

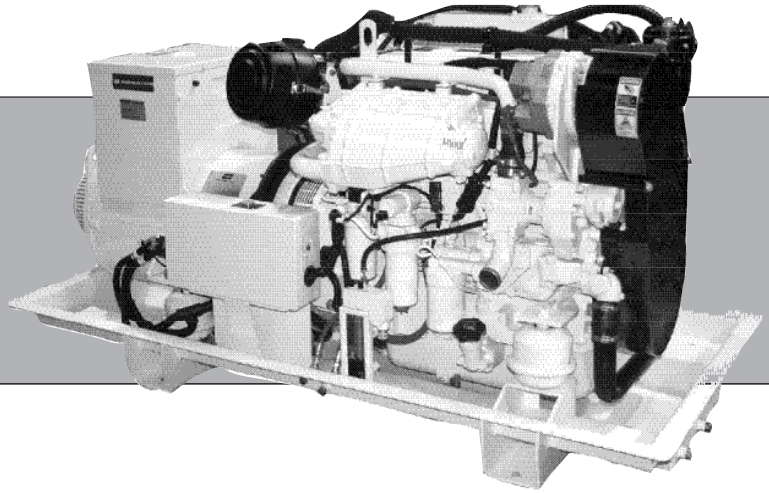




# OPERATOR'S MANUAL

## OM3-80

For Models: M80A13S, M80A13, M99A13S, M99A13,
M116A13, M150A13S & M150A13



NORTHERN LIGHTS

www.northern-lights.com

— CALIFORNIA —
Proposition 65 Warning:

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

* Always start and operate the engine in a well-ventilated area.
* If in an enclosed area, vent the exhaust to the outside.
* Do not modify or tamper with the exhaust system.
* Do not idle the engine except as necessary.

**For more information, go to www.P65warnings.ca.gov/diesel.**

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# OPERATOR'S MANUAL

**For Models:**

**M80A13S, M80A13, M99A13S, M99A13, M116A13, M150A13S & M150A13**

***Read this operator's manual thoroughly before starting to operate your equipment.***
***This manual contains information you will need to run and service your new unit.***

## Table of Contents

## Introduction

Servicing of marine engines and generator sets presents unique problems. In many cases boats cannot be moved to a repair facility. Marine engines cannot be compared to the servicing of automobiles, trucks or even farm equipment. Failures often occur in remote areas far from competent assistance. Marine engines are taxed far more severely than auto or truck engines; therefore, maintenance schedules must be adhered to more strictly.

Failures begin with minor problems that are overlooked and become amplified when not corrected during routine maintenance.

As operator, it is your obligation to learn about your equipment and its proper maintenance. This is not a comprehensive technical service manual. Nor will it make the reader into an expert mechanic. Its aim is to aid you in maintaining your unit properly.

## Model Numbers

**M**80A13S = Northern Lights Tier III turbocharged marine diesel generator set with a John Deere 4045 engine and Stamford generator end, 80 kW at 1800 rpm.

**M**99A13S = Northern Lights Tier III turbocharged marine diesel generator set with a John Deere 4045 engine and Stamford generator end, 80 kW at 1800 rpm.

**M**116A13L = Northern Lights Tier III turbocharged marine diesel generator set with a John Deere 6068 engine and Leroy Somer generator end, 116 kW at 1800 rpm.

**M**150A13S = Northern Lights Tier III turbocharged marine diesel generator set with a John Deere 6068 engine and Stamford generator end, 150 kW at 1800 rpm.

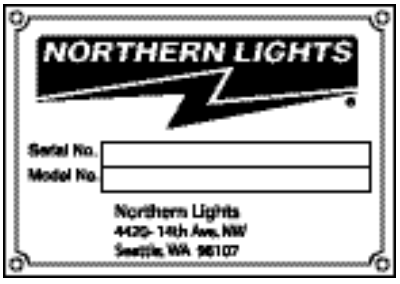
**M**80A13 = Northern Lights Tier III turbocharged marine diesel generator set with a John Deere 4045 engine and Marathon generator end, 80 kW at 1800 rpm.

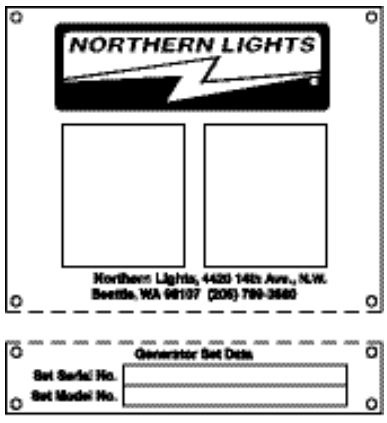
**M**99A13 = Northern Lights Tier III turbocharged marine diesel generator set with a John Deere 4045 engine and Marathon generator end, 80 kW at 1800 rpm.

**M**150A13 = Northern Lights Tier III turbocharged marine diesel generator set with a John Deere 6068 engine and Marathon generator end, 150 kW at 1800 rpm.

## Serial Numbers

When referencing Northern Lights equipment by serial number, please refer only to the number stamped on the Northern Lights® serial number plate.



## Warranty

A warranty registration certificate is supplied with your set. The extent of coverage is described in the Limited Warranty Statement. We recommend that you study the statement carefully.

NOTE: If the warranty is to apply, the servicing instructions outlined in this manual must be followed. If further information is needed, please contact an authorized dealer or the factory.

## Safety Rules

***NOTICE:** Accident reports show that careless use of engines causes a high percentage of accidents. You can avoid accidents by observing these safety rules. Study these rules carefully and enforce them on the job.*

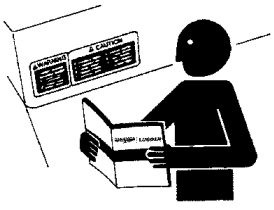
IMPORTANT SAFETY INSTRUCTIONS. Electromagnetic equipment, including generator sets and their accessories, can cause bodily harm and life threatening injuries when improperly installed, operated or maintained. To prevent accidents be aware of potential dangers and act safely.

READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN THIS MANUAL, PRIOR TO THE INSTALLATION OF ANY GENERATOR SET OR ACCESSORY. KEEP THESE INSTRUCTIONS FOR FUTURE REFERENCE.

**Recognize Safety Symbols and Instructions**
In addition to the information found in this section, this operator's manual uses three different signal words to outline potential dangers of a specific nature.

| | |
|---|---|
| DANGER | DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury. |
| WARNING | WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury. |
| CAUTION | CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. |

**Follow All Safety Instructions**



Carefully read and understand all safety messages in this manual and on your machine's safety signs. Keep signs in good and clean condition. Replace missing or damaged signs. Be sure new equipment components and repair parts include the current safety signs. For replacement signs, proper placement of safety signs or clarification on any safety issue, consult your Northern Lights dealer or the factory.
There can be additional safety information contained on parts and components from outside suppliers that is not reproduced in this manual. Consult the suppliers for additional safety information.

Learn how to operate the machine and how to use the controls properly. Only trained personnel should operate machines, or work on or around them.

Keep you machine in proper working condition. UNAUTHORIZED MODIFICATIONS TO THE MACHINERY MAY IMPAIR ITS FUNCTION AND SAFETY PARAMETERS.

**Prevent Bypass and Accidental Starting**

WARNING

Do not start engine by shorting across start terminal. Engine will start if normal circuitry is bypassed, creating a hazard by runaway machinery.

Start engine only from operator's station.

**Handle Fuel Safely - Avoid Flames**

WARNING

Diesel is highly flammable and should be treated with care at all times. Do do not refuel while smoking or when near sparks or open flame.

ALWAYS STOP ENGINE BEFORE FUELING MACHINE. Always fill portable fuel tank outdoors. Never fuel a hot engine.

## Safety Rules (Continued)

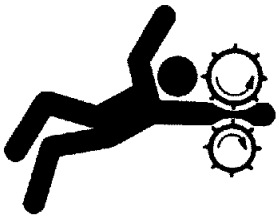
Prevent accidental discharge of starting fluids by storing all cans in a cool, safe place, away from sparks or open flame. Store with cap securely on container. Never incinerate or puncture a fuel container.

Prevent fires by keeping machine clean of accumulated trash, grease and debris. Always clean any spilled fuel as swiftly as possible. Do not store oily rags, which can ignite and burn spontaneously.

Be prepared if a fire starts. Keep a first aid kit and fire extinguisher handy. Keep emergency contact numbers for fire department, doctors, ambulance and hospital near the telephone.

**Service Machines Safely**

**⚠ DANGER**



Do not wear a necktie, scarf, necklace, rings or other jewelry, or any loose clothing when working near moving parts. Tie long hair behind your head. If any of these items get caught in moving machinery, severe injury or death could result.

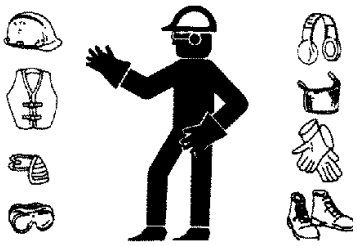
Check for any loose electrical connections or faulty wiring.

Look completely around engine to make sure that everything is clear before starting.

**Wear Protective Clothing**

**⚠ WARNING**

To prevent catching anything in moving machinery, always wear close fitting clothes and safety equipment appropriate to the job.
Prolonged exposure to loud noise can cause hearing loss or impairment.
Wear suitable authorized hearing protection, such as earmuffs or plugs to protect against loud noises.



Operating equipment requires the full attention of the operator. Do not use radio or music headphones while operating machinery.

**Practice Safe Maintenance**

**⚠ CAUTION**

Understand all service procedures before starting work. Keep area clean and dry. Never lubricate, service, or adjust machine while it is in operation.

Keep hands, feet and clothing away from power-driven equipment. When shutting down an engine, disengage all power and operator controls. Allow the engine to cool completely before beginning any service work.

*Securely support any machinery elements that must be raised for service work with support or lifting machinery specifically intended for that purpose.*

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

Disconnect battery ground cable (-) before making any adjustments or service work.

**Stay Clear of Rotating Drivelines**

**⚠ DANGER**

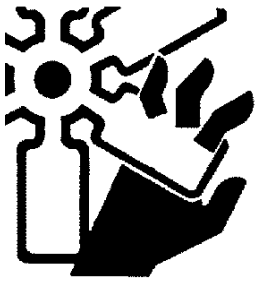
Entanglement in rotating drivelines can cause serious injury or death. Keep shields in place at all times. Make sure that rotating shields turn freely in pace with the drivelines.

Do not wear loose fitting equipment around rotating drivelines. Stop the engine and make sure that all moving parts have stopped before making any adjustments, connections, or performing any other type of service to the engine or other driven equipment.

## Safety Rules (Continued)

**Install all Safety Guards**

**WARNING**



Direct contact with rotating fans, belts, pulley and drives can cause serious injury.

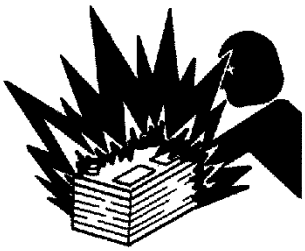
Keep all guards in place at all times during engine operation.

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

Do not allow anything on your person to dangle into or come in contact with a moving fan, belt, pulley or drive. Fans can act as vacuums and pull materials up from below, so avoid that area as well while in service.

**Safe Battery Handling**

**WARNING**



**Prevent Battery Explosions**

Battery gas is highly flammable. Battery explosions can cause severe injury or death. To help prevent battery explosions, keep sparks, lighted matches and open flame away from the top of battery. When checking battery electrolyte level, use a flashlight.

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

Frozen batteries may explode if charged. Never charge a battery that has not been allowed to warm to at least 16$^{o}$C (60$^{o}$F).
Always remove grounded (-) battery clamp first and replace ground clamp last.

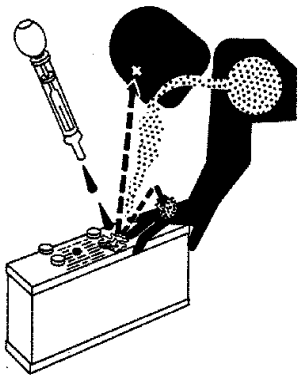
Sulfuric acid in battery electrolyte is poisonous and strong enough to burn skin, eat holes into clothing and other materials, and cause blindness if splashed into eyes.

**To Avoid Hazards:**

- Fill batteries only in well-ventilated areas.
- Wear appropriate eye protection and rubber gloves.
- Never use air pressure to clean batteries.
- Wear appropriate ventilation equipment to avoid inhaling fumes when adding electrolyte.
- Do not spill or drip electrolyte.
- Use correct jump-start procedure if required.

**If acid is spilled on skin or in eyes:**

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



If acid is swallowed:

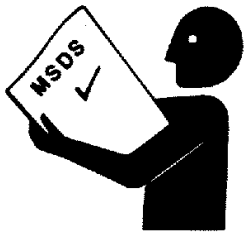
1. DO NOT induce vomiting.
2. Drink large amounts of water or milk, without exceeding 2 liters (2 quarts)
3. Get medical attention immediately

**WARNING**

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

**Handle Chemical Products Safely**

**WARNING**




Direct exposure to hazardous chemicals can cause serious injury. Among the potentially hazardous chemicals that may be used with Northern Lights products are lubricants, coolants, paints and adhesives.

All potentially hazardous chemicals come with a Material Safety Data Sheet (MSDS). The MSDS provides specific details on chemical products, including physical hazards, safety procedures and emergency response techniques

## Safety Rules (Continued)

Read and understand the MSDS for each chemical before you start any job that includes it. Follow the procedures and use appropriate equipment exactly as recommended.

Contact your Northern Lights dealer or Northern Lights factory for MSDS's used on Northern Lights products.

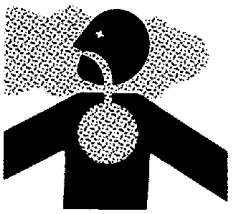
**Work in Well Ventilated Areas**

**⚠ CAUTION**

Exhaust fumes from engines contain carbon monoxide and can cause sickness or death. Work in well ventilated areas to avoid prolonged exposure to engine fumes. If it is necessary to run an engine in an enclosed area, route the exhaust fumes out of the area with an approved, leak proof exhaust pipe extension.

**Remove Paint Before Welding or Heating**

**⚠ WARNING**



Hazardous fumes can be generated when paint is heated by welding, soldering or using a torch. To avoid potentially toxic fumes and dust, remove paint before heating.

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

Do not use a chlorinated solvent in an area where welding will occur. Work only in areas that are well ventilated. Dispose of paint and solvent properly.

**Service Cooling System Safely**

**⚠ WARNING**

Opening a pressurized cooling system can release explosive fluids and causing serious burns. Before opening any pressurized cooling system, make sure the engine has been shut off. Do not remove a filler cap unless it is cool enough to comfortably grip with bare hands. Slowly loosen cap to relieve pressure before opening fully.

**Avoid High Pressure Fluids**

**⚠ WARNING**

Relieve pressure prior to disconnecting pressurized lines. Escaping fluid under pressure can penetrate the skin causing serious injury. Always relieve pressure before disconnecting hydraulic or other pressurized lines. Tighten all connections firmly before re-applying pressure.

If searching for leaks, use a piece of cardboard. Always protect your hands and other body parts from high-pressure fluids.

If an accident occurs, see a doctor immediately. Any high pressure spray injected into the skin must be removed within a few hours to prevent the risk of gangrene or other infection.

**Avoid Heating Near Pressurized Fluid Lines**

**⚠ WARNING**

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns and bodily injury. Pressurized lines can rupture when heat goes beyond the immediate flame area. Do not weld, solder or use a torch or open flame near pressurized lines or other flammable fluids.

**Do Not Open High-Pressure Fuel System**

**⚠ DANGER**

Many Northern Lights engines use high-pressure fuel injection. High-pressure fluid remaining in fuel lines can cause serious injury. Do not disconnect or attempt any repair of fuel lines, sensors, or other

components between the high-pressure fuel pump and nozzles on engines with high pressure fuel systems.

ONLY AUTHORIZED TECHNICIANS CAN PERFORM REPAIRS ON AN HIGH PRESSURE FUEL INJECTION SYSTEMS.

**Avoid Hot Exhaust**

**WARNING**

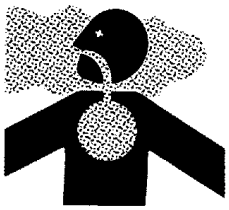
Avoid exposure to and physical contact with hot exhaust gases. Exhaust parts and streams can reach high temperatures during operation, leading to burns or other serious injury.

Cleaning exhaust filters can also lead to exposure to hot exhaust gas and the injury risk associated with it. Avoid exposure to and physical contact with hot exhaust gases when cleaning exhaust filters.

During auto or manual/stationary exhaust filter cleaning operations, the engine will run at elevated temperatures for an extended period of time. Exhaust parts and streams can reach high temperatures during operation, leading to burns or other serious injury.

**Avoid Harmful Asbestos Dust**

**WARNING**

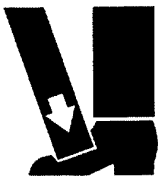


Inhaling asbestos fibers may cause lung cancer. Avoid breathing any dust that may be generated when handling components containing asbestos fibers, including some gaskets.

The asbestos used in these components is usually found in a resin or otherwise sealed. Normal handling of these components is not dangerous, as long as airborne dust containing asbestos is not generated.
Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding materials containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If this vacuum is not available, apply a mist of oil or water on the material containing asbestos. Keep all bystanders away from any area where asbestos dust may be generated.

**Use Proper Lifting Equipment and Techniques**

**WARNING**



Lifting heavy components incorrectly can cause severe injury or damage to machinery. Avoid unbalanced loads. Do not use lifting eyes. Lift the generator set using lifting bars inserted through the lifting holes on the skid. Follow all recommended removal and installation procedures in this and associated Northern Lights manuals.

**Use Proper Tools**

**CAUTION**

Makeshift tools and procedures can create safety hazards. Always use appropriate tools for the job.

Use power tools only to loosen threaded parts and fasteners. For loosening and tightening hardware, always use the correct sized tools.

Do not use US measurement tools on metric fasteners, or vice versa. Use only service parts that meet Northern Lights specifications.

**Dispose of Waste Properly**

**CAUTION**

Disposing of waste improperly can threaten the environment and lead to unsafe working conditions. Potentially harmful waste used in Northern Lights equipment can include oil, fuel, coolant, filters and batteries.

Use leakproof containers to drain fluid. 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.

## Lock Out / Tag Out Procedures

### Scope

During maintenance, repairs or retooling of a Northern Lights generator set, simply turning the machine off or unplugging it while it is being worked on does not give enough protection to others who are not performing the maintenance or repair. Many serious accidents happen when someone thought the machine was turned off, or all of its energy was safely blocked or released.

### General Policy

**⚠ CAUTION**

To avoid dangerous or hazardous situations, refrain from any of the following:

- Removing or bypassing a guard or other safety device
- Placing any part of your body in a position where you could be caught by moving machinery.
- Cleaning or oiling machinery when in operation.
- Adjusting circuits, chillers, pumps, air handlers, valves, circuit breakers or fans while in operation.
- Working on piping or high pressure systems.

### Lock Out/Tag Out Instructions - Electrical Equipment

**⚠ WARNING**

Be sure the equipment's ON/OFF switch is in the OFF position and is unplugged from any electrical source before attempting to perform any type of work on the equipment. Obtain an electrical plug cap cover with a lockset. Secure the plug terminal end using the electrical plug lockout cap. Lock the cap and retain the key.

If the equipment is directly wired into an electrical box with a shut off switch, obtain a lock pad and/or the appropriate colored tags and place the lock and tag through the shut off lever. Retain the key until the repair is completed and the machine is safe to start. Be certain the shut off lever is in the OFF position before restarting. NEVER give a lock out key to unauthorized personnel.

If the equipment is directly wired into an electrical box without a shut off switch and lock out capability, then a circuit breaker lock out will be required. Obtain a circuit lock and tag set. Install the lock onto the circuit breaker box. Ensure the unit ON/OFF switch is in the OFF position before restarting.

### Lock Out/Tag Out Instructions - Pneumatic and Hydraulic Equipment

**⚠ WARNING**

For servicing pneumatic and hydraulic equipment, the following additional procedures must be implemented, following completion of lock out/tag out procedures for the unit to be serviced:

Shut off air, water or supply valves at the equipment to be serviced.

Check the local bleed-off point for completed release of pressurized air, water or oil.

If shutting off of air, water or other material cannot be achieved at the local supply valve, shut off valves further back in the system and re-check the bleed-off point until complete shut-off is achieved.

Affix a DO NOT OPERATE tag to each valve handle that requires shut off. Each DO NOT OPERATE tag must be signed and dated by the authorized technician servicing the equipment.

### Lock Out/Tag Out Instructions - Air Hose Connected Pneumatic Equipment

**⚠ WARNING**

Equipment connected to the compressed air system through an air hose with a detachable fitting must be shutdown and unplugged. Excess air must be bled prior to removing the air hose, prior to any maintenance or repair activities.

Affix a DO NOT OPERATE tag to the air hose near the detachable fitting. Each DO NOT OPERATE tag must be signed and dated by the authorized technician servicing the equipment. Check that the equipment cannot be operated by activating the ON switch.

### Stored Energy

**⚠ WARNING**

Immediately after applying Lock Out or Tag Out devices, ensure that all potentially hazardous stored or residual energy is relieved, disconnected, restrained and otherwise rendered safe.

### Verification of Isolation

**⚠ CAUTION**

Verify the machinery or equipment is actually isolated and de-energized prior to beginning work on a machine or on equipment that has been locked out.

### Restarting Procedures

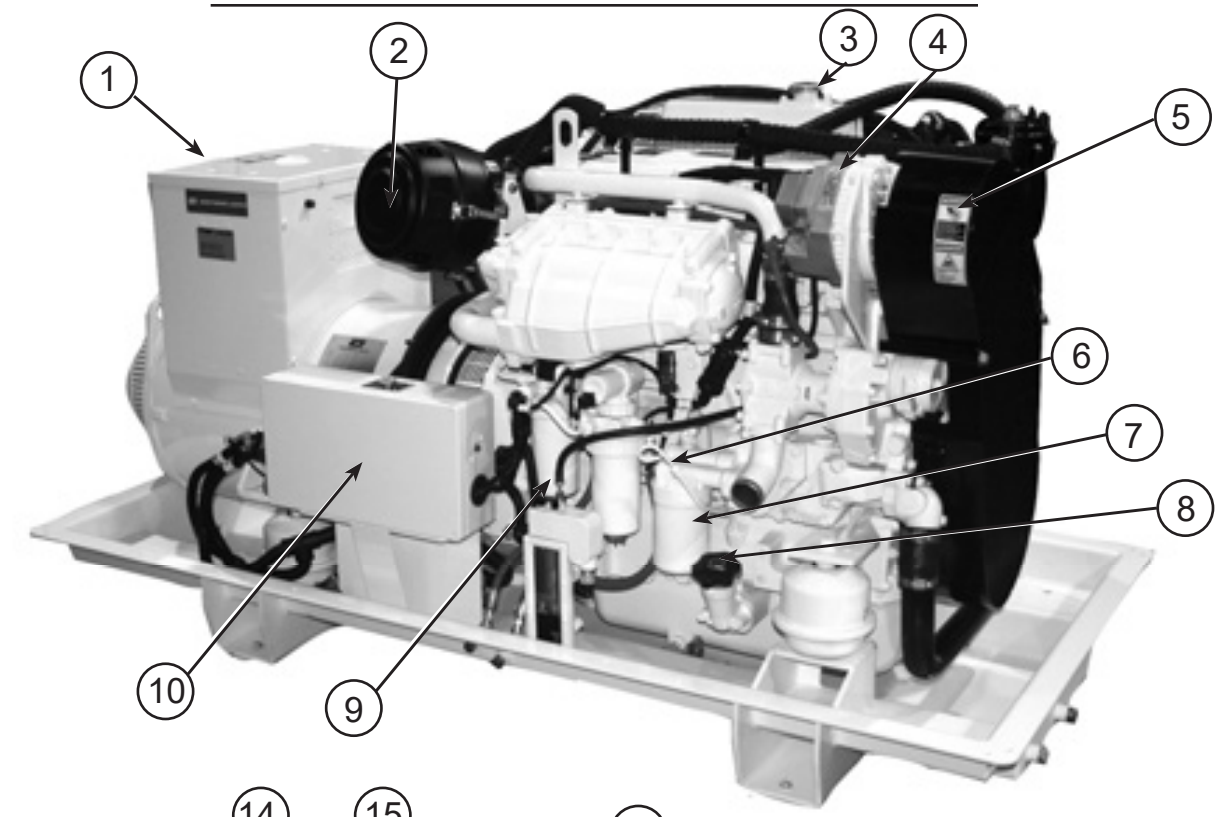
**⚠ CAUTION**

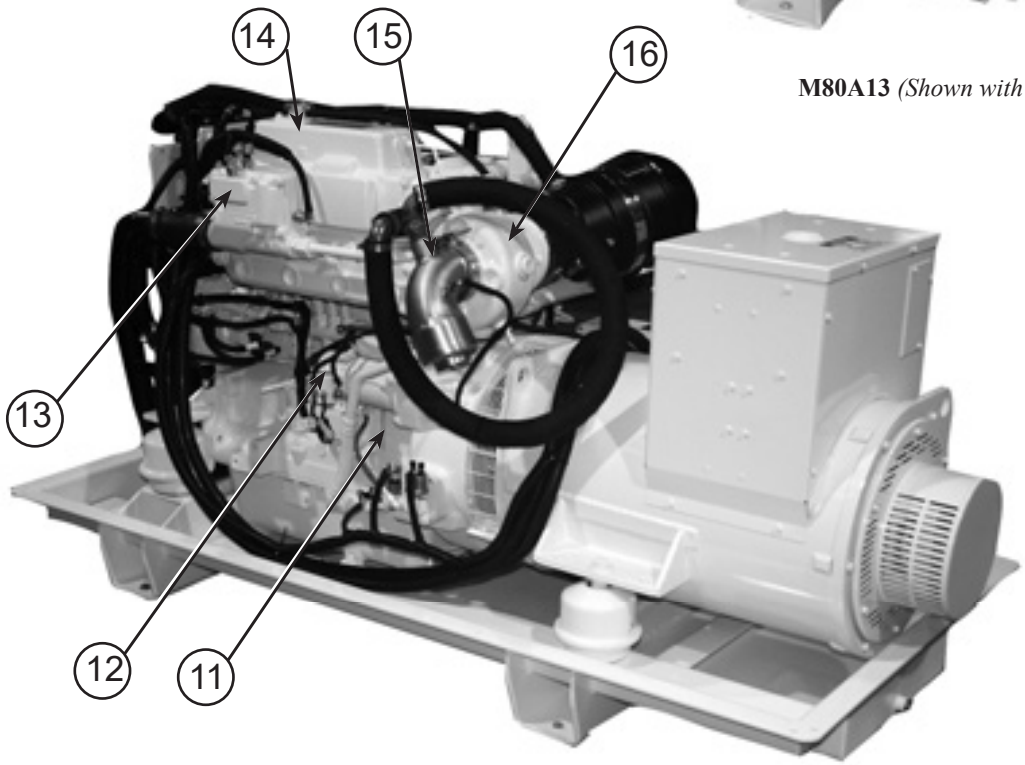
Follow the procedures below prior to restoring energy:

- Ensure that all machinery or equipment is properly reassembled. Inspect the machinery or equipment to verify non-essential items have been removed.
- Ensure that all personnel are safely outside danger zones. Notify personnel that lock out/tag out devices have been removed and energy will be reapplied.
- Only authorized personnel may remove lock out/tag out devices or notices.

## Notes

## Component Locations




**M80A13** *(Shown with optional equipment)*

1. AC Junction Box
2. Air Cleaner
3. Coolant Fill
4. Alternator
5. Belt Guard
6. Lube Oil Dipstick
7. Lube Oil Filter
8. Lube Oil Fill
9. Fuel Filter
10. DC/Control Junction Box
11. Fuel Injection Lines
12. Starter
13. Thermostat Cover
14. Expansion Tank
15. Exhaust Elbow
16. Turbocharger

## Northern Lights Control Panels


**Figure 7:** *Series 3B Generator Control Panel*

1. SHUTDOWN BYPASS SWITCH

   This switch bypasses the safety shutdown feature during the starting process.

2. ENGINE CONTROL SWITCH

   To start the engine, hold this switch in the START position until the engine is running.
   NOTE: Excessive cranking of marine sets equipped with water lift muffler systems can cause engine damage.
   After the engine starts, release the switch and it will return to RUN position. To stop the engine, hold the switch in the STOP position.

3. OIL PRESSURE GAUGE

   The oil pressure gauge shows the oil pressure in the engine lubricating system. If the pressure drops below 15 PSI at a speed higher than idling, stop the engine and investigate.

4. COOLANT TEMPERATURE GAUGE

   Water temperature gauge shows the temperature of the cooling water. If the gauge registers over 200°F (93.3$^0$C) or drops below 140°F (60$^0$C), stop the engine and investigate.

5. HOUR METER

   Keeps track of the engine running time.

6. DC VOLTMETER

   When the engine is running, it indicates the voltage output of the alternator.

## Emission-Related Installation & Instructions

Failing to follow these instructions when installing a certified engine in a vessel violates federal law (40 CFR 1068.105(b)), subject to fines or other penalties as described in the Clean Air Act.

The installed exhaust system should not create exhaust back pressure greater than 30" (760 mm) of water for a turbocharged engine and 48" (1200 mm) for a non-turbocharged unit, measured at the engine exhaust elbow.

If you install the engine in a way that makes the engine's emission control information label hard to read during normal engine maintenance, you must place a duplicate label on the vessel, as described in 40 CFR 1068.105.

## Operating Procedures

### BEFORE STARTING

1. Check the water level by removing the pressure cap from the expansion tank. In order to give the cooling water room to expand, the level should be about 1 3/4 in. (4-5 cm) below the filler cap sealing surface when the engine is cold. When filling with coolant, the venting cock on top of the turbocharger should be opened to ensure that no air pockets form in the cooling system **(see Service Point #14).**

***CAUTION:*** *Use protective clothing and open the filler cap carefully when the engine is warm to prevent burns.*

2. Check the oil level in the crankcase with the dipstick. The oil level should be between the "waffled area" and the "oo". Never allow the level to go below the "oo". Always add the same viscosity of oil as is already in the crankcase **(see Service Point #1)**.
3. Check the fuel tank level and open any fuel valves.
4. Disengage clutch, if equipped.
5. Close the seacock, check and clean the strainer and reopen the seacock.
6. Place the battery switch in the ON position.

***NOTE:*** *The battery switch must always be kept ON while the engine is running. If the switch is turned OFF while the engine is running, the battery charging regulator could be ruined.*

**Starting**

1. While holding the Shutdown Bypass switch in the ON position, push the Engine Control switch to the START position.
2. As soon as the engine starts, release both switches. **Do not crank the starter for more than 20 seconds.**
3. If the engine fails to start the first time, be sure the starter has stopped before re-engaging. Wait 2 minutes before starting engine again.

***NOTE:*** *If there is a governor locked at a specific speed on the generator set, there may not be a slow idle function, so in that case operate the engine at high idle for 1 to 2 minutes before adding load. If the stand-by generator set is loaded as soon as it reaches rated speed, this procedure would not apply.*

**Operating**

1. Check Gauges Often: Oil pressure must be above 29 PSI (if not above 15 PSI within 5 seconds of starting, the engine should be stopped and the problem should be explored). Normal oil pressure is 50 PSI at rated load speed (1800 to 2500 RPM). Oil temperature should be $115^0$C ($240^0$F) for normal operating temperature. The D.C. voltmeter should read between 13 and 14 volts (26-28 volts, 24 volt systems).
2. Check AC voltage and frequency meters (Series 4 Panel). If gauges deviate from normal levels, shut down the set and investigate.
3. Check belt for good alignment.
4. Let the unit run unloaded for a three to five minute warm-up period before applying load.
5. Do not add full electrical load until engine is at maximum operating temperature.

***NOTE:*** *If engine dies while under load, immediately remove load and restart engine. Turbocharger parts could overheat if the oil flow stopped.*

**Shutdown**

1. Move the Engine Control Switch to the OFF position.
2. Close the sea cock and fuel valves, and put the battery switch in the OFF position if the unit will be off for an extended period.

***NOTE:*** *Do not turn the battery switch to OFF while the engine is running.*

3. Fill the fuel tank to minimize possible water condensation problems. Filling tanks at end of day drives out moisture-laden air.
4. **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.
5. Observe the hour meter reading on diagnostic gauge/ hourmeter to determine if periodic maintenance is necessary. Make appropriate entries in maintenance logs. (See LUBRICATION AND MAINTENANCE RECORDS Section.)
6. Perform required periodic maintenance on all other equipment, as recommended by the equipment manufacturers.

## SHUTDOWNS AND ALARMS

1. Your unit is fitted with a system to protect it from high water temperature or low oil pressure.
   a. Generator sets have shutdown systems to stop the engine. They have no warning horns.
   b. Other alarms and shutdowns are available as optional equipment.

   ***NOTE:*** *Do not rely on your warning or shutdown system to the exclusion of careful gauge monitoring. Watching your gauges can prevent damage to the unit and dangerous power losses.*

2. Do the following when your shutdown system is activated:
   a. Check the temperature gauge. If the temperature is above 205°F (97°C), shut off the engine immediately.
   b. Use the Trouble Shooting Guide on pages 22- 24 to isolate the cause of the overheat.

   ***CAUTION:*** *Do not remove the water fill cap of an overheated engine. Escaping high temperature steam can cause severe burns. Allow the engine to cool and then remove the cap slowly,* ***using protective clothing.***

   c. Make repairs and restart after the temperature gauge registers below 180°F (83°C).
   d. Watch the temperature gauge regularly and turn off the unit if the temperature rises above 200°F (94°C). Repeat the troubleshooting process.

3. If the shutdown is activated and the temperature gauge shows temperature within normal temperature range:

   a. Check the engine crankcase oil level.
   b. If the oil level is low, fill with recommended lubricating oil and restart. Watch the oil pressure gauge carefully and shut off the engine if it does not show a normal reading after a few seconds of operation.
   c. If the oil level was normal, DO NOT restart the engine. Call your Northern Lights or Lugger dealer for assistance.

## 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 ENGINE **SPECIFICATIONS in Specifications Section near end of manual for temperature and pressure specifications for** your engine.

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

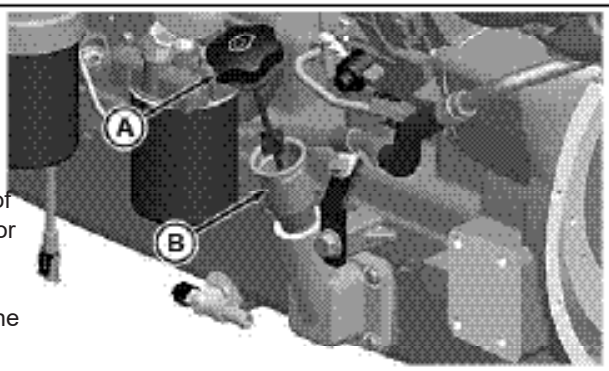
DJCC006,00003BF -19-21JUN07-1/1

## Break-In Service

The engine is ready for normal operation. However, extra care during the first 100 hours of operation will result in more satisfactory long-term engine performance and life. DO NOT exceed 100 hours of operation with break-in oil. See GENERAL ENGINE SPECIFICATIONS in Specifications Section near end of manual for oil pressure and coolant temperature specifications for your engine.

1. This engine is filled with factory break in oil. Operate the engine at heavy loads with minimal idling during the break in period.

2. If the engine has significant operating time at idle, constant speeds and/or light load usage, or makeup oil required in the first 100 hour period, a longer break-in period may be required. In these situations, an additional 100 hour break-in period is recommended using a new change of engine break in oil and a new Northern Lights oil filter.




*Check Engine Oil*

**A—Engine Oil Dipstick** **B—Dipstick Tube**

Continued on next page

RG19681,00003BC -19-28FEB13-1/5

IMPORTANT:
Do not add makeup oil until the oil level is BELOW the ADD mark on the dipstick. Factory provided break in oil required.

3. Check engine oil more frequently during engine break-in period. If oil must be added during this period, factory provided break-in oil is preferred. See ENGINE BREAK-IN oil in Fuels, Lubricants, and Coolant Section.

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

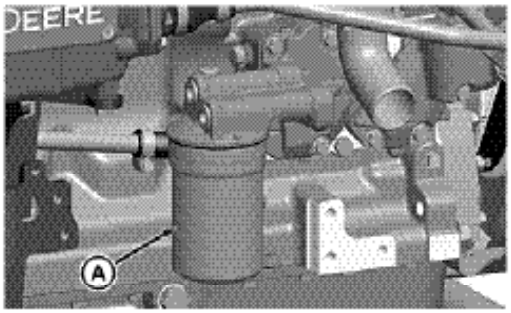
*PLUS-50 is a trademark of Deere & Company*

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

RG19661,00003BC -19-28FEB13-3/5

4. GENERATOR SET POWER UNITS
To assure that your engine will deliver efficient generator operation, start engine and run at rated load (50% - 70% load) for 30 minutes every two weeks. DO NOT allow the engine to run extended period of time with no load.

5. After the first 100 hours (maximum), change engine oil and replace engine oil filter (A). (See CHANGE OIL AND FILTER in Lubrication and Maintenance 250/hour section). Fill crankcase with seasonal viscosity grade oil. (See DIESEL ENGINE OIL, in Fuels, Lubricants and Coolant Section).




RG22045 —UN—28MAY13

*Remove Oil Filter*

A—Oil Filter

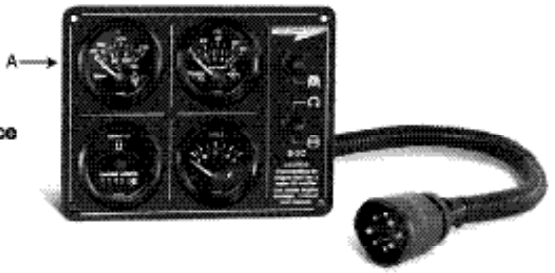
*NOTE: Some increase in oil consumption may be expected when low viscosity oils are used. Check oil levels more frequently when using low viscosity oil).*

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

RG19661,00003BC -19-28FEB13-3/5

6. Watch coolant temperature gauge (A) closely. If coolant temperature rises above maximum coolant temperature (see GENERAL ENGINE **SPECIFICATIONS in Specifications Section), reduce** load on engine. Check sea (raw) water strainer for plugging on heat exchanger engines. Unless temperature drops quickly, stop the engine and determine the cause before resuming operation.

A—Coolant Temperature Gauge




RG13133 —UN—07OCT03

*Coolant Temperature Gauge - Electronically Controlled Engine*

Continued on next page

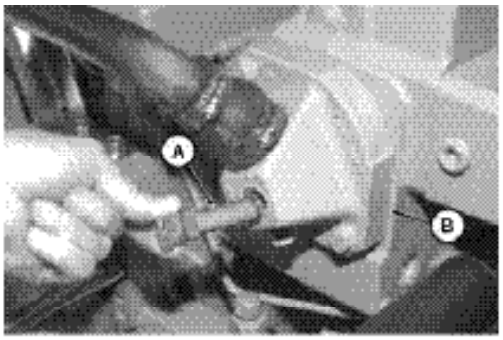
RG19661,00003BC -19-28FEB13-4/5

7. Check poly-vee belt for proper alignment and seating in pulley grooves.

   Two zinc plugs (A) are installed in the sea water cooling system to help neutralize the corrosive action of salt water on internal cavities of marine engine components. The reaction of the zinc, when exposed to the salt water, causes the plugs to deteriorate instead of critical engine components.

8. **After the first 50—100 hours or 2—4 weeks of** operation, remove zinc plug from each heat exchanger end cap (B) and inspect for corrosion to get an idea of rate of deterioration in sea water.

   If rate of corrosion is slight at 50—100 hours or 2—4 weeks initial inspection, zinc plugs should be inspected at 250 hour intervals thereafter. (See INSPECT AND REPLACE ZINC PLUGS in Lubrication & Maintenance/250 Hour Section)




A—Zinc Plugs B—End Cap

## Engaging And Disengaging Front PTO (If Equipped)

⚠ **CAUTION: Entanglement in rotating driveline can cause serious injury or death. Keep shield on PTO driveshaft between clutch housing and the engine driven equipment at all times during engine operation. Wear close fitting clothing. Stop the engine and be sure PTO driveline is stopped before making adjustments.**

⚠ **CAUTION: Metal surfaces of PTO housing may be hot to the touch during operation or at shutdown.**

The optional front power take-off (PTO) transfers engine power to auxiliary equipment or moving components.

The PTO clutch is electric and engaged by a switch. Engage Gen-Set engines at no load rpm.

TS198 —UN—23JUN88

*Avoid Entanglement*

If the power take-off does not work properly, contact your authorized servicing dealer or engine distributor.

OUR0P11,0000144 -19-08DEC03-1/1

## Cold Weather Operation

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

Some engines are equipped with an air intake heater which will make starting the engine easier in cold weather. If equipped, follow steps 1- 3 as listed under STARTING THE ENGINE, earlier in this section.

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

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

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

TS1355 —UN—16MAR92

*Starting Fluid is Flammable*

OUCO006,0000080 -19-22JUN07-1/1

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

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

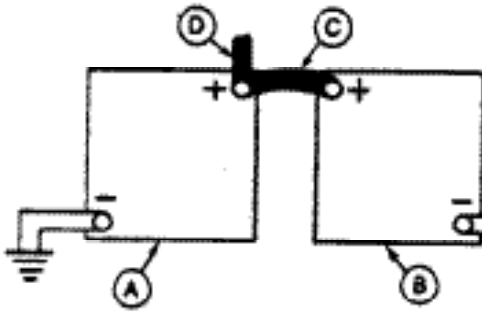
**IMPORTANT: Be sure polarity is correct before making connections. Reversed polarity will damage electrical system. Always connect positive to positive and negative to ground. Always use 12-volt booster battery for 12-volt electrical systems and 24-volt booster battery(ies) for 24-volt electrical systems.**

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

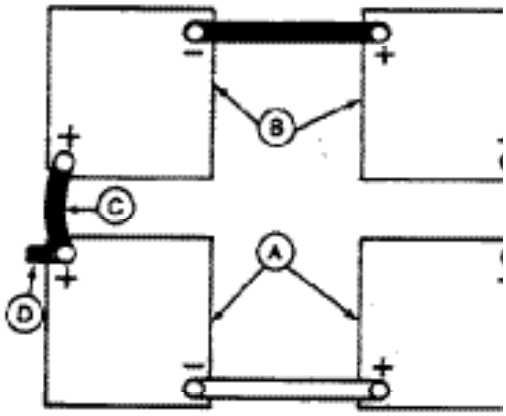
*NOTE: To avoid sparks, DO NOT allow the free ends of jumper cables to touch the engine.*

2. Connect one end of jumper cable to the POSITIVE (+) post of the booster battery.
3. Connect the other end of the jumper cable to the POSITIVE (+) post of battery connected to starter.
4. Connect one end of the other jumper cable to the NEGATIVE (–) post of the booster battery.
5. ALWAYS complete the 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.**

*Exploding Battery*




*12-Volt System*




*24-Volt System*

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

RG,R9

## 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.


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

## Notes

## Lubrication and Maintenance Service Interval Chart—Propulsion and Prime Power Units

| Item | Lubrication and Maintenance Service Intervals | | | | |
|---|---|---|---|---|---|
| | Daily/Before Every Startup | 250 Hour/6 Month | 500 Hour/12 Month | 2000 Hour/24 Month | Service As Required |
| Check Engine Oil Level and Coolant Level | • | | | | |
| Check Sea Water Strainer | • | | | | |
| Check Air Cleaner Dust Unloader Valve & Restriction Indicator Gauge [a] | • | | | | |
| Visual Walkaround Inspection | • | | | | |
| Drain Water From Fuel Filter | • | | | | • |
| Change Engine Oil And Replace Oil Filter [b] | | • | | | |
| Service Fire Extinguisher | | • | | | |
| Service Battery | | • | | | |
| Inspect and Replace Zinc Plugs | | • | | | |
| Check Belt Tension and Wear (Manual Tensioner) | | • | | | |
| Check Engine Mounts | | • | | | |
| Replace Crankcase Vent Filter (If Equipped) | | | • | | |
| Clean Crankcase Ventilation Assembly | | | • | | |
| Check Air Intake Hoses, Connections, & System | | | • | | |
| Replace Fuel Filter Elements | | | • | | |
| Check Automatic Belt Tensioner and Belt Wear | | | • | | |
| Check Cooling System | | | • | | |
| Coolant Solution Analysis-Add SCAs as required | | | • | | |
| Inspect and Clean Heat Exchanger Core and Aftercooler Core (If Equipped) | | | • | | |
| Check Engine Speeds | | | • | | |
| Check Engine Electrical Ground | | | • | | |
| Check Crankshaft Vibration Damper (6-Cylinder) | | | | • | |
| Pressure Test Cooling System | | | | • | |
| Inspect and Repair Sea Water Pump | | | | • | |
| Check and Adjust Engine Valve Clearance | | | | • | |
| **Flush And Refill Cooling System** [c] | | | | • | |
| Test Thermostats | | | | • | |
| Add Coolant | | | | | • |
| Replace Air Cleaner Element | | | | | • |
| Service Dry Air Cleaner Element | | | | | • |
| Replace Alternator Drive Belt | | | | | • |
| Check Front PTO (If Equipped) | | | | | • |
| Bleed Fuel System | | | | | • |

[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 (6068SFM75 / AFM75 only).*

[b] ***Change the oil for the first time before 100 hours maximum of (break-in) operation, then every 250 hours thereafter. If John Deere PLUS-50 or ACEA-E7, ACEA-E6, ACEA-E5 or ACEA-E4 oil is used along with the specified John Deere oil filter, the oil change interval may be extended by 50 percent to 375 hours.***

[c] ***If John Deere COOL-GARD is used, the flushing interval may be extended to 3000 hours or 36 months. If John Deere COOL-GARD*** *is used and the coolant is tested annually AND additives are replenished as needed by adding a supplemental coolant additive, the* ***flushing interval may be extended to 5000 hours or 60 months, whichever occurs first.***

OUOD005,0000081 -19-18AUG11-1/1

## Lubrication and Maintenance Service Interval Chart—Standby Generator Sets

| Item | Lubrication and Maintenance Service Intervals | | | | |
|---|---|---|---|---|---|
| | Daily/Before Every Startup | 250 Hour/6 Month | 500 Hour/12 Month | 2000 Hour/24 Month | Service As Required |
| Operate Engine at Rated Speed and 50%—70% Load for a Minimum of 30 Minutes. Perform every 2 weeks. | | | | | |
| Check Engine Oil Level and Coolant Level | • | | | | |
| Check Sea Water Strainer | • | | | | |
| Check Air Cleaner Dust Unloader Valve & Restriction Indicator Gauge [a] | • | | | | |
| Visual Walkaround Inspection | • | | | | |
| Drain Water From Fuel Filter | • | | | | • |
| Change Engine Oil And Replace Oil Filter [b] | | • | | | |
| Service Fire Extinguisher | | • | | | |
| Service Battery | | • | | | |
| Inspect and Replace Zinc Plugs | | • | | | |
| Check Belt Tension and Wear (Manual Tensioner) | | • | | | |
| Check Engine Mounts | | • | | | |
| Replace Crankcase Vent Filter (If Equipped) | | | • | | |
| Clean Crankcase Ventilation Assembly | | | • | | |
| Check Air Intake Hoses, Connections, & System | | | • | | |
| Replace Fuel Filter Elements | | | • | | |
| Check Automatic Belt Tensioner and Belt Wear | | | • | | |
| Check Cooling System | | | • | | |
| Coolant Solution Analysis-Add SCAs as required | | | • | | |
| Inspect and Clean Heat Exchanger Core and Aftercooler Core (If Equipped) | | | • | | |
| Check Engine Speeds | | | • | | |
| Check Engine Electrical Ground | | | • | | |
| Check Crankshaft Vibration Damper (6-Cylinder) | | | | • | |
| Pressure Test Cooling System | | | | • | |
| Inspect and Repair Sea Water Pump | | | | • | |
| Check and Adjust Engine Valve Clearance | | | | • | |
| **Flush And Refill Cooling System** [c] | | | | • | |
| Test Thermostats | | | | • | |
| Add Coolant | | | | | • |
| Replace Air Cleaner Element | | | | | • |
| Service Dry Air Cleaner Element | | | | | • |
| Replace Alternator Drive Belt | | | | | • |
| Check Front PTO (If Equipped) | | | | | • |
| Bleed Fuel System | | | | | • |

[a] *Replace primary air cleaner element when restriction indicator shows a vacuum of 625 mm (52 in.)H2O.*

[b] ***During engine break-in, change the oil and filter for the first time before 100 hours of operation. Extended oil change interval of 375 hours can be used if John Deere PLUS-50 or ACEA-E7, ACEA-E6, ACEA-E5 or ACEA-E4 oil is used along with the specified John Deere oil filter.***

[c] ***If John Deere COOL-GARD is used, the flushing interval may be extended to 3000 hours or 36 months. If John Deere COOL-GARD*** *is used and the coolant is tested annually AND additives are replenished as needed by adding a supplemental coolant additive, the* ***flushing interval may be extended to 5000 hours or 60 months, whichever occurs first.***

OUOD006,0000082 -19-27OCT11-1/1

## Daily Prestarting Checks

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

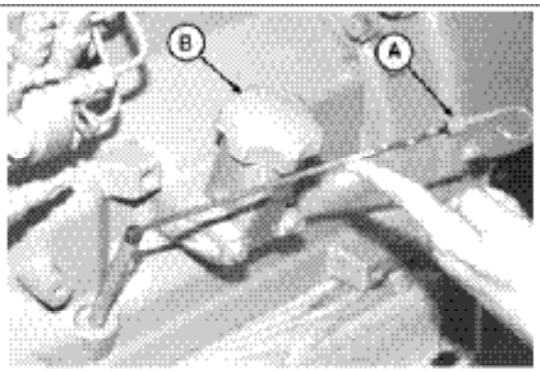
**IMPORTANT: DO NOT add makeup oil until the oil level is BELOW the add mark.**

**Depending on application, oil dipstick (A) and oil filler** cap (B) may be located on either the left or the right side of engine. In addition, oil may be added at rocker arm **filler cap (C).**

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

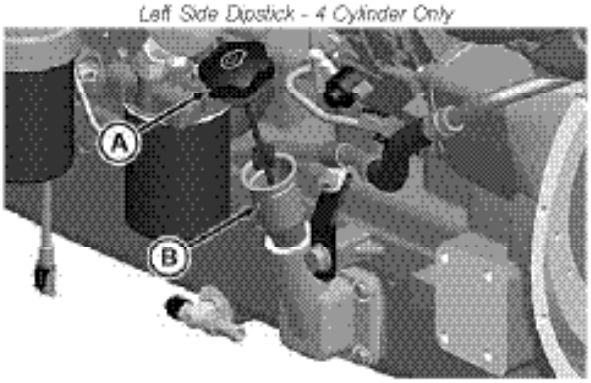
**IMPORTANT: DO NOT fill above the top mark on the dipstick. Oil levels anywhere within crosshatch (D) are considered in the acceptable operating range.**

A—Dipstick
B—Left Side Oil Filler Cap
C—Rocker Arm Filler Cap
D—Crosshatch On Oil Dipstick



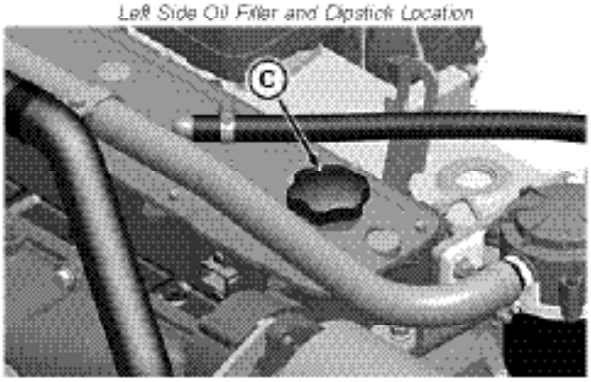

RG9837—UN—12JAN89

*Left Side Dipstick - 4 Cylinder Only*




RG22038—UN—28NOV12

*Left Side Oil Filler and Dipstick Location*




RG22037—UN—28NOV12

*Rocker Arm Cover Filler Cap*

RG22039—UN—06JAN13

*Oil Fill Level on Dipstick*

Continued on next page

RG19661,00003D3-19-29JAN13-1/4

High-Pressure Fluids

TS281—UN—23AUG88


Engine Top Tank

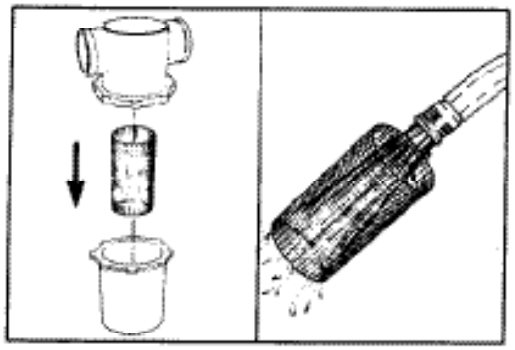
RG20340—UN—28NOV12

A—Engine Top Tank

RG19661,00003D3 -19-28JAN13-3/4

**IMPORTANT: A restricted or clogged sea water strainer will result in hotter than normal (or overheated) engine coolant and marine gear oil temperatures.**

3. The sea water strainer should be checked daily and cleaned as required, depending upon the operating environment.



Sea Water Strainer

RG5993—UN—27JAN92

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RG19661,00003D3 -19-28JAN13-3/4

4. If equipped with air intake restriction indicator gauge (A), check gauge to determine if air cleaner needs to be serviced. The reset button will pop up when air cleaner needs to be serviced.

**IMPORTANT: Maximum air intake restriction is 625 mm (25 in. $H_2O$). A clogged air cleaner element will cause excessive intake restriction and a reduced air supply to the engine.**

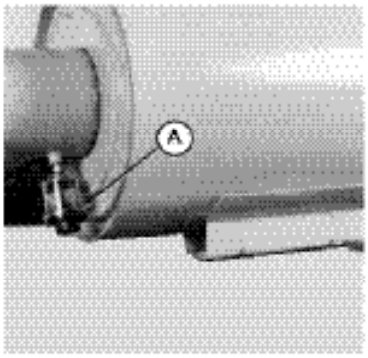
5. Make a thorough inspection of the engine compartment. Look for oil or coolant leaks, worn drive belts, loose connections and trash build-up. Remove trash buildup and have repairs made as needed if leaks are found.

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

Inspect:

- Engine shields and guards for trash build-up.
- Air intake system hoses and connections for cracks and loose clamps.
- Alternator drive belt for cracks, breaks or other damage.
- Water pump for coolant leaks.
- Coolant system for leaks.

*NOTE: It is normal for a small amount of leakage to occur as the engine cools down and parts contract.*




*Air Intake Restriction Gauge*

R009874 —JN—12FEB09

A—Air Intake Restriction Gauge

*Excessive coolant leakage may indicate the need to replace the water pump seal. Contact your engine distributor or servicing dealer for repairs.*

6. Move switch to "ON" position and check instruments for proper operation. Turn key switch "OFF".
7. Refer to manufacturer's literature for generator set daily service recommendations.

RG19861,00003D3 -19-29JAN13-4/4

## Changing Engine Oil and Replacing Oil Filter

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

If John Deere PLUS-50™ or ACEA-E7/E6/E5/E4 engine **oil and a John Deere oil filter are used, the oil and filter** change interval may be extended by 50 percent or to 375 hours.

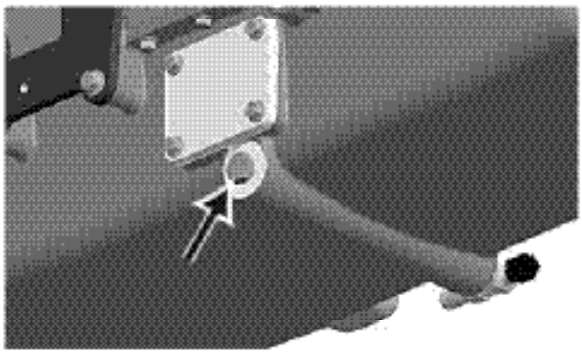
**IMPORTANT: If using BIODIESEL blends greater than B20, shorten oil change interval to half the recommended service interval or monitor engine oil using OILSCAN to ensure that fuel dilution does not exceed 5%.**

*NOTE: On Gen Set engines used as standby units,* ***oil and filter change can be extended to 350*** *hours.* **No *extended interval for oil/filter change*** *is allowed beyond 350 hours.*

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™ or OILSCAN PLUS™ kits are available from your John Deere dealer. Oil samples should be taken prior to the oil change. Refer to instructions provided with kit.

**To change engine oil and oil filter:**

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




*Oil Pan Drain Plug*

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

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



**Continued on next page**

4. Turn filter element (A) using a suitable filter wrench to remove. Discard oil filter element.

*NOTE: Depending on engine application, oil filter may be located on either side of the engine in a high- or low-mount location.*

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

5. Apply clean engine oil to the new filter at the inner (B) and outer (C) seals and to filter threads.

6. Wipe both sealing surfaces of the header (D, E) with a clean rag. Ensure that the notches in dust seal (F) are properly installed in the slots of the housing. Replace if damaged.

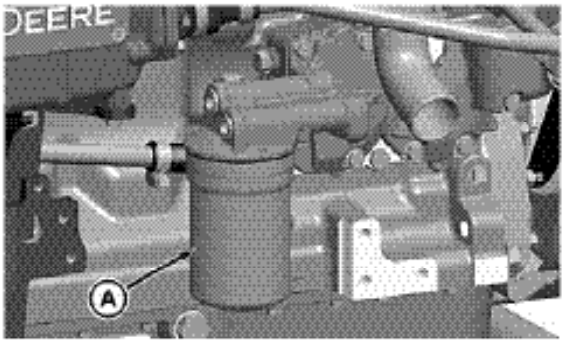
**IMPORTANT: When installing filter element, HAND TIGHTEN only. A filter wrench may be used for REMOVAL ONLY.**

7. Install and tighten oil filter by hand until firmly against dust seal (F). DO NOT apply an extra 3/4 to 1-1/4 turn after gasket contact as done with standard filters.

8. Tighten drain plug to specifications.

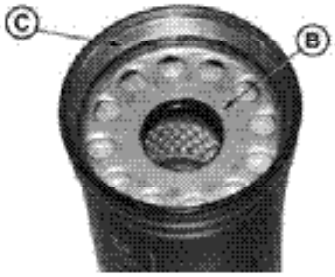
| Specification | |
|---|---|
| Oil Pan Drain Plug With Copper Washer—Torque | 70 N·m (52 lb-ft) |
| Oil Pan Drain Plug With O-Ring—Torque | 50 N·m (37 lb-ft) |

A—Oil Filter Element
B—Inner Seal
C—Outer Seal
D—Sealing Surface On Header
E—Sealing Surface On Header
F—Dust Seal



RG22045—UN—29NOV12

Oil Filter



RG11617—UN—24OCT01

Oil Filter Seals

RG22046—UN—29NOV12

Oil Filter Mounting Header

Continued on next page

RG19661,00003D4 -19-28FEB13-2/3

9. Fill engine crankcase with correct John Deere engine oil through rocker arm cover opening (A). (See DIESEL ENGINE OIL in Fuels, Lubricants, and Coolant Section for determining correct engine oil.)

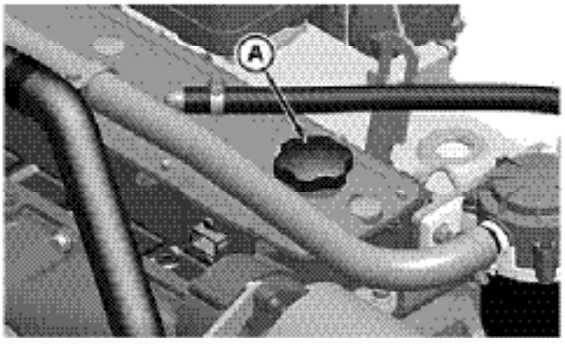
**To determine the correct oil fill quantity for your engine, see ENGINE CRANKCASE OIL FILL QUANTITIES in the Specifications Section of this manual.**

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

*NOTE: Crankcase oil capacity may vary slightly.* ***ALWAYS fill crankcase within crosshatch marks on dipstick. DO NOT overfill.***

10. Start engine and run to check for possible leaks.

11. Stop engine and check oil level after 10 minutes. Oil level reading should be within crosshatch on dipstick.




A—Rocker Arm Cover Oil Filler Opening

RG19661,00003D4 -19-28FEB13-3/3

## 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. If necessary, add clean, soft water* ***to bring level to bottom of filler neck.***

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

TS218M—UN—23AUG88

*Exploding Battery*

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

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

Continued on next page

RG,RG34710,556B-19-20MAY98-1/2

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

**Avoid the hazard by:**

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

**If you spill acid on yourself:**

1. **Flush your skin with water.**
2. **Apply baking soda or lime to help neutralize the acid.**
3. **Flush your eyes with water for 10–15 minutes. Get medical attention immediately.**

**If acid is swallowed:**

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

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

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

| Specification | |
|---|---|
| 12 Volt Standard Duty Starter—Cold Cranking Amps | 640 |
| 12 Volt Heavy Duty Starter—Cold Cranking Amps | 800 |
| 24 Volt Standard Duty Starter—Cold Cranking Amps | 570 |

*Sulfuric Acid*

T8203—UN—23AUG88

RG,RG34710,5568 -19-20MAY98-2/2

## Inspect and Replacing Zinc Plugs

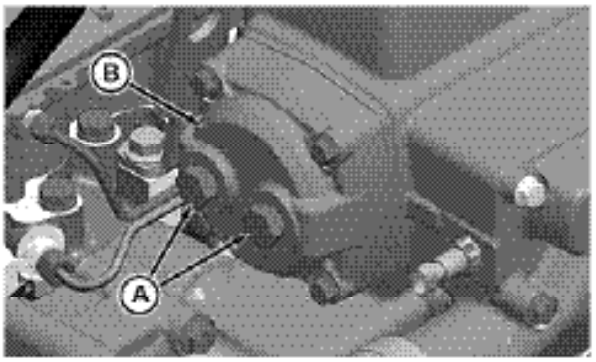
Two zinc plugs (A) are installed in the sea water cooling system to help reduce the corrosive action of salt in the sea water. The reaction of the zinc to sea water causes the plugs to deteriorate, instead of the more critical cooling system parts. Therefore, the zinc plugs MUST BE inspected every 250 Hours.

*NOTE: Zinc plugs are located in each heat exchanger end cap and are mounted on hex-head pipe plug.*

1. Remove zinc rod from each end cap (B) and observe condition of each.

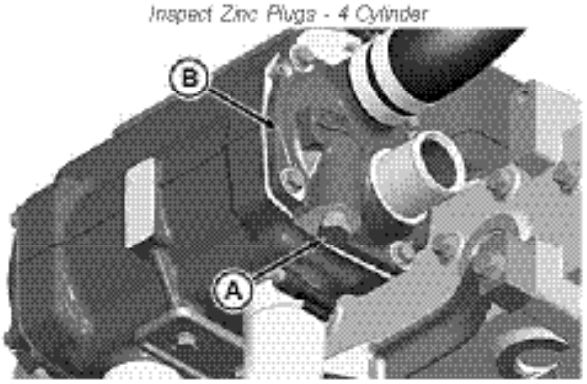
**2. Tap the zinc rods lightly with a hammer. If rod flakes** apart when tapped, install a new zinc plug.

A—Zinc Plugs
B—End Cap




RG22137 —UN—06DEC12

*Inspect Zinc Plugs - 4 Cylinder*




RG22048 —UN—28NOV12

*Inspect Zinc Plugs - 6 Cylinder*

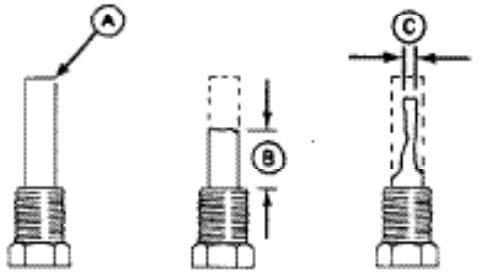
RG19661,00003D5 -19-28JAN13-1/2

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

If length is less than 15.9 mm (0.63 in.) or outer diameter is less than 4.8 mm (0.19 in.) on either plug, replace all zinc plugs.

*NOTE: Zinc plug new part dimensions are 31.8 mm (1.25 in.) long and 9.5 mm (0.38 in.) outer diameter.*

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




RG6907 —UN—27JAN92

*Zinc Plug Erosion*

RG19661,00003D5 -19-28JAN13-2/2

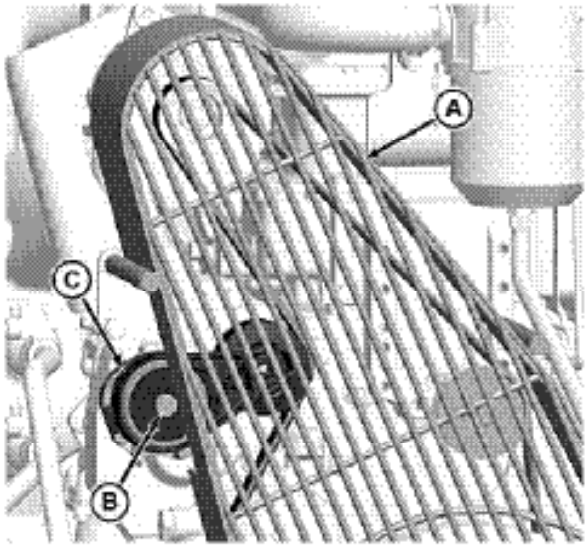
## Checking Belt Wear

1. Remove belt guard (A).
2. Swing tensioner arm (C) to remove all belt slack.
3. Remove and inspect belt for cracks, fraying, or stretched-out areas. Replace if necessary.

*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.*

4. If tensioner has been removed, tighten tensioner mounting cap screw (B) to 70 N·m (52 lb-ft).
5. Install belt guard.

A—Belt Guard
B—Mounting Cap Screw
C—Tensioner Arm



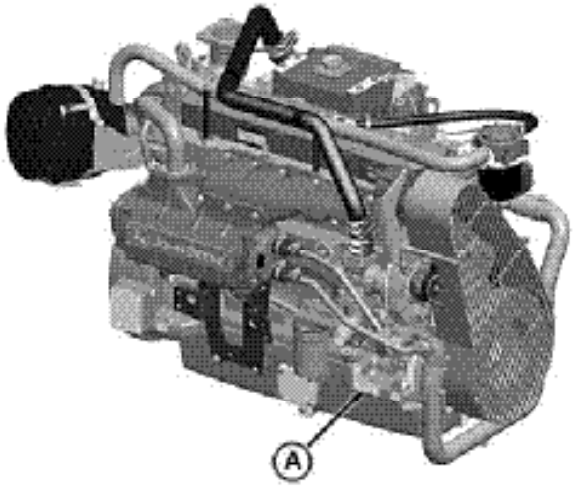

Check Belt Wear

RG19661,0000306 -19-08MAR13-1/1

## Checking Engine Mounts

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

1. Check the engine 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.



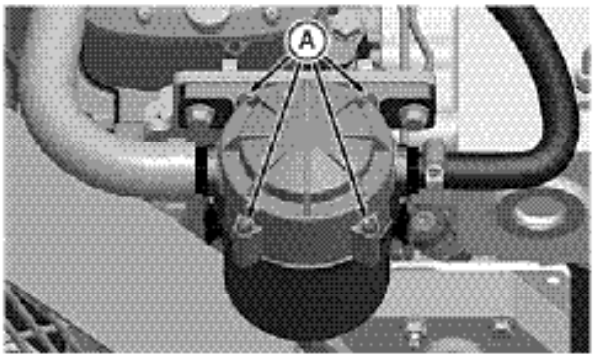

Check Mounting Holes

RG19661,0000307 -19-25JAN13-1/1

## Replace Crankcase Vent Filter

1. Remove screws (A) and remove the crankcase vent lid.
2. **Remove old filter and discard.**
3. **Install new filter into crankcase vent housing and snap** into place.
4. Install lid and lock down screws.

A—Screws




RG22052—UN—25NOV13

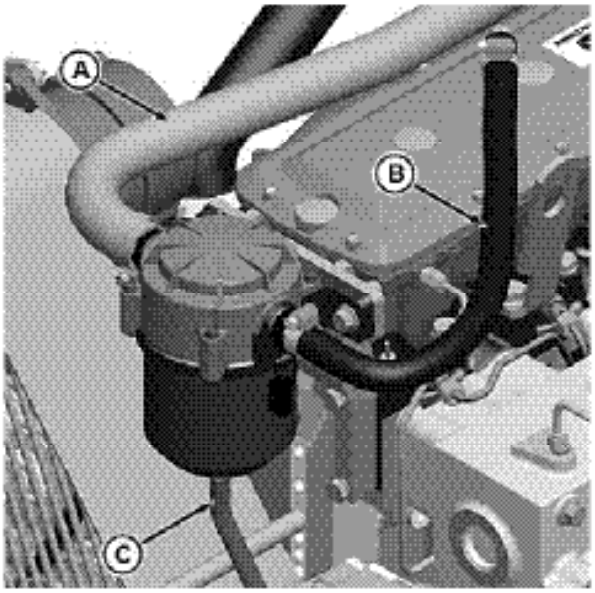
*Replace Crankcase Vent Filter*

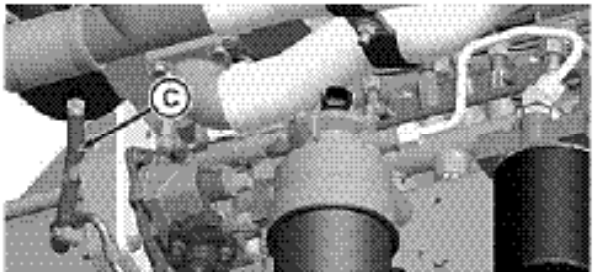
RG18661,0003D3 -19-13FEB13-1/1

## Checking Closed Crankcase Vent System

1. Inspect hoses (A)(B) (C) and oil drain line (D) for kinks, blockage, or other damage.
2. **Inspect crankcase fitting (E) for damage and make** sure it is not plugged.
3. Verify that the crankcase vent system bypass port (E) is not plugged.
4. Inspect turbocharger compressor coupling for cracks, blockage or other damage.

A—Hose, Compressor to Filter Housing
B—Hose, Rocker Arm Cover to Filter Housing
C—Hose, Oil Drain
D—Oil Drain Line
E—Crankcase Vent System Fitting



## Replace Fuel Filter

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

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

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

**2. Clean entire area surrounding fuel filter assembly to** keep debris from entering fuel system.

3. Loosen drain plug and air vent screw. Drain fuel into a suitable container.

**4. Firmly grasp the filter or filer housing and rotate it** clockwise 1/4 turn (when viewed from the top to remove from base.

**5. Inspect filter mounting base for cleanliness. Clean as** required.

***NOTE: Raised locators on fuel filter canister must** be indexed properly with slots in mounting base for correct installation.*

**6. Install new filter element onto mounting base. Be sure element is properly indexed and firmly seated on base. It may be necessary to rotate filter for correct alignment.**

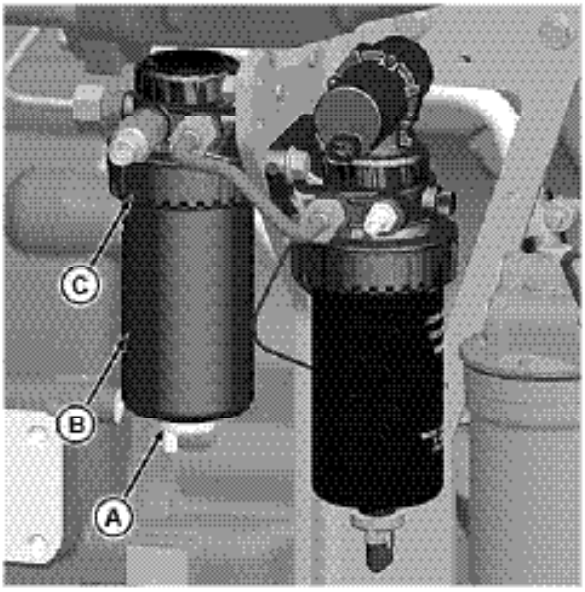
If equipped with a water separator bowl, remove separator **bowl from filter element. Drain and clean separator bowl. Dry with compressed air. Install bowl onto new filter** element. Tighten securely.

**7. Align keys on filter element with slots in filter base.**

8. Install retaining ring onto mounting base making certain **dust seal is in place on filter base. Hand tighten ring** (about 1/3 turn) until it "snaps" into the detent. DO NOT overtighten retaining ring.

*NOTE: The proper installation is indicated when a "click" is heard and a release of the retaining ring is felt.*

*A plug is provided with the new element for plugging the used element.*




RG22096—UN—05DEC12

*Fuel Filter - 4045 Engines*

A—Drain
B—Filter/Filter Housing
C—Filter Base

9. Open fuel shut-off valve. Whenever the fuel system has been opened up for service (lines disconnected or **filters removed), it will be necessary to bleed air from the** system. (See BLEEDING THE FUEL SYSTEM in Service as Required Section.)

RG19661,00003E4 -19-13FEB13-1/1

## Replacing Fuel Filter/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 injury or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.**

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

2. **Clean entire area surrounding fuel filter assembly to** keep debris from entering fuel system.

3. Disconnect water in fuel sensor.

4. Drain fuel into a suitable container.

5. **Firmly grasp the filter or filter housing and rotate it counterclockwise 1/4 turn. Remove ring with filter element** (E).

6. **Inspect filter mounting base for cleanliness. Clean as** required.

***NOTE: Raised locators on fuel filter canisters must** be indexed properly with slots in mounting base for correct installation.*

7. **Install new filter element onto mounting base. Be sure element is properly indexed and firmly seated on base. It may be necessary to rotate filter for correct alignment.**

8. **Align keys on filter element with slots in filter base.**

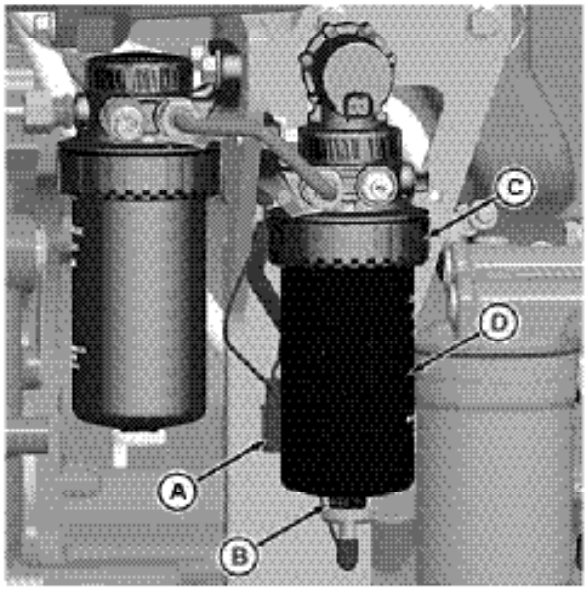
9. Install retaining ring onto mounting base making certain **dust seal is in place on filter base. Hand tighten ring** (about 1/3 turn) until it "snaps" into the detent. DO NOT overtighten retaining ring.

*NOTE: The proper installation is indicated when a "click" is heard and a release of the retaining ring is felt.*

*A plug is provided with the new element for plugging the used element.*

10. Connect water in fuel sensor.

11. Open fuel shut-off valve. Whenever the fuel system has been opened up for service (lines disconnected or **filters removed), it will be necessary to bleed air from the** system. (See BLEEDING THE FUEL SYSTEM in Service as Required Section.)




*Fuel Filter/Water Separator - 4045 Engine*

A—Electrical Connector
B—Drain
C—Filter Base
D—Filter/Water Separator

RG19661,00003E5 -19-13FEB13-1/1

## Checking Belt Tensioner Spring Tension and Belt Wear (Automatic Tensioner)

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

### Checking Belt Wear

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

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

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

### 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 square hole in tensioner arm. (Earlier tensioner arms have bolt in place of square hole, and require breaker bar with socket.) Remove belt from pulleys.

*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.*

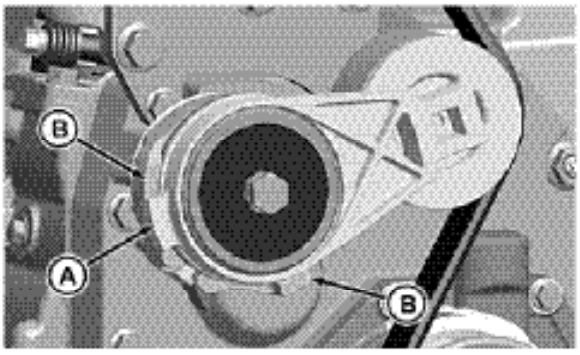
2. Release tension on tension arm and remove drive tool.
3. Put a mark (A) on swing arm of tensioner as shown.
4. Measure 21 mm (0.83 in.) from (A) and put a mark (B) on tensioner mounting base.
5. Install torque wrench (C) so that it is aligned with centers of pulley and tensioner. Rotate the swing 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—Torque ..... 18-22 N·m (13-16 lb-ft)

*NOTE: Threads on belt tensioner roller cap screw are LEFT-HAND threads*

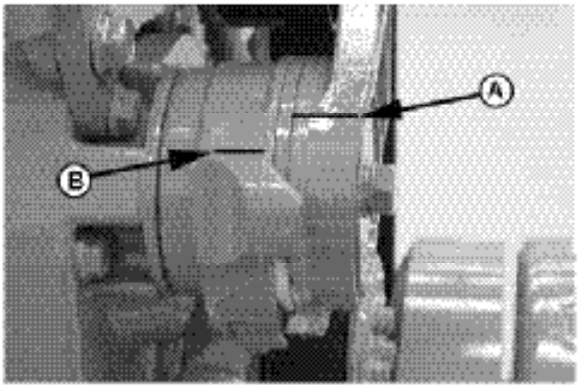
A—Mark On Swing Arm
B—Mark On Tensioner Mounting Base
C—Torque Wrench



RG20180 —UN—03DEC12

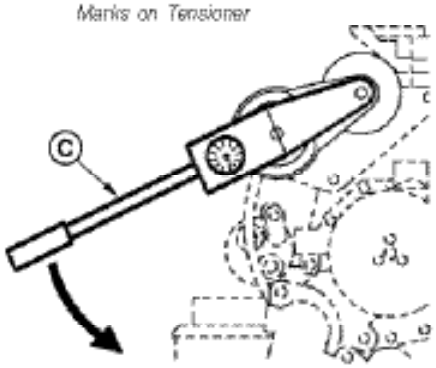
*Cast Stops - Tensioner Arm*

A— Tensioner Cast Stops B— Fixed Cast Stops



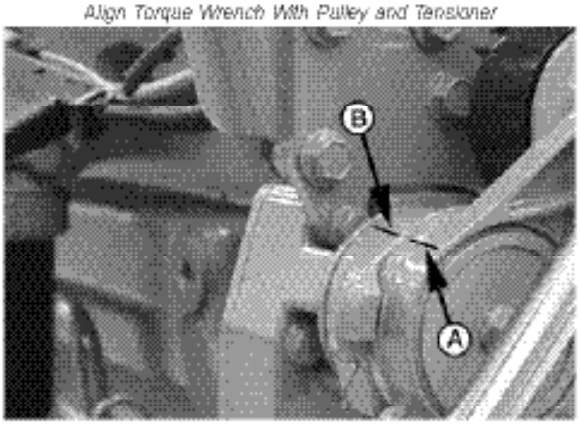
RG13745 —UN—11NOV04

*Marks on Tensioner*



RG12885 —UN—28JAN02

*Align Torque Wrench With Pulley and Tensioner*



RG13748 —UN—11NOV04

*Align Marks*

RG19661,00003E6 -19-13FEB13-2/2

## Checking Cooling System

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

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

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

1. Check entire cooling system for leaks. Tighten all clamps securely.

TS261 —UN—23AUG88

*High-Pressure Fluids*

2. Thoroughly inspect all cooling system hoses. Replace **hoses when hard, flimsy, or cracked.**

RG,RG34710,5580 -19-20MAY98-1/1

## Replenishing Supplemental Coolant Additives (SCAs) Between Coolant Changes

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

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

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

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

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

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

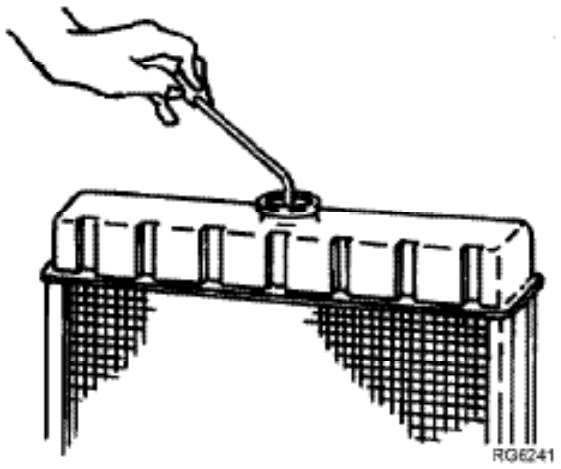
Test the coolant solution at 500 hours or 12 months of operation using either John Deere coolant test strips or a COOLSCAN® or COOLSCAN PLUS® analysis. If a COOLSCAN® or COOLSCAN PLUS® analysis is not available, recharge the system per instructions printed on label of John Deere Liquid Coolant Conditioner.

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

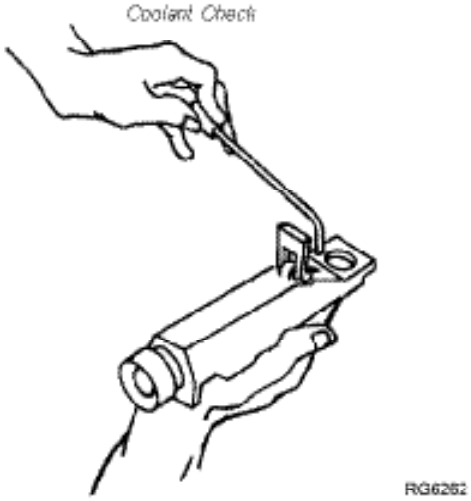
**If frequent coolant makeup is required, the glycol concentration should be checked with JT07298 Coolant/Battery Tester to ensure that the desired freeze point is maintained. Follow manufacturer's instructions provided with Coolant/Battery Tester.**

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

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




*Coolant Check*




*JT07298 Coolant/Battery Tester*

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

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



DPSS,OUOD002,1921 -19-23NOV01-1/1

## Testing Diesel Engine Coolant

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

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

### Coolant Test Strips

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

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

### COOLSCAN Or COOLSCAN PLUS

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

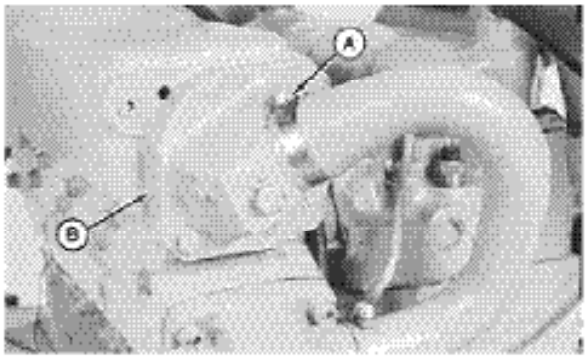
OUOD002,0000175 -19-23NOV01-1/1

## Remove, Inspect and Clean Engine Heat Exchanger Core

**IMPORTANT: Initially remove and inspect the engine heat exchanger core at 250 hour or three month service interval on a new engine. Then, remove and clean at every 500 hour or 12 month interval thereafter.**

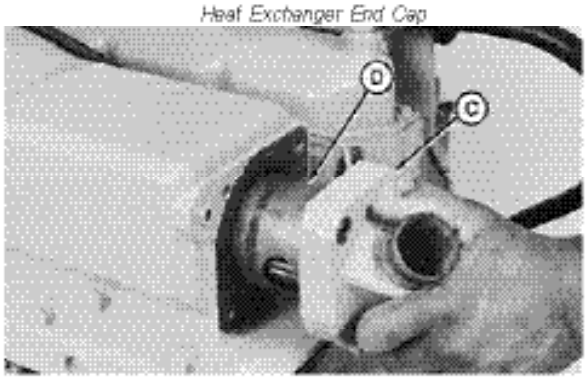
1. Close sea cocks and drain the sea water system.
2. Open drain cock on cylinder block and drain approximately two gallons of engine coolant into a clean container. Close drain cock.
3. Loosen hose clamp (A) and remove hose from rear end cap (B).
4. Remove two end cap mounting cap screws and remove end cap (C) with heat exchanger core (D) from rear of engine.

A—Clamp
B—End Cap
C—End Cap
D—Heat Exchanger Core




*Heat Exchanger End Cap*

RG6083 —UN—23JAN02

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RG19661,000040B -19-18MAR13-1/2

**On All Engines:**

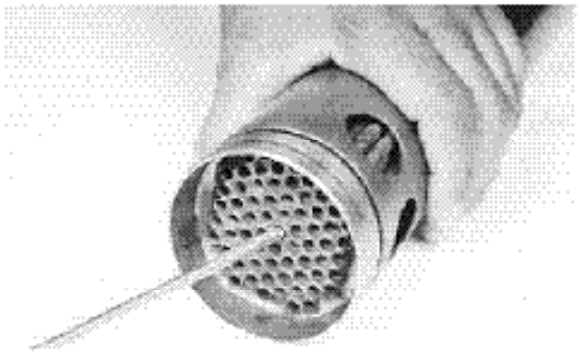
*NOTE: The heat exchanger core may be removed from housing when either end cap is removed. It is strongly recommended that both end caps be removed for cleaning when cleaning the heat exchanger core.*

5. Remove remaining end cap from water manifold/heat exchanger housing. Remove end cap from heat exchanger core.

6. Thoroughly clean all buildup from both end caps and inspect zinc plug in each. Replace plugs as needed. (See INSPECT AND REPLACE ZINC PLUGS in 250 Hour Section.)

7. Use a 4.76 mm (3/16 in.) diameter brass rod to clean out any buildup in each heat exchanger tube. Run the rod the entire length of each tube to push debris out.

8. Flush the heat exchanger tubes with clean water, making sure all tubes are cleared of debris. Clean (with **brass rod) and flush heat exchanger again if necessary to** remove any remaining debris from tubes.



R06866 —UN—23JAN02

*Clean Heat Exchanger*

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.

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

R019661,000040B -19-18MAR13-2/2

## Install Heat Exchanger Core

Thoroughly inspect condition of end cap sealing O-rings (A). Sealing O-rings may be reused if not excessively worn or damaged during disassembly. Replace sealing rings as necessary.

Lubricate front and rear end cap O-rings with clean multi-purpose grease.

1. Install rear end cap, install cap screws and evenly tighten until end cap (B) is about 6.4 mm (0.25 in.) from housing (C). Index end cap in same position as removed.

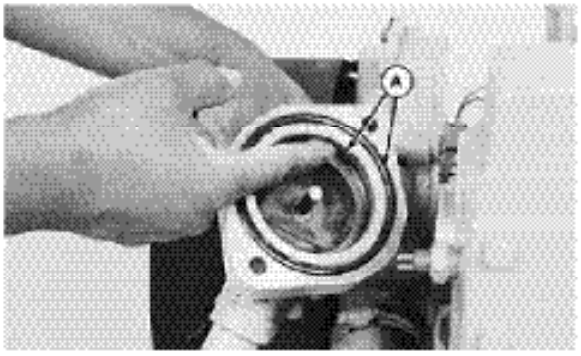
2. Install heat exchanger core. Make sure core is properly seated in rear end cap to avoid cutting O-ring.

3. Install front end cap with heat exchanger core properly seated in cap and cap properly indexed in same position as removed.

4. Install and evenly tighten front end cap screws until cap contacts housing. Evenly tighten rear end cap screws until cap contacts housing. Tighten front and rear end cap screws to 24 N·m (18 lb-ft).

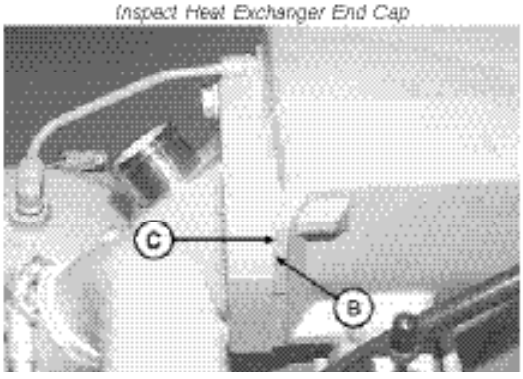
5. Connect all water piping and tighten hose clamps securely. Fill cooling system with the proper amount and concentration of ethylene-glycol base antifreeze.

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




R06867 —UN—23JAN02

*Inspect Heat Exchanger End Cap*




R09848 —UN—05JAN09

*Install Heat Exchanger*

A—O-Rings
B—End Cap
C—Housing

Continued on next page

R019661,000040F -19-18MAR13-1/2

1. Insert two O-rings into front and rear end caps.

2. Lubricate ends of tube bundle lightly with clean multi-purpose grease.

*NOTE: For proper orientation of the tube bundle, the core divider plate must be in line with inlet end cap divider slot with arrow pointing in the correct direction.*

3. Install rear end cap (A) over tube bundle with core divider plate in slot on cap.

4. Guide heat exchanger core into heat exchanger tank. Align core divider vertically with stamped note indicating "This side up". (Core shown separated from cap for illustration purposes.)

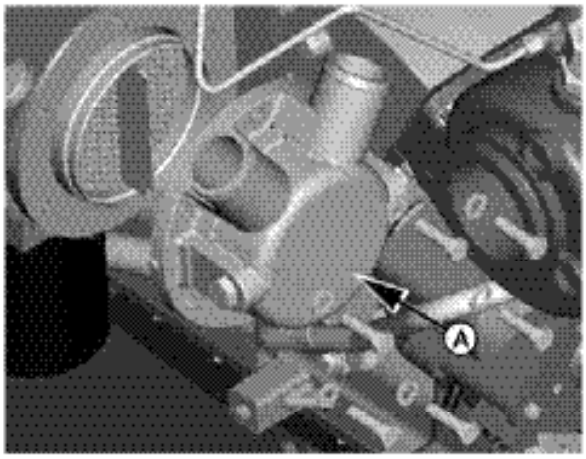
5. Fasten rear end cap and core to tank with bolts and washers. Tighten bolts to 24 +/- 3 N·m (18 +/- 2 lb-ft).

6. Install front end cap (B) over core and bolt to tank. Ensure core holes are aligned with heat exchanger tank holes. Tighten bolts to 24 +/- 3 N·m (18 +/- 2 lb-ft).

7. Connect all water piping and tighten hose clamps securely. Fill cooling system with the proper amount and concentration of ethylene-glycol base antifreeze.

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

A—Rear End Cap B—Front End Cap




R015325—UN—19JUL07

*Install Core and Rear End Cap*

R015326—UN—19JUL07

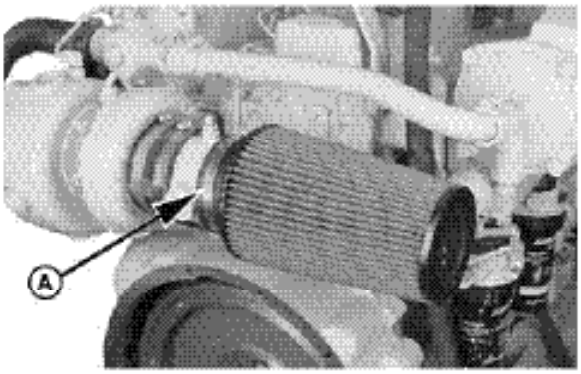
*Install Front End Cap*

RG19861,000040F -19-19MAR13-2/2

## Remove, Inspect and Clean Engine Aftercooler Core

**IMPORTANT: Initially remove and inspect the aftercooler core at 250 hour or three month service interval on a new engine. Then, remove and clean at every 500 hour or 12 month interval thereafter.**

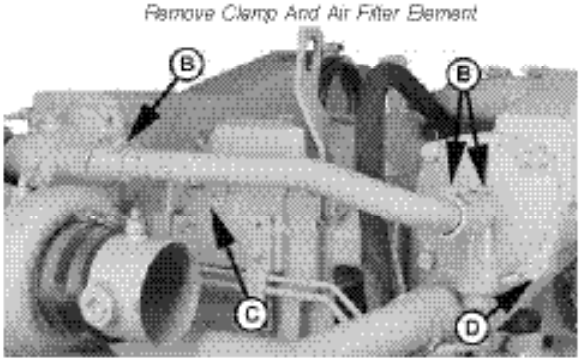
**IMPORTANT: Ensure Service Kit RE18060 is readily available before removing aftercooler core. Air side seals will be destroyed during core removal, and RE18060 kit includes required replacement seals, as well as end cap O-rings.**



Remove Clamp And Air Filter Element

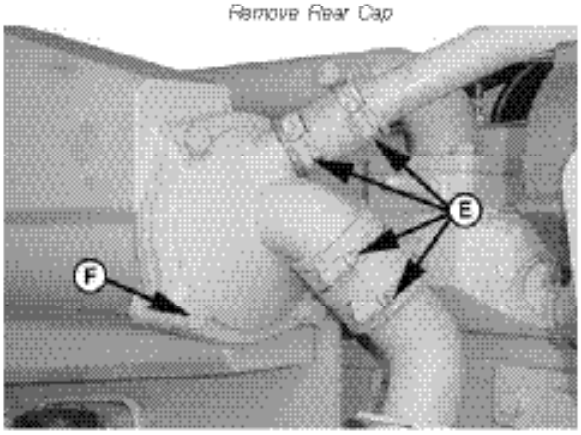
RG12180—UN—25FEB02

1. Close sea cocks and drain the sea water system.
2. **Loosen clamp (A) and remove air filter.**
3. Loosen clamps (B), remove mounting bolt (C) and remove water line from rear of aftercooler.
4. Remove four cap screws (D) and remove rear cap and O-ring.
5. Remove clamps (E) and remove hoses from front cap.
6. Remove four cap screws (F), front cap and O-ring.
7. Remove aftercooler core from the rear of the engine.



Remove Rear Cap

RG12182—UN—25FEB02



Remove Front Cap

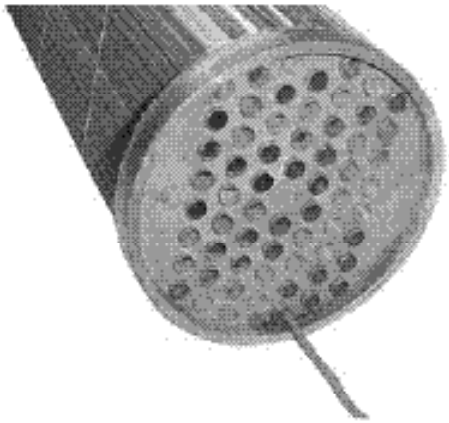
RG12183—UN—25FEB02

RG19661,000040D -19-18MAR13-1/2

A—Clamp
B—Clamps
C—Mounting Bolt
D—Cap Screws
E—Clamps
F—Cap Screws

8. Thoroughly clean all buildup from both end caps.
9. Use a 4.76 mm (3/16 in.) diameter brass rod to clean out any buildup in each tube. Run the rod the entire length of each tube to push debris out.
10. Flush the tubes with clean water, making sure all tubes are cleared of debris. Clean (with brass rod) and **flush aftercooler core again if necessary to remove any** remaining debris from tubes.

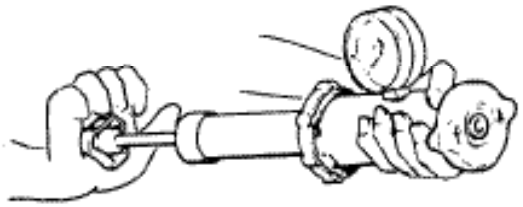
If you suspect that your aftercooler core is defective, have your authorized servicing dealer or engine distributor pressure test for leaks. Replace aftercooler core as required.

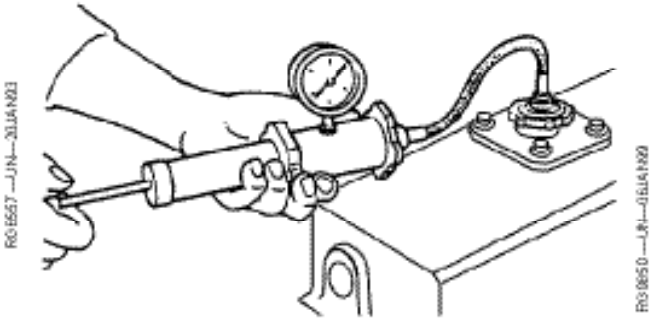

Clean Aftercooler Core

RG12181—UN—25FEB02

RG19661,000040D -19-18MAR13-2/2

## Pressure Testing 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 Coolant Filler Cap

1. **Remove coolant filler cap and attach to an appropriate** tester as shown.
2. **Pressurize cap to specifications. Gauge should hold** pressure for 10 seconds within the normal range if cap is acceptable.

   If gauge does not hold pressure, replace pressure cap.

**Specification**

Radiator Cap—Pressure ..... 110kPa (1.1 bar) (16 psi)

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

### Test Cooling System

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

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

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

3. **Connect gauge and adapter to filler neck. Pressurize cooling system to specifications.**

**Specification**

Cooling System—Pressure ..... 110kPa (16 psi)

4. With pressure applied, check all cooling system hose connections, coolant tank, and overall engine for leaks.

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

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

RG19681,0000489 -19-08MAR13-1/1

## Checking Engine Electrical Ground Connections

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

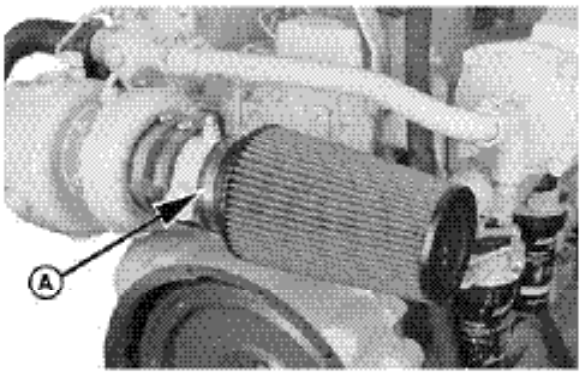
Also see precautions in Troubleshooting Section when welding on engine or machine.

OUOD002,0000189 -19-23NOV01-1/1

## Remove, Inspect and Clean Engine Aftercooler Core

**IMPORTANT: Initially remove and inspect the aftercooler core at 250 hour or three month service interval on a new engine. Then, remove and clean at every 500 hour or 12 month interval thereafter.**

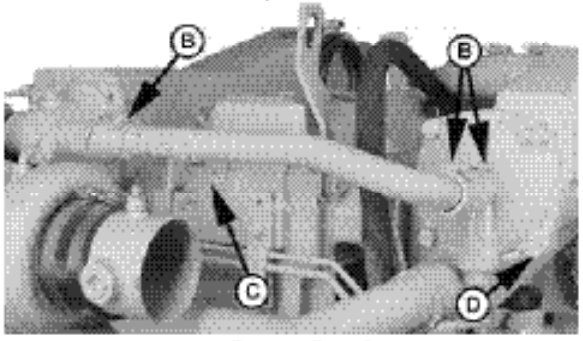
**IMPORTANT: Ensure Service Kit RE18060 is readily available before removing aftercooler core. Air side seals will be destroyed during core removal, and RE18060 kit includes required replacement seals, as well as end cap O-rings.**




Remove Clamp And Air Filter Element

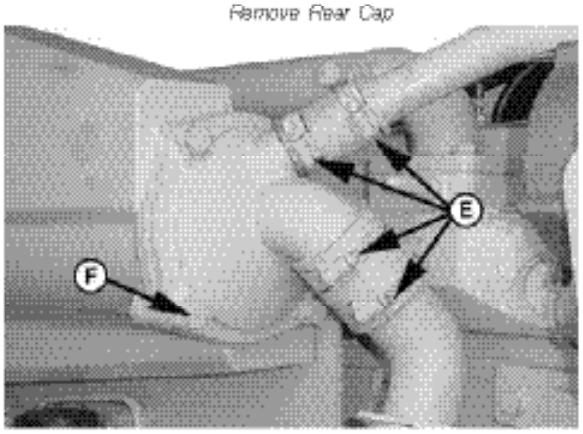
RG12180—UN—25FEB02

1. Close sea cocks and drain the sea water system.
2. **Loosen clamp (A) and remove air filter.**
3. Loosen clamps (B), remove mounting bolt (C) and remove water line from rear of aftercooler.
4. Remove four cap screws (D) and remove rear cap and O-ring.
5. Remove clamps (E) and remove hoses from front cap.
6. Remove four cap screws (F), front cap and O-ring.
7. Remove aftercooler core from the rear of the engine.




Remove Rear Cap

RG12182—UN—25FEB02




Remove Front Cap

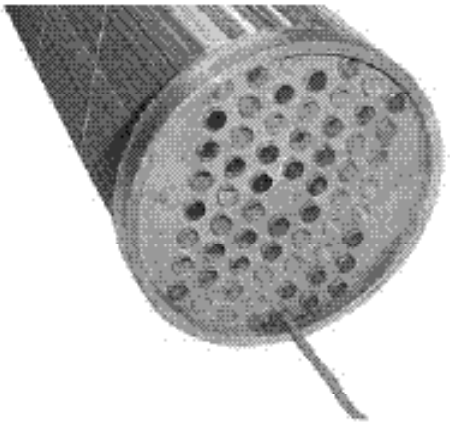
RG12183—UN—25FEB02

RG19661,000040D -19-10MAR13-1/2

A—Clamp
B—Clamps
C—Mounting Bolt
D—Cap Screws
E—Clamps
F—Cap Screws

8. Thoroughly clean all buildup from both end caps.
9. Use a 4.76 mm (3/16 in.) diameter brass rod to clean out any buildup in each tube. Run the rod the entire length of each tube to push debris out.
10. Flush the tubes with clean water, making sure 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

RG19661,000040D -19-10MAR13-2/2

**4-Cylinder Engine**

*NOTE: Firing order is 1-3-4-2.*

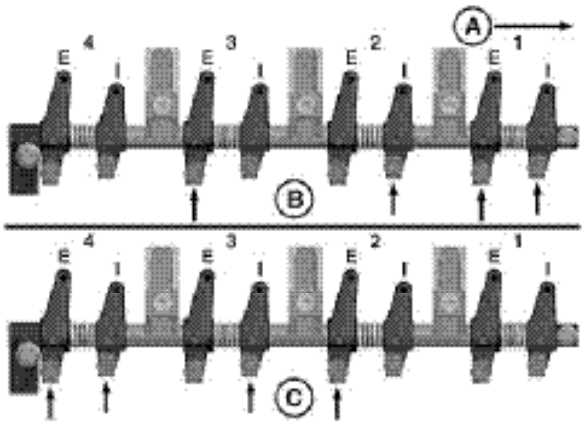
Lock No. 1 piston at TDC compression stroke (B).

Adjust valve clearance on No. 1 and 3 exhaust valves and No. 1 and 2 intake valves.

**Rotate flywheel 360°. Lock No. 4 piston at TDC** compression stroke (C).

Adjust valve clearance on No. 2 and 4 exhaust valves and No. 3 and 4 intake valves.

A—Front of Engine
B—No. 1 Piston at TDC Compression Stroke
C—No. 4 Piston at TDC Compression Stroke
E—Exhaust Valve
I— Intake Valve




RG22378 —UN—28JAN13

*4-Cylinder Engine Valve Adjustment*

RG19661,00003D0 -19-28JAN13-3/4

## 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.**

TS281 —UN—23AUG88

*High-Pressure Fluids*

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

***If COOL-GARD is not used, the flushing interval** is 2000 hours or 24 months of operation.*

**Drain old coolant, flush the entire cooling system, test thermostats, and fill with recommended clean coolant** using the following procedure.

1. Pressure test entire cooling system and pressure cap if not previously done. (See PRESSURE TESTING COOLING SYSTEM, in the Lubrication and Maintenance/500 Hour/12 Month Section.)
2. Slowly open the cap on the top tank (A) or heat exchanger to relieve pressure and allow coolant to drain faster.


RG12040 —UN—28NOV12

*Engine Top Tank*

A—Top Tank Cap

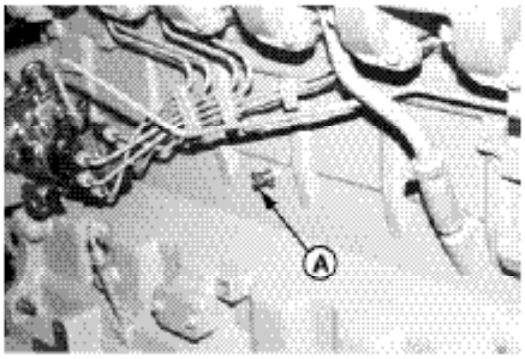
Continued on next page

RG19661,00003D1 -19-28JAN13-1/2

3. Open engine block drain valve (A) on left side of engine. Drain all coolant from engine block.
4. Open heat exchanger or top tank drain valve. Drain all coolant from heat exchanger or top tank.
5. Remove thermostats at this time, if not previously done. Install cover (without thermostats) using old gasket and tighten cap screws to 47 N·m (35 lb-ft).
6. Test thermostat opening temperature. (See Inspecting Thermostats And Testing Opening Temperature following in this section).
7. Close all drain valves after coolant has drained.

**⚠ CAUTION: Do not run engine longer than 10 minutes. Doing so may cause engine to overheat, causing burns when cooling system is draining.**

8. Fill the cooling system with clean water. Run the engine about 10 minutes to stir up possible rust or sediment.
9. Stop engine, pull off lower cooling system hose and remove heat exchanger or top tank cap. Immediately drain the water from system before rust and sediment settle.
10. After draining water, close drain valves. Reinstall cap, lower cooling system hose and clamp. Fill the cooling system with clean water and a heavy duty cooling system cleaner such as Fleetguard® RESTORE™ and RESTORE PLUS™.
11. **After cleaning the cooling system, drain cleaner and fill with water to flush the system. Run the engine about** 10 minutes, remove heat exchanger or top tank cap and pull off lower cooling system hose to drain out **flushing water.**
12. Close all drain valves. Reinstall hoses and tighten clamps securely. Install thermostats using a new gasket.




RG50196 —UN—19JUL00

*Engine Block Drain Valve*

A—Engine Block Drain Valve

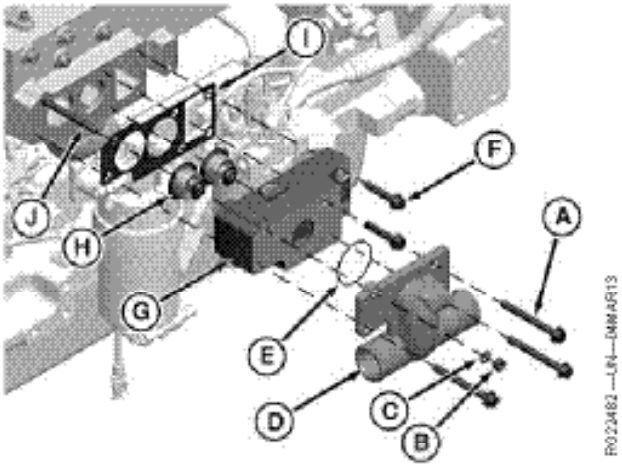
RG19661,0000301 -19-28JAN13-2/2

## Remove Thermostats

**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. DO NOT drain coolant until it has reached ambient temperature.**

1. Visually inspect area around thermostat housing and cover for leaks.
2. Remove coolant tank pressure cap and partially drain coolant system.
3. Remove cap screws (A), nut (B) and washer (C) attaching coolant cover (D) with sealing O-ring (E) to the thermostat housing (G) and exhaust manifold.
4. Remove cap screws (F) attaching thermostat housing to the exhaust manifold.
5. Remove thermostat housing with gasket (I). Remove and disgard all gasket material. Clean all sealing surfaces.
6. Inspect and test thermostats for proper opening temperature.
7. Install thermostats with a new gasket and pilot housing on stud (J). Install thermostat housing cap screws **finger-tight.**




*Remove and Install Thermostats*

A—Cap Screws (Thermostat Cover)
B—Nut
C—Washer
D—Thermostat Cover
E—O-ring
F—Cap Screws (Thermostat Housing)
G—Thermostat Housing
H—Thermostats
I— Gasket
J—Stud

8. Inspect thermostat cover sealing O-ring and replace if necessary. Install thermostat cover with O-ring, cap screws, washer and nut. Tighten nut and all cap screws to 35 N·m (25 lb.-ft.)

RG19661,0000405 -19-08MAR13-1/1

## Inspecting Thermostats and Testing Opening Temperature

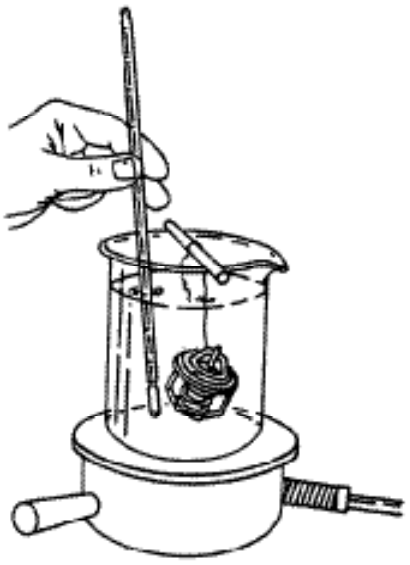
1. Remove thermostats. (See REMOVING THERMOSTATS earlier in this section.)
2. Visually inspect thermostats for corrosion or damage. Replace thermostats as a matched set as necessary.
3. Inspect thermostat with wiggle wire in vent notch. If wire movement is restricted, replace thermostat if cleaning does 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.**

4. Suspend thermostats and a thermometer in a container of water.
5. Stir the water as it heats. Observe opening action of thermostat and compare temperatures **with specifications. See GENERAL ENGINE SPECIFICATIONS in Specification Section.**

*NOTE: Due to varying tolerances of different supplies, initial opening and full open temperatures may **vary slightly from specified temperatures.***

6. 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.



R95971 —UN—23NOV97

*Thermostat And Thermometer In Water*

7. If any one thermostat is defective, replace both thermostats.

DUOD006,0000095 -19-19JUN07-1/1

**Remove and Inspect Impeller**

1. Close sea cock and drain sea water system if not previously done.

2. Remove six cover plate cap screws with washers and remove cover plate (A) with O-ring. Remove impeller end cap from end of impeller bore.

*NOTE: Normally the impeller can 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.*

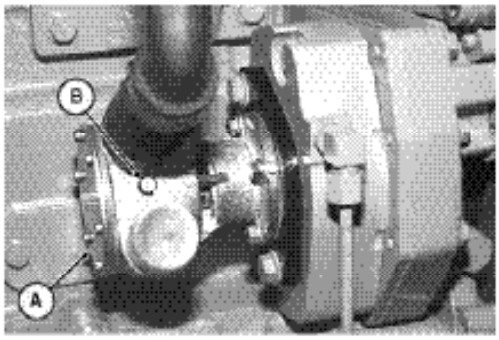
3. Carefully remove impeller with cam plate. Be careful not to damage impeller if in reusable condition. Remove key from shaft keyway.

The impeller must be installed in the same direction as removed. Mark the impeller to ensure installation in proper direction of rotation if impeller is reused.

4. Inspect impeller for damages such as tears, stress cracks, excess abrasions on vane ends, or chunks of material missing. Impellers that are run dry will overheat and fail the impeller blades at the root. Impellers that swell and stick, fail the impeller in the middle of the blade. If impeller replacement is necessary, order an impeller repair kit.

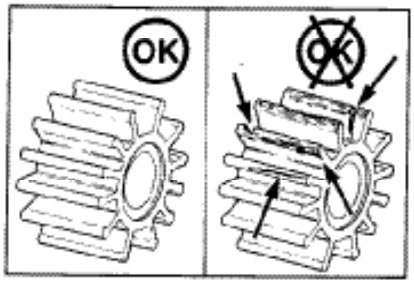
**IMPORTANT: If impeller has chunks of material missing, the heat exchanger, marine gear oil cooler and any other circuit that are cooled by raw water should be thoroughly cleaned and flushed.**

5. Remove cam screw (B) holding cam plate to impeller housing bore.




*Remove Cover Plate*

RG39853 —UN—05JAN09




*Inspect Sea Water Pump Impeller*

RG6243 —UN—28MAR02

**A—Cover Plate** **B—Cam Screw**

6. Thoroughly clean impeller housing bore and cam plate (if cam plate is reused).

Continued on next page

RG15661,0000401 -19-08MAR13-2/3

**Install Impeller**

1. Apply LOCTITE® 242 (Deere Part No. TY9370) to curved side of cam plate near threaded hole and install cam plate into impeller housing bore, be sure holes in cam plate and housing are aligned. Apply LOCTITE® 242 to cam screw (B), install, and tighten.

The cam plate should be inspected to insure that none of **the cam fingers are protruding which could cause impeller** damage. The cam screw should also be inspected to insure that it does not protrude below the cam plate. **Replace cam plate and cam screw or grind screw flush** as needed.

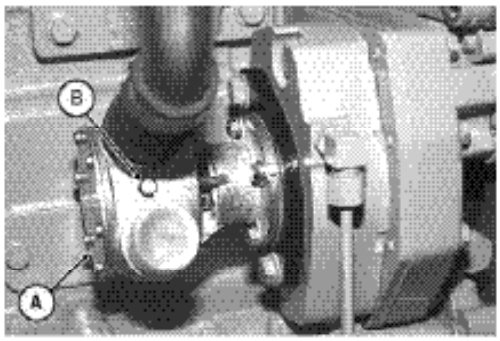
**IMPORTANT: Petroleum based lubricants can cause the impeller to swell, and are not recommended to lubricate the impeller before installation.**

2. Lubricate impeller blades with a non-petroleum based lubricant such as silicone or soapy water. Install impeller using a twisting motion and be sure the impeller blades are bent in the same direction as they were upon removal.

Be sure impeller is installed in same direction as removed if reusing existing impeller.

3. Rotate impeller to align keyway and slide the key in place. Install impeller end cap in end of impeller bore.

*LOCTITE is a registered trademark of Loctite Corp.*




R09853—UN—05JAN99

*Install Cover Plate*

A—Cover Plate B—Cam Screw

4. Using a new O-ring, install cover plate (A) onto impeller housing. Install six screws with washers. Tighten screws evenly.

5. Reconnect all water piping, if disconnected.

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

RG19661,0000401 -19-06MAR13-3/3

## Inspect And Repair Raw Water Pump

*NOTE: Sea water pump with shaft key is illustrated. Sea water pumps with a splined shaft follow the same procedure*

1. Close sea cocks and drain raw water system.
2. Remove cover plate (A) from raw water pump.

*NOTE: Special impeller puller tool is provided with minor and major 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.*

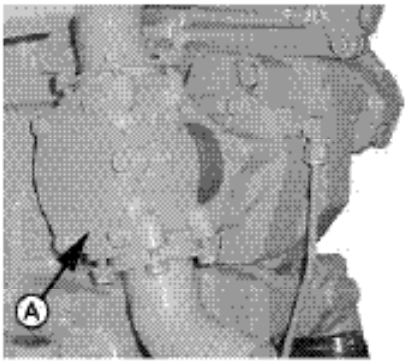
3. Remove impeller (B) and shaft key (C) (if equipped) from pump housing.
4. Remove O-ring (D).
5. Inspect cam plate (E) for evidence of heavy pitting or wear. Replace as needed.
6. Inspect impeller for damages such as tears, stress cracks, excess abrasions on vane ends, or chunks of material missing. Impellers that are run dry will overheat and fail the impeller blades at the root. Impellers that swell and stick, fail the impeller in the middle of the blade. If impeller replacement is necessary, order an impeller repair kit.

**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.**

7. Install shaft key (C) (if equipped) on shaft.

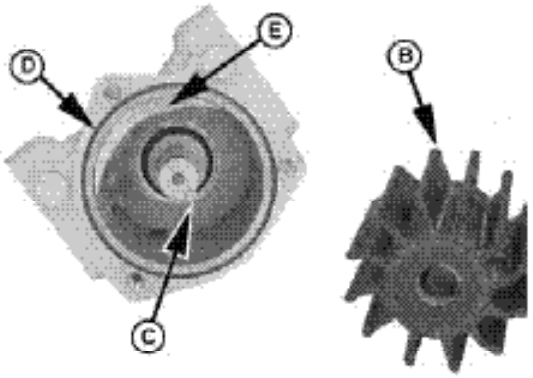
**IMPORTANT: Petroleum based lubricants can cause the impeller to swell, and are not recommended to lubricate the impeller before installation.**

8. Lubricate new impeller blades with a non-petroleum based lubricant such as silicone or soapy water. Install impeller using a twisting motion and be sure the impeller blades are bent in the same direction as they were upon removal to prevent damage at startup. Rotate impeller on shaft to align keyways/splines and slide the impeller onto the shaft.
9. Using a new O-ring (D), install cover plate and tighten cap screws with washers securely.
10. Install pump and tighten cap screws to 73 N·m (54 lb-ft).
11. Connect sea water inlet and outlet tubes. Tighten mounting cap screws **evenly** until secure.



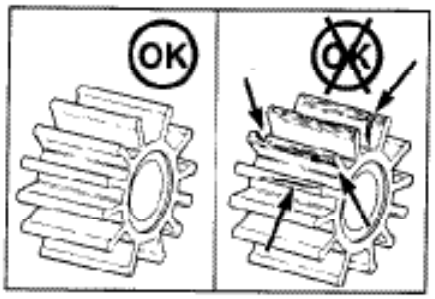

Remove Cover Plate

R014949 —UN—20JUN07




Remove and Inspect Components

R012198 —UN—25FEB02




Inspect Pump Impeller

R08243 —UN—23MAR02

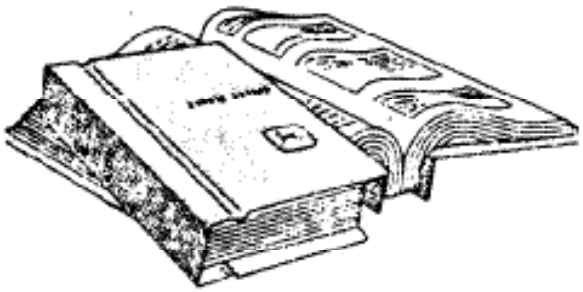
A—Cover Plate
B—Impeller
C—Shaft Key
D—O-Ring
E—Cam Plate

12. **Replace O-rings on oil tubes and install oil filter** housing and oil tubes. Tighten mounting cap screws to 35 N·m (26 lb-ft).
13. Open sea cocks, start engine and check pump operation.

RG19661,0000402 -19-09MAR13-1/1

## Additional Service Information

This is not a detailed service manual. If you want more detailed service information, use the form in the back of this manual to order a component technical manual.



RG34624 —UN—15DEC88

RG,RG34710,5891 -19-20MAY98-1/1

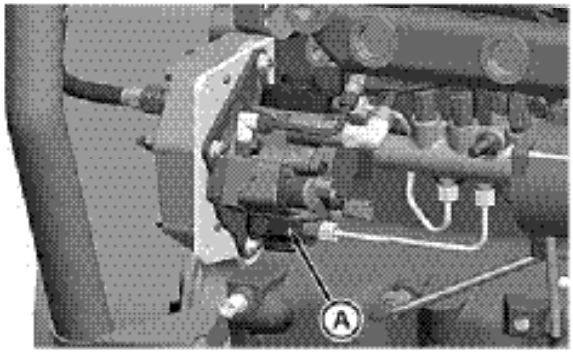
## Do Not Modify Fuel System

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

**In addition, tampering with fuel system which alters emission-related equipment on engines may result in fines or other penalties, per EPA regulations or other local emission laws.**

**Do not attempt to service injection pump or fuel injectors yourself. Special training and special tools are required. (See your authorized servicing dealer or engine distributor.)**

**IMPORTANT: Never steam clean or pour cold water on a high-pressure fuel pump while it is still warm. To do so may cause seizure of pump parts.**




RG22161 —UN—08DEC12

*Fuel Injection Pump*

**A—Fuel Injection Pump**

RG18681,00003C1 -19-23JAN13-1/1

## Adding Coolant

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

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

**IMPORTANT: Never pour cold liquid into a hot engine, as it may crack cylinder head or block. DO NOT operate engine without coolant for even a few minutes.**

**John Deere TY15161 Cooling System Sealer may be added to the 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 ENGINE COOLANT SPECIFICATIONS in Fuels, Lubricants, and Coolant Section for mixing of coolant ingredients before adding to cooling system.)**

TS281—UN—23AUG88

*High-Pressure Fluids*

**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 -19-04JAN02-1/1

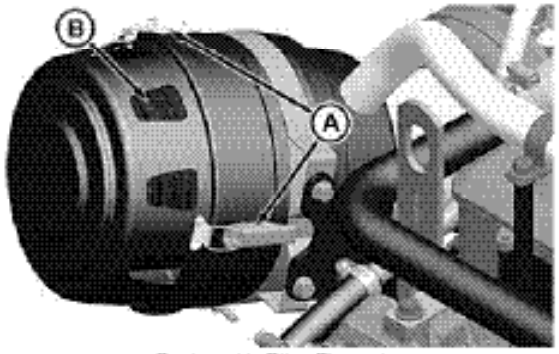
## Replacing Dry Air Cleaner Element

**IMPORTANT: ALWAYS REPLACE primary air cleaner element when air restriction indicator (A) shows vacuum of 625 mm (25 in.) $H_2O$, or when reset button has popped up (if equipped). Also replace element if it is torn, or visibly dirty.**

1. **Release air filter assembly clamps (A) and remove** cover.

**IMPORTANT: Insure all air intake connections are secure to prevent ingestion of abrasive dirt and dust into the system, causing possible engine damage.**

2. **Install new air filter element (B), install cover and** engage clamps.




RG22156—UN—21FEB13

*Replace Air Filter Element*

A—Air Filter Assembly Clamps B—Air Filter Element

RG19661,00003F5 -19-22FEB13-1/1

## Servicing Air Cleaner Filter Element

**IMPORTANT: Always service primary air cleaner element when air restriction indicator shows a vacuum of 625 mm (25 in.) $H_2O$, or when reset button has popped up (6068SFM75/AFM75 only). Also replace element if it is torn, or visibly dirty.**

*NOTE: This procedure applies to John Deere air cleaner kits. Refer to manufacturers' instructions for servicing air cleaners not supplied by John Deere.*

1. **Loosen clamp (A) and remove filter element.**

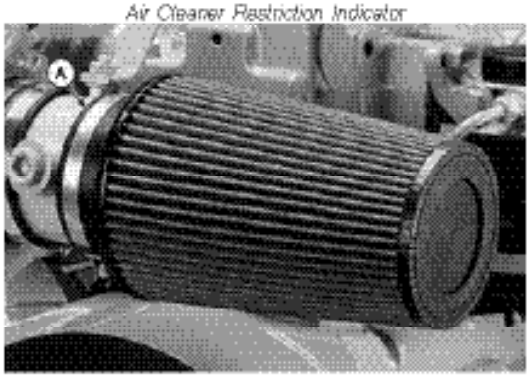
**IMPORTANT: Replace filter element after 10 cleanings. (See following blocks.)**

2. **Tap end of filter GENTLY on hard surface to dislodge** loose dirt.
3. **Brush dirt side of filter GENTLY with soft bristle brush.**

**IMPORTANT: Use kit RE504585 to service filter element. DO NOT clean element with gasoline, solvents, parts cleaners, strong detergents, or caustic cleaning solutions. DO NOT steam clean or use high-pressure washers to clean element. These processes will damage filter** media and/or rubber base or end cap.

*Air Cleaner Restriction Indicator*

RG12749 —UN—24DEC02

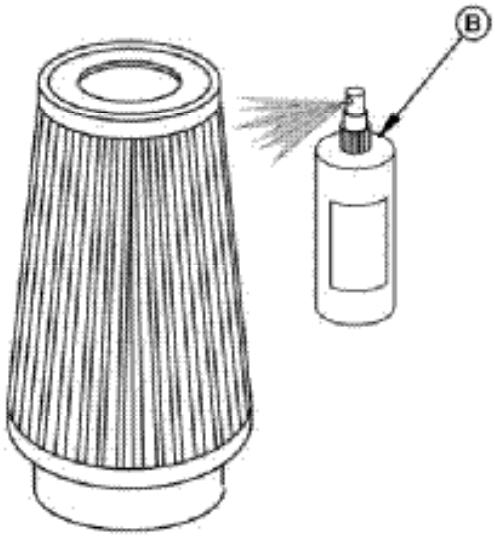



*Remove Filter Element*

RG9926 —UN—18NOV99

OUOD006,0000098 -19-10DEC09-1/5

4. **Spray air filter cleaner (B) (from kit RE504585) liberally onto entire element. Let soak into filter media** for 10 minutes.




*Spray Filter with Cleaner*

RG9943 —UN—17NOV99

**Continued on next page**

OUOD006,0000098-19-10DEC09-2/5

5. **Rinse filter with low pressure water, flushing opposite the direction of air flow (from clean side to dirty side).**

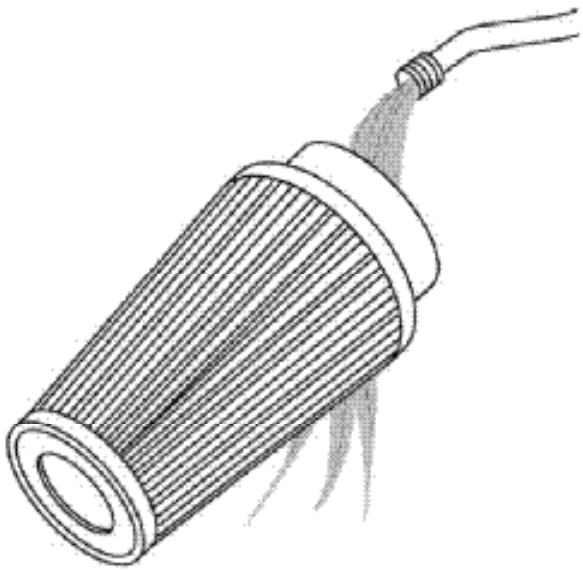
IMPORTANT: Let element dry at room temperature. **Compressed air will damage filter media. Heat will shrink filter media and may damage** rubber base or end cap.

6. Shake off excess water and let the element dry at room temperature.

**IMPORTANT: Never put filter in service without oiling it. The filter will not function properly without** being oiled with oil provided in kit RE504585.

**Do not use automatic transmission fluid,** motor oil, diesel fuel, or any type light-weight spray lubricant. These products will damage **filter or degrade its performance.**

*NOTE: Red dye is added to oil to show areas of oil application.*



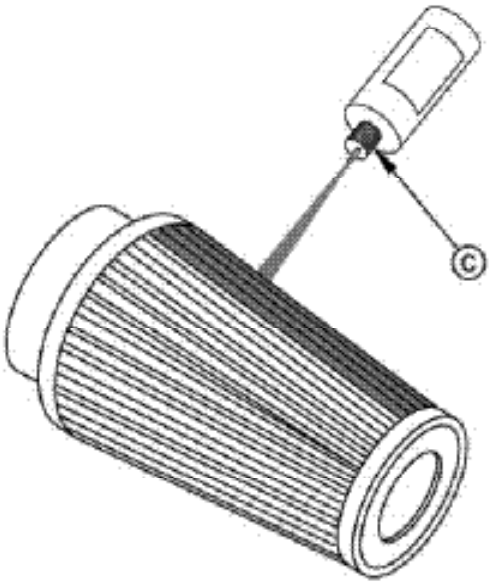
R089944 —UN—17NOV09

*Rinse Filter*

OUOD006,0000098 -19-10DEC09-3/5

7. **Spray air filter oil from squeeze bottle (C) in kit from** distance of 25 cm (10 in.) onto a group of pleats until the pleats become reddish in color. Respray any areas that are still white 10 minutes after initial application.

8. **Install filter and tighten clamp.**




R089945 —UN—17NOV09

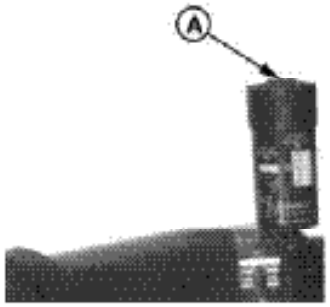
*Apply Oil To Filter*

**Continued on next page**

OUOD006,0000098 -19-10DEC09-4/5

**IMPORTANT: Whenever the air cleaner has been serviced, ALWAYS fully depress the air restriction indicator reset button (if equipped) to assure accurate readings.**

9. If equipped, fully depress air restriction indicator reset button (A) and release to reset indicator.




*Air Restriction Indicator Reset Button*

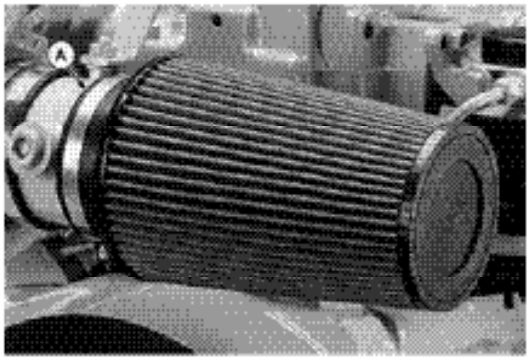
RG9927 —UN—18NOV09

OUOD006,0000098 -19-10DEC09-5/5

## Replacing Air Cleaner Filter Element

**IMPORTANT: Replace the element after 10 cleanings.**

1. **Loosen clamp (A) and remove filter element.**
2. **Install new filter element and tighten clamp.**



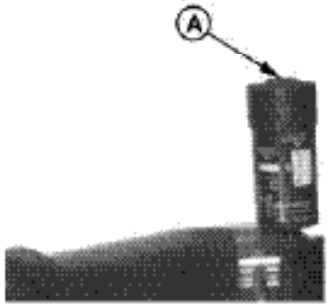

*Remove Filter Element*

RG9926 —UN—18NOV09

OPSG,OUOD007,2998 -19-24DEC02-1/3

**IMPORTANT: Whenever the air cleaner has been serviced, ALWAYS fully depress the air restriction indicator reset button (if equipped) to assure accurate readings.**

3. If equipped, fully depress air restriction indicator reset button (A) and release to reset indicator.




*Air Restriction Indicator Reset Button*

RG9927 —UN—18NOV09

OPSG,OUOD007,2998 -19-24DEC02-3/3

## Replacing Alternator Belt (With Automatic Tensioner)

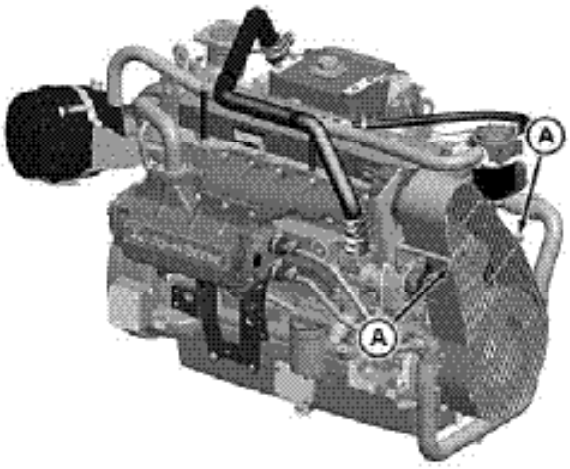
Refer to CHECKING BELT TENSIONER SPRING TENSION AND BELT WEAR in Lubrication and Maintenance/500 Hour/12 Month Section for additional information on the belt tensioner.

**⚠ CAUTION: Belt guard should be in place at all times when engine is running.**

*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.*

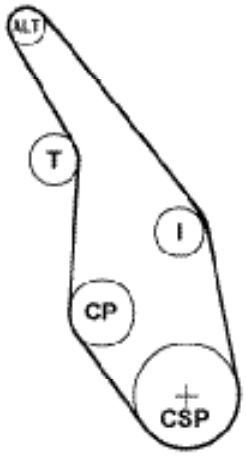
1. Remove cap screws (A) and carefully remove belt guard from engine.
2. Release tension on belt using a breaker bar and socket on tension arm and remove poly-vee belt from pulleys.
3. Inspect belts for cracks, fraying, or stretched out areas. Replace if necessary.
4. Install new belt, making sure belt is correctly seated in all pulley grooves. Refer to belt routing at right.
5. Apply tension to belt with tensioner. Remove socket.
6. Start engine and check belt alignment.

A—Cap Screws
ALT—Alternator
CSP—Crankshaft Pulley
I—Idler Pulley
T—Tensioner
CP—Coolant Pump




*Remove Belt Guard*

RG21162 —UN—01DEC12




*Belt Routing*

RG12077 —UN—28FEB12

RG19681,00003F4 -19-20FEB13-1/1

## Check Front Power Take-Off (PTO)

**CAUTION: Entanglement in rotating driveline can cause serious injury or death. Keep shield on PTO driveshaft between clutch housing and the engine driven equipment at all times during engine operation. Wear close fitting clothing. Stop the engine and be sure PTO driveline is stopped before making adjustments.**

**CAUTION: Metal surfaces of PTO housing may be hot to the touch during operation or at shutdown.**

The optional front power take-off (PTO) from John Deere transfers engine power to auxiliary equipment or moving components.

Proper performance of the power take-off unit will be related to the care it is given. Periodically check for any oil leaks that may occur.

TS1644—UN—22AUG95

*Rotating Drivelines*

If the power take-off does not work properly, contact your authorized servicing dealer or engine distributor.

OUR0P11,0000145 -19-02DEC03-1/1

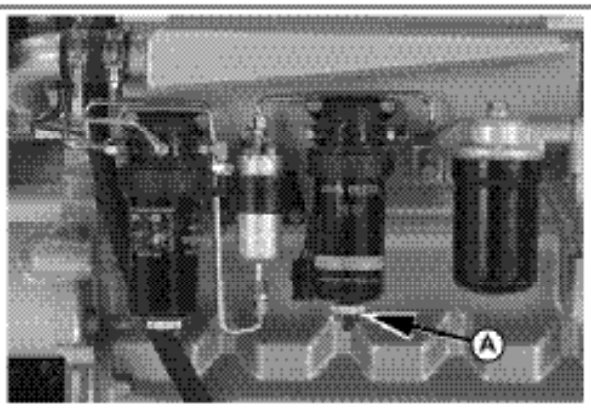
## Drain Water From Fuel Filter

**IMPORTANT: When using BIODIESEL blends, monitor water quantity more closely in the fuel filter element. Water in the filter separator may need to be drained more frequently.**

If instrument panel provides a water in fuel warning, drain **water or debris from filter using the following steps.**

1. Loosen thumb screw (A) and drain water and debris into a suitable container. Tighten thumb screw.
2. Dispose of water and debris in an environmentally safe manner.

**A—Thumb Screw**




RG13253 —UN—08DEC03

*Drain Primary Fuel Filter - 6068SFM50 Shown*

OUOD006,0000083 -19-18OCT07-1/1

## Bleeding Fuel System

**CAUTION: 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.)**

**Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid hazards 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 may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.**

**IMPORTANT: Four-valve cylinder head engines are especially sensitive to fuel contamination. Do not crack any fuel lines to bleed the 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.*

TS1343—UN—18MAR92

*High-Pressure Fuel Lines*

X9811—UN—23AUG88

*High Pressure Fluids*

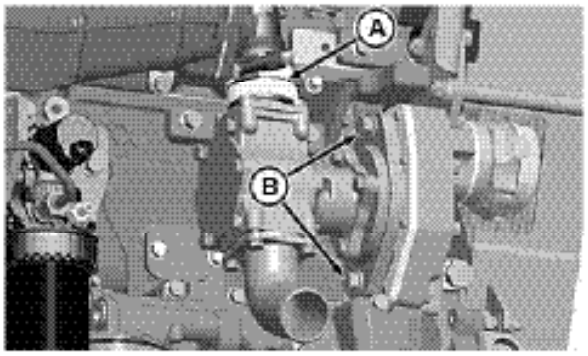
**If engine will not start after filter changes, turn ignition key** ON for 60 seconds to prime the fuel system. It may be necessary to turn the key off and on again to reprime the system before starting.

RG19661,00003FD -19-01MAR13-1/1

## Remove And Install Sea Water Pump (4045AFM85/6068AFM85)

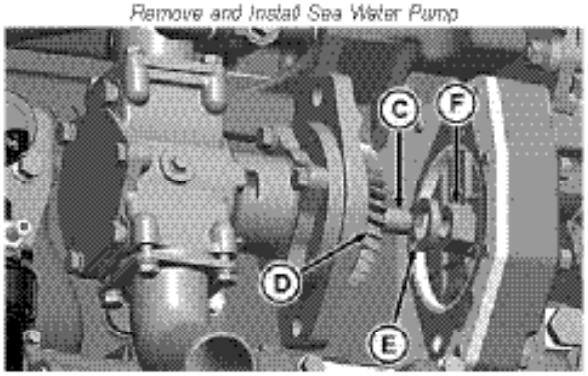
1. Close sea cock and drain sea water system.
2. Remove sea water outlet connection (A), remove sea water pump cap screws (B) and remove pump.
3. Clean all gasket material from both mating surfaces.
4. Inspect gear teeth for damage. Install new gear (D) by aligning key (C) to the pump shaft keyway.
5. **Install lock washer (E) and hex nut (F) finger-tight and** insure key is properly in place.
6. Tighten hex nut to 68 N·m (50 lb.-ft.).
7. Install sea water pump with new gasket to front plate and tighten cap screws (B) to 140 N·m (103 lb.-ft.).
8. Connect sea water inlet and outlet.
9. Open sea cock, start engine and check for leaks.

A—Sea Water Outlet
B—Cap Screws
C—Key
D—Gear
E—Lock Washer
F—Hex Nut




RG32172—UN—11DEC12

*Remove and Install Sea Water Pump*




RG32173—UN—11DEC12

*Sea Water Pump Drive Gear*

RG19681,00003FF -19-02MAR13-1/1

## General Troubleshooting Information

**Troubleshooting engine problems can be difficult. Engine** wiring diagrams are provided in this section to help isolate electrical problems on engines using John Deere wiring harness and instrument (gauge) panel.

Later in this section is a list of possible engine problems that may be encountered, accompanied by possible causes and corrections. The illustrated diagrams and **troubleshooting information are of a general nature; final** design of the overall system for your engine application may be different. See your engine distributor or servicing dealer if you are in doubt.

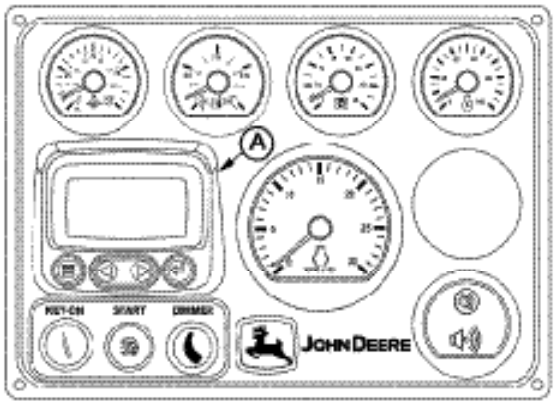
The Engine
Control Unit (ECU) has the ability to detect problems internally and in the electronic control system. This includes determining if any of the sensor input voltages are too high or too low, if the camshaft and crankshaft position sensor inputs are valid, and if the unit injector solenoids are responding properly.

If the ECU detects a problem with the electronic control **system a Diagnostic Trouble Code (DTC) specific to the** failed system will be stored in the ECU's memory.

There are two types of DTCs:
- Active
- Inactive (Stored)

Active DTCs indicate that the failure is occurring. These type of failures are sometimes called "hard" failures. They can be accessed on the diagnostic gauge (A) on the instrument panel.

Inactive or stored DTCs indicate that a failure has occurred in the past, but is not currently occurring. This type of "stored" DTC can be caused by an "intermittent" failure.




*Diagnostic Gauge*

**A—Engine System Profiler**

These could be problems such as a bad connection or a wire intermittently shorting to ground.

To access DTC's with the system profiler (A), see section 15 of this manual.

If a sensor or wiring fails and a DTC is active for the sensor, the ECU will use a substitute "limp home" value in its calculations to continue engine operation.

A list of DTCs is given later in this section with a description of each. Contact your engine servicing dealer to correct any DTCs which are displayed on the instrument panel.

OUOD006,00000F9 -19-25SEP07-1/1

## 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.
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.

TS953—UN—15MAY90

DX,WELDING,PRECAUTIONS -19-08DEC10-1/1

## Precautions For Welding On Vessels Equipped With Electronic Engine Control Unit (ECU)

**IMPORTANT: ALWAYS disconnect Electronic Control Unit (ECU) connectors and engine control system-to-vessel ground before welding. High currents or electro-static discharge in electronic components from welding may cause permanent damage.**

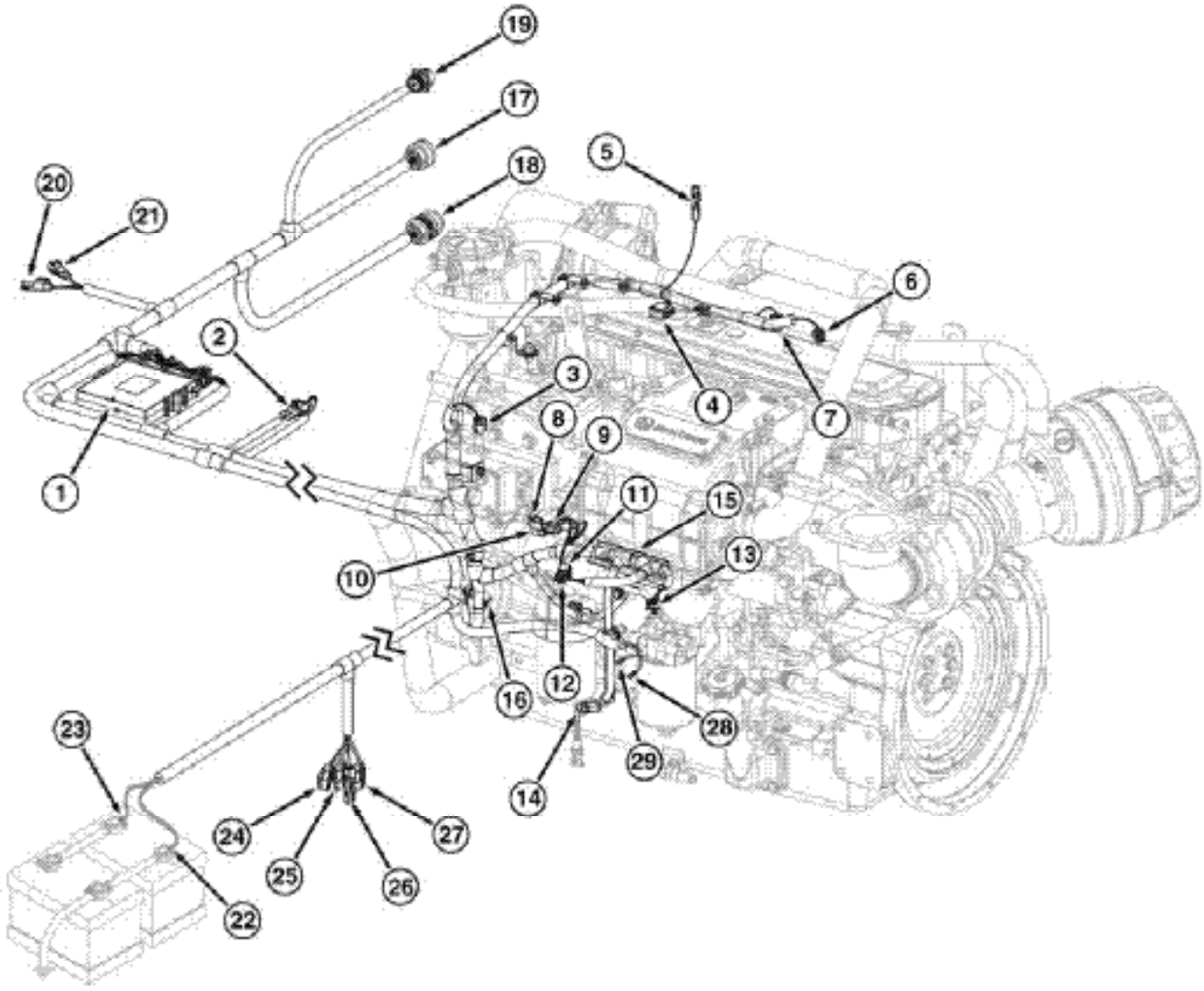
1. Remove the ground connection for the engine control system-to-vessel frame.
2. Disconnect the connectors from the ECU.
3. Connect the welder ground close to the welding point and be sure ECU or other electronic components are not in the ground path.

*Welding Precautions*

TS953—UN—15MAY90

DPSG,OUCO007,2898 -19-04NOV99-1/1

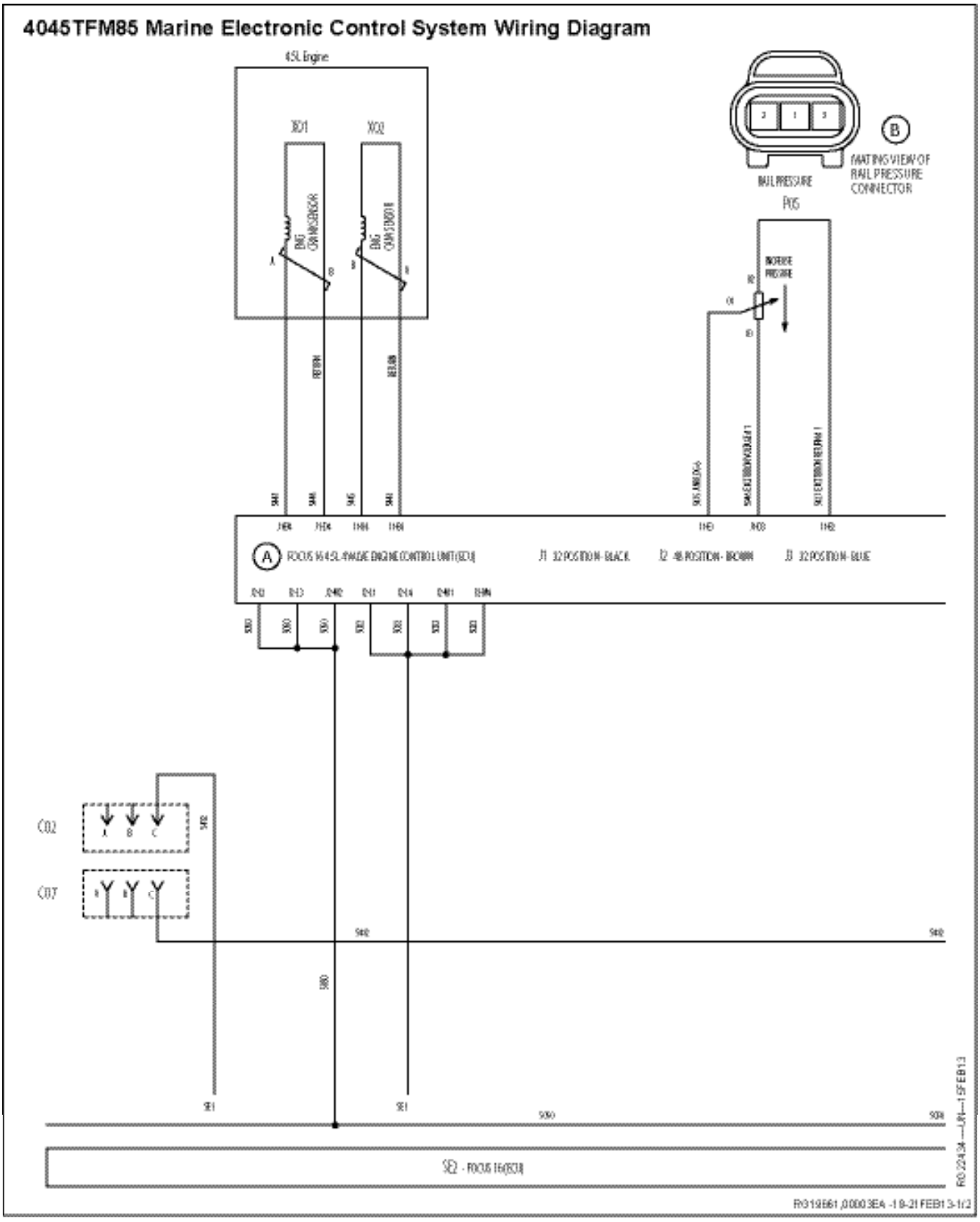
## Electronically Controlled Engine Electrical System Layout




1— Engine Control Unit (ECU)
2— Auxiliary Power Connector
3— Coolant Temperature Sensor Connector
4— Fuel Injection Harness Connector
5— Alternator Connector
6— Manifold Air Pressure Sensor Connector
7— Manifold Air Temperature Sensor Connector
8— Suction Control Valve Sensor Connector
9— Fuel Temperature Sensor Connector
10— Camshaft Position Sensor Connector
11— Low-Pressure Fuel Pump Connector
12— Oil Pressure Sensor Connector
13 — Fuel Pressure Sensor Connector
14— Water-in-Fuel Sensor Connector
15— Fuel Rail Pressure Sensor Connector
16— Crankshaft Position Sensor Connector
17— Control Panel Connector
18— Auxiliary Connector
19— Diagnostic Connector
20— CAN Terminator Connector
21— Remote On/Off Connector
22— Unterminated Ground (Battery)
23— Unterminated Power (Battery)
24— Low-Pressure Fuel Pump Fuse (15 Amp)
25— ECU Fuse (20 Amp)
26— Transient Voltage Protection Connector
27— System Fuse (30 Amp)
28— Starter Relay Coil Connector (Power)
29— Starter Relay Coil Connector (Ground)

RG19661,00003DE -19-15FEB13-1/1

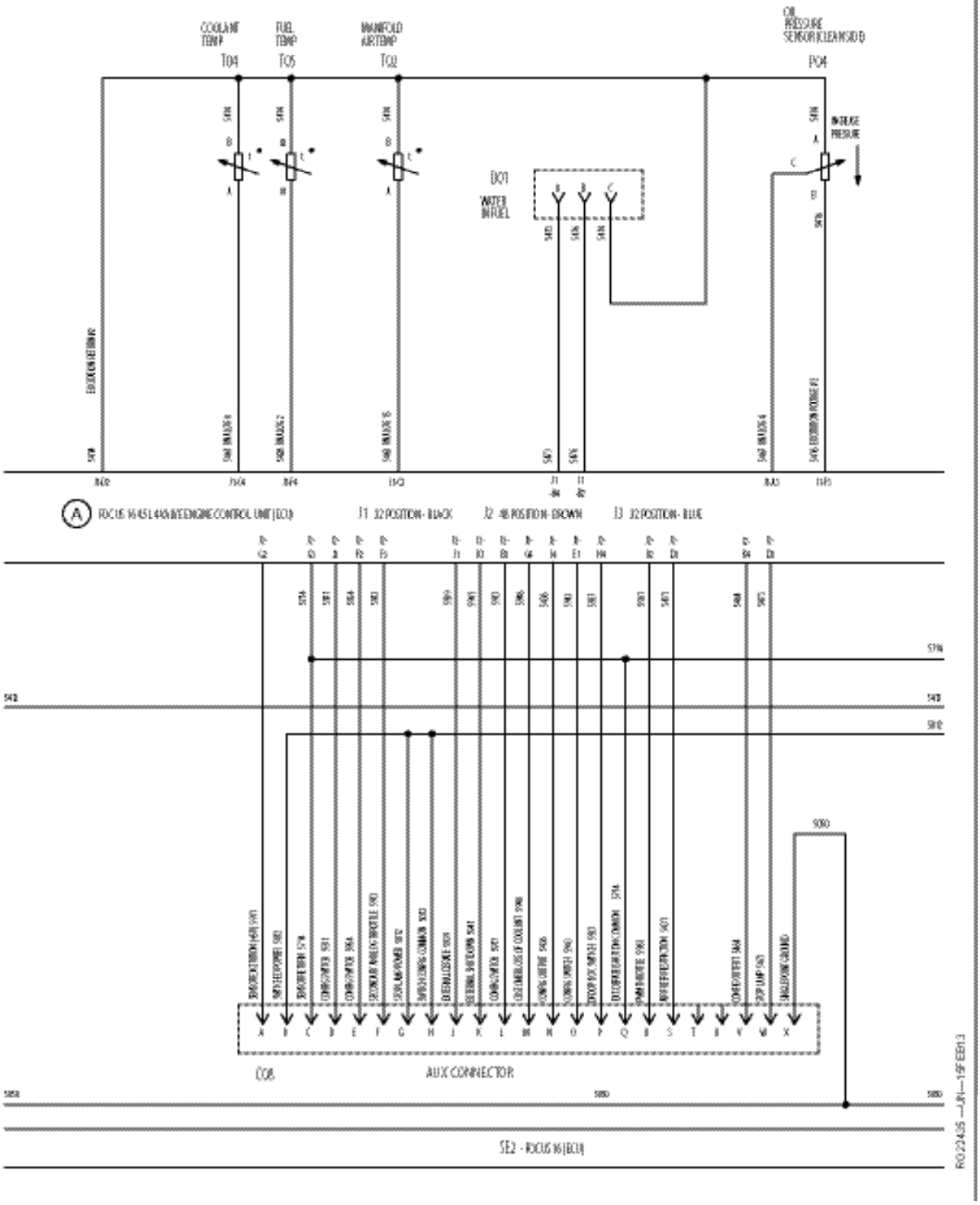
## 4045TFM85 Marine Electronic Control System Wiring Diagram



A— Focus 16, 4.6 L, 4 Valve, Engine Control Unit (ECU)
B— Mating View of Rail Pressure Connector
J1— 32 Position - Black
J1-D3— Excitation Voltage #1
J1-D4— Return
J1-E2— Excitation Return #1
J1-E3— Analog 6
J1-E4— Return
J2— 48 Position - Brown
J3— 32 Position - Blue
P05— Fuel Rail Pressure Sensor
SE2— Focus 16 (ECU)
X01— Crankshaft Position Sensor
X02— Camshaft Position Sensor

R319661,00003EA -19-21FEB13-3/3

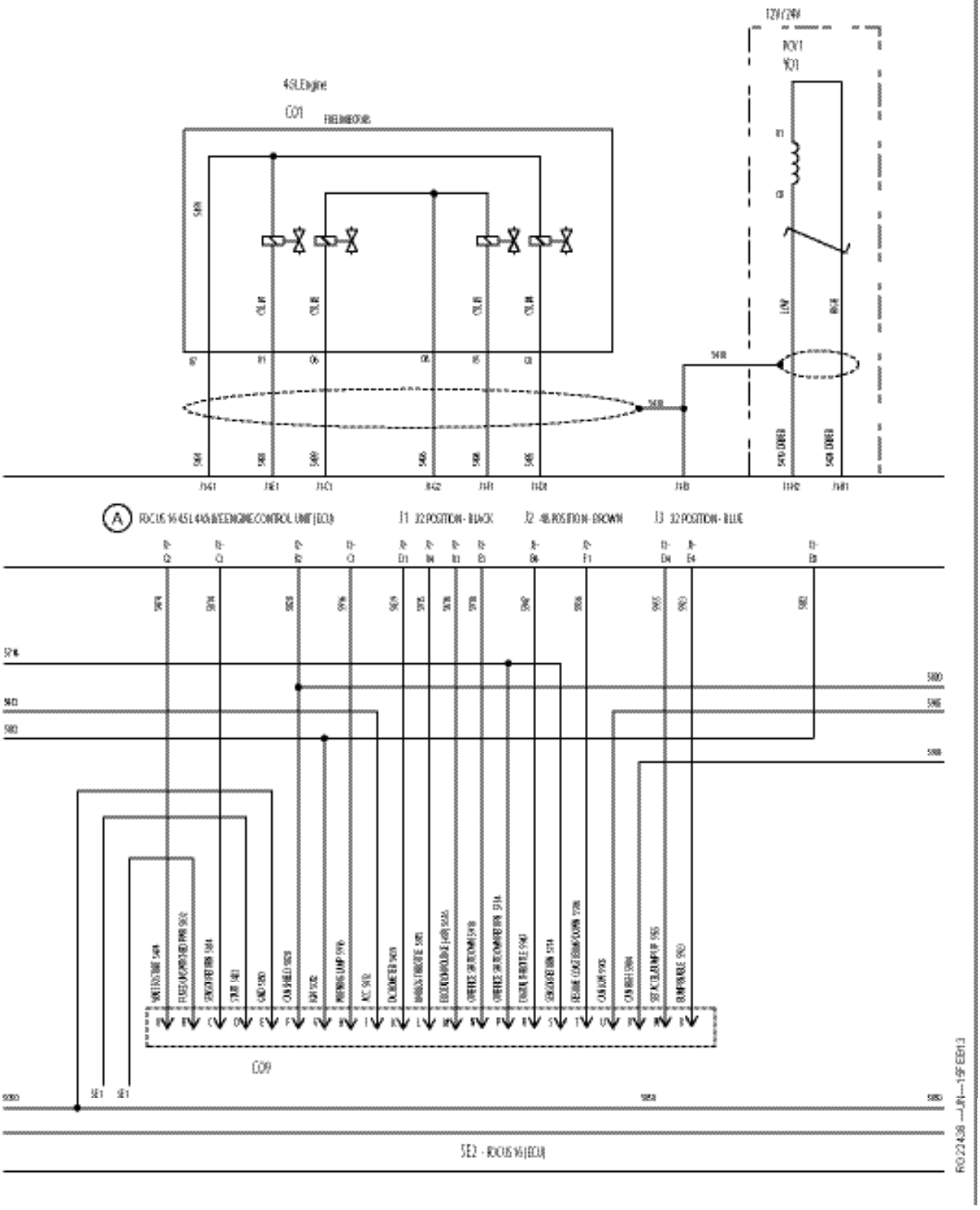
## 4045TFM85 Marine Electronic Control System Wiring Diagram - Cont-d



A— Focus 16, 4.5 L, 4 Valve, Engine Control Unit (ECU)
C09— Auxiliary Connector
C09-A— Sensor Excitation (+5 V)
C09-B— Switched Power
C09-C— Sensor Return
**C09-D— Configurable Switch**
**C09-E— Configurable Switch**
C09-F— Secondary Analog Throttle
C09-G— Stop Lamp Power
**C09-H— Common Configurable Switch**
C09-J— External Derate
C09-K— External Shutdown
**C09-L— Configurable Switch**
C09-M— Customer Loss of Coolant
**C09-N— Configurable Output**
**C09-O— Configurable Switch**
C09-P— Droop Isochronous Switch
C09-Q— External Derate/Shutdown Common
C09-R— PWM Throttle
C09-S— Air Filter Restriction
**C09-V— Configurable Output**
C09-W— Stop Lamp
C09-X— Single Point Ground
D01— Water-In-Fuel Sensor
J1— 32 Position - Black
J1-A3— Analog 4
J1-C2— Analog 15
J1-C4— Analog 8
J1-D2— Excitation Return #2
J1-F3— Excitation Voltage #2
J1-F4— Analog 2
J2— 48 Position - Brown
J3— 32 Position - Blue
P04— Engine Oil Pressure Sensor (Clean Side)
SE2— Focus 16 (ECU)
T02— Manifold Air Temperature Sensor
T04— Engine Coolant Temperature Sensor
T05— Fuel Temperature Sensor

RG19681,00003EC -19-21FEB13-2/2

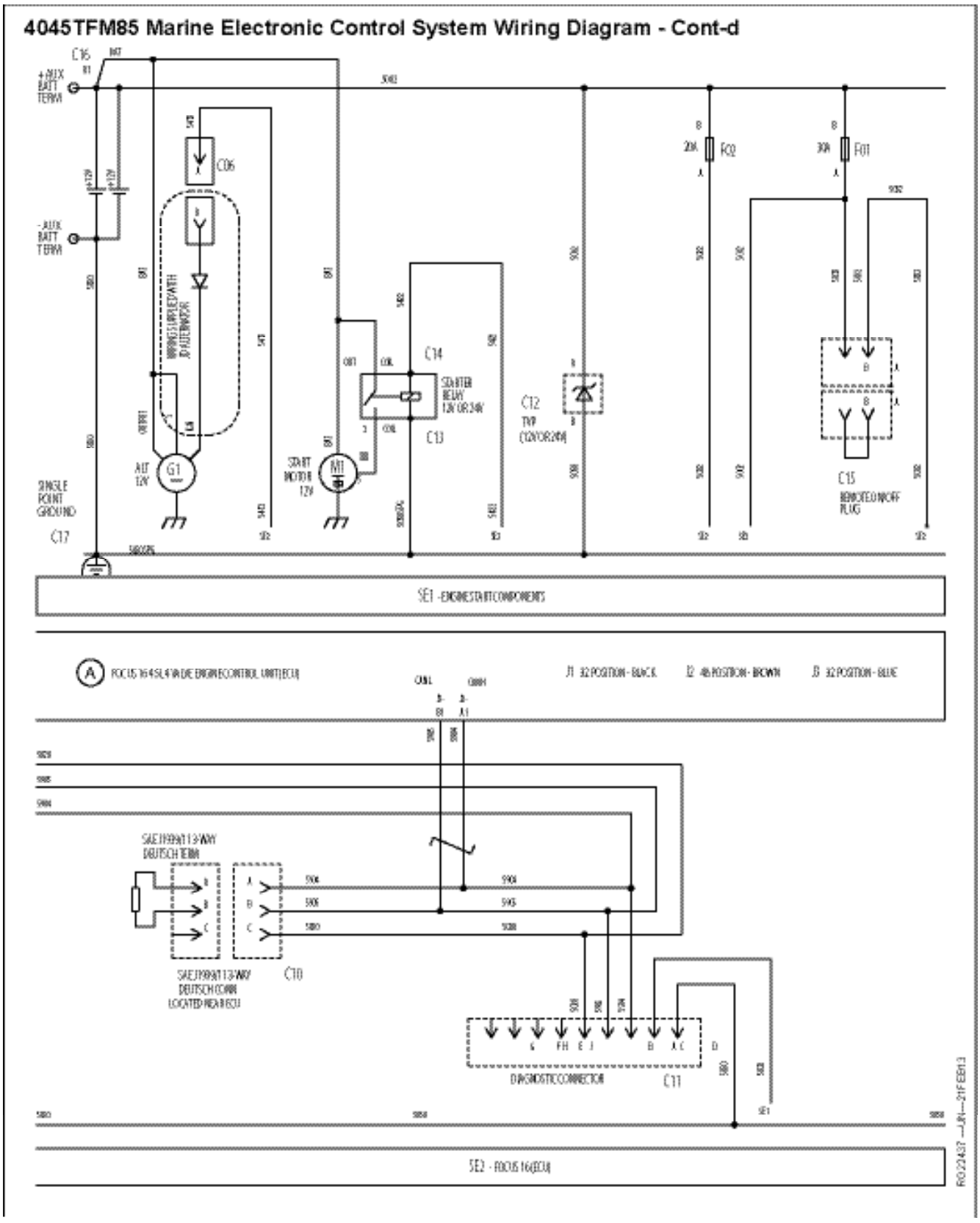
## 4045TFM85 Marine Electronic Control System Wiring Diagram - Cont-d



A— Focus 16, 4.5 L, 4 Valve, Engine Control Unit (ECU)
C01— Fuel Injectors
C09-A— Wait To Start
C09-B— Fused Unswitched Power
C09-C— Sensor Return
C09-D— Start
C09-E— Ground
C09-F— CAN Shield
C09-G— Ignition
C09-H— Warning Lamp
C09-J— Accessory
C09-K— Tachometer
C09-L— Analog Throttle
C09-M— Excitation Voltage (+5 V)
C09-N— Override Shutdown
C09-P— Override Shutdown Return
C09-R— Digital Throttle
C09-S— Sensor Return
C09-T— Resume Coast/Bump Down
C09-U— CAN Low
C09-V— CAN High
C09-W— Set Accelerator/Bump Up
C09-X— Bump Enable
J1— 32 Position - Black
J1-C1— Cylinder 2
J1-D1— Cylinder 4
J1-E1— Cylinder 1
J1-F1— Cylinder 3
J1-H1— High Driver
J1-H2— Low Driver
J2— 48 Position - Brown
J3— 32 Position - Blue
SE2— Focus 16 (ECU)
Y01— Pressure Control Valve 1 (12 V/ 24 V)

RG19681,00003ED -19-21FEB13-2/2

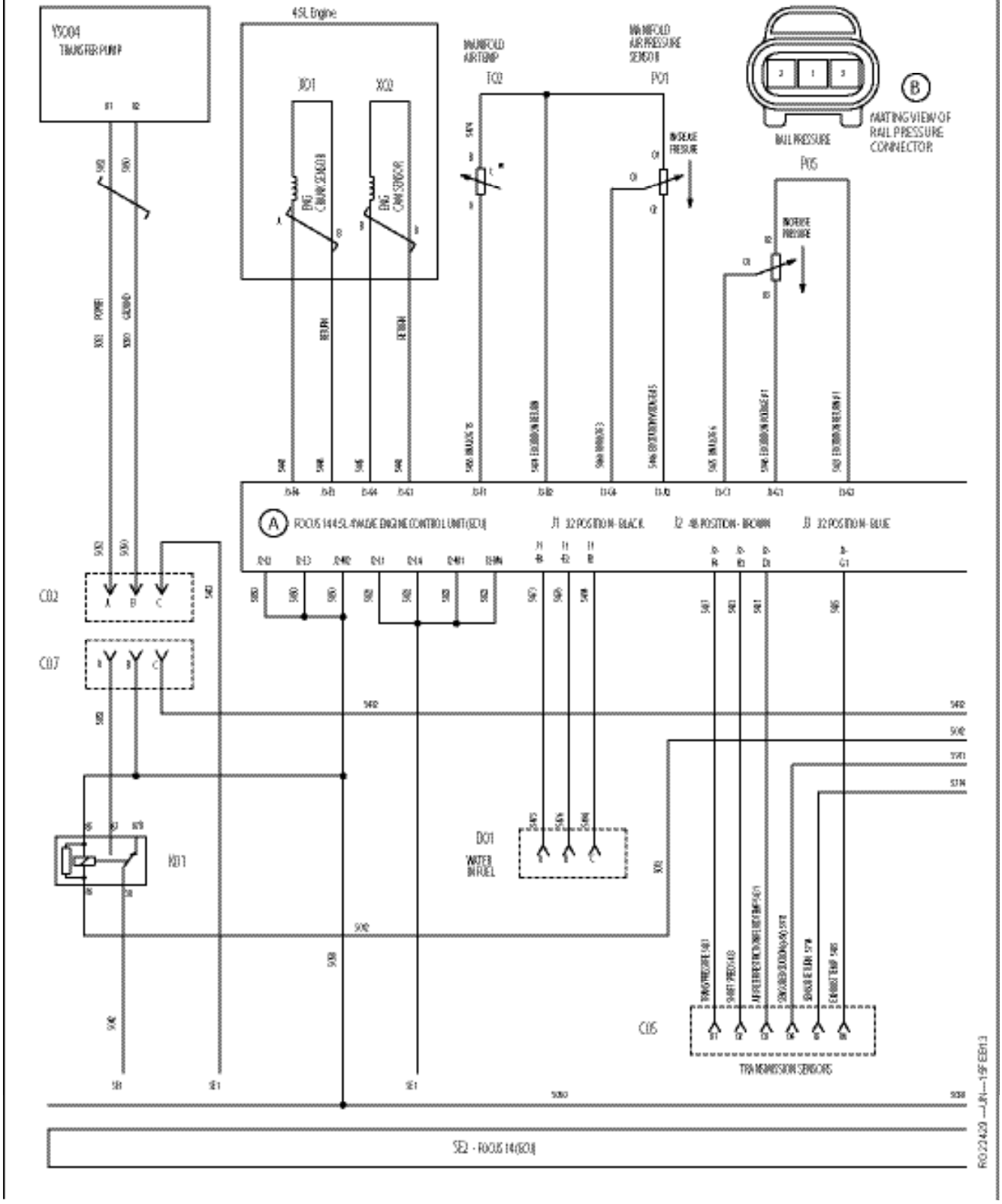
## 4045TFM85 Marine Electronic Control System Wiring Diagram - Cont-d



A— Focus 16, 4.5 L, 4 Valve, Engine Control Unit (ECU)
C06— Wiring Supplied With JD Alternator
C10— SAE J1939/ 11 Way Deutsch Connector, Located Near ECU
C11— Diagnostic Connector
C12— Transient Voltage Protection (12 V or 24 V)
C13— Starter Relay Coil Ground
C14— Starter Relay Coil Power
C15— Remote On/Off
C16— Battery
C17— Single Point Ground
G1— Alternator 12 V
J1— 32 Position - Black
J2— 48 Position - Brown
J3— 32 Position - Blue
J2-A1— CAN High
J2-B1— CAN Low
J3— 32 Position - Blue
M1— Start Motor 12 V
SE1— Engine Start Components
SE2— Focus 16 (ECU)

RG19061,00003EE -19-25FEB13-2/2

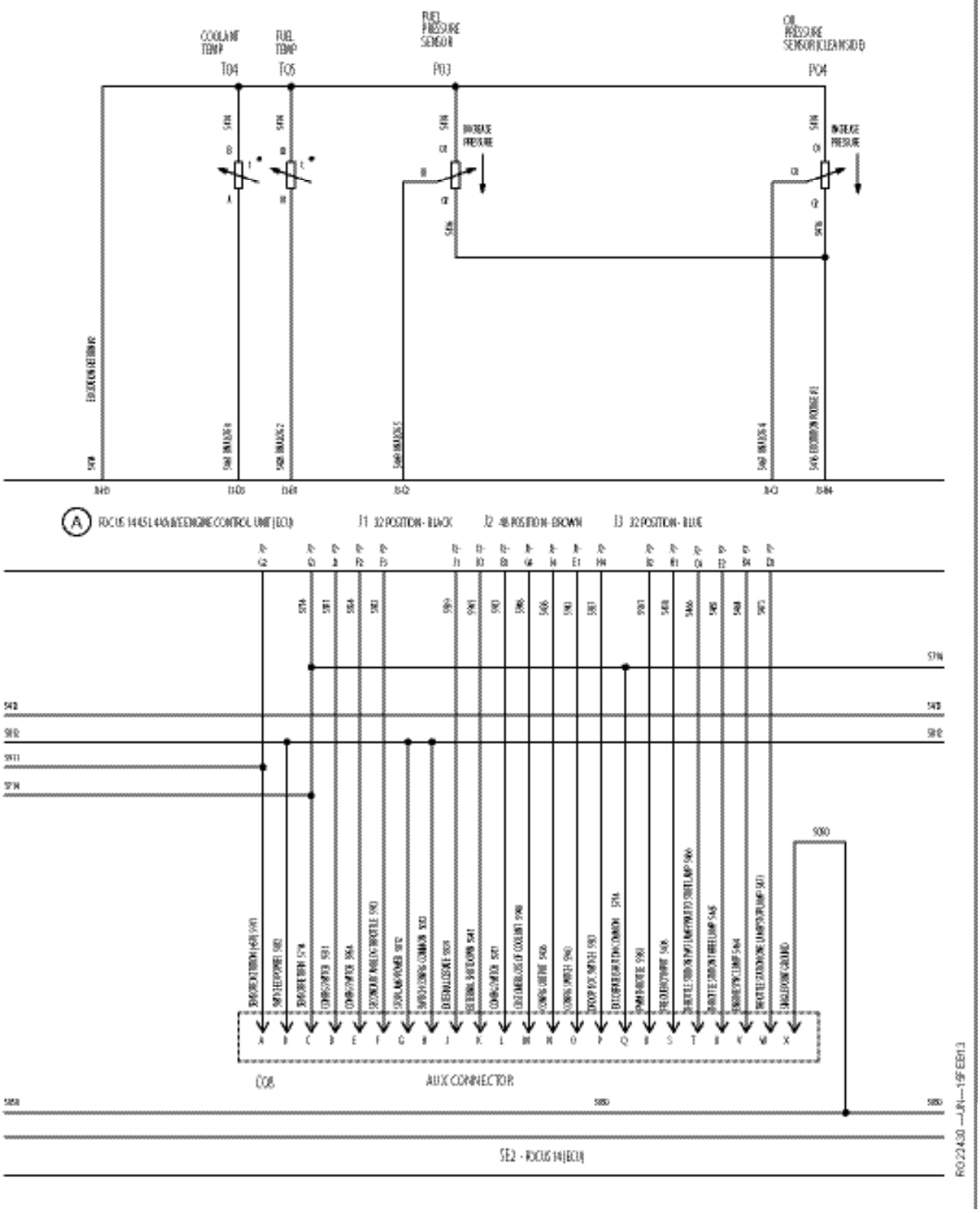
## 4045AFM85 Marine Electronic Control System Wiring Diagram



A— Focus 14, 4.5 L, 4 Valve, Engine Control Unit (ECU)
B— Mating View of Rail Pressure Connector
C05— Transmission Sensors
C05-01— Transmission Pressure
C05-02— Shaft Speed
C05-03— Air Filter Restriction Fluid Temperature
C05-04— Sensor Excitation (+5 V)
C05-05— Sensor Return
C05-06— Exhaust Temperature
D01— Water-In-Fuel Sensor
J3-A2— Excitation Voltage #5
J3-B2— Excitation Return
J3-C1— Analog 6
J3-C4— Analog 3
J3-F1— Analog 15
J3-F3— Return
J3-G1— Excitation Voltage #1
J3-G2— Excitation Return #1
J3-G3— Return
P01— Manifold Air Pressure Sensor
P05— Fuel Rail Pressure Sensor
SE2— Focus 14 (ECU)
T02— Manifold Air Temperature Sensor
X01— Crankshaft Position Sensor
X02— Camshaft Position Sensor
Y5004— Low-Pressure Fuel Pump

RG19681,00003EB -19-21FEB13-2/2

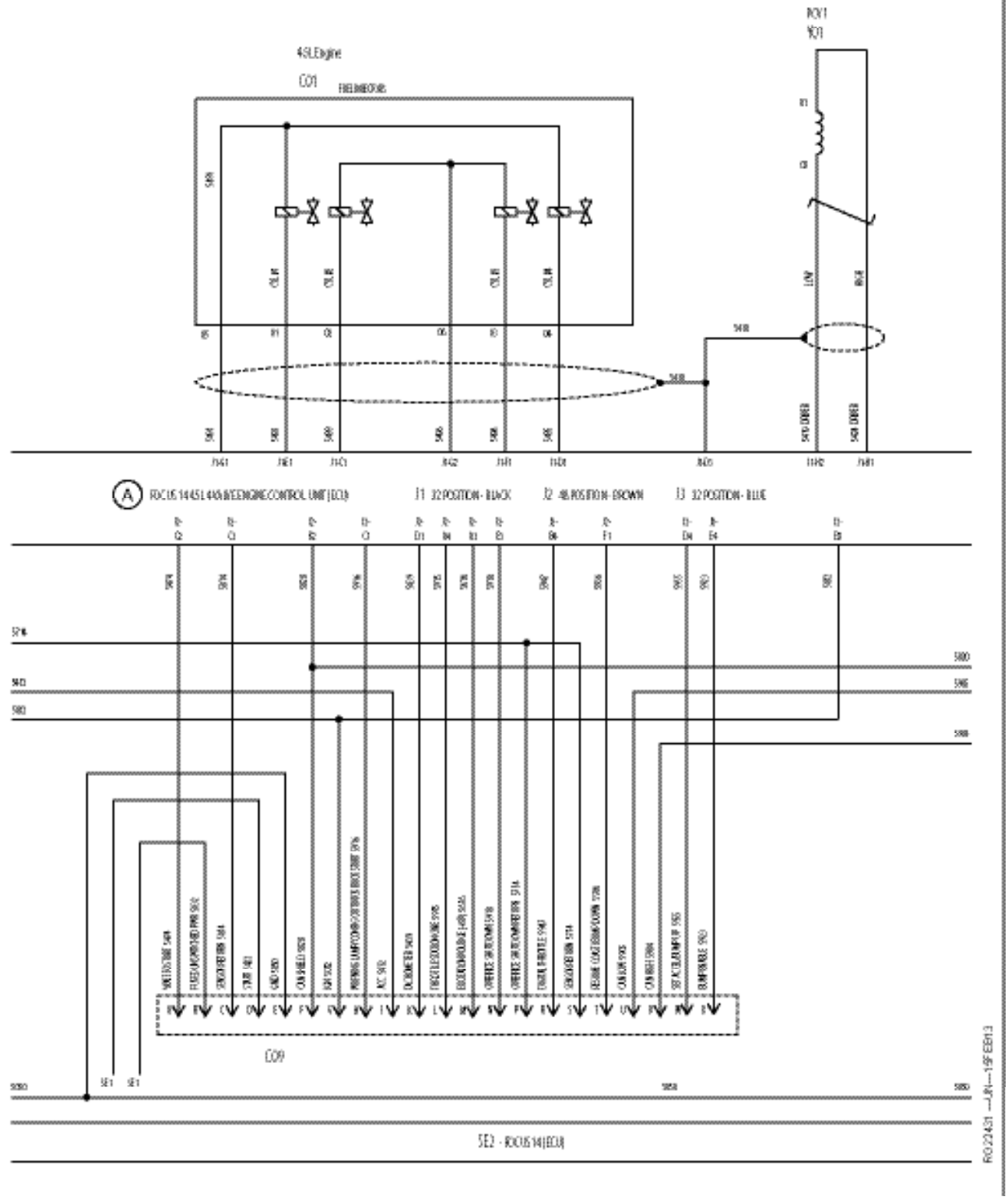
## 4045AFM85 Marine Electronic Control System Wiring Diagram - Cont'd



A— Focus 14, 4.5 L, 4 Valve, Engine Control Unit (ECU)
C08— Auxiliary Connector
C08-A— Sensor Excitation (+5 V)
C08-B— Switched Power
C08-C— Sensor Return
**C08-D— Configurable Switch**
**C08-E— Configurable Switch**
C08-F— Secondary Analog Throttle
C08-G— Stop Lamp Power
**C08-H— Common Configurable** Switch
C08-J— External Derate
C08-K— External Shutdown
**C08-L— Configurable Switch**
C08-M— Customer Loss of Coolant
**C08-N— Configurable Output**
**C08-O— Configurable Switch**
C08-P— Droop Isochronous Switch
C08-Q— External Derate/Shut-down Common
C08-R— PWM Throttle
C08-S— Frequency Input
C08-T— Throttle Station Two Lamp/Wait To Start Lamp
C08-U— Throttle Station Three Lamp
C08-V— Engine Sync Lamp
C08-W— Throttle Station Two Lamp/Stop Lamp
C08-X— Single Point Ground
J1— 32 Position - Black
J2— 48 Position - Brown
J3— 32 Position - Blue
J3-B1— Analog 2
J3-C2— Analog 5
J3-C3— Analog 4
J3-D3— Analog 8
J3-H3— Excitation Return #2
J3-H4— Excitation Voltage #2
P03— Fuel Rail Pressure Sensor
P04— Engine Oil Pressure Sensor (Clean Side)
SE2— Focus 16 (ECU)
T04— Engine Coolant Temperature Sensor
T05— Fuel Temperature Sensor

RG10681,00003EF -19-21FEB13-3/3

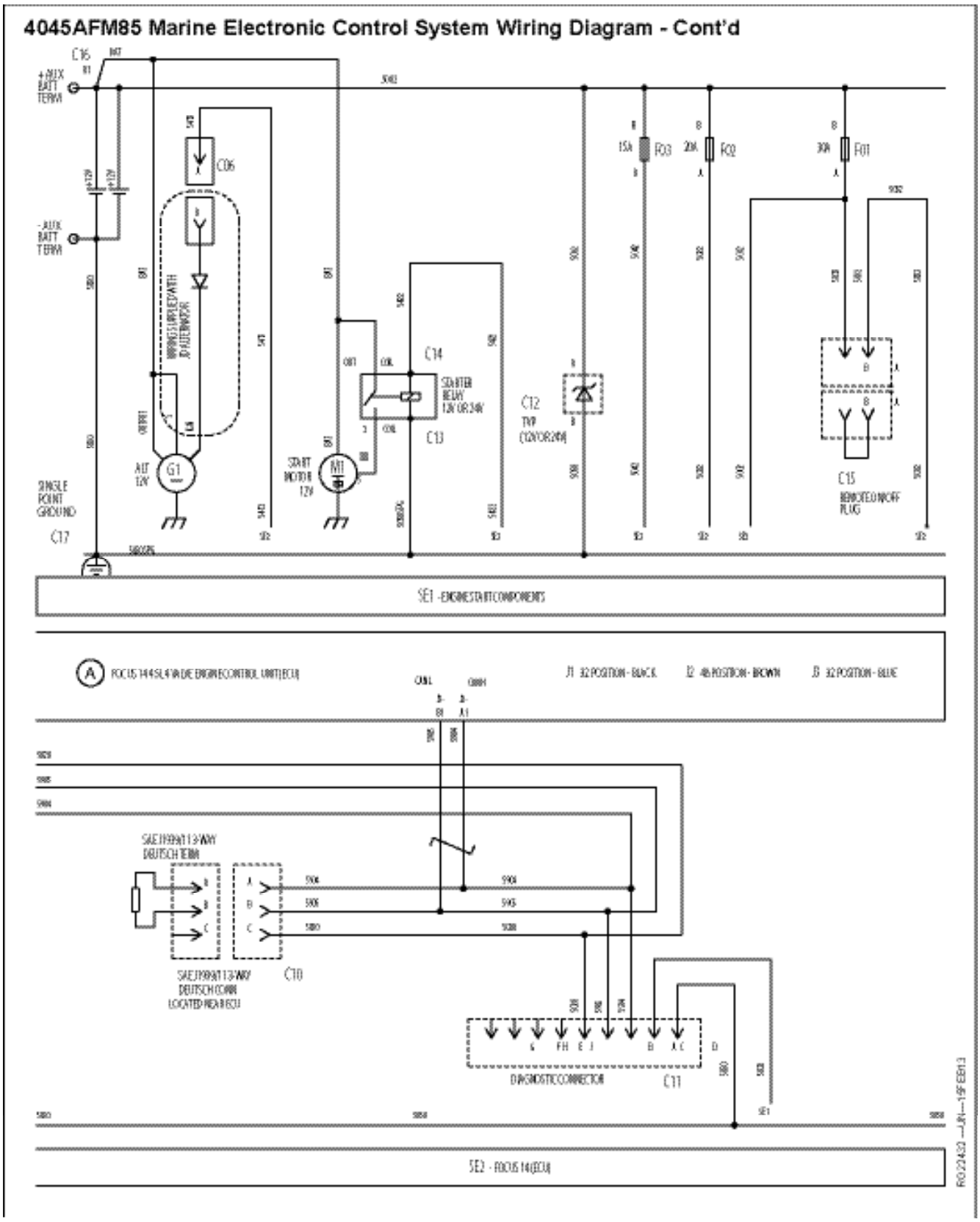
## 4045AFM85 Marine Electronic Control System Wiring Diagram - Cont'd



A— Focus 14, 4.5 L, 4 Valve, Engine Control Unit (ECU)
C01— Fuel Injectors
C09-A— Wait To Start
C09-B— Fused Unswitched Power
C09-C— Sensor Return
C09-D— Start
C09-E— Ground
C09-F— CAN Shield
C09-G— Ignition
**C09-H— Warning Lamp/Configurable Output/Kick Back Start**
C09-J— Accessory
C09-K— Tachometer
C09-L— Throttle Station 1
C09-M— Excitation Voltage (+5 V)
C09-N— Override Shutdown
C09-P— Override Shutdown Return
C09-R— Digital Throttle
C09-S— Sensor Return
C09-T— Resume Coast/Bump Down
C09-U— CAN Low
C09-V— CAN High
C09-W— Set Accelerator/Bump Up
C09-X— Bump Enable
J1— 32 Position - Black
J1-C1— Cylinder 2
J1-D1— Cylinder 4
J1-E1— Cylinder 1
J1-F1— Cylinder 3
J1-H1— High Driver
J1-H2— Low Driver
J2— 48 Position - Brown
J3— 32 Position - Blue
SE2— Focus 14 (ECU)
Y01— Pressure Control Valve 1

RG19661,00003F0 -19-25FEB13-2/2

## 4045AFM85 Marine Electronic Control System Wiring Diagram - Cont'd



A— Focus 14, 4.5 L, 4 Valve, Engine Control Unit (ECU)
C06— Wiring Supplied With JD Alternator
C10— SAE J1939/ 11 Way Deutsch Connector, Located Near ECU
C11— Diagnostic Connector
C12— Transient Voltage Protection (12 V or 24 V)
C13— Starter Relay Coil Ground
C14— Starter Relay Coil Power
C15— Remote On/Off
C16— Battery
C17— Single Point Ground
G1— Alternator 12 V
J1— 32 Position - Black
J2— 48 Position - Brown
J3— 32 Position - Blue
J2-A1— CAN High
J2-B1— CAN Low
J3— 32 Position - Blue
M1— Start Motor 12 V
SE1— Engine Start Components
SE2— Focus 14 (ECU)

RG19861,00003F1 -19-25FEB13-2/2

## Engine Troubleshooting

*NOTE: If using BIODIESEL blends above B20, the possibility of some of the symptoms listed below, such as power loss, could increase.*

***NOTE: Before troubleshooting the engine, first retrieve** any fault codes on the diagnostic gauge display and perform the corrective actions. (See information later in this section.) If any problems remain, use the following charts to solve engine problems.*

| Symptom | Problem | Solution |
|---|---|---|
| **Engine cranks but will not start** | Incorrect starting procedure. | Verify correct starting procedure. |
| | No fuel. | Check fuel in tank and manual shut-off valve. |
| | Exhaust restricted. | Check and correct exhaust restriction. |
| | **Fuel filter plugged or full of water.** | **Replace fuel filter or drain water from filter.** |
| | Injection pump not getting fuel or air in fuel system. | **Check fuel flow at supply pump or** bleed fuel system. |
| | Faulty injection pump or nozzles. | Consult authorized diesel repair station for repair or replacement. |
| **Engine hard to start or will not start** | Engine starting under load. | Disengage PTO (if equipped). |
| | Improper starting procedure. | Review starting procedure. |
| | No fuel. | Check fuel tank. |
| | Air in fuel line. | Bleed fuel line. |
| | Cold weather. | Use cold weather starting aids. |
| | Slow starter speed. | See "Starter Cranks Slowly". |
| | Crankcase oil too heavy. | Use oil of proper viscosity. |
| | Improper type of fuel. | Consult fuel supplier; use proper type fuel for operating conditions. |
| | **Water, dirt, or air in fuel system.** | **Drain, flush, fill, and bleed system.** |
| | **Clogged fuel filter.** | **Replace filter element.** |
| | Dirty or faulty injection nozzles. | Have authorized servicing dealer or engine distributor check injectors. |
| | Electronic fuel system problem | See your authorized servicing dealer |
| | Injection pump shut-off not reset. | Turn key switch to "OFF" then to "ON". |
| **Engine knocks** | Low engine oil level. | Add oil to engine crankcase. |

Continued on next page

OUOD006,0000113-19-16OCT07-1/5

## Troubleshooting (Continued)

| Symptom | Problem | Solution |
|---|---|---|
| | Injection pump out of time. | See your authorized servicing dealer or engine distributor. |
| | Low coolant temperature. | Remove and check thermostat. |
| | Engine overheating. | See "Engine Overheats". |
| **Engine runs irregularly or stalls frequently** | Low coolant temperature. | Remove and check thermostat. |
| | **Clogged fuel filter.** | **Replace fuel filter element.** |
| | **Water, dirt, or air in fuel system.** | **Drain, flush, fill, and bleed system.** |
| | Poor quality fuel. | Change to better quality fuel. |
| | Dirty or faulty injection nozzles. | Have authorized servicing dealer or engine distributor check injectors. |
| | Electronic fuel system problem | See your authorized servicing dealer |
| **Below normal engine temperature** | Defective thermostat. | Remove and check thermostat. |
| | Defective temperature gauge or sender. | Check gauge, sender, and connections. |
| **Lack of power** | Engine overloaded. | Reduce load. |
| | Intake air restriction. | Service air cleaner. |
| | **Clogged fuel filter.** | **Replace filter elements.** |
| | Improper type of fuel. | Use proper fuel. |
| | Overheated engine. | See "Engine Overheats". |
| | Below normal engine temperature. | Remove and check thermostat. |
| | Improper valve clearance. | See your authorized servicing dealer or engine distributor. |
| | Dirty or faulty injection nozzles. | Have authorized servicing dealer or engine distributor check injectors. |
| | Injector tip deposits | Use John Deere approved biodiesel fuel conditioners containing detergents. |
| | Injection pump out of time. | See your authorized servicing dealer or engine distributor. |
| | Turbocharger not functioning. (Turbocharger engines only.) | See your authorized servicing dealer or engine distributor. |

Continued on next page

## Troubleshooting (Continued)

| Symptom | Problem | Solution |
|---|---|---|
| | Leaking exhaust manifold gasket. | See your authorized servicing dealer or engine distributor. |
| | Defective aneroid control line. | See your authorized servicing dealer or engine distributor. |
| | Restricted fuel hose. | Clean or replace fuel hose. |
| | Low fast idle speed. | See your authorized servicing dealer or engine distributor. |
| | Damaged propeller | Have propeller checked. |
| | Marine growth | Clean hull. |
| **Low oil pressure** | Low oil level. | Add oil. |
| | Improper type of oil. | **Drain, fill crankcase with oil of proper** viscosity and quality. |
| **High oil consumption** | Crankcase oil too light. | Use proper viscosity oil. |
| | Oil leaks. | Check for leaks in lines, gaskets, and drain plug. |
| | Restricted crankcase vent tube. | Clean vent tube. |
| | Defective turbocharger (if equipped). | See your authorized servicing dealer or engine distributor. |
| **Engine emits white smoke** | Improper type of fuel. | Use proper fuel. |
| | Low engine temperature. | Warm up engine to normal operating temperature. |
| | Defective thermostat. | Remove and check thermostat. |
| | Defective injection nozzles. | See your authorized servicing dealer or engine distributor. |
| | Engine out of time. | See your authorized servicing dealer or engine distributor. |
| **Engine emits black or gray exhaust smoke** | Improper type of fuel. | Use proper fuel. |
| | Clogged or dirty air cleaner. | Service air cleaner. |
| | Engine overloaded. | Reduce load. |

Continued on next page

## Troubleshooting (Continued)

| Symptom | Problem | Solution |
|---|---|---|
| | Fuel injectors dirty. | Use John Deere approved biodiesel or diesel fuel conditioners containing detergents. If no improvement is seen, see your authorized servicing dealer or engine distributor. |
| | Engine out of time. | See your authorized servicing dealer or engine distributor. |
| | Turbocharger not functioning. | See your authorized servicing dealer or engine distributor. |
| | Electronic fuel system problem | See your authorized servicing dealer |
| **Engine overheats** | Engine overloaded. | Reduce load. |
| | Low coolant level. | Fill coolant tank to proper level, check coolant tank and hoses for loose connections or leaks. |
| | Faulty coolant tank cap. | Have serviceman check. |
| | Stretched poly-vee belt or defective belt tensioner. | Check automatic belt tensioner and check belts for stretching. Replace as required. |
| | Faulty sea (raw) water pump. | Check/replace impeller/pump. |
| | Low engine oil level. | Check oil level. Add oil as required. |
| | **Cooling system needs flushing.** | Flush cooling system. |
| | Defective thermostat. | Remove and check thermostat. |
| | Defective temperature gauge or sender. | Check water temperature with thermometer and replace, if necessary. |
| | Electronic fuel system problem | See your authorized servicing dealer |
| | Incorrect grade of fuel. | Use correct grade of fuel. |
| | 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. |
| **High fuel consumption** | Improper type of fuel. | Use proper type of fuel. |
| | Clogged or dirty air cleaner. | Service air cleaner. |

Continued on next page

## Troubleshooting (Continued)

| Symptom | Problem | Solution |
|---|---|---|
| | Engine overloaded. | Reduce load. |
| | Improper valve clearance. | See your authorized servicing dealer or engine distributor. |
| | Injection nozzles dirty. | See your authorized servicing dealer or engine distributor. |
| | Injector tip deposits | Use John Deere approved biodiesel fuel conditioners containing detergents. |
| | Engine out of time. | See your authorized servicing dealer or engine distributor. |
| | Defective turbocharger. | See your authorized servicing dealer or engine distributor. |
| | Low engine temperature. | Check thermostat. |

OUOD006,0000113 -19-18OCT07-6/6

## Electrical Troubleshooting

| Symptom | Problem | Solution |
|---|---|---|
| **Undercharged electrical system** | Excessive electrical load from added accessories. | Remove accessories or install higher output alternator. |
| | Excessive engine idling. | Increase engine rpm when heavy electrical load is used. |
| | Poor electrical connections on battery, ground strap, starter, or alternator. | Inspect and clean as necessary. |
| | Defective battery. | Test battery. |
| | Defective alternator. | Test charging system. |
| **Battery uses too much water** | Cracked battery case. | Check for moisture and replace as necessary. |
| | Defective battery. | Test battery. |
| | Battery charging rate too high. | Test charging system. |
| **Batteries will not charge** | Loose or corroded connections. | Clean and tighten connections. |
| | Sulfated or worn-out batteries. | See your authorized servicing dealer or engine distributor. |
| | Stretched poly-vee belt or defective belt tensioner. | Adjust belt tension or replace belt. |
| **Starter will not crank** | PTO engaged (if equipped). | Disengage PTO. |
| | Marine gear control engaged. | Disengage marine gear. |
| | Loose or corroded connections. | Clean and tighten loose connections. |
| | Low battery output voltage. | See your authorized servicing dealer or engine distributor. |
| | Faulty start circuit relay. | See your authorized servicing dealer or engine distributor. |
| | Blown main system fuse. | Replace fuse. |
| **Starter cranks slowly** | Low battery output. | See your authorized servicing dealer or engine distributor. |
| | Crankcase oil too heavy. | Use proper viscosity oil. |
| | Loose or corroded connections. | Clean and tighten loose connections. |
| **Starter and hour meter functions; rest of electrical system does not function** | Blown fuse on magnetic switch. | Replace fuse. |

DPSG,OUOD007,335 -19-04JAN02-1/2

| Symptom | Problem | Solution |
|---|---|---|
| **Entire electrical system does not function** | Faulty battery connection. | Clean and tighten connections. |
| | Sulfated or worn-out batteries. | See your authorized servicing dealer or engine distributor. |
| | Blown main system fuse. | Replace fuse. |

DPSG,OUOD007,335 -19-04JAN02-2/2

## Listing Of Diagnostic Trouble Codes (DTC)

The Diagnostic Trouble Codes (DTCs) are output on the diagnostic gauge according to the J1939 standard as a **two-part code. The first part is a two to four-digit Suspect** Parameter Number (SPN) followed by a one or two-digit **Failure Mode Identifier (FMI) code.**

Following is a list of SPNs, FMIs, Blink Codes and description of the diagnostic trouble codes that can occur in the various engine systems. Not all of these codes will be present in all engine applications.

When trouble codes appear on the diagnostic gauge, see your engine dealer for repairs as soon as possible.

### Listing Of Diagnostic Trouble Codes—Continued

| SPN | FMI | Blink Code | Description of Fault | Corrective Action |
|---|---|---|---|---|
| 28 | 03 | 03 | Throttle #3 Signal Out of Range High | Check Sensor and Wiring |
| 28 | 04 | 14 | Throttle #3 Signal Out of Range Low | Check Sensor and Wiring |
| 29 | 03 | 15 | Throttle #2 Signal Out of Range High | Check Sensor and Wiring |
| 29 | 04 | 16 | Throttle #2 Signal Out of Range Low | Check Sensor and Wiring |
| 84 | 02 | 91 | Vehicle Speed Mismatch | Contact Servicing Dealer |
| 91 | 03 | 11 | Throttle #1 Signal Out of Range High | Check Switch and Wiring |
| 91 | 04 | 12 | Throttle #1 Signal Out of Range Low | Check Switch and Wiring |
| 91 | 09 | ---- | Throttle #1 Communication Signal Erratic | Check Sensor and Wiring |
| 94 | 01 | 58 | Low Pressure Fuel Signal Extremely Low | Contact Servicing Dealer |
| 94 | 03 | 27 | Low Pressure Fuel Signal Out of Range High | Check Sensor and Wiring |
| 94 | 04 | 28 | Low Pressure Fuel Signal Out of Range Low | Check Sensor and Wiring |
| 94 | 10 | 86 | Low Pressure Fuel Rate of Change Abnormal | Contact Servicing Dealer |
| 94 | 13 | ---- | Low Pressure Fuel Out of Calibration | Contact Servicing Dealer |
| 94 | 17 | 85 | High Pressure Fuel System- Pressure Slightly Low | Contact Servicing Dealer |
| 94 | 18 | 57 | Fuel Supply Pressure Moderately Low | Contact Servicing Dealer |
| 97 | 00 | ---- | Water-in-Fuel Signal Continuously Detected | Contact Servicing Dealer |
| 97 | 03 | ---- | Water-in-Fuel Signal Out of Range High | Check Sensor and Wiring |
| 97 | 04 | ---- | Water-in-Fuel Signal Out of Range Low | Check Sensor and Wiring |
| 97 | 16 | ---- | Water in Fuel Detected | Stop and Drain Water Separator |
| 100 | 01 | 75 | Engine Oil Pressure Signal Extremely Low | Check Oil Level |
| 100 | 03 | 23 | Engine Oil Pressure Signal Out of Range High | Check Sensor and Wiring |
| 100 | 04 | 24 | Engine Oil Pressure Signal Out of Range Low | Check Sensor and Wiring |
| 100 | 16 | ---- | Engine Oil Pressure Signal Moderately High | Check Sensor and Wiring |
| 100 | 18 | 74 | Engine Oil Pressure Signal Moderately Low | Check Oil Level |
| 105 | 00 | ---- | Intake Manifold Air Temperature Signal Extremely High | Check Air Cleaner, Aftercooler, or Room Temperature |
| 105 | 03 | ---- | Intake Manifold Air Temperature Signal Out of Range High | Check Sensor and Wiring |
| 105 | 04 | ---- | Intake Manifold Air Temperature Signal Out of Range Low | Check Sensor and Wiring |
| 105 | 15 | ---- | Manifold Air Temperature Slightly High | Check Air Cleaner, Aftercooler, or Room Temperature |
| 105 | 16 | ---- | Intake Manifold Air Temperature Signal Moderately High | Check Air Cleaner, Aftercooler, or Room Temperature |
| 107 | 00 | ---- | Air Filter Pressure Differential Extremely High | Contact Servicing Dealer |
| 110 | 00 | 63 | Engine Coolant Temperature Signal Extremely High | Check Cooling System, Reduce Power |
| 110 | 03 | 18 | Engine Coolant Temperature Signal Out of Range High | Check Sensor and Wiring |
| 110 | 04 | 19 | Engine Coolant Temperature Signal Out of Range Low | Check Sensor and Wiring |
| 110 | 15 | 62 | Engine Coolant Temperature Signal Slightly High | Check Cooling System, Reduce Power |
| 110 | 16 | 63 | Engine Coolant Temperature Signal Moderately High | Check Cooling System, Reduce Power |
| 111 | 01 | 61 | Engine Coolant Level Low | Check Operator's Manual |
| 157 | 03 | ---- | Fuel Rail Pressure Signal Out of Range High | Check Sensor and Wiring |
| 157 | 04 | ---- | Fuel Rail Pressure Signal Out of Range Low | Check Sensor and Wiring |
| 157 | 10 | ---- | Fuel Rail Pressure Loss Detected | Contact Servicing Dealer |

Continued on next page

| SPN | FMI | Blink Code | Description of Fault | Corrective Action |
|---|---|---|---|---|
| 158... | 17..... | 54 ..... | ECU Power Down Error (Internal ECU Problem) ..... | Contact Servicing Dealer |
| 174... | 00..... | 67 ..... | Fuel Temperature Signal Extremely High ..... | Add Fuel or Switch Fuel Tanks |
| 174... | 03..... | ..... | Fuel Temperature Signal Out of Range High ..... | Check Sensor and Wiring |
| 174... | 04..... | ..... | Fuel Temperature Signal Out of Range Low..... | Check Sensor and Wiring |
| 174... | 15..... | 33/53..... | Fuel Temperature Slightly High..... | Contact Servicing Dealer |
| 174... | 16..... | 71 ..... | Fuel Temperature Signal Moderately High ..... | Add Fuel or Switch Fuel Tanks |
| 174... | 31..... | 98 ..... | Fuel Temperature Sensor Faulty..... | Contact Servicing Dealer |
| 189... | 00..... | ..... | Engine Speed Derate Condition Exists ..... | Check Fault Codes or Contact Servicing Dealer |
| 189... | 31..... | 48 ..... | Engine Speed Derate..... | Contact Servicing Dealer |
| 190... | 00..... | 42 ..... | Engine Speed Extremely High ..... | Reduce Engine Speed |
| 190... | 01..... | ..... | Engine Speed Extremely Low ..... | Contact Servicing Dealer |
| 190... | 16..... | 42 ..... | Engine Speed Moderately High ..... | Reduce Engine Speed |
| 190... | 18..... | ..... | Engine Speed Moderately Low..... | Contact Servicing Dealer |
| 611... | 03..... | ..... | Injector Shorted to Power..... | Check Wiring |
| 611... | 04..... | ..... | Injector Shorted to Ground ..... | Check Wiring |
| 620... | 03..... | ..... | Sensor Supply Voltage High ..... | Check Wiring |
| 620... | 04..... | ..... | Sensor Supply Voltage Low..... | Check Wiring |
| 627... | 01..... | ..... | All Injector Circuits Have High Resistance | Contact Servicing Dealer |
| 627... | 04..... | 76 ..... | ECU Unswitched, Power Missing ..... | Contact Service Dealer |
| 627... | 18..... | ..... | Injector Power Supply Voltage Out of Range Low | Contact Servicing Dealer |
| 629... | 12..... | ..... | ECU EEPROM Error | Contact Servicing Dealer |
| 629... | 13..... | ..... | ECU Programming Error..... | Contact Service Dealer |
| 629... | 19..... | 34 ..... | ECU to Pump Communication Error..... | Contact Service Dealer |
| 632... | 02..... | 37 ..... | Fuel Shutoff Error ..... | Contact Service Dealer |
| 632... | 05..... | 86 ..... | Fuel Shutoff Not Functioning..... | Contact Service Dealer |
| 636... | 02..... | 44 ..... | Engine Position Sensor Signal Unreliable..... | Check Sensor and Wiring |
| 636... | 05..... | ..... | Camshaft Position Circuit Has High Resistance | Check Sensor and Wiring |
| 636... | 06..... | ..... | Camshaft Position Circuit Has Low Resistance | Check Sensor and Wiring |
| 636... | 08..... | 43 ..... | Engine Position Sensor Signal Missing..... | Check Sensor and Wiring |
| 636... | 10..... | 44 ..... | Engine Position Sensor Signal Rate of Change Abnormal.. | Check Sensor and Wiring |
| 637... | 02..... | 39 ..... | Engine Timing Sensor Signal Unreliable ..... | Check Sensor and Wiring |
| 637... | 05..... | ..... | Crankshaft Position Circuit Has High Resistance..... | Check Sensor and Wiring |
| 637... | 06..... | ..... | Crankshaft Position Circuit Has Low Resistance ..... | Check Sensor and Wiring |
| 637... | 07..... | ..... | Engine Timing and Position Signals Mismatch ..... | Check Sensor and Wiring |
| 637... | 08..... | 38 ..... | Engine Timing Sensor Signal Missing..... | Check Sensor and Wiring |
| 637... | 10..... | 39 ..... | Engine Timing Signal Rate of Change Abnormal ..... | Check Sensor and Wiring |
| 639... | 13..... | ..... | CAN Bus Error ..... | Contact Servicing Dealer |
| 644... | 02..... | ..... | Speed Input Erratic ..... | Contact Servicing Dealer |
| 651... | 05..... | ..... | Injector Number 1 Circuit Has High Resistance..... | Check Injector Wiring or Injector Solenoid |
| 651... | 05..... | ..... | Injector Number 1 Circuit Has High Resistance..... | Check Injector Wiring or Injector Solenoid |
| 651... | 02..... | ..... | – Injector Number 1 Part Number Data Invalid..... | Contact Servicing Dealer |
| 651... | 05..... | ..... | Injector Number 1 Circuit Has High Resistance..... | Check Injector Wiring or Injector Solenoid |
| 651... | 06..... | ..... | Injector Number 1 Circuit Has Low Resistance ..... | Check Injector Wiring or Injector Solenoid |
| 651... | 07..... | ..... | Injector Number 1 Not Responding..... | Injector Failed or Flow Limiter Closed |
| 651... | 13..... | ..... | Injector Number 1 Part Number Calibration Fault ..... | Contact Servicing Dealer |
| 652... | 02..... | ..... | Injector Number 2 Part Number Data Invalid ..... | Contact Servicing Dealer |
| 652... | 05..... | ..... | Injector Number 2 Circuit Has High Resistance..... | Check Injector Wiring or Injector Solenoid |
| 652... | 06..... | ..... | Injector Number 2 Circuit Has Low Resistance ..... | Check Injector Wiring or Injector Solenoid |
| 652... | 07..... | ..... | Injector Number 2 Not Responding..... | Injector Failed or Flow Limiter Closed |

Continued on next page

| SPN | FMI | Blink Code | Description of Fault | Corrective Action |
|---|---|---|---|---|
| 652 | 13 | ..... | Injector Number 2 Part Number Calibration Fault | Contact Servicing Dealer |
| 653 | 02 | ..... | Injector Number 3 Part Number Data Invalid | Contact Servicing Dealer |
| 653 | 05 | ..... | Injector Number 3 Circuit Has High Resistance | Check Injector Wiring or Injector Solenoid |
| 653 | 06 | ..... | Injector Number 3 Circuit Has Low Resistance | Check Injector Wiring or Injector Solenoid |
| 653 | 07 | ..... | Injector Number 3 Not Responding | Injector Failed or Flow Limiter Closed |
| 653 | 13 | ..... | Injector Number 3 Part Number Calibration Fault | Contact Servicing Dealer |
| 654 | 02 | ..... | Injector Number 4 Part Number Data Invalid | Contact Servicing Dealer |
| 654 | 05 | ..... | Injector Number 4 Circuit Has High Resistance | Check Injector Wiring or Injector Solenoid |
| 654 | 06 | ..... | Injector Number 4 Circuit Has Low Resistance | Check Injector Wiring or Injector Solenoid |
| 654 | 07 | ..... | Injector Number 4 Not Responding | Injector Failed or Flow Limiter Closed |
| 654 | 13 | ..... | Injector Number 4 Part Number Calibration Fault | Contact Servicing Dealer |
| 655 | 02 | ..... | Injector Number 5 Part Number Data Invalid | Contact Servicing Dealer |
| 655 | 05 | ..... | Injector Number 5 Circuit Has High Resistance | Check Injector Wiring or Injector Solenoid |
| 655 | 06 | ..... | Injector Number 5 Circuit Has Low Resistance | Check Injector Wiring or Injector Solenoid |
| 655 | 07 | ..... | Injector Number 5 Not Responding | Injector Failed or Flow Limiter Closed |
| 655 | 13 | ..... | Injector Number 5 Part Number Calibration Fault | Contact Servicing Dealer |
| 656 | 02 | ..... | Injector Number 6 Part Number Data Invalid | Contact Servicing Dealer |
| 656 | 05 | ..... | Injector Number 6 Circuit Has High Resistance | Check Injector Wiring or Injector Solenoid |
| 656 | 06 | ..... | Injector Number 6 Circuit Has Low Resistance | Check Injector Wiring or Injector Solenoid |
| 656 | 13 | ..... | Injector Number 6 Part Number Calibration Fault | Contact Servicing Dealer |
| 656 | 07 | ..... | Injector Number 6 Not Responding | Injector Failed or Flow Limiter Closed |
| 676 | 03 | ..... | Glow Plug Signal Received When Not Expected | Check Relay and Wiring |
| 676 | 05 | ..... | Glow Plug Signal Not Received When Expected | Check Relay and Wiring |
| 729 | 03 | ..... | Inlet Air Heater Signal High | Contact Servicing Dealer |
| 729 | 05 | ..... | Inlet Air Heater Signal Low | Contact Servicing Dealer |
| 810 | 02 | 92 ..... | Calculated Vehicle Speed Input Noise | Contact Servicing Dealer |
| 898 | 09 | 77 ..... | Vehicle Speed or Torque Message Not Valid | Contact Servicing Dealer |
| 970 | 02 | ..... | Auxiliary Engine Shutdown Switch Signal Invalid | Contact Servicing Dealer |
| 970 | 31 | ..... | External Shutdown Commanded | Non Engine Fault. Check Other Shutdown Devices |
| 971 | 31 | ..... | External Fuel Derate Switch Active | Non Engine Fault. Check Other Shutdown Devices |
| 1075 | 05 | ..... | Low Pressure Fuel Pump Circuit Has High Resistance | Check Pump and Wiring |
| 1075 | 06 | ..... | Low Pressure Fuel Pump Circuit Has Low Resistance | Check Pump and Wiring |
| 1075 | 12 | ..... | Low Pressure Fuel Pump Status Error | Check Pump and Wiring |
| 1076 | 02 | 66 ..... | Injection Pump Detected Defect | Contact Servicing Dealer |
| 1077 | 07 | 35 ..... | Attempting to Fuel Without Command | Contact Servicing Dealer |
| 1077 | 11 | 68 ..... | Pump Supply Voltage Out of Range | Contact Servicing Dealer |
| 1077 | 12 | 97 ..... | Pump Self Test Error | Contact Servicing Dealer |
| 1077 | 19 | 96 ..... | Pump Detected Communication Error | Contact Servicing Dealer |
| 1077 | 31 | 36 ..... | Pump Initiated Engine Protection | Contact Servicing Dealer |
| 1078 | 07 | 95 ..... | ECU/Pump Timing Moderately Mismatched | Contact Servicing Dealer |
| 1078 | 11 | 87 ..... | ECU/Pump Speed Mismatched | Contact Servicing Dealer |
| 1078 | 31 | 94 ..... | ECU/Pump Timing Extremely Mismatched | Contact Servicing Dealer |

Continued on next page

| SPN | FMI | Blink Code | Description of Fault | Corrective Action |
|---|---|---|---|---|
| 1079 | 03 | 21 | Sensor Supply 1 Voltage High | Check Wiring |
| 1079 | 04 | 22 | Sensor Supply 1 Voltage Low | Check Wiring |
| 1080 | 03 | 31 | Sensor Supply 2 Voltage High | Check Wiring |
| 1080 | 04 | 32 | Sensor Supply 2 Voltage Low | Check Wiring |
| 1109 | 31 | ---- | Engine Protection Shutdown Warning | Check Fault Codes |
| 1110 | 31 | ---- | Engine Protection Shutdown | Check Fault Codes |
| 1136 | 00 | ---- | ECU Temperature Signal Extremely High | Contact Servicing Dealer |
| 1136 | 16 | ---- | ECU Temperature Signal Moderately High | Contact Servicing Dealer |
| 1347 | 03 | 79 | High Pressure Fuel Pump Control Valve Signal Out of Range High | Contact Servicing Dealer |
| 1347 | 05 | 77 | High Pressure Fuel Pump Solenoid Number 1 Circuit Has High Resistance | Check Pump Wiring |
| 1347 | 07 | 78 | High Pressure Fuel Pump Not Able to Meet Required Rail Pressure | Check Fuel Filter and Lines |
| 1485 | 02 | 89 | Pump Power Relay Fault | Contact Servicing Dealer |
| 1568 | 02 | ---- | Requested Torque Curve Signal Unreliable | Contact Servicing Dealer |
| 1569 | 31 | 47 | Engine in Derate Condition | Check Fault Codes |
| 2000 | 13 | ---- | Security Violation | Contact Servicing Dealer |
| 3509 | 03 | ---- | Sensor Supply Number 1 Voltage Out of Range High | Contact Servicing Dealer |
| 3509 | 04 | ---- | Sensor Supply Number 1 Voltage Out of Range Low | Contact Servicing Dealer |
| 3510 | 03 | ---- | Sensor Supply Number 2 Voltage Out of Range High | Contact Servicing Dealer |
| 3510 | 04 | ---- | Sensor Supply Number 2 Voltage Out of Range Low | Contact Servicing Dealer |
| 3511 | 03 | ---- | Sensor Supply Number 3 Voltage Out of Range High | Contact Servicing Dealer |
| 3511 | 04 | ---- | Sensor Supply Number 3 Voltage Out of Range Low | Contact Servicing Dealer |
| 3512 | 03 | ---- | Sensor Supply Number 4 Voltage Out of Range High | Contact Servicing Dealer |
| 3512 | 04 | ---- | Sensor Supply Number 4 Voltage Out of Range Low | Contact Servicing Dealer |
| 3513 | 03 | ---- | Sensor Supply Number 5 Voltage Out of Range High | Contact Servicing Dealer |
| 3513 | 04 | ---- | Sensor Supply Number 5 Voltage Out of Range Low | Contact Servicing Dealer |

*NOTE: Diagnostic gauge on instrument panel may also display text for communication faults, such as "CAN BUS FAILURE". Contact you servicing dealer.*

OURGP12,00001FC -19-08APR10-4/4

## Intermittent Fault Diagnostics

Intermittent faults are problems that periodically "go away". A problem such as a terminal that intermittently doesn't make contact can cause an intermittent fault. Other intermittent faults may be set only under certain operating conditions such as heavy load, extended idle etc. When diagnosing intermittent faults, take special note of the condition of wiring and connectors since a high percentage of intermittent problems originate 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 terminals. Look for broken wires, damaged splices, and wire-to-wire shorts. Use good judgement if component replacement is thought to be required.

*NOTE: The Engine Control Unit (ECU) is the component LEAST likely to fail.*

Suggestions for diagnosing intermittent faults:

If the problem is intermittent, try to reproduce the operating conditions that were present when the Diagnostic Trouble Code (DTC) set.

If a faulty connection or wire is suspected to be the cause of the intermittent problem: clear DTCs, then check the connection or wire by wiggling it while watching the diagnostic gauge to see if the fault resets.

Possible Causes of Intermittent Faults:

1. Faulty connection between sensor or actuator and harness.
2. Faulty contact between terminals in connector.
3. Faulty terminal/wire connection.

Electromagnetic interference (EMI) from an improperly installed 2-way radio, etc. can cause faulty signals to be sent to the ECU.

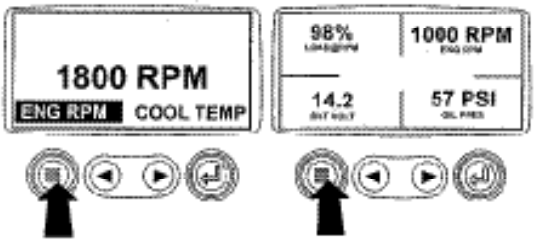
*NOTE: Refer to wiring diagram foldouts earlier in this section as a guide to connections and wires.*

OURGP11,0000206 -19-07OCT03-1/1

## Displaying Diagnostic Gauge Software

*NOTE: The following steps can be used to display the software version of the diagnostic gauge if needed by your dealer for troubleshooting. This is a read only function.*

1. Starting at the single or four engine parameter display, press the "Menu" key.

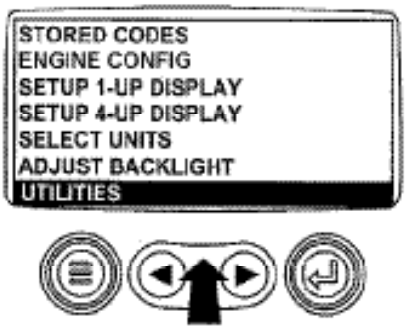



*Menu Key*

R931159 —UN—26SEP03

OURGP11,0000DE3 -19-29SEP03-1/4

2. The main menu will be displayed. Use the "Arrow" key to scroll through the menu until "Utilities" is highlighted.



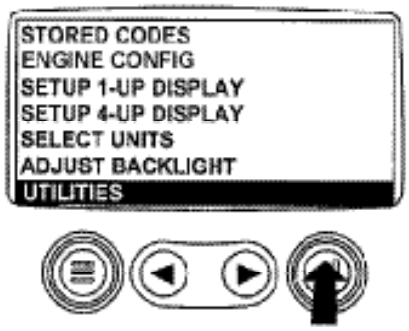

*Select Utilities*

R931234 —UN—22OCT03

Continued on next page

OURGP11,0000DE3 -19-29SEP03-2/4

3. Once "Utilities" is highlighted, press "Enter" to activate the utilities function.




RG12237 —UN—22OCT03

*Select Utilities*

OURGP11,0000DE3 -19-29SEP03-3/4

4. Scroll to the "Software Version". Press "Enter" to view the software version. Press the menu button twice to return to the main menu.


RG12236 —UN—19OCT03

*Software Version*

OURGP11,0000DE3 -19-29SEP03-4/4

## Storage

### Engine Storage Guidelines

1. John Deere engines can be stored outside for up to three (3) months with no long term preparation IF COVERED BY 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 (3) months with no long term preparation.
3. John Deere engines can be stored inside for up to six (6) months with no long term preparation.
4. John Deere engines expected to be stored more than six (6) months MUST have long term storage preparation. ( See PREPARING ENGINE FOR LONG TERM STORAGE, later in this section.)
5. Long term storage includes the use of a stabilized rust preventive oil to protect internal metal components of the engine. This oil should be an SAE 10 oil with 1-4 percent morpholine or equivalent vapor corrosion inhibitor. These rust preventive oils are available from area distributors.

**IMPORTANT: DO NOT USE BIODIESEL DURING MACHINE STORAGE. When using biodiesel blends, switch to petroleum diesel for long term storage. Before storage, operate engine on at least one complete tank of petroleum diesel fuel to purge the fuel system. Follow normal storage procedures once the fuel system has been purged.**

OUOD006,0000114 -19-16OCT07-1/1

## Preparing Engine for Long Term Storage

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.

**IMPORTANT: Any time your engine will not be used for over six (6) months, the following recommendations for storing it and removing it from storage will help to minimize corrosion and deterioration.**

**IMPORTANT: DO NOT USE BIODIESEL DURING MACHINE STORAGE. When using biodiesel blends, switch to petroleum diesel for long term storage. Before storage, operate engine on at least one complete tank of petroleum diesel fuel to purge the fuel system. Follow normal storage procedures once the fuel system has been purged.**

1. **Change engine oil and replace filter. (See CHANGE** ENGINE OIL AND FILTER in Lubrication and Maintenance/500 Hour Section.) Used oil will not give adequate protection. Add one (1) ounce of rust preventive oil to the engine crankcase for every quart of oil. This rust preventive oil should be an SAE 10 oil with 1-4 percent morpholine or equivalent vapor corrosion inhibitor.
2. **Ensure the machine fuel tank is filled with high quality** petroleum diesel fuel. Filling the tank completely will ensure that water does not build up due to condensation. For storage of more than one year, use John Deere PREMIUM DIESEL FUEL CONDITIONER **(or equivalent) at the specified concentration.**
3. Service air cleaner. (See REPLACING AIR CLEANER FILTER ELEMENTS in Service As Required Section.)
4. **Draining and flushing of cooling system is not** necessary if engine is to be stored only for several months. However, for extended storage periods of a year or longer, it is recommended that the cooling **system be drained, flushed, and refilled. Refill with** appropriate coolant. (See RECOMMENDED ENGINE COOLANT in Fuels, Lubricants, and Coolant Section and ADDING COOLANT in Service As Required Section.)
5. Prepare a tank with a solution of diesel fuel and rust preventive oil, at ten (10) ounces of rust preventive oil per gallon of diesel fuel.
6. Remove existing lines/plugs as required, and run a temporary line from the tank to the engine fuel intake, and another temporary line from the fuel return manifold to the tank, so rust preventive oil solution is circulated through the injection system during cranking.
7. Crank the engine several revolutions with starter (do not allow the engine to start). This will allow rust preventive oil solution to circulate.
8. Remove temporary lines installed in Step 6 above, and replace any lines/plugs previously removed.

*NOTE: One gallon of fuel/oil solution can be used to treat 100 engines; two gallons to treat 200 engines, etc. The oil could then be replenished by adding* ***an additional five (5) ounces of rust preventive*** *oil per gallon of solution. However, starting over with a new solution is recommended to dispose of any water or other impurities.*

9. Loosen, or remove and store, fan/alternator poly-vee belt.
10. Remove and clean batteries. Store them in a cool, dry place and keep them fully charged.
11. Disengage the clutch for any driveline.
12. Clean the exterior of the engine with salt-free water and touch up any scratched or chipped painted surfaces with a good quality paint.
13. Coat all exposed (machined) metal surfaces with grease or corrosion inhibitor if not feasible to paint.
14. Seal all openings on engine with plastic bags and tape.
15. 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.

OUCO006,0000FC -19-26FEB10-1/1

## Removing Engine from Long-Term Storage

Refer to the appropriate section for detailed services listed below or have your authorized servicing dealer or engine distributor perform services that you may not be familiar with.

1. Remove all protective coverings from engine. Unseal all openings in engine and remove covering from electrical systems.
2. Remove the batteries from storage. Install batteries (fully charged) and connect the terminals.
3. Install alternator poly-vee belt if removed. Adjust belt tension. (See CHECKING BELT TENSIONER SPRING TENSION AND BELT WEAR in Lubrication and Maintenance/500 Hour/12 Month Section.) Install belt guard.
4. Perform all appropriate prestarting checks. (See DAILY PRESTARTING CHECKS in Lubrication and Maintenance/Daily Section.)
5. Open sea water valve and prime the sea water system.
6. **Open fuel valve, fill fuel filter/water separator with** clean fuel and bleed the fuel system. (See BLEEDING THE FUEL SYSTEM in Service as Required Section.)

**IMPORTANT: DO NOT operate starter more than 30 seconds at a time. Wait at least 2 minutes for starter to cool before trying again.**

7. 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.
8. Start engine and run at low idle and no load for several minutes. Warm up carefully and check all gauges before placing engine under load.
9. **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 may increase initially.***

OUOD006,0000115 -19-16OCT07-1/1

# Specifications

## General Marine Engine Specifications - 4.5L

| ITEM | UNIT OF MEASURE | ENGINE MODEL M90A13 |
|---|---|---|
| **General Data** | | |
| Engine Type | | In-line, 4 cycle diesel |
| Aspiration | | Turbocharged and coolant after cooled |
| Number of Cylinders | | 4 |
| Bore | mm (in.) | 106 (4.17) |
| Stroke | mm (in.) | 127 (5.00) |
| Displacement | L (cu in.) | 4.5 (275) |
| Combustion System | | Direct Injection |
| Compression Ratio | | 16.7:1 |
| **Physical Dimensions:** | | |
| Width | mm (in.) | 770 (30.3) |
| Height | mm (in.) | 964 (31.0) |
| Length | mm (in.) | 1105 (43.5) |
| Basic Dry Weight (approximate) | kg (lb) | 510 (1125) |
| **Lubrication System (Propulsion Applications)** | | |
| Oil Pressure at Rated rpm (±35%) | kPa (psi) | 436 (63) |
| Oil Pressure at Low Idle (800 rpm) | kPa (psi) | 213 (31) |
| **Lubrication System (Generator Applications)** | | |
| Oil Pressure at Rated rpm (±35%) | kPa (psi) | 379 (55) |
| **Cooling System (Liquid, pressurized with centrifugal pump)** | | |
| Recommended Pressure Cap | kPa (psi) | 110 (16) |
| Coolant Temperature Operating Range | °C (°F) | 82-94 (180-202) |
| Coolant Temperature (Maximum) | °C (°F) | 110 (230) |
| Coolant Capacity | L (qt) | --- |
| **Valve Actuation** | | |
| Valve Clearance (Cold) | | |
| Intake | mm (in.) | 0.35 (0.014) |
| Exhaust | mm (in.) | 0.45 (0.018) |
| **Fuel System** | | |
| ECU Description | | L16 |
| Fuel Injection Type | | HPCR |
| Governor Type | | Electronic |
| Primary Fuel Filter | | 10 micron |
| Secondary Fuel Filter | | 2 micron |
| **Electrical System** | | |
| Battery Capacity (Minimum)- 12 Volt System | CCA | 925 |
| Battery Capacity (Minimum)- 24 Volt System | CCA | 625 |
| **Air System** | | |
| Maximum Air Intake Restriction | in. $H_2O$<br>(kPa)<br>(psi) | 25<br>(6.25)<br>(1.0) |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