

9.0 L Marine Diesel Engines (PowerTech™)



OPERATOR'S MANUAL

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

OMRG39578 ISSUE 18AUG22 (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.

John Deere Power Systems

Worldwide Edition
PRINTED IN U.S.A.

TP-6972 8/22



Introduction

OEM Engine and Drivetrain Warranty Registration

RG24614 —UN—21OCT13



Scan this code to register your OEM engine or drivetrain product online. You can also visit us directly at <http://jdpswarrantyreg.deere.com/WarrantyReg>.

Why registering your OEM engine or drivetrain product is a really smart idea:

- **Get faster service.** Registering your engine or drivetrain product gives us the information we need to meet your service needs promptly and completely.
- **Protect your investment.** You'll be kept up-to-date on engine or drivetrain product updates.
- **Extend your warranty.** You'll be given the option to extend your coverage before your standard warranty term expires.
- **Stay informed.** Be the first to know about new products and money-saving offers from John Deere.

You're Covered

When you buy a John Deere engine or drivetrain product you aren't just buying pistons and crankshafts and gear drives. You're buying the ability to get work done. Without downtime, without worries, and without hassles. And you're buying the assurance that if you do need help, a strong support network will be there — ready to step in.

Confidence. That's what John Deere engines, John Deere drivetrains, and John Deere Warranties are all about.

Long durations. Warranties designed to give you confidence in your engine or drivetrain product.

Worldwide support. Get service when and where you need it. John Deere has 4,000+ service locations worldwide.

Genuine John Deere parts and service. Authorized service outlets will use only new or remanufactured parts or components furnished by John Deere.

Warranty Duration

Equipment operators can't afford downtime or unexpected repairs. That's why we offer comprehensive warranties on our OEM industrial engines, marine engines, and drivetrain products.

- **OEM Engines:** 2-year/2,000-hour warranty, with unlimited hours in the first year.
- **Drivetrain Products:** 12-month/2000-hour warranty. In the absence of a functional hour meter, hours of use will be determined on the basis of 12 hours of use per calendar day.

These warranties take effect the date the engine or drivetrain product is delivered to the first retail purchaser. Be sure to register your engine or drivetrain product and take full advantage of the John Deere service and support network.

In addition, engine extended warranties are available under certain conditions. John Deere offers a variety of purchased warranties to extend the warranty period for your engine. You'll be given the option to extend your coverage before your standard warranty term expires.

Obtaining Warranty Service

Warranty service must be requested through an authorized John Deere service outlet before the expiration of the warranty. Evidence of the engine's or drivetrain product's delivery date to the first retail purchaser must be presented when requesting warranty service. Authorized service outlets include:

- John Deere distributor
- John Deere OEM service dealer
- John Deere equipment dealer
- John Deere marine dealer

Worldwide Support Network

Visit <https://dealerlocator.deere.com/> or <https://dealerlocator.deere.ca/> to find the authorized engine or drivetrain service location nearest you. For complete warranty details visit <https://www.deere.com/en/parts-and-service/warranty-and-protection-plans/warranties/warranty-statements> or <https://www.deere.ca/en/parts-and-service/warranty-and-protection-plans/warranties/warranty-statements> to view, download, or print the warranty statement for your engine or drivetrain product.

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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.

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Engine Owner

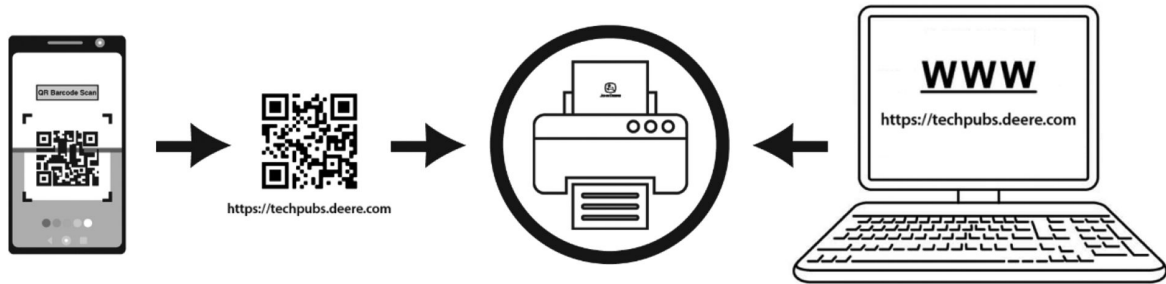
John Deere Engine Owner:

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

The John Deere Engine Distributor or local John Deere Service Dealer can also provide this service. Engine service can be done by all AG, C&F, and JDPS branded dealers. To view the John Deere Service Dealer network or locate the nearest Dealer, use the following URL: <http://www.johndeere.com/dealer>

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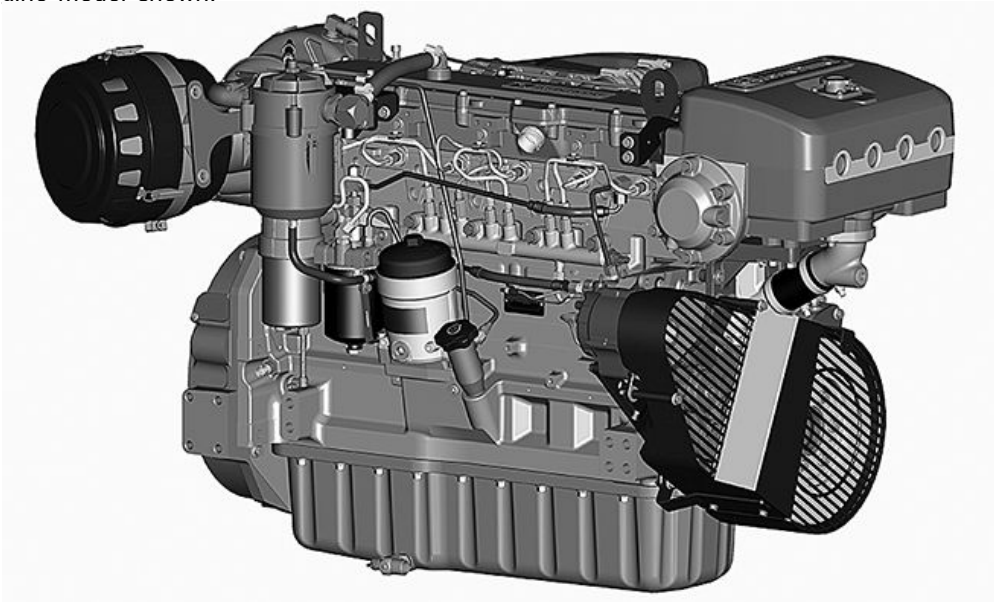
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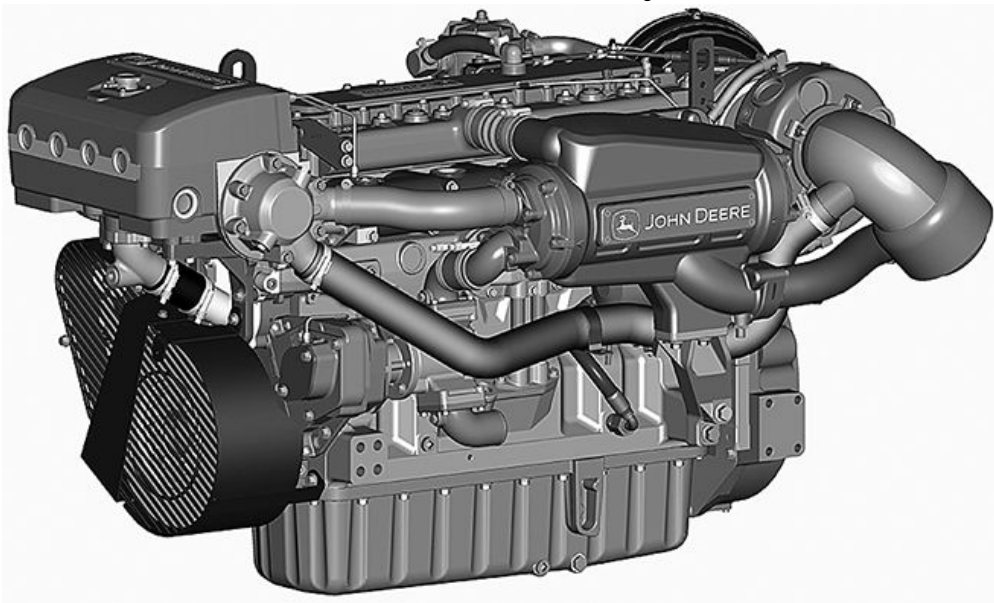
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Identification Views

*NOTE: There are multiple engine configurations.
Base engine model shown.*



John Deere 6090 Marine Base Engine



John Deere 6090 Marine Base Engine

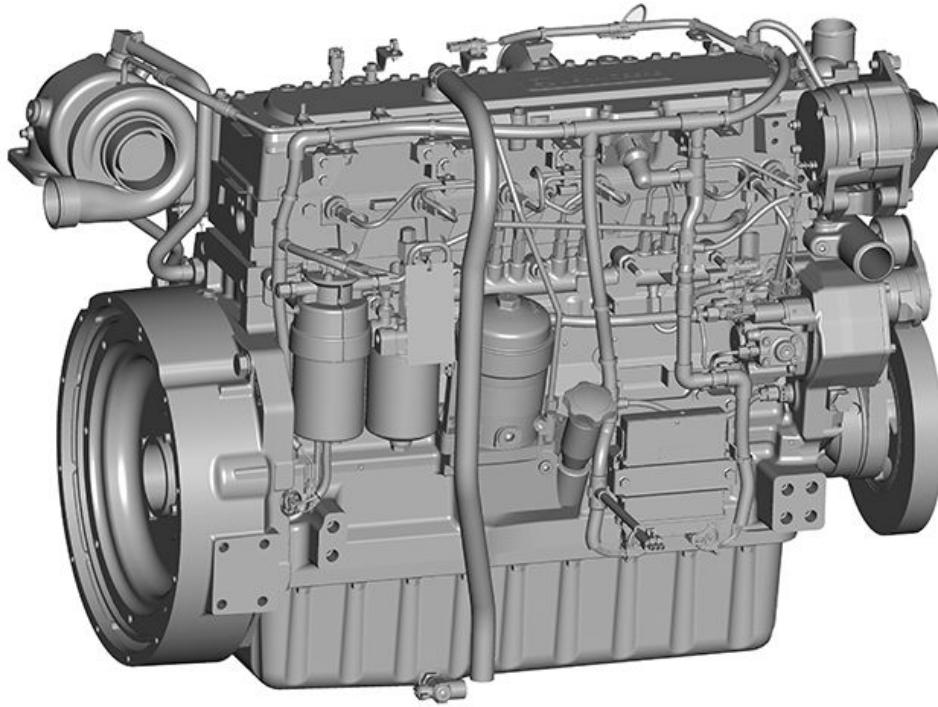
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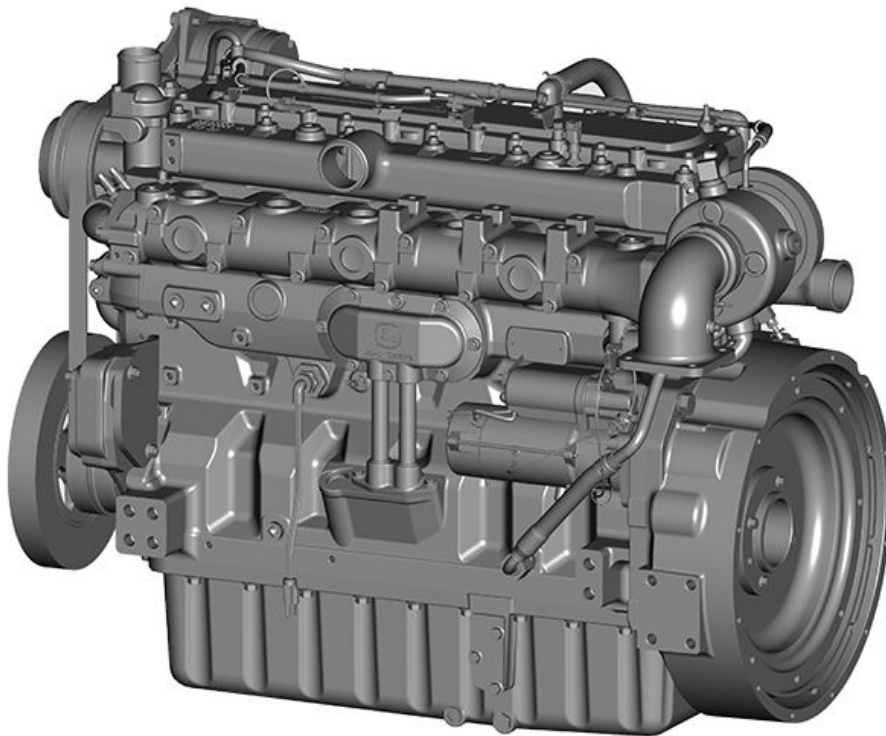
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Introduction



John Deere 6090 Marine Base Engine



John Deere 6090 Marine Base Engine

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Record Keeping

Record Engine Serial Number

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

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

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

Engine Serial Number (A)

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

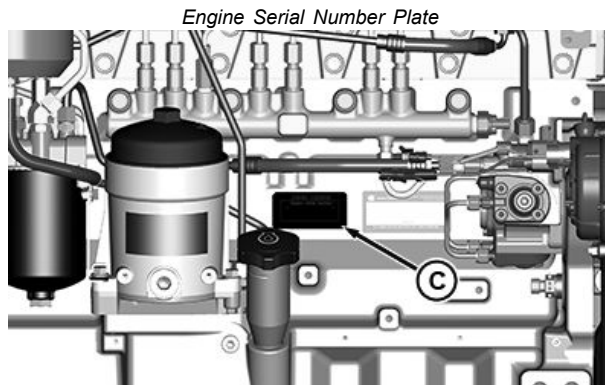
For identification of publications specific to engine model refer to the [PowerAssist App](#) or [John Deere Technical Information Store](#).

A—Engine Serial Number
B—Engine Model Number

C—Serial Number Plate



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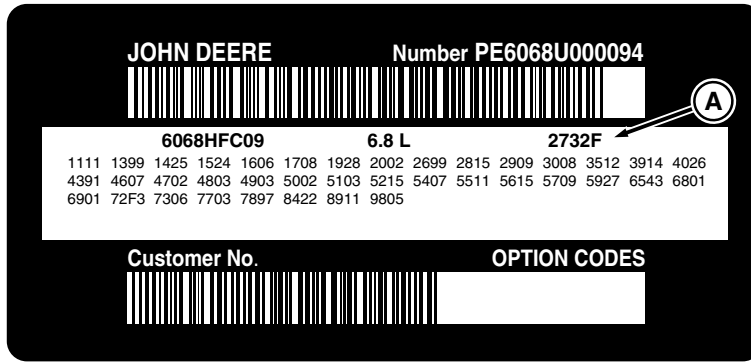
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Engine Option Codes



Option Code Label Example

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A—Engine Base Code (example)

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. At times it will be necessary to furnish this base code to differentiate two identical option codes for the same engine model.

The first two digits of each 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, 120 amp alternator.

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

An additional option code label may also be delivered (in a plastic bag attached to the engine or inserted in the machine documentation). It is recommended to place this label either on this page of the operator's manual or in the Engine Owner's Warranty booklet under Option Codes.

The machine manufacturer may have placed the label in a specific accessible area (inside the enclosure or close to a maintenance area).

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.

Record your engine Base Code (A) in the spaces provided below for easy reference.

Engine Base Code (A):

Option Codes	Description
10_____	Paint Protection
11_____	Rocker Arm Cover
12_____	Oil Filler
13_____	Crankshaft Pulley
14_____	Flywheel Housing
15_____	Flywheel
16_____	Fuel Injection System
17_____	Air Inlet
18_____	Air Cleaner
19_____	Oil Pan
20_____	Water Pump
21_____	Thermostat Cover

Option Codes	Description
56_____	Paint
57_____	Water Pump Inlet
58_____	Power Take Off
59_____	Oil Cooler/Oil Filter
60_____	Add-On Fan Drive Pulley
61_____	After Treatment Device/Muffler
62_____	Alternator Mounting
63_____	Low-Pressure Fuel Lines
64_____	Exhaust Elbow
65_____	Turbocharger
66_____	Temperature Switch
67_____	Engine Sensors

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Record Keeping

Option Codes	Description	Option Codes	Description
22_____	Thermostat	68_____	Damper
23_____	Fan Drive	69_____	Engine Serial Number Plate
24_____	Fan Belt	70_____	Decomposition Tube (OEM)
25_____	Fan	71_____	SCR (OEM)
26_____	Block Heater	72_____	Performance Software and Labels
27_____	Radiator/Heat Exchanger	7A_____	Performance Software and Labels
28_____	Exhaust Manifold	73_____	After Treatment Dosing System
29_____	Ventilator System	74_____	Air Conditioning
30_____	Starting Motor	75_____	Restriction Indicator
31_____	Alternator	76_____	Oil Pressure Switch
32_____	DEF Lines, Pressure (OEM)	77_____	Timing Gear Cover (S450/S650)
33_____	DEF Lines, Supply/Return to Tank (OEM)	78_____	Air Compressor
34_____	DEF Tank and Header (OEM)	79_____	Certification
35_____	Final Fuel Filter	80_____	Sea Water Pump (Marine)
36_____	Front Plate and Idler Shafts	81_____	Primary Fuel Filter/Water Separator
37_____	Fuel Transfer Pump	82_____	Ignition System (Natural Gas)
38_____	Operator Manual	83_____	Vehicle Performance Software
39_____	Thermostat Housing	84_____	Wiring Harness
40_____	Dipstick and Tube	85_____	Fuel System (Natural Gas)
41_____	Belt Driven Auxiliary Drive (Add-On Crank Pulley)	86_____	Fan Pulley
42_____	DEF Line, Supply Module to Injector (OEM)	87_____	Belt Tensioner
43_____	Starting Aid	88_____	Oil Filter
44_____	Timing Gear Cover (S350)	89_____	EGR System
44_____	Tachometer Drive Sensors (S450/S650)	90_____	Trim Software (OEM)
45_____	Secondary Balancers	91_____	Engine Installation Kit (S350)
46_____	Cylinder Block with Camshaft	92_____	Engine Test Certificate/Engine Accessories (S350)
47_____	Crankshaft/Main Bearings	92_____	Engine Installation Kit (S450)
48_____	Connecting Rods/Pistons/Liners	93_____	Emission Label
49_____	Valve Actuating Mechanism	94_____	Custom Software
50_____	Oil Pump	95_____	Parts Installed at Factory
51_____	Cylinder Head with Valves	96_____	Engine Installation Kit/Ship With (S450/S650)
52_____	Gear Driven Auxiliary Drive	96_____	ECU Wiring Harness (6125/6135)
53_____	Fuel Heater	97_____	Field Installed Items
54_____	Turbo Air Intake	98_____	Engine Lift Strap
55_____	Shipping Stand	99_____	Service Only Parts

NOTE: This is a complete option code list based on the latest information available at the time of publication. The right is reserved to make changes

at any time without notice. Your engine will not contain all option codes listed.

RG, RG34710, 5004 -19-16AUG21-2/2

Record High-Pressure Fuel Pump Model and Serial Numbers

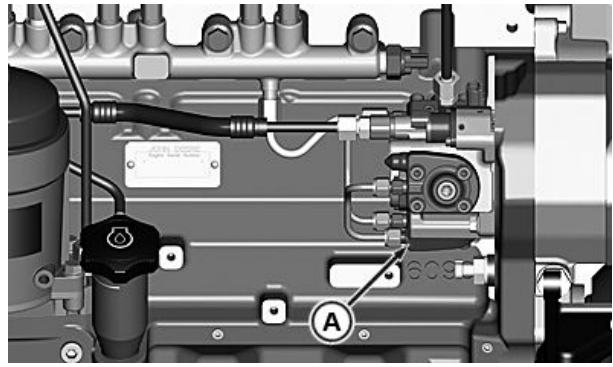
Record the fuel transfer pump model and serial information found on the serial number plate (A).

Model No. _____ RPM _____

Manufacturer's No. _____

Serial No. _____

A—Serial Number Plate



High Pressure Fuel Pump Serial Number Plate

RG17145—UN—26MAY09

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

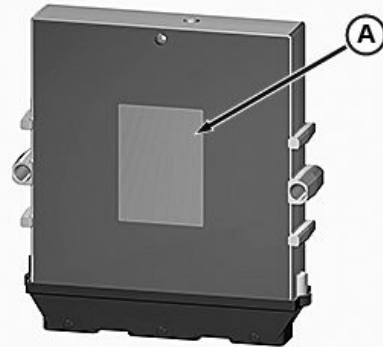
Record Engine Control Unit (ECU) Serial Number

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



Record Engine Control Unit (ECU) Serial Number

RG24314—UN—05SEP13

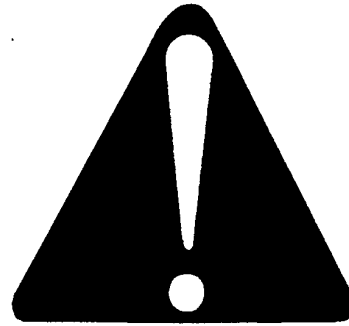
ZE59858,00001B1 -19-17OCT13-1/1

Safety

Recognize Safety Information

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

Follow recommended precautions and safe operating practices.



T81389 —UN—28JUN13

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

Understand Signal Words

DANGER; The signal word DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING; The signal word WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION; The signal word CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. CAUTION may also be used to alert against unsafe practices associated with events which could lead to personal injury.

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 -19-05OCT16-1/1

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.



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

TS201 —UN—15APR13

DX,READ -19-01AUG22-1/1

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.

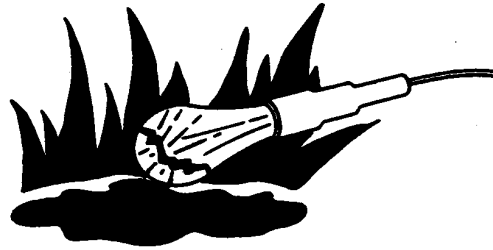


TS201 —UN—15APR13

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

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.



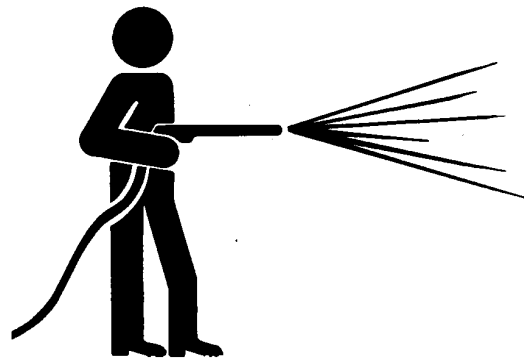
TS223 —UN—29AUG88

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

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

Use Proper Tools

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

Use power tools only to loosen threaded parts and fasteners.

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

Use only service parts meeting John Deere specifications.



TS779 —JUN—08NOV89

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

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

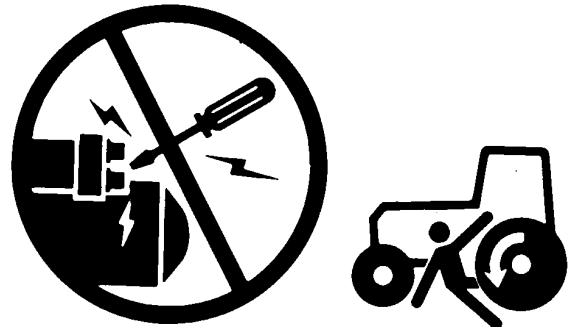
DX,LIVE -19-25SEP92-1/1

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 —JUN—11JAN89

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

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.

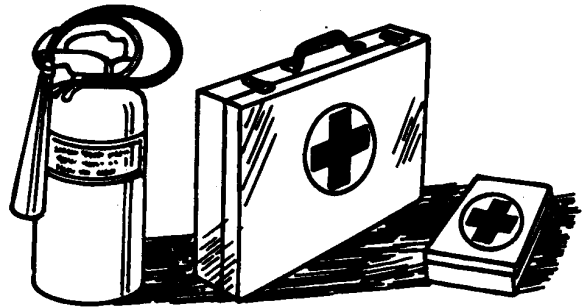
DX,FIRE1 -19-12OCT11-1/1

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

In Case of Fire

CAUTION: Avoid personal injury.

Stop machine immediately at the first sign of fire. Fire may be identified by the smell of smoke or sight of flames. Because fire grows and spreads rapidly, get off the machine immediately and move safely away from the fire. Do not return to the machine! The number one priority is safety.

Call the fire department. A portable fire extinguisher can put out a small fire or contain it until the fire department arrives; but portable extinguishers have limitations. Always put the safety of the operator and bystanders first. If attempting to extinguish a fire, keep your back to the wind with an unobstructed escape path so you can move away quickly if the fire cannot be extinguished.

Read the fire extinguisher instructions and become familiar with their location, parts, and operation before a fire starts. Local fire departments or fire equipment distributors may offer fire extinguisher training and recommendations.

If your extinguisher does not have instructions, follow these general guidelines:



1. Pull the pin. Hold the extinguisher with the nozzle pointing away from you, and release the locking mechanism.
2. Aim low. Point the extinguisher at the base of the fire.
3. Squeeze the lever slowly and evenly.
4. Sweep the nozzle from side-to-side.

DX,FIRE4 -19-22AUG13-1/1

TS227 —UN—15APR13

Handle Fluids Safely—Avoid Fires

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

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

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

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



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

TS227 —UN—15APR13

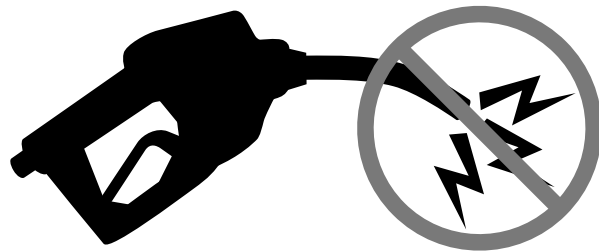
Avoid Static Electricity Risk When Refueling

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

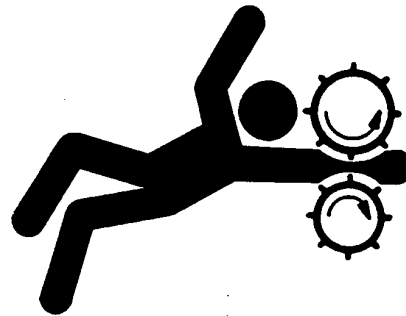
RG21992 —UN—21AUG13

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

Service Machines Safely

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

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



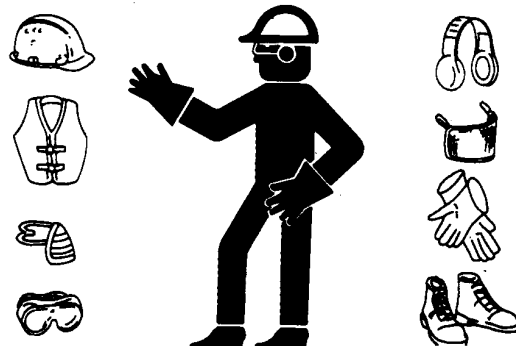
TS228 —UN—23AUG88

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

Wear Protective Clothing

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

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

Protect Against Noise

There are many variables that affect the sound level range, including machine configuration, condition and maintenance level of the machine, ground surface, operating environmental, duty cycles, ambient noise, and attachments.

Exposure to loud noise can cause impairment or loss of hearing.

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



TS207 —UN—23AUG88

DX,NOISE -19-03OCT17-1/1

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.

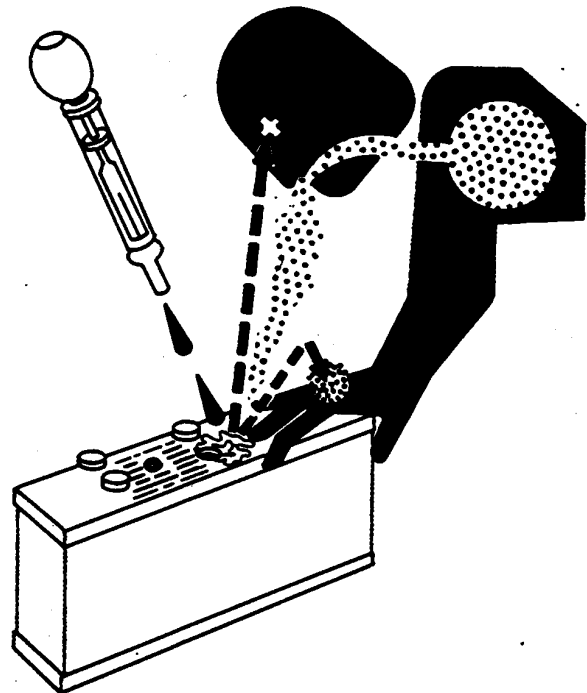
If acid is swallowed:

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,WWW,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:

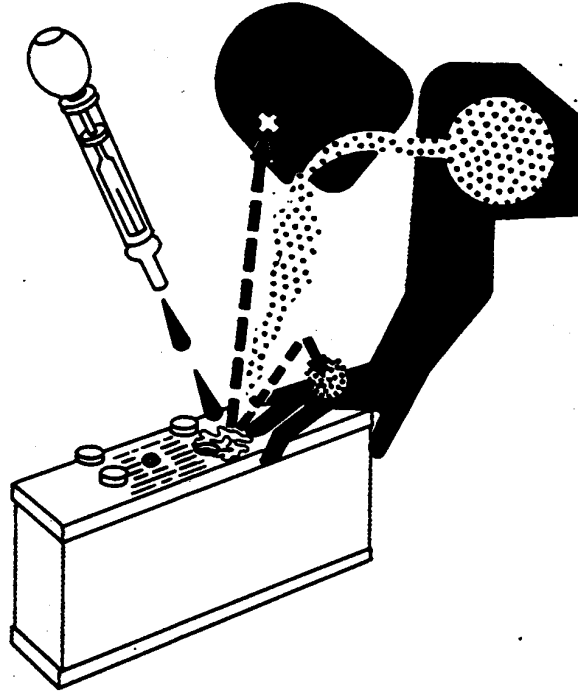
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

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

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

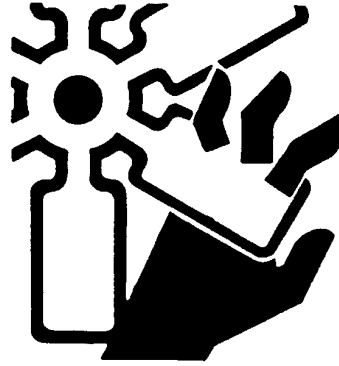
DX,ROTATING -19-18AUG09-1/1

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

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 away 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.

Falling while cleaning or working at height can cause serious injury. Use a ladder or platform to easily reach each location. Use sturdy and secure footholds and handholds.



TS218 —UN—23AUG88

DX, SERV -19-28FEB17-1/1

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.



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

TS220 —UN—15APR13

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.



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

TS953 —UN—15MAY90

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.

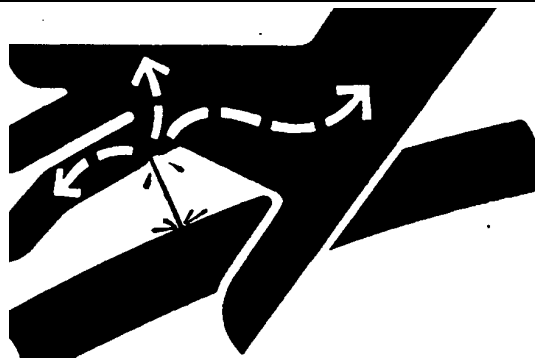
Replace worn or damaged hose assemblies immediately with John Deere approved replacement parts.

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.

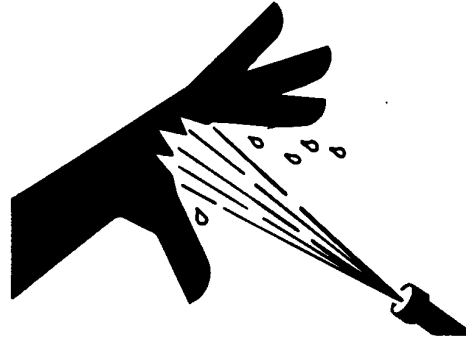
DX,FLUID -19-12OCT11-1/1

X9811 —UN—23AUG88

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.)



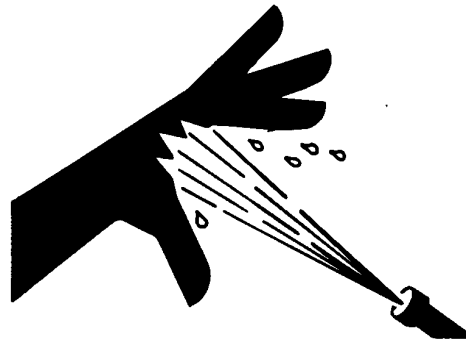
TS1343—UN—18MAR92

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

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

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).



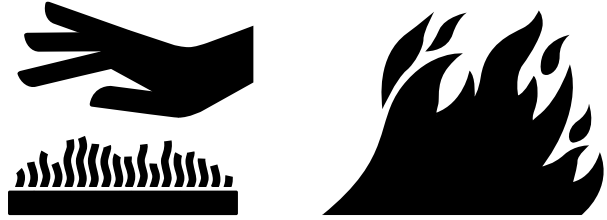
TS204—UN—15APR13

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

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.



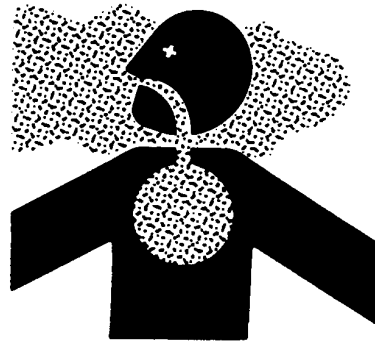
RG17488 —UN—21AUG09

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

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.



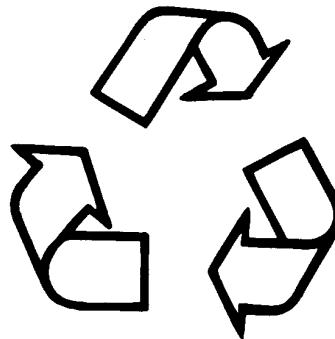
TS281 —UN—15APR13

DX,WW,COOLING -19-19AUG09-1/1

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);



- 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

TS1133—UN—15APR13

Fuels, Lubricants, and Coolant

Diesel Fuel

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

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

Diesel fuels specified to EN 590 or ASTM D975 are recommended. Renewable diesel fuel produced by hydrotreating animal fats and vegetable oils is basically identical to petroleum diesel fuel. Renewable diesel that meets EN 590, ASTM D975, or EN 15940 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.).

Cloud Point should be below the expected lowest ambient temperature or **Cold Filter Plugging Point (CFPP)** should be a maximum 10°C (18°F) below the fuel cloud point.

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).

Materials such as copper, lead, zinc, tin, brass and bronze should be avoided in fuel handling, distribution and storage equipment as these metals can catalyze fuel oxidation reactions which can lead to fuel system deposits and plugged fuel filters.

E-Diesel fuel

DO NOT use E-Diesel (Diesel fuel and ethanol blend). Use of E-Diesel fuel in any John Deere machine may void the machine warranty.

 **CAUTION: Avoid severe injury or death due to the fire and explosion risk from using E-Diesel fuel.**

¹See *DX, ENOIL12, OEM, DX, ENOIL12, T2, STD, or DX, ENOIL12, T2, EXT* for more information on Engine Oil and Filter Service Intervals.

Sulfur Content for Interim Tier 4, Final Tier 4, Stage III A and B, Stage IV, and Stage V Engines Above 560 kW

- Use **ONLY** diesel fuel with a maximum of 500 mg/kg (500 ppm) sulfur content.

Sulfur Content for Interim Tier 4, Final Tier 4, Stage III B, Stage IV Engines, and Stage V 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.¹
- **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 -19-13JUL20-1/1

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 practical 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. Keeping the free water drained and treating the bulk fuel storage tank quarterly with a maintenance dose of a biocide will prevent microbial growth. Contact your fuel supplier or John Deere dealer for recommendations.

DX,FUEL4 -19-13JAN18-1/1

Biodiesel Fuel

Biodiesel fuel is comprised of monoalkyl 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.

John Deere Stage V Engines Operating in the European Union

Where the engine is to be operated within the Union on diesel or non-road gas-oil, a fuel with a FAME content not greater than 8% volume/volume (B8) shall be used.

John Deere Engines with Exhaust Filter Except Stage V Engines Operating in the European Union

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 Fuel conditioners or equivalent, which contain detergent and dispersant additives, are required when using biodiesel blends from B10 to B20, and are recommended when using lower biodiesel blends.

John Deere Engines Without Exhaust Filter

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 fuel conditioners or equivalent, which contain detergent and dispersant additives, are required when using biodiesel blends from B10 to B100, 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 John Deere fuel products 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 fuel additives and conditioners or equivalent containing detergent/dispersants 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, distribution, and storage equipment
- 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 -19-13JAN18-2/2

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 calculated cetane index, fuel type, sulfur content, water content, appearance, suitability for cold weather

operations, bacteria, cloud point, acid number, particulate contamination, and whether the fuel meets ASTM D975 or equivalent specification.

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

DX,FUEL6 -19-13JAN18-1/1

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 Cold 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) or equivalent 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 -19-13JAN18-1/1

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

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

- 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 CK-4	ACEA E9
API CJ-4	ACEA E7
API CI-4 PLUS	ACEA E6
API CI-4	ACEA E5
API CH-4	ACEA E4
API CG-4	ACEA E3
API CF-4	
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 -19-02NOV16-1/1

Diesel Engine Oil — Marine Engines

Failure to follow applicable oil standards and drain intervals can result in severe engine damage that might not be covered under warranty. Warranties, including the emissions warranty, are not conditioned on the use of John Deere oils, parts, or service.

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

John Deere Plus-50™ II oil is preferred.

John Deere Torq-Gard™ is also allowed.

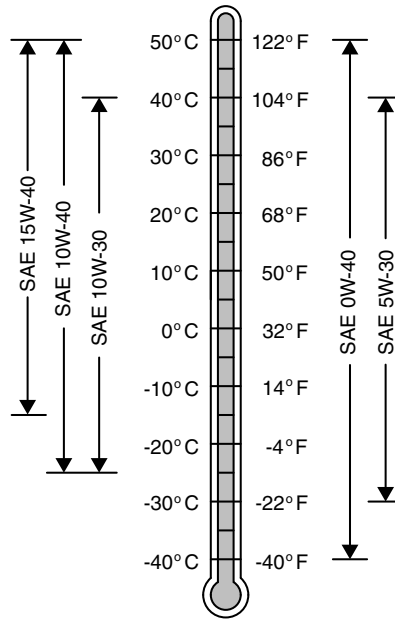
Other oils may be used if they meet one or more of the following standards:

- API Service Category CK-4
- 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).

TS1691 —UN—18JUL07

AK08008,000004A -19-17APR17-1/1

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 or other qualified service provider 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 or qualified service provider.
- **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™ or “Other Oils” with approved oil analysis.
- “Other Oils” include John Deere Torq-Gard™ and oils meeting the following standards: API CK-4, 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		
Engine Model	6090AFM85 6090SFM85	6090HFM85 (Auxiliary)
Engine Type	Generator	Propulsion
Fuel Sulfur	Less than 500 mg/kg (500 ppm)	
Plus-50 Oil and JD Filters*	500 hours	375 hours
Fuel Sulfur	Less than 1000 mg/kg (1000 ppm)	
Plus-50 Oils*	375 hours	500 hours
Other Oils	250 hours	250 hours
Fuel Sulfur	1000—2000 mg/kg (1000—2000 ppm)	
Plus-50 Oils*	300 hours	400 hours
Other Oils	200 hours	200 hours
Fuel Sulfur	2000—10000 mg/kg (2000—10000 ppm)	
Plus-50 Oils*	Contact John Deere dealer or qualified service provider	350 hours
Other Oils	Contact John Deere dealer or qualified service provider	175 hours
Fuel Sulfur	Greater than 10000 mg/kg (Greater than 10000 ppm)	
Plus-50 Oils*	Do not use	250 hours
Other Oils	Do not use	125 hours

*Or “Other Oils” with approved oil analysis

Oil analysis may extend the service interval of “Other Oils” to a maximum not to exceed the interval of Plus-50 II oils. Oil analysis means taking a series of oil samples at 50-hour increments beyond the normal service interval until either the data indicates the end of useful oil life or the maximum service interval of John Deere Plus-50 II oils is reached.

*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 John Deere branded fluids or fluids that have been tested and/or approved for use in John Deere equipment.

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

DX,ALTER -19-13JAN18-1/1

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)

Failure to follow applicable coolant standards and drain intervals can result in severe engine damage that may not be covered under warranty. Warranties, including the emissions warranty, are not conditioned on the use of John Deere coolants, parts, or service.

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:

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¹Coolant analysis may extend the service interval of other "Coolants" to a maximum not to exceed the interval of Cool-Gard II coolants. Coolant analysis means taking a series of coolant samples at 1000 hour increments beyond the normal service interval until either the data indicate the end of useful coolant life or the maximum service interval of Cool-Gard II is reached.

- Pre-mix coolant meeting ASTM D6210 requirements
- Is formulated with a 2-ethylhexanoic acid (2-EHA) free additive package
- 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
- Is formulated with a 2-ethylhexanoic acid (2-EHA) 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. 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.¹

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.

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. 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 l 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 -19-13JAN18-1/1

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 -19-17FEB20-1/1

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.



SERVICEGARD™ Part Number 75240

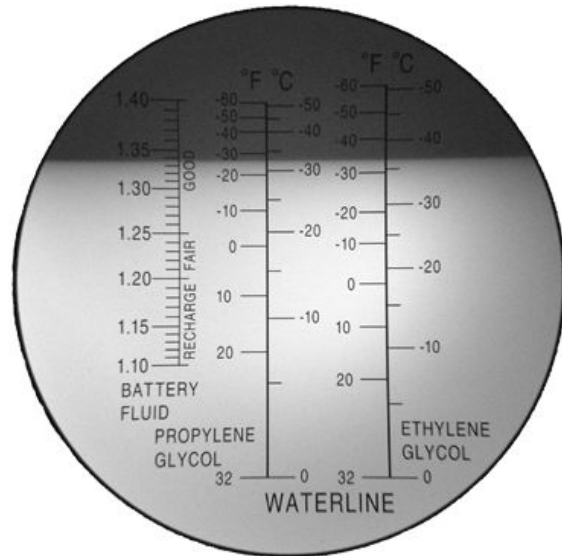


Image with a Drop of 50/50 Coolant Placed on the Refractometer Window

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

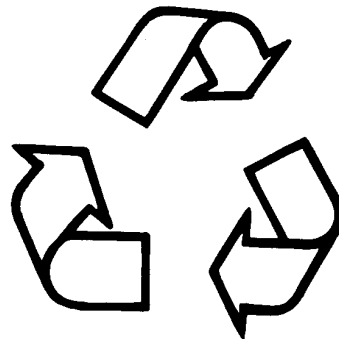
Disposing of Coolant

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.



Recycle Waste

RG,RG34710,7543 -19-26APR18-1/1

Instrument Panels

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



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also verify that the additional requirements set forth in the John Deere Marine Application Guidelines were met during engine installation.

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)

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.

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.

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 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 warns the operator if coolant temperature rises above the preset safe operating temperature.

C—Voltmeter

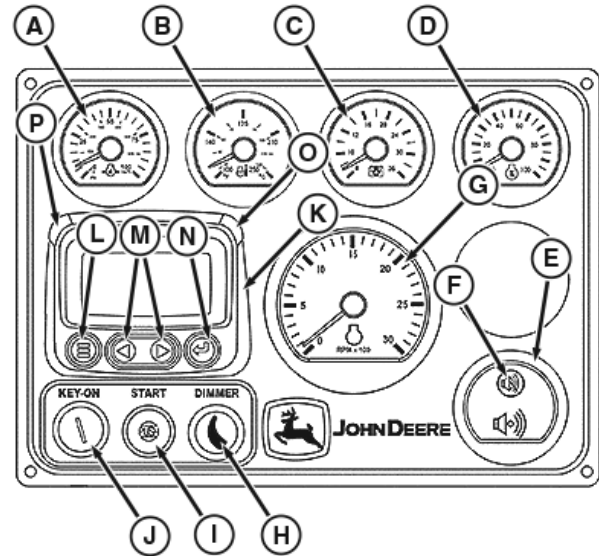
The voltmeter (C) indicates system battery voltage. The amber "Warning" light (P) illuminates when battery voltage is too low for proper operation of the fuel injection system.

D—Percent Load Gauge

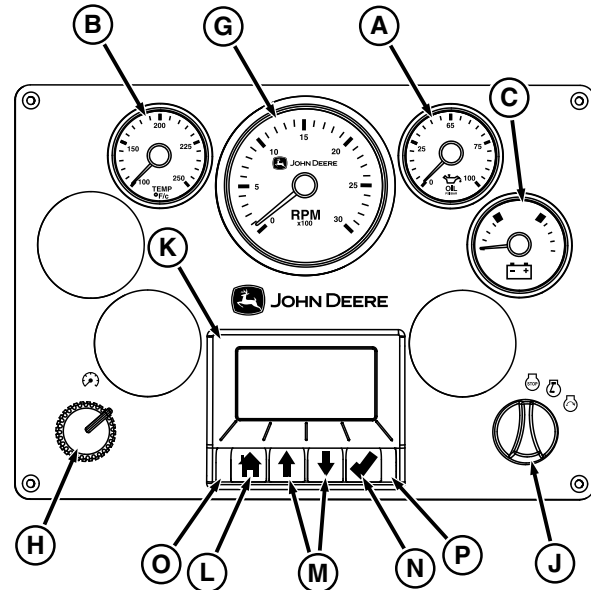
If equipped, the percent load gauge shows percent of available engine power being used by the vessel.

E—Audible Alarm

The audible alarm (E) sounds 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).



Instrument Panel (Option A)



Instrument Panel (Option B)

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

NOTE: Audible alarm is mounted behind the panel on option B.

F—Audible Alarm Override Button (Option A only)

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

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diagnostic gauge (K) also has a backlight adjustment function.

I—Start Button

If equipped, 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.

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

J—Key Switch (Option A)

The main station 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 remote station instrument panel has a start/stop rocker in place of the key switch. With the key switch on the main station instrument panel in the ON position, the engine can be started and stopped from the remote station instrument panel.

J—Key Switch (Option B)

The main station instrument panel has a three-position (OFF/ON/CRANK) key switch (J) which controls the engine electrical system, starts and stops the engine.

The remote station instrument panel has a stop button in place of the key switch. With the key switch on the main station instrument panel in the ON position, the engine can be started and stopped from the remote station 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 switches 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 or OEM Diagnostic Gauges Operator’s Manual OMDZ109098.)

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.

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PV101 Instrument Panels

Interim tier 4 / Stage III B John Deere PowerTech OEM 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. Refer to your engine application manual for specific guidelines if John Deere-sourced controls and instrumentation are not used.

NOTE: This manual only covers operation of engine with a John Deere control system.

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—Diagnostic Gauge/Hour Meter

The diagnostic gauge (A) displays diagnostic trouble codes (DTCs) as they are accessed. Other information on the engine can be accessed using the touch keys (N, O, and P). The hour meter 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.

B—Tachometer

The tachometer (B) indicates engine speed in hundreds of revolutions per minute (rpm). **C—Voltmeter (Optional)**

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

D—Audible Alarm (Optional)

The audible alarm (D) 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).

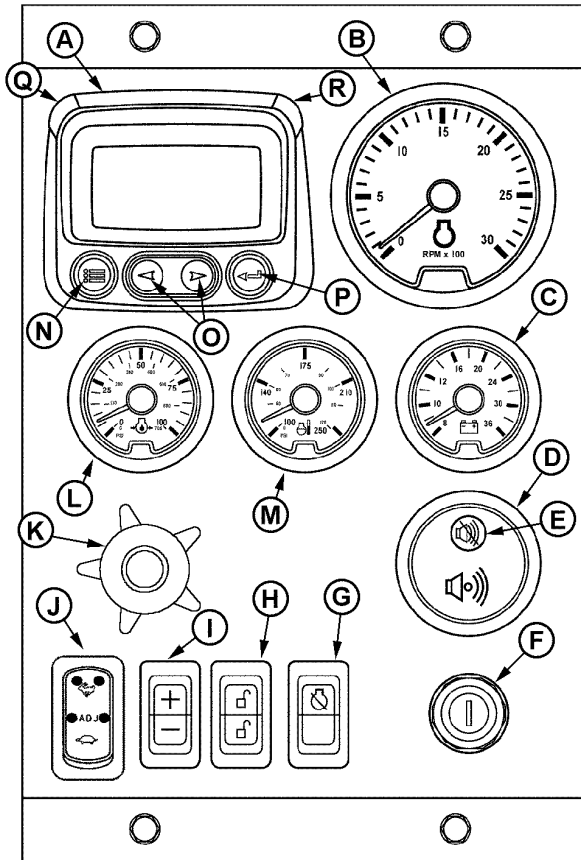
E—Audible Alarm Override Button

The optional audible alarm has an override button (E) that silences the audible alarm for approximately two minutes when pressed.

F—Key Start Switch

The three-position key start switch (F) controls the engine electrical system. From the "OFF" position when the key switch is turned clockwise to "START", the engine will crank. When the engine starts, the key is released and returns to the "ON" (RUN) position.

G—Override Shutdown Rocker Switch



Full-Featured Instrument Panel

- | | |
|------------------------------------------|----------------------------------------------|
| A—Diagnostic Gauge/Hour Meter | J—High-Low Speed Select Rocker Switch |
| B—Tachometer | K—Analog Throttle Control (Optional) |
| C—Voltmeter (Optional) | L—Oil Pressure Gauge |
| D—Audible Alarm (Optional) | M—Coolant Temperature Gauge |
| E—Audible Alarm Override Button | N—Menu Key |
| F—Key Switch | O—Arrow Key (2 used) |
| G—Override Shutdown Rocker Switch | P—Enter Key |
| H—Bump Enable Rocker Switch | Q—Amber "WARNING" Indicator Light |
| I—Speed Select Rocker Switch | R—Red "STOP ENGINE" Indicator Light |

Switch will be present, but may not be active, depending on engine control unit (ECU) options originally selected. If switch is active, pressing the upper half of the override shutdown switch (G) will override an engine shutdown signal. The switch must be pressed within 30 seconds to prevent undesired shutdown of engine. Pressing this switch will override the ECU engine shutdown command for 30 seconds at a time to move vehicle to a safe location.

H—Bump Speed Enable Rocker Switch

Continued on next page

JR74534.00002C7 -19-16AUG21-1/2

This is a three-position switch (H) with the center position as "OFF" (locked). With this switch in the "OFF" position, the speed select switch (I) is also locked, to prevent accidental changes in operating speed. Pressing upper or lower half of switch (H) will unlock or enable the bump speed switch to take effect using speed select switch (I).

I—Speed Select Rocker Switch

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

J—High-Low Speed Select Rocker Switch

The high-low speed select switch (J) is used to set the engine operating speeds at slow (turtle) or fast (rabbit). Factory preset idle speeds can also be adjusted using bump speed enable switch (H) with speed select switch (I).

The basic instrument panel will have the high-low speed select switch only. Press and hold up (+) or down (-) to adjust engine speed as desired. The engine speed selected will not be held in the memory. To adjust engine speeds, See Changing Engine Speeds in Section 20.

How To Select Preset Operating Speeds (Bump Speeds)

First select "Turtle" (slow) or "Adj" by pressing speed select switch (J) to "Turtle" (slow) or "Adj"(center). Then you can press either the upper or lower portion of the bump speed enable switch (H) to unlock the setting. The bump speed enable must be held down as the speed select switch (J) is used to change the setting by pressing (+) to increase speed or (-) to decrease speed.

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

The fast idle speed is not adjustable. It will always go back to the factory preset fast idle speed.

K—Analog Throttle Control (Optional)

The throttle control (K) is used to control engine speed. This control is available only on engines with analog throttle.

L—Engine Oil Pressure Gauge

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

M—Engine Coolant Temperature Gauge

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

N—Menu Key

The menu key is pressed to either enter or exit the menu screens on the diagnostic gauge (A).

O—Arrow Keys

Use the arrow keys (O) to change the display on the window of the diagnostic gauge (A) 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 procedure for accessing engine information on the diagnostic gauge using the touch keys.

P—Enter Key

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

Q—Amber "WARNING" Indicator Light

When light is illuminated, an abnormal condition exists. It is not necessary to shut down the engine immediately, but the problem should be corrected as soon as possible.

R—Red "STOP ENGINE" Indicator Light

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

JR74534,00002C7 -19-16AUG21-2/2

PV101 Diagnostic Gauge — Using

The diagnostic gauge (A) allows the operator to monitor engine functions, view diagnostic trouble codes (DTCs), and perform preliminary diagnostics. The gauge is linked to the electronic control system and sensors.

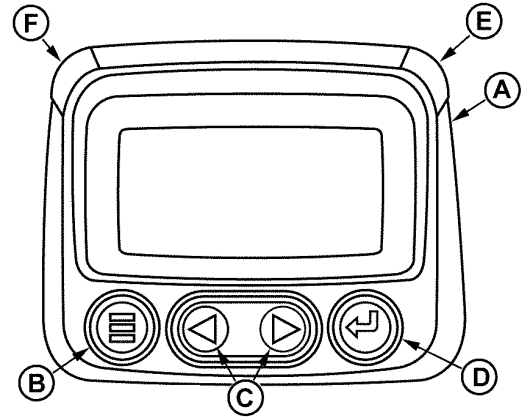
The menu key (B) allows the operator to access the main menu of the diagnostic gauge. For more information see PV101 Diagnostic Gauge — Main Menu in Section 15. This key also allows the operator to cancel an option and go back to the previous menu or home menu.

The arrow keys (C) allows the operator to scroll between menu items. The arrow keys automatically change from up and down, to left and right depending on the menu item to be selected.

The enter key (D) allows the operator to access menu items selected by the arrow keys (C) and confirm changes made by the operator.

The red “STOP ENGINE” indicator light (E) allows the operator to visually see when a condition exists which requires immediate operator action and service.

The amber “WARNING” indicator light (F) allows the operator to visually see when a condition exists which requires operator action.



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

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PV101 Diagnostic Gauge — Main Menu

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens.

The main menu is the starting point in accessing engine information and configuring the diagnostic gauge. Press the menu key (B) to access the main menu.

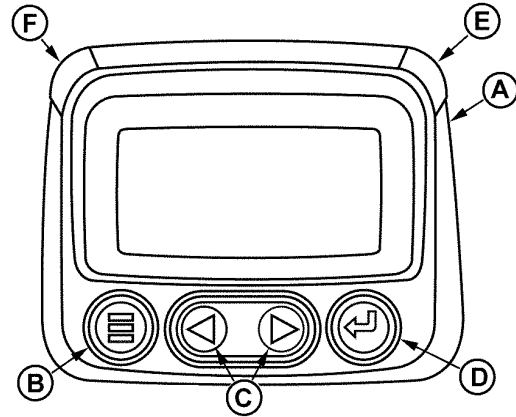
Use the arrow keys (C) and enter key (D) to view menu items displayed:

- Go to 4-up display
- Exhaust filter
- Engine speed control
- Languages
- Stored codes
- Engine configuration
- Setup 1-up display
- Setup 4-up display
- Select units
- Adjust backlight
- Adjust contrast
- Utilities

Listed are examples of features available in main menu items.

In Utilities:

- Gauge data
- Remove all gauges
- Software version
- Modbus setup
- Fault conversion



Diagnostic Gauge

A—Diagnostic Gauge
B—Menu Key
C—Arrow Key (2 used)

D—Enter Key
E—Red “STOP ENGINE”
Indicator Light
F—Amber “WARNING”
Indicator Light

- Select engine ECU
- Clear machine hours
- Performance data
- Interactive tests
- Reset trip
- Set function instance
- ECU software update

JR74534,00002C8 -19-16AUG21-1/1

RG13132 —UN—09SEP03

PV101 Diagnostic Gauge — Essential Menus

Automatic Exhaust Filter Cleaning

To enable auto exhaust filter cleaning mode:

1. Press menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to EXHAUST FILTER
3. Press select key
4. Press arrow keys to scroll up or down to AUTO EXH FLT CLEAN
5. Press select key to enable auto exhaust filter cleaning

Manual/Parked Exhaust Filter Cleaning

To request a manual/parked exhaust filter cleaning:

1. Reduce engine speed to slow idle
2. Press menu key
3. Press arrow keys to scroll up or down to EXHAUST FILTER
4. Press select key
5. Press arrow keys to scroll up or down to REQUEST EXH FLT CLEAN
6. Press select key to request a manual/parked exhaust filter cleaning
7. Follow directions on display and ensure all conditions are met
8. Press select key to CONFIRM all conditions are met

Disable Exhaust Filter Cleaning

To disable the auto exhaust filter cleaning mode:

1. Press menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to EXHAUST FILTER
3. Press select key
4. Press arrow keys to scroll up or down to DISABLE EXH FLT CLEAN
5. Press select key to disable exhaust filter cleaning

Fault Codes — Active

To view active fault code information:

1. Press menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to FAULTS
3. Press select key
4. Press arrow keys to scroll up or down to ACTIVE FAULTS
5. Press select key
6. Press arrow keys to scroll through available faults

Fault Codes — Stored

To view stored fault code information:

1. Press menu key on diagnostic gauge
2. Press arrow keys to scroll up or down to FAULTS
3. Press select key
4. Press arrow keys to scroll up or down to STORED FAULTS
5. Press select key
6. Press arrow keys to scroll up or down to VIEW
7. Press select key
8. Press arrow keys to scroll through available faults

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DG14 Diagnostic Gauge — Using

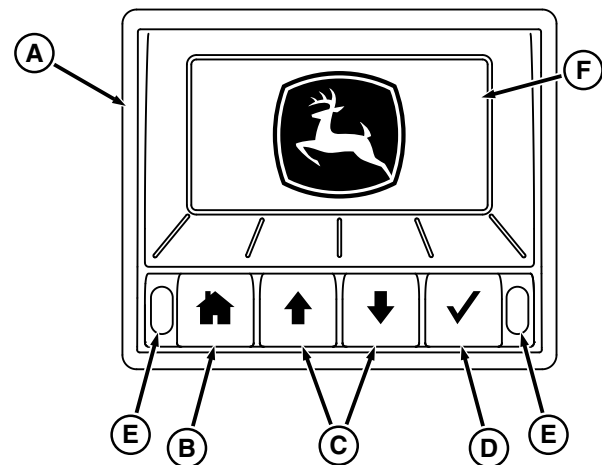
The diagnostic gauge (A) allows the operator to monitor engine functions, view diagnostic trouble codes (DTCs), and perform preliminary diagnostics. The gauge is linked to the electronic control system and sensors.

The home menu key (B) allows the operator to access the main menu of the diagnostic gauge. For more information, see DG14 Diagnostic Gauge — Main Menu in Section 15. This key also allows the operator to cancel an option and go back to the previous menu or home menu.

The arrow keys (C) allows the operator to scroll between menu items. The arrow keys automatically change from up and down, to left and right depending on the menu item to be selected.

The check mark select key (D) allows the operator to access menu items selected by the arrow keys (C) and confirm changes made by the operator.

The indicator lights (E) allows the operator to visually see the presence of an active DTC.



DG14 Diagnostic Gauge

A—Diagnostic Gauge
B—Home Menu Key
C—Arrow Key (2 used)

D—Check Mark Select Key
E—Indicator Light (2 used)
F—Display

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DG14 Diagnostic Gauge — Main Menu

NOTE: The engine does not need to be running to navigate the diagnostic gauge menu screens.

The main menu is the starting point in accessing engine information and configuring the diagnostic gauge. Press the home menu key (B) to access the main menu.

Use the arrow keys (C) and select key (D) to view menu items displayed:

- Function
- Display
- Utility
- Setup

Listed are examples of features available in main menu items.

In Function:

- View DTC
- Reset trip (FT4 Only)
- Exhaust regeneration (IT4 & FT4 Only)
- ECU software updates

In Display:

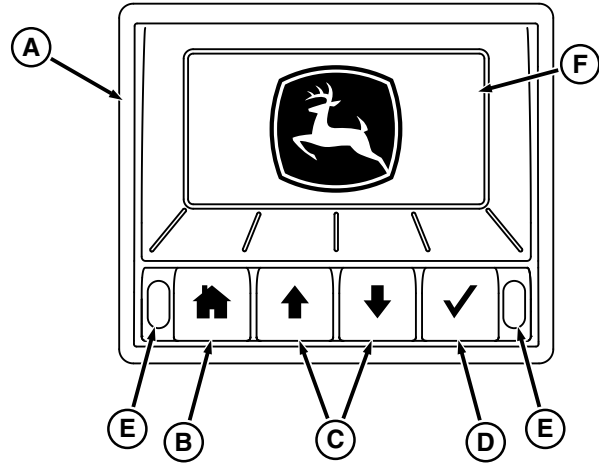
- Adjust backlight
- Adjust indicator brightness
- Display option setup

In Utility:

- Full parameter list
- Software data
- Select units
- Select language

In Setup:

- Select analog input
- Select digital input
- Select digital output



Diagnostic Gauge

A—Diagnostic Gauge
B—Home Menu Key
C—Arrow Key (2 used)

D—Check Mark Select Key
E—Indicator Light (2 used)
F—Display

- Alarm functionality
- Add J1939 gauge
- Set RS485 messaging
- Set engine source address
- Set function instance
- Harness diagnostics
- TSC control (password protected)

Key Code for Password Protected Screens

Numeric values are assigned to keys on diagnostic gauge as identified below:

- 1 — Home Menu Key
- 2 — Up Arrow Key
- 3 — Down Arrow Key
- 4 — Check Mark Select Key

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DG14 Diagnostic Gauge — Essential Menus

Automatic Exhaust Filter Cleaning

To enable auto exhaust filter cleaning mode:

1. Press home menu key on diagnostic gauge.
2. Press arrow keys to scroll up or down to FUNCTION.
3. Press check mark select key.
4. Press arrow keys to scroll up or down to EXHAUST REGENERATION.
5. Press check mark select key.
6. Press arrow keys to scroll up or down to AUTOMATIC.
7. Press check mark select key to enable auto exhaust filter cleaning.

Manual/Parked Exhaust Filter Cleaning

To request a manual/parked exhaust filter cleaning:

1. Reduce engine speed to slow idle.
2. Press home menu key on diagnostic gauge.
3. Press arrow keys to scroll up or down to FUNCTION.
4. Press check mark select key.
5. Press arrow keys to scroll up or down to EXHAUST REGENERATION.
6. Press check mark select key.
7. Press arrow keys to scroll up or down to FORCED.
8. Press check mark select key to request a manual/parked exhaust filter cleaning.
9. Follow directions on display and ensure all conditions are met.
10. Press check mark select key to CONFIRM all conditions are met.

Disable Exhaust Filter Cleaning

To disable the auto exhaust filter cleaning mode:

1. Press home menu key on diagnostic gauge.

2. Press arrow keys to scroll up or down to FUNCTION.
3. Press check mark select key.
4. Press arrow keys to scroll up or down to EXHAUST REGENERATION.
5. Press check mark select key.
6. Press arrow keys to scroll up or down to INHIBIT.
7. Press check mark select key to disable exhaust filter cleaning.
8. Press check mark select key to continue after the warning has been acknowledged.

Fault Codes — Active

To view active fault code information:

1. Press home menu key on diagnostic gauge.
2. Press arrow keys to scroll up or down to FUNCTION.
3. Press check mark select key.
4. Press arrow keys to scroll up or down to VIEW FAULT CODES.
5. Press check mark select key.
6. Press arrow keys to scroll up or down to ACTIVATE.
7. Press check mark select key.
8. Press arrow keys to scroll through available faults.

Fault Codes — Stored

To view stored fault code information:

1. Press (home) menu key on diagnostic gauge.
2. Press arrow keys to scroll up or down to FUNCTION.
3. Press (check mark) select key.
4. Press Arrow keys to scroll up or down to VIEW FAULT CODES.
5. Press (check mark) select key.
6. Press arrow keys to scroll up or down to STORED.
7. Press (check mark) select key.
8. Press Arrow keys to scroll through available faults.

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PV480 Instrument Panel

John Deere PowerTech™ OEM engines have an electronic control system, which has controls and gauges as shown. The following information applies only to those controls and gauges supplied by John Deere. Refer to your engine application manual for specific guidelines if John Deere-sourced controls and instrumentation are not used.

The 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 John Deere.

Instrument Panel

A — Diagnostic Gauge

The diagnostic gauge (A) allows the operator to view fuel level, DEF level, engine parameters, diagnostic trouble codes (DTCs), and other engine functions. 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.

B — Arrow Keys

The arrow keys (B) allow the operator to select menu items.

C — Menu Key

The menu key (C) allows the operator to access the main menu of the diagnostic gauge.

D — Select Key

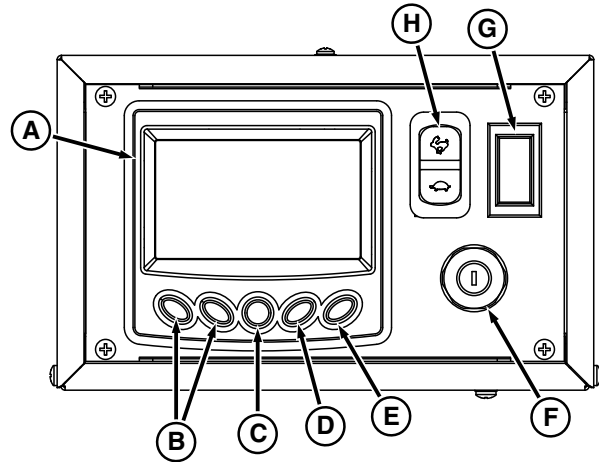
The select key (D) allows the operator to access menu items selected by the arrow keys (B) and confirm changes made by the operator.

E — Exit Key

The exit key (E) allows the operator to cancel an option and to go back to the previous menu.

F — Key Switch

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PV480 Instrument Panel

A—Diagnostic Gauge
B—Arrow Key (2 used)
C—Menu Key
D—Select Key

E—Exit Key
F—Key Switch
G—Cover
H—Speed Select Rocker Switch

The three-position key switch (F) controls the engine electrical system. When the key switch is turned clockwise to "START", the engine cranks. When the engine starts, the key switch is released and returns to the "ON" (RUN) position.

G — Cover

The cover (G) hides an expansion slot for an additional switch.

H — Speed Select Rocker Switch

The speed select rocker switch (H) is used to bump engine speed up (+) or down (-) in small increments during operation.

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PV480 Diagnostic Gauge — Using

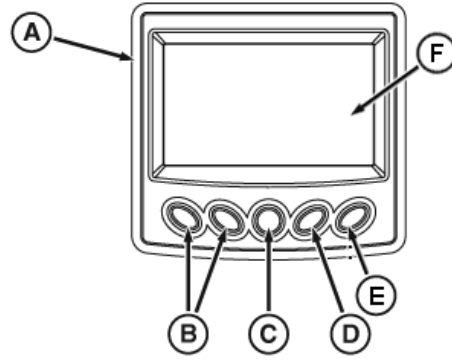
The diagnostic gauge (A) allow the operator to monitor engine functions, view diagnostic trouble codes (DTCs), and perform preliminary diagnostics. The gauge is linked to the electronic control system and sensors.

The arrow keys (B) allows the operator to scroll between menu items. The arrow keys automatically change from up and down, to left and right depending on the menu item to be selected.

The menu key (C) allows the operator to access the main menu of the diagnostic gauge. For more information, see PV480 Diagnostic Gauge — Main Menu in Section 15.

The select key (D) allows the operator to access menu items selected by the arrow keys (B) and confirm changes made by the operator.

The exit key (E) allows the operator to cancel an option and to go back to the previous menu.



PV480 Diagnostic Gauge

- | | |
|----------------------|--------------|
| A—Diagnostic Gauge | D—Select Key |
| B—Arrow Key (2 used) | E—Exit Key |
| C—Menu Key | F—Display |

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PV480 Diagnostic Gauge — Main Menu

NOTE: The engine does not need to be running to navigate the diagnostic gauge screens.

The main menu is the starting point in accessing engine information and configuring the diagnostic gauge. Press the menu key (C) to access the main menu.

Use the arrow keys (B) and select key (D) to view menu items displayed:

- User Settings
- Faults
- Exhaust Filter
- Start Options
- Service
- Utilities

Listed are examples of features available in main menu items.

In User Settings:

- Date
- Time
- Language
- Units
- Brightness
- Ambient Light

In Check Faults:

- ActiveDTCs
- Stored DTCs

In Exhaust Filter:

- Status
- Auto exhaust filter clean
- Disable exhaust filter clean
- Request exhaust filter clean

In Start Options:

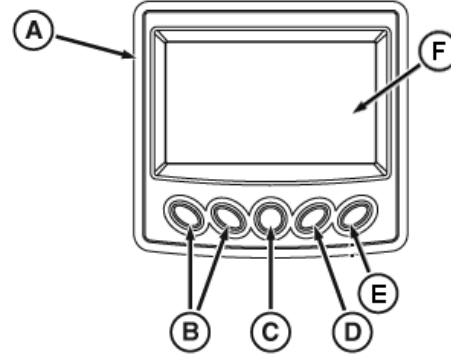
- Auto features
- Manual features
- Clock start
- Temperature start

In Service:

- Data list screens
- Engine hours
- Data logger
- Service reminders
- Harness diagnostics
- Component identification

In Utilities:

- System settings
- Pressure governing
- ECU software update
- Advanced settings (password protected)



PV480 Diagnostic Gauge

- | | |
|----------------------|--------------|
| A—Diagnostic Gauge | D—Select Key |
| B—Arrow Key (2 used) | E—Exit Key |
| C—Menu Key | F—Display |

RG23474—UN—06JUN13

BL90236,0000001 -19-19AUG21-1/1

PV480 Diagnostic Gauge — Essential Menus

Automatic Exhaust Filter Cleaning

To enable auto exhaust filter cleaning mode:

1. Press Menu key on diagnostic gauge.
2. Press Arrow keys to scroll up or down to EXHAUST FILTER.
3. Press Select key.
4. Press Arrow keys to scroll up or down to AUTO EXH FLT CLEAN.
5. Press Select key to enable auto exhaust filter cleaning.

Manual/Parked Exhaust Filter Cleaning

To request a manual/parked exhaust filter cleaning:

1. Reduce engine speed to slow idle.
2. Press Menu key.
3. Press Arrow keys to scroll up or down to EXHAUST FILTER.
4. Press Select key.
5. Press Arrow keys to scroll up or down to REQUEST EXH FLT CLEAN.
6. Press Select key to request a manual/parked exhaust filter cleaning.
7. Follow directions on display and ensure all conditions are met.
8. Press Select key to CONFIRM all conditions are met.

Disable Exhaust Filter Cleaning

To disable the auto exhaust filter cleaning mode:

1. Press Menu key on diagnostic gauge.
2. Press Arrow keys to scroll up or down to EXHAUST FILTER.
3. Press Select key.
4. Press Arrow keys to scroll up or down to DISABLE EXH FLT CLEAN.
5. Press Select key to disable exhaust filter cleaning.

Fault Codes — Active

To view active fault code information:

1. Press Menu key on diagnostic gauge.
2. Press Arrow keys to scroll up or down to FAULTS.
3. Press Select key.
4. Press Arrow keys to scroll up or down to ACTIVE FAULTS.
5. Press Select key.
6. Press Arrow keys to scroll through available faults.

Fault Codes — Stored

To view stored fault code information:

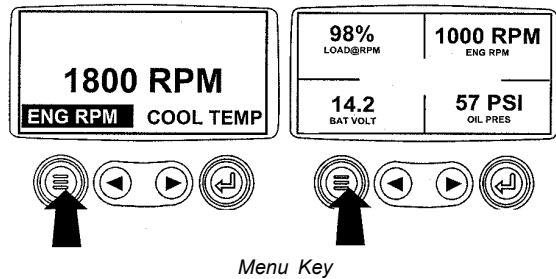
1. Press Menu key on diagnostic gauge.
2. Press Arrow keys to scroll up or down to FAULTS.
3. Press Select key.
4. Press Arrow keys to scroll up or down to STORED FAULTS.
5. Press Select key.
6. Press Arrow keys to scroll up or down to VIEW.
7. Press Select key.
8. Press Arrow keys to scroll through available faults.

BL90236,0000024 -19-19AUG21-1/1

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.



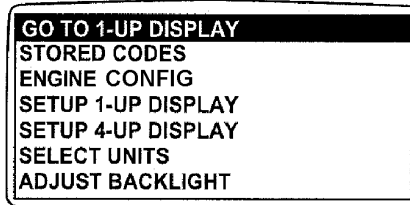
Menu Key

Continued on next page

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

RG13159—UN—26SEP03

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

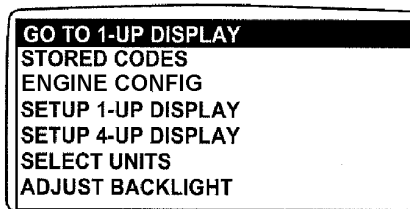


Menu Display

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

RG13160 —UN—02OCT03

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

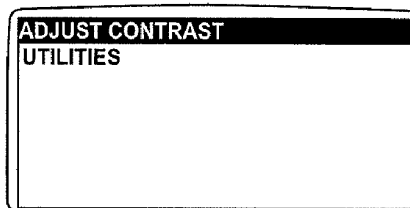


Main Menu Items

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

RG13161 —UN—02OCT03

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



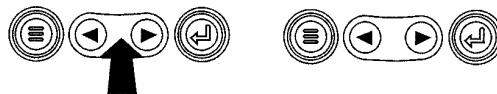
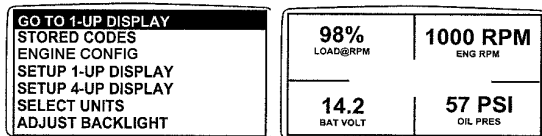
Last Items On Main Menu

Continued on next page

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

RG13162 —UN—26SEP03

- 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.



Use Arrow Buttons To Scroll / Quadrant Display

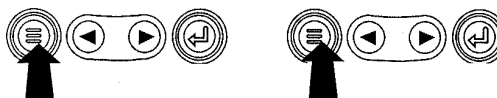
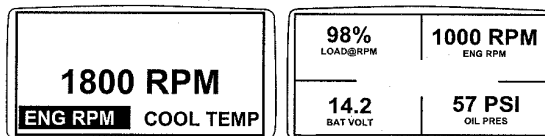
OURGP11,00000A9 -19-20SEP13-5/5

RG13163 —UN—02OCT03

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.



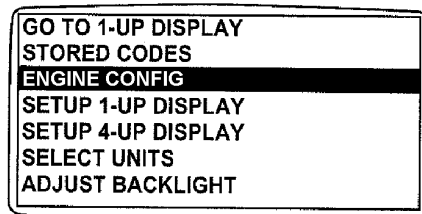
Menu Key

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

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

RG13159 —UN—26SEP03

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



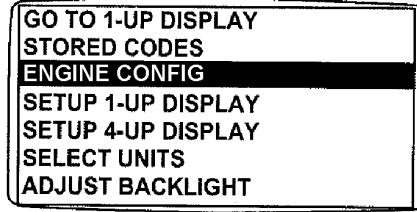
Select Engine Configuration

Continued on next page

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

RG13164 —UN—07OCT03

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

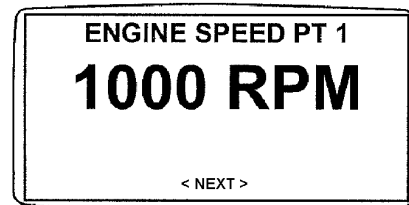


Enter Key

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

RG13165 —UN—02OCT03

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

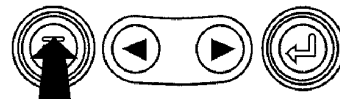
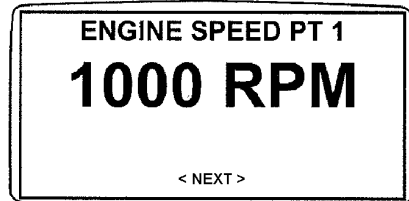


Use Arrow Keys To Scroll

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

RG13166 —UN—29SEP03

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



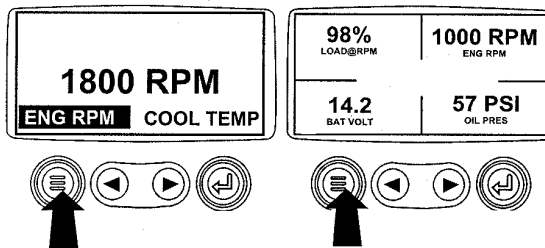
Return To Main Menu

Continued on next page

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

RG13167 —UN—29SEP03

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



Exit Main Menu

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

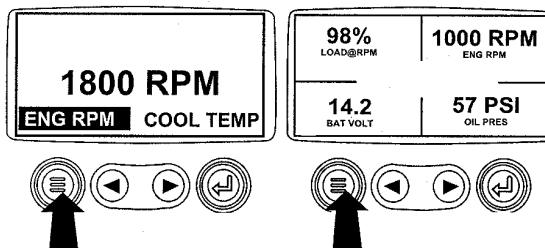
RG13159—UN—26SEP03

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.

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

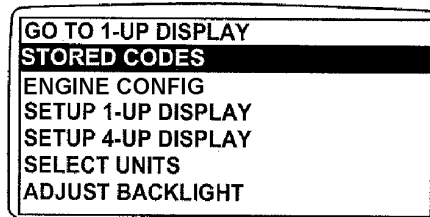


Menu Key

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

RG13159—UN—26SEP03

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



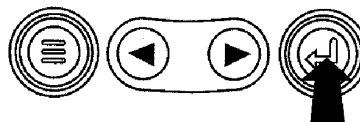
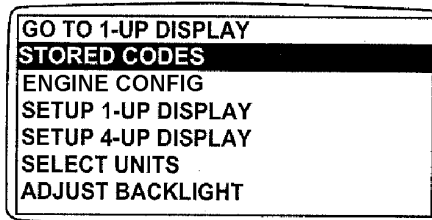
Select Stored Codes

Continued on next page

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

RG13168—UN—02OCT03

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

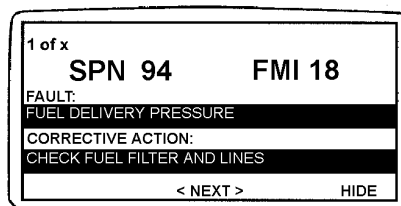


Enter Key

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

RG13169 —UN—02OCT03

- 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.

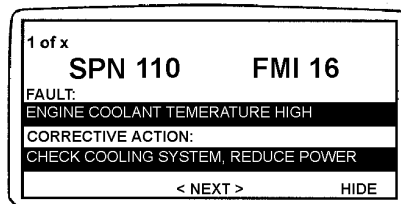


Use Arrow Keys To Scroll

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

RG13245 —UN—02OCT03

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



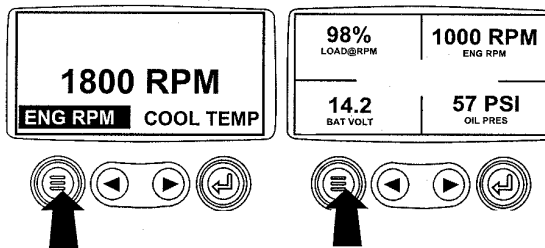
Return To Main Menu

Continued on next page

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

RG13246 —UN—02OCT03

- 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

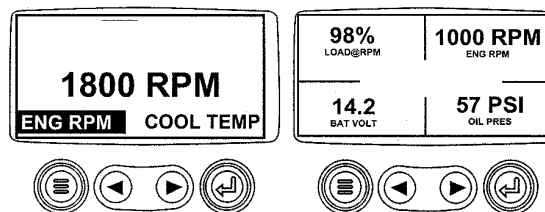
RG13159—UN—26SEP03

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.

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



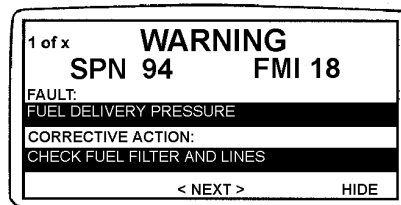
Normal Operation

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

RG13172—UN—26SEP03

- 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

RG13240—UN—30SEP03

- 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.



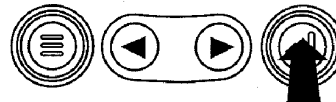
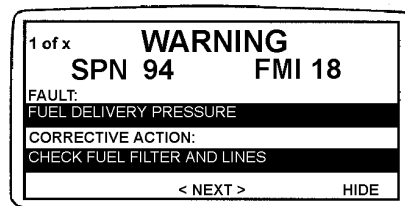
Use Arrow Keys To Scroll

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

RG13241 —UN—30SEP03

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

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

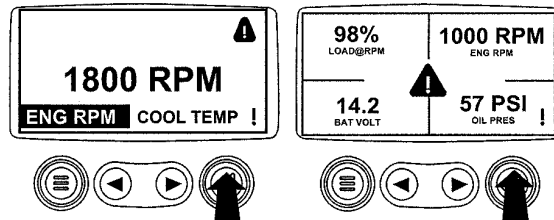


Hide Diagnostic Trouble Codes

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

RG13242 —UN—30SEP03

- 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.



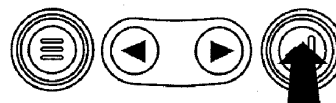
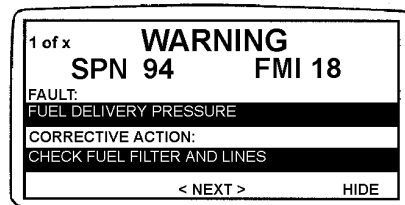
Active Diagnostic Trouble Code Icon

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

RG13176 —UN—26SEP03

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

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



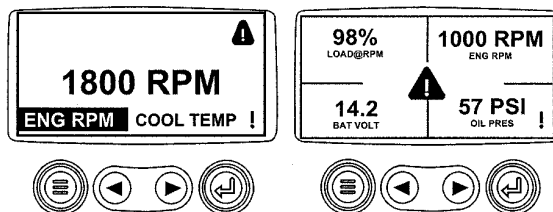
Enter Key

Continued on next page

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

RG13242 —UN—30SEP03

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



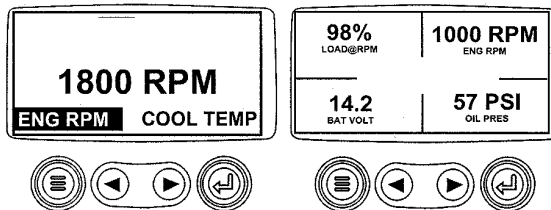
Active Diagnostic Trouble Code Condition

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

RG13243 —UN—01OCT03

Engine Shutdown Diagnostic Trouble Codes

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



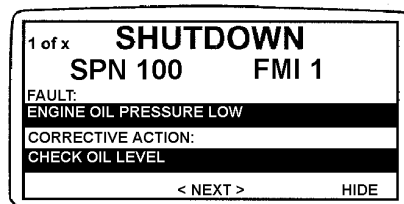
Normal Operation

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

RG13172 —UN—26SEP03

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.



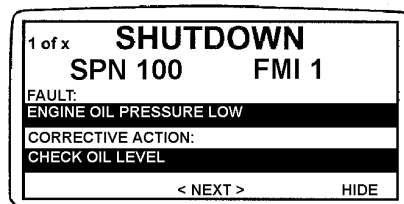
Shutdown Message

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

RG13238 —UN—29SEP03

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.



Hide Diagnostic Trouble Code

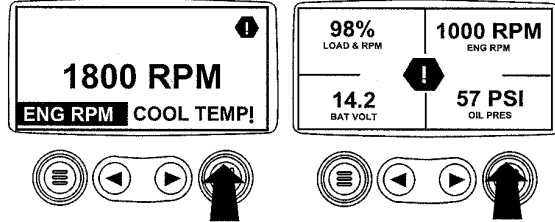
Continued on next page

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

RG13239 —UN—29SEP03

- 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.

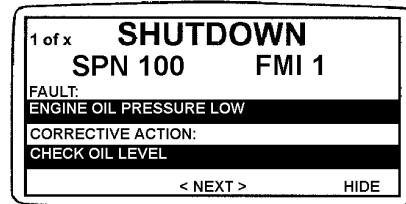


Flashing Shutdown Icon

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

RG13179—UN—26SEP03

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



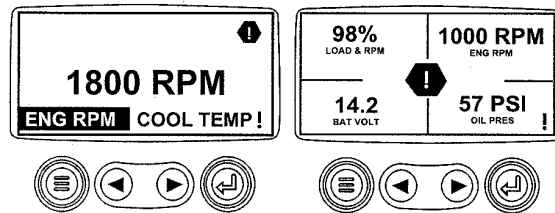
Redisplay Diagnostic Trouble Code

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

RG13239—UN—29SEP03

- 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

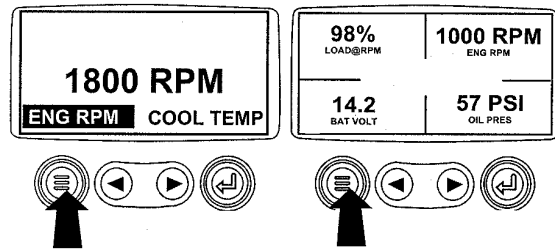
RG13180—UN—26SEP03

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.

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



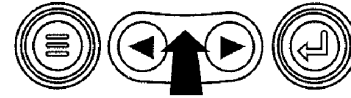
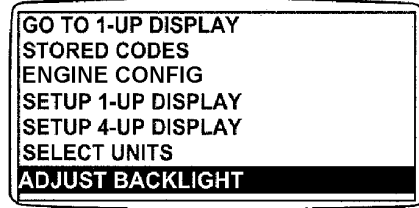
Menu Key

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

RG13159—UN—26SEP03

Continued on next page

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

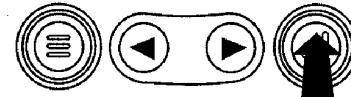
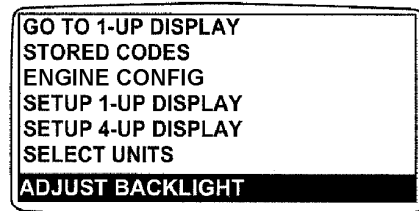


Select Adjust Backlight

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

RG13181—UN—02OCT03

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

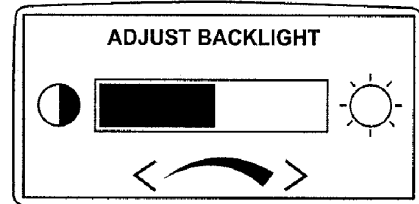


Press Enter Key

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

RG13182—UN—02OCT03

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



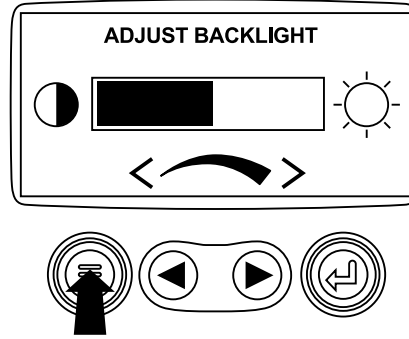
Adjust Backlight Intensity

Continued on next page

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

RG13183—UN—29SEP03

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

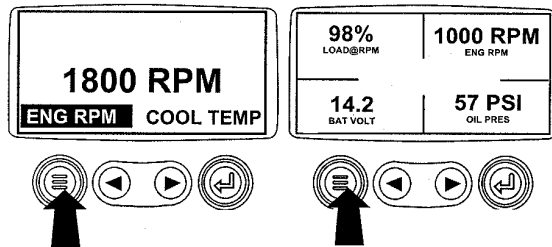


Return To Main Menu

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

RG19048 —UN—23AUG10

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



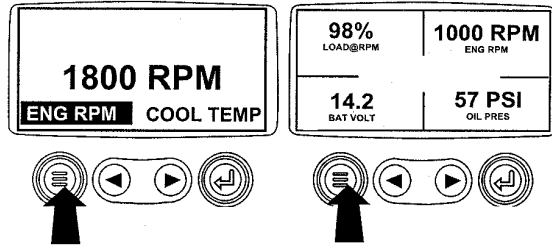
Exit Main Menu

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

RG13159 —UN—26SEP03

Adjusting Contrast

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

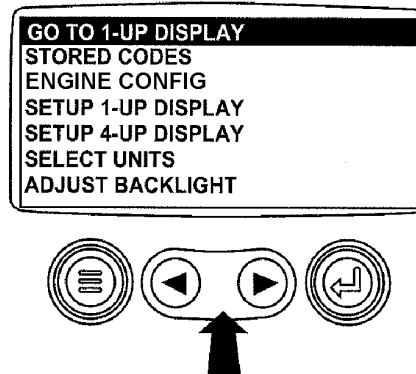


Menu Key

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

RG13159 —UN—26SEP03

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



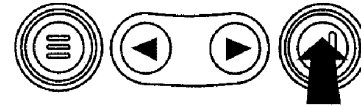
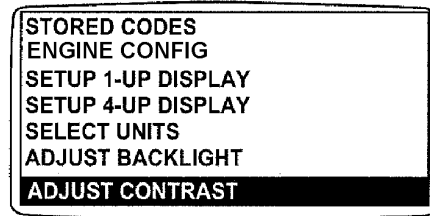
Select Adjust Contrast

Continued on next page

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

RG13161 —UN—02OCT03

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

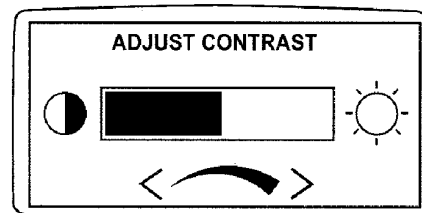


Press Enter Key

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

RG13185 —UN—02OCT03

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

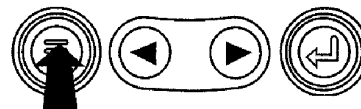
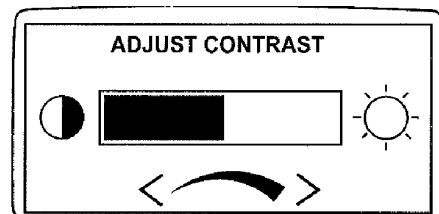


Adjust Contrast Intensity

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

RG13186 —UN—29SEP03

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



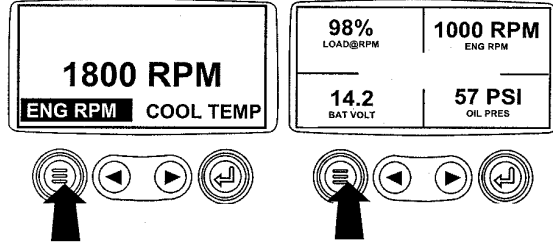
Return To Main Menu

Continued on next page

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

RG13187 —UN—26SEP03

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



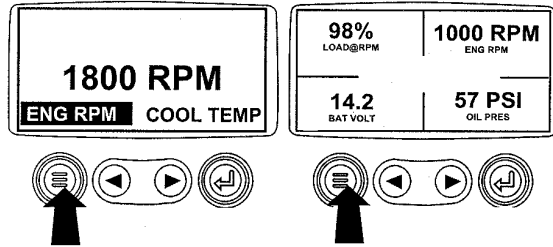
Exit Main Menu

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

RG13159 —UN—26SEP03

Selecting Units Of Measurement

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

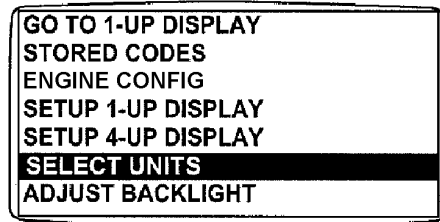


Menu Key

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

RG13159 —UN—26SEP03

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

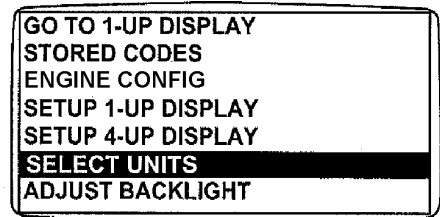


Select Units

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

RG13188 —UN—02OCT03

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



Press Enter Key

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

RG13189 —UN—02OCT03

Continued on next page

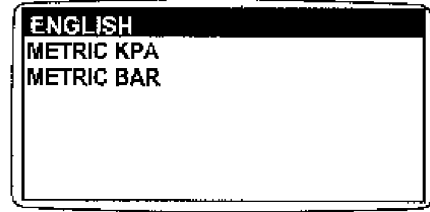
Instrument Panels

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 SI units, with pressures displayed in kPa and bar respectively, and temperatures in °C.

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

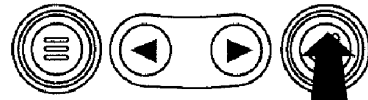
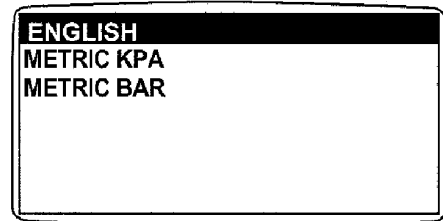


Select Desired Units

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

RG13190 —UN—26SEP03

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

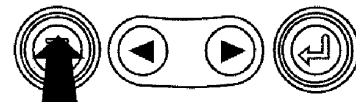
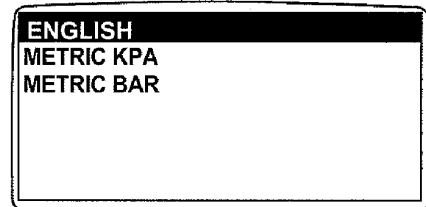


Press Enter Key to Select

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

RG13191 —UN—30SEP03

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



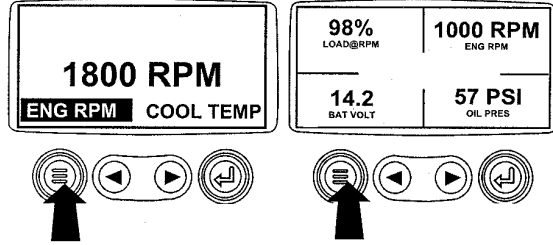
Return To Main Menu

Continued on next page

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

RG13192 —UN—26SEP03

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



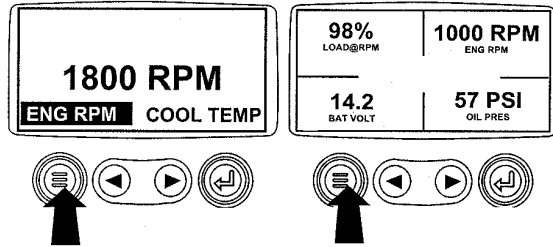
Press Menu Key

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

RG13159—UN—26SEP03

Setup 1-Up Display

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

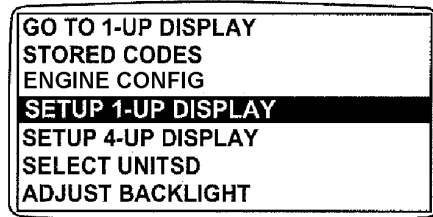


Menu Key

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

RG13159—UN—26SEP03

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

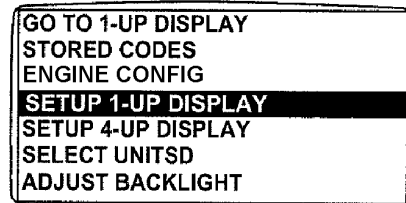


Setup 1-Up Display

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

RG13193—UN—02OCT03

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



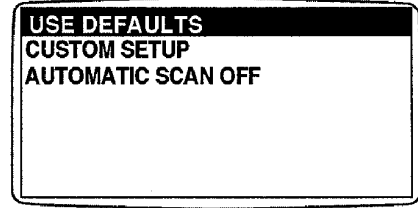
Press Enter Key

Continued on next page

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

RG13194—UN—02OCT03

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.

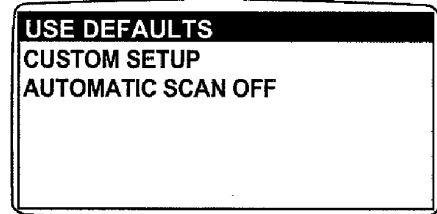


1-Up Display Options

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

RG13196—UN—26SEP03

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

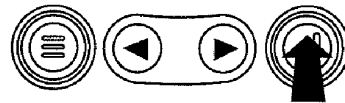
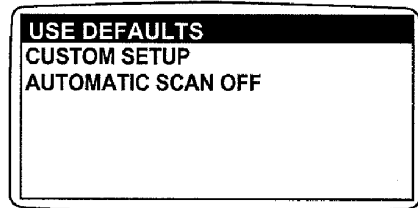


Select Defaults

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

RG13195—UN—26SEP03

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



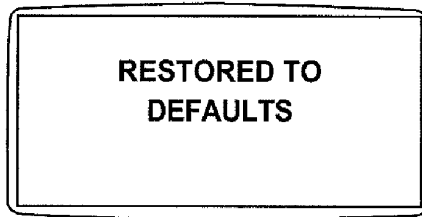
Defaults Selected

Continued on next page

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

RG13197—UN—29SEP03

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

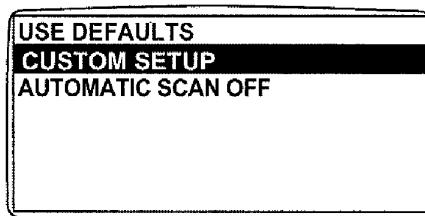


Restored To Defaults

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

RG13149 —UN—24SEP03

- 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.

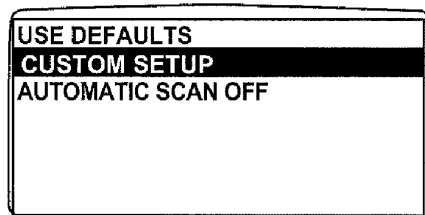


Select Custom Setup

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

RG13198 —UN—26SEP03

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



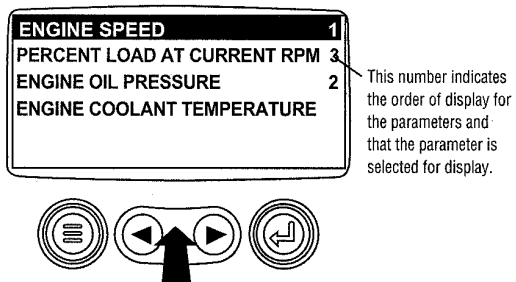
Engine Parameters

Continued on next page

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

RG13199 —UN—26SEP03

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

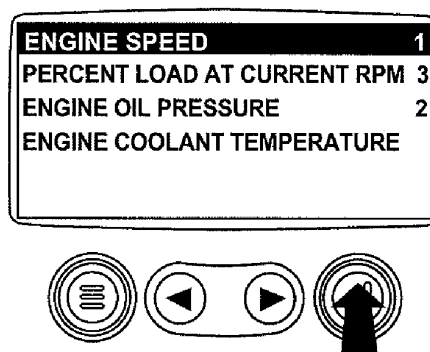


Select Parameters

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

RG13150 —UN—24SEP03

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

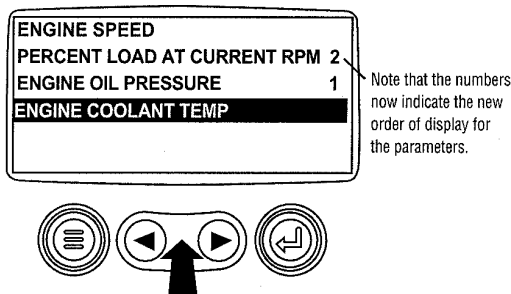


Deselect Parameters

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

RG13219 —UN—26SEP03

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).



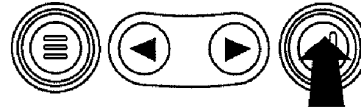
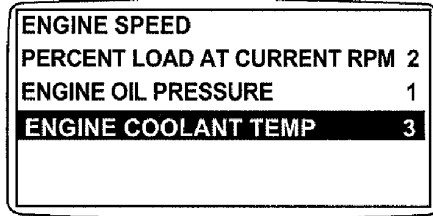
Select Desired Parameters

Continued on next page

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

RG13151 —UN—24SEP03

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.

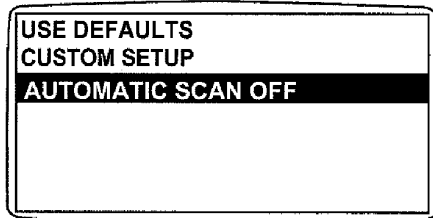


Select Parameters For Display

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

RG13220 —UN—26SEP03

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.

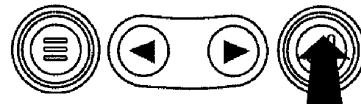
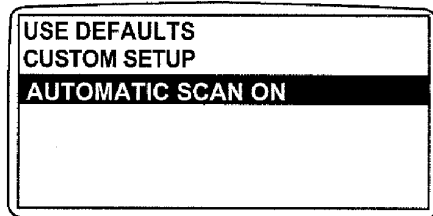


Automatic Scan Off

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

RG13221 —UN—26SEP03

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



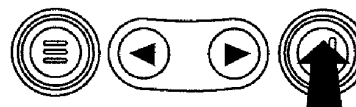
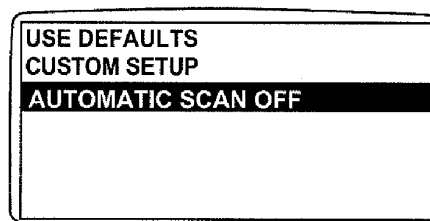
Automatic Scan On

Continued on next page

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

RG13222 —UN—26SEP03

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

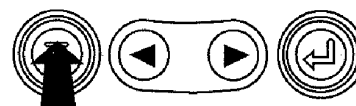
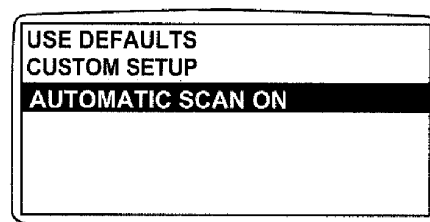


Automatic Scan Off

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

RG13223 —UN—26SEP03

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

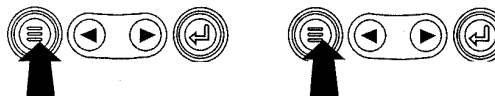
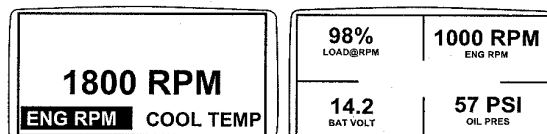


Menu Key

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

RG13224 —UN—26SEP03

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



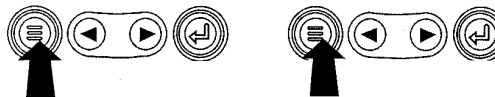
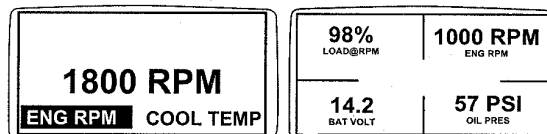
Exit Main Menu

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

RG13159 —UN—26SEP03

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.



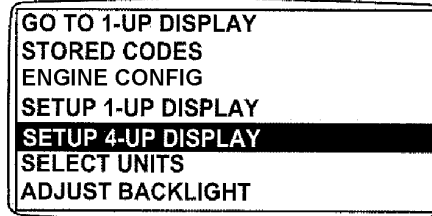
Menu Key

Continued on next page

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

RG13159 —UN—26SEP03

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

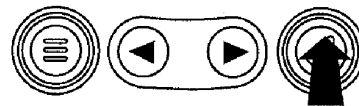
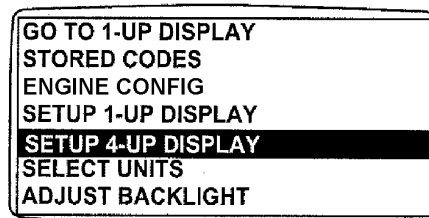


Select Setup 4-Up Display

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

RG13225 —UN—02OCT03

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

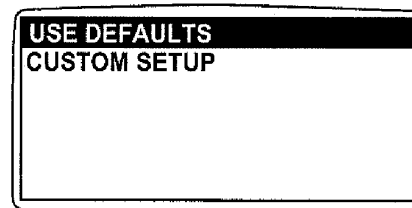


Press Enter Key

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

RG13226 —UN—02OCT03

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.



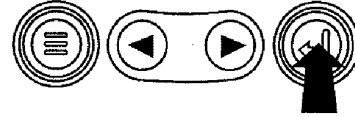
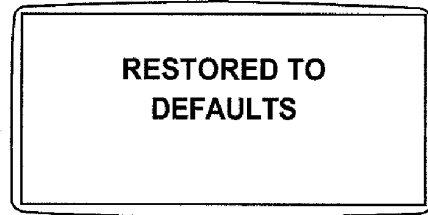
Select Factory Defaults

Continued on next page

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

RG13244 —UN—02OCT03

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.

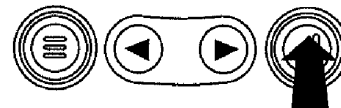
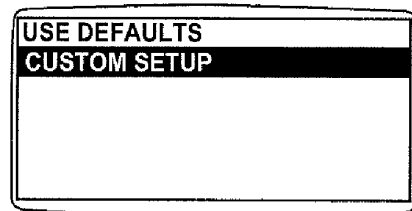


Restored To Defaults

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

RG13149 —UN—24SEP03

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.

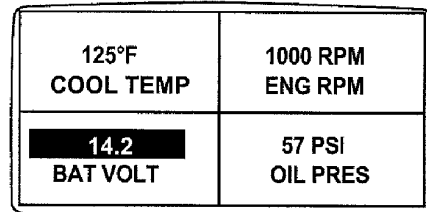


Custom Setup

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

RG13227 —UN—26SEP03

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.



Select Parameters

Continued on next page

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

RG13228 —UN—26SEP03

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

125°F COOL TEMP	1000 RPM ENG RPM
14.2 BAT VOLT	57 PSI OIL PRES



List Of Engine Parameters

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

RG13229 —UN—26SEP03

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".

ENGINE SPEED	3
ENGINE HOURS	
ENGINE COOLANT TEMPERATURE	1
BATTERY POTENTIAL	
ENGINE OIL TEMPERATURE	2
ENGINE OIL PRESSURE	4

The number to the right of the parameter indicates the quadrant in which it is displayed.
 1. = Upper Left Quadrant
 2. = Lower Left Quadrant
 3. = Upper Right Quadrant
 4. = Lower Right Quadrant



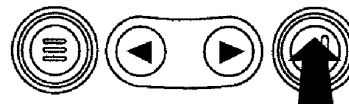
Select Desired Engine Parameter

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

RG13230 —UN—26SEP03

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

ENGINE SPEED	3
ENGINE HOURS	
ENGINE COOLANT TEMPERATURE	1
BATTERY POTENTIAL	2
ENGINE OIL TEMPERATURE	4
ENGINE OIL PRESSURE	



Enter Selected Parameter

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

RG13231 —UN—26SEP03

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

ENGINE SPEED	3
ENGINE HOURS	
ENGINE COOLANT TEMPERATURE	1
BATTERY POTENTIAL	
ENGINE OIL TEMPERATURE	2
ENGINE OIL PRESSURE	4

Note the number to the right of the selected parameter indicating that the parameter is now assigned to that display location.



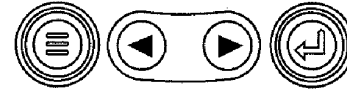
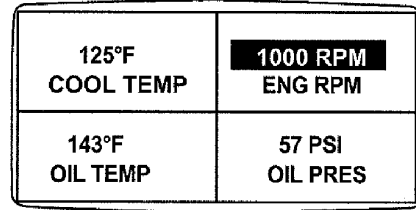
Return To 4-Up Custom Setup

Continued on next page

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

RG13232 —UN—26SEP03

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



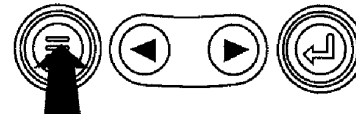
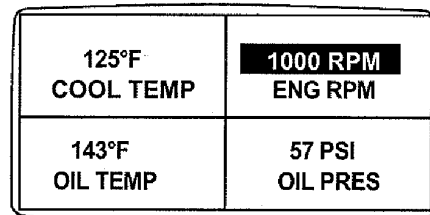
4-Up Display

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

RG13153 —UN—24SEP03

13. Repeat the parameter selection process until all spaces are as desired.

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

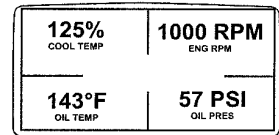
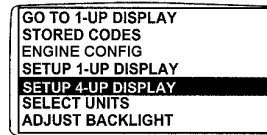


Return To Main Menu

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

RG13154 —UN—24SEP03

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

RG13155 —UN—07OCT03

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.

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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 (6090AFM85 / 6090SFM85)

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:

- 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

¹Load 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%.

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.

M1, M2, and M3 Propulsion Applications — Engine load factors¹ 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 factors¹ 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 factors¹ 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.

Marine Break-In Service (6090HFM85)

The engine is ready for normal operation. However, extra care during the initial break-in period will result in more satisfactory long-term engine performance and life.

During the initial operation of a new or rebuilt engine, change the oil and filter between a minimum of 100 hours and a maximum equal to the specified John Deere Plus 50 or John Deere Plus 50 II engine oil.

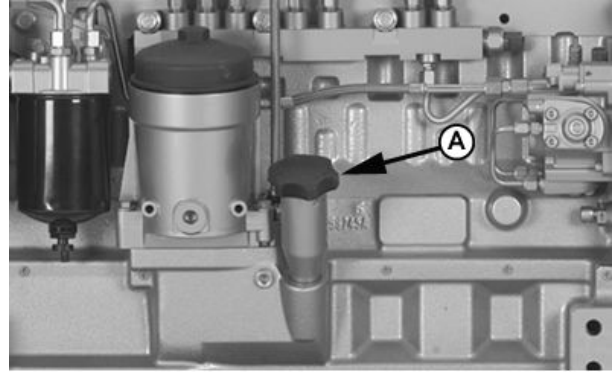
NOTE: In applications with extremely low annual hours (such as emergency generator sets), do not exceed oil usage of two years (24 months) when using Break-In Plus oil. In this circumstance, drain Break-In Plus oil at 24 months if it has not reached 100 hours of initial engine break-in, and refill with fresh Break-In Plus oil to accomplish at least 100 hours of accumulative break-in.

1. This engine is factory-filled with John Deere Engine Break-In Plus oil. Operate the engine at various conditions during the initial 100 hours with at least 15% of the time under heavy loads to achieve adequate engine break-in.
2. If the engine has too much operating time at idle, constant speeds, and/or light load usage, or make-up oil is required during the first 100-hour period, a longer break-in period may be needed without changing Break-In Plus oil until 500 hours.

IMPORTANT: Do not add make-up oil until the oil level is **BELOW** the **ADD** mark on dipstick. If make-up oil is required during the break-in period, John Deere Engine Break-In Plus oil should be used whenever possible.

IMPORTANT: If John Deere Engine Break-In Plus oil is not available for whatever reason, please use 10W-30 viscosity grade of John Deere Plus-50 II (CJ-4) as the make-up oil. If 10W-30 Plus-50 II (CJ-4) is also not available, then use 15W-40 viscosity grade of Plus-50 II (CJ-4) as the make-up oil.

API CJ-4	API CF
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	



Check Engine Oil Level



Engine Oil Level Dipstick

A—Oil Fill Cap/Dipstick

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

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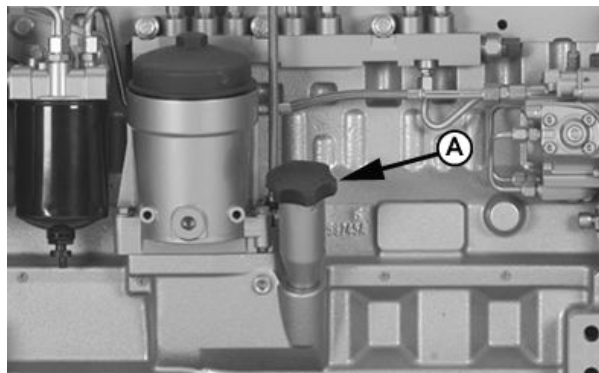
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EJ20264,000065A -19-21FEB18-1/3

3. Check oil by unscrewing and pulling out oil fill cap/dipstick (A). Oil fill cap/dipstick may be located on left or right side of engine, depending on application. Check oil more frequently during engine break-in period. If oil must be added during this period, John Deere Engine Break-In Plus oil is preferred. See ENGINE BREAK-IN OIL, in Fuels, Lubricants, and Coolant Section for other oils allowed.

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



Oil Fill Cap/Dipstick

4. During the first 20 hours, avoid prolonged periods of engine idling or sustained maximum load operation.

A—Oil Fill Cap/Dipstick

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RG13815—UN—11JAN05

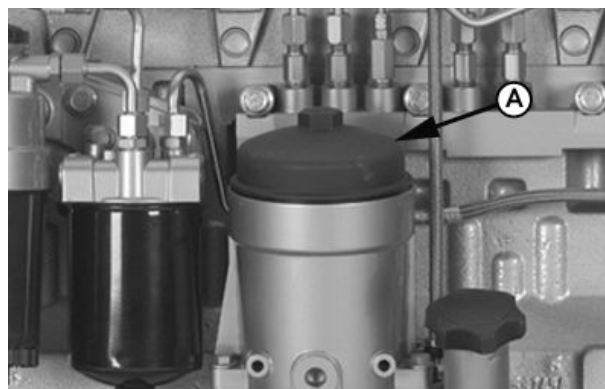
5. If engine will idle longer than 5 minutes, stop engine.
6. Break-In Plus may be changed any time between 100 and 500 hours (or 24 months in the case of low annual usage such as emergency generator sets). (Top-load oil filter illustrated.) (See CHANGING ENGINE OIL AND REPLACING FILTER in Lubrication and Maintenance/500 Hour Section.) Fill crankcase with seasonal viscosity grade oil. (See DIESEL ENGINE OIL, in Fuels, Lubricants, and Coolant Section.)

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

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

If air temperature is below 0° C (32° F), use an engine block heater.

7. Watch coolant temperature gauge closely during engine operation. Normal temperature range at full load rated speed is 82—94° C (180—202° F). If coolant temperature rises above 111° C (231° F), the engine will reduce power automatically. Unless temperature drops quickly, stop the engine and determine the cause before resuming operation.



Replacing Engine Oil Filter

A—Oil Filter

Watch oil pressure gauge for pressure within specification. See General Marine Engine Specifications in Specifications section.

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

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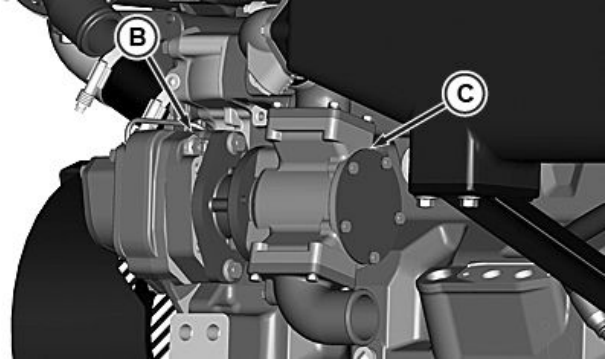
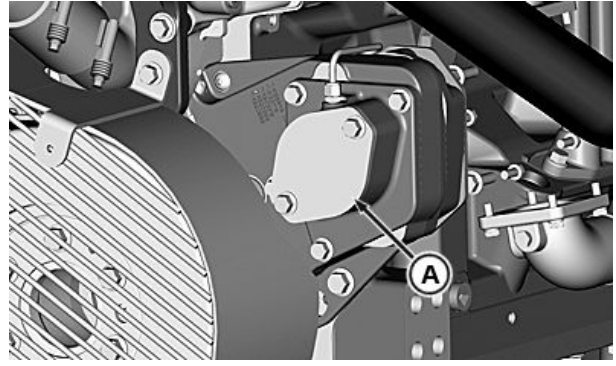
Auxiliary Gear Drive Limitations

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

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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.

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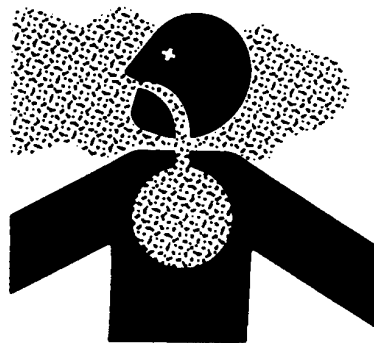
Starting the Engine

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. If equipped, open fuel return shutoff valve. Verify that all fuel return lines are open and free of restrictions.
4. Set marine gear control lever in the "NEUTRAL" position on propulsion units.



Use Proper Ventilation

5. Move the throttle control lever approximately 1/3 of the way off the idle position.
6. 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.

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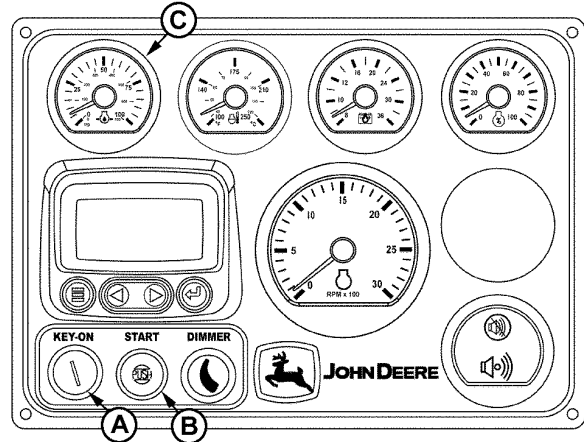
IMPORTANT: Do not operate the starter for more than 30 seconds at a time. To do so may overheat the starter. If the engine does not start the first time, wait at least 2 minutes before trying again. If engine does not start after four attempts, see **Engine Troubleshooting** in the Troubleshooting Section.

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.

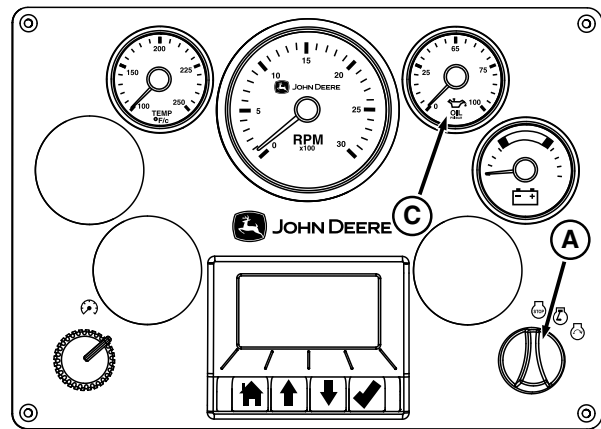
NOTE: Key switch (A) on main (standard) instrument panel must be in "ON" position to start engine using fly bridge (optional) instrument panel.

7. Press start button or turn key switch to crank the engine. When the engine starts, release the button or switch.
8. 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.
9. Warm up the engine at or below 1200 rpm with no load for 1-2 minutes. See following guidelines.
10. Check all gauges for normal engine operation. If operation is not normal, stop the engine and determine the cause.
11. 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.



Start Engine (Option A)



Start Engine (Option B)

A—Key Switch
B—Start Button

C—Oil Pressure Gauge

RG19661,00003BD -19-07MAR17-2/2

RG13134 —UN—07OCT03

RG29320 —UN—23FEB17

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.

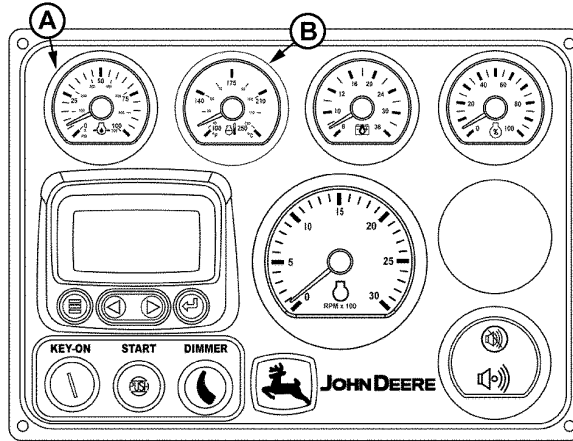
Engines used in generator set applications where the governor is locked at a specified speed may not have a low idle function. Operate these engines at high idle for 1 to 2 minutes before applying the load. This procedure does not apply to standby generator sets where the engine is loaded immediately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

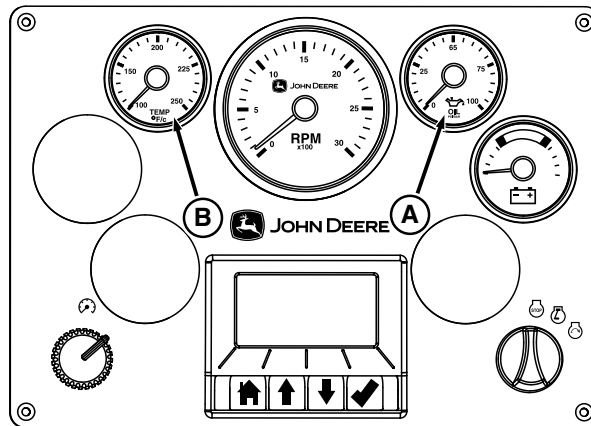
NOTE: On certain engines, the oil pressure and coolant temperature gauges are replaced by indicator warning lights. The lights must be "OFF" when engine is running.

2. Watch coolant temperature gauge (B). Do not place engine under full load until it is properly warmed up. 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.



Oil Pressure And Coolant Temperature Gauges (Option A)



Oil Pressure And Coolant Temperature Gauges (Option B)

A—Oil Pressure Gauge

B—Coolant Temperature Gauge

OUOD006,0000091 -19-01MAR17-1/1

RG13135—UN—07OCT03

RG29321—UN—23FEB17

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.



Starting Fluid is Flammable

TS1356—UN—18MAR92

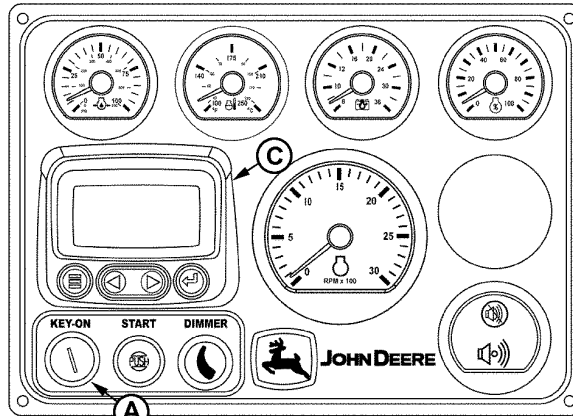
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Stopping the Engine

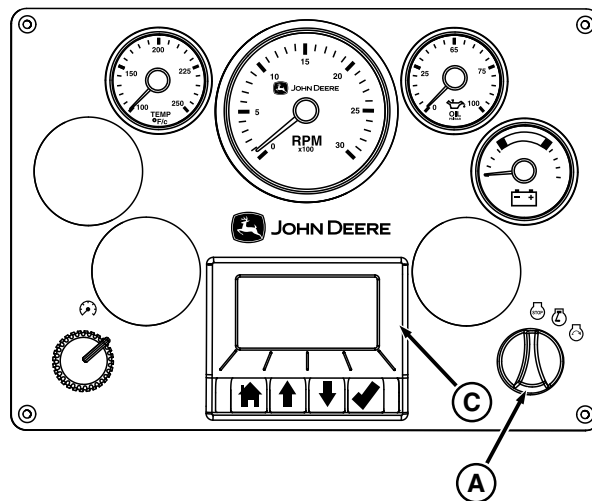
IMPORTANT: Before stopping an engine that has been operating at working load, idle engine at least 5 minutes at 1000–1200 rpm to cool hot engine parts.

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



Electronically Controlled Engines (Option A)



Electronically Controlled Engines (Option B)

A—Key Switch

C—Diagnostic Gauge/Hour Meter

RG13290—UN—06NOV03

RG29318—UN—23FEB17

RG19661,00003BE -19-10MAR17-1/1

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.

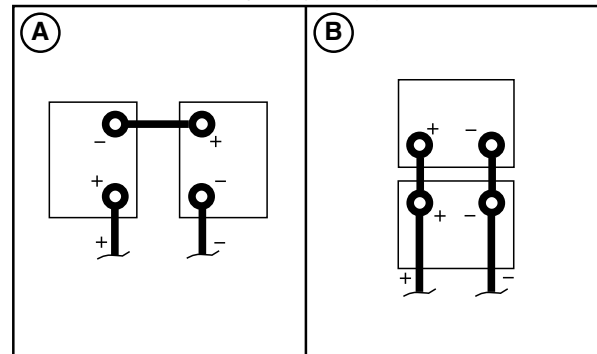
1. Connect booster battery or batteries to produce the required system voltage for your engine application.

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.



Exploding Battery



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

TS204 —UN—15APR13

RG24885 —UN—17DEC13

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

Lubrication and Maintenance

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

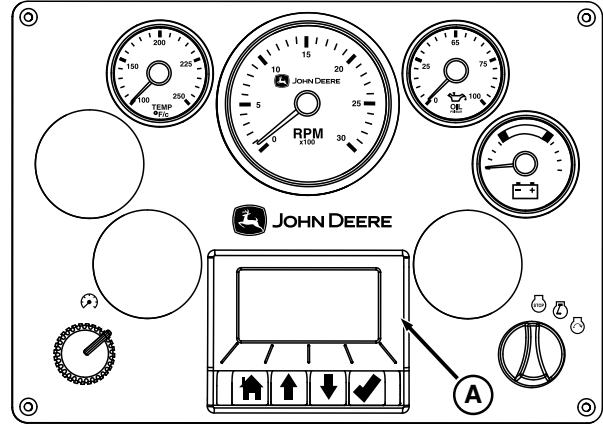
Observe Service Intervals

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.

Perform all services at the hourly intervals. Record the services performed in the Lubrication and Maintenance



Hour Meter On Instrument Panel

A—Hour Meter

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 -19-01MAR17-1/1

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

Item	Lubrication and Maintenance Service Intervals						
	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)				•			
Replace Crankshaft Vibration Damper					•		
Flush and Refill Cooling System						•	
Test Thermostats						•	

Continued on next page

ZE59858.00001B7 -19-21FEB18-1/2

Lubrication and Maintenance

Item	Lubrication and Maintenance Service Intervals						
	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
Drain Water From Fuel Filters							•
Add Coolant							•
Replace Air Cleaner Element							•
Replace Alternator / Fan Belt							•
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.
^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 -19-21FEB18-2/2

Lubrication & Maintenance — Daily

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.
- If equipped, open fuel return shutoff valve. Verify that all fuel return lines are open and free of restrictions.
- 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 -19-10JAN18-1/1

Lubrication & Maintenance — 250 Hours/6 Months

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.

NOTE: Two types of engine oil filters are available. This procedure is for engine equipped with spin on style engine oil filter, or for element style engine oil filter. Use the appropriate procedure.

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

IMPORTANT: Avoid damage to engine components. To prevent contamination from entering the lubrication system, ensure that all surfaces are clean and free from debris.

Drain the Engine Oil

1. Run engine approximately 5 minutes to warm the oil. Stop engine.

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

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

Spin On Style Engine Oil Filter

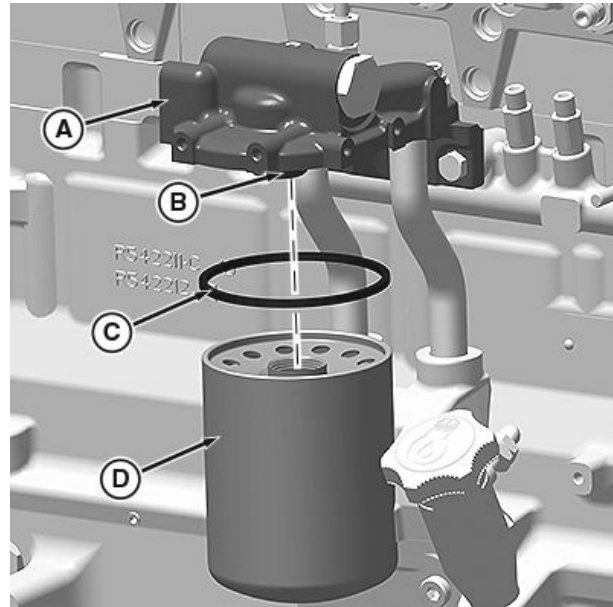
1. Clean any contaminants and debris from the mating surfaces.
2. Remove and discard spin on oil filter (D) and packing (C).

IMPORTANT: Prevent oil leaks. Always replace the packing when replacing the oil filter.

3. Lubricate packing (C) with engine oil and install into the spin on oil filter (D).

IMPORTANT: Prevent damage to components. Do not over tighten oil filter.

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OILSCAN PLUS is a trademark of Deere & Company.



Spin On Oil Filter

- A—Filter Base
B—Adapter Fitting
C—Packing
D—Spin On Oil Filter

4. Install spin on oil filter (D) onto adapter fitting (B). Tighten until the packing (C) contacts filter base (A). Tighten the oil filter an additional 1/2—3/4 turn. DO NOT over tighten the oil filter.

RG33658 —UN—26MAR21

Continued on next page

ZE59858,00001BA -19-28JUL21-1/3

Element Style Engine Oil Filter

1. Clean any contaminants and debris from the mating surfaces.

IMPORTANT: Prevent oil leaks. Always replace the O-ring when replacing the filter element.

NOTE: Do NOT remove pressure relief valve plug (E). Plug (E) is not an oil drain. Oil in the filter will drain automatically as the filter cap is loosened.

2. Loosen filter cap (A) one-half turn. Wait 30 seconds to allow the oil in the filter to drain.
3. Remove filter cap (A), O-ring (B), and filter element (C).
4. While holding filter cap (A), strike filter element (C) against solid surface as shown to loosen filter from cap. Discard the used filter.
5. Remove and discard the used O-ring (B).
6. Lubricate a new O-ring (B) with clean engine oil, and install onto filter cap (A).
7. Press the new filter element (C) into filter cap (A) until it snaps into place.
8. Install filter cap (A), O-ring (B), and filter element (C) into filter housing (D). Tighten cap to specification.

Specification

Oil Filter Element

Cap—Torque..... 45 N·m (33 lb-ft)

Refill the Engine Oil

1. Install oil pan drain plug with a new O-ring and tighten to specification.

Specification

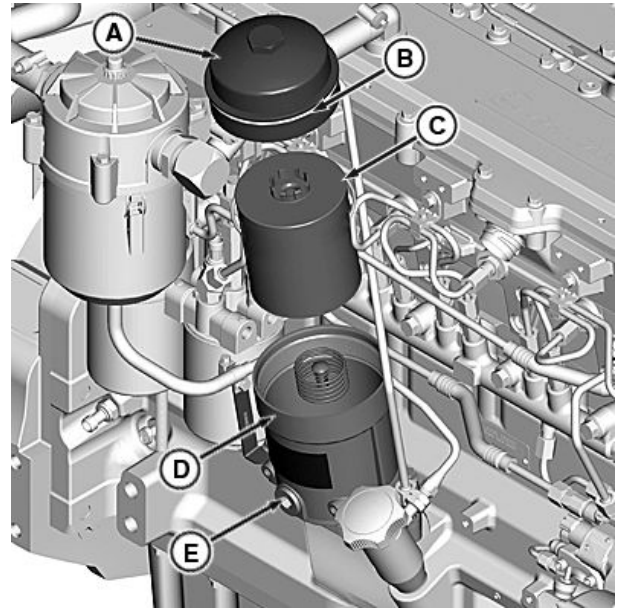
Oil Pan Drain

Plug—Torque..... 46 N·m (34 lb-ft)

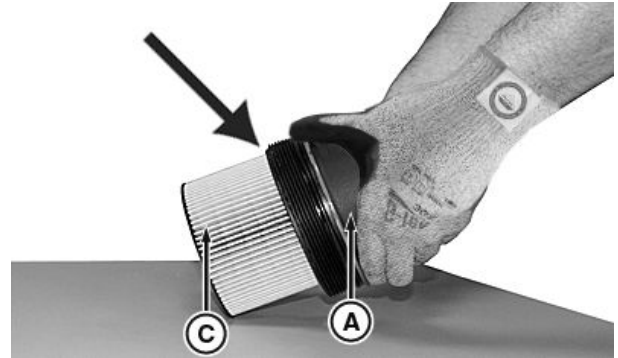
2. Remove oil fill cap/dipstick and fill engine crankcase with the correct John Deere engine oil. See Diesel Engine Oil — Tier 3 and Stage IIIA Marine Engines in the Fuels, Lubricants, and Coolant Section for determining the correct engine oil.

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.



Element Oil Filter



Filter Element Removal

A—Filter Cap
B—O-Ring
C—Filter Element

D—Filter Housing
E—Pressure Relief Valve Plug

IMPORTANT: Stop engine immediately if the engine oil warning is illuminated. Check engine oil level and check for leaks.

3. Start the engine and idle for 30 seconds without any load.
4. Stop engine, and wait for 5 minutes. Check for leaks, check oil level, and top off as necessary. Oil level reading should be on the full mark or within the crosshatch of the dipstick.

Continued on next page

ZE59858,00001BA -19-28JUL21-2/3

RG34392 —UN—22JUL21

RG17135A —UN—26JUL21

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.



Fire Extinguisher

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

RW4918 —UN—15DEC88

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



Exploding Battery

any corrosion, and wash terminals with a solution of 1 part baking soda and 4 parts water. Tighten all connections securely.

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

3. Keep battery fully charged, especially during cold weather. If a battery charger is used, turn 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

TS204 —UN—15APR13

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.

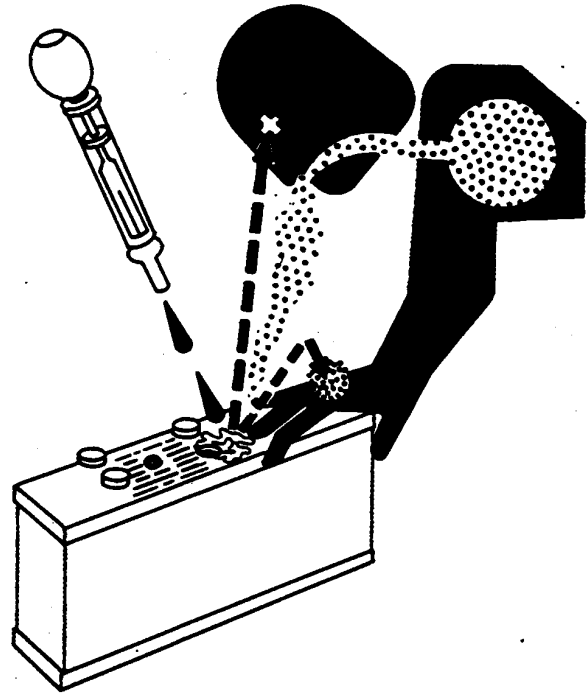
In freezing weather, run engine at least 30 minutes to ensure thorough mixing after adding water to battery.

Replacement battery(ies) must meet or exceed the following recommended capacities¹ at —18 °C (0 °F):

Specification

12-Volt System—Minimum Battery Capacity—Cold Cranking	
Amps.....	1100 Minimum
Reserve Capacity (Minutes).....	350 Minimum

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



Sulfuric Acid

24-Volt System—Minimum Battery Capacity—Cold Cranking	
Amps.....	750 Minimum
Reserve Capacity (Minutes).....	275 Minimum

T5203—UN—23AUG88

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

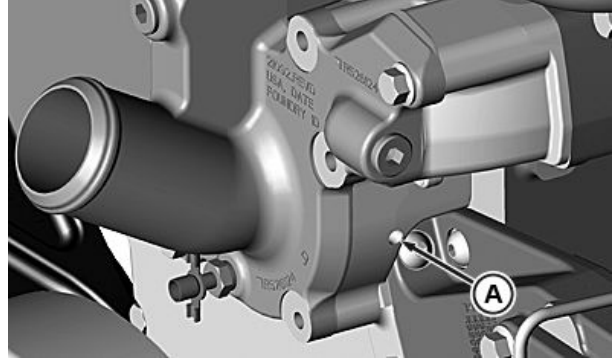
Visually Inspecting Coolant Pump

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.



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

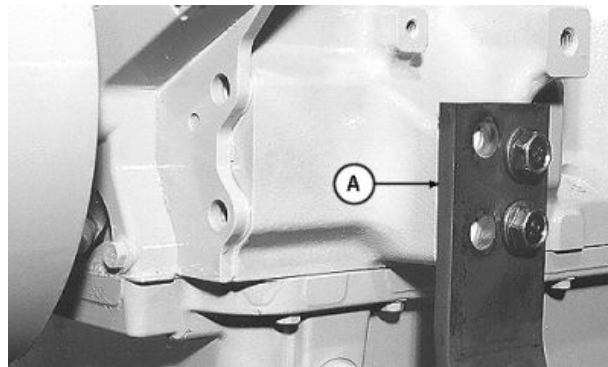
RG17151 —UN—26MAY09

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.



Engine Mounting

A—Mounting Bracket

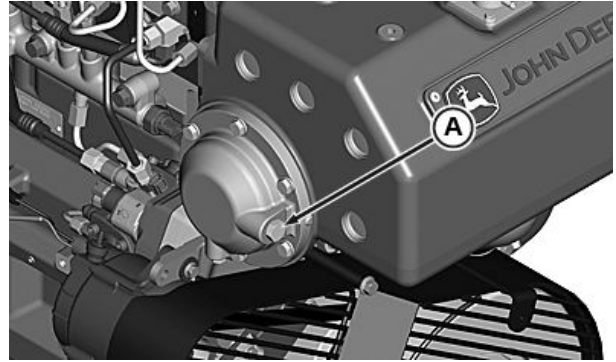
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RG9905 —UN—06/JAN99

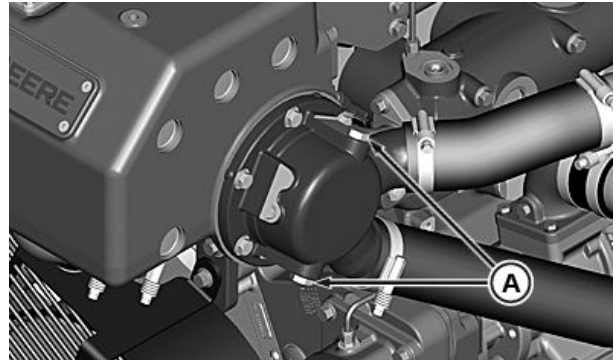
Inspecting and Replacing Zinc Plugs (If Equipped)

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. Two additional zinc plugs (B) are located in the aftercooler. The reaction of the zinc to sea water causes the plugs to deteriorate, instead of the more critical cooling system parts.

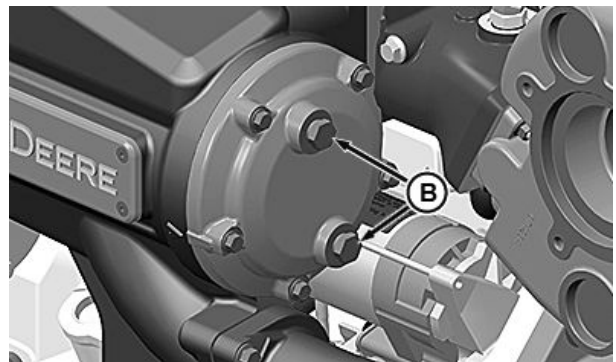
A—Heat Exchanger Zinc Plugs B—Aftercooler Zinc Plugs



RG17449 —UN—24AUG09



RG17450 —UN—03AUG09



RG24646 —UN—28OCT13

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ZE59858,00001BD -19-10MAY18-1/2

1. Remove zinc rod from each end cap 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.
3. Measure zinc plugs (A) to determine the amount of erosion on length (B) and outer diameter (C).

NOTE: Zinc plug new part dimensions are 38 mm (1.50 in) long and 15.8 mm (0.622 in) outer diameter.

4. If a zinc plug is under minimum size on any dimension, replace all zinc plugs.

Specification

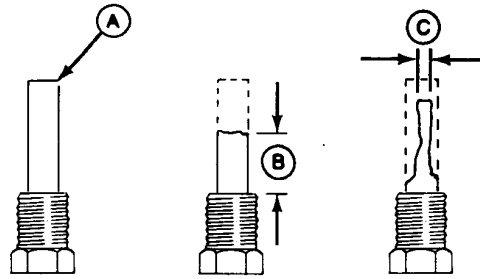
Zinc Plug	
(Minimum)—Length.....	19 mm (0.75 in)
Zinc Plug	
(Minimum)—Diameter.....	7.9 mm (0.311 in)

NOTE: Only use conductive thread sealant when replacing zinc plugs.

5. Install zinc plug and tighten to specifications.

Specification

Zinc Plug—Torque.....	40 N·m (30 lb·ft)
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Zinc Plug Erosion

A—Measure Zinc Plugs **C—Measure Diameter**
B—Measure Length

RG6007—UN—27JAN92

ZE59858.00001BD -19-10MAY18-2/2

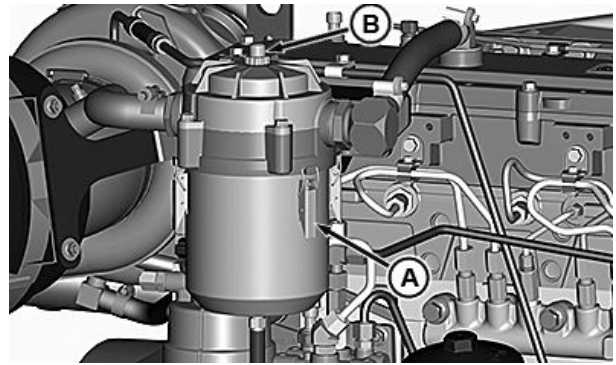
Lubrication & Maintenance — 500 Hours/12 Months

Replacing Crankcase Ventilation Filter

NOTE: Depending on the application the engine may be equipped with crankcase ventilation filter or vent hose. Refer to the procedural steps that are applicable to the engine configuration.

Option A

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.



Crankcase Ventilation Filter — Option A

A—Clips

B—Restriction Indicator

7. Inspect hoses and oil drain line for kinks, blockage, or other damage.

ZE59858,00001BE -19-25JAN22-1/2

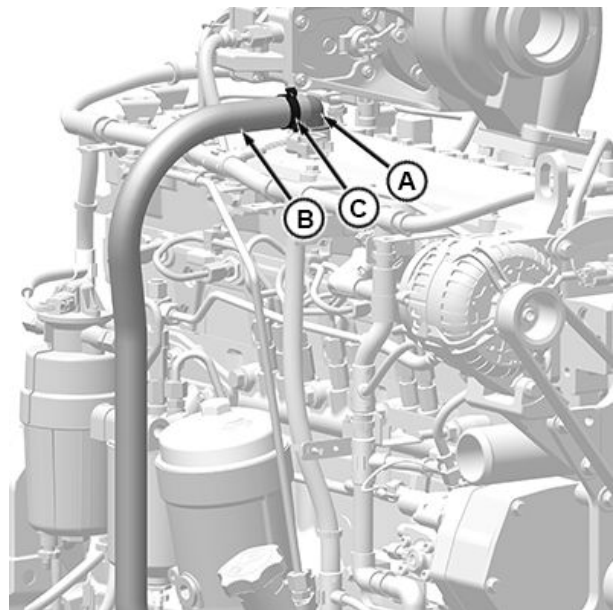
RG24641—UN—29OCT13

Option B

1. Slide the vent hose clamp (C) back and remove the vent hose (B).
2. Check vent elbow (A) on rocker arm cover for bent or damaged condition. Replace as necessary.
3. Clean vent hose (B) for any restrictions. Replace as necessary.

A—Vent Elbow
B—Vent Hose

C—Vent Hose Clamp



Vent Hose — Option B

ZE59858,00001BE -19-25JAN22-2/2

RG36234—UN—03JAN22

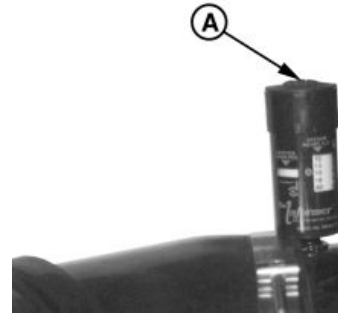
Checking Air Intake System

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.) H₂O, is torn, or visibly dirty.

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



Air Restriction Indicator

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

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

RG9927 —UN—18NOV09

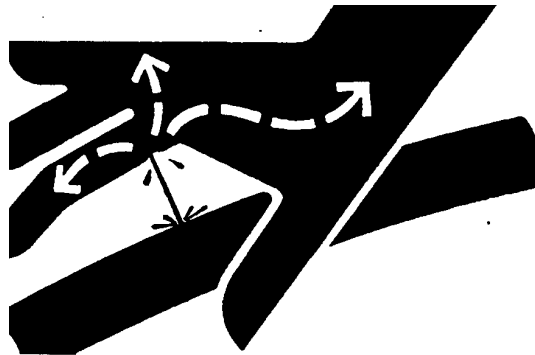
Replacing Fuel Filters/Cleaning Water Separator

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.

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



High Pressure Fluids

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.

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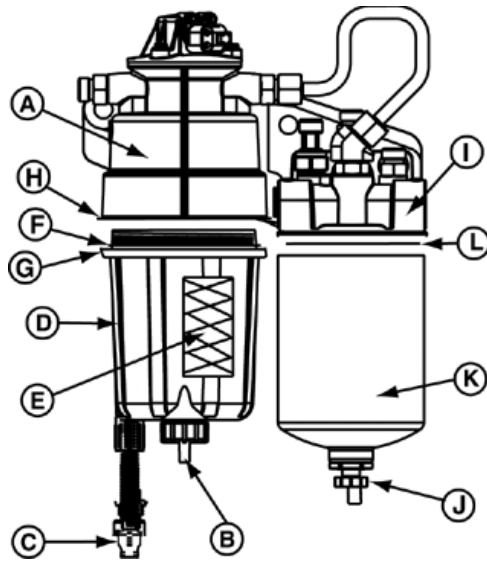
ZE59858,00001C0 -19-08NOV13-1/3

X9811 —UN—23AUG08

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.



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

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

Continued on next page

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

RG14250—UN—06JUN05

Remove and Install Secondary Fuel Filter

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

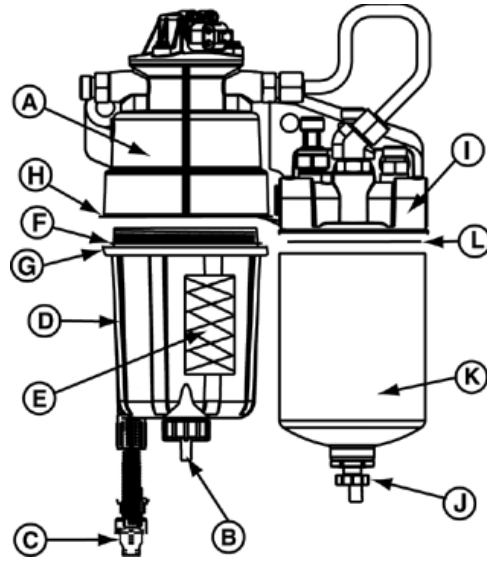
1. Thoroughly clean secondary filter header (I) and surrounding area to keep from getting dirt and debris into fuel system.
2. Connect a fuel drain line to secondary filter drain valve (J) on bottom of filter and drain all fuel from the filter.
3. Turn secondary filter (K) counterclockwise (CCW) to remove.
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 filter 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



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

be necessary to turn key off and on again to reprime the system before starting.

RG14250 —UN—06JUN05

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.

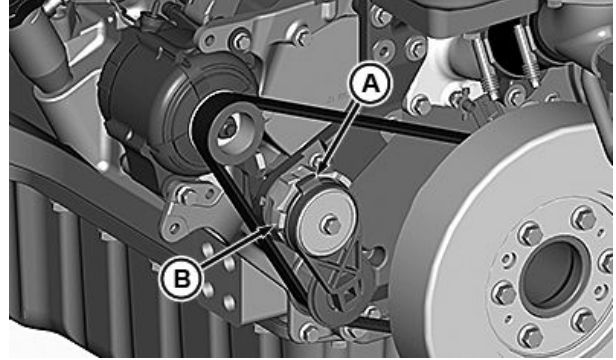
The belt tensioner is designed to operate within the limit of arm movement provided by the stops (A and B) when correct belt length and geometry is used.

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

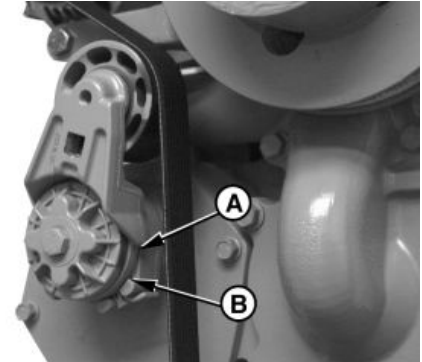
If the tensioner stop (A) on swing arm is hitting the fixed stop (B), check mounting brackets (alternator, belt tensioner, idler pulley, etc.) and the belt length. Replace belt as needed. See [Replacing Alternator / Fan Belt in Service As Required](#) Section.

A—Tensioner Stop

B—Fixed Stop



6090AFM85 / 6090SFM85 Belt Tensioner



6090HFM85 Belt Tensioner

ZE59858,00001C1 -19-16FEB18-1/1

RG24640—UN—28OCT13

RG7380—UN—28NOV97

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:

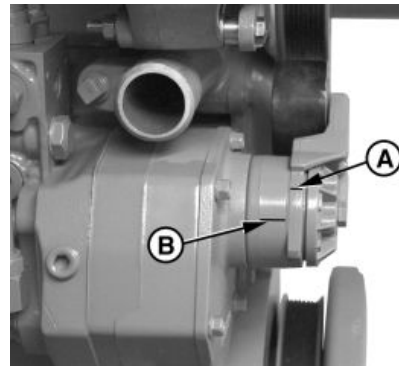
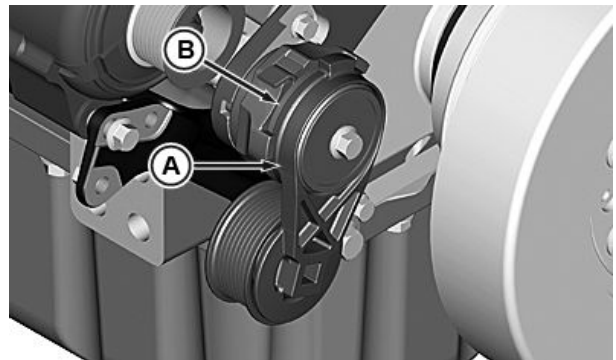
1. Release tension on belt using a long-handled 1/2 inch drive tool in tensioner arm. Remove belt from pulleys.
2. Release tension on tensioner arm and remove drive tool.
3. Put a mark (A) on swing arm of tensioner as shown.
4. Measure 21 mm (0.83 in.) from mark (A) and put a mark (B) on tensioner mounting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

A—Mark

B—Mark



6090HFM85 Belt Tensioner

ZE59858,00001C2 -19-16FEB18-1/1

RG17153—UN—26MAY09

RG7382—UN—28NOV97

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.



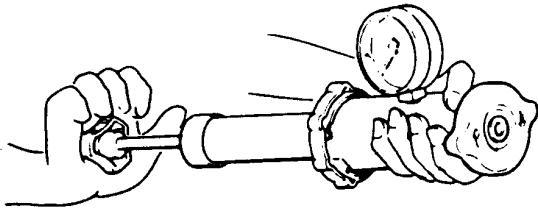
High Pressure Fluids

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

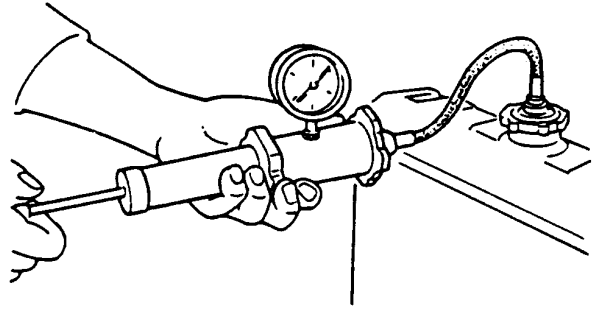
TS281 —UN—15APR13

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.
3. Connect gauge and adapter to radiator filler neck. Pressurize cooling system to the following specifications.
4. With pressure applied, check all cooling system hose connections, radiator, and overall engine for leaks.

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

Specification

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

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.

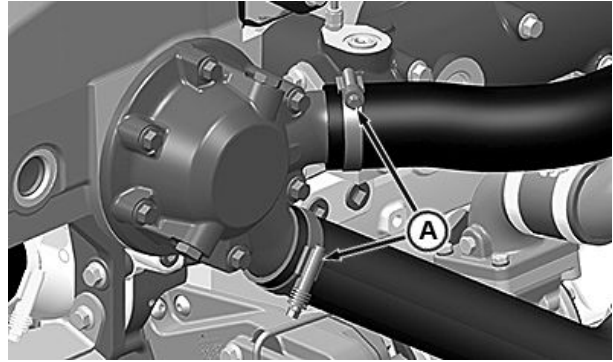
NOTE: This procedure refers to two different types of heat exchangers. Refer to the type that applies to your engine.

Type A Heat Exchanger

1. Close sea cocks and drain the sea water system.

⚠ CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns. **DO NOT** drain coolant until it has cooled below operating temperature. Always loosen heat exchanger pressure cap or drain valve slowly to relieve pressure

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.



Sea Water Tube

A—Hose Clamp (2 used)

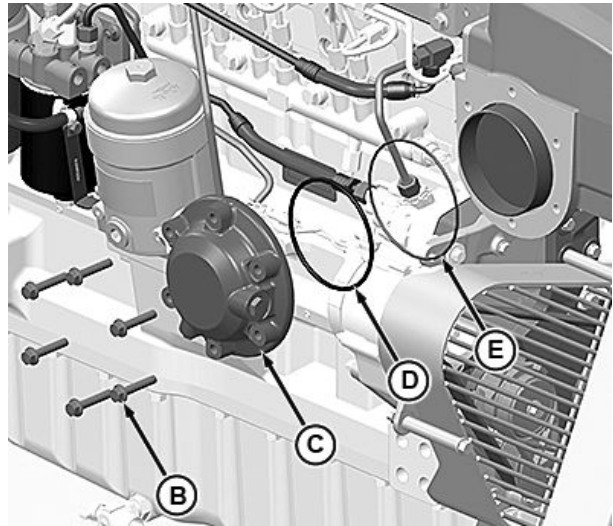
RG24643 —UN—28OCT13

EJ20264,000065C -19-21FEB18-1/10

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.

B—Cap Screw (6 used)
C—Right End Cap

D—O-Ring
E—O-Ring



Right End Cap

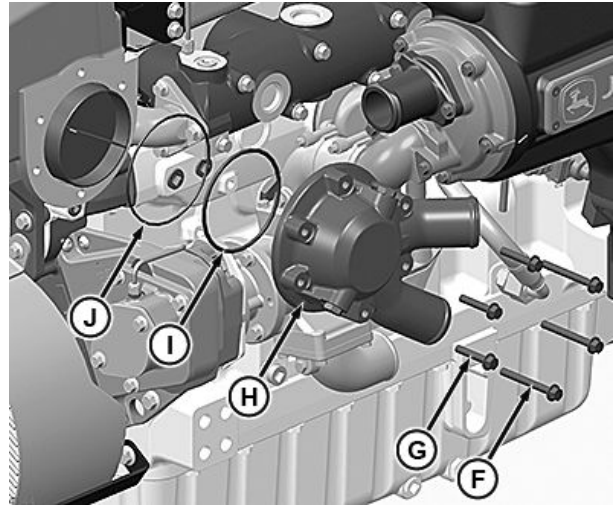
RG24642 —UN—28OCT13

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EJ20264,000065C -19-21FEB18-2/10

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.

F—Cap Screws (Long - 3 used) I— O-Ring
 G—Cap Screws (Short - 3 used) J— O-Ring
 H—Left End Cap



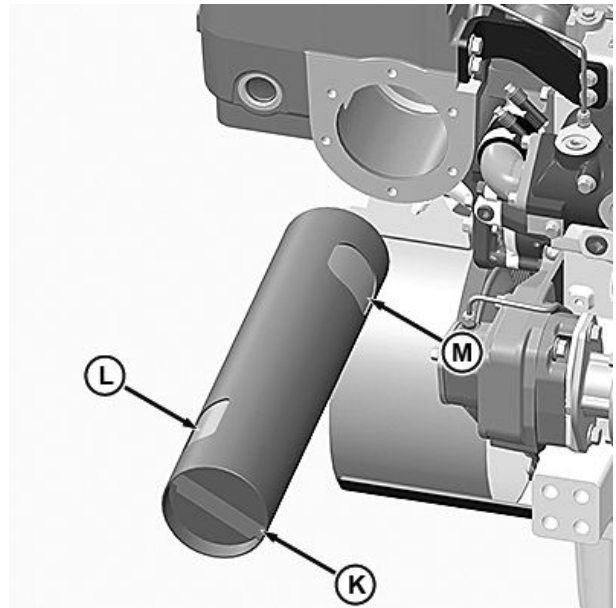
Left End Cap

EJ20264,000065C -19-21FEB18-3/10

RG24644 —UN—28OCT13

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.

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



Heat Exchanger Core

Continued on next page

EJ20264,000065C -19-21FEB18-4/10

RG24645 —UN—28OCT13

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.
11. 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.
12. Remove and thoroughly clean water manifold/heat exchanger housing if needed.



Clean Heat Exchanger

EJ20264.000065C -19-21FEB18-5/10

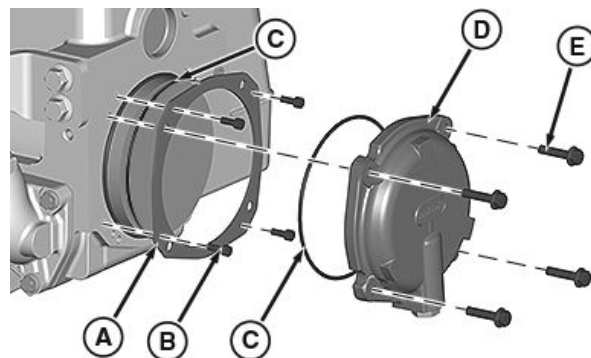
RG6066—UN—23JAN92

Type B Heat Exchanger

1. Close sea cocks and drain the sea water system.

CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns. DO NOT drain coolant until it has cooled below operating temperature. Always loosen heat exchanger pressure cap or drain valve slowly to relieve pressure

2. Open drain valve on cylinder block and drain engine coolant into a clean container. Close drain valve.
3. Remove cap screws (E) and remove right end cap (C).
4. Remove socket head cap screws (B) and plate (A).



Right End Cap

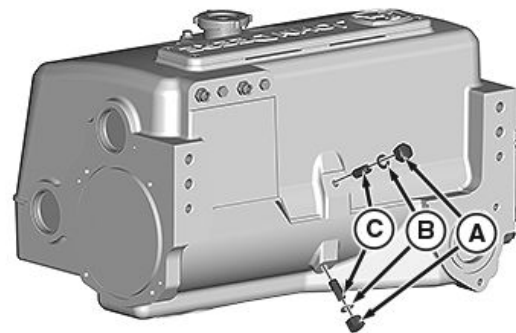
- | | |
|----------------------------------|----------------------|
| A—Plate | D—Right End Cap |
| B—Socket Head Cap Screw (4 used) | E—Cap Screw (4 used) |
| C—O-Ring (2 used) | |

EJ20264.000065C -19-21FEB18-6/10

RG30148—UN—20FEB18

5. Remove caps (A), washers (B), and heat exchanger core retaining set screws (C).

- | | |
|--------------------------|----------------------|
| A—Cap (2 used) | C—Set Screw (2 used) |
| B—Copper Washer (2 used) | |



Heat Exchanger Core Retaining Set Screws

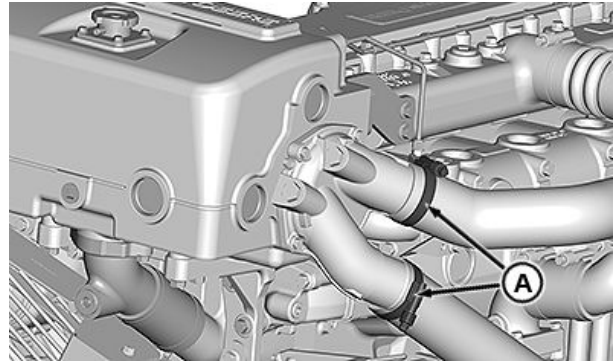
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EJ20264.000065C -19-21FEB18-7/10

RG30150—UN—20FEB18

- Loosen hose clamps (A) and disconnect sea water tubes.

A—Hose Clamp (2 used)



Sea Water Tube

RG30149 —UN—20FEB18

EJ20264,000065C -19-21FEB18-8/10

- Remove cap screws (E) and remove left end cap (D).
- Remove socket head cap screws (C).
- Remove heat exchanger core (A) out the left side of housing.
- 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.

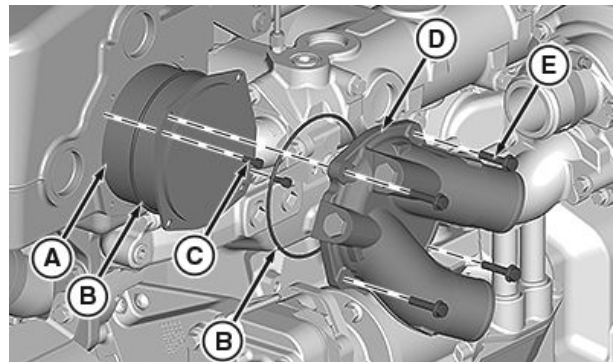
A—Heat Exchanger Core

B—O-Ring (2 used)

C—Socket Head Cap Screw (2 used)

D—Left End Cap

E—Cap Screw (4 used)



Left End Cap

RG30147 —UN—20FEB18

EJ20264,000065C -19-21FEB18-9/10

- 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.
- 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.
- Remove and thoroughly clean water manifold/heat exchanger housing if needed.



Clean Heat Exchanger

RG6066 —UN—23JAN92

EJ20264,000065C -19-21FEB18-10/10

Installing Heat Exchanger Core

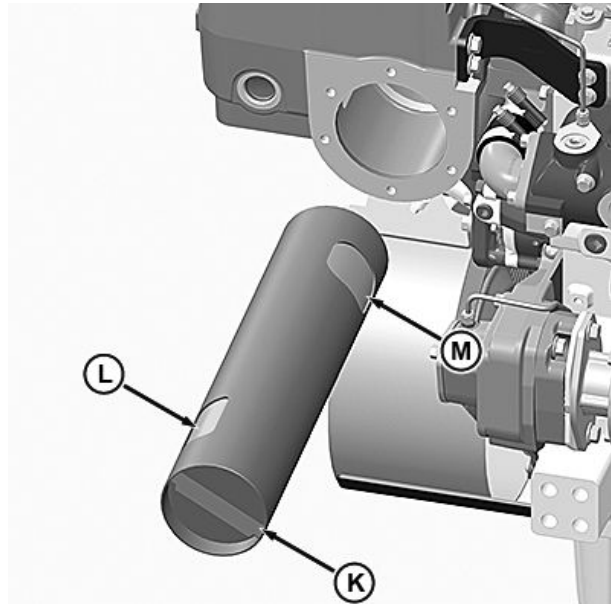
IMPORTANT: This service interval only applies to engines that use sea water for cooling.

NOTE: This procedure refers to two different types of heat exchangers. Refer to the type that applies to your engine.

Type A Heat Exchanger

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 **M**—Rear Coolant Passage
L—Front Coolant Passage



Heat Exchanger Core

RG24645 —UN—28OCT13

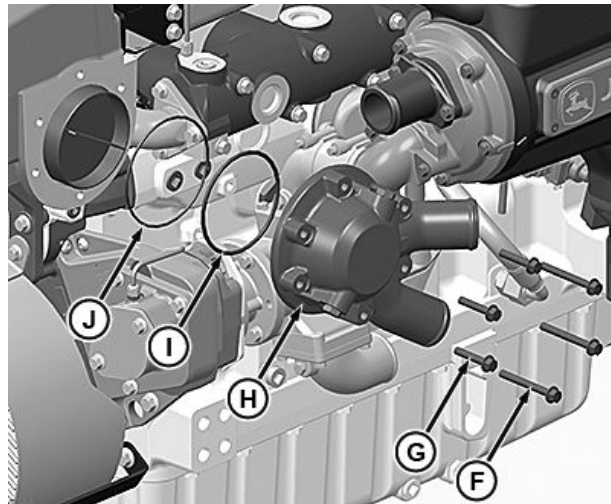
EJ20264,000065D -19-19FEB18-1/8

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..... 80 N-m (59 lb-ft)

F—Cap Screws (Long) **I**— O-Ring
G—Cap Screws (Short) **J**— O-Ring
H—Left End Cap



Left End Cap

RG24644 —UN—28OCT13

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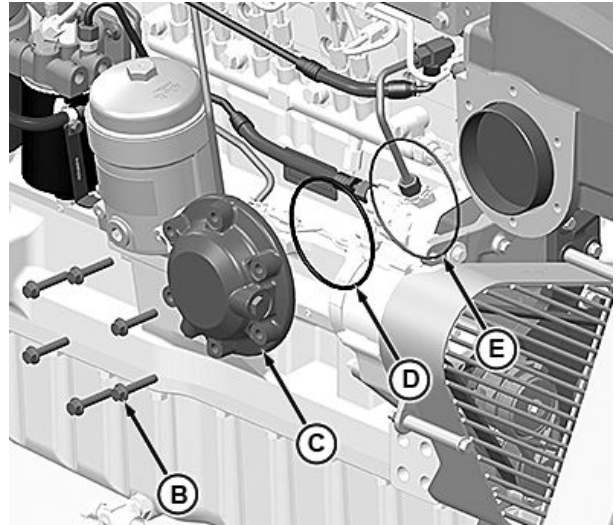
EJ20264,000065D -19-19FEB18-2/8

7. Install O-rings (D and E) in right end cap (C).
8. Install right end cap (C) and install cap screws (B). Index end cap in same position as removed.
9. Tighten cap screws (B) to specifications.

Specification

Cap Screws (D)
 —Torque..... 80 N·m (59 lb·ft)

B—Cap Screws **D—O-Ring**
C—Right End Cap **E—O-Ring**



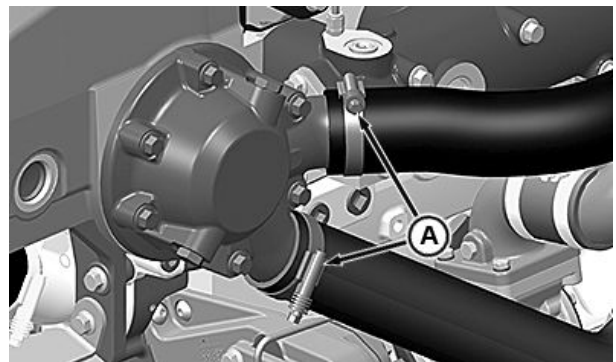
Right End Cap

EJ20264,000065D -19-19FEB18-3/8

RG24642—UN—28OCT13

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

A—Hose Clamps



Sea Water Tube

Continued on next page

EJ20264,000065D -19-19FEB18-4/8

RG24643—UN—28OCT13

Type B Heat Exchanger

1. Thoroughly inspect condition of end cap sealing O-rings. O-rings may be reused if not excessively worn or damaged during disassembly. Replace sealing O-rings as necessary.
2. Install heat exchanger core (A) with O-ring (B) through the left side of the housing.

NOTE: Heat exchanger core and end caps have only one possible orientation for cap screw holes to align.

3. Install socket head cap screws (C) and tighten to specification.

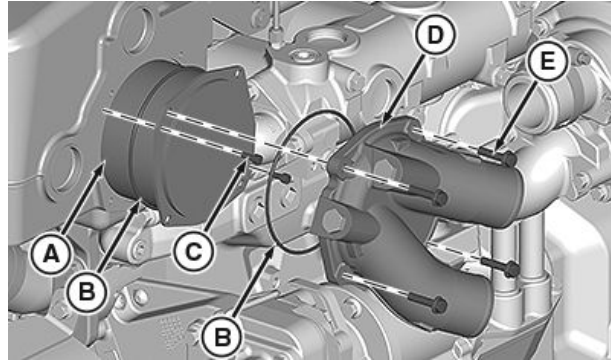
Specification

Socket Head Cap
Screw—Torque.....7.5 N·m (66 lb-in)

4. Install O-ring (B) in left end cap (D).
5. Install end cap (D) and tighten cap screws (E) to specification.

Specification

Cap Screw—Torque.....18 N·m (159 lb-in)



Left End Cap

- A—Heat Exchanger Core
- B—O-Ring (2 used)
- C—Socket Head Cap Screw (2 used)
- D—Left End Cap
- E—Cap Screw (4 used)

RG30147 —UN—20FEB18

EJ20264,000065D -19-19FEB18-5/8

6. Install O-ring (C), plate (A), and tighten socket head cap screws (B) to specification.

Specification

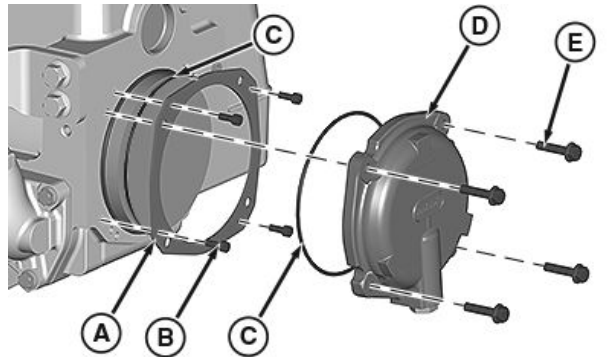
Socket Head Cap
Screw—Torque.....7.5 N·m (66 lb-in)

7. Install O-ring (C) in right end cap (D).
8. Install end cap (D) and tighten cap screws (E) to specification.

Specification

Cap Screw—Torque.....18 N·m (159 lb-in)

- A—Plate
- B—Socket Head Cap Screw (4 used)
- C—O-Ring (2 used)
- D—Right End Cap
- E—Cap Screw (4 used)



Right End Cap

RG30148 —UN—20FEB18

Continued on next page

EJ20264,000065D -19-19FEB18-6/8

9. Install set screws (C) and tighten to specification.

Specification

Set Screw—Torque..... 10 N·m (89 lb·in)

10. Install washers (B) and caps (A). Tighten caps (A) to specification.

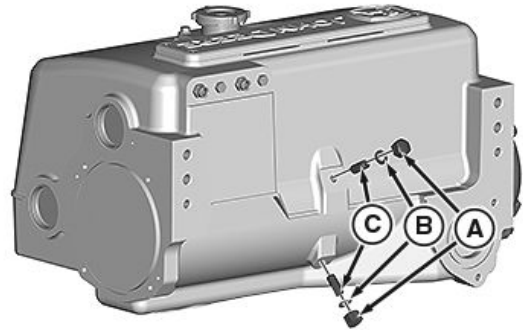
Specification

Set Screw Cap—Torque.....25 N·m (221 lb·in)

A—Cap (2 used)

C—Set Screw (2 used)

B—Copper Washer (2 used)



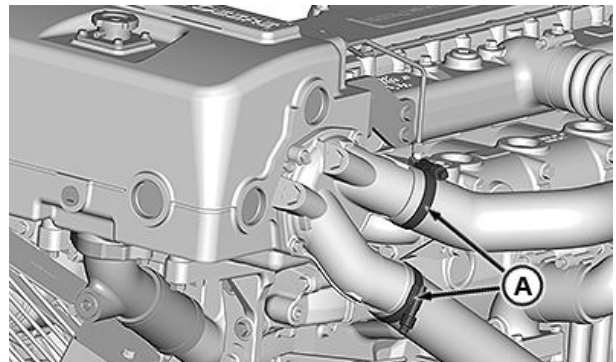
Heat Exchanger Core Retaining Set Screws

EJ20264,000065D -19-19FEB18-7/8

RG30150—UN—20FEB18

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 Clamp (2 used)



Sea Water Tube

EJ20264,000065D -19-19FEB18-8/8

RG30149—UN—20FEB18

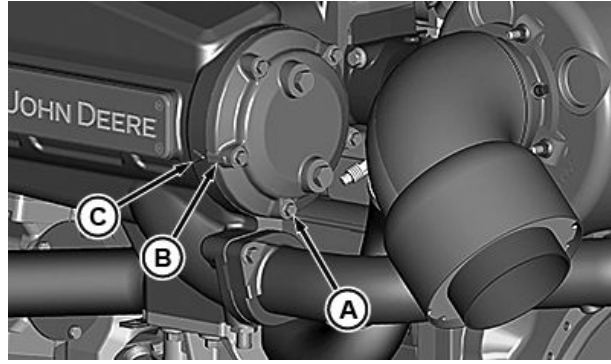
Removing, Inspecting, and Cleaning Engine Aftercooler Core

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

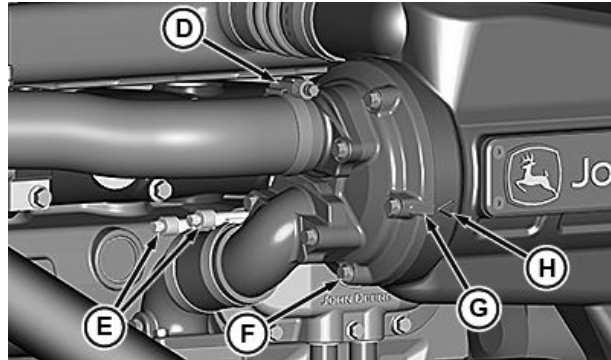
1. Close sea cocks and drain the sea water or coolant system.
2. Remove cap screws (A) and rear end cap (B).
3. Loosen clamps (D and E) and remove lines from front end cap.
4. Remove cap screws (F) and front end cap (G).
5. Remove aftercooler core (I).

A—Cap Screws
B—Rear End Cap
C—Aftercooler Housing Mark
D—Clamps
E—Clamps

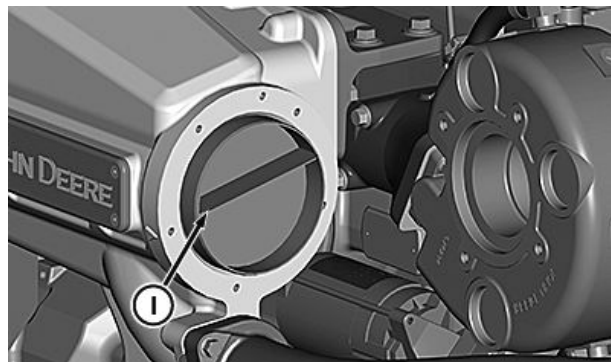
F—Cap Screws
G—Front End Cap
H—Aftercooler Housing Mark
I— Aftercooler Core



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.



Clean Aftercooler Core

RG12181 —UN—25FEB02

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.)

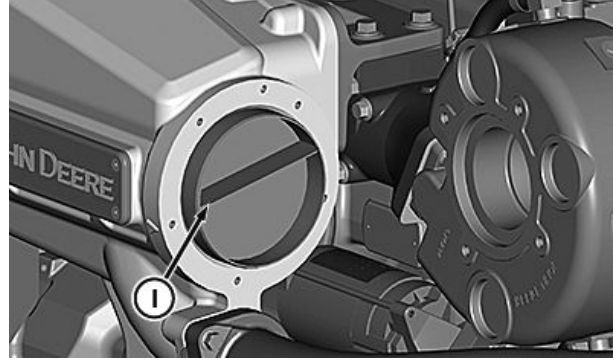
4. Install lines and clamps (D and E).
5. Install rear end cap in same position as removed. Line up end cap mark (B) and aftercooler housing mark (C). Evenly tighten cap screws (A) to specifications.

Specification

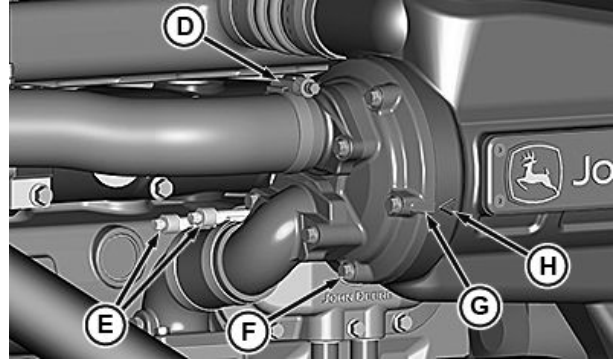
Cap Screws—Torque..... 26 N·m (230 lb.-in.)

6. Open sea cocks.

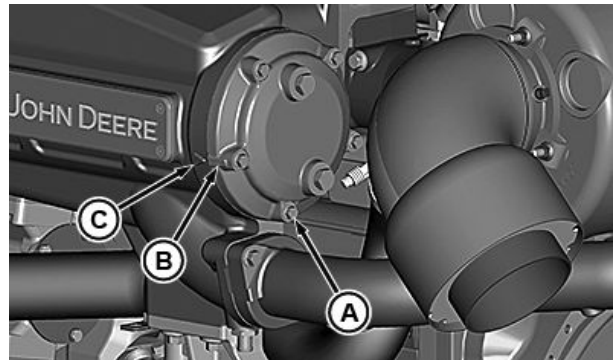
- | | |
|----------------------------|----------------------------|
| A—Cap Screws | F—Cap Screws |
| B—Rear End Cap Mark | G—Front End Cap Mark |
| C—Aftercooler Housing Mark | H—Aftercooler Housing Mark |
| D—Clamps | I—Aftercooler Lip |
| E—Clamps | |



RG24638—UN—28OCT13



RG24637—UN—04NOV13

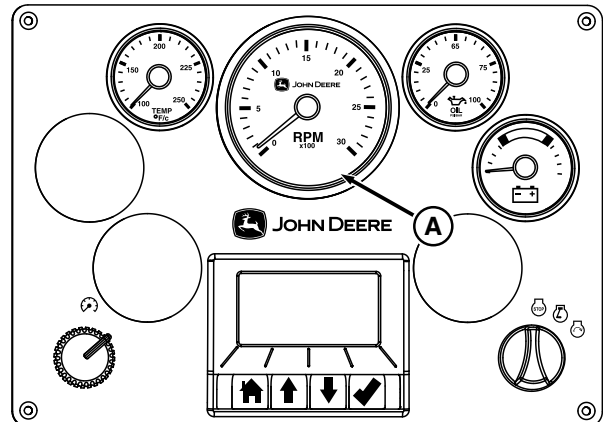


RG24639—UN—04NOV13

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.



RG29322—UN—23FEB17

Observe Tachometer Reading

ZE59858,000027C -19-01MAR17-1/1

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.

OUD002,0000169 -19-23NOV01-1/1

Replacing Sea Water Pump Impeller (If Equipped)

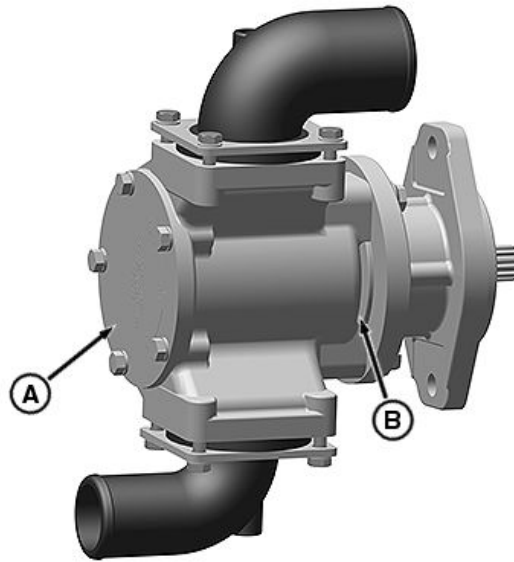
1. Close sea cock and drain sea water system.
2. Inspect the sea water pump housing weep hole (B) for evidence of water or oil indicating seal leakage.

Repair leaks if present, see [Overhauling Sea Water Pump \(If Equipped\)](#) in Lubrication & Maintenance — 2000 Hours/24 Months Section.

3. Remove cap screws and cover plate (A) from sea water pump.

A—Cover Plate

B—Weep Hole



Inspect Sea Water Pump

Continued on next page

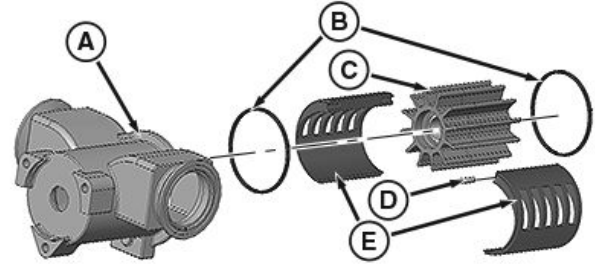
ZE59858,00001CB -19-19FEB18-1/2

RG29973—UN—18DEC17

4. Remove impeller (C) from pump housing.

IMPORTANT: If impeller has chunks of material missing, the heat exchanger, aftercooler, marine gear oil cooler, and any other circuit that are cooled by raw water should be thoroughly cleaned and flushed.

NOTE: Special impeller puller tool is provided with minor and major sea water pump rebuild kits. If tool is not available, the impeller can normally be removed by using two pair of pliers to grip impeller vanes on opposite sides of impeller. Rotating the pump shaft by hand may help free the impeller. Petroleum-based lubricants can cause the impeller to swell, and are not recommended to free a stuck impeller.



Remove Components

- A—Sea Water Pump Housing
- B—Quad Ring (2 used)
- C—Impeller
- D—Alignment Pin
- E—Cam Liner (2 used)

5. Remove quad rings (B), cam liners (E), and alignment pin (D) from sea water pump housing (A).

6. Discard quad rings (B).

7. Inspect cam liners (E) for evidence of heavy pitting or wear. Replace as needed.

8. Clean sealing surfaces and inspect for defects.

9. Install new inner quad ring (B) into sea water pump housing (A).

10. Install cam liners (E), ensuring that alignment pin (D) lines up with slot in sea water pump housing (A).

IMPORTANT: Petroleum-based lubricants can cause the impeller to swell, and are not recommended to lubricate the impeller before installation.

11. Lubricate impeller blades with a non-petroleum based lubricant such as silicone or soapy water. Install

impeller (C) using a counterclockwise twisting motion and be sure that the impeller blades are bent in the same direction as they were upon removal.

12. Rotate impeller (C) to align splines.

13. Install new outer quad ring (B), install cover plate and cap screws with washers and tighten to specifications.

Specification

Cap Screws
 (A)—Torque..... 7.5 N·m (66 lb.-in.)

14. Open sea cock and prime sea water pump with water. Start engine and check for leaks.

Install cap screws (A) and tighten to specifications.

RG29971 —UN—18DEC17

ZE59858,00001CB -19-19FEB18-2/2

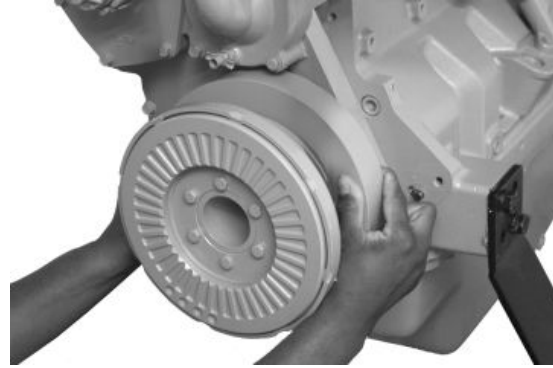
Lubrication & Maintenance — 2000 Hours/24 Months

Checking Crankshaft Vibration Damper

For engines equipped with viscous crankshaft vibration damper replace at major engine overhaul. Also replace viscous crankshaft vibration damper when short block, complete block, or remanufactured basic engine is installed.

NOTE: On engines equipped with dual crankshaft vibration dampers, always replace both crankshaft vibration dampers as a matched set. Checking procedure only applies to elastomeric crankshaft vibration damper.

- Grasp vibration damper with both hands and attempt to turn it in both directions. If rotation is felt, replace crankshaft vibration damper.
- Visually inspect crankshaft vibration damper for cracks or damage. If present, replace crankshaft vibration damper.



Dual Crankshaft Vibration Damper

RG7369—UN—05JAN98

AT89373,0000E95 -19-02NOV15-1/1

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.

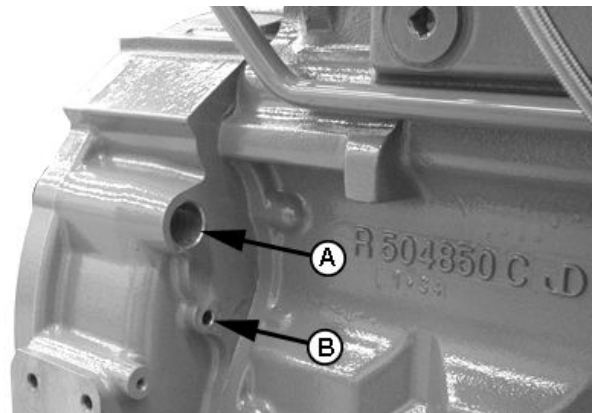
IMPORTANT: Visually inspect contact surfaces of valve tips, bridges, and rocker arm wear pads. Check all parts for excessive wear, breakage, or cracks. Replace parts that show visible damage.

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



Flywheel Housing Timing Holes

A—Timing/Rotation Hole

B—Timing Pin Hole

viewed from front) until No. 1 (front) cylinder is at TDC compression stroke. Insert JDG1571 or JDE81-4 Timing Pin in flywheel.

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.

Continued on next page

ZE59858,00001CC -19-05DEC13-1/3

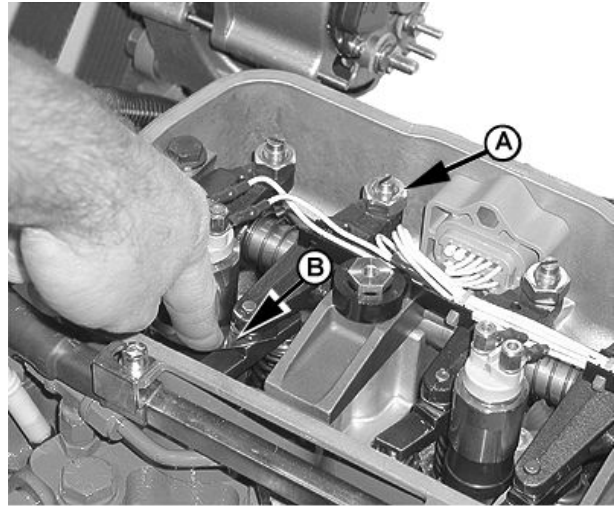
RG13749—UN—11NOV04

- 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.)



Adjusting Valves

A—Adjusting Screw Jam Nut B—Feeler Gauge

ZE59858,00001CC -19-05DEC13-2/3

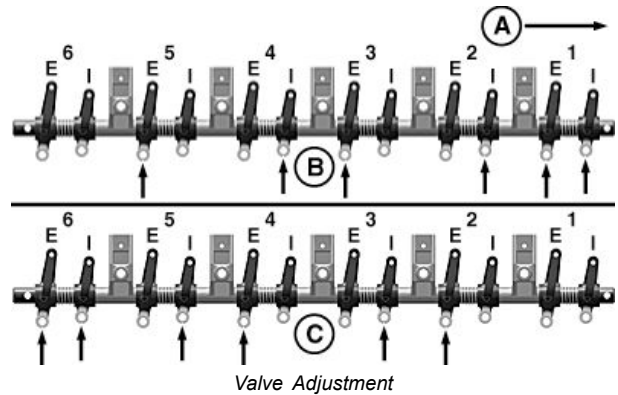
RG13809 —UN—07DEC04

- Lock No. 1 piston at TDC compression stroke (B).
- Adjust valve clearance on No. 1, 3 and 5 exhaust valves and No. 1, 2, and 4 intake valves.
- Turn crankshaft 360°. Lock No. 6 piston at TDC compression stroke (C).
- Adjust valve clearance on No. 2, 4 and 6 exhaust valves and No. 3, 5, and 6 intake valves.
- 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.)
------------------------	---------------------

- Reconnect battery terminal.



Valve Adjustment

A—Front of Engine E—Exhaust Valve
 B—No. 1 Piston TDC I—Intake Valve
 Compression
 C—No. 6 Piston TDC
 Compression

ZE59858,00001CC -19-05DEC13-3/3

RG17725 —UN—04OCT10

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.

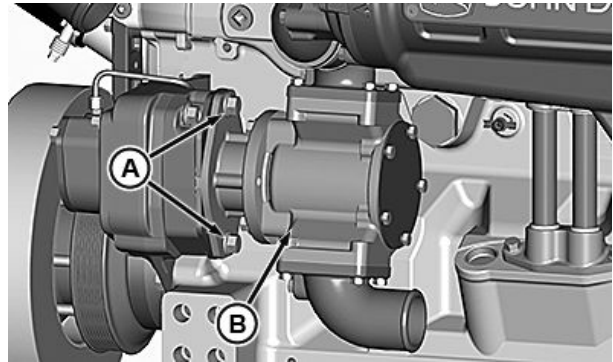
NOTE: An arbor press and drivers are necessary to install this kit. Have an experienced technician install this kit.

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.



Remove and Install Sea Water Pump

A—Cap Screws

B—Sea Water Pump

RG24651 —UN—28OCT13

ZE59858,00001D1 -19-19FEB18-1/1

Lubrication & Maintenance — 4500 Hours/60 Months

Replace Crankshaft Vibration Damper

Crankshaft vibration damper is not repairable. For engines equipped with elastomeric crankshaft vibration damper replace every 4500 hours or 60 months, whichever occurs first. For engines equipped with viscous crankshaft

vibration damper replace at major engine overhaul. Also replace viscous crankshaft vibration damper when short block, complete block, or remanufactured basic engine is installed.

ZE59858,000025F -19-02NOV15-1/1

Flushing And Refilling Cooling System

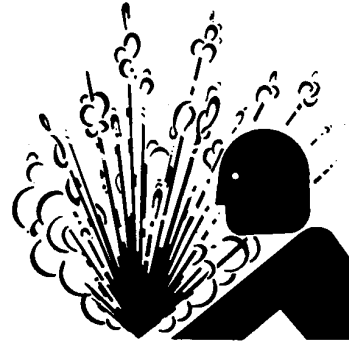
⚠ CAUTION: Explosive release of fluids from pressurized cooling system can cause serious burns.

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.

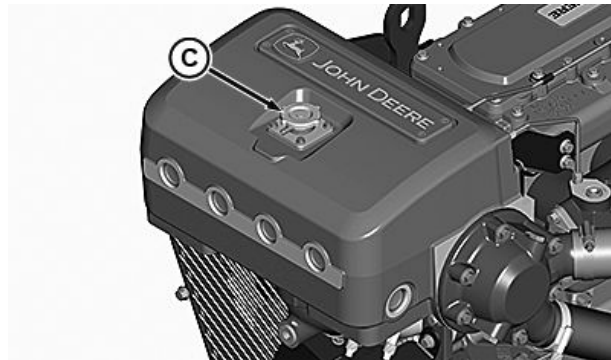
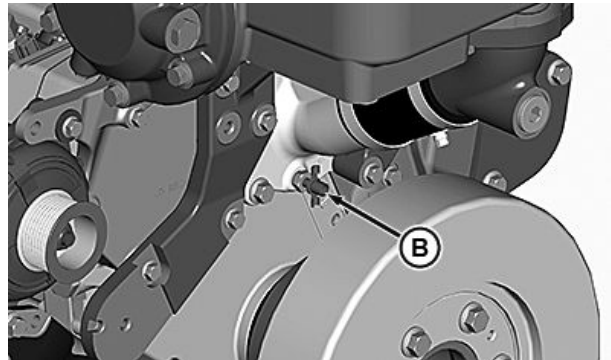
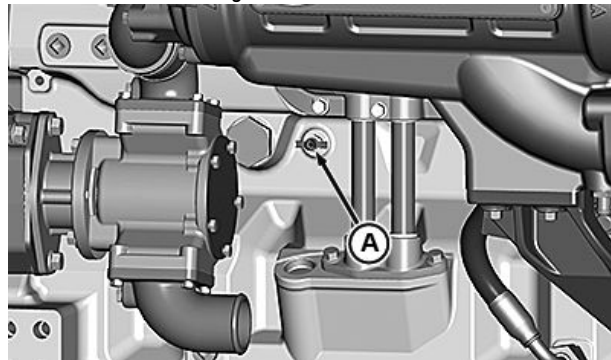
1. Pressure test entire cooling system and pressure cap if not previously done. See [Pressure Testing Cooling System](#) in the Lubrication & Maintenance — 500 Hours/12 Months Section.
2. Slowly open the engine cooling system filler cap or pressure cap (C) to relieve pressure and allow coolant to drain 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

Continued on next page

ZE59858,0000259 -19-16FEB18-1/2

- Remove thermostats (D) at this time, if not previously done. Install cover (without thermostats) and tighten cap screws to specifications.

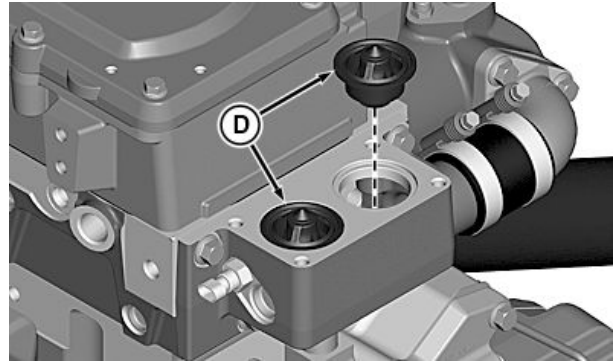
Specification

Thermostat Cover Cap
Screws—Torque..... 45 N·m (33 lb.-ft.)

- 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.

- Close all drain valves after coolant has drained.
- Fill the cooling system with clean water. Run the engine about 10 minutes to stir up possible rust or sediment.
- Stop engine and immediately drain the water from system before rust and sediment settle.
- 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.
- After cleaning the cooling system, drain cleaner and fill with water to flush the system. Run the engine 10 minutes, then drain water.
- Close all drain valves on engine, top tank, and heat exchanger. Install new rubber seal on each thermostat



Thermostats

RG24657 —UN—29OCT13

D—Thermostats

and install thermostats. Install thermostat cover and tighten cap screws to specifications.

Specification

Thermostat Cover Cap
Screws—Torque..... 45 N·m (33 lb.-ft.)

- Refill heat exchanger with fresh coolant until coolant touches bottom of the filler neck. See [Adding Coolant](#) in the Service As Required Section.
- Run engine until it reaches operating temperature. This mixes the solution uniformly and circulates it through the entire system.
- After running the engine, check coolant level and entire cooling system for leaks.

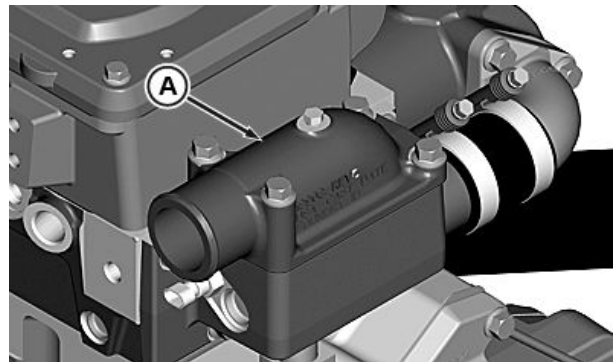
ZE59858.0000259 -19-16FEB18-2/2

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.

- Visually inspect the area around the coolant manifold for leaks. Partially drain coolant from the cooling system.
- Remove thermostat cover (A).

A—Thermostat Cover



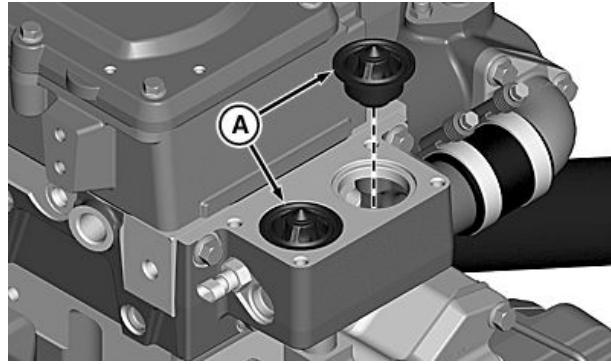
Remove Thermostat Cover

RG17166 —UN—26MAY09

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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

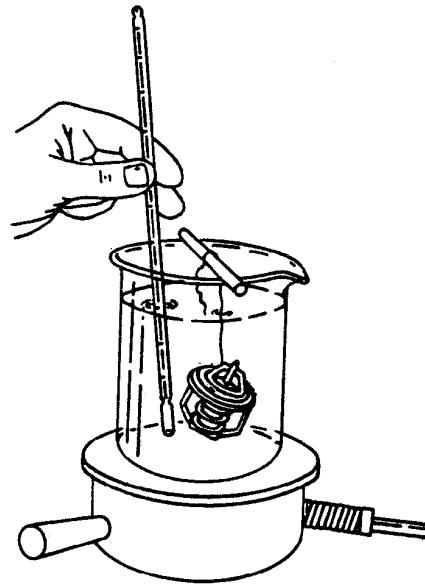
ZE59858,000025A -19-29OCT13-2/4

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.



Thermostats and Thermometer in Water

RG5971 —UN—23NOV97

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ZE59858,000025A -19-29OCT13-3/4

Installing Thermostats

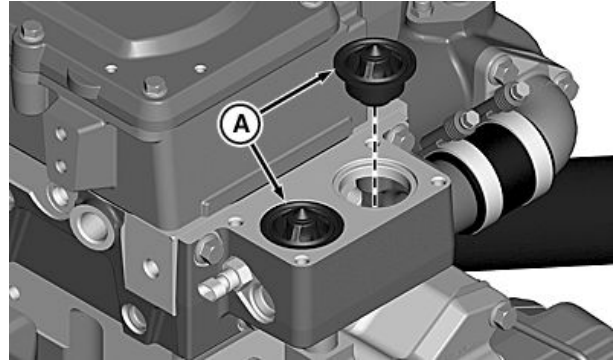
1. Install new rubber seal on each thermostat and install thermostats.
2. Install cover and tighten cap screws to specifications.

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



Installing Thermostats

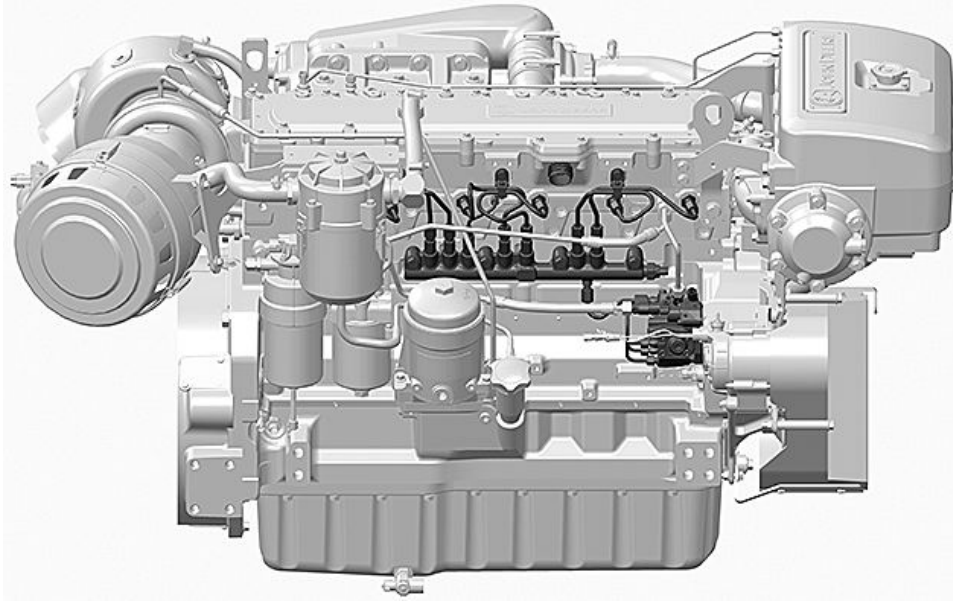
Pressure Testing Cooling System in the Lubrication & Maintenance — 500 Hours/12 Months Section.

RG17155 —UN—26MAY09

ZE59858,000025A -19-29OCT13-4/4

Service As Required

Do Not Modify Fuel System



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.

RG24681 —UN—30OCT13

ZE59858,00001D2 -19-30OCT13-1/1

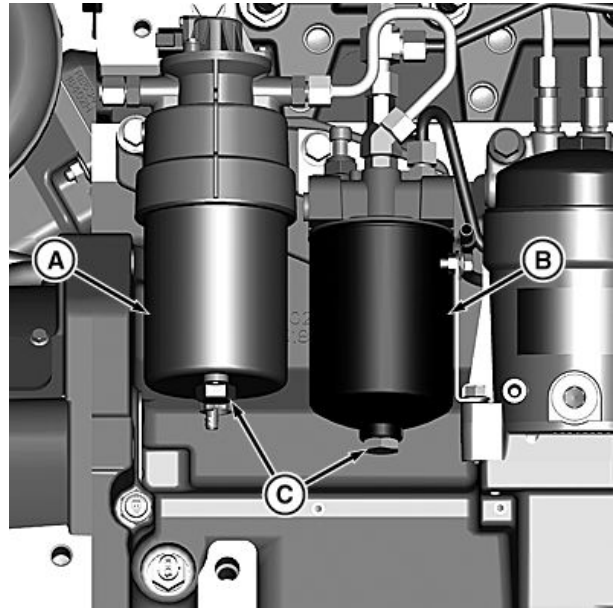
Draining Water From Fuel Filter

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](#).



Drain Water from Fuel Filters

A—Primary Fuel Filter
B—Final Fuel Filter

C—Drain Valves

ZE59858,00001D9 -19-14NOV13-1/1

RG17160 —UN—26MAY09

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](#)



High-Pressure Fluids

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.

RG, RG34710, 5593 -19-29OCT13-1/1

TS281 —UN—15APR13

Pre-Start Cleaning Guide

CAUTION: Avoid injury. Before cleaning machine, allow ample time for hot surfaces to cool.

IMPORTANT: Avoid machine damage. Do not direct high-pressure spray from hose output directly at or close to electrical connections and sensors.

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 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 hydraulic and other fluid leaks.
- Fuel Lines — Check for leaks, cracks, and kinks.
- 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.
- 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, or poor connections.

ZE59858,0000009 -19-07JUL20-1/1

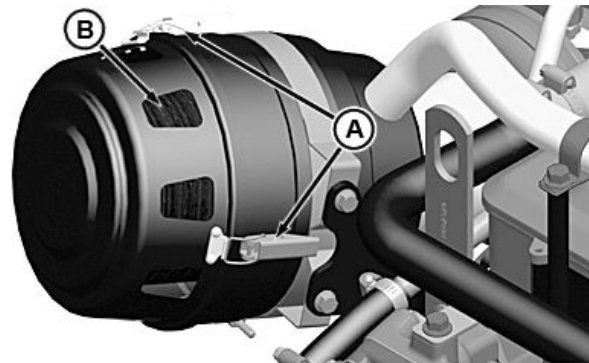
Replacing Air Cleaner Filter Element

IMPORTANT: ALWAYS REPLACE primary air cleaner element when air filter restriction indicator (A) shows vacuum of 625 mm (25 in.) H₂O, 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.



Replace Air Filter Element

A—Air Filter Assembly Clamps B—Air Filter Element

RG22155 —UN—21FEB13

ZE59858,0000263 -19-11NOV13-1/1

Element Storage

IMPORTANT: Air cleaner element MUST BE DRY before storing in plastic bag.

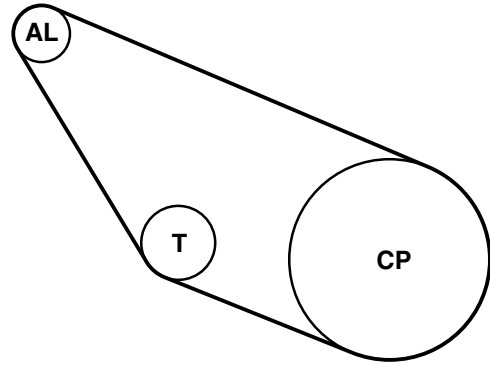
Seal element in a plastic bag and store in shipping container to protect against dust and damage.

ZE59858,00001D6 -19-18SEP13-1/1

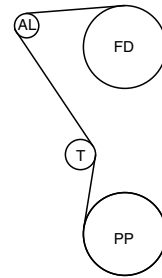
Replacing Alternator / Fan Belt

AL—Alternator
CP—Crankshaft Pulley

FD—Fan Drive (if equipped)
T—Tensioner



6090AFM85 / 6090SFM85 Belt Routing — Option A



6090HFM85 Belt Routing Option B

Continued on next page

ZE59858,00001D7 -19-25JAN22-1/2

RG17194 —UN—26MAY09

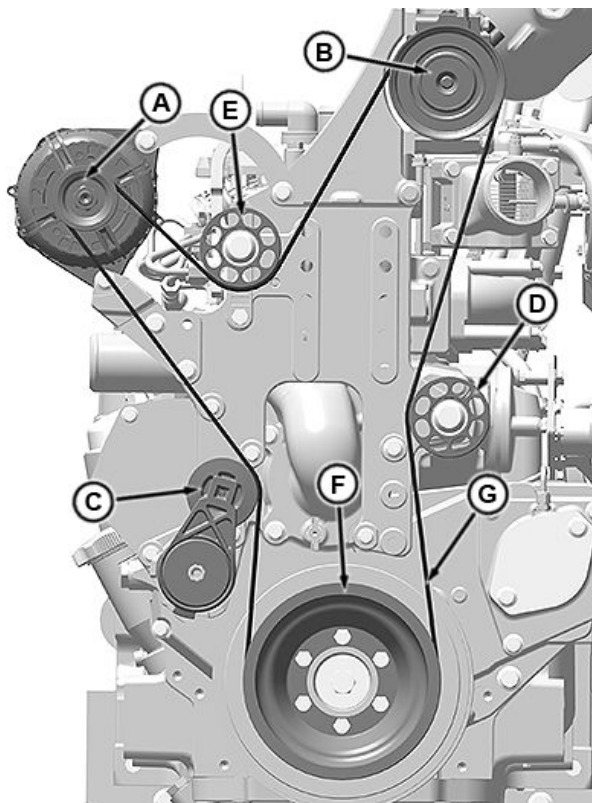
RG30142 —UN—16FEB18

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.

- | | |
|----------------------|----------------------|
| A—Alternator | E—Upper Idler Pulley |
| B—AC Compressor | F—Crankshaft Pulley |
| C—Belt Tensioner | G—Belt |
| D—Lower Idler Pulley | |



Belt Routing — Option C

RG35245 —UN—05JAN12

ZE59858,00001D7 -19-25JAN22-2/2

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.

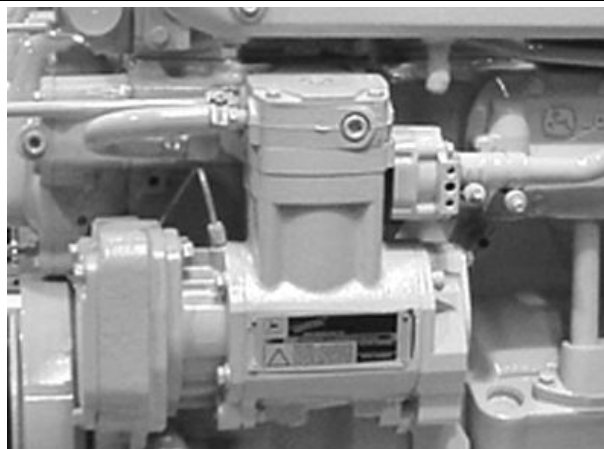
OURGP11,0000026 -19-13OCT06-1/1

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.



Air Compressor (Optional)

RG12738 —UN—07NOV02

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.

⚠ 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.



Rotating Drivelines

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

TS1644 —UN—22AUG95

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.

Later in this section is a list of possible engine problems that may be encountered accompanied by possible causes and corrections. The troubleshooting information is 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 -19-27FEB18-1/1

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.



TSS953—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.

Continued on next page

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Troubleshooting

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.
	Cold weather	Use cold weather starting aids. See <u>Cold Weather Operation</u> 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
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.

Continued on next page

ZE59858.0000273 -19-14NOV13-2/12

Troubleshooting

Symptom	Problem	Solution
	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.
	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.

Continued on next page

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Troubleshooting

Symptom	Problem	Solution
	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 <u>Checking and Adjusting Valve Clearance</u> in the Lubrication & Maintenance — 2000 Hours/24 Months.
	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.

Continued on next page

ZE59858.0000273 -19-14NOV13-4/12

Troubleshooting

Symptom	Problem	Solution
	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.
	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.

Continued on next page

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Troubleshooting

Symptom	Problem	Solution
	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.
	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.

Continued on next page

ZE59858.0000273 -19-14NOV13-6/12

Troubleshooting

Symptom	Problem	Solution
Turbocharger Noise or Vibration <i>NOTE: Do not confuse the whine heard during run down with noise which indicates a bearing failure.</i>	Bearings not lubricated (insufficient oil pressure)	Determine cause of lack of lubrication; repair as required. See your 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.
	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.

Continued on next page

ZE59858,0000273 -19-14NOV13-7/12

Troubleshooting

Symptom	Problem	Solution
	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 <u>Flushing And Refilling Cooling System</u> in the Lubrication & Maintenance — 6000 Hours/72 Months Section.)
	Engine overloaded	Reduce engine load.
	Loose or defective fan belt	Check automatic belt tensioner and belts. Replace as required. (See <u>Checking Tensioner Spring Tension</u> in the Lubrication & Maintenance — 500 Hours/12 Months Section.)

Continued on next page

ZE59858.0000273 -19-14NOV13-8/12

Troubleshooting

Symptom	Problem	Solution
	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.
	Cylinder head or block cracked	Locate crack, repair/replace components as required. See your authorized John Deere engine distributor or servicing dealer.

Continued on next page

ZE59858,0000273 -19-14NOV13-9/12

Troubleshooting

Symptom	Problem	Solution
	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.
	Restricted oil pump screen or cracked pick-up tube	Remove oil pan and clean screen/replace pick-up tube.

Continued on next page

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Troubleshooting

Symptom	Problem	Solution
	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.

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ZE59858,0000273 -19-14NOV13-11/12

Troubleshooting

Symptom	Problem	Solution
	Defective turbocharger	See your authorized John Deere engine distributor or servicing dealer.
	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.

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Troubleshooting

Symptom	Problem	Solution
Batteries Will Not Charge	Defective battery	Test battery.
	Battery charging rate too high	Test charging system.
	Loose or corroded connections	Clean and tighten connections.
	Sulfated or worn-out batteries	Replace batteries.
Starter and Hourmeter Functions; Rest of Electrical System Does Not Function	Stretched belt or defective belt tensioner	Adjust belt tension or replace belts.
	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.

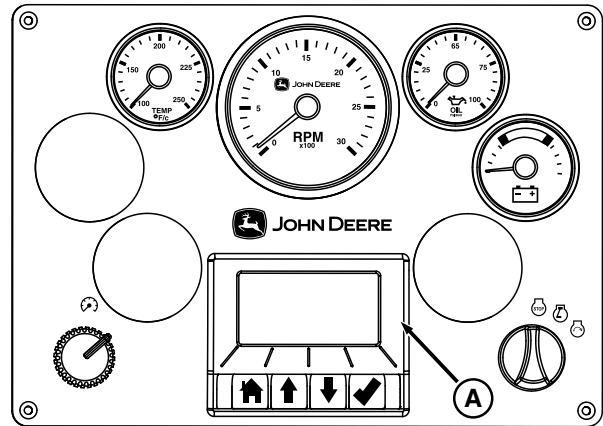
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Instrument Panel Method for Retrieving Diagnostic Trouble Codes

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.



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.

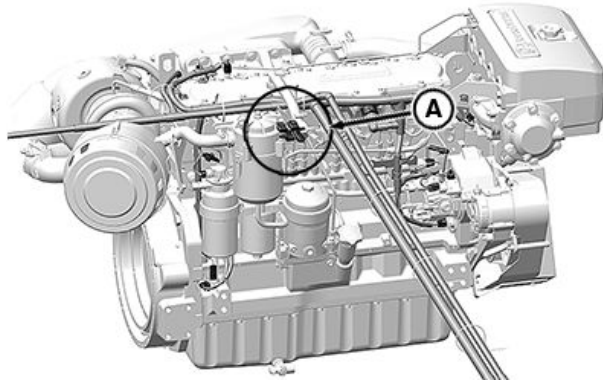
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RG29319—UN—23FEB17

Checking Fuses

NOTE: Fuse location can vary, refer to the type that applies to your engine wiring harness.

Type A refers to engines with fuse located in the control panel wiring harness.



6090AFM85 / 6090SFM85

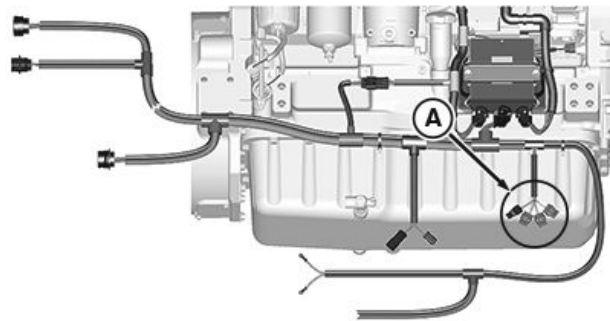
A—Fuse Location

Type A Engine Wiring Harness Fuse Location

Check the following fuses located in the control panel wiring harness. Replace defective fuses.

Type B refers to engines with a fuse block mounted on the engine control unit (ECU) panel.

Check the following fuses and replace any defective fuses.



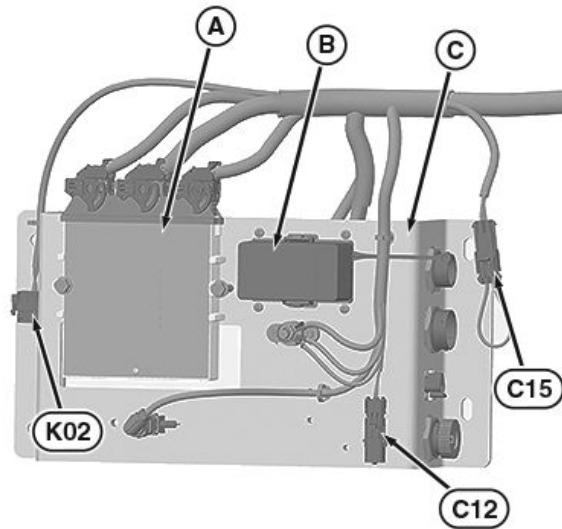
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- Control Panel Fuse — 30 A
- ECU Power Fuse — 20 A
- Fuel Transfer Pump Fuse — 15 A

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Type B Engine Wiring Harness Fuse Location

- | | |
|-----------------------------|----------------------------------|
| A—Engine Control Unit (ECU) | C12— Transient Voltage Protector |
| B—Fuse Block | C15— Remote On / Off |
| C—ECU Panel | K02— Fuel Transfer Pump Relay |

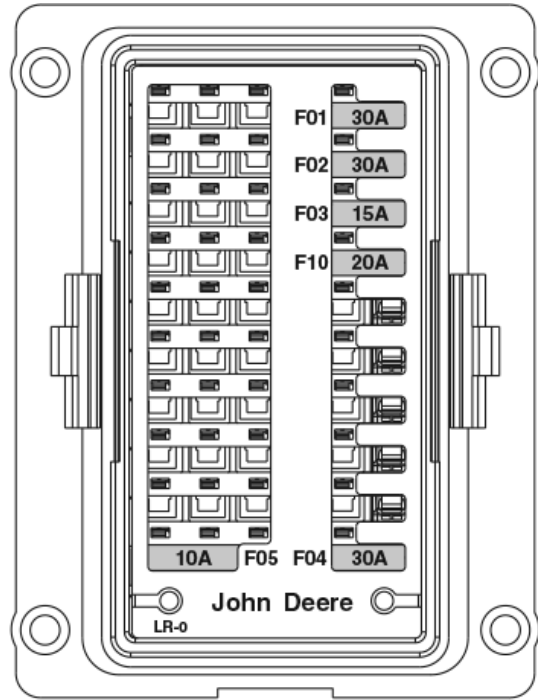


Type B Fuse Block Location

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- | | |
|---------------------------------------|----------------------------------------------|
| F01— Unswitched Power Fuse (30 A) | F04— Transient Voltage Protector Fuse (30 A) |
| F02— Diagnostic Connector Fuse (30 A) | F05— Switched Power Fuse (10 A) |
| F03— Fuel Transfer Pump Fuse (15 A) | F10— ECU Unswitched Power Fuse (20 A) |



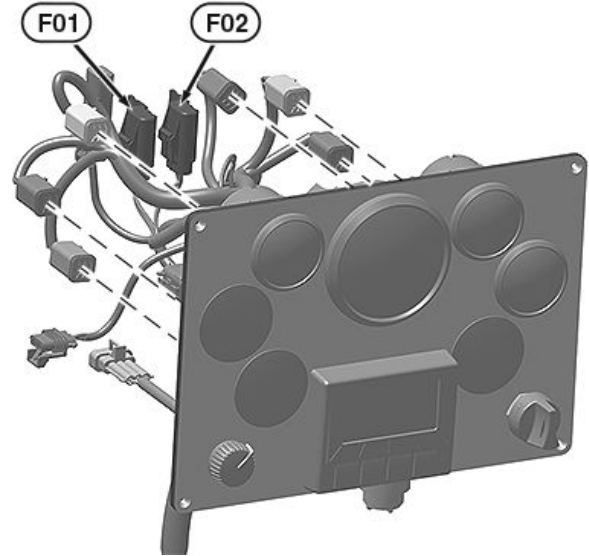
Type B Fuse Block

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Type B Main Station Panel Fuses

- | | |
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| F01— Main Station Switched Power Fuse (10 A) | F02— Main Station Unswitched Power Fuse (10 A) |
|----------------------------------------------|------------------------------------------------|



Type B Main Station Panel Fuses

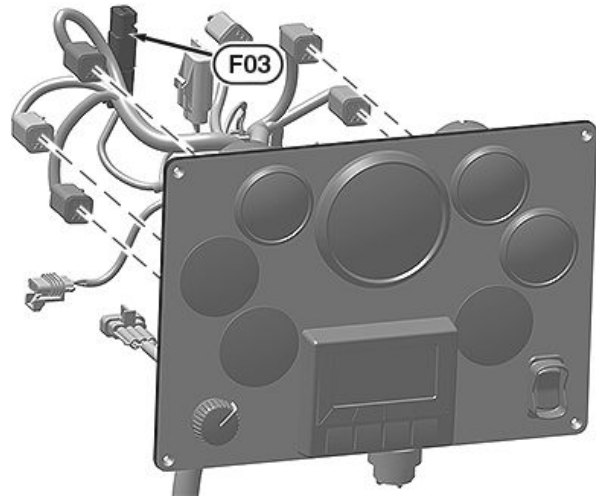
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RG29939—UN—10JAN18

Type B Remote Station Panel Fuses

F03— Remote Station
Switched Power Fuse
(10 A)



Type B Remote Station Panel Fuses

RG29940 —UN—10JAN18

EJ20264,000065B -19-16FEB18-5/5

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.

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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

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

Troubleshooting

SPN Code	SPN Name
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
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 DTC Diagnostics

Intermittent DTCs are problems that periodically “go away”. A problem such as a terminal that intermittently does not make contact can cause an intermittent DTC. Other intermittent DTCs may be set only under certain operating conditions such as heavy load, extended idle, etc. When diagnosing intermittent DTCs, 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 DTCs:

- If diagnostic charts on preceding pages indicate that the problem is intermittent, try to reproduce the operating conditions that were present when the 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 DTCs:

- Poor connection between sensor or actuator harness.
- Poor contact between terminals in connector.
- Poor terminal/wire connection.
- Electromagnetic interference (EMI) from an improperly installed 2-way radio, etc., can cause faulty DTCs to appear.

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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 10W 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.

IMPORTANT: Avoid damage to the engine cooling system components. Engine cooling system must be drained, flushed, and refilled for prolong storage of more than one year.

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.



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RG35532 — JUN—22MAR22

Effects of Prolong Storage of Coolant — More Than One Year

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.

Continued on next page

OUOD006.00000FC -19-23MAR22-1/2

Storage

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 -19-23MAR22-2/2

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

Specifications

General Marine Engine Specifications

ITEM	ENGINE MODEL 6090HFM85	ENGINE MODEL 6090SFM85	ENGINE MODEL 6090AFM85
General Data			
Engine Type	In-line, 4 cycle diesel	In-line, 4 cycle diesel	In-line, 4 cycle diesel
Aspiration	Turbocharged and air to air aftercooled	Turbocharged and seawater aftercooled	Turbocharged and coolant aftercooled
Number of Cylinders	6	6	6
Bore	118 mm (4.65 in)	118 mm (4.65 in)	118 mm (4.65 in)
Stroke	136 mm (5.35 in)	136 mm (5.35 in)	136 mm (5.35 in)
Displacement	9.0 L (549 cu. in.)	9.0 L (549 cu. in.)	9.0 L (549 cu. in.)
Combustion System	Direct Injection	Direct Injection	Direct Injection
Compression Ratio	16.3:1	16.3:1	16.3:1
Physical Dimensions:			
Width	714 mm (28.1 in)	975 mm (38.4 in)	938 mm (36.9 in)
Height	965 mm (38.0 in)	982 mm (38.7 in)	984 mm (38.7 in)
Length	1469 mm (57.8 in)	1714 mm (67.5 in)	1714 mm (67.5 in)
Weight (with oil, without coolant)	—	1056 kg (2327 lb)	1055 kg (2325 lb)
Performance Data			
Engine Power and Speed Ratings	See Engine Power And Speed Specifications in the Specifications Section.		
Lubrication System (Propulsion / Variable Speed Applications)			
Oil Pressure at Rated rpm	281 kPa (41 psi)	245 kPa (36 psi)	274 kPa (40 psi)
Oil Pressure at Low Idle	170 kPa (25 psi)	135 kPa (20 psi)	115 kPa (17 psi)
Engine Oil Capacity	See Engine Crankcase Oil Fill Quantities in the Specifications Section.		
Lubrication System (Generator / Constant Speed Applications)			
Oil Pressure at Rated rpm (±35%)	263 kPa (38 psi)	341 kPa (35 psi)	283 kPa (41 psi)
Engine Oil Capacity	See Engine Crankcase Oil Fill Quantities in the Specifications Section.		
Cooling System			
Recommended Pressure Cap	110 kPa (16 psi)	110 kPa (16 psi)	110 kPa (16 psi)
Coolant Temperature Operating Range	82-94°C (180-202°F)	82-94°C (180-202°F)	71-84°C (160-183°F)
Coolant Temperature (Maximum)	110°C (230°F)	110°C (230°F)	110°C (230°F)
Coolant Capacity (Including Heat Exchanger)	—	38 L (40 qt)	42 L (44.5 qt)
Fuel System			
ECU Level	L14	L14	L14
Fuel Injection Type	HPCR	HPCR	HPCR
Primary Fuel Filter	10 micron	10 micron	10 micron
Secondary Fuel Filter	2 micron	2 micron	2 micron
Electrical System			
Battery Capacity (Minimum)- 12 Volt System	1100 CCA	1100 CCA	1100 CCA
Battery Capacity (Minimum)- 24 Volt System	750 CCA	750 CCA	750 CCA
Air System			

Continued on next page

ZE59858,00001E8 -19-21FEB18-1/2

Specifications

ITEM	ENGINE MODEL 6090HFM85	ENGINE MODEL 6090SFM85	ENGINE MODEL 6090AFM85
Maximum Air Intake Restriction ()	6.25 kPa (0.0625 bar) (0.9 psi)	6.25 kPa (0.0625 bar) (0.9 psi)	6.25 kPa (0.0625 bar) (0.9 psi)
Maximum Exhaust Back Pressure	7.5 kPa (0.075 bar) (1.09 psi)	7.5 kPa (0.075 bar) (1.09 psi)	7.5 kPa (0.075 bar) (1.09 psi)

ZE59858,00001E8 -19-21FEB18-2/2

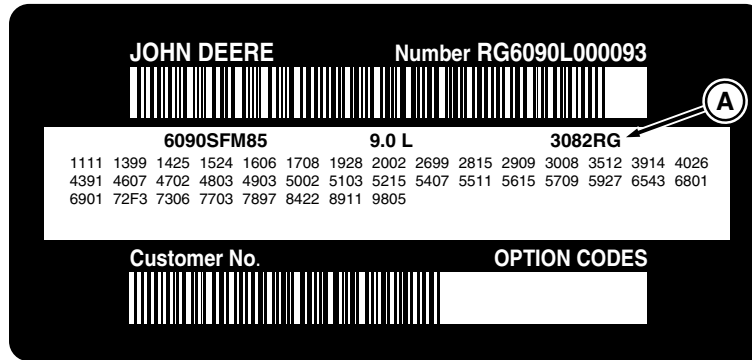
Engine Power And Speed Specifications

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
6090HFM85	Constant Speed	238 kW (319 hp)	1800	1000	—
	Variable Speed	242 kW (325 hp)	2000	800	1500

^aEngine 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.

ZE59858,00001E9 -19-27FEB18-1/1

Engine Crankcase Oil Fill Quantities



Option Code Label

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 1980	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.

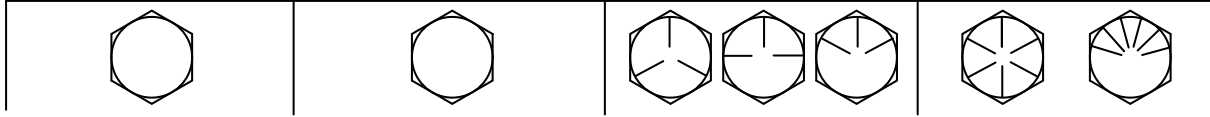
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Specifications

Unified Inch Bolt and Screw Torque Values

TS1671 —UN—01MAY03



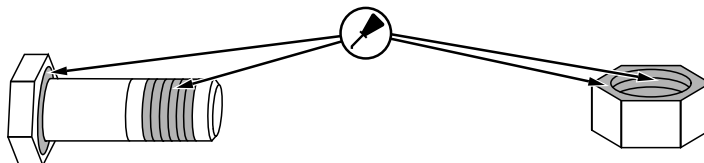
Bolt or Screw Size	SAE Grade 1 ^a				SAE Grade 2 ^b				SAE Grade 5, 5.1 or 5.2				SAE Grade 8 or 8.2			
	Hex Head ^c		Flange Head ^d		Hex Head ^c		Flange Head ^d		Hex Head ^c		Flange Head ^d		Hex Head ^c		Flange Head ^d	
	N·m	lb·in	N·m	lb·in	N·m	lb·in	N·m	lb·in	N·m	lb·in	N·m	lb·in	N·m	lb·in	N·m	lb·in
1/4	3.1	27.3	3.2	28.4	5.1	45.5	5.3	47.3	7.9	70.2	8.3	73.1	11.2	99.2	11.6	103
													N·m	lb·ft	N·m	lb·ft
5/16	6.1	54.1	6.5	57.7	10.2	90.2	10.9	96.2	15.7	139	16.8	149	22.2	16.4	23.7	17.5
									N·m	lb·ft	N·m	lb·ft				
3/8	10.5	93.6	11.5	102	17.6	156	19.2	170	27.3	20.1	29.7	21.9	38.5	28.4	41.9	30.9
					N·m	lb·ft	N·m	lb·ft								
7/16	16.7	148	18.4	163	27.8	20.5	30.6	22.6	43	31.7	47.3	34.9	60.6	44.7	66.8	49.3
	N·m	lb·ft	N·m	lb·ft												
1/2	25.9	19.1	28.2	20.8	43.1	31.8	47	34.7	66.6	49.1	72.8	53.7	94	69.3	103	75.8
9/16	36.7	27.1	40.5	29.9	61.1	45.1	67.5	49.8	94.6	69.8	104	77	134	98.5	148	109
5/8	51	37.6	55.9	41.2	85	62.7	93.1	68.7	131	96.9	144	106	186	137	203	150
3/4	89.5	66	98	72.3	149	110	164	121	230	170	252	186	325	240	357	263
7/8	144	106	157	116	144	106	157	116	370	273	405	299	522	385	572	422
1	216	159	236	174	216	159	236	174	556	410	609	449	785	579	860	634
1-1/8	305	225	335	247	305	225	335	247	685	505	751	554	1110	819	1218	898
1-1/4	427	315	469	346	427	315	469	346	957	706	1051	775	1552	1145	1703	1256
1-3/8	564	416	618	456	564	416	618	456	1264	932	1386	1022	2050	1512	2248	1658
1-1/2	743	548	815	601	743	548	815	601	1665	1228	1826	1347	2699	1991	2962	2185

The nominal torque values listed are for general use only with the assumed wrenching accuracy of 20%, such as a manual torque wrench. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For lock nuts, for stainless steel fasteners, or for nuts on U-bolts, see the tightening instructions for the specific application.

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 that fastener threads are clean.
- Apply a thin coat of Hy-Gard™ or equivalent oil under the head and on the threads of the fastener, as shown in the following image.
- Be conservative with the amount of oil to reduce the potential for hydraulic lockup in blind holes due to excessive oil.
- Properly start thread engagement.

TS1741 —UN—22MAY18



^aGrade 1 applies for hex cap screws over 6 in (152 mm) long, and for all other types of bolts and screws of any length.

^bGrade 2 applies for hex cap screws (not hex bolts) up to 6 in (152 mm) long.

^cHex head column values are valid for ISO 4014 and ISO 4017 hex head, ISO 4162 hex socket head, and ISO 4032 hex nuts.

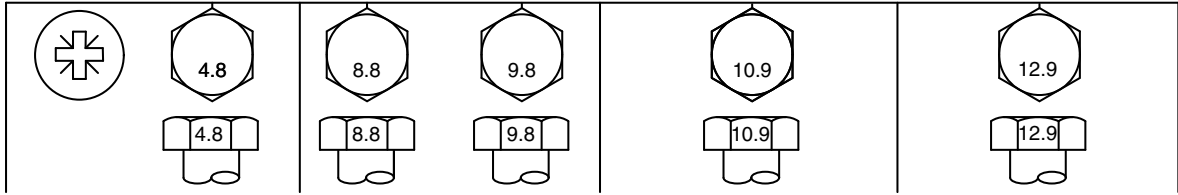
^dHex flange column values are valid for ASME B18.2.3.9M, ISO 4161, or EN 1665 hex flange products.

DX,TORQ1 -19-09MAY22-1/1

Specifications

Metric Bolt and Screw Torque Values

TS1742 —UN—31MAY18



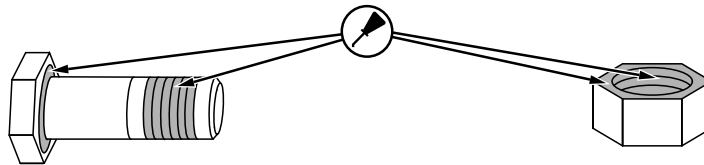
Bolt or Screw Size	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Hex Head ^a		Flange Head ^b		Hex Head ^a		Flange Head ^b		Hex Head ^a		Flange Head ^b		Hex Head ^a		Flange Head ^b	
	N·m	lb·in	N·m	lb·in	N·m	lb·in	N·m	lb·in	N·m	lb·in	N·m	lb·in	N·m	lb·in	N·m	lb·in
M6	3.6	31.9	3.9	34.5	6.7	59.3	7.3	64.6	9.8	86.7	10.8	95.6	11.5	102	12.6	112
									N·m	lb·ft	N·m	lb·ft	N·m	lb·ft	N·m	lb·ft
M8	8.6	76.1	9.4	83.2	16.2	143	17.6	156	23.8	17.6	25.9	19.1	27.8	20.5	30.3	22.3
			N·m	lb·ft	N·m	lb·ft	N·m	lb·ft								
M10	16.9	150	18.4	13.6	31.9	23.5	34.7	25.6	46.8	34.5	51	37.6	55	40.6	60	44.3
	N·m	lb·ft														
M12	—	—	—	—	55	40.6	61	45	81	59.7	89	65.6	95	70.1	105	77.4
M14	—	—	—	—	87	64.2	96	70.8	128	94.4	141	104	150	111	165	122
M16	—	—	—	—	135	99.6	149	110	198	146	219	162	232	171	257	190
M18	—	—	—	—	193	142	214	158	275	203	304	224	322	245	356	263
M20	—	—	—	—	272	201	301	222	387	285	428	316	453	334	501	370
M22	—	—	—	—	365	263	405	299	520	384	576	425	608	448	674	497
M24	—	—	—	—	468	345	518	382	666	491	738	544	780	575	864	637
M27	—	—	—	—	683	504	758	559	973	718	1080	797	1139	840	1263	932
M30	—	—	—	—	932	687	1029	759	1327	979	1466	1081	1553	1145	1715	1265
M33	—	—	—	—	1258	928	1398	1031	1788	1319	1986	1465	2092	1543	2324	1714
M36	—	—	—	—	1617	1193	1789	1319	2303	1699	2548	1879	2695	1988	2982	2199

The nominal torque values listed are for general use only with the assumed wrenching accuracy of 20%, such as a manual torque wrench. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For lock nuts, for stainless steel fasteners, or for nuts on U-bolts, see the tightening instructions for the specific application.

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 that fastener threads are clean.
- Apply a thin coat of Hy-Gard™ or equivalent oil under the head and on the threads of the fastener, as shown in the following image.
- Be conservative with the amount of oil to reduce the potential for hydraulic lockup in blind holes due to excessive oil.
- Properly start thread engagement.

TS1741 —UN—22MAY18



^aHex head column values are valid for ISO 4014 and ISO 4017 hex head, ISO 4162 hex socket head, and ISO 4032 hex nuts.

^bHex flange column values are valid for ASME B18.2.3.9M, ISO 4161, or EN 1665 hex flange products.

DX.TORQ2 -19-09MAY22-1/1

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.
- Open fuel return shutoff valve (if equipped) and verify all fuel return lines are free of restrictions.
- 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.

ZE59858,0000262 -19-16FEB18-1/1

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									
Date									
Hours									
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ZE59858,00001EC -19-26NOV13-1/1

Lubrication and Maintenance Records

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.

Hours									
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ZE59858,00001ED -19-02NOV15-1/1

2000 Hours or 24 Months Service

- Check and adjust engine valve clearance.
- Overhaul sea water pump.
- Check crankshaft vibration damper.

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ZE59858,00001EE -19-02NOV15-1/1

4500 Hours or 60 Months Service

- Replace crankshaft vibration damper.

Hours									
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ZE59858,0000260 -19-02NOV15-1/1

6000 Hours or 72 Months Service

- Test thermostats.

- Flush and refill cooling system.

Hours									
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Lubrication and Maintenance Records

Service As Required

- Drain water from fuel filters.
- Add coolant.
- Replace air cleaner element.
- Replace alternator / fan belt.
- Check air compressor, if equipped.
- Check refrigerant (A/C) compressor, if equipped.
- Check front PTO, if equipped.

Hours									
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ZE59858,00001EF -19-21FEB18-1/1

Warranty

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 Canada ULC 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 the engine online at <https://warrantyregistration.deere.com/WarrantyReg/web/WarrantyReg>.

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.deere.com/or> <https://www.deere.ca/> (click on "Find a Dealer").

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 provides the service required, maintaining a purchaser-dealer relationship of mutual respect from the beginning is always helpful.

Privacy Notice

At John Deere privacy is important. We collect, use, and disclose personal information in accordance with the John Deere privacy statement. For instance, we collect, use, and disclose personal information to provide the products and services requested; to communicate with the 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 personal information. For complete details on privacy rights and to obtain a copy of the John Deere Privacy Statement, visit our website at <https://www.deere.com/or> <https://www.deere.ca/>.

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 are 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 necessary, 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.)

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.deere.com/or> <https://www.deere.ca/> (click on "Find a Dealer").

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 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 that 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.

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 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.

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, that is, 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 must 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 Section 01.

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 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.

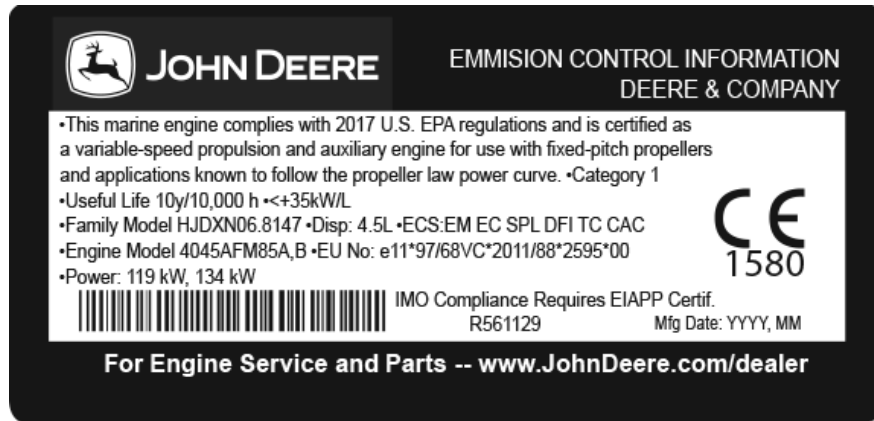
All requested information should be given. Much of it contributes to reports, including those required by governments.

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.

CM22194,00011A1 -19-10MAY22-3/3

Emissions Control System Certification Label

! CAUTION: Statutes providing severe penalties for tampering with emissions controls may apply to the user or dealer.



RG29342—JUN—03MAR17

Emission Label

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 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.

AK08008,0000040 -19-07MAR17-1/1

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, under the transitional provision of (EU) 2016/1628 article 58. 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.

The presence of a CE mark signifies the propulsion engine complies with Exhaust Emission requirements of Recreational Craft Directive 2 (2013/53/EU).

AK08008,0000041 -19-07MAR17-1/1

**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

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