

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

1996 EPA Certification Levels
(U.S.A.)

OPERATION AND MAINTENANCE MANUAL



Deere Power Systems Group
OMRG24828 (01JAN96)

LITHO IN U.S.A.
ENGLISH



DEERE
POWER

Introduction

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.

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.

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 à votre Concessionnaire ou Point de Service le plus proche pour vous adresser à lui.

Renseignez-vous dès que possible pour l'identifier et le localiser. À la première occasion, prenez contact avec lui et faites-vous connaître. Il sera lui aussi heureux de faire votre connaissance et de savoir que vous pourrez compter sur lui le moment venu.

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.

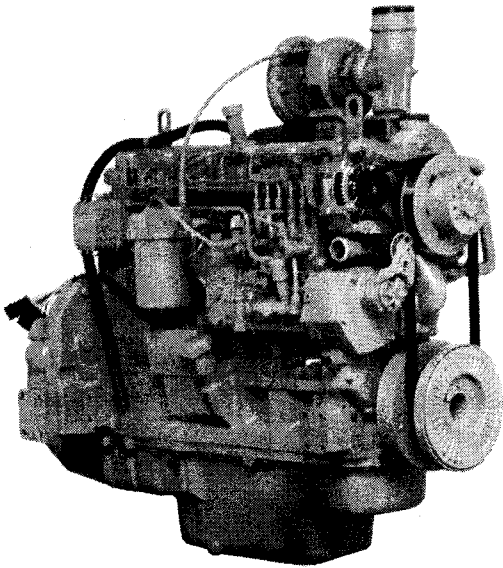
Entérese de quién es, y dónde está situado. Cuando tenga un momento, vaya a visitarlo. A él le gustará conocerlo, y saber cuáles podrían ser sus necesidades.

JOHN DEERE MOTORÄGARE:

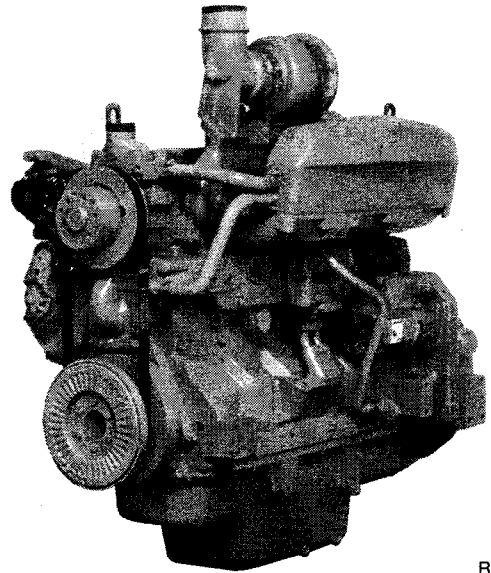
Vänta inte med att besöka Din John Deere återförsäljare till dess att Du behöver service eller garanti reparation.

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.

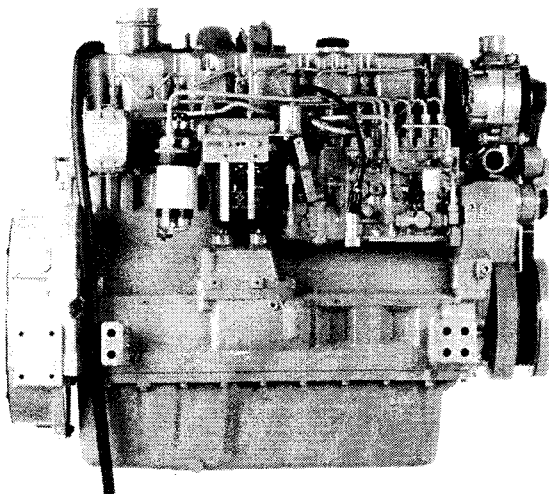
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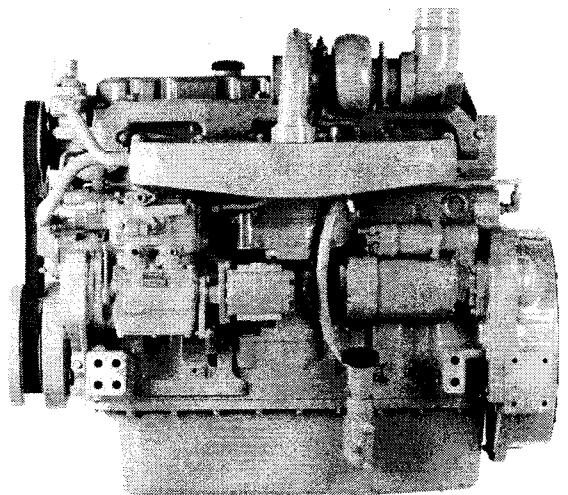
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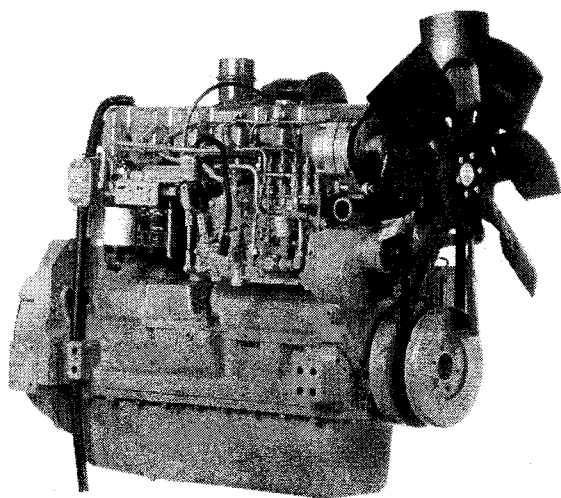


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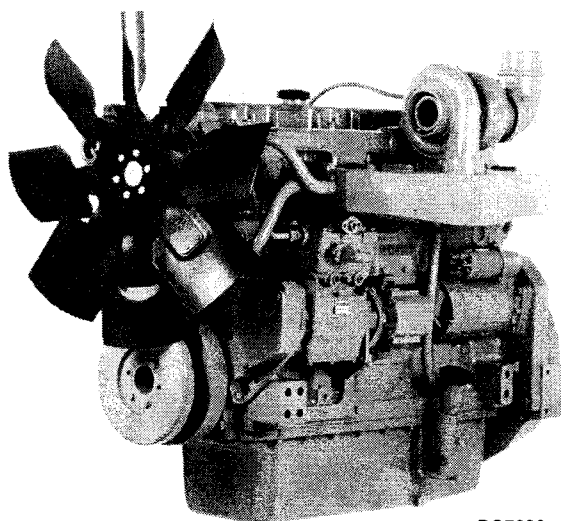


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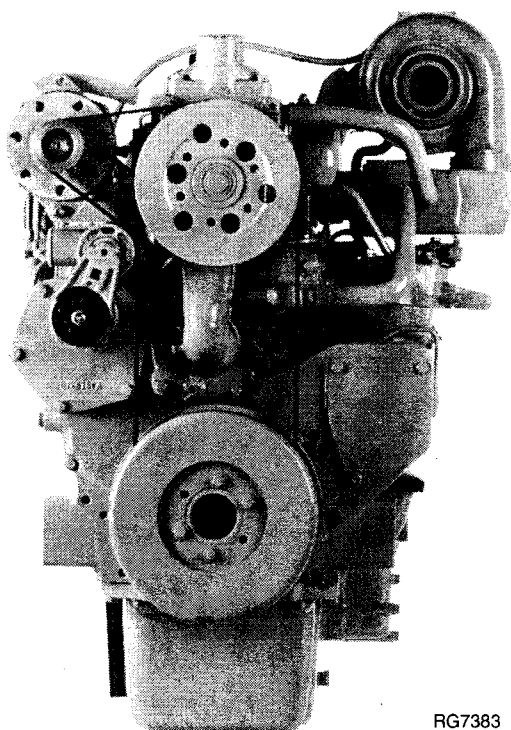
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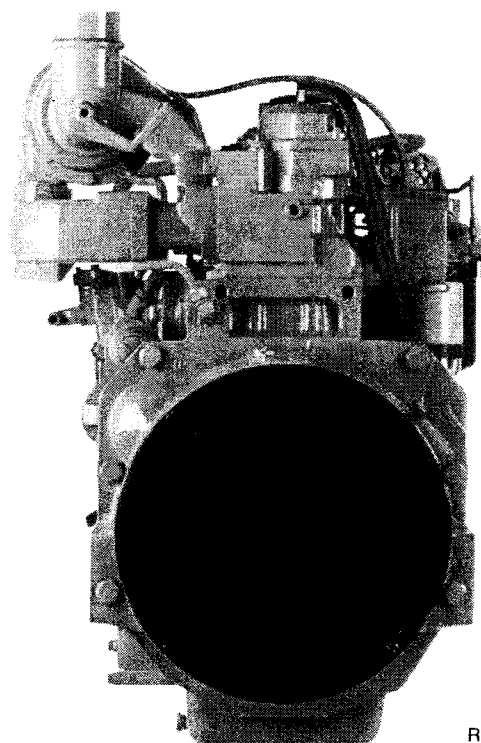
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Contents

	Page		Page
Record Keeping		Lubrication and Maintenance	
Record Engine Serial Number	1	Observe Service Intervals	41
Engine Option Codes	2	Use Correct Fuels, Lubricants, and Coolant	41
Record PTO Serial Number	4	Lubrication & Maintenance Service Interval Chart ..	42
Record Fuel Injection Pump Model Number	4		
Safety	5	Lubrication and Maintenance/Daily	
Fuels, Lubricants, and Coolant		Daily Prestarting Checks	43
Diesel Fuel	15	Lubrication and Maintenance/100 Hour	
Lubricity of Diesel Fuels	15	Servicing Fire Extinguisher	47
Diesel Fuel Storage	16	Lubricating PTO Clutch Shaft Bearings	47
Filling Fuel Tank	16		
Minimizing the Effect of Cold Weather on Diesel Engines	17	Lubrication and Maintenance/250 Hour	
Engine Break-in Oil	18	Servicing Battery	49
Diesel Engine Oil	19	Changing Engine Oil and Replacing Oil Filter	51
Mixing of Lubricants	19	Checking PTO Clutch Adjustment	52
OILSCAN and CoolScan	20	Visually Inspecting Water Pump	53
Alternative and Synthetic Lubricants	20		
Lubricant Storage	20	Lubrication and Maintenance/600 Hour/12 Month	
Grease	21	Lubricating PTO Clutch Internal Levers & Linkage ..	55
Engine Coolant Recommendations	22	Cleaning Crankcase Vent Tube	55
Engine Coolant Specifications	23	Checking Air Intake System	56
Testing Engine Coolant	25	Replacing (Rectangular) Final Fuel Filter Element ..	57
Replenishing Supplemental Coolant Additives (SCA'S) Between Coolant Changes	26	Replacing (Round) Primary Fuel Filter/Water Separator	58
Operating in Tropical Conditions	27	Checking Belt Tensioner Spring Tension and Belt Wear	59
Disposing of Coolant	27	Checking Cooling System	60
Engine Operating Guidelines		Checking Effectiveness of Coolant Solution	61
Instrument (Gauge) Panel	29	Adding Supplemental Coolant Additives (SCAs)	62
Normal Engine Operation	30		
Break-In Service	31	Lubrication and Maintenance/1200 Hour/24 Month	
Auxiliary Gear Drive Limitations	33	Checking and Adjusting Engine Speeds	63
Standby Power Units	33	Checking Crankshaft Vibration Damper	63
Starting the Engine	34	Pressure Test Cooling System and Radiator Cap ..	65
Cold Weather Operation	36	Flushing Cooling System	66
Warming Engine	37		
Changing Engine Speed—Standard (Mechanical) Governor	38	Lubrication and Maintenance/2000 Hour	
Idling Engine	38	Checking and Adjusting Engine Valve Clearance ..	69
Stopping the Engine	39		
Using a Booster Battery or Charger	40		

All information, illustrations, and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

OMRG24828 (01JAN96)

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Page

Service As Required

Additional Service Information	71
Adding Coolant	72
Replacing Air Cleaner Filter Elements	73
Inspecting Primary Filter Element	74
Cleaning Primary Filter Element	75
Washing Primary Filter Element	76
Element Storage	76
Replacing Fan/Alternator V-Belt	77
Power Take-Off (PTO) Clutch	77
Checking Fuses	78
Do Not Modify Fuel System	78
Bleeding The Fuel System	79

Troubleshooting

General Troubleshooting Information	83
Engine Wiring Diagram Legend	84
Engine Wiring Diagram	85
Engine Troubleshooting	86
Electrical Troubleshooting	88

Storage

Engine Storage Guidelines	91
Use AR41785 Engine Storage Kit	91
Preparing Engine for Long-Term Storage	92
Removing Engine from Long-Term Storage	93

Specifications

General OEM Engine Specifications	95
Fuel Injection Pump Specifications	96
Engine Crankcase Oil Fill Quantities	97
Unified Inch Bolt and Cap Screw Torque Values	98
Metric Bolt and Cap Screw Torque Values	99

Lubrication and Maintenance Records 101

Emission System Warranty 105

Service Literature 109

Order Form 110

Index

Record Keeping

RECORD ENGINE SERIAL NUMBER

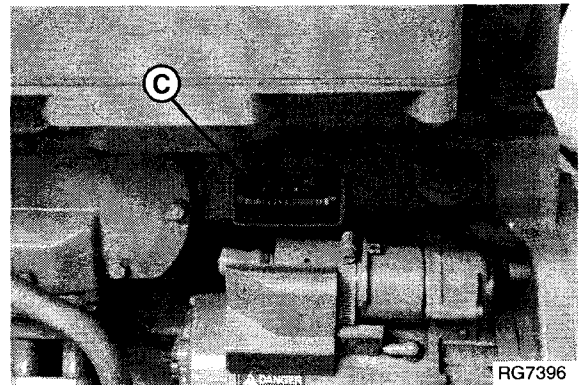
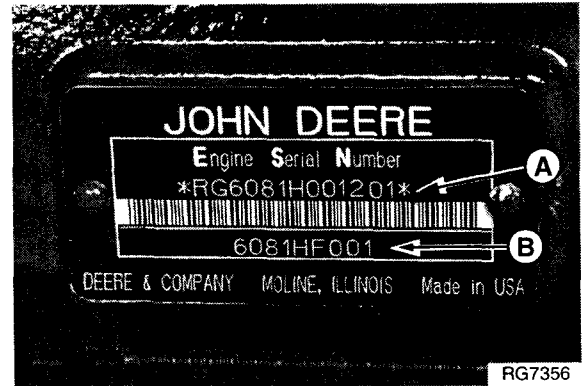
The engine serial number plate (C) is located on the left-hand side of engine block between intake manifold and starting motor.

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)

Application Data or Type(B)



RG7355

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

ENGINE OPTION CODES—CONTINUED

Option Codes	Description	Option Codes	Description
11 _____	Rocker Arm Cover	40 _____	Dipstick
13 _____	Crankshaft Pulley	44 _____	Electronic Speed Sensor
14 _____	Flywheel Housing	46 _____	Cylinder Block
15 _____	Flywheel	52 _____	Gear-driven Auxiliary Drive
16 _____	Fuel Injection Pump	55 _____	Transport Skid/Shipping Stand
17 _____	Air Intake Manifold	56 _____	Paint Option
19 _____	Oil Pan	57 _____	Water Pump Inlet
21 _____	Thermostat Cover	62 _____	Alternator Mounting
23 _____	Fan Drive	64 _____	Exhaust Elbow
24 _____	Fan Belt	65 _____	Turbocharger
26 _____	Engine Coolant Heater	74 _____	A/C Compressor Mounting
28 _____	Exhaust Manifold	78 _____	Air Compressor
30 _____	Starting Motor	91 _____	Special Equipment (Factory Installed)
31 _____	Alternator	97 _____	Special Equipment (Field Installed)
32 _____	Instrument Panel	98 _____	Shipping
35 _____	Fuel Filter		
39 _____	Thermostat Housing		

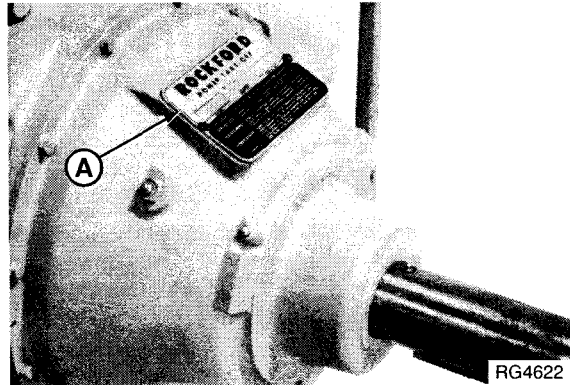
NOTE: These option codes are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

RECORD PTO SERIAL NUMBER

Serial number and model number are located on cover plate (A) of PTO housing. Record the numbers in the following spaces:

Serial Number

Model Number



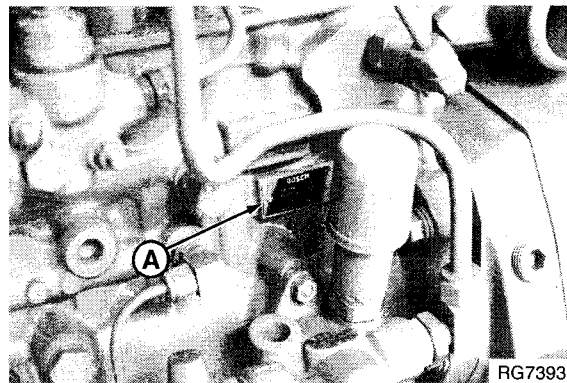
RECORD FUEL INJECTION PUMP MODEL NUMBER

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

Model No. _____ RPM _____

Manufacturer's No. _____

Serial No. _____



Safety

RECOGNIZE SAFETY INFORMATION

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

Follow recommended precautions and safe operating practices.



T81389

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.

 **DANGER**

 **WARNING**

 **CAUTION**

TS187



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.



TS201

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.



RG5419



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.



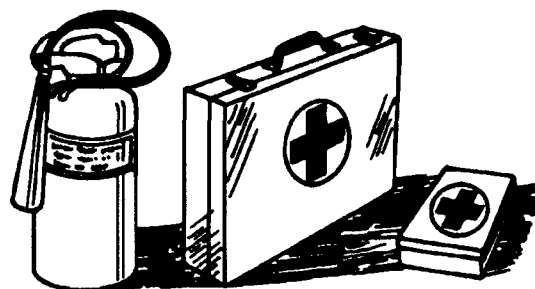
TS202

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

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



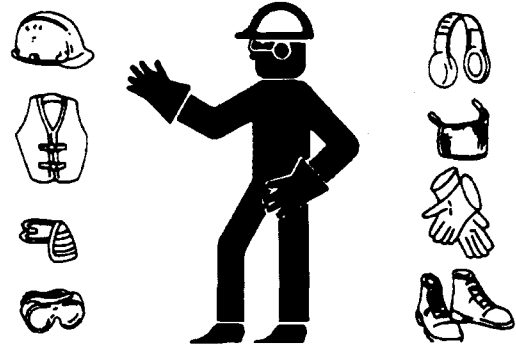
WEAR PROTECTIVE CLOTHING

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

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



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

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



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.

Disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

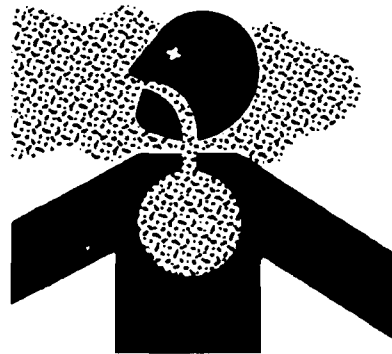


TS218

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



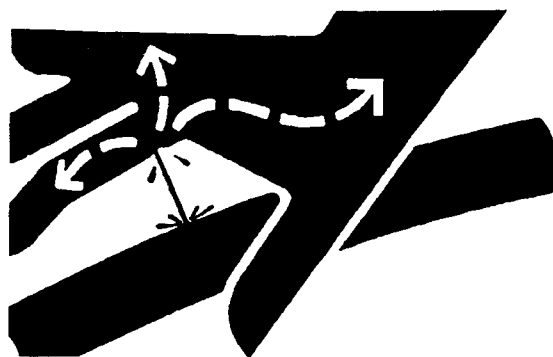
AVOID HIGH-PRESSURE FLUIDS

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

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



REMOVE PAINT BEFORE WELDING OR HEATING

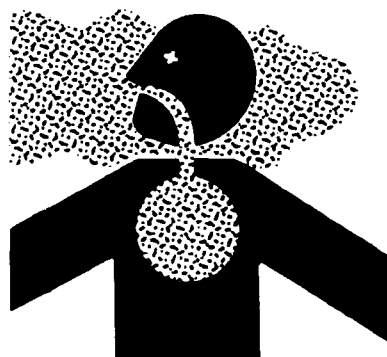
Avoid potentially toxic fumes and dust.

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

Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or 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.

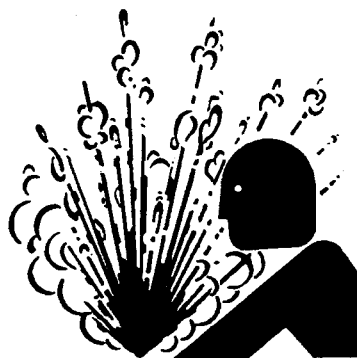


TS220

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



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.



TS220

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.

DISPOSE OF WASTE PROPERLY

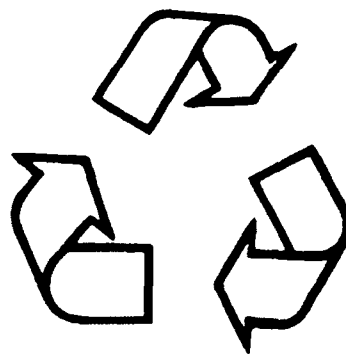
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

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

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 must meet the following properties:

- **Cetane Number 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.

- **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% is used, reduce the service interval for engine oil and filter changes by 50%.
- DO NOT use diesel fuel with sulfur content greater than 1.0%.

Bio-diesel fuels meeting DIN 51606 or equivalent specification may be used.

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 now require sulfur content less than 0.05%. Diesel fuel in the European Union will require sulfur content less than 0.05% by 1 October 1996.

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 injector 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 3300 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. Diesel fuels meeting U.S. Military Specification VV—F—800E pass a fuel lubricity test.

If fuel of low or unknown lubricity is used, add John Deere ALL-SEASON DIESEL FUEL CONDITIONER or equivalent at the specified concentration.

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 TY22030 All Season Diesel Fuel Conditioner or equivalent to stabilize the fuel and prevent water condensation. TY22030 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.

FILLING FUEL TANK



CAUTION: Handle fuel carefully. Never fill tank while engine is hot or running.

DO NOT smoke while filling fuel tank or servicing fuel system.

IMPORTANT: The fuel tank is vented through filler cap. If a new filler cap is required, always replace it with an original vented cap.

Fill fuel tank at the end of each day's operation to prevent condensation in tank as moist air cools and freezing during cold weather.



TS202

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 before temperature drops to 0° C (32° F). For best results, use with untreated fuel. Follow all recommended instructions on label.

Use John Deere TY22030 All Season Diesel Fuel Conditioner or equivalent to treat Grade No. 2-D fuel if No. 1-D is not readily available during the cold weather season.

NOTE: John Deere TY22030 Diesel Fuel Conditioner can also be used to treat No. 1-D fuel.

John Deere TY22030 Diesel Fuel Conditioner will:

- Reduce the formation of wax to improve fuel flow through filters by reducing fuel jelling.
- Lower the pour point of untreated fuel from 5° C (40° F) to less than -40° C (-40° F) allowing the burning of Grade No. 2-D fuel year-round which provides more BTU per gallon than No. 1-D fuel and reduces fuel costs.

Coolant Heaters

Engine block heaters (coolant) are an available option to aid 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).

MINIMIZING THE EFFECT OF COLD WEATHER ON DIESEL ENGINES—CONTINUED

Winterfronts

Use of fabric, cardboard, or solid winterfronts is not recommended with any John Deere engine. Their use can result in excessive engine coolant, oil, and charge air temperatures. This can lead to reduced engine life, loss of power and poor fuel economy. Winterfronts may also put abnormal stress on fan and fan drive components potentially causing premature failures.

If winterfronts are used, they should never totally close off the grill frontal area. Approximately 25% area in the center of the grill should remain open at all times. At no time should the air blockage device be applied directly to the radiator core.

Radiator Shutters

If equipped with a thermostatically controlled radiator shutter system, this system should be regulated in such a way that the shutters are completely open by the time the coolant reaches 93° C (200° F) to prevent excessive intake manifold temperatures. Manually controlled systems are not recommended.

If air-to-air aftercooling is used, the shutters must be completely open by the time the intake manifold air temperature reaches the maximum allowable temperature out of the charge air cooler.

For more information, see your local John Deere dealer.

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
- CCMC Specification D4

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

IMPORTANT: Do not use John Deere PLUS-50 oil or engine oils meeting API CG4, API CF4, or CCMC D5 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.

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™

If John Deere PLUS-50 engine oil and a John Deere oil filter are used, the service interval for oil and filter changes may be extended by 50 hours.

The following oil is also recommended:

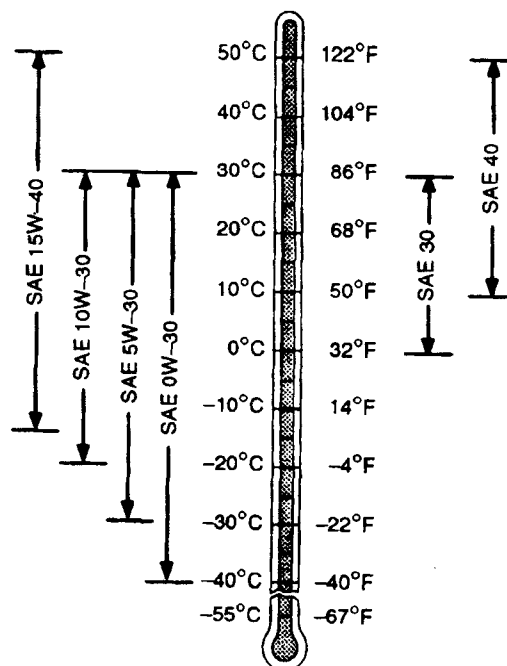
- John Deere TORQ-GARD SUPREME®

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

- John Deere UNI-GARD™
- API Service Classification CG-4
- API Service Classification CF-4
- API Service Classification CE
- CCMC Specification D5 and Mercedes Benz MB228.3
- CCMC Specification D4 and Mercedes Benz MB228.1

Viscosity grade SAE 15W-40 is preferred.

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



TS1619

MIXING OF LUBRICANTS

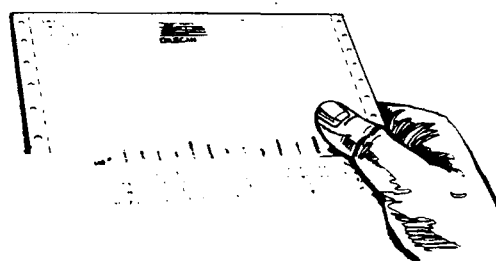
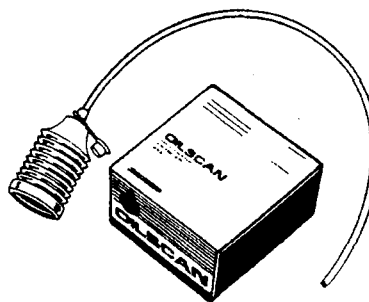
In general, avoid mixing different brands or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements. Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

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.



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ALTERNATIVE AND SYNTHETIC LUBRICANTS

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

LUBRICANT STORAGE

Your equipment can operate at top efficiency only if 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.

GREASE

Use grease based on the expected air temperature range during the service interval.

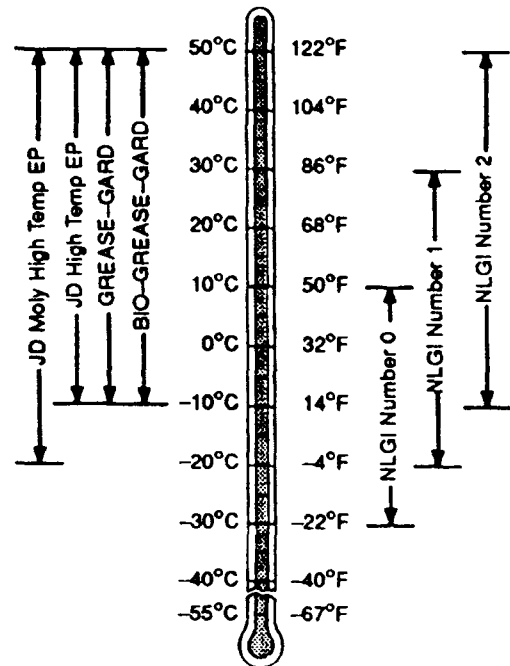
The following greases are preferred:

- John Deere MOLY HIGH TEMPERATURE EP GREASE
- John Deere HIGH TEMPERATURE EP GREASE
- John Deere GREASE-GARD™

Other greases may be used if they meet one of the following:

- SAE Multipurpose EP Grease with a maximum of 5% molybdenum disulfide
- SAE Multipurpose EP Grease

Greases meeting Military Specification MIL-G-10924F may be used as arctic grease.



TS1622

ENGINE COOLANT RECOMMENDATIONS

Solutions of antifreeze and supplemental coolant additives **MUST** be used year-round for freeze protection, boil-over protection, and to provide a stable, noncorrosive environment for seals, hoses and metal engine parts.

The following engine coolant is preferred for service:

- John Deere Prediluted Antifreeze/Summer Coolant
- John Deere COOL-GARD™, where available

The following engine coolant is also recommended:

- John Deere Antifreeze/Summer Coolant Concentrate in a 40 to 60 percent mixture of concentrate and quality water

• JOHN DEERE PREDILUTED ANTIFREEZE/SUMMER COOLANT

This product contains all the necessary ingredients that make up the proper coolant solution: chemically pure water, ethylene glycol (low silicate antifreeze), and supplemental coolant additives (SCA's). It is ready to use; no mixing is required.

John Deere Prediluted Antifreeze/Summer Coolant permits extended service life to 3000 hours or 36 months of operation.

• JOHN DEERE COOL-GARD™

In certain geographical areas, John Deere COOL-GARD is marketed for use in the engine cooling system. This product contains all the necessary ingredients that make up the proper coolant solution: chemically pure water, ethylene glycol (low silicate antifreeze), and supplemental coolant additives (SCA's). It is ready to add to cooling system as is; no mixing or supplemental coolant additives required. Contact your John Deere Parts Network for local availability.

John Deere COOL-GARD has a service life of 2000 hours or 24 months of operation.

• JOHN DEERE ANTIFREEZE/SUMMER COOLANT CONCENTRATE

This product contains ethylene glycol (low silicate antifreeze) and supplemental coolant additives (SCA's). It must be mixed with quality water, as described later in this section, before adding to the engine cooling system. The proportion of water to be used depends upon the lowest freeze protection temperature desired according to the following table:

% CONCENTRATE	FREEZE PROTECTION LIMIT
40	-24° C (-12° F)
50	-37° C (-34° F)
60	-52° C (-62° F)

John Deere Antifreeze/Summer Coolant Concentrate has a service life of 2000 hours or 24 months of operation.

ENGINE COOLANT SPECIFICATIONS

Contact your authorized servicing dealer or engine distributor to determine what the cooling system of this engine is filled with and the winter freeze protection level.

Coolant solutions of quality water, ethylene glycol concentrate (antifreeze), and supplemental coolant additives (SCA's) MUST be used year-round to protect against freezing, boil-over, liner erosion or pitting, and to provide a stable, noncorrosive environment for seals, hoses, and metal engine parts.

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. Mineral (hard/tap) water should NEVER be put in a cooling system unless first tested. All water used in the cooling system should meet the following minimum specifications for quality:

Water Quality Specifications

Item	Parts Per Million	Grains Per U.S. Gallon
Chlorides (maximum)	40	2.5
Sulfates (maximum)	100	5.9
Total Dissolved Solids (maximum)	340	20
Total Hardness (maximum)	170	10
pH Level	5.5—9.0	

Ethylene Glycol Concentrate (Antifreeze):

IMPORTANT: DO NOT use ethylene glycol concentrate containing sealer or stop-leak additives.

The use of John Deere coolant products, as outlined on the previous page, is **strongly recommended**.

If John Deere coolant products are not used, other low silicate ethylene glycol base coolants for heavy-duty diesel engines may be used when mixed with quality water and supplemental coolant additives (SCA's), 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 addition of supplemental coolant additives (SCA's), formulated for heavy-duty diesel engines, for protection against corrosion and cylinder liner erosion and pitting.

IMPORTANT: 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.

ENGINE COOLANT SPECIFICATIONS—CONTINUED

Supplemental Coolant Additives (SCA's):

IMPORTANT: DO NOT over-inhibit antifreeze solutions, as this can cause silicate-dropout. When this happens, a gel-type deposit is created which retards heat transfer and coolant flow causing engine to overheat.

NOTE: John Deere Prediluted Antifreeze/Summer Coolant, John Deere Antifreeze/Summer Coolant Concentrate, and John Deere COOL-GARD contain supplemental coolant additives (SCA's). However, as the coolant solution loses its effectiveness, additives will need to be added.

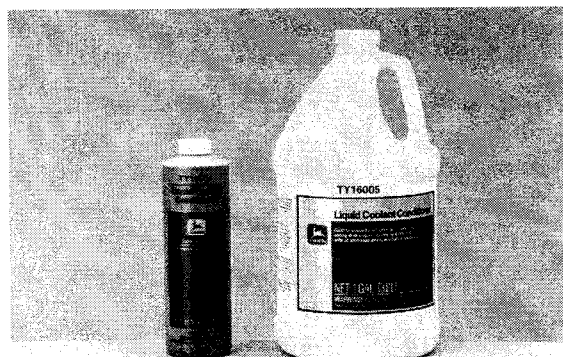
Operating without proper coolant additive will result in increased corrosion, cylinder liner erosion and pitting, and other damage to the engine and cooling system. A simple mixture of ethylene glycol and water WILL NOT give adequate protection. However, the use of supplemental coolant additives will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

Inhibit the antifreeze-coolant mix with a non-chromate inhibitor. John Deere Liquid Coolant Conditioner is recommended as a supplemental coolant additive in John Deere engines.

IMPORTANT: Check inhibitors between drain intervals every 600 hours or 12 months of operation. Replenish inhibitors by the addition of a supplemental coolant additive as necessary.

DO NOT use soluble oil.

Additives eventually lose their effectiveness and must be recharged with additional supplemental coolant additives available in the form of liquid coolant conditioner. See TESTING ENGINE COOLANT and REPLENISHING SUPPLEMENTAL COOLANT ADDITIVES (SCA'S) BETWEEN COOLANT CHANGES, as described later in this section.



RG7276

John Deere Liquid Coolant Conditioner

TESTING 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 600 hours or 12 month intervals to ensure the necessary protection.

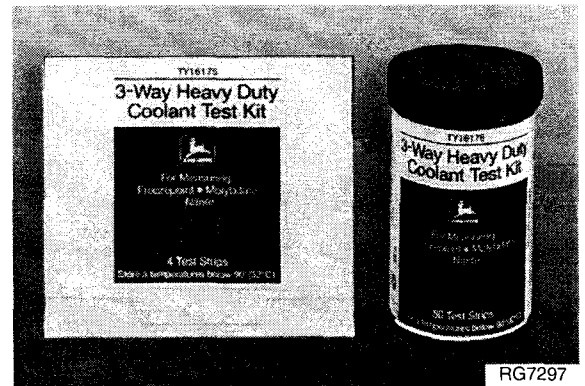
Coolant Test Strips

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.

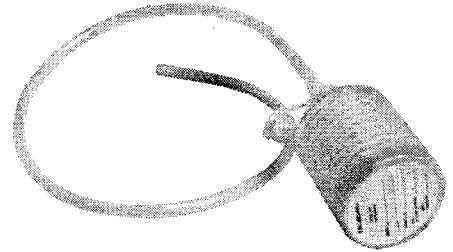
Compare the results to the supplemental coolant additive (SCA) chart to determine the amount of inhibiting additives in your coolant and whether more John Deere Liquid Coolant Conditioner should be added.

Cool-Scan

For a more thorough evaluation of your coolant, perform a Cool-Scan analysis, where available. See your John Deere engine distributor or servicing dealer for information about Cool-Scan.

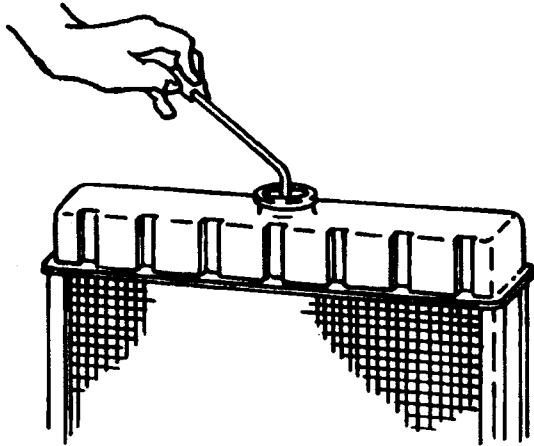


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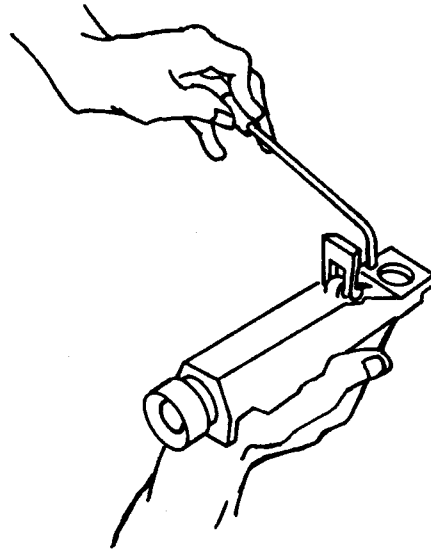


RG7397

REPLENISHING SUPPLEMENTAL COOLANT ADDITIVES (SCA'S) BETWEEN COOLANT CHANGES



RG6261



RG6262

Through time and use, original additives eventually lose their effectiveness and must be recharged with additional supplemental coolant additives available in the form of liquid coolant conditioner. Add the manufacturer's recommended concentration of supplemental coolant additive. **DO NOT** add more than the recommended amount.

Maintaining the correct coolant conditioner concentration (SCA's) 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.

Test the coolant solution at 600 hours or 12 months of operation using either John Deere coolant test strips or a Cool-Scan analysis. If a CoolScan analysis is not available, recharge system per instructions printed on label of John Deere Liquid Coolant Conditioner. **ALWAYS** follow the manufacturer's recommendations printed on the container label.

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

If frequent coolant makeup is required, the glycol concentration should be checked with JT05460 Refractometer to assure that the desired freeze point is maintained. Follow manufacturer's instructions provided with refractometer.

See **ENGINE COOLANT SPECIFICATIONS** earlier in this section for proper mixing of coolant ingredients before adding to the cooling system.

OPERATING IN TROPICAL CONDITIONS

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

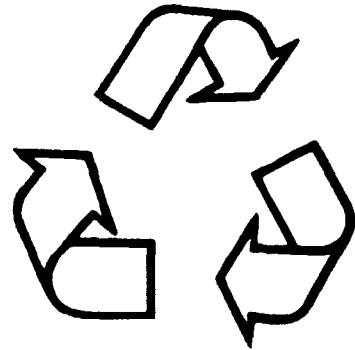
DISPOSING OF COOLANT

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 dealer.



TS1133

Engine Operating Guidelines

INSTRUMENT (GAUGE) PANEL

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.

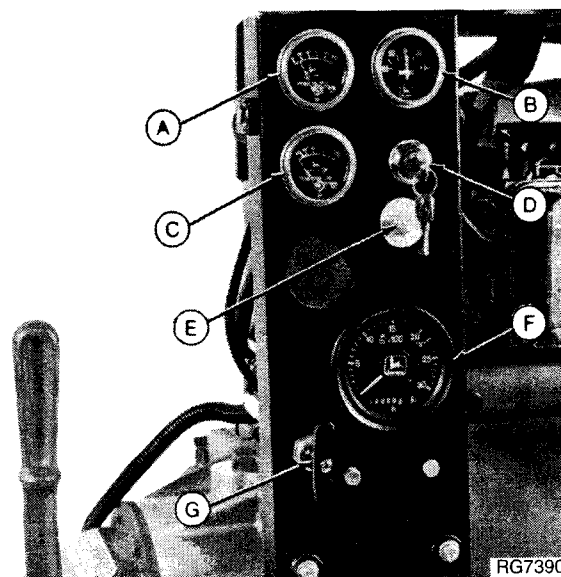
D—Key Switch - The four position key switch controls the electrical system.

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.

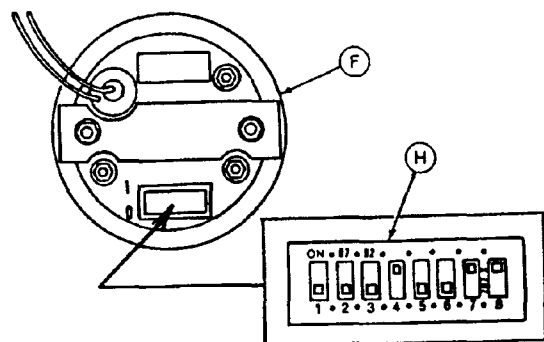
F—Tachometer with Electric Hour Meter - Tachometer senses engine speed from a speed sensor in front timing gear cover and indicates engine speed in revolutions per minute (rpm). Hour meter indicates the operating hours of the engine while key switch is in the "ON" position. The hour meter should be used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

G—Hand Throttle - Controls engine speed.

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



RG7390



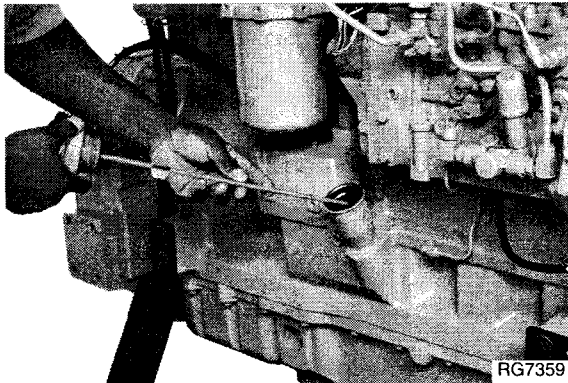
RG6861

- A—Oil Pressure Gauge
- B—Ammeter
- C—Coolant Temperature Gauge
- D—Key Switch
- E—Reset (Safety) Switch
- F—Tachometer with Hour Meter
- G—Hand Throttle
- H—Tachometer Binary Code

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 112° C (234° F), reduce load on engine. Unless temperature drops quickly, stop engine and determine cause before resuming operation.
- 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

BREAK-IN SERVICE



The engine is ready for normal operation, however, thorough break-in during the first 100 hours will result in a 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. John Deere Engine Break-In Oil (TY22041) should be used to make up any oil consumed during the break-in period.



IMPORTANT: DO NOT use PLUS-50™ Engine Oil during break-in period of a new engine or engine that has had a major overhaul. PLUS-50 oil will not allow a new or overhauled engine to properly wear during this break-in period.

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.

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.

ENGINE SPECIFICATIONS*

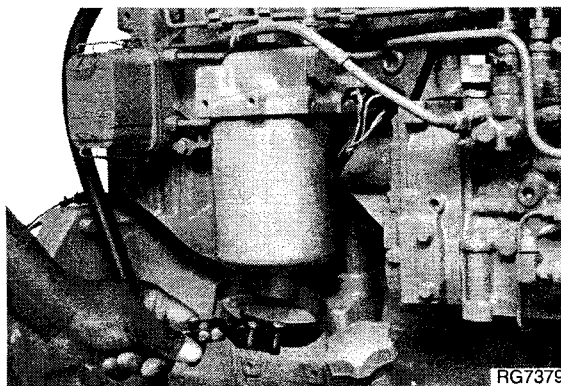
Oil Pressure at Rated Full Load Speed $380 \pm 103\text{kPa}$
($3.80 \pm 1.03\text{ bar}$) ($55 \pm 15\text{ psi}$)

Coolant Temperature Range $82^\circ - 94^\circ\text{ C}$ ($180^\circ - 202^\circ\text{ F}$)

* At normal operating temperature of 115°C (240°F) sump.

BREAK-IN SERVICE—CONTINUED

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.
6. After the first 100 hours maximum, change engine oil and replace engine oil filter (A). (See CHANGE ENGINE OIL AND REPLACE 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.)



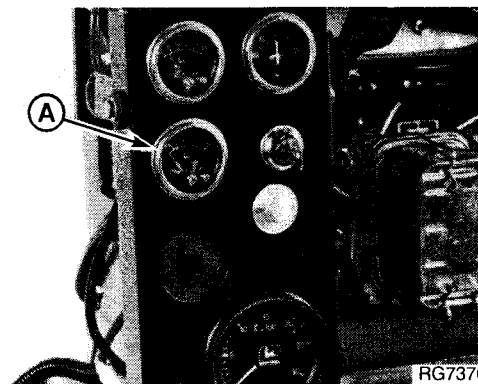
NOTE: Some increase in oil consumption may be expected when low viscosity oils are used. Check oil levels more frequently.

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

7. Watch coolant temperatures (A) closely. If coolant temperature rises above 112° C (234° 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 115° C (239° F), the engine will shutdown automatically, if equipped with recommended safety controls.

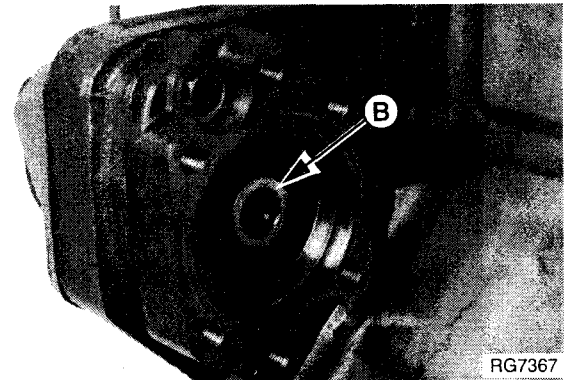
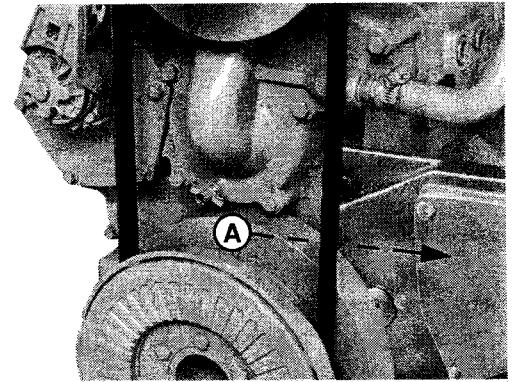
8. Check v-belt for proper alignment and seating in pulley grooves.



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)



RG7367

STANDBY POWER UNITS

To assure that your engine will deliver efficient standby 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 extended period of time with no load.

STARTING THE ENGINE

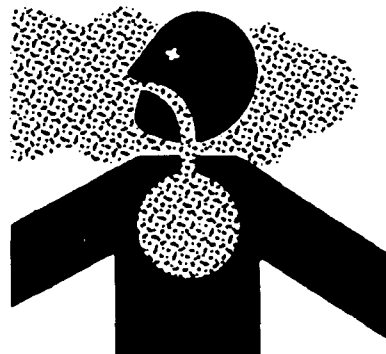
The following instructions apply to the optional controls and instruments available through the John Deere Parts Distribution Network. The controls and instruments for your engine may be different from those shown here; always follow manufacturer's instructions.



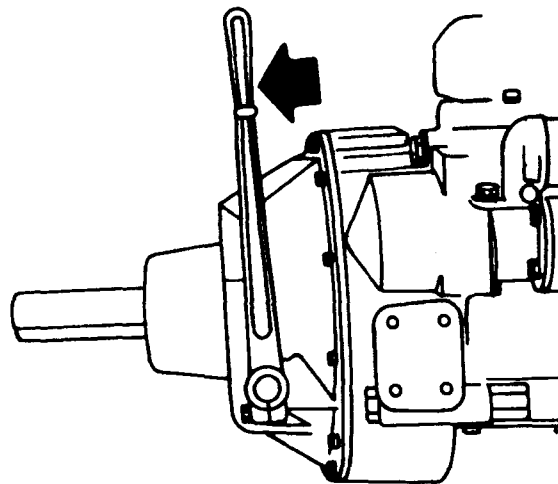
CAUTION: Before starting engine in a confined building, install proper outlet exhaust ventilation equipment. Always use safety approved fuel storage and piping.

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).

1. Perform all prestarting checks outlined in Daily Prestarting Checks, earlier in this section.
2. Open the fuel supply shut-off valve, if equipped.
3. If equipped with PTO clutch, pull lever (arrow) rearward (away from engine) to disengage PTO clutch.



TS220



RG5602

STARTING THE ENGINE—CONTINUED

NOTE: Some electronically controlled governor applications may be equipped with a rotary speed potentiometer on instrument panel.

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.
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.

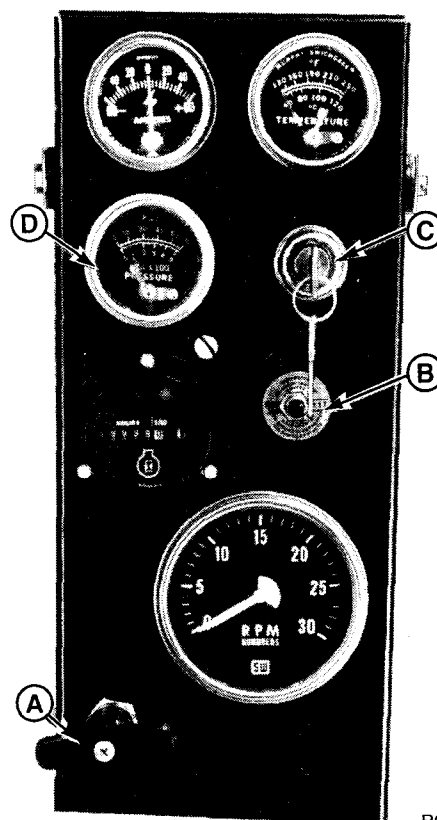
6. Turn the key switch (C) clockwise to crank the engine. When the engine starts, release the key so that it returns to the "ON" position.

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.

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.



RG4695

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

COLD WEATHER OPERATION

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



CAUTION: 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.



TS1356

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.

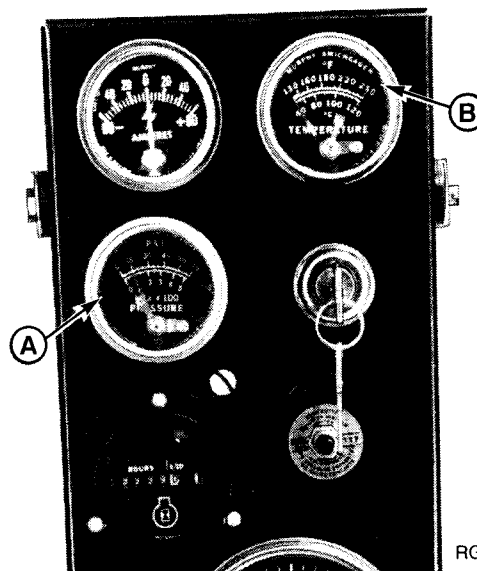
Engines used in generator set applications where the governor is locked at a specified speed may not have a slow idle function. Operate these engines at high idle for 1 to 2 minutes before applying the load. This procedure does not apply to standby generator sets where the engine is loaded immediately 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 380 ± 103 kPa (3.80 bar $\pm$ 1.03 bar) (55 $\pm$ 15 psi) at rated full load speed (1800–2500 rpm) with oil at normal operating temperature of 105° C (220° 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°–94° C (180°–202° F).

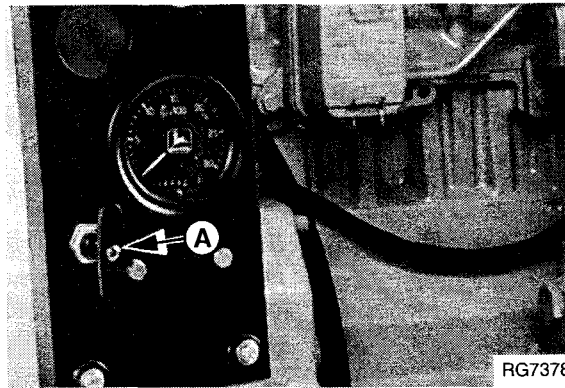
NOTE: It is a good practice to operate the engine under a lighter load and at lower speeds than normal for the first few minutes after start-up.



RG4696

CHANGING ENGINE SPEED—STANDARD (MECHANICAL) GOVERNOR

To increase engine speed, turn 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.



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).

STOPPING THE ENGINE

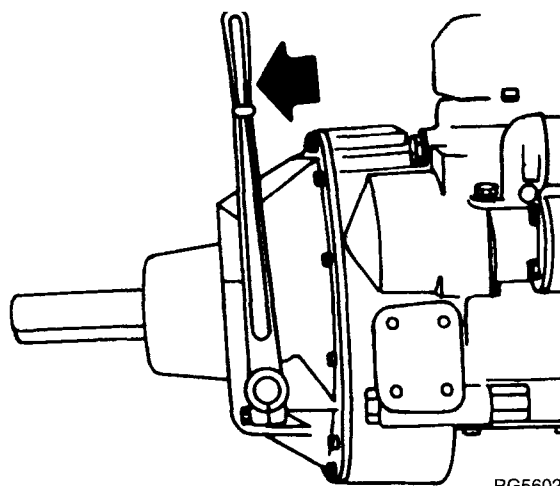
1. Pull PTO clutch lever (arrow) rearward (away from engine) to disengage clutch, if equipped.
2. Move the throttle lever (A) to slow idle on standard (mechanical) governor engines.

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.

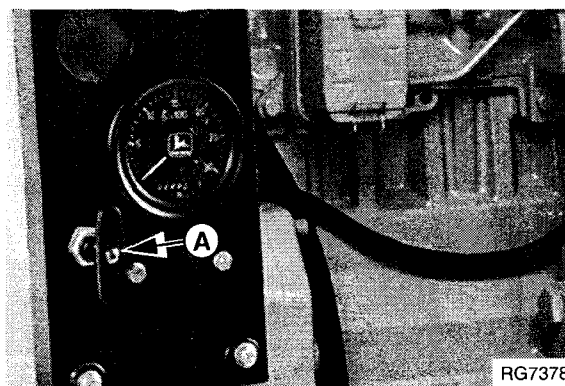
Engines in generator set applications, where the governor is locked at a specified speed and no slow idle function is available, run engine for at least 2 minutes at fast idle and no load.

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

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



RG5602



RG7378

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.



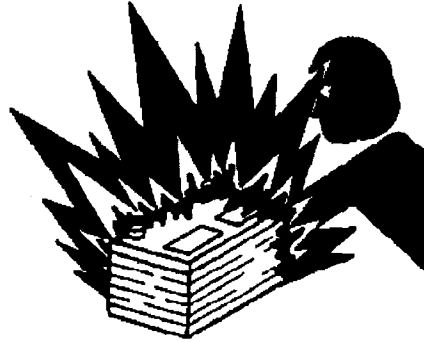
CAUTION: Gas given off by battery is explosive. Keep sparks and flames away from battery. Before connecting or disconnecting a battery charger, turn charger off. Make last connection and first disconnection at a point away from battery. Always connect **NEGATIVE (-)** cable last and disconnect this cable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

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.

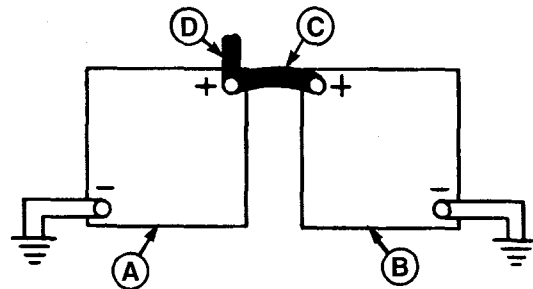
1. Connect booster battery or batteries to produce the required system voltage for your engine application.

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

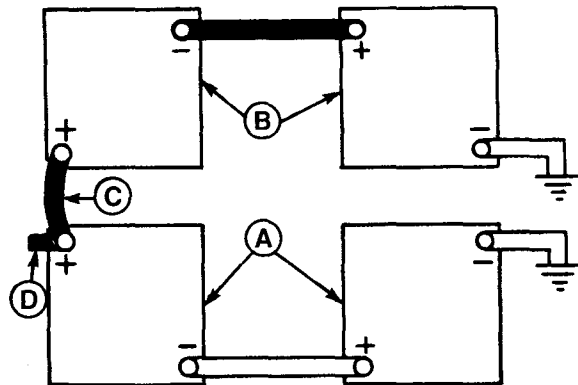


TS204



RG4678

12-Volt System



RG4698

24-Volt System

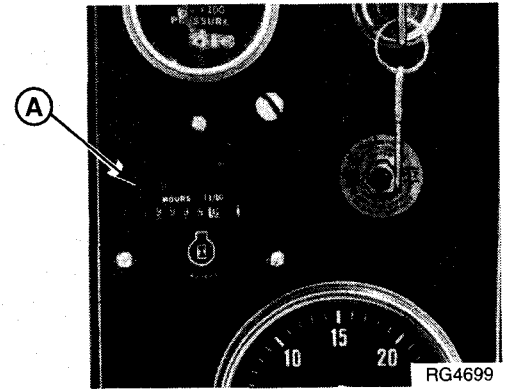
A—12-Volt Machine Battery (ies)
B—12-Volt Booster Battery (ies)
C—Booster Cable
D—Cable to Starting Motor

Lubrication and Maintenance

OBSERVE SERVICE INTERVALS

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.

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.



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.



LUBRICATION AND MAINTENANCE SERVICE INTERVAL CHART

Item	Lubrication and Maintenance Service Intervals					
	Daily	100 Hour	250 Hour	600 Hour/ 12 Month	1200 Hour/ 24 Month	2000 Hour
Check Engine Oil and Coolant Level	•					
Check Air Cleaner Dust Valve & Restriction Indicator*	•					
Check Fuel Filter/Water Separator Bowl	•					
Visual Walk Around Inspection	•					
Lubricate PTO Release Bearing	•					
Service Fire Extinguisher		•				
Lubricate PTO Clutch Shaft Bearing		•				
Service Battery			•			
Change Engine Oil and Replace Filter **			•			
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 Primary and Final Fuel Filter Elements				•		
Check Automatic Belt Tensioner and Belt Wear				•		
Coolant Solution Analysis-Add SCA's as needed				•		
Check Cooling System				•		
Check Crankshaft Vibration Damper					•	
Pressure Test Cooling System					•	
Flush Cooling System ***					•	
Check and Adjust Engine Valve Clearance						•

* Replace primary air cleaner element when restriction indicator shows a vacuum of 625 mm (25 in.) H₂O.

** Change the oil for the first time after 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 change interval may be extended by 50 hours.

*** If John Deere Antifreeze/Summer Coolant Concentrate or John Deere COOL-GARD is used, the flushing interval may be extended to 2000 hours. If John Deere Prediluted Antifreeze/Summer Coolant is used, the flushing interval may be extended to 3000 hours or 36 months, whichever occurs first.

Lubrication & Maintenance/Daily

DAILY PRESTARTING CHECKS

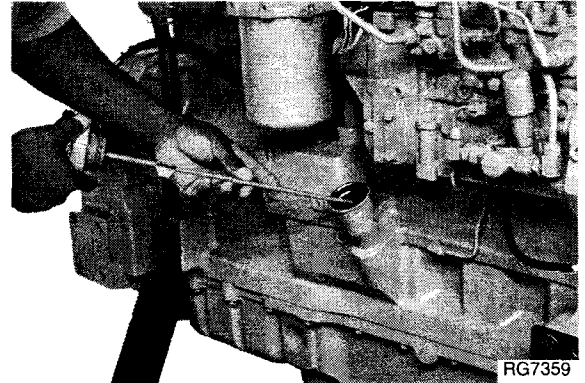
Do the following BEFORE STARTING THE ENGINE for the first time each day:

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.)

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

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



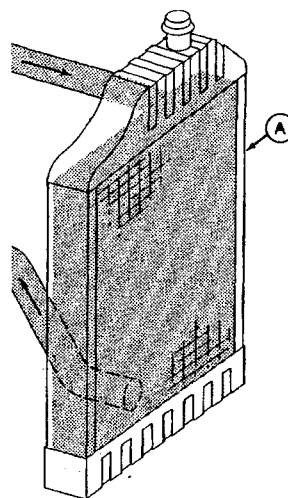


CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

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.

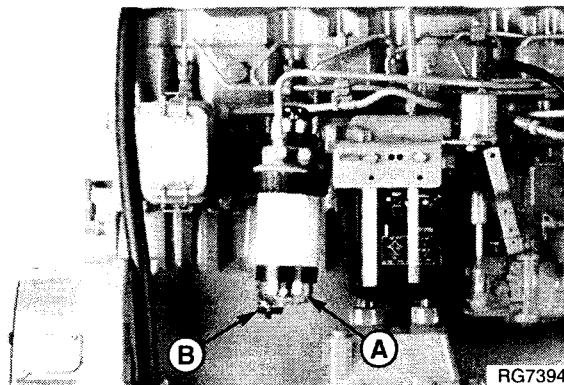
Refer to your vehicle's operator's manual for recommendations for non-John Deere supplied accessories.



RG4675

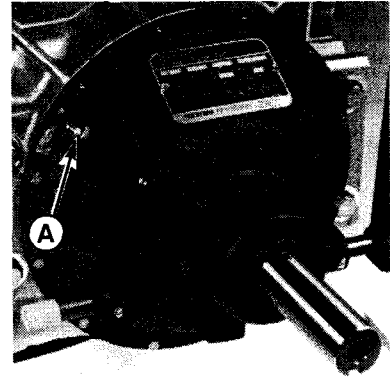
3. Check the glass sediment bowl (A) of the primary fuel filter/water separator for water or debris.

Loosen thumb screw (B) and drain water and debris from bowl as needed.



RG7394

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

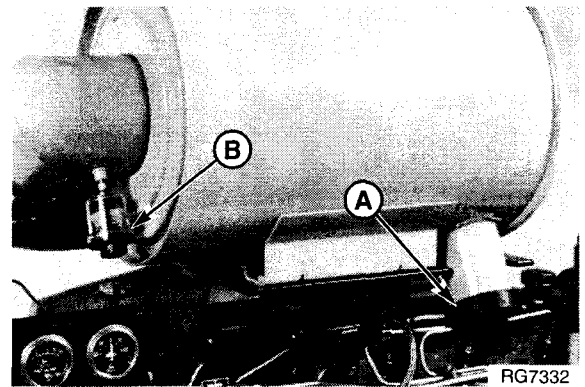


RG7331

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. H₂O). A clogged air cleaner element will cause excessive intake restriction and a reduced air supply to the engine.



RG7332

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.
- Water pump for coolant leaks.

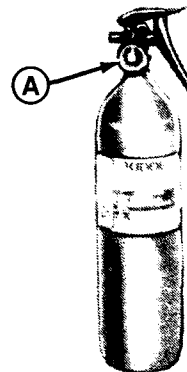
NOTE: It is normal for a small amount of leakage to occur as the engine cools down and parts contract. Excessive coolant leakage may indicate the need to replace the water pump seal. Contact your engine distributor or servicing dealer for repairs.

Lubrication and Maintenance/100 Hour

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.

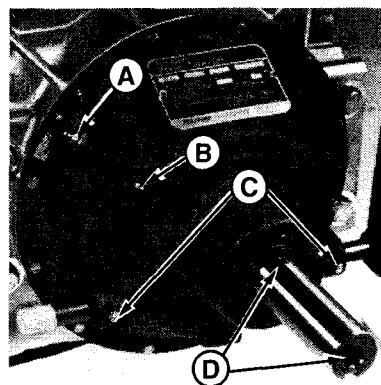


RW4918

LUBRICATING PTO CLUTCH SHAFT BEARINGS

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.



RG7331

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

Lubrication and Maintenance/250 Hour

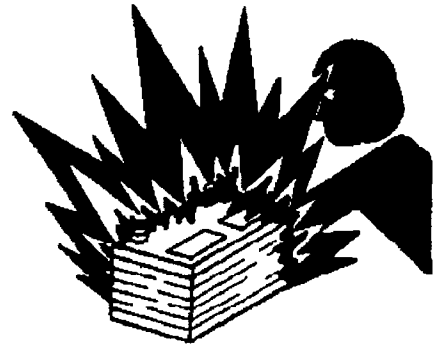
SERVICING BATTERY



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.



TS204

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.



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 10–15 minutes. Get medical attention immediately.

If acid is swallowed:

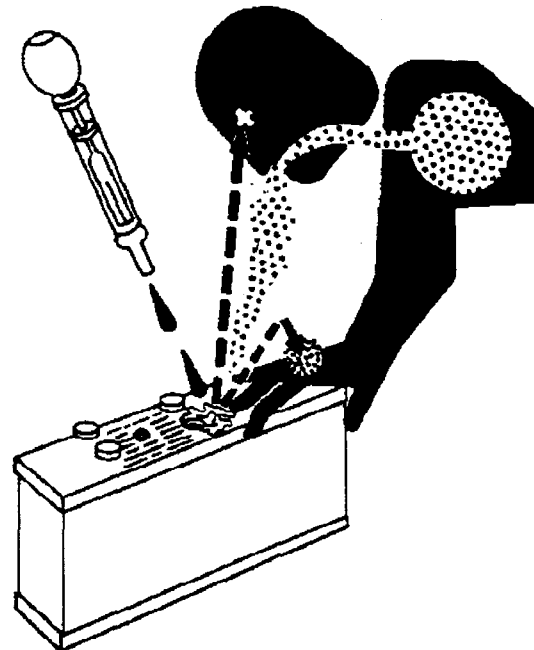
1. Drink large amounts of water or milk.
2. Then drink milk of magnesia, beaten eggs, or vegetable oil.
3. Get medical attention immediately.

In freezing weather, run engine at least 30 minutes to assure thorough mixing after adding water to battery.

If necessary to replace battery(ies), replacements must meet or exceed the following recommended capabilities at -18° C (0° F):

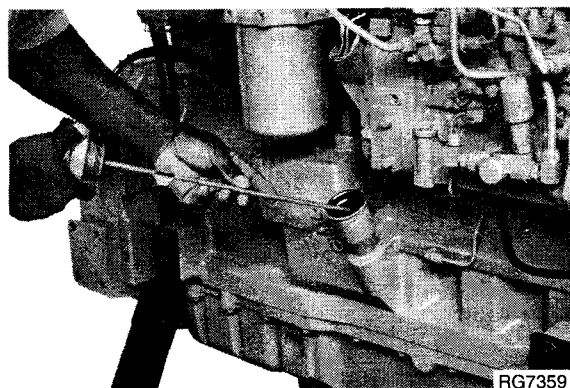
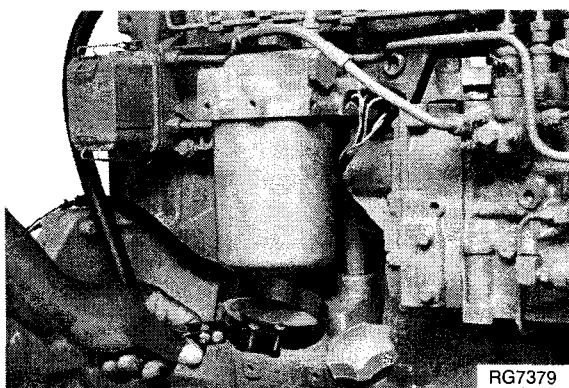
Battery Capabilities

12V-Standard Duty Starter	640 Cold Cranking Amps
12V-Heavy Duty Starter	800 Cold Cranking Amps
24V-Standard Duty Starter	570 Cold Cranking Amps



TS203

CHANGING ENGINE OIL AND REPLACING OIL FILTER



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 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.
3. Drain crankcase oil from engine while warm.

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

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.)

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

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

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.

CHECKING PTO CLUTCH ADJUSTMENT



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.

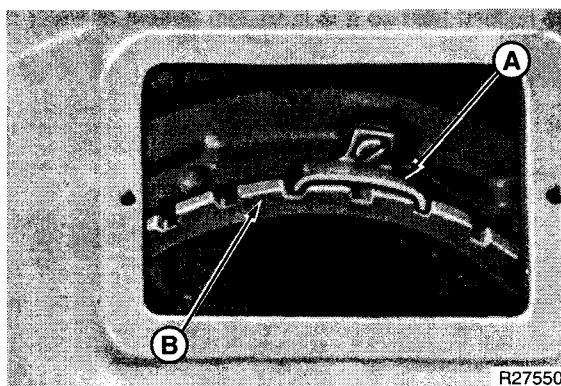
1. Measure clutch engagement force at handle grip using a spring scale. The engagement force should be 267–311 N (60–70 lb force).

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.



TS198



R27550

VISUALLY INSPECTING WATER PUMP

- **Inspect Weep Hole:**

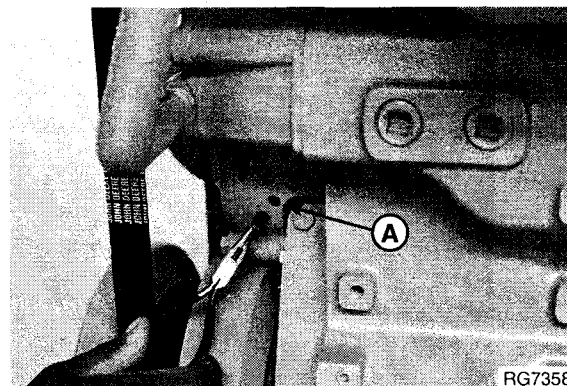
1. Remove foam filter from water pump weep hole (A) as shown
2. Inspect weep hole for oil or coolant leakage.
 - Oil leakage indicates a damaged rear seal.
 - Coolant leakage indicates a damaged front seal.

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

- **Inspect For Impeller Contact With Cover:**

1. Remove radiator-to-water pump hose from water pump inlet elbow.
2. Using a flashlight, inspect ID of water 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 water pump assembly and cover as necessary if impeller contact is detected.



Lubrication & Maintenance/600 Hour/12 Month

LUBRICATING PTO CLUTCH INTERNAL LEVERS AND LINKAGE

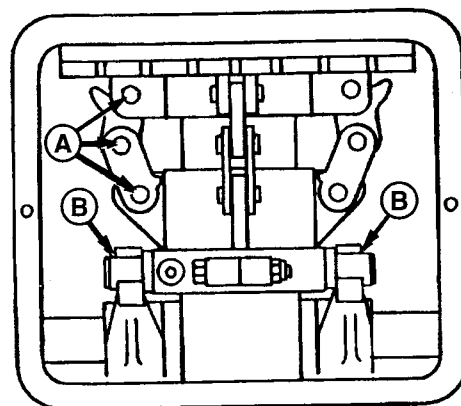


CAUTION: Never attempt to service the PTO while it is in operation. Loose clothing could get caught in moving parts; keep clothing tight against body. Use extreme care when working around the PTO.

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).



TS198

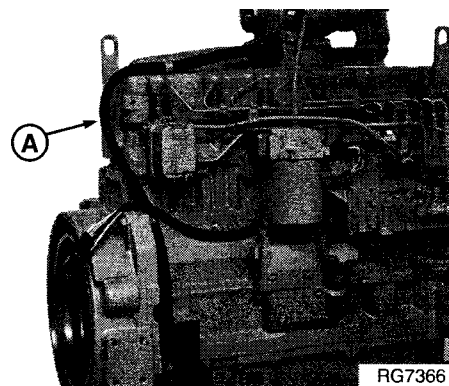


RG6641

CLEANING CRANKCASE VENT TUBE

If you operate the engine 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.



RG7366

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.

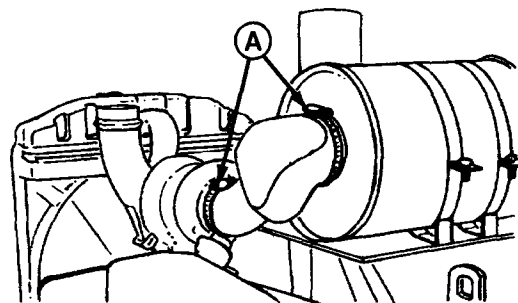
3. If engine has a rubber dust unloader valve (B), inspect the valve on bottom of air cleaner for cracks or plugging. Replace as necessary.

IMPORTANT: ALWAYS REPLACE primary air cleaner element when air restriction indicator shows a vacuum of 625 mm (25 in.) H₂O, is torn, or visibly dirty.

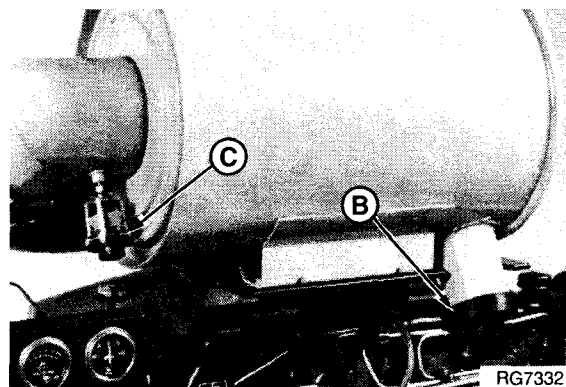
4. Test air restriction indicator (C) for proper operation. Replace indicator as necessary.

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 INSPECTING PRIMARY FILTER ELEMENT and REPLACING AIR CLEANER ELEMENTS in Service As Required Section.)



RG4689



RG7332

REPLACING (RECTANGULAR) FINAL FUEL FILTER ELEMENT



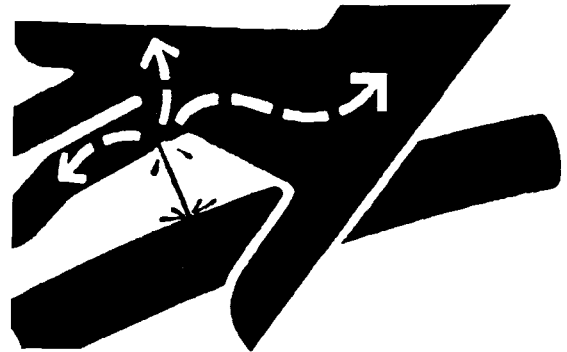
CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting fuel or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes or nozzles which eject fluids under high pressure. Use a piece of cardboard 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.

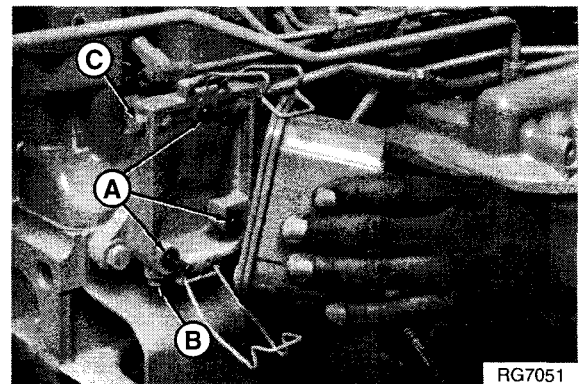
1. Close fuel shut-off valve at bottom of fuel tank (not illustrated).
2. Loosen bleed plug (C) on side of filter base. Remove drain plug (B) to drain from fuel filter.

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

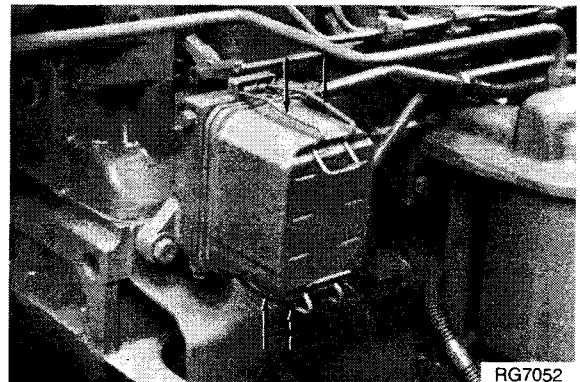
3. With fuel filter firm against base, lift up on top retaining spring and pull down on bottom retaining spring. Pull fuel filter off guide pins (A) of fuel filter base and discard.
4. Install new fuel filter onto guide pins of fuel filter base. Hold filter firmly against base.
5. Secure bottom filter retaining spring first, then secure top retaining spring (four arrows).
6. Install new drain plug, 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, in Service As Required Section.



X9811



RG7051



RG7052

REPLACING (ROUND) PRIMARY FUEL FILTER/WATER SEPARATOR

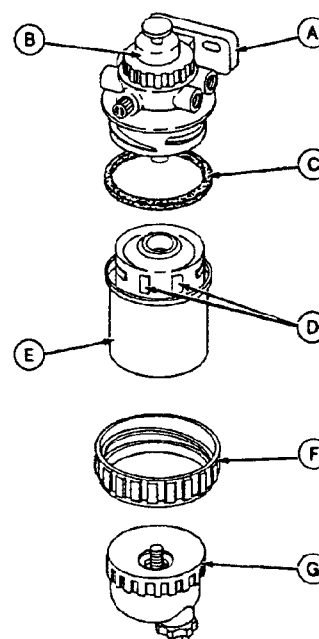
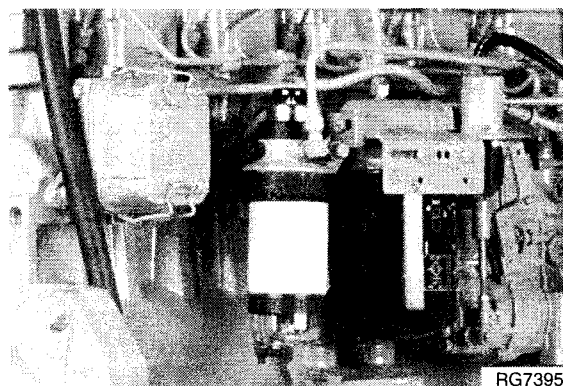
1. Thoroughly clean fuel filter/water separator assembly and surrounding area.

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

2. Rotate retaining ring counterclockwise 1/4 turn. Remove ring with filter element.
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 BLEED THE FUEL SYSTEM in Service As Required Section.)



RG6666

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

CHECKING BELT TENSIONER SPRING TENSION AND BELT WEAR

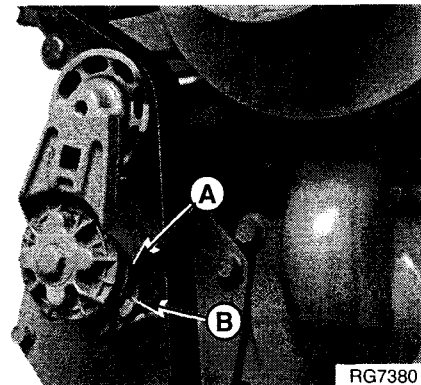
Belt drive systems equipped with automatic (spring) belt tensioners cannot be adjusted or repaired. The automatic belt tensioner is designed to maintain proper belt tension over the life of the belt. If tensioner spring tension is not within specification, replace tensioner assembly.

• 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.

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

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

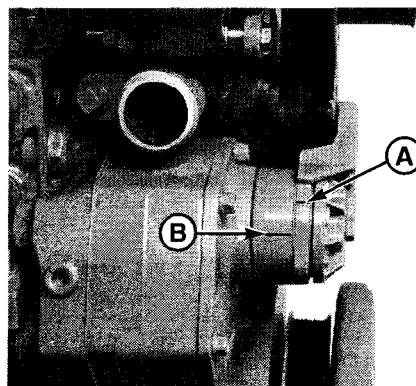


RG7380

• 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 (A) and put a mark (B) on tensioner mounting base.



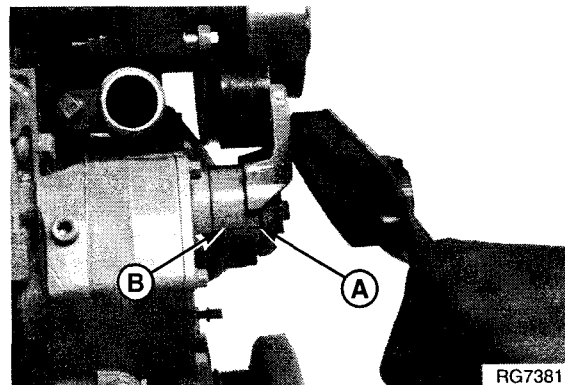
RG7382

CHECKING BELT TENSIONER SPRING TENSION—CONTINUED

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.

SPRING TENSION SPECIFICATION

Spring Tension 24-28 N·m (17-21 lb-ft)



CHECKING COOLING SYSTEM

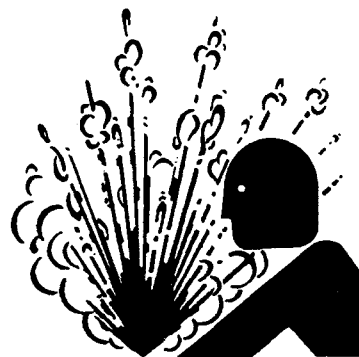


CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

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.



CHECKING EFFECTIVENESS OF COOLANT SOLUTION

When your coolant has accumulated 600 hours or 12 months of operating time, the effectiveness of your engine coolant should be evaluated by obtaining a coolant sample.

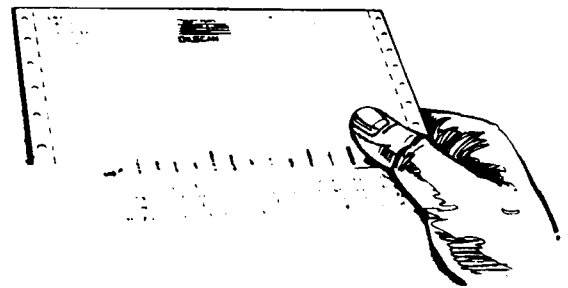
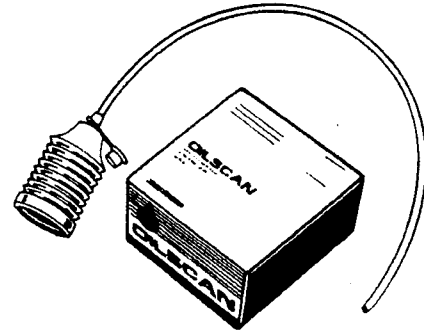
Maintaining the correct coolant conditioner concentration (SCAs) and freeze point is essential in your cooling system to protect against liner pitting, corrosion, and freeze-ups due to incorrect coolant dilution.

A coolant strip test kit provides a simple effective way to check freeze point and molybdate/nitrite levels.

For a more thorough evaluation of your coolant, CoolScan™ is a John Deere sampling program to help you monitor the effectiveness of your engine's coolant solution and identify potential problems before they cause serious damage.

TY16175 or TY16176 3-Way Heavy Duty Coolant Test Kit and DS0251 CoolScan kits are available from your John Deere dealer. Refer to instructions provided with kits.

Usually recharging your engine coolant with the recommended amount of TY16004 or TY16005 Liquid Coolant Conditioner at 600 hours or 12 months of operation is adequate. However, with a CoolScan analysis report you will be given a more thorough evaluation of your engine coolant condition along with detailed service recommendations. (See **ADDING SUPPLEMENTAL COOLANT ADDITIVES**, later in this section.)



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ADDING SUPPLEMENTAL COOLANT ADDITIVES (SCA'S)

After 600 hours or 12 months of engine operating time, recharge your engine coolant with the recommended amount (see label on container) of TY16004 or TY16005 Liquid Coolant Conditioner.

IMPORTANT: TY16004 or TY16005 Liquid Coolant Conditioner is a non-chromate inhibitor and should be used only with low silicate, ethylene-glycol base antifreeze. It does not protect the cooling system from freezing.



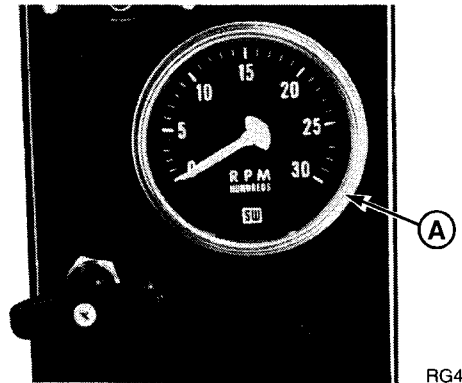
RG7276

Liquid Coolant Conditioner

Lubrication & Maintenance/1200 Hour/24 Month

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.)



RG4697

CHECKING CRANKSHAFT VIBRATION DAMPER

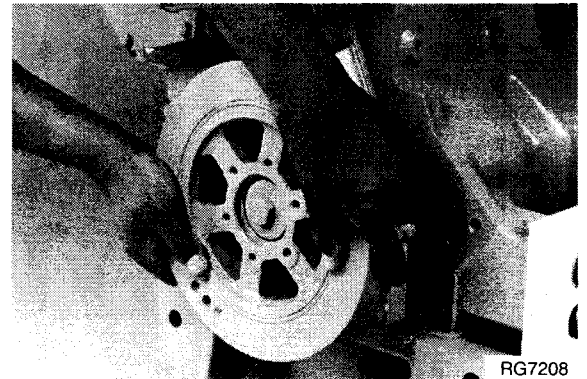
On some applications there may be dual dampers. Make same checks on each damper.

1. Remove belts (shown removed).

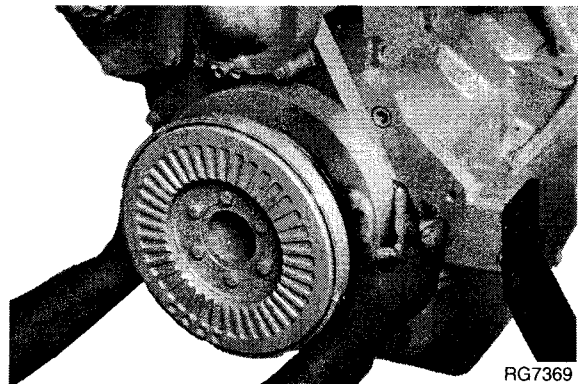
NOTE: On engines equipped with dual dampers, ALWAYS replace both dampers as a matched set.

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.

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



Single Damper



Dual Damper

CHECKING CRANKSHAFT VIBRATION DAMPER—CONTINUED

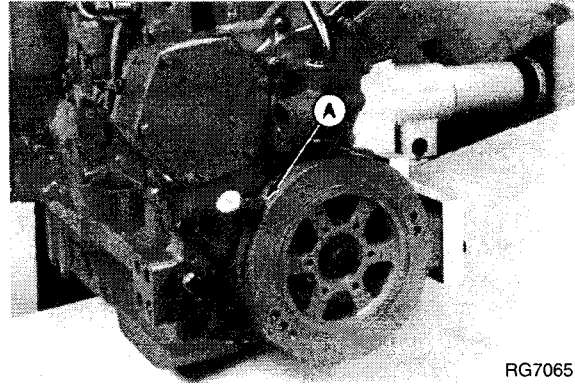
NOTE: On engines equipped with dual dampers, check runout on inner damper only. Always replace both dampers as a matched set.

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.

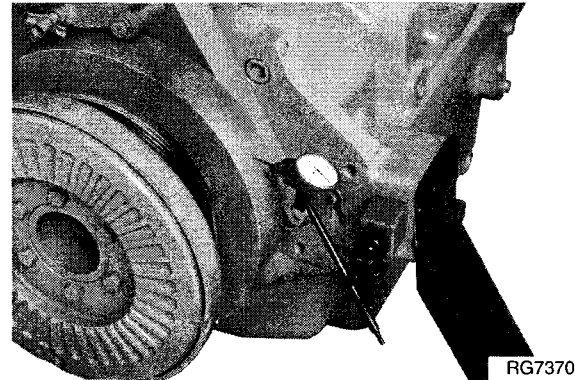
Damper Radial Runout Specification

Maximum..... 1.02 mm (0.040 in.)

If runout exceeds specifications, replace vibration damper.

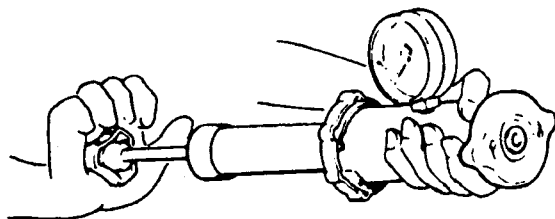


Single Damper

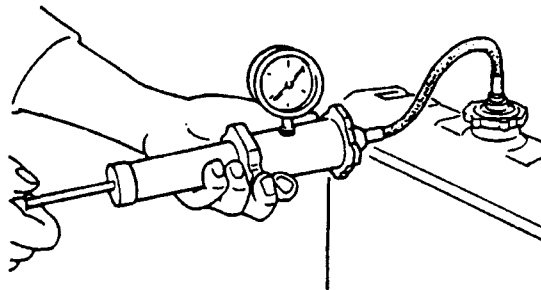


Dual Damper

PRESSURE TESTING COOLING SYSTEM



RG6557



RG6558



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 50 kPa (0.5 bar) (7 psi)*. 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 50 kPa (0.5 bar) (7 psi)*.
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.

*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.

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.



TS281

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**, earlier in this section.)
2. Slowly open the engine cooling system filler cap or radiator cap to relieve pressure and allow coolant to drain faster.
3. Open water 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.
5. Remove thermostats at this time, if not previously done. Install cover (with 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.

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RESTORE™ is a trademark of Fleetguard.

FLUSHING COOLING SYSTEM—CONTINUED

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 TY15979 John Deere Heavy Duty Cooling System Cleaner or an equivalent cleaner such as Fleetguard® RESTORE™. 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.

