WSM

WORKSHOP MANUAL
KUBOTA WHEEL LOADER

R320S,R320S(B)

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KiSC issued 03, 2011 A

CONTENTS

TO THE READER
TO THE READER
INFORMATION
CONTENTS
INFORMATION
1. SAFETY FIRST I-1
2. WORK SAFETY..... I-2
3. SAFETY DECALS I-6
4. TABLE OF MAIN SPECIFICATIONS I-10
5. DIMENSIONS I-12
GENERAL
CONTENTS
GENERAL
1. MACHINE INDENTIFICATION G-1
2. ENGINE INDENTIFICATION.....G-2
3. GENERAL PRECAUTIONS.....G-3
4. HANDLING PRECAUTIONS FOR ELECTRICAL PARTS AND WIRING.....G-7
5. TYPES OF OIL G-11
6. TIGHTENING TORQUES.....G-12
7. MAINTENANCE CHECK LIST G-17
ENGINE
CONTENTS
GENERAL
1. ENGINE 1-G1
2. SPECIAL TOOLS 1-G4
SERVICING
1. TROUBLESHOOTING.....1-S1
2. SERVICE STANDARD 1-S6
3. TIGHTENING TORQUES..... 1-S11
4. DISASSEMBLY, REASSEMBLY AND MAINTENANCE..... 1-S13
5. RADIATOR 1-S70
6. ACCELERATOR..... 1-S71
7. FUEL HOSES 1-S73
8. MUFFLER..... 1-S74
9. AIR CLEANER..... 1-S75
10. ENGINE MOUNTS 1-S76
HYDRAULIC SYSTEM
CONTENTS
MECHANISM
1. HYDRAULIC CIRCUIT 2-M1
2. HYDRAULIC EQUIPMENT SCHEMATIC..... 2-M2
3. OIL FLOW..... 2-M3
4. LST PUMP SPECIFICATIONS..... 2-M5
5. LST MOTOR SPECIFICATIONS..... 2-M6
SERVICING
1. LST PUMP.....2-S1
2. LST MOTOR.....2-S22
3. HL CONTROL VALVE 2-S30
4. FILTER FLANGE 2-S32
5. OIL TANK 2-S33
6. ROUTING OF HYDRAULIC HOSES.....2-S34
7. MEASUREMENT OF HYDRAULIC DEVICE PERFORMANCE 2-S40
8. TROUBLESHOOTING (HYDRAULIC SYSTEM).....2-S47
9. BREAKDOWN TOWING PROCEDURE.....2-S51
POWER TRAIN
CONTENTS
MECHANISM
1. DRIVETRAIN 3-M1
SERVICING
1. TRANSMISSION.....3-S1
2. FRONT AXLE AND REAR AXLE DIFFERENTIAL CASES 3-S7
BRAKES
CONTENTS
MECHANISM
1. BRAKE SYSTEM 4-M1
SERVICING
1. BRAKE COMPONENTS 4-S1
2. MASTER CYLINDER.....4-S5
3. NEGATIVE BRAKE.....4-S6
4. BRAKE LINE AIR BLEEDING PROCEDURE 4-S12
5. BRAKE PERFORMANCE MEASUREMENTS.....4-S13
6. TROUBLESHOOTING (BRAKE SYSTEM).....4-S15
STEERING
CONTENTS
MECHANISM
1. STEERING SYSTEM..... 5-M1
2. STEERING CONTROLLER SPECIFICATIONS 5-M3
3. STEERING CYLINDER SPECIFICATIONS 5-M4
SERVICING
1. STEERING WHEEL UNIT 5-S1
2. STEERING CONTROLLER.....5-S2
3. STEERING CYLINDER 5-S22
4. STEERING PERFORMANCE MEASUREMENT 5-S28
5. TROUBLESHOOTING (STEERING).....5-S29
FRONT LOADER
CONTENTS
MECHANISM
1. FRONT LOADER..... 6-M1
SERVICING
1. FRONT.....6-S1
2. IMPLEMENT CONTROL LEVER.....6-S3
3. CONTROL VALVE.....6-S5
4. MEASURING FRONT PERFORMANCE.....6-S15
5. TROUBLESHOOTING (FRONT).....6-S20

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1. SAFETY FIRST

⚠ SAFETY FIRST

- **This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully.**
- **It is essential that you read the instructions and safety regulations before you attempt to repair or use this unit.**

⚠ DANGER
- **Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**

⚠ WARNING
- **Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

⚠ CAUTION
- **Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.**

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

■ NOTE
- **Gives helpful information.**

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TO THE READER

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

■ General

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

■ Mechanisms

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

■ Service

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

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

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

■ NOTE

- **Corresponding model list**

Machine Model		Engine Model
R320S, R320S(B)	For Canada	V1305-E3-RP

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5. TYPES OF OIL

[1] TABLE OF OIL AND FLUID CAPACITIES

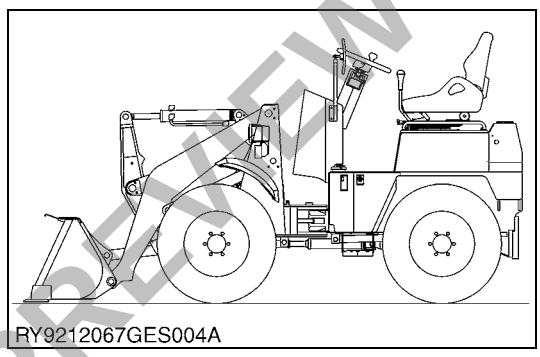
Replenish place	Kind of fuel oil and water	Capacity	Viscosity No. classified by temperature
Fuel tank	Light oil	26 L (6.87 us.gal.)	Refer to recommended fuels
Engine oil pan	Engine oil	4.3 L (1.14 us.gal.)	**SAE 10W (CF)**: -20 to 10 °C (-4 to 50 °F) **SAE 30W (CF)**: 10 to 40 °C (50 to 104 °F) **SAE 10W-30 (CF)**: -20 to 40 °C (-4 to 104 °F)
Front axle differential case	Gear oil	2.3 L (0.61 us.gal.)	**SAE 80W:** -20 to 40 °C (-4 to 104 °F)
Rear axle differential case	Gear oil	4.3 L (1.14 us.gal.)	**SAE 80W**: -20 to 40 °C (-4 to 104 °F)
Hydraulic oil tank	Engine oil	20 L (5.28 us.gal.)	**SAE 5W-30 (CF)**: -20 to 40 °C (-4 to 104 °F) **SAE 10W-30 (CF)**: -10 to 40 °C (14 to 104 °F) **SAE 15W-40 (CF)**: 0 to 40 °C (32 to 104 °F)
Brake fluid reservoir	Hydraulic oil	0.3 L (0.08 us.gal.)	**Hydraulic oil ISO VG32**: -20 to 40 °C (-4 to 104 °F)
Grease nipple	Grease	–	**No.0**: -20 to -10 °C (-4 to 14 °F) **No.1**: -10 to 0 °C (14 to 32 °F) **No.2**: 0 to 40 °C (32 to 104 °F)
Radiator [Reserve tank]	Water	4.1 L (1.08 us.gal.) [1.0 L (0.26 us.gal.)]	**Anti-freeze**: 0 to 20 °C (32 to 68 °F) **Soft water**: 0 to 40 °C (32 to 104 °F)

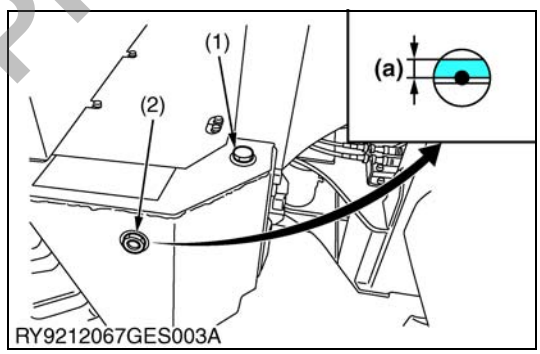
■ **IMPORTANT**

- **In areas where the temperature drops to -10 °C (14 °F) or lower, drain all oil in hydraulic oil tank and replace with all season type engine oil SAE5W-30(CF) for the winter.**
- **Use engine oil API service classification CF.**

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[2] CHECKING AND FILLING HYDRAULIC OIL


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Stop the vehicle on flat ground and lower the bucket to the ground.

With the hydraulic oil at a normal temperature (10 to 30 °C), check whether it is in the center of the oil level sight glass(2).

The level is fine if it is in the middle or above **(a)** of the oil level sight glass.

If it is low, add oil via the filler hole (1).

(1) Filler hole
(2) Oil level sight glass
(a) Hydraulic oil normal range

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Maintenance table

(Each servicing requires that the previously mentioned servicing works have to be performed.)

Servicing works	After			Time meter								
	50 h	100 h	500 h	every 50 h	every 100 h	every 200 h	every 250 h	every 500 h	every 1000 h	every 2000 h	Yearly	Once every two years
Check the battery stage				❍								
Bleed the fuel tank				❍								
Change the engine oil	■				□							
Replace the engine oil filter	■					□						
Check and adjust the V-belt tension						❍						
Check and replace the air filter				●		❍			□			
Check the front/rear differential housing and check the oil level, refill, change			■					❍	□			
Change the hydraulic oil			■						□			
Replace the LST filter								□				
Replace the return filter								□				
Replace the suction filter			■						□			
Replace the fuel filter								□				
Check the alternator and starter										❍		
Change the coolant	Twice a year (Spring and Autumn)											
Check and replace the radiator hoses and hose clamps						❍						□
Check the fuel lines and hoses												□
Replace the hydraulic hoses												□
Check and tighten the wheel nuts		●					❍					
Check the electrical cables and connectors											❍	

- ❍ : checking, refilling, cleaning
- ● : checking for the first time, refilling
- □ : replacing
- ■ : replacing for the first time

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1. TROUBLESHOOTING

Problem	Cause	Remedy	Reference Page
Engine won't start	**Engine**		
	Poor valve clearance (insufficient compression)	Adjust the valve clearance Replace the head gasket	1-S15
	External air leak (insufficient compression)	Tighten the head bolt(s), nozzle holder ASSY, and/or glow plugs	1-S17 1-S19
	Internal air leak (insufficient compression)	Replace the piston rings	1-S27
	Incorrect valve timing (insufficient compression)	Check the timing gear	1-S36
	Poor valve seating (insufficient compression)	Replace valve spring(s) and touch up the valve seats	1-S29 1-S40
	Scorched crankshaft, camshaft, pistons and/or bearings	Repair or replace	–
	Increased combustion chamber volume (insufficient compression)	Correct valve seat recession	1-S32
	Fuel System		
	No fuel	Fill with fuel	–
	Using a fuel with too high a viscosity	Replace with the specified fuel	–
	Using a fuel with too low a cetane number	Replace with the specified fuel	–
	Water in the fuel	Replace with the specified fuel	–
	Gasoline mixed in with the fuel	Replace with the specified fuel	–
	Fuel filter clogged	Replace the fuel filter element	–
	Fuel leaking from the injection pipe nut	Tighten the nut	1-S17
	Fuel pipe clogged	Clean and/or fix	–
	Injection nozzle faulty	Repair or replace	1-S17
	Fuel pump fault	Replace	–
	Incorrect fuel injection timing	Adjust	1-S52
	Injection pump faulty	Replace	–
	Electrical System		
	Insufficient battery capacity	Replace with battery of specified capacity	–
	Battery discharged	Recharge or replace	–
	Starter faulty	Repair or replace	1-S58
	Miswiring and/or faulty wiring	Inspect and correct	–
	Starter switch faulty	Repair or replace	–
	Fuse burned out	Replace after correcting the cause	–
	Engine stop solenoid malfunction or faulty	Inspect, fix or replace	–

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2. SERVICE STANDARD

Engine Overall

Item		Factory Specification	Allowable limit
Compression		3.72 to 4.12 MPa (38 to 42 kgf/cm^2, 539 to 596 psi)	2.25 MPa (23 kgf/cm^2, 327 psi)
	Difference between cylinders	–	10% or less
Top Clearance		0.55 to 0.75 mm 0.0217 to 0.0276 in.	–

Engine

Item			Factory Specification	Allowable limit
Crankcase	Deflection in mating surfaces of the head		–	0.05 mm / 100mm 0.0020 in. / 3.92 in.
	Cylinder I.D.	V1305	76.000 to 76.019 mm 2.9921 to 2.9929 in.	76.15 mm 2.998 in.
		Oversized	+ 0.5 mm 0.0197 in.	–
Cylinder head	Deflection in mating surfaces of the crankcase		–	0.05 mm / 100mm 0.0020 in. / 3.92 in.

Major Moving Parts

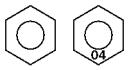
Item			Factory Specification	Allowable limit
Piston	Clearance of the piston pin and its bushing		0.014 to 0.038 mm 0.00055 to 0.00150 in.	0.15 mm 0.0059 in.
	Piston pin O.D.		22.002 to 22.011 mm 0.8662 to 0.8666 in.	–
	Connecting rod small end bushing I.D.		22.025 to 22.040 mm 0.8671 to 0.8677 in.	–
	Piston pin hole I.D.		22.000 to 22.013 mm 0.8661 to 0.8667 in.	22.03 mm 0.8673 in.
Piston rings	Clearance with the ring groove	Second	0.085 to 0.112 mm 0.0033 to 0.0044 in.	0.20 mm 0.0079 in.
		Oil	0.020 to 0.055 mm 0.0008 to 0.0021 in.	0.15 mm 0.0059 in.
	End gap	Top	0.30 to 0.45 mm 0.0118 to 0.0177 in.	1.25 mm 0.0492 in.
		Second	0.30 to 0.45 mm 0.0118 to 0.0177 in.	1.25 mm 0.0492 in.
		Oil	0.25 to 0.40 mm 0.0098 to 0.0157 in.	1.25 mm 0.0492 in.
Connecting rod	Warpage, twisting		–	0.05 mm 0.0020 in.
	Small end bushing I.D.		22.025 to 22.040 mm 0.8671 to 0.8677 in.	–

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3. TIGHTENING TORQUES

When the tightening torques are not specified, tighten the screws, bolts and nuts according to the table below.

Indication on top of bolt	 No-grade or 4T			 7T		
Indication on top of nut	 No-grade or 4T					
Unit	**N·m**	**kgf·m**	**lbf·ft**	**N·m**	**kgf·m**	**lbf·ft**
M6	7.9 to 9.3	0.80 to 0.95	5.8 to 6.8	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31
M8	18 to 20	1.8 to 2.1	13 to 15	24 to 27	2.4 to 2.8	18 to 20
M10	40 to 45	4.0 to 4.6	29 to 33	49 to 55	5.0 to 5.7	37 to 41
M12	63 to 72	6.4 to 7.4	47 to 53	78 to 90	7.9 to 9.2	58 to 66

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Screw and bolt material grades are shown by numbers punched on the screw and bolt heads. Prior to tightening, be sure to check out the numbers as shown below.

Punched number	Screw and bolt material grade
None or 4	Standard screw and bolt SS41, S20C
7	Special screw and bolt S43C, S48C (Refined)

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4. DISASSEMBLY, REASSEMBLY AND MAINTENANCE

[1] ENGINE

(1) Inspection and Adjustments

Checking the Compression

To keep the engine operating in good condition and maintain a good idle, acceleration, output and fuel consumption, the engine demands that three factors be fulfilled, namely good intake of air, good compression and good fuel injection.

Checking the pressure during compression is a way to inspect whether one of these three factors, good compression, exists or not; whether the engine has good compression or not has a huge impact on the engine's condition and of itself increases or decreases the force of combustion in the cylinder.

Consequently, when engine performance is poor, such as when it idles poorly, has low power output or is hard to start, along with inspecting the fuel system, check whether the compression of each of the cylinders is appropriate or not.

When the results of such checks are below the limit for compression and/or outside the limit for the difference between cylinders, it allows the problem(s) to be deduced, such as wear or damage to the cylinders, pistons and piston rings, poor seating of the valves in their seats and/or a blown head gasket.

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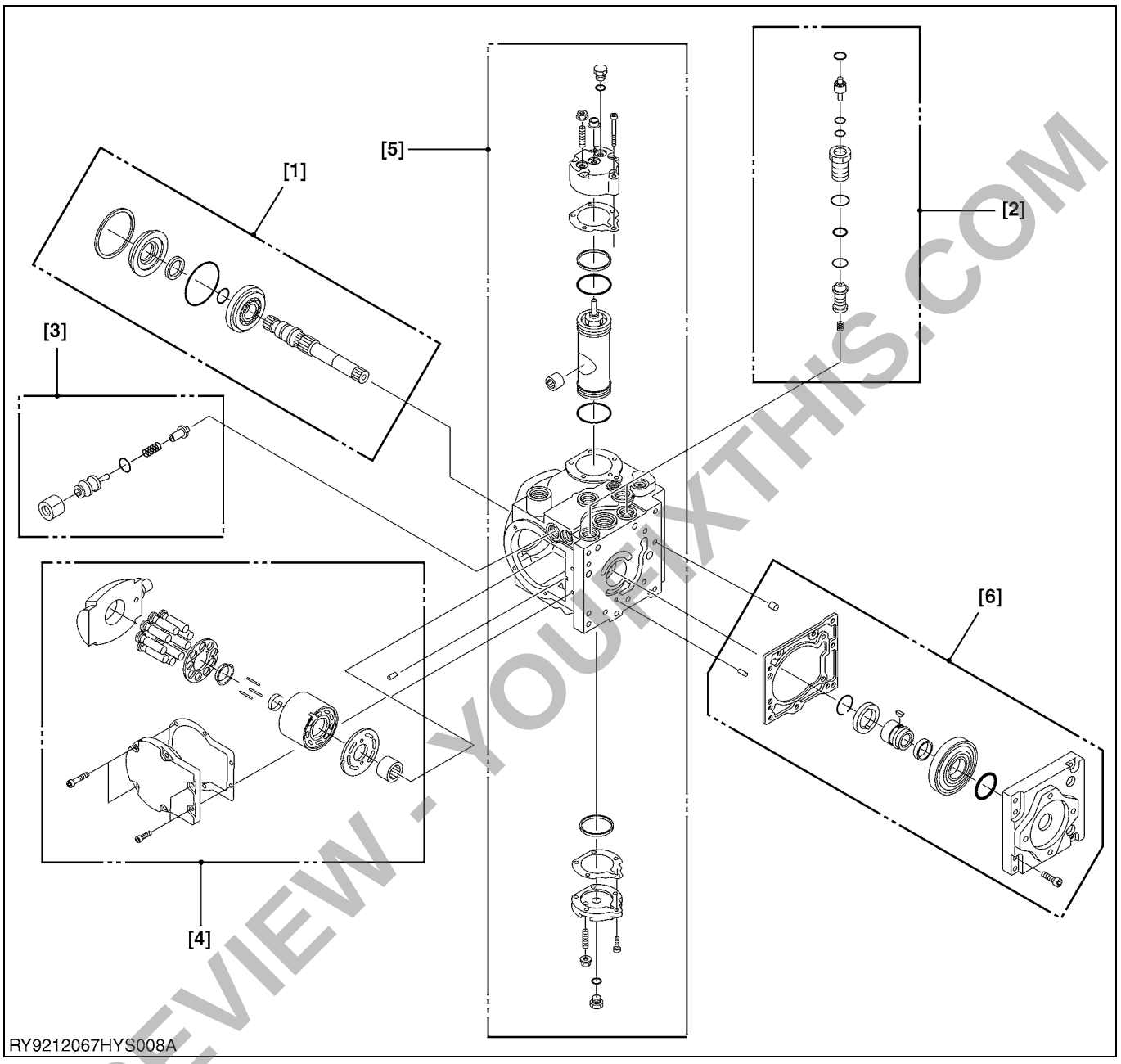
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[4] GUIDE TO LST PUMP DIS/REASSEMBLY

- If a part is indicated with the oil can icon (🛢) in this manual, apply oil to it during installation.

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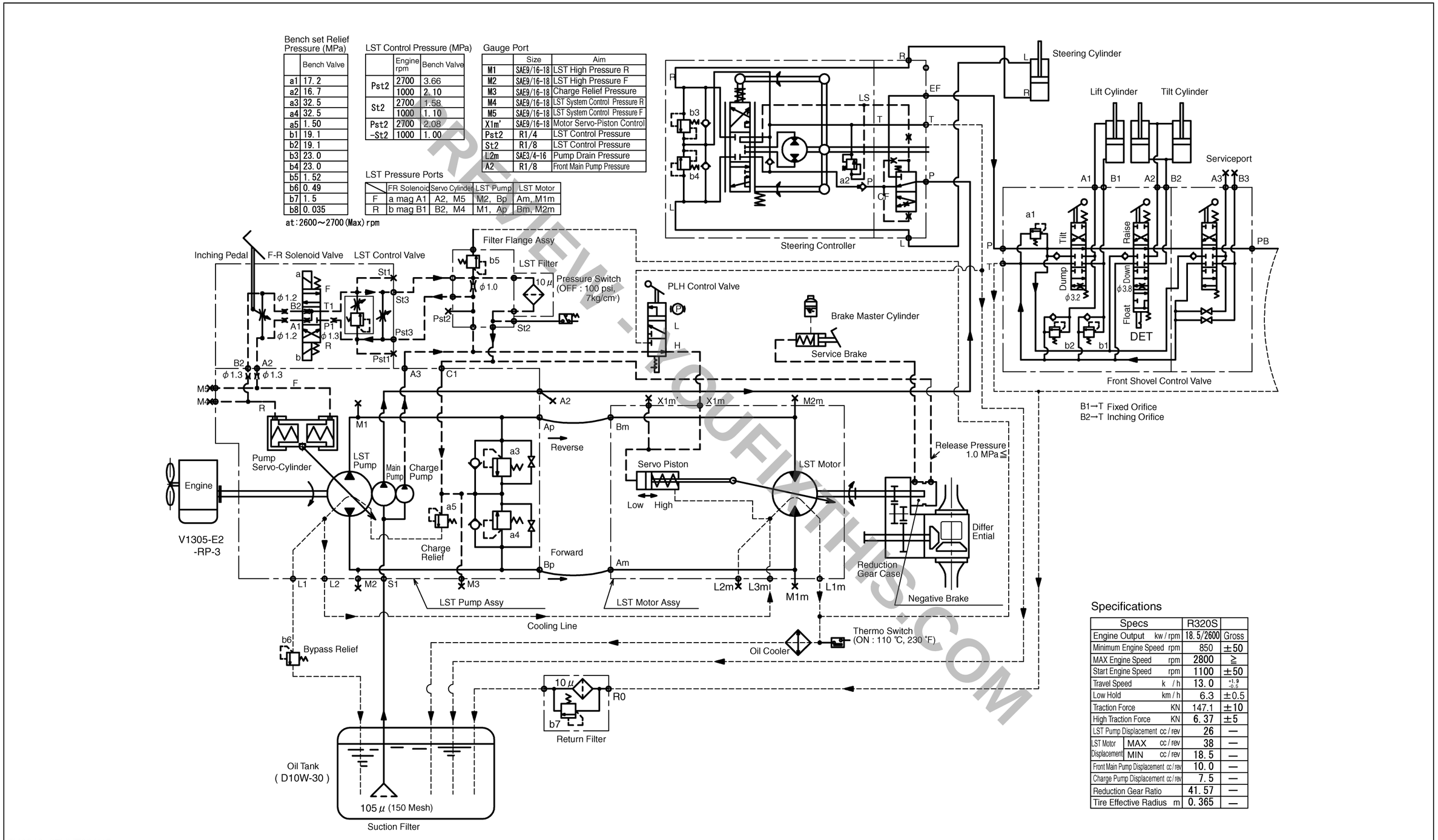
[1] Shaft ASSY
[2] Bypass valve
[3] Charge valve
[4] Cylinder block
[5] Servo piston
[6] Adapter cover

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1. HYDRAULIC CIRCUIT



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Specifications

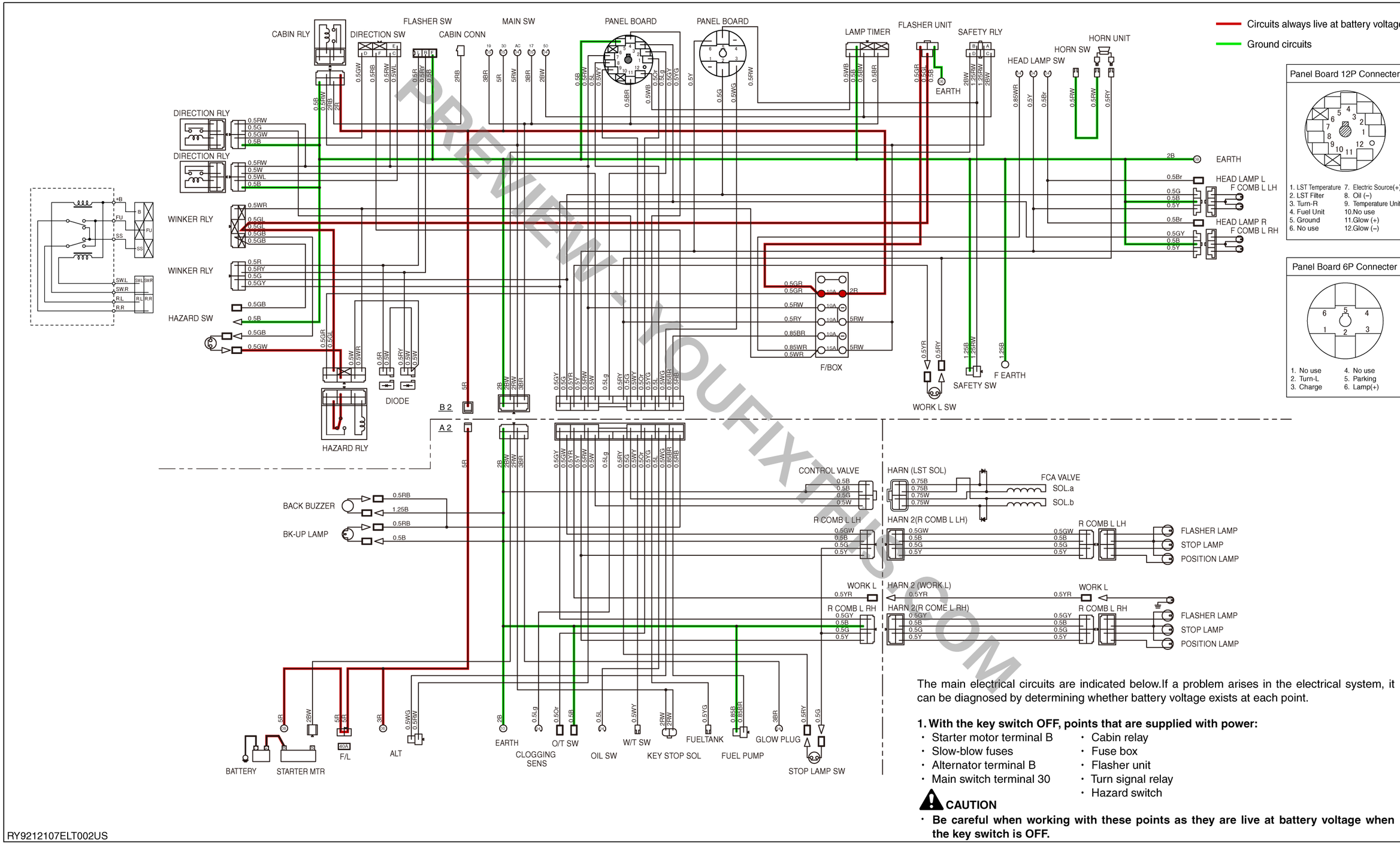
Specs		R320S	
Engine Output	kw / rpm	18.5/2600	Gross
Minimum Engine Speed	rpm	850	±50
MAX Engine Speed	rpm	2800	≧
Start Engine Speed	rpm	1100	±50
Travel Speed	k / h	13.0	+1.9 -0.5
Low Hold	km / h	6.3	±0.5
Traction Force	KN	147.1	±10
High Traction Force	KN	6.37	±5
LST Pump Displacement	cc / rev	26	—
LST Motor Displacement	MAX cc / rev	38	—
	MIN cc / rev	18.5	—
Front Main Pump Displacement	cc / rev	10.0	—
Charge Pump Displacement	cc / rev	7.5	—
Reduction Gear Ratio		41.57	—
Tire Effective Radius	m	0.365	—

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4. CIRCUIT DIAGRAM

[1] ELECTRIC SOURCE CIRCUIT AND GROUND CIRCUIT



The main electrical circuits are indicated below.If a problem arises in the electrical system, it can be diagnosed by determining whether battery voltage exists at each point.

1. With the key switch OFF, points that are supplied with power:

- Starter motor terminal B
- Slow-blow fuses
- Alternator terminal B
- Main switch terminal 30
- Cabin relay
- Fuse box
- Flasher unit
- Turn signal relay
- Hazard switch

CAUTION

- **Be careful when working with these points as they are live at battery voltage when the key switch is OFF.**

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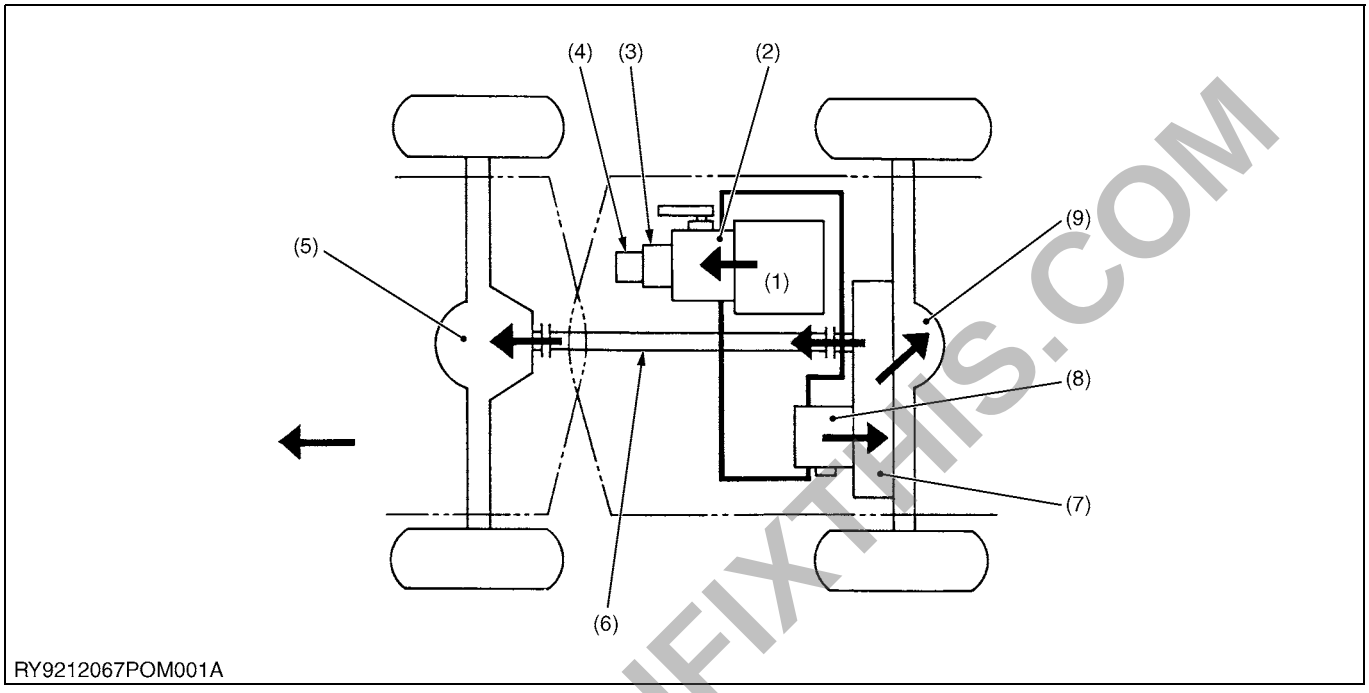
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1. DRIVETRAIN

[1] OVERVIEW

The motive force of the engine is transmitted to the LST pump, which drives the LST motor using hydraulic oil; the LST motor drives the propeller shaft via the transmission and the force is transmitted to the axle and then the tires.



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(1) Engine
(2) LST Pump
(3) Main pump
(4) Gear pump
(5) Front axle
(6) Propeller shaft
(7) Transmission
(8) LST Motor
(9) Rear axle

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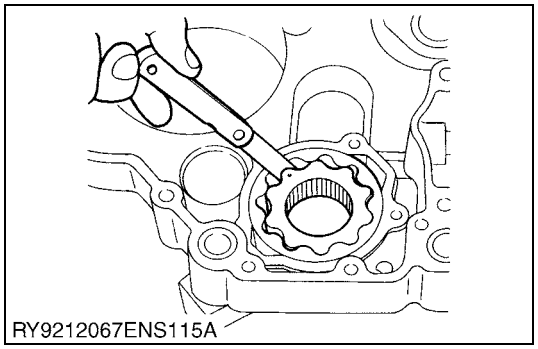
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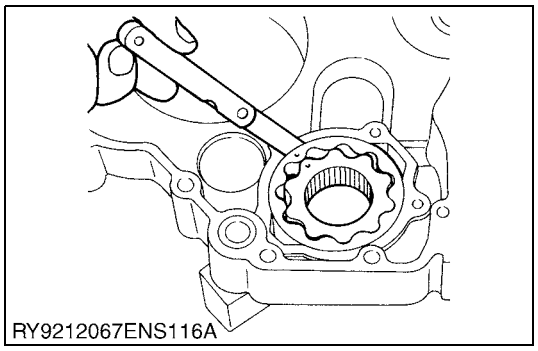
(2) Maintenance

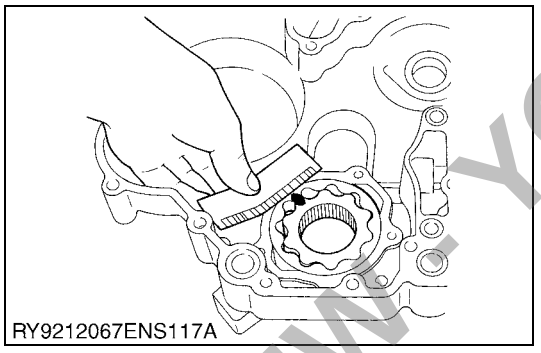
[A] Oil Pump

Make the following checks and if any are outside allowable limits, replace the entire oil pump.

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RY9212067ENS115A


RY9212067ENS116A


RY9212067ENS117A

Checking the Tip Clearance

1. Align the tips of the inner and outer rotors and measure the clearance.

Tip clearance	Factory Specification	0.06 to 0.18 mm 0.0024 to 0.0071 in.
	Allowable limit	0.3 mm 0.012 in.

RY9212105ENS0055US0

Checking the Outer Rotor and Body Clearance

1. Measure the clearance between the outer rotor and the body.

Outer rotor and body clearance	Factory Specification	0.100 to 0.180 mm 0.0039 to 0.0071 in.
	Allowable limit	0.54 mm 0.021 in.

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Checking the Side Clearance

1. Place a piece of Plastigauge on the surface of the inner rotor facing the cover.
2. Mount the cover and tighten it to the specified torque.

Tightening torque	Cover mounting bolt	9.8 to 11.3 N·m 1.0 to 1.15 kgf·m 7.2 to 8.3 lbf·ft

3. Carefully remove the cover and put the paper gauge up against the surface of the crushed Plastigauge and measure the clearance.

Side clearance	Factory Specification	0.025 to 0.075 mm 0.0010 to 0.0030 in.
	Allowable limit	0.225 mm 0.00886 in.

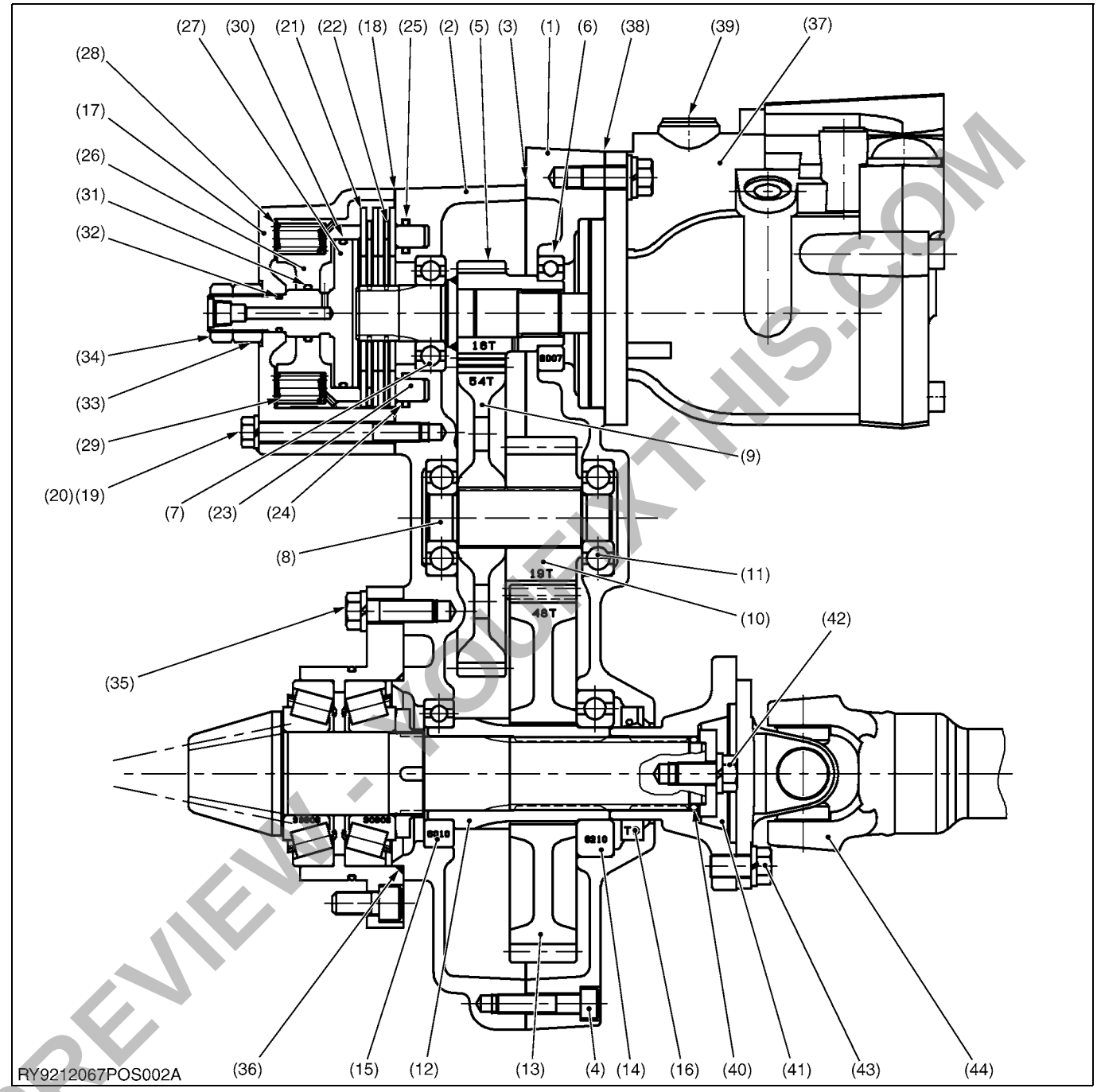
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1. TRANSMISSION

[1] TRANSMISSION COMPONENTS



(To be continued)

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[2] CONTROL VALVE DISASSEMBLY/ASSEMBLY PROCEDURES

Precautions during Disassembly / Assembly

Precautions during Disassembly

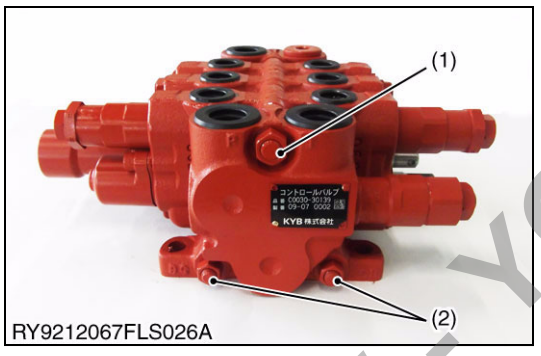
1. Generally, hydraulic devices are precision machined, and disassembly should therefore be conducted in a clean environment to prevent entry of debris into the narrow interstices formed in the device structure.
2. Always use clean tools and cleaning oil.
3. After removing from the machine, first wash 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.)

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Control Valve Disassembly/Assembly Procedures

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

Tightening torque	Nut (1) one location	46 N·m 4.7 kgf·m 34 lbf·ft
	Nut (2) two locations	19 N·m 1.9 kgf·m 14 lbf·ft

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

■ **IMPORTANT**

- **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.**
- **Mark each section with alignment marks.**
- **Excess torque on threads will cause defective spool operation, so always use the specified torque.**
- **Take care to install each spool in the correct direction, aligning the holes and inserting them slowly.**

(1) Nut (2) Nut

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