

SPECIFICATIONS GENERAL VEHICLE SPECIFICATIONS

General Vehicle Specifications

Engine - Diesel

Make.....	Yanmar
Model (ProGator S.N. [-100030]).	3TNE74C-JUV
Model (ProGator S.N. [100031-]).	3TNE74C-EJUV
Type.....	4-cycle diesel
Bore.....	74 mm (72.91 in.)
Stroke.....	78 mm (3.07 in.)
Cylinders.....	3
Valves.....	Overhead
Displacement.....	1006 cm ³ (61.4 cu in.)
Gross Output Power.....	17.1 kW (22.9 hp)
Maximum Torque.....	61.7 N•m (45.5 lb-ft) @ 2400 rpm
Lubrication.....	Full pressure
Oil Filter.....	Spin on (standard)
Engine Rated Speed.....	3600 rpm
Engine Slow Idle.....	1450±50 rpm
Engine Fast Idle.....	3450±50 rpm
Cooling System.....	Liquid with pump and radiator
Air Cleaner.....	Dry replaceable dual element with safety element

1. Specifications and design subject to change without notice.

Electrical

Volts.....	12 VDC
Battery Rating (CCA @ 0°F).....	47 amp-hr (500 amp)
Alternator.....	55 amps
Regulator.....	External, current limiting
Starting Motor.....	1.1 kW
Headlights.....	37.5 W halogen bulb
Instrument Panel Lights.....	1.7 W bayonet base

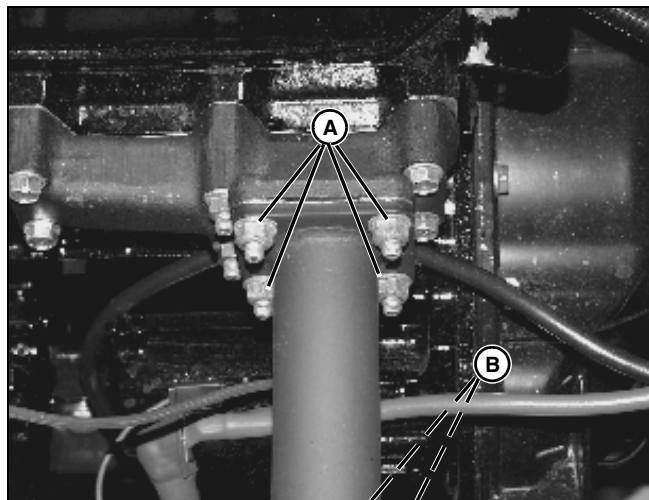
Fuel System

Diesel Engine:

System Type.....	Indirect fuel injection
Injection Pump.....	In-line with electric shutoff
Fuel Type.....	Diesel
Fuel Tank Capacity.....	30.3 L (8 gal)
Fuel Filter.....	Glass bowl with disposable paper element
Fuel Pump.....	Electric

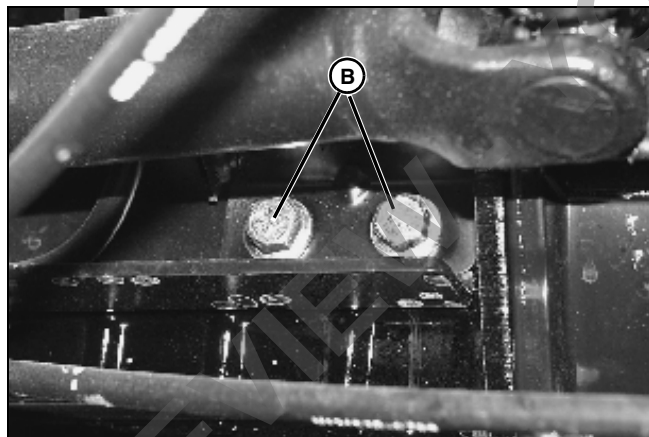
Repair

Remove and Install Muffler



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1. Allow muffler to cool, or wear protective gloves before working on muffler. Access muffler.
2. Remove tailpipe hanger clamp near rear axle and clamp from muffler outlet and remove tailpipe.
3. Remove four nuts (A) holding muffler to exhaust manifold.



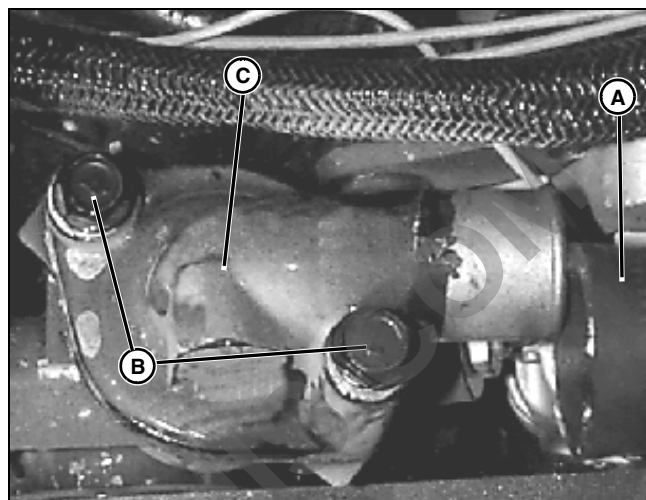
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4. Remove cap screws (B) from lower muffler support, and remove muffler from engine.
5. Clean sealing surfaces of muffler flange and exhaust manifold and replace gasket before installation.

Remove and Install Thermostat

1. Park unit with park brake ON, transmission in NEUTRAL, and engine OFF.
2. Allow engine to cool before attempting to service cooling system.

3. Open radiator cap. Place container under radiator drain and drain coolant.



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4. Loosen clamp and slide hose (A) from thermostat housing.
5. Remove two cap screws (B) holding thermostat housing to coolant pump. Remove housing (C).

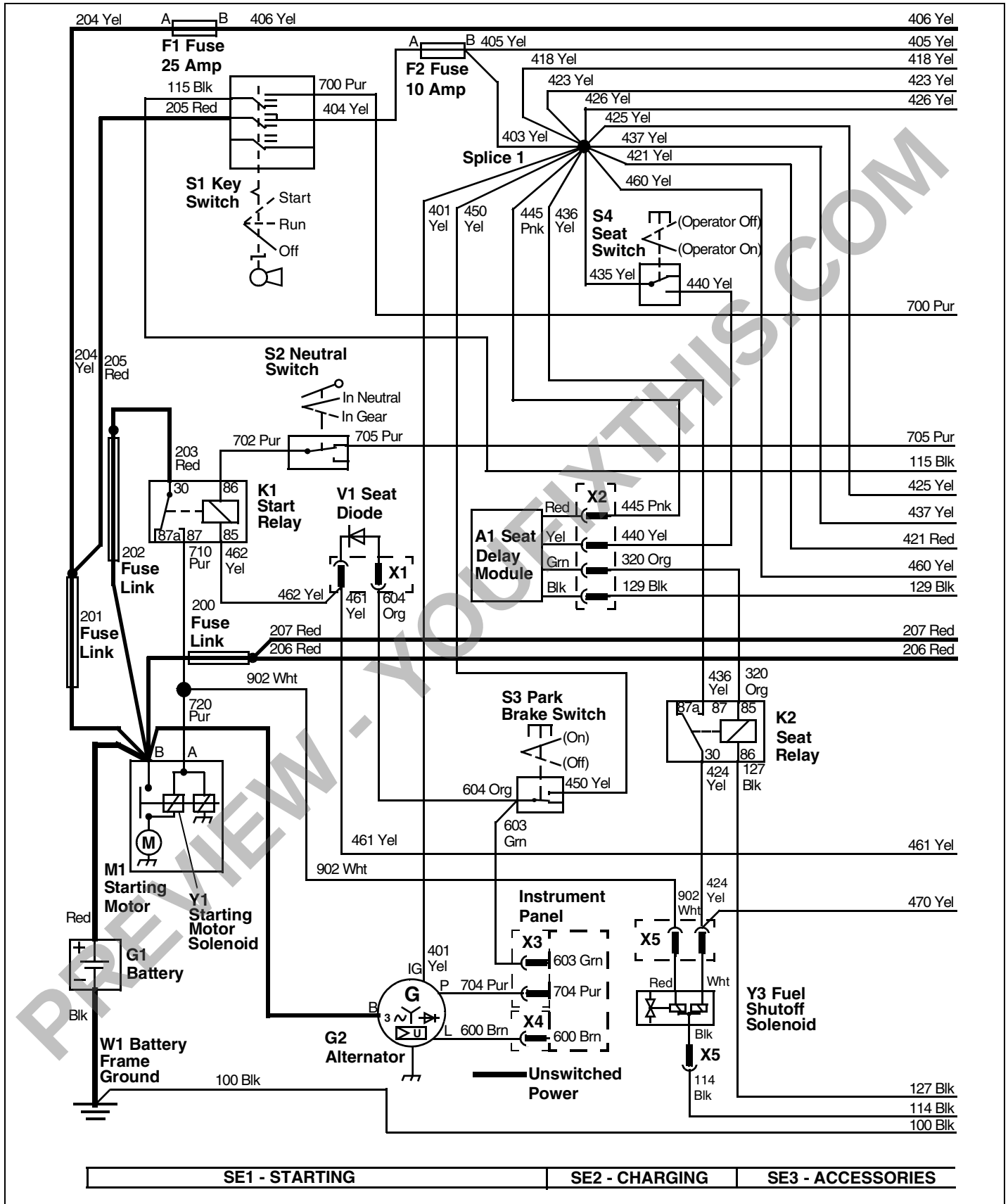


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6. Remove thermostat (D).
7. Test or replace thermostat. (See "Test Thermostat" on page 61.)

ELECTRICAL SCHEMATICS AND HARNESSSES

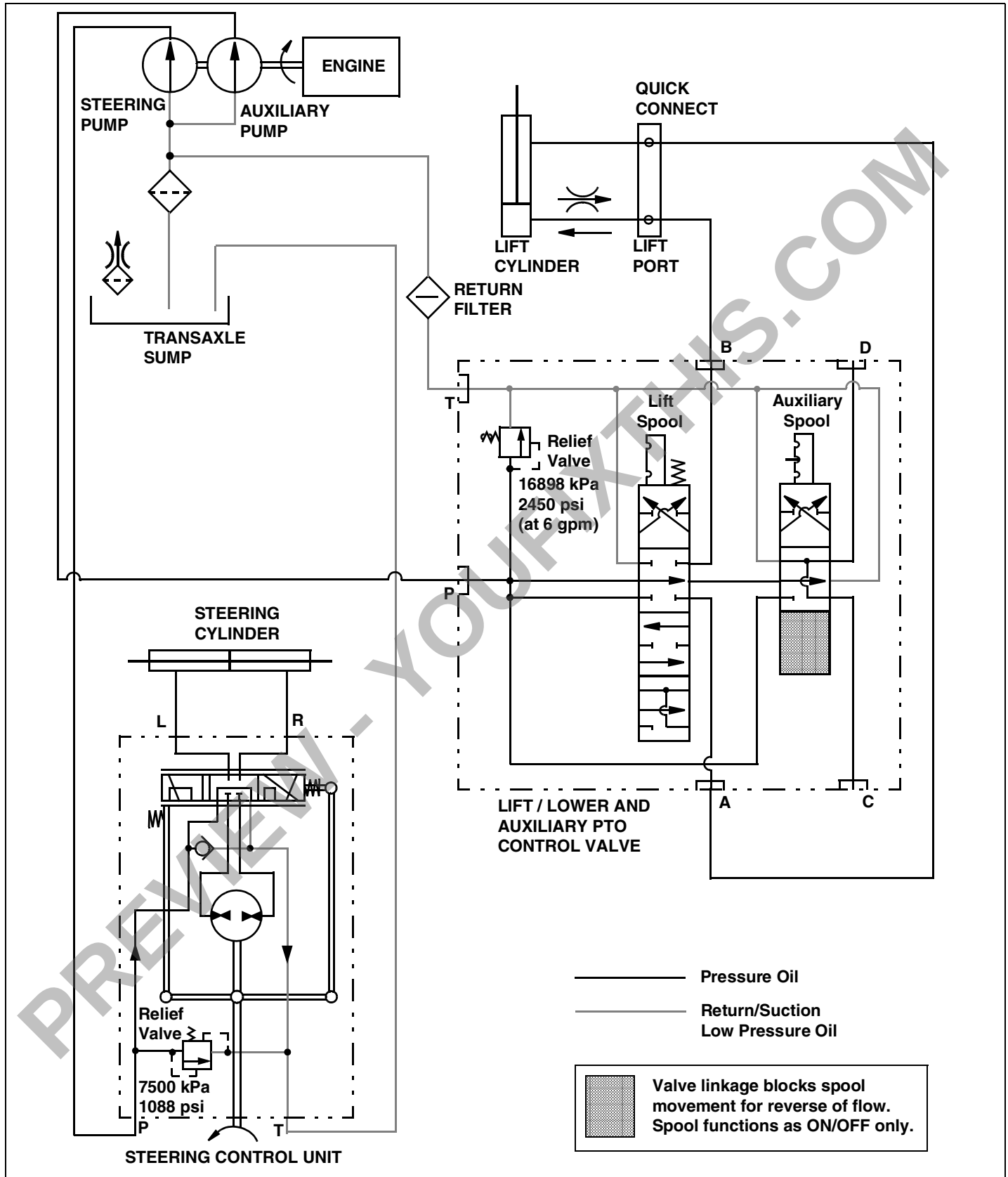
W1 Main Wiring Schematic - Export



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HYDRAULICS SCHEMATICS AND HARNESSSES

Standard Hydraulic System Schematic

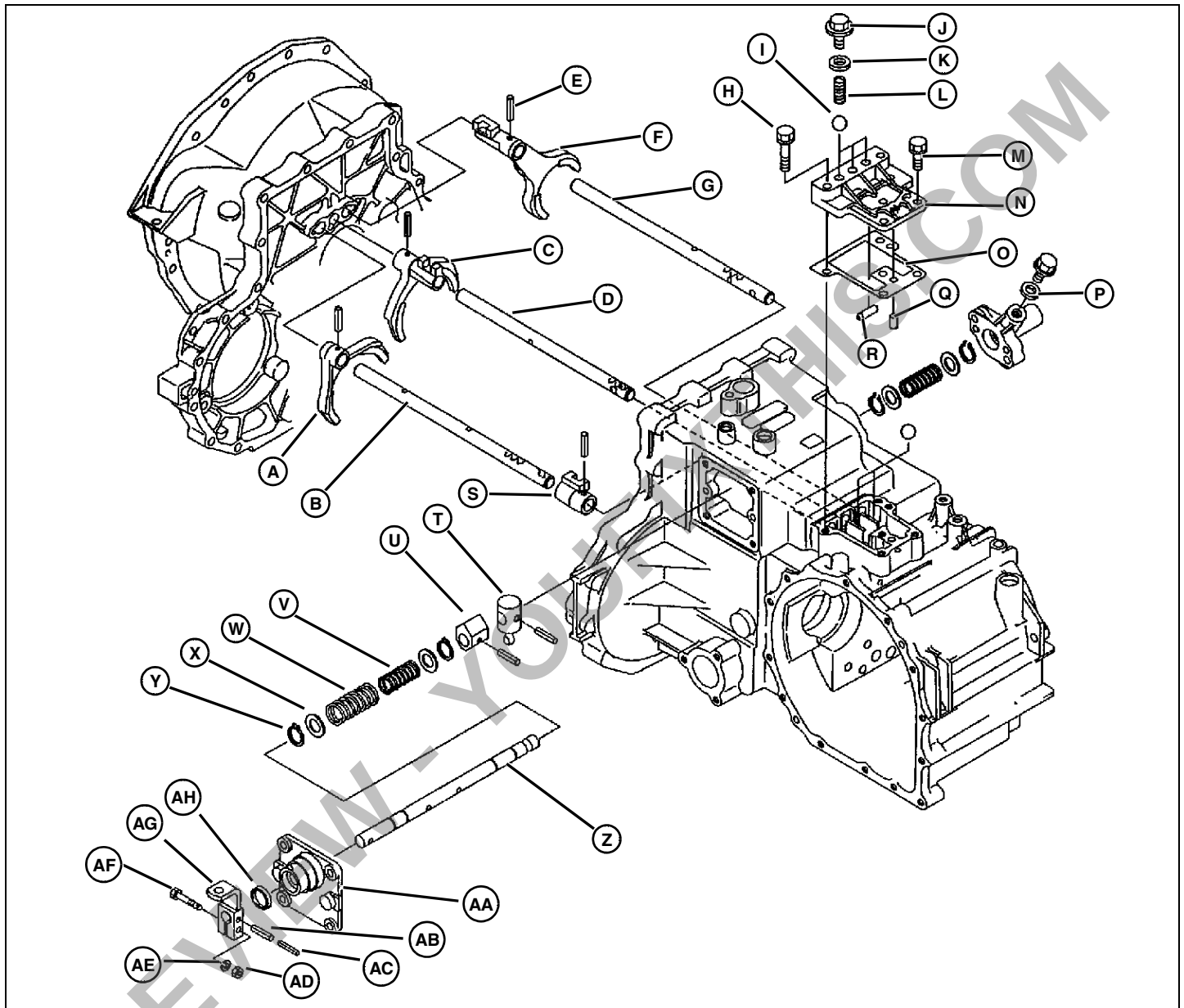


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POWER TRAIN COMPONENT LOCATION

Component Location

Shifter Shafts Component Location



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SPECIFICATIONS GENERAL VEHICLE SPECIFICATIONS

Inch Fastener Torque Values

SAE Grade and Head Markings	1 or 2 ^b No Marks 	5  5.1  5.2 	8  8.2 
SAE Grade and Nut Markings	2 No Marks 	5  	8  

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	Grade 1				Grade 2 ¹				Grade 5, 5.1 or 5.2				Grade 8 or 8.2			
	Lubricated ²		Dry ²		Lubricated ²		Dry ²		Lubricated ²		Dry ²		Lubricated ²		Dry ²	
SIZE	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft
1/4	3.7	2.8	4.7	3.5	6	4.5	7.5	5.5	9.5	7	12	9	13.5	10	17	12.5
5/16	7.7	5.5	10	7	12	9	15	11	20	15	25	18	28	21	35	26
3/8	14	10	17	13	22	16	27	20	35	26	44	33	50	36	63	46
7/16	22	16	28	20	35	26	44	32	55	41	70	52	80	58	100	75
1/2	33	25	42	31	53	39	67	50	85	63	110	80	120	90	150	115
9/16	48	36	60	45	75	56	95	70	125	90	155	115	175	130	225	160
5/8	67	50	85	62	105	78	135	100	170	125	215	160	215	160	300	225
3/4	120	87	150	110	190	140	240	175	300	225	375	280	425	310	550	400
7/8	190	140	240	175	190	140	240	175	490	360	625	450	700	500	875	650
1	290	210	360	270	290	210	360	270	725	540	925	675	1050	750	1300	975
1-1/8	470	300	510	375	470	300	510	375	900	675	1150	850	1450	1075	1850	1350
1-1/4	570	425	725	530	570	425	725	530	1300	950	1650	1200	2050	1500	2600	1950
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2150	1550	2700	2000	3400	2550
1-1/2	1000	725	1250	925	990	725	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

1. "Grade 2" applies for hex cap screws (not hex bolts) up to 152 mm (6-in.) long. "Grade 1" applies for hex cap screws over 152 mm (6-in.) long, and for all other types of bolts and screws of any length.

2. "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated (yellow dichromate - Specification JDS117) without any lubrication.

DO NOT use these hand torque values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only and include a $\pm 10\%$ variance factor. Check tightness of fasteners periodically. DO NOT use air powered wrenches.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same grade. Make sure fastener threads are clean and that you properly start

thread engagement. This will prevent them from failing when tightening.

When bolt and nut combination fasteners are used, torque values should be applied to the NUT instead of the bolt head.

Tighten toothed or serrated-type lock nuts to the full torque value.

Reference: JDS-G200.

ENGINE - DIESEL DIAGNOSTICS

Diagnostics

Diesel Engine Troubleshooting



CAUTION: Avoid Injury! The engine may start to rotate at any time. Keep hands away from all moving parts when testing.

Coolant in the radiator is extremely hot during operation.

Symptom: Engine Will Not Start

(1) Proper starting procedure being used is correct for conditions.

Yes - Go to step (2).

No - Use correct procedure for conditions. See the Operator's Manual. Go to step (2) if problem continues.

(2) Battery 12.7 VDC or higher?

Yes - Go to step (3).

No - Charge and check battery. (See "Battery Test" on page 207.) Go to step (3) if problem continues.

(3) No open circuits in wiring?

Yes - Go to step (4).

No - Repair or replace as needed. (See "Common Circuit Tests" on page 205.) Go to step (4) if problem continues.

(4) Starting motor functioning properly?

Yes - Go to step (5).

No - Repair or replace starting motor. (See "Starting Motor Amperage Draw Test" on page 212.) Go to step (5) if problem continues.

(5) Engine oil of correct viscosity and type?

Yes - Go to step (6).

No - Replace engine oil with oil of proper viscosity and type. Replace oil filter. Go to step (6) if problem continues.

(6) No water in fuel?

Yes - Go to step (7).

No - Drain and replace fuel. Go to step (7) if problem continues.

Symptom: Engine Will Not Start

(7) Fuel filter not clogged?

Yes - Go to step (8).

No - Replace fuel filter. (See "Remove and Install Fuel Filter/Water Separator" on page 107.) Go to step (8) if problem continues.

(8) No air leak in fuel system?

Yes - Go to step (9).

No - Repair fuel system. Go to step (9) if problem continues.

(9) Fuel lines not plugged, pinched or cracked?

Yes - Go to step (10).

No - Repair or replace fuel lines as needed. Go to step (10) if problem continues.

(10) Correct volume of fuel supplied to injection pump?

Yes - Go to step (11).

No - Replace fuel transfer pump. Go to step (11) if problem continues.

(11) Intake and/or exhaust valve clearance correct?

Yes - Go to step (12).

No - Adjust valve clearance. (See "Adjust Valve Clearance" on page 56.) Go to step (12) if problem continues.

(12) Is injection pump timing correct?

Yes - Go to step (13).

No - Correctly time injector pump. (See "Adjust Injection Pump Timing" on page 60.) Go to step (13) if problem continues.

(13) Intake and/or exhaust valve not seized?

Yes - Go to step (14).

No - Replace valve and check valve guide. (See "Recondition Cylinder Head" on page 70.) Go to step (14) if problem continues.

(14) Piston rings not broken or seized?

Yes - Go to step (15).

No - Replace rings. Check piston and cylinder. (See "Inspection and Replacement" on page 92 and "Repair Cylinder Bore" on page 95.) Go to step (15) if problem continues.

INTRODUCTION

Manual Description

This technical manual is written for an experienced technician and contains sections that are specifically for this product. It is a part of a total product support program.

The manual is organized so that all the information on a particular system is kept together. The order of grouping is as follows:

- Table of Contents
- Specifications and Information
- Identification Numbers
- Tools and Materials
- Component Location
- Schematics and Harnesses
- Theory of Operation
- Operation and Diagnostics
- Diagnostics
- Tests and Adjustments
- Repair
- Other

NOTE: Depending on the particular section or system being covered, not all of the above groups may be used.

The bleed tabs for the pages of each section will align with the sections listed on this page. Page numbering is consecutive from the beginning of the Safety section through the last section.

We appreciate your input on this manual. If you find any errors or want to comment on the layout of the manual please contact us.

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Safety

Specifications and Information

Diesel Engine

Electrical

Power Train

Hydraulics

Steering

Brakes

Miscellaneous

SAFETY

Recognize Safety Information



MIF

This is the safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

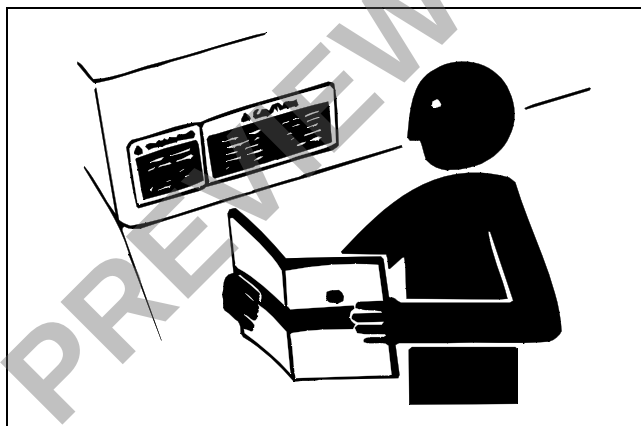
Follow recommended precautions and safe servicing practices.

Understand Signal Words

A signal word - DANGER, WARNING, or CAUTION - is used with the safety-alert symbol. DANGER identifies the most serious hazards.

DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

Replace Safety Signs

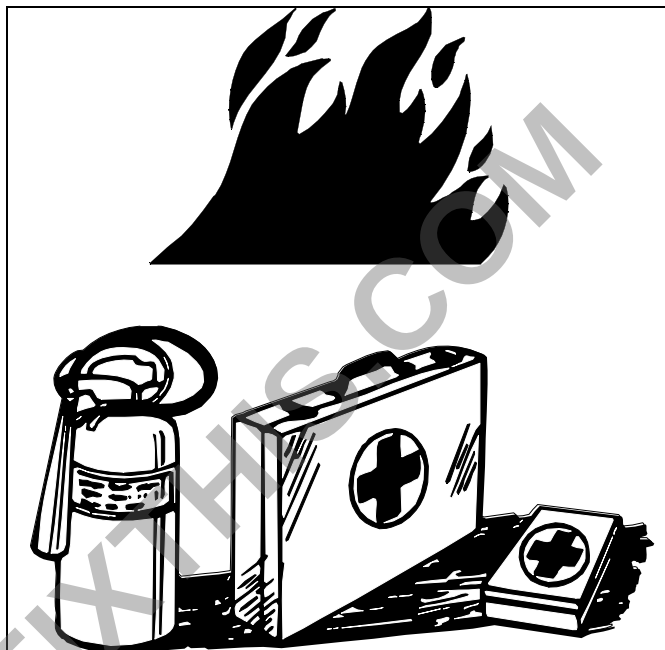


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Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.

Handle Fluids Safely - Avoid Fires

Be Prepared for Emergencies



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When you work around fuel, do not smoke or work near heaters or other fire hazards.

Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.

Make sure machine is clean of trash, grease, and debris.

Do not store oily rags; they can ignite and burn spontaneously.

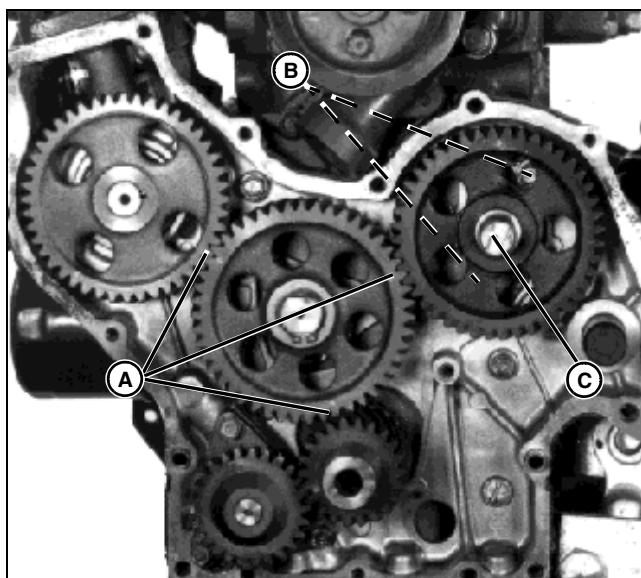
Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.

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NOTE: Due to the odd number of teeth on the idler gear, timing marks will only align periodically.



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7. Rotate crankshaft and align timing marks (A).

IMPORTANT: Avoid damage! DO NOT allow camshaft lobes to hit bearing surfaces while removing camshaft. Machined surfaces can be damaged.

8. Remove two cap screws (B) holding camshaft mounting flange to block (through holes in camshaft gear).

9. Remove camshaft.

10. Inspect all parts for wear or damage. (See "Camshaft Inspection" on page 84.)

Camshaft Installation

IMPORTANT: Avoid damage! DO NOT allow camshaft lobes to hit bearing surfaces while installing camshaft. Machined surfaces can be damaged.

NOTE: Apply clean engine oil on all parts during installation.

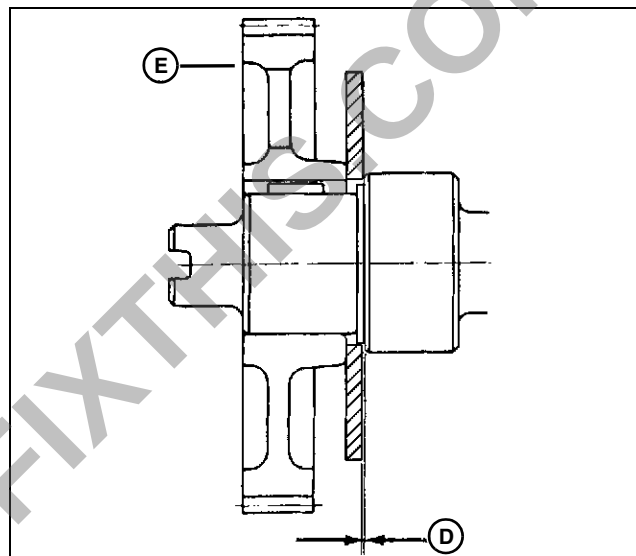
1. Rotate crankshaft to align timing marks.
2. Install camshaft (C) into cylinder block, being careful not to allow camshaft lobes to scratch camshaft bushings. Align camshaft gear timing marks with timing marks on idler gear.
3. Install two camshaft thrust plate cap screws through holes in cam gear. Tighten to specification.
4. Install timing gear cover. (See "Remove and Install Timing Gear Cover" on page 78.)

5. If cam followers were removed, replace into same holes as removed.

6. Install push rods and rocker arm assembly. (See "Repair Rocker Arms and Push Rods" on page 67.)

Camshaft End Play Measurement

1. Check camshaft end play while camshaft is installed in cylinder block using a dial indicator, as described in "Check Camshaft End Play" on page 79.



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1. To check camshaft end play while camshaft is removed from cylinder block: Use a feeler gauge between camshaft thrust plate and front side of first camshaft bearing journal, as shown below.

2. If end play (D) is excessive, remove gear and replace thrust plate.

Camshaft Gear Removal

1. Inspect gear for chipped or broken teeth. Replace if necessary.
2. Remove gear from camshaft using a knife-edge puller and an arbor press. Place flat side of puller against camshaft gear.

ELECTRICAL SPECIFICATIONS

Specifications

Specifications

Battery:

Voltage.....	12 VDC
Rating	45 amp-hr
BCI Group	55
CCA Rating -18° C (0° F)	500 amps
Reserve Capacity (Minutes).....	38
Specific Gravity	1.280 or above
Electrolyte Required Fill (Approx).....	2.0 qt (1.9L)
Load Test (Minimum)	340 amps for 15 seconds

Starting Motor:

Type	Solenoid shift
Starting Motor Current Draw While Cranking Engine (Max).....	150 amps
Starting Motor Current Draw (Max)(No Load at 4300 RPM)	60 amps
Starting Motor RPM (Min at No Load).....	4000 rpm

Alternator:

Rating (Standard)	40 amps
Unregulated Amperage (Min)	50 amps
Regulated Voltage	12.4-13.2 VDC
Regulated Voltage (Max)	14.7 VDC
Unregulated Voltage.....	50 VAC

Fuel Shut-Off Solenoid:

Voltage.....	12 VDC
Pull-in Voltage.....	6.8 VDC
Hold Voltage	3.0 VDC

Sensors:

Fuel Gauge Resistance (Variable).....	33-240 ohms
Fuel Gauge Voltage Drop Across Gauge (Full - Empty)	5.72-0.87 VDC
Engine Oil Pressure Switch.....	Closes at 49 kPa (7.1 psi)
Engine Coolant Temperature Sensor	
Resistance at 71°C (160°F)	100 ohms
Resistance at 82°C (180°F)	80 ohms
Resistance at 93°C (200°F)	60 ohms
Resistance at 112°C (240°F)	40 ohms

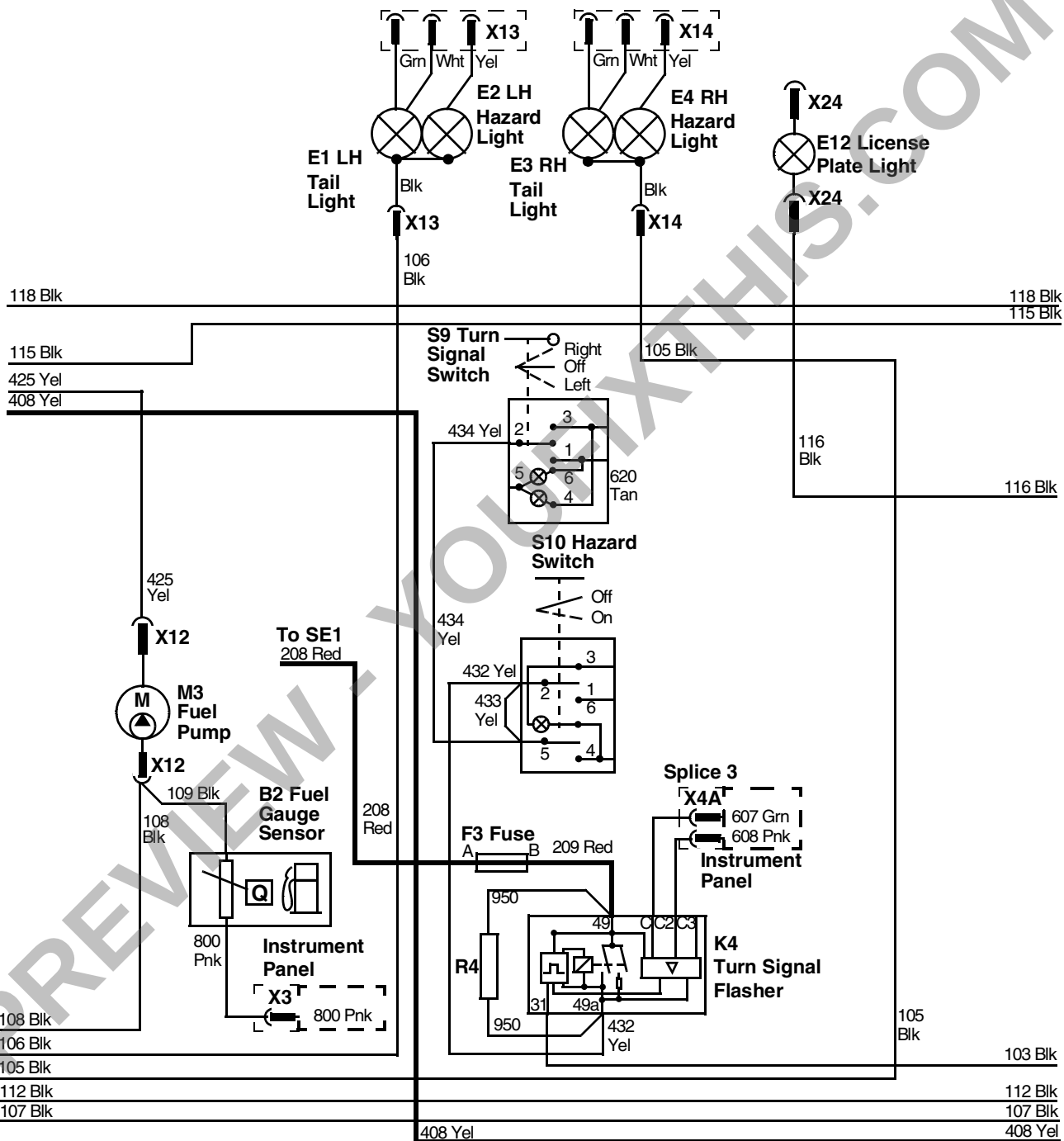
ELECTRICAL OPERATION AND DIAGNOSTICS

406 Yel

406 Yel

430 Yel

430 Yel



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PTO Circuit Operation

Function

To function as an interlock in the cranking circuit to prevent the engine from cranking if either PTO system is engaged, and to engage the electric PTO clutch while illuminating the PTO engaged light on the instrument panel.

Operating Conditions

- Key switch in RUN position
- Engine running

Theory of Operation

The PTO circuit is two switch system to allow for operation of both an electric PTO clutch and a hydraulic PTO pump. Both switches must be in the OFF position for the cranking circuit to be functional.

With the S6 mechanical PTO switch in the OFF position switched power is provided to the PTO circuit through the 201 fuse link, 205 Red wire, S1 key switch, 404 Yel wire, F2 15 amp fuse, 403, 426 and 427 Yel wires, S6 mechanical PTO switch (normally closed contacts), 510 blu wire to the PTO coil. The ground path is from the PTO coil, 520 Blu wire, S6 mechanical PTO switch (normally closed contacts), 117 and 100 Blk wires to ground.

With the S6 mechanical PTO switch in the ON position switched power is provided from the 426 Yel wire across the S6 mechanical PTO switch (normally open contacts) to the 520 Blu wire, PTO coil, 510 Blu wire, S6 mechanical PTO switch (normally open contacts), 130, 117 and 100 Blk wires.

With the S6 mechanical PTO switch in the ON position the PTO engaged light is illuminated by providing a ground for the PTO engaged light through the 510 Blu wire, S6 mechanical PTO switch (normally open contacts), 130, 117 and 100 Blk wires.

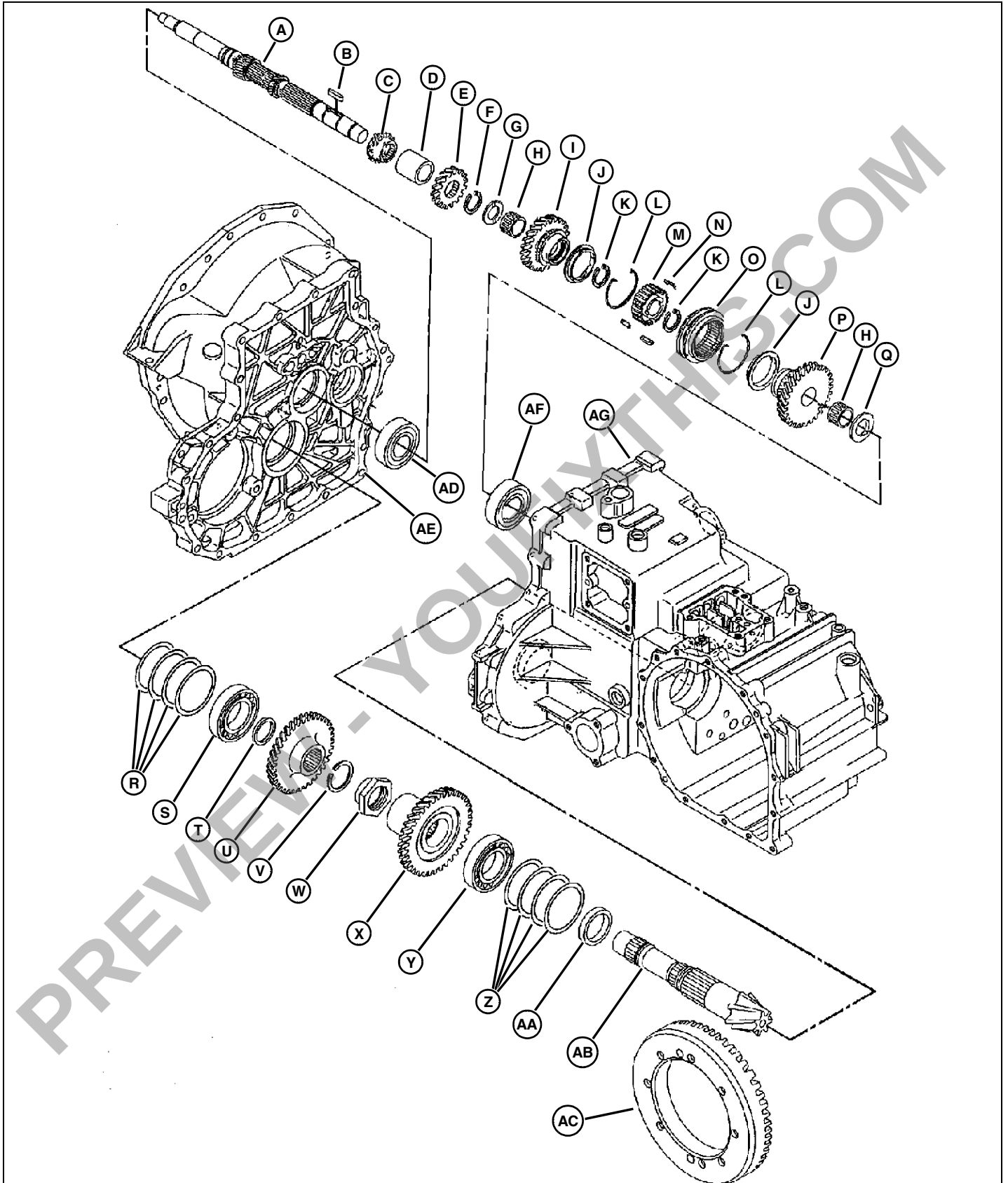
Power for the PTO engaged light is provided from the 201 fuse link, 205 Red wire, S1 key switch, 404 Yel wire, F2 15 amp fuse, 403, 418 and 419 Yel wires, to the instrument panel across the PTO engaged light to the 500 and 501 Blu wires, V2 diode and the 502 Blu wire to the 510 Blu wire.

The S7 PTO engaged sensor switch is activated when the hydraulic PTO system is engaged. This switch interlocks the cranking circuit and provides a alternate path to ground for the PTO engaged light.

The operating circuit for the PTO engaged light when the hydraulic PTO is engaged is provided from the 201 fuse link, 205 Red wire, S1 key switch, 404 Yel wire, F2 15 amp fuse, 403, 418 and 419 Yel wires, to the instrument panel across the PTO engaged light to the 500 Blu wire, S7 PTO engaged sensor switch to the 140, 130, 117 and 100 Blk wires to ground.

POWER TRAIN COMPONENT LOCATION

Input Shaft and Pinion Component Location



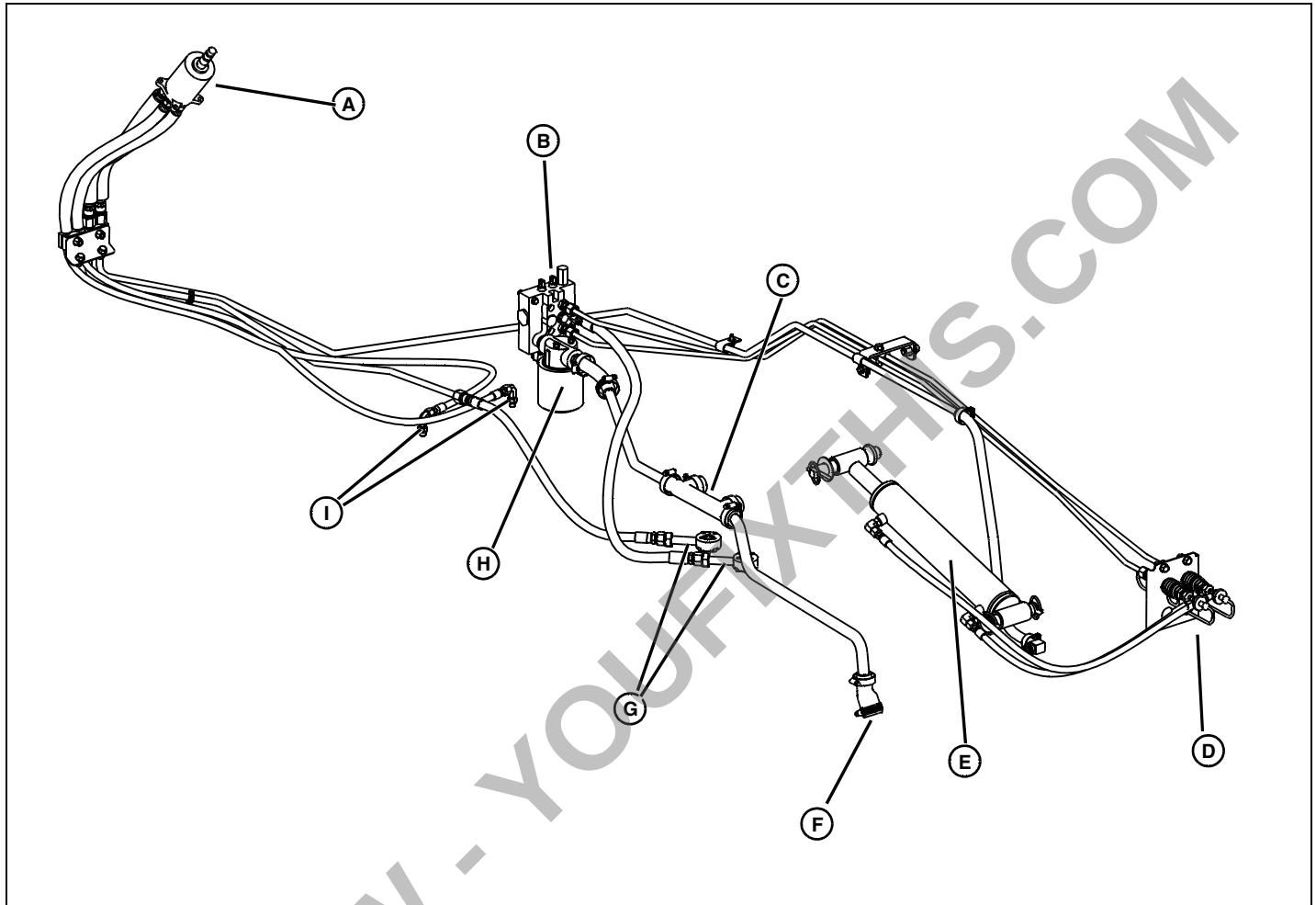
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HYDRAULICS COMPONENT LOCATION

Base Hydraulic System

ProGator

Serial No. (020001-)



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- A - Steering Control Unit**
- B - Control Valve**
- C - Pump Inlet Manifold**
- D - Lift Cylinder Ports**
- E - Lift Cylinder**
- F - Suction Line from Transmission**
- G - Pump Outlet Connections**
- H - Filter**
- I - Hoses to Steering Cylinder**

STEERING DIAGNOSTICS

Symptom: Slow Steering Response

(1) Are the steering lines and hoses in good condition (not leaking or restricted)?

Yes - Go to step (2).

No - Replace lines and hoses as necessary. (See "Steering Hydraulic Schematic" on page 10.) Go to step (2) if problem continues.

(2) Is the steering cylinder in good condition (no internal or external leaks)?

Yes - Go to step (3).

No - Replace cylinder as necessary. (See "Remove and Install Steering Cylinder" on page 323.) Go to step (3) if problem continues.

(3) Is the steering control unit (SCU) in good condition (no internal or external leaks)?

No - Perform "Check Steering System" on page 321. Replace SCU as necessary. (See "Steering Control Unit" on page 323.)

Symptom: MFWD Not Functioning

(1) With all four wheels off the ground, transmission in a forward gear, and engine running, does drive shaft rotate?

Yes - Go to step (2).

No - Inspect transaxle or bi-directional clutch. Go to step (2) if problem continues.

(2) With all four wheels off the ground, transmission in a forward gear, and engine running, do the front wheel(s) rotate?

Yes - Go to step (3).

No - Inspect MFWD differential or slip clutch. Go to step (3) if problem continues.

(3) With all four wheels off the ground, transmission in neutral, and engine stopped (key switch OFF), manually rotate one front wheel. Does the opposing front wheel rotate in the opposite direction?

Yes - Go to step (4).

No - Repair the MFWD differential. (See "Remove and Disassemble MFWD Differential" on page 331.) Go to step (4) if problem continues.

Symptom: MFWD Not Functioning

(4) With all four wheels off the ground, transmission in neutral, and engine stopped (key switch OFF), hold one front wheel while manually rotating the other front wheel. Does the drive shaft rotate?

Yes - Go to step (5).

No - Repair the MFWD slip clutch. (See "Remove and Install MFWD Differential Clutch" on page 330.) Go to step (5) if problem continues.

(5) With both rear wheels OFF the ground, both front wheels ON the ground, transmission in neutral, and engine stopped (key switch OFF), try to manually rotate the drive shaft. Does the drive shaft rotate?

Yes - Repair the MFWD slip clutch. (See "Remove and Install MFWD Differential Clutch" on page 330.)

Tests and Adjustments

Check Steering System

Procedure

1. Engage parking brake.
2. With machine at room temperature, start and run engine at FAST idle for five minutes to warm up hydraulic oil.
3. Run engine at high rpm.
4. Turn steering wheel, at a very fast rate, for a full right turn then a full left turn.

Results

- Should have power steering at all times (low effort).
- If not: Check hydraulic lines for sharp bends or restrictions. Replace damaged lines as necessary.

Check steering cylinder for external or internal leakage. Replace cylinder if necessary. (See "Test Steering Cylinder Leakage" on page 396.)

Check SCU for external or internal leakage. Repair or replace as necessary. (See "Test Steering System" on page 396.)

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