9.0 L Marine Diesel Engines (Tier 3/Stage III A Platform)

OPERATOR'S MANUAL

9.0 L Marine Diesel Engines (Tier 3/Stage III A Platform)

OMRG39578 ISSUE 13OCT15 (ENGLISH)

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.

If this product contains a gasoline engine:

⚠ WARNING

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

The State of California requires the above two warnings.

Additional Proposition 65 Warnings can be found in this manual.

John Deere Power Systems
PRINTED IN U.S.A.

TP-6972 10/15

Introduction

Instructions (INS)

content

ZE59858,000025E -19-25SEP15-1/1

Foreword

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

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

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

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

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

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

CERTAIN ENGINE ACCESSORIES such as air cleaner, and instruments are optional equipment on John Deere Marine 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.

ZE59858,00001AA -19-15OCT13-1/1

Engine Owner

John Deere Engine Owner:

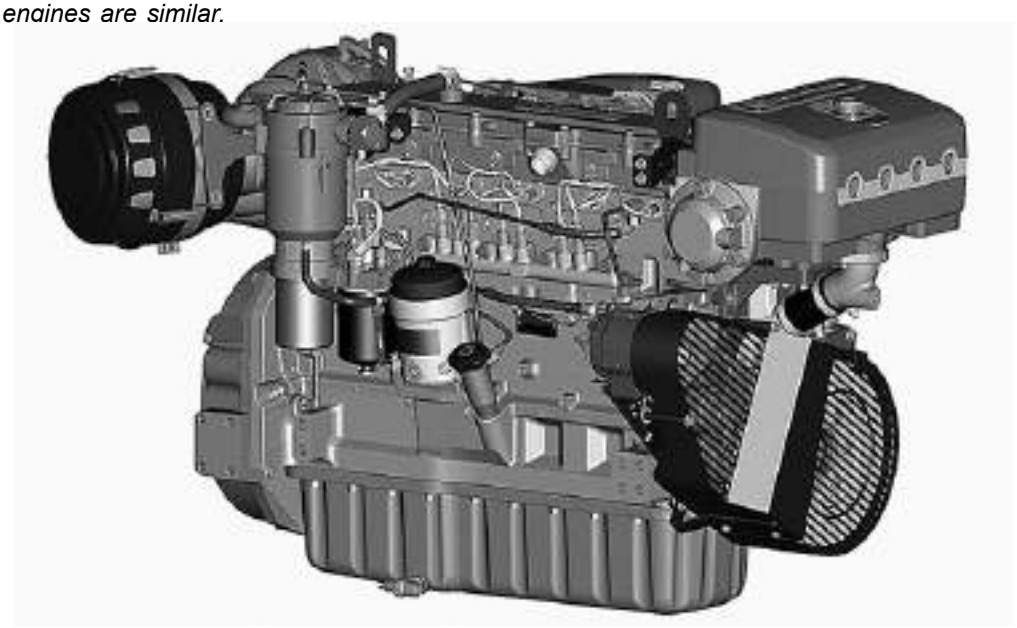
It is important for you to register your new engine for factory warranty. Registering your engine will allow your Service Dealer to verify that your warranty status should a repair be needed. The easiest way to register your engine is via the internet. To register your engine for warranty via the internet, please use the following URL: http://www.johndeere.com/enginewarranty

Your John Deere Engine Distributor or local John Deere Service Dealer will also be happy to provide this service. Engine service can be done by all Ag, C&FD, and JDPS branded dealers. To view the John Deere Service Dealer network or locate your nearest Dealer, use the following URL: http://www.johndeere.com/dealer

JR74534,000026F -19-21JUN12-1/1

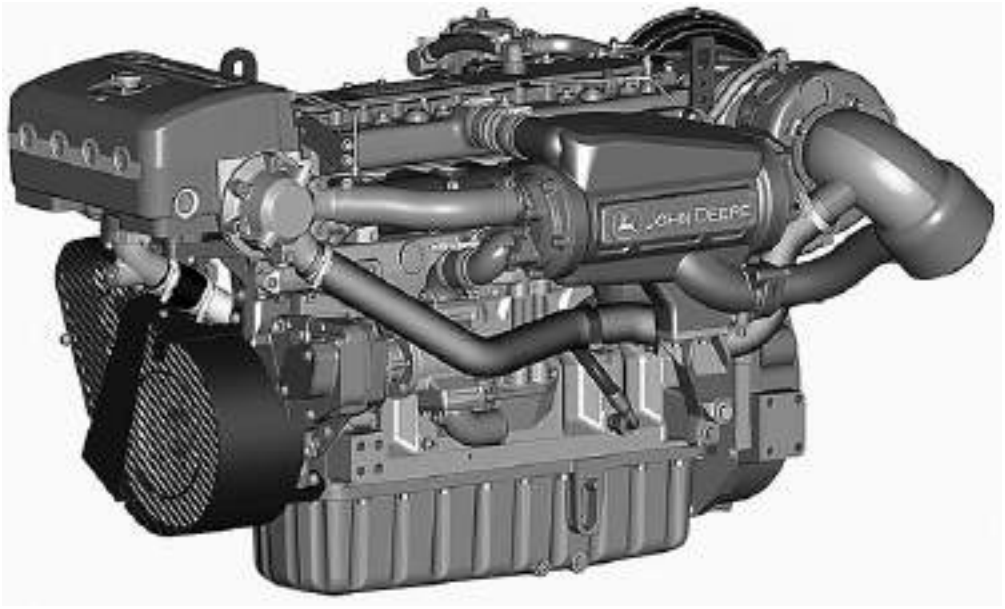
Identification Views

NOTE: Heat exchanged engine model is shown, keel cooled engines are similar.



RG24628 —UN—29OCT13

6090SFM85 Right Front View



RG24627 —UN—29OCT13

6090SFM85 Left Front View

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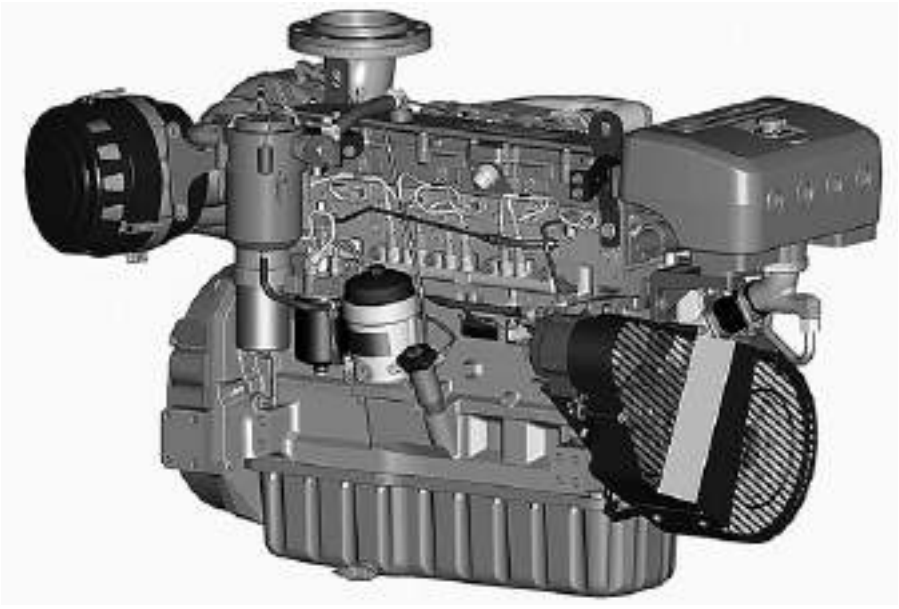
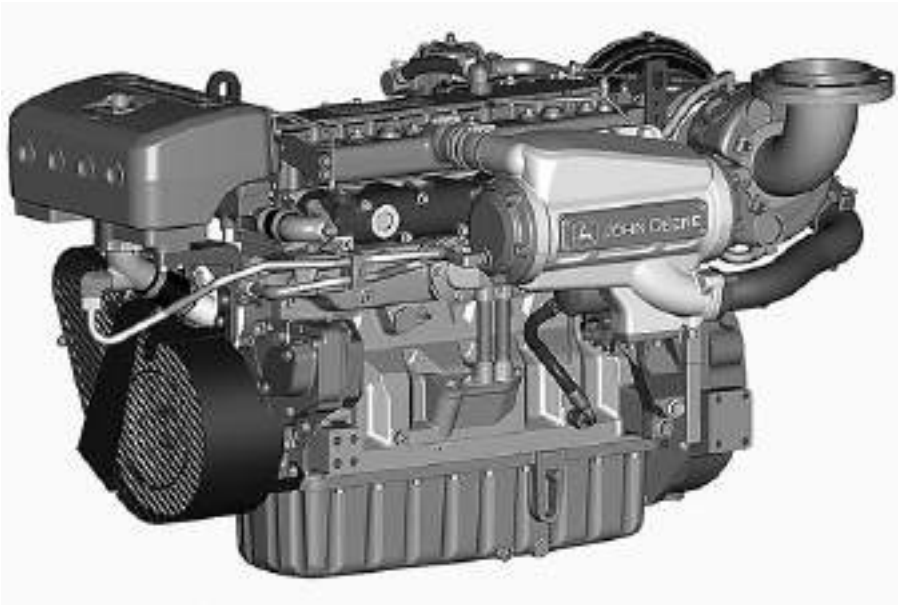
ZE59858,00001AB -19-26NOV13-1/2



6090AFM85 Right Front View

RG24625 —UN—29OCT13



6090AFM85 Left Front View

RG24624 —UN—29OCT13

ZE59858,00001AB -19-26NOV13-2/2

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ZE59858,0000006 -19-13FEB14-2/2

Contents

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Original Instructions. 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.

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Record Engine Serial Number

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

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

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

Engine Serial Number (A)

_____

Engine Model Number (B)

_____

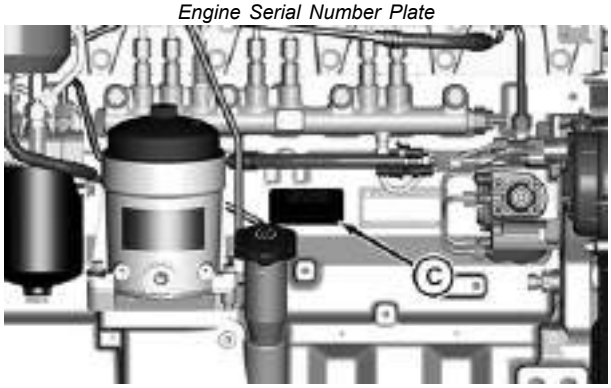
NOTE: On engine serial number (A) the 7th digit shows the emission level as follows:

- *"B" for non-certified engines*
- *"C" for Tier 1 / Stage I engines*
- *"G" for Tier 2 / Stage II engines*
- *"L" for Tier 3 / Stage IIIA engines*

A—Engine Serial Number
B—Engine Model Number
C—Serial Number Plate

RG24621 —UN—24OCT13

Engine Serial Number Plate

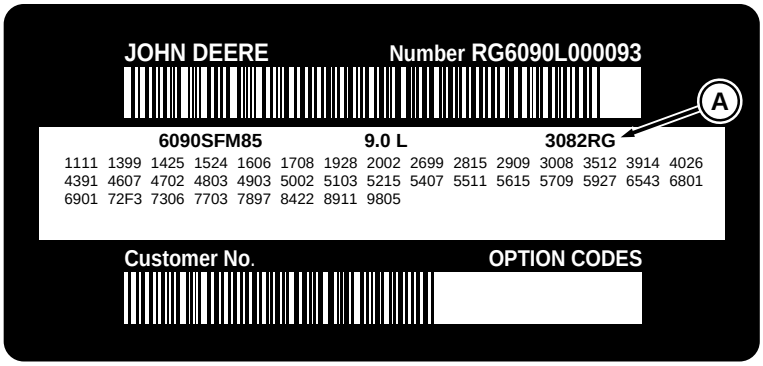


RG24623 —UN—24OCT13

Location of Engine Serial Number Plate

ZE59858,00001AC -19-24OCT13-1/1

Engine Option Codes



RG24622 —UN—24OCT13

Engine Option Code Label

A—Engine Base Code

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

The engine option code label includes an engine base code (A). This base code must also be recorded along with the option codes which may be helpful when ordering service parts or for tracking service work.

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

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

Record engine base code (A) below, as seen on your serial number plate:

_____

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

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

Option Codes	Description	Option Codes	Description
11_____	Rocker Arm Cover	49_____	Rocker Arm
13_____	Crankshaft Pulley/Damper	50_____	Oil Pump
14_____	Flywheel Housing	51_____	Cylinder Head with Valves
15_____	Flywheel	52_____	Auxiliary Gear Drive
16_____	Fuel Pump	54_____	Air Intake Turbocharger
17_____	Air Intake	55_____	Shipping Stand
18_____	Air Cleaner	56_____	Paint
19_____	Oil Pan	57_____	Coolant Pump Inlet
20_____	Coolant Pump	59_____	Oil Cooler and Filter
21_____	Thermostat Cover	62_____	Alternator Mounting Bracket
22_____	Thermostats	64_____	Exhaust Elbow
23_____	Fan Drive	65_____	Turbocharger
24_____	Fan Belts	69_____	Engine Serial Number Plate
26_____	Engine Heater	72_____	Electronic Software Option
27_____	Heat Exchanger	74_____	Air Conditioning (A/C) Compressor Mounting
28_____	Exhaust System	77_____	Timing Gear Cover
29_____	Crankcase Ventilation System	78_____	Air Compressor Mounting
30_____	Starter Motor	80_____	Sea Water Pump
31_____	Alternator	83_____	Electronic Software (Vehicle Option)
35_____	Fuel Filter	84_____	Electrical Wiring Harness
39_____	Thermostat Housing	91_____	Engine Installation Kit

Continued on next page

ZE59858,00001AE -19-24OCT13-1/2

Option Codes	Description	Option Codes	Description
40	Oil Dipstick	93	Emissions Label
43	Starting Aid	97	Special Equipment (Field Installed)
46	Cylinder Block with Liners and Camshaft	98	Engine Lift Straps
47	Crankshaft And Bearings	99	Service Only Items
48	Connecting Rods and Pistons		

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.

ZE59858,00001AE -19-24OCT13-2/2

Record High-Pressure Fuel Pump Model and Serial Numbers

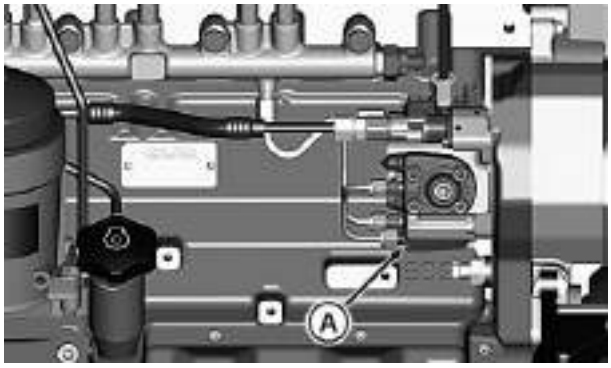
Record the fuel transfer pump model and serial information found on the serial number plate (A).

Model No._____ RPM_____

Manufacturer's No._____

Serial No._____

A—Serial Number Plate



RG17145 —UN—26MAY09

High Pressure Fuel Pump Serial Number Plate

ZE59858,00001B0 -19-17SEP13-1/1

Record Engine Control Unit (ECU) Serial Number

Record the part number and serial number information found on the serial number label (A) on the Engine Control Unit (ECU) mounted on or near the engine.

Part No._____

Serial No._____

A—Serial Number Label

RG24314 —UN—05SEP13

Record Engine Control Unit (ECU) Serial Number

ZE59858,00001B1 -19-17OCT13-1/1

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.

TS187 —19—30SEP88

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

Recognize Safety Information

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

Follow recommended precautions and safe operating practices.

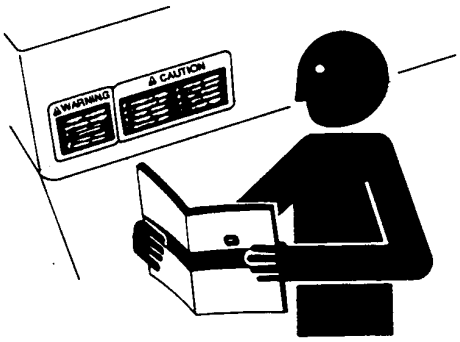
T81389 —UN—28JUN13

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

Replace Safety Signs

Replace missing or damaged safety signs. Use this operator's manual for correct safety sign placement.

There can be additional safety information contained on parts and components sourced from suppliers that is not reproduced in this operator's manual.



TS201 —UN—15APR13

DX,SIGNS -19-18AUG09-1/1

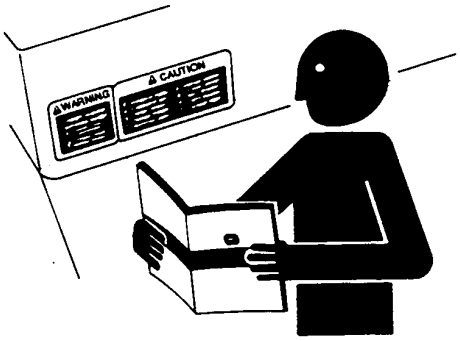
Follow Safety Instructions

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.

There can be additional safety information contained on parts and components sourced from suppliers that is not reproduced in this operator's manual.

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.



TS201 —UN—15APR13

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

DX,READ -19-16JUN09-1/1

California Proposition 65 Warning

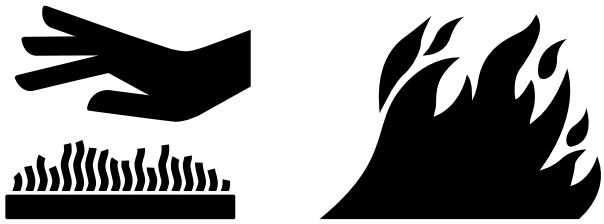
Diesel engine exhaust, some of its constituents, along with certain machine components contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. In addition, certain fluids contained in the machine and certain products of component wear contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

RG41061,000001F -19-12JAN10-1/1

Avoid Hot Exhaust

Servicing machine or attachments with engine running can result in serious personal injury. Avoid exposure and skin contact with hot exhaust gases and components.

Exhaust parts and streams become very hot during operation. Exhaust gases and components reach temperatures hot enough to burn people, ignite, or melt common materials.



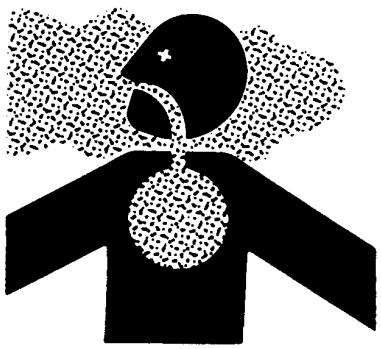
RG17488 —UN—21AUG09

DX,EXHAUST -19-20AUG09-1/1

Work In Ventilated Area

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

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



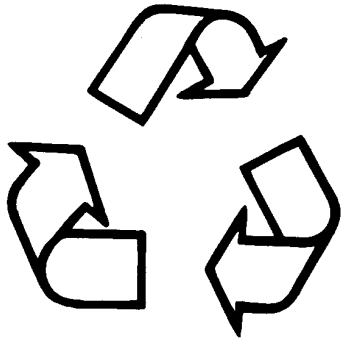
TS220 —UN—15APR13

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

Decommissioning: Proper Recycling and Disposal of Fluids and Components

Safety and environmental stewardship measures must be taken into account when decommissioning a machine and/or component. These measures include the following:

- Use appropriate tools and personal protective equipment such as clothing, gloves, face shields or glasses, during the removal or handling of objects and materials.
- Follow instructions for specialized components.
- Release stored energy by lowering suspended machine elements, relaxing springs, disconnecting the battery or other electrical power, and releasing pressure in hydraulic components, accumulators, and other similar systems.
- Minimize exposure to components which may have residue from agricultural chemicals, such as fertilizers and pesticides. Handle and dispose of these components appropriately.
- Carefully drain engines, fuel tanks, radiators, hydraulic cylinders, reservoirs, and lines before recycling components. Use leak-proof containers when draining fluids. Do not use food or beverage containers.
- Do not pour waste fluids onto the ground, down a drain, or into any water source.
- Observe all national, state, and local laws, regulations, or ordinances governing the handling or disposal of waste fluids (example: oil, fuel, coolant, brake fluid);



TS1133 —UN—15APR13

filters; batteries; and, other substances or parts. Burning of flammable fluids or components in other than specially designed incinerators may be prohibited by law and could result in exposure to harmful fumes or ashes.
- Service and dispose of air conditioning systems appropriately. Government regulations may require a certified service center to recover and recycle air conditioning refrigerants which could damage the atmosphere if allowed to escape.
- Evaluate recycling options for tires, metal, plastic, glass, rubber, and electronic components which may be recyclable, in part or completely.
- Contact your local environmental or recycling center, or your John Deere dealer for information on the proper way to recycle or dispose of waste.

DX,DRAIN -19-01JUN15-1/1

Prevent Machine Runaway

Avoid possible injury or death from machinery runaway.

Do not start engine by shorting across starter terminals. Machine will start in gear if normal circuitry is bypassed.

NEVER start engine while standing on ground. Start engine only from operator's seat, with transmission in neutral or park.

TS177 —UN—11JAN89

DX,BYPAS1 -19-29SEP98-1/1

Practice Safe Maintenance

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

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

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

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

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

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

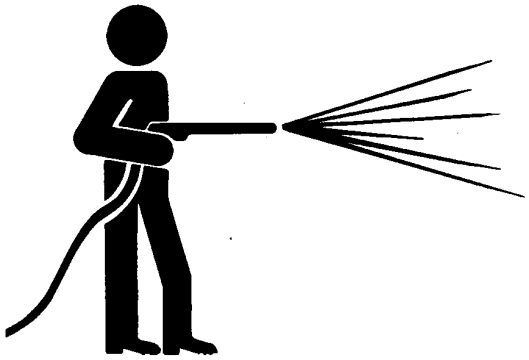
TS218 —UN—23AUG88

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

Work in Clean Area

Before starting a job:

- Clean work area and machine.
- Make sure you have all necessary tools to do your job.
- Have the right parts on hand.
- Read all instructions thoroughly; do not attempt shortcuts.



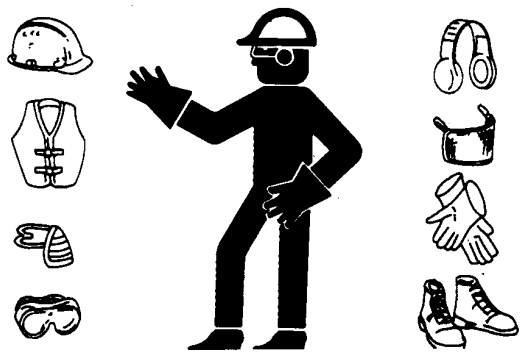
T6642EJ —UN—18OCT88

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

Wear Protective Clothing

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

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



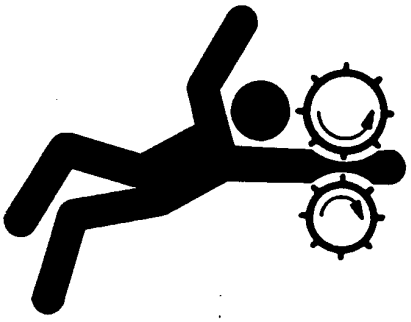
TS206 —UN—15APR13

DX,WEAR2 -19-03MAR93-1/1

Service Machines Safely

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

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



TS228 —UN—23AUG88

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

Use Proper Tools

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

Use power tools only to loosen threaded parts and fasteners.

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

Use only service parts meeting John Deere specifications.

TS779 —UN—08NOV89

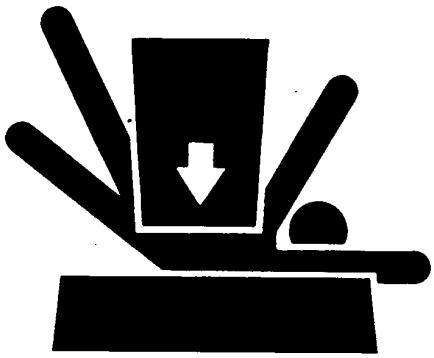
DX,REPAIR -19-17FEB99-1/1

Support Machine Properly

Always lower the attachment or implement to the ground before you work on the machine. If the work requires that the machine or attachment be lifted, provide secure support for them. If left in a raised position, hydraulically supported devices can settle or leak down.

Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.

When implements or attachments are used with a machine, always follow safety precautions listed in the implement or attachment operator's manual.



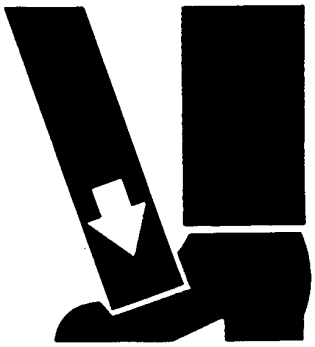
TS229 —UN—23AUG88

DX,LOWER -19-24FEB00-1/1

Use Proper Lifting Equipment

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

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



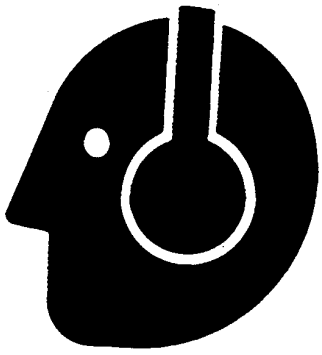
TS226 —UN—23AUG88

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

Protect Against Noise

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

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

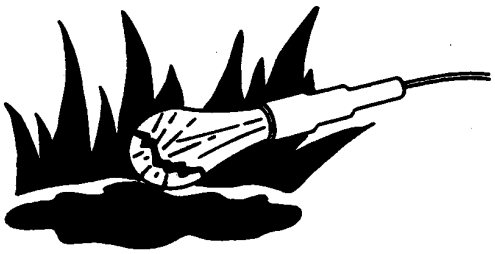


TS207 —UN—23AUG88

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

Illuminate Work Area Safely

Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.



TS223 —UN—23AUG88

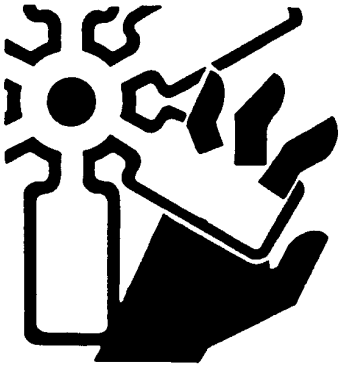
DX,LIGHT -19-04JUN90-1/1

Install All Guards

Rotating cooling system fans, belts, pulleys, and drives can cause serious injury.

Keep all guards in place at all times during engine operation.

Wear close-fitting clothes. Stop the engine and be sure fans, belts, pulleys, and drives are stopped before making adjustments, connections, or cleaning near fans and their drive components.



TS677 —UN—21SEP89

DX,GUARDS -19-18AUG09-1/1

Stay Clear of Rotating Drivelines

Entanglement in rotating driveline can cause serious injury or death.

Keep all shields in place at all times. Make sure rotating shields turn freely.

Wear close-fitting clothing. Stop the engine and be sure that all rotating parts and drivelines are stopped before making adjustments, connections, or performing any type of service on engine or machine driven equipment.

TS1644 —UN—22AUG95

DX,ROTATING -19-18AUG09-1/1

Protect Against High Pressure Spray

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

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

TS1343 —UN—18MAR92

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

Service Cooling System Safely

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

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

TS281 —UN—15APR13

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

Remove Paint Before Welding or Heating

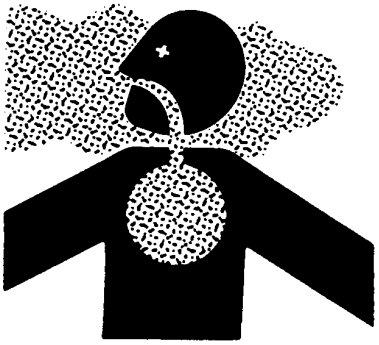
Avoid potentially toxic fumes and dust.

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

Remove paint before heating:

- Remove paint a minimum of 100 mm (4 in.) from area to be affected by heating. If paint cannot be removed, wear an approved respirator before heating or welding.
- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

Do not use a chlorinated solvent in areas where welding will take place.



TS220 —UN—15APR13

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

Dispose of paint and solvent properly.

DX,PAINT -19-24JUL02-1/1

Do Not Open High-Pressure Fuel System

High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect or attempt repair of fuel lines, sensors, or any other components between the high-pressure fuel pump and nozzles on engines with High Pressure Common Rail (HPCR) fuel system.

Only technicians familiar with this type of system can perform repairs. (See your John Deere dealer.)

TS1343 —UN—18MAR92

DX,WW,HPCR1 -19-07JAN03-1/1

Avoid High-Pressure Fluids

Inspect hydraulic hoses periodically – at least once per year – for leakage, kinking, cuts, cracks, abrasion, blisters, corrosion, exposed wire braid or any other signs of wear or damage.

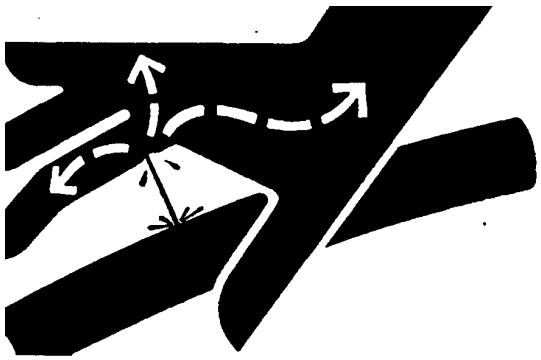
Replace worn or damaged hose assemblies immediately with John Deere approved replacement parts.

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 in English from Deere & Company Medical Department in Moline, Illinois, U.S.A., by calling 1-800-822-8262 or +1 309-748-5636.



X9811 —UN—23AUG88

DX,FLUID -19-12OCT11-1/1

Avoid Heating Near Pressurized Fluid Lines

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

TS953 —UN—15MAY90

DX,TORCH -19-10DEC04-1/1

Avoid Static Electricity Risk When Refueling

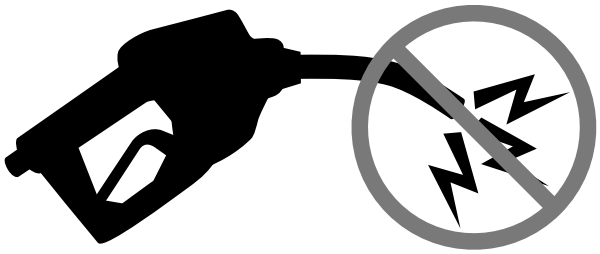
The removal of sulfur and other compounds in Ultra-Low Sulfur Diesel (ULSD) fuel decreases its conductivity and increases its ability to store a static charge.

Refineries may have treated the fuel with a static dissipating additive. However, there are many factors that can reduce the effectiveness of the additive over time.

Static charges can build up in ULSD fuel while it is flowing through fuel delivery systems. Static electricity discharge when combustible vapors are present could result in a fire or explosion.

Therefore, it is important to ensure that the entire system used to refuel your machine (fuel supply tank, transfer pump, transfer hose, nozzle, and others) is properly grounded and bonded. Consult with your fuel or fuel system supplier to ensure that the delivery system is in compliance with fueling standards for proper grounding and bonding practices.

RG22142 —UN—17MAR14



RG21992 —UN—21AUG13

DX,FUEL,STATIC,ELEC -19-12JUL13-1/1

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.

Use only an approved fuel container for transporting flammable liquids.

Never fill fuel container in pickup truck with plastic bed liner. Always place fuel container on ground before refueling. Touch fuel container with fuel dispenser nozzle before removing can lid. Keep fuel dispenser nozzle in contact with fuel container inlet when filling.

TS202 —UN—23AUG88

Do not store fuel container where there is an open flame, spark, or pilot light such as within a water heater or other appliance.

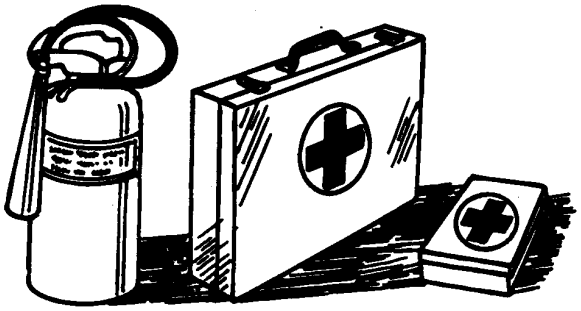
DX,FIRE1 -19-12OCT11-1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

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



TS291 —UN—15APR13

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

Handle Starting Fluid Safely

Starting fluid is highly flammable.

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

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

Do not incinerate or puncture a starting fluid container.

Do not use starting fluid on an engine equipped with glow plugs or an air intake heater.

TS1356 —UN—18MAR92

DX,FIRE3 -19-14MAR14-1/1

Handling Batteries Safely

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

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

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

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

Avoid hazards by:

- Filling batteries in a well-ventilated area
- Wearing eye protection and rubber gloves
- Avoiding use of air pressure to clean batteries
- Avoiding breathing fumes when electrolyte is added
- Avoiding spilling or dripping electrolyte
- Using correct battery booster or charger procedure.

If acid is spilled on skin or in eyes:

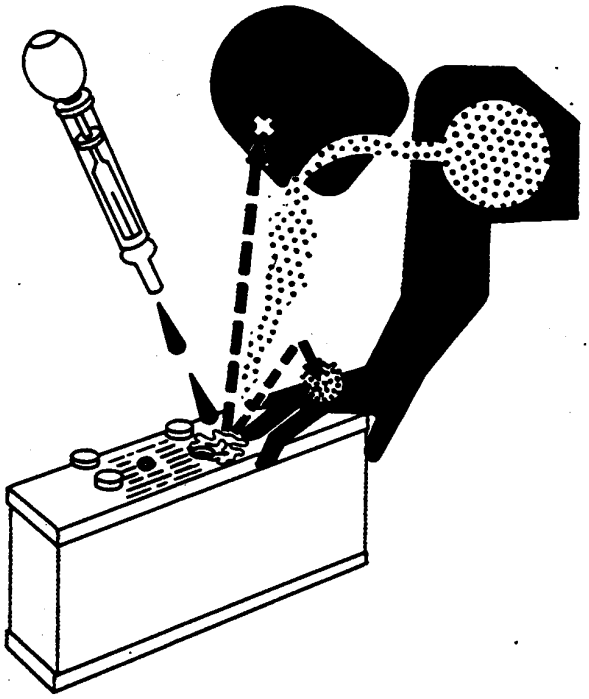
1. Flush skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush eyes with water for 15—30 minutes. Get medical attention immediately.

If acid is swallowed:

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

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

TS204 —UN—15APR13



TS203 —UN—23AUG88

DX,WW,BATTERIES -19-02DEC10-1/1

Prevent Acid Burns

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

Avoid the hazard by:

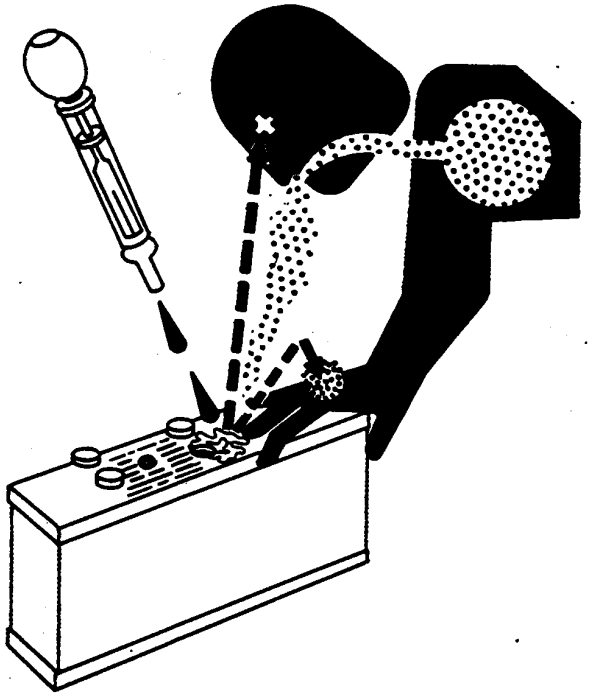
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

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

If acid is swallowed:

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



TS203 —UN—23AUG88

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

Prevent Battery Explosions

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

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

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

TS204 —UN—15APR13

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

Live With Safety

Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.

TS231 —19—07OCT88

DX,LIVE -19-25SEP92-1/1

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. Renewable diesel fuel produced by hydrotreating animal fats and vegetable oils is basically identical to petroleum diesel fuel. Renewable diesel that meets EN 590 or ASTM D975 is acceptable for use at all percentage mixture levels.

Required Fuel Properties

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

Cetane number of 40 minimum. Cetane number greater than 47 is preferred, especially for temperatures below –20 °C (–4 °F) or elevations above 1675 m (5500 ft.).

Cold Filter Plugging Point (CFPP) should be at least 5 °C (9 °F) below the expected lowest temperature or **Cloud Point** below the expected lowest ambient temperature.

Fuel lubricity should pass a maximum scar diameter of 0.52 mm as measured by ASTM D6079 or ISO 12156-1. A maximum scar diameter of 0.45 mm is preferred.

Diesel fuel quality and sulfur content must comply with all existing emissions regulations for the area in which the engine operates. DO NOT use diesel fuel with sulfur content greater than 10 000 mg/kg (10 000 ppm).

Sulfur content for Interim Tier 4, Final Tier 4, Stage III B, and Stage IV Engines

- Use ONLY ultra low sulfur diesel (ULSD) fuel with a maximum of 15 mg/kg (15 ppm) sulfur content.

Sulfur Content for Tier 3 and Stage III A Engines

- Use of diesel fuel with sulfur content less than 1000 mg/kg (1000 ppm) is RECOMMENDED.
- Use of diesel fuel with sulfur content 1000—2000 mg/kg (1000—2000 ppm) REDUCES the oil and filter change interval.
- BEFORE using diesel fuel with sulfur content greater than 2000 mg/kg (2000 ppm), contact your John Deere dealer.

Sulfur Content for Tier 2 and Stage II Engines

- Use of diesel fuel with sulfur content less than 2000 mg/kg (2000 ppm) is RECOMMENDED.
- Use of diesel fuel with sulfur content 2000—5000 mg/kg (2000—5000 ppm) REDUCES the oil and filter change interval.
- BEFORE using diesel fuel with sulfur content greater than 5000 mg/kg (5000 ppm), contact your John Deere dealer.

Sulfur Content for Other Engines

- Use of diesel fuel with sulfur content less than 5000 mg/kg (5000 ppm) is RECOMMENDED.
- Use of diesel fuel with sulfur content greater than 5000 mg/kg (5000 ppm) REDUCES the oil and filter change interval.

IMPORTANT: Do not mix used diesel engine oil or any other type of lubricating oil with diesel fuel.

Improper fuel additive usage may cause damage on fuel injection equipment of diesel engines.

DX,FUEL1 -19-24OCT14-1/1

Supplemental Diesel Fuel Additives

Diesel fuel can be the source of performance or other operational problems for many reasons. Some causes include poor lubricity, contaminants, low cetane number, and a variety of properties that cause fuel system deposits. These and others are referenced in other sections of this Operator's Manual.

To optimize engine performance and reliability, closely follow recommendations on fuel quality, storage, and handling, which are found elsewhere in this Operator's Manual.

To further aid in maintaining performance and reliability of the engine's fuel system, John Deere has developed a family of fuel additive products for most global markets. The primary products include Fuel-Protect Diesel Fuel Conditioner (full feature conditioner in winter and summer formulas) and Fuel-Protect Keep Clean (fuel injector deposit removal and prevention). Availability of these and other products varies by market. See your local John Deere dealer for availability and additional information about fuel additives that might be right for your needs.

DX,FUEL13 -19-07FEB14-1/1

Lubricity of Diesel Fuel

Most diesel fuels manufactured in the United States, Canada, and the European Union have adequate lubricity to ensure proper operation and durability of fuel injection system components. However, diesel fuels manufactured in some areas of the world may lack the necessary lubricity.

IMPORTANT: Make sure the diesel fuel used in your machine demonstrates good lubricity characteristics.

Fuel lubricity should pass a maximum scar diameter of 0.52 mm as measured by ASTM D6079 or ISO 12156-1. A maximum scar diameter of 0.45 mm is preferred.

If fuel of low or unknown lubricity is used, add John Deere Fuel-Protect Diesel Fuel Conditioner (or equivalent) at the specified concentration.

Lubricity of BioDiesel Fuel

Fuel lubricity can improve significantly with BioDiesel blends up to B20 (20% BioDiesel). Further increase in lubricity is limited for BioDiesel blends greater than B20.

DX,FUEL5 -19-07FEB14-1/1

Handling and Storing Diesel Fuel

CAUTION: Reduce the risk of fire. Handle fuel carefully. DO NOT fill the fuel tank when engine is running. DO NOT smoke while you fill the fuel tank or service the fuel system.

Fill the fuel tank at the end of each day's operation to prevent water condensation and freezing during cold weather.

Keep all storage tanks as full as practicable to minimize condensation.

Ensure that all fuel tank caps and covers are installed properly to prevent moisture from entering. Monitor water content of the fuel regularly.

When using BioDiesel fuel, the fuel filter may require more frequent replacement due to premature plugging.

Check engine oil level daily prior to starting engine. A rising oil level may indicate fuel dilution of the engine oil.

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

When fuel is stored for an extended period or if there is a slow turnover of fuel, add a fuel conditioner to stabilize the fuel and prevent water condensation. Contact your fuel supplier or John Deere dealer for recommendations.

DX,FUEL4 -19-15FEB13-1/1

BioDiesel Fuel

BioDiesel fuel is comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats. BioDiesel blends are BioDiesel mixed with petroleum diesel fuel on a volume basis.

Before using fuel containing BioDiesel, review the BioDiesel Use Requirements and Recommendations in this Operator's Manual.

Environmental laws and regulations can encourage or prohibit the use of biofuels. Operators should consult with appropriate governmental authorities prior to using biofuels.

All John Deere Engines with Exhaust Filter (Released 2011 and After)

While 5% blends (B5) are preferred, BioDiesel concentrations up to a 20% blend (B20) in petroleum diesel fuel can be used. BioDiesel blends up to B20 can be used ONLY if the BioDiesel (100% BioDiesel or B100) meets ASTM D6751, EN 14214, or equivalent specification. Expect a 2% reduction in power and a 3% reduction in fuel economy when using B20.

BioDiesel concentrations above B20 can harm the engine's emission control systems and should not be used. Risks include, but are not limited to, more frequent stationary regeneration, soot accumulation, and increased intervals for ash removal.

John Deere approved fuel conditioners, which contain detergent and dispersant additives, are required when using BioDiesel blends from B10—B20, and are recommended when using lower BioDiesel blends.

All John Deere Engines Excluding Exhaust Filter (Primarily Released Prior to 2012)

While 5% blends (B5) are preferred, BioDiesel concentrations up to a 20% blend (B20) in petroleum diesel fuel can be used. BioDiesel blends up to B20 can be used ONLY if the BioDiesel (100% BioDiesel or B100) meets ASTM D6751, EN 14214, or equivalent specification. Expect a 2% reduction in power and a 3% reduction in fuel economy when using B20.

These John Deere engines can operate on BioDiesel blends above B20 (up to 100% BioDiesel). Operate at levels above B20 ONLY if the BioDiesel is permitted by law and meets the EN 14214 specification (primarily available in Europe). Engines operating on BioDiesel blends above B20 might not fully comply with or be permitted by all applicable emissions regulations. Expect up to a 12% reduction in power and an 18% reduction in fuel economy when using 100% BioDiesel.

John Deere approved fuel conditioners, which contain detergent and dispersant additives, are required when using BioDiesel blends from B10—B20, and are recommended when using lower BioDiesel blends.

BioDiesel Use Requirements and Recommendations

The petroleum diesel portion of all BioDiesel blends must meet the requirements of ASTM D975 (US) or EN 590 (EU) commercial standard.

BioDiesel users in the U.S. are strongly encouraged to purchase BioDiesel blends from a BQ-9000 Certified Marketer and sourced from a BQ-9000 Accredited Producer (as certified by the National BioDiesel Board). Certified Marketers and Accredited Producers can be found at the following website: http://www.bq9000.org.

BioDiesel contains residual ash. Ash levels exceeding the maximums allowed in either ASTM D6751 or EN14214 can result in more rapid ash loading and require more frequent cleaning of the Exhaust Filter (if present).

The fuel filter can require more frequent replacement, when using BioDiesel fuel, particularly if switching from diesel. Check engine oil level daily prior to starting engine. A rising oil level can indicate fuel dilution of the engine oil. BioDiesel blends up to B20 must be used within 90 days of the date of BioDiesel manufacture. BioDiesel blends above B20 must be used within 45 days from the date of BioDiesel manufacture.

When using BioDiesel blends up to B20, the following must be considered:

- Cold-weather flow degradation
- Stability and storage issues (moisture absorption, microbial growth)
- Possible filter restriction and plugging (usually a problem when first switching to BioDiesel on used engines)
- Possible fuel leakage through seals and hoses (primarily an issue with older engines)
- Possible reduction of service life of engine components

Request a certificate of analysis from your fuel distributor to ensure that the fuel is compliant with the specifications provided in this Operator's Manual.

Consult your John Deere dealer for approved fuel conditioners to improve storage and performance with BioDiesel fuels.

The following must also be considered if using BioDiesel blends above B20:

- Possible coking or blocked injector nozzles, resulting in power loss and engine misfire if John Deere approved fuel conditioners are not used
- Possible crankcase oil dilution (requiring more frequent oil changes)
- Possible lacquering or seizure of internal components
- Possible formation of sludge and sediments
- Possible thermal oxidation of fuel at elevated temperatures
- Possible compatibility issues with other materials (including copper, lead, zinc, tin, brass, and bronze) used in fuel handling equipment

Continued on next page

DX,FUEL7 -19-15MAY13-1/2

- Possible reduction in water separator efficiency
- Possible damage to paint if exposed to BioDiesel
- Possible corrosion of fuel injection equipment
- Possible elastomeric seal and gasket material degradation (primarily an issue with older engines)
- Possible high acid levels within fuel system
- Because BioDiesel blends above B20 contain more ash, using blends above B20 can result in more rapid ash loading and require more frequent cleaning of the Exhaust Filter (if present)

IMPORTANT: Raw pressed vegetable oils are NOT acceptable for use as fuel in any concentration in John Deere engines. Their use could cause engine failure.

DX,FUEL7 -19-15MAY13-2/2

Testing Diesel Fuel

A fuel analysis program can help to monitor the quality of diesel fuel. The fuel analysis can provide critical data such as cetane number, fuel type, sulfur content, water content, appearance, suitability for cold weather operations, bacteria, cloud point, acid number, particulate contamination, and whether the fuel meets specification.

Contact your John Deere dealer for more information on diesel fuel analysis.

DX,FUEL6 -19-14APR11-1/1

Fuel Filters

The importance of fuel filtration cannot be overemphasized with modern fuel systems. The combination of increasingly restrictive emission regulations and more efficient engines requires fuel system to operate at much higher pressures. Higher pressures can only be achieved using fuel injection components with very close tolerances. These close manufacturing tolerances have significantly reduced capacities for debris and water.

John Deere brand fuel filters have been designed and produced specifically for John Deere engines.

To protect the engine from debris and water, always change engine fuel filters as specified in this manual.

DX,FILT2 -19-14APR11-1/1

Minimizing the Effect of Cold Weather on Diesel Engines

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

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

Use Winter Grade Fuel

When temperatures fall below 0 °C (32 °F), winter grade fuel (No. 1-D in North America) is best suited for cold-weather operation. Winter grade fuel has a lower cloud point and a lower pour point.

Cloud point is the temperature at which wax begins to form in the fuel. This wax causes fuel filters to plug. **Pour point** is the lowest temperature at which movement of the fuel is observed.

NOTE: On average, winter grade diesel fuel has a lower Btu (heat content) rating. Using winter grade fuel may reduce power and fuel efficiency, but should not cause any other engine performance effects. Check the grade of fuel being used before troubleshooting for low-power complaints in cold-weather operation.

Air Intake Heater

An air intake heater is an available option for some engines to aid cold weather starting.

Ether

An ether port on the intake is available to aid cold weather starting.

CAUTION: Ether is highly flammable. Do not use ether when starting an engine equipped with glow plugs or an air intake heater.

Coolant Heater

An engine block heater (coolant heater) is an available option to aid cold weather starting.

Seasonal Viscosity Oil and Proper Coolant Concentration

Use seasonal grade viscosity engine oil based on the 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 in this section.)

Diesel Fuel Flow Additive

Use John Deere Fuel-Protect Diesel Fuel Conditioner (winter formula), which contains anti-gel chemistry, or equivalent fuel conditioner to treat non-winter grade fuel (No. 2-D in North America) during the cold-weather season. This generally extends operability to about 10 °C (18 °F) below the fuel cloud point. For operability at even lower temperatures, use winter grade fuel.

IMPORTANT: Treat fuel when outside temperature drops below 0 °C (32 °F). For best results, use with untreated fuel. Follow all recommended instructions on label.

BioDiesel

When operating with BioDiesel blends, wax formation can occur at warmer temperatures. Begin using John Deere Fuel-Protect Diesel Fuel Conditioner (winter formula) at 5 °C (41 °F) to treat BioDiesel fuels during the cold-weather season. Use B5 or lower blends at temperatures below 0 °C (32 °F). Use only winter grade petroleum diesel fuel at temperatures below -10 °C (14 °F).

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 John Deere dealer.

DX,FUEL10 -19-15MAY13-1/1

Diesel Engine Break-In Oil — Non-Emissions Certified and Certified Tier 1, Tier 2, Tier 3, Stage I, Stage II, and Stage III

New engines are filled at the factory with either John Deere Break-In™ or John Deere Break-In Plus™ Engine Oil. During the break-in period, add John Deere Break-In™ or Break-In Plus™ Engine Oil, respectively, as needed to maintain the specified oil level.

Operate the engine under various conditions, particularly heavy loads with minimal idling, to help seat engine components properly.

If John Deere Break-In™ Engine Oil is used during the initial operation of a new or rebuilt engine, change the oil and filter at a maximum of 100 hours.

If John Deere Break-In Plus™ Engine Oil is used, change the oil and filter at a minimum of 100 hours and a maximum equal to the interval specified for John Deere Plus-50™ II or Plus-50™ oil.

After engine overhaul, fill the engine with either John Deere Break-In™ or Break-In Plus™ Engine Oil.

If John Deere Break-In™ or Break-In Plus™ Engine Oil is not available, use an SAE 10W-30 viscosity grade diesel engine oil meeting one of the following and change the oil and filter at a maximum of 100 hours of operation:

- API Service Classification CE
- API Service Classification CD
- API Service Classification CC
- ACEA Oil Sequence E2
- ACEA Oil Sequence E1

Break-In is a trademark of Deere & Company.
Break-In Plus is a trademark of Deere & Company
Plus-50 is a trademark of Deere & Company.

IMPORTANT: Do not use Plus-50™ II, Plus-50™, or engine oils meeting any of the following for the initial break-in of a new or rebuilt engine:

API CJ-4	**ACEA E9**
API CI-4 PLUS	**ACEA E7**
API CI-4	**ACEA E6**
API CH-4	**ACEA E5**
API CG-4	**ACEA E4**
API CF-4	**ACEA E3**
API CF-2	
API CF	

These oils do not allow the engine to break in properly.

John Deere Break-In Plus™ Engine Oil can be used for all John Deere diesel engines at all emission certification levels.

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

DX,ENOIL4 -19-15MAY13-1/1

Diesel Engine Oil — Tier 3 and Stage IIIA Marine Engines

Category	Displacement per Cylinder (D)	
	Tier 1 and 2	Tier 3 and 4
1	D < 5 L	D < 7 L
2	5 L ≤ D < 30 L	7 L ≤ D < 30 L
3	D ≥ 30 L	

IMPORTANT: Category 2 and Category 3 marine engine owners should consult their engine Operator's Manual or see their engine distributor before using Plus-50 II oil.

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

John Deere Plus-50™ II oil is preferred.

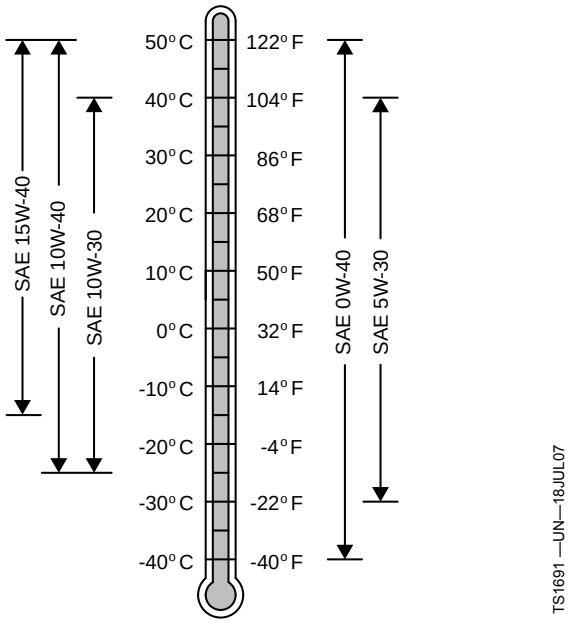
Other oils may be used if they meet one or more of the following:

- John Deere Torq-Gard™
- API Service Category CJ-4
- API Service Category CI-4 PLUS
- API Service Category CI-4
- ACEA Oil Sequence E9
- ACEA Oil Sequence E7
- ACEA Oil Sequence E6
- ACEA Oil Sequence E5
- ACEA Oil Sequence E4

Multi-viscosity diesel engine oils are preferred.

Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates.

Plus-50 is a trademark of Deere & Company
Torq-Gard is a trademark of Deere & Company



Oil Viscosities for Air Temperature Ranges

DO NOT use diesel fuel with sulfur content greater than 10000 mg/kg (10000 ppm).

ZE59858,000024D -19-08NOV13-1/1

Engine Oil and Filter Service Intervals — Tier 3 and Stage IIIA — Marine Engines

Recommended oil and filter service intervals are based on a combination of oil pan capacity, type of engine oil and filter used, and sulfur content of the diesel fuel. Actual service intervals also depend on operation and maintenance practices.

Use oil analysis to evaluate the condition of the oil and to aid in selection of the proper oil and filter service interval. Contact your John Deere dealer for more information on engine oil analysis.

Change the oil and oil filter at least once every 12 months even if the hours of operation are fewer than the otherwise recommended service interval.

Diesel fuel sulfur content affects engine oil and filter service intervals.

- Use of diesel fuel with sulfur content less than 1000 mg/kg (1000 ppm) is RECOMMENDED.
- Use of diesel fuel with sulfur content 1000—2000 mg/kg (1000—2000 ppm) REDUCES the oil and filter change interval.
- BEFORE using diesel fuel with sulfur content greater than 2000 mg/kg (2000 ppm), contact your John Deere dealer.
- DO NOT use diesel fuel with sulfur content greater than 10000 mg/kg (10000 ppm).

IMPORTANT: To avoid engine damage:

- **Reduce oil and filter service intervals by 50% when using BioDiesel blends greater than B20. Oil analysis may allow longer service intervals.**
- **Use only approved oil types.**

Approved Oil Types:

- “Plus-50 Oils” include John Deere Plus-50™ II and John Deere Plus-50™.
- “Other Oils” include John Deere Torq-Gard™, API CJ-4, API CI-4 PLUS, API CI-4, ACEA E9, ACEA E7, ACEA E6, ACEA E5, and ACEA E4.

Engine Oil and Filter Service Intervals	
Fuel Sulfur	Less than 1000 mg/kg (1000 ppm)
Plus-50 Oils	375 hours
Other Oils	250 hours
Fuel Sulfur	1000—2000 mg/kg (1000—2000 ppm)
Plus-50 Oils	300 hours
Other Oils	200 hours
Fuel Sulfur	2000—10000 mg/kg (2000—10000 ppm)
Plus-50 Oils	Contact John Deere dealer
Other Oils	Contact John Deere dealer
Fuel Sulfur	Greater than 10000 mg/kg (Greater than 10000 ppm)
Plus-50 Oils	Do not use
Other Oils	Do not use
Oil analysis may extend the service interval of “Other Oils” to a maximum not to exceed the interval of Plus-50 Oils.	

Plus-50 is a trademark of Deere & Company
Torq-Gard is a trademark of Deere & Company

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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.

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

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

Alternative and Synthetic Lubricants

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

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

Consult your John Deere dealer to obtain information and recommendations.

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

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

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

DX,ALTER -19-11APR11-1/1

Lubricant Storage

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

Use clean containers to handle all lubricants.

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

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

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

DX,LUBST -19-11APR11-1/1

Oil Filters

Filtration of oils is critically important for proper operation and lubrication. John Deere brand oil filters have been designed and produced specifically for John Deere applications.

John Deere filters adhere to engineering specifications for quality of the filter media, filter efficiency rating, strength of the bond between the filter media and the element end cap, fatigue life of the canister (if applicable), and pressure capability of the filter seal. Non-John Deere branded oil filters might not meet these key John Deere specifications.

Always change oil filters regularly as specified in this manual.

DX,FILT1 -19-11APR11-1/1

Diesel Engine Coolant (engine with wet sleeve cylinder liners)

Preferred Coolants

The following pre-mix engine coolants are preferred:

- **John Deere COOL-GARD™II**
- **John Deere COOL-GARD II PG**

COOL-GARD II pre-mix coolant is available in several concentrations with different freeze protection limits as shown in the following table.

COOL-GARD II pre-mix	Freeze Protection Limit
COOL-GARD II 20/80	-9 °C (16 °F)
COOL-GARD II 30/70	-16 °C (3 °F)
COOL-GARD II 50/50	-37 °C (-34 °F)
COOL-GARD II 55/45	-45 °C (-49 °F)
COOL-GARD II PG 60/40	-49 °C (-56 °F)
COOL-GARD II 60/40	-52 °C (-62 °F)

Not all COOL-GARD II pre-mix products are available in all countries.

Use COOL-GARD II PG when a non-toxic coolant formulation is required.

Additional Recommended Coolants

The following engine coolant is also recommended:

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

IMPORTANT: When mixing coolant concentrate with water, do not use less than 40% or greater than 60% concentration of coolant. Less than 40% gives inadequate additives for corrosion protection. Greater than 60% can result in coolant gelation and cooling system problems.

Other Coolants

Other ethylene glycol or propylene glycol base coolants may be used if they meet the following specification:

- Pre-mix coolant meeting ASTM D6210 requirements
- Coolant concentrate meeting ASTM D6210 requirements in a 40—60% mixture of concentrate with quality water

If coolant meeting one of these specifications is unavailable, use a coolant concentrate or pre-mix coolant that has a minimum of the following chemical and physical properties:

- Provides cylinder liner cavitation protection according to either the John Deere Cavitation Test Method or a fleet study run at or above 60% load capacity
- Is formulated with a nitrite-free additive package
- Protects the cooling system metals (cast iron, aluminum alloys, and copper alloys such as brass) from corrosion

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 and propylene glycol base engine coolant concentrate.

Coolant Drain Intervals

Drain and flush the cooling system and refill with fresh coolant at the indicated interval, which varies with the coolant used.

When COOL-GARD II or COOL-GARD II PG is used, the drain interval is 6 years or 6000 hours of operation.

If a coolant other than COOL-GARD II or COOL-GARD II PG is used, reduce the drain interval to 2 years or 2000 hours of operation.

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

Do not mix ethylene glycol and propylene glycol base coolants.

Do not use coolants that contain nitrites.

COOL-GARD is a trademark of Deere & Company

DX,COOL3 -19-15MAY13-1/1

Water Quality for Mixing with Coolant Concentrate

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

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

All water used in the cooling system should meet the following minimum specifications for quality:

Chlorides	<40 mg/L
Sulfates	<100 mg/L
Total solids	<340 mg/L
Total dissolved I hardness	<170 mg/L
pH	5.5—9.0

IMPORTANT: Do not use bottled drinking water because it often contains higher concentrations of total dissolved solids.

Freeze Protection

The relative concentrations of glycol and water in the engine coolant determine its freeze protection limit.

Ethylene Glycol	Freeze Protection Limit
40%	-24 °C (-12 °F)
50%	-37 °C (-34 °F)
60%	-52 °C (-62 °F)
Propylene Glycol	**Freeze Protection Limit**
40%	-21 °C (-6 °F)
50%	-33 °C (-27 °F)
60%	-49 °C (-56 °F)

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

DX,COOL19 -19-15MAY13-1/1

Operating in Warm Temperature Climates

John Deere engines are designed to operate using recommended engine coolants.

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

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

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

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

DX,COOL6 -19-15MAY13-1/1

Testing Coolant Freeze Point

The use of a handheld coolant refractometer is the quickest, easiest, and most accurate method to determine coolant freeze point. This method is more accurate than a test strip or a float-type hydrometer which can produce poor results.

A coolant refractometer is available through your John Deere dealer under the SERVICEGARD™ tool program. Part number 75240 provides an economical solution to accurate freeze point determination in the field.

To use this tool:

1. Allow cooling system to cool to ambient temperatures.
2. Open radiator cap to expose coolant.
3. With the included dropper, collect a small coolant sample.
4. Open the lid of the refractometer, place one drop of coolant on the window and close the lid.
5. Look through the eyepiece and focus as necessary.
6. Record the listed freeze point for the type of coolant (ethylene glycol coolant or propylene glycol) being tested.

TS1732 —UN—04SEP13

SERVICEGARD™ Part Number 75240

TS1733 —UN—04SEP13

Image with a Drop of 50/50 Coolant Placed on the Refractometer Window

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DX,COOL,TEST -19-13JUN13-1/1

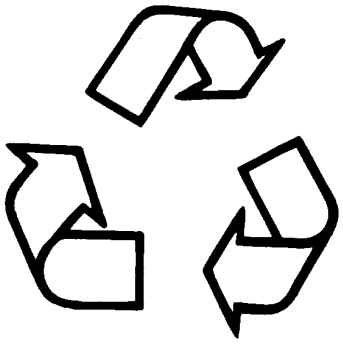
Disposing of Coolant

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

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

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

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



TS1133 —UN—15APR13

Recycle Waste

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Sea Trials for Performance and Warranty

NOTE: John Deere Marine Engines are not eligible for an extended warranty until proper installation and performance is found to be consistent with John Deere's Application Guidelines; verified by a sea trial. Once a sea trial has been completed, your John Deere dealer / distributor will provide the results to John Deere for analysis. If the engine installation meets all guidelines it will then be eligible for extended warranty.

Following any John Deere marine engine installation a John Deere Marine dealer should conduct a sea trial in order to validate proper installation. In order to maximize the performance of each vessel, it is very important to have each installation checked mechanically and electronically before it is put into regular service. The testing and investigation conducted during sea trials can proactively identify issues before they potentially result in performance problems. Sea trials also provide valuable insight to optimize engine performance, improve long-term durability, and provide a useful reference for future updates.

Two important requirements examined in a sea trial are exhaust backpressure and rated engine speed. Exceeding the recommended backpressure could result in extensive engine damage or failure. The rated engine speed is checked to verify the vessel is not over-propped (propeller is too big) or under-propped (propeller is too small). Either of these conditions will reduce engine life expectancy, increase repair costs and negatively impact fuel consumption. The John Deere Marine dealer should also verify that the additional requirements set forth in the John Deere Marine Application Guidelines were met during engine installation.

RG17228 —UN—12JUN09

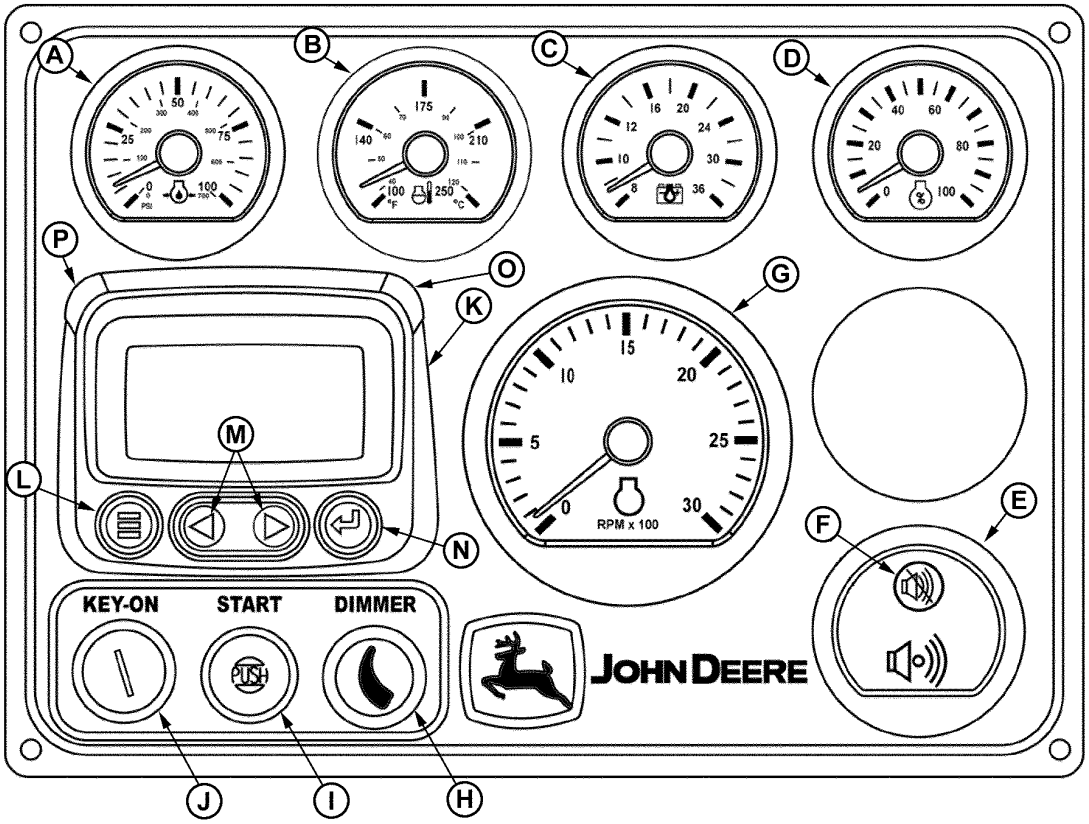
The overall benefit of the sea trial is to verify the engines are installed correctly and are properly matched to the vessel. This provides for the best possible performance in the unpredictable conditions you may operate in on the open water.

NOTICE: ANY ENGINE DAMAGE RESULTING FROM OVER-PROPPING, EXCESSIVE EXHAUST BACK-PRESSURE OR OTHER INSTALLATION / RIGGING ISSUES ARE NOT COVERED UNDER WARRANTY.

NOTE: The specifications section in the back of this manual lists the rated speed for each of the different available power ratings.

JR74534,0000294 -19-23AUG11-1/1

John Deere Instrument (Gauge) Panel (Electronically Controlled Engines)



RG13131 —UN—09OCT03

Instrument Panel (Main Station Panel Shown)

A—Oil Pressure Gauge
B—Coolant Temperature Gauge
C—Voltmeter
D—Percent Load Gauge
E—Audible Alarm
F—Audible Alarm Override Button
G—Tachometer
H—Dimmer Switch
I— Start Button
J— Key Switch
K—Diagnostic Gauge
L—Menu Key
M—Arrow Keys
N—Enter Key
O—Red "STOP ENGINE" Indicator Light
P—Amber "WARNING" Indicator Light

Tier 3 John Deere ***POWERTECH***™ Marine Engines have an electronic control system, which has the following controls and gauges as shown. The following information applies only to those controls and gauges supplied by John Deere for electronically controlled engines. Refer to your engine application manual or boat builder for specific guidelines if John Deere-sourced controls and instrumentation are not used.

NOTE: The standard main station (wheel house) instrument panel is shown. An optional fly-bridge panel is also available that includes the same gauges as the standard panel, but has a stop button in place of the key start switch.

NOTE: On generator-set engines, the gauges are supplied by the gen-set manufacturer. Minimum gauges required are: hour meter, oil pressure gauge and coolant temperature gauge as well as safety shutdown devices.

Continued on next page

RG19661,00003B4 -19-08NOV13-1/2

IMPORTANT: Whenever an electronic gauge or sensor does not register a correct reading, replace it with a new one. DO NOT attempt to repair it. Wiring diagrams are located in the TROUBLESHOOTING Section later in this manual.

Following is a brief description of the available optional electronic controls and gauges found on John Deere provided instrument panels. Refer to manufacturer's literature for information on controls not provided by Deere.

A—Engine Oil Pressure Gauge

The oil pressure gauge (A) indicates engine oil pressure. An audible alarm (E) warns the operator if engine oil pressure falls below a safe operating pressure.

B—Engine Coolant Temperature Gauge

The engine coolant temperature gauge (B) indicates engine coolant temperature. An audible alarm (E) warns the operator if coolant temperature rises above the preset safe operating temperature.

C—Voltmeter

The voltmeter (C) indicates system battery voltage. The amber "Warning" light (P) will illuminate when battery voltage is too low for proper operation of the fuel injection system.

D—Percent Load Gauge

The percent load gauge shows percent of available engine power being used by the vessel.

E—Audible Alarm

The audible alarm (E) will sound whenever low oil pressure, high coolant temperature, or water-in-fuel conditions exist. This includes all signals that light up the amber "warning" indicator (intermittent alarm) or the red "stop engine" indicator (steady alarm).

F—Audible Alarm Override Button

The audible alarm has an override button (F) that silences the audible alarm for approximately Two minutes when pressed.

G—Tachometer

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

H—Dimmer Switch

The dimmer switch (H) allows the operator to dim or brighten the illumination of the instrument panel. The diagnostic gauge (K) also has a backlight adjustment function.

I—Start Button

The start button (I), when pressed and held in, operates the starting motor to start the engine. The engine will only start with key switch (J) in the "ON" position.

RG19661,00003B4 -19-08NOV13-2/2

John Deere Instrument (Gauge) Panel (Electronically Controlled Engines) (Continued)

J—Key Switch

The wheel house instrument panel has a two-position (OFF/ON) key switch (J) which controls the engine electrical system, starts and stops the engine. When the switch is in the “ON” position, the engine may be started by pressing the start button (I).

The fly bridge instrument panel has a stop button in place of the key switch. With the key switch on the wheel house instrument panel in the ON position, the engine can be started and stopped from the fly bridge instrument panel.

K—Diagnostic Gauge/Hour Meter

The diagnostic gauge (K) displays diagnostic trouble codes (DTCs) as they are accessed. Other information on the engine can be accessed using the touch keys (L, M and N). The hour meter feature shows the operating hours of the engine and should be used as a guide for scheduling periodic maintenance. If the diagnostic gauge receives a trouble code from an engine control unit, the current display will switch to a warning or shutdown (depending on the severity of the code) screen that will display the trouble code number, the description of the code and the corrective action needed. (Refer to the following pages for use of the diagnostic gauge.)

L—Menu Key

The menu key is pressed to either enter or exit the menu screens.

M—Arrow Keys

Use the touch keys (M) to change the display on the window of the diagnostic gauge and to access engine performance data.

Pressing the left arrow to scroll to the left or upward or the right arrow to scroll to the right or downward. This will allow you to view various engine parameters and any diagnostic trouble codes that occur.

Refer to the following story for accessing engine information on the diagnostic gauge using the touch keys.

N—Enter Key

The enter key is pressed to select the parameter that is highlighted on the screen.

O—Red “STOP ENGINE” Indicator Light

When light comes on, stop engine immediately or as soon as safely possible to prevent engine damage. Correct problem before restarting.

P—Amber “WARNING” Indicator Light

When light comes on, an abnormal condition exists. It is not necessary to shutdown engine immediately, but problem should be corrected as soon as possible.

OURGP12,0000218 -19-28APR06-1/1

Using Diagnostic Gauge to Access Engine Information

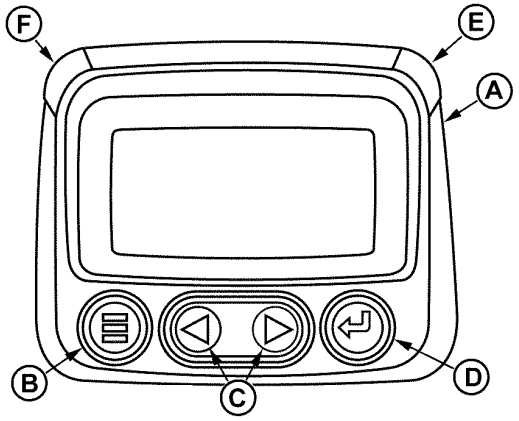
The diagnostic gauge (A) allows the operator to view many readouts of engine functions and trouble codes (DTCs). The gauge is linked to the electronic control system and its sensors. This allows the operator to monitor engine functions and to troubleshoot the engine systems when needed.

Press the menu key (B) to access the various engine functions in sequence. The displays can be selected as either customary English or metric units.

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

- Engine hours
- Engine rpm
- System voltage
- Percent engine load at the current rpm
- Coolant temperature
- Oil pressure
- Throttle position
- Intake manifold temperature
- Current fuel consumption
- Active service (diagnostic) codes
- Stored service (diagnostic) codes from the engine
- Set the units for display
- View the engine configuration parameters

The diagnostic gauge includes a graphical backlit Liquid Crystal Display (LCD) screen. The display can show either a single parameter or a quadrant display showing four parameters simultaneously. The diagnostic gauge uses two arrow keys (C) for scrolling through the engine parameter list and viewing the menu list and an enter key (D) for selecting highlighted items. The red (E) and amber (F) lights are used to signal active trouble code received by the diagnostic gauge.



RG13132 —UN—09SEP03

Diagnostic Gauge

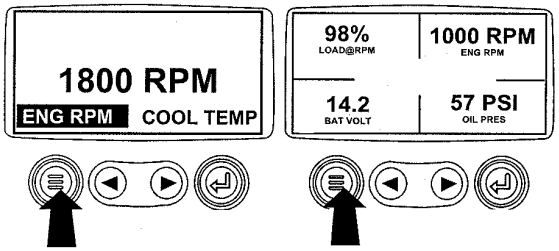
A—Diagnostic Gauge
B—Menu Key
C—Arrow Keys
D—Enter Key
E—Red "STOP ENGINE" Indicator Light
F—Amber "WARNING" Indicator Light

OURGP11,00000A7 -19-03SEP03-1/1

Main Menu Navigation

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting the Engine in the Engine Operation Section. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.



RG13159 —UN—26SEP03

Menu Key

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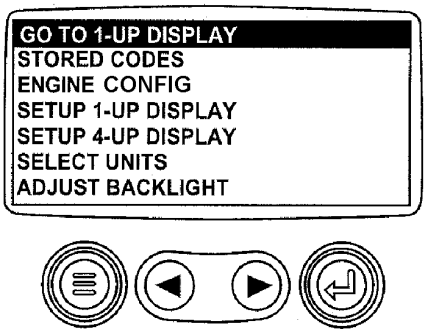
OURGP11,00000A9 -19-20SEP13-1/5

2. The first seven items of the "Main Menu" will be displayed.

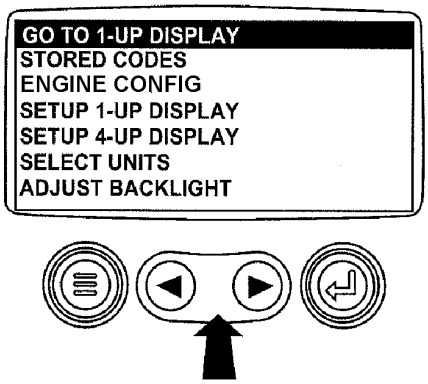


RG13160 —UN—02OCT03

Menu Display

OURGP11,00000A9 -19-20SEP13-2/5

3. Pressing the "Arrow" keys will scroll through the menu selections.

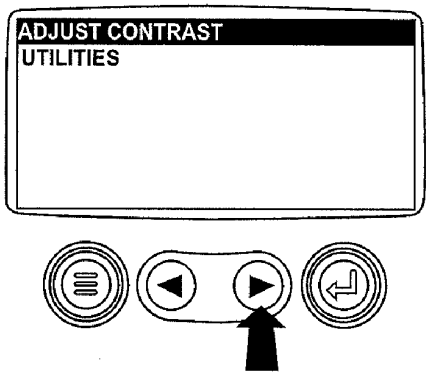


RG13161 —UN—02OCT03

Main Menu Items

OURGP11,00000A9 -19-20SEP13-3/5

4. Pressing the right arrow key will scroll down to reveal the last items of "Main Menu" screen, highlighting the next item down.



RG13162 —UN—26SEP03

Last Items On Main Menu

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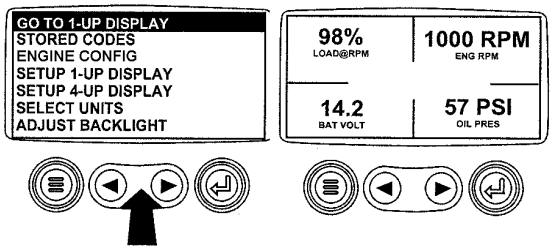
OURGP11,00000A9 -19-20SEP13-4/5

5. Use the arrow keys to scroll to the desired menu item or press the "Menu Button" to exit the main menu and return to the engine parameter display.



RG13163 —UN—02OCT03

Use Arrow Buttons To Scroll / Quadrant Display

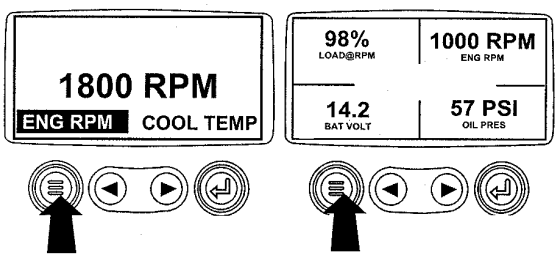
OURGP11,00000A9 -19-20SEP13-5/5

Engine Configuration Data

NOTE: The engine configuration data is a read only function.

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, see Starting the Engine in the Engine Operation Section. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

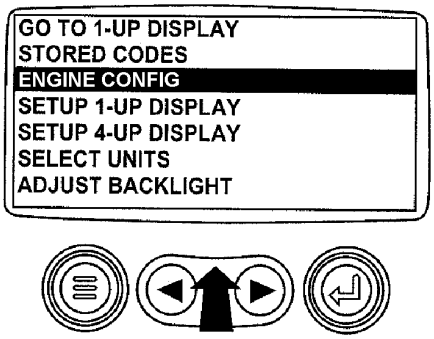


RG13159 —UN—26SEP03

Menu Key

OURGP11,00000AB -19-08NOV13-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Engine Config" is highlighted.



RG13164 —UN—07OCT03

Select Engine Configuration

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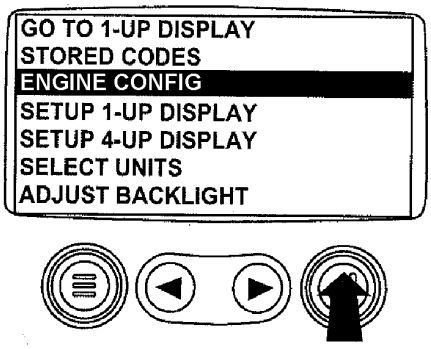
OURGP11,00000AB -19-08NOV13-2/6

3. Once "Engine Config" menu item has been highlighted, press the "Enter" key to view the engine configuration data.

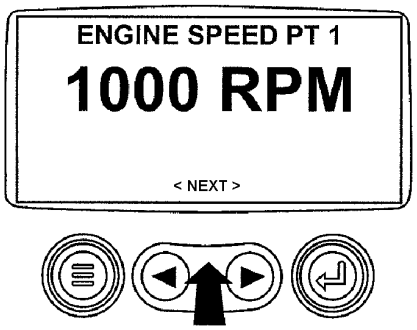


RG13165 —UN—02OCT03

Enter Key

OURGP11,00000AB -19-08NOV13-3/6

4. Use the "Arrow" keys to scroll through the engine configuration data.

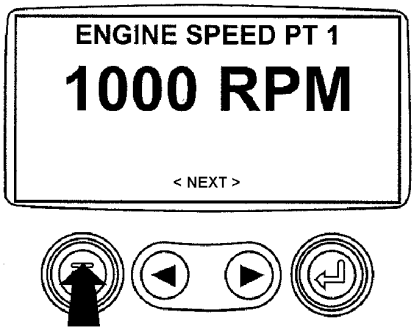


RG13166 —UN—29SEP03

Use Arrow Keys To Scroll

OURGP11,00000AB -19-08NOV13-4/6

5. Press the "Menu" key to return to the main menu.



RG13167 —UN—29SEP03

Return To Main Menu

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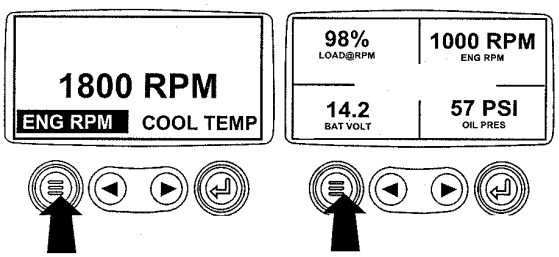
OURGP11,00000AB -19-08NOV13-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



RG13159 —UN—26SEP03

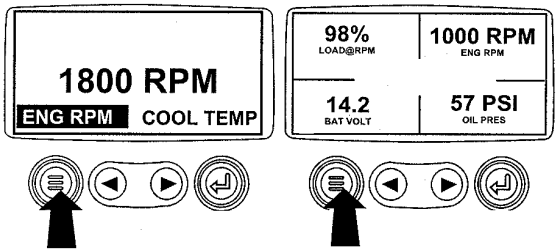
Exit Main Menu

OURGP11,00000AB -19-08NOV13-6/6

Accessing Stored Diagnostic Trouble Codes

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, See Starting The Engine in the Engine Operation Section. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

For description of diagnostic trouble codes, see Diagnostic Trouble Codes (DTCs) — Listing in the Troubleshooting Section.



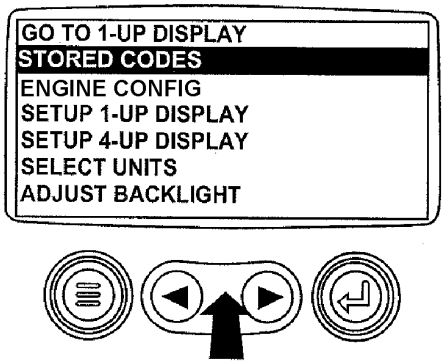
RG13159 —UN—26SEP03

Menu Key

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

OURGP11,00000AC -19-29OCT13-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Stored Codes" is highlighted.



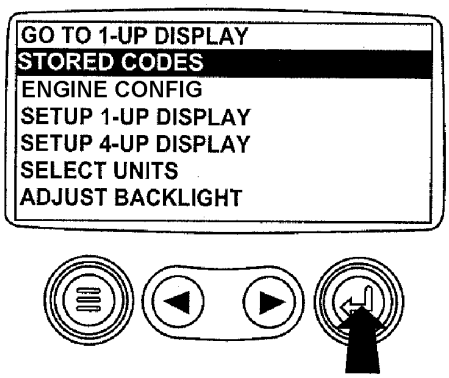
RG13168 —UN—02OCT03

Select Stored Codes

Continued on next page

OURGP11,00000AC -19-29OCT13-2/6

3. Once the "Stored Codes" menu item has been highlighted press the "Enter" key to view the stored codes.

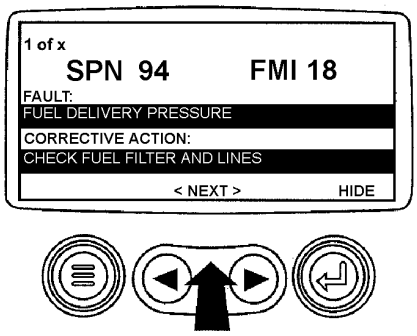


RG13169 —UN—02OCT03

Enter Key

OURGP11,00000AC -19-29OCT13-3/6

4. If the word "Next" appears above the "Arrow" keys, there are more stored codes that may be viewed. Use the "Arrow" key to scroll to the next stored code.

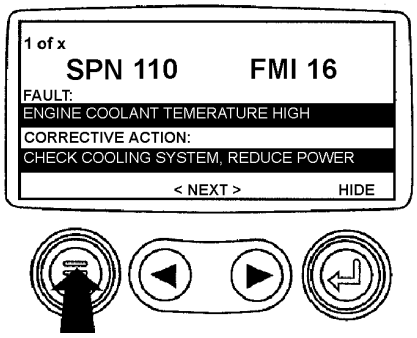


RG13245 —UN—02OCT03

Use Arrow Keys To Scroll

OURGP11,00000AC -19-29OCT13-4/6

5. Press the "Menu" key to return to the main menu.



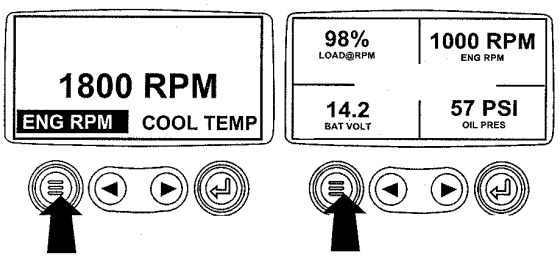
RG13246 —UN—02OCT03

Return To Main Menu

Continued on next page

OURGP11,00000AC -19-29OCT13-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



Exit Main Menu

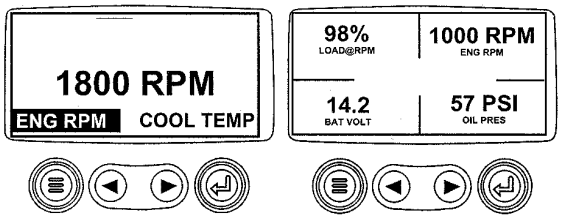
OURGP11,00000AC -19-29OCT13-6/6

Accessing Active Diagnostic Trouble Codes

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, see Starting The Engine in the Engine Operation Section. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

For description of diagnostic trouble codes, see Diagnostic Trouble Codes (DTCs) — Listing in the Troubleshooting Section.

1. During normal operation the single or four parameter screen will be displayed.

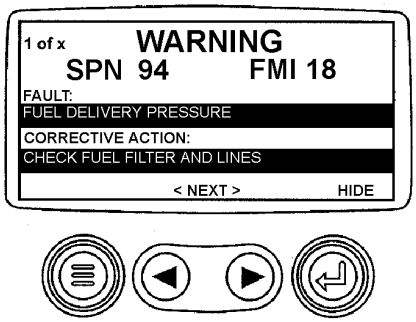


Normal Operation

OURGP11,00000AD -19-08NOV13-1/7

2. When the diagnostic gauge receives a diagnostic trouble code from an engine control unit, the single or four parameter screen will be replaced with the "Warning" message. The SPN and FMI number will be displayed along with a description of the problem and the corrective action needed.

IMPORTANT: Ignoring active diagnostic trouble codes can result in severe engine damage.

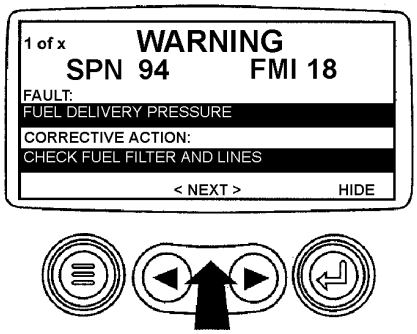


Active Diagnostic Trouble Codes Displayed

Continued on next page

OURGP11,00000AD -19-08NOV13-2/7

3. If the word "Next" appears above the arrow keys, there are more diagnostic trouble codes that can be viewed by using the arrow keys to scroll to the next diagnostic trouble code.



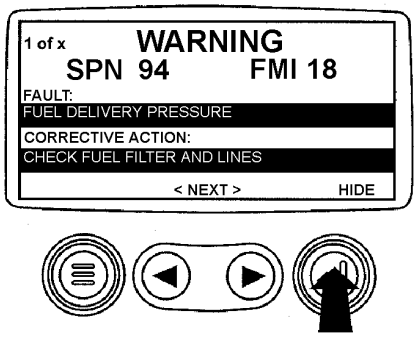
RG13241 —UN—30SEP03

Use Arrow Keys To Scroll

OURGP11,00000AD -19-08NOV13-3/7

IMPORTANT: Ignoring active diagnostic trouble codes can result in severe engine damage.

4. To acknowledge and hide the code and return to the single or four parameter display, press the "Enter" Key.

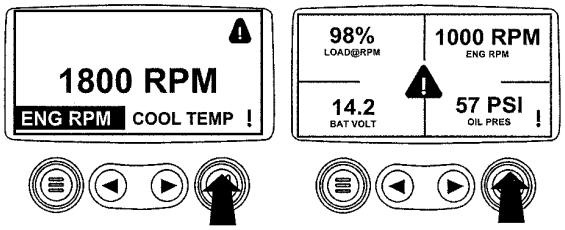


RG13242 —UN—30SEP03

Hide Diagnostic Trouble Codes

OURGP11,00000AD -19-08NOV13-4/7

5. The display will return to the single or four parameter display, but the display will contain the warning icon. Pressing the "Enter" key will redisplay the hidden diagnostic trouble code.



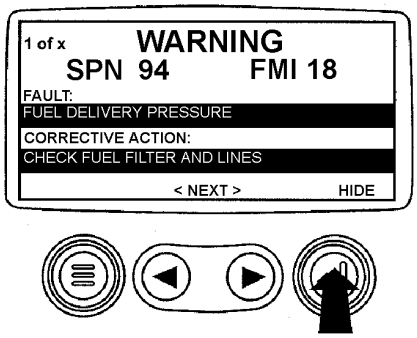
RG13176 —UN—26SEP03

Active Diagnostic Trouble Code Icon

OURGP11,00000AD -19-08NOV13-5/7

IMPORTANT: Ignoring active diagnostic trouble codes can result in severe engine damage.

6. Pressing the "Enter" key once again will hide the diagnostic trouble code and return the screen to the single or four parameter display.



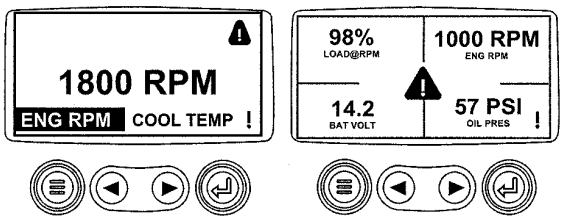
RG13242 —UN—30SEP03

Enter Key

Continued on next page

OURGP11,00000AD -19-08NOV13-6/7

7. The single or four parameter screen will display the warning icon until the diagnostic trouble code condition is corrected.



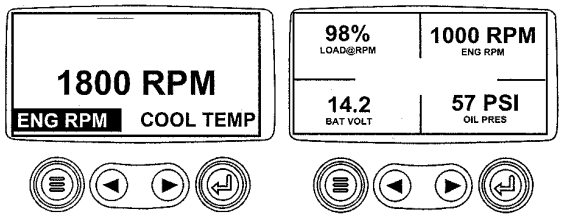
RG13243 —UN—01OCT03

Active Diagnostic Trouble Code Condition

OURGP11,00000AD -19-08NOV13-7/7

Engine Shutdown Diagnostic Trouble Codes

1. During normal operation the single or four parameter screen will be displayed.



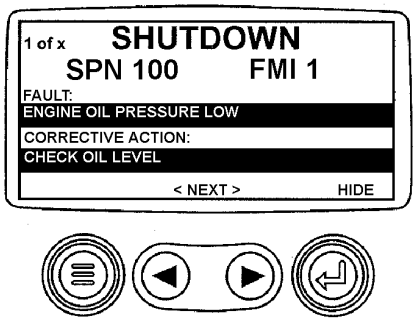
RG13172 —UN—26SEP03

Normal Operation

OURGP11,00000AE -19-29OCT13-1/6

2. When the diagnostic gauge receives a severe diagnostic trouble code from an engine control unit, the single or four parameter screen will be replaced with the "Shutdown" message. The SPN and FMI number will be displayed along with a description of the problem and the corrective action needed.

   If the word "Next" appears above the arrow keys, there are more diagnostic trouble codes that can be viewed by using the arrow keys to scroll to the next diagnostic trouble code.



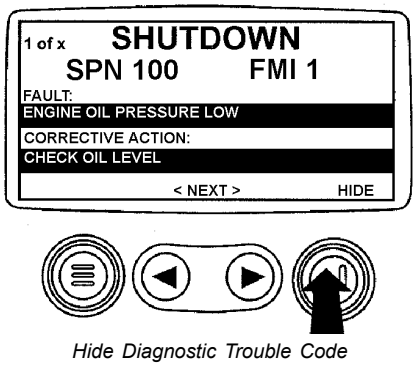
RG13238 —UN—29SEP03

Shutdown Message

OURGP11,00000AE -19-29OCT13-2/6

3. To acknowledge and hide the diagnostic trouble code and return to the single or four parameter display, press the "Enter" key".

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



RG13239 —UN—29SEP03

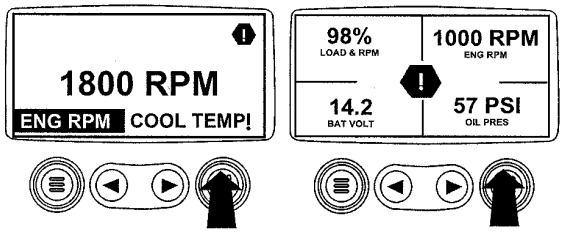
Hide Diagnostic Trouble Code

Continued on next page

OURGP11,00000AE -19-29OCT13-3/6

4. The display will return to the single or four parameter display, but the display will contain the "Shutdown" icon. Pressing the "Enter" key will redisplay the hidden diagnostic trouble code.

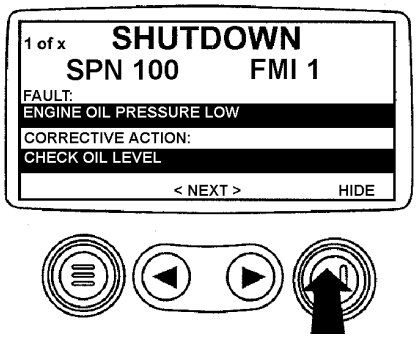
IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



Flashing Shutdown Icon

OURGP11,00000AE -19-29OCT13-4/6

5. Pressing the "Enter" key once again will hide the diagnostic trouble code and return the screen to the single or four parameter display.

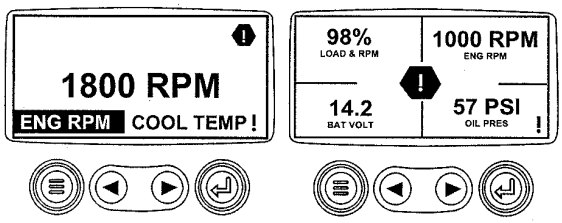


Redisplay Diagnostic Trouble Code

OURGP11,00000AE -19-29OCT13-5/6

6. The single or four parameter screen will display the shutdown icon until the diagnostic trouble code condition is corrected.

IMPORTANT: Ignoring the shutdown message can result in severe engine damage.



Shutdown Icon

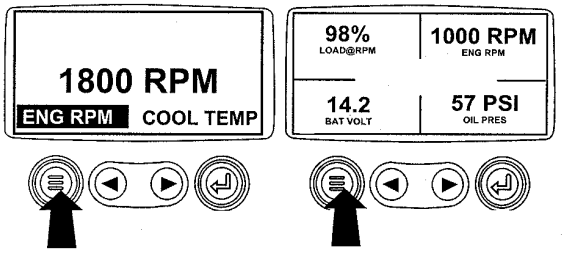
OURGP11,00000AE -19-29OCT13-6/6

Adjusting Backlighting

NOTE: The backlight control on the instrument panel may also be used to adjust backlighting. This control will override any adjustment made on the diagnostic gauge.

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens. If engine start up is desired, see Starting the Engine in the Engine Operation Section. All of the engine values illustrated on the diagnostic gauge indicate the engine is running.

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.

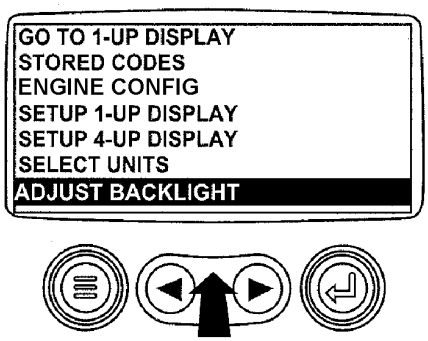


Menu Key

Continued on next page

OURGP11,00000AA -19-06NOV13-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Adjust Backlight" is highlighted.

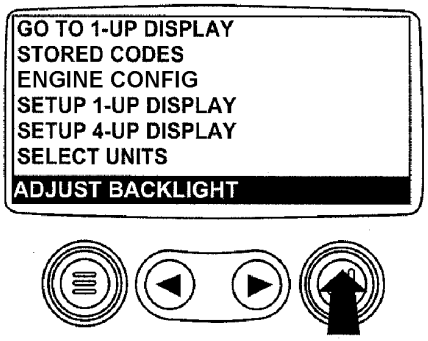


RG13181 —UN—02OCT03

Select Adjust Backlight

OURGP11,00000AA -19-06NOV13-2/6

3. Once the "Adjust Backlight" menu item has been highlighted, press the "Enter" key to activate the "Adjust Backlight" function.

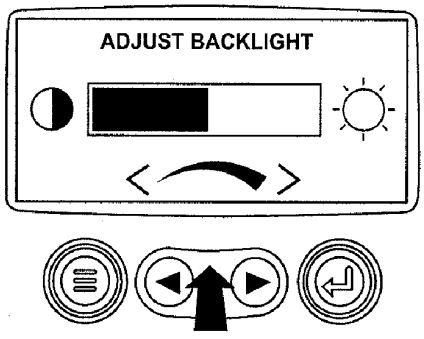


RG13182 —UN—02OCT03

Press Enter Key

OURGP11,00000AA -19-06NOV13-3/6

4. Use the "Arrow" keys to select the desired backlight intensity.



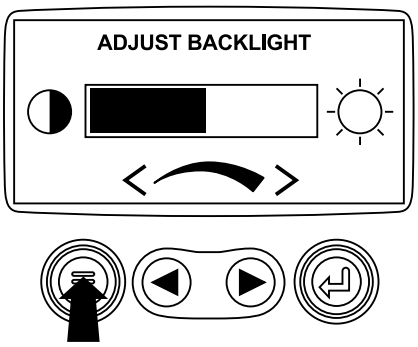
RG13183 —UN—29SEP03

Adjust Backlight Intensity

Continued on next page

OURGP11,00000AA -19-06NOV13-4/6

5. Press the "Menu" key to return to the main menu.

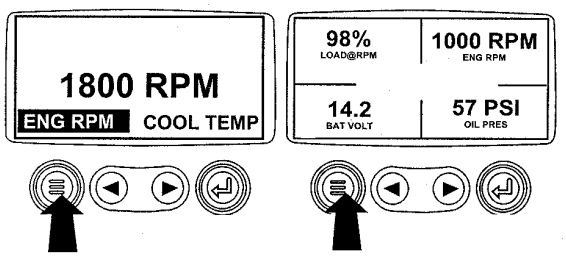


RG19048 —UN—23AUG10

Return To Main Menu

OURGP11,00000AA -19-06NOV13-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.



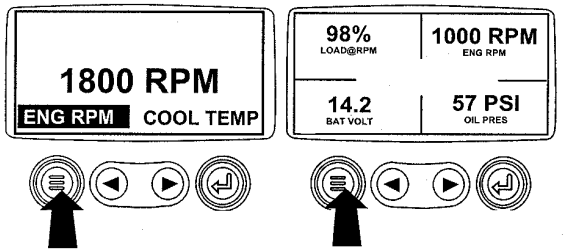
RG13159 —UN—26SEP03

Exit Main Menu

OURGP11,00000AA -19-06NOV13-6/6

Adjusting Contrast

1. Turn the key switch to the ON position. Starting at the single or four engine parameter display press the "Menu" key.

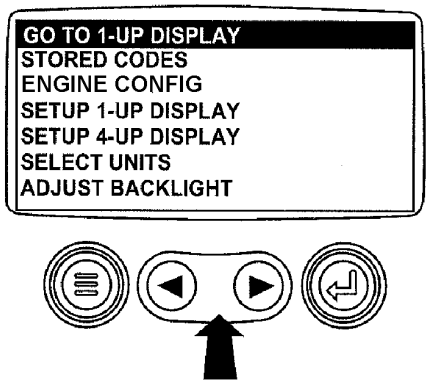


RG13159 —UN—26SEP03

Menu Key

OURGP11,00000AF -19-13NOV13-1/6

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Adjust Contrast" is highlighted.



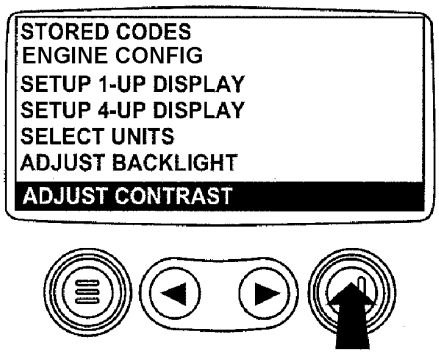
RG13161 —UN—02OCT03

Select Adjust Contrast

Continued on next page

OURGP11,00000AF -19-13NOV13-2/6

3. Once the "Adjust Contrast" menu item has been highlighted, press the "Enter" key to activate the "Adjust Contrast" function.

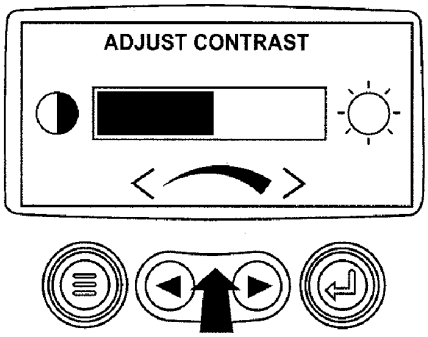


RG13185 —UN—02OCT03

Press Enter Key

OURGP11,00000AF -19-13NOV13-3/6

4. Use the "Arrow" keys to select the desired contrast intensity.

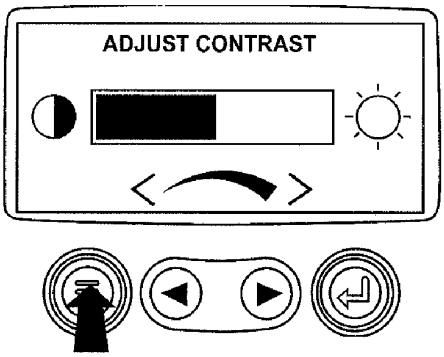


RG13186 —UN—29SEP03

Adjust Contrast Intensity

OURGP11,00000AF -19-13NOV13-4/6

5. Press the "Menu" key to return to the main menu.



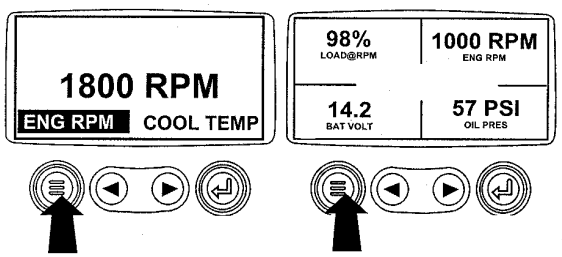
RG13187 —UN—26SEP03

Return To Main Menu

Continued on next page

OURGP11,00000AF -19-13NOV13-5/6

6. Press the "Menu" key to exit the main menu and return to the engine parameter display.

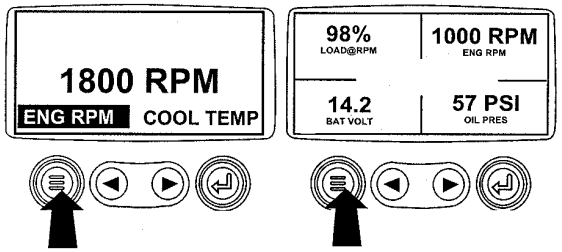


Exit Main Menu

OURGP11,00000AF -19-13NOV13-6/6

Selecting Units Of Measurement

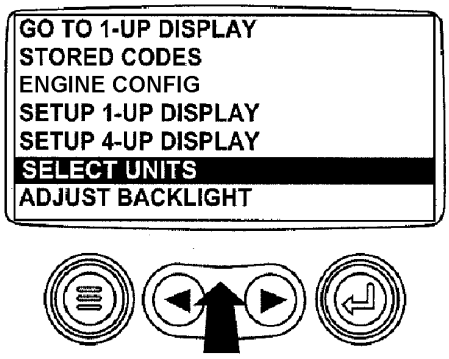
1. Turn the key switch to the ON position. Starting at the single or four engine parameter display, press the "Menu" key.



Menu Key

OURGP11,00000B0 -19-13NOV13-1/7

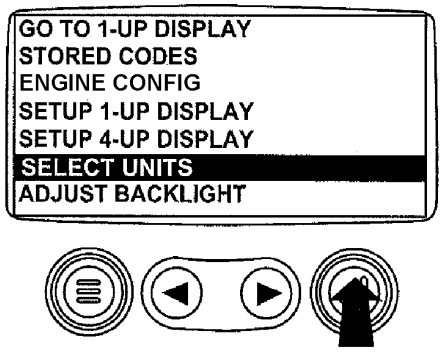
2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Select Units" is highlighted.



Select Units

OURGP11,00000B0 -19-13NOV13-2/7

3. Once the "Select Units" menu item has been highlighted press the "Enter" key to access the "Select Units" function.



Press Enter Key

Continued on next page

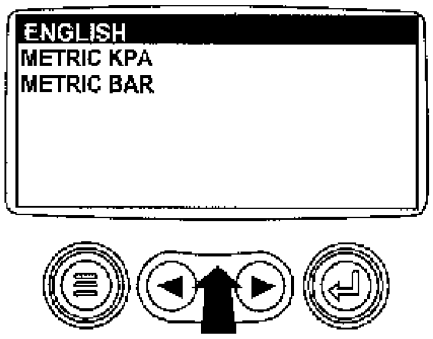
OURGP11,00000B0 -19-13NOV13-3/7

4. There are three choices for units of measurement, English, Metric kPa or Metric Bar.

   English is for Imperial units, with pressures displayed in PSI and temperatures in °F.

   Metric kPa and Metric bar are for IS units, with pressures displayed in kPa and bar respectively, and temperatures in °C.

   Use the "Arrow" keys to highlight the desired units of measurement.

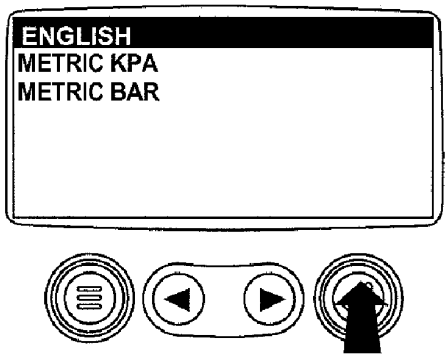


RG13190 —UN—26SEP03

Select Desired Units

OURGP11,00000B0 -19-13NOV13-4/7

5. Press the "Enter" key to select the highlighted units.

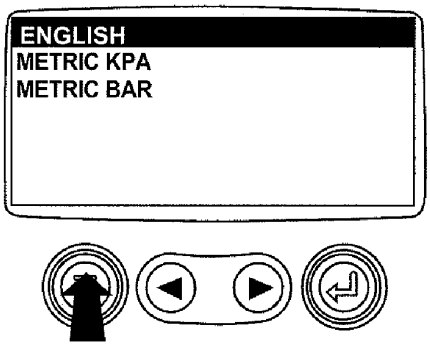


RG13191 —UN—30SEP03

Press Enter Key to Select

OURGP11,00000B0 -19-13NOV13-5/7

6. Press the "Menu" key to return to the main menu.



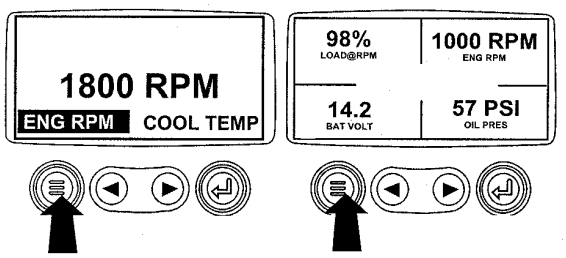
RG13192 —UN—26SEP03

Return To Main Menu

Continued on next page

OURGP11,00000B0 -19-13NOV13-6/7

7. Press the "Menu" key to return to the engine parameter display.

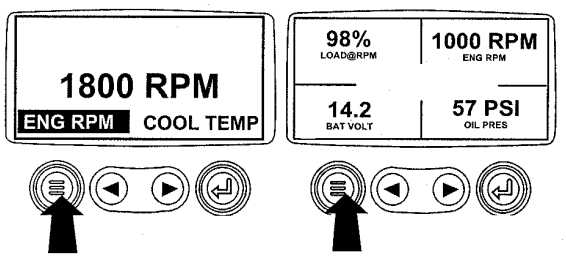


Press Menu Key

OURGP11,00000B0 -19-13NOV13-7/7

Setup 1-Up Display

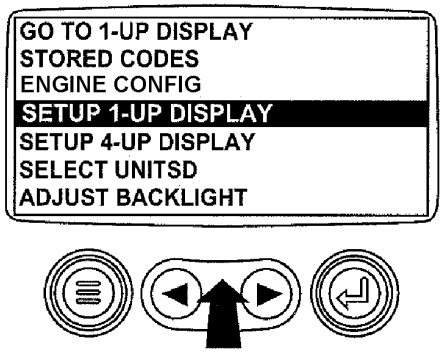
1. Turn the key switch to the ON position. Starting at the single engine parameter display, press the "Menu" key.



Menu Key

OURGP11,00000B1 -19-13NOV13-1/18

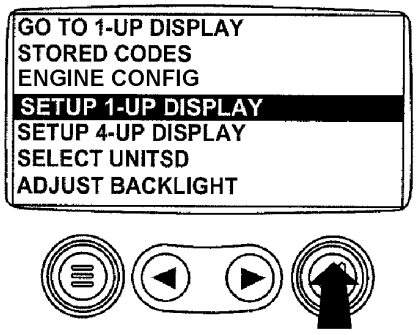
2. Use the "Arrow" keys to scroll through the menu until "Setup 1-Up Display" is highlighted.



Setup 1-Up Display

OURGP11,00000B1 -19-13NOV13-2/18

3. Once "Setup 1-Up Display" menu item has been highlighted press the "Enter" key to access the "Setup 1-Up Display" function.

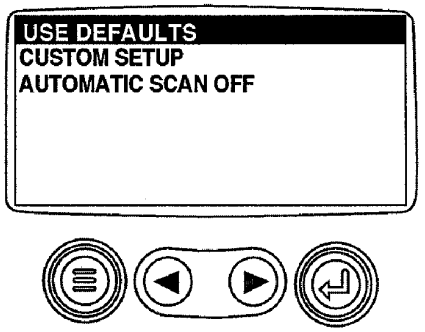


Press Enter Key

Continued on next page

OURGP11,00000B1 -19-13NOV13-3/18

4. Three options are available for modification of the 1-Up Display.
   a. **Use Defaults** – This option contains the following engine parameters for display: Engine Hours, Engine Speed, Battery Voltage, % Load, Coolant Temperature and Oil Pressure.
   b. **Custom Setup** – This option contains a list of engine parameters. Engine parameters from this list can be selected to replace any or all of the default parameters. This option can be used to add parameters available for scrolling in the 1-Up Display.
   c. **Automatic Scan** – Selecting the scan function will allow the 1-Up Display to scroll through the selected set of parameters one at a time, momentarily pausing at each.

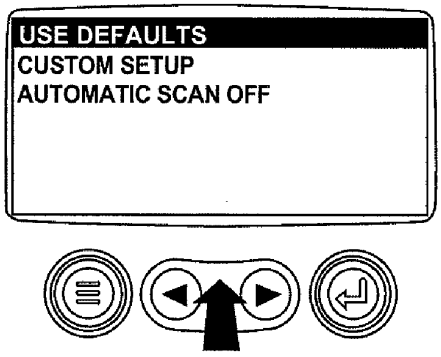


RG13196 —UN—26SEP03

1-Up Display Options

OURGP11,00000B1 -19-13NOV13-4/18

5. **Use Defaults** - To select "Use Defaults" use the Arrow keys to scroll to and highlight "Use Defaults" in the menu display.

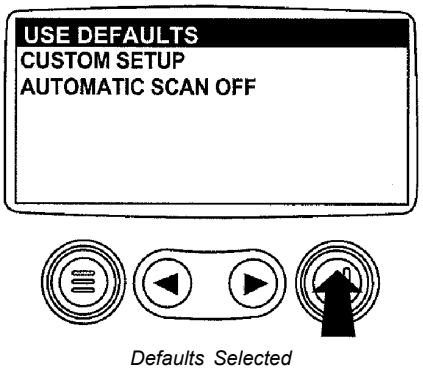


RG13195 —UN—26SEP03

Select Defaults

OURGP11,00000B1 -19-13NOV13-5/18

6. Press the "Enter" key to activate the "Use Defaults" function.



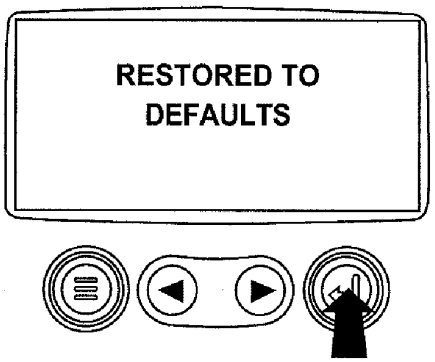
RG13197 —UN—29SEP03

Defaults Selected

Continued on next page

OURGP11,00000B1 -19-13NOV13-6/18

7. The display parameters are reset to the factory defaults, then the display will return to the "Setup 1-Up Display" menu.

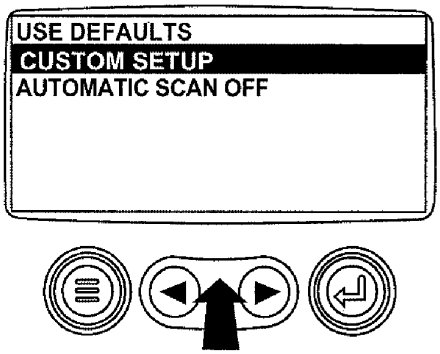


RG13149 —UN—24SEP03

Restored To Defaults

OURGP11,00000B1 -19-13NOV13-7/18

8. **Custom Setup** - To perform a custom setup of the 1-Up Display, use the arrow buttons to scroll to and highlight "Custom Setup" on the display.

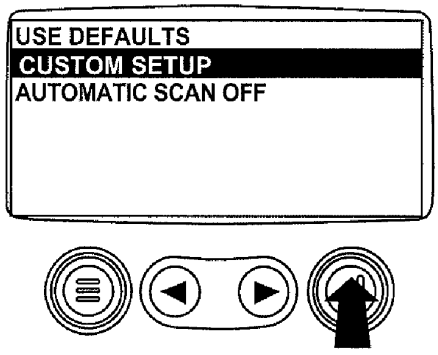


RG13198 —UN—26SEP03

Select Custom Setup

OURGP11,00000B1 -19-13NOV13-8/18

9. Press the "Enter" key to display a list of engine parameters.



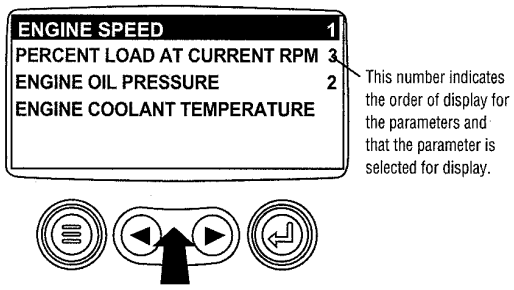
RG13199 —UN—26SEP03

Engine Parameters

Continued on next page

OURGP11,00000B1 -19-13NOV13-9/18

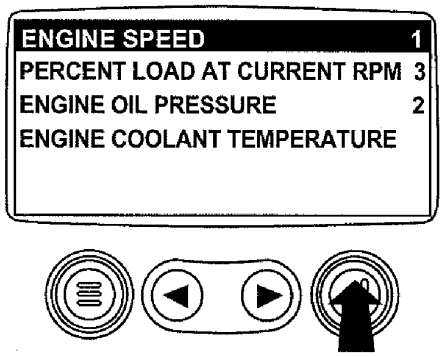
10. Use the "Arrow" keys to scroll to and highlight a selected parameter (parameter with a number to right of it).



Select Parameters

OURGP11,00000B1 -19-13NOV13-10/18

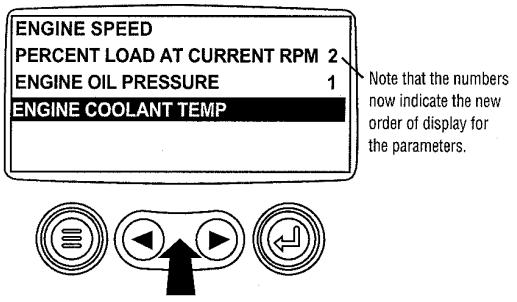
11. Press the "Enter" key to deselect the selected parameter, removing it from the list of parameters being displayed on the 1-Up Display.



Deselect Parameters

OURGP11,00000B1 -19-13NOV13-11/18

12. Use the "Arrow" keys to scroll and highlight the desired parameter that has not been selected for display (parameter without a number to right of it).

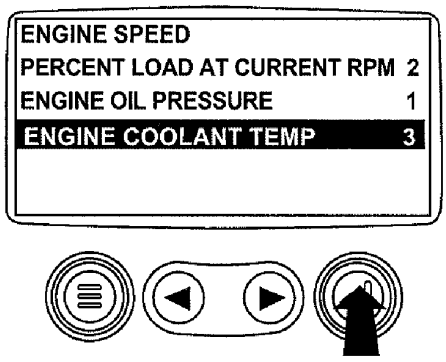


Select Desired Parameters

Continued on next page

OURGP11,00000B1 -19-13NOV13-12/18

13. Press the "Enter" key to select the parameter for inclusion in the Single Engine Parameter Display.
14. Continue to scroll through and select additional parameters for the custom 1-Up Display. Press the "Menu" key at any time to return to the "Custom Setup" menu.

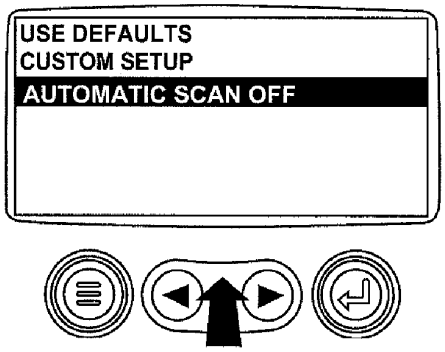


RG13220 —UN—26SEP03

Select Parameters For Display

OURGP11,00000B1 -19-13NOV13-13/18

15. **Automatic Scan** - Selecting the scan function will allow the 1- Up Display to scroll through the selected set of parameters one at a time. Use the "Arrow" keys to scroll to the "Automatic Scan" function.

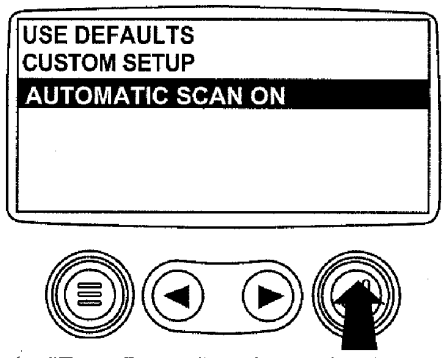


RG13221 —UN—26SEP03

Automatic Scan Off

OURGP11,00000B1 -19-13NOV13-14/18

16. Press the "Enter" key to toggle the "Automatic Scan" function on.



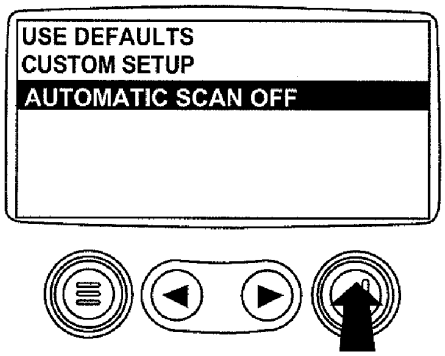
RG13222 —UN—26SEP03

Automatic Scan On

Continued on next page

OURGP11,00000B1 -19-13NOV13-15/18

17. Press the "Enter" key again to toggle the "Automatic Scan" function off.

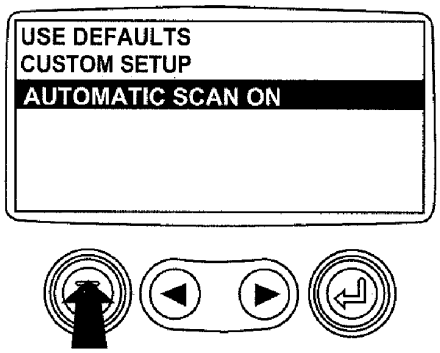


RG13223 —UN—26SEP03

Automatic Scan Off

OURGP11,00000B1 -19-13NOV13-16/18

18. Once the "Use Defaults", "Custom Setup" and "Automatic Scan" functions have been set, press the "Menu" key to return to the main menu.

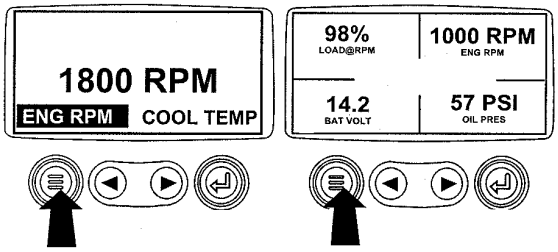


RG13224 —UN—26SEP03

Menu Key

OURGP11,00000B1 -19-13NOV13-17/18

19. Press the "Menu" key to exit the main menu and return to the engine parameter display.



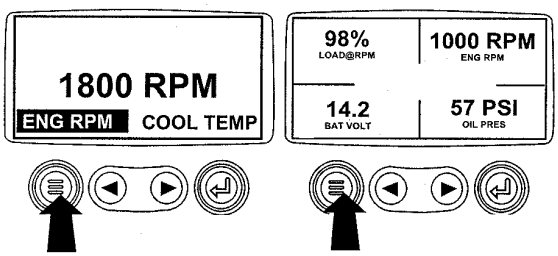
RG13159 —UN—26SEP03

Exit Main Menu

OURGP11,00000B1 -19-13NOV13-18/18

Setup 4-Up Display

1. Turn the key switch to the ON position. From the single or four engine parameter display, press the "Menu" key.



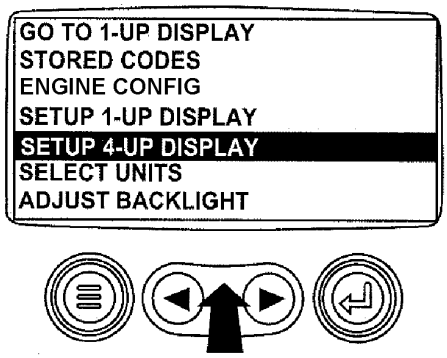
RG13159 —UN—26SEP03

Menu Key

Continued on next page

OURGP11,00000B2 -19-13NOV13-1/14

2. The main menu will be displayed. Use the "Arrow" keys to scroll through the menu until "Setup 4-Up Display" is highlighted.

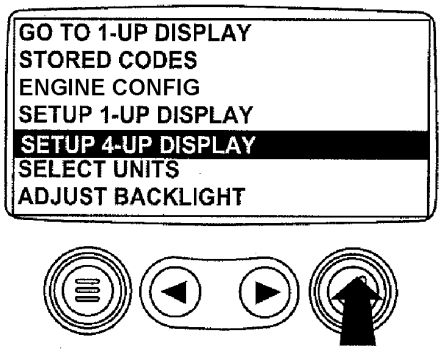


RG13225 —UN—02OCT03

Select Setup 4-Up Display

OURGP11,00000B2 -19-13NOV13-2/14

3. Once the "Setup 4-Up Display" menu item has been highlighted, press the "Enter" key to activate the "Setup 4-Up Display" menu.

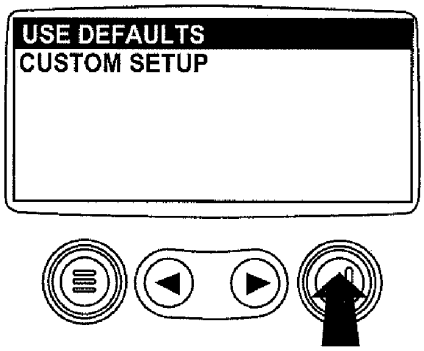


RG13226 —UN—02OCT03

Press Enter Key

OURGP11,00000B2 -19-13NOV13-3/14

4. Two options are available for the 4-Up Display.
   a. **Use Defaults** – This option contains the following engine parameters for display: Engine Speed, Battery Voltage, Coolant Temperature and Oil Pressure.
   b. **Custom Setup** – This option contains a list of engine parameters. Engine parameters from this list can be selected to replace any or all of the default parameters.



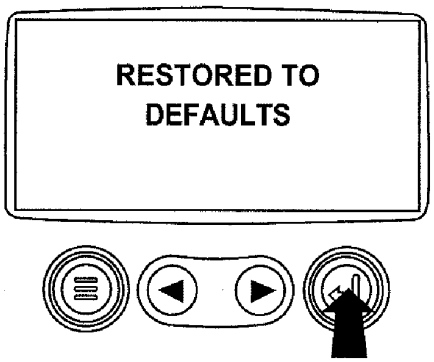
RG13244 —UN—02OCT03

Select Factory Defaults

Continued on next page

OURGP11,00000B2 -19-13NOV13-4/14

5. To reset the display parameters to the factory defaults, scroll to and highlight "Use Defaults". Press the "Enter" key to activate the "Use Defaults" function. A message indicating the display parameters are reset to the factory defaults will be displayed, then the display will return to the "Setup 4-Up Display" menu.

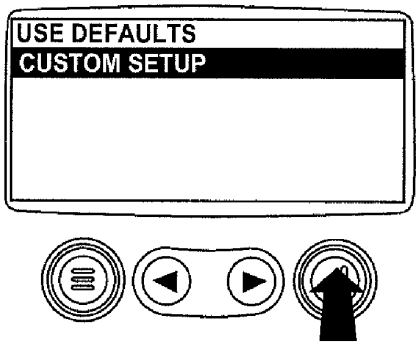


RG13149 —UN—24SEP03

Restored To Defaults

OURGP11,00000B2 -19-13NOV13-5/14

6. **Custom Setup** - To perform a custom setup of the 4-Up Display, use the arrow buttons to scroll to and highlight "Custom Setup" on the display.

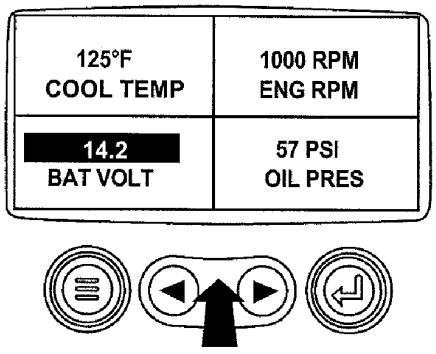


RG13227 —UN—26SEP03

Custom Setup

OURGP11,00000B2 -19-13NOV13-6/14

7. The quadrant with the highlighted parameter value is the current selected parameter. Use the "Arrow" keys to highlight the value in the quadrant you wish to change to a new parameter.



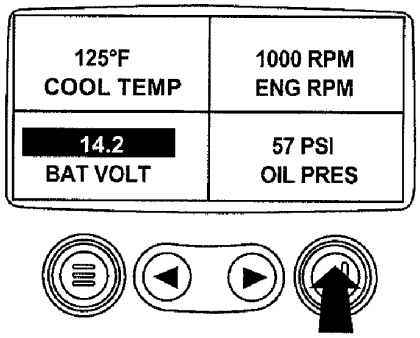
RG13228 —UN—26SEP03

Select Parameters

Continued on next page

OURGP11,00000B2 -19-13NOV13-7/14

8. Press the "Enter" key and a list of engine parameters will be displayed.

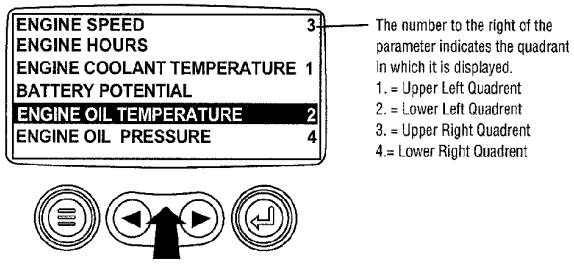


RG13229 —UN—26SEP03

List Of Engine Parameters

OURGP11,00000B2 -19-13NOV13-8/14

9. The parameter that is highlighted is the selected parameter for the screen. Use the "arrow" keys to highlight the new parameter to be placed in the "4-Up Display".

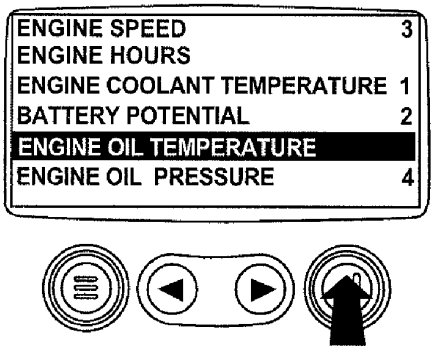


RG13230 —UN—26SEP03

Select Desired Engine Parameter

OURGP11,00000B2 -19-13NOV13-9/14

10. Press the "Enter" key to change the selected parameter in the quadrant to the new parameter.

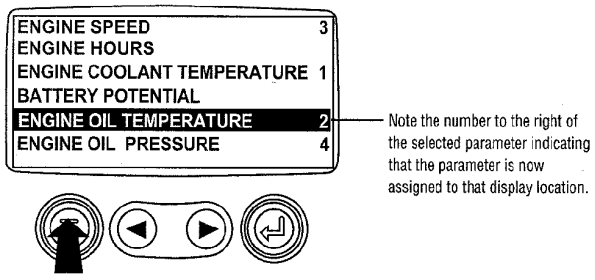


RG13231 —UN—26SEP03

Enter Selected Parameter

OURGP11,00000B2 -19-13NOV13-10/14

11. Use the "Menu" keys to return to the "4-Up Custom Setup" screen.



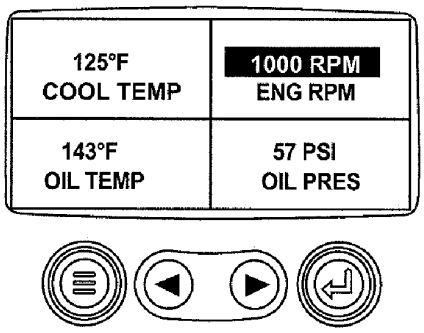
RG13232 —UN—26SEP03

Return To 4-Up Custom Setup

Continued on next page

OURGP11,00000B2 -19-13NOV13-11/14

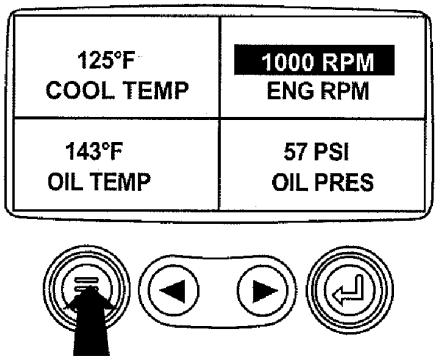
12. The selected quadrant has now changed to the new selected parameter.



4-Up Display

OURGP11,00000B2 -19-13NOV13-12/14

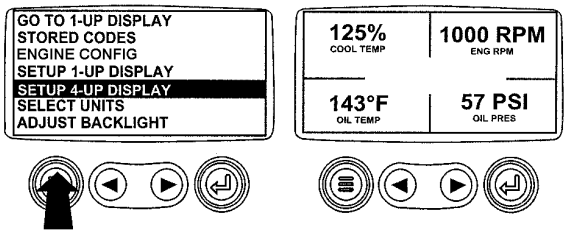
13. Repeat the parameter selection process until all spaces are as desired.
14. Press the "Menu" key to return to the main menu.



Return To Main Menu

OURGP11,00000B2 -19-13NOV13-13/14

15. Press the "Menu" key to exit the main menu and return to the engine parameter display.



Select Remaining Parameters

OURGP11,00000B2 -19-13NOV13-14/14

John Deere PowerSight

John Deere PowerSight is a web based service that allows remote access to machine data. John Deere PowerSight is accessible from a laptop, desktop or mobile device.

John Deere PowerSight works by combining a controller that includes cellular communication and GPS antennas. Machine data is collected by the controller and wirelessly transferred to a data server, where it is made available on a website.

John Deere PowerSight allows you to:

- Stay informed on machine location and hours
- Protect assets with Geofence and Curfew alerts
- Keep assets running with maintenance tracking and preventive maintenance plans
- Track and analyze machine and fuel usage
- Conduct remote machine diagnostics and programming

For more information and availability, contact an authorized John Deere dealer or servicing dealer.

BL90236,0000031 -19-13FEB14-1/1

Engine Operation

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. See General Marine Engine Specifications in the Specifications Section for temperature and pressure specifications.

If coolant temperature rises above the maximum coolant temperature (see Specifications Section) 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 unless necessary for maneuvering out of dock and harbor.

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
- High marine gear oil temperature
- Unusual noise or vibration
- Sudden loss of power
- Excessive black exhaust
- Excessive fuel consumption
- Excessive oil consumption
- Fluid leaks

ZE59858,000027B -19-29OCT13-1/1

Marine Break-In Service

A proper break-in procedure is critical with John Deere marine diesel engines. A proper break-in will ensure optimal engine life. A proper break-in for John Deere marine engines is expected to take approximately 100 hours if performed correctly.

During this process, it is recommended that the vessel is operated in open water sufficient for safe extended operation.

Initial Run-In Procedure

NOTE: The sea trial procedure should not be replaced by the initial run-in procedure.

Ideally, the initial run-in procedure is accomplished during the sea trial process with a qualified John Deere marine engine technician onboard, following a successful completion of all basic functional testing.

1. Engine speeds and loads should be increased at 100 rpm intervals while simultaneously monitoring engine vitals. Engine operation should be maintained at each 100 rpm interval for a minimum of 5—10 minutes or until engine temperature stabilizes.
2. Speed and load should be increased until rated speed is achieved. If rated speed cannot be achieved abort process and review installation and application guidelines. As with the previous speed and load intervals, rated speed should be maintained for a minimum of 5—10 minutes or until engine temperature stabilizes. If a diagnostic trouble code occurs, abort this process and review installation and application guidelines.
3. Following stabilization at rated speed, proceed to test 100% throttle operation. At 100% throttle the engine should increase above rated speed to operate on the governor. As with the previous speed and load intervals, 100% throttle speed should be maintained for a minimum of 5—10 minutes or until engine temperature stabilizes. If a diagnostic trouble code occurs, abort this process and review installation and application guidelines.

NOTE: The engine speed achieved above rated speed at 100% throttle is dependent on propeller or impeller matching and will vary accordingly.

Exceptions

Bollard pull applications such as working tugs and push boats. Due to the high power to weight ratio and hull designs, it may not be practical to achieve rated speed without bollard operation. For bollard pull applications, perform speed steps and loads as defined previously in a bollard operation with an immovable object. In bollard pull applications only, it is acceptable if 100% throttle results in an engine speed of no more than 100 rpm less than rated speed (rated speed - 100 rpm = GOOD; rated speed - 101 rpm = REVIEW). If under full bollard pull operation with an immovable object and a minimum engine speed of 100 rpm less than rated speed is not achieved, abort process and review installation and application guidelines.

Constant speed engine operation such as generators. A similar process should be followed, except instead of changing speed, the engine load should be increased until the point of maximum engine fueling (100% load or maximum generator output). These 10% steps in engine percent load should be performed for a minimum of 5—10 minutes each or until engine temperature stabilizes while monitoring all engine criticals. If a fault code should occur, abort process and review application and installation guidelines.

Break-In Oil

The engine is factory filled with John Deere Diesel Engine Break-In Oil. This is a special formulation of oil that is designated to aid with the proper break-in of engine components. If performed correctly, it is expected the break-in process will take 100 hours. During this process some make-up oil may be required. As it is not unusual for some oil consumption during the break-in process; it is critical that the oil level be frequently monitored during this process. If make up oil is required use only John Deere Diesel Engine Break-In Oil.

Following the 100 hour break-in process it is recommended that change of oil and filter should occur. If the break-in procedure has been followed and sufficient extended loading of the engine has occurred it is acceptable to proceed with normal oil changes as advised in this operator's manual. However, if during the first 100 hours of operation the engine has operated at periods of light loading and/or idle it is recommended that the oil should be drained and replaced with John Deere Diesel Engine Break-In Oil, and the oil filter should be changed and replaced with a new John Deere oil filter. Following this, the break-in procedure should continue for an additional 100 hours.

IMPORTANT: DO NOT fill above the top of the crosshatch pattern or the FULL mark, whichever is present. Marine engines installed at an angle will have an alternate pattern as identified by the dipstick remarking process to compensate for installation angle. Oil levels anywhere within crosshatch are considered in the acceptable operating range. John Deere Break-In engine oil should be used to make up any oil consumed during the break-in period.

IMPORTANT: DO NOT use Plus-50 or Plus-50 II engine oil during the break-in period of a new engine or engine that has had a major overhaul. Plus-50 or Plus-50 II engine oil will not allow a new or overhauled engine to properly seat in during this break-in period.

IMPORTANT: If John Deere Break-In or Break-In Plus engine oils are not available, use a SAE 10W-30 viscosity grade diesel engine oil meeting one of the following:

Continued on next page

API Service Classification CE
API Service Classification CD
API Service Classification CC
ACEA Oil Sequence E2
ACEA Oil Sequence E1

IMPORTANT: Do not use Plus-50 II, Plus-50, or engine oils meeting any of the following for the initial break-in of a new or rebuilt engine:

API CJ-4	ACEA E9
API CI-4 PLUS	ACEA E7
API CI-4	ACEA E6
API CH-4	ACEA E5
API CG-4	ACEA E4
API CF-4	ACEA E3
API CF-2	
API CF	

These oils do not allow the engine to break-in properly.

Break-In Procedure

During the 100 hour break-in period it is important to adequately work the engine to properly seat the engine components. Extended idle and light load operation should be minimized. Extended idle and/or light load operation intervals should not exceed 30 minutes during the break-in process. Minimum operating engine loads should be sufficient to result in coolant temperatures at or above the thermostat opening temperature.

IMPORTANT: It is critically important to properly break in the engine within the first 100 hours. Attempting a break-in at higher hour intervals may be unsuccessful. To correctly perform the break-in, extra effort is required to ensure that engine is heavily exercised and may include running the engine harder than normal usage. This is especially true with M1-M3 ratings and lightly loaded applications such as trawlers and oversized generator sets.

[1]Load factor – is the actual fuel burned over a period of time divided by the full-power fuel consumption for the same period of time. For example, if an engine burns 160 L of fuel during an eight-hour run, and the full-power fuel consumption is 60 L per hour, the load factor is 160 L / (60 L per hour x 8 hours) = 33.3%.

M1, M2, and M3 Propulsion Applications — Engine load factors[1] during the break-in period should be greater than 40%. Underway, it is recommended that the vessel is operated at a minimum engine speed of approximately 200—300 rpm below rated speed greater than 50% of the time to provide the minimum sufficient loading.

M4 and M5 Propulsion Applications — Engine load factors[1] during the break-in period should be greater than 25%. Underway, it is recommended that the vessel is operated at a minimum engine speed of approximately 400—500 rpm below rated speed greater than 50% of the time to provide the minimum sufficient loading.

Constant Speed Applications — Minimum engine load factors[1] during the break-in period should be greater than 30%. It is recommended that the engine operate between 50% and 90% load greater than 50% of the time during the break-in period.

IMPORTANT: Lightly Loaded Applications Post Break-In: Engine break-in will not compensate for the observable conditions of a lightly loaded engine such as black fuel oil residue in the exhaust system. These conditions can be common among trawler propulsion engines, oversized generator sets, applications that spend long intervals at idle, and will occur on any lightly loaded diesel engine. John Deere marine diesel engines are designed to operate at loaded conditions. To prevent exhaust system contamination in a lightly loaded application, regularly exercise the engine by periodically increasing the load.

For example, in a trawler propulsion application underway increase the throttle to achieve an engine speed of the break-in speeds defined above for a minimum of 10 minutes every 3 hours. For a generator application, increase the load to 50% load for a minimum of 10 minutes every 3 hours.

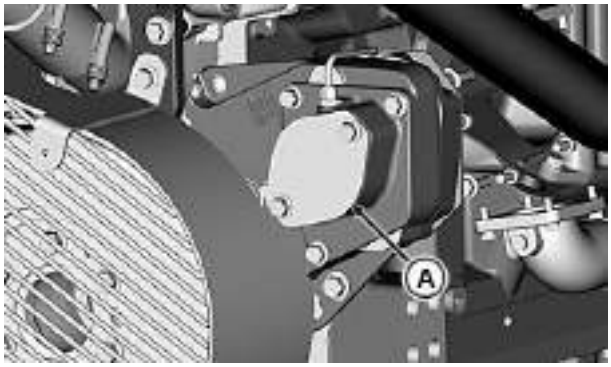
RG19661,00003BC -19-10FEB14-2/2

Auxiliary Gear Drive Limitations

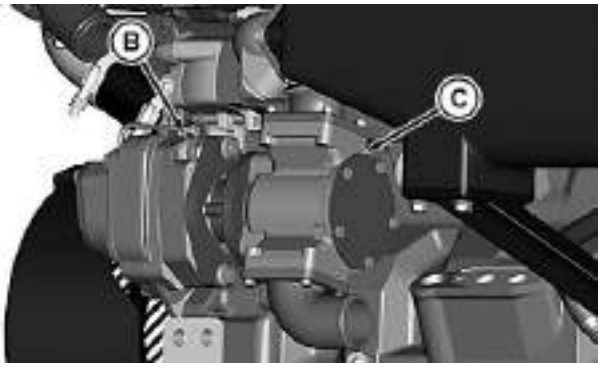
IMPORTANT: When attaching an air compressor, hydraulic pump, or other accessory to be driven by the auxiliary gear drive (engine timing gear train at front of engine), power requirements of the accessory must be limited to values listed below:

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

A—SAE Drive, Front
B—SAE Drive, Rear
C—Seawater Pump



RG17148 —UN—26MAY09



RG17149 —UN—26MAY09

ZE59858,00001B4 -19-17SEP13-1/1

Generator Set Power Units

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

RG,RG34710,5556 -19-20MAY96-1/1

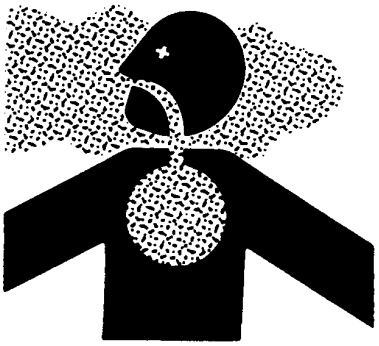
Starting the Engine

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

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

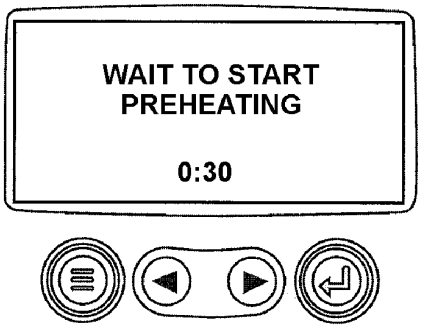
NOTE: If temperature is below 0 °C (32 °F), it may be necessary to use cold weather starting aids. See Cold Weather Operation in the Engine Operation Section.

1. Perform all prestarting checks. See Daily Prestarting Checks in the Lubrication & Maintenance — Daily Section.
2. Open the fuel supply shutoff valve.
3. Set marine gear control lever in the “NEUTRAL” position on propulsion units.
4. Move the throttle control lever approximately 1/3 of the way off the idle position.
5. Turn the key switch to the ON position. The "Wait To Start Preheating" message will be displayed when ambient temperatures require preheating (for engines with preheating options). The timer will display minutes and seconds, counting down to zero. Once the timer has reached 0:00 and the "Wait to Start" message is no longer displayed, you may start the engine.



Use Proper Ventilation

TS220 —UN—15APR13



Wait To Start Screen

RG13233 —UN—29SEP03

Continued on next page

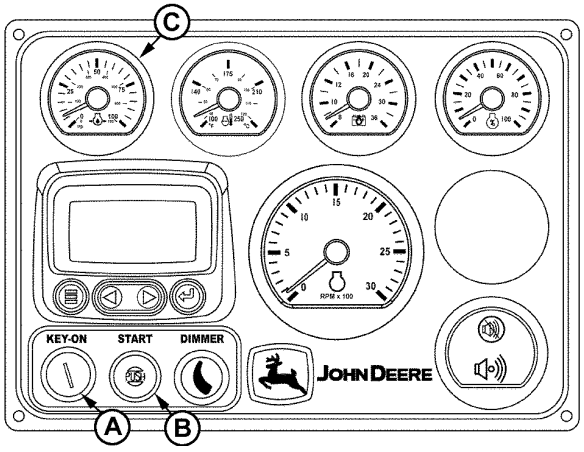
RG19661,00003BD -19-29OCT13-1/2

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 Engine Troubleshooting in the Troubleshooting Section.

If the start switch button 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.

NOTE: Key switch (A) on main (standard) instrument panel must be in "ON" position to start engine using fly bridge (optional) instrument panel.

6. Press start button (B) to crank the engine. When the engine starts, release the button.
7. After the engine starts, observe the oil pressure gauge (C) until it reads at least the slow idle pressure. See General Marine Engine Specifications in the Specifications Section.
8. Warm up the engine at or below 1200 rpm with no load for 1-2 minutes. See following guidelines.
9. Check all gauges for normal engine operation. If operation is not normal, stop the engine and determine the cause.



RG13134 —UN—07OCT03

Start Engine

A—Key Switch
B—Start Button
C—Oil Pressure Gauge

10. Check sea water outlet for water flow. Check exhaust pipe for water flow on engines with wet exhaust systems.

    If sea water does not flow within one minute after engine starts, stop engine and check sea cock, sea water strainer, and sea water pump for restrictions.

RG19661,00003BD -19-29OCT13-2/2

Warming Engine

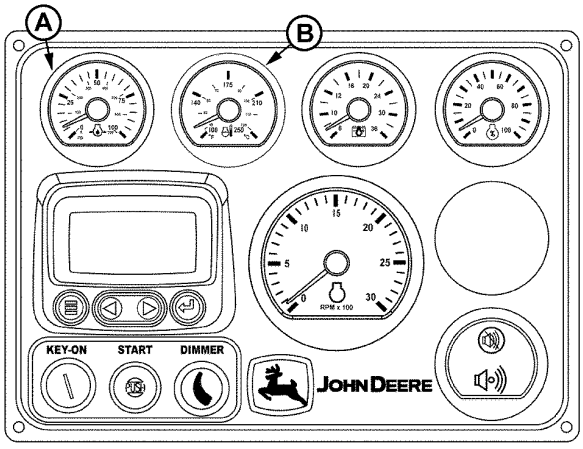
IMPORTANT: To assure proper lubrication, operate engine at or below 1200 rpm with no load for 1–2 minutes. Extend this period 2–4 minutes when operating at temperatures below freezing.

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 within 5 seconds, stop the engine and determine the cause. See General Marine Engine Specifications and Engine Power And Speed Specifications in the Specifications Section for all oil pressure, engine speed, and coolant temperature specifications.

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.



RG13135 —UN—07OCT03

Oil Pressure And Coolant Temperature Gauges

A—Oil Pressure Gauge

B—Coolant Temperature Gauge

See General Marine Engine Specifications in the Specifications Section for the normal engine coolant temperature range specification.

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.

OUOD006,0000091 -19-06NOV13-1/1

Idling Engine

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

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

Slow idle speed for this engine is set at the factory. See Engine Power And Speed Specifications in the Specifications Section near end of manual for slow idle speed for your engine. 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).

OUOD006,0000092 -19-08NOV13-1/1

Cold Weather Operation

Engines may be equipped with coolant heaters as cold weather starting aids.

Engine coolant heaters should be used when temperatures are at or below 0 °C (32 °F).

Switch on the engine coolant heater for a minimum of 2 hours before starting the engine. Additional information on cold weather operation is available from your engine distributor or authorized servicing dealer. Follow steps listed in Starting the Engine in the Engine Operation Section.

Synthetic oils improve flow at low temperatures, especially in arctic conditions.

TS1356 —UN—18MAR92

Starting Fluid is Flammable

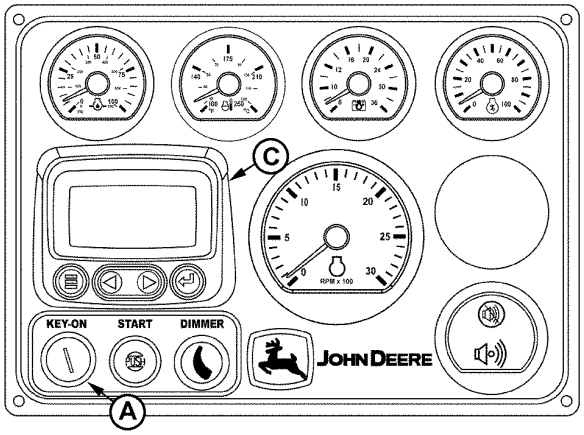
ZE59858,00002A8 -19-02DEC13-1/1

Stopping the Engine

IMPORTANT: Before stopping an engine that has been operating at working load, idle engine at least 5 minutes at 1000–1200 rpm to cool hot engine parts.

Engines in generator set applications where the engine control unit (ECU) is locked at a specified speed and no slow idle function is available, run engine for at least 5 minutes at fast idle and no load.

1. Remove load from engine or shift marine gear to “NEUTRAL” and run engine for at least 5 minutes at 1000–1200 rpm to allow coolant and oil to carry heat away from the combustion chamber, turbocharger, pistons, and bearings.
2. Turn key switch (A) to “OFF” position and remove key from ignition.
3. If vessel will not be used for several days, close fuel valves and sea cock.
4. Turn main electrical power switch to “OFF”, if equipped.
5. Fill the fuel tank to minimize possible water condensation problems. Filling tanks at end of day drives out moisture-laden air.
6. **For Heat Exchanger Engines:** If the engine will be subjected to temperatures at or below 0° C (32° F), open the sea water pump end cover to drain the sea water from the system to prevent freezing. The sea water pump will require priming before starting the engine.



RG13290 —UN—06NOV03

Stopping The Engine - Electronically Controlled Engines

A—Key Switch
B—Stop Button - Mechanically Controlled Engines
C—Diagnostic Gauge/Hour Meter

7. Observe the hour meter reading on diagnostic gauge/hour meter (C) to determine if periodic maintenance is necessary. Make appropriate entries in maintenance logs in the Lubrication and Maintenance Records Section.
8. Perform required periodic maintenance on all other equipment, as recommended by the equipment manufacturers.

RG19661,00003BE -19-20SEP13-1/1

Using a Booster Battery or Charger

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

Series:

- Amps = Same as single battery
- Volts = Twice as a single battery

Parallel:

- Amps = Twice as a single battery
- Volts = Same as a single battery

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 that 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.

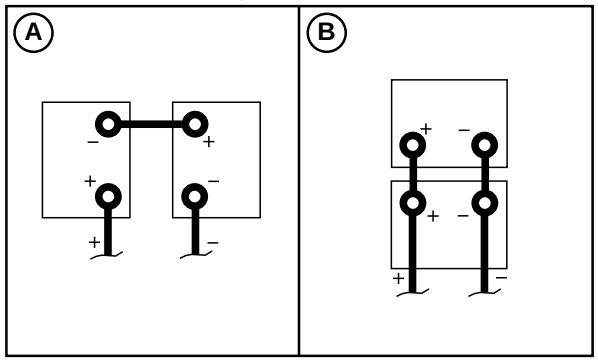
1. Connect booster battery or batteries to produce the required system voltage for your engine application.

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.

TS204 —UN—15APR13

Exploding Battery



RG24885 —UN—17DEC13

A—Series **B—Parallel**

5. ALWAYS complete the hookup 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. Disconnect NEGATIVE (–) cable first.

RG,RG34710,5564 -19-17DEC13-1/1

Welding Near Electronic Control Units

IMPORTANT: Do not jump-start engines with arc welding equipment. Currents and voltages are too high and may cause permanent damage.

1. Disconnect the negative (-) battery cable(s).
2. Disconnect the positive (+) battery cable(s).
3. Connect the positive and negative cables together. Do not attach to vehicle frame.
4. Clear or move any wiring harness sections away from welding area.
5. Connect welder ground close to welding point and away from control units.

TS953 —UN—15MAY90

6. After welding, reverse Steps 1—5.

DX,WW,ECU02 -19-14AUG09-1/1

Keep Electronic Control Unit Connectors Clean

IMPORTANT: Do not open control unit and do not clean with a high-pressure spray. Moisture, dirt, and other contaminants may cause permanent damage.

1. Keep terminals clean and free of foreign debris. Moisture, dirt, and other contaminants may cause the terminals to erode over time and not make a good electrical connection.
2. If a connector is not in use, put on the proper dust cap or an appropriate seal to protect it from foreign debris and moisture.
3. Control units are not repairable.
4. Since control units are the components LEAST likely to fail, isolate failure before replacing by completing a diagnostic procedure. (See your John Deere dealer.)
5. The wiring harness terminals and connectors for electronic control units are repairable.

DX,WW,ECU04 -19-11JUN09-1/1

Required Emission-Related Information

Service Provider

A qualified repair shop or person of the owner's choosing may maintain, replace, or repair emission control devices and systems with original or equivalent replacement parts. However, warranty, recall, and all other services paid for by John Deere must be performed at an authorized John Deere service center.

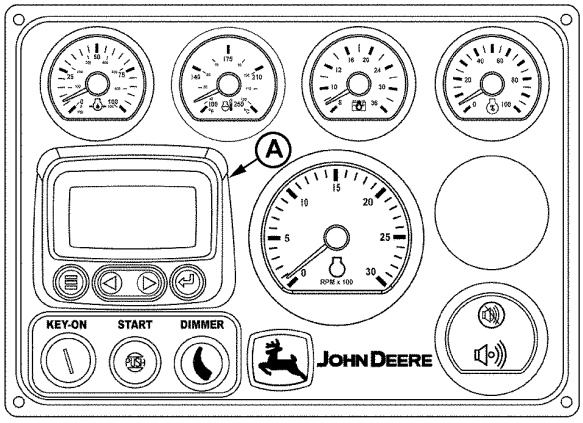
DX,EMISSIONS,REQINFO -19-12JUN15-1/1

Observe Service Intervals

In an emergency, where an authorized John Deere service location is not available, repairs may be performed at any available service establishment, or by the owner, using any replacement part, provided such parts are warranted by their manufacturer to be the equivalent of John Deere parts in performance and durability and the failure does not arise from the owner's failure to perform required maintenance.

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. Perform maintenance at interval which occurs first, for example, either at 500 hours of operation or every 12 months. Service more often if engine operated under adverse conditions. Neglecting maintenance can result in failures or permanent damage to the engine.



RG13137 —UN—07OCT03

Hour Meter On Instrument Panel

A—Hour Meter

Perform all services at the hourly intervals. Record the services performed in the Lubrication and Maintenance Records Section. When scheduled service at any hourly level is performed, also perform all subordinate hourly level services.

Main Service	Subordinate Services				
	250 Hours	500 Hours	2000 Hours	4500 Hours	6000 Hours
250 Hours	X				
500 Hours	X	X			
2000 Hours	X	X	X		
4500 Hours	X	X		X	
6000 Hours	X	X	X		X

ZE59858,00002F7 -19-02JUL15-1/1

Use Correct Fuels, Lubricants, and Coolant

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

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

RG17133 —UN—18MAY09

JR74534,0000297 -19-24JUL09-1/1

Lubrication and Maintenance Service Interval Chart

	Lubrication and Maintenance Service Intervals						
Item	**Daily or Before Every Startup**	**250 Hours or 6 Months**	**500 Hours or 12 Months**	**2000 Hours or 24 Months**	**4500 Hours or 60 Months**	**6000 Hours or 72 Months**	**As Required**
Operate Engine at Rated Speed and 50%—70% Load for a Minimum of 30 Minutes. Perform every 2 weeks. (Generator Sets Only)							
Check Engine Oil and Coolant Level	•						
Check Sea Water Pump and Strainer (Heat Exchanger Engines)	•						
Check Accessory Drive Belts	•						
Drain Fuel Filter Water Separator Bowl	•						
Check Aftercooler Condensate Drain	•						
Inspect Wiring Harness and Fuses	•						
Check Air Cleaner Dust Unloader Valve and Air Filter Restriction Indicator [a]	•						
Check Air Intake System	•						
Visual Walkaround Inspection	•						
Change Engine Oil and Replace Oil Filter[b]		•					
Service Fire Extinguisher		•					
Service Battery		•					
Check Coolant Pump Weep Hole		•					
Check Engine Mounts		•					
Inspect and Replace Zinc Plugs (Heat Exchanger Engines)		•					
Replace Crankcase Ventilation Filter			•				
Check Air Intake System			•				
Replace Fuel Filter Elements and Clean Water Separator [c]			•				
Check Automatic Belt Tensioner and Belt Wear			•				
Check Cooling System			•				
Pressure Test Cooling System			•				
Inspect and Clean Heat Exchanger Core (Heat Exchanger Engines)[d]			•				
Inspect and Clean Aftercooler Core[d]			•				
Check and Adjust Engine Speeds			•				
Check Engine Electrical Ground Connections			•				
Replace Sea Water Pump Impeller			•				
Check Crankshaft Vibration Damper			•				
Check and Adjust Engine Valve Clearance				•			
Overhaul Sea Water Pump (If Equipped)				•			
Change Rubber Crankshaft Vibration Damper (If Equipped)					•		
Flush and Refill Cooling System						•	
Test Thermostats						•	
Drain Water From Fuel Filters							•
Add Coolant							•
Service Air Cleaner Element							•
Replace Air Cleaner Element							•
Replace Alternator Belt							•
Check Fuses							•
Check Air Compressor (If Equipped)							•
Check Front Power Take-Off (If Equipped)							•

[a] Replace primary air cleaner element when restriction indicator shows a vacuum of 625 mm (52 in.) H2O, or when reset button has popped up.
[b] During engine break-in, change the oil and filter for the first time before 100 hours of operation.

Continued on next page

ZE59858,00001B7 -19-26NOV13-1/2

[c]Replace fuel filter element when audible alarm sounds and trouble codes indicate plugged fuel filter (low fuel pressure). If no alarm sounds during a 12 month interval, replace element at that time, or after every 500 hours of operation.
[d]This service interval only applies to engines that use sea water for cooling.

ZE59858,00001B7 -19-26NOV13-2/2

Daily Prestarting Checks

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

- Operate Engine at Rated Speed and 50%—70% Load for a Minimum of 30 Minutes. Perform every 2 weeks. (Generator Sets Only)
- Check engine oil level on dipstick. Fill cap/dipstick may be located on left or right side, depending on application. Add as required, using seasonal viscosity grade oil. See Diesel Engine Oil — Tier 3 and Stage IIIA Marine Engines in the Fuels, Lubricants, and Coolants Section for oil specifications.

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

- Check the coolant level when engine is cold. Fill radiator or surge tank with proper coolant if level is low. See Adding Coolant in the Service As Required Section. Check overall cooling system for leaks.
- Check the sea water strainer for trash buildup and rinse to clean, if equipped.
- Check the sea water pump for coolant leaks, if equipped.

  NOTE: It is normal for a small amount of coolant to weep from the engine weep hole, especially as the engine cools down and parts contract. If enough coolant weeps from the engine where coolant drips from the engine, this may indicate the need to replace the coolant pump seal. Contact your engine distributor or servicing dealer for repairs.

- Check accessory drive belts for cracks, breaks, or other damage.
- Loosen water drain valve on each fuel filter all the way so that the valve opens to drain water and debris as needed. Retighten valves securely.

  NOTE: Any water in fuel is drained into the bottom of the fuel filters. The operator is signaled by an amber indicator on the instrument panel. To service, see Draining Water From Fuel Filter in the Service As Required Section.

- Inspect seawater aftercooler condensate drain for leaks (if equipped).
- Inspect wiring harness and fuses for frayed wires, damages, or blown fuses.
- Squeeze the automatic dust unloader valve (if equipped) on air cleaner assembly to clear away any dust buildup.
- Check air intake restriction indicator gauge and service air cleaner as required (if equipped).
- Check air intake system hoses and connections for cracks and loose clamps.
- Inspect the engine compartment. Look for fluid leaks, worn fan and accessory drive belts, loose connections, and trash buildup. Remove trash buildup and have repairs made as needed.

ZE59858,00001F9 -19-14NOV13-1/1

Changing Engine Oil and Replacing Oil Filter

NOTE: Service intervals depend on sulfur content of the diesel fuel, oil pan capacity, and the oil and filter used. See Engine Oil and Filter Service Intervals — Tier 3 and Stage IIIA — Marine Engines in the Fuels, Lubricants, and Coolant Section.

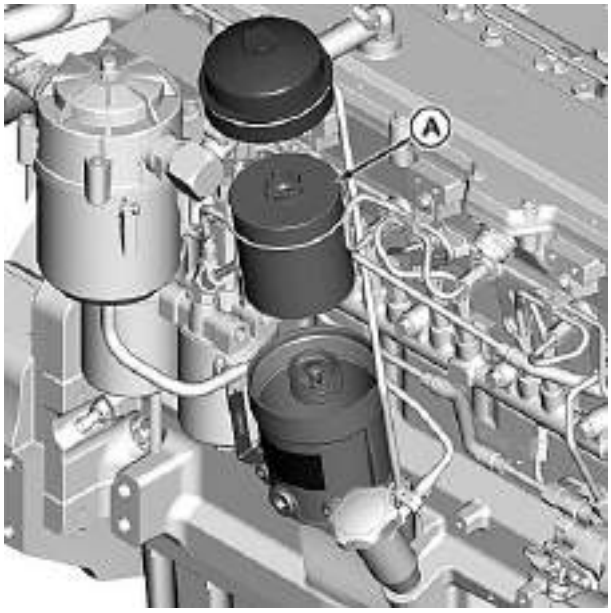
OILSCAN™ or OILSCAN PLUS™ is a John Deere sampling program to help you monitor machine performance and identify potential problems before they cause serious damage. OILSCAN™ and OILSCAN PLUS™ kits are available from your John Deere engine distributor or servicing dealer. Oil samples should be taken prior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

CAUTION: Engine oil and metal surfaces of engine may be hot to the touch after shutdown. Use care to prevent burns.

1. Run engine approximately 5 minutes to warm up oil. Shut off engine.

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

2. Remove oil pan drain plug.
3. Drain crankcase oil from engine while warm.



RG17147 —UN—26MAY09

Changing Engine Oil and Replacing Oil Filter

A—Oil Filter Element

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OILSCAN PLUS is a trademark of Deere & Company.

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ZE59858,00001BA -19-26MAY15-1/2

NOTE: Do NOT remove plug (B). Plug (B) is not an oil drain. Oil in filter will drain down automatically as filter cap is loosened.

4. Loosen filter cap (A) one-half turn with wrench. Wait 30 seconds to allow oil filter housing to drain. Remove cap and filter assembly.
5. While holding cap, strike filter element against solid surface as shown to unfasten filter from cap. Discard used filter.
6. Remove O-ring seal, and replace with new O-ring provided with new filter element.
7. Press new filter element into cap until it snaps into place.
8. Insert cap and filter assembly into oil filter housing. Screw cap into place.
9. Tighten cap to specifications.

Specification	
Top-Load Oil Filter Cap—Torque	45 N·m (33 lb.-ft.)

10. Install oil pan drain plug with a new O-ring and tighten to specifications.

Specification	
Oil Pan Drain Plug—Torque	46 N·m (34 lb.-ft.)

11. Remove oil fill cap/dipstick and fill engine crankcase with correct John Deere engine oil. See Diesel Engine Oil — Tier 3 and Stage IIIA Marine Engines in the Fuels, Lubricants, and Coolant Section for determining correct engine oil.

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

    To determine the correct oil fill quantity for your engine, see Engine Crankcase Oil Fill Quantities in the Specifications Section.

RG13817A —UN—01APR05

Remove Oil Filter Cap

RG17135 —UN—18MAY09

Remove Filter Element from Cap

A—Oil Filter Cap **B—Plug (DO NOT REMOVE)**

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.

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

ZE59858,00001BA -19-26MAY15-2/2

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 250 hours of engine operation or every 6 months. 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 —UN—15DEC88

Fire Extinguisher

OURGP11,000015D -19-07NOV13-1/1

Servicing Battery

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

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

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

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

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

NOTE: Low-maintenance or maintenance-free batteries should require little additional service. However, electrolyte level can be checked by cutting the center section of decal on dash-line, and removing cell plugs. Fill each cell to bottom of filler neck with distilled water.

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.

TS204 —UN—15APR13

Exploding Battery

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 off charger 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.

Continued on next page

ZE59858,00001B9 -19-17SEP13-1/2

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. **Using 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:

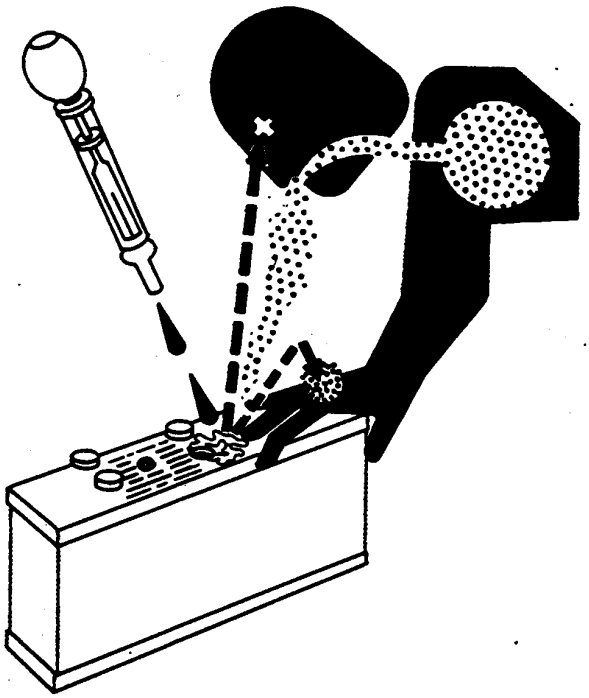
1. **Drink large amounts of water or milk.**
2. **Then drink milk of magnesia, beaten eggs, or vegetable oil.**
3. **Get medical attention immediately.**

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

Replacement battery(ies) must meet or exceed the following recommended capacities[1] at —18 °C (0 °F):

Specification	
12-Volt System—Minimum Battery Capacity—Cold Cranking Amps	1100 Minimum
Reserve Capacity (Minutes)	350 Minimum
24-Volt System—Minimum Battery Capacity—Cold Cranking Amps	750 Minimum
Reserve Capacity (Minutes)	275 Minimum

[1] Total recommended capacity based on batteries connected in series or parallel.



TS203 —UN—23AUG88

Sulfuric Acid

ZE59858,00001B9 -19-17SEP13-2/2

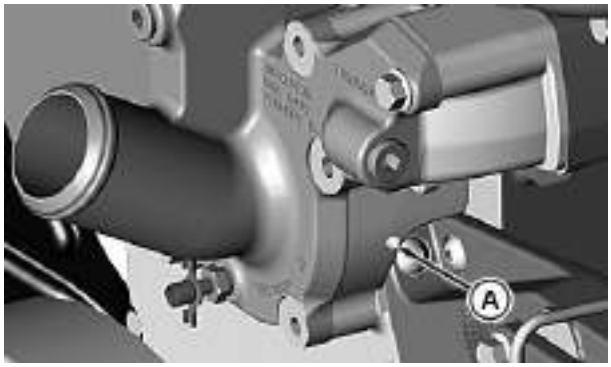
Visually Inspecting Coolant Pump

Inspect Weep Hole

1. Inspect weep hole (A) for oil or coolant leakage.
   - Oil leakage indicates a damaged rear seal.
   - Coolant leakage indicates a damaged front seal.
2. Replace complete coolant pump assembly if leakage is detected: individual repair parts are not available.

Inspect for Impeller Contact with Cover

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



RG17151 —UN—26MAY09

Coolant Pump Weep Hole

A—Weep Hole

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

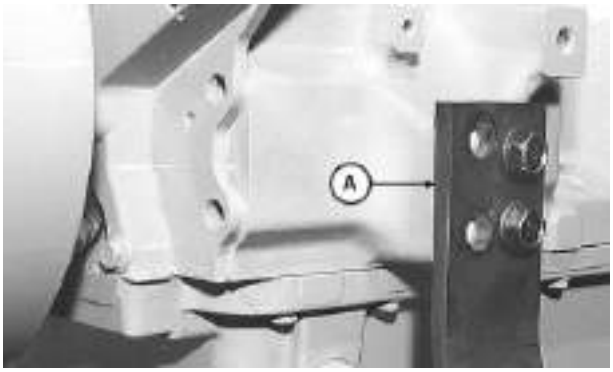
ZE59858,00001BB -19-17SEP13-1/1

Checking Engine Mounts

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

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

1. Check the engine mounting brackets (A), vibration isolators, and mounting bolts on support frame and engine block for tightness. Tighten as necessary.
2. Inspect overall condition of vibration isolators, if equipped. Replace isolators, as necessary, if rubber has deteriorated or mounts have collapsed.



RG9905 —UN—06JAN99

Engine Mounting

A—Mounting Bracket

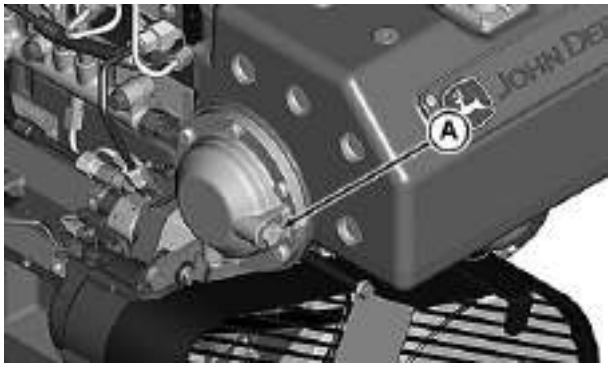
ZE59858,00001BC -19-17SEP13-1/1

Inspecting and Replacing Zinc Plugs (If Equipped)

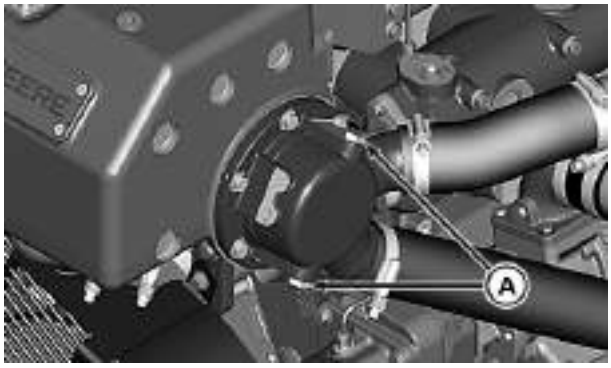
One zinc plug (A) is located in the end of the right side and two plugs (A) are located in the left side of the heat exchanger. These plugs are installed in the engine's sea water cooling system to help reduce the corrosive action of the salt from sea water. There are also two zinc plugs (B) in the aftercooler which should be checked at the same interval. The reaction of the zinc to sea water causes the plugs to deteriorate, instead of the more critical cooling system parts.

1. Remove both zinc plugs and observe condition of each.
2. Tap the zinc rods lightly with a hammer. If rod flakes apart when tapped, install a new zinc plug.

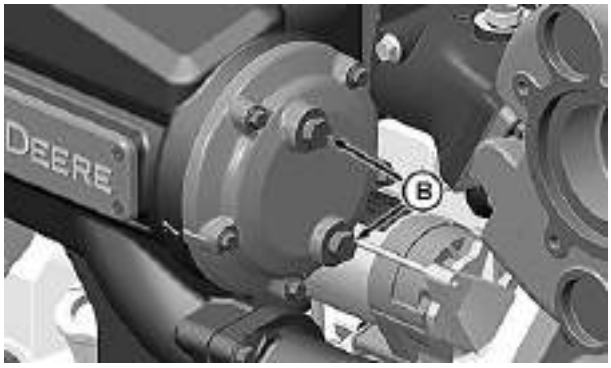
A—Heat Exchanger Zinc Plugs **B—Aftercooler Zinc Plugs**



RG17449 —UN—24AUG09



RG17450 —UN—03AUG09



RG24646 —UN—28OCT13

ZE59858,00001BD -19-26NOV13-1/2

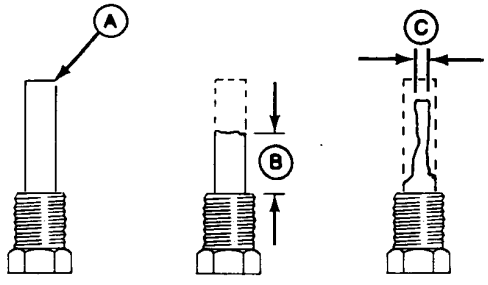
3. Measure zinc plugs (A) to determine the amount of erosion on length (B) and outer diameter (C).

Specification

Zinc Plug (New)—	
Length	38 mm (1.50 in.)
Outside Diameter	15.8 mm (0.622 in.)

If outside length is less than 19 mm (0.75 in.) or outer diameter is less than 7.9 mm (0.311 in.) on either plug, replace both zinc plugs.

A—Zinc Plug **C—Outside Diameter Erosion**
B—Length Erosion



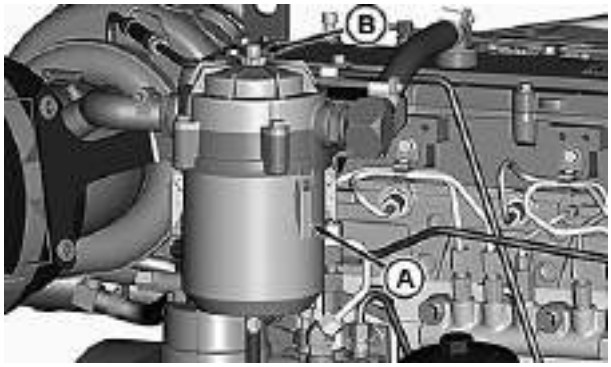
RG6007 —UN—27JAN92

Measure Zinc Plugs

ZE59858,00001BD -19-26NOV13-2/2

Replacing Crankcase Ventilation Filter

1. Open clips (A) and remove the crankcase ventilation bowl.
2. Remove old filter and discard.
3. Install new filter in bowl and install bowl.
4. Press restriction indicator (B) down to reset.
5. Inspect crankcase fitting for damage and make sure that it is not plugged.
6. Verify that the crankcase vent system bypass port is not plugged.
7. Inspect hoses and oil drain line for kinks, blockage, or other damage.



RG24641 —UN—29OCT13

Replace Crankcase Ventilation Filter

A—Clips **B—Restriction Indicator**

ZE59858,00001BE -19-11NOV13-1/1

Checking Air Intake System

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

1. Inspect all intake hoses (piping) for cracks. Replace as necessary.
2. Check clamps 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.

IMPORTANT: ALWAYS REPLACE primary air cleaner element when air filter restriction indicator shows a vacuum of 625 mm (25 in.) H_2O, is torn, or visibly dirty.

3. Test air filter restriction indicator (A) for proper operation. Replace indicator as necessary.

IMPORTANT: If not equipped with air filter restriction indicator, replace air cleaner elements at 500 Hours or 12 Months, whichever occurs first.

RG9927 —UN—18NOV99

Air Restriction Indicator

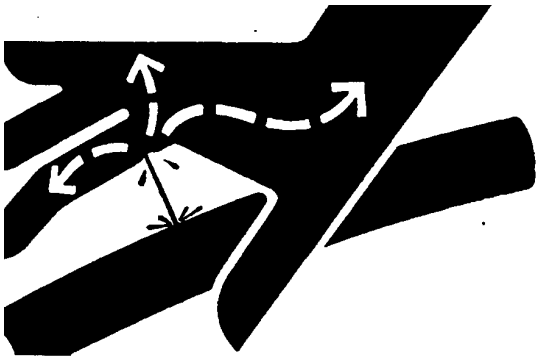
4. Remove and inspect primary air cleaner element. Service as necessary. See Replacing Air Cleaner Filter Element and Servicing Air Cleaner Filter Element in Service As Required Section.

ZE59858,00001BF -19-11NOV13-1/1

Replacing Fuel Filters/Cleaning Water Separator

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

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



X9811 —UN—23AUG88

High Pressure Fluids

CAUTION: Due to High-Pressure Common-Rail system design, fuel in filter is likely to be under high pressure. To avoid possible personal harm, open valves (B) and (J) on bottom of filters to relieve pressure prior to removing each filter.

IMPORTANT: Replace fuel filter elements anytime audible alarm sounds and trouble codes indicate plugged fuel filters (low fuel pressure). If no alarm sounds during the 12 month service interval, replace elements at that time, or after 500 hours operation, whichever comes first.

Both primary and secondary fuel filters must be replaced at the same time.

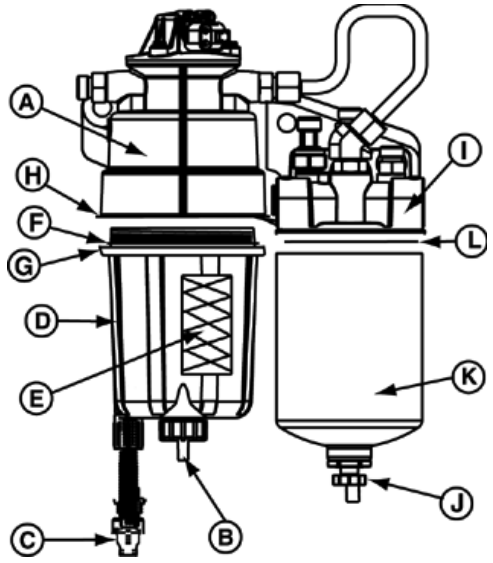
Continued on next page

ZE59858,00001C0 -19-08NOV13-1/3

Remove and Install Primary Fuel Filter Element

IMPORTANT: Do NOT pre-fill filter with fuel. This may introduce debris into the fuel system.

1. Thoroughly clean primary filter header (A) and surrounding area to keep from getting dirt and debris into fuel system.
2. Connect a fuel drain line to primary filter drain valve (B) on bottom of filter and drain all fuel from the primary filter canister (D).
3. Disconnect water-in-fuel sensor connector (C).
4. Turn primary filter canister (D) counterclockwise (CCW) to remove.
5. Once primary filter canister (D) is removed, pull primary filter element (E) down to remove from primary filter header (A).
6. Inspect primary filter header (A) and primary filter canister (D) sealing surfaces. Clean as required.
7. Place new packing (F) on primary filter canister (D).
8. Place thin film of fuel on primary filter packing (F).
9. Place new primary filter element (E) in canister (D) with tangs on bottom going into canister.
10. Screw canister (D) into filter header (A), turn clockwise (CW). Tighten until canister lip (G) snugly mates with header lip (H).
11. Turn filter additional 3/4 turn after seal contact with header.



RG14250 —UN—06JUN05

A—Primary Filter Header
B—Primary Filter Canister Drain Valve
C—Water-In-Fuel Sensor Connector
D—Primary Filter Canister
E—Primary Filter Element
F—Primary Filter Packing
G—Primary Filter Canister Lip
H—Primary Filter Header Lip
I— Secondary Fuel Filter Header
J— Secondary Filter Drain Valve
K—Secondary Fuel Filter
L—Secondary Filter Packing

12. Connect water-in-fuel sensor connector (C).

Continued on next page

ZE59858,00001C0 -19-08NOV13-2/3

Remove and Install Secondary Fuel Filter

IMPORTANT: Do NOT pre-fill filter with fuel. This may introduce debris into the fuel system.

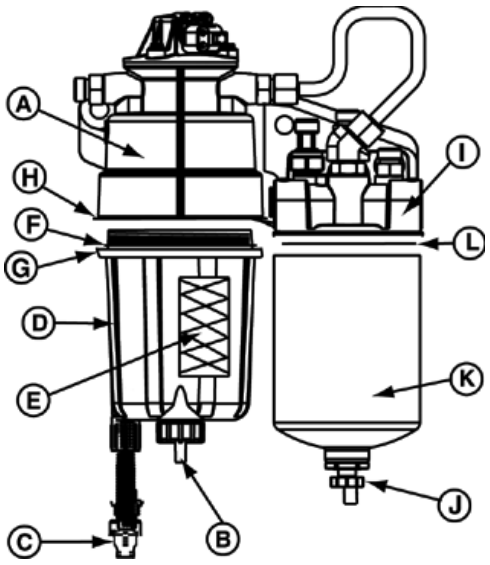
1. Thoroughly clean secondary filter header (I) and surrounding area to keep from getting dirt and debris into fuel system.
2. Connect a fuel drain line to secondary filter drain valve (J) on bottom of filter and drain all fuel from the filter.
3. Turn secondary filter (K) counterclockwise (CCW) to remove.
4. Inspect secondary filter header (I) sealing surface. Clean as required.
5. Install new secondary filter fuel drain valve (J), tighten to specification.

Specification

Secondary Fuel Filter
Drain Valve—Torque..... 3.4—4 N·m (30—35 lb.-in.)

6. Place new secondary filter packing (L) on filter.
7. Place thin film of fuel on packing (L).
8. Screw secondary fuel filter (K) into secondary fuel filter header (I), turn clockwise (CW). Tighten until secondary fuel filter (K) snugly mates with secondary fuel filer header (I).
9. Turn filter additional 3/4 turn after seal contact with header.

NOTE: Turn ignition Key to ON for 60 seconds to prime the fuel system before starting engine. It may be necessary to turn key off and on again to reprime the system before starting.



RG14250 —UN—06JUN05

A—Primary Filter Header
B—Primary Filter Canister Drain Valve
C—Water-In-Fuel Sensor Connector
D—Primary Filter Canister
E—Primary Filter Element
F—Primary Filter Packing
G—Primary Filter Canister Lip
H—Primary Filter Header Lip
I— Secondary Fuel Filter Header
J— Secondary Filter Drain Valve
K—Secondary Fuel Filter
L—Secondary Filter Packing

ZE59858,00001C0 -19-08NOV13-3/3

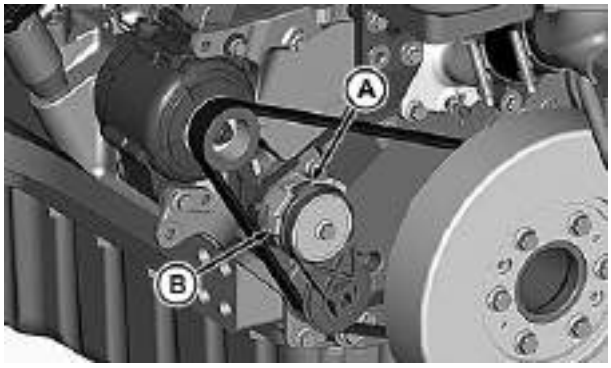
Checking Belt Wear

NOTE: While belt is loosened, inspect pulleys and bearings. Rotate and feel for hard turning or any unusual sounds. If pulleys or bearings need replacement, see your John Deere dealer.

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

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

If the tensioner stop (A) on swing arm is hitting the fixed stop (B), check mounting brackets (alternator, belt tensioner, idler pulley, etc.) and the belt length. Replace belt as needed. See Replacing Alternator Belt in Service As Required Section.



RG24640 —UN—28OCT13

Belt Tensioner

A—Tensioner Stop **B—Fixed Stop**

ZE59858,00001C1 -19-29OCT13-1/1

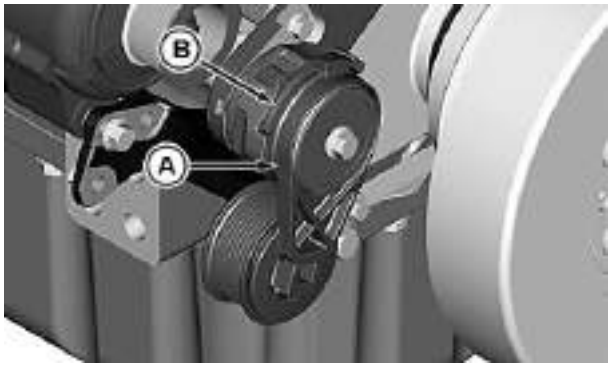
Checking Tensioner Spring Tension

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

1. Release tension on belt using a long-handled 1/2 inch drive tool in tensioner arm. Remove belt from pulleys.
2. Release tension on tensioner arm and remove drive tool.
3. Put a mark (A) on swing arm of tensioner as shown.
4. Measure 21 mm (0.83 in.) from mark (A) and put a mark (B) on tensioner mounting base.
5. Rotate the swing arm using a torque wrench until marks (A and B) are aligned.
6. Record torque wrench measurement and compare with specification below. Replace tensioner assembly as required.

Specification

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



RG17153 —UN—26MAY09

A—Mark **B—Mark**

ZE59858,00001C2 -19-23OCT13-1/1

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.

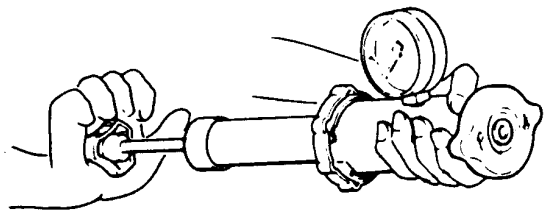
TS281 —UN—15APR13

High Pressure Fluids

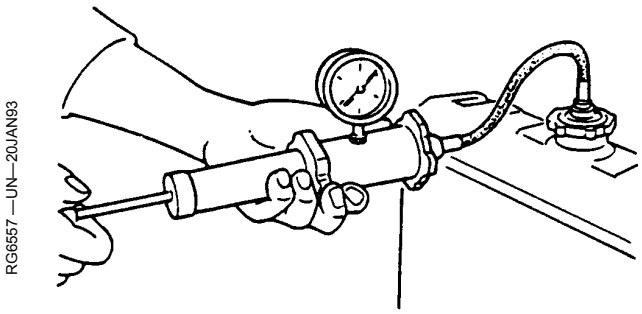
2. Thoroughly inspect all cooling system hoses for hard, flimsy, or cracked conditions. Replace hoses if any of the above conditions are found.

ZE59858,00001C3 -19-17SEP13-1/1

Pressure Testing Cooling System



Test Radiator Cap



Test 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.

Test Radiator Cap

1. Remove radiator cap and attach to D05104ST Tester as shown.
2. Pressurize cap to following specifications. Gauge should hold pressure for 10 seconds within the normal range if cap is acceptable.

Specification

Radiator Cap—Minimum
Test Pressure.....110 kPa (1.10 bar) (16 psi)

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 for Leaks

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

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 the following specifications.

Specification

Radiator Cap—Minimum
Test Pressure.....110 kPa (1.10 bar) (16 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.

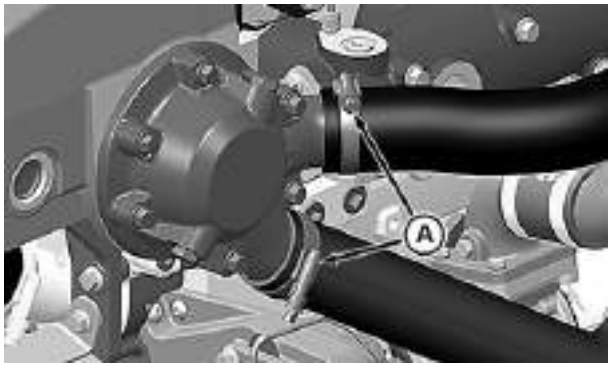
ZE59858,00001C4 -19-23OCT13-1/1

Removing, Inspecting, and Cleaning Heat Exchanger Core

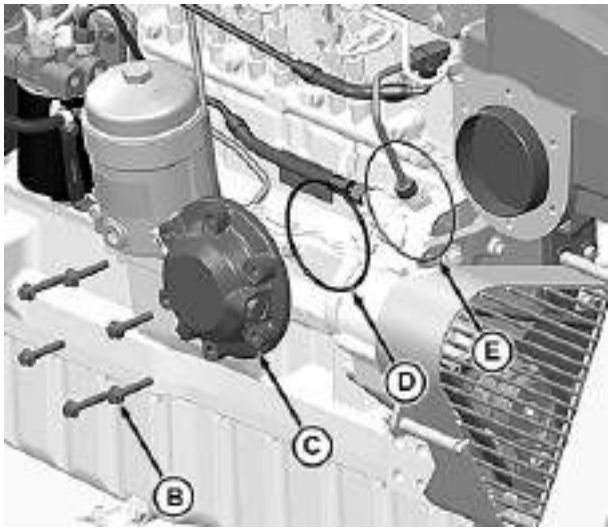
IMPORTANT: This service interval only applies to engines that use sea water for cooling.

1. Close sea cocks and drain the sea water system.
2. Open drain valve on cylinder block and drain engine coolant into a clean container. Close drain valve.
3. Loosen hose clamps (A) and disconnect sea water tubes.
4. Remove cap screws (B) and remove right end cap (C). Identify end cap so it can be installed in the same position as removed.
5. Remove short and long cap screws (G and F) and remove left end cap (H) . Identify end cap so it can be installed in the same position as removed.
6. Thoroughly inspect condition of end cap sealing O-rings. Sealing O-rings may be reused if not excessively worn or damaged during disassembly. Replace sealing rings as necessary.

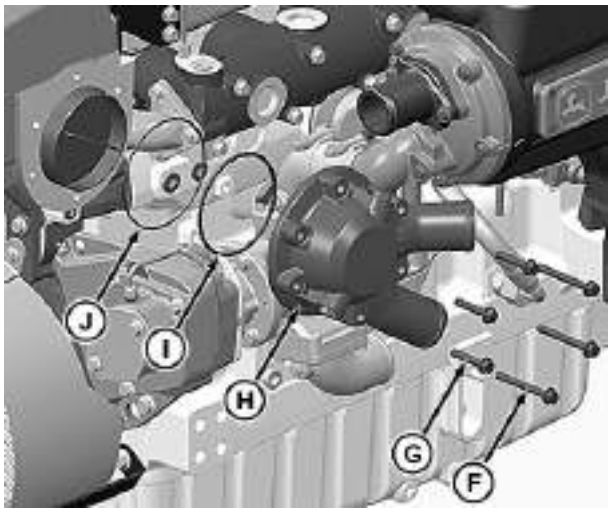
A—Hose Clamps
B—Cap Screws
C—Right End Cap
D—O-Ring
E—O-Ring
F—Cap Screws (Long)
G—Cap Screws (Short)
H—Left End Cap
I— O-Ring
J— O-Ring



RG24643 —UN—28OCT13



RG24642 —UN—28OCT13



RG24644 —UN—28OCT13

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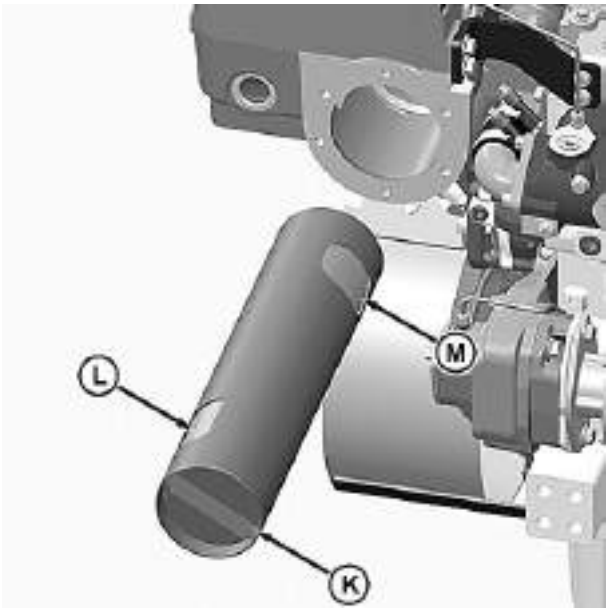
ZE59858,00001C5 -19-26NOV13-1/2

7. Remove heat exchanger core (K).
8. Thoroughly clean all buildup from both end caps and inspect zinc plug in each. Replace zinc plugs as needed. See Inspecting and Replacing Zinc Plugs (If Equipped) in the Lubrication & Maintenance — 250 Hours/6 Months Section.
9. Use a brass rod to clean out any buildup in each heat exchanger tube. Run the rod the entire length of each tube to push out debris.
10. Flush the heat exchanger tubes with clean water, making sure that all tubes are cleared of debris. Clean (with brass rod) and flush heat exchanger again if necessary to remove any remaining debris from tubes. If you suspect that your heat exchanger core is defective, have your authorized servicing dealer or engine distributor pressure test for leaks. Replace heat exchanger core as required.
11. Remove and thoroughly clean water manifold/heat exchanger housing if needed.

K—Heat Exchanger Core
L—Front Coolant Passage
M—Rear Coolant Passage



RG24645 —UN—28OCT13

RG6066 —UN—23JAN92

Clean Heat Exchanger

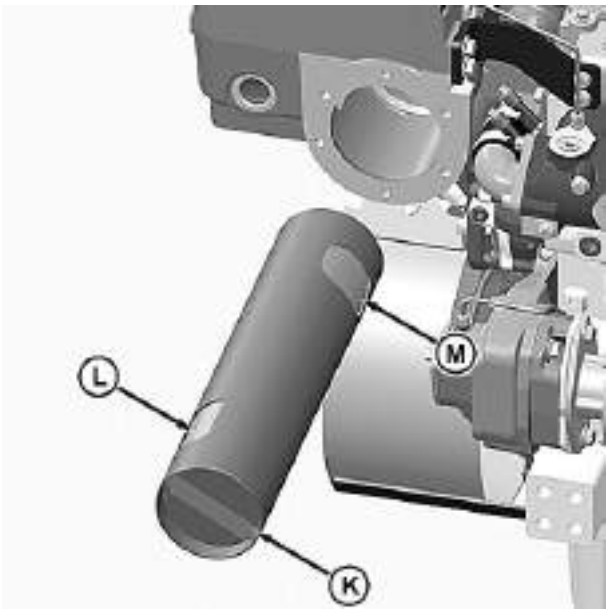
ZE59858,00001C5 -19-26NOV13-2/2

Installing Heat Exchanger Core

IMPORTANT: This service interval only applies to engines that use sea water for cooling.

1. Orient heat exchanger core as shown. Front and rear coolant passages (L and M) must line up with passages in heat exchanger housing.
2. Install heat exchanger core (K).

K—Heat Exchanger Core
L—Front Coolant Passage
M—Rear Coolant Passage



RG24645 —UN—28OCT13

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ZE59858,00001C6 -19-26NOV13-1/2

3. Thoroughly inspect condition of end cap sealing O-rings. Sealing O-rings may be reused if not excessively worn or damaged during disassembly. Replace sealing O-rings as necessary.
4. Install O-rings (I and J) in left end cap (H).
5. Install left end cap (H) and install short cap screws (G) in the front of left end cap. Install long cap screws (F) in the rear of left end cap (G). Index end cap in same position as removed.
6. Tighten cap screws (F and G) to specifications.

Specification

Cap Screws (F and G)—Torque ..... 49 N·m (36 lb.-ft.)

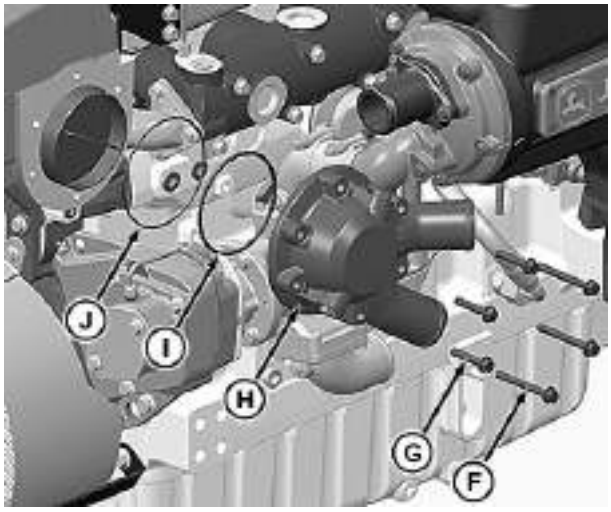
7. Thoroughly inspect condition of end cap sealing O-rings. Sealing O-rings may be reused if not excessively worn or damaged during disassembly. Replace sealing O-rings as necessary.
8. Install O-rings (D and E) in right end cap (C).
9. Install right end cap (C) and install cap screws (B). Index end cap in same position as removed.
10. Tighten cap screws (B) to specifications.

Specification

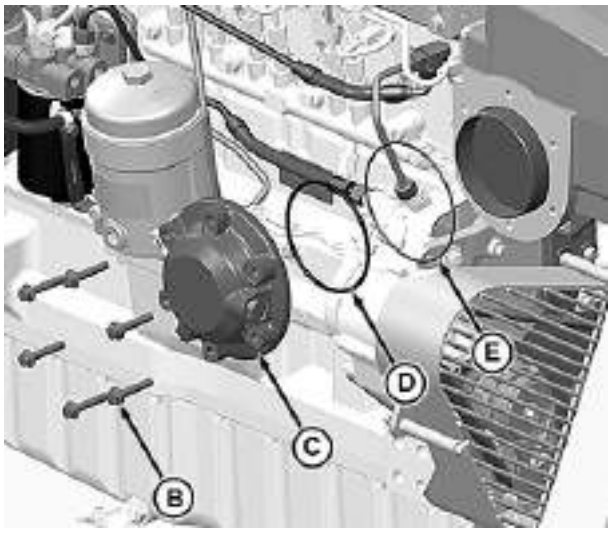
Cap Screws (D)—Torque ..... 49 N·m (36 lb.-ft.)

11. Connect sea water tubes and tighten hose clamps (A) securely. Fill cooling system with the proper amount and concentration of ethylene glycol base antifreeze.
12. Open sea cock, start engine, and check for leaks.

A—Hose Clamps
B—Cap Screws
C—Right End Cap
D—O-Ring
E—O-Ring
F—Cap Screws (Long)
G—Cap Screws (Short)
H—Left End Cap
I— O-Ring
J— O-Ring



RG24644 —UN—28OCT13



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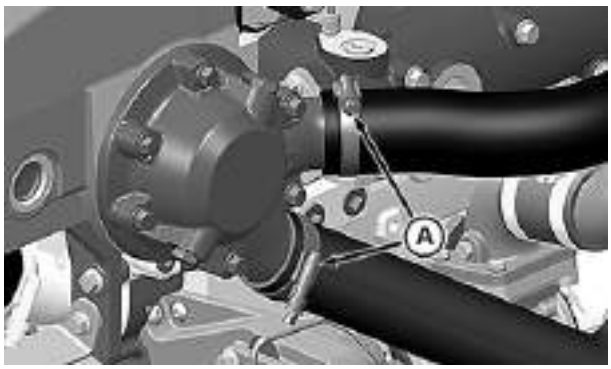


RG24643 —UN—28OCT13

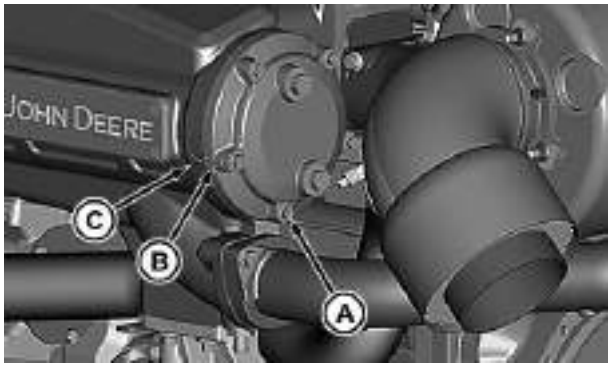
ZE59858,00001C6 -19-26NOV13-2/2

Removing, Inspecting, and Cleaning Engine Aftercooler Core

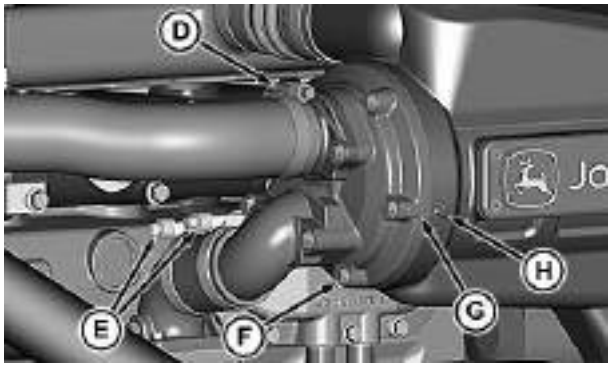
IMPORTANT: This service interval only applies to engines that use sea water for cooling.

1. Close sea cocks and drain the sea water or coolant system.
2. Remove cap screws (A) and rear end cap (B).
3. Loosen clamps (D and E) and remove lines from front end cap.
4. Remove cap screws (F) and front end cap (G).
5. Remove aftercooler core (I).

A—Cap Screws
B—Rear End Cap
C—Aftercooler Housing Mark
D—Clamps
E—Clamps
F—Cap Screws
G—Front End Cap
H—Aftercooler Housing Mark
I— Aftercooler Core



RG24639 —UN—04NOV13



RG24637 —UN—04NOV13

RG24638 —UN—28OCT13

ZE59858,00001C7 -19-26NOV13-1/2

6. Thoroughly clean all buildup from both end caps.
7. Use a brass rod to clean out any buildup in each tube. Run the rod the entire length of each tube to push out debris.
8. Flush the tubes with clean water, making sure that all tubes are cleared of debris. Clean (with brass rod) and flush aftercooler core again if necessary to remove any remaining debris from tubes.
   If you suspect that your aftercooler core is defective, have your authorized servicing dealer or engine distributor pressure test for leaks. Replace aftercooler core as required.

RG12181 —UN—25FEB02

Clean Aftercooler Core

ZE59858,00001C7 -19-26NOV13-2/2

Installing Aftercooler Core

IMPORTANT: This service interval only applies to engines that use sea water for cooling.

1. Install O-rings on front and rear end caps. Lubricate front and rear end cap O-rings with clean multi-purpose grease.
2. Install aftercooler core in same position as removed. Orient aftercooler lip (I) as shown.
3. Install front end cap in same position as removed. Line up end cap mark (G) and aftercooler housing mark (H). Evenly tighten cap screws (F) to specifications.

Specification

Cap Screws—Torque..... 26 N·m (230 lb.-in.)

4. Install lines and clamps (D and E).
5. Install rear end cap in same position as removed. Line up end cap mark (B) and aftercooler housing mark (C). Evenly tighten cap screws (A) to specifications.

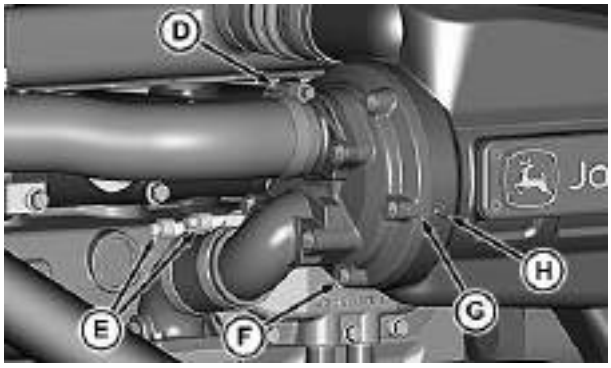
Specification

Cap Screws—Torque..... 26 N·m (230 lb.-in.)

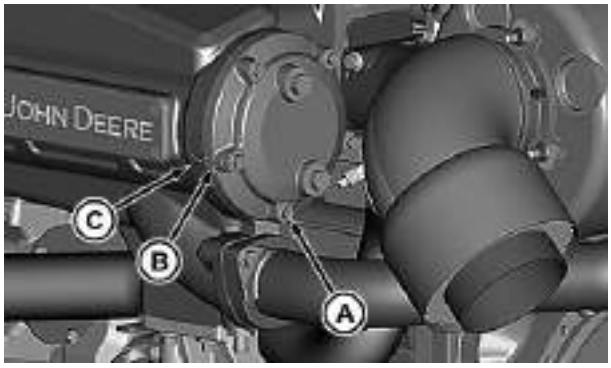
6. Open sea cocks.

A—Cap Screws
B—Rear End Cap Mark
C—Aftercooler Housing Mark
D—Clamps
E—Clamps
F—Cap Screws
G—Front End Cap Mark
H—Aftercooler Housing Mark
I— Aftercooler Lip

RG24638 —UN—28OCT13



RG24637 —UN—04NOV13

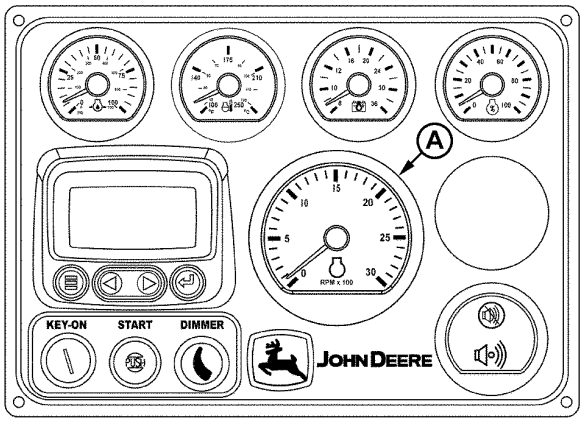


RG24639 —UN—04NOV13

ZE59858,00001C8 -19-26NOV13-1/1

Checking and Adjusting Engine Speeds

Observe tachometer reading (A) on the instrument panel to verify engine speeds. See Engine Power and Speed Specifications in Specifications Section.



RG13138 —UN—07OCT03

Observe Tachometer Reading

ZE59858,000027C -19-29OCT13-1/1

Checking Engine Electrical Ground Connections

Keep all engine ground connections clean and tight to prevent electrical arcing which can damage electronic components.

Also see precautions in Troubleshooting Section when welding on engine or machine.

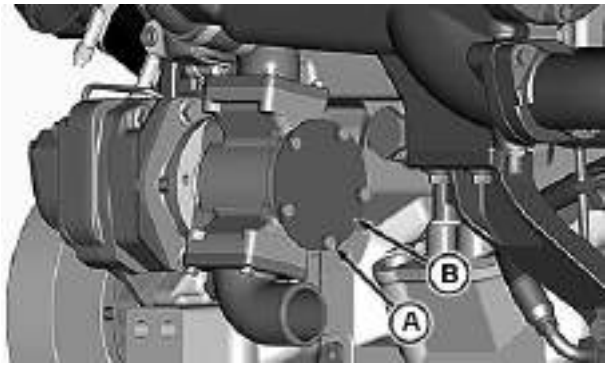
OUOD002,0000169 -19-23NOV01-1/1

Replacing Sea Water Pump Impeller (If Equipped)

1. Close sea cock and drain sea water system.
2. Remove cap screws (A). Remove sea water pump cover (B).
3. Clean sealing surfaces and inspect for defects.
4. Install sea water pump impeller.
5. Install sea water pump cover (B).
6. Install cap screws (A) and tighten to specifications.

Specification	
Cap Screws (A)—Torque	26 N·m (230 lb.-in.)

7. Open sea cock, start engine, and check for leaks.



RG24650 —UN—28OCT13

Remove and Install Sea Water Pump

A—Cap Screw **B—Sea Water Pump Cover**

ZE59858,00001CB -19-26NOV13-1/1

Checking Crankshaft Vibration Damper

Most applications will utilize a viscous damper. The viscous damper has no maintenance items or service checks and should last the life of the engine. On some applications there may be single or dual rubber dampers. Make same checks on each damper.

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

- Inspect visually and with hands to see if the rear portion of the viscous damper is bulging. If bulging is present, replace the damper.
- 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.

RG7369 —UN—05JAN98

Dual Damper

RK80614,0000032 -19-22OCT13-1/1

Checking and Adjusting Valve Clearance

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

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

NOTE: Firing order is 1-5-3-6-2-4.

1. Remove rocker arm cover and crankcase ventilator tube.

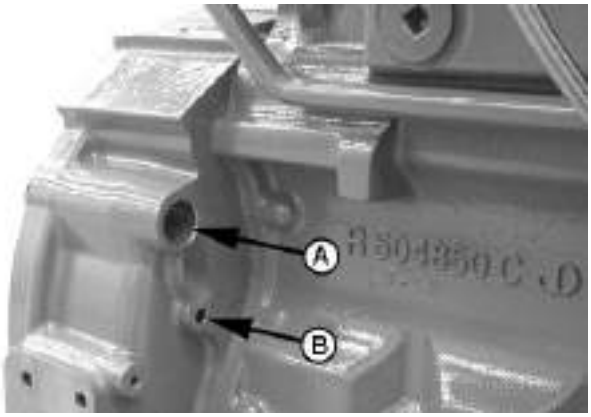
IMPORTANT: Visually inspect contact surfaces of valve tips, bridges, and rocker arm wear pads. Check all parts for excessive wear, breakage, or cracks. Replace parts that show visible damage.

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

2. Remove plastic plugs or cover plate from engine timing/rotation hole (A) and timing pin hole (B).

NOTE: Some engines are equipped with flywheel housings which do not allow use of an engine flywheel rotation tool. These engines with straight nose crankshafts may be rotated from front nose of engine, using JDG966 Crankshaft Front/Rear Rotation Adapter.

3. Using JDE83 or JDG820 Flywheel Turning Tool, rotate engine flywheel in running direction (clockwise viewed from front) until No. 1 (front) cylinder is at TDC compression stroke. Insert JDG1571 or JDE81-4 Timing Pin in flywheel.



RG13749 —UN—11NOV04

Flywheel Housing Timing Holes

A—Timing/Rotation Hole **B—Timing Pin Hole**

If No. 1 cylinder rocker arms are loose, the engine is at No. 1 TDC compression.

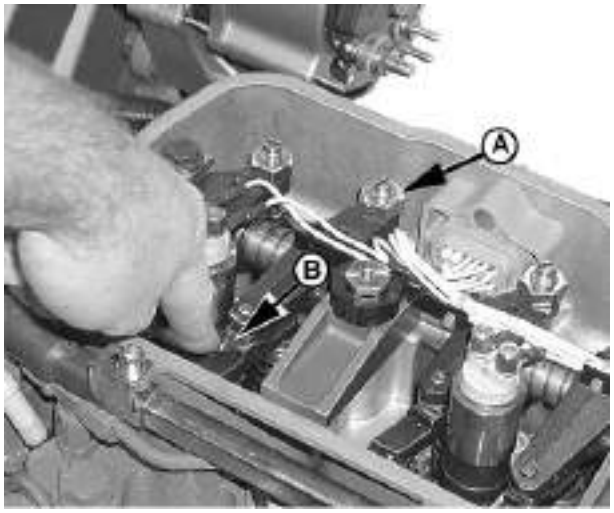
If No. 1 cylinder rocker arms are not loose, rotate engine one full revolution (360°) to No. 1 TDC compression.

ZE59858,00001CC -19-05DEC13-1/3

4. Adjust valves to specifications below using the appropriate valve clearance adjustment procedure as outlined in the following below. Loosen the nut (A) on rocker arm adjusting screw. Turn adjusting screw until feeler gauge (B) slips with a slight drag. Hold the adjusting screw from turning with screwdriver and tighten nut to specifications. Recheck clearance again after tightening nut. Readjust clearance as necessary.

Specification	
Intake Valve Clearance Adjustment (Rocker Arm-to-Bridge) (Engine Cold)—Clearance	0.18 mm (0.007 in.)
Exhaust Valve Clearance Adjustment (Rocker Arm-to-Bridge) (Engine Cold)—Clearance	0.63 (0.025 in.)
Rocker Arm Adjusting Screw Jam Nut—Torque	27 N·m (20 lb.-ft.)

NOTE: While rocker arm cover is removed, test glow plugs. (See following procedure.)



RG13809 —UN—07DEC04

Adjusting Valves

A—Adjusting Screw Jam Nut **B—Feeler Gauge**

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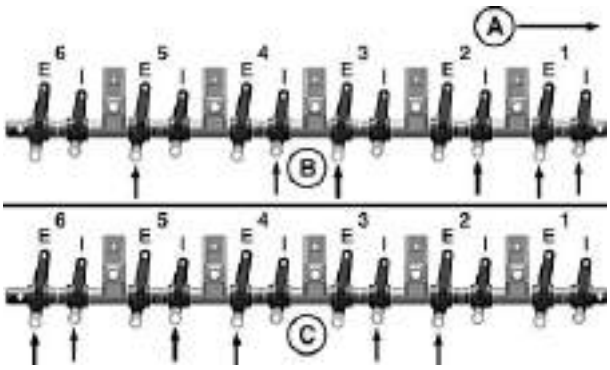
ZE59858,00001CC -19-05DEC13-2/3

5. Lock No. 1 piston at TDC compression stroke (B).
6. Adjust valve clearance on No. 1, 3 and 5 exhaust valves and No. 1, 2, and 4 intake valves.
7. Turn crankshaft 360°. Lock No. 6 piston at TDC compression stroke (C).
8. Adjust valve clearance on No. 2, 4 and 6 exhaust valves and No. 3, 5, and 6 intake valves.
9. Connect crankcase ventilation tube and install rocker arm cover. Tighten rocker arm cover cap screws to specification.

Specification

Cap Screws—Torque..... 36 N·m (27 lb.-ft.)

10. Reconnect battery terminal.



RG17725 —UN—04OCT10

Valve Adjustment

A—Front of Engine
B—No. 1 Piston TDC Compression
C—No. 6 Piston TDC Compression
E—Exhaust Valve
I— Intake Valve

ZE59858,00001CC -19-05DEC13-3/3

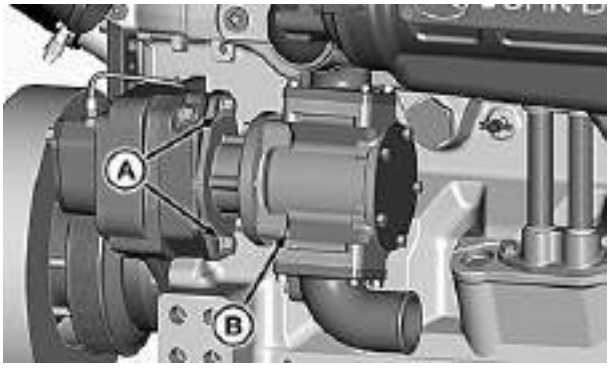
Overhauling Sea Water Pump (If Equipped)

1. Close sea cock and drain sea water system.
2. Remove sea water pump inlet connection.
3. Clean sealing surfaces and inspect for defects.
4. Install pump overhaul kit.
5. Install sea water pump. Tighten cap screws (A) to specifications.

Specification

Cap Screws—Torque..... 105 N·m (77 lb.-ft.)

6. Connect sea water pump inlet and outlet hoses.
7. Open sea cock, start engine, and check for leaks.



RG24651 —UN—28OCT13

Remove and Install Sea Water Pump

A—Cap Screws
B—Sea Water Pump

ZE59858,00001D1 -19-26NOV13-1/1

Changing Rubber Crankshaft Vibration Damper (If Equipped)

See your authorized John Deere engine distributor or servicing dealer.

ZE59858,000025F -19-26NOV13-1/1

Flushing And Refilling Cooling System

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

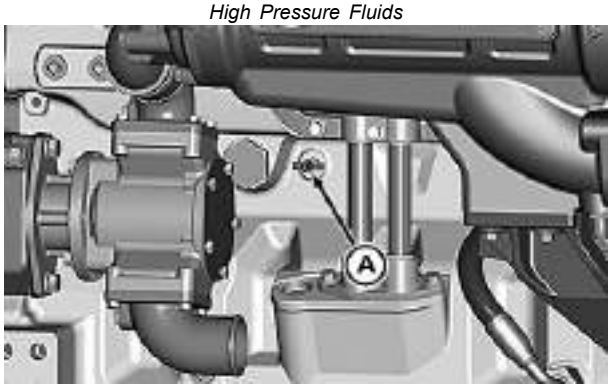
Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

1. Pressure test entire cooling system and pressure cap if not previously done. See Pressure Testing Cooling System in the Lubrication & Maintenance — 500 Hours/12 Months Section.
2. Slowly open the engine cooling system filler cap or pressure cap (C) to relieve pressure and allow coolant to drain faster.
3. Open coolant pump drain valve (A) and engine block drain valve (B) on left side of engine. Drain all coolant from engine block.
4. Open the coolant drain valve and drain coolant from engine.

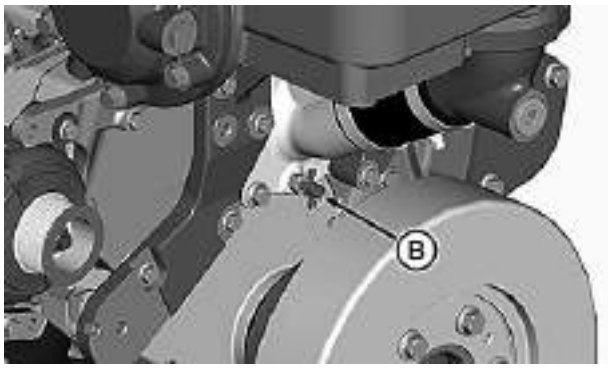
A—Block Drain Valve
B—Pump Drain Valve
C—Pressure Cap

High Pressure Fluids

TS281 —UN—15APR13



RG24648 —UN—28OCT13



RG24649 —UN—28OCT13

RG24647 —UN—28OCT13

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ZE59858,0000259 -19-29OCT13-1/2

5. Remove thermostats (D) at this time, if not previously done. Install cover (without thermostats) and tighten cap screws to specifications.

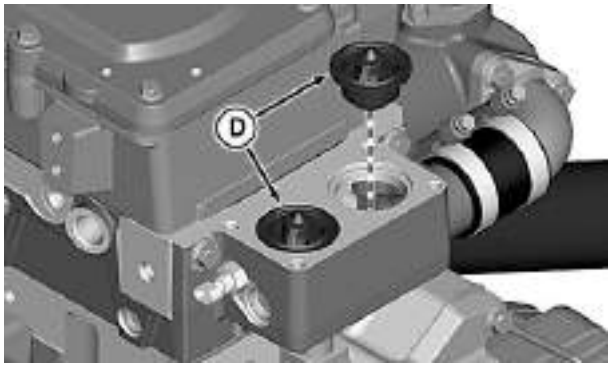
Specification

Thermostat Cover Cap Screws—Torque..... 45 N·m (33 lb.-ft.)

6. Test thermostat opening temperature. See Testing Thermostats in the Lubrication & Maintenance — 6000 Hours/72 Months Section.

CAUTION: Do not run engine longer than 10 minutes. Doing so may cause engine to overheat which may cause burns when radiator water is draining.

7. Close all drain valves after coolant has drained.
8. Fill the cooling system with clean water. Run the engine about 10 minutes to stir up possible rust or sediment.
9. Stop engine and immediately drain the water from system before rust and sediment settle.
10. After draining water, close drain valves and fill the cooling system with clean water and a heavy duty cooling system cleaner such as FLEETGARD RESTORE or RESTORE PLUS. Follow manufacturer's directions on label.
11. After cleaning the cooling system, drain cleaner and fill with water to flush the system. Run the engine 10 minutes, then drain water.
12. Close all drain valves on engine, top tank, and heat exchanger. Install new rubber seal on each thermostat and install thermostats. Install thermostat cover and tighten cap screws to specifications.



RG24657 —UN—29OCT13

Thermostats

D—Thermostats

Specification

Thermostat Cover Cap Screws—Torque..... 45 N·m (33 lb.-ft.)

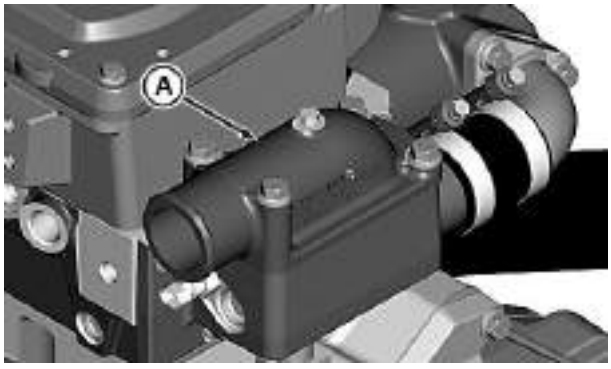
13. Refill heat exchanger with fresh coolant until coolant touches bottom of the filler neck. See Adding Coolant in the Service As Required Section.
14. Run engine until it reaches operating temperature. This mixes the solution uniformly and circulates it through the entire system.
15. After running the engine, check coolant level and entire cooling system for leaks.

ZE59858,0000259 -19-29OCT13-2/2

Testing Thermostats

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns. Do not drain coolant until coolant temperature is below operating temperature. Always loosen cooling system filler cap, radiator cap, or drain valve slowly to relieve pressure.

1. Visually inspect the area around the coolant manifold for leaks. Partially drain coolant from the cooling system.
2. Remove thermostat cover (A).



RG17156 —UN—26MAY09

Remove Thermostat Cover

A—Thermostat Cover

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ZE59858,000025A -19-29OCT13-1/4

3. Inspect thermostats.
4. Test each thermostat for proper opening temperature.

RG17155 —UN—26MAY09

Removing Thermostats

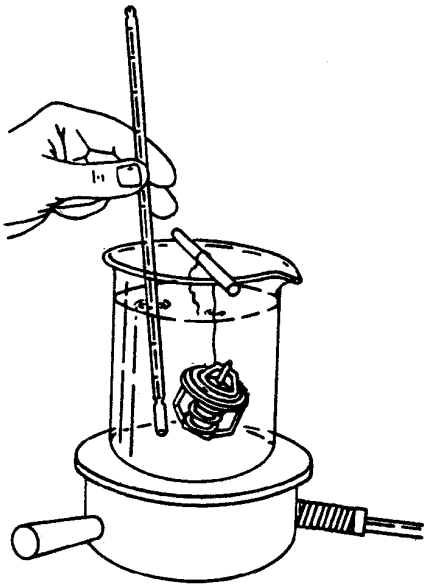
ZE59858,000025A -19-29OCT13-2/4

Testing Thermostats Opening Temperature

1. Visually inspect thermostats for corrosion or damage. Replace thermostats as a matched set as necessary.
2. Inspect thermostat with wiggle wire in vent notch. If wire movement is restricted, replace thermostat if cleaning does not free movement.

CAUTION: DO NOT allow thermostat or thermometer to rest against the side or bottom of container when heating water. Either may rupture if overheated.

3. Suspend thermostat and a thermometer in a container of water.
4. Stir the water as it heats. Observe opening action of thermostat and compare temperatures with specification given in General Marine Engine Specifications in the Specifications Section.
5. Remove thermostat and observe its closing action as it cools. In ambient air the thermostat should close completely. Closing action should be smooth and slow.
6. If any one thermostat is defective, replace both thermostats.



RG5971 —UN—23NOV97

Thermostats and Thermometer in Water

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ZE59858,000025A -19-29OCT13-3/4

Installing Thermostats

1. Install new rubber seal on each thermostat and install thermostats.
2. Install cover and tighten cap screws to specifications.

Specification	
Cast Iron Thermostat Cover Cap Screws—Torque	45 N·m (33 lb.-ft.)

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 when all air has been expelled. Damage to EGR cooler (if equipped) could result if cooling system is not bled properly.

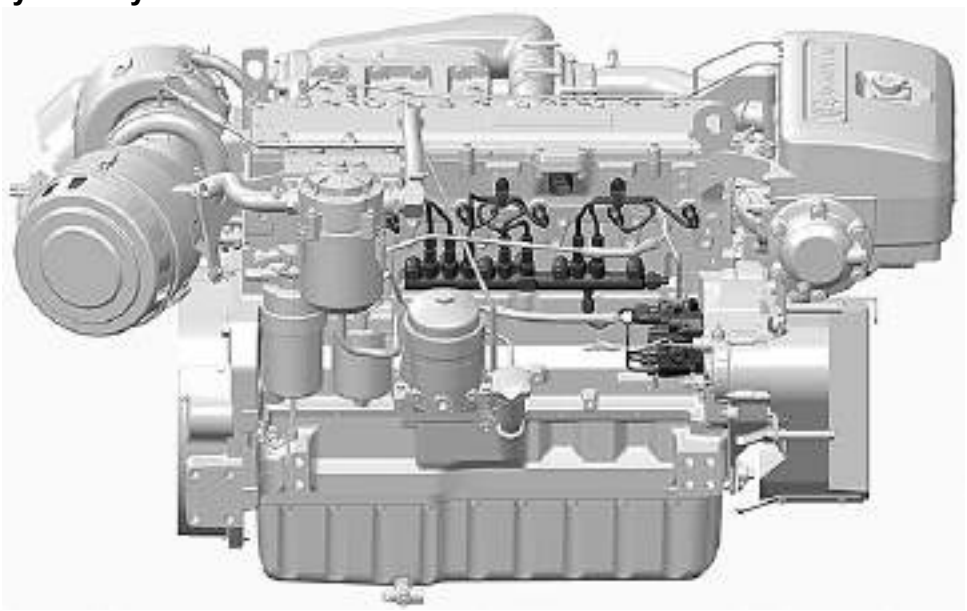
3. Pressure test the cooling system a second time to be sure that the thermostat cover is sealed. See Pressure Testing Cooling System in the Lubrication & Maintenance — 500 Hours/12 Months Section.

RG17155 —UN—26MAY09

Installing Thermostats

ZE59858,000025A -19-29OCT13-4/4

Do Not Modify Fuel System



RG24681 —UN—30OCT13

Fuel System

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

In addition, tampering with fuel system which alters emission-related equipment on engines may result in fines or other penalties, per EPA regulations or other local emission laws.

Do not attempt to service fuel pump, fuel rail, or fuel injectors yourself. Special training and special tools are required. (See your authorized servicing dealer or engine distributor.)

Avoid seizure of internal precision parts in high-pressure fuel pump or fuel injection rail. Never steam clean or pour cold water on pump or rail while these components are until warm.

ZE59858,00001D2 -19-30OCT13-1/1

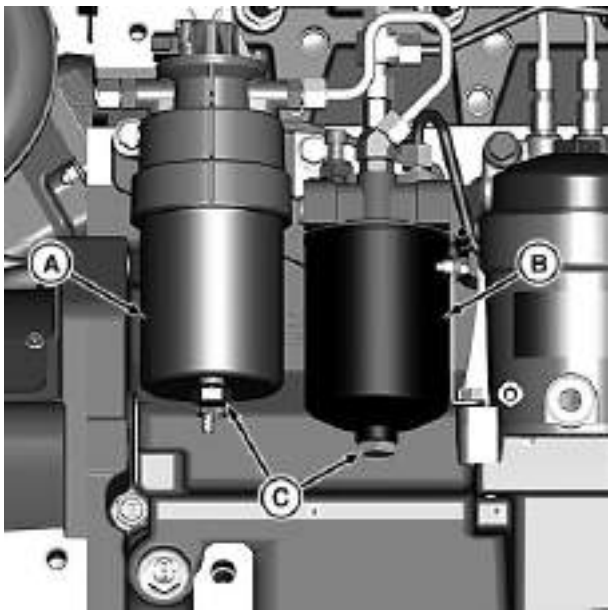
Draining Water From Fuel Filter

The primary fuel filter is equipped with a sensor that detects the presence of water in the fuel filter element. This sensor will illuminate the red “STOP ENGINE” warning light on the diagnostic gauge and also sound an audible alarm. A Diagnostic Trouble Code (DTC), a description of the trouble code and the corrective action needed will be displayed on the diagnostic gauge.

ALWAYS STOP ENGINE IMMEDIATELY and drain water from the primary (A) and final fuel filter (B) when these warnings occur.

1. Loosen drain valves (C) to drain water and debris as needed.
2. Retighten valves securely.

NOTE: Also replace fuel filter elements when amber indicator on instrument panel lights up AND Diagnostic Trouble Code (DTC) in diagnostic gauge window indicates plugged fuel filters (“low fuel pressure”). To replace fuel filter elements, see Replacing Fuel Filters/Cleaning Water Separator in the Lubrication & Maintenance — 500 Hours/12 Months Section.



RG17160 —UN—26MAY09

Drain Water from Fuel Filters

A—Primary Fuel Filter
B—Final Fuel Filter
C—Drain Valves

ZE59858,00001D9 -19-14NOV13-1/1

Adding Coolant

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

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

IMPORTANT: Never pour cold liquid into a hot engine, as it may crack cylinder head or block. DO NOT operate engine without coolant for even a few minutes.

John Deere Cooling System Sealer may be added to the cooling system to stop leaks. DO NOT use any other stop-leak additives in the cooling system.

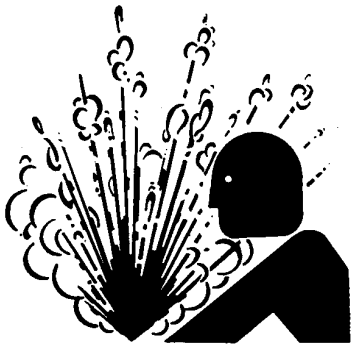
Air must be expelled from cooling system when coolant is added.

1. Loosen temperature sending unit fitting at rear of cylinder head or plug in side of thermostat housing to allow air to escape when filling system.

IMPORTANT: When adding coolant to the system, use the appropriate coolant solution. See Diesel Engine Coolant (engine with wet sleeve cylinder liners) in the Fuels, Lubricants, and Coolant Section for mixing of coolant ingredients before adding to cooling system.

Do not overfill cooling system. A pressurized system needs space for heat expansion without overflowing at top of coolant tank.

2. Fill until coolant level touches bottom of coolant tank filler neck.
3. Tighten plugs and fittings when air has been expelled from system.



TS281 —UN—15APR13

High-Pressure Fluids

RG,RG34710,5593 -19-29OCT13-1/1

Pre-Start Cleaning Guide

IMPORTANT: Before cleaning machine, allow ample time for hot surfaces to cool.

IMPORTANT: Do not direct high-pressure spray from hose output directly at or close to electrical connections and sensors.

Rigorous cleaning as needed is recommended. Clean more frequently during heavy machine use, and when weather conditions are dry.

- Check enclosed areas daily. Clean the engine and other enclosed areas of equipment to remove debris and any buildup of oil and grease. Keep the engine and engine compartment free of combustible material.
- Check for debris buildup daily on and around intake systems, exhaust systems, and intercooler piping systems. Verify that there are no holes or leaks in intake or exhaust systems. Do not allow debris to build up near hot exhaust components. Verify that hot exhaust components are cleaned as often as environmental conditions require.
- Inspect cooling system daily to determine whether cooling system needs cleaning. Visible buildup of residue that blocks airflow may degrade machine performance and requires more frequent cleaning depending on environmental conditions.
- Inspect difficult to observe areas daily as conditions may require additional cleaning care to remove debris.
- Check for oil and fuel leaks daily. Replace or repair any sources of leaks, including gaskets, seals, breather tubes, fittings, and fluid lines.

Maintenance and Service Reminders

- Keep surfaces free of grease and oil.
- Clean up after hydraulic and other fluid leaks.
- Fuel Lines — Check for leaks, cracks, and kinks that require service before use.
- Fuel Pumps — Check fittings, especially compression ring couplings, for cracks and leaks.
- Fuel Injectors — Check pressure and return lines for signs of leaks.
- When servicing fuel filter or draining water separator, avoid fuel spills. Immediately clean up any fuel spill.
- Handle transmission and power steering fluids with care. Immediately clean up any spills, especially around fill points.
- Check for transmission case venting system seepage, transmission case leakage, power steering cylinder leakage, or power steering line leakage.
- Check for loose electrical connectors, damaged wiring, corrosion, and poor connections.

ZE59858,0000009 -19-20MAY13-1/1

Servicing Air Cleaner Filter Element

IMPORTANT: Always service primary air cleaner element when air filter restriction indicator shows a vacuum of 625 mm (25 in.) H_2O, or when reset button has popped up. Also replace element if it is torn, or visibly dirty.

NOTE: This procedure applies to John Deere air cleaner kits. Refer to manufacturers' instructions for servicing air cleaners not supplied by John Deere.

1. Loosen clamp and remove filter element.

IMPORTANT: Replace filter element after 10 cleanings.

2. Tap end of filter GENTLY on hard surface to dislodge loose dirt.
3. Brush dirt side of filter GENTLY with soft bristle brush.

IMPORTANT: DO NOT clean element with gasoline, solvents, parts cleaners, strong detergents, or caustic cleaning solutions. DO NOT steam clean or use high-pressure washers to clean element. These processes will damage filter media and/or rubber base or end cap.

4. Spray air filter cleaner liberally onto entire element. Let soak into filter media for 10 minutes.
5. Rinse filter with low-pressure water, flushing opposite the direction of air flow (from clean side to dirty side).

IMPORTANT: Let element dry at room temperature. Compressed air will damage filter media. Heat will shrink filter media and may damage rubber base or end cap.

6. Shake off excess water and let the element dry at room temperature.

IMPORTANT: Never put filter in service without oiling it. The filter will not function properly without being oiled with oil provided in kit.

Do not use automatic transmission fluid, motor oil, diesel fuel, or any type light-weight spray lubricant. These products will damage filter or degrade its performance.

NOTE: Red dye is added to oil to show areas of oil application.

RG9927 —UN—18NOV99

RG9926 —UN—18NOV99

Remove Filter Element

A—Air Filter Restriction Indicator Button

7. Spray air filter oil from squeeze bottle in kit from distance of 25 cm (10 in.) onto a group of pleats until the pleats become reddish in color. Respray any areas that are still white 10 minutes after initial application.
8. Install filter and tighten clamp.

IMPORTANT: Whenever the air cleaner has been serviced, ALWAYS fully depress the air filter restriction indicator reset button (if equipped) to assure accurate readings.

9. If equipped, fully depress air filter restriction indicator reset button (A) and release to reset indicator.

ZE59858,0000183 -19-11NOV13-1/1

Replacing Air Cleaner Filter Element

IMPORTANT: ALWAYS REPLACE primary air cleaner element when air filter restriction indicator (A) shows vacuum of 625 mm (25 in.) H_2O, or when reset button has popped up (if equipped). Also replace element if it is torn, or visibly dirty.

1. Release air filter assembly clamps (A) and remove cover.

   IMPORTANT: Insure all air intake connections are secure to prevent ingestion of abrasive dirt and dust into the system, causing possible engine damage.

2. Install new air filter element (B), install cover and engage clamps.

RG22155 —UN—21FEB13

Replace Air Filter Element

A—Air Filter Assembly Clamps B—Air Filter Element

ZE59858,0000263 -19-11NOV13-1/1

Element Storage

IMPORTANT: Air cleaner element MUST BE DRY before storing in plastic bag.

Seal element in a plastic bag and store in shipping container to protect against dust and damage.

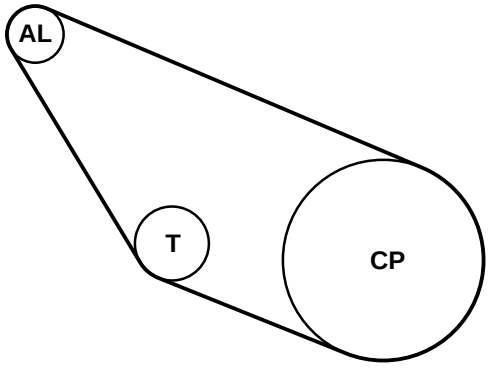
ZE59858,00001D6 -19-18SEP13-1/1

Replacing Alternator Belt

NOTE: While belt is removed, inspect pulleys and bearings. Rotate and feel for hard turning or any unusual sounds. If pulleys or bearings need replacement, see your John Deere dealer.

See Checking Belt Wear in the Lubrication & Maintenance — 500 Hours/12 Months Section to determine if belt needs replacing.

1. Release tension on belt using a long-handled 1/2 in. drive tool in square hole on end of tensioner arm.
2. Remove belt from pulleys and discard belt.
3. Install new belt, be sure that belt is correctly seated in all pulley grooves.
4. Apply tension to belt with tensioner. Remove drive tool.
5. Start engine and check belt alignment.



RG17194 —UN—26MAY09

Belt Routing

AL—Alternator T—Tensioner
CP—Crankshaft Pulley

ZE59858,00001D7 -19-11NOV13-1/1

Checking Fuses

Check the following fuses located in the control panel wiring harness. Replace defective fuses.

- Control Panel fuse — 30 amp
- ECU Power fuse — 20 amp
- Low-Pressure Fuel Pump fuse — 15 amp

See 9.0L Wiring Diagram 3 in the Troubleshooting Section.

ZE59858,00001DA -19-11NOV13-1/1

Bleeding Fuel System

NOTE: Normally the fuel system on these engines is self-priming and self-bleeding, and does not require a bleeding procedure by the operator.

If engine will not start after filter changes, turn ignition key ON for 60 seconds to prime the fuel system. It may be necessary to turn the key off and on again to reprime the system before starting.

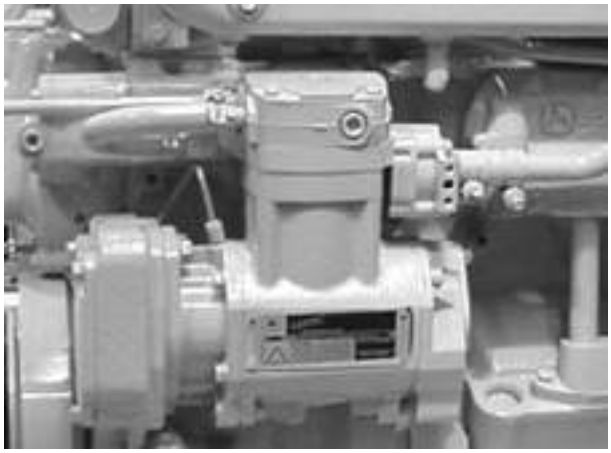
OURGP11,0000026 -19-13OCT06-1/1

Checking Air Compressors (If Equipped)

Air compressors are offered as options with John Deere OEM engines to provide compressed air to operate air-powered devices like vehicle air brakes.

Air compressors are engine-driven piston types. They are either air cooled or cooled with engine coolant. The compressors are lubricated with engine oil. The compressor runs continuously as gear or spline driven by the auxiliary drive of the engine but has “loaded” and “unloaded” operating modes. This is controlled by the vehicle's air system (refer to vehicle technical manual for complete air system checks and services).

See your John Deere engine distributor or servicing dealer for diagnostic and troubleshooting information. If diagnosis leads to an internal fault in the compressor, replace the complete compressor as a new or remanufactured unit.



RG12738 —UN—07NOV02

Air Compressor (Optional)

OUOD006,0000080 -19-11OCT06-1/1

Checking Front Power Take-Off (PTO)

CAUTION: Entanglement in rotating driveline can cause serious injury or death. Keep shield on PTO drive shaft between clutch housing and the engine driven equipment at all times during engine operation. Wear close fitting clothing. Stop the engine and be sure that PTO driveline is stopped before making adjustments.

If options are ordered to make the rear PTO compatible with other manufacturer's drivelines, be sure that proper shielding is in place before operation.

TS1644 —UN—22AUG95

Rotating Drivelines

CAUTION: Metal surfaces of PTO housing may be hot to the touch during operation or at shutdown.

The optional front power take-off (PTO) from John Deere transfers engine power to auxiliary equipment or moving components.

Proper performance of the power take-off unit will be related to the care it is given. Periodically check for any oil leaks that may occur.

If the power take-off does not work properly, contact your authorized servicing dealer or engine distributor.

ZE59858,0000005 -19-03MAR14-1/1

Checking Refrigerant (A/C) Compressor (If Equipped)

Contact your authorized servicing dealer for any service or repairs to the air conditioning system.

JR74534,00001FF -19-07JAN10-1/1

Troubleshooting

General Troubleshooting Information

Troubleshooting engine problems can be difficult. An engine wiring diagram is provided in this section to help isolate electrical problems on power units using John Deere wiring harness and instrument (gauge) panel.

Later in this section is a list of possible engine problems that may be encountered accompanied by possible causes and corrections. The illustrated diagrams and troubleshooting information are of a general nature; final design of the overall system for your engine application may be different. See your engine distributor or servicing dealer if you are in doubt.

A reliable program for troubleshooting engine problems should include the following basic diagnostic thought process:

- Know the engine and all related systems.
- Study the problem thoroughly.
- Relate the symptoms to your knowledge of engine and systems.
- Diagnose the problem starting with the easiest things first.
- Double-check before beginning the disassembly.
- Determine cause and make a thorough repair.
- After making repairs, operate the engine under normal conditions to verify that the problem and cause was corrected.

NOTE: All engines have electronic control systems which may send diagnostic trouble codes to signal problems. See Diagnostic Trouble Codes (DTCs) — Listing in the Troubleshooting Section.

1. *If fault codes are present, perform the suggested corrective actions.*
2. *If this does not correct the engine problem, contact your servicing dealer.*
3. *If engine has problems but no fault codes are displayed, see Engine Troubleshooting in the Troubleshooting Section for problems and solutions.*

ZE59858,00001DB -19-29OCT13-1/1

Precautions for Welding

Remove paint before welding or heating (see Safety Section in this manual for more information on paint removal and high-pressure lines).

CAUTION: 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. If you sand or grind paint, avoid breathing the dust by wearing an approved respirator. If you use solvent or paint stripper, remove with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area before welding. Allow fumes to disperse at least 15 minutes before welding or heating.

IMPORTANT: Welding on the engine is NOT ALLOWED. If welding must be performed on the machine, follow these precautions.

IMPORTANT: High currents or electrostatic discharge into electronic components from welding may cause permanent damage.

1. Remove paint from the area to be welded and ground cable clamp location.

TS953 —UN—15MAY90

2. Disconnect the negative (-) battery cable(s) or open battery (-) switch if equipped.
3. Disconnect the positive (+) battery cable(s) or open battery (+) switch if equipped.
4. Clear or move any wiring harness sections away from the welding area.
5. Welding on engine components is not allowed.
6. Never connect the welder ground to any engine component or engine driven components that may be connected to the engine.
7. After welding, reverse steps 2—3.

DX,WELDING,PRECAUTIONS -19-06DEC10-1/1

Engine Troubleshooting

NOTE: Before troubleshooting the engine, first retrieve any fault codes on the diagnostic gauge display and perform the corrective actions. If any problems remain, use the following charts to solve engine problems.

Symptom	Problem	Solution
Engine Will Not Crank	Low battery output voltage or discharged battery	Charge or replace batteries.
	Loose or corroded connections	Clean and tighten connections.
	Faulty start circuit relay	See your authorized John Deere engine distributor or servicing dealer.
	Blown fuse	Replace fuse.
	Defective main switch or start safety switch	Repair switch as required.
	Starter solenoid defective	Replace solenoid.
	Starter defective	Replace starter.
Starter Cranks Slowly	Low battery output voltage or discharged battery	Charge or replace batteries.
	Too high viscosity crankcase oil	Drain crankcase oil and replace with correct viscosity oil.
	Loose or corroded connections	Clean and tighten connections.
Hard to Start or Will Not Start	Engine starting under load	Disengage PTO.
	Improper starting procedure	Review starting procedure.
	Exhaust restricted	Check and correct exhaust restriction.
	No fuel	Check fuel tank.
	Air in fuel line	Bleed fuel lines.
	Poor fuel quality	Drain fuel and replace with proper grade and quality of fuel for operating condition.
	Water, dirt, or air in fuel system	Drain, flush, fill, and bleed fuel system.
	Fuel filter restricted or full of water	Replace fuel filter or drain water from fuel filter.
	Dirty or faulty fuel injectors	See your authorized John Deere engine distributor or servicing dealer.
	Electronic fuel system problem	See your authorized John Deere engine distributor or servicing dealer.

Continued on next page

Symptom	Problem	Solution
	Cold weather	Use cold weather starting aids. See Cold Weather Operation in the Engine Operation Section.
	Too high viscosity crankcase oil	Drain crankcase oil and replace with correct viscosity oil.
	Electronic Control System Problem or Basic Engine Problem	See your authorized John Deere engine distributor or servicing dealer.
Engine Misfiring or Runs Irregularly	Poor fuel quality	Incorrect fuel/dirty fuel
		Test fuel, drain water from fuel bowl.
	Restricted fuel filter	Replace fuel filter element.
	Water, dirt, or air in fuel system	Drain, flush, fill, and bleed fuel system.
	Low coolant temperature	Remove and check thermostat.
	Dirty or faulty fuel injectors	See your authorized John Deere engine distributor or servicing dealer.
	Electronic fuel system problem	See your authorized John Deere engine distributor or servicing dealer.
	Electronic Control System problem or basic engine problem	See your authorized John Deere engine distributor or servicing dealer.
Lack of Engine Power	Intake air restriction	Service air cleaner.
	Exhaust restricted	Check and correct exhaust restriction.
	Poor fuel quality	Drain fuel and replace with proper grade and quality of fuel for operating condition.
	Restricted fuel filter	Replace fuel filter elements.
	Restricted fuel hose.	Clean or replace fuel hose.
	Engine overloaded	Reduce engine load.
	Improper crankcase oil	Drain crankcase oil and replace with correct viscosity oil.
	Low coolant temperature	Remove and check thermostat.
	Improper valve clearance	Adjust valve clearance. See Checking and Adjusting Valve Clearance in the Lubrication & Maintenance — 2000 Hours/24 Months.

Continued on next page

Symptom	Problem	Solution
	Dirty or faulty fuel injectors	See your authorized John Deere engine distributor or servicing dealer.
	Turbocharger not functioning properly	See your authorized John Deere engine distributor or servicing dealer.
	Air leak in engine intake or exhaust manifold	Check intake and exhaust manifold gaskets and manifolds; repair as required. See your authorized John Deere engine distributor or servicing dealer.
	Engine is in derate due to DTC	See your authorized John Deere engine distributor or servicing dealer.
	Electronic Control System problem or basic engine problem	See your authorized John Deere engine distributor or servicing dealer.
	Damaged propeller	Have propeller checked.
	Marine growth	Clean hull.
Engine Idles Poorly	Poor fuel quality	Drain fuel and replace with proper grade and quality of fuel for operating condition.
	Electronic control system problem or basic engine problem	See your authorized John Deere engine distributor or servicing dealer.
Excessive Fuel Consumption	Engine overloaded	Reduce engine load.
	Air cleaner restricted or dirty	Replace air cleaner element as required.
	Compression too low	Determine cause of low compression and repair as required.
	Leaks in fuel supply system	Locate source of leak and repair as required.
	Improper type of fuel	Drain fuel and replace with proper grade and quality of fuel for operating condition.
	Poor fuel quality	Drain fuel and replace with proper grade and quality of fuel for operating condition.
	Improper valve clearance	Adjust valve clearance. See Checking and Adjusting Valve Clearance in the Lubrication & Maintenance — 2000 Hours/24 Months.

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ZE59858,0000273 -19-14NOV13-3/11

Symptom	Problem	Solution
	Dirty or faulty fuel injectors	See your authorized John Deere engine distributor or servicing dealer.
	Electronic fuel system problem	See your authorized John Deere engine distributor or servicing dealer.
	Electronic Control System problem or basic engine problem	See your authorized John Deere engine distributor or servicing dealer.
	Turbocharger not functioning properly	Inspect turbocharger. See your authorized John Deere engine distributor or servicing dealer.
	Low engine temperature	Remove and check thermostat.
Fuel in Oil	Restricted fuel return line	Check and fix fuel return lines.
	Engine load too light	Increase engine load
	Leaking fuel injectors	See your authorized John Deere engine distributor or servicing dealer.
Low-Pressure Fuel System — Fuel Pressure Low	Restricted fuel filter	Replace fuel filter.
	Restricted fuel line	Locate restriction, repair as required.
	Faulty transfer pump	See your authorized John Deere engine distributor or servicing dealer.
	Faulty high-pressure fuel pump	Remove fuel pump, repair/replace pump as required. See your authorized John Deere engine distributor or servicing dealer.
Abnormal Engine Noise	Worn main or connecting rod bearings	Determine bearing clearance. See your authorized John Deere engine distributor or servicing dealer.
	Excessive crankshaft end play	Check crankshaft end play. See your authorized John Deere engine distributor or servicing dealer.
	Loose main bearing caps	Check bearing clearance; replace bearings and bearing cap screws as required. See your authorized John Deere engine distributor or servicing dealer.
	Worn connecting rod bushings and piston pins	Inspect piston pins and bushings. See your authorized John Deere engine distributor or servicing dealer.

Continued on next page

Symptom	Problem	Solution
	Scored pistons	Inspect pistons. See your authorized John Deere engine distributor or servicing dealer.
	Worn timing gears or excess backlash	Check timing gear back lash. See your authorized John Deere engine distributor or servicing dealer.
	Excessive valve clearance	Check and adjust valve clearance. See Checking and Adjusting Valve Clearance in the Lubrication & Maintenance — 2000 Hours/24 Months Section.
	Worn camshaft lobes	Inspect camshaft. See your authorized John Deere engine distributor or servicing dealer.
	Worn rocker arm shaft(s)	Inspect rocker arm shafts. See your authorized John Deere engine distributor or servicing dealer.
	Worn valve guides	Check valve guides for wear. See your authorized John Deere engine distributor or servicing dealer.
	Loose or worn rocker arms	Inspect rocker arms for wear. See your authorized John Deere engine distributor or servicing dealer.
	Bent pushrods	Inspect pushrods for straightness and check contact ends for wear and damage. See your authorized John Deere engine distributor or servicing dealer.
	Broken valve springs	Inspect valve springs. See your authorized John Deere engine distributor or servicing dealer.
	Bent connecting rods	Inspect connecting rod and cap for damage. See your authorized John Deere engine distributor or servicing dealer.
	Worn flywheel	Inspect flywheel and ring gear for damage. See your authorized John Deere engine distributor or servicing dealer.
	Loose flywheel	Check flywheel mounting screw. See your authorized John Deere engine distributor or servicing dealer.

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ZE59858,0000273 -19-14NOV13-5/11

Symptom	Problem	Solution
	Excessive piston to liner clearance	Check and adjust piston liner clearance. See your authorized John Deere engine distributor or servicing dealer.
	Excessive thrust bearing clearance	Check and adjust thrust bearing clearance. See your authorized John Deere engine distributor or servicing dealer.
	High oil viscosity	Drain engine oil and refill with correct viscosity engine oil
Turbocharger "Screams"	Leak in intake air system	Check air system for loose clamps, damaged tubes, charged air cooler leaks, and intake manifold gasket leaks; repair as required. See your authorized John Deere engine distributor or servicing dealer.
Turbocharger Noise or Vibration *NOTE: Do not confuse the whine heard during run down with noise which indicates a bearing failure.*	Bearings not lubricated (insufficient oil pressure)	Determine cause of lack of lubrication; repair as required. See your authorized John Deere engine distributor or servicing dealer.
	Air leak in engine intake or exhaust manifold	Check intake and exhaust manifold gaskets and manifolds; repair as required. See your authorized John Deere engine distributor or servicing dealer.
	Improper clearance between turbine wheel and turbine housing	Inspect turbocharger; repair/replace as required. See your authorized John Deere engine distributor or servicing dealer.
	Broken blades (or other wheel failures)	Inspect turbocharger; repair/replace as required. See your authorized John Deere engine distributor or servicing dealer.
Engine Emits White Smoke	Engine compression too low	Determine cause of low compression and repair as required. See your authorized John Deere engine distributor or servicing dealer.
	Defective thermostat(s) (does not close)	Test thermostats; replace thermostats as required.
	Coolant entering combustion chamber (failed cylinder head gasket or cracked cylinder head)	Repair or replace as required. See your authorized John Deere engine distributor or servicing dealer.
	Electronic Control System problem or basic engine problem	See your authorized John Deere engine distributor or servicing dealer.

Continued on next page

Symptom	Problem	Solution
	Improper type of fuel	Drain fuel and replace with proper grade and quality of fuel for operating condition.
	Poor fuel quality	Drain fuel and replace with proper grade and quality of fuel for operating condition.
	Low engine temperature	Warm up engine to normal operating temperature.
	Defective thermostat.	Remove and check thermostat.
	Defective fuel injectors	See your authorized John Deere engine distributor or servicing dealer.
Engine Emits Black, Gray or Blue Smoke	Engine overloaded	Reduce engine load.
	Engine burning oil	See your authorized John Deere engine distributor or servicing dealer.
	Air cleaner restricted or dirty	Replace air cleaner element as required.
	Electronic control system problem or basic engine problem	See your authorized John Deere engine distributor or servicing dealer.
	Improper type of fuel	Use proper fuel.
	Fuel injectors dirty	See your authorized John Deere engine distributor or servicing dealer.
	Electronic Control System problem or basic engine problem	See your authorized John Deere engine distributor or servicing dealer.
	Turbocharger not functioning properly	See your authorized John Deere engine distributor or servicing dealer.
Engine Overheats	Air cleaner restricted or dirty	Replace air cleaner element as required.
	Lack of coolant in cooling system	Fill cooling system to proper level. Check radiator and hoses for loose connections or leaks.
	Low engine oil level	Check oil level. Add oil as required.
	Radiator core dirty	Clean cooling system as required.
	Cooling system needs flushing	Flush coolant system. (See Flushing And Refilling Cooling System in the Lubrication & Maintenance — 6000 Hours/72 Months Section.)

Continued on next page

Symptom	Problem	Solution
	Engine overloaded	Reduce engine load.
	Loose or defective fan belt	Check automatic belt tensioner and belts. Replace as required. (See Checking Tensioner Spring Tension in the Lubrication & Maintenance — 500 Hours/12 Months Section.)
	Defective or wrong type of thermostats	Test thermostat opening temperature, replace thermostats as required.
	Damaged cylinder head gasket	Replace cylinder head gasket. See your authorized John Deere engine distributor or servicing dealer.
	Leak at cylinder head gasket	Replace cylinder head gasket. See your authorized John Deere engine distributor or servicing dealer.
	Defective coolant pump	Replace coolant pump. See your authorized John Deere engine distributor or servicing dealer.
	Defective radiator cap	Replace radiator cap as required.
	Defective temperature gauge or sender	Check coolant temperature with thermometer and replace, if necessary.
	Incorrect grade of fuel	Use correct grade of fuel.
	Faulty sea water pump.	Check/replace impeller/pump.
	Plugged heat exchanger.	Clean heat exchanger and core.
	Plugged keel cooler.	Flush and clean keel cooler. Check for marine growth on O.D. of keel cooler tubes.
	Trash or debris in engine compartment.	Clean engine compartment.
Coolant Temperature Below Normal	Defective thermostat(s)	Test thermostats, replace thermostats as required.
	Defective temperature gauge or temperature sender	Check gauge, sender, and connections.
Coolant in Crankcase	Cylinder head gasket defective	Replace cylinder head gasket. See your authorized John Deere engine distributor or servicing dealer.

Continued on next page

Symptom	Problem	Solution
	Cylinder head or block cracked	Locate crack, repair/replace components as required. See your authorized John Deere engine distributor or servicing dealer.
	Cylinder liner seals leaking	Remove and inspect cylinder liners. See your authorized John Deere engine distributor or servicing dealer.
	Pitted cylinder liners	Remove and inspect cylinder liners. See your authorized John Deere engine distributor or servicing dealer.
	Leaking oil cooler	Pressure test oil cooler, repair/replace as required. See your authorized John Deere engine distributor or servicing dealer.
	Defective oil cooler O-rings	Remove and inspect oil cooler O-rings, replace as required. See your authorized John Deere engine distributor or servicing dealer.
	Faulty coolant pump seal; weep hole plugged; coolant leaking through bearing	Replace coolant pump seals. See your authorized John Deere engine distributor or servicing dealer.
Low Oil Pressure	Low crankcase oil level	Fill crankcase to proper oil level.
	Faulty pressure sensor	Replace sensor. See your authorized John Deere engine distributor or servicing dealer.
	Restricted oil cooler or filter	Remove and inspect oil cooler. See your authorized John Deere engine distributor or servicing dealer.
	Excessive oil temperature	Remove and inspect oil cooler. See your authorized John Deere engine distributor or servicing dealer.
	Defective oil pump	Remove and inspect oil pump. See your authorized John Deere engine distributor or servicing dealer.
	Incorrect oil	Drain crankcase and refill with correct oil.
	Oil pressure regulating valve failure	Remove and inspect oil pressure regulating valve. See your authorized John Deere engine distributor or servicing dealer.

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ZE59858,0000273 -19-14NOV13-9/11

Symptom	Problem	Solution
	Restricted oil pump screen or cracked pick-up tube	Remove oil pan and clean screen/replace pick-up tube.
	Excessive main or connecting rod bearing clearance	Determine bearing clearance. See your authorized John Deere engine distributor or servicing dealer.
	Crankcase oil level too high	Check engine oil level and drain as necessary.
High Oil Pressure	Improper oil classification	Drain crankcase and refill with correct oil.
	Faulty pressure sensor	Replace sensor. See your authorized John Deere engine distributor or servicing dealer.
	Oil pressure regulating valve failure	Remove and inspect oil pressure regulating valve. See your authorized John Deere engine distributor or servicing dealer.
	Stuck or damaged filter bypass valve	Remove and inspect filter bypass valve. See your authorized John Deere engine distributor or servicing dealer.
	Stuck or damaged oil cooler bypass valve	Remove and inspect oil cooler bypass valve. See your authorized John Deere engine distributor or servicing dealer.
Excessive Oil Consumption	Too low viscosity crankcase oil	Drain crankcase and refill with correct viscosity oil.
	Crankcase oil level too high	Drain oil until oil level is correct.
	External oil leak(s)	Determine source of oil leak(s) and repair as required.
	Excessive oil pressure	See **High Oil Pressure**
	Oil control rings not seated	See your authorized John Deere engine distributor or servicing dealer.
	Oil control rings worn or broken	Replace piston rings. See your authorized John Deere engine distributor or servicing dealer.
	Restricted crankcase vent tube	Clean vent tube, verify that crankcase oil level is not too high.
	Defective turbocharger	See your authorized John Deere engine distributor or servicing dealer.

Continued on next page

Symptom	Problem	Solution
	Scored cylinder liners or pistons	Remove and inspect cylinders and liners; replace as required. See your authorized John Deere engine distributor or servicing dealer.
	Worn valve guides or stems	Inspect and measure valve stems and valve guides; repair as required. See your authorized John Deere engine distributor or servicing dealer.
	Piston ring grooves excessively worn	Remove and inspect pistons. See your authorized John Deere engine distributor or servicing dealer.
	Piston rings sticking in ring grooves	Remove and inspect pistons. See your authorized John Deere engine distributor or servicing dealer.
	Insufficient piston ring tension	Remove and inspect pistons. See your authorized John Deere engine distributor or servicing dealer.
	Piston ring gaps not staggered	Remove and inspect pistons. See your authorized John Deere engine distributor or servicing dealer.
	Front and/or rear crankshaft oil seal faulty	Replace oil seals. See your authorized John Deere engine distributor or servicing dealer.
Undercharged Electrical System	Excessive electrical load from added accessories	Remove accessories or install higher output alternator. See your authorized John Deere engine distributor or servicing dealer.
	Excessive engine idling	Increase engine rpm when heavy electrical load is used.
	Poor electrical connections on battery, ground strap, starter, or alternator	Inspect and clean as necessary.
	Defective battery	Test batteries.
	Defective alternator	Test charging system.
Battery Used Too Much Water	Cracked battery case	Check for moisture and replace as necessary.
	Defective battery	Test battery.
	Battery charging rate too high	Test charging system.
Batteries Will Not Charge	Loose or corroded connections	Clean and tighten connections.
	Sulfated or worn-out batteries	Replace batteries.

ZE59858,0000273 -19-14NOV13-11/11

Symptom	Problem	Solution
	Stretched belt or defective belt tensioner	Adjust belt tension or replace belts.
Starter and Hourmeter Functions; Rest of Electrical System Does Not Function	Blown fuse	Replace fuse.
Entire Electrical System Does Not Function	Faulty battery connection	Clean and tighten connections.
	Sulfated or worn-out batteries	Replace batteries.
	Blown fuse	Replace fuse.

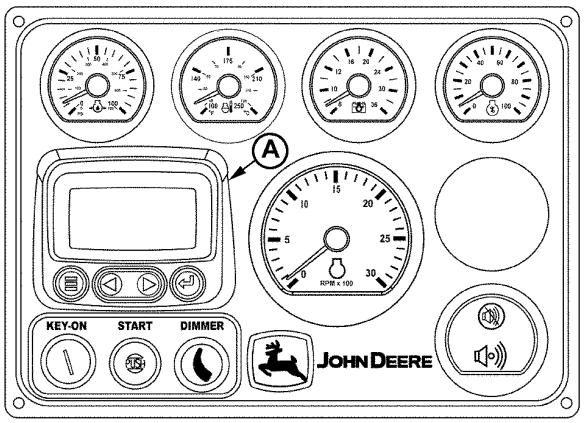
ZE59858,0000273 -19-14NOV13-12/11

Instrument Panel Method for Retrieving Diagnostic Trouble Codes

IMPORTANT: Care should be used during diagnostic procedures to avoid damaging the terminals of connectors, sensors, and actuators. Probes should not be poked into or around the terminals or damage will result. Probes should only be touched against the terminals to make measurements.

Diagnosis of the electronic control system should be performed according to the following procedure:

1. Make sure all engine mechanical and other systems not related to the electronic control system are operating properly.
2. Read and record diagnostic trouble codes (DTCs) displayed on the diagnostic gauge (A). To access trouble codes on diagnostic gauge (A), see Section 15 of this manual.
3. Go to the LISTING OF DIAGNOSTIC TROUBLE CODES (DTCs) later in this section, to interpret the DTCs present.



RG13140 —UN—07OCT03

Diagnostic Gauge

A—Diagnostic Gauge

4. Contact your nearest engine distributor or servicing dealer with a list of DTC codes that are displayed so necessary repairs can be made.

OURGP11,00000BB -19-05SEP03-1/1

Diagnostic Trouble Codes (DTCs) — Operation

SPN/FMI CODES

Stored and active diagnostic trouble codes are output on the diagnostic gauge on the Deere electronic instrument panel according to the J1939 standard as a two-part code as shown on the tables on the following pages.

The first part is a Suspect Parameter Number (SPN) followed by a Failure Mode Identifier (FMI) code. In order to determine the exact failure, both parts (SPN and FMI) of the code are needed.

The SPN identifies the system or the component that has the failure; for example SPN 000110 indicates a failure in the engine coolant temperature circuit.

The FMI identifies the type of failure that has occurred; for example FMI 03 indicates value above normal. Combining SPN 000110 with FMI 03 yields a fault code “engine coolant temperature input voltage too high”. A corrective action will also be displayed, “check sensor and wiring”. If this check does not solve the engine fault, contact your servicing dealer.

Always contact your servicing dealer for help in correcting unsolved diagnostic trouble codes which are displayed for your engine.

RK80614,000004A -19-26AUG13-1/1

Diagnostic Trouble Codes (DTCs) — Listing

NOTE: Not all of these codes are used in all engine applications.

NOTE: Not all DTCs are listed below. See your application technical manual for more information.

There are several possible combinations of SPN and FMI codes. To use the table below, first write down the SPN and FMI codes you received from the engine diagnostic gauge. Locate each SPN and its associated definition. In the same way, locate the FMI and its associated definition.

FMI Code	FMI Name
0	Extremely High
1	Extremely Low
2	Invalid
3	Out of Range High
4	Out of Range Low
5	High Resistance
6	Low Resistance
7	Mismatch
8	Signal Missing
9	Loss of Communication
10	Change Abnormal
11	Activated
12	Error
13	Fault
14	Incorrect Message
15	Slightly High
16	Moderately High
17	Slightly Low
18	Moderately Low
19	Communication Error
31	Condition Exists

SPN Code	SPN Name
000028	Digital Throttle
000029	Secondary Analog Throttle
000084	Vehicle Speed
000091	Primary Analog Throttle
000094	Low Pressure Fuel Pressure Signal
000097	Water-in-fuel Signal
000100	Engine Oil Pressure Signal
000102	Manifold Air Pressure Signal
000105	Manifold Air Temperature Signal
000107	Air Filter Restriction Switch
000108	Barometric Pressure Signal
000110	Engine Coolant Temperature Signal
000111	Engine Coolant Level Alarm Switch
000157	Fuel Rail Pressure Signal
000158	ECU Power Down
000160	Vehicle Speed Signal
000171	Ambient Air Temperature
000174	Fuel Temperature Signal
000189	Engine Speed Derate
000190	Engine Speed
000611	Injector Drive #1
000627	Injector Power Supply
000629	ECU EEPROM
000636	Camshaft Position Signal
000637	Crankshaft Position Signal
000640	External Derate Commanded
000644	Speed Input
000651	Injector #1
000652	Injector #2

Continued on next page

SPN Code	SPN Name
000653	Injector #3
000654	Injector #4
000655	Injector #5
000656	Injector #6
000676	Cold Start Aid
000695	Unapproved Engine Speed Request
000898	Vehicle Speed or Torque
000970	External Shutdown Switch
000971	External Fuel Derate Switch
001075	Low Pressure Fuel Pump Data
001109	Engine Protection Shutdown Warning
001110	Engine Protection Shutdown
001136	ECU Temperature Signal
001172	Intake Air Temperature
001321	Engine Starter Control Circuit
001347	Suction Control Valve
001349	Fuel Rail Pressure
001569	Engine in Derate Condition
002000	Security Violation
002002-002253	Source Address 2-253
002790	Fixed Turbocharger Compressor Outlet Temp
003509	Sensor Supply #1 Voltage
003510	Sensor Supply #2 Voltage
003511	Sensor Supply #3 Voltage
003512	Sensor Supply #4 Voltage
003513	Sensor Supply #5 Voltage
516598	Engine Overload Condition
524225	Engine Start Protection

NOTE: Diagnostic gauge on instrument panel may also display text for communication faults, such as “CAN Bus FAILURE”. Contact your servicing dealer.

ZE59858,00001DD -19-24OCT13-2/2

Intermittent Fault Diagnostics

Intermittent faults are problems that periodically “go away”. A problem such as a terminal that intermittently doesn't make contact can cause an intermittent fault. Other intermittent faults may be set only under certain operating conditions such as heavy load, extended idle, etc. When diagnosing intermittent faults, take special note of the condition of wiring and connectors, since a high percentage of intermittent problems originates here. Check for loose, dirty, or disconnected connectors. Inspect the wiring routing, looking for possible shorts caused by contact with external parts (for example, rubbing against sharp sheet metal edges). Inspect the connector vicinity, looking for wires that have pulled out of connector terminals, damaged connectors, poorly positioned terminals, and corroded or damaged splices and terminals. Look for broken wires, damaged splices, and wire-to-wire shorts. Use good judgment if component replacement is thought to be required.

NOTE: The engine control unit (ECU) is the component LEAST likely to fail.

Suggestions for diagnosing intermittent faults:

- If diagnostic charts on preceding pages indicate that the problem is intermittent, try to reproduce the operating conditions that were present when the diagnostic trouble code (DTC) set.
- If a faulty connection or wire is suspected to be the cause of the intermittent problem: clear DTCs, then check the connection or wire by wiggling it while watching the diagnostic gauge to see if the fault resets.

Possible causes of intermittent faults:

- Faulty connection between sensor or actuator harness.
- Faulty contact between terminals in connector.
- Faulty terminal/wire connection.
- Electromagnetic interference (EMI) from an improperly installed 2-way radio, etc., can cause faulty signals to be sent to the ECU.

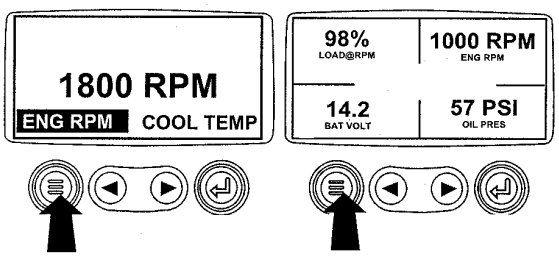
NOTE: Refer to wiring diagrams later in this section as a guide to connections and wiring.

RK80614,000004C -19-26AUG13-1/1

Displaying Diagnostic Gauge Software

NOTE: The following steps can be used to display the software version of the diagnostic gauge if needed by your dealer for troubleshooting. This is a read only function.

1. Starting at the single or four engine parameter display, press the "Menu" key.

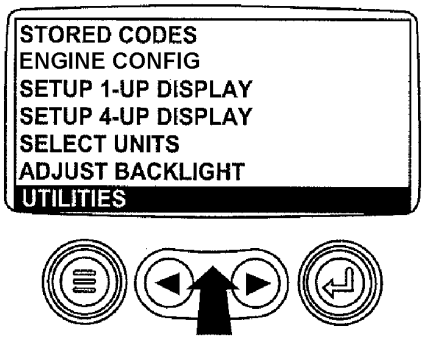


RG13159 —UN—26SEP03

Menu Key

OURGP11,00000E3 -19-29SEP03-1/4

2. The main menu will be displayed. Use the "Arrow" key to scroll through the menu until "Utilities" is highlighted.



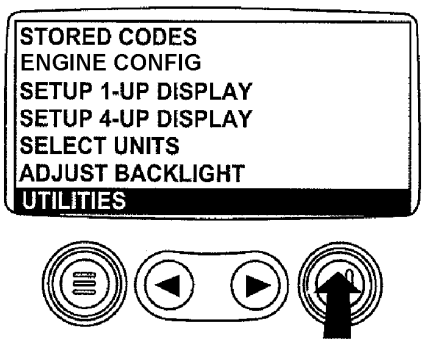
RG13234 —UN—22OCT03

Select Utilities

Continued on next page

OURGP11,00000E3 -19-29SEP03-2/4

3. Once "Utilities" is highlighted, press "Enter" to activate the utilities function.

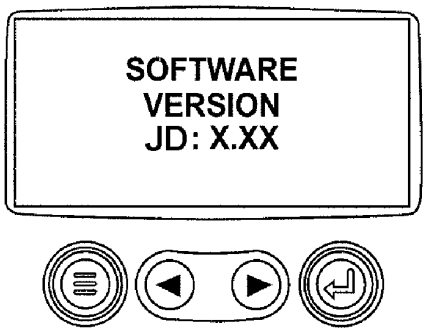


RG13237 —UN—22OCT03

Select Utilities

OURGP11,00000E3 -19-29SEP03-3/4

4. Scroll to the "Software Version". Press "Enter" to view the software version. Press the menu button twice to return to the main menu.

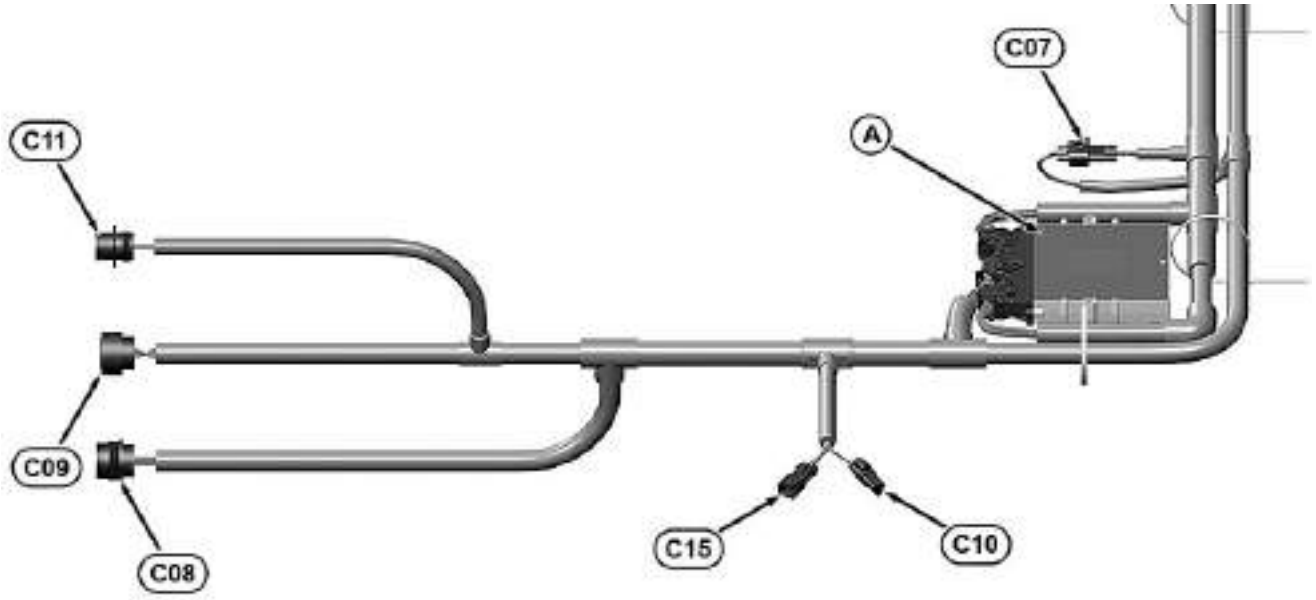


RG13236 —UN—13OCT03

Software Version

OURGP11,00000E3 -19-29SEP03-4/4

Electrical System Layout



A—ECU
C07— Auxiliary Power Connector
C08— Auxiliary Connector
C09— Control Panel Connector
C10— CAN Terminator
C11— Diagnostic Connector
C15— Remote On/Off

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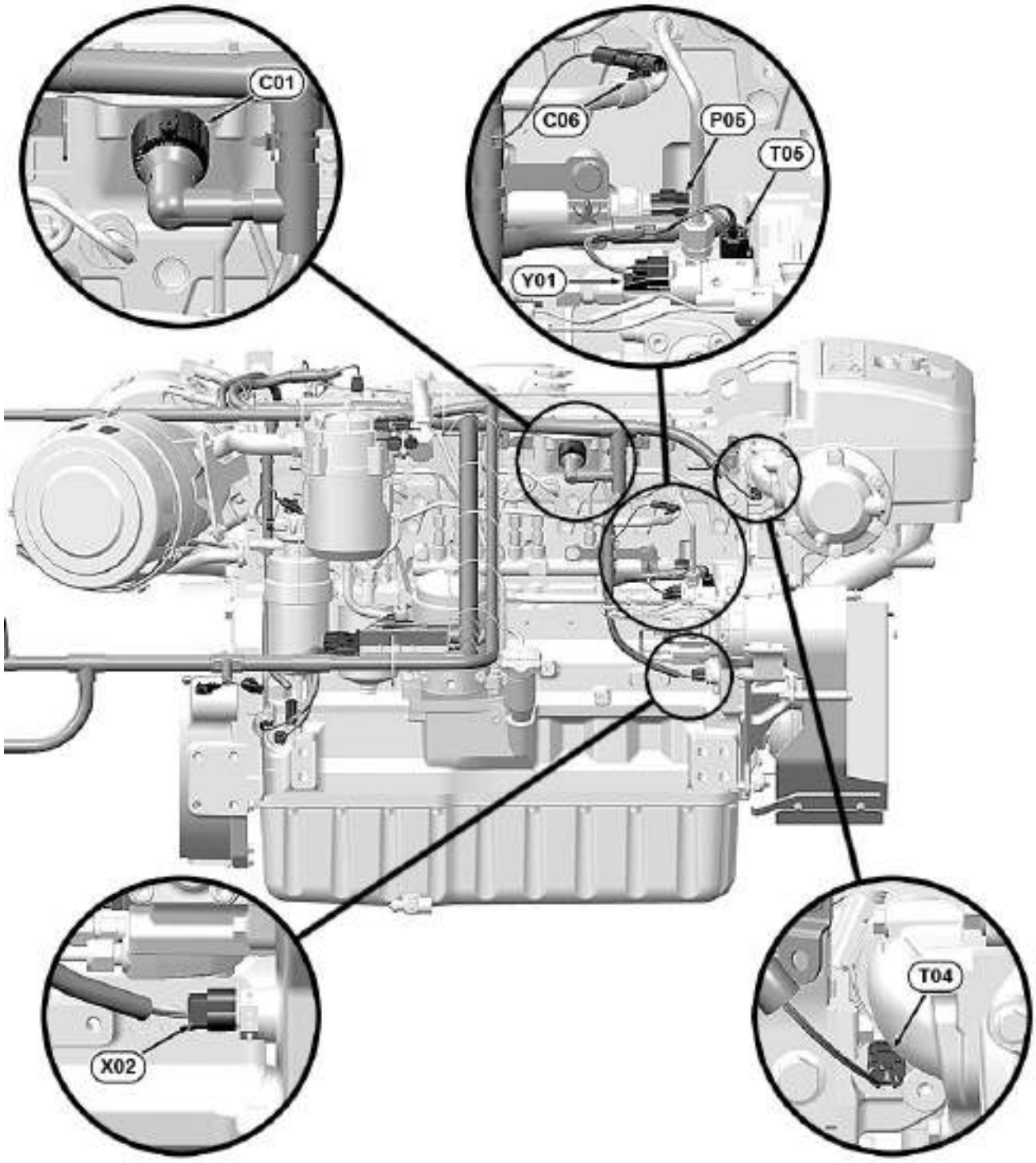
ZE59858,00001E4 -19-30OCT13-1/4



C01— Fuel Injector Harness Connector
C06— Alternator Excitation
P05— Fuel Rail Pressure Sensor
T04— Engine Coolant Temperature Sensor
T05— Fuel Temperature Sensor
X02— Camshaft Position Sensor
Y01— Suction Control Valve

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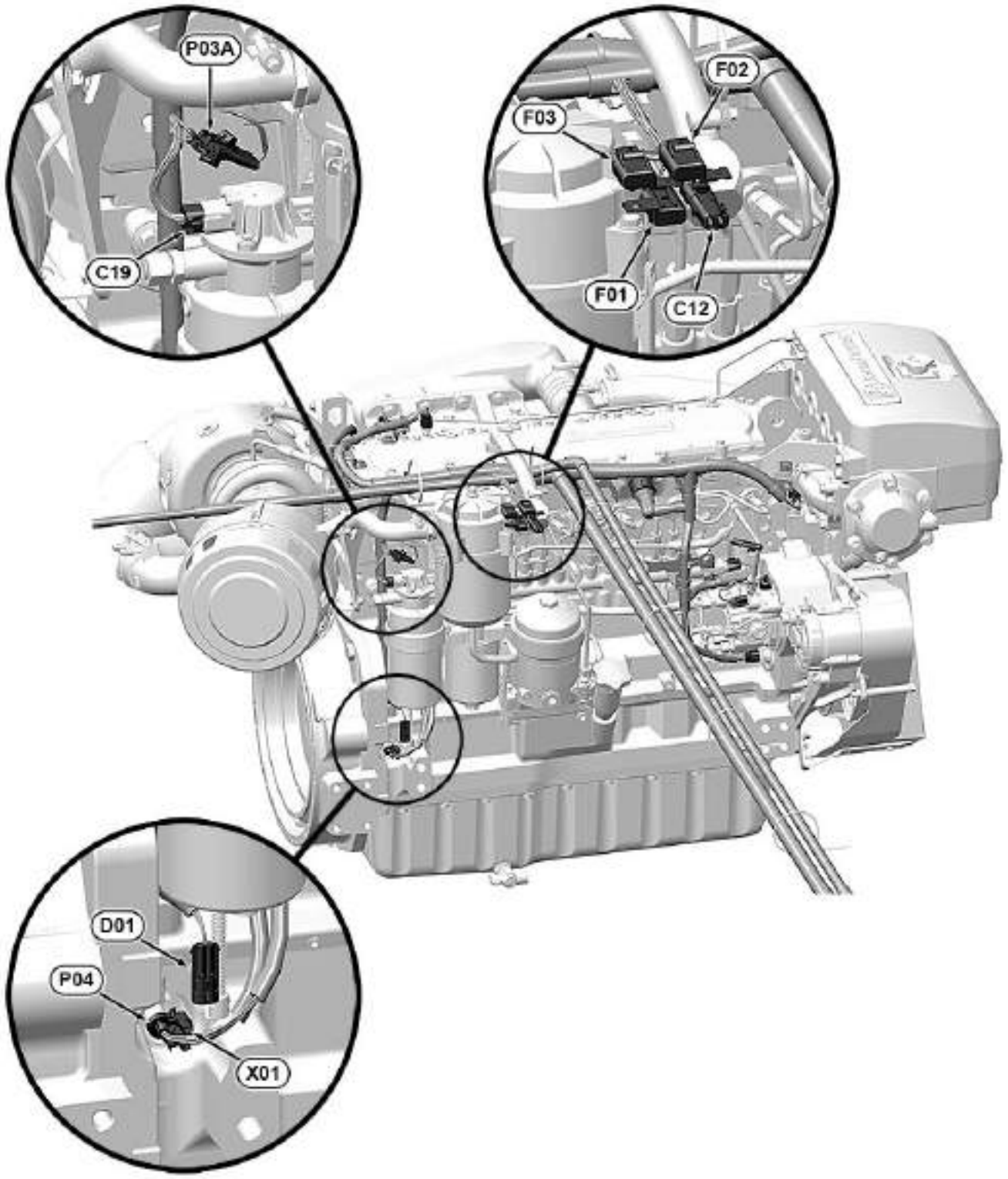
ZE59858,00001E4 -19-30OCT13-2/4



F01— Control Panel Fuse (30 A)
F02— ECU Power Fuse (20 A)
F03— Low-Pressure Fuel Pump Fuse (15 A)
C12— Transient Voltage Protection
C19— Low-Pressure Fuel Pump
D01— Water-In-Fuel Sensor
P03A— Low-Pressure Fuel Pressure Sensor Interconnect
P04— Engine Oil Pressure Sensor
X01— Crankshaft Position Sensor

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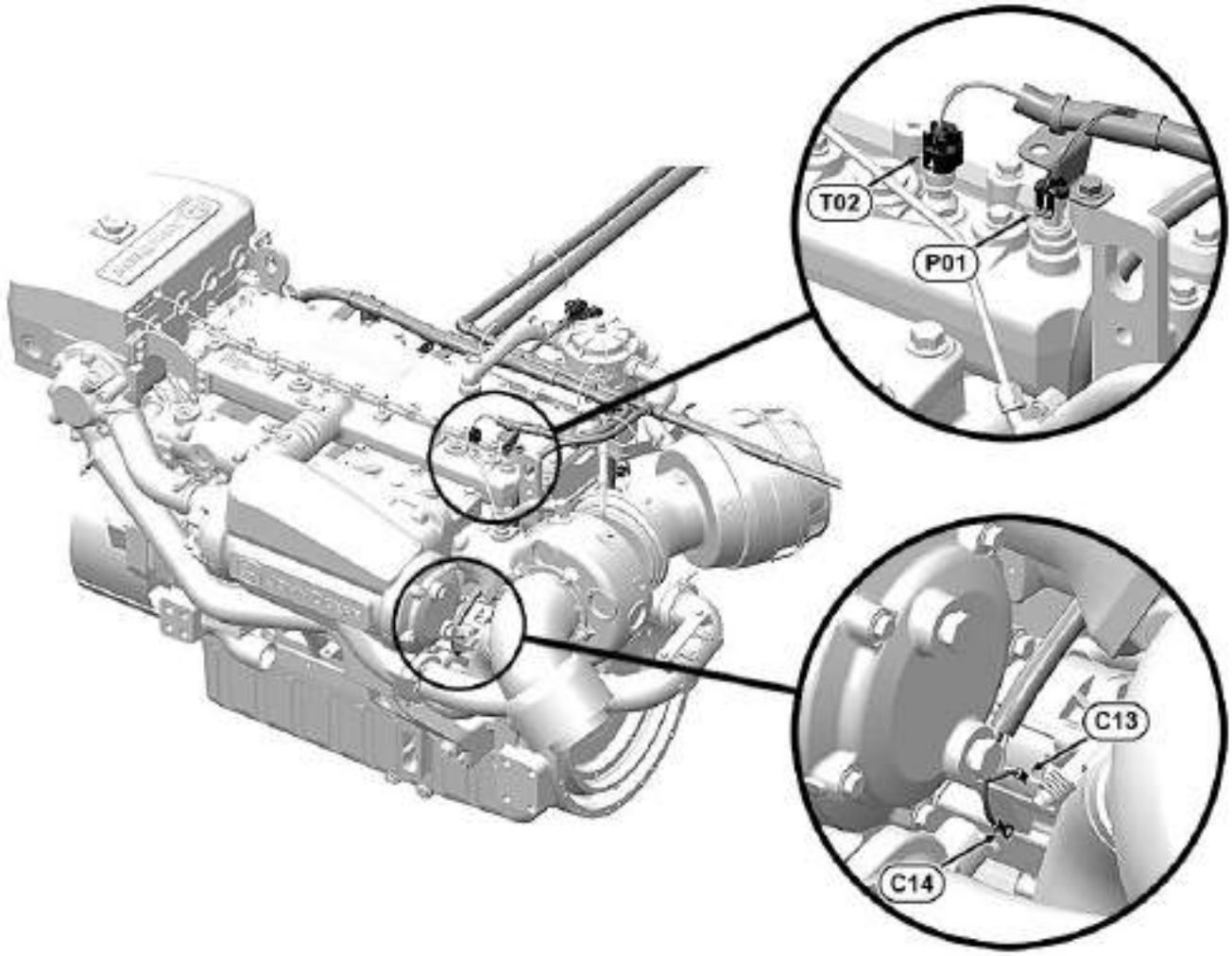
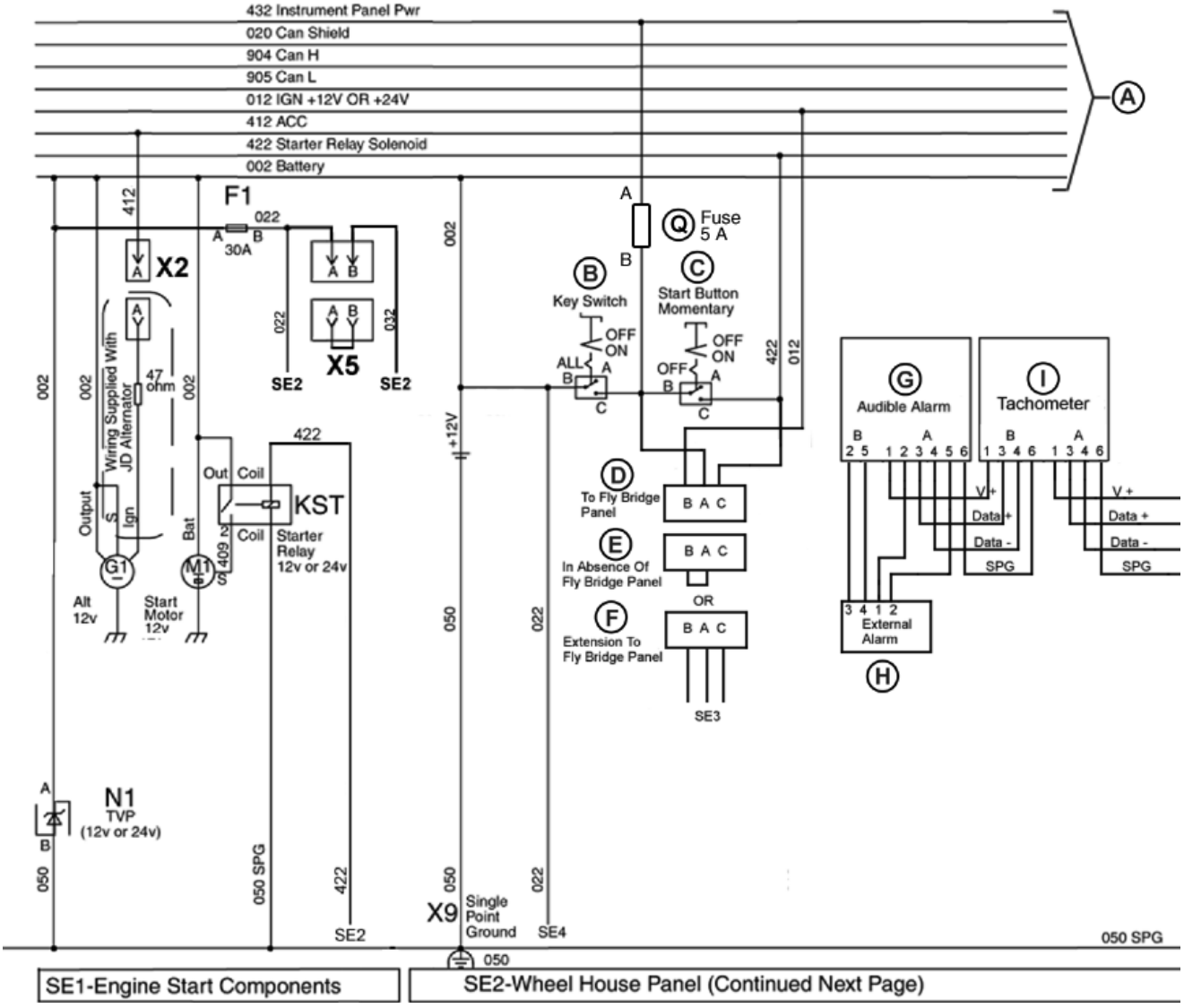
ZE59858,00001E4 -19-30OCT13-3/4



C13— Starter Relay Coil (Ground)
C14— Starter Relay Coil (Power)
P01— Manifold Air Pressure Sensor
T02— Manifold Air Temperature Sensor

ZE59858,00001E4 -19-30OCT13-4/4

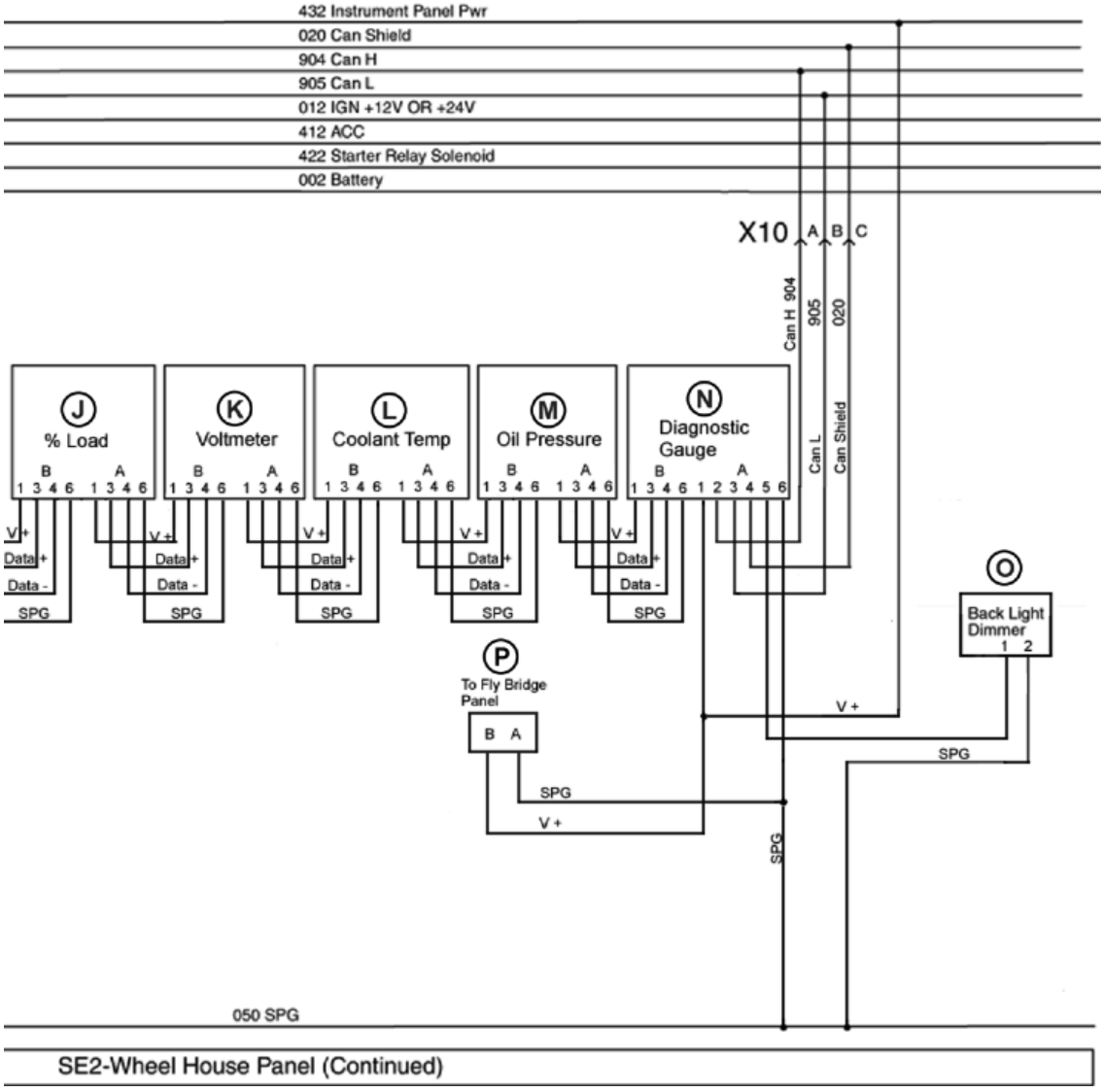
Engine Wiring Diagram for John Deere (Wheel House) Instrument Panel 1



A—Vehicle Harness Connector
B—Key Switch
C—Start Button- Momentary
D—To Fly Bridge Panel
E—In Absence of Fly Bridge Panel
F—Extension to Fly Bridge Panel
F1—Fuse (30 Amp)
G—Audible Alarm
G1—Alternator
H—External Alarm
I—Tachometer
J—Percent Load
K—Voltmeter
KST—Starter Relay
L—Coolant Temp
M—Oil Pressure
M1—Start Motor
N—Diagnostic Gauge
N1—Transient Voltage Protection
O—Back Light Dimmer
P—To Fly Bridge Panel
Q—Fuse (5 Amp)
X2—Alternator Harness Connector
X5—Remote On/Off
X9—Single Point Ground
X10—CAN Terminator
002—Battery
012—IGN +12V or +24V
020—CAN Shield
412—ACC
422—Starter Relay Solenoid
432—Instrument Panel Power
904—Can H
905—Can L

ZE59858,00001DF -19-04NOV13-1/1

Engine Wiring Diagram for John Deere (Wheel House) Instrument Panel 2

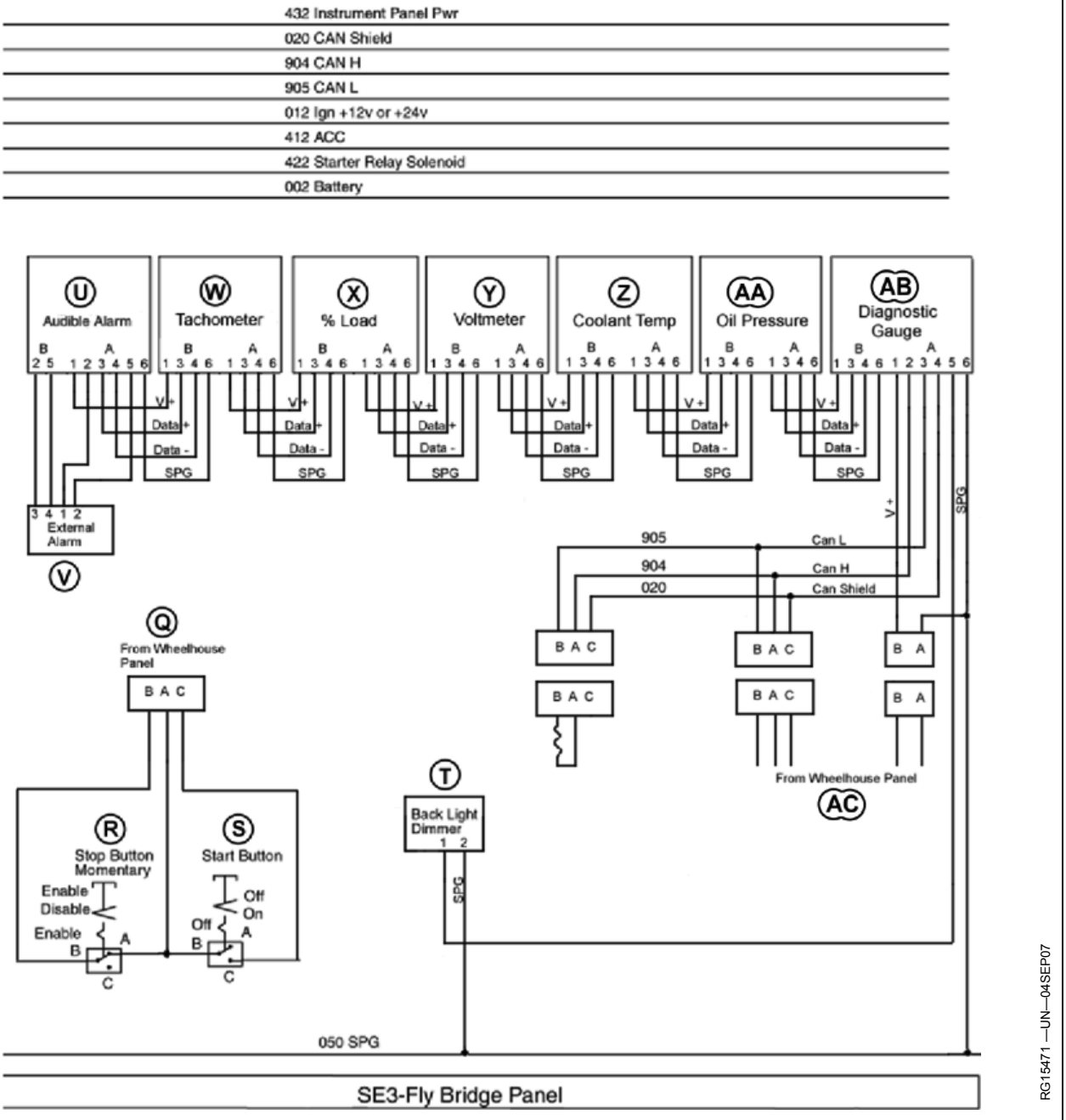


RG15470 —UN—04SEP07

A—Vehicle Harness Connector
B—Key Switch
C—Start Button- Momentary
D—To Fly Bridge Panel
E—In Absence of Fly Bridge Panel
F—Extension to Fly Bridge Panel
F1—Fuse (30 Amp)
G—Audible Alarm
G1—Alternator
H—External Alarm
I—Tachometer
J—Percent Load
K—Voltmeter
KST—Starter Relay
L—Coolant Temp
M—Oil Pressure
M1—Start Motor
N—Diagnostic Gauge
N1—Transient Voltage Protection
O—Back Light Dimmer
P—To Fly Bridge Panel
X2—Alternator Harness Connector
X5—Remote On/Off
X9—Single Point Ground
X10—CAN Terminator
002—Battery
012—IGN +12V or +24V
020—CAN Shield
412—ACC
422—Starter Relay Solenoid
432—Instrument Panel Power
904—CAN High
905—CAN Low

ZE59858,00001E0 -19-28OCT13-1/1

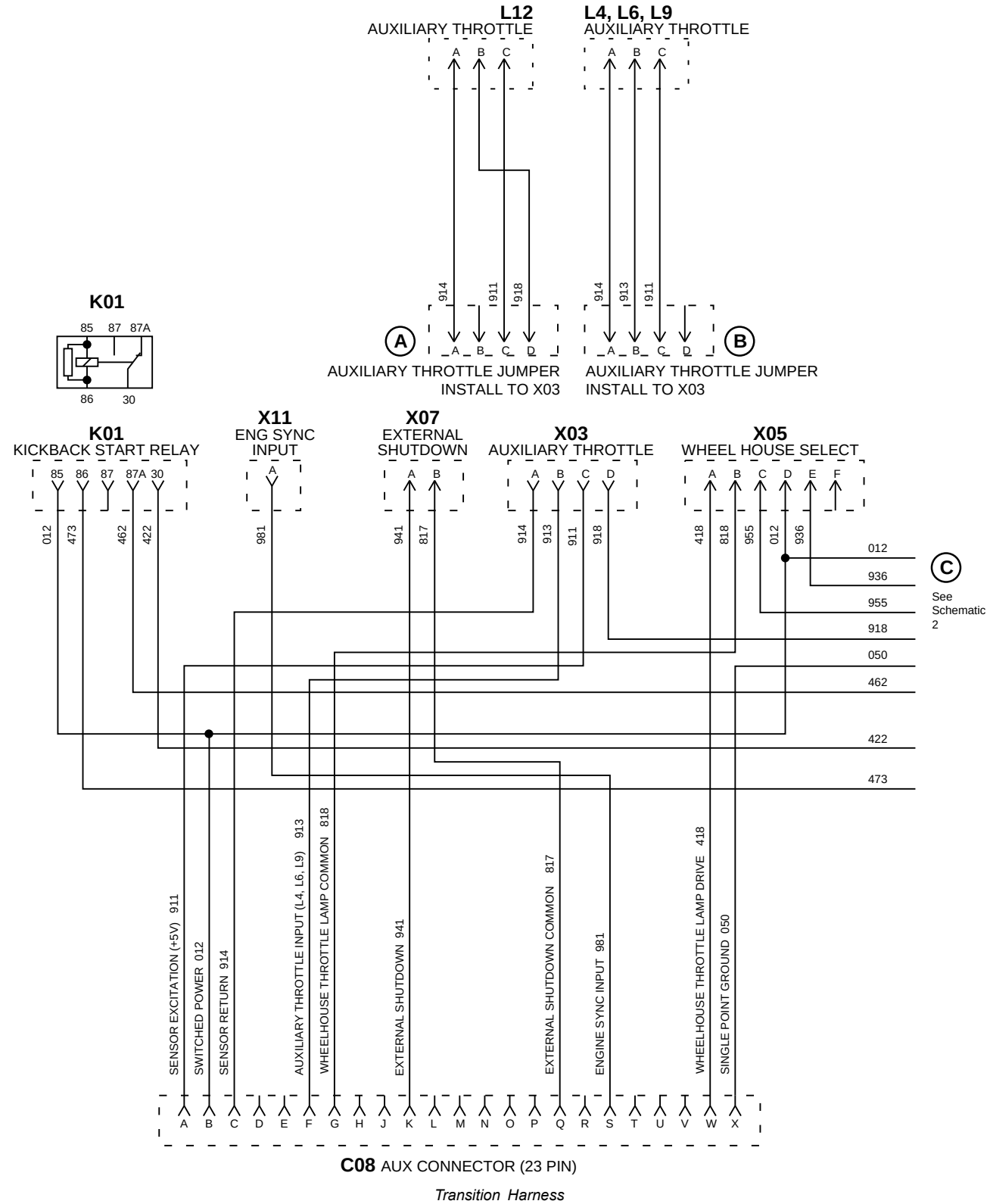
Engine Wiring Diagram for John Deere (Fly Bridge) Instrument Panel



Q—From Wheelhouse Panel
R—Stop Button — Momentary
S—Start Button — Momentary
T—Back Light Dimmer
U—Audible Alarm
V—External Alarm
W—Tachometer
X—Percent Load
Y—Voltmeter
Z—Coolant Temp
AA—Oil Pressure
AB—Diagnostic Gauge
AC—From Wheelhouse Panel
002— Battery
012— IGN +12V or +24V
020— CAN Shield
412— ACC
422— Starter Relay Solenoid
432— Instrument Panel Power
904— CAN High
905— CAN Low

ZE59858,00001E1 -19-28OCT13-1/1

Transition Harness Wiring Diagram 1



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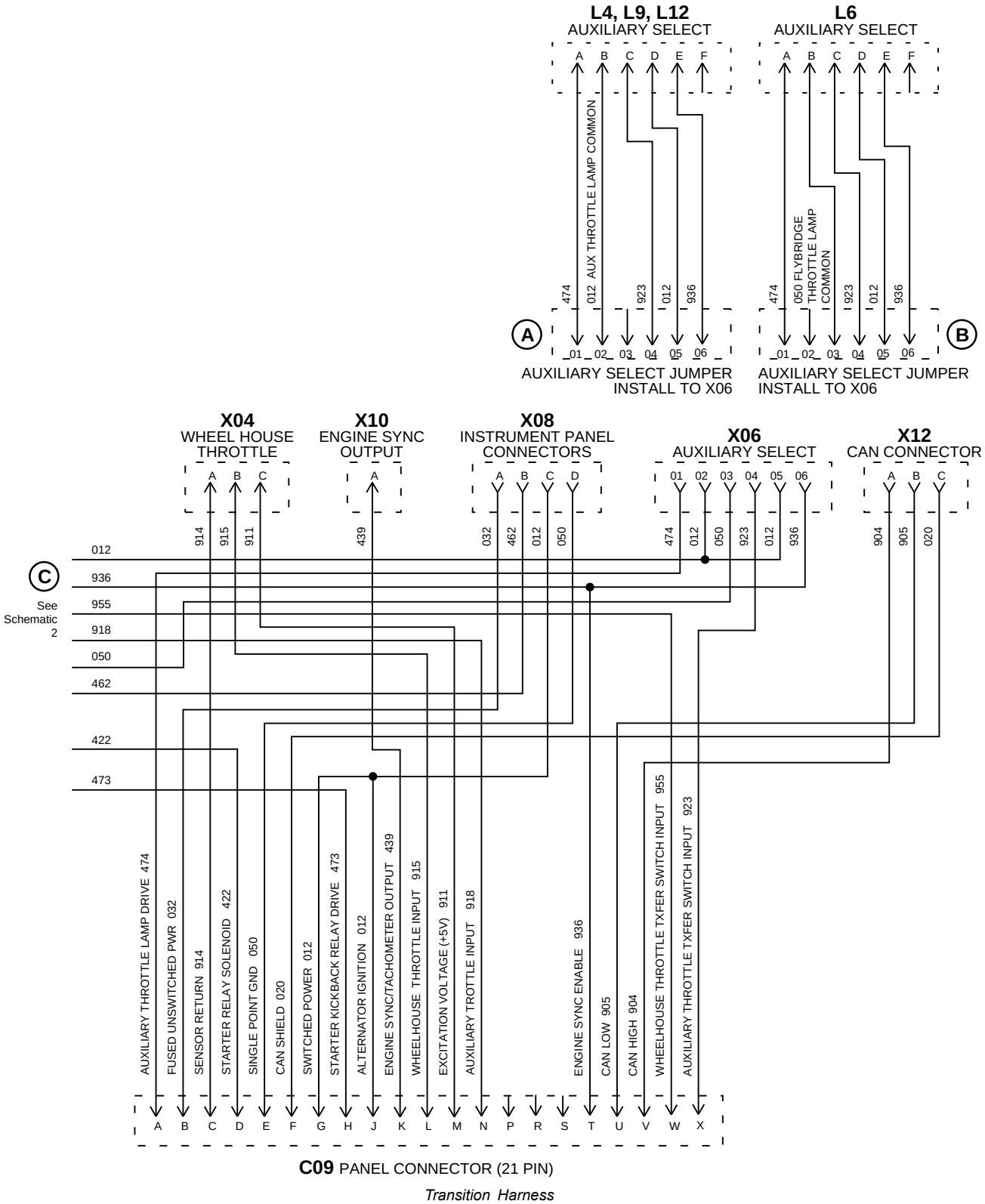
ZE59858,00001DE -19-30OCT13-1/2

A—Auxiliary Throttle Jumper - Install to X03
B—Auxiliary Throttle Jumper - Install to X03
C—See Transition Harness Wiring Diagram 2
C08— Auxiliary Connector (23 Pin) See 9.0L Wiring Diagram 4
L12— Auxiliary Throttle
L4, L6, L9—Auxiliary Throttle
K01— Kickback Start Relay
X03— Auxiliary Throttle
X05— Wheelhouse Select
X07— External Shutdown
X11— Engine Sync Input
012— Switched Power
050— Single Point Ground
418— Wheelhouse Throttle Lamp Drive
422— Starter Relay Solenoid
473— Starter Kickback Relay Drive
817— External Shutdown Common
818— Wheelhouse Throttle Lamp - Common
911— Sensor Excitation (+5 V)
913— Auxiliary Throttle Input (L4, L6, L9)
914— Sensor Return
918— Auxiliary Throttle Input
936— Engine Sync Enable
941— External Shutdown
955— Wheelhouse Throttle Transfer Switch Input
981— Engine Sync Input

ZE59858,00001DE -19-30OCT13-2/2

Transition Harness Wiring Diagram 2



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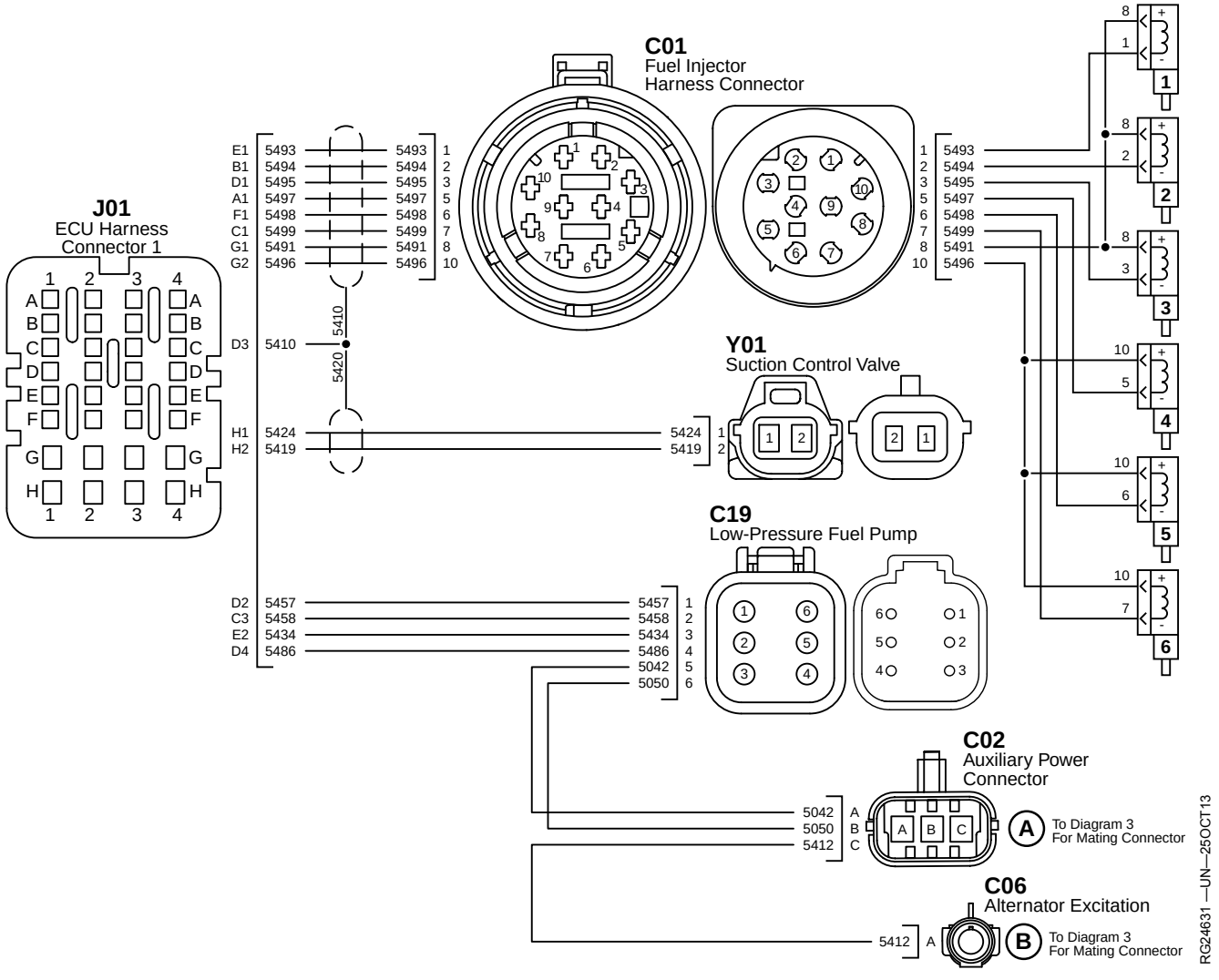
ZE59858,0000274 -19-30OCT13-1/2

A—Auxiliary Select Jumper Install to X06
B—Auxiliary Select Jumper Install to X06
C—See Transition Harness Wiring Diagram 1
C09— Panel Connector (21 Pin) See 9.0L Wiring Diagram 4
L4, L9, L12—Auxiliary Select
L6— Auxiliary Select
X04— Wheelhouse Throttle
X06— Auxiliary Select
X08— Instrument Panel Connectors
X10— Engine Sync Output
X12— CAN Connector
012 (X02 Pin G)—Alternator Ignition
012 (X02 Pin J) —Switched Power
012 (Inside A)—Auxiliary Throttle Lamp Common
020— CAN Shield
032— Fused Unswitched Power
050 (X02)—Single Point Ground
050 (Inside B)—Flybridge Throttle Lamp Common
422— Starter Relay Solenoid
473— Starter Kickback Relay Drive
474— Auxiliary Throttle lamp Drive
914— Sensor Return
439— Engine Sync/Tachometer Output
904— CAN High
905— CAN Low
911— Excitation Voltage (+5 volts)
915— Wheelhouse Throttle Input
918— Auxiliary Throttle Input
923— Auxiliary Throttle Transfer Switch Input
936— Engine Sync Enable
955— Wheelhouse Throttle Transfer Switch Input

ZE59858,0000274 -19-30OCT13-2/2

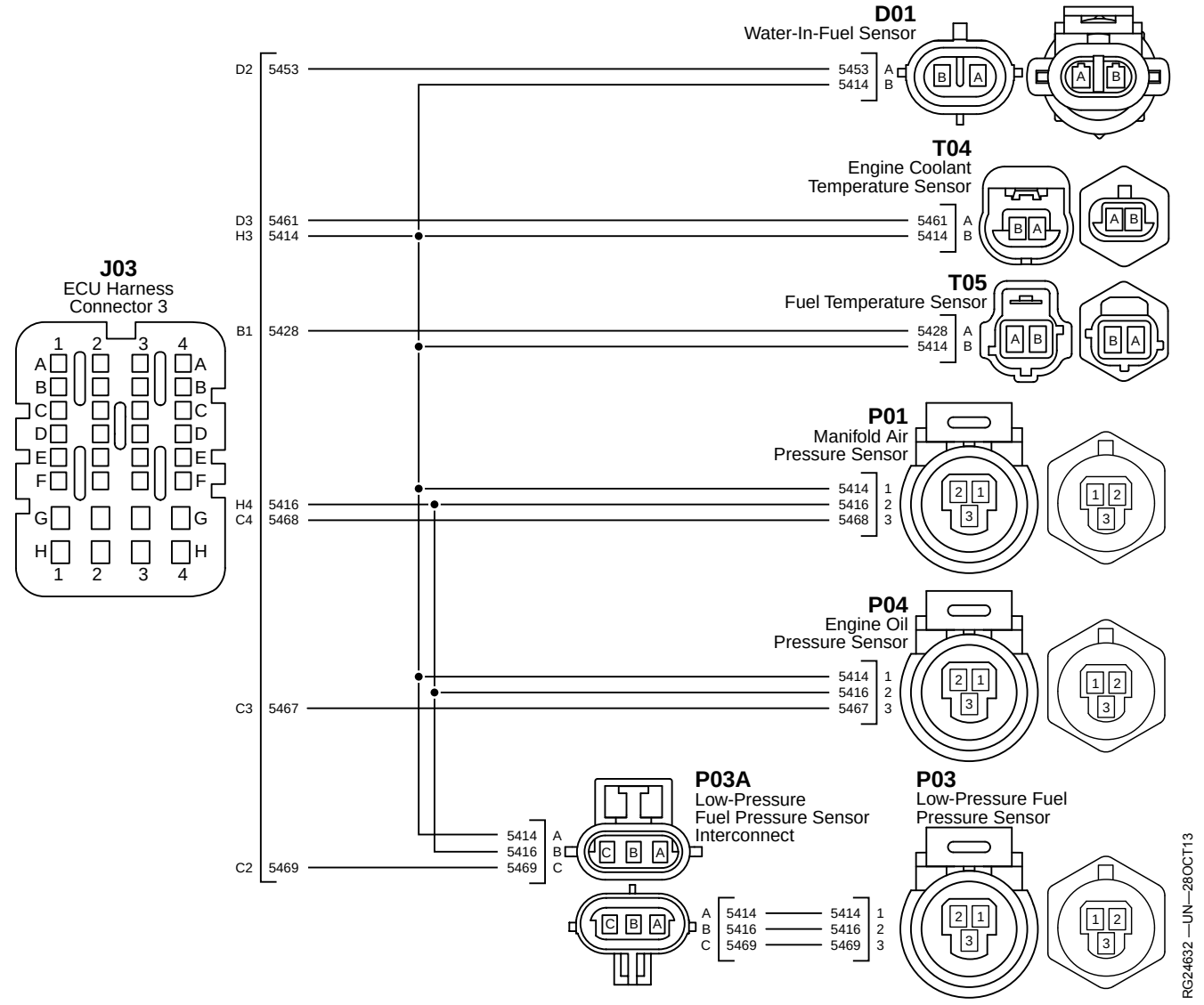
9.0L Wiring Diagram 1



A—See 9.0L Wiring Diagram 3
B—See 9.0L Wiring Diagram 3
C01— Fuel Injector Harness Connector
C02— Auxiliary Power Connector
C06— Alternator Excitation
C19— Low-Pressure Fuel Pump
J01— ECU Harness Connector 1
Y01— Suction Control Valve

ZE59858,0000266 -19-30OCT13-1/1

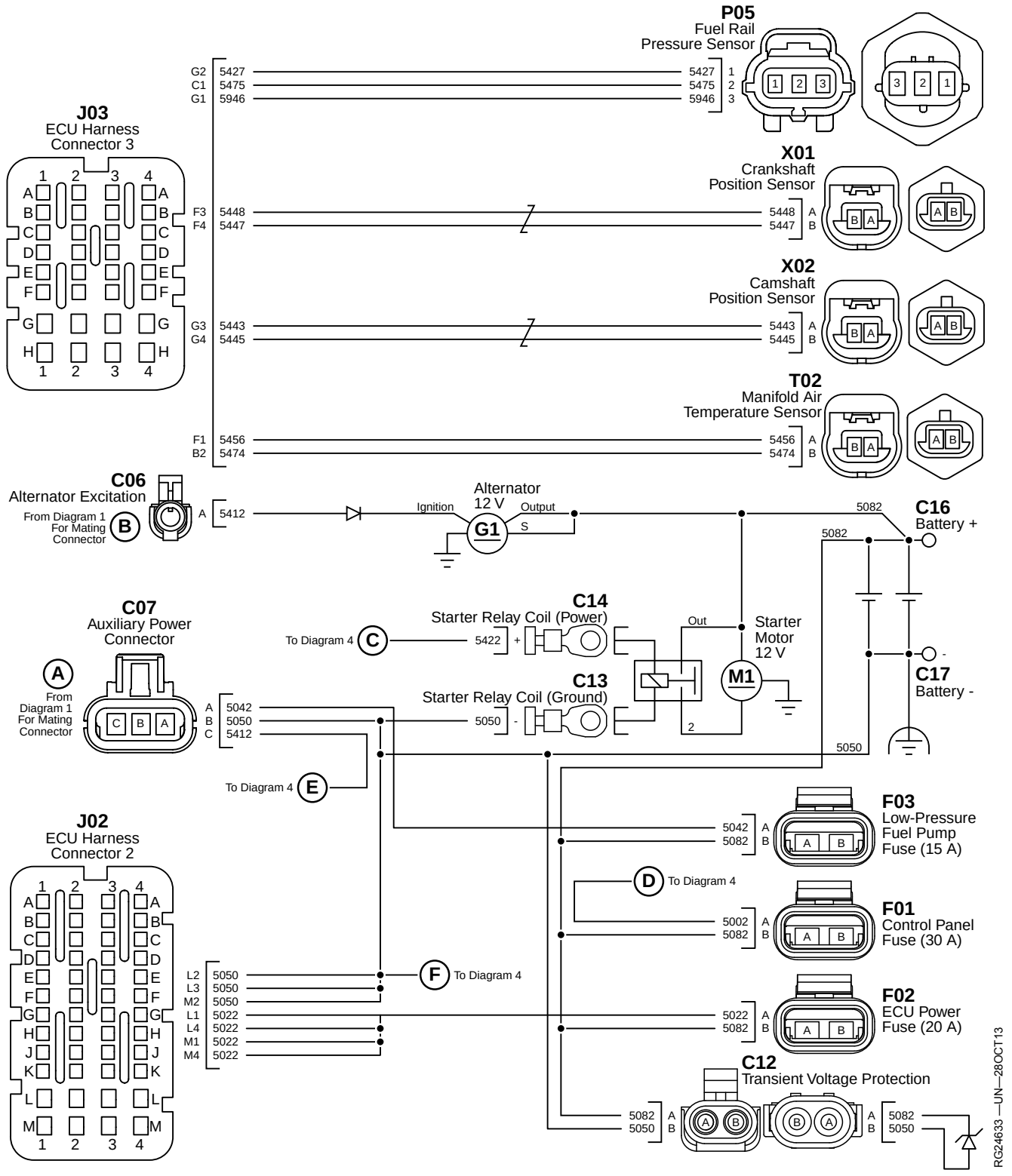
9.0L Wiring Diagram 2



D01— Water-In-Fuel Sensor
J03— ECU Harness Connector 3
P01— Manifold Air Pressure Sensor
P03— Low-Pressure Fuel Pressure Sensor
P03A— Low-Pressure Fuel Pressure Sensor Interconnect
P04— Engine Oil Pressure Sensor
T04— Engine Coolant Temperature Sensor
T05— Fuel Temperature Sensor

ZE59858,0000267 -19-29OCT13-1/1

9.0L Wiring Diagram 3



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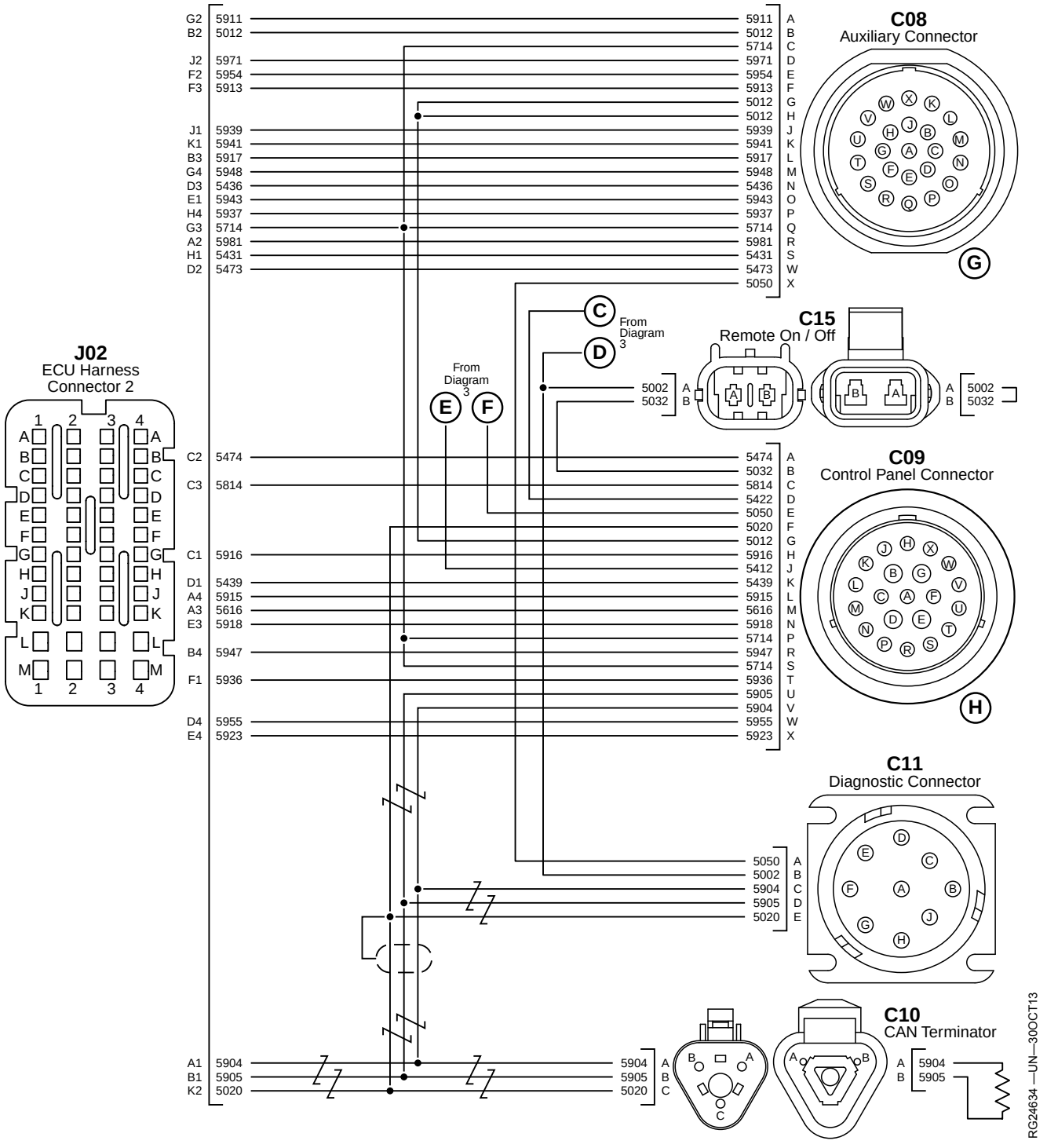
ZE59858,0000268 -19-30OCT13-1/2

A—See 9.0L Wiring Diagram 1
B—See 9.0L Wiring Diagram 1
C—To 9.0L Wiring Diagram 4
C06— Alternator Excitation
C07— Auxiliary Power Connector
C12— Transient Voltage Protection
C13— Starter Relay Coil (Ground)
C14— Starter Relay Coil (Power)
C16— Battery +
C17— Battery -
D—See 9.0L Wiring Diagram 4
E—See 9.0L Wiring Diagram 4
F—See 9.0L Wiring Diagram 4
F01— Control Panel Fuse (30 A)
F02— ECU Power Fuse (20 A)
F03— Low-Pressure Fuel Pump Fuse (15 A)
G1—Alternator 12V
J02— ECU Harness Connector 2
J03— ECU Harness Connector 3
M1—Starter Motor 12V
P05— Fuel Rail Pressure Sensor
T02— Manifold Air Temperature Sensor
X01— Crankshaft Position Sensor
X02— Camshaft Position Sensor

ZE59858,0000268 -19-30OCT13-2/2

9.0L Wiring Diagram 4



C08— Auxiliary Connector
C09— Control Panel Connector
C10— CAN Terminator
C11— Diagnostic Connector
C15— Remote On/Off
C—See 9.0L Wiring Diagram 3
D—See 9.0L Wiring Diagram 3
E—See 9.0L Wiring Diagram 3
F—See 9.0L Wiring Diagram 3
G—See Transition Harness Wiring Diagram 1
H—See Transition Harness Wiring Diagram 2
J02— ECU Harness Connector 2

ZE59858,0000269 -19-04NOV13-1/1

Storage

Engine Storage Guidelines

IMPORTANT: Special considerations should be taken prior to storage when using BioDiesel. See BioDiesel Fuel in the Fuels, Lubricants, and Coolant Section.

1. John Deere engines can be stored outside for up to three months with no long-term preparation if covered by a waterproof covering. No outside storage is recommended without a waterproof covering.
2. John Deere engines can be stored in a standard overseas shipping container for up to three months with no long-term preparation.
3. John Deere engines can be stored inside for up to six months with no long-term preparation.
4. John Deere engines expected to be stored more than six months **must** have long-term storage preparation. See Preparing Engine for Long-Term Storage in the Storage Section.

OUOD006,0000114 -19-04FEB15-1/1

Preparing Engine for Long-Term Storage

IMPORTANT: Any time the engine is not used for over six months, the following recommendations for storing it and removing it from storage helps to minimize corrosion and deterioration.

IMPORTANT: Long-term storage is not advised when using BioDiesel. For storage longer than one year, use straight hydrocarbon fuel.

If BioDiesel must be used it is recommended the blend not exceed B7 and a high-quality fuel stabilizer be used. Storage should not exceed one year.

For more information see BioDiesel Fuel in the Fuels, Lubricants, and Coolants Section.

NOTE: The following storage preparations are used for long-term engine storage up to one year. After that, the engine should be started, warmed up, and retreated for an extended storage period.

1. Change engine oil and replace filter. Used oil does not give adequate protection. Add 30 mL of rust preventive oil to the engine crankcase for every 1 L of engine oil, or 1 oz. of rust preventative oil per 1 qt. of engine oil. This rust preventive oil should be an SAE 10 oil with 1%-4% morpholine or equivalent vapor corrosion inhibitor, such as NOX RUST VCI-10 OIL from Daubert Chemical Company, Inc.
2. Replace air cleaner.
3. Draining and flushing of cooling system is not necessary if the engine is only stored for less than one year. However, for extended storage periods of a year or longer, it is recommended that the cooling system be drained, flushed, and refilled. Refill with appropriate coolant. See Diesel Engine Coolant (engine with wet sleeve cylinder liners) in the Fuels, Lubricants, and Coolants Section.
4. Prepare a solution of diesel fuel and rust preventive oil in a temporary container, add 78 mL of rust preventive oil per 1 L of diesel fuel, 10 oz. of rust preventive oil per 1 gal. of diesel fuel.
5. Remove existing lines and plugs as required. Run a temporary line from the temporary container to the engine fuel intake before the fuel filters, and another temporary line from the fuel return to the temporary container, so rust preventive oil solution is circulated through the injection system during cranking.

IMPORTANT: Do not operate starter more than 30 seconds at a time. Wait at least 2 minutes for starter to cool before trying again.

6. Crank the engine several revolutions with starter. Do not allow the engine to start. This allows rust preventive oil solution to circulate.

   See your authorized dealer for the proper procedure for your application.
7. Remove temporary lines installed in Step 5 and replace any lines or plugs previously removed.
8. Loosen (or remove) and store fan and alternator poly-vee belt.
9. Remove and clean batteries. Store them in a cool, dry place and keep them fully charged.
10. Disengage the clutch for any driveline.
11. Clean the exterior of the engine with salt-free water and touch up any scratched or chipped painted surfaces with a good quality paint.
12. Coat all exposed bare metal surfaces with grease or corrosion inhibitor if not feasible to paint.
13. Seal all openings on engine with plastic bags and tape.
14. Store the engine in a dry protected place. If engine must be stored outside, cover it with a waterproof canvas or other suitable protective material and use a strong waterproof tape.

OUOD006,00000FC -19-07APR15-1/1

Removing Engine from Long-Term Storage

NOTE: The following storage removal procedure is used for long-term engine storage up to one year. After that, the engine should be started, warmed up, and retreated for an extended storage period.

Refer to the appropriate section for detailed services listed below or have an authorized servicing dealer or engine distributor perform unfamiliar services.

1. Remove all protective coverings from engine. Unseal all openings in engine and remove covering from electrical systems.
2. Remove grease from all exposed metal surfaces.
3. Remove the batteries from storage. Install batteries (fully charged) and connect the terminals.
4. Install fan and alternator poly-vee belt, if removed.
5. Fill fuel tank.
6. Perform all appropriate prestarting checks. See Daily Prestarting Checks in the Lubrication & Maintenance — Daily Section for more information.
7. Open sea water valve and prime the sea water system.

IMPORTANT: DO NOT operate starter more than 30 seconds at a time. Wait at least 2 minutes for starter to cool before trying again.

8. Crank engine for 20 seconds with starter. Do not allow the engine to start. Wait 2 minutes and crank engine an additional 20 seconds to assure bearing surfaces are adequately lubricated.

   See your authorized dealer for the proper procedure for your application.
9. Start engine and run at low idle and no load for 15 minutes.
10. Shut engine off. Change engine oil and replace filter.
11. Warm up engine and check all gauges before placing engine under load.
12. On the first day of operation after storage, check overall engine for leaks and check all gauges for correct operation.

NOTE: If using BioDiesel blends after long-term storage, frequency of fuel filter plugging can increase initially.

OUOD006,0000115 -19-24OCT13-1/1

General Marine Engine Specifications

ITEM	UNIT OF MEASURE	ENGINE MODEL 6090SFM85	ENGINE MODEL 6090AFM85
General Data			
Engine Type		In-line, 4 cycle diesel	In-line, 4 cycle diesel
Aspiration		Turbocharged and seawater aftercooled	Turbocharged and coolant aftercooled
Number of Cylinders		6	6
Bore	mm (in.)	118 (4.65)	118 (4.65)
Stroke	mm (in.)	136 (5.35)	136 (5.35)
Displacement	L (cu in.)	9.0 (549)	9.0 (549)
Combustion System		Direct Injection	Direct Injection
Compression Ratio		16.3:1	16.3:1
Physical Dimensions:			
Width	mm (in.)	975 (38.4)	938 (36.9)
Height	mm (in.)	982 (38.7)	984 (38.7)
Length	mm (in.)	1714 (67.5)	1714 (67.5)
Weight (with oil, without coolant)	kg (lb)	1056 (2327)	1055 (2325)
Performance Data			
Engine Power and Speed Ratings		See Engine Power And Speed Specifications in the Specifications Section.	
Lubrication System (Propulsion Applications)			
Oil Pressure at Rated rpm	kPa (psi)	245 (36)	274 (40)
Oil Pressure at Low Idle	kPa (psi)	135 (20)	115 (17)
Engine Oil Capacity		See Engine Crankcase Oil Fill Quantities in the Specifications Section.	
Lubrication System (Generator Applications)			
Oil Pressure at Rated rpm (±35%)	kPa (psi)	341 (35)	283 (41)
Engine Oil Capacity		See Engine Crankcase Oil Fill Quantities in the Specifications Section.	
Cooling System			
Recommended Pressure Cap	kPa (psi)	110 (16)	110 (16)
Coolant Temperature Operating Range	°C (°F)	82-94 (180-202)	71-84 (160-183)
Coolant Temperature (Maximum)	°C (°F)	110 (230)	110 (230)
Coolant Capacity (Including Heat Exchanger)	L (qt)	28 (30)	38 (40)
Fuel System			
ECU Level		L14	L14
Fuel Injection Type		HPCR	HPCR
Primary Fuel Filter		10 micron	10 micron
Secondary Fuel Filter		2 micron	2 micron
Electrical System			
Battery Capacity (Minimum)- 12 Volt System	CCA	1100	1100
Battery Capacity (Minimum)- 24 Volt System	CCA	750	750
Air System			
Maximum Air Intake Restriction	kPa (Bar) (psi)	3.0 (0.03) (0.44)	3.0 (0.03) (0.44)
Maximum Exhaust Back Pressure	kPa (Bar) (psi)	7.5 (0.075) (1.09)	7.5 (0.075) (1.09)

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Engine Power And Speed Specifications

Engine Model	Application Rating	Power Rating kW (hp)[a]	Rated Speed (rpm)	Slow Idle (rpm)	Peak Torque (rpm)
6090SFM85	Gen-Set 60 Hz	278 kW (373 hp)	1800	1000	—
	Gen-Set 50 Hz	222 kW (298 hp)	1500	1000	—
	M1	242 kW (325 hp)	2100	650	1600
	M2	280 kW (375 hp)	2200	650	1700
	M3	317 kW (425 hp)	2300	650	1700
	M4	373 kW (500 hp)	2400	650	1900
	M5	410 kW (550 hp)	2500	650	1900
6090AFM85	Gen-Set 60 Hz	222 kW (298 hp)	1800	1000	—
	Gen-Set 50 Hz	194 kW (260 hp)	1500	1000	—
	M1	213 kW (285 hp)	2100	650	1600
	M2	242 kW (325 hp)	2200	650	1700
	M3	280 kW (375 hp)	2300	650	1800
	M4	317 kW (425 hp)	2400	650	1900

[a]Engine speeds listed are preset to factory specification. Slow idle speed may be reset depending upon specific boat application requirements. Refer to your boat operator's manual for engine speeds that are different from those preset at the factory.

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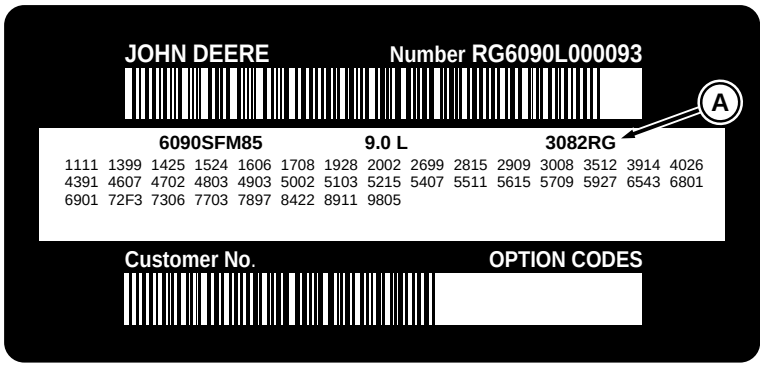
Engine Crankcase Oil Fill Quantities



Option Code Label

RG24622 —UN—24OCT13

A—Engine Base Code

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

The engine option code label includes an engine base code (A). At times it will be necessary to furnish this base code to differentiate two identical option codes for the same engine model.

To determine the option code for the oil fill quantity of your engine, refer to the engine option code label affixed to the rocker arm cover. The first two digits of the code (19) identify the oil pan group. The last two digits of each code identify the specific oil pan on your engine.

Item	Measurement	Specification
Oil Pan Option Code 1932	Volume	31.0 L (32.75 qt.)

NOTE: Crankcase oil capacity may vary slightly from amount shown. ALWAYS fill crankcase to full mark or between arrows on dipstick, whichever is present. DO NOT overfill.

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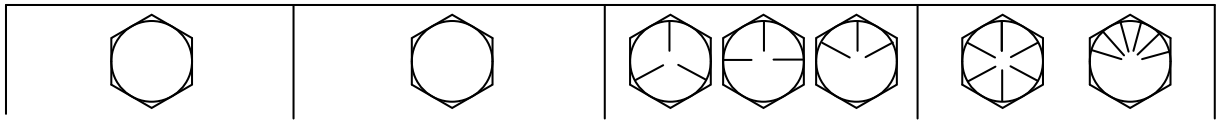
Unified Inch Bolt and Screw Torque Values

TS1671 —UN—01MAY03



Bolt or Screw Size	SAE Grade 1				SAE Grade 2[a]				SAE Grade 5, 5.1 or 5.2				SAE Grade 8 or 8.2			
	Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]	
	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.
1/4	3.7	33	4.7	42	6	53	7.5	66	9.5	84	12	106	13.5	120	17	150
													N·m	lb.-ft.	N·m	lb.-ft.
5/16	7.7	68	9.8	86	12	106	15.5	137	19.5	172	25	221	28	20.5	35	26
									N·m	lb.-ft.	N·m	lb.-ft.				
3/8	13.5	120	17.5	155	22	194	27	240	35	26	44	32.5	49	36	63	46
			N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.								
7/16	22	194	28	20.5	35	26	44	32.5	56	41	70	52	80	59	100	74
	N·m	lb.-ft.														
1/2	34	25	42	31	53	39	67	49	85	63	110	80	120	88	155	115
9/16	48	35.5	60	45	76	56	95	70	125	92	155	115	175	130	220	165
5/8	67	49	85	63	105	77	135	100	170	125	215	160	240	175	305	225
3/4	120	88	150	110	190	140	240	175	300	220	380	280	425	315	540	400
7/8	190	140	240	175	190	140	240	175	490	360	615	455	690	510	870	640
1	285	210	360	265	285	210	360	265	730	540	920	680	1030	760	1300	960
1-1/8	400	300	510	375	400	300	510	375	910	670	1150	850	1450	1075	1850	1350
1-1/4	570	420	725	535	570	420	725	535	1280	945	1630	1200	2050	1500	2600	1920
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2140	1580	2700	2000	3400	2500
1-1/2	990	730	1250	930	990	730	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For plastic insert or crimped steel type lock nuts, for stainless steel fasteners, or for nuts on U-bolts, see the tightening instructions for the specific application. Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Replace fasteners with the same or higher grade. If higher grade fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

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

[b] "Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or 7/8 in. and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.

[c] "Dry" means plain or zinc plated without any lubrication, or 1/4 to 3/4 in. fasteners with JDM F13B, F13E or F13H zinc flake coating.

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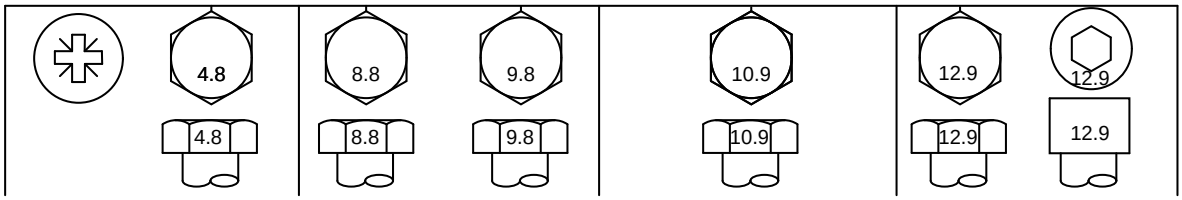
Metric Bolt and Screw Torque Values

TS1670 —UN—01MAY03



Bolt or Screw Size	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]	
	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.
M6	4.7	42	6	53	8.9	79	11.3	100	13	115	16.5	146	15.5	137	19.5	172
									N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.
M8	11.5	102	14.5	128	22	194	27.5	243	32	23.5	40	29.5	37	27.5	47	35
			N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.								
M10	23	204	29	21	43	32	55	40	63	46	80	59	75	55	95	70
	N·m	lb.-ft.														
M12	40	29.5	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	46	80	59	120	88	150	110	175	130	220	165	205	150	260	190
M16	100	74	125	92	190	140	240	175	275	200	350	255	320	235	400	300
M18	135	100	170	125	265	195	330	245	375	275	475	350	440	325	560	410
M20	190	140	245	180	375	275	475	350	530	390	675	500	625	460	790	580
M22	265	195	330	245	510	375	650	480	725	535	920	680	850	625	1080	800
M24	330	245	425	315	650	480	820	600	920	680	1150	850	1080	800	1350	1000
M27	490	360	625	460	950	700	1200	885	1350	1000	1700	1250	1580	1160	2000	1475
M30	660	490	850	625	1290	950	1630	1200	1850	1350	2300	1700	2140	1580	2700	2000
M33	900	665	1150	850	1750	1300	2200	1625	2500	1850	3150	2325	2900	2150	3700	2730
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2770	4750	3500

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For stainless steel fasteners or for nuts on U-bolts, see the tightening instructions for the specific application. Tighten plastic insert or crimped steel type lock nuts by turning the nut to the dry torque shown in the chart, unless different instructions are given for the specific application.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class. Replace fasteners with the same or higher property class. If higher property class fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a] *"Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or M20 and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.*

[b] *"Dry" means plain or zinc plated without any lubrication, or M6 to M18 fasteners with JDM F13B, F13E or F13H zinc flake coating.*

DX,TORQ2 -19-12JAN11-1/1

Lubrication and Maintenance Records

Using Lubrication and Maintenance Records

Refer to specific Lubrication and Maintenance Section for detailed service procedures.

1. Keep a record of the number of hours you operate your engine by regular observation of hour meter.
2. Check your record regularly to learn when your engine needs service.
3. DO ALL the services within an interval section. Write the number of hours (from your service records) and the date in the spaces provided. For a complete listing of all items to be performed and the service intervals required, refer to the quick-reference chart near the front of the Lubrication and Maintenance Section.

IMPORTANT: The service recommendations covered in this manual are for the accessories that are provided by John Deere. Follow manufacturer's service recommendations for servicing engine driven equipment not supplied by Deere.

OURGP11,0000159 -19-28JAN04-1/1

Daily (Prestarting) Service

- Operate engine at rated speed and 50%—70% load for a minimum of 30 minutes. Perform every 2 weeks. (Generator Sets Only)
- Check engine oil level.
- Check coolant level.
- Check sea water pump and strainer.
- Check accessory drive belts.
- Drain fuel filter water separator bowl.
- Check aftercooler condensate drain, if equipped.
- Inspect wiring harness and fuses.
- Check air cleaner dust unloader valve and air restriction indicator, if equipped.
- Check air intake system.
- Visual walkaround inspection.

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250 Hours or 6 Months Service

- Change engine oil and replace oil filter.
- Service fire extinguisher.
- Service battery.
- Visually inspecting coolant pump.
- Check engine mounts.
- Inspect and replace zinc plugs, if equipped.

Hours									
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500 Hours or 12 Months Service

- Replace crankcase ventilation filter.
- Check air intake system.
- Replace fuel filter element and clean water separator bowl.
- Check automatic belt tensioner and belt wear.
- Check cooling system.
- Pressure test cooling system.
- Inspect and clean heat exchanger core.
- Inspect and clean aftercooler core.
- Check and adjust engine speeds.
- Check engine electrical ground connections.
- Replace sea water pump impeller.
- Check crankshaft vibration damper.

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2000 Hours or 24 Months Service

- Check and adjust engine valve clearance.
- Overhaul sea water pump.

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4500 Hours or 60 Months Service

- Change rubber crankshaft vibration damper.

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6000 Hours or 72 Months Service

- Flush and refill cooling system.
- Test thermostats.

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Service As Required

- Drain water from fuel filters.
- Add coolant.
- Service air cleaner element.
- Replace air cleaner element.
- Replace alternator belt.
- Check fuses.
- Check air compressor, if equipped.
- Check refrigerant (A/C) compressor, if equipped.
- Check front PTO, if equipped.

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John Deere Warranty in OEM Applications

Overview

This section focuses on John Deere engines marketed in products manufactured by companies other than John Deere or its affiliates, and on John Deere repower engines in all applications. Herein appears the original warranty applicable to the engine as delivered to the retail purchaser on or after 1 May 2010. The following is information about the warranty and warranty service.

NOTE: "John Deere" means John Deere Power Systems with respect to users in the United States, John Deere Limited with respect to users in Canada, and Deere & Company or its subsidiary responsible for making John Deere equipment in other countries where the user is located.

Promptly register your engine online at https://www.johndeere.com/enginewarranty

or

Mail or FAX the registration form found in this manual to John Deere as indicated on the form.

When Warranty Service Is Needed

The nearest dealer stands ready with genuine parts and trained and equipped personnel should the need arise. If following the Operator's Manual delivered with the engine/machine are not adequate to correct an engine problem, contact the nearest John Deere service dealer for assistance. Authorized engine service dealers can be found at: https://www.johndeere.com/ (click on "Dealer Locator").

NOTE: When requesting warranty service, the purchaser must be prepared to provide proof that the engine is within the warranty period.

The following information is always required: Engine serial number, date of delivery, engine owner, name and location of dealer and specific person contacted, date of contact, nature of engine problem, and outcome of the service dealer contact.

Given that normally it is the dealer contacted who in the end will provide the service required, maintaining a purchaser-dealer relationship of mutual respect from the beginning is always helpful.

Privacy Notice

At John Deere your privacy is important to us. We collect, use, and disclose your personal information in accordance with the John Deere privacy statement. For instance, we collect, use, and disclose your personal information to provide you with the products and services that you request; to communicate with you as our customer (examples include warranty and product improvement programs) and to meet safety and legal requirements; and for marketing and promotional purposes. Sometimes, we may ask our John Deere affiliates, dealers, or business partners to do work for us which involves your information. For complete details on your privacy rights and to obtain a copy of the John Deere Privacy Statement, please visit our website at https://www.johndeere.com/.

Warranty Duration

Unless otherwise provided in writing by John Deere, John Deere makes the following warranty to the first retail purchaser and each subsequent purchaser (if purchase is made prior to the expiration of applicable warranty) of each John Deere new off-highway engine marketed as part of a product manufactured by a company other than John Deere or its affiliates and on each John Deere engine used in an off-highway repower application:

- 12 months, unlimited hours of use, or
- 24 months and before the accumulation of 2000 hours of use.

NOTE: In the absence of a functional hourmeter, hours of use will be determined on the basis of 12 hours of use per calendar day.

Warranty Coverage

This warranty applies to the engine and to integral components and accessories sold by John Deere, and delivered to the first retail purchaser on or after 1 May 2010.

All John Deere-warranted parts and components of John Deere engines which, as delivered to the purchaser, are defective in materials and/or workmanship will be repaired or replaced, as John Deere elects. Warrantable repairs will be made without charge for parts or engine repair labor, including reasonable labor costs to remove and reinstall non-engine parts or components of the equipment in which the engine is installed. If required, reasonable labor costs for engine removal and reinstallation will also be included. All coverage is based on the defect appearing within the warranty period as measured from the date of delivery to the first retail purchaser.

Obtaining Warranty Service

Warranty service must be requested of the nearest authorized John Deere engine service outlet before the expiration of the warranty. An *authorized* service outlet is a John Deere engine distributor, a John Deere engine service dealer, or a John Deere equipment dealer selling and servicing equipment with an engine of the type covered by this warranty. (See When Warranty Service is Needed above.)

Authorized service outlets will use only new or remanufactured parts or components furnished or approved by John Deere.

NOTE: Authorized engine service locations are listed on the Internet at https://www.johndeere.com/ (Click on "Dealer Locator".)

Continued on next page

At the time of requesting warranty service, the purchaser must be prepared to present evidence of the date of delivery of the engine.

John Deere reimburses authorized service outlets for limited travel expenses incurred in making warranty service repairs in non-John Deere applications when travel is actually performed. The limit, as of the date of publication of this booklet, is US$400.00 (US$500.00 if engine is marine) or equivalent. **If distances and travel times are greater than reimbursed by John Deere, the service outlet will charge the purchaser for the difference.**

Warranty Exclusions

John Deere's obligations will not apply to components and accessories which are not furnished or installed by John Deere, nor to failures caused by such items, except as required by law.

Purchaser's Responsibilities

The cost of normal maintenance and depreciation.

Periodic cleaning of the diesel particulate filter (DPF).

Consequences of negligence, misuse, or accident involving the product, or improper application, installation, or storage.

Consequences of service performed by someone other than an authorized John Deere engine service outlet.

Consequences of any product modification or alteration not approved by John Deere, including, but not limited to, tampering with engine fuel and air delivery systems.

Consequences of failure of non-product components.

Consequences of fuels, lubricants, or coolants that fail to meet the specifications and requirements listed in the Operator's Manual.

The effects of cooling system neglect as manifested in cylinder liner or cylinder block cavitation ("pitting, "erosion", "electrolysis").

Any premium for overtime labor requested by the purchaser.

Costs of transporting the product or the equipment in which it is installed to and from the location at which the warranty service is performed, if such costs are in excess of the travel reimbursement payable to the dealer had the warranty service been performed at the product's location.

Costs incurred in gaining access; for example, overcoming physical barriers such as walls, fences, floors, decks, or similar structures impeding access to the product, rental of cranes or similar, or construction of ramps or lifts or protective structures for product removal and reinstallation.

Incidental travel costs including meals, lodging, and similar, and any travel time or mileage costs in excess of the maximum allowance.

Service outlet costs incurred in solving or attempting to solve non-warrantable problems.

Services performed by a party other than an authorized John Deere service dealer.

Charges by dealers for initial start-up and inspection deemed unnecessary by John Deere when an Operator's Manual is supplied with the product are followed.

Costs related to interpretation or translation services.

No Representations or Implied Warranty

Where permitted by law, neither John Deere nor any company affiliated with it makes any guaranties, warranties, conditions, representations or promises, express or implied, oral or written, as to the nonoccurrence of any defect or the quality of performance of its engines other than those set forth in this booklet, and DOES NOT MAKE ANY IMPLIED WARRANTY OR CONDITIONS OF MERCHANTABILITY OR FITNESS otherwise provided for in the Uniform Commercial Code or required by any Sale of Goods Act or any other statute. This exclusion includes fundamental terms. In no event will a John Deere engine distributor or engine service dealer, John Deere equipment dealer, or John Deere or any company affiliated with John Deere be liable for incidental or consequential damages or injuries including, but not limited to, loss of profits, loss of crops, rental of substitute equipment or other commercial loss, damage to the equipment in which the engine is installed or for damage suffered by purchaser as a result of fundamental breaches of contract or breach of fundamental terms, unless such damages or injuries are caused by the gross negligence or intentional acts of the foregoing parties.

Remedy Limitation

The remedies set forth in this warranty are the purchaser's exclusive remedies in connection with the performance of, or any breach of guaranty, condition, or warranty in respect of new John Deere engines. In the event the above warranty fails to correct purchaser's performance problems caused by defects in workmanship and/or materials, purchaser's exclusive remedy shall be limited to payment by John Deere of actual damages in an amount not to exceed the cost of the engine.

No Seller's Warranty

No person or entity, other than John Deere, who sells the engine or product in which the engine has been installed makes any guaranty or warranty of its own on any engine warranted by John Deere unless it delivers to the purchaser a separate written guaranty certificate specifically guaranteeing the engine, in which case John Deere shall have no obligation to the purchaser. Neither original equipment manufacturers, engine or equipment distributors, engine or equipment dealers, nor any other person or entity, has any authority to make any representation or promise on behalf of John Deere or to modify the terms or limitations of this warranty in any way.

Continued on next page

Replacement Parts Warranty

John Deere and John Deere Reman parts and components (excluding replacement engines) installed during engine warranty service are warranted for the remaining warranty period of the engine or the applicable warranty term for the installed service part, whichever is greater. A new or remanufactured engine replacing a failed engine under warranty is warranted for 90 days or the remaining warranty period of the original engine, whichever is greater.

Warranty Transfer

The remainder of the original engine warranty and the emissions control-related warranty may be transferred to a subsequent owner of the engine. The Engine Warranty Transfer card should be used to report the transfer to John Deere. If a card is not available, contact your Dealer or simply send the following Information to JDPS Warranty Administration at Diesel-US@JohnDeere.com.

1. The complete 13-character engine serial number.
2. The name and mailing address of the original purchaser.
3. Delivery date to the original purchaser.
4. Hours at the time of transfer.
5. Date of transfer to the new owner.
6. Name and mailing address of the new owner.
7. How the engine/drivetrain being used, i.e., what equipment it powers, by manufacturer and model.
8. Equipment it powers, by manufacturer and model.

Purchased Extended Warranty

Extended warranty may be purchased on most engines in many areas of the world. John Deere engine distributors and equipment dealers, and dealers of manufacturers using John Deere engines in their products, have details. John Deere may also be contacted at U.S.A. fax number 1-309-749-0816, or in Europe fax number 33.2.38.84.62.66.

Emissions Warranties

Emissions warranties appear in the Operator's Manual furnished with the engine/machine. **(Warning: Statutes providing severe penalties for tampering with emissions controls may apply at the user's location.)** John Deere may also be contacted at U.S.A. fax number 1-309-749-0816; or in Europe fax number 33.2.38.84.62.66.

Local Warranty Requirements

Warranties required by local statutes will be furnished by the seller.

Option Codes (Engine Manufacturing Configuration)

When in need of engine replacement parts, your authorized John Deere service dealer will need to know the corresponding "Option Codes" for your engine. The option code label on the engine rocker arm cover may become damaged over time. By recording the four-digit codes when the engine is new, and storing this manual where it can be found when parts are needed, fast, accurate parts ordering and service will be assured. (See Engine Option Codes in the Record Keeping Section).

Should there be a question about an engine option code, note the engine serial number and call 1-800-JDENGINE from the U.S.A. or Canada, or fax U.S.A. number 1-309-749-0816; or E-mail at diesel-us@johndeere.com, Attention: Warranty Administration; or in Europe fax number 33.2.38.84.62.66, or E-mail at saranservice@johndeere.com.

Registering The Engine For Warranty

Completion and submission of the John Deere Engine Warranty Registration form (cut out sheet found in this manual) is very important. John Deere will not deny warranty service on an engine within its warranty period if the engine has not been registered. However, registering your engine will assure your servicing dealer that the engine is within the warranty period.

The easiest way to register your engine is via the Internet. Go to website https://www.johndeere.com/enginewarranty You can use the sheet in this manual to gather the information needed to register the warranty.

NOTE: Information provided on the form must be legible!

Typing is preferred, but legible handwritten reports are acceptable. "Block" numbers and Roman alphabet letters should be used. For example: 1,2,3,4 and A, B, C, D.

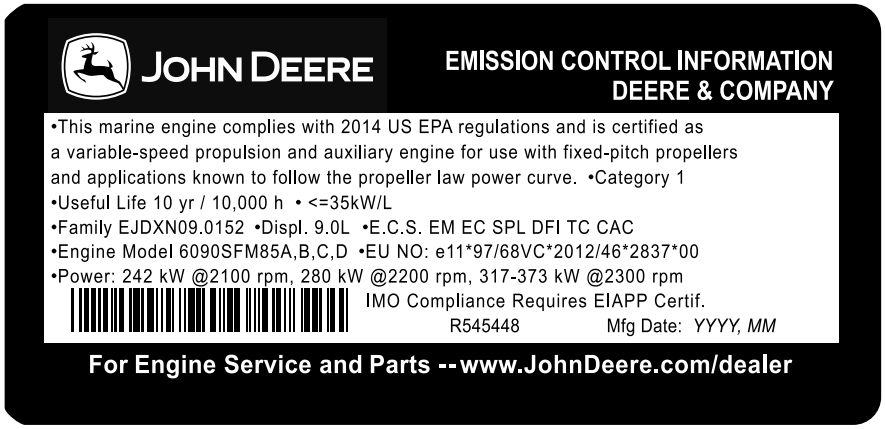
All requested information should be given. Much of it contributes to reports, including those required by governments.

The purchaser's telephone number or E-mail address allows John Deere to make contact should there be questions concerning the registration. The purchaser should sign and date the form.

JR74534,0000462 -19-27MAY15-3/3

Emissions Control System Certification Label

CAUTION: Statutes providing severe penalties for tampering with emissions controls may apply to the user or dealer.



RG24658 —UN—30OCT13

Emission Label - Sample

The emissions warranty applies to those engines marketed by John Deere that have been certified by the United States Environmental Protection Agency (EPA) and/or California Air Resources Board (CARB); and used in the United States and Canada in Non-road equipment (excluding marine engines for Canada). The presence of an emissions label like the one shown signifies that the engine has been certified with the EPA and/or CARB. The EPA and CARB warranties only apply to new engines having the certification label affixed to the engine and sold as stated above in the geographic areas. The presence of an EU number signifies that the engine has been certified with the European Union countries per Directive 97/68/EC. The EPA and/or CARB emissions warranties do not apply to the EU countries.

Emission Control System(s) Laws

The U.S. EPA and CARB prohibit the removal or rendering inoperative of any device or element of design installed on or in engines/equipment in compliance with applicable emission regulations prior to or after the sale and delivery of the engines/equipment to the ultimate purchaser.

ZE59858,00001F0 -19-19MAY14-1/1

U.S. Marine Compression-Ignition Engine Emission Control Warranty Statement

DXLOGOV1 —UN—28APR09

JOHN DEERE

U.S. MARINE COMPRESSION-IGNITION ENGINE EMISSION CONTROL WARRANTY STATEMENT

YOUR WARRANTY RIGHTS AND OBLIGATIONS
To determine if the John Deere engine qualifies for the additional warranties set forth below, look for the “Emission Control Information” label located on the engine and verify that it states the engine conforms to U.S. EPA regulations for Recreational or commercial marine compression-ignition engines.

Warranties stated on this certificate refer only to emissions-related parts and components of your engine. The complete engine warranty, less emissions-related parts and components, is provided separately. The U.S. EPA Emissions Warranty only applies to engines in vessels that are registered and operated in the USA. Engines that are not covered by the U.S. EPA Emissions regulations are not covered by the EPA Emissions Warranty. If you have any questions about your warranty rights and responsibilities, you should contact John Deere at 1-319-292-5400.

JOHN DEERE’S WARRANTY RESPONSIBILITY:
John Deere warrants to the ultimate purchaser and each subsequent purchaser that this marine diesel engine including all parts of its emission control system was designed, built and equipped so as to conform at the time of sale with applicable regulations under section 213 of the Clean Air Act and is free from defects in materials and workmanship which would cause the engine to fail to conform with applicable US EPA regulations for the following periods:

Recreational Category 1 Marine Engine	Five years or 500 hours, whichever comes first *
Commercial Category 1 Marine Engine	Five years or 5,000 hours, whichever comes first *

Where a warrantable condition exists, John Deere will repair or replace, as it elects, any part or component with a defect in materials or workmanship that would increase the engine’s emissions of any pollutant within the stated warranty period at no cost to you, including expenses related to diagnosing and repairing or replacing emission-related parts. Warranty coverage is subject to the limitations and exclusions set forth herein.

EMISSION WARRANTY EXCLUSIONS:
John Deere may deny warranty claims for malfunctions or failures caused by:
- Non-performance of maintenance requirements listed in the Operator’s Manual.
- The use of the engine / equipment in a manner for which it was not designed.
- Abuse, neglect, improper maintenance or unapproved modifications or alterations.
- Accidents for which it does not have responsibility or by acts of God.

The marine engine is designed to operate on diesel fuel as specified in the Fuels, Lubricants and Coolants section in the Operators Manual. Use of any other fuel can harm the emission control system of the engine / equipment and is not approved for use.

To the extent permitted by law, John Deere is not liable for damage to other engine components caused by a failure of an emission-related part, unless otherwise covered by standard warranty.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. REMEDIES UNDER THIS WARRANTY ARE LIMITED TO THE PROVISIONS OF MATERIAL AND SERVICES AS SPECIFIED HEREIN. WHERE PERMITTED BY LAW, NEITHER JOHN DEERE NOR ANY AUTHORIZED JOHN DEERE ENGINE DISTRIBUTOR, DEALER, OR REPAIR FACILITY OR ANY COMPANY AFFILIATED WITH JOHN DEERE WILL BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

* The emissions-related warranty shall not be shorter than any published warranty Deere offers without charge to the customer.

Emission_Marine_EPA(13Mar10)

JR74534,00002FC -19-08MAR13-1/1

European Union (EU) Declaration of Emissions Conformity

The presence of an EU number on the label signifies that the Marine Diesel Engine has been certified with the European Union countries per Directives 97/68/EC as amended by Directive 2004/26/EC. The EU engine family is listed on the Emissions Label. When installed in accordance with the manufacturer’s instructions, John Deere marine diesel propulsion engines without integral exhaust certified under Directive 97/68/EC as amended by Directive 2004/26/EC produce exhaust emissions of carbon monoxide, hydrocarbons, nitrogen oxides and particle emissions which comply with the requirements of the Recreational Craft Directive 2003/44/EC.

OURGP11,00000C7 -19-19JUN07-1/1

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Z

Engine Registration

Instructions (INS)

content

ZE59858,000025E -19-25SEP15-1/1

Mail-In Registration

OEM Engine and Drivetrain Warranty Registration

Register your OEM engine or drivetrain product online at JohnDeere.com/warranty or fax this from to John Deere at 309-749-0816.

PURCHASER INFORMATION*: Type or print in BLOCK letters

Company Name: _____

First Name: _____

Last Name: _____

Email: _____

Telephone: _____

Country: _____

Street Address: _____

City / State / Prov: _____

Zip / Postal Code: _____

PURCHASER TYPE:

- □ Commercial
- □ Federal Government
- □ State / Province
- □ County
- □ City / Town / Village
- □ Armed Forces
- □ National Account
- □ Residential
- □ Farm
- □ Very Large Fleet (>74)
- □ Large Fleet (25-74)
- □ Medium Fleet (10-24)
- □ Small Fleet (<10)

EQUIPMENT TYPE:

- □ Agriculture
- □ Earth Moving
- □ Forestry
- □ Generator Set (Industrial / Marine)
- □ Industrial Moveable
- □ Marine Propulsion
- □ Material Handling
- □ Municipal / Utility Commercial
- □ On-Highway
- □ Road and Miscellaneous Construction
- □ Rail Maintenance
- □ Other

Purchase's Signature: _____

PRODUCT AND EQUIPMENT INFORMATION

Product Serial Number: _____

Date Delivered: (dd/mm/yyyy)_____

Amount of Use: (Hours / Miles) _____

New or Used: _____

* Use of Information: All personal information obtained with this registration is subject to the John Deere privacy policy. It will be used for the purpose of offer fulfillment and may be used to provide you with additional information about John Deere products and services. For complete details on your privacy rights and to obtain a copy of the John Deere Privacy Statement, visit www.JohnDeere.com/privacy.

Cut out to mail in registration card

BL90236,0000028 -19-07OCT15-1/1

Mail-In Registration

MAILING INFORMATION
(Return Address)

_____
_____
_____
_____

John Deere Power Systems
P.O. Box 5100
Waterloo, IA 50704-5100
USA

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