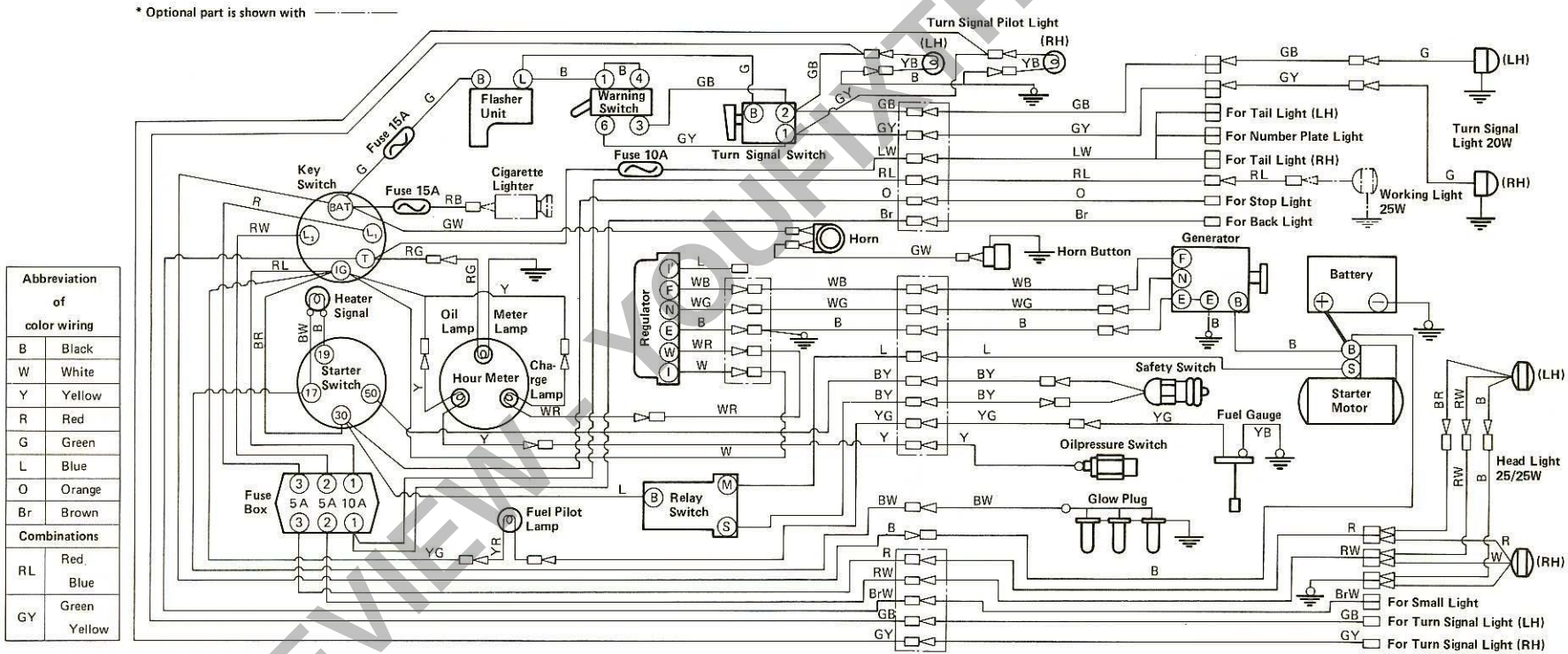


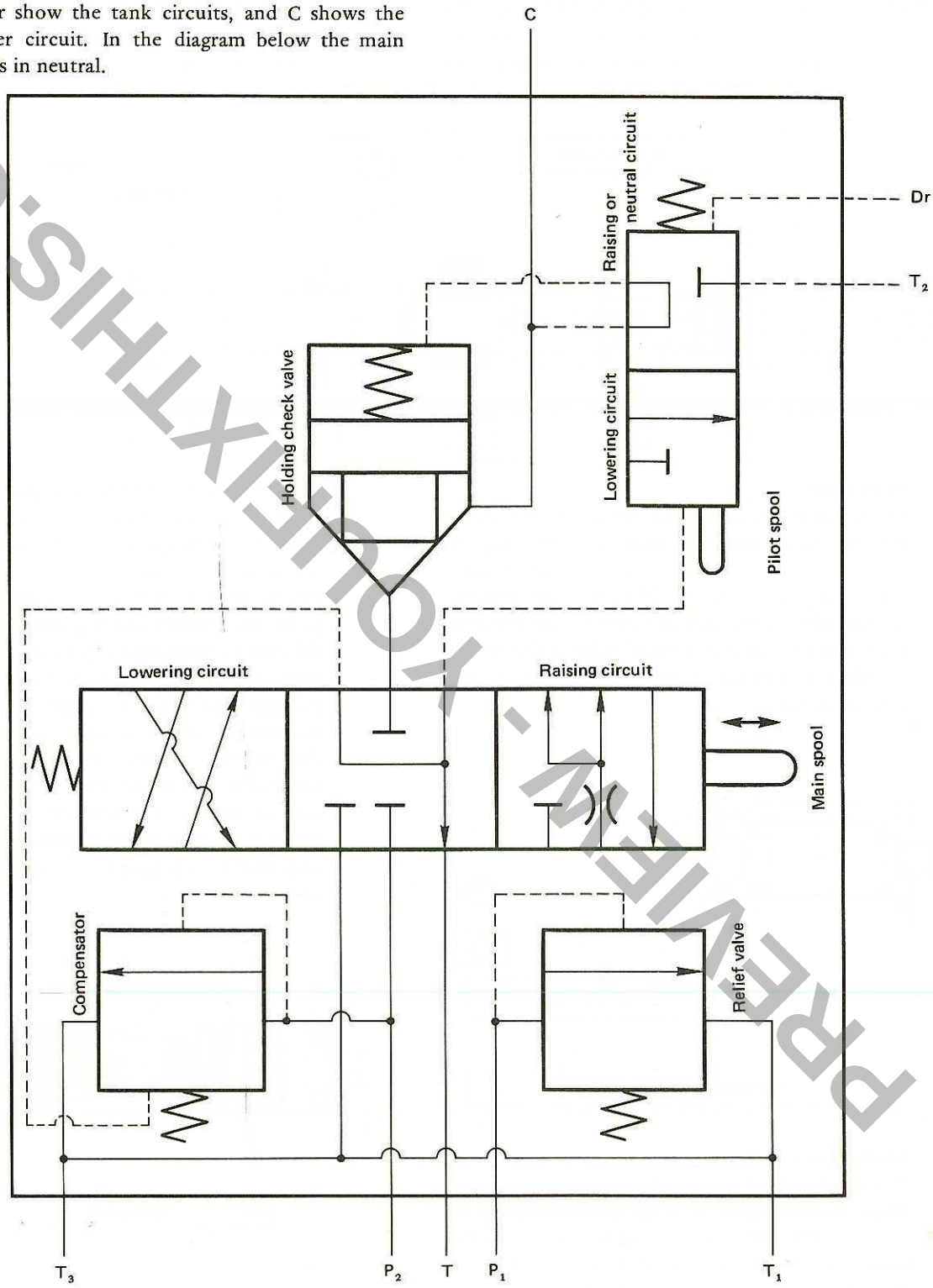
Abbreviation of color wiring	
B	Black
W	White
Y	Yellow
R	Red
G	Green
L	Blue
O	Orange
Br	Brown
Combinations	
RL	Red Blue
GY	Green Yellow

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(3) Hydraulic circuit of the control valve

P_1 and P_2 show the pump circuits, T, T_1, T_2, T_3, and Dr show the tank circuits, and C shows the cylinder circuit. In the diagram below the main spool is in neutral.



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14. INSTALLATION OF COMMON PARTS

14-1 Bearings

(1) When a bearing is fitted in by the outer race, the tool used for the installation must be one which is designed to push only the outer race, and vise versa.
(2) The installing tool must be designed to install the bearing on the shaft in a parallel positions.
(3) When installing a bearing which appears the same on both sides, install it so that the face which has the identification number comes in a direction for easier identification. All the bearings which are to be installed in the transmission case should face outward.
(4) If a shaft or a hole, where a bearing is going to be installed, has a stopper, the bearing should be pushed in completely until it is seated against the stopper.
(5) The installed bearing should turn smoothly.

14-2 Oil seals

(1) The tool used for unstallation should be designed so that it does not deform the oil seal.
(2) When installing, be careful not to damage the lips.
(3) The oil seal should be fitted in paralledl with the shaft.
(4) When the oil seal is installed, there should be no turning-over of the lips nor removal of the springs.
(5) There should be no oil or water leakage through the installed oil seal.
(6) When a multi-lip, oil seal is used, the grooves between the lips should be filled with grease.
(7) Lubrication of oil seals

When lubricating oil seals, be sure to use a lithium-based grease. Don't use cup grease.

14-3 O-rings

(1) When installing, don't damage the O-ring.
(2) The installed O-ring should have no slack and no twist.
(3) When installed, the O-ring should have proper air-tightness.
(4) Before installation, it should be coated with grease.

14-4 Snap rings

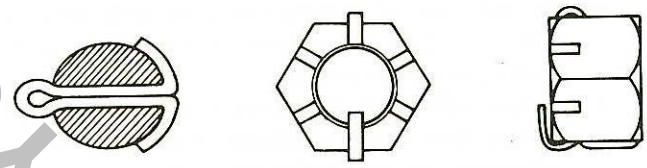
(1) The tool used for installation should be designed so as not to premanently deform the snap ring.
(2) The snap ring should be securely fitted in the groove.
(3) The installed snap ring should not have excessive thrust, to avoid its being deformed.

14-5 Spring pins

(1) The spring pin should always be driven in properly.
(2) When installed, there should be no play.
(3) It should be driven in so that its seam faces the direction from which the load is applied.

14-6 Cotter pins

(1) When installed, the cotter pin should be bent securely at the end, as shown in the figure.



14-7 Bolts and nuts

(1) Tightening torque of bolts and nuts

Tightening torque kg-cm (lb-in)

	4T bolts and nuts	9T bolts and nuts, and 7T nuts
M5	30–40 (26–34)	60–70 (52–60)
M6	60–80 (52–69)	100–130 (87–113)
M8	130–180 (113–156)	250–350 (217–303)
M10	200–300 (173–260)	550–700 (477–700)
M12	500–600 (434–520)	900–1100(781–954)
M14	700–800 (607–694)	1300–1500(1128–1302)
M16	1000–1200(868–1041)	1600–1800(1388–1562)
M18	1200–1400(1041–1215)	2000–2400(1739–2083)
M20	1500–1700(1302–1475)	2400–2600(2083–2256)

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Steps to be followed prior to overhauling the engine

The following checks should be made to determine whether or not the engine is in need of overhauling.
The engine is to be overhauled if one or more of the following conditions apply.

1. Check compression pressure in the cylinders
   After allowing the engine coolant to reach 75°C, remove the 4 nozzles and check compression pressure in cylinders by cranking the engine (at a speed of 250 rpm) with the intake shutter wide open.
   If the compression pressure is lower than the value specified in the following table, the engine is in need of overhauling.

Inspection item		Value indicating need for servicing
Compression pressure kg/cm² (psi)	All models	20 (284)

2. Check oil consumption
   Assuming that the oil mileage (or hours/1tr) of a new engine is 100%, the engine is due for overhauling when oil mileage (or hours/1tr) has declined to 50%.

3. Check fuel consumption
   Assuming that the fuel mileage (or hours/ltr) has declined to 60%.

4. Check for abnormal operating noises.

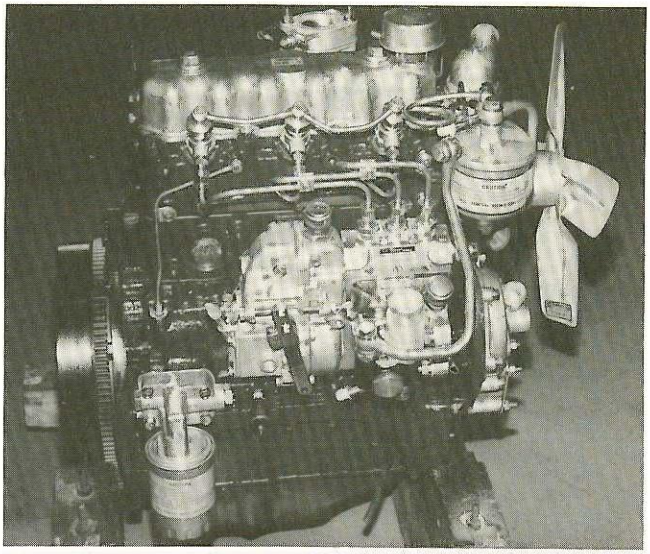
1. Major components

1-1 Major disassembly

Drain the engine crankcase and cooling system prior to disassembly.

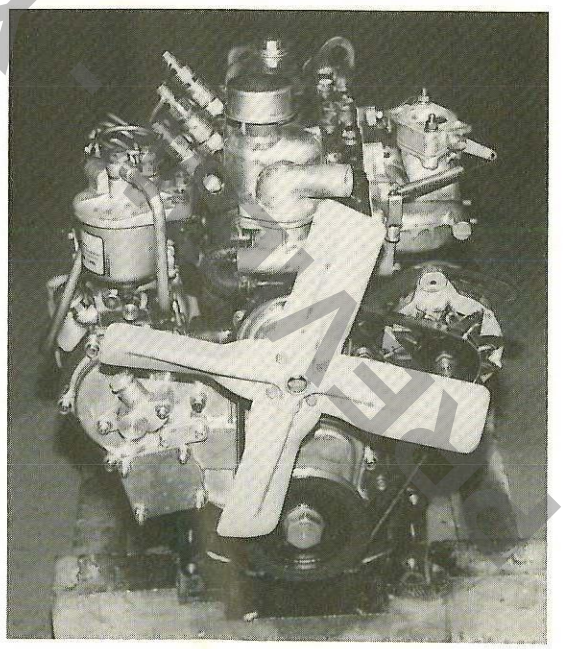
(1) Disconnect the fuel pipe at the joint on the fuel filter and on the injection pipe.
(2) Remove the bolts attaching the fuel filter and remove the fuel filter assembly.
(3) Disconnect the injection pipes.
(4) Disconnect the leak-off pipe from the nozzle holders.
(5) Remove the oil filter assembly and disconnect the rocker arm shaft oil feed pipe.

Note: When removing the oil filter assembly be careful not to spill engine oil.



(6) Remove the bolts attaching the timing gear case and remove the injection pump assembly.

Note: Use a suitable cover on the injection pump to prevent the entry of dust or other foreign matter into the delivery valve holder.



(7) Remove the injection nozzle holders.
(8) Remove the oil pressure indicator switch.

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SECTION VI. TROUBLESHOOTING

1. ENGINE

Troubles	Possible Causes	Countermeasures
1. DIFFICULTY IN STARTING		
1) Starter switch does not activate pinion.	– Poor or run down battery	When discharged, it must be re-charged, or replaced. When its capacity is reduced due to cold weather, it must be warmed gradually, and recharged or replaced.
	– Broken wiring or poor contact of battery or switch terminals	Repair.
	– Splined part meshing with armature pinion shaft, is bitten to lock pinion	Repair splined part.
	– Poor starter switch	Repair or replace.
	– Poor action of magnetic switch plunger or broken short-circuit coil	Repair or replace.
	– Starter brush, due to seizure, break, or wear, does not make contact with commutator.	Disassemble, clean it and replace broken parts.
2) Pinion engages with ring gear, but starter does not start.	– Poor or run down battery	Take the same countermeasures mentioned above.
	– Broken wire connecting magnetic switch and battery, or poorly connected wire from starter switch to starter motor	Repair, retighten or replace.
	– Poorly engaged pinion and ring gear	Repair cogs.
	– Worn brush or interfering brush spring	Repair or replace.
	– Poor armature coil or field coil	Repair or replace.
	– Poor contactor	Repair or replace.
	– Rough contact faces of contactor	Repair or replace.
3) Pinion turns fully before engaging with ring gear.	– Improper setting of starter	Repair mounting position.
	– Poorly adjusted plunger cap	Adjust.
	– Tired pinion sleeve spring	Replace.
4) Pinion engages with ring gear, and starter turns, but engine does not start.	– Engine is out of order	Repair.
5) Engine is cranked, but does not start.	– Empty fuel tank	Fill with fuel.
	– Fuel piping has gotten air into it.	Bleed it.
	– Clogged fuel filter element	Clean.
	– Vapor-locked injection pump	Bleed it.
	– Seized/poor acting of plunger or delivery valve	Disassemble, and repair them.
	– Seized tappet or worn cam of injection pump .	Repair or replace.
	– Loose connection of high pressure pipe	Re-tighten.
	– Seized, or too tight needle valve of nozzle	Repair of replace.

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2. SPECIFICATIONS

mm (in.)

Specifications \ Models		TS3510		TS4010
		DU, DUG	FDU, FDUG	DU, DUG
Dimensions				
Overall length (with 3P hitch)		3100 (122.05)		
Overall width		1494 (58.27)		1533 (59.79)
Overall height (with muffler)		1995 (77.81)		2030 (79.17)
Wheelbase		1750 (68.90)	1780 (70.08)	1750 (68.90)
Wheel tread	Front	1100–1500 (42.90–58.50)	1120 (44.09)	1100–1500 (42.90–58.50)
	Rear	1200–1520 (46.80–59.28)		1190–1540 (46.41–60.06)
Min. ground clearance		360 (4.17)	320 (12.60)	380 (14.96)
Weight kg (lb)		1196 (2637)	1340 (2954)	1280 (2822)
Engine				
Model		3AD1	3AD1	3AB1
Type		Water-cooled, 4-cycle, diesel		
Cylinders		3, in line		
Bore x stroke		86 x 86 (3.39 x 3.39)		86 x 102 (3.39 x 4.02)
Displacement	cc (cu.in.)	1498 (91.41)		1777 (108.43)
Rated rpm		2600		2400
Max. torque	kg-m (lb-ft)/rpm	9.1 (65.84)/1800		11 (79.59)/1600
Type of combustion chamber		Swirl chamber		
Compression ratio		20		
Injection pump		Bosch type		
Filter		Full flow with paper cartridge		
Lubrication system		Forced circulation system		
Air cleaner		Cyclone type, dry		
Starting method		Starter (12V)		
Battery capacity (AH)		96		
Fuel tank capacity	liter (Imp. gal.)	30 (6.60)		
Tractor				
Main clutch:	Type	Dry, single clutch (Dual clutch for type D)		
Clutch disc:	Outer dia.	225 (8.86)		
	Inner dia.	150 (5.91)		
	Thickness	Main: 7.8 (0.307), PTO: 8.8 (0.343)		
Transmission:	Type	Selective, and sliding system		
Speeds	(F-R)	8–2		
Final drive gear		Spur gears (pinion gears)		
Differential gears		Bevel gears (with differential lock)		
Front axle		Lemoine	Joint	Lemoine
Rear axle		Central axle		
Tire	Front	5.00–15 (4P)	6.00–16 (4P)	5.50–16 (6P)
	Rear	12.4–24 (4P)		13.6–24 (4P)

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SECTION IV. PERIODIC INSPECTION, LUBLICATION TABLE, AND STORAGE INSTRUCTIONS

1. PERIODIC INSPECTIONS

Transmission gear oil
- Inspection interval: Every 100 hours of operation.
- Replacement: Every 900 hours of operation.

Free play of the clutch pedal
- Inspection: Every day before operation
- Standards: 15 to 20 mm (0.0591 to 0.787 in.)

Free play of the brake pedals
- Inspection: Every day before operation
- Standards: 15 to 20 mm (0.591 to 0.787 in.)
- Remarks: Both the brakes and the pedals must work simultaneously.

Control levers
- Inspection: Every day before operation
- Remarks: They must work properly and accurately.

Hydraulic fluid
- Insepction, and replacement: Inspect every 100 hours of operation, and replace after every 300 hours of operation.

Suction filter
- Cleaning: Every 300 hours of operation

Free play of the steering wheel
- Inspection: Every day before operation
- Standards: 20 mm (0.8 in.) at wheel circumference ference

Air pressure of tires
- Inspection: Every day before operation
- Standards:

		kg/cm² (psi)
	Front	Rear
2DW	2.0 (28.5)	1.2 (17.1)
4WD	1.2 (17.1)	

Toe-in
- Inspection: Every 300 hours of operation
- Standards: 2 to 4 mm (0.079 to 0.157 in.)

Lubrication of the front wheel hubs with grease
- Inspection, and replenishment: Every 900 hours of operation

Retightening front wheel bearings
- Interval: Every 900 hours of operation

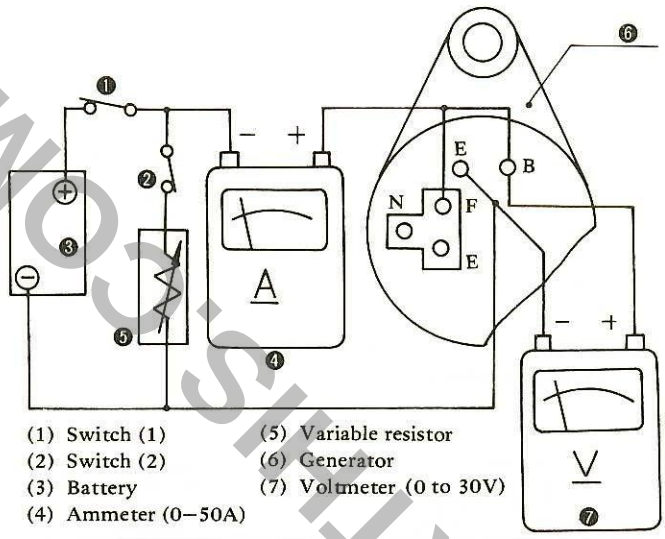
Retightening ball joints
- Interval: Every 300 hours of operation

Wheel clamping bolts
- Inspection: Every day before operation
- Remarks: Always keep them tightened securely.

Electrical apparatuses
- Inspection: Every day before operation for proper work
  Adjustment of the throttle lever, and the foot acceletor
- Adjustment inverval: Every 300 hours of operation
  Clamping of bolts, and nuts
- Inspection: Every day before operation
  Oil leakage in the clutch housing, or the brake chamber
- Inspection: Every year by removing the plugs on the bottom of the chambers

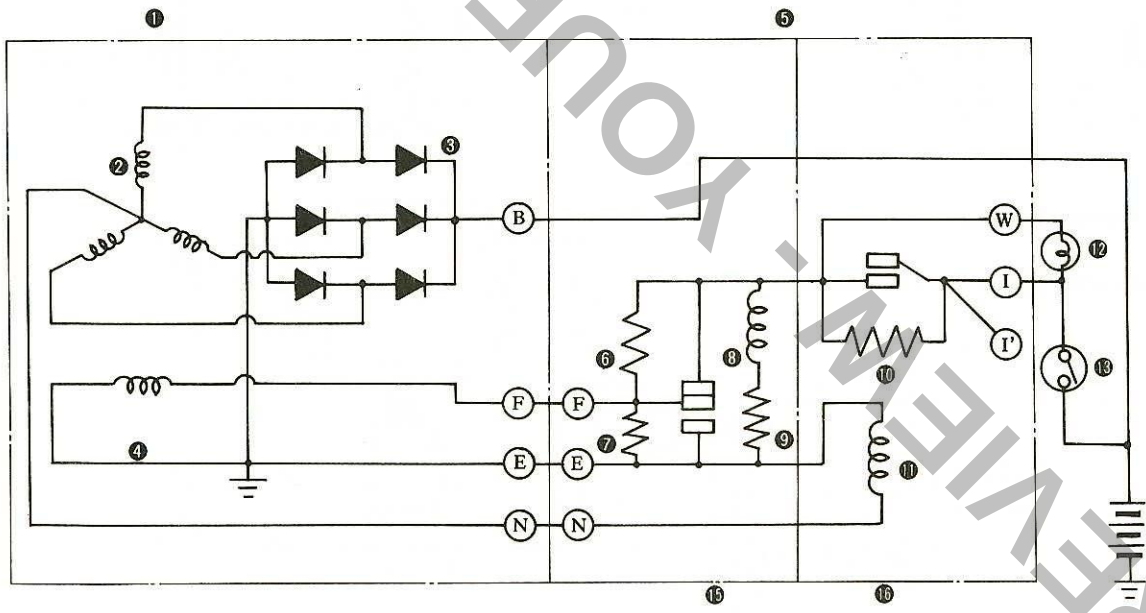
Grease-up
- Interval: Every 50 hours of operation

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(1) Switch (1)
(2) Switch (2)
(3) Battery
(4) Ammeter (0–50A)
(5) Variable resistor
(6) Generator
(7) Voltmeter (0 to 30V)

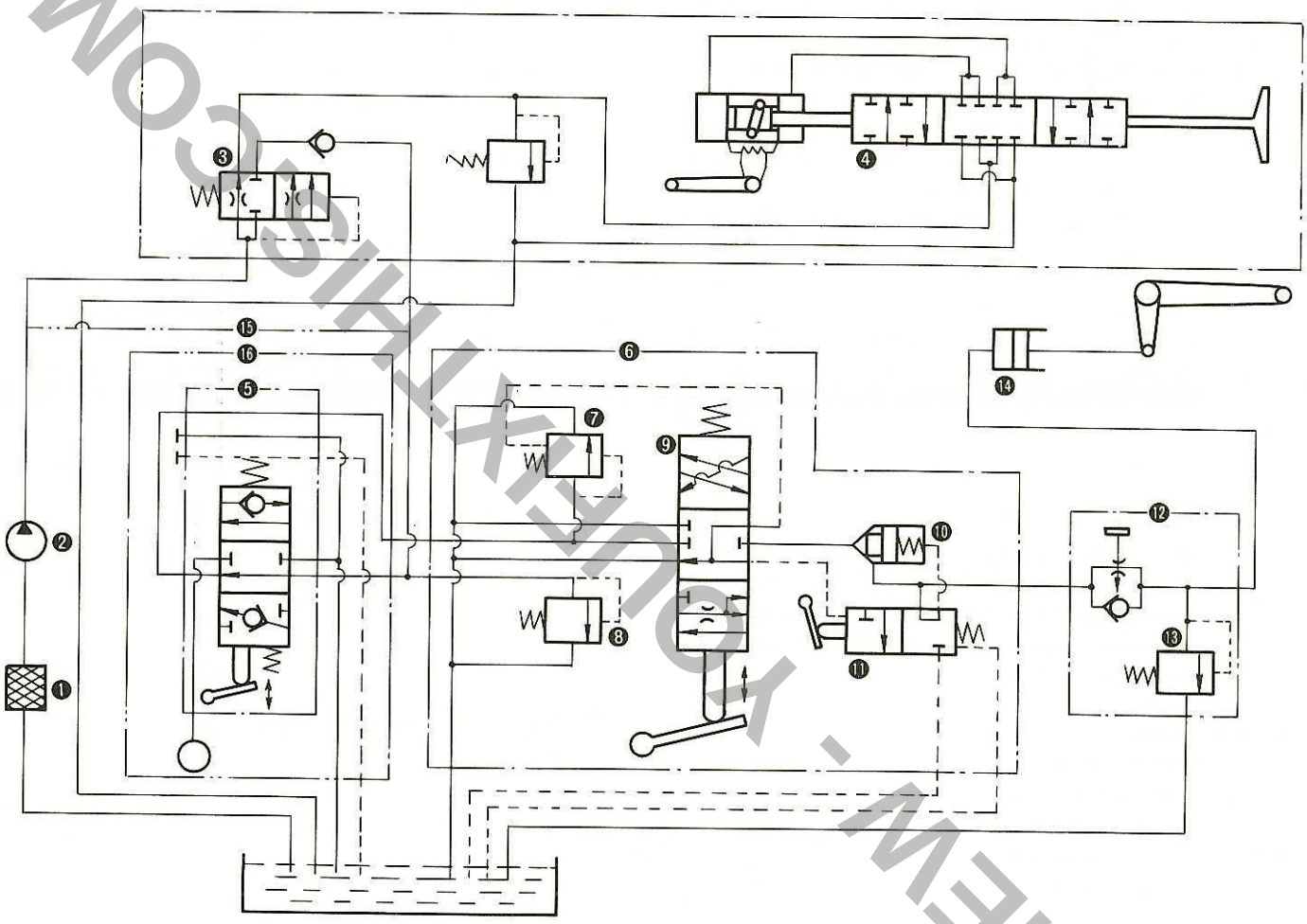
Wiring diagram of AC generator and regulator



(1) Generator
(2) Stator coil
(3) Diode
(4) Rotor coil
(5) Regulator
(6) Inserted resistance for rotor coil
(7) Ballast resistance
(8) Voltage coil
(9) Inserted resistance
(10) Field resistance
(11) Voltage coil
(12) Charge lamp
(13) Starter switch
(14) Battery
(15) Voltage regulator
(16) Field relay

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- **Hydraulic circuit diagram**



(1) Suction filter
(2) Gear pump
(3) Flow-divider
(4) Power steering system
(5) Sub-control valve (Option)
(6) Main control valve
(7) Compensator
(8) Relief valve
(9) Main spool
(10) Holding check valve
(11) Pilot spool
(12) Slow return check valve
(13) Safety valve
(14) Cylinder
(15) Circuit for the models without the power steering system
(16) Sub-control cover

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(2) Bearing adapter nuts

Nuts		Tightening torque
Symbol	Nominal	kg-cm (lb-in)
AN02	M15	300–400 (260–347)
03	M17	200–400 (173–347)
04	M20	300–500 (260–434)
05	M25	300–500 (260–434)
06	M30	300–500 (260–434)
07	M35	400–600 (347–520)
08	M40	600–800 (520–694)
09	M45	600–800 (520–694)
10	M50	800–1000 (694–868)
11	M55	800–1000 (694–868)
12	M60	800–1000 (694–868)

(3) In the case of locking bolts or nuts with wire or lock washers, be sure of the winding direction, twisting of the wire and bending of the lock washers for secure locking.
(4) In the case of locking bolts and nuts with an adhesive, apply the adhesive on the threaded parts and tighten them securely.
(5) Apply screw locking adhesive to the parts through which there is any possibility of oil leak, such as stud bolts and tapped-through parts.
(6) All the lock nuts should be tightened securely.

14-8 Grease fittings

(1) After installation, grease should be filled through the fittings.
(2) When installing the grease fittings of types B and C, be sure to turn the fittings in a direction that will provide convenient access by a grease gun.

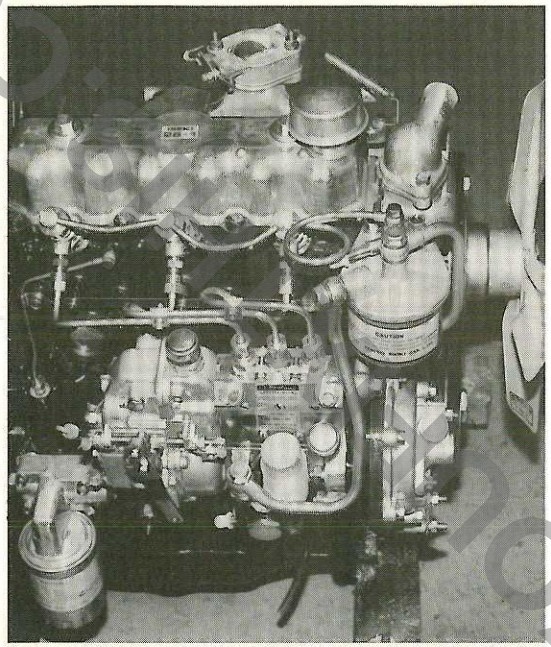
14-9 Other precautions

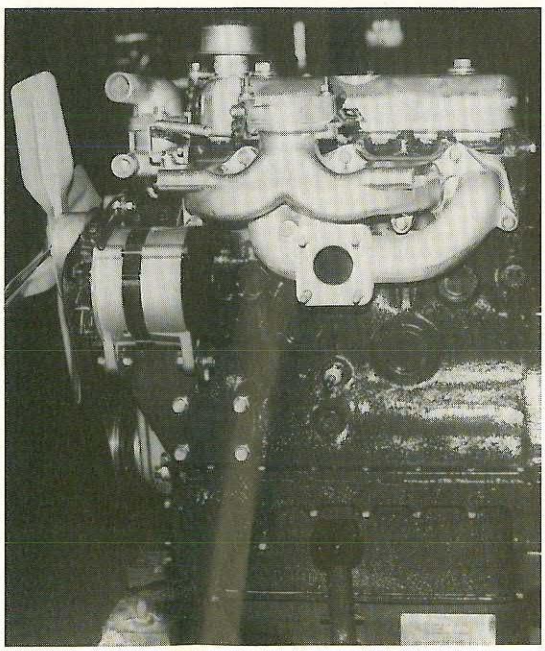
(1) Pay special attention not to harm the finished surfaces.
(2) Refrain from any forcible installation. Every part is designed to fit in smoothly.
(3) The grips and knobs of levers should be fastened with a strong adhesive. (Super-three cement 1000A)

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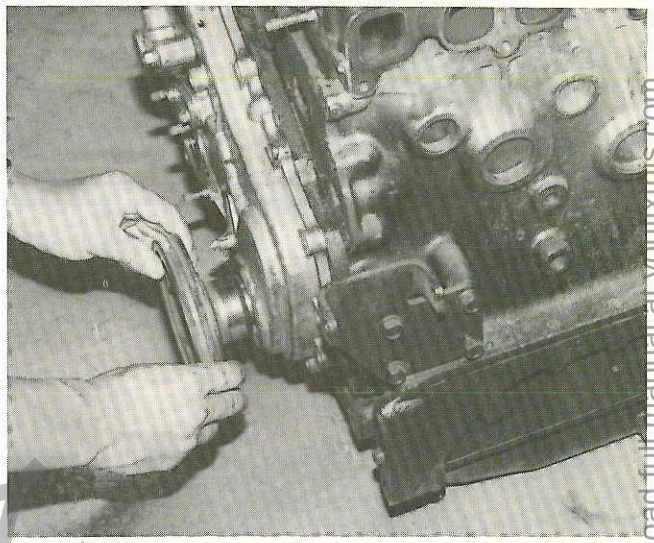
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(9) Remove the generator adjust plate bolts and the lower mounting bolt and remove the generator assembly.
(10) Remove the fan, fan pulley and fan belt.



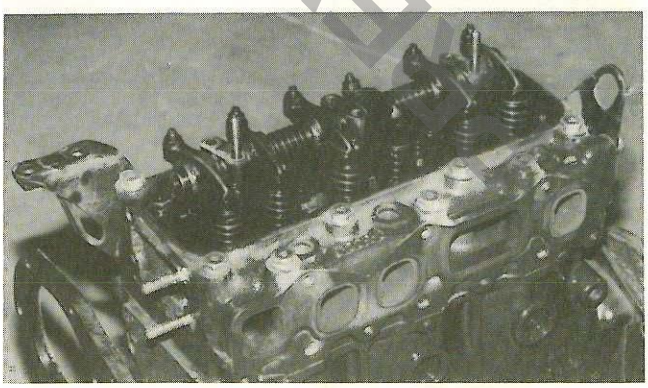


(11) Remove the starter motor mounting bolts and remove the starter motor assembly.
(12) Pull out the oil level gauge (oil dipstick) and remove the manifold assembly.
(13) Remove the bolts fixing the water pump and remove the water pump assembly.
(14) Flatten out the crankshaft pulley bolt lock washer. Take out the bolt and remove the pulley, using a puller.
(15) Remove the timing gear case.



(16) Remove the idle gear.
(17) Remove the cylinder head cover.
Then, remove the rocker arm shaft assembly.

Note: Loosen the rocker arm shaft bracket bolts evenly, in progression.



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Troubles	Possible Causes	Countermeasures
	– Fuel leak from needle valve	Repair or replace.
	– Improper injection pressure	Adjust.
	– Poorly operating glow plug	Continue putting on the glow switch until the control register is heated red.
	– Poor glow plug or poor wiring	Replace. Inspect wiring, and amend faults.
	– Inferior compression	
	a) Poorly seated valve	Inspect valve and valve seat and correct fitting if necssary.
	b) Broken or tired valve spring	Replace.
	c) Broken cylinder head gasket	Replace.
	d) Worn piston or cylinder or worn bore	Repair bore.
2. IMPROPER IDLING Engine starts but quickly stops by itself.	– Clogged fuel piping or filter	Clean.
	– Air in fuel system	Bleeding
	– Poorly adjusted accelerator lever	Repair.
	– Insufficient fuel supply due to clogged breather in fuel tank	Replace breather.
	– Air-locked injection pump	Bleeding
	– Poor nozzle	Repair or replace.
	– Uneven compression of each cylinder	Repair or replace.
	– Poor injection pump	Disassemble and repair faults.
3. POOR OUTPUT	– Improper valve clearance	Adjust.
	– Poor valve seating	Inspect valve, and valve seat and fit if necesary.
	– Broken cylinder head gasket	Replace.
	– Seized, worn, or broken piston ring	Replace.
	– Worn cylinder wall	Repair.
	– Improper fuel injection timing	Adjust.
	– Insufficient fuel injection volume	Adjust injection pump.
	– Improper injection pressure, or seized nozzle	Repair or replace.
	– Insufficient air intake	Clean air cleaner.
	– Clogged fuel piping	Unclog.
	– Air in fuel	Bleed.
	– Water in fuel	Replace fuel completely.
	– Clutch slips	Adjust clutch.
	– Dragged brake shoe	Adjust.
4. OVER HEATING	– Insufficient or improper engine oil	Replenish or replace.
	– Insufficient coolant, or scale formation in cooling system	
	– Loose, worn, or broken fan belt	Tension or replace.
	– Poor function of water pump	Repair or replace.

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