WSM

WORKSHOP MANUAL
KUBOTA EXCAVATOR

KX101-3α4

Kubota

KiSC issued 08, 2016 A

CONTENTS

TO THE READER

This work shop manual is consisted of additional/changes function of the KX101-3α3 and KX101-3α4 based on KX101-3α2.
Please refer KX101-3α2 and engine work shop manual for base and main information.

Applicable publication

Publication Number	Model	Region
97899-61520	KX101-3α2	Europe
9Y111-02574	D1803-M-E3B	All countries

All of the illustrations, specifications and 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.

August 2016

I INFORMATION

INFORMATION

CONTENTS

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.**

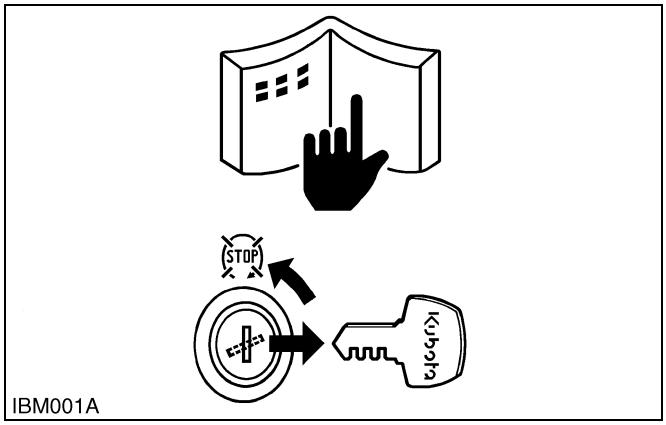
[NOTE]
- Indicates other supplementary information to take note of.

RY9212001INI0001US0

2. IN THE INTEREST OF WORK SAFETY

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

(1) Precautions Before Working on the Machine

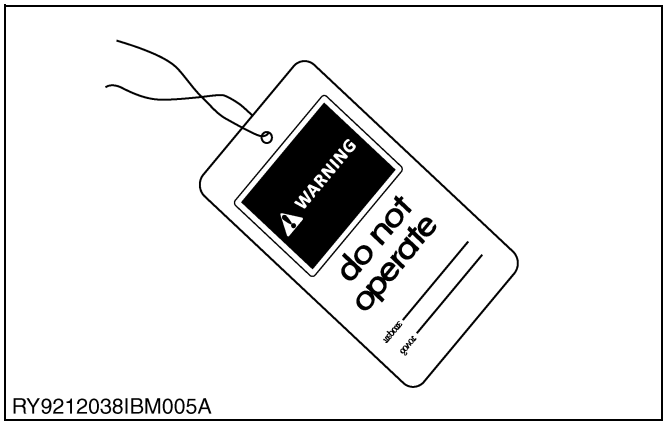


IBM001A

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.

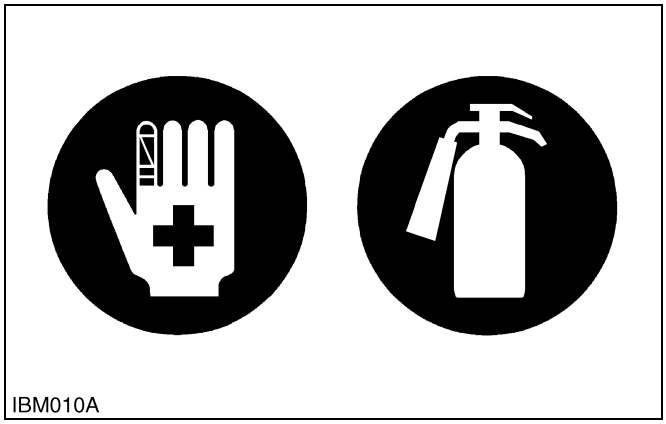
RY9212001INI0002US0



RY9212038IBM005A

- 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.

RY9212001INI0003US0

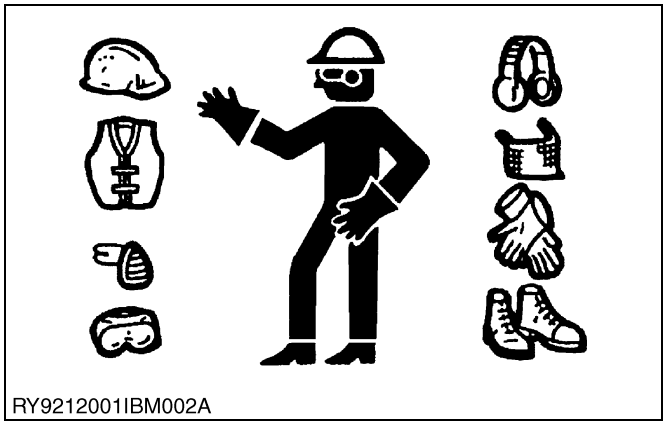


IBM010A

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.

RY9212001INI0004US0

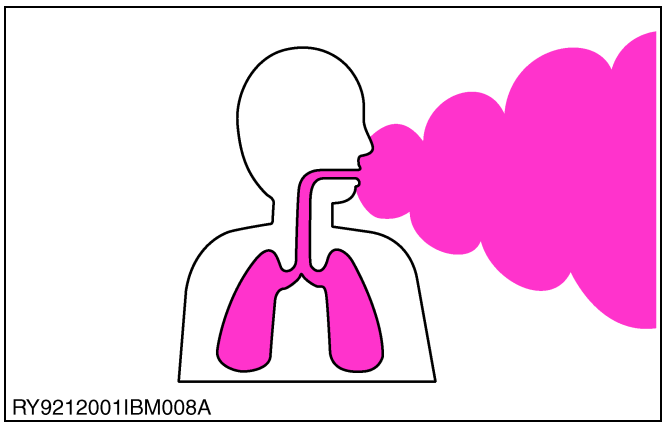


RY9212001IBM002A

- 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.

RY9212001INI0005US0

(2) Precautions Before Working on the Equipment


RY9212001IBM008A

- 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 go flying, 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.

RY9212001INI0006US0


RY9212001IBM003A

- 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.**

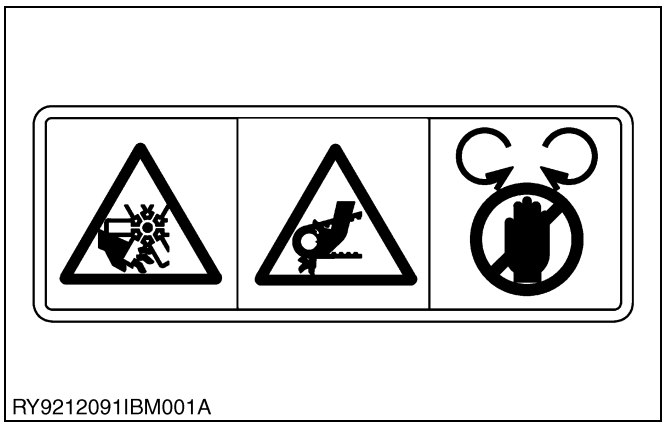
RY9212001INI0007US0


RY9212001IBM004A

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.

RY9212001INI0008US0


RY9212091IBM001A

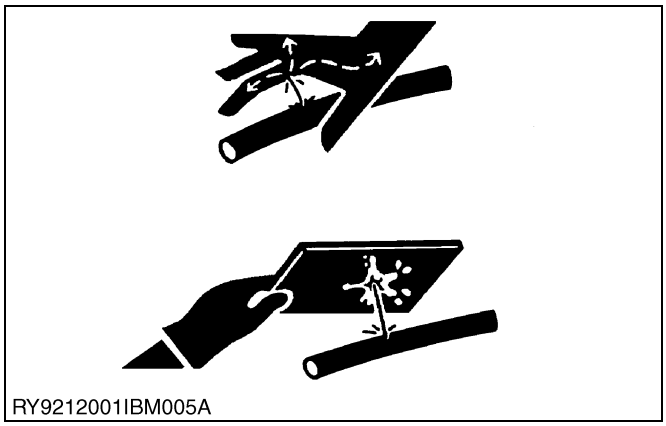
- Whenever it is necessary to open the engine covers or hood in order to service the machine, always prop them open.
- If it is absolutely necessary to run the engine while working on the machine, make sure you are clear of all rotating or moving parts. Also take care not to leave anything, such as tools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

RY9212001INI0009US0


RY9212091IBM002A

- 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.

RY9212001INI0016US0


RY9212001IBM005A

- 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.

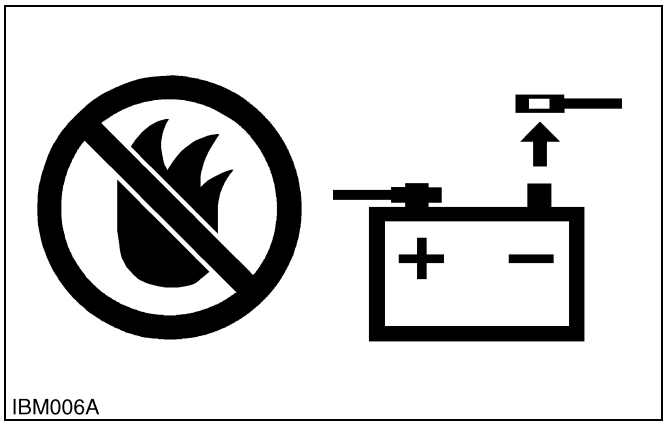
RY9212001INI0011US0


RY9212001IBM006A

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.

RY9212001INI0012US0


IBM006A

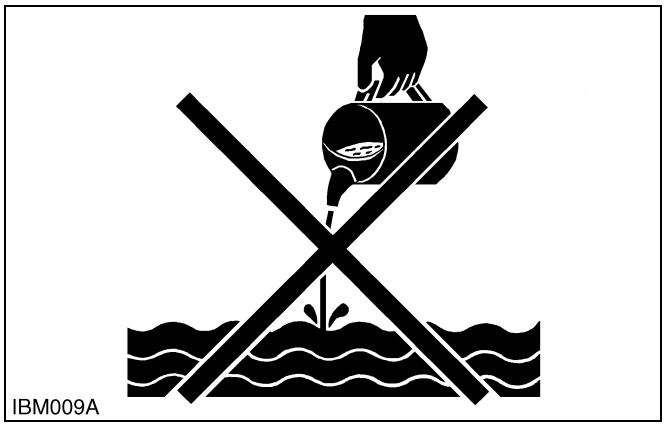
- Always wear safety glasses and gloves when handling the battery.
- The gas generated by the battery is flammable. Never weld or use tools like a grinder near the battery. And never smoke near it.
- When disconnecting the battery, always disconnect the negative cable first. When connecting the battery,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

RY9212001INI0013US0


RY9212001IBM007A

- 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.

RY9212001INI0014US0


IBM009A

Dispose of Waste Fluids Properly

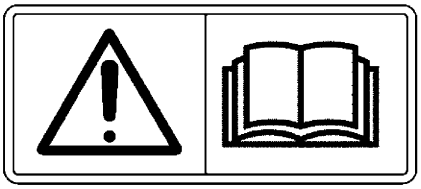
- Never dispose of waste fluids on the ground, in the gutter, a river, pond or lake. Always dispose of hazardous substances like waste oil, coolant and electrolytic fluid in accordance with the relevant environmental protection regulations.
- Keep the safety plates clean so they can be read. If a safety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

RY9212001INI0015US0

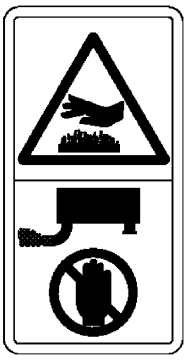
3. LABELS DISPLAYED TO PROMOTE WORK SAFETY

[1] LOCATIONS

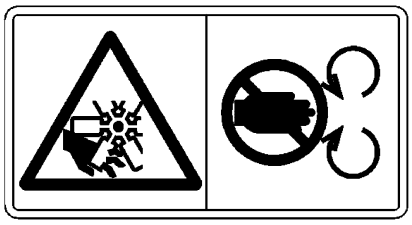
(1) Code No. RG308-5702△



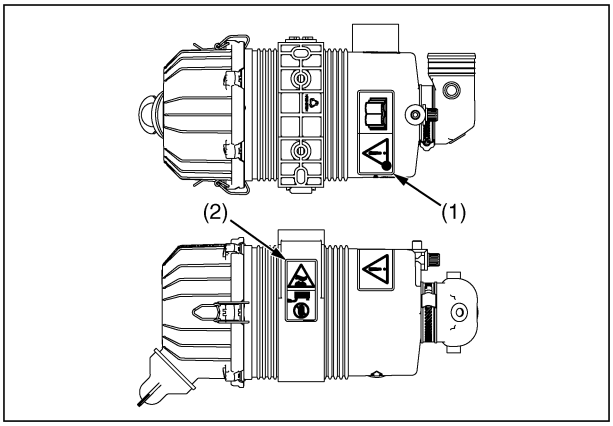
(2) Code No. RG158-5758△

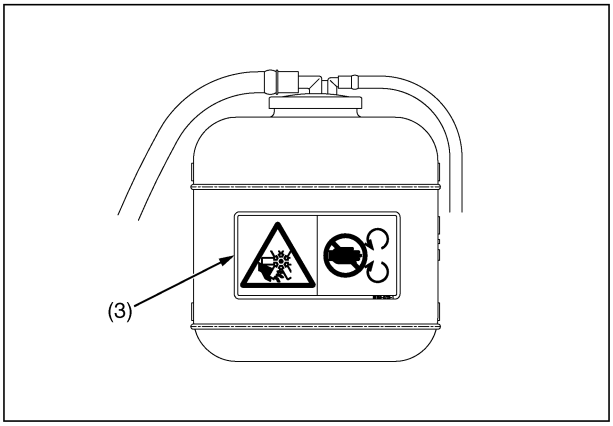


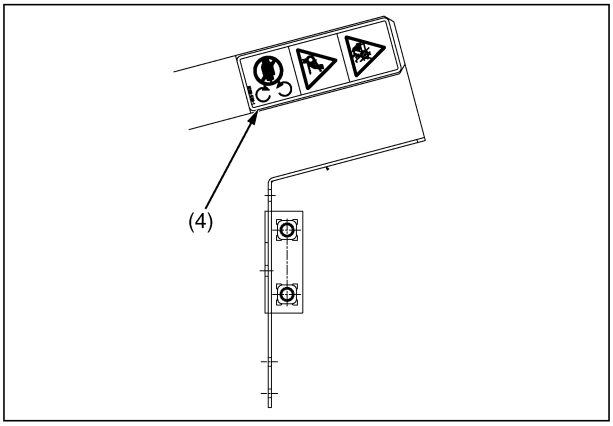
(3) Code No. RG158-5726△



(4) Code No. RG158-5789△

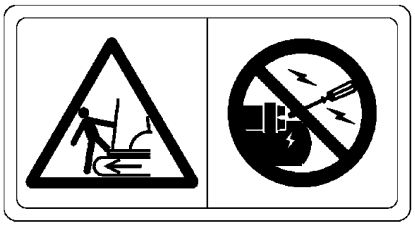




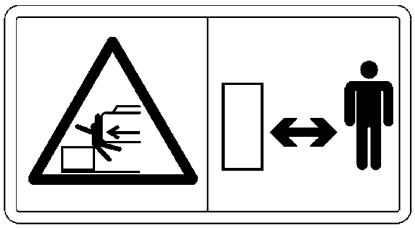


RY9212468ICI001A

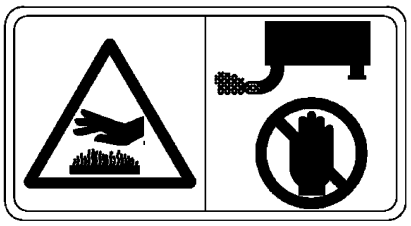
(5) Code No. RG158-5723△



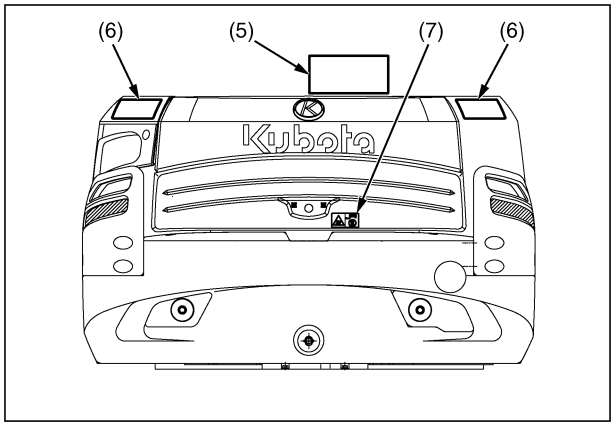
(6) Code No. RG158-5727△

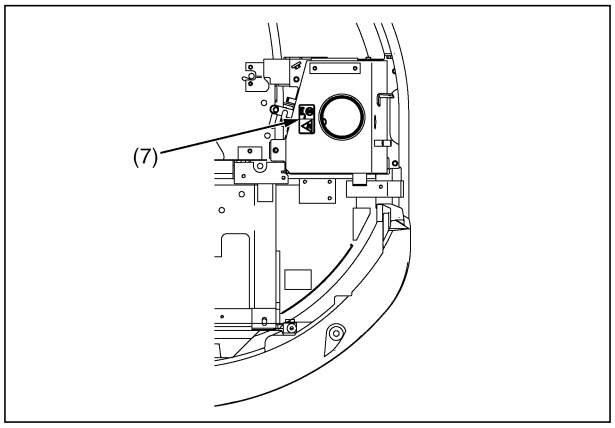


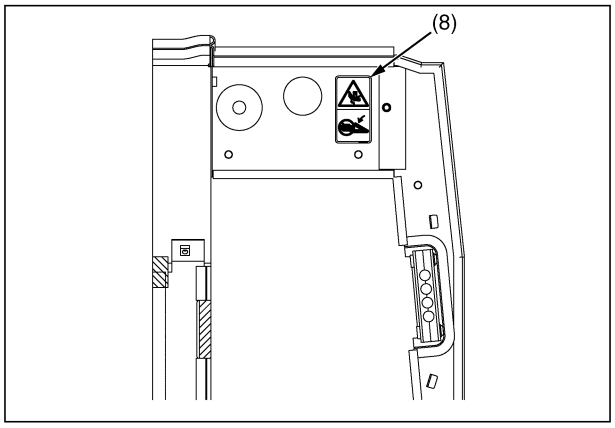
(7) Code No. RG158-5721△



(8) Code No. RG648-5724△

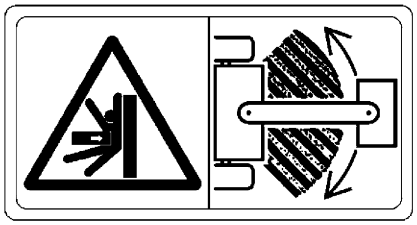




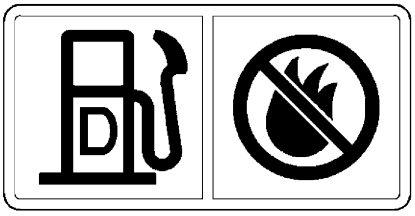


RY9212468ICI002A

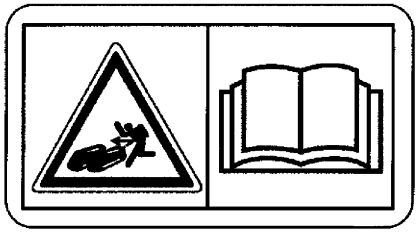
(9) Code No. RG158-5722△



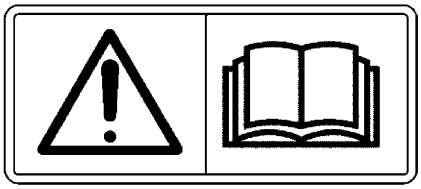
(10) Code No. R2491-5736△



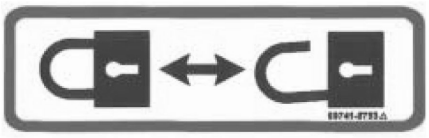
(11) Code No. RG138-5791△

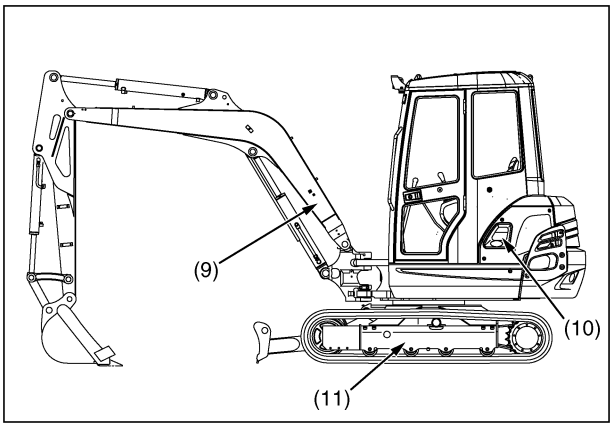


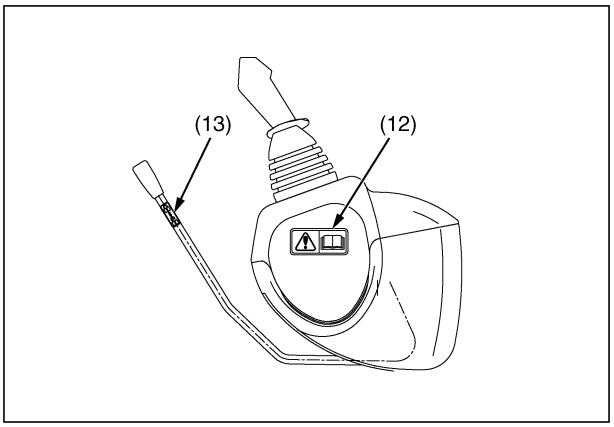
(12) Code No. RG308-5702△



(13) Code No. 69741-5753△

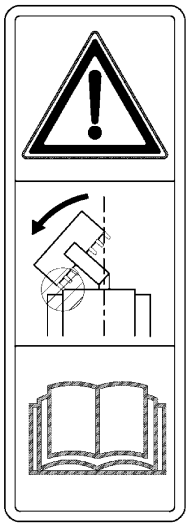




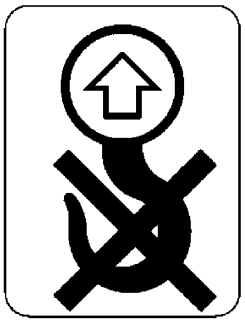


RY9212468ICI003A

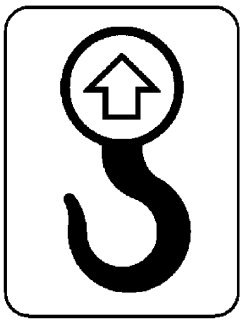
(14) Code No. RG138-5717△



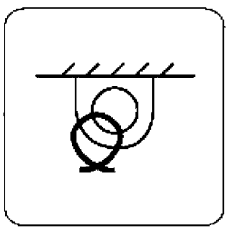
(15) Code No. RG109-5796△

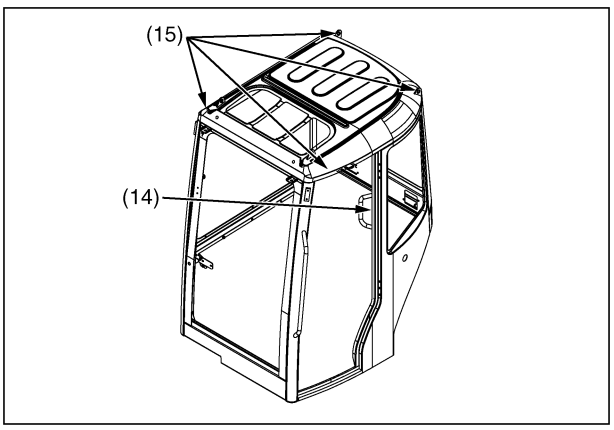


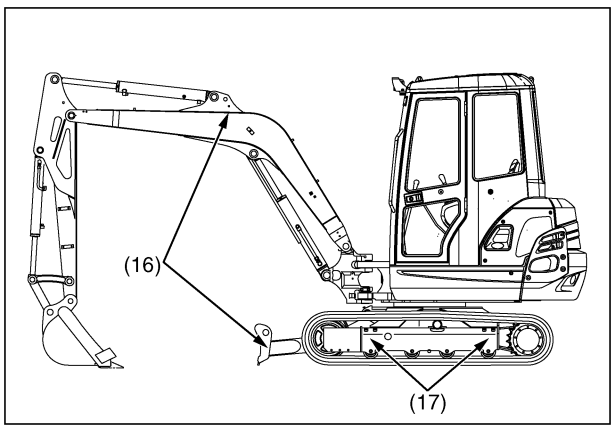
(16) Code No. R2491-5796△



(17) Code No. RD809-5733△

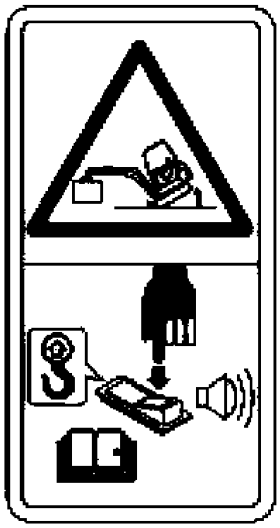




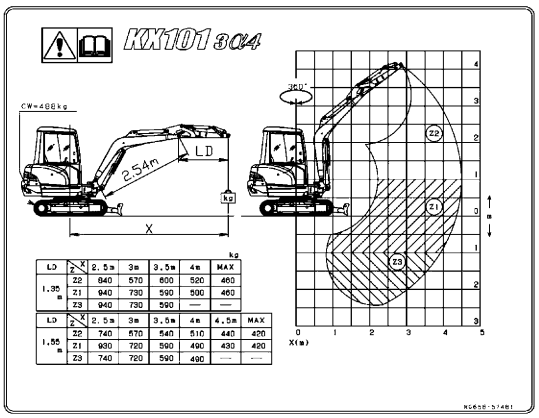


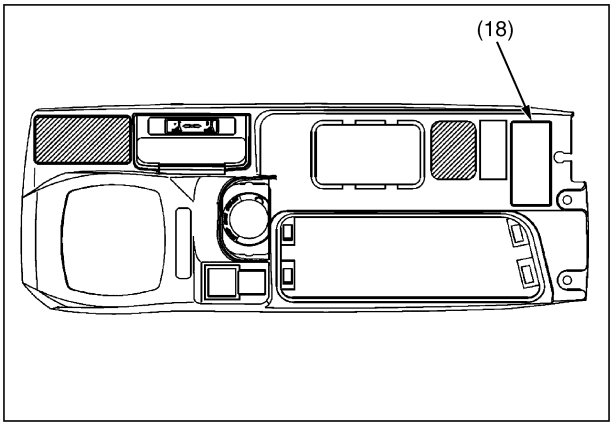
RY9212468ICI004A

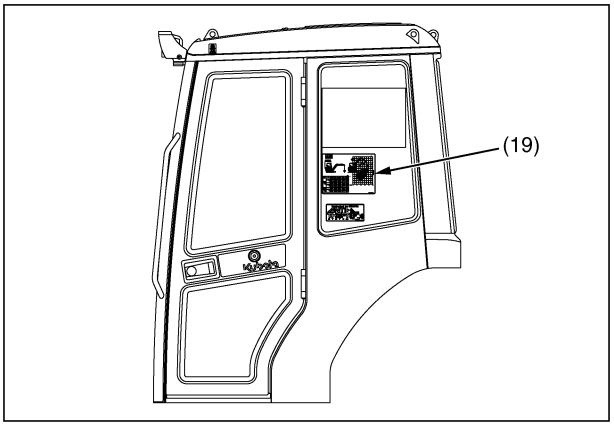
(18) Code No. RG158-5749△



(19) Code No. RG658-5748△

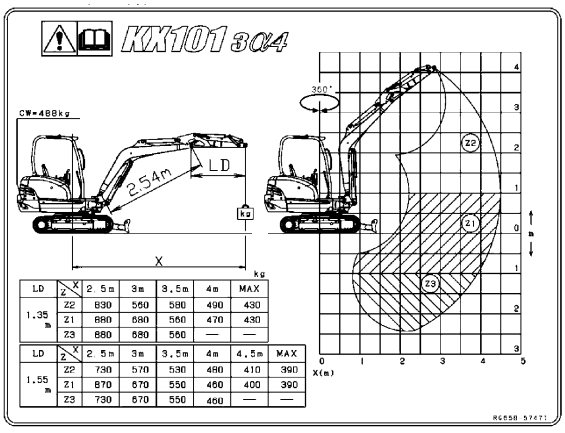






RY9212468ICI005A

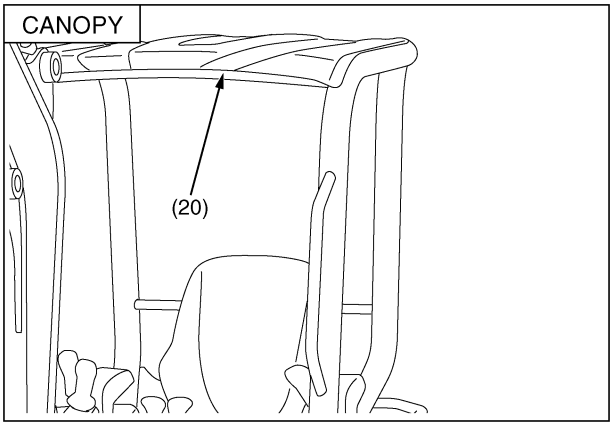
(20) Code No. RG658-5747△

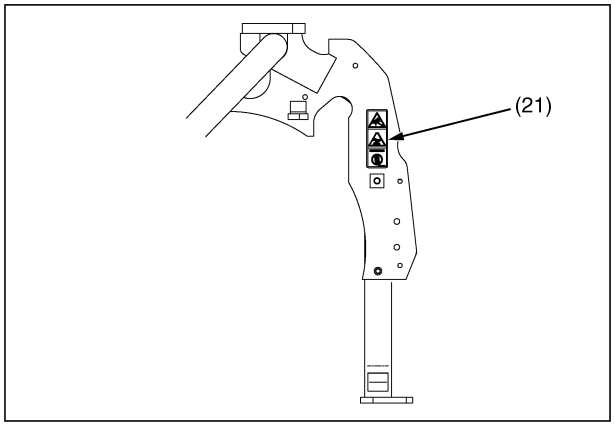


LD	Z	2.5m	3m	3.5m	4m	MAX
1.35 m	Z2	630	560	580	490	430
	Z1	680	680	560	470	430
	Z3	880	680	560	—	—

LD	Z	2.5m	3m	3.5m	4m	4.5m	MAX
1.55 m	Z2	730	570	530	480	410	390
	Z1	870	670	550	460	400	390
	Z3	730	670	550	460	—	—

(21) Code No. RG158-5724△





RY9212468ICI006A

RY9212469INI0002US0

[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

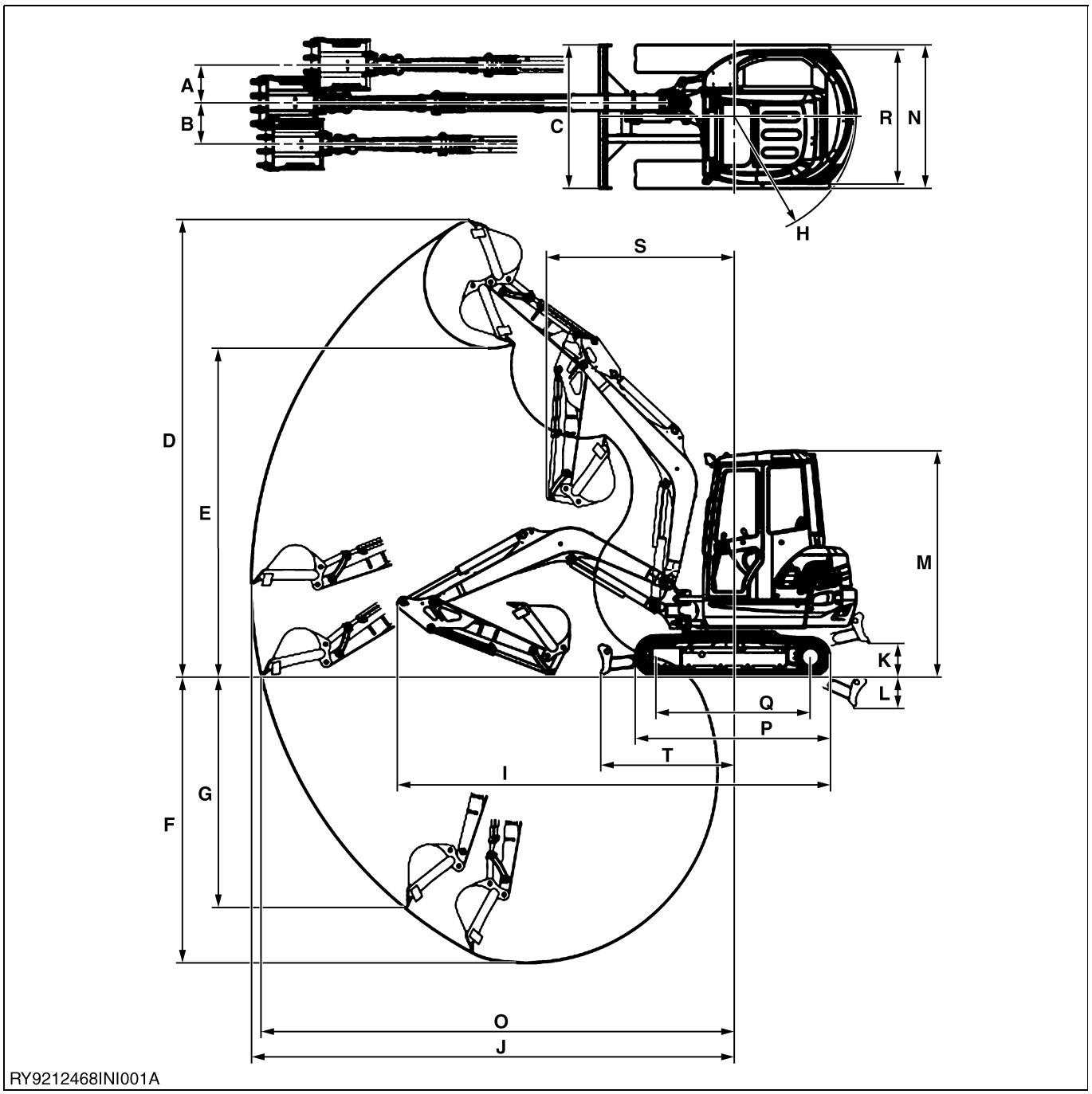
4. MAIN SPECIFICATIONS

			KUBOTA EXCAVATOR	
Model name			KX101-3α4	
Type			CANOPY	CABIN
Machine weight			3335 kg 7352 lbs	3445 kg 7595 lbs
Operating weight			3410 kg 7518 lbs	3520 kg 7760 lbs
Standard bucket	Volume (CECE)		0.107 m^3	
	Width (with side cutter)		550 mm (575 mm) 21.7 in. (22.6 in.)	
Engine	Type (water cooled 4 cycle diesel)		3 cylinder	
	Model name		D1803-M-E3-BH-EU1	
	Total displacement		1826 cm^3	
	Output (ISO 9249)		22.9 kW	
	Rated speed		2300 rpm	
Performance	Swing speed		9.0 rpm	
	Travel speed	1F	5.1 km / h	
		2F	3.0 km / h	
	Ground pressure		31.8 kPa 0.32 kgf/cm^2	32.8 kPa 0.33 kgf/cm^2
	Climbing angle		0.36 rad (20 deg)	
Blade (width and height)			1550 x 335 mm 61.0 x 13.2 in.	
Boom swing angle	Left		1.40 rad (80 deg)	
	Right		0.87 rad (50 deg)	
Pressure connection for attachments	AUX1	Max. displacement (Theoretical)	55 L/min	
		Max. pressure	24.5 MPa (250 kgf/cm^2, 3553 psi)	
	AUX2	Max. displacement (Theoretical)	28 L/min	
Fuel tank capacity			48 L	

■ **NOTE**
- **Above dimensions are based on the machine with rubber tracks and JPN bucket.**
  JPN = made in Japan
- **Specifications subject to change without notice.**
- **With unloaded digging bucket.**
- **Firm compacted soil.**
- **Operators must exercise extra caution and follow instructions in the operator's manual.**
- **Worse condition or heavier attachment to the above will decrease climbing angle.**

RY9212469INI0001US0

5. DIMENSIONS



RY9212468INI001A

	A	B	C	D	E	F	G	H	I	J
Standard arm	410 mm 16.1 in.	480 mm 18.9 in.	1550 mm 61.0 in.	4980 mm 196.1 in.	3590 mm 141.3 in.	3100 mm 122.0 in.	2350 mm 92.5 in.	1310 mm 51.6 in.	4920 mm 193.7 in.	5210 mm 205.1 in.
Long arm				5110 mm 201.2 in.	3720 mm 146.5 in.	3300 mm 129.9 in.	2530 mm 99.6 in.			5400 mm 212.6 in.

	K	L	M	N	O	P	Q	R	S	T
Standard arm	360 mm 14.2 in.	340 mm 13.4 in.	2440 mm 96.1 in.	1550 mm 61.0 in.	5100 mm 200.8 in.	2100 mm 82.7 in.	1670 mm 65.7 in.	1440 mm 56.7 in.	1980 mm 78.0 in.	1440 mm 56.7 in.
Long arm					5300 mm 208.7 in.				2010 mm 79.1 in.	

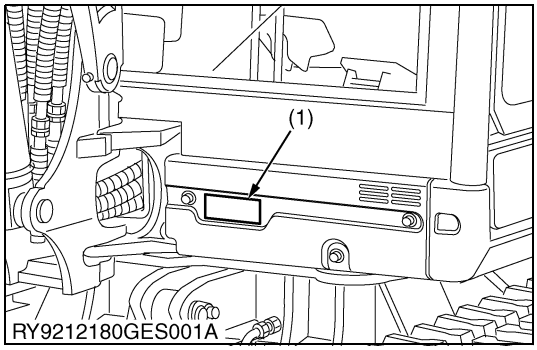
RY9212469INI0003US0

G GENERAL

GENERAL

CONTENTS

1. MACHINE INDENTIFICATION



RY9212180GES001A

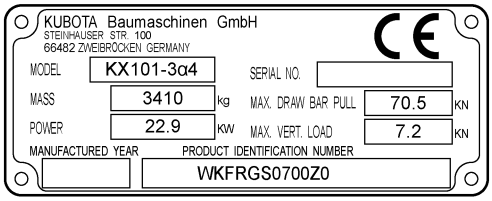
When consulting with your local Kubota dealer about this machine, please provide the model of the machine, its frame and engine numbers and the number of hours on the hour meter.

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

(a) Model Nameplate (CANOPY)
(b) Model Nameplate (CABIN)

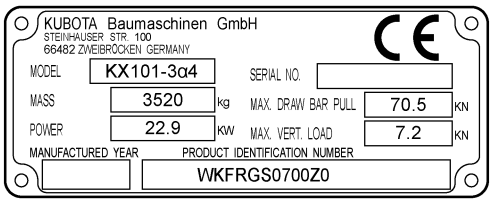
RY9212469GEG0001US0

(a)

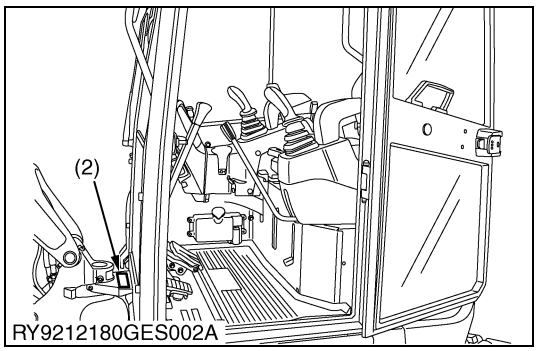


RY9212468GES001A

(b)



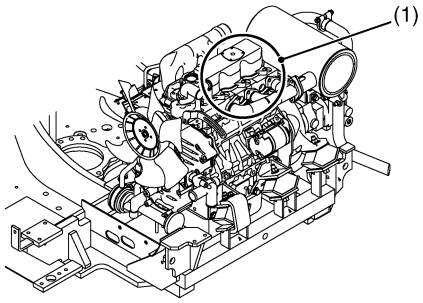
RY9212468GES002A



RY9212180GES002A

2. ENGINE INDENTIFICATION

[1] MODEL NAME AND SERIAL NUMBER



RY9212468GES003A

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. D1803 - 7 G Q 1237

(a) **D1803**: Engine Model Name
(b) 7: Engine Series (03 series)
(c) **G**: Production Year (2016)
(d) **Q**: Production Month (August)
(e) **1237**: Lot Number: (**0001 to 9999** or **A001 to Z999**)

RY9212469GEG0002US0

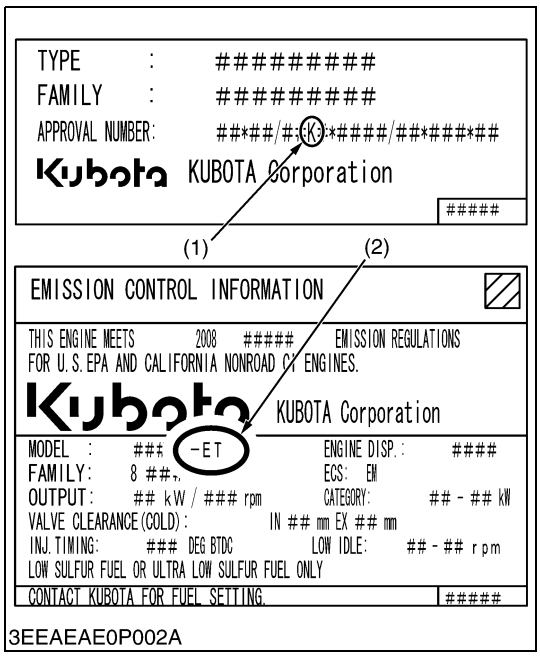
[2] E3B ENGINE

[Example : Engine Model Name D1803-M-**E3B**-XXXX or D1803-M-DI-**E3B**-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, E3B will be the designation that identifies engine models affected by the next emission phase (See the table below).

When servicing or repairing ###-E3B series engines, use only replacement parts for that specific E3B engine, designated by the appropriate E3B Kubota Parts List and perform all maintenance services listed in the appropriate Kubota Operator's Manual or in the appropriate E3B Kubota Workshop Manual. Use of incorrect replacement parts or replacement parts from other emission level engines (for example: E2B engines), may result in emission levels out of compliance with the original E3B 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. E3B engines are identified with "ET" at the end of the Model designation, on the US EPA label. Please note : E3B is not marked on the engine.



3EEAEAE0P002A

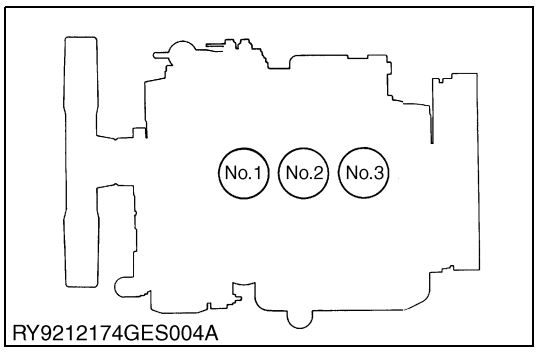
Category (1)	Engine output classification	EU regulation
K	From 19 to less than 37 kW	STAGE IIIA
J	From 37 to less than 75 kW	STAGE IIIA
I	From 75 to less than 130 kW	STAGE IIIA

Category (2)	Engine output classification	EPA regulation
ET	Less than 19kW	Tier 4
	From 19 to less than 56 kW	Interim Tier 4
	From 56 to less than 75 kW	Tier 3
	From 75 to less than 130 kW	Tier 3

(1) EU regulation engine output classification category
(2) "E3B" engines are identified with "ET" at the end of the Model designation, on the US EPA label.
"E3B" designates Tier 3 and some Interim Tier 4 / Tier 4 models, depending on engine output classification.

RY9212469GEG0003US0

[3] CYLINDER NUMBER



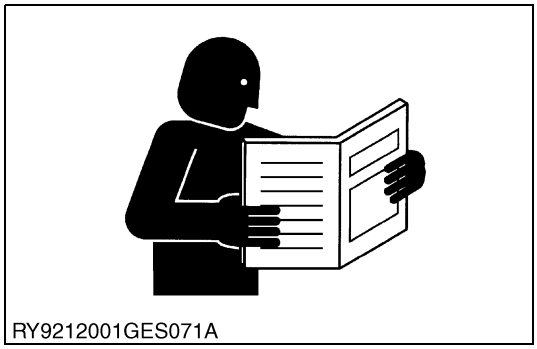
RY9212174GES004A

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 gear case side.

RY9212174GEG0003US0

3. 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.

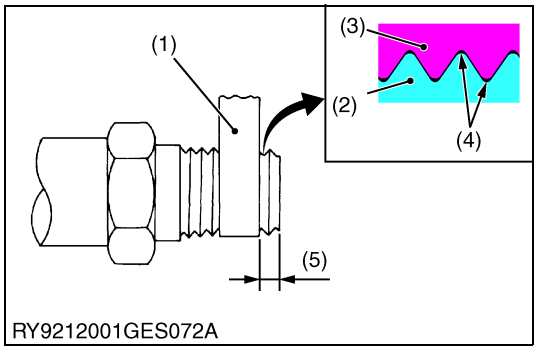
Before performing any maintenance on the machine, make sure it is sufficiently clean and choose a sufficiently clean location to perform any disassembly.

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.

RY9212001GEG0011US0



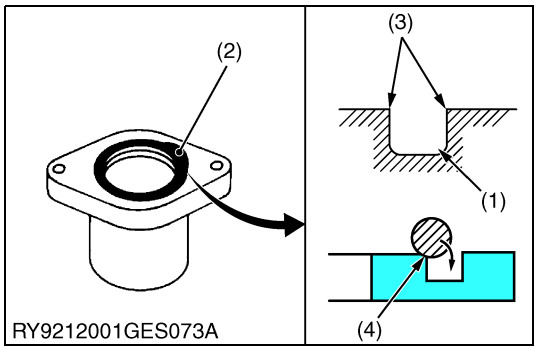
RY9212001GES072A

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



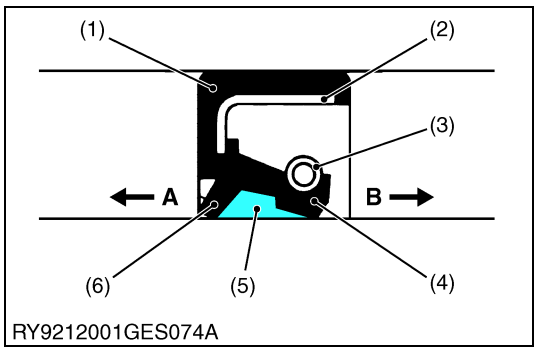
RY9212001GES073A

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

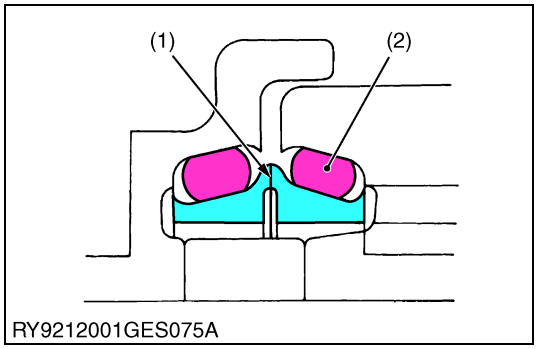
Oil Seal

- 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



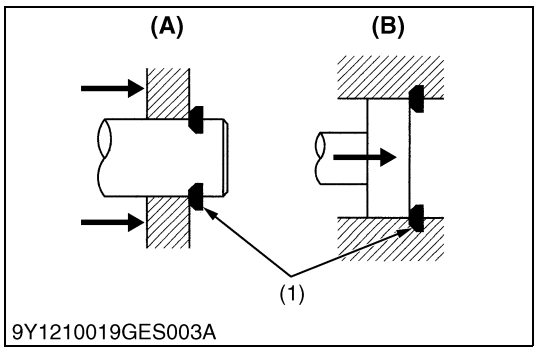
RY9212001GES075A

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



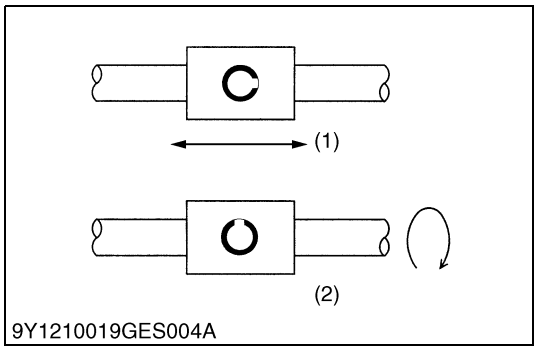
9Y1210019GES003A

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



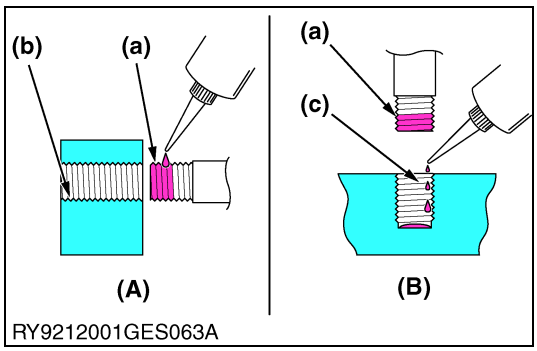
9Y1210019GES004A

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



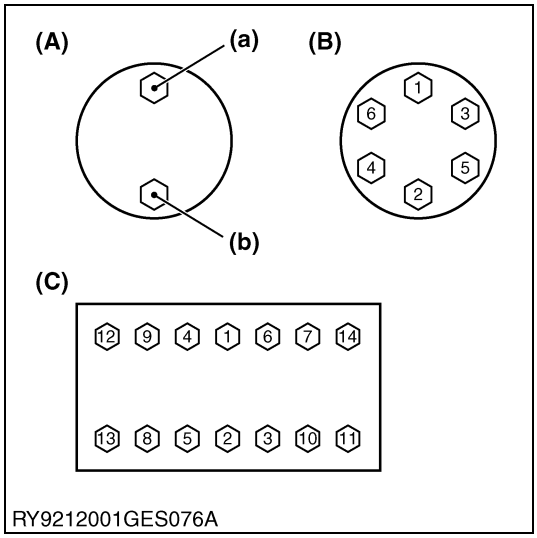
RY9212001GES063A

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.

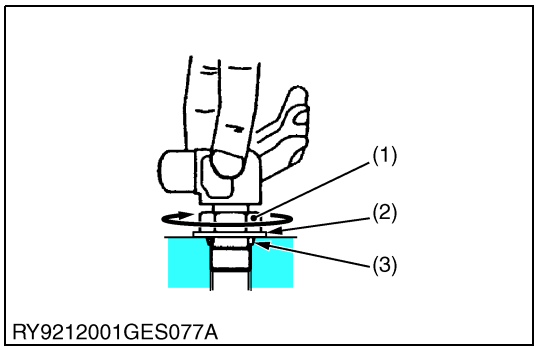
(A) Top/Bottom Alternately
(B) Across Diagonally
(C) Diagonally Across the Center

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

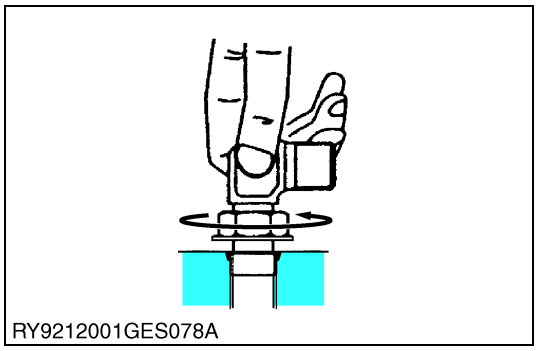


RY9212001GES077A

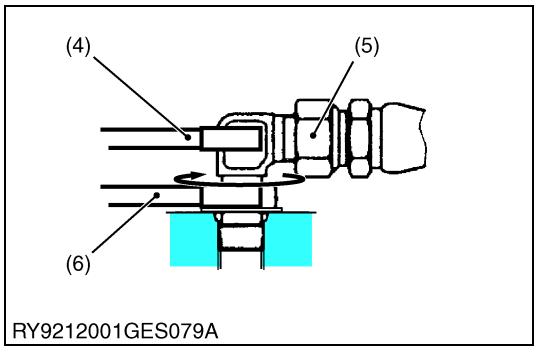
Elbow with Male Seat Assembly Procedure

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)

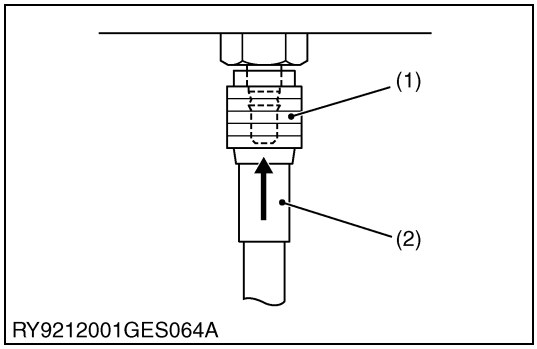


RY9212001GES079A

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

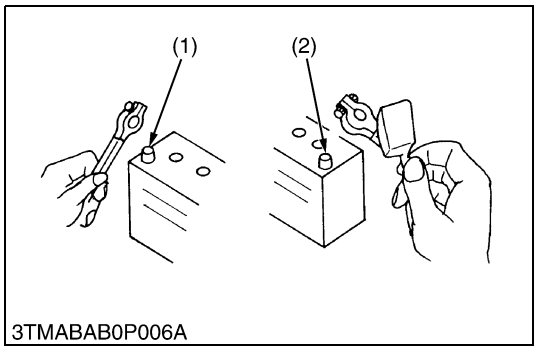
Installing and Removing Quick Couplings

- 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

4. 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.

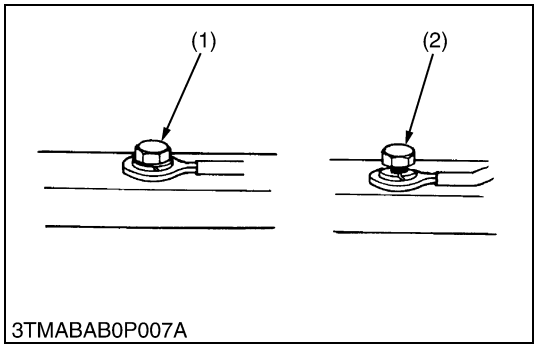
■ **IMPORTANT**

- **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

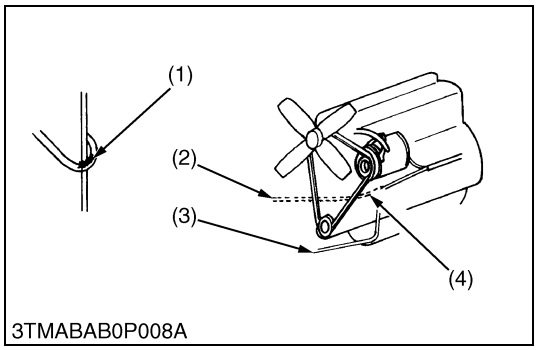


3TMABAB0P007A

- Tighten wiring terminals securely.

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

RY9212001GEG0024US0

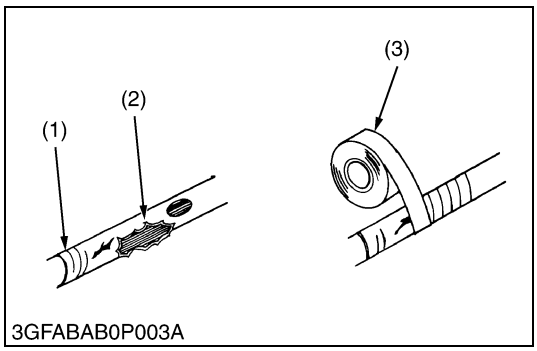


3TMABAB0P008A

- Keep wiring away from hazards.

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

RY9212001GEG0025US0

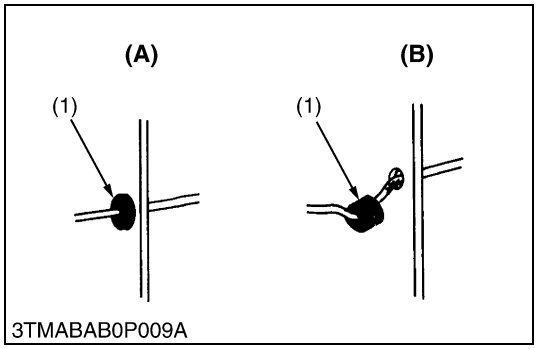


3GFABAB0P003A

- Immediately repair or replace old or damaged wiring.

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

RY9212001GEG0026US0

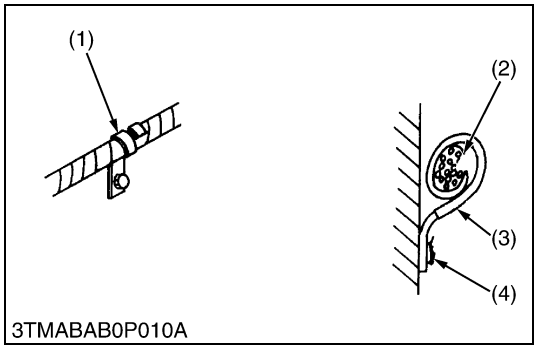


3TMABAB0P009A

- Insert grommet securely.

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

RY9212001GEG0027US0

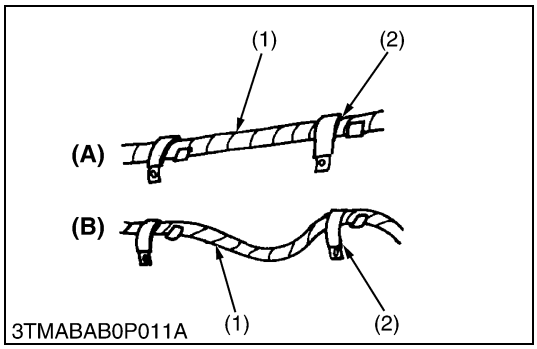


3TMABAB0P010A

- 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

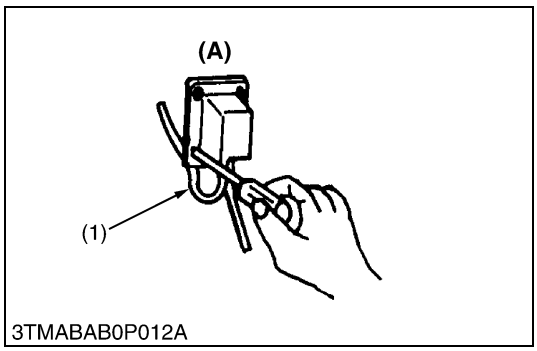


3TMABAB0P011A

- 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

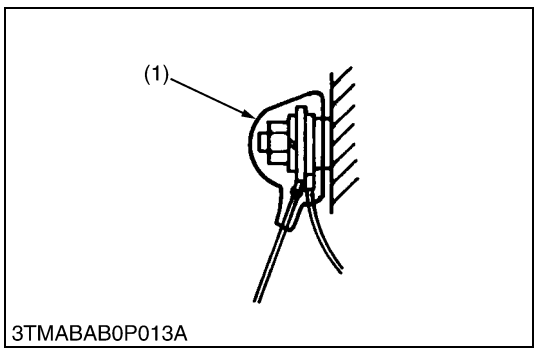


3TMABAB0P012A

- Do not pinch or bind wiring when installing parts.

(1) Wire
(A) Incorrect

RY9212001GEG0030US0



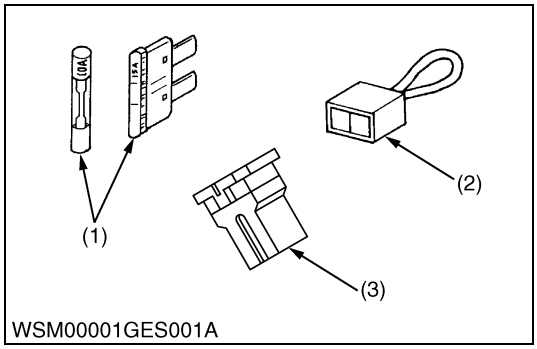
3TMABAB0P013A

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

(1) Cover (Install Covers Securely)

RY9212001GEG0031US0

[2] FUSES



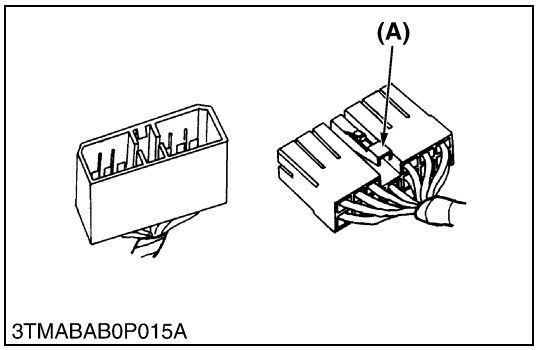
WSM00001GES001A

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

RY9212001GEG0032US0

[3] CONNECTOR

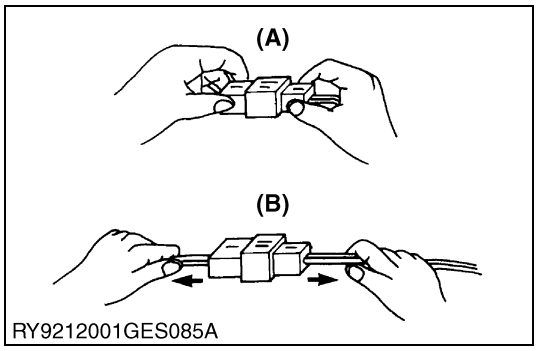


3TMABAB0P015A

- Press the lock to disconnect locking connectors.

(A) Push

RY9212001GEG0033US0

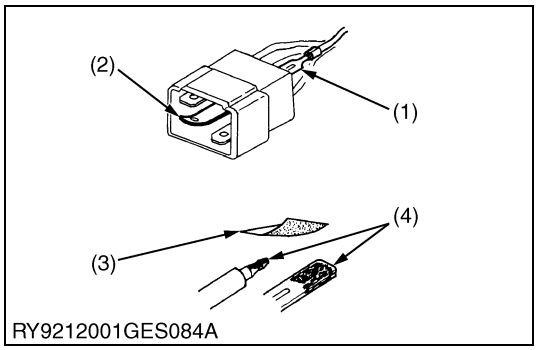


RY9212001GES085A

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

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

RY9212001GEG0034US0

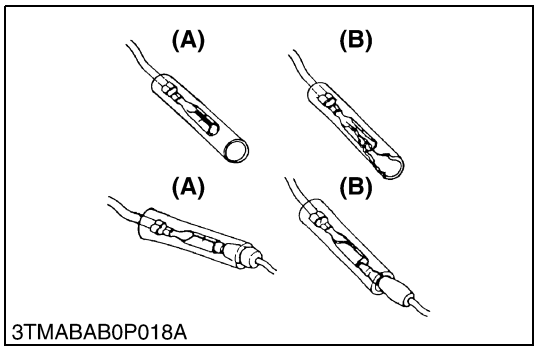


RY9212001GES084A

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

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

RY9212001GEG0035US0

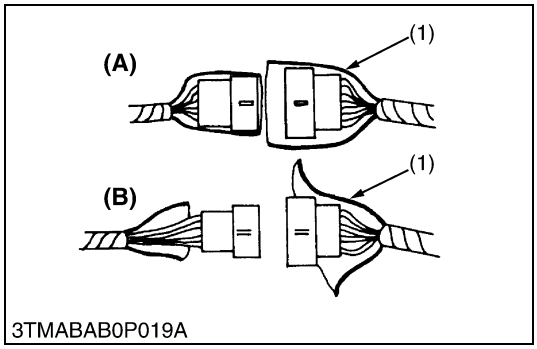


3TMABAB0P018A

- Female connectors must not be spread too far open

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

RY9212001GEG0036US0



3TMABAB0P019A

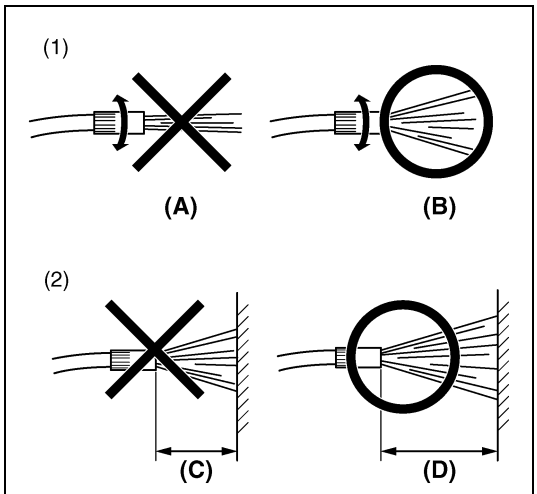
- The plastic covers of connectors must cover them completely.

(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

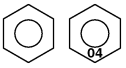
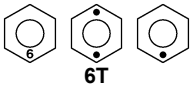
(A) Blasting
(B) Wide Spray
(C) Less Than 2.0 m (80 in.)
(D) Over 2.0 m (80 in.)

RY9212001GEG0038US0

5. 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

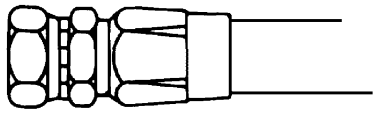
[2] TORQUES OF STUD BOLTS

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	–	–	–

RY9212032GEG0002US0

[3] TORQUE FOR HYDRAULIC HOSE FITTINGS

(1) Torque for Hydraulic Hose Fittings

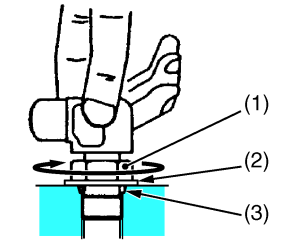


RY9212001GES067B

Hose size	Thread size	Wrench size	Torque
DN 4 - 1 / 8	M12 × 1.5	14 mm	15 to 20 N·m 1.5 to 2.0 kgf·m 11.1 to 14.8 lbf·ft
DN 6 - 1 / 4	M14 × 1.5	17 mm	15 to 20 N·m 1.5 to 2.0 kgf·m 11.1 to 14.8 lbf·ft
DN 8 - 5 / 16	M16 × 1.5	19 mm	30 to 35 N·m 3.1 to 3.6 kgf·m 22.1 to 25.8 lbf·ft
DN 10 - 3 / 8	M18 × 1.5	22 mm	40 to 45 N·m 4.1 to 4.6 kgf·m 29.5 to 33.2 lbf·ft
DN13 - 1 / 2	M22 × 1.5	27mm	50 to 55 N·m 5.1 to 5.6 kgf·m 36.9 to 40.6 lbf·ft

RY9212091GEG0017US0

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



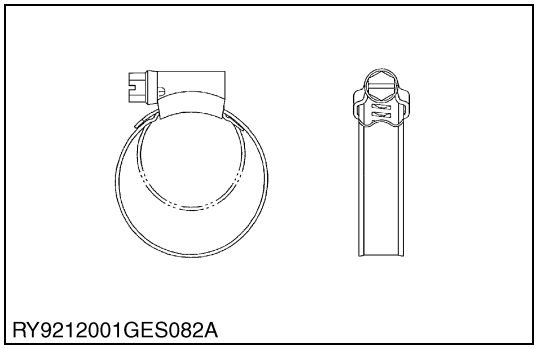
RY9212001GES077A

Hose size	Thread size	Wrench size	Torque
1 / 8	M10 × 1.0	14 mm	15 to 20 N·m 1.5 to 2.0 kgf·m 11.1 to 14.8 lbf·ft
1 / 8	M12 × 1.5	17 mm	25 to 35 N·m 2.6 to 3.6 kgf·m 18.4 to 25.8 lbf·ft
1 / 4	M14 × 1.5	19 mm	34 to 45 N·m 3.5 to 4.6 kgf·m 25.1 to 33.2 lbf·ft
1 / 4	M16 × 1.5	19 - 22 mm	40 to 55 N·m 4.1 to 5.6 kgf·m 29.5 to 40.6 lbf·ft
3 / 8	M18 × 1.5	22 - 24 mm	45 to 65 N·m 4.6 to 6.6 kgf·m 33.2 to 47.9 lbf·ft
1 / 2	M22 × 1.5	27 mm	70 to 80 N·m 7.1 to 8.2 kgf·m 51.6 to 59.0 lbf·ft
1 / 2	M24 × 1.5	27 mm	80 to 90 N·m 8.2 to 9.2 kgf·m 59.0 to 66.4 lbf·ft
3 / 4	M26 × 1.5	32 mm	100 to 120 N·m 10.2 to 12.2 kgf·m 73.8 to 88.5 lbf·ft
1	M30 × 2.0	36 mm	120 to 140 N·m 12.2 to 14.3 kgf·m 88.5 to 103.3 lbf·ft

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

RY9212091GEG0018US0

[4] HOSE CLAMP SCREW TORQUE



RY9212001GES082A

	Hose diameter	Hydraulic oil	Water	Air
Tightening torque	ϕ10-ϕ16	5.4 N·m 0.55 kgf·m 4.0 lbf·ft	3.0 N·m 0.35 kgf·m 2.2 lbf·ft	2.0 N·m 0.20 kgf·m 1.5 lbf·ft
	ϕ12-ϕ20	5.4 N·m 0.55 kgf·m 4.0 lbf·ft	3.0 N·m 0.35 kgf·m 2.2 lbf·ft	2.0 N·m 0.20 kgf·m 1.5 lbf·ft
	ϕ16-ϕ25	5.4 N·m 0.55 kgf·m 4.0 lbf·ft	4.5 N·m 0.46 kgf·m 3.3 lbf·ft	2.0 N·m 0.20 kgf·m 1.5 lbf·ft
	ϕ20-ϕ32	5.4 N·m 0.55 kgf·m 4.0 lbf·ft	4.5 N·m 0.46 kgf·m 3.3 lbf·ft	2.0 N·m 0.20 kgf·m 1.5 lbf·ft
	ϕ25-ϕ40	5.4 N·m 0.55 kgf·m 4.0 lbf·ft	4.5 N·m 0.46 kgf·m 3.3 lbf·ft	2.0 N·m 0.20 kgf·m 1.5 lbf·ft
	ϕ40-ϕ60	5.4 N·m 0.55 kgf·m 4.0 lbf·ft	4.5 N·m 0.46 kgf·m 3.3 lbf·ft	2.0 N·m 0.20 kgf·m 1.5 lbf·ft
	ϕ32-ϕ50	5.4 N·m 0.55 kgf·m 4.0 lbf·ft	4.5 N·m 0.46 kgf·m 3.3 lbf·ft	2.0 N·m 0.20 kgf·m 1.5 lbf·ft
	ϕ50-ϕ70	5.4 N·m 0.55 kgf·m 4.0 lbf·ft	4.5 N·m 0.46 kgf·m 3.3 lbf·ft	2.0 N·m 0.20 kgf·m 1.5 lbf·ft
	ϕ68-ϕ85	5.4 N·m 0.55 kgf·m 4.0 lbf·ft	4.5 N·m 0.46 kgf·m 3.3 lbf·ft	2.0 N·m 0.20 kgf·m 1.5 lbf·ft

Assembling instruction for clamps

1. At normal Temperature
2. Tightening rpm = max. 350 rpm
3. Tightening the clamps by hand only; measure torque value after tightening (within ≤ 20 sec.)
4. If using powertool, insure torque adjustment to result in same as above.

RY9212180GEG0006US0

6. TYPES OF OIL

[1] TABLE OF OIL AND FLUID CAPACITIES

Item		Capacity
Engine oil (when replacing filter)		6.6 L
Radiator coolant		5.6 L
Reserve tank coolant		1.6 L
Hydraulic oil	Total amount of oil	55 L
	In tank (gauge center)	36 L
Fuel tank capacity when full		49 L
Wheel motor		0.6 L
Track roller		70 ml
Carrier roller (Top track roller)		60 ml
Front idler		80 ml

RY9212469GEG0005US0

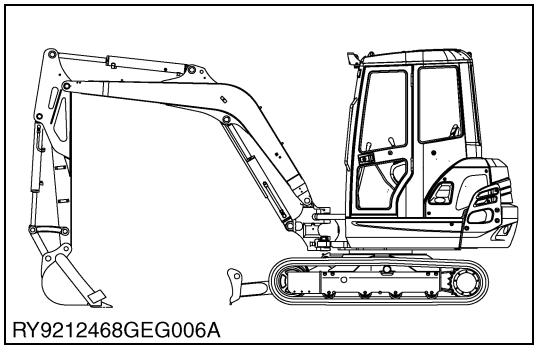
[2] RECOMMENDED LUBRICANTS

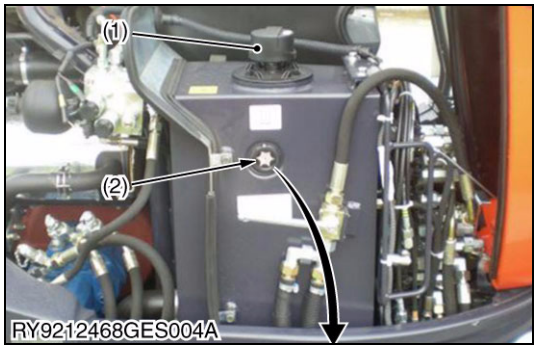
	Recommendation			Ex factory filling		Note
	Ambient Temperature Condition	Viscosity	Quality Standard	Brand	Type	
Engine oil	In winter, at low temperatures	SAE 10W SAE 20W	API CF * API CI-4 * API CJ-4 *			When diesel fuel with a higher sulfur content (between 0.50% and 1.00%) is used, the engine oil and engine oil filter must be replaced at shorter intervals. Never use diesel fuel with a sulfur content exceed 1.00%.
	In summer, at high ambient temperatures	SAE 30 SAE 40 SAE 50				
	All weather	15W40 *		Shell	Rimula R4L	15W40
Coolant			G048 * SAE J1034 * MB 325.0 * ASTM D3306 * D4985	ROWE	Hightec Antifreeze AN (–37 °C) *	For mixing with anti-freeze, always use distilled water. Always refer to the recommendations of coolant manufacturer as for the mixing ratios.Don't mix with other coolants.
Grease		NLGI-2 *	DIN 51825 KP2K-30 *	Mobil	Mobilux EP2 *	
		NLGI-1		Weicon	Antiseize Standard	To be used only for the first 50 working hours, on all greasing points around the swing bracket.
Hydraulic oil	In winter, at low temperatures	ISO 32 ISO 46 *		Shell	Tellus S2M46 *	
	In summer, at high ambient temperatures	ISO 46 ISO 68				
Gear oil	In winter, at low temperatures	SAE 75 SAE 80	MIL-L-2105C *			
	In summer, at high ambient temperatures	SAE 90 SAE 140				
	All weather	80W90 *		Shell	Spirax MA80W *	
Diesel			EN 590 ASTM D975			The factory filled-up fuel is no winterized diesel. To winterize the machine, fill up the fueltank with winterized diesel, and let the engine run for a few minutes.
Refrigerant			HFC R134a			

* : This lubricant is filled up at the production line.

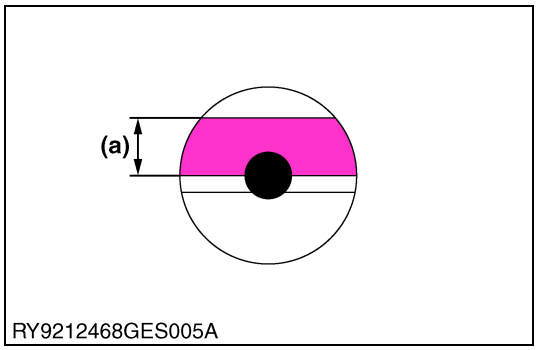
RY9212469GEG0008US0

[3] CHEKING AND FILLING HYDRAULIC OIL


RY9212468GEG006A



RY9212468GES004A



RY9212468GES005A

Stop vehicle body on horizontal ground, extend cylinder rods to near central position, and place bucket and blade on the ground.

Check that the oil level is in the centre of the oil level gauge when the hydraulic oil is at room temperature (10 to 30 °C).

The level is normal, if the oil is in the range **(a)** at or above the centre of the level gauge.

If there is insufficient oil, refill via the filler port.

(1) Filler port
(2) Oil level gauge

(a) Normal range of hydraulic oil

RY9212469GEG0004US0

7. MAINTENANCE INTERVALS

[1] OPERATOR SERVICING

No.	Check points	Hour meter indicator																			Intervals	
		50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	
1	Check the fuel level																				Daily	
2	Check the coolant level																				Daily	
3	Check the engine oil level																				Daily	
4	Check the hydraulic oil level																				Daily	
5	Lubricate the front-end attachment																				Daily	
6	Check the V-belt																				Daily	
7	Check the water separator																				Daily	
8	Grease the swivel gear	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	50 h	
9	Crawlers and chassis: Clean, visually inspect and chain tension	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍	Weekly (50 h)	
10	Check bolted joints		❍		❍		❍		❍		❍		❍		❍		❍		❍		❍	100 h	
11	Grease the pitch bearing				❍				❍				❍				❍				❍	200 h	
12	Check, clean the air filter				❍				❍				❍				❍				❍	200 h	*1
13	Check the battery electrolyte level										❍										❍	500 h	
14	Drain water from the fuel tank										❍										❍	500 h	

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

RY9212469GEG0006US0

[2] SERVICNG BY SKILLED PERSONAL OR KUBOTA DEALER

No.	Check points	Hour meter indicator																				Intervals	
		50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000		
1	Check the coolant hoses and hose clamps					❍					❍					❍					❍	250 h	
2	Check and adjust the V-belt					❍					❍					❍					❍	250 h	
3	Lubricate pilot valve linkage					❍					❍					❍					❍	250 h	
4	Charge the engine oil and oil filter										❍										❍	500 h	
5	Replace the drive unit oil	●									❍										❍	500 h	
6	Replace fuel filter										❍										❍	500 h	*4
7	Replace the return filter					●					❍										❍	500 h	*3
8	Replace the pilot circuit filter																				❍	1000 h	
9	Replace the auxiliary valve filter																				❍	1000 h	
10	Change the hydraulic oil and replace the suction filter																				❍	1000 h	*2
11	Change line filter																				❍	1000 h	
12	Replace the air filter elements																				❍	1000 h	*1
13	Change the oil of the idler and track roller	Please contact your KUBOTA dealer.																				2000 h	
14	Check alternator and starter motor	Please contact your KUBOTA dealer.																				2000 h	
15	Check the electric cables and connections	Please contact your KUBOTA dealer.																				Annually	
16	Safety inspection																					Annually	
17	Replace the coolant																					Every 2 years	
18	Replace the hydraulic hoses	Please contact your KUBOTA dealer.																				Every 6 years	

*1: Under very dusty conditions, the air filter must be cleaned more frequently or replaced.
*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: When using a breaker up to 50% → every 200 h.
When using a breaker over 50% → every 100 h.
*4: At least annually. Earlier if necessary.

■ **IMPORTANT**

- **The maintenance tasks identified with must be carried out once the specified hours of operation after initial commissioning have been reached.**

RY9212469GEG0007US0

1 ENGINE

GENERAL

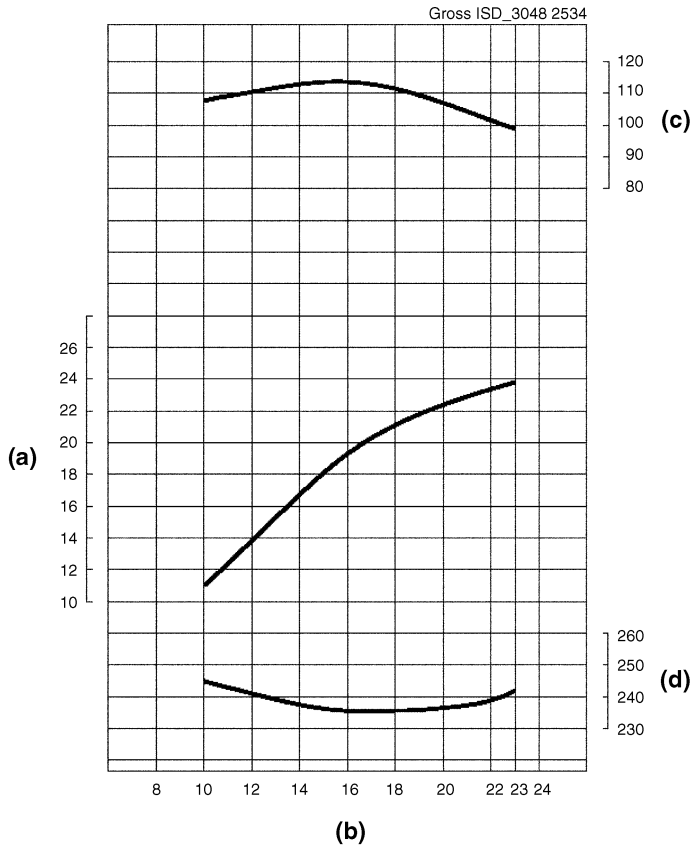
CONTENTS

1. ENGINE SPECIFICATIONS

		KX101-3α4	Remarks
Model		D1803-M-E3-BH-EU1	
Number of cylinder		3	
Bore x Stroke		87 x 102.4 mm 3.43 x 4.03 in.	
Displacement		1826 cc 111.44 in^3	
Max. output/rpm		22.9 kW / 2300 rpm 31.1 PS / 2300 rpm 30.7 HP / 2300 rpm	ISO 9249 NET SAEJ 9249 NET
Compression ratio		24.3 : 1	
Max. torque/rpm		110.8 N·m / 1600 rpm 110.3 kgf·m / 1600 rpm 81.7 lbf·ft / 1600 rpm	
Dimensions: L x W x H		560 x 480 x 648 mm 22.1 x 18.9 x 25.5 in.	
Dry weight		158 kg 348.3 lbs	
Valve clearance		0.18 to 0.22 mm 0.0071 to 0.0087 in.	Cold condition
Firing sequence		1-2-3	
Combustion chamber		IDI	
Compression pressure		3.23 to 3.72 MPa 33 to 38 kgf/cm^2 468 to 539 psi	At 290 rpm
Fan belt		Mitsuboshi RE-MF6410	
Fuel consumption ratio		241.8 g/kWh 177.8 g/PSh 0.400 lbs/HPh	Gross value
Engine speed with idling		1150 to 1300 rpm	On the machine
Engine oil pressure with rated engine rpm		196 to 445 kPa 2.0 to 4.5 kgf/cm^2 28.4 to 64.5 psi	
Fuel injection pressure		13.7 to 14.7 MPa 140 to 150 kgf/cm^2 1987 to 2132 psi	
Engine oil consumption ratio		Less than 0.95 g/kWh Less than 0.70 g/PSh Less than 0.00156 lbs/HPh	Gross
Alternator		12 V (360 W)	
Charging current		30 A	
Regulation voltage		14.2 to 14.8 V	
Battery	ETN	572 033 072	
	DIN	57233	
	JIS	80D26R	
Electrolyte gravity		More than 1.26	
Starter		12 V - 2.0 kW	
Glow plug		Approx. 0.9 Ω	

RY9212469END0001US0

2. PERFORMANCE CURVE

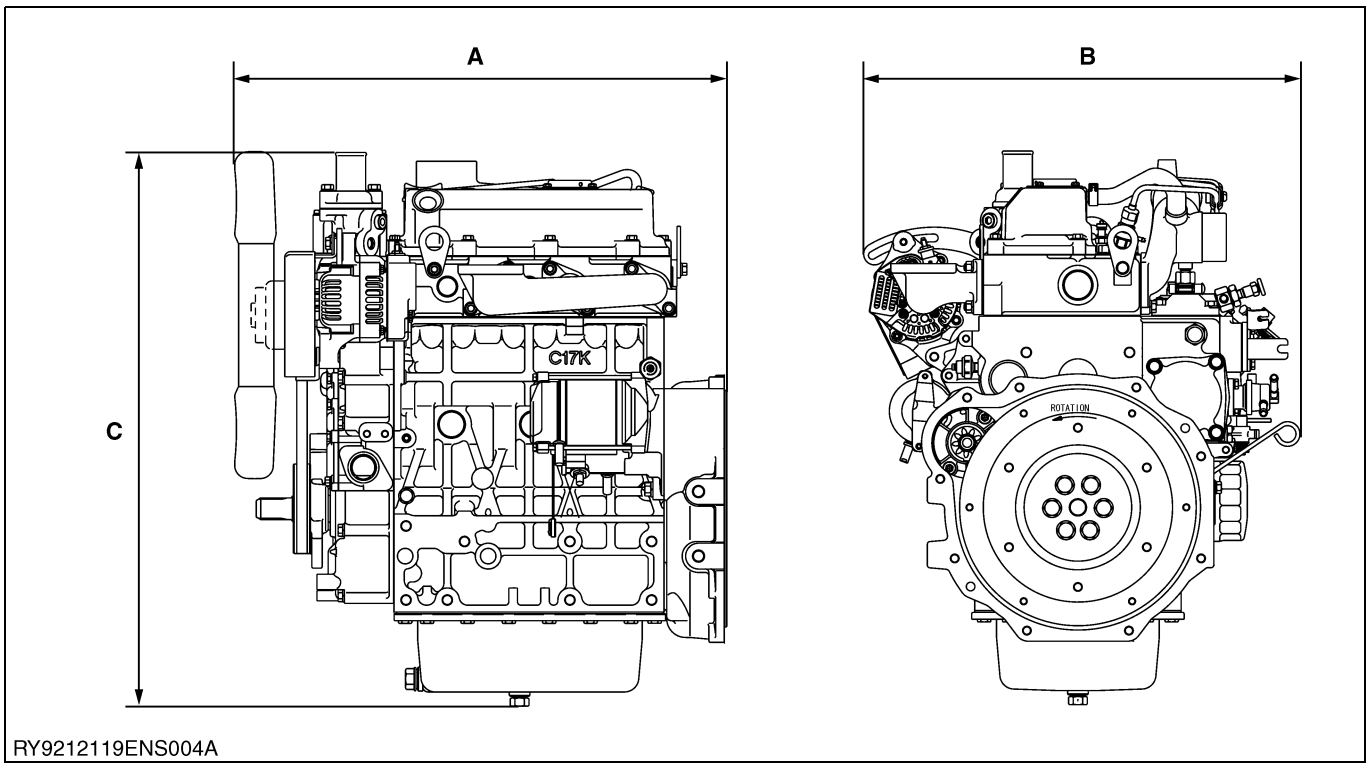


RY9212119ENS001A

(a) Brake Horse Power (kW) **(b) Engine Speed (rpm x 100)** **(c) Torque (N·m)** **(d) BSFC (g/kW·h)**

RY9212119END0001US0

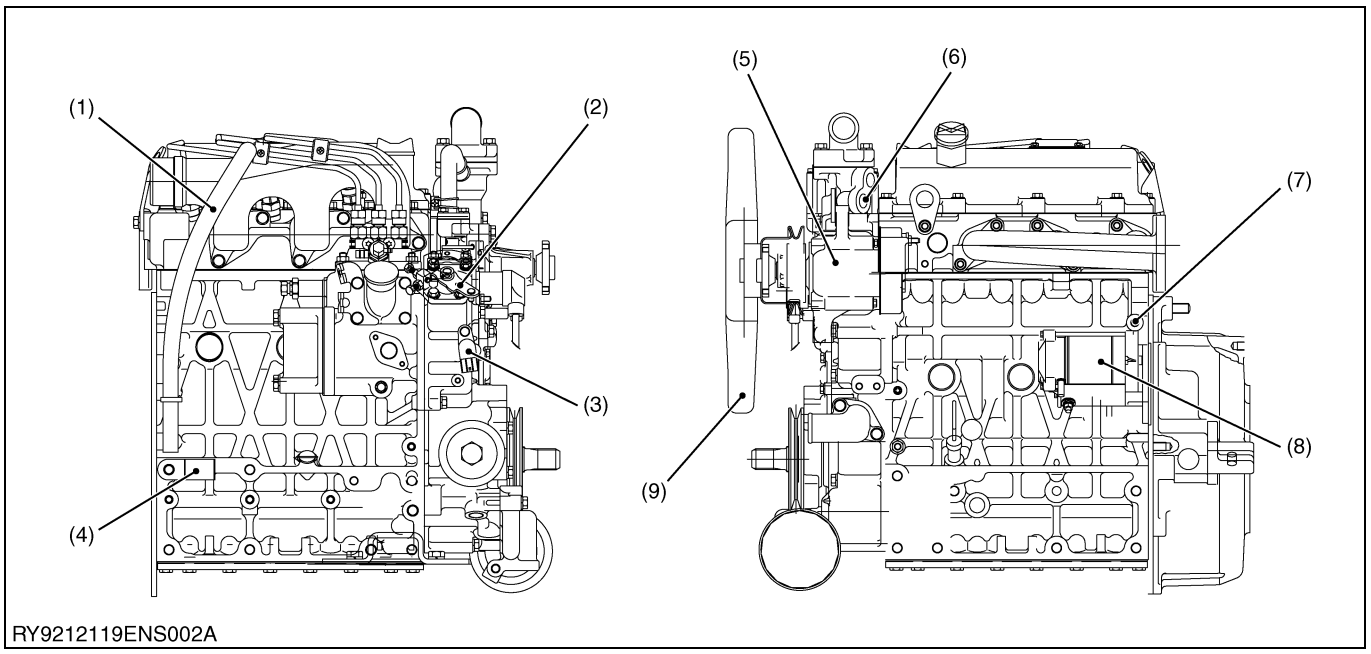
3. DIMENSIONS



RY9212119ENS004A

	D1803-M
A	560.0 mm (22.05 in.)
B	480.0 mm (18.90 in.)
C	648.0 mm (25.51 in.)

Components layout



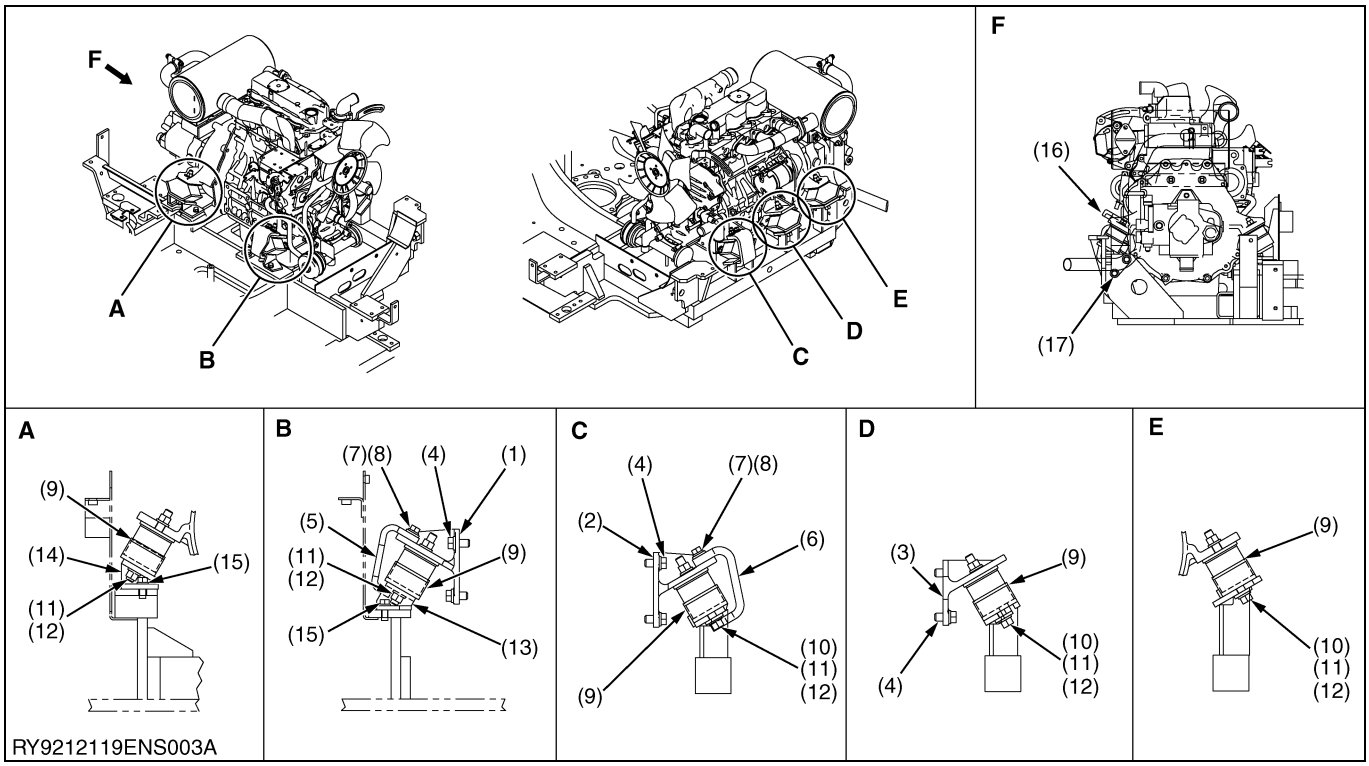
RY9212119ENS002A

(1) Breather Pipe
(2) Acceleration
(3) Rotation Sensor
(4) Hose Clamp
(5) Alternator
(6) Temperature Sensor
(7) Oil Switch
(8) Starter
(9) Fan

RY9212469END0002US0

4. ENGINE MOUNT

[1] ENGINE MOUNT STRUCTURAL COMPONENTS



(1) Bracket (1, Engine)
(2) Bracket (2, Engine)
(3) Bracket (5, Engine)
(4) Bolt, Sems
(5) Stopper (1, Engine)
(6) Stopper (2, Engine)
(7) Bolt, Sems
(8) Washer
(9) Cushion
(10) Washer, Plain
(11) Washer, Spring Lock
(12) Hex. Nut
(13) Support (1, Engine)
(14) Support (2, Engine)
(15) Bolt, Sems
(16) Stopper (3, Engine)
(17) Bolt, Sems

Tightening torque	Bolt (4) Nut (12)	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 lbf·ft
	Bolts (15)	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 lbf·ft

Apply thread locking compound (Loctite 302-71) onto part number (4), (12) and (15).

RY9212119END0004US0

2 MACHINE BODY

SERVICING

CONTENTS

1. FRONT EQUIPMENT

[1] BUCKET

(1) Removal and Installation Procedure

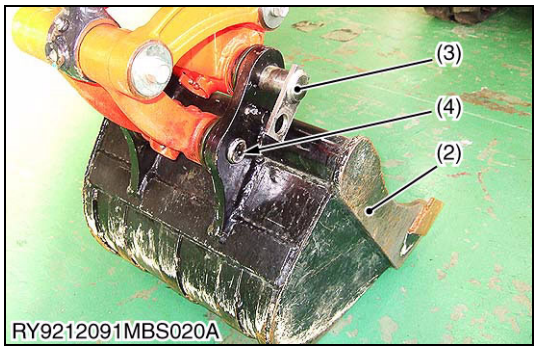
CAUTION

- **Wear safety equipment such as a helmet and safety glasses during mounting and removal.**
- **When working with others, pay full attention to safety and make sure communication signals are completely clear to each other.**
- **Never ever put a finger in a pin hole when aligning a pin to the hole.**

RY9212001MBS0020US0

Removing the Bucket

1. Place the back of the bucket on a flat, hard ground surface. Stop the engine and relieve pressure from the hydraulic system. Remove the mounting pin.



2. Use a hammer and a round punch to remove pin A and pin B.

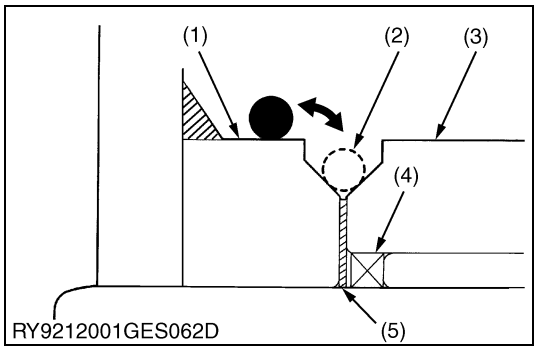
CAUTION

- **After removing pins, make sure no sand or mud gets on them.**
- **When removing/installing the pins take care not to damage the dust seals on both ends of the bushings.**

3. Start the engine, raise the boom and separate the arm and the bucket.

(1) Mounting Pin
(2) Bucket
(3) Pin A
(4) Pin B

RY9212091MBS0001US0



Assembling the Bucket

1. Place O-ring on the boss section of the bucket before assembling the bucket.
2. Assemble the bucket in the reverse order of disassembly.
3. Put the O-ring in the groove.

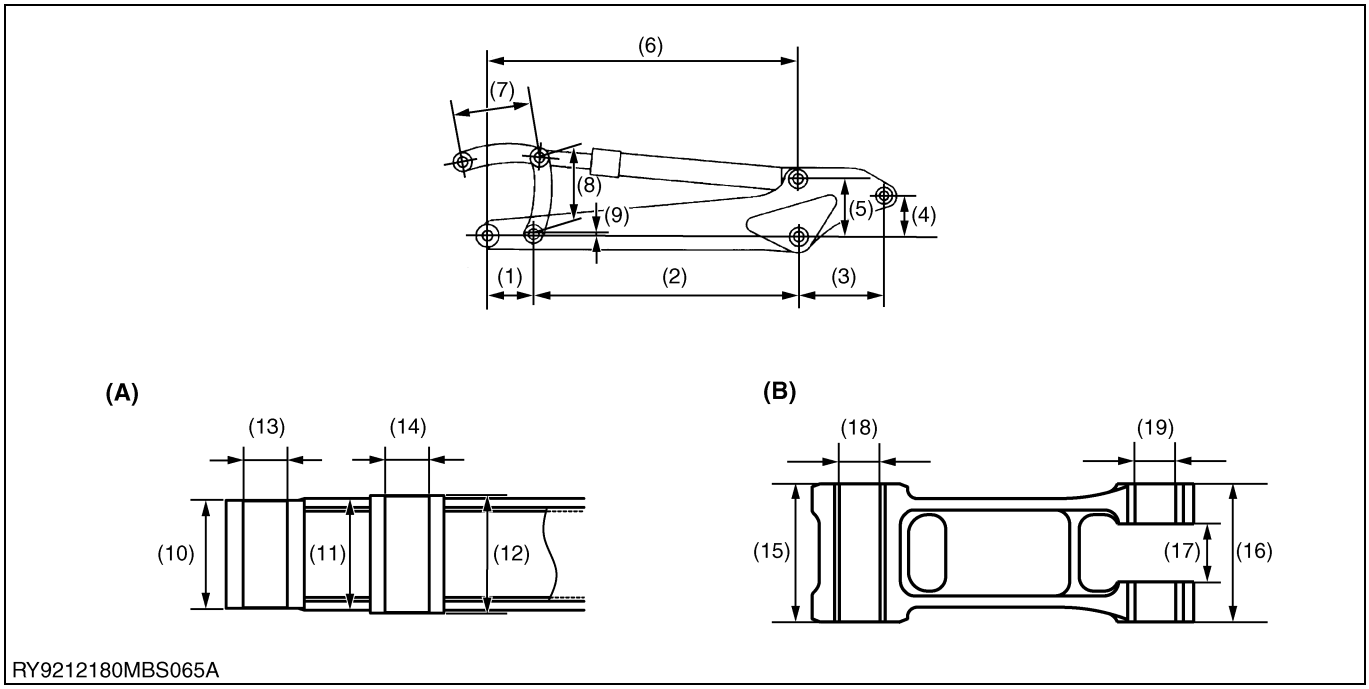
IMPORTANT

- **The axial free play must be within 0.6 mm. If the free play exceeds, insert suitable spacers.**
- **This O-ring protects against incoming dirt and soil. Therefore it prevents from excessive wear.**

(1) Bucket
(2) O-ring
(3) Arm
(4) Dust seal
(5) Shim

RY9212180MBS0065US0

(2) Relative Dimensions of Bucket Installation Joints



RY9212180MBS065A

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

No.		No.		No.		No.	
(1)	165 mm 6.50 in.	(6)	1151 mm 45.31 in.	(11)	118 mm 4.65 in.	(16)	134 mm 5.28 in.
(2)	1350 mm 53.15 in.	(7)	310 mm 12.20 in.	(12)	134 mm 5.28 in.	(17)	51 mm 2.0 in.
(3)	301 mm 11.85 in.	(8)	310 mm 12.20 in.	(13)	ϕ 40 mm ϕ 1.57 in.	(18)	ϕ 40 mm ϕ 1.57 in.
(4)	140.5 mm 5.53 in.	(9)	7.5 mm 0.30 in.	(14)	ϕ 40 mm ϕ 1.57 in.	(19)	ϕ 40 mm ϕ 1.57 in.
(5)	259 mm 10.20 in.	(10)	134 mm 5.28 in.	(15)	134 mm 5.28 in.		

RY9212469MBS0001US0

[2] FRONT EQUIPMENT

(1) Removal and Installation Procedure

CAUTION

- **Each of the devices and the hydraulic and lubricating oils are hot and/or under high pressure immediately after operating the machine. If the hydraulic oil reached a high operating temperature, it may cause a burn.**
- **Oil gushing out under pressure has enough force to pierce your skin and may cause you injury. Always allow the temperature of each part to drop and relieve any remaining pressure prior to starting to remove any parts of the hydraulic system.**

RY9212091MBS0013US0


RY9212180MBS004A


RY9212180MBS005A


RY9212180MBS006A


RY9212180MBS007A

Removing Front Machine

1. Operate the front machine as shown on the left, and lower the arm tip to the ground.
2. Remove the bucket cylinder and AUX hydraulic hoses.
3. After suspending the Nylon sling from the bucket and arm, take out the pin from the arm cylinder rod and then the linkage pin between the arm and the boom, and remove the bucket and arm section.
4. Lower the boom end to the ground and remove the worklight harness and the arm cylinder hydraulic hose.
5. Remove the pin on the boom cylinder rod and lower the rod side to the ground.
6. After suspending the Nylon sling from the boom, take out the boom base pin and remove the front machine.

Attaching the Front Equipment

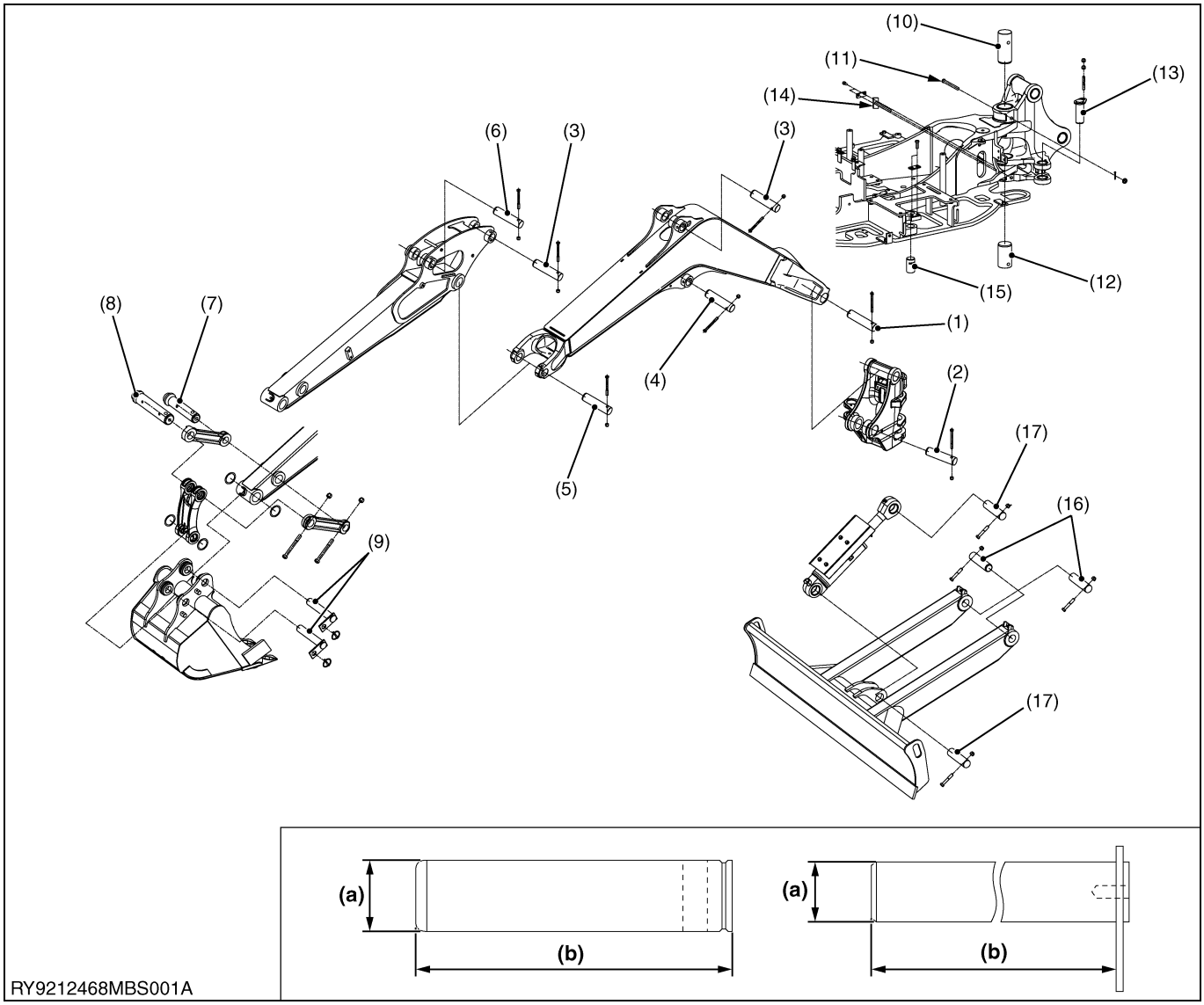
Perform the procedures in reverse to attach the equipment.

■ **NOTE**

- **The thrust play must be within 0.6 mm. If it is bigger, insert suitable / additional shims.**

RY9212469MBS0013US0

(2) Diagram and List of Front Pins



(a) Pin Diameter **(b) Pin Length**

Pin Diameter and Length

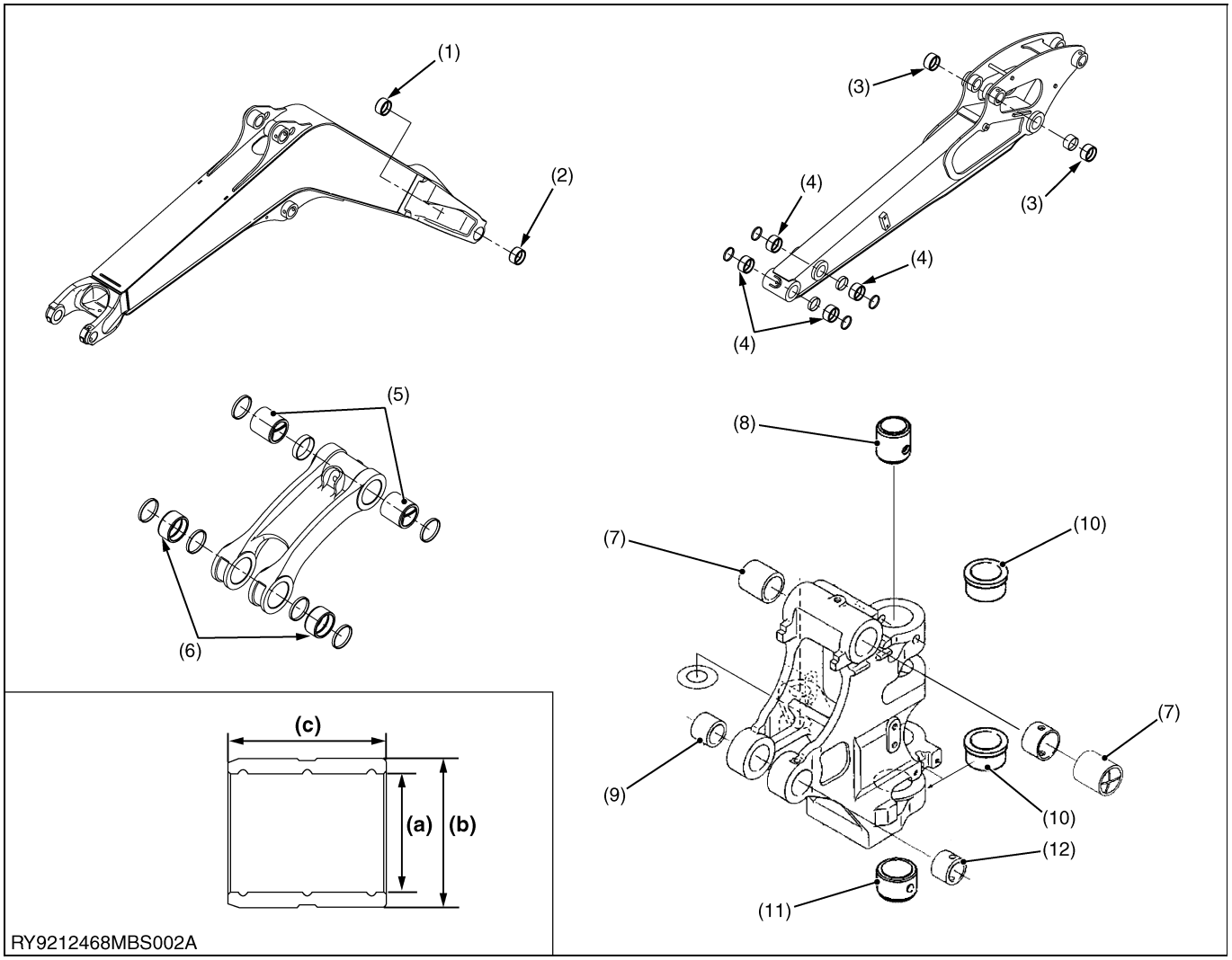
No.		Q'ty	No.		Q'ty	No.		Q'ty
(1)	ϕ50 × 278 mm ϕ1.97 × 10.9 in.	1	(7)	ϕ40 × 210 mm ϕ1.57 × 8.3 in.	1	(13)	ϕ70 × 142 mm ϕ2.8 × 5.6 in.	1
(2)	ϕ45 × 160mm ϕ1.77 × 6.3 in.	1	(8)	ϕ40 × 210 mm ϕ1.57 × 8.3 in.	1	(14)	ϕ16 × 138 mm ϕ0.6 × 5.4 in.	1
(3)	ϕ45 × 172 mm ϕ1.77 × 6.8 in.	1	(9)	ϕ45 × 172 mm ϕ1.77 × 6.8 in.	2	(15)	ϕ40 × 132 mm ϕ1.6 × 5.2 in.	1
(4)	ϕ40 × 155 mm ϕ1.57 ×6.1 in.	1	(10)	ϕ70 × 155 mm ϕ2.8 × 6.1 in.	1	(16)	ϕ40 × 168 mm ϕ1.6 × 6.6 in.	2
(5)	ϕ40 × 244 mm ϕ1.57 × 9.6 in.	1	(11)	ϕ16 × 145 mm ϕ0.6 × 5.7 in.	1	(17)	ϕ45 × 131 mm ϕ1.8 × 5.2 in.	2
(6)	ϕ40 × 168 mm ϕ1.57 × 6.6 in.	1	(12)	ϕ70 × 145 mm ϕ2.8 × 5.7 in.	1			

■ **NOTE**

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

RY9212469MBS0002US0

(3) List of Front Bushing Dimensions



(a) I.D. **(b) O.D.** **(c) Length**

I.D. x O.D. x Length

No.		Q'ty	Material Quality
(1)	50 x 60 x 48 mm (1.97 x 2.36 x 1.89 in.)	1	STKM16A, S43C
(2)		1	
(3)	40 × 50 × 55 mm (1.57 × 1.97 × 2.17 in.)	2	STKM16A, S40C
(4)	40 × 50 × 40 mm (1.57 × 1.97 × 1.57 in.)	4	
(5)		2	
(6)	40 × 50 × 32 mm (1.57 × 1.97 × 1.26 in.)	2	STK400
(7)	70 × 82 × 61 mm (2.76 × 3.23 × 2.40 in.)	2	CK45
(8)		1	
(9)	70 × 82 × 33 mm (2.76 × 3.23 × 1.30 in.)	2	
(10)	70 × 82 × 41 mm (2.76 × 3.23 × 1.61 in.)	1	
(11)	45 × 55 × 45 mm (1.77 × 2.17 × 1.77 in.)	1	
(12)		1	

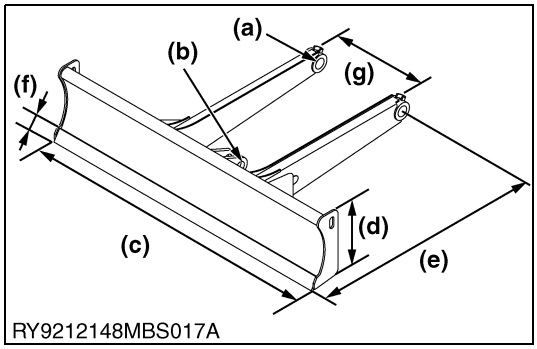
■ **NOTE**

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

RY9212469MBS0003US0

[3] BLADE

(1) Blade Dimensions



RY9212148MBS017A

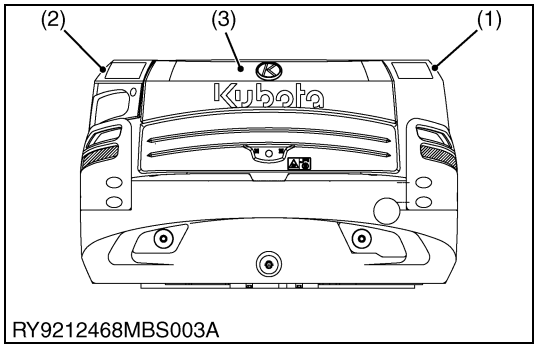
No.	Item	KX101-3α4
(a)	I.D. X Length	ϕ40 × 161 mm ϕ1.57 × 6.34 in.
(b)		ϕ45 × 131 mm ϕ1.77 × 5.16 in.
(c)	Width	1550 mm 61.0 in.
(d)	Height	337 mm 13.27 in.
(e)	Length	1112 mm 43.78 in.
(f)	Tip height - plate thickness	65 × 12 mm 2.56 × 0.47 in.
(g)	Distance between supports	483 mm 19.02 in.

RY9212469MBS0004US0

2. SWIVEL FRAME

[1] WEIGHT

(1) Removal and Installation Procedure



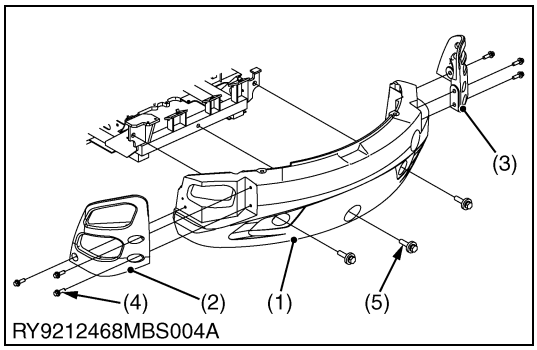
RY9212468MBS003A

Removing the Bonnet

1. Remove the right bonnet, left bonnet and rear bonnet.

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

RY9212469MBS0005US0

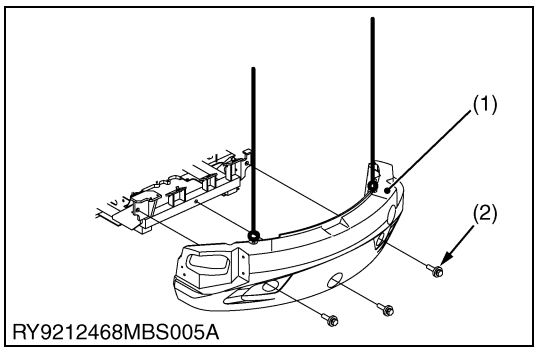


RY9212468MBS004A

2. Remove the left and right weight.

(1) Weight
(2) Left Weight
(3) Right Weight
(4) Bolt (M14 x 2.0)
(5) Bolt (M20 x 2.5)

RY9212469MBS0008US0



RY9212468MBS005A

Removing the Weight

1. Attach two eyebolts (M16 x 2.0) to the weight, connect a nylon sling to these and support the weight with a crane.
2. Remove the two weight mounting bolts, lift slightly with the crane, slide the weight to the rear, and with the weight suspended, remove it from the frame.

- Weight: Approx. 445 kg (982 lbs)

Tightening torque	Weight (1)	367.7 to 431.5 N·m 37.5 to 44.0 kgf·m 271.2 to 318.2 lbf·ft

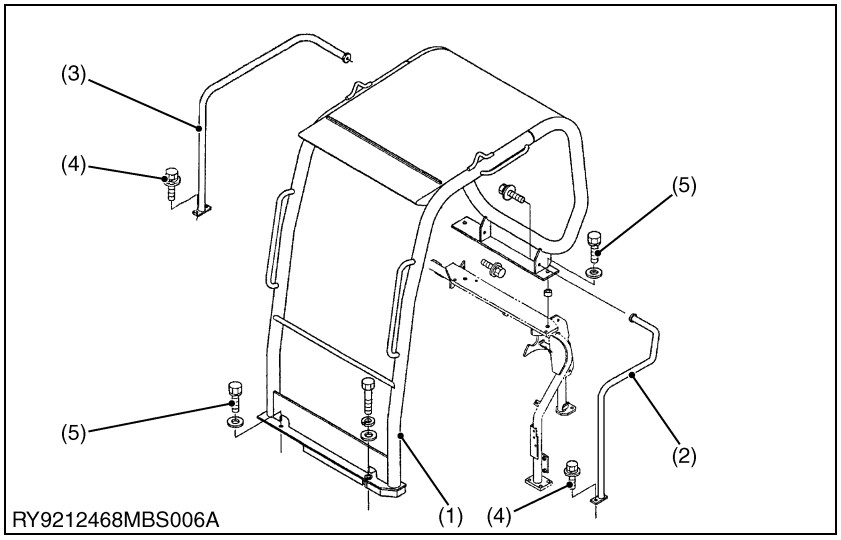
Apply thread lock (Loctite AN302-71).

(1) Weight
(2) Bolt

RY9212469MBS0006US0

[2] CANOPY

(1) Removal and Installation Procedure



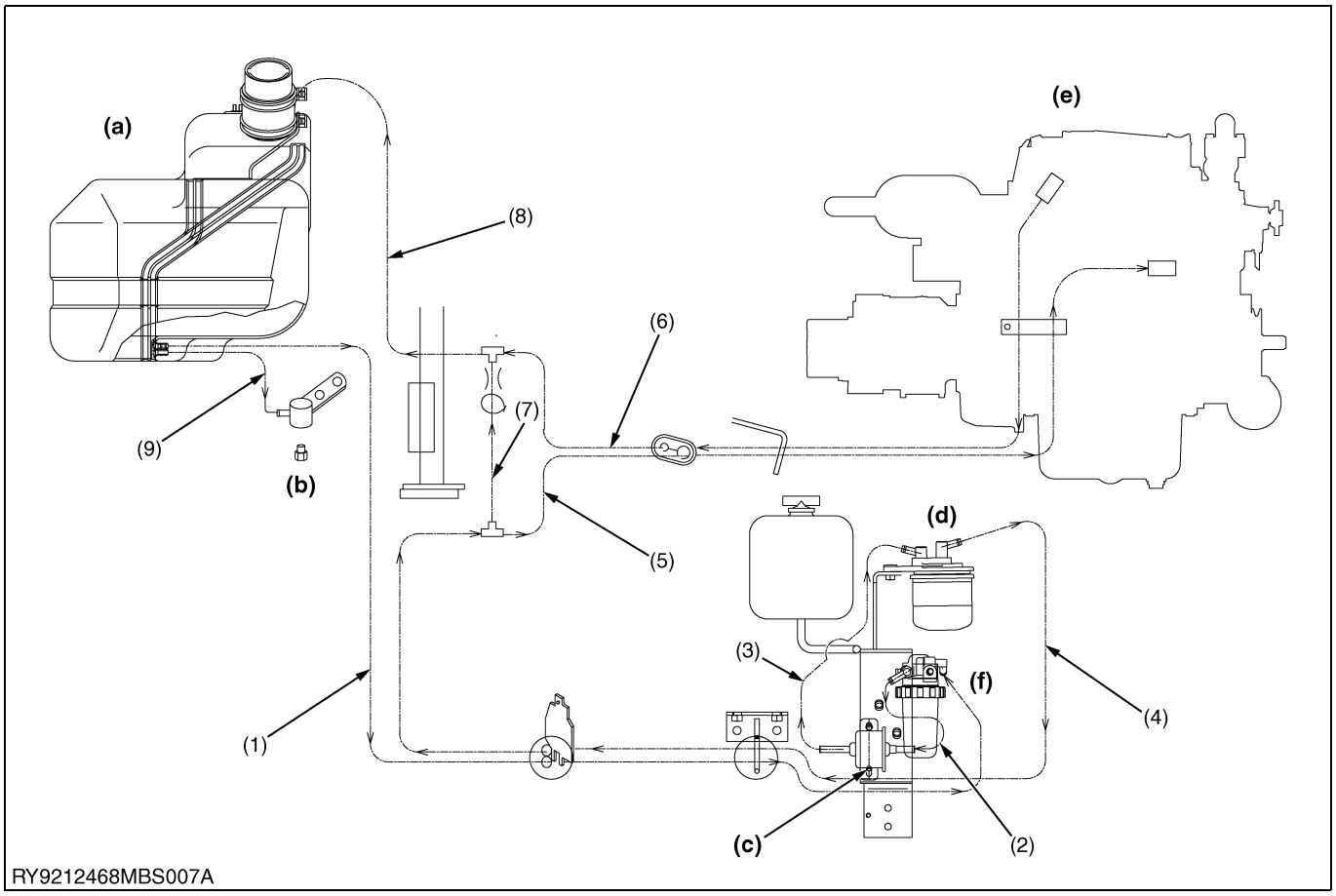
(1) ROPS Canopy
(2) Left Handrail
(3) Right Handrail
(4) Bolt (M10 x 1.25)
(5) Bolt (M14 x 2.0)

Tightening torque	Bolt (5)	166.7 to 196.1 N·m 17.0 to 20.0 kgf·m 123.0 to 144.6 lbf·ft

RY9212469MBS0009US0

[3] FUEL TANK

Fuel Hose Routing



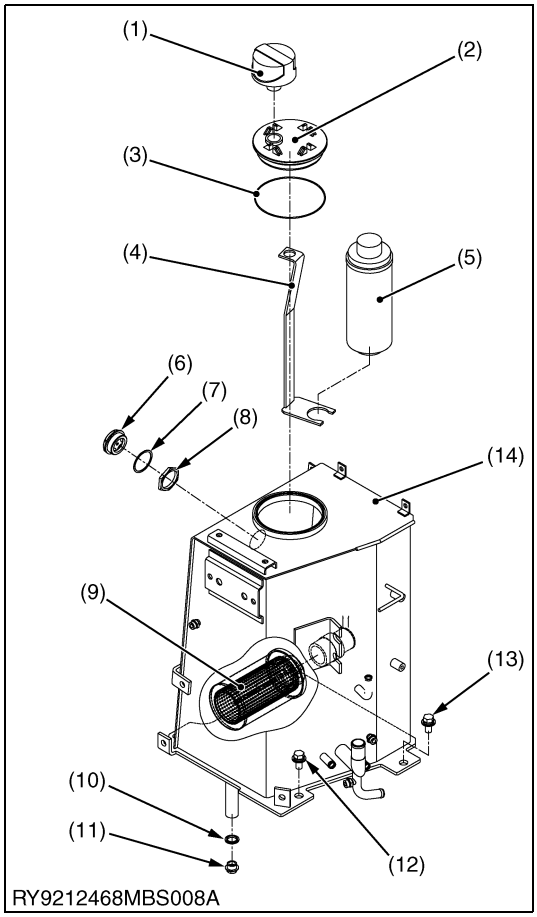
(a) Fuel Tank
(b) Water Drain Cock
(c) Fuel Pump
(d) Fuel Filter
(e) Engine
(f) Water Separator

No.	Fuel tube length	Protective tube length
(1)	1750 mm (68.9 in.)	1650 mm (65.0 in.)
(2)	190 mm (6.5 in.)	–
(3)	460 mm (18.1 in.)	340 mm (13.4 in.)
(4)	1450 mm (57.1 in.)	1350 mm (53.1 in.)
(5)	1250 mm (49.2 in.)	1150 mm (45.3 in.)
(6)	1400 mm (55.1 in.)	1300 mm (51.2 in.)
(7)	220 mm (8.7 in.)	150 mm (5.9 in.)
(8)	340 mm (13.4 in.)	240 mm (9.4 in.)
(9)	400 mm (15.7 in.)	–

RY9212469MBS0010US0

[4] HYDRAULIC OIL TANK

(1) Components



RY9212468MBS008A

No.	Part Name	Q'ty
(1)	Breather	1
(2)	Plug	1
(3)	O-ring	1
(4)	Filter Support	1
(5)	Return Filter	1
(6)	Oil Gauge	1
(7)	Oil Seal	1
(8)	Nut (M22)	1
(9)	Suction Filter	1
(10)	Plug	1
(11)	Gasket	1
(12)	Bolt (M12 x 1.25)	3
(13)	Bolt (M12 x 1.25)	1
(14)	Oil Tank	1

Tightening torque	Oil Gauge (6)	15 N·m 1.5 kgf·m 11 lbf·ft
	Mounting Bolt (12) (13)	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 lbf·ft

RY9212469MBS0011US0

3. TRACK FRAME

[1] RUBBER TRACK

(1) Removal and Installation Procedure

CAUTION

- **The pressure in the grease cylinder is high so if loosened quickly, the nipple may pop off and the highly pressurized grease in the cylinder may fly out so do not get your face near the nipple nor place your body in front of the nipple and loosen the nipple gradually.**

RY9212001MBS0008US0

RY9212468MBS009A

Removing the Grease Nipple

1. Place a socket wrench on the base of the grease nipple and loosen slowly.
   If there is a rock etc. caught in the sprocket, remove the rock first.

Tightening torque	Grease nipple	98.0 to 108.0 N·m 10.0 to 11.0 kgf·m 72.0 to 79.7 lbf·ft

(1) Grease Nipple

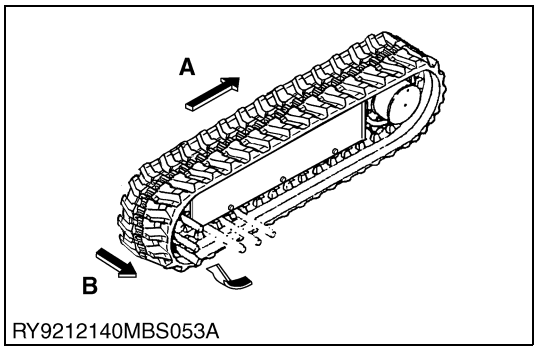
RY9212469MBS0007US0


RY9212180MBS052A

Loosening the Track

1. Jack up the body using the front attachments and blade, expel grease from inside the grease cylinder, and fully loosen up the track.
   Once the track is loosened up, attach the grease nipple.

RY9212180MBS0021US0



RY9212140MBS053A

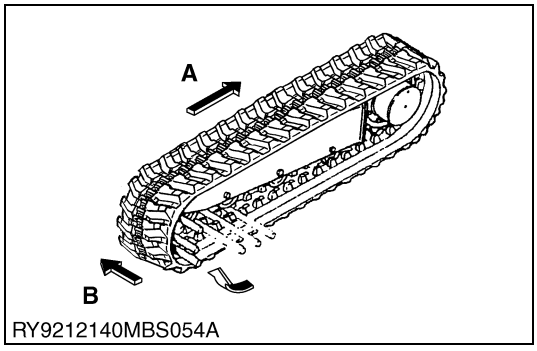
Removing the rubber tracks

1. With the machine lifted slightly, 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 126 kg (278 lbs)

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

RY9212180MBS0022US0



RY9212140MBS054A

Assembling the rubber tracks

1. Jack up the machine with the front attachments and the blade 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.

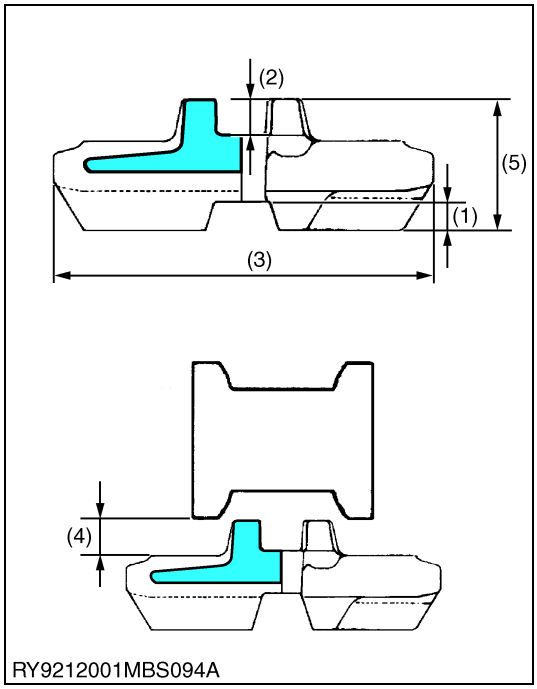
CAUTION

- **Be sure to assemble the rubber track the right way round.**

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

RY9212182MBS0102US0

(2) Rubber Track Dimensions



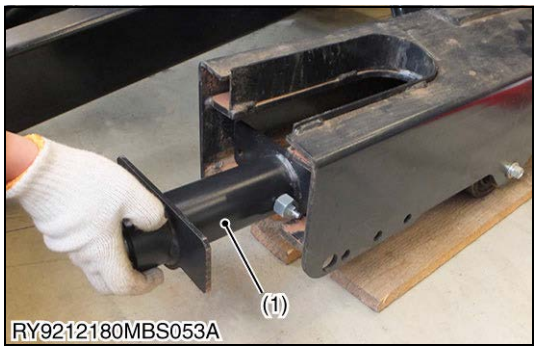
RY9212001MBS094A

Identification mark (Steel cord lapping position)	∞
(1) Lug height	18 mm 0.71 in.
(2) Link height	23.5 mm 0.925 in.
(3) Crawler width	300 mm 11.8 in.
(4) Crawler sag distance	10 to 15 mm 0.39 to 0.59 in.
(5) Crawler height	79 mm 3.1 in.
Number of core metal	80
Circumference	4240 mm 166.9 in.
Core metal pitch	53 mm 2.1 in.

RY9212180MBS0023US0

[2] CYLINDER ASSEMBLY

(1) Removal and Installation Procedure



RY9212180MBS053A

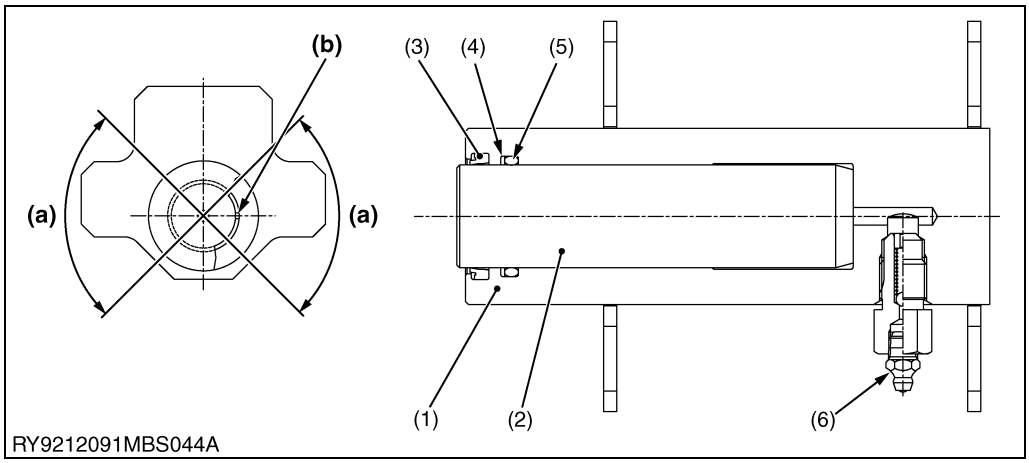
Removing the Cylinder ASSY

1. Remove the track and the front idler.
   (Refer to the "Front Idler" chapter for assembly/disassembly of the front idler.)
   After removing the spring ASSY, pull out the cylinder ASSY from the track frame.

(1) Cylinder ASSY

RY9212180MBS0051US0

(2) Cylinder ASSY Components



RY9212091MBS044A

(1) Cylinder Tube
(2) Rod
(3) Dust Seal
(4) Backup Ring
(5) O-Ring
(6) Nipple ASSY

(a) 90 °
(b) Backup Ring Mating Surface

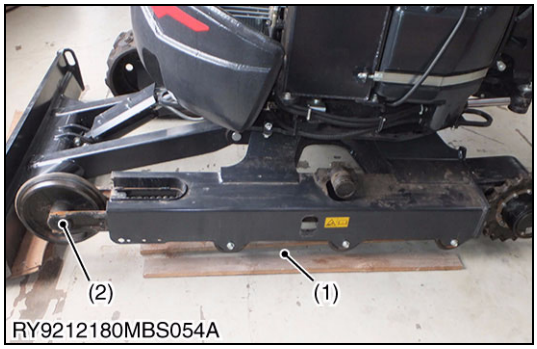
Tightening torque	Nipple ASSY (6)	98.0 to 108.0 N·m 10.0 to 11.0 kgf·m 72.0 to 79.7 lbf·ft

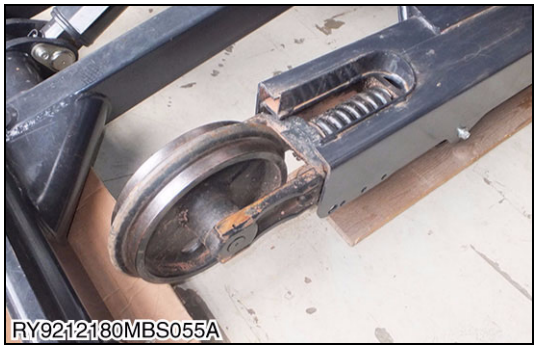
- Position the mating surface of the backup ring within a range of 90 ° laterally.

RY9212091MBS0064US0

[3] FRONT IDLER

(1) Removal and Installation Procedure





Removing the Idler

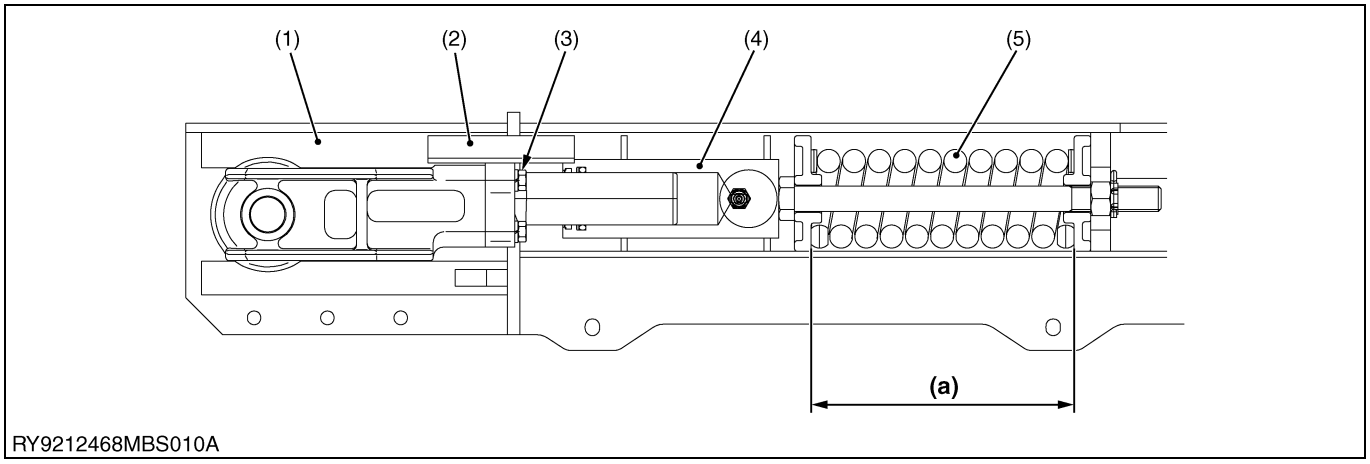
1. Remove the track.
   (Refer to the chapter "Track Removal and Installation.")
   Jack up the machine with the front and the blade and place timbers or the like under the frame.

2. Separate the front idler from the frame.

(1) Block (2) Front Idler

RY9212180MBS0027US0

(2) Front Idler Components



(1) Front Idler, ASSY
(2) Idler Plate
(3) Bolt (M12 x 1.25)
(4) Cylinder ASSY
(5) Spring ASSY
(a) 242 ± 1 mm (9.53 ± 0.04 in.)

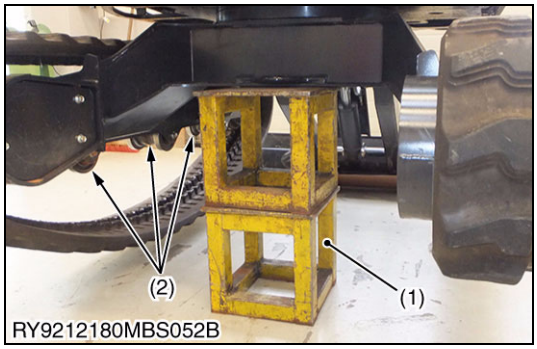
Tightening torque	Bolt (3)	77.4 to 90.2 N·m 7.9 to 9.2 kgf·m 57.1 to 66.5 lbf·ft

- Apply thread lock (Loctite AN302-71 equivalent).

RY9212469MBS0012US0

[4] TRACK ROLLER AND CARRIER ROLLER

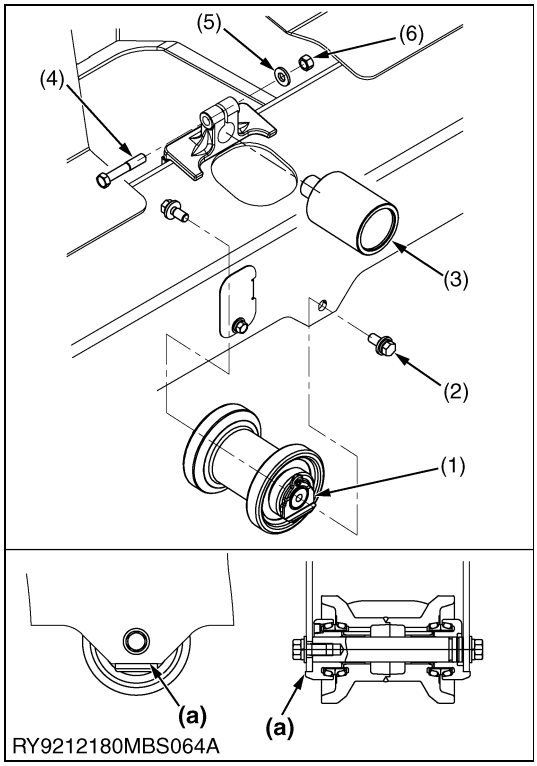
(1) Removal and Installation Procedure



1. Loosen the track.
   (Refer to the chapter "Track Removal and Installation".)
   Jack up the machine with the front and the blade and place timbers or the like under the frame.
2. Loosen the track roller mounting bolt, and remove the track roller.
3. Loosen the carrier roller mounting bolts and nuts, and then remove the carrier roller.

(1) Stand
(2) Track Roller

RY9212180MBS0024US0



Tightening torque	Track roller, ASSY mounting bolt (2)	103.0 to 117.7 N·m 10.5 to 12.0 kgf·m 76.0 to 86.8 lbf·ft
	Carrier roller, ASSY mounting nut (6)	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 lbf·ft

Apply thread lock (Loctite AN302-71 equivalent).

(1) Track Roller, ASSY
(2) Bolt
(3) Carrier roller, ASSY
(4) Bolt
(5) Spring Washer
(6) Nut

(a) Less than 2.0 mm (0.08 in.) (Gap between Working Surfaces)

RY9212180MBS0025US0

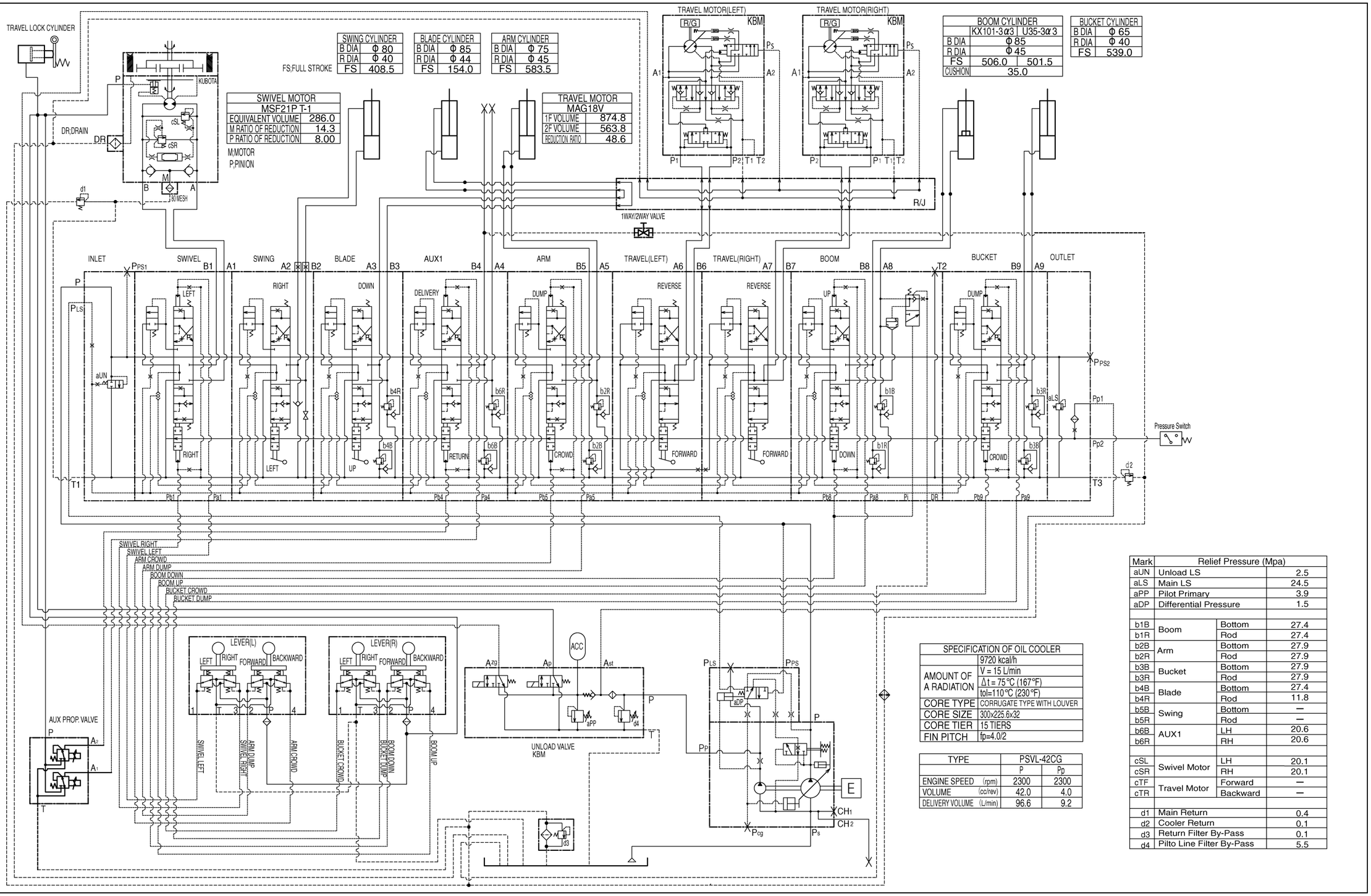
3 HYDRAULIC SYSTEM

MECHANISM

CONTENTS

1. HYDRAULIC CIRCUIT DIAGRAM

Standard



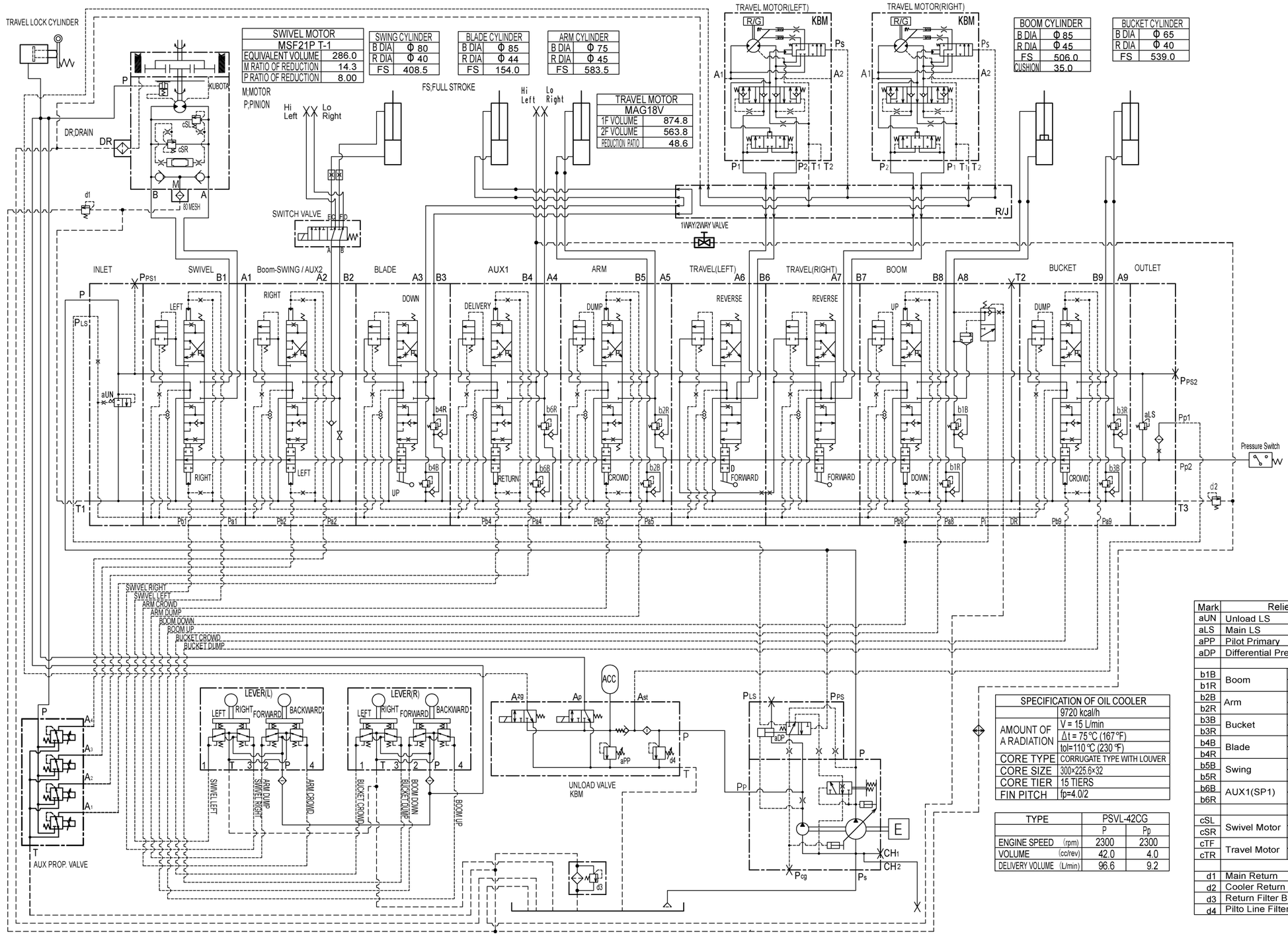
Mark	Relief Pressure (Mpa)		
aUN	Unload LS		2.5
aLS	Main LS		24.5
aPP	Pilot Primary		3.9
aDP	Differential Pressure		1.5
b1B	Boom	Bottom	27.4
b1R		Rod	27.4
b2B	Arm	Bottom	27.9
b2R		Rod	27.9
b3B	Bucket	Bottom	27.9
b3R		Rod	27.9
b4B	Blade	Bottom	27.4
b4R		Rod	11.8
b5B	Swing	Bottom	—
b5R		Rod	—
b6B	AUX1	LH	20.6
b6R		RH	20.6
cSL	Swivel Motor	LH	20.1
cSR		RH	20.1
cTF	Travel Motor	Forward	—
cTR		Backward	—
d1	Main Return		0.4
d2	Cooler Return		0.1
d3	Return Filter By-Pass		0.1
d4	Pilto Line Filter By-Pass		5.5

SPECIFICATION OF OIL COOLER	
AMOUNT OF A RADIATION	9720 kcal/h
	V = 15 L/min
	Δt = 75°C (167°F)
	tol=110°C (230°F)
CORE TYPE	CORRUGATE TYPE WITH LOUVER
CORE SIZE	300x225.6x32
CORE TIER	15 TIERS
FIN PITCH	fp=4.0/2

TYPE		PSVL-42CG	
		P	Pp
ENGINE SPEED	(rpm)	2300	2300
VOLUME	(cc/rev)	42.0	4.0
DELIVERY VOLUME	(L/min)	96.6	9.2

RY9212468HYT002US

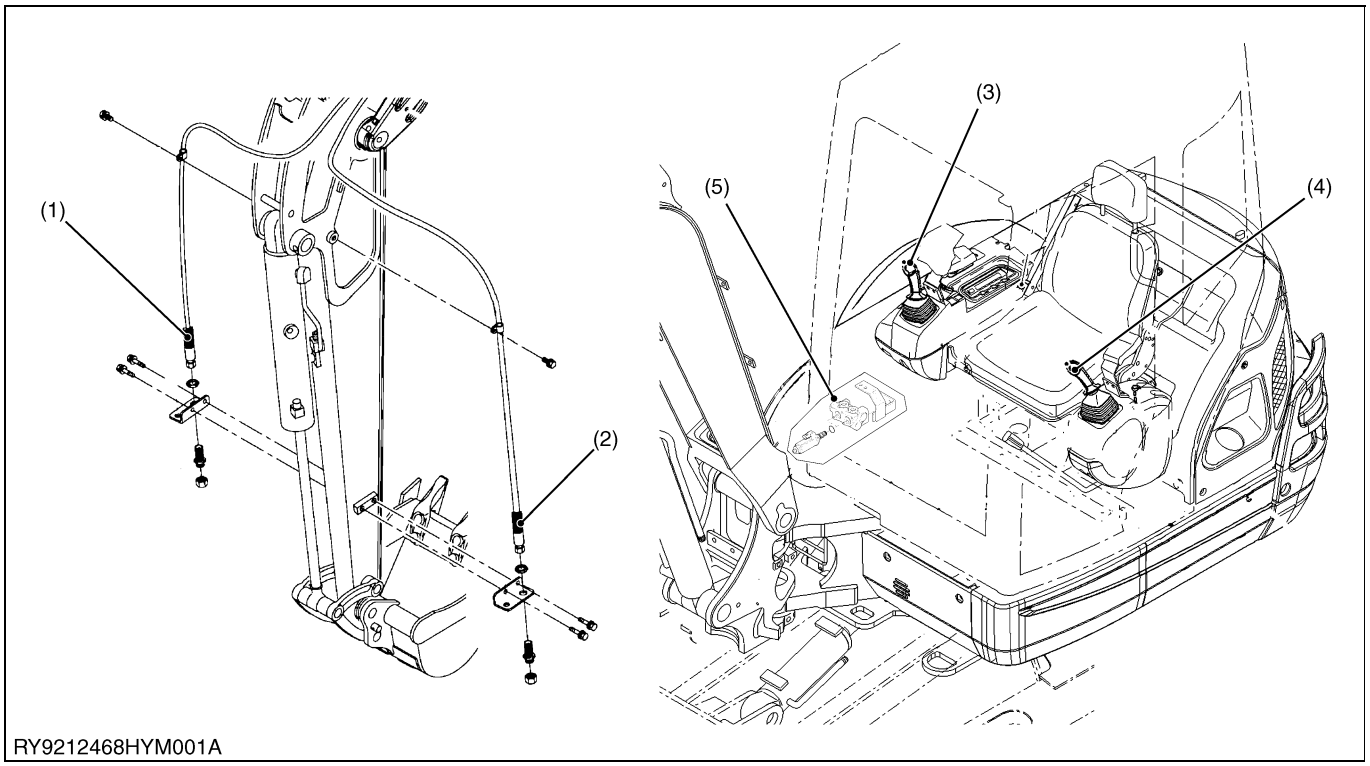
Hi Spec



RY9212468HYS001US

2. HYDRAULIC DEVICES LAYOUT

Standard

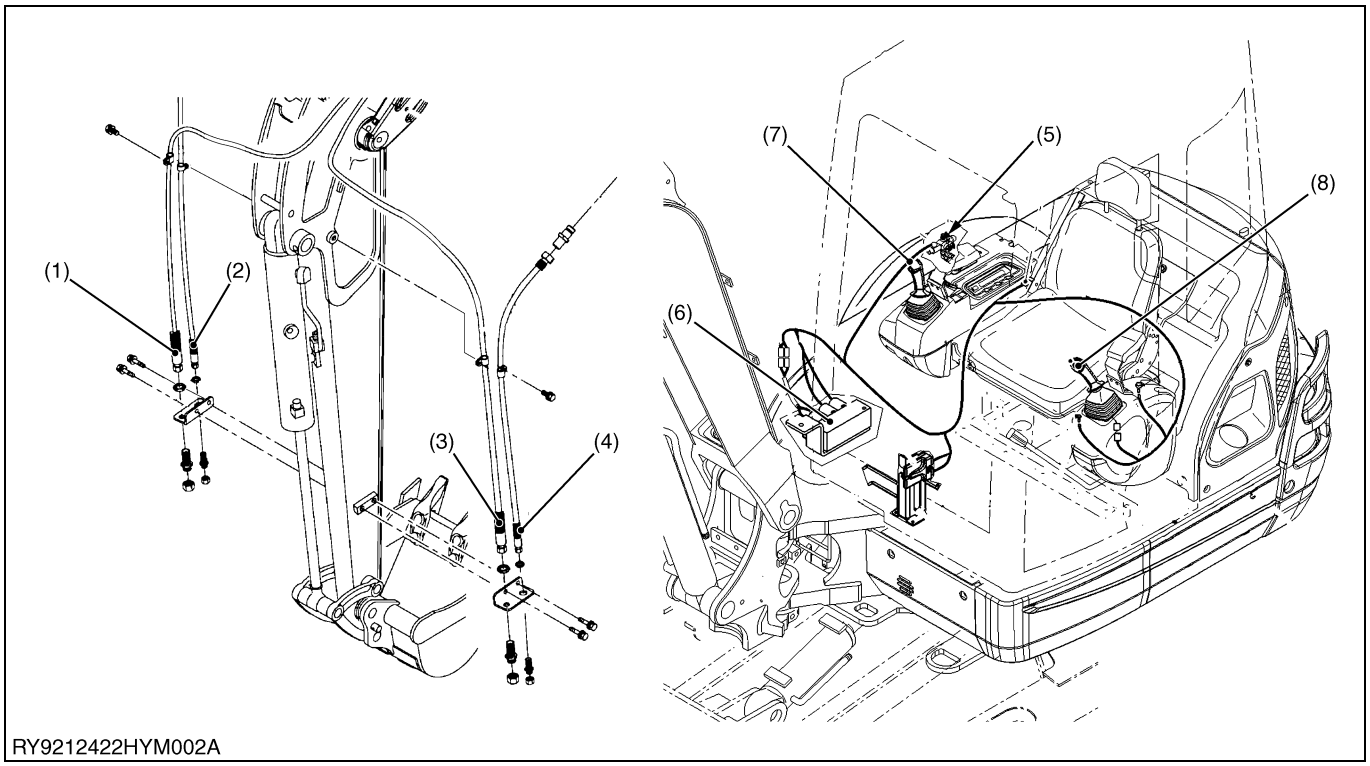


RY9212468HYM001A

(1) AUX1 RH
(2) AUX1 LH
(3) Control Lever RH (Pilot Valve)
(4) Control Lever LH (Pilot Valve)
(5) Proportional Valve

RY9212469HYM0003US0

Hi Spec

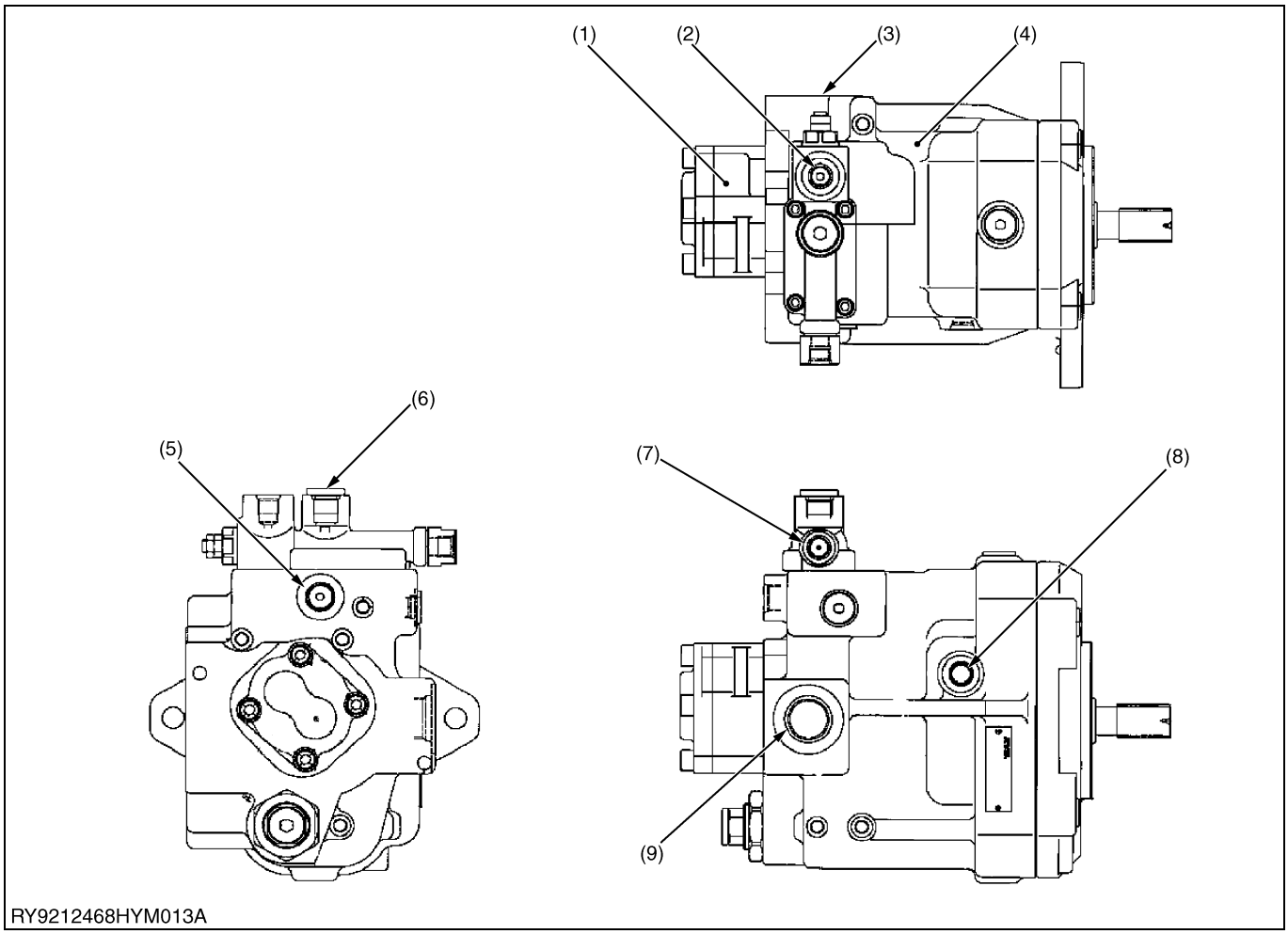


RY9212422HYM002A

(1) AUX1 RH
(2) AUX2 RH
(3) AUX1 LH
(4) AUX2 LH
(5) Selector Valve
(6) Proportional Valve
(7) Control Lever LH (Pilot Valve)
(8) Control Lever RH (Pilot Valve)

RY9212469HYM0004US0

3. PUMP
[1] SPECIFICATIONS

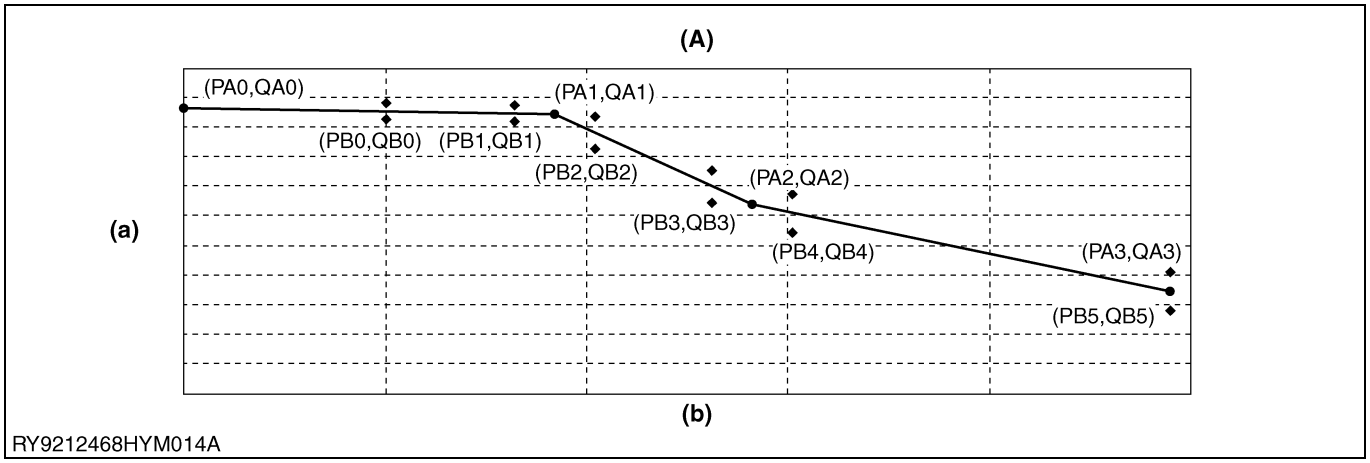


RY9212468HYM013A

(1) Gear Pump (Pilot Pump)
(2) Port PLS
(3) Port PS
(4) Variable Pump, Piston Pump (First Pump)
(5) Port PP
(6) L/S Regulator
(7) Port PPS
(8) Port T
(9) Port P

		KX101-3α4
Manufacturer		KYB
Model		PSVL-42CG
Rated RPM		2300 rpm
Piston Pump	Max. Displacement	42 cm^3/rev (2.56 cu.in./rev) (Min. 10 cm^3/rev (0.61 cu.in./rev) at 1000 rpm)
	Max. Discharge Capacity	96.6 L/min (5890 cu.in./min, 25.5 USGPM)
	Max. Pressure	24.5 MPa (250 kgf/cm^2, 3550 psi)
Pilot Pump (Gear Pump)	Max. Displacement	4.0 cm^3/rev (0.24 cu.in./rev)
	Max. Discharge Capacity	9.2 L/min (562 cu.in./min, 2.43 USGPM)
	Max. Pressure	4.9 MPa (50 kgf/cm^2, 711 psi)
Stand by Flow Rate		23 L/min (6.08 USGPM)

RY9212469HYM0016US0



(A) Piston Pump Power Constant Characteristics **(a) Delivery Flow: Q (L/min)** **(b) Pressure: P (MPa)**

(Bench Date)

Shaft speed: 2300 rpm		Total input torque: 84 N·m +0 , -3.0	
Pressure (MPa)	**Delivery flow (L/min)**	**Pressure (MPa)**	**Delivery flow (L/min)**
PAo = 0.0	QA0 = 96.6 ± 2.9	PB0 = 5.0	QB0 = 95.4 ± 2.9
PA1 = 9.2	QA1 = 94.3 (Target value)	PB1 = 8.2	QB1 = 94.6 ± 2.9
PA2 = 14.1	QA2 =63.7 (Target value)	PB2 = 10.2	QB2 = 88.1 ± 5.5
PA3 = 24.5	QA3 = 34.5 (Target value)	PB3 = 13.1	QB3 = 69.9 ± 5.5
		PB4 = 15.1	QB4 = 60.9 ± 6.5
		PB5 = 24.5	QB5 = 34.5 ± 6.5

RY9212469HYM0017US0

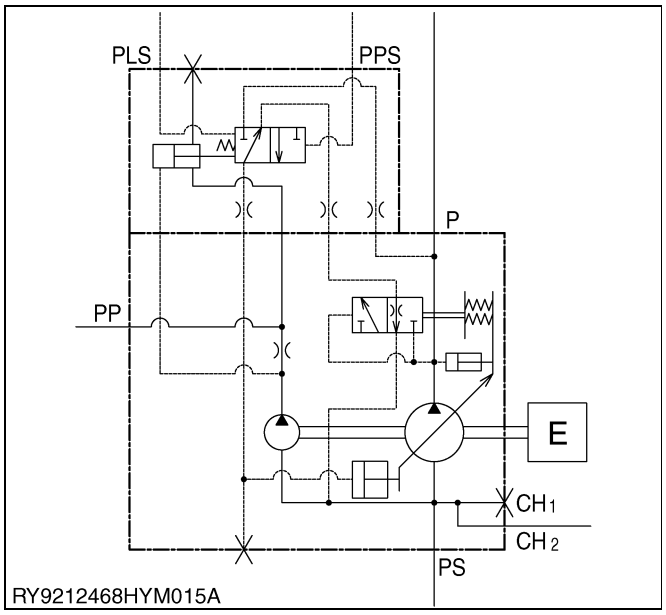
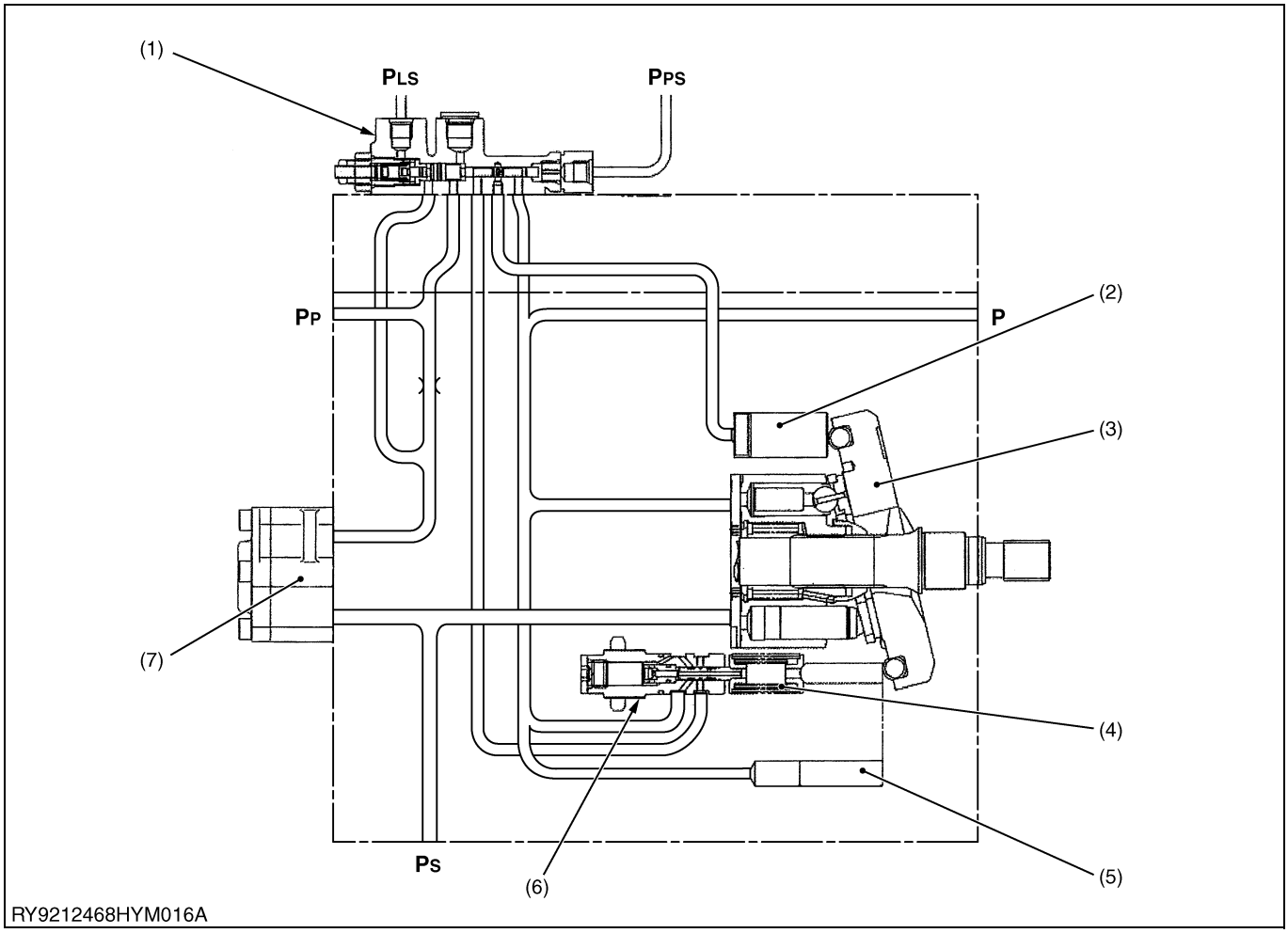


Diagram of Hydraulic Circuit

P: Piston Pump Discharge Pressure
PP: Pilot Pump Discharge Pressure
PLS: Load Pressure
PPS: Valve Inlet Pressure
PS: Suction Pressure
CH: Air Bleeds

RY9212469HYM0018US0

Configuration Diagram



RY9212468HYM016A

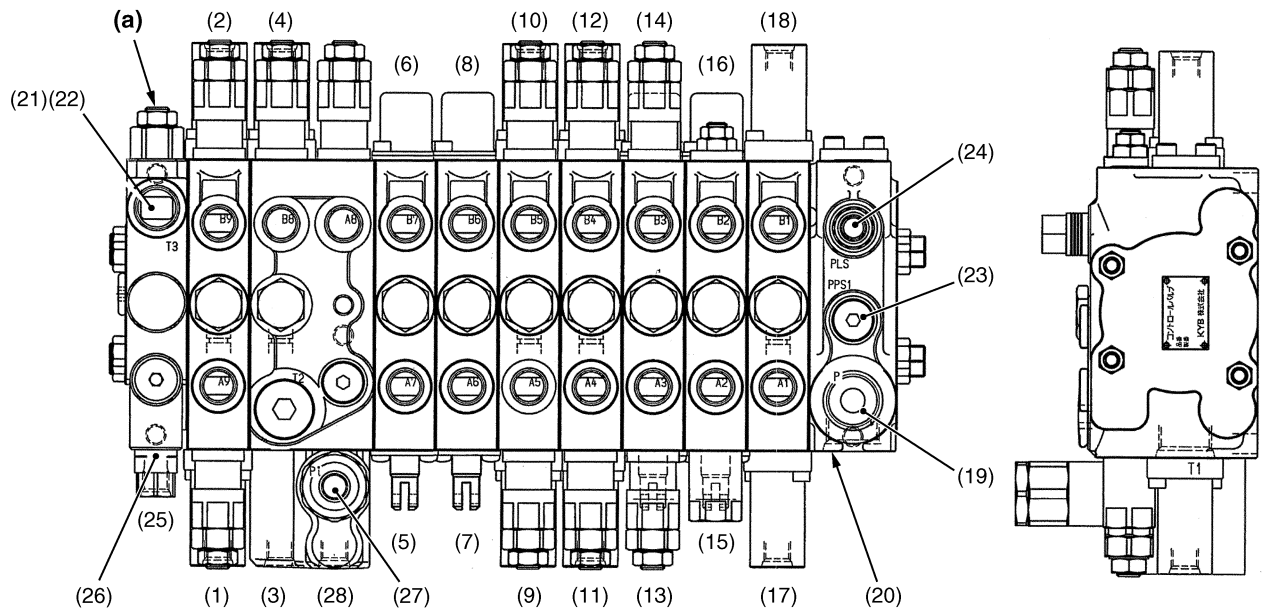
(1) L/S regulator
(2) Control pin B
(3) Swash plate
(4) Horsepower control spring
(5) Control pin A
(6) Horsepower control valve
(7) Gear Pump

RY9212469HYM0019US0

4. CONTROL VALVE

[1] SPECIFICATIONS

Standard



RY9212468HYM003A

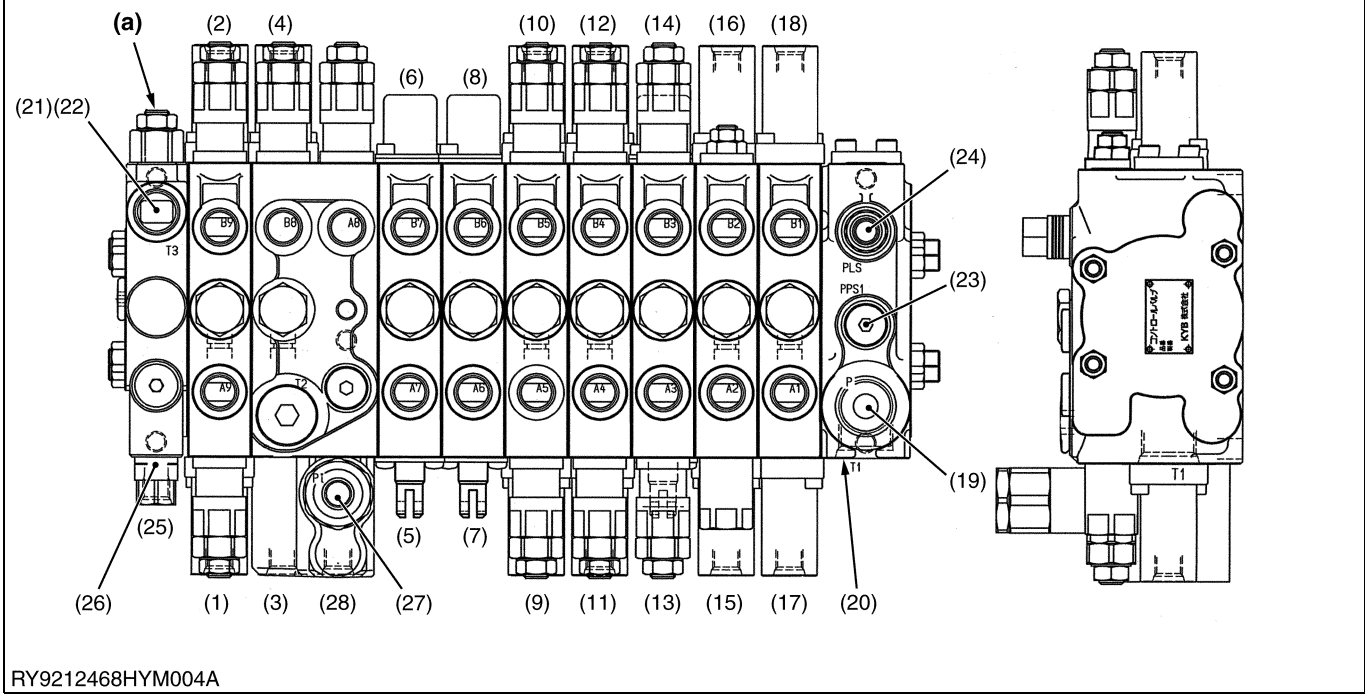
(1) Bucket Rod (Pa9)
(2) Bucket Bottom (Pb9)
(3) Boom Rod (Pa8)
(4) Boom Bottom (Pb8)
(5) Travel RH Reverse
(6) Travel RH Forward
(7) Travel LH Reverse
(8) Travel LH Forward
(9) Arm Rod (Pa5)
(10) Arm Bottom (Pb5)
(11) AUX1 LH (Pa4)
(12) AUX1 RH (Pb4)
(13) Blade Bottom
(14) Blade Rod
(15) Swing Rod
(16) Swing Bottom
(17) Swivel LH (Pa1)
(18) Swivel RH (Pb1)
(19) P Port
(20) T1 Port
(21) T2 Port
(22) T3 Port
(23) Pps Port
(24) Pls Port
(25) Pp1 Port
(26) Pp2 Port
(27) P1 Port
(28) Dr Port

(a) Main Relief Valve

Item				Remarks
Manufacturer			KYB	
Model			KVSX-12B-9	
Main relief valve pressure setting			24.5 MPa 250 kgf/cm^2 3553 psi	at 36 L/min 2197 cu.in./min 9.5USGPM
Overload relief valve pressure setting	Bucket (A9) (B9)		27.9 MPa 285 kgf/cm^2 4047 psi	at 5 L/min 305 cu.in./min 1.3 USGPM
	Boom (A8) (B8)		27.4 MPa 279 kgf/cm^2 3974 psi	at 5 L/min 305 cu.in./min 1.3 USGPM
	Arm (A5) (B5)		27.9 MPa 285 kgf/cm^2 4047 psi	at 5 L/min 305 cu.in./min 1.3 USGPM
	AUX1 (A4) (B5)		20.6 MPa 210 kgf/cm^2 2988 psi	at 5 L/min 305 cu.in./min 1.3 USGPM
	Blade	(A3)	27.4 MPa 279 kgf/cm^2 3974 psi	at 5 L/min 305 cu.in./min 1.3 USGPM
		(B3)	11.8 MPa 120 kgf/cm^2 1711 psi	

RY9212469HYM0005US0

Hi SPec



RY9212468HYM004A

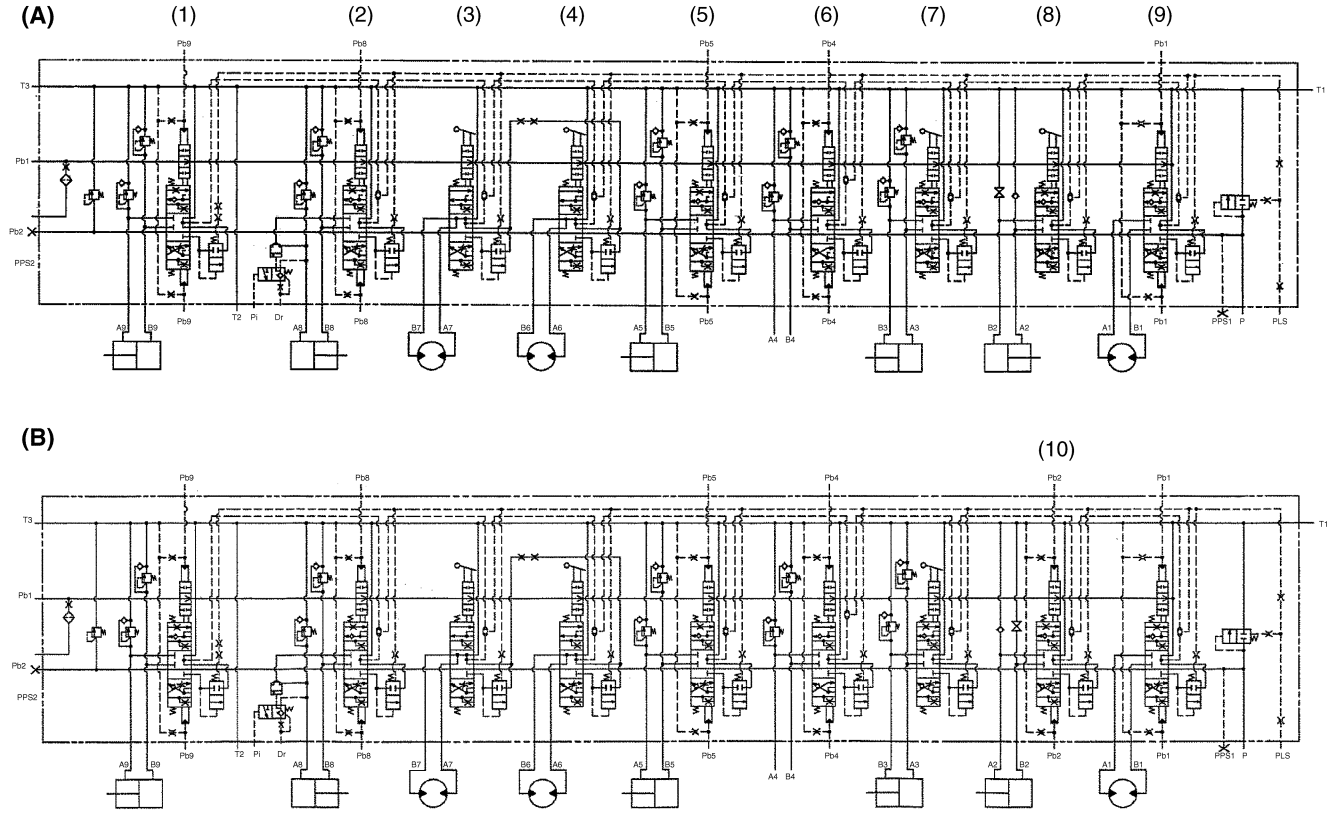
(1) Bucket Rod (Pa9)
(2) Bucket Bottom (Pb9)
(3) Boom Rod (Pa8)
(4) Boom Bottom (Pb8)
(5) Travel RH Reverse
(6) Travel RH Forward
(7) Travel LH Reverse
(8) Travel LH Forward
(9) Arm Rod (Pa5)
(10) Arm Bottom (Pb5)
(11) AUX1 LH (Pa4)
(12) AUX1 RH (Pb4)
(13) Blade Bottom
(14) Blade Rod
(15) Swing Rod / AUX2 RH (Pa2)
(16) Swing Bottom / AUX2 LH (Pb2)
(17) Swivel LH (Pa1)
(18) Swivel RH (Pb1)
(19) P Port
(20) T1 Port
(21) T2 Port
(22) T3 Port
(23) Pps Port
(24) Pls Port
(25) Pp1 Port
(26) Pp2 Port
(27) P1 Port
(28) Dr Port

(a) Main Relief Valve

Item				Remarks
Manufacturer			KYB	
Model			KVSX-12B-9	
Main relief valve pressure setting			24.5 MPa 250 kgf/cm^2 3553 psi	at 36 L/min 2197 cu.in./min 9.5USGPM
Overload relief valve pressure setting	Bucket (A9) (B9)		27.9 MPa 285 kgf/cm^2 4047 psi	at 5 L/min 305 cu.in./min 1.3 USGPM
	Boom (A8) (B8)		27.4 MPa 279 kgf/cm^2 3974 psi	at 5 L/min 305 cu.in./min 1.3 USGPM
	Arm (A5) (B5)		27.9 MPa 285 kgf/cm^2 4047 psi	at 5 L/min 305 cu.in./min 1.3 USGPM
	AUX1 (A4) (B5)		20.6 MPa 210 kgf/cm^2 2988 psi	at 5 L/min 305 cu.in./min 1.3 USGPM
	Blade	(A3)	27.4 MPa 279 kgf/cm^2 3974 psi	at 5 L/min 305 cu.in./min 1.3 USGPM
		(B3)	11.8 MPa 120 kgf/cm^2 1711 psi	

RY9212469HYM0006US0

[2] DIAGRAM OF HYDRAULIC CIRCUIT



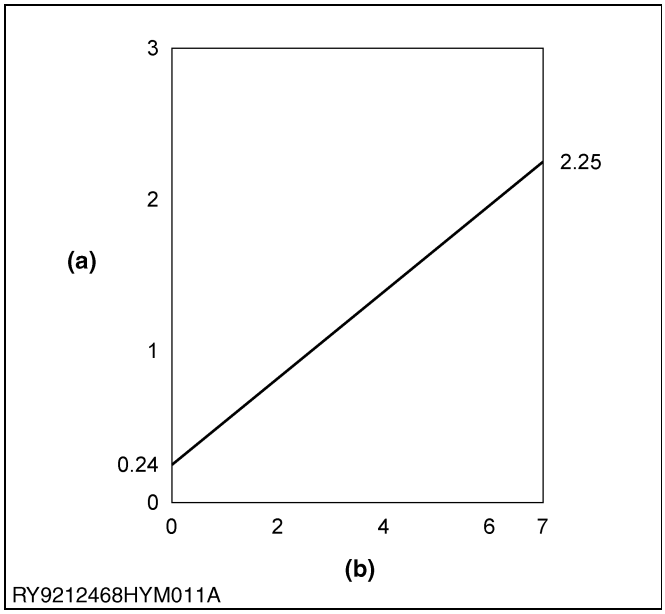
RY9212468HYM005A

(1) Bucket
(2) Boom
(3) Travel RH
(4) Travel LH
(5) Arm
(6) AUX1
(7) Blade
(8) Swing
(9) Swivel
(10) Swing / AUX2

(a) Standard
(b) Hi SPec

RY9212469HYM0007US0

[3] VALVE SPOOL SHIFT PERFORMANCE



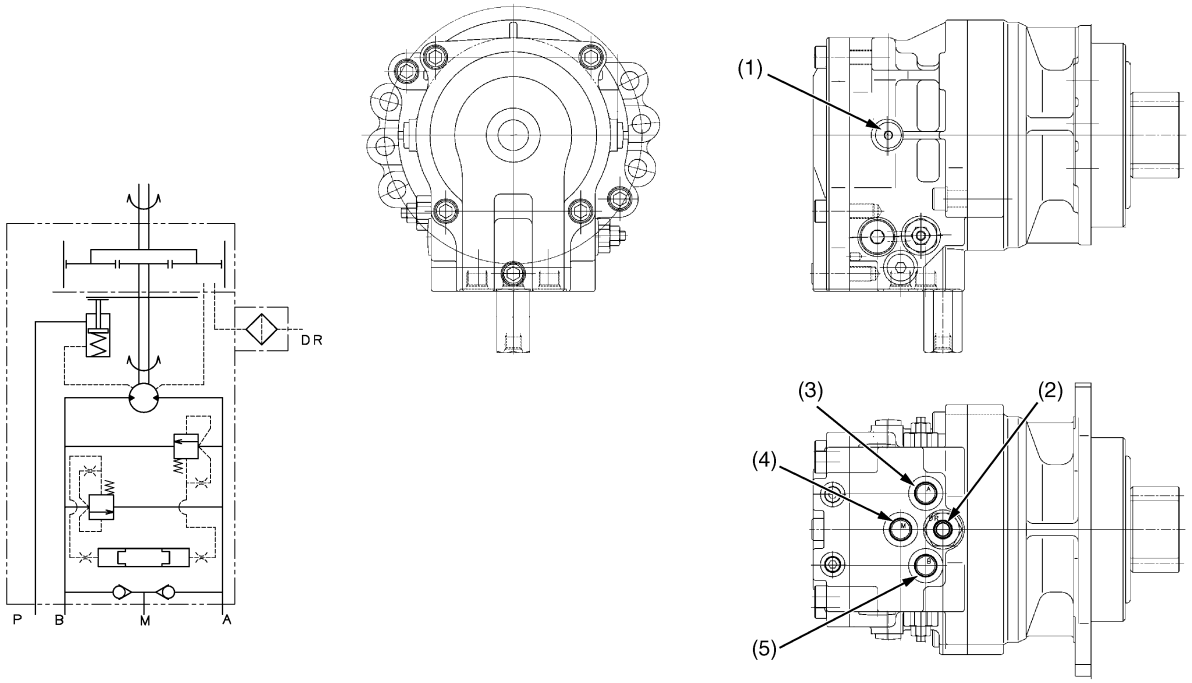
RY9212468HYM011A

(a) Pilot Pressure (MPa) **(b) Spool Stroke (mm)**

RY9212469HYM0008US0

5. SWIVEL MOTOR

[1] SPECIFICATIONS



RY9212468HYS012A

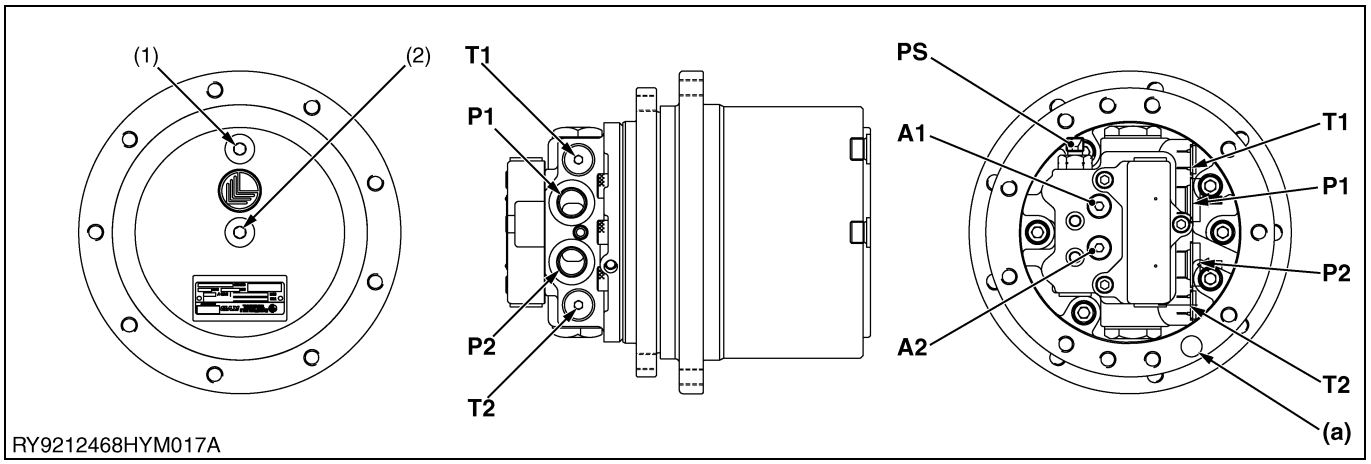
(1) P port
(2) Drain Port
(3) A port
(4) M port
(5) B port

Item		Notes
Manufacturer	Kubota seiki	
Model	MSF21P T-1	
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	20.90 L/min (5.52 U.S.gals.)	
Theoretical RPM	72.1 rpm	
Relief valve brake pressure	20.1 MPa (205 kgf/cm^2)	at 20.9 L/min
Mechanical brake torque	927 N·m (94.5 kgf·m)	
Parking brake release pressure	≤ 1.5 MPa (15 kgf/cm^2)	

RY9212469HYM0021US0

6. TRAVEL MOTOR

[1] SPECIFICATIONS



RY9212468HYM017A

(1) Oil Filling and Draining Plug
(2) Oil Level Plug
A1, A2: Gauge Ports
P1, P2: Motor Ports
T1, T2: Motor Drain Ports
PS: Pilot Ports for 2 Speed Control
(a) Red mark to identify gearbox

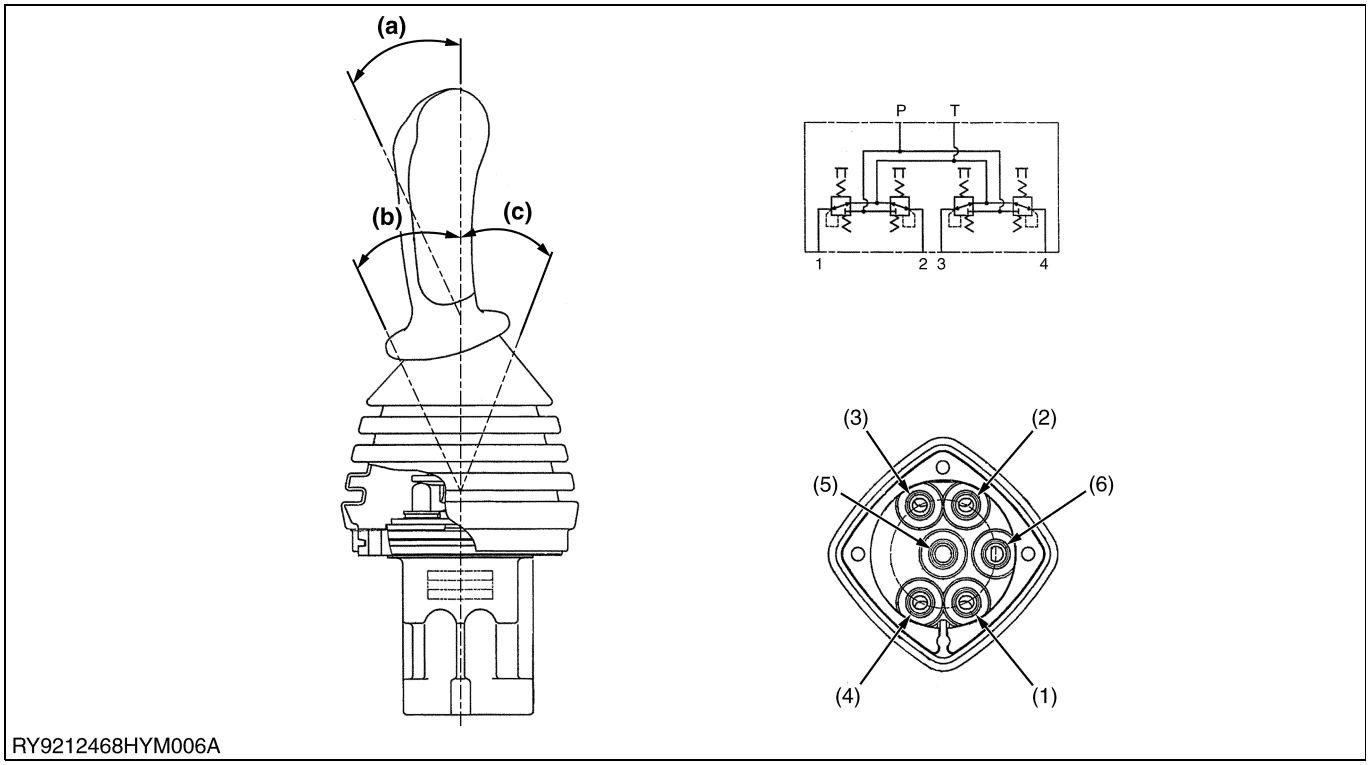
		KX101-3α4
Manufacturer		BONFIGLIOLI TRASMITAL
Model		2T702C2K049005
Motor Displacement	High Speed	10.6 cc/rev (0.65 cu.in./rev)
	Low Speed	18.4 cc/rev (1.12 cu.in./rev)
Reduction Ratio		1 : 48.6
Max. Pressure		24.5 MPa (250 kgf/cm^2, 3550 psi)
Max. Flow		38 L/min (10 USGPM)
Max. Motor Output Torque (Theoretical)	High Speed (at Max. Pressure)	41.33 N·m (4.21 kgf·m, 30.5 lbf·ft)
	Low Speed (at Max. Pressure)	71.75 N·m (7.32 kgf·m, 52.9 lbf·ft)
Max. Motor Output Speed (Theoretical)	High Speed	3585 rpm
	Low Speed	2065 rpm
Max. Gearbox Output Torque (Theoretical)	High Speed	2010 N·m (205 kgf·m, 1482 lbf·ft)
	Low Speed	3490 N·m (356 kgf·m, 2574 lbf·ft)
Max. Gearbox Output Speed (Theoretical)	High Speed	73.7 rpm
	Low Speed	42.5 rpm
Displacement Control Pressure	Low to High Speed	15.7 to 18.5 MPa 160 to 189 kgf/cm^2 2277 to 2683 psi
	High to Low Speed	16.4 to 19.2 MPa 167 to 196 kgf/cm^2 2379 to 2785 psi
2 Speed Control Min. Pressure		3.4 to 3.7 MPa 34.7 to 37.7 kgf/cm^2 493 to 537 psi

RY9212469HYM0020US0

7. PILOT CONTROL VALVE (BOOM, ARM, BUCKET, SWIVEL)

[1] SPECIFICATIONS

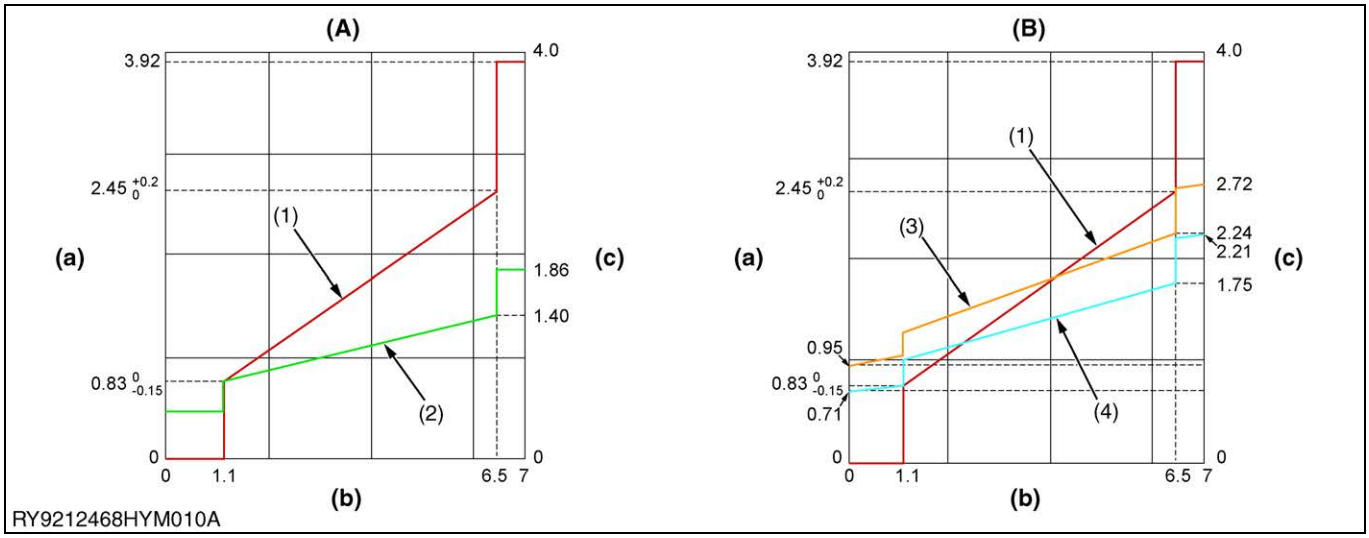
Standard LH



RY9212468HYM006A

(1) Port 1 (Arm Crowd)
(2) Port 2 (Swivel Left)
(3) Port 3 (Arm Dump)
(4) Port 4 (Swivel Right)
(5) P Port
(6) T Port
(a) Grip Shift Angle: 19°
(b) Simultaneous Operation Angle: 25°
(c) Single Operation Angle: 19°

RY9212469HYM0009US0



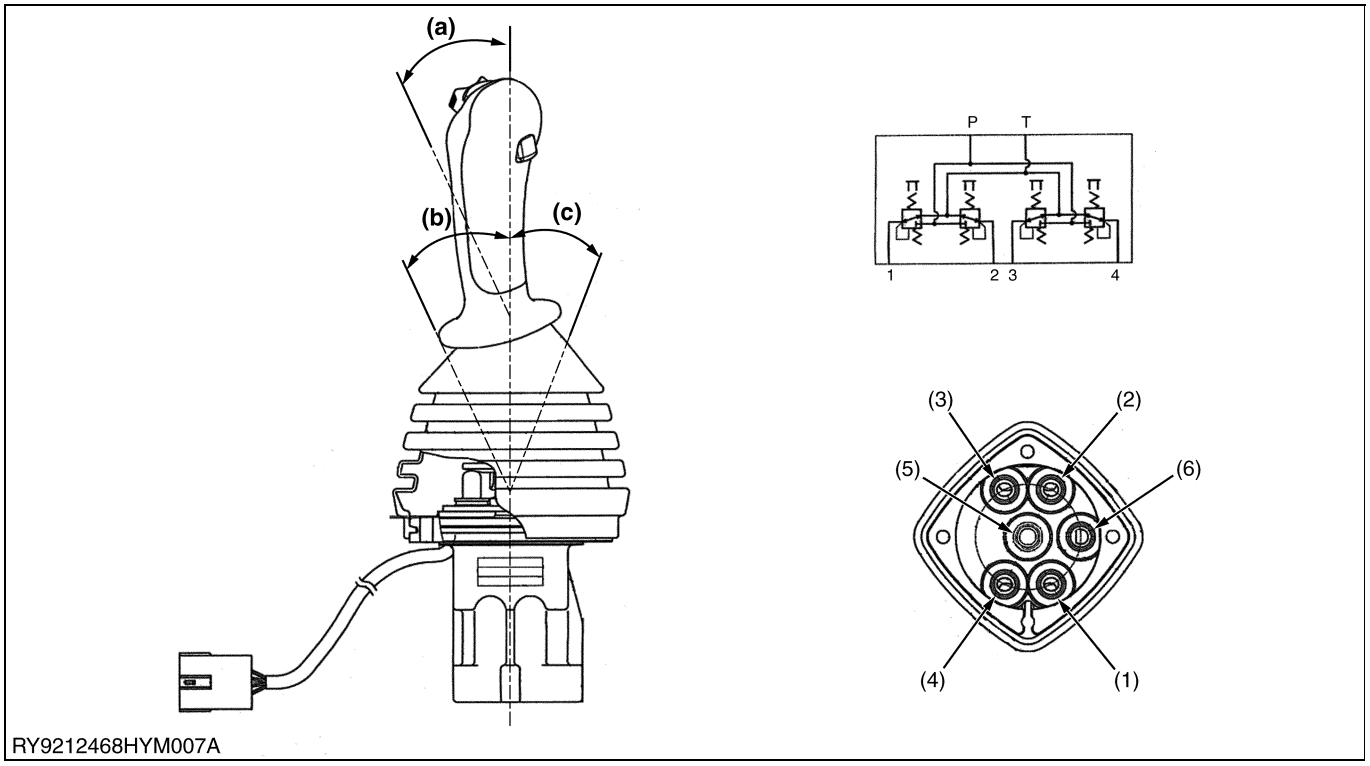
RY9212468HYM010A

(1) Secondary Pressure
(2) Operating Torque: Port 1, Port 3
(3) Operating Torque: Port 2
(4) Operating Torque: Port 4
(A) Port 1, Port 3
(B) Port 2, Port 4
(a) Secondary Pressure (MPa)
(b) Rod Stroke (mm)
(c) Operating Torque (N·m)

Manufacturer	KAWASAKI PRECION MACHINERY
Model	PV48M2178

RY9212469HYM0010US0

Standard RH / Hi Spec RH, LH

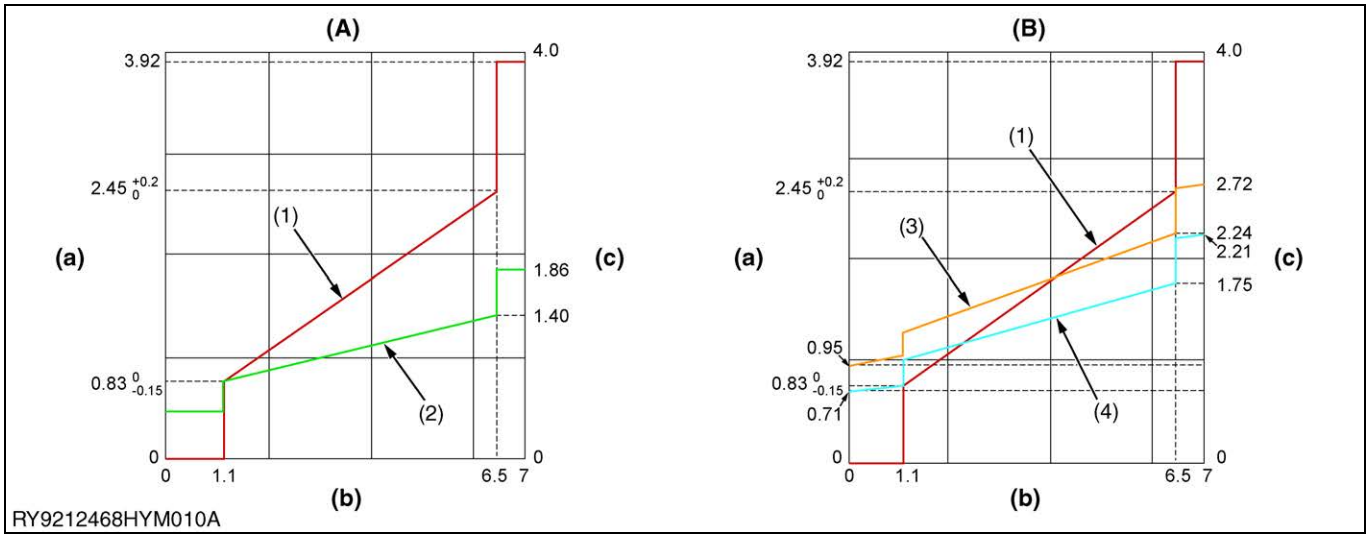


RY9212468HYM007A

(1) Port 1 (Arm Crowd)
(2) Port 2 (Swivel Left)
(3) Port 3 (Arm Dump)
(4) Port 4 (Swivel Right)
(5) P Port
(6) T Port

(a) Grip Shift Angle: 19°
(b) Simultaneous Operation Angle: 25°
(c) Single Operation Angle: 19°

RY9212469HYM0011US0



RY9212468HYM010A

(1) Secondary Pressure
(2) Operating Torque: Port 1, Port 3
(3) Operating Torque: Port 2
(4) Operating Torque: Port 4

(A) Port 1, Port 3
(B) Port 2, Port 4

(a) Secondary Pressure (MPa)
(b) Rod Stroke (mm)
(c) Operating Torque (N·m)

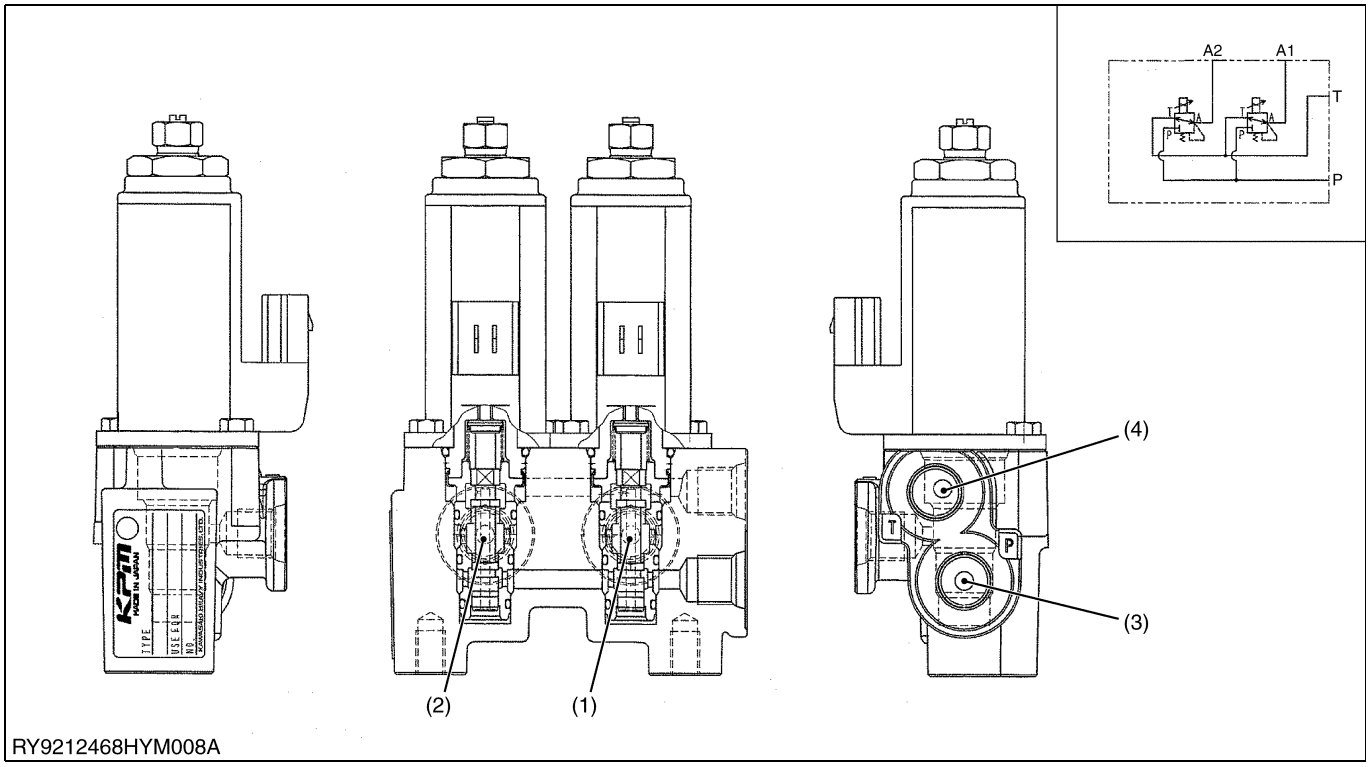
Manufacturer	KAWASAKI PRECION MACHINERY
Model	PV48M2281 (LH Hi spec)
	PV48M2179B (RH)

RY9212469HYM0012US0

8. PROPORTIONAL VALVE

[1] SPECIFICATIONS

Standard



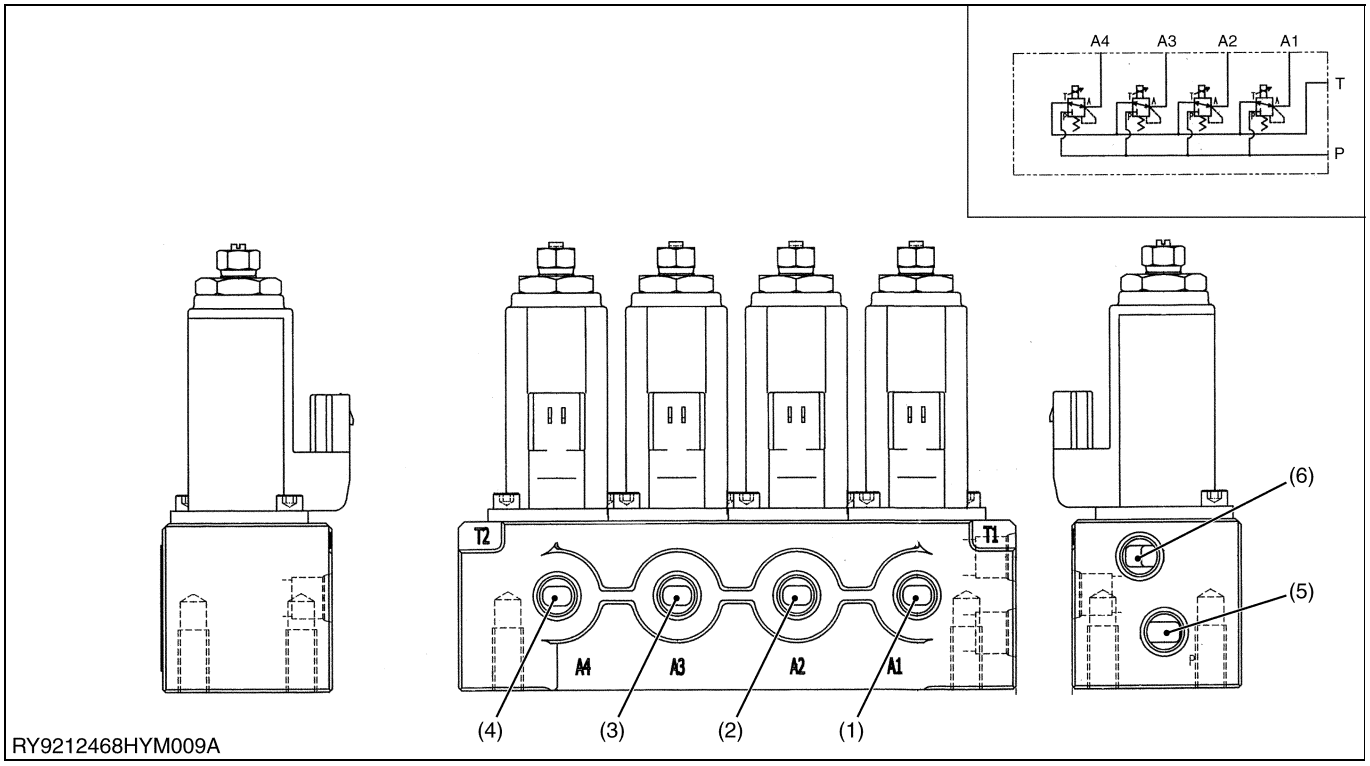
RY9212468HYM008A

(1) A1 (AUX1 LH) (2) A2 (AUX1 RH) (3) P Port (4) T Port

Manufacturer	KAWASAKI PRECION MACHINERY
Model	2KWE5A-30/G12R-271A
Operation temperature range	-20 to 90 °C
Voltage	DC 12 V
Maximum working pressure	7.0 MPa
Maximum flow rate	10.0 L/min

RY9212469HYM0013US0

Hi Spec



(1) A1 (AUX1 LH)
(2) A2 (AUX1 RH)
(3) A3 (AUX2 LH / Swing)
(4) A4 (AUX2 RH / Swing))
(5) P Port
(6) T Port

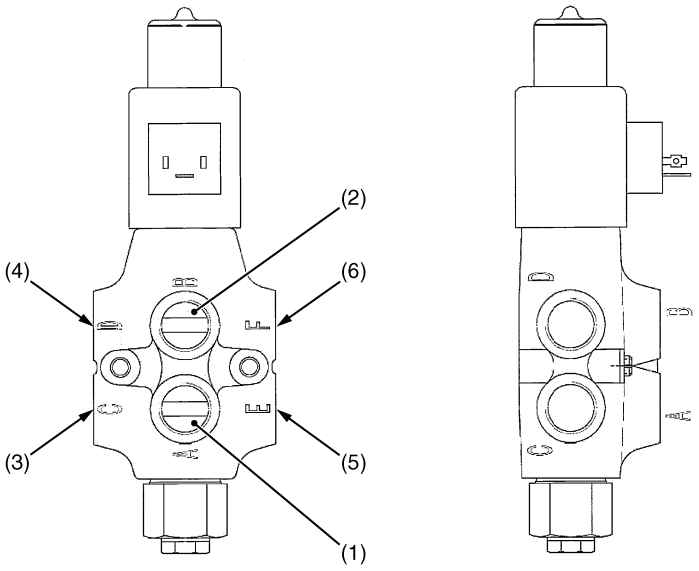
Manufacturer	KAWASAKI PRECION MACHINERY
Model	4KWE5A-30/G12R-431
Operation temperature range	-20 to 90 °C
Voltage	DC 12 V
Maximum working pressure	7.0 MPa
Maximum flow rate	10.0 L/min

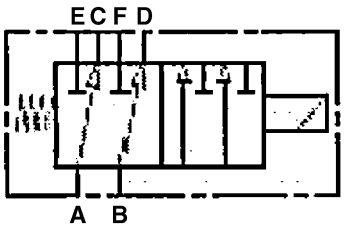
RY9212469HYM0014US0

9. SELECTOR VALVE

[1] SPECIFICATIONS

Hi Spec





RY9212422HYM011A

(1) Port A (to Control Valve)
(2) Port B (to Control Valve)
(3) Port C (to AUX2 L)
(4) Port D (to AUX2 R)
(5) Port E (to Swing Bottom)
(6) Port F (to Swing Rod)

Manufacturer	HYDRO CONTROL
Model	HC-SVE056
Max temperature range	+80 °C
Voltage	DC 12 V

RY9212469HYM0015US0

SERVICING

CONTENTS

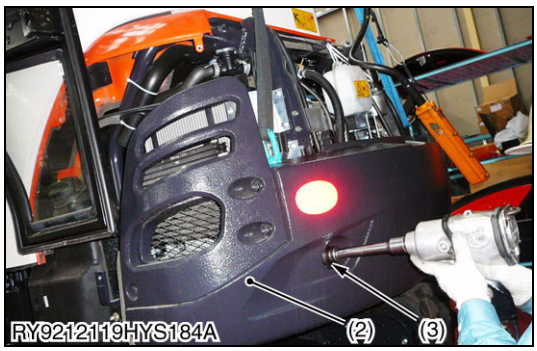
1. PISTON PUMP

[1] REMOVING AND INSTALLING

CAUTION

- **When removing a hydraulic device after operating the machine, lower the bucket and blade to the ground and turn off the engine.**
- **Each of the devices and the hydraulic oil are hot and under high pressure immediately after operating the machine. If the hydraulic oil reached a high operating temperature, it may cause a burn.**
- **Oil gushing out under pressure has enough force to pierce your skin and may cause you injury. Always allow the temperature to drop and relieve any remaining pressure prior to working to remove any hydraulic equipment.**

RY9212001MBS0004US0



Removing the Rear Cover and Weight

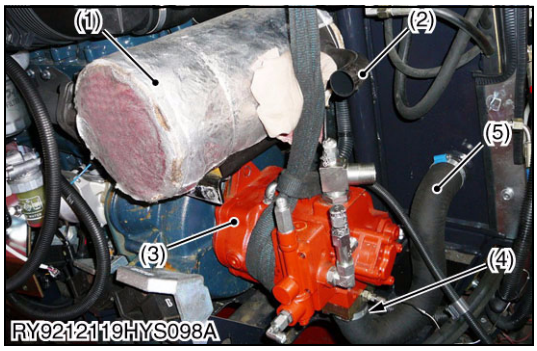
1. Open the rear bonnet, remove the snap rings and separate the gas damper and bonnet.
2. Slide the rear bonnet towards the right of the machine to remove.
3. Attach two eyebolts to the weight, connect a nylon sling to these and support the weight with a crane.
4. Remove the weight mounting bolts, lift slightly with the crane, slide the weight to the rear, and with the weight suspended, remove it from the frame.

Tightening torque	Weight	367.7 to 431.5 N·m 37.5 to 44 kgf·m 271.2 to 318.3 lbf·ft

Apply thread lock (Loctite AN302-71).

(1) Rear cover
(2) Weight
(3) Bolt

RY9212119HYS0055US0

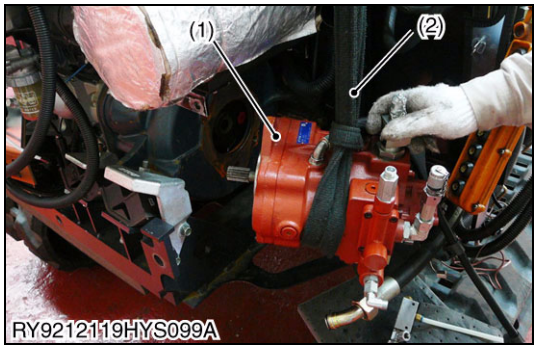


Removing the Mufflertail and Pump

1. Loosen the muffler tail clamp, then remove the muffler tail.
2. Remove all hoses from the pump and fit plugs to the adapter and disconnected hoses.
3. Loosen the suction hose tightening clamp and remove the suction hose from the pump.

(1) Muffler
(2) Muffler Tail Joint
(3) Piston Pump Assy
(4) Hose Clamp
(5) Suction Hose

RY9212119HYS0004US0



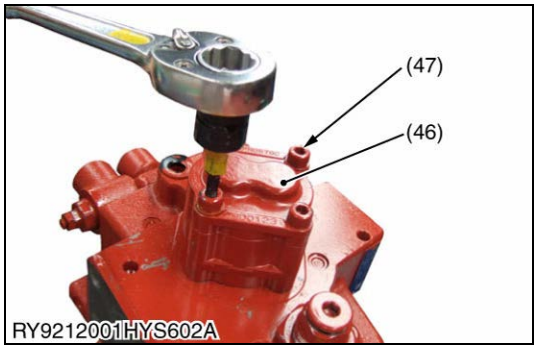
4. Suspend the pump by a nylon sling and support it with a crane. Remove the bolts in two locations, and pull the shaft of the pump from the coupling suspended by the crane.

Tightening torque	Pump	103 to 117.7 N·m 10.5 to 12 kgf·m 76 to 86.8 lbf·ft

(1) Piston Pump Assy
(2) Nylon Sling

RY9212119HYS0006US0

[2] DISASSEMBLING

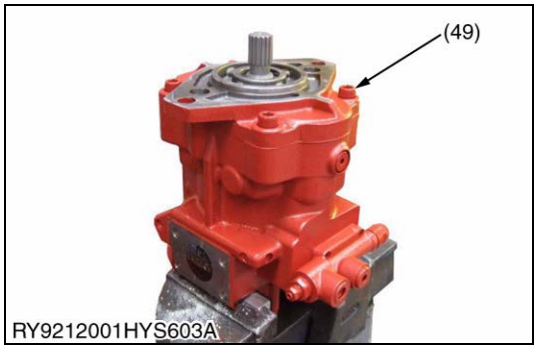


1. Remove the gear pump (46).

- Tool to use: M8 hex socket

(46) Gear Pump (47) Socket Head Bolt

RY9212001HYS0031US0

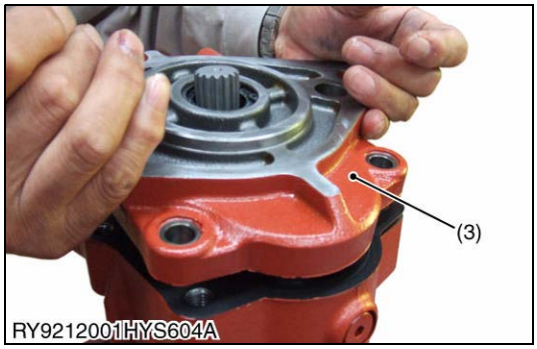


2. Lift the input axle up and clamp the pump in a vise.

■ **IMPORTANT**
- **Take care not to scratch the suction or discharge ports in the vise.**

(49) Socket Head Bolt

RY9212001HYS0032US0



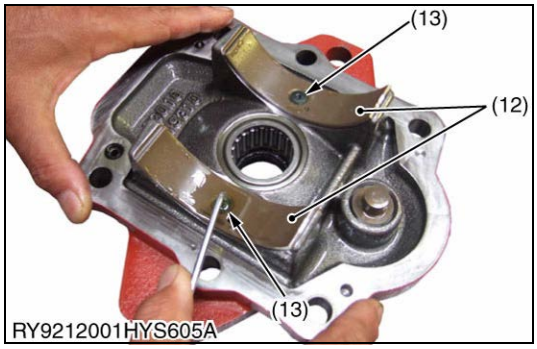
3. Loosen the bolt and remove flange (3).

CAUTION
- **If the flange is difficult to remove, tap lightly on it with a plastic hammer and take it apart.**
- **Don't pinch your fingers between the flange and the case.**

- Tool to use: M10 hex socket

(3) Flange

RY9212001HYS0033US0

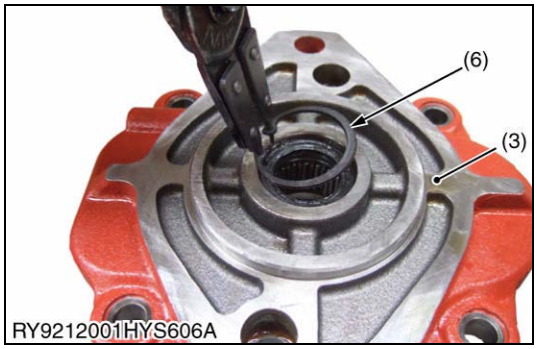


4. Remove the screw (13) and the bushing (12).

- Tool to use: M3 hex socket

(12) Bushing (13) Screw

RY9212001HYS0034US0



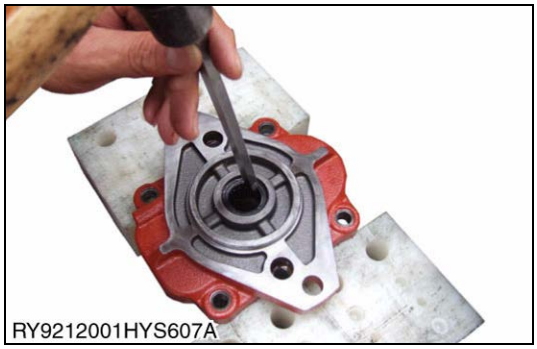
5. Remove the snap ring (6) from the flange (3).

CAUTION
- **Take care that the snap ring does not jump off.**

- Tool to use: Snap ring pliers

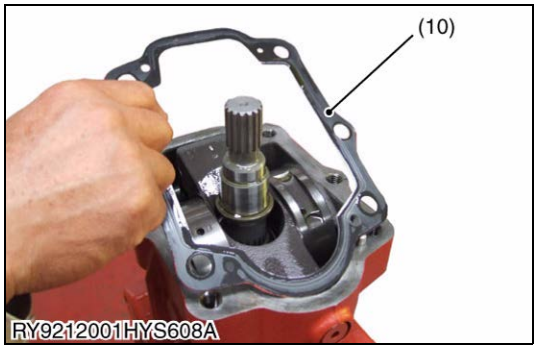
(3) Flange (6) Snap Ring

RY9212001HYS0035US0


RY9212001HYS607A

6. Remove the oil seal and the needle bearing from the flange.

RY9212001HYS0036US0



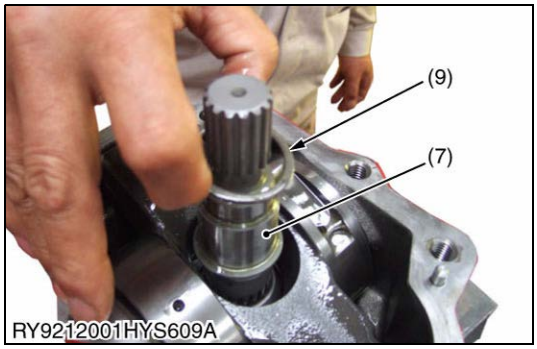
RY9212001HYS608A

7. Remove the gasket (10).

CAUTION
- **Be careful not to cut your fingers on the gasket.**

(10) Gasket

RY9212001HYS0037US0

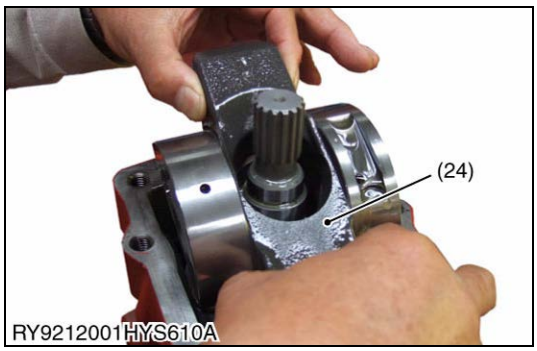


RY9212001HYS609A

8. Remove the thrust washer (9) from the shaft (7).

(7) Shaft (9) Thrust Washer

RY9212001HYS0038US0

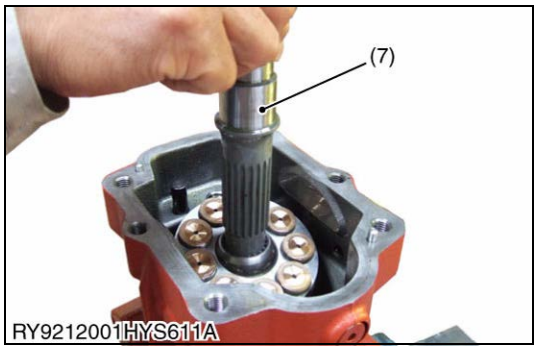


RY9212001HYS610A

9. Remove the swash-plate (24).

(24) Swash-Plate

RY9212001HYS0039US0

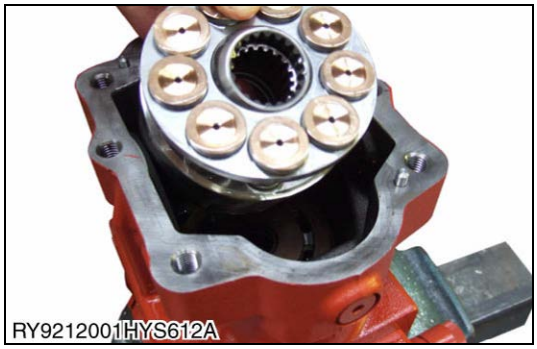


RY9212001HYS611A

10. Remove the shaft (7).

(7) Shaft

RY9212001HYS0040US0



11. Remove the cylinder block ASSY.

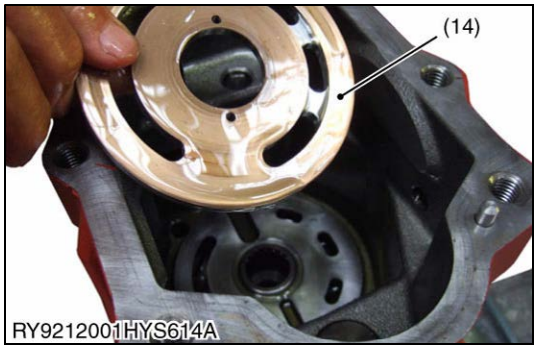
- Cylinder Block ASSY Components
  Cylinder block, collar, spring, collar, snap ring, pin, piston ASSY, retainer holder, retainer plate

RY9212001HYS0041US0

12. Remove the thrust washer (8).

(8) Thrust Washer

RY9212001HYS0042US0

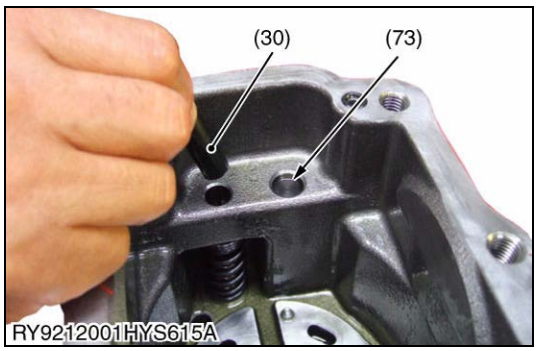


13. Remove the valve plate (14).

■ **IMPORTANT**
- **Do not scratch the valve plate.**

(14) Valve Plate

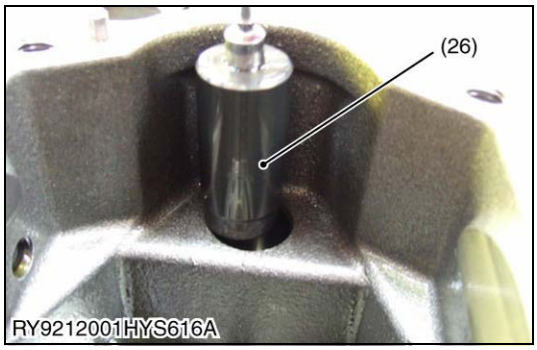
RY9212001HYS0043US0



14. Remove the pins (30) and (73).

(30) Pin (73) Pin

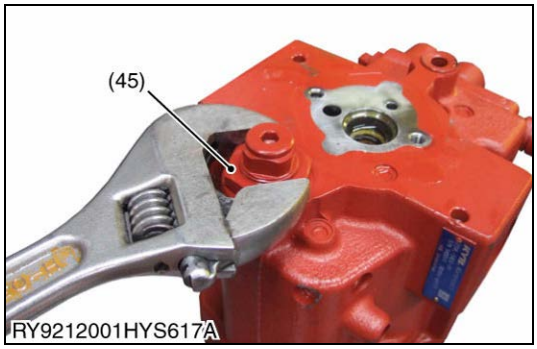
RY9212001HYS0044US0



15. Remove the pin (26).

(26) Pin

RY9212001HYS0045US0

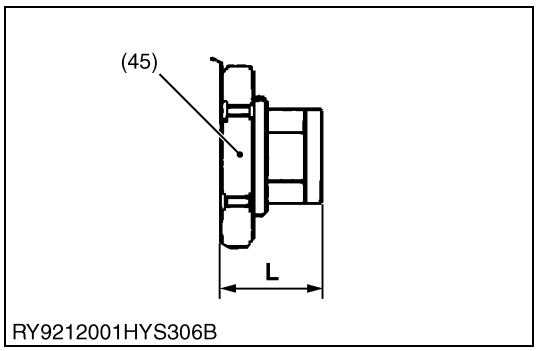


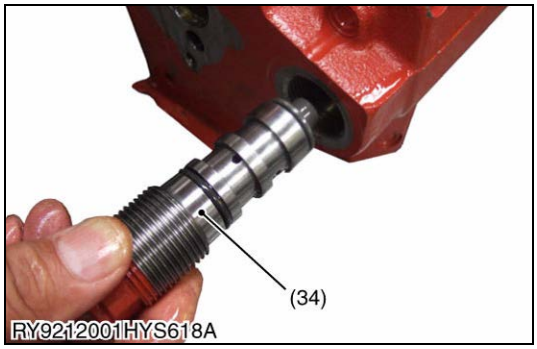
16. Remove the nut (45).

■ **IMPORTANT**
- **Measure the length L before removing the nut.**
- Tool to use: Monkey wrench

(45) Nut

RY9212001HYS0046US0

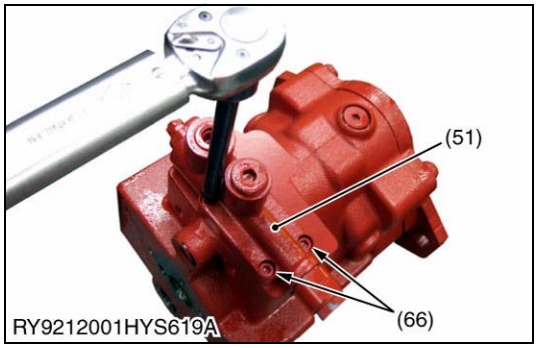




17. Remove the valve ASSY (34).

(34) Valve ASSY

RY9212001HYS0047US0

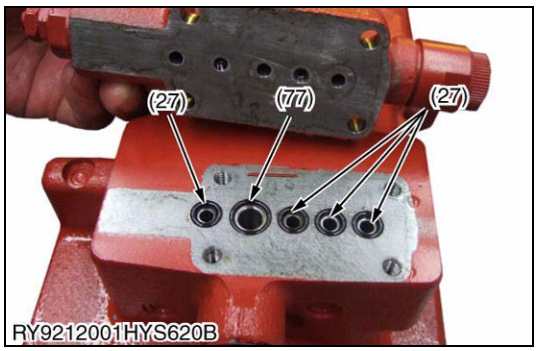


18. Remove the valve ASSY (51).

- Tool to use: M5 hex socket

(51) Valve ASSY (66) Socket Head Bolt

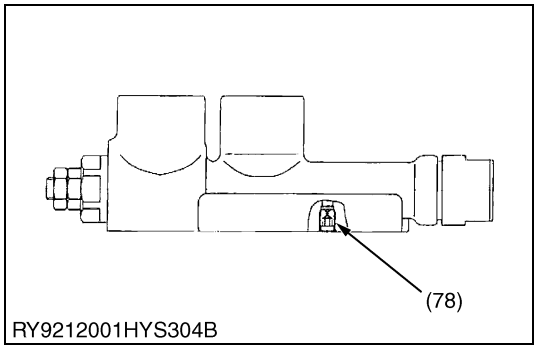
RY9212001HYS0048US0



19. Remove O-rings (27) and (77).

(27) O-Ring (77) O-Ring

RY9212001HYS0049US0



RY9212001HYS304B

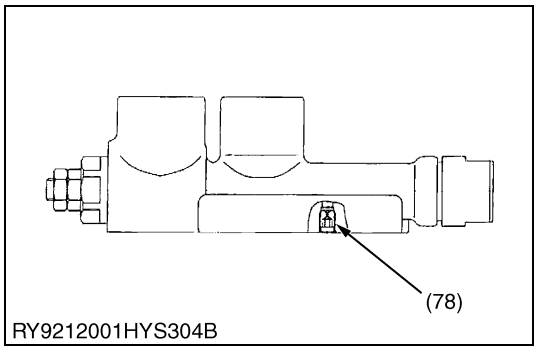
20. Remove the orifice (78) of the valve ASSY.

- Tool to use: M3 hex socket

(78) Orifice

RY9212001HYS0050US0

[3] ASSEMBLING



RY9212001HYS304B

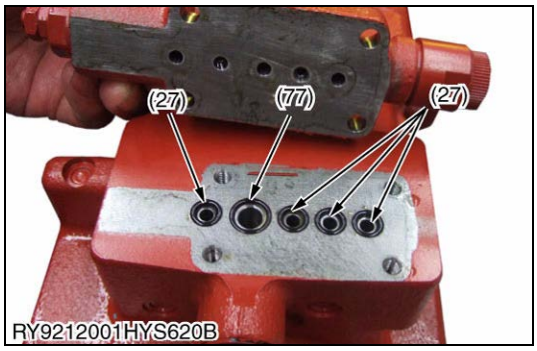
1. Install the orifice.

Tightening torque	Orifice (78)	2.5 N·m 0.25 kgf·m 1.8 lbf·ft

- Tool to use: M3 hex socket

(78) Orifice

RY9212001HYS0051US0

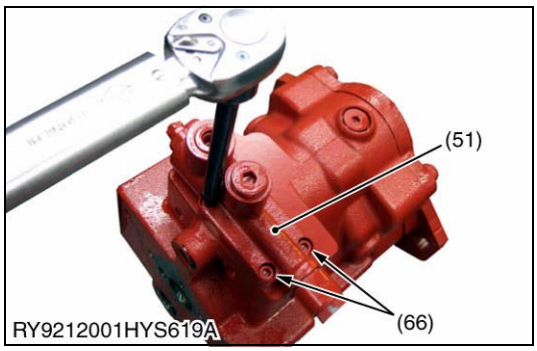


RY9212001HYS620B

2. Install O-rings (27) and (77).

(27) O-Ring (77) O-Ring

RY9212001HYS0052US0



RY9212001HYS619A

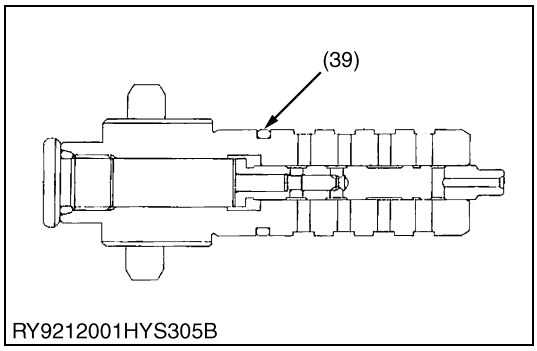
3. Attach the valve ASSY (51) to the case.

Tightening torque	Socket head bolt (66)	12.7 N·m 1.3 kgf·m 9.37 lbf·ft

- Tool to use: M5 hex socket

(51) Valve ASSY (66) Socket Head Bolt

RY9212001HYS0053US0

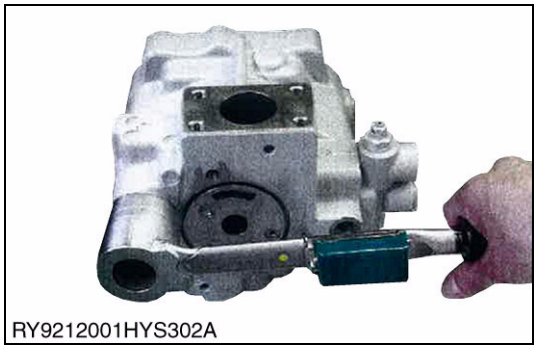


RY9212001HYS305B

4. Install the O-ring (39) on the valve ASSY sleeve.

(39) O-Ring

RY9212001HYS0054US0


RY9212001HYS302A

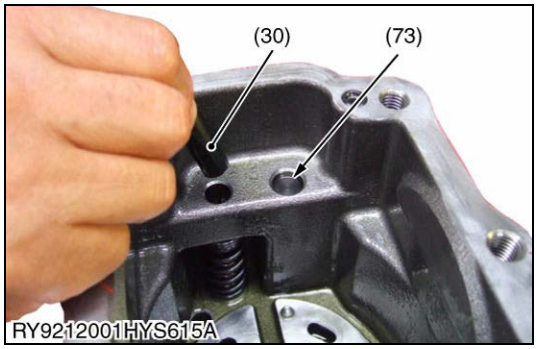
5. Attach the valve ASSY to the case.

■ **IMPORTANT**
- **Install the nut and adjust it to the length (L) measured before disassembly.**

Tightening torque	Nut (45)	68.6 N·m 7.0 kgf·m 50.6 lbf·ft

- Tool to use: M41 socket

RY9212001HYS0055US0



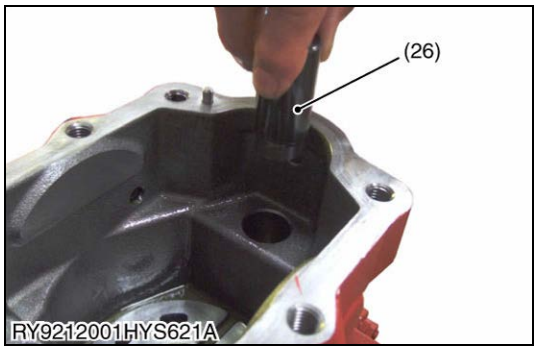
RY9212001HYS615A

6. Clamp the case in a vice and install pins (30), (73) and (26).

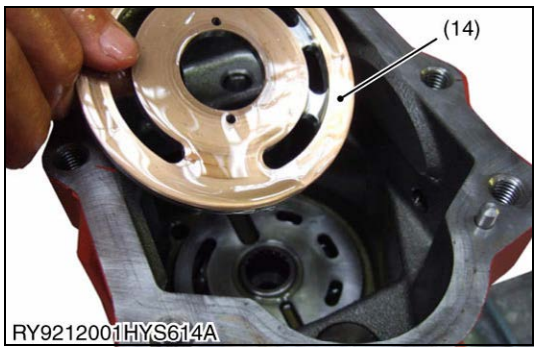
■ **IMPORTANT**
- **Take care not to scratch the suction or discharge ports in the vise.**

(26) Pin
(30) Pin
(73) Pin

RY9212001HYS0056US0



RY9212001HYS621A



RY9212001HYS614A

7. Install the valve plate (14).

■ **IMPORTANT**
- **Apply hydraulic oil to both faces of the valve plate.**

(14) Valve Plate

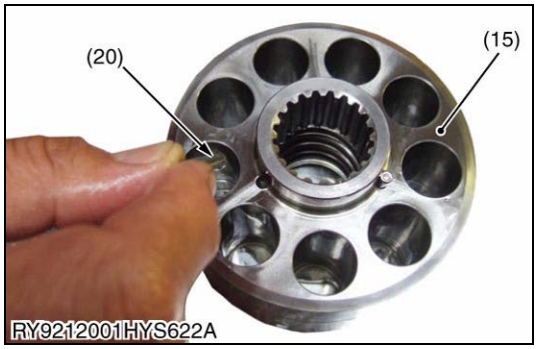
RY9212001HYS0057US0

RY9212001HYS613A

8. Install the thrust washer (8).

(8) Thrust Washer

RY9212001HYS0058US0

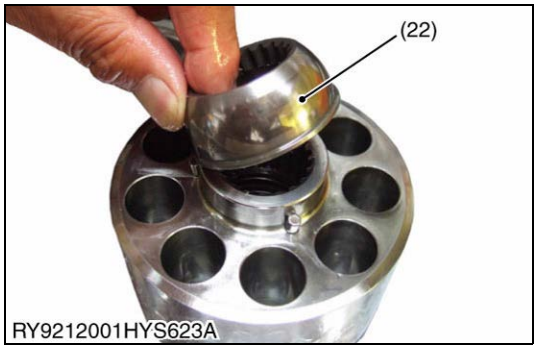


9. Insert the three pins (20) into the cylinder block (15).

■ **IMPORTANT**
- **Apply grease to the pins.**

(15) Cylinder Block (20) Pin

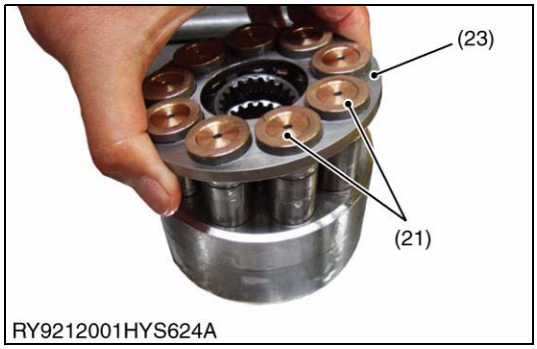
RY9212001HYS0059US0



10. Install the retainer holder (22) onto the cylinder block.

(22) Retainer Holder

RY9212001HYS0060US0

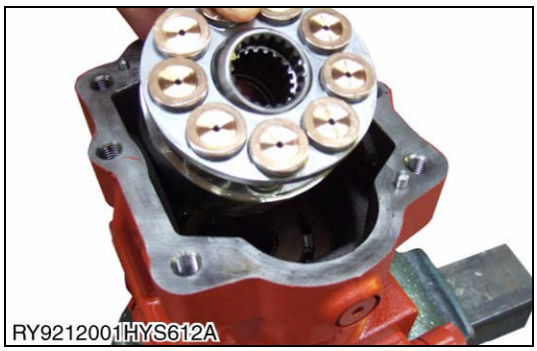


11. Install the piston ASSY (21) into the retainer plate (23) and then install it into the cylinder block.

■ **IMPORTANT**
- **Do not scratch the pistons.**
- **Do not use a hammer.**
- **Apply hydraulic oil to the body and shoe face of the pistons.**

(21) Piston ASSY (23) Retainer Plate

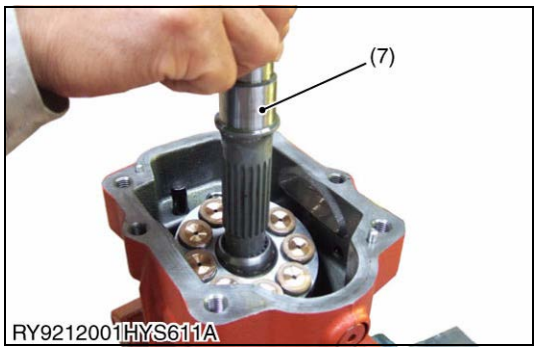
RY9212001HYS0061US0



12. Install the cylinder block ASSY.

■ **IMPORTANT**
- **Apply hydraulic oil to the sliding surfaces of the cylinder block.**
- **Assemble carefully to avoid scratching.**

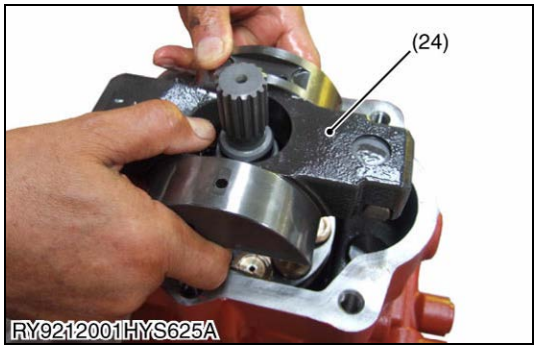
RY9212001HYS0062US0



13. Install the shaft (7).

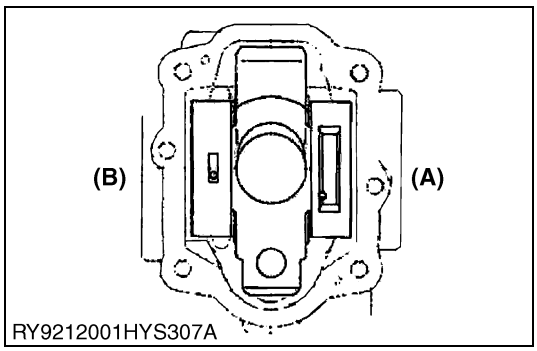
(7) Shaft

RY9212001HYS0063US0



14. Install the swash-plate (24).

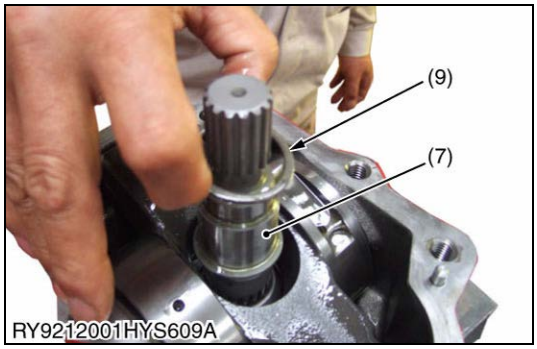
■ **IMPORTANT**
- **Install the sliding surfaces so that the piston shoes are not scratched.**
- **Double-check that the swash-plate is facing the right direction.**



(24) Swash-Plate

(A) Discharge Port Side
(B) Suction Port Side

RY9212001HYS0064US0

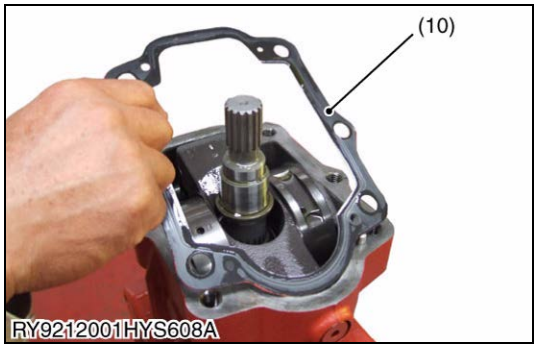


15. Install the thrust washer (9) on the shaft (7).

(7) Shaft

(9) Thrust Washer

RY9212001HYS0065US0

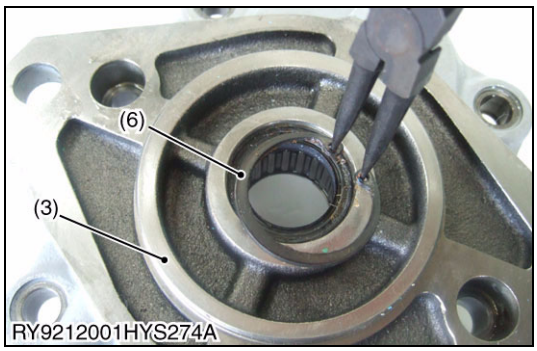


16. Install the gasket (10).

CAUTION
- **Be careful not to cut your fingers on the gasket.**

(10) Gasket

RY9212001HYS0066US0



17. Install the snap ring (6) onto the flange (3).

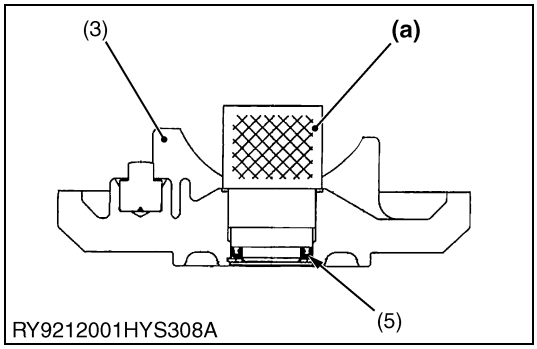
■ **IMPORTANT**
- **Install the snap ring so its angled surface faces the outside of the housing.**

- Tool to use: Snap ring pliers

(3) Flange

(6) Snap Ring

RY9212001HYS0067US0

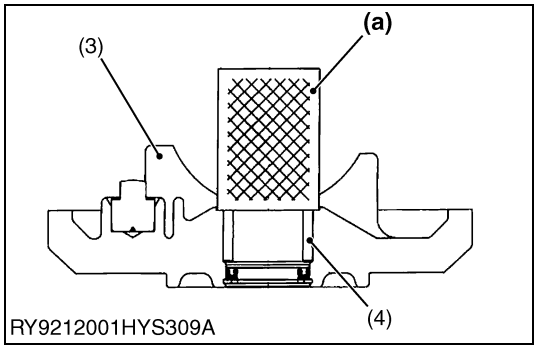


18. Use the jig **(a)** to insert the oil seal (5) into the flange (3).

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

(3) Flange
(5) Oil Seal
(a) Tool

RY9212001HYS0068US0

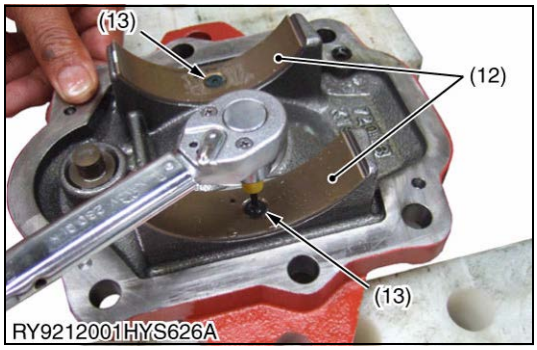


19. Use the jig **(a)** to install the needle bearing (4) into the flange (3).

■ **IMPORTANT**
- **Press the bearing in so its stamped side is facing up.**

(3) Flange
(4) Needle Bearing
(a) Tool

RY9212001HYS0069US0



20. Fasten the bushing (12) with the screws (13).

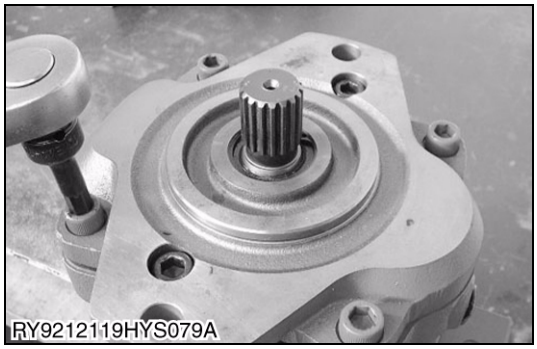
■ **IMPORTANT**
- **Be careful that the bushing faces the right direction.**

Tightening torque	Screw (13)	5.9 N·m 0.6 kgf·m 4.4 lbf·ft

- Tool to use: M3 hex socket

(12) Bushing
(13) Screw

RY9212001HYS0070US0



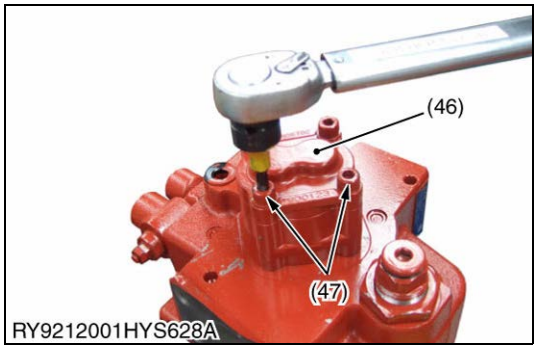
21. Attach the valve ASSY to the case.

■ **IMPORTANT**
- **Don't scratch the lip of the oil seal.**

Tightening torque	Socket head bolt	106.9 N·m 10.9 kgf·m 78.9 lbf·ft

- Tool to use: M10 hex socket

RY9212119HYS0183US0



22. Install the gear pump (46).

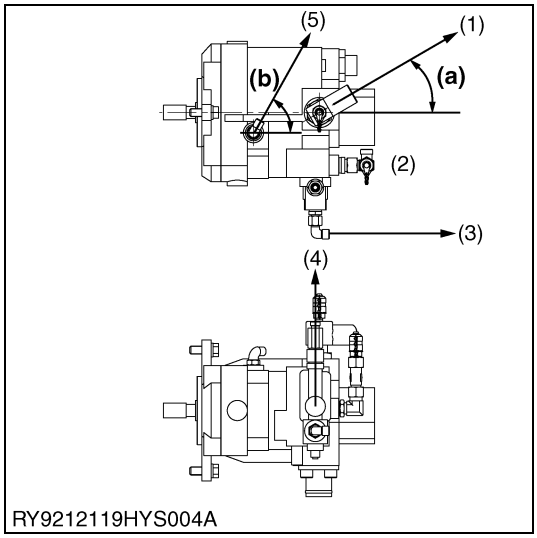
Tightening torque	Socket head bolt (47)	28.9 N·m 2.95 kgf·m 21.3 lbf·ft

- Tool to use: M6 hex socket

(46) Gear Pump
(47) Socket Head Bolt

RY9212001HYS0072US0

[4] ADAPTER INSTALLATION ANGLES



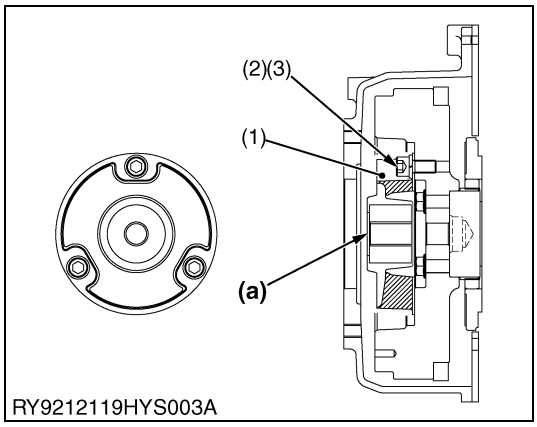
RY9212119HYS004A

(1) P
(2) PP
(3) PLS
(4) PPS
(5) Air Port

(a) 45 °
(b) 60 °

RY9212469HYS0045US0

[5] ASSEMBLING COUPLING



RY9212119HYS003A

Spline section grease application

Apply the correct amount of grease to the spline section.

■ **IMPORTANT**
- **Do not apply grease to the rubber section of the coupling.**

(1) Coupling
(2) Bolt (Socket Head)
(3) Washer (Spring Lock)

(a) Spline section grease application

RY9212119HYS0007US0

Tightening the coupling assembly bolts

Apply an extremely thin layer of lubricating oil to the coupling seat surface, then tighten to the torque indicated in the following table.

Tightening torque	Bolt (Socket Head)	107 to 117 N·m 10.9 to 11.9 kgf·m 78.9 to 86.3 lbf·ft

■ **IMPORTANT**
- **Do not apply a threadlock.**

RY9212119HYS0008US0

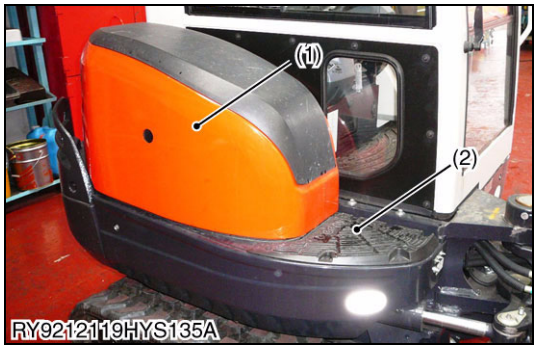
2. CONTROL VALVE

[1] REMOVING AND INSTALLING

CAUTION

- **When removing a hydraulic device after operating the machine, lower the bucket and blade to the ground and turn off the engine.**
- **Each of the devices and the hydraulic oil are hot and under high pressure immediately after operating the machine. If the hydraulic oil reached a high operating temperature, it may cause a burn.**
- **Oil gushing out under pressure has enough force to pierce your skin and may cause you injury. Always allow the temperature to drop and relieve any remaining pressure prior to working to remove any hydraulic equipment.**

RY9212001MBS0004US0



1. Open the right bonnet, remove the snap ring, pin and bonnet.
2. Remove the mounting bolts and remove the swivel cover.
3. Attach the breather hose of the hydraulic fluid tank to the vacuum pump, and apply vacuum pressure to the hydraulic fluid tank.
4. Disconnect all hydraulic hoses and electrical wiring from the control valve.

CAUTION

- **Plug all disconnected hydraulic hoses, and affix identification labels on each for reassembly.**

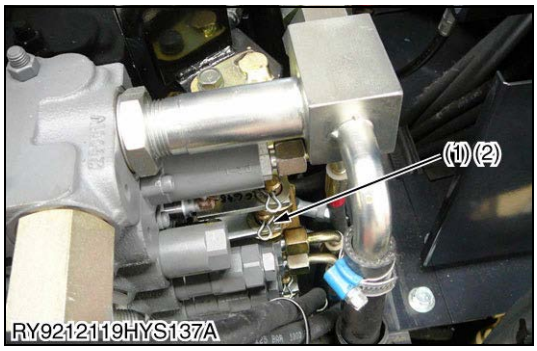
(1) Right Bonnet (2) Swivel Cover

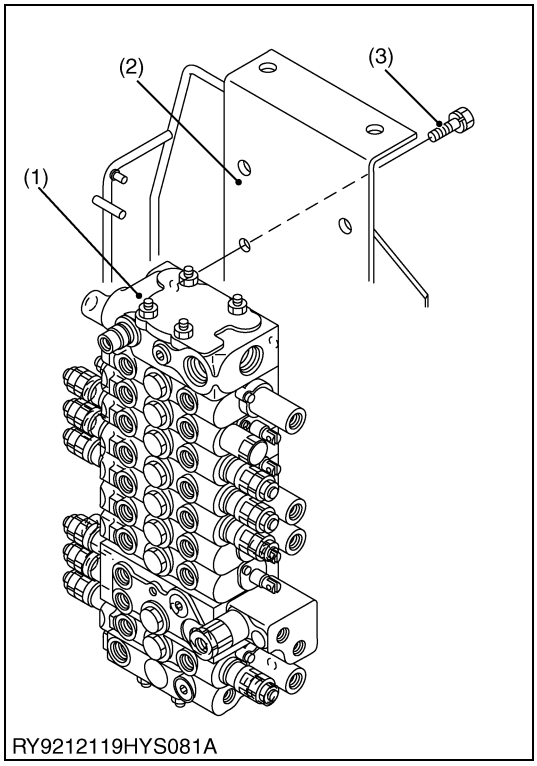
RY9212119HYS0012US0

5. Disconnect all snap pins and joint pins from the control valve.

(1) Snap pin (2) Joint pin

RY9212119HYS0015US0





RY9212119HYS081A

Removing the control valve assembly

1. Remove the control valve assembly mounting bolts, and remove the control valve assembly from the bracket (control valve).

Tightening torque	Control valve assembly	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 lbf·ft

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

(1) Control Valve Assembly
(2) Bracket (Control Valve)
(3) Flange Bolt (M10 × 18)

RY9212119HYS0019US0

[2] DISASSEMBLING AND ASSEMBLING

Precautions during Disassembly / Assembly

Precautions during Disassembly

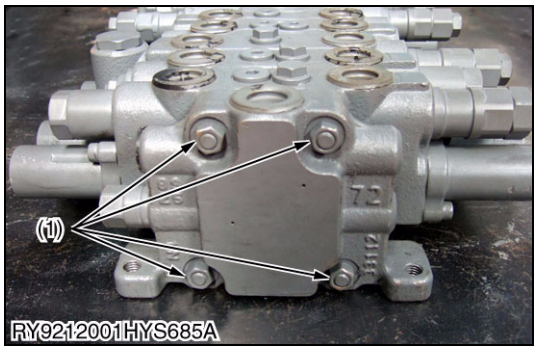
1. Generally, hydraulic devices are precision machined, and disassembly should therefore be conducted in a clean environment to prevent entry of debris into the narrow interstices formed in the device structure.
2. Always use clean tools and cleaning oil.
3. After removing from the machine, first wash 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)	27 to 30 N·m 2.8 to 3.1 kgf·m 19.9 to 22.1 lbf·ft

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

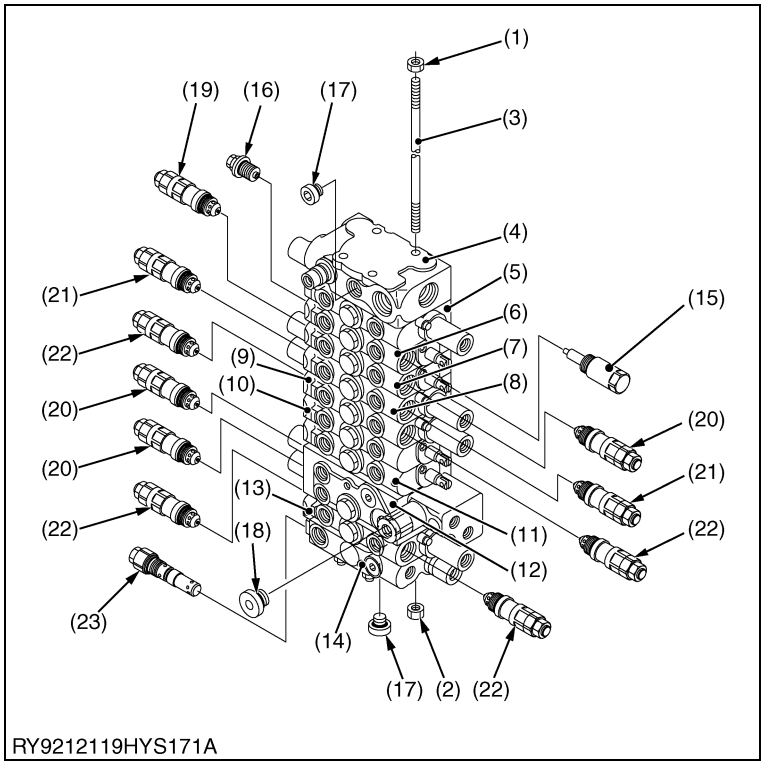
CAUTION

- **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

RY9212119HYS0043US0

[3] COMPONENTS



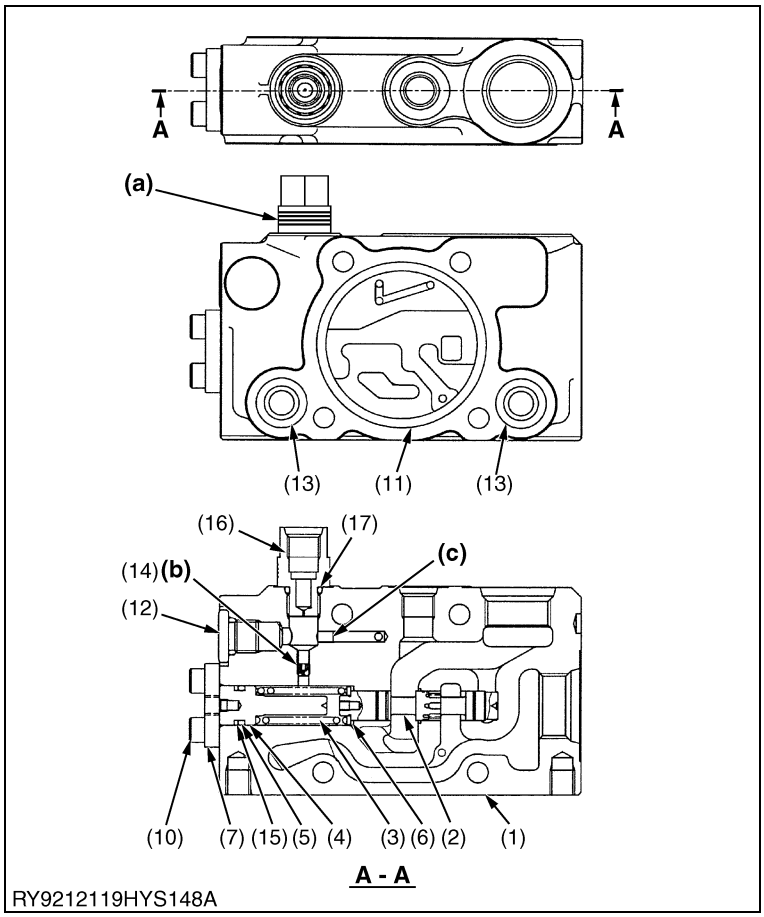
RY9212119HYS171A

Control Valve Components

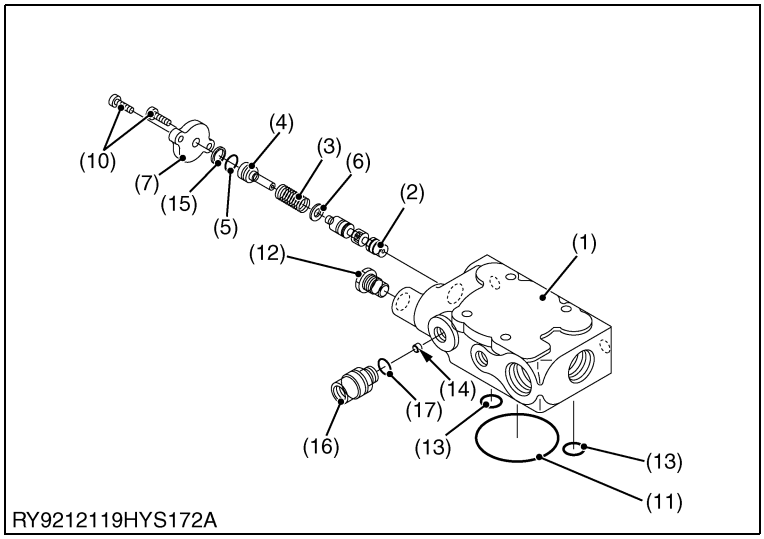
No.	Parts Name	Q'ty	Tightening torque
(1)	Nut	4	
(2)	Nut with Seal	4	
(3)	Tie Rod	4	
(4)	Spool Section Assy (Inlet)	1	
(5)	Spool Section Assy (Swivel)	1	
(6)	Spool Section Assy (Swing)	1	
(7)	Spool Section Assy (Blade)	1	
(8)	Spool Section Assy (AUX1)	1	
(9)	Spool Section Assy (Arm)	1	
(10)	Spool Section Assy (Travel Left)	1	
(11)	Spool Section Assy (Travel Right)	1	
(12)	Spool Section Assy (Boom)	1	
(13)	Spool Section Assy (Bucket)	1	
(14)	Spool Section Assy (Outlet)	1	
(15)	Valve Assy (Anti-Void)	1	69 to 78 N·m 7.0 to 8.0 kgf·m 50.9 to 57.5 lbf·ft
(16)	Valve Assy (Shut Off)	1	69 to 78 N·m 7.0 to 8.0 kgf·m 50.9 to 57.5 lbf·ft
(17)	Plug Assy	2	28.4 to 30.4 N·m 2.9 to 3.1 kgf·m 20.9 to 22.4 lbf·ft
(18)	Plug Assy	1	88.3 to 96.1 N·m 9.0 to 9.8 kgf·m 65.1 to 70.9 lbf·ft

No.	Valve Assy (Relief) Pressure Setting	Q'ty	Tightening torque
(19)	11.8 MPa 120 kgf/cm^2 1711 psi	1	69 to 78 N·m 7.0 to 8.0 kgf·m 50.9 to 57.5 lbf·ft
(20)	27.4 MPa 279 kgf/cm^2 3973 psi	3	
(21)	20.6 MPa 210 kgf/cm^2 2987 psi	2	
(22)	27.9 MPa 285 kgf/cm^2 4046 psi	4	
(23)	24.5 MPa 250 kgf/cm^2 3553 psi	1	49 to 54 N·m 5.0 to 5.5 kgf·m 36.1 to 39.8 lbf·ft

RY9212119HYS0184US0



RY9212119HYS148A



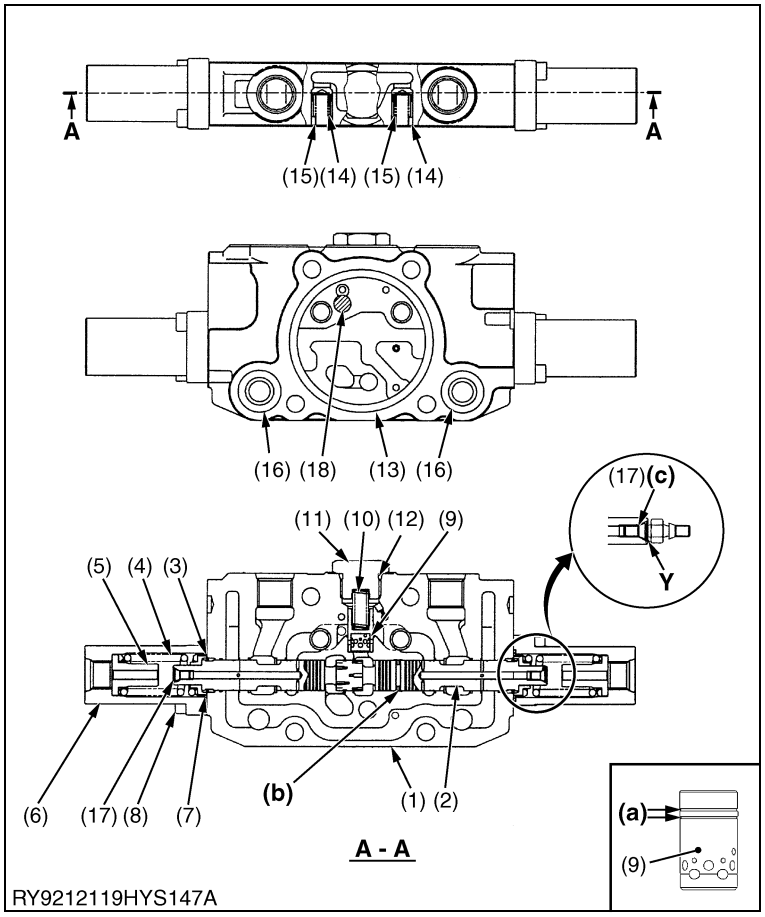
RY9212119HYS172A

(A) Spool Section (Inlet) Components

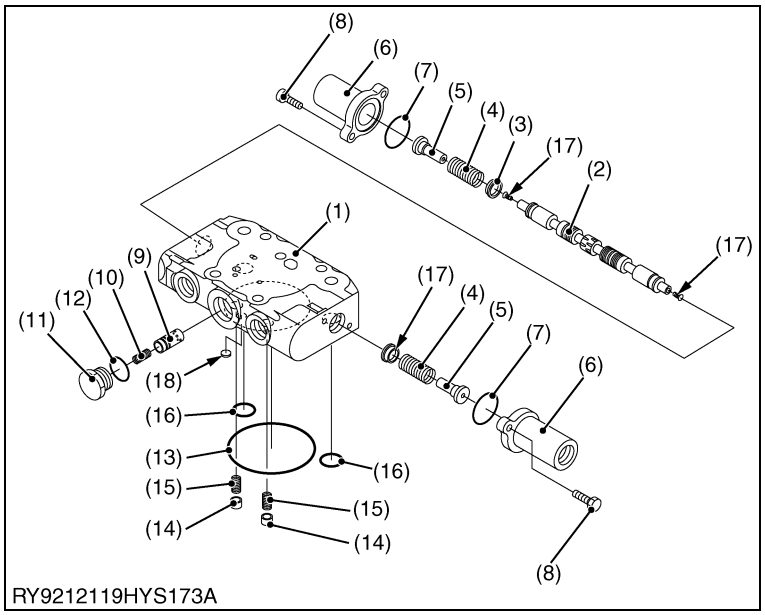
No.	Parts Name	Q'ty	Tightening torque
(1)	Inlet Housing	1	
(2)	Spool	1	
(3)	Spring	2	
(4)	Spacer	1	
(5)	O-ring	1	
(6)	Washer	1	
(7)	Flange	1	
(8)	–		
(9)	–		
(10)	Socket Head Bolt	4	8.8 to 11 N·m 0.9 to 1.1 kgf·m 6.5 to 8.1 lbf·ft
(11)	O-ring	1	
(12)	Plug Assy	1	28.4 to 30.4 N·m 2.9 to 3.1 kgf·m 21 to 22.4 lbf·ft
(13)	O-ring	1	
(14)	Orifice Plug	1	
(15)	Backup Ring	1	
(16)	Plug	1	28.4 to 30.4 N·m 2.9 to 3.1 kgf·m 21 to 22.4 lbf·ft
(17)	O-ring	1	

(a) Identification Groove (x 4)
(b) Identification mark in yellow
(c) No orifice plug

RY9212119HYS0054US0



RY9212119HYS147A



RY9212119HYS173A

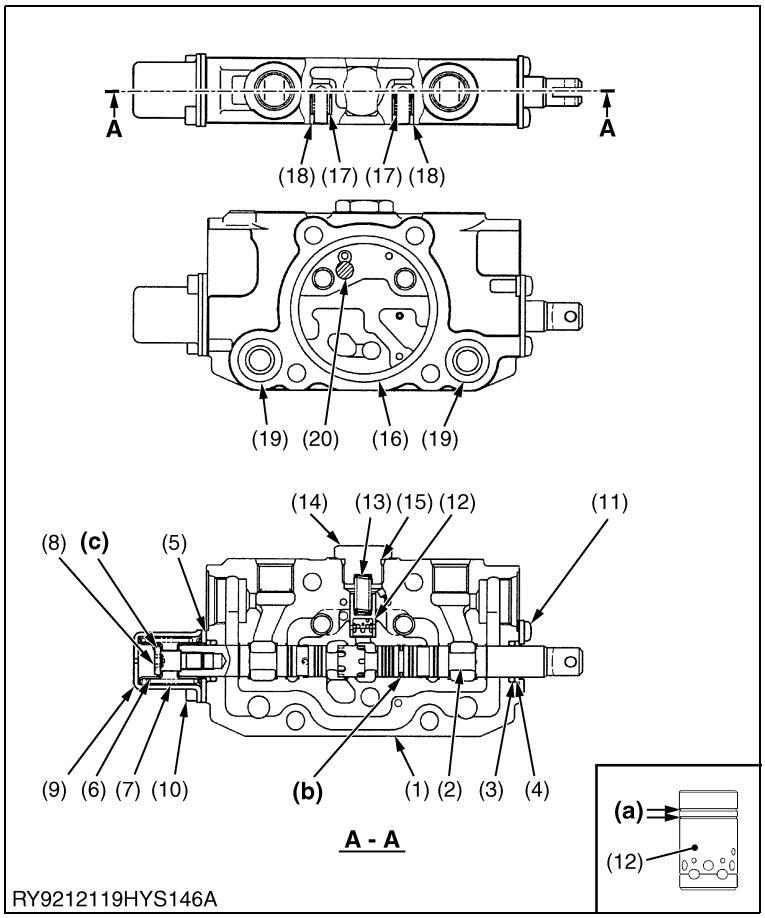
(B) Spool Section (Swivel) Components

No.	Parts Name	Q'ty	Tightening torque
(1)	Valve Housing	1	
(2)	Spool	1	
(3)	Spring Seat	2	
(4)	Spring	2	
(5)	Spring Seat	2	
(6)	Cap	2	
(7)	O-ring (S24, 1A)	2	
(8)	Socket Head Bolt	4	7.5 N·m 0.77 kgf·m 5.53 lbf·ft
(9)	Spool	1	
(10)	Spring	1	
(11)	Plug	2	69 to 78 N·m 7.0 to 8.0 kgf·m 50.9 to 57.5 lbf·ft
(12)	O-ring	1	
(13)	O-ring	1	
(14)	Load Check Valve	2	
(15)	Spring	2	
(16)	O-ring	1	
(17)	Plug	2	
(18)	Plate	1	

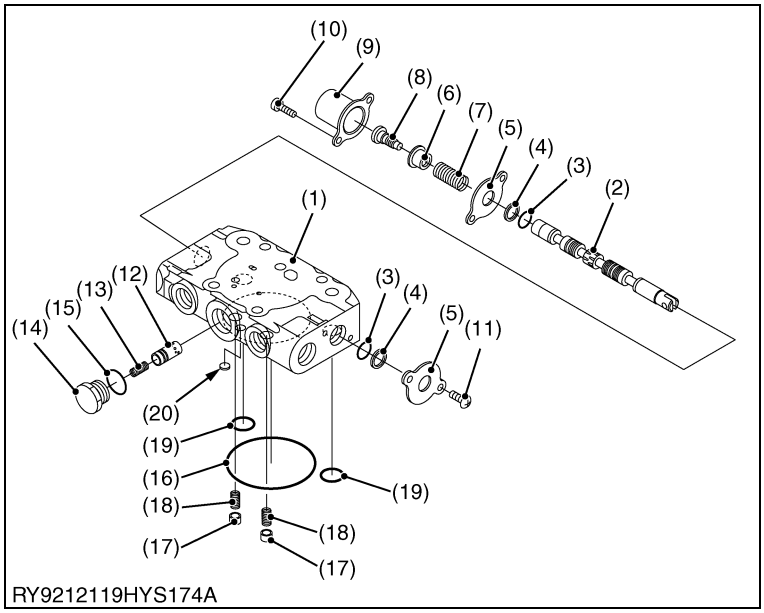
(a) Identification Groove (x 2)
(b) Assembly Direction Identification Groove
(c) Tighten nut until cutting Y. (Torque control) [Cutting torque approximately 6.9 N·m (0.7 kgf·m, 5.1 lbf·ft)]

RY9212469HYS0055US0

Standard



RY9212119HYS146A



RY9212119HYS174A

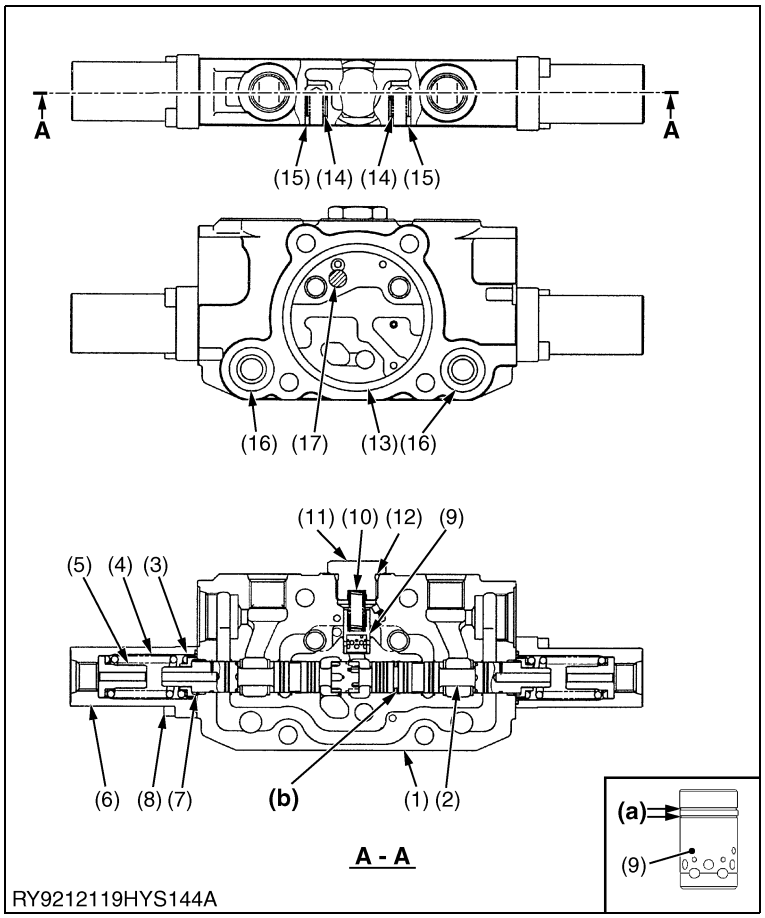
(C-1) Spool Section (Swing) Components

No.	Parts Name	Q'ty	Tightening torque
(1)	Valve Housing	1	
(2)	Spool	1	
(3)	O-ring	2	
(4)	Wiper	2	
(5)	Seal Plate	2	
(6)	Spring Seat	2	
(7)	Spring	1	
(8)	Cap Screw	1	
(9)	Cap	1	
(10)	Socket Head Bolt	2	7.3 to 10 N·m 0.74 to 1.02 kgf·m 5.38 to 7.38 lbf·ft
(11)	Screw	2	7.5 N·m 0.77 kgf·m 5.53 lbf·ft
(12)	Spool	1	
(13)	Spring	1	
(14)	Plug	1	69 to 78 N·m 7.0 to 8.0 kgf·m 50.9 to 57.5 lbf·ft
(15)	O-ring	1	
(16)	O-ring	1	
(17)	Load Check Valve	2	
(18)	Spring	2	
(19)	O-ring	2	
(20)	Plate	1	

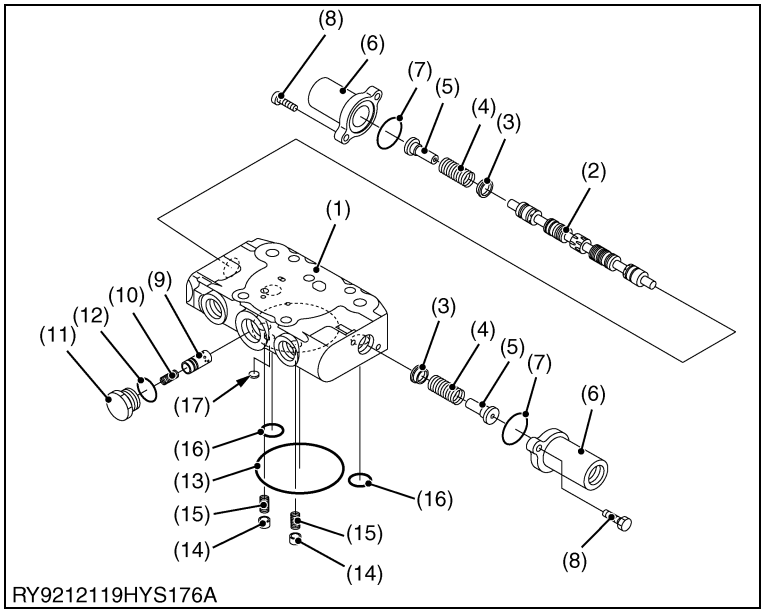
(a) Identification Groove (x 2)
(b) Assembly Direction Identification Groove
(c) Identification groove on the end

RY9212469HYS0046US0

Hi Spec



RY9212119HYS144A



RY9212119HYS176A

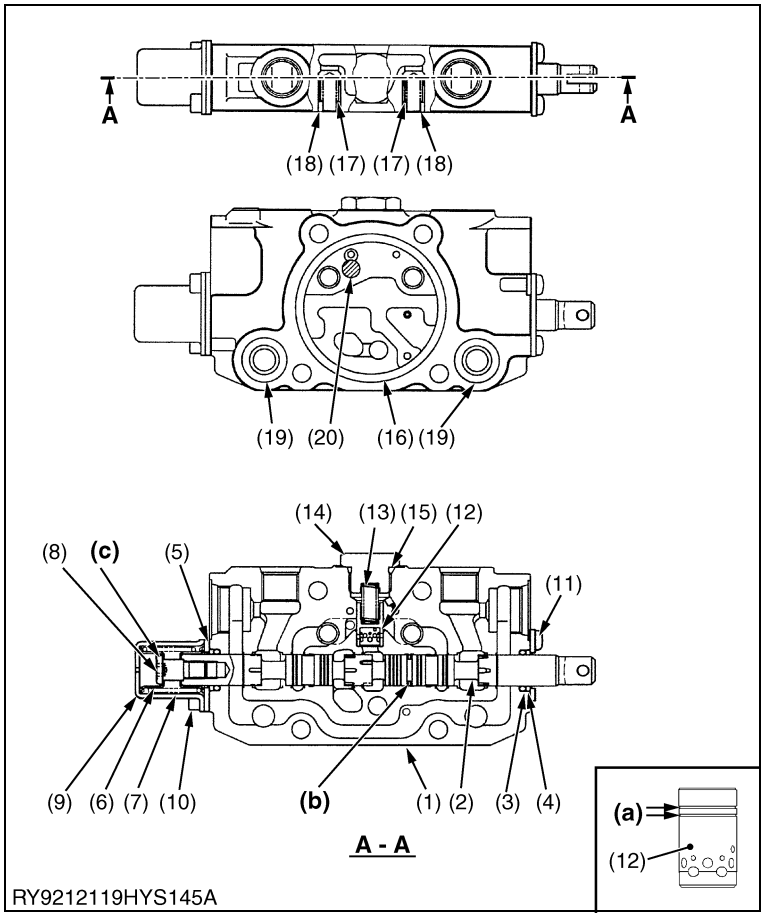
(C-2) Spool Section (Swing / AUX2)

Components

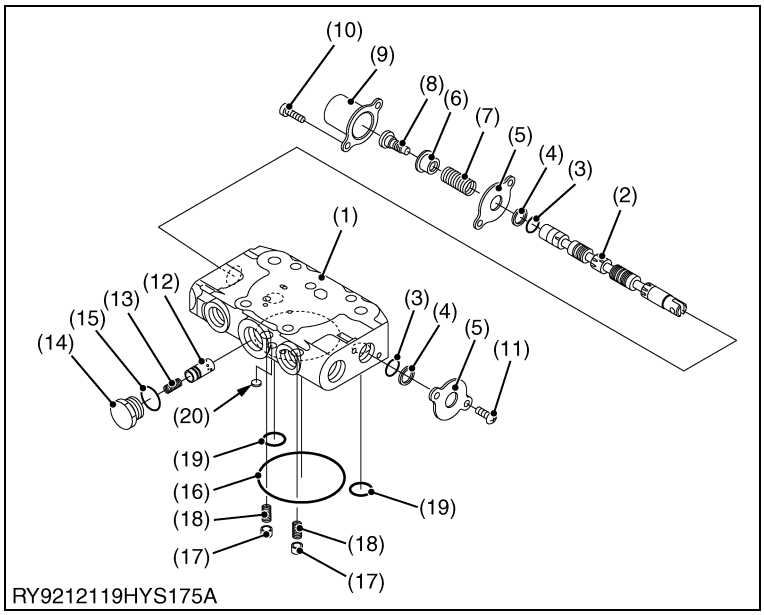
No.	Parts Name	Q'ty	Tightening torque
(1)	Valve Housing	1	
(2)	Spool	1	
(3)	Spring Seat	2	
(4)	Spring	2	
(5)	Spring Seat	2	
(6)	Cap	2	
(7)	O-ring (S24, 1A)	2	
(8)	Socket Head Bolt	4	7.5 N·m 0.77 kgf·m 5.53 lbf·ft
(9)	Spool	1	
(10)	Spring	1	
(11)	Plug	1	69 to 78 N·m 7.0 to 8.0 kgf·m 50.9 to 57.5 lbf·ft
(12)	O-ring	1	
(13)	O-ring	1	
(14)	Load Check Valve	2	
(15)	Spring	2	
(16)	O-ring	1	
(17)	Plate	1	

(a) Identification Groove (x 2)
(b) Assembly Direction Identification Groove

RY9212469HYS0054US0



RY9212119HYS145A



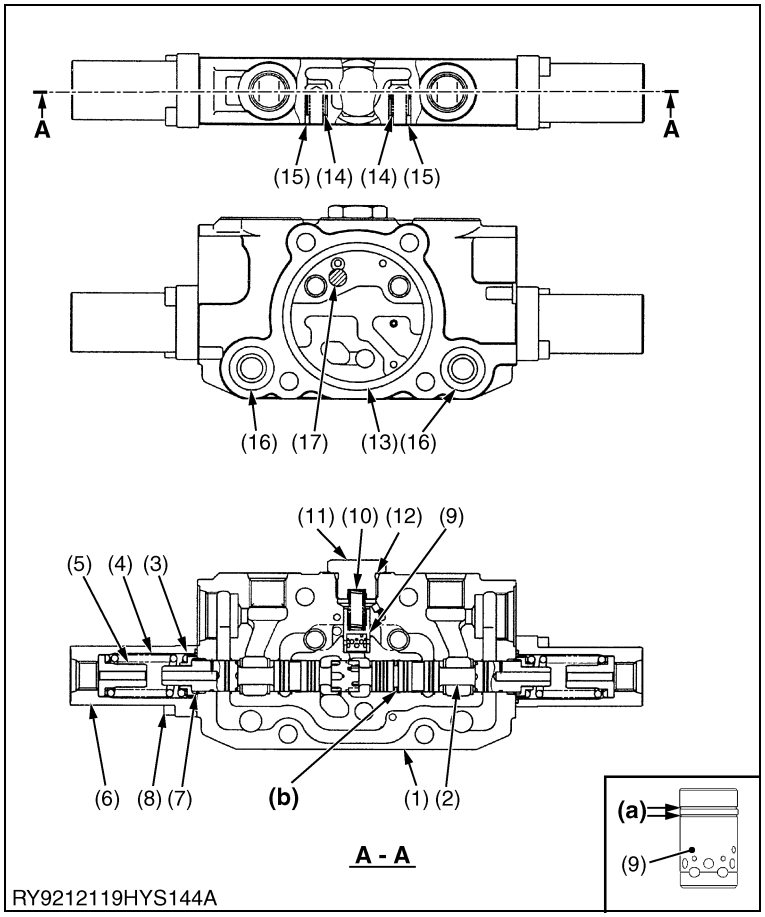
RY9212119HYS175A

(D) Spool Section (Blade) Components

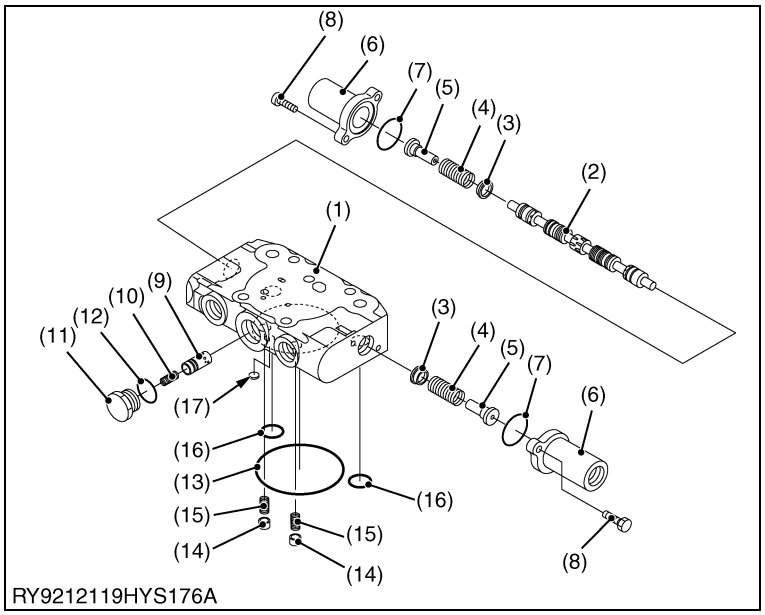
No.	Parts Name	Q'ty	Tightening torque
(1)	Valve Housing	1	
(2)	Spool	1	
(3)	O-ring	1	
(4)	Wiper	2	
(5)	Seal Plate	2	
(6)	Spring Seat	2	
(7)	Spring	2	
(8)	Cap Screw	1	
(9)	Cap	1	
(10)	Socket Head Bolt	2	7.3 to 10 N·m 0.74 to 1.02 kgf·m 5.38 to 7.38 lbf·ft
(11)	Screw	2	7.5 N·m 0.77 kgf·m 5.53 lbf·ft
(12)	Spool	1	
(13)	Spring	1	
(14)	Plug	1	69 to 78 N·m 7.0 to 8.0 kgf·m 50.9 to 57.5 lbf·ft
(15)	O-ring	1	
(16)	O-ring	1	
(17)	Load Check Valve	2	
(18)	Spring	2	
(19)	O-ring	1	
(20)	Plate	1	

(a) Identification Groove (x 2)
(b) Assembly Direction Identification Groove
(c) Identification groove on the end

RY9212119HYS0051US0



RY9212119HYS144A



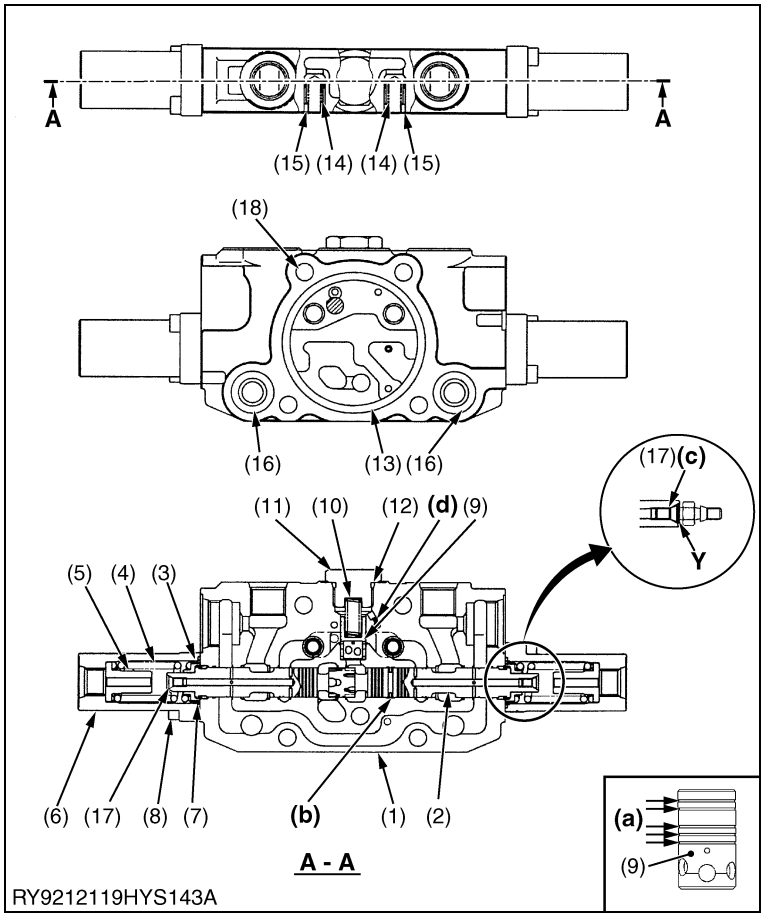
RY9212119HYS176A

(E) Spool Section (AUX1) Components

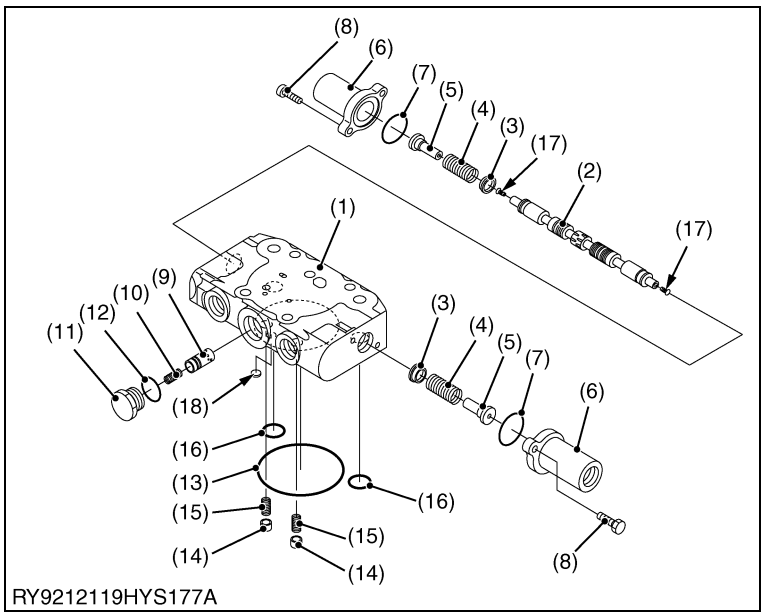
No.	Parts Name	Q'ty	Tightening torque
(1)	Valve Housing	1	
(2)	Spool	1	
(3)	Spring Seat	2	
(4)	Spring	2	
(5)	Spring Seat	2	
(6)	Cap	2	
(7)	O-ring (S24, 1A)	2	
(8)	Socket Head Bolt	4	7.5 N·m 0.77 kgf·m 5.53 lbf·ft
(9)	Spool	1	
(10)	Spring	1	
(11)	Plug	1	69 to 78 N·m 7.0 to 8.0 kgf·m 50.9 to 57.5 lbf·ft
(12)	O-ring	1	
(13)	O-ring	1	
(14)	Load Check Valve	2	
(15)	Spring	2	
(16)	O-ring	1	
(17)	Plate	1	

(a) Identification Groove (x 2)
(b) Assembly Direction Identification Groove

RY9212119HYS0050US0



RY9212119HYS143A



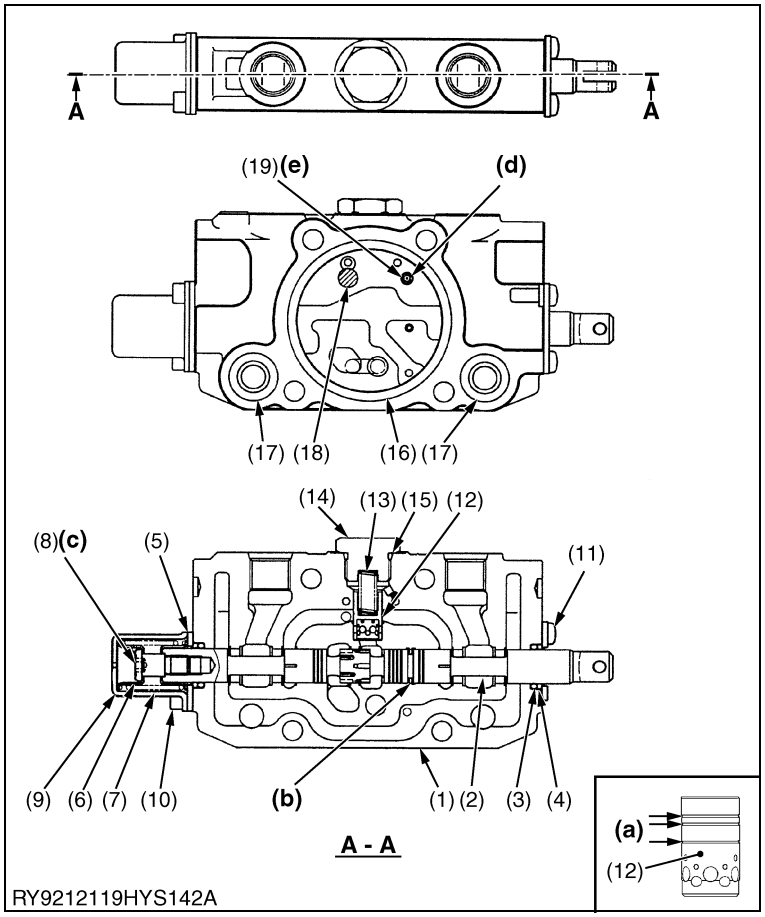
RY9212119HYS177A

(F) Spool Section (Arm) Components

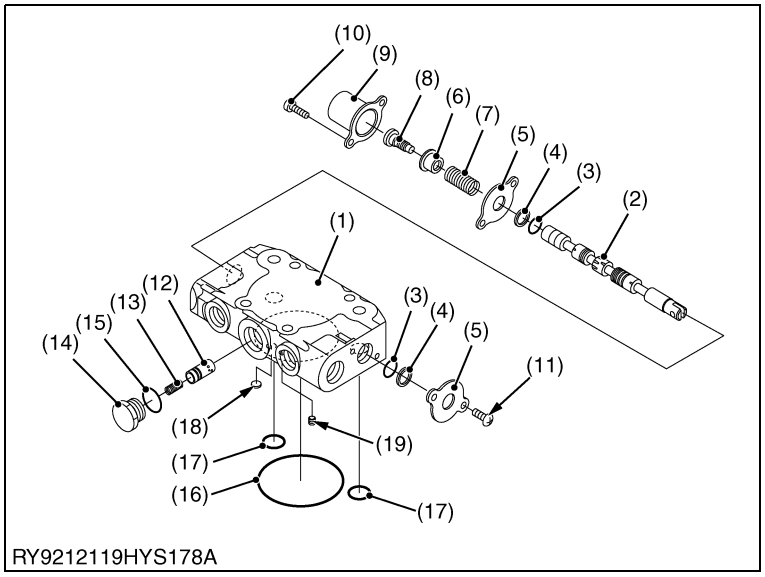
No.	Parts Name	Q'ty	Tightening torque
(1)	Valve Housing	1	
(2)	Spool	1	
(3)	Spring Seat	2	
(4)	Spring	2	
(5)	Spring Seat	2	
(6)	Cap	2	
(7)	O-ring	2	
(8)	Socket Head Bolt	4	7.5 N·m 0.77 kgf·m 5.53 lbf·ft
(9)	Spool	1	
(10)	Spring	1	
(11)	Plug	2	69 to 78 N·m 7.0 to 8.0 kgf·m 50.9 to 57.5 lbf·ft
(12)	O-ring	1	
(13)	O-ring	1	
(14)	Load Check Valve	2	
(15)	Spring	2	
(16)	O-ring	2	
(17)	Plug	2	
(18)	Plate	1	

(a) Identification Groove (x 5)
(b) Assembly Direction Identification Groove
(c) Tighten nut until cutting Y. (Torque control) [Cutting torque approximately 6.9 N·m (0.7 kgf·m, 5.1 lbf·ft)]
(d) ϕ0.6 drill thru

RY9212469HYS0056US0



RY9212119HYS142A



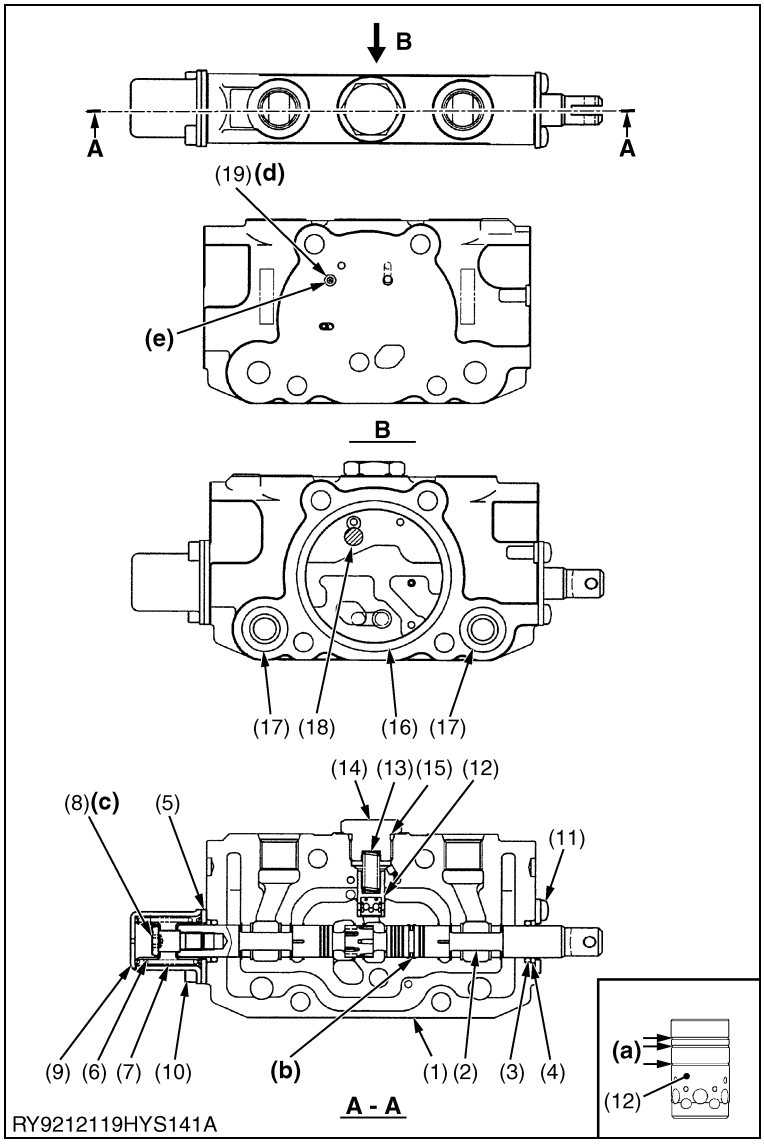
RY9212119HYS178A

(G) Spool Section (Travel Left) Components

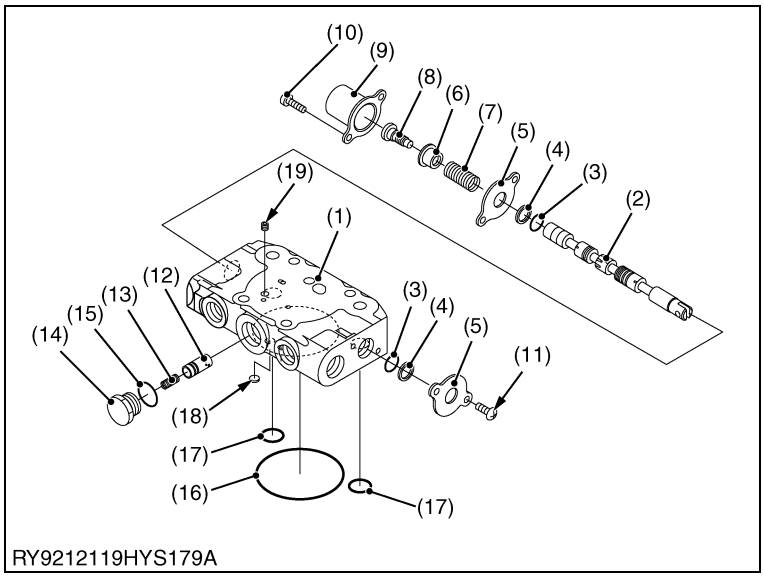
No.	Parts Name	Q'ty	Tightening torque
(1)	Valve Housing	1	
(2)	Spool	1	
(3)	O-ring	2	
(4)	Wiper	2	
(5)	Seal Plate	2	
(6)	Spring Seat	2	
(7)	Spring	1	
(8)	Cap Screw	1	19 to 22 N·m 1.94 to 2.24 kgf·m 14 to 16.2 lbf·ft
(9)	Cap	2	
(10)	Socket Head Bolt	2	7.3 to 10 N·m 0.74 to 1.02 kgf·m 5.38 to 7.38 lbf·ft
(11)	Screw	2	7.5 N·m 0.77 kgf·m 5.53 lbf·ft
(12)	Spool	1	
(13)	Spring	1	
(14)	Plug	2	69 to 78 N·m 7.0 to 8.0 kgf·m 50.9 to 57.5 lbf·ft
(15)	O-ring	1	
(16)	O-ring	1	
(17)	O-ring	2	
(18)	Plate	1	
(19)	Orifice Plug	2	7.5 N·m 0.77 kgf·m 5.53 lbf·ft

(a) Identification Groove (x 3)
(b) Assembly Direction Identification Groove
(c) Identification groove on the end
(d) Identification mark in red
(e) Communication orifice ϕ0.6

RY9212119HYS0048US0



RY9212119HYS141A



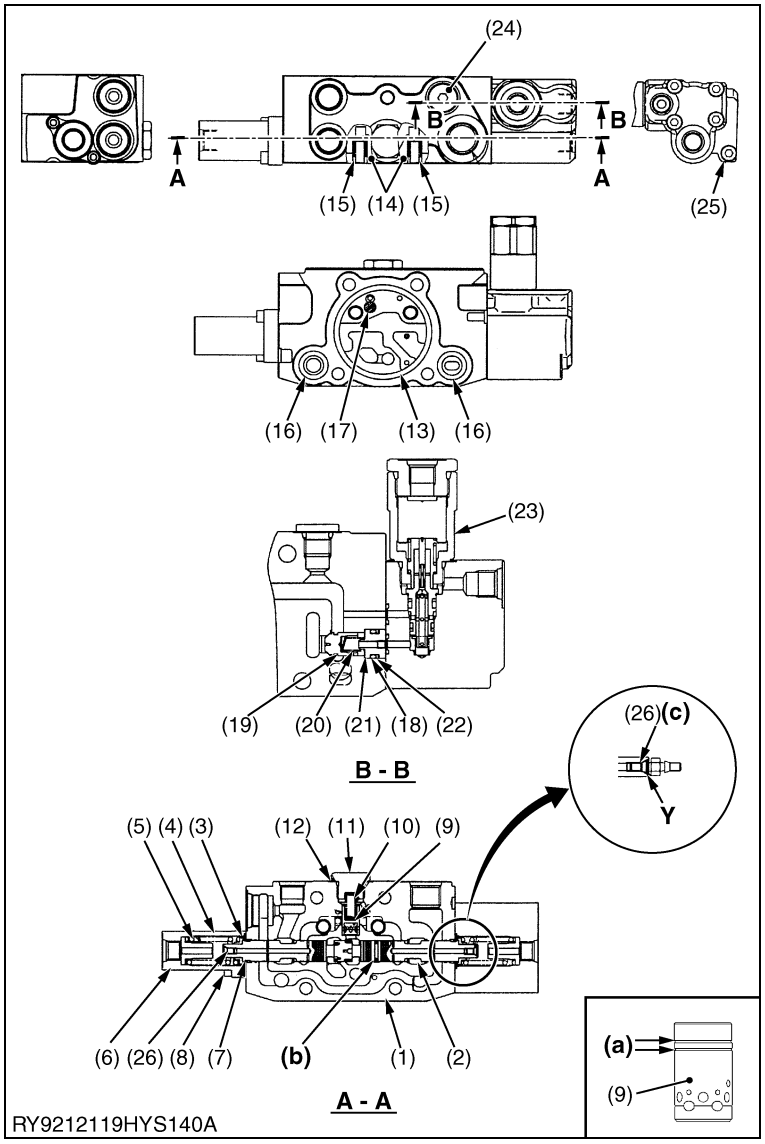
RY9212119HYS179A

(H) Spool Section (Travel Right) Components

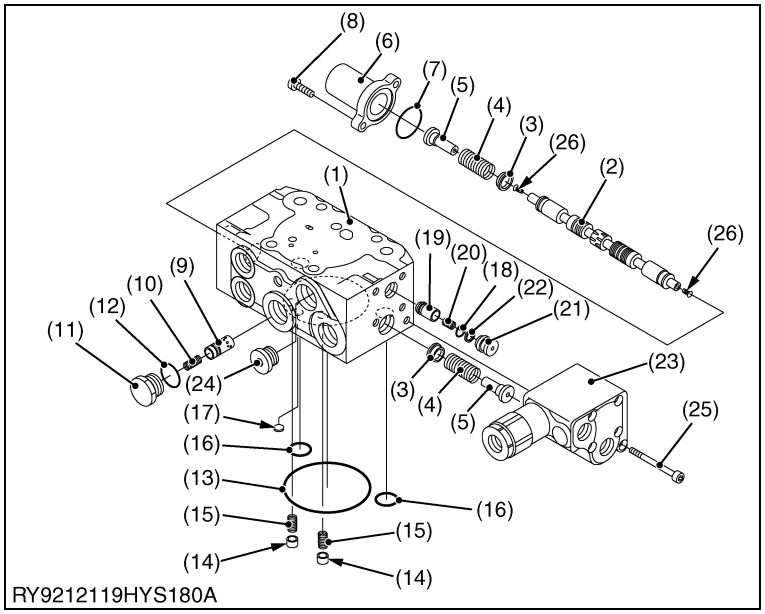
No.	Parts Name	Q'ty	Tightening torque
(1)	Valve Housing	1	
(2)	Spool	1	
(3)	O-ring	2	
(4)	Wiper	2	
(5)	Seal Plate	2	
(6)	Spring Seat	2	
(7)	Spring	1	
(8)	Cap Screw	1	19 to 22 N·m 1.94 to 2.24 kgf·m 14 to 16.2 lbf·ft
(9)	Cap	2	
(10)	Socket Head Bolt	2	7.3 to 10 N·m 0.74 to 1.02 kgf·m 5.38 to 7.38 lbf·ft
(11)	Screw	2	7.5 N·m 0.77 kgf·m 5.53 lbf·ft
(12)	Spool	1	
(13)	Spring	1	
(14)	Plug	2	69 to 78 N·m 7.0 to 8.0 kgf·m 50.9 to 57.5 lbf·ft
(15)	O-ring	1	
(16)	O-ring	1	
(17)	O-ring	2	
(18)	Plate	1	
(19)	Orifice Plug	2	7.5 N·m 0.77 kgf·m 5.53 lbf·ft

(a) Identification Groove (x 3)
(b) Assembly Direction Identification Groove
(c) Identification groove on the end
(d) Identification mark in red
(e) Communication orifice ϕ0.6

RY9212119HYS0047US0



RY9212119HYS140A



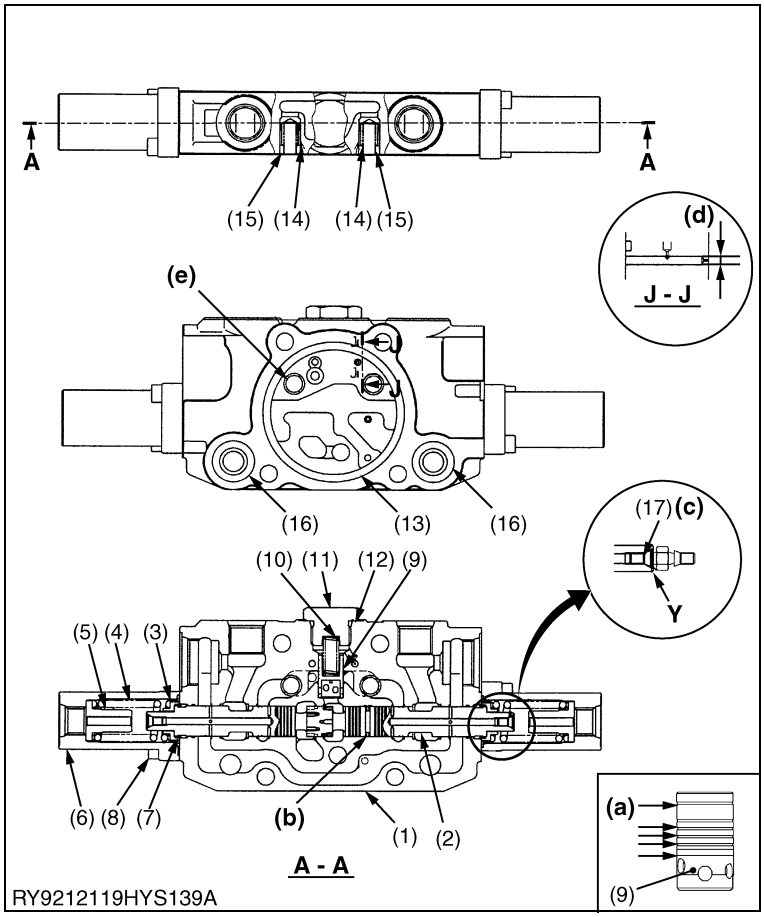
RY9212119HYS180A

(I) Spool Section (Boom) Components

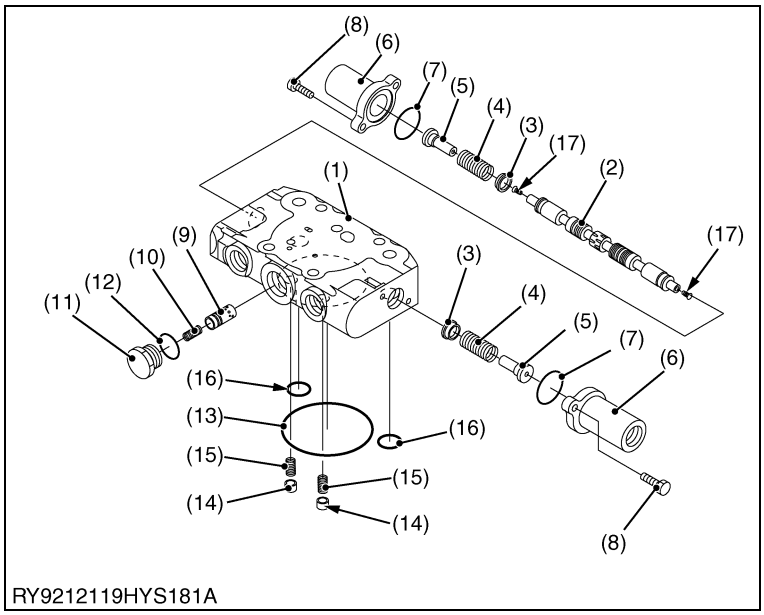
No.	Parts Name	Q'ty	Tightening torque
(1)	Valve Housing	1	
(2)	Spool	1	
(3)	Spring Seat	2	
(4)	Spring	2	
(5)	Spring Seat	2	
(6)	Cap	1	
(7)	O-ring (S24, 1A)	2	
(8)	Socket Head Bolt	2	7.5 N·m 0.77 kgf·m 5.53 lbf·ft
(9)	Spool	1	
(10)	Spring	2	
(11)	Plug	1	69 to 78 N·m 7.0 to 8.0 kgf·m 50.9 to 57.5 lbf·ft
(12)	O-ring	1	
(13)	O-ring	1	
(14)	Load Check Valve	1	
(15)	Spring	2	
(16)	O-ring	1	
(17)	Plate	1	
(18)	O-ring	1	
(19)	Poppet	2	
(20)	Spring	1	
(21)	Spacer	1	
(22)	Backup Ring	1	
(23)	Anti-Drift Assembly	1	69 to 78 N·m 7.0 to 8.0 kgf·m 50.9 to 57.5 lbf·ft
(24)	Plug Assy	1	28.4 to 30.4 N·m 2.9 to 3.1 kgf·m 20.9 to 22.4 lbf·ft
(25)	Socket Head Bolt	5	8.8 to 11 N·m 0.9 to 1.12 kgf·m 6.49 to 8.11 lbf·ft
(26)	Plug	2	

(a) Identification Groove (x 2)
(b) Assembly Direction Identification Groove
(c) Tighten nut until cutting Y. (Torque control) [Cutting torque approximately 6.9 N·m (0.7 kgf·m, 5.1 lbf·ft)]

RY9212469HYS0057US0



RY9212119HYS139A



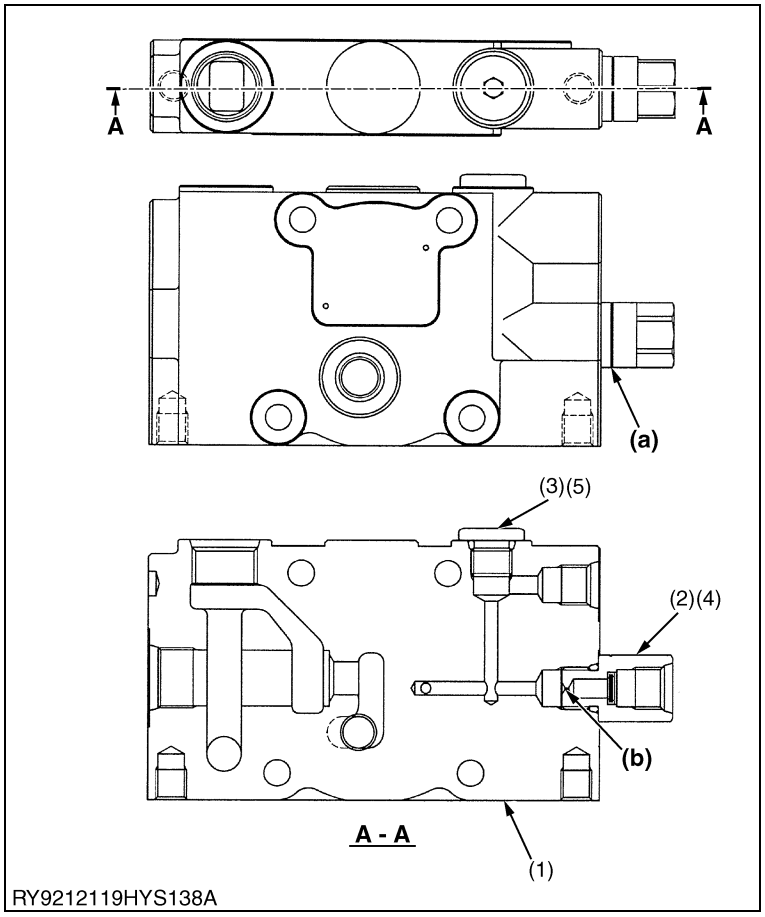
RY9212119HYS181A

(J) Spool Section (Bucket) Components

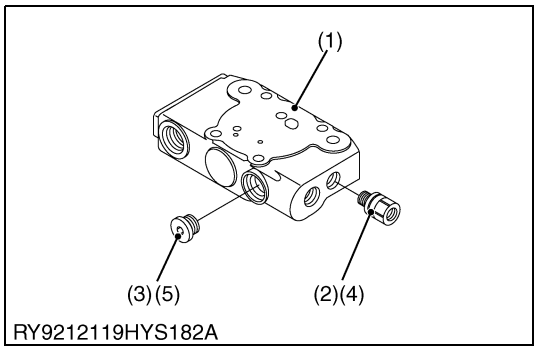
No.	Parts Name	Q'ty	Tightening torque
(1)	Valve Housing	1	
(2)	Spool	1	
(3)	Spring Seat	2	
(4)	Spring	2	
(5)	Spring Seat	2	
(6)	Cap	2	
(7)	O-ring (S24, 1A)	2	
(8)	Socket Head Bolt	4	7.5 N·m 0.77 kgf·m 5.53 lbf·ft
(9)	Spool	1	
(10)	Spring	1	
(11)	Plug	2	69 to 78 N·m 7.0 to 8.0 kgf·m 50.9 to 57.5 lbf·ft
(12)	O-ring	1	
(13)	O-ring	1	
(14)	Load Check Valve	1	
(15)	Spring	1	
(16)	O-ring	2	
(17)	Plug	2	

(a) Identification Groove (x 5)
(b) Assembly Direction Identification Groove
(c) Tighten nut until cutting Y. (Torque control) [Cutting torque approximately 6.9 N·m (0.7 kgf·m, 5.1 lbf·ft)]
(d) (ϕ0.6)
(e) No plate

RY9212469HYS0058US0



RY9212119HYS138A



RY9212119HYS182A

(K) Spool Section (Outlet) Components

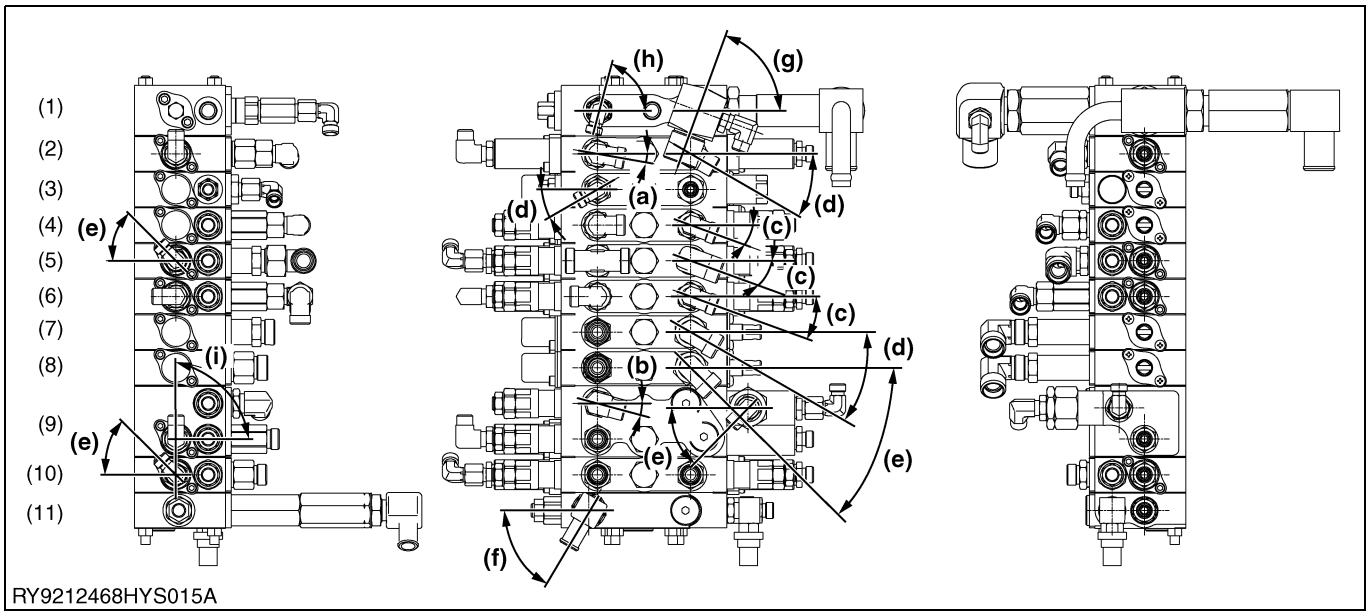
No.	Parts Name	Q'ty	Tightening torque
(1)	Outlet Housing	1	
(2)	Plug Assembly	1	28.4 to 30.4 N·m 2.9 to 3.1 kgf·m 21 to 22.4 lbf·ft
(3)	Plug Assembly	1	28.4 to 30.4 N·m 2.9 to 3.1 kgf·m 21 to 22.4 lbf·ft
(4)	O-ring	1	
(5)	O-ring	1	

(a) Identification Groove (x 1)
(b) 100 mesh, ϕ 0.4

RY9212119HYS0044US0

[4] ADAPTER INSTALLATION ANGLES

Standard

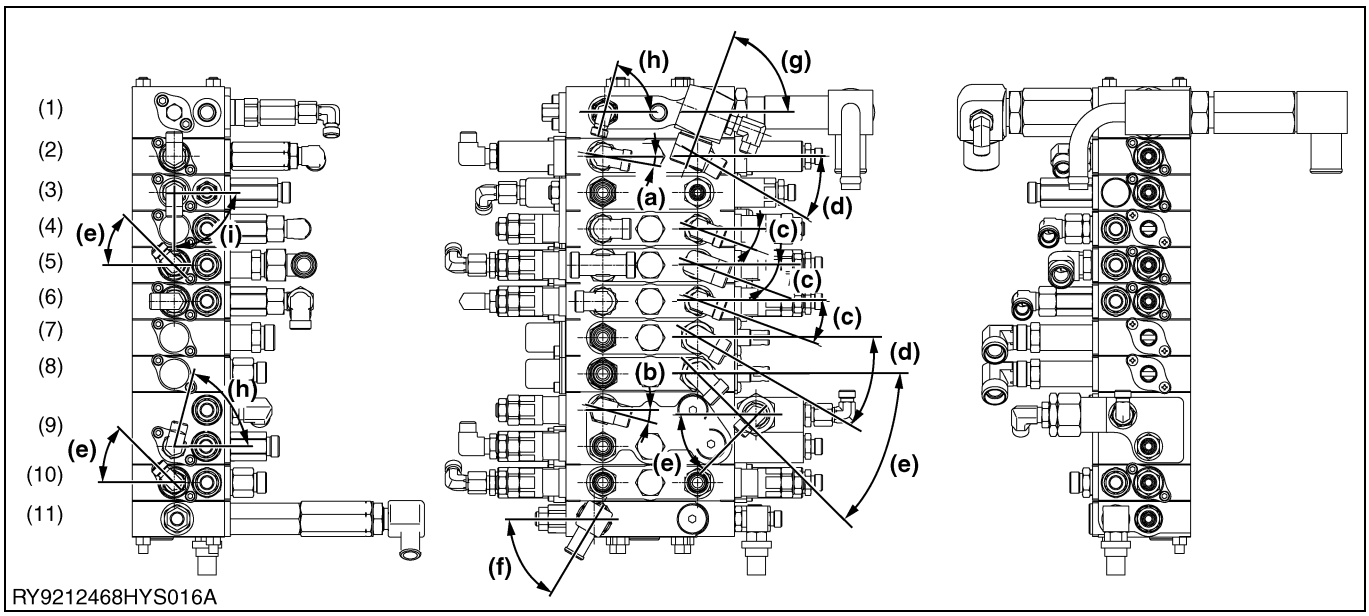


(1) Inlet
(2) Swivel
(3) Swing
(4) Blade
(5) AUX1
(6) Arm
(7) Travel (LH)
(8) Travel (RH)
(9) Boom
(10) Bucket
(11) Outlet

(a) 10°
(b) 15°
(c) 20°
(d) 30°
(e) 45°
(f) 60°
(g) 70°
(h) 75°
(i) 90°

RY9212469HYS0037US0

Hi Spec



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

(a) 10°
(b) 15°
(c) 20°
(d) 30°
(e) 45°
(f) 60°
(g) 70°
(h) 75°
(i) 90°

RY9212469HYS0038US0

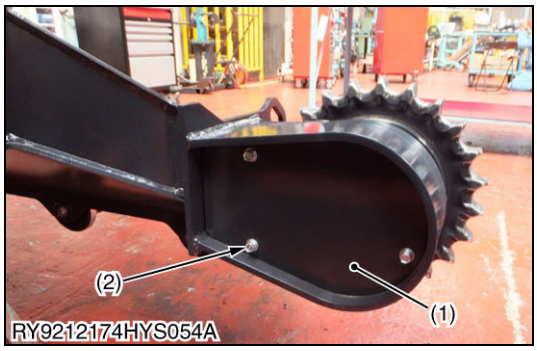
3. TRAVEL MOTOR

[1] REMOVING AND INSTALLING

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



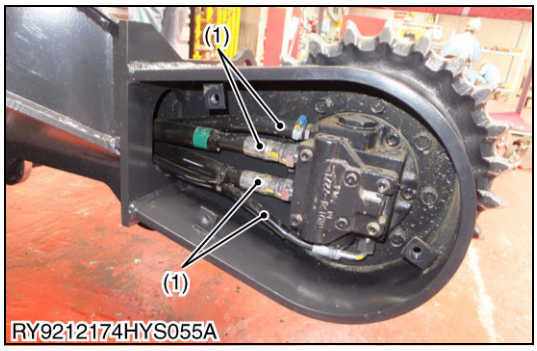
1. Remove the track and cover.
   - Tool to use: 14 mm socket

DANGER

- **Always support the track frame with 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.

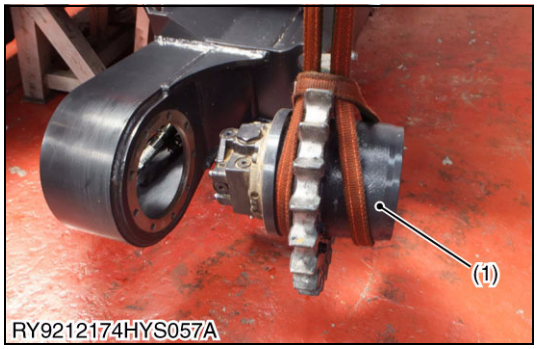
■ **IMPORTANT**

- **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

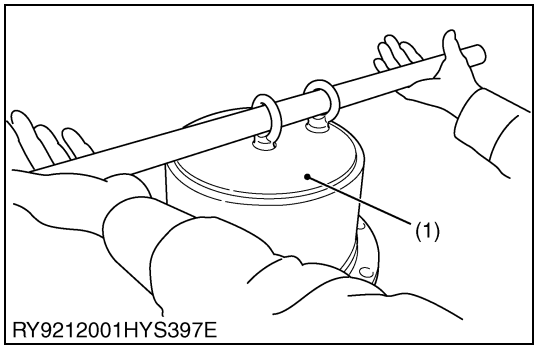
(1) Gear Case Disassembling

1. Attach the travel motor to the special disassembly platform.
2. Remove the circlip.

- Tool to use: Slotted screwdriver

(1) Circlip

RY9212119HYS0056US0

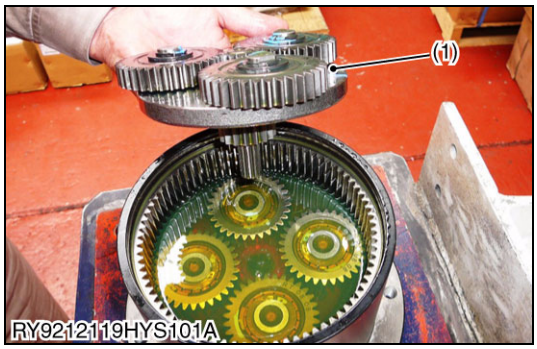


3. Remove the cover.
- Remove the plugs and attach eye-bolts.
- Put the rod through the eyebolt holes.
- Knock upwards on both sides of the rod and remove the cover.

- Tool to use: Eyebolts and round rod

(1) Cover

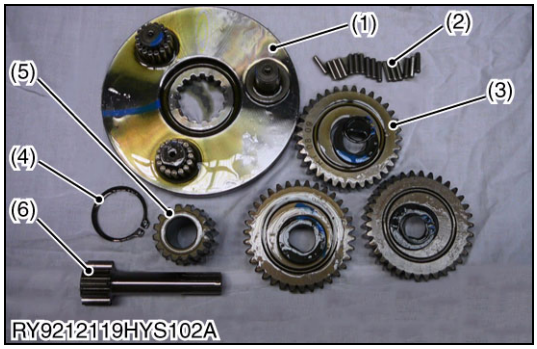
RY9212091HYS0116US0



4. Remove the holder and sub-assembly.

(1) Holder, Sub-Assy

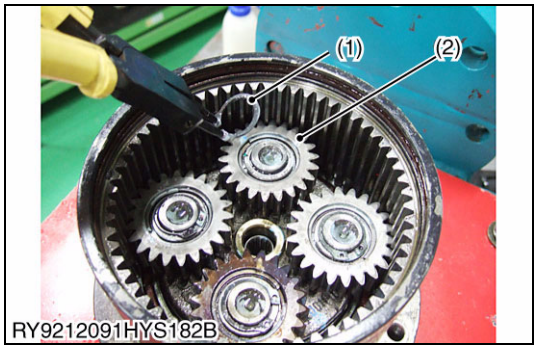
RY9212119HYS0057US0



Components of the holder and sub-assy

(1) Holder
(2) Needle Bearing
(3) Gear (Planetary)
(4) External Circlip
(5) Gear (Sun)
(6) Gear (Drive)

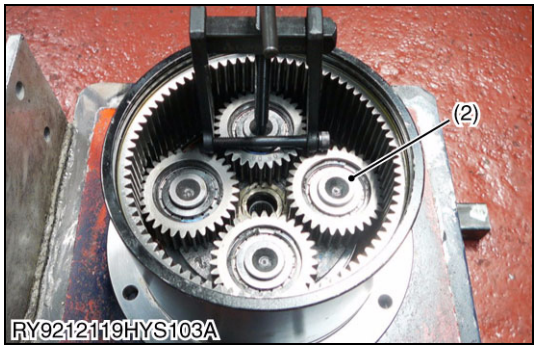
RY9212119HYS0091US0



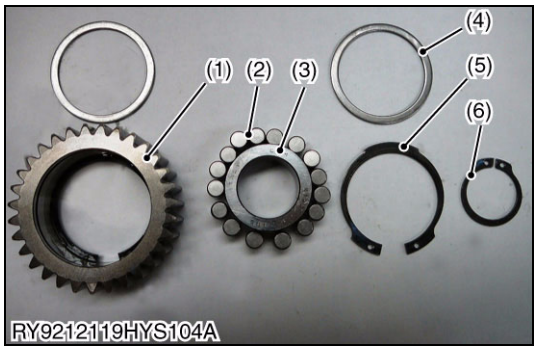
5. Remove the external circlip and planetary gear assy.

(1) External Circlip
(2) Planetary Gear Assy

RY9212119HYS0058US0

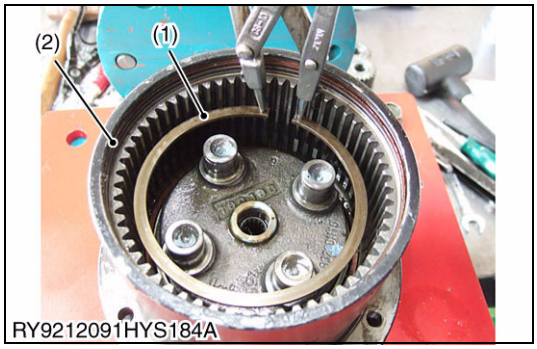


Components of the planetary gear assy



(1) Gear (Planetary)
(2) Needle Bearing
(3) Coller
(4) Plate
(5) Internal Circlip
(6) External Circlip

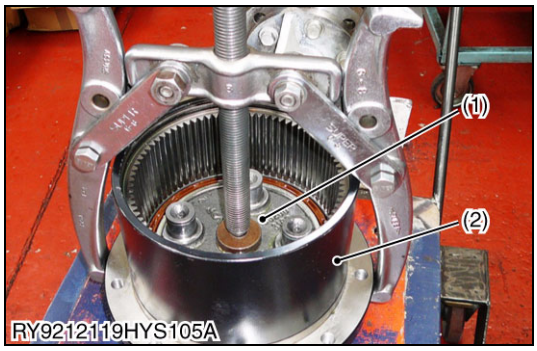
RY9212119HYS0092US0



6. Remove the circlip and O-ring.

(1) Circlip
(2) O-ring

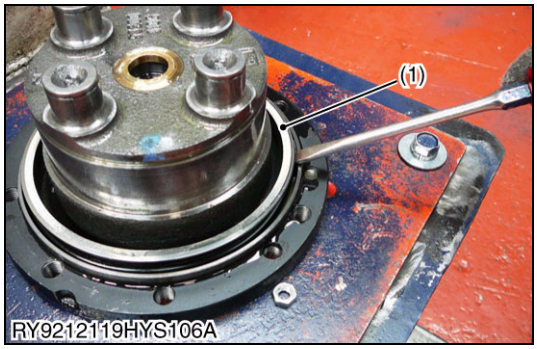
RY9212091HYS0183US0



7. Remove the gear case from the flange holder.

(1) Gear Case
(2) Flange Holder

RY9212119HYS0060US0



8. Remove the seal from the flange holder side.

- Tool to use: Slotted screwdriver

(1) Seal

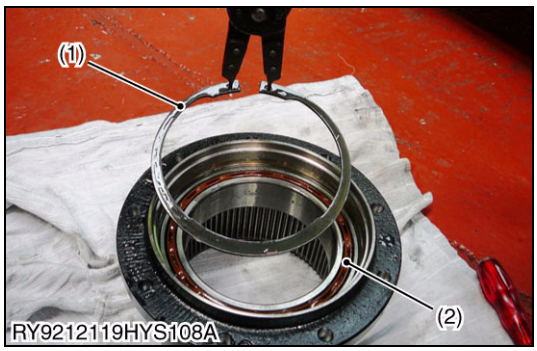
RY9212119HYS0061US0

9. Remove the seal from the gear case side.

- Tool to use: Slotted screwdriver

(1) Seal

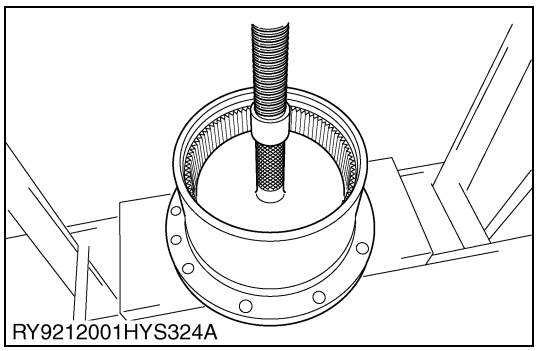
RY9212119HYS0062US0



10. Remove the circlip.
11. Remove the bearing (angular) with a press.

(1) Circlip (2) Bearing (Angular)

RY9212119HYS0063US0



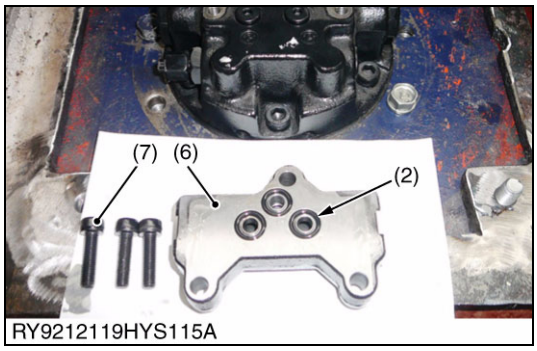
(2) Motor Disassembling

1. Remove the plug.

- Tool to use: M8 hex socket

(1) Plug

RY9212119HYS0064US0

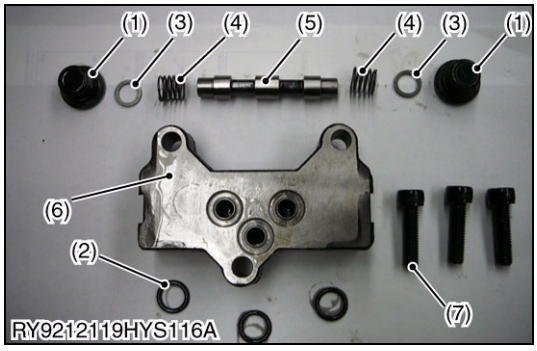


2. Remove the body (anti-cavitation).

■ **IMPORTANT**

- **Replace O-rings with new ones during reassembly.**

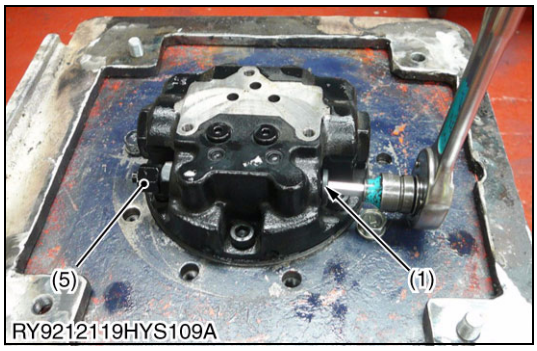
- Tool to use: M6 hex socket



Body (anti-cavitation), Assy Components

(1) Plug
(2) O-Ring
(3) Spring Washer
(4) Spring (Anti-Cavitation)
(5) Spool (Anti-Cavitation)
(6) Body (Anti-Cavitation)
(7) Hex Socket Bolt

RY9212119HYS0065US0

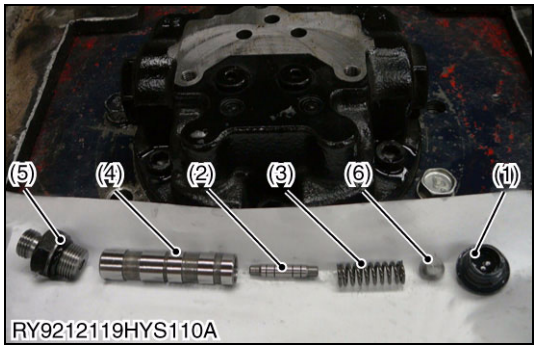


3. Remove the 2-speed parts.

■ **IMPORTANT**

- **Check to make sure there are not any scratches around the circumference of the spools.**

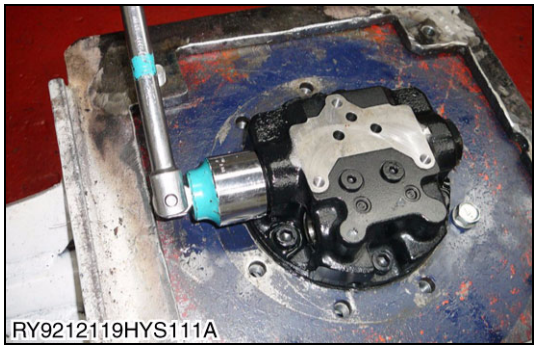
- Tool to use: M8 hex socket, M22 socket wrench



Components of the 2-speed Assy

(1) Plug
(2) Spool (2-Speed, S)
(3) Spring (2-Speed, S)
(4) Spool (2-Speed Switch)
(5) Pipe connector (2-Speed)
(6) Spring Seat

RY9212119HYS0066US0

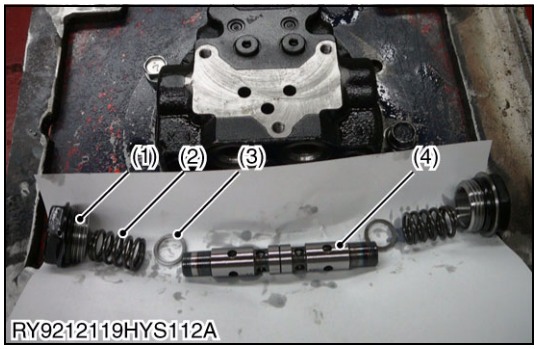

RY9212119HYS111A

4. Remove the plug.

CAUTION
- **There is only a small room for the wrench (or socket), so be careful not to let it slip.**

- Tool to use: M36 wrench (socket)

RY9212119HYS0067US0



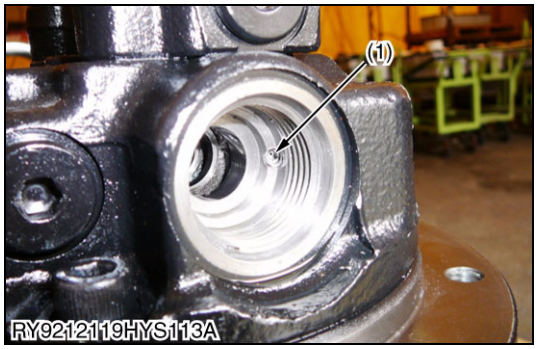
RY9212119HYS112A

5. Remove the compression spring, metal washer (spring) and plunger (counterbalance) in order.

IMPORTANT
- **Check to make sure there are not any scratches around the circumference of the spools.**

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

RY9212119HYS0068US0

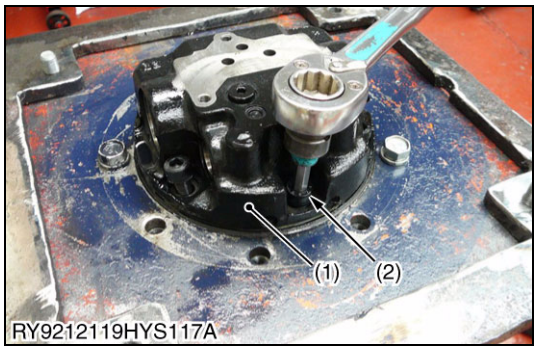


RY9212119HYS113A

6. Remove the orifice.

(1) Orifice

RY9212119HYS0069US0



RY9212119HYS117A

7. Remove the hex socket bolt.

(1) Body (Counterbalance)
(2) Hex Socket Bolt

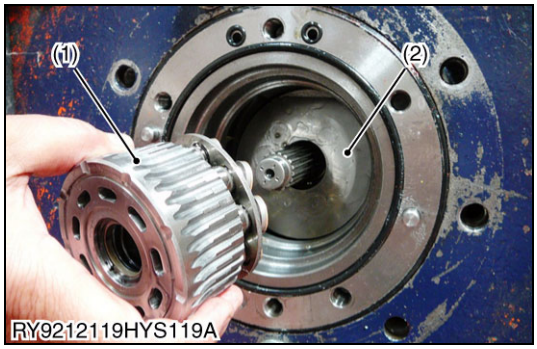
RY9212119HYS0070US0


RY9212119HYS118A

8. Tap the body (counterbalance) with a plastic hammer to raise it. Insert a slotted screwdriver into the gap and tap the body (counterbalance) from the opposite side with the hammer to remove it.

IMPORTANT
- **Be very careful because using force to insert a slotted screwdriver may scratch the body (counterbalance).**

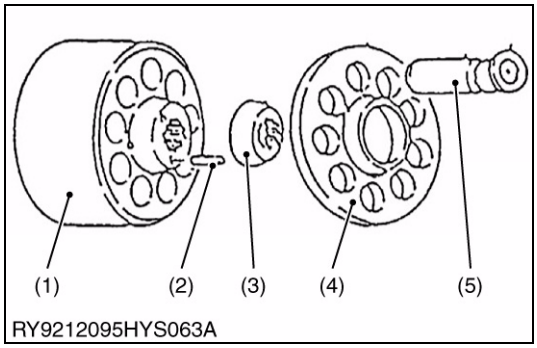
RY9212119HYS0071US0



9. Rotate the assembly platform 90° and remove the cylinder block, sub-assembly and swash-plate (variable).

(1) Cylinder Block and Sub-Assembly (2) Swash-Plate

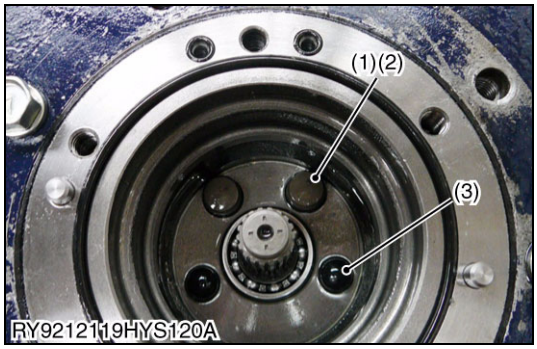
RY9212119HYS0093US0

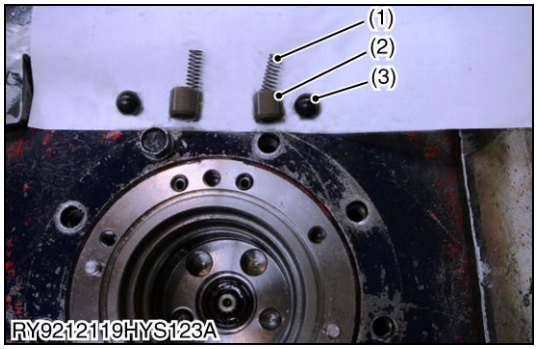


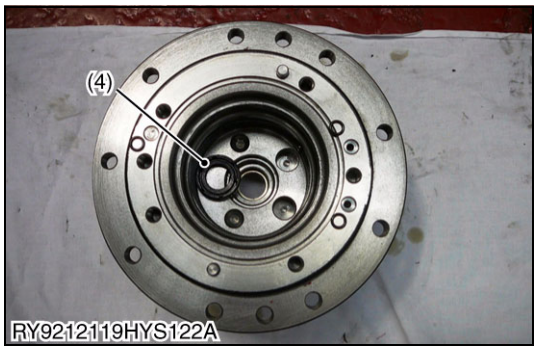
10. Remove the nine piston-shoes, shoe holder, retainer holder and three pins.

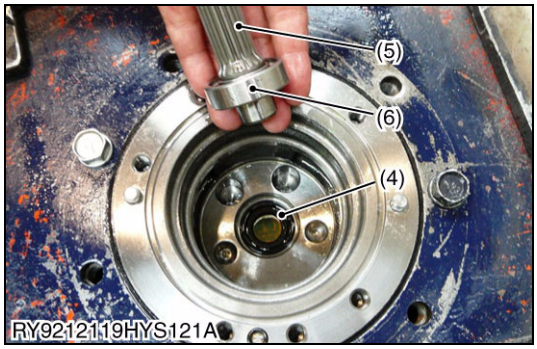
(1) Cylinder Barrel
(2) Pin
(3) Retainer Holder
(4) Shoe Holder
(5) Piston

RY9212095HYS0032US0









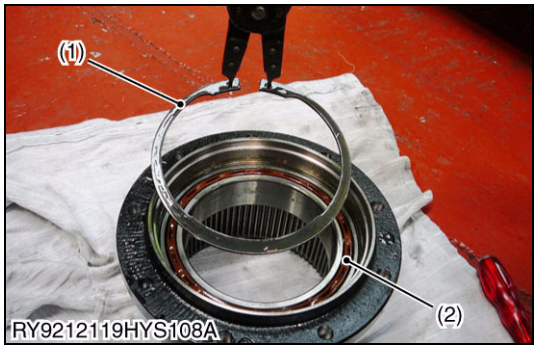
11. Turn the assembly platform back to its original position and remove the piston Assy and spring.
12. Remove the two steel balls.
13. Remove the shaft and bearing, turn the assembly platform over and remove the oil seal.

(1) Spring
(2) Piston Assy
(3) Steel Ball
(4) Oil Seal
(5) Shaft
(6) Bearing

RY9212119HYS0072US0

[3] ASSEMBLING

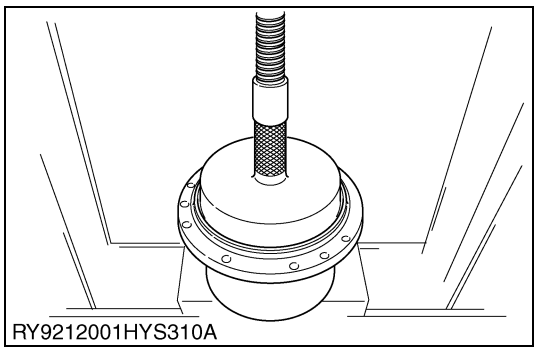
(1) Gear Case Assembling

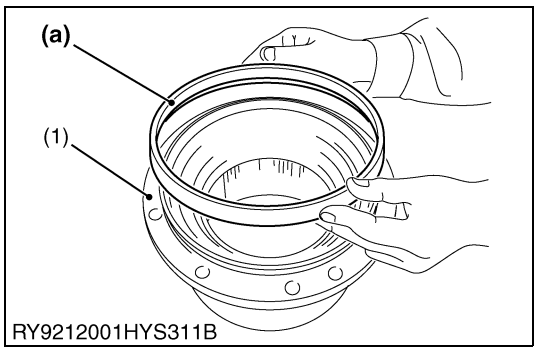


1. Install the circlip.
2. Set the angular bearing in the gear case and install it with a press.

(1) Circlip

RY9212119HYS0073US0





3. Set the floating seal installation tool **(a)** on the gear case.

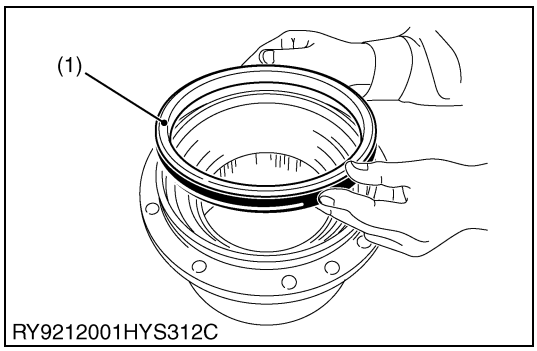
(1) Gear Case

(a) Floating seal installation tool guide (for housing)

RY9212119HYS0074US0

4. Apply grease to the O-ring of the seal and install the seal.

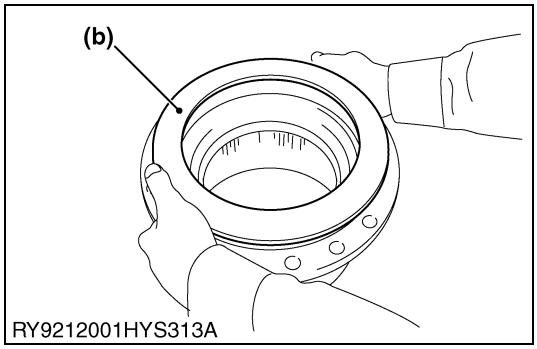
RY9212001HYS0007US0



5. Set the seal in the gear case.

(1) Seal

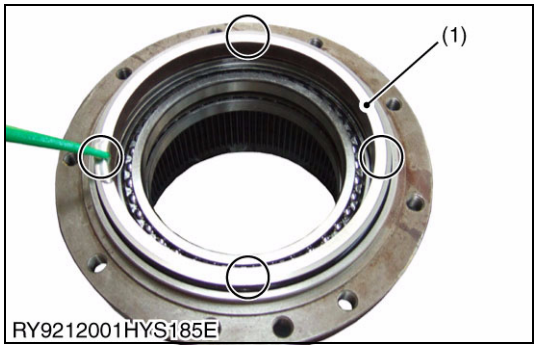
RY9212119HYS0194US0



6. Install the seal in the gear case with the floating seal installation tool **(b)**.

(b) Floating Seal Installation Tool (Pusher)

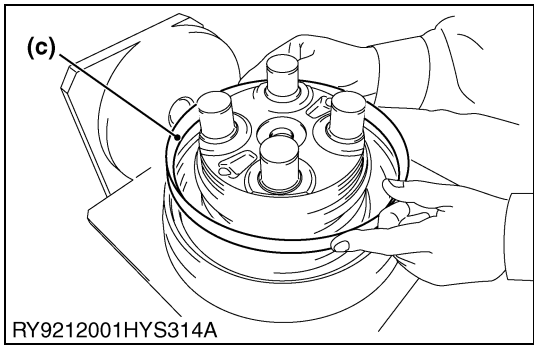
RY9212001HYS0008US0



7. Apply a little gear oil to the sliding surface of the seal. (4 places, every 90º)

(1) Floating Seal

RY9212119HYS0075US0



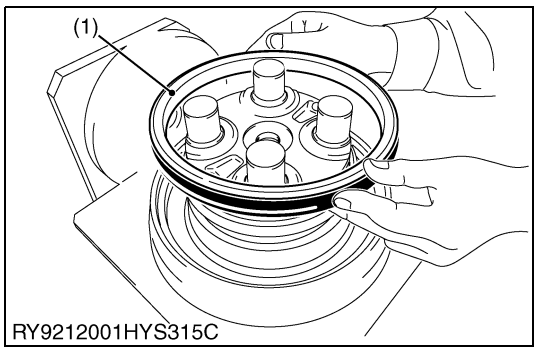
8. Set the holder (flange) on the assembly platform.
Set the floating seal installation tool on the holder (flange).

(c) Floating Seal Installation Tool Guide (for Flange Holder)

RY9212001HYS0009US0

9. Apply grease to the O-ring of the seal and install the seal.

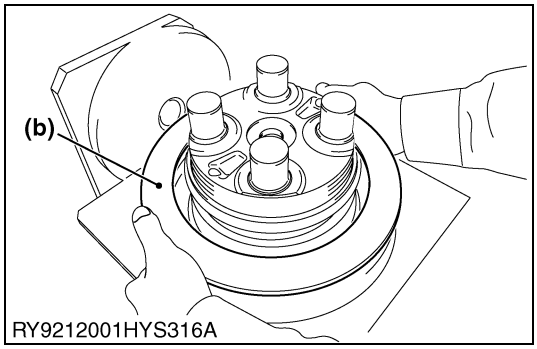
RY9212001HYS0010US0



10. Set the seal in the holder (flange).

(1) Seal

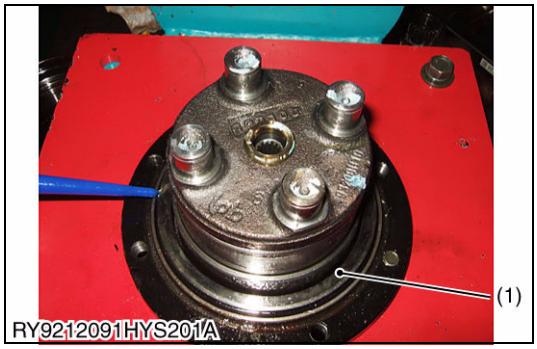
RY9212119HYS0195US0



11. Install the seal on the holder (flange) with the floating seal installation tool.

(b) Floating Seal Installation Tool (Pusher)

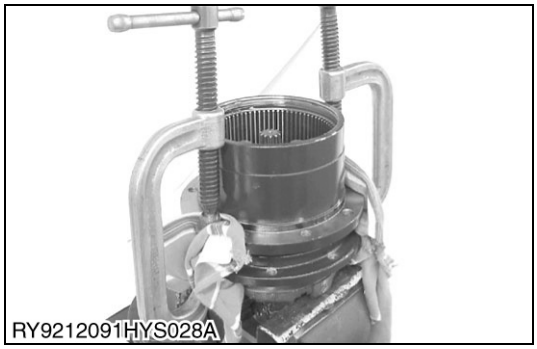
RY9212001HYS0011US0



12. Apply a little gear oil to the sliding surface of the floating seal. (4 places, every 90 °)

(1) Floating Seal

RY9212091HYS0198US0

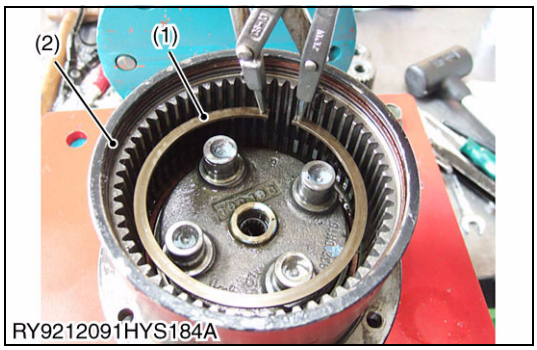


13. Use a vice or hydraulic press to press the flange holder and gear case together.

■ **IMPORTANT**

- **Rotate the gear case by hand to seat the angular bearing.**

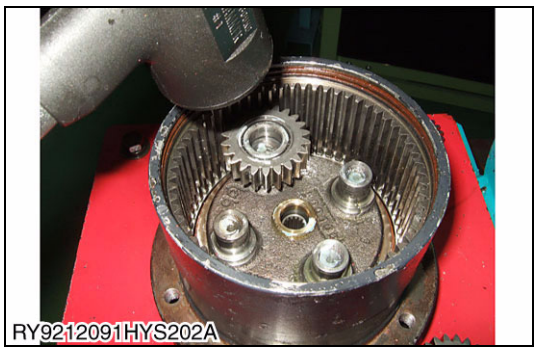
RY9212091HYS0199US0



14. Install the circlip.

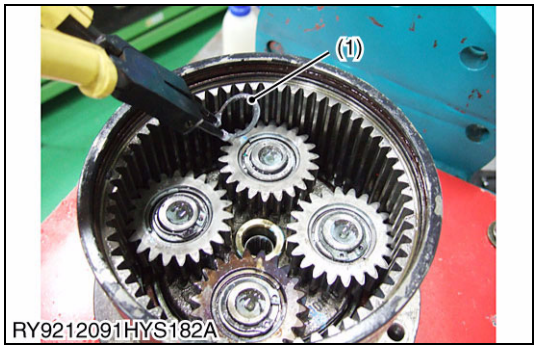
(1) Circlip (2) Gear Case

RY9212091HYS0200US0



15. Gently tap the planetary gear into place with a plastic hammer.

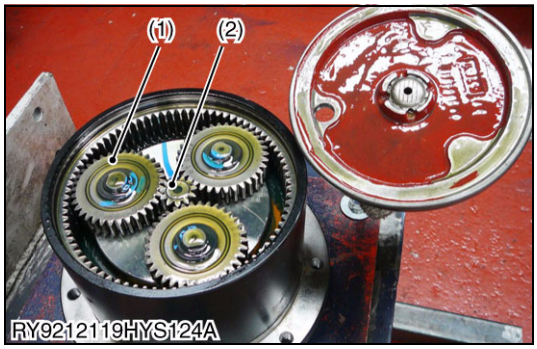
RY9212091HYS0201US0



16. Install the external circlip.

(1) External Circlip

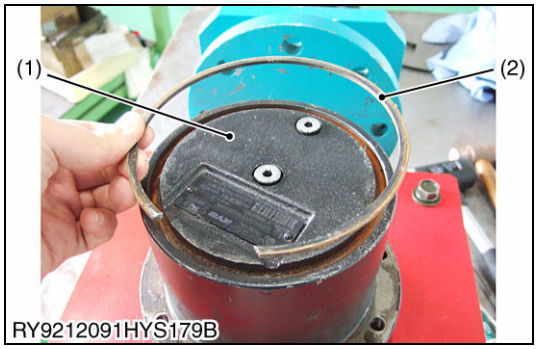
RY9212091HYS0202US0



17. Install the holder, sub-assembly and sun gear.

(1) Holder, Sub-Assy (2) Sun Gear

RY9212119HYS0076US0



18. After installing the O-ring, install the cover and the circlip.

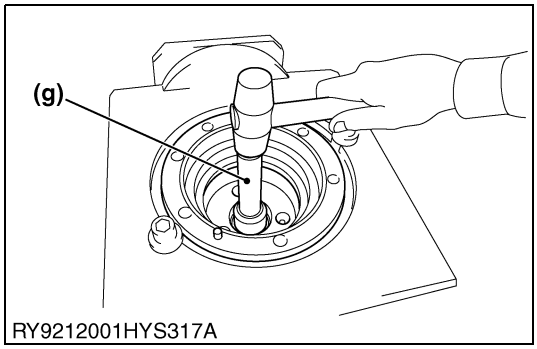
■ **IMPORTANT**

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

(1) Cover (2) Circlip

RY9212091HYS0205US0

(2) Motor Assembling

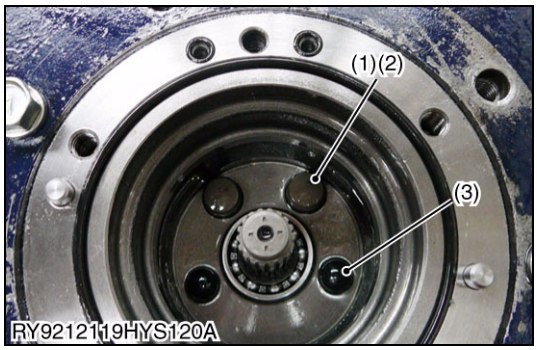


1. Tap the oil seal in with the oil seal installation tool **(g)**.

■ **IMPORTANT**
- **Take care to face the oil seal into the right direction.**
- **Apply grease to its lip and circumference.**

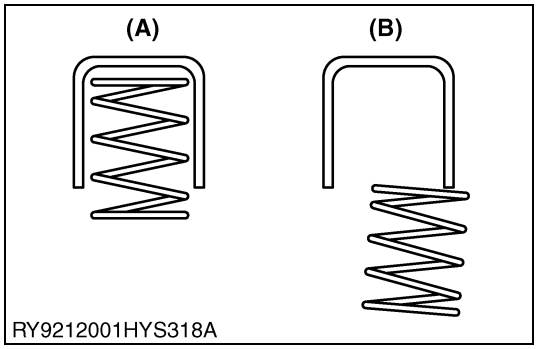
(g) Oil Seal Installation Tool

RY9212119HYS0077US0



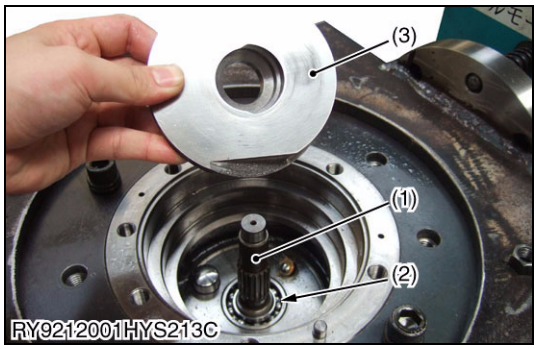
2. Install the pistons and Assy.
3. Apply grease to the two balls and install them.

■ **IMPORTANT**
- **The spring comes out easily, so apply some grease to it.**
- **Press the piston Assy down and make sure it moves smoothly.**



(1) Spring
(2) Piston Assy
(3) Steel Ball
(A) Correct
(B) Incorrect

RY9212119HYS0078US0

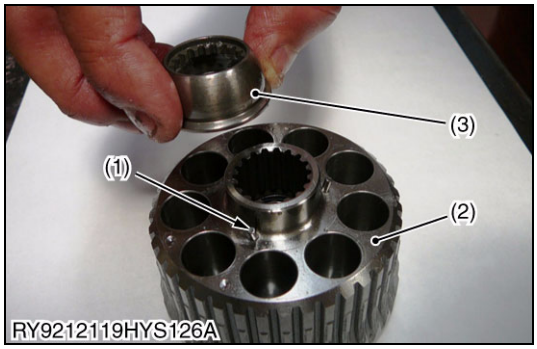


4. Install the shaft and bearing and then the swash-plate (variable).

■ **IMPORTANT**
- **Make sure the piston Assy moves smoothly.**

(1) Shaft
(2) Bearing
(3) Swash-Plate (Variable)

RY9212119HYS0079US0

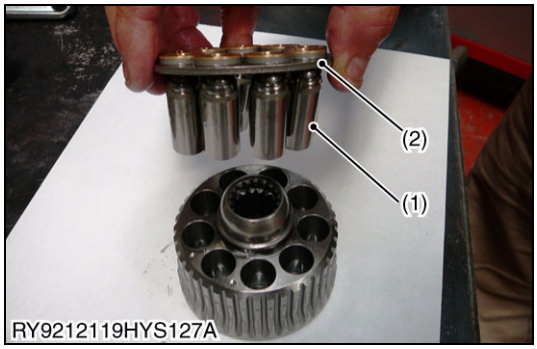


5. Install the three pins into the cylinder block.
6. Install the holder (retainer).

■ **IMPORTANT**
- **Apply grease to the pins.**

(1) Pin
(2) Cylinder Block (Travel)
(3) Holder (Retainer)

RY9212119HYS0080US0

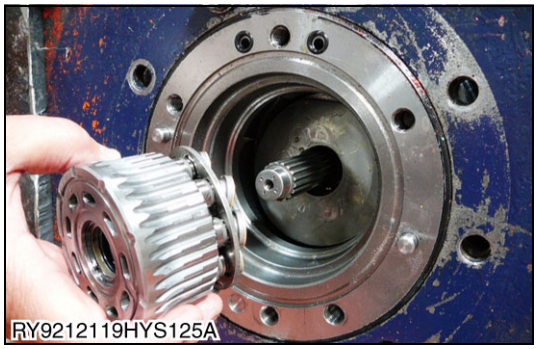


7. Install the piston Assy into the plate (retainer) and then install it into the cylinder block.

■ **IMPORTANT**
- **Apply hydraulic oil to the pistons.**
- **Make sure the pistons move smoothly.**

(1) Piston Assy
(2) Plate (Retainer)

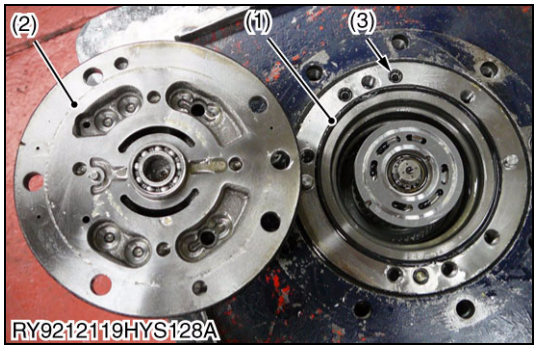
RY9212119HYS0081US0



8. Install the cylinder block, sub-assembly.

■ **IMPORTANT**
- **Turn the disassembly / assembly platform on its side.**

RY9212119HYS0082US0

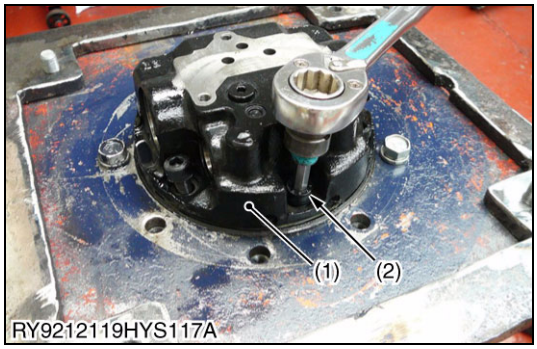


9. Install the plate (valve) and O-ring on the body (counterbalance).
Install the O-ring on the holder (flange).

■ **IMPORTANT**
- **Apply grease on the back of the plate (valve) so it does not fall off the base plate.**
- **Be careful so the plate (valve) faces in the correct direction.**
- **Apply grease to the O-ring.**

(1) O-Ring
(2) Plate (Valve)
(3) O-Ring

RY9212119HYS0083US0



10. Install the body (counterbalance).

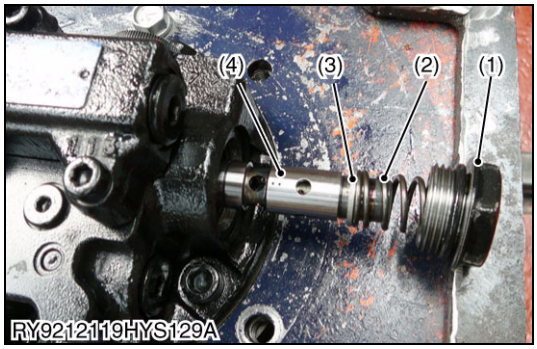
■ **IMPORTANT**
- **Be careful so the plate (valve) does not fall off.**
- **Tighten the hex socket bolts in a criss-cross pattern.**

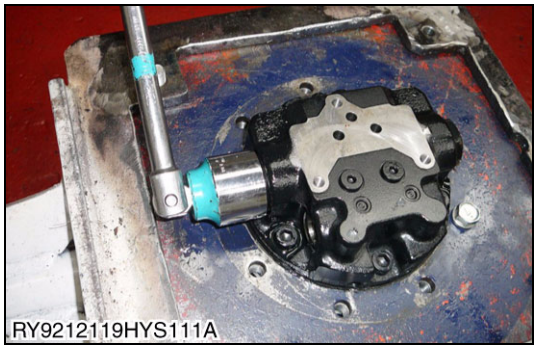
Tightening torque	Hex socket bolt	59 to 69 N·m 6.0 to 7.0 kgf·m 43.5 to 50.9 lbf·ft

- Tool to use: M8 hex socket

(1) Body (Counterbalance)
(2) Hex Socket Bolt

RY9212119HYS0084US0





11. Install the counterbalance unit. Install the plunger (counterbalance) and metal washer (spring) in order.

■ **IMPORTANT**
- **The spool itself slides smoothly.**
- **The rounder side of the metal washer (spring) goes on the plug side.**
- **Apply hydraulic oil to the spool.**

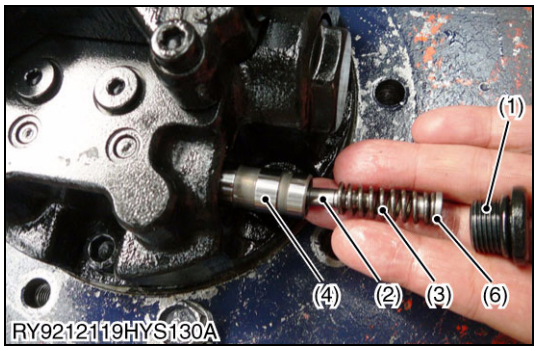
12. Install the compression spring and plugs.

Tightening torque	Plug	235 to 245 N·m 24 to 25 kgf·m 173 to 181 lbf·ft

- Tool to use: M36 wrench (socket)

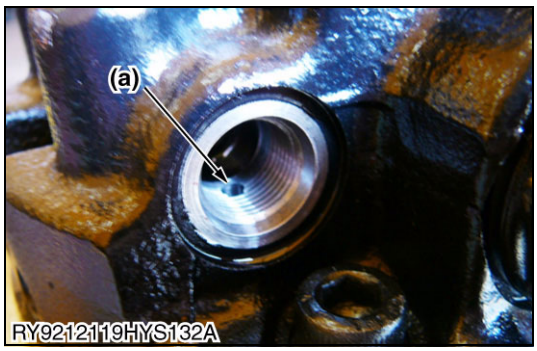
(1) Plug
(2) Compression Spring
(3) Metal Washer (Spring)
(4) Plunger (Counterbalance)

RY9212119HYS0085US0

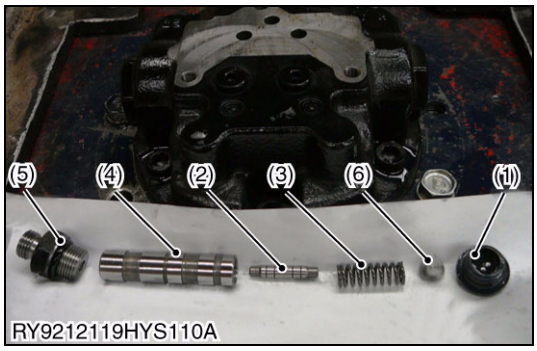


13. Install spool (2-speed switch).
Install the spring (2-speed, S) and spool (2-speed, S) on the spool (2-speed switch).

■ **IMPORTANT**
- **The spool itself slides smoothly.**
- **Be careful to install the spool in the right direction.**
- **Apply hydraulic oil to the spool.**



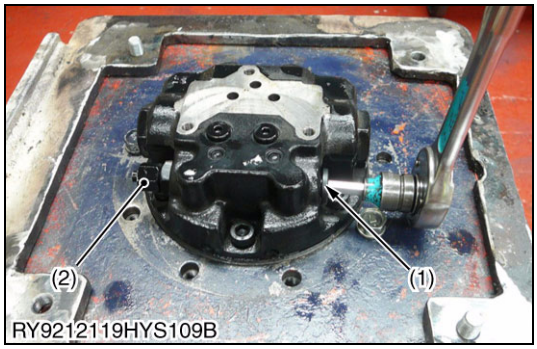
Install so the spool side is toward the side with the hole **(a)**.



Components of the 2-speed Assy

(1) Plug
(2) Spool (2-Speed, S)
(3) Spring (2-Speed, S)
(4) Spool (2-Speed Switch)
(5) Pipe connector (2-Speed)

RY9212119HYS0094US0



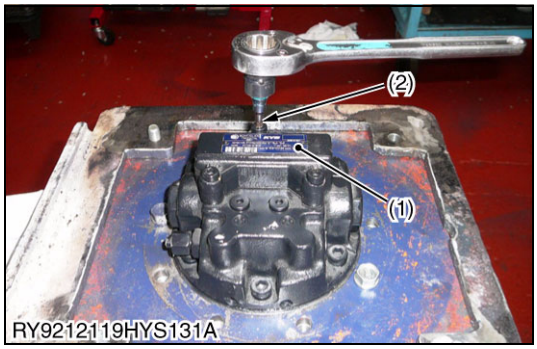
14. Install the pipe connector (2-speed) and the plug.

Tightening torque	Plug and pipe connector (2-speed)	49 to 58.8 N·m 5.0 to 6.0 kgf·m 36 to 43.4 lbf·ft

- Tool to use: M8 hex socket, M22 socket wrench

(1) Plug
(2) Pipe Connector (2-Speed)

RY9212119HYS0087US0



15. Install the body (anti-cavitation).

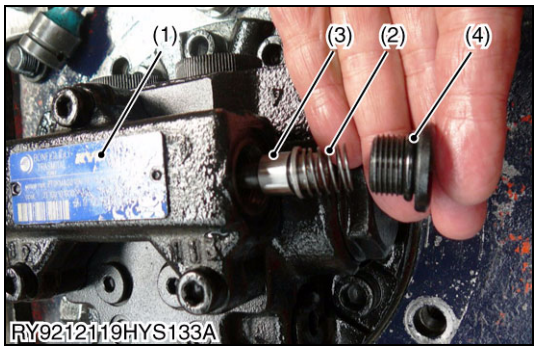
■ **IMPORTANT**
- **There are many O-rings, so be careful not to forget to install any of them.**

- Tool to use: M6 hex socket

Tightening torque	Hex socket bolt	35 to 39 N·m 3.6 to 4.0 kgf·m 25.8 to 28.8 lbf·ft

(1) Body (Anti-Cavitation)
(2) Hex Socket Bolt

RY9212119HYS0088US0



16. Install the spool (anti-cavitation) and spring (anti-cavitation).

■ **IMPORTANT**
- **Apply hydraulic oil to the entire spool.**
- **The spool itself slides smoothly.**

(1) Body (Anti-Cavitation)
(2) Spring (Anti-Cavitation)
(3) Spool (Anti-Cavitation)
(4) Plug

RY9212119HYS0089US0

17. Install the two plugs.

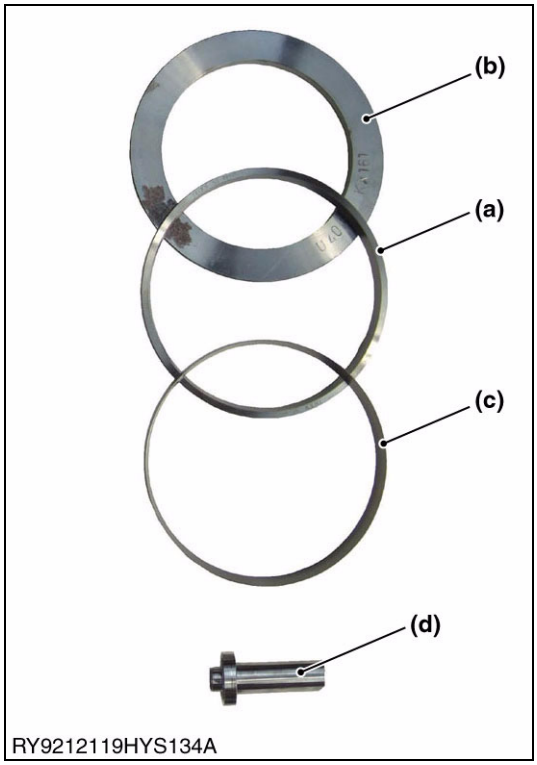
- Tool to use: M8 hex socket

Tightening torque	Plug	49 to 58.8 N·m 5.0 to 6.0 kgf·m 36 to 43.4 lbf·ft

(1) Plug

RY9212119HYS0090US0

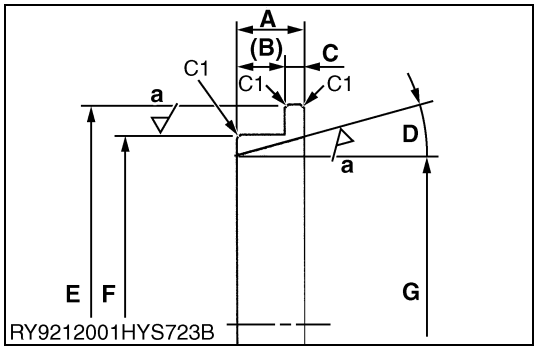
[4] SPECIAL TOOLS



RY9212119HYS134A

No.	Parts Name
(a)	Floating seal installation tool [Guide (for housing)]
(b)	Floating seal installation tool (pusher)
(c)	Floating seal installation tool [Guide (for flange holder)]
(d)	Oil seal installation tool

RY9212119HYS0024US0

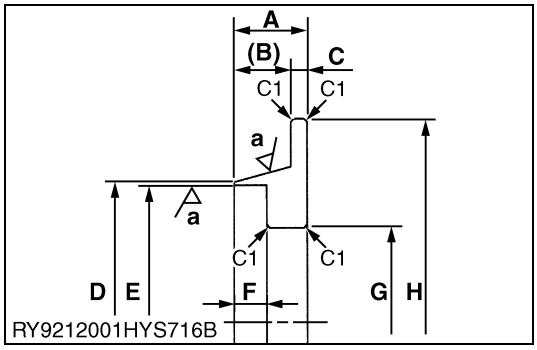


RY9212001HYS723B

(a) Floating seal installation tool [Guide (for housing)]

A	17 mm, 0.67 in.
(B)	12 mm, 0.47 in.
C	5 mm, 0.2 in.
D	15 °
E	ϕ198 mm, 7.8 in.
F	ϕ179.6 mm, 7.071 in.
G	ϕ170.5 mm, 6.713 in.
C1	1 mm, 0.04 in. bevel
a	Ra=6.3a

RY9212119HYS0025US0

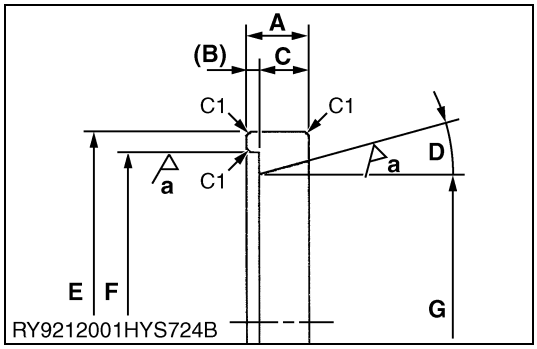


RY9212001HYS716B

(b) Floating seal installation tool (pusher)

A	22 mm, 0.87 in.
(B)	17 mm, 0.67 in.
C	5 mm, 0.2 in.
D	ϕ170.5 mm, 6.713 in.
E	ϕ168.5 mm, 6.634 in.
F	7.8 mm, 0.307 in.
G	ϕ156 mm, 6.142 in.
H	ϕ208 mm, 8.189 in.
C1	1 mm, 0.04 in. bevel
a	Ra=6.3a

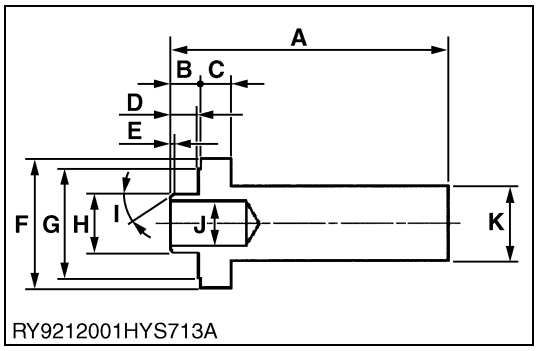
RY9212119HYS0026US0



(c) Floating seal installation tool [Guide (for flange holder)]

A	15 mm, 0.59 in.
(B)	3 mm, 0.1 in.
C	12 mm, 0.47 in.
D	15 °
E	ϕ189.5 mm, 7.461 in.
F	ϕ179.5 mm, 7.067 in.
G	ϕ170 mm, 6.693 in.
C1	1 mm, 0.04 in. bevel
a	Ra=6.3a

RY9212119HYS0027US0



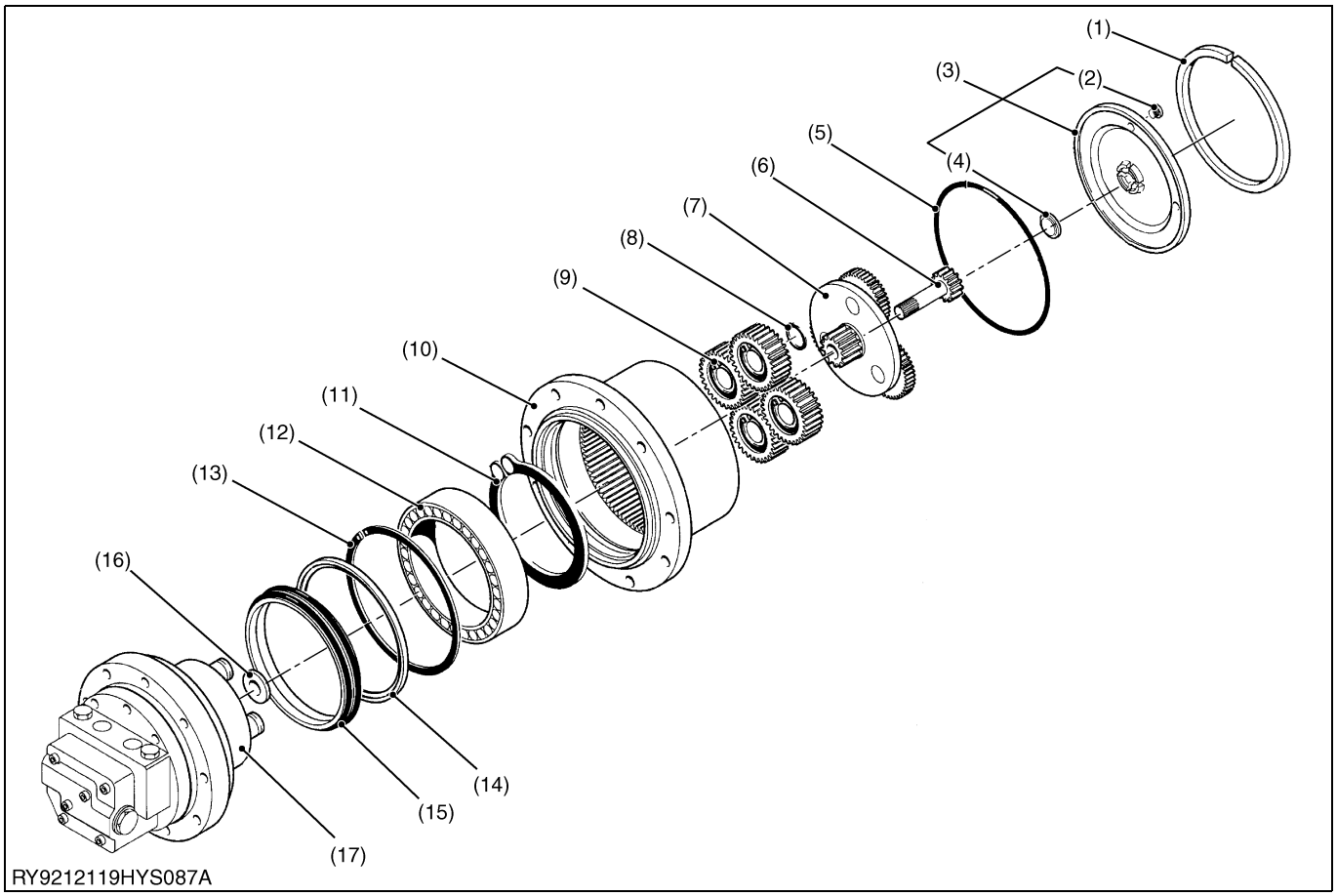
(d) Oil seal installation tool

A	110 mm, 4.33 in.
B	12 mm, 0.47 in.
C	12 mm, 0.47 in.
D	11 mm, 0.43 in.
E	2 mm, 0.08 in.
F	ϕ52 mm, 2.0 in.
G	ϕ44 mm, 1.7 in.
H	23.8 mm, 0.937 in.
I	30 °
J	ϕ18 mm, 0.71 in.
K	ϕ30 mm, 1.2 in.

RY9212119HYS0028US0

[5] COMPONENTS

Gear Case Components

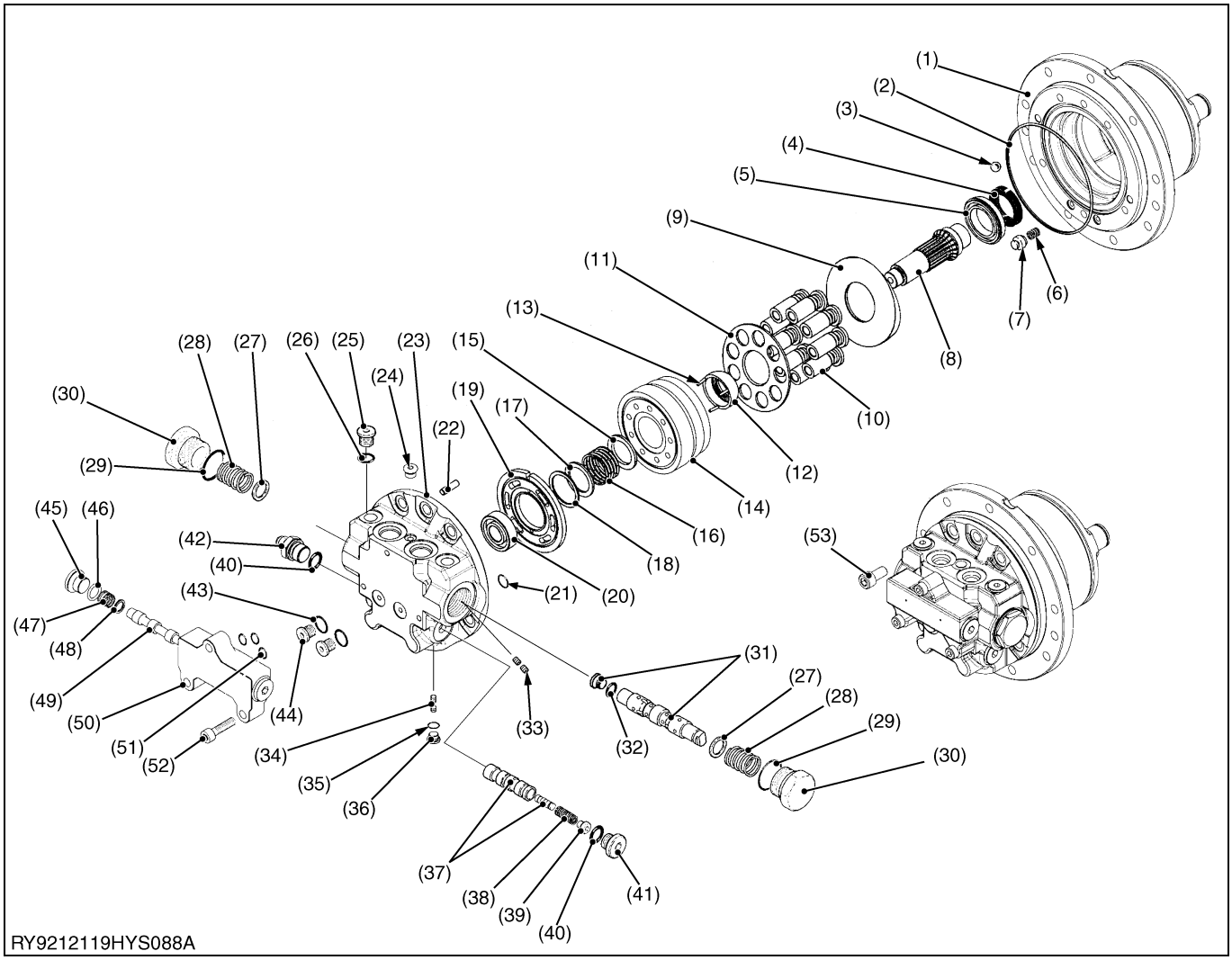


RY9212119HYS087A

No.	Parts Name	Q'ty	Notes	No.	Parts Name	Q'ty	Notes
(1)	Circlip	1	BR 180	(10)	Gearbox Housing	1	
(2)	Plug	2	3/8"	(11)	Circlip	1	UNI 7435-130
(3)	Cover Assembly	1		(12)	Bearing	1	ϕi 130
(4)	Pad	1		(13)	Circlip	1	UNI7437-170
(5)	O-ring	1	2.62 x 177.47	(14)	Disc	1	
(6)	Sun Gear	1	1 : 8.27 z11 m2.00	(15)	Lifetime Seal	1	ϕi 154
(7)	1st Red. Assembly	1	1 : 8.27	(16)	Centering Ring	1	
(8)	Circlip	4	UNI 7435-25	(17)	Hydraulic Motor	1	MAG-18V-TRF4
(9)	Reduction Assembly	4	1:6.00				

RY9212119HYS0166US0

Motor Components



(To be continued)

(Continued)

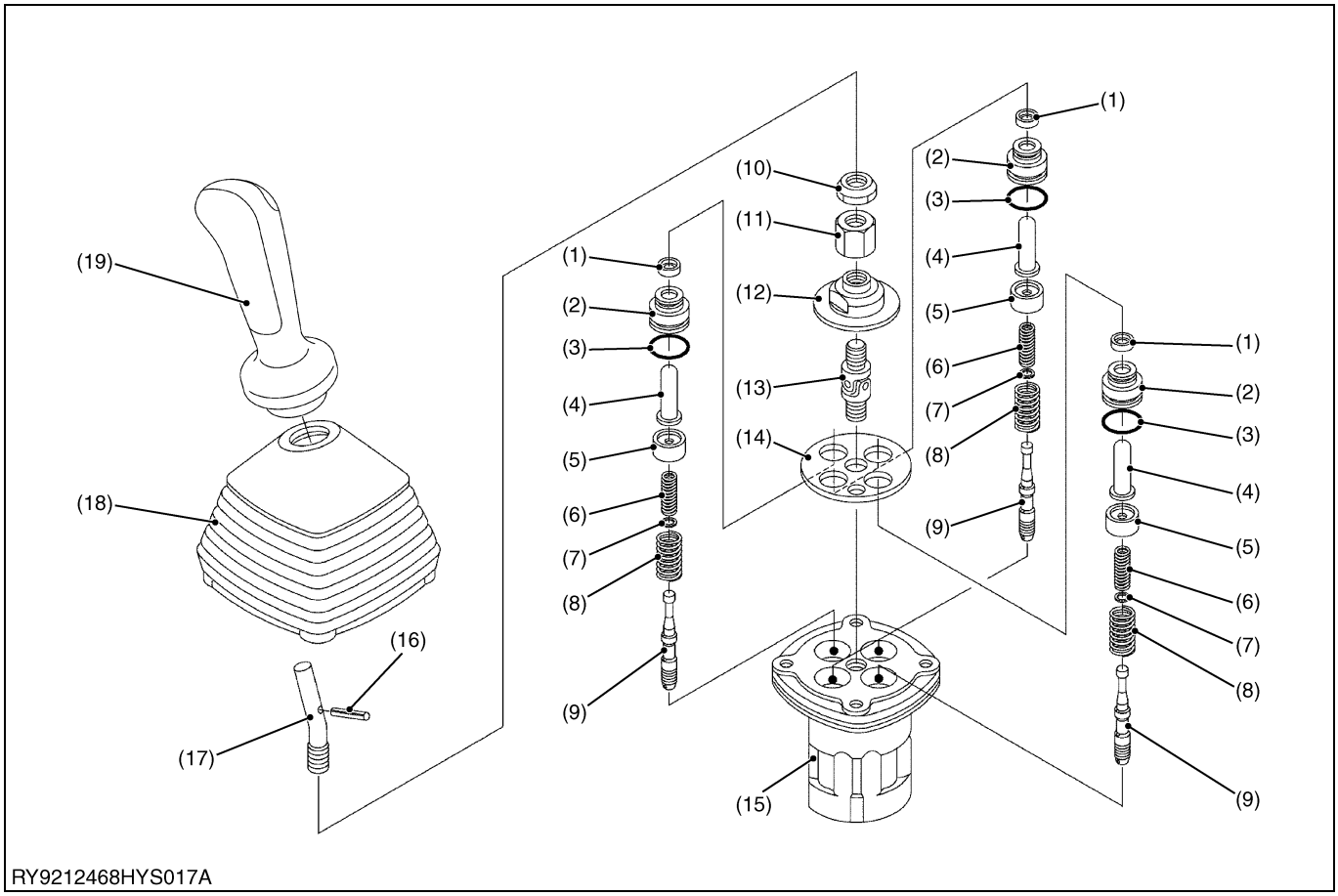
No.	Parts Name	Q'ty	Notes	No.	Parts Name	Q'ty	Notes
(1)	Hub	1		(28)	Spring	2	
(2)	O-ring	1		(29)	O-ring	2	
(3)	Ball	2		(30)	Plug	2	
(4)	Motor Seal Ring	1		(31)	Plunger Assy	2	
(5)	Bearing	1		(32)	O-ring	2	
(6)	Spring	2		(33)	Orifice	2	ϕ0.6
(7)	Piston	2		(34)	Orifice	4	ϕ0.5
(8)	Motor Shaft Assy	1		(35)	O-ring	2	
(9)	Swash Plate	1		(36)	Plug	4	SAE2
(10)	Piston	9		(37)	Spool	2	
(11)	Retainer Plate	1		(38)	Spring	1	
(12)	Spherical Bush	1		(39)	Spring Seat	1	
(13)	Pin	3		(40)	O-ring	2	
(14)	Cylinder Block	1		(41)	Plug	1	JIS PF 3/8
(15)	Spring Holder	1		(42)	Plug	1	M14
(16)	Spring	1		(43)	O-ring	2	
(17)	Collar Washer	1		(44)	Plug	2	JIS PF 1/8
(18)	Circlip	1		(45)	Plug	2	JIS PF 3/8
(19)	Valve Plate	1		(46)	O-ring	2	
(20)	Bearing	1		(47)	Spring	2	
(21)	O-ring	2		(48)	Spring Seat	2	
(22)	Pin	2		(49)	Spool Valve	1	
(23)	Base Plate	1		(50)	Valve Housing	1	
(24)	Plug	1	M10 x 1.5	(51)	O-ring	3	
(25)	Plug	1		(52)	Screw	3	M8 x 30
(26)	O-ring	1		(53)	Screw	6	M10 x 20-12.9
(27)	Spring Seat	2					

RY9212119HYS0167US0

4. PILOT CONTROL VALVE

[1] COMPONENTS

Standard LH

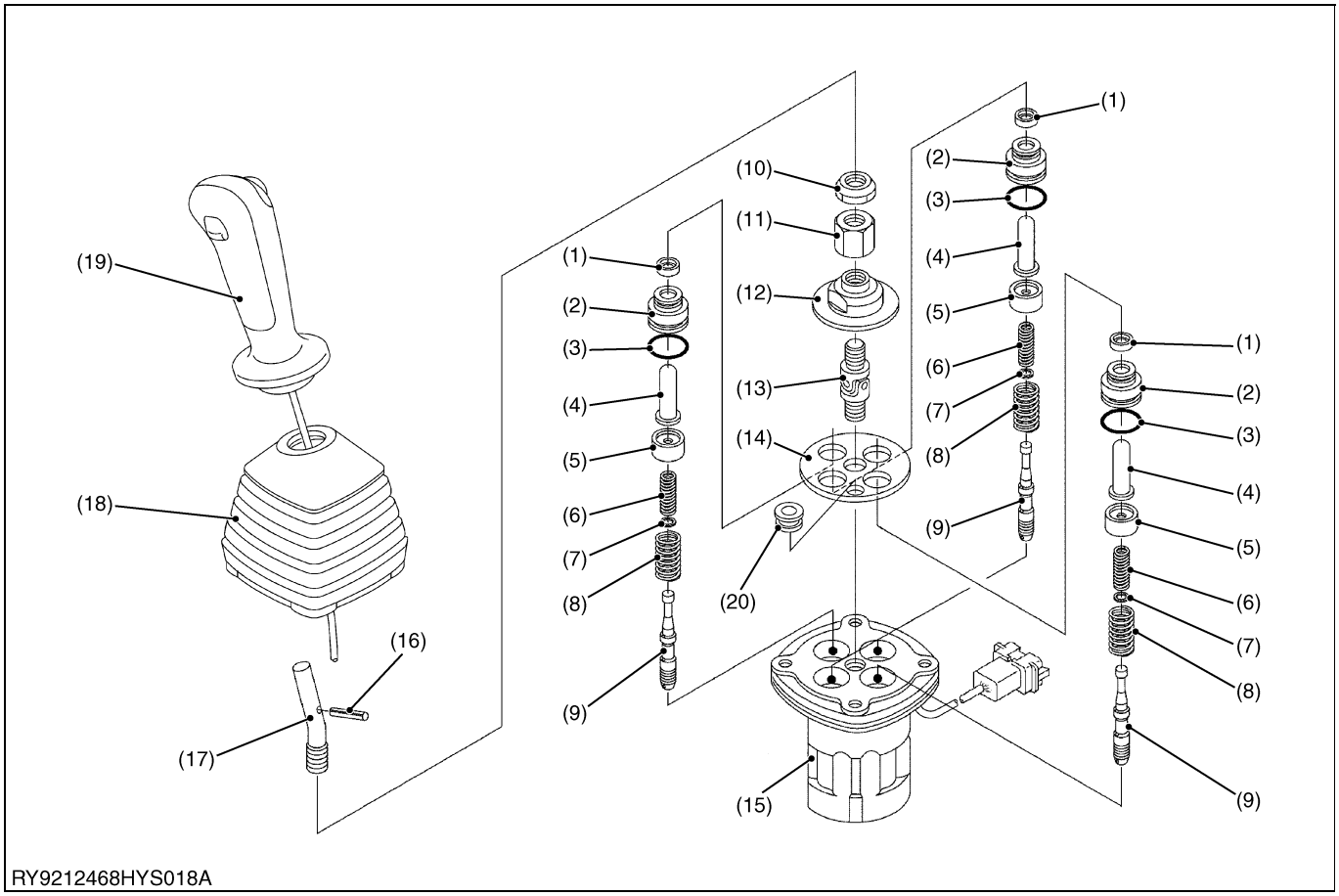


RY9212468HYS017A

No.	Name of part	Q'ty	No.	Name of part	Q'ty
(1)	Seal	4	(11)	Adjusting Nut	1
(2)	Plug	4	(12)	Nut	1
(3)	O-ring	4	(13)	Joint	1
(4)	Push Rod	4	(14)	Plate	1
(5)	Spring Seat	4	(15)	Casing	1
(6)	Spring	4	(16)	Spring Pin	1
(7)	Washer	4	(17)	Lever	1
(8)	Spring	4	(18)	Boot	1
(9)	Spool	4	(19)	Knob	1
(10)	Lock Nut	1			

RY9212469HYS0049US0

Standard RH / Hi Spec RH, LH

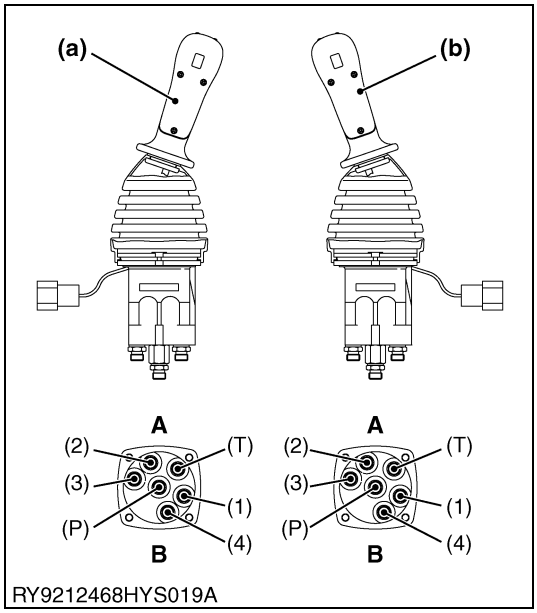


RY9212468HYS018A

No.	Name of part	Q'ty	No.	Name of part	Q'ty
(1)	Seal	4	(11)	Adjusting Nut	1
(2)	Plug	4	(12)	Nut	1
(3)	O-ring	4	(13)	Joint	1
(4)	Push Rod	4	(14)	Plate	1
(5)	Spring Seat	4	(15)	Casing	1
(6)	Spring	4	(16)	Spring Pin	1
(7)	Washer	4	(17)	Lever	1
(8)	Spring	4	(18)	Boot	1
(9)	Spool	4	(19)	Knob	1
(10)	Lock Nut	1	(20)	Bush	1

RY9212469HYS0050US0

Pilot Valve Hydraulic Hose Usage Positions



RY9212468HYS019A

Pilot valve RH

	Position used	Hose tape color
(1)	Bucket dump	Pink
(2)	Bucket down	Light blue
(3)	Bucket Crowd	Brown
(4)	Boom up	Gray
(P)	P port	White
(T)	T port	

Pilot valve LH

	Position used	Hose tape color
(1)	Swivel left	Red
(2)	Arm dump	Blue
(3)	Swivel right	Yellow
(4)	Arm crowd	Green
(P)	P port	White
(T)	T port	

(a) RH
(b) LH
A: Front of Vehicle
B: Rear of Vehicle

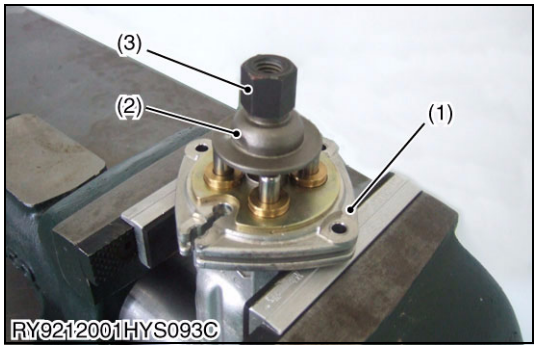
RY9212469HYS0051US0

[2] DISASSEMBLY PROCEDURE

CAUTION

- **All of the parts are precisely made, so be very careful in handling them and taking 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.**

RY9212091HYS0284US0



RY9212001HYS093C

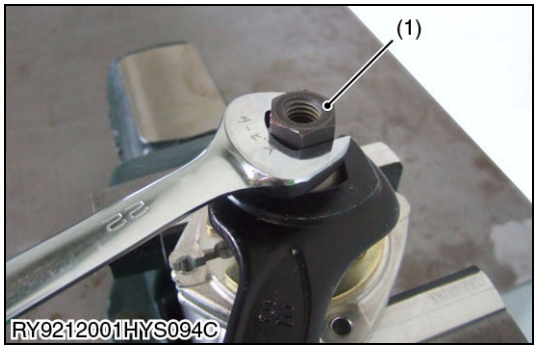
1. Clamp the pilot valve in a vise.

■ **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



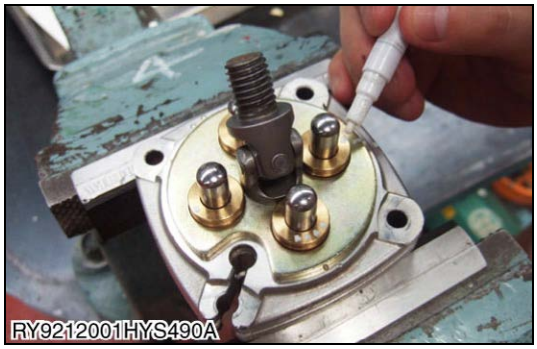
RY9212001HYS094C

2. Use wrenches to remove the adjusting nut and round plate nut.

- Tools to use: 22 mm and 32 mm wrenches

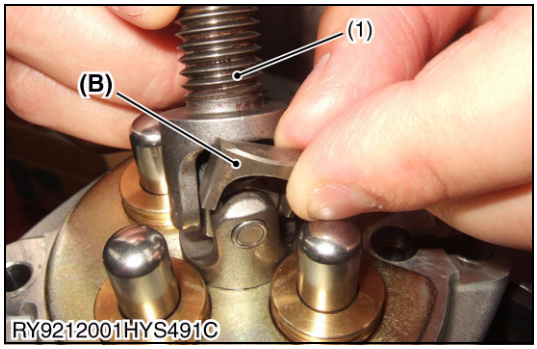
(1) Adjusting Nut

RY9212148HYS0152US0


RY9212001HYS490A

3. Mark the alignment of holes to the casing.

RY9212001HYS0479US0

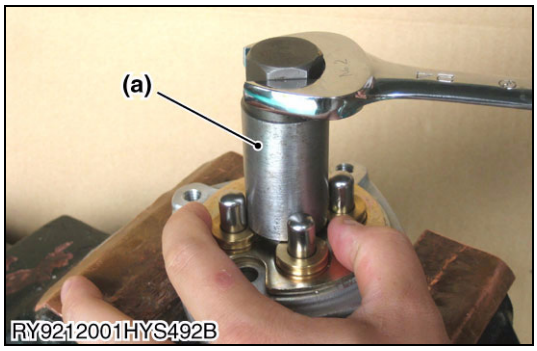


RY9212001HYS491C

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)

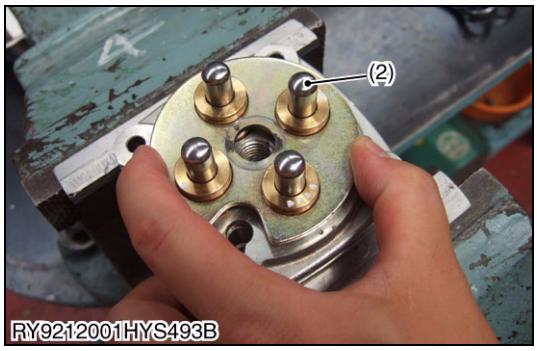
CAUTION
- **When removing the U-joint, take care that it does not pop off.**



RY9212001HYS492B

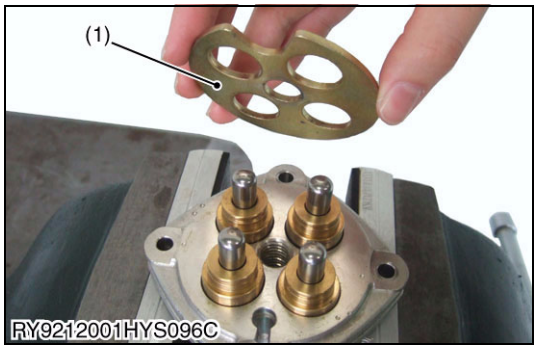
(1) U-Joint (2) Plug

RY9212148HYS0153US0



RY9212001HYS493B

5. Remove the plate.



RY9212001HYS096C

(1) Plate

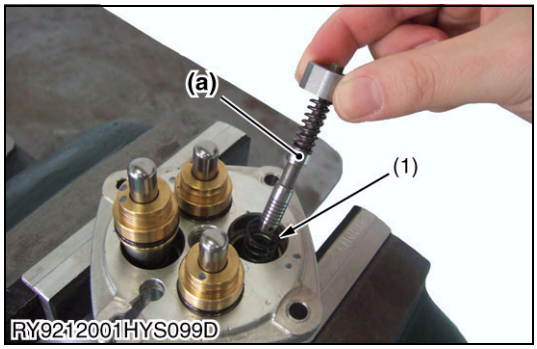
RY9212148HYS0154US0

6. Slip a slotted screwdriver in the groove in the plug to remove the plug.

CAUTION
- **Take care so the plug does not go flying.**
- **Take care not to damage it by exerting force unevenly.**
- **If a burr is formed, use a whetstone to remove it.**

(1) Plug

RY9212148HYS0155US0

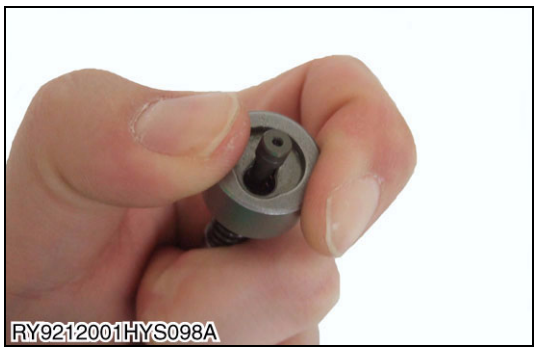


7. Remove the reducing valve ASSY and the return spring.

IMPORTANT
- **Tag the return springs to positively ID which port they go to.**

(1) Return Spring
(a) Reducing Valve ASSY

RY9212148HYS0156US0



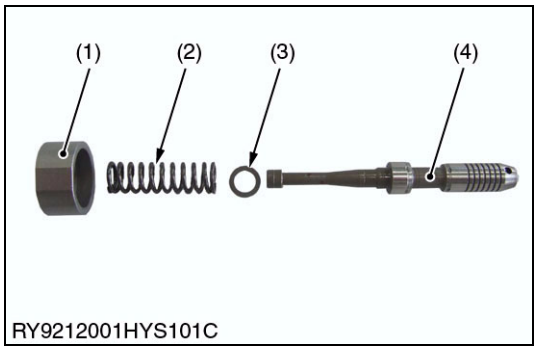
8. To disassemble a reducing valve, press the spring seat in and while compressing the secondary pressure spring, shift the spring seat to the side and remove it from the spool via the larger hole.

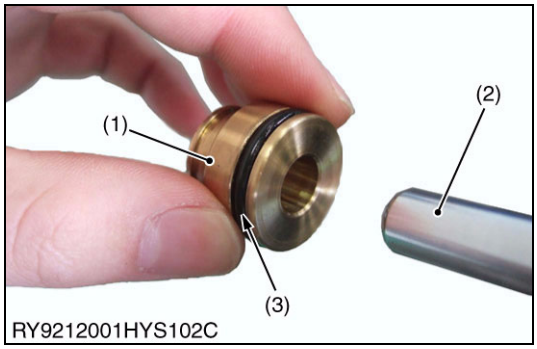
IMPORTANT
- **Be careful not to scratch the surface of the spool.**
- **Do not depress the spring seat more than 6mm (0.24 in.).**
- **Do not disassemble the reducing valve unless there is a problem with it.**

Components of the reducing valve

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

RY9212148HYS0157US0

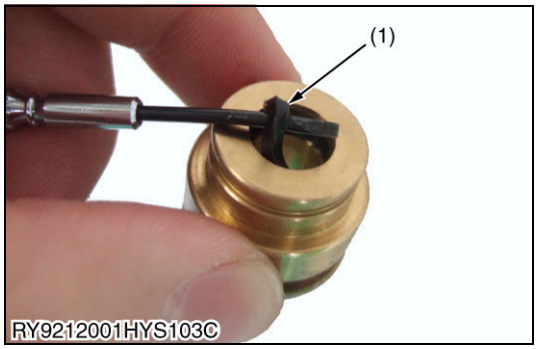




9. Remove the plug from the pushrod.

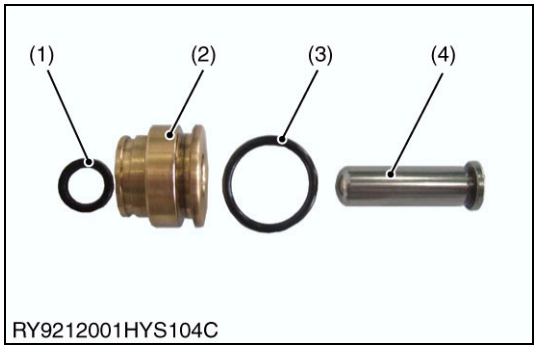
(1) Plug
(2) Pushrod
(3) O-Ring

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

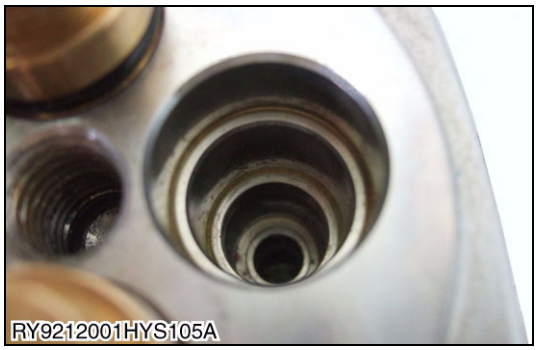
(1) Seal
(2) Plug
(3) O-Ring
(4) Pushrod

RY9212148HYS0159US0

[3] ASSEMBLY

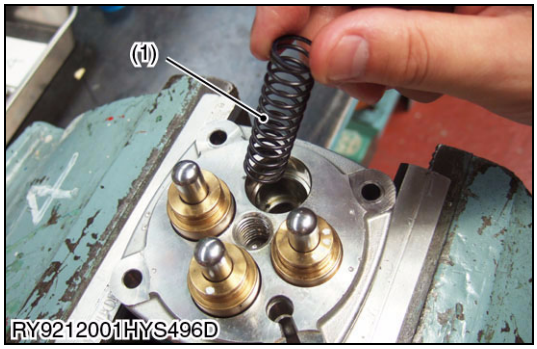
CAUTION
- **Prepare your workbench in the same way as for disassembly.**
- **Follow the same general precautions as in the disassembly.**
- **When assembling the parts, remove all bits of metal or foreign matter from all the parts and make sure there aren't any burrs or dings on the parts.**
- **Replace 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

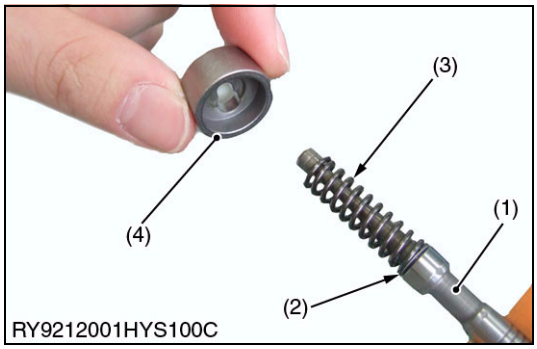


2. Install the return spring in the casing.

■ **IMPORTANT**
- **Install it in the same position as before disassembly.**

(1) Return Spring

RY9212148HYS0161US0

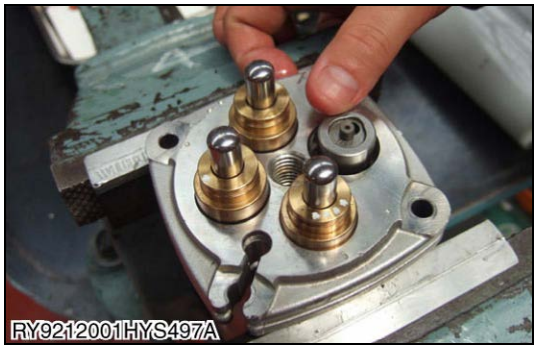


3. Install the washer, secondary pressure spring and spring seat on the spool in order.

■ **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

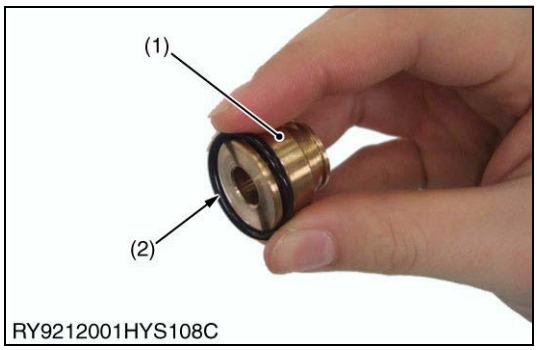
RY9212148HYS0162US0



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.**

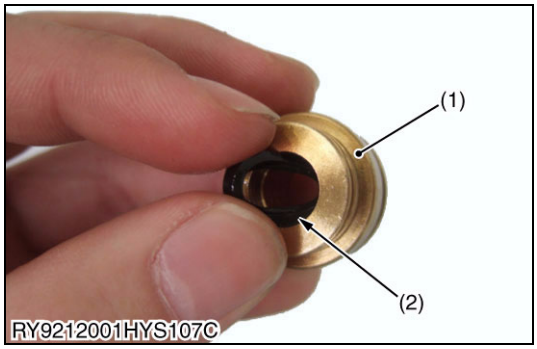
RY9212001HYS0490US0



5. Install the O-ring on the plug.

(1) Plug
(2) O-Ring

RY9212148HYS0163US0

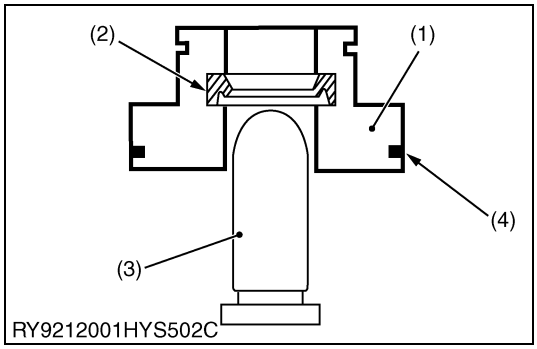


6. Install the seal on the plug.

■ **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

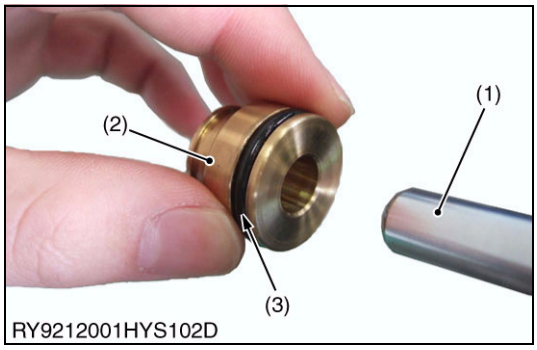


7. Install the plug on the pushrod.

■ **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.

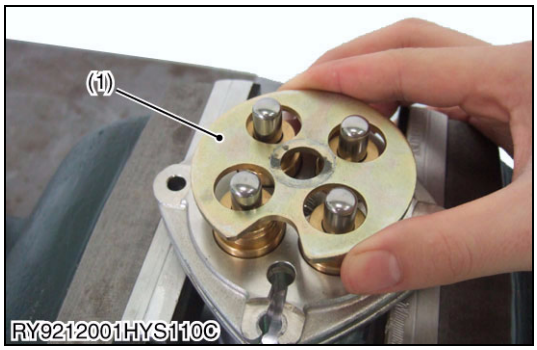
■ **IMPORTANT**
- **Be careful not to scratch the hole of the casing by prying on the spool.**
- **Take care so the plug ASSY does not go flying.**

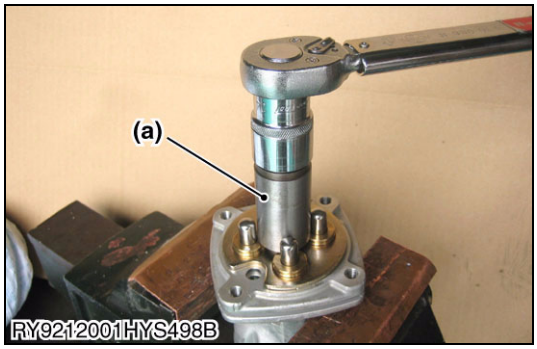
RY9212001HYS0494US0

9. Install the plate.

(1) Plate

RY9212148HYS0166US0



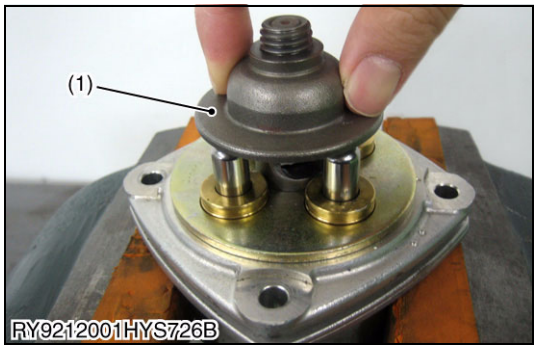


10. Install the U-joint.

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.

CAUTION
- **If you tighten it too far, the mechanism will not function properly when the lever is in neutral, so be careful to adjust the round plate nut to the correct position.**

IMPORTANT
- **Apply Loctite 262 to the top threads of the U-joint.**

(1) Round Plate Nut

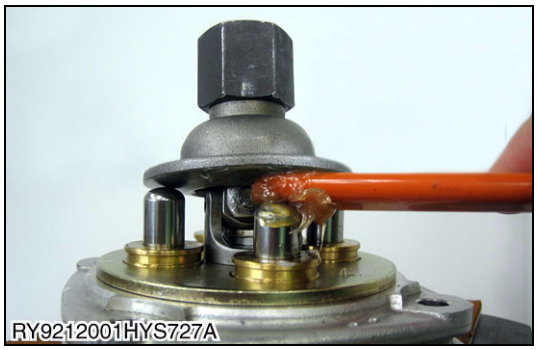
RY9212148HYS0168US0

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

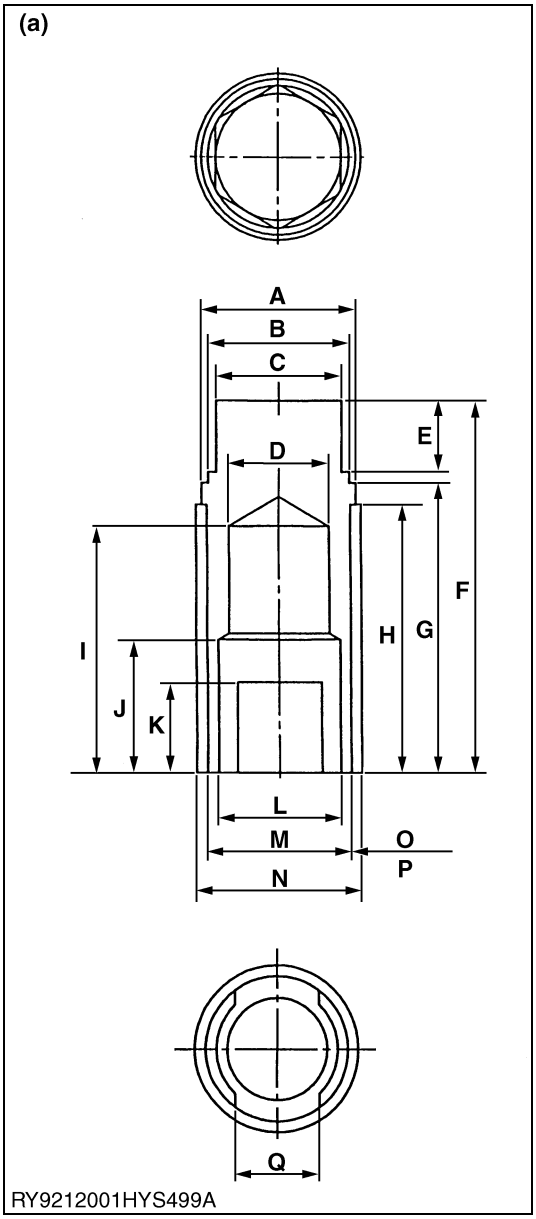
RY9212148HYS0169US0



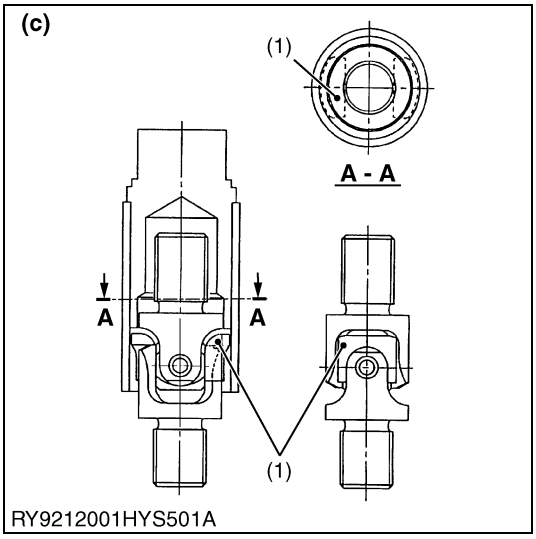
13. Apply grease to the rotating parts of the universal joint and to the ends of the pushrods.

RY9212001HYS0499US0

[4] SPECIAL TOOLS

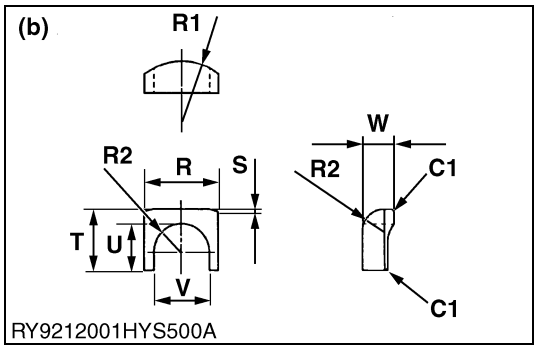


RY9212001HYS499A



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

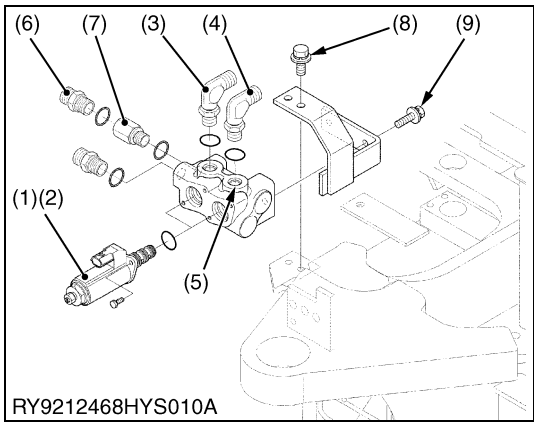
(1) Bushing

(a) U-Joint Tightening Tool, Detailed Schematic
(b) Bushing, Detailed Schematic
(c) Assembled U-Joint

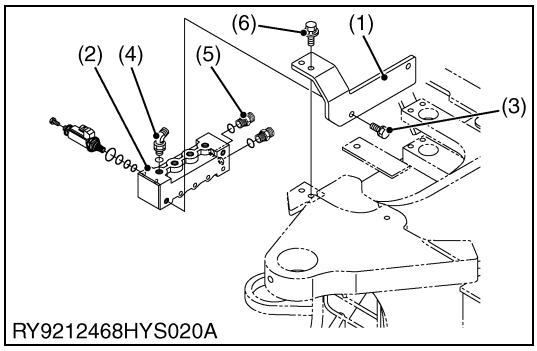
RY9212001HYS0500US0

5. PROPORTIONAL VALVE

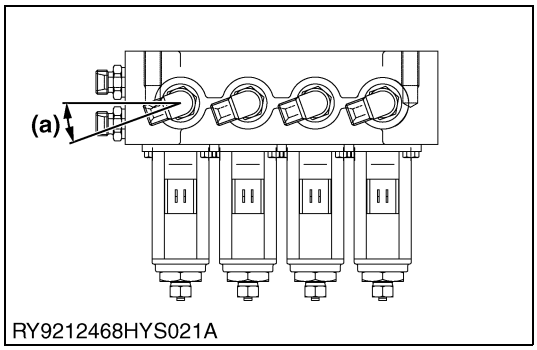
[1] INSTALLING



RY9212468HYS010A



RY9212468HYS020A



RY9212468HYS021A

Standard

Tightening torque	Adapter (3) to (7)	17.5 to 20.6 N·m 1.78 to 2.10 kgf·m 12.9 to 15.2 lbf·ft
	Bolt (9)	

(1) Proportional Valve (AUX1 LH)
(2) Proportional Valve (AUX1 RH)
(3) Adapter (PortA1 to AUX1 LH)
(4) Adapter (PortA1 to AUX1 RH)
(5) Adapter (T Port)
(6) Adapter (P Port)
(7) Adapter (P Port)
(8) Bolt (M10 x 20)
(9) Bolt (M8 x 16)

RY9212469HYS0004US0

Hi Spec

Tightening torque	Proportional valve	39.2 to 45.1 N·m 4.00 to 4.60 kgf·m 28.9 to 33.3 lbf·ft
	Adapter	

(1) Bracket
(2) Proportional Valve ASSY
(3) Bolt (M10 x 25)
(4) Joint Pipe
(5) Adapter
(6) Bolt (M10 x 25)

RY9212469HYS0005US0

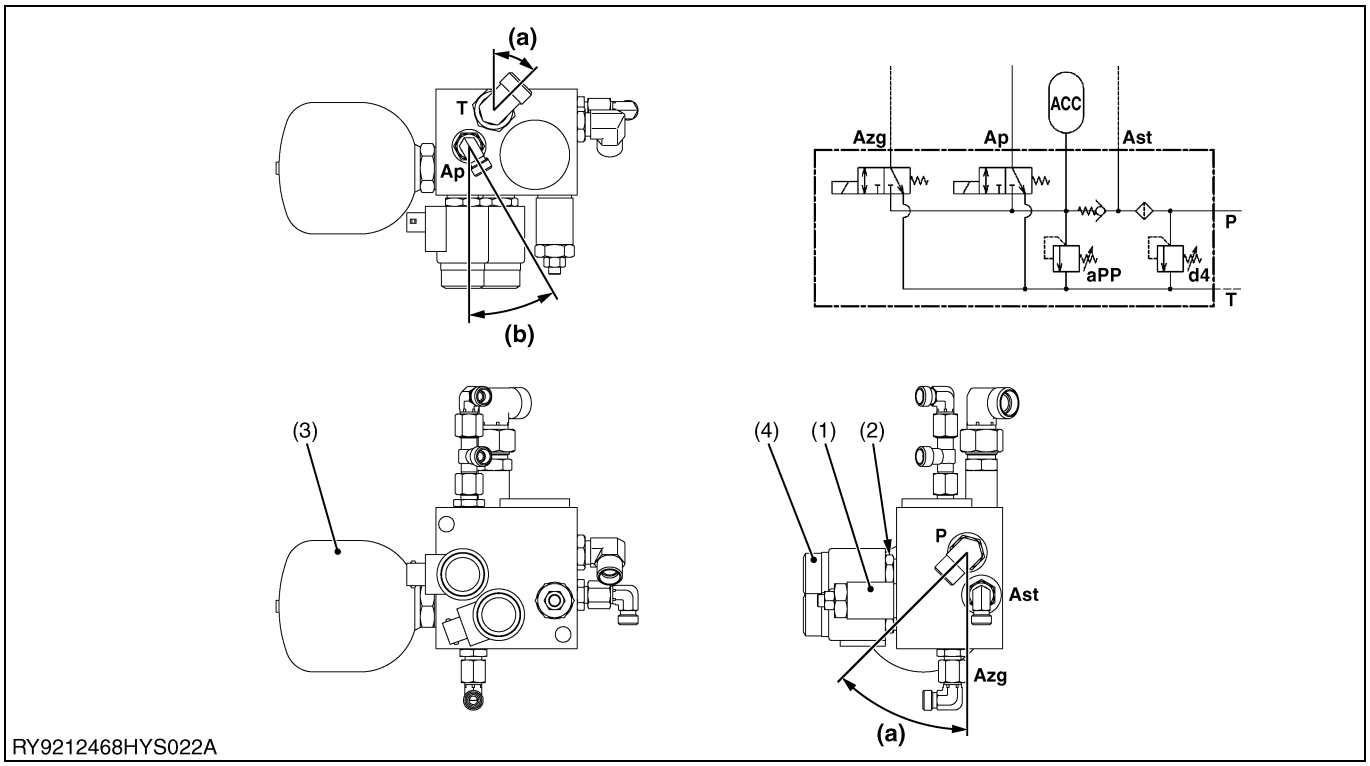
Adapter Angle

(a) 20°

RY9212469HYS0052US0

6. UNLOAD VALVE

[1] ASSEMBLY PROCEDURE



RY9212468HYS022A

No.	Name of part	Tightening torque	Notes
(1)	Relief valve	20 to 30 N·m (2.0 to 3.1 kgf·m, 15 to 22 lbf·ft)	
(2)	Valve		
(3)	Accumulator	50 to 60 N·m (5.1 to 6.1 kgf·m, 37 to 44 lbf·ft)	(Loctite 2701)
(4)	Nut	4 to 6 N·m (0.4 to 0.6 kgf·m, 3 to 4 lbf·ft)	

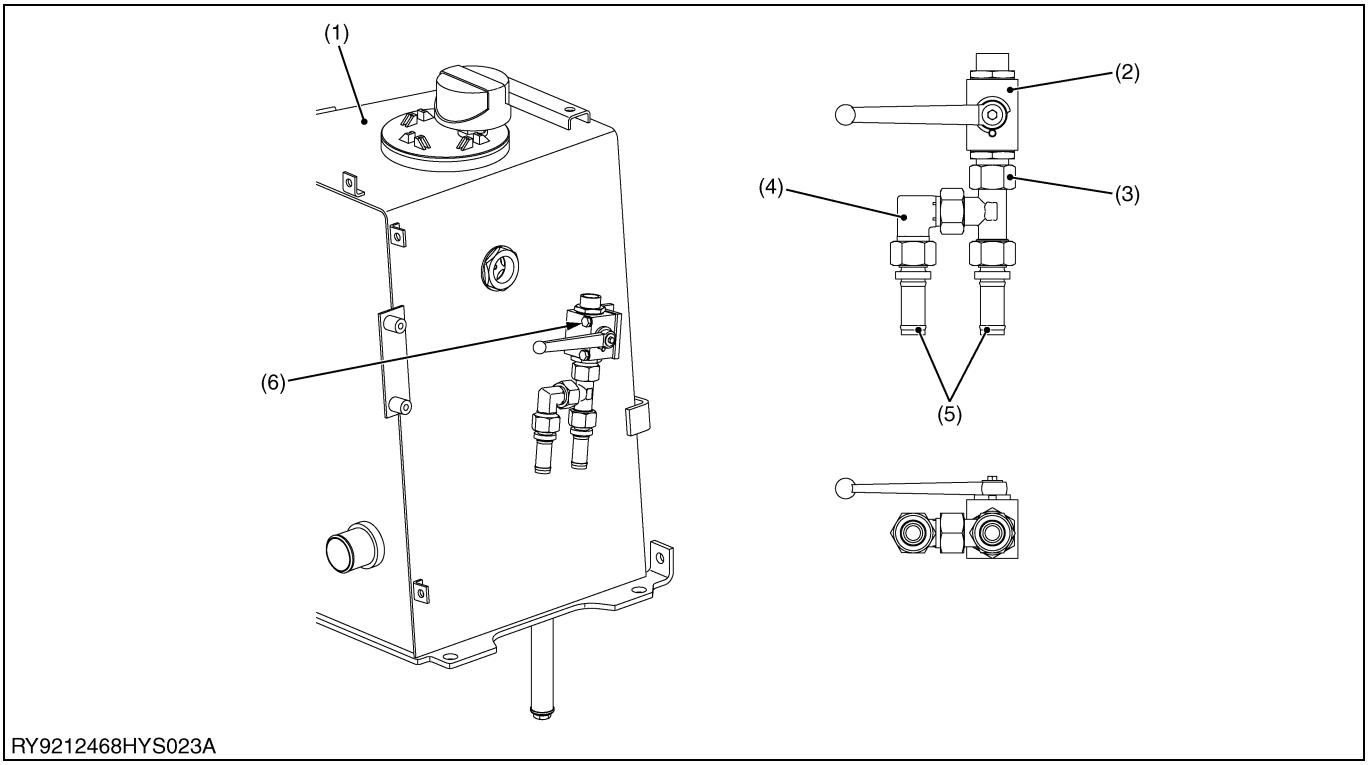
■ **IMPORTANT**

- **This accumulator cannot be filled with gas.**

RY9212469HYS0048US0

7. THIRD LINE VALVE

[1] INSTALLING



RY9212468HYS023A

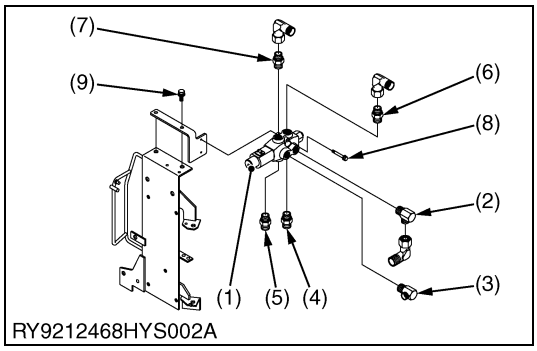
(1) Oil Tank
(2) Valve ASSY
(3) Adapter
(4) Adapter
(5) Adapter
(6) Bolt (M5 x 45)

Tightening torque	Adapter	45 to 65 N·m 4.6 to 6.6 kgf·m 33.2 to 47.9 lbf·ft
	Bolt (6)	3.0 to 4.0 N·m 0.3 to 0.4 kgf·m 2.0 to 3.0 lbf·ft

RY9212469HYS0053US0

8. SELECTOR VALVE

[1] INSTALLING



RY9212468HYS002A

Hi Spec

■ **IMPORTANT**

- **(6) and (7) are dedicated adapters with orifices inside to adjust the swing speed.**
- **Do not replace to other adapter.**

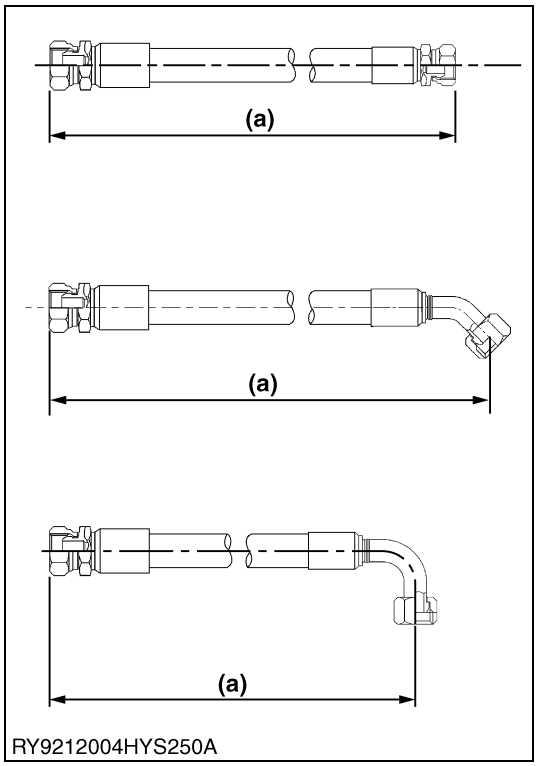
Tightening torque	Adapter (2), (3)	80 N·m 8.16 kgf·m 59.0 lbf·ft
	Adapter (4) to (7)	45.0 to 65.0 N·m 4.6 to 6.6 kgf·m 33.2 to 48.0 lbf·ft
	Bolt (8)	9.8 to 11.3 N·m 1.0 to 5.6 kgf·m 7.2 to 8.3 lbf·ft

(1) Selector Valve
(2) Port A (from Control Valve)
(3) Port B (from Control Valve)
(4) Port C (to AUX2 RH)
(5) Port D (to AUX2 LH)
(6) Port E (to Swing Rod)
(7) Port F (to Swing Bottom)
(8) Bolt (M6 x 55)
(9) Bolt (M10 x 25)

RY9212469HYS0006US0

9. HYDRAULIC HOSES ROUTE

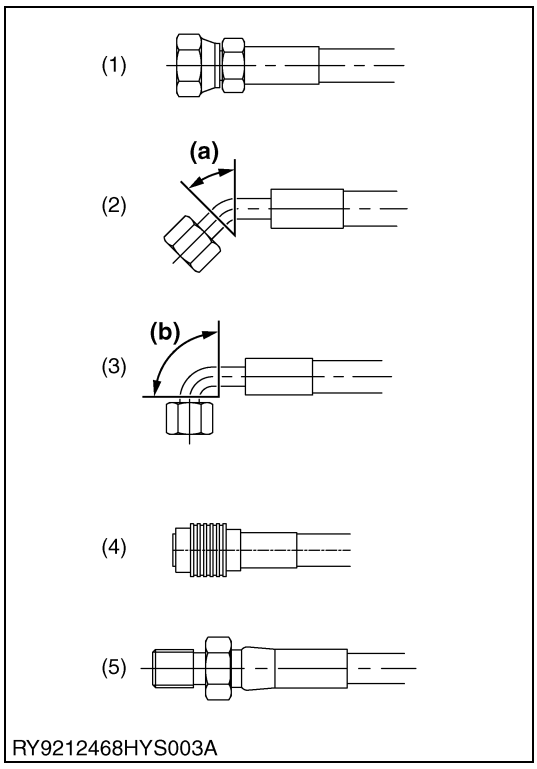
[1] HYDRAULIC HOSES SPECIFICTIONS



RY9212004HYS250A

(a) Total Length

RY9212004HYS0147US0



RY9212468HYS003A

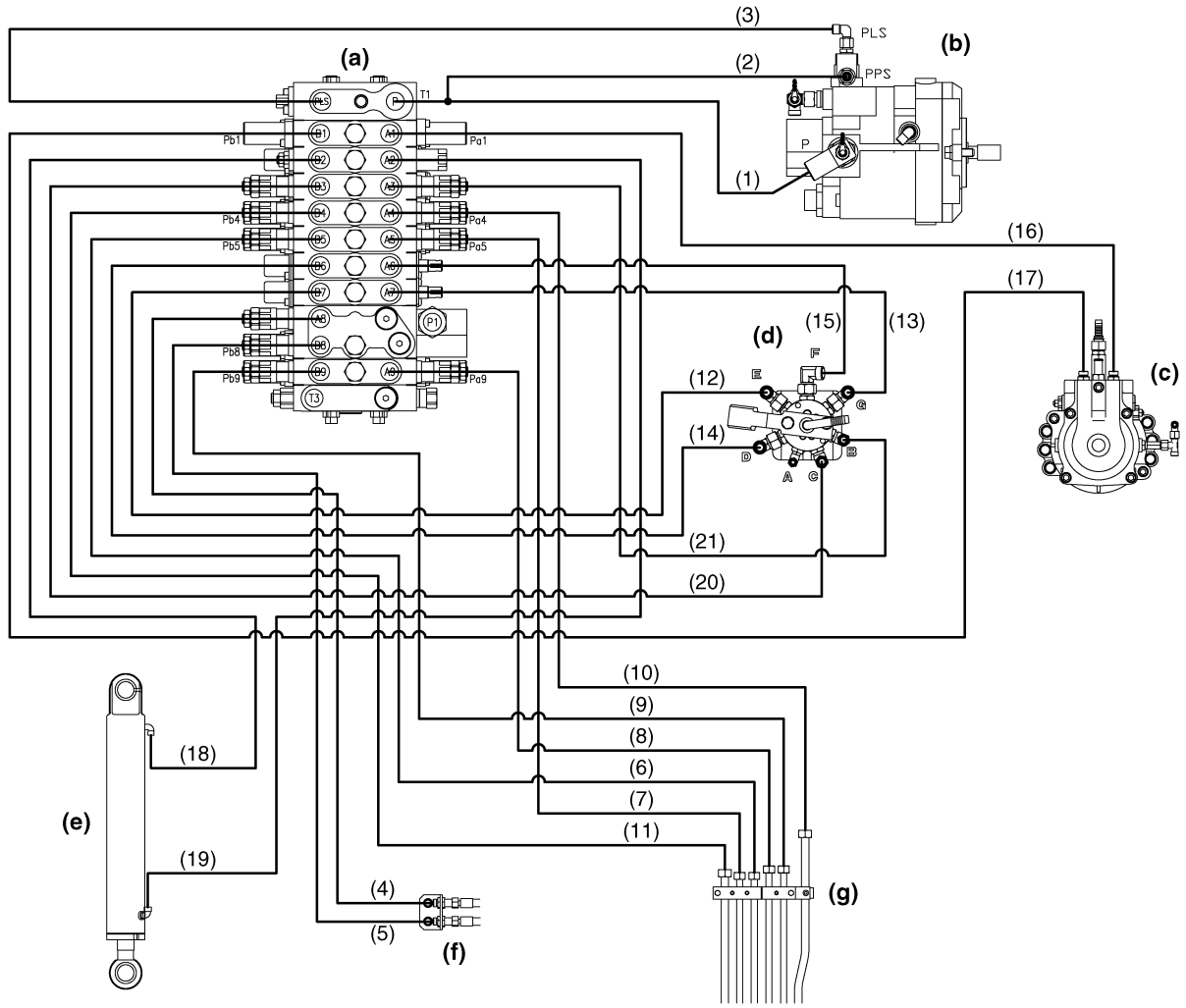
(1) C Type (Straight)
(2) CR4 Type (45°)
(3) CR9 Type (90°)
(4) QM Type (Quick)
(5) CM Type (Male Thread)

(a) 45 °
(b) 90 °

RY9212469HYS0001US0

[2] HIGH PRESSURE HOSES ROUTE

Standard



RY92124689HYS004A

(a) Control Valve
(b) Pump
(c) Swivel Motor
(d) Rotary Joint
(e) Swing Cylinder
(f) Swing Bracket Right Side
(g) Boom Back Side

(To be continued)

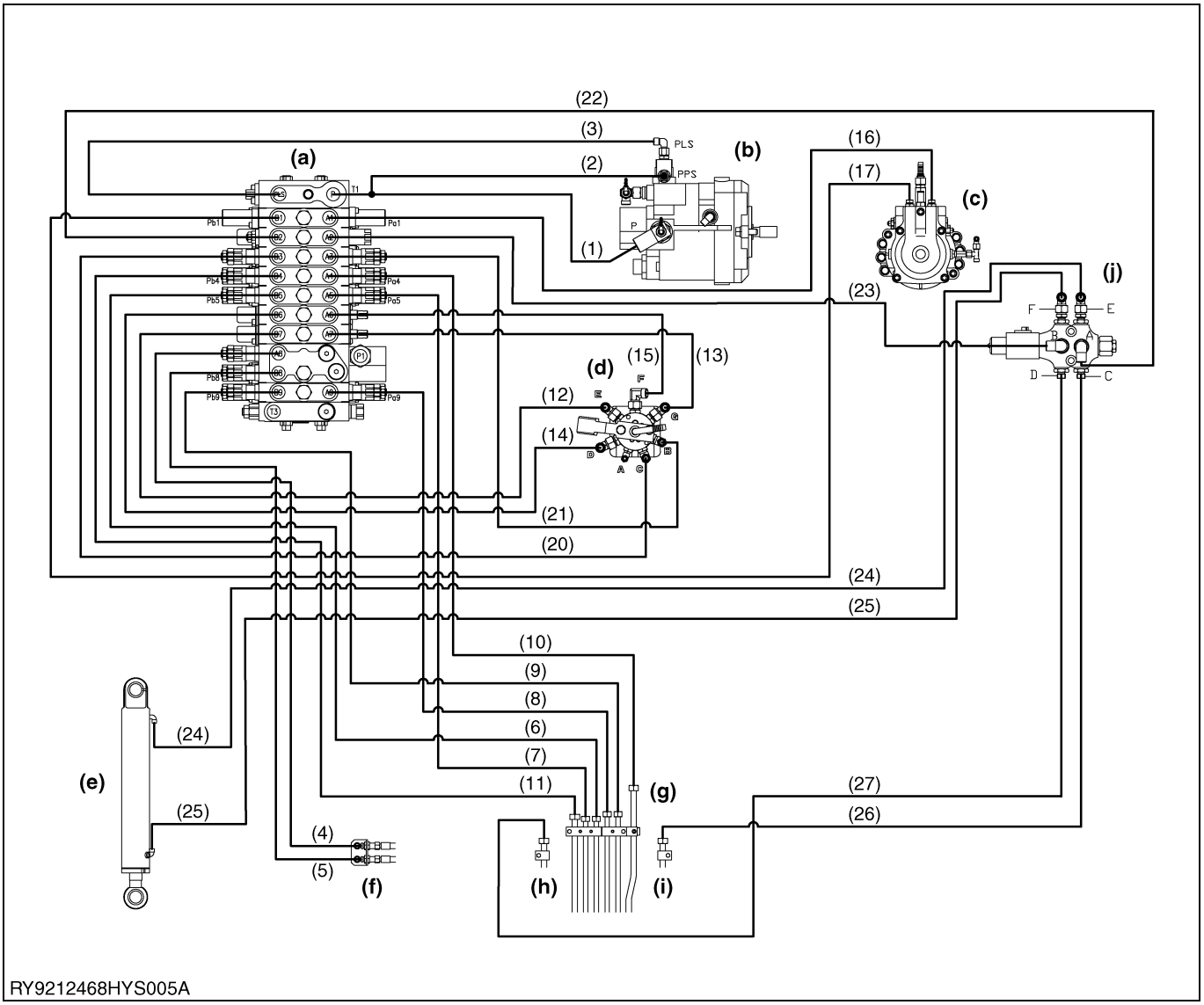
(Continued)

■ Table of Hydraulic Hoses

No.	Function	Hoses					Fitting		Guard	Position Used
		Total length	Size	Tape color	O.D.	I.D.	Type	Size		
(1)	Delivery	1310 mm (51.6 in.)	3/4	2 × White	26.7 mm (1.05 in.)	20.9 mm (0.82 in.)	CR4-C	M30	–	Pump P to C/V (P)
(2)	PPS	1570 mm (61.8 in.)	1/4	2 × Red	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-C	M14	–	Pump PPS to C/V (PPS)
(3)	PLS	1420 mm (55.9 in.)	1/4	2 × Blue	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-C	M14	–	Pump PLS to C/V (PLS)
(4)	Boom bottom (Up)	1160 mm (45.7 in.)	3/8	2 × Yellow	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	C-C	M18	–	C/V (A8) to Hose on (Bot)
(5)	Boom rod (Down)	1150 mm (45.3 in.)	3/8	2 × Green	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CR9-C	M18	–	C/V (B8) to Hose under (Rod)
(6)	Arm bottom (Crowd)	2320 mm (91.3 in.)	3/8	2 × Blue	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CR9-CM	M18	–	C/V (B5) to Hose (Bot)
(7)	Arm rod (Dump)	2070 mm (81.5 in.)	3/8	2 × Gray	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CR4-CM	M18	–	C/V (A5) to Hose (Rod)
(8)	Bucket rod (Dump)	1970 mm (77.6 in.)	3/8	2 × Yellow	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CR9-CM	M18	–	C/V (A9) to Hose (Rod)
(9)	Bucket bottom (Crowd)	2070 mm (81.5 in.)	3/8	2 × White	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CR9-CM	M18	–	C/V (B9) to Hose (Bot)
(10)	AUX high (LH)	2140 mm (84.3 in.)	1/2	2 × Brown	20.4 mm (0.80 in.)	12.7 mm (0.50 in.)	CR4-C	M22	–	C/V (A4) to Hose (High)
(11)	AUX low (RH)	2180 mm (85.8 in.)	1/2	2 × White	20.4 mm (0.80 in.)	12.7 mm (0.50 in.)	C-CM	M22	–	C/V (B4) to Hose (Low)
(12)	Travel forward right	640 mm (25.2 in.)	1/2	2 × Green	20.4 mm (0.80 in.)	12.7 mm (0.50 in.)	CR9-C	M22	–	C/V (B7) to R/J (E)
(13)	Travel rear right	660 mm (26.0 in.)	1/2	2 × Yellow	20.4 mm (0.80 in.)	12.7 mm (0.50 in.)	C-CR4	M22	–	C/V (A7) to R/J (G)
(14)	Travel forward left	640 mm (25.2 in.)	1/2	2 × Blue	20.4 mm (0.80 in.)	12.7 mm (0.50 in.)	CR9-C	M22	–	C/V (B6) to R/J (D)
(15)	Travel rear left	570 mm (22.4 in.)	1/2	2 × Red	20.4 mm (0.80 in.)	12.7 mm (0.50 in.)	C-CR9	M22	–	C/V (A6) to R/J (F)
(16)	Swivel left	880 mm (34.6 in.)	3/8	2 × Gray	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CR9-C	M18	–	C/V (A1) to S/M (A)
(17)	Swivel right	900 mm (35.4 in.)	3/8	2 × Blue	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	C-CR9	M18	–	C/V (B1) to S/M (B)
(18)	Swing left	460 mm (18.1 in.)	1/4	2 × Yellow green	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-C	M14	–	C/V (B2) to Swing cylinder (Bot)
(19)	Swing right	930 mm (36.6 in.)	1/4	2 × Orange	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-C	M14	–	C/V (A2) to Swing cylinder (Rod)
(20)	Blade rod (Up)	760 mm (29.9 in.)	3/8	2 × Red	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	C-CR4	M18	–	C/V (B3) to R/J (C)
(21)	Blade bottom (Down)	720 mm (28.3 in.)	3/8	2 × Brown	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CR4-C	M18	–	C/V (A3) to R/J (B)

RY9212469HYS0002US0

Hi Spec



RY9212468HYS005A

(a) Control Valve
(b) Pump
(c) Swivel Motor
(d) Rotary Joint
(e) Swing Cylinder
(f) Swing Bracket Right Side
(g) Boom Back Side
(h) Boom RH
(i) Boom LH
(j) Selector Valve

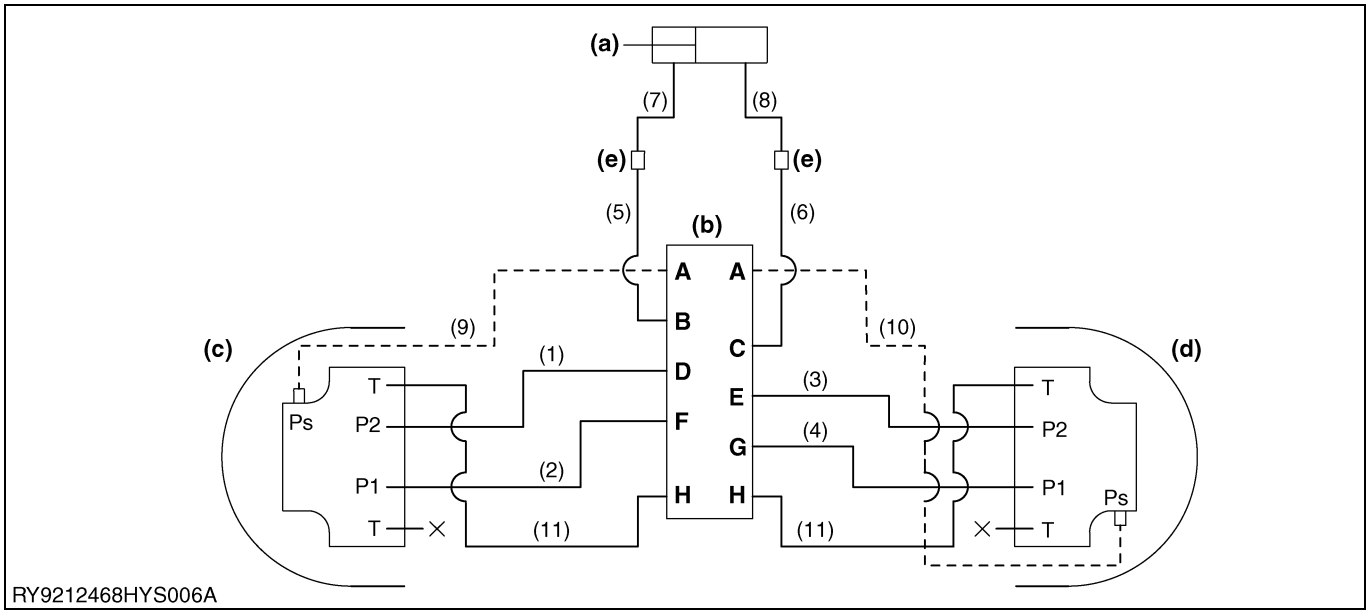
■ Table of Hydraulic Hoses

No.	Function	Hoses					Fitting		Guard	Position Used
		Total length	Size	Tape color	O.D.	I.D.	Type	Size		
(1)	Delivery	1310 mm (51.6 in.)	3/4	2 × White	26.7 mm (1.05 in.)	20.9 mm (0.82 in.)	CR4-C	M30	–	Pump P to C/V (P)
(2)	PPS	1570 mm (61.8 in.)	1/4	2 × Red	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-C	M14	–	Pump PPS to C/V (PPS)
(3)	PLS	1420 mm (55.9 in.)	1/4	2 × Blue	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-C	M14	–	Pump PLS to C/V (PLS)
(4)	Boom bottom (Up)	1160 mm (45.7 in.)	3/8	2 × Yellow	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	C-C	M18	–	C/V (A8) to Hose on (Bot)
(5)	Boom rod (Down)	1150 mm (45.3 in.)	3/8	2 × Green	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CR9-C	M18	–	C/V (B8) to Hose under (Rod)
(6)	Arm bottom (Crouwd)	2320 mm (91.3 in.)	3/8	2 × Blue	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CR9-CM	M18	–	C/V (B5) to Hose (Bot)
(7)	Arm rod (Dump)	2070 mm (81.5 in.)	3/8	2 × Gray	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CR4-CM	M18	–	C/V (A5) to Hose (Rod)

No.	Function	Hoses					Fitting		Guard	Position Used
		Total length	Size	Tape color	O.D.	I.D.	Type	Size		
(8)	Bucket rod (Dump)	1970 mm (77.6 in.)	3/8	2 × Yellow	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CR9-CM	M18	–	C/V (A9) to Hose (Rod)
(9)	Bucket bottom (Crowd)	2070 mm (81.5 in.)	3/8	2 × White	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CR9-CM	M18	–	C/V (B9) to Hose (Bot)
(10)	AUX high (LH)	2140 mm (84.3 in.)	1/2	2 × Brown	20.4 mm (0.80 in.)	12.7 mm (0.50 in.)	CR4-C	M22	–	C/V (A4) to Hose (High)
(11)	AUX low (RH)	2180 mm (85.8 in.)	1/2	2 × White	20.4 mm (0.80 in.)	12.7 mm (0.50 in.)	C-CM	M22	–	C/V (B4) to Hose (Low)
(12)	Travel forward right	640 mm (25.2 in.)	1/2	2 × Green	20.4 mm (0.80 in.)	12.7 mm (0.50 in.)	CR9-C	M22	–	C/V (B7) to R/J (E)
(13)	Travel rear right	660 mm (26.0 in.)	1/2	2 × Yellow	20.4 mm (0.80 in.)	12.7 mm (0.50 in.)	C-CR4	M22	–	C/V (A7) to R/J (G)
(14)	Travel forward left	640 mm (25.2 in.)	1/2	2 × Blue	20.4 mm (0.80 in.)	12.7 mm (0.50 in.)	CR9-C	M22	–	C/V (B6) to R/J (D)
(15)	Travel rear left	570 mm (22.4 in.)	1/2	2 × Red	20.4 mm (0.80 in.)	12.7 mm (0.50 in.)	C-CR9	M22	–	C/V (A6) to R/J (F)
(16)	Swivel left	880 mm (34.6 in.)	3/8	2 × Gray	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CR9-C	M18	–	C/V (A1) to S/M (A)
(17)	Swivel right	900 mm (35.4 in.)	3/8	2 × Blue	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	C-CR9	M18	–	C/V (B1) to S/M (B)
(18)	–	–	–	–	–	–	–	–	–	–
(19)	–	–	–	–	–	–	–	–	–	–
(20)	Blade rod (Up)	760 mm (29.9 in.)	3/8	2 × Red	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	C-CR4	M18	–	C/V (B3) to R/J (C)
(21)	Blade bottom (Down)	720 mm (28.3 in.)	3/8	2 × Brown	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CR4-C	M18	–	C/V (A3) to R/J (B)
(22)	Selector valve	450 mm (17.7 in.)	3/8	2 × Yellow green	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	C-CR9	M18	–	C/V (B2) to 6/2 (A)
(23)	Selector valve	350 mm (13.8 in.)	3/8	2 × Orange	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	C-CR9	M18	–	C/V (A2) to 6/2 (B)
(24)	Swing left	930 mm (36.6 in.)	1/4	2 × Yellow green	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	6/2 (E) to Swing cylinder (Bot)
(25)	Swing right	1270 mm (50.0 in.)	1/4	2 × Orange	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	6/2 (F) to Swing cylinder (Rod)
(26)	AUX2 (LH)	2850 mm (112.2 in.)	3/8	2 × Yellow green	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CM-C	M18	–	6/2 (C) to Boom (LH)
(27)	AUX2 (RH)	2850 mm (112.2 in.)	3/8	2 × Orange	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	CM-C	M18	–	6/2 (D) to Boom (RH)

RY9212469HYS0007US0

[3] TRACK FRAME HOSES ROUTE



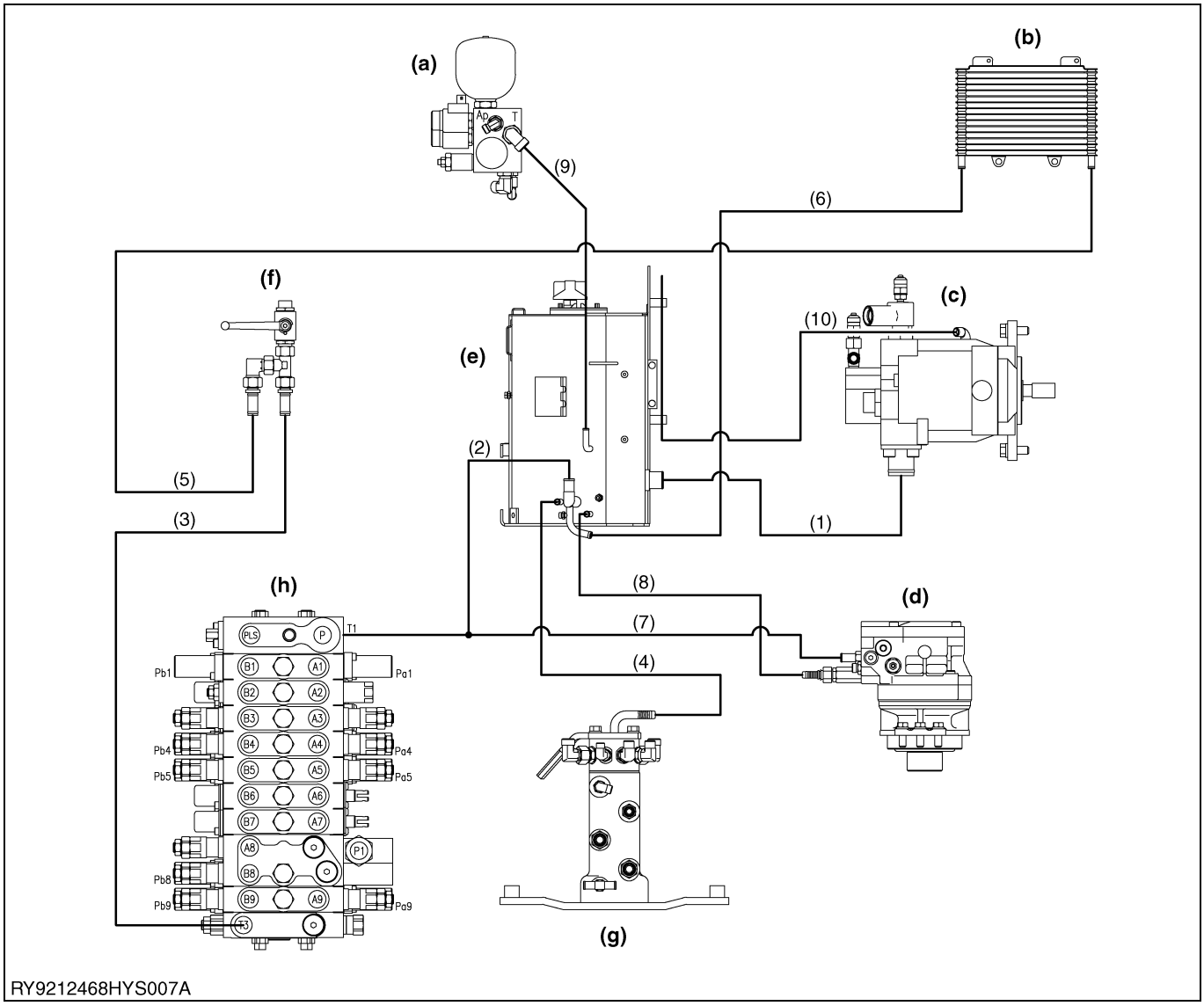
(a) Blade Cylinder **(c) Wheel Motor LH** **(d) Wheel Motor RH** **(e) Blade Joint**
(b) Rotary Joint

■ Table of Hydraulic Hoses

No.	Function	Hoses					Fitting		Guard	Position Used
		Total length	Size	Tape color	O.D.	I.D.	Type	Size		
(1)	Travel forward left	1140 mm (44.9 in.)	1/2	–	23 mm (0.9 in.)	12.5 mm (0.5 in.)	C-CR9	M22	PP Tube	R/J (D) to Wheel motor (Left Top)
(2)	Travel rear left	1140 mm (44.9 in.)	1/2	–	23 mm (0.9 in.)	12.5 mm (0.5 in.)	C-CR9	M22	PP Tube	R/J (F) to Wheel motor (Left Bot)
(3)	Travel forward right	960 mm (37.8 in.)	1/2	–	23 mm (0.9 in.)	12.5 mm (0.5 in.)	C-CR9	M22	PP Tube	R/J (B) to Wheel motor (Right Top)
(4)	Travel rear right	960 mm (37.8 in.)	1/2	–	23 mm (0.9 in.)	12.5 mm (0.5 in.)	C-CR9	M22	PP Tube	R/J (C) to Wheel motor (Right Bot)
(5)	Blade up	445 mm (17.5 in.)	3/8	–	17.4 mm (0.69 in.)	9.5 mm (0.4 in.)	C-CR9	M18	–	R/J (B) to Blade joint
(6)	Blade down	470 mm (18.5 in.)	3/8	–	17.4 mm (0.69 in.)	9.5 mm (0.4 in.)	C-CR9	M18	–	R/J (C) to Blade joint
(7)	Blade up	530 mm (20.9 in.)	3/8	–	17.4 mm (0.69 in.)	9.5 mm (0.4 in.)	C-CR4	M18	Spring	Blade joint to Blade cylinder rod
(8)	Blade down	530 mm (20.9 in.)	3/8	–	17.4 mm (0.69 in.)	9.5 mm (0.4 in.)	C-CR4	M18	Spring	Blade joint to Blade cylinder bottom
(9)	Travel left 2-speed	1220 mm (48.0 in.)	1/4	–	13.4 mm (0.5 in.)	6.4 mm (0.3 in.)	C-CR9	M14	PP Tube	R/J (A) to Wheel motor (Left, speed-up)
(10)	Travel right 2-speed	1160 mm (45.7 in.)	1/4	–	13.4 mm (0.5 in.)	6.4 mm (0.3 in.)	C-CR9	M14	PP Tube	R/J (A) to Wheel motor (Right, speed-up)
(11)	Wheel motor drain	985 mm (38.8 in.)	–	–	19.8 mm (0.8 in.)	12.7 mm (0.5 in.)	–	–	–	Drain

RY9212469HYS0008US0

[4] LOW PRESSURE HOSES ROUTE



RY9212468HYS007A

(a) Unload Valve
(b) Oil Cooler
(c) Pump
(d) Swivel Motor
(e) Oil Tank
(f) Third Line Valve
(g) Rotary Joint
(h) Control Valve

(To be continued)

(Continued)

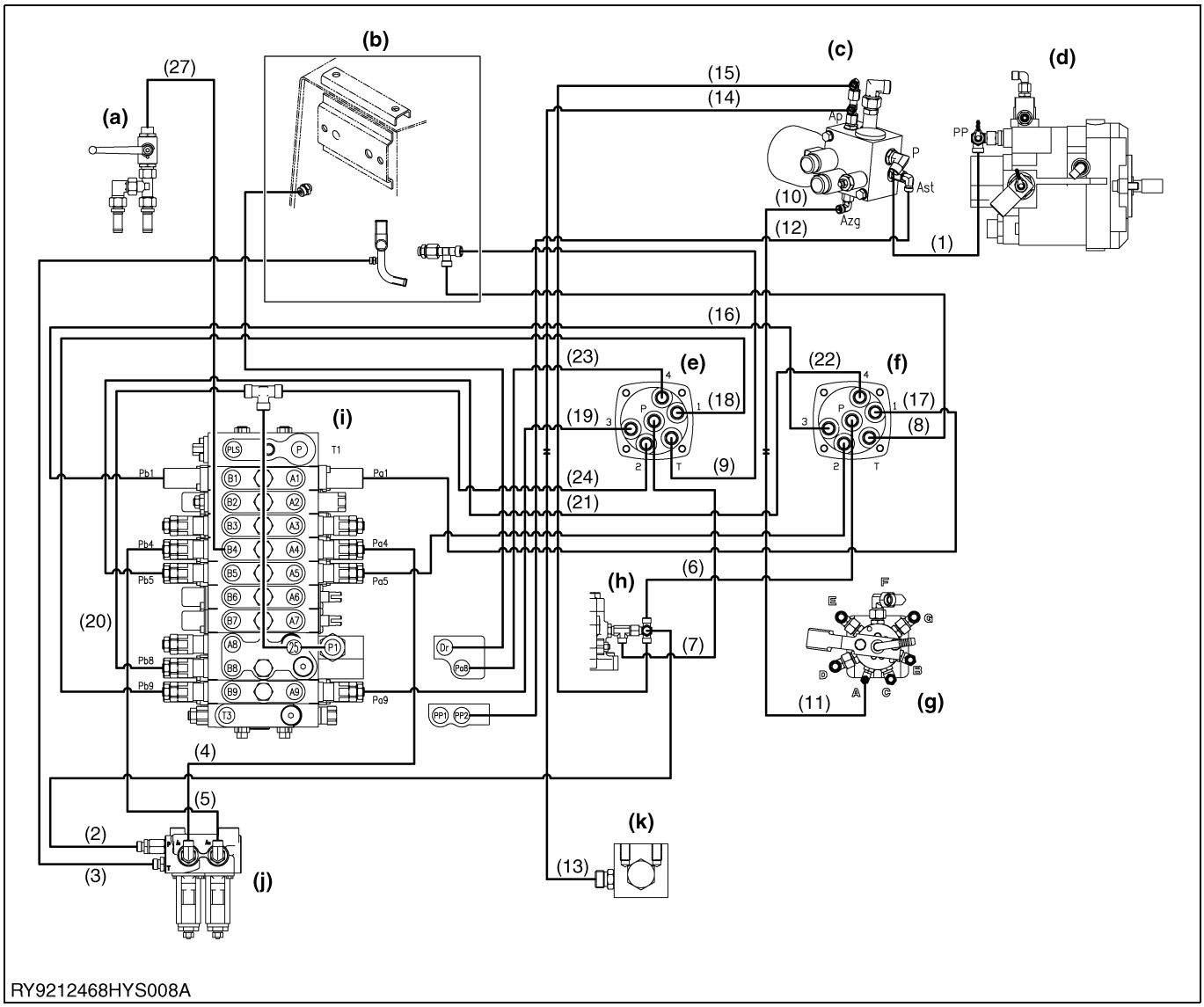
■ Table of Hydraulic Hoses

No.	Function	Hoses					Fitting		Guard	Position Used
		Total length	Size	Tape color	O.D.	I.D.	Type	Size		
(1)	Suction	–	–	–	51 mm (2.0 in.)	37 mm (1.5 in.)	–	–	–	Oil tank to Pump
(2)	Return	–	–	–	37 mm (1.5 in.)	25 mm (1.0 in.)	–	–	–	C/V (T1) to Oil tank
(3)	Oil cooler in	730 mm (28.7 in.)	–	–	23.5 mm (0.9 in.)	15.9 mm (0.6 in.)	–	–	PP Tube	C/V (T3) to Third line valve
(4)	Travel motor drain	1000 mm (39.4 in.)	–	–	18.7 mm (0.7 in.)	12.7 mm (0.5 in.)	–	–	–	R/J to Oil tank
(5)	Oil cooler in	1890 mm (74.4 in.)	–	–	23.5 mm (0.9 in.)	15.9 mm (0.6 in.)	–	–	PP Tube	Third line valve to Oil cooler (Back)
(6)	Oil cooler out	1170 mm (46.1 in.)	–	–	23.5 mm (0.9 in.)	15.9 mm (0.6 in.)	–	–	PP Tube	Oil cooler (Front) to Oil tank
(7)	Swivel make up	1200 mm (47.2 in.)	–	–	23.5 mm (0.9 in.)	15.9 mm (0.6 in.)	–	–	PP Tube	Swivel motor M to C/V (T1)
(8)	Swivel motor drain	450 mm (17.7 in.)	–	–					–	Swivel motor DR to Oil tank
(9)	Unload valve T	560 mm (22.0 in.)	–	–	18.7 mm (0.7 in.)	12.7 mm (0.5 in.)	–	–	–	Unload valve (T) to Oil tank
(10)	Air drain hose	750 mm (29.5 in.)	1/4	–	8.8 mm (0.3 in.)	5.1 mm (0.2 in.)	QM-C	M14	–	Pump to Partition

RY9212469HYS0009US0

[5] PILOT HOSE ROUTE

Standard



RY9212468HYS008A

(a) Third LineValve
(b) Hydraulic Tank
(c) Unload Valve
(d) Swivel Motor
(e) Pump
(f) Pilot Valve Right
(g) Pilot Valve Left
(h) Swivel Motor
(i) Control Valve
(j) Solenoid Valve
(k) Travel Lock Release

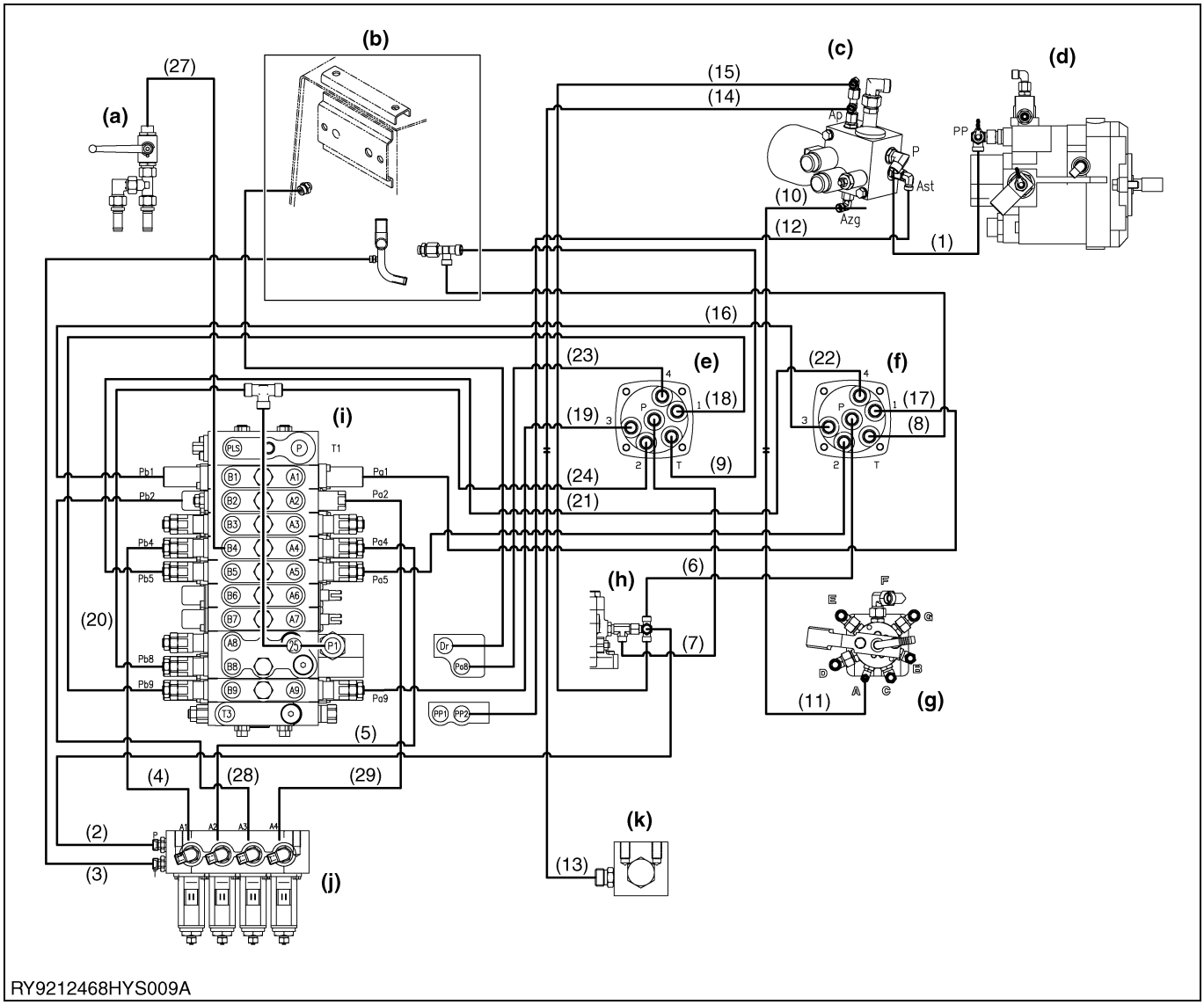
■ Table of Hydraulic Hoses

No.	Function	Hoses					Fitting		Guard	Position Used
		Total length	Size	Tape color	O.D.	I.D.	Type	Size		
(1)	P4	520 mm (20.5 in.)	3/8	–	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	C-CR4	M18	–	Pump PP to U/V (P)
(2)	AUX solenoid P	940 mm (37.0 in.)	1/4	2 × White	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-C	M14	–	S/M to S/V (P)
(3)	AUX solenoid T	710 mm (28.0 in.)	1/4	–	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-C	M14	–	S/V (T) to Tank
(4)	AUX Hi	675 mm (26.6 in.)	1/4	2 × Pink	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	S/V (A1) to C/V (Pa4)
(5)	AUX Low	1310 mm (51.6 in.)	1/4	2 × Yellow green	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	S/V (A2) to C/V (Pb4)
(6)	Pilot P, LH	1600 mm (63.0 in.)	1/4	2 × White	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-C	M14	–	S/M to P/V (Left) P

No.	Function	Hoses					Fitting		Guard	Position Used
		Total length	Size	Tape color	O.D.	I.D.	Type	Size		
(7)	Pilot P, RH	1070 mm (42.1 in.)	1/4	2 × White	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-C	M14	–	S/M to P/V (Right) P
(8)	Pilot T, LH	1500 mm (59.1 in.)	1/4	–	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	P/V L to Tank
(9)	Pilot T, RH	880 mm (34.6 in.)	1/4	–	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	P/V R to Tank
(10)	High speed signal	980 mm (38.6 in.)	1/4	2 × White	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-C	M14	–	U/V (Azg) to Hose
(11)	High speed signal	1130 mm (44.5 in.)	1/4	2 × White	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	Hose to R/J (Shaft) A
(12)	Travel lock release	1515 mm (59.6 in.)	1/4	2 × Brown	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	U/V (Ast) to C/V (PP2)
(13)	Travel lock release	1810 mm (71.3 in.)	1/4	2 × Yellow	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-CM	M14	–	Travel lock release to Hose
(14)	Travel lock release	1000 mm (39.4 in.)	1/4	2 × Yellow	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-C	M14	–	Hose to U/V (Ap)
(15)	Swivel brake	2140 mm (84.3 in.)	1/4	2 × Blue	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-C	M14	–	U/V (Ap) to S/M
(16)	Swivel RH	2425 mm (95.5 in.)	1/4	2 × Yellow	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	P/V (L, 3) to C/V (Pb1)
(17)	Swivel LH	1980 mm (78.0 in.)	1/4	2 × Red	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	P/V (L, 1) to C/V (Pa1)
(18)	Bucket bottom (Crowd)	2050 mm (80.7 in.)	1/4	2 × Pink	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	P/V (R, 1) to C/V (Pb9)
(19)	Bucket rod (Dump)	1070 mm (42.1 in.)	1/4	2 × Brown	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	P/V (R, 3) to T adapter
(20)	Boom Rod (Down)	490 mm (19.3 in.)	1/4	2 × LIght blue	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR4-C	M14	–	T adapter to C/V (Pb8)
(21)	Arm rod (Dump)	1915 mm (75.4 in.)	1/4	2 × Blue	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	P/V (L, 2) to C/V (Pa5)
(22)	Arm bottom (Crowd)	2675 mm (105.3 in.)	1/4	2 × Green	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	P/V (L, 4) to C/V (Pb5)
(23)	Boom bottom (Up)	1100 mm (43.3 in.)	1/4	2 × Gray	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	P/V (R, 4) to C/V (Pa8)
(24)	Boom rod (Down)	1500 mm (59.1 in.)	1/4	2 × LIght blue	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	P/V (R, 2) to C/V (Pb8)
(25)	Boom Lock	400 mm (15.7 in.)	1/4	2 × LIght blue	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-C	M14	–	C/V (P1) to T adapter
(26)	Boom drain	660 mm (26.0 in.)	1/4	–	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	C/V (Dr) to Tank
(27)	AUX low	580 mm (22.8 in.)	1/2	–	20.6 mm (0.81 in.)	12.7 mm (0.50 in.)	C-CR9	M22	–	Third line to C/V (B4)

RY9212469HYS0010US0

Hi Spec



RY9212468HYS009A

(a) Third LineValve
(b) Hydraulic Tank
(c) Unload Valve
(d) Pump
(e) Pilot Valve Right
(f) Pilot Valve Left
(g) Rotary Joint
(h) Swivel Motor
(i) Control Valve
(j) Solenoid Valve
(k) Travel Lock Release

■ Table of Hydraulic Hoses

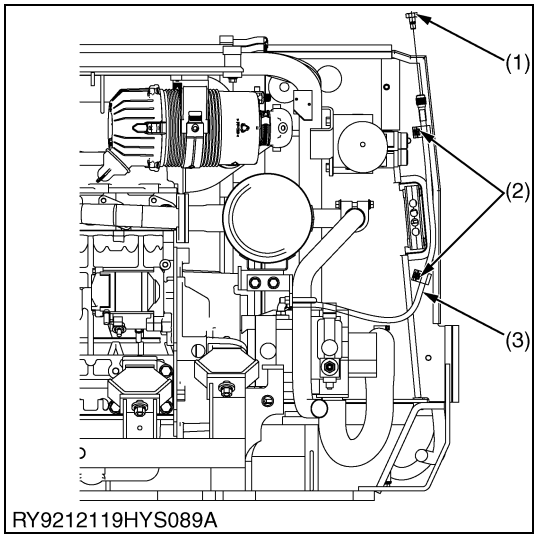
No.	Function	Hoses					Fitting		Guard	Position Used
		Total length	Size	Tape color	O.D.	I.D.	Type	Size		
(1)	P4	520 mm (20.5 in.)	3/8	–	17.4 mm (0.69 in.)	12.7 mm (0.50 in.)	C-CR4	M18	–	Pump PP to U/V (P)
(2)	AUX solenoid P	680 mm (26.8 in.)	1/4	2 × White	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	S/M to S/V (P)
(3)	AUX solenoid T	480 mm (18.9 in.)	1/4	–	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-C	M14	–	S/V (T) to Tank
(4)	AUX low, RH	1160 mm (456.7 in.)	1/4	2 × Green	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	S/V (A1) to C/V (Pb4)
(5)	AUX high, LH	700 mm (27.6 in.)	1/4	2 × Pink	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	S/V (A2) to C/V (Pa4)
(6)	Pilot P, LH	1600 mm (63.0 in.)	1/4	2 × White	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-C	M14	–	S/M to P/V (Left) P
(7)	Pilot P, RH	1070 mm (42.1 in.)	1/4	2 × White	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-C	M14	–	S/M to P/V (Right) P

No.	Function	Hoses					Fitting		Guard	Position Used
		Total length	Size	Tape color	O.D.	I.D.	Type	Size		
(8)	Pilot T, LH	1500 mm (59.1 in.)	1/4	–	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	P/V L to Tank
(9)	Pilot T, RH	880 mm (34.6 in.)	1/4	–	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	P/V R to Tank
(10)	High speed signal	980 mm (38.6 in.)	1/4	2 × White	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-C	M14	–	U/V (Azg) to Hose
(11)	High speed signal	1130 mm (44.5 in.)	1/4	2 × White	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	Hose to R/J (Shaft) A
(12)	Travel lock release	1515 mm (59.6 in.)	1/4	2 × Brown	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	U/V (Ast) to C/V (PP2)
(13)	Travel lock release	1810 mm (71.3 in.)	1/4	2 × Yellow	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-CM	M14	–	Travel lock release to Hose
(14)	Travel lock release	1000 mm (39.4 in.)	1/4	2 × Yellow	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-C	M14	–	Hose to U/V (Ap)
(15)	Swivel brake	2140 mm (84.3 in.)	1/4	2 × Blue	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-C	M14	–	U/V (Ap) to S/M
(16)	Swivel RH	2425 mm (95.5 in.)	1/4	2 × Yellow	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	P/V (L, 3) to C/V (Pb1)
(17)	Swivel LH	1980 mm (78.0 in.)	1/4	2 × Red	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	P/V (L, 1) to C/V (a1)
(18)	Bucket bottom (Crowd)	2050 mm (80.7 in.)	1/4	2 × Pink	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	P/V (R, 1) to C/V (Pb9)
(19)	Bucket rod (Dump)	1070 mm (42.1 in.)	1/4	2 × Brown	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	P/V (R, 3) to T adapter
(20)	Boom Rod (Down)	490 mm (19.3 in.)	1/4	2 × LIght blue	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR4-C	M14	–	T adapter to C/V (Pb8)
(21)	Arm rod (Dump)	1915 mm (75.4 in.)	1/4	2 × Blue	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	P/V (L, 2) to C/V (Pa5)
(22)	Arm bottom (Crowd)	2675 mm (105.3 in.)	1/4	2 × Green	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	P/V (L, 4) to C/V (Pb5)
(23)	Boom bottom (Up)	1100 mm (43.3 in.)	1/4	2 × Gray	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	P/V (R, 4) to C/V (Pa8)
(24)	Boom rod (Down)	1500 mm (59.1 in.)	1/4	2 × LIght blue	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	P/V (R, 2) to C/V (Pb8)
(25)	Boom Lock	400 mm (15.7 in.)	1/4	2 × LIght blue	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	CR9-C	M14	–	C/V (P1) to T adapter
(26)	Boom drain	660 mm (26.0 in.)	1/4	–	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	C/V (Dr) to Tank
(27)	AUX low	580 mm (22.8in.)	1/2	–	20.6 mm (0.81 in.)	12.7 mm (0.50 in.)	C-CR9	M22	–	Third line to C/V (B4)
(28)	AUX2 high, LH	720 mm (28.3 in.)	1/4	2 × Gray	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR4	M14	–	S/V (A3) to C/V Pb2
(29)	AUX2 low, RH	930 mm (36.6in.)	1/4	2 × Blue white	11.8 mm (0.46 in.)	6.4 mm (0.25 in.)	C-CR9	M14	–	S/V (A4) to C/V Pa2

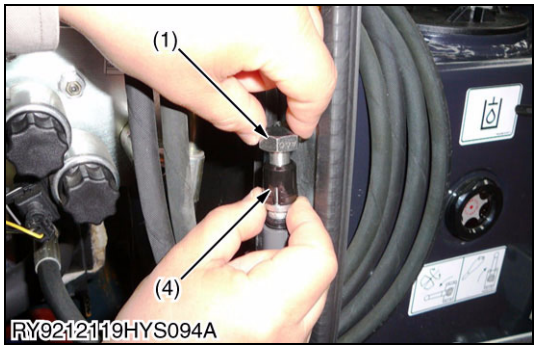
RY9212469HYS0011US0

10. MEASURING HYDRAULIC DEVICE PERFORMANCE

[1] PISTON PUMP AIR BLEEDING



RY9212119HYS089A



RY9212119HYS094A

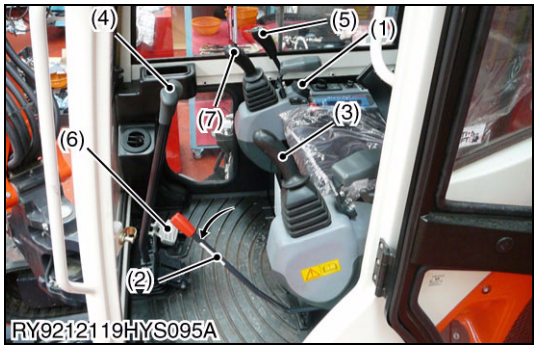
When disassembling hydraulic equipment and replacing hoses, etc., or after changing the hydraulic fluid and using the vacuum pump, before operating the machine, be sure to carry out air bleeding to prevent pump scorching and cavitation.

1. After operating, with the engine stopped, remove the hose at the top of the pump from its clamp.
2. Press in 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. Move down the hose on the front of the weight, and leave for 30 seconds.
4. Fit the hexagonal plug (removed in step 2) to the hose, start the engine, set idling and check whether there is any cavitation noise from the pump.
5. Repeat operations in 2. 3. 4 until pump cavitation noise disappears.
6. When cavitation noise disappears, raise the engine speed to 1500 rpm, slowly move the arm and check whether cavitation noise is gone (Make sure not to reach relief pressure when operating the arm).
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 emitted, stop the engine and carry out 2, 3, 4 until pump cavitation noise disappears.
8. If there is no cavitation noise in step 7, raise the engine speed to maximum rpm, slowly operate the arm, and check again for cavitation noise. If cavitation noise is emitted, stop the engine and carry out 2, 3, 4 until pump cavitation noise disappears (Make sure there is no relief when operating the arm).
9. If there was no cavitation noise when performing step 8, air bleeding is finished. Clamp the air bleed hose in its original position.

(1) Hexagonal Plug
(2) Clamp
(3) Air Bleed Hose
(4) Lock Section

RY9212469HYS0019US0

[2] HYDRAULIC SYSTEM PRESSURE RELEASE

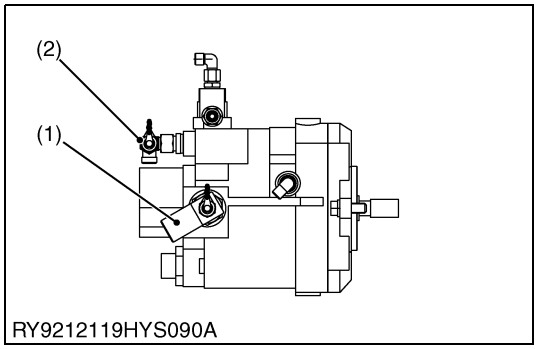


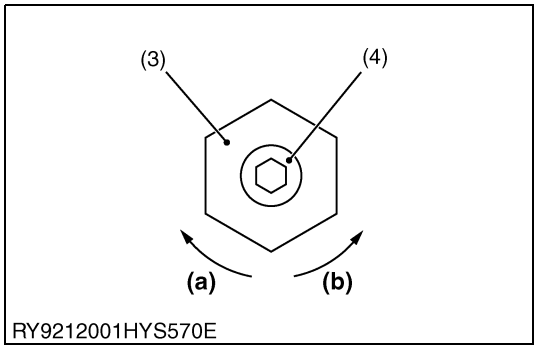
1. Place the excavator on flat hard ground, lower the bucket and the blade, and stop the engine.
2. Without starting the engine, place the engine starter switch in the "RUN" position.
3. Place the machine lock lever in the release position.
4. Operate each control lever for the boom, arm, bucket and swivel to full stroke.
5. Operate the travel lever, blade lever, swing pedal and service port knob to full stroke each. Before releasing the residual pressure of the service port, you have to activate the service port on the dashboard.
6. Place the machine's lock lever in the "Lock" position, and the engine starter switch to the "STOP" position.

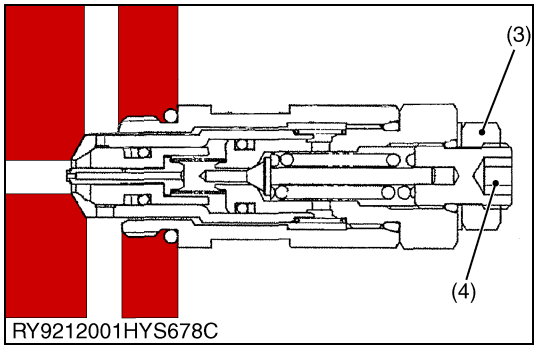
(1) Starter Switch
(2) Machine Lock Lever
(3) Control Lever
(4) Travel Lever
(5) Blade Lever
(6) Swing Pedal
(7) Service Port Switch

RY9212469HYS0020US0

[3] MAIN RELIEF VALVE PRESSURE







(1) Procedure for Measuring the Main Relief Valve

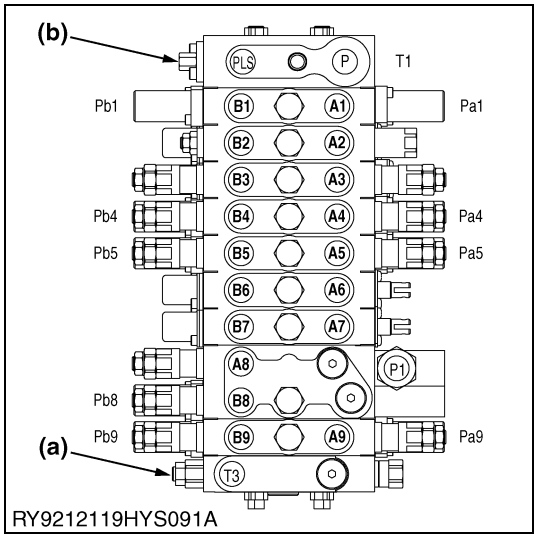
1. Place the excavator on flat, hard ground, lower the bucket and the blade and stop the engine.
2. Follow the chapter on "Releasing Pressure in the Hydraulic System" and release pressure in the hydraulic lines.
3. Attach a pressure gauge to the pump pressure detection port.
4. Start and idle the engine, and check that there is no oil leakage.
5. Slowly operate the control lever of the front operation to be measured, operate until the cylinder reaches the end of its stroke, then relieve.
6. In the case of travel, lock the travel section, gradually operate the travel lever, then relieve.
7. Measure three times at maximum engine speed, and take the average value as the measurement.
8. Conduct at oil temperature 50 ± 5 °C (122 ± 9 °F).

(2) Main Relief Valve Adjustment Procedure

1. Loosen the relief valve lock nut.
   Use a hexagonal wrench to turn the adjuster screw, and tighten the lock nut.
2. Operate the lever at maximum engine speed, and check the pressure setting.

(1) Pump Pressure Detection Port
(2) Pilot pump Pressure Detection Port
(3) Lock Nut
(4) Adjuster Screw
(a) Pressure Increase
(b) Pressure Decrease

RY9212469HYS0021US0



RY9212119HYS091A

CAUTION

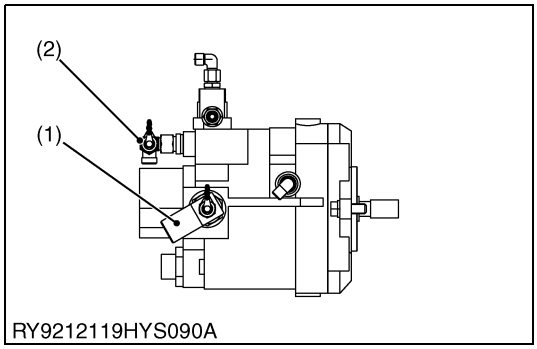
- **Actual measured values may vary with the machine.**

(a) Main LS Relief Valve **(b) Unload LS Valve**

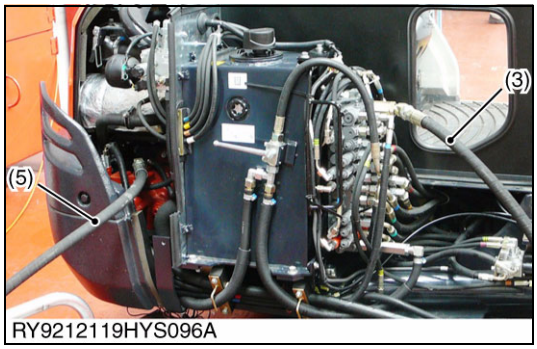
RY9212469HYS0022US0

[4] MEASUREING THE FLOW RATE

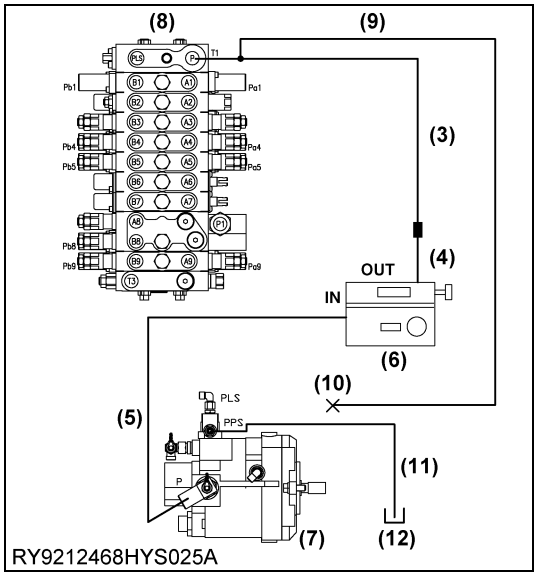
(1) Main Pump Flow Measurement



RY9212119HYS090A



RY9212119HYS096A



RY9212468HYS025A

[Measurement preparation]

1. Place the excavator on hard, flat ground, lower the bucket and the blade and stop the engine.
2. Follow the chapter on "Releasing Pressure in the Hydraulic System" and release pressure in the hydraulic line.
3. Connect a vacuum pump.
4. Attach a pressure gauge to the pump pressure detection port.
5. Connect the pipe joint of the pump to be measured to the IN side of the flow gauge with a test hose.
6. Connect the removed hose to a test hose and connect them to the OUT side of the flow meter.
7. Disconnect the PPS hose from the port PPS of hydraulic pump, and install a plug to PPS hose.
8. Connect the test hose (C) to the port PPS of the piston pump, and collect the drain by the oil receiver.
9. Remove the vacuum pump, and make sure to check for oil leakage.
10. Bleed air from the piston pump.

[Measurement]

1. Hydraulic oil temperature of 50 ± 5 °C (122 ± 9 °F).
2. Open the loading valve of the flow meter and start the engine. Set the engine speed to maximum, gradually close the loading valve of the flow meter, and measure the flow and engine speed at each pressure level.
3. Perform the measurement 3 times; take the average and use this as the measurement value.

(Pump Performance Inspection Procedure)

The pump performance inspection entails placing a specified pressure load on the pump discharge and taking measurements at a specified engine speed to check the volumetric efficiency.

$$\text{Volumetric efficiency} = \frac{\text{Rated load discharge rate}}{\text{Logical discharge value (Calculated value)}} \times 100\,(\%)$$

RY9212032HYS074A

1. The pump volumetric efficiency is proportional to pump rotational speed and inversely proportional to load pressure so set the engine speed at maximum speed for the test.
2. Volumetric efficiency is the ratio of the discharge amount per revolution (cc/rev) at a specified load and the theoretical discharge amount (calculated value). The specified load is the main relief set pressure.
3. The measurement value of the discharge flow at the specified load must be corrected to one pump revolution because the rotational speed of the pump is reduced from its normal speed.

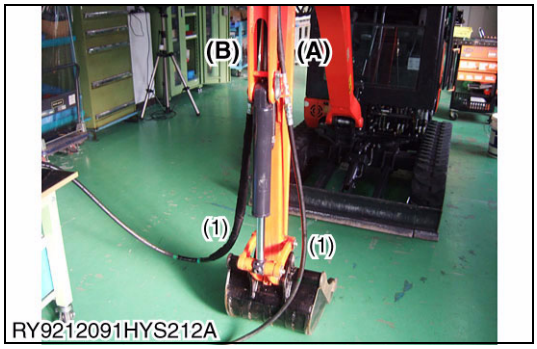
$$\text{Rated load discharge rate} = \frac{\text{Rated load discharge rate (L/min)} \times 1000}{\text{Rated load pump (rpm)}}$$

RY9212032HYS073A

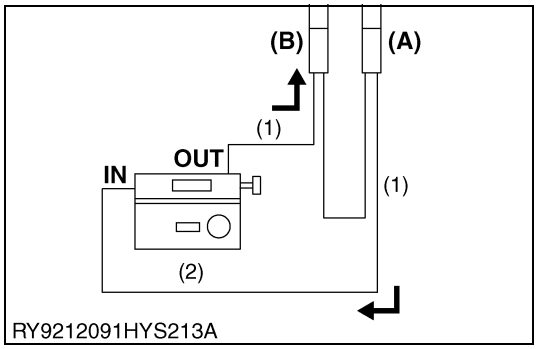
(1) Pump Pressure Detection Port
(2) Pilot Pump Pressure Detection Port
(3) P1 Hose
(4) Test Hose (A)
(5) Test Hose (B)
(6) Flow Meter
(7) Pump
(8) Control Valve
(9) PPS Hose
(10) Plug
(11) Test Hose (C)
(12) Oil Receiver

RY9212469HYS0059US0

(2) Actual AUX PQ Value Measurement



RY9212091HYS212A



RY9212091HYS213A

[Measurement preparation]

1. Place the excavator on flat, hard ground, lower the bucket and the blade and stop the engine.
2. Follow the chapter on "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. Hydraulic oil temperature of 50 ± 5 °C (122 ± 9 °F).
2. Open the loading valve of the flow meter and start the engine.
3. After bringing the engine to maximum RPM, operate the AUX.
4. Gradually close down the loading valve of the flow meter and measure the flow at each pressure level.
5. Perform the measurement 3 times; take the average and use this as the measurement value.

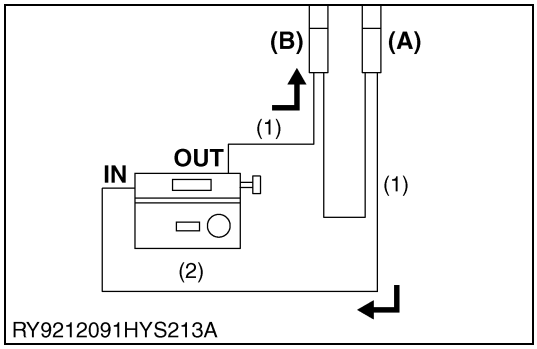
■ **IMPORTANT**

- **Take care not to make an error in the direction of oil flow and the IN direction of the flow meter.**

(1) Test Hose
(2) Flow Meter
(A) AUX High Pressure Side
(B) AUX Low Pressure Side

RY9212469HYS0024US0

(3) Measuring the AUX Proportional Settings



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 all the way and start the engine.
2. Hydraulic oil temperature of 50 ± 5 °C (122 ± 9 °F).
3. After beginning the engine to maximum RPM.
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**

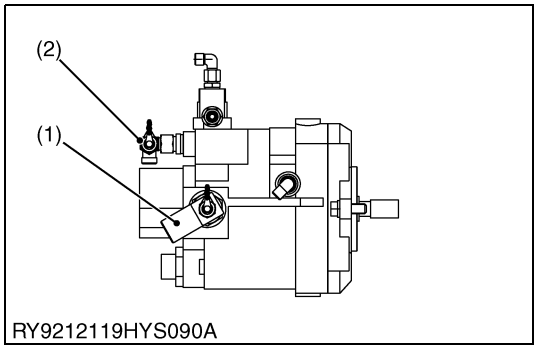
- **Do not make a mistake in the oil flow direction or the direction oil flows into the flow meter.**
- **Refer to the Operator's Manual for how to set the flow limit values.**

(1) Test Hose
(2) Flow Meter
(A) AUX High-Pressure Side
(B) AUX Low-Pressure Side

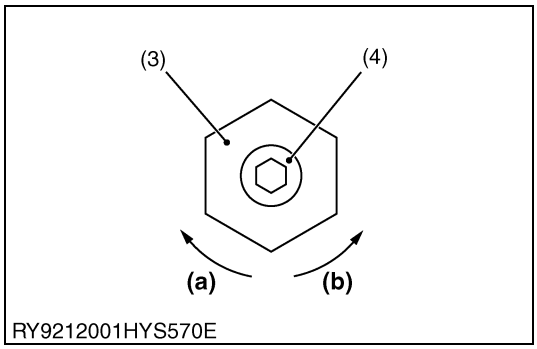
RY9212469HYS0025US0

[5] MESURING PRESSURE

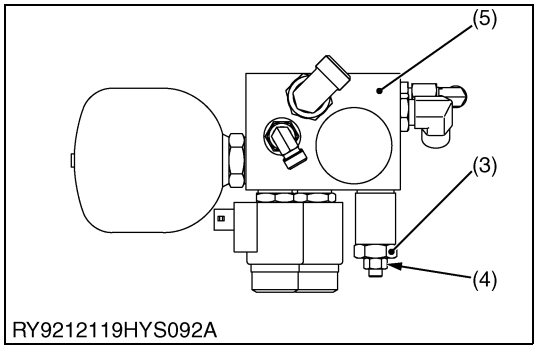
(1) Pilot Pressure



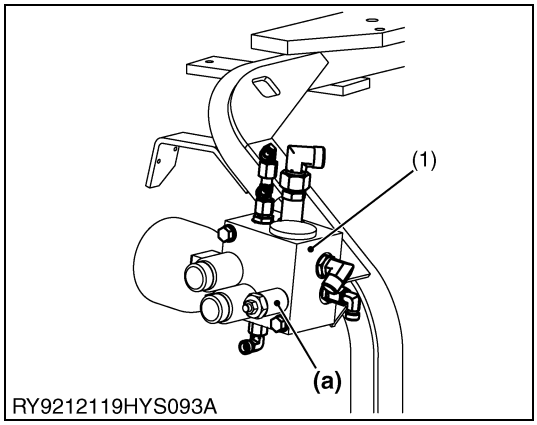
RY9212119HYS090A



RY9212001HYS570E



RY9212119HYS092A



RY9212119HYS093A

[Pilot Primary Pressure Measuring Procedure]

1. Place the excavator on flat, hard ground, lower the bucket and the blade and stop the engine.
2. Follow the chapter on "Releasing Pressure in the Hydraulic System" and release pressure in the hydraulic lines.
3. Attach a pressure gauge to the pilot pressure detection port.
4. Start and idle the engine, and check that there is no oil leakage when the machine's lock lever is released.
5. Raise engine speed to maximum rpm, and use the pressure gauge to measure pilot pressure under no load.
   Perform the measurement 3 times; take the average and use this as the measurement value.
   Conduct at oil temperature 50 ± 5 °C (122 ± 9 °F).

[Pilot Primary Pressure Adjustment Method]

1. Loosen the relief valve lock nut of the unload valve.
   Adjust by turning the adjuster screw with a hexagonal wrench and then tighten the lock nut.
2. After adjusting, check the set pressure.

(1) Pump Pressure Detection port
(2) Pilot Pump Pressure Detection Port
(3) Lock Nut
(4) Adjuster Screw
(5) Unload Valve

(a) Pressure Increase
(b) Pressure Decrease

RY9212469HYS0026US0

CAUTION

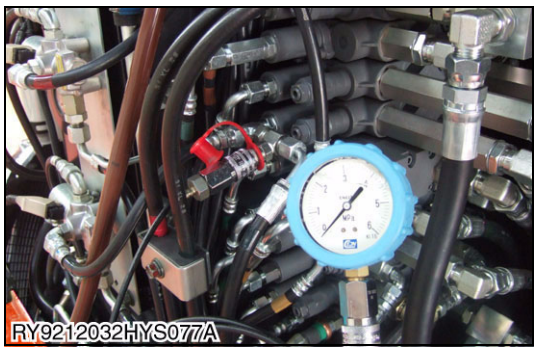
- **Actual measured values may vary with the machine.**

(1) Unload Valve

(a) Pilot Primary Pressure Relief Valve

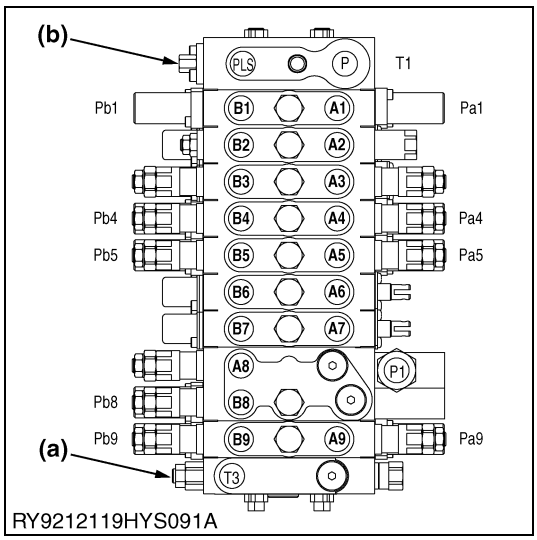
RY9212469HYS0047US0

(2) Pilot Secondary Pressure Measuring Procedure



1. Place the excavator on flat hard ground, lower the bucket and the blade, and stop the engine.
2. In accordance with "Releasing Residual Hydraulic System Pressure" in this manual, release pressure from the hydraulic line.
3. Fit a T-joint to the pilot port on the control valve side to be measured, and attach a pressure gage.
4. Start and idle the engine, and after checking that there is no oil leakage.
5. Operate the measuring lever after raise engine speed to maximum rpm, and take the pilot pressure reading at full throttle.
6. Perform the measurement 3 times, take the average and use this as the measurement value. Conduct at oil temperature 50 ± 5 °C (122 ± 9 °F).

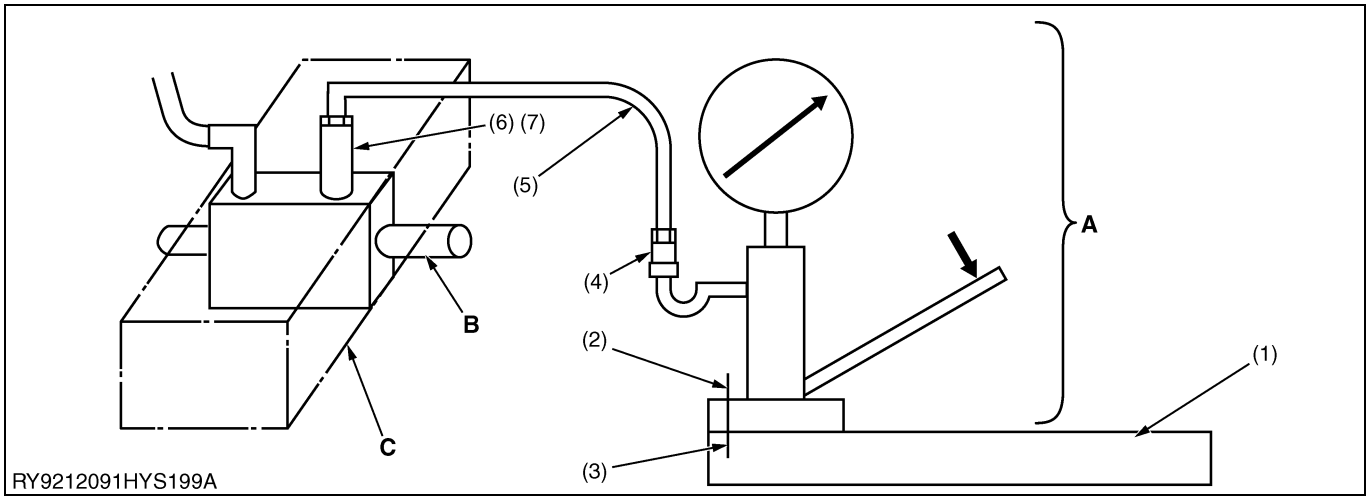
RY9212469HYS0027US0



A1: Swivel Left (Pa1)
B1: Swivel Right (Pb1)
A2: Swing Rod
B2: Swing Bottom
A3: Blade Bottom
B3: Blade Rod
A4: AUX1 (Pa4)
B4: AUX1 (Pb4)
A5: Arm Rod (Pa5)
B5: Arm Bottom (Pb5)
A6: Travel Left Reverse
B6: Travel Left Forward
A7: Travel Right Reverse
B7: Travel Right Forward
A8: Boom Bottom
B8: Boom Rod (Pb8)
A9: Bucket Rod (Pa9)
B9: Bucket Bottom (Pb9)
(a) Main LS Relief Valve
(b) Unload LS Valve

RY9212119HYS0038US0

(3) Overload Relief Valve Pressure Measurement Procedure



A : Injection Pressure Tester **B : Overload Relief Valve Tested** **C : Control Valve**

No.	Parts Name	Qty	Notes
(1)	Support	1	To hold the tester steady, fasten the tester to this support with bolts/nuts (2) and (3).
(2)	Bolt (M10 x 35)	2	
(3)	Nut (M12)	2	
(4)	Pipe joint (M12-G2)	1	Connect the hose and the tester.
(5)	Test hose (1/4)	1	
(6)	Straight pipe joint (S, G3-G2)	1	
(7)	Plug (PT1/8)	1	Plug the pressure detection port of the straight pipe joint (6).

[Measurement preparation]

1. Place the excavator on flat, hard ground, lower the bucket and the blade and stop the engine.
2. Follow the chapter on "Releasing Pressure in the Hydraulic System" and release pressure in the hydraulic lines.
3. Using the vacuum pump, disconnect the high pressure hose on the valve suction port fitted for the overload relief valve to be tested and then plug the disconnected hose.
4. Remove the pipe joint from where the hose was disconnected and fit a straight pipe joint (6).
5. Connect a test hose to this pipe joint (6) and to the injection pressure tester.
6. Remove the vacuum pump.

[Overload Relief Valve Measurement]

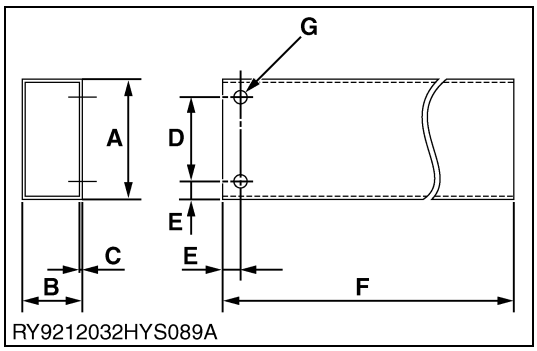
1. Add pressure until the overload relief valve opens and then read the pressure at that point.
2. Perform the measurement 3 times; take the average and use this as the measurement value.

CAUTION

- **Be sure to use a test hose that is durable enough to withstand the set pressure that is being tested.**
- **Be careful to tighten connections fully and to the right ports.**
- **When removing hoses after the tests, loosen the pipe joint (4) and the injection pressure tester slightly and make sure the pressure is relieved before disconnecting any hoses.**

RY9212469HYS0028US0

(4) Measurement Equipment



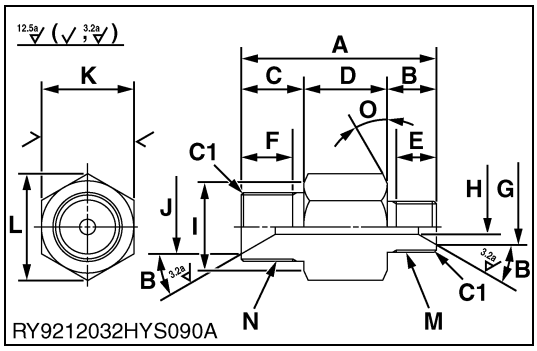
RY9212032HYS089A

[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 quality: STKR400

RY9212469HYS0029US0



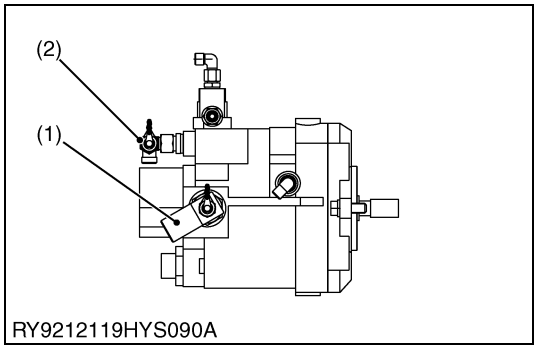
RY9212032HYS090A

[Pipe joint (M12-G2)]

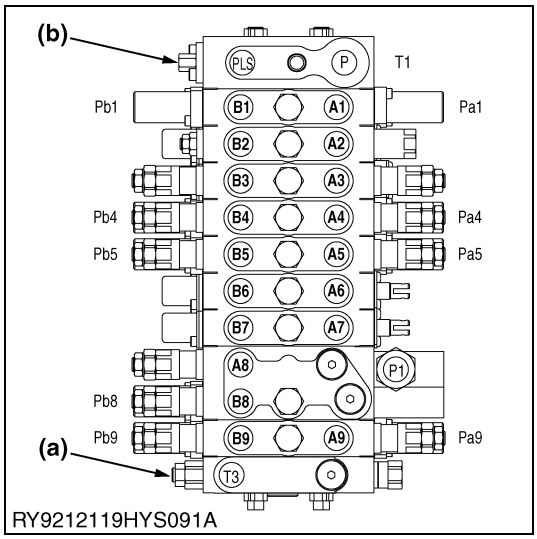
A	47 mm (1.8 in.)
B	12 mm (0.47 in.)
C	15 mm (0.59 in.)
D	20 mm (0.79 in.)
E	10 mm (0.39 in.)
F	12 mm (0.47 in.)
G	ϕ8 mm (0.3 in.)
H	ϕ3 mm (0.1 in.)
I	ϕ18 mm (0.71 in.)
J	ϕ9.5 ± 0.2 mm (0.37 ± 0.01 in.)
K	19 + 0, − 0.35 mm (0.75 + 0, − 0.01 in.)
L	21.9 mm (0.86 in.)
M	M12 × 1.5
N	G1/4
O	30 °

RY9212469HYS0030US0

(5) Unload LS Valve Pressure



RY9212119HYS090A



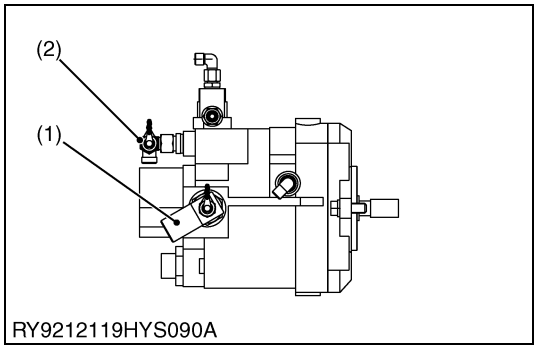
RY9212119HYS091A

1. Place the machine on firm, level ground, lower the bucket and blade to ground level, and stop the engine.
2. In accordance with "Releasing Hydraulic System Pressure" in this manual, release pressure from the hydraulic line.
3. Remove the plug from the adapter's inspection port on the discharge side of the pump to be measured, and attach a pressure gage.
4. Start and idle the engine, and check that there is no oil leakage.
5. Raise engine speed to maximum rpm, and measure the pressure during load-free operation (control lever in neutral).
6. Measure three times at maximum engine speed, and take the average value as the measurement.
7. Conduct at oil temperature 50 ± 5 °C (122 ± 9 °F).

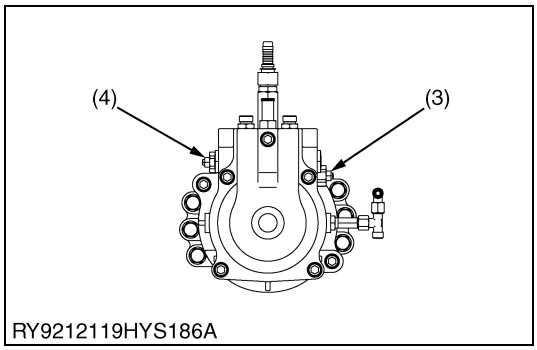
(1) Pump Pressure Detection Port **(a) Main LS Relief Valve**
(2) Pilot Pump Pressure Detection Port **(b) Unload LS Valve**

RY9212469HYS0031US0

(6) Swivel Relief Valve Pressure



RY9212119HYS090A



RY9212119HYS186A

1. Place the excavator on flat, hard ground, lower the bucket and the blade and stop the engine.
2. Follow the chapter on "Releasing Pressure in the Hydraulic System" and release pressure in the hydraulic lines.
3. Attach a pressure gauge to the pump pressure detection port.
4. Start and idle the engine, and check that there is no oil leakage.
5. Place the bucket against something robust, lock the machine so that it does not move, slowly operate the swivel lever from left to right and from right to left, and take the relief pressure reading at maximum engine speed.
   Perform the measurement 3 times, take the average and use this as the measurement value.
   Conduct at oil temperature 50 ± 5 °C (122 ± 9 °F).

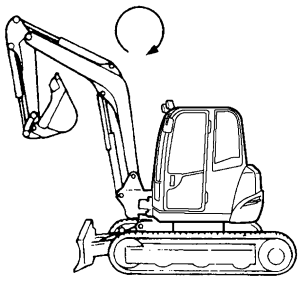
■ **NOTE**

- **When measuring the relief valve pressure of the swivel motor on the pump inspection port side, the pressure is higher than the relief valve pressure setting.**
  For a more accurate measurement, attach the pressure gauge to the swivel motor.

(1) Pump Pressure Detection Port (3) Left Swivel Relief Valve (cSL)
(2) Pilot Pump Pressure Detection Port (4) Right Swivel Relief Valve (cSR)

RY9212469HYS0032US0

(7) LS Control Pressure



RY9212001HYS562A

The actual measurement of LS control differential pressure requires special equipment such as a differential pressure instrument. General maintenance shops do not have such a expertise measuring device. This section introduces a simple method that makes use of one of the LS functions, such as the swivel motion of an actual machine.

1. Place the machine on hard ground.
2. Warm up the machine to the oil temperature of 50 ± 5 °C (122 ± 9 °F).
3. Raise up the engine speed at Max. rpm.
4. Measure the time for three turns constant swivel

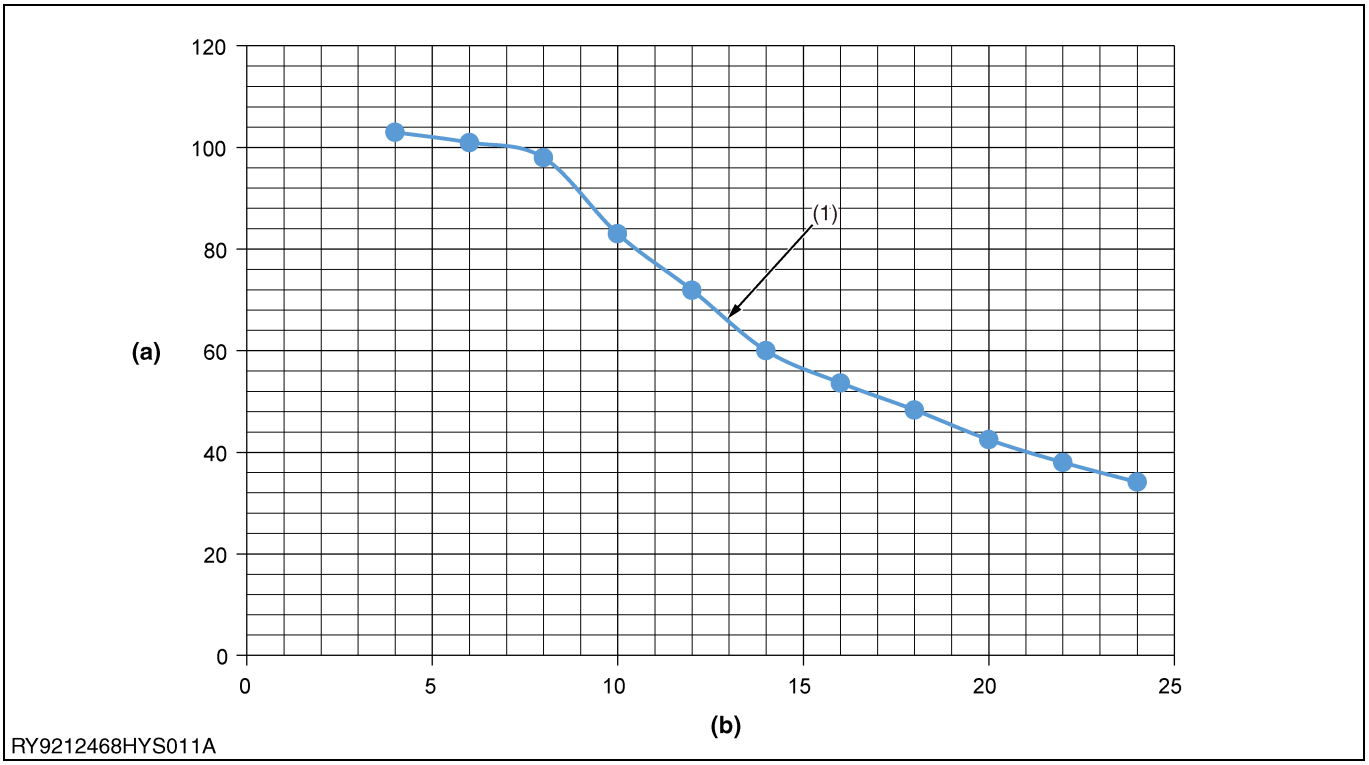
Swivel function	
Reference value [three turns]	18.2 - 22.2 sec.

- Machine condition:
  Boom raised, arm and bucket crowd
  Dozer-down on ground.

RY9212469HYS0033US0

11. HYDRAULIC DEVICE PERFORMANCE STANDARDS

[1] PISTON PUMP P-Q PERFORMANCE (MEASURED VALUES)



(1) P Mode **(a) Flow Rate (L/min)** **(b) Pressure (MPa)**

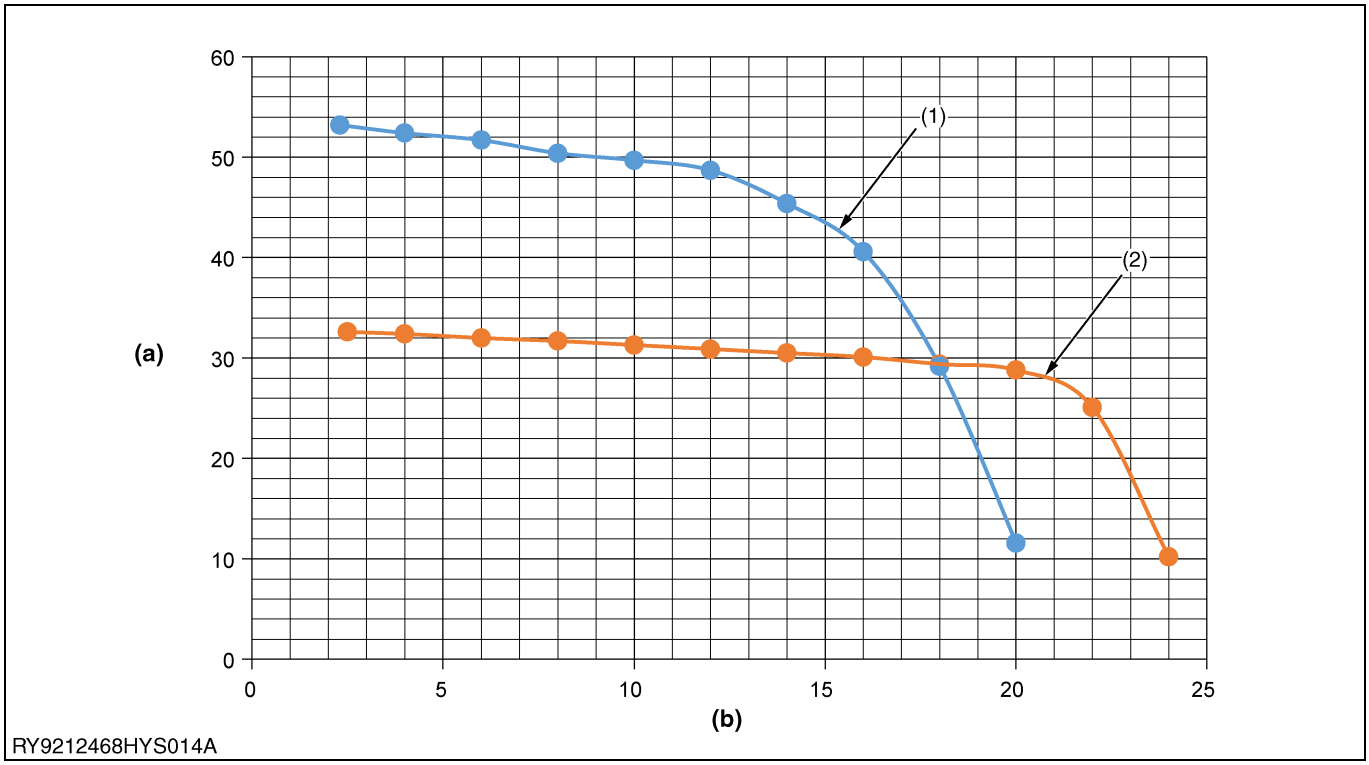
CAUTION

- **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	P mode
4.0 MPa (40.8 kgf/cm^2, 580 psi)	103 L/min (27.2 U.S.gals)
6.0 MPa (61.2 kgf/cm^2, 870 psi)	101 L/min (26.7 U.S.gals)
8.0 MPa (81.6 kgf/cm^2, 1160 psi)	98 L/min (25.9 U.S.gals)
10 MPa (102.0 kgf/cm^2, 1450 psi)	83 L/min (21.9 U.S.gals)
12 MPa (122.4 kgf/cm^2, 1741 psi)	71.9 L/min (19.0 U.S.gals)
14 MPa (142.8 kgf/cm^2, 2031 psi)	60 L/min (15.8 U.S.gals)
16 MPa (163.2 kgf/cm^2, 2321 psi)	53.7 L/min (14.2 U.S.gals)
18 MPa (183.5 kgf/cm^2, 2611 psi)	48.3 L/min (12.8 U.S.gals)
20 MPa (203.9 kgf/cm^2, 2901 psi)	42.5 L/min (11.2 U.S.gals)
22 MPa (224.3 kgf/cm^2, 3191 psi)	38.0 L/min (10.0 U.S.gals)
24 MPa (244.7 kgf/cm^2, 3481 psi)	34.1 L/min (9.0 U.S.gals)

RY9212469HYS0012US0

[2] AUX P-Q PERFORMANCE (MEASURED VALUES)



RY9212468HYS014A

(1) AUX1 (2) AUX2 **(a) Flow Volume (L/min)** **(b) Pressure (MPa)**

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.)**

RY9212469HYS0014US0

[3] RELIEF PRESSURE (MEASURED VALUES)

Item			Notes
Main P1 (aP1)		24.5 (-0.2, +0.3) MPa 250 (-2.0, +3.1) kgf/cm^2 3553 (-29, +44) psi	
Unload LS (aUN)		2.3 ± 0.25 MPa 23.5 ± 2.5 kgf/cm^2 334 ± 36 psi	
Pilot primary (aPP)		4.3 ± 0.15 MPa 43.9 ± 1.5 kgf/cm^2 624 ± 22 psi	
Boom	Bottom (b1B)	27.4 ± 0.5 MPa 279 ± 5.1 kgf/cm^2 3974 ± 73 psi	
	Rod (b1R)		
Arm	Bottom (b2B)		
	Rod (b2R)		
Bucket	Bottom (b3B)		
	Rod (b3R)		
Blade	Bottom (b4B)		
	Rod (b4R)	11.8 ± 0.5 MPa 120 ± 5.1 kgf/cm^2 1711 ± 73 psi	
AUX1	LH (b6B)	20.6 ± 0.5 MPa 210 ± 5.1 kgf/cm^2 2988 ± 73 psi	
	RH (b6R)		
Swivel motor	LH (cSL)	20.1 ± 0.5 MPa 210 ± 5.1 kgf/cm^2 2915 ± 73 psi	
	RH (cSR)		

RY9212469HYS0015US0

[4] SWIVEL PERFORMANCE

Item			Notes
Swivel block performance	Brake activate	≤ 1.0 mm (0.14 in.)	
	Brake deactivate		
Swivel speed	3revs	18.2 to 22.2 sec.	

RY9212469HYS0016US0

[5] TRAVEL PERFORMANCE

Item			Notes
Travel speed	Rubber 1 speed	10.9 to 13.3 sec.	10 m traveling time
	Rubber 2 speed	6.4 to 7.8 sec.	

RY9212469HYS0017US0

[6] CYLINDER PERFORMANCE

Item				Notes
Hydraulic cylinder operating time	Boom	Ground to max lift	2.8 ± 0.3 sec.	
		Max lift to ground	2.5 ± 0.3 sec.	
	Arm	Crowd	2.9 ± 0.3 sec.	
		Dump	2.5 ± 0.3 sec.	
	Bucket	Crowd	3.0 ± 0.3 sec.	
		Dump	1.9 ± 0.3 sec.	
	Swing	Left	4.6 ± 0.3 sec.	
		Right	6.2 ± 0.3 sec.	
	Blade	Max down to max up	2.7 ± 0.3 sec.	
		Max up to max down	2.9 ± 0.3 sec.	
Hydraulic cylinder drift	Boom	Factory specification	≤ 4.0 mm ≤ 0.16 in.	
		Usage limit	≤ 20 mm ≤ 0.79 in.	
	Arm	Factory specification	≤ 20 mm ≤ 0.79 in.	
		Usage limit	≤ 100 mm ≤ 3.94 in.	
	Bucket	Factory specification	≤ 25 mm ≤ 0.98 in.	
		Usage limit	≤ 125 mm ≤ 4.92 in.	
	Blade	Factory specification	≤ 20 mm ≤ 0.79 in.	
		Usage limit	≤ 60 mm ≤ 2.36 in.	

RY9212469HYS0018US0

12. TROUBLESHOOTING

[1] FRONT SYSTEM TROUBLESHOOTING

All front operations slow or not moving

Cause	Inspection point	Remedy
Defect of the engine itself	Engine speed measurement	Adjust each engine part
Insufficient hydraulic fluid volume or oil degradation	Check hydraulic tank oil level and oil quality	Replenish the hydraulic fluid supply or change the oil
Suction line (suction filter) blockage	Inspect the suction line (suction filter)	Wash the suction line Replace the suction line
Pilot filter blockage	Pilot filter blockage inspection	Replace pilot filter
Pilot relief valve faulty operation or poor pilot pump performance	Pilot primary pressure measurement	Adjust, wash or replace pilot relief valve Replace pilot pump
Poor main relief valve operation or seating	Main relief valve pressure measurement	Adjust, wash or replace main relief valve
Poor unload valve operation or seating	Control valve unload pressure measurement	Wash unload valve seat surface or replace
Drop in control differential pressure due to LS regulator spool stick	Pump LS regulator spool inspection	Wash LS regulator spool Replace LS regulator spool
Defective pump installation coupling	Pump installation coupling inspection	Replace pump coupling
Pump drive shaft breakage	Pump drive shaft inspection	Replace shaft
Pump internal parts wear or damage	Pump inspection	Repair or replace pump

RY9212469HYS0034US0

Either pilot valve right or left front does not move or is slow

Cause	Inspection point	Remedy
Pilot valve line filter blockage	Pilot valve line filter blockage inspection	Clean pilot filter line filter
Defective pilot valve	Pilot secondary pressure measurement of applicable cylinder	Pilot valve disassembly, cleaning or replacement

RY9212469HYS0039US0

Low power of entire hydraulic system

Cause	Inspection point	Remedy
Pilot relief valve faulty operation or poor pilot pump performance	Pilot primary pressure measurement	Adjust, wash or replace pilot relief valve Replace pilot pump
Poor main relief valve operation or seating	Main relief valve pressure measurement	Adjust, wash or replace main relief valve
Defective control differential pressure due to LS regulator spool stick	Pump LS regulator spool inspection	Wash LS regulator spool Replace LS regulator spool

RY9212469HYS0040US0

A certain cylinder only does not move or is slow

Cause	Inspection point	Remedy
Applicable pilot valve defect	Pilot secondary pressure measurement of applicable cylinder	Pilot valve disassembly, cleaning or replacement
Defective specified pressure of overload relief valve	Inspection of overload relief valve of applicable cylinder	Wash overload relief valve seat surface or replace
Control valve spool stick	Inspection of control valve spool of applicable cylinder	Control valve spool disassembly and washing
Defective seal of cylinder internal parts	Inspection of applicable cylinder	Cylinder disassembly and seal replacement

RY9212469HYS0041US0

Low power of certain implement

Cause	Inspection point	Remedy
Pilot relief valve faulty operation or poor pilot pump performance	Pilot primary pressure measurement	Adjust, wash or replace pilot relief valve Replace pilot pump
Defective specified pressure of overload relief valve	Inspection of overload relief valve of applicable cylinder	Wash overload relief valve seat surface or replace
Drop in control differential pressure due to LS regulator spool stick	Pump LS regulator spool inspection	Disassemble and wash LS regulator spool Replace LS regulator spool

RY9212469HYS0042US0

Major front leak (drift) volume

Cause	Inspection point	Remedy
Defective specified pressure of overload relief valve	Inspection of overload relief valve of applicable cylinder	Wash overload relief valve seat surface or replace
Control valve spool stick	Inspection of control valve spool of applicable cylinder	Control valve spool disassembly and washing
Defective seal of cylinder internal parts	Inspection of applicable cylinder	Cylinder disassembly and seal replacement

RY9212469HYS0043US0

[2] TRAVEL SYSTEM TROUBLESHOOTING

No travel on one side. Slow Meandering

Cause	Inspection point	Remedy
Crawler tension trouble or earth blockage around crawler	Crawler tension and blockage inspection	Earth removal around crawler and crawler tension adjustment
Defective travel pilot valve operation	Travel pilot valve secondary pressure measurement	Travel pilot valve disassembly, cleaning or replacement
Control valve spool stick	Control valve spool stick inspection	Control valve spool disassembly and washing
Control valve spool stick	Travel motor counterbalance spool inspection	Travel motor counterbalance valve disassembly, cleaning or replacement
Defective travel motor	Travel motor drain volume measurement	Travel motor disassembly, replacement
Internal leak of swivel joint	Remove the travel outlet hose of the swivel joint, plug it and measure the relief pressure	Swivel joint seal replacement

RY9212469HYS0035US0

[3] SWIVEL SYSTEM TROUBLESHOOTING

Swivel speed low or no swivel

Cause	Inspection point	Remedy
Defective pilot valve	Travel pilot valve secondary pressure measurement	Pilot valve disassembly, cleaning or replacement
Swivel section spool stick	Control valve swivel section spool inspection	Clean spool
Defective swivel relief specified pressure	Swivel relief pressure measurement	Swivel relief valve washing or replacement
Internal defect of swivel motor	Swivel motor drain volume measurement	Swivel motor disassembly, replacement
Snagging or sticking of friction plate for swivel motor parking brake	Inspection for snagging or sticking of friction plate for swivel motor parking brake	Replace friction plate

RY9212469HYS0036US0

Swivel drift

Cause	Inspection point	Remedy
Pilot valve spool stick	Check that the pilot valve spool has returned to neutral	Pilot valve disassembly, cleaning or replacement
Swivel section spool stick	Control valve swivel section spool inspection	Control valve spool disassembly and washing
Defective swivel relief specified pressure	Swivel relief pressure measurement	Swivel relief valve washing or replacement
Swivel motor make-up poppet stick or defective seat surface	Swivel motor make-up poppet inspection	Make-up poppet disassembly and washing
Internal defect of swivel motor	Swivel motor drain volume measurement	Swivel motor disassembly, replacement

RY9212469HYS0044US0

4 ELECTRICAL SYSTEM

MECHANISM

CONTENTS

1. GENERAL

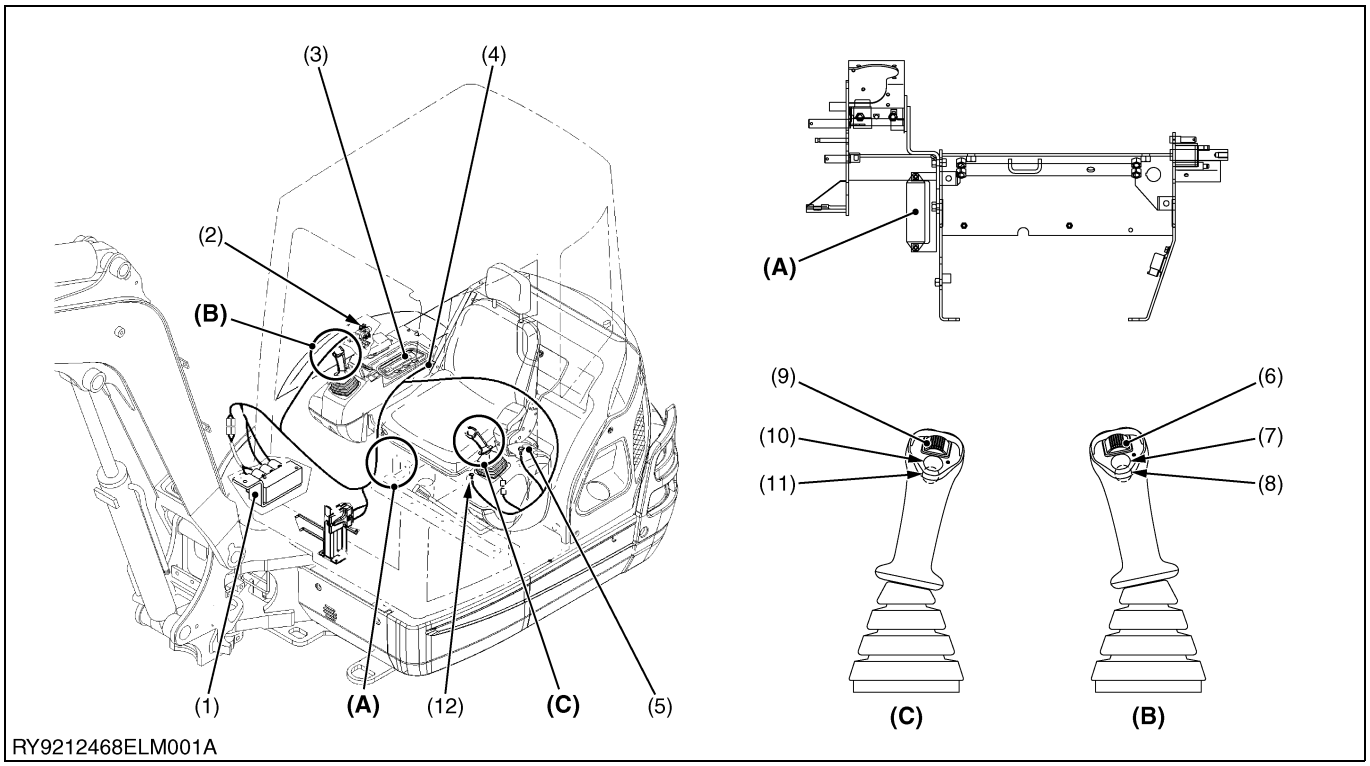
[1] GENERAL EXPLANATION FOR HI SPEC VERSION

- The additional need electrical power supplies for Hi spec version are taken from the main harness and secured with additional fuse.
- Main control system of the machine (include AUX1) is same as KX101-3α4 Standard version.
- AUX2 is controlled by HYDRAFORCE software.
- Flow control for AUX2 can be adjusted with rotary switch.
- Select AUX2 or Boom swing by pressing a switch (10).
- Default setting when starting the engine is AUX2. When AUX2 is selected, the indicator is OFF.
- When Boom swing operation is selected, the indicator is ON. (Green light)

RY9212469ELM0001US0

[2] ELECTRICAL DEVICES LAYOUT

Hi Spec



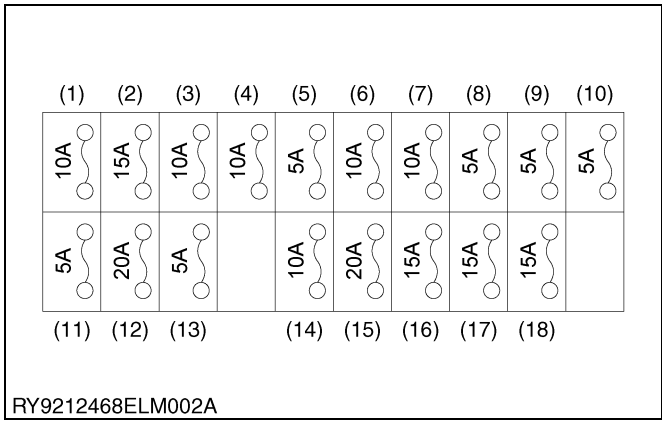
RY9212468ELM001A

(1) Proportional Valve
(2) Selector Valve
(3) Meter
(4) Connected to Main Harness
(5) Rotary Switch (Potentiometer)
(6) Switch (AUX1)
(7) Switch (Horn)
(8) Switch (AUX1 Hold)
(9) Switch (AUX2)
(10) Switch (Selector)
(11) Non Function
(12) Indicator

(A) Fuse Box
(B) Control Lever (RH)
(C) Control Lever (LH)

RY9212469ELM0002US0

[3] FUSE

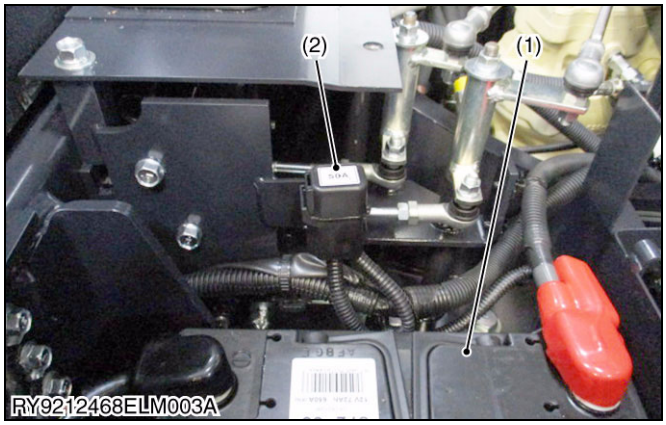


RY9212468ELM002A

(1) Heater Fan
(2) AI Motor
(3) Anti-Theft (Sub)
(4) Alternator / Fuel Pump
(5) Lever Lock
(6) Horn
(7) Meter Panel (Main)
(8) High Speed
(9) Relay
(10) Anti-Theft (Main)
(11) Room Light
(12) Work Light
(13) Meter Panel (Sub)
(14) Electrical Outlet 1 (Hi Spec Only)
(15) Electrical Outlet 2 (Hi Spec Only)
(16) Cigarette Lighter
(17) Auxiliary (Radio)
(18) Wiper, Washer

RY9212469ELM0003US0

[4] SLOW BLOW FUSE



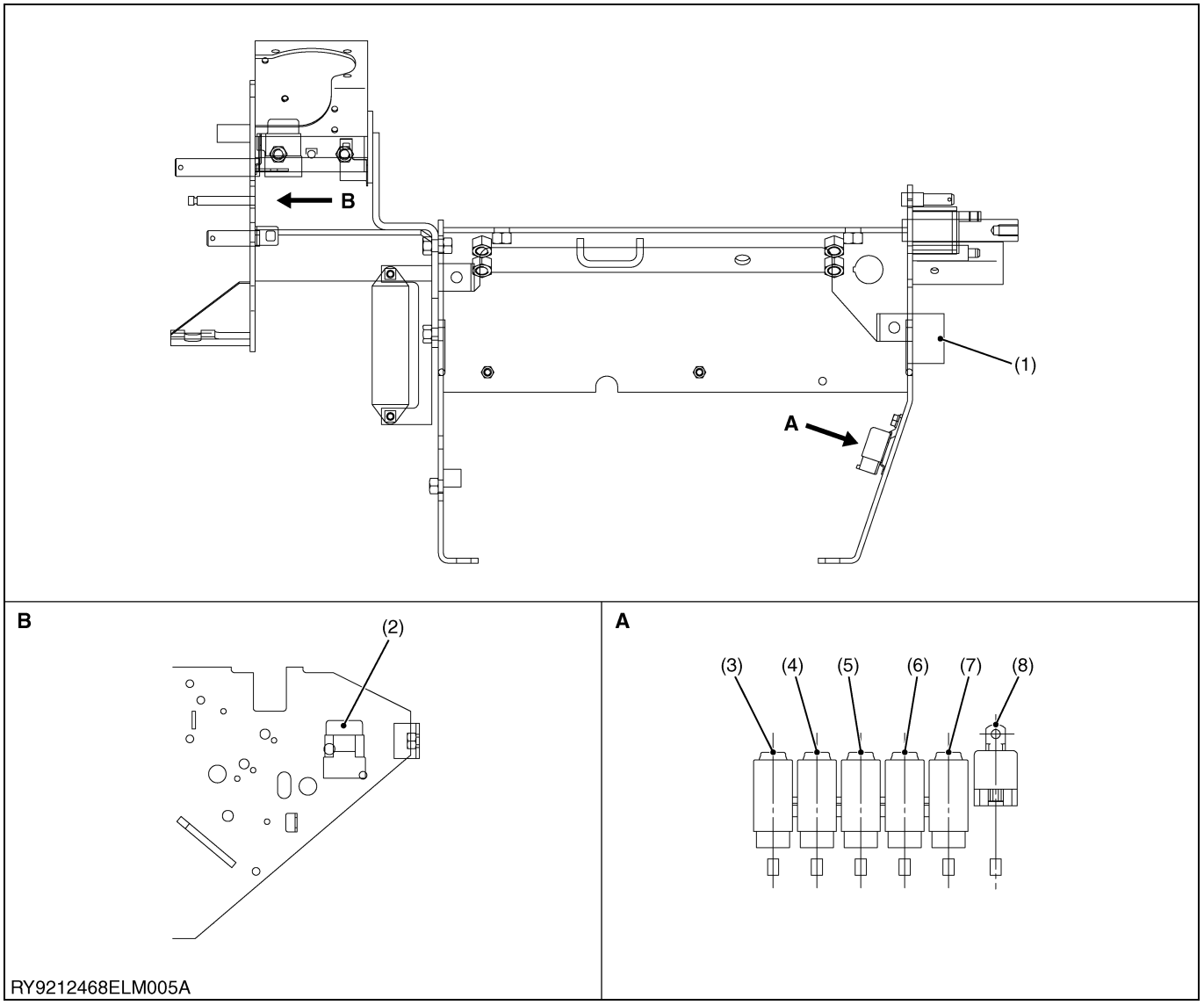
(1) Battery
(2) Main (50 A)

RY9212469ELM0004US0

(3) Alternator
(4) Alternator (60 A)

RY9212469ELM0005US0

[5] RELAY



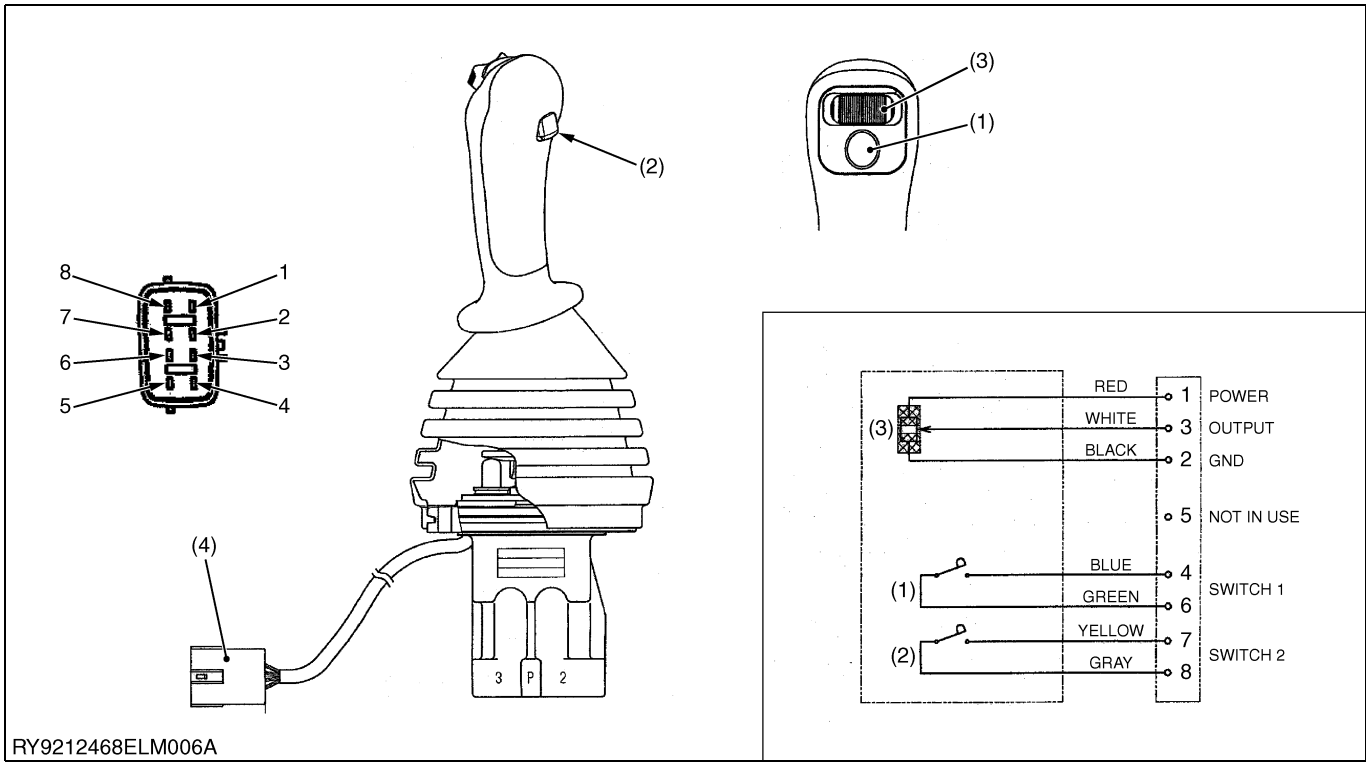
(1) AI Self-Hold
(2) Glow
(3) Auto Idle
(4) Work Light
(5) Horn
(6) Auto Release
(7) Cabin
(8) Heater

RY9212469ELM0006US0

2. CONTROL SWITCH (CONTROL LEVER)

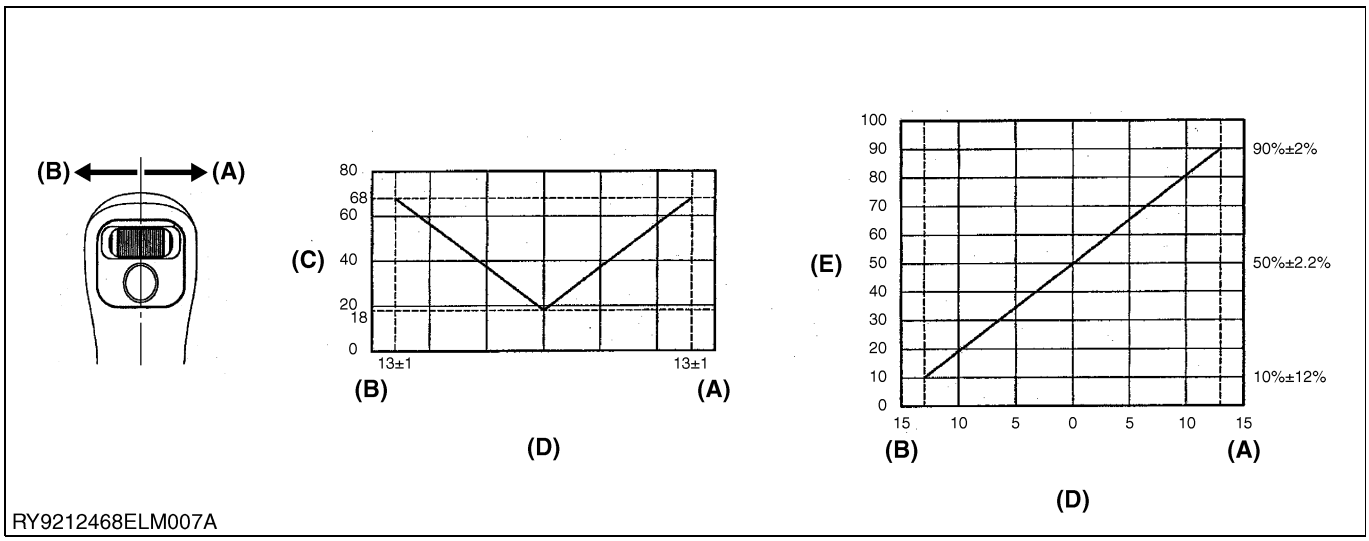
[1] SPECIFICATIONS

Standard RH / Hi Spec RH, LH



(1) Switch 1 (2) Switch 2 (3) Slider Lever (4) Connector

RY9212469ELM0007US0

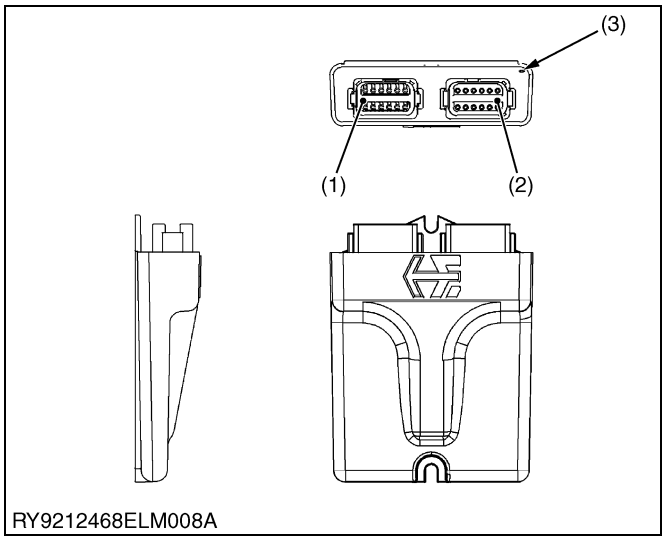


(A) RH End
(B) LH End
(C) Operating Torque (N·m) **(D) Operating Angle (Deg)** **(E) Output (%)**

RY9212469ELM0008US0

3. CONTROLLER AUX2

[1] SPECIFICATIONS



RY9212468ELM008A

Hi Spec

Manufacturer	HYDRAFORCE
Model	ECDR-0506A-001

Gray Plug - X1	
Description	**Pin**
Supply Voltage	1
Signal Ground	2
Output 1 +	3
Output 1 –	4
Output 2 +	5
Output 2 –	6
+5 Volt Supply	7
CAN Low	8
CAN High	9
Input 1 Signal	10
Input 2 Signal	11
Supply Voltage Ground	12

Gray Plug - X2	
Description	**Pin**
Output 3 –	1
Output 4 +	2
Output 4 –	3
Output 5 +	4
Output 5 –	5
Input 5 Signal	6
Input 6 Signal	7
Input 3 Signal	8
Signal Ground	9
Input 4 Signal	10
Signal Ground	11
Output 3 +	12

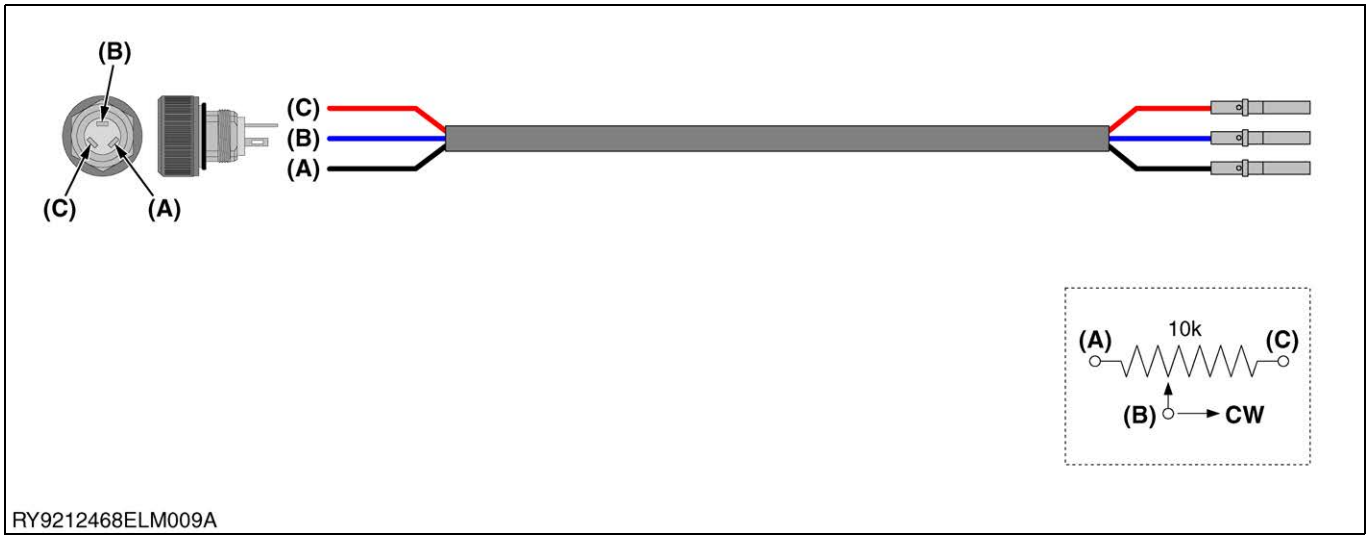
(1) X1
(2) X2
(3) LED

RY9212469ELM0009US0

4. POTENTIOMETER

[1] SPECIFICATIONS

Hi Spec



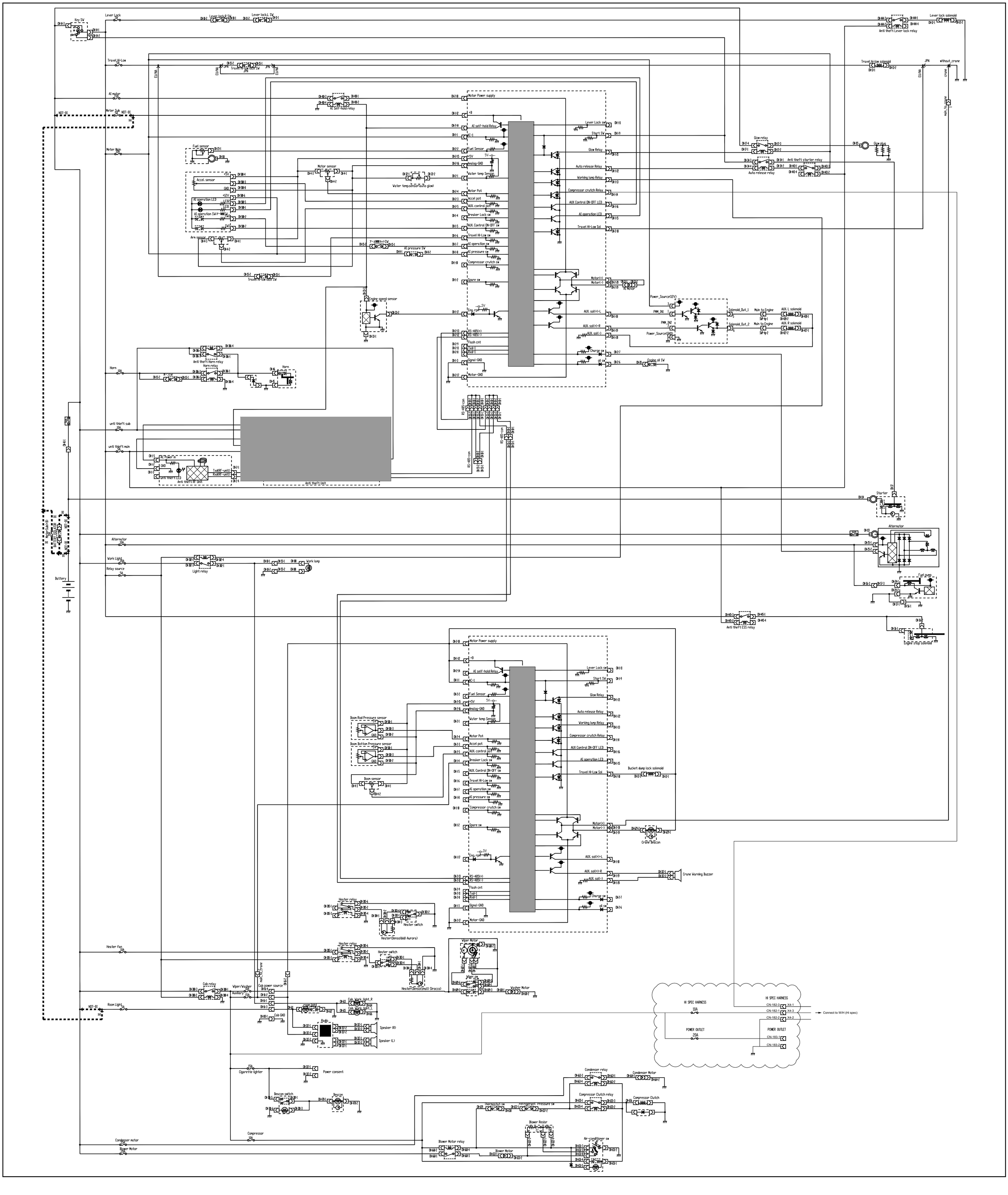
RY9212468ELM009A

(A) GND **(B) OUTPUT** **(C) POWER**

Manufacturer	HYDRAFORCE
Model	ECDR-0506A-001

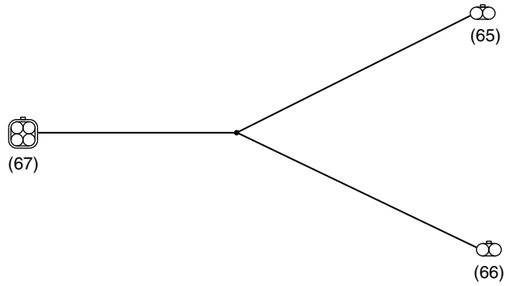
RY9212469ELM0010US0

5. ELECTRICAL CIRCUIT DIAGRAM (KX101-3α4)

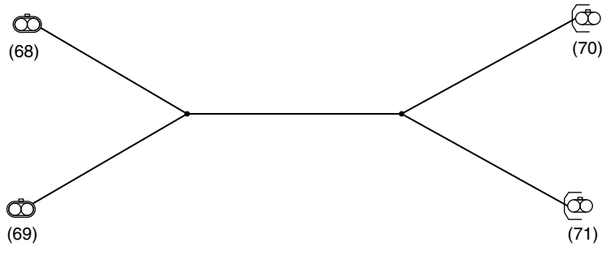


6. WIRE HARNESS

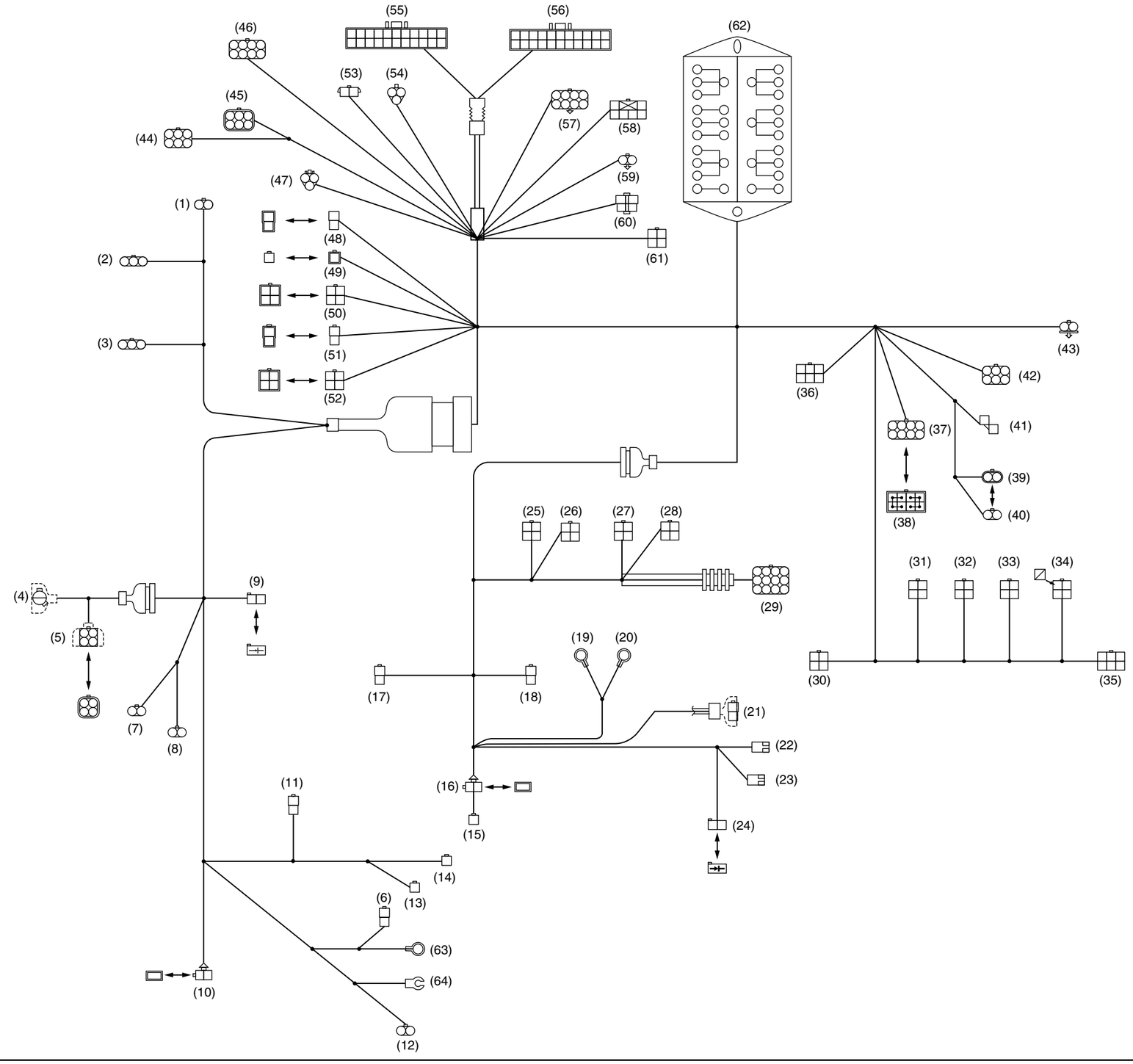
AUX1 HARNESS



AUX2 HARNESS



MAIN HARNESS



MAIN HARNESS

(1) Engine Stop Solenoid 7383-1528	(2) Governor Sensor 7383-7131	(3) Engine Speed Sensor 7383-8732	(4) AI Pressure SW 7383-7222	(5) Control Solenoid Harness 7223-7444 7323-7444	(6) Alternator 7323-2820	(7) 2-Speed Solenoid 7319-5326	(8) Lever Locl Solenoid 7319-5326
(9) Diode 7323-7729	(10) SBF 60A 7147-5846	(11) Fuel Pump 7323-2820	(12) Oil Temperature sensor No Image 7383-5106	(13) Starter 7323-2710	(14) Oil SW 7323-2710	(15) Battery 7323-4113	(16) SBF 50A 7147-5846
(17) Front Harness 7323-2820	(18) Fuel Sensor Harness 7323-2820	(19) (20) Ground 7009-1836	(21) AI Motor 7323-2820	(22) (23) Horn No Image 7116-2030	(24) Diode (Horn) 7323-7729	(25) Theft ESS Relay 7323-2840	(26) Theft Horn Relay 7323-2840
(27) Theft Lever Lock Relay 7323-2840	(28) Theft Starter Relay 7323-2840	(29) Unit No Image 7323-7923	(30) AI Self Hold Relay 7323-2840	(31) Work Light Relay 7323-2840	(32) Horn Relay 7323-2840	(33) Auto Release Relay 7323-2840	(34) Cabin Relay 7323-2840
(35) Heater Relay 7323-5365	(36) Heater Harness 7323-2860	(37) Joint Connector 7383-1081	(38) Cap No Image 7382-1481	(39) Signal 7382-4421	(40) Signal 7382-1639	(41) Cigarette Lighter 7323-8322	(42) AUX Cont 7323-8968
(43) Lever Lock SW (LH) 7383-1528	(44) Cap 7323-1461	(45) Antenna Unit 7322-1461	(46) AI Panner 7323-8988	(47) Key Switch 7323-6234	(48) AMP 7322-2810	(49) Cabin Ground 7323-2840	(50) Cabin 7323-2840
(51) Beacon Power 7323-2820	(52) Hi-Spec Harness 7323-2840	(53) 2-Speed Lamp 7323-1520	(54) 2-Speed Lock SW 7328-1231	(55) (56) Panel 7383-2360	(57) JS Control 7383-1588	(58) Beacon SW 7383-1261	(59) Lever Lock SW (RH) 7383-1528
(60) Glow Relay 7323-9246	(61) Heater SW 7323-2840	(62) F / Box 7147-9178					
(63) Alternator 7009-1342	(64) Glow Relay 7010-3025						

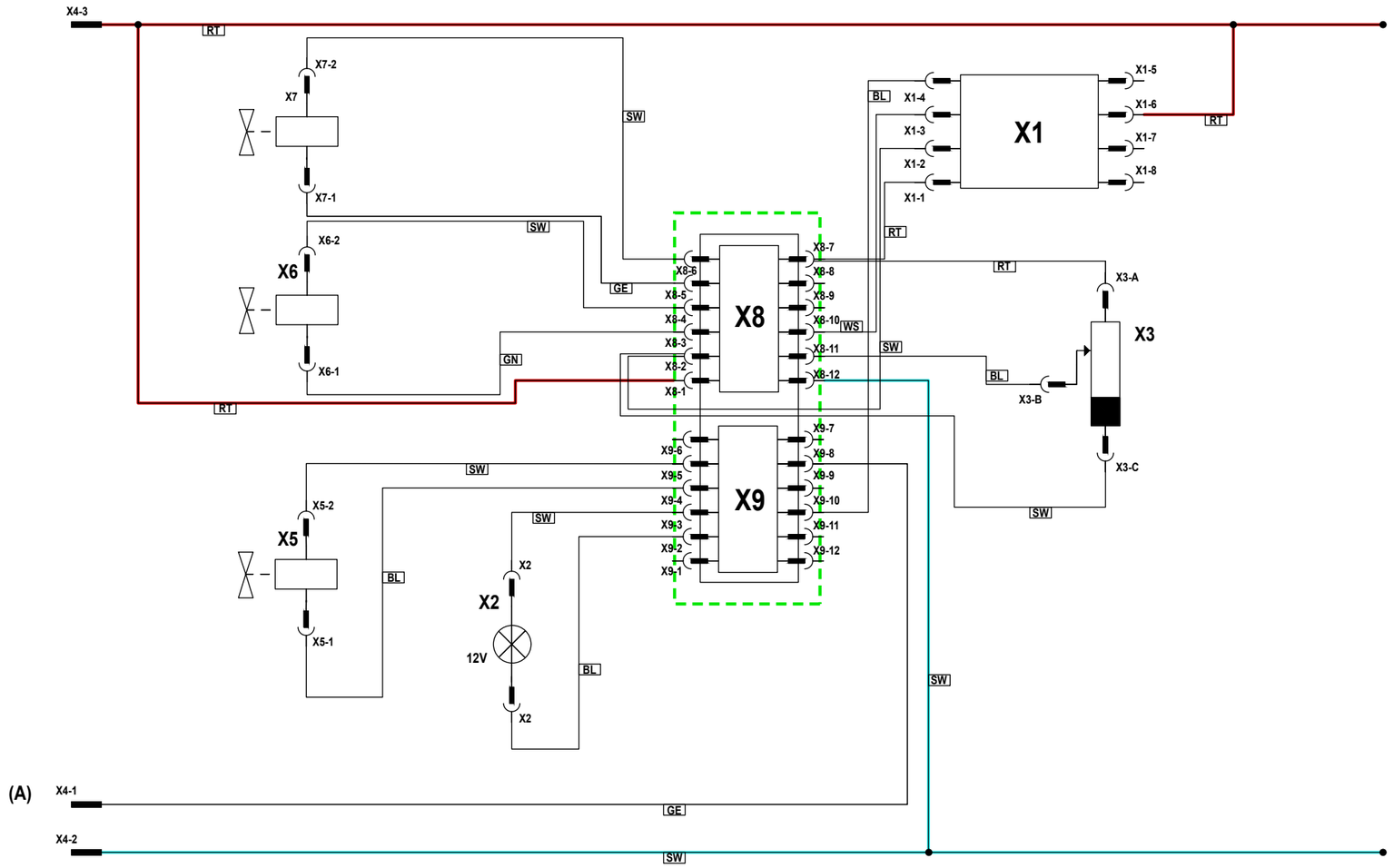
AUX1 HARNESS

(65) AUX (RH) CTL SOL 7223-8321	(66) AUX (LH) CTL SOL 7223-8321	(67) To Main Harness 7322-7444

AUX2 HARNESS

(68) Main Harness 1 7328-1076	(69) Main Harness 2 7328-1076	(70) AUX (RH) CTL SOL 7323-8321	(71) AUX (RH) CTL SOL 7323-8321

7. ELECTRICAL CIRCUIT DIAGRAM (HI SPEC)



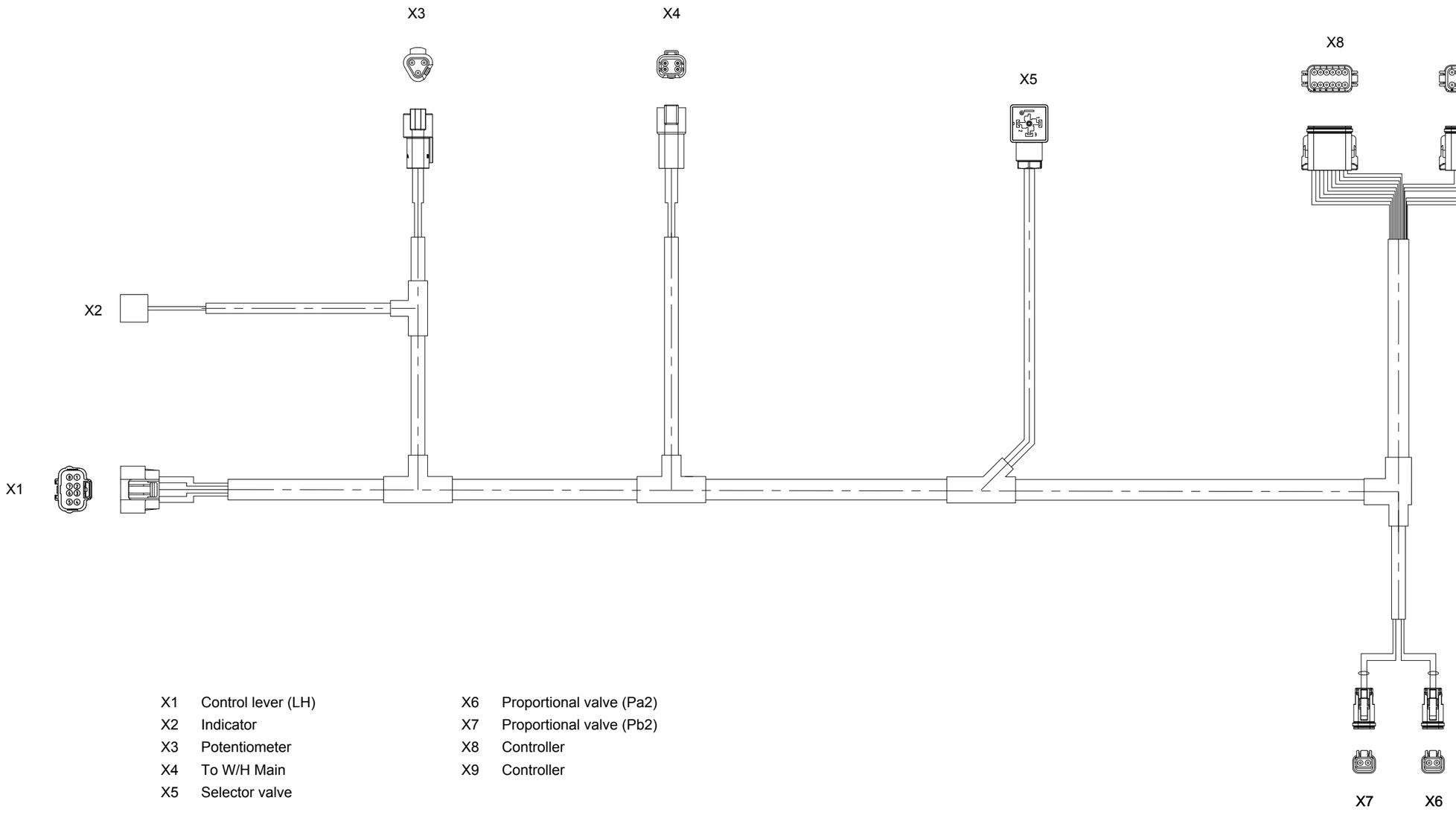
Scheme of cable run					
Wire No.	From	To	Colour	L[m]	A[mm²]
1	X4-2	X8-12	black	1.63	2.50
2	X4-1	X9-8	yellow	1.63	0.50
3a	X4-3	X8-1	red	1.63	2.50
3b	X4-3	X1-6	red	1.30	0.75
4	X1-4	X9-10	blue	2.35	0.75
5	X9-4	X5-1	blue	1.50	0.75
6	X9-5	X5-2	black	1.50	0.75
7a	X8-2	X3-C	black	2.33	0.75
7b	X8-2	X1-2	black	2.35	0.75
8a	X8-7	X3-A	red	2.33	0.75
8b	X8-7	X1-1	red	2.35	0.75
9	X1-3	X8-10	White	2.35	0.75
10	X3-B	X8-11	blue	2.33	0.75
11	X8-3	X6-1	green	0.92	0.75
12	X8-4	X6-2	black	0.92	0.75
13	X8-5	X7-1	yellow	0.92	0.75
14	X8-6	X7-2	black	0.92	0.75
15	X9-2	X-2	blue	2.60	0.75
16	X9-3	X-2	black	2.60	0.75

RT	RED
GN	GREEN
SW	BLACK
WS	WHITE / BLACK
BL	BLUE
GE	YELLOW

X1 : Pilot control lever (LH)
X2 : Lamp
X3 : Potentiometer (LH)
X5 : Selector valve
X6 : Proportional valve
X7 : Proportional valve
X8 : Controller
X9 : Controller
(A) : To Meter

8. WIRE HARNESS (HI SPEC)

HI SPEC HARNESS



X1	Control lever (LH)	X6	Proportional valve (Pa2)
X2	Indicator	X7	Proportional valve (Pb2)
X3	Potentiometer	X8	Controller
X4	To W/H Main	X9	Controller
X5	Selector valve		

EDITOR:
KUBOTA CORPORATION
CONSTRUCTION MACHINERY
SERVICE TECHNICAL SUPPORT DEPARTMENT
1-1 NAKAMIYA-OHIKE 1-CHOME, HIRAKATA-CITY, OSAKA, 573-8573, JAPAN
PHONE : (81)72-840-1195
FAX : (81)72-890-2883
E-mail : kbt_g.ce-sv@kubota.com

KUBOTA Corporation Printed in Japan 2016. 08, H, EI, EI, engusa Code No.RY911-24690