaporator's (3) pipes and evaporates vigorously at 0 °C (32 °F).
6. As this happens, warm air from inside the cabin is drawn into the evaporator (3) by the blower motor (4) and the refrigerant captures the heat and evaporates. In this way the air in the cabin is cooled.
   [NOTE]
   - Because the warm air inside the cabin is cooled quickly, the moisture in the air condenses. In other words, the air in the cabin can be dehumidified.
7. The refrigerant vaporized in the evaporator (3) is returned to the compressor (5) and compressed, changing it back into a liquid. In doing so, the refrigerant is put under high pressure and temperature.
8. The air that passed through the evaporator (3) can be adjusted to the desired temperature by then passing it through the heater core (11). Engine coolant is heated by the engine and the amount of the coolant that flows into the heater core (11) is controlled by the hot water valve (12), and this adjusts the temperature of the air that flows through the heater core (11).

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[3] COMPRESSOR



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The vane type of compressor installed in this system is composed of a cylinder (1) that is elliptical in cross-section, along with five vanes (3) attached to the rotor (2). This vane compressor has two each of intake and discharge ports.

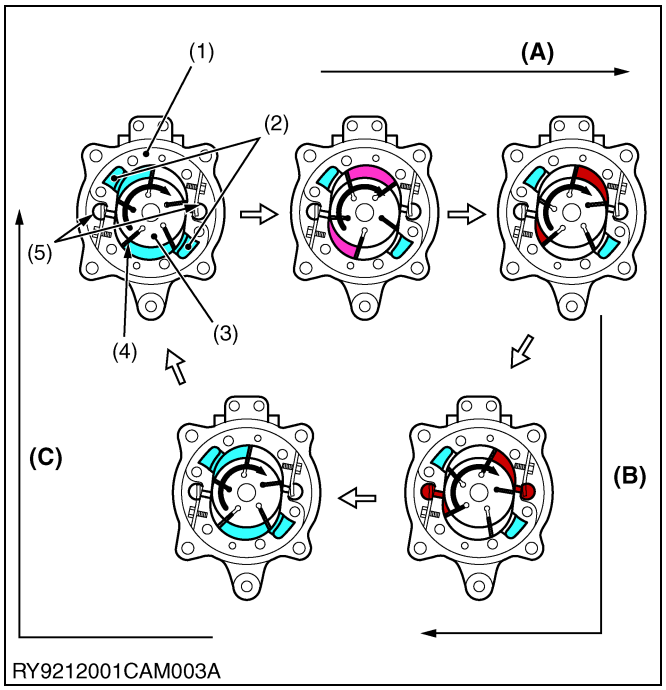
The five vanes (3) are attached to the rotor (2) and as it rotates, the tips of the vanes come in contact with the walls of the cylinder (1) and an airtight compression space is maintained both by the centrifugal force exerted by the rotor (2) along with the back pressure on the vanes (3), which is in proportion to the rpms of the rotor (2).

As a result, the volume changes in each of the five segments of the cylinder, which are divided by the five vanes (3) in the cylinder (1).

Each time that the rotor (2) rotates, each of the five segments of the cylinder goes through two cycles of intake, compression and discharge.

(1) Cylinder
(2) Rotor
(3) Vane

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How it Works

As the rotor (3) turns, the volume of space in a segment, as divided by the cylinder (1) and vanes (4), increases, sucking refrigerant gas from the intake port (2) into the cylinder space.

As the rotor (3) turns further, the volume of the space created between the cylinder (1) and vanes (4) decreases, compressing the refrigerant gas. As the rotor (3) continues to turn, the refrigerant gas is compressed further, putting it under a great deal of pressure, pressing on the discharge valve and opening it. The refrigerant gas is then expelled via the discharge port (5).

(1) Cylinder
(2) Intake Port
(3) Rotor
(4) Vane
(5) Discharge Port
(A) Compression Cycle
(B) Discharge Cycle
(C) Intake Cycle

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Compressor Oil

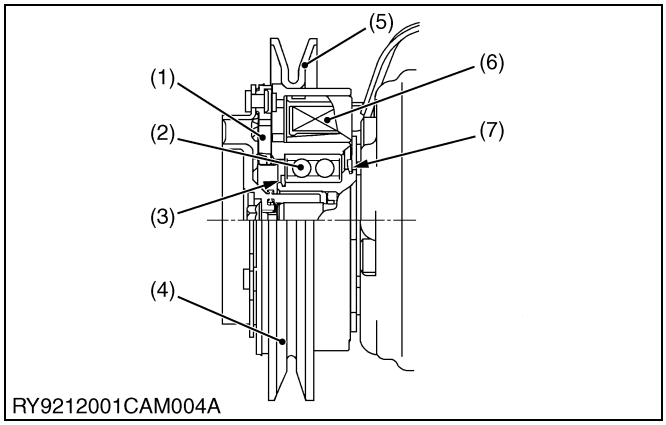
The compressor oil is dissolved in the refrigerant and circulates throughout the entire cooling system acting as the lubricating oil for the compressor. However, because the previously used R12 compressor oil does not dissolve in R134a, it does not circulate through the cooling cycle. So it drastically reduces the working life of the compressor.

As a result, it is imperative that the right compressor oil is always used. The mineral oil that is used in an R12 cooling system cannot be used in an R134a cooling system. A synthetic PAG oil has to be used in an R134a cooling system. This oil mixes extremely well with refrigerant gas and provides the entire system with the optimum lubrication.

Volume of Oil	Product Name
110 to 120 cc 0.116 to 0.127 U.S.qts 0.098 to 0.106 Imp.qts	ND–OIL8 <PAG* oil>

*PAG : Polyalkylene glycol (synthetic oil)

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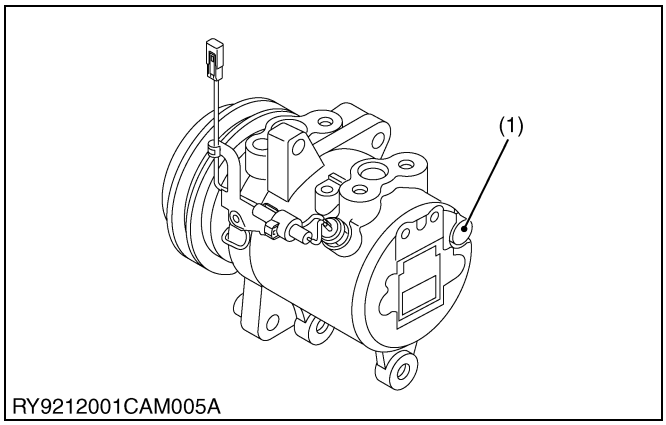
Magnetic Clutch

A magnetic clutch is a device that governs the mechanical linkage between the engine and the compressor. When the engine is rotating and the A/C switch is on, air at cabin temperature comes out and when the temperature reaches the temperature set with the temperature control switch, or when the cabin gets hot, the clutch works to stop or to drive the compressor, respectively.

The hub of the magnetic clutch is attached to the compressor shaft and when it is not driving the compressor, it is separate from the rotor and just the pulley turns. When the A/C switch is turned on, current flows into the stator coil, making the stator into a magnet, which then holds onto the hub and the pulley turns along with the compressor.

(1) Pressure Plate
(2) Ball Bearing
(3) Snap Ring
(4) Pulley
(5) Rotor w/ Pulley
(6) Stator
(7) Snap Ring

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B. Safety Valve

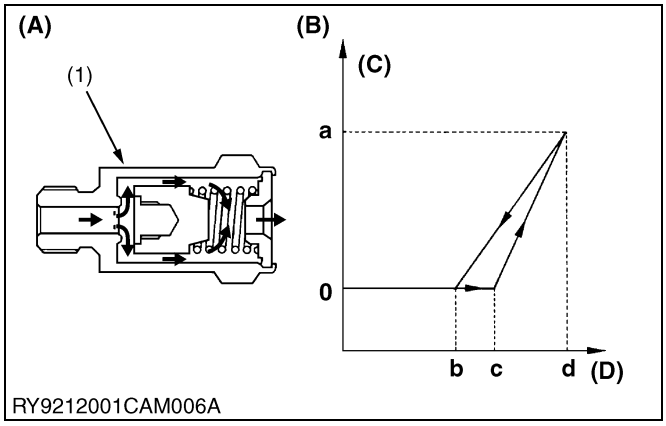
The valve opens when the refrigerant pressure reaches the specified pressure, thus relieving the pressure. When the pressure becomes abnormally high, it overcomes the force of the spring, allowing refrigerant to leak out of the relief port; when the pressure drops the reverse happens--the spring overcomes the pressure and the safety valve closes. When an error occurs, this also keeps the discharge of refrigerant to a minimum.

(1) Safety Valve

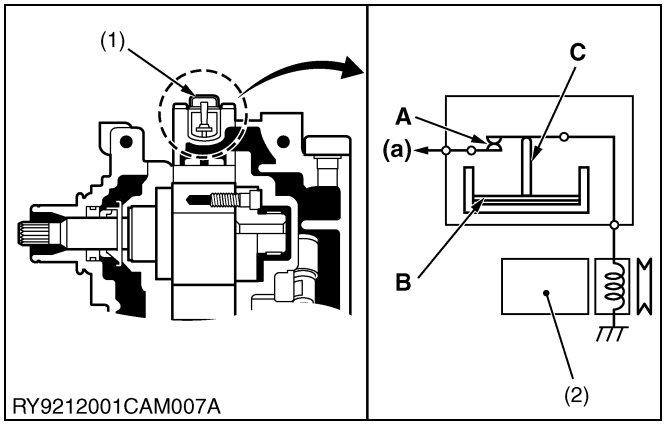
(A) Refrigerant Leak Route
(B) Functional Characteristics
(C) Amount of Refrigerant Leaked
(D) Pressure

a : 113 L/min. (27.2 U.S.gals./min., 24.86 Imp.gals./min.)
b : 2.75 MPa (28.1 kgf/cm^2, 399.7 psi)
c : 3.43 MPa (35.0 kgf/cm^2, 497.8 psi)
d : 4.12 MPa (42.0 kgf/cm^2, 598.0 psi)

RY9212001CAM0007US0



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Temperature Sensor

A temperature sensor is installed on the head of the vane type of compressor. This sensor detects the temperature of the refrigerant and when the refrigerant becomes unusually hot, it cuts off the magnetic clutch, stopping the compressor. The temperature sensor is composed of a bimetallic strip and contacts. A bimetallic strip is a sandwich of two metals with different rates of expansion and it bends when heated due to these different rates of expansion. This characteristic is exploited when there is an excessive temperature via the rod, which breaks the contact and switches the magnetic clutch off.

Operating Ranges	OFF	153 to 163 °C 307 to 325 °F
	ON	120 ± 5 °C 248 ± 41 °F

Tightening torque	Temperature Sensor	11.8 ± 1.47 N·m 1.2 ± 0.15 kg·fm 8.7 ± 1.08 lbf·ft

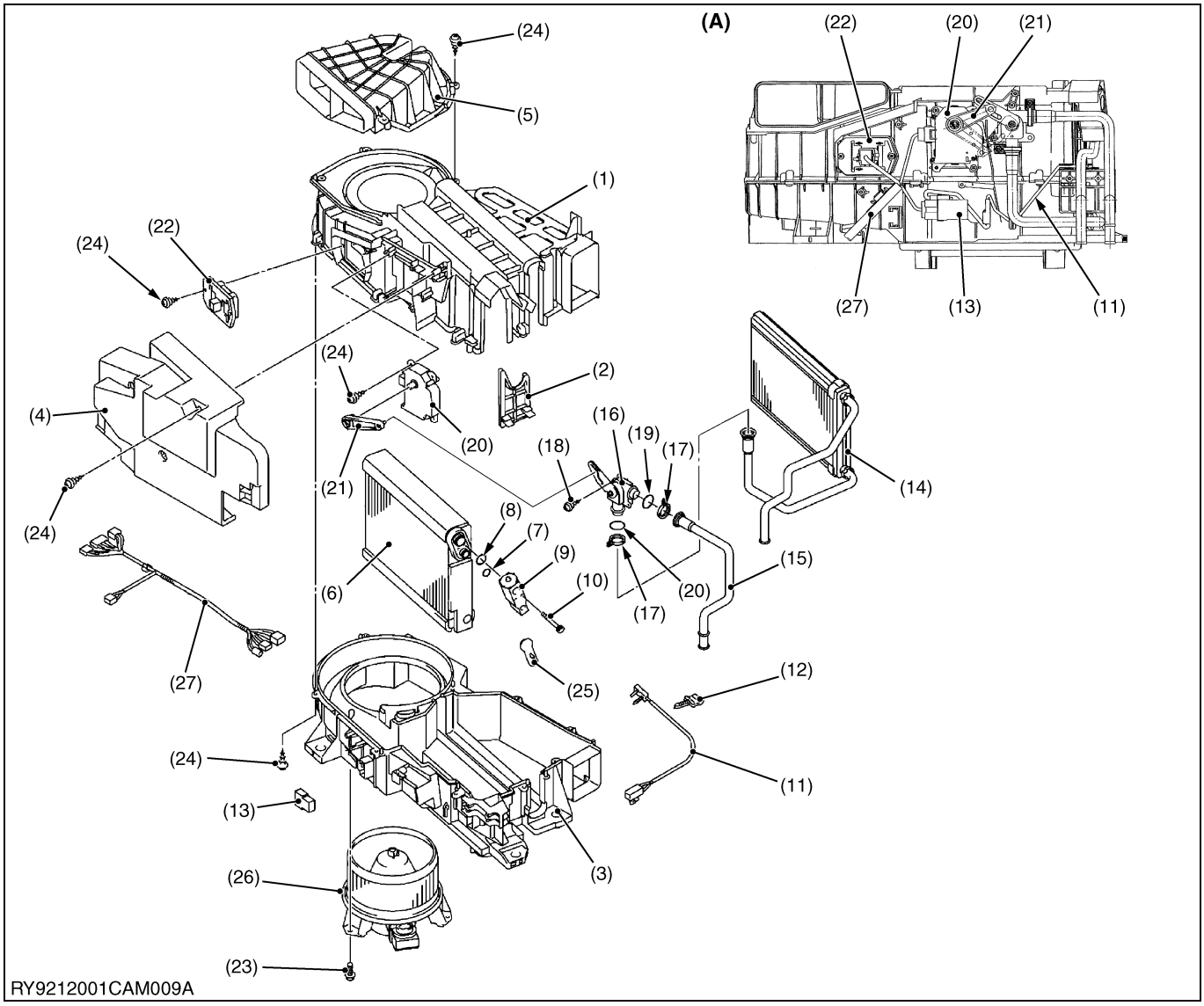
(1) Temperature Sensor
(2) Compressor

A : Contact
B : Bimetallic Strip
C : Rod

(a) To battery + Terminal

RY9212001CAM0008US0

[4] AIR CONDITIONING UNIT



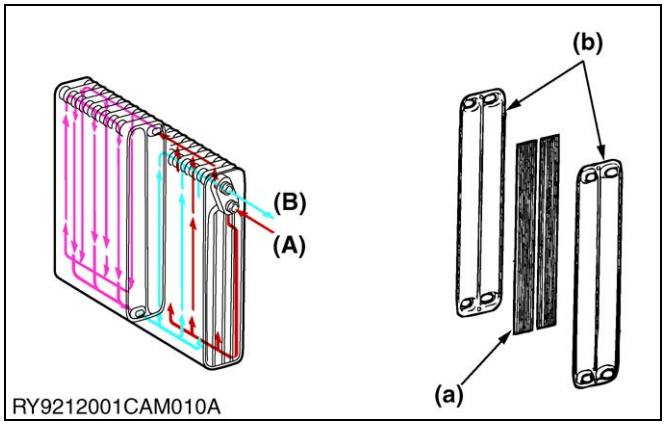
(A) Diagram of Linkages and Electrical Parts

The diagram above was created for general explanations of the air conditioning unit, so it may differ from the air conditioning unit installed in the machine covered by this workshop manual. Similarly, this does not guarantee the parts used inside the air conditioning unit are the same.

The air conditioning unit is composed of an evaporator, an expansion valve, a heater core, a blower, etc.

No.	Name of part	No.	Name of part	No.	Name of part
(1)	Upper case	(10)	Bolt	(19)	O-Ring
(2)	Side cover	(11)	Fin thermistor	(20)	Servo motor
(3)	Lower case	(12)	Clamp	(21)	Linkage lever
(4)	Linkage cover	(13)	A/C Amp	(22)	Blower resistor
(5)	Intake cover	(14)	Heater core	(23)	Self-tapping screw
(6)	Evaporator	(15)	Pipe	(24)	Self-tapping screw
(7)	O-Ring	(16)	Hot water valve	(25)	Cap
(8)	O-Ring	(17)	Pipe clip	(26)	Blower motor
(9)	Expansion valve	(18)	Screw	(27)	Wire harness

RY9212148CAM0001US0



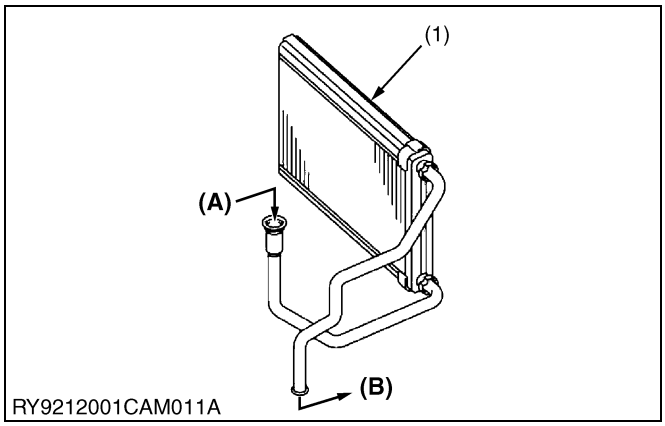
RY9212001CAM010A

Evaporator

The evaporator takes the refrigerant, which has been made liquid by the condenser and cooled and put under low-pressure by the expansion valve, and by evaporating it, the heat and humidity of the air passing through the evaporator is removed, thus producing cool, dehumidified air.

(a) Fins
(b) Tubes
(A) Inlet
(B) Outlet

RY9212001CAM0010US0



RY9212001CAM011A

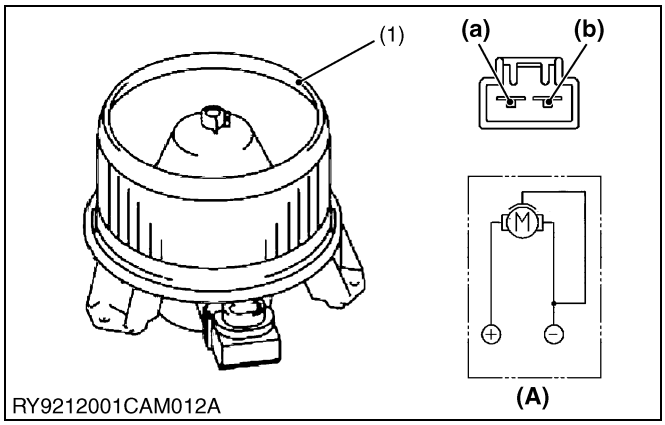
Heater Core

The heater core dissipates the heat of the heated engine coolant. So, the air that is blown through it by the blower motor passes through the fins of the heater core and the air takes on the heat of the coolant.

(1) Heater Core

(A) Inlet
(B) Outlet

RY9212001CAM0011US0



RY9212001CAM012A

Blower

The blower is built into the right side of the A/C unit. The blower forces cool, warm or fresh outside air through the vents into the cabin.

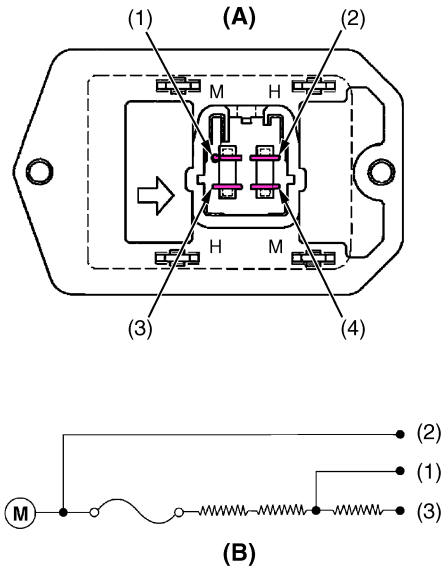
The rpm of the blower motor can be adjusted to three levels with the blower resistor. The blower fan is the type that uses centrifugal force and it sucks in air parallel to its axis of rotation and blows it out perpendicular to the centrifugal force, or in other words, perpendicular to the axis of rotation.

Specifications (at 20 °C)	
Model	DC Ferrite
Rated Voltage	12 V
No load RPM	4300 ± 400 rpm
No load amperage	1 to 3 A
Direction of rotation (viewed from drive side)	Left
Rated load torque	461 N·m, 47.0 kgf·m, 340 lbf·ft
RPM	2800 ± 280 rpm
Amperage	18.3 ± 1.8A

(1) Blower

(A) Circuit Diagram
(a) (+) Terminal
(b) (-) Terminal

RY9212001CAM0012US0



(B)

RY9212148CAM002A

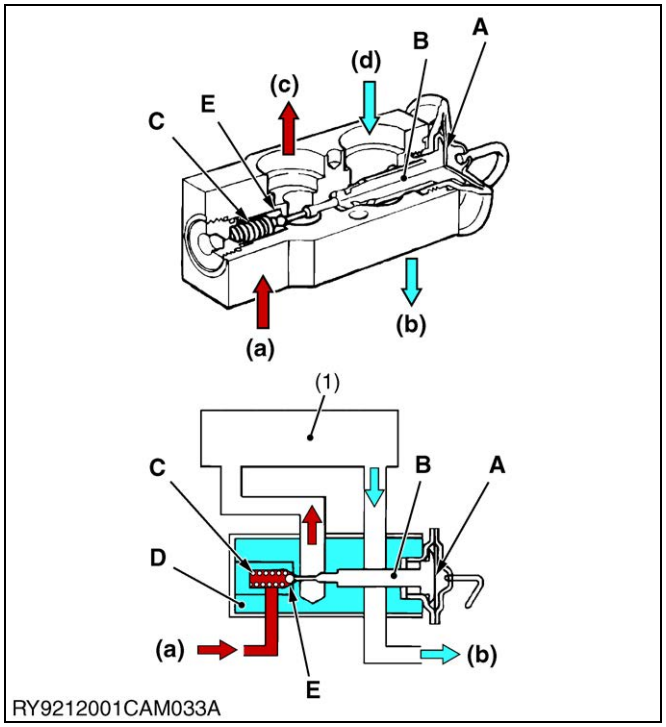
Blower resistor

Acts as the blower switch and controls the rpm of the blower motor by switching the degree of resistance. The fan speed can be switched to three levels, 1, 2 and 3, with 3 being the fastest.

(1) MI
(2) HI
(3) LO
(4) Blank

(A) Blower Resistor
(B) Wiring Diagram

RY9212148CAM0006US0



Expansion Valve

[Functions]

The expansion valve works in the following two ways.

1. By spraying the liquid refrigerant, which is hot and under high pressure, it makes it expand rapidly, producing a low-temp, low-pressure refrigerant vapor.
2. It adjusts the amount of refrigerant according to the vaporized state of the refrigerant in the evaporator. In order to take full advantage of the capabilities of the evaporator, a state must always be maintained in which the liquid refrigerant takes on the ambient heat, then it is completely vaporized at the outlet of the evaporator. In order to do so, the expansion valve automatically adjusts the volume of refrigerant in response to changes in the cabin temperature (cooling load) and changes in the compressor RPM.

[Structure (box type)]

- The expansion valve is composed of a diaphragm, heat-sensing rod, and a needle valve (ball) and the refrigerant gas is enclosed upstream of the diaphragm. The downstream side of the diaphragm is pressurized by the evaporator outlet pressure.

[How it Works]

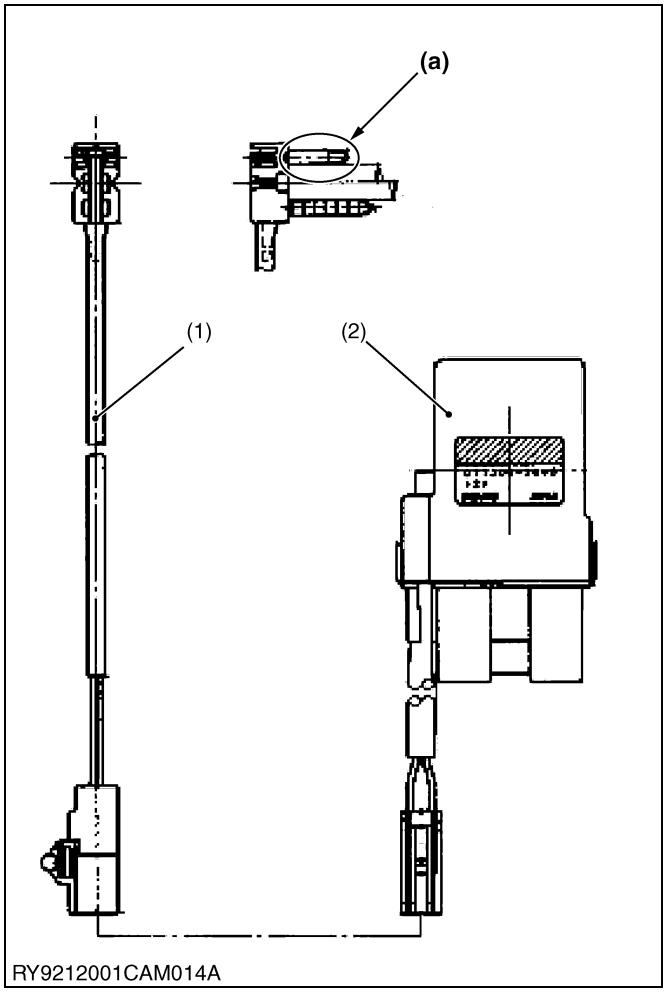
- The heat-sensitive rod senses the temperature of the refrigerant passing to the evaporator and the temperature at that point is communicated to the refrigerant gas on the upstream side of the diaphragm via the heat-sensitive rod. As such, the pressure of the gas varies with the temperature, thus moving the heat-sensitive rod directly connected to the diaphragm and adjusting the opening of the needle valve.

Evaporator outlet temperature	Operation
When low (when cooling load is low)	The pressure of the gas in the diaphragm chamber drops, reducing the volume and moving the heat-sensitive rod to the right, which constricts the needle valve and reduces the flow of refrigerant to the evaporator.
When high (when cooling load is high)	The pressure of the gas in the diaphragm chamber rises, increasing the volume and moving the heat-sensitive rod to the left, which opens the needle valve and supplies more refrigerant to the evaporator.

(1) Evaporator

A : Diaphragm
B : Heat-Sensitive Rod
C : Spring
D : Body
E : Needle Valve
(a) From Receiver (Hi-Pressure)
(b) To Compressor (Lo-Pressure)
(c) To Evaporator
(d) From Evaporator

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Fin Thermistor (for frost control)

[Function]

Senses the temperature of the fins of the evaporator and when they are too cold, it stops the compressor and prevents frost from forming before it happens.

[How it Works]

The sensor of the fin thermistor senses the evaporator's fin temperature and if the resistance inside the sensor exceeds the thermo-amp resistance setting, its internal circuit shuts off the power to the compressor clutch.

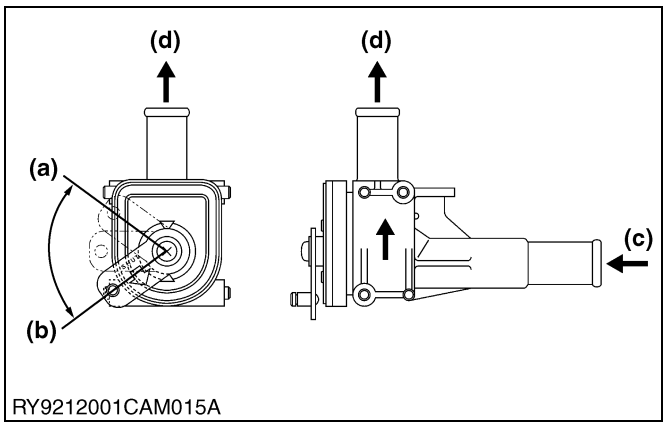
Specifications		
Rated Voltage	DC12 V	
Measurement Conditions	DC13 ±0.2 V at 25 ± 5 °C (77 ± 9 °F)	
Temperature Detection	OFF R1	4383 ±131 Ω (2 °C, 36 °F)
	ON R2	(4095 Ω) (3.35 °C, 38 °F)
	Hysteresis	215 ±5.0 Ω (1 °C, 34 °F)

Usage Conditions	
Temperature Range	–30 to 80 °C (–22 to 176 °F)
Voltage Range	DC10 to 16 V
Operating Voltage Range	DC8 to 16 V (at 25 °C, 77 °F)

Temperature Detection	10 °C / 50 °F	15 °C / 59 °F	20 °C / 68 °F	25 °C / 77 °F	30 °C / 86 °F
Resistance Value	2.96 kΩ	2.34 kΩ	1.87 kΩ	1.50 kΩ	1.22 kΩ

(1) Fin Thermistor
(2) Thermo-Amp
(a) Evaporator Fin Temperature Detector

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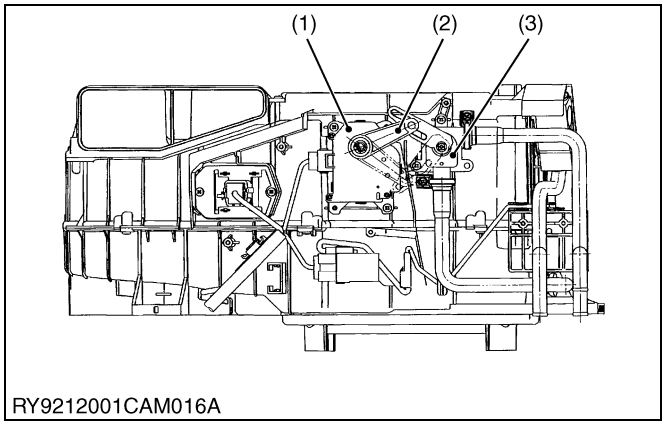
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Hot Water Valve

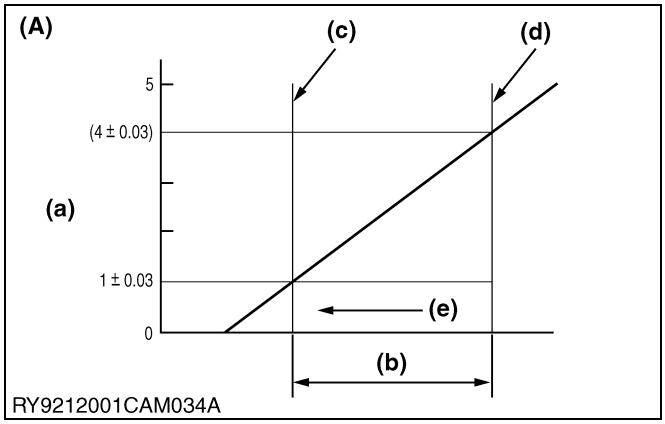
The hot water valve is the valve that adjusts the volume of engine coolant that flows into the heater core, and this adjustment changes the temperature of the heater core and thus controls the temperature of air flowing through it.

(a) Open (MAX Hot)
(b) Closed (MAX Cool)
(c) Inlet
(d) Outlet

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RY9212001CAM016A



RY9212001CAM034A

Servo Motor (for adjusting temperature)

The servo motor is composed of a motor, a potentiometer, movable contacts, etc., and operates according to signals from the A/C's CPU.

The servo motor uses a DC ferrite motor and rotates forward and reverse. Its potentiometer also uses variable resistance and changes the resistance value according to the operating angle.

The servo motor and the hot water valve are linked via a linkage lever and turning the temperature control dial on the control panel opens/closes the hot water valve and adjusts the temperature of air vented inside the cabin.

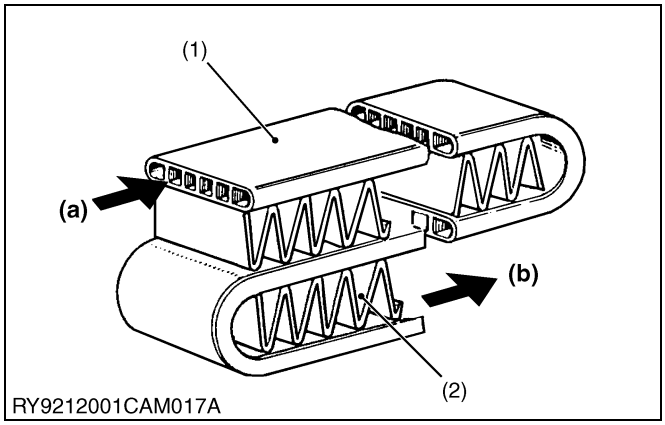
Specifications (at 20 °C, 68 °F)	
Model	DC Ferrite
Rated Voltage	12 V
Rated load torque	0.3 N·m, 0.03 kgf·m, 0.2 lbf·ft
RPM	3.5 to 5.5 rpm
Amperage	0.02 to 0.10 A
Potentiometer Linearity	± 3 %
Impressed Voltage Terminals	6 (POS.2) 7 (POS.1)

(1) Servo Motor
(2) Linkage Lever
(3) Hot Water Valve

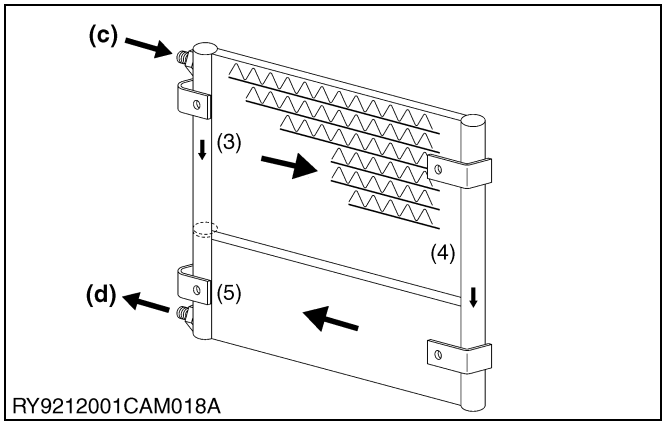
(A) Potentiometer Output Schematic
(a) Voltage (V)
(b) Operating Angle 60 °
(c) MAXCOOL
(d) MAXHOT
(e) CW

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[5] CONDENSER



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RY9212001CAM018A

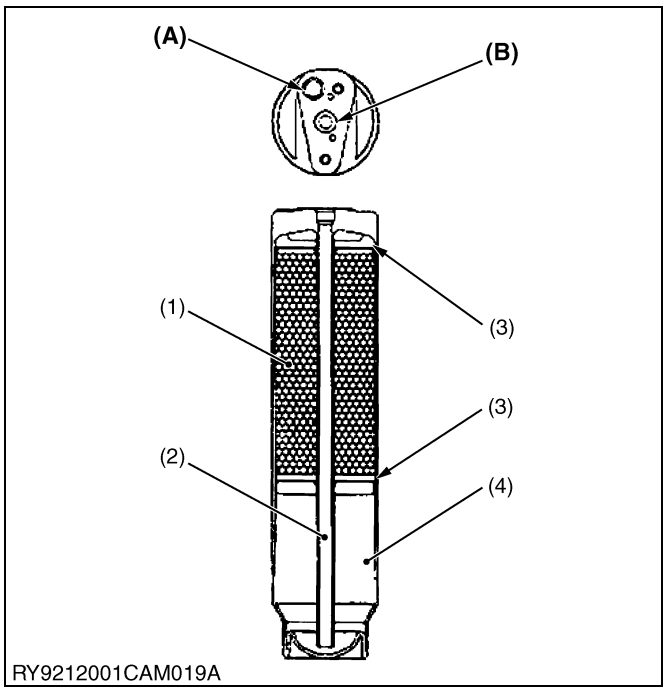
The hot, compressed refrigerant is under high pressure and in a gaseous state; the condenser cools it and returns it to a liquid state. In the interval between entering and passing through the condenser, the refrigerant is cooled and becomes liquid refrigerant again. At this point, it is necessary to be sure the refrigerant is liquid at the outlet of the condenser. If the refrigerant is not condensed enough in the condenser some refrigerant would be in a gaseous state and that would reduce the A/C's cooling efficiency.

(1) Tubes
(2) Fins
(3) Vapor
(4) Vapor/Liquid Mix
(5) Liquid

(a) Gaseous Refrigerant
(b) Liquid Refrigerant
(c) Inlet (70 °C, 158 °F)
(d) Outlet (50 °C, 122 °F)

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[6] RECEIVER



RY9212001CAM019A

The receiver is composed of a receiver tank, dryer, strainer and a receiver tube.

[Receiver Tank]

In the A/C system, the rpm of the compressor changes in response to changes in the engine rpm, so the appropriate amount of refrigerant in the cooling circuit also changes. The receiver tank is the part that reacts to those changes; when a lot of refrigerant is not required in the cooling circuit, excess refrigerant is stored temporarily in the tank and when more coolant is needed, it is supplied to the circuit via the receiver tube.

It also acts to store the balance of refrigerant charges and for extra refrigerant to counteract the leak of small amounts of refrigerant, such as via permeation of rubber hoses.

[Dryer]

If any moisture exists in the cooling circuit, it damages the system by deteriorating the valves of the compressor, its oil, by corroding metal parts in the circuit, and/or freezes in the expansion valve and blocks the circuit. The A/C system uses synthetic zeolite as a dryer that is compatible with the circuit, and it absorbs any moisture that gets mixed into the circuit during installation or charging of refrigerant.

If the expansion valve freezes up frequently due to moisture (icing), it means the dryer has lost its ability to absorb it, so the receiver has to be replaced.

[Strainer]

If dirt gets into the cooling circuit, it blocks the expansion valve, damages the compressor and otherwise hampers its cooling function. The strainer works to prevent any dirt flowing in the refrigerant from going any further. The strainer cannot be cleaned, so when it becomes severely clogged up, (in which case the high pressure gets high, low pressure gets low), the receiver has to be changed.

[Sight Glass]

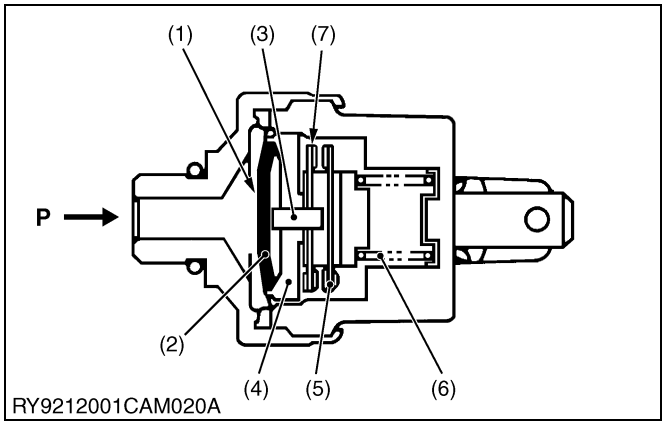
The sight glass is mounted at the receiver joint on top of the receiver and it is the only place in the circuit where the amount of refrigerant can be visually inspected.

(1) Dryer
(2) Receiver Tube
(3) Strainer
(4) Receiver Tank

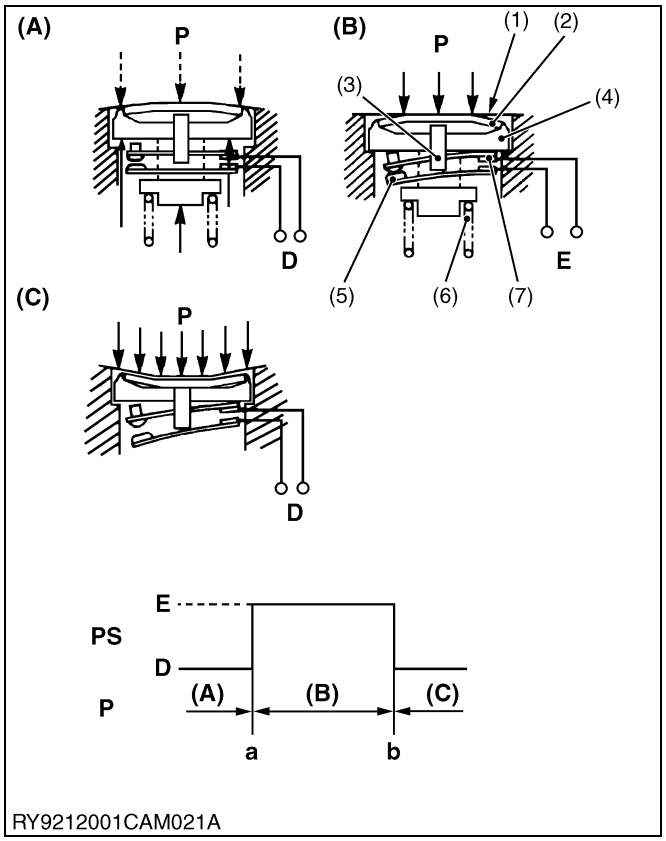
(A) Refrigerant Inlet
(B) Refrigerant Outlet

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[7] PRESSURE SWITCH



RY9212001CAM020A



RY9212001CAM021A

This dual type of switch detects unusually high and low pressures in the cooling cycle. If the pressure gets abnormally high or, due to a leak, abnormally low, it may damage the equipment or deteriorate the lubricating ability of the compressor oil, leading to scorching and breakdown. To prevent these kind of problems from occurring, the switch cuts the power to the compressor clutch and stops the compressor.

	Refrigerant pressure	Operation
(A)	No increase in pressure state (when abnormally low)	The refrigerant pressure becomes less than the force of the spring, so the spring presses the plate up and the upper contact opens (OFF).
(B)	Contact ON (normal operation)	The refrigerant pressure is greater than the force of the spring, so the pressure plate is pressed down, which presses the upper contact down, closing the contact (ON).
(C)	Contact OFF (abnormally high pressure)	The refrigerant pressure becomes greater than the force of the plate spring and the plate spring pushes down on the pin, which press on the lower contact, opening it (OFF).

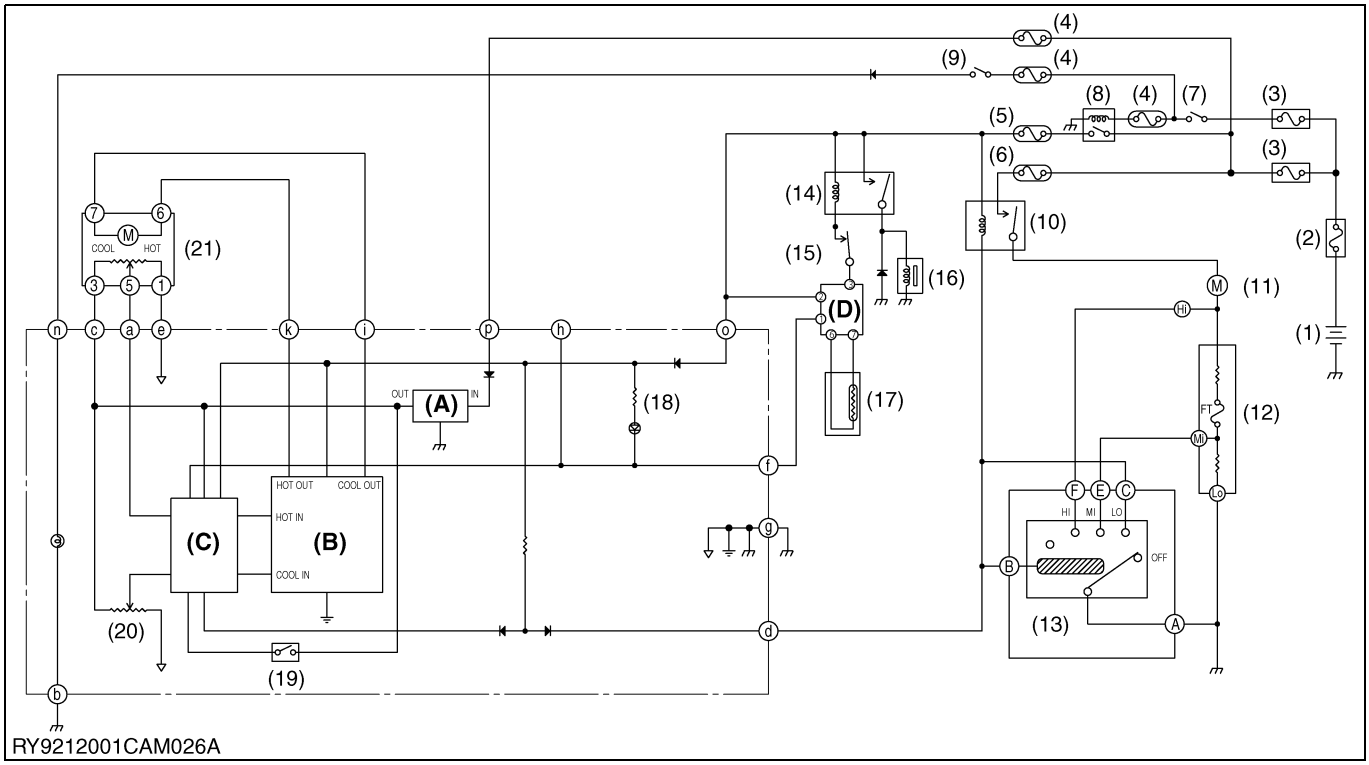
(1) Diaphragm
(2) Plate Spring
(3) Pin
(4) Plate
(5) Contact
(6) Spring
(7) Terminal

a : 0.19 MPa (2.0 kgf/cm^2, 28.4 psi)
b : 3.14 MPa (32 kgf/cm^2, 455 psi)
D : OFF
E : ON
P : Pressure
PS : Pressure Switch

RY9212001CAM0020US0

[8] ELECTRICAL SYSTEM

(1) Electrical Circuits



(1) Battery
(2) Slow-Blow Fuse (80A)
(3) Slow-Blow Fuse (50A)
(4) Fuse (5A)
(5) Fuse (10A)
(6) Fuse (30A)
(7) Start Switch
(8) Cab Relay
(9) Headlight Switch
(10) Blower Motor Relay
(11) Blower Motor
(12) Blower Resistor
(13) Blower Switch (Shorting Type)
(14) Compressor Clutch Relay
(15) Pressure Switch
(16) Compressor Magnetic Clutch
(17) Fin Thermistor (Frost Sensor)
(18) Indicator Lamp
(19) A/C switch
(20) Volume (Temperature Setting)
(21) Servo Motor

(A) Fixed Voltage Circuit
(B) Servo Motor Drive Circuit
(C) CPU
(D) Electronic Thermo Amp

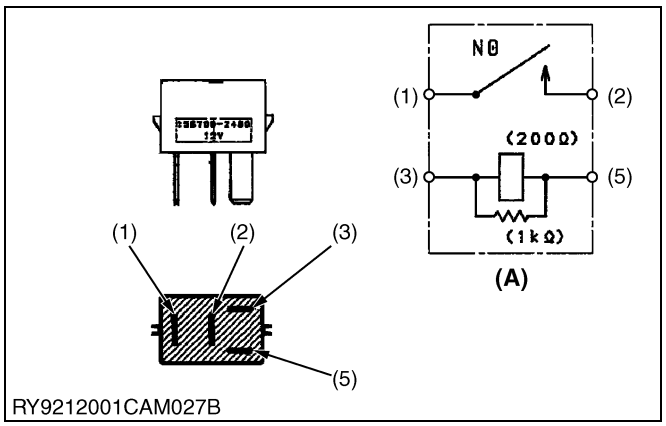
(a) Potentiometer Signal
(b) ILL–
(c) Potentiometer Power
(d) Blower Motor
(e) Potentiometer GND
(f) Electronic thermo
(g) GND
(h) (Free)
(i) Servo Motor Output1 (COOL Output)
(j) (Free)
(k) Servo Motor Output2 (HOT Output)
(l) (Free)
(m) (Free)
(n) Headlight Switch
(o) IG
(p) +B Power

The processes up to the compressor's magnetic clutch engaging are indicated below.

1. Start switch → cab relay ON → blower motor relay ON → blower switch ON (LO, MI or HI) →blower motor ON
2. A/C switch ON (indicator lamp lights up) → pressure switch ON → fin thermistor ON → compressor clutch relay ON → compressor magnetic clutch ON (compressor operates)

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(2) Relays



RY9212001CAM027B

Current flows in the components of the A/C system to the blower motor and compressor's magnetic clutch. If all of the current were supplied via the main switch, the current would be too much for the switch, so the contacts of the main switch would be in danger of burning out. Similarly, if this current flowed directly from the battery and the operator forget to turn the blower motor off, the battery would discharge.

The system is equipped with relays in order to prevent these kind of problems. When the current flows through the coils of these relays, their contacts close, allowing electricity to be supplied from the battery. By adopting these relays, only a tiny amount of current is needed to operate the relays, so very little current flows through the main switch. As a result, the concern over its contacts burning out is eliminated and when the main switch is open, the relays' contacts open at the same time. When this occurs, the flow of electricity in the A/C circuit ceases and the possibility of the battery discharging is also eliminated.

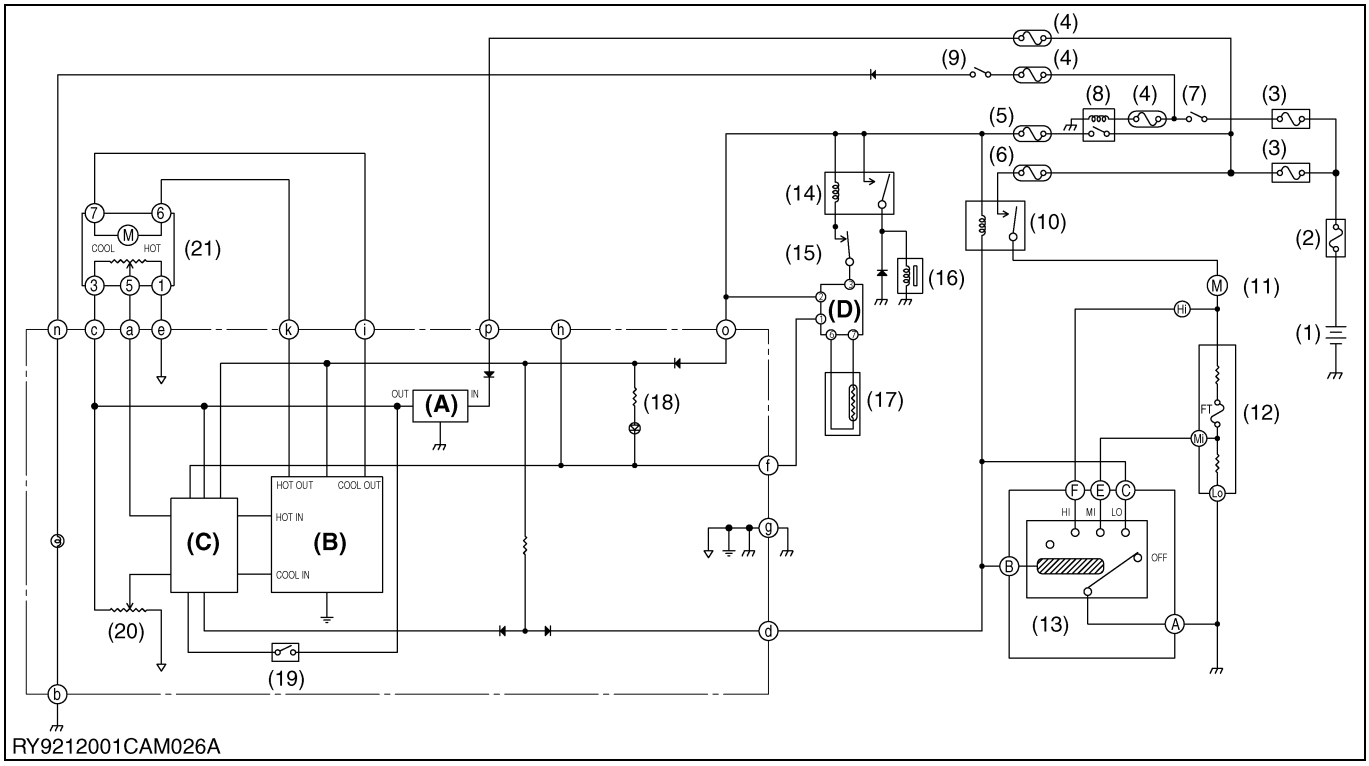
(1) Relay Terminal 1
(2) Relay Terminal 2
(3) Relay Terminal 3
(5) Relay Terminal 5

(A) Connection Diagram

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(3) Blower Switch

When the blower switch is in the LO, MI, or HI position



(1) Battery
(2) Slow-Blow Fuse (80A)
(3) Slow-Blow Fuse (50A)
(4) Fuse (5A)
(5) Fuse (10A)
(6) Fuse (30A)
(7) Start Switch
(8) Cab Relay
(9) Headlight Switch
(10) Blower Motor Relay
(11) Blower Motor
(12) Blower Resistor
(13) Blower Switch (Shorting Type)
(14) Compressor Clutch Relay
(15) Pressure Switch
(16) Compressor Magnetic Clutch
(17) Fin thermistor (Frost Sensor)
(18) Indicator Lamp
(19) A/C Switch
(20) Volume (Temperature Setting)
(21) Servo Motor
(A) Fixed Voltage Circuit
(B) Servo Motor Drive Circuit
(C) CPU
(D) Electronic Thermo Amp

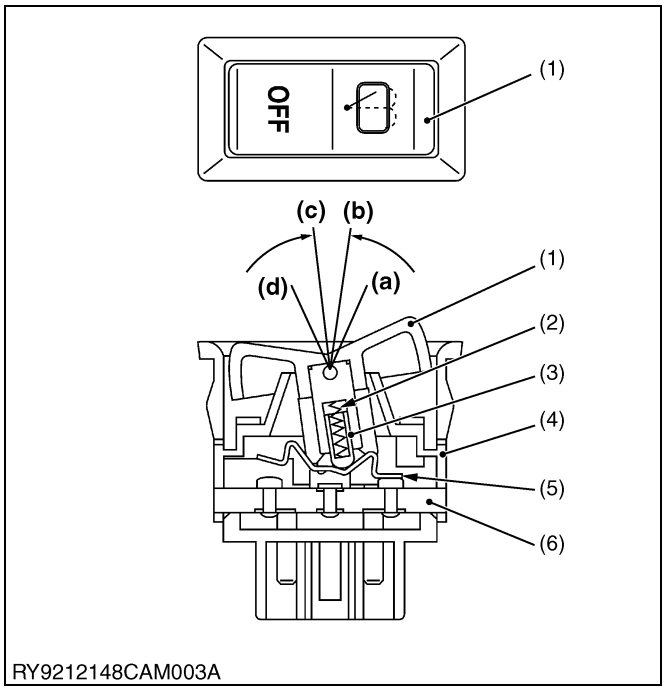
When the starter switch and the blower switch are turned on, electricity flows from the battery to the coil of the blower motor relay, turning the blower motor relay on. With the blower motor relay on, the electricity flows to the blower motor as indicated below.

- **Lo Position**
  - Battery → slow-blow fuse (80A) → slow-blow fuse (50A) → fuse (30A) → blower motor relay → blower motor → blower resistor → ground
- **Mi Position**
  - Battery → slow-blow fuse (80A) → slow-blow fuse (50A) → fuse (30A) → blower motor relay → blower motor → blower resistor → blower switch (E→A) → ground
- **Hi Position**
  - Battery → slow-blow fuse (80A) → slow-blow fuse (50A) → fuse (30A) → blower motor relay → blower motor → blower resistor → blower switch (F→A) → ground

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2. WIPER

[1] WIPER SWITCH



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This switch has four positions, namely **(a)**, **(b)**, **(c)** and **(d)** as indicated in the figure. When the starter key is in its [RUN] position and the switch is pressed to its **(b)** position, the wiper motor operates; pressing it in further to its **(a)** position operates the window washer. When the operator releases the switch, it automatically returns from position **(a)** to position **(b)**.

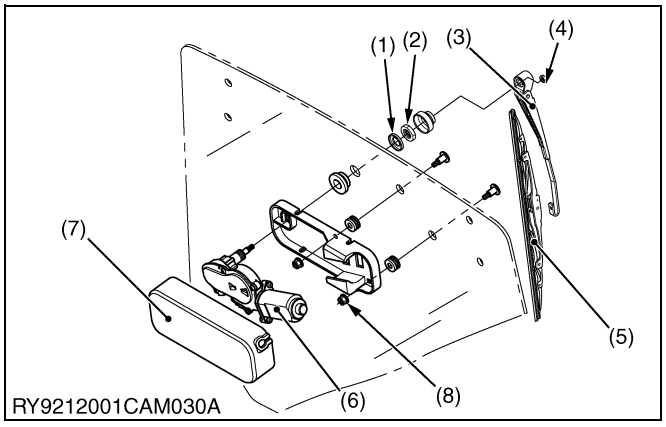
The window washer also operates if it is pressed in to position **(d)** on the [OFF] side. When it is released, it automatically returns in the same way to position **(c)**.

(1) Switch
(2) Spring
(3) Contact
(4) Switch Body
(5) Movable Contact
(6) Insulator

(a) Wash 1 Position (Both Wiper Motor and Window Washer Operate)
(b) On position (Only the Wiper Motor Operates)
(c) Off Position
(d) Wash 2 Position (Only the Window Washer Operates)

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[2] WIPER



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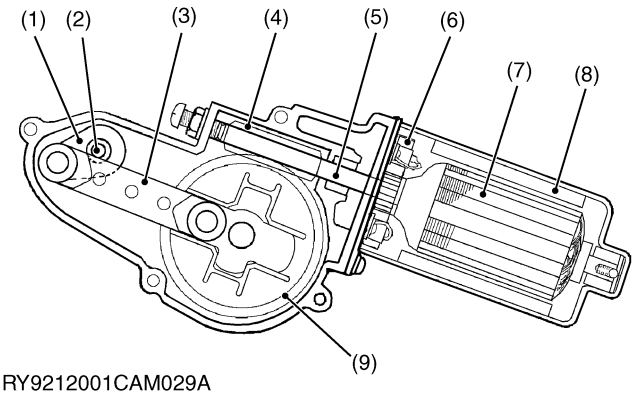
The wiper is composed of a motor, wiper arm, wiper blade, etc.

The motor is fixed speed and automatically returns to a set position.

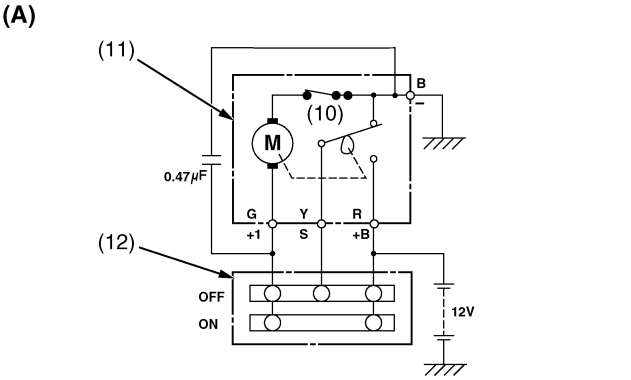
(1) Washer
(2) Nut
(3) Wiper Arm
(4) Nut
(5) Wiper Blade
(6) Wiper Motor
(7) Wiper Motor Cover
(8) Flange Nut

RY9212001CAM0028US0

[3] WIPER MOTOR



RY9212001CAM029A



RY9212001CAM031A

A cylindrical ferrite magnet and an armature are assembled inside the housing of the wiper motor.
A worm gear and a helical gear are attached to the end of the armature and act as reduction gears and the rod and a segmented arm provide reciprocating motion, which is communicated to the wiper arm via the arms axis.

The motor is a 2-brush specification model and its rpm cannot be altered.

(1) Segmented Arm
(2) Arm's Axis
(3) Rod
(4) Worm Gear
(5) Armature Axle
(6) Brush
(7) Armature
(8) Ferrite Magnet
(9) Helical Gear
(10) Breaker
(11) Motor
(12) Switch

(A) Wiring Diagram (Motor Stop Position)

RY9212001CAM0029US0

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1. TROUBLESHOOTING

Compressor

Problem and/or Situation	Possible Cause	Solution
Noise (compressor on)	Wearing of or damage to the compressor's bearings	Replace
	Compressor valve damaged	Replace
	Belt slipping	Adjust or replace
	Compressor bracket mounting bolt(s) loose	Tighten
	Lines vibrating	Tighten and/or add clamp(s)
Noise (compressor off)	Blower damaged	Repair or replace
	Magnetic clutch, idler pulley and/or crank pulley bearings damaged or wearing	Replace

Air Conditioning System

Problem and/or Situation	Possible Cause	Solution
Cooling not working (air not blowing)	Blown fuse	Replace
	Main A/C relay defective	Replace
	A/C's blower motor damaged	Replace
	A/C's blower switch broken	Replace
	Wiring harness unplugged or poor contact	Fix
Cooling not working (compressor not turning)	Blown fuse	Replace
	Magnetic clutch broken	Repair or replace
	A/C switch broken	Replace
	Pressure switch broken	Replace
	Belt slipping	Adjust or replace
Cooling not working (other)	Not enough refrigerant	Check with a manifold gauge
	Expansion valve broken	Replace
	Compressor broken	Replace
Cooling not working effectively (not enough air blowing)	Filter clogged	Clean or replace
	Frost on the evaporator	Clean or replace the temperature switch
	A/C's blower motor damaged	Replace
	A/C blower resistor broken	Replace
Not cooling effectively (lots of foam visible in sight glass)	Not enough refrigerant	Check with a manifold gauge
	Refrigerant gas leaking from the cooling circuit	Repair and/or recharge refrigerant
	Air got in	Check with a manifold gauge
Too much refrigerant (no foam in sight glass)	Refrigerant overcharged	Check with a manifold gauge
Not cooling effectively (compressor not rotating properly)	Belt slipping	Adjust or replace
	Magnetic clutch broken	Repair or replace
	Compressor broken	Replace

Problem and/or Situation	Possible Cause	Solution
Not cooling effectively (other)	Thermistor broken	Replace
	Hot water valve damaged	Replace
	Condenser clogged with dirt or debris	Clean
	Expansion valve broken	Replace
Not heating effectively	Hot water valve damaged	Replace
	Servo motor broken	Check and repair
Not enough air flow (blower motor not turning)	Blower fan switch broken	Check and repair
	A/C main relay broken	Replace
	Brushes have poor contact	Replace
	Blown fuse	Replace
	Miswiring or poor connections	Check and repair
Not enough air flow (air flow does not change to speed 3)	Blower resistor damaged	Replace
	Relay damaged	Replace
	Blower fan switch broken	Replace
Not enough air flow (other)	Blower not tight enough	Check and repair
	Blower deformed	Replace
	Blower hitting its casing	Check and repair
	Something blocking the inlet	Check and repair
	Frost on the evaporator	Clean or replace
	Filter clogged	Clean or replace
	Vent ducts clogged or detached	Check and repair
Not cooling effectively (compressor clutch not working)	Battery voltage too low	Charge the battery
	Rotor is hitting the stator	Replace
	Miswiring or loose connectors	Check and repair
	Relay damaged	Replace
	Coil shorted	Replace
	Ground defective	Check and repair
	Coil burned out	Replace
Not cooling effectively (high-pressure level too high)	Refrigerant overcharged	Check with a manifold gauge
	Condenser clogged with dirt or debris	Clean
	Air got in	Check with a manifold gauge
Not cooling effectively (high-pressure level too low)	Not enough refrigerant	Check with a manifold gauge
	Compressor discharge valve damaged	Replace
	Compressor gasket damaged	Replace
	Error in the low-pressure line (cracked or clogged)	Replace
Not cooling effectively (low-pressure level too high)	Refrigerant overcharged	Check with a manifold gauge
	Expansion valve too far open	Replace

Problem and/or Situation	Possible Cause	Solution
Not cooling effectively (low-pressure level too low)	Not enough refrigerant	Check with a manifold gauge
	Frost on the evaporator	Clean or replace
	Error in the low-pressure line (cracked or clogged)	Replace
	Expansion valve clogged	Replace
Not cooling effectively (both low and high pressure levels too high)	Refrigerant overcharged	Check with a manifold gauge
Not cooling effectively (both low and high pressure levels too low)	Not enough refrigerant	Check with a manifold gauge
Cannot control temperature (servo motor and/or temperature control dial defective)	Servo motor broken	Replace
	Temperature control dial broken	Replace
	Controller of the wire harness is off	Repair or replace
Cannot control the temperature (hot water valve does not open normally)	Servo motor broken	Replace
	Hot water valve damaged	Replace
Cannot control the temperature (poor heater hose layout)	Heater hose is pinched	Fix
	Heater hose is bent or broken	Repair or replace
Water leak (water leak inside the cab)	Drain hose bent or broken	Check and repair
	Drain hose clogged	Clean

Wiper

Problem and/or Situation	Possible Cause	Solution
Wiper doesn't work	Fuse blown (a part inside the wiper motor or some other moving part is shorted or burned out)	Pinpoint the cause of the damage and replace
	Wiper motor faulty (damaged armature, worn motor brushes, motor shaft locked)	Replace
	Wiper switch faulty	Replace
	Faulty operation of linkage mechanism due to foreign matter	Fix
	Wiper arm locked or rusted together	Grease up or replace
Wiper moves too slowly	Wiper motor faulty (damaged armature, poor contact due to worn motor brushes, faulty operation of motor shaft)	Replace
	Battery voltage low	Recharge or replace
	Wiper arm shaft rusty, foreign matter stuck in it	Grease up or replace
	Poor contact in wiper switch	Replace
Wiper fails to stop in the correct position	Wiper motor faulty (Dirty or poor contact of the contacts at the auto-stop position due to foreign matter)	Replace

RY9212001CAS0001US0

2. SERVICE SPECIFICATIONS

Item		Factory Specification	Allowable Limit Value
AC Compressor Magnetic Clutch	Clearance	0.30 to 0.65 mm 0.0118 to 0.0255 in.	–
Magnetic Clutch Stator Coil	Electrical Resistance	3.0 to 4.0 Ω	–
Cooling Cycle (cooling cycle when operating normally)	Pressure (low-pressure side)	0.15 to 0.20 MPa 1.5 to 2.0 kgf/cm^2 21 to 28 psi	–
	Pressure (high-pressure side)	1.27 to 1.66 MPa 13 to 17 kgf/cm^2 185 to 242 psi	–
Pressure switch (dual type) (when pressure switch is off)	Pressure setting (low-pressure side)	Lower than the values below About 0.196 MPa 2.0 kgf/cm^2 28.4 psi	–
	Pressure setting (high-pressure side)	Higher than the values below About 3.14 MPa 32 kgf/cm^2 455 psi	–
AC drive belt	Tension	Deflects 12 to 15 mm (0.47 to 0.59 in.) when 68.6 N (7.0 kgf, 15.4 lbf) of forced is applied	–
Refrigerant	Type (recharge volume)	R134a 700 ± 50 g 1.5 to 0.11 lbs	–
Compressor Oil	Type (usage volume)	ND-OIL8<PAG*oil> 110 to 120 cc 0.116 to 0.127 U.S.qts 0.097 to 0.106 Imp.qts	–

*PAG: Polyalkylene glycol (synthetic oil)

RY9212174CAS0001US0

3. TORQUE

The following table indicates the specified tightening torque for nuts.

Items		N·m	kgf·m	lbf·ft
Condenser mounting	M8 nut	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
Compressor mounting	M8 bolt	16.7 to 19.6	1.7 to 2.0	12.3 to 14.5
Compressor bracket mounting	M12 bolt	77.5 to 90.2	7.9 to 9.2	57.1 to 66.5
	M8 bolt	16.7 to 19.6	1.7 to 2.0	12.3 to 14.5
Receiver mounting	M8 bolt	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2
High pressure line 1 mounting (on condenser side)	M6 bolt	7.8 to 11.8	0.8 to 1.2	5.8 to 8.7
	M22 × 1.5 lock nut	19.6 to 24.5	2.0 to 2.5	14.5 to 18.1
Between condenser and receiver	M6 bolt	3.9 to 6.9	0.4 to 0.7	2.9 to 5.1
	M16 × 1.5 lock nut	11.8 to 14.7	1.2 to 1.5	8.7 to 10.8
High pressure line 2 mounting (on receiver side)	M16 × 1.5 lock nut	11.8 to 14.7	1.2 to 1.5	8.7 to 10.8
Low-pressure line between A/C and compressor	M6 bolt	7.8 to 11.8	0.8 to 1.2	5.8 to 8.7
	M24 × 1.5 lock nut	29.4 to 34.3	3.0 to 3.5	21.7 to 25.3
A/C mounting	M6 bolt	3.9 to 6.9	0.4 to 0.7	2.9 to 5.1
	M8 bolt	9.8 to 15.7	1.0 to 1.6	7.2 to 11.6
Magnetic clutch mounting	M6 bolt	10.8 to 16.2	1.10 to 1.65	8.0 to 11.9

RY9212148CAS0002US0

4. PRECAUTIONS WHEN REPAIRING THE REFRIGERANT SYSTEM

[1] USE OF SERVICE TOOLS

(1) Manifold Gauge Set

Always follow the warnings and regulations below when inspecting or repairing the air conditioning system. It is also extremely important that no one other than specially trained service personnel handles refrigerants.

⚠ CAUTION

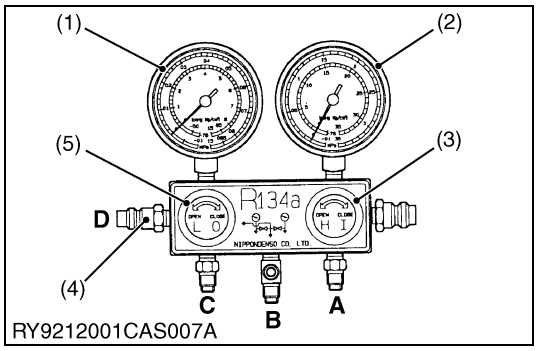
- **If the liquid refrigerant comes in contact with skin, it results in frostbite, so always be careful when handling refrigerants. Always wear goggles when working on this system in order to protect your eyes.**
- **Refrigerant service containers are made very sturdy for safety. However, they can explode if handled improperly. Always follow the instructions printed on their labels. In particular, never heat a refrigerant container above 40 °C (104 °F). Also, never drop one from any height.**
- **Do not steam clean this system. In particular, this system is under extremely high pressure, so do not steam clean the condenser as it may cause the system to explode.**
- **If an error is made in handling the service valve or in connecting a hose between the compressor's service valve and a manifold gauge, it may cause the refrigerant service container or the charging hose to explode. When connecting hoses or handling service valves, always check the pressure on the high-pressure side or on the low-pressure side.**
- **When recharging refrigerant with the compressor operating, do not open the high-pressure valve of the manifold gauge.**
- **Be careful of gas toxicity. The refrigerant gas in its natural state is harmless and is not toxic. However, when it comes in contact with very hot parts, it can break down chemically, producing hazardous materials.**
- **Do not heat service canisters unless absolutely necessary. When necessary to heat a canister, use water at or below 40 °C (104 °F). Never use boiling water to heat a canister.**
- **Take care with the following points on storing and handling service canisters.**
  - **Store in a cool, dry place.**
  - **Never drop or strike a canister.**
  - **Do not use service canisters that are deformed, have unusable screws or are otherwise damaged.**
  - **Never heat a service canister unless necessary. If one must be heated for some reason, use water at or below 40 °C (In such cases, never warm the canister while heating up the water). Do not immerse the valve of the service canister in water. Do not turn the service canister upside down. Turning it upside down allows liquid refrigerant into the compressor, which damages the valve.**
  - **Do not shake hard (If the mounting of the valve is not secure, it may come off).**
  - **Use ND-OIL8 (made by DENSO (Co. Ltd.)) compressor oil (ND-OIL6 is designated for use with R12, so do not mistakenly use ND-OIL6).**
- **Precautions on Inspecting and Charging A/C Gas**
  - **Perform all work in a well-ventilated location.**
  - **Be careful when handling high-pressure valves. When recharging refrigerant with the engine running, do not open the high-pressure valve (HI) of the manifold gauge. Overcharging refrigerant may cause problems such as poor cooling and overheating.**

■ **IMPORTANT**

- **Using R12 refrigerant in an R134a A/C system may cause problems to result, such as leaks of refrigerant at O-rings and fogging of the sight glass. Consequently, the shapes of line joints, service valves and service tools are different in order to prevent mistakes in connecting or recharging the wrong system.**
- **Always keep the work area clean, dry and free of any dirt or dust. Always wipe off any water from line fittings with a clean cloth before opening the fitting.**
- **Only use R134a refrigerant service tools.**
- **When discharging refrigerant, use an R134a refrigerant collection/recycling machine.**
- **Prior to connecting a charging hose to the tap valve of a refrigerant canister, check each seal and make sure it is not clogged up.**
- **When disconnecting charging hoses from compressor and receiver valves, do so as quickly as possible to minimize the leakage of gas.**
- **Be careful to only charge with the specified amount of refrigerant; never overcharge the system. This is important because overcharging the refrigerant can cause poor cooling performance among other things.**

- **Hand tighten when connecting the charging hose to the canister's tap valve. Do not use pliers to tighten the charging hose.**
- **Store refrigerant containers in a cool, dark place and never leave them in direct sunlight or in a hot place.**
- **R134a compressor oil readily absorbs moisture, so always seal any parts after disconnecting them.**
- **Do not use any of the old style R12 refrigerant or previous kinds of refrigerant compressor oil.**

RY9212079CAS0001US0

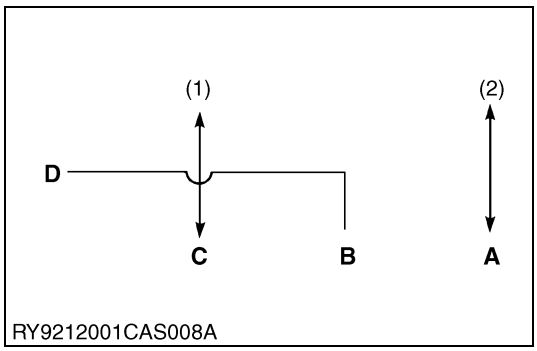


RY9212001CAS007A

The manifold gauge set has a valve handle for opening and closing valves. The valve handle marked LO is for use on the low-pressure valve (5) and the valve handle marked HI is for use on the high-pressure valve (3). The following circuits can be achieved by variously opening and closing the high and low pressure valves.

(1) Low-Pressure Gauge
(2) High-Pressure Gauge
(3) High-Pressure Valve
(4) Valve Core
(5) Low-Pressure Valve

RY9212001CAS0005US0



RY9212001CAS008A

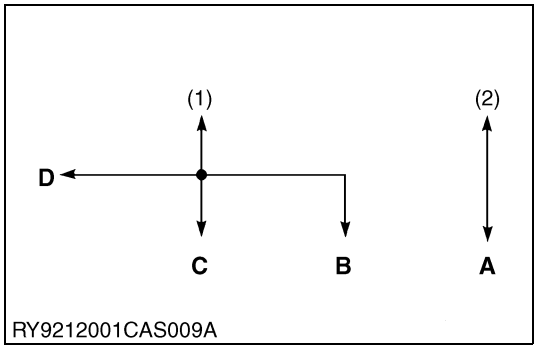
When low and high pressure valves are closed

The following 2 circuits are formed.
Port (C) → Low-pressure gauge (1)
Port (A) → High-pressure gauge (2)

CAUTION
- **Be sure to open the valve core (d).**

(1) Low-Pressure Gauge
(2) High-Pressure Gauge

RY9212001CAS0006US0



RY9212001CAS009A

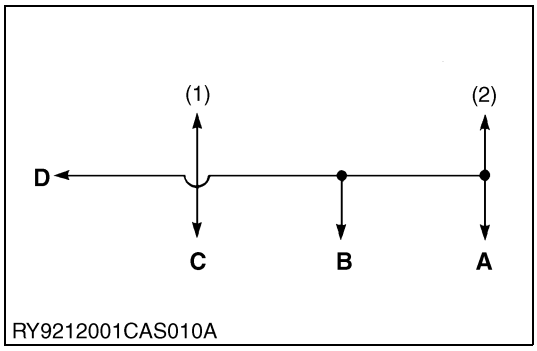
With the low-pressure valve open and the high-pressure valve closed

The following circuits are formed.
Port (C) → Low-pressure gauge (1)
Port (C) → Port (B)
Port (C) → Port (D)
Port (A) → High-pressure gauge (2)

CAUTION
- **Be sure to open the valve core (D).**

(1) Low-Pressure Gauge
(2) High-Pressure Gauge

RY9212001CAS0007US0



RY9212001CAS010A

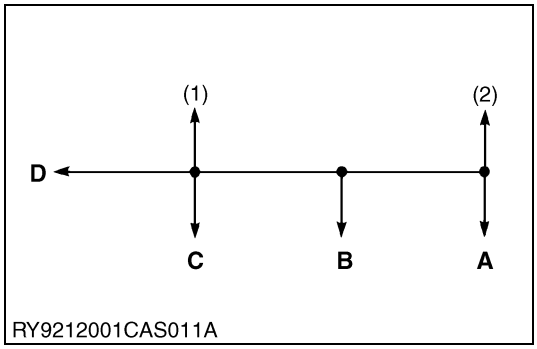
With the low-pressure valve closed and the high-pressure valve open

The following circuits are formed.
Port (C) → Low-pressure gauge (1)
Port (A) → Port (B)
Port (A) → Port (D) (Be sure to open the valve core).
Port (A) → High-pressure gauge (2)

CAUTION
- **Be sure to open the valve core (D).**

(1) Low-Pressure Gauge
(2) High-Pressure Gauge

RY9212001CAS0008US0



RY9212001CAS011A

With low and high pressure valves open

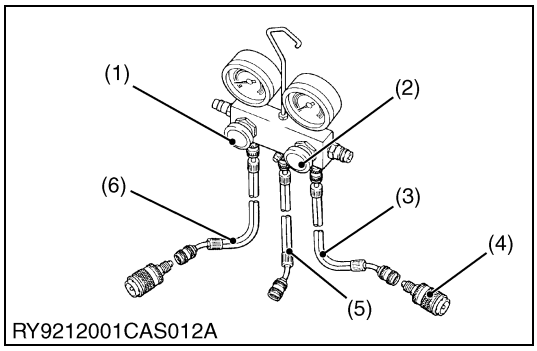
The following circuits are formed.
Port (A) → High-pressure gauge (2)
Port (A) → Low-pressure gauge (1)
Port (A) → Port (B)
Port (A) → Port (C)
Port (A) → Port (D) (Be sure to open the valve core).

CAUTION
- **Be sure to open the valve core (D).**

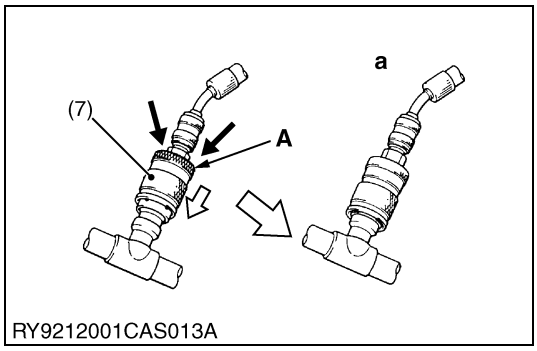
(1) Low-Pressure Gauge
(2) High-Pressure Gauge

RY9212001CAS0009US0

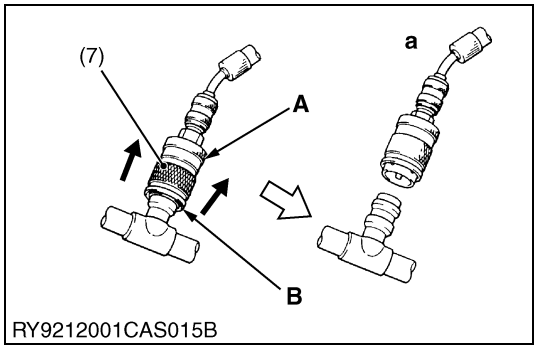
(2) Refrigerant Charging Hoses



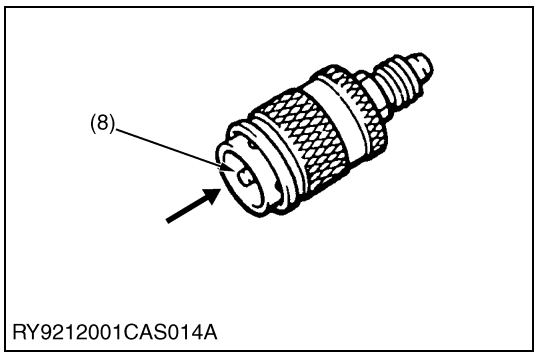
RY9212001CAS012A



RY9212001CAS013A



RY9212001CAS015B



RY9212001CAS014A

The three kinds of refrigerant charging hoses can be identified by color. Each of the refrigerant charging hoses is to be used as follows.
- In line with the A/C manufacturer's recommendation, the blue hose (6) is to be used on the low-pressure side (intake side), the green hose (5) on the cooling side (center connection port) and the red hose (3) on the high-pressure side (discharge side).

(When connecting)
- Press the quick disconnect adapter (4) into the recharge valve and push in on part **A** until you hear it catch.

CAUTION
- **While pressing in to make a connection, be careful not to bend any lines.**
- **If the sleeve (7) moves prior to connecting the quick disconnect adapter to the recharge valve, move the sleeve back to its original position and try again to make the connection.**
- **If there is any refrigerant remaining in the refrigerant recharge hose, it makes it difficult to connect the quick disconnect adapter. In this case, relieve the pressure in the refrigerant recharge hose and then connect the adapter (Pressing on the plunger (8) eliminates any residual pressure).**

(When disconnecting)
- With part **A** of the quick-disconnect adaptor held in place, slide part **B** up.

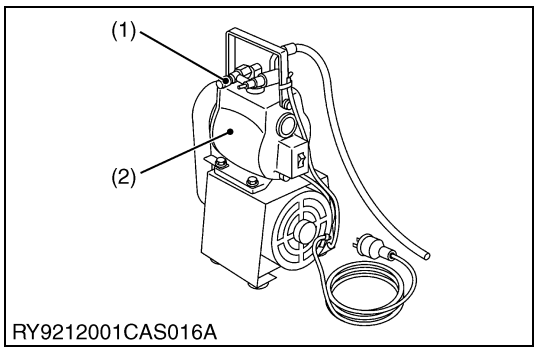
CAUTION
- **After removing the quick-disconnect adapter, be sure to put a cap on the service valve of the adapter.**

(1) Low Pressure Valve
(2) High Pressure Valve
(3) Red Hose
(4) Quick Disconnect Adapter
(5) Green Hose
(6) Blue Hose
(7) Sleeve
(8) Pusher

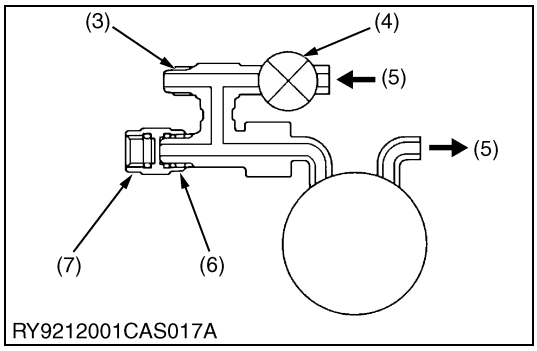
a : Makes a catching sound

RY9212148CAS0003US0

(3) Vacuum Pump Adapter



RY9212001CAS016A



RY9212001CAS017A

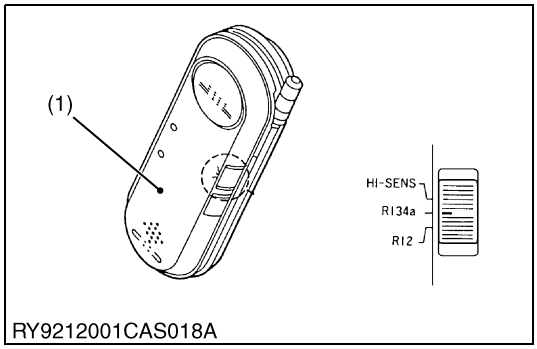
Purpose of the Vacuum Pump Adapter

1. After the A/C cooling system is vacuumed, when the vacuum pump is stopped, there is a vacuum inside the hoses of the manifold gauge, so the oil of the vacuum pump flows back into the refrigerant charging hose. If the refrigerant system is charged in this state, the vacuum pump oil remaining in the refrigerant charging hose will go into the A/C refrigerant system along with the refrigerant. A vacuum pump adaptor equipped with a solenoid valve is used to prevent this backflow of oil from the vacuum pump. The role of the solenoid valve is to close when electricity is flowing to the solenoid valve, cutting it off from outside air and maintaining the vacuum; when the electricity is cut off, the valve opens, bringing in outside air and relieving the vacuum.
2. If this adapter is connected to the currently used R12 vacuum pump, it enables the vacuum pump to be used for both R134a and R12.

(1) Vacuum Pump Adapter
(2) Vacuum Pump
(3) For R134a
(4) Solenoid Valve
(5) Air
(6) For R12
(7) Plug Cap

RY9212001CAS0011US0

(4) Electric Gas Leak Tester



RY9212001CAS018A

The old style R12 gas leak tester are not sensitive enough for R134a and cannot be used. Consequently a new and very sensitive electrical gas leak tester has been designed that can be used with both R134a and R12.

[NOTE]

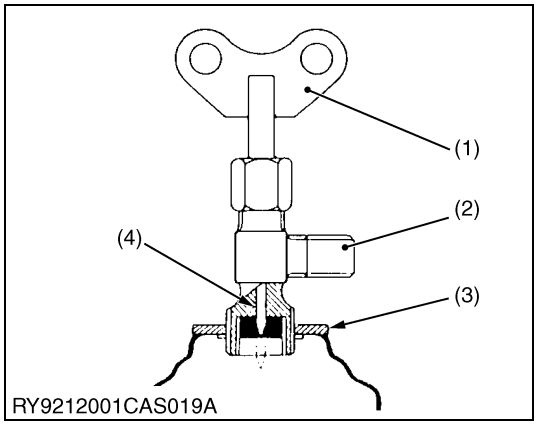
Halogenated Torch Gas Leak Testers

- Because this tester detects gas leaks based on the reaction of chlorine in the refrigerant, it cannot detect R134a because it does not contain chlorine.

(1) Electrical Gas Leak Tester

RY9212001CAS0012US0

(5) Canister Tap Valve



RY9212001CAS019A

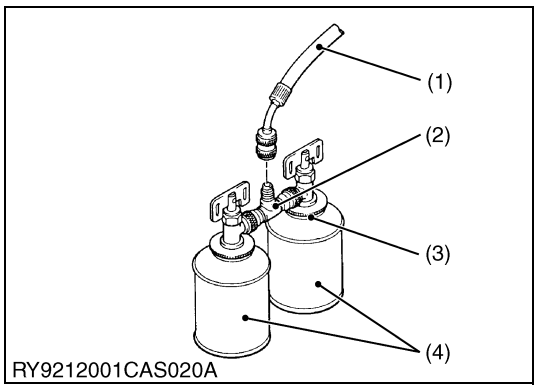
The canister tap valve used in recharging the refrigerant of the A/C system has to be used as follows.

1. Before attaching the canister tap valve to the refrigerant container, rotate the handle (1) counterclockwise until the needle of the valve is completely retracted.
2. Rotate the plate nut (disk) (3) counterclockwise to its highest position and then screw the canister tap valve into the sealed tap.
3. Rotate the plate nut clockwise as far as you can and fasten the center charging hose to the canister tap valve.
4. Tighten the plate nut securely by hand.
5. Rotate the handle (1) clockwise to open a hole in the sealed tap.
6. To charge the system with refrigerant, turn the handle (1) counterclockwise. To stop charging, turn the handle clockwise.

(1) Butterfly Handle
(2) Connector
(3) Disc
(4) Needle

RY9212148CAS0004US0

(6) T-Joint



RY9212001CAS020A

A T-joint (2) is used when using two refrigerant canisters (4) at the same time to make gas recharging more efficient.

1. Attach a refrigerant canister service valve on each side of the T-joint (2) and connect a refrigerant charging hose (1) to the T-joint.

(1) Refrigerant Charging Hose (Green)
(2) T-Joint
(3) Canister Tap Valve
(4) Refrigerant Canister

RY9212001CAS0014US0

(7) R134a Refrigerant Collection/Recycling Device

When it is necessary to discharge the refrigerant in order to work on the machine, a collection / recycling device must be used (Never release refrigerant into the atmosphere).

■ **IMPORTANT**

- **Use a dedicated R134a refrigerant collection/recycling device.**
- **To prevent any damage to the compressor, use neither R12 system refrigerant nor cooling system oil in R134a equipment.**

RY9212001CAS0015US0

5. INSPECTING AND CHARGING THE REFRIGERANT SYSTEM

[1] CHECKING THE SYSTEM WITH A MANIFOLD GAUGE

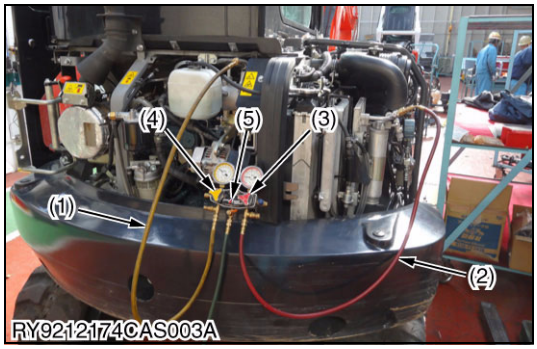
■ **IMPORTANT**

- **Be aware that the gauge pressure values noted in the following test are measured under identical conditions and they may vary somewhat from your gauge pressure values, depending on the prevailing conditions.**

Conditions

- **Ambient temperature : 30 to 35 °C (86 to 95 °F)**
- **Engine RPM : Approx. 1500**
- **Temperature control lever : Max cooling position**
- **Blower switch : HI Position**

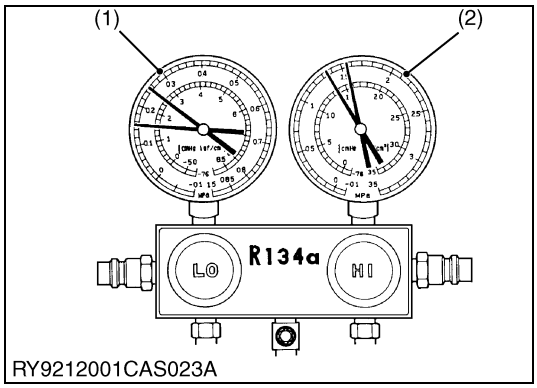
RY9212001CAS0016US0



RY9212174CAS003A



RY9212174CAS004A



RY9212001CAS023A

Manifold connections and test preparations

1. Close the manifold gauge's high (3) and low (4) pressure valves tightly.
2. Connect the red (2) refrigerant charging hose to the high-pressure charge valve (7) and the blue or yellow (1) refrigerant charging hose to the low-pressure charge valve (6).

CAUTION

- **Use the refrigerant pressure in the refrigerant cycle to completely flush out the air in the refrigerant charging hose from the end of the manifold gauge's connection.**

3. Start up the engine and set it at approximately 1500 RPM.
4. Turn the AC switch on and set the temperature control dial to the max cooling position.
5. Set the blower switch to its HI position.

(1) Refrigerant charging hose (blue or yellow)
(2) Refrigerant charging hose (red)
(3) High pressure valve
(4) Low pressure valve
(5) Manifold gauge
(6) Low-pressure side (L mark)
(7) High-pressure side (H mark)

RY9212174CAS0002US0

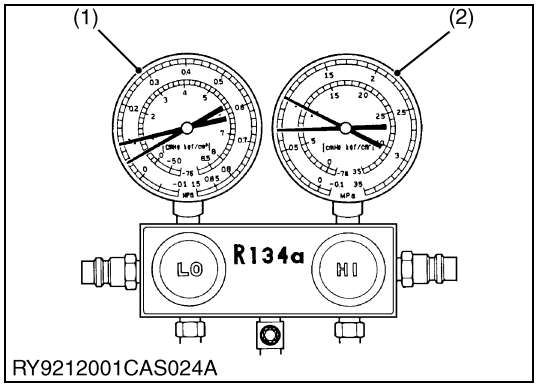
When operating normally

If the refrigerant cycle is operating normally, readings will be around the factory specifications in the table below.

Gas Pressure	Factory specification	Low pressure side	0.15 to 0.20 MPa 1.5 to 2.0 kgf/cm^2 21 to 28 psi
		High pressure side	1.27 to 1.66 MPa 13 to 17 kgf/cm^2 185 to 242 psi

(1) Low Pressure Side
(2) High Pressure Side

RY9212001CAS0018US0



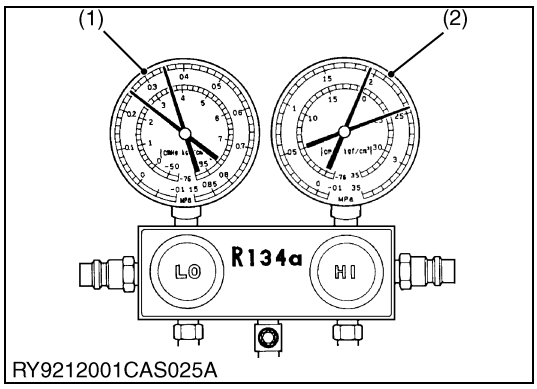
RY9212001CAS024A

Without enough refrigerant

1. Symptoms that appear in the refrigerant cycle
   - Both high (2) and low (1) side pressures are too low. Low-pressure side (1) : 0.05 to 0.10 MPa (0.5 to 1.0 kgf/cm^2, 7.1 to 14.2 psi)
     High-pressure side (2) : 0.69 to 0.98 MPa (7 to 10 kgf/cm^2, 99.6 to 142.2 psi)
   - Foam visible in the sight glass.
   - Air output by the A/C appears to be cooled.
2. Possible Cause
   - Gas leaking from the circuit of the refrigerant cycle.
3. Solution Methods
   - Use an electric gas leak tester to check for leaks and repair any found.
   - Recharge the system with an appropriate amount of refrigerant.

(1) Low Pressure Side (2) High Pressure Side

RY9212001CAS0019US0



RY9212001CAS025A

Excess refrigerant or insufficient condenser cooling

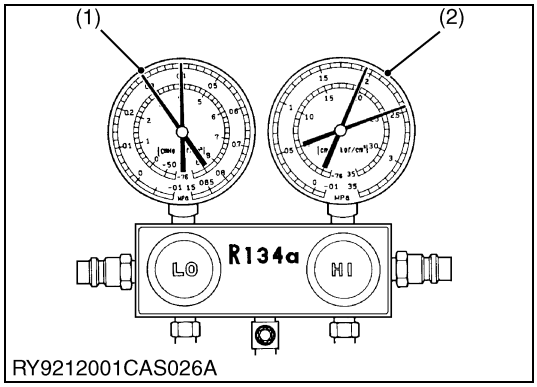
1. Symptoms that appear in the refrigerant cycle
   - Both high (2) and low (1) side pressures are too high. Low-pressure side (1) : 0.20 to 0.35 MPa (2.0 to 3.5 kgf/cm^2, 28.4 to 49.8 psi)
     High-pressure side (2) : 1.96 to 2.45 MPa (20 to 25 kgf/cm^2, 284.5 to 355.6 psi)
2. Possible Causes
   - Cycle charged with too much refrigerant.
   - Poor condenser cooling.
3. Solution Methods
   - Clean the condenser.
   - Adjust the tension of the A/C drive belt to the appropriate tension.
   - If the 2nd item above is normal, check the amount of refrigerant.

CAUTION

- **To discharge excess refrigerant, loosen the manifold's gauge's low-pressure valve and slow discharge it.**

(1) Low Pressure Side (2) High Pressure Side

RY9212001CAS0020US0



RY9212001CAS026A

Air mixed into the cycle

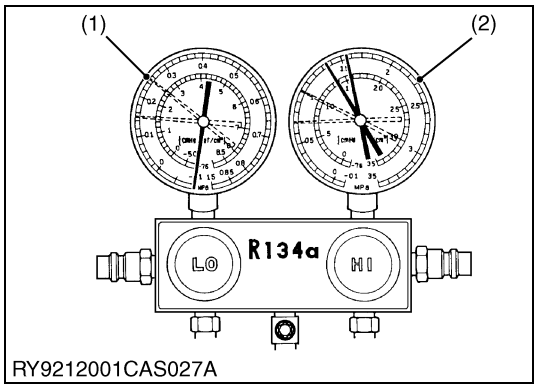
1. Symptoms that appear in the refrigerant cycle
   - Both high (2) and low (1) side pressures are too high. Low-pressure side (1) : 0.20 to 0.35 MPa (2.0 to 3.5 kgf/cm^2, 28.4 to 49.8 psi)
     High-pressure side (2) : 1.96 to 2.45 MPa (20 to 25 kgf/cm^2, 284.5 to 355.6 psi)
   - The line on the low-pressure side (1) feels cold to the touch.
2. Possible Causes
   - Air is mixed in the refrigerant cycle
3. Solution Methods
   - Replace the receiver.
   - Check the amount of compressor oil and whether it is contaminated.
   - Vacuum it out and charge the cycle again with fresh refrigerant.

CAUTION

- **If you fail to vacuum out a refrigerant cycle like that mentioned above and simply charge the cycle with refrigerant, the problem may recur.**

(1) Low Pressure Side (2) High Pressure Side

RY9212001CAS0021US0



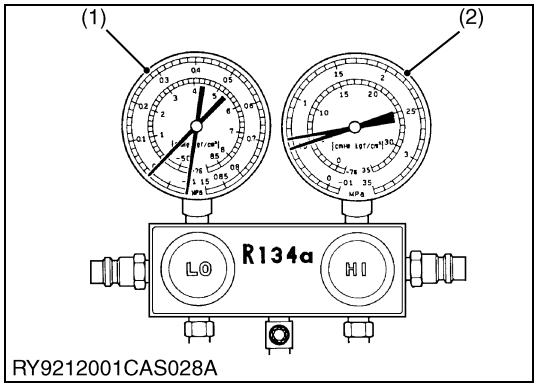
RY9212001CAS027A

Moisture mixed into the cycle

1. Symptoms that appear in the refrigerant cycle
   - At first the A/C works normally, but after some time, the pressure on the low-pressure side (1) becomes a vacuum and the high-pressure side (2) is at a low pressure. Low-pressure side (1) : Vacuum;
     High-pressure side (2) : 0.69 to 0.98 MPa (7 to 10 kgf/cm^2, 99.6 to 142.2 psi)
2. Possible Causes
   - Moisture in the refrigerant cycle freezes up in the expansion valve orifice, creating a temporary blockage. As time elapses, the ice thaws and it returns to normal.
3. Solution Methods
   - Replace the receiver.
   - Eliminate the moisture in the refrigerant cycle by repeatedly vacuuming it out.
   - Recharge the system with an appropriate amount of refrigerant.

(1) Low Pressure Side (2) High Pressure Side

RY9212001CAS0022US0



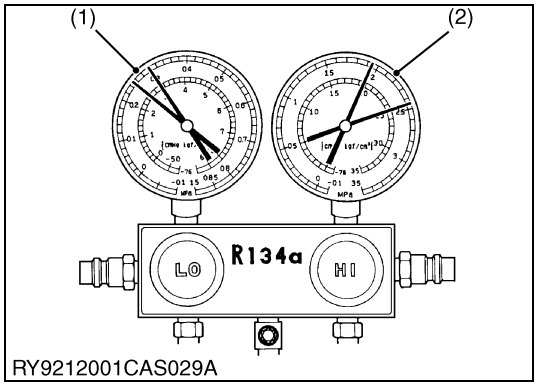
RY9212001CAS028A

Refrigerant fails to circulate

1. Symptoms that appear in the refrigerant cycle
   - Low-pressure side (1) becomes a vacuum and the high-pressure side (2) is at low pressure.
     Low-pressure side (1) : Vacuum;
     High-pressure side (2) : 0.49 to 0.59 MPa (5 to 6 kgf/cm^2, 71.2 to 85.3 psi)
2. Possible Causes
   - The line above the expansion valve orifice is frozen up and the refrigerant cannot flow due to moisture and/or dirt stuck in the refrigerant cycle.
3. Solution Methods
   Wait for some time to elapse and determine whether it is dirt or moisture blocking the line by whether A/C operation recovers or not.
   - If the problem is moisture, the problem resolves itself, as indicated in the previous section.
   - If the cause is dirt, remove the expansion valve and blow out any dirt with compressed air.
   - If the dirt cannot be eliminated, replace the expansion valve and the receiver. Vacuum out the line and charge the cycle with an appropriate amount of fresh refrigerant.
   - If the problem is caused by a gas leak in the heat-sensitive tube, replace the expansion valve.

(1) Low Pressure Side (2) High Pressure Side

RY9212001CAS0023US0



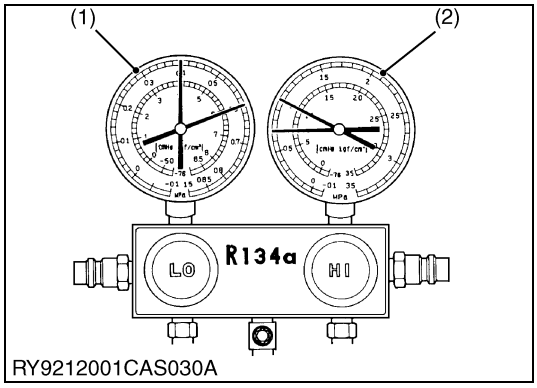
RY9212001CAS029A

Expansion valve too far open

1. Symptoms that appear in the refrigerant cycle
   - Both high (2) and low (1) side pressures are too high. Low-pressure side (1) : 0.29 to 0.39 MPa (3 to 4 kgf/cm^2, 42.7 to 56.9 psi)
     High-pressure side (2) : 1.96 to 2.45 MPa (20 to 25 kgf/cm^2, 284.5 to 355.6 psi)
   - Either frost or heavy condensation on the low-pressure side line
2. Possible Causes
   - Problem with the expansion valve.
   - The flow volume adjustment is set improperly.
3. Solution Methods
   - Replace the expansion valve.

(1) Low Pressure Side (2) High Pressure Side

RY9212001CAS0024US0



RY9212001CAS030A

Faulty compression from compressor

1. Symptoms that appear in the refrigerant cycle
   - Low-pressure side (1) : 0.39 to 0.59 MPa (4 to 6 kgf/cm^2, 56.9 to 85.3 psi)
     High-pressure side (2) : 0.69 to 0.98 MPa (7 to 10 kgf/cm^2, 99.6 to 142.2 psi)
2. Possible Causes
   - Compressor is leaking.
3. Solution Methods
   - Replace the compressor.

CAUTION

- **When the compressor is producing a faulty compression, it can be detected with a manifold gauge (figure at left).**

(1) Low Pressure Side (2) High Pressure Side

RY9212001CAS0025US0

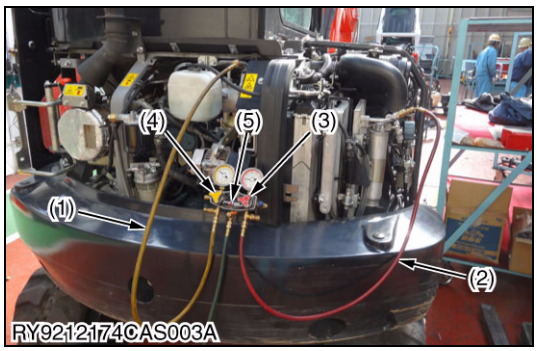
[2] COLLECTION, VACUUMING AND CHARGING

■ **IMPORTANT**

- **Follow 4. Precautions when Repairing the Refrigerant Cycle when discharging, vacuuming and charging the refrigerant system.**

RY9212001CAS0026US0

(1) Collecting Refrigerant





Have a R134a refrigerant collection/recycling device ready to use.

1. Connect the low-pressure hose (blue) (4) from the refrigerant collection/recycling machine to the low-pressure side charge valve (1). Connect the high-pressure hose (red) (5) to the high-pressure charge valve (2).
2. Follow the instructions of the manufacturer and discharge the refrigerant from the cooling system.

■ **IMPORTANT**

- **Do not use any device except an R134a refrigerant collection and recycling machine. In order to prevent damage to the compressor, do not mix R134a equipment, refrigerant or compressor oil into an R12 system.**

CAUTION

- **When removing the charge valve hose, cover it with a rag to protect your fingers and eyes from frost bite from the refrigerant.**

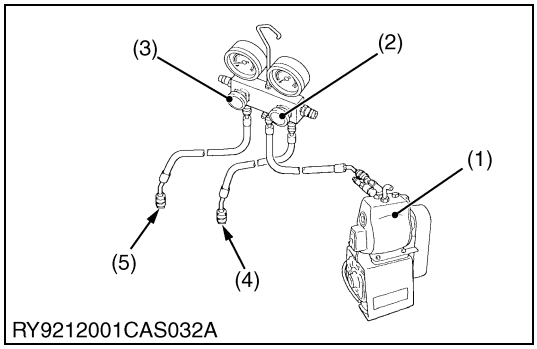
(1) Refrigerant Charging Hose (Blue or Yellow)
(2) Refrigerant Charging Hose (Red)
(3) High Pressure Valve
(4) Low Pressure Valve
(5) Manifold gauge
(6) Low-Pressure Side (L Mark)
(7) High-Pressure Side (H Mark)

RY9212174CAS0003US0

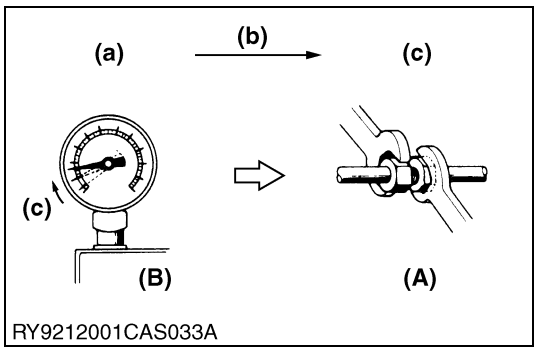
(2) Vacuuming Out the System

No.	Description of Work	Remarks
(1)	Check the connected parts and correct any problems	
(2)	Start vacuuming	Approx 15 minutes, 750 mmHg (229 in.Hg) or greater
(3)	Stop vacuuming	Leave for five minutes
(4)	Check the concentration	If the gauge indicates abnormally, return to (1)
(5)	Charge with refrigerant	98 kPa (1.0 kgf/cm^2, 14 psi)
(6)	Check for gas leaks	
(7)	Charge with refrigerant	

RY9212001CAS0028US0



RY9212001CAS032A



RY9212001CAS033A

Manifold gauge connections and vacuuming

1. Close the high-pressure (HI) and low-pressure (LO) valves of the manifold gauge.
2. Connect the L-shaped side of 2 charging hoses to quick joints and connect them to the compressor and receiver service valves.

Blue hose	Low-pressure side (L mark)
Red hose	High-pressure side (H mark)

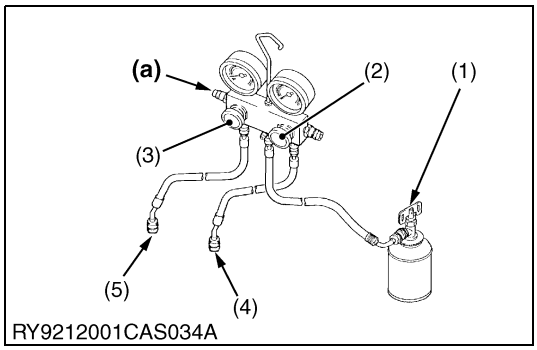
3. Connect the charging hose (green) in the middle of the manifold gauge to the vacuum pump.
4. Open the high and low pressure valves of the manifold gauge.
5. Turn the vacuum pump switch on and vacuum the line until the low-pressure gauge reaches a reading of approximately –0.1 MPa (–750 mmHg). (about 15 minutes)
6. Once about –0.1 MPa (–750 mmHg) is reached, close the high and low pressure valves of the manifold gauge and stop the vacuum pump.
7. Let it set for at least five minutes and check to make sure the indicator needle of the low-pressure gauge does not approach 0.
8. If the needle of the gauge approaches 0, the system's airtightness is compromised somewhere, so after inspecting and repairing the line connections, run the vacuum again and check to make sure there are not any places that are not airtight.

(1) Vacuum Pump
(2) High-Pressure Valve
(3) Low-Pressure Valve
(4) High-Pressure Side (H Mark)
(5) Low-Pressure Side (L Mark)

(A) Inspection Line Connections
(B) Low-Pressure Gauge

(a) Valve Settings (L: Closed, H: Closed)
(b) Leave for at Least Five Minutes
(c) If the Needle Approaches 0, Inspecting and Repairing the Line Connections.

RY9212001CAS0029US0



RY9212001CAS034A

Connections with a refrigerant collector or service canister

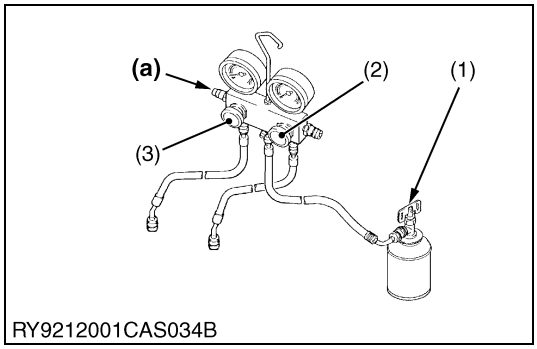
1. Close the high-pressure (HI) and low-pressure (LO) valves of the manifold gauge.
2. Connect the charging hose (green) connected to the vacuum pump to the collector or service canister (Air is in the charging hose, so do not open the high or low pressure valves).
3. Discharge from the collector or open the service canister's valve.
4. Press on the valve core of the manifold gauge for three to five seconds to discharge any air from the hose.

(1) Service Canister Valve
(2) High-Pressure Valve
(3) Low-Pressure Valve
(4) High-Pressure Side (H Mark)
(5) Low-Pressure Side (L Mark)

(a) Press Valve Core to Expel Air

RY9212001CAS0030US0

(3) Charging from the High-Pressure Side



RY9212001CAS034B

Charging from the High-pressure Side

CAUTION
- **Important : do not start the engine. If the engine is running, the gas will flow back and burst either the service canister or a hose.**

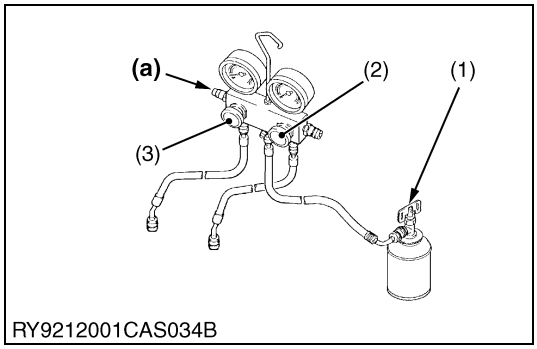
■ **IMPORTANT**
- **Do not open the low-pressure valve of the manifold gauge.**
- **If the service canister has been changed, be sure to expel any air out of the charging hose (green).**

1. Without starting the engine, open the high-pressure valve and charge with approx 500 g of gas.
2. While charging, once the low-pressure gauge indicates approx 0.10 MPa (approx 1.0 kgf/cm^2), close the high-pressure valve and the service canister valve for the time being.
3. Use a gas detector to check the hoses and pipe connections for gas leaks; if any exist, repair them. If there are no leaks, continue charging the refrigerant.
4. When charging on the high-pressure side stops, close the high-pressure valve on the manifold gauge and the service canister valve, and then charge from the low-pressure side.

(1) Service Canister Valve
(2) High-Pressure Valve
(3) Low-Pressure Valve
(a) Press Valve Core to Expel Air

RY9212001CAS0031US0

(4) Charging from the Low-Pressure Side



RY9212001CAS034B

Charging from the Low-Pressure Side

CAUTION
- **Never open the manifold gauge's high-pressure valve when charging refrigerant while the engine is running (If the high-pressure valve is opened, high-pressure gas will flow back up the line and rupture the service canister or a charging hose).**
- **Always keep the service canister upright when charging.**

■ **IMPORTANT**
- **If the service canister has been changed, be sure to expel any air out of the charging hose (green).**

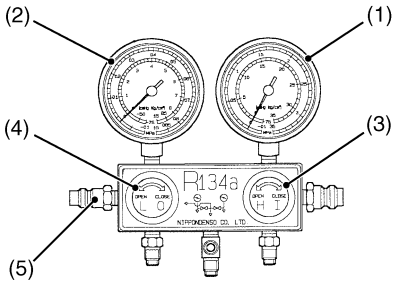
1. Check and make sure the manifold gauge's high-pressure valve is closed.
2. After starting the engine, set it to approx 1500 rpms and open all of the doors.
3. Turn the A/C switch on and set the temperature control to maximum cooling.
4. Open the manifold gauge's low-pressure valve and the service canister valve and charge with the specified amount of gas.
5. After completing refrigerant charging, close the manifold gauge's low-pressure valve and the service canister valve and stop the engine.
6. Check for any gas leaks with the gas leak tester.

(1) Service Canister Valve
(2) High-Pressure Valve
(3) Low-Pressure Valve
(a) Press Valve Core to Expel Air

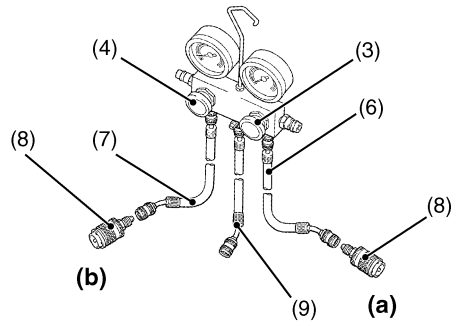
RY9212148CAS0022US0

(5) Inspections and Troubleshooting

[A] Checking the Quantity of A/C Gas



RY9212001CAS035A



RY9212001CAS036A

Checking with a manifold gauge

All the manifold gauge values indicated below are measurements taken under the specified conditions. Please note that the measurements you take will vary depending on the prevailing conditions.

Conditions

Doors	All open
Inside/outside air switch	Inside
Ambient air temperature	30 to 35 °C (86 to 95 °F)
Engine RPM	About 1,500
Temperature control	Max cooling position
Blower switch	HI

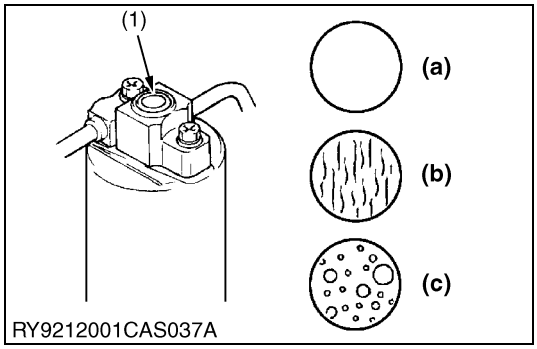
1. After closing both the high and low-pressure valves of the manifold gauge, connect charging hoses (red/blue) to the compressor and the service canister valve of the receiver tank.
2. Loosen the low-pressure valve slightly to expel any air from the charging hose. After expelling the air, close the low-pressure valve again.
3. Expel air from the charging hose on the high-pressure side in the same way.
4. Start the engine and set it at approximately 1500 rpms.
5. Turn the A/C switch ON and set the temperature control to maximum cooling and the blower switch to HI.
6. Read the values on the low-pressure and high-pressure gauges.

When Normal	Factory specification	Low pressure side	0.15 to 0.20 MPa 1.5 to 2.0 kgf/cm^2 21 to 28 psi
	Factory specification	High pressure side	1.27 to 1.66 MPa 13 to 17 kgf/cm^2 185 to 242 psi

(1) High-Pressure Gauge
(2) Low-Pressure Gauge
(3) High-Pressure Valve
(4) Low-Pressure Valve
(5) Valve Core
(6) Red
(7) Blue
(8) Quick Joint
(9) Green

(a) High-Pressure Side (Compressor's H-Mark Side)
(b) Low-Pressure Side (Compressor's L-Mark Side)

RY9212001CAS0033US0



Checking with the sight glass

Conditions

Doors	All open
Inside/outside air switch	Inside
Ambient air temperature	30 to 35 °C (86 to 95 °F)
Engine RPM	About 1500 rpm
Temperature control	Max cooling position
Blower switch	HI

Criteria

(a)	Overcharged	No air bubbles at all in the flow. In this case, both high and low-pressure sides are at high pressure and the cooling is ineffective.
(b)	Normal amount	Almost no air bubbles in the flow. If the engine rpm is raised gradually from idle to 1500 rpm, the air bubbles disappear and the flow becomes transparent.
(c)	Undercharged	Air bubbles flow past constantly.

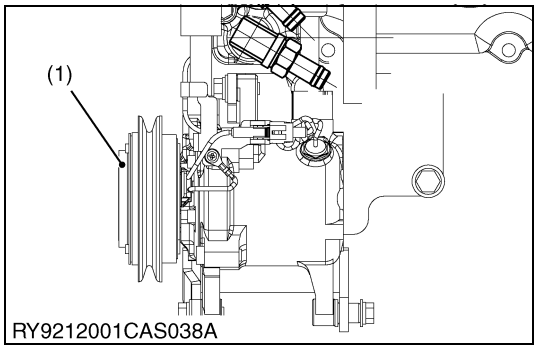
(1) Sight Glass

RY9212001CAS0034US0

6. INSPECTION AND DISASSEMBLY

[1] CHECKS AND ADJUSTMENTS

(1) Compressor



Magnetic clutch

1. Start the engine.
2. With the A/C switch on the A/C control panel off, check and make sure that no scraping sounds or other noise comes from the pulley as it turns.
3. Turn the A/C switch and the fan switch on to make the A/C system operate. With the A/C working, check and make sure the magnetic clutch is not slipping.
4. If there is any noise, repair or replace it.

(1) Magnetic Clutch

RY9212148CAS0008US0

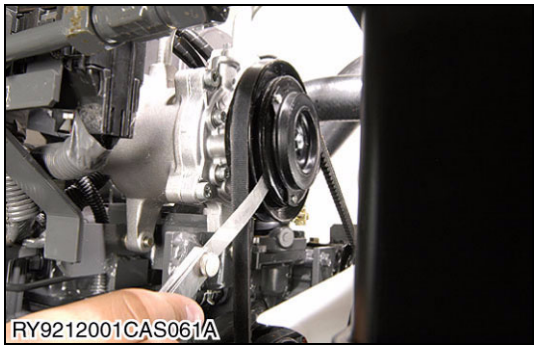


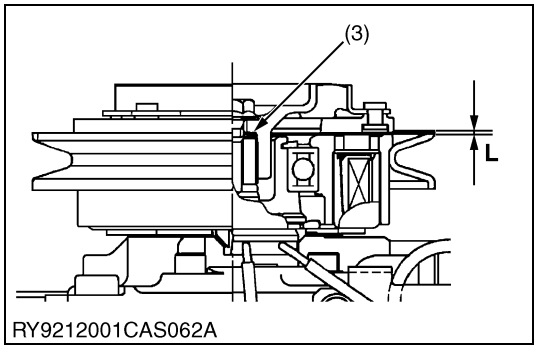
Stator coil

1. Remove the magnetic clutch's 1P connector.
2. Measure the resistance between the 1P connector on the magnetic clutch side and the body of the stator.
3. If the measurement falls outside of the factory specification, replace the stator coil.

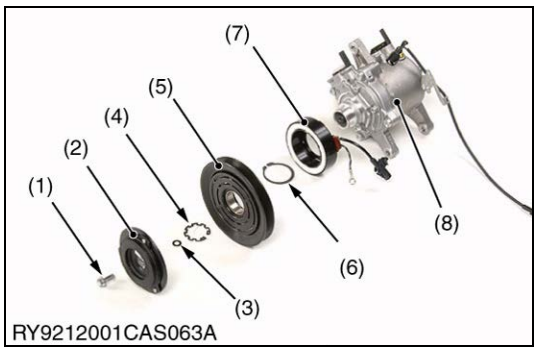
Between stator body and harness side of stator coil	Factory specification	3 to 5 Ω

RY9212148CAS0009US0


RY9212001CAS061A



RY9212001CAS062A



RY9212001CAS063A

Adjusting clearance

1. Use a feeler gauge to check the clearance.
2. If the measurement is outside the factory specification, adjust the clearance.

Clearance	Factory specification	0.30 to 0.65 mm 0.0118 to 0.0255 in.

[NOTE]

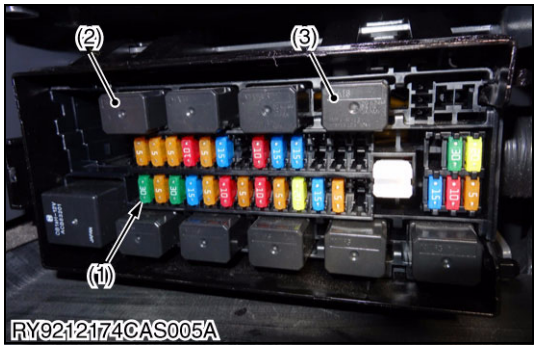
Shim Thickness	Part No.
0.10 mm (0.0039 in.)	T1065-87340
0.15 mm (0.0059 in.)	T1065-87350
0.40 mm (0.016 in.)	T1065-87360
0.60 mm (0.024 in.)	T1065-87370
1.0 mm (0.0394 in.)	T1065-87380

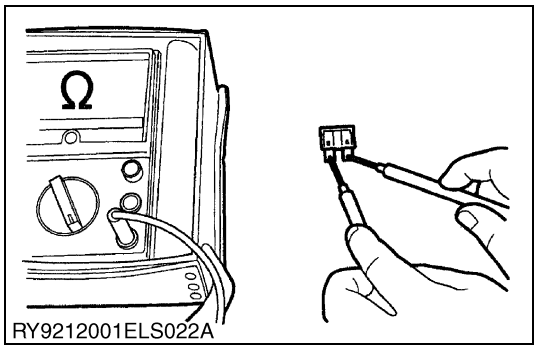
(1) Magnetic Clutch Mounting Screw
(2) Hub Plate
(3) Shim
(4) Snap Ring
(5) Rotor
(6) Snap Ring
(7) Stator
(8) Compressor Body

L : Clearance

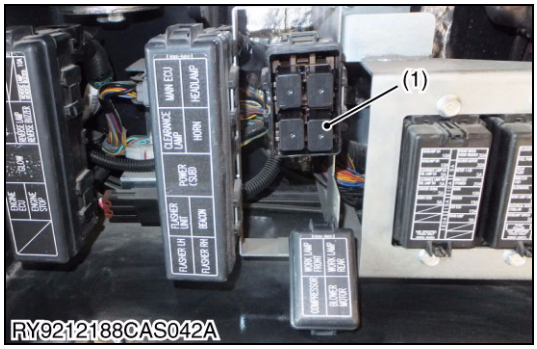
RY9212148CAS0010US0

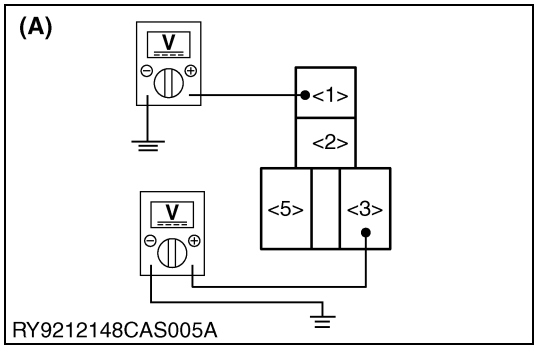
(2) Relays











Blower motor inspection

1. Key switch: STOP
2. Check whether the blower motor fuse (30A) is blown.

Criteria
Regular: no break
Irregular: has a break

3. Switch the blower motor and horn relays.
4. Start the engine, then turn the fan switch to [3] and check if it works.

Criteria
Regular: it works
Irregular: it does not work

(1) Blower Motor Fuse (30 A)
(2) Blower Motor Relay
(3) Horn Relay
(4) Fan Switch

RY9212174CAS0004US0

Blower motor relay voltage check

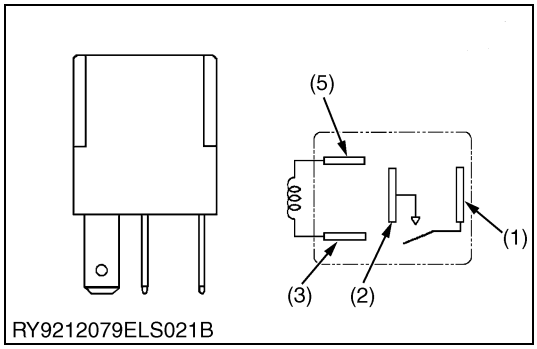
1. Take out the blower motor relay.
2. Key switch: RUN
3. Measure the voltage based on the table below.

Measurement	Connector name (+ terminal side)	Pin No.	Connector name (- terminal side)	Pin No.
(a)	Blower motor relay	<1>	Body GND	–
(b)	Blower motor relay	<3>	Body GND	–

Regular: 12 V
Irregular: Large discrepancy from 12 V

(1) Blower Motor Relay
(A) Fuse Box Terminals

RY9212148CAS0012US0



RY9212079ELS021B

Blower motor inspection

1. Key switch: STOP
2. Take out the blower motor relay.
3. Measure the resistance based on the table below.

Measurement	Relay terminal (+ terminal side)	Relay terminal (- terminal side)
(a)	(3)	(5)

Factory spec: 92 to 112 Ω
Outside factory spec: NG

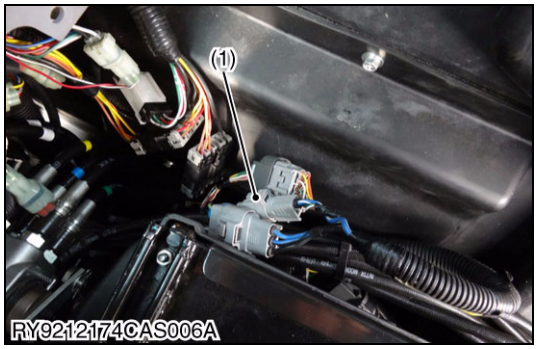
4. Test the continuity based on the table below.

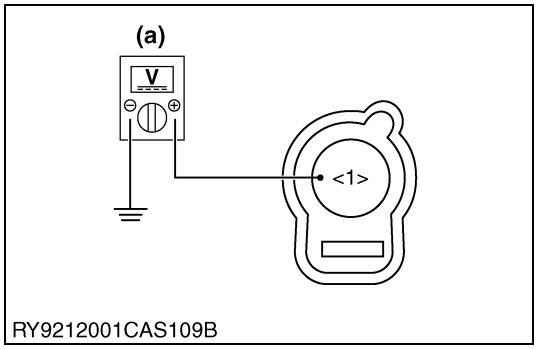
Measurement	Relay terminal (+ terminal side)	Relay terminal (- terminal side)
(a)	(1)	(2)

Regular: No continuity
Irregular: Continuity

RY9212148CAS0013US0

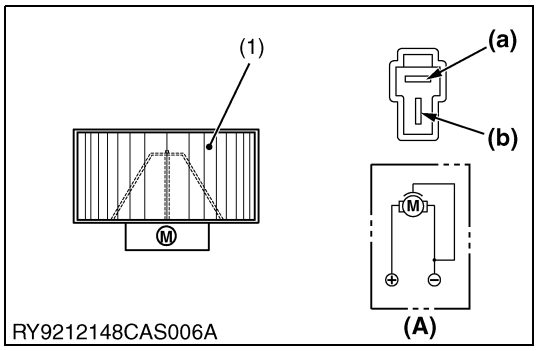
(3) Blower Motor











Checking the Voltage

1. Remove the blower motor connector.
2. After starting the engine, set the fan switch on [3].

   Measure the voltage based on the table below.

Measurement Points	Connector Name (+terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(a)	Blower motor connector	<1>	Body GND	–

Normal: 12 V
Irregular: Large discrepancy from 12 V

(1) Blower Motor Connector (2) Fan Switch

RY9212174CAS0005US0

Blower motor test

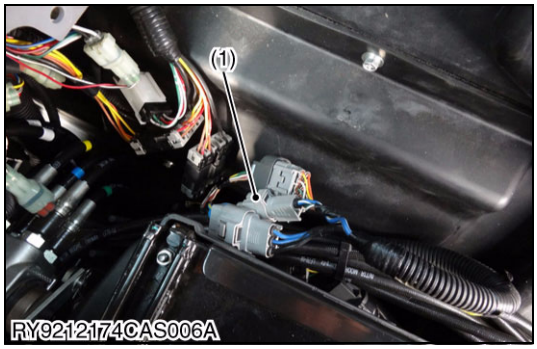
1. Remove the blower resistor.
2. Turn the blower motor by hand and check whether it turns smoothly.
3. If the blower motor fails to turn, check the motor.

(1) Blower Motor

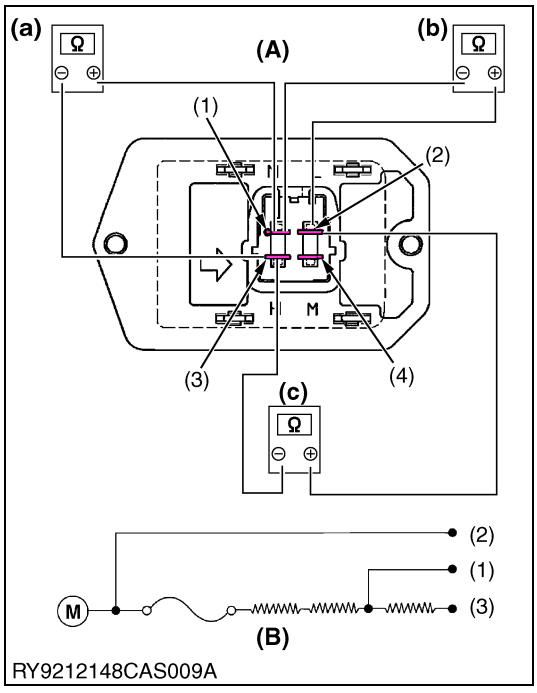
(A) Circuit Diagram
(a) (+) Terminal
(b) (–) Terminal

RY9212148CAS0015US0

(4) Blower Resistor







Checking the Voltage

1. Remove the blower resistor connector.
2. After starting the engine, set the fan switch off.
3. Measure the voltage based on the table below.

Measurement	Connector Name (+terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(a)	Blower resistor connector	<2>	Body GND	–

Normal: 12 V
Irregular: Large discrepancy from 12 V

(1) Blower Resistor Connector (2) Fan Switch

RY9212174CAS0006US0

Inspecting the Blower Resistor

1. Put the key switch in its STOP position.
2. Disconnect the blower resistor connector from the machine and test the resistor on its own.
3. Measure the resistance based on the table below.

Measurement	Between terminals	Factory specification	Assessment Results
(a)	1 – 3	Approx. 1.0 Ω	
(b)	1 – 2	Approx. 0.7 Ω	
(c)	2 – 3	Approx. 1.7 Ω	

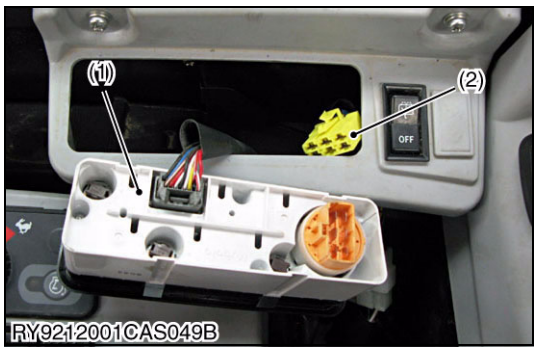
Regular: Within factory specification
Irregular: Outside factory specification

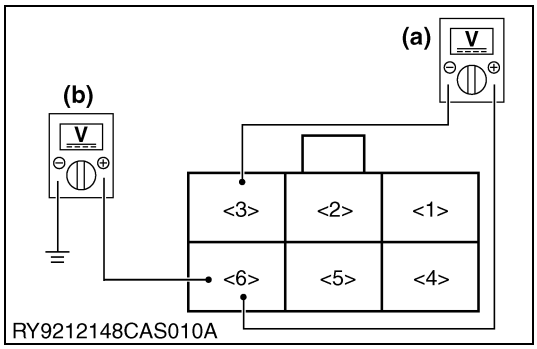
(1) MI
(2) HI
(3) LO
(4) Blank

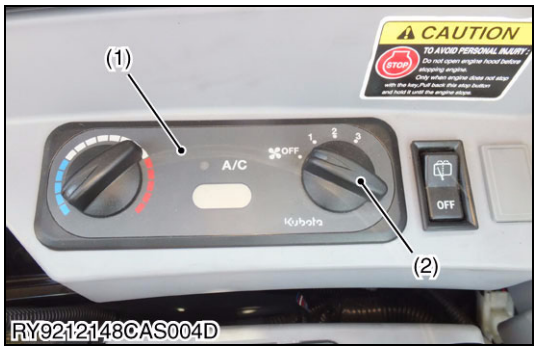
(A) Blower Resistor
(B) Wiring Diagram

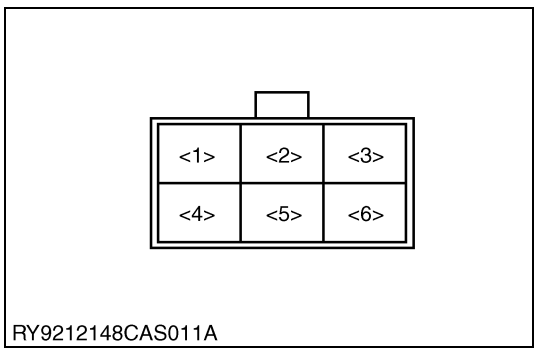
RY9212148CAS0017US0

(5) Blower Switch









Voltage check

1. Disconnect the blower switch connector.
2. Turn the key switch to the RUN position.
3. Measure the voltage based on the table below.

Measurement	Connector terminal name (+ terminal side)	Pin No.	Connector terminal name (- terminal side)	Pin No.
(a)	Blower switch connector	<6>	Blower switch connector	<3>
(b)	Blower switch connector	<6>	Body GND	–

Regular: 12 V
Irregular: Large discrepancy from 12 V

(1) Control Panel (2) Blower Switch Connector

RY9212148CAS0024US0

1. Turn the key switch to the STOP position.
2. Remove the control panel from the machine and test the blower switch independently.

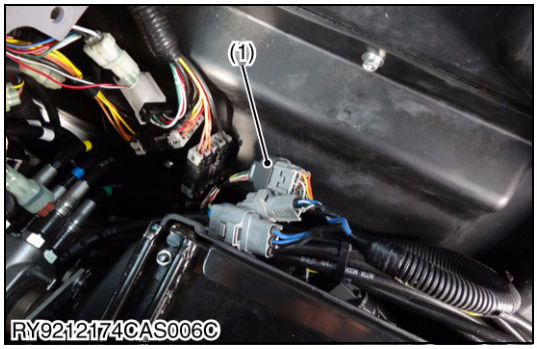
Position		<3>	<6>	<2>	<5>	<1>	<4>
Blower switch	OFF						
	● 1	●	●	●			
	● 2	●	●			●	
	● 3	●	●				●

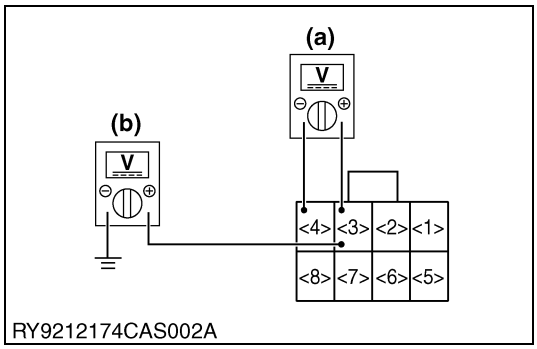
RY9212032CAS011A

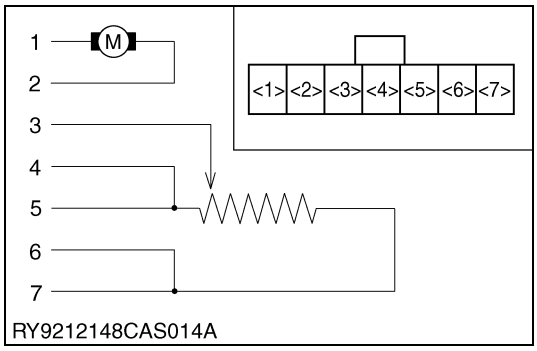
(1) Control Panel (2) Blower Switch

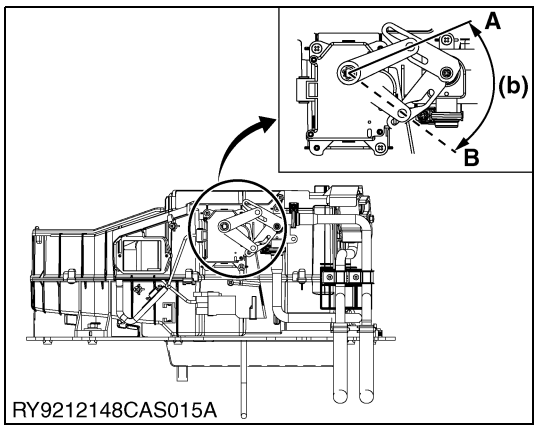
RY9212148CAS0025US0

(6) Servo Motor (for Temp Control)









Voltage check

1. Disconnect the servo motor connector.
2. Turn the key switch to the RUN position.
3. Measure the voltage based on the table below.

Measurement	Connector terminal name (+ terminal side)	Pin No.	Connector terminal name (- terminal side)	Pin No.
(a)	Servo motor connector	<3>	Servo motor connector	<4>
(b)	Servo motor connector	<3>	Body GND	–

Regular: 5 V
Irregular: Large discrepancy from 5 V

(1) Servo Motor Connector

RY9212174CAS0007US0

Servo motor inspection

1. Turn the key switch to the STOP position.
2. Disconnect the servo motor connector from the machine and test the servo motor independently.
3. Measure the resistance based on the table below.

Measurement	Connector terminal name (+ terminal side)	Pin No.	Connector terminal name (- terminal side)	Pin No.
(a)	Servo motor	<1>	Servo motor	<2>

Regular: Approx. 33 Ω (actual reference value)
Irregular: Large discrepancy from 33 Ω

4. Apply the battery voltage to terminals 1 and 2 of the servo motor and check whether it drives the servo motor.
5. Measure the resistance between A and B in the diagram at left according to the table below.

Measurement	Connector terminal name (+ terminal side)	Pin No.	Connector terminal name (- terminal side)	Pin No.
(b)	Servo motor	<3>	Servo motor	<5>

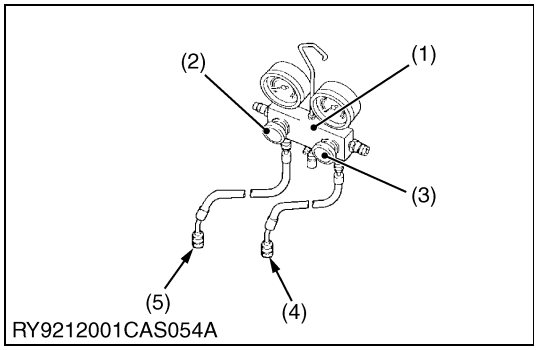
Regular: Gradual change in resistance (0 to within 6 kΩ)
Irregular: No change in resistance

RY9212148CAS0027US0

(7) Pressure Switch

When a pressure switch (inside the high-pressure/low-pressure switch) is operating normally, electricity is conducted (ON) and when an abnormal pressure occurs, it trips the switch, blocking the electricity (OFF).

RY9212001CAS0046US0



RY9212001CAS054A

Manifold gauge connections

1. Close the HI (high-pressure side) valve (3) and the LO (low-pressure side) valve (2) of the manifold gauge (1) securely.
2. Connect the red charging hose (4) to the HI (high-pressure side) charge valve (1) and the blue charging hose (5) to the LO (low-pressure side) charge valve (2).
3. Open the manifold gauge's HI (high-pressure side) valve (3) a little and press on the valve core to expel any air inside its charging hose (4). Then close the HI (high-pressure side) valve (3) tightly.
4. Open the manifold gauge's LO (low-pressure side) valve (2) a little and press on the valve core to expel any air inside its charging hose (5). Then close the LO (low-pressure side) valve (2) tightly.

(1) Manifold Gauge
(2) Low-Pressure Valve
(3) High-Pressure Valve
(4) Red Charging Hose
(5) Blue Charging Hose

RY9212001CAS0047US0


RY9212174CAS007A

When refrigerant pressure is rising (OFF)

1. Start the engine and set it at 1500 rpms. Turn the AC switch on the control panel on, set the fan switch to HI and set the temperature control lever to the max cool position.
2. Cover the front of the condenser with cardboard or the like and raise the pressure on the high-pressure side of the AC cycle.
3. Once the pressure on the high-pressure side rises, the high-pressure switch operates, turning the magnetic clutch of the compressor off. When it does so, read the HI (high-pressure) gauge of the manifold gauge and if it reads higher than the pressure setting, replace the pressure switch (8).

- Pressure setting on the high-pressure side of the switch:
  Switches off at approximately 3.14 MPa (32 kgf/cm^2, 460 psi) or higher

RY9212174CAS0008US0

When refrigerant pressure is dropping (OFF)

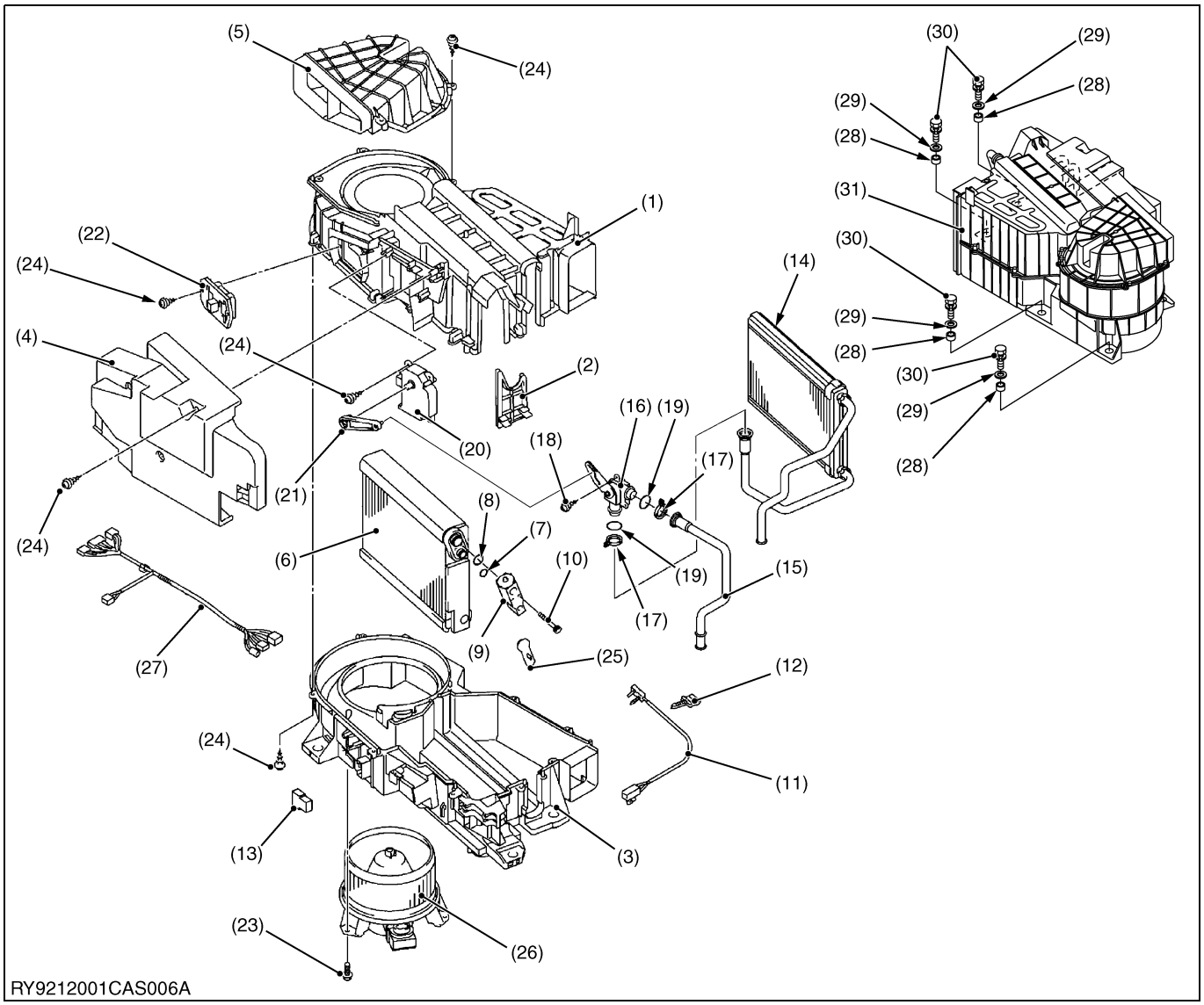
1. Remove the connector of the pressure switch.
2. Measure the resistance between the terminals of the pressure switch with a circuit tester. It should register 0 Ω unless there is insufficient gas due to a leak or unless the pressure switch is faulty.

- Pressure setting on the low-pressure side of the switch:
  Switches off at approximately 0.196 MPa (2.0 kgf/cm^2, 28 psi)

RY9212001CAS0049US0

[2] DISASSEMBLING AND ASSEMBLING

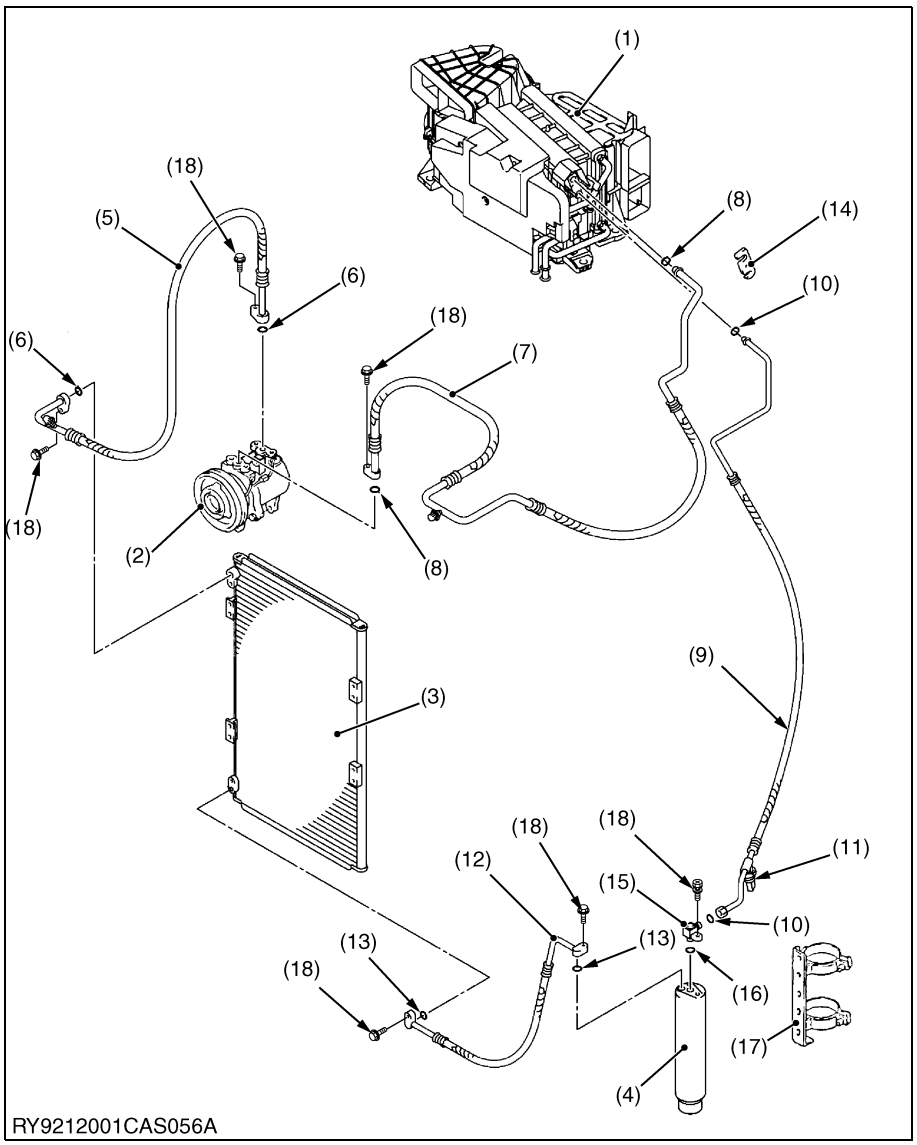
Diagram of AC Unit



(1) Top Case
(2) Evaporator
(3) Bottom Case
(4) Linkage Cover
(5) Intake Cover
(6) Evaporator
(7) O-Ring
(8) O-Ring
(9) Expansion Valve
(10) Expansion Bolt
(11) Thermistor ASSY
(12) Thermistor Clamp
(13) AC Amp
(14) Heater Core
(15) Pipe
(16) Water Valve
(17) Clip
(18) Washer Screw
(19) O-Ring
(20) Servo Motor
(21) Linkage Lever
(22) Blower Resistor
(23) Tapping Screw
(24) Tapping Screw
(25) Cap (Plug)
(26) Blower Fan
(27) Wire Harness
(28) AC Collar
(29) Flat Washer
(30) Bolt
(31) Air Conditioning Unit

RY9212001CAS0050US0

(1) Removing and Installing the AC Hoses



RY9212001CAS056A

(1) Air Conditioning Unit
(2) Compressor and magnetic clutch
(3) Condenser
(4) Receiver
(5) Hose (Discharge)
(6) O-ring
(7) Hose (Suction)
(8) O-ring
(9) Hose (Liquid, Pressure)
(10) O-ring
(11) Pressure Switch
(12) Hose (Liquid)
(13) O-ring
(14) Tube connector
(15) Joint
(16) O-ring
(17) Receiver holder
(18) Bolt (M6)

(When removing)

1. Collect the refrigerant from the AC system.
2. Disconnect the negative (–) cable from the battery and the 1P connector of the magnetic clutch.
3. Remove the AC hoses.

CAUTION

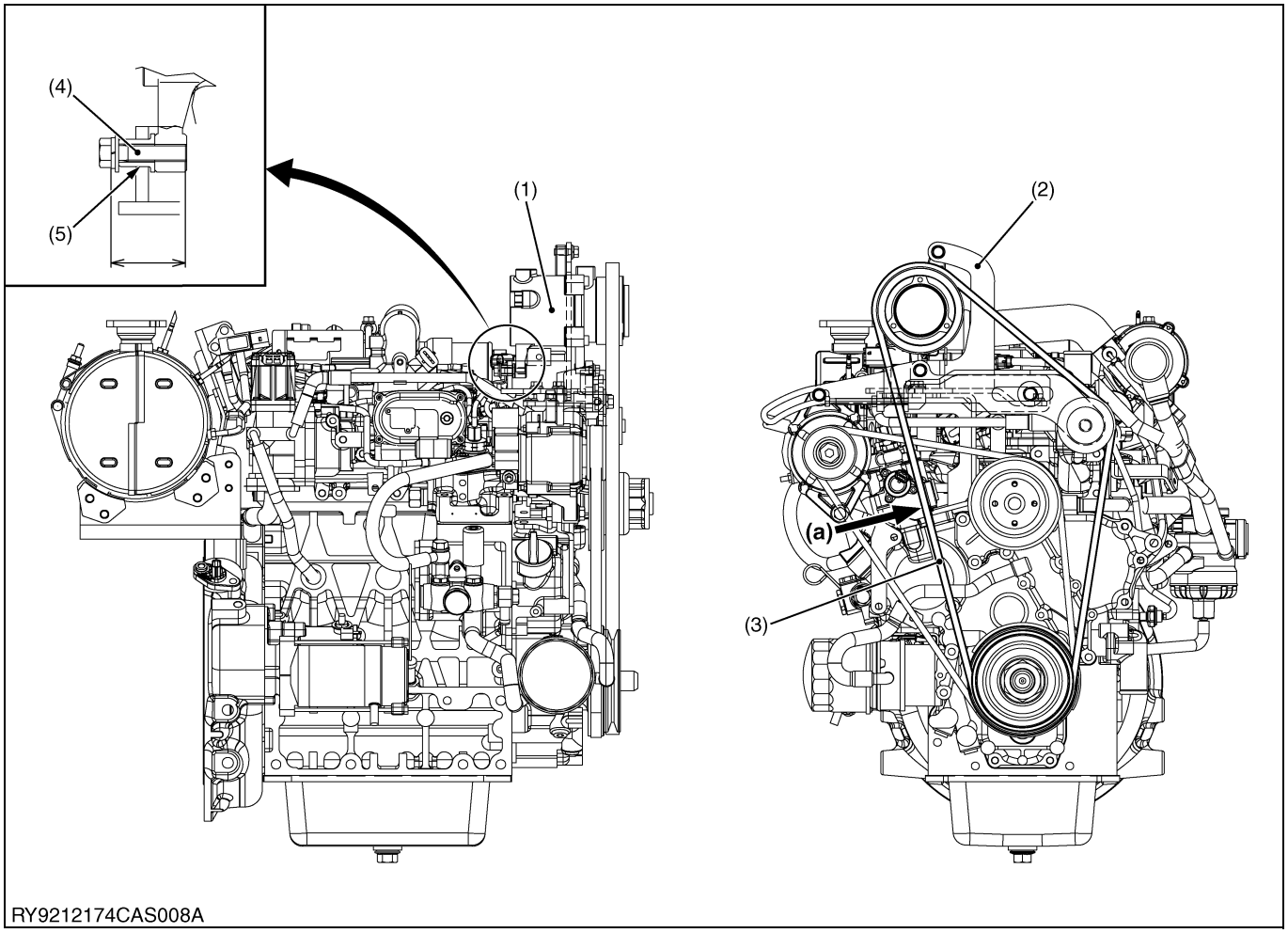
- **After removing hoses, immediately seal the AC system so no moisture or water gets into it.**

(When attaching)

- Pay attention to whether each hose is for high or low pressure.
- Pay attention to whether each hose is an inlet or outlet hose.
- Attach each bolt and tighten to its specified torque.
- Tighten the nuts for aluminum pipe with two wrenches, holding one side from turning and tightening the nut to it. (The mating side is soft, so be careful when tightening.)
- Tighten carefully so the pipe does not turn.
- Apply some compressor oil to pipes that have O-rings and press the tip into the stepped surface.

RY9212001CAS0051US0

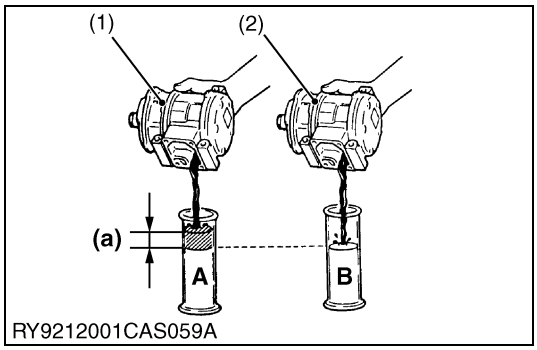
(2) Removing and Installing the Compressor



RY9212174CAS008A

(1) Compressor
(2) Compressor Bracket
(3) V Belt
(4) Bolt
(5) Compressor Bushing
(a) Point to measure compressor belt tension

RY9212174CAS0009US0



RY9212001CAS059A

Filling the Compressor with Oil

When replacing the compressor

- The amount of oil required by the new compressor is enclosed within the A/C cycle. A certain amount of compressor oil circulates along with the gas in the A/C system.
- When replacing the compressor, remove the excess oil from the new compressor.
- Compressor oil (ND-OIL8) readily absorbs moisture, so seal it immediately.

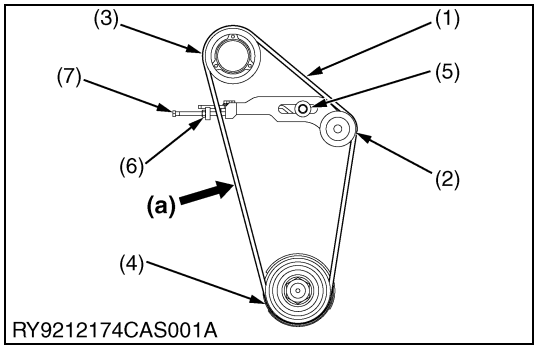
Compressor Oil	Type: ND-OIL8	Capacity (reference value): 60 cc

(1) New Compressor
(2) Compressor Being Replaced

A : Amount of Oil for New Compressor
B : Amount of Oil from Old Compressor

(a) Remove Excess Oil (A-B)

RY9212079CAS0037US0



RY9212174CAS001A

When replacing the compressor, press at point **(a)** on the drive belt and adjust the tension.

■ **IMPORTANT**

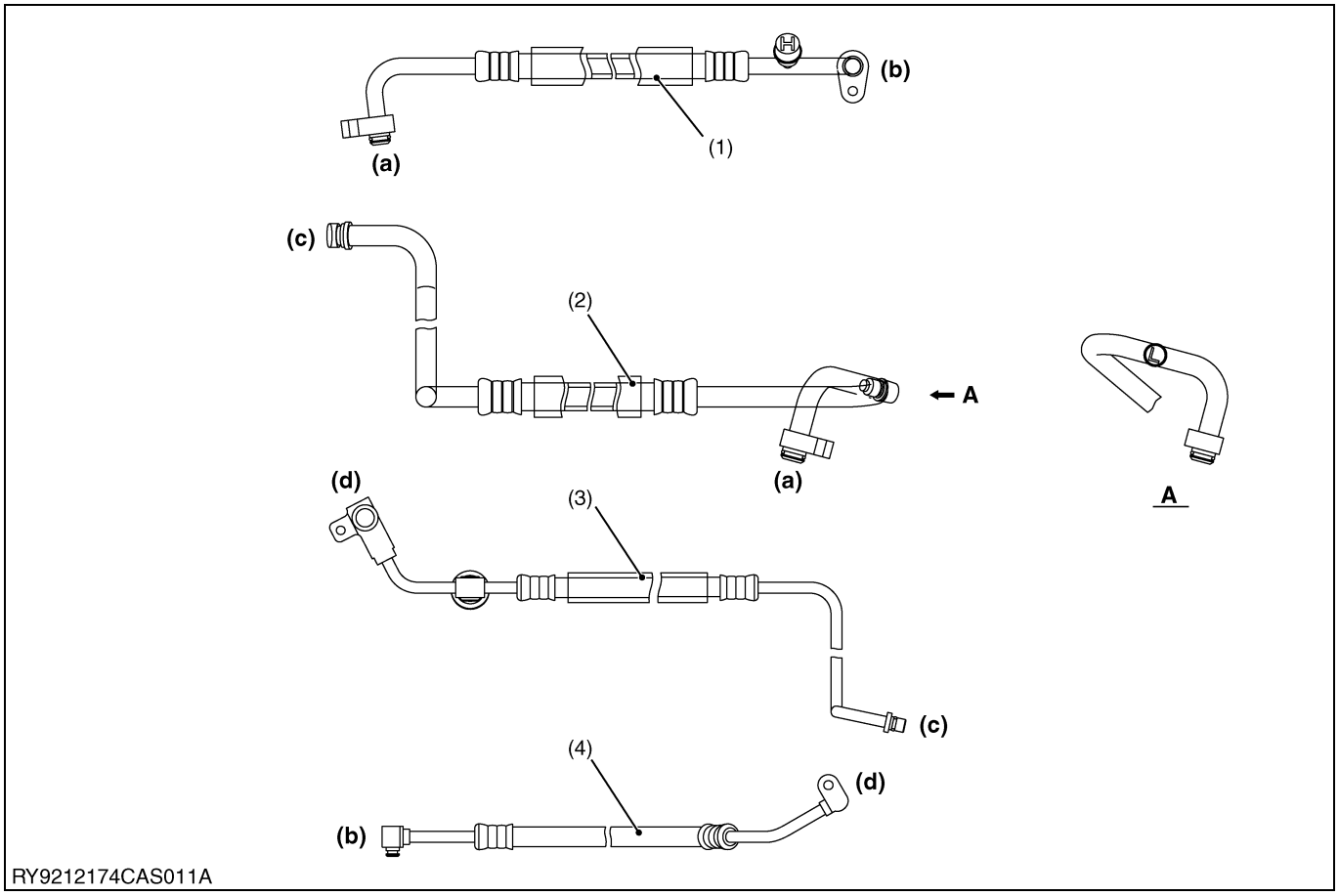
- **Be careful that the compressor bushing faces the right direction.**

Belt tension adjustment	58.8 to 68.6 N 6.0 to 7.0 kgf 13.2 to 15.4 lbf	12 to 15 mm 0.47 to 0.59 in.

(1) V Belt
(2) Tensioner Pulley
(3) Compressor
(4) Drive Pulley
(5) Bolt
(6) Lock Nut
(7) Tension Adjustment Bolt

RY9212174CAS0010US0

(3) Diagram of AC Hoses



RY9212174CAS011A

(1) Discharge Hose
(2) Suction Hose
(3) Liquid Pressure Hose
(4) Liquid Hose
(a) Compressor Side
(b) Condenser Side
(c) AC Unit Side
(d) Receiver Side

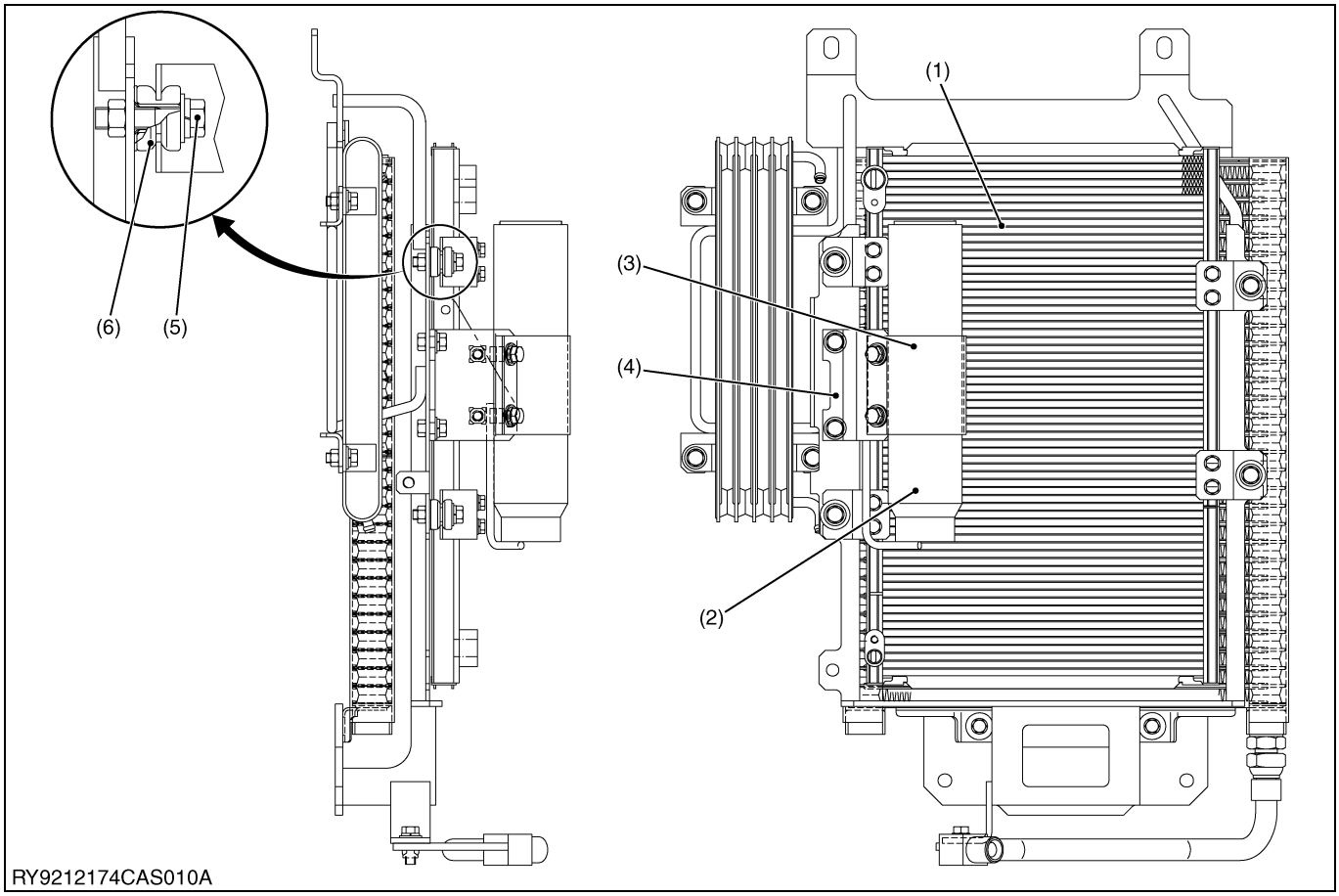
Tightening torque	Compressor (M6 bolt) **(a)**	7.9 to 11.8 N·m 0.8 to 1.2 kgf·m 5.8 to 8.7 lbf·ft
	Condenser (M6 bolt) **(b)**	3.9 to 6.9 N·m 0.4 to 0.7 kgf·m 2.9 to 5.1 lbf·ft
	AC unit (M6 bolt) **(c)**	2.3 to 4.2 N·m 0.2 to 0.4 kgf·m 1.7 to 3.1 lbf·ft
	Receiver (M6 bolt) **(d)**	3.9 to 6.9 N·m 0.4 to 0.7 kgf·m 2.9 to 5.1 lbf·ft

CAUTION

- **Always collect the refrigerant before disconnecting any hoses and promptly seal the AC system so no moisture or water gets into it.**
- **Disconnect the negative battery terminal before disconnecting any connectors.**
- **Be careful not to mix up the high and low-pressure hoses or the charge/discharge hoses.**
- **Apply compressor oil to pipes with O-rings and push the tip in to the ridged surface.**
- **Install so pipes and hoses are not twisted.**
- **Use two wrenches on aluminum pipe nuts and fasten to keep the companion nut from turning. (the material of the companion nut is softer, so be careful when tightening it.)**

RY9212174CAS0011US0

(4) Removing and Installing the Condenser and Receiver



(1) Condenser
(2) Receiver
(3) Receiver Holder
(4) Receiver Bracket
(5) Bolt
(6) Condenser Cushion

Tightening torque	Condenser cushion	17.7 to 20.6 N·m 1.8 to 2.1 kgf·m 13.1 to 15.2 lbf·ft
	Receiver bracket Receiver holder	23.5 to 27.5 N·m 2.4 to 2.8 kgf·m 17.3 to 20.3 lbf·ft

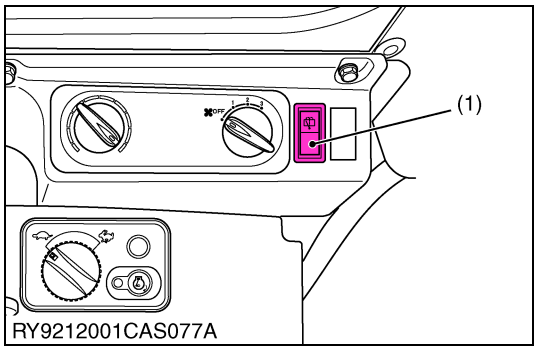
CAUTION

- **Do not remove the cap on the receiver until the hose is installed.**

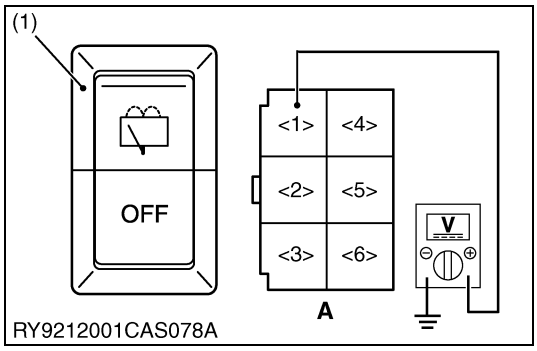
RY9212174CAS0012US0

7. WINDOW WASHER

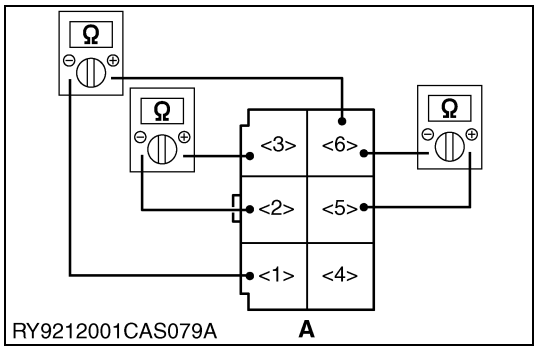
[1] WIPER SWITCH



RY9212001CAS077A



RY9212001CAS078A



RY9212001CAS079A

Connector voltage

1. Remove the 6P connector from the wiper switch.
2. Switch the starter switch to [RUN] and the wiper switch to ON.
3. Measure the voltage between terminal 1of the connector on the harness side and ground on the body.
4. If is the same as the battery voltage (DC 11 to 14 V), it is normal.

(1) Wiper Switch **A : 6P Connector (Harness Side)**

RY9212001CAS0071US0

Checking the wiper switch

1. Check the continuity between each of the terminals according to the table below.
2. If continuity exists, it is normal.

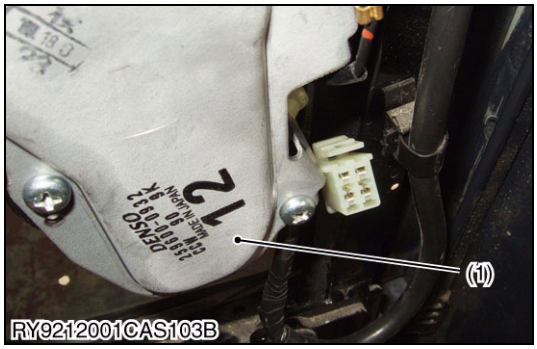
Position	<3>	<2>	<1>	<6>	<5>
WASH1	●	●		●	●
ON			●	●	
OFF				●	●
WASH2	●	●	●	●	

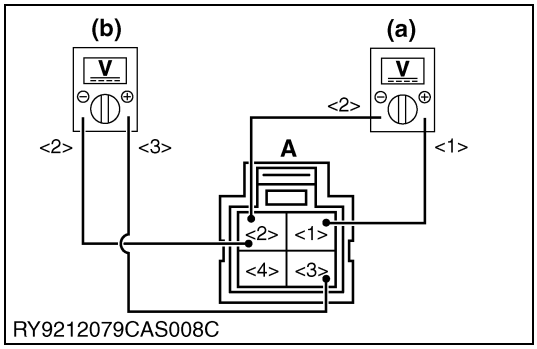
RY9212032CAS012A

A : 6P Connector (Switch Side)

RY9212001CAS0072US0

[2] WIPER MOTOR





Checking the Voltage

1. Remove the wiper motor connector.
2. Start the engine and turn the wiper switch ON.

Measure the voltage based on the table below.

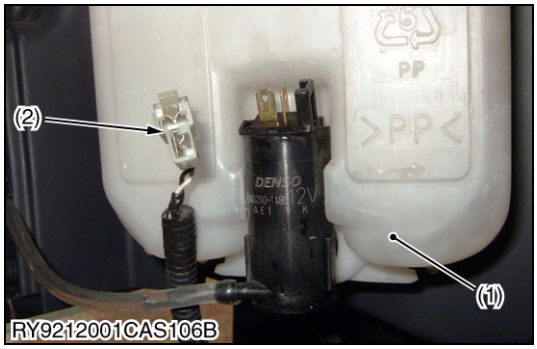
Measurement Points	Connector Name (+terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(a)	Wiper motor connector	<1>	Wiper motor connector	<2>
(b)	Wiper motor connector	<3>	Wiper motor connector	<2>

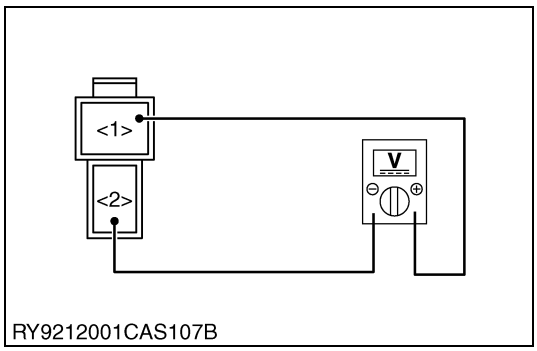
Regular: 12 V
Irregular: Large discrepancy from 12 V

(1) Wiper Motor **A : Wiper Motor Connector**

RY9212148CAS0019US0

[3] WASHER MOTOR





Checking the Voltage

1. Remove the washer motor connector.
2. Start the engine and turn the wiper switch ON.

Measure the voltage based on the table below.

Measurement Points	Connector Name (+terminal side)	Pin No.	Connector Name (- terminal side)	Pin No.
(a)	Washer motor connector	<2>	Washer motor connector	<1>

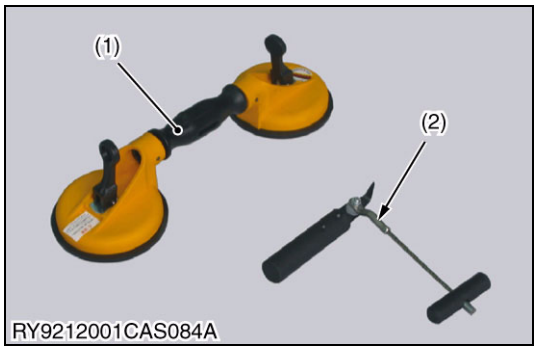
Regular: 12 V
Irregular: Large discrepancy from 12 V

(1) Washer Tank (2) Washer Motor Connector

RY9212148CAS0020US0

8. REMOVING AND INSTALLING THE GLASS

[1] PREPARATION



Items required

- Cleaner : Equivalent of Seeker Cleaner 205
- Adhesive : Equivalent of Seeker Flex 250PC-JM
- Primer : Equivalent of Seeker Primer 206
- Scraper
- Awl
- Adhesive cutter
- Glass suction cups (use if needed)

■ **NOTE**

- **The cleaner and adhesive have a short shelf-life (9 to 12 months), so obtain them immediately before use from a nearby manufacturer or a shop that handles auto glass products.**

(1) Glass Suction Cups (2) Adhesive Cutter

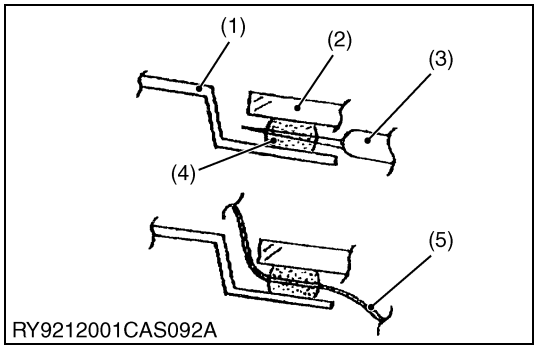
RY9212001CAS0085US0

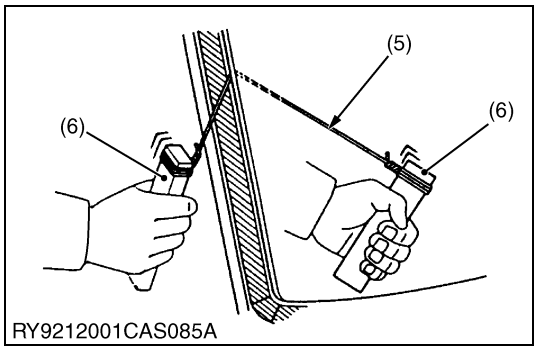
[2] REMOVING GLASS

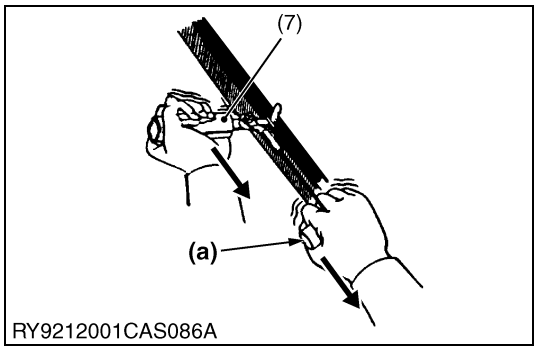
CAUTION

- **The section on removing and installing glass was created as a general explanation of the work method and it may differ from the removal/installation methods for glass installed on the machine covered by this workshop manual.**

RY9212148CAS0035US0







1. Mask off painted surface around the glass to protect them from scratching while removing/installing glass.
2. Remove the glass.

[When using piano wire (damages parts of the glass)]

- Pierce and make a hole in the adhesive with an awl (or knife of glass cutter, etc.).
- Pass the piano wire (or steel wire) through the hole.
- Wrap both ends of the piano wire around a wood block or the like.
- Pull the piano wire along the edge of the window, sawing through the adhesive between the cab and the glass; then remove the glass from the cab.

[When using an adhesive cutter (completely ruins the glass)]

- Insert the adhesive cutter into the adhesive.
- Pull on part **(a)** of the cutter and cut the glass out.

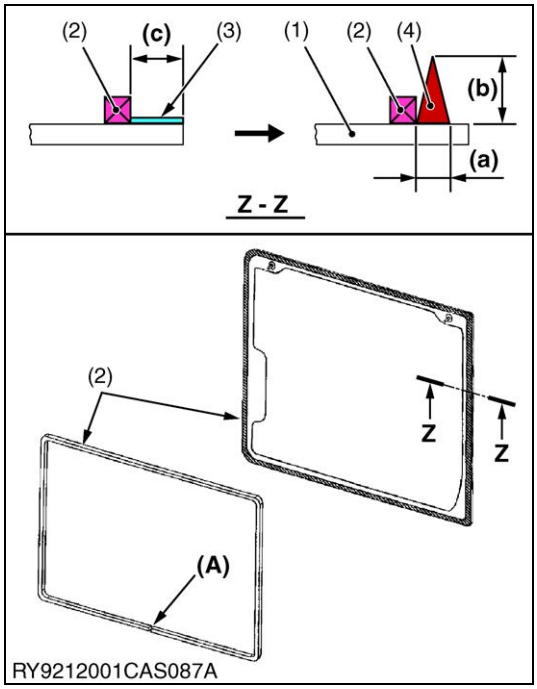
CAUTION

- **If the piano wire gets very hot in one place, it may break. Avoid rubbing it with much force against the edge of the glass.**
- **Be careful not to cut yourself on fragments of glass or the blade of the cutter.**

(1) Cab Frame
(2) Glass
(3) Awl
(4) Adhesive
(5) Piano Wire
(6) Wood
(7) Adhesive Cutter

RY9212001CAS0086US0

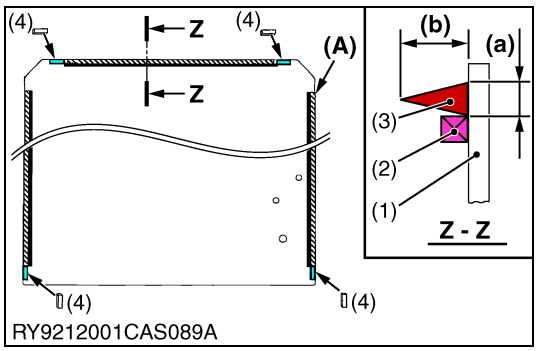
[3] INSTALLING GLASS



1. Completely eliminate all old adhesive on the frame of the cab.
2. Use the cleaner to clean the cab frame and the surface of the new glass where adhesive will be applied to get rid of any dirt or oil.
3. Affix the windshield dam to the surface of the new glass where the adhesive will be applied.
4. Apply primer uniformly around the circumference of the windshield dam.
5. Apply adhesive uniformly along the outer circumference of the windshield dam.
6. Apply primer uniformly around the entire circumference of the flange of the cab frame. (Application width: 18 mm (0.71 in.) or more)
7. Make and install a spacer for in between the edge of the glass and the cab's frame so that the glass does not slide down during installation. (holds position and prevents slipping)
8. Press slightly all the way around the edge of the glass from the outside, so the glass touches the shield dam and they stick together.
9. Hold the glass in place with packing tape until the adhesive hardens so the glass does not shift or come off.

(1)	Glass	**(a)**	**At Least 7 mm (0.28 in.)**
(2)	Windshield Dam (W/Adhesive)	**(b)**	**At Least 12 mm (0.47 in.)**
(3)	Primer (Apply)	**(c)**	**12 mm (0.47 in.)**
(4)	Adhesive (Apply)	**(A)**	**Start Affixing Dam Here**

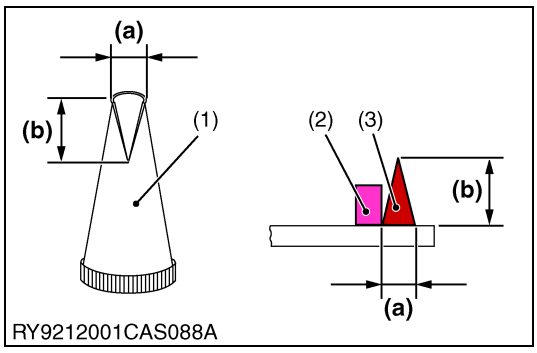
RY9212001CAS0087US0



- For the front window

(1)	Glass	**(a)**	**At Least 7 mm (0.28 in.)**
(2)	Windshield Dam (W/Adhesive)	**(b)**	**At Least 12 mm (0.47 in.)**
(3)	Adhesive (Apply)		
(4)	Fastener (Affix as Male/Female Set)	**(A)**	**Line Up with the Edge of the Frame**

RY9212001CAS0088US0



- Recommended shape of triangular bead

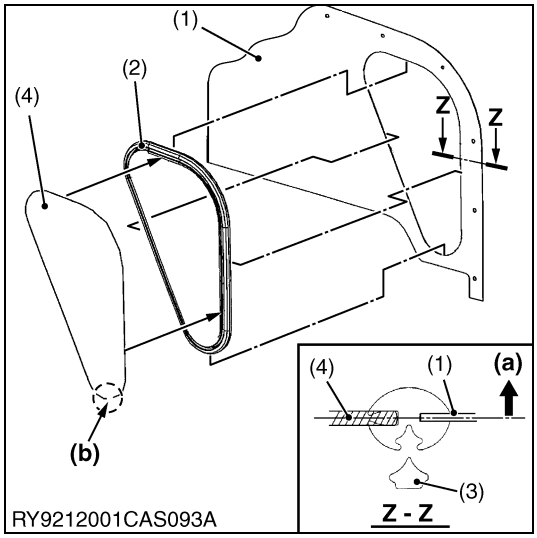
■ **NOTE**

- **Cut the tip of the nozzle of the adhesive cartridge in the shape of a V.**
- **Apply the adhesive to the glass so it forms a uniform triangular bead.**

(1)	Nozzle Tip	**(a)**	**At Least 8 mm (0.31 in.)**
(2)	Windshield Dam (W/Adhesive)	**(b)**	**At Least 12 mm (0.47 in.)**
(3)	Adhesive (Apply)		

RY9212001CAS0089US0

[4] GLASS TRIM TYPE



(When removing)
1. Lift the rubber core by its seam and remove it.
2. Remove the glass to the outside.

(When attaching)
1. From the outside, insert the glass into the glass trim.
2. Insert the rubber core into the groove all the way around the trim.
3. Start inserting the rubber core at the bottom center. (to prevent rain from getting in)

(1) Panel
(2) Glass Trim
(3) Rubber Core
(4) Glass

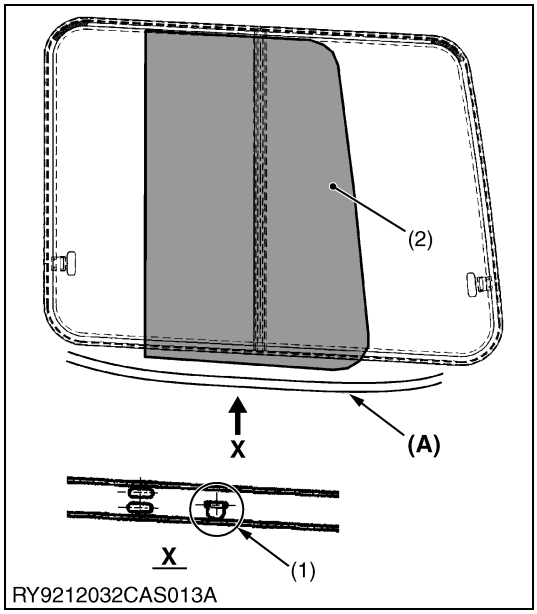
(a) Inside
(b) Start Here

RY9212001CAS0090US0

[5] HOW TO REPLACE THE GLASS OF THE RIGHT-SIDE WINDOW

Put something like a piano wire into the outer window frame, pull it along the frame, remove the adhesive agent and cut it off from the cab frame. Replace the window glass followed by the next procedure.

RY9212032CAS0012US0



How to replace the glass

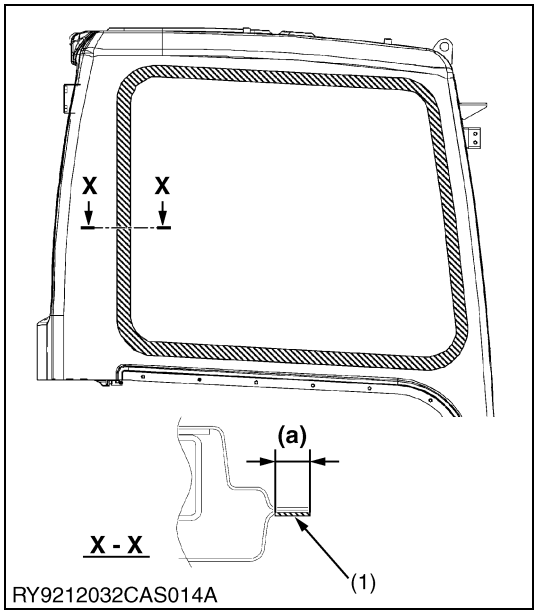
1. Lift the pin up with a flat-head driver.
   Remove the sealant first and lift the pin.
2. Open the window to the point as shown in the figure.
3. Push down to widen up the window frame within elastic deflection not enough to deform itself permanently and replace the glass.
   And the same way when you install the glass.
4. Put the pin back and apply sealant.

■ **NOTE**
- **Use same brand of an adhesive agent and a primer**
  E.g.)
  - **Cleaner: TK cleaner made in Daishin Chemistry**
  - **Adhesive agent: Sikaflex-260AP (SikaTack-Go!) or MSI made Sunrise U90**
  - **Primer: Sika Coating Activator or MSI made Sunrise Primer 24**

(1) Pin
(2) Window

(A) Push down to widen up the window frame

RY9212148CAS0023US0



RY9212032CAS014A

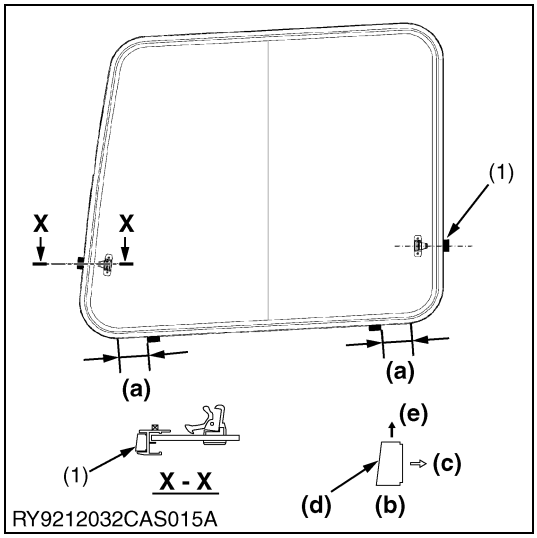
How to apply primer on the cab side

1. Remove dirt and grease on the opening surface of the glass sash's flange with a cleaner such as white gasoline. Avoid using an alcoholic cleaner.
2. Apply body primer evenly all around of flange from the end.

■ **NOTE**
- **You have to finish the glass installation within 3 min. to 6 hours after coating the primer.**

(1) Primer (Apply)
(a) 18 mm (0.71 in.) or more

RY9212032CAS0014US0



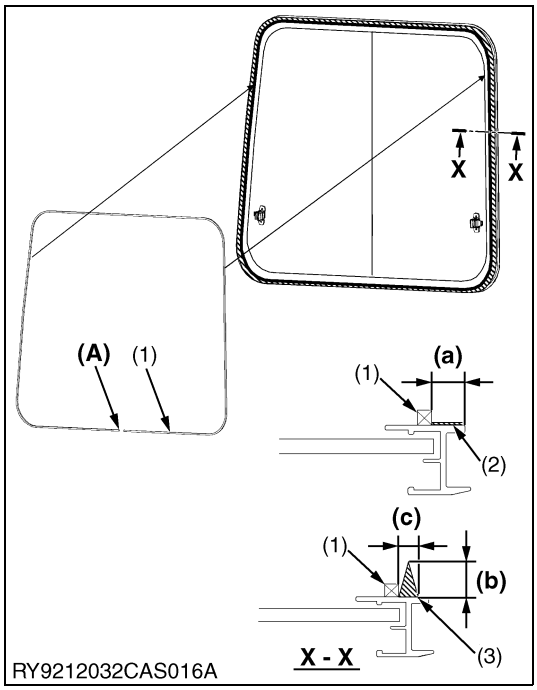
RY9212032CAS015A

How to install the glass spacer

1. Remove dirt and grease on the surface of glass spacer with a cleaner such as white gasoline.
2. Apply the primer to the glass spacer.
3. Install the glass spacer in the glass sash. (4 spots)

(1) Glass Spacer
(a) 100 mm (3.9 in.)
(b) Cross Section of the Spacer
(c) Install in the Sash
(d) Inclined Surface
(e) Cab Side

RY9212032CAS0015US0



RY9212032CAS016A

How to install the sealant dam and apply the primer

1. Remove dirt and grease on the surface of the circumference at the back of the sash glass to apply an adhesive agent and on the surface of applying a sealant dam with a cleaner such as white gasoline. Avoid using an alcoholic cleaner.
2. Put a sealant dam on the position as shown in the figure and evenly apply the primer peripherally.

[How to apply adhesive]

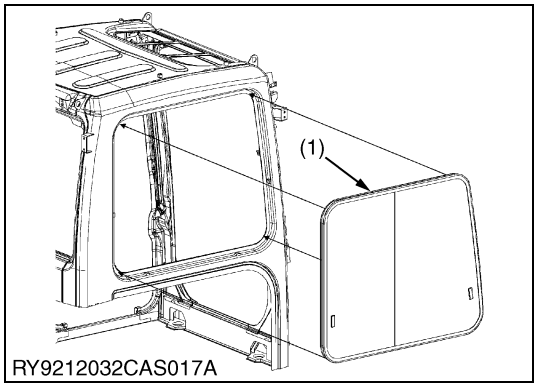
1. Apply the adhesive along the circumference of the sealant dam.

■ **NOTE**
- **You have to finish the glass installation within 3 min. to 6 hours after coating the primer.**
- **In order to keep water-tightness, the adhesive must be applied unbrokenly.**
- **Installation of glass needs to be done within 3 min. after the adhesive is applied.**

(1) Sealant Dam (W/Adhesive)
(2) Primer (Apply)
(3) Adhesive (Apply)
(a) 12 mm (0.47 in.)
(b) 12 mm (0.47 in.) or more
(c) 7 mm (0.27 in.) or more

(A) Starting Point of Installation

RY9212032CAS0016US0



RY9212032CAS017A

How to install the glass sash

1. Set the glass in the sash on which the adhesive has been already applied and install to attach on the cabin frame.

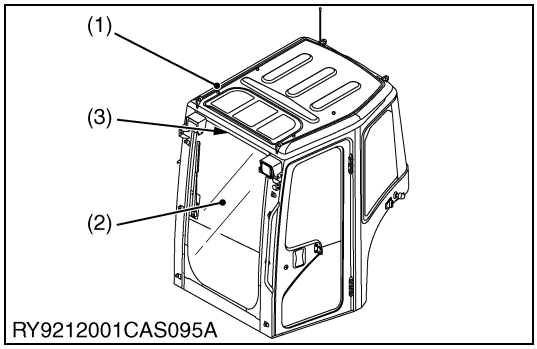
■ **NOTE**
- **Adhesive should not be run off the edge of the sash after the glass sash is set.**
- **Need to maintain that state for about 24 hours after the glass sash is set.**

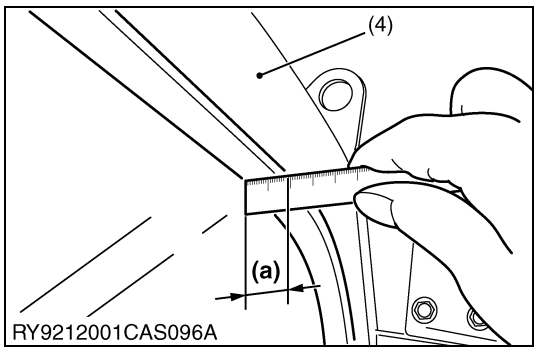
(1) Glass Sash

RY9212032CAS0017US0

9. FRONT WINDOW

[1] ADJUSTING THE CLOSING LOCK OF THE FRONT WINDOW (TOP)





When water leaks in the cabin or it rattles

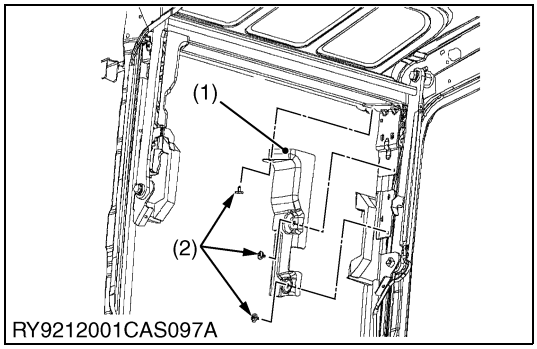
1. Close the front window (top) and lock it securely.
2. Remove the trim on the top edge of the front window (top) about half way along the frame and measure the clearance between the glass and the cab frame.

■ **NOTE**

- **If you remove the trim too far, the glass may shift out of position, preventing a reliable measurement of the clearance.**

(1) Cab ASSY
(2) Front Window (Top)
(3) Trim
(4) Cab Frame
(a) Clearance

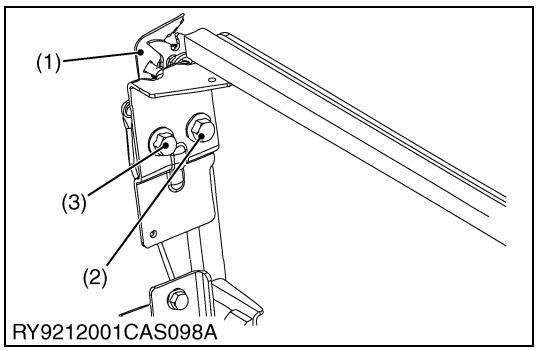
RY9212001CAS0091US0



3. Remove the clip and then the lock cover.

(1) Lock Cover
(2) Clip

RY9212001CAS0092US0



4. Remove the lock of the front window (top) and loosen the lock's mounting bolts.
5. Leave the rear bolt as is and lift up the front bolt 1.0 to 1.5 mm (0.04 to 0.06 in.).

■ **NOTE**

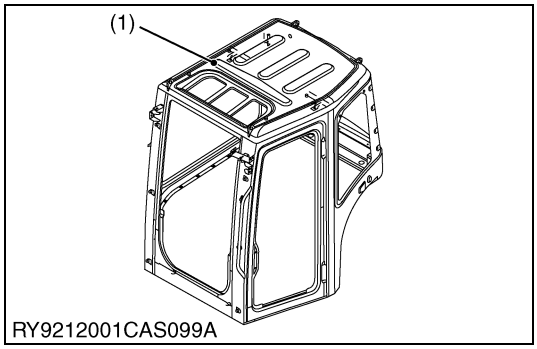
- **Lifting the bolt more than 1.5 mm (0.06 in.) may prevent the lock from working.**

6. Re-tighten the bolts to the specified torque.
7. Close the front window (top) and lock it securely.
8. Recheck the clearance between the glass and the cab frame and make sure the clearance is smaller.
9. Operate the machine and make sure the rattling has stopped while driving.
10. Spray some water on the window and make sure it does not leak.

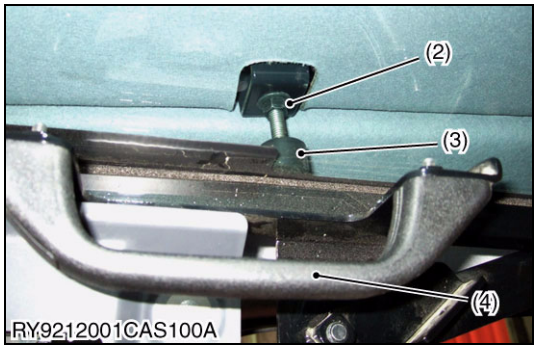
(1) Lock
(2) Bolt (Front)
(3) Bolt (Rear)

RY9212001CAS0093US0

[2] ADJUSTING THE OPEN LOCK OF THE FRONT WINDOW (TOP)



RY9212001CAS099A



RY9212001CAS100A

When it rattles on the cabin

1. Lift the front window (top) and lock it securely to the ceiling.
2. While pulling down on the handle, check whether there is a gap between the glass and the cushion.
3. If the glass is up against the cushion without a gap, it is OK.
4. If there is a gap between the glass and the cushion, it causes the rattling. Loosen the nut and stretch the cushion until it is against the surface of the glass.
5. After adjusting the cushion, re-tighten the nut.
6. Lift the front window (top) and lock it securely to the ceiling.
7. Operate the machine and make sure the rattling has stopped while driving.

(1) Cabin
(2) Nut
(3) Cushion
(4) Handle

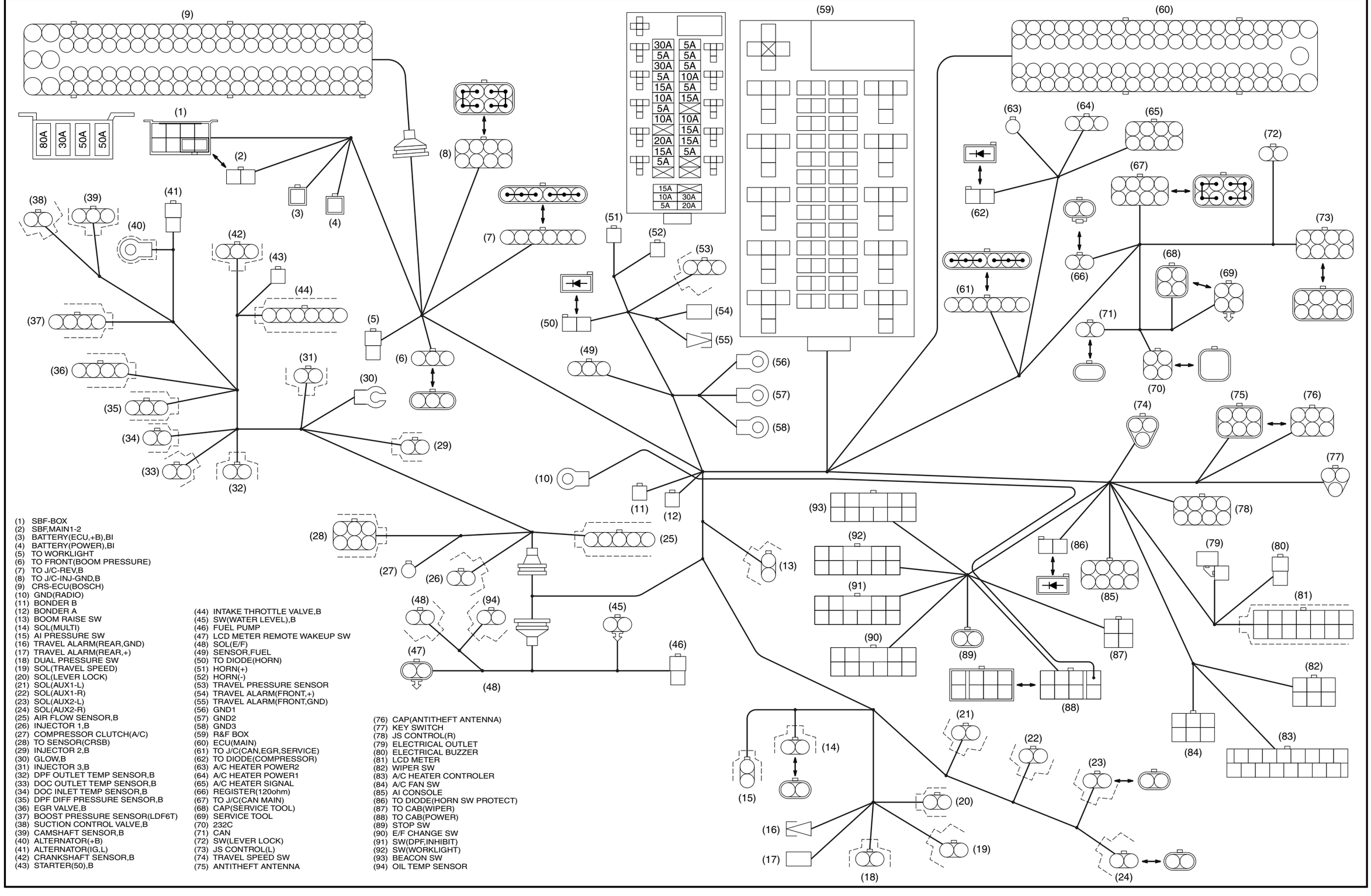
RY9212001CAS0094US0

APPENDICES

1. WIRE HARNESS
2. CONNECTOR CHART
3. ELECTRICAL CIRCUIT DIAGRAM

WIRE HARNESS

W/H00 MAIN HARNESS

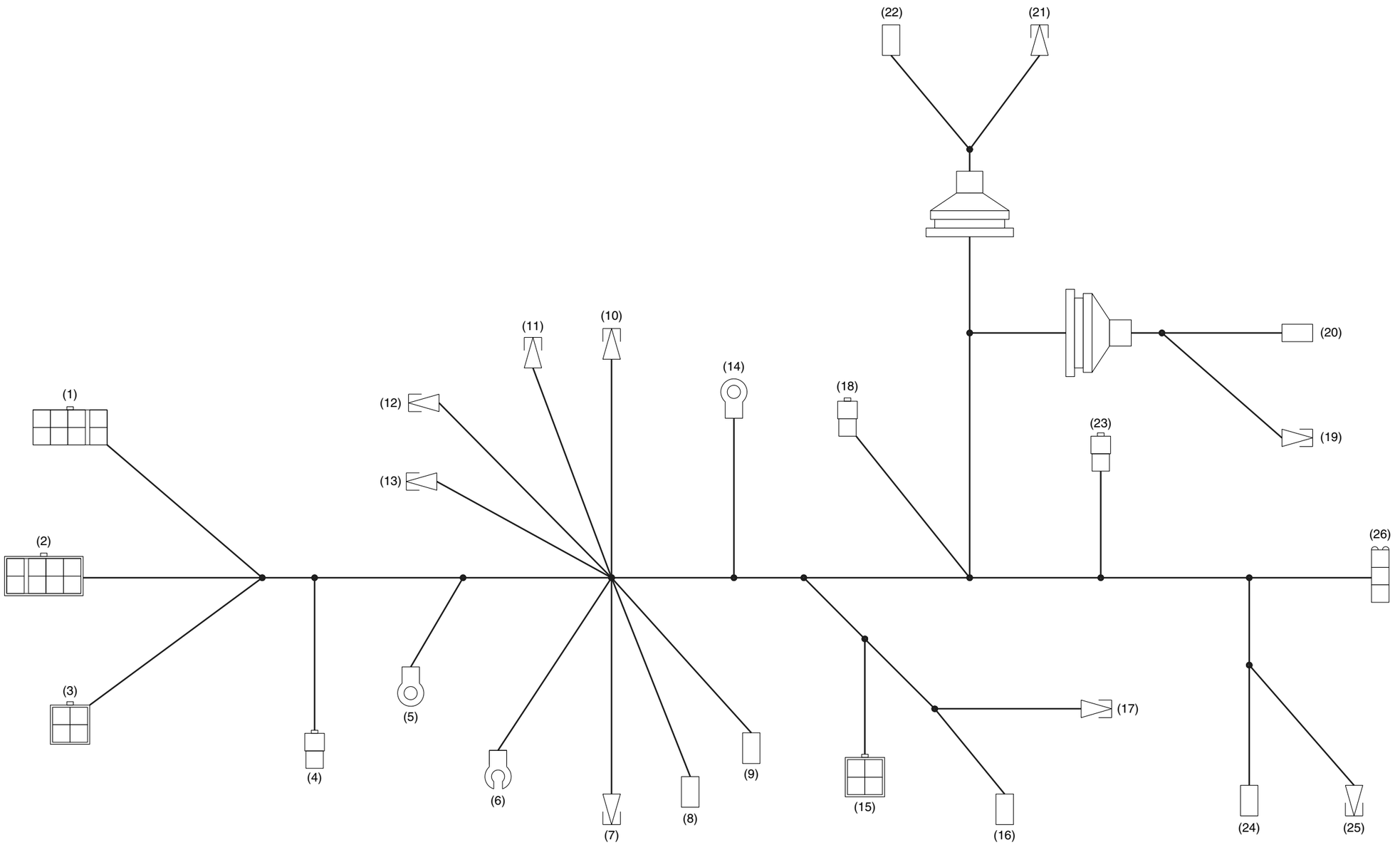


(1) SBF-BOX
(2) SBF,MAIN1-2
(3) BATTERY(ECU,+B),BI
(4) BATTERY(POWER),BI
(5) TO WORKLIGHT
(6) TO FRONT(BOOM PRESSURE)
(7) TO J/C-REV,B
(8) TO J/C-INJ-GND,B
(9) CRS-ECU(BOSCH)
(10) GND(RADIO)
(11) BONDER B
(12) BONDER A
(13) BOOM RAISE SW
(14) SOL(MULTI)
(15) AI PRESSURE SW
(16) TRAVEL ALARM(REAR,GND)
(17) TRAVEL ALARM(REAR,+)
(18) DUAL PRESSURE SW
(19) SOL(TRAVEL SPEED)
(20) SOL(LEVER LOCK)
(21) SOL(AUX1-L)
(22) SOL(AUX1-R)
(23) SOL(AUX2-L)
(24) SOL(AUX2-R)
(25) AIR FLOW SENSOR,B
(26) INJECTOR 1,B
(27) COMPRESSOR CLUTCH(A/C)
(28) TO SENSOR(CRSB)
(29) INJECTOR 2,B
(30) GLOW,B
(31) INJECTOR 3,B
(32) DPF OUTLET TEMP SENSOR,B
(33) DOC OUTLET TEMP SENSOR,B
(34) DOC INLET TEMP SENSOR,B
(35) DPF DIFF PRESSURE SENSOR,B
(36) EGR VALVE,B
(37) BOOST PRESSURE SENSOR(LDF6T)
(38) SUCTION CONTROL VALVE,B
(39) CAMSHAFT SENSOR,B
(40) ALTERNATOR(+B)
(41) ALTERNATOR(IG,L)
(42) CRANKSHAFT SENSOR,B
(43) STARTER(50),B

(44) INTAKE THROTTLE VALVE,B
(45) SW(WATER LEVEL),B
(46) FUEL PUMP
(47) LCD METER REMOTE WAKEUP SW
(48) SOL(E/F)
(49) SENSOR,FUEL
(50) TO DIODE(HORN)
(51) HORN(+)
(52) HORN(-)
(53) TRAVEL PRESSURE SENSOR
(54) TRAVEL ALARM(FRONT,+)
(55) TRAVEL ALARM(FRONT,GND)
(56) GND1
(57) GND2
(58) GND3
(59) R&F BOX
(60) ECU(MAIN)
(61) TO J/C(CAN,EGR,SERVICE)
(62) TO DIODE(COMPRESSOR)
(63) A/C HEATER POWER2
(64) A/C HEATER POWER1
(65) A/C HEATER SIGNAL
(66) REGISTER(120ohm)
(67) TO J/C(CAN MAIN)
(68) CAP(SERVICE TOOL)
(69) SERVICE TOOL
(70) 232C
(71) CAN
(72) SW(LEVER LOCK)
(73) JS CONTROL(L)
(74) TRAVEL SPEED SW
(75) ANTITHEFT ANTENNA

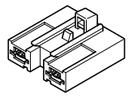
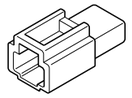
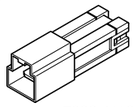
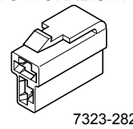
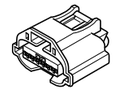
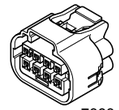
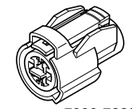
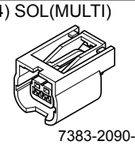
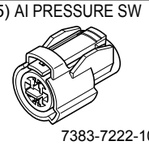
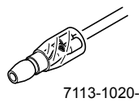
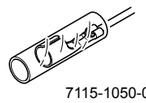
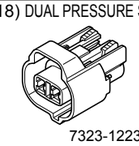
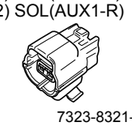
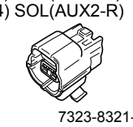
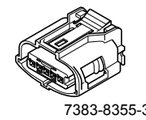
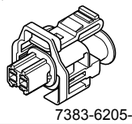
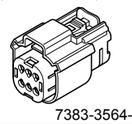
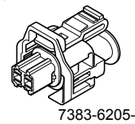
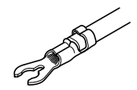
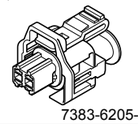
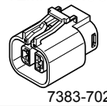
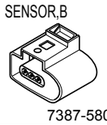
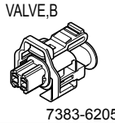
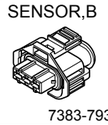
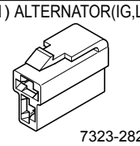
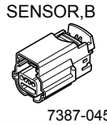
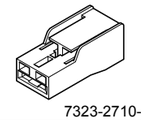
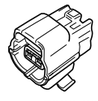
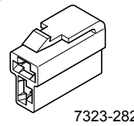
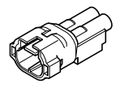
(76) CAP(ANTITHEFT ANTENNA)
(77) KEY SWITCH
(78) JS CONTROL(R)
(79) ELECTRICAL OUTLET
(80) ELECTRICAL BUZZER
(81) LCD METER
(82) WIPER SW
(83) A/C HEATER CONTROLER
(84) A/C FAN SW
(85) AI CONSOLE
(86) TO DIODE(HORN SW PROTECT)
(87) TO CAB(WIPER)
(88) TO CAB(POWER)
(89) STOP SW
(90) E/F CHANGE SW
(91) SW(DPF,INHIBIT)
(92) SW(WORKLIGHT)
(93) BEACON SW
(94) OIL TEMP SENSOR

W/H19 CABIN HARNESS



(1) CAB POWER SOURCE
(2) TO MAIN(CAB POWER)
(3) TO MAIN(CAB WIPER)
(4) WASHER TANK
(5) GND(RADIO,CAB)
(6) RADIOFRAME(GND)
(7) RADIO(GND)
(8) RADIO(AC)
(9) RADIO(+B)
(10) SPEAKER(R-)
(11) SPEAKER(R+)
(12) SPEAKER(L-)
(13) SPEAKER(L+)
(14) GND(CABFRAME)
(15) TO WIPER
(16) CAB WORKLIGHT,FR(+)
(17) CAB WORKLIGHT,FR(-)
(18) SPEAKER(R)
(19) CAB WORKLIGHT,B(-)
(20) CAB WORKLIGHT,B(+)
(21) TO (BEACON-)
(22) TO (BEACON+)
(23) SPEAKER(L)
(24) CAB WORKLIGHT,FL(+)
(25) CAB WORKLIGHT,FL(-)
(26) ROOM LIGHT

MAIN HARNESS

(2) SBF,MAIN1-2  7323-3220	(3) BATTERY(ECU,+B),BI  7322-2810-30	(4) BATTERY(POWER),BI  7322-4113-30	(5) TO WORKLIGHT  7323-2820	(6) TO FRONT (BOOM PRESSURE)  7323-7434-40	(7) TO J/C-REV,B  7383-8850-30	(8) TO J/C-INJ-GND,B  7383-1081	(10) GND(RADIO)  7009-1324-02	(13) BOOM RAISE SW  7383-7222-10
(14) SOL(MULTI)  7383-2090-30	(15) AI PRESSURE SW  7383-7222-10	(16) TRAVEL ALARM (REAR,GND)  7113-1020-02	(17) TRAVEL ALARM (REAR,+)  7115-1050-02	(18) DUAL PRESSURE SW  7323-1223-40	(19) SOL(TRAVEL SPEED) (20) SOL(LEVER LOCK)  7383-2090-30	(21) SOL(AUX1-L) (22) SOL(AUX1-R)  7323-8321-30	(23) SOL(AUX2-L) (24) SOL(AUX2-R)  7323-8321-30	(25) AIR FLOW SENSOR,B  7383-8355-30
(26) INJECTOR 1,B  7383-6205-30	(27) COMPRESSOR CLUTCH(A/C)  7323-8918-30	(28) TO SENSOR(CRSB)  7383-3564-30	(29) INJECTOR 2,B  7383-6205-30	(30) GLOW,B  7010-3025-02	(31) INJECTOR 3,B  7383-6205-30	(32) DPF OUTLET TEMP SENSOR,B  7383-7023	(33) DOC OUTLET TEMP SENSOR,B  7383-7028-10	(34) DOC INLET TEMP SENSOR,B  7383-7026-30
(35) DPF DIFF PRESSURE SENSOR,B  7387-5800-30	(36) EGR VALVE,B  7383-1740-10	(37) BOOST PRESSURE SENSOR(LDF6T)  7383-8543-30	(38) SUCTION CONTROL VALVE,B  7383-6205-30	(39) CAMSHAFT SENSOR,B  7383-7938-30	(40) ALTERNATOR(+B)  7009-1342-02	(41) ALTERNATOR(IG,L)  7323-2820	(42) CRANKSHAFT SENSOR,B  7387-0450-30	(43) STARTER(50),B  7323-2710-40
(44) INTAKE THROTTLE VALVE,B  7383-1968-30	(45) SW(WATER LEVEL),B  7323-8321-30	(46) FUEL PUMP  7323-2820	(47) LCD METER REMOTE WAKEUP SW  7322-9422-30	(48) SOL(E/F) (94) OIL TEMP SENSOR 7323-8321-30	(49) SENSOR,FUEL 7383-8730-30	(50) TO DIODE(HORN) 7323-7729-40	(51) HORN(+) (52) HORN(-) 7323-2010	(53) TRAVEL PRESSURE SENSOR 7323-6536-30
(54) TRAVEL ALARM (FRONT,+) 7115-1050-02	(55) TRAVEL ALARM (FRONT,GND) 7113-1020-02	(56) GND1 (57) GND2 (58) GND3 7009-1836	(61) TO J/C (CAN,EGR,SERVICE) 7383-8850-30	(62) TO DIODE (COMPRESSOR) 7323-7729-40	(63) A/C HEATER POWER2 7383-7011-40	(64) A/C HEATER POWER1 7383-1036-40	(65) A/C HEATER SIGNAL 7383-1081-10	(66) REGISTER(120ohm) 7323-6423-30
(67) TO J/C(CAN MAIN) 7383-1081	(68) CAP(SERVICE TOOL) 7322-7340-30	(69) SERVICE TOOL 7323-7340-30	(70) 232C 7323-7740-40	(71) CAN 7323-8520-40	(72) SW(LEVER LOCK) 7383-1528-10	(73) JS CONTROL(L) 7383-1588-10	(74) TRAVEL SPEED SW 7328-1231	(75) ANTITHEFT ANTENNA 7322-1461
(76) CAP(ANTITHEFT ANTENNA) 7323-1461	(77) KEY SW 7323-6234-40	(78) JS CONTROL(R) 7383-1588-10	(79) ELECTRICAL OUTLET 7323-8322	(80) ELECTRICAL BUZZER 7323-2820	(81) LCD METER 7383-5832	(82) WIPER SW 7323-2860	(83) A/C HEATER CONTROLER 7319-1746-40	(84) A/C FAN SW 7323-2865-70
(1) SBF-BOX 7357-5155-30	(9) CRS-ECU(BOSCH) 7319-1474-30	(59) R&F BOX 7154-0089-30	(60) ECU(MAIN) 7319-1148-30					

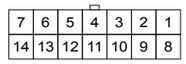
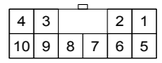
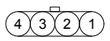
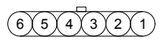
CABIN HARNESS

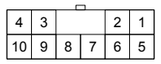
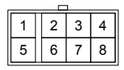
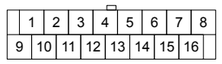
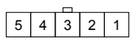
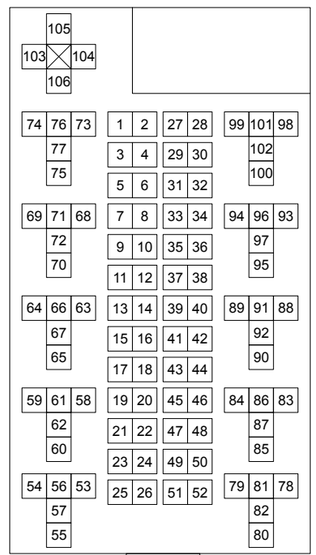
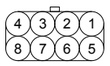
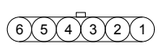
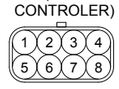
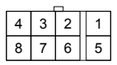
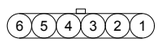
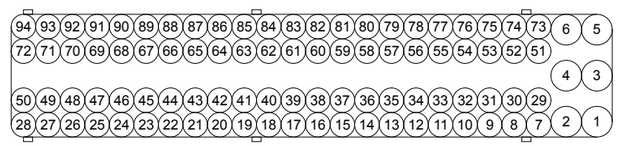
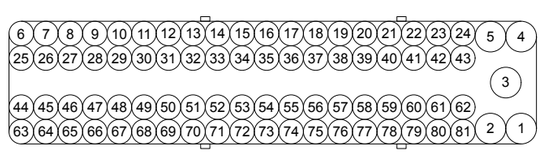
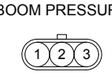
(1) CAB POWER SOURCE 7323-6083-30	(2) TO MAIN(CAB POWER) 7322-6083-30	(3) TO MAIN(CAB WIPER) 7322-6040
(4) WASHER TANK 7323-2820	(5) GND(RADIO,CAB) 7009-1324-02	(6) RADIOFRAME(GND) 7010-3016-02
(7) RADIO(GND) 7113-1020-02	(8) RADIO(AC) (9) RADIO(+B) 7115-1050-02	(10) SPEAKER(R-) (11) SPEAKER(R+) 7113-1020-02
(12) SPEAKER(L-) (13) SPEAKER(L+) 7113-1020-02	(14) GND(CABFRAME) 7009-1334-02	(15) TO WIPER 7382-1042
(16) CAB WORKLIGHT, FR(+) 7115-1050-02	(17) CAB WORKLIGHT, FR(-) 7113-1020-02	(18) SPEAKER(R) 7323-2820
(19) CAB WORKLIGHT,B(-) 7113-1020-02	(20) CAB WORKLIGHT,B(+) 7115-1050-02	(21) TO (BEACON-) 7113-1020-02
(22) TO (BEACON+) 7115-1050-02	(23) SPEAKER(L) 7323-2820	(24) CAB WORKLIGHT, FL(+) 7115-1050-02
(25) CAB WORKLIGHT, FL(-) 7113-1020-02	(26) ROOM LIGHT 7323-1030	
(85) AI CONSOLE 7323-8988	(86) TO DIODE(HORN SW PROTECT) 7323-7729-40	(87) TO CAB(WIPER) 7323-6040
(89) STOP SW 7322-9422	(90) E/F CHANGE SW (91) SWI(DPF,INHIBIT) 7323-8307	(92) SW(WORKLIGHT) (93) BEACON SW 7323-8307

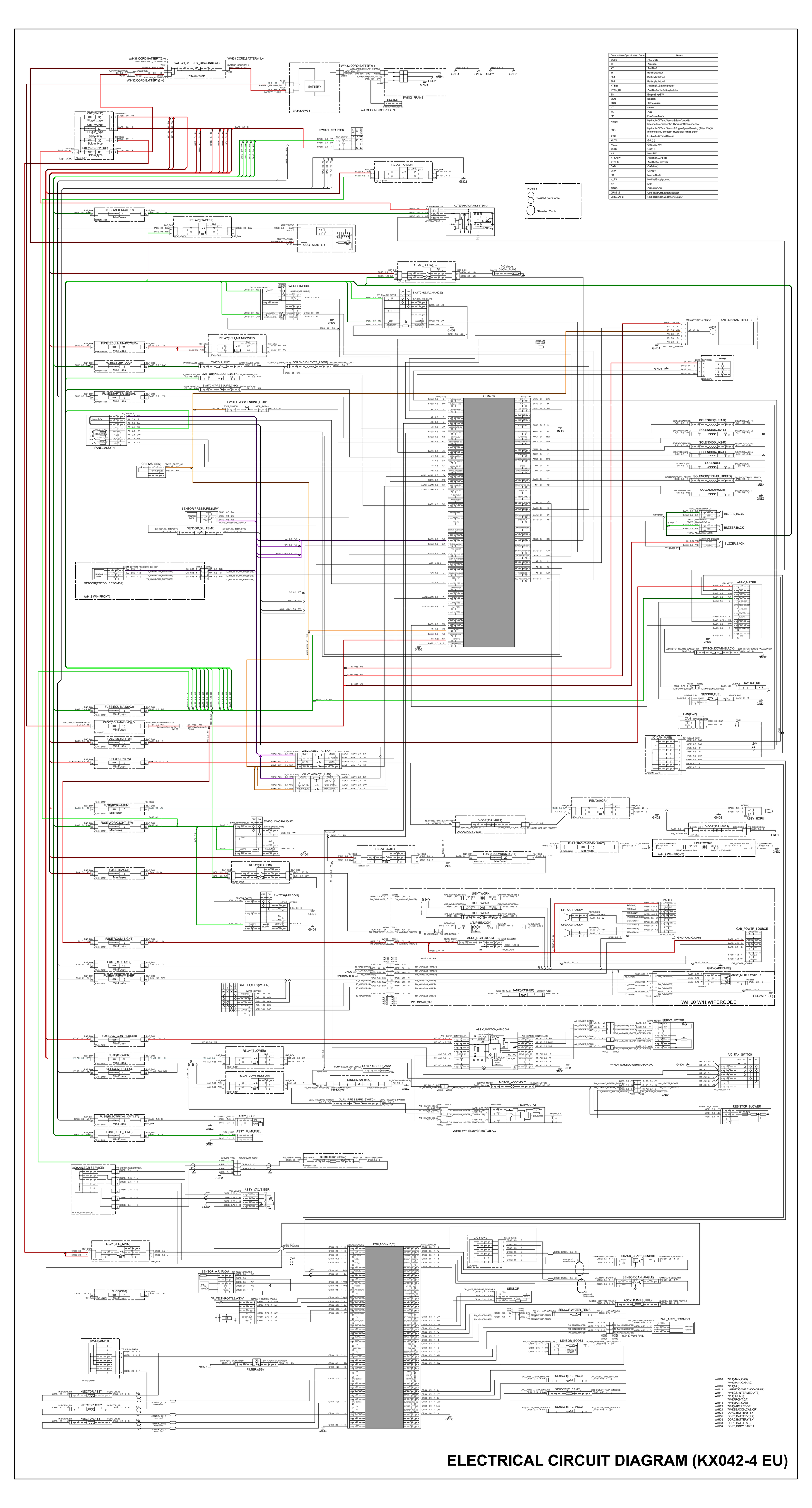
(88) TO CAB(POWER) 7323-6083-30

KX042-4 (EU) (3/3)

CONNECTOR CHART

232C  YAZAKI 62Z 7123-7740-40	ANTITHEFT ANTENNA  SUMITOMO MT 6189-6171	BLOWER MOTOR  SUMITOMO TS187 6098-0325	CAB WORKLIGHT,FL(-)  BULLET TERMINAL PLUG CA	CORD,BATTERY(-) (BATTERY)  YAZAKI 7003-2090-02	DUAL PRESSURE SWITCH  SUMITOMO 090 6189-0094	GND1  YAZAKI 7009-1836	INJECTOR 2,B  BOSCH 1-928-403-874	LCD METER  YAZAKI 040 III 7283-5832	REGISTER(120ohm)  YAZAKI 58X 7123-6423-30	SOLENOID(AUX2-L)  AMP EJ II 174352-2	SPEAKER(R+)  BULLET TERMINAL PLUG CA
A/C FAN SWITCH  YAZAKI CN(B) 7123-2865-70	BATTERY(+),1,BI-2  YAZAKI 7106-3105	BODYEARTH(ENGINE)  YAZAKI 7003-1192-02	CAB WORKLIGHT,FR(+)  BULLET TERMINAL RECEPTACLE CB	CORD,BATTERY(-) (MAIN FRAME)  YAZAKI 7003-1190-02	E/F CHANGE SWITCH  YAZAKI SDL 7123-8307	GND2  YAZAKI 7009-1836	INJECTOR 3,B  BOSCH 1-928-403-874	LCD METER REMOTE WAKEUP SW  SUMITOMO 6187-2802	RESISTOR BLOWER  SUMITOMO TS187 6098-0514	SOLENOID(AUX2-R)  AMP EJ II 174352-2	SPEAKER(R-)  BULLET TERMINAL PLUG CA
A/C HEATER POWER1  SUMITOMO TS187 6189-0165	BATTERY(ECU,+B),BI  YAZAKI CN(A) 7122-2810-30	BODYEARTH(MAIN FRAME)  YAZAKI 7003-1190-02	CAB WORKLIGHT,FR(-)  BULLET TERMINAL PLUG CA	CRANKSHAFT SENSOR,B  MOLEX MX64 31403-3700	EGR VALVE,B  SUMITOMO DL090 6195-0030	GND3  YAZAKI 7009-1836	INTAKE THROTTLE VALVE,B  YAZAKI 090 II 7283-1968-30	MAIN(POWER),BI  YAZAKI 58L 7123-4113-30	ROOM LIGHT  SUMITOMO MTW110 6130-2330	SOLENOID(E/F)  AMP EJ II 174352-2	STARTER(50),B  AMP 172320-1
A/C HEATER POWER2  SUMITOMO TS187 6189-0145	BATTERY ISOLATOR(G)  YAZAKI 7009-2132	BOOM BOTTOM PRESSURE SENSOR  AMP 070 2822366-1	CAMSHAFT SENSOR,B  BOSCH 1-928-403-966	DIODE(COMPRESSOR) YAZAKI 7321-9822	ELECTRICAL BUZZER YAZAKI CN(A) 7123-2820	GND(CABFRAME) RING TERMINAL LA M8	J/C(CAN,EGR,SERVICE) YAZAKI RH 7182-9630-30	OIL-SW,B AMP 250 172320-2	SBF,MAIN1-2 YAZAKI 305 7323-3220	SOLENOID(LEVER LOCK) YAZAKI HS 7283-2090-30	STARTER(+B),B,BI YAZAKI 7003-1190-02
A/C HEATER SIGNAL YAZAKI 090 II 7283-1081-10	BATTERY ISOLATOR(H) YAZAKI 7003-2090-02	BOOM RAISE SW SUMITOMO 6189-0156	CAN YAZAKI 62Z 7123-8520-40	DIODE(HORN) YAZAKI 7321-9822	ELECTRICAL OUTLET YAZAKI POSITEIVE LOCK 7123-8322	GND(RADIO) RING TERMINAL LA M8	J/C(CAN MAIN) YAZAKI 090 II 7382-1481-10	RADIO(AC) BULLET TERMINAL RECEPTACLE CB	SBF-BOX YAZAKI 7257-5155-30	SOLENOID(MULTI) YAZAKI HS 7283-2090-30	STOP SWITCH SUMITOMO HM090 6187-2801
AI CONSOLE FURUKAWA RFW P010531	BATTERY(POWER),BI YAZAKI 58L 7122-4113-30	BOOST PRESSURE SENSOR(LDF6T) BOSCH 1-928-403-736	CAP(232C) YAZAKI 7234-2604-40	DIODE (HORN SW PROTECT) YAZAKI 7321-9822	FRONT WORKLIGHT(+) YAZAKI CB	GND(RADIO,CAB) RING TERMINAL LA M8	J/C-INJ-GND,B YAZAKI 090 II 7382-1481-10	RADIO(+B) BULLET TERMINAL RECEPTACLE CB	SENSOR,FUEL YAZAKI SSD 7283-8730-30	SOLENOID (TRAVEL SPEED) YAZAKI HS 7283-2090-30	SUCTION CONTROL VALVE,B BOSCH 1-928-403-874
AI PRESSURE SW SUMITOMO 6189-0156	BATTERY TERMINAL,BI-2 YAZAKI 58L 7123-4113-30	CAB POWER SOURCE YAZAKI 58M 7123-6083-30	CAP (ANTITHEFT ANTENNA) SUMITOMO MT/HM090 6180-6181	DOC INLET TEMP SENSOR,B YAZAKI 090 II 7283-7026-30	FRONT WORKLIGHT(-) BULLET TERMINAL PLUG CA	GND(WIPER,F) RING TERMINAL LA M8	J/C-REV,B YAZAKI RH 7182-9630-30	RADIO(GND) BULLET TERMINAL PLUG CA	SERVICE TOOL AMP EJ II 174257-2	SPEAKER(L) YAZAKI CN(A) 7123-2820	SWITCH (BATTERY DISCONNECT) YAZAKI 7003-2090-02
AIR FLOW SENSOR,B SUMITOMO TS025 6189-1046	BEACON(+) FORK TERMINAL LE M3	CAB WORKLIGHT,B(+) BULLET TERMINAL RECEPTACLE CB	CAP(CAN) YAZAKI 7234-2601-40	DOC OUTLET TEMP SENSOR,B YAZAKI 090 II 7283-7028-10	FUEL PUMP YAZAKI CN(A) 7123-2820	HORN(+) YAZAKI 250 7123-2010	JS CONTROL(L) SUMITOMO DL090 6195-0051	RADIOFRAME(GND) FORK TERMINAL LE M5	SERVO MOTOR JAE IL-AG5 IL-AG5-7S-S3C1	SPEAKER(L+) BULLET TERMINAL PLUG CA	SWITCH(DPF,INHIBIT) YAZAKI SDL 7123-8307
ALTERNATOR(+B) RING TERMINAL LA M6	BEACON(-) FORK TERMINAL LE M3	CAB WORKLIGHT,B(-) BULLET TERMINAL PLUG CA	CAP(SERVICE TOOL) AMP EJ II 174259-2	DPF DIFF PRESSURE SENSOR,B AMP 1813271-1	FUSE BOX (ECU-MAIN(+B)),BI SUMITOMO 6353-0123	HORN(-) YAZAKI 250 7123-2010	JS CONTROL(R) SUMITOMO DL090 6195-0051	RAIL PRESSURE SENSOR,B BOSCH 1-928-403-968	SOLENOID(AUX1-L) AMP EJ II 174352-2	SPEAKER(L-) BULLET TERMINAL PLUG CA	SWITCH(LEVER LOCK) SUMITOMO DL090 6195-0003
ALTERNATOR(IG,L) YAZAKI CN(A) 7123-2820	BEACON SWITCH YAZAKI SDL 7123-8307	CAB WORKLIGHT,FL(+) BULLET TERMINAL RECEPTACLE CB	COMPRESSOR CLUTCH (A/C) FURUKAWA RFW P010463	DPF OUTLET TEMP SENSOR,B YAZAKI 090 II 7283-7023	GLOW,B FORK TERMINAL LE M4	INJECTOR 1,B BOSCH 1-928-403-874	KEY SWITCH YAZAKI 58X 7123-6234-40	REGISTER YAZAKI 7382-5053-3R	SOLENOID(AUX1-R) AMP EJ II 174352-2	SPEAKER(R) YAZAKI CN(A) 7123-2820	SWITCH(WATER LEVEL),B AMP EJ II 174352-2

SWITCH(WORKLIGHT)  YAZAKI SDL 7123-8307	TO DIODE(HORN)  SUMITOMO 090 6098-0017	TO MAIN(CAB POWER)  YAZAKI 58M 7122-6083-30	TRAVEL ALARM (FRONT,GND)  BULLET TERMINAL PLUG CA	WATER TEMP SENSOR,B  AMP EJ II 178449-6	A/C HEATER CONTROLER  JAE MX34 MX34016SF1
THERMOSTAT  YAZAKI 090 II 7283-1050	TO DIODE (HORN SW PROTECT)  SUMITOMO 090 6098-0017	TO MAIN(CAB WIPER)  YAZAKI 58M 7122-6040	TRAVEL ALARM(REAR,+)  BULLET TERMINAL RECEPTACLE CB	WIPER,F  SUMITOMO HM090 6090-1011	R&F BOX 
TO (BEACON+)  BULLET TERMINAL RECEPTACLE CB	TO FRONT (BOOM PRESSURE)  YAZAKI SWP 7123-7434-40	TO MAIN(ECU,+B),BI  YAZAKI 7123-2810-30	TRAVEL ALARM (REAR,GND)  BULLET TERMINAL PLUG CA	WIPER SWITCH  YAZAKI CN(A) 7123-2860	
TO (BEACON-)  BULLET TERMINAL PLUG CA	TO J/C(CAN MAIN)  YAZAKI 090 II 7283-1081	TO MAIN(SENSOR,CRSB)  MOLEX MX150 33482-0601	TRAVEL PRESSURE SENSOR  YAZAKI 91RV 7223-6536-30	OIL TEMP SENSOR  AMP EJ II 178449-6	
TO (CAB BEACON+)  BULLET TERMINAL PLUG CA	TO J/C(CAN,EGR,SERVICE)  YAZAKI RH 7283-8850-30	TO MAIN(W/H HEATER CONTROLER)  YAZAKI 090 II 7282-1081-10	TRAVEL SPEED SW  SUMITOMO TNS040 6092-0013		
TO (CAB BEACON-)  BULLET TERMINAL RECEPTACLE CB	TO J/C-INJ-GND,B  YAZAKI 090 II 7283-1081	TO MAIN(WORKLIGHT)  YAZAKI CN(A) 7122-2820	WASHER TANK  YAZAKI CN(A) 7123-2820		
TO CAB(POWER)  YAZAKI 58M 7123-6083-30	TO J/C-REV,B  YAZAKI RH 7283-8850-30	TO SENSOR(CRSB)  MOLEX MX150 33472-0606	CRS-ECU(BOSCH)  AMP 3-1355136-3		
TO CAB(WIPER)  YAZAKI 58M 7123-6040	TO MAIN (A/C HEATER POWER1)  SUMITOMO TS187 6188-0129	TO WIPER  YAZAKI 7282-1042			
TO CAB(WIPER)  YAZAKI 7283-1040	TO MAIN (A/C HEATER POWER2)  SUMITOMO TS187 6188-0083	TO WORKLIGHT  YAZAKI CN(A) 7123-2820	ECU(MAIN)  AMP 1473244-1		
TO DIODE(COMPRESSOR)  SUMITOMO 090 6098-0017	TO MAIN (BOOM PRESSURE)  YAZAKI SWP 7222-7434-40	TRAVEL ALARM(FRONT,+)  BULLET TERMINAL RECEPTACLE CB			



ELECTRICAL CIRCUIT DIAGRAM (KX042-4 EU)

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