

*POWERTECH*® 8.1 L  
**6081 OEM Diesel  
Engines**

**OPERATION AND  
SERVICE MANUAL**



**Deere Power Systems Group  
OMRG24828 Issue (20DEC00)  
TP-5824 12/00**

LITHO IN U.S.A.  
ENGLISH



# Introduction

## FOREWORD

READ THIS MANUAL carefully to learn how to operate and service your engine correctly. Failure to do so could result in personal injury or equipment damage.

THIS MANUAL SHOULD BE CONSIDERED a permanent part of your engine and should remain with the engine when you sell it.

MEASUREMENTS IN THIS MANUAL are given in both metric and customary U.S. unit equivalents. Use only correct replacement parts and fasteners. Metric and inch fasteners may require a specific metric or inch wrench.

RIGHT-HAND AND LEFT-HAND sides are determined by standing at the drive or flywheel end (rear) of the engine and facing toward the front of the engine.

WRITE ENGINE SERIAL NUMBERS and option codes in the spaces indicated in the Record Keeping Section. Accurately record all the numbers. Your dealer also needs these numbers when you order parts. File the identification numbers in a secure place off the engine.

SETTING FUEL DELIVERY beyond published factory specifications or otherwise overpowering will result in loss of warranty protection for this engine.

CERTAIN ENGINE ACCESSORIES such as radiator, air cleaner, and instruments are optional equipment on

John Deere OEM Engines. These accessories may be provided by the equipment manufacturer instead of John Deere. This operator's manual applies only to the engine and those options available through the John Deere distribution network.

**IMPORTANT:** This manual covers all **POWERTECH® 8.1L OEM engines.** Those engines produced starting in the year 1996 are noted as engines ( —199,999). Engines produced after January 2001 which are redesigned to meet the 2001 emission standards are noted as engines (200,000— ). These engines also have a suffix “070” in the engine model number, as in “6081HF070”.

*NOTE: This operators manual covers only engines provided to OEM (Outside Equipment Manufacturers). For engines in Deere machines, refer to the machine operators manual.*

**CALIFORNIA PROPOSITION 65 WARNING: Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.**

## ENGINE OWNER

### John Deere Engine Owner:

Don't wait until you need warranty or other service to meet your local John Deere Engine Distributor or Service Dealer.

Learn who he is and where he is. At your first convenience, go meet him. He'll want to get to know you and to learn what your needs might be.

### Utilisateurs De Moteurs John Deere:

N'attendez pas d'être obligé d'avoir recours a votre Concessionnaire ou Point de Service le plus proche pour vous adresser a lui.

Renseignez-vous des que possible pour l'identifier et le localiser. A la premiere occasion, prenez contact avec lui et faites-vous connaître. Il sera lui aussi heureux de faire votre connaissance et de savoir que vous Perez computer Sur lui le moment menu.

### An Den Besitzer Des John Deere Motors:

Warten Sie nicht auf einen evt. Reparaturfall um den nächstgelegenen John Deere Händler kennen zu lernen.

Machen Sie sich bei ihm bekannt und nutzen Sie sein "Service Angebot".

### Proprietario Del Motore John Deere:

Non aspetti fino a quando ha bisogno della garanzia o di un altro tipo di assistenza per incontrarsi con il Suo Concessionario che fornisce l'assistenza tecnica.

Impari a conoscere chi è e dove si trova. Alla Sua prima occasione cerchi d'incontrarlo. Egli desidera farsi conoscere e conoscere le Sue necessità.

### Propietario De Equipo John Deere:

No espere hasta necesitar servicio de garantía o de otro tipo para conocer a su Distribuidor de Motores John Deere o al Concesionario de Servicio.

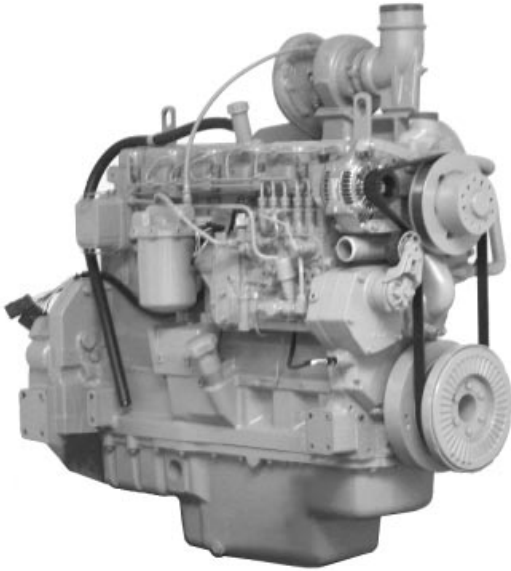
Entérese de quién es, y dónde está situado. Cuando tenga un momento, vaya a visitarlo. A él le gustará conocerlo, y saber cuáles podrían ser sus necesidades.

### John Deere MotorÄgare:

Vänta inte med att besöka Din John Deere återförsäljare till dess att Du behöver service eller garanti reparation.

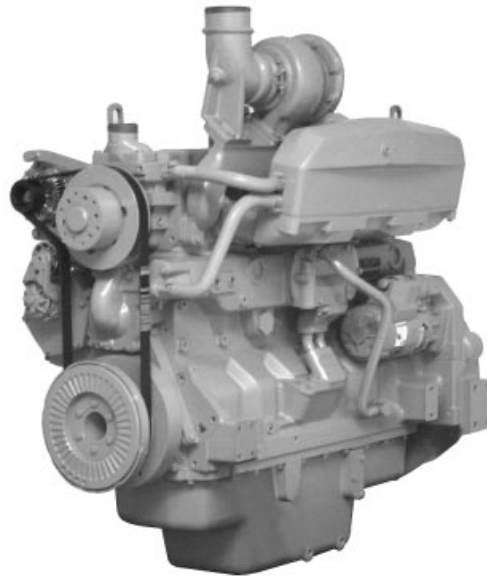
Bekanta Dig med var han är och vem han är. Tag första tillfälle att besöka honom. Han vill också träffa Dig för att få veta vad Du behöver och hur han kan hjälpa Dig.

## IDENTIFICATION VIEWS— ENGINE SERIAL NUMBER ( —199,999)



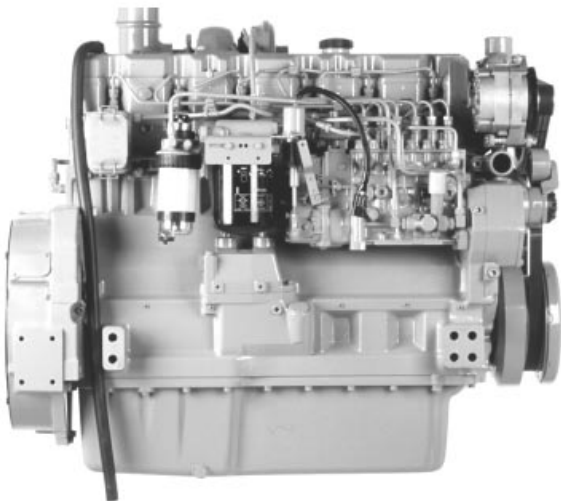
RG7362 —UN-05JAN98

8.1 L Diesel Engine Right Front View—Engines ( —199,999)



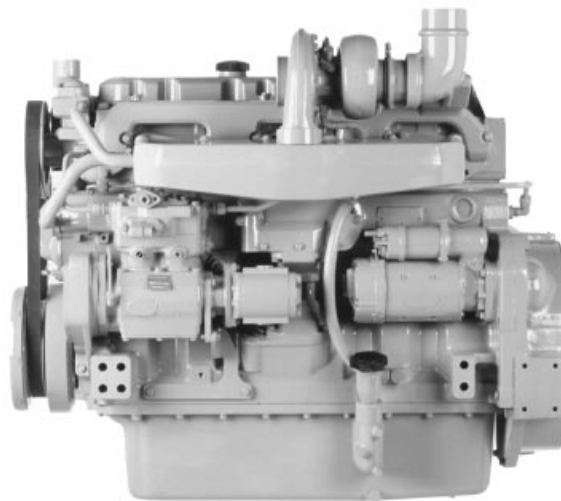
RG7363 —UN-05JAN98

8.1 L Diesel Engines Left Front View—Engines ( —199,999)



RG7385 —UN-05JAN98

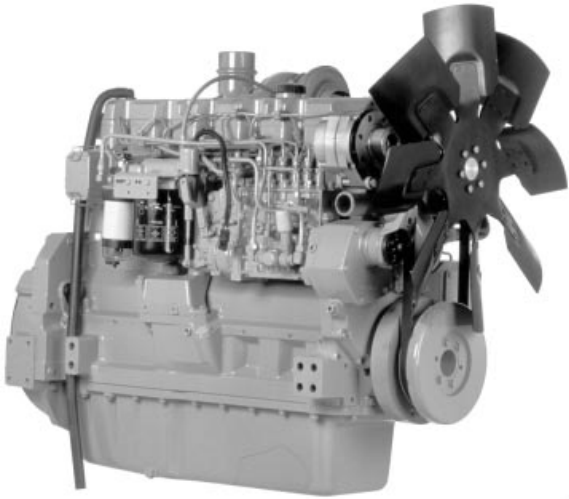
8.1 L Diesel Engines Right Side View—Engines ( —199,999)



RG7387 —UN-05JAN98

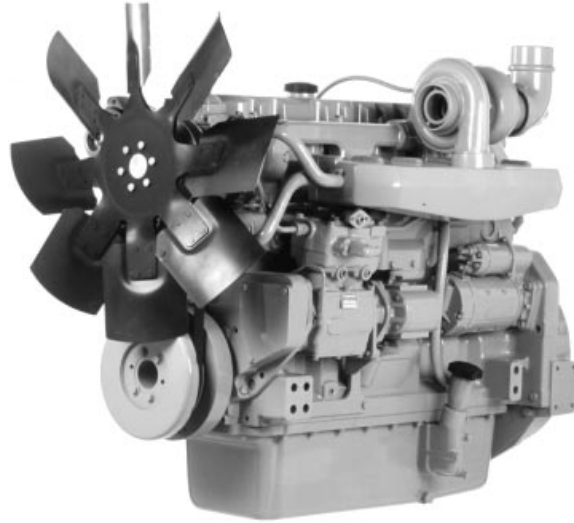
8.1 L Diesel Engines Left Side View—Engines ( —199,999)

RG, RG34710, 4001 —19-18JUN99-1/2



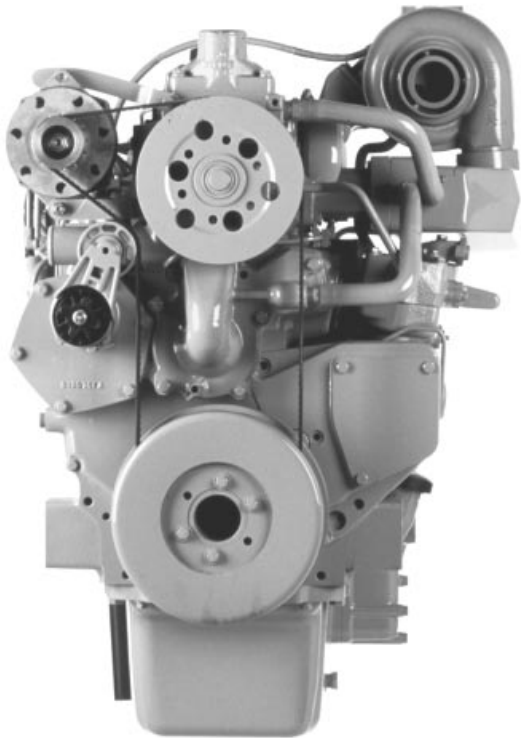
RG7388 —UN-20JUN00

8.1 L Diesel Engine Right Front View—Engines ( —199,999)



RG7386 —UN-20JUN00

8.1 L Diesel Engine Left Front View—Engines ( —199,999)



RG7383 —UN-05JAN98

8.1 L Diesel Engine Front View—Engines ( —199,999)



RG7384 —UN-05JAN98

8.1 L Diesel Engine Rear View—Engines ( —199,999)

## IDENTIFICATION VIEWS— ENGINE SERIAL NUMBER (200,000— )



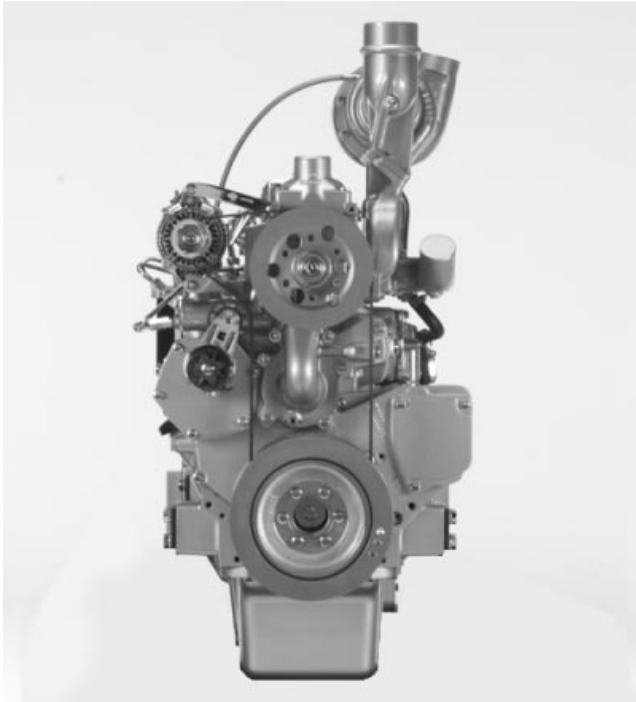
RG11511 -UN-13DEC00

8.1 L Diesel Engine Right Front View—Engines (200,000— )



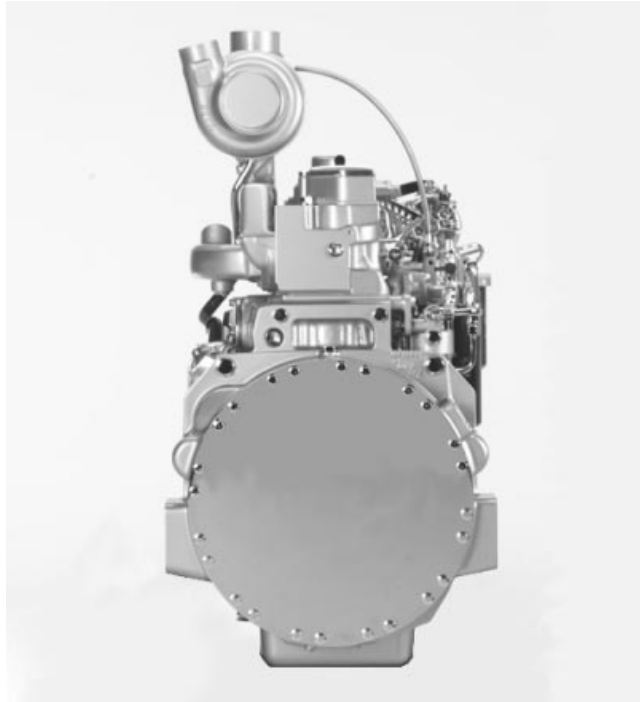
RG11512 -UN-31OCT00

8.1 L Diesel Engines Left Front View—Engines (200,000— )



RG11513 -UN-31OCT00

8.1 L Diesel Engine Front View—Engines (200,000— )



RG11514 -UN-31OCT00

8.1 L Diesel Engine Rear View—Engines (200,000— )

RG,OUOD007,4002 -19-01NOV00-1/1



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# Record Keeping

## RECORD ENGINE SERIAL NUMBER

The engine serial number plate (C) is located on the left-hand side of engine block between intake manifold and starter motor.

Record all of the numbers and letters found on your engine serial number plate in the spaces provided below.

This information is very important for repair parts or warranty information.

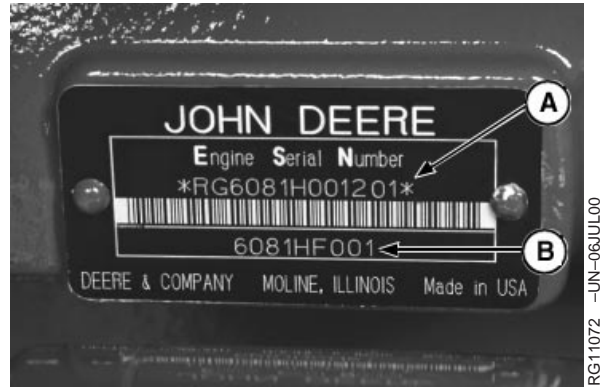
Engine Serial Number (A)

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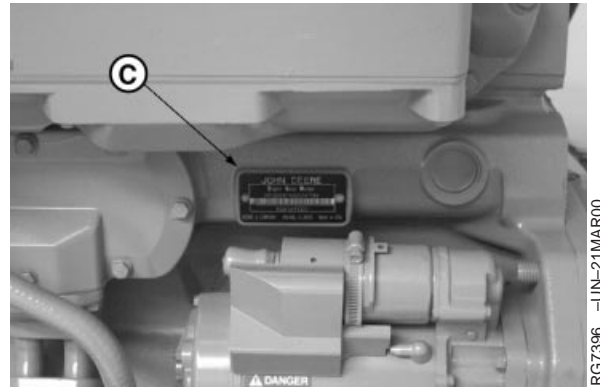
Application Data or Type (B)

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**A—Engine Serial Number**  
**B—Application Data or Type**  
**C—Serial Number Plate**



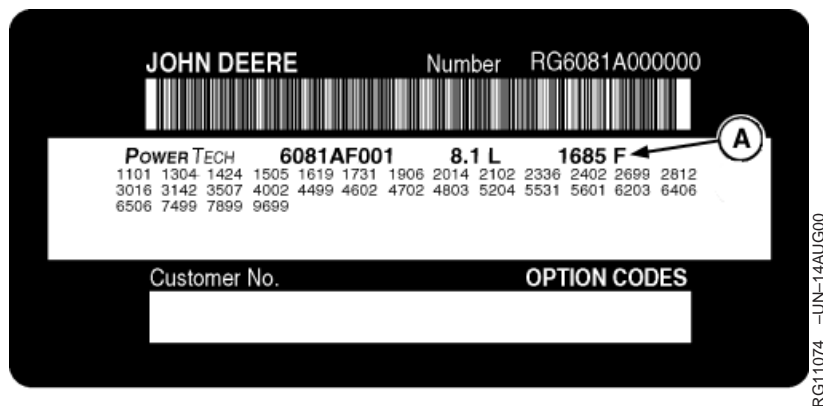
*Engine Serial Number Plate*



*Location of Engine Serial Number Plate*

RG, RG34710, 4001 -19-01JAN96-1/1

## ENGINE OPTION CODES



Option Code Label

## A—Engine Base Code

In addition to the serial number plate, OEM engines have an engine option code label affixed to the side of the cylinder block. These codes indicate which of the engine options were installed on your engine at the factory. When in need of parts or service, furnish your authorized servicing dealer or engine distributor with these numbers.

The engine option code label includes an engine base code (A). This base code must also be recorded along with the option codes.

The first two digits of each option code identify a specific group, such as alternators. The last two digits of each code identify one specific option provided on your engine, such as a 24-volt, 42-amp alternator.

If an engine is ordered without a particular component, the last two digits of that functional group option code will be 99, 00, or XX. The following list shows only the first two digits of the code numbers. For future reference such as ordering repair parts, it is important to have these code numbers available. To ensure this availability, enter the third and fourth digits shown on your engine option code label in the spaces provided on the following page.

Engine Base Code (A):

Continued on next page

RG, RG34710, 4002 -19-01JAN96-1/2

**NOTE:** Your engine option code label may not contain all option codes if an option has been added after the engine left the producing factory.

If option code label is lost or destroyed, consult your servicing dealer or engine distributor selling the engine for a replacement.

Option Codes	Description	Option Codes	Description
11_____	Rocker Arm Cover	46_____	Cylinder Block
13_____	Crankshaft Pulley/Damper	47_____	Crankshaft
14_____	Flywheel Housing	48_____	Pistons and Connecting Rods
15_____	Flywheel	49_____	Valve Actuating Mechanism
16_____	Fuel Injection Pump	50_____	Oil Pump
17_____	Air Intake	51_____	Cylinder Head
19_____	Oil Pan	52_____	Gear-Driven Auxiliary Drive
20_____	Water Pump	55_____	Transport Skid/Shipping Stand
21_____	Thermostat Cover	56_____	Paint
22_____	Thermostats	57_____	Water Pump Inlet
23_____	Fan Drive	59_____	Oil Cooler and Filter
24_____	Fan Belts	62_____	Alternator Mounting
26_____	Engine Coolant Heater	64_____	Exhaust Elbow
28_____	Exhaust System	65_____	Turbocharger
29_____	Vent Hose	66_____	Coolant Temperature Sensor/Switch
30_____	Starter Motor	74_____	Air Conditioning (A/C) Compressor (Optional)
31_____	Alternator	76_____	Oil Pressure Sensor/Switch
35_____	Fuel Filter	77_____	Timing Gear Cover
38_____	Operator's Manual	78_____	Air Compressor (Optional)
39_____	Outlet Manifold	92_____	Accessories (Factory Installed)
40_____	Oil Dipstick	96_____	Wiring Harness
44_____	Electronic Speed Sensor	97_____	Special Equipment (Field Installed)

**NOTE:** These option codes are based on the latest information available at the time of publication.

The right is reserved to make changes at any time without notice.

## RECORD FUEL INJECTION PUMP MODEL NUMBER

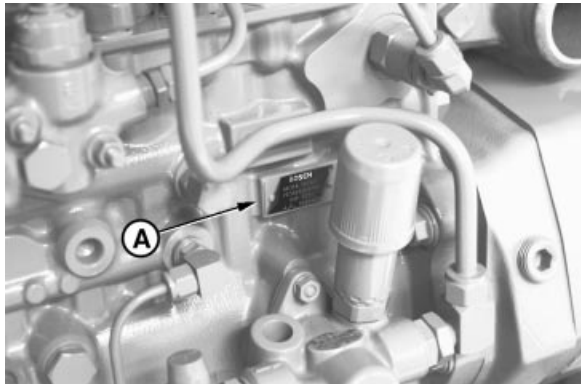
Record the fuel injection pump model and serial information found on the serial number plate (A).

Model No. \_\_\_\_\_ RPM \_\_\_\_\_

Manufacturer's No. \_\_\_\_\_

Serial No. \_\_\_\_\_

**A—Serial Number Plate**



*Fuel Injection Pump Serial Number Plate*

RG, RG34710, 4005 -19-01JAN96-1/1

3G7393 -11N-20 11 IN00

JIN-15DEC88

RG, RG34710, 4004 -19-01JAN96-1/1



# Safety

## RECOGNIZE SAFETY INFORMATION

This is a 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 operating practices.



DX,ALERT -19-29SEP98-1/1

TS1389 -UN-07DEC88

## 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.



DX,SIGNAL -19-03MAR93-1/1

TS187 -19-30SEP88

## FOLLOW SAFETY INSTRUCTIONS

Carefully read all safety messages in this manual and on your machine safety signs. Keep safety signs in good condition. Replace missing or damaged safety signs. Be sure new equipment components and repair parts include the current safety signs. Replacement safety signs are available from your John Deere dealer.

Learn how to operate the machine and how to use controls properly. Do not let anyone operate without instruction.

Keep your machine in proper working condition. Unauthorized modifications to the machine may impair the function and/or safety and affect machine life.

If you do not understand any part of this manual and need assistance, contact your John Deere dealer.



DX,READ -19-03MAR93-1/1

TS201 -UN-23AUG88

## REPLACE SAFETY SIGNS

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



DX,SIGNS1 -19-04JUN90-1/1

TS201 -UN-23AUG88

## PREVENT BYPASS STARTING

Avoid possible injury or death from engine runaway.

Do not start engine by shorting across starter terminal. Engine will start with PTO engaged if normal circuitry is bypassed.

Start engine only from operator's station with PTO disengaged or in neutral.



DPSG,OUOD002,1569 -19-20JUN00-1/1

RG5419 -UN-28FEB89

## HANDLE FUEL SAFELY—AVOID FIRES

Handle fuel with care: it is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks.

Always stop engine before refueling machine. Fill fuel tank outdoors.

Prevent fires by keeping machine clean of accumulated trash, grease, and debris. Always clean up spilled fuel.



DX,FIRE1 -19-03MAR93-1/1

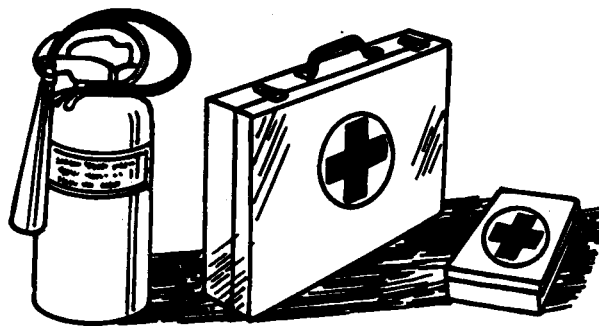
TS202 -UN-23AUG88

## PREPARE FOR EMERGENCIES

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.



TS291 -UN-23AUG88

DX,FIRE2 -19-03MAR93-1/1

## HANDLE STARTING FLUID SAFELY

Starting fluid is highly flammable.

Keep all sparks and flame away when using it. Keep starting fluid away from batteries and cables.

To prevent accidental discharge when storing the pressurized can, keep the cap on the container, and store in a cool, protected location.

Do not incinerate or puncture a starting fluid container.



TS1356 -UN-18MAR92

DX,FIRE3 -19-16APR92-1/1

## HANDLE FLUIDS SAFELY—AVOID FIRES

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.



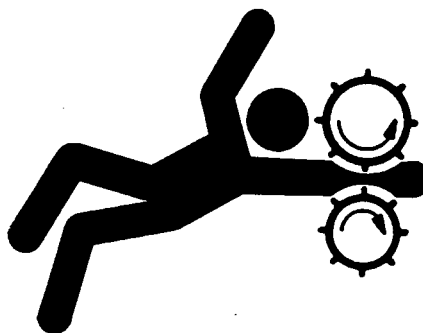
TS227 -UN-23AUG88

DX,FLAME -19-29SEP98-1/1

## SERVICE MACHINES SAFELY

Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



TS228 -UN-23AUG88

DX,LOOSE -19-04JUN90-1/1

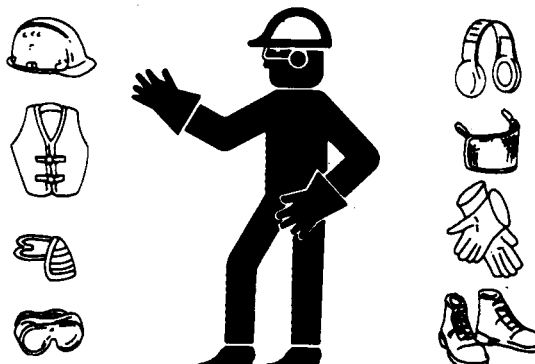
## WEAR PROTECTIVE CLOTHING

Wear close fitting clothing and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.



TS206 -UN-23AUG88

DX,WEAR -19-10SEP90-1/1

## PROTECT AGAINST NOISE

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.



TS207 -UN-23AUG88

DX,NOISE -19-03MAR93-1/1

## HANDLE CHEMICAL PRODUCTS SAFELY

Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

(See your John Deere dealer for MSDS's on chemical products used with John Deere equipment.)



TS1132 -UN-26NOV90

DX,MSDS,NA -19-03MAR93-1/1

## STAY CLEAR OF ROTATING DRIVELINES

Entanglement in rotating driveline can cause serious injury or death.

Keep master shield and driveline shields in place at all times. Make sure rotating shields turn freely.

Wear close fitting clothing. Stop the engine and be sure the PTO driveline is stopped before making adjustments or performing any type service on the engine or PTO-driven equipment.



TS1644 -UN-22AUG95

RG,RG34710,4016 -19-01JAN96-1/1

## PRACTICE SAFE MAINTENANCE

Understand service procedure before doing work. Keep area clean and dry.

Never lubricate, service, or adjust machine while it is moving. Keep hands, feet, and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.

Securely support any machine elements that must be raised for service work.

Keep all parts in good condition and properly installed. Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.

On self-propelled equipment, disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

On towed implements, disconnect wiring harnesses from tractor before servicing electrical system components or welding on machine.



TS218 -UN-23AUG88

DX,SERV -19-17FEB99-1/1

## WORK IN VENTILATED AREA

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area



TS220 -UN-23AUG88

DX,AIR -19-17FEB99-1/1



## USE PROPER TOOLS

Use tools appropriate to the work. Makeshift tools and procedures can create safety hazards.

Use power tools only to loosen threaded parts and fasteners.

For loosening and tightening hardware, use the correct size tools. DO NOT use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches.

Use only service parts meeting John Deere specifications.



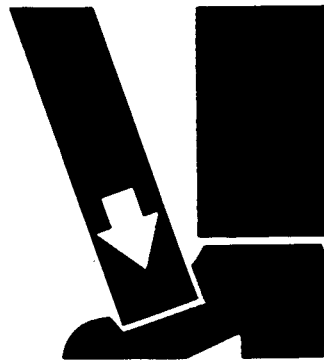
TS779 -JUN-08NOV89

DX,REPAIR -19-17FEB99-1/1

## USE PROPER LIFTING EQUIPMENT

Lifting heavy components incorrectly can cause severe injury or machine damage.

Follow recommended procedure for removal and installation of components in the manual.



TS226 -JUN-23AUG88

DX,LIFT -19-04JUN90-1/1

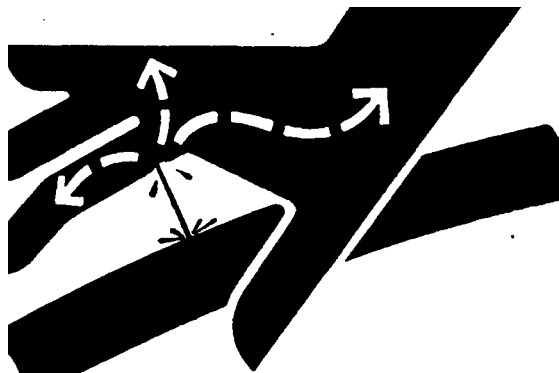
## AVOID HIGH-PRESSURE FLUIDS

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.



X9811 -UN-23AUG88

DX,FLUID -19-03MAR93-1/1

## AVOID HEATING NEAR PRESSURIZED FLUID LINES

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area.



TS953 -UN-15MAY90

DX,TORCH -19-03MAR93-1/1

## REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

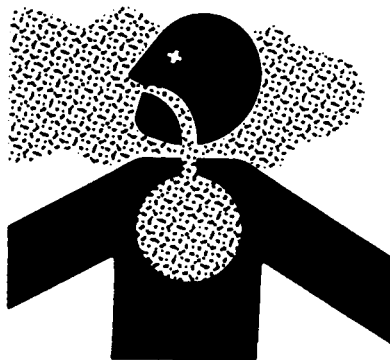
Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Remove paint before heating:

- Remove paint a minimum of 76 mm (3 in.) from area to be affected by heating.
- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

Do all work in an area that is ventilated to carry toxic fumes and dust away.

Dispose of paint and solvent properly.



TS220 -UN-23AUG88

DX,PAINT -19-22OCT99-1/1

## SERVICE COOLING SYSTEM SAFELY

Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.



TS281 -UN-23AUG88

DX,RCAP -19-04JUN90-1/1

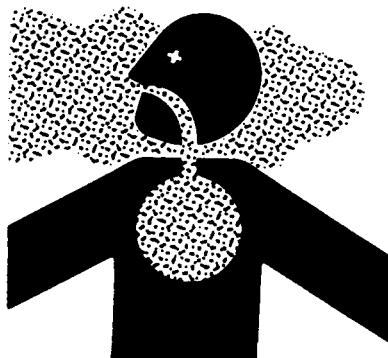
## AVOID HARMFUL ASBESTOS DUST

Avoid breathing dust that may be generated when handling components containing asbestos fibers. Inhaled asbestos fibers may cause lung cancer.

Components in products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates, and some gaskets. The asbestos used in these components is usually found in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust containing asbestos is not generated.

Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding material containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, apply a mist of oil or water on the material containing asbestos.

Keep bystanders away from the area.



TS220 -JN-23AUG88

DX,DUST -19-15MAR91-1/1

## PREVENT BATTERY EXPLOSIONS

Keep sparks, lighted matches, and open flame away from the top of battery. Battery gas can explode.

Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer.

Do not charge a frozen battery; it may explode. Warm battery to 16°C (60°F).



TS204 -JN-23AUG88

DX,SPARKS -19-03MAR93-1/1

## PREVENT ACID BURNS

Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid the hazard by:

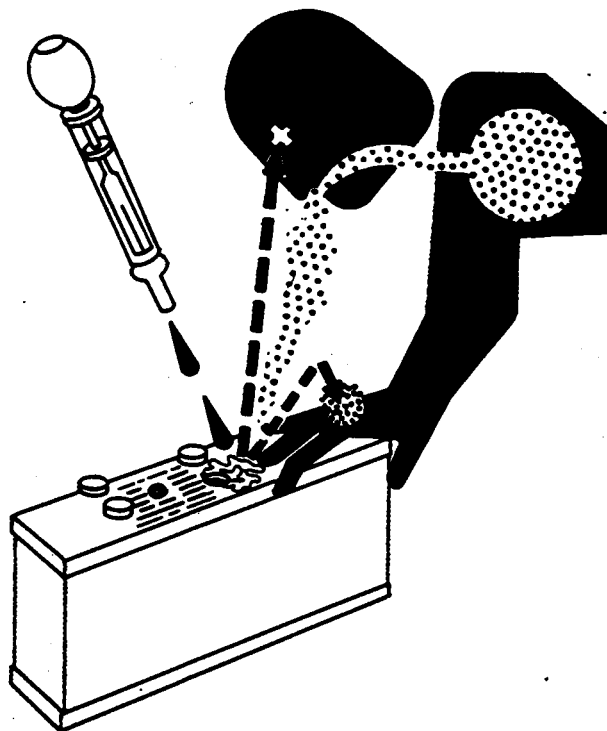
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 15—30 minutes. Get medical attention immediately.

If acid is swallowed:

1. Do not induce vomiting.
2. Drink large amounts of water or milk, but do not exceed 2 L (2 quarts).
3. Get medical attention immediately.



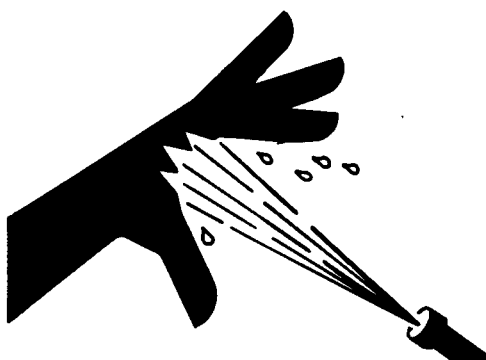
TS203 -UN-23AUG88

DX,POISON -19-21APR93-1/1

## PROTECT AGAINST HIGH PRESSURE SPRAY

Spray from high pressure nozzles can penetrate the skin and cause serious injury. Keep spray from contacting hands or body.

If an accident occurs, see a doctor immediately. Any high pressure spray injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.



TS1343 -UN-18MAR92

DX,SPRAY -19-16APR92-1/1

## DISPOSE OF WASTE PROPERLY

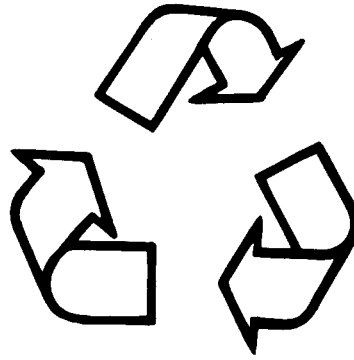
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Air conditioning refrigerants escaping into the air can damage the Earth's atmosphere. Government regulations may require a certified air conditioning service center to recover and recycle used air conditioning refrigerants.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.



TS1133 -UN-26NOV90

DX,DRAIN -19-03MAR93-1/1



# Fuels, Lubricants, and Coolant

## DIESEL FUEL

Consult your local fuel distributor for properties of the diesel fuel available in your area.

In general, diesel fuels are blended to satisfy the low temperature requirements of the geographical area in which they are marketed.

Diesel fuels specified to EN 590 or ASTM D975 are recommended.

In all cases, the fuel shall meet the following properties:

**Cetane number of 40 minimum.** Cetane number greater than 50 is preferred, especially for temperatures below -20°C (-4°F) or elevations above 1500 m (5000 ft).

**Cold Filter Plugging Point (CFPP)** below the expected low temperature OR **Cloud Point** at least 5°C (9°F) below the expected low temperature.

**Fuel lubricity** should pass a minimum of 3100 gram load level as measured by the BOCLE scuffing test.

### Sulfur content:

- Sulfur content should not exceed 0.5%. Sulfur content less than 0.05% is preferred.
- If diesel fuel with sulfur content greater than 0.5% sulfur content is used, reduce the service interval for engine oil and filter by 50%.
- DO NOT use diesel fuel with sulfur content greater than 1.0%.

Bio-diesel fuels may be used ONLY if the fuel properties meet DIN 51606 or equivalent specification.

DO NOT mix used engine oil or any other type of lubricant with diesel fuel.

DX,FUEL1 -19-24JAN00-1/1

## LUBRICITY OF DIESEL FUELS

Diesel fuel must have adequate lubricity to ensure proper operation and durability of fuel injection system components.

Diesel fuels for highway use in the United States and Canada require sulfur content less than 0.05%.

Diesel fuel in the European Union requires sulfur content less than 0.05%.

Experience shows that some low sulfur diesel fuels may have inadequate lubricity and their use may reduce performance in fuel injection systems due to inadequate lubrication of injection pump components. The lower concentration of aromatic compounds in these fuels also adversely affects injection pump seals and may result in leaks.

Use of low lubricity diesel fuels may also cause accelerated wear, injection nozzle erosion or corrosion, engine speed instability, hard starting, low power, and engine smoke.

Fuel lubricity should pass a minimum of 3100 gram load level as measured by the BOCLE scuffing test.

ASTM D975 and EN 590 specifications do not require fuels to pass a fuel lubricity test.

If fuel of low or unknown lubricity is used, add John Deere PREMIUM DIESEL FUEL CONDITIONER (or equivalent) at the specified concentration.

DX,FUEL5 -19-24JAN00-1/1

## DIESEL FUEL STORAGE

Proper fuel storage is critically important. Use clean storage and transfer tanks. Periodically drain water and sediment from bottom of tank. Store fuel in a convenient place away from buildings.

**IMPORTANT: DO NOT store diesel fuel in galvanized containers. Diesel fuel stored in galvanized containers reacts with zinc coating on container to form zinc flakes. If fuel contains water, a zinc gel will also form. The gel and flakes will quickly plug fuel filters, damage injection nozzles and injection pump.**

**DO NOT use brass-coated containers for fuel storage. Brass is an alloy of copper and zinc.**

Store diesel fuel in plastic, aluminum, and steel containers specially coated for diesel fuel storage.

Avoid storing fuel over long periods of time. If fuel is stored for more than a month prior to use, or there is a slow turnover in fuel tank or supply tank, add a fuel conditioner such as John Deere PREMIUM DIESEL FUEL CONDITIONER or equivalent to stabilize the fuel and prevent water condensation. John Deere PREMIUM DIESEL FUEL CONDITIONER is available in winter and summer formulas. Fuel conditioner also reduces fuel gelling and controls wax separation during cold weather.

Consult your John Deere engine distributor or servicing dealer for recommendations and local availability. Always follow manufacturer's directions on label.

RG, RG34710, 7526 -19-30JUN97-1/1

## DIESELSCAN FUEL ANALYSIS

DIESELSCAN™ is a John Deere fuel sampling program to help you monitor the quality of your fuel source. It verifies fuel type, cleanliness, water content, suitability for cold weather operation, and if fuel is within ASTM specifications. Check with your John Deere dealer for availability of DIESELSCAN kits.

*DIESELSCAN is a trademark of Deere & Company*

DX, FUEL6 -19-06DEC00-1/1

## MINIMIZING THE EFFECT OF COLD WEATHER ON DIESEL ENGINES

John Deere diesel engines are designed to operate effectively in cold weather.

However, for effective starting and cold weather operation, a little extra care is necessary. The information below outlines steps that can minimize the effect that cold weather may have on starting and operation of your engine. See your authorized engine distributor or servicing dealer for additional information and local availability of cold weather aids.

### Use Grade No. 1-D Fuel

When temperatures fall below 5°C (40°F), Grade No. 1-D fuel is best suited for cold weather operation. Grade No. 1-D fuel has a lower cloud point and a lower pour point.

**Cloud point** is the temperature at which wax will begin to form in the fuel and this wax causes fuel filters to plug. **Pour point** is the temperature at which fuel begins to thicken and become more resistant to flow through fuel pumps and lines.

*NOTE: On an average, Grade No. 1-D fuel has a lower BTU (heat content) rating than Grade No. 2-D fuel. When using Grade No. 1-D fuel you may notice a drop in power and fuel efficiency, but should not experience any other engine performance effects. Check the grade of fuel being used before troubleshooting for low power complaints in cold weather operation.*

### Diesel Fuel Flow Additive

**IMPORTANT:** Treat fuel when outside temperature drops below 0°C (32°F). For best

**results, use with untreated fuel. Follow all recommended instructions on label.**

Use John Deere Premium Diesel Fuel Conditioner (Winter) or equivalent to treat fuel during the cold weather season. This winter formulation is a combination diesel fuel conditioner and anti-gel additive.

For more information, see your John Deere engine distributor or servicing dealer.

### Cold Weather Starting Aids

Coolant heaters, air intake heaters, or ether starting aids are available options to aid in cold weather starting.

### Seasonal Viscosity Oil and Proper Coolant Concentration

Use seasonal grade viscosity engine oil based on expected air temperature range between oil changes and a proper concentration of low silicate antifreeze as recommended. (See DIESEL ENGINE OIL and ENGINE COOLANT REQUIREMENTS later in this section).

For more information, see your John Deere engine distributor or servicing dealer.

RG, RG34710, 4030 -19-01JAN96-1/1

## DIESEL ENGINE BREAK-IN OIL

New engines are filled at the factory with John Deere ENGINE BREAK-IN OIL. During the break-in period, add John Deere ENGINE BREAK-IN OIL as needed to maintain the specified oil level.

Change the oil and filter after the first 100 hours of operation of a new or rebuilt engine.

After engine overhaul, fill the engine with John Deere ENGINE BREAK-IN OIL.

If John Deere ENGINE BREAK-IN OIL is not available, use a diesel engine oil meeting one of the following during the first 100 hours of operation:

- API Service Classification CE

- ACEA Specification E1

After the break-in period, use John Deere PLUS-50® or other diesel engine oil as recommended in this manual.

**IMPORTANT:** Do not use PLUS-50 oil or engine oils meeting API CH-4, API CG4, API CF4, ACEA E3, or ACEA E2 performance levels during the first 100 hours of operation of a new or rebuilt engine. These oils will not allow the engine to break-in properly.

*PLUS-50 is a registered trademark of Deere & Company.*

DX,ENOIL4 -19-24JAN00-1/1

## DIESEL ENGINE OIL

Use oil viscosity based on the expected air temperature range during the period between oil changes.

The following oil is preferred:

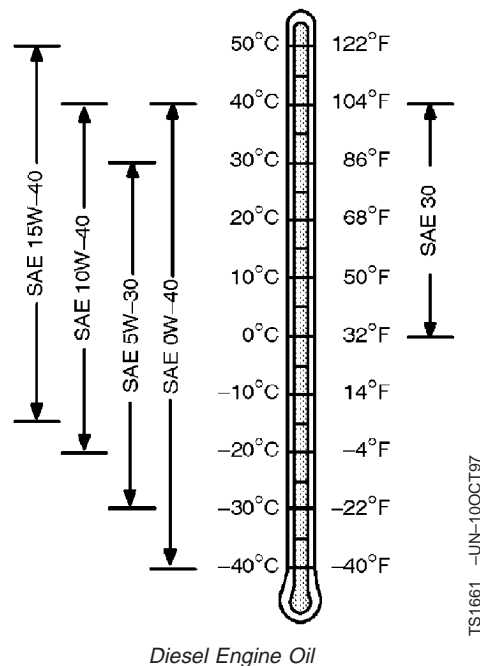
- John Deere PLUS-50®

The following oil is also recommended:

- John Deere TORQ-GARD SUPREME®

Other oils may be used if they meet one or more of the following:

- API Service Classification CH-4
- API Service Classification CG-4
- API Service Classification CF-4
- ACEA Specification E3
- ACEA Specification E2



### Multi-viscosity diesel engine oils are preferred.

If diesel fuel with sulfur content greater than 0.5% is used, reduce the service interval by 50%.

Extended service intervals may apply when John Deere preferred engine oils are used. Consult your John Deere dealer for more information.

*PLUS-50 is a registered trademark of Deere & Company.  
TORQ-GARD SUPREME is a registered trademark of Deere & Company*

DX,ENOil -19-24JAN00-1/1

## **EXTENDED DIESEL ENGINE OIL SERVICE INTERVALS**

When John Deere PLUS-50<sup>®</sup> oil and the specified John Deere filter are used, the service interval for engine oil and filter changes may be increased by 50%.

If other than<sup>®</sup>oil and the specified John Deere filter are used, change the engine oil and filter at the normal service interval.

*PLUS-50 is a registered trademark of Deere & Company*

DX,ENOIL6 -19-10OCT97-1/1

## **MIXING OF LUBRICANTS**

In general, avoid mixing different brands or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements.

Consult your John Deere dealer to obtain specific information and recommendations.

Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

DX,LUBMIX -19-18MAR96-1/1

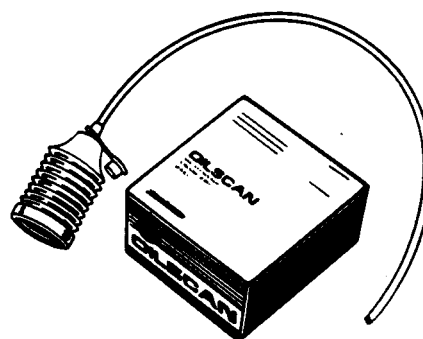


## OILSCAN® AND COOLSCAN®

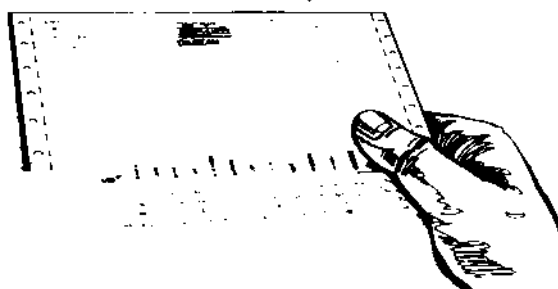
OILSCAN® and COOLSCAN® are John Deere sampling programs to help you monitor machine performance and identify potential problems before they cause serious damage.

Oil and coolant samples should be taken from each system prior to its recommended change interval.

Check with your John Deere dealer for the availability of OILSCAN® and COOLSCAN® kits.



OILSCAN



*OILSCAN is a registered trademark of Deere & Company.  
COOLSCAN is a registered trademark of Deere & Company.*

Sampling Program

DPSG,OUOD002,1824 -19-02AUG00-1/1

T6828AB -UN-15JUN89

T6829AB -UN-18OCT88

## ALTERNATIVE AND SYNTHETIC LUBRICANTS

Conditions in certain geographical areas may require lubricant recommendations different from those printed in this manual.

Some John Deere brand coolants and lubricants may not be available in your location.

Consult your John Deere dealer to obtain information and recommendations.

Synthetic lubricants may be used if they meet the performance requirements as shown in this manual.

The temperature limits and service intervals shown in this manual apply to both conventional and synthetic oils.

Re-refined base stock products may be used if the finished lubricant meets the performance requirements.

DX,ALTER -19-15JUN00-1/1

## LUBRICANT STORAGE

Your equipment can operate at top efficiency only when clean lubricants are used.

Use clean containers to handle all lubricants.

Whenever possible, store lubricants and containers in an area protected from dust, moisture, and other contamination. Store containers on their side to avoid water and dirt accumulation.

Make certain that all containers are properly marked to identify their contents.

Properly dispose of all old containers and any residual lubricant they may contain.

DX,LUBST -19-18MAR96-1/1

## GREASE

Use grease based on NLGI consistency numbers and the expected air temperature range during the service interval.

The following greases are preferred:

- John Deere SD POLYUREA GREASE

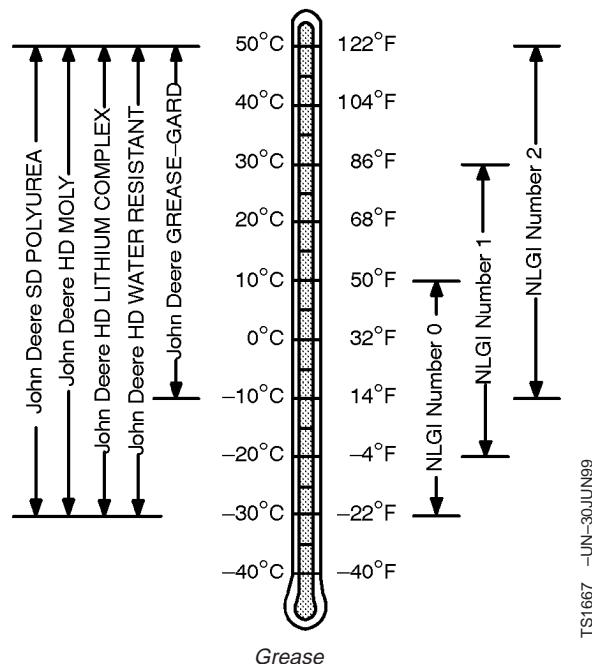
The following greases are also recommended:

- John Deere HD MOLY GREASE
- John Deere HD LITHIUM COMPLEX GREASE
- John Deere HD WATER RESISTANT GREASE
- John Deere GREASE-GARD

Other greases may be used if they meet the following:

- NLGI Performance Classification GC-LB

**IMPORTANT:** Some types of grease thickener are not compatible with others. Consult your grease supplier before mixing different types of grease.



DX,GREAI -19-24JAN00-1/1

## DIESEL ENGINE COOLANT

The engine cooling system is filled to provide year-round protection against corrosion and cylinder liner pitting, and winter freeze protection to -37°C (-34°F).

The following engine coolant is preferred for service:

- John Deere COOL-GARD Prediluted Coolant

The following engine coolant is also recommended:

- John Deere COOL-GARD Coolant Concentrate in a 40 to 60% mixture of concentrate with quality water.

Other low silicate ethylene glycol base coolants for heavy-duty engines may be used if they meet one of the following specifications:

- ASTM D5345 (prediluted coolant)
- ASTM D4985 (coolant concentrate) in a 40 to 60% mixture of concentrate with quality water

Coolants meeting these specifications require use of supplemental coolant additives, formulated for heavy-duty diesel engines, for protection against corrosion and cylinder liner erosion and pitting.

A 50% mixture of ethylene glycol engine coolant in water provides freeze protection to -37°C (-34°F). If

protection at lower temperatures is required, consult your John Deere dealer for recommendations.

Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended for mixing with ethylene glycol base engine coolant concentrate.

**IMPORTANT: Do not use cooling system sealing additives or antifreeze that contains sealing additives.**

### Coolant Drain Intervals

Drain the factory fill engine coolant, flush the cooling system, and refill with new coolant after the first 3 years or 3000 hours of operation. Subsequent drain intervals are determined by the coolant used for service. At each interval, drain the coolant, flush the cooling system, and refill with new coolant.

When John Deere COOL-GARD is used, the drain interval may be extended to 5 years or 5000 hours of operation, provided that the coolant is tested annually AND additives are replenished, as needed, by adding a supplemental coolant additive.

If COOL-GARD is not used, the drain interval is reduced to 2 years or 2000 hours of operation.

DX.COOL3 -19-05FEB99-1/1

## DIESEL ENGINE COOLANTS AND SUPPLEMENTAL ADDITIVE INFORMATION

Engine coolants are a combination of three chemical components: ethylene glycol (antifreeze), inhibiting coolant additives, and quality water.

### Coolant Specifications

Some products, including John Deere COOL-GARD Prediluted Coolant, are fully formulated coolants that contain all three components in their correct concentrations. Do not add an initial charge of supplemental coolant additives to these fully formulated products.

Some coolant concentrates, including John Deere COOL-GARD Coolant Concentrate, contain both ethylene glycol antifreeze and inhibiting coolant additives. Mix these products and quality water, but do not add an initial charge of supplemental coolant additives.

Coolants meeting ASTM D5345 (prediluted coolant) or ASTM D4985 (coolant concentrate) require an initial charge of supplemental coolant additives.

### Replenish Coolant Additives

The concentration of coolant additives is gradually depleted during engine operation. Periodic replenishment of inhibitors is required, even when John Deere COOL-GARD is used. Follow the recommendations in this manual for the use of supplemental coolant additives.

### Why Use Supplemental Coolant Additives?

Operating without proper coolant additives will result in increased corrosion, cylinder liner erosion and pitting, and other damage to the engine and cooling system. A simple mixture of ethylene glycol and water will not give adequate protection.

Use of supplemental coolant additives reduces corrosion, erosion, and pitting. These chemicals reduce the number of vapor bubbles in the coolant and help form a protective film on cylinder liner surfaces.

This film acts as a barrier against the harmful effects of collapsing vapor bubbles.

### Avoid Automotive-Type Coolants

Never use automotive-type coolants (such as those meeting ASTM D3306 or ASTM D4656). These coolants do not contain the correct additives to protect heavy-duty diesel engines. They often contain a high concentration of silicates and may damage the engine or cooling system.

### Non-Aqueous Propylene Glycol

Non-aqueous propylene glycol should not be used with John Deere diesel engines. This coolant works best with coolant temperatures above the acceptable engine operating range. This could decrease engine life due to lower engine oil viscosity. In addition, electronically controlled engines could experience premature power de-rate due to high coolant temperature.

### Water Quality

Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended for mixing with ethylene glycol base engine coolant concentrate. All water used in the cooling system should meet the following minimum specifications for quality:

Chlorides	40 mg/L or less
Sulfates	100 mg/L or less
Total Dissolved Solids	340 mg/L or less
Total Hardness	170 mg/L or less
pH Level	5.5 to 9.0

### Freeze Protection

The relative concentrations of ethylene glycol and coolant in the engine coolant determine its freeze protection limit. Refer to the chart on the following page.

Continued on next page

DPSG.OUOD002,1835 -19-03AUG00-1/2

Ethylene Glycol	Freeze Protection Limit
40%	-24°C (-12°F)
50%	-37°C (-34°F)
60%	-52°C (-62°F)

DO NOT use a coolant-water mixture greater than 60% ethylene glycol.

DPSG,OUOD002,1835 -19-03AUG00-2/2

## TESTING DIESEL ENGINE COOLANT

Maintaining adequate concentrations of glycol and inhibiting additives in the coolant is critical to protect the engine and cooling system against freezing, corrosion, and cylinder liner erosion and pitting.

Test the coolant solution at intervals of 12 months or less and whenever excessive coolant is lost through leaks or overheating.

### Coolant Test Strips

Coolant test strips are available from your John Deere dealer. These test strips provide a simple, effective method to check the freeze point and additive levels of your engine coolant.

Compare the results to the supplemental coolant additive (SCA) chart to determine the amount of inhibiting additives in your coolant and whether more John Deere COOLANT CONDITIONER should be added.

### COOLSCAN

For a more thorough evaluation of your coolant, perform a COOLSCAN analysis. See your John Deere dealer for information about COOLSCAN.

DPSG,OUOD002,1825 -19-02AUG00-1/1

## SUPPLEMENTAL COOLANT ADDITIVES

The concentration of coolant additives is gradually depleted during engine operation. For all recommended coolants, replenish additives between drain intervals by adding a supplemental coolant additive every 12 months or as determined necessary by coolant testing.

John Deere COOLANT CONDITIONER is recommended as a supplemental coolant additive in John Deere engines.

**IMPORTANT: Do not add a supplemental coolant additive when the cooling system is drained and refilled with John Deere COOL-GARD.**

If other coolants are used, consult the coolant supplier and follow the manufacturer's recommendation for use of supplemental coolant additives.

The use of non-recommended supplemental coolant additives may result in additive drop-out and gelation of the coolant.

Add the manufacturer's recommended concentration of supplemental coolant additive. DO NOT add more than the recommended amount.

DX,COOL4 -19-15JUN00-1/1

## OPERATING IN WARM TEMPERATURE CLIMATES

John Deere engines are designed to operate using glycol base engine coolants.

Always use a recommended glycol base engine coolant, even when operating in geographical areas where freeze protection is not required.

**IMPORTANT: Water may be used as coolant *in emergency situations only*.**

**Foaming, hot surface aluminum and iron corrosion, scaling, and cavitation will occur when water is used as the coolant, even when coolant conditioners are added.**

**Drain cooling system and refill with recommended glycol base engine coolant as soon as possible.**

DX,COOL6 -19-18MAR96-1/1

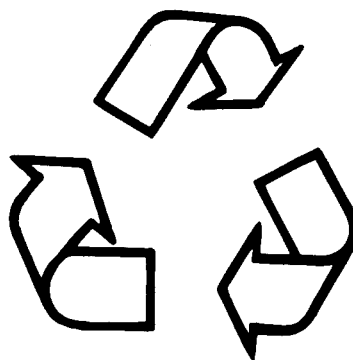
## DISPOSING OF COOLANT

Improperly disposing of engine coolant can threaten the environment and ecology.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere engine distributor or servicing dealer.



*Recycle Waste*

TS1133 -UN-26NOV90

RG, RG34710, 7543 -19-30JUN97-1/1

# Engine Operating Guidelines

## INSTRUMENT (GAUGE) PANELS (STANDARD INSTRUMENT PANELS)

All controls and gauges are optional equipment for John Deere OEM Engines. They may be provided by the equipment manufacturer instead of John Deere. The following information applies only to those controls and gauges provided by John Deere.

**IMPORTANT:** Any time an electric gauge or meter does not register correctly, replace it with a new one. Do not attempt to repair it.

Following is a brief description of the components on the John Deere instrument (gauge) panel:

**A—Oil Pressure Gauge** - Indicates engine oil pressure.

**B—Ammeter** - Indicates charging current within electrical system.

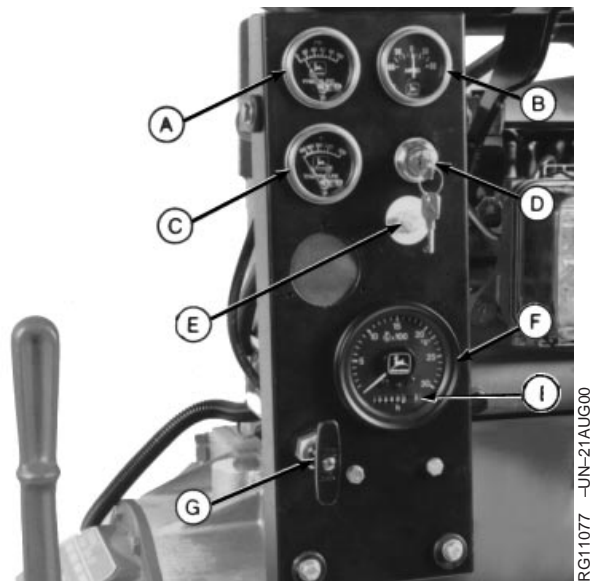
**C—Coolant Temperature Gauge** - Indicates the engine coolant temperature.

**D—Key Switch** - The four-position key switch controls the electrical system.

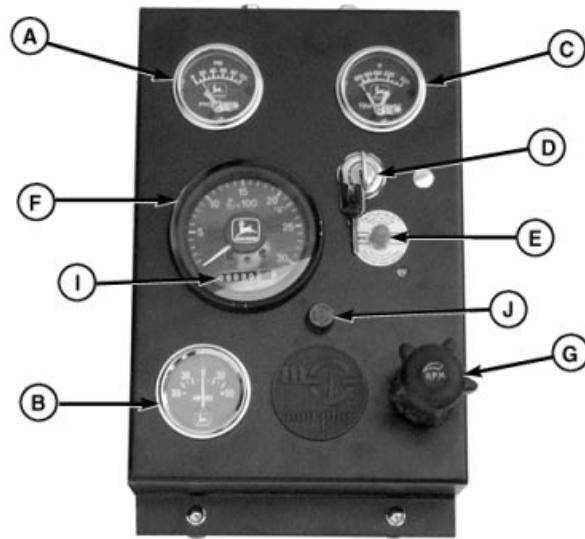
**E—Reset (Safety) Switch** - Overrides safety shutdown switch when depressed and held in during engine startup. Hold button in until engine oil pressure is at a safe operating level. Switch will shut engine down when oil pressure drops below or coolant temperature rises above a (preset) safe operating level.

**F—Tachometer (with Electric Hour Meter, Some Engines)** - Tachometer senses engine speed from a speed sensor in front timing gear cover and indicates engine speed in revolutions per minute (rpm). Hour meter indicates the operating hours of the engine while key switch is in the "ON" position. The hour meter should be used as a guide for scheduling periodic service.

**G—Hand Throttle** - Controls engine speed.



Standard Instrument Panel for Earlier Engines



Standard Instrument Panel for Later Engines

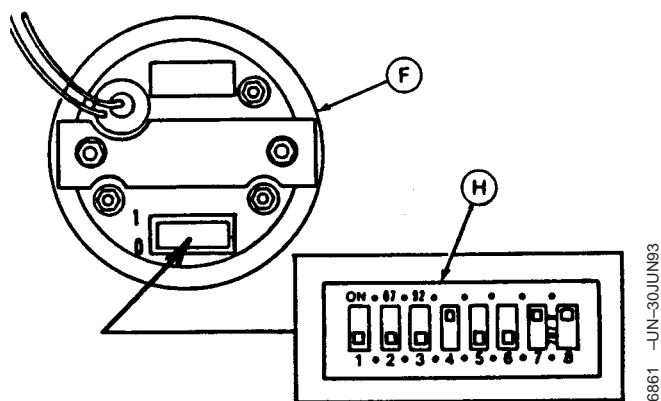
- A—Oil Pressure Gauge
- B—Ammeter
- C—Coolant Temperature Gauge
- D—Key Switch
- E—Reset (Safety) Switch
- F—Tachometer (With Hour Meter, Some Engines)
- G—Hand Throttle
- H—Tachometer Binary Code
- I—Hour Meter (Separate on Some Engines)
- J—Fuse Holder (14 Amp) (Later Engines)



**H— Tachometer Binary Code** - Located in back of tachometer and must be set at “00010011” to operate at 27 pulses per revolution as shown.

**I— Hour Meter (Separate on Some Engines)** - On some instrument panels, the hour meter is a separate gauge from the tachometer. This electric hour meter shows the accumulated hours of engine service. The hour meter operates when the engine is operating, or when the reset button is manually held in while the key switch is in the ON Position. The accumulated hours are displayed in hours and tenths of hours.

**J— Fuse Holder (14 Amp Fuse) (Later Engines)** - On later instrument panels the fuse holder is located on the panel. (On earlier panels, fuse is a 25-amp located on the back of the panel.) See “Checking Fuses” in “Service as Required” section later in this manual.



Setting Code for Tachometer

RG6861 -UN-30JUN93

RG, RG34710, 4046 -19-01JAN96-2/2

## INSTRUMENT (GAUGE) PANEL (ENGINES WITH ELECTRONIC INSTRUMENT PANEL)

This electronic instrument panel was introduced in 1999. It is linked to the John Deere engine control unit (ECU).

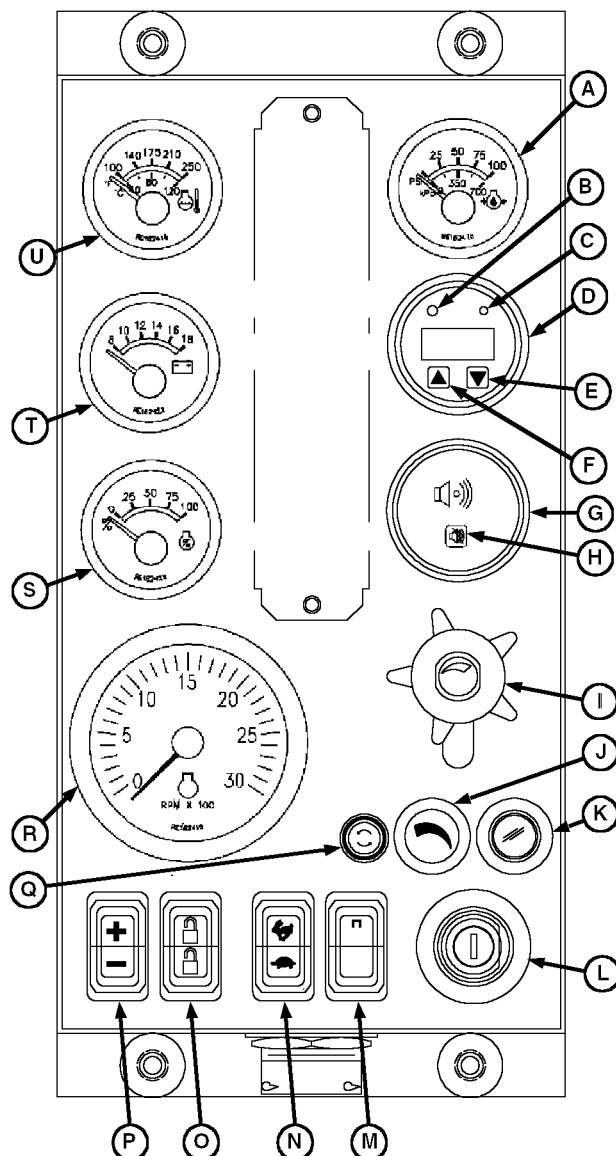
This allows the operator to monitor engine performance as well as to diagnose any troubles during engine operation.

**IMPORTANT:** Any time an electric gauge or meter does not register correctly, replace with a new one. Do not attempt to repair it. All gauges are plug-in type.

Refer to manufacturers literature for information on controls not provided by Deere.

Following is a brief description of the gauges and controls on the John Deere electronic instrument panel.

- A—Engine Oil Pressure Gauge
- B—Amber “WARNING” Indicator
- C—Red “STOP ENGINE” Indicator
- D—Diagnostic Gauge/Hour Meter
- E—Touch Switch
- F—Touch Switch
- G—Audible Alarm
- H—Audible Alarm Override Switch (Optional)
- I—Throttle Control (Optional)
- J—Dimmer Control (Optional)
- K—Engine Preheater Indicator (Optional)
- L—Key Start Switch
- M—Override Shutdown Rocker Switch (Optional)
- N—High-Low Speed Select Rocker Switch (Optional)
- O—Bump Speed Enable Rocker Switch (Optional)
- P—Speed Select Rocker Switch (Optional)
- Q—Fuse Holder (5-Amp Fuse)
- R—Tachometer
- S—Power Meter (Percent Load) (Optional)
- T—Voltmeter
- U—Engine Coolant Temperature Gauge



RG9547 -UN-14AUG00

Instrument Panel (Engines With Electronic Instrument Panel)

DPSG,OUOD002,1571 -19-20JUN00-1/1

## ENGINE OIL PRESSURE GAUGE

The engine oil pressure gauge (A) indicates engine oil pressure in pounds per square inch (psi). It is connected to an audible alarm (G) to warn the operator if oil pressure drops below the preset safe operating pressure set for the engine.

## AMBER “WARNING” INDICATOR

The amber “WARNING” indicator (B) signals an abnormal condition such as low oil pressure, high coolant temperature, water in fuel, low battery voltage, etc. Use the Service Code menu of the diagnostic gauge (D) to identify the trouble.

## RED “STOP ENGINE” INDICATOR

The red “STOP ENGINE” indicator (C) signals operator to stop engine immediately or as soon as safely possible. A condition exists that could cause damage to engine.

## DIAGNOSTIC GAUGE/HOUR METER

The diagnostic gauge (D) displays diagnostic trouble codes (DTCs) as they occur. Other information on the engine can be accessed using the touch switches (E and F). The hour meter shows the operating hours of the engine. Normally, the gauge will alternately flash from the displayed parameters to the message “SvrcCode”. (See following in this section for operating the diagnostic gauge switches to access engine

information. Also see TROUBLESHOOTING section for a list of diagnostic trouble codes (DTCs) and corresponding engine problems.)

## TOUCH SWITCHES

The touch switches are used to change the display on the window of the diagnostic gauge to access engine performance data. Pressing the DOWN switch (E) or UP switch (F) scrolls through various engine parameters and diagnostic fault codes.

## AUDIBLE ALARM

The audible alarm (G) sounds whenever a low oil pressure or high coolant temperature condition exists.

## AUDIBLE ALARM OVERRIDE SWITCH (OPTIONAL)

The audible alarm override switch (H) can be pressed to silence the alarm for approximately 2-1/2 minutes.

## THROTTLE CONTROL (OPTIONAL)

The throttle control (I) is used to control engine speed. This control is available as part of the panel only on engines with analog throttle.

## DIMMER CONTROL (OPTIONAL)

The dimmer control (J) is used to control illumination of the instrument panel gauges.

**ENGINE PREHEATER INDICATOR (OPTIONAL)**

The engine preheater indicator (K) lights up while the engine is being preheated for cold weather starting. When the engine is warmed up, the light goes off, indicating the engine can now be started.

**KEY START SWITCH**

The three-position key switch (L) controls the engine electrical system. When the key switch is turned clockwise to "START", the engine will crank. When the engine starts, the key is released and returns to the "ON" (Run) position.

**OVERRIDE SHUTDOWN ROCKER SWITCH (OPTIONAL)**

*NOTE: This switch may be present, but not active, depending on panel options originally selected.*

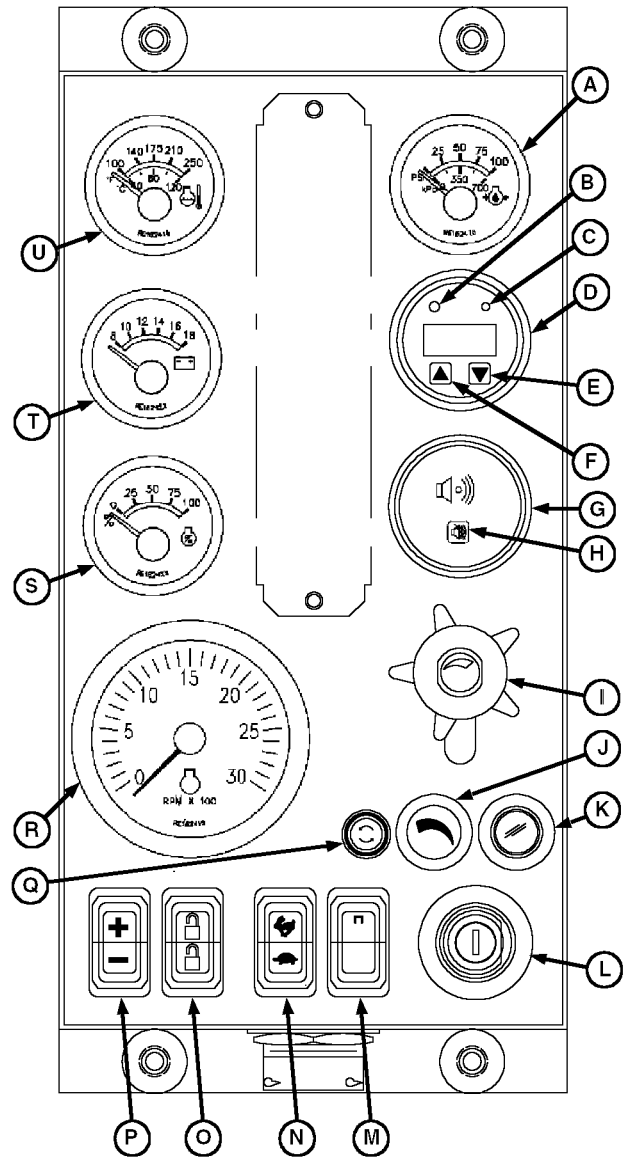
Pressing the upper half of the override shutdown switch (M) will override an engine shutdown signal. The switch must be pressed within 30 seconds to prevent undesired shutdown of engine.

**HIGH-LOW SPEED SELECT ROCKER SWITCH (OPTIONAL)**

The high-low speed select switch (N) is used to set the engine at operating speeds of slow (turtle) or fast (rabbit). Factory preset idle speeds can then be adjusted using the Bump Enable Switch (O) with the Speed Select Switch (P).

**BUMP SPEED ENABLE ROCKER SWITCH**

The bump speed enable switch (O) has a center position which locks the speed select switch (P) to prevent accidental changes in operating speed. To unlock the speed select switch, press and hold either the upper or lower half of the speed enable switch (O).



Instrument Panel (Engines With Electronic Instrument Panel)

RG9547 -UN-14AUG00

DPSG,OUOD002,1573 -19-20JUN00-1/1

## **SPEED SELECT ROCKER SWITCH**

The speed select switch (P) is used to bump engine speed up (+) or down (-) in small increments during operation. This switch must be used with the bump speed enable switch (O) in the unlocked position (top or bottom half of button depressed).

## **HOW TO SELECT PRESET OPERATING SPEEDS (BUMP SPEEDS)**

First select slow or fast speed option by pressing speed select switch (N) to “turtle” (slow) or “rabbit” (fast). Then you can press either the upper or lower portion of the bump enable switch (O) to unlock the high or low speed setting. The bump enable must be held down as the speed select rocker (P) is used to change the high or low speed setting by pressing (+) to increase speed or (-) to decrease speed.

Once the speed has been set, the bump enable rocker must be pressed and released three times within two seconds to commit the operating speed to memory. If not done, the engine’s new speed will only be effective until the key switch is shut off. Then the high or low operating speed will revert back to the previous setting.

## **FUSE HOLDER**

The fuse holder (Q) contains a 5-amp fuse for power to the instrument panel.

## **TACHOMETER**

The tachometer (R) indicates engine speed in hundreds of revolutions per minute (rpm).

## **POWER (PERCENT LOAD) METER (OPTIONAL)**

The power meter (S) shows percent of available power being used by the engine.

## **VOLTMETER**

The voltmeter (T) indicates system battery voltage. The amber “WARNING” light (B) will illuminate when

battery voltage is too low for proper operation of the fuel injection system.

## **ENGINE COOLANT TEMPERATURE GAUGE**

The coolant temperature gauge (U) indicates engine coolant temperature in degrees Centigrade or Fahrenheit. It is connected to an audible alarm (G) to warn the operator if coolant temperature rises above the preset safe operating temperature.

## **CRUISE CONTROL (OPTIONAL)**

Engine ECU's are available with and without the Cruise Control function. The Cruise Control is an Off-Road type that maintains a constant engine RPM under varying load conditions. An automotive type cruise control maintains a constant road speed.

The Cruise Cancel/Resume function is a one-button Cancel then Resume function. The first time contact is made with Cruise Control active, the Cruise Control will disengage and the engine speed will drop to idle. If the contact is made again within one minute and with the engine speed above 1300 RPM, the Cruise Control will “Resume”. This feature allows the placement of the Cancel/Resume button in a convenient location in the vehicle cab and does not require the use of the normal Cruise controls for momentary interruptions in cruise operation.

The Cancel/Resume function is intended for applications like ag tractors and sprayers that turn around at the end of each row in a field. This allows the operator to use the throttle and/or brake to turn the vehicle around. When ready to resume field operations, the operator brings the engine speed above 1300 RPM and activates the Cancel/Resume function again to resume cruise speed. An internal timer gives the operator one minute to complete the turn around maneuver.

The Cruise Control has the normal functions of:

- Cruise Control power “ON” or “OFF”
- “Set” or “Bump Up” Engine Speed
- “Resume” or “Bump Down” Engine Speed

- Vehicle brake or clutch pedal to disengage Cruise Control.

The “Bump Up” and “Bump Down” speed controls allow the operator to change the set speed. Small engine speed changes can be made by “bumping” the control switch. Holding the “Bump Up” or “Bump Down” switch will result in greater engine RPM changes until the engine reaches either full speed or idle. The Cruise Control cannot operate beyond the normal min-max engine speeds.

*NOTE: The Bump Throttle feature cannot be used while operating cruise control.*

On 12-volt ECU's, the engine speed can be set from two different locations. The primary location would normally be in the cab of the vehicle and is used to set a constant engine speed while the vehicle is being driven. The secondary cruise control is normally used in a location that provides for engine PTO speed control and is used with the engine in “neutral” or out of gear. Both locations can have the normal “cruise” functions.

See Specifications section under Fuel Injection Pump Specifications for the 1600 option code group which matches your code to find rated speeds and idle speeds for your engine.

AG,OUOD002,1620 –19–05JUL00–2/2

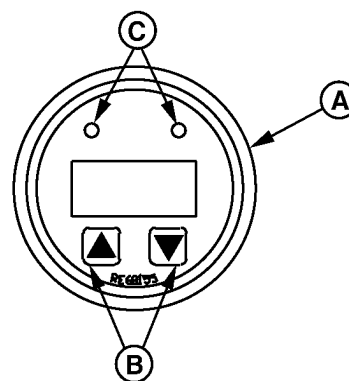
## Using Diagnostic Gauge To Access Engine Information

The diagnostic gauge (A) allows the operator to view many readouts of engine functions and diagnostic trouble codes (DTCs). The gauge is linked to the electronic control system and its sensors. This allows the operator to monitor engine functions and to troubleshoot the engine systems when needed.

Press the two touch switches (B) to view the various engine functions in sequence. The displays can be selected as either customary english or metric units.

The following menu of engine parameters can be displayed on the diagnostic gauge window:

- Engine hours
- Engine rpm
- System voltage
- Percent engine load at the current rpm
- Coolant temperature
- Oil pressure
- Fuel economy
- Throttle position
- Current fuel consumption
- Active service (diagnostic) codes
- Stored service (diagnostic) codes from the engine
- Set the units for display
- View the engine configuration parameters
- Accelerator pedal position
- Percentage load at current speed
- Actual engine percent torque
- Engine speed
- Trip distance
- Total vehicle distance
- Engine hours
- Trip fuel
- Total fuel used
- Coolant temperature
- Fuel temperature
- Engine oil temperature
- Engine intercooler temperature
- Fuel deliver pressure
- Engine oil level
- Engine oil pressure



Diagnostic Gauge

A—Diagnostic Gauge  
B—Touch Switches  
C—Amber and Red Lights

RG10031 -JUN-28OCT99

- Coolant pressure
- Coolant level
- Wheel base vehicle speed
- Fuel rate
- Instant fuel economy check
- Average fuel economy
- Barometric pressure
- Air inlet temperature
- Boost pressure
- Intake manifold temperature
- Air filter differential pressure
- Exhaust gas temperature
- Electrical potential (voltage)
- Battery potential (voltage), switched
- Transmission oil pressure
- Transmission oil temperature
- Injector metering rail No. 1 pressure
- Injector metering rail No. 2 pressure
- Estimated percent fan speed

*NOTE: Engine parameters which can be accessed will vary with the engine application.*

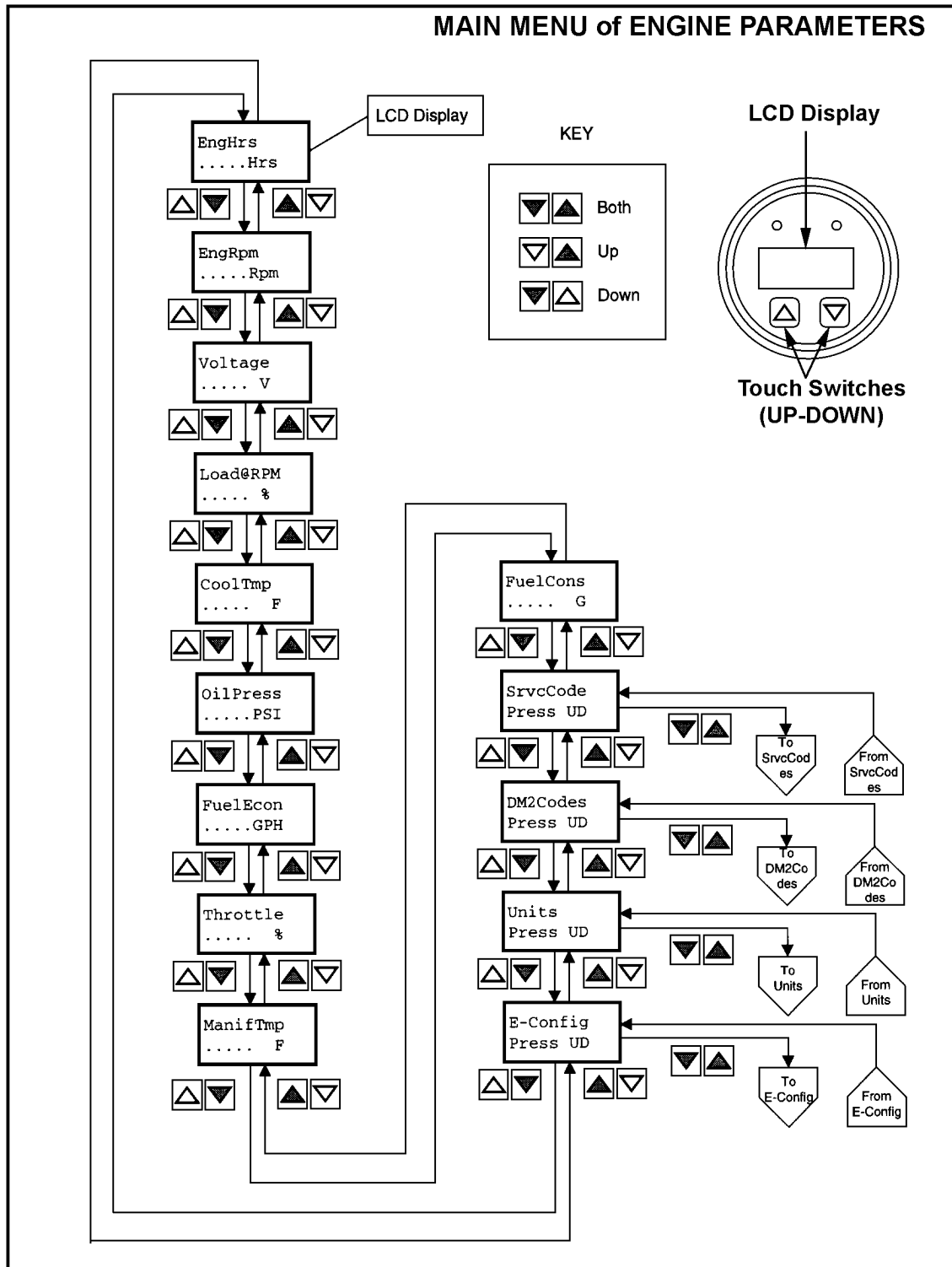
The diagnostic gauge includes a two-line by eight-character backlit Liquid Crystal Display (LCD). The top line displays the data label, i.e. "EngHrs" and the bottom line displays the matching unit information, i.e. "1200 Hrs". The diagnostic gauge uses two touch switches (UP and DOWN) for scrolling through the engine parameter list and viewing the menu list. Two lights (C) (amber and red) are used to signal active trouble messages received by the diagnostic gauge.

DPSG,OUOD007,2840 -19-21OCT99-2/2





## USING TOUCH SWITCHES TO DISPLAY INFORMATION



RG9947 -19-09DEC99

Using Touch Switches

Continued on next page

DPSG.OUOD007.2841 -19-21OCT99-1/2

The touch switches on the diagnostic gauge allow quick and easy navigation through the menu to find the information needed. The diagram on the previous page is a typical Main Menu of Engine Parameters. The Main Menu has 14 entries; the first 10 are engine data parameters, and the last four are sub-menu entry points. The following two rules are used for accessing the various items on the menus:

1. To scroll through the parameter list, press **either** the UP or DOWN touch switches.
2. To select or exit a sub-menu, **simultaneously** press the UP and DOWN switches.

### Selecting Engine Data Parameters

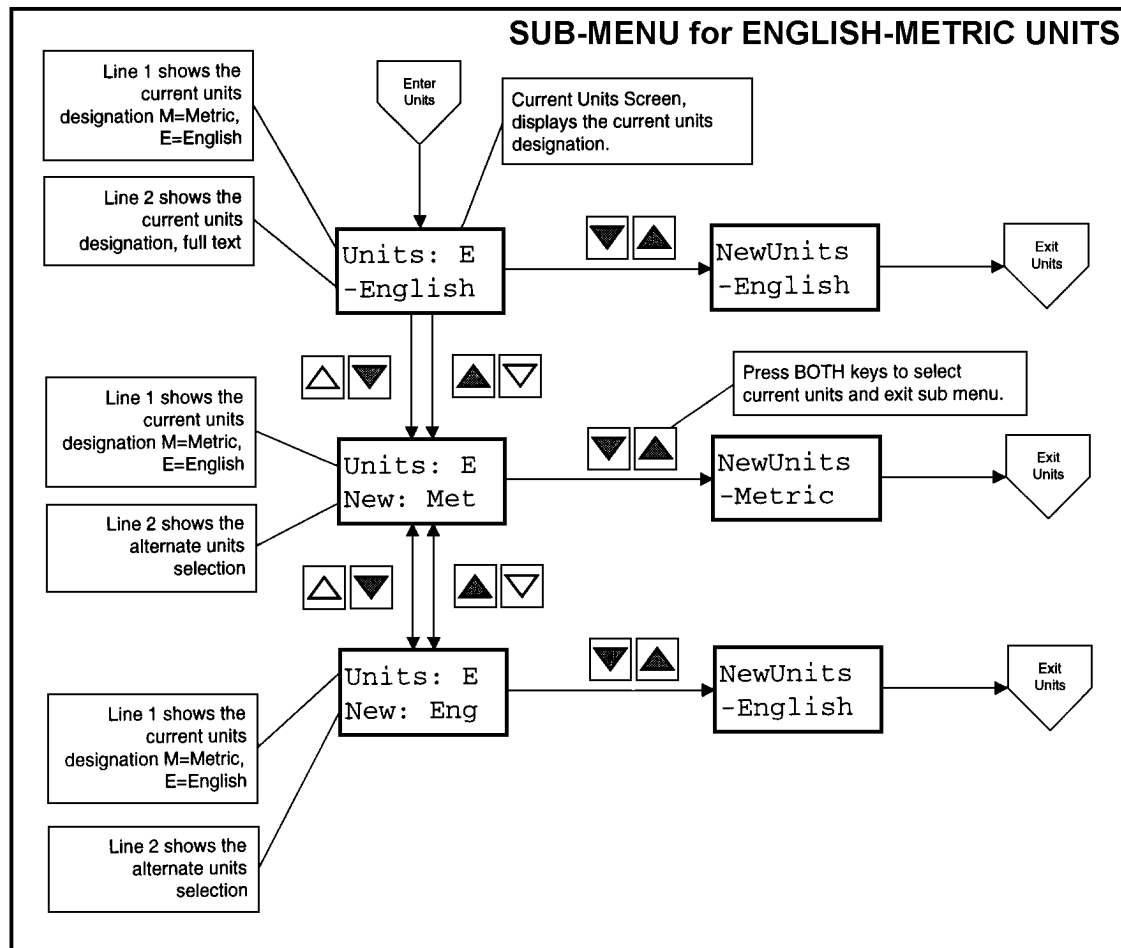
To read any of the engine parameters, press either UP or DOWN switches (as shown on diagram) until the top line of the display shows the desired information.

### Selecting Sub-Menus

Press either the UP or DOWN switches until the top line of the display shows the label of the desired sub-menu. Then press **BOTH** the UP and DOWN switches at the same time. This action will select the sub-menu and the next screen on the display will list the Sub-Menu items. This is also the way to access Diagnostic Trouble Codes (DTCs).

DPSG,OUOD007,2841 -19-21OCT99-2/2

## CHANGING UNITS OF MEASURE (ENGLISH OR METRIC)



RG10018 -19-28OCT99

### Changing Units Of Measure

The diagnostic gauge can display engine data in either English or Metric units. To toggle between these, the *Units Sub-Menu*, must be selected.

To select the *Units Sub-Menu*, press the UP or DOWN switches until the top line of the display reads "UNITS". Then press BOTH the UP and DOWN switches at the same time to select the *Units Sub-Menu*. The above

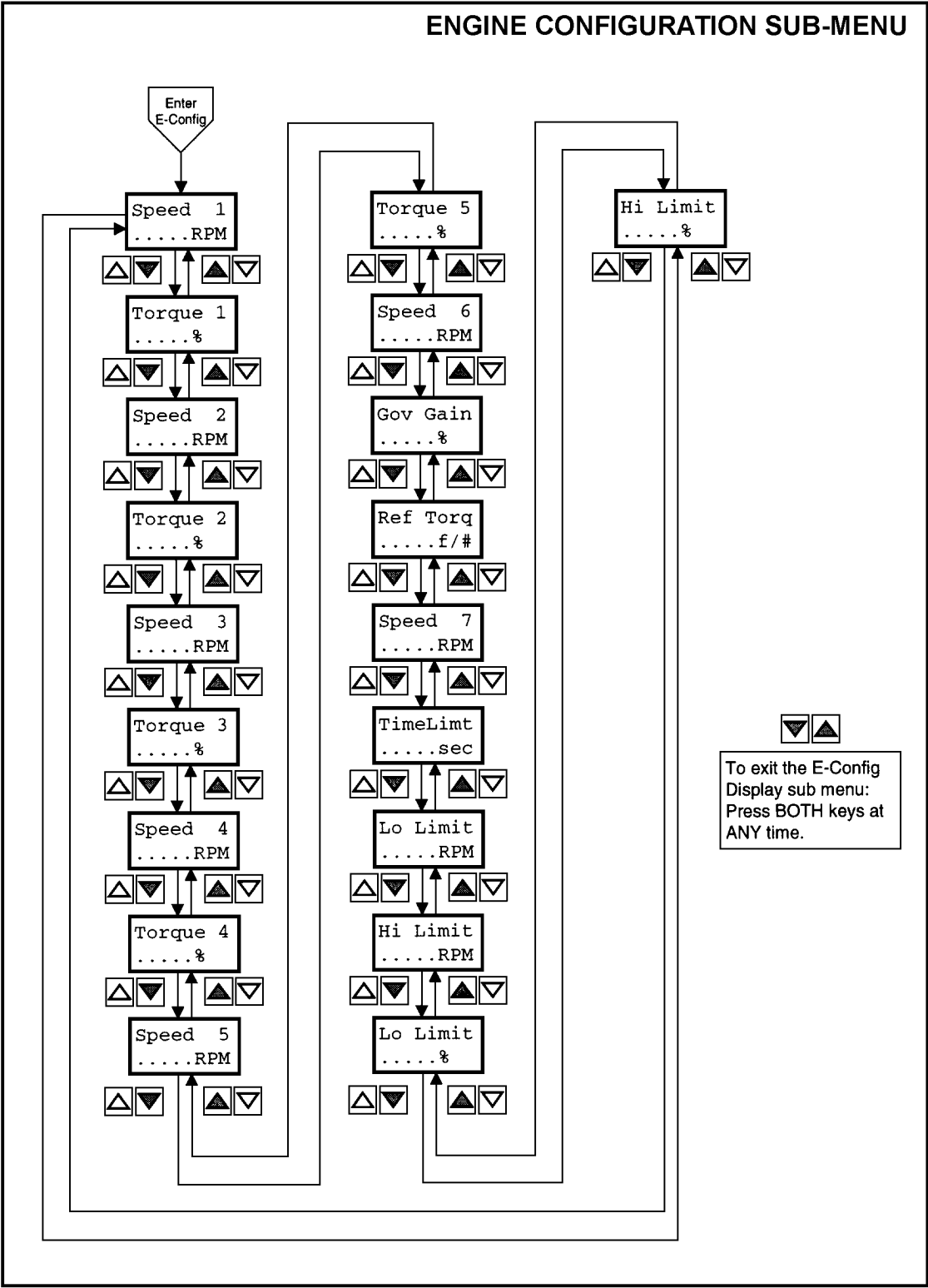
diagram shows the steps for selecting the desired units of measure. Two options are available:

1. Press both the switches to retain the current units designation.
2. Press either UP or DOWN switch to toggle the units selection, then press both switches to select the desired unit of measure.

DPSG,OUOD007,2842 -19-21OCT99-1/1



VIEWING ENGINE CONFIGURATION DATA



RG10019 -19-28OCT99

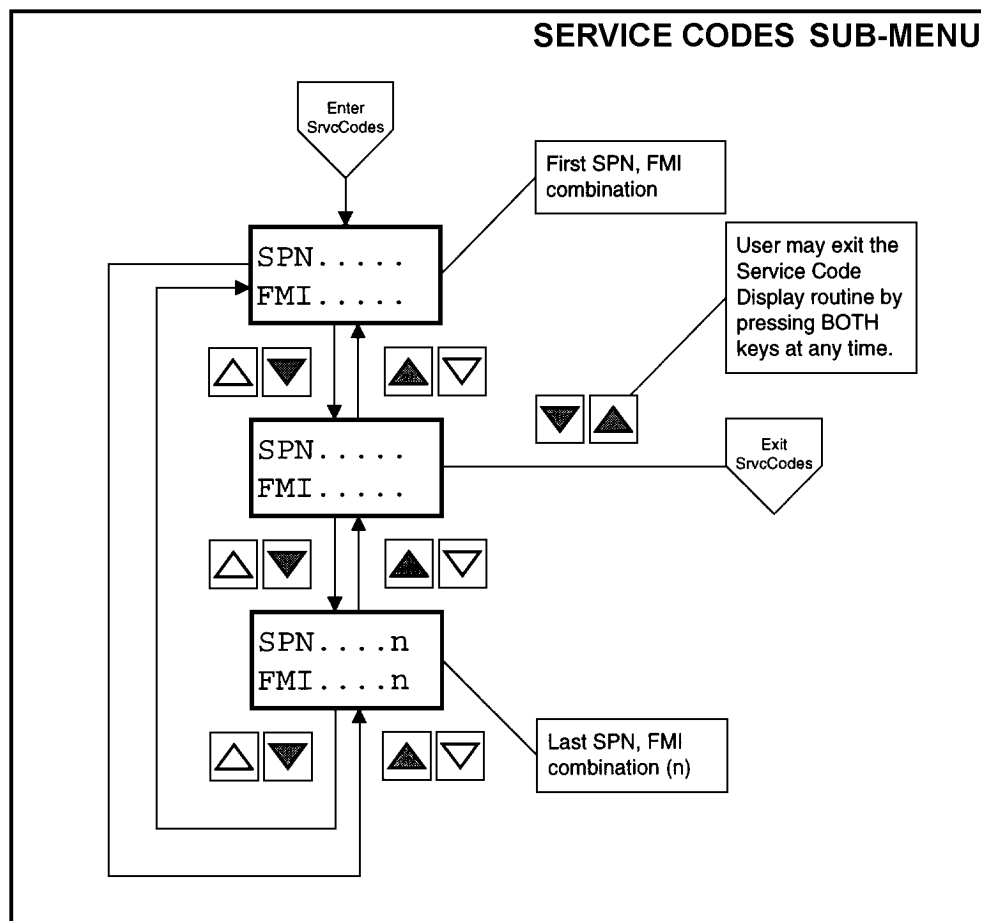
Viewing Engine Configuration Data

The diagnostic gauge can display the engine configuration data stored in the Engine Control Unit (ECU). To select the *Engine Configuration Sub-Menu* (see diagram on previous page), press the UP or DOWN switches until the top line of the display reads

“E-Config”. Then press BOTH the UP and DOWN switches at the same time to select the *Engine Configuration Sub-Menu* . The diagnostic gauge will display the engine configuration data as shown in the diagram.

DPSG,OUOD002,1927 -19-19DEC00-2/2

## VIEWING ACTIVE ENGINE SERVICE CODES (DTC)



Viewing Active Service Codes

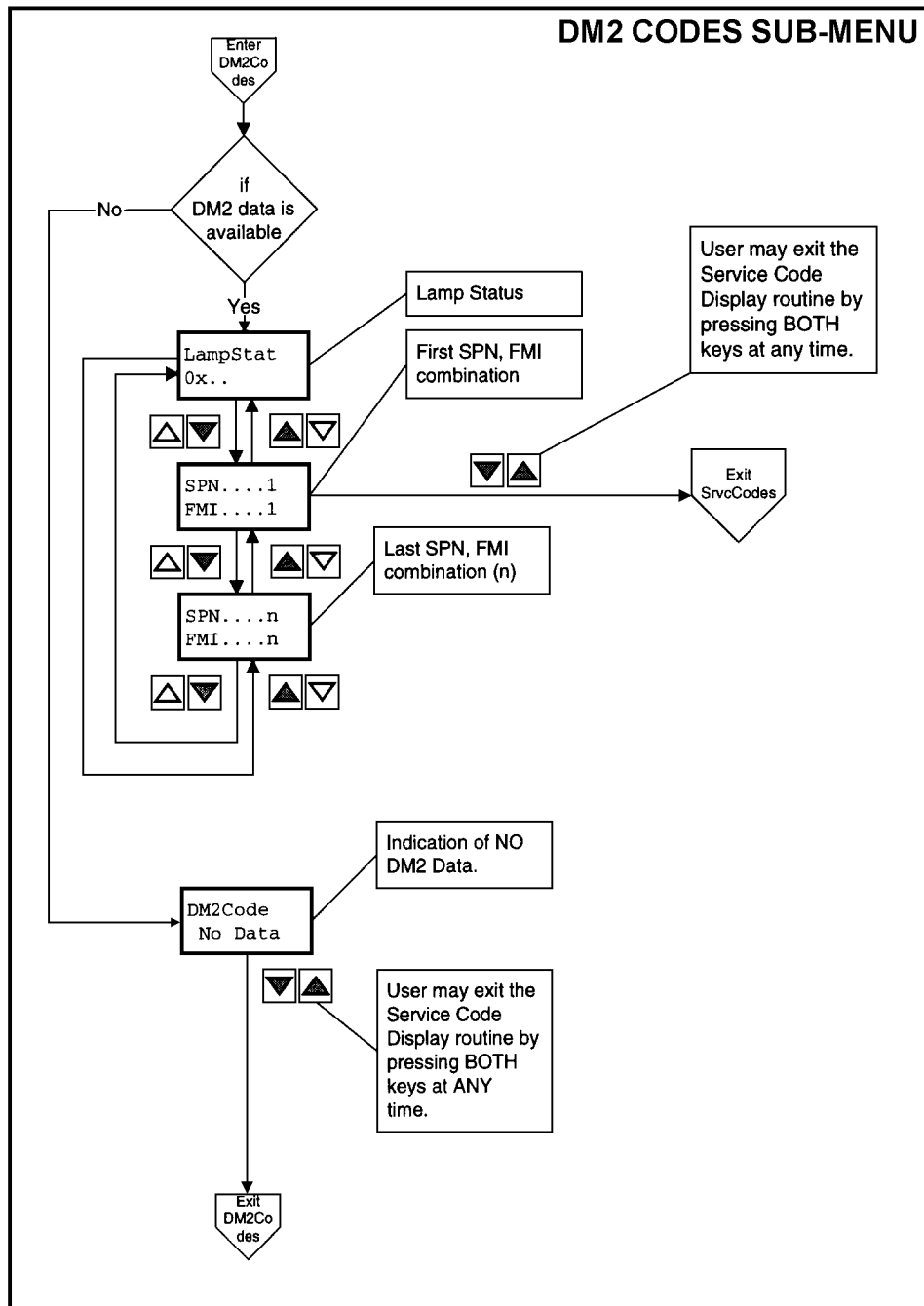
The diagnostic gauge continuously monitors all messages broadcast over the Control Area Network (CAN) and displays all Active Service Codes (DTCs) at the time the message is broadcast. The word "SrvcCode" is displayed on the second line. The display will cycle every 5 seconds between the currently displayed parameter and the "SrvcCode" message until the active trouble code clears. To view the active codes, select the *Service Code Sub-Menu* by pressing the UP or DOWN switches until the top line of the display reads "SrvcCode". Then press

BOTH the UP and DOWN switches at the same time to select the Service (DTC) Code Sub-Menu. The diagnostic gauge has the ability to display all Active Service Codes received. The diagram above titled *Service Codes Sub-Menu* shows the process for selecting Active Service Codes and their values.

**NOTE:** For a list of Service Codes or Diagnostic Trouble Codes (DTCs) and their causes, refer to *TROUBLESHOOTING* section later in this manual.



## VIEWING STORED SERVICE CODES (DTC) IN THE ENGINE ECU



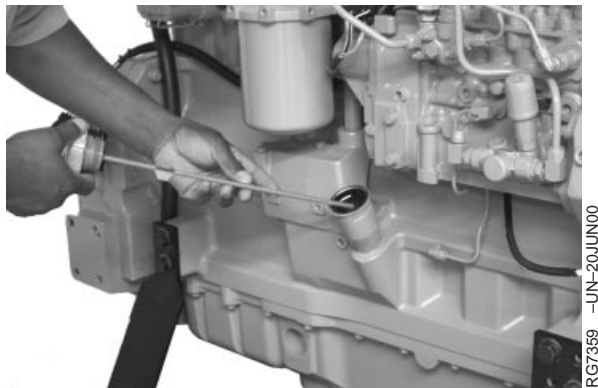
RG10021 -19-28OCT99

Viewing Stored Service Codes

The diagnostic gauge can request Stored Service Codes (DTCs) from the engine. The Stored Service Codes may be used for diagnostic and service needs. To view the Stored Service Codes, it is necessary to select the *DM2Codes Sub-Menu* by pressing the UP or DOWN switches until the top line of the display

reads "DM2Codes". Then press BOTH the UP and DOWN switches at the same time to select the *DM2Codes Sub-Menu*. The gauge will display the Stored Service Codes according to the menus shown in the diagram.

## BREAK-IN SERVICE



Check Engine Oil Level

RG7359 -UN-20JUN00



RG5895 -UN-13AUG91

Engine Oil Level Dipstick

The engine is ready for normal operation. However, extra care during the first 100 hours will result in more satisfactory long-term engine performance and life. DO NOT exceed 100 hours of operation with break-in oil.

1. This engine is factory-filled with John Deere Engine Break-in Oil. Operate the engine at heavy loads with minimal idling during the break-in period.
2. If the engine has significant operating time at idle, constant speeds, and/or light load usage, or make-up oil is required in the first 100 hour period, a longer break-in period may be required. In these situations, an additional 100 hour break-in period is recommended using a new change of John Deere Engine Break-In Oil and new John Deere oil filter.

**IMPORTANT:** Do not add makeup oil until the oil level is **BELOW** the add mark on dipstick. If make-up oil is required during the break-in period, an

**additional 100 hour break-in period is required. John Deere Engine Break-In Oil (TY22041) should be used to make up any oil consumed during the break-in period.**

**DO NOT use PLUS-50® Engine Oil or engine oils meeting API CG4, API CF4, ACEA E3, ACEA E2 or CCMC D5 performance levels during the first 100 hours of operation of a new or rebuilt engine. These oils will not allow a new or rebuilt engine to break-in properly.**

3. Check oil more frequently during engine break-in period. If oil must be added during this period, John Deere Engine Break-In Oil is preferred. See ENGINE BREAK-IN OIL, in Fuels, Lubricants, and Coolant Section.

Continued on next page

RG, RG34710, 4048 -19-01JAN96-1/4

**IMPORTANT: DO NOT fill above the top of the crosshatch pattern or the FULL mark, whichever is present. Oil levels anywhere within crosshatch are considered in the acceptable operating range.**

**Specification**

—Oil Pressure at Rated Full Load Speed <sup>1</sup> .....		345 ± 103 kPa (3.45 ± 1.03 bar) (50 ± 15 psi)
Coolant Temperature Range .....		82° - 94° C (180°- 202° F)

- 4. During the first 20 hours, avoid prolonged periods of engine idling or sustained maximum load operation.
- 5. If engine will idle longer than 5 minutes, stop engine.

<sup>1</sup>At normal operating temperature of 115°C (240°F) sump.

RG, RG34710, 4048 -19-01JAN96-2/4

6. After the first 100 hours maximum, change engine oil and replace engine oil filter as shown. (See CHANGING ENGINE OIL AND REPLACING FILTER in Lubrication and Maintenance/250 Hour Section.) Fill crankcase with seasonal viscosity grade oil. (See DIESEL ENGINE OIL, in Fuels, Lubricants, and Coolant Section.)

**NOTE:** Some increase in oil consumption may be expected when low viscosity oils are used. Check oil levels more frequently.

If air temperature is below -10° C (14° F), use an engine block heater.



Replacing Engine Oil Filter

RG7379 -UN-20JUN00

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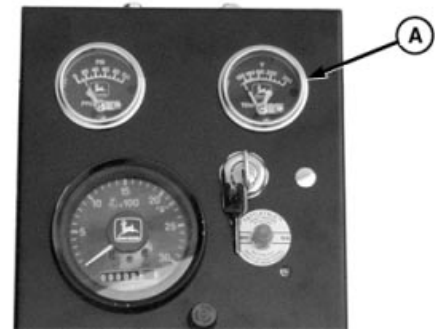
RG, RG34710, 4048 -19-01JAN96-3/4

7. Watch coolant temperature gauge (A) closely. If coolant temperature rises above 104° C (220° F), reduce load on engine. Unless temperature drops quickly, stop the engine and determine the cause before resuming operation.

*NOTE: When the coolant temperature gauge reads approximately 104° C (220° F), the engine will reduce power automatically if equipped with recommended safety controls.*

8. Check belt for proper alignment and seating in pulley grooves.

A—Coolant Temperature Gauge



Engine Coolant Temperature Gauge

RG11299D -UN-21AUG00

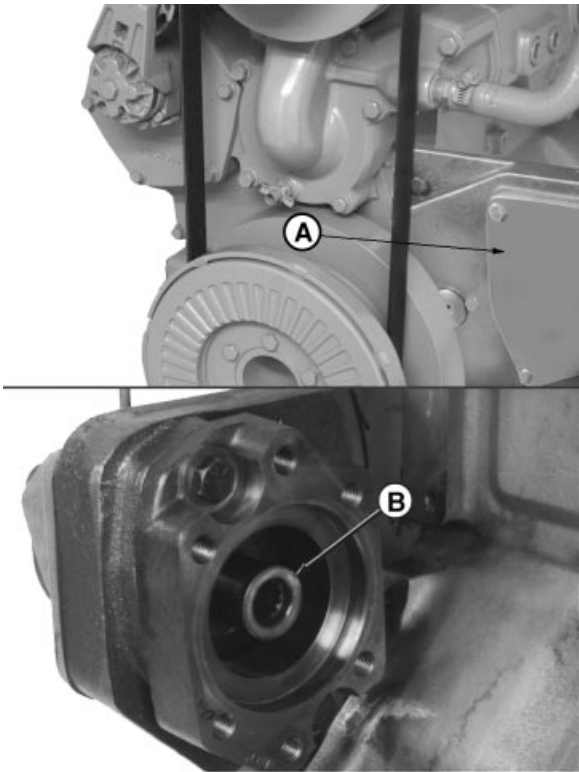
RG, RG34710, 4048 -19-01JAN96-4/4

AUXILIARY GEAR DRIVE LIMITATIONS

**IMPORTANT:** When attaching an air compressor, hydraulic pump, or other accessory to be driven by the auxiliary gear drive (engine timing gear train at front of engine), power requirements of the accessory must be limited to values listed below:

SAE Drive	Continuous Power	Intermittent Power
A .....	19 kW (25 hp) .....	22.5 kW (30 hp)
B or (A + B) .....	37 kW (50 hp) .....	45 kW (60 hp)

A—SAE Drive, Front  
B—SAE Drive, Rear



Auxiliary Drives

RG7367 -UN-21MAR00

RG, RG34710, 4051 -19-01JAN96-1/1

## GENERATOR SET (STANDBY) POWER UNITS

To assure that your engine will deliver efficient standby generator operation when needed, start engine and run at rated speed (with 50%—70% load) for 30 minutes every 2 weeks. DO NOT allow engine to run for an extended period of time with no load.

RG, RG34710, 4052 -19-01JAN96-1/1

## STARTING THE ENGINE

The following instructions apply to the optional controls and instruments available through the John Deere Parts Distribution Network. The controls and instruments for your engine may be different from those shown here; always follow manufacturer's instructions.

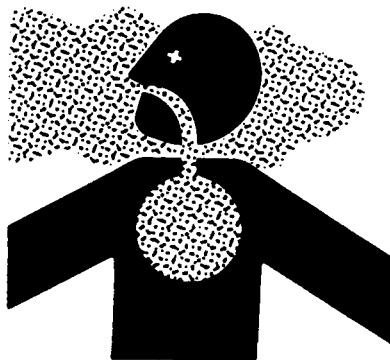


**CAUTION:** Before starting engine in a confined building, install proper outlet exhaust ventilation equipment. Always use safety approved fuel storage and piping.

**NOTE:** If temperature is below 0°C (32°F), it may be necessary to use cold weather starting aids (See *COLD WEATHER OPERATION*, later in this section).

**IMPORTANT:** If engine has run out of fuel, it may be necessary to prime the fuel system, engines (200,000— ). See following in this section.

1. Perform all prestarting checks outlined in DAILY PRESTARTING CHECKS in Lubrication & Maintenance/Daily Section.
2. Open the fuel supply shut-off valve, if equipped.



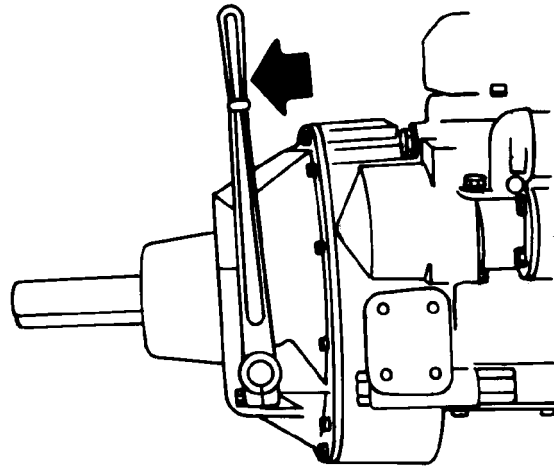
Use Proper Ventilation

TS220 -UN-23AUG88

Continued on next page

RG, RG34710, 4053 -19-01JAN96-1/4

3. If equipped with PTO clutch, pull lever (arrow) rearward (away from engine) to disengage PTO clutch.



RG5602 -UN-16JUN00

*PTO Clutch Control Lever*

Continued on next page

RG, RG34710, 4053 -19-01JAN96-2/4

**NOTE:** Some electronically controlled governor applications may be equipped with a rotary speed potentiometer on instrument panel. (See (A) in lower drawing.)

4. On standard, mechanical governor (7-10% regulation) engines, pull hand throttle (A) 1/3 of the way out. Turn the handle in either direction to lock it in place.

On later engines, turn throttle (A) clockwise 1/3 of the way (see lower illustration). (If not equipped with analog throttle, move throttle control 1/3 of the distance away from slow idle stop.)

5. If equipped, depress and hold reset button (B) while starting.

**IMPORTANT:** Do not operate the starter for more than 30 seconds at a time. To do so may overheat the starter. If the engine does not start the first time, wait at least 2 minutes before trying again. If engine does not start after four attempts, see Troubleshooting Section.

6. Turn the key switch (C) clockwise to crank the engine. When the engine starts, release the key so that it returns to the "ON" position.

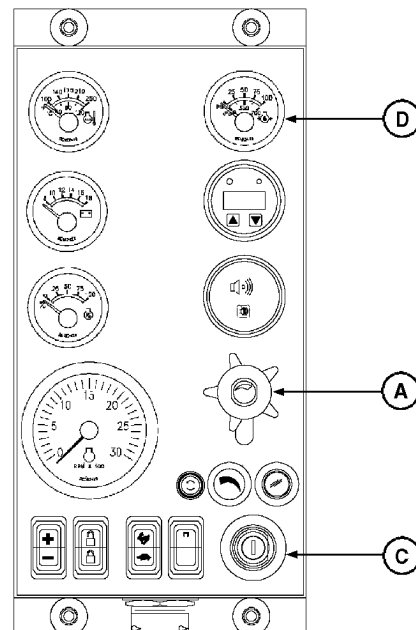
**IMPORTANT:** If the key switch is released before the engine starts, wait until the starter and the engine stop turning before trying again. This will prevent possible damage to the starter and/or flywheel.

7. After the engine starts, continue to hold the reset button in until the oil pressure gauge (D) reads at least 140 kPa (1.4 bar) (20 psi). The safety controls will not allow the engine to run at a lower oil pressure unless the reset button is held in.

A—Hand Throttle  
B—Reset Button  
C—Key Switch  
D—Oil Pressure Gauge



Instrument Panel—Engines with Standard Panel



Instrument Panel—Engines With Electronic Panel

Continued on next page

RG, RG34710, 4053 —19-01JAN96-3/4

**IMPORTANT:** Should the engine die when operating under load, immediately disengage PTO clutch and restart the engine. Overheating of turbocharger parts may occur when oil flow is stopped.

8. Check all gauges for normal engine operation. If operation is not normal, stop the engine and determine the cause.

RG, RG34710, 4053 -19-01JAN96-4/4

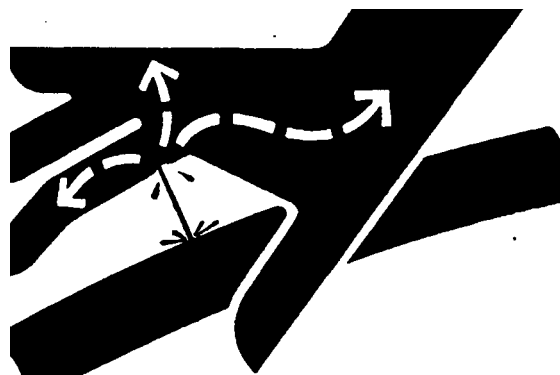


## RESTARTING ENGINE THAT HAS RUN OUT OF FUEL—ENGINES (200,000— )



**CAUTION:** Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles that eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, a doctor familiar with this type of injury must surgically remove it within a few hours or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.



X9811 -UN-23AUG88

Whenever the fuel system has been opened up for service (lines disconnected or filters removed), it will be necessary to **bleed** air from the system. (See BLEEDING THE FUEL SYSTEM—ENGINES (200,000— ) in Service as Required section.)

In case the engine has run out of fuel, the fuel system must be **primed** by the following method:

1. Fill fuel tank

Continued on next page

RG41221,0000001 -19-18DEC00-1/2

2. Loosen fuel pump low pressure outlet line (A) (outboard lower line of fuel pump). Unlock and pump hand primer (B) until primary filter bowl is full of fuel and all air is bled from the line (Must pull hand primer all the way up between pumps). Tighten outlet line to specification below:

**Specification**

Low Pressure Outlet Line—  
Torque ..... 27 N•m (20 lb-ft)

3. Connect JT03472 coupler and hose to diagnostic port (D). If JT03472 coupler is not available, loosen the diagnostic port to allow air and fuel to escape. Bleed fuel into suitable container. Tighten diagnostic port to specification below.

**Specification**

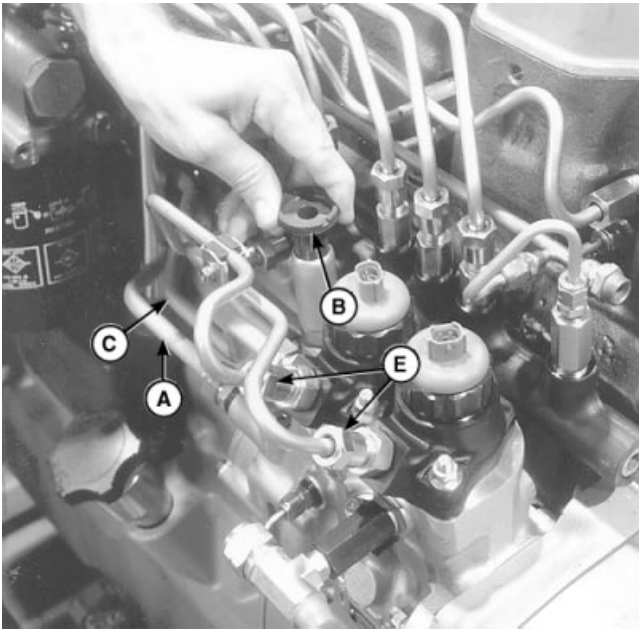
Diagnostic Port—Torque ..... 14 N•m (10 lb-ft)

4. Loosen high pressure fuel lines (E). Pump hand primer (B) until steady flow of fuel escapes the fuel pump. Tighten fuel lines to specification below and lock hand primer (pull up, then push down and lock).

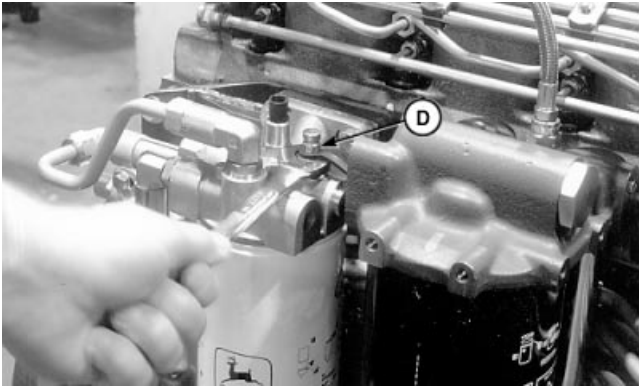
**Specification**

High Pressure Fuel Lines—  
Torque ..... 27 N•m (20 lb-ft)

5. Start engine. If engine will not start, do NOT crank for more than 30 seconds. Repeat step 4.
6. Once engine starts, run at 1200-1500 RPM for 3-5 minutes.



RG11600 -UN-11DEC00



RG11599 -UN-11DEC00

- A—Low Pressure Outlet Line  
B—Hand Primer  
C—Low Pressure Inlet Line  
D—Diagnostic Port  
E—High Pressure Fuel Lines

RG41221,0000001 -19-18DEC00-2/2

## NORMAL ENGINE OPERATION

Observe engine coolant temperature and engine oil pressure. Temperatures and pressures will vary between engines and with changing operating conditions, temperatures, and loads.

Normal engine coolant operating temperature range is 82°–94° C (180°–202° F). If coolant temperature rises above 104° C (220° F), reduce load on engine. Unless temperature drops quickly, stop engine and determine cause before resuming operation.

*NOTE: When coolant temperature is excessive (above 104° C (220° F) engine will reduce power automatically if equipped with recommended safety controls.*

Operate the engine under a lighter load and at slower than normal speed for first 15 minutes after start-up. DO NOT run engine at slow idle.

Stop engine immediately if there are any signs of part failure. Symptoms that may be early signs of engine problems are:

- Sudden drop in oil pressure
- Abnormal coolant temperatures
- Unusual noise or vibration
- Sudden loss of power
- Excessive black exhaust
- Excessive fuel consumption
- Excessive oil consumption
- Fluid leaks

RG, RG34710, 4047 –19–01JAN96–1/1

## COLD WEATHER OPERATION

**CAUTION:** Ether injector starting fluid is highly flammable. **DO NOT** use starting fluid on engines equipped with air intake heaters.

**DO NOT** use starting fluid near fire, sparks, or flames. **DO NOT** incinerate or puncture a starting fluid container.

Engines may be equipped with intake air heaters, coolant heaters, or ether injectors as a cold weather starting aid.

Starting aids are required below 14°F (-10°C). They will enhance starting performance above these temperatures and may be needed to start applications that have high parasitic loads during cranking and/or start acceleration to idle.

Using correct grade oil (per engine and machine operator's manual) is critical to achieving adequate cold weather cranking speed.

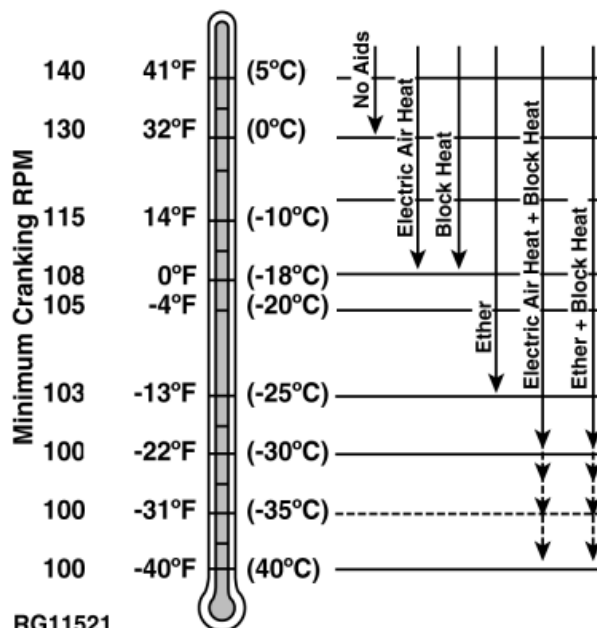
Other cold weather starting aids are required at temperatures below -22°F (-30°C) or at altitudes above 1500 m (5000 ft).

1. Follow steps 1—4 as listed under STARTING THE ENGINE, earlier in this section, then proceed as follows according to the instrument (control) panel on your engine.
2. Use cold weather starting aids as needed. Follow supplier instructions for starting aid provided on your engine.
3. Follow remaining steps 5—8 as listed under STARTING THE ENGINE earlier in this section.

Additional information on cold weather operation is available from your authorized servicing dealer.



Starting Fluid is Flammable



Cold Weather Starting Guidelines

## WARMING ENGINE

**IMPORTANT:** To assure proper lubrication, operate engine at or below 1200 rpm with no load for 1–2 minutes. Extend this period 2–4 minutes when operating at temperatures below freezing.

Engines used in generator set applications where the governor is locked at a specified speed may not have a slow idle function. Operate these engines at high idle for 1 to 2 minutes before applying the load. This procedure does not apply to standby generator sets where the engine is loaded immediately upon reaching rated speed.

1. Check oil pressure gauge (A) as soon as engine starts. If gauge needle does not rise above minimum oil pressure specification of 140 kPa (1.4 bar) (20.0 psi) within 5 seconds, stop the engine and determine the cause. Normal engine oil pressure is  $345 \pm 103$  kPa ( $3.45 \text{ bar} \pm 1.03 \text{ bar}$ ) ( $50 \pm 15$  psi) at rated full load speed (1800–2500 rpm) with oil at normal operating temperature of  $115^\circ \text{C}$  ( $240^\circ \text{F}$ ).

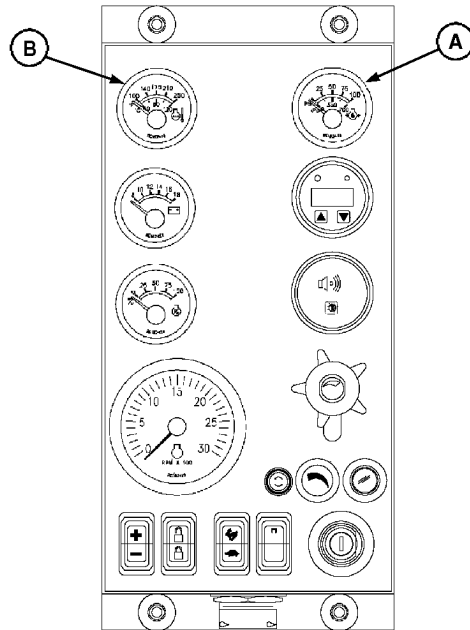
**NOTE:** On certain engines, the oil pressure and coolant temperature gauges are replaced by indicator warning lights. The lights must be "OFF" when engine is running.

2. Watch coolant temperature gauge (B). Do not place engine under full load until it is properly warmed up. The normal engine coolant temperature range is  $82^\circ\text{--}94^\circ \text{C}$  ( $180^\circ\text{--}202^\circ \text{F}$ ).

**NOTE:** It is a good practice to operate the engine under a lighter load and at lower speeds than normal for the first few minutes after start-up.



Oil Pressure and Coolant Temp. Gauges (Standard Panel)



Oil Pressure and Coolant Temp. Gauges (Electronic Panel)

A—Oil Pressure Gauge  
B—Coolant Temperature Gauge

RG11299E –UN–21AUG00

RG9917 –UN–16NOV99

RG, RG34710, 4056 –19–01JAN96–1/1

## IDLING ENGINE

Avoid excessive engine idling. Prolonged idling may cause the engine coolant temperature to fall below its normal range. This, in turn, causes crankcase oil dilution, due to incomplete fuel combustion, and permits formation of gummy deposits on valves, pistons, and piston rings. It also promotes rapid accumulation of engine sludge and unburned fuel in the exhaust system.

Once an engine is warmed to normal operating temperatures, engine should be idled at slow idle

speed. Slow idle speed for this engine is 850 rpm at factory. If an engine will be idling for more than 5 minutes, stop and restart later.

*NOTE: Generator set applications where the governor is locked at a specified speed may not have a slow idle function. These engines will idle at no load governed speed (high idle).*

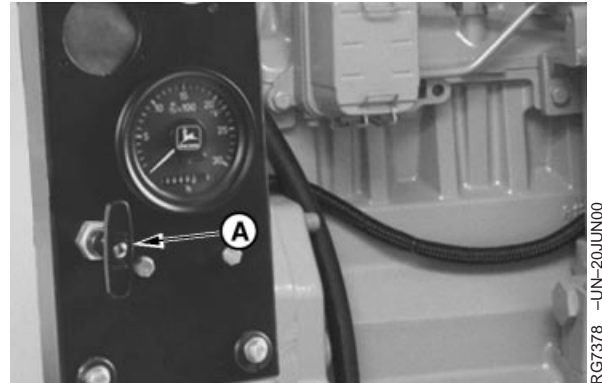
RG, RG34710, 4058 -19-01JAN96-1/1

## CHANGING ENGINE SPEED—STANDARD (MECHANICAL) GOVERNOR

To increase engine speed on earlier engines, turn hand throttle handle (A) to the horizontal position and pull out until desired engine speed is obtained. Turn the handle in either direction to lock throttle position. The handle is pushed inward to decrease engine speed.

To increase speed on later engines, turn throttle control clockwise.

**A—Hand Throttle Handle**



Hand Throttle Handle

RG, RG34710, 4057 -19-01JAN96-1/1

## CHANGING ENGINE SPEED (ENGINES WITH ELECTRONIC INSTRUMENT PANEL)

Changing from slow to fast speed using High-Low Speed Select Rocker Switch (A):

- For slow speed, press lower half of switch (indicated by turtle symbol).
- For fast speed, press upper half of switch (indicated by rabbit symbol).

**NOTE:** To adjust preset fast or slow speeds for High-Low Speed Select Rocker Switch:

1. Select fast (rabbit) or slow (turtle) position on High-Low Speed Select Rocker Switch (A).
2. Press and hold top or bottom half of Bump Speed Enable Rocker Switch (B) while using Speed Select Rocker Switch (C).
3. Use Speed Select Rocker Switch (C) to bump engine speed up (+) or down (-).

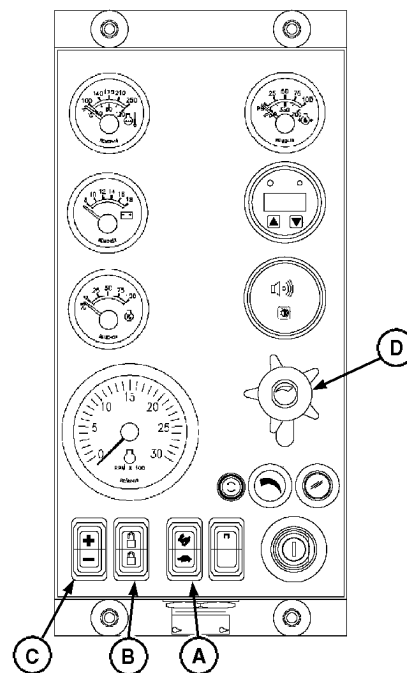
**NOTE:** Once the speed has been set, the Bump Speed Enable Switch (B) must be pressed and released three times within two seconds to commit the new slow or fast speed to memory. If not done, the engine's new slow or fast speed will only be effective until the key switch is shut off. Then the speed will revert to its previous setting.

Changing engine speed using optional analog potentiometer throttle (D):

**NOTE:** Pushing in on analog potentiometer will immediately take engine to slow idle speed.

1. Set High-Low Speed Select Rocker Switch (A) to low speed position.
2. Turn potentiometer throttle clockwise to increase speed or counterclockwise to decrease speed.

**NOTE:** Engine Control Unit (ECU) reads the higher of the High-Low Speed Select Rocker Switch or the Analog Throttle(s) Speed Settings. With High-Low switch at low speed, Analog Throttle(s) will control speed higher than low idle setting.



Changing Engine Speed

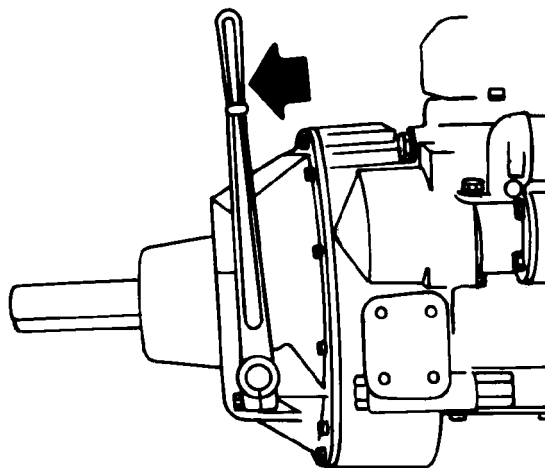
- A—High-Low Speed Select Rocker Switch  
 B—Bump Speed Enable Rocker Switch  
 C—Speed Select Rocker Switch  
 D—Analog Potentiometer Throttle (Optional)

RG9918 —UN—16NOV99



## STOPPING THE ENGINE (STANDARD INSTRUMENT PANELS)

1. Pull PTO clutch lever (arrow) rearward (away from engine) to disengage clutch, if equipped.



RG5602 -UN-16JUN00

PTO Clutch Control Lever

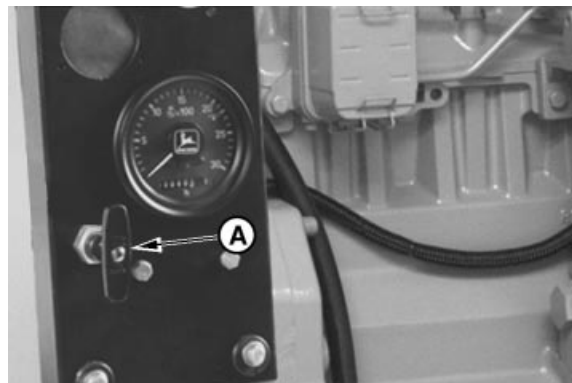
RG, RG34710, 4059 -19-01JAN96-1/2

2. Move the hand throttle handle (A) to slow idle on standard (mechanical) governor engines. On later engines, turn throttle control counterclockwise.

**IMPORTANT:** Before stopping an engine that has been operating at working load, idle engine at least 2 minutes at 1000–1200 rpm to cool hot engine parts.

Engines in generator set applications, where the governor is locked at a specified speed and no slow idle function is available, run engine for at least 2 minutes at fast idle and no load.

Make sure that exhaust stack cap (rain cap) is installed when engine is not running. This will prevent water and dirt from entering engine.



RG7378 -UN-20JUN00

Hand Throttle Handle (Early Engine Shown)

A—Hand Throttle Handle

3. Turn key switch to “OFF” position to stop the engine. Remove ignition key.

RG, RG34710, 4059 -19-01JAN96-2/2



## STOPPING THE ENGINE (ENGINES WITH ELECTRONIC INSTRUMENT PANEL)

1. Pull PTO clutch lever rearward (away from engine) to disengage clutch, if equipped.

**IMPORTANT:** Before stopping an engine that has been operating at working load, idle engine at least 2 minutes at 1000—1200 rpm to cool hot engine parts.

**Engines in generator set applications where the ECU is locked at a specified speed and no slow idle function is available, run engine for at least 2 minutes at fast idle and no load.**

2. Run engine at 1000—1200 rpm for at least 2 minutes to cool.

Panels with High-Low Speed Select Rocker Switch (B) only: Set rpm using Bump Speed Enable Switch (C) with Speed Select Rocker Switch (D).

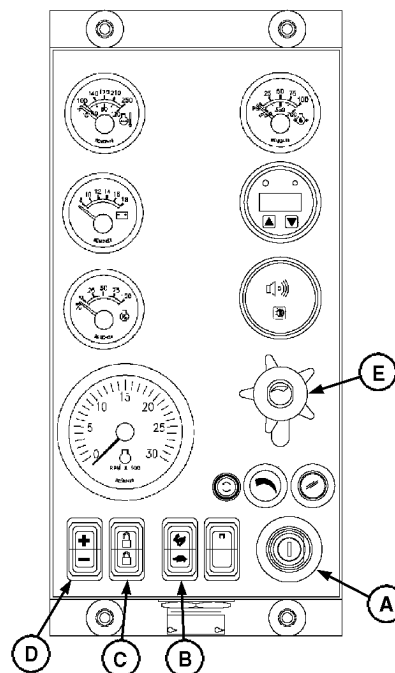
Panels with optional Analog Throttle (E): Set either High-Low Speed Select Switch (B) or Analog Throttle (E) to low idle, and set desired speed with remaining control.

**NOTE:** Engine Control Unit (ECU) reads the higher of the High-Low Speed Select Rocker Switch or the Analog Throttle(s) Speed settings.

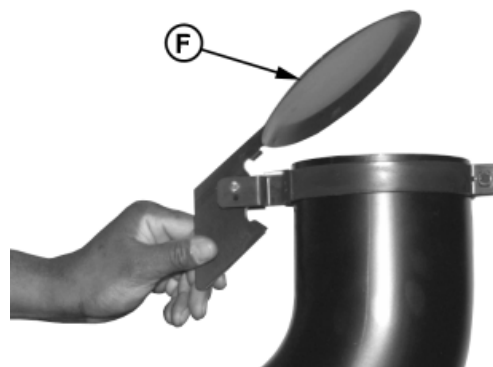
3. Push in on analog throttle potentiometer handle (if equipped) so that engine goes to slow idle, or set slow speed with High-Low Speed Select Rocker Switch.

4. Turn key switch (A) to "OFF" position to stop the engine. Remove ignition key.

**IMPORTANT:** Make sure that exhaust stack rain cap (F) is installed when engine is not running. This will prevent water and dirt from entering engine.



Stopping The Engine



Exhaust Stack Rain Cap

- A—Key Switch
- B—High-Low Speed Select Rocker Switch
- C—Bump Speed Enable Switch
- D—Speed Select Rocker Switch
- E—Analog Throttle
- F—Exhaust Stack Rain Cap

RG9916 —UN—16NOV99

RG9933 —UN—18NOV99

## USING A BOOSTER BATTERY OR CHARGER

A 12-volt booster battery can be connected in parallel with battery(ies) on the unit to aid in cold weather starting. ALWAYS use heavy duty jumper cables.

**CAUTION:** Gas given off by battery is explosive. Keep sparks and flames away from battery. Before connecting or disconnecting a battery charger, turn charger off. Make last connection and first disconnection at a point away from battery. Always connect **NEGATIVE (-)** cable last and disconnect this cable first.

**WARNING:** Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. **Wash hands after handling.**

**IMPORTANT:** Be sure polarity is correct before making connections. Reversed polarity will damage electrical system. Always connect positive to positive and negative to ground. Always use 12-volt booster battery for 12-volt electrical systems and 24-volt booster battery(ies) for 24-volt electrical systems.

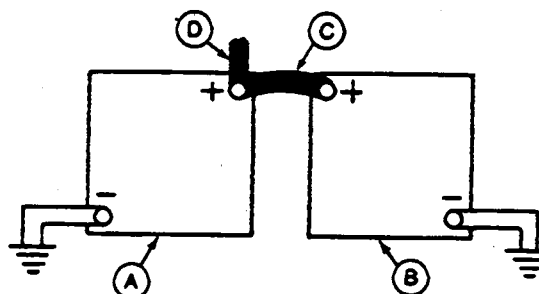
1. Connect booster battery or batteries to produce the required system voltage for your engine application.

**NOTE:** To avoid sparks, **DO NOT** allow the free ends of jumper cables to touch the engine.

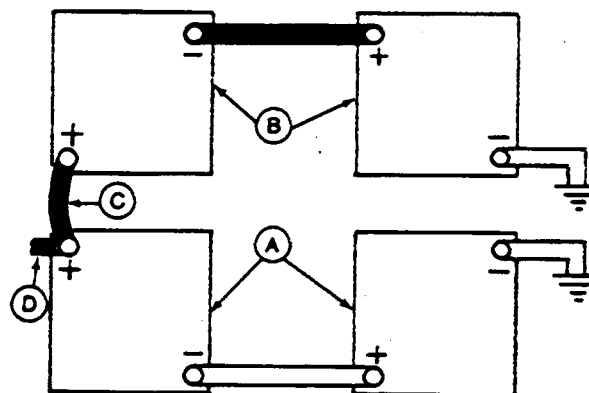
2. Connect one end of jumper cable to the **POSITIVE (+)** post of the booster battery.
3. Connect the other end of the jumper cable to the **POSITIVE (+)** post of battery connected to starter.
4. Connect one end of the other jumper cable to the **NEGATIVE (-)** post of the booster battery.
5. ALWAYS complete the hook-up by making the last connection of the **NEGATIVE (-)** cable to a good ground on the engine frame and away from the battery(ies).



Exploding Battery



12-Volt System



24-Volt System

A—12-Volt Machine Battery (ies)  
 B—12-Volt Booster Battery (ies)  
 C—Booster Cable  
 D—Cable to Starting Motor

TS204 -JUN-23AUG88

RG4678 -JUN-14DEC88

RG4698 -JUN-14DEC88

Continued on next page

RG, RG34710, 4060 -19-01JAN96-1/2

6. Start the engine. Disconnect jumper cables immediately after engine starts. Always disconnect NEGATIVE (–) cable first.

RG, RG34710, 4060 –19–01JAN96–2/2

# Lubrication and Maintenance

## OBSERVE SERVICE INTERVALS

**IMPORTANT:** Recommended service intervals are for normal operating conditions. Service **MORE OFTEN** if engine is operated under adverse conditions. Neglecting maintenance can result in failures or permanent damage to the engine.

Using hour meter (A) as a guide, perform all services at the hourly intervals indicated on following pages. At each scheduled maintenance interval, perform all previous maintenance operations in addition to the ones specified. Keep a record of hourly intervals and services performed using charts provided in Lubrication and Maintenance Records Section.



*Hour Meter (Standard Instrument Panel Shown)*

**A—Hour Meter**

RG, RG34710, 4061 -19-01JAN96-1/1

## USE CORRECT FUELS, LUBRICANTS, AND COOLANT

**IMPORTANT:** Use only fuels, lubricants, and coolants meeting specifications outlined in Fuels, Lubricants, and Coolant Section when servicing your John Deere Engine.

Consult your John Deere Servicing Distributor or your nearest John Deere Parts Network for recommended fuels, lubricants, and coolant. Also available are necessary additives for use when operating engines in tropical, arctic, or any other adverse conditions.



*John Deere Parts Network*

RG, RG34710, 4062 -19-01JAN96-1/1

## LUBRICATION AND MAINTENANCE SERVICE INTERVAL CHART—INDUSTRIAL UNITS AND GENERATOR SETS (PRIME POWER)

Item	Lubrication and Maintenance Service Intervals				
	Daily	250 Hour/6 Month	600 Hour/12 Month	2000 Hour/24 Month	As Required
Check Engine Oil and Coolant Level	•				
Check Fuel Filter/Water Separator Bowl—Engines ( — 199,999)	•				
Check Fuel Strainer—Engines (200,000— )	•				
Check Air Cleaner Dust Valve Restriction Indicator Gauge <sup>a</sup>	•				
Perform Visual Walkaround Inspection	•				
Lubricate PTO Release Bearing (if equipped)		•			
Service Fire Extinguisher		•			
Service Battery		•			
Change Engine Oil and Replace Oil Filter <sup>b</sup>		•			
Check PTO Clutch Adjustment		•			
Check Water Pump Weep Hole Foam Filter		•			
Lubricate PTO Clutch Levers and Linkage			•		
Clean Crankcase Vent Tube			•		
Check Air Intake Hoses, Connections & System			•		
Replace Fuel Filter Element(s)			•		
Check Belt Tensioner and Belt Wear			•		
Check Cooling System			•		
Coolant Solution Analysis-SCAs as required			•		
Pressure Test Cooling System			•		
Check Engine Speeds			•		
Check Crankshaft Vibration Damper <sup>c</sup>			•		
Check Engine Ground Connection			•		
Flush Cooling System <sup>d</sup>				•	
Adjust Engine Valve Clearance				•	
Drain Water Separator Bowl When Alarm Sounds					•
Add Coolant					•
Service Air Cleaner Elements					•
Replace Belt					•
Check PTO Clutch (if equipped)					•
Check Fuses					•
Bleed Fuel System					•

<sup>a</sup>Service air cleaner element when restriction indicator shows a vacuum of 625 mm (25 in.) H<sub>2</sub>O.

<sup>b</sup>Change the oil for the first time before 100 hours maximum of (break-in) operation, then every 250 hours thereafter. If PLUS-50 oil is used along with a John Deere oil filter, the oil and filter change interval may be extended by 50 percent to every 375 hours.

Continued on next page

RG, RG34710, 4063 —19—01JAN96—1/2

## Lubrication and Maintenance

Lubrication and Maintenance Service Intervals					
Item	Daily	250 Hour/6 Month	600 Hour/12 Month	2000 Hour/24 Month	As Required
°Replace crankshaft damper at 4500 hours or 60 months, whichever occurs first. Damper cannot be repaired.					
¶If John Deere COOL-GARD is used, the flushing interval may be extended to 3000 hours or 36 months. If John Deere COOL-GARD is used and the coolant is tested annually AND additives are replenished by adding supplemental coolant additives (SCAs), the flushing interval may be extended to 5000 hours or 60 months, whichever occurs first.					

RG, RG34710, 4063 -19-01JAN96-2/2

## LUBRICATION AND MAINTENANCE SERVICE INTERVAL CHART—GENERATOR APPLICATIONS (STANDBY POWER ONLY)

**NOTE:** The service intervals in the Lubrication and Maintenance Sections that follow reflect standard engines. Use service intervals listed

below for standby generators. Match service items below to titles in Lubrication and Maintenance Sections for procedures.

Item	Lubrication and Maintenance Service Intervals				
	Every 2 Weeks	250 Hour/6 Month	600 Hour/12 Month	2000 Hour/24 Month	As Required
Operate Engine at Rated Speed and 50%–70% Load a Minimum of 30 Minutes	•				
Check Engine Oil and Coolant Level	•				
Check Fuel Filter/Water Separator Bowl—Engines ( — 199,999)	•				
Check Fuel Strainer—Engines (200,000— )	•				
Check Air Cleaner Dust Valve Restriction Indicator Gauges <sup>a</sup>	•				
Perform Visual Walkaround Inspection	•				
Lubricate PTO Release Bearing (if equipped)	•				
Service Battery		•			
Change Engine Oil and Replace Oil Filter <sup>b</sup>		•			
Check Water Pump Weep Hole Foam Filter		•			
Check Engine Mounts		•			
Service Fire Extinguisher		•			
Lubricate PTO Clutch Shaft Bearing (if equipped)		•			
Lubricate PTO Clutch Levers and Linkage (if equipped)			•		
Clean Crankcase Vent Tube			•		
Check Air Intake Hoses, Connections, & System			•		
Replace Fuel Filter Element(s)			•		
Check Automatic Belt Tensioner and Belt Wear			•		
Check Cooling System			•		
Coolant Solution Analysis-Add SCAs as required			•		
Pressure Test Cooling System			•		
Check Crankshaft Vibration Damper <sup>c</sup>			•		
Checking and Adjusting Engine Speeds			•		
Checking Engine Ground Connection			•		
<sup>a</sup> Replace primary air cleaner element when restriction indicator shows a vacuum of 625 mm (25 in.) H <sub>2</sub> O.					
<sup>b</sup> Change the oil for the first time before 100 hours maximum of (break-in) operation, then every 250 hours thereafter. If PLUS-50 oil is used along with a John Deere oil filter, the oil and filter change interval may be extended by 50 percent to every 375 hours.					
<sup>c</sup> Replace crankshaft damper at 4500 hours or 60 months, whichever occurs first. Damper cannot be repaired.					

Continued on next page

RG, RG34710, 20063 -19-31MAR99-1/2

Item	Lubrication and Maintenance Service Intervals				
	Every 2 Weeks	250 Hour/6 Month	600 Hour/12 Month	2000 Hour/24 Month	As Required
Flush Cooling System <sup>d</sup>				•	
Adjust Engine Valve Clearance				•	
Drain Water Separator Bowl When Alarm Sounds <sup>e</sup>					•
Add Coolant					•
Service Air Cleaner Element					•
Replace Belt					•
Check Fuses					•
Bleed Fuel System					•
<sup>d</sup> If John Deere COOL-GARD is used, the flushing interval may be extended to 3000 hours or 36 months. If John Deere COOL-GARD is used and the coolant is tested annually AND additives are replenished by adding supplemental coolant additives (SCAs), the flushing interval may be extended to 5000 hours or 60 months, whichever occurs first.					
<sup>e</sup> Replace fuel filter element when audible alarm sounds and trouble codes indicate plugged fuel filter (low fuel pressure). If no alarm sounds during a 12 month interval, replace element at that time, or after every 600 hours of operation.					

RG, RG34710, 20063 -19-31MAR99-2/2



# Lubrication & Maintenance/Daily

## DAILY PRESTARTING CHECKS

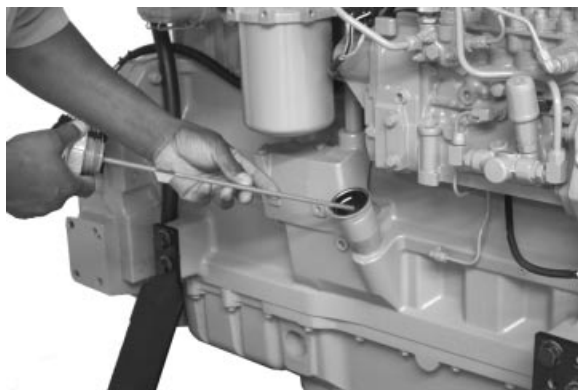
Do the following BEFORE STARTING THE ENGINE for the first time each day:

**IMPORTANT: DO NOT** add makeup oil until the oil level is **BELOW** the add mark.

1. Check engine oil level on dipstick. Add as required, using seasonal viscosity grade oil. (See DIESEL ENGINE OIL in Fuels, Lubricants, and Coolant Section for oil specifications.)

**IMPORTANT: DO NOT** fill above the top mark on the dipstick. Oil levels anywhere within crosshatch are considered in the acceptable operating range.

Oil may be added at dipstick tube or rocker arm cover filler cap locations.



RG7359 -UN-20JUN00

*Checking Engine Oil Level*

Continued on next page

RG, RG34710, 4064 -19-01JAN96-1/5

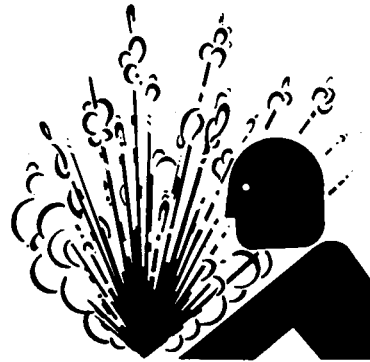
**CAUTION:** Explosive release of fluids from pressurized cooling system can cause serious burns.

Only remove filler cap when engine is cold or when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

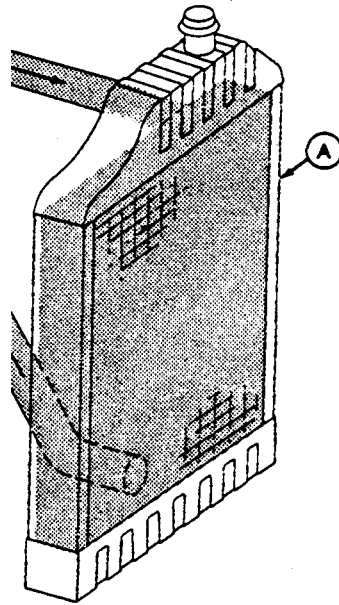
2. Check the coolant level when engine is cold. Coolant level should be at bottom of filler neck. Fill radiator (A) with proper coolant solution if level is low. (See **ADDING COOLANT** in Service As Required Section.) Check overall cooling system for leaks.

Refer to your vehicle's operator's manual for recommendations for non-John Deere supplied accessories.

A—Radiator



High Pressure Fluids



Radiator and Coolant

RG4675 -UN-14DEC88

TS281 -UN-23AUG88

Continued on next page

RG, RG34710, 4064 -19-01JAN96-2/5

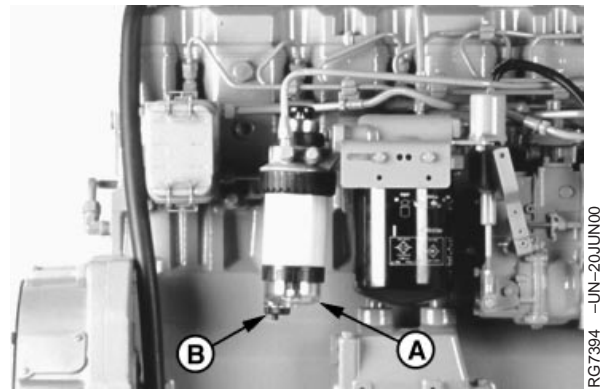
3. On engines ( —199,999), check the separator bowl (A) of the primary fuel filter/water separator for water or debris.

On engines ( —199,999), loosen thumb screw (B) and drain water and debris from bowl as needed.

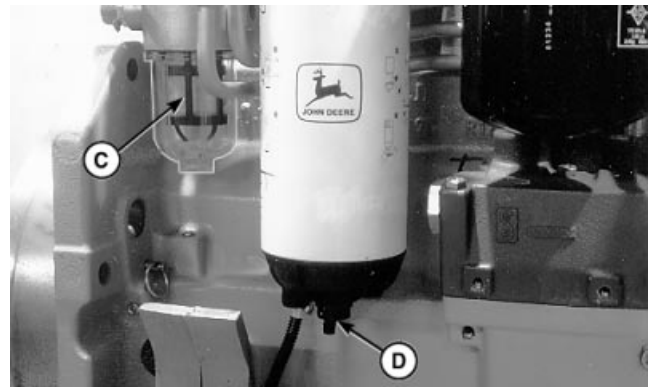
On engines (200,000— ), check filter screen (C) for debris. To service, see CLEAN FUEL STRAINER in Lubrication and Maintenance/600 Hour/12Month

**NOTE:** On engines (200,000— ) with electronic instrument panel, any water in fuel is drained into the bowl (D). The operator is signaled by an amber indicator on the instrument panel. To service, see DRAIN FUEL/WATER SEPARATOR BOWL in Service as Required.

- A—Separator Bowl
- B—Thumb Screw
- C—Filter Screen
- D—Separator Bowl



Drain Separator Bowl—Engines ( —199,999)

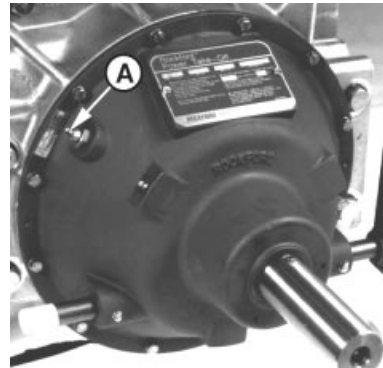


Inspect Filter Screen—Engines (200,000— )

RG, RG34710, 4064 —19-01JAN96-3/5

4. Apply one shot of John Deere Multi-Purpose Lubricant or equivalent at PTO release bearing grease fitting (A). DO NOT over-lubricate.

- A—Grease Fitting



PTO Bearing Grease Fitting

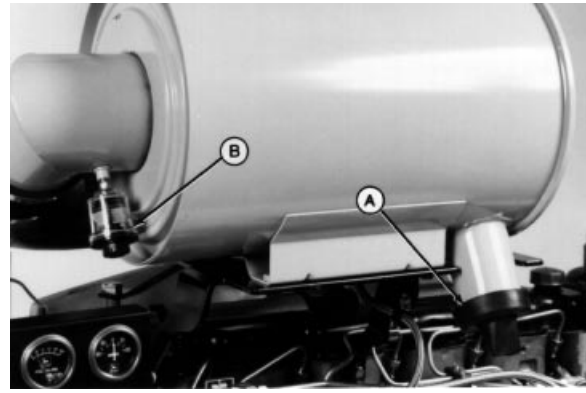
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RG, RG34710, 4064 —19-01JAN96-4/5

5. If the air cleaner has an automatic dust unloader valve (A), squeeze the unloader valve on air cleaner assembly to clear away any dust buildup.

If equipped with air intake restriction indicator gauge (B), check gauge to determine if air cleaner needs to be serviced.

**IMPORTANT:** Maximum air intake restriction is 6.25 kPa (0.06 bar) (1.0 psi) (25 in. H<sub>2</sub>O). A clogged air cleaner element will cause excessive intake restriction and a reduced air supply to the engine.



Air Cleaner

A—Unloader Valve  
B—Restriction Indicator Gauge

6. Make a thorough inspection of the engine compartment. Look for oil or coolant leaks, worn fan and accessory drive belts, loose connections and trash build-up. Remove trash build-up and have repairs made as needed if leaks are found.

**NOTE:** Wipe all fittings, caps, and plugs before performing any maintenance to reduce the chance of system contamination.

Inspect:

- Radiator for leaks and trash build-up.
- Air intake system hoses and connections for cracks and loose clamps.
- Fan, alternator, and accessory drive belts for cracks, breaks or other damage.
- Coolant pump for coolant leaks.

**NOTE:** It is normal for a small amount of leakage to occur as the engine cools down and parts contract. Excessive coolant leakage may indicate the need to replace the coolant pump seal. Contact your engine distributor or servicing dealer for repairs.

RG, RG34710, 4064 -19-01JAN96-5/5

# Lubrication & Maintenance/250 Hour/6 Month

## SERVICING FIRE EXTINGUISHER

A fire extinguisher (A) is available from your authorized servicing dealer or engine distributor.

Read and follow the instructions which are packaged with it. The extinguisher should be inspected at least every 100 hours of engine operation or once a month. Once extinguisher is operated, no matter how long, it must be recharged. Keep record of inspections on the tag which comes with the extinguisher instruction booklet.

A—Fire Extinguisher



Fire Extinguisher

RW4918 —UN—15DEC88

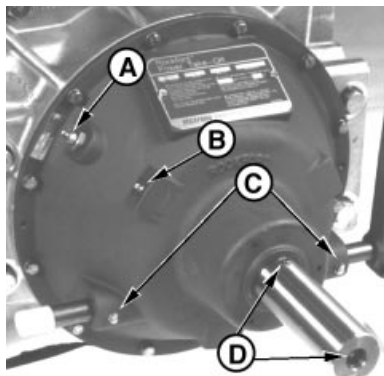
DPSG,OUOD002,1575 —19—21JUN00—1/1

## LUBRICATING PTO CLUTCH SHAFT BEARINGS (IF EQUIPPED)

Apply one or two shots of John Deere Multipurpose Lubricant or equivalent at clutch drive shaft bearing fitting (B) and pilot bearing fittings (D). DO NOT over-lubricate to avoid getting oil on clutch facings.

**NOTE:** Location of pilot bearing fitting will depend on application. Only one fitting will be used.

- A—Release Bearing Grease Fitting
- B—Drive Shaft Bearing Fitting
- C—Lever Cross Shaft Fittings
- D—Pilot Bearing Fitting



Lubricate PTO Clutch

RG7331C —UN—26JUN00

DPSG,OUOD002,1576 —19—21JUN00—1/1

## SERVICING BATTERY



**CAUTION:** Battery gas can explode. Keep sparks and flames away from batteries. Use a flashlight to check battery electrolyte level.

Never check battery charge by placing a metal object across the posts. Use a voltmeter or hydrometer.

Always remove grounded **NEGATIVE (-)** battery clamp first and replace it last.



Exploding Battery

TS204 -JUN-23AUG88

**WARNING:** Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. **Wash hands after handling.**

1. On regular batteries, check electrolyte level. Fill each cell to bottom of filler neck with distilled water.

**NOTE:** *Low-maintenance or maintenance-free batteries should require little additional service. However, electrolyte level can be checked by cutting the center section of decal on dash-line, and removing cell plugs. If necessary, add clean, soft water to bring level to bottom of filler neck.*

2. Keep batteries clean by wiping them with a damp cloth. Keep all connections clean and tight. Remove any corrosion, and wash terminals with a solution of 1 part baking soda and 4 parts water. Tighten all connections securely.

**NOTE:** *Coat battery terminals and connectors with a mixture of petroleum jelly and baking soda to retard corrosion.*

3. Keep battery fully charged, especially during cold weather. If a battery charger is used, turn charger off before connecting charger to battery(ies). Attach **POSITIVE (+)** battery charger lead to **POSITIVE (+)** battery post. Then attach **NEGATIVE (-)** battery charger lead to a good ground.

## HANDLING BATTERIES SAFELY



**CAUTION:** Battery gas can explode. Keep sparks and flames away from batteries. Use a flashlight to check battery electrolyte level.

Never check battery charge by placing a metal object across the posts. Use a voltmeter or hydrometer.

Always remove grounded (-) battery clamp first and replace it last.



**CAUTION:** Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid the hazard by:

1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 15—30 minutes. Get medical attention immediately.

If acid is swallowed:

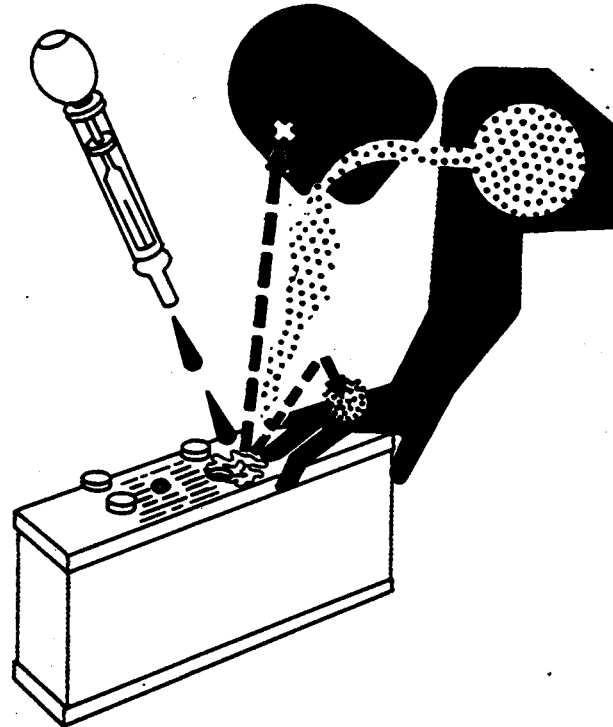
1. Do not induce vomiting.
2. Drink large amounts of water or milk, but do not exceed 2 L (2 quarts).
3. Get medical attention immediately.

**WARNING:** Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. **Wash hands after handling.**



Exploding Battery

TS204 -JUN-23AUG88



Sulfuric Acid

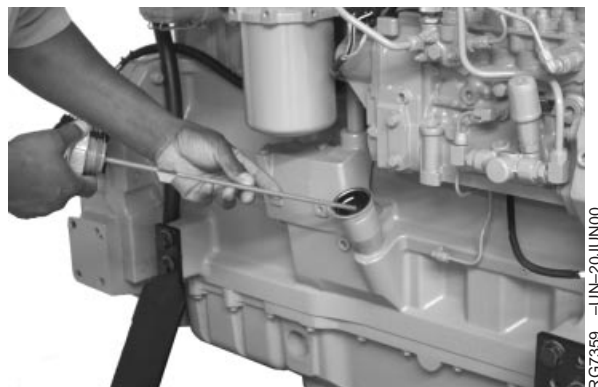
TS203 -JUN-23AUG88



## CHANGING ENGINE OIL AND REPLACING OIL FILTER



Replace Engine Oil Filter—Engines ( —199,999) Illustrated



Checking Engine Oil Level—Engines ( —199,999) Illustrated

**NOTE:** Change engine oil and filter for the first time after 100 hours maximum of operation, then every 250 hours thereafter.

If John Deere PLUS-50® engine oil and a John Deere oil filter are used, the oil and filter change interval may be extended by 50 percent or to every 375 hours.

OILSCAN® is a John Deere sampling program to help you monitor machine performance and identify potential problems before they cause serious damage. OILSCAN® kits are available from your John Deere dealer. Oil samples should be taken prior to the oil change. Refer to instructions provided with kit.

1. Run engine approximately 5 minutes to warm up oil. Shut engine off.
2. Remove oil pan drain plug.

**NOTE:** Drain plug location may vary, depending on the application.

3. Drain crankcase oil from engine while warm.
4. Remove and discard oil filter element using a suitable filter wrench.
5. Remove oil filter packing and clean filter mounting pad.

**IMPORTANT:** Filtration of oils is critical to proper lubrication. Always change filter regularly. Use filter meeting John Deere performance specifications.

6. Oil new packing and install new filter element on to filter housing, tighten element approximately 1/2 - 3/4 turn after packing contacts filter housing. DO NOT overtighten filter element.
7. Install oil pan drain plug with a new seal when equipped.
8. Fill engine crankcase with correct John Deere engine oil through dipstick tube opening. (See DIESEL ENGINE OIL in Fuels, Lubricants, and Coolant Section for determining correct engine oil.)

**NOTE:** Crankcase oil capacity may vary slightly. ALWAYS fill crankcase to full mark or within crosshatch on dipstick, whichever is present. DO NOT overfill.

To determine the correct oil fill quantity for your engine, see ENGINE CRANKCASE OIL FILL QUANTITIES in the Specifications Section.

PLUS-50 is a registered trademark of Deere & Company.  
OILSCAN is a registered trademark of Deere & Company.

Continued on next page

DPSG,OUOE003,8005 —19-18JUN99-1/2



**IMPORTANT:** Immediately after completing any oil change, crank engine for 30 seconds without permitting engine to start. This will help insure adequate lubrication to engine components before engine starts.

9. Start engine and run to check for possible leaks.
10. Stop engine and check oil level after 10 minutes. Oil level reading should be on upper mark of dipstick.

DPSG,OUOE003,8005 -19-18JUN99-2/2

## CHECKING PTO CLUTCH ADJUSTMENT (IF EQUIPPED)

**CAUTION:** Never attempt to service the PTO while it is in operation. Loose clothing could get caught in moving parts; keep clothing tight against body. Use extreme care when working around the PTO.

1. Measure clutch engagement force at handle grip using a spring scale. The engagement force should be 267–311 N (60–70 lb force).

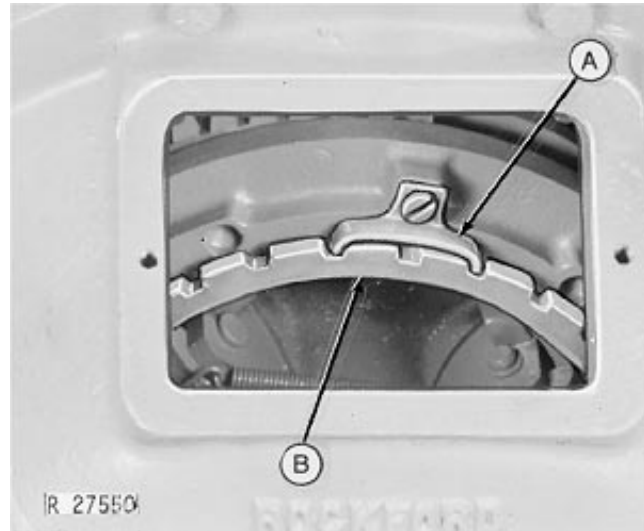
**IMPORTANT:** Improper adjustments of the PTO clutch may shorten clutch life. Make sure adjustments are made properly.

2. If adjustments are needed, disengage clutch and stop engine. Remove cover plate from clutch housing (shown removed).
3. Remove adjusting lock (A).
4. Turn adjusting ring (B) to adjust clutch engagement pressure.
5. Measure engagement force at clutch handle with spring scale.
6. Install lock screw and adjusting lock in clutch body splines when specified engagement pressure is achieved.
7. Tighten screw securely.
8. Recheck clutch engagement force with spring scale. Install cover plate. Disengage clutch.



Rotating Driveline

TS198 -JUN-23AUG88



PTO Clutch Adjustment

A—Adjusting Lock  
B—Adjusting Ring

R27550 -JUN-14DEC88

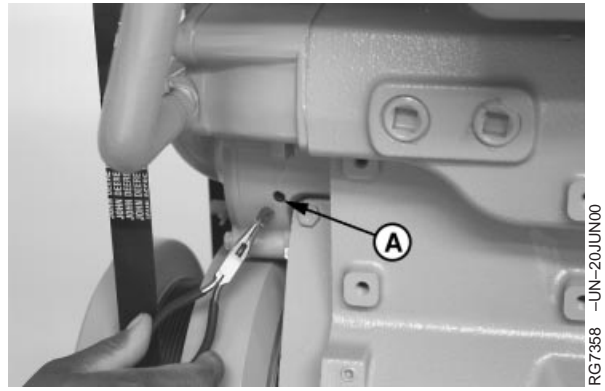
RG, RG34710, 4068 -19-01JAN96-1/1

## VISUALLY INSPECTING COOLANT PUMP

### Inspect Weep Hole

1. Remove foam filter from coolant pump weep hole (A) as shown.
2. Inspect weep hole for oil or coolant leakage.
  - Oil leakage indicates a damaged rear seal.
  - Coolant leakage indicates a damaged front seal.

Replace complete coolant pump assembly if leakage is detected: individual repair parts are not available.



*Coolant Pump Weep Hole Filter*

**A—Weep Hole**

### Inspect for Impeller Contact with Cover

1. Remove radiator-to-coolant pump hose from coolant pump inlet elbow.
2. Using a flashlight, inspect ID of coolant pump cover for internal impeller contact.
  - Impeller contact with cover usually indicates that impeller has moved on shaft or there is a damaged bearing.

Replace coolant pump assembly and cover as necessary if impeller contact is detected.

RG, RG34710, 4069 -19-01JAN96-1/1

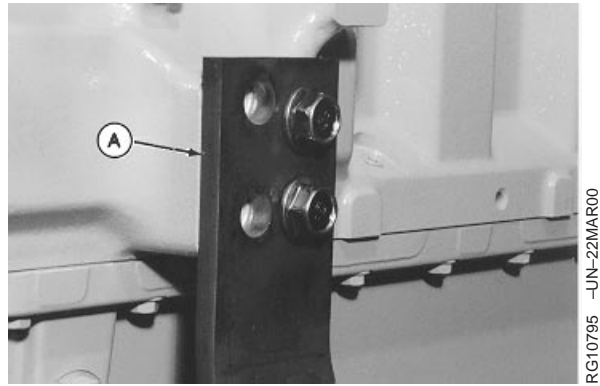
## CHECKING ENGINE MOUNTS (GENERATOR SETS)

Engine mounting is the responsibility of the generator manufacturer. Follow manufacturer's guidelines for mounting specifications.

**IMPORTANT: Use only Grade SAE 8 or higher grade of hardware for engine mounting.**

1. Check the engine mounting brackets (A), vibration isolators, and mounting bolts on support frame and engine block for tightness. Tighten as necessary to recommended torque of generator manufacturer.

2. Inspect overall condition of vibration isolators, if equipped. Replace isolators if rubber has deteriorated or mounts have collapsed, as necessary.



*Engine Mounting*

**A—Engine Mounting Brackets**

DPSG,OUOD002,1578 -19-21JUN00-1/1

## LUBRICATING PTO CLUTCH INTERNAL LEVERS AND LINKAGE

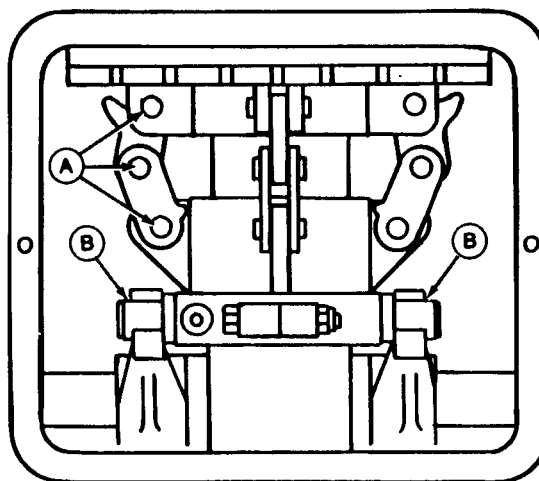
**CAUTION:** Never attempt to service the PTO while it is in operation. Loose clothing could get caught in moving parts; keep clothing tight against body. Use extreme care when working around the PTO.

1. Remove the PTO housing cover and apply one shot of John Deere Multipurpose Lubricant or equivalent (See Fuels, Lubricants, and Coolant Section) to the pivot points (A) of each clutch linkage.
2. Apply one shot of John Deere Multipurpose Lubricant or equivalent to the two PTO release lever shaft fittings (B).

A—Pivot Points  
B—Shaft Fittings



*Rotating Driveline*



*PTO Lubrication*

TS198 -JUN-23AUG88

RG6641 -JUN-18FEB93

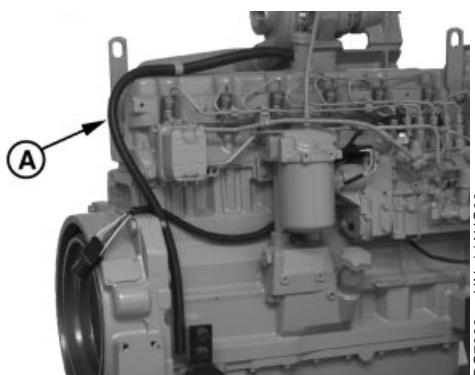
RG, RG34710, 4070 -19-01JAN96-1/1

## CLEANING CRANKCASE VENT TUBE

If the engine is operated in dusty conditions, clean the tube at shorter intervals.

1. Remove and clean crankcase vent tube (A).
2. Install the vent tube. Be sure the O-ring fits correctly in the rocker arm cover for elbow adapter. Tighten hose clamp securely.

A—Vent Tube



*Clean Crankcase Vent—Engines ( -199,999) Illustrated*

RG7366 -JUN-14AUG00

RG, RG34710, 4071 -19-01JAN96-1/1

## CHECKING AIR INTAKE SYSTEM

**IMPORTANT:** The air intake system must not leak. Any leak, no matter how small, may result in internal engine damage due to abrasive dirt and dust entering the intake system.

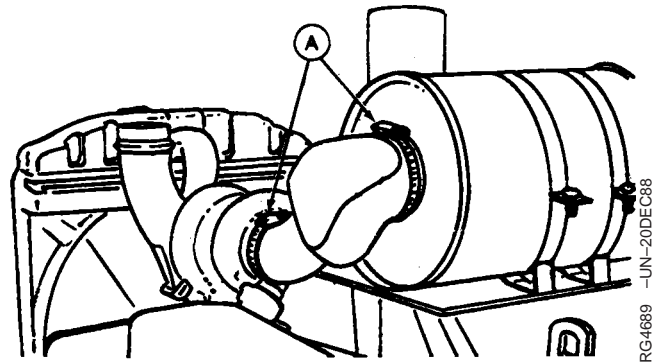
1. Inspect all intake hoses (piping) for cracks. Replace as necessary.
2. Check clamps (A) on piping which connect the air cleaner to the engine. Tighten clamps as necessary. This will help prevent dirt from entering the air intake system through loose connections causing internal engine damage.
3. If engine has a rubber dust unloader valve (B), inspect the valve on bottom of air cleaner for cracks or plugging. Replace as necessary.

**IMPORTANT:** ALWAYS REPLACE primary air cleaner element when air restriction indicator shows a vacuum of 625 mm (25 in.) H<sub>2</sub>O, is torn, or visibly dirty.

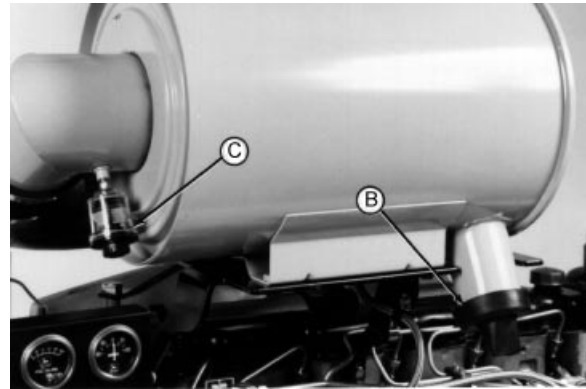
4. Test air restriction indicator gauge (C) for proper operation. Replace indicator as necessary.

**IMPORTANT:** If not equipped with air restriction indicator, replace air cleaner elements at 600 Hours or 12 Months, whichever occurs first.

5. Remove and inspect primary air cleaner element. Service as necessary. (See REPLACING AIR CLEANER ELEMENTS in Service As Required Section.)



*Air Intake Hose Clamps*



*Air Cleaner*

- A—Clamps
- B—Unloader Valve
- C—Restriction Indicator Gauge

## REPLACING (RECTANGULAR) FINAL FUEL FILTER ELEMENT—ENGINES ( —199,999)



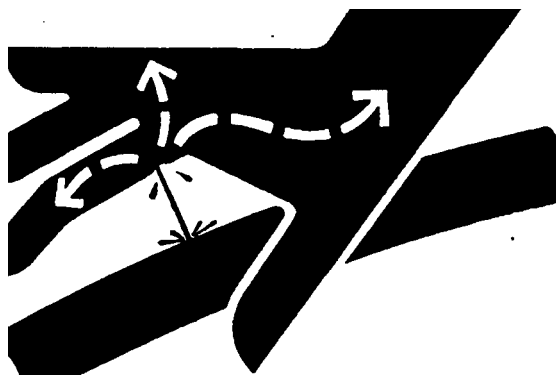
**CAUTION:** Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

1. Close fuel shut-off valve at bottom of fuel tank (not illustrated).

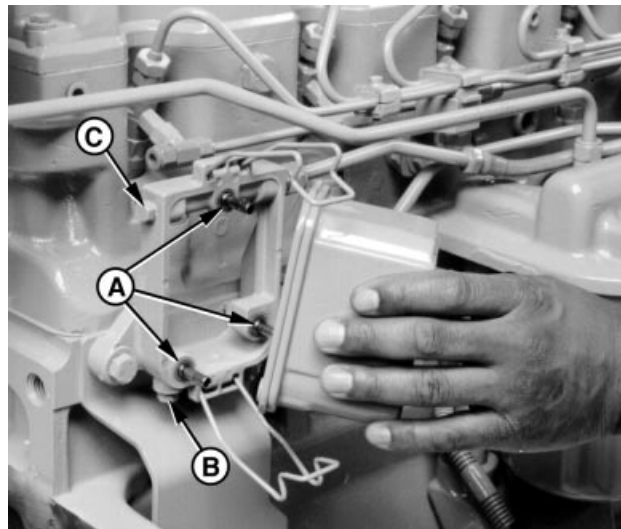
**NOTE:** Keep a small container under drain plug to catch draining fuel.

2. Loosen bleed plug (C) on side of filter base. Remove drain plug (B) to drain from fuel filter.
3. With fuel filter firm against base, lift up on top retaining spring and pull down on bottom retaining spring. Pull fuel filter off guide pins (A) of fuel filter base and discard.
4. Install new fuel filter onto guide pins of fuel filter base. Hold filter firmly against base.
5. Secure bottom filter retaining spring first, then secure top retaining spring (four arrows).
6. Install drain plug (B), shown installed. Tighten bleed plug and drain plug securely. Do not overtighten.
7. Open fuel shut-off valve and bleed the fuel system. See BLEEDING THE FUEL SYSTEM—Engines ( —199,999) , in Service As Required Section.



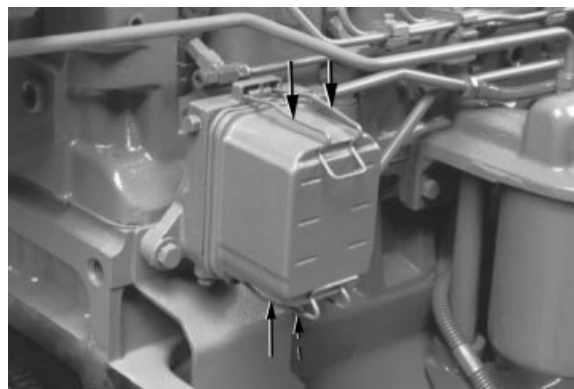
High Pressure Fluid

X9811 -UN-23AUG88



Replace Fuel Filter

RG7051 -UN-26NOV97



Fuel Filter Retaining Springs

RG7052 -UN-26NOV97

A—Guide Pins  
B—Drain Plug  
C—Bleed Plug

## REPLACING (ROUND) PRIMARY FUEL FILTER/WATER SEPARATOR— ENGINES ( —199,999)

1. Thoroughly clean fuel filter/water separator assembly and surrounding area.

*NOTE: Lifting up on retaining ring (F) as it is rotated helps to get it past retaining dent.*

2. Rotate retaining ring (F) counterclockwise 1/4 turn. Remove ring with filter element (E).
3. Remove water separator bowl (G) from filter element (E). Drain and clean separator bowl. Dry with compressed air.

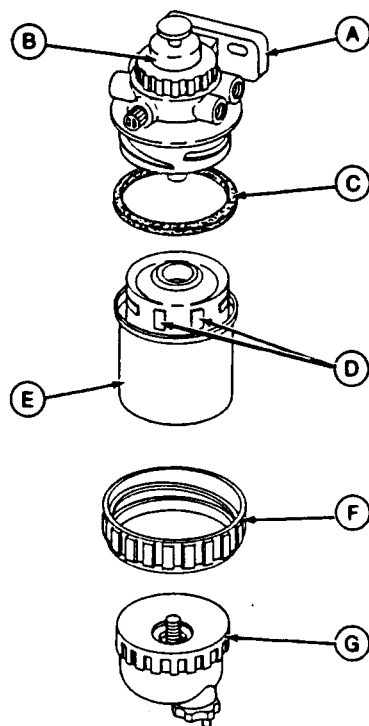
*NOTE: Notice raised locators on filter element. These locators insure proper alignment of filter element to filter base.*

4. Install water separator bowl onto new filter element. Tighten securely.
5. Index filter element until longer, vertical locators (D) are oriented opposite mounting base. Insert filter element into base securely. It may be necessary to rotate filter for correct alignment.
6. Install retaining ring to filter base, making certain dust seal (C) is in place on filter base. Tighten retaining ring until it locks into detent position and a “click” sound can be heard.
7. Bleed fuel system. (See BLEEDING THE FUEL SYSTEM—Engines ( —199,999) in Service As Required Section.)

A—Mounting Base  
B—Hand Primer  
C—Dust Seal  
D—Vertical Locators  
E—Filter Element  
F—Retaining Ring  
G—Water Separator Bowl



Primary Fuel Filter



Primary Fuel Filter/Water Separator Parts

RG7395 —UN-20JUN00

RG6666 —UN-13MAR93

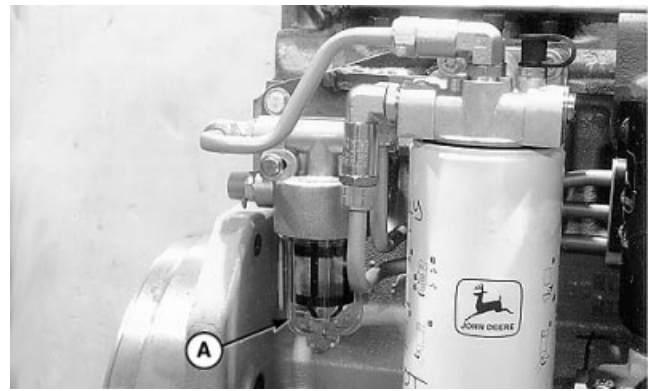


## CLEAN FUEL STRAINER —ENGINES (200,000— )

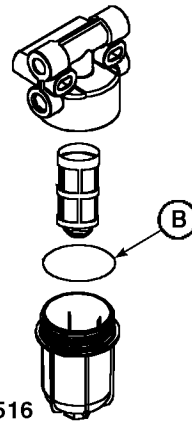
**NOTE:** Do not clean fuel strainer and change fuel filter at the same time. Clean fuel strainer and run engine before changing fuel filter.

1. Close shut-off valve at bottom of fuel tank (not illustrated).
2. Thoroughly clean fuel strainer assembly and surrounding area.
3. Remove fuel strainer bowl (A) using a 1 in. socket on bottom of bowl.
4. Clean screen and replace O-ring (B) on bowl.
5. Install screen and bowl. Open shut-off valve and start engine.

A—Fuel Strainer  
B—O-Ring



Fuel Strainer



RG11516

Fuel Strainer Parts

RG11516 -JUN-10NOV00

RG11078 -JUN-10NOV00

AG.OUOD007,3500 -19-30OCT00-1/1

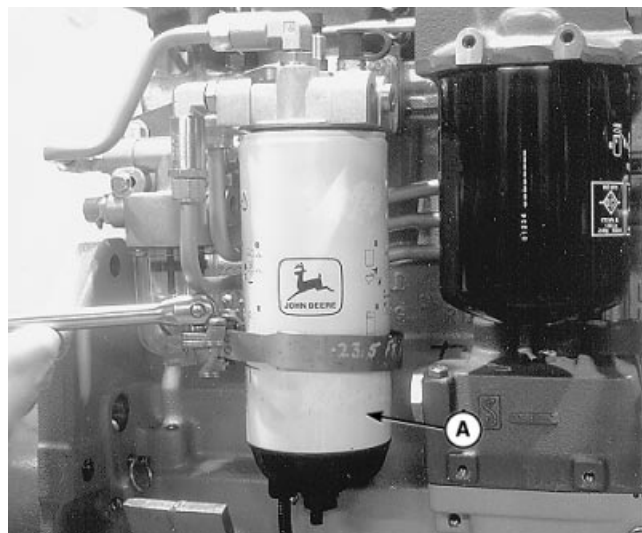
## REPLACING MAIN FUEL FILTER—ENGINES (200,000— )

**NOTE:** Do not clean fuel strainer and change fuel filter at the same time. Clean fuel strainer and run engine before changing fuel filter.

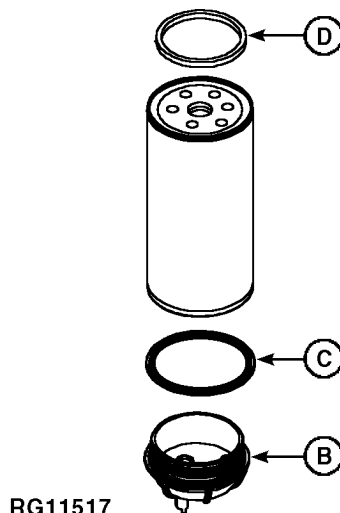
1. Close shut-off valve at bottom of fuel tank and disconnect water-in-fuel sensor (not illustrated).
2. Thoroughly clean fuel filter/water separator assembly and surrounding area.
3. Remove filter (A) using a suitable filter wrench.
4. Remove water separator bowl (B) from filter element. Drain and clean separator bowl. Dry with compressed air.
5. Inspect bowl (B) and O-ring (C). Replace if necessary.

**IMPORTANT:** DO NOT prefill the fuel filter element or bowl with fuel as damage to injectors could occur.

6. Lubricate O-ring and install separator bowl onto new filter element. Tighten 1/2 turn after O-ring contacts filter.
7. Lubricate packing (D) and install filter onto base. Tighten 3/4 turn after packing contacts base. Connect sensor.
8. Open shut-off valve and bleed fuel system (See Service As Required section. (If engine will not start after bleeding the fuel system, prime the fuel system. See "Restarting Engine Which Has Run Out Of Fuel", earlier in this manual.)



Fuel Filter



RG11517

Fuel Filter Parts

- A—Filter
- B—Separator Bowl
- C—O-ring
- D—Packing

RG11517 -JUN-10NOV00

RG11079 -JUN-10NOV00

AG,OUOD007,3501 -19-30OCT00-1/1

## CHECKING BELT TENSIONER SPRING TENSION AND BELT WEAR

Belt drive systems equipped with automatic (spring) belt tensioners cannot be adjusted or repaired. The automatic belt tensioner is designed to maintain proper belt tension over the life of the belt. If tensioner spring tension is not within specification, replace tensioner assembly.

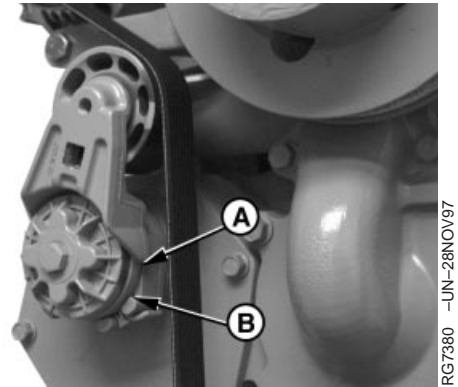
DPSG,OUOD002,1917 -19-08DEC00-1/1

## CHECKING BELT WEAR

The belt tensioner is designed to operate within the limit of arm movement provided by the cast stops (A and B) when correct belt length and geometry is used.

Visually inspect cast stops (A and B) on belt tensioner assembly.

If the tensioner stop (A) on swing arm is hitting the fixed stop (B), check mounting brackets (alternator, belt tensioner, idler pulley, etc.) and the belt length. Replace belt as needed (see REPLACING FAN / ALTERNATOR BELT in Service As Required Section).



*Belt Tensioner*

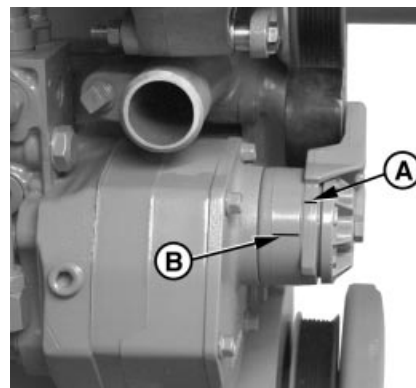
A—Tensioner Stop  
B—Fixed Stop

DPSG,OUOD002,1918 -19-08DEC00-1/1

## CHECKING TENSIONER SPRING TENSION

A belt tension gauge will not give an accurate measure of the belt tension when automatic spring tensioner is used. Measure tensioner spring tension using a torque wrench and procedure outlined below:

1. Release tension on belt using a long-handle 1/2 inch breaker bar in tension arm. Remove belt from pulleys.
2. Release tension on tension arm and remove breaker bar.
3. Put a mark (A) on swing arm of tensioner as shown.
4. Measure 21 mm (0.83 in.) from mark (A) and put a mark (B) on tensioner mounting base.



*Checking Belt Tension Spring*

A—Mark  
B—Mark

Continued on next page

DPSG,OUOD002,1919 -19-08DEC00-1/2

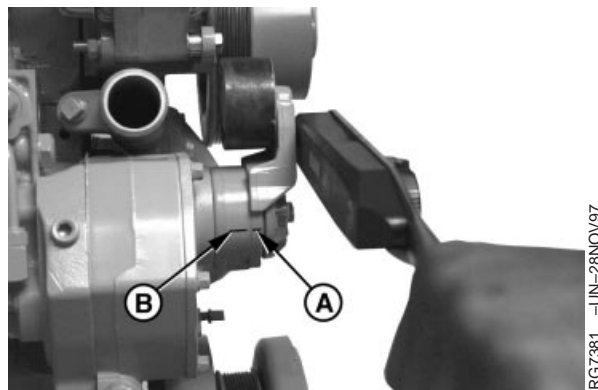
5. Rotate the swing arm using a torque wrench until marks (A and B) are aligned.

6. Record torque wrench measurement and compare with specification below. Replace tensioner assembly as required.

	Specification
Spring—Tension .....	24-28 N•m (17-21 lb-ft)

A—Mark

B—Mark



RG7381 -UN-28NOV97

Checking Belt Tensioner Spring Tension

DPSG,OUOD002,1919 -19-08DEC00-2/2

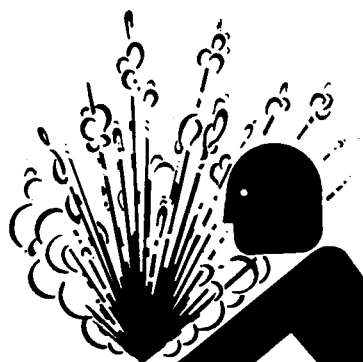
## CHECKING COOLING SYSTEM

**CAUTION:** Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

**IMPORTANT:** Air must be expelled from cooling system when system is refilled. Loosen temperature sending unit fitting at rear of cylinder head or plug in thermostat housing to allow air to escape when filling system. Retighten fitting or plug when all the air has been expelled.

1. Check entire cooling system for leaks. Tighten all clamps securely.
2. Thoroughly inspect all cooling system hoses. Replace hoses when hard, flimsy, or cracked.



High Pressure Fluids

TS281 -UN-23AUG88

RG,RG34710,4077 -19-01JAN96-1/1

## TESTING DIESEL ENGINE COOLANT

Maintaining adequate concentrations of glycol and inhibiting additives in the coolant is critical to protect the engine and cooling system against freezing, corrosion, and cylinder liner erosion and pitting.

Test the coolant solution at intervals of 12 months or less and whenever excessive coolant is lost through leaks or overheating.

### Coolant Test Strips

Coolant test strips are available from your John Deere dealer. These test strips provide a simple, effective method to check the freeze point and additive levels of your engine coolant.

Compare the results to the supplemental coolant additive (SCA) chart to determine the amount of inhibiting additives in your coolant and whether more John Deere COOLANT CONDITIONER should be added.

### COOLSCAN™

For a more thorough evaluation of your coolant, perform a COOLSCAN analysis. See your John Deere dealer for information about COOLSCAN.

*COOLSCAN is a trademark of Deere & Company*

DX,COOL9 -19-17FEB99-1/1

## REPLENISHING SUPPLEMENTAL COOLANT ADDITIVES (SCAs) BETWEEN COOLANT CHANGES

**IMPORTANT:** Do not add supplemental coolant additives when the cooling system is drained and refilled with John Deere ANTIFREEZE/SUMMER COOLANT or COOL-GARD™

**NOTE:** If system is to be filled with coolant that does not contain SCAs, the coolant must be precharged. Determine the total system capacity and premix with 3% John Deere Coolant Conditioner.

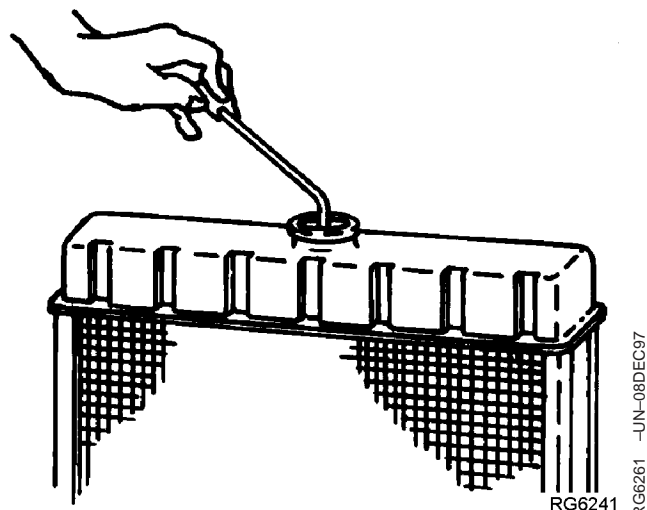
Through time and use, the concentration of coolant additives is gradually depleted during engine operation. Periodic replenishment of inhibitors is required, even when John Deere ANTIFREEZE/SUMMER COOLANT is used. The cooling system must be recharged with additional supplemental coolant additives available in the form of liquid coolant conditioner.

Maintaining the correct coolant conditioner concentration (SCAs) and freeze point is essential in your cooling system to protect against rust, liner pitting and corrosion, and freeze-ups due to incorrect coolant dilution.

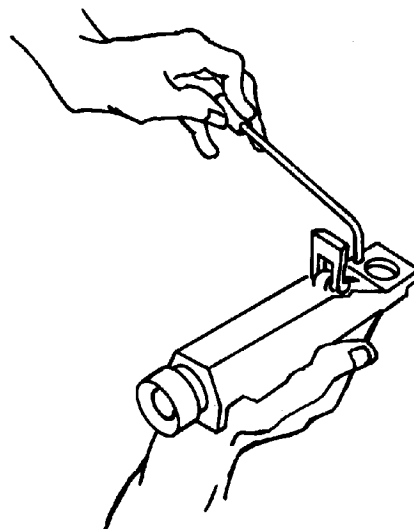
**John Deere LIQUID COOLANT CONDITIONER is recommended as a supplemental coolant additive in John Deere engines.**

**DO NOT mix one brand of SCA with a different brand.**

Test the coolant solution at 600 hours or 12 months of operation using either John Deere coolant test strips or a COOLSCAN™ analysis. If a COOLSCAN™ analysis is not available, recharge the system per instructions printed on label of John Deere Liquid Coolant Conditioner.



Radiator Coolant Check



JTO7298 Coolant/Battery Tester

COOL-GARD is a trademark of Deere & Company  
COOLSCAN is a trademark of Deere & Company

Continued on next page

DPSG,OUOD002,1921 -19-12DEC00-1/2

**IMPORTANT: ALWAYS maintain coolant at correct level and concentration. DO NOT operate engine without coolant even for a few minutes.**

**If frequent coolant makeup is required, the glycol concentration should be checked with JTO7298 Coolant/Battery Tester to ensure that the desired freeze point is maintained. Follow manufacturer's instructions provided with Coolant/Battery Tester.**

Add the manufacturer's recommended concentration of supplemental coolant additive. DO NOT add more than the recommended amount.

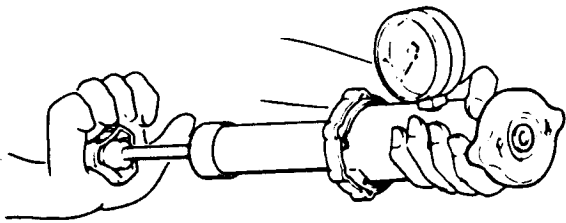
The use of non-recommended supplemental coolant additives may result in additive drop-out and gelation of the coolant.

If other coolants are used, consult the coolant supplier and follow the manufacturer's recommendation for use of supplemental coolant additives.

See DIESEL ENGINE COOLANTS AND SUPPLEMENTAL ADDITIVE INFORMATION for proper mixing of coolant ingredients before adding to the cooling system.

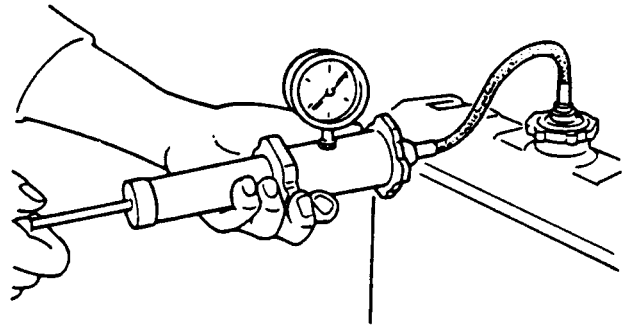
DPSG,OUOD002,1921 -19-12DEC00-2/2

## PRESSURE TESTING COOLING SYSTEM



Test Radiator Cap

RG6657 -JUN-20JAN93



Test Cooling System

RG6658 -JUN-20JAN93

**CAUTION:** Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

### Test Radiator Cap

1. Remove radiator cap and attach to D05104ST Tester as shown.
2. Pressurize cap to 67 kPa (0.7 bar) (10 psi)<sup>1</sup>. Gauge should hold pressure for 10 seconds within the normal range if cap is acceptable.

If gauge does not hold pressure, replace radiator cap.

3. Remove the cap from gauge, turn it 180°, and retest cap. This will verify that the first measurement was accurate.

### Test Cooling System

**NOTE:** Engine should be warmed up to test overall cooling system.

1. Allow engine to cool, then carefully remove radiator cap.
2. Fill radiator with coolant to the normal operating level.

**IMPORTANT:** DO NOT apply excessive pressure to cooling system, doing so may damage radiator and hoses.

3. Connect gauge and adapter to radiator filler neck. Pressurize cooling system to 67 kPa (0.7 bar) (10 psi)<sup>1</sup>.
4. With pressure applied, check all cooling system hose connections, radiator, and overall engine for leaks.

If leakage is detected, correct as necessary and pressure test system again.

If no leakage is detected, but the gauge indicated a drop in pressure, coolant may be leaking internally within the system or at the block-to-head gasket. Have your servicing dealer or distributor correct this problem immediately.

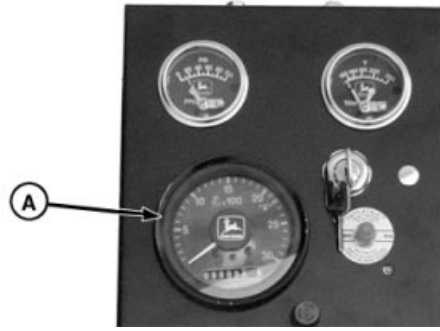
<sup>1</sup>Test pressures recommended are for all Deere OEM cooling systems. On specific vehicle applications, test cooling system and pressure cap according to the recommended pressure for that vehicle.



## CHECKING AND ADJUSTING ENGINE SPEEDS

If equipped with a tachometer (A) on the instrument panel, observe tachometer reading to verify engine speeds. (Refer to FUEL INJECTION PUMP SPECIFICATIONS in Specifications Section later in this manual for engine speed specifications.)

A—Tachometer



Using Tachometer to Check Engine Speeds

RG11076 -UN-21AUG00

RG, RG34710, 4080 -19-01JAN96-1/1

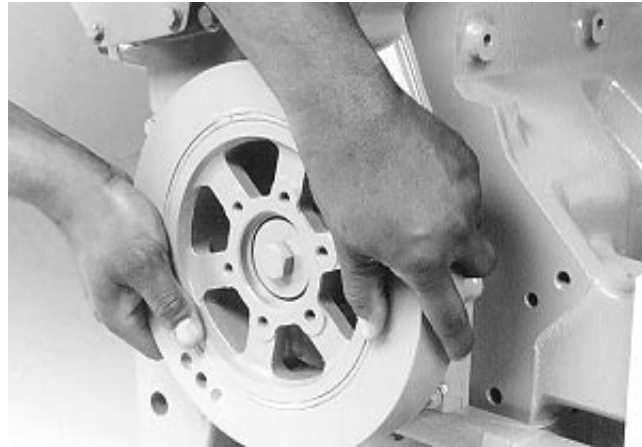
## CHECKING CRANKSHAFT VIBRATION DAMPER

On some applications there may be dual dampers. Make same checks on each damper.

1. Remove belts (shown removed).

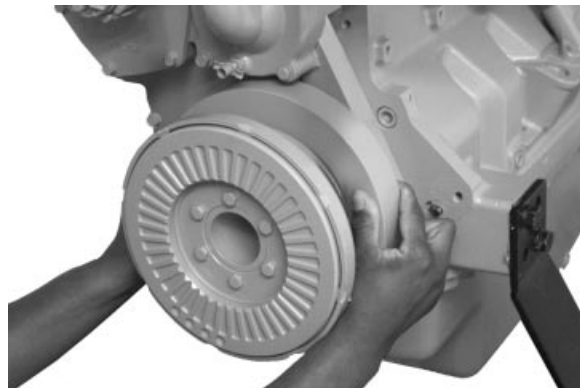
**NOTE:** On engines equipped with dual dampers, ALWAYS replace both dampers as a matched set.

2. Grasp vibration damper with both hands and attempt to turn it in both directions. If rotation is felt, damper is defective and should be replaced.



Single Damper

RG7208 -UN-28JUL94



Dual Damper

RG7369 -UN-05JAN98

Continued on next page

RG, RG34710, 4081 -19-01JAN96-1/2

**NOTE:** On engines equipped with dual dampers, check runout on inner damper only. Always replace both dampers as a matched set.

3. Check vibration damper radial runout by positioning a dial indicator (A) so probe contacts damper outer diameter.
4. Rotate crankshaft using JDG820 Flywheel Turning Tool.
5. Note dial indicator reading.

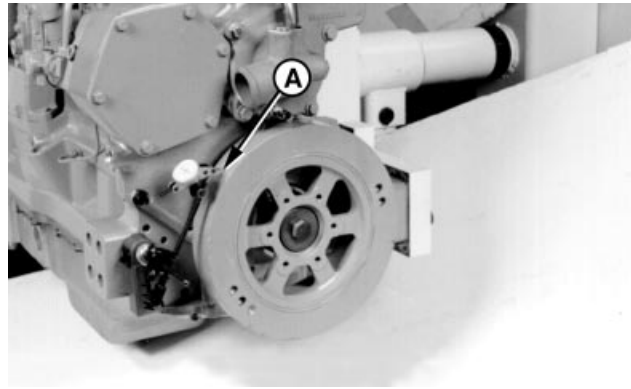
#### Specification

Damper—Maximum Radial  
Runout ..... 1.02 mm (0.040 in.)

If runout exceeds specifications, replace vibration damper.

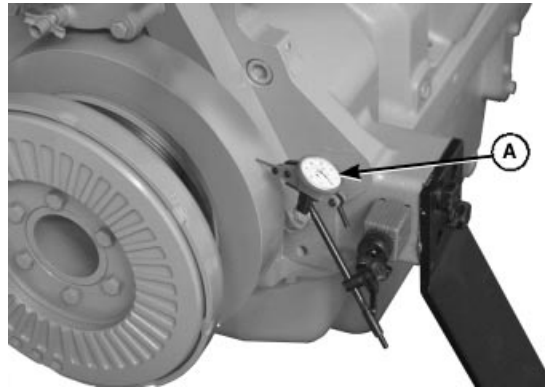
**IMPORTANT:** The vibration damper assembly is not repairable and should be replaced every 4500 hours or 60 months, whichever occurs first.

A—Dial Indicator



Single Damper

RG7065 -UN-26NOV97



Dual Damper

RG11601 -UN-11DEC00

RG, RG34710, 4081 -19-01JAN96-2/2

## CHECKING ENGINE GROUND CONNECTION

Check engine ground connection to be sure it is secure and clean. This will prevent electrical arcing which can damage engine.

DPSG, OUOD002, 1920 -19-08DEC00-1/1

## FLUSHING COOLING SYSTEM



**CAUTION:** Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

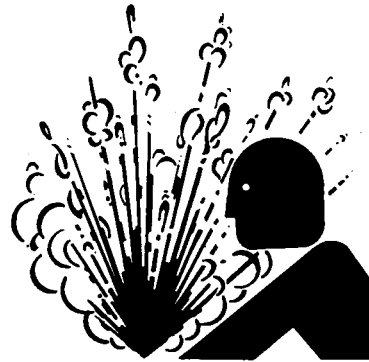
**NOTE:** Drain the initial factory fill engine coolant after the first 3000 hours or 36 months of operation. Subsequent drain intervals are determined by the coolant used for service.

When John Deere COOL-GARD is used, the drain interval is 3000 hours or 36 months. The drain interval may be extended to 5000 hours or 60 months of operation **provided that the coolant is tested annually AND additives are replenished as needed, by adding a supplemental cooling additive (SCA).**

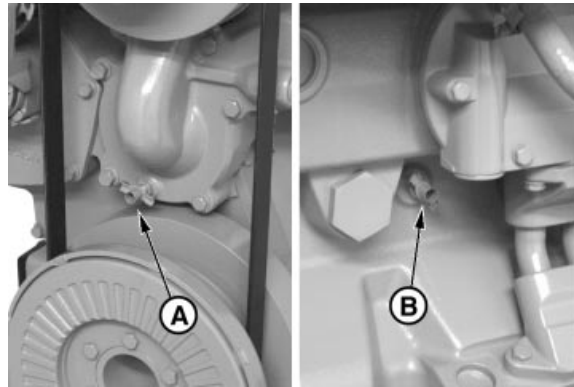
If COOL-GARD is not used, the drain interval is reduced to 2000 hours or 24 months of operation.

Drain old coolant, flush the entire cooling system, replace thermostats, and fill with recommended clean coolant.

1. Pressure test entire cooling system and pressure cap if not previously done. (See PRESSURE TESTING COOLING SYSTEM, in Lubrication and Maintenance 600 hour/12month.)
2. Slowly open the engine cooling system filler cap or radiator cap to relieve pressure and allow coolant to drain faster.
3. Open coolant pump drain valve (A) and engine block drain valve (B) on left side of engine. Drain all coolant from engine block.
4. Open radiator drain valve and drain coolant from radiator.



High Pressure Fluids



Cooling System Drains

A—Pump Drain Valve  
B—Block Drain Valve

TS281 -UN-23AUG88

RG7371 -UN-20JUN00

Continued on next page

RG, RG34710, 4084 -19-01JAN96-1/2

5. Remove thermostats at this time, if not previously done. Install cover (without thermostats) and tighten cap screws to 20 N•m (15 lb-ft).
6. Close all drain valves after coolant has drained. Fill the cooling system with clean water. Run the engine about 10 minutes to stir up possible rust or sediment.
7. Stop engine and immediately drain the water from system before rust and sediment settle.
8. After draining water, close drain valves and fill the cooling system with clean water and a heavy duty cooling system cleaner such as FLEETGUARD® RESTORE™ or RESTORE PLUS™. Follow manufacturer's directions on label.
9. After cleaning the cooling system, drain cleaner and fill with water to flush the system. Run the engine about 10 minutes, then drain out flushing water.
10. Close all drain valves on engine and radiator. Install thermostats using a new gasket.

**IMPORTANT: Air must be expelled from cooling system when system is refilled. Loosen temperature sending unit fitting in cylinder head or plug in thermostat housing to allow air to escape when filling system. Retighten fitting or plug when all the air has been expelled.**

11. Add coolant to radiator until coolant touches bottom of filler neck. (See ADDING COOLANT in Service As Required Section.)
12. Run engine until it reaches operating temperature. This mixes the solution uniformly and circulates it through the entire system. The normal engine coolant temperature range is 82°- 94°C (180° - 202°F).
13. After running the engine, check coolant level and entire cooling system for leaks.

FLEETGUARD is a trademark of Cummins Engine Company, Inc.  
 RESTORE is a trademark of Fleetguard Inc.  
 RESTORE PLUS is a trademark of Fleetguard Inc.

RG, RG34710, 4084 -19-01JAN96-2/2

## CHECKING AND ADJUSTING ENGINE VALVE CLEARANCE—ENGINES ( —199,999)

Too little valve clearance throws valves out of time. Valves open too early and close too late. This causes the valves to overheat due to hot combustion gases rushing past valves when out of time. Overheating lengthens valve stems which prevents proper seating of valves. The valves seat so briefly or poorly that normal heat transfer into the cooling system does not have time to take place causing burned valves and low power.

Too much valve clearance causes a lag in valve timing causing engine valve train imbalance. The fuel-air mixture enters the cylinders late during intake stroke. The exhaust valve closes early and prevents waste gases from being completely removed from cylinders. Also, the valves close with a great deal of impact, which may crack or break the valves and scuff the camshaft and followers

**IMPORTANT: Valve clearance MUST BE checked and adjusted with engine COLD.**

1. Remove rocker arm cover with vent tube.

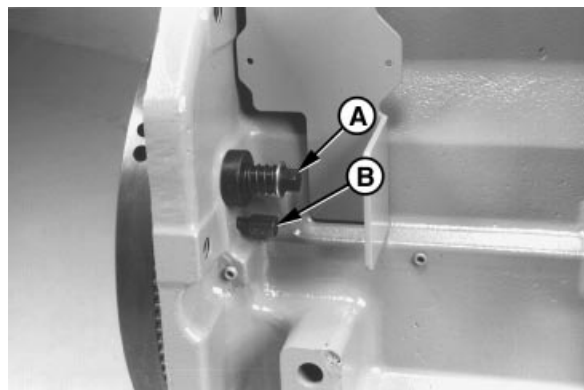
**IMPORTANT: Visually inspect contact surfaces of wear caps and rocker arm wear pads. Check all parts for excessive wear, breakage, or cracks. Replace parts that show visible damage.**

2. Remove plastic plugs from cylinder block bores as shown and install JDG820 Flywheel Turning Tool (A) and JDE81-4 Timing Pin (B).

3. Rotate engine with the flywheel turning tool until timing pin engages timing hole in flywheel.

If the rocker arms for No. 1 cylinder are loose, the engine is at No. 1 "TDC-Compression."

If the rocker arms for No. 6 cylinder are loose, the engine is at No. 6 "TDC-Compression." Rotate the engine one full revolution to No. 1 "TDC-Compression."



*Flywheel Turning Tool and Timing Pin*

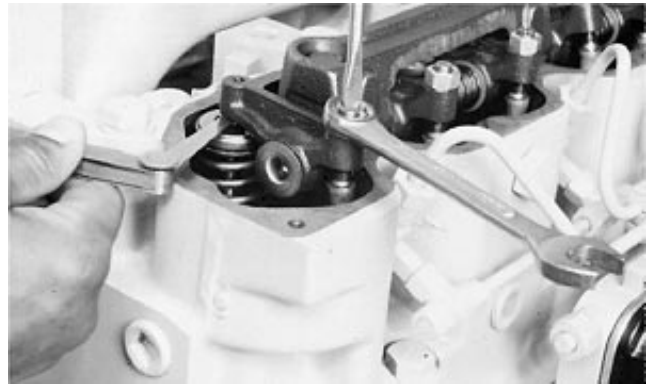
**A—Flywheel Turning Tool  
B—Timing Pin**

RG7013 -UN-26NOV97

4. With engine lock-pinned at "TDC" of No. 1 piston's compression stroke, check and adjust (as needed) valve clearance on Nos. 1, 3 and 5 exhaust valves and Nos. 1, 2 and 4 intake valves.

—Specification

Intake Valve Clearance Checking (Rocker Arm-To-Valve Tip With Engine Cold)—Clearance.....	0.41-0.51 mm (0.016-0.020 in.)
Exhaust Valve Clearance Checking (Rocker Arm-To-Valve Tip With Engine Cold)— Clearance .....	0.66-0.76 mm (0.026-0.030 in.)



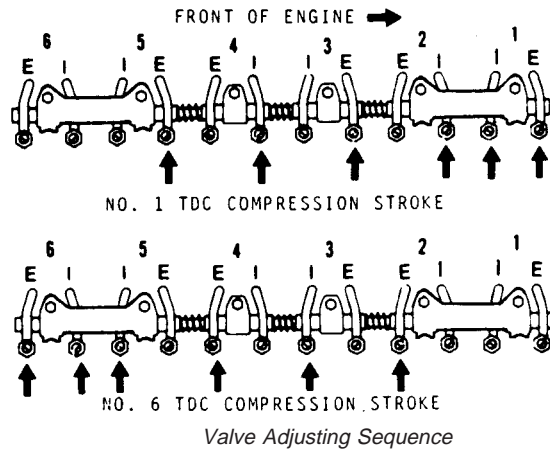
Adjust Engine Valve Clearance (If Needed)

5. Rotate flywheel 360° until No. 6 piston is at "TDC" of its compression stroke. Rocker arms for No. 6 piston should be loose.

6. Check valve clearance to the same specifications on Nos. 2, 4 and 6 exhaust and Nos. 3, 5 and 6 intake valves.

**NOTE:** Adjust valve clearance in the same sequence used for checking clearance.

7. If valve clearance needs to be adjusted, loosen the lock nut on rocker arm adjusting screw. Turn adjusting screw until feeler gauge slips with a slight drag. Hold the adjusting screw from turning with screwdriver and tighten lock nut to specifications.



—Specification

Valve Adjusting Screw Lock Nut—Torque Value.....	27 N•m (20 lb-ft)
---	----------------------

Recheck clearance again after tightening lock nut and compare to the following specifications. Readjust clearance as necessary.

Continued on next page

RG, RG34710, 4085 -19-01JAN96-2/3

—Specification

Intake Valve Clearance	
Adjustment (Rocker	
Arm-To-Valve Tip With Engine	
Cold)—Clearance .....	0.46 mm
	(0.018 in.)
Exhaust Valve Clearance	
Adjustment (Rocker	
Arm-To-Valve Tip With Engine	
Cold)—Clearance .....	0.71 mm
	(0.028 in.)

8. Install rocker arm cover and tighten cap screws to specifications.

—Specification

Rocker Arm Cover-To-Cylinder	
Head Cap Screws Torque—Value .....	8 N•m (6 lb-ft) (72 lb-in.)

RG,RG34710,4085 -19-01JAN96-3/3

CHECK VALVE CLEARANCE—ENGINES  
(200,000— )

Too little valve clearance throws valves out of time. Valves open too early and close too late. This causes the valves to overheat due to hot combustion gases rushing past valves when out of time. Overheating lengthens valve stems which prevents proper seating of valves. The valves seat so briefly or poorly that normal heat transfer into the cooling system does not have time to take place, causing burned valves and low power.

Too much valve clearance causes a lag in valve timing, causing engine valve train imbalance. The fuel-air mixture enters the cylinders late during intake stroke. The exhaust valve closes early and prevents waste gases from being completely removed from cylinders. Also, the valves close with a great deal of impact, which may crack or break the valves and scuff the camshaft and followers.

Continued on next page RG41165,0000032 -19-12DEC00-1/4



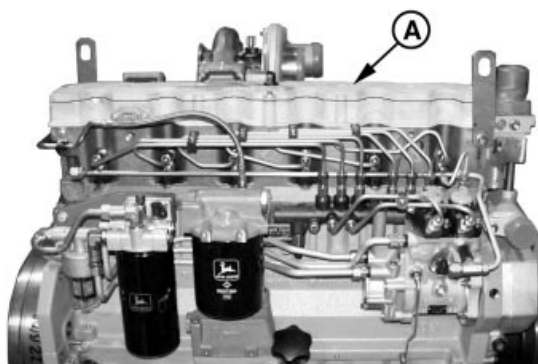
**CAUTION:** To prevent accidental starting of engine while performing valve adjustments, always disconnect **NEGATIVE (—)** battery terminal.

**IMPORTANT:** Valve clearance **MUST BE** checked and adjusted with engine **COLD**.

1. Disconnect carrier wiring harness (shown removed).
2. Remove rocker arm cover (A) with vent tube.

**IMPORTANT:** Visually inspect contact surfaces of valve tips and rocker arm wear pads. Check all parts for excessive wear, breakage, or cracks. Replace parts that show visible damage.

Rocker arms that exhibit excessive valve clearance should be inspected more thoroughly to identify damaged parts.



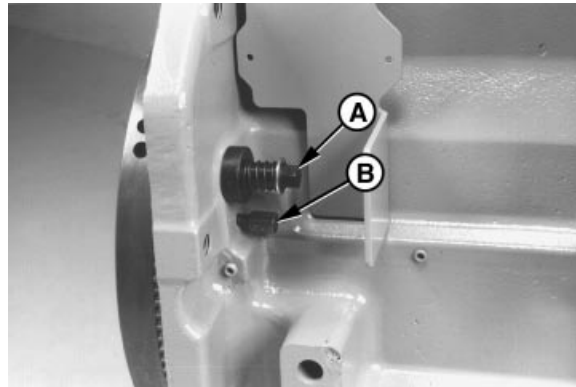
Remove Rocker Arm Cover

A—Rocker Arm Cover

RG11562B -UN-17NOV00

RG41165,0000032 -19-12DEC00-2/4

3. Remove plastic plug from cylinder block bores and install JDE81-1 or JDG820 Flywheel Turning Tool (A) and JDE81-4 Timing Pin (B).
4. Rotate engine with the flywheel turning tool until timing pin engages timing hole in flywheel.
5. If the rocker arms for No. 1 (front) cylinder are loose, the engine is at No. 1 "TDC-Compression."
6. If the rocker arms for No. 6 (rear) cylinder are loose, the engine is at No. 6 "TDC-Compression." Rotate the engine one full revolution (360°) to No. 1 "TDC-Compression."



Flywheel Turning Tool and Timing Pin

A—Flywheel Turning Tool  
B—Timing Pin

RG7013 -UN-26NOV97

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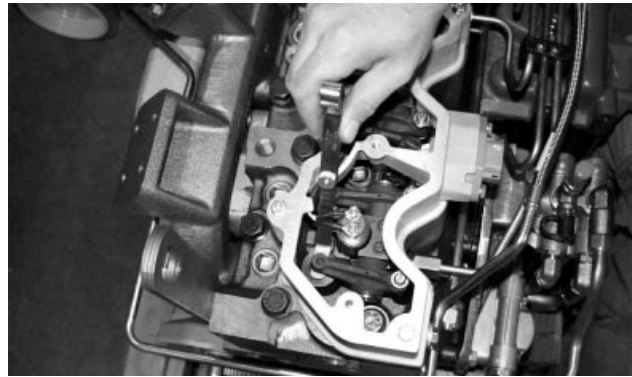
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7. With engine lock-pinned at "TDC" of No. 1 piston's compression stroke, use a bent feeler gauge to check valve clearance on Nos. 1, 3, and 5 exhaust valves and Nos. 1, 2, and 4 intake valves.

#### Specification

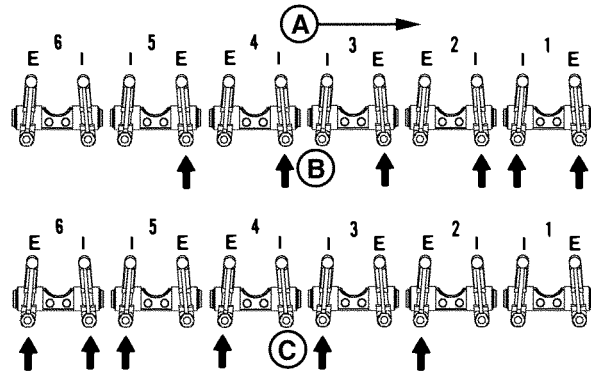
Intake Valve Clearance Checking (Rocker Arm-to-Valve Tip With Engine Cold)—Clearance.....	0.30—0.41 mm (0.012—0.016 in.)
Exhaust Valve Clearance Checking (Rocker Arm-to-Valve Tip With Engine Cold)—Clearance .....	0.51—0.61 mm (0.020—0.024 in.)



Checking Valve Clearance Using Bent Feeler Gauge

RG11559 -UN-07NOV00

8. Rotate flywheel 360° until No. 6 piston is at "TDC" of its compression stroke. Rocker arms for No. 6 piston should be loose.
9. Check valve clearance to the same specifications on Nos. 2, 4, and 6 exhaust and Nos. 3, 5, and 6 intake valves.
10. If valve clearance needs to be adjusted, see ADJUSTING VALVE CLEARANCE (SERIAL NUMBERS 200,000- ), later in this section.
11. Install rocker arm cover with vent tube and tighten cap screws to specifications in order shown.



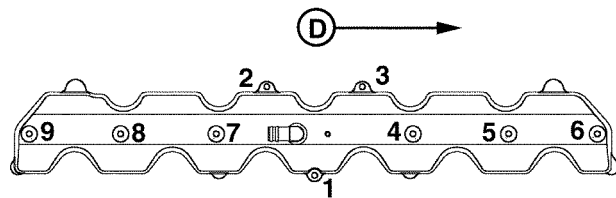
Valve Checking Sequence

RG11569 -UN-14NOV00

#### Specification

Rocker Arm Cover-to-Carrier Cap Screws—Torque.....	8 N•m (5.9 lb-ft)
--	-------------------

- A—Front of Engine
- B—No. 1 Cylinder "TDC"
- C—No. 6 Cylinder "TDC"
- D—Front of Engine



Order to Tighten Rocker Arm Cover Cap Screws

RG11620 -UN-11DEC00

## **ADJUST VALVE CLEARANCE—ENGINES (200,000— )**

Too little valve clearance throws valves out of time. Valves open too early and close too late. This causes the valves to overheat due to hot combustion gases rushing past valves when out of time. Overheating lengthens valve stems which prevents proper seating of valves. The valves seat so briefly or poorly that normal heat transfer into the cooling system does not have time to take place, causing burned valves and low power.

Too much valve clearance causes a lag in valve timing, causing engine valve train imbalance. The fuel-air mixture enters the cylinders late during intake stroke. The exhaust valve closes early and prevents waste gases from being completely removed from cylinders. Also, the valves close with a great deal of impact, which may crack or break the valves and scuff the camshaft and followers.

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RG41165,0000031 -19-12DEC00-1/7

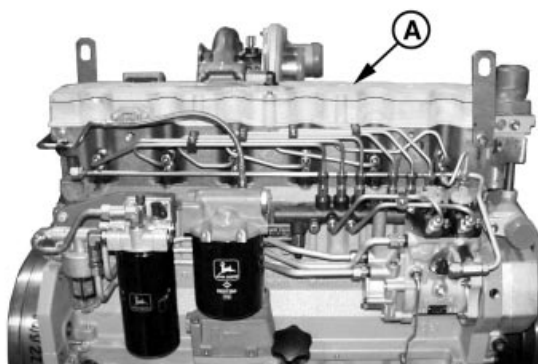
**CAUTION:** To prevent accidental starting of engine while performing valve adjustments, always disconnect **NEGATIVE (—)** battery terminal.

**IMPORTANT:** Valve clearance **MUST BE** checked and adjusted with engine **COLD**.

1. Disconnect carrier wiring harness (shown removed).
2. Remove rocker arm cover (A) with vent tube.
3. Remove wires from electronic injectors.
4. Remove carrier (B).

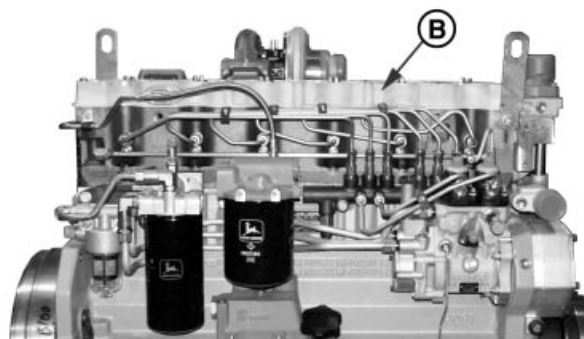
**IMPORTANT:** Visually inspect contact surfaces of valve tips and rocker arm wear pads. Check all parts for excessive wear, breakage, or cracks. Replace parts that show visible damage.

Rocker arms that exhibit excessive valve clearance should be inspected more thoroughly to identify damaged parts.



Remove Rocker Arm Cover

RG11562B -UN-17NOV00



Remove Carrier

RG11574A -UN-20NOV00

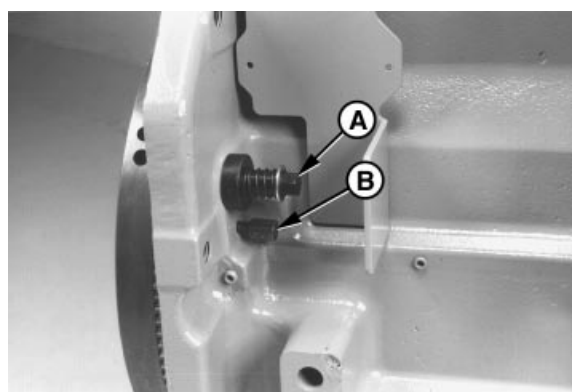
A—Rocker Arm Cover  
B—Carrier

RG41165,0000031 -19-12DEC00-2/7

5. Remove plastic plug from cylinder block bores and install JDE81-1 or JDG820 Flywheel Turning Tool (A) and JDE81-4 Timing Pin (B).
6. Rotate engine with the flywheel turning tool until timing pin engages timing hole in flywheel.

If the rocker arms for No. 1 (front) cylinder are loose, the engine is at No. 1 "TDC-Compression."

If the rocker arms for No. 6 (rear) cylinder are loose, the engine is at No. 6 "TDC-Compression." Rotate the engine one full revolution (360°) to No. 1 "TDC-Compression."



Flywheel Turning Tool and Timing Pin

A—Flywheel Turning Tool  
B—Timing Pin

RG7013 -UN-26NOV97

Continued on next page

RG41165,0000031 -19-12DEC00-3/7

7. With engine lock-pinned at "TDC" of No. 1 piston's compression stroke, adjust valve clearance on Nos. 1, 3, and 5 exhaust valves and Nos. 1, 2, and 4 intake valves to specifications. Loosen lock nut on rocker arm adjusting screw. Turn adjusting screw until feeler gauge slips with a slight drag. Hold the adjusting screw from turning with screwdriver and tighten lock nut to specifications.

#### Specification

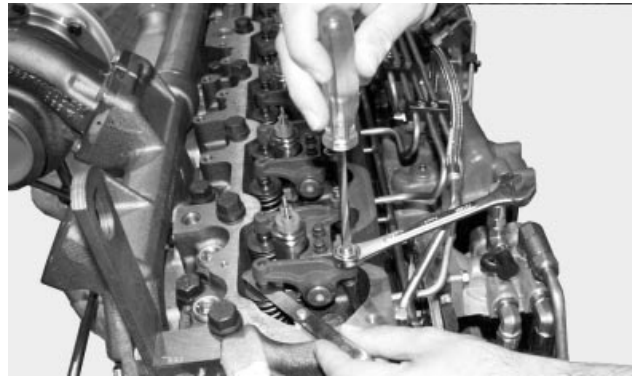
Intake Valve Clearance Adjustment (Rocker Arm-to-Valve Tip With Engine Cold)— Clearance .....	0.36 mm (0.014 in.)
Exhaust Valve Clearance Adjustment (Rocker Arm-to-Valve Tip With Engine Cold)— Clearance .....	0.56 mm (0.022 in.)
Valve Adjusting Screw Lock Nut—Torque .....	27 N•m (20 lb-ft)

Recheck clearance again after tightening lock nut.  
Readjust clearance as necessary.

8. Rotate flywheel 360° until No. 6 piston is at "TDC" of its compression stroke. Rocker arms for No. 6 piston should be loose.

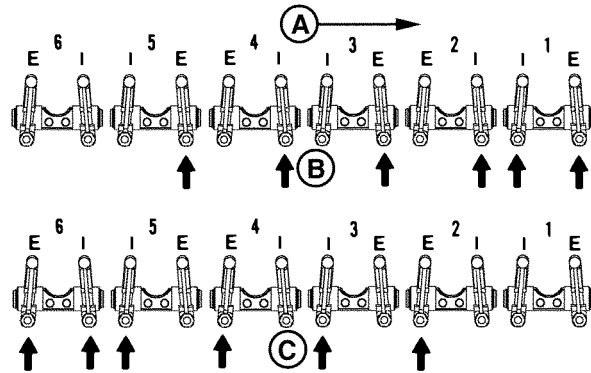
9. Adjust valve clearance to the same specifications on Nos. 2, 4, and 6 exhaust and Nos. 3, 5, and 6 intake valves.

Recheck clearance again after tightening lock nut.  
Readjust clearance as necessary.



RG11560 -JUN-08NOV00

Adjusting Valve Clearance



RG11569 -JUN-14NOV00

Valve Adjusting Sequence

A—Front of Engine  
B—No. 1 Cylinder "TDC"  
C—No. 6 Cylinder "TDC"

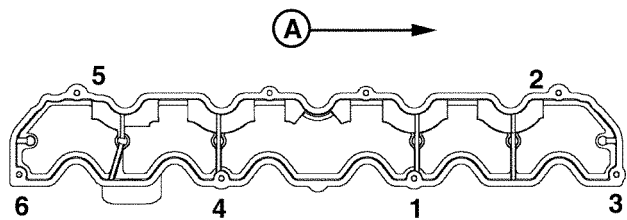
RG41165,0000031 -19-12DEC00-4/7

10. Install carrier. Tighten cap screws in order shown to specifications.

#### Specification

Carrier-to-Cylinder Head Cap Screws—Torque .....	8 N•m (5.9 lb-ft)
---	-------------------

A—Front of Engine



RG11621 -JUN-11DEC00

Order to Tighten Carrier Cap Screws

Continued on next page

RG41165,0000031 -19-12DEC00-5/7

11. Install injector wiring leads on injector studs.

**IMPORTANT: DO NOT use red or blue LOCTITE® on injector studs. Bonding strength is too high for small studs, making future removal impossible without twisting off stud.**

12. Apply LOCTITE® 222 (TY24311) to injector studs.

13. Install solenoid wire retaining nuts to injector studs and tighten to specifications.

**Specification**

Solenoid Wire Retaining Nuts—

Torque ..... 1.75 N•m (1.29 lb-ft)



Install Solenoid Wire Retaining Nuts to Injector Studs

RG11570 -UN-14NOV00

LOCTITE is a trademark of Loctite Corp.

RG41165,0000031 -19-12DEC00-6/7

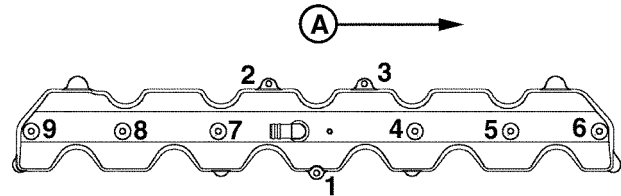
14. Install rocker arm cover with vent tube. Tighten capscrews in order shown to specifications.

**Specification**

Rocker Arm Cover Capscrews—

Torque ..... 8 N•m (5.9 lb-ft)

A—Front of Engine



Order to Tighten Rocker Arm Cover Cap Screws

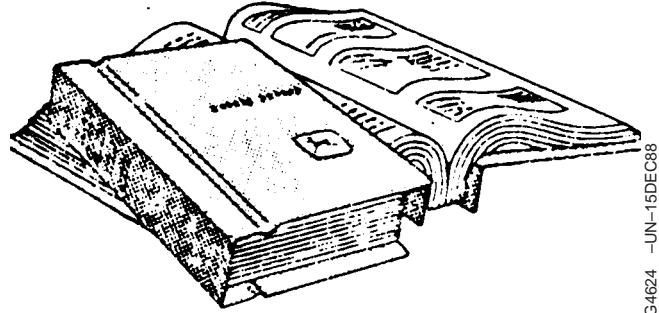
RG11620A -UN-11DEC00

RG41165,0000031 -19-12DEC00-7/7

# Service As Required

## ADDITIONAL SERVICE INFORMATION

This is not a detailed service manual. If you want more detailed service information, See Publications For This Engine in the back of this manual to order the Component Technical Manuals for "Base Engine", "Mechanical Fuel System", or "Electronic Fuel System".



RG4624 -UN-15DEC88

*Additional Service Information*

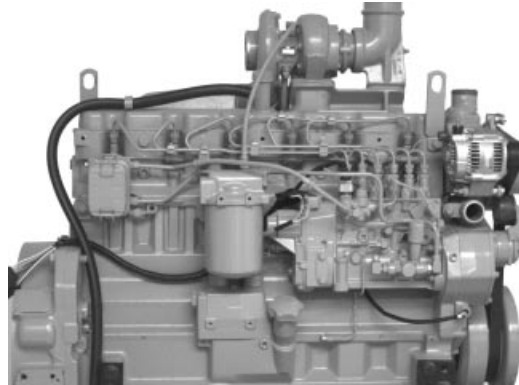
RG, RG34710, 3591 -19-30AUG96-1/1

## DO NOT MODIFY FUEL SYSTEM

**IMPORTANT:** Modification or alteration of the injection pump, the injection pump timing, or the fuel injectors in ways not recommended by the manufacturer will terminate the warranty obligation to the purchaser.

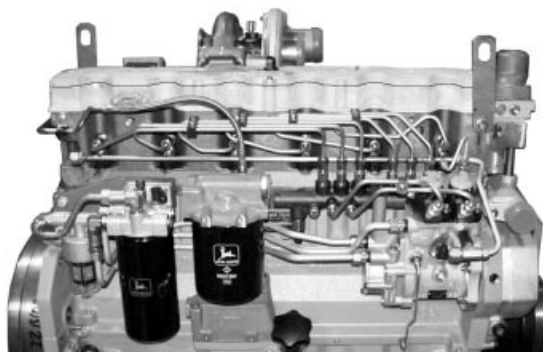
In addition, tampering with fuel system which alters emission-related equipment on engines may result in fines or other penalties, per EPA regulations or other local emission laws.

Do not attempt to service injection pump or fuel injectors yourself. Special training and special tools are required. (See your authorized servicing dealer or engine distributor.)



RG7374 -UN-20JUN00

*Fuel System—Engines ( —199,999)*



RG11602 -UN-11DEC00

*Fuel System—Engines (200,000— )*

RG, RG34710, 3592 -19-30AUG96-1/1



## DRAIN FUEL/WATER SEPARATOR BOWL

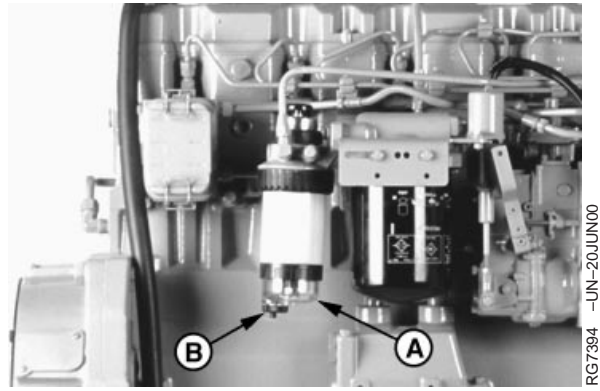
On engines ( —199,999), check the separator bowl (A) of the primary fuel/water separator for water or debris.

On engines ( —199,999), loosen thumb screw (B) and drain water and debris from bowl as needed.

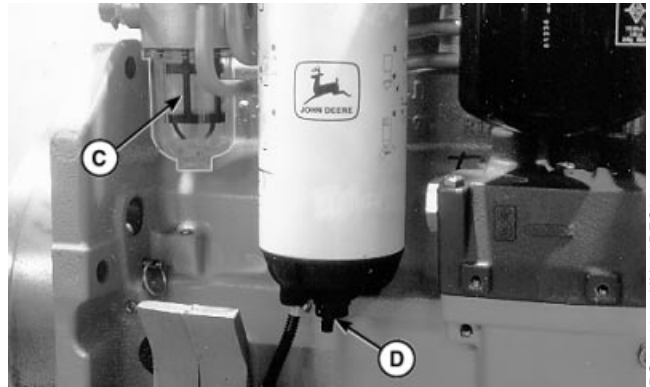
On engines (200,000— ), check filter screen (C) for debris. To service, see **CLEANING FUEL STRAINER—ENGINES (200,000—)** in Lubrication and Maintenance 600 Hour/12Month.

On engines (200,000— ) with electronic instrument panel, any water in fuel is drained into the separator bowl. The operator is signaled by an amber indicator on the instrument panel. Loosen thumb screw (D) and drain water and debris as needed.

**NOTE:** On engines (200,000—) with electronic instrument panel, also replace fuel filter element (above separator bowl) when amber indicator on instrument panel lights up AND Diagnostic Trouble Code (DTC) in diagnostic gauge window indicates a plugged fuel filter ("low fuel pressure"). To replace fuel filter element, see **REPLACING FUEL FILTER—ENGINES (200,000— )** in Lubrication and Maintenance, 600 Hour/12 Month.



Drain Separator Bowl—Engines ( —199,999)



Drain Separator Bowl—Engines (200,000— )

- A—Separator Bowl
- B—Thumb Screw
- C—Filter Screen
- D—Thumb Screw

DPSG,OUOD002,1579 -19-21JUN00-1/1

## ADDING COOLANT



**CAUTION:** Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

**IMPORTANT:** Never pour cold liquid into a hot engine, as it may crack cylinder head or block. **DO NOT** operate engine without coolant for even a few minutes.

John Deere TY15161 Cooling System Sealer may be added to the radiator to stop leaks on a temporary or emergency basis only. **DO NOT** use any other stop-leak additives in the cooling system. Leaks should be permanently repaired as quickly as possible.

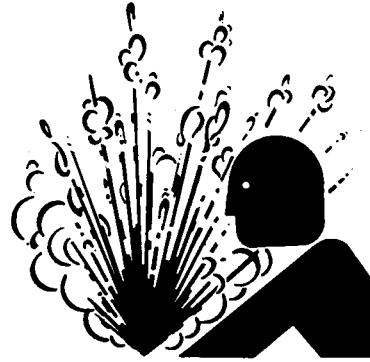
Air must be expelled from cooling system when coolant is added.

1. Loosen temperature sending unit fitting at rear of cylinder head to allow air to escape when filling system.

**IMPORTANT:** When adding coolant to the system, use the appropriate coolant solution. (See **DIESEL ENGINE COOLANTS AND SUPPLEMENTAL ADDITIVE INFORMATION** in Fuels, Lubricants, and Coolant Section for mixing of coolant ingredients before adding to cooling system.)

Do not overfill cooling system. A pressurized system needs space for heat expansion without overflowing at top of radiator.

2. Fill until coolant level touches bottom of radiator filler neck.



High Pressure Fluids

TS281 -JUN-23AUG88



3. Tighten fitting when air has been expelled from system.

RG, RG34710, 3593 -19-30AUG96-2/2

## REPLACING AIR CLEANER FILTER ELEMENTS

**IMPORTANT:** ALWAYS REPLACE primary air cleaner element when air restriction indicator shows a vacuum of 625 mm (25 in.) H<sub>2</sub>O, is torn, or visibly dirty.

*NOTE: This procedure applies to John Deere air cleaner kits. Refer to manufacturers' instructions for servicing air cleaners not supplied by John Deere.*

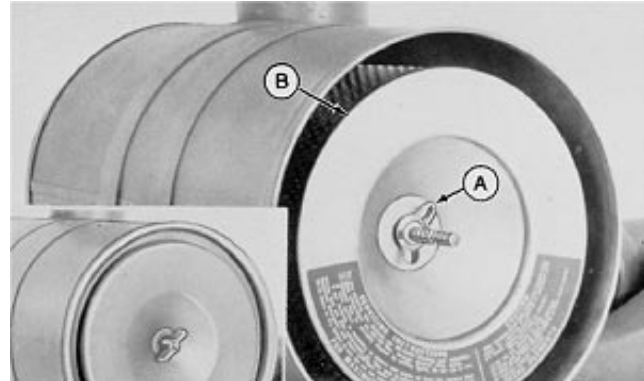
1. Remove wing nut and remove canister cover shown in small illustration inset.
2. Remove wing nut (A) and remove primary element (B) from canister.
3. Thoroughly clean all dirt from inside canister.

*NOTE: Some engines may have a dust unloader valve (C) on the air cleaner. If equipped, squeeze valve tip to release any trapped dirt particles.*

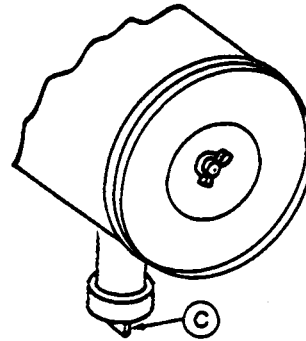
**IMPORTANT:** Remove secondary (safety) element (E) **ONLY** for replacement. **DO NOT** attempt to clean, wash, or reuse secondary element. Replacement of secondary element is usually necessary **ONLY** when primary element has a hole in it.

4. To replace secondary element, remove retaining nut (D) and secondary element (E). Immediately replace secondary element with new element to prevent dust from entering air intake system.

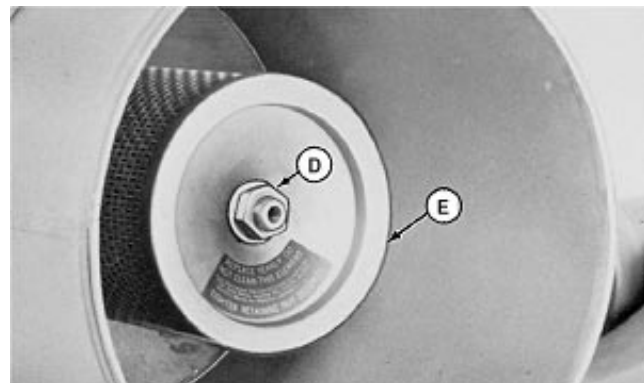
5. Install new primary element and tighten wing nut securely. Install cover assembly and tighten retaining wing nut securely.



Air Cleaner Primary Element



Dust Unloader Valve



Air Cleaner Secondary Element

- A—Wing Nut
- B—Primary Element
- C—Unloader Valve
- D—Retaining Nut
- E—Secondary Element

Continued on next page

DPSG, OUOD002, 1580 -19-21JUN00-1/2

**IMPORTANT:** Whenever the air cleaner has been serviced or had cover removed, **ALWAYS** fully depress the air restriction indicator reset button (if equipped) to assure accurate readings.

6. If equipped, fully depress air restriction indicator reset button and release to reset indicator.

DPSG,OUOD002,1580 -19-21JUN00-2/2

## INSPECTING PRIMARY FILTER ELEMENT

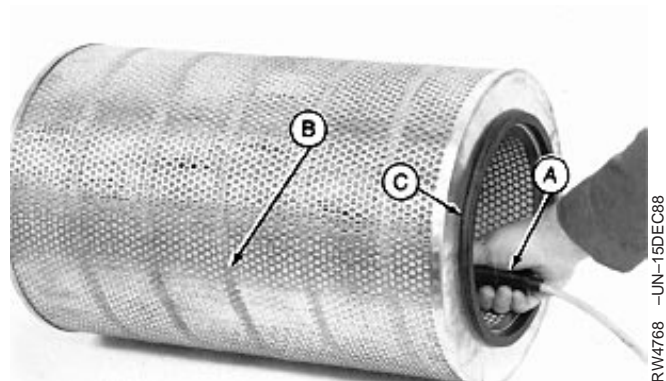
**IMPORTANT:** Do not wash primary filter element. Clean with dry air only (see procedure on following pages).

Inspect filter to determine if it is practical to clean or for damage after cleaning filter.

1. Hold a bright light (A) inside element and check carefully for holes. Discard any element which shows the smallest hole or rupture.
2. Be sure outer screen (B) is not dented. Vibration would quickly wear a hole in filter.
3. Be sure filter gasket (C) is in good condition. If gasket is damaged or missing, replace element.

**IMPORTANT:** Air cleaner **MUST BE DRY** before storing in plastic bag.

If the filter is to be stored for later use, place it in a plastic bag to protect it from dust and damage.



*Inspecting Primary Air Filter Element*

A—Light  
B—Outer Screen  
C—Gasket

RG,RG34710,3598 -19-30AUG96-1/1

## CLEANING PRIMARY FILTER ELEMENT

**IMPORTANT:** Always replace secondary (safety) filter elements. DO NOT attempt to clean them.

**Do not blow air from outside portion of filter with air nozzle. Wear safety glasses and remove bystanders.**

1. Gently pat sides of element with palm of hand to loosen dirt. DO NOT tap element against a hard surface.

RG, RG34710, 3599 -19-30AUG96-1/2

**CAUTION:** Only a special air cleaning gun (A) should be used. Concentrated air pressure from an ordinary air nozzle may severely damage filter element. Do not exceed 210 kPa (2.1 bar) (30 psi) when cleaning filter element.

2. Insert the cleaning gun into element, hold air nozzle about 25.4 mm (1.0 in.) from perforated metal retainer. Force air through filter from inside to outside and move air gun up and down pleats to remove as much dirt as possible.
3. Repeat steps 1 and 2 to remove additional dirt.
4. Inspect element for damage after cleaning (see previous instructions). Replace element if any damage is found.



RG11065 -JUN-26JUN00

*Cleaning Primary Element*

**A—Air Cleaning Gun**

RG, RG34710, 3599 -19-30AUG96-2/2

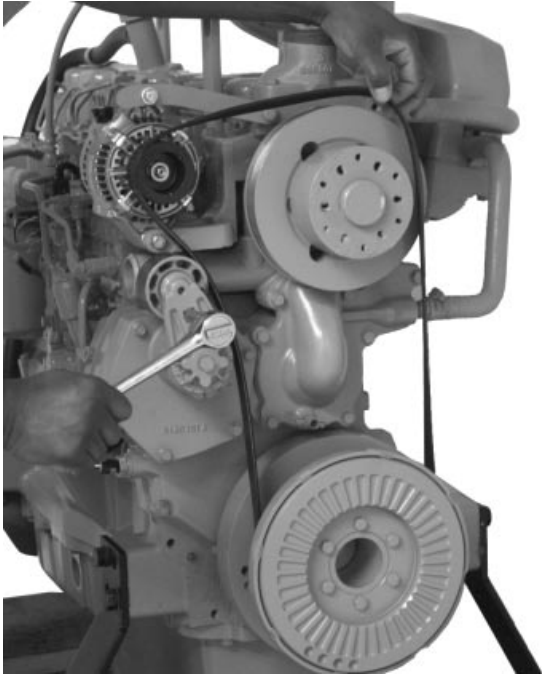
## **ELEMENT STORAGE**

**IMPORTANT: Air cleaner element MUST BE DRY  
before storing in plastic bag.**

Seal element in a plastic bag and store in shipping  
container to protect against dust and damage.

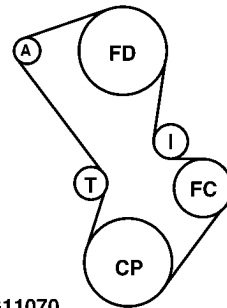
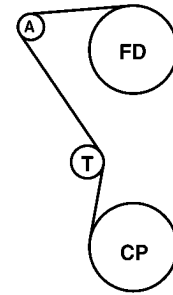
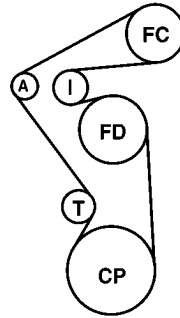
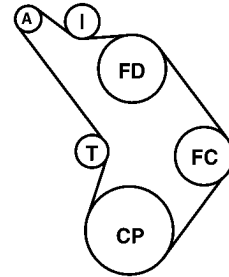
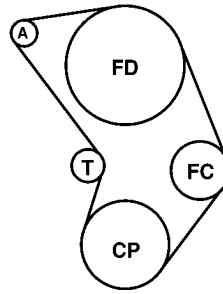
RG, RG34710, 3601 -19-30AUG96-1/1

## REPLACING FAN/ALTERNATOR BELT

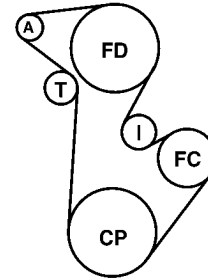


Replacing Belt

RG7392 -UN-26JUN00



RG11070



RG11070 -UN-05JUL00

Belt Routing Options

A—Alternator  
CP—Crankshaft Pulley

FC—Freon (A/C) Compressor  
(Optional)

FD—Fan Drive  
I—Idler

T—Tensioner

Refer to CHECKING BELT TENSIONER SPRING TENSION AND BELT WEAR in Lubrication and Maintenance/600 Hour/12 Month section to determine if belt needs replacing.

1. Release tension on belt using a 1/2 in. drive ratchet as shown in photo.

2. Remove belt from pulleys and discard belt.

3. Install new belt, be sure that belt is correctly seated in all pulley grooves.

4. Apply tension to belt with tensioner. Remove ratchet.

5. Start engine and check belt alignment.

## POWER TAKE-OFF (PTO) CLUTCH



**CAUTION:** Entanglement in rotating driveline can cause serious injury or death. Keep shield on PTO drive shaft (A) between the clutch housing and the engine driven equipment at all times during engine operation. Wear close fitting clothing. Stop the engine and be sure PTO driveline is stopped before making adjustments.

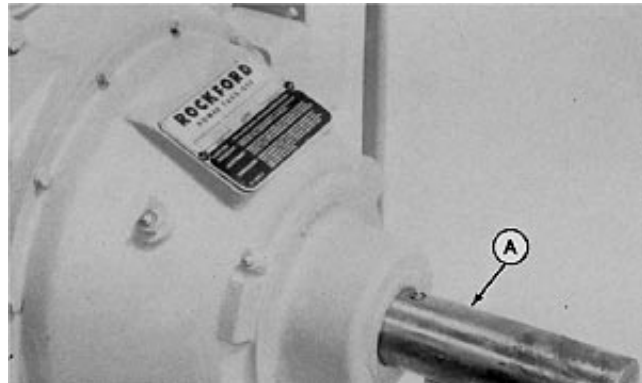
Proper performance of the power take-off unit will be related to the care it is given. Lubricate it periodically and keep the clutch properly adjusted. (See Lubrication and Maintenance/250 Hour/6 Month Section.)

If the power take-off does not work properly after adjustment and lubrication, contact your authorized servicing dealer or engine distributor.

A—PTO Drive Shaft



*Rotating Driveline*



*PTO Clutch Drive Shaft*

RG, RG34710, 3603 -19-30AUG96-1/1

TS198 -UN-23AUG88

RG4693 -UN-14DEC88

## CHECKING FUSES

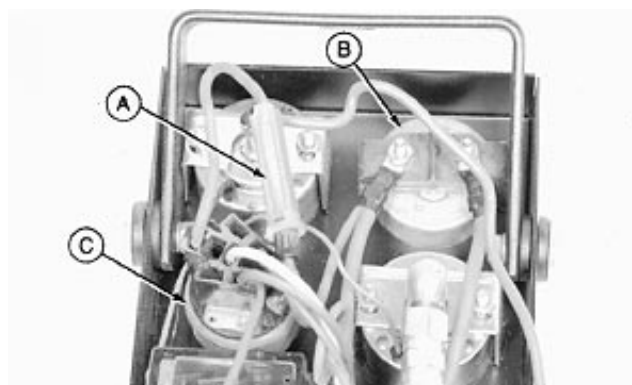
The following instructions apply to engines equipped with a John Deere instrument panel.

1. *Early Engines With Standard Instrument Panel* — Check the fuse (A) between the ammeter (B) and key switch (C) located on back side of instrument panel. If defective, replace with an equivalent 25-amp fuse.
2. *Later Engines With Standard Instrument Panel* — Check the fuse mounted in the fuse holder (D) on the face of the instrument panel. If defective, install an equivalent 14 amp fuse. (Some earlier engines have a separate hourmeter and fuse. See F3 on Engine Wiring Diagram, Later Engines With Standard Instrument Panel).

3. *Engines With Electronic Instrument Panel* — Check the fuse (E) located in the fuse holder on the face of the instrument panel. If defective, replace with a 5-amp fuse.

Also check the main electrical system fuse located in the engine wiring harness (see F1 on ENGINE WIRING DIAGRAM, ENGINES WITH ELECTRONIC INSTRUMENT PANEL in Troubleshooting Section). If defective, replace with a 30-amp fuse on engines ( — 199,999) or a 10 amp fuse on engines (200,000— ).

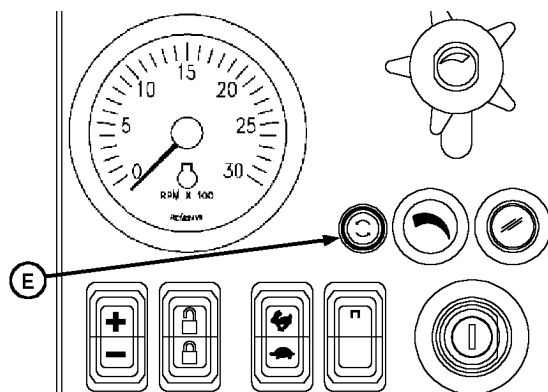
- A—Fuse
- B—Ammeter
- C—Key Switch
- D—Fuse Holder
- E—Fuse



Fuse - Early Engines with Standard Instrument Panel



Fuse - Later Engines with Standard Instrument Panel



Fuse - Engines with Electronic Instrument Panel

RG, RG34710, 3604 -19-30AUG96-1/1

RG4493 -UN-14DEC88

RG11069 -UN-26JUN00

RG11066 -UN-26JUN00

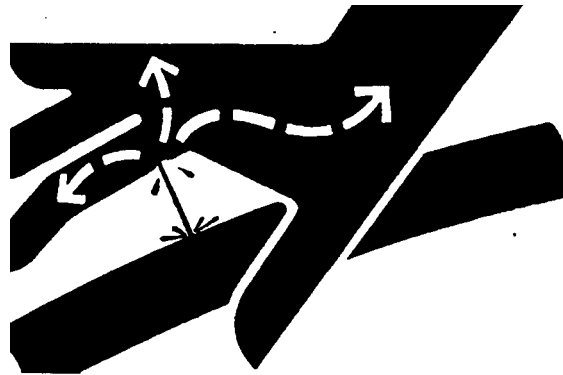


## BLEEDING THE FUEL SYSTEM—ENGINES ( —199,999)



**CAUTION:** Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.



*High Pressure Fluids*

X9811 —UN-23AUG88

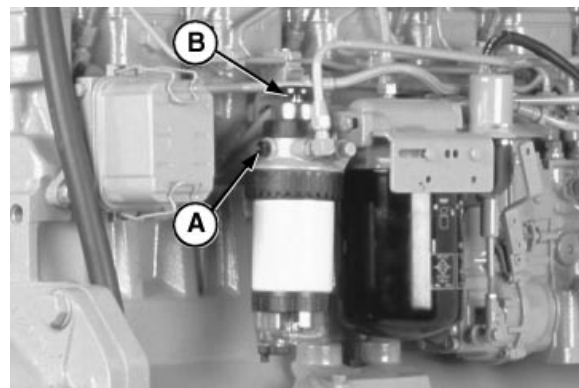
Whenever the fuel system has been opened up for service (lines disconnected or filters removed), it will be necessary to bleed air from the system.

DPSG,OUOD002,1581 —19-21JUN00-1/2

### • At Round Primary Fuel Filter/Water Separator:

1. Drain water and contaminants from clear sediment bowl.
2. Loosen air bleed vent screw (A) on fuel filter base.
3. Operate hand primer (B) until fuel flow is free from air bubbles.
4. Tighten vent screw as hand primer is held in downward pumping position.

A—Vent Screw  
B—Hand Primer



*Bleed Fuel/Water Separator*

RG11071 —UN-06JUL00

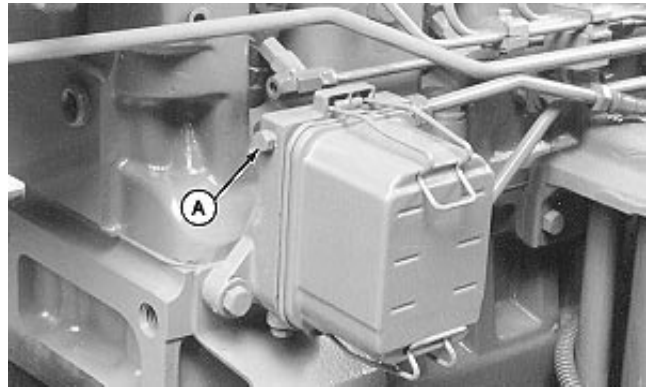
DPSG,OUOD002,1581 —19-21JUN00-2/2



- **At Rectangular Final Fuel Filter:**

1. Turn key switch to "ON" position.
2. Loosen bleed plug (A) on fuel filter base.

**A—Bleed Plug**



*Fuel Filter Bleed Plug*

RG7072 -UN-07SEP94

DPSG,OUOD002,1583 -19-21JUN00-1/1

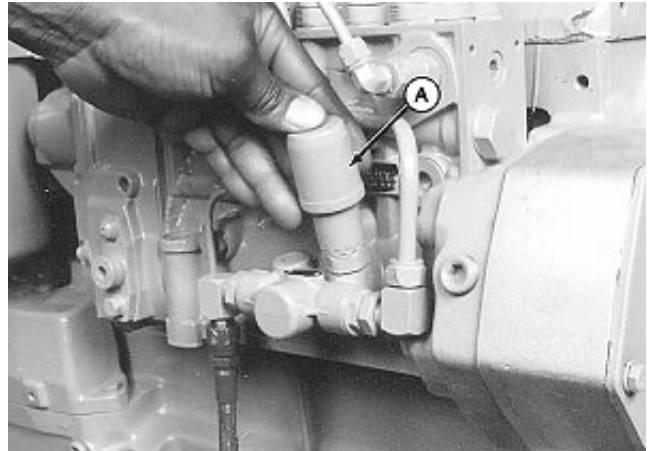
3. Operate hand primer (A) on fuel supply pump until a smooth flow of fuel, free of bubbles, comes out of the filter plug hole.

4. Simultaneously stroke the hand primer down and close the filter port plug. This prevents air from entering the system. Tighten plug securely. DO NOT overtighten.

5. Start engine and check for leaks.

If engine will not start, it may be necessary to bleed air from fuel system at injection nozzles as explained next.

**A—Hand Primer**



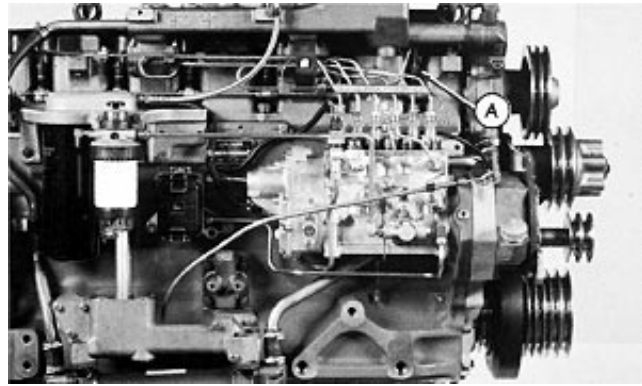
*Hand Primer for Bleeding Fuel System*

RG7071 -UN-07SEP94

DPSG,OUOD002,1584 -19-21JUN00-1/1

• **At Fuel Injection Nozzles:**

1. Place throttle lever in fast speed position, if so equipped.
2. Loosen fuel line connection at No. 1 (front) injection nozzle (A).
3. Crank engine with starting motor (but do not start engine), until fuel free of bubbles flows out of loosened connections. Retighten connection.
4. Start engine and check for leaks.
5. If engine does not start, repeat procedure at remaining injection nozzles (if necessary) until enough air has been removed from fuel system to allow engine to start.



No. 1 (Front) Fuel Injection Nozzle

A—No. 1 Injection Nozzle

RG6727 —UN-14APR93

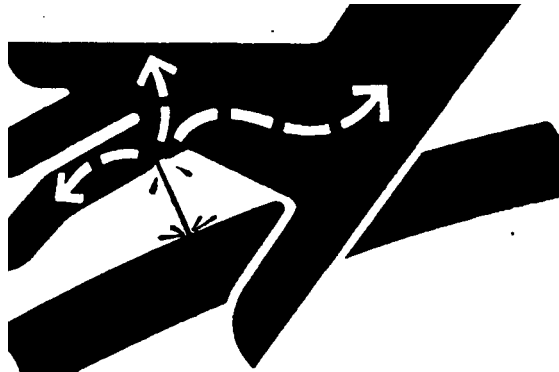
DPSG,OUOD002,1585 —19-21JUN00-1/1

**BLEEDING THE FUEL SYSTEM—ENGINES  
(200,000— )**

**CAUTION:** Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles that eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, a doctor familiar with this type of injury must surgically remove it within a few hours or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.

Whenever the fuel system has been opened up for service (lines disconnected or filters removed), it will be necessary to bleed air from the system.



X9811 —UN-23AUG88

Continued on next page

RG41221,0000031 —19-11OCT00-1/2

1. Drain water and contaminants from water separator bowl by opening the drain valve (D).
2. Connect JT03472 coupler and hose to diagnostic port (A). If JT03472 coupler is not available, loosen the diagnostic port to allow air and fuel to escape. Bleed fuel into suitable container.
3. Unlock and operate hand primer (B) until a steady flow of fuel (without bubbles) flows out of hose (Must pull hand primer all the way up between pumps).

**NOTE:** It can take up to 200 strokes until fuel comes out steadily.

4. Continue to pump hand primer while disconnecting JT03472 coupler from diagnostic port, or while tightening diagnostic port to specification below.

#### Specification

Diagnostic Port—Torque ..... 14 N•m (10 lb-ft)

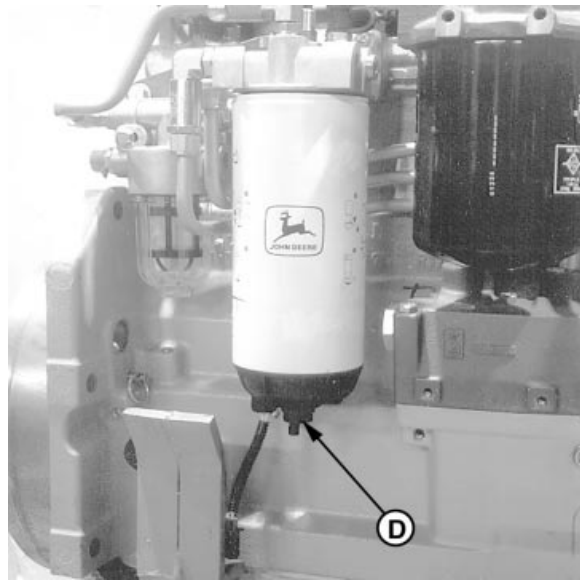
5. Start engine and run at 1200-1500 RPM for 3-5 minutes.
6. If engine fails to start, loosen high pressure fuel lines (C). Pump hand primer (B) until steady flow of fuel escapes the fuel pump. Tighten fuel lines to specification below and lock hand primer (pull up, then push down and lock).

#### Specification

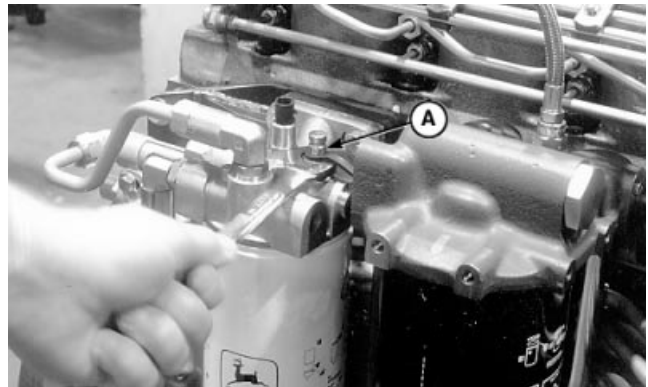
High Pressure Fuel Lines—  
Torque ..... 27 N•m (20 lb-ft)

7. Start engine. If engine fails to start, repeat step 6.

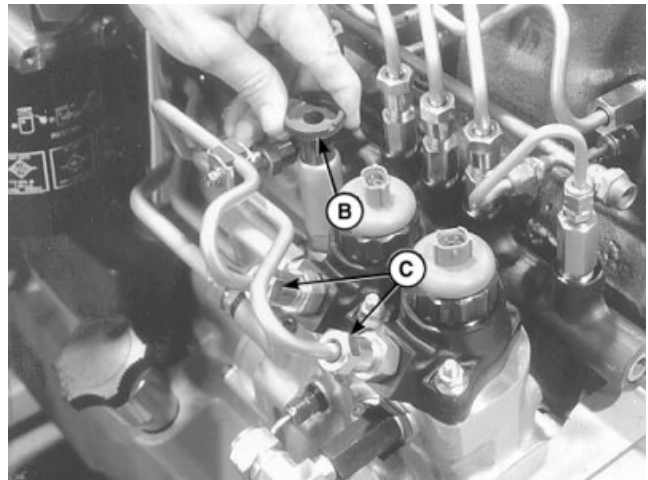
A—Diagnostic Port  
B—Hand Primer  
C—High Pressure Fuel Lines  
D—Drain Valve



RG11519B -UN-14DEC00



RG11081 -UN-10NOV00



RG11518 -UN-11DEC00

# Troubleshooting

## GENERAL TROUBLESHOOTING INFORMATION

Troubleshooting engine problems can be difficult. An engine wiring diagram is provided in this section to help isolate electrical problems on power units using John Deere wiring harness and instrument (gauge) panel.

Later in this section is a list of possible engine problems that may be encountered accompanied by possible causes and corrections. The illustrated diagrams and troubleshooting information are of a general nature; final design of the overall system for your engine application may be different. See your engine distributor or servicing dealer if you are in doubt.

A reliable program for troubleshooting engine problems should include the following basic diagnostic thought process:

- Know the engine and all related systems.
- Study the problem thoroughly.
- Relate the symptoms to your knowledge of engine and systems.
- Diagnose the problem starting with the easiest things first.
- Double-check before beginning the disassembly.
- Determine cause and make a thorough repair.
- After making repairs, operate the engine under normal conditions to verify that the problem and cause was corrected.

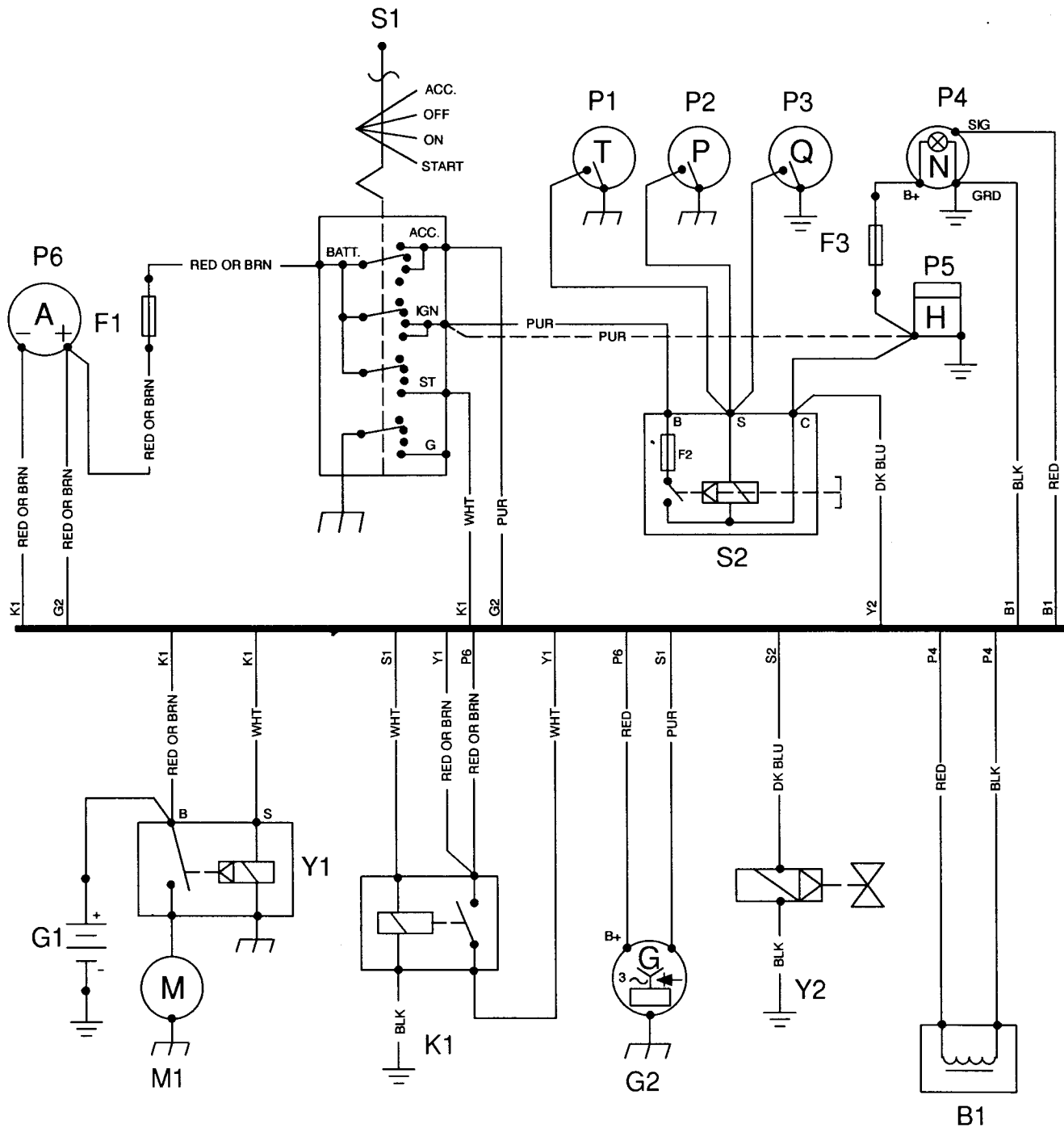
*NOTE: Later engines have electronic control systems which send diagnostic trouble codes to signal problems (see DIAGNOSTIC TROUBLE CODE PROCEDURE, later in this section).*

RG, RG34710, 4086 —19-01JAN96-1/1



# ENGINE WIRING DIAGRAM (ENGINES WITH EARLIER STANDARD INSTRUMENT PANELS—ENGINES ( —199,999)

KEY SWITCH					
	B	G	ACC.	ON	ST.
OFF					
ACC.	•		•		
ON	•		•	•	
START	•	•		•	•



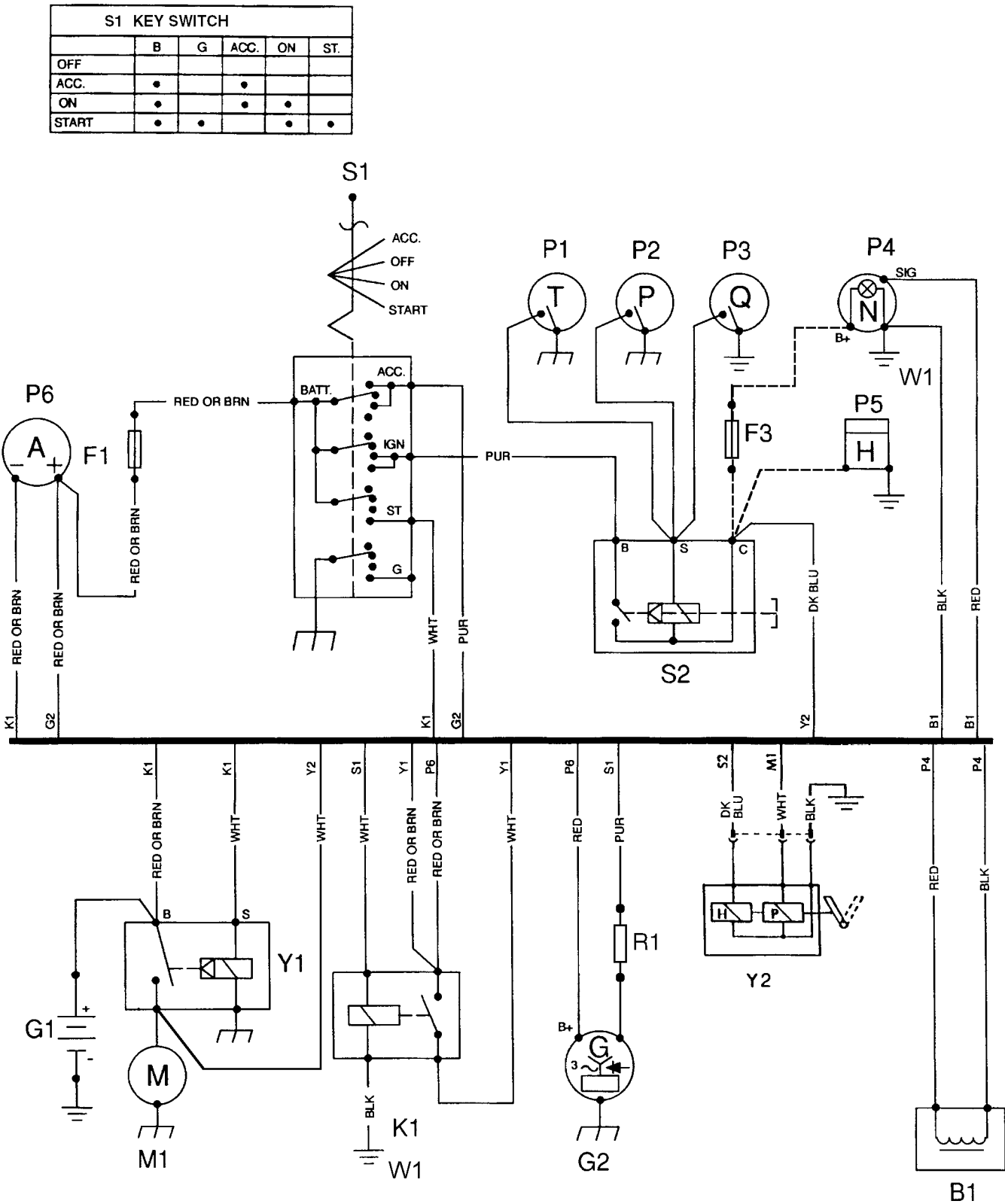
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DPSG,OUOD002,1587 -19-21JUN00-1/2

A1—Speed Control Unit	G1—Battery	P1—Coolant Temperature Gauge	Y3—Electric Fuel Pump
B1—Magnetic Speed Sensor	G2—Alternator	P3—Crankcase Oil Level Switch/Gauge	BLK—Black
B2—Coolant Temperature Sensor	H1—Coolant Temperature Indicator Lamp	P4—Tachometer	BLU—Blue
B3—Oil Pressure Sensor	H2—Oil Pressure Indicator Lamp	P5—Hourmeter	BRN—Brown
F1—Starting Circuit Fuse (25 amp)	H3—Alternator Indicator Lamp	P6—Ammeter	DK BLU—Dark Blue
F2—Safety Switch Fuse (10 amp)	K1—Starter Relay	S1—Key Switch	GRN—Green
F3—Tachometer Fuse (3 amp)	K2—Fuel Shut-Off Relay	S2—Magnetic Safety Switch	ORG—Orange
	M1—Starter Motor	Y2—Fuel Shut-off Solenoid	PUR—Purple
			RED—Red
			YEL—Yellow

DPSG,OUOD002,1587 -19-21JUN00-2/2

ENGINE WIRING DIAGRAM—(ENGINES WITH LATER STANDARD INSTRUMENT PANELS)



RG9537 -UN-08APR89



A1—Speed Control Unit	G2—Alternator	P3—Crankcase Oil Level Switch/Gauge	W1—Ground on K1 Starter Relay Mounting Stud
B1—Magnetic Speed Sensor	H1—Coolant Temperature Indicator Lamp	P4—Tachometer <sup>1</sup>	Y1—Starter Solenoid
B2—Coolant Temperature Sensor	H2—Oil Pressure Indicator Lamp	P5—Hourmeter (Early Models) <sup>2</sup>	Y2—Fuel Shut-Off Solenoid <sup>3</sup>
B3—Oil Pressure Sensor	H3—Alternator Indicator Lamp	P6—Ammeter	BLK—Black
F1—Starting Circuit Fuse (14 amp)	K1—Starter Relay	R1—Resistor (48 ohm)	BLU—Blue
F3—Fuse (Early Models) <sup>1</sup>	K2—Fuel Shut-Off Relay	S1—Key Switch	BRN—Brown
G1—Battery	M1—Starter Motor	S2—Magnetic Safety Switch-North American Auto Override Module-European (Saran)	GRN—Green
	P1—Coolant Temperature Gauge		ORG—Orange
	P2—Oil Pressure Gauge		PUR—Purple
			RED—Red
			YEL—Yellow

<sup>1</sup>P4 tachometer has a built-in hourmeter. On some earlier engines, a separate hourmeter (P5) and fuse (F3) were used.

<sup>2</sup>P4 tachometer has a built-in hourmeter. On some engines, a separate hourmeter (P5) and fuse (F3) are used.

<sup>3</sup>Y2 Fuel Shut-Off Solenoid shown is for 3-wire in-line fuel injection pump. Single connection rotary pumps will have one dark blue wire for power and one black wire for ground.

DPSG,OUOD002,1588 -19-21JUN00-2/2

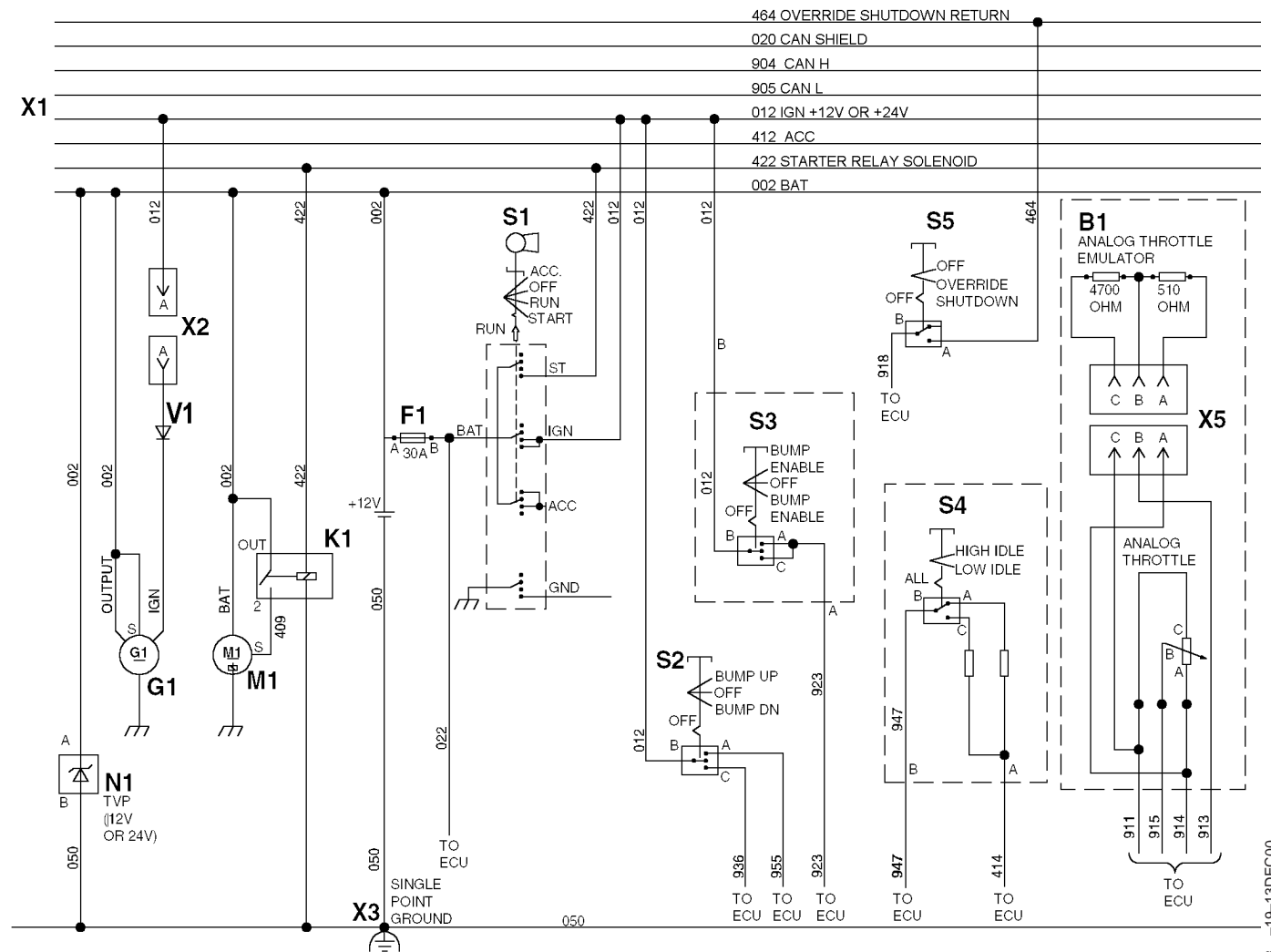
## PRECAUTIONS FOR WELDING ON MACHINES EQUIPPED WITH ELECTRONIC ENGINE CONTROL UNIT (ECU)

**IMPORTANT:** ALWAYS disconnect Electronic Control Unit (ECU) connectors and engine control system-to-machine ground before welding. High currents or electro-static discharge in electronic components from welding may cause permanent damage.

1. Remove the ground connection for the engine control system-to-machine frame.
2. Disconnect the connectors from the ECU.
3. Connect the welder ground close to the welding point and be sure ECU or other electronic components are not in the ground path.

DPSG,OUOD002,1836 -19-15AUG00-1/1

# ENGINE WIRING DIAGRAM (ENGINES WITH ELECTRONIC INSTRUMENT PANEL)— ENGINES ( —199,999)



## SE-1 ENGINE START COMPONENTS

## SE-2 INSTRUMENT PANEL (CONTINUED NEXT PAGE)

B1—Analog Throttle or Emulator

E1—Back Light Regulator (24V) or Plug (12V)

F1—Fuse (30 Amp) (for harness)

F2—Fuse (5 Amp) (for instrument panel)

G1—Alternator

K1—Starter Relay

M1—Starter Motor

N1—Transient Voltage Protector

N2—Voltage Regulator (for 24V Operation)

P1—Optional Gauge

P2—Optional Gauge

P3—Oil Pressure Gauge

P4—Coolant Temperature Gauge

P5—Tachometer Display

P6—Hourmeter/Diagnostic Meter

S1—Ignition Key Switch

S2—Speed Select Switch (Momentary)

S3—Bump Enable Switch (Momentary)

S4—High Low Speed Switch

S5—Override Shutdown Switch (Momentary)

S6—Dimmer Control or Jumper Plug

V1—Diode

X1—Vehicle Harness Connector

X2—Alternator Harness Connector

X3—Single Point Ground

X4—CAN Terminator

X5—Analog Throttle Connector

# ENGINE WIRING DIAGRAM (ENGINES WITH ELECTRONIC INSTRUMENT PANEL)— ENGINES ( —199,999) —CONTINUED

464 OVERRIDE SHUTDOWN RETURN

020 CAN SHIELD

904 CAN H

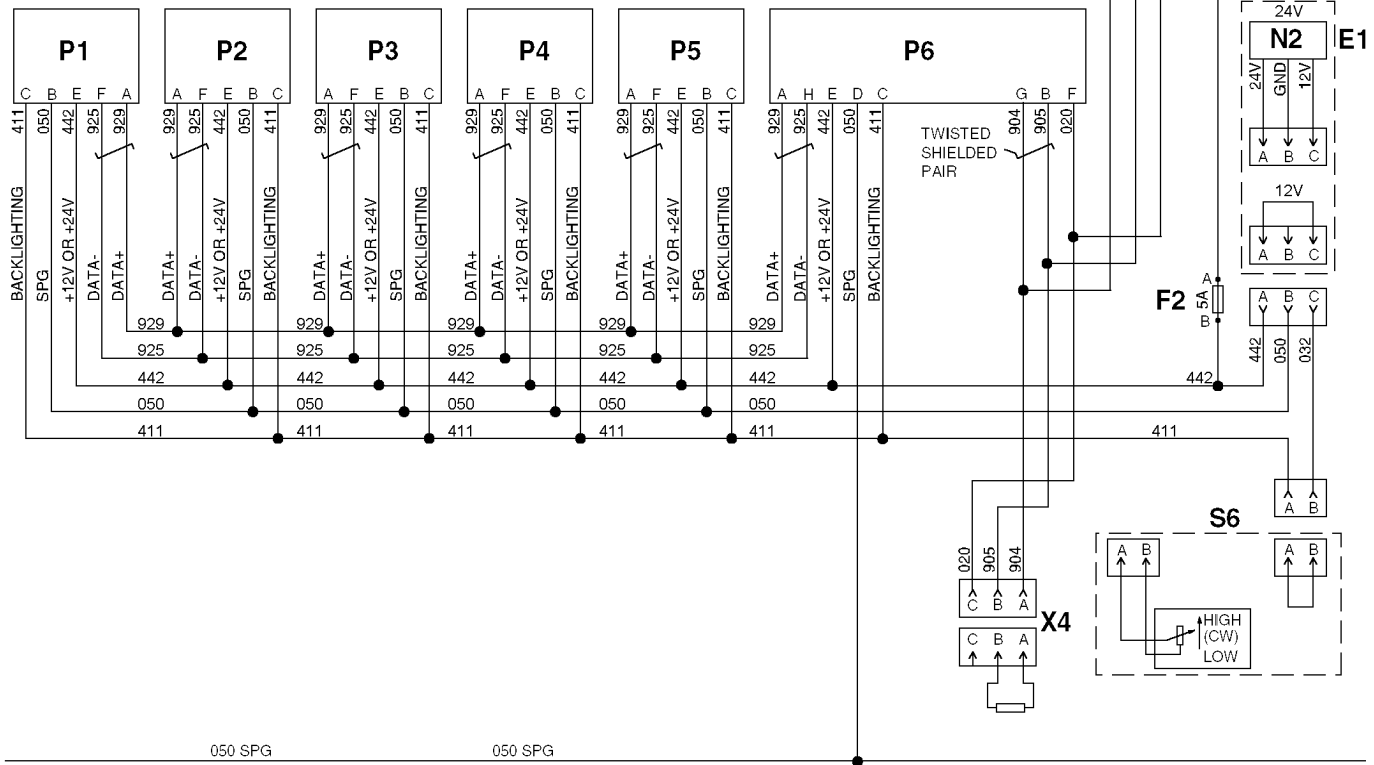
905 CAN L

012 IGN +12V OR +24V

412 ACC

422 STARTER RELAY SOLENOID

002 BAT



## SE-2 INSTRUMENT PANEL (CONTINUED)

B1—Analog Throttle or Emulator

E1—Back Light Regulator (24V) or Plug (12V)

F1—Fuse (30 Amp) (for harness)

F2—Fuse (5 Amp) (for instrument panel)

G1—Alternator

K1—Starter Relay

M1—Starter Motor

N1—Transient Voltage Protector

N2—Voltage Regulator (for 24V Operation)

P1—Optional Gauge

P2—Optional Gauge

P3—Oil Pressure Gauge

P4—Coolant Temperature Gauge

P5—Tachometer Display

P6—Hourmeter/Diagnostic Meter

S1—Ignition Key Switch

S2—Speed Select Switch (Momentary)

S3—Bump Enable Switch (Momentary)

S4—High-Low Speed Switch

S5—Override Shutdown Switch (Momentary)

S6—Dimmer Control or Jumper Plug

V1—Diode

X1—Vehicle Harness Connector

X2—Alternator Harness Connector

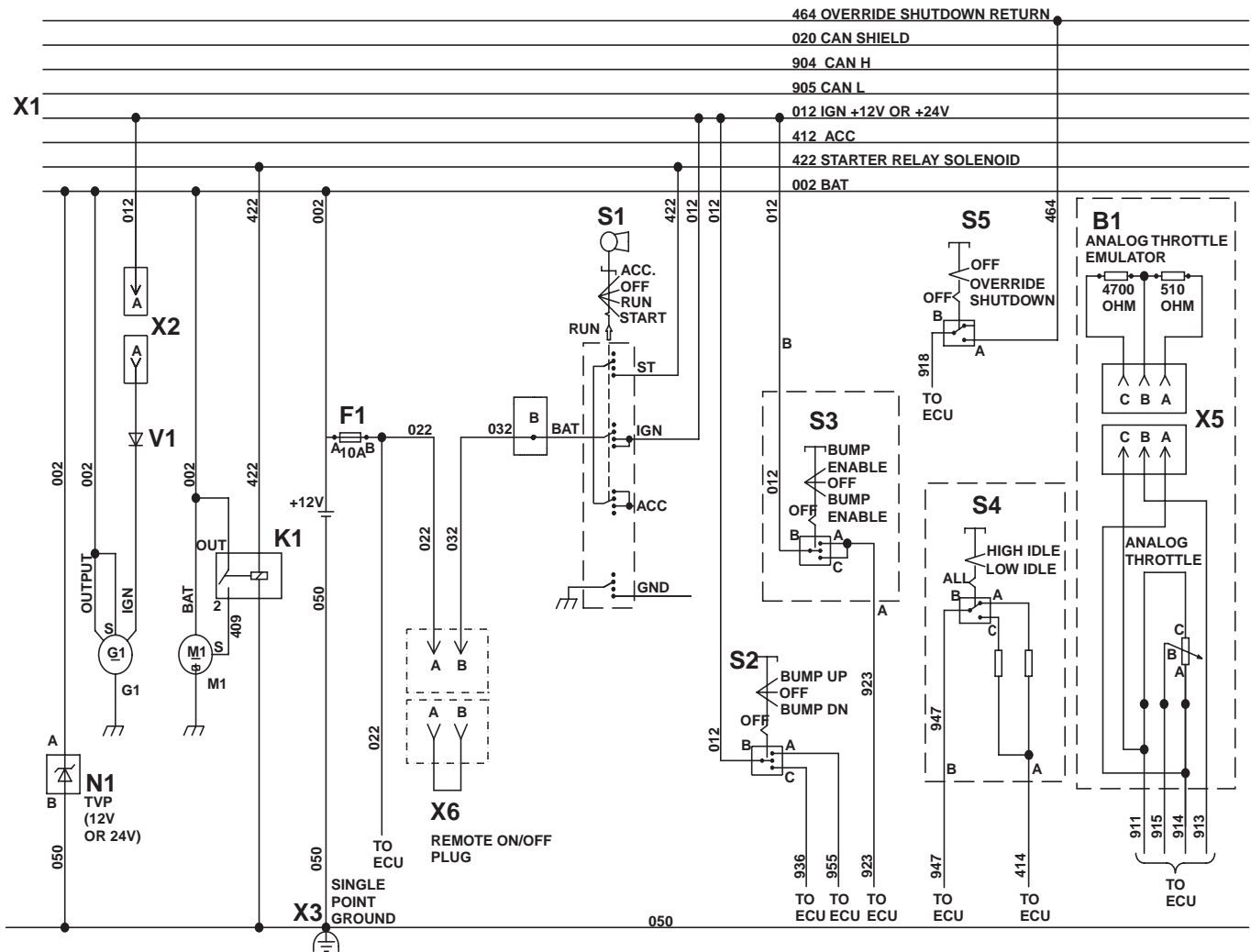
X3—Single Point Ground

X4—CAN Terminator

X5—Analog Throttle Connector

RG10040 —19-18MAY99

# ENGINE WIRING DIAGRAM (ENGINES WITH ELECTRONIC INSTRUMENT PANEL)— ENGINES (200,000—)



SE-1 ENGINE START COMPONENTS

SE-2 INSTRUMENT PANEL (CONTINUED NEXT PAGE)

- |   |  |   |                              |
|---|--|---|------------------------------|
| B1—Analog Throttle or Emulator              | N1—Transient Voltage Protector           | S1—Ignition Key Switch                  | V1—Diode                     |
| E1—Back Light Regulator (24V) or Plug (12V) | N2—Voltage Regulator (for 24V Operation) | S2—Speed Select Switch (Momentary)      | X1—Vehicle Harness Connector |
| F1—Fuse (10 Amp) (for harness)              | P1—Optional Gauge                        | S3—Bump Enable Switch (Momentary)       | X2—Alternator Harness        |
| F2—Fuse (5 Amp) (for instrument panel)      | P2—Optional Gauge                        | S4—High Low Speed Switch (Momentary)    | X3—Single Point Ground       |
| G1—Alternator                               | P3—Oil Pressure Gauge                    | S5—Override Shutdown Switch (Momentary) | X4—CAN Terminator            |
| K1—Starter Relay                            | P4—Coolant Temperature Gauge             | S6—Dimmer Control or Jumper Plug        | X5—Analog Throttle Connector |
| M1—Starter Motor                            | P5—Tachometer Display                    |   | X6—Remote On-Off Plug        |
|   | P6—Hourmeter/Diagnostic Meter            |   |                              |

# ENGINE WIRING DIAGRAM (ENGINES WITH ELECTRONIC INSTRUMENT PANEL)— ENGINES (200,000—) —CONTINUED

464 OVERRIDE SHUTDOWN RETURN

020 CAN SHIELD

904 CAN H

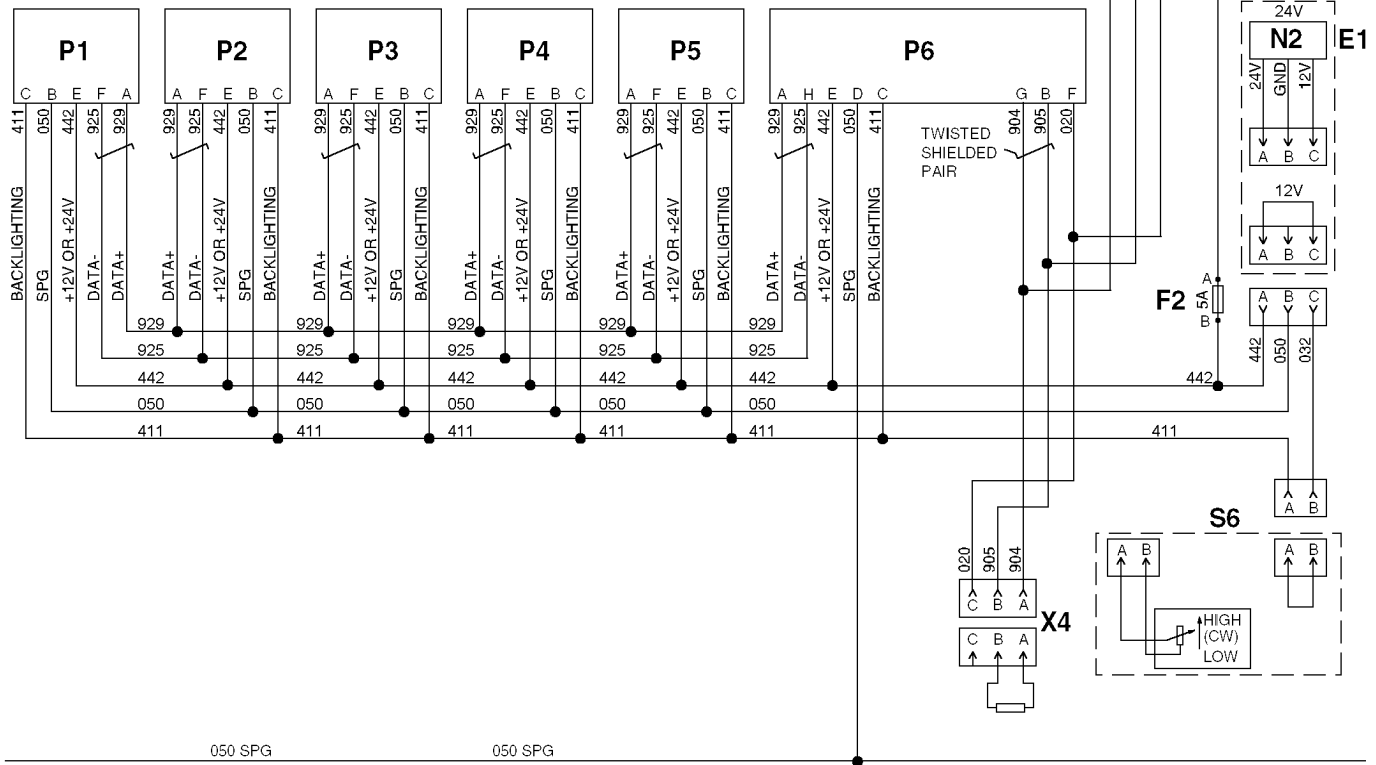
905 CAN L

012 IGN +12V OR +24V

412 ACC

422 STARTER RELAY SOLENOID

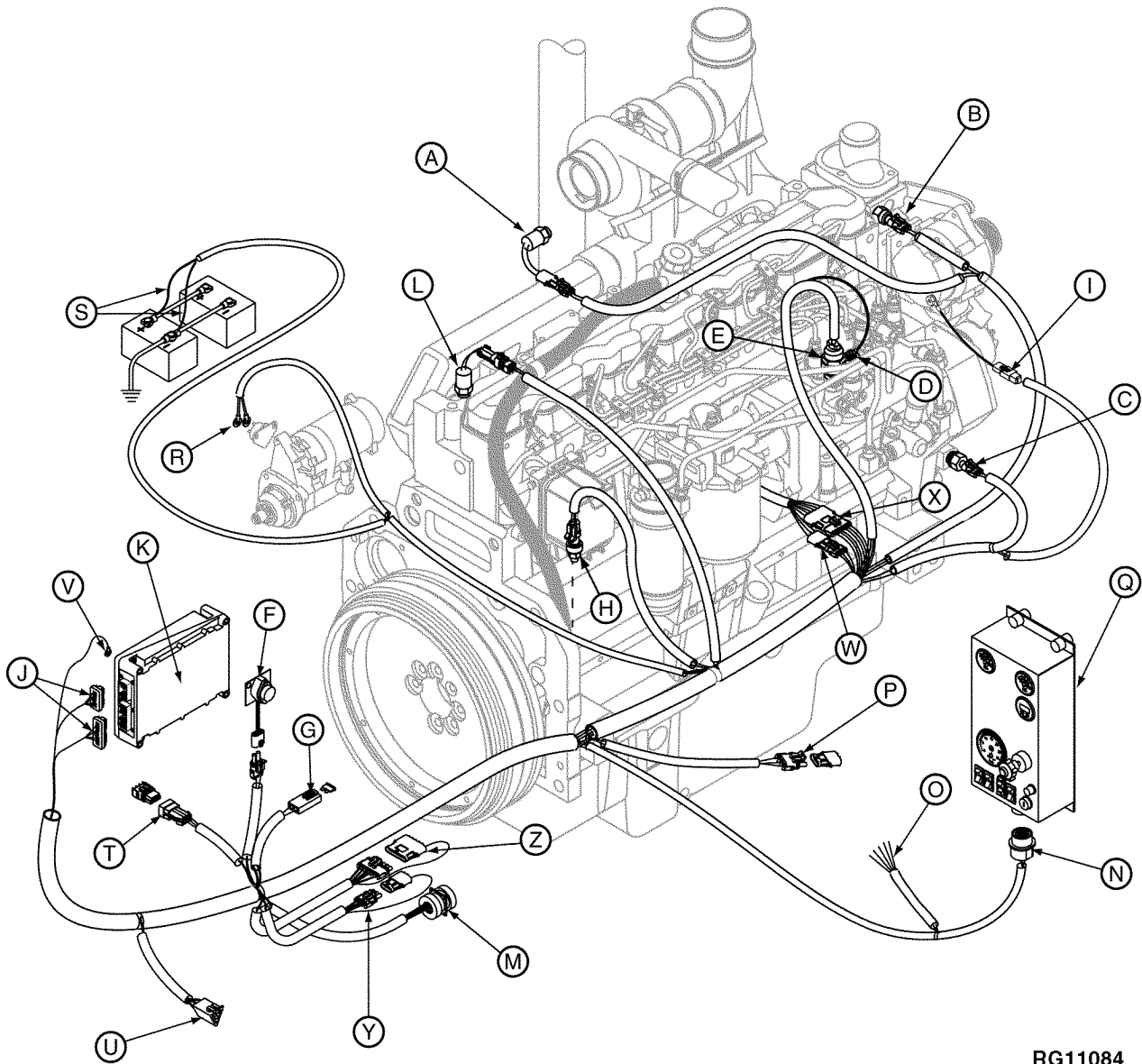
002 BAT



## SE-2 INSTRUMENT PANEL (CONTINUED)

- |   |  |   |                              |
|---|--|---|------------------------------|
| B1—Analog Throttle or Emulator              | N1—Transient Voltage Protector           | S1—Ignition Key Switch                  | V1—Diode                     |
| E1—Back Light Regulator (24V) or Plug (12V) | N2—Voltage Regulator (for 24V Operation) | S2—Speed Select Switch (Momentary)      | X1—Vehicle Harness Connector |
| F1—Fuse (10 Amp) (for harness)              | P1—Optional Gauge                        | S3—Bump Enable Switch (Momentary)       | X2—Alternator Harness        |
| F2—Fuse (5 Amp) (for instrument panel)      | P2—Optional Gauge                        | S4—High Low Speed Switch                | X3—Single Point Ground       |
| G1—Alternator                               | P3—Oil Pressure Gauge                    | S5—Override Shutdown Switch (Momentary) | X4—CAN Terminator            |
| K1—Starter Relay                            | P4—Coolant Temperature Gauge             | S6—Dimmer Control or Jumper Plug        | X5—Analog Throttle Connector |
| M1—Starter Motor                            | P5—Tachometer Display                    |   | X6—Remote On-Off Plug        |
|   | P6—Hourmeter/Diagnostic Meter            |   |                              |

# ENGINE WIRING LAYOUT (ENGINES WITH ELECTRONIC INSTRUMENT PANEL)— ENGINES ( —199,999)



RG11084 -JUN-25OCT00

A—Manifold Air Temperature (Mat) Sensor (Used On “H” engines only)  
B—Coolant Temperature Sensor  
C—Engine Speed Sensor  
D—Fuel Shutoff Solenoid  
E—Fuel Temperature Sensor  
F—Transient Voltage Protection (TVP) Module  
G—Main System Fuse (20 Amp)

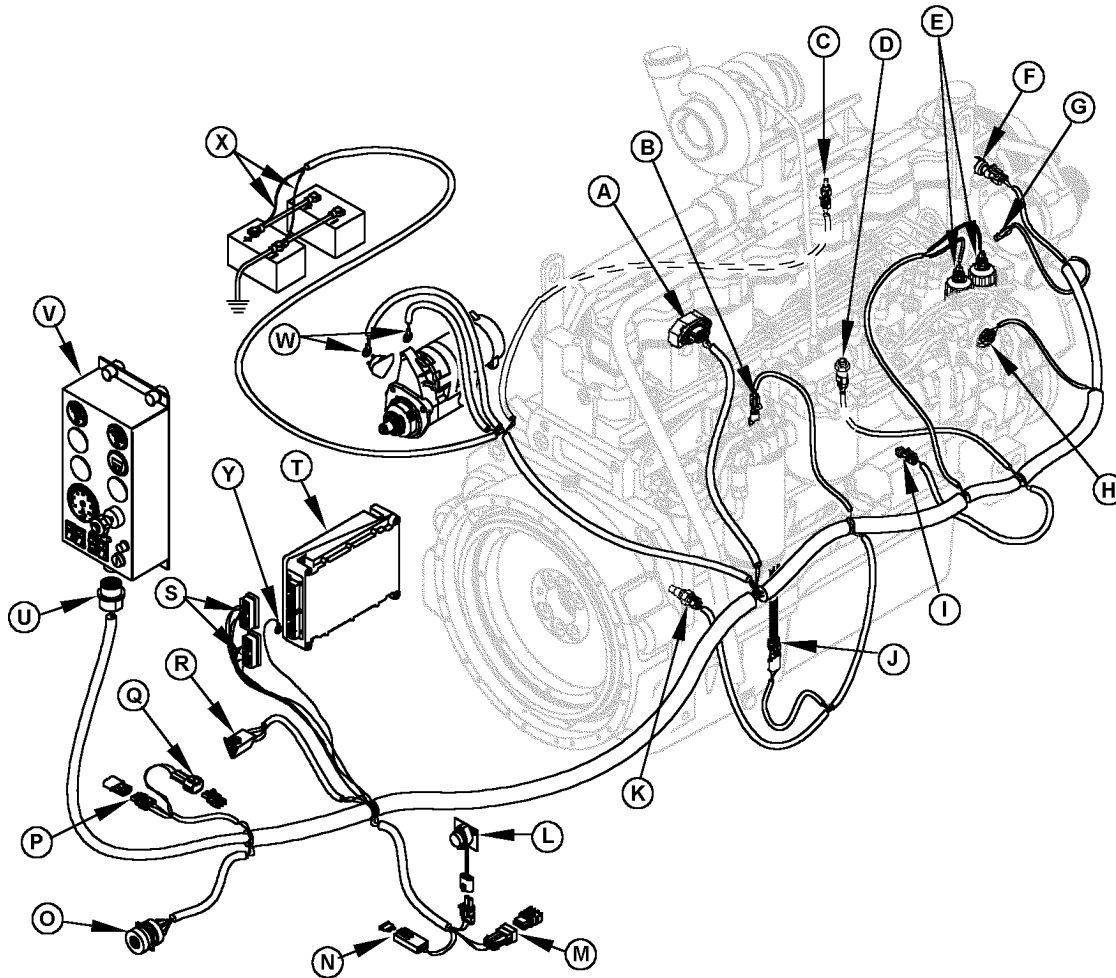
H—Oil Pressure Sensor  
I—Alternator Ignition Connector  
J—ECU Connectors  
K—Engine Control Unit  
L—Loss of Coolant Sensor  
M—CAN Diagnostic Sensor  
N—Instrument Panel Connector  
O—Unterminated Wires

P—Secondary Analog Throttle Connector (with terminator)  
Q—Optional Instrument Panel  
R—Starter Relay Connections  
S—Power And Ground Connections  
T—12V/24V Jumper Connection (with jumper)  
U—SAE 1939 CAN Connector  
V—System Ground (ECU must also be grounded to frame)

W—Injection Pump Solenoid Connector  
X—Injection Pump Rack Position Sensor Connector  
Y—Diagnostic Voltages Connector  
Z—Diagnostic Reader Connector

RG11084

# **ENGINE WIRING LAYOUT (ENGINES WITH ELECTRONIC INSTRUMENT PANEL)— ENGINES (200,000— )**



A—Electronic Injector Wiring Harness  
B—Fuel Temperature Sensor  
C—Manifold Air Temperature (MAT) Sensor (H engines only)  
D—Fuel Rail Pressure Sensor  
E—Fuel Pump Control Valve Connectors  
F—Coolant Temperature Sensor

G—Alternator Ignition Connector  
H—Fuel Pump Event Sensor  
I—Oil Pressure Sensor  
J—Water-in-Fuel Sensor  
K—Crank Position Sensor  
L—Transient Voltage Protection (TVP) Module  
M—Diagnostic Reader Connector

N—Main System Fuse (10 Amp)  
O—CAN Diagnostic Connector  
P—Secondary Analog Throttle Connector  
Q—Remote On / Off Connector  
R—SAE 1939 CAN Connector  
S—ECU Connectors  
T—Engine Control Unit (ECU)

U—Instrument Panel Connector  
V—Instrument Panel (Optional)  
W—Starter Relay Connections  
X—Power And Ground Battery Connections  
Y—System Ground (ECU must also be grounded to frame)

RG11579 -JUN-01DEC00

## ENGINE TROUBLESHOOTING

Symptom	Problem	Solution
<b>Engine Will Not Crank</b>	Weak battery	Replace battery.
	Corroded or loose battery connections	Clean battery terminals and connections.
	Defective main switch or start safety switch	Repair switch as required.
	Starter solenoid defective	Replace solenoid.
	Starter defective	Replace starter.
<b>Hard to Start or Will Not Start</b>	Poor fuel quality	Drain fuel and replace with quality fuel of the proper grade.
	Slow cranking speed	Check for problem in the charging/starting system.
	Too high viscosity crankcase oil	Drain crankcase oil and replace with correct viscosity oil.
	Electronic Control System Problem or Basic Engine Problem	See your John Deere engine distributor or servicing dealer.
<b>Engine Misfiring or Runs Irregularly</b>	Electronic Control System problem or basic engine problem	See your John Deere engine distributor or servicing dealer.
<b>Lack of Engine Power</b>	Poor fuel quality	Drain fuel and replace with quality fuel of the proper grade.
	Engine overloaded	Reduce engine load.
	Improper crankcase oil	Drain crankcase oil and replace with correct viscosity oil.
	Electronic Control System problem or basic engine problem	See your John Deere engine distributor or servicing dealer.

Continued on next page

RG, RG34710, 4089 -19-01JAN96-1/7



Symptom	Problem	Solution
<b>Black or Gray Exhaust Smoke</b>	Engine overloaded	Reduce engine load.
	Engine burning oil	See LUBRICATION SYSTEM TROUBLESHOOTING, later in this section.
	Air cleaner restricted or dirty	Replace air cleaner element as required.
	Defective muffler/exhaust piping (causing back-pressure)	Replace muffler or defective piping.
	Electronic Control System problem or basic engine problem	See your John Deere engine distributor or servicing dealer.
<b>White Exhaust Smoke</b>	Engine compression too low	Determine cause of low compression and repair as required. See your John Deere engine distributor or servicing dealer.
	Defective thermostat(s) (does not close)	Test thermostats; replace thermostats as required.
	Coolant entering combustion chamber (failed cylinder head gasket or cracked cylinder head)	Repair or replace as required. See your John Deere engine distributor or servicing dealer.
	Failed water-to-air aftercooler (6081AF engines only)	Remove and inspect water-to-air aftercooler. See your John Deere engine distributor or servicing dealer.
<b>Engine Idles Poorly</b>	Poor fuel quality	Drain fuel and replace with quality fuel of the proper grade.
	Air leak on suction side of air intake system.	Check hose and pipe connections for tightness; repair as required.
	Electronic control system problem or basic engine problem	See your John Deere engine distributor or servicing dealer.

Continued on next page

RG, RG34710, 4089 -19-01JAN96-2/7

Symptom	Problem	Solution
<b>Excessive Fuel Consumption</b>	Poor fuel quality	Drain fuel and replace with quality fuel of the proper grade.
	Engine overloaded	Reduce engine load.
	Air cleaner restricted or dirty	Replace air cleaner element as required.
	Compression too low	Determine cause of low compression and repair as required.
	Leaks in fuel supply system	Locate source of leak and repair as required.
	Improper type of fuel.	Use proper type of fuel.
	Clogged or dirty air cleaner.	Service air cleaner.
	Engine overloaded.	Reduce load.
	Improper valve clearance.	See your authorized servicing dealer or engine distributor.
	Injection nozzles dirty.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
	Defective turbocharger.	See your authorized servicing dealer or engine distributor.
	Low engine temperature.	Check thermostat.
<b>Fuel in Oil</b>	Cracked cylinder head	Locate crack, repair/replace components as required. See your John Deere engine distributor or servicing dealer.

Continued on next page

RG, RG34710, 4089 -19-01JAN96-3/7

Symptom	Problem	Solution
<b>Low-Pressure System - Fuel Pressure Low—Engines (200,000—)</b>	Plugged fuel filter	Replace fuel filter.
	Restricted fuel line	Locate restriction, repair as required.
	Faulty high-pressure fuel pump	Remove fuel pump, repair/replace pump as required. See your John Deere engine distributor or servicing dealer.
Continued on next page		RG, RG34710, 4089 -19-01JAN96-4/7

Symptom	Problem	Solution
<b>Abnormal Engine Noise</b>	Worn main or connecting rod bearings	Determine bearing clearance. See your John Deere engine distributor or servicing dealer.
	Excessive crankshaft end play	Check crankshaft end play. See your John Deere engine distributor or servicing dealer.
	Loose main bearing caps	Check bearing clearance; replace bearings and bearing cap screws as required. See your John Deere engine distributor or servicing dealer.
	Worn connecting rod bushings and piston pins	Inspect piston pins and bushings. See your John Deere engine distributor or servicing dealer.
	Scored pistons	Inspect pistons. See your John Deere engine distributor or servicing dealer.
	Worn timing gears or excess backlash	Check timing gear back lash. See your John Deere engine distributor or servicing dealer.
	Excessive valve clearance	Check and adjust valve clearance. See your John Deere engine distributor or servicing dealer.
	Worn camshaft lobes	Inspect camshaft. See your John Deere engine distributor or servicing dealer.
	Worn rocker arm shaft(s)	Inspect rocker arm shafts. See your John Deere engine distributor or servicing dealer.
	Insufficient engine lubrication	See LUBRICATION SYSTEM TROUBLESHOOTING, later in this section.
	Turbocharger noise	See AIR INTAKE SYSTEM TROUBLESHOOTING, later in this section.

Continued on next page

RG, RG34710, 4089 -19-01JAN96-5/7

Symptom	Problem	Solution
<b>Engine emits white smoke</b>	Improper type of fuel.	Use proper fuel.
	Low engine temperature.	Warm up engine to normal operating temperature.
	Defective thermostat.	Remove and check thermostat.
	Defective injection nozzles.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
<b>Engine emits black or gray exhaust smoke</b>	Improper type of fuel.	Use proper fuel.
	Clogged or dirty air cleaner.	Service air cleaner.
	Engine overloaded.	Reduce load.
	Injection nozzles dirty.	See your authorized servicing dealer or engine distributor.
	Engine out of time.	See your authorized servicing dealer or engine distributor.
	Turbocharger not functioning.	See your authorized servicing dealer or engine distributor.

Continued on next page

RG, RG34710, 4089 -19-01JAN96-6/7

Symptom	Problem	Solution
<b>Engine Overheats</b>	Engine overloaded.	Reduce load.
	Low coolant level.	Fill radiator to proper level, check radiator and hoses for loose connections or leaks.
	Faulty radiator cap.	Have technician check.
	Stretched V-belt or defective belt tensioner.	Check automatic belt tensioner and check belts for stretching. Replace as required.
	Low engine oil level.	Check oil level. Add oil as required.
	Cooling system needs flushing.	Flush cooling system.
	Defective thermostat.	Remove and check thermostat.
	Defective temperature gauge or sender.	Check coolant temperature with thermometer and replace, if necessary.
	Incorrect grade of fuel.	Use correct grade of fuel.

RG, RG34710, 4089 -19-01JAN96-7/7

## ELECTRICAL TROUBLESHOOTING

Symptom	Problem	Solution
<b>Undercharged system</b>	Excessive electrical load from added accessories.	Remove accessories or install higher output alternator.
	Excessive engine idling.	Increase engine rpm when heavy electrical load is used.
	Poor electrical connections on battery, ground strap, starter, or alternator.	Inspect and clean as necessary.
	Defective battery.	Test battery.
	Defective alternator.	Test charging system.
<b>Battery used too much water</b>	Cracked battery case.	Check for moisture and replace as necessary.
	Defective battery.	Test battery.
	Battery charging rate too high.	Test charging system.
<b>Batteries will not charge</b>	Loose or corroded connections.	Clean and tighten connections.
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
	Stretched belt or defective belt tensioner.	Adjust belt tension or replace belts.
<b>Starter will not crank</b>	PTO engaged.	Disengage PTO.
	Loose or corroded connections.	Clean and tighten loose connections.
	Low battery output voltage.	See your authorized servicing dealer or engine distributor.
	Faulty start circuit relay.	See your authorized servicing dealer or engine distributor.
	Blown fuse.	Replace fuse.

Continued on next page

RG, RG34710, 4090 -19-01JAN96-1/2

Symptom	Problem	Solution
<b>Starter cranks slowly</b>	Low battery output.	See your authorized servicing dealer or engine distributor.
	Crankcase oil too heavy.	Use proper viscosity oil.
	Loose or corroded connections.	Clean and tighten loose connections.
<b>Starter and hour meter functions; rest of electrical system does not function</b>	Blown fuse on magnetic switch.	Replace fuse.
<b>Entire electrical system does not function</b>	Faulty battery connection.	Clean and tighten connections.
	Sulfated or worn-out batteries.	See your authorized servicing dealer or engine distributor.
	Blown fuse.	Replace fuse.

RG, RG34710, 4090 —19-01JAN96-2/2



## LUBRICATION SYSTEM TROUBLESHOOTING

Symptom	Problem	Solution
<b>Low Oil Pressure</b>	Low crankcase oil level	Fill crankcase to proper oil level.
	Clogged oil cooler or filter	Remove and inspect oil cooler. See your John Deere engine distributor or servicing dealer.
	Excessive oil temperature	Remove and inspect oil cooler. See your John Deere engine distributor or servicing dealer.
	Defective oil pump	Remove and inspect oil pump. See your John Deere engine distributor or servicing dealer.
	Incorrect oil	Drain crankcase and refill with correct oil.
	Oil pressure regulating valve failure	Remove and inspect oil pressure regulating valve. See your John Deere engine distributor or servicing dealer.
	Clogged oil pump screen or cracked pick-up tube	Remove oil pan and clean screen/replace pick-up tube.
<b>High Oil Pressure</b>	Excessive main or connecting rod bearing clearance	Determine bearing clearance. See your John Deere engine distributor or servicing dealer.
	Improper oil classification	Drain crankcase and refill with correct oil.
	Oil pressure regulating valve failure	Remove and inspect oil pressure regulating valve. See your John Deere engine distributor or servicing dealer.
	Stuck or damaged filter bypass valve	Remove and inspect filter bypass valve. See your John Deere engine distributor or servicing dealer.
	Stuck or damaged oil cooler bypass valve	Remove and inspect oil cooler bypass valve. See your John Deere engine distributor or servicing dealer.

Continued on next page

RG, RG34710, 7600 -19-30JUN97-1/3

Symptom	Problem	Solution
<b>Excessive Oil Consumption</b>	Too low viscosity crankcase oil	Drain crankcase and refill with correct viscosity oil.
	Crankcase oil level too high	Drain oil until oil level is correct.
	External oil leak(s)	Determine source of oil leak(s) and repair as required.
	Oil control rings worn or broken	Replace piston rings. See your John Deere engine distributor or servicing dealer.
	Scored cylinder liners or pistons	Remove and inspect cylinders and liners; replace as required. See your John Deere engine distributor or servicing dealer.
	Worn valve guides or stems	Inspect and measure valve stems and valve guides; repair as required. See your John Deere engine distributor or servicing dealer.
	Excessive oil pressure	See High Oil Pressure.
	Piston ring grooves excessively worn	Remove and inspect pistons. See your John Deere engine distributor or servicing dealer.
	Piston rings sticking in ring grooves	Remove and inspect pistons. See your John Deere engine distributor or servicing dealer.
	Insufficient piston ring tension	Remove and inspect pistons. See your John Deere engine distributor or servicing dealer.
	Piston ring gaps not staggered	Remove and inspect pistons. See your John Deere engine distributor or servicing dealer.
	Front and/or rear crankshaft oil seal faulty	Replace oil seals. See your John Deere engine distributor or servicing dealer.

Continued on next page

RG, RG34710, 7600 -19-30JUN97-2/3

Symptom	Problem	Solution
		See LOW PRESSURE SYSTEM-FUEL PRESSURE LOW TROUBLESHOOTING earlier in this section.
Fuel in Oil		See FUEL IN OIL TROUBLESHOOTING earlier in this section.
Coolant in Oil		See COOLING SYSTEM TROUBLESHOOTING later in this section.

RG, RG34710, 7600 -19-30JUN97-3/3

## COOLING SYSTEM TROUBLESHOOTING

Symptom	Problem	Solution
Engine Overheats	Lack of coolant in cooling system	Fill cooling system to proper level.
	Radiator core dirty	Clean radiator as required.
	Engine overloaded	Reduce engine load.
	Too low crankcase oil level	Fill crankcase to proper oil level.
	Loose or defective fan belt	Replace fan belt as required. Check belt tensioner. (See Lubrication and Maintenance 600 Hour/12 Month Section.)
	Defective thermostat(s)	Test thermostat opening temperature; replace thermostats as required.
	Damaged cylinder head gasket	Replace cylinder head gasket. See your John Deere engine distributor or servicing dealer.
	Defective coolant pump	Replace coolant pump. See your John Deere engine distributor or servicing dealer.
	Defective radiator cap	Replace radiator cap as required.

Continued on next page

RG, RG34710, 7601 -19-30JUN97-1/2

Symptom	Problem	Solution
<b>Coolant in Crankcase</b>	Cylinder head gasket defective	Replace cylinder head gasket. See your John Deere engine distributor or servicing dealer.
	Cylinder head or block cracked	Locate crack, repair/replace components as required.
	Cylinder liner seals leaking	Remove and inspect cylinder liners. See your John Deere engine distributor or servicing dealer.
	Leaking oil cooler	Pressure test oil cooler; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Defective oil cooler O-rings	Remove and inspect oil cooler O-rings; replace as required. See your John Deere engine distributor or servicing dealer.
	Faulty coolant pump seal; weep hole plugged; coolant leaking through bearing	Replace coolant pump seals. See your John Deere engine distributor or servicing dealer.
<b>Coolant Temperature Below Normal</b>	Defective thermostat(s)	Test thermostats; replace thermostats as required.

RG, RG34710, 7601 -19-30JUN97-2/2

## AIR INTAKE SYSTEM TROUBLESHOOTING

If turbocharger requires replacement, determine what caused the failure of the defective unit, and correct the condition. This will prevent an immediate repeat failure of the replacement unit.

Symptom	Problem	Solution
<b>Hard to Start or Will Not Start</b>		See ENGINE TROUBLESHOOTING earlier in this section.
<b>Engine Misfiring or Runs Irregularly</b>		See ENGINE TROUBLESHOOTING earlier in this section.
<b>Black or Grey Exhaust Smoke</b>		See ENGINE TROUBLESHOOTING earlier in this section.
<b>Lack of Engine Power</b>		See ENGINE TROUBLESHOOTING earlier in this section.
<b>Turbocharger "Screams"</b>	Air leak in intake manifold.	Check intake manifold gasket and manifold; repair as required. See your John Deere engine distributor or servicing dealer.
<b>Turbocharger Noise or Vibration</b>  <i>NOTE: Do not confuse the whine heard during run down with noise which indicates a bearing failure.</i>	Bearings not lubricated (insufficient oil pressure)	Determine cause of lack of lubrication; repair as required. See your John Deere engine distributor or servicing dealer.
	Air leak in engine intake or exhaust manifold	Check intake and exhaust manifold gaskets and manifolds; repair as required. See your John Deere engine distributor or servicing dealer.
	Improper clearance between turbine wheel and turbine housing	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Broken blades (or other wheel failures)	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.

Continued on next page

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Symptom	Problem	Solution
<b>Oil on Turbocharger Compressor Wheel or in Compressor Housing (Oil Being Pushed or Pulled Through Center Housing)</b>	Excessive crankcase pressure.	Determine cause of excessive crankcase pressure; repair as required. See your John Deere engine distributor or servicing dealer.
	Air intake restriction	Determine cause of intake restriction; repair as required. See your John Deere engine distributor or servicing dealer.
	Drain tube restriction	Determine cause of drain tube restriction; repair as required. See your John Deere engine distributor or servicing dealer.
<b>Oil in Intake Manifold or Dripping from Turbocharger Housing</b>	Excessive crankcase pressure	Determine cause of excessive crankcase pressure; repair as required. See your John Deere engine distributor or servicing dealer.
	Air intake restriction	Determine cause of intake restriction; repair as required. See your John Deere engine distributor or servicing dealer.
	Drain tube restriction	Determine cause of drain tube restriction; repair as required. See your John Deere engine distributor or servicing dealer.
	Damaged or worn housing bearings	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Imbalance of rotating assembly	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Damage to turbine or compressor wheel or blade	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Dirt or carbon build-up on wheel or blade	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.

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RG, RG34710, 7602 -19-30JUN97-2/3

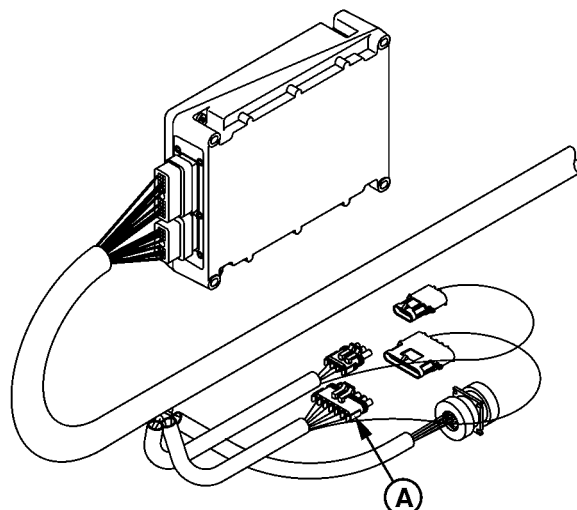
Symptom	Problem	Solution
<b>Turbocharger Turbine Wheel Drag</b>	Bearing wear	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Oil starvation or insufficient lubrication	Determine cause of lack of lubrication; repair as required. See your John Deere engine distributor or servicing dealer.
	Shaft seals worn	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Carbon build-up behind turbine wheel caused by coked oil or combustion deposits	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Dirt build-up behind compressor wheel caused by air intake leaks.	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.
	Bearing seizure or dirty, worn bearings	Inspect turbocharger; repair/replace as required. See your John Deere engine distributor or servicing dealer.

RG, RG34710, 7602 -19-30JUN97-3/3

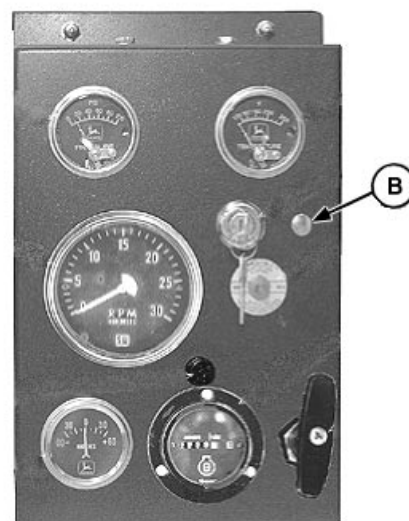
## DIAGNOSTIC TROUBLE CODE PROCEDURE (ENGINES WITH STANDARD INSTRUMENT PANELS)

On OEM applications that have a Fault Lamp (B), the ECU has the ability to display diagnostic trouble codes (DTCs) using blinking sequences of the fault lamp. To retrieve DTCs from the ECU using the "blink code" method:

1. Locate and uncap the 6-way WEATHER PACK™ diagnostic reader connector (A).
2. Using a short piece of wire, jump terminals B and F in the diagnostic reader connector together.
3. Turn the ignition switch "ON".
4. The Fault Lamp (B) will begin to flash a code number. For example, flash three times..short pause..flash two times..long pause. This example is code 32.
5. The ECU begins the flashing sequence by flashing a code 32, this indicates the start of blinking active codes. If there are any active DTCs, the ECU will flash its 2-digit number. If there is more than one active DTC, the ECU will flash each code in numerical order. If there are no active DTCs, the Fault Lamp will flash a code 88.
6. Following the active codes, the Fault Lamp will flash a code 33, this indicates the start of blinking stored codes. If there are any stored DTCs, the Fault Lamp will flash its 2-digit number. If there is more than one stored DTC, the ECU will flash each code in numerical order. If there are no stored DTCs, the Fault Lamp will flash a code 88.
7. Once complete, this sequence will repeat.
8. When complete, turn ignition "OFF", remove jumper wire, and recap the diagnostic reader connector.



Diagnostic Reader Connector



Fault Lamp on Standard Instrument Panel

A—Diagnostic Reader Connector  
B—Fault Lamp

RG10016A -UN-19FEB89

RG11075 -UN-14AUG00



As an example, if an engine had an active DTC 18, and a stored DTC 53, the flashing sequence would be: flash three times..short pause..flash two times..long pause..flash one time..short pause..flash eight times..long pause..flash three times..short pause..flash three times..long pause..flash five times..short pause..flash three times.

9. Go to the LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs) later in this section, to interpret to the DTC(s) present.

10. Contact your nearest engine distributor or servicing dealer with a list of DTC(s) so that necessary repairs can be made.

DPSG,OUOD002,1831 -19-02AUG00-2/2

## DIAGNOSTIC TROUBLE CODE PROCEDURE (ENGINES WITH ELECTRONIC INSTRUMENT PANELS)

**IMPORTANT:** Care should be used during diagnostic procedures to avoid damaging the terminals of connectors, sensors, and actuators. Probes should not be poked into or around the terminals or damage will result. Probes should only be touched against the terminals to make measurements.

Diagnosis of the Deere electronic control system should be performed according to the following procedure:

1. Make sure all engine mechanical and other systems not related to the electronic control system are operating properly.

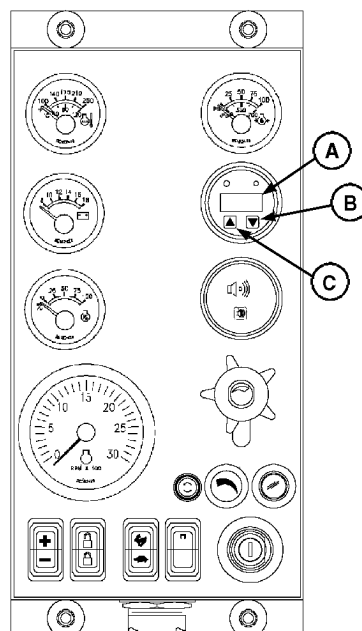
**NOTE:** Liquid Crystal Display [LCD] will always default to last menu item. If an active Diagnostic Trouble Code (DTC) is present, display will alternately flash from the hour meter reading to DTC(s).

*The code number will appear on the first line and the words SrvcCode on the second line. Active DTC(s) can be viewed by selecting "SrvcCode" on the menu and pressing both touch switches at the same time. Pressing touch switches (B) and (C) scrolls through various engine parameters and diagnostic trouble codes.*

2. Read and record DTC(s) displayed on LCD of diagnostic gauge (A). For procedure to access diagnostic trouble codes, refer to "Using Diagnostic Gauge to Access Engine Information", earlier in this manual.

3. Go to the LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs) later in this section, to interpret to the DTC(s) present.

4. Contact your nearest engine distributor or servicing dealer with a list of DTC(s) so that necessary repairs can be made.



Diagnostic Gauge - Electronic Instrument Panels

- A—LCD Display on Diagnostic Gauge
- B—Touch Switch (DOWN)
- C—Touch Switch (UP)

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## DISPLAYING OF DIAGNOSTIC TROUBLE CODES (DTCs)

There are several different methods for displaying both stored and active DTCs from the ECU or from a fault lamp.

### 2-3 DIGIT CODES

Some engines display Service Codes or DTCs as 2-3 digit codes read from a display on the instrument panel.

### SPN/FMI CODES

On most engines, including those with fault lamps, the DTCs are output according to the J1939 standard as a two part code.

The first part is a two to four-digit Suspect Parameter Number (SPN) followed by a one or two-digit Failure Mode Identifier (FMI) code. In order to determine the exact failure, both parts (SPN and FMI) of the code are needed.

The SPN identifies the system or the component that has the failure; for example SPN 110 indicates a failure in the engine coolant temperature circuit.

The FMI identifies the type of failure that has occurred; for example FMI 3 indicates value above normal. Combining SPN 110 with FMI 3 yields engine coolant temperature input voltage too high, or the equivalent of 2-3 digit fault code 18.

If diagnosing an application that shows DTCs as SPNs and FMIs, using the following list, determine the equivalent 2-3 digit code and use the diagnostic procedure in CTM134 for that 2-3 digit code.

Contact your servicing dealer for help in correcting diagnostic trouble codes which are displayed for your engine.

## LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs)—Engines ( —199,999)

*NOTE: Not all of these codes are used in all engine applications.*

DIAGNOSTIC TROUBLE CODES (DTCs)			
SPN	FMI	2-Digit Code	Description
91, 29	3	11	Primary Analog Throttle Voltage Too High
91, 29	4	12	Primary Analog Throttle Voltage Too Low
29*, 28	3	13	Secondary Analog Throttle Voltage Too High
29**, 28	4	14	Secondary Analog Throttle Voltage Too Low
171	3	16	Ambient Air Temperature Input Voltage Too High
171	4	17	Ambient Air Temperature Input Voltage Too Low
110	3	18	Engine Coolant Temperature Input Voltage Too High
110	4, 9	19	Engine Coolant Temperature Input Voltage Too Low
620	3	21	Sensor Supply Voltage Too High
620	4	22	Sensor Supply Voltage Too Low
100	3	23	Oil Pressure Input Voltage Too High
100	4	24	Oil Pressure Input Voltage Too Low
105	3	25	Manifold Air Temperature Input Voltage Too High
105	4	26	Manifold Air Temperature Input Voltage Too Low
51, 91	2, 9	27	CAN Throttle Not Valid/Received
629	12, 13	28	Engine Control Unit (ECU) Error
1568	2	29	Torque Curve Selection Not Valid/Received
733, 833	2	31	Engine Off Rack Position Error
638, 834	7	34	Rack Position Error
733, 833	3	35	Rack Position Voltage Too High
733, 833	4	36	Rack Position Voltage Too Low
174	3	37	Fuel Temperature Input Voltage Too High
174	4	38	Fuel Temperature Input Voltage Too Low
191	2	39	Pump Speed Input Error
1041	2	41	Start Signal Missing
190, 191	0, 16	42	Engine Overspeed
		43	PWM Throttle Erratic
190, 723	2	44	Engine Speed Input Error
190, 191	14	45	Speed Signal Mismatch
1041	3	46	Start Signal Always Active
105, 1569	0, 31	47	Derated Torque Curve Selected
632	11	48	Fuel Shut-Off Circuit Fault
640, 970	11	49	External Shutdown Signal Invalid
640, 970	31, 0	52	External Shutdown
834, 638	2	53	Rack Instability
158	2	54	Power Glitch Detected
639	0, 2	55	CAN Error
111	1	61	Coolant Level Low
110	0, 16	62	Coolant Temperature Moderately High
110	0	63	Coolant Temperature Extremely High
100	1, 18	64	Oil Pressure Moderately Low
100	1	65	Oil Pressure Extremely Low
105	16	66	Manifold Air Temperature High
1110	31	67	Shutdown Warning
1569	31	68	Fuel Derate

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DIAGNOSTIC TROUBLE CODES (DTCs)

SPN	FMI	2-Digit Code	Description
		71	Diagnostic Fault Code Output Stuck High
		72	Diagnostic Fault Code Output Stuck Low
		73	Fuel Flow/Throttle Output Stuck High
		74	Fuel Flow/Throttle Output Stuck Low
834	5	75	Rack Actuator Circuit Open
834	6	76	Rack Actuator Circuit Grounded
834	3	77	Rack Actuator Circuit Shorted to Power
2000	13	78	Security Violation
174	16	81	Fuel Temperature Warning
970	31	83	External Engine Protection Shutdown Requested
190	5	85	Speed Sensor Input Open
190	4	86	Speed Sensor Circuit Open
190	3	87	Speed Sensor Input Shorted to Power

\* This SPN 29 applies to the throttle wired to terminal G1 on OEM applications.

\*\* This SPN 29 applies to the throttle wired to terminal G2 on OEM applications.

**NOTE:** The Diagnostic Gauge on the electronic instrument panel can have communication problems that result in Error Codes being shown on its LCD display window. The following Error Codes all indicate that there is a Diagnostic Gauge communication error with the ECU. Contact your servicing dealer for help in correcting these codes:

EE — Error	XXXXX — EP No Data
ACP — Err No Addr	XXXXX — BO No Data
ACP — Err BUS — EP	XXXXX — BR No Data

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## LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs)—Engines (200,000— )

*NOTE: Not all of these codes are used in all engine applications.*

SPN	FMI	DIAGNOSTIC TROUBLE CODES (DTCs)	
		2-3 Digit Code	Description
28	3	115	Multi-State Throttle No. 3 Voltage High
28	4	116	Multi-State Throttle No. 3 Voltage Low
29	3	13	Analog Throttle (B) No. 2 Voltage High
29	4	14	Analog Throttle (B) No. 2 Voltage Low
91	3	11	Analog Throttle (A) No. 1 Voltage High
91	4	12	Analog Throttle (A) No. 1 Voltage Low
94	3	127	Fuel Rail Pressure Input Voltage High
94	4	129	Fuel Rail Pressure Input Voltage Low
94	10	171	Fuel Fuel Rail Pressure Loss Detected
94	17	172	Fuel Rail Pressure Not Developed
97	3	176	Water In Fuel Signal Voltage Too High
97	4	176	Water In Fuel Signal Voltage Too Low
97	16	175	Water In Fuel Detected
100	1	65	Engine Oil Pressure Extremely Low
100	3	—	Engine Oil Pressure Input Voltage High
100	4	—	Engine Oil Pressure Input Voltage Low
100	18	64	Engine Oil Pressure Moderately Low
105	3	23	Manifold Air Temperature Input Voltage High
105	4	24	Manifold Air Temperature Input Voltage Low
105	16	66	Manifold Air Temperature Moderately High
107	31	120	Air Filter Restriction High
110	0	63	Engine Coolant Temperature Extremely High
110	3	25	Engine Coolant Temperature Input Voltage High
110	4	26	Engine Coolant Temperature Input Voltage Low
110	16	62	Engine Coolant Temperature Moderately High
111	1	61	Engine Coolant Level Low
158	17	84	ECU Power Down Error
174	3	37	Fuel Temperature Input Voltage High
174	4	38	Fuel Temperature Input Voltage Low
174	16	81	Fuel Temperature Moderately High
611	3	98	Injector Wiring Shorted To Power Source
611	4	99	Injector Wiring Shorted To Ground
620	3	21	Sensor Supply 1 Voltage High
620	4	22	Sensor Supply 2 Voltage Low
627	1	97	Electronic Injector Supply Voltage Problem
629	13	28	ECU Error
636	2	144	Pump Position Input Noise
636	8	143	Pump Position Input Missing
636	10	144	Pump Position Input Pattern Error
637	2	142	Crank Position Input Noise
637	7	145	Crank Position/Pump Position Out of Sync
637	8	141	Crank Position Input Missing
637	10	142	Crank Position Input Pattern Error
639	13	55	CAN Error

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DIAGNOSTIC TROUBLE CODES (DTCs)

SPN	FMI	2-3 Digit Code	Description
651	5	131	Cylinder No. 1 Electronic Injector Circuit Open
651	6	91	Cylinder No. 1 Electronic Injector Circuit Shorted
652	5	132	Cylinder No. 2 Electronic Injector Circuit Open
652	6	92	Cylinder No. 2 Electronic Injector Circuit Shorted
653	5	133	Cylinder No. 3 Electronic Injector Circuit Open
653	6	93	Cylinder No. 3 Electronic Injector Circuit Shorted
654	5	134	Cylinder No. 4 Electronic Injector Circuit Open
654	6	94	Cylinder No. 4 Electronic Injector Circuit Shorted
655	5	135	Cylinder No. 5 Electronic Injector Circuit Open
655	6	95	Cylinder No. 5 Electronic Injector Circuit Shorted
656	5	136	Cylinder No. 6 Electronic Injector Circuit Open
656	6	96	Cylinder No. 6 Electronic Injector Circuit Shorted
1080	3	173	Sensor Supply 2 Voltage High
1080	4	174	Sensor Supply 2 Voltage Low
1110	31	—	Engine Protection Shutdown
1347	5	177	Fuel Pump Control Valve Solenoid No. 1 Error
1347	7	178	Rail Pressure Lower Than Expected
1348	5	179	Fuel Pump Control Valve Solenoid No. 2 Error
1568	2	29	Torque Curve Selection Error
1569	31	68	Fuel Derate

\* This SPN 29 applies to the throttle wired to terminal G1 on OEM applications.

\*\* This SPN 29 applies to the throttle wired to terminal G2 on OEM applications.

**NOTE:** The Diagnostic Gauge on the electronic instrument panel can have communication problems that result in Error Codes being shown on its LCD display window. The following Error Codes all indicate that there is a Diagnostic Gauge communication error with the ECU. Contact your servicing dealer for help in correcting these codes:

EE — Error	XXXXX — EP No Data
ACP — Err No Addr	XXXXX — BO No Data
ACP — Err BUS — EP	XXXXX — BR No Data

# Storage

## ENGINE STORAGE GUIDELINES

1. John Deere engines can be stored outside for up to three (3) months with no long term preparation IF COVERED BY WATER PROOF COVERING.
2. John Deere engines can be stored in a standard overseas shipping container for up to three (3) months with no long term preparation.
3. John Deere engines can be stored inside, warehoused, for up to six (6) months with no long term preparation.
4. John Deere engines expected to be stored more than six (6) months, long term storage preparation MUST BE taken. (See PREPARING ENGINE FOR LONG TERM STORAGE, later in this section.)
5. For John Deere engines not yet installed in machines, run a line from a container of AR41937 Nucle Oil to the fuel transfer pump intake, and another line from the fuel return manifold to the tank, so that Nucle Oil is circulated through the injection system during cranking.

RG, RG34710, 4091 -19-01JAN96-1/1

## USE AR41785 ENGINE STORAGE KIT

**IMPORTANT:** Inhibitors can easily change to gas.  
Seal or tape each opening immediately  
after adding inhibitor.

See your John Deere servicing dealer or engine distributor for an AR41785 Engine Storage Kit. Closely follow instructions provided with this kit.



*Engine Storage Kit*

T85452 -UN-06DEC88

RG, RG34710, 4092 -19-01JAN96-1/1



## PREPARING ENGINE FOR LONG TERM STORAGE

The following storage preparations are good for long term engine storage up to one year. After that, the engine should be started, warmed up, and retreated for an extended storage period.

**IMPORTANT:** Any time your engine will not be used for over six (6) months, the following recommendations for storing it and removing it from storage will help to minimize corrosion and deterioration. Use the AR41785 Engine Storage Kit. Follow recommended service procedure included with storage kit.

1. Change engine oil and replace filter. Used oil will not give adequate protection. (See CHANGE ENGINE OIL AND FILTER in Lubrication and Maintenance/250 Hour/6 Month Section.)
2. Service air cleaner. (See REPLACING AIR CLEANER FILTER ELEMENTS in Service As Required Section.)
3. Draining and flushing of cooling system is not necessary if engine is to be stored only for several months. However, for extended storage periods of a year or longer, it is recommended that the cooling system be drained, flushed, and refilled. Refill with appropriate coolant. (See RECOMMENDED ENGINE COOLANT in Fuels, Lubricants, and Coolant Section and ADDING COOLANT in Service As Required Section.)
4. Drain fuel tank and add 30 ml (1 oz) of inhibitor to the fuel tank for each 15 L (4 U.S. gal) of tank capacity. Completely drain fuel filter and close fuel valve, if equipped.
5. Add 30 ml (1 oz) of inhibitor to the engine crankcase for each 0.95 L (1 qt) of crankcase oil.
6. Disconnect air intake piping from the manifold. Pour 90 ml (3 oz) of inhibitor into intake system and reconnect the piping.
7. Crank the engine several revolutions with starter (do not allow the engine to start).
8. Remove fan/alternator belt, if desired.
9. Remove and clean batteries. Store them in a cool, dry place and keep them fully charged.
10. Disengage the PTO clutch.
11. Clean the exterior of the engine with salt-free water and touchup any scratched or chipped painted surfaces with a good quality paint.
12. Coat all exposed (machined) metal surfaces with grease or corrosion inhibitor if not feasible to paint.
13. Seal all openings on engine with plastic bags and tape supplied in storage kit. Follow instructions supplied in kit.
14. Store the engine in a dry protected place. If engine must be stored outside, cover it with a water proof canvas or other suitable protective material and use a strong water proof tape.

RG, RG34710, 4093 -19-01JAN96-1/1

## REMOVING ENGINE FROM LONG TERM STORAGE

Refer to the appropriate section for detailed services listed below or have your authorized servicing dealer or engine distributor perform services that you may not be familiar with.

**IMPORTANT: DO NOT operate starter more than 30 seconds at a time. Wait at least 2 minutes for starter to cool before trying again.**

1. Remove all protective coverings from engine. Unseal all openings in engine and remove covering from electrical systems.
2. Remove the batteries from storage. Install batteries (fully charged) and connect the terminals.
3. Install fan/alternator belts if removed.
4. Fill fuel tank.
5. Perform all appropriate prestarting checks. (See DAILY PRESTARTING CHECKS in Engine Operating Guidelines Section.)
6. Crank engine for 20 seconds with starter (do not allow the engine to start). Wait 2 minutes and crank engine an additional 20 seconds to assure bearing surfaces are adequately lubricated.
7. Start engine and run at low idle and no load for several minutes. Warm up carefully and check all gauges before placing engine under load.
8. On the first day of operation after storage, check overall engine for leaks and check all gauges for correct operation.

RG, RG34710, 4094 -19-01JAN96-1/1

# Specifications

## GENERAL OEM ENGINE SPECIFICATIONS

*NOTE: For John Deere vehicle engines, see Machine Technical Manual.*

ITEM	UNIT OF MEASURE	6081TF	6081AF
<b>General Data</b>			
Engine Type	—	In-line, 4 cycle diesel	In-line, 4 cycle diesel
Aspiration	—	Turbocharged	Turbocharged, water-to-air aftercooled
Number of Cylinders	—	6	6
Bore	mm (in.)	116 (4.56)	116 (4.56)
Stroke	mm (in.)	129 (5.06)	129 (5.06)
Displacement	L (cu in.)	8.1 (496)	8.1 (496)
Combustion System	—	Direct Injection	Direct Injection
Compression Ratio	—	16.5:1	16.5:1
<b>Physical Dimensions:</b>			
Width	mm (in.)	599 (23.8)	698 (27.5)
Height	mm (in.)	1138 (44.8)	1138 (44.8)
Length	mm (in.)	1200 (47.6)	1200 (47.6)
Basic Dry Weight	kg (lb)	735 (1620)	796 (1755)
<b>Performance Data (Industrial Applications)</b>			
Net Rated Power (Cont.) at 2200 rpm	kW (hp)	127 (170)	160 (215)
Net Peak Torque(Cont.) at 1200 rpm	N•m (lb-ft)	758 (559)	967 (713)
Net Rated Power (Intermit.) at 2200 rpm	kW (hp)	149 (200)	168 (225)
Net Peak (Intermit) at 1200 rpm	N•m (lb-ft)	891 (656)	1012 (747)
Low Idle Speed	rpm	850	850
Fast Idle Speed	rpm	2300	2300
<b>Performance Data (Generator Applications)</b>			
Net Rated Power (Prime) at 1800 rpm	kW (hp)	142 (190)	168 (225)
Net Rated Power (Standby) at 1800 rpm	kW (hp)	157 (211)	187 (250)
Net Rated Power (Prime) at 1500 rpm	kW (hp)	119 (160)	142 (190)
Net Rated Power (Standby) at 1500 rpm	kW (hp)	130 (175)	157 (210)
Low Idle Speed	rpm	850	850
Fast Idle Speed	rpm	1900/1600	1900/1600
<b>Lubrication System</b>			
Oil Pressure at Rated rpm	kPa (psi)	345 (50)	345 (50)
Oil Pressure at Low Idle	kPa (psi)	210 (30)	210 (30)
In-Crankcase Oil Temp at Rated rpm	°C (°F)	115°C (240°F)	115°C (240°F)
<b>Cooling System (Liquid, pressurized with centrifugal pump)</b>			
Recommended Pressure Cap	kPa (psi)	69 (10)	69 (10)
Coolant Temperature Operating Range	°C (°F)	82°-94°C (180°-202°F°)	82°-94°C (180°-202°F°)
Coolant Flow (Industrial)	L/min (gal/min)	330 (87)	330 (87)
Coolant Flow (Generator)			
at 1800 rpm	L/min (gal/min)	270 (71)	270 (71)
at 1500 rpm	L/min (gal/min)	210 (55)	210 (55)
<b>Engine Operation System</b>			

Continued on next page

RG, RG34710, 4095 -19-01JAN96-1/2

## Specifications

ITEM	UNIT OF MEASURE	6081TF	6081AF
Hot Cylinder Compression Pressure with Injection Nozzles Removed	kPa (psi)	2380-2790 (345-405)	2380-2790 (345-405)
Valve Clearance (Cold)			
Intake	mm (in.)	0.46 (0.018)	0.46 (0.018)
Exhaust	mm (in.)	0.71 (0.028)	0.71 (0.028)
<b>Fuel System</b>			
Nozzle Opening Pressure New	kPa (psi)	29000 (4200)	29000 (4200)
Nozzle Opening Pressure Used (min.)	kPa (psi)	26200 (3800)	26200 (3800)
<b>Injection Pump Timing</b>			
Timing Lines aligned with flywheel at TDC			

RG, RG34710, 4095 -19-01JAN96-2/2

## GENERAL OEM ENGINE SPECIFICATIONS— CONTINUED

*NOTE: For John Deere vehicle engines, see Machine Technical Manual.*

ITEM	UNIT OF MEASURE	6081HF001 Engine S.N. (—199,999)	6081HF070 Engine S.N. (200,000— )
<b>General Data</b>			
Engine Type	—	In-line, 4 cycle diesel	In-line, 4 cycle diesel
Aspiration	—	Turbocharged and air-to-air after cooled	Turbocharged and air-to-air after cooled
Number of Cylinders	—	6	6
Bore	mm (in.)	116 (4.56)	116 (4.56)
Stroke	mm (in.)	129 (5.06)	129 (5.06)
Displacement	L (cu in.)	8.1 (496)	8.1 (496)
Combustion System	—	Direct Injection	Direct Injection
Compression Ratio	—	15.7:1	15.7:1
<b>Physical Dimensions:</b>			
Width	mm (in.)	597 (23.5)	597 (23.5)
Height	mm (in.)	1152 (45.3)	1152 (45.3)
Length	mm (in.)	1200 (47.6)	1200 (47.6)
Basic Dry Weight	kg (lb)	776 (1710)	776 (1710)
<b>Performance Data (Industrial Applications)</b>			
Net Rated Power (Cont.) at 2200 rpm	kW (hp)	190 (255)	206 (276)
Net Peak Torque(Cont.) at 1200 rpm	N•m (lb-ft)	1184 (873)	928 (1259)
Net Rated Power (Intermit.) at 2200 rpm	kW (hp)	224 (300)	242 (325)
Net Peak (Intermit) at 1200 rpm	N•m (lb-ft)	1393 (1027)	1280 (944)
Low Idle Speed	rpm	850	850
Fast Idle Speed	rpm	2300	2300
<b>Performance Data (Generator Applications)</b>			
Net Rated Power (Prime) at 1800 rpm	kW (hp)	218 (292)	308 (413)
Net Rated Power (Standby) at 1800 rpm	kW (hp)	240 (322)	345 (462)
Net Rated Power (Prime) at 1500 rpm	kW (hp)	182 (244)	220 (295)
Net Rated Power (Standby) at 1500 rpm	kW (hp)	200 (268)	259 (347)
Low Idle Speed	rpm	850	850
Fast Idle Speed	rpm	1900/1600	1900/1600
<b>Lubrication System</b>			
Oil Pressure at Rated rpm	kPa (psi)	345 (50)	345 (50)
Oil Pressure at Low Idle	kPa (psi)	210 (30)	210 (30)
In-Crankcase Oil Temp at Rated rpm	°C (°F)	115°C (240°F)	115°C (239°F)
<b>Cooling System (Liquid, pressurized with centrifugal pump)</b>			
Recommended Pressure Cap	kPa (psi)	69 (10)	69 (10)
Coolant Temperature Operating Range	°C (°F)	82°-94°C (180°-202°F°)	82°-94°C (180°-202°F°)
Coolant Flow (Industrial)	L/min (gal/min)	330 (87)	330 (87)
Coolant Flow (Generator)			
at 1800 rpm	L/min (gal/min)	270 (71)	270 (71)
at 1500 rpm	L/min (gal/min)	210 (55)	210 (55)

Continued on next page

DPSG.OUOD007,3504 -19-28NOV00-1/2

## Specifications

ITEM	UNIT OF MEASURE	6081HF001 Engine S.N. ( —199,999)	6081HF070 Engine S.N. (200,000— )
<b>Engine Operation System</b>			
Hot Cylinder Compression Pressure with Injectors Removed	kPa	2380-2790 (345-405)	2380-2790 (345-405)
Valve Clearance (Cold)			
Intake	mm (in.)	0.46 (0.018)	0.36 (0.014)
Exhaust	mm (in.)	0.71 (0.028)	0.56 (0.022)
<b>Fuel System</b>			
Injector Opening Pressure	kPa (psi)	29000 (4200)	ECU Programed
New			
Injector Opening Pressure	kPa (psi)	26200 (3800)	ECU Programed
Used (min.)			
<b>Injection Pump Timing S.N. ( —199,999)</b>		Timing lines aligned with flywheel at TDC	
<b>Injection Pump Timing S.N. (200,000— )</b>			Timing pin inserted with flywheel at TDC

DPSG,OUOD007,3504 —19—28NOV00—2/2

## FUEL INJECTION PUMP SPECIFICATIONS<sup>1</sup> (OEM ENGINES)

ENGINE MODEL	INJECTION PUMP OPTION CODES	POWER RATING @ RATED SPEED WITHOUT FAN kW (hp)	RATED SPEED <sup>2</sup> (rpm)	SLOW IDLE (rpm)	FAST IDLE <sup>3</sup> (rpm)
6081TF	1601, 1602, 1605, 1606	149 (200)	2200	850	2420
	1603, 1604, 1606	157 (211)	1800	850	1890
	1608, 1609, 1610	131 (175)	1500	850	1575
	1611, 1612, 1613	128 (172)	2200	1000	2420
	1614, 1615, 1616	194 (260)	1800	850	1890
	1603, 1604, 1605	157 (211)	1500	850	1575
	1607, 1608, 1609	187 (250)	1500	850	1575
	1611	168 (225)	2200	850	2420
	1617, 1618	149 (200)	2200	850	2420
	1619, 1620, 1621	169 (227)	1500	850	1575
6081AF	1603, 1604, 1605	182 (244)	1500	850	1575
	1613, 1615, 1620, 1621	205 (275) <sup>4</sup>	2200	850	2420
	1607, 1608, 1609	219 (293)	1500	850	1575
	1610, 1618, 1640	187 (250)	2200	850	2420
	1617, 1656	168 (225) <sup>4</sup>	2200	850	2420
	1611, 1656, 1617	205 (275)	2200	850	2420
	1612, 1619, 1676	187 (250)	1800	850	1890
	1612, 1619, 1676	205 (275)	2200	850	1890
	1616	159 (213) <sup>4</sup>	2200	850	2420
	1616, 1660	187 (250) <sup>4</sup>	2200	850	2420
	1621	175 (235) <sup>4</sup>	2200	850	2420
	1622, 1623, 1624	224 (300)	1800	850	1890
	1632, 1634, 1640, 1641, 1643, 1645, 1646, 1647, 1648, 1649, 1650	187 (250) <sup>4</sup>	2200	850	2420
	1633, 1635, 1642, 1644, 1651, 1652, 1653, 1654, 1655, 1657, 1658, 1659	205 (275) <sup>4</sup>	2200	850	2420

Continued on next page

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## Specifications

ENGINE MODEL	INJECTION PUMP OPTION CODES	POWER RATING @ RATED SPEED WITHOUT FAN kW (hp)	RATED SPEED <sup>2</sup> (rpm)	SLOW IDLE (rpm)	FAST IDLE <sup>3</sup> (rpm)
6081HF001 Engine S.N. ( —199,999)	1673, 1674	168 (225)	2200	850	2420
	1681	205 (275)	2100	850	2320
	1682, 1683, 1684	258 (347)	1800	850	1890
	1601, 1602, 1605, 1621, 1633, 1639, 1640, 1641, 1642, 1643, 1644, 1645, 1646, 1647, 1648	224 (300) <sup>4</sup>	2200	850	2420
	1603, 1604, 1606	240 (322)	1800	850	1890
	1621	190 (255) <sup>4</sup>	2200	850	2420
	1622, 1623, 1624	200 (268)	1500	850	1575
	1624	245 (328)	1500	850	1575
	1661, 1662, 1663	255 (342)	1500	850	1575
	1673, 1674	225 (302)	2200	850	2350
	1681, 1682, 1683	263 (353)	1800	850	1890
	1680	224 (300)	2100	850	2320
	1685	225 (302)	1500	850	1575
	1686	268 (359)	1500	850	1575
	1687	308 (413)	1800	850	1890
6081HF070 Engine S.N. (200,000— )	166A, 166B, 166C, 166D, 166E, 166F, 166G, 166H, 166J, 166K, 166L, 166M	242 (325) <sup>4</sup>	2200	800	2350
	16GA, 16GB, 16GC, 16GD,	308 (413)	1800	850	1800
	16JA, 16JB, 16JC, 16JD	259 (347)	1800	850	1800

<sup>1</sup> Engine speeds listed are preset to factory specification for application. Therefore, speeds may vary depending upon specific vehicle application requirements. Refer to your machine operator's manual for engine speeds that are different from those preset at the factory.

<sup>2</sup> Generator set engines (3-5% governor) usually run at 1500 rpm (50 Hz) or 1800 (60 Hz) when operating under load depending on cycles of AC current.

<sup>3</sup> For engines with standard governor, fast idle is 7-10% above rated speed. For engines with generator set governors, fast idle is 3-5% above rated speed.

<sup>4</sup> These engines have a 7% power bulge which allows for INTERMITTENT operation of 7% above rated power.

Continued on next page

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*NOTE: Some Option Codes appear more than once. This is because the option number was used on earlier engines, then used on later engines with a different power rating.*

*NOTE: Cruise Control option is available with the following injection pump option codes:*

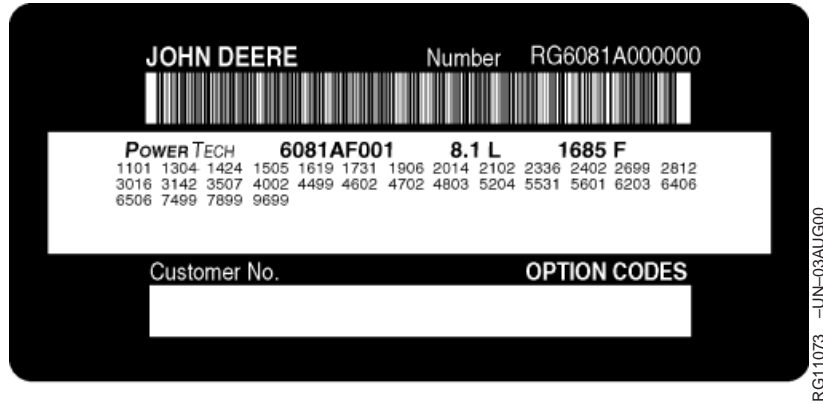
*6081 AF: 1632, 1633, 1634, 1635, 1644, 1645, 1646, 1651, 1652, 1653, 1654, 1660.*

*6081 HF: 1633, 1639, 1641, 1642, 1643, 1644.*

*6081HF070: 166E, 166F, 166G, 166H.*

DPSG,OUOD002,1594 -19-21JUN00-3/3

## ENGINE CRANKCASE OIL FILL QUANTITIES



Option Code Label

Each engine has a 13-digit John Deere engine serial number. The first two digits identify the factory that produced the engine:

“RG” indicates the engine was built in Waterloo, Iowa.

In addition to the serial number plate, OEM engines have an engine option code label affixed to the rocker arm cover. These codes indicate which of the engine options were installed on your engine at the factory. When in need of parts or service, furnish your

authorized servicing dealer or engine distributor with these numbers.

To determine the option code for the oil fill quantity of your engine, refer to the engine option code label affixed to the rocker arm cover. The first two digits of the code (19) identify the oil pan group. The last two digits of each code identify the specific oil pan on your engine.

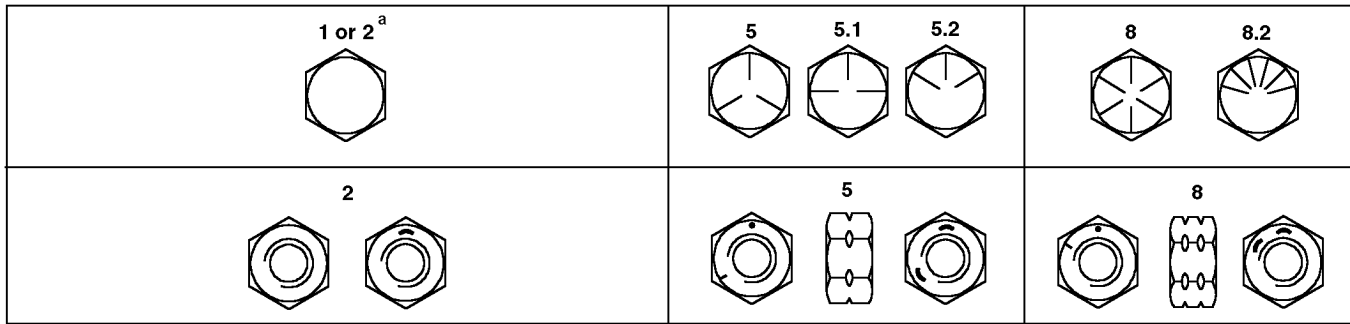
Listed below are engine crankcase oil fill quantities:

Engine Model	Oil Pan Option Code(s)	Crankcase Oil Capacity
6081TF,AF,HF	1905, 1910	28 L (29.7 qts)
	1906, 1908, 1911, 1912, 1913, 1916	28.5 L (30.1 qts)
	1901, 1909	32 L (34 qts)

**NOTE:** Crankcase oil capacities are based on installing a new (dry) oil filter and then filling crankcase with oil to “FULL” mark on dipstick.

RG, RG34710, 4097 -19-21AUG00-1/1

## UNIFIED INCH BOLT AND CAP SCREW TORQUE VALUES



Top, SAE Grade and Head Markings; Bottom, SAE Grade and Nut Markings

Size	Grade 1 (No Mark)		Grade 2 <sup>a</sup> (No Mark)		Grade 5, 5.1 or 5.2		Grade 8 or 8.2	
	Lubricated <sup>b</sup> N•m(lb-ft)	Dry <sup>c</sup> N•m(lb-ft)	Lubricated <sup>b</sup> N•m(lb-ft)	Dry <sup>c</sup> N•m(lb-ft)	Lubricated <sup>b</sup> N•m(lb-ft)	Dry <sup>c</sup> N•m(lb-ft)	Lubricated <sup>b</sup> N•m(lb-ft)	Dry <sup>c</sup> N•m(lb-ft)
1/4	3.8 (2.8)	4.7 (3.5)	6 (4.4)	7.5 (5.5)	9.5 (7)	12 (9)	13.5 (10)	17 (12.5)
5/16	7.7 (5.7)	9.8 (7.2)	12 (9)	15.5 (11.5)	19.5 (14.5)	25 (18.5)	28 (20.5)	35 (26)
3/8	13.5 (10)	17.5 (13)	22 (16)	27.5 (20)	35 (26)	44 (32.5)	49 (36)	63 (46)
7/16	22 (16)	28 (20.5)	35 (26)	44 (32.5)	56 (41)	70 (52)	80 (59)	100 (74)
1/2	34 (25)	42 (31)	53 (39)	67 (49)	85 (63)	110 (80)	120 (88)	155 (115)
9/16	48 (35.5)	60 (45)	76 (56)	95 (70)	125 (92)	155 (115)	175 (130)	220 (165)
5/8	67 (49)	85 (63)	105 (77)	135 (100)	170 (125)	215 (160)	240 (175)	305 (225)
3/4	120 (88)	150 (110)	190 (140)	240 (175)	300 (220)	380 (280)	425 (315)	540 (400)
7/8	190 (140)	240 (175)	190 (140)	240 (175)	490 (360)	615 (455)	690 (510)	870 (640)
1	285 (210)	360 (265)	285 (210)	360 (265)	730 (540)	920 (680)	1030 (760)	1300 (960)
1-1/8	400 (300)	510 (375)	400 (300)	510 (375)	910 (670)	1150 (850)	1450 (1075)	1850 (1350)
1-1/4	570 (420)	725 (535)	570 (420)	725 (535)	1280 (945)	1630 (1200)	2050 (1500)	2600 (1920)
1-3/8	750 (550)	950 (700)	750 (550)	950 (700)	1700 (1250)	2140 (1580)	2700 (2000)	3400 (2500)
1-1/2	990 (730)	1250 (930)	990 (730)	1250 (930)	2250 (1650)	2850 (2100)	3600 (2650)	4550 (3350)

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

<sup>b</sup> "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.

<sup>c</sup> "Dry" means plain or zinc plated without any lubrication.

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

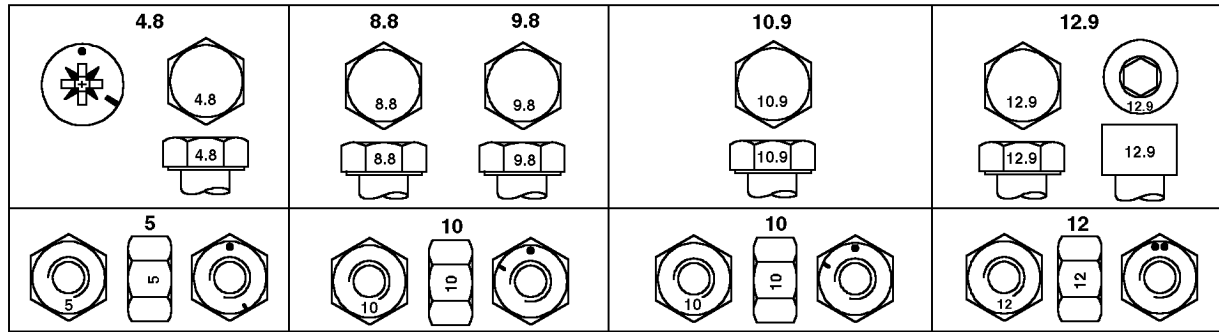
Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, these should only be tightened to the strength of the original.

Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

## METRIC BOLT AND CAP SCREW TORQUE VALUES



Top, Property Class and Head Markings; Bottom, Property Class and Nut Markings

Size	Class 4.8		Class 8.8 or 9.8		Class 10.9		Class 12.9	
	Lubricated <sup>a</sup> N•m(lb-ft)	Dry <sup>b</sup> N•m(lb-ft)	Lubricated <sup>a</sup> N•m(lb-ft)	Dry <sup>b</sup> N•m(lb-ft)	Lubricated <sup>a</sup> N•m(lb-ft)	Dry <sup>b</sup> N•m(lb-ft)	Lubricated <sup>a</sup> N•m(lb-ft)	Dry <sup>b</sup> N•m(lb-ft)
M6	4.7 (3.5)	6 (4.4)	9 (6.6)	11.5 (8.5)	13 (9.5)	16.5 (12.2)	15.5 (11.5)	19.5 (14.5)
M8	11.5 (8.5)	14.5 (10.7)	22 (16)	28 (20.5)	32 (23.5)	40 (29.5)	37 (27.5)	47 (35)
M10	23 (17)	29 (21)	43 (32)	55 (40)	63 (46)	80 (59)	75 (55)	95 (70)
M12	40 (29.5)	50 (37)	75 (55)	95 (70)	110 (80)	140 (105)	130 (95)	165 (120)
M14	63 (46)	80 (59)	120 (88)	150 (110)	175 (130)	220 (165)	205 (150)	260 (190)
M16	100 (74)	125 (92)	190 (140)	240 (175)	275 (200)	350 (255)	320 (235)	400 (300)
M18	135 (100)	170 (125)	265 (195)	330 (245)	375 (275)	475 (350)	440 (325)	560 (410)
M20	190 (140)	245 (180)	375 (275)	475 (350)	530 (390)	675 (500)	625 (460)	790 (580)
M22	265 (195)	330 (245)	510 (375)	650 (480)	725 (535)	920 (680)	850 (625)	1080 (800)
M24	330 (245)	425 (315)	650 (480)	820 (600)	920 (680)	1150 (850)	1080 (800)	1350 (1000)
M27	490 (360)	625 (460)	950 (700)	1200 (885)	1350 (1000)	1700 (1250)	1580 (1160)	2000 (1475)
M30	660 (490)	850 (625)	1290 (950)	1630 (1200)	1850 (1350)	2300 (1700)	2140 (1580)	2700 (2000)
M33	900 (665)	1150 (850)	1750 (1300)	2200 (1625)	2500 (1850)	3150 (2325)	2900 (2150)	3700 (2730)
M36	1150 (850)	1450 (1075)	2250 (1650)	2850 (2100)	3200 (2350)	4050 (3000)	3750 (2770)	4750 (3500)

<sup>a</sup> "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.

<sup>b</sup> "Dry" means plain or zinc plated without any lubrication.

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

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

Fasteners should be replaced with the same or higher property class. If higher property class fasteners are used, these should only be tightened to the strength of the original.

Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

TORQ2 -UN-07SEP99

# Lubrication and Maintenance Records

## USING LUBRICATION AND MAINTENANCE RECORDS

Refer to specific Lubrication and Maintenance Section for detailed service procedures.

1. Keep a record of the number of hours you operate your engine by regular observation of hour meter.
2. Check your record regularly to learn when your engine needs service.
3. DO ALL the services within an interval section. Write the number of hours (from your service records) and the date in the spaces provided. For a

complete listing of all items to be performed and the service intervals required, refer to the quick-reference chart near the front of the Lubrication and Maintenance Section.

**IMPORTANT:** The service recommendations covered in this manual are for the accessories that are provided by John Deere. Follow manufacturer's service recommendations for servicing engine driven equipment not supplied by Deere.

RG, RG34710, 4100 -19-01JAN96-1/1

## DAILY (PRESTARTING) SERVICE

*NOTE: Refer to DAILY PRESTARTING CHECKS in Engine Operating Guidelines Section for detailed procedures.*

Check engine oil level.

Check (primary) fuel filter/water separator

Check coolant level.

Check air cleaner dust unloader valve and air restriction indicator, if equipped.

Lubricate PTO release bearing, if equipped.

Perform visual walk around inspection.

RG, RG34710, 4101 -19-01JAN96-1/1

## 250 HOUR/6 MONTH SERVICE

Service fire extinguisher.

Lubricate PTO clutch shaft bearings (if equipped).

Change engine oil and filter.<sup>1</sup>

Service battery.

Check PTO clutch adjustment (if equipped).

Check coolant pump weep hole foam filter.

Check engine mounts (generator sets).

Hours									
Date									
Hours									
Date									
Hours									
Date									
Hours									
Date									

<sup>1</sup>If John Deere PLUS-50 oil is used along with a John Deere oil filter, the oil change interval may be extended by 50 percent or to 375 hours.

## 600 HOUR/12 MONTH SERVICE

Lubricate PTO clutch internal levers and linkage (if equipped).

Clean crankcase vent tube.

Check automatic belt tensioner and belt wear.

Check cooling system

Coolant solution analysis - add SCA's as needed.

Check air intake hoses, connections, and system.

Replace primary and final fuel filter elements.

Check engine speeds.

Check crankshaft vibration damper.

Pressure test cooling system.

Hours									
Date									
Hours									
Date									
Hours									
Date									
Hours									
Date									

RG, RG34710, 4104 -19-01JAN96-1/1

## 2000 HOUR/24 MONTH SERVICE

Have your authorized servicing dealer or engine distributor adjust valve clearance.

Flush cooling system.<sup>1</sup>

Hours									
Date									
Hours									
Date									
Hours									
Date									
Hours									
Date									

<sup>1</sup>If John Deere COOL-GARD is used, the flushing interval may be extended to 3000 hours or 36 months. If John Deere COOL-GARD is used and the coolant is tested annually AND additives are replenished by adding supplemental coolant additives (SCA's), the flushing interval may be extended to 5000 hours or 60 months, whichever occurs first.

RG, RG34710, 4105 -19-01JAN96-1/1



**SERVICE AS REQUIRED**

Drain water separator bowl.

Clean fuel strainer (engines 200,000— ).

Add coolant.

Service air cleaner.

Replace fan-alternator belt.

Service PTO clutch (if equipped).

Check fuses.

Bleed fuel system.

Hours									
Date									
Hours									
Date									
Hours									
Date									

RG, RG34710, 4106 –19-01JAN96-1/1

# Emission System Warranty

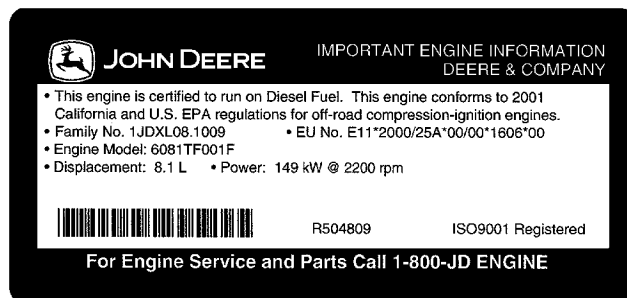
## EMISSIONS CONTROL SYSTEM CERTIFICATION LABEL



**CAUTION:** Statutes providing severe penalties for tampering with emissions controls may apply at the user's location.

The emissions warranty described below applies only to those engines marketed by John Deere that have been certified by the United States Environmental Protection Agency (EPA) and/or California Air Resources Board (CARB); and used in the United States and Canada in non-road mobile (self-propelled or portable/transportable<sup>1</sup>) equipment. The presence of an emissions label like the one shown signifies that the engine has been certified with the EPA and/or CARB. The EPA and CARB warranties only apply to new engines having the certification label affixed to the engine and sold as stated above in the geographic areas. The presence of an EU number in the third line of the label signifies that the engine has been certified with the European Union countries per Directive 97/68/EC. The emissions warranty does not apply to the EU countries.

**NOTE:** The hp/kW rating on the engine emissions certification label specifies the gross engine hp/kW, which is flywheel power without fan. In most applications this will not be the same rating as the advertised vehicle hp/kW rating.



*Emissions Label*

RG11598 -UN-08DEC00

<sup>1</sup>Equipment moved at least once every 12 months.

## **U.S. EMISSIONS CONTROL WARRANTY STATEMENT**

Emissions control-related parts and components are warranted by John Deere for five years or 3000 hours of operation, whichever occurs first. John Deere further warrants that the engine covered by this warranty was designed, built, and equipped so as to conform at the time of sale with all U.S. emissions standards at the time of manufacture, and that it is free of defects in materials and workmanship which would cause it not to meet these standards within the period of five years or 3000 hours of operation, whichever occurs first.

Warranties stated in this manual refer only to emissions-related parts and components of your engine. The complete engine warranty, less emissions-related parts and components, is provided separately as the "John Deere New Off-Highway Engine Warranty".

RG, RG34710, 4108 -19-01JAN96-1/1

# John Deere Service Literature Available

## Technical Information

Technical information is available from John Deere. Some of this information is available in electronic as well as printed form. Order from your John Deere dealer or call **1-800-522-7448**. Please have available the model number, serial number, and name of the product.

Available information includes:

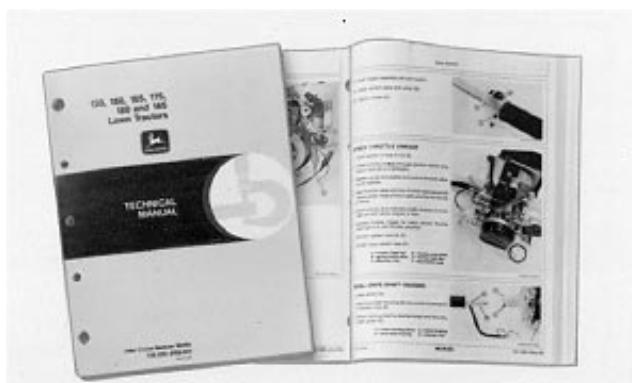
- **PARTS CATALOGS** list service parts available for your machine with exploded view illustrations to help you identify the correct parts. It is also useful in assembling and disassembling.
- **OPERATOR'S MANUALS** providing safety, operating, maintenance, and service information. These manuals and safety signs on your machine may also be available in other languages.
- **OPERATOR'S VIDEO TAPES** showing highlights of safety, operating, maintenance, and service information. These tapes may be available in multiple languages and formats.
- **TECHNICAL MANUALS** outlining service information for your machine. Included are specifications, illustrated assembly and disassembly procedures, hydraulic oil flow diagrams, and wiring diagrams. Some products have separate manuals for repair and diagnostic information. Some components, such as engines, are available in separate component technical manuals
- **FUNDAMENTAL MANUALS** detailing basic information regardless of manufacturer:
  - Agricultural Primer series covers technology in farming and ranching, featuring subjects like computers, the Internet, and precision farming.
  - Farm Business Management series examines "real-world" problems and offers practical solutions in the areas of marketing, financing, equipment selection, and compliance.
  - Fundamentals of Services manuals show you how to repair and maintain off-road equipment.
  - Fundamentals of Machine Operation manuals explain machine capacities and adjustments, how to improve machine performance, and how to eliminate unnecessary field operations.



TS189 -UN-17JAN89



TS191 -UN-02DEC88



TS224 -UN-17JAN89



TS1663 -UN-10OCT97

## PUBLICATIONS FOR THIS ENGINE

Technical information is available from John Deere in support of our products. Some of this information is available in electronic as well as printed form. Order from your John Deere dealer or call **1-800-522-7448**. Please have available the model number and serial number, and name of your John Deere engine.

Title		Order Number
POWERTECH 8.1 L OEM Engines		
Operation and Maintenance Manual (English)		OMRG24828
Parts Catalog—Engines ( —199,999)		PC2527
Parts Catalog—Engines (200,000— )		PC2876
Component Technical Manuals		
	Base Engine	CTM86
	Mechanical Fuel System	CTM243
	Level 3 Electronic Fuel System	CTM134
	Level 9 Electronic Fuel System	CTM255
OEM Engine Accessories		CTM67
Alternators and Starter Motors		CTM77

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TS100 -JUN-23AUG88

RG, RG34710, 4115 -19-01JAN96-1/1

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TS101 -JUN-23AUG88

RG, RG34710, 4116 -19-01JAN96-1/1

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Experience you can count on!



TS102 -JUN-23AUG88

RG, RG34710, 4117 -19-01JAN96-1/1

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Our goal is to provide prompt, efficient care when you want it and where you want it.

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**JOHN DEERE SERVICE SUPERIORITY:** We'll be around when you need us.



TS103 -JUN-23AUG88

RG, RG34710, 4118 -19-01JAN96-1/1





